

***Technical Manual***

iDEN

Enhanced Base Tranceiver System  
(EBTS)

Volume 3 of 3  
RF Distribution Systems

68P80801E35-C

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**MOTOROLA**  
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***RF SUB-SYSTEM***

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**QUAD Base Radio Cabling**

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# ***RF Distribution Systems***

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## **About This Volume**

Volume 3 of the Enhanced Base Transceiver System (EBTS) manual, *RF Distribution Systems*, provides the experienced service technician with an overview of the EBTS RF Distribution Systems. Information in this volume includes 800 MHz and 900 MHz duplexed RFDS, Cavity Combining RFDS, and single cabinet systems.

The EBTS System has three major components:

- ☐ Generation 3 Site Controller (Gen 3 SC or integrated Site Controller (iSC))
- ☐ Base Radios (BRs)
- ☐ RF Distribution System (RFDS)

The BRs are described in Volume 2, *Base Radios*. Installation and testing information is available in Volume 1, *System Installation and Testing*. Detailed information about the Gen 3 SC is contained in the *Gen 3 SC Supplement Manual*, 68P80801E30. Detailed information about the iSC is contained in the *iSC Supplement Manual*, 68P81098E05. (This manual is incomplete without the requisite Site Controller Supplement.)

In addition, Volume 3 provides installation and reference information for the Multi-Sector Expansion Rack (MSER).

The information in this manual is current as of the printing date. If changes to this manual occur after the printing date, they will be documented and issued as Schaumburg Manual Revisions (SMRs).

## **Target Audience**

The target audience of this document includes field service technicians responsible for installing, maintaining, and troubleshooting the EBTS.

In keeping with Motorola's field replaceable unit (FRU) philosophy, this manual provides sufficient functional information to the FRU level. Please refer to the appropriate section of this manual for removal and replacement instructions.

## Maintenance Philosophy

The EBTS has been designed using a Field Replaceable Unit (FRU) maintenance concept. To minimize system down time, faulty FRUs may be quickly and easily replaced with replacement FRUs. This helps to restore normal system operation quickly.

Due to the high percentage of surface mount components and multi-layer circuit boards, field repair is discouraged. Faulty or suspect FRUs should be returned to the Motorola Customer Support Center for further troubleshooting and repair.

Each FRU has a bar code label attached to its front panel. This label identifies a sequential serial number for the FRU. Log this number whenever contacting the Motorola Customer Support Center. For complete information on ordering replacement FRUs, or instructions on how to return faulty FRUs for repair, contact:

**Nippon Motorola LTD.**  
**Tokyo Service Center**  
**044-366-8860**

**OR**

**Motorola Customer Support Center**  
**1311 East Algonquin Road**  
**Schaumburg, Illinois 60196**  
**(800) 448-3245 or (847) 576-7300**

## Technical Support Service

Motorola provides technical support services for installation, optimization, and maintenance of its fixed network equipment. Before calling the Motorola Customer Support Center, please note the following information:

- ☐ Where the system is located.
- ☐ The date the system was put into service.
- ☐ A brief description of problem.
- ☐ Any other unusual circumstances.



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## General Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of the equipment described in this manual. The safety precautions listed below represent warnings of certain dangers of which we are aware. You should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

Read and follow all warning notices and instructions marked on the product or included in this manual before installing, servicing or operating the equipment. Retain these safety instructions for future reference. Also, all applicable safety procedures, such as Occupational, Safety, and Health Administration (OSHA) requirements, National Electrical Code (NEC) requirements, local code requirements, safe working practices, and good judgement must be used by personnel.

Refer to appropriate section of the product service manual for additional pertinent safety information.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modifications of equipment.

Identify maintenance actions that require two people to perform the repair. Two people are required when:

- ✓ A repair has the risk of injury that would require one person to perform first aid or call for emergency support. An example would be work around high voltage sources. A second person may be required to remove power and call for emergency aid if an accident occurs to the first person.
- ✓ Use the National Institute of Occupational Safety and Health (NIOSH) listing equation to determine whether a one or two person lift is required when a system component must be removed and replaced in its rack.

If troubleshooting the equipment while power is applied, be aware of the live circuits.

DO NOT operate the transmitter of any radio unless all RF connectors are secure and all connectors are properly terminated.

All equipment must be properly grounded in accordance with *Motorola Standards and Guidelines for Communication Sites "R56"* (6881089E50) and specified installation instructions for safe operation.

Slots and openings in the cabinet are provided for ventilation. To ensure reliable operation of the product and protect it from overheating, these slots and openings must not be blocked or covered.

Only a qualified technician familiar with similar electronic equipment should service equipment.

**General Safety Information**

Some equipment components can become extremely hot during operation. Turn off all power to the equipment and wait until sufficiently cool before touching.

**Human Exposure Compliance**

This equipment is designed to generate and radiate radio frequency (RF) energy by means of an external antenna. When terminated into a non-radiating RF load, the base station equipment is certified to comply with Federal Communications Commission (FCC) regulations pertaining to human exposure to RF radiation in accordance with the FCC Rules Part 1 section 1.1310 as published in title 47 code of federal regulations and procedures established in TIA/EIA TSB92, Report on EME Evaluation for RF Cabinet Emissions Under FCC MPE Guidelines, Compliance to FCC regulations of the final installation should be assessed and take into account site specific characteristics such as type and location of antennas, as well as site accessibility of occupational personnel (controlled environment) and the general public (uncontrolled environment). This equipment should only be installed and maintained by trained technicians. Licensees of the FCC using this equipment are responsible for insuring that its installation and operation comply with FCC regulations Part 1 section 1.1310 as published in title 47 code of federal regulations.

Whether a given installation meets FCC limits for human exposure to radio frequency radiation may depend not only on this equipment but also on whether the "environments" being assessed are being affected by radio frequency fields from other equipment, the effects of which may add to the level of exposure. Accordingly, the overall exposure may be affected by radio frequency generating facilities that exist at the time the licensee's equipment is being installed or even by equipment installed later. Therefore, the effects of any such facilities must be considered in site selection and in determining whether a particular installation meets the FCC requirements.

FCC OET Bulletin 65 provides materials to assist in making determinations if a given facility is compliant with the human exposure to RF radiation limits. Determining the compliance of transmitter sites of various complexities may be accomplished by means of computational methods. For more complex sites direct measurement of power density may be more expedient. Additional information on the topic of electromagnetic exposure is contained in the *Motorola Standards and Guideline for Communications Sites* publication. Persons responsible for installation of this equipment are urged to consult the listed reference material to assist in determining whether a given installation complies with the applicable limits.

In general the following guidelines should be observed when working in or around radio transmitter sites:

- All personnel should have electromagnetic energy awareness training.
- All personnel entering the site must be authorized.
- Obey all posted signs
- Assume all antennas are active
- Before working on antennas, notify owners and disable appropriate transmitters.
- Maintain minimum 3 feet clearance from all antennas.
- Do not stop in front of antennas.

- Use personal RF monitors while working near antennas.
- Never operate transmitters without shields during normal operation.
- Do not operate base station antennas in equipment rooms

For installations outside of the U.S., consult with the applicable governing body and standards for RF energy human exposure requirements and take necessary steps for compliance with local regulations.

#### References:

TIA/EIA TSB92 "Report on EME Evaluation for RF Cabinet Emissions Under FCC MPE Guidelines", Global Engineering Documents: <http://global.ihs.com/>

FCC OET Bulletin 65 "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields"; <http://www.fcc.gov/oet/rfsafety/>.

Motorola Standards and Guideline for Communications Sites, Motorola manual 68P81089E50.

IEEE Recommended Practice for the Measure of Potentially Hazardous Electromagnetic Fields-- RF and Microwave, IEEE Std. C95.3-1991, Publication Sales, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331

IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, IEEE C95.1-1991, Publication Sales, 445 Hoes Lane. P.O. Box 1331, Piscataway, NJ 08855-1331

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# ***GEN 2/3 Duplexed RFDS Upgrade***

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## **Overview**

This section describes the upgrade of the GEN 2 (P/N 0182020V03) and GEN 3 800 MHz (P/N 0182020V06) Duplexed RF Distribution System (hereinafter collectively called “GEN 2/3”) through the use of GEN 4 expansion hardware.

Topics covered in this section are listed in the following table.

| <b>Section</b>      | <b>Page</b> | <b>Description</b>                                                                                                                                                                      |
|---------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description         | 2           | Describes the GEN 2/3 Upgrade. Shows how the upgrade interfaces into typical GEN 2/3 systems, and specifies pertinent requirements and considerations.                                  |
| Kit Listing         | 8           | Provides a list and identification of the GEN 2/3 Upgrade kits available. Correlates application of the various kits to typical GEN 2/3 systems.                                        |
| Installation        | 9           | Provides references to procedures required for installation of the GEN 2/3 Upgrade expansion cabinet.                                                                                   |
| Cabling Information | 10          | Provides instructions and diagrams for all cabling specific to the interfacing the expansion cabinet with the Main RF Cabinet. Provides other pertinent cabling information references. |

**Description**

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**Description**

The GEN 2/3 RF Distribution System (RFDS) upgrade provides a minimum 6-BR system expansion with no modifications to the Main RF Cabinet. As such, system expansion is easily accomplished in the field with minimum downtime. The upgrade uses a GEN 4 expansion cabinet to allow more BRs per expansion cabinet than possible with previous duplexed expansion cabinets. (Refer to *800 MHz GEN 4 Duplexed RF Distribution System* section of this manual for detailed theory of operation for the GEN 4 RFDS.) The expansion upgrade can be applied in various stages, which are discussed in this section.

The upgrade procedure basically consists of simply connecting a pre-configured GEN 4 Expansion RF Cabinet to an existing GEN 2/3 Main RF Cabinet.

The upgrade discussed herein is a direct, superseding replacement for all earlier duplexed expansion cabinets (which are all currently obsolete).

**Interfacing a GEN 4 Expansion RF Cabinet to An Existing GEN 2/3 Site**

Interfacing a GEN 4 Expansion RF Cabinet to an existing GEN 2/3 Main RF Cabinet mostly consists of the same procedures as required for an expansion system using all GEN 2/3 components.

The only special consideration is the existing Main RF Cabinet *transmit structure* (i.e., number of Base Radios, extent of hybrid combining, etc.). Because a large amount of flexibility exists in the types of transmit structures found in GEN 2/3 systems, the transmit structure of the system being upgraded must be considered. (The receive subsystem is independent of transmit structure and is discussed separately.)

**Block Diagrams Of GEN 4 Interface To Typical GEN 2/3 Transmit Structures**

Figure 1 shows, in simplified block diagram form, the transmit interface of GEN 4 Expansion RF Cabinets to the typical GEN 2/3 transmit structures. Most GEN 2/3 Main RF Cabinets fall within one of the five transmit structure types (Type I through Type V) shown in Figure 1.

Circles in Figure 1 represent transmit (TX) combining points. In the GEN 2/3 Main RF Cabinet, these points are the add-on expansion assemblies. In the GEN 4 Expansion RF Cabinet, these are hybrid couplers within a standard Dual 3-Way Combiner Deck or optional Triple 2-Way Combiner Deck.

**NOTE**

Refer to appropriate section of this manual for detailed theory of operation for GEN 3 or GEN 4 components and systems. For detailed information on the GEN 2 RFDS, refer to *iDEN EBTS manual*, 68P81091E20-C.

Basically, there are five types of interfaces corresponding to the GEN 2/3 transmit structures, as follows:

- ❑ **Type I** – The Main RF Cabinet is equipped with one BR and is non-expanded, with duplexers 2 and 3 available. A standard GEN 4 Expansion RF Cabinet is connected to the available duplexer TX inputs.
- ❑ **Type II** – This is an extension of the Type I interface. By adding a Triple 2-Way Combiner Deck to the Expansion RF Cabinet, the six expansion BR TX signals are combined onto one line. A second BR is added in the Main RF Cabinet. The two Main RF Cabinet BRs are applied to duplexers 1 and 2, and the Expansion RF Cabinet BRs are applied to duplexer 3.

This interface type also applies to a non-expanded Main RF Cabinet equipped with two BRs. Note that in this case, a double-combining Expansion RF Cabinet (cabinet equipped with Dual 3-Way and Triple 2-Way Combiner Decks) would be required.

- ❑ **Type III** – The Main RF Cabinet is equipped with two BRs combined onto duplexer 1, with duplexers 2 and 3 available. A standard GEN 4 Expansion RF Cabinet is connected to the duplexer 2 and 3 TX inputs.
- ❑ **Type IV** – This is an extension of the Type III interface. By adding a Triple 2-Way Combiner Deck to the Expansion RF Cabinet, the six expansion BR TX signals are combined onto one line. Two Main RF Cabinet BRs remain applied to duplexer 1, a third BR is added to the Main RF Cabinet and applied to duplexer 2, and the Expansion RF Cabinet BRs are applied to duplexer 3.

This interface type also applies to a 3-BR Main RF Cabinet equipped with one expansion assembly. Note that in this case, a double-combining Expansion RF Cabinet (cabinet equipped with Dual 3-Way and Triple 2-Way Combiner Decks) would be required.

- ❑ **Type V** – This interface type applies to a 4-BR Main RF Cabinet equipped with two expansion assemblies. The four Main RF Cabinet BRs are respectively combined onto two lines and applied to duplexers 1 and 2. The Expansion RF Cabinet BRs are applied to duplexer 3. Note that in this case, a double-combining Expansion RF Cabinet (cabinet equipped with Dual 3-Way and Triple 2-Way Combiner Decks) would be required.

#### NOTE

When connecting TX signals from the Expansion Cabinet to the Main RF Cabinet, do not connect the expansion cabinet signal(s) to the dual-stage isolator input. This results in severe intermodulation products at the antenna output.

Instead, the expansion cabinet signal(s) are applied directly to the duplexer TX input, as shown in the Cabling Information subsection that follows.

**Description**

It is important to note the transmit structure of the GEN 2/3 system being upgraded in terms of how it fits into one of the five transmit structure types (Type I through Type V). This information will determine:

- ☐ the form and extent to which expansion can be accomplished, and
- ☐ the equipment (kit) required to accomplish an expansion.

In summary:

- ☐ Types I and II apply to a GEN 2/3 Main RF Cabinet that is **not equipped with 2-channel expansion assemblies**.
- ☐ Types III and IV apply to a GEN 2/3 Main RF Cabinet that is **equipped with one, 2-channel expansion assembly**.
- ☐ Type V applies to a GEN 2/3 Main RF Cabinet that is **equipped with two, 2-channel expansion assemblies**.

**NOTE**

The GEN 2/3 Duplex Hybrid Expansion cabinet is incompatible with a GEN 4 Expansion RF Cabinet. In such cases, the Main RF Cabinet must be reconfigured into one of the five types discussed above. (Refer to "Theory of Operation - Duplex Hybrid Expansion RFDS" (800 MHz Duplexed RF Distribution System section of this manual for detailed information and identification regarding Duplex Hybrid Expansion.)

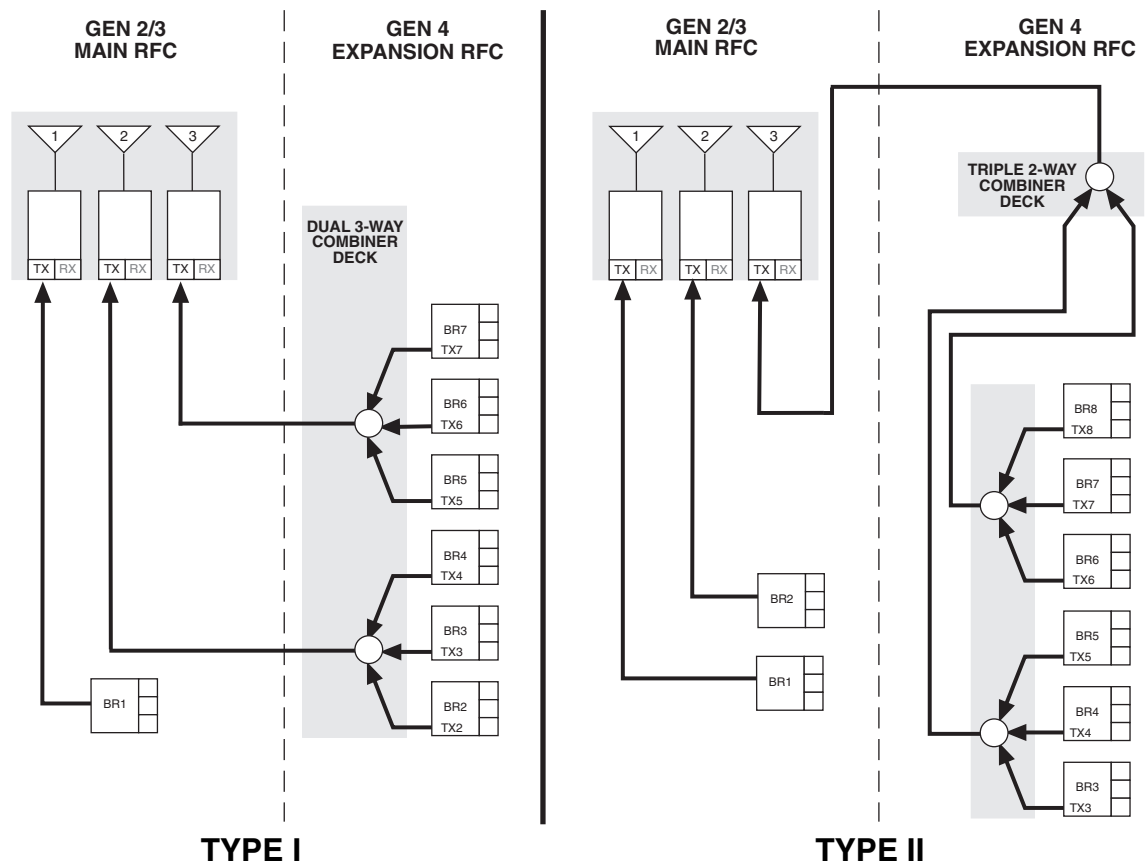
**Receive Interface****NOTE**

Refer to appropriate section of this manual for detailed theory of operation for GEN 3 or GEN 4 components and systems. For detailed information on the GEN 2 RFDS, refer to *iDEN EBTS manual*, 68P81091E20-C.

Figure 3 shows a simplified block diagram of the receive interface from the GEN 2/3 Main RF Cabinet to the GEN 4 Expansion RF Cabinet. An Rx1, Rx 2, and Rx3 receive signal is respectively taken from a reserve output port on each of the three standard Receive Splitters (multicouplers) in the Main RF Cabinet. The Rx1 through Rx3 signals are respectively applied to three local Expansion Multicouplers in the Rx Tray (located in the Expansion RF Cabinet). The Expansion Multicouplers, in turn, provide individual Rx signals for the Expansion RF Cabinet BRs.



Note that in this arrangement, in the Main RF Cabinet a 2 dB inline attenuator is added to each Base Radio Rx input. This is required because the Rx paths to the Expansion Multicouplers experience a nominal 2 dB loss due to the relatively long intercabinet Rx cabling. The 2 dB attenuators at the Rx inputs of each Main RF Cabinet Base Radio balances the main cabinet Rx path gain with that of the expansion cabinet.



EBTS558  
031998LLN

Figure 1 GEN 2/3 Upgrade Transmit Interface Types (Sheet 1 of 2)

## Description

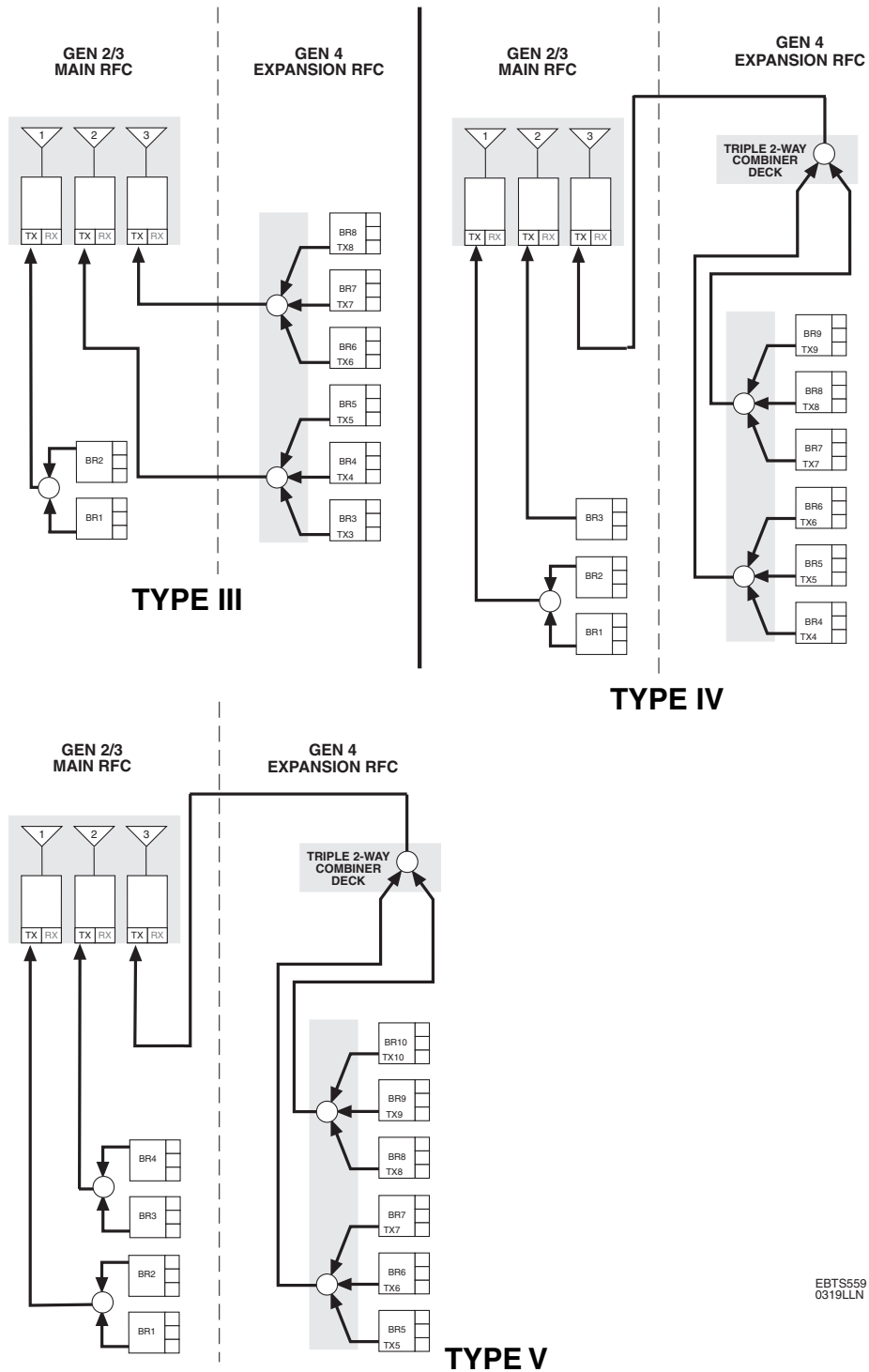
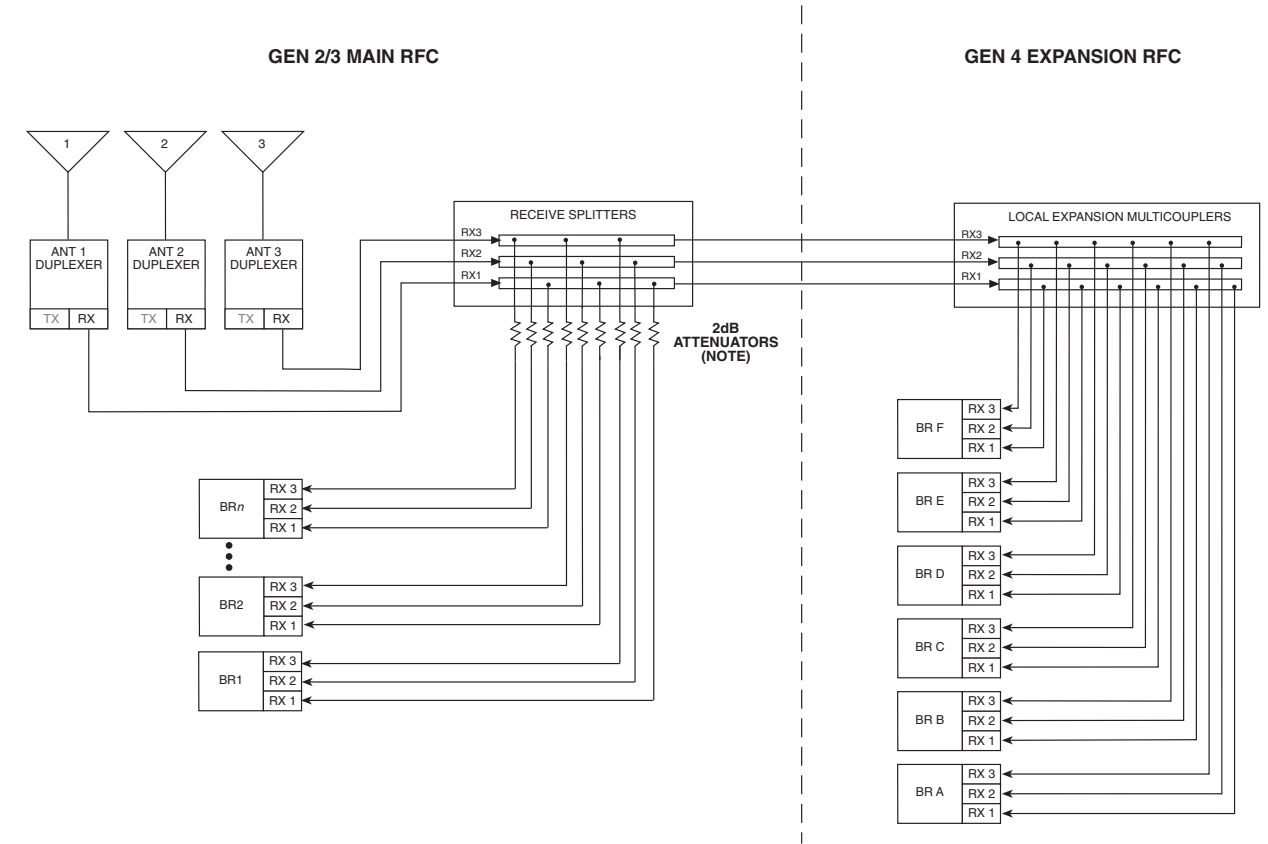
EBTS559  
0319LLN

Figure 2 GEN 2/3 Upgrade Transmit Interface Types (Sheet 2 of 2)



NOTE: 2 dB ATTENUATORS ARE FIELD-PROCURED.

EBTS560  
031998LLN

Figure 3 GEN 2/3 Upgrade Simplified Rx Block Diagram

**Kit Listing**

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**Kit Listing**

Table 1 lists the available kits for adding a GEN 4 Expansion RF Cabinet to a GEN 2/3 Main RF Cabinet.

**NOTE**

Before proceeding, determine the interface type required (as defined in “Interfacing a GEN 4 Expansion RF Cabinet to An Existing GEN 2/3 Site” paragraph earlier). This information is needed for ordering the proper equipment.

*Table 1 GEN 2/3 Upgrade Kit Descriptions And Applicability*

| Type                                                                                                                                                                                                                | Total BRs<br>(Main RFC +<br>Exp. RFC) | Required Kit(s)                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| I                                                                                                                                                                                                                   | 7                                     | <ul style="list-style-type: none"> <li>6-BR Expansion RF Cabinet, including:               <ul style="list-style-type: none"> <li>Internal cabinet cabling (6-BR)</li> <li>Expansion intercabinet cabling</li> </ul> </li> </ul>                                                                                  |
| II<br>(NOTE)                                                                                                                                                                                                        | 8                                     | <ul style="list-style-type: none"> <li>6-BR Expansion RF Cabinet, including:               <ul style="list-style-type: none"> <li>Internal cabinet cabling (6-BR)</li> <li>Expansion intercabinet cabling</li> <li>Triple 2-Way Combiner Deck w/o Isolators</li> <li>Combiner Deck cabling</li> </ul> </li> </ul> |
| III                                                                                                                                                                                                                 | 8                                     | <ul style="list-style-type: none"> <li>6-BR Expansion RF Cabinet, including:               <ul style="list-style-type: none"> <li>Internal cabinet cabling (6-BR)</li> <li>Expansion intercabinet cabling</li> </ul> </li> </ul>                                                                                  |
| IV<br>(NOTE)                                                                                                                                                                                                        | 9                                     | <ul style="list-style-type: none"> <li>6-BR Expansion RF Cabinet, including:               <ul style="list-style-type: none"> <li>Internal cabinet cabling (6-BR)</li> <li>Expansion intercabinet cabling</li> <li>Triple 2-Way Combiner Deck w/o Isolators</li> <li>Combiner Deck cabling</li> </ul> </li> </ul> |
| V                                                                                                                                                                                                                   | 10                                    | <ul style="list-style-type: none"> <li>6-BR Expansion RF Cabinet, including:               <ul style="list-style-type: none"> <li>Internal cabinet cabling (6-BR)</li> <li>Expansion intercabinet cabling</li> <li>Triple 2-Way Combiner Deck w/o Isolators</li> <li>Combiner Deck cabling</li> </ul> </li> </ul> |
| <b>NOTE:</b> If expanding from preceding level of GEN 2/3 upgrade (e.g., going from “Type I” to “Type II”), Triple 2-Way Combiner Deck FRU (CLN1351) can be ordered and installed in existing Expansion RF Cabinet. |                                       |                                                                                                                                                                                                                                                                                                                   |

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## Installation

Install a GEN 4 Expansion RF Cabinet as described below.

1. Observe the guidelines specified in the *Pre-Installation* section of this manual.
2. Perform cabinet installation in accordance with “EBTS Cabinet Installation” (*Installation* section of this manual).
3. Perform (or verify) the cabinet and intercabinet general connections listed below in accordance with “Intercabling Procedures” (*Installation* section of this manual).
  - Cabinet Ground Connections
  - 5 MHz / 1 PPS Intercabling
  - Ethernet Intercabling
  - Alarm Intercabling
  - -48 VDC Power (Hot) Connections
  - Equipment Cabinet Power Connections
  - DC Return Connections
4. Perform intercabinet cabling specific to the TX and RX interfaces in accordance with “Cabling Information” in this section.
5. Perform the procedures specified in *Final Checkout* section of this manual.
6. Perform “RF Cabinet Verification” (*System Testing* section of this manual) for added Expansion RF Cabinet.

**Cabling Information**


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## Cabling Information

**Cabling Within An RF Cabinet**

Refer to the *800 MHz Duplexed RF Distribution System* section or the *800 MHz GEN 4 Duplexed RF Distribution System* section of this manual for cabling within the GEN 2/3 Main RF Cabinet or the GEN 4 Expansion RF Cabinet, respectively.

**Specific Intercabinet Cabling**

The illustrations and corresponding tables within this section identify cabling part numbers and point-to-point connections specific to TX and RX intercabinet cabling between a GEN 2/3 Main RF Cabinet and a GEN 4 Expansion RF Cabinet. Connections appearing in **bold** are accordingly labeled on the equipment.

The cabling diagrams included in this section are listed in the following table.

| Section                                | Page | Description                                                                                                                                            |
|----------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Receive Intercabinet Cabling           | 11   | Provides intercabinet receive cabling information                                                                                                      |
| Type I Transmit Intercabinet Cabling   | 13   | Provides transmit intercabinet cabling information for the Type I configuration (as defined in the Upgrade Types paragraph earlier in this section).   |
| Type II Transmit Intercabinet Cabling  | 17   | Provides transmit intercabinet cabling information for the Type II configuration (as defined in the Upgrade Types paragraph earlier in this section).  |
| Type III Transmit Intercabinet Cabling | 21   | Provides transmit intercabinet cabling information for the Type III configuration (as defined in the Upgrade Types paragraph earlier in this section). |
| Type IV Transmit Intercabinet Cabling  | 25   | Provides transmit intercabinet cabling information for the Type IV configuration (as defined in the Upgrade Types paragraph earlier in this section).  |
| Type V Transmit Intercabinet Cabling   | 29   | Provides transmit intercabinet cabling information for the Type V configuration (as defined in the Upgrade Types paragraph earlier in this section).   |

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

For detailed information and equipment views of the GEN 2 RFDS, refer to *Enhanced Base Transceiver System (System Manual 68P81091E20-C)*.

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## Receive Intercabinet Cabling

Table 2 lists and Figure 4 shows the receive intercabinet cabling for all GEN 2/3 Upgrade multicabinet expansion configurations.

### NOTE

Figure 4 depicts GEN 3 Main RF Cabinet. Point-to-point connections for GEN 2 Main RF Cabinet are identical. For detailed information and equipment views of the GEN 2 RFDS, refer to *Enhanced Base Transceiver System (System Manual 68P81091E20-C)*.

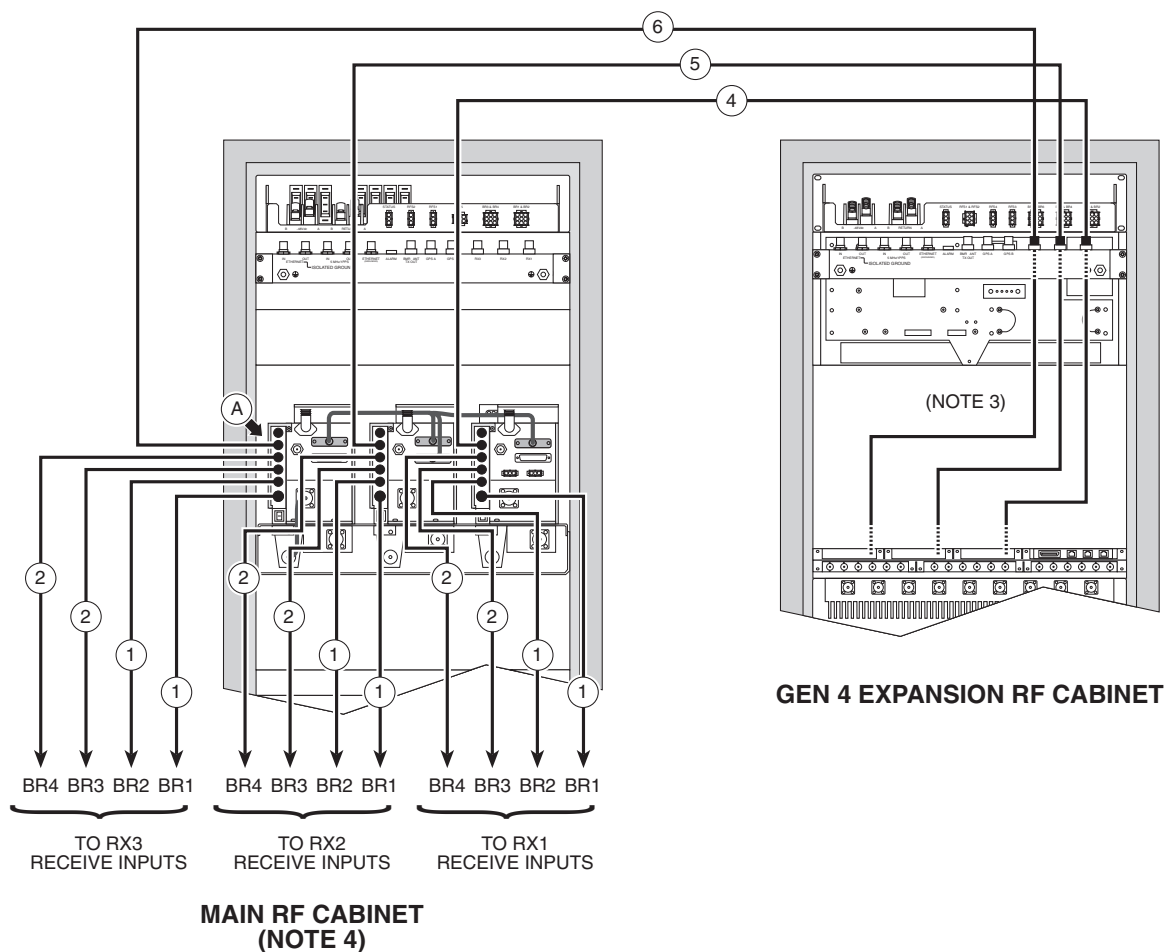
Table 2 **Receive Intercabinet Cabling**

| Index | Part Number | From                                      | To                                                          | Notes                                                                                                              |
|-------|-------------|-------------------------------------------|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| 1     | —           | 2 dB inline attenuator (index 3)          | Base Radio (BR) <b>RX</b> input                             | Shown for reference only. Refer to applicable section of this manual for cable part numbers and other information. |
| 2     | —           | 2 dB inline attenuator (index 3)          | Base Radio (BR) <b>RX</b> input                             | Shown for reference only. Refer to applicable section of this manual for cable part numbers and other information. |
| 3     | —           | Rx multicoupler output port               | BR receive input cable (index 1 or 2)                       | 2 dB inline attenuator (NOTE 2)                                                                                    |
| 4     | 3012029E37  | Rx output port on Rx1 branch multicoupler | <b>RX1</b> connector on Expansion RF Cabinet Junction Panel |                                                                                                                    |
| 5     | 3012029E37  | Rx output port on Rx2 branch multicoupler | <b>RX2</b> connector on Expansion RF Cabinet Junction Panel |                                                                                                                    |
| 6     | 3012029E37  | Rx output port on Rx3 branch multicoupler | <b>RX3</b> connector on Expansion RF Cabinet Junction Panel |                                                                                                                    |
| 7     | 0909906D01  | —                                         | Rx Multicoupler output port                                 | 50 $\Omega$ termination (NOTE 4)                                                                                   |

#### NOTES:

- Above listing for part no. identification and function description only. Refer to accompanying diagram for point-to-point connections.
- Quantity of 2 dB inline attenuators required is determined by number of BRs and receive branches used within Main RF Cabinet. Each Rx input on each BR shall use a 2 dB attenuator installed as shown in Figure 4. (2 dB attenuators are field-procured and not part of cabling kit.)
- Refer to "Receive Cabling" (*800 MHz GEN 4 Duplexed RF Distribution System* section of this manual) for Rx cabling details within GEN 4 expansion cabinet.
- Unused Rx multicoupler output ports shall be terminated into 50 $\Omega$  termination (P/N 0909906D01).

## Cabling Information



## NOTES:

1. Unused Rx multicoupler output ports shall be terminated into 50Ω termination (P/N 0909906D01).
2. Quantity of 2 dB inline attenuators required is determined by number of BRs and receive branches used within Main RF Cabinet. Each Rx feed to each Main RF Cabinet BR shall use a 2 dB attenuator installed as shown in this figure. (2 dB attenuators are field-procured and not part of cabling kit.)
3. Refer to "Receive Cabling" (800 MHz GEN 4 Duplexed RF Distribution System section of this manual) for Rx cabling details within GEN 4 expansion cabinet.
4. Rx connections shown apply to GEN 2 or GEN 3. (GEN 3 RFDS shown.)

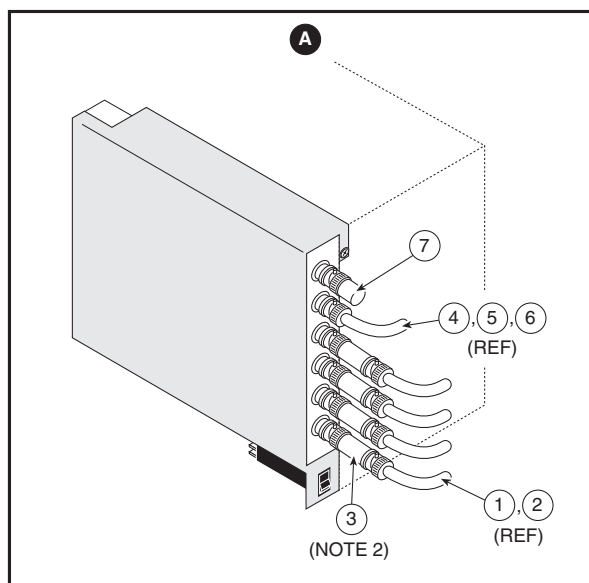
EBTS561  
032698LLN

Figure 4 Receive Intercabinet Cabling



## Type I Transmit Intercabinet Cabling

### GEN 3 Intercabinet Cabling

Table 3 lists and Figure 5 shows the transmit intercabinet cabling for a Type I configuration (single-combined Expansion RFC to non-expansion GEN 3 Main RFC).

*Table 3      Type I Transmit Intercabinet Cabling (GEN 3 Main RF Cabinet)*

| Index                                                                                                                                                                                                                          | Part Number | From                                                                                                      | To                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------|----------------------------------|
| 1                                                                                                                                                                                                                              | CKN6288A    | Expansion RFC Dual 3-Way Combiner Deck<br><b>T1</b> (OUT) port<br>(combined TX signal of lower-three BRs) | Main RFC ANT 2 duplexer TX input |
| 2                                                                                                                                                                                                                              | CKN6288A    | Expansion RFC Dual 3-Way Combiner Deck<br><b>T6</b> (OUT) port<br>(combined TX signal of upper-three BRs) | Main RFC ANT 3 duplexer TX input |
| <b>NOTE:</b> Refer to "Transmit Power Out Cabling" (Cabling Information subsection in <i>800 MHz GEN 4 Duplexed RF Distribution System</i> section of this manual) for BR-to-Combiner Deck cabling within GEN 4 Expansion RFC. |             |                                                                                                           |                                  |

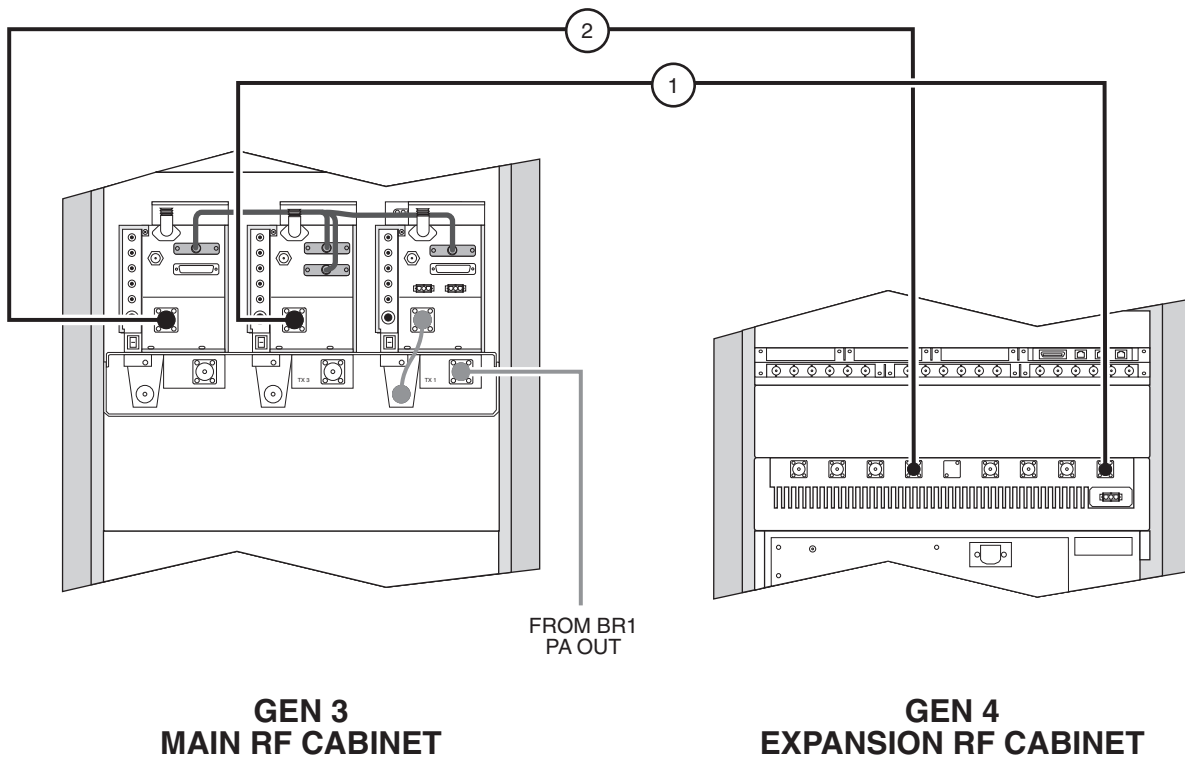
**Cabling Information**EBTS563  
032698LLN

Figure 5 **Type I Transmit Intercabinet Cabling  
(GEN 3 Main RF Cabinet)**

## GEN 2 Intercabinet Cabling

Table 4 lists and Figure 6 shows the transmit intercabinet cabling for a Type I configuration (single-combined Expansion RFC to non-expansion GEN 2 Main RFC).

### NOTE

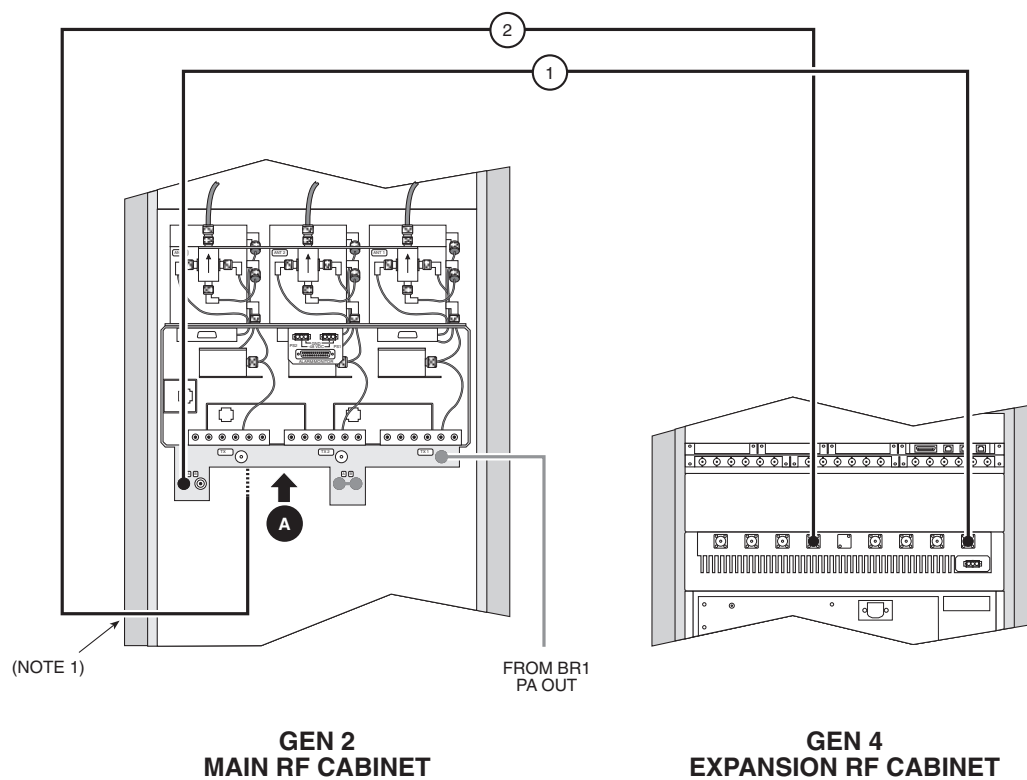
When connecting TX signals from the Expansion Cabinet to the Main RF Cabinet, do not connect the expansion cabinet signal(s) to the dual-stage isolator input. This results in severe intermodulation products at the antenna output.

Instead, the expansion cabinet signal(s) are applied directly to the duplexer TX input, as described and shown below.

Table 4 **Type I Transmit Intercabinet Cabling (GEN 2 Main RF Cabinet)**

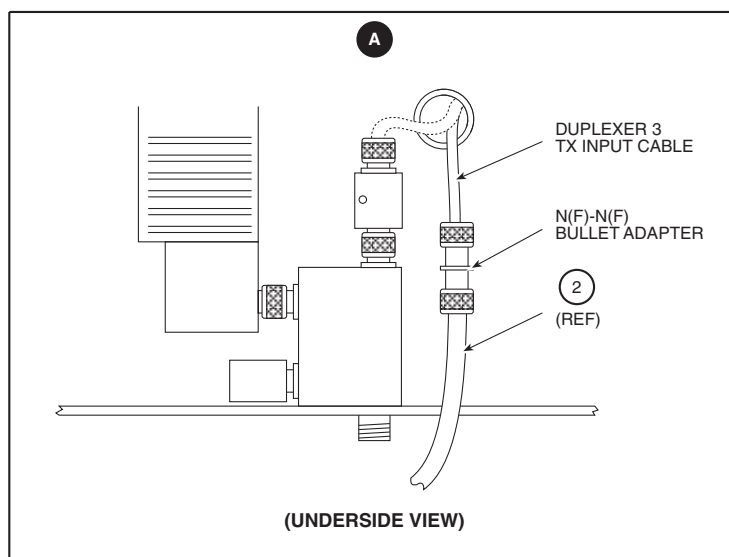
| Index                                                                                                                                                                                                                          | Part Number | From                                                                                                      | To                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                              | CKN6288A    | Expansion RFC Dual 3-Way Combiner Deck<br><b>T1</b> (OUT) port<br>(combined TX signal of lower-three BRs) | Main RFC ANT 2 duplexer TX input<br>(‘A’ port on jumper panel)                                           |
| 2                                                                                                                                                                                                                              | CKN6288A    | Expansion RFC Dual 3-Way Combiner Deck<br><b>T6</b> (OUT) port<br>(combined TX signal of upper-three BRs) | Main RFC ANT 3 duplexer TX input<br>Flying connection to TX input cable. See detail ‘A’<br>in Figure 6.) |
| <b>NOTE:</b> Refer to “Transmit Power Out Cabling” (Cabling Information subsection in <i>800 MHz GEN 4 Duplexed RF Distribution System</i> section of this manual) for BR-to-Combiner Deck cabling within GEN 4 Expansion RFC. |             |                                                                                                           |                                                                                                          |

## Cabling Information



## NOTES:

1. Connection to duplexer input is flying connection. Connection must be strain-relieved by tie-wrapping intercabinet cable to cabinet frame.



EBTS571  
033098LLN

Figure 6 **Type I Transmit Intercabinet Cabling  
(GEN 2 Main RF Cabinet)**

## Type II Transmit Intercabinet Cabling

### GEN 3 Intercabinet Cabling

Table 5 lists and Figure 7 shows the transmit intercabinet cabling for a Type II configuration (double-combined Expansion RFC to non-expansion GEN 3 Main RFC).

Table 5 **Type II Transmit Intercabinet Cabling (GEN 3 Main RF Cabinet)**

| Index                                                                                                                                                              | Part Number | From                                                                                                       | To                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1                                                                                                                                                                  | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck<br>T1 (OUT) port<br>(combined TX signal of all six expansion BRs) | Main RFC ANT 3 duplexer TX input |
| <b>NOTE:</b> Refer to "Double-Combining Expansion RF Cabinet Cabling" in this section for BR-to-Combiner Deck cabling within double-combining GEN 4 Expansion RFC. |             |                                                                                                            |                                  |

## Cabling Information

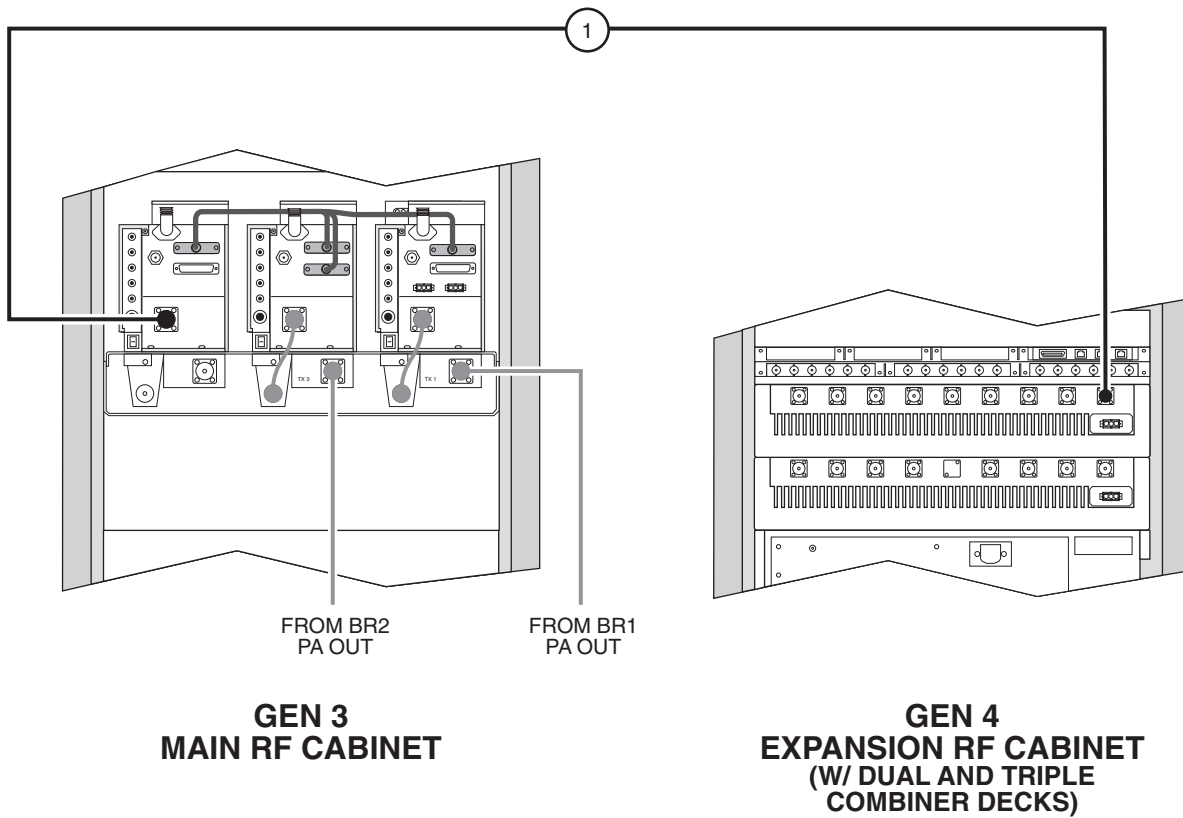
EBTS567  
032698LLN

Figure 7 **Type II Transmit Intercabinet Cabling  
(GEN 3 Main RF Cabinet)**

## GEN 2 Intercabinet Cabling

Table 6 lists and Figure 8 shows the transmit intercabinet cabling for a Type II configuration (double-combined Expansion RFC to non-expansion GEN 2 Main RFC).

### NOTE

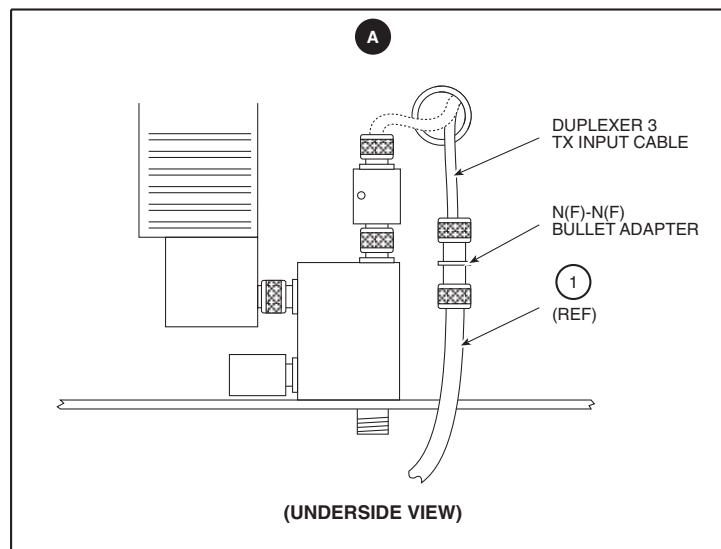
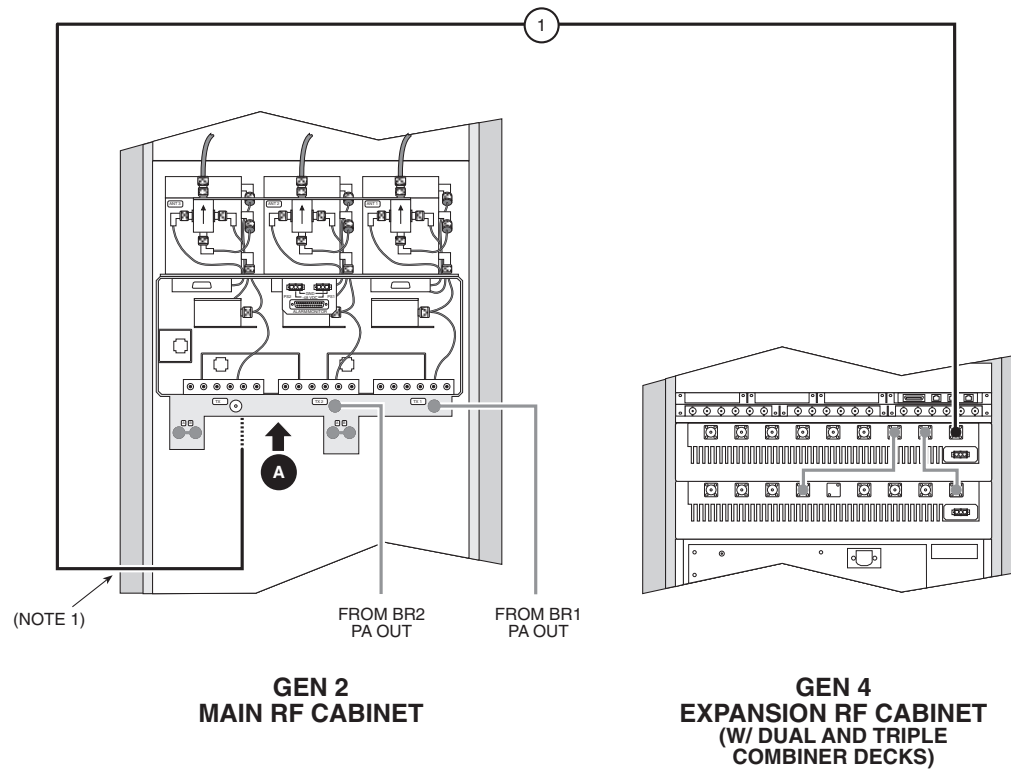
When connecting TX signals from the Expansion Cabinet to the Main RF Cabinet, do not connect the expansion cabinet signal(s) to the dual-stage isolator input. This results in severe intermodulation products at the antenna output.

Instead, the expansion cabinet signal(s) are applied directly to the duplexer TX input, as described and shown below.

Table 6 **Type II Transmit Intercabinet Cabling (GEN 2 Main RF Cabinet)**

| Index                                                                                                                                                              | Part Number | From                                                                                                    | To                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                  | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck T1 (OUT) port<br>(combined TX signal of all six expansion BRs) | Main RFC ANT 3 duplexer TX input.<br>(Flying connection to TX input cable. See detail 'A' in Figure 8.) |
| <b>NOTE:</b> Refer to "Double-Combining Expansion RF Cabinet Cabling" in this section for BR-to-Combiner Deck cabling within double-combining GEN 4 Expansion RFC. |             |                                                                                                         |                                                                                                         |

## Cabling Information



## NOTES:

1. Connection to duplexer input is flying connection. Connection must be strain-relieved by tie-wrapping intercabinet cable to cabinet frame.
2. N(F) - N(F) bullet adapter is field-procured.

EBTS572  
033098LLN

Figure 8 **Type II Transmit Intercabinet Cabling  
(GEN 2 Main RF Cabinet)**



## Type III Transmit Intercabinet Cabling

### GEN 3 Intercabinet Cabling

Table 7 lists and Figure 9 shows the transmit intercabinet cabling for a Type III configuration (single-combined Expansion RFC to expansion GEN 3 Main RFC).

*Table 7      Type III Transmit Intercabinet Cabling (GEN 3 Main RF Cabinet)*

| Index                                                                                                                                                                                                                          | Part Number | From                                                                                                        | To                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1                                                                                                                                                                                                                              | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck<br><b>T1</b> (OUT) port<br>(combined TX signal of lower-three BRs) | Main RFC ANT 2 duplexer TX input |
| 2                                                                                                                                                                                                                              | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck<br><b>T6</b> (OUT) port<br>(combined TX signal of upper-three BRs) | Main RFC ANT 3 duplexer TX input |
| <b>NOTE:</b> Refer to "Transmit Power Out Cabling" (Cabling Information subsection in <i>800 MHz GEN 4 Duplexed RF Distribution System</i> section of this manual) for BR-to-Combiner Deck cabling within GEN 4 Expansion RFC. |             |                                                                                                             |                                  |

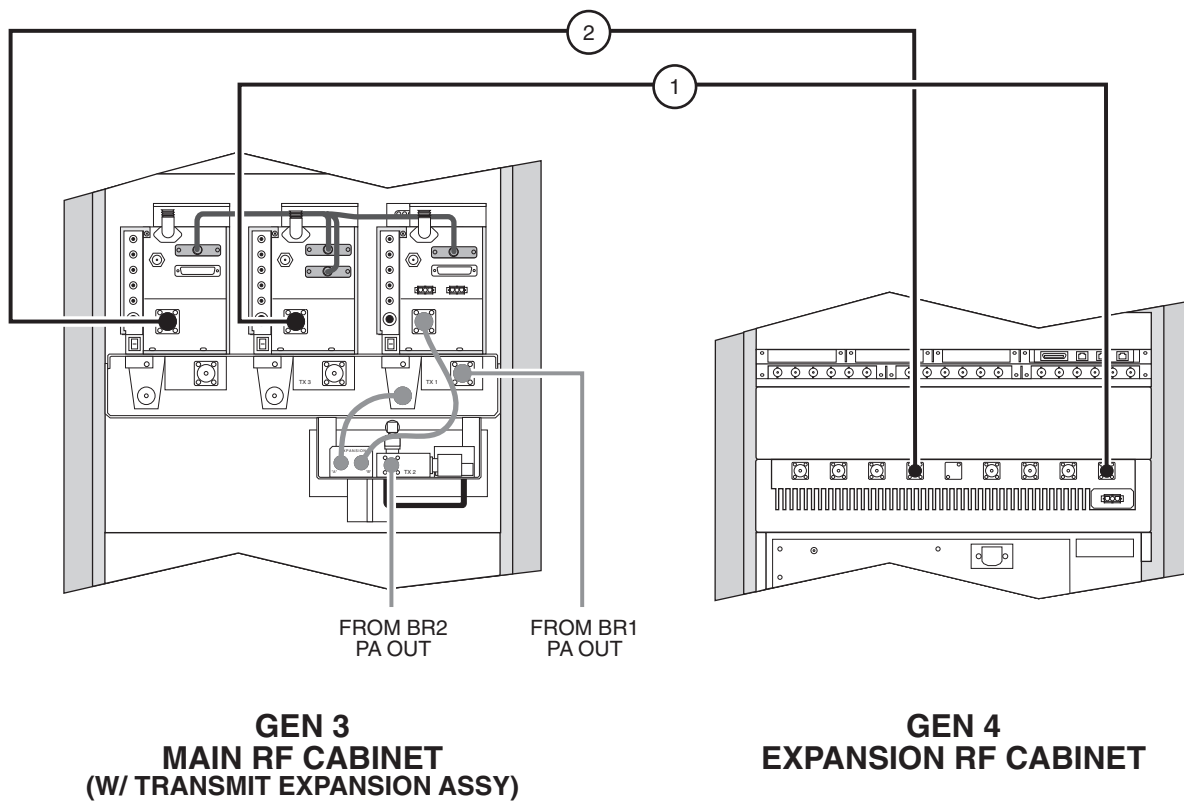
**Cabling Information**EBTS564  
032698LLN

Figure 9 **Type III Transmit Intercabinet Cabling**  
(GEN 3 Main RF Cabinet)

## GEN 2 Intercabinet Cabling

Table 8 lists and Figure 10 shows the transmit intercabinet cabling for a Type III configuration (single-combined Expansion RFC to expansion GEN 2 Main RFC).

### NOTE

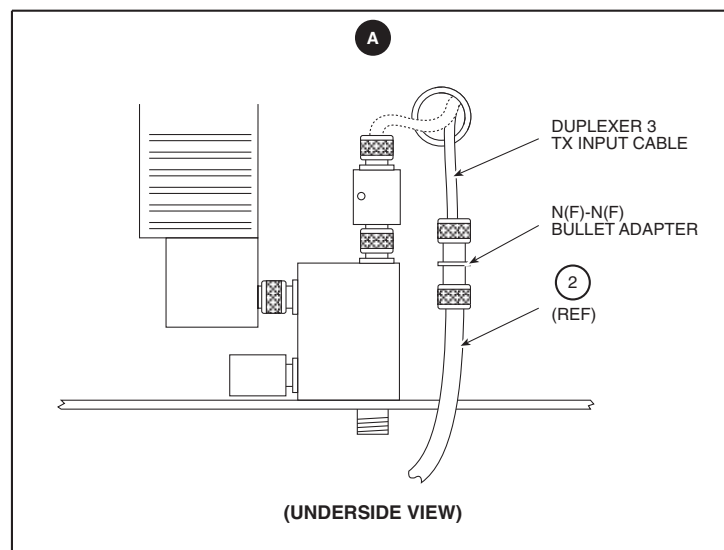
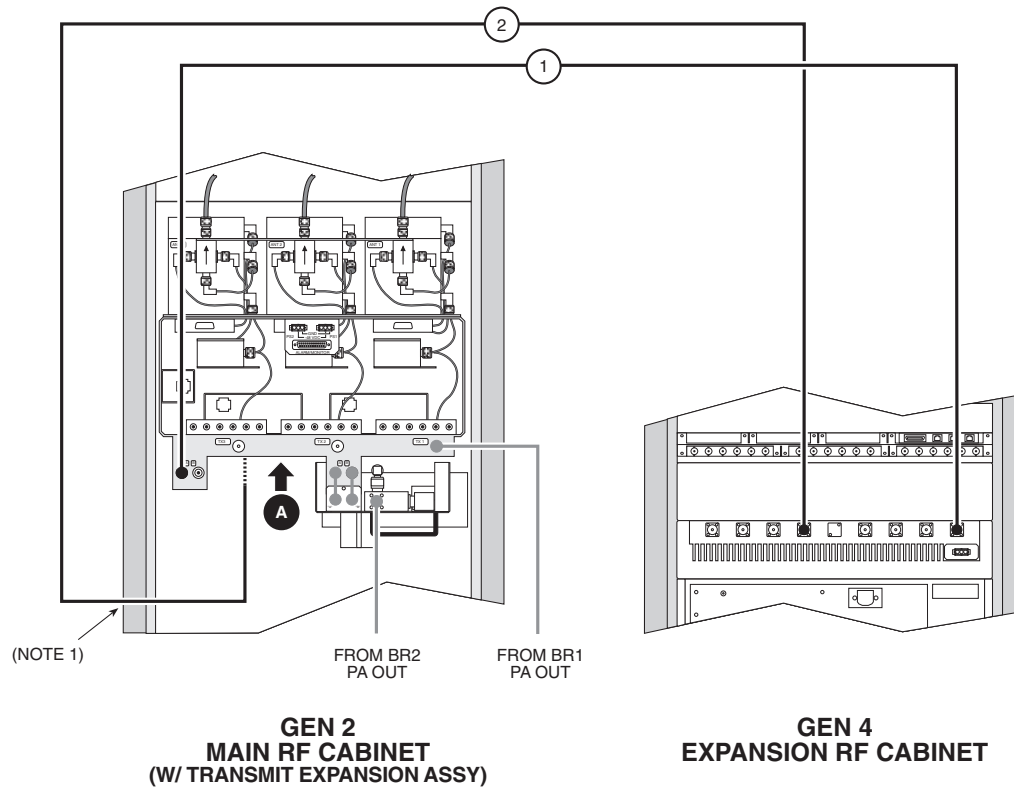
When connecting TX signals from the Expansion Cabinet to the Main RF Cabinet, do not connect the expansion cabinet signal(s) to the dual-stage isolator input. This results in severe intermodulation products at the antenna output.

Instead, the expansion cabinet signal(s) are applied directly to the duplexer TX input, as described and shown below.

Table 8 **Type III Transmit Intercabinet Cabling (GEN 2 Main RF Cabinet)**

| Index                                                                                                                                                                                                                          | Part Number | From                                                                                                        | To                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                              | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck<br><b>T1</b> (OUT) port<br>(combined TX signal of lower-three BRs) | Main RFC ANT 2 duplexer TX input<br>(‘A’ port on jumper panel)                                            |
| 2                                                                                                                                                                                                                              | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck<br><b>T6</b> (OUT) port<br>(combined TX signal of upper-three BRs) | Main RFC ANT 3 duplexer TX input<br>Flying connection to TX input cable. See detail ‘A’<br>in Figure 10.) |
| <b>NOTE:</b> Refer to “Transmit Power Out Cabling” (Cabling Information subsection in <i>800 MHz GEN 4 Duplexed RF Distribution System</i> section of this manual) for BR-to-Combiner Deck cabling within GEN 4 Expansion RFC. |             |                                                                                                             |                                                                                                           |

## Cabling Information



## NOTES:

1. Connection to duplexer input is flying connection. Connection must be strain-relieved by tie-wrapping inter-cabinet cable to cabinet frame.
2. N(F) - N(F) bullet adapter is field-procured.

EBTS576  
033098LLN

Figure 10 **Type III Transmit Intercabinet Cabling  
(GEN 2 Main RF Cabinet)**

## Type IV Transmit Intercabinet Cabling

### GEN 3 Intercabinet Cabling

Table 9 lists and Figure 11 shows the transmit intercabinet cabling for a Type IV configuration (double-combined Expansion RFC to expansion GEN 3 Main RFC).

*Table 9      Type IV Transmit Intercabinet Cabling (GEN 3 Main RF Cabinet)*

| Index                                                                                                                                                              | Part Number | From                                                                                                              | To                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1                                                                                                                                                                  | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck<br><b>T1</b> (OUT) port<br>(combined TX signal of all six expansion BRs) | Main RFC ANT 3 duplexer TX input |
| <b>NOTE:</b> Refer to "Double-Combining Expansion RF Cabinet Cabling" in this section for BR-to-Combiner Deck cabling within double-combining GEN 4 Expansion RFC. |             |                                                                                                                   |                                  |

## Cabling Information

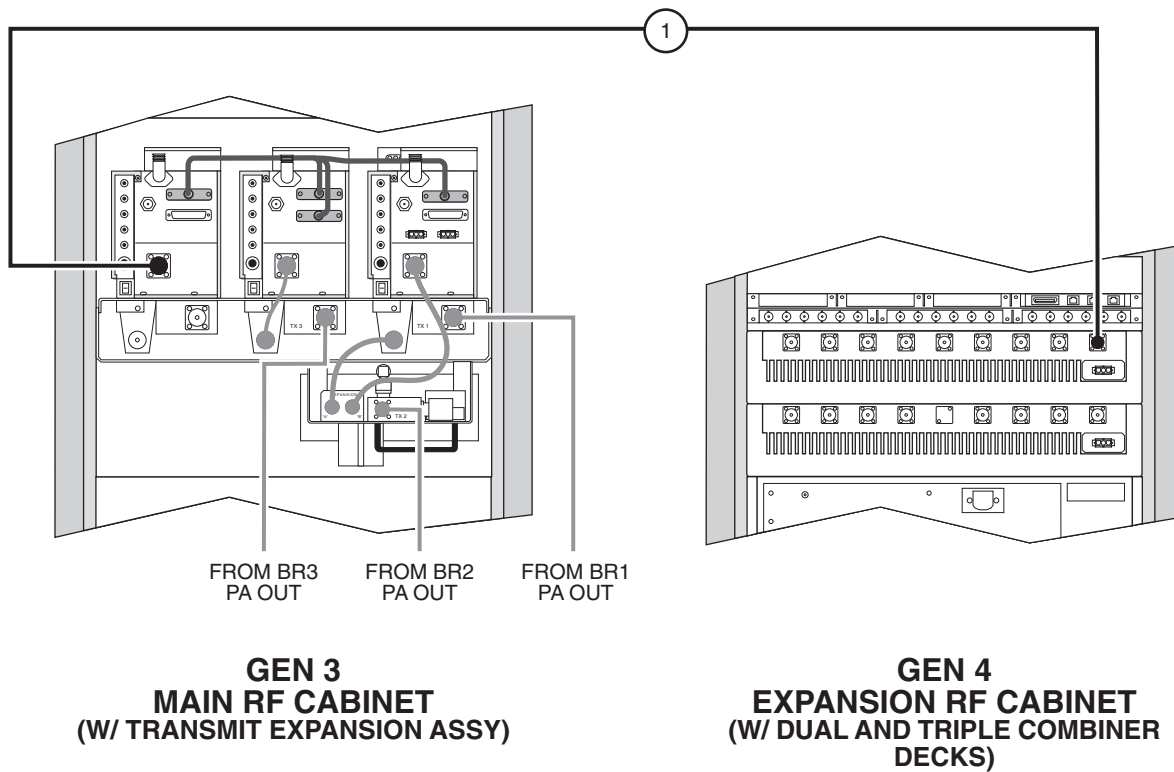
EBTS565  
032698LLN

Figure 11 **Type IV Transmit Intercabinet Cabling  
(GEN 3 Main RF Cabinet)**

## Type IV Transmit Intercabinet Cabling

### GEN 2 Intercabinet Cabling

Table 10 lists and Figure 12 shows the transmit intercabinet cabling for a Type IV configuration (double-combined Expansion RFC to expansion GEN 2 Main RFC).

#### NOTE

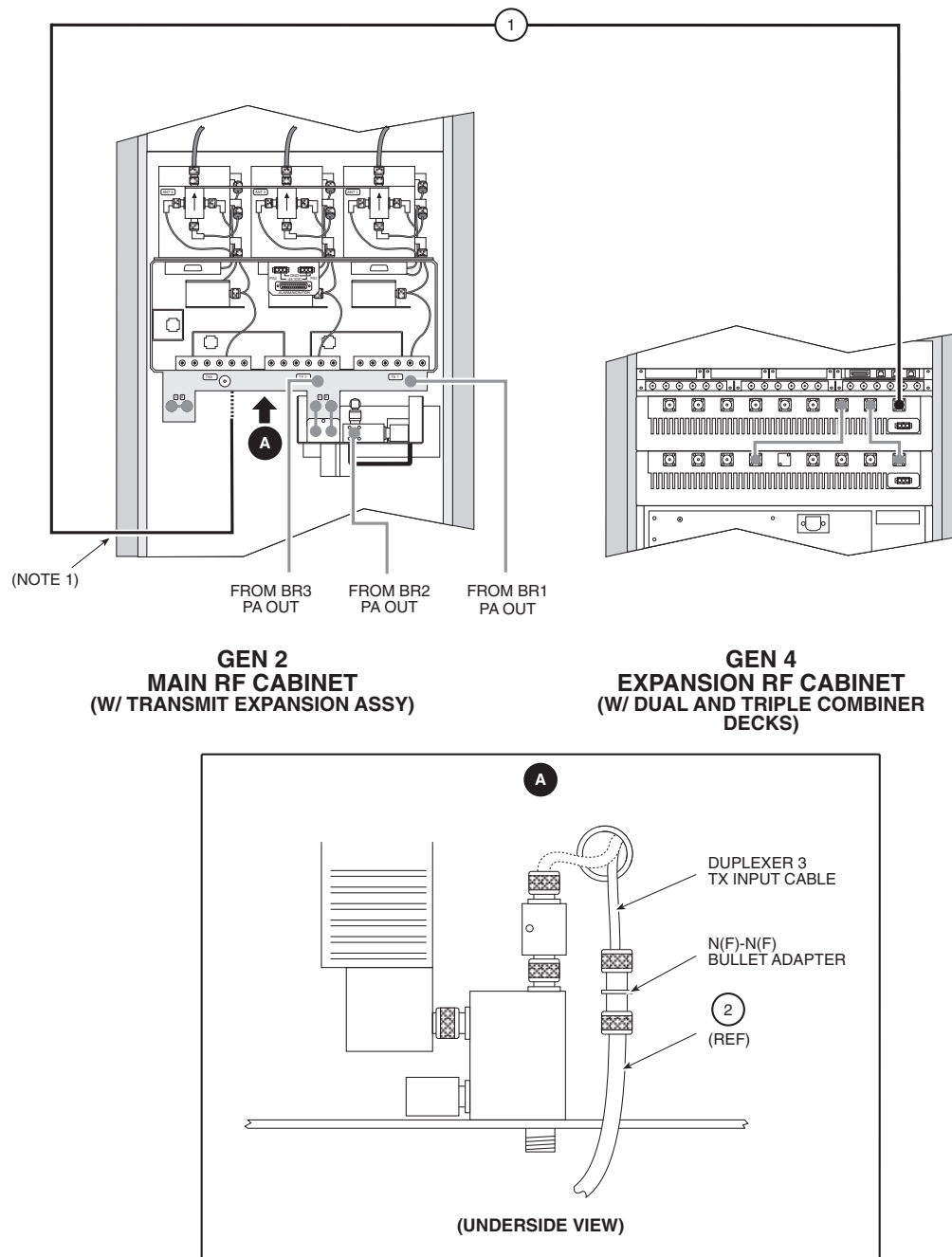
When connecting TX signals from the Expansion Cabinet to the Main RF Cabinet, do not connect the expansion cabinet signal(s) to the dual-stage isolator input. This results in severe intermodulation products at the antenna output.

Instead, the expansion cabinet signal(s) are applied directly to the duplexer TX input, as described and shown below.

Table 10 **Type IV Transmit Intercabinet Cabling (GEN 2 Main RF Cabinet)**

| Index                                                                                                                                                              | Part Number | From                                                                                                       | To                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                  | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck<br>T1 (OUT) port<br>(combined TX signal of all six expansion BRs) | Main RFC ANT 3 duplexer TX input<br>Flying connection to TX input cable. See detail 'A' in Figure 12.) |
| <b>NOTE:</b> Refer to "Double-Combining Expansion RF Cabinet Cabling" in this section for BR-to-Combiner Deck cabling within double-combining GEN 4 Expansion RFC. |             |                                                                                                            |                                                                                                        |

## Cabling Information



## NOTES:

EBTS574  
033098LLN

1. Connection to duplexer input is flying connection. Connection must be strain-relieved by tie-wrapping intercabinet cable to cabinet frame.
2. N(F) - N(F) bullet adapter is field-procured.

Figure 12 **Type IV Transmit Intercabinet Cabling (GEN 2 Main RF Cabinet)**



## Type V Transmit Intercabinet Cabling

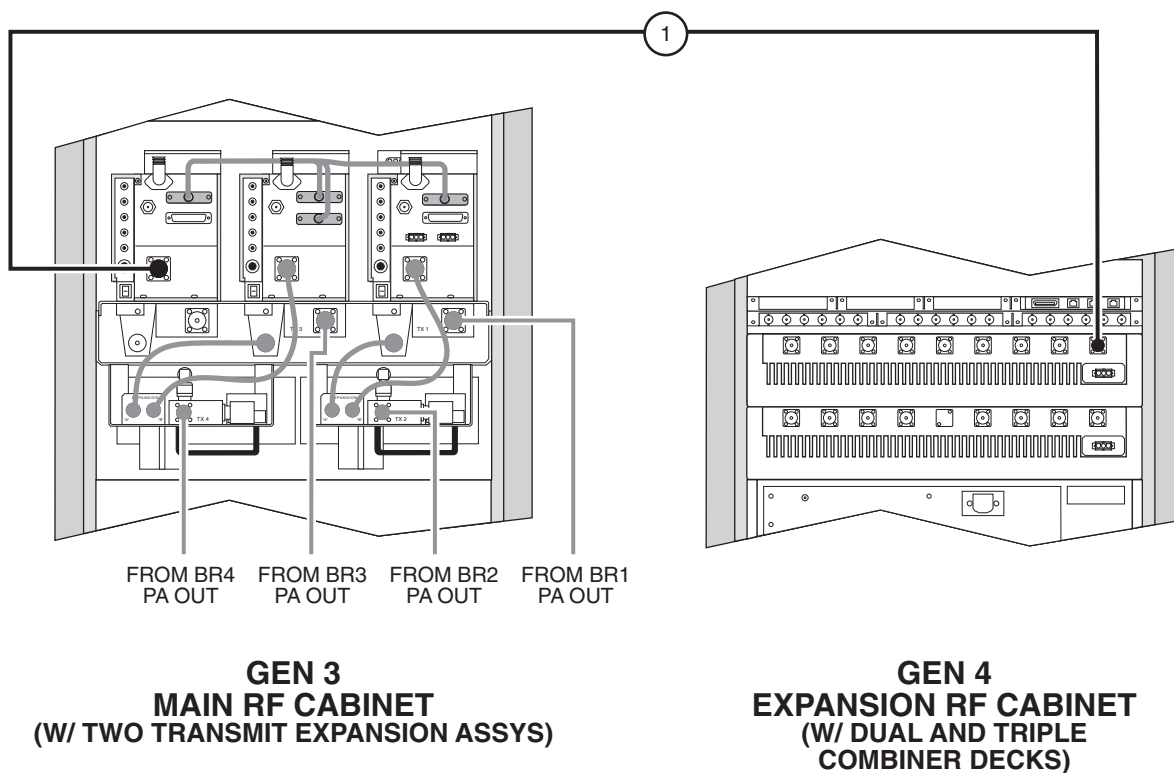
### GEN 3 Intercabinet Cabling

Table 11 lists and Figure 13 shows the transmit intercabinet cabling for a Type V configuration (double-combined Expansion RFC to expansion GEN 3 Main RFC).

Table 11      **Type V Transmit Intercabinet Cabling (GEN 3 Main RF Cabinet)**

| Index                                                                                                                                                              | Part Number | From                                                                                                              | To                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1                                                                                                                                                                  | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck<br><b>T1</b> (OUT) port<br>(combined TX signal of all six expansion BRs) | Main RFC ANT 3 duplexer TX input |
| <b>NOTE:</b> Refer to "Double-Combining Expansion RF Cabinet Cabling" in this section for BR-to-Combiner Deck cabling within double-combining GEN 4 Expansion RFC. |             |                                                                                                                   |                                  |

## Cabling Information



EBTS566  
032698LLN

Figure 13 **Type V Transmit Intercabinet Cabling**  
(GEN 3 Main RF Cabinet)

## GEN 2 Intercabinet Cabling

Table 12 lists and Figure 14 shows the transmit intercabinet cabling for a Type V configuration (double-combined Expansion RFC to expansion GEN 2 Main RFC).

### NOTE

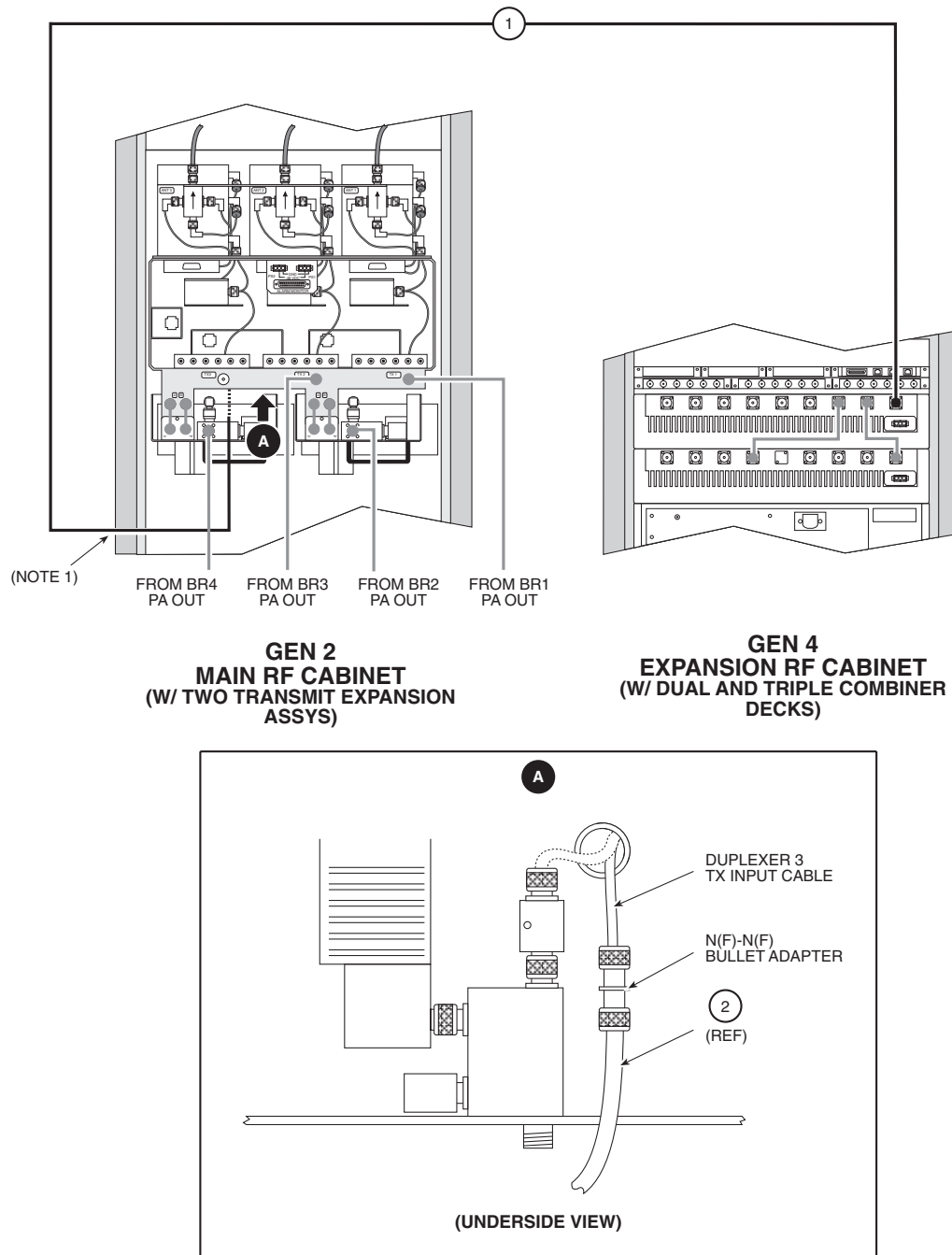
When connecting TX signals from the Expansion Cabinet to the Main RF Cabinet, do not connect the expansion cabinet signal(s) to the dual-stage isolator input. This results in severe intermodulation products at the antenna output.

Instead, the expansion cabinet signal(s) are applied directly to the duplexer TX input, as described and shown below.

Table 12 **Type V Transmit Intercabinet Cabling (GEN 2 Main RF Cabinet)**

| Index                                                                                                                                                              | Part Number | From                                                                                                       | To                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                  | CKN6288A    | Expansion RFC Triple 2-Way Combiner Deck<br>T1 (OUT) port<br>(combined TX signal of all six expansion BRs) | Main RFC ANT 3 duplexer TX input<br>Flying connection to TX input cable. See detail' in Figure 14.) |
| <b>NOTE:</b> Refer to "Double-Combining Expansion RF Cabinet Cabling" in this section for BR-to-Combiner Deck cabling within double-combining GEN 4 Expansion RFC. |             |                                                                                                            |                                                                                                     |

## Cabling Information



## NOTES:

1. Connection to duplexer input is flying connection.  
Connection must be strain-relieved by tie-wrapping intercabinet cable to cabinet frame.
2. N(F) - N(F) bullet adapter is field-procured.

EBTS575  
033098LLN

Figure 14 **Type V Transmit Intercabinet Cabling  
(GEN 2 Main RF Cabinet)**

## Double-Combining Expansion RF Cabinet Cabling

### NOTE

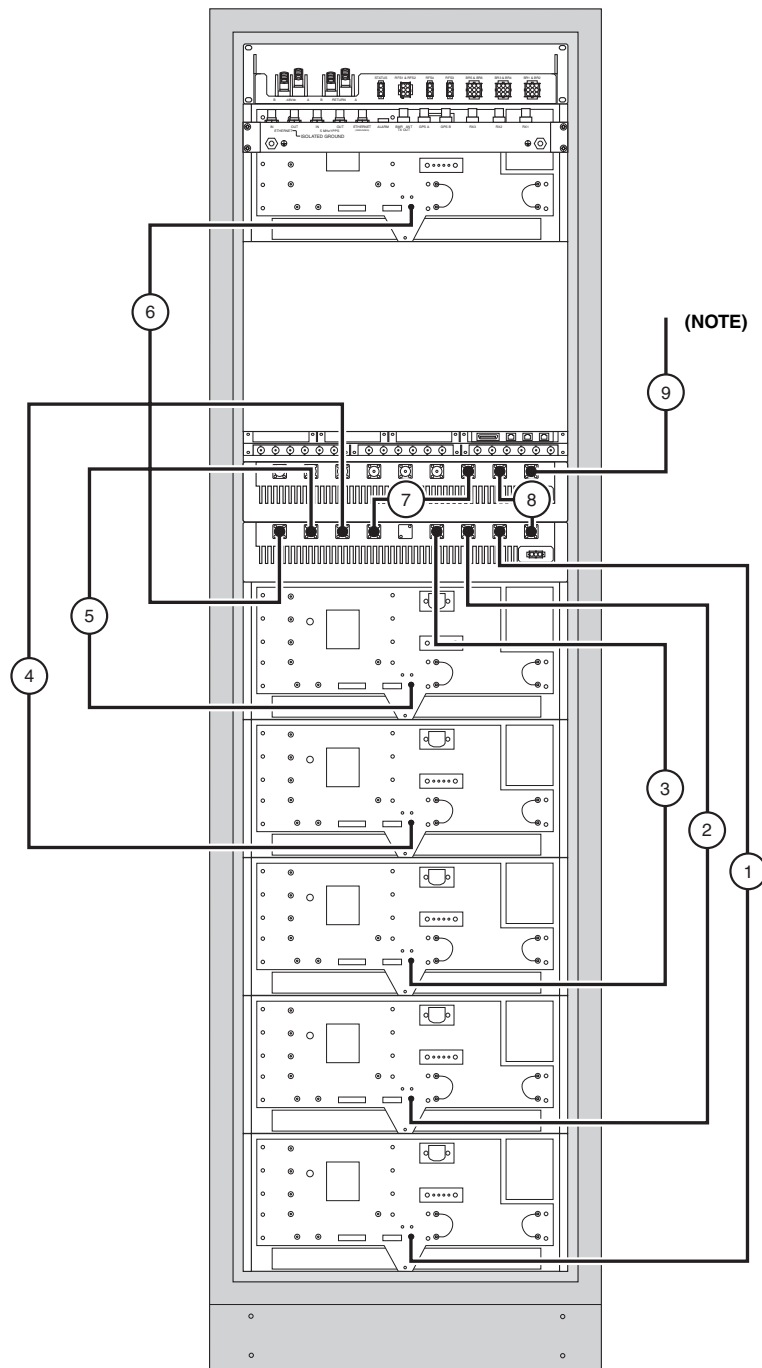
If adding a Triple 2-Way Combiner Deck to a GEN 4 cabinet, install deck in accordance with "Combiner Deck Replacement Procedure" (800 MHz GEN 4 Duplexed RF Distribution System section of this manual). Perform cabling as described below.

Table 13 identifies and Figure 15 shows the Tx cabling in a double-combining Expansion RF Cabinet.

Use this information if adding a Triple 2-Way Combiner Deck to a standard GEN 4 Expansion RF Cabinet.

Table 13 **Transmit Cabling (Double-Combining Expansion RF Cabinet)**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Part Number | From                                                                        | To                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------|------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0112004K14  | PA OUT connector on BR A                                                    | Dual 3-Way Combiner Deck <b>T2</b> (IN) port   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0112004K14  | PA OUT connector on BR B                                                    | Dual 3-Way Combiner Deck <b>T3</b> (IN) port   |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0112004K14  | PA OUT connector on BR C                                                    | Dual 3-Way Combiner Deck <b>T4</b> (IN) port   |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0112004K08  | PA OUT connector on BR D                                                    | Dual 3-Way Combiner Deck <b>T7</b> (IN) port   |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0112004K08  | PA OUT connector on BR E                                                    | Dual 3-Way Combiner Deck <b>T8</b> (IN) port   |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0112004K08  | PA OUT connector on BR F                                                    | Dual 3-Way Combiner Deck <b>T9</b> (IN) port   |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0112004B02  | Dual 3-Way Combiner Deck <b>T6</b> (OUT) port (BR D - BR F combined signal) | Triple 2-Way Combiner Deck <b>T3</b> (IN) port |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0112004B02  | Dual 3-Way Combiner Deck <b>T1</b> (OUT) port (BR A - BR C combined signal) | Triple 2-Way Combiner Deck <b>T2</b> (IN) port |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CKN6288A    | Dual 3-Way Combiner Deck <b>T1</b> (OUT) port                               | Main RF Cabinet (NOTE 2)                       |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. In above listing: BR A is lowest BR; BR F is highest BR.</li> <li>2. Index 9 shown for reference only. Refer to applicable preceding Transmit Intercabinet Cabling paragraph for intercabinet connection.</li> <li>3. Refer to "Receiver Cabling" (Cabling Information subsection in 800 MHz GEN 4 Duplexed RF Distribution System section of this manual) for Rx Tray-to-BR cabling within GEN 4 Expansion RFC.</li> <li>4. Refer to "Receive Intercabinet Cabling" in this section for intercabinet receive connections.</li> </ol> |             |                                                                             |                                                |

**Cabling Information**

EBTS562  
031998LLN

**NOTE:** Index 9 shown for reference only. Refer to applicable preceding Transmit Intercabinet Cabling paragraph for intercabinet connection.

Figure 15 **Transmit Cabling (Double-Combining Expansion RF Cabinet)**

# ***800 MHz GEN 4 Duplexed RF Distribution System***

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## **Overview**

This chapter provides technical information for the 800 MHz GEN 4 Duplexed RF Distribution System, hereinafter called the GEN 4 Duplexed RFDS.

| <b>Section</b>                                     | <b>Page</b> | <b>Description</b>                                                                                                                                                    |
|----------------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description                                        | 2           | Describes the GEN 4 Duplexed RFDS                                                                                                                                     |
| GEN 4 Duplexed RFDS Specifications                 | 8           | Provides performance specifications for the GEN 4 Duplexed RFDS                                                                                                       |
| GEN 4 Duplexed RFDS Theory of Operation            | 11          | Describes the transmit and receive functionalities of the GEN 4 Duplexed RFDS                                                                                         |
| Removal/Replacement Procedures                     | 36          | Provides instructions for replacing components of the GEN 4 Duplexed RFDS                                                                                             |
| Field Retrofit of Duplexed TTA Interface (CLN1403) | 49          | Provides instructions for field installation to retrofit the Main RF Cabinet with DTTA kits                                                                           |
| Cabling Information                                | 54          | Provides information on how to connect all cabling required for proper operation of EBTS with the GEN 4 Duplexed RFDS                                                 |
| Base Radio Buildout/GEN 4 Duplexed RFDS Expansion  | 80          | Provides instructions on adding additional Base Radios to an existing EBTS                                                                                            |
| Duplexed TTA Receive Branch Equalization           | 84          | Describes receive branch equalization requirements and methods for GEN 4 systems using Duplexed TTAs. Provides procedures for performing receive branch equalization. |

**Description**

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**Description**

The GEN 4 Duplexed RFDS is an 800 MHz duplexing/hybrid combining and receiver multicoupler system. Duplexers allow a transmit (Tx) and a receive (Rx) path to share a common antenna. Cascaded transmit combiner stages allow several transmit signals to be fed to a single duplexer/ antenna. Figure 1 shows the GEN 4 Duplexed RFDS.

The GEN 4 Duplexed RFDS contains several Field Replaceable Units (FRUs), including:

- ❑ An Rx LNA/Multicoupler Tray (Rx Tray), consisting of the following FRUs:
  - Three First Multicoupler/ Amplifier (4-Way) assemblies
  - Three Expansion Multicoupler/ Amplifier (6-Way) assemblies
  - Two Power Supplies
  - Alarm Board
  - Input/Output Interface Board (I/O Board)
- ❑ A Dual 3-Way Combiner Deck with Isolators

**NOTE**

The dual 3-Way Combiner is an optional item that may be used with QUAD Carrier sites or as an expansion FRU subsequent to the original site order. The Dual 3-Way Combiner combines Single Carrier Base Radios. In most circumstances, QUAD Base Radios cannot balance links when combined by 3 Way Combiner. Also, the QUAD BR does not require the isolators resident on the Dual 3-way tray. Refer to the iDEN price book for configuration and pricing information. A Triple 2-Way Combiner Deck without Isolators (optional).



- ❑ A Triple 2-Way Combiner Deck without Isolators (optional)

**NOTE**

The Triple 2-Way Combiner without isolators is an optional item that can be ordered with QUAD Carrier (and Single Carrier) sites or as an expansion FRU subsequent to the original site order. Refer to the iDEN price book for configuration and pricing information. The Triple 2-Way Combiner is used to combine multiple QUAD BRs into a single transmit antenna. Capacity limits may apply

- ❑ A Tower-Top Amplifier (TTA) Alarm Tray (optional), which contains three TTA alarm interface modules

Although similar in function to the earlier 0182020V06 duplexed RFDS, the GEN 4 Duplexed RFDS employs cascaded combining in a modularized, compact design. This modularization, along with a combining scheme based around the modularization, allows expansion with a minimum amount of added components. The cascaded combining, with the compact design, allow up to six Base Radios (BRs) per RF cabinet. This allows a maximum of 18 channels in a three-branch diversity site. (A 24-channel three-branch diversity site uses a fourth, transmit-only, antenna and two additional BRs.)

**Description**

For expansion, the earlier standard duplexed RFDS required “add-on” expansion assemblies in the Main RF Cabinet that took space that could be better used for Base Radios. However, the GEN 4 Duplexed RFDS expands without using Base Radio space for expansion assemblies. Expansion is phased; first, through full use of the existing Main RF Cabinet expansion space, and , secondly through additional expansion cabinet(s). (Expansion is explained in detail below.)

To eliminate the retrofit of several discrete expansion hardware items, the GEN 4 Duplexed RFDS uses combiner decks. The decks provide the various combining and signal conditioning functions normally associated with discrete hybrid coupler and coupler /load assemblies used in the standard duplexed expansion RFDS.

The Dual 3-Way Combiner Deck with Isolators and the Triple 2-Way Combiner Deck without Isolators (shown in Figures 2 and 3, respectively) provide a combining and signal conditioning interface between the Duplexers and several Base Radio transmit signals. Each RF Cabinet within a system uses a Dual 3-Way Combiner Deck as the primary interface between Base Radio Tx signals and the RFDS. Where required, a Triple 2-Way Combiner Deck is used in the Main RF cabinet to provide cascaded combining for systems consisting of more than 9 Base Radios.

The decks utilize a microstrip /groundplane design to facilitate transmission line properties that provide functions such as hybrid combining and harmonic filters. Due to the compact, high-density design of the combiner decks, a coldplate and forced-air cooling is used instead of the simple radiational /convective cooling used in the other RFDSs. The coldplate is a casting with integral heat sinks which conducts heat away from the circuitry. Additionally, fans provide concentrated cooling air flow across the assembly. The fans are not thermostatically controlled and operate continuously while power is applied to the cabinet.

An Rx Tray (Figure 4) is used for Rx signal distribution. Corresponding to the three Rx diversity branches, the Rx Tray contains three First Multicouplers (MCs) and three local Expansion MCs. Each First MC contains an amplifier /4-way multicoupler that accepts a single Rx signal and provides four outputs. These outputs provide the Rx signal to the 6-Way Expansion amplifiers in the Main RF Cabinet, and up to three expansion RF cabinets. Each Expansion MC contains an amplifier /6-way multicoupler that accepts a single Rx signal from the First MC and then provides six local outputs which are applied to the six Base Radios resident within each of the RF cabinets.

The Rx Tray also contains a dual-redundant power supply, an I/O board, an alarm diagnostics board, and a power /signal backplane (“midplane” board). The power supplies provide operating power for the Rx Tray receive multicouplers, as well as the combiner deck fans, tower top amplifiers, and the duplexer power monitor assemblies. The I/O board provides a power and alarm interconnect between various RFDS assemblies. The alarm diagnostics board detects and routes RFDS failure status information to the Environmental Alarm System (EAS) or the iDEN Monitor Unit (iMU) via the I/O board alarm interconnect.

## Multicarrier EBTS Configurations

Multicarrier specific racking configurations maximize RF density in a single iDEN RF rack. These new Multicarrier based sites include the Single Rack Redundant Controller (SRRC), Single Rack Single Controller (SRSC), and standalone primary rack configurations. The major differences between the Multicarrier optimized racks and its single carrier counterpart are:

- ❑ Multicarrier racks ship with a maximum of three (3) QUAD BRs per sector.
- ❑ Dual 3-way and triple 2-way combiners are optional in Multicarrier racking configurations. The Dual 3-way combiner with isolators can be purchased as part of the Multicarrier rack if single carrier BRs will be placed in that sector.

### Multicarrier SRRC

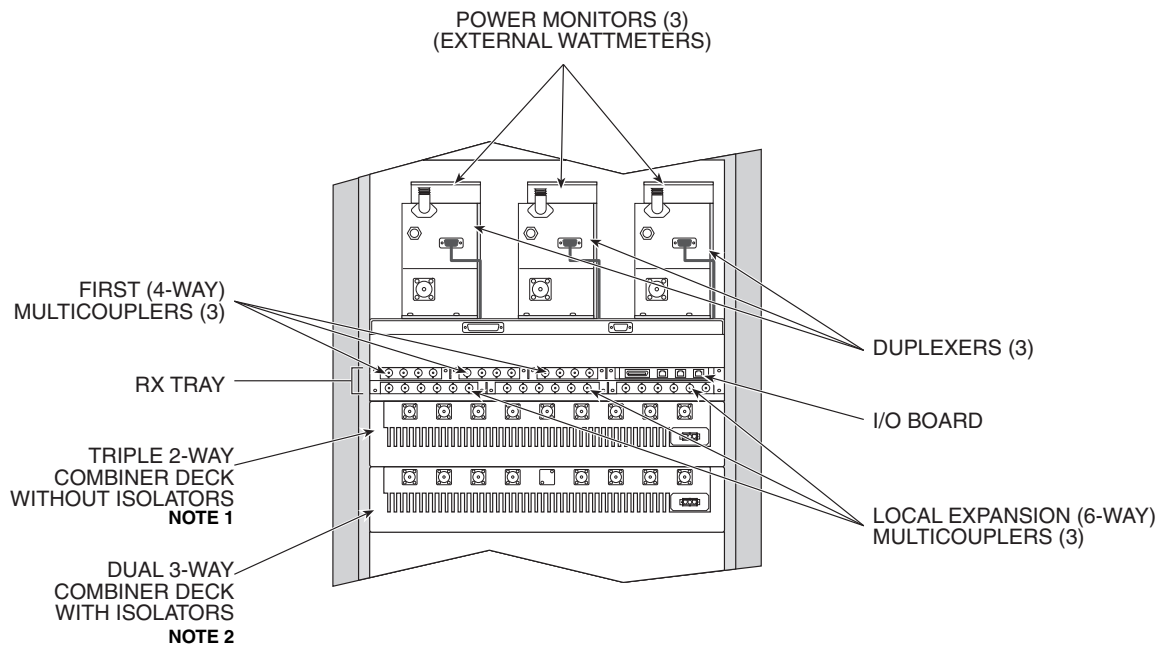
This configuration is the same as the Single Carrier SRRC Rack, except it ships with a maximum of three Multicarrier Base Radios. A triple 2-way combiner without isolators can be purchased as an option or installed as a field expansion when combining two Multicarrier BRs onto a single transmit antenna. The Dual 3-way combiner with isolators is also an option if Single Carrier BRs are planned for the site. Refer to Figure 1.

### Multicarrier SRSC

The Single Rack Single Controller (SRSC) Multicarrier BR configuration uses the same equipment as the Single Carrier version; however ships without a triple isolator deck in standard configuration. The triple isolator desk is optional for sites that may use Single Carrier Radios. Refer to Figure 1.

### Multicarrier Primary Rack

The Multicarrier Primary Rack configuration is similar to the Single Carrier Base Radio Primary Rack with the exception that the dual 3-way and triple 2-way combiners are optional in the Multicarrier configuration. The dual 3-way combiner can be added for Single Carrier Base Radio use while the triple 2-way combiner is required for combining two Multicarrier BRs onto a single antenna. Refer to Figure 1.

**Description**

EBTS461  
121897AJF

**NOTE 1:** FOR SINGLE CARRIER BR SITES: TRIPLE 2-WAY COMBINER DECK WITHOUT ISOLATORS IS ONLY REQUIRED FOR SYSTEMS WITH 10 OR MORE BASE RADIOS (REFER TO 'RFDS THEORY OF OPERATION' FOR MORE INFORMATION.)

**NOTE 2:** FOR QUAD PRIMARY RACK: DUAL 3-WAY COMBINER WITH ISOLATORS IS OPTIONAL, REQUIRED IF A SINGLE CARRIER BR WILL BE OPERATING IN A QUAD SITE.

Figure 1 **GEN 4 Duplexed RF Distribution System**

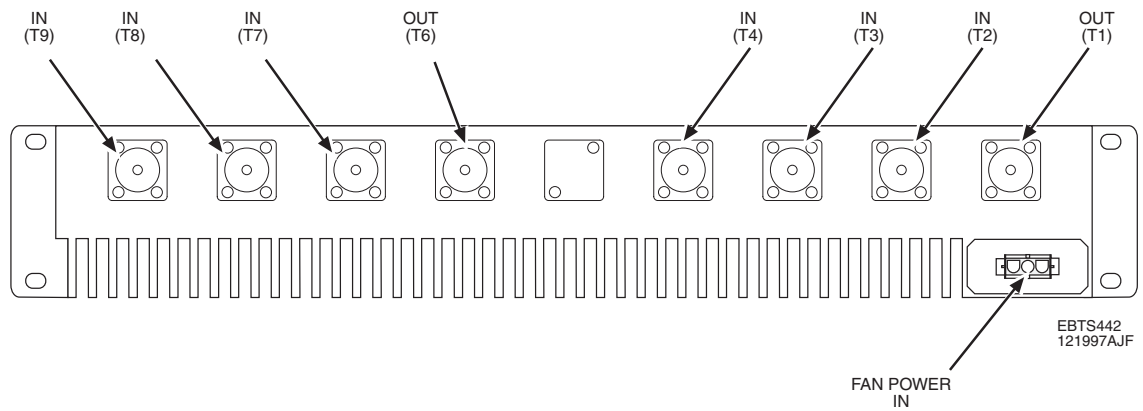
**Description**

Figure 2 **Dual 3-Way Combiner Deck**

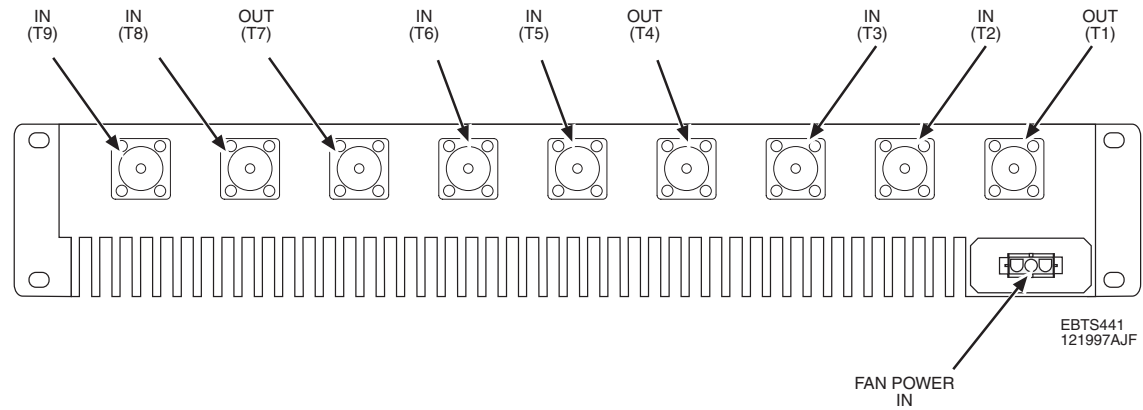


Figure 3 **Triple 2-Way Combiner Deck**

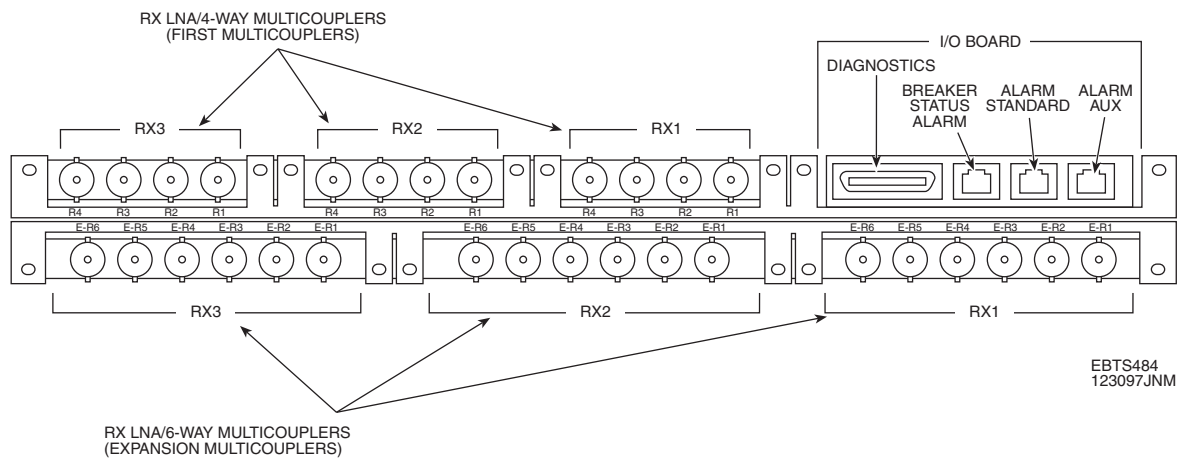


Figure 4 **Rx Tray**

**GEN 4 Duplexed RFDS Specifications**

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**GEN 4 Duplexed RFDS Specifications****GEN 4 Duplexed RFDS General Specifications**

Table 1 lists the general specifications for the GEN 4 Duplexed RFDS.

*Table 1 GEN 4 Duplexed RFDS General Specifications*

| Specification                           | Value or Range                               |
|-----------------------------------------|----------------------------------------------|
| Rack Space Requirement                  | 6 EIA Rack Units (RU)                        |
| Storage Temperature Range               | -40° to +203° F (-40 to +95° C)              |
| Operating Temperature Range             | +32° to +104° F (0 to +40° C)                |
| Cooling (Combiner Decks)                | Coldplate with continuous forced-air cooling |
| Frequency Range:<br>Receive<br>Transmit | 806 to 821 MHz<br>851 to 866 MHz             |
| Tx - Rx Spacing                         | 45 MHz                                       |
| Channel Spacing                         | 25 kHz (min.)                                |
| Port Impedance                          | 50 $\Omega$ (nom.)                           |
| Input Supply Voltage; RFDS              | -48 VDC t(-41 to -65 VDC )                   |
| Input Current; RFDS                     | 2.25 A (steady-state max.)                   |
| Input Supply Voltage; Fan Array         | 12 VDC                                       |

**Antenna to Receiver Specifications**

Table 2 lists the GEN 4 Duplexed RFDS antenna port-to-receiver port specifications for a single receive branch.

*Table 2 Duplexer Antenna Port-to-Receiver Port Specifications*

| Specification                                                                                  | Value or Range |
|------------------------------------------------------------------------------------------------|----------------|
| Gain (806 to 821 MHz):<br>$T_A = 77^\circ \text{ F } (25^\circ \text{ C})$ ambient temperature | 10.0 dB        |

## Transmitter to Antenna Specifications

Table 3 lists the GEN 4 Duplexed RFDS transmitter port-to-antenna port specifications. Figures 5 through 6 shows the 800 MHz transmit and receive filter response plots, respectively.

Table 3 **Duplexer Transmitter Port-to-Antenna Port Specifications**

| Specification                                                                                                           | Value or Range |         |
|-------------------------------------------------------------------------------------------------------------------------|----------------|---------|
|                                                                                                                         | Maximum        | Typical |
| Insertion Loss Passband*                                                                                                |                |         |
| 9-BR (3-way hybrid combining)                                                                                           | 8.5 dB         | 7.5 dB  |
| 12-BR (4-way hybrid combining)                                                                                          | 10.45 dB       | 9.2 dB  |
| 18-BR (6-way hybrid combining)                                                                                          | 12.5 dB        | 11.1 dB |
| * Includes combiner and associated cabling losses over 854-866 MHz range. (Losses are higher in the 851-854 MHz range.) |                |         |

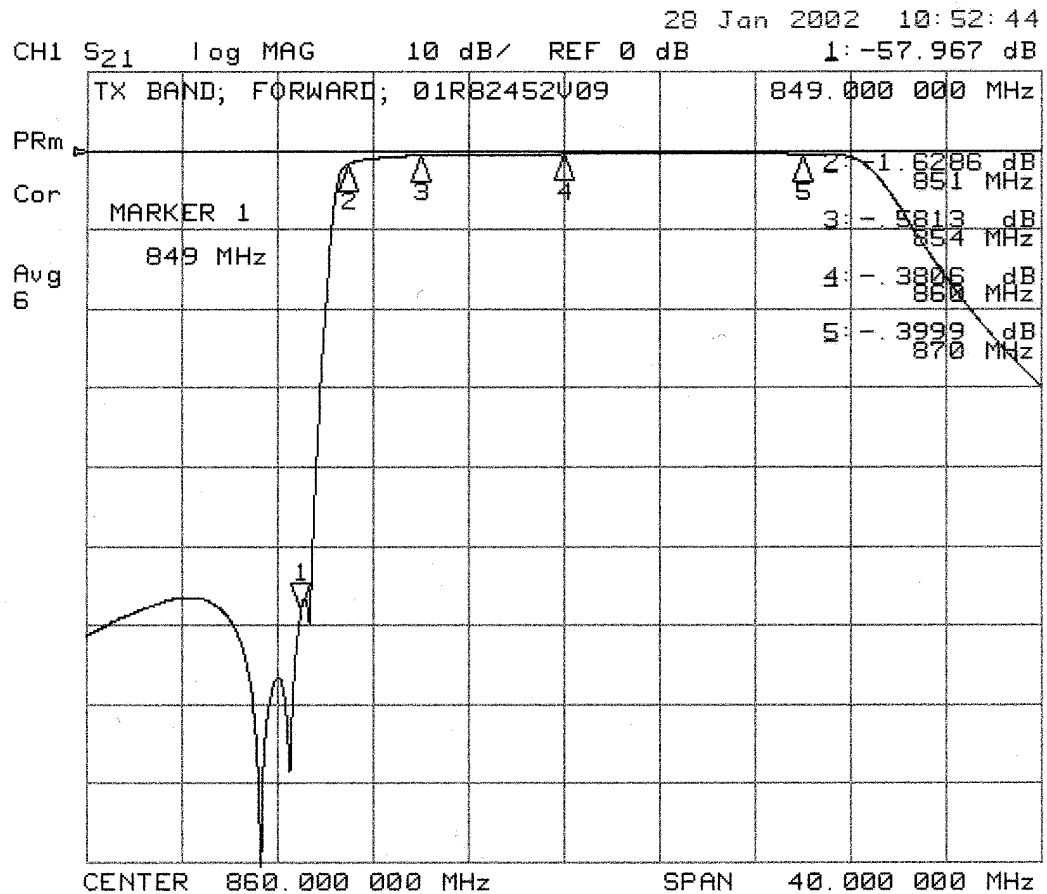


Figure 5 **Typical 800 MHz TX Duplexer filter response plot**

## GEN 4 Duplexed RFDS Specifications

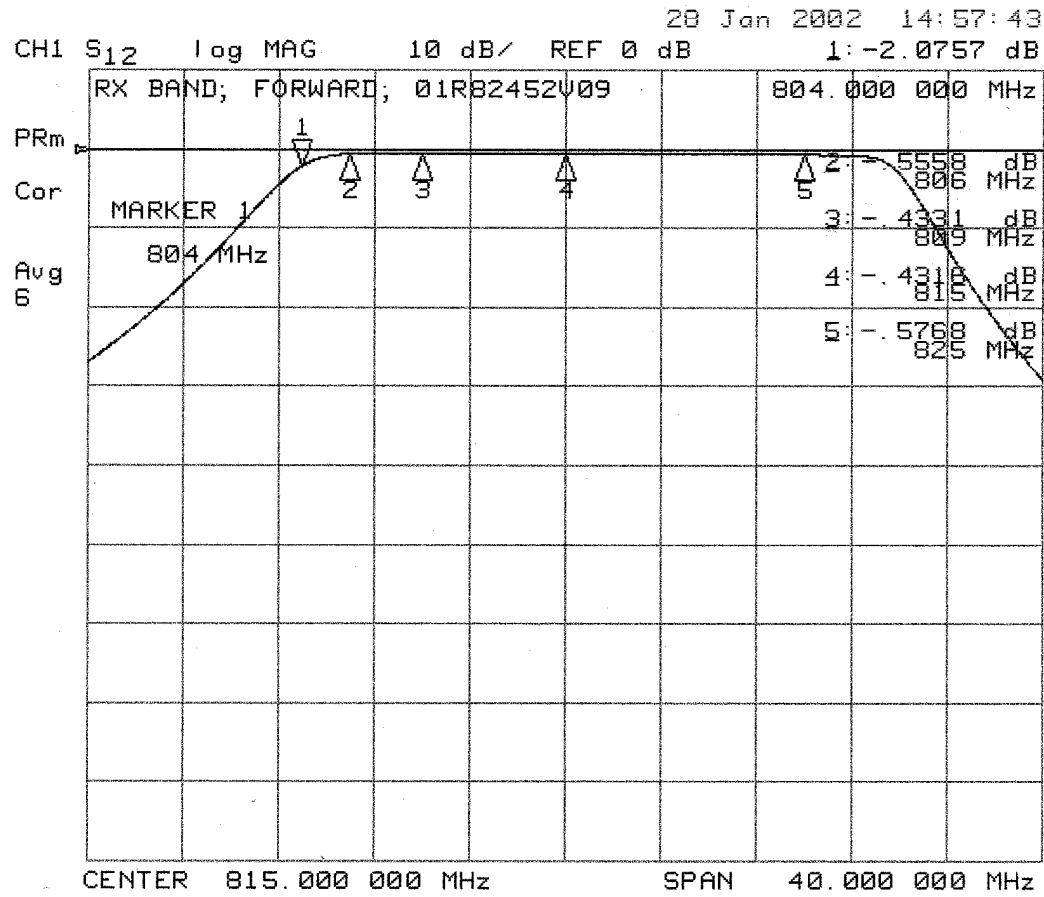


Figure 6 **Typical 800 MHz RX Duplexer filter response plot**



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## GEN 4 Duplexed RFDS Theory of Operation

Figures 7 through 8 show block diagrams for various GEN 4 Duplexed RFDS configurations.

### GEN 4 Duplexed RFDS Baseline Configuration

(See Figure 7.) The baseline configuration consists of a six Base Radio (BR), triple-receive diversity system. Without additional RFDS assemblies, the Main RF Cabinet can directly accommodate nine Base Radios with the addition of an Expansion RF Cabinet. All configurations build off of the baseline configuration. Therefore, the following applies to all configurations, except where noted.

#### Duplexer Operation

Three Duplexers accommodate three Transmit/Receive (Tx/Rx) antennas, ANT 1 through ANT 3. Each Duplexer is tuned to accept a transmit input (TX IN 1 through TX IN 3) in the 851-866 MHz range. (For transmit operation in the baseline configuration, only the ANT 1 and ANT 2 Duplexers are used.)

The respective Rx outputs furnished by the three Duplexers (RX OUT 1 through RX OUT 3) provide triple-diversity Rx signals for individual Base Radio receivers operating in the 806 - 821 MHz range. The RX OUT1 through RX OUT3 signals are applied to the Base Radio receivers through multicouplers, which are discussed later.

#### Transmit Operation

A Dual 3-Way Combiner Deck provides combining and isolation of multiple TX signals from the Base Radios. The deck consists of two microstrip / groundplane printed circuits which provide filtering and combining functions. The circuit cards also contain discrete isolator devices.

Base Radio 1 through 3 transmit signals TX1 through TX3 are applied to the first of two sections of the Dual 3-Way Combiner Deck. Each section of the deck combines three Tx inputs onto one line. Tx signals TX1 through TX3 are each applied through a single-stage isolator. From the isolators, the signals are passed through harmonic filters and then combined by a Wilkinson three-input coupler. The output of the Wilkinson coupler is then fed to the ANT 1 Duplexer TX input.

Harmonic filters are used in each Tx signal path to prevent undesired intermodulation products due to simultaneous Tx signals.

Base Radio 4 through 6 transmit signals TX4 through TX6 are similarly applied to the second section of the Dual 3-Way Combiner Deck. (In cases where less than six BRs are used, the unused TX inputs are left unconnected.) The output of the second Wilkinson coupler is then fed to the ANT 2 Duplexer TX input.

**GEN 4 Duplexed RFDS Theory of Operation****Receive Operation**

Each receive branch of the GEN 4 Duplexed RFDS uses a First Multicoupler (First MC) and a local Expansion MC. Both splitters each use a Multicoupler/ Amplifier (MC/ Amp) which converts a single receive signal into multiple buffered receive signals. All three Rx branches function identically; therefore, only the RX1 is discussed here.

The First MC consists of a low-noise amplifier and a four-way multicoupler (splitter). The First MC takes the RX OUT signal from the ANT 1 Duplexer and provides four outputs. Three outputs (R2 through R4) respectively provide RX1 signal feeds for up to three expansion cabinets. The remaining output (R1) feeds the local Expansion MC through a 2-dB inline attenuator. The 2-dB inline attenuator balances the Main RF Cabinet Rx path with that of the higher-loss expansion Rx paths.

**NOTE**

On systems using local Expansion (6-Way) Multicoupler with board kit CTF6140B (and later), an external attenuator is not required since the attenuator is built-in to the board design. In addition, the attenuator is automatically activated when a First (4-Way) Multicoupler is present, and deactivated when a First (4-Way) Multicoupler is not present.

The local Expansion MC uses a low-noise amplifier and a six-way splitter to provide RX1 signals to the Main RF Cabinet Base Radios. The splitter takes the RX1 signal from the First MC and provides six Expansion Receive outputs (E-R1 through E-R6). The E-R1 through E-R6 outputs respectively feed the RX1 receivers in Main RF Cabinet Base Radios 1 through 6. (On systems using less than six BRs, unused Expansion Receive ports are terminated with 50 $\Omega$  load, P/N 0909906D01.)

Although the baseline system combines the Tx signals onto the ANT 1 and ANT 2 Duplexer/ antennas, the three Tx/Rx antennas (along with the Rx circuitry shown in Figure 7) provide triple-diversity receive for all configurations.

**Power Monitoring**

A dual-directional coupler is installed on each Duplexer antenna port. The couplers are in-line and provide forward and reflected RF signal samples. These signal samples are fed to power monitors that, in turn, read the forward and reflected power readings from the antenna.

## GEN 4 Duplexed RFDS Theory of Operation

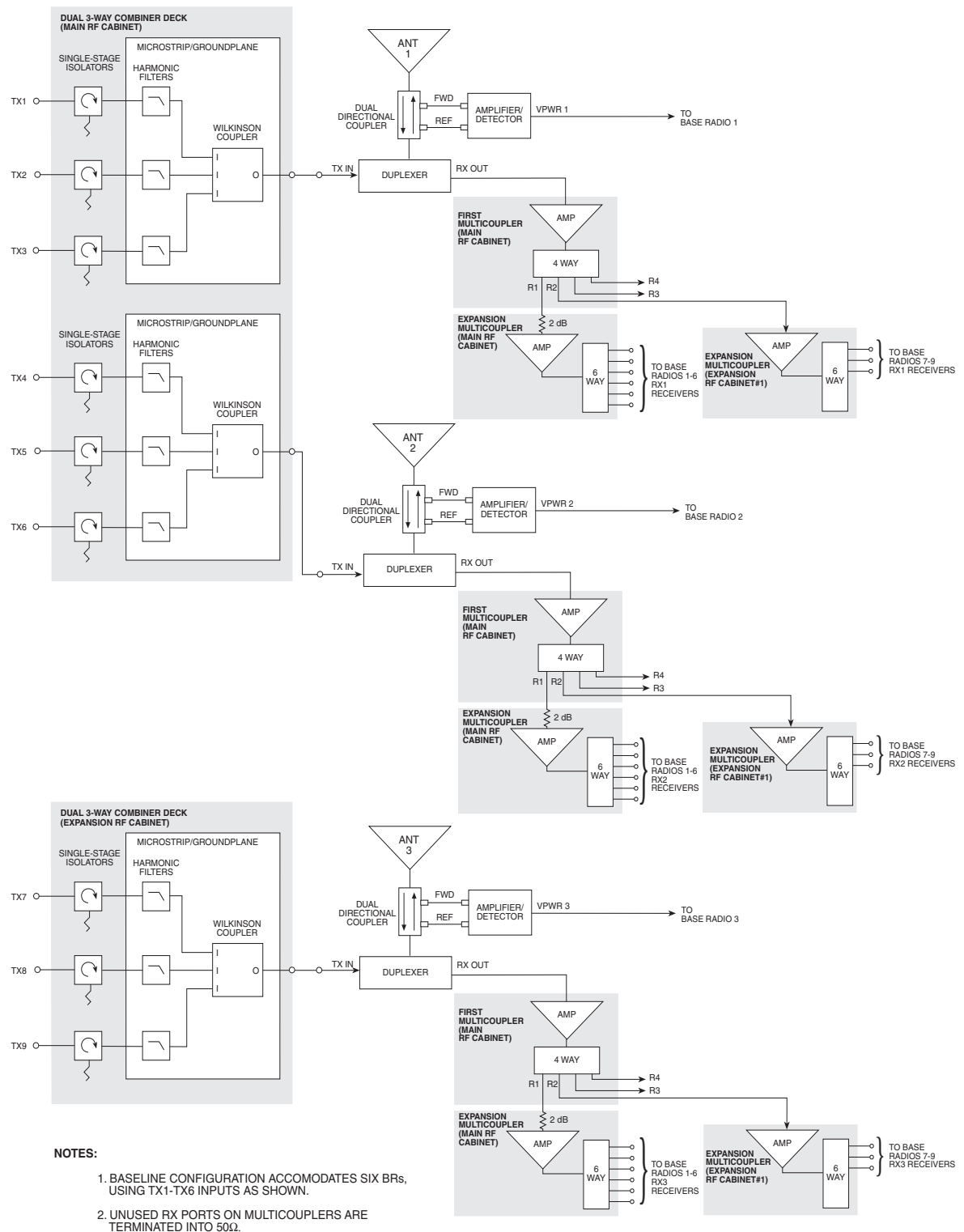
EBTS398  
122397AJF

Figure 7 1-9 BR GEN 4 Duplexed RFDS Block Diagram

## GEN 4 Duplexed RFDS Theory of Operation

The power monitors measure the power readings by converting forward-power signal sample FWD and reflected-power signal sample REF into DC voltages. These DC voltages (VPWR1 through VPWR3) are proportional to the forward and reflected power readings. VPWR1 through VPWR3 are sent to Base Radios 1 through 3, respectively, where they are used to determine the forward and reflected power readings. They are also used to calculate the VSWR at a particular antenna port.

### NOTE

It should be noted that even though Base Radios 2 and 3 are both transmitting over antenna 1, these Base Radios are in fact actually monitoring antennas 2 and 3 via the Base Radio 2 VPWR2 interface to duplexer 2, and the Base Radio 3 VPWR3 interface to duplexer 3.

As such, on systems where no transmit signals are applied to duplexer 2 and/or 3, these monitor connections would provide false alarm indications. Therefore, in such cases the power monitor cables connected to the corresponding Base Radio(s) must be disconnected from the Base Radio's ALARM connector.

## GEN 4 Duplexed RFDS Alarm Circuit

Two opto-isolator outputs send alarm closure signals to the Environmental Alarm System (EAS) or the iDEN Monitor Unit (iMU): One diagnostic alarm output is provided for both of the power supplies; the other alarm is provided for each of the MC/Amps in both the First MCs and local Expansion MCs. The alarms operate as normally closed loops. As such, when either (or both) of the power supplies experiences a failure, an alarm is generated. Similarly, when any combination of amplifiers experiences a failure, an alarm is generated. Upon detection of an alarm condition, the respective alarm will open to generate an alarm signal. The alarm signals are routed to the EAS/iMU by way of the Alarm output telco connector on the Rx Tray I/O board.

## GEN 4 Duplexed RFDS Expansion Configurations

System expansion is organized into four different levels of total BR count, as follows:

- ☐ 9-BR System Expansion
- ☐ 12-BR System Expansion
- ☐ 18-BR System Expansion
- ☐ 19-24 BR System Expansion

The expansion level ranges listed above are basically dictated by the level of expansion assemblies installed in the system. Intermediate levels of expansion are feasible between any of the levels stated above.

### **Receive Expansion**

(See Figure 8.) All expansion configurations use the same method to distribute the triple-diversity Rx signals to the BRs. Therefore, this discussion applies to all of the expansion configurations.

The expansion R2 through R4 outputs of the Main RF Cabinet First MC provide the Rx signal feeds for up to three Expansion RF Cabinets. This arrangement accommodates up to 24 Base Radios. In this manner, the system expands a single receive path from an antenna/duplexer using 6-way local Expansion MCs that cascade off of the Main RF Cabinet four-way First MC. Each Rx distribution system for each antenna branch of the system is identical. Therefore, only the RX1 signal for antenna/duplexer 1 is discussed here.

The R2 receive signal at the Main RF Cabinet First MC is fed to Expansion RF Cabinet #1 via an intercabinet cable. The R2 receive signal is then applied to a local Expansion MC in the expansion cabinet. The local Expansion MC develops six outputs (E-R1 through E-R6) which are respectively applied to expansion cabinet Base Radios 7 through 12.

Similar to the R2 signal, the R3 output provides an Rx feed which develops signals E-R1 through E-R6 for Base Radios 13 through 18 in expansion cabinet #2. Furthermore, the R4 output provides an Rx feed which develops signals E-R1 through E-R6 for Base Radios 19 through 24 in expansion cabinet #3.

Because the Rx paths for the Expansion RF Cabinet(s) experience more loss than the Main RF Cabinet Rx path, a 2-dB inline attenuator is inserted between the Main RF Cabinet First MC and Expansion MC. The 2-dB inline attenuator balances the Main RF Cabinet Rx path with that of the higher-loss expansion Rx paths.



## 1-6 BR System (Baseline System)

The baseline system using a single Main RF Cabinet supports up to six BRs simply by adding Base Radios to the cabinet.

## 1-9 BR System Expansion

(See Figure 7.) The baseline system directly supports up to nine BRs. The 9-BR arrangement uses one section of a Dual 3-Way Combiner Deck located in an Expansion RF Cabinet for Base Radios 7 through 9; this Combiner Deck is identical to that used for Base Radios 1 through 6 in the Main RF Cabinet.

Via a low-loss intercabinet cable, the combined Tx output for Base Radios 7 through 9 is fed to the ANT 3 Duplexer/antenna in the Main RF Cabinet.

In summary, Base Radios 1 through 3 send their Tx signals to the ANT 1 Duplexer, Base Radios 4 through 6 send their Tx signals to the ANT 2 Duplexer, and Base Radios 7 through 9 send their Tx signals to the ANT 3 Duplexer.

## 1-12 BR System Expansion

(See Figure 7.) The 1-12 BR system expansion uses cascaded combining, consisting of Dual 3-Way Combiner Decks and a Triple 2-Way Combiner Deck.

The Triple 2-Way Combiner Deck (located in the Main RF cabinet) consists of three microstrip/groundplane printed circuits which function as three, 2-input hybrid couplers. Each of three sections of this deck combines a pair of signals from a Dual 3-Way Combiner Deck into one signal that feeds to a Duplexer Tx input.

In the 1-12 BR system expansion configuration, the Main RF Cabinet is fully populated with BR1 through BR6 and an Expansion RF Cabinet is fully populated with BR7 through BR12.

The TX1-TX3 combined output and TX4-TX6 combined output from the Main RF Cabinet Dual 3-Way Combiner Deck are applied to the first section of the Triple 2-Way Combiner Deck. From the hybrid coupler in the deck, the combined TX1-TX6 signal is then applied to the ANT 1 Duplexer TX input.

Similarly, the TX7-TX9 combined output and TX10-TX12 combined output from the Expansion RF Cabinet #1 Dual 3-Way Combiner Deck are applied to the second section of the Triple 2-Way Combiner Deck via two low-loss intercabinet cables. From the hybrid coupler in the deck, the combined TX7-TX12 signal is then applied to the ANT 2 Duplexer TX input. (The third section of the Triple 2-Way Combiner Deck is totally unused in this configuration.)

In summary, Base Radios 1 through 6 send their Tx signals to the ANT 1 Duplexer, and Base Radios 7 through 12 send their Tx signals to the ANT 2 Duplexer.

## 1-18 BR System Expansion

(See Figure 7.) The 1-18 BR system expansion uses the 1-12 BR system expansion arrangement discussed above, along with a similar arrangement for Base Radios 13 through 18.

**GEN 4 Duplexed RFDS Theory of Operation**

In the 1-18 BR system expansion configuration, the Main RF Cabinet is fully populated with BR1 through BR6, Expansion RF Cabinet #1 is fully populated with BR7 through BR12, and Expansion RF Cabinet #2 is fully populated with BR13 through BR18.

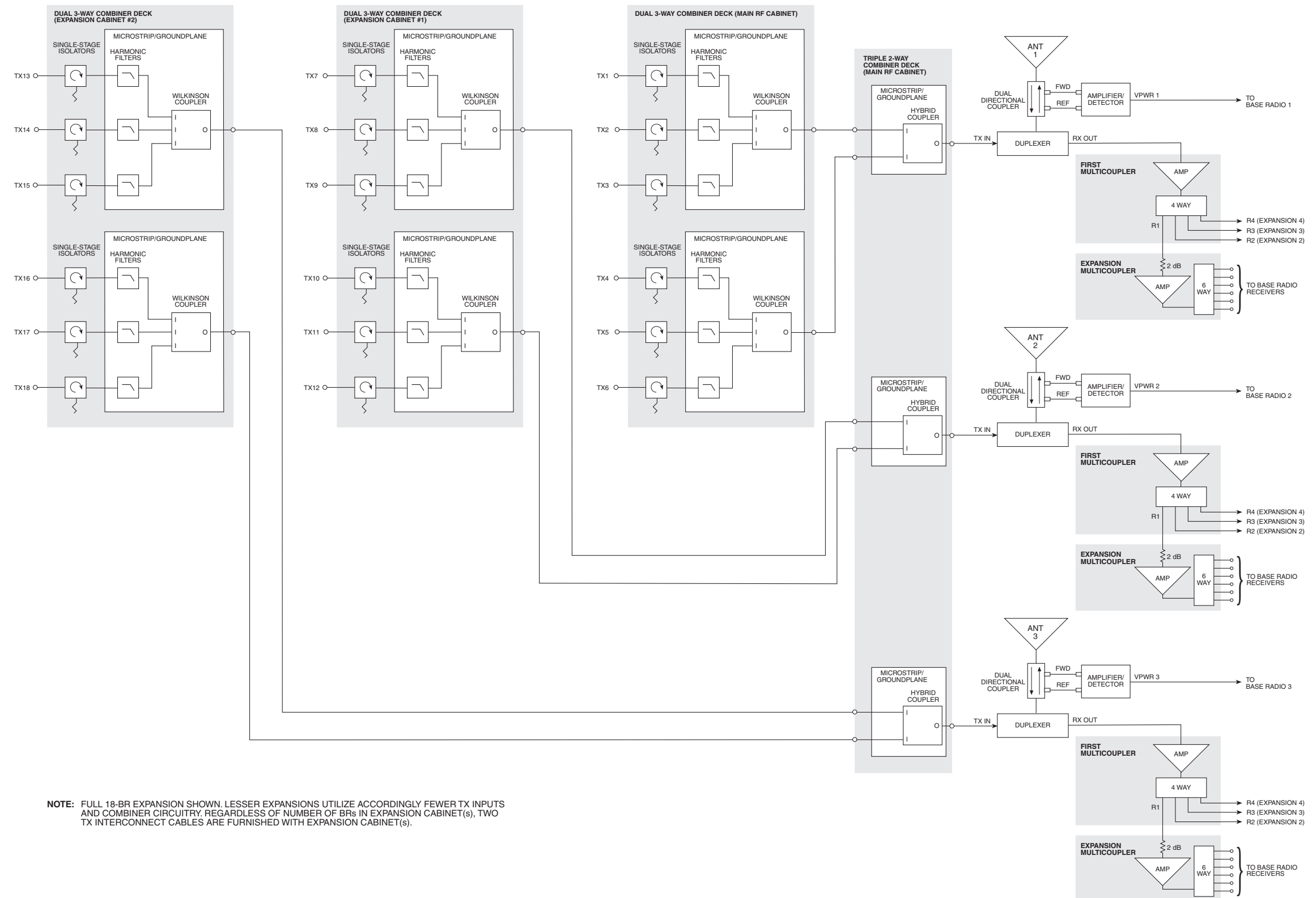
The 1-18 BR system expansion utilizes the 1-12 BR expansion discussed earlier. Additionally, this configuration uses an arrangement for Expansion RF Cabinet #2 Base Radios 13 through 18 that is identical to that used for Base Radios 1 through 6 discussed earlier.

Via two low-loss intercabinet cables, the TX13-TX15 combined output and TX16-TX18 combined output from the Dual 3-Way Combiner Deck in Expansion RF Cabinet #2 are applied to third section of the Triple 2-Way Combiner Deck in the Main RF Cabinet. From the hybrid coupler in the deck, the combined TX13-TX18 signal is then applied to the ANT 3 Duplexer TX input.

In summary, Base Radios 1 through 6 send their Tx signals to the ANT 1 Duplexer, Base Radios 7 through 12 send their Tx signals to the ANT 2 Duplexer, and Base Radios 13 through 18 send their Tx signals to the ANT 3 Duplexer.



### Theory of Operation



**NOTE:** FULL 18-BR EXPANSION SHOWN. LESSER EXPANSIONS UTILIZE ACCORDINGLY FEWER TX INPUTS AND COMBINER CIRCUITRY. REGARDLESS OF NUMBER OF BRs IN EXPANSION CABINET(S), TWO TX INTERCONNECT CABLES ARE FURNISHED WITH EXPANSION CABINET(S).

EBTS483  
122397AJF

**Figure 9 1-12 BR And 1-18 BR GEN 4 Duplexed RFDS Block Diagram**

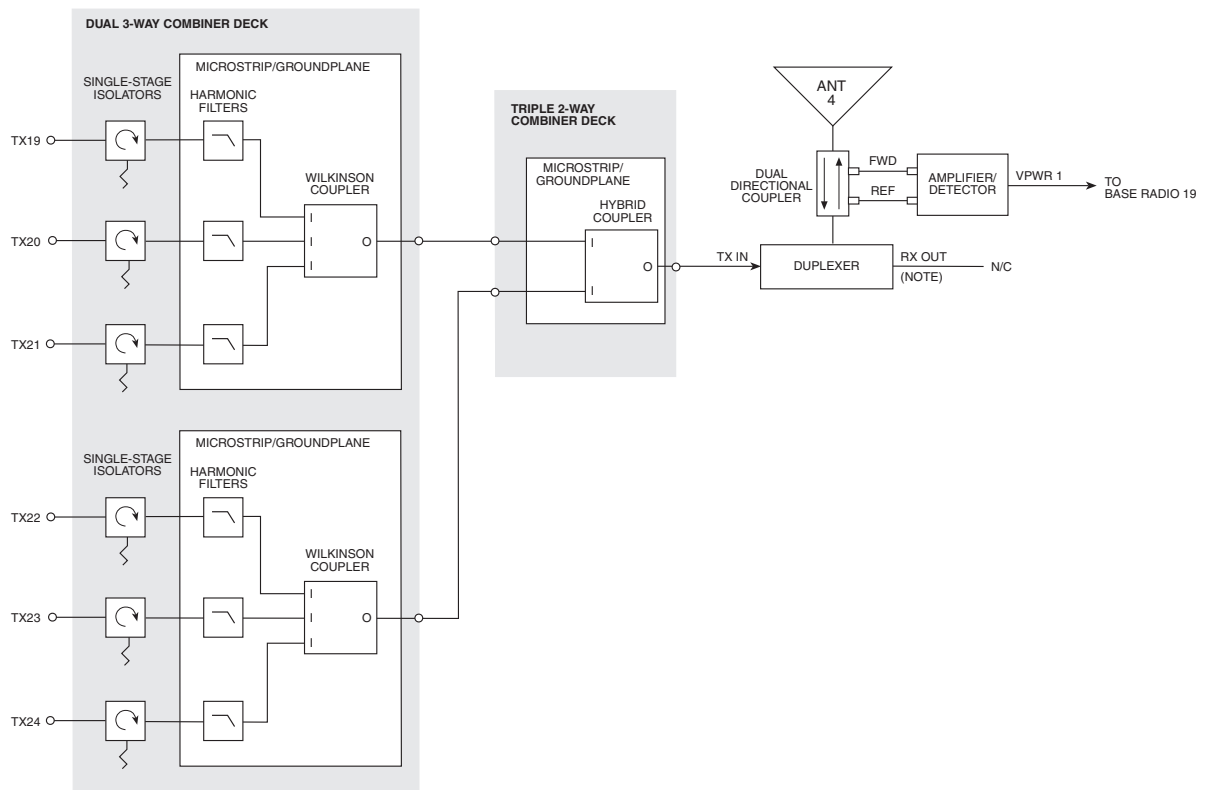
Theory of Operation

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## 19-24 BR Omni Expansion

(See Figure 10.) The 19-24 BR omni expansion uses the 1-18 BR expansion discussed earlier, along with an added transmit-only branch for Base Radios 19 through 24 located in a third expansion RF cabinet. As such, the BR19-BR24 expansion uses an abbreviated arrangement similar to that used in the 1-18 BR expansion to combine Tx signals TX19 through TX24. The combined TX19-TX24 signal is fed to a fourth Duplexer which drives a fourth, transmit-only antenna.

The Rx output of the fourth Duplexer is not used; the Rx1 through Rx3 receivers in BR19 through BR24 tie into the standard Rx1 through Rx3 receive expansion as described in "Receive Expansion."



**NOTE:** ANTENNA 4 IS TRANSMIT-ONLY. RX1 THROUGH RX3 ARE VIA SYSTEM DUPLEXED ANTENNAS 1 THROUGH 3 AND RECEIVE EXPANSION ASSEMBLIES.

EBTS536  
031098JNM

Figure 10 24-BR Omni Expansion

## Theory of Operation

## Duplexed Tower Top Amplifier Interface

The Main RF Cabinet can be equipped with DC injectors installed on each duplexer, and a Tower Top Amplifier (TTA) interface tray. The TTA Alarm Tray and DC injectors, as installed on the duplexers, are shown in Figure 11. The DC injectors allow the RFDS to work with Duplexed (DTTAs). The DC injectors also provide a low-impedance path to ground in cases of a lightning strike. Typically, a TTA assembly itself is mounted on the antenna mast structure; the assembly contains three identical subassemblies for the respective three branches of the antenna system. The DTTAs augment system coverage of an EBTS by providing increased receive gain.

### TTA Alarm Tray

The TTA Alarm Tray consists of three TTA power/alarm interface modules. These three modules provide the TTA power interface from the power supplies (located in the Rx Tray) to the TTAs. The power/alarm interface modules control application of power to the TTAs, and monitor the TTA interface for alarm conditions.

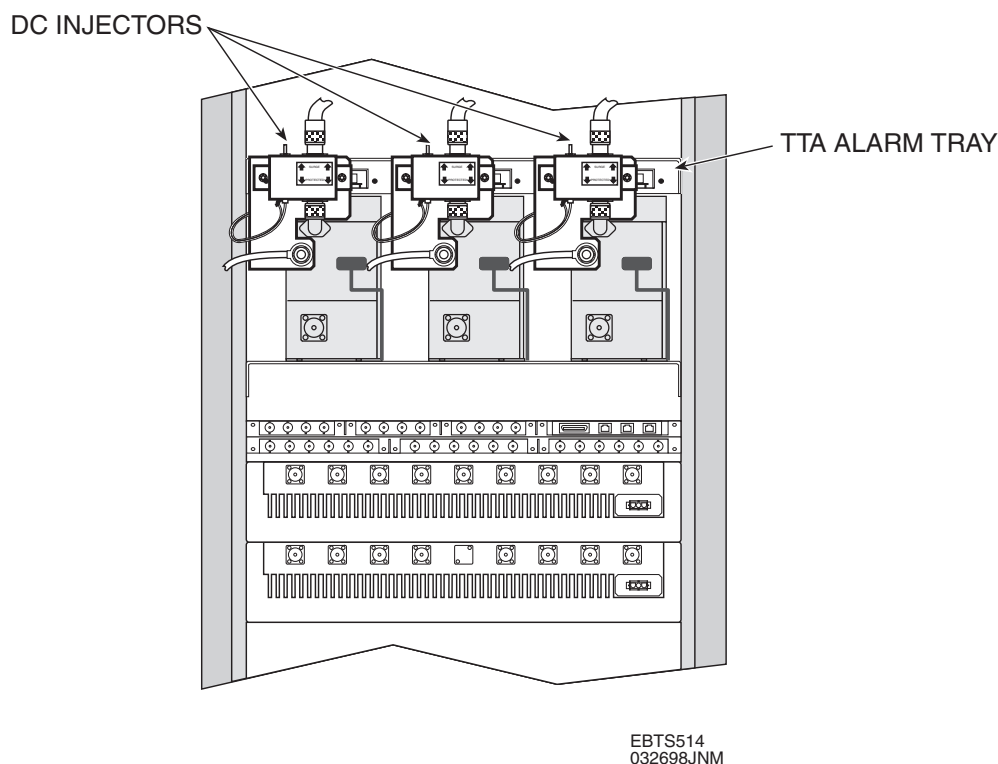


Figure 11 **Duplexed TTA FRUs/Assemblies**

## Tx/Rx Signal Flow

Figure 12 shows the incorporation of the Duplexed TTAs into the Tx/Rx signal flow path of a 800 MHz Duplexed RFDS. For each Tx/Rx antenna branch, a Duplexed TTA is inserted into the Tx/Rx path. DC injectors receive +24V power from the power supplies in the Rx Tray. Using the DC injectors, the existing Tx/Rx coaxial cables carry the Tx/Rx signals, along with the injected +24V operating power, to the Duplexed TTAs.

The tower-mounted Duplexed TTA assembly consist of the following:

- ❑ Three Low-Noise Amplifiers (LNAs) which increase receive path gain
- ❑ A test port which allows calibration signal injection into the LNA input
- ❑ Three duplexing devices which isolate the LNA s from the Tx signals

The Duplexed TTA assembly contains duplexers which provide isolation of the TX and Rx signals. The Tx signal is coupled directly to the antenna. However, the Rx signal is diverted by the duplexer and then fed to an LNA before being recoupled to the main RF Tx/RX cable that connects to the RFDS. The duplexed TTA TEST PORT allows for the injection of a calibration reference signal into the receive path. The reference signal is applied to a four-way splitter; three of the splitter outputs serve as inputs to the LNAs. The reference signal is used in calculating the EBTS receive path gain.

## DC Injectors

The DC injectors are two-port devices with an additional DC injection terminal. The antenna-side port (labeled "SURGE") allows injection of the DC power onto the coaxial connection. This port is also capable of discharging to ground a high-energy pulse received over the antenna connection (as in the case of a lightning strike). The opposite port (labeled "PROTECTED"), which is connected to the RFDS, is isolated from the injected DC as well as any high-energy entering through the SURGE (antenna) port.

## TTA Alarm Interface

The TTA power / alarm interface modules contain circuitry which monitors the operation of the TTAs for both TTA current draw and surge-protect tripping of a DC injector.

The TTA power / alarm interface module monitors the current draw of the TTA. If the current draw exceeds or dips below a pre-defined threshold window, an alarm is generated.

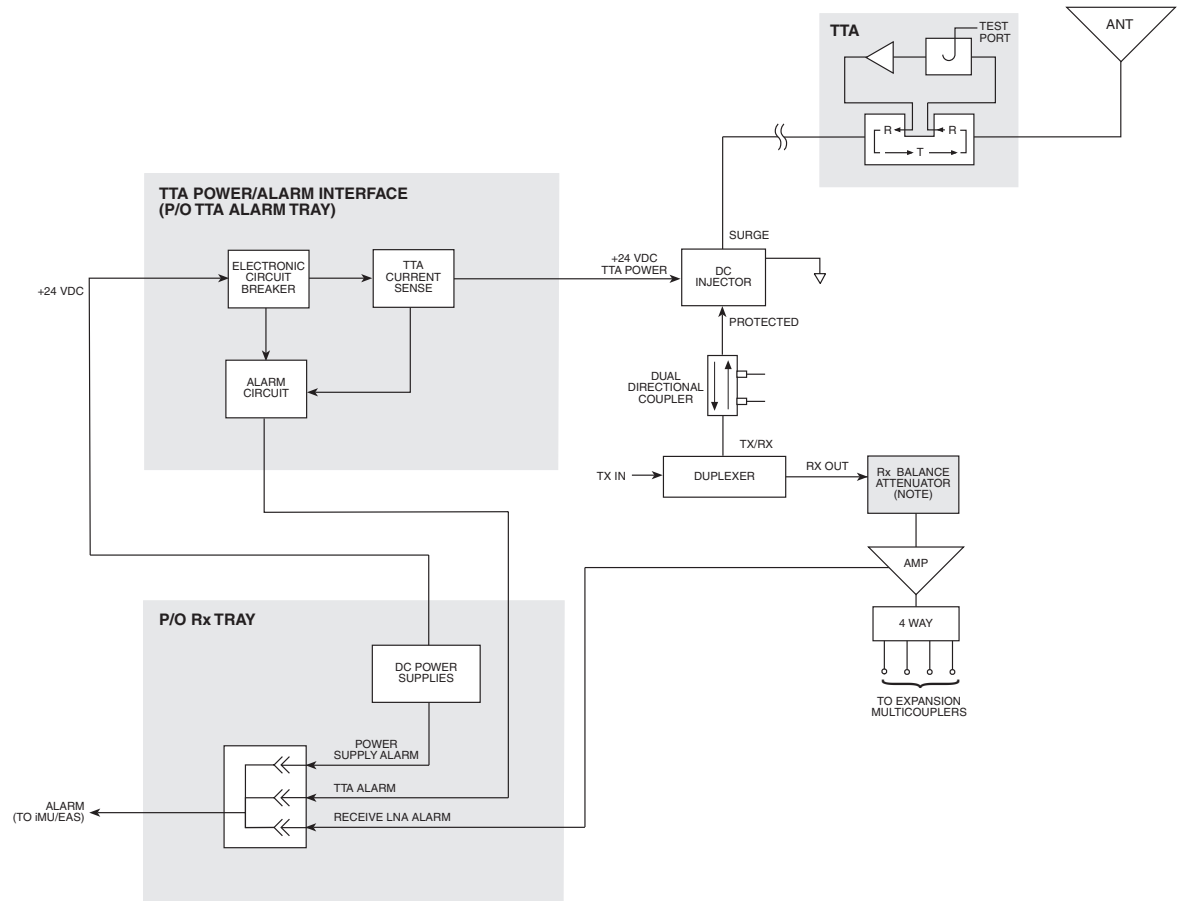
In the case of a high-energy discharge through a DC injector, the DC injector dumps the energy to ground. Unfortunately, this mode also momentarily shorts the injected DC power to ground, in turn shorting the TTA power feed from the Rx Tray power supply. To handle this condition, the TTA power / alarm interface module is equipped with an electronic circuit breaker which detects this condition.

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**Theory of Operation**

Upon detection of a short-circuit, the electronic circuit breaker opens to remove the power supply from the short circuit imposed by the DC injector. The electronic circuit breaker waits an ample amount of time, at which point the high-energy event is expected to have ceased and the DC injector should have recovered (i.e., no short circuit). At this point, the electronic circuit breaker re-applies RFDS power to the DC injector. The electronic breaker repeats this cycle indefinitely until the DC injector recovers. If a DC injector will not recover, the repeated cycling will manifest itself as a persistent alarm, thereby indicating a shorted DC injector at the site.

The TTA power/alarm interface module alarm circuits are wired such that when any combination of TTA amplifiers experience an over/under current failure, or the electronic breaker indicates failure to properly reset, an alarm is sent to the Rx Tray I/O board. In turn, the alarm is then forwarded to the EAS.



**NOTE:** Balance attenuator value is determined using field equalization procedure. Attenuators are field-procured and not supplied with TTA FRUs.

EBTS544  
032398LLN

Figure 12 800 MHz Duplexed TTA Block Diagram

## Theory of Operation

### Power Supplies

The RFDS uses two Power Supply boards (power supply A and power supply B) in a dual-redundant arrangement. The Power Supply boards are located in the Rx Tray. The power supplies convert the -48 VDC (hot) site power to +12 VDC and +24 VDC. The +12 VDC is used for the Rx Tray receive multicouplers, and the Combiner Deck fan assemblies. The +24 VDC is used for the Duplexer power monitors and (where applicable) tower top amplifiers.

Each Power Supply board is equipped with green and red LED indicators which indicate when the board is receiving power and properly functioning. The RFS1 and RFS2 circuit breakers on the cabinet breaker panel control the application of -48 VDC power to the A and B Power Supply boards.

### Connectors, Pinouts, and Wiring

#### Power Monitor Wiring Harness

(See Figure 13.) The GEN 4 Duplexed RFDS contains 25-pin power monitor connector (P4) that interconnects the External Wattmeter FWD and REF signals to BR1 through BR3.

The GEN 4 Duplexed RFDS also contains 9-pin monitor power connector (P5) that interconnects the power monitors on each duplexer with DC power from the Rx Tray assembly. The power monitors interconnect with connectors P4 and P5 through duplexer connectors P1 through P3, which respectively connect to the ANT1 through ANT3 duplexers.

Table 4 is a wire-run list that correlates the connections from connectors P4 and P5 to the P1 through P3 duplexer connectors.



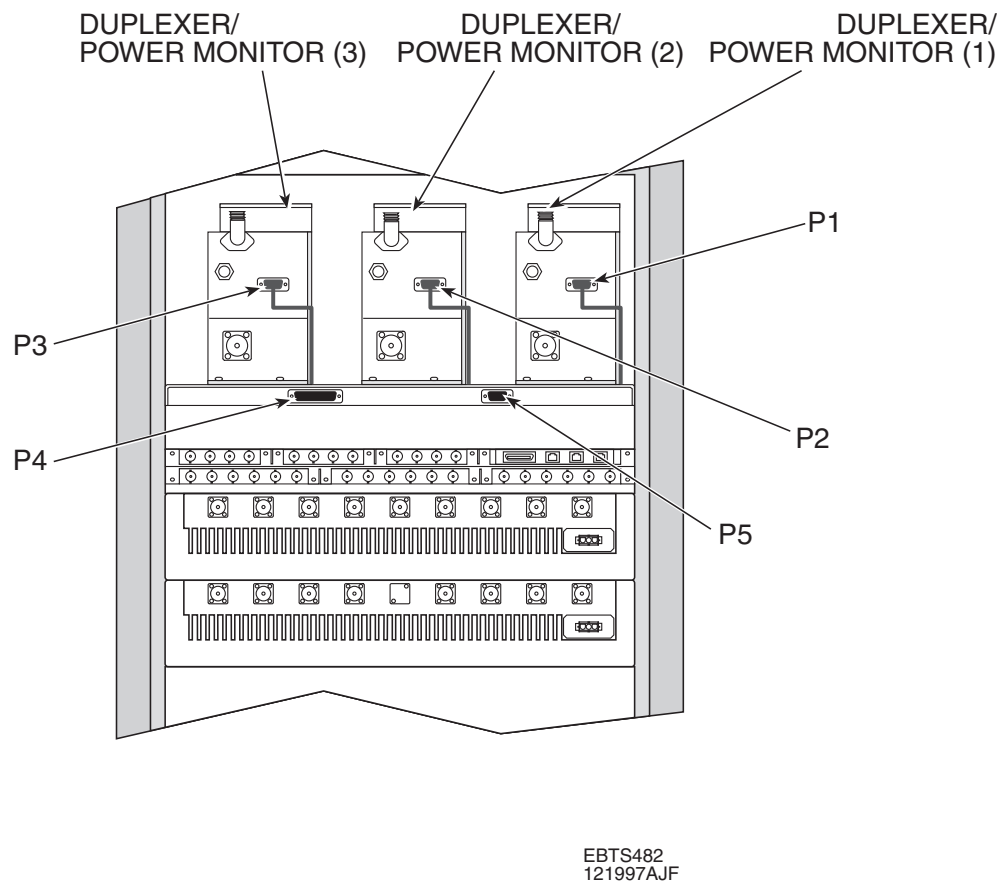


Figure 13 **GEN 4 RFDS Alarm/Monitor Connections**

## Theory of Operation

Table 4 **GEN 4 Duplexed RFDS Alarm/Monitor Harness Wire Run List**

| From  | To   | Function                            |
|-------|------|-------------------------------------|
| P4-1  | —    | no connection                       |
| P4-2  | —    | no connection                       |
| P4-3  | —    | no connection                       |
| P4-4  | P1-3 | GND                                 |
| P4-5  | P1-5 | ANT A (antenna 1) FWD power monitor |
| P4-6  | P1-1 | Antenna A REF power monitor         |
| P4-7  | P2-3 | GND                                 |
| P4-8  | P2-5 | ANT B (antenna 2) FWD power monitor |
| P4-9  | P2-1 | ANT B (antenna 2) REF power monitor |
| P4-10 | P3-3 | GND                                 |
| P4-11 | P3-5 | ANT C (antenna 3) FWD power monitor |
| P4-12 | P3-1 | ANT C (antenna 3) REF power monitor |
| P4-13 | —    | no connection                       |
| P4-14 | —    | no connection                       |
| P4-15 | —    | no connection                       |
| P4-16 | —    | no connection                       |
| P4-17 | —    | no connection                       |
| P4-18 | P1-4 | GND (power monitor return)          |
| P4-19 | P2-4 | GND (power monitor return)          |
| P4-20 | P3-4 | GND (power monitor return)          |
| P4-21 | —    | no connection                       |
| P4-22 | —    | no connection                       |
| P4-23 | —    | no connection                       |
| P4-24 | —    | no connection                       |
| P4-25 | —    | no connection                       |
| P5-1  | P1-2 | +24 VDC (monitor 1)                 |
| P5-2  | P1-7 | GND (monitor 1)                     |
| P5-3  | P1-9 | no connection                       |
| P5-4  | P2-2 | +24 VDC (monitor 2)                 |
| P5-5  | P2-7 | GND (monitor 2)                     |
| P5-6  | P2-9 | no connection                       |
| P5-7  | P3-2 | +24 VDC (monitor 3)                 |
| P5-8  | P3-7 | GND (monitor 3)                     |
| P5-9  | P3-9 | no connection                       |

### I/O Board Alarm Output Cabling

Two versions of the I/O Board currently exist: CTF6220A and CTF6220B. The two versions are functionally identical, but do use different pinouts for the RJ-45 ALARM STANDARD connector that connects the cabinet alarms to the EAS/iMU.

Version CTF6220B eliminates the need for an extra, second cable to be connected between the I/O Board and the EAS/iMU. Figure 14 shows the cabling for both versions.

#### NOTE

The CTF6220A and CTF6220B I/O boards are totally interchangeable. However, appropriate cabling must be used for the version being used (as shown in Figure 14). If cabling does not correspond to version, false alarms will result.

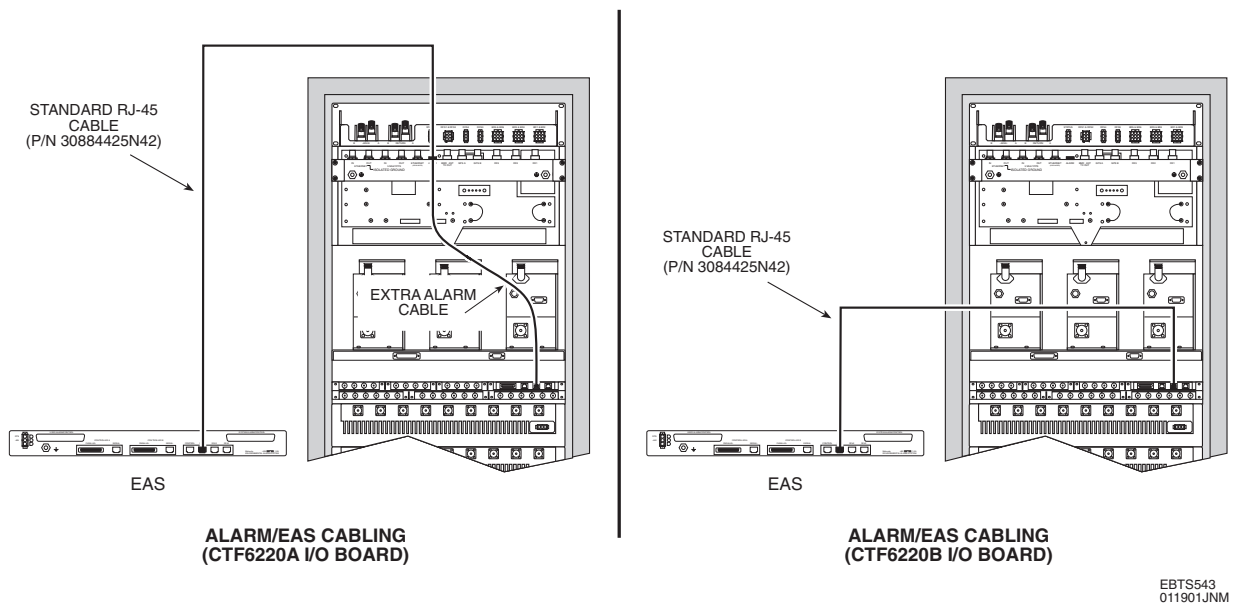


Figure 14 I/O Board Alarm-to-EAS Cabling (I/O Board CTF6220A and CTF6220B)

## Theory of Operation

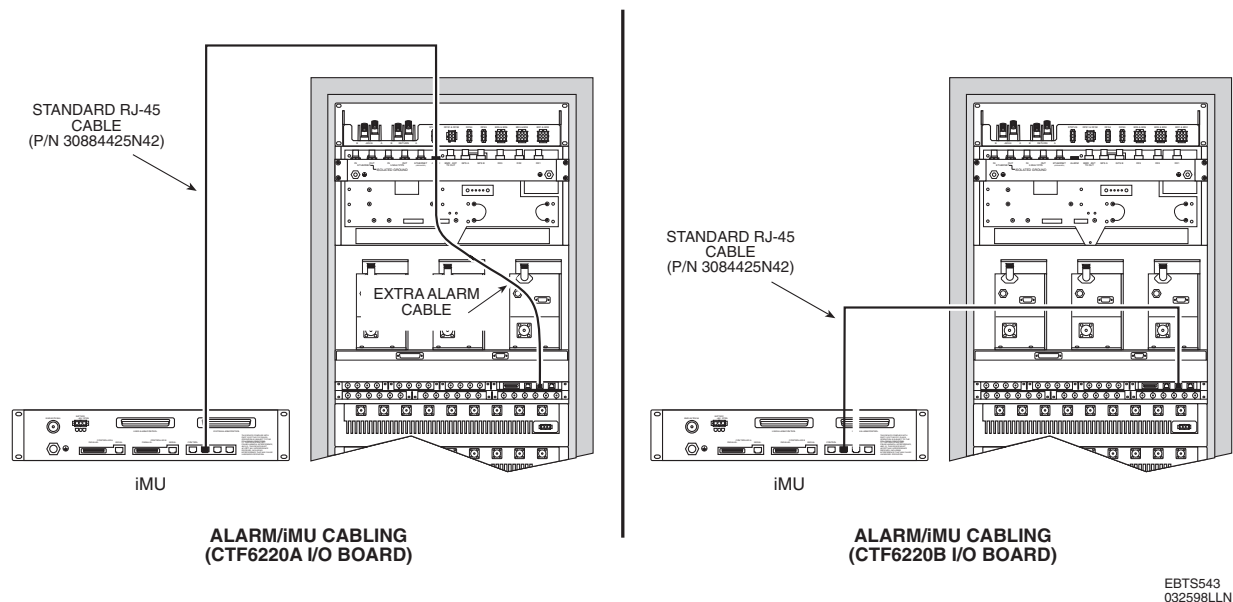


Figure 15 I/O Board Alarm to iMU Cabling (I/O Board CTF6220A and CTF6220B)

### I/O Board Rear Panel Connector Pinouts

The I/O Board rear panel connectors provide the cabinet alarm interface to the I/O board and a diagnostics connector. (Figure 4 shows and identifies the connectors.) The connectors are as follows:

- ❑ **Diagnostics** – 36-pin SCSI-style connector (reserved for future use)
- ❑ **Breaker Status (Alarm Expansion)** – RJ-45 connector receives breaker status from breaker panel. (Also has reserved function of receiving alarm signals from GEN 3 (P/N 0182020V06) RFDS.)
- ❑ **Alarm Standard** – RJ-45 connector sends cabinet alarm status to the EAS/iMU.
- ❑ **Alarm Auxiliary** – RJ-45 connector receives additional, auxiliary alarm signals (reserved).

Table 5 lists the rear panel connector pinouts for I/O Board CTF6220A. Table 6 lists the connector pinout for I/O Board CTF6220B.

Table 5 **I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220A)**

| Pin | Function/Connector |                       |                                |                           |
|-----|--------------------|-----------------------|--------------------------------|---------------------------|
|     | Diagnostics        | Breaker Status Alarm  | Alarm Standard                 | Alarm Auxiliary           |
| 1   | 1st MC #2 Alarm    | Breaker               | Breaker Alarm                  | PS Alarm Expansion        |
| 2   | 1st MC #3 Alarm    | Breaker return        | Breaker Alarm return           | PS Alarm Expansion return |
| 3   | Exp MC #1 Alarm    | RFDS MC Alarm         | RFDS Multicoupler Alarm        | 1st MC Alarm              |
| 4   | Exp MC #2 Alarm    | RFDS TTA Alarm        | RFDS TTA Alarm                 | Expansion MC Alarm        |
| 5   | Exp MC #3 Alarm    | RFDS PS Alarm         | RFDS Power Supply Alarm        | Fan Alarm                 |
| 6   | MC Alarm Expansion | RFDS MC Alarm return  | RFDS Multicoupler Alarm return | 1st MC Alarm return       |
| 7   | TTA #1 Alarm       | RFDS TTA Alarm return | RFDS TTA Alarm return          | Expansion MC Alarm return |
| 8   | TTA #2 Alarm       | RFDS PS Alarm return  | RFDS Power Supply Alarm return | Fan Alarm return          |

**Theory of Operation****Table 5 I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220A) (Continued)**

| Pin | Function/Connector  |                      |                |                 |
|-----|---------------------|----------------------|----------------|-----------------|
|     | Diagnostics         | Breaker Status Alarm | Alarm Standard | Alarm Auxiliary |
| 9   | TTA #3 Alarm        |                      |                |                 |
| 10  | TTA Alarm Expansion |                      |                |                 |
| 11  | Fans #1 Alarm       |                      |                |                 |
| 12  | Fans #2 Alarm       |                      |                |                 |
| 13  | PS#1 +12VDC Alarm   |                      |                |                 |
| 14  | PS#1 +24VDC Alarm   |                      |                |                 |
| 15  | PS#2 +12VDC Alarm   |                      |                |                 |
| 16  | PS#2 +24VDC Alarm   |                      |                |                 |
| 17  | PS Alarm Expansion  |                      |                |                 |
| 18  | N/C                 |                      |                |                 |
| 19  | 1st MC #1 Alarm     |                      |                |                 |
| 20  | GND                 |                      |                |                 |
| 21  | GND                 |                      |                |                 |
| 22  | GND                 |                      |                |                 |
| 23  | GND                 |                      |                |                 |
| 24  | GND                 |                      |                |                 |
| 25  | N/C                 |                      |                |                 |
| 26  | N/C                 |                      |                |                 |
| 27  | +24 VDC             |                      |                |                 |
| 28  | +24 VDC             |                      |                |                 |
| 29  | +24 VDC             |                      |                |                 |
| 30  | +24 VDC             |                      |                |                 |
| 31  | N/C                 |                      |                |                 |
| 32  | N/C                 |                      |                |                 |
| 33  | +12 VDC             |                      |                |                 |
| 34  | +12 VDC             |                      |                |                 |
| 35  | +12 VDC             |                      |                |                 |
| 36  | +12 VDC             |                      |                |                 |

Table 6 I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220B)

| Pin | Function/Connector  |                       |                                |                           |
|-----|---------------------|-----------------------|--------------------------------|---------------------------|
|     | Diagnostics         | Breaker Status Alarm  | Alarm Standard                 | Alarm Auxiliary           |
| 1   | 1st MC #2 Alarm     | Breaker               | RFDS Power Supply Alarm return | Fan Alarm return          |
| 2   | 1st MC #3 Alarm     | Breaker return        | RFDS TTA Alarm return          | Expansion MC Alarm return |
| 3   | Exp MC #1 Alarm     | RFDS MC Alarm         | RFDS Multicoupler Alarm return | 1st MC Alarm return       |
| 4   | Exp MC #2 Alarm     | RFDS TTA Alarm        | RFDS Power Supply Alarm        | Fan Alarm                 |
| 5   | Exp MC #3 Alarm     | RFDS PS Alarm         | RFDS TTA Alarm                 | Expansion MC Alarm        |
| 6   | MC Alarm Expansion  | RFDS MC Alarm return  | RFDS Multicoupler Alarm        | 1st MC Alarm              |
| 7   | TTA #1 Alarm        | RFDS TTA Alarm return | Breaker Alarm return           | PS Alarm Expansion return |
| 8   | TTA #2 Alarm        | RFDS PS Alarm return  | Breaker Alarm                  | PS Alarm Expansion        |
| 9   | TTA #3 Alarm        |                       |                                |                           |
| 10  | TTA Alarm Expansion |                       |                                |                           |
| 11  | Fans #1 Alarm       |                       |                                |                           |
| 12  | Fans #2 Alarm       |                       |                                |                           |
| 13  | PS#1 +12VDC Alarm   |                       |                                |                           |
| 14  | PS#1 +24VDC Alarm   |                       |                                |                           |
| 15  | PS#2 +12VDC Alarm   |                       |                                |                           |
| 16  | PS#2 +24VDC Alarm   |                       |                                |                           |
| 17  | PS Alarm Expansion  |                       |                                |                           |
| 18  | N/C                 |                       |                                |                           |
| 19  | 1st MC #1 Alarm     |                       |                                |                           |
| 20  | GND                 |                       |                                |                           |
| 21  | GND                 |                       |                                |                           |
| 22  | GND                 |                       |                                |                           |
| 23  | GND                 |                       |                                |                           |
| 24  | GND                 |                       |                                |                           |
| 25  | N/C                 |                       |                                |                           |

## Theory of Operation

Table 6 **I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220B) (Continued)**

| Pin | Function/Connector |                      |                |                 |
|-----|--------------------|----------------------|----------------|-----------------|
|     | Diagnostics        | Breaker Status Alarm | Alarm Standard | Alarm Auxiliary |
| 26  | N/C                |                      |                |                 |
| 27  | +24 VDC            |                      |                |                 |
| 28  | +24 VDC            |                      |                |                 |
| 29  | +24 VDC            |                      |                |                 |
| 30  | +24 VDC            |                      |                |                 |
| 31  | N/C                |                      |                |                 |
| 32  | N/C                |                      |                |                 |
| 33  | +12 VDC            |                      |                |                 |
| 34  | +12 VDC            |                      |                |                 |
| 35  | +12 VDC            |                      |                |                 |
| 36  | +12 VDC            |                      |                |                 |

**I/O Board Power Connectors**

The I/O Board power connectors provide the I/O board power interface from the cabinet breaker panel -48 VDC power feed to the RFDS and combiner deck fans. (The I/O Board power connectors are mounted on the printed circuit board surface and are identified in Figures 25 and 31.) The connectors are as follows:

- ❑ **-48 VDC input** – 8-pin Mate-N-Lok header connector P1008. Receives -48 VDC feed from RFS1 & RFS2 connector on the breaker panel.
- ❑ **Fan Power output** – 8-pin Mate-N-Lok header connector P1007. Sends +12 VDC to the combiner deck fans.
- ❑ **RFDS Power output (power monitor interface)** – Mate-N-Lok header connector which terminates to 9-pin submini-D connector P5 (located on the duplexer shelf). Refer to Table 4 for pinout and signal functions.
- ❑ **TTA Power output/Alarm input** – 16-pin Mini Mate-N-Lok header connector P1006. Only used on systems with TTA interface. Sends +24 VDC to TTA Alarm Tray. Receives alarm signals from TTA Alarm Tray.

Table 7 lists the power connector pinouts for all versions of the I/O Board.



Table 7 **I/O Board Power Connector Pinouts**

| Pin | Function/Connector                 |                        |                         |
|-----|------------------------------------|------------------------|-------------------------|
|     | TTA Power/Alarm Interface<br>P1006 | -48 VDC Input<br>P1008 | Fan Power<br>P1007      |
| 1   | TTA #1 +24 VDC                     | -48 VDC ('A' side)     | N/C                     |
| 2   | TTA #1 GND                         | Return ('A' side)      | Return ('A' side)       |
| 3   | TTA #1 alarm enable                | N/C                    | Alarm enable ('A' side) |
| 4   | TTA #1 alarm                       | N/C                    | +12 VDC ('A' side)      |
| 5   | TTA #1 alarm return                | -48 VDC ('B' side)     | N/C                     |
| 6   | TTA #2 +24 VDC                     | Return ('B' side)      | Return ('B' side)       |
| 7   | TTA #2 GND                         | N/C                    | Alarm enable ('B' side) |
| 8   | TTA #2 alarm enable                | N/C                    | +12 VDC ('B' side)      |
| 9   | TTA #2 alarm                       |                        |                         |
| 10  | TTA #2 alarm return                |                        |                         |
| 11  | TTA #3 +24 VDC                     |                        |                         |
| 12  | TTA #3 GND                         |                        |                         |
| 13  | TTA #3 alarm enable                |                        |                         |
| 14  | TTA #3 alarm                       |                        |                         |
| 15  | TTA #3 alarm return                |                        |                         |
| 16  | N/C                                |                        |                         |

**Removal/Replacement Procedures**

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## **Removal/Replacement Procedures**

### **Replacement of FRUs**

Instructions are provided below for replacing FRUs within the GEN 4 Duplexed RFDS. Figure 1 identifies the GEN 4 Duplexed RFDS assemblies and FRUs. Figure 16 identifies the Rx Tray assemblies and attaching hardware.

Replace suspected FRUs with known non-defective FRUs to restore the RFDS to proper operation.

### **CAUTION**

The RFDS contains static-sensitive modules. Take precautionary measures to prevent static discharge damage when servicing the RFDS.

---

### **CAUTION**

Burn Hazard. Some RFDS components may be hot. Allow to cool before handling to prevent personal injury.

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## First (4-Way) Multicoupler Board Replacement Procedure

Perform the following steps to replace a 4-Way Multicoupler Board.

### Removal

(See Figure 16.) Remove 4-Way Multicoupler Board as follows:

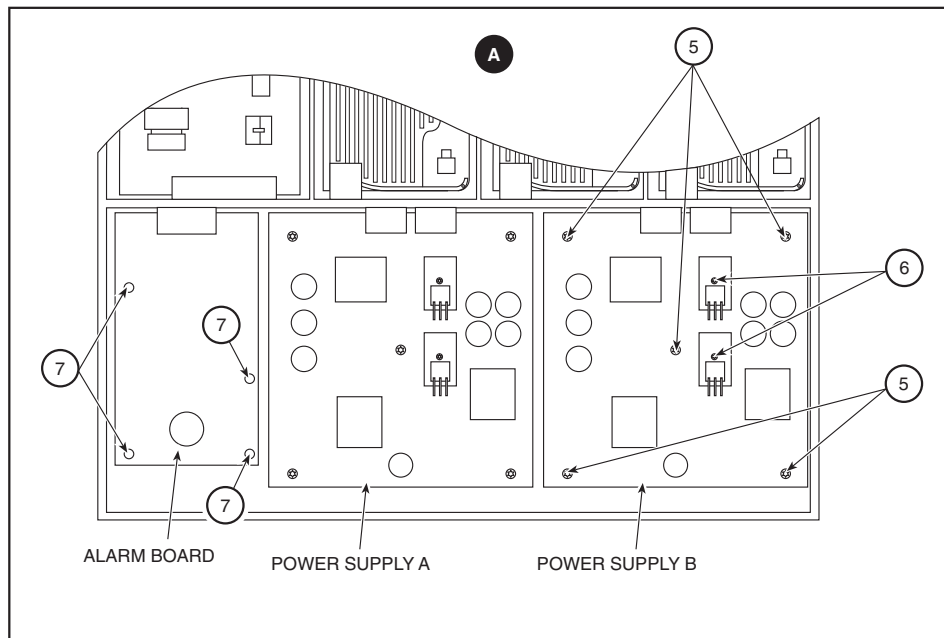
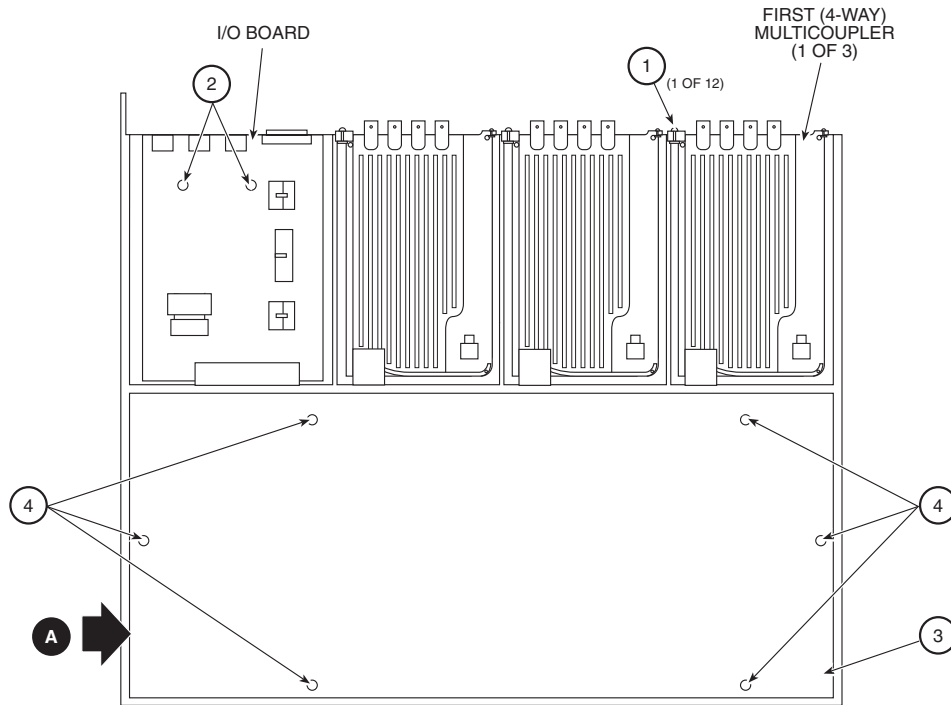
1. Tag and remove all BNC connections at the **R1** through **R4** BNC connectors on the 4-Way Multicoupler Board.
2. Remove two M3.5 TORX screws (1, Figure 16) which secure board assembly to Rx Tray chassis (one screw on each side of board). Save screws for reuse.
3. Partially draw board assembly out of Rx Tray until blindmate connector at front of board is disengaged.
4. Remove board from slot enough to gain access to input port SMA cable termination on top of board. Disconnect SMA cable from board connector.
5. Remove board fully from Rx Tray slot.

### Installation

(See Figure 16.) Install 4-Way Multicoupler Board as follows:

1. Align 4-Way Multicoupler Board with Rx Tray board slot. Partially slide board into slot enough to allow Rx input SMA cable to mate with SMA connector on top of board.
2. Connect SMA cable to SMA connector on top of board. Using a breaking-type 5/16" torque wrench, torque the SMA connector to 5 in-lb.
3. Carefully slide board fully into slot, making certain blindmate connection at front of board is fully mated to Rx Tray chassis midplane connector.
4. Install two M3.5 TORX screws (1, Figure 16), one on each side of assembly, (saved during removal) which secure board assembly to Rx Tray chassis.
5. Connect cabling to the **R1** through **R4** BNC connectors on the 4-Way Multicoupler Board as tagged during removal.

If adding the 4-Way Multicoupler Board, perform the required cabling in accordance with the Cabling Information subsection of this section.

**Removal/Replacement Procedures**

**NOTE:** THREE EXPANSION (6-WAY) MULTICOUPLERS (NOT SHOWN) ARE LOCATED ON UNDERSIDE OF RX TRAY. ATTACHING HARDWARE AND REMOVAL/INSTALLATION IS SIMILAR TO THAT FOR FIRST (4-WAY) MULTICOUPLER.

EBTS490  
123197JNM

Figure 16 **Rx Tray FRU/Assembly Replacement**

## Local Expansion (6-Way) Multicoupler Board Replacement Procedure

Perform the following steps to replace a 6-Way Multicoupler Board.

### Removal

(See Figure 16.) Remove 6-Way Multicoupler Board as follows:

1. Tag and remove all BNC connections at the **E-R1** through **E-R6** BNC connectors on the 6-Way Multicoupler Board.
2. Remove two M3.5 TORX screws (1, Figure 16) which secure board assembly to Rx Tray chassis (one screw on each side of board). Save screws for reuse.
3. Partially draw board assembly out of Rx Tray until blindmate connector at front of board is disengaged.
4. Remove board from slot enough to gain access to SMA cable termination on underside of board. Disconnect SMA cable from board connector (or inline attenuator, if so equipped).
5. Remove board fully from Rx Tray slot.
6. If multicoupler board is equipped with inline input attenuator, remove attenuator and save for reuse.

### Installation

(See Figure 16.) Install 6-Way Multicoupler Board as follows:

1. If multicoupler board being replaced was equipped with inline input attenuator (saved during removal), install attenuator on SMA connector on underside of board.  
Using a breaking-type 5/16" torque wrench, torque the SMA connector to 5 in-lb.
2. Align 6-Way Multicoupler Board with Rx Tray board slot. Partially slide board into slot enough to allow Rx input SMA cable to mate with SMA connector (or attenuator, if so equipped) on underside of board.
3. Connect SMA cable to SMA connector (or attenuator, if so equipped) on underside of board. Using a breaking-type 5/16" torque wrench, torque the SMA connector to 5 in-lb.
4. Carefully slide board fully into slot, making certain blindmate connection at front of board is fully mated to Rx Tray chassis midplane connector.
5. Install two M3.5 TORX screws (1, Figure 16), one on each side of assembly, (saved during removal) which secure board assembly to Rx Tray chassis.
6. Connect cabling to the **E-R1** through **E-R6** BNC connectors on the 6-Way Multicoupler Board as tagged during removal.

If adding the 6-Way Multicoupler Board, perform the required cabling in accordance with the Cabling Information subsection of this section.

**Removal/Replacement Procedures****I/O Board Replacement Procedure**

Perform the following steps to replace an I/O Board.

**NOTE**

During I/O Board replacement, the site will become inoperative due to loss of alarm and certain power functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

**NOTE**

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

**Removal**

(See Figure 16.) Remove I/O Board as follows:

1. Remove four M3.5 TORX screws which secure Rx Tray chassis to front panel. (Do not remove the four M6 TORX screws which secure front panel to equipment cabinet.) Save screws for reuse.
2. From rear of cabinet, carefully slide Rx Tray chassis from cabinet enough to access two M3.5 TORX screws (2, Figure 16) that secure I/O Board to Rx Tray chassis.
3. Remove two M3.5 TORX screws that secure I/O Board to Rx Tray chassis. Save screws for reuse.
4. Slide I/O Board away from Rx Tray midplane until connector at front of board is disengaged.
5. With board still connected to RJ45 alarm and Mate-N-Lok power connectors, tag wiring connections. Position board aside with all connections intact.

## Installation

(See Figure 16.) Install I/O Board as follows:

6. Disconnect connection on board being replaced. Connect harness to replacement I/O Board noting tagged position.
7. Place new I/O Board in mounting position.
8. Align connector at front of board with mating connector on Rx Tray chassis midplane. Gently slide board toward front of Rx Tray chassis until connectors are fully mated.
9. Secure board using two M3.5 TORX screws (2, Figure 16) saved during removal.
10. Carefully slide Rx Tray chassis toward front panel until chassis is flush with front panel. Make certain no wiring is pinched between Rx Tray chassis and front panel.
11. Start four M3.5 TORX screws that secure Rx Tray chassis to Rx Tray front panel. Tighten all four screws evenly.
12. Reactivate site via OMC.

## Power Supply Board Replacement Procedure

The Rx Tray Power Supply boards are located in the Rx Tray as shown in Figure 16. Because two Power Supply boards are used in a redundant arrangement, a defective power supply board can be replaced without taking the system out of operation.

### ▲ CAUTION

Power Supply board opposite to board being replaced remains energized. When replacing board, use care to prevent accidental contact of tools with components and/or surfaces of energized board. Failure to adhere to caution may result in damage to equipment.

## Removal

(See Figure 16.) Perform the following steps to determine and replace a defective Power Supply board.

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 16).

**Removal/Replacement Procedures**

3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.
4. Determine which Power Supply board has failed by observing the green and red LED indicators on each board. (On properly functioning supply, green LED is lit and red LED is off.)
5. Noting the Power Supply board that has failed, on Breaker Panel turn off power for the defective power supply as follows:

| Power Supply Board                   | Breaker Panel<br>Circuit Breaker |
|--------------------------------------|----------------------------------|
| A (left board as viewed from front)  | RFS1                             |
| B (right board as viewed from front) | RFS2                             |

6. On failed board, remove five M3.5 TORX screws (5) that secure board to Rx Tray chassis. Save screws for reuse.
7. Remove two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis.

**NOTE**

Observe if TO-220 devices use plastic insulator collars along with each screw. If collars are used, save screws and collars for possible reuse. Plastic insulating collars and insulator pads are not needed when replacing newer-version power supply that uses plastic-encased TO-220 devices.

8. Slide board towards front of Rx Tray chassis until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

**Installation**

(See Figure 16.) Install Power Supply Board as follows:

1. Place Power Supply Board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane. Gently slide board toward rear of chassis until connectors are fully mated.
3. Start (but do not tighten) five M3.5 TORX screws (5, Figure 16) that secure board to Rx Tray chassis.



 **CAUTION**

In following step, if TO-220 devices on replacement Power Supply Board have **metal tabs**, plastic insulator collar and insulator pad must be used with retaining screws. If TO-220 devices on replacement power supply are **plastic encased** (encapsulated TO-220), collars are not used.

Failure to use insulator collars on metal-tab device will result in damage to replacement power supply.

4. Note the TO-220 devices (D120 and D122) on the board, each secured by a screw (6) in the device mounting tabs. If devices have a metal mounting tab, make certain that a plastic insulator collar (saved during removal) is properly installed in each mounting tab on TO-220 devices, D120 and D122.
5. Start (but do not tighten) two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis.
6. Tighten five screws (5) and two screws (6) evenly.
7. Apply power to board being replaced by resetting appropriate breaker on Breaker Panel. Verify proper operation by observing green LED indicator on board.
8. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
9. Secure cover using six M3.5 TORX screws (4).
10. Carefully slide Rx Tray fully into cabinet.
11. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).

**Removal/Replacement Procedures****Alarm Board Replacement Procedure**

Perform the following steps to replace an Alarm Board.

**NOTE**

During Alarm Board replacement, the site will become inoperative due to loss of alarm functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

**NOTE**

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

**Removal**

(See Figure 16.) Remove Alarm Board as follows:

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 16).
3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.
4. Remove four M3.5 TORX screws (7) that secure Alarm Board to Rx Tray chassis. Save screws for reuse.
5. Using the finger hole in the Alarm Board, place finger in hole and pull board forward until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

**Installation**

(See Figure 16.) Install Alarm Board as follows:

1. Place Alarm Board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane.

3. Using finger hole in board, gently slide board toward rear of Rx Tray chassis until connector is fully mated.
4. Secure board using four M3.5 TORX screws (7, Figure 16) saved during removal.
5. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
6. Secure cover using six M3.5 TORX screws (4) saved during removal.
7. Carefully slide Rx Tray fully into cabinet.
8. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
9. Reactivate site via OMC.

### Combiner Deck Replacement Procedure

The following procedure applies to all types of combiner decks. Perform the following steps to replace a Combiner Deck.

#### CAUTION

Combiner deck surfaces are hot. contact can cause burns. allow combiner deck surfaces to cool before proceeding to prevent injury.

#### CAUTION

Verify that the **dekey** command has been issued to all base radios that connect to the combiner deck to prevent injury or damage to equipment while disconnecting or connecting transmit cabling.

#### NOTE

During Combiner Deck replacement the site will become inoperative.

**Removal/Replacement Procedures****Removal**

Remove Combiner Deck as follows:

1. Make certain the **dekey** command has been issued to all base radios that connect to the Combiner Deck being removed.
2. At rear of Combiner Deck, disconnect Mate-N-Lok fan power connector.
3. Tag and disconnect N-connector RF cables from Combiner Deck rear panel connectors.
4. Remove the four M6 TORX screws which secure the Combiner Deck front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
5. While supporting the Combiner Deck, carefully remove the Combiner Deck from the Equipment Cabinet by sliding it from the front of cabinet.

**Installation**

Install Combiner Deck as follows:

1. While supporting the Combiner Deck, carefully lift and slide the Combiner Deck into the pre-installed side rails in the Equipment Cabinet mounting position.

(If adding a Combiner Deck, see Cabling Information subsection for Combiner Deck mounting locations.)

2. Secure the Combiner Deck to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
3. Connect cabling to the Combiner Deck rear panel connectors as tagged during removal.

If adding the Combiner Deck, perform the required cabling in accordance with the Cabling Information subsection of this section.

4. Reactivate system as follows:
  - On an up-and-running system which was deactivated with a **dekey** command, reset the Base Radio Controller on Base Radios where the command was issued.
  - On a system that was completely shut down, perform activation in accordance with the *System Testing* section of this manual.

## TTA Alarm Module Replacement

The TTA Alarm Modules are located in the TTA Alarm Tray. Perform the following steps to replace a TTA Alarm Module.

### NOTE

During TTA Alarm Module replacement, the site will become inoperative due to loss of TTA functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

### NOTE

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

## Removal

Remove TTA Alarm Module as follows:

1. On front of TTA Alarm Tray, remove the two TORX screws which secure TTA Alarm Module being removed to tray. Save screws for reuse.
2. Draw TTA Alarm Module away from front panel enough to access cabling at rear of module.
3. At rear of TTA Alarm Module, tag and disconnect the two harnesses which connect to module.
4. Remove TTA Alarm Module from front of tray.

**Removal/Replacement Procedures****Installation**

Install TTA Alarm Module as follows:

1. From front of TTA Alarm Tray, position the TTA Alarm Module for installation into tray.
2. Noting tagged wiring positions, connect two wiring harnesses to replacement TTA Alarm Module.
3. Place replacement TTA Alarm Module in mounting position and start two TORX screws (removed during removal) which secure module to tray.
4. Tighten two TORX screws to 8 in-lb.
5. Reactivate site via OMC.

---

## Field Retrofit of Duplexed TTA Interface (CLN1403)

**NOTE**

During field retrofit, the site will become inoperative. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

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**NOTE**

To prevent alarm reports while the retrofit procedures are being performed, the site should be taken down via the Operations and Maintenance Center (OMC).

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Figures 17 and 18 show the Duplexed TTA interface FRUs. Field retrofit of the CLN1403 Duplexed TTA interface consists of installing the following TTA hardware:

- ☐ TTA Alarm Tray
- ☐ DC Injectors (3 used)
- ☐ DC Injector Mounting Hardware
- ☐ TTA Tray Cabling

When all of the field retrofit procedures have been completed, perform receive branch equalization in accordance with the Duplexed TTA Receive Branch Equalization procedure later in this section.

**NOTE**

The tower-mounted TTA assemblies themselves are not part of the FRU described herein. The tower-mounted TTA assemblies are drop-shipped to the customer site.

---

**Field Retrofit of Duplexed TTA Interface (CLN1403)****TTA Alarm Tray Installation**

The TTA Alarm Tray interfaces alarm monitoring and operating power for the Duplexed TTAs via the DC injectors. The TTA Alarm Tray occupies one rack unit above the RFDS front panel.

(See Figure 17.) Install TTA Alarm Tray as follows:

1. Unpack the TTA Alarm Tray and record the bar code number in the site records.
2. On Main RF Cabinet, remove the 1-RU blank panel directly above the RFDS front panel blank. Save screws for reuse.
3. Insert the TTA Alarm Tray into the rack in the location shown in Figure 17.
4. Secure the TTA Alarm Tray to the front of the cabinet using four TORX screws. Torque the screws to 40 in.-lbs.
5. Proceed to DC Injector Installation procedure below.

**DC Injector Installation**

The DC injectors allow the Duplexed TTA +24V operating power to be fed to the Duplexed TTA LNAs via the Tx/Rx coaxial feed cable. A DC injector must be installed at the antenna port of each duplexer.

(See Figure 18.) Install DC injectors as follows:

1. On Antenna 1 duplexer antenna port, disconnect antenna cable.
2. On Antenna 1 duplexer, remove nut that secures ground cable to duplexer. Disconnect cable and position aside.
3. Place DC injector mounting bracket over duplexer ground stud.
4. Place ground cable over stud. Start (but do not tighten) hex nut that secures ground cable along with bracket.

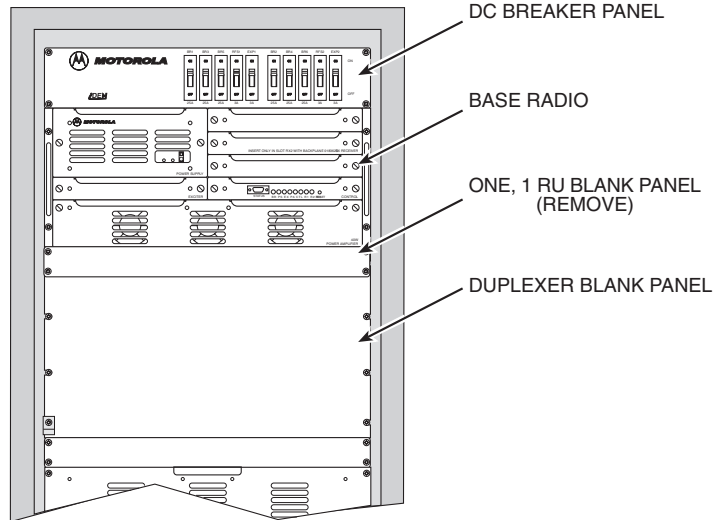
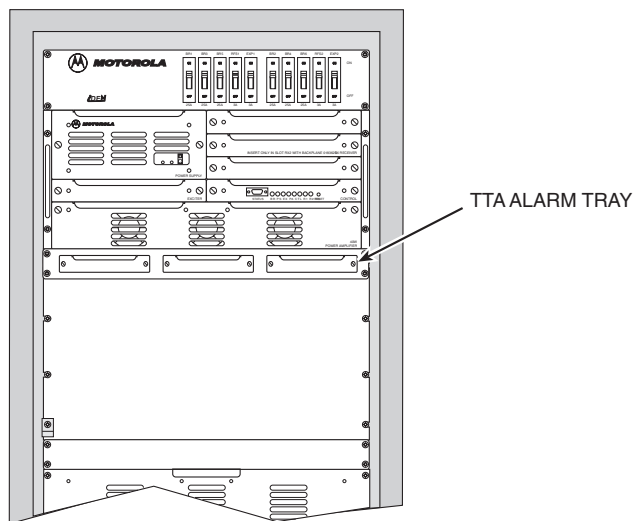
**NOTE**

In next step, DC Injector must be oriented properly.

5. Orientate DC Injector such that port labeled "PROTECTED" is facing duplexer port. Connect PROTECTED port on DC Injector to duplexer port.
6. Align mounting holes in bracket with mounting holes on DC injector. Secure DC injector to bracket using two M4 screws.
7. Fully tighten ground cable hex nut.
8. Connect the antenna cable to DC injector port labeled "SURGE".



9. Repeat steps 1 through 8 for antenna branch 2 and branch 3.
10. Perform cabling in accordance with Duplexed TTA Cabling (provided in Cabling Information later in this section).
11. Reactivate site via OMC.
12. Proceed to Duplexed TTA Receive Branch Equalization procedure later in this section.

**Field Retrofit of Duplexed TTA Interface (CLN1403)****EXISTING FRONT PANEL LAYOUT****TTA ALARM TRAY INSTALLATION**EBTS568  
032698 LLNFigure 17 **TTA Alarm Tray Installation**

## Field Retrofit of Duplexed TTA Interface (CLN1403)

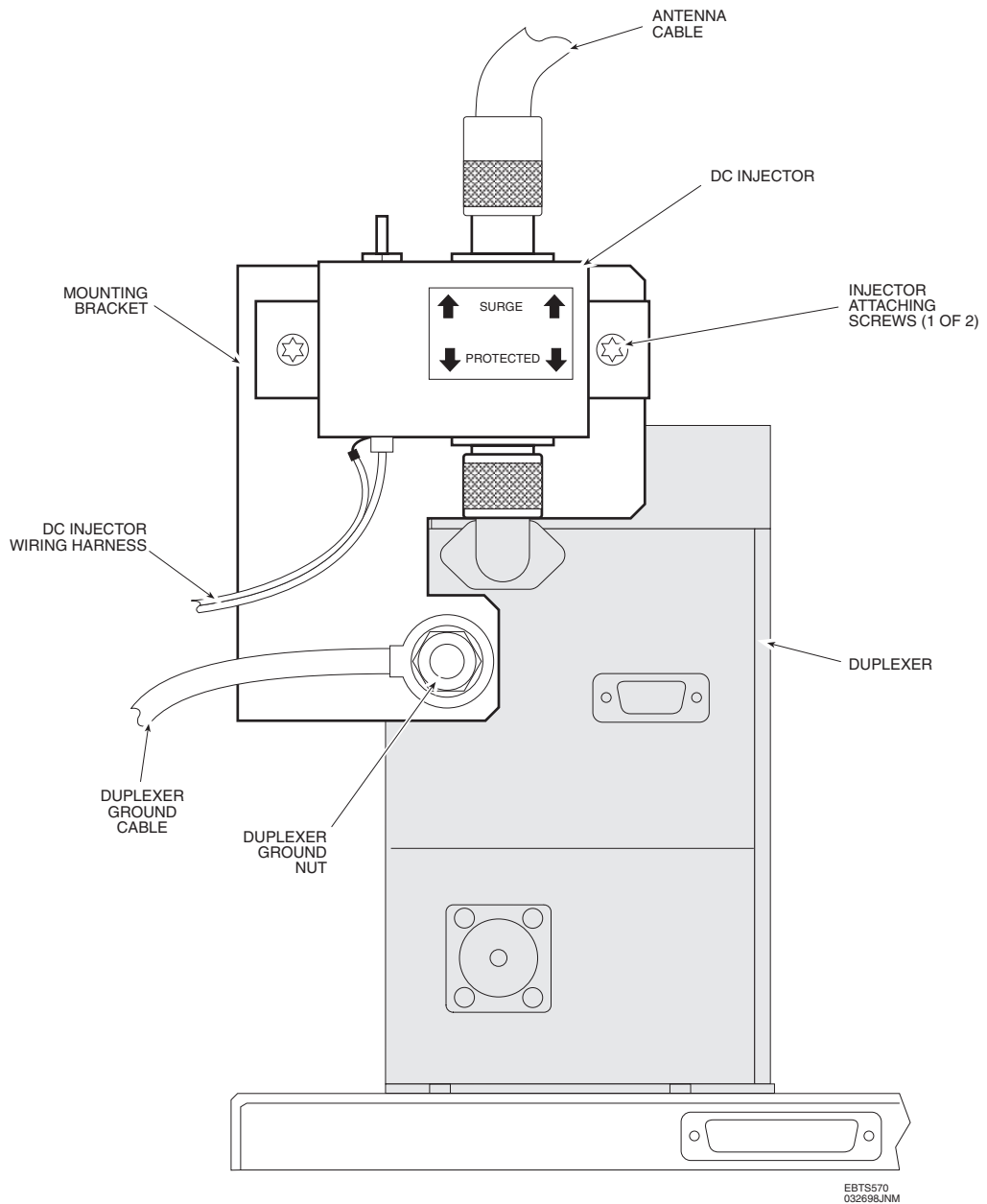


Figure 18 **DC Injector Installation**

## Cabling Information

## Cabling Information

The illustrations and corresponding tables within this section identify cabling part numbers and point-to-point connections. The illustrations show the location and connections of the cables. Each cable is identified by an index number. The corresponding tables identify the point-to-point connection, function, and part number of the cables. Connections appearing in **bold** are labeled accordingly on the equipment.

The cabling diagrams included in this section are listed in the following table.

| Section                                            | Page | Description                                                                                                                                                                     |
|----------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Duplexer-To-Rx Tray Cabling                        | 55   | Provides cabling information for the receive connections between the Duplexers and the Rx Tray.                                                                                 |
| Receiver Cabling                                   | 57   | Provides cabling information for the Rx Tray-to-Base Radio Rx input connections. Also provides intercabinet receive cabling information on systems using expansion RF cabinets. |
| Chassis Grounding                                  | 60   | Provides cabling information for the chassis ground connections of each module                                                                                                  |
| 5 MHz/1 PPS Cabling                                | 62   | Provides 5 MHz/1 PPS cabling information for the time frequency reference signal connections within the equipment cabinet                                                       |
| Ethernet Cabling                                   | 64   | Provides Ethernet cabling information for the Ethernet connections within the equipment cabinet                                                                                 |
| DC Power Cabling                                   | 66   | Provides power cabling information for the cabling between the Power Distribution Panel and the modules within the cabinet                                                      |
| RF Cabinet Alarm/Power Monitor Harness Connections | 68   | Provides cabinet alarm connections information for interconnection to the various cabinet modules.                                                                              |
| Transmit Power Out Cabling                         | 70   | Provides cabling information for the Base Radio transmit power out connections to other modules within the equipment cabinet                                                    |
| Transmit Expansion Cabling                         | 72   | Provides transmit cabling information for expansion configurations                                                                                                              |
| 19-24 BR Transmit Cabling                          | 76   | Provides cabling information for BR19-BR24 transmit expansion configuration                                                                                                     |
| Duplexed TTA Cabling                               | 78   | Provides information for cabling between the Rx Tray, TTA Alarm Tray, and DC injectors for systems equipped to operate with TTAs                                                |

## Duplexer-To-Rx Tray Cabling

### NOTE

Duplexer-to-Rx Tray cabling is factory configured. This information is provided as a reference when adding multicoupler boards or performing maintenance.

Duplexer-to-Rx Tray cabling routes the Rx output from the Duplexer to the 4-way multicouplers and 6-way multicouplers in the Rx Tray. Table 8 identifies and Figure 19 shows the Duplexer cabling and connecting points.

Table 8 **Duplexer-To-Rx Tray Cabling**

| Index | Part Number | From                                              | To                                                                           | Notes                                                                                                                        |
|-------|-------------|---------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| 1     | 3012028G17  | Duplexer Rx output port (see detail A in Fig. 19) | Input port on 4-Way Multicoupler Board (see detail B in Fig. 19)             |                                                                                                                              |
| 2     | 3012029A14  | R1 output port on 4-Way Multicoupler Board        | 2 dB inline attenuator on 6-Way Multicoupler Board (see detail C in Fig. 19) |                                                                                                                              |
| 3     | 5882345W02  | 2 dB inline attenuator male SMA connector         | Input port on 6-Way Multicoupler Board (see detail C in Fig. 19)             | Index 3 is 2 dB inline attenuator.<br>Attenuator is not required with 6-Way Multicoupler board version CTF6140B (and later). |

## Cabling Information

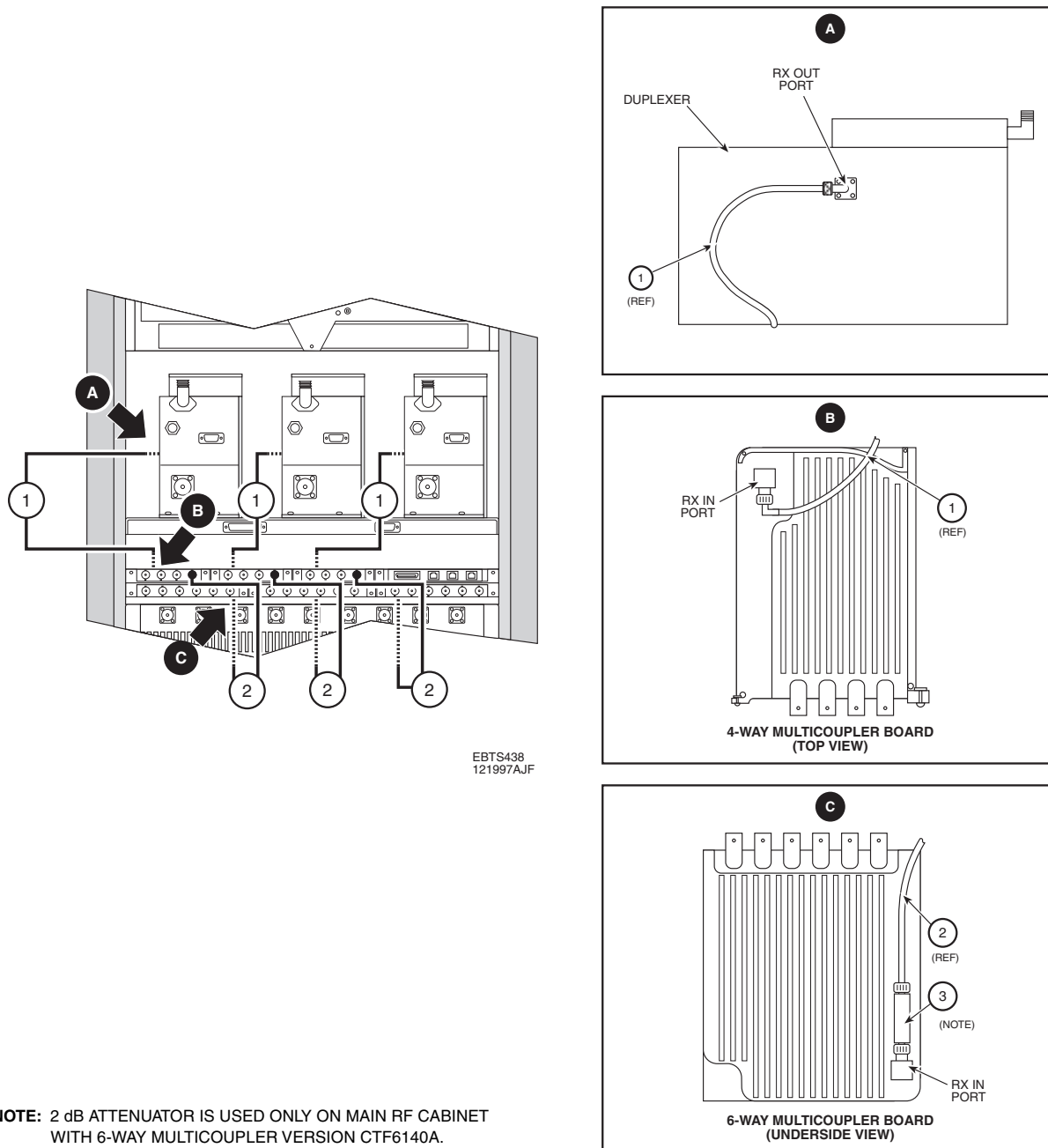


Figure 19 **Duplexer-To-Rx Tray Cabling (GEN 4 Duplexed RFDS Systems)**

## Receiver Cabling

Table 9 lists receiver cabling information and Figure 21 shows the receiver cabling connections for an EBTS equipped with the GEN 4 Duplexed RFDS. Table 10 lists and Figure 21 shows intercabinet receive cabling for multi-cabinet expansion configurations.

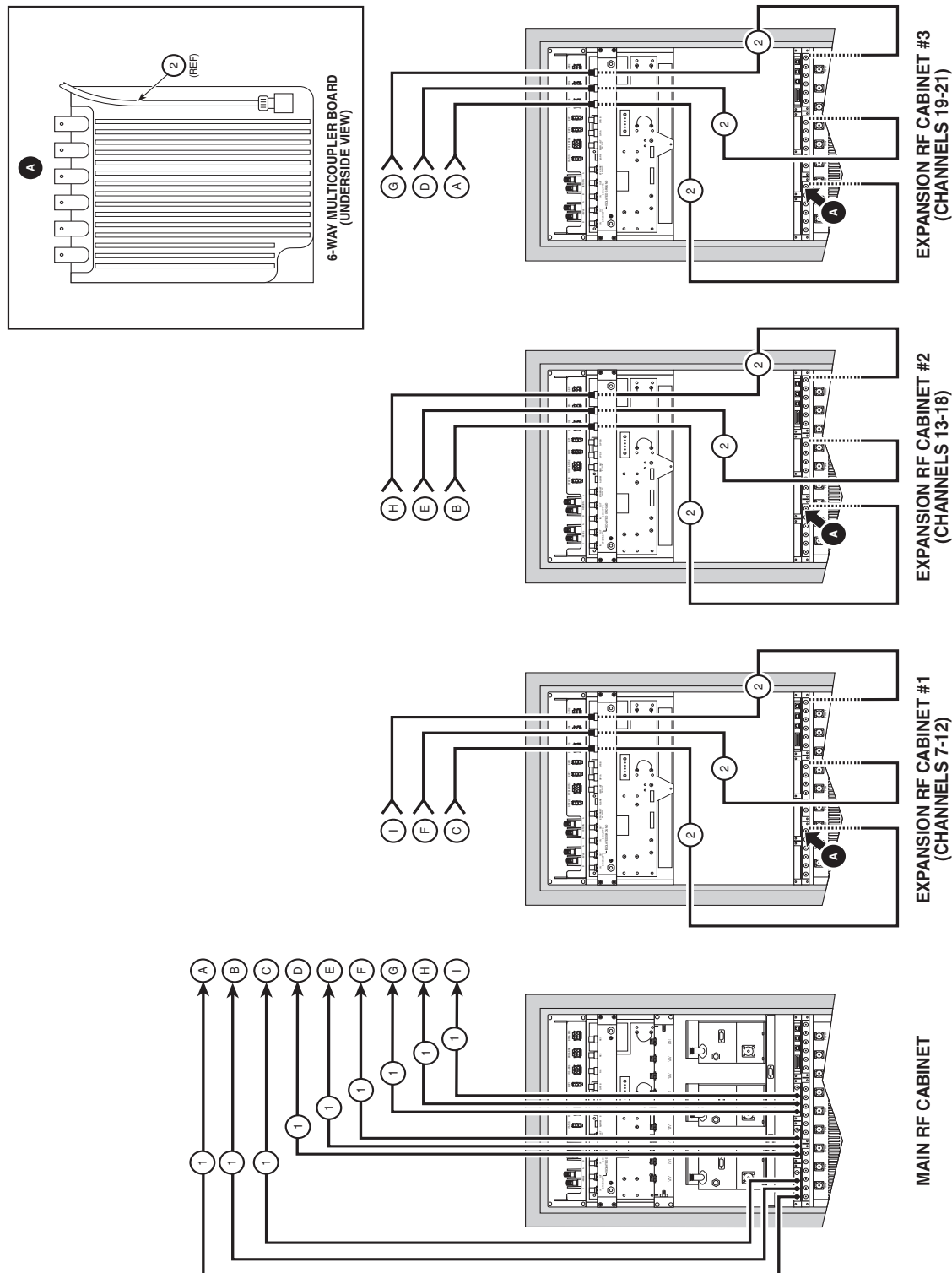
### NOTE

In multicabinet systems, BR1 through BR6 Base Radio connections in Table 9 and Figure 21 also apply to BR7 through BR12 in Expansion RF Cabinet #1, BR13 through BR18 in Expansion RF Cabinet #2, and BR19 through BR24 in Expansion RF Cabinet #3, respectively.

Table 9 **Receiver Cabling**

| Index                                                                                                                                                                                                                                                                                                                                                                              | Part Number | From:                                      | To:                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------|---------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                  | 0112004Y15  | E-R1 connector on 6-Way Multicoupler Board | RX connector on BR1 |
| 2                                                                                                                                                                                                                                                                                                                                                                                  | 0112004Y15  | E-R2 connector on 6-Way Multicoupler Board | RX connector on BR2 |
| 3                                                                                                                                                                                                                                                                                                                                                                                  | 0112004Y12  | E-R3 connector on 6-Way Multicoupler Board | RX connector on BR3 |
| 4                                                                                                                                                                                                                                                                                                                                                                                  | 0112004Y12  | E-R4 connector on 6-Way Multicoupler Board | RX connector on BR4 |
| 5                                                                                                                                                                                                                                                                                                                                                                                  | 0112004Y07  | E-R5 connector on 6-Way Multicoupler Board | RX connector on BR5 |
| 6                                                                                                                                                                                                                                                                                                                                                                                  | 0112004Y07  | E-R6 connector on 6-Way Multicoupler Board | RX connector on BR6 |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cabinets (regardless of ordered configuration) are equipped with full 6-BR, triple-diversity receive cabling.</li> <li>2. BR5 and BR6 are expansion BRs. Baseline system is equipped with BR1 through BR4 only.</li> <li>3. Unused Rx output ports shall be terminated with 50Ω terminator, P/N 0909906D01.</li> </ol> |             |                                            |                     |

## Cabling Information



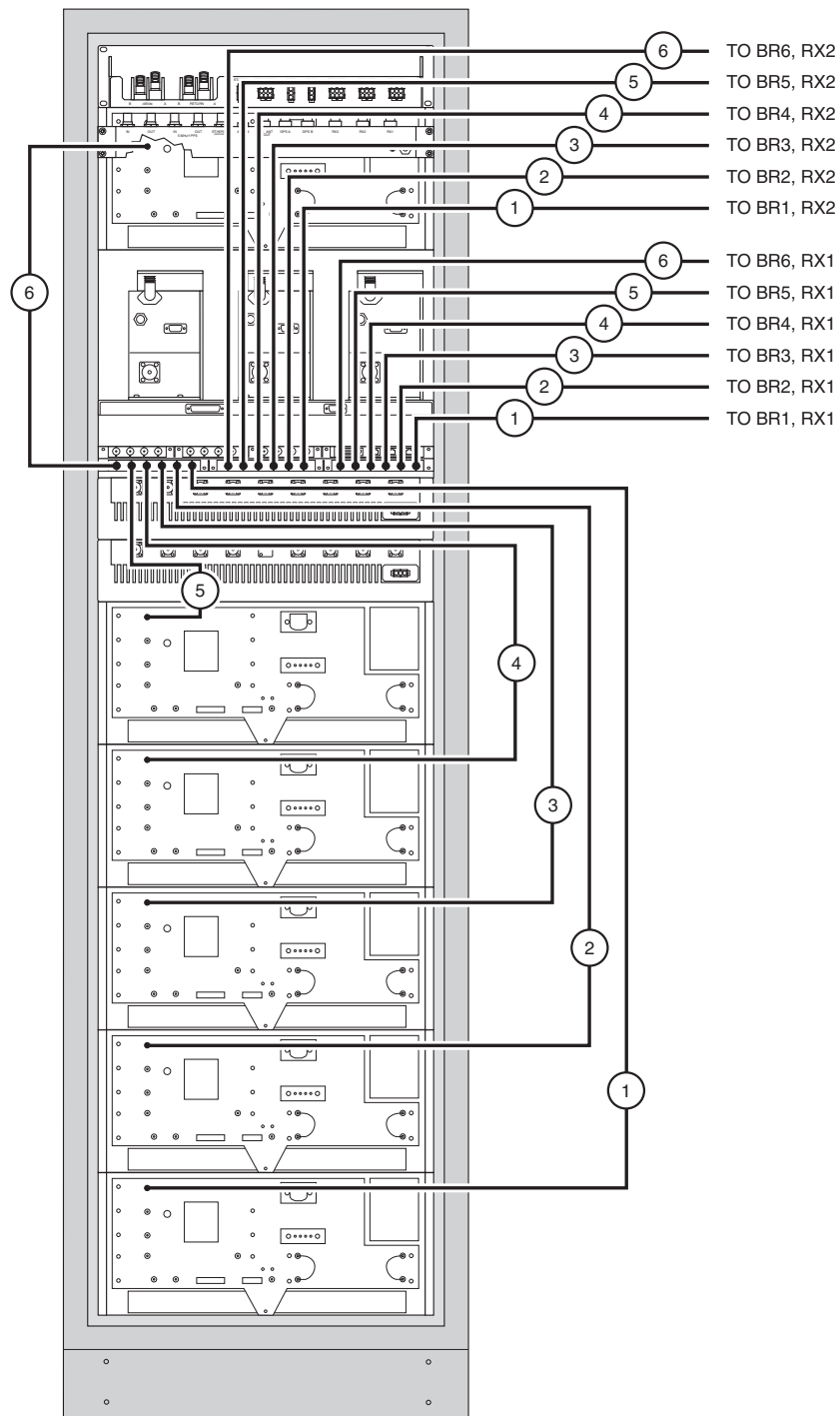
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## NOTES:

1. 6-WAY MULTICOUPLER TO BASE RADIO RX CONNECTIONS FOR ALL CABINETS ARE AS SHOWN IN "RECEIVER CABLING" DIAGRAM.
2. 6-WAY MULTICOUPLER INPUT CONNECTION (INDEX 2) AS SHOWN IN DETAIL 'A'. TORQUE CONNECTION TO 5 IN-LB.

Figure 20 Receive Expansion Cabling (Multicabinet GEN 4 Duplexed RFDS Systems)





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Figure 21 **Receiver Cabling (GEN 4 Duplexed RFDS Systems)**

**Cabling Information**Table 10 **Receiver Cabling (Expansion Cabinets)**

| Index                                                                                                                                               | Part Number | From                                                          | To                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------------------------------|------------------------------------------------------------------|
| 1                                                                                                                                                   | 3012029E37  | R2, R3, R4 expansion output ports on 4-Way Multicoupler Board | Expansion RF Cabinet junction panel                              |
| 2                                                                                                                                                   | 3012028E23  | Expansion RF Cabinet junction panel                           | Input port on 6-Way Multicoupler Board (see detail A in Fig. 20) |
| <b>NOTE:</b> Above listing for part no. identification and function description only. Refer to accompanying diagram for point-to-point connections. |             |                                                               |                                                                  |

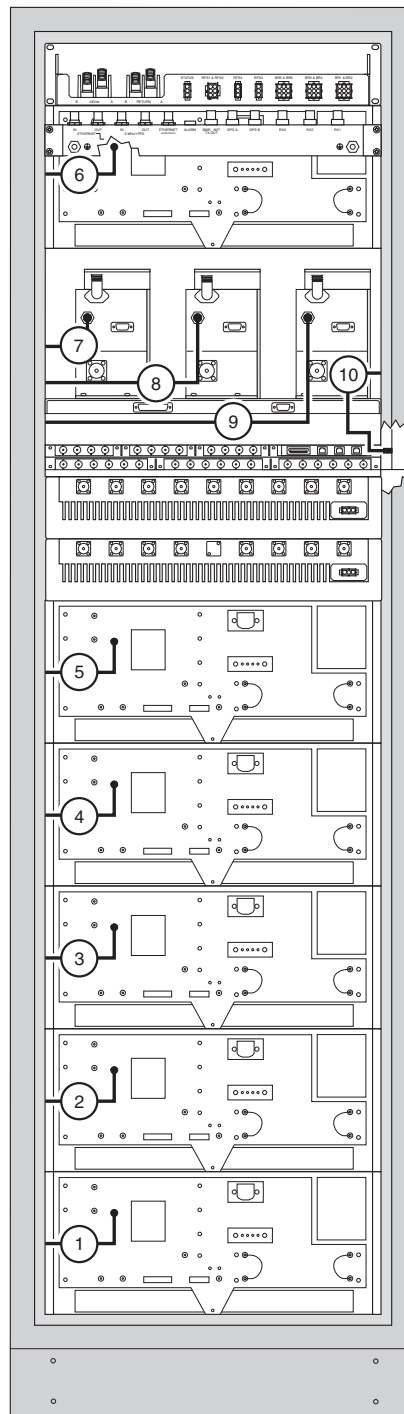
**Chassis Grounding**

Chassis grounding refers to the ground cable connections between the equipment modules within the equipment cabinet and the cabinet frame. Chassis grounds help prevent interference and damage to equipment in the event of a lightning strike.

Table 11 identifies and Figure 22 shows the ground cabling.

Table 11 **Ground Straps (GEN 4 Duplexed RFDS Systems)**

| Index | Part Number | From                                                  | To                                        |
|-------|-------------|-------------------------------------------------------|-------------------------------------------|
| 1     | 3082000X04  | Ground stud on equipment cabinet or secondary bus bar | <b>GROUND</b> ground stud on Base Radio 1 |
| 2     | 3082000X04  | Ground stud on equipment cabinet or secondary bus bar | <b>GROUND</b> ground stud on Base Radio 2 |
| 3     | 3082000X04  | Ground stud on equipment cabinet or secondary bus bar | <b>GROUND</b> ground stud on Base Radio 3 |
| 4     | 3082000X04  | Ground stud on equipment cabinet or secondary bus bar | <b>GROUND</b> ground stud on Base Radio 4 |
| 5     | 3082000X04  | Ground stud on equipment cabinet or secondary bus bar | <b>GROUND</b> ground stud on Base Radio 5 |
| 6     | 3082000X04  | Ground stud on equipment cabinet or secondary bus bar | <b>GROUND</b> ground stud on Base Radio 6 |
| 7     | 3082000X05  | Ground stud on equipment cabinet or secondary bus bar | ground stud on Antenna 3 Duplexer         |
| 8     | 3082000X05  | Ground stud on equipment cabinet or secondary bus bar | ground stud on Antenna 2 Duplexer         |
| 9     | 3082000X05  | Ground stud on equipment cabinet or secondary bus bar | ground stud on Antenna 1 Duplexer         |
| 10    | 3082000X02  | Ground stud on equipment cabinet or secondary bus bar | ground lug on Rx Tray                     |

**NOTES:**

Indexes 7, 8, and 9 can also attach to the studs on the Junction Panel.

Index 10 can also attach to the left side of the secondary ground bus bar.

There may also be ground connections from the Combiners to the secondary ground bus bar.

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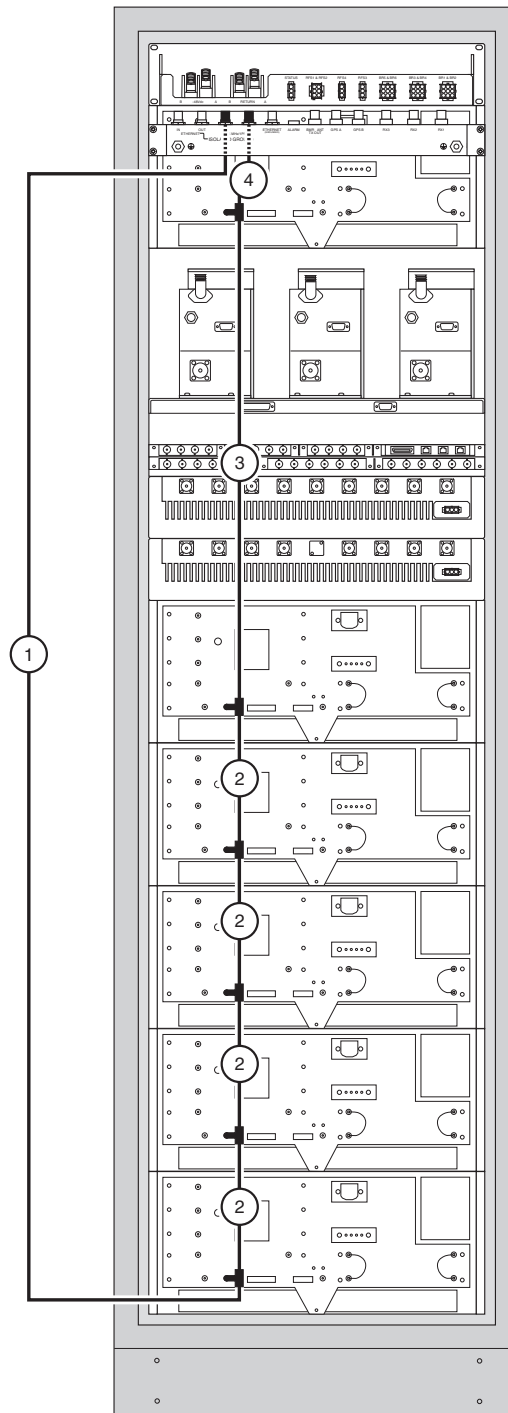
Figure 22 Chassis Grounding Diagram (GEN 4 Duplexed RFDS Systems)

**Cabling Information****5 MHz/1 PPS Cabling**

5 MHz / 1 PPS cabling routes the time frequency reference signal between the Junction Panel and each Base Radio. Table 12 identifies and Figure 23 shows the 5 MHz / 1 PPS cabling.

Table 12 **5 MHz/1 PPS Cabling**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Part Number | From                                                           | To                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3082004X03  | Underside of <b>5 MHZ/1 PPS IN</b> connector on Junction Panel | BNC T-adapter on Base Radio 1                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0112004Z17  | BNC T-adapter on Base Radio 1                                  | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3<br>BNC T-adapter on Base Radio 4<br>BNC T-adapter on Base Radio 5 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0112004Z07  | BNC T-adapter on Base Radio 5                                  | BNC T-adapter on Base Radio 6                                                                                                    |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3082004X05  | BNC T-adapter on Base Radio 6                                  | Underside of <b>5 MHZ/1 PPS OUT</b> connector on Junction Panel                                                                  |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cables are connected between the BNC T-adapters (P/N 0909907D01), which are mounted to the appropriate module connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to six BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, 5 MHz/1 PPS OUT connector must be terminated with 50Ω terminator.</li> </ol> |             |                                                                |                                                                                                                                  |



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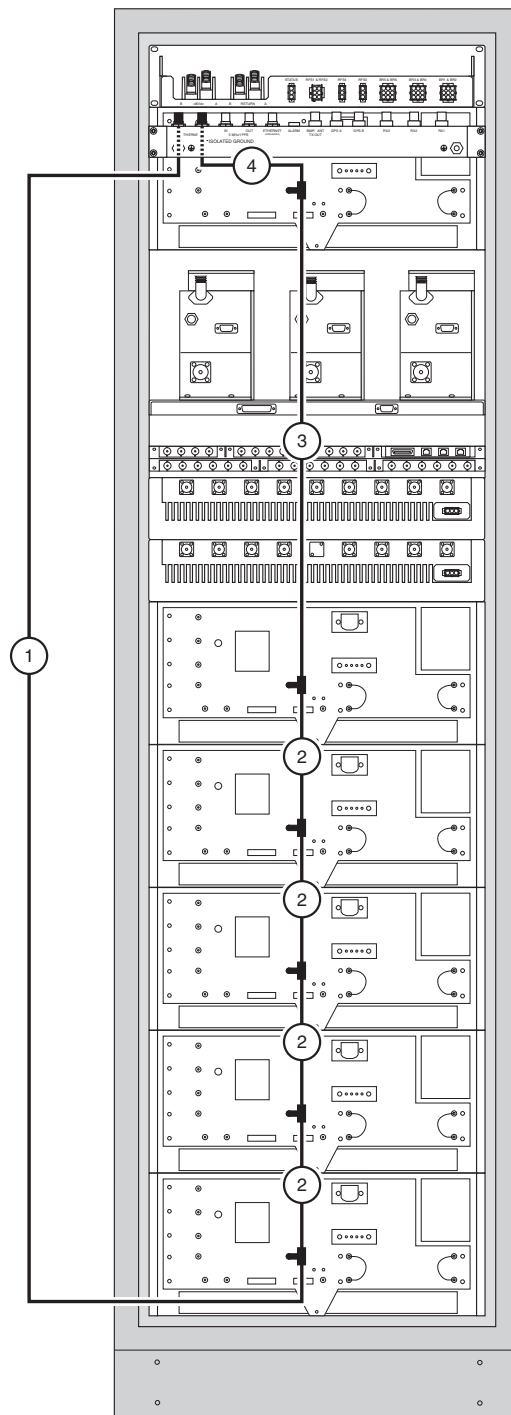
Figure 23 5 MHz/1 PPS Cabling (GEN 4 Duplexed RFDS Systems)

**Cabling Information****Ethernet Cabling**

Ethernet cabling routes the Ethernet network between the Junction Panel and each Base Radio. Table 13 identifies and Figure 24 shows the Ethernet cabling.

Table 13 ***Ethernet Cabling***

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Part Number | From                                                        | To                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3082004X03  | Underside of <b>ETHERNET IN</b> connector on Junction Panel | BNC T-adapter on Base Radio 1                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0112004Z17  | BNC T-adapter on Base Radio 1                               | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3<br>BNC T-adapter on Base Radio 4<br>BNC T-adapter on Base Radio 5 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0112004Z07  | BNC T-adapter on Base Radio 5                               | BNC T-adapter on Base Radio 6                                                                                                    |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3082004X03  | BNC T-adapter on Base Radio 6                               | Underside of <b>ETHERNET OUT</b> connector on Junction Panel                                                                     |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cables are connected between the BNC T-adapters (P/N 0909907D01), which are mounted to the appropriate module connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to six BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, ETHERNET OUT connector must be terminated with 50Ω terminator.</li> </ol> |             |                                                             |                                                                                                                                  |



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Figure 24 **Ethernet Cabling (GEN 4 Duplexed RFDS Systems)**

**Cabling Information****DC Power Cabling**

DC power connections refer to power cabling between the Equipment Cabinet Power Distribution Panel and the modules within the cabinet. Table 14 identifies and Figure 25 shows the DC power connections.

**NOTE**

Table 14 and Figure 25 represent full cabinet capacity (6 BR). Systems using less BRs have accordingly fewer connections.

Table 14 **DC Power Cabling**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Part Number | From                                                              | To                                                             | Notes                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082050X02  | <b>BR1&amp;BR2</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 1 and 2                | Y-cable assembly                         |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082050X01  | <b>BR3&amp;BR4</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 3 and 4                | Y-cable assembly                         |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082050X03  | <b>BR5&amp;BR6</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 5 and 6                | Y-cable assembly                         |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082129X04  | <b>RFS1&amp;RFS2</b> connectors on Power Distribution Panel       | <b>-48 VDC</b> Mate-N-Lok input connector on Rx Tray I/O board | See detail A in Fig. 25                  |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082129X02  | <b>FAN POWER</b> output Mate-N-Lok connector on Rx Tray I/O board | Mate-N-Lok input connector on Combiner Tray (NOTE 3)           | Y-cable assembly see detail A in Fig. 25 |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082056X03  | RFDS power output Mate-N-Lok connector on Rx Tray I/O board       | 9-pin submini D connector (P5) on RFDS duplexer shelf          | See detail A in Fig. 25                  |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cabinets (regardless of ordered configuration) are equipped with full 6-BR power cabling.</li> <li>2. Connections for BR7-BR12 in expansion RF cabinet #1 (or BR13-BR18 in expansion RF cabinet #2) are connected in same pattern as for BR1-BR6 in main RF cabinet.</li> <li>3. If cabinet is equipped with only one Combiner Tray, unused end of index 5 is cable-tied out of way.</li> </ol> |             |                                                                   |                                                                |                                          |



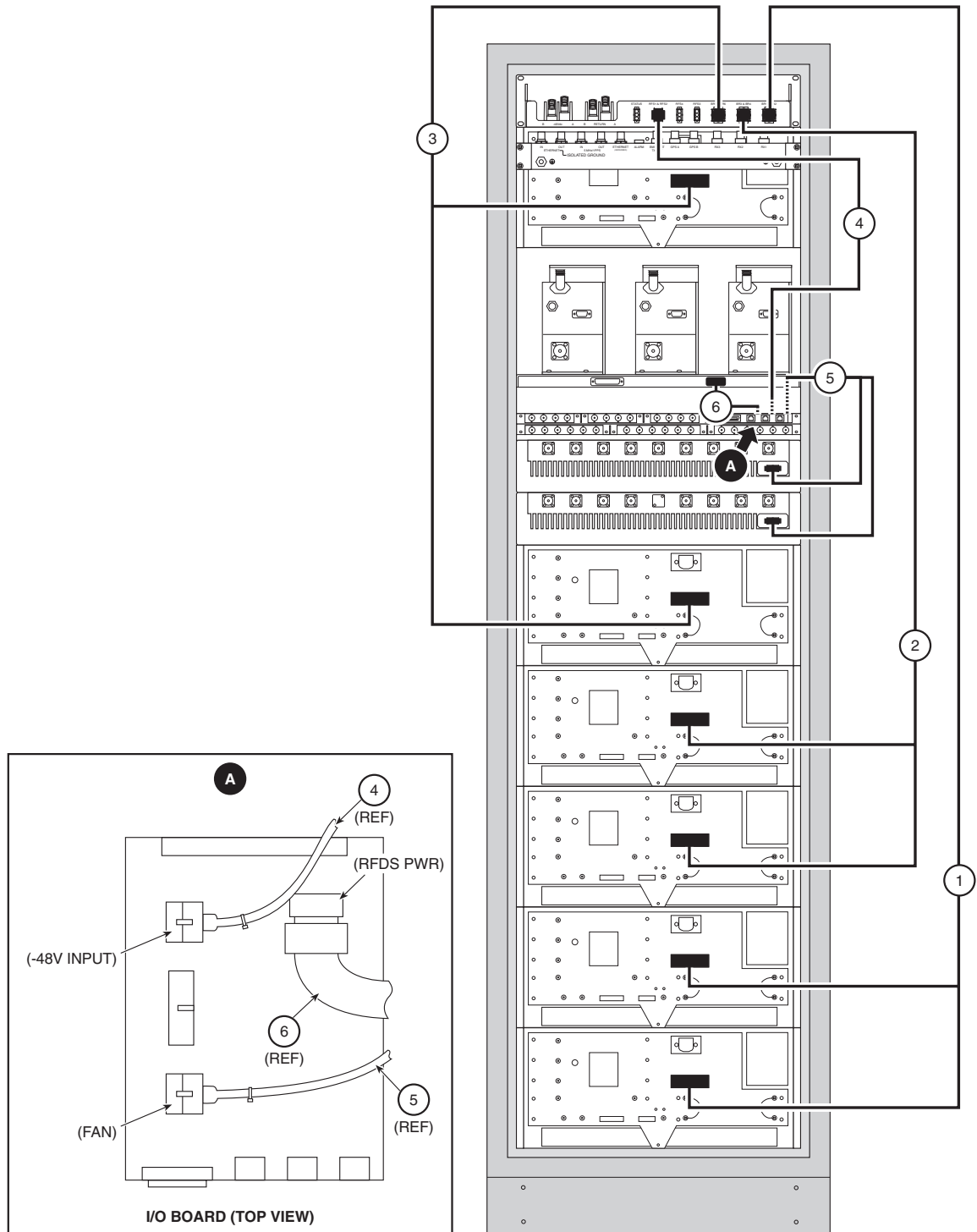
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Figure 25 DC Power Cabling (GEN 4 Duplexed RFDS Systems)

**Cabling Information****RF Cabinet Alarm/Power Monitor Harness Connections**

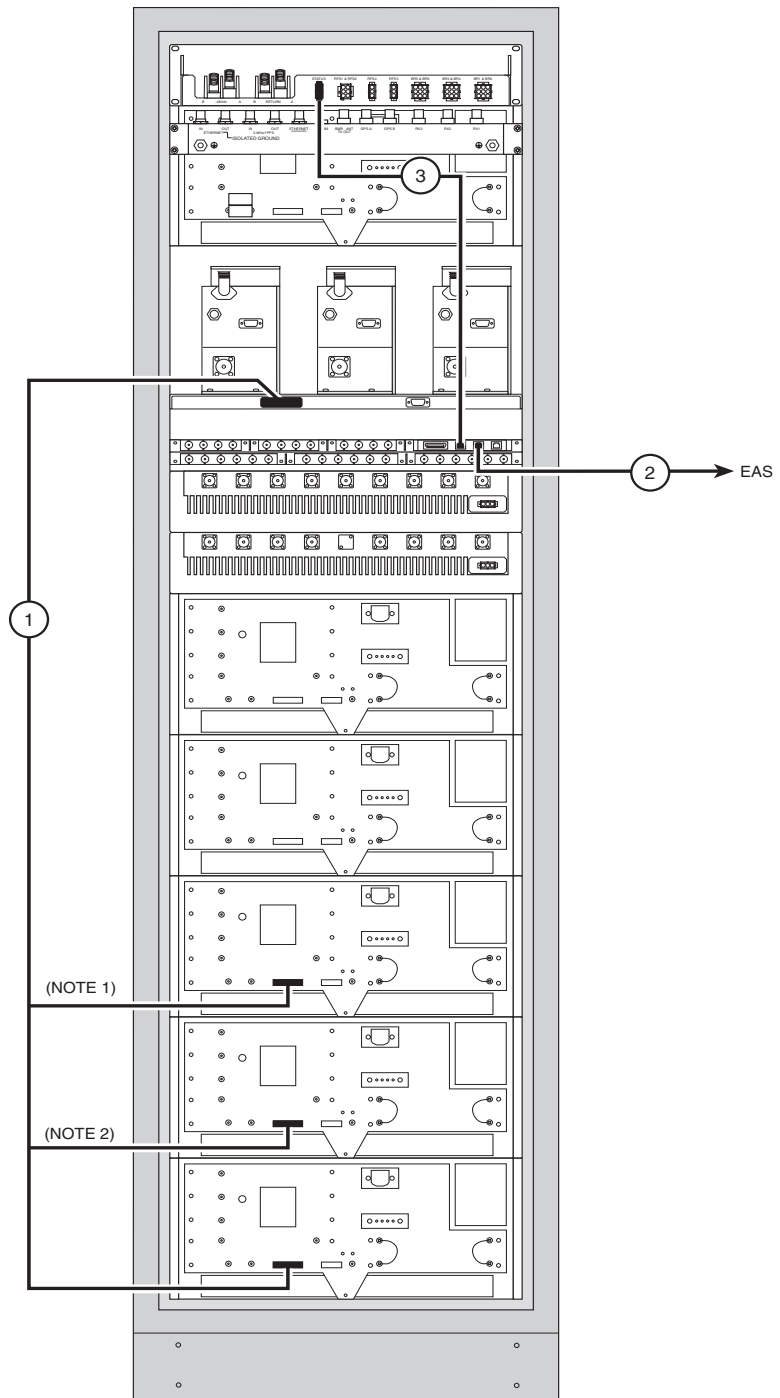
The cabinet alarm connections use a multi-connector wiring harness assembly that provides for daisy-chain connection of the various modules. Table 15 identifies and Figure 26 shows the harness connecting points.

**NOTE**

System in Table 15 and Figure 26 represents full cabinet capacity (6 BR). Systems using less BRs have accordingly fewer connections. Unused connectors are cable-tied to equipment cabinet frame.

Table 15 **Alarm/Power Monitor Harness Connections**

| Index                                                                                                                                                                                                                                                                                              | Part Number | From                                                   | To                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                  | 3082053X01  | 25-pin submini-D connector (P4) on RFDS duplexer shelf | Power monitor multi-connector harness. From top-to-bottom, connects to: <ul style="list-style-type: none"> <li>• 25-pin <b>ALARM</b> connector on Base Radio 3 (NOTE 1)</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 2 (NOTE 2)</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 1</li> </ul> |
| 2                                                                                                                                                                                                                                                                                                  | 3084225N42  | RJ45 STANDARD alarm connector on I/O board             | RJ45 alarm input connector on Environmental Alarm System/iDEN Monitor Unit                                                                                                                                                                                                                                    |
| 3                                                                                                                                                                                                                                                                                                  | 3082129X03  | <b>STATUS</b> connector on breaker panel               | RJ45 EXPANSION alarm input connector on I/O board                                                                                                                                                                                                                                                             |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Base Radio 3 ALARM connection performed only on systems with Base Radio PA outputs applied to Duplexer 3.</li> <li>2. Base Radio 2 ALARM connection performed only on systems with Base Radio PA outputs applied to Duplexer 2.</li> </ol> |             |                                                        |                                                                                                                                                                                                                                                                                                               |

**NOTES:**

1. BASE RADIO 3 ALARM CONNECTION PERFORMED ONLY ON SYSTEMS WITH BASE RADIO PA OUTPUTS APPLIED TO DUPLEXER 3.
2. BASE RADIO 2 ALARM CONNECTIONS PERFORMED ONLY ON SYSTEMS WITH BASE RADIO PA OUTPUTS APPLIED TO DUPLEXER 2.

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**Figure 26 RF Cabinet Alarm/Power Monitor Harness Connections (GEN 4 Duplexed RFDS Systems)**

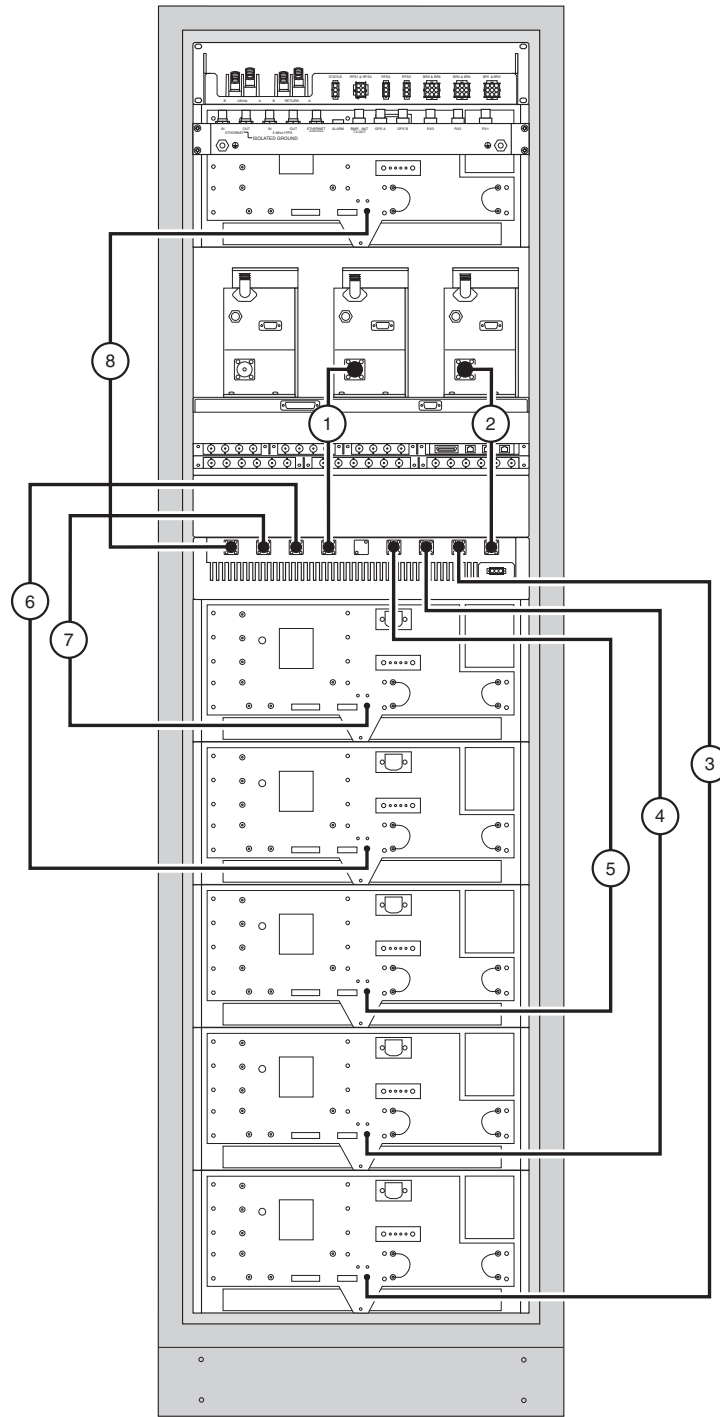
**Cabling Information****Transmit Power Out Cabling**

Transmit power output cabling routes the Base Radio RF output to the transmit inputs on the RFDS.

Table 16 identifies and Figure 27 shows the location and connecting points for the power out cables.

Table 16 **Transmit Power Out (GEN 4 Duplexed RFDS Systems)**

| Index                                                                                                                                                                                                                                              | Part Number | From                                      | To                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------|---------------------------------------|
| 1                                                                                                                                                                                                                                                  | 0112004B03  | T6 (OUT) port on Dual 3-Way Combiner Deck | Antenna 2 Duplexer Tx input port      |
| 2                                                                                                                                                                                                                                                  | 0112004B03  | T1 (OUT) port on Dual 3-Way Combiner Deck | Antenna 1 Duplexer Tx input port      |
| 3                                                                                                                                                                                                                                                  | 0112004K14  | PA OUT connector on BR 1 (NOTE)           | Dual 3-Way Combiner Deck T2 (IN) port |
| 4                                                                                                                                                                                                                                                  | 0112004K14  | PA OUT connector on BR 2 (NOTE)           | Dual 3-Way Combiner Deck T3 (IN) port |
| 5                                                                                                                                                                                                                                                  | 0112004K14  | PA OUT connector on BR 3 (NOTE)           | Dual 3-Way Combiner Deck T4 (IN) port |
| 6                                                                                                                                                                                                                                                  | 0112004K08  | PA OUT connector on BR 4 (NOTE)           | Dual 3-Way Combiner Deck T7 (IN) port |
| 7                                                                                                                                                                                                                                                  | 0112004K08  | PA OUT connector on BR 5 (NOTE)           | Dual 3-Way Combiner Deck T8 (IN) port |
| 8                                                                                                                                                                                                                                                  | 0112004K08  | PA OUT connector on BR 6 (NOTE)           | Dual 3-Way Combiner Deck T9 (IN) port |
| <b>NOTE:</b> For 1-12 BR system, BR7 through BR12 Tx cabling in expansion cabinet #1 is connected in same pattern as BR1 through BR6 Tx cabling. For 13-18 BR system, BR13 through BR18 Tx cabling in expansion cabinet #2 is similarly connected. |             |                                           |                                       |



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Figure 27 **Transmit Power Out Cabling Diagram (GEN 4 Duplexed RFDS Systems)**

**Cabling Information****Transmit Expansion Cabling**

Table 17 identifies and Figure 28 shows the required combiner deck cabling and intercabinet (Main to expansion RF cabinet (RFC)) cabling for up to 9-BR expansion.

Table 18 identifies and Figure 29 shows the required combiner deck cabling and intercabinet cabling for 1-12 BR expansion and 1-18 BR expansion systems.

**NOTE**

Refer to Receiver Cabling for receive expansion cabling information.

Refer to Transmit Power Out Cabling for information on transmit cabling between individual Base Radios and combiner deck(s).

Table 17 **Transmit Expansion Cabling (Up to 9-BR Expansion)**

| Expansion Level                                                                                                                                                                                                                                        | Index | Part Number         | From                                                                                                                            | To                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|---------------------|---------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| —                                                                                                                                                                                                                                                      | 1     | 0112004B03 (NOTE 1) | Main RFC Dual 3-Way Combiner Deck <b>T1</b> (OUT) port (TX1-TX3 combined signal)                                                | Antenna 1 Duplexer Tx input port |
| BR5/BR6                                                                                                                                                                                                                                                | 2     | 0112004B03 (NOTE 1) | Main RFC Dual 3-Way Combiner Deck <b>T6</b> (OUT) port (TX4-TX6 combined signal)                                                | Antenna 2 Duplexer Tx input port |
| BR7-BR9                                                                                                                                                                                                                                                | 3     | CKN6288A            | (Low-loss intercabinet cable)<br>Expansion RFC Dual 3-Way Combiner Deck <b>T1</b> (OUT) port (TX7-TX9 combined signal) (NOTE 1) | Antenna 3 Duplexer Tx input port |
| <b>NOTES:</b><br>1. Index 1 and 2, and connections shown, are part of baseline system.<br>2. Configuration shown cannot be directly expanded beyond 9 BRs. For expansion greater than 9 BR, refer to 1-12 BR expansion information in following table. |       |                     |                                                                                                                                 |                                  |

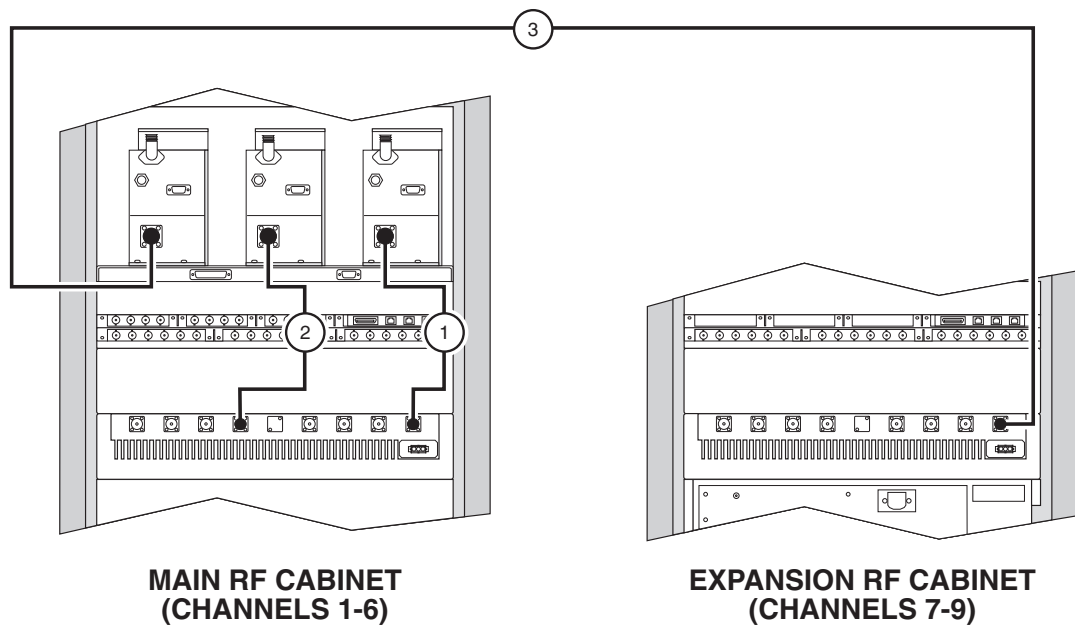
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Figure 28 **Transmit Expansion Cabling (Up to 9-BR Expansion)**

**Cabling Information****Table 18** *Transmit Expansion Cabling (1-12 BR and 1-18 BR Expansions)*

| <b>Expansion Level</b> | <b>Index</b> | <b>Part Number</b> | <b>From</b>                                                                                                                 | <b>To</b>                                               |
|------------------------|--------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| BR1-BR12               | 1            | 0112004B03         | Main RFC Triple 2-Way Combiner Deck <b>T1</b> (OUT) port (TX1-TX6 cascaded combined signal)                                 | Antenna 1 Duplexer Tx input port                        |
|                        | 2            | 0112004B03         | Main RFC Dual 3-Way Combiner Deck <b>T1</b> (OUT) port (TX1-TX3 combined signal)                                            | Main RFC Triple 2-Way Combiner Deck <b>T2</b> (IN) port |
|                        | 3            | 0112004B03         | Main RFC Dual 3-Way Combiner Deck <b>T6</b> (OUT) port (TX4-TX6 combined signal)                                            | Main RFC Triple 2-Way Combiner Deck <b>T3</b> (IN) port |
|                        | 4            | 0112004B03         | Main RFC Triple 2-Way Combiner Deck <b>T4</b> (OUT) port (TX7-TX12 cascaded combined signal)                                | Antenna 2 Duplexer Tx input port                        |
|                        | 5            | CKN6288A           | (Low-loss intercabinet cable)<br>Expansion RFC #1 Dual 3-Way Combiner Deck <b>T1</b> (OUT) port (TX7-TX9 combined signal)   | Main RFC Triple 2-Way Combiner Deck <b>T6</b> (IN) port |
|                        | 6            | CKN6288A           | (Low-loss intercabinet cable)<br>Expansion RFC #1 Dual 3-Way Combiner Deck <b>T6</b> (OUT) port (TX10-TX12 combined signal) | Main RFC Triple 2-Way Combiner Deck <b>T5</b> (IN) port |
| BR13-BR18              | 7            | 0112004B03         | Main RFC Triple 2-Way Combiner Deck <b>T7</b> (OUT) port (TX13-TX18 cascaded combined signal)                               | Antenna 3 Duplexer Tx input port                        |
|                        | 8            | CKN6288A           | (Low-loss intercabinet cable)<br>Expansion RFC #2 Dual 3-Way Combiner Deck <b>T1</b> (OUT) port (TX13-TX15 combined signal) | Main RFC Triple 2-Way Combiner Deck <b>T9</b> (IN) port |
|                        | 9            | CKN6288A           | (Low-loss intercabinet cable)<br>Expansion RFC #2 Dual 3-Way Combiner Deck <b>T6</b> (OUT) port (TX16-TX18 combined signal) | Main RFC Triple 2-Way Combiner Deck <b>T8</b> (IN) port |



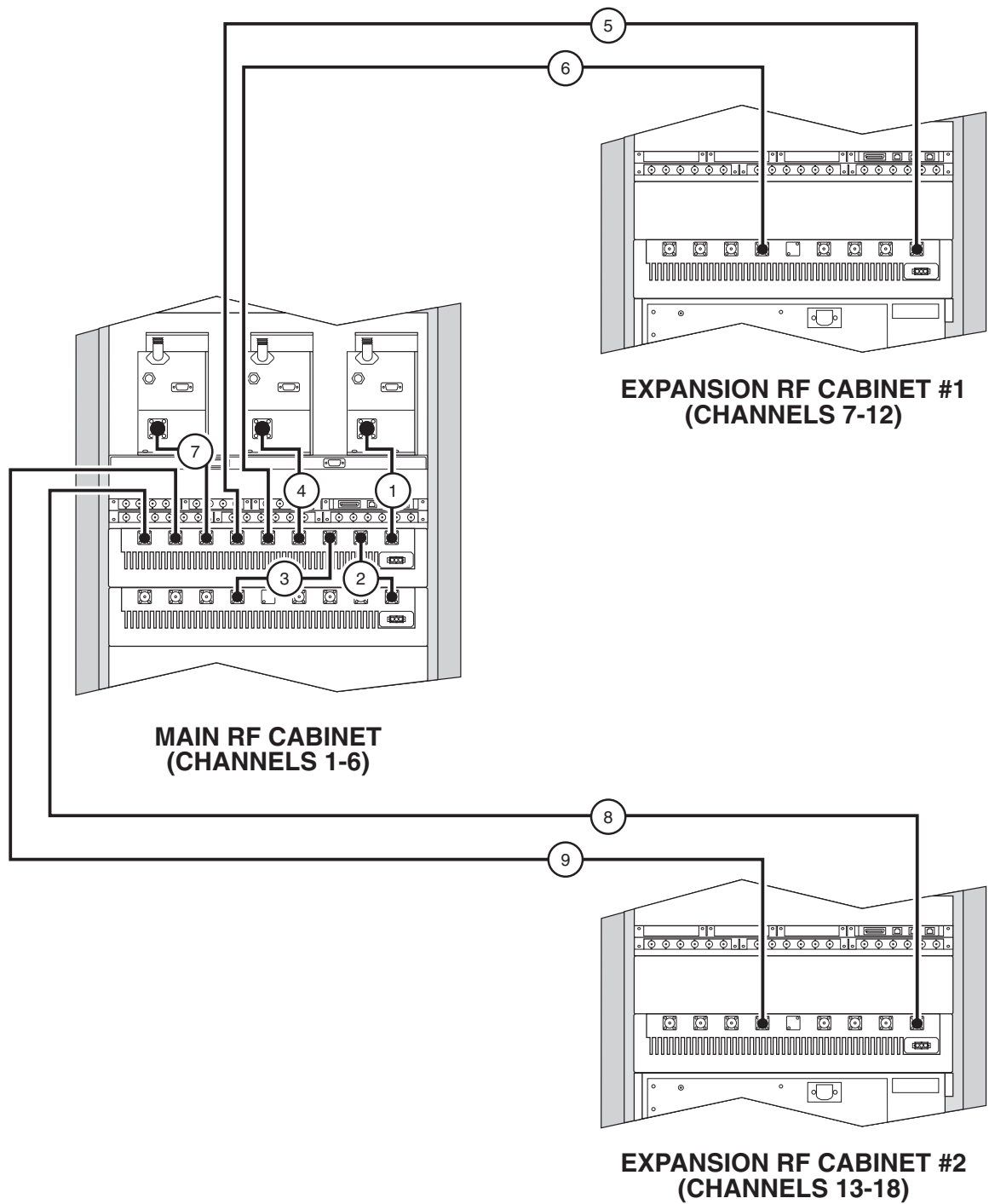
EBTS436  
12189AAA

Figure 29 **Transmit Expansion Cabling (1-12 BR and 1-18 BR Expansions)**

**Cabling Information****19-24 BR Transmit Cabling**

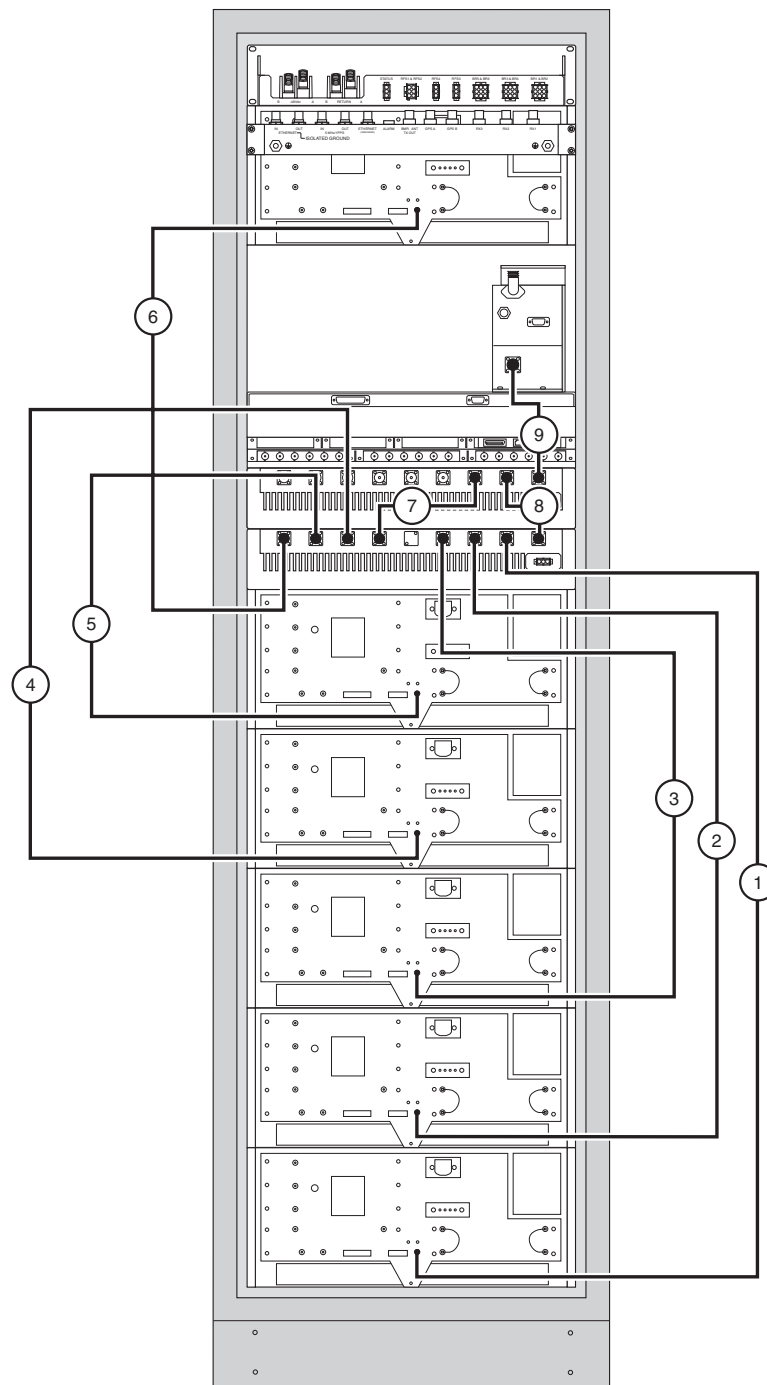
Table 19 identifies and Figure 30 shows the Tx cabling in Expansion RF Cabinet #3 for Base Radios 19 through 24.

**NOTE**

Receive cabling for 19-24 BR system is as described in Receiver Cabling.

Table 19 **Transmit Expansion Cabling (19-24 BR Expansion)**

| Index | Part Number | From                                                                         | To                                             |
|-------|-------------|------------------------------------------------------------------------------|------------------------------------------------|
| 1     | 0112004K14  | PA OUT connector on BR 17                                                    | Dual 3-Way Combiner Deck <b>T2</b> (IN) port   |
| 2     | 0112004K14  | PA OUT connector on BR 18                                                    | Dual 3-Way Combiner Deck <b>T3</b> (IN) port   |
| 3     | 0112004K14  | PA OUT connector on BR 19                                                    | Dual 3-Way Combiner Deck <b>T4</b> (IN) port   |
| 4     | 0112004K08  | PA OUT connector on BR 20                                                    | Dual 3-Way Combiner Deck <b>T7</b> (IN) port   |
| 5     | 0112004K08  | PA OUT connector on BR 21                                                    | Dual 3-Way Combiner Deck <b>T8</b> (IN) port   |
| 6     | 0112004K08  | PA OUT connector on BR 22                                                    | Dual 3-Way Combiner Deck <b>T9</b> (IN) port   |
| 7     | 0112004B03  | Dual 3-Way Combiner Deck <b>T6</b> (OUT) port<br>(TX22-TX24 combined signal) | Triple 2-Way Combiner Deck <b>T3</b> (IN) port |
| 8     | 0112004B03  | Dual 3-Way Combiner Deck <b>T1</b> (OUT) port<br>(TX19-TX21 combined signal) | Triple 2-Way Combiner Deck <b>T2</b> (IN) port |
| 9     | 0112004B03  | Dual 3-Way Combiner Deck <b>T1</b> (OUT) port                                | Antenna 4 Duplexer input port                  |



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Figure 30 19-24 BR Transmit Cabling (GEN 4 Duplexed RFDS Systems)

**Cabling Information****Duplexed TTA Cabling**

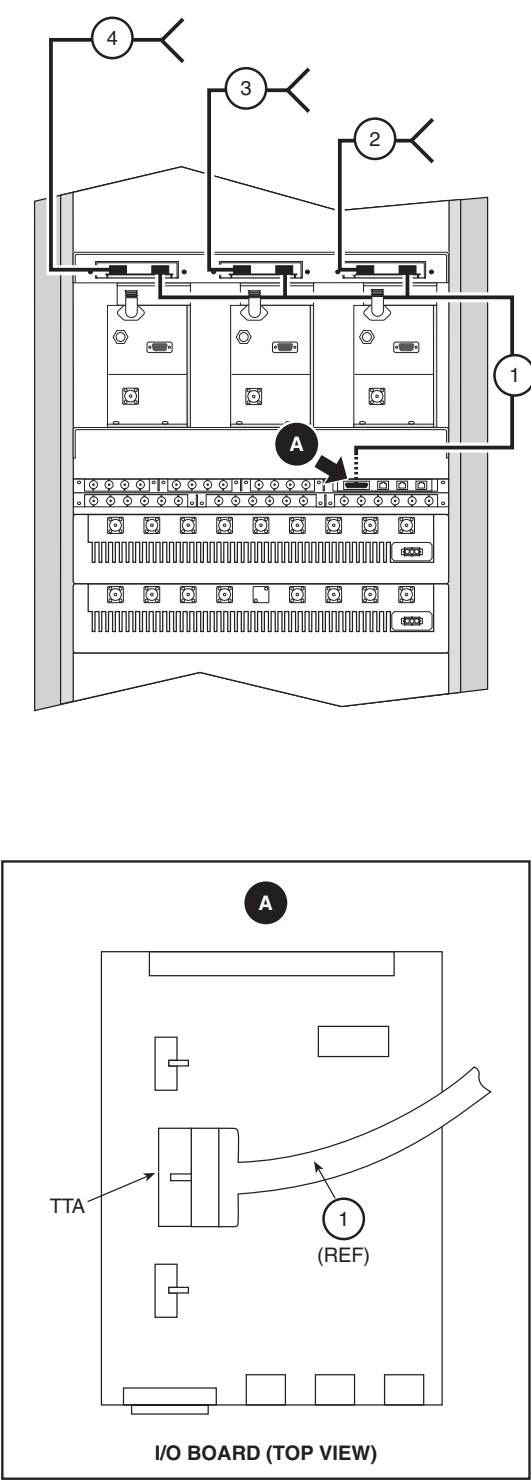
Table 20 lists and Figure 31 shows the cabling for the TTA Alarm Tray and DC Injectors within the Main RF Cabinet.

Table 20 ***Duplexed TTA Cabling***

| Index | Part Number | From                                                                          | To                                                                                     | Notes                                                |
|-------|-------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------|
| 1     | 3082136X02  | TTA Mate-N-Lok connector on Rx Tray I/O Board<br>(See detail A in Figure 31.) | Right-side connector on rear of TTA power/alarm interface card<br>(3 places, as shown) | Multi-branch wiring harness                          |
| 2     | —           | Duplexer 1 DC injector                                                        | Left-side connector on rear of TTA #1 power/alarm interface card                       | Cable is integral part of DC Injector P/N 8082223Y01 |
| 3     | —           | Duplexer 2 DC injector                                                        | Left-side connector on rear of TTA #2 power/alarm interface card                       | Cable is integral part of DC Injector P/N 8082223Y01 |
| 4     | —           | Duplexer 3 DC injector                                                        | Left-side connector on rear of TTA #3 power/alarm interface card                       | Cable is integral part of DC Injector P/N 8082223Y01 |

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

Index 1 and index 2 (and respective connectors on TTA power/alarm interface cards) are identically keyed. If connections are interposed, TTA will not function.



**NOTE:** DC INJECTORS OMITTED FOR CLARITY.

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032698JNM

Figure 31 Duplexed TTA Cabling

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## Base Radio Buildout/GEN 4 Duplexed RFDS Expansion

### Buildout General Information

“Base Radio Buildout” refers to adding more base radios to an existing EBTS. After a certain number of Base Radios are added to a system, RFDS expansion is required to accommodate the total Base Radio complement.

IPL software is added with each BR that is ordered. The system software must be modified for each additional BR.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

The following procedures and references specify procedures required in installing hardware and cabling only.

Complete the installation by performing system reprogramming (as applicable) in accordance with the *Software Commands* and *System Testing* sections of this manual.

A site can be built-out to a maximum of six BRs installed in a single RF cabinet and up to a maximum of 24 BRs using three additional Expansion RF Cabinets. Any additional BRs should be of the same rating (40 or 70 Watt transmit) as the BRs presently installed.

### Buildout Procedures

Depending on the existing number of Base Radios in a system, and the build out configuration being performed, various build out steps need to be taken. Table 21 lists the steps (or provides reference to procedures) in installing the various modules. Table 21 also lists the additional modules required in performing various levels of build out.

#### Installing Hardware

Using Table 21, install required hardware and perform cabling as follows:

1. Noting the existing configuration of the system, and the intended buildout configuration, note the expansion level (“Buildout Level” column) required to bring the system to the desired buildout level.

The “Buildout Level” column correspondingly lists the GEN 4 Duplexed RFDS configuration that accommodates a given number of BRs.

2. Noting the range of Expansion Levels required in accomplishing the buildout, note any additional equipment required in the "Equipment" column.
3. Perform the steps listed in the "Installation" column.

Examples on using the buildout table are provided below.

**Example #1:** When a baseline system containing four BRs is expanded to nine BRs, the procedures required in performing the buildout are:

- ☐ "Up to 6 BRs" buildout instructions
- ☐ "7 through 9 BRs" buildout instructions

The following equipment will be installed during the buildout procedure:

- ☐ BR5 and BR6 in the Main RF Cabinet
- ☐ BR7 through BR9 in an Expansion RF Cabinet

**Example #2:** When a baseline system containing four BRs is expanded to 12 BRs, the procedures required in performing the buildout are:

- ☐ "Up to 6 BRs" buildout instructions
- ☐ "7 through 12 BRs" buildout instructions

The following equipment will be installed during the buildout procedure:

- ☐ BR5 and BR6 in the Main RF Cabinet
- ☐ one Triple 2-Way Combiner Deck in the Main RF Cabinet
- ☐ BR7 through BR12 in an Expansion RF Cabinet

**Example #3:** When a previously expanded 6-BR system is expanded to 18 BRs, the procedures required in performing the buildout are:

- ☐ "7 through 12 BRs" buildout instructions
- ☐ "13 through 18 BRs" buildout instructions

The following equipment will be installed during the buildout procedure:

- ☐ Expansion RF Cabinet #1 containing BR7 through BR12
- ☐ Expansion RF Cabinet #2 containing BR13 through BR18
- ☐ one Triple 2-Way Combiner Deck in the Main RF Cabinet

## Base Radio Buildout/GEN 4 Duplexed RFDS Expansion

Table 21 GEN 4 Duplexed RFDS Buildout Instructions

| Buildout Level<br>(RFDS<br>Configuration)  | Expansion<br>Equipment<br>Required                                                   | Installation Instructions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                |
|--------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
|                                            |                                                                                      | Procedure/Reference                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Page                           |
| Up to 6 BRs<br>(Baseline)                  | No additional<br>equipment required                                                  | <ol style="list-style-type: none"> <li>1. Install Base Radio(s) in accordance with "Base Radio/Base Radio FRU Replacement" (<i>Base Radio</i> section of this manual).</li> <li>2. Perform the following cabling in accordance with "Cabling Information" subsection. <ul style="list-style-type: none"> <li>• Receiver Cabling</li> <li>• 5 MHz/1 PPS Cabling</li> <li>• Ethernet Cabling</li> <li>• DC Power Cabling</li> <li>• Transmit Power Out Cabling</li> </ul> </li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | —<br><br>54                    |
| 7 through 9 BRs<br>(9 BR Expansion)        | Expansion RF Cabinet<br>with 3 BRs                                                   | <ol style="list-style-type: none"> <li>1. Perform "Up to 6 BRs" buildout above, as applicable.</li> <li>2. Install Base Radio(s) in accordance with "Base Radio/Base Radio FRU Replacement" (<i>Base Radio</i> section of this manual).</li> <li>3. Connect intercabinet Tx cable (supplied with expansion cabinet) to Main RF Cabinet in accordance with "Transmit Expansion Cabling" (Cabling Information subsection).</li> <li>4. Perform Rx expansion cabling in accordance with Table 10. Receiver Cabling (Expansion Cabinets).</li> <li>5. Connect power monitor harness connector to ALARM connector on Base Radio in accordance with Table 15. Alarm/Power Monitor Harness Connections.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | —<br>—<br>72<br>60<br>68       |
| 7 through 12 BRs<br>(1-12 BR<br>Expansion) | Expansion RF Cabinet<br>with 6 BRs<br><br>Triple 2-Way<br>Combiner Deck<br>(CLN1351) | <p><b>NOTE:</b> Due to different combining architectures, incremental expansion to go from a 9-BR expansion to a 12-BR expansion cannot be performed. Perform 12-BR expansion procedure in its entirety as specified below. (Refer to Theory of Operation subsection for more information.)<br/>If system is currently equipped with 7 through 9 BRs, the Tx cabling will need to be reconfigured in accordance with the instructions specified below.</p> <ol style="list-style-type: none"> <li>1. If not currently installed, add Base Radios 1 through 6 in Main RF cabinet as described in "Up to 6 BRs" buildout instructions above.</li> <li>2. On ANT 1 through ANT 3 Duplexers, disconnect existing cabling between Duplexers and Dual 3-Way Combiner Deck. Save cables for reuse.</li> <li>3. Install Triple 2-Way Combiner Deck in accordance with "Combiner Deck Replacement Procedure" (Removal/Replacement Procedures).</li> <li>4. Connect intercabinet Tx cables (supplied with expansion cabinet) to Triple 2-Way Combiner Deck in accordance with "Transmit Expansion Cabling" (Cabling Information subsection).</li> <li>5. Perform Rx expansion cabling in accordance with Table 10. Receiver Cabling (Expansion Cabinets).</li> <li>6. Connect power monitor harness connector to ALARM connector on Base Radio in accordance with Table 15. Alarm/Power Monitor Harness Connections.</li> </ol> | —<br>—<br>45<br>72<br>60<br>68 |



## Base Radio Buildout/GEN 4 Duplexed RFDS Expansion

Table 21 **GEN 4 Duplexed RFDS Buildout Instructions (Continued)**

| Buildout Level<br>(RFDS<br>Configuration)    | Expansion<br>Equipment<br>Required                                                                                                              | Installation Instructions                                                                                                                                 |      |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|                                              |                                                                                                                                                 | Procedure/Reference                                                                                                                                       | Page |
| 13 through 18<br>BRs<br>(18 BR<br>Expansion) | Two Expansion RF<br>Cabinets with 6 BRs<br><br>Triple 2-Way<br>Combiner Deck<br>(CLN1351)                                                       | 1. If not currently installed, perform 12-BR expansion as described in “7 through 12 BRs” buildout instructions above.                                    | —    |
|                                              |                                                                                                                                                 | 2. Perform Main RF Cabinet combiner cabling and intercabinet Tx cabling in accordance with “Transmit Expansion Cabling” (Cabling Information subsection). | 72   |
|                                              |                                                                                                                                                 | 3. Perform Rx expansion cabling in accordance with Table 10. Receiver Cabling (Expansion Cabinets).                                                       | 60   |
|                                              |                                                                                                                                                 | 4. Connect power monitor harness connector to ALARM connector on Base Radio in accordance with Table 15. Alarm/Power Monitor Harness Connections.         | 68   |
| 19-24 BR Omni                                | Two Expansion RF<br>Cabinets with 6 BRs<br><br>Triple 2-Way<br>Combiner Deck<br>(CLN1351)<br><br>19-24 BR Fourth RF<br>Cabinet with<br>Duplexer | 1. If not currently installed, perform 18-BR expansion as described in “13 through 18 BRs” buildout instructions above.                                   | —    |
|                                              |                                                                                                                                                 | 2. Perform 19-24 BR Tx Cabling in accordance with “19-24 BR Transmit Cabling” (Cabling Information subsection).                                           | 76   |
|                                              |                                                                                                                                                 | 3. Perform Rx expansion cabling in accordance with Table 10. Receiver Cabling (Expansion Cabinets).                                                       | 60   |
|                                              |                                                                                                                                                 | 4. Connect power monitor harness connector to ALARM connector on Base Radio in accordance with Table 15. Alarm/Power Monitor Harness Connections.         | 68   |

**Duplexed TTA Receive Branch Equalization**

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## Duplexed TTA Receive Branch Equalization

**NOTE**

The procedures described in this section apply only to systems using the Duplexed TTA option.

### Reason For Receive Branch Equalization

The required gain of all branches of the receiver system is  $8.5 \text{ dB} \pm 0.5 \text{ dB}$ . This gain is measured through the receiver antenna system including the Duplexed TTA and the RFDS to the receiver input port of the Base Radio. However, due to variables such as cable run length and other factors, the loss value from antenna to Base Radio Rx input cannot be assumed to be a given value.

The following procedure equalizes the system gain for all receiver branches to a specified value. In performing this procedure, the value of a required inline attenuator is calculated which balances the gain to the required  $8.5 \text{ dB} \pm 0.5 \text{ dB}$  value.

As shipped, each duplexer Rx output is directly cabled to its respective receive LNA input. In performing the following procedures, the inline attenuator discussed above will be inserted between the duplexer Rx output and its respective receive LNA input; this will be required for each duplexer branch.

As mentioned earlier, the value of the attenuators will be determined in the following procedures. SMA inline attenuators shall be used; these are not part of the TTA FRUs and are locally procured. The recommended attenuator type is as follows:

**Mini-Circuits**

**Model SAT-\_\_**

**(where \_ is value in dB)**

### Equalization Methods Available

Two methods of determining the balance attenuator value are available. Either method may be used. The two methods are as follows:

- ☐ Using the procedures in this section. These procedures are listed below.
  - Test Equipment Considerations
  - Equipment Set-up
  - Equalization Procedure

These procedures use the iDEN Analyzer as a signal source and Base Radio Received Signal Strength Indicator (RSSI) command as a precision signal strength measurement tool.

- ❑ Using the iDEN Branch Attenuator Calculator, which is a software package that runs on the service computer. The package calculates required attenuator values by determining the receive budget based on cabling run lengths.

Contact the iDEN Customer Response Center to obtain this software.

Regardless of the method used for receive equalization, install the required attenuators as described in the Inline Attenuator Installation procedure at the end of this section.

## Test Equipment Considerations

An R2600-series analyzer is used in the equalization procedure. The output level of the R2660 analyzers is specified with an output accuracy of  $\pm 2$  dB relative to the front panel reading. Since this procedure requires a precision of  $\pm 0.5$  dB, only relative measurements referenced to a normalized setting will be made using the analyzer. Therefore, it is very important to follow the procedure exactly so the equalization results are within the specified  $\pm 0.5$  dB tolerance.

### NOTE

The equalization procedure requires the R2660 analyzers. The R2600 analyzers with the iDEN modulation can also be used for the test. The same procedure is used for both instruments.

## Definitions

This paragraph defines the data required to perform the equalization procedure and associated calculations.

### Receive branch calibration data

The tower top amplifier is equipped with a test port and is supplied with calibration data. The following calibration data is required for each receive branch:

- ❑ Antenna Port to Output Port Gain (GAO)
- ❑ Test Port to Output Port Gain (GTO)

### Analyzer cable

The analyzer cable used with the R2660 analyzer (Figure 32) must be long enough to reach the primary cabinet junction panel. The loss of this cable is not required for the calculations. The analyzer cable is used in all of the test procedures and signal level is referenced to the end of the cable instead of to the output of the R2660 analyzer.

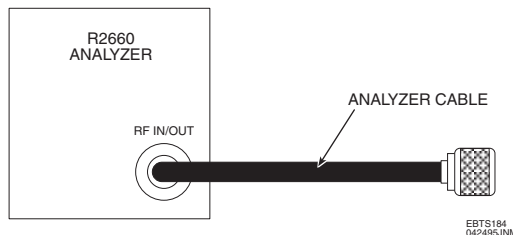


Figure 32 **R2660 Analyzer and Cable**

### Test cable

Each site should be equipped with a Test Cable connected from an accessible area to the test port of the tower amplifiers as shown in Figure 33. This cable should be of known length and attenuation which should be supplied by the customer. If the attenuation of the cable is not available, the attenuation can be calculated given the cable length. This cable is referred to as the Test Cable, and its loss is referred to as TCL (dB). The TCL (dB) value should include the loss of the main Test Port transmission line, tower top jumper cable, tower bottom jumper cable, and lightning surge arrestor. All cables and jumpers shown in Figure 33 are considered part of the test cable.

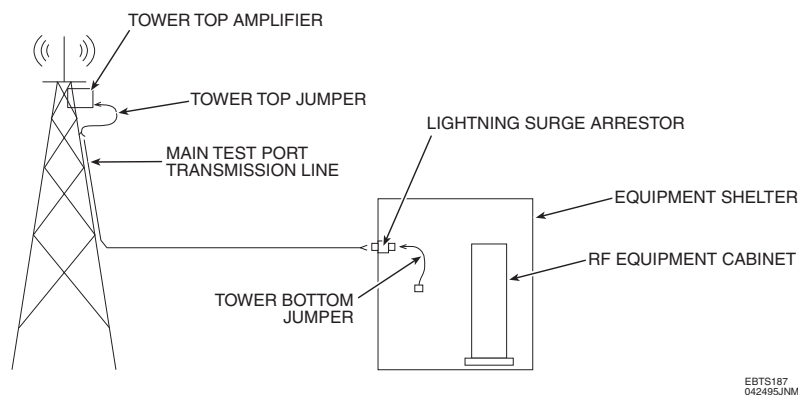


Figure 33 **EBTS Tower Top Amplifier Configuration**

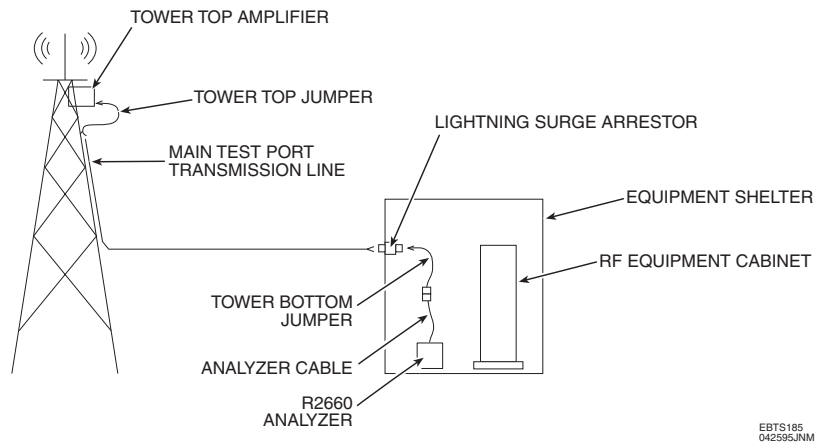
## Receive antenna branch gain

GBA is the Receive Antenna Branch Gain of the RFDS. Use 9.0 dB for all entries in the procedure where GBA is requested.

## Equipment Set-up

Set up the equipment using the following procedure. Base Radio 1 will be used during the equalization procedure.

1. Connect one end of the RS-232 cable to the service computer.
2. Connect the other end of the RS-232 cable to the Status port located on the front panel of the BRC of Base Radio 1 (the bottom Base Radio in the primary cabinet). It is important to use the bottom Base Radio.
3. Be sure the Test Cable is connected to the tower top amplifier Test Port.
4. Connect the Analyzer Cable to the other end of the Test Cable as shown in Figure 34. All other connections remain connected. All cables and jumpers shown in Figure 34 except the analyzer cable are considered part of the test cable.



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Figure 34 **Analyzer Cable/Test Cable Connection**

5. Remove power from the R2660 and connect the Rubidium Frequency Standard 10 MHz Output to a 10 dB attenuator.
6. Connect the other end of the 10 dB attenuator to the 10 MHz Reference Oscillator In/Out connector in the R2660.
7. Set the R2660 to the EXT REF mode.
8. Apply power to the R2660 running the iDEN modulation.

**NOTE**

Refer to the equipment manual provided with the R2660 for further information regarding mode configuration of the unit (Motorola P/N 68P80309F16).

9. Set the R2660 to the frequency at which the tower top amplifier calibration data was taken (typically 815 MHz).
10. Set the R2660 to generate the test signal at an output level of -80 dBm.

## Equalization Procedure

Perform the following procedure to equalize the receive gain for each branch.

1. Set up the service computer to communicate to the station through the RS-232 port.
2. Log on. The default password is **motorola**.

 **CAUTION**

Make certain all Base Radios are dekeyed. Execute **dekey** command on service computer.

3. Set the receive frequency of the Base Radio to the frequency which the tower top amplifier calibration data was taken. This should be the same frequency that the R2660 was set during step 9 of equipment set-up.

At the prompt type: **set rx\_freq XXX.XXXXX** to set the receive frequency.

**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set rx_freq XXX.XXXXX
set RECEIVE FREQUENCY to XXX.XXXXX MHz in RAM
```

4. At the prompt, type: **set rx\_mode 123**

This command enables all antennas / receivers in the Base Radio.

```
BRC>set rx_mode 123
set RECEIVER 1 to ENABLED in RAM
set RECEIVER 2 to ENABLED in RAM
set RECEIVER 3 to ENABLED in RAM
```

5. At the prompt type: **set sgc off**

This command disables the software gain control routine within the Base Radio.

```
BRC> set sgc off
set SOFTWARE GAIN CONTROL to DISABLED in RAM
```

6. At the prompt type: **set sys\_gain on**

This command enables the system gain for proper readout of the RSSI.

```
BRC> set sys_gain on
set SOFTWARE GAIN to ENABLED in RAM
```

7. At the prompt type: **get rssi 1 100**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

```
BRC> get rssi 1 100
```

Starting RSSI monitor for 1 repetitions averaged each 100 reports.

| Line | RSSI1<br>dBm | RSSI2<br>dBm | RSSI3<br>dBm | SGC<br>dB | CI     | BER<br>dBm dBm% | OffsetSyncMiss<br>Hz% |
|------|--------------|--------------|--------------|-----------|--------|-----------------|-----------------------|
| 1    | -101.3       | -100.9       | -102.0       | 0.0       | -100.3 | -124.70.000e+00 | -5.10.000e+00         |

8. Adjust the output level from the R2660 and repeat step 6 until the RSSI for receiver 1 (RSSI1) is approximately -100 dBm.

**NOTE**

Once the level of the R2660 is set in step 8, the level should **NOT** be changed again for any other receiver or any other step in the calibration procedure. This level serves as the normalized value to which other relative measurements will be referenced.

9. Log the received signal strengths for all of the receivers present (i.e. RSSI 1, RSSI 2, and RSSI 3).  
  
These values will be referred to as #RSSI1, #RSSI2, and #RSSI3 respectively and are required in the following steps.
10. Disconnect the Analyzer Cable from the Test Cable.
11. (See Figure 35.) At the duplexer 1 antenna port, disconnect the antenna feed cable.
12. Connect the Analyzer Cable to the duplexer antenna port just disconnected in the previous step.



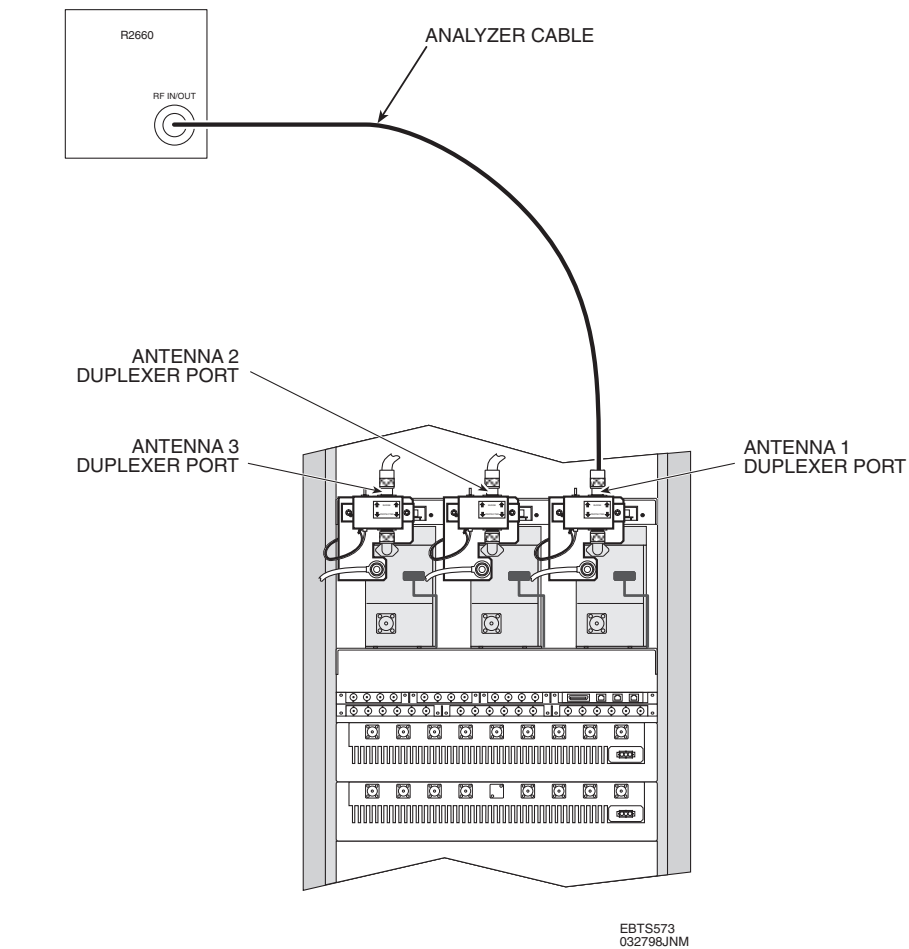


Figure 35 Analyzer Cable to Duplexer Antenna Port Connection (Typical)

13. At the prompt type: **get rssi 1 100**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

```
BRC> get rssi 1 100
Starting RSSI monitor for 1 repetitions averaged each 100 reports.
```

| Line | RSSI1<br>dBm | RSSI2<br>dBm | RSSI3<br>dBm | SGC<br>dB | CI<br>dBm    | BER<br>dBm%    | OffsetSyncMiss<br>Hz% |
|------|--------------|--------------|--------------|-----------|--------------|----------------|-----------------------|
| 1    | -101.3       | -100.9       | -102.0       | 0.0       | -100.3-124.7 | 0.000e+00-5.10 | 0.000e+00             |

14. Log the received signal strengths for the present receiver.

This value will be referred to as \$RSSI1.

15. Disconnect the Analyzer Cable from the duplexer antenna port and reconnect the antenna feed cable to the antenna port.
16. Repeat steps 11 through 15 for the antenna 2 receive path and log the received signal strength for the Rx2 path as \$RSSI2.
17. Repeat steps 11 through 15 for the antenna 3 receive path and log the received signal strength for the Rx3 path as \$RSSI3.
18. Calculate the value of the inline attenuator required to equalize each receive branch using the appropriate RSSI value for the given branch. Use the following equation to determine this value.

$$\text{Attenuator} = (\text{GAO1-GTO}) + (\#RSSI1 - \$RSSI1) + \text{TCL} + (\text{GBA1}-0.85)-8.5$$

The above equation describes the attenuation required to obtain the required system path gain of 8.5 dB. As such, gain is represented as negative attenuation (negative numbers) and losses are represented as positive attenuation (positive numbers). In summary:

- GAO is the Antenna Port to Output Port gain in dB given on the Tower Top Amplifier (this is a positive number).
- GTO is the Test Port to Output Port gain in dB given on the Tower Top Amplifier (this is a negative number).
- #RSSI is the reading in dBm given by the station in step 9 (this is a negative number).
- \$RSSI is the reading in dBm given by the station in step 14 (this is a negative number).
- TCL is the Test Cable Loss in dB either given by the customer or calculated given the length of the cable (this number is a positive number in dB).
- GBA is the Receive Gain constant of 9.0 dB.
- 0.85 dB is the loss of the cable that connects the Rx Multicoupler to the receiver in Base Radio 1.
- 8.5 dB is the expected gain for the entire path.

### Example

| Variable | Value      |
|----------|------------|
| GAO1     | 16.8 dB    |
| GTO      | -9.7 dB    |
| #RSSI1   | -100 dBm   |
| \$RSSI1  | -85.45 dBm |
| TCL      | -2.7 dB    |

$$\begin{aligned}
 \text{Attenuator} &= (\text{GAO1} - \text{GTO}) + (\# \text{RSSI1} - \$ \text{RSSI1}) + \text{TCL} + (\text{GBA1} - 0.85) - 8.5 \\
 &= (16.8 - (-9.7)) + (-100 - (-85.45)) + (2.7) + (9.0 - 0.85) - 8.5 \\
 &= (26.5) + (-14.55) + (2.7) + (8.15) - 8.5 \\
 &= 14.3 \text{ dB}
 \end{aligned}$$

Therefore, choose a 14 dB attenuator for path 1.

19. On Rx1 receive path, install an inline attenuator of value determined in the previous step as described in "Inline Attenuator Installation" procedure below.
20. Repeat the calculation for the remaining receive branches replacing the appropriate values for paths 2 and 3.
21. Using an attenuator of the value determined in step 18 for the branch being equalized, install an inline attenuator as described in "Inline Attenuator Installation" procedure below. This is to be done for each branch.
22. Reconnect the Analyzer Cable to the Test Cable.
23. At the prompt type: **get rssi 1 100**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

**BRC> get rssi 1 100**

Starting RSSI monitor for 1 repetitions averaged each 100 reports.

| Line | RSSI1<br>dBm | RSSI2<br>dBm | RSSI3<br>dBm | SGC<br>dB | CI<br>dBm | BER<br>dBm% | OffsetSyncMiss<br>Hz%  |
|------|--------------|--------------|--------------|-----------|-----------|-------------|------------------------|
| 1    | -101.3       | -100.9       | -102.0       | 0.0       | -100.3    | -124.70     | 0.000e+00-5.10.000e+00 |

24. The reported RSSI numbers for Receivers 1, 2, and 3 should all be within  $\pm 0.5$  dB of each other. If not, repeat the procedure.

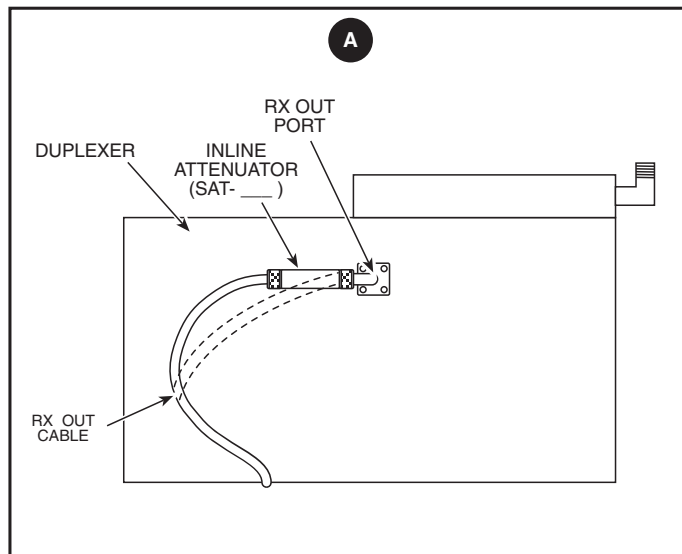
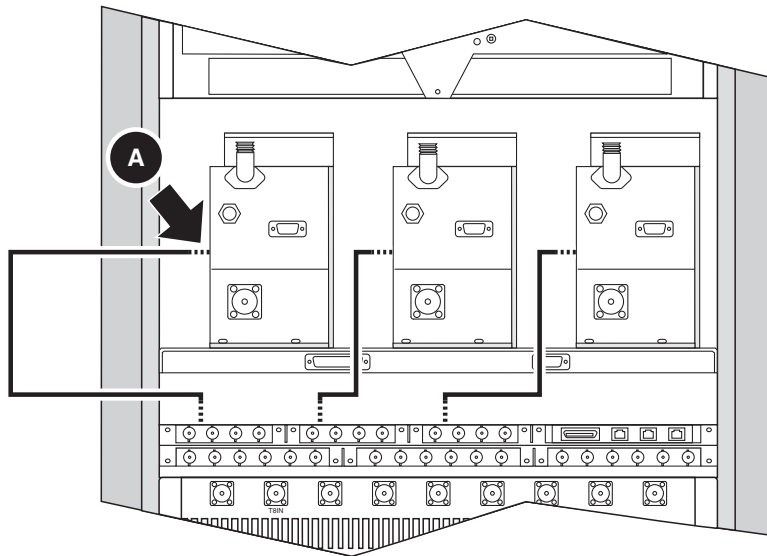
**NOTE**

Once the cabinet is equalized for Base Radio 1, all the other Base Radios in the cabinet (as well as any expansion cabinets) are also equalized. No other checks or tests need to be done for the other radios.

## Inline Attenuator Installation

(See Figure 36.) Install inline attenuators as follows:

1. On side of ANT 1 duplexer, disconnect the Rx output cable from the SMA connector on duplexer side.
2. Connect inline attenuator to SMA connector on duplexer side.
3. Connect free end of cable disconnected above to inline attenuator.
4. Repeat steps 1 through 3 for each additional branch, using attenuator values determined in previous procedure.



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Figure 36 **Inline Attenuator Installation**

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# ***Cavity Combining RF Distribution System***

## **Overview**

This chapter provides technical information for the Cavity Combining RF Distribution System (RFDS), an 800 MHz transmit combining and receiver multicoupler system.

The topics of this section are listed in the following table.

| Section                                       | Page | Description                                                                             |
|-----------------------------------------------|------|-----------------------------------------------------------------------------------------|
| Description                                   | 2    | Describes the cavity combining version of the RF Distribution System.                   |
| Performance Specifications                    | 3    | Lists specifications for the cavity combining RFDS.                                     |
| Theory of Operation                           | 7    | Describes how the 1 - 5 channel and expansion cavity combining RFDS works.              |
| Pinouts and Wiring                            | 16   | Provides information on pinouts and wiring for the RFDS.                                |
| Removal/Replacement Procedures                | 20   | Describes how to remove and replace cavity combining RFDS FRUs.                         |
| Cabling Information                           | 31   | Provides instructions and cabling diagrams for cavity combining systems                 |
| Cavity Tuning Procedure                       | 54   | Describes the procedure for tuning the cavities to specific frequencies.                |
| Cavity Combiner / Isolator Load FRU Expansion | 59   | Describes how to add additional channel capability to a cavity combining RFDS system.   |
| Cavity RFDS Buildout                          | 76   | Provides instructions for adding an RF Expansion Rack to a cavity combining RFDS system |

**Description****Description**

Figure 1 shows the front view of the cavity combining RFDS. The cavity combining RFDS supports up to three receive antennas and a single transmit antenna. Each RFDS accommodates up to five Base Radios. Each RF cabinet has the capability of housing five Base Radios. A 10-channel system, for example, would require two RF cabinets. An additional two expansion cabinets (each fitted with its own cavity combining RFDS and five Base Radios) yields a 20-channel system. The cavity combining RFDS contains two Power Supply Field-Replaceable Units (FRUs).

**NOTE**

The Power Monitor in the Main RF Cabinet is used to monitor the transmit power output of the entire system. The external wattmeter reading can only be taken from the Base Radios located in the Main RF Cabinet (BR1 through BR5).

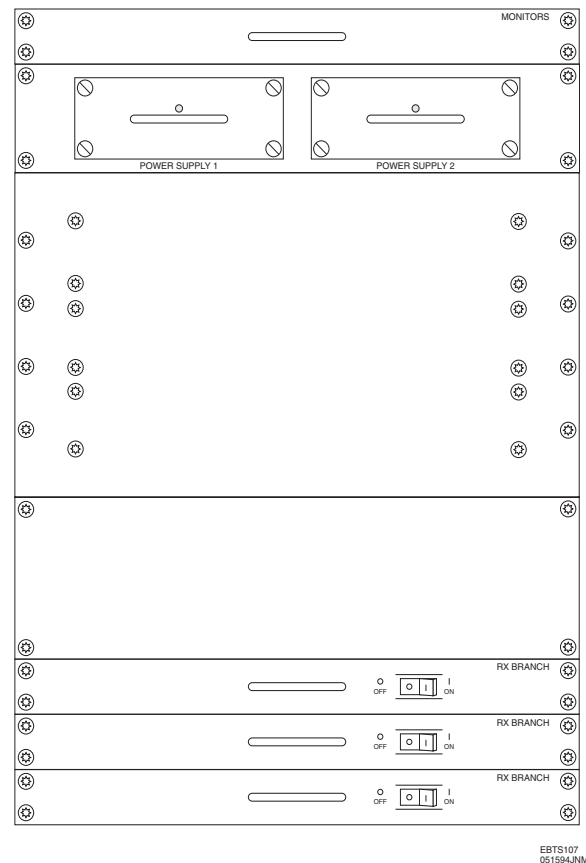


*Figure 1* Cavity Combining RF Distribution System



## Performance Specifications

### General Cavity Combining RFDS Specifications

Table 1 lists the general specifications for the cavity combining RFDS.

*Table 1 General Specifications*

| Specification               | Value or Range                  |
|-----------------------------|---------------------------------|
| Dimensions:                 |                                 |
| Height                      | 15 EIA Rack Units (RU)          |
| Width                       | 19" (482.6 mm)                  |
| Depth                       | 18.5" (470 mm)                  |
| Storage Temperature Range   | -40° to +203° F (-40 to +95° C) |
| Operating Temperature Range | -22° to +104° F (-30 to +40° C) |
| Frequency Range:            |                                 |
| Receive                     | 806 to 821 MHz                  |
| Transmit                    | 851 to 866 MHz                  |
| Tx - Rx Spacing             | 45 MHz                          |
| Tx - Tx Spacing             | 250 kHz (min.)                  |
| Port Impedance              | 50 $\Omega$ (nom.)              |
| Input Supply Voltage        | -48 VDC (-41 VDC to -60 VDC)    |
| Input Current               | 3 Amps (max.)                   |

### Receive Branch Specifications

Table 2 lists the cavity combining RFDS antenna port-to-receiver port specifications for a single receive branch. Table 3 lists the low-noise tower top amplifier specifications.

*Table 2 Cavity Combining Receive Specifications*

| Specification                                    | Value or Range      |
|--------------------------------------------------|---------------------|
| Gain (806 to 821 MHz):                           |                     |
| $T_A = 25^\circ \text{ C}$ (ambient temperature) | 2.0 dB $\pm 0.5$ dB |
| $-30^\circ \text{ C} < T_A < 60^\circ \text{ C}$ | 2.0 dB $\pm 1.0$ dB |
| Selectivity Relative to 815 MHz                  |                     |
| DC - 750 MHz                                     | 70 dB               |
| 650 - 680 MHz                                    | 85 dB               |
| 785 MHz                                          | 40 dB               |
| 851 - 866 MHz                                    | 80 dB               |
| 866 - 2000 MHz                                   | 55 dB               |

**Performance Specifications****Table 3 Cavity Combining Tower Top Amplifier Specifications**

| Specification                                                                                                                  | Value or Range                                                              |
|--------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Storage Temperature Range                                                                                                      | -40° to +203° F (-40° to +95° C)                                            |
| Specification Temperature Range                                                                                                | -22° to +140° F (-30° to +60° C)                                            |
| Receive Frequency Range                                                                                                        | 806 to 821 MHz                                                              |
| Port Impedance                                                                                                                 | 50 $\Omega$ (nom.)                                                          |
| Input Supply Voltage                                                                                                           | 24 VDC $\pm$ 2 VDC                                                          |
| Input Current Range                                                                                                            | 270 mA (max.)                                                               |
| Gain (806 to 821 MHz):<br>$T_A = 25^\circ \text{ C}$ (ambient temperature)<br>$-30^\circ \text{ C} < T_A < 60^\circ \text{ C}$ | 17 dB $\pm$ 0.5 dB<br>$\pm$ 1.0 dB from Gain ( $T_A = 25^\circ \text{ C}$ ) |

**Transmitter to Antenna Specifications**

Table 4 lists the cavity combining RFDS transmitter port-to-antenna port specifications.

**Table 4 Cavity Combining Transmitter Port-to-Antenna Port Specifications**

| Specification                                                                                                                                                                                                                                       | Value or Range |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Maximum Insertion Loss:<br>(@ 250 kHz Channel Spacing)                                                                                                                                                                                              |                |
| 2-Channel                                                                                                                                                                                                                                           | 4.2 dB         |
| 3-Channel                                                                                                                                                                                                                                           | 4.6 dB         |
| 4-Channel                                                                                                                                                                                                                                           | 4.6 dB         |
| 5-channel                                                                                                                                                                                                                                           | 4.7 dB         |
| 6-10 Channel †                                                                                                                                                                                                                                      | < 6.0 dB       |
| 11-20 Channel †                                                                                                                                                                                                                                     | < 6.0 dB       |
| Transmit to Transmit Isolation                                                                                                                                                                                                                      | 60 dB min.     |
| Input Return Loss                                                                                                                                                                                                                                   | 19 dB min.     |
| Antenna to PA Isolation                                                                                                                                                                                                                             | 50 dB min.     |
| <b>NOTE:</b> The cavities are factory set for 250 kHz spacing. Cavities are not tuned to customer frequency, and must be field tuned.<br>† Expansion RF Cabinet cavities are factory tuned to the same frequencies as those in the Main RF Cabinet. |                |

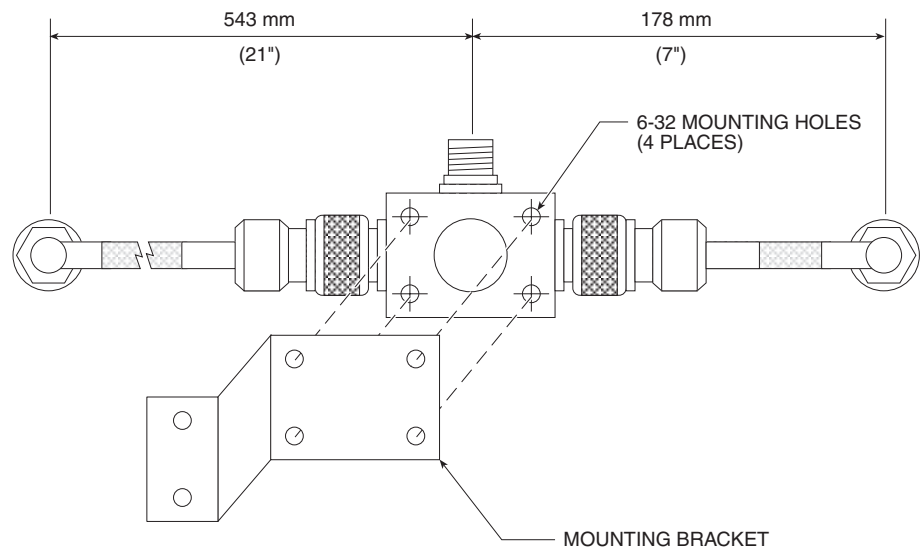
**Phasing Harness**

A phasing harness allows two Cavity RF Cabinets to share a single Tx antenna. As such, a phasing harness is used to connect the Tx antenna signals of Cavity RF Expansion Cabinet #1 and the Main RF Cabinet to the Tx antenna. Where Cavity RF Expansion Cabinets #2 and #3 are used, an additional phasing harness similarly connects these cabinets to a second Tx antenna. Table 5 lists the specifications for the phasing harness.

Table 5 **Cavity Combining Transmitter Phasing Harness Port Specifications**

| Specification                          | Value or Range                |
|----------------------------------------|-------------------------------|
| Motorola Part #0182004W04              | -40° to +95 °C                |
| Nominal Cable and Connector Impedance  | 50 $\Omega$                   |
| Input Connectors                       | 7/16" DIN, male (right angle) |
| Output Connectors                      | 7/16" DIN, female             |
| Cable Type                             | RG393                         |
| Input Power, Average                   | 400 W                         |
| Input Power, Peak Envelope Power (PEP) | 5,000 W                       |
| Output Power, Avg.                     | 800 W                         |
| Output Power, PEP                      | 20,000 W                      |

The phasing harness comes pre-installed in Cavity Expansion RF Cabinets #1 and #3, and is mounted with the assumption that the Cavity Main RF Cabinet (or Cavity Expansion Cabinet #2 in 11-20 channel sites) will be placed to its left side (as viewed from the rear). For such a site configuration, connectors on the phasing harness are torqued to 110 in-lbs. and are oriented relative to the 6-32 mounting holes as shown in Figure 2.



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Figure 2 **Left Mount Phasing Harness**

**Performance Specifications**

In situations where the Cavity Main RF Cabinet (or Expansion Cabinet #2 in 11-20 channel sites) must be placed to the right side of its companion Cavity Expansion RF Cabinet (as viewed from the rear), the phasing harness will need to be disassembled and reconfigured as shown in Figure 3. Connectors on the assembled unit should be torqued to 110 in-lbs. and oriented relative to the 6-32 mounting holes as shown in Figure 3.

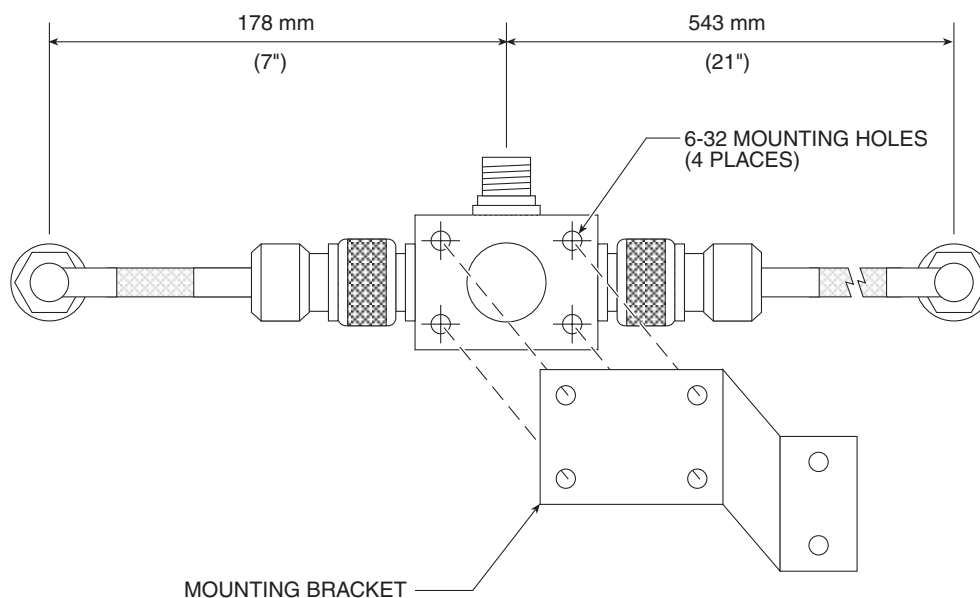
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Figure 3 **Right Mount Phasing Harness**

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## Theory of Operation

### 1-5 Channel Cavity Combining RFDS

Figure 4 is a block diagram of the 1-5 channel cavity combining RFDS, used in the Cavity Main RF Cabinet.

#### Transmit Operation

The transmit side of the 1-5 channel cavity combining RFDS consists of up to five dual stage isolators, up to five combining cavities, and a dual directional coupler. Each cavity is tuned to accept a single transmit input in the 851 - 866 MHz range.

The dual isolator assembly includes a power monitor port with a BNC connector. The monitor port samples the reflected power from the cavity combiner. A spectrum analyzer can be connected to the monitor port to adjust the tuning of the cavity combiner. Refer to the cavity tuning procedure for additional information.

#### Receive Operation

Each receive branch in the 1-5 channel cavity combining RFDS uses a Receive Splitter Tray. Each tray takes the single receive signal from a receive antenna and distributes the receive signal to several Base Radios within the cabinet. Each Receive Splitter Tray contains a preselector, low noise RF amplifier, four way divider, and a six way divider. The six way divider is capable of handling up to five individual receivers operating in the 806 - 821 MHz range for each antenna. The sixth port is not used by the EBTS and is always terminated.

Additional receivers are connected to the RFDS through the use of the expansion four way divider. Each expansion port of the four way divider drives a six way splitter which, in turn, allows up to five additional receivers within each Cavity Expansion RF Cabinet.

#### Power Supplies

The 1-5 channel cavity combining RFDS contains two redundant power supplies (DC/DC converters) connected in parallel. The power supplies convert the -48 VDC (hot) site power to +24 VDC. The +24 VDC is used to power the low noise amplifiers, low noise tower top amplifiers, and Power Monitor.

The Power Supplies are located in the Power Supply Tray. In addition to the various connectors, on the rear of the Power Supply Tray are six LEDs that indicate the status of the low noise tower top amplifier and of the low noise multicoupler amplifiers located internal to the RFDS. A reset switch is also provided to allow for manual reset of the solid state breaker in the event of a tower top amplifier failure.

## Theory of Operation

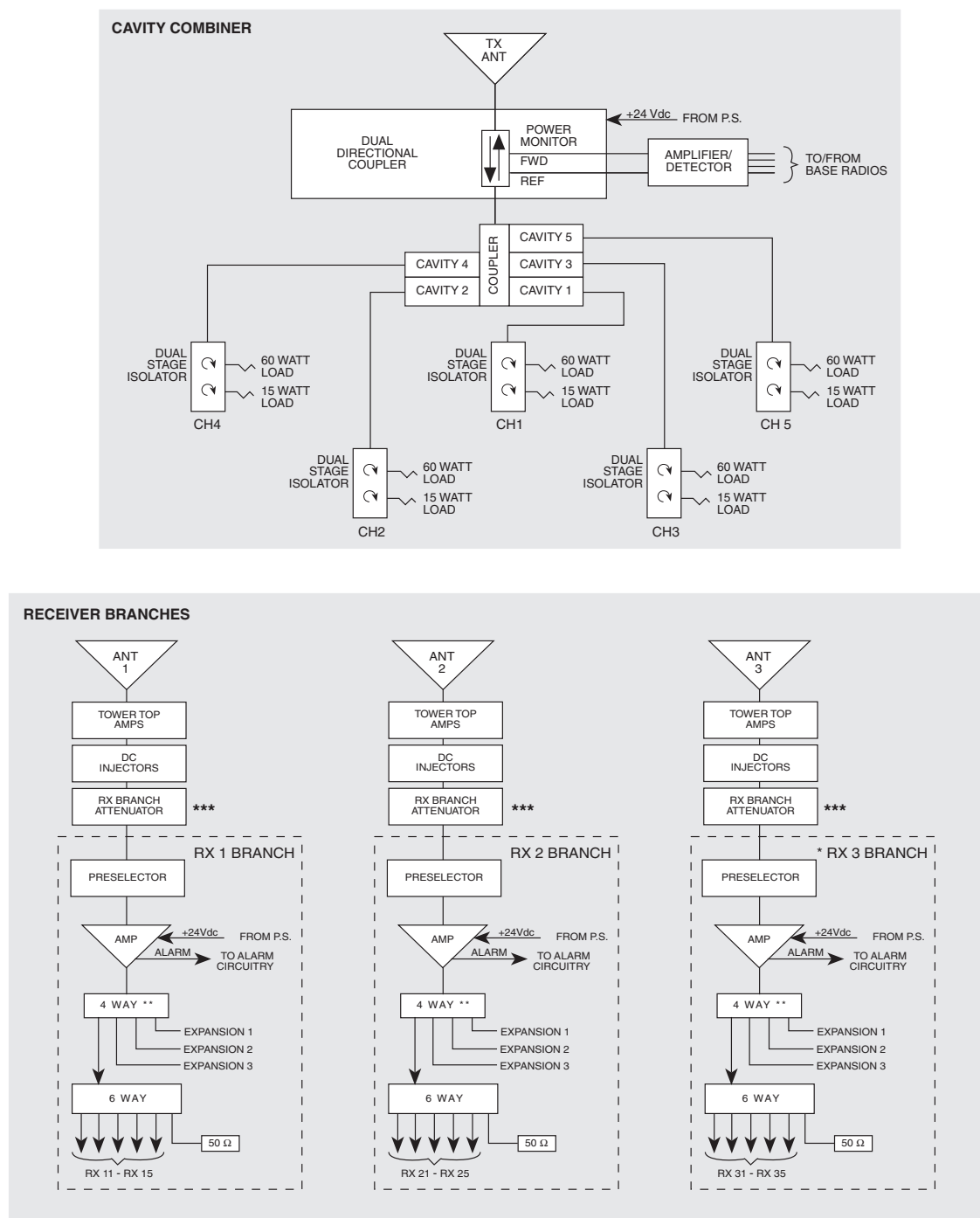


Figure 4 1-5 Channel Cavity Combining RFDS Block Diagram

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## Coupler, Power Monitoring, and Alarms

A dual directional coupler is installed on the transmit antenna port of the 1-5 channel cavity combining RFDS. The coupler is an in-line device that provides a path for the power monitor to read the forward and reflected power readings from the transmit antenna.

The power monitor measures the power readings and converts them into output DC voltages. These DC voltages are proportional to the forward and reflected power readings. These voltages are sent to the RF Power Monitor Tray before being routed to the Base Radio where it is used to determine the forward and reflected power readings. These readings are also used to calculate the VSWR at the transmit antenna port.

Three relay contact closure pairs are provided on the RFDS for alarms. One diagnostic alarm output is provided for both of the power supplies, another for all of the RF distribution amplifiers, and the last pair for all of the tower top amplifiers.

The power supply alarm is wired such that when either, or both, of the power supplies experiences a failure, an alarm is generated. The multicoupler amplifier alarm is wired such that when any combination of amplifiers experiences a failure, an alarm is generated. The tower top amplifier alarm is wired such that when any combination of amplifiers experiences a failure, an alarm is generated.

Under normal operating conditions (no alarm conditions present), the alarm outputs for all of these alarms are closed (i.e. short circuit across the terminal block connections). Upon detection of an alarm condition, the alarm outputs will open. The alarm signals are routed from the Telco connector on the Power Supply Tray to the EAS/iMU. Refer to the Gen 3 SC or iSC Supplement to this manual for additional alarm detection information.

## Cavity Expansion Configurations

Figures 5 and 6 respectively show the transmit and receive block diagrams of the cavity expansion configurations.

A 6-10 channel expansion uses one expansion RF cabinet. An 11-15 channel expansion uses two expansion RF cabinets (expansion cabinets #1 and #2). A 16-20 channel expansion uses three expansion RF cabinets (expansion cabinets #1 through #3).

### Transmit Operation

Figure 5 shows the transmit operation of the cavity expansion configuration. The transmit side of the expansion cavity combining RFDS consists of up to 20 dual stage isolators and up to 20 combining cavities. Each cavity is tuned to accept a single transmit input in the 851 - 866 MHz range.

Each pair of cabinets make use of a phasing harness to combine Tx signals from two cavity combiners onto a single Tx antenna feed. As shown, this arrangement allows for a symmetrical doubling of the number of Base Radios and, therefore,

## Theory of Operation

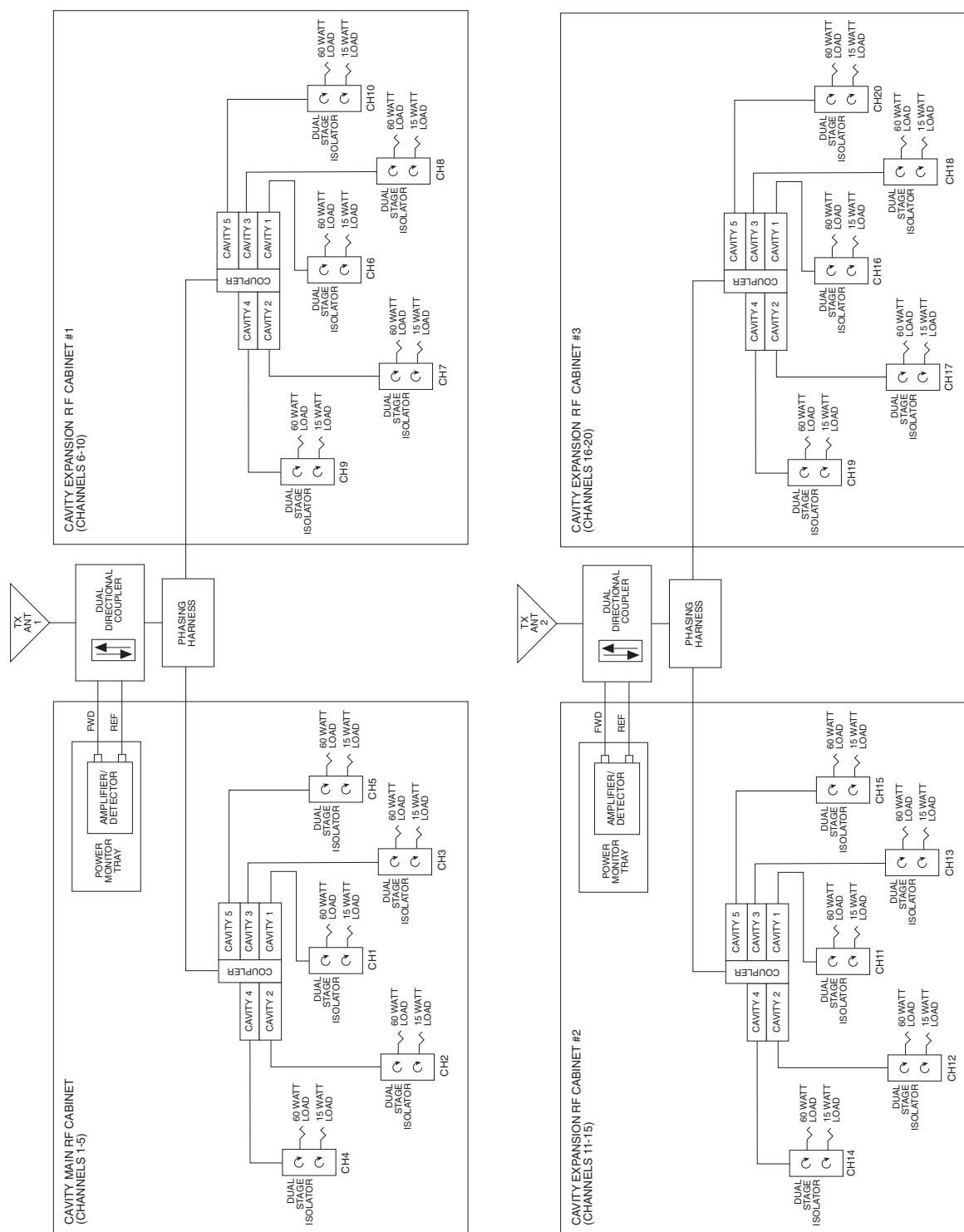
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Figure 5 Cavity Expansion Block Diagram (Transmit Operation)



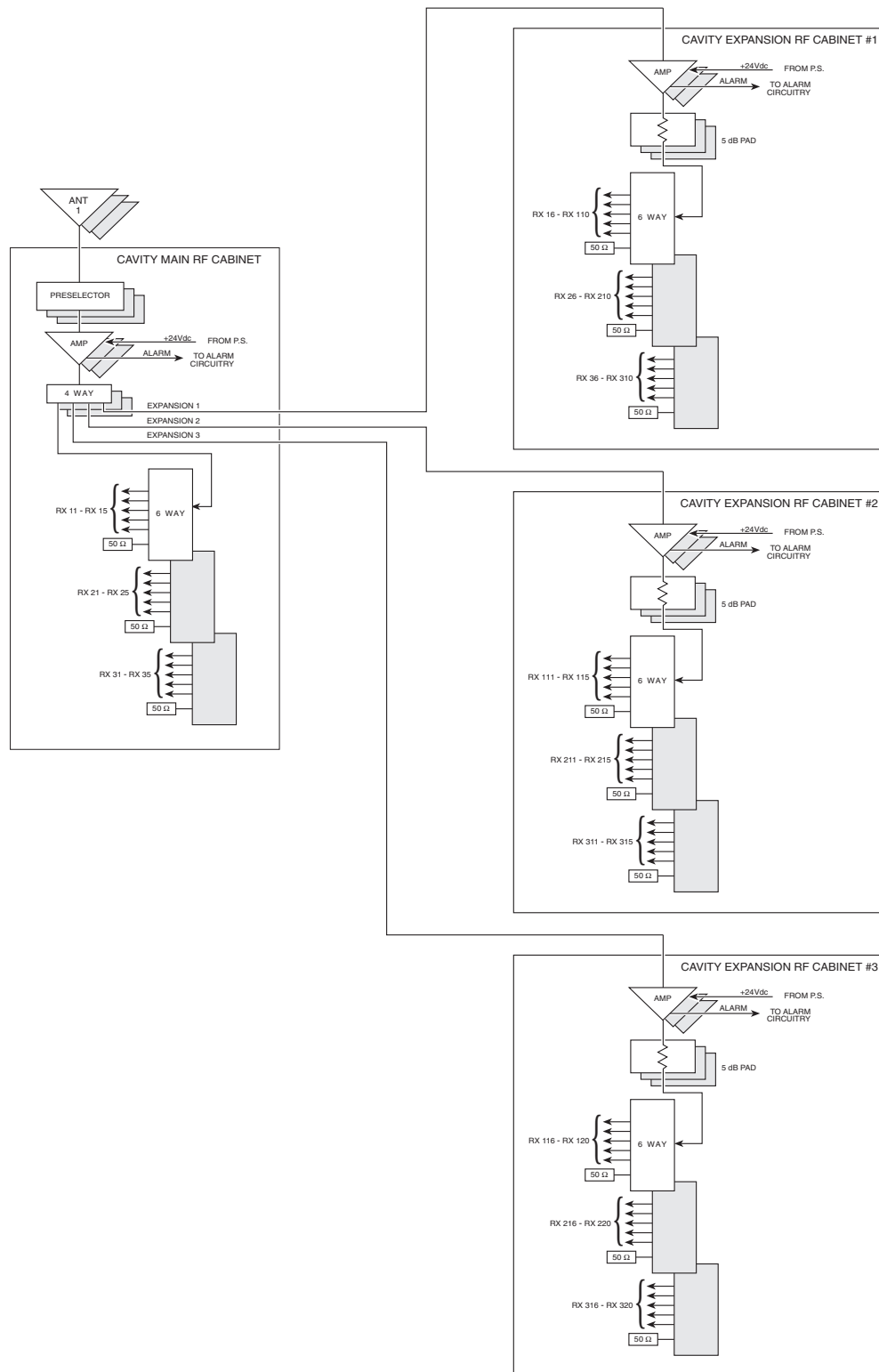
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Figure 6 Cavity Expansion Block Diagram (Receive Operation)

## Theory of Operation

the number of channels. Using the phasing harness, up to 10 channels can be accommodated per a pair of combiners. A functional duplication of the 1-10 channel expansion results in the 20-channel expansion system. (Note that this system requires two separate Tx antennas.)

The dual isolator assemblies at each Tx input includes a power monitor port with a BNC connector. The monitor port samples the reflected power from the cavity combiner. A spectrum analyzer can be connected to the monitor port to adjust the tuning of the cavity combiner. Refer to the cavity tuning procedure for additional information.

### Receive Operation

In expansion configurations, the receive signal flow for Base Radios 1 through 5 is as discussed earlier for the 1-5 channel configuration. The receivers of the expansion Base Radios are connected to the RFDS through the use of the four way divider on each Receive Splitter Tray. The four way divider has three expansion ports. Each expansion port allows up to five additional receivers to be connected to the existing receive antennas.

Figure 6 shows the receive signal flow of the cavity expansion configuration. With a 6-10 channel expansion, the EXPANSION 1 port on each Main RF Cabinet Receive Splitter Tray is connected to the input of the respective Receive Splitter Tray in expansion cabinet #1. 11-15 channel expansions and 16-20 channel expansions are handled similarly using the EXPANSION 2 and EXPANSION 3 ports.

Each expansion cabinet Receive Splitter Tray contains a low noise RF amplifier, a 5 dB attenuator, and a six way divider. The six way divider is capable of handling up to five expansion receivers operating in the 806 - 821 MHz range for each antenna. The sixth port is not used and is terminated with a 50Ω load.

### Power Supplies

The expansion cabinets each contain two redundant power supplies (DC/DC converters) connected in parallel. The power supplies convert the -48 VDC (hot) site power to +24 VDC. The +24 VDC is used to power the low noise amplifiers, low noise tower top amplifiers, and power monitor.

The Power Supplies are located in the Power Supply tray. In addition to the various connectors, on the rear of the Power Supply tray are six LEDs, that indicate the status of the low noise tower top amplifier and the low noise multicoupler amplifiers located internal to the RFDS. However, the low noise tower top amplifier is only connected to the Power Supply tray located in the Main RF cabinet. Therefore, the tower top alarm LEDs of the Power Supply tray in the Expansion RF cabinet will indicate that there are tower top amplifier alarms since no amps are connected to this tray. Therefore, the alarms are to be masked out at the OMC.

### **Coupler, Power Monitoring, and Alarms**

A dual directional coupler is installed on the transmit antenna port of the cavity combining RFDS. The coupler is an in-line device that provides a path for the power monitor to read the forward and reflected power readings from the transmit antenna.

The power monitor measures the RF power and converts them into output DC voltages. These DC voltages are proportional to the forward and reflected RF power readings. These voltages are sent to the RF Power Monitor tray (located in the Cavity Main RF Cabinet) before being routed to the Base Radio(s) in the Cavity Main RF cabinet. The Base Radios use the voltages to determine the forward and reflected RF power readings. These readings are also used to calculate the VSWR at the transmit antenna port. System power measurements for channels 1-10 can only be made from the Base Radios located in the Cavity Main RF cabinet (channels 1-5). System power measurements for channels 11-20 can only be made from Base Radios located in Cavity Expansion Cabinet #2 (channels 11-15).

Three relay contact closure pairs are provided on each of the RFDS for alarms. One diagnostic alarm output is provided for both of the power supplies, another for all of the RF distribution amplifiers, and the last pair for all of the tower top amplifiers.

The power supply alarm is wired such that when either or both of the power supplies experiences a failure, an alarm is generated. The RFDS amplifier alarm is wired such that when any combination of amplifiers experiences a failure, an alarm is generated. The tower top amplifier alarm is wired such that when any combination of amplifiers experiences a failure, an alarm is generated.

Under normal operating conditions (no alarm conditions present), the alarm outputs for all of these alarms are closed (i.e. short circuit across the terminal block connections). Upon detection of an alarm condition, the alarm outputs will open. The alarm signals are routed from the Telco connector on the back of the Power Supply tray to the EAS/iMU. Refer to the Gen 3 SC or iSC Supplement to this manual for additional alarm detection information.

### **Primary Control Channel (PCCH) Redundancy Operation**

An omni site PCCH is typically assigned to BR1 and is transmitted through cavity 1 of the RFDS (similarly, each cell of a sectored site will have a PCCH). In the event BR1 should fail, the PCCH redundant backup base radio (typically BR2) is re-assigned by the Gen 3 SC or iSC as the PCCH, with the transmit frequency of BR2 accordingly changed to that of BR1. In itself, the re-assignment of BR2 to the PCCH frequency is insufficient, as cavity 2 used by BR2 is not tuned to the PCCH frequency. During redundant backup, a means to transfer BR2's Tx signal to cavity 1 is required to transmit the PCCH. Either an Antenna Switch or a Transfer Switch is used to automatically connect the redundant backup base radio to the PCCH cavity. Either switch is actuated via a branched control connector harness that connects between the EAS/iMU CONTROL connector and the antenna or transfer switch.

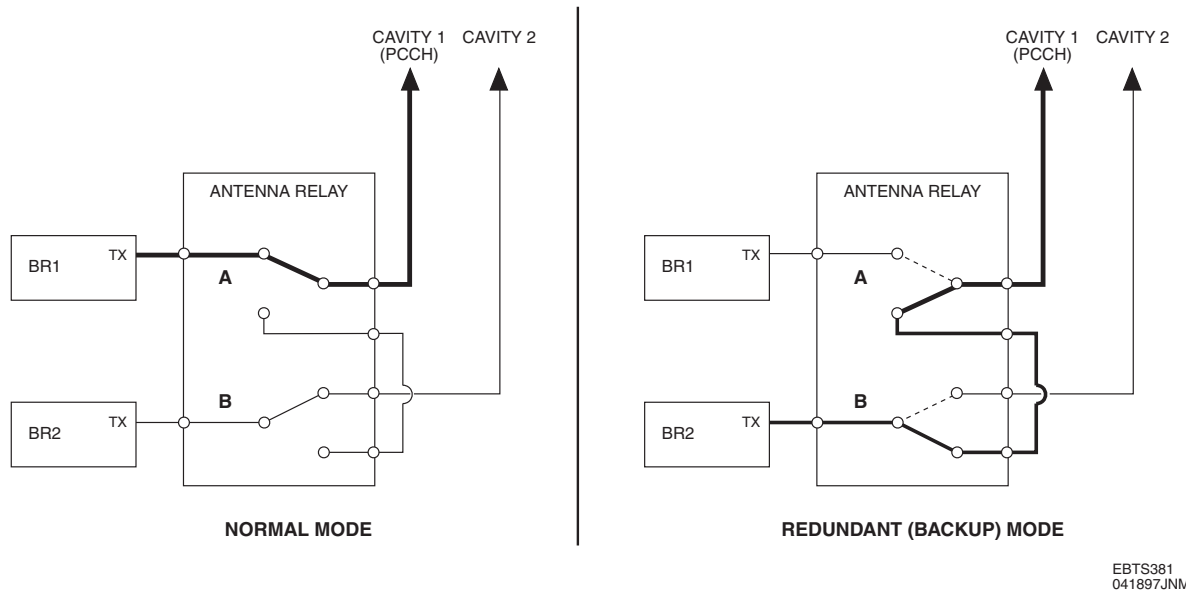
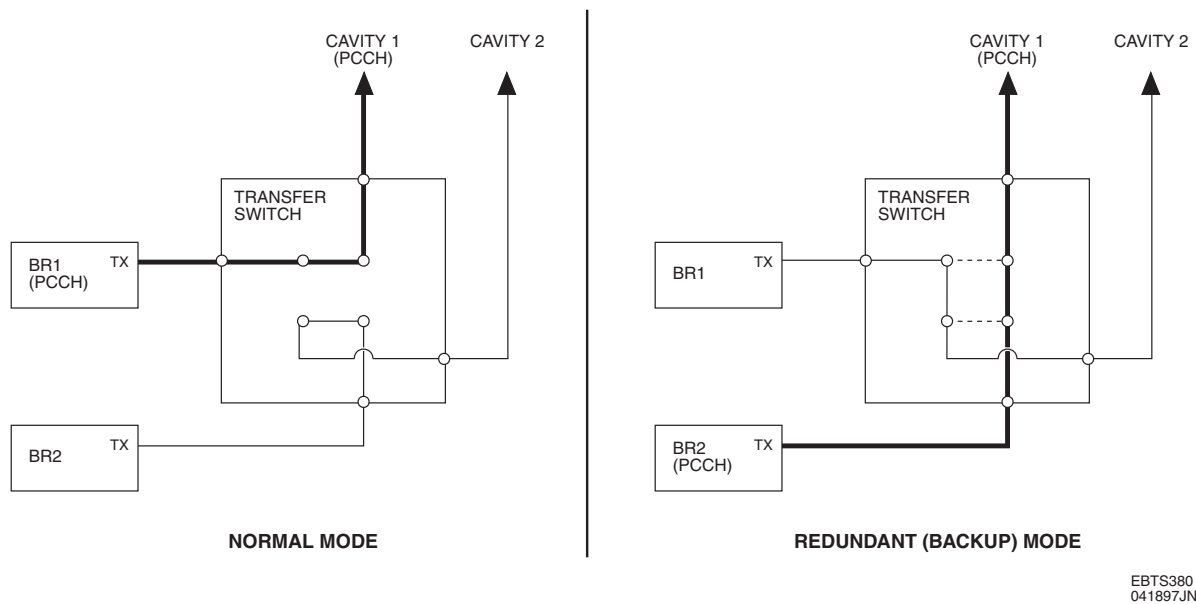
**Theory of Operation**

Figure 7 shows the block diagram of the PCCH Antenna Switch, which is a pair of SPDT RF relays. (The PCCH signal path is represented by bold lines in Figure 7.) Under normal operation ("Normal Mode" in Figure 7) the PCCH on BR1 is passed through the normally closed (NC) port and the common port of switch section A. The PCCH signal at the common port is then fed to cavity 1. However, when a failure of BR1 is detected, the EAS/iMU energizes the relay solenoids. During backup operation, the backup circuit path exists ("Redundant (Backup) Mode" in Figure 7) which now connects BR2 to cavity 1. During redundant operation, the Antenna Switch leaves the Tx output of BR1 unconnected, with BR1 being totally out of service.

The Transfer Switch shown in Figure 8 is a replacement for the Antenna Switch. It performs an identical function to the Antenna Switch described above, except that it uses a special four-port switch that allows both BRs to be connected to a cavity regardless of switch position. (The PCCH signal path is represented by bold lines in Figure 8.)

Under normal operation ("Normal Mode" in Figure 8) the Transfer Switch passes BR1's output to cavity 1 and BR2's output to cavity 2. However, when a failure of BR1 is detected, the EAS/iMU energizes the switch. During backup operation, the PCCH backup circuit path exists ("Redundant (Backup) Mode" in Figure 8) which now connects BR2 to cavity 1. During redundant operation, a connection from BR1 to cavity 2 now also exists. The Transfer Switch has the advantage over the Antenna Switch described above in that the system need not be "brought down" to re-establish the Tx connection for BR1. When BR1 is brought back to operational status, it will serve as a regular-channel base radio while BR2 stays assigned as the PCCH base radio.

## Theory of Operation

Figure 7 **PCCH Redundancy Antenna Switch Operation**Figure 8 **PCCH Redundancy Transfer Switch Operation**

## Pinouts and Wiring

## Pinouts and Wiring

The 1-5 channel and 6-10 channel cavity combining RFDS Power Supply trays contain seven connectors. Each of the connectors (listed below) route various power and control signals throughout the system.

- ☐ ALARM (Table 6)
- ☐ POWER MON (Table 7)
- ☐ AMP POWER (Table 8)
- ☐ ALARM (Table 9)
- ☐ TOWER AMP (Table 10)
- ☐ POWER IN A (Table 11)
- ☐ POWER IN B (Table 12)

**Table 6 25-Pin ALARM Connector**

| Pin                                                                                                                                                                                                                                                                         | Description                  | Cavity Main RF Cabinet Output*    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|-----------------------------------|
| 1                                                                                                                                                                                                                                                                           | Fan Alarm                    | Not Used                          |
| 2                                                                                                                                                                                                                                                                           | Fan Alarm                    | Not Used                          |
| 3                                                                                                                                                                                                                                                                           | 12 VDC-Fans                  | Not Used                          |
| 4                                                                                                                                                                                                                                                                           | 12 VDC-Fans                  | Not Used                          |
| 5                                                                                                                                                                                                                                                                           | 24 VDC (Spare)               | Not Used                          |
| 6                                                                                                                                                                                                                                                                           | Return (Spare)               | Not Used                          |
| 7                                                                                                                                                                                                                                                                           | GND (Fans Return)            | Not Used                          |
| 8                                                                                                                                                                                                                                                                           | GND (Fans Return)            | Not Used                          |
| 9                                                                                                                                                                                                                                                                           | GND                          | To Radio 3 (Conditioned) - Pin 18 |
| 10                                                                                                                                                                                                                                                                          | Antenna 3 FWD Power Monitor  | To Radio 3 (Conditioned) - Pin 19 |
| 11                                                                                                                                                                                                                                                                          | Antenna 3 REF Power Monitor  | To Radio 3 (Conditioned) - Pin 20 |
| 12                                                                                                                                                                                                                                                                          | GND (Power Monitor 3 Return) | To Radio 3 (Conditioned) - Pin 21 |
| 13                                                                                                                                                                                                                                                                          | Battery Stat 3               | Battery Stat - Radio 3 Backplane  |
| 14                                                                                                                                                                                                                                                                          | GND                          | To Radio 4 (Conditioned) - Pin 18 |
| 15                                                                                                                                                                                                                                                                          | Antenna 1 FWD Power Monitor  | To Radio 4 (Conditioned) - Pin 19 |
| <b>NOTE:</b> *Antenna Power Monitor connections are to be made on Cavity Main RF Cabinet only. Alarms will result if connections are made from Cavity Expansion RF Cabinets or RF power outputs, because no external wattmeter DC signals are sourced to these Base Radios. |                              |                                   |

Table 6 **25-Pin ALARM Connector (Continued)**

| Pin | Description                  | Cavity Main RF Cabinet Output*    |
|-----|------------------------------|-----------------------------------|
| 16  | Antenna 1 REF Power Monitor  | To Radio 4 (Conditioned) - Pin 20 |
| 17  | GND (Power Monitor 1 Return) | To Radio 4 (Conditioned) - Pin 21 |
| 18  | Battery Stat 4               | Battery Stat - Radio 4 Backplane  |
| 19  | GND                          | To Radio 5 (Conditioned) - Pin 18 |
| 20  | Antenna 2 FWD Power Monitor  | To Radio 5 (Conditioned) - Pin 19 |
| 21  | Antenna 2 REF Power Monitor  | To Radio 5 (Conditioned) - Pin 20 |
| 22  | GND (Power Monitor 2 Return) | To Radio 5 (Conditioned) - Pin 21 |
| 23  | Battery Stat5                | Battery Stat - Radio 5 Backplane  |
| 24  | Not Connected                |                                   |
| 25  | Not Connected                |                                   |

Table 7 **25-Pin POWER MON Connector**

| Pin                                                                                  | Description                  | Cavity Main RF Cabinet Output*    |
|--------------------------------------------------------------------------------------|------------------------------|-----------------------------------|
| 1                                                                                    | VCC_24V                      | To Power Monitor 1 - Pin 2        |
| 2                                                                                    | Antenna 1 FWD Power Monitor  | To Power Monitor 1 - Pin 5        |
| 3                                                                                    | Antenna 1 REF Power Monitor  | To Power Monitor 1 - Pin 1        |
| 4                                                                                    | GND (Power Monitor 1 Return) | To Power Monitor 1 - Pin 7        |
| 5                                                                                    | GROUND                       | To Radio 1 (Conditioned) - Pin 18 |
| 6                                                                                    | Antenna 1 FWD Power Monitor  | To Radio 1 (Conditioned) - Pin 19 |
| 7                                                                                    | Antenna 1 REF Power Monitor  | To Radio 1 (Conditioned) - Pin 20 |
| 8                                                                                    | GND (Power Monitor 1 Return) | To Radio 1 (Conditioned) - Pin 21 |
| 9                                                                                    | Battery Stat 1               | Battery Stat - Radio 1 Backplane  |
| 10                                                                                   | VCC_24V                      | To Power Monitor 2 - Pin 2        |
| 11                                                                                   | Antenna 2 FWD Power Monitor  | To Power Monitor 2 - Pin 5        |
| 12                                                                                   | Antenna 2 REF Power Monitor  | To Power Monitor 2 - Pin 1        |
| 13                                                                                   | GND (Power Monitor 2 Return) | To Power Monitor 2 - Pin 7        |
| 14                                                                                   | GROUND                       | To Radio 2 (Conditioned) - Pin 18 |
| 15                                                                                   | Antenna 2 FWD Power Monitor  | To Radio 2 (Conditioned) - Pin 19 |
| 16                                                                                   | Antenna 2 REF Power Monitor  | To Radio 2 (Conditioned) - Pin 20 |
| <b>NOTE:</b> The Power Monitor Tray is installed in the Cavity Main RF Cabinet only. |                              |                                   |

**Pinouts and Wiring****Table 7 25-Pin POWER MON Connector (Continued)**

| Pin | Description                  | Cavity Main RF Cabinet Output*    |
|-----|------------------------------|-----------------------------------|
| 17  | GND (Power Monitor 2 Return) | To Radio 2 (Conditioned) - Pin 21 |
| 18  | Battery Stat 2               | Battery Stat - Radio 2 Backplane  |
| 19  | VCC_24V                      | To Power Monitor 3 - Pin 2        |
| 20  | Antenna 3 FWD Power Monitor  | To Power Monitor 3 - Pin 5        |
| 21  | Antenna 3 REF Power Monitor  | To Power Monitor 3 - Pin 1        |
| 22  | GND (Power Monitor 3 Return) | To Power Monitor 3 - Pin 7        |
| 23  | Breaker Alarm In             | 8 Position Telco - Pin 1          |
| 24  | Breaker Alarm In             | 8 Position Telco - Pin 2          |
| 25  | Not Connected                |                                   |

**NOTE:** There is no actual power monitor #2 or power monitor #3 in a cavity combining RFDS. The power supply tray contains DIP switches that route power monitor #1 information (FWD and REF power) from the power supply tray to all the Base Radios identified as "power meter #1", "power meter #2", and "power meter #3".

**Table 8 9-Pin AMP POWER Connector**

| Pin | Description  | Output                   |
|-----|--------------|--------------------------|
| 1   | Return Amp 3 | RX Branch Tray 1 - Pin 1 |
| 2   | 24 VDC Amp 3 | RX Branch Tray 1 - Pin 2 |
| 3   | Sense Amp 3  | RX Branch Tray 1 - Pin 3 |
| 4   | Return Amp 2 | RX Branch Tray 2- Pin 1  |
| 5   | 24 VDC Amp 2 | RX Branch Tray 2- Pin 2  |
| 6   | Sense Amp 2  | RX Branch Tray 2- Pin 3  |
| 7   | Return Amp 1 | RX Branch Tray 3- Pin 1  |
| 8   | 24 VDC Amp 1 | RX Branch Tray 3- Pin 2  |
| 9   | Sense Amp 1  | RX Branch Tray 3- Pin 3  |

**Table 9 8-Pin ALARM Connector**

| Pin | Description                        | Output |
|-----|------------------------------------|--------|
| 1   | Breaker Panel Alarm Closure Pin #1 | To EAS |
| 2   | Breaker Panel Alarm Closure Pin #2 | To EAS |
| 3   | Base Amp Alarm Closure Pin #1      | To EAS |
| 4   | Tower Amp Alarm Closure Pin #1     | To EAS |
| 5   | PS Alarm Closure Pin #1            | To EAS |
| 6   | Base Amp Alarm Closure Pin #2      | To EAS |
| 7   | Tower Amp Alarm Closure Pin #2     | To EAS |
| 8   | PS Alarm Closure Pin #2            | To EAS |



Table 10 **3-Pin TOWER AMP Connector**

| Pin | Description            | Output           |
|-----|------------------------|------------------|
| 1   | 24 VDC Tower Amp 3 SMB | To DC Injector 3 |
| 2   | 24 VDC Tower Amp 2 SMB | To DC Injector 2 |
| 3   | 24 VDC Tower Amp 1 SMB | To DC Injector 1 |

Table 11 **3-Pin POWER IN A**

| Pin | Description | Output                 |
|-----|-------------|------------------------|
| 1   | Return      | Breaker Panel - Side B |
| 2   | -48 VDC     | Breaker Panel - Side B |

Table 12 **3-Pin POWER IN B**

| Pin | Description | Output                 |
|-----|-------------|------------------------|
| 1   | Return      | Breaker Panel - Side A |
| 2   | -48 VDC     | Breaker Panel - Side A |

**Removal/Replacement Procedures**

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## Removal/Replacement Procedures

### Cavity Combining RFDS Power Supply Replacement

The Cavity Combining RFDS itself contains one FRU, the Power Supply Assembly. Replace suspected power supply FRU with known non-defective FRUs to restore the RFDS to proper operation. The procedure for replacing the RFDS Power Supply is provided below.

**NOTE**

The Cavity RFDS contains static-sensitive modules. Take precautionary measures to prevent static discharge damage when servicing the RFDS.

 **CAUTION**

Burn Hazard. Some RFDS components may be hot. Allow to cool before handling to prevent personal injury.

#### Removal Procedure

1. Remove power from the affected side of the RFDS by setting the appropriate circuit breaker OFF (RFS1 or RFS2).
2. Using a screwdriver, loosen the four captive panel fasteners securing the faulty Power Supply to the RFDS chassis.  
  
The captive panel fasteners are located on each side of the module.
3. Carefully pull the module out of the RFDS chassis until the connections on the rear of the Power Supply module can be accessed.
4. Disconnect the 6-position Mate-N-Lok connector from the Power Supply chassis.

#### Installation Procedure

1. Connect the 6-position Mate-N-Lok connector to the appropriate connection on the replacement Power Supply chassis.
2. Insert the Power Supply module into the RFDS chassis.

3. Using a screwdriver, secure the Power Supply module by tightening the captive panel fasteners.
4. Apply power to the RFDS by setting the appropriate circuit breaker ON (RFS1 or RFS2).

## DC Power Supply Tray Replacement

The DC Power Supply Tray occupies two rack units, and is typically located near the top of the Main RF Cabinet. Figure 9 shows the typical mounting location of the DC Power Supply Tray. The following procedures describe how to replace the DC Power Supply Tray and how to properly set the DIP switches that determine the external wattmeter and receiver branch configurations.

DIP switch S101 determines receiver branch configuration. The settings of S101 must be changed if the number of receive antennas is changed. If S101 is not properly set, an antenna DC supply linkage alarm will be sent to the OMC.

DIP switch S102 determines transmit configuration. The settings of S102 must be changed if the number of transmit antennas is changed.

When replacing the DC Power Supply Tray, verify that the DIP switches on the replacement tray are set correctly for your system configuration.

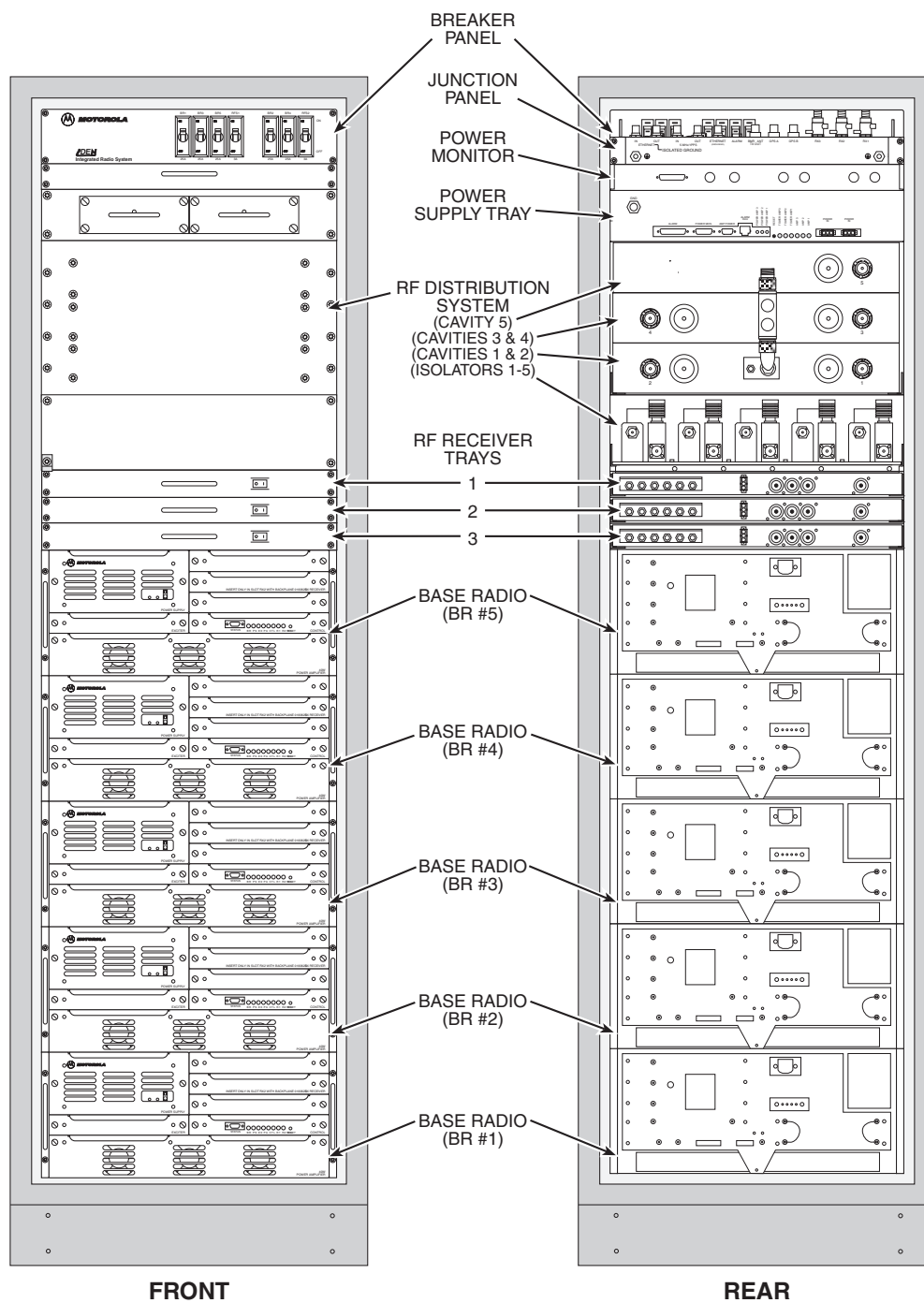
### **WARNING**

A SMALL STEP LADDER IS REQUIRED FOR THIS PROCEDURE. FAILURE TO USE CAUTION WHEN USING THE STEP LADDER COULD RESULT IN PERSONAL INJURY.

### **NOTE**

You must have access to the rear of the RF cabinet to replace the DC Power Supply Tray. To ensure that the replacement power supply is properly connected, always tag all wires and cables before disconnecting them.

## Removal/Replacement Procedures

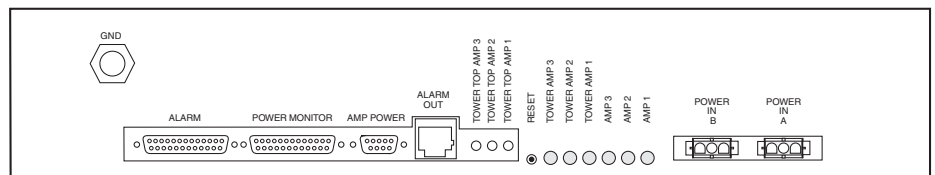
EBTS287  
042597JNMFigure 9 **FRU Mounting Locations (Typical)**

## Removal Procedure

### NOTE

During installation, the site will become inoperative because the DC Power Supply Tray provides DC voltage to the tower top amplifiers and the receiver tray low noise amplifiers. However, a full-site shutdown is unnecessary as long as the procedures are carefully followed.

1. Remove power from the DC Power Supply Tray by turning off circuit breakers RFS1 and RFS2, located on the cabinet breaker panel.
2. Label each cable that connects to the DC power supply tray. Figure 10 shows the rear panel connectors.



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Figure 10 **DC Power Supply Tray (Rear View)**

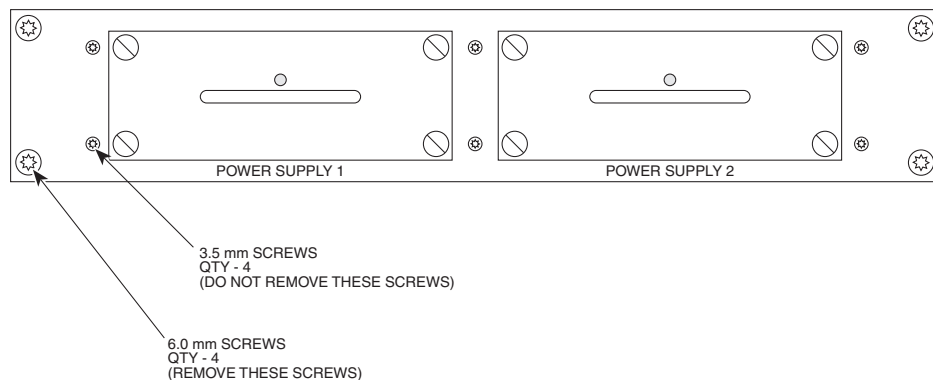
3. Disconnect the cables from the back of the DC Power Supply Tray in the following order:
  - 3.1 Power in A
  - 3.2 Power in B
  - 3.3 Alarm
  - 3.4 Power Monitor
  - 3.5 Amp Power
  - 3.6 Alarm Out
  - 3.7 Tower Top Amp 3
  - 3.8 Tower Top Amp 2
  - 3.9 Tower Top Amp 1
  - 3.10 Ground

**Removal/Replacement Procedures**

4. (See Figure 11.) Using a TORX driver, remove the four mounting screws from the front panel of the DC Power Supply Tray.

**NOTE**

Save the mounting screws for use in the Installation procedure.



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Figure 11 **DC Power Supply Tray (Front View)**

5. Remove the DC Power Supply Tray from the equipment cabinet.
6. Record the bar code number of the faulty DC Power Supply Tray in the site records. Continue with the Installation procedure.

**Installation Procedure**

1. Unpack the new DC Power Supply Tray and record the bar code number in the site records.
2. Gently lift the cover of the tray using a flat blade screwdriver.
3. On the TTN4012 board in the DC Power Supply Tray, configure DIP switches S101 and S102 as listed below.
4. Replace the cover on the tray.
5. Insert the new DC Power Supply Tray into the equipment cabinet.
6. Using the four screws removed during the Removal procedure, secure the DC Power Supply Tray to the front of the equipment cabinet. Torque the screws to 40 in-lb.
7. Reconnect all cables to the back of the DC Power Supply Tray in the following order:

**Removal/Replacement Procedures**

| <b>SWITCH</b>                                               | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> |
|-------------------------------------------------------------|----------|----------|----------|----------|
| <b>S101 - Receive Branch Tower Top Amplifier Monitoring</b> |          |          |          |          |
| 3-Branch Diversity                                          | ON       | ON       | OFF      | OFF      |
| 2-Branch Diversity                                          | ON       | OFF      | OFF      | ON       |
| No Tower Top Amplifiers                                     | OFF      | OFF      | ON       | ON       |
| <b>S102 - External Wattmeter Monitoring</b>                 |          |          |          |          |
| 3 Tx External Wattmeters                                    | OFF      | OFF      | OFF      | OFF      |
| 1 Tx External Wattmeter                                     | ON       | ON       | ON       | ON       |

**7.1** Ground

**7.2** Tower Top Amp 1

**7.3** Tower Top Amp 2

**7.4** Tower Top Amp 3

**7.5** Alarm Out

**7.6** Amp Power

**7.7** Power Monitor

**7.8** Alarm

**7.9** Power in B

**7.10** Power in A

- 8.** Set circuit breakers RFS1 and RFS2 to ON to power the DC Power Supply Tray.
- 9.** If the entire cabinet was powered down, reapply power to the cabinet and reinitialize the entire site. Follow the recommended site startup procedure.

## Removal/Replacement Procedures

## Receiver Branch Tray Replacement

The Receiver (RX) Branch Tray occupies one rack unit. The RX Branch Trays are located directly above the Base Radios (BRs). Refer to Figure 12 for the location.

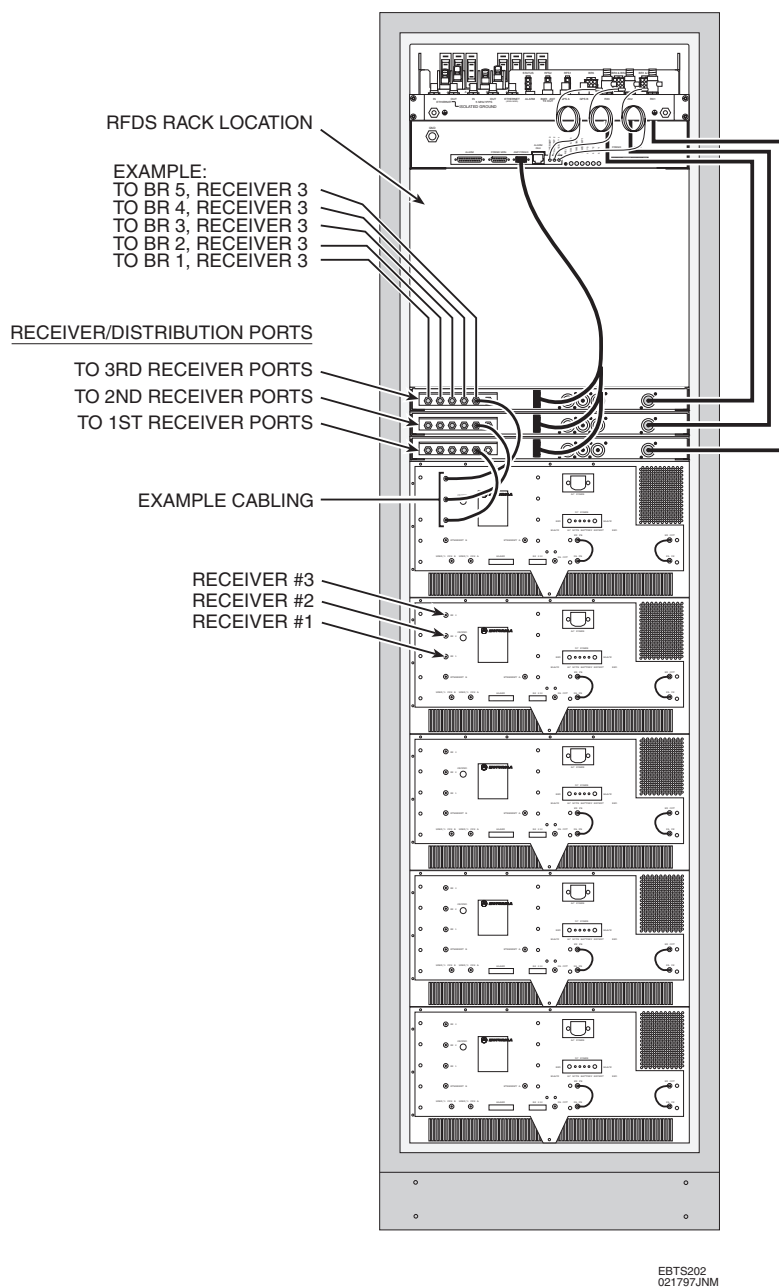


Figure 12 **Typical Receiver Branch Tray Location and Connection (Rear View)**



## Removal Procedure

1. Using the switch on the front panel of the RX Branch Tray that will be replaced, turn power OFF. Refer to Figure 13.



Figure 13 **RX Branch Tray (Front View)**

2. From the rear of the RF cabinet, remove DC power from the RX Branch Tray to be replaced.
3. Unplug the 3-wire Mate-N-Lok II connector from the RX Branch Tray. Refer to Figure 14.

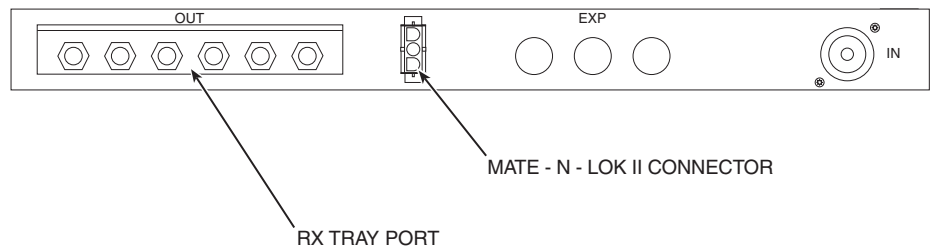


Figure 14 **RX Branch Tray (Rear View)**

4. From right to left (for easier removal) label and remove all cables connected to the "OUT" ports and "EXP" ports.
5. Label and disconnect the cable leading into the RX Branch Tray port, labeled "IN".
6. Using a TORX driver, remove the four mounting screws from the front panel of the RX Branch Tray. Refer to Figure 13.

**Removal/Replacement Procedures****NOTE**

Save the mounting screws. They are needed in the Installation Procedure.

7. Using the handles on the front of the RX Branch Tray, remove the tray from the cabinet.
8. Record the bar code number of the faulty RX Branch Tray in the site records. Continue with the Installation Procedure.

**Installation Procedure**

1. Unpack the new RX Branch Tray and record the bar code number in the site records.
2. Secure the RX Branch Tray to the front of the RF cabinet using the screws removed in the Removal Procedure. Torque the screws to 40 in-lb.
3. Reconnect the cables that were connected to the BR receivers (labeled OUT), making sure to maintain the original order.
4. Using a 5/16" breaking type torque wrench, torque the SMA connectors to approximately 5 in-lb.
5. Reconnect the RX RF input and EXP cables until finger tight.
6. Reconnect the Mate-N-Lok II connector.
7. Using the switch on the front panel, turn the RX Branch Tray ON.

**NOTE**

The RX Branch Trays are tested in the factory and the gain for each tray is marked on a label located on the back of the tray. Use this information for RX Branch Tray calibration.

**Power Monitor Tray Replacement**

The Power Monitor Tray occupies one rack unit, and is located directly above the DC Power Supply Tray. Refer to Figure 9 for the location of the Power Monitor Tray.

## ! WARNING

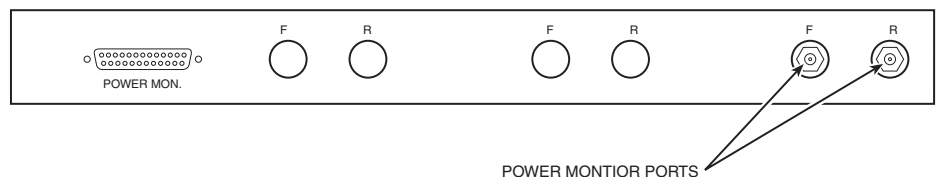
A SMALL STEP LADDER IS REQUIRED FOR THIS PROCEDURE. FAILURE TO USE CAUTION WHEN USING THE STEP LADDER COULD RESULT IN PERSONAL INJURY.

## NOTE

Access to the rear of the Main RF Cabinet is necessary to complete the removal and installation procedures.

### Removal Procedure

1. Use a small step ladder to reach the faulty power monitor tray.
2. Using a #1 slotted blade screwdriver (6" long handle), remove the 25-pin connector on the rear of the Power Monitor Tray by unscrewing the two retaining screws located on either side of the connector. Refer to Figure 15.



NOTE: The number of Power Monitors may vary from 1 to 3 units.

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Figure 15 **Power Monitor Tray (Rear View)**

3. Tag each cable that connects to the Power Monitor Tray ports. (A Power Monitor Tray can support up to three wattmeters.)
4. Using a TORX driver, remove all four securing screws from the front panel of the Power Monitor Tray. Refer to Figure 16.

**Removal/Replacement Procedures****NOTE**

Save the mounting screws. The mounting screws are used in the Installation Procedure.

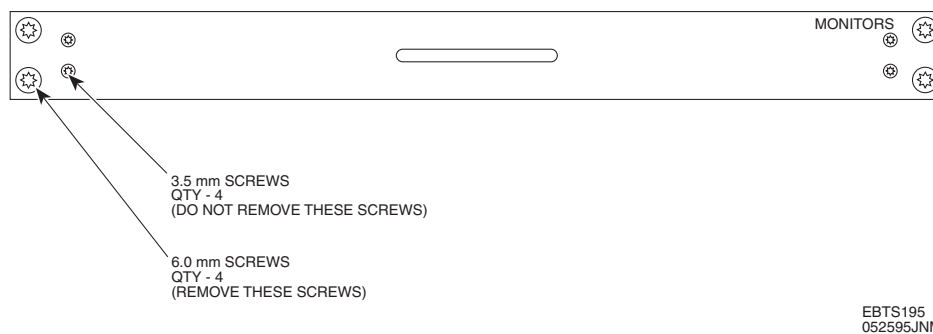


Figure 16 **Power Monitor Tray (Front View)**

5. Using the handles on the front of the Power Monitor Tray, remove the tray from the RF cabinet.
6. Record the faulty Power Monitor Tray bar code number in the site records. Continue with the Installation procedure.

**Installation Procedure**

1. Unpack the new Power Monitor Tray and record the bar code number in the site records.
2. Insert the new Power Monitor Tray into the cabinet.
3. Using the four screws obtained during the Removal procedure, secure the Power Monitor Tray to the RF cabinet. Torque the screws to 40 in-lb.
4. Making sure to maintain the original order, reconnect the cables back to the "F" and "R" ports.
5. Using the 5/16" breaking type torque wrench, torque the SMA connectors to 5 in-lb.
6. Reconnect and secure the 25-pin connector to the Power Monitor Tray. Torque the connector securing screws to 5 in-lb.

## Cabling Information

### Overview

This section contains cabling information for the cavity combining EBTS. The cabling diagrams included in this section are listed in the following table.

| Section                          | Page | Description                                                                                                                                                                      |
|----------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Receiver Cabling                 | 32   | Provides cabling information for the antenna connections of the receive branches. Also provides intercabinet receive cabling information on systems using expansion RF cabinets. |
| Chassis Grounding                | 36   | Provides cabling information for the chassis ground connections of each module                                                                                                   |
| 5 MHz/1 PPS Cabling              | 38   | Provides 5 MHz/1 PPS cabling information for the time frequency reference signal connections within the equipment cabinet                                                        |
| Ethernet Cabling                 | 40   | Provides Ethernet cabling information for the Ethernet bus connections within the equipment cabinet                                                                              |
| Transmit Power Out Cabling       | 42   | Provides cabling information for the transmit power out connections of the equipment cabinet                                                                                     |
| Power Monitor/Alarm/PCCH Cabling | 46   | Provides cabling information for cabinet power monitor, alarm, and PCCH cabling harness connections                                                                              |
| Expansion Transmit Cabling       | 50   | Provides cabling information for transmit connections and cabling on systems using expansion RF cabinets                                                                         |

The cabling tables are presented with corresponding illustrations. Each cable is identified by an index number in the illustration. The illustrations show the location of the cables. The corresponding tables identify each of the cables and connections. Connections appearing in **bold** are labeled accordingly on the equipment.

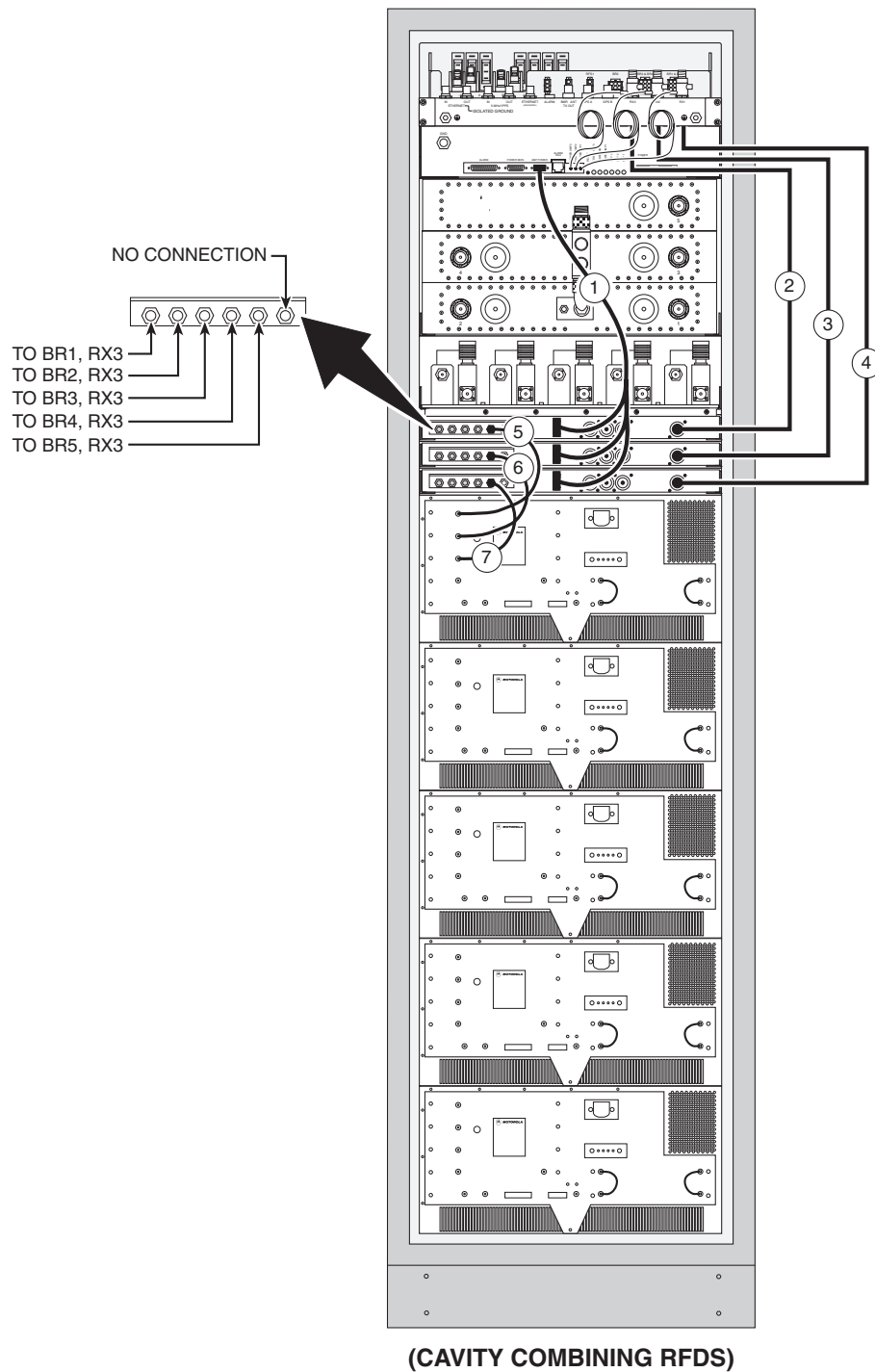
**Cabling Information****Receiver Cabling**

Receiver cabling refers to the cable connections between the RFDS and the Base Radio RX inputs.

Table 13 identifies and Figure 17 shows Main RF Cabinet receiver cabling for cavity combining systems. Table 14 identifies and Figure 18 shows Expansion RF Cabinet receiver cabling for cavity combining systems.

*Table 13      **Receiver Cabling (Main RF Cabinet)***

| <b>Index</b> | <b>Part Number</b> | <b>From</b>                                         | <b>To</b>                                                             | <b>Notes</b>                                                            |
|--------------|--------------------|-----------------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1            | 0180704F97         | <b>AMP POWER</b> connector on RFDS Power Supply     | 3 wire Mate-N-Lok II power connector on all RFDS branches (RX1 - RX3) | This is a pigtail connector which connects to each RFDS receiver branch |
| 2            | 0180704F37         | DC injector #3 on junction panel                    | <b>IN</b> connector on RFDS RX3 branch                                | This connection is required for 3 branch diversity sites                |
| 3            | 0180704F37         | DC injector #2 on junction panel                    | <b>IN</b> connector on RFDS RX2 branch                                | This connection is required for 2 and 3 branch diversity sites          |
| 4            | 0180704F37         | DC injector #1 on junction panel                    | <b>IN</b> connector on RFDS RX1 branch                                | This connection is required for 2 and 3 branch diversity sites          |
| 5            | 0112004W03         | <b>OUT</b> connector on 6 way divider of RX3 branch | <b>RX3</b> connector on Base Radio #5                                 | This connection is required for 3 branch diversity sites only           |
| 6            | 0112004W03         | <b>OUT</b> connector on 6 way divider of RX2 branch | <b>RX2</b> connector on Base Radio #5                                 | This connection is required for 2 and 3 branch diversity sites          |
| 7            | 0112004W03         | <b>OUT</b> connector on 6 way divider of RX1 branch | <b>RX1</b> connector on Base Radio #5                                 | This connection is required for 2 and 3 branch diversity sites          |



NOTE: Only the connection from the 6-way splitter output to the BR#5 receiver inputs is shown. Connections from the 6-way splitter outputs to the other BR receivers follow in the same pattern.

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Figure 17 Receiver Cabling Diagram (Main RF Cabinet)

**Cabling Information**Table 14 **Receiver Cabling (Expansion Cabinets)**

| Index                                                                                                                                               | Part Number | From                                                             | To                                                                    | Notes                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------|
| 1                                                                                                                                                   | 0112004W41  | <b>OUT</b> connector on 6 way divider of Receive Splitter Tray   | <b>RX</b> connector on Base Radio                                     | Rx3 connections used only for 3-branch diversity sites               |
| 2                                                                                                                                                   | 0112004W42  | <b>OUT</b> connector on 6 way divider of Receive Splitter Tray   | <b>RX</b> connector on Base Radio                                     | Rx3 connections used only for 3-branch diversity sites               |
| 3                                                                                                                                                   | 0112004C06  | <b>EXP</b> (expansion) output connector on Receive Splitter Tray | Expansion Junction Panel EXP connector hole                           | Rx3 connections used only for 3-branch diversity sites               |
| 4                                                                                                                                                   | 0112004B24  | Expansion Junction Panel (Main RF Cabinet) <b>EXP</b> connectors | Expansion Cabinet attenuators                                         | Intercabinet Rx cable                                                |
| 5                                                                                                                                                   | –           | Intercabinet Rx cable                                            | Junction Panel <b>RX</b> connectors                                   | Attenuator value determined in field equalization procedure          |
| 6                                                                                                                                                   | 0112004C06  | Junction Panel <b>RX</b> connectors                              | <b>IN</b> connector on Receive Splitter Tray                          |                                                                      |
| 7                                                                                                                                                   | 0180704F97  | <b>AMP POWER</b> connector on RFDS Power Supply                  | 3 wire Mate-N-Lok II power connector on all RFDS branches (RX1 - RX3) | Three-ended power cable which connects to each Receive Splitter Tray |
| <b>NOTE:</b> Above listing for part no. identification and function description only. Refer to accompanying diagram for point-to-point connections. |             |                                                                  |                                                                       |                                                                      |



## Cabling Information

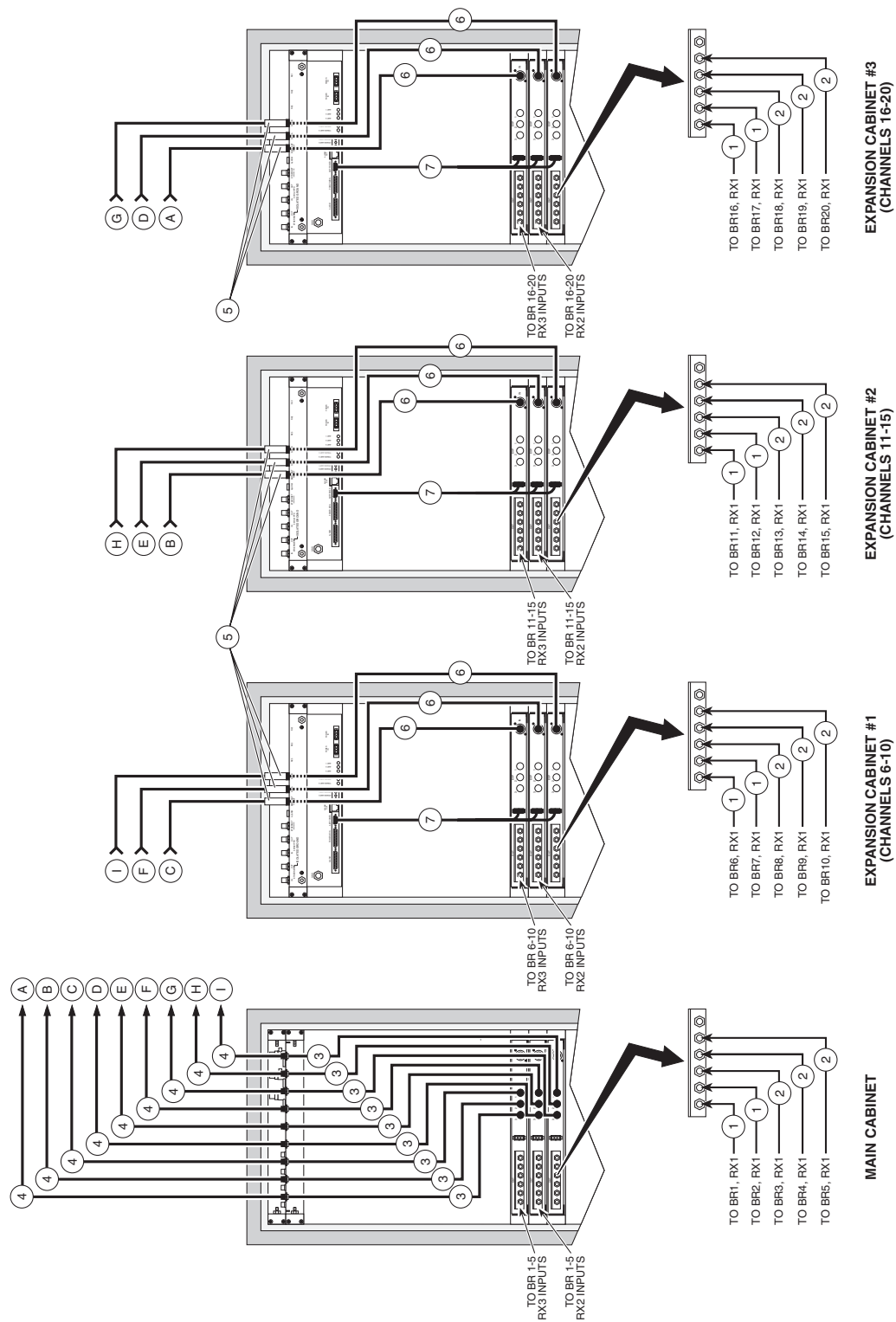
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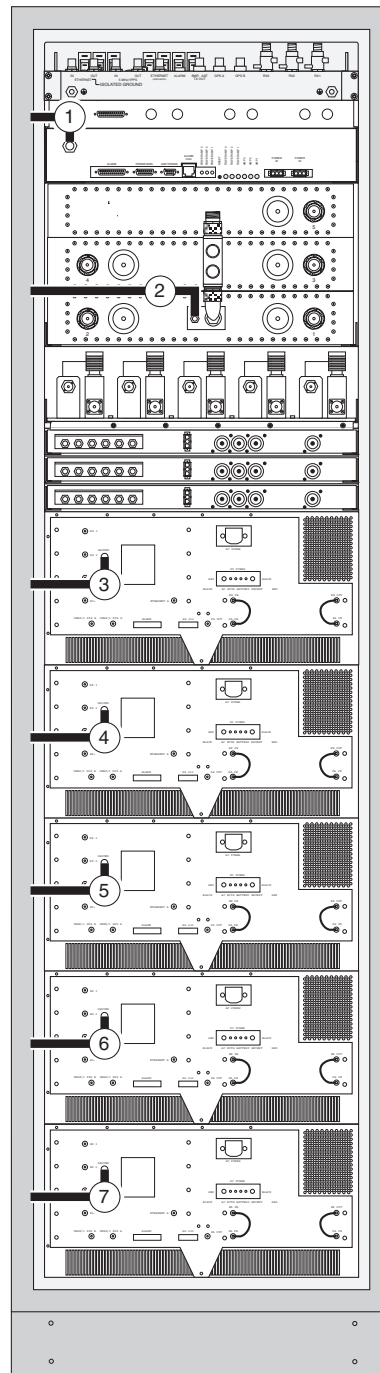
Figure 18 Receiver Cabling Diagram (Expansion Cabinets and Intercabling)

**Cabling Information****Chassis Grounding**

Chassis grounding refers to the ground strap connections between the equipment modules within the equipment cabinet and the cabinet frame. Chassis grounds help prevent interference and damage to equipment in the event of a lightning strike. Table 15 identifies and Figure 19 shows the ground straps for the cavity combining system.

Table 15 **Ground Straps**

| Index | Part Number | From                             | To                                              | Notes                                                               |
|-------|-------------|----------------------------------|-------------------------------------------------|---------------------------------------------------------------------|
| 1     | 3082000X01  | Ground stud on equipment cabinet | <b>GND</b> ground stud on the RFDS Power Supply | This connection provides a chassis ground for the RFDS Power Supply |
| 2     | 3082000X01  | Ground stud on equipment cabinet | <b>Ground</b> stud on RFDS antenna output port  | This connection provides a chassis ground for the RFDS cavities     |
| 3     | 3082000X01  | Ground stud on equipment cabinet | <b>GROUND</b> ground stud on Base Radio #5      | This connection provides a chassis ground for Base Radio #5         |
| 4     | 3082000X01  | Ground stud on equipment cabinet | <b>GROUND</b> ground stud on Base Radio #4      | This connection provides a chassis ground for Base Radio #4         |
| 5     | 3082000X01  | Ground stud on equipment cabinet | <b>GROUND</b> ground stud on Base Radio #3      | This connection provides a chassis ground for Base Radio #3         |
| 6     | 3082000X01  | Ground stud on equipment cabinet | <b>GROUND</b> ground stud on Base Radio #2      | This connection provides a chassis ground for Base Radio #2         |
| 7     | 3082000X01  | Ground stud on equipment cabinet | <b>GROUND</b> ground stud on Base Radio #1      | This connection provides a chassis ground for Base Radio #1         |



(CAVITY COMBINING RFDS)

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Figure 19 Chassis Grounding Diagram

**Cabling Information****5 MHz/1 PPS Cabling**

The 5 MHz/1 PPS cabling refers to the cables that route the time frequency reference signal between the Junction Panel and each Base Radio. Table 16 identifies and Figure 20 shows the 5 MHz/1 PPS cabling.

Table 16 **5 MHz/1 PPS Cabling**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Part Number | From                                                           | To                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082004X03  | Underside of <b>5 MHz/1 PPS IN</b> connector on Junction Panel | BNC T-adapter on Base Radio #1                                                                     |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0112004Z17  | BNC T-adapter on Base Radio #1                                 | BNC T-adapter on Base Radio #2<br>BNC T-adapter on Base Radio #3<br>BNC T-adapter on Base Radio #4 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082004X03  | BNC T-adapter on Base Radio #5                                 | Underside of <b>5 MHz/1 PPS OUT</b> connector on Junction Panel                                    |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cables are connected between the BNC T-adapters (P/N 0909907D01), which are mounted to the appropriate module connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to five BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, 5 MHz/1 PPS OUT connector must be terminated with 50Ω terminator.</li> </ol> |             |                                                                |                                                                                                    |

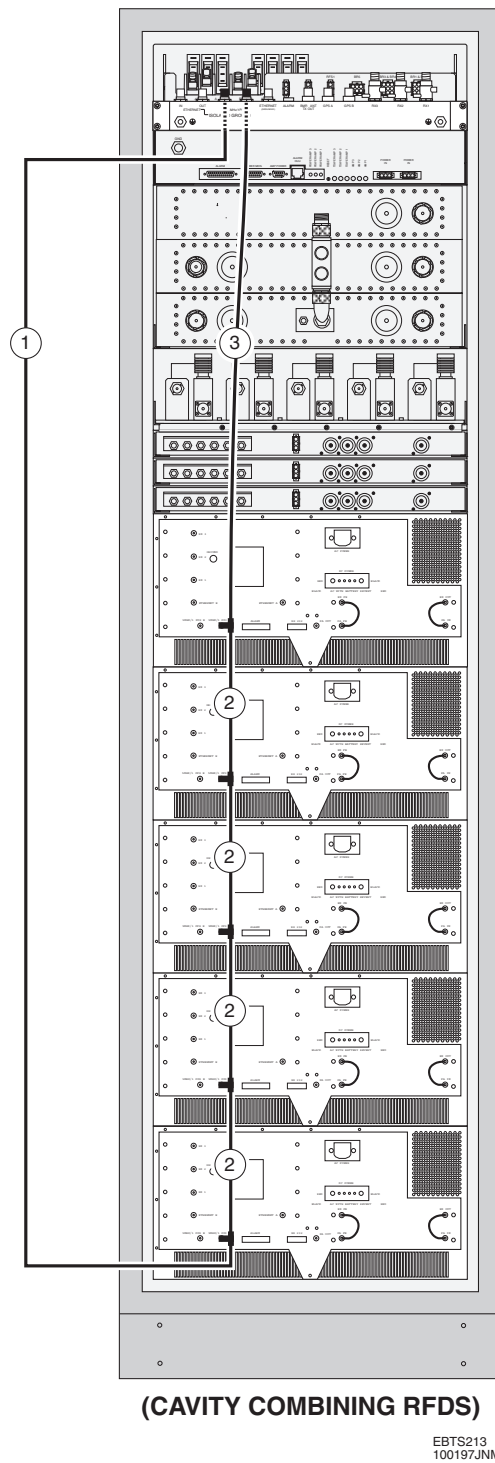


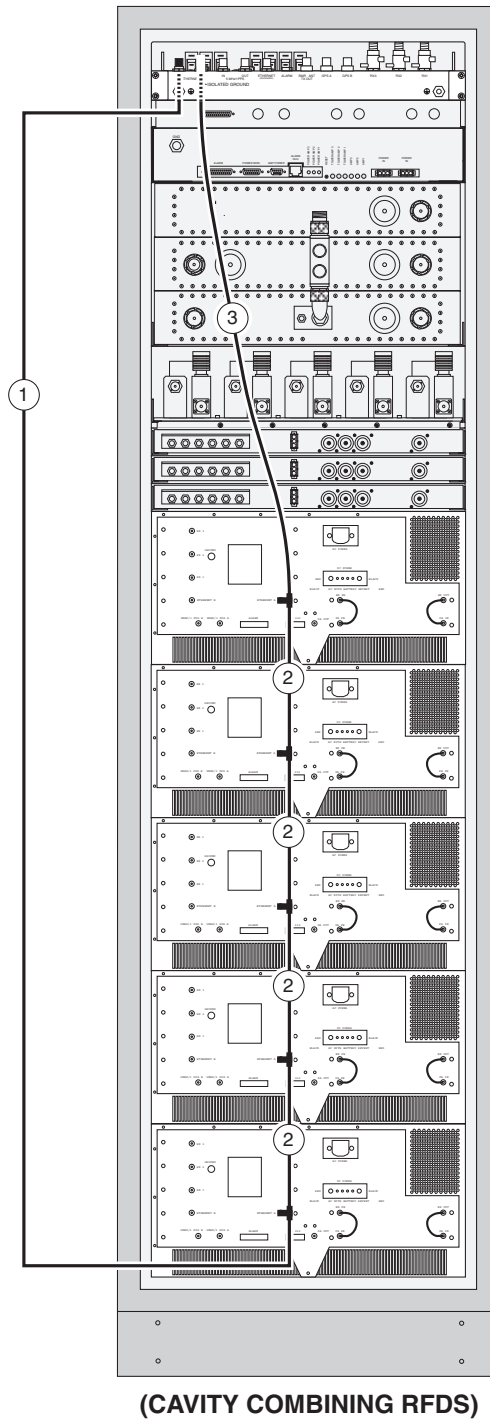
Figure 20 5 MHz/1 PPS Cabling Diagram

**Cabling Information****Ethernet Cabling**

Ethernet cabling refers to the network cables routed between the Junction Panel and each Base Radio. Table 17 identifies and Figure 21 shows the Ethernet cabling.

Table 17 **Ethernet Cabling**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Part Number | From                                                        | To                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3082004X03  | Underside of <b>ETHERNET IN</b> connector on Junction Panel | BNC T-adapter on Base Radio #1                                                                     |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0112004Z17  | BNC T-adapter on Base Radio #1                              | BNC T-adapter on Base Radio #2<br>BNC T-adapter on Base Radio #3<br>BNC T-adapter on Base Radio #4 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3082004X03  | BNC T-adapter on Base Radio #5                              | Underside of <b>ETHERNET OUT</b> connector on Junction Panel                                       |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cables are connected between the BNC T-adapters (P/N 0909907D01), which are mounted to the appropriate module connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to five BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, ETHERNET OUT connector must be terminated with 50Ω terminator.</li> </ol> |             |                                                             |                                                                                                    |



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Figure 21 Ethernet Cabling Diagram

**Cabling Information****Transmit Power Out Cabling**

Transmit power output cabling refers to the cables that route the Base Radio PA outputs to the RFDS transmit inputs.

Systems either use Antenna Switch TLF1980 or Transfer Switch TLF1980A to switch the primary control channel to Base Radio #2 should Base Radio #1 fail.

Table 18 identifies and Figure 22 shows the transmit power out cabling for a system equipped with Antenna Switch TLF1980.

Table 19 identifies and Figure 23 shows the transmit power out cabling for a system equipped with Transfer Switch TLF1980A.

*Table 18      **Transmit Power Out Cabling (Systems Using Antenna Switch TLF1980)***

| <b>Index</b> | <b>Part Number</b> | <b>From</b>                   | <b>To</b>                  |
|--------------|--------------------|-------------------------------|----------------------------|
| 1            | 0112004K14         | Base Radio 1 PA OUT connector | Normally Closed RF Relay A |
| 2            | 0112004K10         | Base Radio 2 PA OUT connector | Common Port RF Relay B     |
| 3            | 0112004K10         | Base Radio 3 PA OUT connector | Input - Dual Isolator #3   |
| 4            | 0112004K99         | Base Radio 4 PA OUT connector | Input - Dual Isolator #4   |
| 5            | 0112004K99         | Base Radio 5 PA OUT connector | Input - Dual Isolator #5   |
| 6            | 0112004B04         | Normally Closed RF Relay A    | Input - Dual Isolator #1   |
| 7            | 0112004B04         | Output - Dual Isolator #1     | Tx Cavity #1               |
| 8            | 0112004B04         | Output - Dual Isolator #3     | Tx Cavity #3               |
| 9            | 0112004B04         | Output - Dual Isolator #5     | Tx Cavity #5               |
| 10           | 0112004B04         | Output - Dual Isolator #4     | Tx Cavity #4               |
| 11           | 0112004B04         | Output - Dual Isolator #2     | Tx Cavity #2               |
| 12           | 0112004B04         | Normally Closed RF Relay B    | Input - Dual Isolator #2   |
| 13           | 0112004B04         | Normally Open RF Relay B      | Normally Open RF Relay A   |



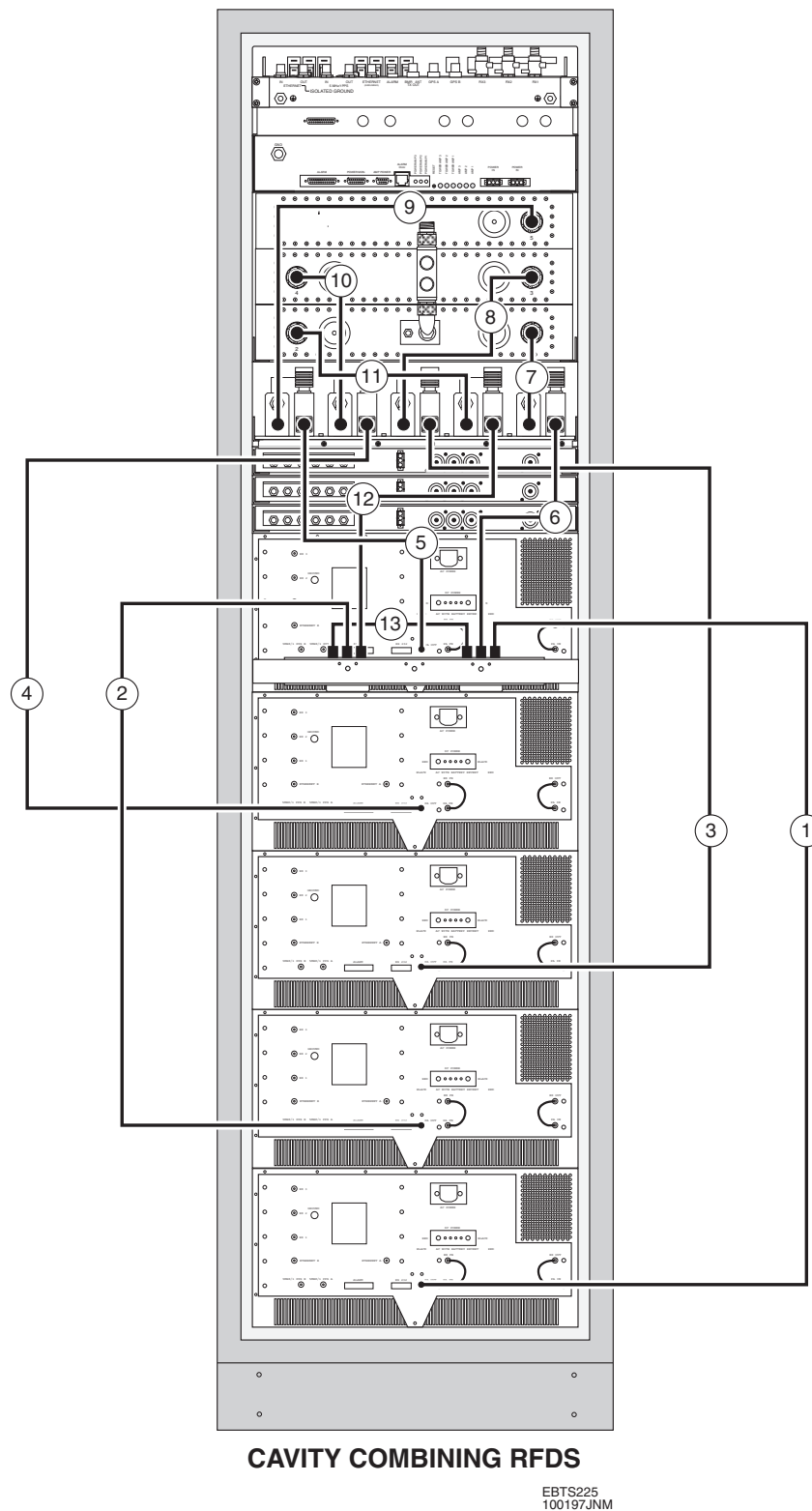


Figure 22 **Transmit Power Out Cabling Diagram (Systems Using Antenna Switch TLF1980)**

**Cabling Information****Table 19 Transmit Power Out Cabling (System Using Transfer Switch TLF1980A)**

| <b>Index</b> | <b>Part Number</b> | <b>From</b>                       | <b>To</b>                                    | <b>Notes</b>                                                                      |
|--------------|--------------------|-----------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------|
| 1            | 6483963N05         |                                   |                                              | Switch Bracket                                                                    |
| 2            | 8082894X03         |                                   |                                              | Transfer Switch                                                                   |
| 3            | 0112004K14         | Base Radio 1 PA OUT connector     | Transfer Switch port #3                      |                                                                                   |
| 4            | 0112004K14         | Base Radio 2 PA OUT connector     | Transfer Switch port #2                      |                                                                                   |
| 5            | 3083813X02         | Transfer Switch control connector |                                              | Refer to Power Monitor / Alarm / PCCH Cabling (this section) for control cabling. |
| 6            | 0112004B04         | Transfer Switch port #1           | Input - Dual Isolator #1 (Primary Channel)   | Cavity #1 is typically utilized as primary channel, as shown.                     |
| 7            | 0112004B04         | Transfer Switch port #4           | Input - Dual Isolator #2 (Secondary Channel) | Cavity #2 is typically utilized as secondary channel, as shown.                   |
| 8            | 0112004K10         | Base Radio 3 PA OUT connector     | Input - Dual Isolator #3                     |                                                                                   |
| 9            | 0112004K99         | Base Radio 4 PA OUT connector     | Input - Dual Isolator #4                     |                                                                                   |
| 10           | 0112004K99         | Base Radio 5 PA OUT connector     | Input - Dual Isolator #5                     |                                                                                   |
| 11           | 0112004B04         | Output - Dual Isolator #1         | Tx Cavity #1                                 |                                                                                   |
| 12           | 0112004B04         | Output - Dual Isolator #2         | Tx Cavity #2                                 |                                                                                   |
| 13           | 0112004B04         | Output - Dual Isolator #3         | Tx Cavity #3                                 |                                                                                   |
| 14           | 0112004B04         | Output - Dual Isolator #4         | Tx Cavity #4                                 |                                                                                   |
| 15           | 0112004B04         | Output - Dual Isolator #5         | Tx Cavity #5                                 |                                                                                   |

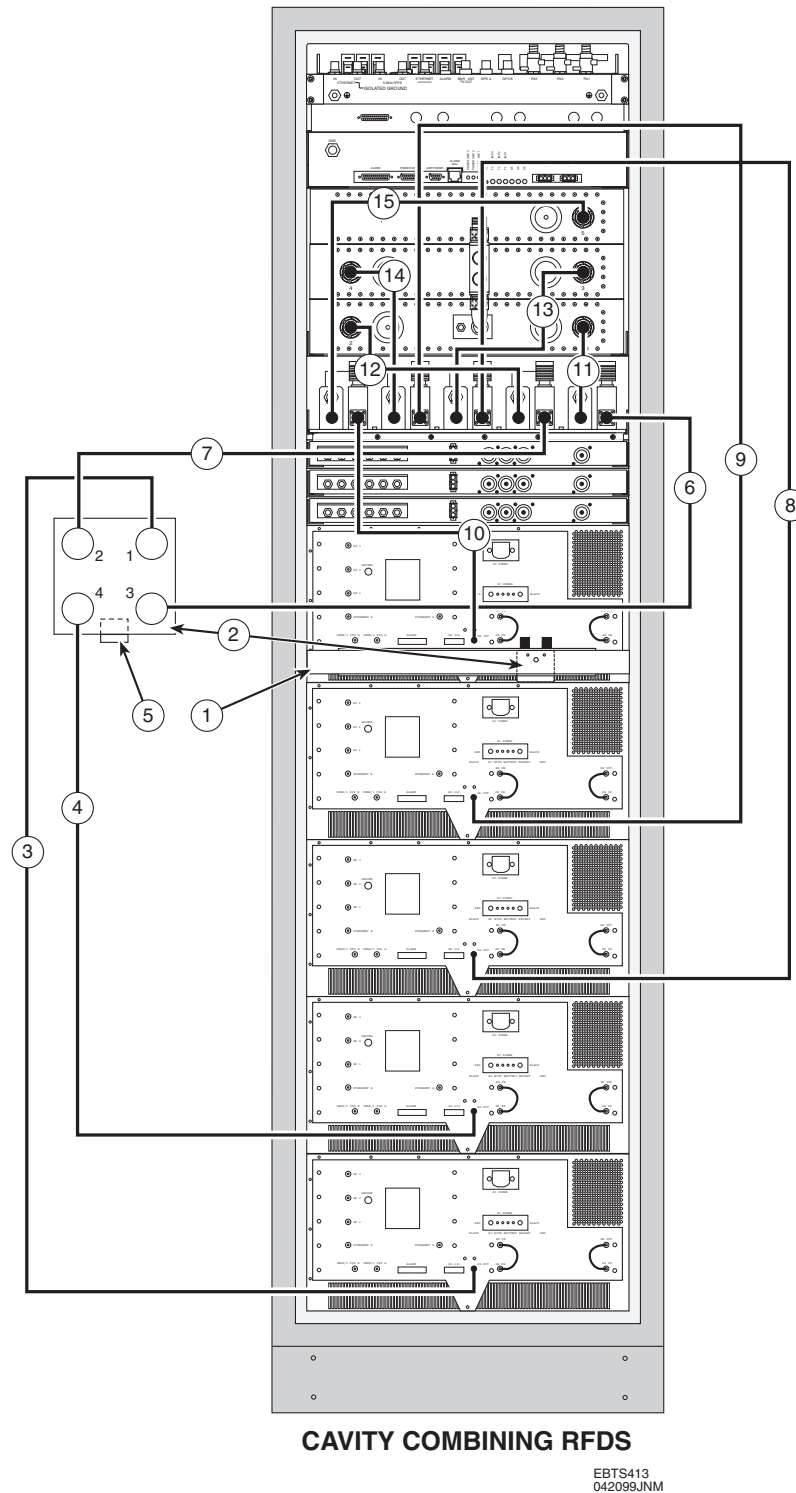


Figure 23 **Transmit Power Out Cabling Diagram (Systems Using Transfer Switch TLF1980A)**

**Cabling Information****Power Monitor/Alarm/PCCH Cabling**

Power monitor/ alarm/ PCCH cabling refers to the cabinet alarm/ power monitor wiring harness connections and the PCCH wiring harness connections.

Table 18 identifies and Figure 24 shows the power monitor/ alarm/ PCCH cabling for a system equipped with Antenna Switch TLF1980.

Table 21 identifies and Figure 25 shows the power monitor/ alarm/ PCCH cabling for a system equipped with Transfer Switch TLF1980A.

*Table 20      **Power Monitor/Alarm/PCCH Cabling (Systems Using Antenna Switch TLF1980)***

| <b>Index</b>                                                                                                                                   | <b>Part Number</b> | <b>From</b>                                                                                                                                                                                | <b>To</b>                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                              | 0180704F39         | Reverse port of Tx Output Directional Coupler                                                                                                                                              | Power Monitor Tray - REV                                                                                                                                                                                                                                                                                                                                                                                   |
| 2                                                                                                                                              | 0180704F39         | Forward port of Tx Output Directional Coupler                                                                                                                                              | Power Monitor Tray - FWD                                                                                                                                                                                                                                                                                                                                                                                   |
| 3                                                                                                                                              | 0180704F96         | 25-pin <b>ALARM</b> connector on DC Power Supply Tray                                                                                                                                      | Multi-connector harness. Connects to: <ul style="list-style-type: none"> <li>• 25-pin <b>ALARM</b> connector on Base Radio 3</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 4</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 5</li> </ul>                                                                                                                                                  |
| 4                                                                                                                                              | 0180705F19         | 25-pin <b>POWER MONITOR</b> connector on DC Power Supply Tray                                                                                                                              | Multi-connector harness. Connects to: <ul style="list-style-type: none"> <li>• 3-pin Mate-N-Lok <b>STATUS</b> connector on Breaker Panel</li> <li>• 25-pin <b>POWER MON</b> connector on Power Monitor Tray</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 1</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 2</li> <li>• Two, 3-pin Mate-N-Lok connectors on index no. 5 (NOTE)</li> </ul> |
| 5                                                                                                                                              | 3082074X01         | Mate-N-Lok connector on PCCH cable (P/N 3082070X01) from Control Cabinet. (Refer to Primary Control Channel Redundancy Intercabling (Installation section) for control cable connections.) | Multi-connector harness. Connects to: <ul style="list-style-type: none"> <li>• Two, 3-pin mini connectors on antenna switches</li> <li>• Two, 3-pin Mate-N-Lok connectors on index no. 4 (NOTE)</li> </ul>                                                                                                                                                                                                 |
| <b>NOTE:</b> Connectors are not keyed. Make sure Mate-N-Lok connectors with orange wires connect with orange, and yellow connects with yellow. |                    |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                            |

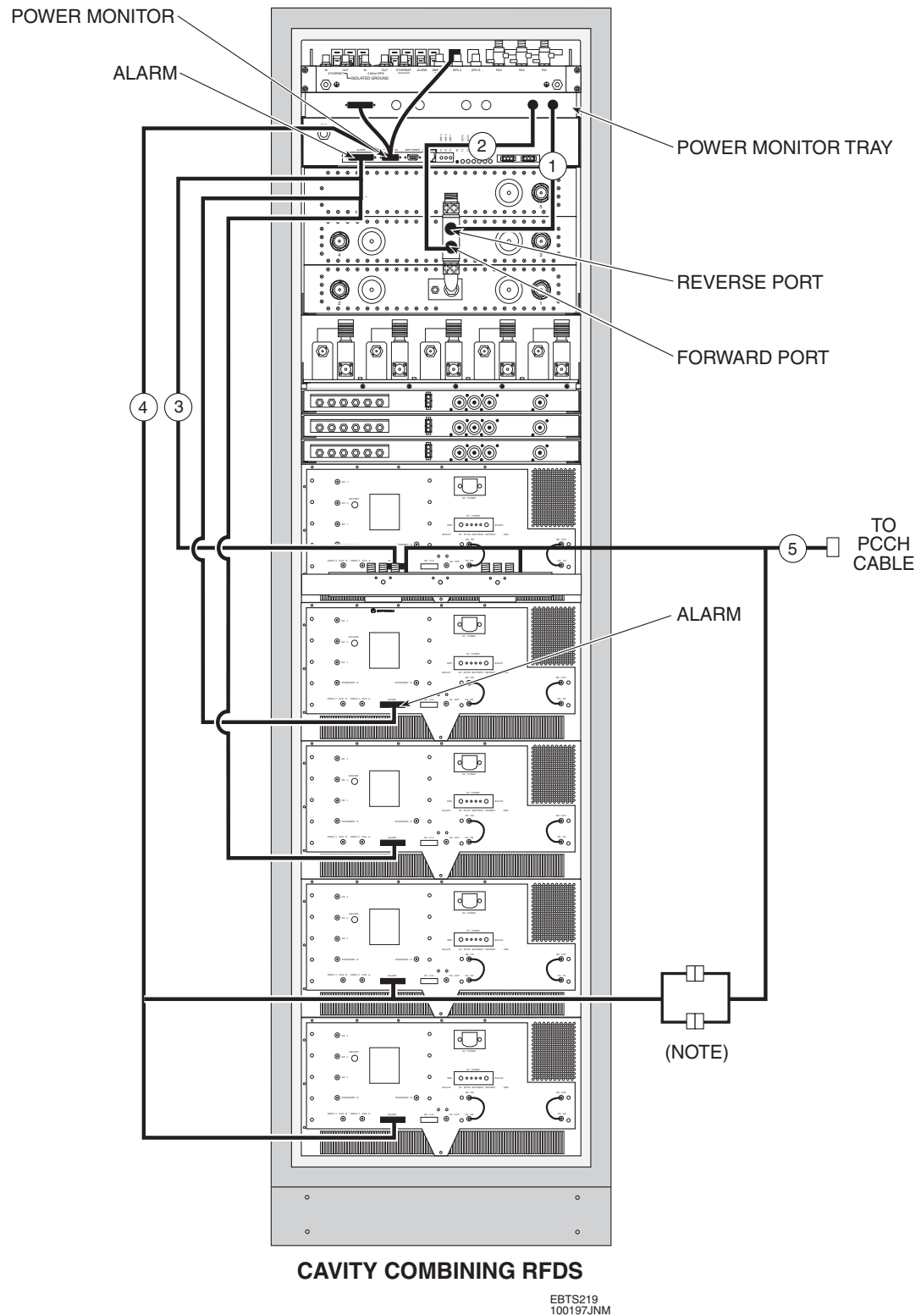


Figure 24 **Power Monitor/Alarm/PCCH Cabling Diagram (Systems Using Antenna Switch TLF1980)**

**Cabling Information**Table 21 **Power Monitor/Alarm/PCCH Cabling (Systems Using Transfer Switch TLF1980A)**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Part Number | From                                                                                                                                                                                       | To                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0180704F39  | Reverse port of Tx Output Directional Coupler                                                                                                                                              | Power Monitor Tray - REV                                                                                                                                                                                                                                                                                                                                                                                   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0180704F39  | Forward port of Tx Output Directional Coupler                                                                                                                                              | Power Monitor Tray - FWD                                                                                                                                                                                                                                                                                                                                                                                   |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0180704F96  | 25-pin <b>ALARM</b> connector on DC Power Supply Tray                                                                                                                                      | Multi-connector harness. Connects to: <ul style="list-style-type: none"> <li>• 25-pin <b>ALARM</b> connector on Base Radio 3</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 4</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 5</li> </ul>                                                                                                                                                  |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0180705F19  | 25-pin <b>POWER MONITOR</b> connector on DC Power Supply Tray                                                                                                                              | Multi-connector harness. Connects to: <ul style="list-style-type: none"> <li>• 3-pin Mate-N-Lok <b>STATUS</b> connector on Breaker Panel</li> <li>• 25-pin <b>POWER MON</b> connector on Power Monitor Tray</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 1</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 2</li> <li>• Two, 3-pin Mate-N-Lok connectors on index no. 5 (NOTE)</li> </ul> |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3082074X01  | Mate-N-Lok connector on PCCH cable (P/N 3082070X01) from Control Cabinet. (Refer to Primary Control Channel Redundancy Intercabling (Installation section) for control cable connections.) | Multi-connector harness. Connects to: <ul style="list-style-type: none"> <li>• 3-pin mini connector on Transfer Switch (NOTE 1)</li> <li>• Two, 3-pin Mate-N-Lok connectors on index no. 4 (NOTE 2)</li> </ul>                                                                                                                                                                                             |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Wiring harness (P/N 3082074X01) is equipped with two, 3-pin mini connectors for connection to antenna or transfer switches. Connect longer branch of two mini connectors to Transfer Switch. Other mini connector is left unconnected.</li> <li>2. Connectors are not keyed. Make sure Mate-N-Lok connectors with orange wires connect with orange, and yellow connects with yellow.</li> </ol> |             |                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                            |

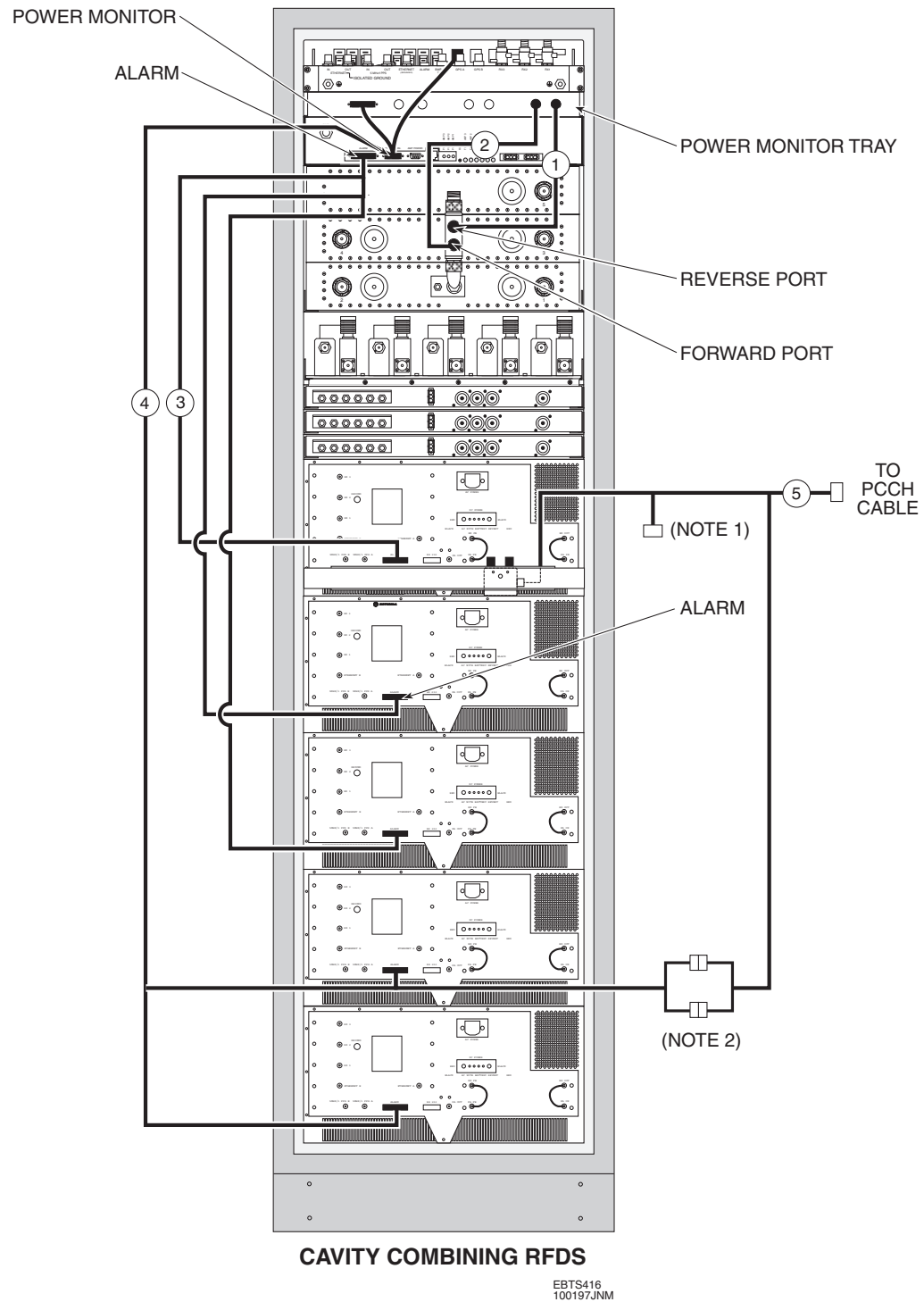


Figure 25 **Power Monitor/Alarm/PCCH Cabling Diagram (Systems Using Transfer Switch TLF1980A)**

**Cabling Information****Expansion Transmit Cabling**

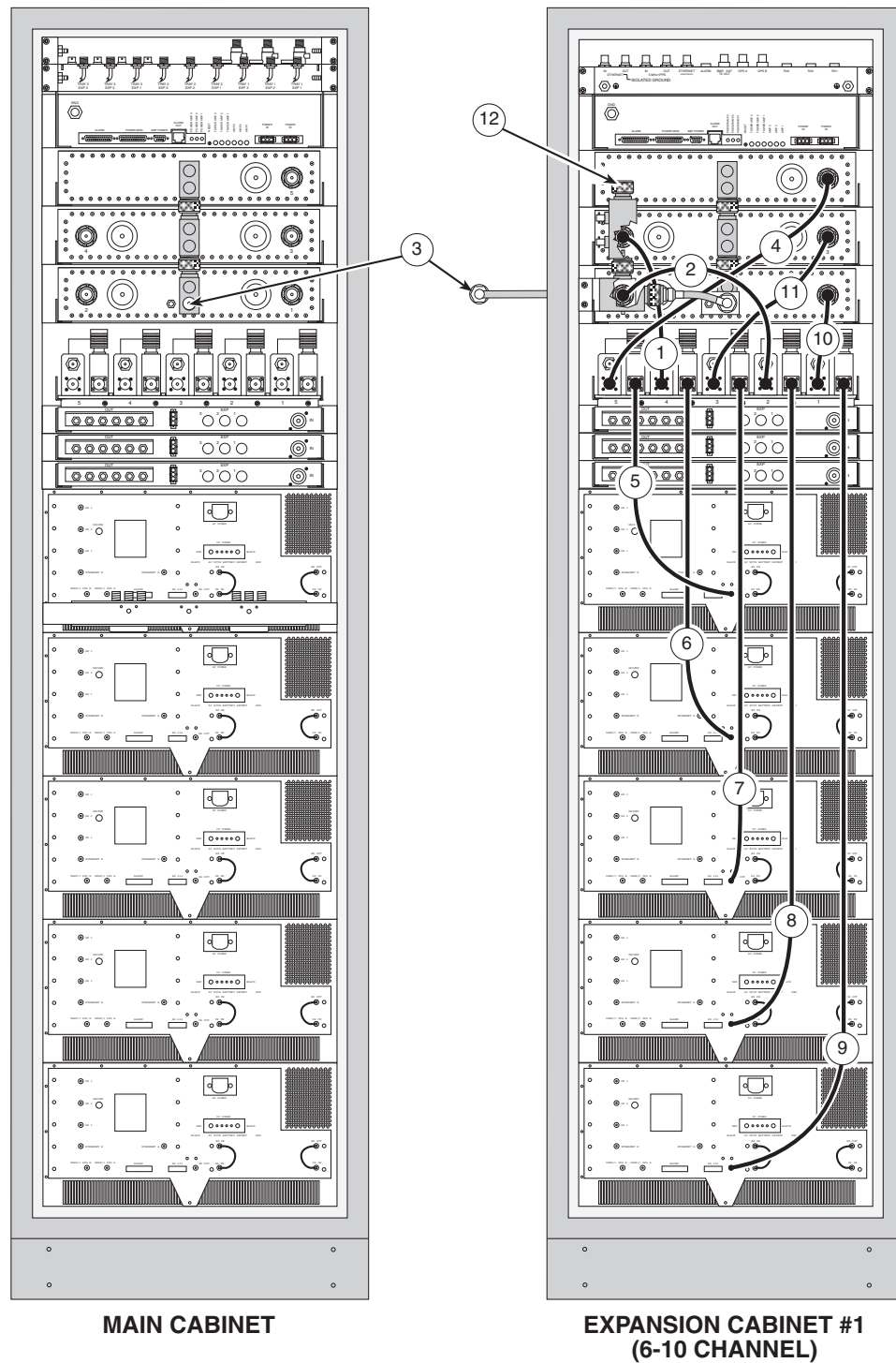
Expansion transmit cabling refers to the Tx cabling between the Main Cabinet and the Expansion Cabinet(s) and Tx cabling within the expansion cabinet(s).

Table 22 identifies and Figure 26 shows the Tx cabling for the 6-10 channel expansion. Table 23 identifies and Figure 27 shows the Tx cabling for the 11-20 channel expansion.

*Table 22      **Expansion Transmit Cabling (6-10 Channel)***

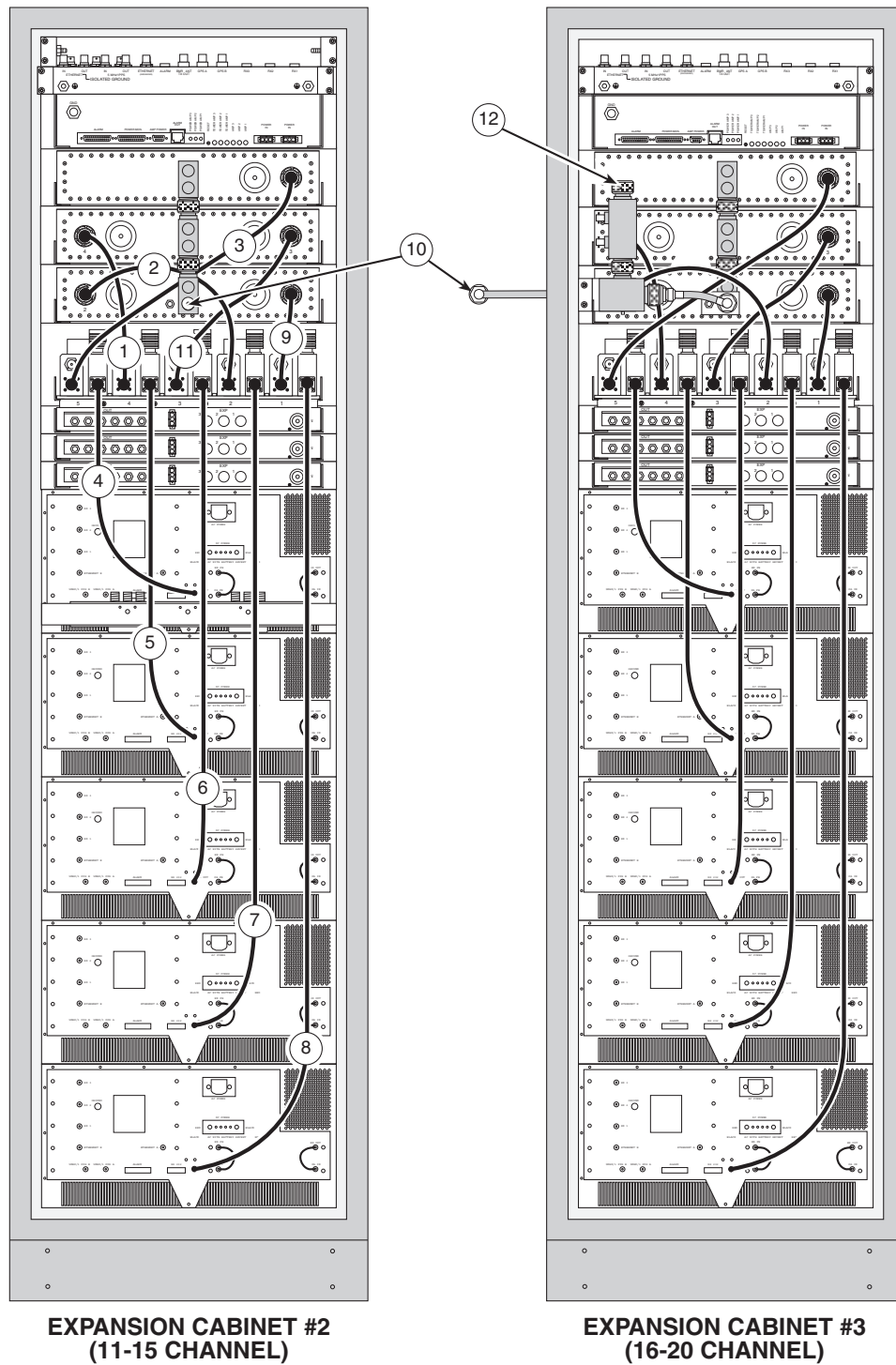
| <b>Index</b> | <b>Part Number</b> | <b>From</b>                    | <b>To</b>                           | <b>Notes</b>             |
|--------------|--------------------|--------------------------------|-------------------------------------|--------------------------|
| 1            | 0112004B04         | Output - Dual Isolator #4      | Tx Cavity #4                        |                          |
| 2            | 0112004B04         | Output - Dual Isolator #2      | Tx Cavity #2                        |                          |
| 3            | 0182004W04         | Output of Main RF Cabinet RFDS | Output of Expansion RF Cabinet RFDS | Phasing harness assembly |
| 4            | 0112004B04         | Output - Dual Isolator #5      | Tx Cavity #5                        |                          |
| 5            | 0112004K41         | PA Out Connector on BR #10     | Input - Dual Isolator #5            |                          |
| 6            | 0112004K99         | PA Out Connector on BR #9      | Input - Dual Isolator #4            |                          |
| 7            | 0112004K10         | PA Out Connector on BR #8      | Input - Dual Isolator #3            |                          |
| 8            | 0112004K10         | PA Out Connector on BR #7      | Input - Dual Isolator #2            |                          |
| 9            | 0112004K14         | PA Out Connector on BR #6      | Input - Dual Isolator #1            |                          |
| 10           | 0112004B04         | Output - Dual Isolator #1      | Tx Cavity #1                        |                          |
| 11           | 0112004B04         | Output - Dual Isolator #3      | Tx Cavity #3                        |                          |
| 12           |                    |                                | Phasing harness output (to Tx ANT)  | Part of phasing harness  |



EBTS220  
040197LLNFigure 26 **Expansion Transmit Cabling Diagram (6-10 Channel)**

**Cabling Information***Table 23      Expansion Transmit Cabling (11-20 Channel)*

| <b>Index</b> | <b>Part Number</b> | <b>From</b>                        | <b>To</b>                          | <b>Notes</b>             |
|--------------|--------------------|------------------------------------|------------------------------------|--------------------------|
| 1            | 0112004B04         | Output - Dual Isolator #4          | Tx Cavity #4                       |                          |
| 2            | 0112004B04         | Output - Dual Isolator #2          | Tx Cavity #2                       |                          |
| 3            | 0112004B04         | Output - Dual Isolator #5          | Tx Cavity #5                       |                          |
| 4            | 0112004K41         | PA Out Connector on BR #15 (or 20) | Input - Dual Isolator #5           |                          |
| 5            | 0112004K99         | PA Out Connector on BR #14 (or 19) | Input - Dual Isolator #4           |                          |
| 6            | 0112004K10         | PA Out Connector on BR #13 (or 18) | Input - Dual Isolator #3           |                          |
| 7            | 0112004K10         | PA Out Connector on BR #12 (or 17) | Input - Dual Isolator #2           |                          |
| 8            | 0112004K14         | PA Out Connector on BR #11 (or 16) | Input - Dual Isolator #1           |                          |
| 9            | 0112004B04         | Output - Dual Isolator #1          | Tx Cavity #1                       |                          |
| 10           | 0182004W04         | Output of Expansion RF Cabinet #2  | Output of Expansion RF Cabinet #3  | Phasing harness assembly |
| 11           | 0112004B04         | Output - Dual Isolator #3          | Tx Cavity #3                       |                          |
| 12           |                    |                                    | Phasing harness output (to Tx ANT) | Part of phasing harness  |



## NOTE:

1. Expansion cabinets have no RF relay switches. The PA OUT connections are routed directly to the input of the isolators.
2. Expansion Cabinet #3 is cabled identically as Expansion Cabinet #2.

EBTS362  
040197LLN

Figure 27 **Expansion Transmit Cabling Diagram (11-20 Channel)**

**Cavity Tuning Procedure**

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## Cavity Tuning Procedure

### Introduction

When manufactured, the cavities are not tuned to customer specific frequencies and must be tuned in the field. Perform the following tuning procedure:

- ❑ at the initial site installation
- ❑ after Base Radio / cavity FRU expansion

The cavity tuning procedure is an intrusive procedure that requires the system to be taken out of service until it is complete.

Each cavity may be tuned to a frequency in the range of 851 - 866 MHz. The cavities should be tuned from the lowest customer frequency to the highest customer frequency in consecutive order. The operating frequency of Base Radio 1 (located in the bottom position in the Cavity Main RF Cabinet) should be tuned to the lowest transmit frequency in the cabinet. Base Radio 2 should be the second lowest transmit frequency, Base Radio 3, the third lowest, etc.

If additional Base Radios are subsequently added, the frequency order should be verified and readjusted, if necessary, so that the progression of transmit frequencies is maintained from the bottom Base Radio position to the top Base Radio position within the RF Cabinet(s).

Perform the cavity tuning procedure for each Base Radio within the RF cabinet(s). Start with Base Radio 1 and repeat the procedure for each of the remaining Base Radios, working from the bottom of the cabinet to the top.

### Procedure

#### **WARNING**

ALL BASE RADIOS IN THE RF CABINETS MUST BE DEKEYED BEFORE PERFORMING THE FOLLOWING PROCEDURES TO PREVENT SERIOUS INJURY.

---

#### **NOTE**

The following procedure requires the use of the R2660 Frequency Analyzer. Refer to the equipment manual provided with the R2660 for further information on its use (Motorola p/n 68P80309F16).

---

1. Connect the service computer to the local service port of Base Radio 1 and log on.

The service port connector is located on the front of the Base Radio Controller module. The default password is **motorola**.

**NOTE**

Motorola recommends that you change the default password once proper operation of the equipment is verified.

2. At the prompt, type: **dekey**

This command stops all RF transmission.

```
BRC> dekey
completed successfully
```

3. Repeat step 2 for all Base Radios in all the RF Cabinet(s).
4. Verify that power is not being applied to the R2660 Analyzer and connect the Rubidium Frequency Standard 10 MHZ OUTPUT to a 10 dB attenuator.
5. Connect the other end of the 10 dB attenuator to the 10 MHZ REFERENCE OSCILLATOR IN/OUT connector on the R2660 Analyzer.
6. Set the R2660 to the EXT REF mode.
7. Apply power to the R2660.
8. Set the R2660 to operate in the SPECTRUM ANALYZER mode (0 dB attenuation, 50 kHz / div, in expand mode).
9. At the rear of the RFDS, connect the R2660 to the monitor port of the isolator load tray for the desired Base Radio.  
  
Adjust the center frequency to the desired transmit frequency of Base Radio.
10. Loosen the lock knob of the cavity to be tuned.

The lock knob should be completely loosened so that there is no space between it and the tuning knob. The lock knob is located behind the tuning knob of the cavity. Refer to Figure 28.

## Cavity Tuning Procedure

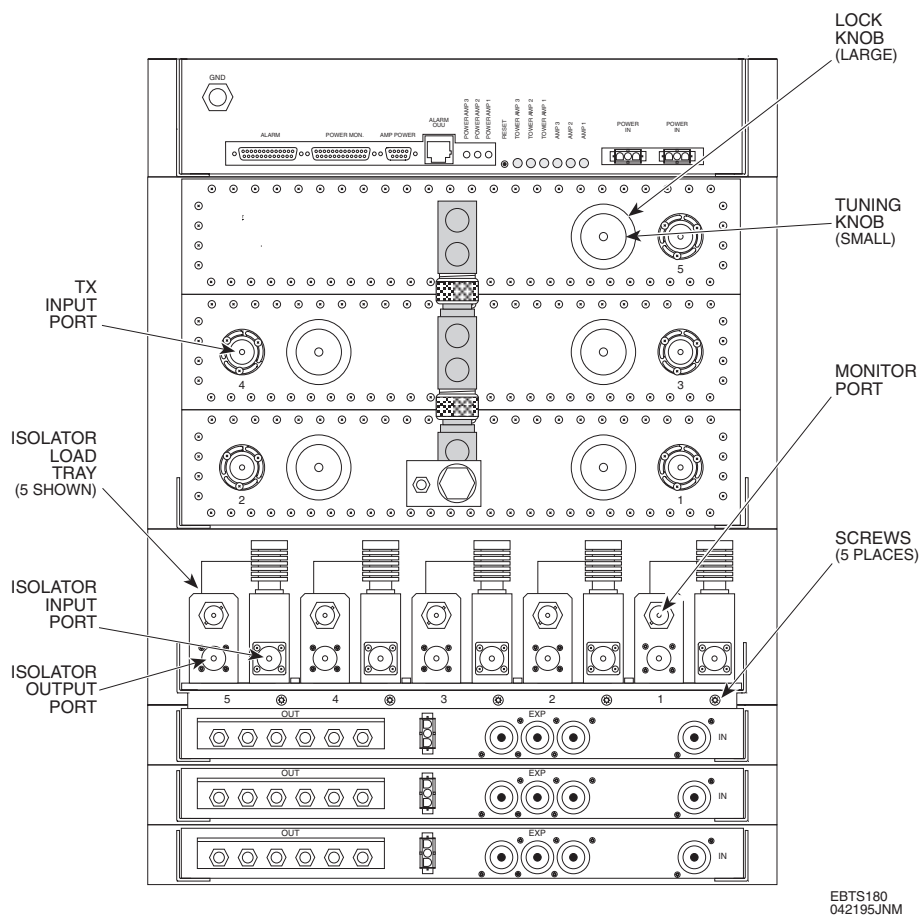


Figure 28 Cavity Combining RFDS (Rear View)

11. Type **set tx\_freq XXX.XXXXX** to set the transmit frequency.  
**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set tx_freq XXX.XXXXX
set TRANSMIT FREQUENCY to XXX.XXXXX MHz in RAM
```

12. Type **get tx\_freq XXX.XXXXX** to return the programmed transmit frequency.

**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> get tx_freq  
TRANSMIT FREQUENCY is 851.00000 MHz
```

## ▲ CAUTION

The following command causes the Base Radio to begin transmitting. Verify that the transmit frequency is a valid, licensed frequency or that the antenna port is properly terminated into a load.

13. At the prompt, type: **set tx\_power 40**

This command sets the transmitter output to 40 Watts.

```
BRC> set tx_power 40  
setting transmitter power to 40 watts  
  
TXLIN ATTENUATION: 5.000000  
  
TARGET POWER: 40.00 watts [46.02 dbm]  
ACTUAL POWER: 37.77 watts [45.07 dbm]  
POWER WINDOW: 38.20-> 41.89 watts [45.82 -> 46.22 dbm]  
TXLIN LEVEL REGISTER REDUCED 59 STEPS [-2.30 db].  
TXLIN LEVEL: 0x6f  
  
completed successfully
```

14. Monitor the reflected power on the spectrum analyzer and adjust the tuning knob for the minimum peak height.
15. Carefully tighten the lock knob while maintaining the minimum peak height on the spectrum analyzer.

**Cavity Tuning Procedure**

16. At the prompt, type: **dekey**

This command stops all RF transmission.

```
BRC> dekey  
completed successfully
```

17. Repeat steps 9 through 16 for all remaining Base Radios in the RF Cabinet from the bottom up, in a consecutive order.
18. Repeat for all remaining RF Cabinets at site.



---

## Cavity Combiner / Isolator Load FRU Expansion

The basic cavity combining RFDS is equipped with a two-channel cavity combiner. Each Base Radio requires an isolator assembly. When Base Radios are added to the RF Cabinet, be sure to add the required isolator assemblies and cavity combiners.

The following procedures detail the steps to add isolator load assemblies and additional cavities. These procedures should be performed when expanding from a two-channel to a four-channel cavity combiner or when expanding from a four-channel to a five-channel cavity combiner.

### WARNING

ALL BASE RADIOS IN THE RF CABINET MUST BE DEKEYED BEFORE PERFORMING THE FOLLOWING PROCEDURES TO PREVENT SERIOUS INJURY.

---

### Isolator FRU Expansion

When additional Base Radios are added to the cabinet, additional isolator load assemblies are required. Refer to Figure 28.

1. Remove the securing screw from the isolator load tray for the next isolator load assembly position.
2. Slide the new isolator load assembly into the isolator load tray such that the tab on the front of the assembly unit is inserted into the slot on the tray.
3. Secure the assembly into the tray with the screw that was removed in step 1.
4. Connect the PA Out cable from the newly installed Base Radio to the input of the isolator load assembly.
5. Connect the output of the isolator load assembly to the appropriate cavity.

### Two-Channel to Four-Channel Cavity Combining Expansion

1. Identify the new frequency assignments for both the existing and added Base Radios.

Adjust the assignments as necessary to ensure that the transmit frequency of Base Radio 1 is the lowest assigned frequency in the cabinet, followed by Base Radio 2, and so on.

**Cavity Combiner / Isolator Load FRU Expansion**

2. Connect the service computer to the local service port of Base Radio 1 and log on.

The service port connector is located on the front of the Base Radio Controller module. The default password is **motorola**.

**NOTE**

Motorola recommends that you change the default password once proper operation of the equipment is verified.

3. Type **set tx\_freq XXX.XXXXX** to set the transmit frequency.  
**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set tx_freq XXX.XXXXX
set TRANSMIT FREQUENCY to XXX.XXXXX MHz in RAM
```

4. Type: **set rx\_freq XXX.XXXXX** to set the receive frequency.  
**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set rx_freq XXX.XXXXX
set RECEIVE FREQUENCY to XXX.XXXXX MHz in RAM
```

5. Tune cavity 1 per the tuning procedure detailed in the Cavity Tuning Procedure section of this chapter.
6. Repeat step 2 through step 5 for Base Radio 2 / cavity 2.
7. Verify that all Base Radios in the RF Cabinet are dekeyed.
8. Remove all cabling to the cavity combiner.  
  
This includes the inputs from the Isolator Load Tray, the transmit antenna output, two outputs from the directional coupler, and the ground braid.
9. Remove the 7/16" DIN cavity termination stub from the cavity combiner.
10. Remove the four screws from the front panel for expansion unit mounting.
11. Install the two-channel FRU cavity combiner expansion unit.
12. Replace the four front panel screws to secure the expansion unit.

13. Install the 7/16" DIN cavity termination stub on the two-channel expansion unit, cavity channels 3 and 4.
14. Connect all cabling to the cavity combiner.  
This includes the inputs from the Isolator Load Tray, the transmit antenna output, two outputs from the directional coupler, and the ground braid.
15. Connect the service computer to the local service port of the Base Radio 3 and log on.
16. Type **set tx\_freq XXX.XXXXX** to set the transmit frequency.  
**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set tx_freq XXX.XXXXX
set TRANSMIT FREQUENCY to XXX.XXXXX MHz in RAM
```

17. Type: **set rx\_freq XXX.XXXXX** to set the receive frequency.  
**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set rx_freq XXX.XXXXX
set RECEIVE FREQUENCY to XXX.XXXXX MHz in RAM
```

18. Perform the Cavity Tuning Procedure for cavity 3.
19. Repeat steps 15 through 18 for Base Radio 4 / cavity 4, if necessary.  
If expanding only to three Base Radios, de-tune cavity 4 by rotating the tuning rod fully clockwise. Terminate the cavity with a 50Ω load.

## Four-Channel to Five-Channel Cavity Combining Expansion

1. Identify the new frequency assignments for both the existing and expanded Base Radios.  
Adjust the assignments as necessary to ensure that the transmit frequency of Base Radio 1 is the lowest assigned frequency in the cabinet, followed by Base Radio 2, and so on.
2. Connect the service computer to the local service port of the Base Radio 1 and log on.
3. The service port connector is located on the front of the Base Radio Controller module. The default password is **motorola**.

**Cavity Combiner / Isolator Load FRU Expansion****NOTE**

Motorola recommends changing the default password once proper operation of the equipment is verified.

4. Type **set tx\_freq XXX.XXXXX** to set the transmit frequency.  
**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set tx_freq XXX.XXXXX
set TRANSMIT FREQUENCY to XXX.XXXXX MHz in RAM
```

5. Type: **set rx\_freq XXX.XXXXX** to set the receive frequency.  
**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set rx_freq XXX.XXXXX
set RECEIVE FREQUENCY to XXX.XXXXX MHz in RAM
```

6. Tune cavity 1 per the tuning procedure detailed in the Cavity Tuning Procedure section of this chapter.
7. Repeat steps 2 through 6 for Base Radios 2-4 / cavities 2-4.
8. Verify that all Base Radios in the RF Cabinet are dekeyed.
9. Remove all cabling to the cavity combiner.  
This includes the inputs from the Isolator Load Tray, the transmit antenna output, two outputs from the directional coupler, and the ground braid.
10. Remove the 7/16" DIN cavity termination stub from the cavity combiner.
11. Remove the eight screws which secure the cavity combiner to the RF Cabinet and slide this assembly out to install the fifth-channel FRU expansion.
12. Remove the four screws from the front panel for expansion unit mounting.
13. Install the fifth-channel FRU expansion unit.  
This unit has a built-in termination stub. The 7/16" DIN cavity termination stub removed from the four-channel combiner is not needed.
14. Replace the four front panel screws to secure the expansion unit.

15. Slide the cavity combining assembly back into the RF Cabinet and replace the eight mounting screws.
16. Connect all cabling to the cavity combiner.  
This includes the inputs from the Isolator Load Tray, the transmit antenna output, two outputs from the directional coupler, and the ground braid.
17. Connect the service computer to the local service port of the Base Radio 5 and log on.
18. Type **set tx\_freq XXX.XXXXX** to set the transmit frequency.  
**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set tx_freq XXX.XXXXX
set TRANSMIT FREQUENCY to XXX.XXXXX MHz in RAM
```

19. Type: **set rx\_freq XXX.XXXXX** to set the receive frequency.  
**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set rx_freq XXX.XXXXX
set RECEIVE FREQUENCY to XXX.XXXXX MHz in RAM
```

20. Tune cavity 5 per the tuning procedure detailed in the Cavity Tuning Procedure section of this chapter.

## Receive Branch Equalization

The required gain of the receiver system is 8.5 dB  $\pm$ 0.5 dB. This gain is measured through the receiver antenna system including the low noise tower amplifier and the RFDS to the receiver input port of the Base Radio. The following procedure ensures that the proper system gain is maintained for all receiver branches. By performing this procedure, the value of the required in-line attenuator is calculated.

### NOTE

The equalization procedure requires the R2660 analyzers. The R2600 analyzers with the iDEN modulation can also be used for the test. The same procedure is used for both instruments.

**Cavity Combiner / Isolator Load FRU Expansion**

Some important issues arise with the use of the R2660 analyzers. The output power of the R2660 analyzers is specified with an output accuracy of  $\pm 2$  dB relative to the front panel reading; thus, it is very important to follow the procedure exactly so the equalization results are within the specified  $\pm 0.5$  dB tolerance. Only relative measurements will be made using the analyzer.

**Definitions**

This paragraph defines the data required to perform the equalization procedure and associated calculations.

**Receive branch calibration data**

The low noise tower amplifier is equipped with a test port and is supplied with calibration data. The following calibration data is required for each receive branch:

- ☐ Antenna Port to Output Port Gain (GAO)
- ☐ Test Port to Output Port Gain (GTO)

All three tower amplifiers are located in a single enclosure with one test port available.

**Analyzer cable**

The analyzer cable used with the R2660 analyzer (Figure 29) must be long enough to reach the RF cabinet junction panel. The loss of this cable is not required for the calculations. The analyzer cable is used in all of the test procedures and power is referenced to the end of the cable instead of to the output of the R2660 analyzer.

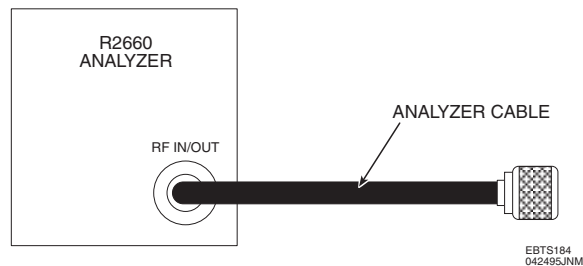


Figure 29 **R2660 Analyzer and Cable**

**Test cable**

Each site should be equipped with a Test Cable connected from an accessible area to the test port of the tower amplifiers as shown in Figure 30. This cable should be of known length and attenuation which should be supplied by the customer. If the attenuation of the cable is not available, the attenuation can be calculated given the cable length. This cable is referred to as the Test Cable, and its loss is referred to as TCL (dB). The TCL (dB) value should include the loss of the main

Test Port transmission line, tower top jumper cable, tower bottom jumper cable, and lightning surge arrestor. All cables and jumpers shown in Figure 30 are considered part of the test cable.

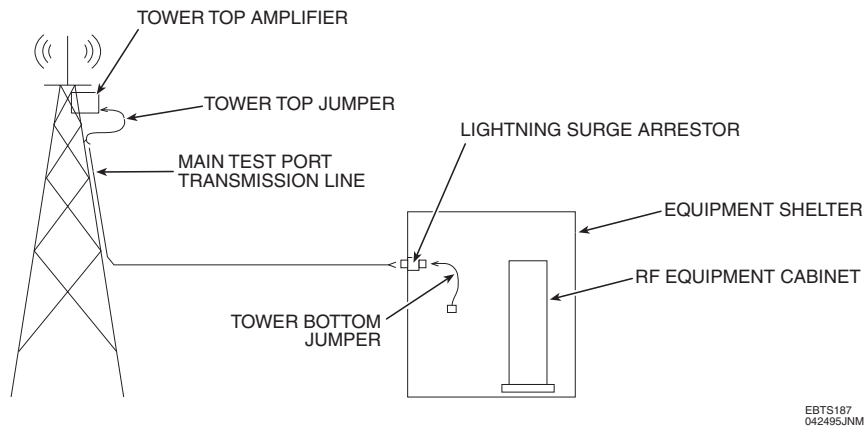


Figure 30 **EBTS Tower Top Amplifier Configuration**

### Receive antenna branch gain

GBA is the Receive Antenna Branch Gain listed on each of the multicoupler receive trays. The back of each of the trays should contain a sticker listing the Receive Gain. If the gain is not given, use 3.2 dB.

## Equipment Set-up

Set up the equipment using the following procedure. Base Radio 1 will be used during the equalization procedure.

1. Connect one end of the RS-232 cable to the service computer.
2. Connect the other end of the RS-232 cable to the Status port located on the front panel of the BRC of Base Radio 1 (the bottom Base Radio in the RF Cabinet). It is important to use the bottom Base Radio.
3. Be sure the Test Cable is connected to the tower top amplifier Test Port.
4. Connect the Analyzer Cable to the other end of the Test Cable as shown in Figure 31. All other connections remain connected. All cables and jumpers shown in Figure 31 except the analyzer cable are considered part of the test cable.

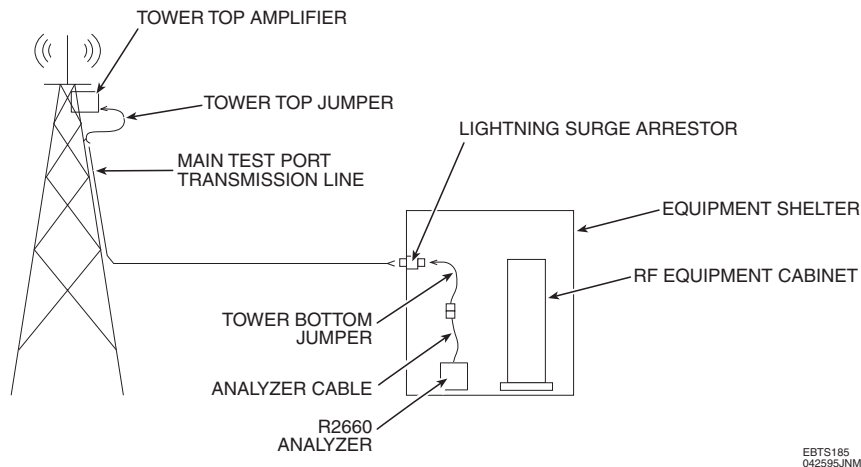
**Cavity Combiner / Isolator Load FRU Expansion**

Figure 31 **Analyzer Cable/Test Cable Connection**

5. Remove power from the R2660 and connect the Rubidium Frequency Standard 10 MHz Output to a 10 dB attenuator.
6. Connect the other end of the 10 dB attenuator to the 10 MHz Reference Oscillator In/Out connector in the R2660.
7. Set the R2660 to the EXT REF mode.
8. Apply power to the R2660 running the iDEN modulation.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

Refer to the equipment manual provided with the R2660 for further information regarding mode configuration of the unit (Motorola P/N 68P80309F16).

9. Set the R2660 to the frequency at which the tower top amplifier calibration data was taken (typically 815 MHz).
10. Set the R2660 to generate the test signal at an output level of -80 dBm.

## Equalization Procedure for Cavity Main RF Cabinet

Perform the following procedure to equalize the receive gain for each branch of the Main RF cabinet.

1. Set up the service computer to communicate to the station through the RS-232 port.
2. Log on. The default password is **motorola**.



3. Set the receive frequency of the Base Radio to the frequency which the tower top amplifier calibration data was taken. This should be the same frequency that the R2660 was set during step 9 of equipment set-up.

At the prompt type: **set rx\_freq XXX.XXXXX** to set the receive frequency.

**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set rx_freq XXX.XXXXX
set RECEIVE FREQUENCY to XXX.XXXXX MHz in RAM
```

4. At the prompt, type: **set rx\_mode 123**

This command enables all antennas / receivers in the Base Radio.

```
BRC> set rx_mode 123
set RECEIVER 1 to ENABLED in RAM
set RECEIVER 2 to ENABLED in RAM
set RECEIVER 3 to ENABLED in RAM
```

5. At the prompt type: **set sgc off**

This command disables the software gain control routine within the Base Radio.

```
BRC> set sgc off
set SOFTWARE GAIN CONTROL to DISABLED in RAM
```

6. At the prompt type: **set sys\_gain on**

This command enables the system gain for proper readout of the RSSI.

```
BRC> set sys_gain on
set SOFTWARE GAIN to ENABLED in RAM
```

**Cavity Combiner / Isolator Load FRU Expansion**

7. At the prompt type: **get rssi 1 100**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

```

BRC> get rssi 1 100
Starting RSSI monitor for 1 repetitions averaged each 100 reports.

```

| Line | RSSI1  | RSSI2  | RSSI3  | SGC  | CI | BER    | Offset  | SyncMiss               |
|------|--------|--------|--------|------|----|--------|---------|------------------------|
|      | dBm    | dBm    | dBm    | dB   |    | dBm    | dBm%    | Hz%                    |
| ---- | -----  | -----  | -----  | ---- |    | -----  | -----   | -----                  |
| 1    | -101.3 | -100.9 | -102.0 | 0.0  |    | -100.3 | -124.70 | 0.000e+00-5.10.000e+00 |

8. Adjust the output level from the R2660 and repeat step 6 until the RSSI for receiver 1 (RSSI1) is approximately -100 dBm.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

Once the level of the R2660 is set in step 8, the level should **NOT** be changed again for any other receiver or any other step in the calibration procedure. The reason for this is the output display of the R2660 has a 2 dB accuracy. Thus once this level is set in step 8, only relative measurements will be taken using the station RSSI reports as the measurement tool. The station's receiver provides a very stable measurement of receive signal. For proper calibration, the level of the R2660 should remain the same as in step 8 to maintain signal strength accuracy.

9. Log the received signal strengths for all of the receivers present (i.e. RSSI 1, RSSI 2, and RSSI 3).

These values will be referred to as #RSSI1, #RSSI2, and #RSSI3 respectively and are required in the following steps.

10. Disconnect the Analyzer Cable from the Test Cable.

**Cavity Combiner / Isolator Load FRU Expansion**

11. Disconnect RX1 cable from the bottom side of the Junction Panel from the antenna input.

Antenna connections are accessed from the top rear of the RF Distribution System as shown in Figure 32.

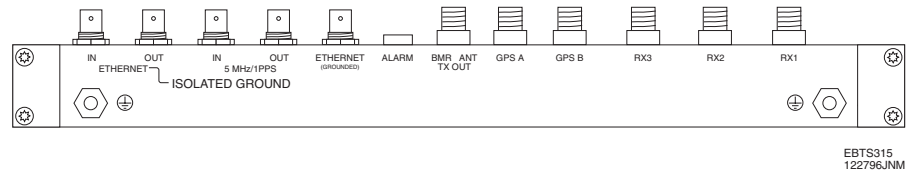


Figure 32 **Junction Panel Connections**

12. Connect the Analyzer Cable to the RX1 cable just disconnected in the previous step as shown in Figure 33. Also note the Receive Multicoupler Tray to which the RX1 cable is connected. Note the Receive Gain listed on the Multicoupler Tray and record the number as GBA1. If no number is given, use 3.2 dB for GBA1.

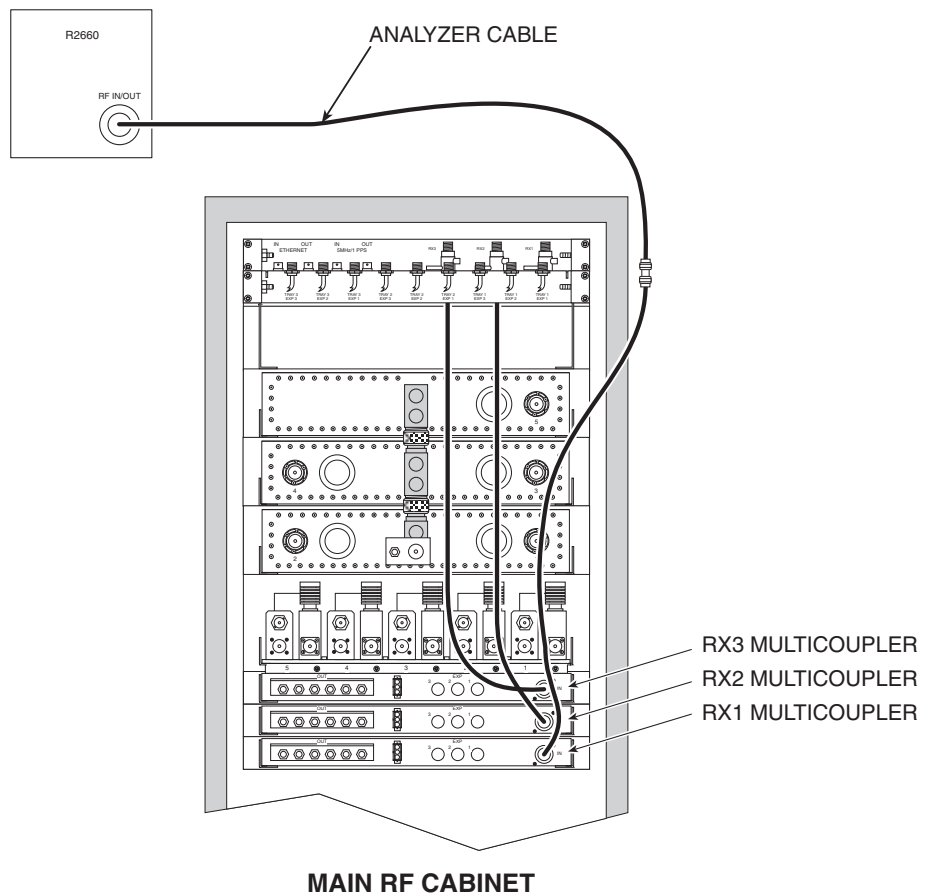


Figure 33 **Analyzer Cable to Main RF Cabinet Connections**

**Cavity Combiner / Isolator Load FRU Expansion****13. At the prompt type: `get rssi 1 100`**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

**BRC> `get rssi 1 100`**

Starting RSSI monitor for 1 repetitions averaged each 100 reports.

| Line | RSSI1<br>dBm | RSSI2<br>dBm | RSSI3<br>dBm | SGC<br>dB | CI<br>dBm | BER<br>dBm%     | OffsetSyncMiss<br>Hz% |
|------|--------------|--------------|--------------|-----------|-----------|-----------------|-----------------------|
| 1    | -81.4        | -180.0       | -180.0       | 0.0       | -80.3     | -124.70.000e+00 | -5.10.000e+00         |

**14. Log the received signal strengths for the present receiver.**

This value will be referred to as \$RSSI1.

**15. Disconnect the Analyzer Cable from the RX1 cable and reconnect the RX1 cable to the junction panel.****16. Repeat steps 11 through 15 for the RX2 cable and log gain on the multicoupler as GBA2 and the received signal strength as \$RSSI2.****17. Repeat steps 11 through 15 for the RX3 cable and log gain on the multicoupler as GBA3 and the received signal strength as \$RSSI3.****18. Calculate the value of the in-line attenuator required to equalize each receive branch. Use the following equation to determine this value.**

$$\text{Attenuator} = (\text{GAO1} - \text{GTO}) + (\# \text{RSSI1} - \$ \text{RSSI1}) + \text{TCL} + (\text{GBA1} - 0.5 - 0.85) - 8.5$$

The equation shown above describes the attenuation required to balance the path to obtain the required system path gain of 8.5 dB. As such, gain is represented as negative attenuation (negative numbers) and losses are represented as positive attenuation (positive numbers). In summary:

- GAO is the Antenna Port to Output Port gain in dB given on the Tower Top Amplifier (this is a positive number).
- GTO is the Test Port to Output Port gain in dB given on the Tower Top Amplifier (this is a negative number).
- #RSSI is the reading in dB given by the station in step 9 (this is a negative number).
- \$RSSI is the reading in dB given by the station in step 14 (this is a negative number).
- TCL is the Test Cable Loss in dB either given by the customer or calculated given the length of the cable (this number is a positive number in dB).
- GBA is the Receive Gain in dB recorded in step 12 (this is a negative number).

**Cavity Combiner / Isolator Load FRU Expansion**

- 0.5 dB is the loss of the cable from the junction panel to the Receiver Multicoupler Tray.
- 0.85 dB is the loss in the cable from the Receiver Multicoupler Tray to the receiver in Base Repeater 1.
- 8.5 dB is the expected gain for the entire path.

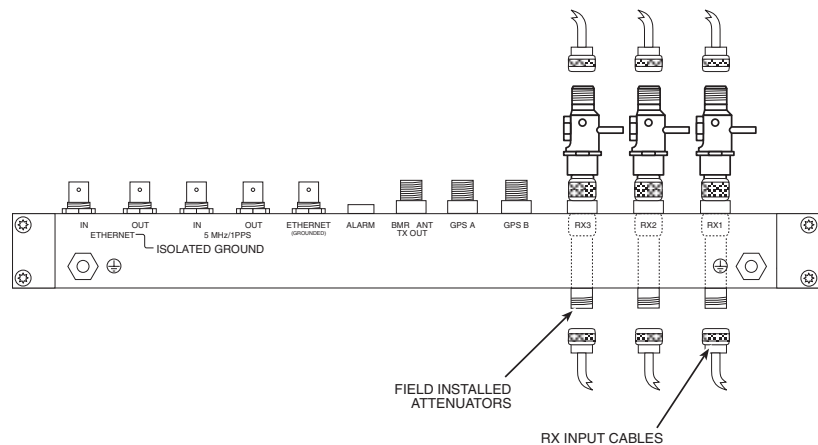
**Example**

| Variable | Value      |
|----------|------------|
| GAO1     | 16.8 dB    |
| GTO      | -9.7 dB    |
| #RSSI1   | -100 dBm   |
| \$RSSI1  | -85.45 dBm |
| TCL      | -2.7 dB    |
| GBA1     | 3.2 dB     |

$$\begin{aligned}
 \text{Attenuator} &= (16.8 - (-9.7)) + (-100 - (-85.45)) + (2.7) + (3.2 - 0.5 - 0.85) - 8.5 \\
 &= (26.5) + (-14.55) + (2.7) + (1.85) - 8.5 \\
 &= 8.0 \text{ dB}
 \end{aligned}$$

Therefore, choose an 8 dB attenuator for path 1.

- Repeat the calculation for the remaining receive branches replacing the appropriate values for paths 2 and 3.
- Connect an attenuator with the value determined in step 18 between the bottom of the appropriate DC injector and Rx input cable. This is to be done for each branch. Figure 34 shows the attenuator placement.



NOTE: Attenuators are determined from RX Equalization Procedure.

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061197ADW

**Figure 34 Cavity Main RF Cabinet Attenuator Placements**

**Cavity Combiner / Isolator Load FRU Expansion**

21. Reconnect the Analyzer Cable to the Test Cable.

22. At the prompt type: **get rssi 1 100**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

BRC> **get rssi 1 100**

Starting RSSI monitor for 1 repetitions averaged each 100 reports.

| Line | RSSI1<br>dBm | RSSI2<br>dBm | RSSI3<br>dBm | SGC<br>dB | CI<br>dBm | BER<br>dBm% | OffsetSyncMiss<br>Hz%  |
|------|--------------|--------------|--------------|-----------|-----------|-------------|------------------------|
| 1    | -102.0       | -102.0       | -102.0       | 0.0       | -101.3    | -127.70     | 0.000e+00-5.10.000e+00 |

23. The reported RSSI numbers for Receivers 1, 2, and 3 should all be within  $\pm 0.5$  dB of each other. If not, repeat the procedure.

**NOTE**

Once the cabinet is equalized for Base Radio 1, all the other Base Radios in the cabinet are also equalized. No other checks or tests need to be done for the other radios.

## Equalization Procedure for Cavity Expansion Cabinets

The previous procedure (steps 1 through 23) must be performed for the Cavity Main RF Cabinet prior to performing the equalization procedure for the Cavity Expansion RF Cabinets. This procedure is a continuation of the previous section once step 23 is completed on the Cavity Main RF Cabinet. On systems using multiple expansion cabinets, start this procedure on expansion cabinet #1.

1. Use the values for RSSI1, RSSI2, and RSSI3 taken in step 22 where all values are within  $\pm 0.5$  dB. Store these values as EQRSSI1, EQRSSI2, and EQRSSI3.
2. On the bottom Base Radio in the expansion cabinet, connect the RS-232 cable to the Status connector of the BRC.
3. Log on. The default password is **motorola**.

4. Set the receive frequency of the Base Radio to the frequency which the tower top amplifier calibration data was taken. This should be the same frequency that the R2660 was set during step 9 of equipment set-up.

At the prompt type: **set rx\_freq XXX.XXXXX** to set the receive frequency.

**XXX.XXXXX** represents the desired 800 MHz frequency.

```
BRC> set rx_freq XXX.XXXXX
set RECEIVE FREQUENCY to XXX.XXXXX MHz in RAM
```

5. At the prompt, type: **set rx\_mode 123**

This command enables all antennas / receivers in the Base Radio.

```
BRC> set rx_mode 123
set RECEIVER 1 to ENABLED in RAM
set RECEIVER 2 to ENABLED in RAM
set RECEIVER 3 to ENABLED in RAM
```

6. At the prompt type: **set sgc off**

This command disables the software gain control routine within the Base Radio.

```
BRC> set sgc off
set SOFTWARE GAIN CONTROL to DISABLED in RAM
```

7. At the prompt type: **set sys\_gain on**

This command enables the system gain for proper readout of the RSSI.

```
BRC> set sys_gain on
set SYSTEM GAIN to ENABLED in RAM
```

8. The R2660 analyzer should still be connected as in step 21 of the Equalization Procedure for the Cavity Main RF Cabinet, with the analyzer set at the level determined in step 8 of the same procedure.

**Cavity Combiner / Isolator Load FRU Expansion****9. At the prompt type: `get rssi 1 100`**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

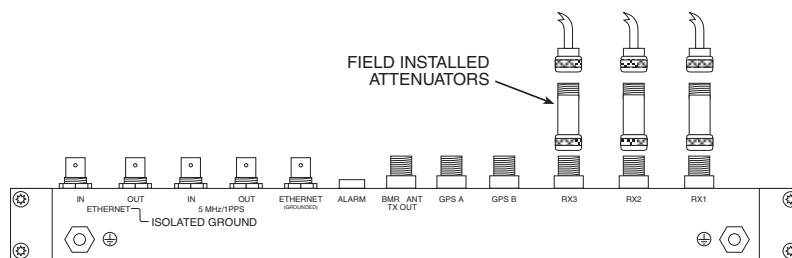
**BRC> `get rssi 1 100`**

Starting RSSI monitor for 1 repetitions averaged each 100 reports.

| Line | RSSI1<br>dBm | RSSI2<br>dBm | RSSI3<br>dBm | SGC<br>dB | CI<br>dBm | BER<br>dBm% | OffsetSyncMiss<br>Hz%  |
|------|--------------|--------------|--------------|-----------|-----------|-------------|------------------------|
| 1    | -98.3        | -98.9        | -99.0        | 0.0       | -100.3    | -124.70     | 0.000e+00-5.10.000e+00 |

10. Record the RSSI values taken above as EXP\_RSSI1, EXP\_RSSI2, and EXP\_RSSI3.
11. Calculate the attenuator values for the attenuation in the Cavity Expansion RF Cabinet using the following formula:  

$$\text{Atten1} = (\text{EXP\_RSSI1} - \text{EQRSSI1})$$
12. Repeat the calculation for paths 2 and 3.
13. Connect an attenuator with the value determined in step 11 within  $\pm 0.5$  dB to the appropriate antenna cable and connect this up to the Junction Panel in the Expansion RF Cabinet. This is to be done for each branch. Figure 35 shows the attenuator placement.



NOTE: Attenuators are determined from RX Equalization Procedure.

EBTS183  
021897JNM

Figure 35 **Expansion RF Cabinet Attenuator Placements**



**14. At the prompt type: `get rssi 1 100`**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

**BRC> `get rssi 1 100`**

Starting RSSI monitor for 1 repetitions averaged each 100 reports.

| Line | RSSI1<br>dBm | RSSI2<br>dBm | RSSI3<br>dBm | SGC<br>dB | CI<br>dBm | BER<br>dBm% | OffsetSyncMiss<br>Hz%  |
|------|--------------|--------------|--------------|-----------|-----------|-------------|------------------------|
| 1    | -102.4       | -102.0       | -102.0       | 0.0       | -101.3    | -124.70     | 0.000e+00-5.10.000e+00 |

- 15.** The reported RSSI numbers for Receivers 1, 2, and 3 should all be within  $\pm 0.5$  dB of each other. If not, repeat the procedure.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

Once the Expansion RF Cabinet is equalized for Base Radio 6, all the other Base Radios in the cabinet are also equalized. No other checks or tests need to be done for the other radios.

- 16.** Repeat steps 1 through 16 of this procedure for expansion cabinets #2 and #3, as applicable.

**Cavity RFDS Buildout**


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## Cavity RFDS Buildout

The buildout requirements for a cavity system are described in the following paragraphs for two and three branch diversity sites.

A cavity combining site can be built up to any combination up to 20 channels. (The 20-channel configuration uses the maximum of four RF cabinets each containing the buildout maximum of five Base Radios per RF cabinet.)

Each RF cabinet is pre-cabled for five BRs. Any additional Base Radios should be of the same rating (40 or 70 Watt transmit) as the Base Radios presently installed. When adding Base Radios to the RF Cabinet, the RFDS requires some modifications. The modifications may include adding:

- ☐ **cavity combiners** – consisting of cavities that requires tuning after installation.
- ☐ **isolator load assemblies** – consisting of an isolator and a load
- ☐ **RF expansion rack** – consisting of an RF rack with the appropriate number of BRs, ganging hardware, phasing harness, and intercabinet cabling.

IPL software is added with each Base Radio that is ordered. The system software must be modified for each additional BR.

Table 24 describes the necessary equipment and references to instructions contained in this manual when adding Base Radios to a Cavity RF Cabinet. The RFDS column is divided into seven sub-columns; BR2 through BR5, BR6 through BR10, BR11 through BR15, and BR16 through BR20. These numbers refer to the Base Radio positions in the cabinet. The Installation Instructions column shows the title of the equipment installation procedure and the respective page reference. Following are three examples of how to use the table.

**Example #1:** When two Base Radios are added, bringing the total number of Base Radios to four, verify the following equipment is installed:

- ☐ two cavity combiners (one for BR1 and BR2; one for BR3 and BR4)

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

|                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The cavity combiner for BR1 and BR2 is shipped with the RF Cabinet. When ordering a cavity for BR3, the cavity for BR4 is included with the shipment.</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|

- ☐ four isolator load assemblies (one each for BR1, BR2, BR3, and BR4)

**Example #2:** When Base Radios are added to bring the total number to seven, verify the following equipment is installed:

- ❑ Main RF Cabinet with 5 BRs and the following:
  - three cavity combiners (one for BR1 and BR2; one for BR3 and BR4; one for BR5)
  - five isolator load assemblies (one each for BR1 through BR5)
- ❑ Expansion RF Cabinet with 2 BRs and the following:
  - one cavity combiner (for BR6 and BR7)
  - two isolator loads (one each for BR6 and BR7)
  - Transmit phasing harness and receive interconnect cables to Main RF Cabinet

**Example #3** When Base Radios are added to bring the total number to 20, verify the following equipment is installed:

- ❑ Main RF Cabinet with 5 BRs and the following:
  - three cavity combiners (one for BR1 and BR2; one for BR3 and BR4; one for BR5)
  - five isolator load assemblies (one each for BR1 through BR5)
- ❑ Three Expansion RF Cabinets, each with 5 BRs and the following:
  - three cavity combiners
  - five isolator load assemblies (one each for 5 BRs per cabinet)
  - two phasing harness assemblies (one for Main RF Cabinet-to-Expansion Cabinet #1 link; one for Expansion Cabinet #2-to-Expansion Cabinet #3 link)
  - Receive interconnect cabling (as identified in Receiver Cabling)

Table 24 **Two or Three Branch Cavity Buildout**

| Equipment                                                                                                                                                                                                         | RFDS |     |     |     |            |            |            | Installation Instructions                                         |                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|-----|-----|------------|------------|------------|-------------------------------------------------------------------|-----------------------------------|
|                                                                                                                                                                                                                   | BR2  | BR3 | BR4 | BR5 | BR6 - BR10 | BR11- BR15 | BR16- BR20 | Description                                                       | Page or Section                   |
| Base Radio                                                                                                                                                                                                        |      |     |     |     |            |            |            | Base Radio/Base Radio FRU Replacement Procedures                  | Base Radio section of this manual |
| Cavity Combiner                                                                                                                                                                                                   |      |     |     |     |            |            |            | Cavity Combiner / Isolator Load FRU Expansion                     | 59                                |
| • TTF1560                                                                                                                                                                                                         |      | X   |     |     |            |            |            |                                                                   |                                   |
| • TTF1570                                                                                                                                                                                                         |      |     |     | X   |            |            |            | Cavity Tuning Procedure                                           | 54                                |
| Isolator (TLF2000)                                                                                                                                                                                                | X    | X   | X   | X   |            |            |            | Cavity Combiner / Isolator Load FRU Expansion                     | 59                                |
| RF Expansion Rack *                                                                                                                                                                                               |      |     |     |     | X          | X          | X          | Phasing Harness<br>Receiver Cabling<br>Expansion Transmit Cabling | 4<br>32<br>50                     |
| <b>NOTE:</b> * The RF Expansion Rack can be ordered directly from the factory with the appropriate number of BRs already installed. The RF Expansion Rack can be built out in a similar manner as for BR2 to BR5. |      |     |     |     |            |            |            |                                                                   |                                   |

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# 900 MHz QUAD Duplexed RF Distribution System

## Overview

This section provides technical information for the 900 MHz QUAD Duplexed RFDS.

The topics of this section are listed in the following table.

| Section                                                  | Page | Description                                                                                                                  |
|----------------------------------------------------------|------|------------------------------------------------------------------------------------------------------------------------------|
| Introduction                                             | 2    | Describes the 900 MHz QUAD Duplexed RFDS                                                                                     |
| Performance Specifications                               | 6    | Provides performance specifications for the 900 MHz QUAD Duplexed RFDS                                                       |
| Theory of Operation                                      | 11   | Describes the transmit and receive path of the 900 MHz QUAD Duplexed RFDS                                                    |
| Removal/Replacement Procedures                           | 16   | Provides instructions for replacing components of the 900 MHz QUAD Duplexed RFDS                                             |
| Cabling Information                                      | 27   | Provides information on how to connect all cabling required for proper operation of EBTS with the 900 MHz QUAD Duplexed RFDS |
| Base Radio Buildout/900 MHz QUAD Duplexed RFDS Expansion | 47   | Provides instructions on adding additional Base Radios to an existing EBTS                                                   |

## Introduction

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## Introduction

The 900 MHz QUAD Duplexed RFDS (P/N 0183984X01) is a 900 MHz duplexing/hybrid combining and receiver multicoupler system. Duplexers allow a transmit (Tx) and a receive (Rx) path to share a common antenna. Transmit combiner stages allow several transmit signals to be fed to a single antenna. Figure 1 shows the 900 MHz QUAD Duplexed RFDS.

The 900 MHz QUAD Duplexed RFDS contains several Field Replaceable Units (FRUs), including:

- ☐ Duplexer Tray with 3 Duplexers
- ☐ Preselector Tray with 3 Preselectors
- ☐ Either of the following trays:
  - Duplexer Tray with 3 Duplexers
  - Triple 2-Way Combiner
- ☐ Three Receive Multicoupler/Amplifier (4-Way) assemblies

The 900 MHz QUAD Duplexed RFDS employs a modularized, compact design. This modularization, along with a combining scheme based around the modularization, allows expansion with a minimum amount of added components. The combining, along with the compact design, allows up to six Base Radios (BRs) to be connected to the RFDS. The Main RF Cabinet allows space for up to five BRs. When a sixth BR is added to the system, it should be installed in an adjacent rack that has available space. The BR should be located such that none of the TX or RX cable lengths exceed six feet.

The 900 MHz QUAD Duplexed RFDS accommodates expansion without using Base Radio space for expansion assemblies. Expansion is carried out progressively, with expansion first consisting of the full utilization of existing Main RF Cabinet expansion capabilities, and then adding expansion using an expansion cabinet as needed.

To eliminate the bulk associated with extensive combining, the 900 MHz QUAD Duplexed RFDS uses a combiner deck. The deck provides the various combining and signal conditioning functions normally associated with discrete hybrid coupler and coupler/load assemblies.

The Triple 2-Way Combiner Deck (shown in Figure 2) provides a combining and signal conditioning interface between the Duplexers and several Base Radio transmit signals. Each RF Cabinet within a system uses a Triple 2-Way Combiner Deck as the primary interface between Base Radio Tx signals and the RFDS or antennas.

The deck utilizes a microstrip/groundplane design to facilitate transmission line properties that provide hybrid combining. Due to the compact, high-density design of the combiner decks, a coldplate and forced-air cooling is used instead of the simple radiational/convective cooling used in other RFDSs. The coldplate is a casting with integral heat sinks which conducts heat away from

the circuitry. Additionally, fans provide concentrated cooling air flow across the assembly. The fans are not thermostatically controlled and operate continuously while power is applied to the cabinet.

The Receive Multicouplers shown in Figure 1 are used for Rx signal distribution. Corresponding to the three Rx diversity branches, each Receive Multicoupler contains an amplifier/4-way multicoupler that accepts a single Rx signal and provides four outputs. These outputs provide the Rx signal to the Main RF Cabinet in systems using six or less Base Radios.

In systems using more than six Base Radios (expansion systems), an Rx Tray (Figure 3) is used in conjunction with the Receive Multicouplers discussed above. In expansion systems, the Receive Multicouplers instead provide Rx signals to an Rx Tray which then, in turn, provides the Rx signals for the Base Radios. As such, the Receive Multicoupler outputs provide the Rx signal to the Main RF Cabinet Rx Tray, and also to the expansion cabinet Rx Tray.

Corresponding to the three Rx diversity branches, the Rx Tray contains three local Expansion Multicouplers. Each Expansion Multicoupler contains an amplifier/4-way multicoupler that accepts a single Rx signal from a Receive Multicoupler and then provides four local outputs which are applied to the six Base Radios in which the expansion MC resides.

The Rx Tray also contains a dual-redundant power supply, an I/O board, and a power/signal backplane ("midplane" board). The power supplies provide operating power for the Rx Tray receive multicouplers, as well as the combiner deck fans. The I/O board provides a power and alarm interconnect between various RFDS assemblies.

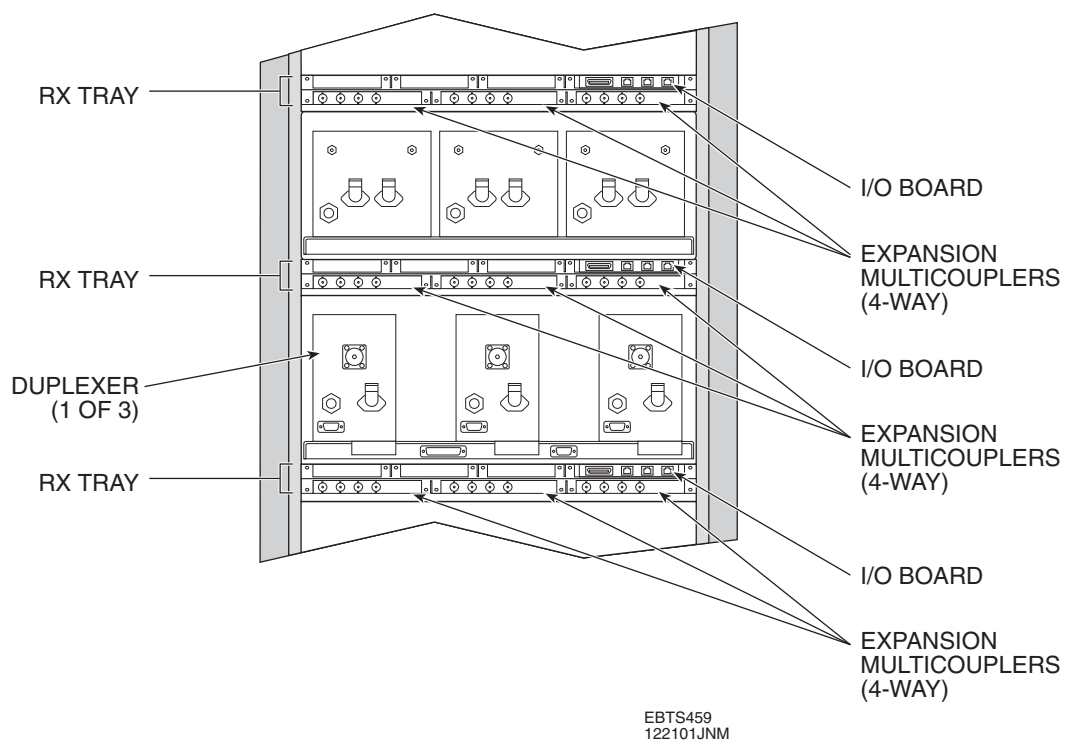
**Introduction**

Figure 1 **900 MHz QUAD Duplexed RF Distribution System**



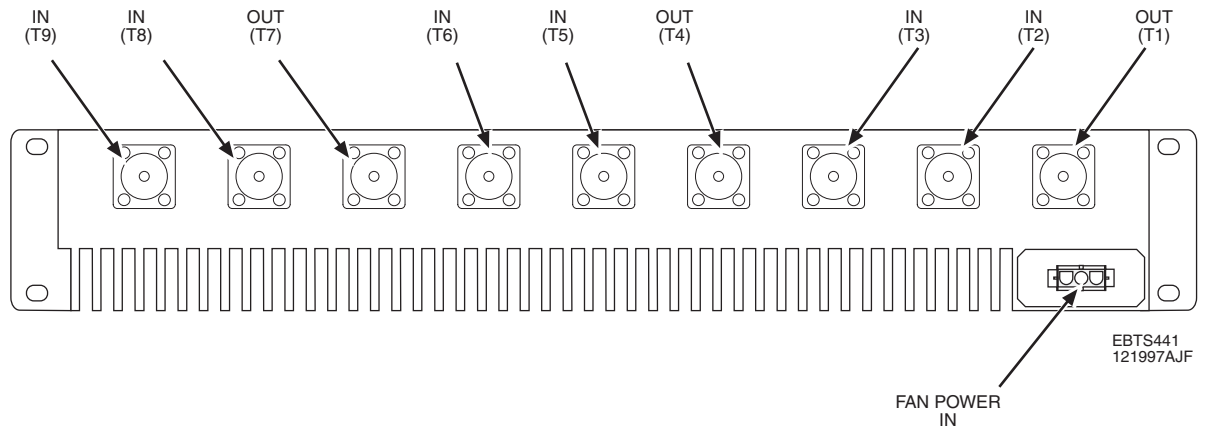


Figure 2 **Triple 2-Way Combiner Deck without Isolator**

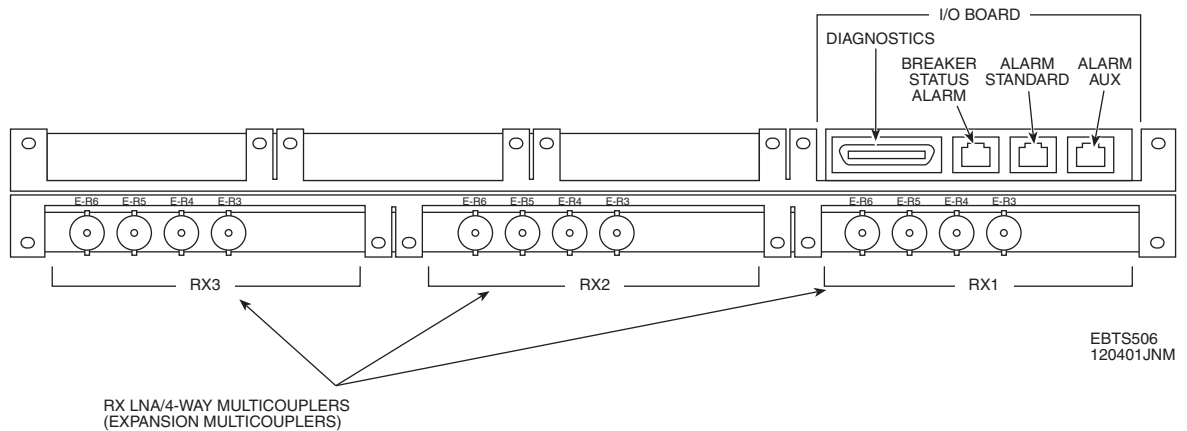


Figure 3 **Rx Tray**

**Performance Specifications**

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**Performance Specifications****Breakers**

The Receive Multicoupler power supplies themselves are protected through the RFS1 and RFS2 breakers for Multicoupler Tray 1, RFS3 and RFS4 breakers for Multicoupler Tray 2, and RFS5 and RFS6 breakers for Multicoupler Tray 3, which are part of the breaker panel assembly near the top of the RF Cabinet.

**900 MHz QUAD Duplexed RFDS General Specifications**

Table 1 lists the general specifications for the 900 MHz QUAD Duplexed RFDS. Table 2 lists the transmit level specifications for the 900 MHz QUAD Duplexed RFDS. Table 3 lists the receive level specifications for the 900 MHz QUAD Duplexed RFDS.

*Table 1 900 MHz QUAD Duplexed RFDS General Specifications*

| Specification               | Value or Range                               |
|-----------------------------|----------------------------------------------|
| Dimensions:                 |                                              |
| Height                      | 6 EIA Rack Units (RU)                        |
| Width                       | 19" (482.6 mm)                               |
| Depth                       | 18.5" (470 mm)                               |
| Storage Temperature Range   | -40° to +203° F (-40 to +95° C)              |
| Operating Temperature Range | +32° to +104° F (0 to +40° C)                |
| Cooling (Combiner Decks)    | Coldplate with continuous forced-air cooling |
| Frequency Range:            |                                              |
| Receive                     | 896 to 901 MHz                               |
| Transmit                    | 935 to 940 MHz                               |
| Tx - Rx Spacing             | 39 MHz                                       |
| Channel Spacing             | 25 kHz (min.)                                |
| Port Impedance              | 50 $\Omega$ (nom.)                           |
| Input Supply Voltage; RFDS  | -48 VDC (-41 VDC to -60 VDC)                 |

## Performance Specifications

Table 2 **900 Quad RFDS Transmit Level Specifications**

| Function                                                                                          | Tolerance (typical) |                          |                             |
|---------------------------------------------------------------------------------------------------|---------------------|--------------------------|-----------------------------|
|                                                                                                   | PA Out of BR        | RF Power at Antenna Port |                             |
|                                                                                                   |                     | Duplexed (1)             | Two Way Hybrid Combined (1) |
| One Channel Maximum Forward Power                                                                 | 52 watts            | $\geq 34.5$ watts        | $\geq 12.5$ watts           |
| Two Channel Total Maximum Forward Power                                                           | 52 watts            | $\geq 34.5$ watts        | $\geq 12.5$ watts           |
| Three Channel Total Maximum Forward Power                                                         | 48 watts            | $\geq 31.5$ watts        | $\geq 11.5$ watts           |
| Four Channel Total Maximum Forward Power                                                          | 42 watts            | $\geq 27.5$ watts        | $\geq 10.25$ watts          |
| All Channel Configurations Total Maximum Reflected Power (when antenna port is 50 ohm terminated) | $\leq 2$ watts      | $\leq 2$ watts           | $\leq 2$ watts              |
| <b>External Wattmeter</b>                                                                         |                     |                          |                             |
| One Channel Wattmeter Forward Power                                                               | na                  | $\geq 31$ watts          | $\geq 11.5$ watts           |
| Two Channel Wattmeter Total Forward Power                                                         | na                  | $\geq 31$ watts          | $\geq 11.5$ watts           |
| Three Channel Total Wattmeter Forward Power                                                       | na                  | $\geq 28$ watts          | $\geq 10.5$ watts           |
| Four Channel Total Wattmeter Forward Power                                                        | na                  | $\geq 24.5$ watts        | $\geq 9$ watts              |
| All Channel Total Wattmeter Reflected Power (when antenna port is 50 ohm terminated)              | na                  | $\leq 2$ watts           | $\leq 2$ watts              |
| VSWR(2)                                                                                           | $< 1.6:1$           | $< 1.8:1$                | $< 2.8:1$                   |
| All Channel Configurations Minimum Forward Power                                                  | 5 watts             | $< 3.3$ watts            | $< 1.25$ watts              |
| (1) Measured at the antenna port of the 900 MHz RFDS                                              |                     |                          |                             |
| (2) VSWR with forward and reflected power limits indicated above                                  |                     |                          |                             |

Table 3 **900 Quad RFDS Receiver Level Specifications**

| Function                              | Tolerance         |
|---------------------------------------|-------------------|
| Sensitivity (8%) BER                  | $\leq -113.5$ dBm |
| Nominal BER (-80dBm applied level)    | $\leq 0.01\%$ BER |
| BER at Maximum Signal Level (-31 dBm) | $\leq 0.1\%$      |

Performance Specifications

Antenna to Receiver Specifications

Table 4 lists the 900 MHz QUAD Duplexed RFDS antenna port-to-receiver port specifications for a single receive branch. Figures 4 through 5 show the typical 900 MHz transmit and receive filter response plots, respectively.

Table 4 Duplexer Antenna Port-to-Receiver Port Specifications

| Specification                                              | Value or Range |
|------------------------------------------------------------|----------------|
| Gain (896 to 901 MHz):                                     |                |
| T <sub>A</sub> = 77° F (25° C) ambient temperature         | 9.0 ±0.75 dB   |
| -22° <T <sub>A</sub> <140° F (-30° <T <sub>A</sub> <60° C) | 9.0 ±1.10 dB   |

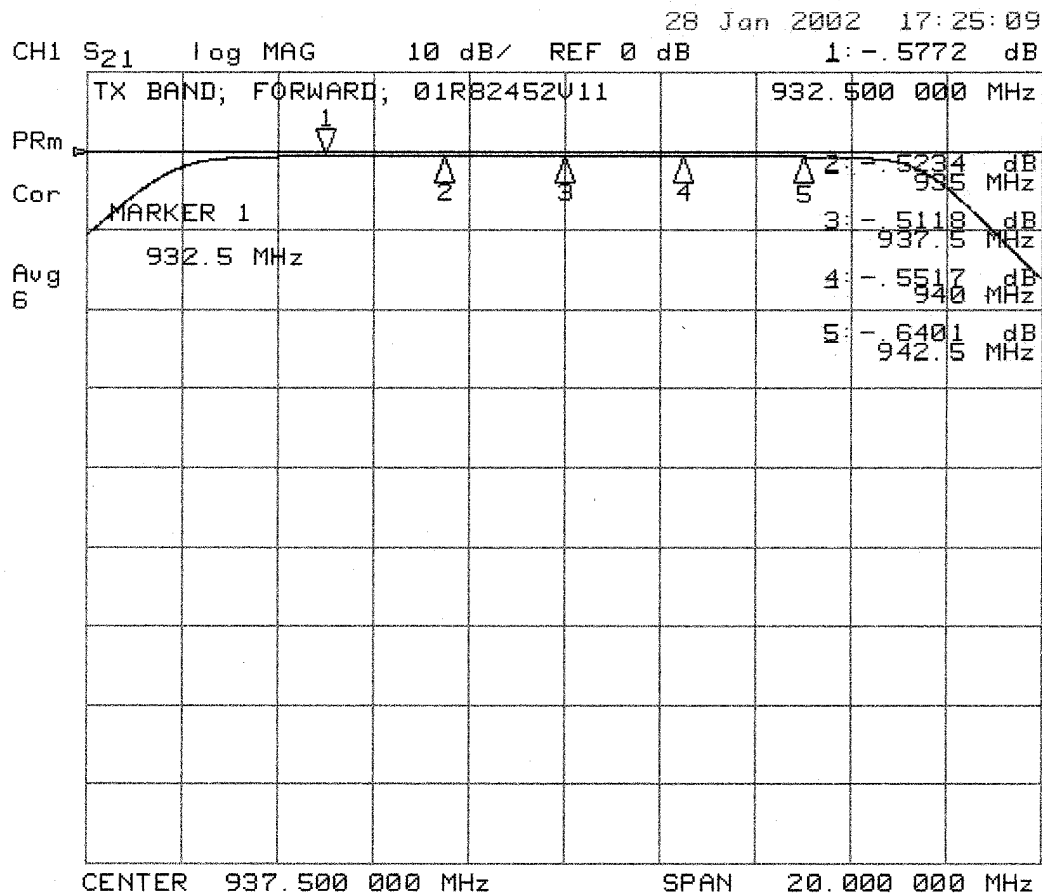


Figure 4 Typical 900 MHz TX Duplexer filter response plot

## Performance Specifications

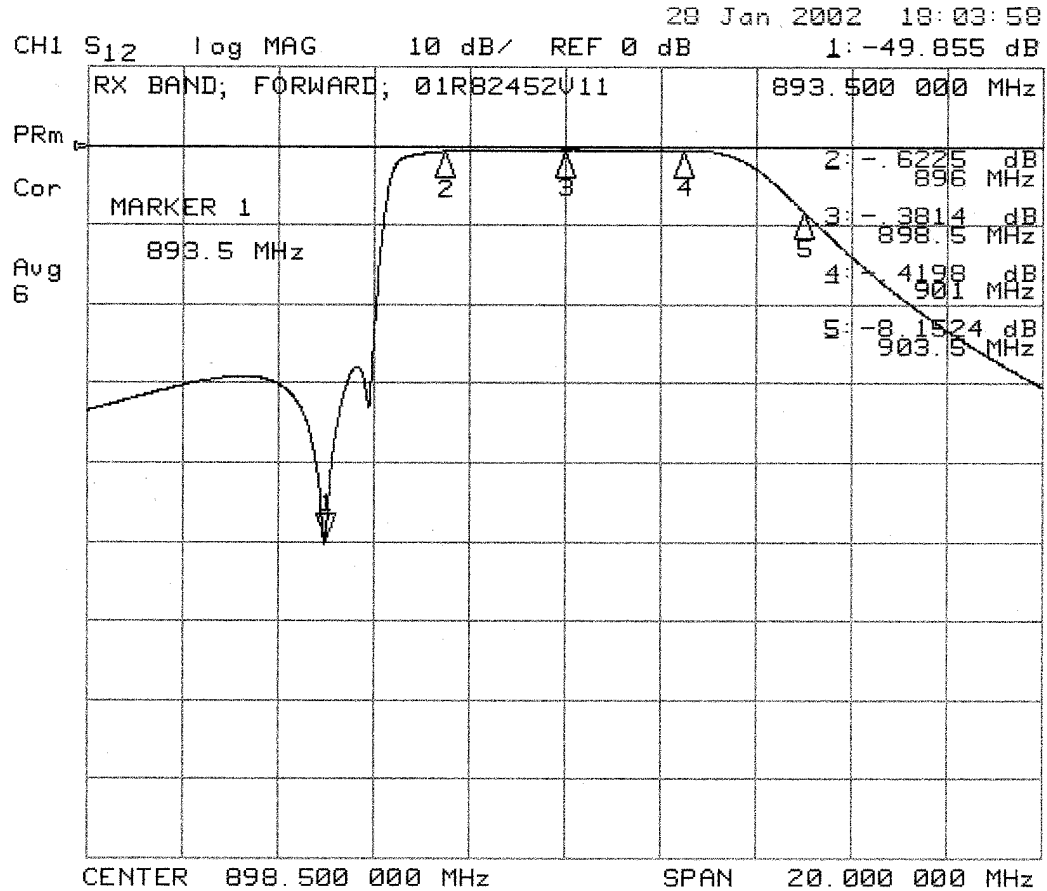


Figure 5 Typical 900 MHz RX Duplexer filter response plot

## Transmitter to Antenna Specifications

Table 5 lists the 900 MHz QUAD Duplexed RFDS transmitter port-to-antenna port specifications. Table 6 lists the Diplexer 800 MHz port-to-antenna port specifications. Table 7 lists the Diplexer 900 MHz port-to-antenna port specifications.

Table 5 Duplexer Transmitter Port-to-Antenna Port Specifications

| Specification                              | Value or Range (dB) |              |
|--------------------------------------------|---------------------|--------------|
|                                            | No Expansion *      | Expansion ** |
| Insertion Loss, 935 to 940 MHz             | 2.0                 | 5.7          |
| * Excluding hybrid type combiner           |                     |              |
| ** Expansion includes hybrid combiner loss |                     |              |

**Performance Specifications****Table 6 Diplexer 800 MHz Port-to-Antenna Port**

| Specification                  | Value or Range |
|--------------------------------|----------------|
| Insertion loss, 806 to 870 MHz | 0.25 dB        |
| Port Impedance                 | 50 $\Omega$    |
| Power Input                    |                |
| RMS                            | 100 watts      |
| Peak envelope                  | 1500 watts     |
| Peak instantaneous             | 3000 watts     |

**Table 7 Diplexer 900 MHz Port-to-Antenna Port**

| Specification                  | Value or Range |
|--------------------------------|----------------|
| Insertion loss, 896 to 940 MHz | 0.25 dB        |
| Port Impedance                 | 50 $\Omega$    |
| Power Input                    |                |
| RMS                            | 50 watts       |
| Peak envelope                  | 750 watts      |
| Peak instantaneous             | 1500 watts     |

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## Theory of Operation

Figure 6 shows a block diagram for the baseline 900 MHz QUAD Duplexed RFDS configuration.

### 900 MHz QUAD Duplexed RFDS Basic Configuration

(See Figure 6.) The baseline configuration supports a six Base Radio (BR), triple-receive diversity system.

#### Duplexer Operation

Three Duplexers accommodate three Transmit/Receive (Tx/Rx) antennas, ANT 1 through ANT 3. Each Duplexer is tuned to accept a transmit input (TX IN 1 through TX IN 3) in the 935-940 MHz range.

The respective Rx outputs furnished by the three Duplexers (RX OUT 1 through RX OUT 3) provide triple-diversity Rx signals for individual Base Radio receivers operating in the 896 - 901 MHz range. The RX OUT1 through RX OUT3 signals are applied to the Base Radio receivers through multicouplers, which are discussed later.

#### Transmit Operation

(See Figure 6.) A Triple 2-Way Combiner Deck with Isolators provides combining and isolation of multiple TX signals from the Base Radios. The deck consists of three microstrip/groundplane printed circuits which provide filtering and combining functions. The circuit cards also contain discrete isolator devices.

Base Radio 1 and 4 transmit signals TX1 and TX4 are applied to the first of three sections of the Triple 2-Way Combiner Deck. Each section of the deck combines two Tx inputs onto one line. Tx signals TX1 and TX4 are each combined by a hybrid coupler. The output of the hybrid coupler is then fed to the ANT 1 Duplexer TX input.

Base Radio 2 and 5 transmit signals TX2 and TX5 are similarly applied to the second section of the Triple 2-Way Combiner Deck. The combined TX2/TX5 signal is then fed to the ANT 2 Duplexer TX input. Base Radio 3 and 6 transmit signals TX3 and TX6 are similarly applied to the third section of the Triple 2-Way Combiner Deck. The combined TX3/TX6 signal is then fed to the ANT 3 Duplexer TX input.

Duplexers 1 through 3 power monitor signals VPWR1 through VPWR3 must be interfaced with Base Radios 1 through 3, respectively. Therefore, a Tx signal allocation is used for the six Base Radios that maintains the arrangement of duplexers 1 through 3 power monitor signals VPWR1 through VPWR3 interfacing with Base Radios 1 through 3, respectively. As such, a Base Radio 1-4 / 2-5 / 3-6 Tx signal allocation across the three duplexers is utilized (rather than a simple 1-2 / 3-4 / 5-6 distribution). (Power Monitors are discussed in detail later.)

**Theory of Operation****Receive Operation**

Each receive branch of the 900 MHz QUAD Duplexed RFDS uses a Receive Multicoupler assembly consisting of a Low Noise Amplifier and a 4-way multicoupler. The Receive Multicouplers convert a single receive signal into multiple buffered receive signals. All three Rx branches function identically; therefore, only the RX1 is discussed here.

The Receive Multicoupler uses a low-noise amplifier and a four-way splitter to provide RX1 signals to the Main RF Cabinet Base Radios. The splitter takes the RX1 signal from the amp and provides four outputs (ER3 through ER6), which respectively feed the RX1 receivers in Base Radios 1 through 3.

**Power Monitoring**

A dual-directional coupler is integrated into each Duplexer antenna port. The couplers are in-line and provide forward and reflected RF signal samples. These signal samples are fed to power monitors that, in turn, read the forward and reflected power readings from the antenna.

The power monitors measure the power readings by converting forward-power signal sample FWD and reflected-power signal sample REF into DC voltages. These DC voltages (VPWR1 through VPWR3) are proportional to the forward and reflected power apparent while Base Radio 1, 2, or 3 is transmitting. VPWR1 through VPWR3 are then sent to the Base Radios 1 through 3, respectively, where they are used to determine the forward and reflected power readings for Base Radios 1 through 3. In turn, the VPWR1 through VPWR3 signals are also used to calculate the VSWR at a particular antenna port.

**900 MHz QUAD Duplexed RFDS Alarm Circuit**

Two opto-isolator buffered alarm signals send alarm closure signals to the Environmental Alarm System (EAS) or the iDEN Monitor Unit (iMU) in the Control Cabinet: One diagnostic alarm output is provided for all of the power supplies; the other alarm is provided for all of the Multicoupler amps. The alarms operate as normally closed loops. As such, when any combination of the power supplies experiences a failure, an alarm is generated. Similarly, the MC/Amp alarm loop is wired such that when any combination of amplifiers experiences a failure, an alarm is generated. Upon detection of an alarm condition (including cabling failure or disconnection), the respective alarm will send an alarm signal. The alarm signals are routed from the RJ45 connector on the Rx Expansion Tray I/O board to the EAS/iMU.



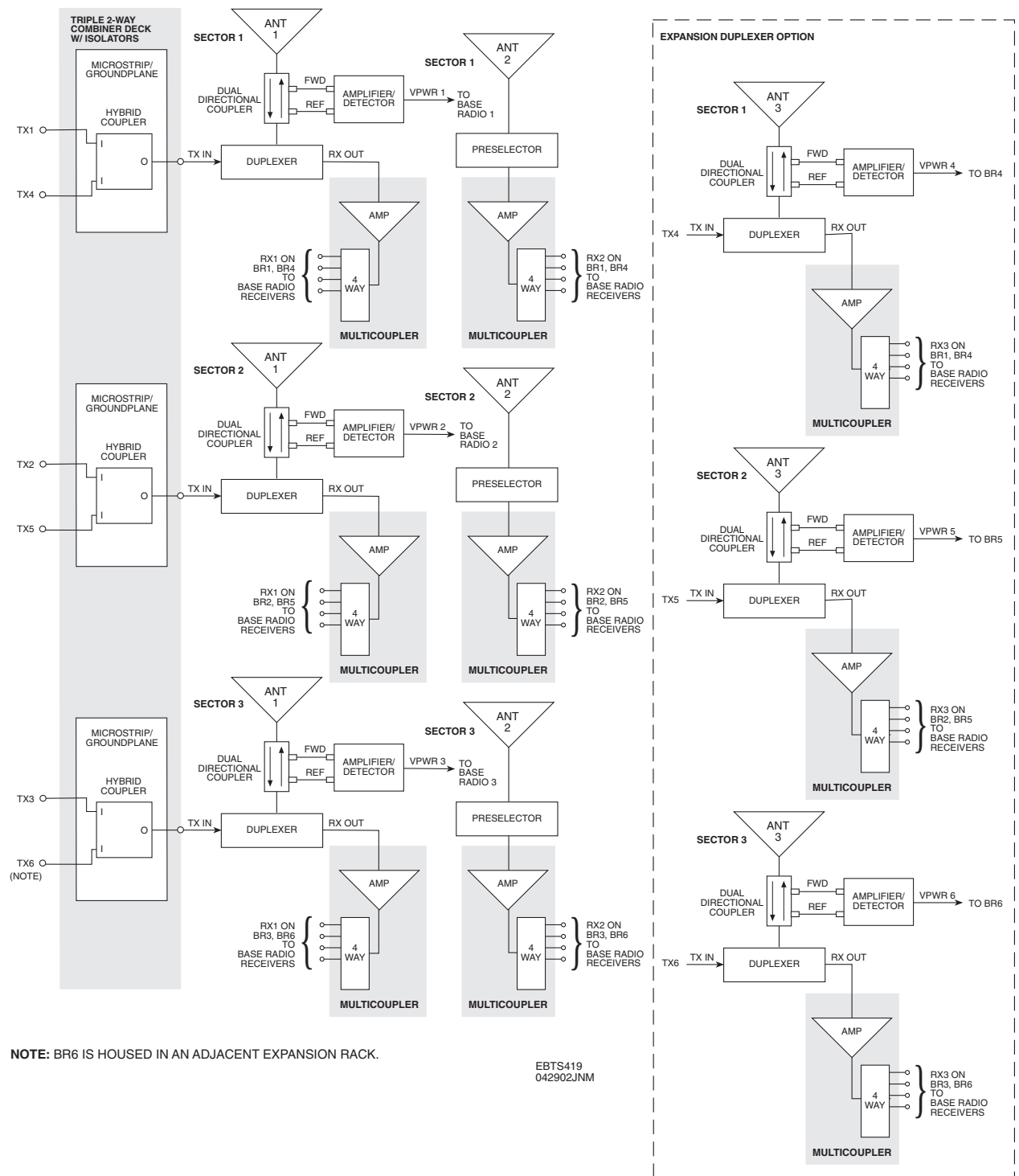


Figure 6 900 MHz QUAD Duplexed RFDS Block Diagram (6-BR Baseline System)

## Theory of Operation

### Power Supplies

The 900 MHz QUAD Duplexed RFDS uses two separate power supply systems for different functions within the RFDS and associated assemblies. The power supply systems are as follows:

- Rx Tray Power Supplies

#### Rx Tray Power Supplies

The Rx Tray uses two Power Supply boards (located in the Rx Tray) in a dual-redundant arrangement. The power supplies convert the -48 VDC (hot) site power to the +12 VDC required to power the Rx Tray 4-Way Rx Multicoupler Boards, and the fans in the Combiner Deck(s).

Each Power Supply board is equipped with a green LED indicator which indicates when the board is receiving power and properly functioning. The RFS1 and RFS2 circuit breakers on the cabinet breaker panel control the application of +48 VDC power to the A and B Power Supply boards.

### Pinouts and Wiring

The 900 MHz QUAD Duplexed RFDS contains a 25-pin ALARM/MON connector that interconnects the RFDS with other components within the RF Cabinet. Table 8 lists the pinouts for this 25-pin connector.

Table 8 **25-Pin ALARM/MON Connector Pinouts**

| Pin | Description                                                |
|-----|------------------------------------------------------------|
| 1   | PS Alarm Closure Pin #1                                    |
| 2   | GND                                                        |
| 3   | Amp Alarm Closure Pin #1                                   |
| 4   | GND                                                        |
| 5   | Antenna 1 FWD Power Monitor                                |
| 6   | Antenna 1 REF Power Monitor                                |
| 7   | GND                                                        |
| 8   | Antenna 2 FWD Power Monitor                                |
| 9   | Antenna 2 REF Power Monitor                                |
| 10  | GND                                                        |
| 11  | Antenna 3 FWD Power Monitor                                |
| 12  | Antenna 3 REF Power Monitor                                |
| 13  | Not Connected                                              |
| 14  | PS Alarm Closure Pin #2                                    |
| 15  | GND                                                        |
| 16  | Amp Alarm Closure Pin #2                                   |
| 17  | Not Connected                                              |
| 18  | GND (Power Monitor Return)                                 |
| 19  | GND (Power Monitor Return)                                 |
| 20  | GND (Power Monitor Return)                                 |
| 21  | TTA Alarm Closure Pin #1                                   |
| 22  | TTA Alarm Closure Pin #2                                   |
| 23  | 28 V Input                                                 |
| 24  | GND (28V Return)<br>(Pin Grounded at RF Distribution Unit) |
| 25  | Not Connected                                              |

**Removal/Replacement Procedures**

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## Removal/Replacement Procedures

### Replacement of FRUs

 **CAUTION**

The RFDS contains static-sensitive modules. Take precautionary measures to prevent static discharge damage when servicing the RFDS.

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Instructions are provided below for replacing FRUs within the 900 MHz QUAD Duplexed RFDS. Figure 1 identifies the 900 MHz QUAD Duplexed RFDS assemblies and FRUs. Figure 7 identifies the Rx Tray assemblies and attaching hardware.

Replace suspected FRUs with known non-defective FRUs to restore the RFDS to proper operation.

**NOTE**

In the following procedures, the term “Rx Tray” is used to equally denote either the DC & Alarm Tray or the Rx Tray. (A DC & Alarm Tray is simply a tray not equipped with receive multicoupler boards; systems not equipped for expansion use the DC & Alarm Tray instead of an Rx Tray.)

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## Combiner Deck Replacement Procedure

The following procedure applies to all types of combiner decks. Perform the following steps to replace a Combiner Deck.

### CAUTION

Combiner deck surfaces are hot. Allow combiner deck to cool before proceeding to prevent injury.

### CAUTION

RF Energy hazard. Be sure the **dekey** command has been issued to all base radios that connect to the combiner deck to prevent injury or damage to equipment while disconnecting or connecting transmit cabling.

### NOTE

During Combiner Deck replacement the site will become inoperative.

## Removal

Remove Combiner Deck as follows:

1. Make certain the **dekey** command has been issued to all base radios that connect to the Combiner Deck being removed.
2. At rear of Combiner Deck, disconnect Mate-N-Lok fan power connector.
3. Tag and disconnect N-connector RF cables from Combiner Deck rear panel connectors.
4. Remove the four M6 TORX screws which secure the Combiner Deck front panel to the Equipment Cabinet mounting rails.
5. While supporting the Combiner Deck, carefully remove the Combiner Deck from the Equipment Cabinet by sliding it from the front of cabinet.

**Removal/Replacement Procedures****Installation**

Install Combiner Deck as follows (if not already in the rack):

1. If adding a Combiner Deck, install side rails in the appropriate Combiner Deck mounting position in the rack. (See Cabling Information subsection for Combiner Deck mounting locations.)
2. While supporting the Combiner Deck, carefully lift and slide the Combiner Deck in the Equipment Cabinet mounting position.
3. Secure the Combiner Deck to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
4. Connect cabling to the Combiner Deck rear panel connectors as tagged during removal.

If adding the Combiner Deck, perform the required cabling in accordance with the Cabling Information subsection of this section.

5. Reactivate system as follows:
  - On an up-and-running system which was deactivated with a **dekey** command, reset the Base Radio Controller on Base Radios where the command was issued.
  - On a system that was completely shut down, perform activation in accordance with the *System Testing* section of this manual.

**Rx Tray Replacement Procedure****NOTE**

The Rx Tray removal and installation procedures are included for reference or buildout/expansion retrofit purposes only.

Field maintenance of the Rx Tray typically consists of replacement of FRUs within the tray. Perform Rx Tray FRU replacement in accordance with applicable Rx Tray FRU replacement procedure below.

During Rx Tray replacement the site will become inoperative.

Perform the following steps to replace an Rx Tray.

## Removal

Remove Rx Tray as follows:

1. On Rx Tray I/O Board, disconnect the -48V input and fan power Mate-N-Lok connections. (See Figure 15 for detailed view of I/O Board connector locations.)
2. Tag and disconnect BNC connector RF cables from Rx Tray rear panel connectors.
3. Remove one nut which secures ground cable to Rx Tray. Disconnect ground cable and position aside.
4. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails.
5. While supporting the Rx Tray, carefully remove the Rx Tray from the Equipment Cabinet by sliding it from the front of cabinet.

## Installation

Install Rx Tray as follows:

1. If adding an Rx Tray, install side rails in the appropriate Rx Tray mounting position in the rack. (See Cabling Information subsection for Rx Tray mounting locations.)
2. While supporting the Rx Tray, carefully lift and slide the Rx Tray in the Equipment Cabinet mounting position.
3. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
4. On Rx Tray I/O Board, connect the -48V input and fan power Mate-N-Lok connections. (See Figure 15 for detailed view of I/O Board connector locations.)
5. Secure ground cable to Rx Tray ground stud using one nut.
6. Connect RF cabling to the Rx Tray rear panel connectors as tagged during removal.

If adding the Rx Tray, perform the required cabling in accordance with the Cabling Information subsection of this section.

**Removal/Replacement Procedures****Local Expansion (4-Way) Rx Multicoupler Board Replacement Procedure**

Perform the following steps to replace a 4-Way Multicoupler Board.

**Removal**

(See Figure 7.) Remove 4-Way Multicoupler Board as follows:

1. Tag and remove all BNC connections at the **E-R3** through **E-R6** BNC connectors on the 4-Way Multicoupler Board.
2. Remove two M3.5 TORX screws (1, Figure 7) which secure board assembly to Rx Tray chassis (one screw on each side of board). Save screws for reuse.
3. Partially draw board assembly out of Rx Tray until blindmate connector at front of board is disengaged.
4. Remove board from slot enough to gain access to SMA cable termination on underside of board. Disconnect SMA cable from connector on board.
5. Remove board fully from Rx Tray slot.

**Installation**

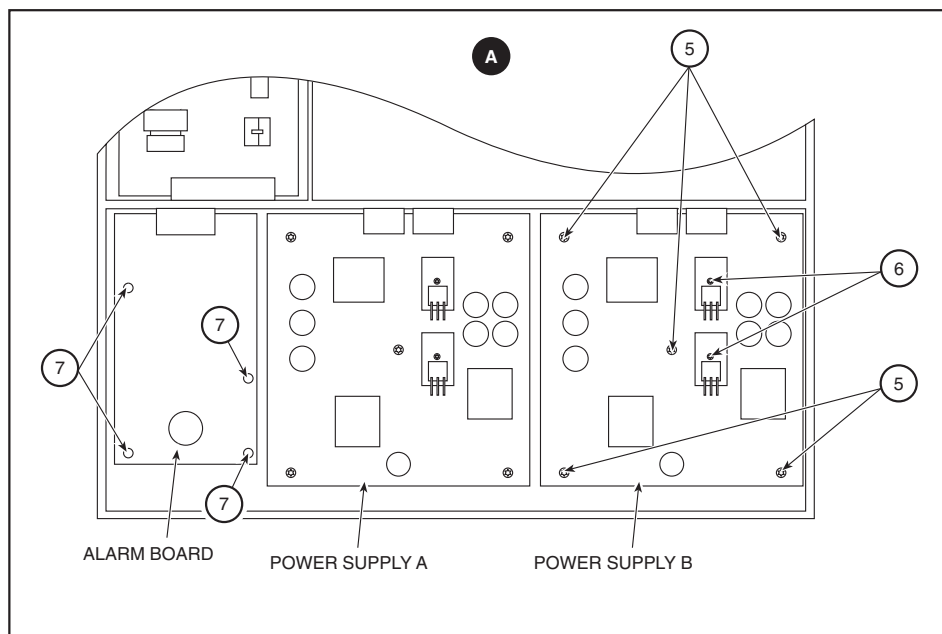
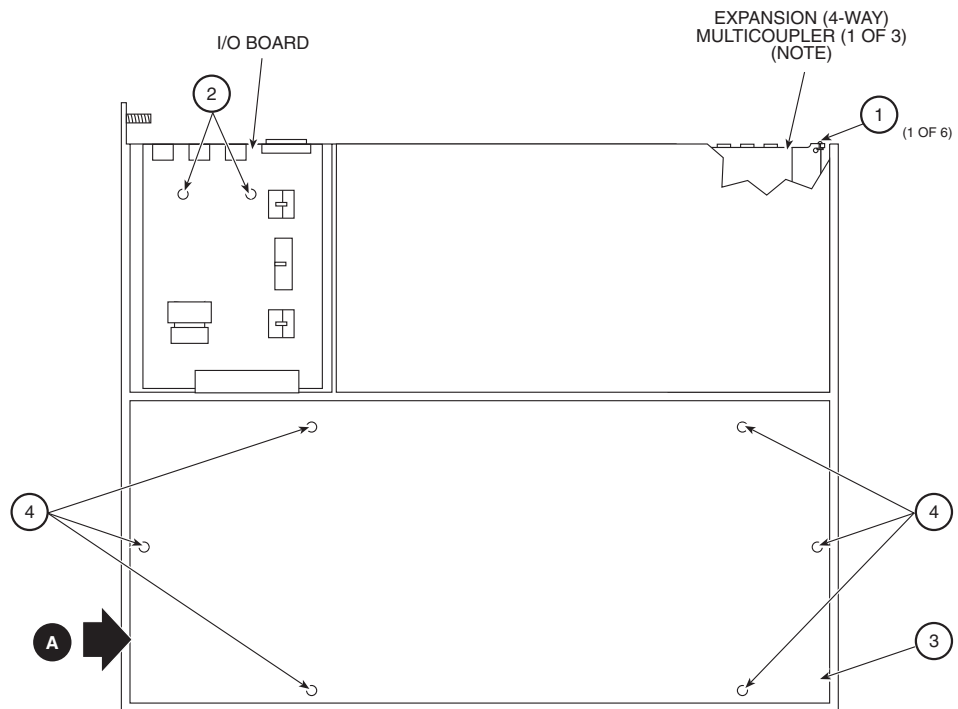
(See Figure 7.) Install 4-Way Multicoupler Board as follows:

1. Align 4-Way Multicoupler Board with Rx Tray board slot. Partially slide board into slot enough to allow Rx input SMA cable to mate with SMA connector on underside of board.
2. Connect SMA cable to SMA connector on underside of board. Using a breaking-type 5/16" torque wrench, torque the SMA connector to 5 in-lb.
3. Carefully slide board fully into slot, making certain blindmate connection at front of board is fully mated to Rx Tray chassis midplane connector.
4. Install two M3.5 TORX screws (1, Figure 7), one on each side of assembly, (saved during removal) which secure board assembly to Rx Tray chassis.
5. Connect cabling to the **E-R3** through **E-R6** BNC connectors on the 4-Way Multicoupler Board as tagged during removal.

If adding the 4-Way Multicoupler Board, perform the required cabling in accordance with the Cabling Information subsection of this section.



## Removal/Replacement Procedures



**NOTE:** THREE EXPANSION (6-WAY) MULTICOUPLERS ARE LOCATED ON UNDERSIDE OF RX TRAY.

EBTS507  
120401JNM

Figure 7 **Rx Tray FRU/Assembly Replacement**

**Removal/Replacement Procedures****I/O Board Replacement Procedure**

Perform the following steps to replace an I/O Board.

**NOTE**

During I/O Board replacement, the site will become inoperative due to loss of alarm and certain power functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

**NOTE**

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

**Removal**

(See Figure 7.) Remove I/O Board as follows:

1. Remove four M3.5 TORX screws which secure Rx Tray chassis to front panel. (Do not remove the four M6 TORX screws which secure front panel to equipment cabinet.) Save screws for reuse.
2. From rear of cabinet, carefully slide Rx Tray chassis from cabinet enough to access two M3.5 TORX screws (2, Figure 7) that secure I/O Board to Rx Tray chassis.
3. Remove two M3.5 TORX screws that secure I/O Board to Rx Tray chassis. Save screws for reuse.
4. Slide I/O Board away from Rx Tray midplane until connector at front of board is disengaged.
5. With board still connected to RJ45 alarm and Mate-N-Lok power connectors, tag wiring connections. Position board aside with all connections intact.

## Installation

(See Figure 7.) Install I/O Board as follows:

6. On each wiring harness connecting to I/O Board being replaced, proceed as follows:
  - 6.1 Carefully cut the tie-wrap which secures harness to board.
  - 6.2 Disconnect connection on board being replaced. Connect harness to replacement I/O Board noting tagged position.
  - 6.3 Secure harness to new board using tie-wrap in similar manner as done on board being replaced.
7. Place new I/O Board in mounting position.
8. Align connector at front of board with mating connector on Rx Tray chassis midplane. Gently slide board toward front of Rx Tray chassis until connectors are fully mated.
9. Secure board using two M3.5 TORX screws (2, Figure 7) saved during removal.
10. Carefully slide Rx Tray chassis toward front panel until chassis is flush with front panel. Make certain no wiring is pinched between Rx Tray chassis and front panel.
11. Start four M3.5 TORX screws that secure Rx Tray chassis to Rx Tray front panel. Tighten all four screws evenly.
12. Reactivate site via OMC.

## Power Supply Board Replacement Procedure

The Rx Tray Power Supply boards are located in the Rx Tray as shown in Figure 7. Because two Power Supply boards are used in a redundant arrangement, a defective power supply board can be replaced without taking the system out of operation.

### Removal

(See Figure 7.) Perform the following steps to determine and replace a defective Power Supply board.

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 7).
3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.

**Removal/Replacement Procedures**

4. Determine which Power Supply board has failed by observing the green LED indicator on each board. (On properly functioning supply, green LED is lit.)
5. Noting the Power Supply board that has failed, on Breaker Panel turn off power for the defective power supply as follows:

| Power Supply Board                                                   | Breaker Panel<br>Circuit Breaker |
|----------------------------------------------------------------------|----------------------------------|
| Multicoupler Branch 1, Board A<br>(left board as viewed from front)  | RFS1                             |
| Multicoupler Branch 1, Board B<br>(right board as viewed from front) | RFS2                             |
| Multicoupler Branch 2, Board A<br>(left board as viewed from front)  | RFS3                             |
| Multicoupler Branch 2, Board B<br>(right board as viewed from front) | RFS4                             |
| Multicoupler Branch 3, Board A<br>(left board as viewed from front)  | RFS5                             |
| Multicoupler Branch 3, Board B<br>(right board as viewed from front) | RFS6                             |

6. On failed board, remove five M3.5 TORX screws (5) that secure board to Rx Tray chassis. Save screws for reuse.
7. Remove two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis. Note the plastic insulator collar used with each screw. Save screws and collars for reuse.
8. Slide board towards front of Rx Tray chassis until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

**Installation**

(See Figure 7.) Install Power Supply Board as follows:

1. Place Power Supply Board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane. Gently slide board toward rear of chassis until connectors are fully mated.
3. Start (but do not tighten) five M3.5 TORX screws (5, Figure 7) that secure board to Rx Tray chassis.

 **CAUTION**

In following step, if plastic insulator collars are not properly installed, replacement power supply will be damaged.

---

4. Note the TO-220 devices (D120 and D122) on the board, each secured by a screw (6) in the device mounting tabs. Make certain that a plastic insulator collar (saved during removal) is properly installed in each mounting tab on TO-220 devices, D120 and D122.
5. Start (but do not tighten) two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis.
6. Tighten five screws (5) and two screws (6) evenly.
7. Apply power to board being replaced by resetting appropriate breaker on Breaker Panel. Verify proper operation by observing green LED indicator on board.
8. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
9. Secure cover using six M3.5 TORX screws (4).
10. Carefully slide Rx Tray fully into cabinet.
11. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).

## Alarm Board Replacement Procedure

Perform the following steps to replace an Alarm Board.

**NOTE**

During Alarm Board replacement, the site will become inoperative due to loss of alarm functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

---

**Removal/Replacement Procedures****NOTE**

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

**Removal**

(See Figure 7.) Remove Alarm Board as follows:

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 7).
3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.
4. Remove four M3.5 TORX screws (7) that secure Alarm Board to Rx Tray chassis. Save screws for reuse.
5. Using the finger hole in the Alarm Board, place finger in hole and pull board forward until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

**Installation**

(See Figure 7.) Install Alarm Board as follows:

1. Place Alarm Board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane.
3. Using finger hole in board, gently slide board toward rear of Rx Tray chassis until connector is fully mated.
4. Secure board using four M3.5 TORX screws (7, Figure 7) saved during removal.
5. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
6. Secure cover using six M3.5 TORX screws (4) saved during removal.
7. Carefully slide Rx Tray fully into cabinet.
8. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
9. Reactivate site via OMC.

## Cabling Information

The illustrations and corresponding tables within this section identify cabling part numbers and point-to-point connections. The illustrations show the location and connections of the cables. Each cable is identified by an index number. The corresponding tables identify the point-to-point connection, function, and part number of the cables. Connections appearing in **bold** are labeled accordingly on the equipment.

The cabling diagrams included in this section are listed in the following table.

| Section                                      | Page | Description                                                                                                                                                                     |
|----------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Duplexer-To-Rx Multicoupler Cabling          | 28   | Provides cabling information for the receive connections between the Duplexers and the Rx Tray.                                                                                 |
| Receiver Cabling                             | 30   | Provides cabling information for the Rx Tray-to-Base Radio Rx input connections. Also provides intercabinet receive cabling information on systems using expansion RF cabinets. |
| Chassis Grounding                            | 34   | Provides cabling information for the chassis ground connections of each module                                                                                                  |
| 5 MHz/1 PPS Cabling                          | 36   | Provides 5 MHz/1 PPS cabling information for the time frequency reference signal connections within the equipment cabinet                                                       |
| Ethernet Cabling                             | 38   | Provides Ethernet cabling information for the Ethernet connections within the equipment cabinet                                                                                 |
| DC Power Cabling                             | 40   | Provides power cabling information for the cabling between the Power Distribution Panel and the modules within the cabinet                                                      |
| RF Cabinet Alarm/Monitor Harness Connections | 42   | Provides cabinet alarm/monitor connections information for interconnection to the various cabinet modules.                                                                      |
| Transmit Power Out Cabling                   | 44   | Provides cabling information for the Base Radio transmit power out connections to the RFDS                                                                                      |

Cabling Information

Duplexer-To-Rx Multicoupler Cabling

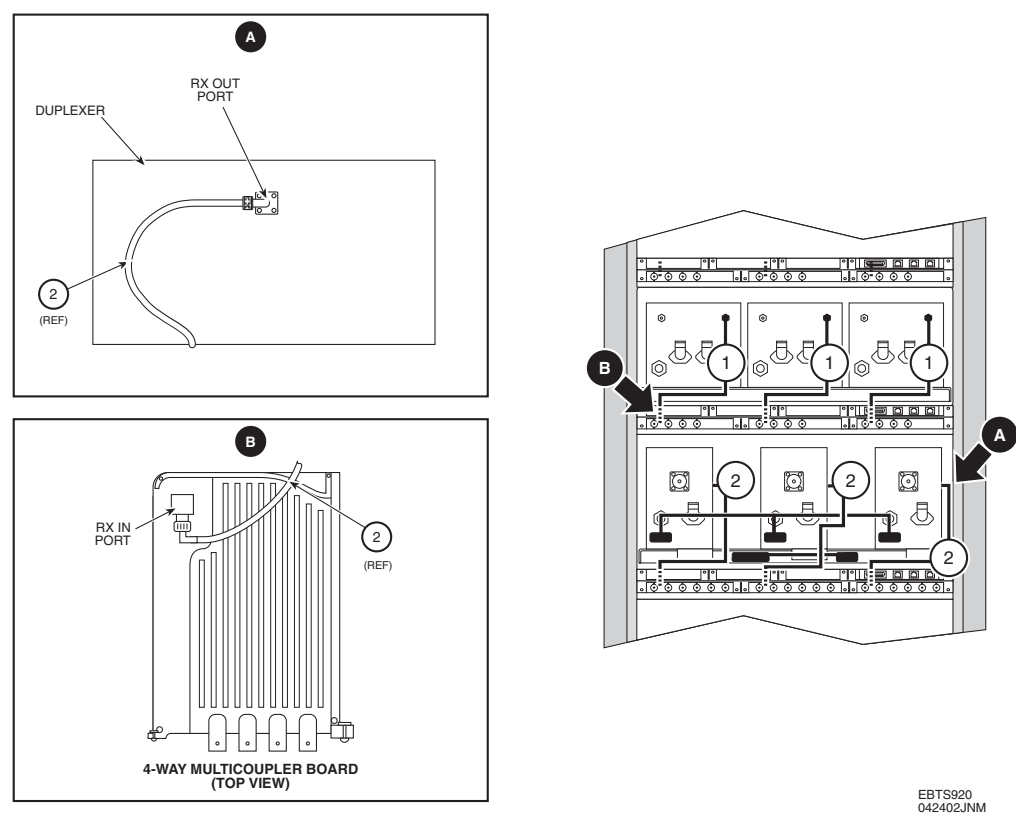
Duplexer-to-Rx Multicoupler cabling routes the Rx output from the Duplexer to the Receive Multicouplers (and the 4-way multicouplers in the Rx Tray in multi-cabinet systems). Table 9 identifies and Figure 8 shows the Duplexer cabling and connecting points. Table 10 identifies and Figure 9 shows the Duplexer cabling and connecting points in a system with the Duplexer option.

Table 9 Duplexer-To-Rx Multicoupler Cabling (900 MHz QUAD Duplexed RFDS Systems)

| Index | Part Number | From                                   | To                                             |
|-------|-------------|----------------------------------------|------------------------------------------------|
| 1     |             | Preselector                            | Receive Multicoupler Tray 2 receive input port |
| 2     | 3012028G17  | Duplexer Rx output cable (index no. 2) | Receive Multicoupler Tray 1 receive input port |

**NOTES:**

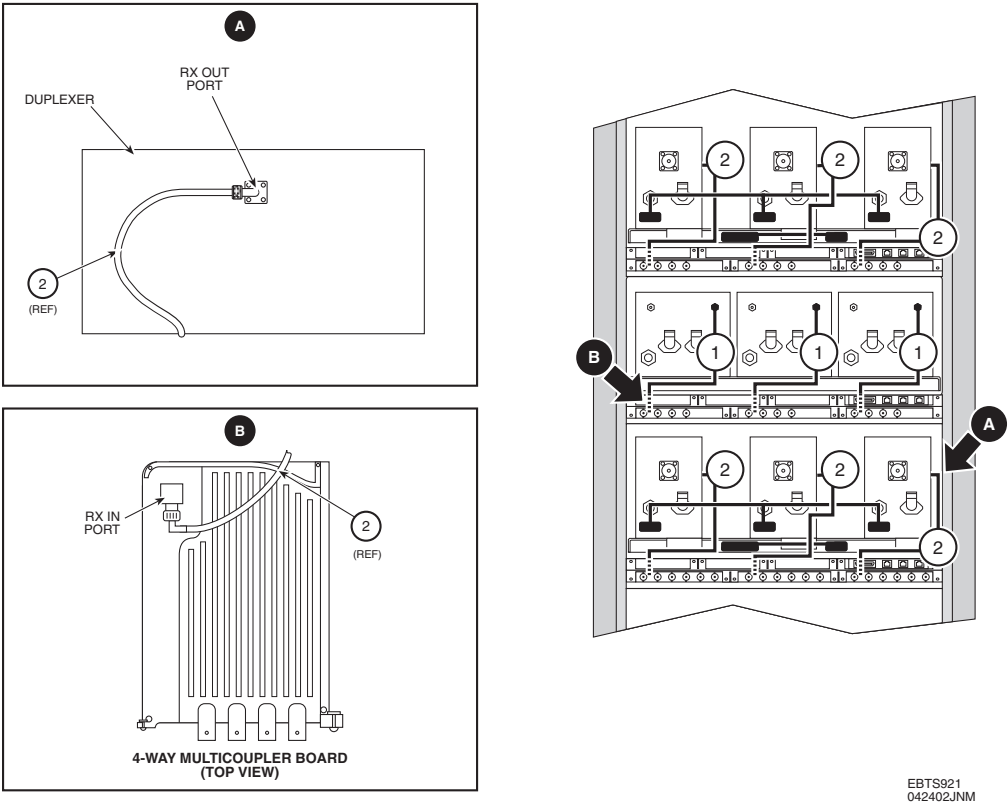
- 1. All cabinets (regardless of ordered configuration) are equipped with full 5-BR, triple-diversity receive cabling.
- 4. Unused output ports on receive multicoupler assembly are terminated using 50Ω termination, P/N 5882741Y02.



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Figure 8 Duplexer-To-Rx Multicoupler Cabling (900 MHz QUAD Duplexed RFDS Systems)





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Figure 9 **Duplexer-To-Rx Multicoupler Cabling (900 MHz QUAD Duplexed RFDS Systems with Duplexer Option)**

Table 10 **Duplexer-To-Rx Multicoupler Cabling (with Duplexer Option)**

| Index                                                                                                                                                                                                                                                  | Part Number | From                                   | To                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------|--------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                      |             | Preselector                            | Receive Multicoupler Tray 2 receive input port                                                   |
| 2                                                                                                                                                                                                                                                      | 3012028G17  | Duplexer Rx output cable (index no. 2) | Receive Multicoupler Tray 1 receive input port<br>Receive Multicoupler Tray 3 receive input port |
| <b>NOTES:</b><br>1. All cabinets (regardless of ordered configuration) are equipped with full 5-BR, triple-diversity receive cabling.<br>4. Unused output ports on receive multicoupler assembly are terminated using 50Ω termination, P/N 5882741Y02. |             |                                        |                                                                                                  |

**Cabling Information****Receiver Cabling**

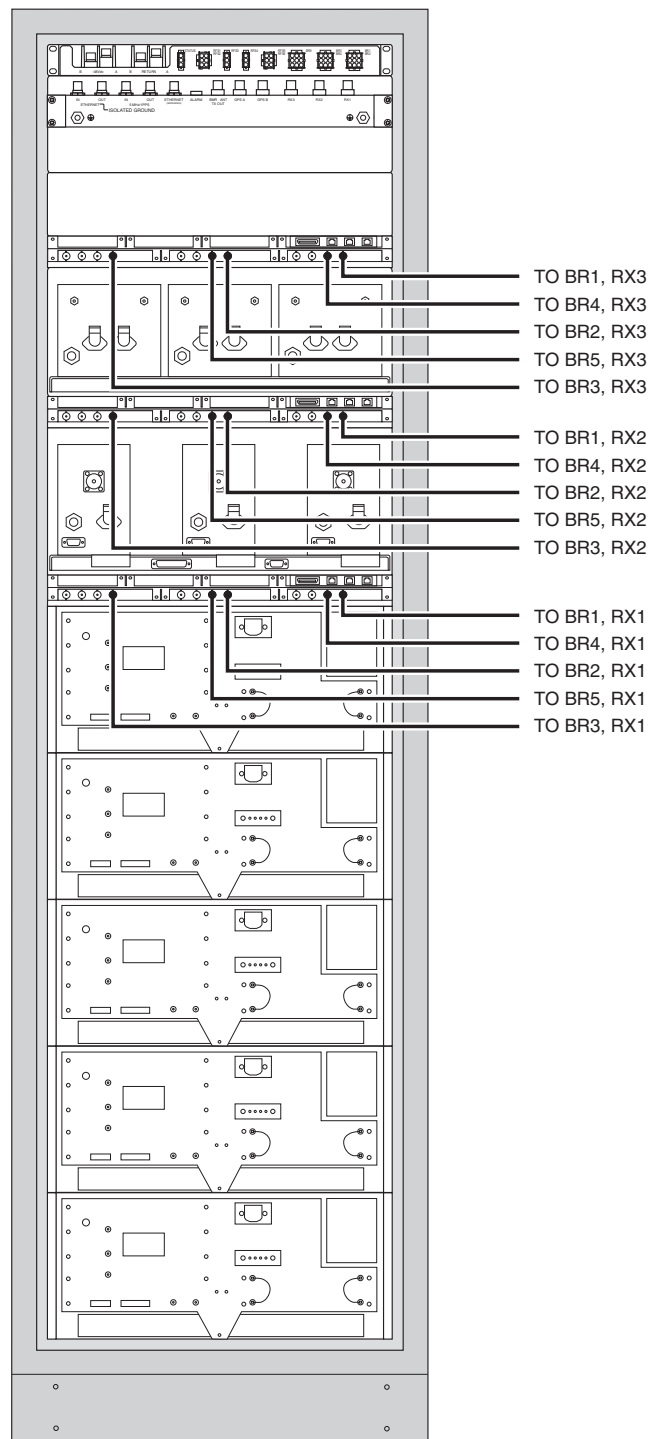
Tables 11 and 12 list receiver cabling information and Figures 10 and 11 show the receiver cabling connections for systems equipped with a 900 MHz QUAD Duplexed RFDS.

**NOTE**

Table 11 and Figure 10 apply **only** to systems using no more than five BRs. Refer to Table 12 and Figure 11 for systems using more than five Base Radios.

Table 11 **Receiver Cabling (Single RF Cabinet System)**

| Index                                                                                                                          | Part Number | From                                         | To                  |
|--------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------|---------------------|
| 1                                                                                                                              | 3013943C41  | Output port on Receive Multicoupler assembly | RX connector on BR1 |
| 2                                                                                                                              | 3013943C38  | Output port on Receive Multicoupler assembly | RX connector on BR2 |
| 3                                                                                                                              | 3013943C38  | Output port on Receive Multicoupler assembly | RX connector on BR3 |
| 4                                                                                                                              | 3013943C33  | Output port on Receive Multicoupler assembly | RX connector on BR4 |
| 5                                                                                                                              | 3013943C33  | Output port on Receive Multicoupler assembly | RX connector on BR5 |
| <b>NOTE:</b> All cabinets (regardless of ordered configuration) are equipped with full 5-BR, triple-diversity receive cabling. |             |                                              |                     |

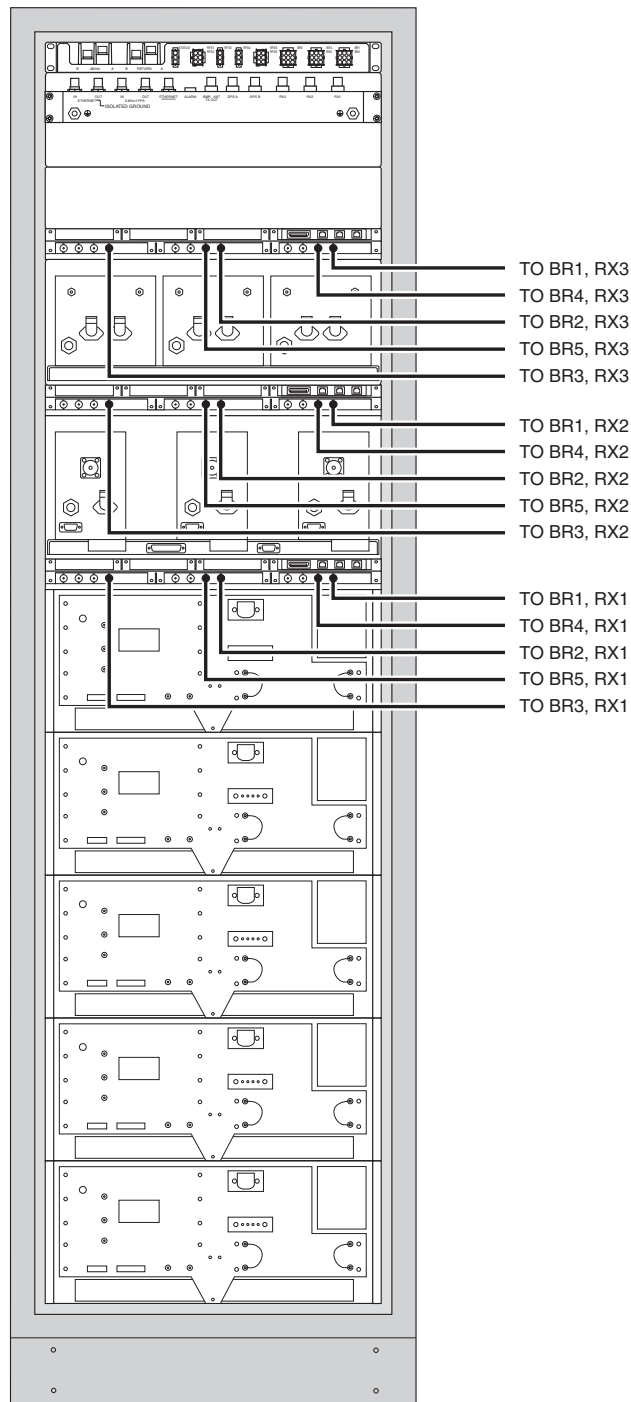


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Figure 10 **Receiver Cabling, Single RF Cabinet System (900 MHz QUAD Duplexed RFDS Systems)**

**Cabling Information**Table 12 **Receiver Cabling (Multi-Cabinet Expansion Systems)**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Part Number | From                                                                              | To                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y12  | <b>E-R3</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 1             | RX connector on BR1                                                          |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y12  | <b>E-R4</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 1             | RX connector on BR4                                                          |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y07  | <b>E-R5</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 1             | 50 $\Omega$                                                                  |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y07  | <b>E-R6</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 1             | 50 $\Omega$                                                                  |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3013942B30  | <b>RX-2</b> connector on duplexer shelf Receive Multicoupler assembly<br>(NOTE 1) | Input port on Rx Tray 4-Way Multicoupler Board<br>(see detail B in Figure 9) |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y12  | <b>E-R3</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 2             | RX connector on BR2                                                          |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y12  | <b>E-R4</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 2             | RX connector on BR5                                                          |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y07  | <b>E-R5</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 2             | 50 $\Omega$ Term                                                             |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y07  | <b>E-R6</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 2             | 50 $\Omega$ Term                                                             |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3013943B30  | <b>RX-2</b> connector on duplexer shelf Receive Multicoupler assembly<br>(NOTE 1) | Input port on Rx Tray 4-Way Multicoupler Board<br>(see detail B in Figure 9) |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y12  | <b>E-R3</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 3             | RX connector on BR3                                                          |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y12  | <b>E-R4</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 3             | RX connector on BR6                                                          |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y07  | <b>E-R5</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 3             | 50 $\Omega$ terminator                                                       |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0112004Y07  | <b>E-R6</b> connector on Rx Tray 4-Way Multicoupler Board<br>Sector 3             | 50 $\Omega$ terminator                                                       |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3013943B30  | <b>RX-2</b> connector on duplexer shelf Receive Multicoupler assembly<br>(NOTE 1) | Input port on Rx Tray 4-Way Multicoupler Board<br>(see detail B in Figure 9) |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Duplexer shelf multicoupler-to-Rx Tray cable (3 places). Refer to Table 9/Figure 8 (Duplexer-To-Rx Multicoupler Cabling) for connector locations, cable P/N, and other details.</li> <li>2. All cabinets (regardless of ordered configuration) are equipped with full 5-BR, triple-diversity receive cabling.</li> <li>4. Unused output ports on receive multicoupler assembly are terminated using 50<math>\Omega</math> termination, P/N 5882741Y02.</li> <li>5. Above listing for part no. identification and function description only. Refer to accompanying diagram for point-to-point connections.</li> </ol> |             |                                                                                   |                                                                              |



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Figure 11 **Receiver Cabling, Multi RF Cabinet System  
 (900 MHz QUAD Duplexed RFDS Systems)**

**Cabling Information****Chassis Grounding**

Chassis grounding refers to the ground strap connections between the equipment modules within the equipment cabinet and the cabinet frame. Chassis grounds help prevent interference and damage to equipment in the event of a lightning strike.

Table 13 identifies and Figure 12 shows the ground straps.

*Table 13*      **Ground Straps**

| <b>Index</b>                                               | <b>Part Number</b> | <b>From</b>                   | <b>To</b>                               |
|------------------------------------------------------------|--------------------|-------------------------------|-----------------------------------------|
| 1                                                          | 3082000X10         | Ground stud on Grounding Bar  | <b>GROUND</b> stud on Junction Panel    |
| 2                                                          | 3082000X12         | Ground stud on Grounding Bar  | ground lug on RX Tray                   |
| 3                                                          | 3082000X04         | Ground stud on Grounding Bar  | <b>GROUND</b> stud on Base Radios       |
| 4                                                          | 3082000X05         | Ground stud on Junction Panel | ground stud on ANT 4, 5 Preselector     |
| 4                                                          | 3082000X05         | Ground stud on Junction Panel | ground stud on ANT 6, 7 Preselector     |
| 4                                                          | 3082000X05         | Ground stud on Junction Panel | ground stud on ANT 8, 9 Preselector     |
| 5                                                          | 3082000X05         | Ground stud on Grounding Bar  | ground stud on ANT 3 Duplexer           |
| 5                                                          | 3082000X05         | Ground stud on Grounding Bar  | ground stud on ANT 2 Duplexer           |
| 5                                                          | 3082000X05         | Ground stud on Grounding Bar  | ground stud on ANT 1 Duplexer           |
| (NOTE)                                                     | 3082000X12         | Ground stud on Junction Panel | ground stud on Expansion TX Combiner    |
| (NOTE)                                                     | 3082000X05         | Ground stud on Junction Panel | ground stud on Ant 4 Expansion Duplexer |
| (NOTE)                                                     | 3082000X05         | Ground stud on Junction Panel | ground stud on Ant 5 Expansion Duplexer |
| (NOTE)                                                     | 3082000X05         | Ground stud on Junction Panel | ground stud on Ant 6 Expansion Duplexer |
| <b>NOTE:</b> Expansion options are not shown in Figure 12. |                    |                               |                                         |

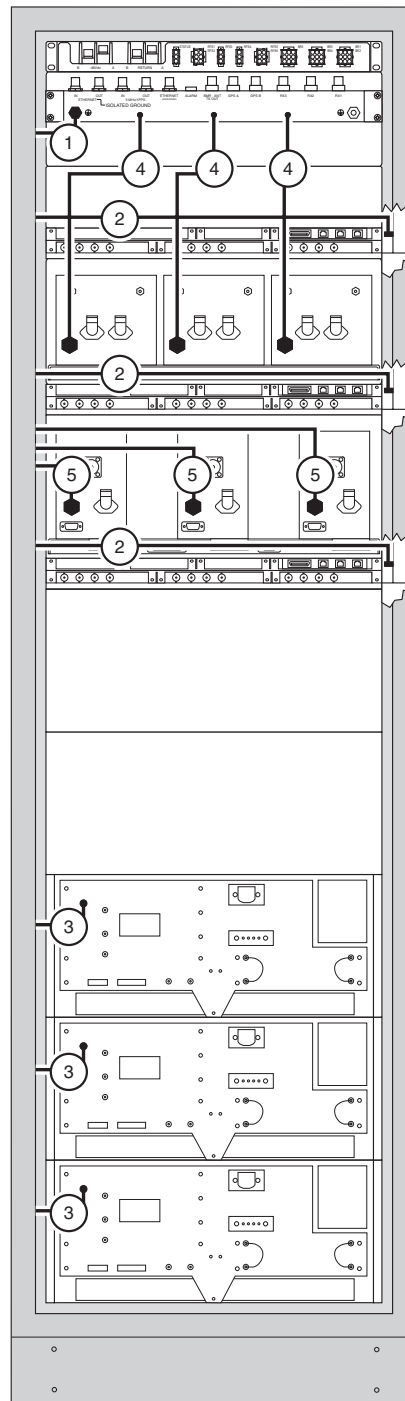
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Figure 12 **Chassis Grounding Diagram (900 MHz QUAD Duplexed RFDS Systems)**

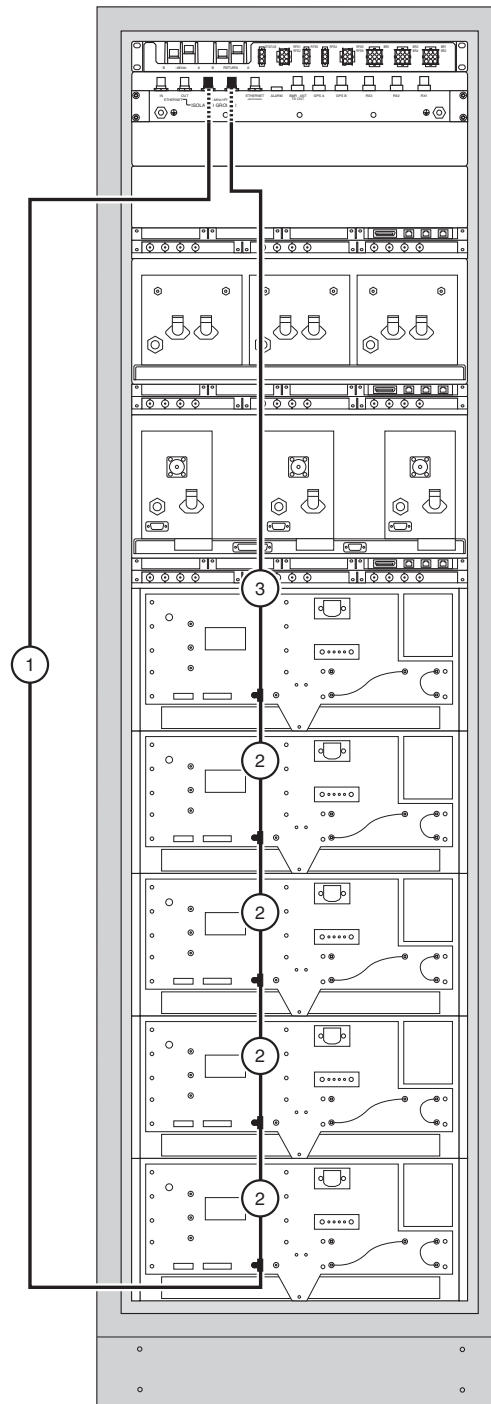
**Cabling Information****5 MHz/1 PPS Cabling**

5 MHz / 1 PPS cabling routes the time frequency reference signal between the Junction Panel and each Base Radio. Table 14 identifies and Figure 13 shows the 5 MHz / 1 PPS cabling.

Table 14 **5 MHz/1 PPS Cabling**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Part Number | From                                                           | To                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082004X03  | Underside of <b>5 MHZ/1 PPS IN</b> connector on Junction Panel | BNC T-adapter on Base Radio 1                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0112004Z17  | BNC T-adapter on Base Radio 1                                  | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3<br>BNC T-adapter on Base Radio 4<br>BNC T-adapter on Base Radio 5 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082004X02  | BNC T-adapter on Base Radio 5                                  | Underside of <b>5 MHZ/1 PPS OUT</b> connector on Junction Panel                                                                  |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cables are connected between the BNC T-adapters (P/N 0909907D01), which are mounted to the appropriate module connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to five BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, 5 MHz/1 PPS OUT connector must be terminated with 50Ω terminator.</li> </ol> |             |                                                                |                                                                                                                                  |





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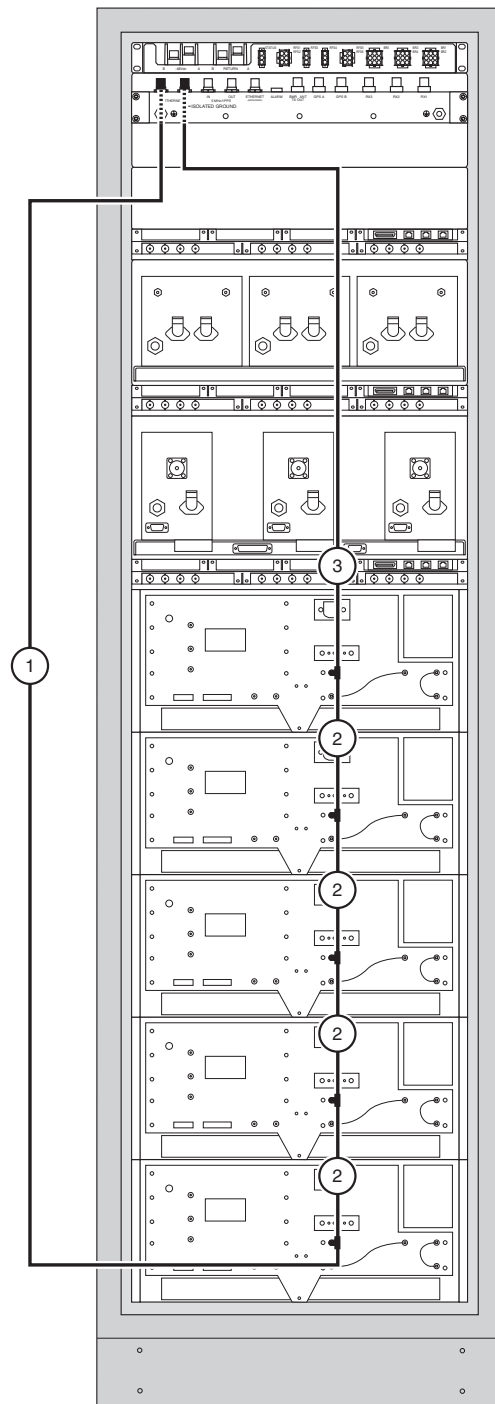
Figure 13 **5 MHz/1 PPS Cabling (900 MHz QUAD Duplexed RFDS Systems)**

**Cabling Information****Ethernet Cabling**

Ethernet cabling routes the Ethernet network between the Junction Panel and each Base Radio. Table 15 identifies and Figure 14 shows the Ethernet cabling.

Table 15 ***Ethernet Cabling***

| <b>Index</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Part Number</b> | <b>From</b>                                                 | <b>To</b>                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3082004X03         | Underside of <b>ETHERNET IN</b> connector on Junction Panel | BNC T-adapter on Base Radio 1                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0112004Z17         | BNC T-adapter on Base Radio 1                               | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3<br>BNC T-adapter on Base Radio 4<br>BNC T-adapter on Base Radio 5 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3082004X03         | BNC T-adapter on Base Radio 6                               | Underside of <b>ETHERNET OUT</b> connector on Junction Panel                                                                     |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cables are connected between the BNC T-adapters (P/N 0909907D01), which are mounted to the appropriate module connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to five BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, ETHERNET OUT connector must be terminated with 50Ω terminator.</li> </ol> |                    |                                                             |                                                                                                                                  |



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Figure 14 **Ethernet Cabling (900 MHz QUAD Duplexed RFDS Systems)**

## Cabling Information

## DC Power Cabling

DC power connections refer to power cabling between the Equipment Cabinet Power Distribution Panel and the modules within the cabinet. Table 16 identifies and Figure 15 shows the DC power connections.

## NOTE

Table 16 and Figure 15 represent full cabinet capacity (6 BR). Systems using fewer BRs have fewer connections.

Table 16 **DC Power Connections**

| Index                                                                                                                                                                                                                                                                                                                                                                                                     | Part Number | From                                                         | To                                                      | Notes            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------|---------------------------------------------------------|------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                         | 3082050X02  | <b>BR1&amp;BR2</b> connector on Power Distribution Panel     | <b>DC POWER</b> connector on Base Radio 1 and 2         | Y-cable assembly |
| 2                                                                                                                                                                                                                                                                                                                                                                                                         | 3082050X01  | <b>BR3&amp;BR4</b> connector on Power Distribution Panel     | <b>DC POWER</b> connector on Base Radio 3 and 4         | Y-cable assembly |
| 3                                                                                                                                                                                                                                                                                                                                                                                                         | 3082050X03  | <b>BR5&amp;BR6</b> connector on Power Distribution Panel     | <b>DC POWER</b> connector on Base Radio 5 and 6         | Y-cable assembly |
| 4                                                                                                                                                                                                                                                                                                                                                                                                         | 3082129X04  | <b>RFS1&amp;RFS2</b> connector on Power Distribution Panel   | –48 VDC Mate-N-Lok input connector on Rx Tray I/O board | see detail A     |
| 5                                                                                                                                                                                                                                                                                                                                                                                                         | 3082565Y02  | <b>RFS3 &amp; RFS4</b> connector on Power Distribution Panel | Multicoupler Tray Branch 2                              | Y-cable assembly |
|                                                                                                                                                                                                                                                                                                                                                                                                           |             | <b>RFS5 &amp; RFS6</b> connector on Power Distribution Panel | Multicoupler Tray Branch 3                              |                  |
| 6                                                                                                                                                                                                                                                                                                                                                                                                         | 3082129X03  | <b>STATUS</b>                                                | Expansion MC Alarm (MC Branch 3)                        |                  |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cabinets (regardless of ordered configuration) are equipped with full 5-BR power cabling.</li> <li>2. Connections for BR7-BR12 in expansion RF cabinet are connected in same pattern as for BR1-BR6 in main RF cabinet.</li> <li>3. If cabinet is equipped with out Combiner Tray, unused end of index 7 is cable-tied out of way.</li> </ol> |             |                                                              |                                                         |                  |

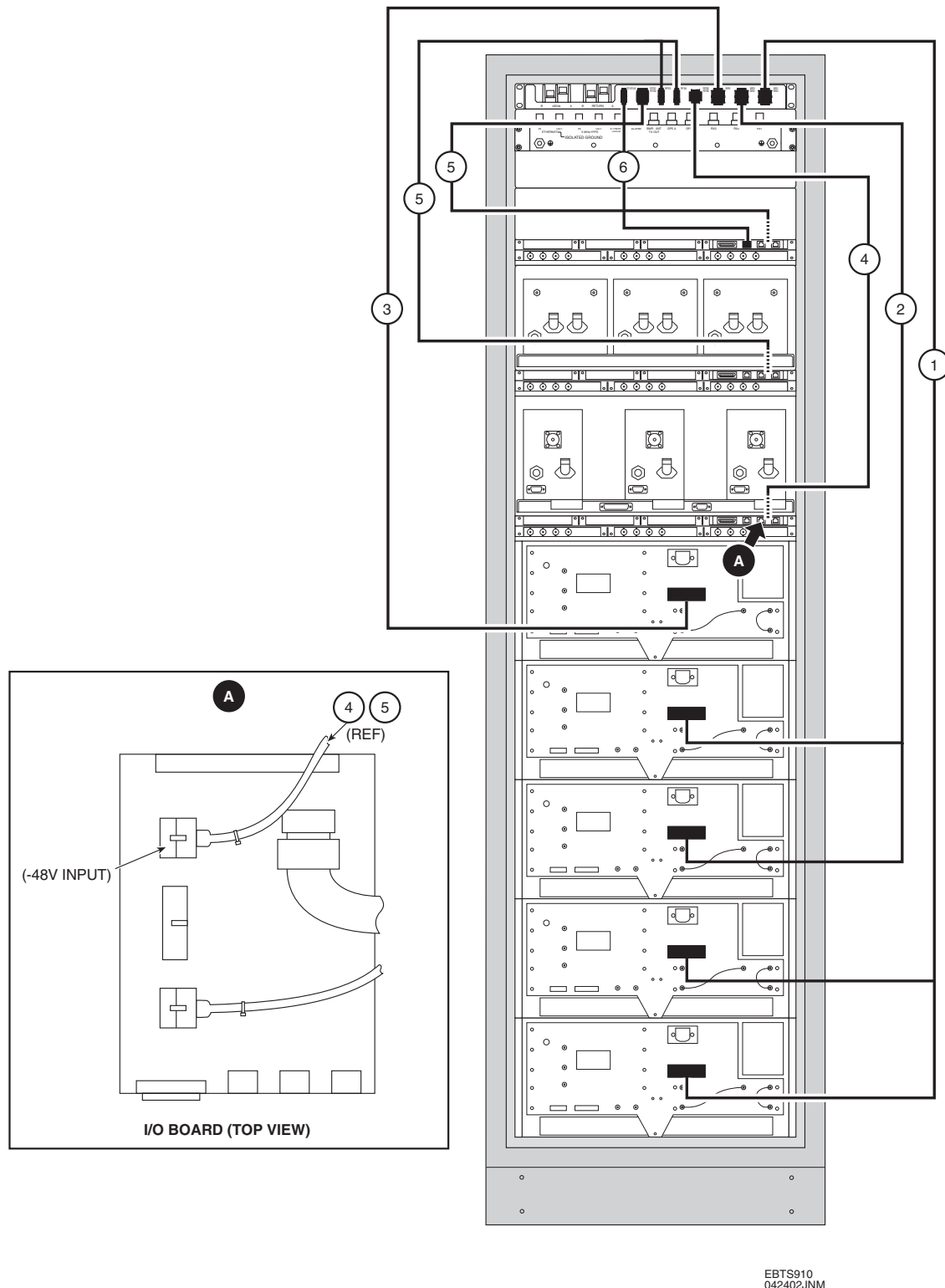


Figure 15 **DC Power Cabling (900 MHz QUAD Duplexed RFDS Systems)**

**Cabling Information****RF Cabinet Alarm/Monitor Harness Connections**

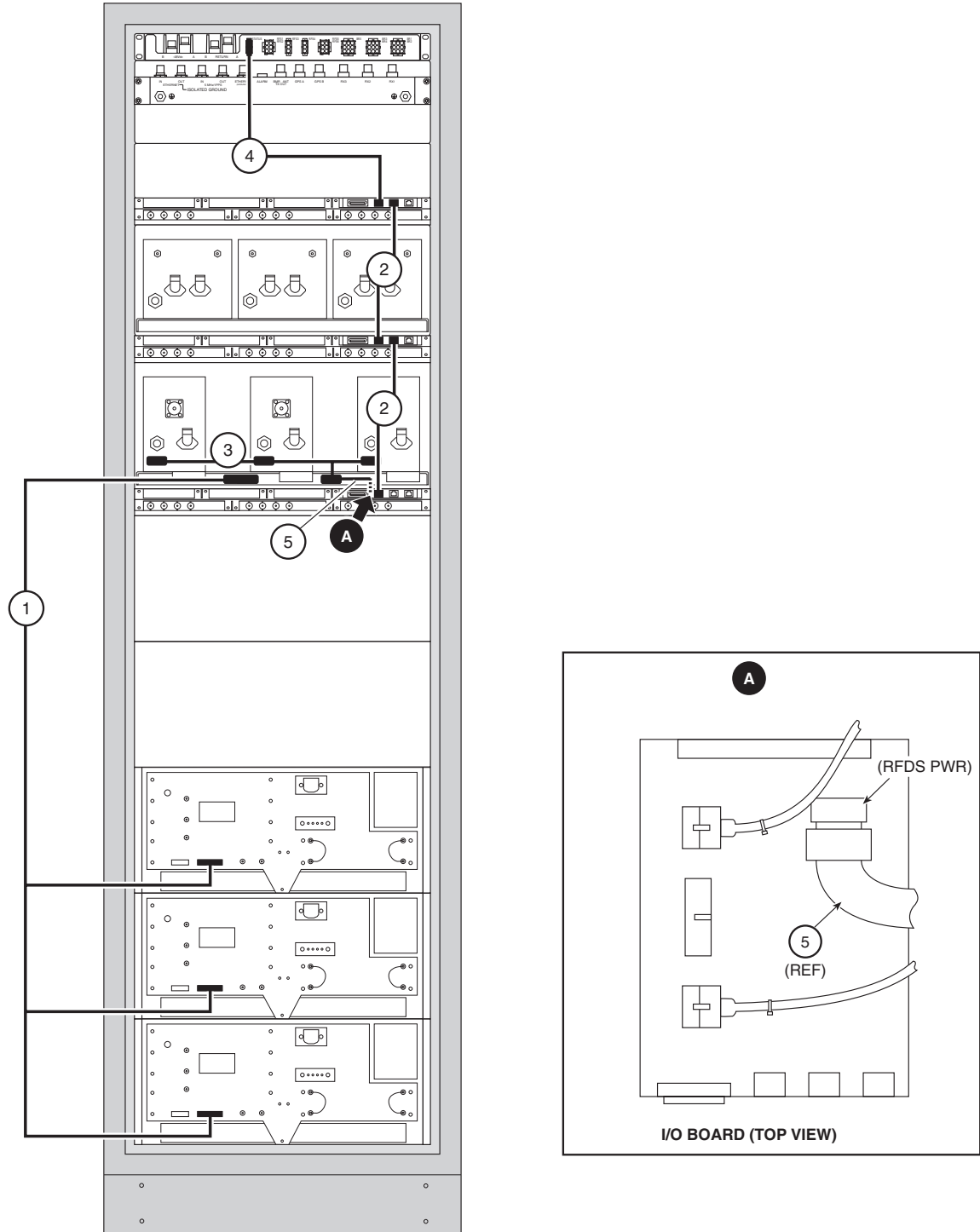
The cabinet alarm connections use a multi-connector wiring harness assembly that provides for daisy-chain connection of the various modules. Table 17 identifies and Figure 16 shows the harness connecting points.

**NOTE**

System in Table 17 and Figure 16 represents full cabinet capacity (6 BR). Systems using less BRs have accordingly fewer connections. Unused connectors are cable-tied to equipment cabinet frame.

Table 17 **Alarm/Power Monitor Harness Connections**

| Index                                                                                                                                                                                                                                                           | Part Number | From                                                  | To                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                               | 3082070Y01  | 25-pin submini-D connector on ANT1 duplexer           | Multi-connector harness. From top-to-bottom, connects to: <ul style="list-style-type: none"> <li>• 25-pin <b>ALARM</b> connector on Base Radio 3 (NOTE 1)</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 2 (NOTE 2)</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 1</li> </ul> |
| 2                                                                                                                                                                                                                                                               | 3084225N55  | RJ45 STANDARD alarm connector on I/O board            | RJ45 EXPANSION alarm input connector on I/O board                                                                                                                                                                                                                                               |
| 3                                                                                                                                                                                                                                                               | 3082053X05  | 9-pin harness on Sector 1; Antennas 1, 2, 3           | 9-pin harness on Sector 1; Antennas 1, 2, 3                                                                                                                                                                                                                                                     |
| 4                                                                                                                                                                                                                                                               | 3082129X03  | <b>STATUS</b> connector on breaker panel              | RJ45 EXPANSION alarm input connector on I/O board                                                                                                                                                                                                                                               |
| 5                                                                                                                                                                                                                                                               | 3082056X03  | 9-pin submini D connector (P5) on RFDS duplexer shelf | RFDS power output Mate-N-Lok connector on Rx Tray I/O board                                                                                                                                                                                                                                     |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Base Radio 3 ALARM connection performed only on systems using seven or more Base Radios.</li> <li>2. Base Radio 2 ALARM connection performed only on systems using four or more Base Radios.</li> </ol> |             |                                                       |                                                                                                                                                                                                                                                                                                 |



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Figure 16 **RF Cabinet Alarm Cabling (900 MHz QUAD Duplexed RFDS Systems)**

**Cabling Information****Transmit Power Out Cabling**

Transmit power output cabling routes the Base Radio RF output to the transmit inputs on the RFDS.

Table 18 identifies and Figure 17 shows the location and connecting points for the power out cables for main RF cabinet Base Radios 1 through 3. Table 19 identifies and Figure 18 shows the location and connecting points for the power out cables for main RF cabinet Base Radios 1 through 6 in a system with the Duplexer Option. Table 20 identifies and Figure 19 shows the location and connecting points for the power out cables for main RF cabinet Base Radios 1 through 6 in a system with a TX Combiner Option.

**NOTE**

Refer to Receiver Cabling for receive expansion cabling information.

*Table 18      **Transmit Power Out Cabling (1-3 BR)***

| <b>Index</b> | <b>Part Number</b> | <b>From</b>              | <b>To</b>         |
|--------------|--------------------|--------------------------|-------------------|
| 1            | 0112004K14         | PA OUT connector on BR 1 | Duplexer Sector 1 |
| 2            | 0112004K14         | PA OUT connector on BR 2 | Duplexer Sector 2 |
| 3            | 0112004K14         | PA OUT connector on BR 3 | Duplexer Sector 3 |

*Table 19      **Transmit Power Out Cabling (1-6 BR) with Duplexer Option***

| <b>Index</b> | <b>Part Number</b> | <b>From</b>              | <b>To</b>                   |
|--------------|--------------------|--------------------------|-----------------------------|
| 1            | 0112004K14         | PA OUT connector on BR 1 | Duplexer Sector 1           |
| 2            | 0112004K14         | PA OUT connector on BR 2 | Duplexer Sector 2           |
| 3            | 0112004K14         | PA OUT connector on BR 3 | Duplexer Sector 3           |
| 4            | 0112004K08         | PA OUT connector on BR 4 | Expansion Duplexer Sector 1 |
| 5            | 0112004K08         | PA OUT connector on BR 5 | Expansion Duplexer Sector 2 |
| 6            | 0112004K08         | PA OUT connector on BR 6 | Expansion Duplexer Sector 3 |

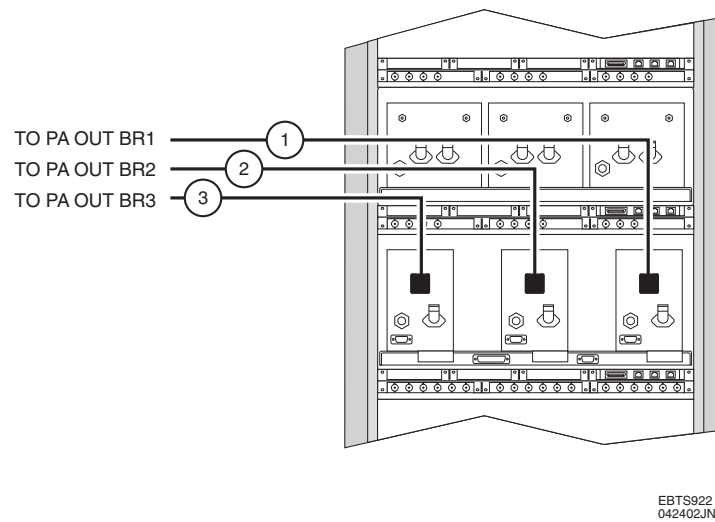
*Table 20      **Transmit Power Out Cabling (1-6 BR) with TX Combiner Option***

| <b>Index</b> | <b>Part Number</b> | <b>From</b>              | <b>To</b>                                      |
|--------------|--------------------|--------------------------|------------------------------------------------|
| 1            | 0112004K14         | PA OUT connector on BR 1 | Triple 2-Way Combiner Deck <b>T2</b> (IN) port |
| 2            | 0112004K14         | PA OUT connector on BR 2 | Triple 2-Way Combiner Deck <b>T5</b> (IN) port |
| 3            | 0112004K14         | PA OUT connector on BR 3 | Triple 2-Way Combiner Deck <b>T8</b> (IN) port |
| 4            | 0112004K08         | PA OUT connector on BR 4 | Triple 2-Way Combiner Deck <b>T3</b> (IN) port |



Table 20 **Transmit Power Out Cabling (Continued)(1-6 BR) with TX Combiner Option (Continued)**

| Index | Part Number | From                                        | To                                         |
|-------|-------------|---------------------------------------------|--------------------------------------------|
| 5     | 0112004K08  | PA OUT connector on BR 5                    | Triple 2-Way Combiner Deck T6 (IN) port    |
| 6     | 0112004K08  | PA OUT connector on BR 6                    | Triple 2-Way Combiner Deck T9 (IN) port    |
| 7     | 0112004B03  | T1 (OUT) port on Triple 2-Way Combiner Deck | Sector 1, Antenna 1 Duplexer Tx input port |
| 8     | 0112004B03  | T4 (OUT) port on Triple 2-Way Combiner Deck | Sector 2, Antenna 1 Duplexer Tx input port |
| 9     | 0112004B03  | T7 (OUT) port on Triple 2-Way Combiner Deck | Sector 3, Antenna 1 Duplexer Tx input port |

Figure 17 **1-3 BR Transmit Power Out Cabling (900 MHz QUAD Duplexed RFDS Systems)**

## Cabling Information

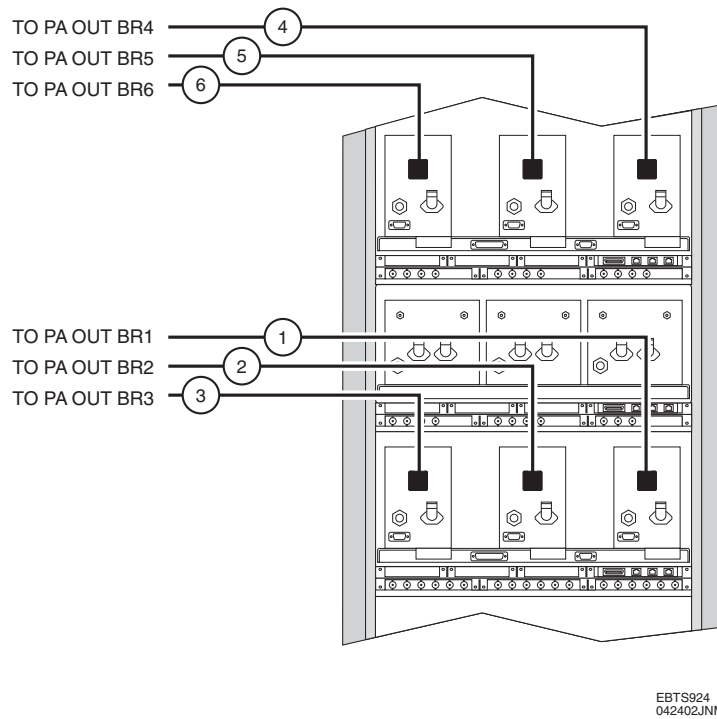


Figure 18 1-6 BR Transmit Power Out Cabling (900 MHz QUAD Duplexed RFDS with Duplexer Option)

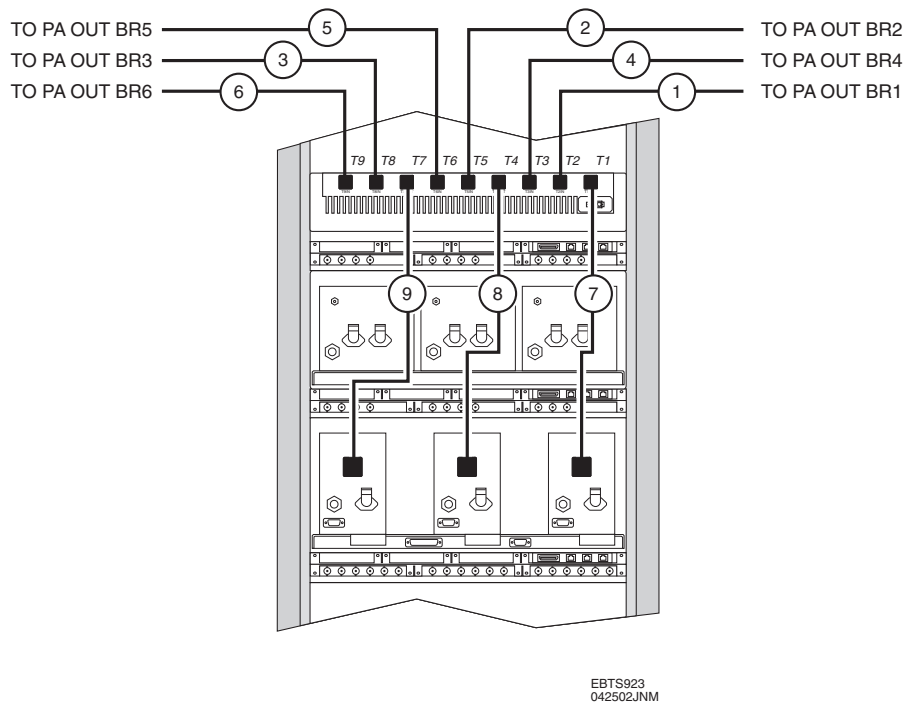


Figure 19 1-6 BR Transmit Power Out Cabling (900 MHz QUAD Duplexed RFDS with TX Combiner Option)

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## Base Radio Buildout/900 MHz QUAD Duplexed RFDS Expansion

### Buildout General Information

“Base Radio Buildout” refers to adding more base radios to an existing EBTS. After a certain number of Base Radios are added to a system, RFDS expansion is required to accommodate the total Base Radio complement.

IPL software is added with each BR that is ordered. The system software must be modified for each additional BR.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

The following procedures and references specify procedures required in installing hardware and cabling only.

Complete the installation by performing system reprogramming (as applicable) in accordance with the *Software Commands* and *System Testing* sections of this manual.

---

A 900 QUAD RFDS can be built-out to a maximum of five BRs installed in a single RF cabinet and up to a maximum of 12 BRs using an additional Expansion RF Cabinet.

### Buildout Procedures

Depending on the existing number of Base Radios in a system, and the build out configuration being performed, various build out steps need to be taken. Table 21 lists the steps (or provides reference to procedures) in installing the various modules. Table 21 also lists the additional modules required in performing various levels of build out.

#### Installing Hardware

Using Table 21, install required hardware and perform cabling as follows:

1. Noting the existing configuration of the system, and the intended buildout configuration, note the expansion level (“Buildout Level” column) required to bring the system to the desired buildout level.

The “Buildout Level” column correspondingly lists the 900 MHz QUAD Duplexed RFDS configuration that accommodates a given number of BRs.

**Base Radio Buildout/900 MHz QUAD Duplexed RFDS Expansion**

2. Noting the range of Expansion Levels required in accomplishing the buildout, note any additional equipment required in the “Equipment” column.
3. Perform the steps listed in the “Installation” column.

Examples on using the buildout table are provided below.

**Example:** When a system containing three BRs is expanded to six BRs, the procedures required in performing the buildout are:

- ☐ “Up to 6 BRs” buildout instructions

Other than BR4, BR5, and RF cables for BR6, no additional equipment is required; the RF cabinet is equipped with all cabling for up to 5 BRs.

The following equipment will be installed during the buildout procedure:

- ☐ BR4 and BR5 in the Main RF Cabinet, BR6 in the expansion cabinet.

Table 21 **900 MHz QUAD Duplexed RFDS Buildout Instructions**

| Buildout Level<br>(900 MHz QUAD<br>Duplexed RFDS<br>Configuration)                                                                                                                                           | Expansion<br>Equipment<br>Required                                               | Installation Instructions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|                                                                                                                                                                                                              |                                                                                  | Procedure/Reference                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Page    |
| Up to 6 BRs                                                                                                                                                                                                  | Expansion RF Cabinet with 1BR, Power, RF, Ethernet, 5MHz and Alarm cables (NOTE) | <ol style="list-style-type: none"> <li>1. Install Base Radio(s) in accordance with “Base Radio/Base Radio FRU Replacement” (<i>Base Radio</i> section of this manual).</li> <li>2. Perform the following cabling in accordance with “Cabling Information” subsection. <ul style="list-style-type: none"> <li>• Receiver Cabling (Single RF Cabinet System)</li> <li>• 5 MHz/1 PPS Cabling</li> <li>• Ethernet Cabling</li> <li>• DC Power Cabling</li> <li>• Transmit Power Out Cabling</li> </ul> </li> </ol> | —<br>27 |
| <b>NOTE:</b> The customer provide cables for BR6. The RF Cabinet housing BR6 should be immediately adjacent to the 900 MHz QUAD RFDS so that the RF interconnection cables do not exceed six feet in length. |                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |

## System Activation

Following installation of the Base Radio(s) and required RFDS connections, the installation must be completed and verified by performing system reprogramming and testing in accordance with the *Software Commands* and *System Testing* sections of this manual. Other materials may also be supplied with equipment, as applicable. Where provided, perform these instructions also.



# 1500 MHz RF Distribution System

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## Overview

This chapter provides technical information for the 1500 MHz RFDS.

| Section                                   | Page | Description                                                                                                                                            |
|-------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Overview                                  | 2    | Describes the 1500 MHz RFDS                                                                                                                            |
| 1500 MHz RFDS Specifications              | 5    | Provides performance specifications for the 1500 MHz RFDS                                                                                              |
| Theory of Operation                       | 8    | Describes the transmit and receive path of the 1500 MHz RFDS                                                                                           |
| Removal/Replacement Procedures            | 14   | Provides instructions for replacing components of the 1500 MHz RFDS                                                                                    |
| Cabling Information                       | 25   | Provides information on how to connect all cabling required for proper operation of EBTS with the 1500 MHz RFDS                                        |
| Tower Top Amp Receive Branch Equalization | 42   | Describes receive branch equalization requirements and methods for systems using TTAs. Provides procedures for performing receive branch equalization. |

**Overview**

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## Overview

The 1500 MHz RFDS is a 1500 MHz duplexing/hybrid combining and receiver multicoupler system. Duplexers allow a transmit (Tx) and a receive (Rx) path to share a common antenna. Transmit combiner stages allow several transmit signals to be fed to a single antenna. Figure 1 shows the 1500 MHz RFDS.

The 1500 MHz RFDS contains several Field Replaceable Units (FRUs), including:

- ❑ One Dual 3-Way Hybrid Combiner Deck with Isolators and Three 6-Way splitters for Receive
- ❑ Up to three Multicoupler / Amplifier (4-Way) assemblies
- ❑ Rx Tray Multicoupler Alarm Board
- ❑ Two Power Supplies

The 1500 MHz RFDS employs a modularized, compact design. This modularization, along with a combining scheme based around the modularization, allows expansion with a minimum amount of added components. The combining, along with the compact design, allows up to six Base Radios (BRs) per RF cabinet.

To eliminate the bulk associated with extensive combining, the 1500 MHz RFDS uses a hybrid combiner deck. The deck provides the various combining and signal conditioning functions normally associated with discrete hybrid coupler and coupler/load assemblies.

The Dual 3-Way Hybrid Combiner Deck with Isolators (shown in Figure 2) provides a combining and signal conditioning interface between several Base Radio transmit signals. Each RF Cabinet within a system uses a Dual 3-Way Combiner Deck with Isolators as the primary interface between Base Radio Tx signals and the RFDS or antennas.

The Receive Multicouplers shown in Figure 1 are used for Rx signal distribution. Corresponding to up to three Rx diversity branches, each 4-way amplifier accepts a single Rx signal which then passes through the 6-way multicoupler. The outputs of each multicoupler provides the Rx signal to the Main RF Cabinet in systems using six or less Base Radios.

The Rx Tray also contains a dual-redundant power supply, an I/O board, and a power/signal backplane ("midplane" board). The power supplies provide operating power for the Rx Tray receive multicouplers. The I/O board provides a power and alarm interconnect between various RFDS assemblies.

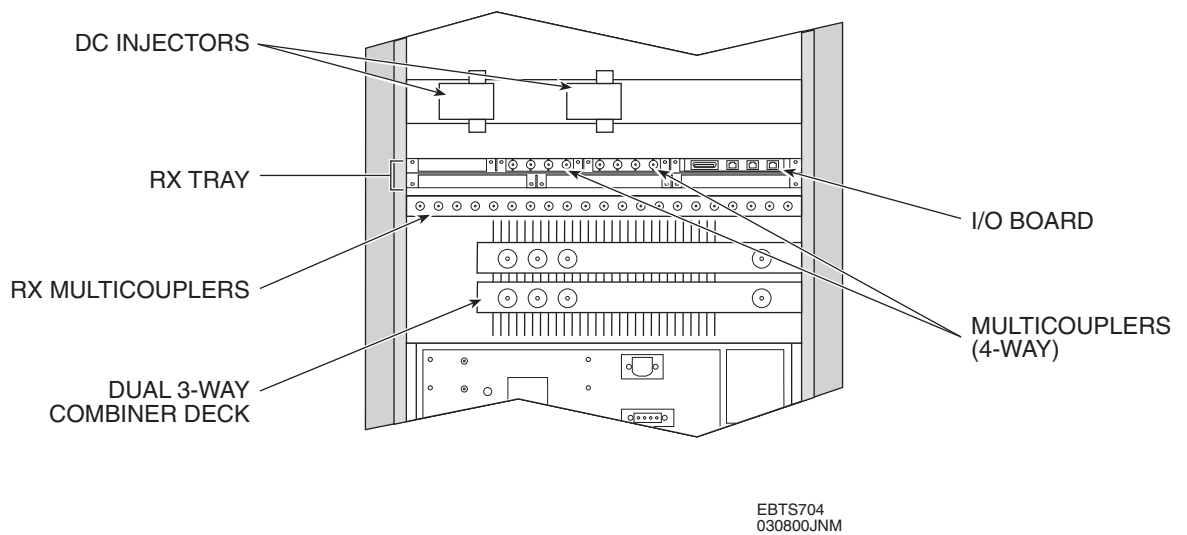


Figure 1 **1500 MHz RF Distribution System**

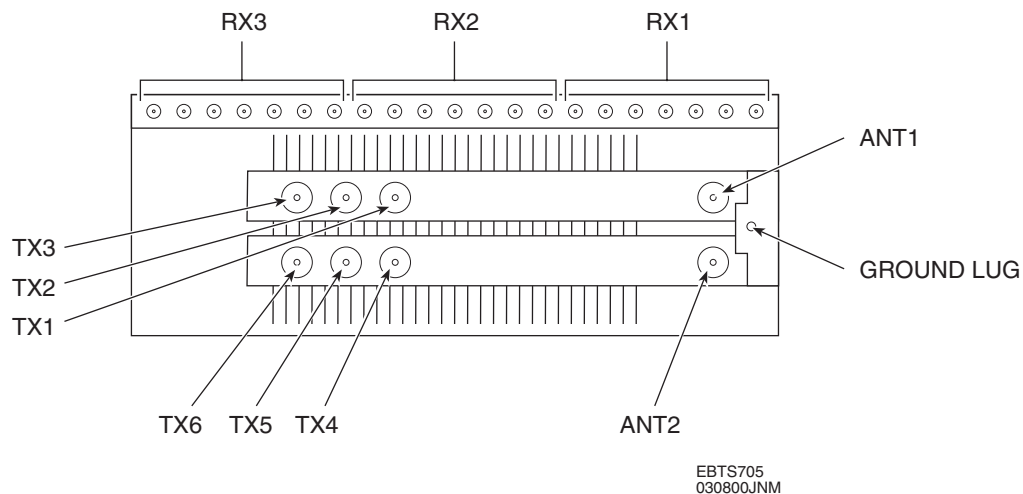
**Overview**

Figure 2 **Dual 3-Way Combiner Deck**

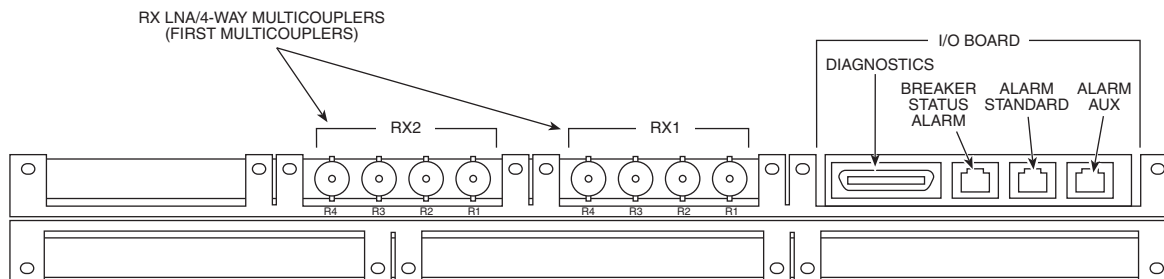


Figure 3 **Rx Tray**



## Performance Specifications

### Fuses

The duplexed RFDS contains three resettable fuses for the Receive Multicoupler modules. The fuses are accessed from the rear of the cabinet. The power supplies themselves are fused through the RFS1 and RFS2 breakers, which are part of the breaker panel assembly near the top of the RF Cabinet.

### 1500 MHz RFDS General Specifications

Table 1 lists the general specifications for the 1500 MHz RFDS.

*Table 1 1500 MHz RFDS General Specifications*

| Specification               | Value or Range                  |
|-----------------------------|---------------------------------|
| Dimensions:                 |                                 |
| Height                      | 6 EIA Rack Units (RU)           |
| Width                       | 19" (482.6 mm)                  |
| Depth                       | 18.5" (470 mm)                  |
| Storage Temperature Range   | -40° to +203° F (-40 to +95° C) |
| Operating Temperature Range | +32° to +104° F (0 to +40° C)   |
| Cooling (Combiner Decks)    | Coldplate                       |
| Frequency Range:            |                                 |
| Receive                     | 1453 to 1465 MHz                |
| Transmit                    | 1504 to 1513 MHz                |
| Tx - Rx Spacing             | 48 MHz                          |
| Channel Spacing             | 25 kHz (min.)                   |
| Port Impedance              | 50 $\Omega$ (nom.)              |
| Input Supply Voltage; RFDS  | -48 VDC (-41 VDC to -65 VDC)    |

**Performance Specifications****Antenna to Receiver Specifications**

Table 2 lists the 1500 MHz RFDS antenna port-to-receiver port specifications for a single receive branch.

*Table 2 Duplexer Antenna Port-to-Receiver Port Specifications*

| Specification                                                                   | Value or Range            |
|---------------------------------------------------------------------------------|---------------------------|
| Gain (1453 to 1465 MHz):                                                        |                           |
| $T_A = 77^\circ \text{ F } (25^\circ \text{ C})$ ambient temperature            | $9.0 \pm 0.75 \text{ dB}$ |
| $-22^\circ < T_A < 140^\circ \text{ F } (-30^\circ < T_A < 60^\circ \text{ C})$ | $9.0 \pm 1.10 \text{ dB}$ |

**Transmitter to Antenna Specifications**

Table 3 lists the 1500 MHz RFDS transmitter port-to-antenna port specifications.

*Table 3 BR Duplexer Transmitter Port-to-Antenna Port Specifications*

| Specification                    | Value or Range (dB) |
|----------------------------------|---------------------|
| Insertion Loss, 1501 to 1513 MHz | 7.0 dB*             |
| * Includes cables                |                     |

**Performance Specifications**

Tables 4 through 6 list the system specifications for systems using low-noise duplexed tower top amplifiers.

*Table 4   **Tower Top Amplifier General Specifications***

| <b>Specification</b>            | <b>Value or Range</b>            |
|---------------------------------|----------------------------------|
| Storage Temperature Range       | -40° to +203° F (-40° to +95° C) |
| Specification Temperature Range | -22° to +140° F (-30° to +60° C) |
| Port Impedance                  | 50 $\Omega$ (nom.)               |
| Input Supply Voltage            | 20 VDC $\pm$ 2 VDC               |

*Table 5   **Tower Top Amplifier Transmit Path Specifications***

| <b>Specification</b>              | <b>Value or Range</b> |
|-----------------------------------|-----------------------|
| Insertion Loss (1501 to 1513 MHz) | 1.5 dB                |

*Table 6   **Tower Top Amplifier Receive Path Specifications***

| <b>Specification</b>                                        | <b>Value or Range</b> |
|-------------------------------------------------------------|-----------------------|
| Frequency Range                                             | 1453 to 1465 MHz      |
| Gain (1453 to 1465 MHz):<br>-30° C < T <sub>A</sub> < 60° C | 15.6 dB, +1.0/-0.6 dB |
| Selectivity relative to 1455 MHz:<br>DC to 1451 MHz         | $\geq$ 25 dB          |

---

## Theory of Operation

Figures 4 through 5 show block diagrams for the baseline and expansion 1500 MHz RFDS configurations.

### 1500 MHz RFDS Basic Configuration

(See Figure 4.) The baseline configuration supports a six Base Radio (BR), triple-receive diversity system.

#### Transmit Operation

(See Figure 4.) A Dual 3-Way Combiner Deck with Isolators provides combining and isolation of multiple TX signals from the Base Radios. The deck consists of circuits which provide filtering and combining functions. The circuit cards also contain discrete isolator devices.

Base Radio 1, 2, and 3 transmit signals TX1, TX2, and TX3 are applied to the first of three inputs of the Dual 3-Way Combiner Deck. Each section of the this deck combines the two Tx inputs onto one line. The output of the hybrid coupler is then fed to the ANT 1.

Base Radio 4, 5, and 6 transmit signals TX4, TX5, and TX6 are similarly applied to the second inputs of the Dual 3-Way Combiner Deck. The combined signal is then fed to the ANT 2.

#### Receive Operation

Each receive branch of the 1500 MHz RFDS uses a Receive Multicoupler assembly consisting of a Low Noise Amplifier and a 6-way multicoupler. The Receive Multicouplers convert a single receive signal into multiple buffered receive signals. All three Rx branches function identically; therefore, only the RX1 is discussed here.

The Receive Multicoupler uses a low-noise amplifier and a six-way splitter to provide RX1 signals to the Main RF Cabinet Base Radios. The splitter takes the RX1 signal from the amp and provides six outputs (RX11 through RX16), which respectively feed the RX1 receivers in Base Radios 1 through 6.

The in-line balance attenuators between the duplexer Rx outputs and Receive Multicouplers inputs compensate for individual branch gain differences when Tower Top Amplifiers (TTAs) are used. (TTAs and associated circuitry are discussed later in this section.)

#### 1500 MHz RFDS Alarm Circuit

Two opto-isolator buffered alarm signals send alarm closure signals to the Environmental Alarm System (EAS)/iDEN Monitor Unit (iMU) : One diagnostic alarm output is provided for all of the power supplies; the other alarm is provided for all of the Multicoupler amps. The alarms operate as normally closed loops. As such, when any combination of the power supplies experiences a

failure, an alarm is generated. Similarly, the MC/Amp alarm loop is wired such that when any combination of amplifiers experiences a failure, an alarm is generated. Upon detection of an alarm condition (including cabling failure or disconnection), the respective alarm will send an alarm signal. The alarm signals are routed from the RJ45 connector on the Rx Expansion Tray I/O board to the EAS/iMU.

## Theory of Operation

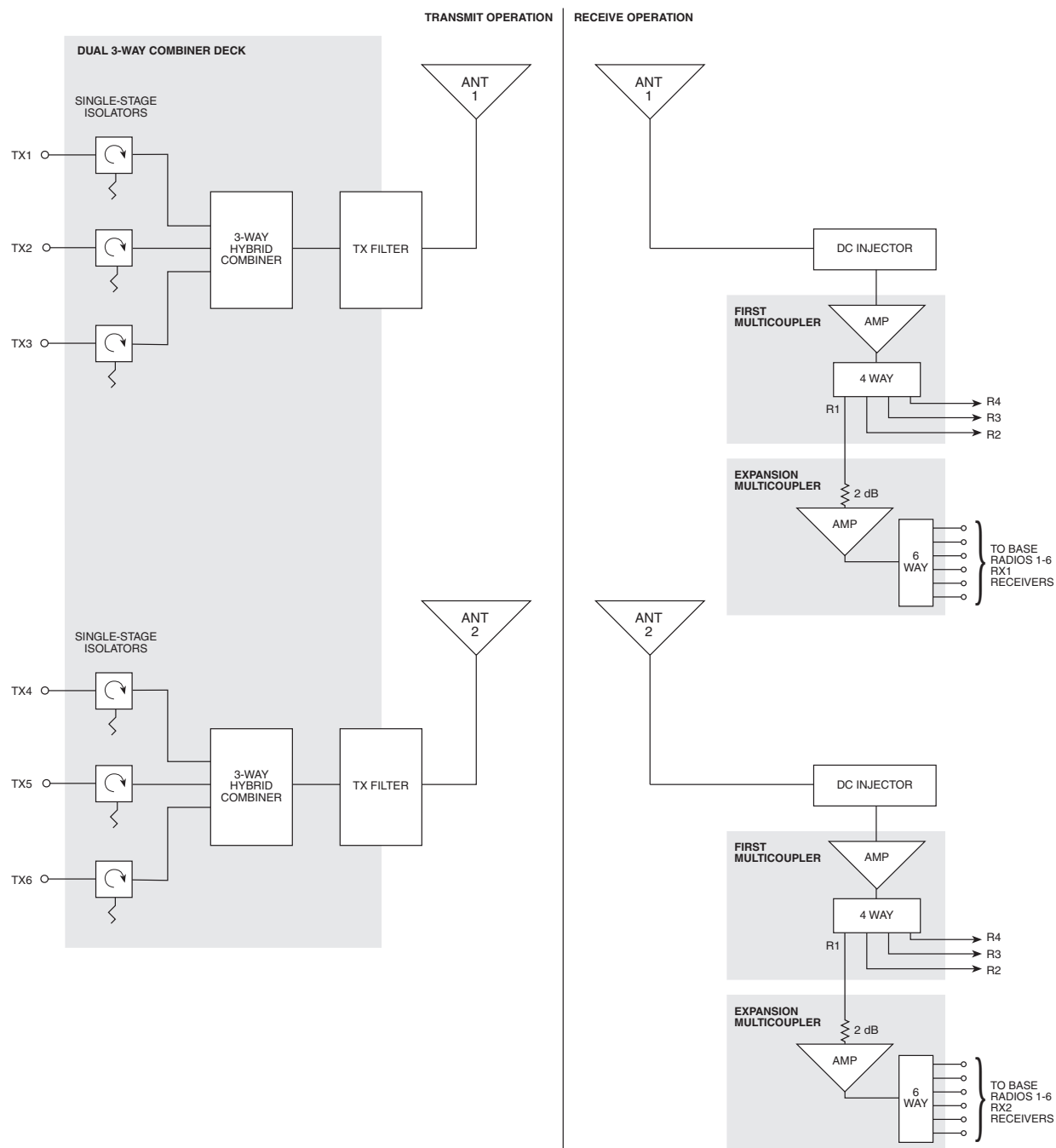
EBTS713  
022200JNM

Figure 4 1500 MHz RFDS Block Diagram (6-BR Baseline System)

## 1500 MHz Tower Top Amplifier System

Sites using the 1500 MHz RFDS are equipped with integral DC injectors. The DC injectors allow the RFDS to work with Tower Top Amplifiers (TTAs). Typically, a TTA assembly is mounted on the antenna mast structure; the assembly contains three identical subassemblies for the respective three branches of the antenna system. The TTAs augment system coverage of an EBTS by providing increased receive gain.

### Tx/Rx Signal Flow

Figure 5 shows the incorporation of the TTAs into the Tx/Rx signal flow path of a 1500 MHz RFDS. For each Tx/Rx antenna branch, a TTA is inserted into the Tx/Rx path. DC injectors receive +20V power from the RFDS power supplies. Using the DC injectors, the existing Tx/Rx coaxial cables carry the Tx/Rx signals, along with the injected +20V operating power, to the TTAs.

The tower-mounted TTA assembly consist of the following:

- ❑ Three Low-Noise Amplifiers (LNAs) which increase receive path gain
- ❑ A test port which allows calibration signal injection into the LNA input
- ❑ Three duplexing devices which isolate the LNA s from the Tx signals

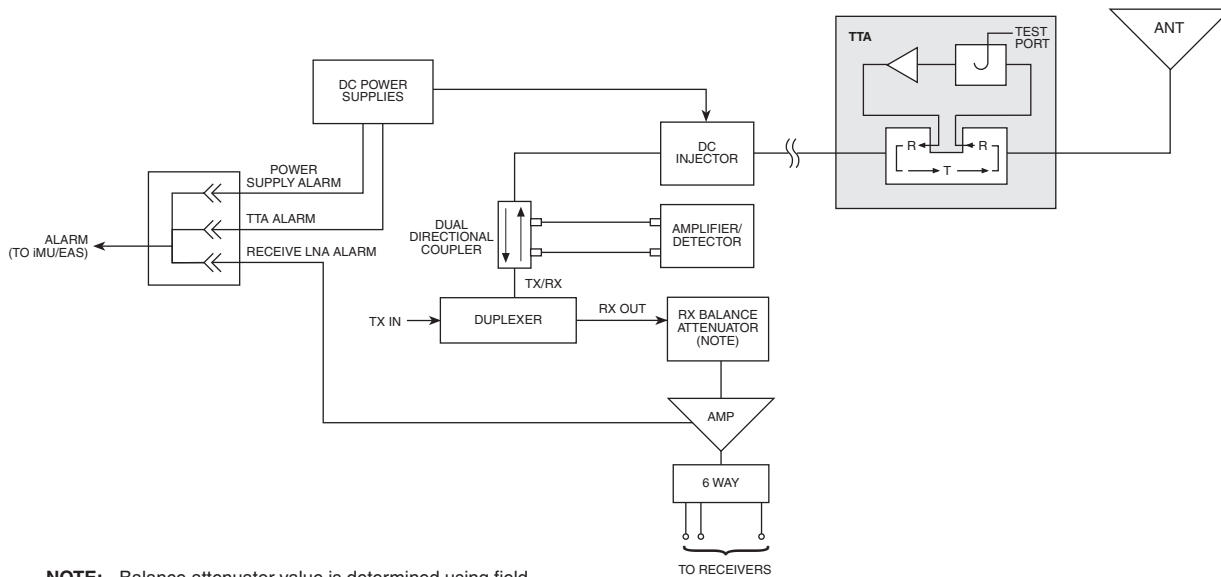
The TTA assembly contains duplexers which provide isolation of the TX and Rx signals. The Tx signal is coupled directly to the antenna. However, the Rx signal is diverted by the duplexer and then fed to an LNA before being recoupled to the main RF Tx/RX cable that connects to the RFDS. The duplexed TTA TEST PORT allows for the injection of a calibration reference signal into the receive path. The reference signal is applied to a four-way splitter; three of the splitter outputs serve as inputs to the LNAs. The reference signal is used in calculating the EBTS receive path gain.

### TTA Alarm Interface

The RFDS contains circuitry which monitors the operation of the TTAs. In the RFDS, TTA alarm circuits are wired such that when any combination of amplifiers experiences a failure, an alarm is generated. Under normal operating conditions (no alarm conditions present), the alarm outputs for all of these alarms are closed (i.e. short circuit across the terminal block connections). Upon detection of an alarm condition, the alarm outputs will open.

The alarm signal is routed from a DB-25 alarm connector on the RFDS to an RJ-48 connector on the RF cabinet junction panel. From the junction panel, the signal is connected to the Rx Expansion Tray. From the Rx Expansion Tray, the signal is connected to the Environmental Alarm System/iDEN Monitor Unit in the control cabinet.

## Theory of Operation



EBTS439  
102997JNM

Figure 5 1500 MHz TTA Block Diagram

## Power Supplies

The 1500 MHz RFDS uses the power supply system in the RX Tray. The Rx Tray uses two Power Supply boards (located in the Rx Tray) in a dual-redundant arrangement. The power supplies convert the -48 VDC (hot) site power to the +12 VDC required to power the Rx Tray 6-Way Rx Multicoupler Boards, and the fans in the Combiner Deck(s).

Each Power Supply board is equipped with a green LED indicator which indicates when the board is receiving power and properly functioning. The RFS1 and RFS2 circuit breakers on the cabinet breaker panel control the application of +48 VDC power to the A and B Power Supply boards.

## Pinouts and Wiring

The 1500 MHz RFDS contains a 25-pin ALARM/MON connector that interconnects the RFDS with other components within the RF Cabinet. Table 7 lists the pinouts for this 25-pin connector.



Table 7 **25-Pin ALARM/MON Connector Pinouts**

| Pin | Description                                                |
|-----|------------------------------------------------------------|
| 1   | PS Alarm Closure Pin #1                                    |
| 2   | GND                                                        |
| 3   | Amp Alarm Closure Pin #1                                   |
| 4   | GND                                                        |
| 5   | Antenna 1 FWD Power Monitor                                |
| 6   | Antenna 1 REF Power Monitor                                |
| 7   | GND                                                        |
| 8   | Antenna 2 FWD Power Monitor                                |
| 9   | Antenna 2 REF Power Monitor                                |
| 10  | GND                                                        |
| 11  | Antenna 3 FWD Power Monitor                                |
| 12  | Antenna 3 REF Power Monitor                                |
| 13  | Not Connected                                              |
| 14  | PS Alarm Closure Pin #2                                    |
| 15  | GND                                                        |
| 16  | Amp Alarm Closure Pin #2                                   |
| 17  | Not Connected                                              |
| 18  | GND (Power Monitor Return)                                 |
| 19  | GND (Power Monitor Return)                                 |
| 20  | GND (Power Monitor Return)                                 |
| 21  | TTA Alarm Closure Pin #1                                   |
| 22  | TTA Alarm Closure Pin #2                                   |
| 23  | 28 V Input                                                 |
| 24  | GND (28V Return)<br>(Pin Grounded at RF Distribution Unit) |
| 25  | Not Connected                                              |

**Removal/Replacement Procedures**

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## Removal/Replacement Procedures

### Replacement of FRUs

 **CAUTION**

The RFDS contains static-sensitive modules. Take precautionary measures to prevent static discharge damage when servicing the RFDS.

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Instructions are provided below for replacing FRUs within the 1500 MHz RFDS. Figure 1 identifies the 1500 MHz RFDS assemblies and FRUs. Figure 6 identifies the Rx Tray assemblies and attaching hardware.

Replace suspected FRUs with known non-defective FRUs to restore the RFDS to proper operation.

**NOTE**

In the following procedures, the term “Rx Tray” is used to equally denote either the DC & Alarm Tray or the Rx Tray. (A DC & Alarm Tray is simply a tray not equipped with receive multicoupler boards; systems not equipped for expansion use the DC & Alarm Tray instead of an Rx Tray.)

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## Hybrid Combiner Deck Replacement Procedure

The following procedure applies to all types of combiner decks. Perform the following steps to replace a Combiner Deck.

### CAUTION

Combiner deck surfaces are hot. Allow combiner deck to cool before proceeding to prevent injury.

### CAUTION

RF Energy hazard. Be sure the **dekey** command has been issued to all base radios that connect to the combiner deck to prevent injury or damage to equipment while disconnecting or connecting transmit cabling.

### NOTE

During Combiner Deck replacement the site will become inoperative.

## Removal

Remove Combiner Deck as follows:

1. Make certain the **dekey** command has been issued to all base radios that connect to the Combiner Deck being removed.
2. Tag and disconnect N-connector RF cables from Combiner Deck rear panel connectors.
3. Remove the four M6 TORX screws which secure the Combiner Deck front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
4. Tag and disconnect all SMA and BNC cables from the Combiner Deck rear panel. (Only if used)
5. Remove ground lug connection.
6. While supporting the Combiner Deck, carefully remove the Combiner Deck from the Equipment Cabinet by sliding it from the front of cabinet.

**Removal/Replacement Procedures****Installation**

Install Combiner Deck as follows:

1. While supporting the Combiner Deck, carefully lift and slide the Combiner Deck into the pre-installed side rails in the Equipment Cabinet mounting position.

(If adding a Combiner Deck, see Cabling Information subsection for Combiner Deck mounting locations.)

2. Secure the Combiner Deck to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
3. Connect ground lug connection.
4. Connect cabling to the Combiner Deck rear panel connectors as tagged during removal.

If adding the Combiner Deck, perform the required cabling in accordance with the Cabling Information subsection of this section.

5. Reactivate system as follows:
  - On an up-and-running system which was deactivated with a **dekey** command, reset the Base Radio Controller on Base Radios where the command was issued.
  - On a system that was completely shut down, perform activation in accordance with the *System Testing* section of this manual.

**Rx Tray Replacement Procedure****NOTE**

The Rx Tray removal and installation procedures are included for reference or buildout/expansion retrofit purposes only.

Field maintenance of the Rx Tray typically consists of replacement of FRUs within the tray. Perform Rx Tray FRU replacement in accordance with applicable Rx Tray FRU replacement procedure below.

**NOTE**

During Rx Tray replacement the site will become inoperative.

Perform the following steps to replace an Rx Tray.

## Removal

Remove Rx Tray as follows:

1. On Rx Tray I/O Board, disconnect the -48V input, fan power and breaker status alarm Mate-N-Lok connections. (See Figure 6 for detailed view of I/O Board connector locations.)
2. Tag and disconnect BNC connector RF cables from Rx Tray rear panel connectors.
3. Remove one nut which secures ground cable to Rx Tray. Disconnect ground cable and position aside.
4. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails.
5. While supporting the Rx Tray, carefully remove the Rx Tray from the Equipment Cabinet by sliding it from the front of cabinet.

## Installation

Install Rx Tray as follows:

1. If adding an Rx Tray, install side rails in the appropriate Rx Tray mounting position in the rack. (See Cabling Information subsection for Rx Tray mounting locations.)
2. While supporting the Rx Tray, carefully lift and slide the Rx Tray in the Equipment Cabinet mounting position.
3. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
4. On Rx Tray I/O Board, connect the -48V input, fan power and breaker status alarm Mate-N-Lok connections. (See Figure 6 for detailed view of I/O Board connector locations.)
5. Secure ground cable to Rx Tray ground stud using one nut.
6. Connect RF cabling to the Rx Tray rear panel connectors as tagged during removal.

If adding the Rx Tray, perform the required cabling in accordance with the Cabling Information subsection of this section.

**Removal/Replacement Procedures****First (4-Way) Multicoupler Board Replacement Procedure**

Perform the following steps to replace a 4-Way Multicoupler Board.

**Removal**

(See Figure 6.) Remove 4-Way Multicoupler Board as follows:

1. Tag and remove all BNC connections at the **R1** through **R4** BNC connectors on the 4-Way Multicoupler Board.
2. Remove two M3.5 TORX screws (1, Figure 6) which secure board assembly to Rx Tray chassis (one screw on each side of board). Save screws for reuse.
3. Partially draw board assembly out of Rx Tray until blindmate connector at front of board is disengaged.
4. Remove board from slot enough to gain access to input port SMA cable termination on top of board. Disconnect SMA cable (5, Figure 6) from board connector.
5. Remove board fully from Rx Tray slot.

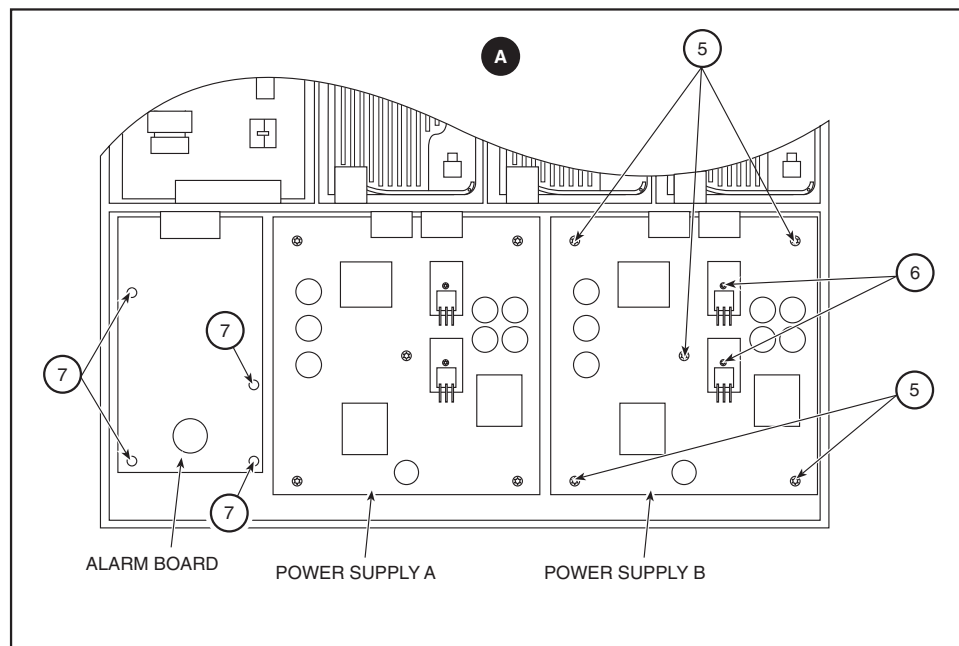
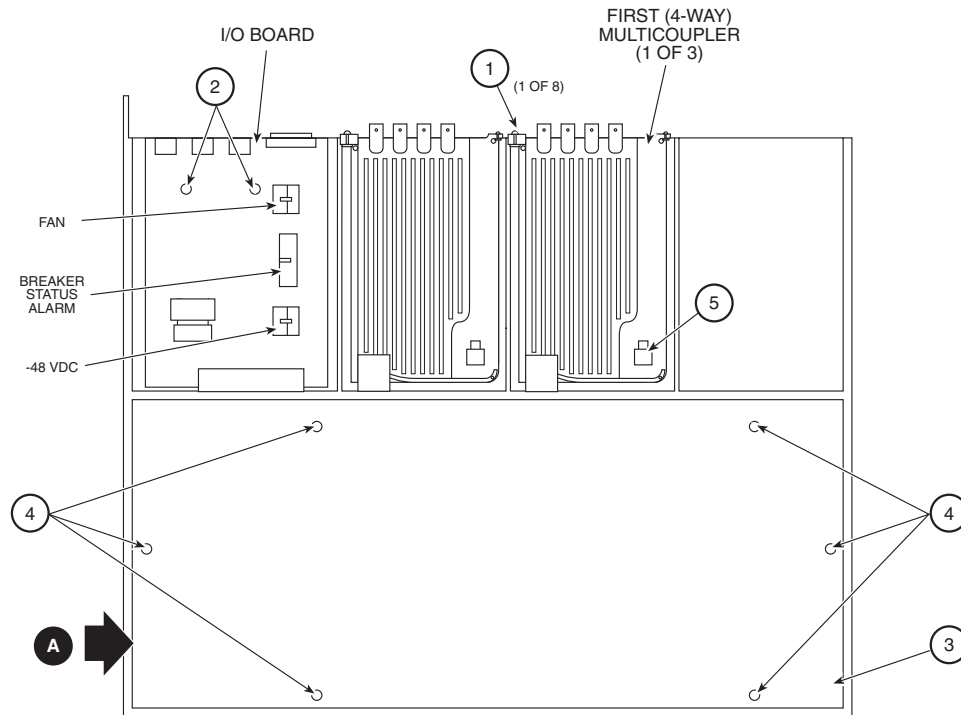
**Installation**

(See Figure 6.) Install 4-Way Multicoupler Board as follows:

1. Align 4-Way Multicoupler Board with Rx Tray board slot. Partially slide board into slot enough to allow Rx input SMA cable to mate with SMA connector on top of board.
2. Connect SMA cable to SMA connector (5, Figure 6) on top of board. Using a breaking-type 5/16" torque wrench, torque the SMA connector to 5 in-lb.
3. Carefully slide board fully into slot, making certain blindmate connection at front of board is fully mated to Rx Tray chassis midplane connector.
4. Install two M3.5 TORX screws (1, Figure 6), one on each side of assembly, (saved during removal) which secure board assembly to Rx Tray chassis.
5. Connect cabling to the **R1** through **R4** BNC connectors on the 4-Way Multicoupler Board as tagged during removal.

If adding the 4-Way Multicoupler Board, perform the required cabling in accordance with the Cabling Information subsection of this section.

## Removal/Replacement Procedures



**NOTE:** THREE EXPANSION (6-WAY) MULTICOUPLERS (NOT SHOWN) ARE LOCATED ON UNDERSIDE OF RX TRAY. ATTACHING HARDWARE AND REMOVAL/INSTALLATION IS SIMILAR TO THAT FOR FIRST (4-WAY) MULTICOUPLER.

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Figure 6 **Rx Tray FRU/Assembly Replacement**

**Removal/Replacement Procedures****I/O Board Replacement Procedure**

Perform the following steps to replace an I/O Board.

**NOTE**

During I/O Board replacement, the site will be inoperative due to loss of alarm and certain power functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

**NOTE**

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

**Removal**

(See Figure 6.) Remove I/O Board as follows:

1. Remove four M3.5 TORX screws which secure Rx Tray chassis to front panel. (Do not remove the four M6 TORX screws which secure front panel to equipment cabinet.) Save screws for reuse.
2. From rear of cabinet, carefully slide Rx Tray chassis from cabinet enough to access two M3.5 TORX screws (2, Figure 6) that secure I/O Board to Rx Tray chassis.
3. Remove two M3.5 TORX screws that secure I/O Board to Rx Tray chassis. Save screws for reuse.
4. Slide I/O Board away from Rx Tray midplane until connector at front of board is disengaged.
5. With board still connected to RJ45 alarm and Mate-N-Lok power connectors, tag wiring connections. Position board aside with all connections intact.



## Installation

(See Figure 6.) Install I/O Board as follows:

6. On each wiring harness connecting to I/O Board being replaced, proceed as follows:
  - 6.1 Carefully cut the tie-wrap which secures harness to board.
  - 6.2 Disconnect connection on board being replaced. Connect harness to replacement I/O Board noting tagged position.
  - 6.3 Secure harness to new board using tie-wrap in similar manner as done on board being replaced.
7. Place new I/O Board in mounting position.
8. Align connector at front of board with mating connector on Rx Tray chassis midplane. Gently slide board toward front of Rx Tray chassis until connectors are fully mated.
9. Secure board using two M3.5 TORX screws (2, Figure 6) saved during removal.
10. Carefully slide Rx Tray chassis toward front panel until chassis is flush with front panel. Make certain no wiring is pinched between Rx Tray chassis and front panel.
11. Start four M3.5 TORX screws that secure Rx Tray chassis to Rx Tray front panel. Tighten all four screws evenly.
12. Reactivate site via OMC.

## Power Supply Board Replacement Procedure

The Rx Tray Power Supply boards are located in the Rx Tray as shown in Figure 6. Because two Power Supply boards are used in a redundant arrangement, a defective power supply board can be replaced without taking the system out of operation.

### Removal

(See Figure 6.) Perform the following steps to determine and replace a defective Power Supply board.

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 6).
3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.

**Removal/Replacement Procedures**

4. Determine which Power Supply board has failed by observing the green LED indicator on each board. (On properly functioning supply, green LED is lit.)
5. Noting the Power Supply board that has failed, on Breaker Panel turn off power for the defective power supply as follows:

| Power Supply Board                   | Breaker Panel<br>Circuit Breaker |
|--------------------------------------|----------------------------------|
| A (left board as viewed from front)  | RFS1                             |
| B (right board as viewed from front) | RFS2                             |

6. On failed board, remove five M3.5 TORX screws (5) that secure board to Rx Tray chassis. Save screws for reuse.
7. Remove two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis. Note the plastic insulator collar used with each screw. Save screws and collars for reuse.
8. Slide board towards front of Rx Tray chassis until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

**Installation**

(See Figure 6.) Install Power Supply Board as follows:

1. Place Power Supply Board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane. Gently slide board toward rear of chassis until connectors are fully mated.
3. Start (but do not tighten) five M3.5 TORX screws (5, Figure 6) that secure board to Rx Tray chassis.

 **CAUTION**

In following step, if plastic insulator collars are not properly installed, the replacement power supply will be damaged.

4. Note the TO-220 devices (D120 and D122) on the board, each secured by a screw (6) in the device mounting tabs. Make certain that a plastic insulator collar (saved during removal) is properly installed in each mounting tab on TO-220 devices, D120 and D122.
5. Start (but do not tighten) two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis.

6. Tighten five screws (5) and two screws (6) evenly.
7. Apply power to board being replaced by resetting appropriate breaker on Breaker Panel. Verify proper operation by observing green LED indicator on board.
8. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
9. Secure cover using six M3.5 TORX screws (4).
10. Carefully slide Rx Tray fully into cabinet.
11. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).

## Alarm Board Replacement Procedure

Perform the following steps to replace an Alarm Board.

### NOTE

During Alarm Board replacement, the site will become inoperative due to loss of alarm functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

### NOTE

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

## Removal

(See Figure 6.) Remove Alarm Board as follows:

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 6).

**Removal/Replacement Procedures**

3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.
4. Remove four M3.5 TORX screws (7) that secure Alarm Board to Rx Tray chassis. Save screws for reuse.
5. Using the finger hole in the Alarm Board, place finger in hole and pull board forward until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

**Installation**

(See Figure 6.) Install Alarm Board as follows:

1. Place Alarm Board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane.
3. Using finger hole in board, gently slide board toward rear of Rx Tray chassis until connector is fully mated.
4. Secure board using four M3.5 TORX screws (7, Figure 6) saved during removal.
5. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
6. Secure cover using six M3.5 TORX screws (4) saved during removal.
7. Carefully slide Rx Tray fully into cabinet.
8. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
9. Reactivate site via OMC.

## Cabling Information

The illustrations and corresponding tables within this section identify cabling part numbers and point-to-point connections. The illustrations show the location and connections of the cables. Each cable is identified by an index number. The corresponding tables identify the point-to-point connection, function, and part number of the cables. Connections appearing in **bold** are labeled accordingly on the equipment.

The cabling diagrams included in this section are listed in the following table.

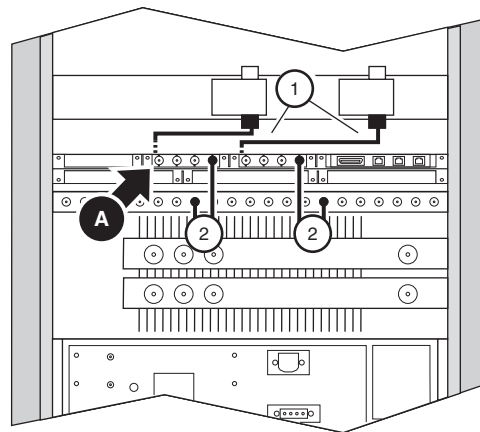
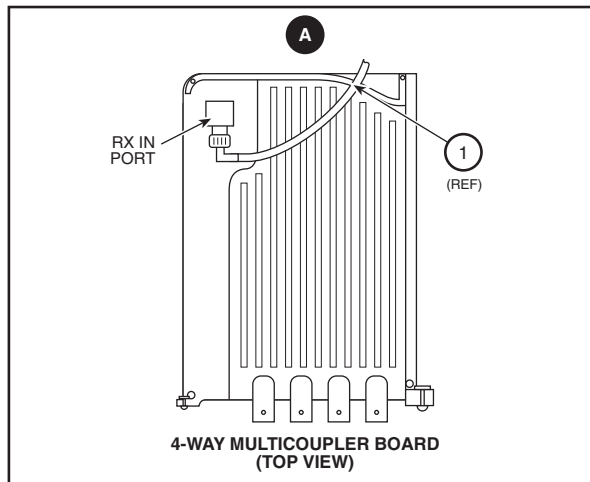
| Section                                             | Page | Description                                                                                                                                                                     |
|-----------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4-way to Hybrid Combiner Cabling                    | 26   | Provides cabling information for the receive connections between the Rx Tray and Combiner.                                                                                      |
| Receiver Cabling                                    | 28   | Provides cabling information for the Rx Tray-to-Base Radio Rx input connections. Also provides intercabinet receive cabling information on systems using expansion RF cabinets. |
| Chassis Grounding                                   | 30   | Provides cabling information for the chassis ground connections of each module                                                                                                  |
| 5 MHz/1 PPS Cabling                                 | 32   | Provides 5 MHz/1 PPS cabling information for the time frequency reference signal connections within the equipment cabinet                                                       |
| Ethernet Cabling                                    | 34   | Provides Ethernet cabling information for the Ethernet connections within the equipment cabinet                                                                                 |
| DC Power Cabling                                    | 36   | Provides power cabling information for the cabling between the Power Distribution Panel and the modules within the cabinet                                                      |
| RF Cabinet Alarm/<br>Monitor Harness<br>Connections | 38   | Provides cabinet alarm/monitor connections information for interconnection to the various cabinet modules.                                                                      |
| Transmit Power Out Cabling                          | 40   | Provides cabling information for the Base Radio transmit power out connections to the RFDS                                                                                      |

**Cabling Information****4-way to Hybrid Combiner Cabling**

The 4-way to Hybrid Combiner cabling routes the Rx output from the DC Injector to the Receive Multicouplers (and the 6-way multicouplers in multi-cabinet systems). Table 8 identifies and Figure 7 shows the 4-way to Hybrid Combiner cabling and connecting points.

*Table 8      Duplexer-To-Rx Multicoupler Cabling*

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Part Number | From                     | To                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------|--------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3012028E23  | DC Injector              | 4-way multicoupler board |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3013943C08  | 4-way multicoupler board | Hybrid Combiner          |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cabinets (regardless of ordered configuration) are equipped with full 6-BR, triple-diversity receive cabling.</li> <li>2. Attenuator value determined in field balance procedure. Refer to Tower Top Amp Receive Branch Equalization subsection for more information.</li> <li>3. Rx Tray and index no. 3 appear only on system using more than six BRs.</li> <li>4. Unused output ports on receive multicoupler assembly are terminated using 50Ω termination, P/N 0909906D01.</li> </ol> |             |                          |                          |



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Figure 7 **4-Way to Hybrid Combiner Cabling (1500 MHz RFDS Systems)**

**Cabling Information****Receiver Cabling**

Table 9 lists receiver cabling information and Figure 8 shows the receiver cabling connections for systems equipped with a 1500 MHz RFDS.

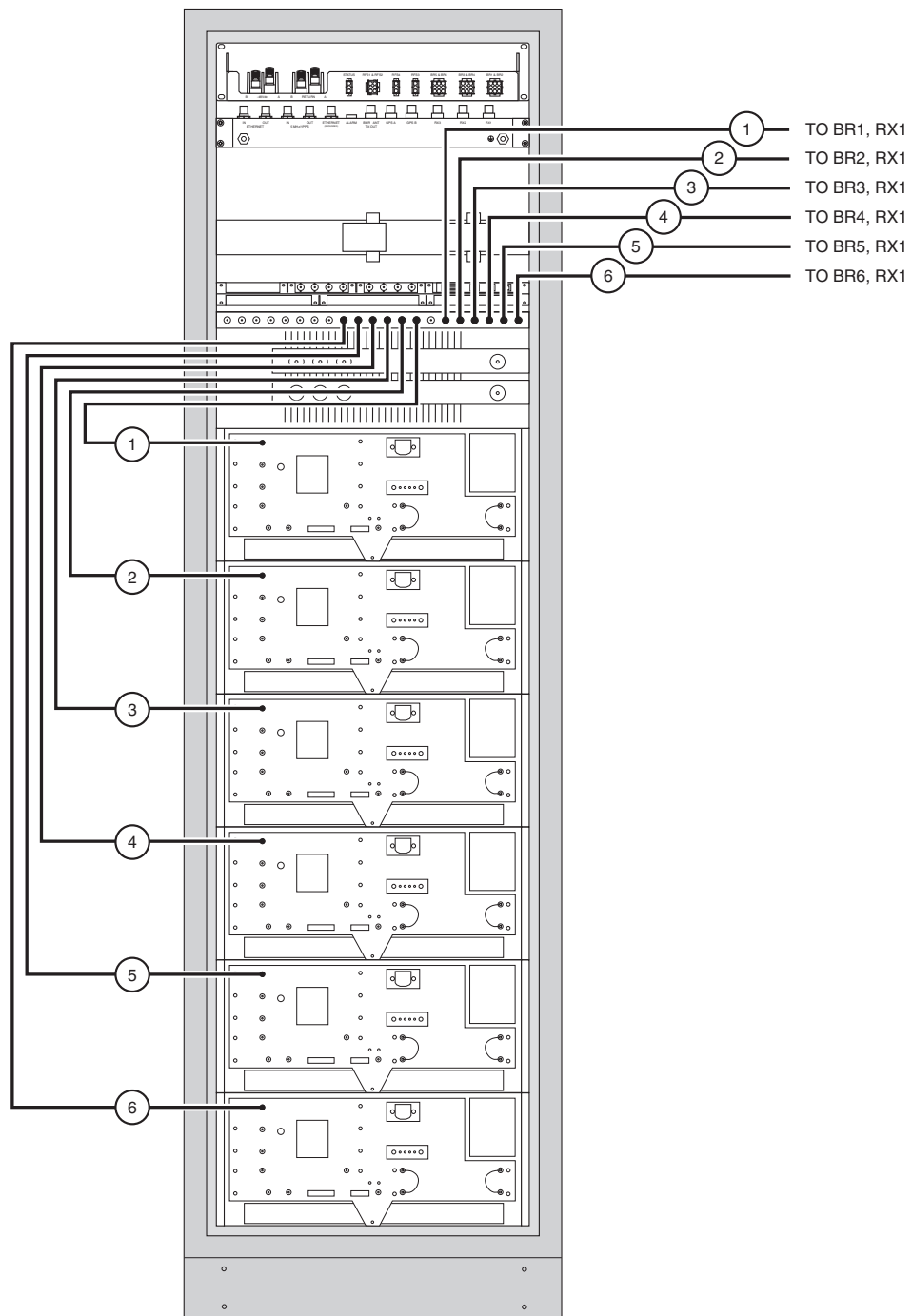
**NOTE**

Table 9 and Figure 8 apply **only** to systems using no more than six BRs.

Table 9 **Receiver Cabling (Single RF Cabinet System)**

| Index                                                                                                                          | Part Number | From:                                        | To:                 |
|--------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------|---------------------|
| 1                                                                                                                              | 3013943C28  | Output port on Receive Multicoupler assembly | RX connector on BR1 |
| 2                                                                                                                              | 3013943C28  | Output port on Receive Multicoupler assembly | RX connector on BR2 |
| 3                                                                                                                              | 3013943C33  | Output port on Receive Multicoupler assembly | RX connector on BR3 |
| 4                                                                                                                              | 3013943C33  | Output port on Receive Multicoupler assembly | RX connector on BR4 |
| 5                                                                                                                              | 3013943C38  | Output port on Receive Multicoupler assembly | RX connector on BR5 |
| 6                                                                                                                              | 3013943C38  | Output port on Receive Multicoupler assembly | RX connector on BR6 |
| <b>NOTE:</b> All cabinets (regardless of ordered configuration) are equipped with full 6-BR, triple-diversity receive cabling. |             |                                              |                     |





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Figure 8 **Receiver Cabling, Single RF Cabinet System (1500 MHz RFDS Systems)**

## Cabling Information

## Chassis Grounding

Chassis grounding refers to the ground strap connections between the equipment modules within the equipment cabinet and the cabinet frame. Chassis ground connections are a critical safety feature and provide a crucial function in the shunting away of surge energy and minimizing ground potential differences between system components in the event of a lightning strike. Chassis grounds also help prevent interference and damage to equipment in the event of a lightning strike.

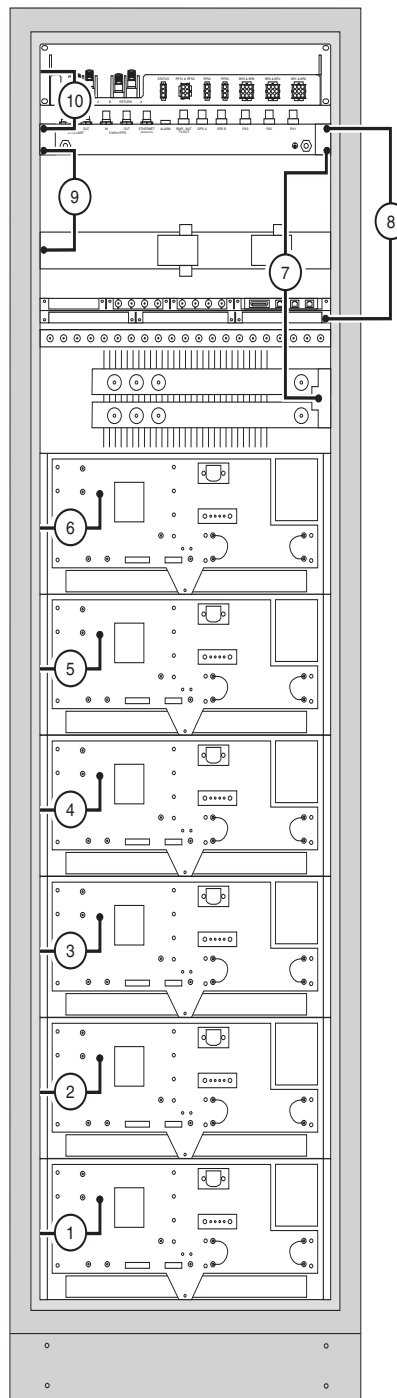
**NOTE**

Always ensure all chassis ground connections are in place and properly tightened.

Table 10 identifies and Figure 9 shows the ground straps.

Table 10 **Ground Straps**

| Index | Part Number | From                        | To                                        |
|-------|-------------|-----------------------------|-------------------------------------------|
| 1     | 3082000X04  | Ground Buss Bar             | <b>GROUND</b> ground stud on Base Radio 1 |
| 2     | 3082000X04  | Ground Buss Bar             | <b>GROUND</b> ground stud on Base Radio 2 |
| 3     | 3082000X04  | Ground Buss Bar             | <b>GROUND</b> ground stud on Base Radio 3 |
| 4     | 3082000X04  | Ground Buss Bar             | <b>GROUND</b> ground stud on Base Radio 4 |
| 5     | 3082000X04  | Ground Buss Bar             | <b>GROUND</b> ground stud on Base Radio 5 |
| 6     | 3082000X04  | Ground Buss Bar             | <b>GROUND</b> ground stud on Base Radio 6 |
| 7     | 3082000X05  | Junction panel ground screw | Ground stud on Hybrid Combiner            |
| 8     | 3082000X02  | Junction panel ground screw | Ground stud on Multicoupler Tray          |
| 9     | 3082000X02  | Junction panel ground screw | DC Injector bracket mounting screw        |
| 10    | 3082000X11  | Junction panel ground screw | Ground Buss Bar                           |



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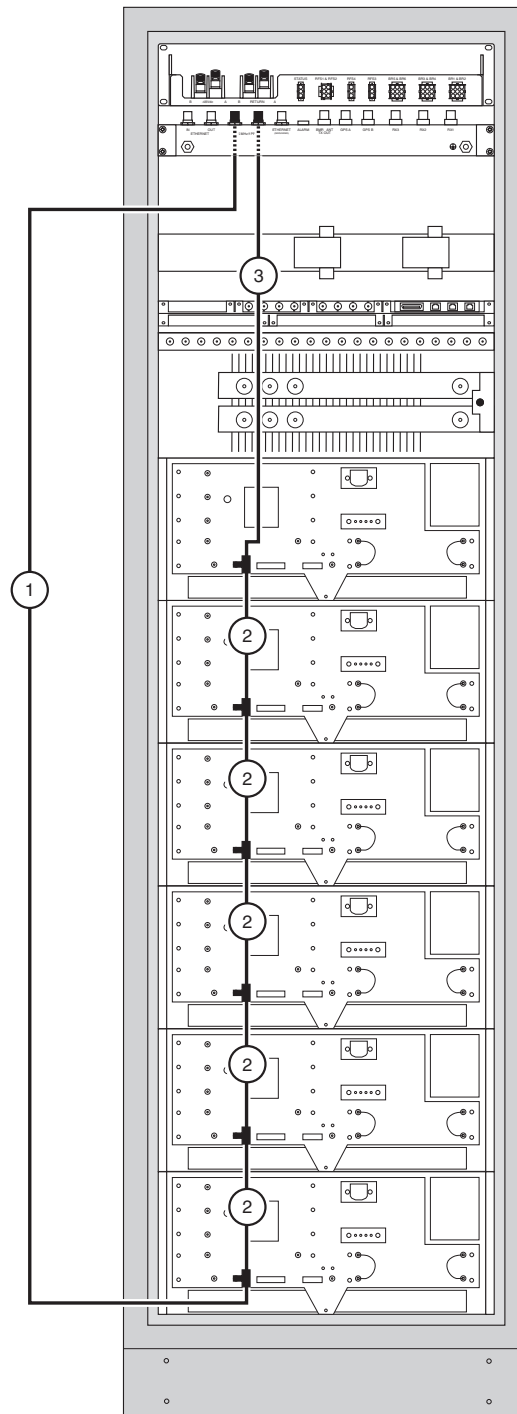
Figure 9 Chassis Grounding Diagram (1500 MHz RFDS Systems)

**Cabling Information****5 MHz/1 PPS Cabling**

5 MHz / 1 PPS cabling routes the time frequency reference signal between the Junction Panel and each Base Radio. Table 11 identifies and Figure 10 shows the 5 MHz / 1 PPS cabling.

Table 11 **5 MHz/1 PPS Cabling**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Part Number | From                                                           | To                                                                                                                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3082004X03  | Underside of <b>5 MHZ/1 PPS IN</b> connector on Junction Panel | BNC T-adapter on Base Radio 1                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3013943N19  | BNC T-adapter on Base Radio 1                                  | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3<br>BNC T-adapter on Base Radio 4<br>BNC T-adapter on Base Radio 5 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3082004X05  | BNC T-adapter on Base Radio 6                                  | Underside of <b>5 MHZ/1 PPS OUT</b> connector on Junction Panel                                                                  |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cables are connected between the BNC T-adapters (P/N 0909907D01), which are mounted to the appropriate module connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to six BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, 5 MHz/1 PPS OUT connector must be terminated with 50Ω terminator.</li> </ol> |             |                                                                |                                                                                                                                  |



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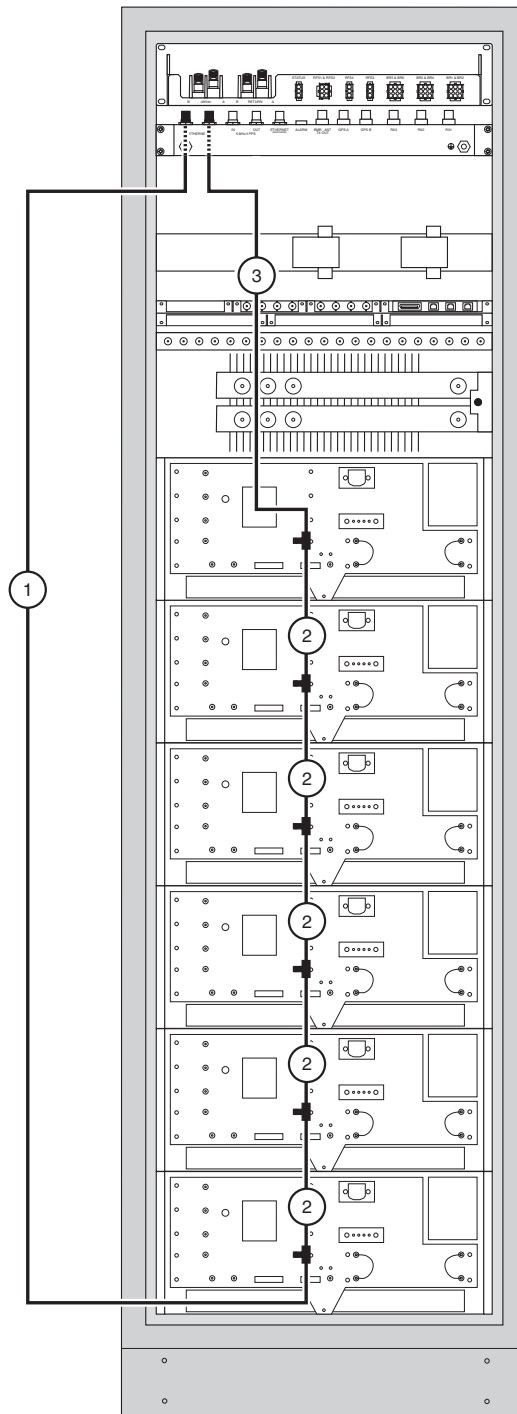
Figure 10 5 MHz/1 PPS Cabling (1500 MHz RFDS Systems)

**Cabling Information****Ethernet Cabling**

Ethernet cabling routes the Ethernet network between the Junction Panel and each Base Radio. Table 12 identifies and Figure 11 shows the Ethernet cabling.

Table 12 ***Ethernet Cabling***

| <b>Index</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Part Number</b> | <b>From</b>                                                 | <b>To</b>                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3082004X03         | Underside of <b>ETHERNET IN</b> connector on Junction Panel | BNC T-adapter on Base Radio 1                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3013943N19         | BNC T-adapter on Base Radio 1                               | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3<br>BNC T-adapter on Base Radio 4<br>BNC T-adapter on Base Radio 5 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3082004X03         | BNC T-adapter on Base Radio 6                               | Underside of <b>ETHERNET OUT</b> connector on Junction Panel                                                                     |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cables are connected between the BNC T-adapters (P/N 0909907D01), which are mounted to the appropriate module connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to six BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, ETHERNET OUT connector must be terminated with 50Ω terminator.</li> </ol> |                    |                                                             |                                                                                                                                  |



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Figure 11 **Ethernet Cabling (1500 MHz RFDS Systems)**

## Cabling Information

## DC Power Cabling

DC power connections refer to power cabling between the Equipment Cabinet Power Distribution Panel and the modules within the cabinet. Table 13 identifies and Figure 12 shows the DC power connections.

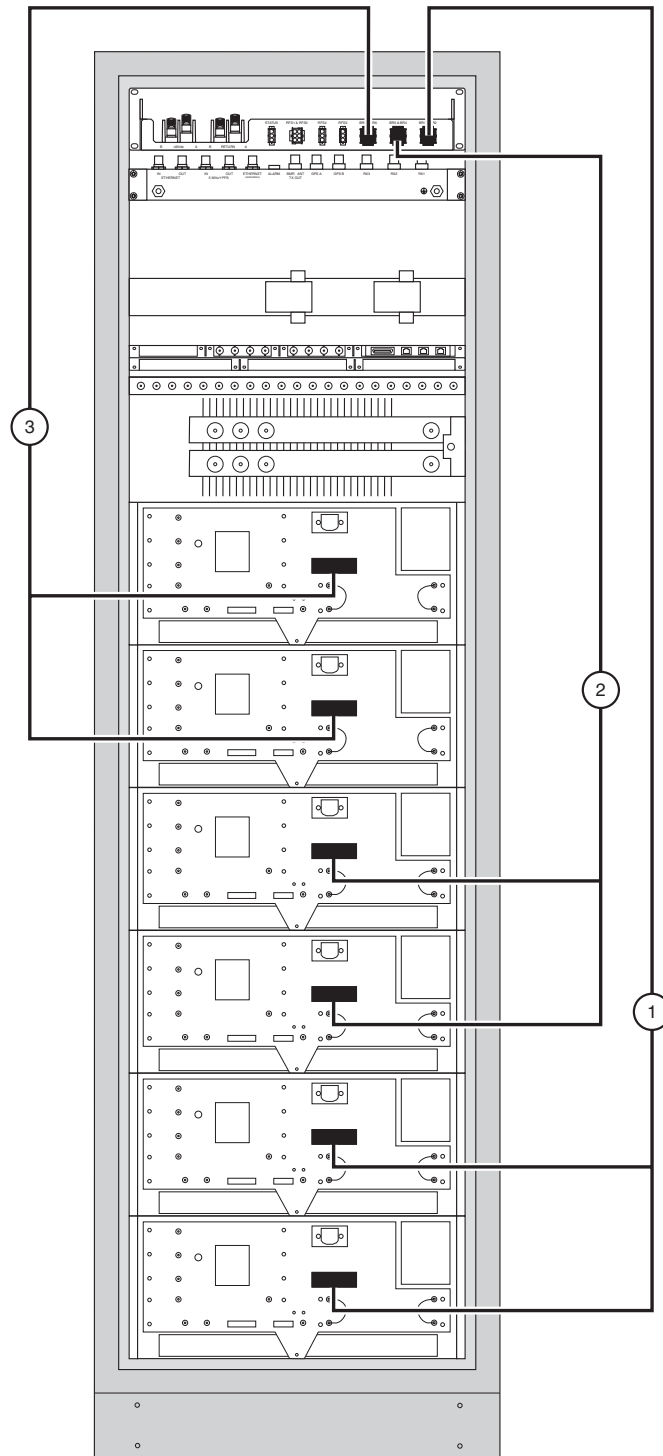
**NOTE**

Table 13 and Figure 12 represent full cabinet capacity (6 BR). Systems using less BRs have accordingly fewer connections.

Table 13 **DC Power Connections**

| Index                                                                                                                                                                                                                                                                                                                                                                                                          | Part Number | From                                                     | To                                              | Notes            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------------------|-------------------------------------------------|------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                              | 3082050X01  | <b>BR1&amp;BR2</b> connector on Power Distribution Panel | <b>DC POWER</b> connector on Base Radio 1 and 2 | Y-cable assembly |
| 2                                                                                                                                                                                                                                                                                                                                                                                                              | 3082050X01  | <b>BR3&amp;BR4</b> connector on Power Distribution Panel | <b>DC POWER</b> connector on Base Radio 3 and 4 | Y-cable assembly |
| 3                                                                                                                                                                                                                                                                                                                                                                                                              | 3082050X02  | <b>BR5&amp;BR6</b> connector on Power Distribution Panel | <b>DC POWER</b> connector on Base Radio 5 and 6 | Y-cable assembly |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cabinets (regardless of ordered configuration) are equipped with full 6-BR power cabling.</li> <li>2. Connections for BR7-BR12 in expansion RF cabinet are connected in same pattern as for BR1-BR6 in main RF cabinet.</li> <li>3. If cabinet is equipped with only one Combiner Tray, unused end of index 7 is cable-tied out of way.</li> </ol> |             |                                                          |                                                 |                  |





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Figure 12 **DC Power Cabling (1500 MHz RFDS Systems)**

**Cabling Information****RF Cabinet Alarm/Monitor Harness Connections**

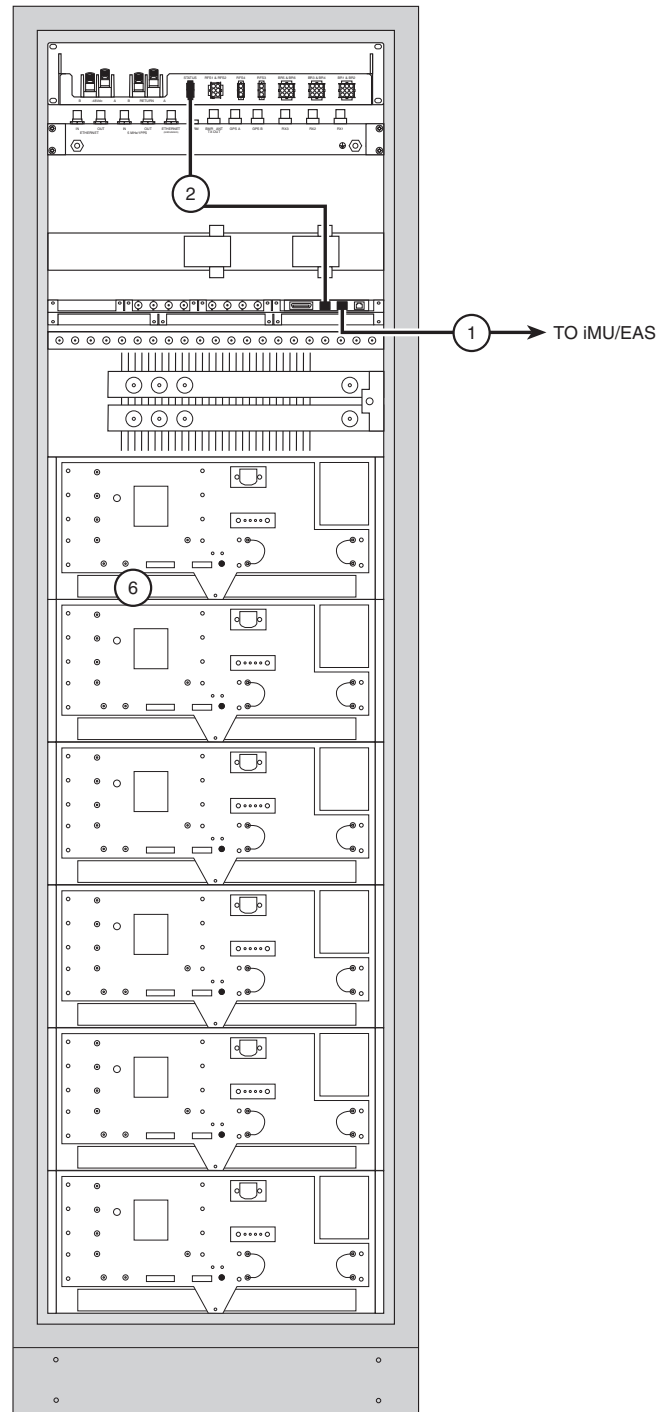
The cabinet alarm connections use a multi-connector wiring harness assembly that provides for daisy-chain connection of the various modules. Table 14 identifies and Figure 13 shows the harness connecting points.

**NOTE**

System in Table 14 and Figure 13 represents full cabinet capacity (6 BR). Systems using less BRs have accordingly fewer connections. Unused connectors are cable-tied to equipment cabinet frame.

Table 14 **Alarm/Power Monitor Harness Connections**

| Index                                                                                                                                                                                                      | Part Number | From                                          | To                                                  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------|-----------------------------------------------------|
| 1                                                                                                                                                                                                          | 3084225N28  | RJ45 <b>ALARM</b> connector on junction panel | RJ45 alarm input connector on Rx Tray I/O board     |
| 2                                                                                                                                                                                                          | 3082083X01  | Mate-N-Lok connector on index no. 1           | <b>STATUS</b> connector on Power Distribution Panel |
| <b>NOTES:</b><br>1. Base Radio 3 ALARM connection performed only on systems using seven or more Base Radios.<br>2. Base Radio 2 ALARM connection performed only on systems using four or more Base Radios. |             |                                               |                                                     |



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**Figure 13 RF Cabinet Alarm Cabling (1500 MHz RFDS Systems)**

**Cabling Information****Transmit Power Out Cabling**

Transmit power output cabling routes the Base Radio RF output to the transmit inputs on the RFDS.

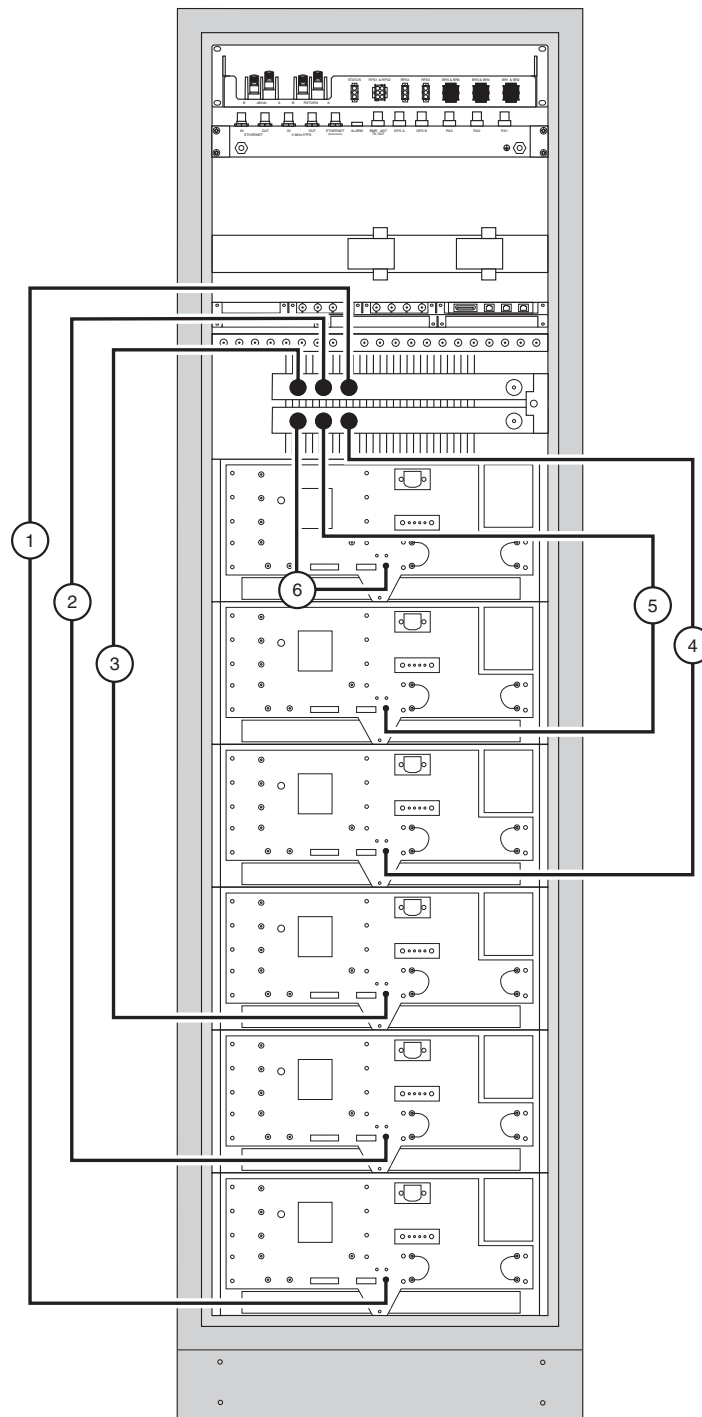
Table 15 identifies and Figure 14 shows the location and connecting points for the power out cables for main RF cabinet Base Radios 1 through 6.

**NOTE**

Refer to Receiver Cabling for receive expansion cabling information.

Table 15 **Transmit Power Out Cabling (1-6 BR)**

| Index | Part Number | From                     | To                                     |
|-------|-------------|--------------------------|----------------------------------------|
| 1     | 3082763Y01  | PA OUT connector on BR 1 | Dual 3-Way Combiner Deck TX1 (IN) port |
| 2     | 3082763Y02  | PA OUT connector on BR 2 | Dual 3-Way Combiner Deck TX2 (IN) port |
| 3     | 3082763Y02  | PA OUT connector on BR 3 | Dual 3-Way Combiner Deck TX3 (IN) port |
| 4     | 3082763Y03  | PA OUT connector on BR 4 | Dual 3-Way Combiner Deck TX4 (IN) port |
| 5     | 3082763Y03  | PA OUT connector on BR 5 | Dual 3-Way Combiner Deck TX5 (IN) port |
| 6     | 3082763Y03  | PA OUT connector on BR 6 | Dual 3-Way Combiner Deck TX6 (IN) port |



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Figure 14 1-6 BR Transmit Power Out Cabling (1500 MHz RFDS Systems)

**Tower Top Amp Receive Branch Equalization**

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## **Tower Top Amp Receive Branch Equalization**

### **Reason For Receive Branch Equalization**

The required gain of all branches of the receiver system is  $12 \text{ dB} \pm 0.5 \text{ dB}$ . This gain is measured through the receiver antenna system including the TTA and the RFDS to the receiver input port of the Base Radio. However, due to variables such as cable run length and other factors, the loss value from antenna to Base Radio Rx input cannot be assumed to be a given value.

The following procedure equalizes the system gain for all receiver branches to a specified value. In performing this procedure, the value of a required inline attenuator is calculated which balances the gain to the required  $12 \text{ dB} \pm 0.5 \text{ dB}$  value.

As shipped, each duplexer Rx output is directly cabled to its respective receive LNA input. In performing the following procedures, the inline attenuator discussed above will be inserted between the duplexer Rx output and its respective receive LNA input; this will be required for each duplexer branch.

As mentioned earlier, the value of the attenuators will be determined in the following procedures. SMA inline attenuators shall be used; these are not part of the TTA kit and are locally procured. The recommended attenuator type is as follows:

**Mini-Circuits**

**Model SAT-\_\_**

(where \_ is value in dB)

### **Equalization Methods Available**

Two methods of determining the balance attenuator value are available. Either method may be used. The two methods are as follows:

- ❑ Using the procedures in this section. These procedures are listed below.
  - Test Equipment Considerations
  - Equipment Set-up
  - Equalization Procedure

These procedures use the iDEN Analyzer as a signal source and Base Radio Received Signal Strength Indicator (RSSI) command as a precision signal strength measurement tool.

- ❑ Using the iDEN Branch Attenuator Calculator, which is a software package that runs on the service computer. The package calculates required attenuator values by determining the receive budget based on cabling run lengths.

Contact the iDEN Customer Response Center to obtain this software.

Regardless of the method used for receive equalization, install the required attenuators as described in the Inline Attenuator Installation procedure at the end of this section.

## Test Equipment Considerations

An R2600-series analyzer is used in the equalization procedure. The output level of the R2660 analyzers is specified with an output accuracy of  $\pm 2$  dB relative to the front panel reading. Since this procedure requires a precision of  $\pm 0.5$  dB, only relative measurements referenced to a normalized setting will be made using the analyzer. Therefore, it is very important to follow the procedure exactly so the equalization results are within the specified  $\pm 0.5$  dB tolerance.

### NOTE

The equalization procedure requires the R2660 analyzers. The R2600 analyzers with the iDEN modulation can also be used for the test. The same procedure is used for both instruments.

### NOTE

The iDEN 1500 MHz system uses internal DC injection at the RFDS antenna port to power the TTA. A DC block must be used when connecting a signal generator to the antenna port.

Because the DC block has an insertion loss, it must be considered in all measurements involving the R2600. Making certain that the DC block is connected to the R2600 output cable for all measurements and setups ensures that the insertion loss will be nulled (along with the connecting cable) from the measurements.

**Tower Top Amp Receive Branch Equalization****Definitions**

This paragraph defines the data required to perform the equalization procedure and associated calculations.

**Receive branch calibration data**

The tower top amplifier is equipped with a test port and is supplied with calibration data. The following calibration data is required for each receive branch:

- ☐ Antenna Port to Output Port Gain (GAO)
- ☐ Test Port to Output Port Gain (GTO)

**Analyzer cable**

The analyzer cable used with the R2660 analyzer (Figure 15) must be long enough to reach the RF cabinet junction panel. The loss of this cable is not required for the calculations. The analyzer cable is used in all of the test procedures and signal level is referenced to the end of the cable instead of to the output of the R2660 analyzer.

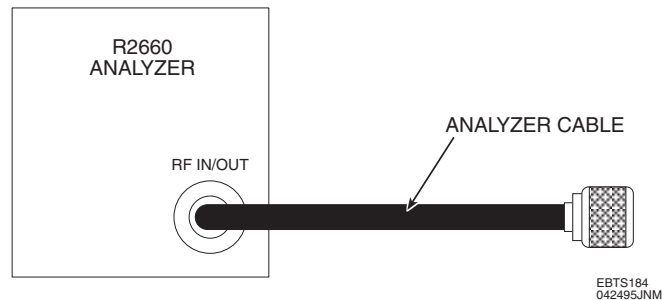


Figure 15 **R2660 Analyzer and Cable**

**Test cable**

Each site should be equipped with a Test Cable connected from an accessible area to the test port of the tower amplifiers as shown in Figure 16. This cable should be of known length and attenuation which should be supplied by the customer. If the attenuation of the cable is not available, the attenuation can be calculated given the cable length. This cable is referred to as the Test Cable, and its loss is referred to as TCL (dB). The TCL (dB) value should include the loss of the main Test Port transmission line, tower top jumper cable, tower bottom jumper cable,



**Tower Top Amp Receive Branch Equalization**

and lightning surge arrestor. All cables and jumpers shown in Figure 16 are considered part of the test cable.

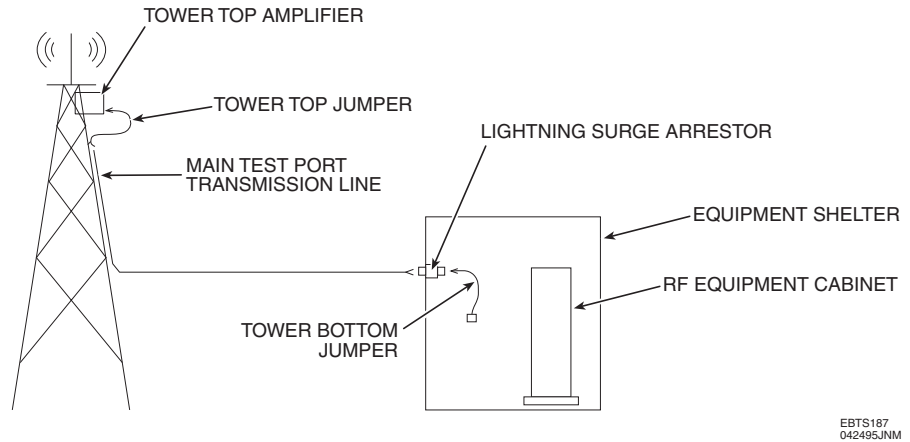


Figure 16 **EBTS Tower Top Amplifier Configuration**

### Receive antenna branch gain

GBA is the Receive Antenna Branch Gain of the RFDS. Use 9.0 dB for all entries in the procedure where GBA is requested.

## Equipment Set-up

Set up the equipment using the following procedure. Base Radio 1 will be used during the equalization procedure.

1. Connect one end of the RS-232 cable to the service computer.
2. Connect the other end of the RS-232 cable to the Status port located on the front panel of the BRC of Base Radio 1 (the bottom Base Radio in the RF Cabinet). It is important to use the bottom Base Radio.
3. Be sure the Test Cable is connected to the tower top amplifier Test Port.
4. Connect a calibrated DC block to the Analyzer output cable.
5. Connect the Analyzer Cable, along with the DC block, to the other end of the Test Cable as shown in Figure 17. All other connections remain connected. All cables and jumpers shown in Figure 17 except the analyzer cable are considered part of the test cable.

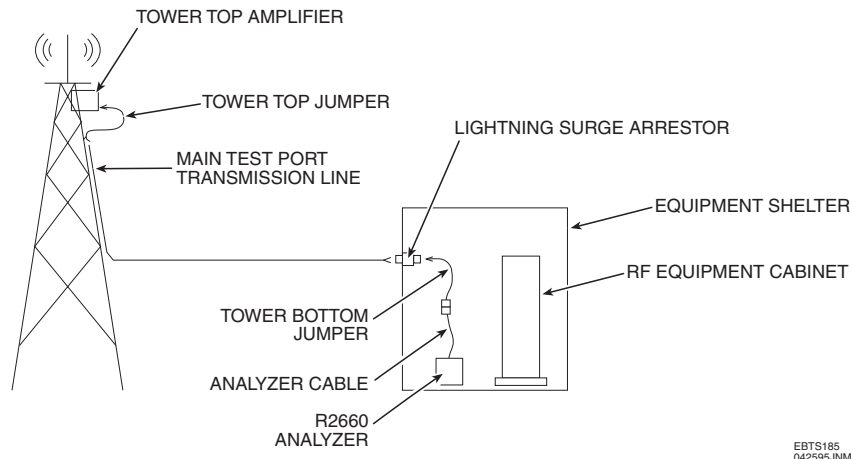
**Tower Top Amp Receive Branch Equalization**

Figure 17 **Analyzer Cable/Test Cable Connection**

6. Remove power from the R2660 and connect the Rubidium Frequency Standard 10 MHz Output to a 10 dB attenuator.
7. Connect the other end of the 10 dB attenuator to the 10 MHz Reference Oscillator In/Out connector in the R2660.
8. Set the R2660 to the EXT REF mode.
9. Apply power to the R2660 running the iDEN modulation.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

Refer to the equipment manual provided with the R2660 for further information regarding mode configuration of the unit (Motorola P/N 68P80309F16).

10. Set the R2660 to the frequency at which the tower top amplifier calibration data was taken (typically 898 MHz).
11. Set the R2660 to generate the test signal at an output level of -80 dBm.

## Equalization Procedure

Perform the following procedure to equalize the receive gain for each branch.

1. Set up the service computer to communicate to the station through the RS-232 port.
2. Log on. The default password is **motorola**.

### ▲ CAUTION

Make certain all Base Radios are dekeyed. Execute **dekey** command on service computer.

3. Set the receive frequency of the Base Radio to the frequency which the tower top amplifier calibration data was taken. This should be the same frequency that the R2660 was set during step 10 of equipment set-up.

At the prompt, type: **set rx\_freq XXX.XXXXX** to set the receive frequency.

**XXX.XXXXX** represents the desired 1500 MHz frequency.

```
set rx_freq XXX.XXXXX
set RECEIVE FREQUENCY to XXX.XXXXX MHz in RAM
```

4. At the prompt, type: **set rx\_mode 123**

This command enables all antennas / receivers in the Base Radio.

```
set rx_mode 123
set RECEIVER 1 to ENABLED in RAM
set RECEIVER 2 to ENABLED in RAM
set RECEIVER 3 to ENABLED in RAM
```

5. At the prompt, type: **set sgc off**

This command disables the software gain control routine within the Base Radio.

```
set sgc off
set SOFTWARE GAIN CONTROL to DISABLED in RAM
```

**Tower Top Amp Receive Branch Equalization**

6. At the prompt, type: **set sys\_gain on**

This command enables the system gain for proper readout of the RSSI.

```
set sys_gain on
set SOFTWARE GAIN to ENABLED in RAM
```

7. At the prompt, type: **get rssi 1 100**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

**get rssi 1 100**

Starting RSSI monitor for 1 repetitions averaged each 100 reports.

| Line | RSSI1<br>dBm | RSSI2<br>dBm | RSSI3<br>dBm | SGC<br>dB | CI<br>dBm | BER<br>dBm% | OffsetSyncMiss<br>Hz%  |
|------|--------------|--------------|--------------|-----------|-----------|-------------|------------------------|
| 1    | -101.3       | -100.9       | -102.0       | 0.0       | -100.3    | -124.70     | 0.000e+00-5.10.000e+00 |

8. Adjust the output level from the R2660 and repeat step 6 until the RSSI for receiver 1 (RSSI1) is approximately -100 dBm.

**NOTE**

Once the level of the R2660 is set in step 8, the level should **NOT** be changed again for any other receiver or any other step in the calibration procedure. This level serves as the normalized value to which other relative measurements will be referenced.

9. Log the received signal strengths for all of the receivers present (i.e. RSSI 1, RSSI 2, and RSSI 3).

These values will be referred to as #RSSI1, #RSSI2, and #RSSI3 respectively and are required in the following steps.

10. Disconnect the Analyzer Cable from the Test Cable.
11. (See Figure 18.) At the duplexer 1 antenna port, disconnect the antenna feed cable.

**NOTE**

The iDEN 1500 MHz system uses internal DC injection at the RFDS antenna port to power the TTA. A DC block must be used when connecting a signal generator to the antenna port.

12. Connect the Analyzer Cable to the duplexer antenna port just disconnected in the previous step.

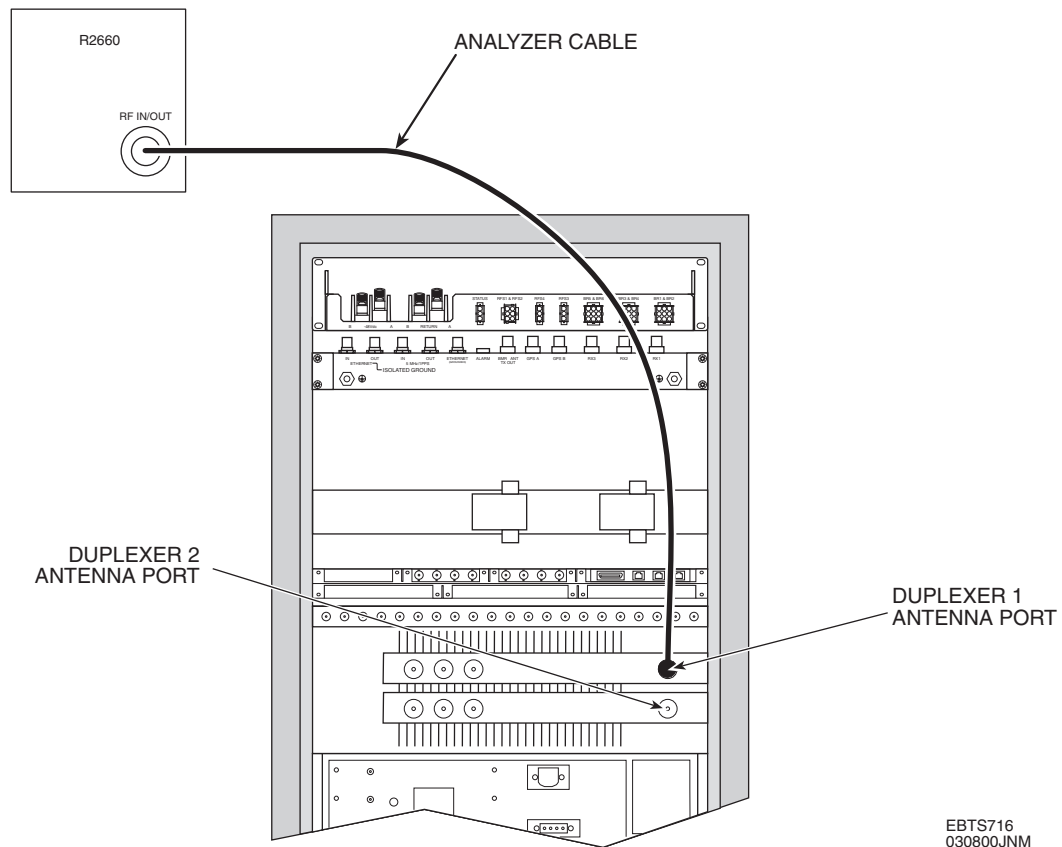


Figure 18 **Analyzer Cable to Duplexer Antenna Port Connection**

**Tower Top Amp Receive Branch Equalization****13. At the prompt, type: `get rssi 1 100`**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

**get rssi 1 100**

Starting RSSI monitor for 1 repetitions averaged each 100 reports.

| Line | RSSI1  | RSSI2  | RSSI3  | SGC  | CI     | BER     | Offset    | SyncMiss      |
|------|--------|--------|--------|------|--------|---------|-----------|---------------|
|      | dBm    | dBm    | dBm    | dB   |        | dBm     | dBm%      | Hz%           |
| ---- | -----  | -----  | -----  | ---- |        | -----   | -----     | -----         |
| 1    | -101.3 | -100.9 | -102.0 | 0.0  | -100.3 | -124.70 | 0.000e+00 | -5.10.000e+00 |

**14. Log the received signal strengths for the present receiver.**

This value will be referred to as \$RSSI1.

**15. Disconnect the Analyzer Cable from the duplexer antenna port and reconnect the antenna feed cable to the antenna port.****16. Repeat steps 11 through 15 for the antenna 2 receive path and log the received signal strength for the Rx2 path as \$RSSI2.****17. Repeat steps 11 through 15 for the antenna 3 receive path and log the received signal strength for the Rx3 path as \$RSSI3.****18. Calculate the value of the inline attenuator required to equalize each receive branch using the appropriate RSSI value for the given branch. Use the following equation to determine this value.**

$$\text{Attenuator} = (\text{GAO1-GTO}) + (\# \text{RSSI1} - \$ \text{RSSI1}) + \text{TCL} + (\text{GBA1}-0.85)-12$$

The above equation describes the attenuation required to obtain the required system path gain of 12 dB. As such, gain is represented as negative attenuation (negative numbers) and losses are represented as positive attenuation (positive numbers). In summary:

- GAO is the Antenna Port to Output Port gain in dB given on the Tower Top Amplifier (this is a positive number).
- GTO is the Test Port to Output Port gain in dB given on the Tower Top Amplifier (this is a negative number).
- #RSSI is the reading in dBm given by the station in step 9 (this is a negative number).
- \$RSSI is the reading in dBm given by the station in step 14 (this is a negative number).
- TCL is the Test Cable Loss in dB either given by the customer or calculated given the length of the cable (this number is a positive number in dB).
- GBA is the Receive Gain constant of 9.0 dB.

- 0.85 dB is the loss of the cable that connects the Rx Multicoupler (or Splitter Tray) to the receiver in Base Repeater 1.
- 12 dB is the expected gain for the entire path.

### Example

| Variable | Value      |
|----------|------------|
| GAO1     | 16.8 dB    |
| GTO      | -9.7 dB    |
| #RSSI1   | -100 dBm   |
| \$RSSI1  | -85.45 dBm |
| TCL      | -2.7 dB    |

$$\begin{aligned}
 \text{Attenuator} &= (\text{GAO1}-\text{GTO}) + (\# \text{RSSI1} - \$ \text{RSSI1}) + \text{TCL} + (\text{GBA1}-0.85)-12 \\
 &= (16.8 - (-9.7)) + (-100 - (-85.45)) + (2.7) + (9.0 - 0.85) - 12 \\
 &= (26.5) + (-14.55) + (2.7) + (8.15) - 12 \\
 &= 10.8 \text{ dB}
 \end{aligned}$$

Therefore, choose an 11 dB attenuator for path 1.

19. On Rx1 receive path, install an inline attenuator of value determined in the previous step as described in Inline Attenuator Installation procedure below.
20. Repeat the calculation for the remaining receive branches replacing the appropriate values for paths 2 and 3.
21. Using an attenuator of the value determined in step 18 for the branch being equalized, install an inline attenuator as described in Inline Attenuator Installation procedure below. This is to be done for each branch.
22. Reconnect the Analyzer Cable to the Test Cable.
23. At the prompt, type: **get rssi 1 100**

This command returns several fields that indicate the receiver performance. The data includes The Received Signal Strength Indicator (RSSI) and Bit Error Rate (BER).

#### **get rssi 1 100**

Starting RSSI monitor for 1 repetitions averaged each 100 reports.

| Line | RSSI1<br>dBm | RSSI2<br>dBm | RSSI3<br>dBm | SGC<br>dB | CI<br>dBm | BER<br>dBm% | OffsetSyncMiss<br>Hz%  |
|------|--------------|--------------|--------------|-----------|-----------|-------------|------------------------|
| 1    | -101.3       | -100.9       | -102.0       | 0.0       | -100.3    | -124.70     | 0.000e+00-5.10.000e+00 |

**Tower Top Amp Receive Branch Equalization**

24. The reported RSSI numbers for Receivers 1, 2, and 3 should all be with  $\pm 0.5$  dB of each other. If not, repeat the procedure.

**NOTE**

Once the cabinet is equalized for Base Radio 1, all the other Base Radios in the cabinet (as well as any expansion cabinets) are also equalized. No other checks or tests need to be done for the other radios.

**Inline Attenuator Installation**

Install inline attenuators as follows:

1. On side of ANT 1 duplexer, disconnect the Rx output cable from the SMA connector on duplexer side.
2. Connect inline attenuator to SMA connector on duplexer side.
3. Connect free end of cable disconnected above to inline attenuator.
4. Repeat steps 1 through 3 for each additional branch, using attenuator values determined in previous procedure.





# Single Rack, Redundant Controller GEN 4 EBTS

## Overview

This section provides technical information for the Single Rack, Redundant Controller GEN 4 800 MHz Duplexed EBTS, hereinafter called the SRRC System.

The topics of this section are listed in the following table.

| Section                                            | Page | Description                                                                                                                                              |
|----------------------------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Description                                        | 2    | Describes the SRRC system                                                                                                                                |
| SRRC General Specifications                        | 9    | Provides performance specifications for the SRRC system                                                                                                  |
| Site Control Theory Of Operation                   | 11   | Provides reference to Gen 3 SC theory of operation and descriptions                                                                                      |
| RFDS Theory of Operation                           | 12   | Provides theory of operation for the 800 MHz GEN 4 Duplexed RFDS, as used in the SRRC system                                                             |
| Removal/Replacement Procedures                     | 37   | Provides instructions for replacing SRRC components                                                                                                      |
| Field Retrofit of Duplexed TTA Interface (CLN1403) | 50   | Provides instructions for field installation to retrofit the primary cabinet with DTTA kits                                                              |
| Cabling Information                                | 55   | Provides information on how to connect all cabling required for installing and expanding the SRRC system                                                 |
| Base Radio Buildout/ RFDS Expansion                | 97   | Provides instructions on adding additional Base Radios to an existing SRRC system. Provides instructions on expanding the BR capacity of an SRRC system. |
| Duplexed TTA Receive Branch Equalization           | 101  | For systems using Duplexed TTAs, provides reference to receive branch equalization requirements and procedures.                                          |
| Five Base Radio 800 MHz QUAD (Multicarrier) SRRC   | 102  | Describes the BR SRRC system and provides details regarding the differences between the 5 BR and 4 BR systems.                                           |

**Description**

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## Description

The SRRC primary cabinet combines the Control Cabinet and RF Cabinet functions in one cabinet. As such, the SRRC consists of a single cabinet (called the SRRC primary cabinet, shown in Figure 1) which contains an 800 MHz GEN 4 Duplexed RFDS and three Base Radios (baseline), along with a redundant (dual) Gen 3 SC.

The SRRC system contains an RF Distribution System (functionally consisting of the same RFDS equipment used in a Stand-alone Control And RF Cabinet system), and a Controller subsystem (functionally consisting of the same Control Cabinet equipment used in a Stand-alone Control And RF Cabinet system). These subsystems are individually discussed below.

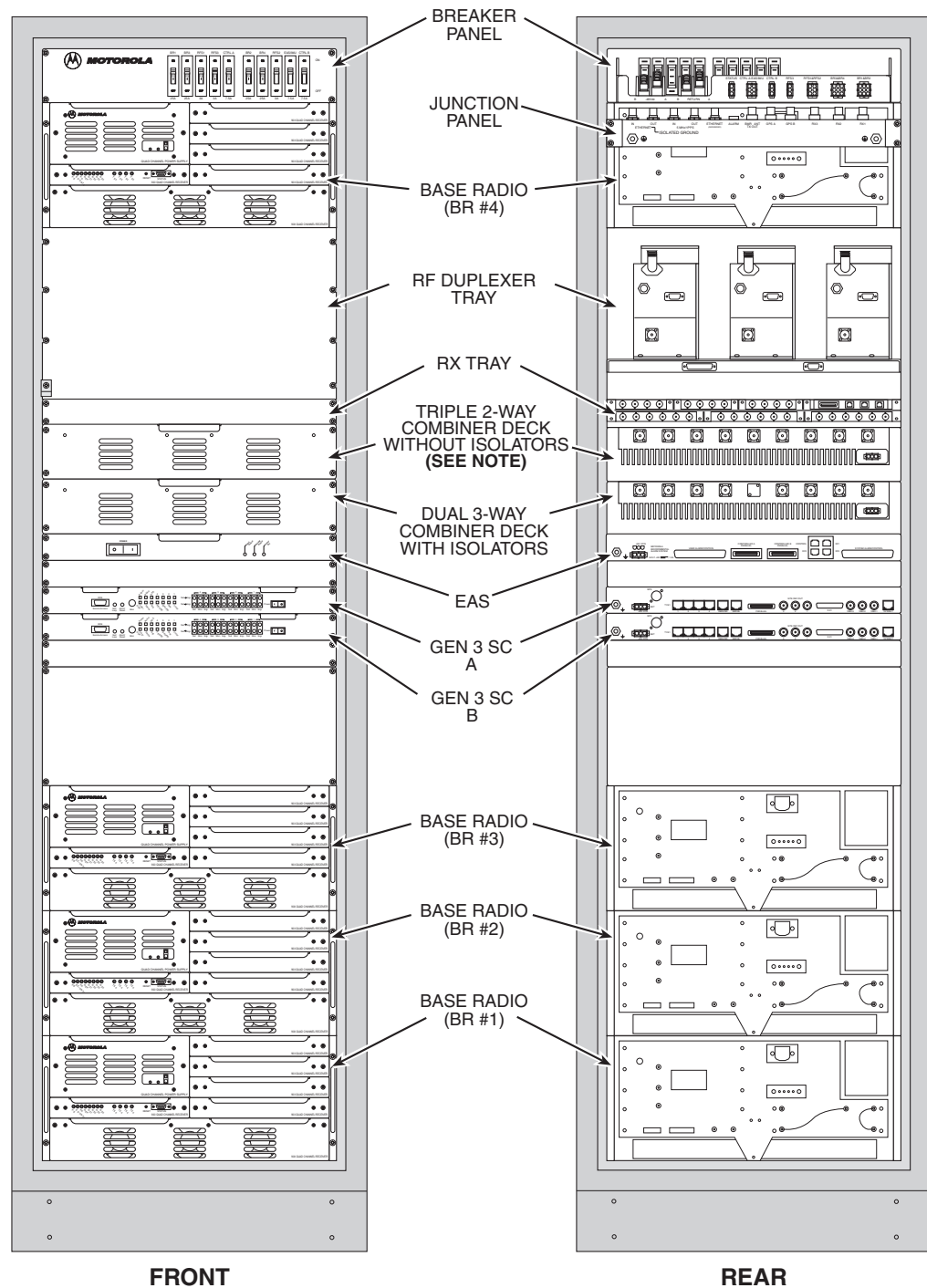
## RF Distribution System

The SRRC system uses a GEN 4 Duplexed RFDS, which is an 800 MHz duplexing/hybrid combining and receiver multicoupler system. Duplexers allow a transmit (Tx) and a receive (Rx) path to share a common antenna. Cascaded transmit combiner stages allow several transmit signals to be fed to a single duplexer/antenna. Figure 3 shows the GEN 4 Duplexed RFDS used within the SRRC system.

The baseline system is equipped with three BRs. In the baseline system, the fourth BR position (located at the top of the rack) is not installed; however, the cabinet is pre-cabled to accept a total of four BRs.

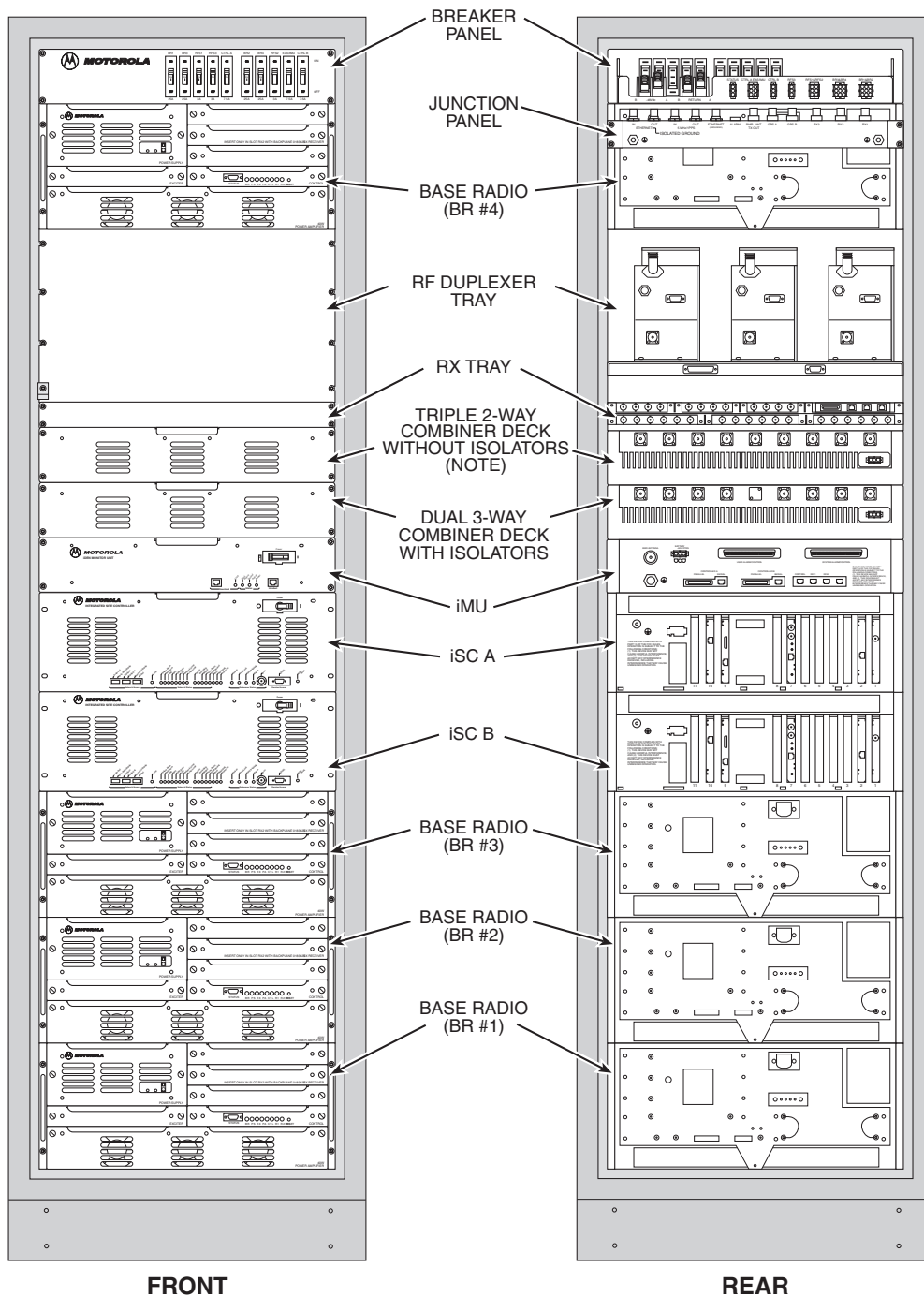
The GEN 4 Duplexed RFDS contains several Field Replaceable Units (FRUs), including:

- ❑ An Rx LNA/Multicoupler Tray (Rx Tray), consisting of the following FRUs:
  - Three First Multicoupler/Amplifier (4-Way) assemblies
  - Three Expansion Multicoupler/Amplifier (6-Way) assemblies
  - Two Power Supplies
  - Alarm Board
  - Input/Output Interface Board (I/O Board)
- ❑ A Dual 3-Way Combiner Deck with Isolators
- ❑ A Triple 2-Way Combiner Deck without Isolators (optional)
- ❑ A Tower-Top Amplifier (TTA) Alarm Tray (optional), which contains three TTA alarm interface modules

EBTS512  
082702JNM

**NOTE:** TRIPLE 2-WAY COMBINER DECK WITHOUT ISOLATORS IS ONLY REQUIRED FOR SYSTEMS WITH 10 OR MORE BASE RADIOS (OR SYSTEMS WITH FOUR BASE RADIOS IN PRIMARY CABINET (REFER TO 'RFDS THEORY OF OPERATION' FOR MORE INFORMATION.)

Figure 1 **SRRC System Primary Cabinet with Generation 3 Site Controller**

**Description**EBTS512Q  
032398LLN

**NOTE:** TRIPLE 2-WAY COMBINER DECK WITHOUT ISOLATORS IS ONLY REQUIRED FOR SYSTEMS WITH 10 OR MORE BASE RADIOS (OR SYSTEMS WITH FOUR BASE RADIOS IN PRIMARY CABINET (REFER TO 'RFDS THEORY OF OPERATION' FOR MORE INFORMATION.)

Figure 2 **SRRC System Primary Cabinet with integrated Site Controller**

The GEN 4 Duplexed RFDS employs cascaded combining in a modularized, compact design. This modularization, along with a combining scheme based around the modularization, allows expansion with a minimum amount of added components. The cascaded combining along with the compact design allows up to four Base Radios (BRs) in the SRRC primary cabinet; each standard expansion cabinet contains six BRs. This allows a maximum of 16 channels in a three-branch diversity site. (A 22-channel site is obtained using a fourth, transmit-only antenna and six additional BRs.)

The GEN 4 Duplexed RFDS accommodates expansion without using Base Radio space for expansion assemblies. Expansion is carried out progressively, with expansion first consisting of the addition of an Expansion RF Cabinet, then equipping the primary cabinet with additional expansion capability and an additional BR. Finally, more Expansion RF Cabinets are added up to the system capacity. (Expansion is explained in greater detail later in this section.)

To eliminate the retrofit of several discrete expansion hardware items, the GEN 4 Duplexed RFDS uses combiner decks. The decks provide the various combining and signal conditioning functions normally associated with discrete hybrid coupler and coupler/load assemblies.

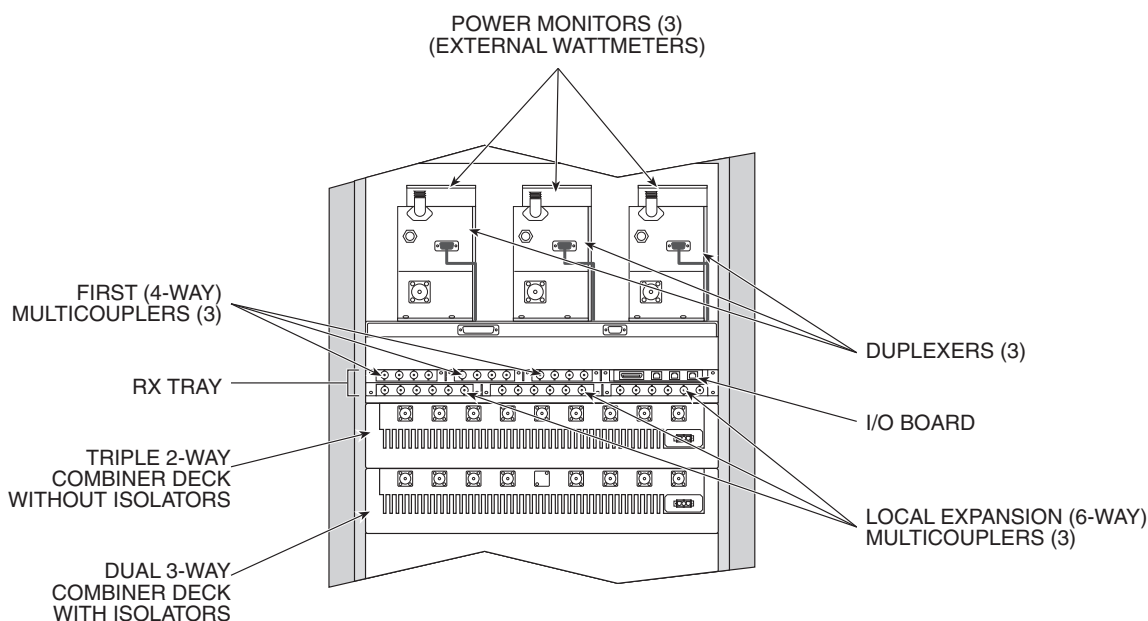
The Dual 3-Way Combiner Deck with Isolators and Triple 2-Way Combiner Deck without Isolators (shown in Figures 4 and 5, respectively) provide a combining and signal conditioning interface between the Duplexers and several Base Radio transmit signals. The SRRC primary cabinet, as well as expansion cabinets, use a Dual 3-Way Combiner Deck as the primary interface between Base Radio Tx signals and the RFDS. Where required, a Triple 2-Way Combiner Deck is used in the SRRC primary cabinet to provide cascaded combining for systems consisting of more than 9 BRs.

The decks utilize a microstrip/groundplane design to facilitate transmission line properties that provide functions such as hybrid combining and harmonic filters. Due to the compact, high-density design of the combiner decks, a coldplate and forced-air cooling is used instead of the simple radiational/convective cooling used in the other RFDSs. The coldplate is a casting with integral heat sinks which conducts heat away from the circuitry. Additionally, fans provide concentrated cooling air flow across the assembly. The fans are not thermostatically controlled and operate continuously while power is applied to the cabinet.

An Rx Tray (Figure 6) is used for Rx signal distribution. Corresponding to the three Rx diversity branches, the Rx Tray contains three First Multicouplers (MCs) and three local Expansion MCs. Each First MC contains an amplifier/4-way multicoupler that accepts a single Rx signal and provides four outputs. These outputs provide the Rx signal to the 6-Way Expansion amplifiers in the SRRC primary cabinet, and up to three expansion RF cabinets. Each Expansion MC contains an amplifier/6-way multicoupler that accepts a single Rx signal from the First MC and then provides six local outputs which are applied to up to four BRs in the SRRC primary cabinet, and six Base Radios resident within an Expansion RF Cabinet.

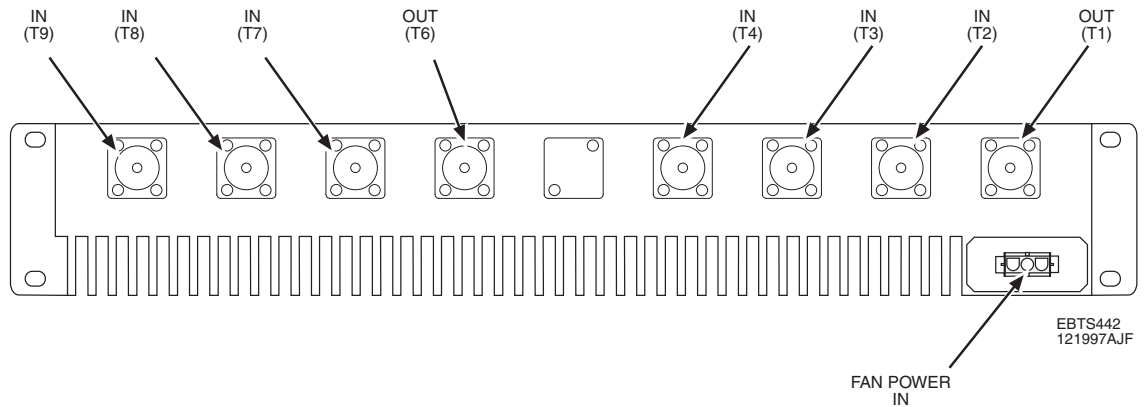
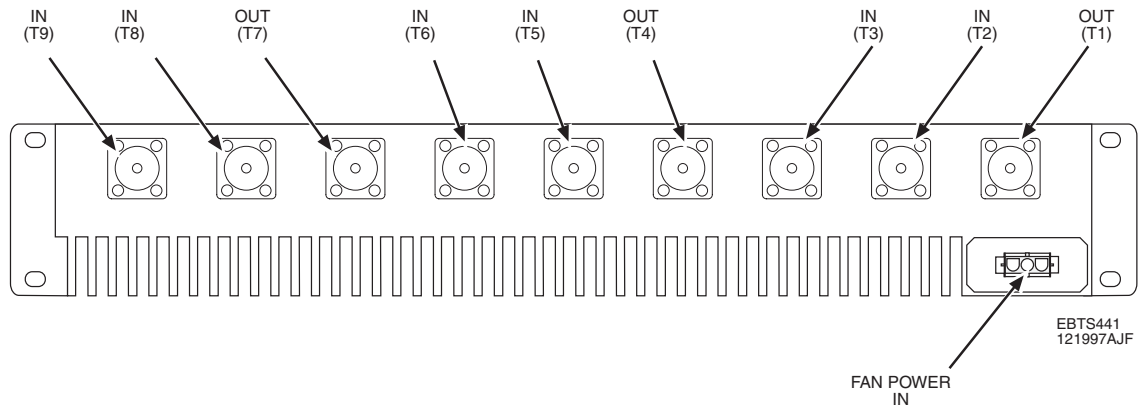
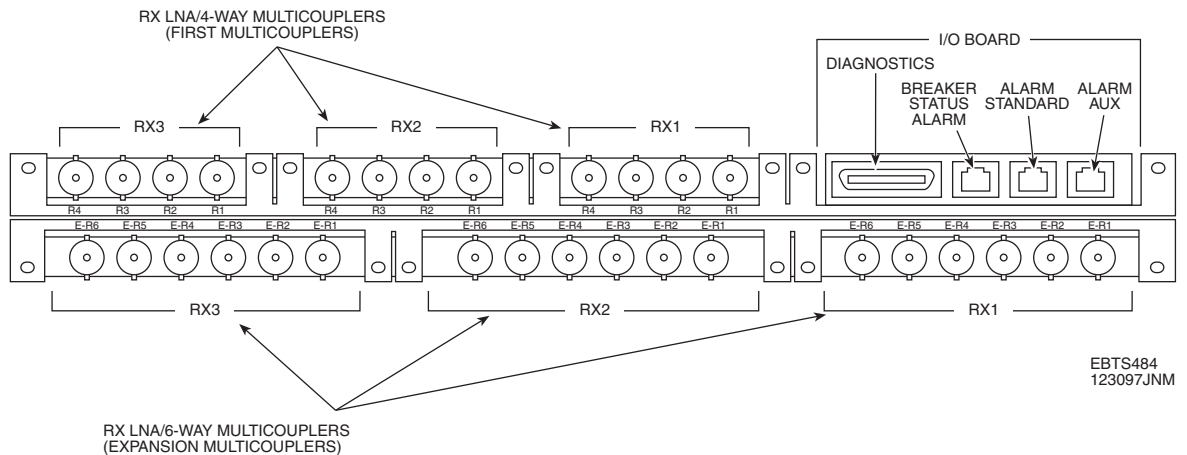
**Description**

The Rx Tray also contains a dual-redundant power supply, an I/O board, an alarm diagnostics board, and a power/signal backplane ("midplane" board). The power supplies provide operating power for the Rx Tray receive multicouplers, as well as the combiner deck fans, tower top amplifiers, and the duplexers power monitor assemblies. The I/O board provides a power and alarm interconnect between various RFDS assemblies. The alarm diagnostics board detects and routes RFDS failure status information to the Environmental Alarm System (EAS) or iDEN Monitor Unit (iMU) via the I/O board alarm interconnect.



EBTS461  
121897AJF

Figure 3 **GEN 4 Duplexed RF Distribution System**

Figure 4 **Dual 3-Way Combiner Deck**Figure 5 **Triple 2-Way Combiner Deck**Figure 6 **Rx Tray**

**Description****Controller System**

The SRRC system uses the same integrated Generation 3 Site Controller (Gen 3 SC) or integrated Site Controller (iSC) assemblies as the standard Control Cabinet used in the Stand-alone Control And RF Cabinet system. This system consists of the following:

- ❑ Two Gen 3 SCs /iSCs (one main, one redundant)
- ❑ Environmental Alarm System (EAS) or iDEN Monitor Unit (iMU)

The Gen 3 SC/iSC provides the interface between the Base Radios and the telco network, as well as providing a common interface point for all system alarms.

Refer to the Gen 3 SC or iSC Supplement of this manual for more information on the applicable Controller.

**Generation 3 Site Controller  
System Manual 68P80801E30**

**integrated Site Controller  
System Manual 68P81098E05**



## SRRC General Specifications

### SRRC RFDS Specifications

#### GEN 4 Duplexed RFDS General Specifications

Table 1 lists the general specifications for the GEN 4 Duplexed RFDS.

*Table 1 GEN 4 Duplexed RFDS General Specifications*

| Specification                           | Value or Range                               |
|-----------------------------------------|----------------------------------------------|
| Rack Space Requirement                  | 6 EIA Rack Units (RU)                        |
| Storage Temperature Range               | -40° to +203° F (-40 to +95° C)              |
| Operating Temperature Range             | +32° to +104° F (0 to +40° C)                |
| Cooling (Combiner Decks)                | Coldplate with continuous forced-air cooling |
| Frequency Range:<br>Receive<br>Transmit | 806 to 821 MHz<br>851 to 866 MHz             |
| Tx - Rx Spacing                         | 45 MHz                                       |
| Channel Spacing                         | 25 kHz (min.)                                |
| Port Impedance                          | 50 $\Omega$ (nom.)                           |
| Input Supply Voltage; RFDS              | -48 VDC (-41 VDC to -65 VDC)                 |
| Input Current; RFDS                     | 2.25 A (steady-state max.)                   |
| Input Supply Voltage; Fan Array         | 12 VDC                                       |

#### Antenna to Receiver Specifications

Table 2 lists the GEN 4 Duplexed RFDS antenna port-to-receiver port specifications for a single receive branch.

*Table 2 Duplexer Antenna Port-to-Receiver Port Specifications*

| Specification                                                                                  | Value or Range |
|------------------------------------------------------------------------------------------------|----------------|
| Gain (806 to 821 MHz):<br>$T_A = 77^\circ \text{ F } (25^\circ \text{ C})$ ambient temperature | 10.0 dB        |

**SRRC General Specifications****Transmitter to Antenna Specifications**

Table 3 lists the GEN 4 Duplexed RFDS transmitter port-to-antenna port specifications.

*Table 3 Duplexer Transmitter Port-to-Antenna Port Specifications*

| Specification                                                                                                           | Value or Range |         |
|-------------------------------------------------------------------------------------------------------------------------|----------------|---------|
|                                                                                                                         | Maximum        | Typical |
| Insertion Loss; Passband*                                                                                               |                |         |
| 9-BR (3-way hybrid combining)                                                                                           | 8.5 dB         | 7.5 dB  |
| 16-BR (6-way hybrid combining)                                                                                          | 12.5 dB        | 11.0 dB |
| * Includes combiner and associated cabling losses over 854-866 MHz range. (Losses are higher in the 851-854 MHz range.) |                |         |

**SRRC Gen 3 SC/iSC Specifications**

For Gen 3 SC controllers, refer to Supplement 68P80801E30 to this manual for specifications.

For iSC controllers, refer to Supplement 68P1098E05 to this manual for specifications.

---

## Site Control Theory Of Operation

The Gen 3 SC/iSC assigns available frequencies and time slots to the mobiles. It also links the EBTS Base Radios to the T1/E1 lines. Alarm monitoring functions are provided by the Environmental Alarm System (which is a functional part of the Gen 3 SC) or the iDEN Monitor Unit (iMU) which mates with the iSC. The SRRC uses a redundant controller arrangement. As such, the SRRC Gen 3 SC/iSC consists of the following:

- ☐ Two Controllers (one main, one redundant)
- ☐ One Environmental Alarm System (EAS) or iDEN Monitor Unit (iMU)

Refer to the Gen 3 SC supplement to this manual for more information on the Gen 3 SC.

**Generation 3 Site Controller  
System Manual 68P80801E30**

Refer to iSC supplement to this manual for more information on the iSC.

**integrated Site Controller  
System Manual 68P81098E05**

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## RFDS Theory of Operation

Figures 7 and 8 are block diagrams for the GEN 4 Duplexed RFDS configurations used within the SRRC system.

### GEN 4 Duplexed RFDS Baseline Configuration

(See Figure 7.) The baseline configuration consists of a three Base Radio (BR), triple-receive diversity system located in the SRRC primary cabinet. Without additional RFDS assemblies, the SRRC primary cabinet can directly accommodate nine Base Radios with the addition of an Expansion RF Cabinet. All configurations build off of the baseline configuration. Therefore, the following applies to all configurations, except where noted.

#### Duplexer Operation

Three Duplexers accommodate three Transmit/Receive (Tx/Rx) antennas, ANT 1 through ANT 3. Each Duplexer is tuned to accept a transmit input (TX IN 1 through TX IN 3) in the 851-866 MHz range. (For transmit operation in the baseline configuration, only the ANT 1 Duplexer is used.)

The respective Rx outputs furnished by the three Duplexers (RX OUT 1 through RX OUT 3) provide triple-diversity Rx signals for individual Base Radio receivers operating in the 806 - 821 MHz range. The RX OUT1 through RX OUT3 signals are applied to the Base Radio receivers through multicouplers, which are discussed later.

#### Transmit Operation

A Dual 3-Way Combiner Deck provides combining and isolation of multiple TX signals from the Base Radios. The deck consists of two microstrip/groundplane printed circuits which provide filtering and combining functions. The circuit cards also contain discrete isolator devices.

Base Radios 1 through 3 transmit signals TX1 through TX3 are applied to one of two sections of the Dual 3-Way Combiner Deck in the primary cabinet. Each section of the deck combines three Tx inputs onto one line. Tx signals TX1 through TX3 are each applied through a single-stage isolator. From the isolators, the signals are passed through harmonic filters and then combined by a Wilkinson three-input coupler. The output of the Wilkinson coupler is then fed to the ANT 1 Duplexer TX input.

Harmonic filters are used in each Tx signal path to prevent undesired intermodulation products due to simultaneous Tx signals.

## Receive Operation

Each receive branch of the GEN 4 Duplexed RFDS uses a First Multicoupler (First MC) and a local Expansion MC. Both splitters each use a Multicoupler/Amplifier (MC/Amp) which converts a single receive signal into multiple buffered receive signals. All three Rx branches function identically; therefore, only the RX1 is discussed here.

The First MC consists of a low-noise amplifier and a four-way multicoupler (splitter). The First MC takes the RX OUT signal from the ANT 1 Duplexer and provides four outputs. Three outputs (R2 through R4) respectively provide RX1 signal feeds for up to three expansion cabinets. The remaining output (R1) feeds the local Expansion MC through a 2-dB inline attenuator. The 2-dB inline attenuator balances the SRRC primary cabinet Rx path with that of the higher-loss expansion Rx paths. (This loss is due to the relatively long feed cables that connect the Rx signals to the expansion cabinets.)

### NOTE

On systems using local Expansion (6-Way) Multicoupler with board kit CTF6140B (and later), an external attenuator is not required since the attenuator is built-in to the board design. In addition, the attenuator is automatically activated when a First (4-Way) Multicoupler is present, and deactivated when a First (4-Way) Multicoupler is not present.

The local Expansion MC uses a low-noise amplifier and a six-way splitter to provide RX1 signals to the SRRC primary cabinet Base Radios. The splitter takes the RX1 signal from the First MC and provides six Expansion Receive outputs (E-R1 through E-R6). The E-R1 through E-R6 outputs provide receive signals for the RX1 receivers of SRRC primary cabinet Base Radios 1 through 3. (In the baseline configuration, E-R4 through E-R6 are not used; these ports are terminated with 50Ω loads, P/N 0909906D01.)

Although the baseline system combines the Tx signals onto only the ANT 1 Duplexer/antenna, the three Tx/Rx antennas (along with the Rx circuitry shown in Figure 7) provide triple-diversity receive for all configurations.

## Power Monitoring

A dual-directional coupler is installed on each Duplexer antenna port. The couplers are in-line and provide forward and reflected RF signal samples. These signal samples are fed to power monitors that, in turn, read the forward and reflected power readings from the antenna.

## RFDS Theory of Operation

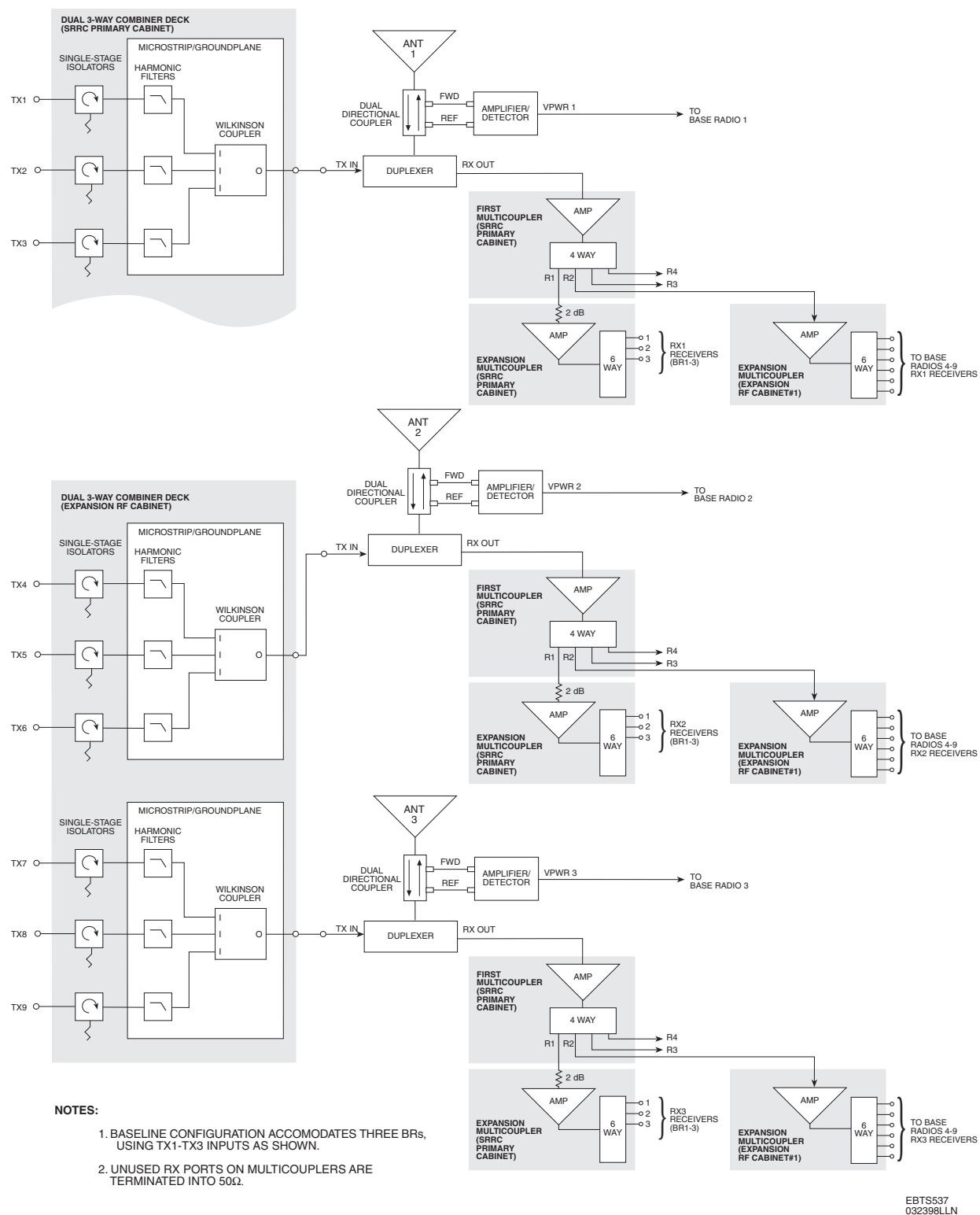


Figure 7 1-9 BR SRRC GEN 4 Duplexed RFDS Block Diagram

The power monitors measure the power readings by converting forward-power signal sample FWD and reflected-power signal sample REF into DC voltages. These DC voltages (VPWR1 through VPWR3) are proportional to the forward and reflected power readings. VPWR1 through VPWR3 are sent to Base Radios 1 through 3, respectively, where they are used to determine the forward and reflected power readings. They are also used to calculate the VSWR at a particular antenna port.

**NOTE**

It should be noted that even though Base Radios 2 and 3 are both transmitting over antenna 1, these Base Radios are in fact actually monitoring antennas 2 and 3 via the Base Radio 2 VPWR2 interface to duplexer 2, and the Base Radio 3 VPWR3 interface to duplexer 3.

As such, on systems where no transmit signals are applied to duplexer 2 and/or 3, these monitor connections would provide false alarm indications. Therefore, in such cases the power monitor cables connected to the corresponding Base Radio(s) must be disconnected from the Base Radio's ALARM connector.

**GEN 4 Duplexed RFDS Alarm Circuit**

Two opto-isolator outputs send alarm closure signals to the Environmental Alarm System (EAS) or iDEN Monitor Unit (iMU): One diagnostic alarm output is provided for both of the power supplies; the other alarm is provided for each of the MC/Amps in both the First MCs and local Expansion MCs. The alarms operate as normally closed loops. As such, when either (or both) of the power supplies experiences a failure, an alarm is generated. Similarly, when any combination of amplifiers experiences a failure, an alarm is generated. Upon detection of an alarm condition, the respective alarm will open to generate an alarm signal. The alarm signals are routed to the EAS/iMU by way of the Alarm output telco connector on the Rx Tray I/O board.

**SRRC Expansion Configurations**

System expansion is organized into four different levels of total BR count, as follows:

- ☐ 1-9 BR System Expansion
- ☐ 1-10 BR System Expansion
- ☐ 1-16 BR System Expansion
- ☐ 17-22 BR System Expansion

**RFDS Theory of Operation**

The SRRC system utilizes an expansion philosophy basically described in the following progression:

- ❑ First expansion (1-9 BR): Provides expansion with no modifications to SRRC primary cabinet. Expansion performed through expansion cabinet and simple field cabling.
- ❑ Second expansion (1-10 BR): Provides additional expansion capabilities utilizing cascaded combining. Requires retrofit of primary cabinet with additional Combiner Deck and RFDS cabling. Supports nine expansion cabinet BRs, while supporting three baseline primary cabinet BRs and another added BR in primary cabinet.
- ❑ Third expansion (1-16 BR): With expansion capability availed by second level, an additional expansion cabinet is added to expand to an additional six BRs.
- ❑ Fourth expansion (17-22 BR): This expansion utilizes a fourth TX branch, totally separate of the TX combining discussed above. However, this configuration does interface with the triple diversity RX system of the configurations discussed above.

Intermediate levels of expansion are feasible between any of the levels stated above.

**Receive Expansion**

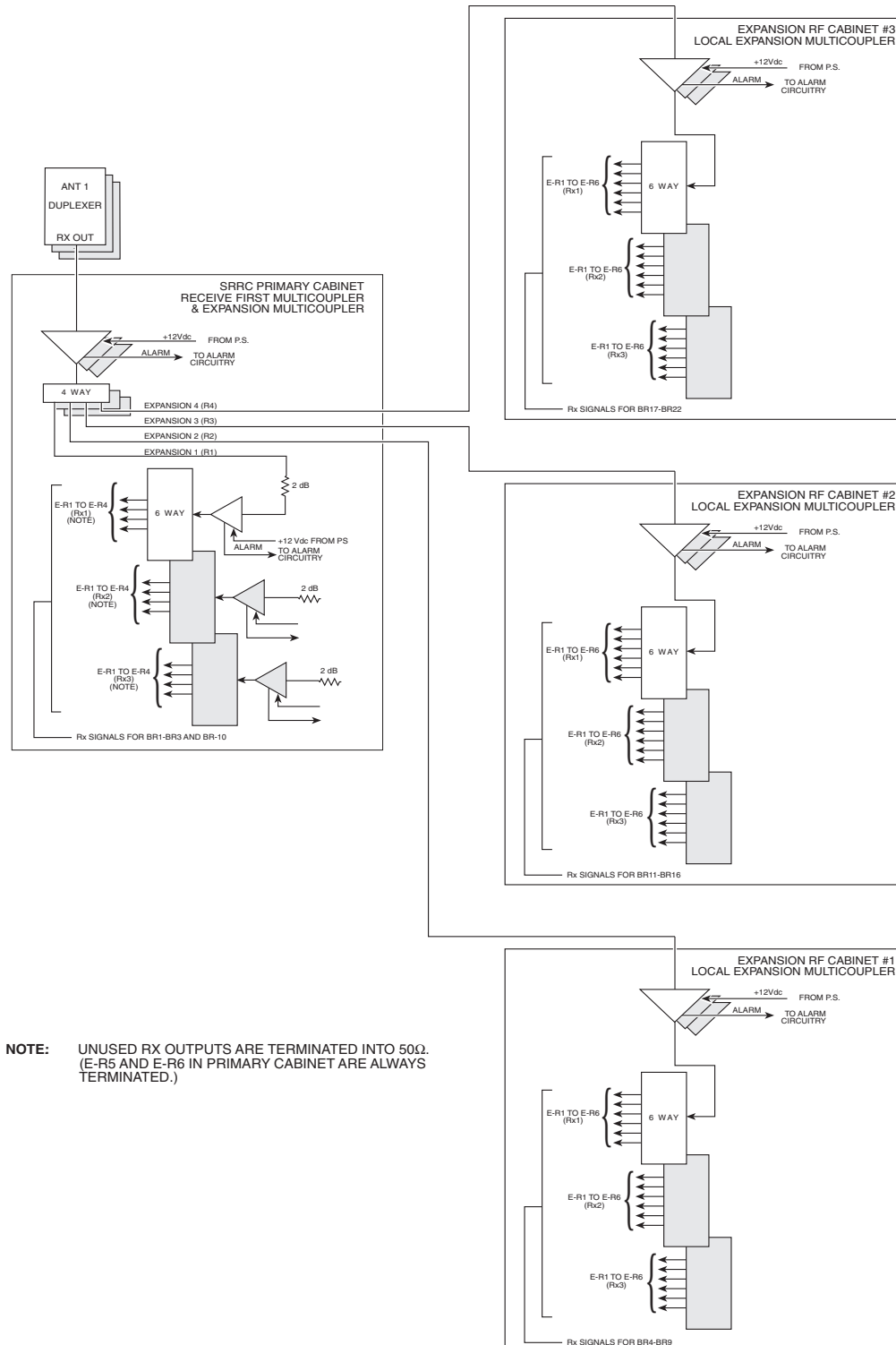
(See Figure 8.) Receive expansion for a fourth BR (BR10) in the primary cabinet is accomplished by simply connecting the E-R4 outputs of the First MCs to BR10. (E-R5 and E-R6 in the primary cabinet are always terminated.)

All receive expansions from the primary cabinet to expansion cabinets use the same method to distribute the triple-diversity Rx signals to the BRs. Therefore, this discussion applies to all branches of all the expansion configurations. The expansion R2 through R4 outputs of the primary cabinet First MC provide the Rx signal feeds for up to three Expansion RF Cabinets. This arrangement accommodates up to 22 Base Radios. In this manner, the system expands a single receive path from an antenna/duplexer using 6-way local Expansion MCs that cascade off of the SRRC primary cabinet four-way First MC. Each Rx distribution system for each antenna branch of the system is identical. Therefore, only the RX1 signal for antenna/duplexer 1 is discussed here.

The R2 receive signal at the SRRC primary cabinet First MC is fed to Expansion RF Cabinet #1 via an intercabinet cable. The R2 receive signal is then applied to a local Expansion MC in the expansion cabinet. The local Expansion MC develops six outputs (E-R1 through E-R6) which are respectively applied to expansion cabinet Base Radios 4 through 9.

Similar to the R2 signal, the R3 output provides an Rx feed which develops signals E-R1 through E-R6 for Base Radios 11 through 16 in expansion cabinet #2. Furthermore, the R4 output provides an Rx feed which develops signals E-R1 through E-R6 for Base Radios 17 through 22 in expansion cabinet #3.



EBTS539  
032398LLNFigure 8 **SRRC GEN 4 Duplexed RFDS Receive Expansion Block Diagram**

**RFDS Theory of Operation**

Due to the relatively long cabling runs required for the Rx link to an expansion cabinet, the Rx paths for the Expansion RF Cabinet(s) experience more loss than the SRRC primary cabinet Rx path, a 2-dB inline attenuator is inserted between the SRRC primary cabinet First MC and Expansion MC. The 2-dB inline attenuator balances the SRRC primary cabinet Rx path with that of the higher-loss expansion Rx paths.

**1-9 BR System Expansion**

(See Figure 7.) The baseline system, along with the addition of one expansion cabinet, directly supports up to nine BRs. The 9-BR arrangement uses both sections of a Dual 3-Way Combiner Deck located in an Expansion RF Cabinet for Base Radios 4 through 9; this Combiner Deck is identical to that used in the SRRC primary cabinet.

Via a low-loss intercabinet cable, the combined Tx output for Base Radios 4 through 6 is fed to the ANT 2 Duplexer / antenna in the SRRC primary cabinet. Similarly, the combined Tx output for Base Radios 7 through 9 is fed to the ANT 3 Duplexer / antenna in the SRRC primary cabinet.

In summary, Base Radios 1 through 3 send their Tx signals to the ANT 1 Duplexer, Base Radios 4 through 6 send their Tx signals to the ANT 2 Duplexer, and Base Radios 7 through 9 send their Tx signals to the ANT 3 Duplexer.

**1-10 BR System Expansion**

(See Figure 9.) The 1-10 BR system expansion uses cascaded combining, consisting of Dual 3-Way Combiner Decks and a Triple 2-Way Combiner Deck.

The Triple 2-Way Combiner Deck (located in the SRRC primary cabinet) consists of three microstrip / groundplane printed circuits which function as three, 2-input hybrid couplers. Each of three sections of this deck combines a pair of signals from a Dual 3-Way Combiner Deck into one signal that feeds to a Duplexer Tx input.

Because the 1-10 BR expansion follows in progression the 1-9 BR expansion, the BR designations for BR1 through BR9 are carried over from the 1-9 BR: BRs 1-3 are the baseline BRs in the primary cabinet; BRs 4-9 are the six expansion cabinet BRs. Accordingly, the 10th-BR position is found in the primary cabinet, with a BR space located near the top of the cabinet.

**NOTE**

A four-BR system is feasible using the cascaded combining arrangement discussed here. In such a system the expansion cabinet is merely omitted, resulting in a system consisting of BR1-3, and BR10 (or BR4 in this case).

In the 1-10 BR expansion, the TX1-TX3 combined output and TX10 output from the SRRC primary cabinet Dual 3-Way Combiner Deck are applied to the first section of the Triple 2-Way Combiner Deck. (Even though the TX10 signal does not require the initial combining as the Tx1-TX3 do, it is applied through the second half of the Dual 3-Way combiner to provide the isolation afforded by the combiner, as well as maintaining loss balance with that of the TX1-TX3 signals.) From the hybrid coupler in the deck, the combined TX1-TX3/TX10 signal is then applied to the ANT 1 Duplexer TX input.

Similarly, the TX4-TX6 combined output and TX7-TX9 combined output from the Expansion RF Cabinet #1 Dual 3-Way Combiner Deck are applied to the second section of the Triple 2-Way Combiner Deck via two low-loss intercabinet cables. From the hybrid coupler in the deck, the combined TX4-TX9 signal is then applied to the ANT 2 Duplexer TX input. (The third section of the Triple 2-Way Combiner Deck is totally unused in this configuration.)

In summary, Base Radios 1 through 3, and Base Radio 10, send their Tx signals to the ANT 1 Duplexer, and Base Radios 4 through 9 send their Tx signals to the ANT 2 Duplexer.

### 1-16 BR System Expansion

(See Figure 9.) The 1-16 BR system expansion uses the 1-10 BR system expansion arrangement discussed above, along with a similar arrangement for Base Radios 11 through 16.

In the 1-16 BR system expansion, the SRRC primary cabinet is fully populated with BR1 through BR3 (and BR10), Expansion RF Cabinet #1 is fully populated with BR4 through BR9, and Expansion RF Cabinet #2 is fully populated with BR11 through BR16.

The 1-16 BR system expansion utilizes the 1-10 BR expansion discussed earlier. Additionally, this configuration uses an arrangement for Expansion RF Cabinet #2 Base Radios 11 through 16 that is identical to that used for Base Radios 4 through 9 discussed earlier.

Via two low-loss intercabinet cables, the TX11-TX13 combined output and TX14-TX16 combined output from the Dual 3-Way Combiner Deck in Expansion RF Cabinet #2 are applied to third section of the Triple 2-Way Combiner Deck in the SRRC primary cabinet. From the hybrid coupler in the deck, the combined TX11-TX16 signal is then applied to the ANT 3 Duplexer TX input.

In summary, Base Radios 1 through 3 (and Base Radio 10) send their Tx signals to the ANT 1 Duplexer, Base Radios 4 through 9 send their Tx signals to the ANT 2 Duplexer, and Base Radios 11 through 16 send their Tx signals to the ANT 3 Duplexer.

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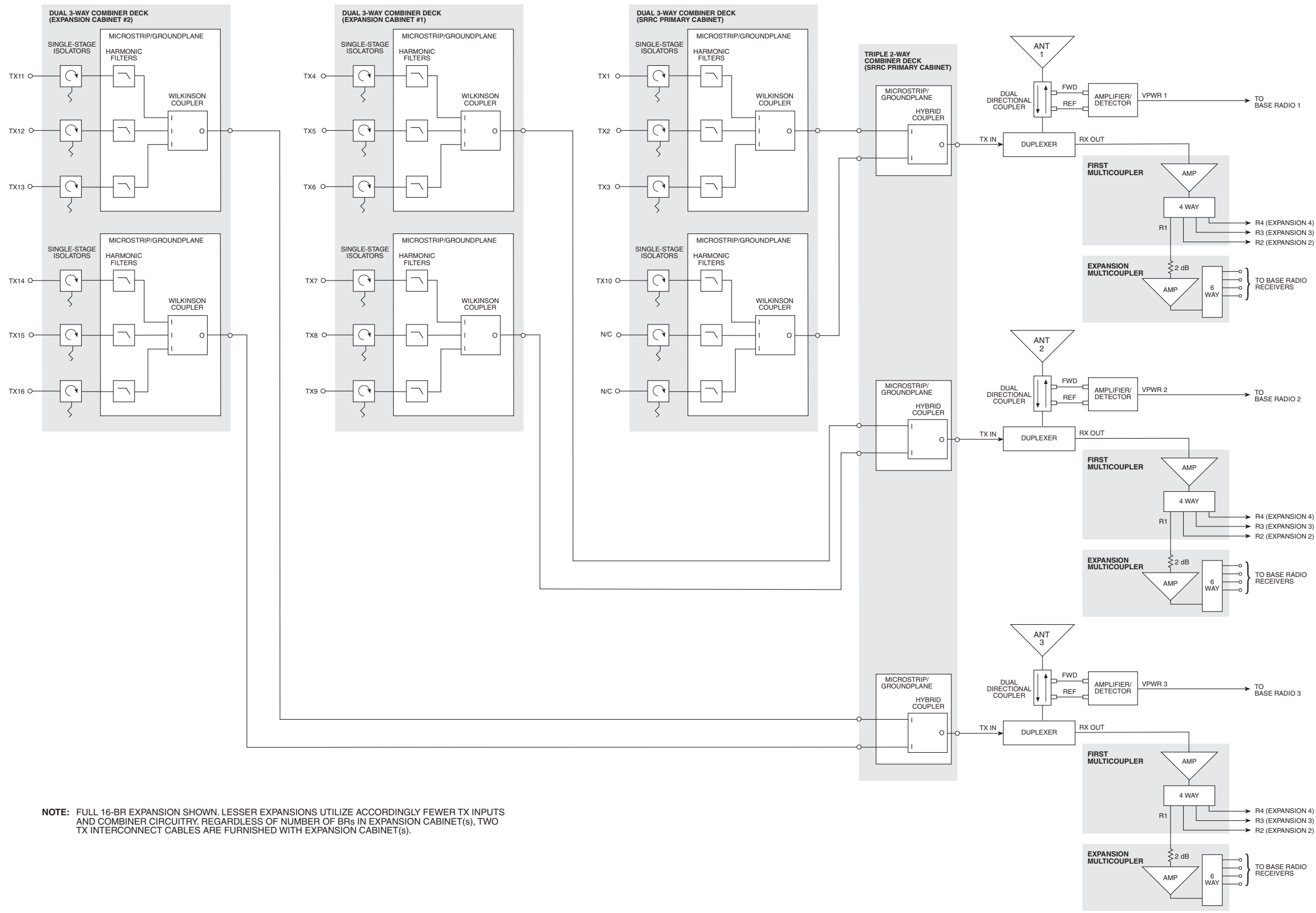


Figure 91-10 BR And 1-16 BR SRRC RFDS Block Diagram

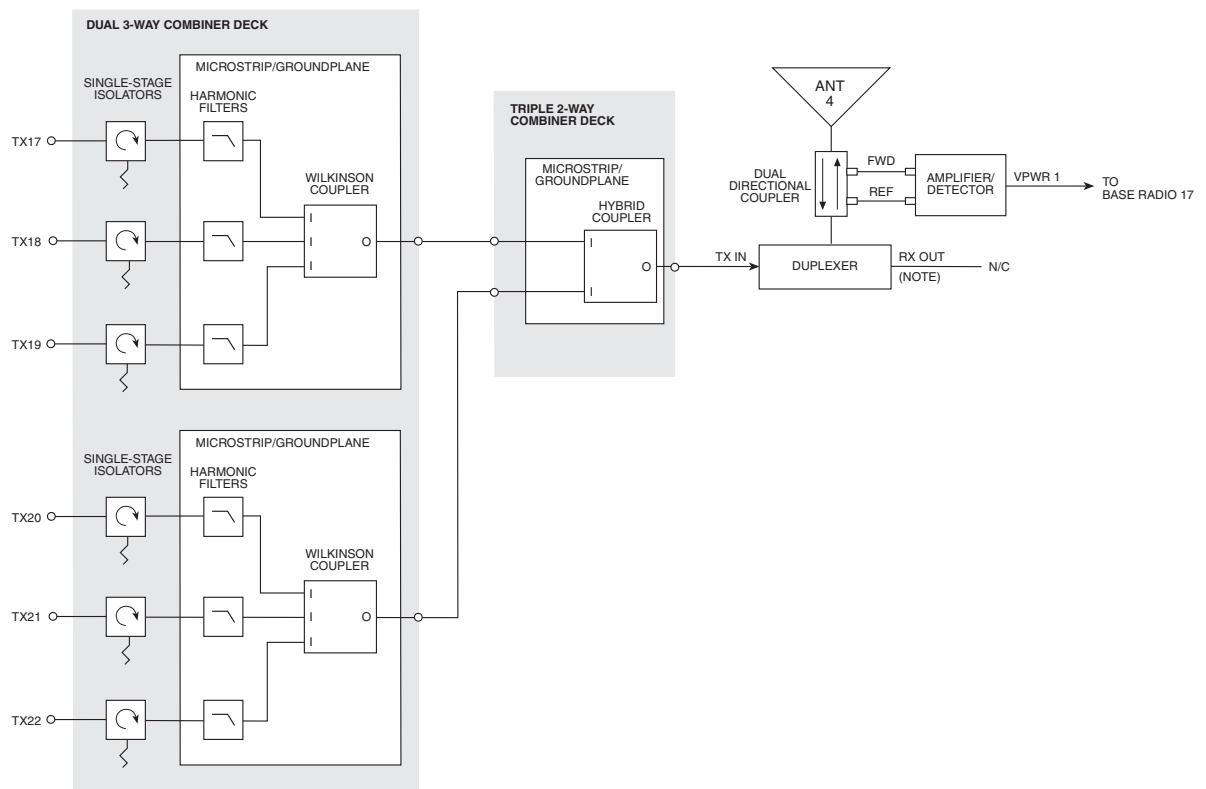
Theory of Operation

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## 17-22 BR Omni Expansion

(See Figure 10.) The 17-22 BR omni expansion uses the 1-16 BR expansion discussed earlier, along with an added transmit-only branch for Base Radios 17 through 22 located in a third expansion RF cabinet. As such, the BR17-BR22 expansion uses an abbreviated arrangement similar to that used in the 1-10 BR expansion to combine Tx signals TX17 through TX22. The combined TX17-TX22 signal is fed to a fourth Duplexer which drives a fourth, transmit-only antenna.

The Rx output of the fourth Duplexer is not used; the Rx1 through Rx3 receivers in BR17 through BR22 tie into the standard Rx1 through Rx3 receive expansion as described in "Receive Expansion".



**NOTE:** ANTENNA 4 IS TRANSMIT-ONLY. RX1 THROUGH RX3 ARE VIA SYSTEM DUPLEXED ANTENNAS 1 THROUGH 3 AND RECEIVE EXPANSION ASSEMBLIES.

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Figure 10 **22-BR Omni Expansion**

## Theory of Operation

## Duplexed Tower Top Amplifier Interface

The SRRC can be equipped with DC injectors installed on each duplexer, and a Tower Top Amplifier (TTA) interface tray. The TTA Alarm Tray and DC injectors, as installed on the duplexers, are shown in Figure 11. The DC injectors allow the RFDS to work with Duplexed (DTTAs). The DC injectors also provide a low-impedance path to ground in cases of a lightning strike. Typically, a TTA assembly itself is mounted on the antenna mast structure; the assembly contains three identical subassemblies for the respective three branches of the antenna system. The DTTAs augment system coverage of an EBTS by providing increased receive gain.

### TTA Alarm Tray

The TTA Alarm Tray consists of three TTA power/alarm interface modules. These three modules provide the TTA power interface from the power supplies (located in the Rx Tray) to the TTAs. The power/alarm interface modules control application of power to the TTAs, and monitor the TTA interface for alarm conditions.

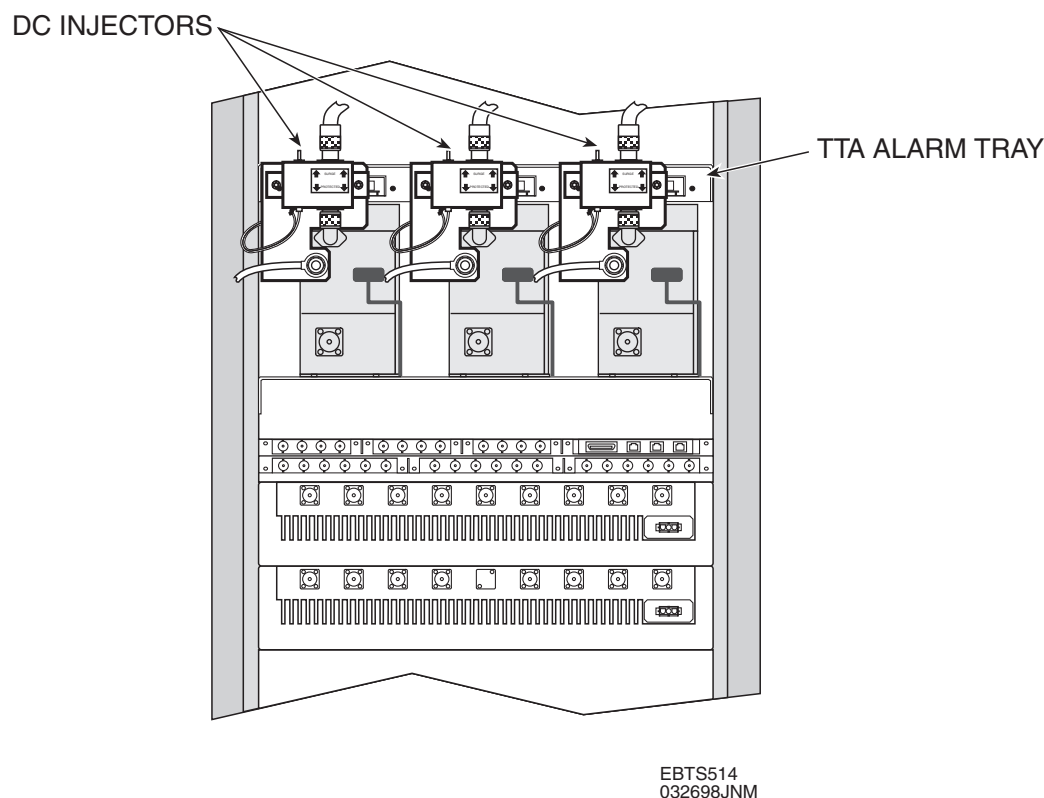


Figure 11 **Duplexed TTA FRUs/Assemblies**



## Tx/Rx Signal Flow

Figure 12 shows the incorporation of the Duplexed TTAs into the Tx/Rx signal flow path of a 800 MHz Duplexed RFDS. For each Tx/Rx antenna branch, a Duplexed TTA is inserted into the Tx/Rx path. DC injectors receive +24V power from the power supplies in the Rx Tray. Using the DC injectors, the existing Tx/Rx coaxial cables carry the Tx/Rx signals, along with the injected +24V operating power, to the Duplexed TTAs.

The tower-mounted Duplexed TTA assembly consist of the following:

- ❑ Three Low-Noise Amplifiers (LNAs) which increase receive path gain
- ❑ A test port which allows calibration signal injection into the LNA input
- ❑ Three duplexing devices which isolate the LNA s from the Tx signals

The Duplexed TTA assembly contains duplexers which provide isolation of the TX and Rx signals. The Tx signal is coupled directly to the antenna. However, the Rx signal is diverted by the duplexer and then fed to an LNA before being recoupled to the main RF Tx/RX cable that connects to the RFDS. The duplexed TTA TEST PORT allows for the injection of a calibration reference signal into the receive path. The reference signal is applied to a four-way splitter; three of the splitter outputs serve as inputs to the LNAs. The reference signal is used in calculating the EBTS receive path gain.

## DC Injectors

The DC injectors are two-port devices with an additional DC injection terminal. The antenna-side port (labeled "SURGE") allows injection of the DC power onto the coaxial connection. This port is also capable of discharging to ground a high-energy pulse received over the antenna connection (as in the case of a lightning strike). The opposite port (labeled "PROTECTED"), which is connected to the RFDS, is isolated from the injected DC as well as any high-energy entering through the SURGE (antenna) port.

## TTA Alarm Interface

The TTA power / alarm interface modules contain circuitry which monitors the operation of the TTAs for both TTA current draw and surge-protect tripping of a DC injector.

The TTA power / alarm interface module monitors the current draw of the TTA. If the current draw exceeds or dips below a pre-defined threshold window, an alarm is generated.

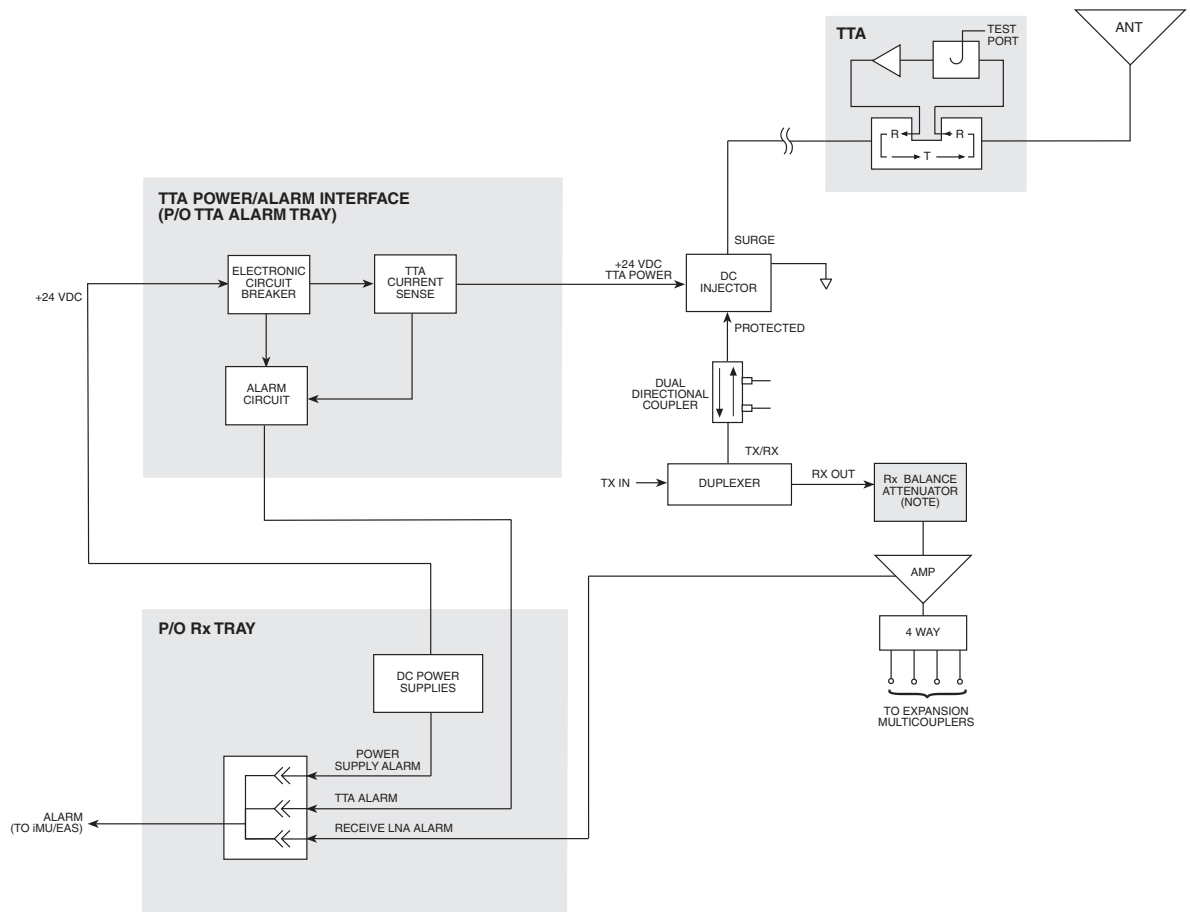
In the case of a high-energy discharge through a DC injector, the DC injector dumps the energy to ground. Unfortunately, this mode also momentarily shorts the injected DC power to ground, in turn shorting the TTA power feed from the Rx Tray power supply. To handle this condition, the TTA power / alarm interface module is equipped with an electronic circuit breaker which detects this condition.

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**Theory of Operation**

Upon detection of a short-circuit, the electronic circuit breaker opens to remove the power supply from the short circuit imposed by the DC injector. The electronic circuit breaker waits an ample amount of time, at which point the high-energy event is expected to have ceased and the DC injector should have recovered (i.e., no short circuit). At this point, the electronic circuit breaker re-applies RFDS power to the DC injector. The electronic breaker repeats this cycle indefinitely until the DC injector recovers. If a DC injector will not recover, the repeated cycling will manifest itself as a persistent alarm, thereby indicating a shorted DC injector at the site.

The TTA power/alarm interface module alarm circuits are wired such that when any combination of TTA amplifiers experience an over/under current failure, or the electronic breaker indicates failure to properly reset, an alarm is sent to the Rx Tray I/O board. In turn, the alarm is then forwarded to the Environmental Alarm System.



**NOTE:** Balance attenuator value is determined using field equalization procedure. Attenuators are field-procured and not supplied with TTA FRUs.

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Figure 12 800 MHz Duplexed TTA Block Diagram

## Theory of Operation

### Power Supplies

The RFDS uses two Power Supply boards (power supply A and power supply B) in a dual-redundant arrangement. The Power Supply boards are located in the Rx Tray. The power supplies convert the -48 VDC (hot) site power to +12 VDC and +24 VDC. The +12 VDC is used for the Rx Tray receive multicouplers, and the Tx Combiner fan assemblies. The +24 VDC is used for the Duplexer power monitors and (where applicable) tower top amplifiers.

Each Power Supply board is equipped with green and red LED indicators which indicate when the board is receiving power and properly functioning. The RFS1 and RFS2 circuit breakers on the cabinet breaker panel control the application of -48 VDC power to the A and B Power Supply boards.

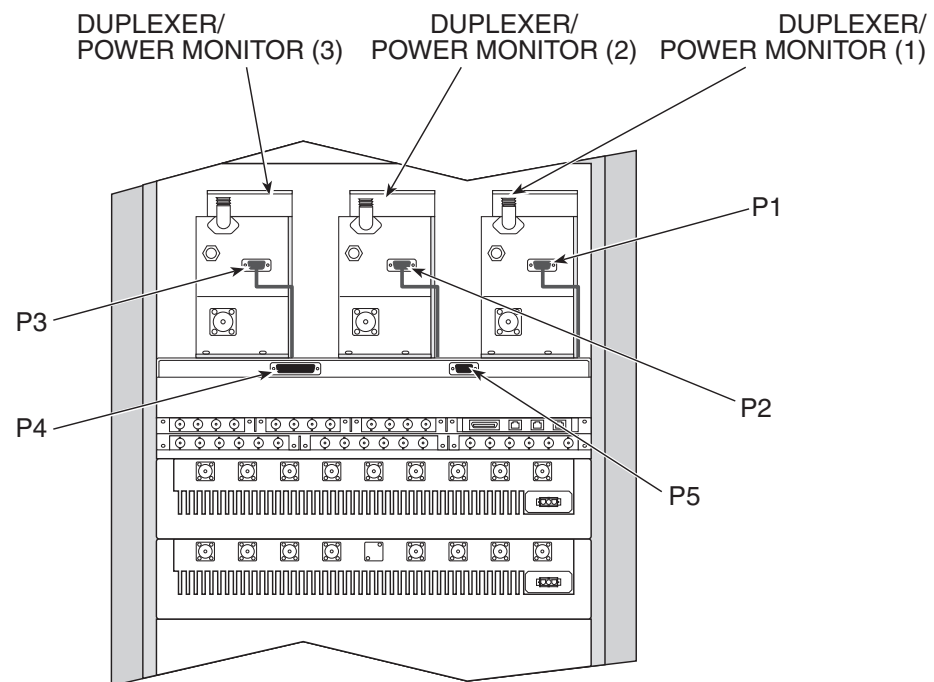
### Connectors, Pinouts, and Wiring

#### Power Monitor Wiring Harness

(See Figure 13.) The GEN 4 Duplexed RFDS contains 25-pin power monitor connector (P4) that interconnects the Power Monitor (sometimes called “external wattmeter”) FWD and REF signals to BR1 through BR3.

The GEN 4 Duplexed RFDS also contains 9-pin monitor power connector (P5) that interconnects the power monitors on each duplexer with DC power from the Rx Tray assembly. The power monitors interconnect with connectors P4 and P5 through duplexer connectors P1 through P3, which respectively connect to the ANT1 through ANT3 duplexers.

Table 4 is a wire-run list that correlates the connections from connectors P4 and P5 to the P1 through P3 duplexer connectors.



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Figure 13 **GEN 4 RFDS Alarm/Monitor Connections**

## Theory of Operation

Table 4 **GEN 4 Duplexed RFDS Alarm/Monitor Harness Wire Run List**

| From  | To   | Function                            |
|-------|------|-------------------------------------|
| P4-1  | —    | no connection                       |
| P4-2  | —    | no connection                       |
| P4-3  | —    | no connection                       |
| P4-4  | P1-3 | GND                                 |
| P4-5  | P1-5 | ANT A (antenna 1) FWD power monitor |
| P4-6  | P1-1 | Antenna A REF power monitor         |
| P4-7  | P2-3 | GND                                 |
| P4-8  | P2-5 | ANT B (antenna 2) FWD power monitor |
| P4-9  | P2-1 | ANT B (antenna 2) REF power monitor |
| P4-10 | P3-3 | GND                                 |
| P4-11 | P3-5 | ANT C (antenna 3) FWD power monitor |
| P4-12 | P3-1 | ANT C (antenna 3) REF power monitor |
| P4-13 | —    | no connection                       |
| P4-14 | —    | no connection                       |
| P4-15 | —    | no connection                       |
| P4-16 | —    | no connection                       |
| P4-17 | —    | no connection                       |
| P4-18 | P1-4 | GND (power monitor return)          |
| P4-19 | P2-4 | GND (power monitor return)          |
| P4-20 | P3-4 | GND (power monitor return)          |
| P4-21 | —    | no connection                       |
| P4-22 | —    | no connection                       |
| P4-23 | —    | no connection                       |
| P4-24 | —    | no connection                       |
| P4-25 | —    | no connection                       |
| P5-1  | P1-2 | +24 VDC (monitor 1)                 |
| P5-2  | P1-7 | GND (monitor 1)                     |
| P5-3  | P1-9 | no connection                       |
| P5-4  | P2-2 | +24 VDC (monitor 2)                 |
| P5-5  | P2-7 | GND (monitor 2)                     |
| P5-6  | P2-9 | no connection                       |
| P5-7  | P3-2 | +24 VDC (monitor 3)                 |
| P5-8  | P3-7 | GND (monitor 3)                     |
| P5-9  | P3-9 | no connection                       |

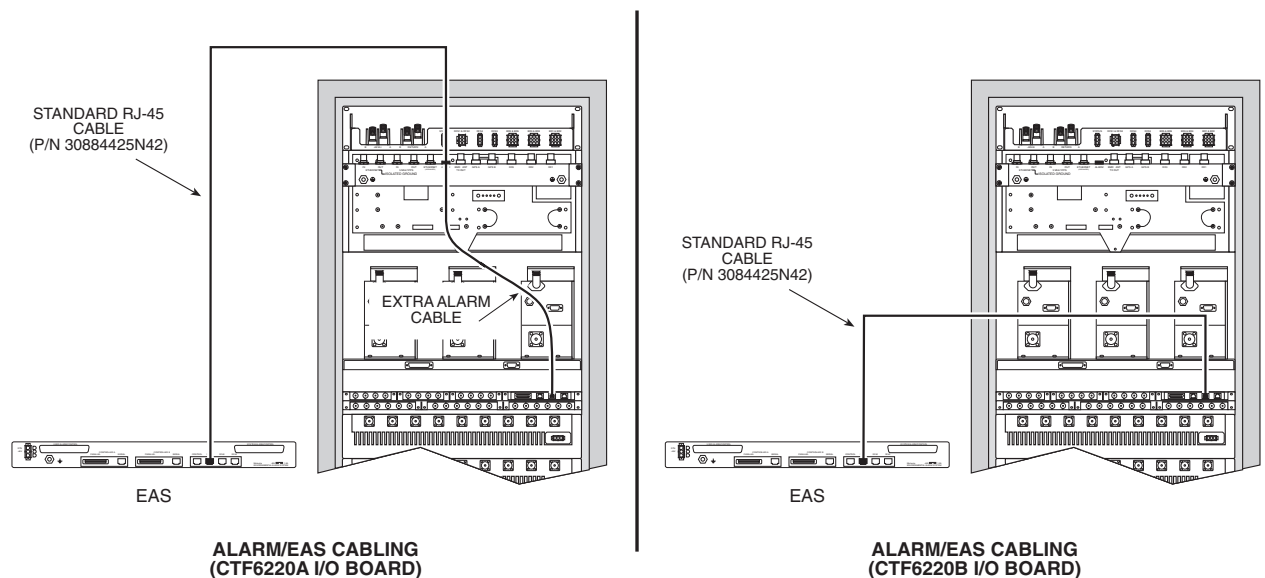
## I/O Board Alarm Output Cabling

Two versions of the I/O Board currently exist: CTF6220A and CTF6220B. The two versions are functionally identical, but do use different pinouts for the RJ-45 ALARM STANDARD connector that connects the cabinet alarms to the EAS/iMU.

Version CTF6220B eliminates the need for an extra, second cable to be connected between the I/O Board and the EAS. Figure 14 shows the cabling for both versions.

### NOTE

The CTF6220A and CTF6220B I/O boards are totally interchangeable. However, appropriate cabling must be used for the version being used (as shown in Figure 14). If cabling does not correspond to version, false alarms will result.



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Figure 14 I/O Board Alarm-to-EAS Cabling (I/O Board CTF6220A and CTF6220B)

## Theory of Operation

**I/O Board Rear Panel Connector Pinouts**

The I/O Board rear panel connectors provide the cabinet alarm interface to the I/O board and a diagnostics connector. (Figure 5 shows and identifies the connectors.) The connectors are as follows:

- ❑ **Diagnostics** – 36-pin SCSI-style connector (reserved for future use)
- ❑ **Breaker Status (Alarm Expansion)** – RJ-45 connector receives breaker status from breaker panel. (Also has reserved function of receiving alarm signals from GEN 3 (P/N 0182020V06) RFDS.)
- ❑ **Alarm Standard** – RJ-45 connector sends cabinet alarm status to the EAS.
- ❑ **Alarm Auxiliary** – RJ-45 connector receives additional, auxiliary alarm signals (reserved).

Table 5 lists the rear panel connector pinouts for I/O Board CTF6220A. Table 6 lists the connector pinout for I/O Board CTF6220B.

Table 5 **I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220A)**

| Pin | Function/Connector |                       |                                |                           |
|-----|--------------------|-----------------------|--------------------------------|---------------------------|
|     | Diagnostics        | Breaker Status Alarm  | Alarm Standard                 | Alarm Auxiliary           |
| 1   | 1st MC #2 Alarm    | Breaker               | Breaker Alarm                  | PS Alarm Expansion        |
| 2   | 1st MC #3 Alarm    | Breaker return        | Breaker Alarm return           | PS Alarm Expansion return |
| 3   | Exp MC #1 Alarm    | RFDS MC Alarm         | RFDS Multicoupler Alarm        | 1st MC Alarm              |
| 4   | Exp MC #2 Alarm    | RFDS TTA Alarm        | RFDS TTA Alarm                 | Expansion MC Alarm        |
| 5   | Exp MC #3 Alarm    | RFDS PS Alarm         | RFDS Power Supply Alarm        | Fan Alarm                 |
| 6   | MC Alarm Expansion | RFDS MC Alarm return  | RFDS Multicoupler Alarm return | 1st MC Alarm return       |
| 7   | TTA #1 Alarm       | RFDS TTA Alarm return | RFDS TTA Alarm return          | Expansion MC Alarm return |
| 8   | TTA #2 Alarm       | RFDS PS Alarm return  | RFDS Power Supply Alarm return | Fan Alarm return          |



Table 5 **I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220A) (Continued)**

| Pin | Function/Connector  |                      |                |                 |
|-----|---------------------|----------------------|----------------|-----------------|
|     | Diagnostics         | Breaker Status Alarm | Alarm Standard | Alarm Auxiliary |
| 9   | TTA #3 Alarm        |                      |                |                 |
| 10  | TTA Alarm Expansion |                      |                |                 |
| 11  | Fans #1 Alarm       |                      |                |                 |
| 12  | Fans #2 Alarm       |                      |                |                 |
| 13  | PS#1 +12VDC Alarm   |                      |                |                 |
| 14  | PS#1 +24VDC Alarm   |                      |                |                 |
| 15  | PS#2 +12VDC Alarm   |                      |                |                 |
| 16  | PS#2 +24VDC Alarm   |                      |                |                 |
| 17  | PS Alarm Expansion  |                      |                |                 |
| 18  | N/C                 |                      |                |                 |
| 19  | 1st MC #1 Alarm     |                      |                |                 |
| 20  | GND                 |                      |                |                 |
| 21  | GND                 |                      |                |                 |
| 22  | GND                 |                      |                |                 |
| 23  | GND                 |                      |                |                 |
| 24  | GND                 |                      |                |                 |
| 25  | N/C                 |                      |                |                 |
| 26  | N/C                 |                      |                |                 |
| 27  | +24 VDC             |                      |                |                 |
| 28  | +24 VDC             |                      |                |                 |
| 29  | +24 VDC             |                      |                |                 |
| 30  | +24 VDC             |                      |                |                 |
| 31  | N/C                 |                      |                |                 |
| 32  | N/C                 |                      |                |                 |
| 33  | +12 VDC             |                      |                |                 |
| 34  | +12 VDC             |                      |                |                 |
| 35  | +12 VDC             |                      |                |                 |
| 36  | +12 VDC             |                      |                |                 |

**Theory of Operation****Table 6 I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220B)**

| Pin | Function/Connector  |                       |                                |                           |
|-----|---------------------|-----------------------|--------------------------------|---------------------------|
|     | Diagnostics         | Breaker Status Alarm  | Alarm Standard                 | Alarm Auxiliary           |
| 1   | 1st MC #2 Alarm     | Breaker               | RFDS Power Supply Alarm return | Fan Alarm return          |
| 2   | 1st MC #3 Alarm     | Breaker return        | RFDS TTA Alarm return          | Expansion MC Alarm return |
| 3   | Exp MC #1 Alarm     | RFDS MC Alarm         | RFDS Multicoupler Alarm return | 1st MC Alarm return       |
| 4   | Exp MC #2 Alarm     | RFDS TTA Alarm        | RFDS Power Supply Alarm        | Fan Alarm                 |
| 5   | Exp MC #3 Alarm     | RFDS PS Alarm         | RFDS TTA Alarm                 | Expansion MC Alarm        |
| 6   | MC Alarm Expansion  | RFDS MC Alarm return  | RFDS Multicoupler Alarm        | 1st MC Alarm              |
| 7   | TTA #1 Alarm        | RFDS TTA Alarm return | Breaker Alarm return           | PS Alarm Expansion return |
| 8   | TTA #2 Alarm        | RFDS PS Alarm return  | Breaker Alarm                  | PS Alarm Expansion        |
| 9   | TTA #3 Alarm        |                       |                                |                           |
| 10  | TTA Alarm Expansion |                       |                                |                           |
| 11  | Fans #1 Alarm       |                       |                                |                           |
| 12  | Fans #2 Alarm       |                       |                                |                           |
| 13  | PS#1 +12VDC Alarm   |                       |                                |                           |
| 14  | PS#1 +24VDC Alarm   |                       |                                |                           |
| 15  | PS#2 +12VDC Alarm   |                       |                                |                           |
| 16  | PS#2 +24VDC Alarm   |                       |                                |                           |
| 17  | PS Alarm Expansion  |                       |                                |                           |
| 18  | N/C                 |                       |                                |                           |
| 19  | 1st MC #1 Alarm     |                       |                                |                           |
| 20  | GND                 |                       |                                |                           |
| 21  | GND                 |                       |                                |                           |
| 22  | GND                 |                       |                                |                           |
| 23  | GND                 |                       |                                |                           |
| 24  | GND                 |                       |                                |                           |
| 25  | N/C                 |                       |                                |                           |

Table 6 **I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220B) (Continued)**

| Pin | Function/Connector |                      |                |                 |
|-----|--------------------|----------------------|----------------|-----------------|
|     | Diagnostics        | Breaker Status Alarm | Alarm Standard | Alarm Auxiliary |
| 26  | N/C                |                      |                |                 |
| 27  | +24 VDC            |                      |                |                 |
| 28  | +24 VDC            |                      |                |                 |
| 29  | +24 VDC            |                      |                |                 |
| 30  | +24 VDC            |                      |                |                 |
| 31  | N/C                |                      |                |                 |
| 32  | N/C                |                      |                |                 |
| 33  | +12 VDC            |                      |                |                 |
| 34  | +12 VDC            |                      |                |                 |
| 35  | +12 VDC            |                      |                |                 |
| 36  | +12 VDC            |                      |                |                 |

### I/O Board Power Connectors

The I/O Board power connectors provide the I/O board power interface from the cabinet breaker panel -48 VDC power feed to the RFDS and combiner deck fans. (The I/O Board power connectors are mounted on the printed circuit board surface and are identified in Figures 28 and 38.) The connectors are as follows:

- ❑ **-48 VDC input** – 8-pin Mate-N-Lok header connector P1008. Receives -48 VDC feed from RFS1 & RFS2 connector on the breaker panel.
- ❑ **Fan Power output** – 8-pin Mate-N-Lok header connector P1007. Sends +12 VDC to the combiner deck fans.
- ❑ **RFDS Power output (power monitor interface)** – Mate-N-Lok header connector which terminates to 9-pin submini-D connector P5 (located on the duplexer shelf). Refer to Table 4 for pinout and signal functions.
- ❑ **TTA Power output/Alarm input** – 16-pin Mini Mate-N-Lok header connector P1006. Only used on systems with TTA interface. Sends +24 VDC to TTA Alarm Tray. Receives alarm signals from TTA Alarm Tray.

Table 7 lists the power connector pinouts for all versions of the I/O Board.

**Theory of Operation****Table 7 I/O Board Power Connector Pinouts**

| Pin | Function/Connector                 |                        |                         |
|-----|------------------------------------|------------------------|-------------------------|
|     | TTA Power/Alarm Interface<br>P1006 | -48 VDC Input<br>P1008 | Fan Power<br>P1007      |
| 1   | TTA #1 +24 VDC                     | -48 VDC ('A' side)     | N/C                     |
| 2   | TTA #1 GND                         | Return ('A' side)      | Return ('A' side)       |
| 3   | TTA #1 alarm enable                | N/C                    | Alarm enable ('A' side) |
| 4   | TTA #1 alarm                       | N/C                    | +12 VDC ('A' side)      |
| 5   | TTA #1 alarm return                | -48 VDC ('B' side)     | N/C                     |
| 6   | TTA #2 +24 VDC                     | Return ('B' side)      | Return ('B' side)       |
| 7   | TTA #2 GND                         | N/C                    | Alarm enable ('B' side) |
| 8   | TTA #2 alarm enable                | N/C                    | +12 VDC ('B' side)      |
| 9   | TTA #2 alarm                       |                        |                         |
| 10  | TTA #2 alarm return                |                        |                         |
| 11  | TTA #3 +24 VDC                     |                        |                         |
| 12  | TTA #3 GND                         |                        |                         |
| 13  | TTA #3 alarm enable                |                        |                         |
| 14  | TTA #3 alarm                       |                        |                         |
| 15  | TTA #3 alarm return                |                        |                         |
| 16  | N/C                                |                        |                         |

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## Removal/Replacement Procedures

### Replacement of Gen 3 SC/iSC FRUs

Instructions for replacing the Gen 3 SC FRUs are provided in the Gen 3 SC Supplement to this manual.

**Generation 3 Site Controller  
System Manual 68P80801E30**

### Replacement of RFDS FRUs

Instructions are provided below for replacing FRUs within the GEN 4 Duplexed RFDS. Figure 1 identifies the GEN 4 Duplexed RFDS assemblies and FRUs. Figure 15 identifies the Rx Tray assemblies and attaching hardware. Replace suspected FRUs with known non-defective FRUs to restore the RFDS to proper operation.

## CAUTION

The RFDS contains static-sensitive modules. Take precautionary measures to prevent static discharge damage when servicing the RFDS.

### First (4-Way) Multicoupler Board Replacement Procedure

Perform the following steps to replace a 4-Way Multicoupler Board.

#### Removal

(See Figure 15.) Remove 4-Way Multicoupler Board as follows:

1. Tag and remove all BNC connections at the **R1** through **R4** BNC connectors on the 4-Way Multicoupler Board.
2. Remove two M3.5 TORX screws (1, Figure 15) which secure board assembly to Rx Tray chassis (one screw on each side of board). Save screws for reuse.
3. Partially draw board assembly out of Rx Tray until blindmate connector at front of board is disengaged.
4. Remove board from slot enough to gain access to input port SMA cable termination on top of board. Disconnect SMA cable from board connector.
5. Remove board fully from Rx Tray slot.

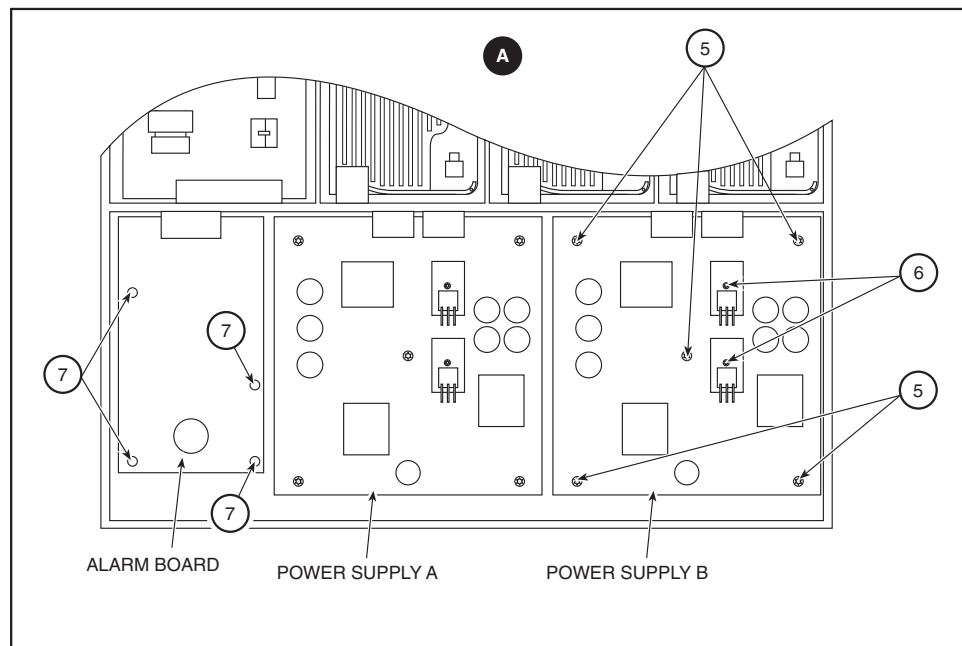
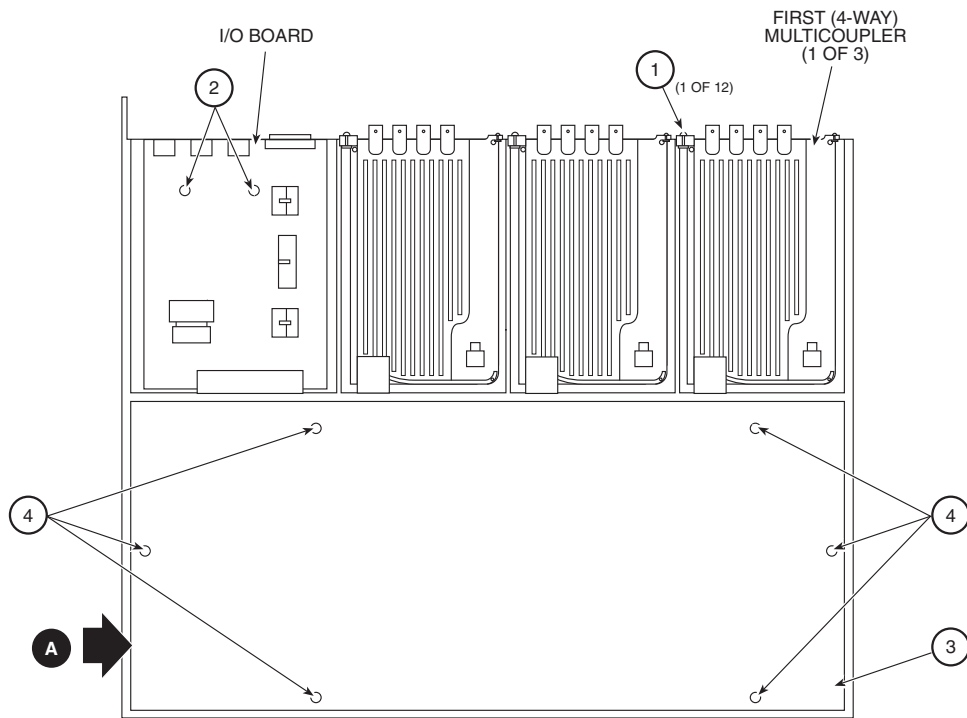
**Removal/Replacement Procedures****Installation**

(See Figure 15.) Install 4-Way Multicoupler Board as follows:

1. Align 4-Way Multicoupler Board with Rx Tray board slot. Partially slide board into slot enough to allow Rx input SMA cable to mate with SMA connector on top of board.
2. Connect SMA cable to SMA connector on top of board. Using a breaking-type 5/16" torque wrench, torque the SMA connector to 5 in-lb.
3. Carefully slide board fully into slot, making certain blindmate connection at front of board is fully mated to Rx Tray chassis midplane connector.
4. Install two M3.5 TORX screws (1, Figure 15), one on each side of assembly, (saved during removal) which secure board assembly to Rx Tray chassis.
5. Connect cabling to the **R1** through **R4** BNC connectors on the 4-Way Multicoupler Board as tagged during removal.

If adding the 4-Way Multicoupler Board, perform the required cabling in accordance with the Cabling Information subsection of this section.

## Removal/Replacement Procedures



**NOTE:** THREE EXPANSION (6-WAY) MULTICOUPLERS (NOT SHOWN) ARE LOCATED ON UNDERSIDE OF RX TRAY. ATTACHING HARDWARE AND REMOVAL/INSTALLATION IS SIMILAR TO THAT FOR FIRST (4-WAY) MULTICOUPLER.

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Figure 15 Rx Tray FRU/Assembly Replacement

**Removal/Replacement Procedures****Local Expansion (6-Way) Multicoupler Board Replacement Procedure**

Perform the following steps to replace a 6-Way Multicoupler Board.

**Removal**

(See Figure 15.) Remove 6-Way Multicoupler Board as follows:

1. Tag and remove all BNC connections at the **E-R1** through **E-R6** BNC connectors on the 6-Way Multicoupler Board.
2. Remove two M3.5 TORX screws (1, Figure 15) which secure board assembly to Rx Tray chassis (one screw on each side of board). Save screws for reuse.
3. Partially draw board assembly out of Rx Tray until blindmate connector at front of board is disengaged.
4. Remove board from slot enough to gain access to SMA cable termination on underside of board. Disconnect SMA cable from board connector (or inline attenuator, if so equipped).
5. Remove board fully from Rx Tray slot.
6. If multicoupler board is equipped with inline input attenuator, remove attenuator and save for reuse.

**Installation**

(See Figure 15.) Install 6-Way Multicoupler Board as follows:

1. If multicoupler board being replaced was equipped with inline input attenuator (saved during removal), install attenuator on SMA connector on underside of board.  
Using a breaking-type 5/16" torque wrench, torque the SMA connector to 5 in-lb.
2. Align 6-Way Multicoupler Board with Rx Tray board slot. Partially slide board into slot enough to allow Rx input SMA cable to mate with SMA connector (or attenuator, if so equipped) on underside of board.
3. Connect SMA cable to SMA connector (or attenuator, if so equipped) on underside of board. Using a breaking-type 5/16" torque wrench, torque the SMA connector to 5 in-lb.
4. Carefully slide board fully into slot, making certain blindmate connection at front of board is fully mated to Rx Tray chassis midplane connector.



5. Install two M3.5 TORX screws (1, Figure 15), one on each side of assembly, (saved during removal) which secure board assembly to Rx Tray chassis.
6. Connect cabling to the **E-R1** through **E-R6** BNC connectors on the 6-Way Multicoupler Board as tagged during removal.

If adding the 6-Way Multicoupler Board, cable in accordance with the Cabling Information subsection of this chapter.

## I/O Board Replacement Procedure

### NOTE

During I/O Board replacement, the site will be inoperative due to loss of alarm and certain power functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

### NOTE

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

## Removal

(See Figure 15.) Remove I/O Board as follows:

1. Remove four M3.5 TORX screws which secure Rx Tray chassis to front panel. (Do not remove the four M6 TORX screws which secure front panel to equipment cabinet.) Save screws for reuse.
2. From rear of cabinet, carefully slide Rx Tray chassis from cabinet enough to access two M3.5 TORX screws (2, Figure 15) that secure I/O Board to Rx Tray chassis.
3. Remove two M3.5 TORX screws that secure I/O Board to Rx Tray chassis. Save screws for reuse.
4. Slide I/O Board away from Rx Tray midplane until connector at front of board is disengaged.

**Removal/Replacement Procedures**

5. With board still connected to RJ45 alarm and Mate-N-Lok power connectors, tag wiring connections. Position board aside with all connections intact.

**Installation**

(See Figure 15.) Install I/O Board as follows:

6. Disconnect connection on board being replaced. Connect harness to replacement I/O Board noting tagged position.
7. Place new I/O Board in mounting position.
8. Align connector at front of board with mating connector on Rx Tray chassis midplane. Gently slide board toward front of Rx Tray chassis until connectors are fully mated.
9. Secure board using two M3.5 TORX screws (2, Figure 15) saved during removal.
10. Carefully slide Rx Tray chassis toward front panel until chassis is flush with front panel. Make certain no wiring is pinched between Rx Tray chassis and front panel.
11. Start four M3.5 TORX screws that secure Rx Tray chassis to Rx Tray front panel. Tighten all four screws evenly.
12. Reactivate site via OMC.

**Power Supply Board Replacement Procedure**

The Rx Tray Power Supply boards are located in the Rx Tray as shown in Figure 15. Because two Power Supply boards are used in a redundant arrangement, a defective power supply board can be replaced without taking the system out of operation.

**CAUTION**

The Power Supply Board opposite the board being replaced will remain energized during this procedure. When replacing board, use care to prevent accidental contact of tools with components and/or surfaces of energized board. Failure to do so may result in damage to equipment.

## Removal

(See Figure 15.) Perform the following steps to determine and replace a defective Power Supply board.

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 15).
3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.
4. Determine which Power Supply board has failed by observing the green and red LED indicators on each board. (On properly functioning supply, green LED is lit and red LED is off.)
5. Noting the Power Supply board that has failed, on Breaker Panel turn off power for the defective power supply as follows:

| Power Supply Board                   | Breaker Panel<br>Circuit Breaker |
|--------------------------------------|----------------------------------|
| A (left board as viewed from front)  | RFS1                             |
| B (right board as viewed from front) | RFS2                             |

6. On failed board, remove five M3.5 TORX screws (5) that secure board to Rx Tray chassis. Save screws for reuse.
7. Remove two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis.

### NOTE

Check if TO-220 devices use plastic insulator collars with each screw. If collars are used, save screws and collars for reuse. Plastic insulating collars and insulator pads are not needed when replacing newer-version power supply using plastic-encased TO-220 devices.

8. Slide board towards front of Rx Tray chassis until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

**Removal/Replacement Procedures****Installation**

(See Figure 15.) Install Power Supply Board as follows:

1. Place Power Supply Board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane. Gently slide board toward rear of chassis until connectors are fully mated.
3. Start (but do not tighten) five M3.5 TORX screws (5, Figure 15) that secure board to Rx Tray chassis.

## CAUTION

If the TO-220 devices on replacement Power Supply Board in the following step have **metal tabs**, plastic insulator collar and insulator pad must be used with retaining screws. If the TO-220 devices on the replacement power supply are **plastic encased** (encapsulated TO-220), collars are not used.

Failing to use insulator collars on metal-tab device will result in damage to the replacement power supply.

4. Note the TO-220 devices (D120 and D122) on the board, each secured by a screw (6) in the device mounting tabs. If devices have a metal mounting tab, make certain that a plastic insulator collar (saved during removal) is properly installed in each mounting tab on TO-220 devices, D120 and D122.
5. Start (but do not tighten) two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis.
6. Tighten five screws (5) and two screws (6) evenly.
7. Apply power to board being replaced by resetting appropriate breaker on Breaker Panel. Verify proper operation by observing green LED indicator on board.
8. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
9. Secure cover using six M3.5 TORX screws (4).
10. Carefully slide Rx Tray fully into cabinet.
11. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).

## Alarm Board Replacement Procedure

Perform the following steps to replace an Alarm Board.

### NOTE

The site will be inoperative during the Alarm Board replacement (loss of alarm functions). When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during non-peak periods.

### NOTE

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

## Removal

(See Figure 15.) Remove Alarm Board as follows:

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 15).
3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.
4. Remove four M3.5 TORX screws (7) that secure Alarm Board to Rx Tray chassis. Save screws for reuse.
5. Using the finger hole in the Alarm Board, place finger in hole and pull board forward until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

## Installation

(See Figure 15.) Install Alarm Board as follows:

1. Place Alarm Board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane.

---

**Removal/Replacement Procedures**

3. Using finger hole in board, gently slide board toward rear of Rx Tray chassis until connector is fully mated.
4. Secure board using four M3.5 TORX screws (7, Figure 15) saved during removal.
5. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
6. Secure cover using six M3.5 TORX screws (4) saved during removal.
7. Carefully slide Rx Tray fully into cabinet.
8. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
9. Reactivate site via OMC.

**Combiner Deck Replacement Procedure**

The following procedure applies to all types of combiner decks. Perform the following steps to replace a Combiner Deck.

 **CAUTION**

Combiner deck surfaces are hot. Allow combiner deck to cool before proceeding to prevent injury.

---

 **CAUTION**

RF Energy hazard. Be sure the **dekey** command sequence (see Set the transmit power to 40 watts. Key the BR in the Software Commands section for details) has been issued to all base radios that connect with the combiner deck. This will prevent injury or damage to equipment while disconnecting or connecting transmit cabling.

---

**NOTE**

During Combiner Deck replacement the site will be inoperative.

---

## Removal

Remove Combiner Deck as follows:

1. Make certain the **dekey** command sequence (see Set the transmit power to 40 watts. Key the BR in the Software Commands section for details) has been issued to all base radios that connect to the Combiner Deck being removed.
2. At rear of Combiner Deck, disconnect Mate-N-Lok fan power connector.
3. Tag and disconnect N-connector RF cables from Combiner Deck rear panel connectors.
4. Remove the four M6 TORX screws which secure the Combiner Deck front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
5. While supporting the Combiner Deck, carefully remove the Combiner Deck from the Equipment Cabinet by sliding it from the front of cabinet.

## Installation

Install Combiner Deck as follows:

1. While supporting the Combiner Deck, carefully lift and slide the Combiner Deck into the pre-installed side rails in the Equipment Cabinet mounting position.

(If adding a Combiner Deck, see Cabling Information subsection for Combiner Deck mounting locations.)

2. Secure the Combiner Deck to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
3. Connect cabling to the Combiner Deck rear panel connectors as tagged during removal.

If adding the Combiner Deck, perform the required cabling in accordance with the Cabling Information subsection of this section.

4. Reactivate system as follows:
  - On an up-and-running system which was deactivated with a **dekey** command sequence (see Set the transmit power to 40 watts. Key the BR. in the Software Commands section for details), reset the Base Radio Controller on Base Radios where the command was issued.
  - On a system that was completely shut down, perform activation in accordance with the System Testing section of this manual.

**Removal/Replacement Procedures****TTA Alarm Module Replacement**

The location of the Duplexed TTA FRUs are shown in Figure 16. Perform the following steps to replace a TTA Alarm Module.

**NOTE**

During TTA Alarm Module replacement, the site will be inoperative (loss of TTA functions). When this procedure is followed exactly as written, downtime will be minimized.

Motorola recommends performing this procedure during non-peak periods.

**NOTE**

To prevent alarm reports during this procedure, take the site down through the Operations and Maintenance Center (OMC).

**Removal**

Remove TTA Alarm Module as follows:

1. On front of TTA Alarm Tray, remove the two TORX screws which secure TTA Alarm Module being removed to tray. Save screws for reuse.
2. Draw TTA Alarm Module away from front panel enough to access cabling at rear of module.
3. At rear of TTA Alarm Module, tag and disconnect the two harnesses which connect to module.
4. Remove TTA Alarm Module from front of tray.

**Installation**

Install TTA Alarm Module as follows:

1. From front of TTA Alarm Tray, position the TTA Alarm Module for installation into tray.
2. Noting tagged wiring positions, connect two wiring harnesses to replacement TTA Alarm Module.
3. Place replacement TTA Alarm Module in mounting position and start two TORX screws (removed during removal) which secure module to tray.
4. Tighten two TORX screws to 8 in-lb.



5. Reactivate site via OMC.

**Field Retrofit of Duplexed TTA Interface (CLN1403)**

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## Field Retrofit of Duplexed TTA Interface (CLN1403)

**NOTE**

The site will be inoperative during field retrofit. Following this procedure exactly as written will minimize downtime.

Motorola recommends performing this procedure in non-peak periods.

---

**NOTE**

To prevent alarm reports during the retrofit procedure, take down the site through the Operations and Maintenance Center

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Figures 16 and 17 show the Duplexed TTA interface FRUs. Field retrofit of the CLN1403 Duplexed TTA interface consists of installing the following TTA hardware:

- ☐ TTA Alarm Tray
- ☐ DC Injectors (3 used)
- ☐ DC Injector Mounting Hardware
- ☐ TTA Tray Cabling

When all of the field retrofit procedures have been completed, perform receive branch equalization in accordance with the “Duplexed TTA Receive Branch Equalization” procedure later in this section.

**NOTE**

The tower-mounted TTA assemblies themselves are not part of the FRU described here. The tower-mounted TTA assemblies are drop-shipped to the customer site.

---

## TTA Alarm Tray Installation

The TTA Alarm Tray interfaces alarm monitoring and operating power for the Duplexed TTAs via the DC injectors. The TTA Alarm Tray occupies one rack unit above the RFDS front panel.

(See Figure 16.) Install TTA Alarm Tray as follows:

1. Unpack the TTA Alarm Tray and record the bar code number in the site records.
2. On equipment cabinet, remove the 1-RU blank panel directly above the RFDS front panel blank. Save screws for reuse.
3. Insert the TTA Alarm Tray into the rack in the location shown in Figure 16.
4. Secure the TTA Alarm Tray to the front of the cabinet using four TORX screws. Torque the screws to 40 in.-lbs.
5. Proceed to DC Injector Installation procedure below.

## DC Injector Installation

The DC injectors allow the Duplexed TTA +24V operating power to be fed to the Duplexed TTA LNAs via the Tx/Rx coaxial feed cable. A DC injector must be installed at the antenna port of each duplexer.

(See Figure 17.) Install DC injectors as follows:

1. On Antenna 1 duplexer antenna port, disconnect antenna cable.
2. On Antenna 1 duplexer, remove nut that secures ground cable to duplexer. Disconnect cable and position aside.
3. Place DC injector mounting bracket over duplexer ground stud.
4. Place ground cable over stud. Start (but do not tighten) hex nut that secures ground cable along with bracket.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

In next step, DC Injector must be properly oriented.

5. Orientate DC Injector such that port labeled "PROTECTED" is facing duplexer port. Connect PROTECTED port on DC Injector to duplexer port.
6. Align mounting holes in bracket with mounting holes on DC injector. Secure DC injector to bracket using two M4 screws.
7. Fully tighten ground cable hex nut.
8. Connect the antenna cable to DC injector port labeled "SURGE".

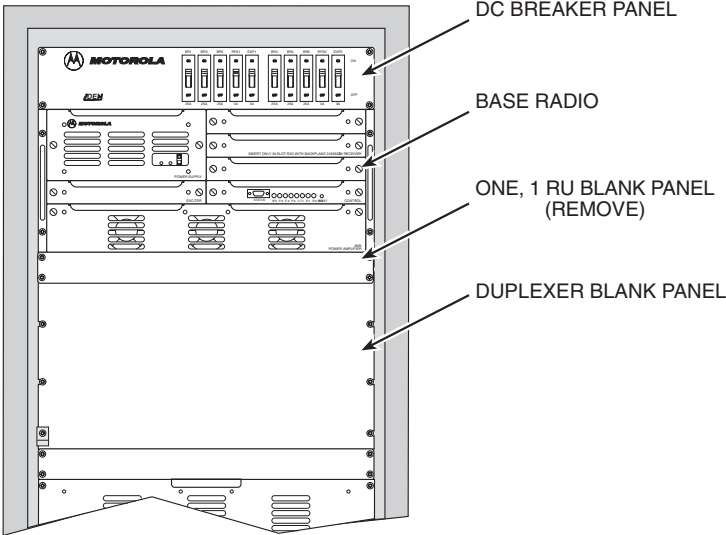
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**Field Retrofit of Duplexed TTA Interface (CLN1403)**

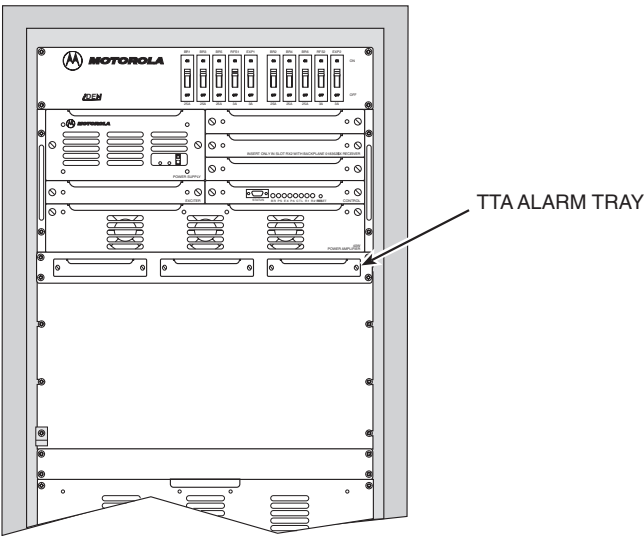
9. Repeat steps 1 through 8 for antenna branch 2 and branch 3.
10. Perform cabling in accordance with Duplexed TTA Cabling (provided in Cabling Information later in this section).
11. Reactivate site via OMC.
12. Proceed to Duplexed TTA Receive Branch Equalization procedure later in this section.

Field Retrofit of Duplexed TTA Interface (CLN1403)

EXISTING FRONT PANEL LAYOUT



TTA ALARM TRAY INSTALLATION



EBTS568  
032698 LLN

Figure 16 TTA Alarm Tray Installation

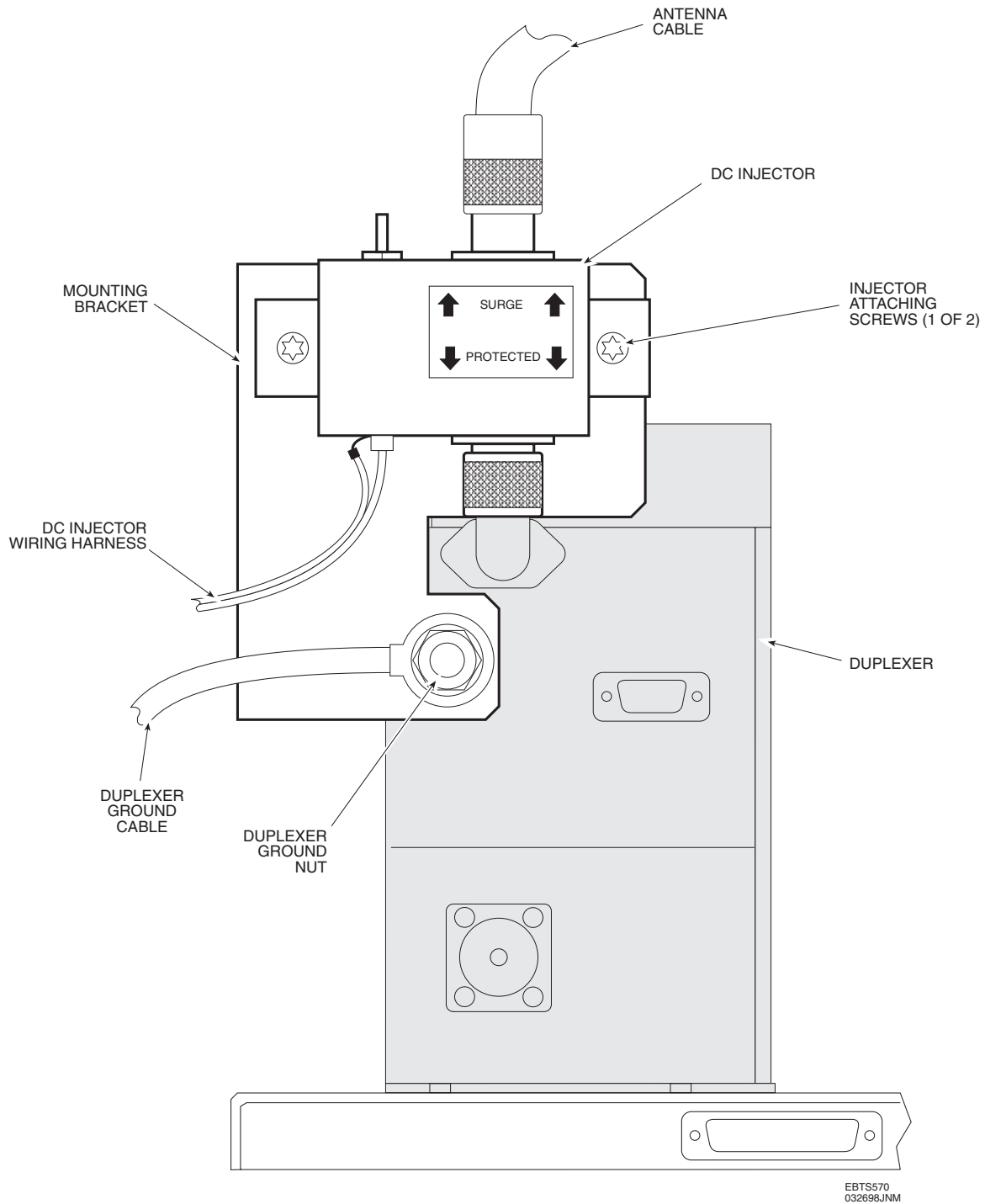
**Field Retrofit of Duplexed TTA Interface (CLN1403)**

Figure 17 **DC Injector Installation**

## Cabling Information

The illustrations and corresponding tables within this section identify cabling part numbers and point-to-point connections. The illustrations show the location and connections of the cables. Each cable is identified by an index number. The corresponding tables identify the point-to-point connection, function, and part number of the cables. Connections appearing in **bold** are labeled accordingly on the equipment.

The cabling diagrams included in this section are listed in the following table.

| Section                                         | Page | Description                                                                                                                                                                                                                                   |
|-------------------------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Duplexer-To-Rx Tray Cabling                     | 56   | Provides cabling information for the receive connections between the Duplexers and the Rx Tray.                                                                                                                                               |
| Receiver Cabling                                | 58   | Provides cabling information for the Rx Tray-to-Base Radio Rx input connections. Also provides intercabinet receive cabling information on systems using expansion RF cabinets, as well as Expansion RF Cabinet receive cabling.              |
| Chassis Grounding                               | 62   | Provides chassis ground connection information for each module within the SRRC primary cabinet and Expansion RF Cabinet(s)                                                                                                                    |
| 5 MHz/1 PPS Cabling                             | 66   | Provides information for the 5 MHz/1 PPS cabling connections within the SRRC primary cabinet and Expansion RF Cabinet(s)                                                                                                                      |
| Ethernet Cabling                                | 70   | Provides information for the Ethernet connections within the SRRC primary cabinet and Expansion RF Cabinet(s)                                                                                                                                 |
| Gen 3 SC/EAS Interconnections                   | 74   | Provides information for the connections between the Gen 3 SCs and EAS                                                                                                                                                                        |
| DC Power Cabling                                | 75   | Provides information for the cabling between the Power Distribution Panel and the modules within the SRRC primary cabinet and Expansion RF Cabinet(s)                                                                                         |
| Alarm/Power Monitor Harness Connections         | 79   | Provides information for alarm and power monitor interconnection for various modules within the SRRC primary cabinet and Expansion RF Cabinet(s).                                                                                             |
| Transmit Power Out Cabling                      | 83   | Provides cabling information for the SRRC primary cabinet Base Radio transmit power out connections. Also provides information for expansion cabling within the SRRC primary cabinet and intercabinet transmit expansion cabling information. |
| Transmit Cabling (Within Expansion RF Cabinets) | 91   | Provides information for Base Radio transmit power out connections to various modules with the Expansion RF Cabinets.                                                                                                                         |
| Duplexed TTA Cabling                            | 95   | Provides information for cabling between the Rx Tray, TTA Alarm Tray, and DC injectors for systems equipped to operate with TTAs                                                                                                              |

**Cabling Information****Duplexer-To-Rx Tray Cabling****NOTE**

Duplexer-to-Rx Tray cabling is factory configured. This information is provided as a reference when adding multicoupler boards or performing maintenance.

Duplexer-to-Rx Tray cabling routes the Rx output from the Duplexers to the 4-way multicouplers and 6-way multicouplers in the SRRC primary cabinet Rx Tray. Table 8 identifies and Figure 18 shows the Duplexer cabling and connecting points.

Table 8 ***Duplexer-To-Rx Tray Cabling***

| Index | Part Number | From                                              | To                                                                           | Notes                                                                                                                        |
|-------|-------------|---------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| 1     | 3012028G17  | Duplexer Rx output port (see detail A in Fig. 18) | Input port on 4-Way Multicoupler Board (see detail B in Fig. 18)             |                                                                                                                              |
| 2     | 3012029A14  | R1 output port on 4-Way Multicoupler Board        | 2 dB inline attenuator on 6-Way Multicoupler Board (see detail C in Fig. 18) |                                                                                                                              |
| 3     | 5882345W02  | 2 dB inline attenuator male SMA connector         | Input port on 6-Way Multicoupler Board (see detail C in Fig. 18)             | Index 3 is 2 dB inline attenuator.<br>Attenuator is not required with 6-Way Multicoupler board version CTF6140B (and later). |



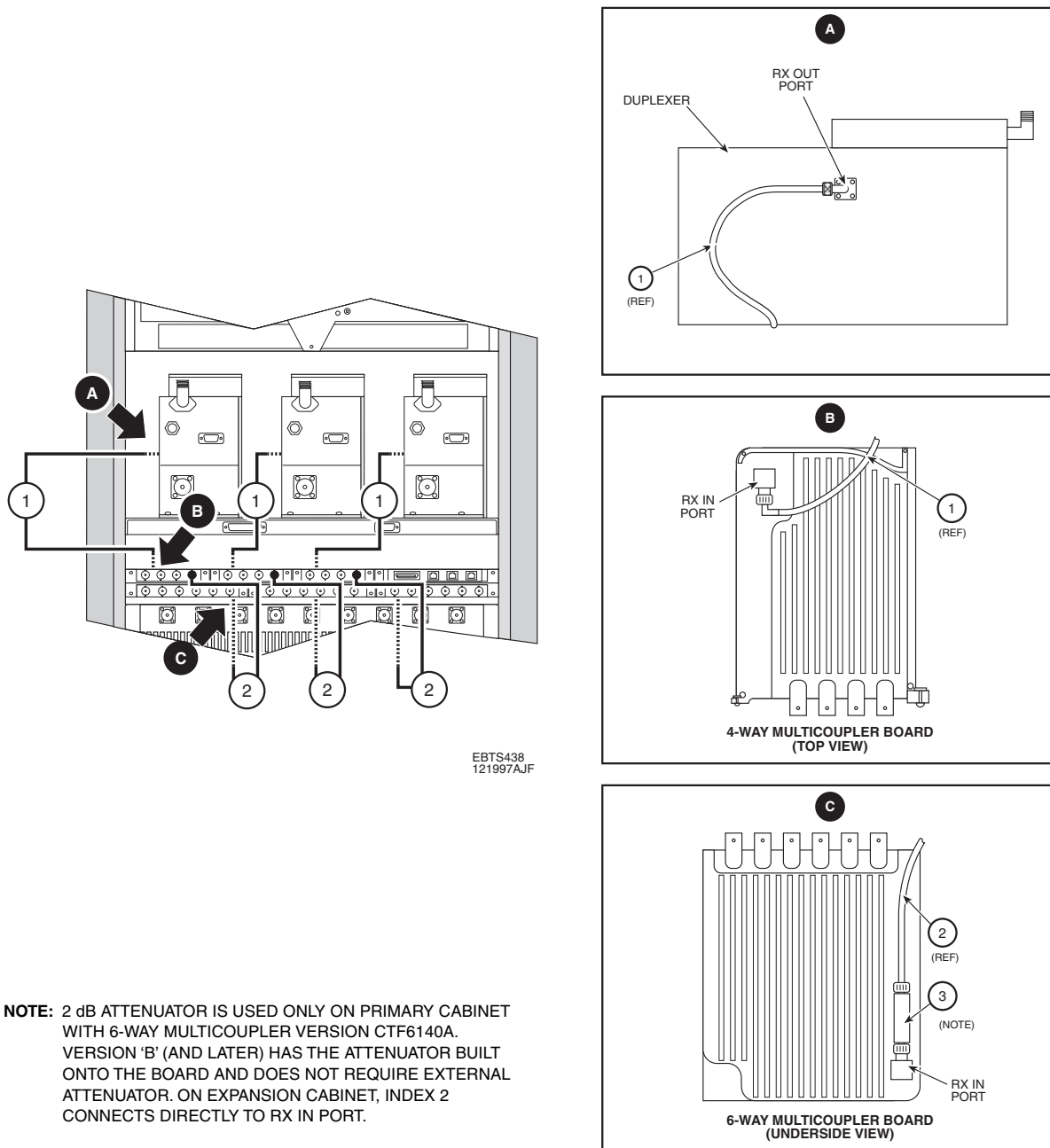


**Figure 18 Duplexer-To-Rx Tray Cabling (SRRC Primary Cabinet)**

**Cabling Information****Receiver Cabling**

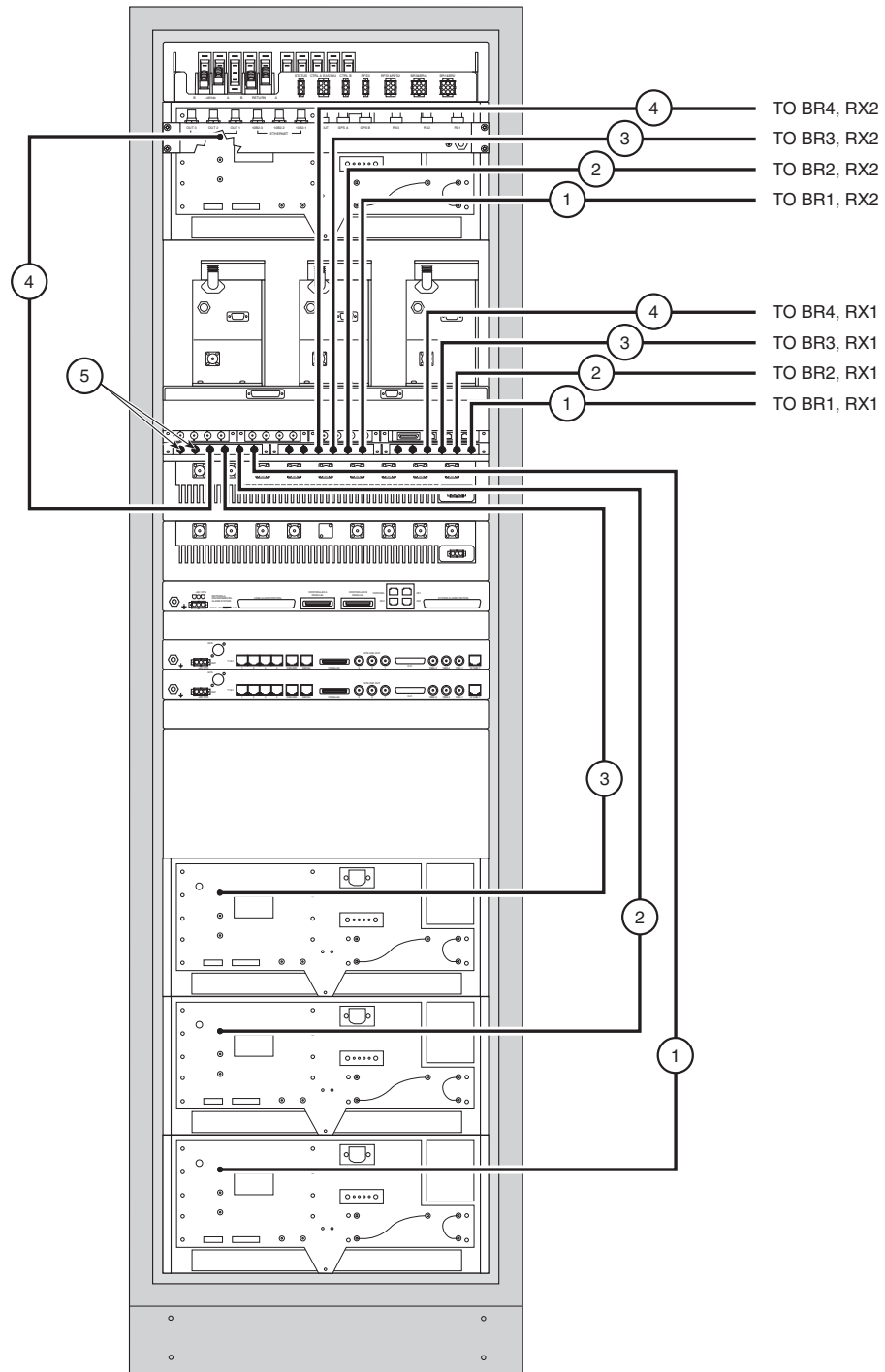
Receiver cabling refers to the cabling within the cabinet(s) from the Rx Tray to the Base Radios, and intercabinet receive cabling for expansion systems.

**SRRC Primary Cabinet Receiver Cabling**

Table 9 lists receiver cabling information and Figure 19 shows the receiver cabling connections for the SRRC primary cabinet.

*Table 9*      **Receiver Cabling (SRRC Primary Cabinet)**

| <b>Index</b>                                                                                                                                                                                                                                | <b>Part Number</b> | <b>From</b>                                | <b>To</b>                                                                                                                           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                           | 0112004Y15         | E-R1 connector on 6-Way Multicoupler Board | RX connector on BR1                                                                                                                 |
| 2                                                                                                                                                                                                                                           | 0112004Y15         | E-R2 connector on 6-Way Multicoupler Board | RX connector on BR2                                                                                                                 |
| 3                                                                                                                                                                                                                                           | 0112004Y12         | E-R3 connector on 6-Way Multicoupler Board | RX connector on BR3                                                                                                                 |
| 4                                                                                                                                                                                                                                           | 0112004Y07         | E-R4 connector on 6-Way Multicoupler Board | RX connector on BR10 (NOTE 1)                                                                                                       |
| 5                                                                                                                                                                                                                                           | 0909906D01         | —                                          | 50Ω terminations connected to E-R5 and E-R6 connectors on Rx1, Rx 2, and Rx3 6-Way Multicoupler Boards. (6 total terminations used) |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. BR10 is expansion BR. Baseline system is equipped with BR1 through BR3 only.</li> <li>2. Unused Rx output ports shall be terminated with 50Ω terminator, P/N 0909906D01.</li> </ol> |                    |                                            |                                                                                                                                     |



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Figure 19 **Receiver Cabling (SRR Primary Cabinet)**

**Cabling Information****Receive Intercabinet Cabling**

Table 10 lists and Figure 20 shows receive intercabinet cabling for multi-cabinet expansion configurations.

*Table 10      **Receive Intercabinet Expansion Cabling***

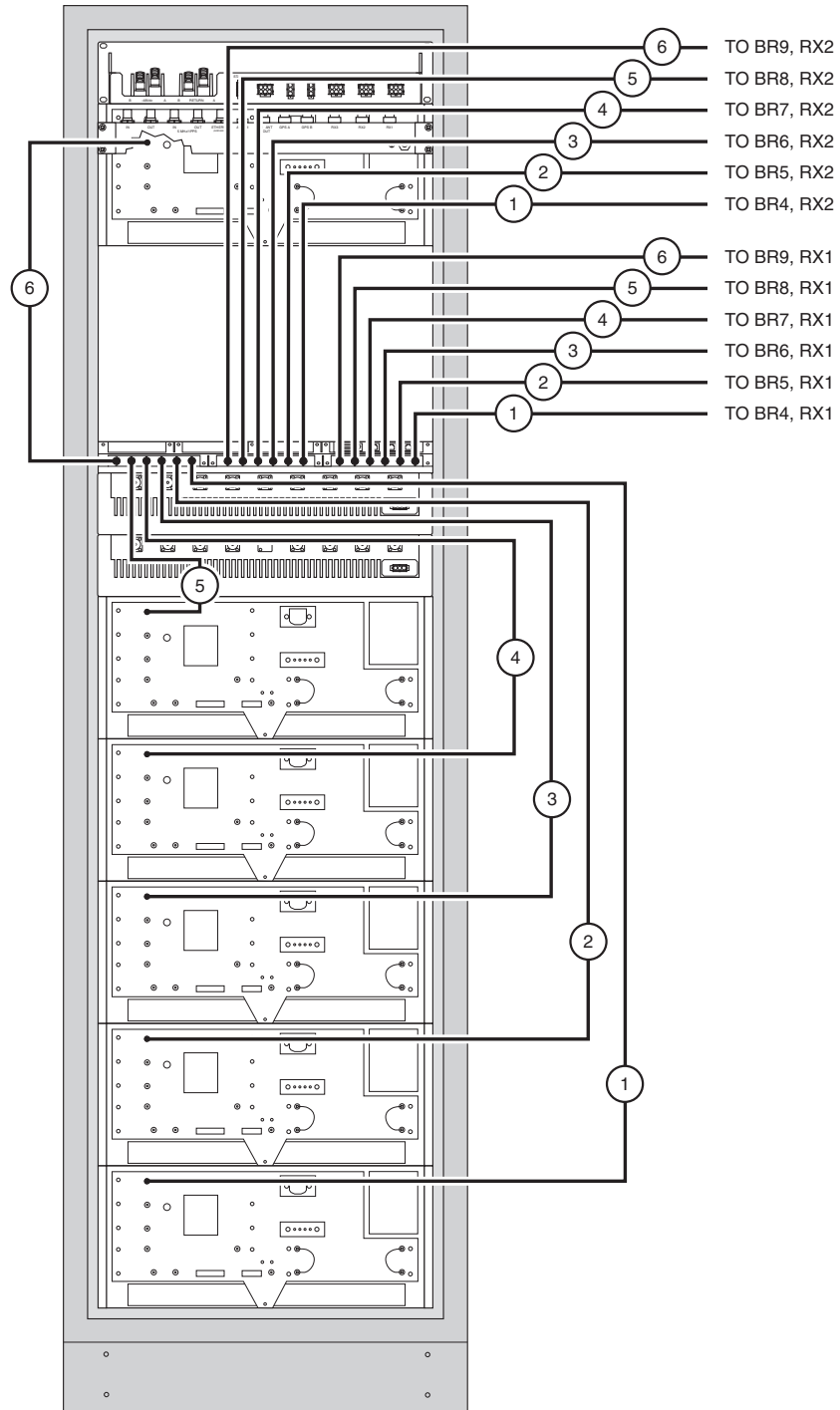
| <b>Index</b>                                                                                                                                        | <b>Part Number</b> | <b>From</b>                                                                          | <b>To</b>                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------|
| 1                                                                                                                                                   | 3012029E37         | <b>R2, R3, R4</b> expansion output ports on primary cabinet 4-Way Multicoupler Board | Expansion RF Cabinet junction panel                              |
| 2                                                                                                                                                   | 3012028E23         | Expansion RF Cabinet junction panel                                                  | Input port on 6-Way Multicoupler Board (see detail A in Fig. 20) |
| <b>NOTE:</b> Above listing for part no. identification and function description only. Refer to accompanying diagram for point-to-point connections. |                    |                                                                                      |                                                                  |

**Expansion RF Cabinet Receiver Cabling**

Table 11 lists and Figure 20 shows the receiver cabling within an Expansion RF Cabinet.

*Table 11      **Receiver Cabling (Expansion RF Cabinet)***

| <b>Index</b>                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Part Number</b> | <b>From:</b>                                      | <b>To</b>           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------|---------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0112004Y15         | <b>E-R1</b> connector on 6-Way Multicoupler Board | RX connector on BR4 |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0112004Y15         | <b>E-R2</b> connector on 6-Way Multicoupler Board | RX connector on BR5 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0112004Y12         | <b>E-R3</b> connector on 6-Way Multicoupler Board | RX connector on BR6 |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0112004Y12         | <b>E-R4</b> connector on 6-Way Multicoupler Board | RX connector on BR7 |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0180702F04         | <b>E-R5</b> connector on 6-Way Multicoupler Board | RX connector on BR8 |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0180702F04         | <b>E-R6</b> connector on 6-Way Multicoupler Board | RX connector on BR9 |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cabinets (regardless of ordered configuration) are equipped with full 6-BR, triple-diversity receive cabling.</li> <li>2. Where applicable, BR11 - BR16 (Expansion RF Cabinet #2) and BR17 - BR22 (Expansion RF Cabinet #3) are cabled in same pattern as shown here.</li> <li>3. Unused Rx output ports shall be terminated with 50Ω terminator, P/N 0909906D01.</li> </ol> |                    |                                                   |                     |



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Figure 20 Receiver Cabling (Expansion RF Cabinet)

**Cabling Information****Chassis Grounding**

Chassis grounding refers to the ground cable connections between the equipment modules within the equipment cabinet and the cabinet frame. Chassis grounds help prevent interference and damage to equipment in the event of a lightning strike.

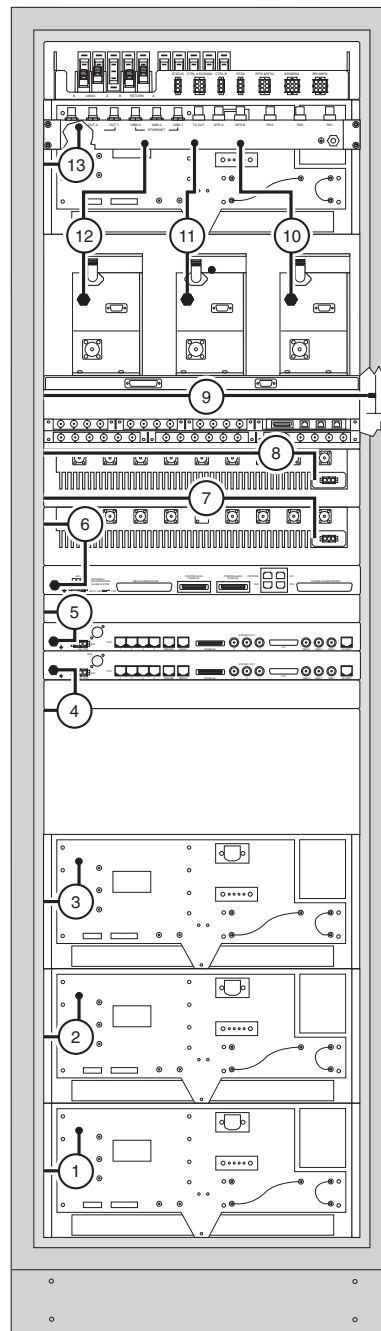
Information for both the SRRC primary cabinet and expansion cabinets is respectively provided below.

**SRRC Primary Cabinet Ground Connections**

Table 12 identifies and Figure 21 shows the SRRC primary cabinet ground cabling.

Table 12 **Ground Straps (SRRC Primary Cabinet)**

| Index | Part Number | From                          | To                                                                          |
|-------|-------------|-------------------------------|-----------------------------------------------------------------------------|
| 1     | 3082000X04  | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 1                                          |
| 2     | 3082000X04  | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 2                                          |
| 3     | 3082000X04  | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 3                                          |
| 4     | 3082000X12  | Ground Bus Bar                | <b>GROUND</b> stud on Gen 3 SC B/iSC B                                      |
| 5     | 3082000X12  | Ground Bus Bar                | <b>GROUND</b> stud on Gen 3 SC A/iSC A                                      |
| 6     | 3082000X12  | Ground Bus Bar                | <b>GROUND</b> stud on EAS                                                   |
| 7     | 3082000X12  | Ground Bus Bar                | <b>GROUND</b> stud on Dual 3-Way                                            |
| 8     | 3082000X12  | Ground Bus Bar                | <b>GROUND</b> stud on Triple 2-Way                                          |
| 9     | 3082000X12  | Ground Bus Bar                | Ground stud on Rx Tray                                                      |
| 10    | 3082000X05  | Ground stud on junction panel | ground stud on Antenna 1 Duplexer                                           |
| 11    | 3082000X05  | Ground stud on junction panel | ground stud on Antenna 2 Duplexer                                           |
| 12    | 3082000X05  | Ground stud on junction panel | ground stud on Antenna 3 Duplexer                                           |
| 13    | 3082000X04  | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 10<br><b>NOTE:</b> BR10 is expansion item. |



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Figure 21 Chassis Grounding Diagram (SRRC Primary Cabinet)

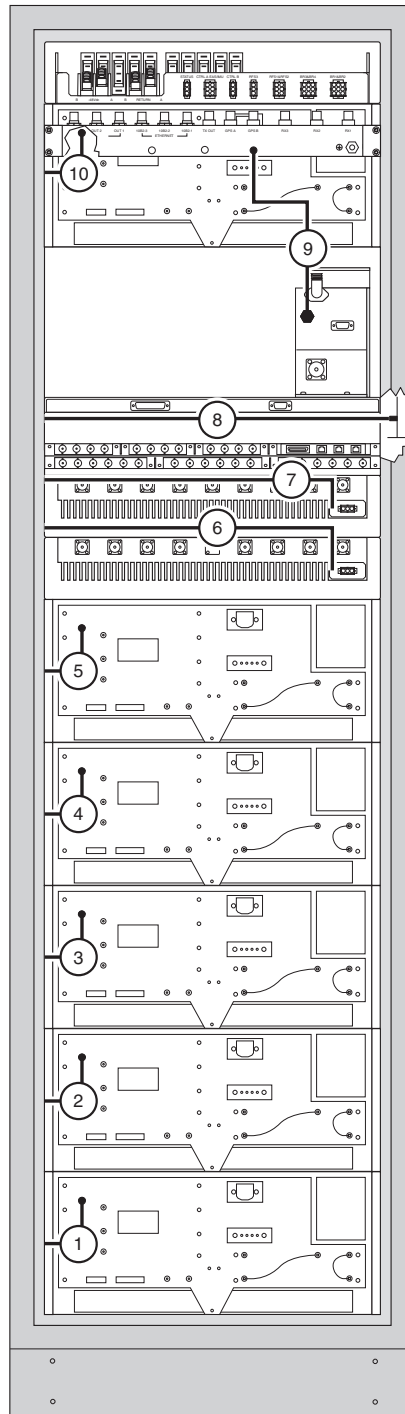
**Cabling Information****Primary Expansion RF Cabinet Ground Connections**

Table 13 identifies and Figure 22 shows the Primary Expansion RF Cabinet ground cabling.

*Table 13*      **Ground Straps (SRRC Primary Expansion Cabinet)**

| <b>Index</b> | <b>Part Number</b> | <b>From</b>                   | <b>To</b>                          |
|--------------|--------------------|-------------------------------|------------------------------------|
| 1            | 3082000X04         | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 4 |
| 2            | 3082000X04         | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 5 |
| 3            | 3082000X04         | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 6 |
| 4            | 3082000X04         | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 7 |
| 5            | 3082000X04         | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 8 |
| 6            | 3082000X12         | Ground Bus Bar                | <b>GROUND</b> stud on Dual 3-Way   |
| 7            | 3082000X12         | Ground Bus Bar                | <b>GROUND</b> stud on Triple 2-Way |
| 8            | 3082000X12         | Ground Bus Bar                | <b>GROUND</b> stud on RX Tray      |
| 9            | 3082000X05         | Ground stud on junction panel | ground stud on Antenna 1 Duplexer  |
| 10           | 308200X04          | Ground Bus Bar                | <b>GROUND</b> stud on Base Radio 9 |





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Figure 22 Chassis Grounding Diagram (Expansion RF Cabinet)

**Cabling Information****5 MHz/1 PPS Cabling**

5 MHz/1 PPS cabling routes the time frequency reference signal between the Junction Panel and each Base Radio.

Information for both the SRRC primary cabinet and expansion cabinets is respectively provided below.

**SRRC Primary Cabinet 5MHz/1PPS Cabling**

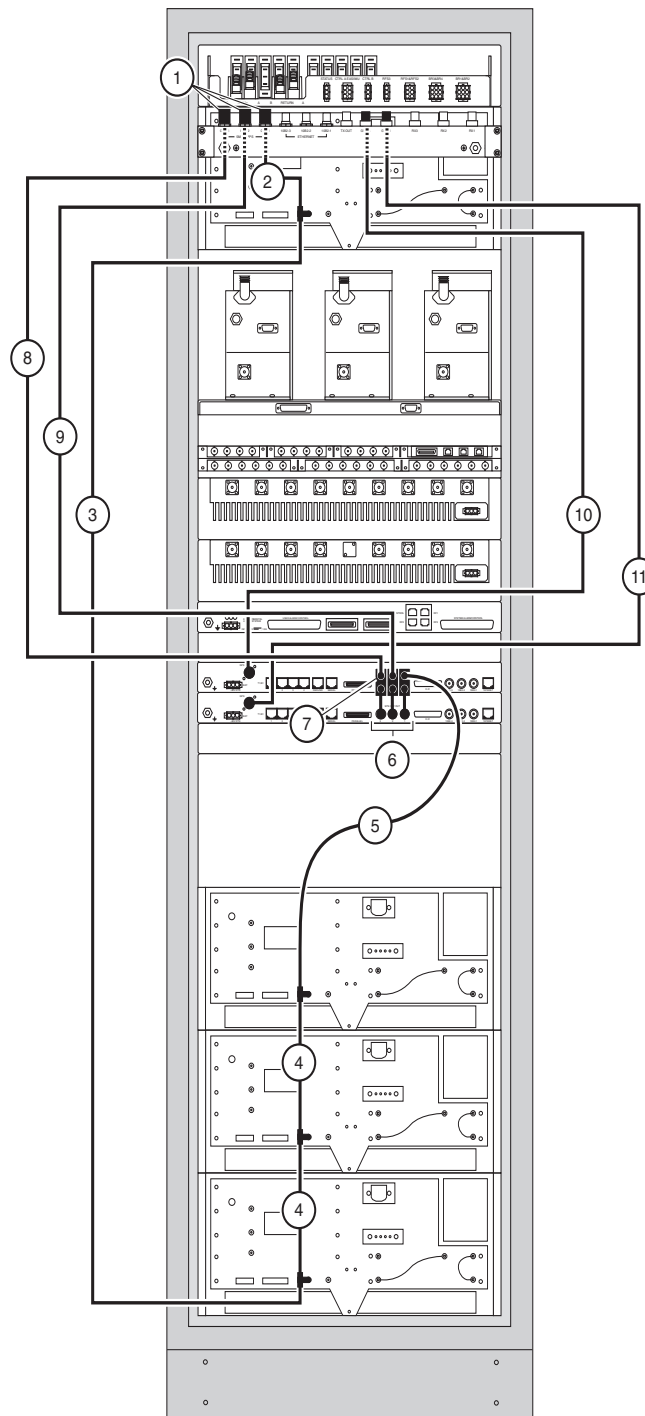
Table 14 identifies and Figure 23 shows the 5 MHz/1 PPS cabling for the SRRC primary cabinet.

Table 14 **5 MHz/1 PPS Cabling (SRRC Primary Cabinet)**

| Index | Part Number | From                                                                  | To                                                                                                |
|-------|-------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 1     | 0909906D01  | —                                                                     | <b>5 MHz/1 PPS OUT 1, OUT 2 and OUT 3</b> connectors on Junction Panel (50Ω termination) (NOTE 3) |
| 2     | 3082363Y05  | Underside of <b>5 MHz/1 PPS OUT</b> connector on Junction Panel       | BNC T-adapter on Base Radio 10 (NOTE 5)                                                           |
| 3     | 3013943N45  | BNC T-adapter on Base Radio 10                                        | BNC T-adapter on Base Radio 1                                                                     |
| 4     | 3013943N19  | BNC T-adapter on Base Radio 1                                         | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3                                    |
| 5     | 3013943N22  | T-adapter on Base Radio 3                                             | BNC Y-adapter on Gen3 SC A <b>OUT 1</b> connector                                                 |
| 6     | 3013943N05  | BNC Y-adapter on Gen3 SC A, <b>OUT 1, OUT 2, and OUT 3</b> connectors | BNC <b>OUT 1, OUT 2 and OUT 3</b> connectors on Gen 3 SC B                                        |
| 7     | 5882669Y01  | —                                                                     | BNC <b>OUT 1, OUT 2 and OUT 3</b> connectors on Gen 3 SC A (BNC Y-adapter)                        |
| 8     | 3082363Y03  | Underside of <b>5 MHz/1 PPS OUT 3</b> connector on Junction Panel     | BNC Y-adapter on Gen 3 SC A <b>OUT 3</b> connector                                                |
| 9     | 3082363Y03  | Underside of <b>5 MHz/1 PPS OUT 2</b> connector on Junction Panel     | BNC Y-adapter on Gen 3 SC A <b>OUT 2</b> connector                                                |
| 10    | 3013942P34  | Underside of <b>GPS A</b> connector on Junction Panel                 | <b>GPS</b> connector on Gen3 SC A                                                                 |
| 11    | 3013942P34  | Underside of <b>GPS B</b> connector on Junction Panel                 | <b>GPS</b> connector on Gen3 SC B                                                                 |

**NOTES:**

1. Cables are connected between BNC T-adapters (P/N 0909907D01), which are connected to the appropriate BR connector.
2. Cabinet is equipped with cables (index no. 4) and T-adapters for connection to four BRs regardless of BR complement. Unused T-adapters are left unconnected.
3. 50Ω termination required only if Expansion RF Cabinet(s) is not used.
4. If installation uses more than 15 BRs, index terminations are not used. Instead, use **OUT 1, OUT 2 and OUT 3** connections, as described in "5 MHz/1 PPS Interconnections" (Installation section of this manual).
5. BR10 is expansion BR. Baseline system is equipped with BR1 through BR3 only.



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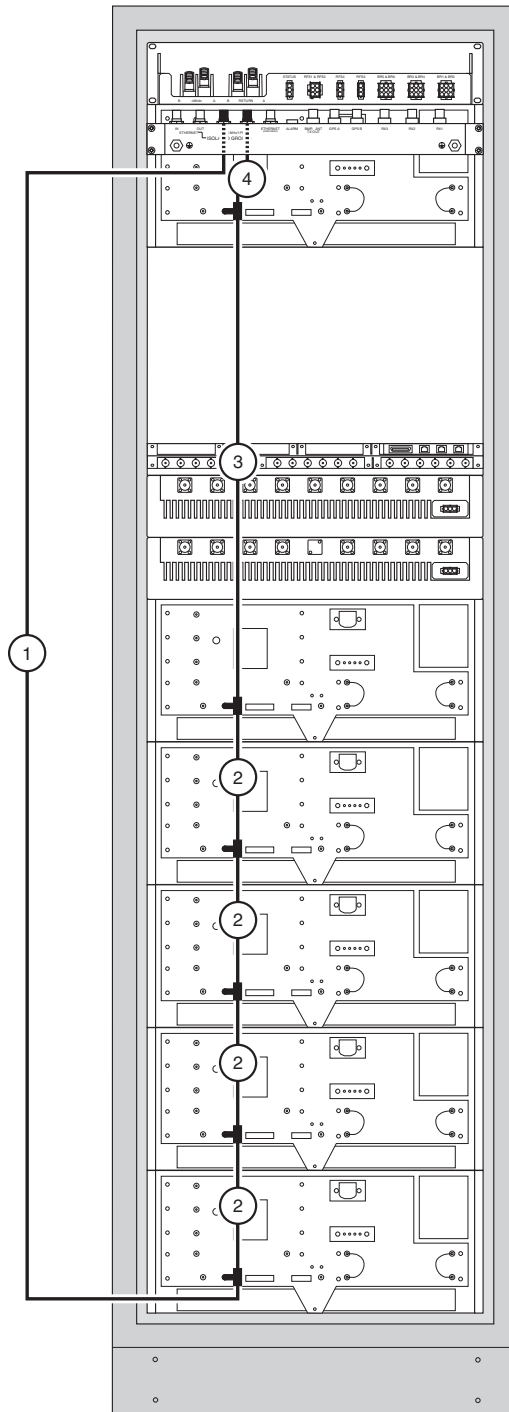
Figure 23 5 MHz/1 PPS Cabling (SRRC Primary Cabinet)

**Cabling Information****Expansion RF Cabinet 5MHz/1PPS Cabling**

Table 15 identifies and Figure 24 shows the 5 MHz / 1 PPS cabling within an Expansion RF Cabinet.

*Table 15*      **5 MHz/1 PPS Cabling (Expansion RF Cabinet)**

| <b>Index</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Part Number</b> | <b>From</b>                                                    | <b>To</b>                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3082004X03         | Underside of <b>5 MHZ/1 PPS IN</b> connector on Junction Panel | BNC T-adapter on Base Radio 4                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0112004Z17         | BNC T-adapter on Base Radio 4                                  | BNC T-adapter on Base Radio 5<br>BNC T-adapter on Base Radio 6<br>BNC T-adapter on Base Radio 7<br>BNC T-adapter on Base Radio 8 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 0112004Z07         | BNC T-adapter on Base Radio 8                                  | BNC T-adapter on Base Radio 9                                                                                                    |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3082004X05         | BNC T-adapter on Base Radio 9                                  | Underside of <b>5 MHZ/1 PPS OUT</b> connector on Junction Panel                                                                  |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Cables are connected between BNC T-adapters (P/N 0909907D01), which are connected to the appropriate BR connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to six BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, 5 MHz/1 PPS OUT connector must be terminated with 50Ω termination (P/N 0909906D01).</li> <li>4. Where applicable, BR11 - BR16 (Expansion RF Cabinet #2) and BR17 - BR22 (Expansion RF Cabinet #3) are cabled in same pattern as shown here.</li> </ol> |                    |                                                                |                                                                                                                                  |



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Figure 24 5 MHz/1 PPS Cabling (Expansion RF Cabinet)

**Cabling Information****Ethernet Cabling**

Ethernet cabling routes the Ethernet network between the Junction Panel and each Base Radio.

Information for both the SRRC primary cabinet and expansion cabinets is respectively provided below.

**SRRC Primary Cabinet Ethernet Cabling**

Table 16 identifies and Figure 25 shows the Ethernet cabling for the SRRC primary cabinet.

Table 16 **Ethernet Cabling (SRRC Primary Cabinet)**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Part Number | From                                                                     | To                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0909906D01  | —                                                                        | <b>ETHERNET 10B2-1, 10B2-2, and 10B2-3</b> connectors on Junction Panel (50 $\Omega$ Termination) (NOTE 3) |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082363Y05  | Underside of <b>ETHERNET OUT</b> on Junction Panel                       | BNC T-adapter on Base Radio 10 (NOTE 4)                                                                    |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3013943N45  | BNC T-adapter on Base Radio 10                                           | BNC T-adapter on Base Radio 1                                                                              |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3013943N19  | BNC T-adapter on Base Radio 1                                            | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3                                             |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3013943N22  | T-adapter on Base Radio 3                                                | BNC Y-adapter on Gen3SC B, <b>10 B2-1</b> connector                                                        |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3013943N19  | BNC Y-adapter on Gen3 SC A, <b>10B2-1, 10B2-2, and 10B2-3</b> connectors | BNC Y-adapter on <b>10B2-1, 10B2-2, and 10B2-3</b> connectors on Gen 3 SC B                                |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 0909906D01  | —                                                                        | <b>ETHERNET 10B2-1, 10B2-2, and 10B2-3</b> connectors on Junction Panel (50 $\Omega$ Termination) (NOTE 3) |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082363Y03  | Underside of <b>10B2-2</b> connector on Junction Panel                   | BNC Y-adapter on Gen3 SC A, <b>10B2-2</b> connector                                                        |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3082363Y03  | Underside of <b>10B2-3</b> connector on Junction Panel                   | BNC Y-adapter on Gen3 SC A, <b>10B2-3</b> connector                                                        |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5882669Y01  |                                                                          | BNC on <b>10B2-1, 10B2-2, and 10B2-3</b> connectors on Gen 3 SC B (BNC Y-adapter)                          |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Cables are connected between BNC T-adapters (P/N 0909907D01), which are connected to the appropriate BR connector.</li> <li>2. Cabinet is equipped with cables (index no. 4) and T-adapters for connection to four BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. 50<math>\Omega</math> termination required only if Expansion RF Cabinet(s) is not used.</li> <li>4. BR10 is expansion BR. Baseline system is equipped with BR1 through BR3 only.</li> </ol> |             |                                                                          |                                                                                                            |

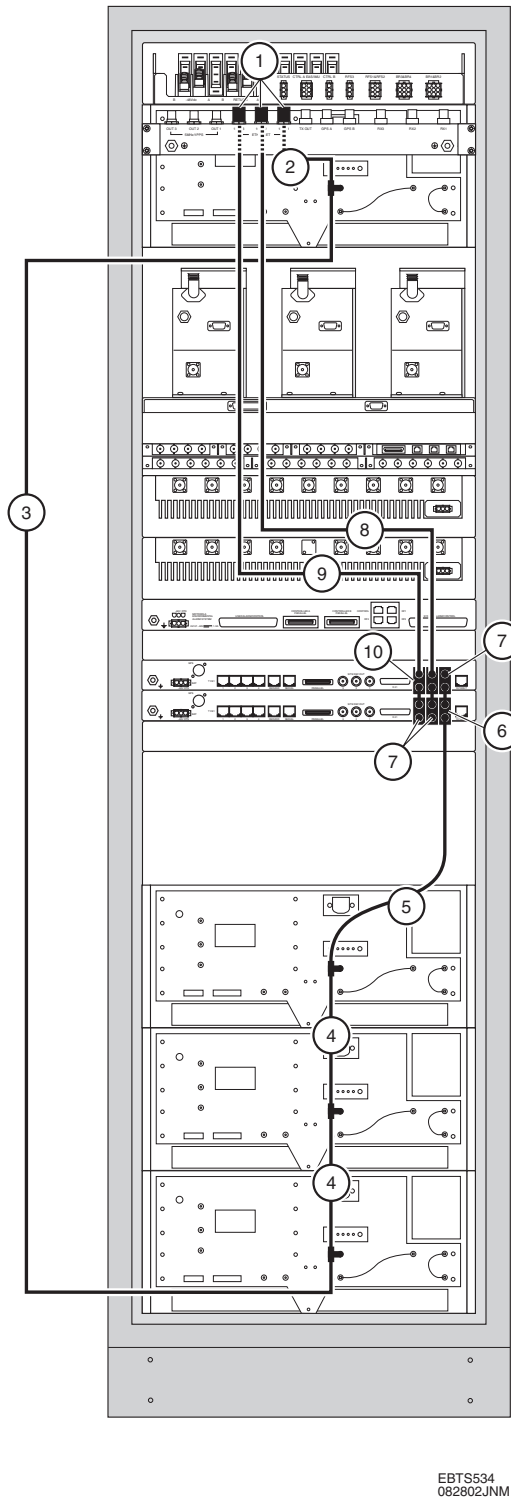


Figure 25 Ethernet Cabling (SRRC Primary Cabinet)

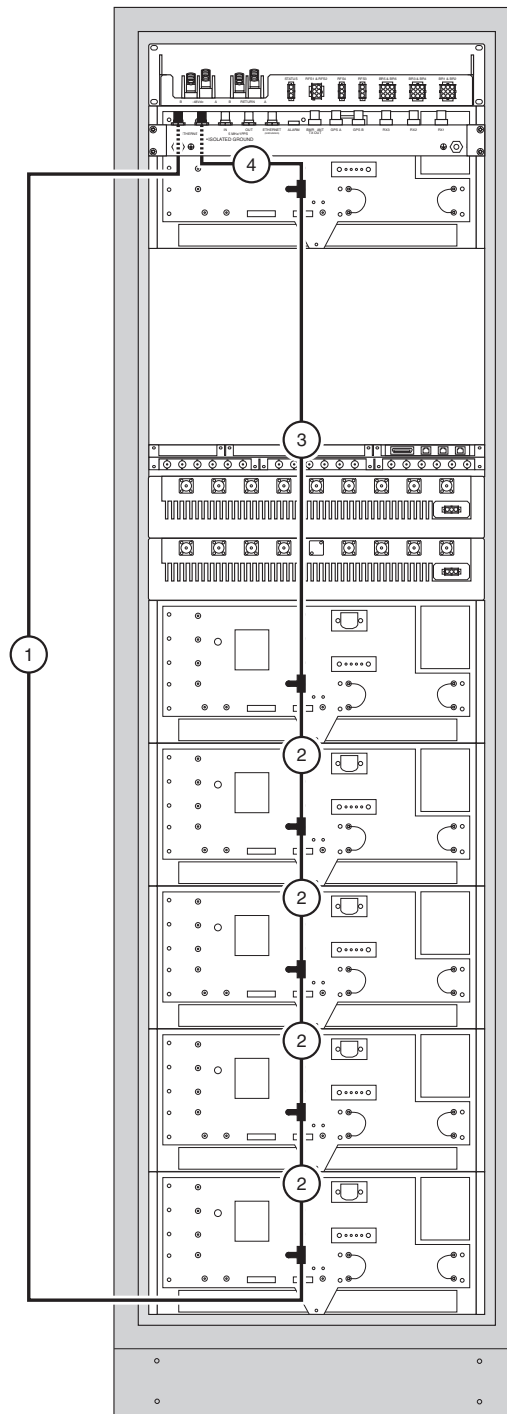
**Cabling Information****Expansion RF Cabinet Ethernet Cabling**

Table 17 identifies and Figure 26 shows the Ethernet cabling within an Expansion RF Cabinet.

*Table 17 Ethernet Cabling (Expansion RF Cabinet)*

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Part Number | From                                                        | To                                                                                                                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3082004X03  | Underside of <b>ETHERNET IN</b> connector on Junction Panel | BNC T-adapter on Base Radio 4                                                                                                    |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0112004Z17  | BNC T-adapter on Base Radio 4                               | BNC T-adapter on Base Radio 5<br>BNC T-adapter on Base Radio 6<br>BNC T-adapter on Base Radio 7<br>BNC T-adapter on Base Radio 8 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0112004Z07  | BNC T-adapter on Base Radio 8                               | BNC T-adapter on Base Radio 9                                                                                                    |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3082004X03  | BNC T-adapter on Base Radio 9                               | Underside of <b>ETHERNET OUT</b> connector on Junction Panel                                                                     |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Cables are connected between BNC T-adapters (P/N 0909907D01), which are connected to the appropriate BR connector.</li> <li>2. Cabinet is equipped with cables (index no. 2) and T-adapters for connection to six BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. Unless cabinet is to be used with other RF cabinets, ETHERNET OUT connector must be terminated with 50Ω termination (P/N 0909906D01).</li> <li>4. Where applicable, BR11 - BR16 (Expansion RF Cabinet #2) and BR17 - BR22 (Expansion RF Cabinet #3) are cabled in same pattern as shown here.</li> </ol> |             |                                                             |                                                                                                                                  |





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Figure 26 **Ethernet Cabling (Expansion RF Cabinet)**

Cabling Information

Gen 3 SC/EAS Interconnections

Gen 3 SC/EAS interconnections refer to the SRRC primary cabinet system redundancy connections between Gen 3 SC A and Gen 3 SC B, and the connections between the Gen 3 SC and the EAS.

Table 18 identifies and Figure 27 shows the Gen 3 SC-to-EAS.

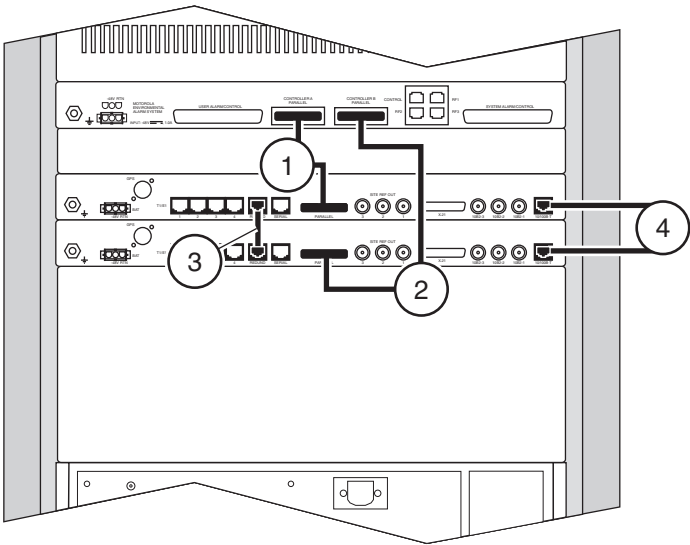
Table 18      **Gen 3 SC/EAS Interconnections**

| Index | Part Number | From                                   | To                                                                |
|-------|-------------|----------------------------------------|-------------------------------------------------------------------|
| 1     | 3083499X01  | CONTROLLER A PARALLEL connector on EAS | PARALLEL connector on Gen 3 SC A Transient Protection (S/P) card. |
| 2     | 3083499X01  | CONTROLLER B PARALLEL connector on EAS | PARALLEL connector on Gen 3 SC B Transient Protection (S/P) card. |
| 3     | 3084225N24  | REDUND connector on Gen 3 SC A         | REDUND connector on Gen 3 SC B                                    |
| 4     | 3082505Y12  | 10/100 B-T Connector on Gen 3 SC A     | 10/100 B-T Connector on Gen 3 SC B                                |

NOTES:

1. Refer to Gen 3 SC Supplement to this manual, 68P880801E30, for Gen 3 SC-to-network cabling.

2. Refer to Gen 3 SC Supplement to this manual, 68P880801E30, for EAS USER ALARM connections.



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Figure 27      **Gen 3 SC/EAS Interconnections**

## DC Power Cabling

DC power connections refer to power cabling between the Equipment Cabinet Power Distribution Panel and the modules within the cabinet.

Information for both the SRRC primary cabinet and expansion cabinets is respectively provided below.

### SRRC Primary Cabinet DC Power Cabling

Table 19 identifies and Figure 28 shows the DC power connections for the SRRC primary cabinet.

Table 19 **DC Power Cabling (SRRC Primary Cabinet)**

| Index                                                                                                                                                                                                                                                                                                                | Part Number | From                                                              | To                                                                                                                                        | Notes                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                    | 3082050X02  | <b>BR1&amp;BR2</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 1 and 2                                                                                           | Y-cable assembly                         |
| 2                                                                                                                                                                                                                                                                                                                    | 3082050X01  | <b>BR3&amp;BR4</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 3 and 10 (NOTE 2)                                                                                 | Y-cable assembly                         |
| 3                                                                                                                                                                                                                                                                                                                    | 3082129X04  | <b>RFS1&amp;RFS2</b> connectors on Power Distribution Panel       | <b>-48 VDC</b> Mate-N-Lok input connector on Rx Tray I/O board                                                                            | See detail A in Fig. 28                  |
| 4                                                                                                                                                                                                                                                                                                                    | 3082129X02  | <b>FAN POWER</b> output Mate-N-Lok connector on Rx Tray I/O board | Mate-N-Lok input connector on Combiner Deck (NOTE 3)                                                                                      | Y-cable assembly see detail A in Fig. 28 |
| 5                                                                                                                                                                                                                                                                                                                    | 3082056X03  | RFDS power output Mate-N-Lok connector on Rx Tray I/O board       | 9-pin submini D connector (P5) on RFDS duplexer shelf                                                                                     | See detail A in Fig. 28                  |
| 6                                                                                                                                                                                                                                                                                                                    | 3083609X01  | <b>CTRL A</b> connector on Power Distribution Panel               | <ul style="list-style-type: none"> <li><b>BATTERY</b> connector on EAS/iMU</li> <li><b>BATTERY</b> connector on Gen 3 SC/iSC A</li> </ul> | Y-cable assembly                         |
| 7                                                                                                                                                                                                                                                                                                                    | 3082082X02  | <b>CTRL B</b> connector on Power Distribution Panel               | <b>BATTERY</b> connector on Gen 3 SC/iSC B                                                                                                |                                          |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>Cabinet is equipped with full 4-BR power cabling.</li> <li>BR10 is expansion BR. Baseline system is equipped with BR1 through BR3 only.</li> <li>If cabinet is equipped with only one Combiner Deck, unused end of index 4 is cable-tied out of way.</li> </ol> |             |                                                                   |                                                                                                                                           |                                          |

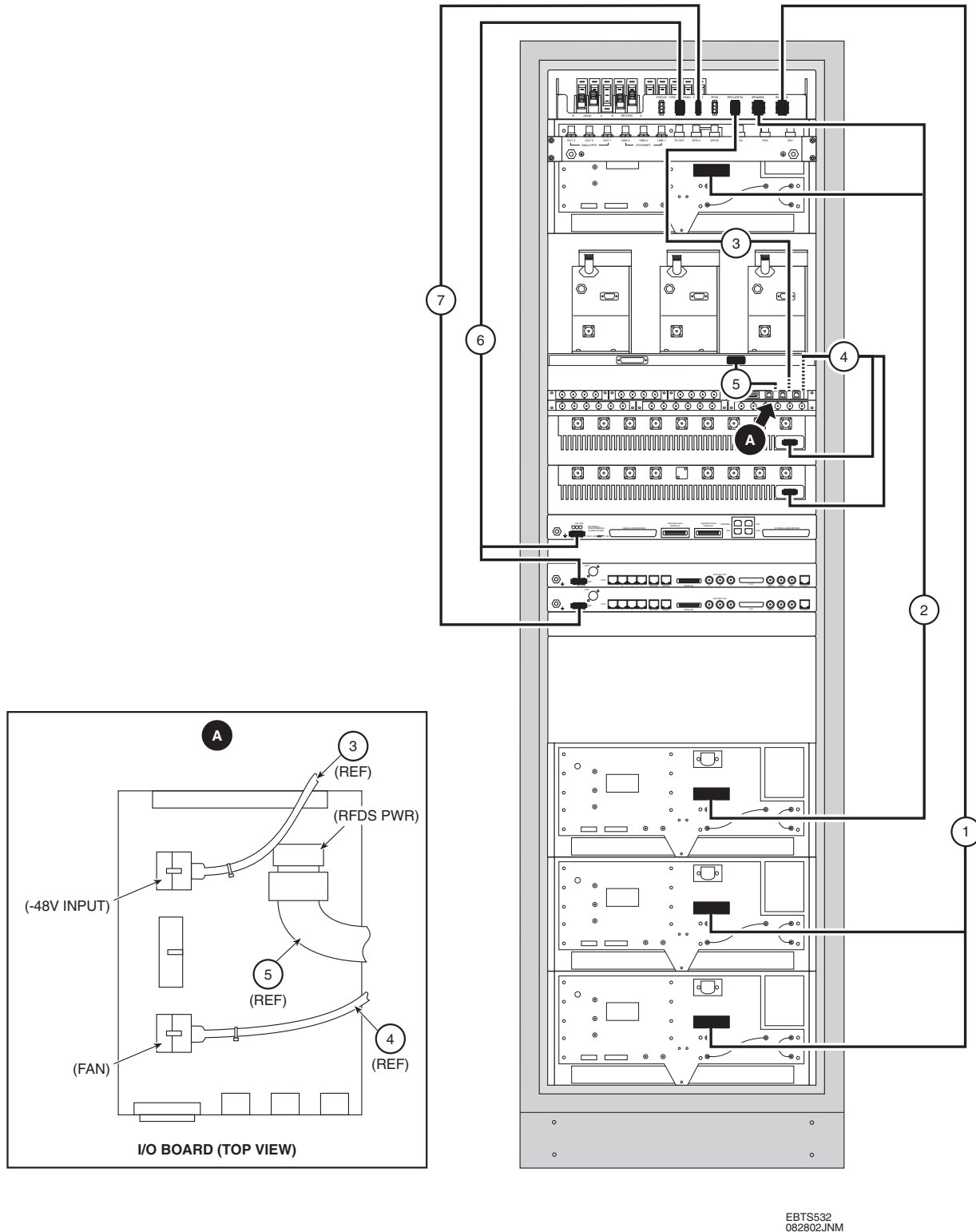
**Cabling Information**

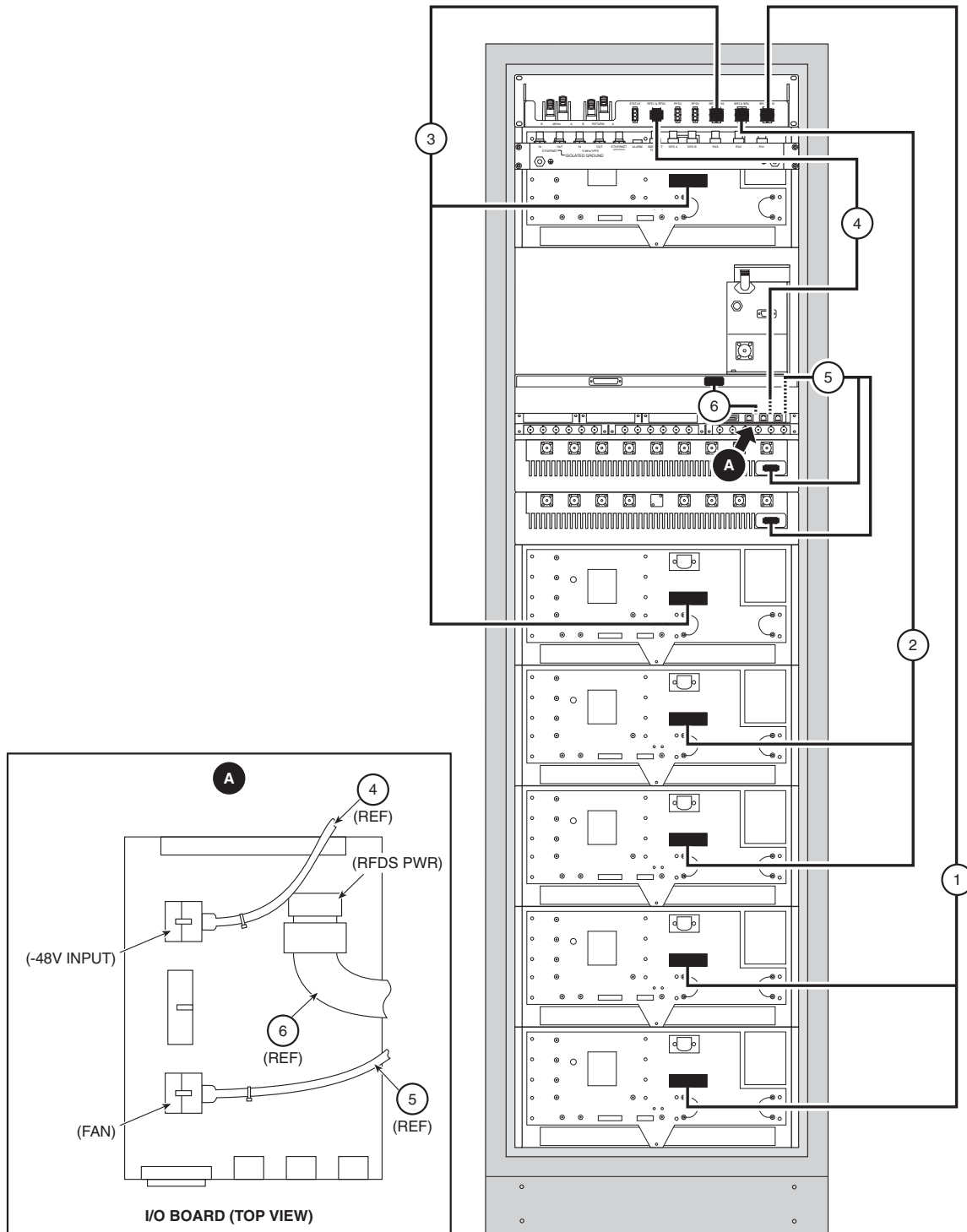
Figure 28 **DC Power Cabling (SRRS Primary Cabinet)**

## Expansion RF Cabinet DC Power Cabling

Table 20 identifies and Figure 29 shows the DC power connections within an Expansion RF Cabinet.

Table 20 **DC Power Cabling (Expansion RF Cabinet)**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Part Number | From                                                              | To                                                             | Notes                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3082050X02  | <b>BR1&amp;BR2</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 4 and 5                | Y-cable assembly                         |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3082050X01  | <b>BR3&amp;BR4</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 6 and 7                | Y-cable assembly                         |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3082050X03  | <b>BR5&amp;BR6</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 8 and 9                | Y-cable assembly                         |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3082129X05  | <b>RFS1&amp;RFS2</b> connectors on Power Distribution Panel       | <b>-48 VDC</b> Mate-N-Lok input connector on Rx Tray I/O board | See detail A in Fig. 29                  |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3082129X02  | <b>FAN POWER</b> output Mate-N-Lok connector on Rx Tray I/O board | Mate-N-Lok input connector on Combiner Deck (NOTE 3)           | Y-cable assembly see detail A in Fig. 29 |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3082056X03  | RFDS power output Mate-N-Lok connector on Rx Tray I/O board       | 9-pin submini D connector (P5) on RFDS duplexer shelf          | See detail A in Fig. 29 (NOTE 4)         |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. All cabinets (regardless of ordered configuration) are equipped with full 6-BR power cabling.</li> <li>2. Where applicable, BR11 - BR16 (Expansion RF Cabinet #2) and BR17 - BR22 (Expansion RF Cabinet #3) are cabled in same pattern as shown here.</li> <li>3. If cabinet is equipped with only one Combiner Deck, unused end of index 5 is cable-tied out of way.</li> <li>4. Duplexer shelf and index 6 connection only for Expansion RF Cabinet #3.</li> </ol> |             |                                                                   |                                                                |                                          |

**Cabling Information**EBTS554  
031298JNM**Figure 29 DC Power Cabling (Expansion RF Cabinet)**

## Alarm/Power Monitor Harness Connections

The cabinet alarm connections use a multi-connector wiring harness assembly that provides for daisy-chain connection of the various modules.

Information for both the SRRC primary cabinet and expansion cabinets is respectively provided below.

### NOTE

I/O Board alarm-to-EAS cabling varies with I/O Board version. Refer to “I/O Board Alarm Output Cabling” and Figure 14 earlier in this section for details.

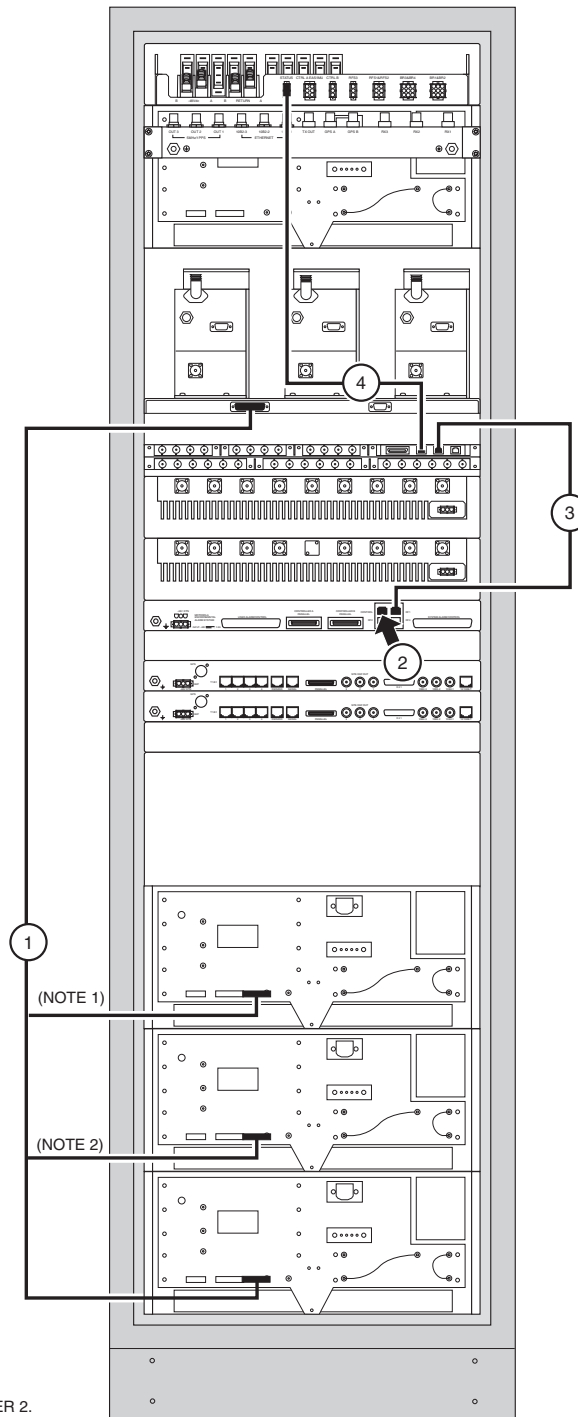
## SRRC Primary Cabinet Alarm/Power Monitor Harness Connections

Table 21 identifies and Figure 30 shows the harness connecting points for the SRRC primary cabinet.

Table 21 **Alarm/Power Monitor Harness Connections (SRRC Primary Cabinet)**

| Index                                                                                                                                                                                                                                                                                              | Part Number | From                                                   | To                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                  | 3082053X05  | 25-pin submini-D connector (P4) on RFDS duplexer shelf | Power monitor multi-connector harness. From top-to-bottom, connects to: <ul style="list-style-type: none"> <li>• 25-pin <b>ALARM</b> connector on Base Radio 3 (NOTE 1)</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 2 (NOTE 2)</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 1</li> </ul> |
| 2                                                                                                                                                                                                                                                                                                  | 3082733X02  | —                                                      | Shorting plug. Connects to <b>CONTROL</b> connector on EAS/iMU.<br><b>CAUTION: If shorting plug is not used, false alarms will result.</b>                                                                                                                                                                    |
| 3                                                                                                                                                                                                                                                                                                  | 3084225N02  | RJ45 STANDARD alarm connector on I/O board             | <b>RF#1</b> connector on EAS/iMU                                                                                                                                                                                                                                                                              |
| 4                                                                                                                                                                                                                                                                                                  | 3082129X03  | <b>STATUS</b> connector on breaker panel               | RJ45 EXPANSION alarm input connector on I/O board                                                                                                                                                                                                                                                             |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Base Radio 3 ALARM connection performed only on systems with Base Radio PA outputs applied to Duplexer 3.</li> <li>2. Base Radio 2 ALARM connection performed only on systems with Base Radio PA outputs applied to Duplexer 2.</li> </ol> |             |                                                        |                                                                                                                                                                                                                                                                                                               |

## Cabling Information



## NOTES:

1. BASE RADIO 3 ALARM CONNECTION PERFORMED ONLY ON SYSTEMS WITH BASE RADIO PA OUTPUTS APPLIED TO DUPLEXER 3.
2. BASE RADIO 2 ALARM CONNECTIONS PERFORMED ONLY ON SYSTEMS WITH BASE RADIO PA OUTPUTS APPLIED TO DUPLEXER 2.

EBTS522  
082802JNM

Figure 30 **Alarm/Power Monitor Harness Connections  
(SRRC Primary Cabinet)**



## Expansion RF Cabinet Alarm/Power Monitor Harness Connections

Table 22 identifies and Figure 31 shows the harness connecting points within an Expansion RF Cabinet.

Table 22 **Alarm/Power Monitor Harness Connections (Expansion RF Cabinet)**

| Index                                                                                  | Part Number | From                                                   | To                                                                                                                     |
|----------------------------------------------------------------------------------------|-------------|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| 1                                                                                      | 3082053X01  | 25-pin submini-D connector (P4) on RFDS duplexer shelf | 25-pin <b>ALARM</b> connector on Base Radio 17 (NOTE)                                                                  |
| 2                                                                                      | 3084225N42  | RJ-45 ALARM STANDARD connector on Rx Tray I/O Board    | SRRC primary cabinet EAS. (Refer to "Alarm Intercabling" in the Installation section of this manual for instructions.) |
| 3                                                                                      | 3082129X03  | <b>STATUS</b> connector on breaker panel               | RJ45 EXPANSION alarm input connector on Rx Tray I/O board                                                              |
| <b>NOTE:</b> Base Radio 17 ALARM connection performed only on Expansion RF Cabinet #3. |             |                                                        |                                                                                                                        |

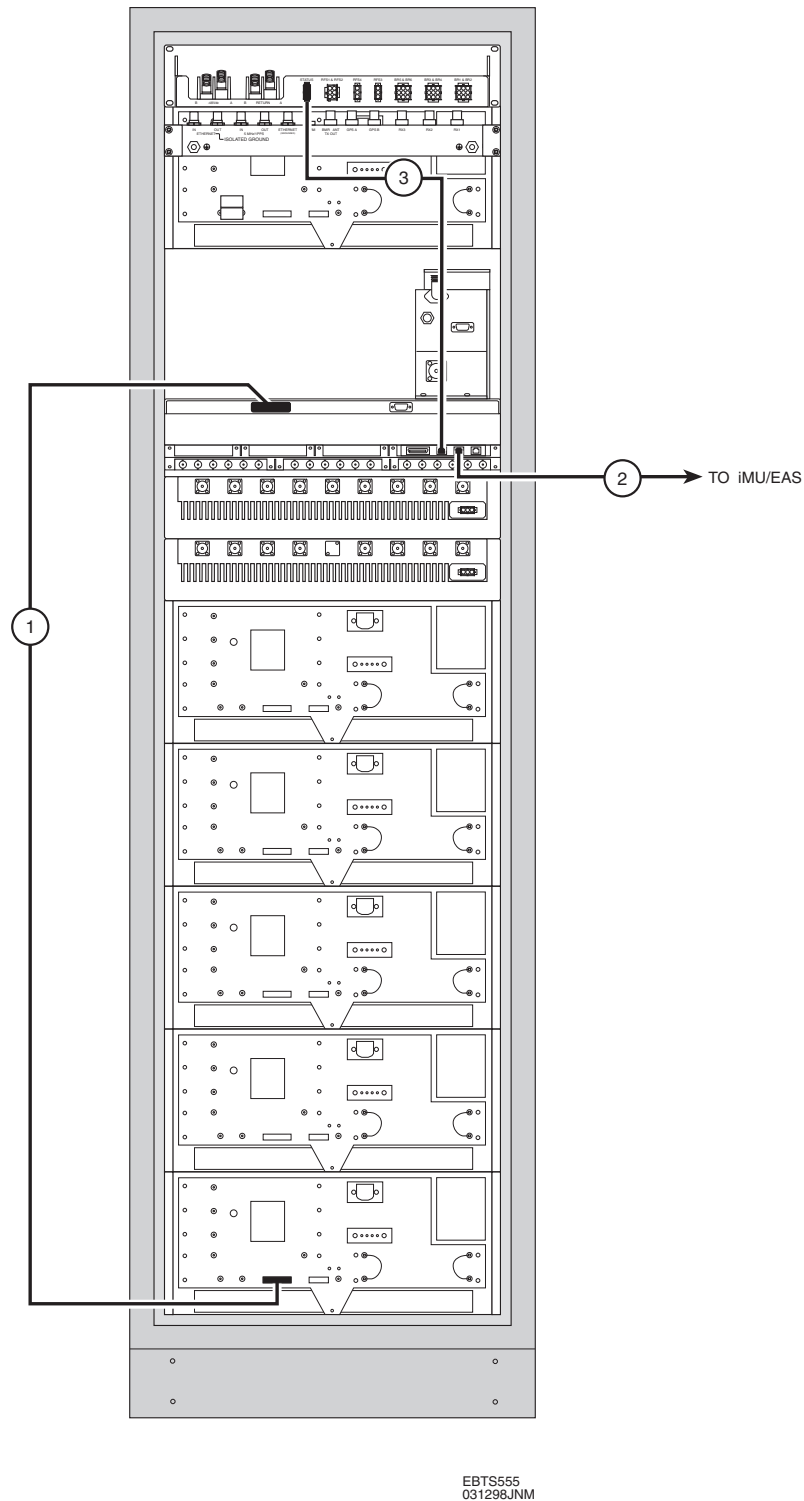
**Cabling Information**

Figure 31 **Alarm/Power Monitor Harness Connections  
(Expansion RF Cabinet)**

## Transmit Power Out Cabling

### NOTE

Refer to Receiver Cabling for receive expansion cabling information.

Transmit power output cabling routes the Base Radio RF output to the transmit inputs on the RFDS. In expansion systems, transmit power output cabling also describes intercabinet cabling, combiner deck cascading cabling, and Expansion RF Cabinet power out cabling.

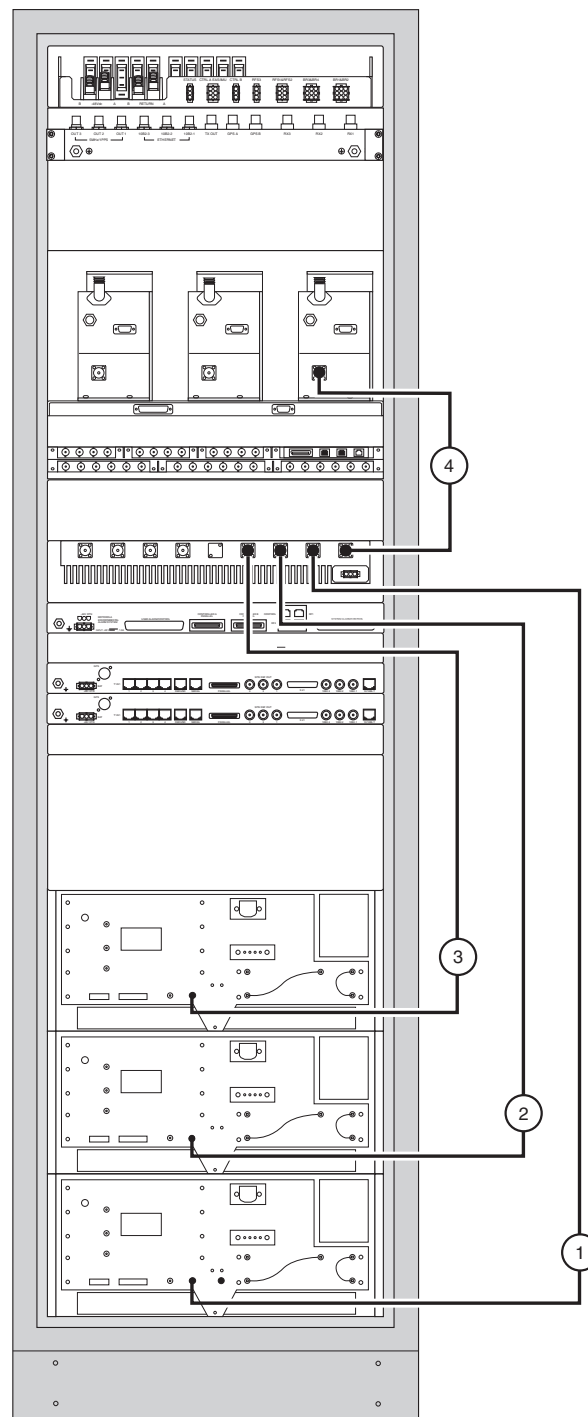
Cabling information is provided below in accordance with the expansion level break points utilized in the SRRC system.

### 1-3 BR (Baseline) SRRC Transmit Cabling

Table 23 identifies and Figure 32 shows the baseline 1-3 BR SRRC Tx cabling. This cabling is also the basis for all system expansion, as well.

Table 23 **Transmit Power Out Cabling, 1-3 BR (SRRC Primary Cabinet)**

| Index | Part Number | From                                      | To                                    |
|-------|-------------|-------------------------------------------|---------------------------------------|
| 1     | 0112004K14  | PA OUT connector on BR 1                  | Dual 3-Way Combiner Deck T2 (IN) port |
| 2     | 0112004K14  | PA OUT connector on BR 2                  | Dual 3-Way Combiner Deck T3 (IN) port |
| 3     | 0112004K14  | PA OUT connector on BR 3                  | Dual 3-Way Combiner Deck T4 (IN) port |
| 4     | 0112004B03  | T1 (OUT) port on Dual 3-Way Combiner Deck | Antenna 1 Duplexer Tx input port      |

**Cabling Information**

EBTS523  
082802JNM

Figure 32 **Transmit Power Out Cabling, 1-3 BR (SRRC Primary Cabinet)**

### 4-9 BR Transmit Expansion Intercabinet Cabling

Table 24 identifies and Figure 33 shows the intercabinet cabling between a baseline SRRC primary cabinet and an Expansion RF Cabinet.

#### NOTE

Refer to Transmit Cabling (Within Expansion RF Cabinets) for BR transmit cabling within the Expansion RF Cabinet.

Table 24 **Transmit Expansion Intercabinet Cabling (4-9 BR Expansion)**

| Index                                                                                                                                                                                                                                                                                                | Part Number            | From                                                                                                                               | To                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| 1                                                                                                                                                                                                                                                                                                    | 0112004B03<br>(NOTE 1) | SRRC primary cabinet Dual 3-Way Combiner Deck <b>T1</b> (OUT) port (TX1-TX3 combined signal)                                       | Antenna 1 Duplexer Tx input port |
| 2                                                                                                                                                                                                                                                                                                    | CKN6288A               | (Low-loss intercabinet cable)<br>Expansion RFC Dual 3-Way Combiner Deck <b>T1</b> (OUT) port (TX4-TX6 combined signal)<br>(NOTE 2) | Antenna 2 Duplexer Tx input port |
| 3                                                                                                                                                                                                                                                                                                    | CKN6288A               | (Low-loss intercabinet cable)<br>Expansion RFC Dual 3-Way Combiner Deck <b>T6</b> (OUT) port (TX7-TX9 combined signal)<br>(NOTE 2) | Antenna 3 Duplexer Tx input port |
| <b>NOTES:</b><br>1. Index 1, and connections shown, are part of baseline system. BR1-BR3 are connected as shown in Figure 32.<br>2. Configuration shown here cannot be directly expanded beyond 9 BRs. For expansion greater than 9 BR, refer to 10 BR Expansion information in the following table. |                        |                                                                                                                                    |                                  |

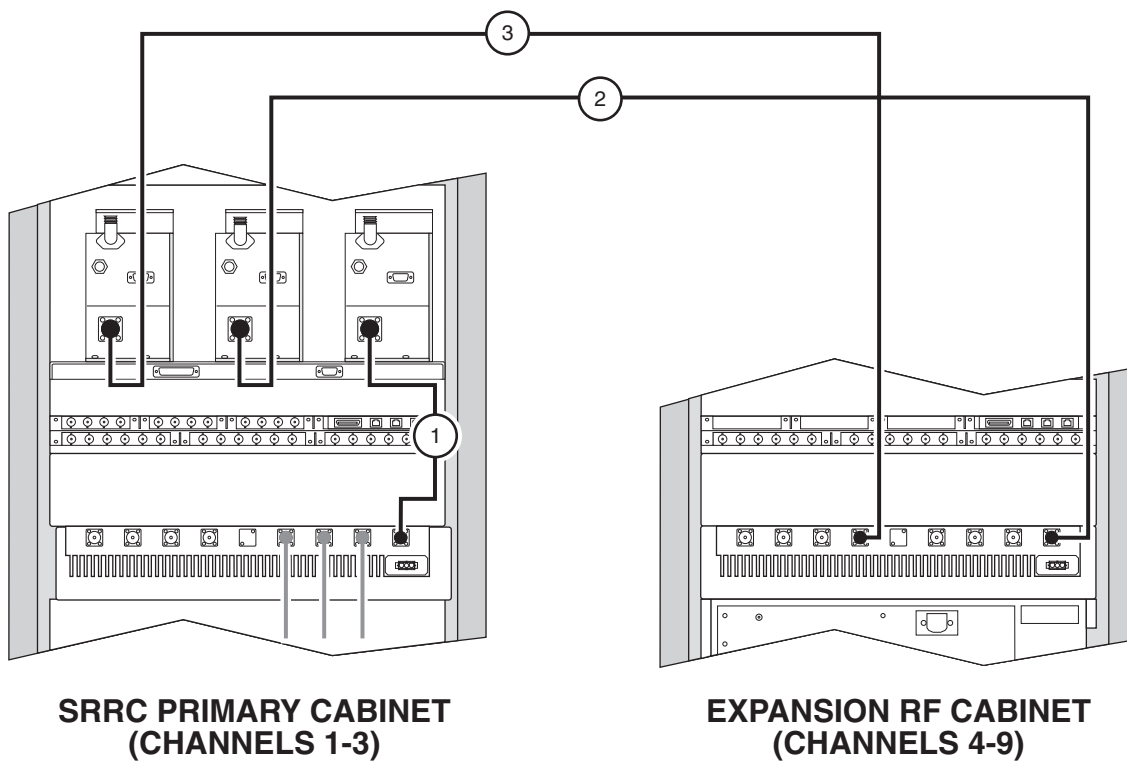
**Cabling Information**EBTS527  
031198LLN

Figure 33 *Transmit Expansion Intercabinet Cabling (4-9 BR Expansion)*

## 10-BR Transmit Expansion Cabling

Table 25 identifies and Figure 34 shows the combiner deck and BR cabling within the SRRC primary cabinet for a 10-BR expansion. **This expansion level is also required as an intermediate step to greater expansion levels.**

### NOTE

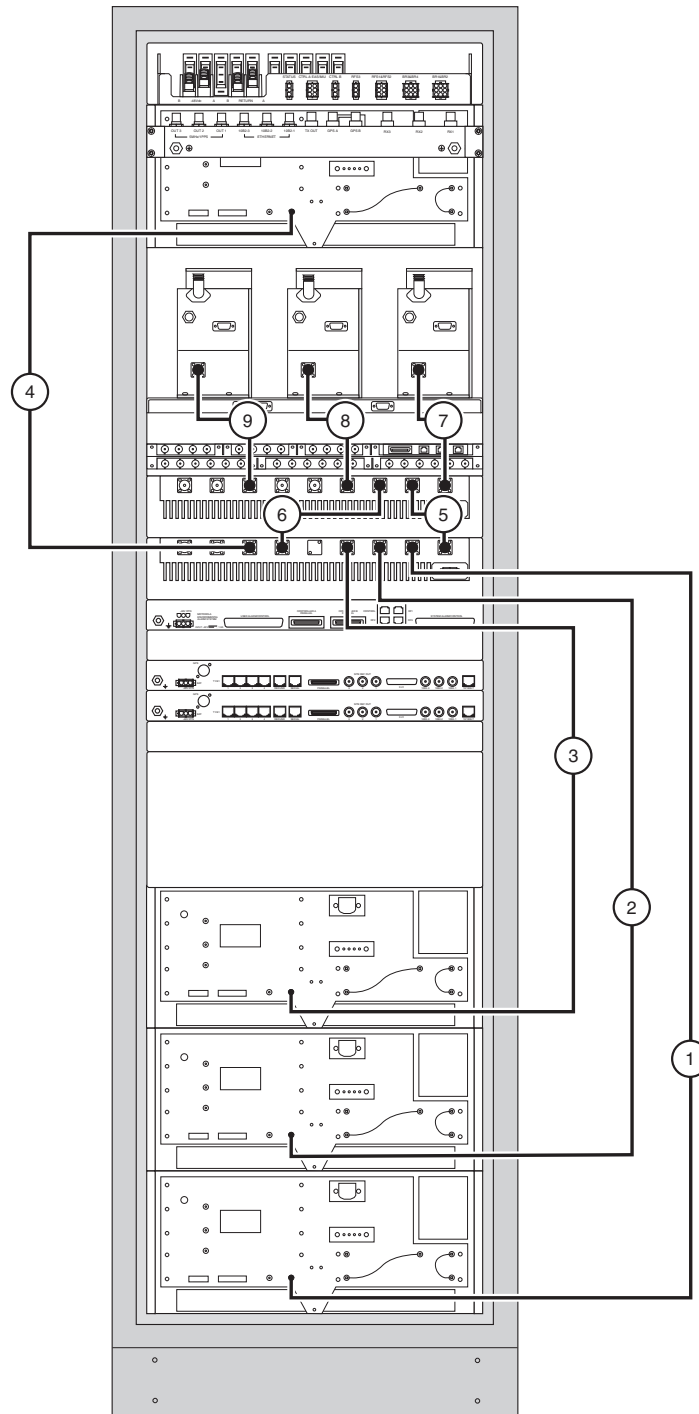
Refer to Transmit Cabling (Within Expansion RF Cabinets) for BR transmit cabling within the Expansion RF Cabinet.

### NOTE

A 4-BR SRRC primary cabinet system is built using the equipment and connections listed below. For the 4-BR primary cabinet system, Expansion RF Cabinet #1 (BR4-9) is omitted along with all other expansions.

Table 25 **Transmit Expansion Cabling (10 BR Expansion)**

| Index                                                                       | Part Number | From                                                                     | To                                      |
|-----------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------|-----------------------------------------|
| 1                                                                           | 0112004K14  | PA OUT connector on BR 1 (NOTE)                                          | Dual 3-Way Combiner Deck T2 (IN) port   |
| 2                                                                           | 0112004K14  | PA OUT connector on BR 2 (NOTE)                                          | Dual 3-Way Combiner Deck T3 (IN) port   |
| 3                                                                           | 0112004K14  | PA OUT connector on BR 3 (NOTE)                                          | Dual 3-Way Combiner Deck T4 (IN) port   |
| 4                                                                           | 0112004K08  | PA OUT connector on BR 10                                                | Dual 3-Way Combiner Deck T7 (IN) port   |
| 5                                                                           | 0112004B03  | Dual 3-Way Combiner Deck T1 (OUT) port (TX1-TX3 combined signal)         | Triple 2-Way Combiner Deck T2 (IN) port |
| 6                                                                           | 0112004B03  | Dual 3-Way Combiner Deck T6 (OUT) port (TX10 signal)                     | Triple 2-Way Combiner Deck T3 (IN) port |
| 7                                                                           | 0112004B03  | Triple 2-Way Combiner Deck T1 (OUT) port (TX1-TX3, TX10 combined signal) | Antenna 1 Duplexer                      |
| 8                                                                           | 0112004B03  | Triple 2-Way Combiner Deck T4 (OUT) port (TX4-TX9 combined signal)       | Antenna 2 Duplexer                      |
| 9                                                                           | 0112004B03  | Triple 2-Way Combiner Deck T7 (OUT) port (TX11-TX16 combined signal)     | Antenna 3 Duplexer                      |
| <b>NOTE:</b> Index 1-3, and connections shown, are part of baseline system. |             |                                                                          |                                         |

**Cabling Information**

EBTS530  
062602JNM

Figure 34 **Transmit Expansion Cabling (10 BR Expansion)**



#### 4-16 BR Transmit Expansion Intercabinet Cabling

Table 26 identifies and Figure 35 shows the intercabinet cabling between the SRRC primary cabinet and Expansion RF Cabinets #1 and #2 for a 4-16 BR expansion.

##### NOTE

Refer to Transmit Cabling (Within Expansion RF Cabinets) for BR transmit cabling within the Expansion RF Cabinet.

##### NOTE

Any existing 4-9 BR expansion intercabinet cabling must be disconnected at the SRRC primary cabinet and reconnected as shown here.

Table 26 **Transmit Expansion Intercabinet Cabling (4-9 BR / 11-16 BR Expansion)**

| Index | Part Number | From                                                                                                                              | To                                                                     |
|-------|-------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| 1     | CKN6288A    | (Low-loss intercabinet cable)<br>Expansion RFC #1 Dual 3-Way Combiner Deck<br><b>T1</b> (OUT) port<br>(TX4-TX6 combined signal)   | SRRC primary cabinet Triple 2-Way Combiner<br>Deck <b>T6</b> (IN) port |
| 2     | CKN6288A    | (Low-loss intercabinet cable)<br>Expansion RFC #1 Dual 3-Way Combiner Deck<br><b>T6</b> (OUT) port<br>(TX7-TX9 combined signal)   | SRRC primary cabinet Triple 2-Way Combiner<br>Deck <b>T5</b> (IN) port |
| 3     | CKN6288A    | (Low-loss intercabinet cable)<br>Expansion RFC #2 Dual 3-Way Combiner Deck<br><b>T1</b> (OUT) port<br>(TX11-TX13 combined signal) | SRRC primary cabinet Triple 2-Way Combiner<br>Deck <b>T9</b> (IN) port |
| 4     | CKN6288A    | (Low-loss intercabinet cable)<br>Expansion RFC #1 Dual 3-Way Combiner Deck<br><b>T6</b> (OUT) port<br>(TX14-TX16 combined signal) | SRRC primary cabinet Triple 2-Way Combiner<br>Deck <b>T8</b> (IN) port |

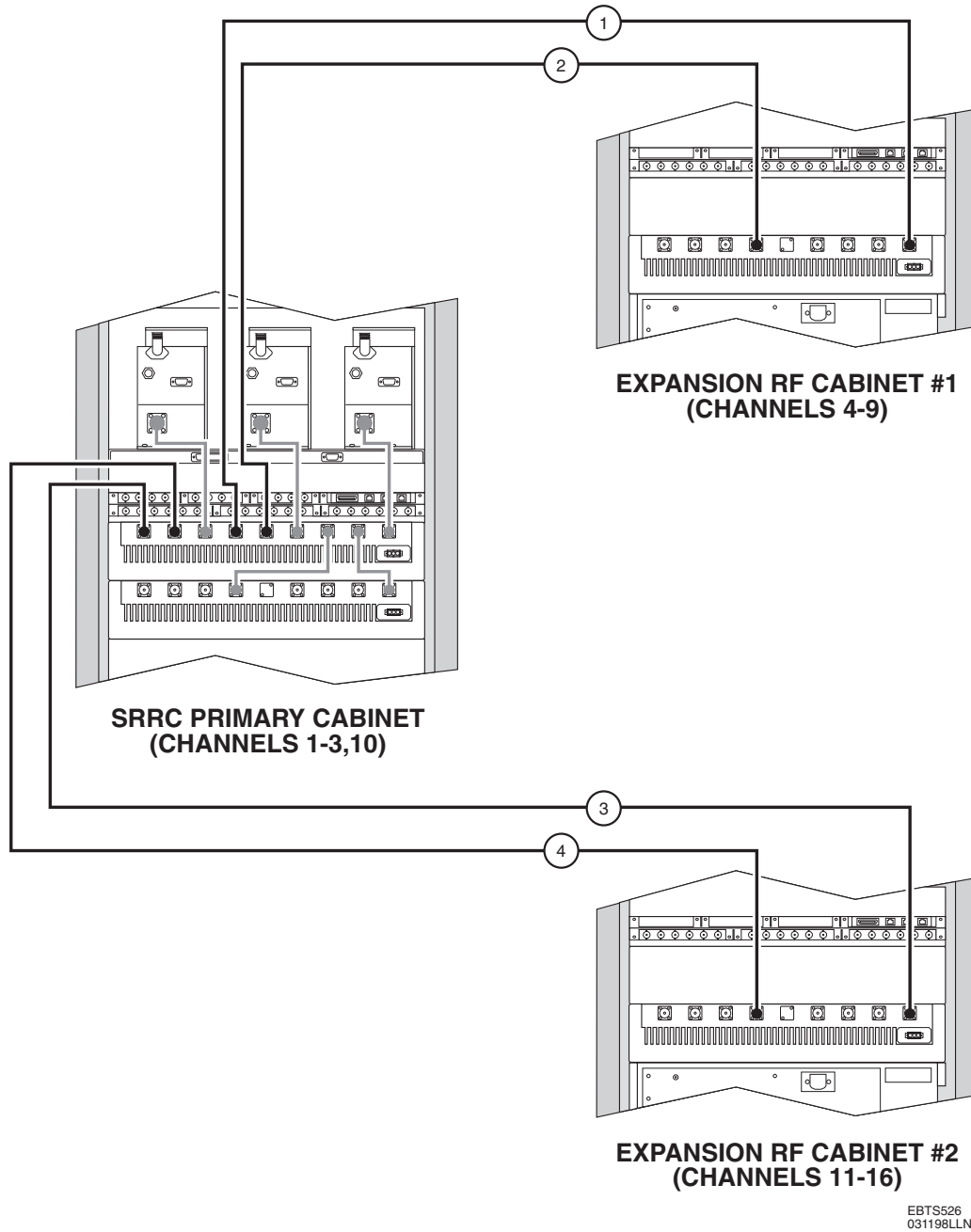
**Cabling Information**

Figure 35 **Transmit Expansion Intercabinet Cabling (4-9BR / 11-16BR Expansion)**

## Transmit Cabling (Within Expansion RF Cabinets)

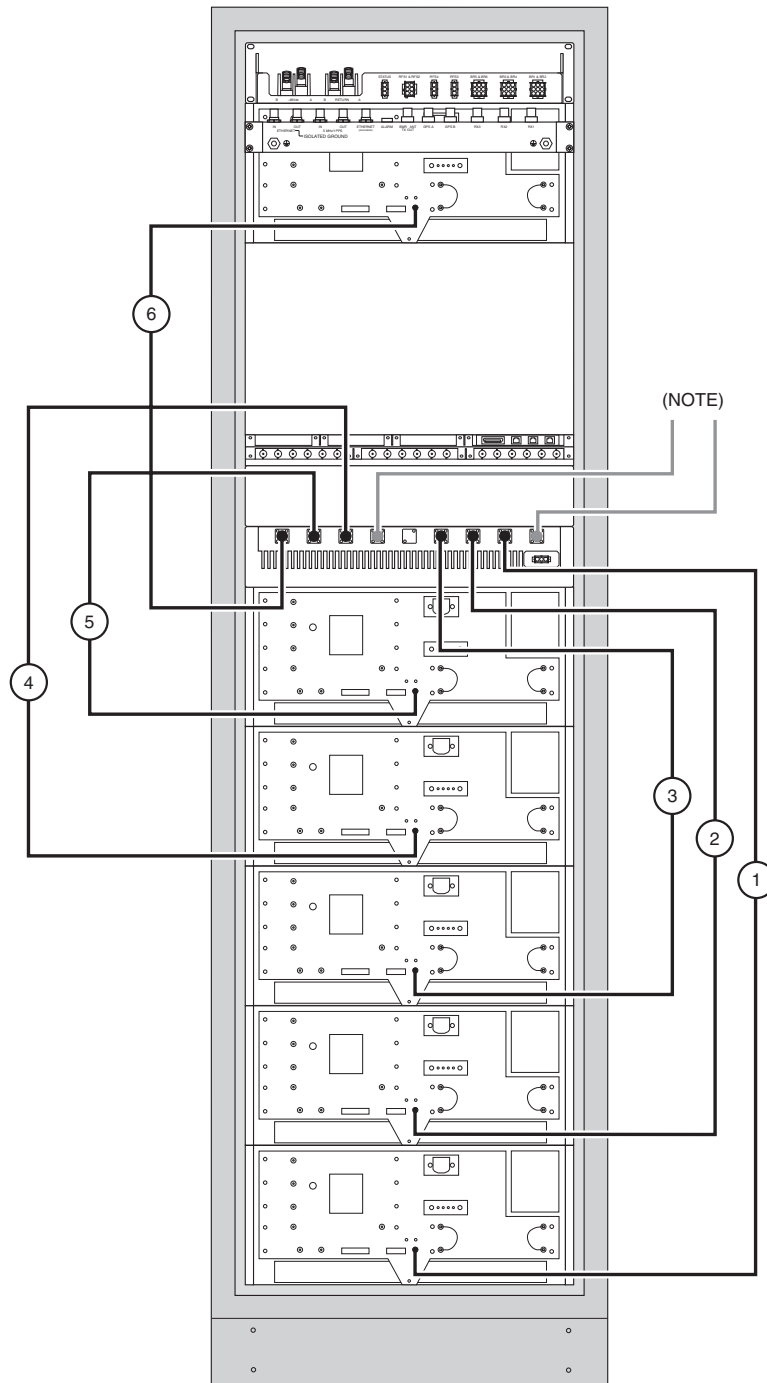
Transmit cabling within the Expansion RF Cabinet refers to the Base Radio-to-Combiner Deck cabling within the Expansion RF Cabinet. Cabling for Expansion RF Cabinets #1 and #2 differs from that of separate-Tx branch Expansion RF #3. Information for each type of cabinet is respectively provided below.

### Expansion RF Cabinet #1 and #2 Transmit Cabling

Table 27 identifies and Figure 36 shows the Tx cabling in Expansion RF Cabinet #1 or #2 (BRs 4-9 or BRs 11-16).

Table 27 **Transmit Cabling (Expansion RF Cabinet #1 or #2)**

| Index                                                                                                                                           | Part Number | From (NOTE)              | To                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------|---------------------------------------|
| 1                                                                                                                                               | 0112004K14  | PA OUT connector on BR 4 | Dual 3-Way Combiner Deck T2 (IN) port |
| 2                                                                                                                                               | 0112004K14  | PA OUT connector on BR 5 | Dual 3-Way Combiner Deck T3 (IN) port |
| 3                                                                                                                                               | 0112004K14  | PA OUT connector on BR 6 | Dual 3-Way Combiner Deck T4 (IN) port |
| 4                                                                                                                                               | 0112004K08  | PA OUT connector on BR 7 | Dual 3-Way Combiner Deck T7 (IN) port |
| 5                                                                                                                                               | 0112004K08  | PA OUT connector on BR 8 | Dual 3-Way Combiner Deck T8 (IN) port |
| 6                                                                                                                                               | 0112004K08  | PA OUT connector on BR 9 | Dual 3-Way Combiner Deck T9 (IN) port |
| <b>NOTE:</b> Where applicable, BR11 through BR16 Tx cabling in expansion cabinet #2 is connected in same pattern as BR4 through BR9 Tx cabling. |             |                          |                                       |

**Cabling Information**

**NOTE:** INTERCABINET CABLES SHOWN FOR REFERENCE ONLY.  
REFER TO "TRANSMIT POWER OUT CABLING" DIAGRAMS  
FOR CONNECTING POINT AND PART NO. DETAILS.

EBTS41  
060198JNM

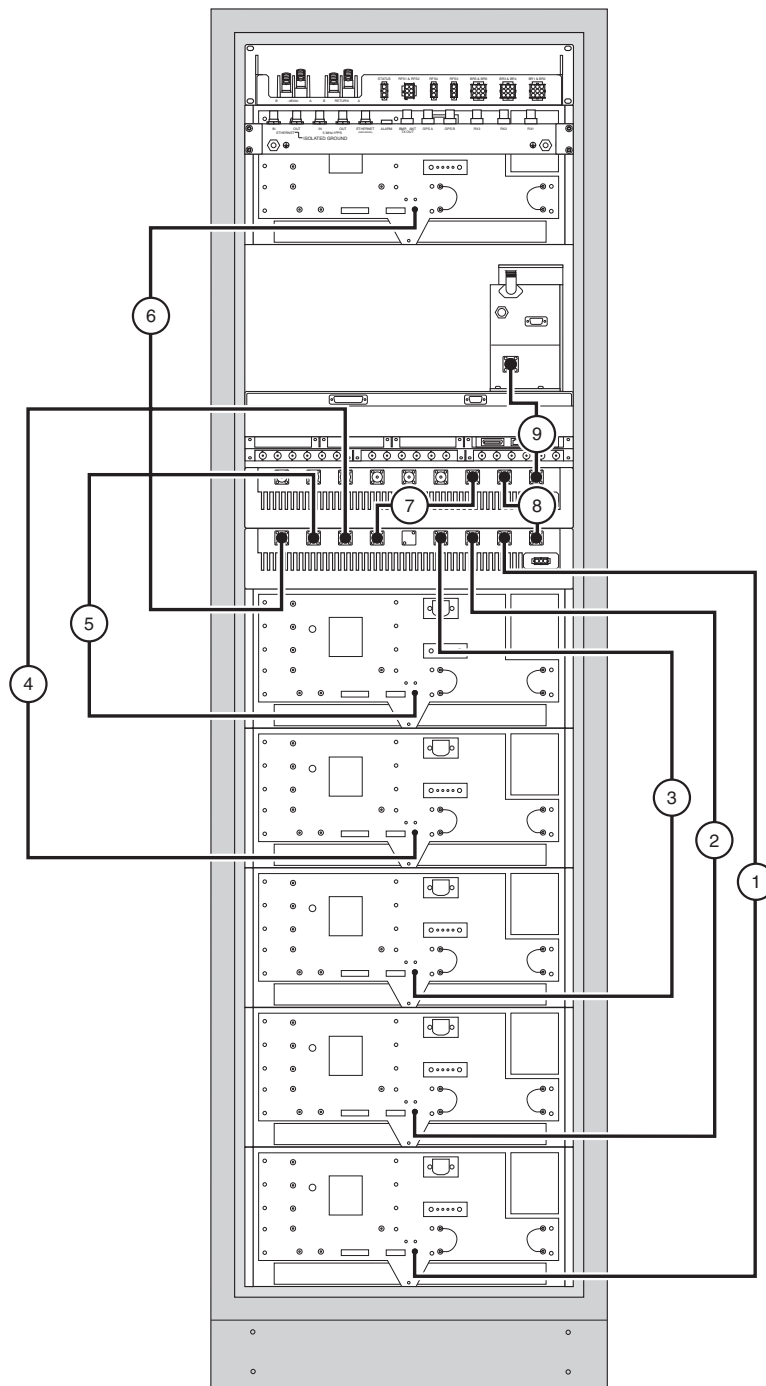
Figure 36 **Transmit Cabling (Expansion RF Cabinet #1 or #2)**

### Expansion RF Cabinet #3 Transmit Cabling

Table 28 identifies and Figure 37 shows the Tx cabling in Expansion RF Cabinet #3 for BRs 17 through 22.

*Table 28*      **Transmit Cabling (Expansion RF Cabinet #3)**

| <b>Index</b> | <b>Part Number</b> | <b>From</b>                                                                  | <b>To</b>                                      |
|--------------|--------------------|------------------------------------------------------------------------------|------------------------------------------------|
| 1            | 0112004K14         | <b>PA OUT</b> connector on BR 17                                             | Dual 3-Way Combiner Deck <b>T2</b> (IN) port   |
| 2            | 0112004K14         | <b>PA OUT</b> connector on BR 18                                             | Dual 3-Way Combiner Deck <b>T3</b> (IN) port   |
| 3            | 0112004K14         | <b>PA OUT</b> connector on BR 19                                             | Dual 3-Way Combiner Deck <b>T4</b> (IN) port   |
| 4            | 0112004K08         | <b>PA OUT</b> connector on BR 20                                             | Dual 3-Way Combiner Deck <b>T7</b> (IN) port   |
| 5            | 0112004K08         | <b>PA OUT</b> connector on BR 21                                             | Dual 3-Way Combiner Deck <b>T8</b> (IN) port   |
| 6            | 0112004K08         | <b>PA OUT</b> connector on BR 22                                             | Dual 3-Way Combiner Deck <b>T9</b> (IN) port   |
| 7            | 0112004B03         | Dual 3-Way Combiner Deck <b>T6</b> (OUT) port<br>(TX20-TX22 combined signal) | Triple 2-Way Combiner Deck <b>T3</b> (IN) port |
| 8            | 0112004B03         | Dual 3-Way Combiner Deck <b>T1</b> (OUT) port<br>(TX17-TX19 combined signal) | Triple 2-Way Combiner Deck <b>T2</b> (IN) port |
| 9            | 0112004B03         | Dual 3-Way Combiner Deck <b>T1</b> (OUT) port                                | Antenna 4 Duplexer input port                  |

**Cabling Information**

EBTS542  
031198JNM

Figure 37 **Transmit Cabling (Expansion RF Cabinet #3)**

## Duplexed TTA Cabling

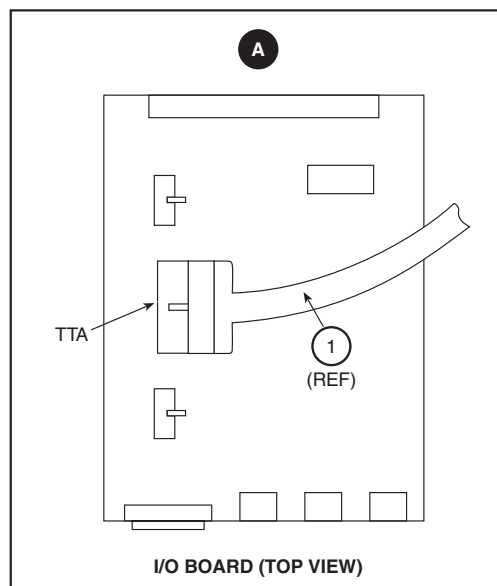
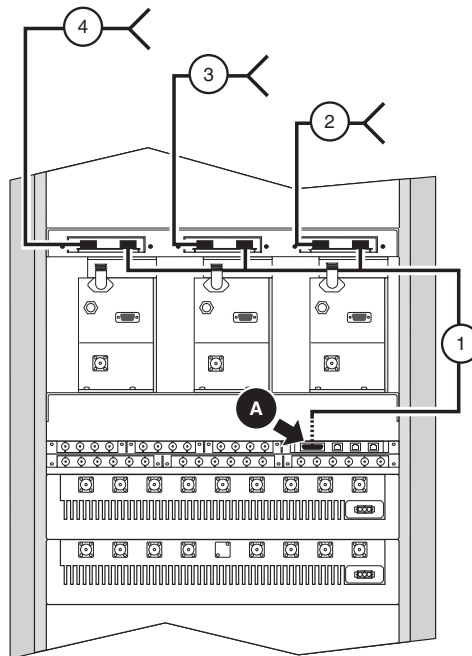
Table 29 lists and Figure 38 shows the cabling for the TTA Alarm Tray and DC Injectors within the SRRC primary cabinet.

Table 29 ***Duplexed TTA Cabling***

| Index | Part Number | From                                                                     | To                                                                                  | Notes                                                |
|-------|-------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------|
| 1     | 3082136X02  | TTA Mate-N-Lok connector on Rx Tray I/O Board (See detail A in Fig. 38.) | Right-side connector on rear of TTA power/alarm interface card (3 places, as shown) | Multi-branch wiring harness                          |
| 2     | —           | Duplexer 1 DC injector                                                   | Left-side connector on rear of TTA #1 power/alarm interface card                    | Cable is integral part of DC Injector P/N 8082223Y01 |
| 3     | —           | Duplexer 2 DC injector                                                   | Left-side connector on rear of TTA #2 power/alarm interface card                    | Cable is integral part of DC Injector P/N 8082223Y01 |
| 4     | —           | Duplexer 3 DC injector                                                   | Left-side connector on rear of TTA #3 power/alarm interface card                    | Cable is integral part of DC Injector P/N 8082223Y01 |

### NOTE

Index 1 and index 2 (and respective connectors on TTA power/alarm interface cards) are identically keyed. If connections are interposed, TTA will not function.

**Cabling Information**

**NOTE:** DC INJECTORS OMITTED FOR CLARITY.

EBTS524  
032698JNM

Figure 38 **Duplexed TTA Cabling**



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## Base Radio Buildout/RFDS Expansion

### Buildout General Information

“Base Radio Buildout” refers to adding more base radios to an existing EBTS. After a certain number of Base Radios are added to a system, RFDS expansion is required to accommodate the total Base Radio complement.

IPL software is added with each BR that is ordered. The system software must be modified for each additional BR.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

The following procedures and references specify procedures required in installing hardware and cabling only.

Complete the installation by performing system reprogramming (as applicable) in accordance with the “Software Commands” and “System Testing” sections of this manual.

An SRRC site can be built-out to a maximum of four BRs installed in the SRRC primary cabinet, and up to a maximum of 22 BRs using three additional Expansion RF Cabinets. Any additional BRs should be of the same rating (40 or 70 Watt transmit) as the BRs presently installed.

### Buildout Procedures

Depending on the existing number of Base Radios in a system, and the build out configuration being performed, various build out steps need to be taken. Table 30 lists the steps (or provides reference to procedures) in installing the various modules. Table 30 also lists the additional modules required in performing various levels of build out.

#### Installing Hardware

Using Table 30, install required hardware and perform cabling as follows:

1. Noting the existing configuration of the system, and the intended buildout configuration, note the expansion level (“Buildout Level” column) required to bring the system to the desired buildout level.

The “Buildout Level” column correspondingly lists the SRRC configuration that accommodates a given number of BRs.

**Base Radio Buildout/RFDS Expansion**

2. Noting the range of Expansion Levels required in accomplishing the buildout, note any additional equipment required in the "Equipment" column.
3. Perform the steps listed in the "Installation" column.

Examples on using the buildout table are provided below.

**Example #1:** When a baseline system containing two BRs is expanded to nine BRs, the procedures required in performing the buildout are:

- ☐ "Up to 3 BRs" buildout instructions
- ☐ "4 through 9 BRs" buildout instructions

The following equipment will be installed during the buildout procedure:

- ☐ BR4 through BR9 in an Expansion RF Cabinet

**Example #2:** When a baseline system containing three BRs is expanded to four BRs (with all four BRs to be in the primary cabinet, as opposed to adding an expansion cabinet), the procedures required in performing the buildout are:

- ☐ "10 BR" buildout instructions. (The Triple 2-Way Combiner Deck and its cabling are required in installing four BRs in the SRRC primary cabinet; this type of 4-BR SRRC system is actually a 10-BR system, less the BR4-9 expansion cabinet.)

The following equipment will be installed during the buildout procedure:

- ☐ Fourth BR (referred to as "BR10" in a normal expansion) in the SRRC primary cabinet
- ☐ One Triple 2-Way Combiner Deck in the SRRC primary cabinet

**Example #3:** When a previously expanded 9-BR system is expanded to 16 BRs, the procedures required in performing the buildout are:

- ☐ "10BRs" buildout instructions
- ☐ "11 through 16 BRs" buildout instructions

The following equipment will be installed during the buildout procedure:

- ☐ Expansion RF Cabinet #2 containing BR11 through BR16
- ☐ One Triple 2-Way Combiner Deck in the SRRC primary cabinet

## Base Radio Buildout/RFDS Expansion

Table 30 **SRRC Buildout Instructions**

| Buildout Level<br>(RFDS<br>Configuration) | Expansion<br>Equipment<br>Required         | Installation Instructions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |
|-------------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
|                                           |                                            | Procedure/Reference                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Page                                 |
| Up to 3 BRs<br>(Baseline)                 | No additional<br>equipment required        | <ol style="list-style-type: none"> <li>1. Install Base Radio(s) in accordance with “Base Radio/Base Radio FRU Replacement” (Base Radio section of this manual).</li> <li>2. Perform the following cabling in accordance with “Cabling Information” subsection. <ul style="list-style-type: none"> <li>• Receiver Cabling</li> <li>• Chassis Grounding</li> <li>• Ethernet Cabling</li> <li>• DC Power Cabling</li> <li>• Transmit Power Out Cabling</li> </ul> </li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | —<br><br>55                          |
| 4 through 9 BRs<br>(9 BR Expansion)       | Expansion RF Cabinet<br>with 6 BRs         | <ol style="list-style-type: none"> <li>1. Perform “Up to 3 BRs” buildout above, as applicable.</li> <li>2. Install Base Radio(s) in accordance with “Base Radio/Base Radio FRU Replacement” (Base Radio section of this manual).</li> <li>3. Connect intercabinet Tx cables (supplied with expansion cabinet) to SRRC primary cabinet in accordance with “4-9 BR Transmit Expansion Intercabinet Cabling”.</li> <li>4. Perform Rx expansion cabling in accordance with “Receive Intercabinet Cabling”.</li> <li>5. Connect power monitor harness connector to ALARM connector on Base Radios in accordance with “SRRC Primary Cabinet Alarm/Power Monitor Harness Connections”. (See NOTE in table regarding Base Radio ALARM connections versus duplexers used.)</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | —<br>—<br>85<br>60<br>79             |
| 10 BRs<br>(10 BR<br>Expansion)            | Triple 2-Way<br>Combiner Deck<br>(CLN1351) | <p><b>NOTE:</b> Due to different combining architectures, incremental expansion to go from a 9-BR expansion to a 10-BR expansion cannot be performed. Perform 10-BR expansion procedure in its entirety as specified below. (Refer to “Theory of Operation” subsection for more information.)<br/>If system is currently equipped with 4 through 9 BRs, the Tx cabling will need to be reconfigured in accordance with the instructions specified below.</p> <ol style="list-style-type: none"> <li>1. If not currently installed, add Base Radios 1 through 3 in SRRC primary cabinet as described in “Up to 3 BRs” buildout instructions above.</li> <li>2. On ANT 1 through ANT 3 Duplexers, disconnect existing cabling between Duplexers and Dual 3-Way Combiner Deck. Save cables for reuse.</li> <li>3. Install Triple 2-Way Combiner Deck in accordance with “Combiner Deck Replacement Procedure”.</li> <li>4. In primary cabinet, perform cabling between Combiner Decks, Duplexers, and BRs in accordance with “10-BR Transmit Expansion Cabling”.</li> <li>5. Connect Expansion RF Cabinet (BRs 4-9) Tx intercabinet cabling in accordance with “4-16 BR Transmit Expansion Intercabinet Cabling”. (Perform instructions for Expansion RF Cabinet #1 only.)</li> <li>6. Perform Rx expansion cabling in accordance with “Receive Intercabinet Cabling”.</li> <li>7. Reconfigure power monitor harness connection to ALARM connector on Base Radios in accordance with “SRRC Primary Cabinet Alarm/Power Monitor Harness Connections”. (See NOTE in table regarding Base Radio ALARM connections versus duplexers used.)</li> </ol> | —<br>—<br>46<br>87<br>89<br>60<br>79 |

**Base Radio Buildout/RFDS Expansion**Table 30 **SRRC Buildout Instructions (Continued)**

| Buildout Level<br>(RFDS<br>Configuration) | Expansion<br>Equipment<br>Required                 | Installation Instructions                                                                                                                                                                                                                              |      |
|-------------------------------------------|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
|                                           |                                                    | Procedure/Reference                                                                                                                                                                                                                                    | Page |
| 11 through 16 BRs<br>(16 BR<br>Expansion) | Two (total) Expansion<br>RF Cabinets with 6<br>BRs | 1. If not currently installed, perform 10-BR expansion as described in "10 BRs" buildout instructions above.                                                                                                                                           | —    |
|                                           |                                                    | 2. Perform intercabinet Tx cabling in accordance with "4-16 BR Transmit Expansion Intercabinet Cabling".                                                                                                                                               | 89   |
|                                           |                                                    | 3. Perform Rx expansion cabling in accordance with "Receive Intercabinet Cabling".                                                                                                                                                                     | 60   |
|                                           |                                                    | 4. Reconfigure power monitor harness connection to ALARM connector on Base Radios in accordance with "SRRC Primary Cabinet Alarm/Power Monitor Harness Connections". (See NOTE in table regarding Base Radio ALARM connections versus duplexers used.) | 79   |
| 17-22 BR<br>Expansion                     | Two (total) Expansion<br>RF Cabinets with 6<br>BRs | 1. If not currently installed, perform 18-BR expansion as described in "11 through 16 BRs" buildout instructions above.                                                                                                                                | —    |
|                                           |                                                    | 2. Perform 17-22 BR Tx Cabling in accordance with "Expansion RF Cabinet #3 Transmit Cabling".                                                                                                                                                          | 93   |
|                                           |                                                    | 3. Perform Rx expansion cabling in accordance with "Receive Intercabinet Cabling".                                                                                                                                                                     | 60   |
|                                           |                                                    | 4. Connect power monitor harness connector to ALARM connector on Base Radio in accordance with "Expansion RF Cabinet Alarm/Power Monitor Harness Connections".                                                                                         | 81   |
|                                           | Triple 2-Way<br>Combiner Deck<br>(CLN1351)         |                                                                                                                                                                                                                                                        |      |
|                                           | 17-22 BR Expansion<br>RF Cabinet with<br>Duplexer  |                                                                                                                                                                                                                                                        |      |

---

## Duplexed TTA Receive Branch Equalization

**NOTE**

The procedures referenced below apply only to systems using the Duplexed TTA option.

On systems equipped with (or retrofitted with) Duplexed TTAs, the receive branches of the system must be equalized to a gain of  $8.5 \pm 0.5$  dB. Refer to “Duplexed TTA Receive Branch Equalization” in the *800 MHz GEN 4 Duplexed RF Distribution System* section of this manual for more information and required procedures.

**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC**

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## **Five Base Radio 800 MHz QUAD (Multicarrier) SRRC**

A version of the 800 MHz Gen 3 Site Control Rack is also available that supports up to five base radios in the primary rack. The first version of the five base radio SRRC is only shipped from Motorola with at most three 800 QUAD base radios. This configuration is fully expandable by means of adding loose base radios in the field or expansion rack hardware listed in this and other sections. In addition, most of the concepts listed in this chapter apply to the five base radio SRRC rack. This section, however, identifies key aspects that are unique to this QUAD-based rack. Reference the information provided earlier in the SRRC chapter for any information that is not provided in this section.

### **Multicarrier EBTS Configurations**

Multicarrier specific racking configurations maximize RF density in a single iDEN RF rack. These new Multicarrier based sites include the Single Rack Redundant Controller (SRRC), Single Rack Single Controller (SRSC), and standalone primary rack configurations. The major differences between the Multicarrier optimized racks and its single carrier counterpart are:

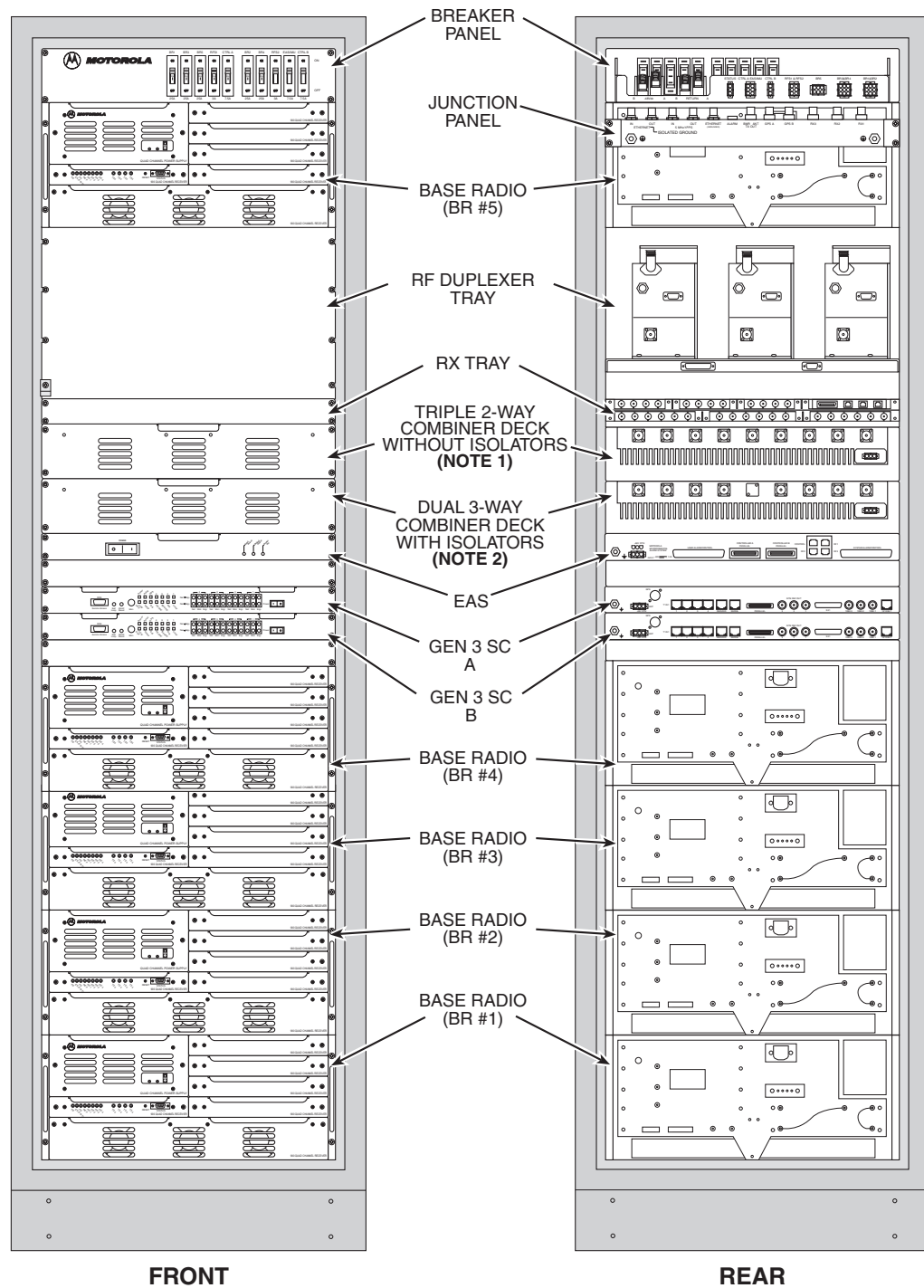
- ❑ Multicarrier racks ship with a maximum of three (3) QUAD BRs per sector.
- ❑ Dual 3-way and triple 2-way combiners are optional in Multicarrier racking configurations. The Dual 3-way combiner with isolators can be purchased as part of the Multicarrier rack if single carrier BRs will be placed in that sector.

#### **Multicarrier SRRC**

This configuration is the same as the Single Carrier SRRC Rack, except it ships with a maximum of three Multicarrier Base Radios. A triple 2-way combiner without isolators can be purchased as an option or installed as a field expansion when combining two Multicarrier BRs onto a single transmit antenna. The Dual 3-way combiner with isolators is also an option if Single Carrier BRs are planned for the site. Refer to Figure 39.

#### **Multicarrier SRSC**

The Single Rack Single Controller (SRSC) Multicarrier BR configuration uses the same equipment as the Single Carrier version; however ships without a triple isolator deck in standard configuration. The triple isolator desk is optional for sites that may use Single Carrier Radios.

**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC**EBTS950  
022802JNM

**NOTE 1:** FOR QUAD SRRC SITES: TRIPLE 2-WAY COMBINER IS OPTIONAL FOR COMBINING QUAD BASE RADIOS WITH 3 OR FEWER CONFIGURED CARRIERS.

**NOTE 2:** FOR QUAD SRRC SITES: DUAL 3-WAY COMBINER WITH ISOLATORS IS OPTIONAL, REQUIRED IF A SINGLE CARRIER BR WILL BE OPERATING IN A QUAD SITE.

Figure 39 **Five BR SRRC System (Primary Cabinet - Fully Loaded)**

**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC****DC Power Cabling**

DC power connections refer to power cabling between the Equipment Cabinet Power Distribution Panel and the modules within the cabinet.

Information for the 5 BR SRRC primary cabinet is provided below.

**SRRC Primary Cabinet DC Power Cabling**

Table 31 identifies and Figure 40 shows the DC power connections for the 5 BR SRRC primary cabinet.

Table 31 **DC Power Cabling (SRRC Primary Cabinet)**

| Index | Part Number | From                                                              | To                                                                                                                                        | Notes                                    |
|-------|-------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| 1     | 3082050X02  | <b>BR1&amp;BR2</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 1 and 2                                                                                           | Y-cable assembly                         |
| 2     | 3082050X01  | <b>BR3&amp;BR4</b> connector on Power Distribution Panel          | <b>DC POWER</b> connector on Base Radio 3 and 4 (NOTE 2)                                                                                  | Y-cable assembly                         |
| 3     | 3082050X01  | <b>BR5</b> connector on Power Distribution Panel                  | <b>DC POWER</b> connector on Base Radio 5 (NOTE 2)                                                                                        | Single BR cable                          |
| 4     | 3082129X04  | <b>RFS1&amp;RFS2</b> connectors on Power Distribution Panel       | <b>-48 VDC</b> Mate-N-Lok input connector on Rx Tray I/O board                                                                            | See detail A in Fig. 40                  |
| 5     | 3082129X02  | <b>FAN POWER</b> output Mate-N-Lok connector on Rx Tray I/O board | Mate-N-Lok input connector on Combiner Deck (NOTE 3)                                                                                      | Y-cable assembly see detail A in Fig. 40 |
| 6     | 3082056X03  | RFDS power output Mate-N-Lok connector on Rx Tray I/O board       | 9-pin submini D connector (P5) on RFDS duplexer shelf                                                                                     | See detail A in Fig. 40                  |
| 7     | 3083609X01  | <b>CTRL A</b> connector on Power Distribution Panel               | <ul style="list-style-type: none"> <li><b>BATTERY</b> connector on EAS/iMU</li> <li><b>BATTERY</b> connector on Gen 3 SC/iSC A</li> </ul> | Y-cable assembly                         |
| 8     | 3082082X02  | <b>CTRL B</b> connector on Power Distribution Panel               | <b>BATTERY</b> connector on Gen 3 SC/iSC B                                                                                                |                                          |

**NOTES:**

1. Cabinet is equipped with full 5-BR power cabling.
2. BR4 and BR5 are expansion BRs. Baseline system is equipped with BR1 through BR3 only.
3. If cabinet is equipped without Combiner Decks, unused end of index 4 is cable-tied out of way.



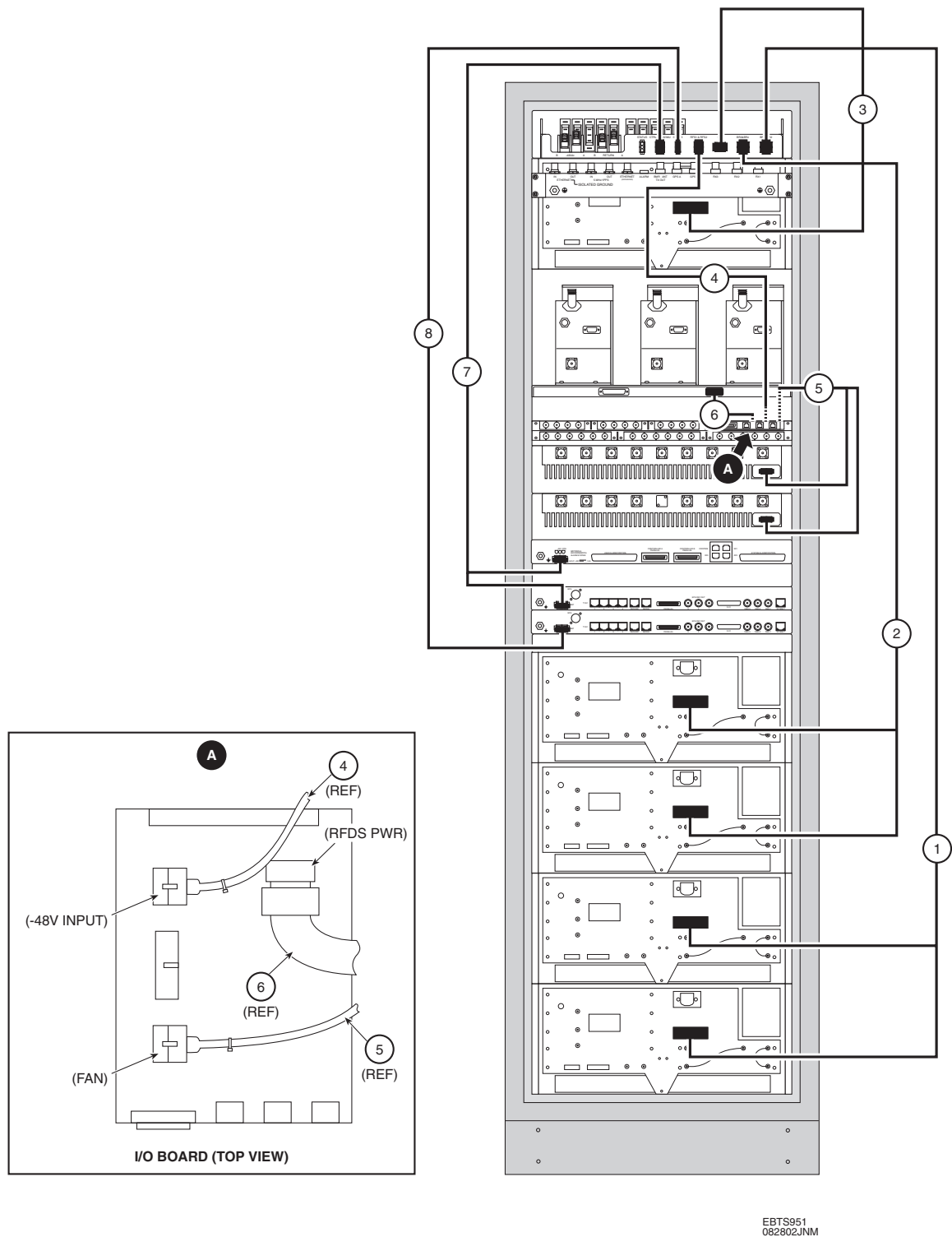
**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC**

Figure 40 **DC Power Cabling (5 BR SRRC Primary Cabinet)**

**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC****Transmit Power Out Cabling****NOTE**

Refer to Receiver Cabling for receive expansion cabling information.

Transmit power output cabling routes the Base Radio RF output to the transmit inputs on the RFDS. In expansion systems, transmit power output cabling also describes intercabinet cabling, combiner deck cascading cabling, and Expansion RF Cabinet power out cabling.

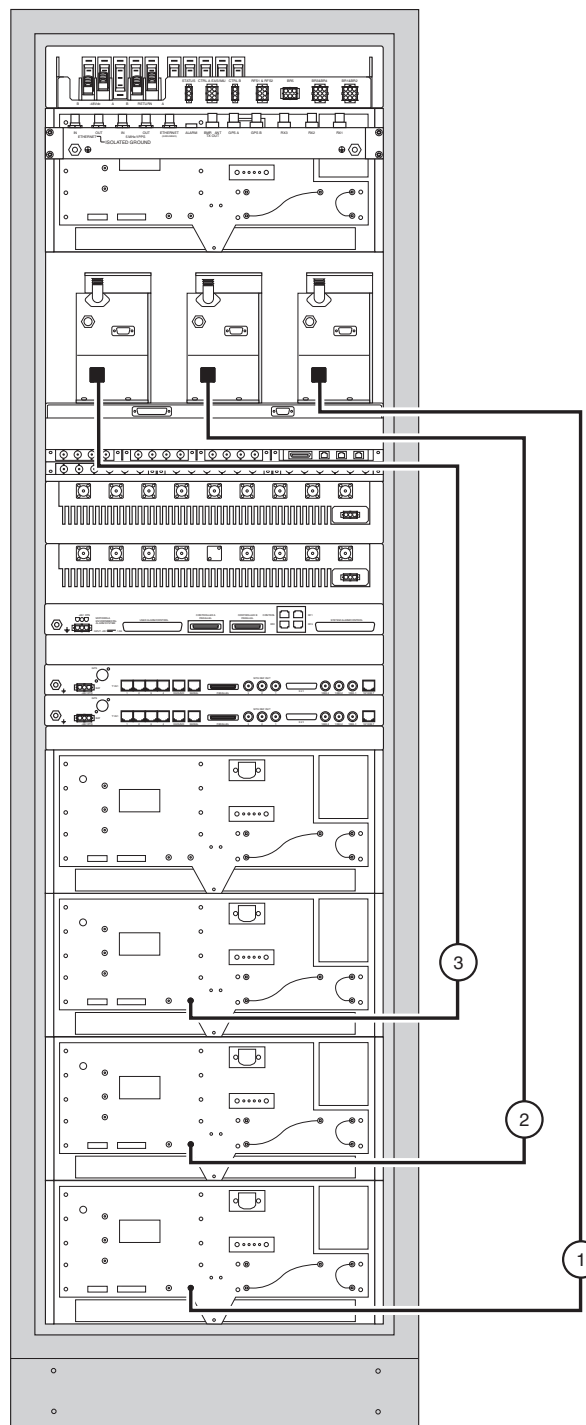
There are many different options for expansion in a 5 BR SRRC system and the examples given below provides a basis for all types of expansion.

**1-3 QUAD BR (Baseline) SRRC Transmit Cabling**

Table 32 identifies and Figure 41 shows the baseline 5 BR SRRC Tx cabling with 3 QUAD BRs. This cabling is basic and does not provide information for future expansion.

Table 32 **Transmit Power Out Cabling, 1-3 QUAD BR (5 BR SRRC Primary Cabinet)**

| Index                          | Part Number | From                     | To                               |
|--------------------------------|-------------|--------------------------|----------------------------------|
| 1                              | 0112004K14  | PA OUT connector on BR 1 | Antenna 1 Duplexer Tx input port |
| 2                              | 0112004K14  | PA OUT connector on BR 2 | Antenna 2 Duplexer Tx input port |
| 3                              | 0112004K14  | PA OUT connector on BR 3 | Antenna 3 Duplexer Tx input port |
| NOTE: All 3 BRs must be QUADs. |             |                          |                                  |

**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC**EBTS952  
082802JNM**Figure 41 Transmit Power Out Cabling, 1-3 BR (SRRC Primary Cabinet)**

**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC****Combination Single Multicarrier (1-5 BRs) 5 BR SRRC  
Transmit Cabling**

There are a variety of combining methods that can be used when the SRRC contains both QUADS and Singles, as well as when RF Expansion Racks are being utilized. Some general rules are as follows:

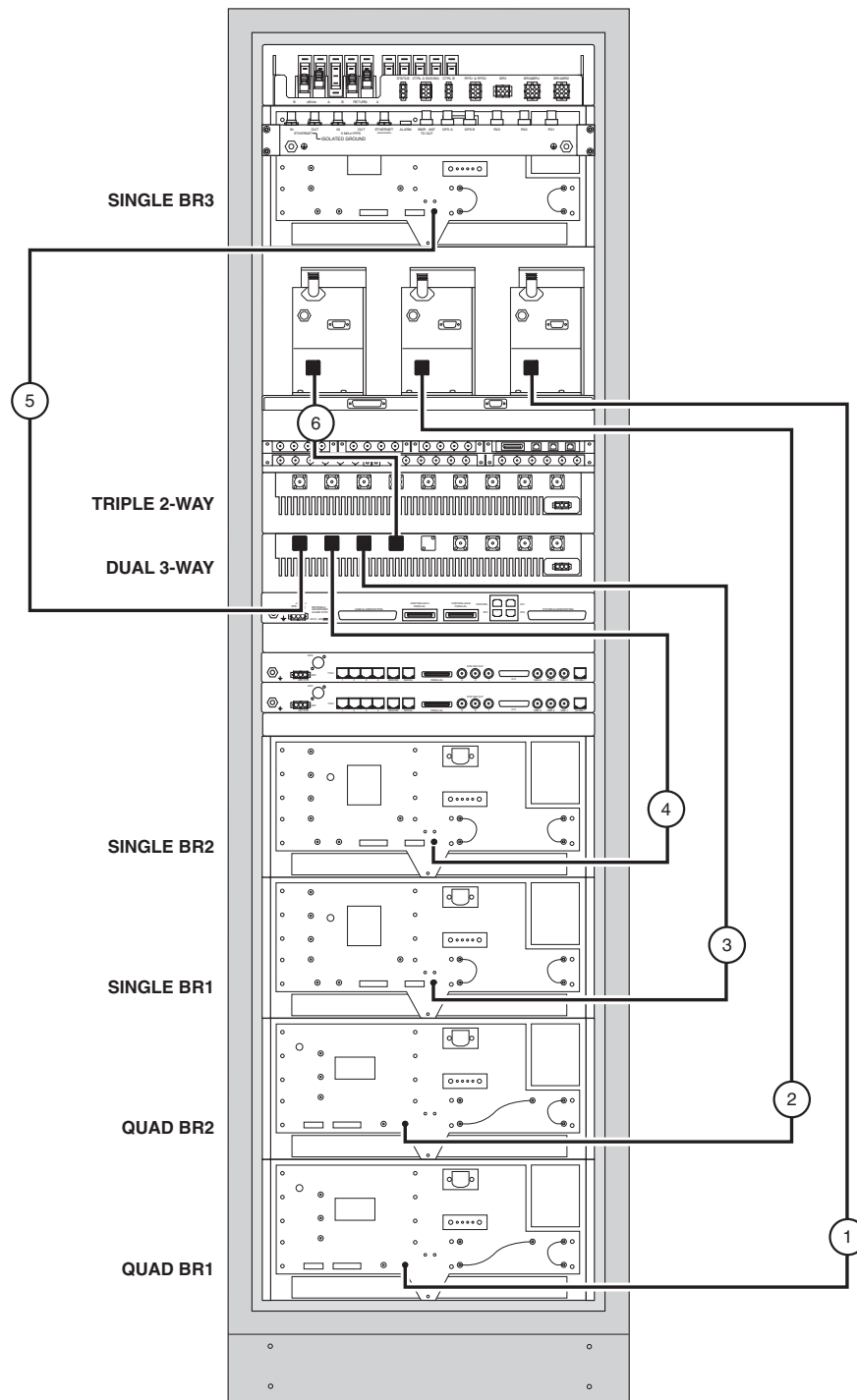
- ❑ QUAD TX OUTS can be connected directly to the Duplexers.
- ❑ QUADs should not be combined with the Dual 3-Way Combiner. The Triple 2-Way Combiner should always be used when combining QUAD TX signals
- ❑ It is acceptable to combine QUAD and Single TX signals.
- ❑ All other rules specified in previous sections apply to the 5 BR SRRC.

**Intracabinet Cabling**

Table 33 identifies and Figure 42 shows the transmit cabling for a SRRC configuration which contains 2 QUAD BRs and 3 Legacy BRs. This basic cabling and combining approach can be used for all different combinations of up to 5 BRs within the 5 BR SRRC cabinet.

*Table 33*      ***DC Power Cabling (SRRC Primary Cabinet)***

| <b>Index</b> | <b>Part Number</b> | <b>From</b>                                                      | <b>To</b>                             |
|--------------|--------------------|------------------------------------------------------------------|---------------------------------------|
| 1            | 0112004K14         | PA OUT connector on QUAD BR 1                                    | Antenna 1 Duplexer                    |
| 2            | 0112004K14         | PA OUT connector on QUAD BR 2                                    | Antenna 2 Duplexer                    |
| 3            | 0112004K14         | PA OUT connector on Single BR 1 (BR3)                            | Dual 3-Way Combiner Deck T7 (IN) port |
| 4            | 0112004K10         | PA OUT connector on Single BR 2 (BR4)                            | Dual 3-Way Combiner Deck T8 (IN) port |
| 5            | 0112004K08         | PA OUT connector on Single BR 3 (BR5)                            | Dual 3-Way Combiner Deck T9 (IN) port |
| 6            | 0112004B03         | Dual 3-Way Combiner Deck T6 (OUT) Port (TX3-TX5) combined signal | Antenna 3 Duplexer                    |

**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC**

EBTS953  
082802J/NM

Figure 42 **Combination Single and Multicarrier Transmit Cabling**

**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC****Transmit Expansion Cabling with the 5 BR SRRC**

Many of the expansion cabling details given in the previous sections are relevant to expansion with the 5 BR SRRC cabinet. One specific example will be given to provide the basic formula for expansion with both single and multicarrier BRs.

**NOTE**

Refer to Transmit Cabling (within Expansion RF Cabinets) for BR transmit cabling within the Expansion RF Cabinet.

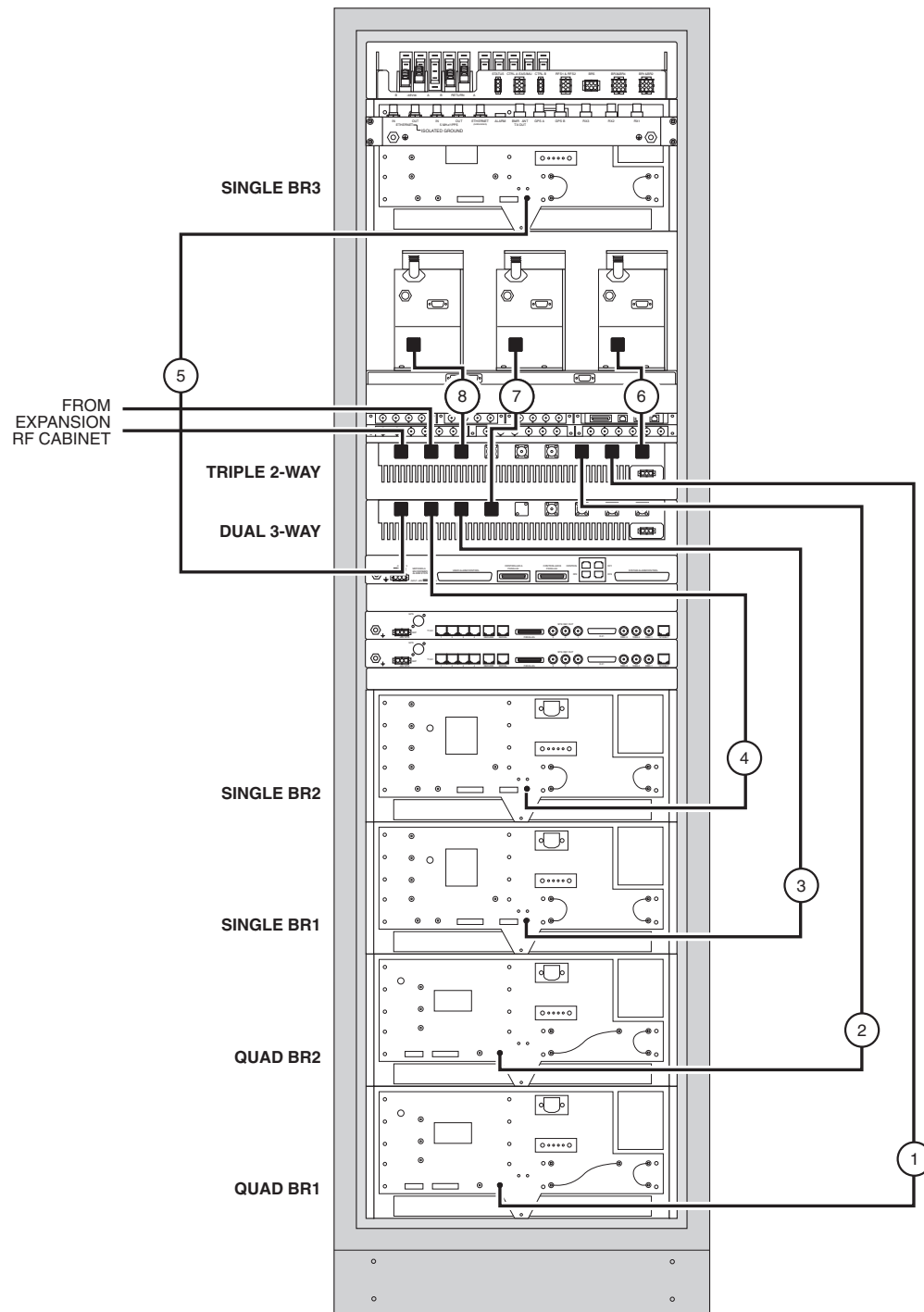
**NOTE**

Any existing expansion intercabinet or intracabinet cabling must be disconnected at the SRRC primary cabinet and reconnected as shown here.

Table 34 identifies and Figure 43 shows the transmit expansion cabling involving a 2 QUAD/3 Single BR SRRC cabinet and a Single Expansion cabinet with six BRs (BR6 - BR11). See previous sections for detail not included here.

Table 34 **Transmit Expansion Cabling**

| Index | Part Number | From                                                                                                               | To                                                           |
|-------|-------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
| 1     | 0112004K14  | PA OUT connector on QUAD BR 1                                                                                      | Triple 2-Way Combiner Deck T2 (IN) Port                      |
| 2     | 0112004K14  | PA OUT connector on QUAD BR 2                                                                                      | Triple 2-Way Combiner Deck T3 (IN) Port                      |
| 3     | 0112004K14  | PA OUT connector on Single BR 1 (BR3)                                                                              | Dual 3-Way Combiner Deck T7 (IN) Port                        |
| 4     | 0112004K14  | PA OUT connector on Single BR 2 (BR4)                                                                              | Dual 3-Way Combiner Deck T8 (IN) Port                        |
| 5     | 0112004K08  | PA OUT connector on Single BR 3 (BR5)                                                                              | Dual 3-Way Combiner Deck T9 (IN) Port                        |
| 6     | 0112004B03  | Triple 2-Way Combiner Deck T1 (OUT) port (TX1-TX2) combined signal                                                 | Antenna 1 Duplexer                                           |
| 7     | 0112004B03  | Dual 3-Way Combiner Deck T6 (OUT) port (TX6-TX11) combined signal                                                  | Antenna 2 Duplexer                                           |
| 8     | 0112004B03  | Triple 2-Way Combiner Deck T7 (OUT) port (TX6-TX11) combined signal                                                | Antenna 3 Duplexer                                           |
| 9     | CKN6288     | (Low-Loss intercabinet cable)<br>Expansion RFC #1 Dual 3-Way Combiner Deck T1 (OUT) port (TX6-TX8 combined signal) | SRRC primary cabinet Triple 2-Way Combiner Deck T8 (IN) port |
| 10    | CKN6288     | (Low-Loss intercabinet cable)<br>Expansion RFC #1 Dual 3-Way Combiner Deck T6 (OUT) port (TX6-TX8 combined signal) | SRRC primary cabinet Triple 2-Way Combiner Deck T9 (IN) port |

**Five Base Radio 800 MHz QUAD (Multicarrier) SRRC**EBTS954  
082802JNM**Figure 43 Transmit Expansion Cabling**

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# Single Rack, Single Controller GEN 4 EBTS

## Overview

This chapter provides technical information for the Single Rack, Single Controller GEN 4 800 MHz Duplexed EBTS, which includes three or four Base Radios (hereinafter called the SRSC system and the SRSC4 system, respectively).

The topics of this section are listed in the following table.

| Section                                            | Page | Description                                                                                                         |
|----------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------|
| Description                                        | 2    | Describes the SRSC and SRSC4 systems                                                                                |
| SRSC and SRSC4 General Specifications              | 10   | Provides performance specifications for the SRSC and SRSC4 systems                                                  |
| AC/DC Power System Theory Of Operation             | 13   | Provides theory of operation for the AC/DC Power System, as used in the SRSC and SRSC4 systems                      |
| Site Controller Theory Of Operation                | 18   | Provides reference to Gen 3 SC theory of operation and descriptions                                                 |
| RFDS Theory of Operation                           | 19   | Provides theory of operation for the 800 MHz GEN 4 Duplexed RFDS, as used in the SRSC and SRSC4 systems             |
| Removal/Replacement Procedures                     | 34   | Provides instructions for replacing SRSC and SRSC4 FRUs                                                             |
| Field Retrofit of Duplexed TTA Interface (CLN1403) | 49   | Provides instructions for field installation to retrofit the SRSC and SRSC4 cabinets with DTTA kits                 |
| Cabling Information                                | 54   | Provides information on how to connect all cabling required for installing and expanding the SRSC and SRSC4 systems |
| Duplexed TTA Receive Branch Equalization           | 79   | For systems using Duplexed TTAs, provides reference to receive branch equalization requirements and procedures.     |

**Description**

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**Description**

The SRSC EBTS and the SRSC4 EBTS each combine the Control Cabinet, RF Cabinet, and AC/DC power supply functions in one cabinet.

The SRSC consists of a single cabinet ( Figure 1) containing an 800 MHz GEN 4 Duplexed RF Distribution System (RFDS), three Base Radios (BRs), a Generation 3 Site Controller (Gen 3 SC) or ), and an AC/DC Power System. The SRSC EBTS is a single cabinet, stand-alone, 3-BR EBTS directly connected to site antennas, T1/E1 interface, and AC mains.

The SRSC4 is a single cabinet (shown in Figure 2) containing an 800 MHz GEN 4 Duplexed RF Distribution System (RFDS), four BRs, a Generation 3 Site Controller (Gen 3 SC), and an AC/DC Power System. The SRSC4 EBTS is a single cabinet, stand-alone, non-expandable, 4-BR EBTS directly connected to site antennas, T1/E1 interface, and AC mains.

The AC/DC Power System, Gen 3 SC, and RFDS subsystems used are functionally similar to those used in a Stand-alone Control And RF Cabinet system. These subsystems are individually discussed below.

**Multicarrier EBTS Configurations**

Multicarrier specific racking configurations maximize RF density in a single iDEN RF rack. These new Multicarrier based sites include the Single Rack Redundant Controller (SRRC), Single Rack Single Controller (SRSC), and standalone primary rack configurations. The major differences between the Multicarrier optimized racks and its single carrier counterpart are:

- ❑ Multicarrier racks ship with a maximum of three (3) QUAD BRs per sector.
- ❑ Dual 3-way and triple 2-way combiners are optional in Multicarrier racking configurations. The Dual 3-way combiner with isolators can be purchased as part of the Multicarrier rack if single carrier BRs will be placed in that sector.

**Multicarrier SRRC**

This configuration is the same as the Single Carrier SRRC Rack, except it ships with a maximum of three Multicarrier Base Radios. A triple 2-way combiner without isolators can be purchased as an option or installed as a field expansion when combining two Multicarrier BRs onto a single transmit antenna. The Dual 3-way combiner with isolators is also an option if Single Carrier BRs are planned for the site. Refer to Figure 1.

**Multicarrier SRSC**

The Single Rack Single Controller (SRSC) Multicarrier BR configuration uses the same equipment as the Single Carrier version; however ships without a triple isolator deck in standard configuration. The triple isolator desk is optional for sites that may use Single Carrier Radios. Refer to Figure 1.

## **AC/DC Power System**

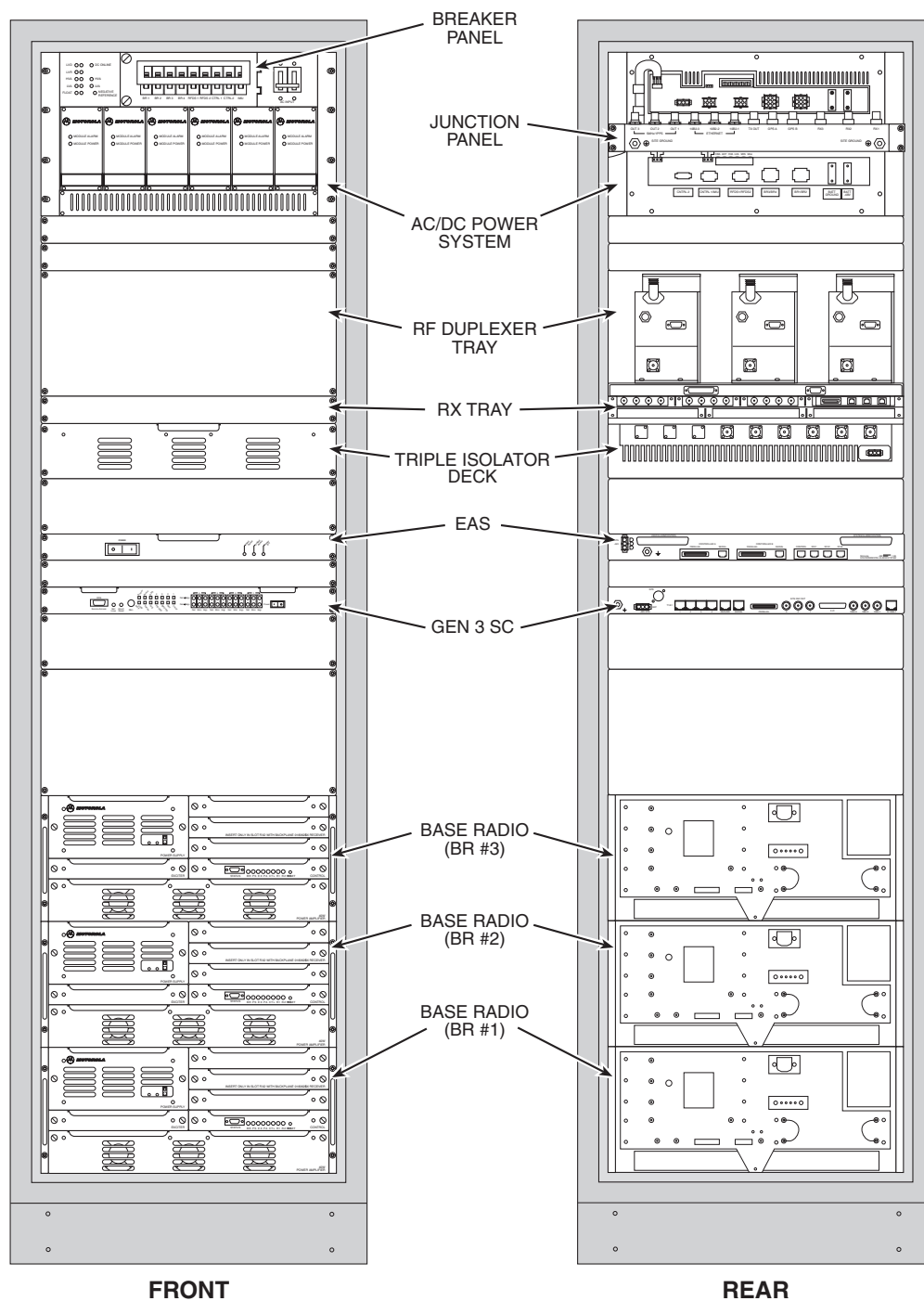
The AC/DC Power System (Figure 3) draws 240 VAC, single phase, 50/60 Hz from the site AC mains and provides -48 VDC outputs for EBTS components within the SRSC and SRSC4 cabinets. Figure 8 shows the AC/DC Power System used.

The AC/DC Power System uses six identical, front-panel accessible rectifier module Field Replaceable Units (FRUs). The module FRUs convert AC into the -48 VDC (nominal) required. Multiple modules provide redundancy.

Each rectifier module is equipped with MODULE POWER and MODULE ALARM indicators which show operational status of each module. The AC/DC Power System is designed to allow "hot pull" of defective modules, eliminating the need for system power-down when replacing a defective module. The AC/DC Power System also sends alarm status signals to the EAS/iMU an, the OMC should a malfunction occur.

The AC/DC Power System front panel contains test points (with corresponding trimmers adjustments) for setting up and checking various power system parameters. System status indicators are also provided.

The AC/DC Power System includes an integral breaker panel which provides an AC mains breaker, and individual DC output breakers for each component that receives power from the AC/DC Power System.

**Description**EBTS701  
072001JNM

**NOTE:** FOR QUAD SITES: TRIPLE ISOLATOR DECK IS OPTIONAL, REQUIRED IF SINGLE CARRIER BASE RADIOS WILL BE OPERATING IN A QUAD SITE.

Figure 1 **SRSC Cabinet with Gen 3 SC and EAS**

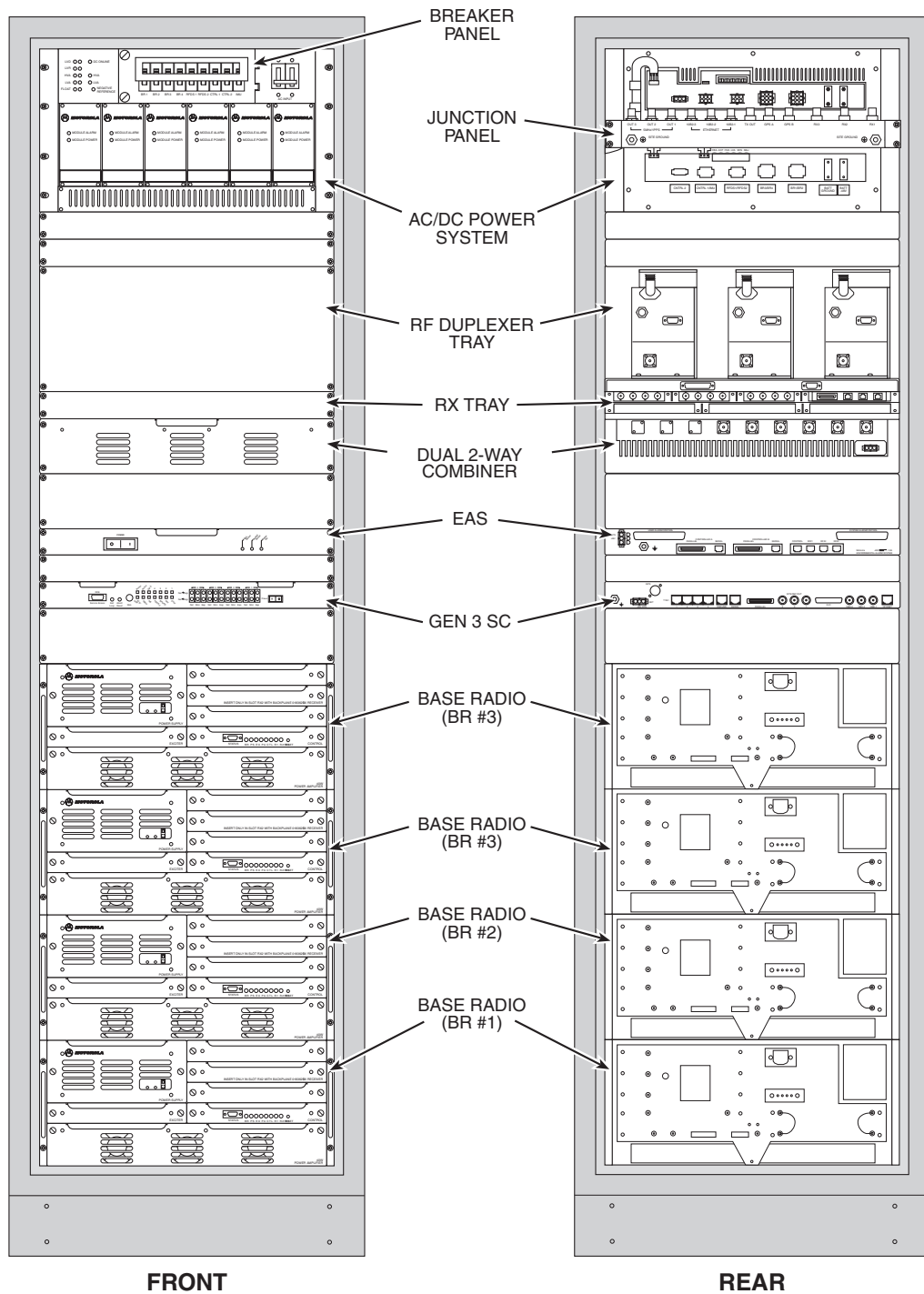


Figure 2 **SRSC4 Cabinet with Gen 3 SC and EAS**

EBTS688  
072301JNM

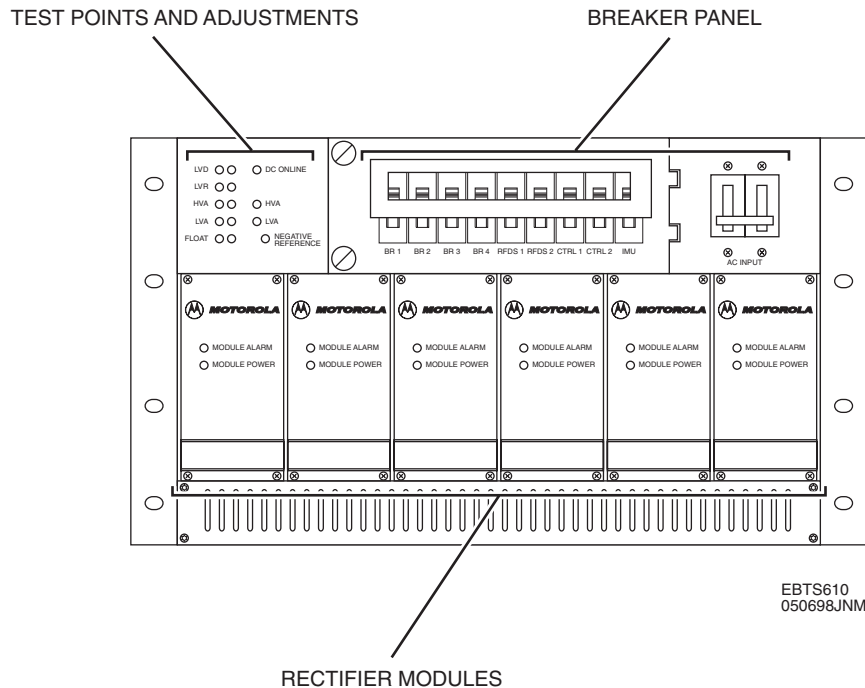
**Description**

Figure 3 **AC/DC Power System**

**Controller System**

The SRSC and SRSC4 systems use the same Generation 3 Site Controller (Gen 3 SC) and Environmental Alarm System (EAS)/used in the Stand-alone Control And RF Cabinet system. The SRSC and SRSC4 systems consist of the following:

- ☐ One Gen 3 SC (non-redundant)
- ☐ Environmental Alarm System (EAS)

The Gen 3 SC provides the interface between the Base Radios and the telco network, as well as providing a common interface point for all system alarms.

Refer to the Gen 3 SC supplement to this manual for more information on the appropriate controller:

**Generation 3 Site Controller  
System Manual 68P80801E30**

## RF Distribution System

The SRSC and SRSC4 systems use a GEN 4 Duplexed RFDS, which is an 800 MHz duplexing and receiver multicoupler system that accommodates three and four BRs, respectively. Duplexers allow a transmit (Tx) and a receive (Rx) path to share a common antenna. Figure 4 shows the GEN 4 Duplexed RFDS used within the SRSC and SRSC4 systems.

The SRSC and SRSC4 versions of the GEN 4 Duplexed RFDS contain several Field Replaceable Units (FRUs), including:

- ❑ An Rx LNA/Multicoupler Tray (Rx Tray), consisting of the following FRUs:
  - Three, 4-Way Multicoupler/Amplifier assemblies
  - Two Power Supplies
  - Alarm Board
  - Input/Output Interface Board (I/O Board)
- ❑ A Triple Isolator Deck (for SRSC) or a Dual 2-Way Combiner (for SRSC4)
- ❑ A Tower-Top Amplifier (TTA) Alarm Tray (optional), which contains three TTA alarm interface modules

The Triple Isolator Deck (shown in Figure 5) provides isolation and signal conditioning interface between the Duplexers and the Base Radio transmit signals.

The Dual 2-Way Combiner (shown in Figure 6) provides a signal conditioning interface between the Duplexers and the Base Radio transmit signals.

The Triple Isolator Deck and the Dual 2-Way Combiner utilize a microstrip/groundplane design to facilitate transmission line properties that provide functions such as harmonic filters. Due to the compact, high-density design of the deck and combiner, a coldplate and forced-air cooling is used instead of the simple radiational/convective cooling used in the other RFDSs. The coldplate is a casting with integral heat sinks which conducts heat away from the circuitry. Additionally, fans provide concentrated cooling air flow across the assembly. The fans are not thermostatically controlled and operate continuously while power is applied to the cabinet.

An Rx Tray (Figure 7) is used for Rx signal distribution. Corresponding to the three Rx diversity branches, the Rx Tray contains three, 4-Way Multicouplers (MCs). Each MC contains an amplifier/4-way multicoupler that accepts a single Rx signal from the Duplexer Rx output and then provides four outputs which are either applied to the three BRs in the SRSC cabinet (the fourth output is not used and terminated) or applied to the four BRs in the SRSC4 cabinet.

**Description**

The Rx Tray also contains a dual-redundant power supply, an I/O board, an alarm diagnostics board, and a power/signal backplane ("midplane" board). The power supplies provide operating power for the Rx Tray receive multicouplers, as well as the isolator deck fans (or the combiner fans), tower top amplifiers, and the duplexer power monitor assemblies. The I/O board provides a power and alarm interconnect between various RFDS assemblies. The alarm diagnostics board detects and routes RFDS failure status information to the Environmental Alarm System (EAS) via the I/O board alarm interconnect.

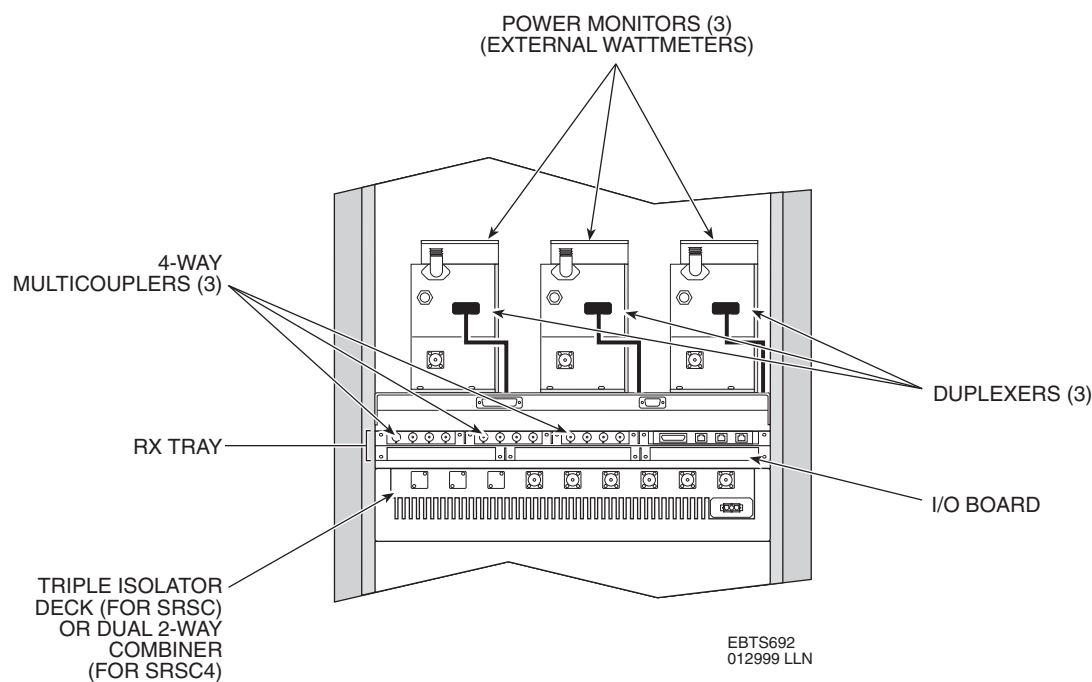


Figure 4 **SRSC and SRSC4 GEN 4 Duplexed RF Distribution System**



Description

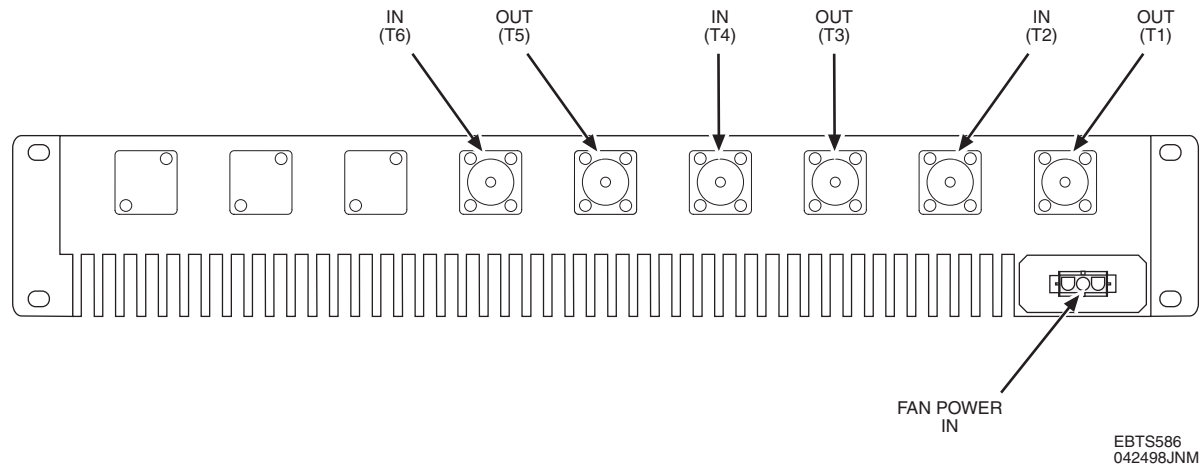


Figure 5 Triple Isolator Deck

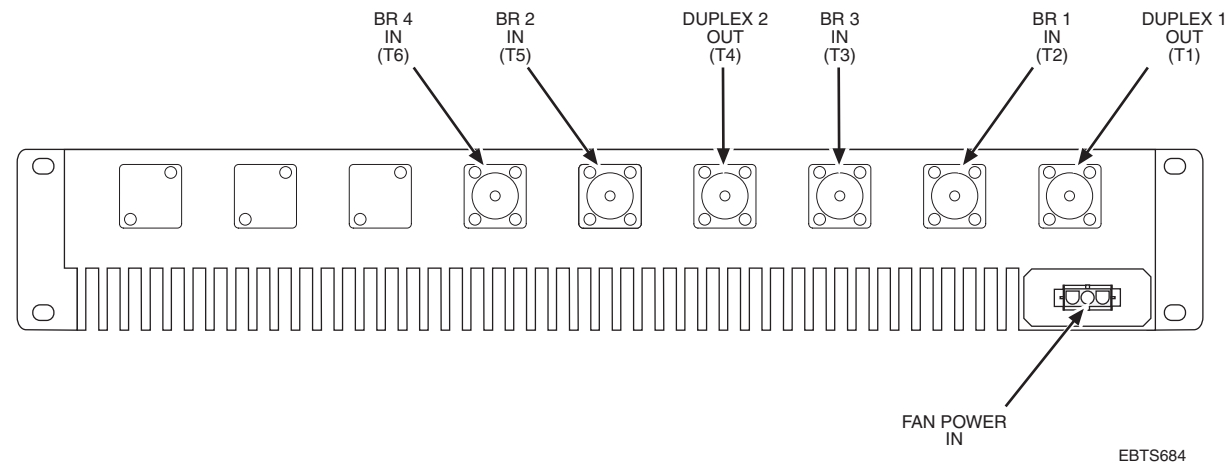


Figure 6 Dual 2-Way Combiner

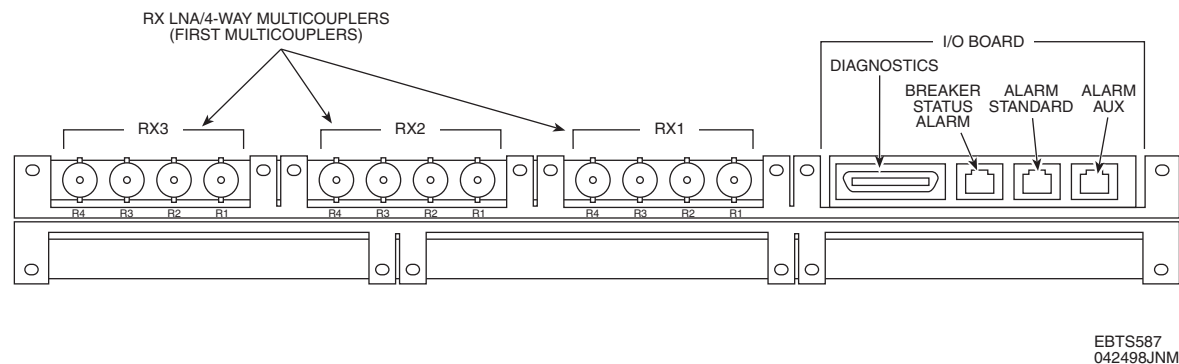


Figure 7 SRSC and SRSC4 Rx Tray

**SRSC and SRSC4 General Specifications**

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**SRSC and SRSC4 General Specifications****SRSC and SRSC4 AC/DC Power System Specifications**

Table 1 lists the AC/DC Power System specifications.

*Table 1 AC/DC Power System Specifications*

| Specification                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Value or Range                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Rack Space Requirement                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6 EIA Rack Units (RU)                                                                                              |
| Storage Temperature Range (NOTE 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                | -40° to +185° F (-40 to +85° C)                                                                                    |
| Operating Temperature Range (NOTE 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                              | +32° to +122° F (0 to +50° C)                                                                                      |
| AC mains service                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 240 VAC, 30 A, 45-60 Hz, 1-phase                                                                                   |
| AC Line Input Range<br>maximum:<br>minimum:                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 264.5 VAC<br>172.0 VAC                                                                                             |
| DC Rated Output (total)                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 54 V @ 50 A                                                                                                        |
| Regulation (at rated output)<br>Line:<br>Load:                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.5% max<br>2% max                                                                                                 |
| Ripple and Noise (at rated output)                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 200 mV max                                                                                                         |
| Front Panel Adjustment Cal Levels (NOTES 2, 3)<br>LVD (low voltage disconnect):<br>LVR (low voltage reconnect):<br>HVA (voltage alarm; high threshold):<br>LVA: (voltage alarm; low threshold):<br>FLOAT:                                                                                                                                                                                                                                                                                         | 4.2 VDC (4 - 5 V)<br>4.81 VDC (4.5 - 5.5 V)<br>5.8 VDC (5.1 - 6 V)<br>4.3 VDC (4 - 5 V)<br>5.4 VDC (5.15 - 5.62 V) |
| <b>NOTES:</b><br>1. Temperature ranges specified at 5-95% relative humidity (non-condensing)<br>2. Values listed are applicable to front panel test points, which are scaled at 1/10 bus value. Actual voltages and tolerances at -48V bus are 10X test point values.<br>3. Values listed are recommended factory cal points. Corresponding ranges (in parentheses) indicates allowable deviation from factory spec, and/or acceptable range of accommodation for customer-preferred differences. |                                                                                                                    |

**SRSC and SRSC4 Gen 3 SC Specifications**

Refer to Gen 3 SC Supplement 68P808101E30 to this manual for Gen 3 SC specifications

## SRSC and SRSC4 RFDS Specifications

### GEN 4 Duplexed RFDS General Specifications

Table 2 lists the general specifications for the GEN 4 Duplexed RFDS.

*Table 2 GEN 4 Duplexed RFDS General Specifications*

| Specification                           | Value or Range                               |
|-----------------------------------------|----------------------------------------------|
| Rack Space Requirement                  | 6 EIA Rack Units (RU)                        |
| Storage Temperature Range               | -40° to +203° F (-40 to +95° C)              |
| Operating Temperature Range             | +32° to +104° F (0 to +40° C)                |
| Cooling (Isolator Deck)                 | Coldplate with continuous forced-air cooling |
| Frequency Range:<br>Receive<br>Transmit | 806 to 821 MHz<br>851 to 866 MHz             |
| Tx - Rx Spacing                         | 45 MHz                                       |
| Channel Spacing                         | 25 kHz (min.)                                |
| Port Impedance                          | 50 $\Omega$ (nom.)                           |
| Input Supply Voltage; RFDS              | -48 VDC (-41 VDC to -65 VDC )                |
| Input Current; RFDS                     | 2.25 A (steady-state max.)                   |
| Input Supply Voltage; Fan Array         | 12 VDC                                       |

### Antenna to Receiver Specifications

Table 3 lists the GEN 4 Duplexed RFDS antenna port-to-receiver port specifications for a single receive branch.

*Table 3 Duplexer Antenna Port-to-Receiver Port Specifications*

| Specification                                                                                  | Value or Range |
|------------------------------------------------------------------------------------------------|----------------|
| Gain (806 to 821 MHz):<br>$T_A = 77^\circ \text{ F } (25^\circ \text{ C})$ ambient temperature | 10.0 dB        |

### Transmitter to Antenna Specifications

Table 4 lists the GEN 4 Duplexed RFDS path loss from Base Radio transmitter port-to-antenna port specifications.

**SRSC and SRSC4 General Specifications***Table 4 Base Radio Transmitter Port-to-Antenna Port Specifications*

| Specification                                                                                                       | Value or Range                          |                                         |
|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------|
|                                                                                                                     | Maximum                                 | Typical                                 |
| Insertion Loss; Passband*                                                                                           | 3.0 dB (for SRSC)<br>6.5 dB (for SRSC4) | 2.0 dB (for SRSC)<br>5.5 dB (for SRSC4) |
| * Includes deck and associated cabling losses over 854-866 MHz range. (Losses are higher in the 851-854 MHz range.) |                                         |                                         |

## AC/DC Power System Theory Of Operation

Figure 8 shows a block diagram of the AC/DC Power System used within the SRSC and SRSC4 systems. The AC/DC Power System receives 240 VAC, 1-phase, 50/60 Hz power from the site AC mains and provides several -48 VDC outputs for use by various EBTS components within the SRSC and SRSC4 cabinets. Its functional elements are as follows:

- ☐ Six Rectifier Modules
- ☐ Control/Calibration Circuitry
- ☐ Alarm Circuitry
- ☐ Low Voltage Disconnect (LVD) Contactor
- ☐ Breaker Panel, consisting of nine circuit breakers

### Rectifier Modules

Six identical switching power supply modules (Rectifier Modules) provide  $n+1$  redundant, parallel conversion of AC mains power to cabinet -48 VDC power. (five modules must be operational to assure proper power capacity to the cabinet.) The modules draw AC power from the AC input breaker. Each module applies -48 VDC output over the -48V bus.

Each Rectifier Module is equipped with the following indicators:

| Indicator    | Function                                                                                              |
|--------------|-------------------------------------------------------------------------------------------------------|
| MODULE POWER | Green LED indicator which shows module is receiving mains power and properly providing -48 VDC output |
| MODULE ALARM | Red LED indicator which shows module is not operating properly and requires replacement               |

In addition to the front panel visual status indications described above, each module sends alarm status signals to the alarm circuitry discussed below. Each module receives control and calibration for various parameters from the control/calibration circuitry, which is also discussed below.

### Alarm Circuitry

The alarm circuitry within the AC/DC Power System sends alarm signals to the EAS. The EAS, in turn, communicates these alarms to the Operations and Maintenance Center. (Refer to the Gen 3 SC supplement of this manual for more information on the EAS.)

**AC/DC Power System Theory Of Operation**

The alarm circuitry monitors various power system parameters. Under normal conditions, the alarm circuitry sends alarm switch closures to the EAS/iMU. However, if any of the monitored signals indicate a fault within the AC/DC Power System the respective alarm switch closure opens to indicate the alarm.

For some alarms which involve voltage thresholds, the alarm circuitry works in conjunction with the control/calibration circuitry. The control/calibration circuitry sets the trip points at which various parameters are considered out of acceptable range. (The control/calibration circuitry is discussed below.)

The alarms and their conditions are described as follows:

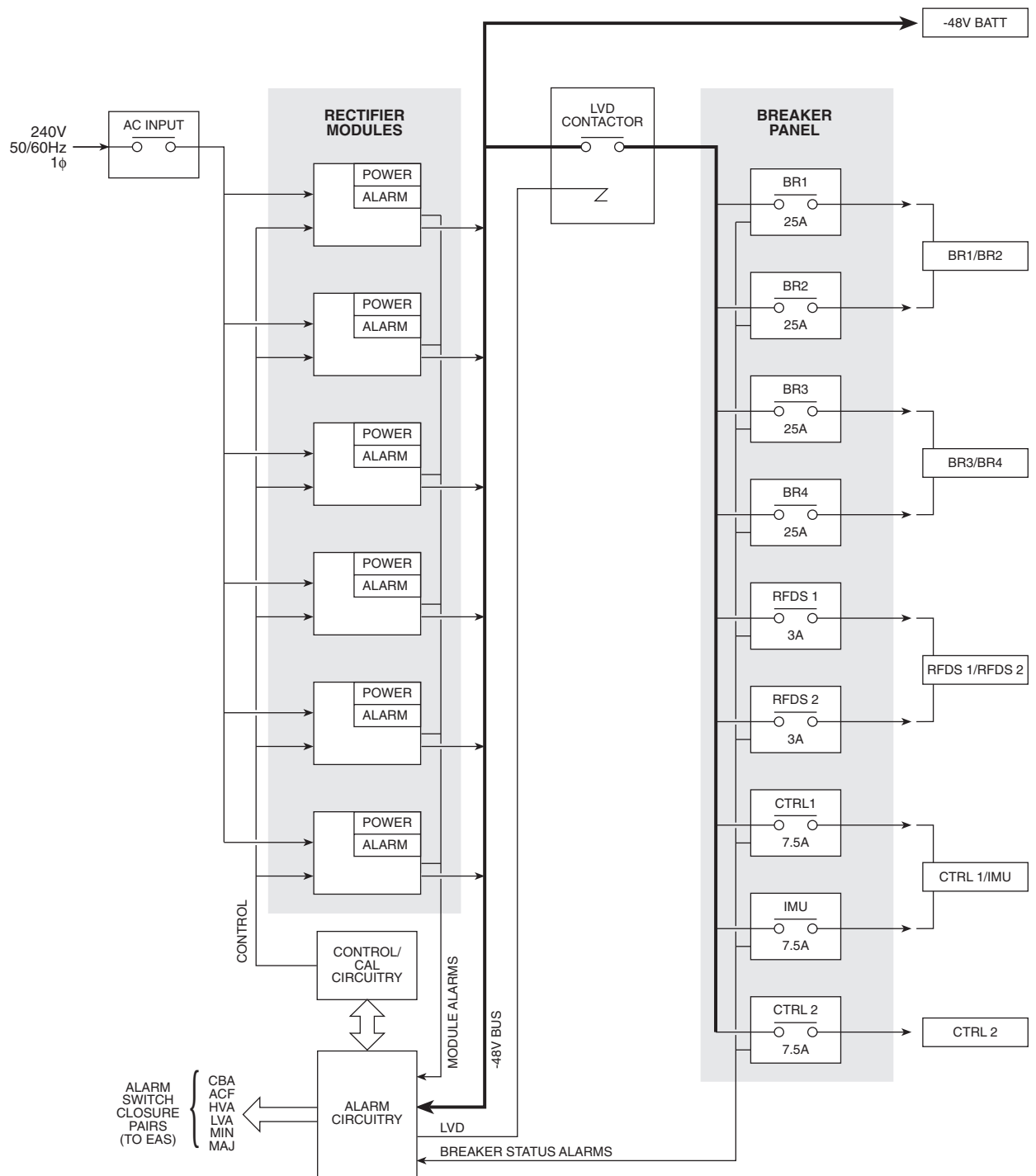
| <b>Alarm</b> | <b>Description</b>                                                                                                                                                                  |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CBA          | Circuit Breaker Alarm – Via BREAKER STATUS ALARM interface, alarm circuitry detects tripped circuit breaker.                                                                        |
| ACF          | AC Failure – Alarm circuitry detects loss of AC mains power.                                                                                                                        |
| HVA          | High Voltage Alarm – Via -48V bus and control/calibration circuitry, alarm circuitry detects voltage on -48V bus exceeding bus high threshold set by control/calibration circuitry. |
| LVA          | Low Voltage Alarm – Via -48V bus and control/calibration circuitry, alarm circuitry detects voltage on -48V bus exceeding bus low threshold set by control/calibration circuitry.   |
| MIN          | Minor rectifier failure – Via MODULE ALARMS interface, alarm circuitry detects a failed module.                                                                                     |
| MAJ          | Major rectifier failure – Via MODULE ALARMS interface, alarm circuitry detects that two or more modules have failed.                                                                |

In addition to the alarm signals discussed above, the alarm circuitry also sends low voltage disconnect signal LVD to the load LVD contactor should the bus voltage fall below the minimum trip point.

**Load LVD Contactor**

The load LVD contactor (high-current relay) is used to disconnect the equipment cabinet components should the bus voltage fall below a preset minimum trip point. An LVD trip point is specified at a point where reliable operation of the various cabinet components can no longer be assured. Note that, by positioning the contactor at the load (i.e., breaker panel connecting the components to the power system), low voltage disconnect for any condition leading to excessively low bus voltage is assured. As such, in addition to site shutdown, the LVD protects the backup batteries from damage due to deep depletion by disconnecting the batteries from the load when an excessive low bus voltage condition occurs.

Reconnection of the load (LVD disable) occurs when the LVR threshold is crossed. This value is somewhat higher than the LVD trip point to add hysteresis between the LVD and LVR trip points. Also, the higher LVR provides a margin of assurance that the backup batteries have received a deep enough charge to prevent repeated LVR cycling.

**AC/DC Power System Theory Of Operation**EBTS608  
011901JNM**NOTE:** BR 4 and CTRL 2 outputs are not used on SRSC systems.**NOTE:** CTRL 2 outputs are not used on SRSC4 systems.**Figure 8 AC/DC Power System Block Diagram for the SRSC System**

**AC/DC Power System Theory Of Operation****Control/Calibration Circuitry**

The control/calibration circuitry sets the thresholds of the various level-sensitive alarms discussed above, as well as setting the nominal (float) -48VDC bus voltage. The circuitry also allows front panel measurement and adjustment of the various parameters and thresholds.

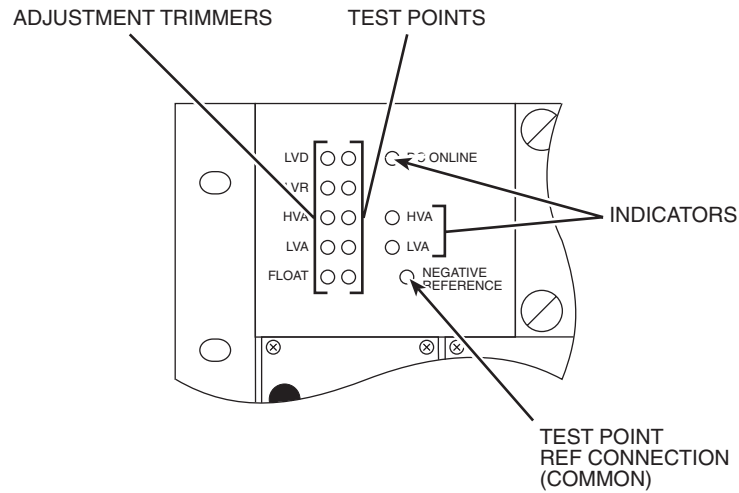
For each parameter, a front panel adjustment and corresponding test point is provided. The adjustments/test points are described below:

| <b>Adjustment/<br/>Test Point</b>                                                                                               | <b>Description</b>                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LVD                                                                                                                             | Low Voltage Disconnect – Sets the voltage trip point for the -48V bus at which a bus voltage equal to or less than the LVD setting will result in a forced site shutdown. (Refer to Load LVD Contactor paragraph above for explanation of LVD operation.)                           |
| LVR                                                                                                                             | Low Voltage Reconnect – Following a LVD trip, sets the voltage trip point for the -48VDC bus at which a bus voltage equal to or greater than the LVR setting will result in resumed site operation. (Refer to Load LVD Contactor paragraph above for explanation of LVD operation.) |
| HVA                                                                                                                             | High Voltage Alarm – Sets the voltage trip point for the -48VDC bus at which a bus voltage equal to or greater than the HVA setting will result in a “-48V bus voltage too high” site alarm.                                                                                        |
| LVA                                                                                                                             | Low Voltage Alarm – Sets the voltage trip point for the -48VDC bus at which a bus voltage equal to or less than the LVA setting will result in a “-48V bus voltage too low” site alarm.                                                                                             |
| FLOAT                                                                                                                           | Sets the nominal (float) voltage of the -48VDC bus.                                                                                                                                                                                                                                 |
| <b>NOTE:</b> Adjustment values and ranges for the parameters above are specified in Table 1. AC/DC Power System Specifications. |                                                                                                                                                                                                                                                                                     |

Figure 9 shows the AC/DC Power System adjustments, test points, and system indicators. The test points accept a standard multimeter probe. The multimeter common probe is inserted into the NEGATIVE REFERENCE test point, and the + probe is inserted into one of five test points corresponding to the parameter to be measured. Adjustment trimmers corresponding to the five test points are adjacent to the test points. The adjustment trimmers use slotted screws and accept a small flat blade (1/8”) screwdriver or alignment tool.

A green DC ONLINE indicator shows if the -48VDC bus is energized. Red HVA and LVA indicators respectively show if an HVA or LVA condition is occurring on the -48VDC bus.





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**NOTE:** Measurements at front panel test points are scaled at 1/10 bus value. Actual voltages and tolerances at -48V bus are 10X test point values.

Figure 9 **AC/DC Power System Adjustments, Test Points, and Indicators**

### Breaker Panel

The breaker panel consists of nine load circuit breakers which connect the -48V bus to the various Mate-N-Lok component connectors on the AC/DC Power System rear panel. The circuit breaker complement and ratings are shown in Figure 8.

Each breaker is equipped with a second, contact monitor SPST contact pair which sends notification to the alarm circuitry anytime one of the nine breakers open. The alarm circuitry, in turn, sends a CBA (breaker alarm) to the EAS/iMU.

**Site Controller Theory Of Operation**

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## **Site Controller Theory Of Operation**

The Gen 3 SC assigns available frequencies and time slots to the mobiles. It also links the EBTS Base Radios to the T1/E1 lines. Alarm monitoring functions are provided by the Environmental Alarm System (the EAS is a functional part of the Gen 3 SC). The SRSC and SRSC4 Gen 3 SC consist of the following:

- ☐ One Controller
- ☐ One Environmental Alarm System (EAS)

Refer to the Gen 3 SC supplement of this manual for more information on the Gen 3 SC.

**Generation 3 Site Controller  
System Manual 68P80801E30**

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## RFDS Theory of Operation

Figure 10 shows a block diagrams for the GEN 4 Duplexed RFDS used within the SRSC system. Figure 11 shows the block diagrams used within the SRSC4 system.

### Duplexer Operation for SRSC

Three Duplexers accommodate three Transmit/Receive (Tx/Rx) antennas, ANT 1 through ANT 3. Each Duplexer is tuned to accept a transmit input (TX IN 1 through TX IN 3) in the 851-866 MHz range.

The respective Rx outputs furnished by the three Duplexers (RX OUT 1 through RX OUT 3) provide triple-diversity Rx signals for individual Base Radio receivers operating in the 806 - 821 MHz range. The RX OUT1 through RX OUT3 signals are applied to the Base Radio receivers through multicouplers, which are discussed later.

### Duplexer Operation for SRSC4

Two Duplexers accommodate two Transmit/Receive (Tx/Rx) antennas, ANT 1 through ANT 2. Each Duplexer is tuned to accept a transmit input (TX IN 1 and TX IN 2) in the 851-866 MHz range.

The Rx outputs furnished by Duplexers 1, 2 and 3 provide Rx signals for Base Radio receivers operating in the 806 - 821 MHz range. The RX OUT1, RX OUT2, and RX OUT3 signals are applied to the Base Radio receivers through multicouplers, which are discussed later.

### Transmit Operation for SRSC

A Triple Isolator Deck provides isolation and filtering of the Tx signals from the Base Radios. The deck consists of three microstrip/groundplane printed circuits which provide the filtering function. Each circuit card also contains a discrete isolator device.

Base Radios 1 through 3 transmit signals TX1 through TX3 are respectively applied to the three sections of the Triple Isolator Deck. Each section of the deck applies a Tx input through a single-stage isolator. From the isolator, each signal is passed through a harmonic filter. The output of the filter is then fed to the TX input of its respective Duplexer. TX1 through TX3 are respectively applied to Duplexers ANT1 through ANT3.

Harmonic filters are used in each Tx signal path to prevent undesired intermodulation products due to simultaneous Tx signals.

### Transmit Operation for SRSC4

A Dual 2-Way Combiner provides isolation filtering and 2-way combining of the Tx signals from the Base Radios. The combiner consists of three microstrip/

**RFDS Theory of Operation**

groundplane printed circuits which provide the filtering function. Each circuit card also contains a discrete isolator device and a hybrid 2-way combiner.

Base Radios 1 through 4 transmit signals TX1 through TX4 are respectively applied to the two sections of the Dual 2-Way Combiner. Each section of the combiner applies a Tx input through an isolator. From the isolator, each signal is passed through a harmonic filter. The output of each filter is then fed into one of the two inputs of a 2-way combiner. The two segments of the dual 2-way combiner add the Tx signals in the following way:

- ❑ TX1 and TX3 are applied to Duplexer ANT1
- ❑ TX2 and TX4 are applied to Duplexer ANT2.

Harmonic filters are used in each Tx signal path to prevent undesired intermodulation products due to simultaneous Tx signals.

**Receive Operation**

Each receive branch of the GEN 4 Duplexed RFDS uses a 4-Way Multicoupler (MC). The MC uses a Multicoupler/ Amplifier (MC/ Amp) which converts a single receive signal into multiple buffered receive signals. All three Rx branches function identically; therefore, only the RX1 is discussed here.

The MC consists of a low-noise amplifier and a four-way multicoupler (splitter) which takes the RX OUT signal from the ANT 1 Duplexer and provides four outputs.

For the SRSC system, three outputs (R1 through R3) respectively provide RX1 signal feeds for the RX1 receivers of Base Radios 1 through 3. (The R4 output is not used and is terminated into 50Ω load, P/N 0909906D01.)

For the SRSC4 system, four outputs (R1 through R4) respectively provide RX1 signal feeds for the RX1 receivers of Base Radios 1 through 4.

**Power Monitoring**

A dual-directional coupler is installed on each Duplexer antenna port. The couplers are in-line and provide forward and reflected RF signal samples. These signal samples are fed to power monitors that, in turn, read the forward and reflected power readings from the antenna.

The power monitors measure the power readings by converting forward-power signal sample FWD and reflected-power signal sample REF into DC voltages. These DC voltages (VPWR1 through VPWR3) are proportional to the forward and reflected power readings.

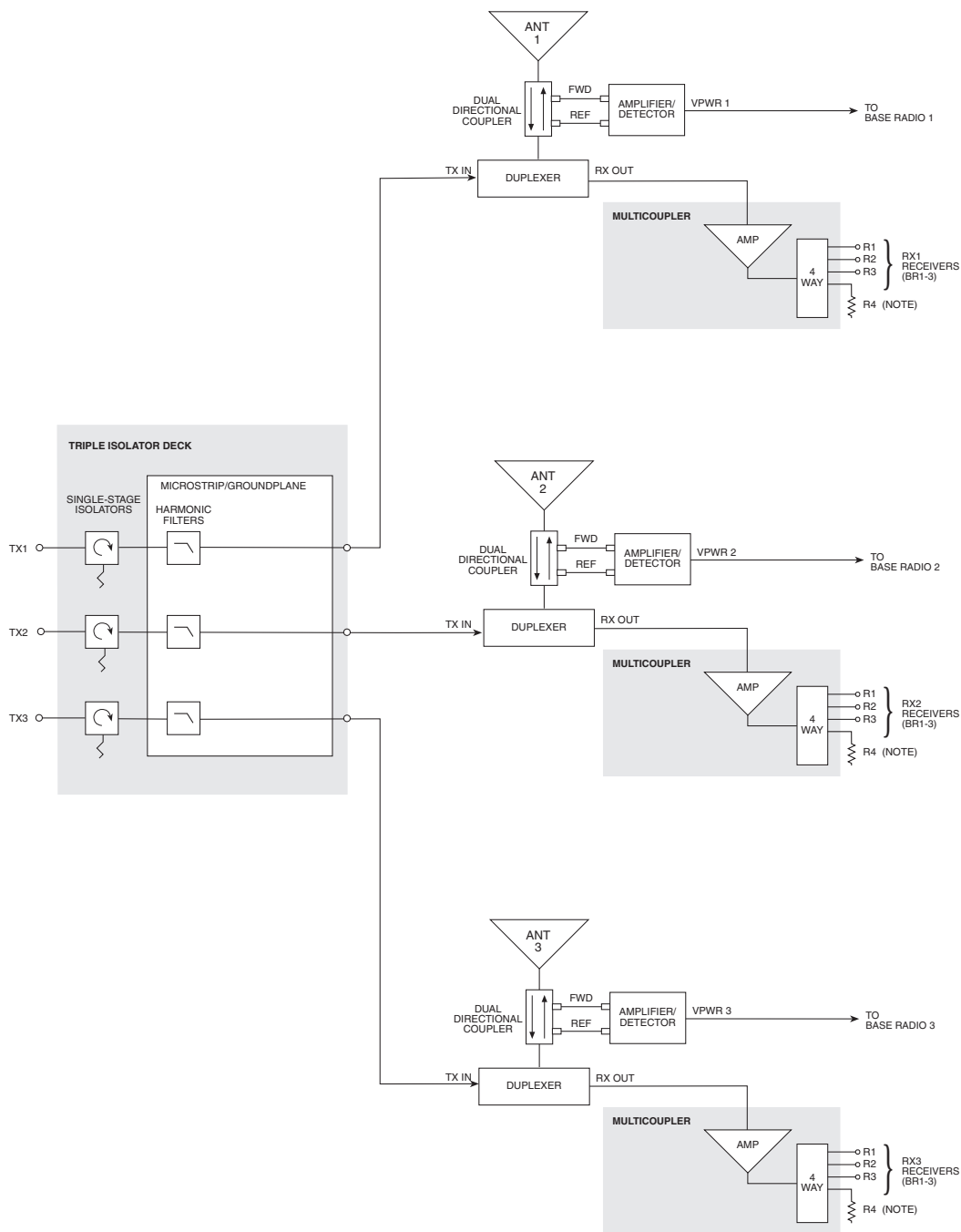
For the SRSC system, VPWR1 through VPWR3 are sent to Base Radios 1 through 3, respectively, where they are used to determine the forward and reflected power readings. They are also used to calculate the VSWR at a particular antenna port.

For the SRSC4 system, VPWR1 and VPWR2 are sent to Base Radios 1 and 2, respectively, where they are used to determine the forward and reflected power readings. They are also used to calculate the VSWR at that particular antenna port. (Base Radios 3 and 4 are not monitored.)

### **GEN 4 Duplexed RFDS Alarm Circuit**

Two opto-isolator outputs send alarm closure signals to the Environmental Alarm System (EAS): One diagnostic alarm output is provided for both of the power supplies; the other alarm is provided for each of the MC/Amps in the MCs. The alarms operate as normally closed loops. As such, when either (or both) of the power supplies experiences a failure, an alarm is generated. Similarly, when any combination of amplifiers experiences a failure, an alarm is generated. Upon detection of an alarm condition, the respective alarm will open to generate an alarm signal. The alarm signals are routed to the EAS by way of the Alarm output telco connector on the Rx Tray I/O board.

## RFDS Theory of Operation

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**NOTE:** R4 output of all multicouplers terminated into 50Ω termination (P/N 0909906D01).

Figure 10 **SRSC GEN 4 Duplexed RFDS Block Diagram**

## RFDS Theory of Operation

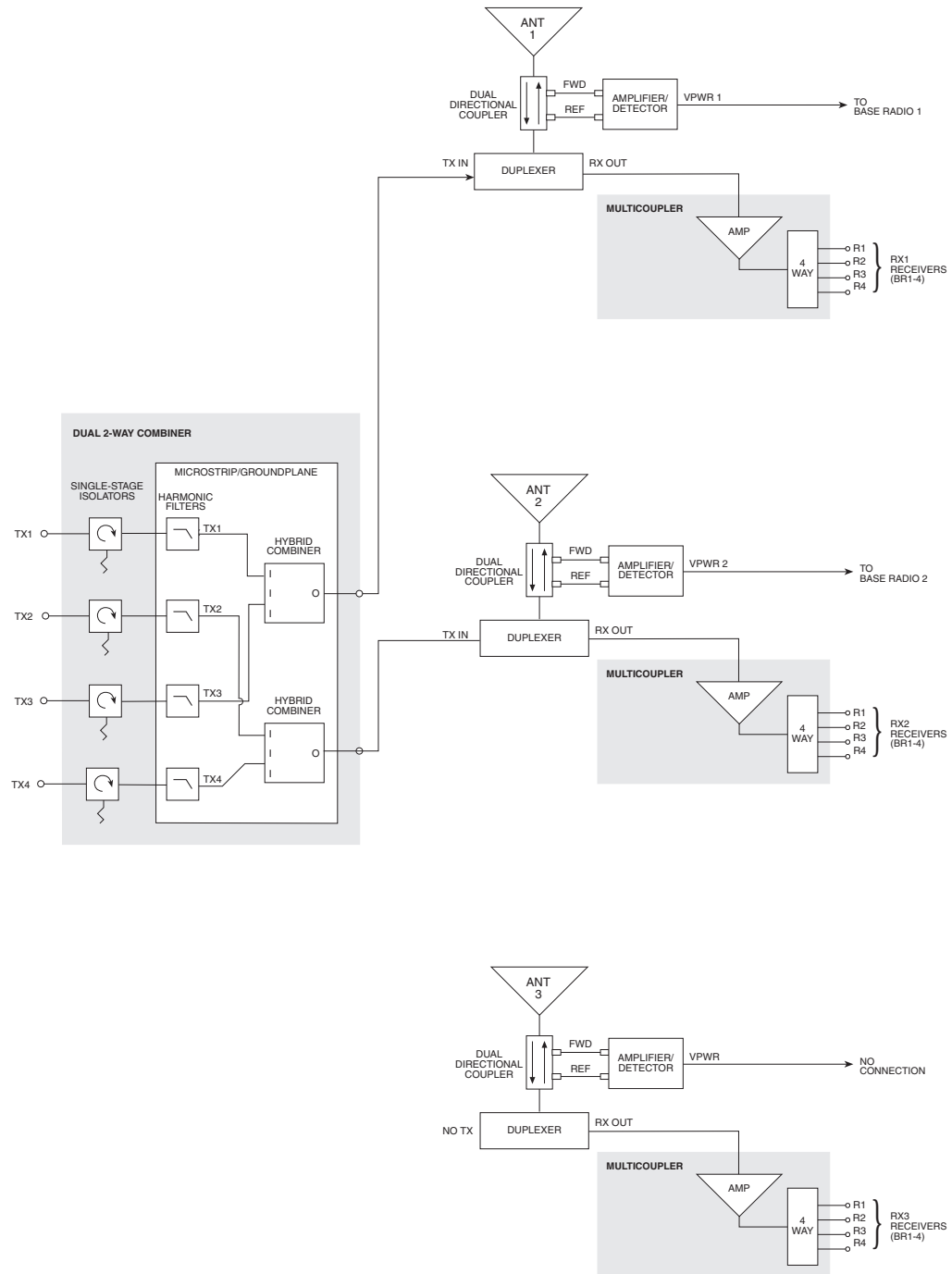
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021299LLN

Figure 11 SRSC4 GEN 4 Duplexed RFDS Block Diagram

**RFDS Theory of Operation****Duplexed Tower Top Amplifier Interface**

The SRSC and SRSC4 systems can be equipped with DC injectors installed on each duplexer, and a Tower Top Amplifier (TTA) interface tray. The TTA Alarm Tray and DC injectors, as installed on the duplexers, are shown in Figure 12. The DC injectors allow the RFDS to work with Duplexed (DTTAs). The DC injectors also provide a low-impedance path to ground in cases of a lightning strike. Typically, a TTA assembly itself is mounted on the antenna mast structure; the assembly contains three identical subassemblies for the respective three branches of the antenna system. The DTTAs augment system coverage of an EBTS by providing increased receive gain.

**TTA Alarm Tray**

The TTA Alarm Tray consists of three TTA power/alarm interface modules. These three modules provide the TTA power interface from the power supplies (located in the Rx Tray) to the TTAs. The power/alarm interface modules control application of power to the TTAs, and monitor the TTA interface for alarm conditions.

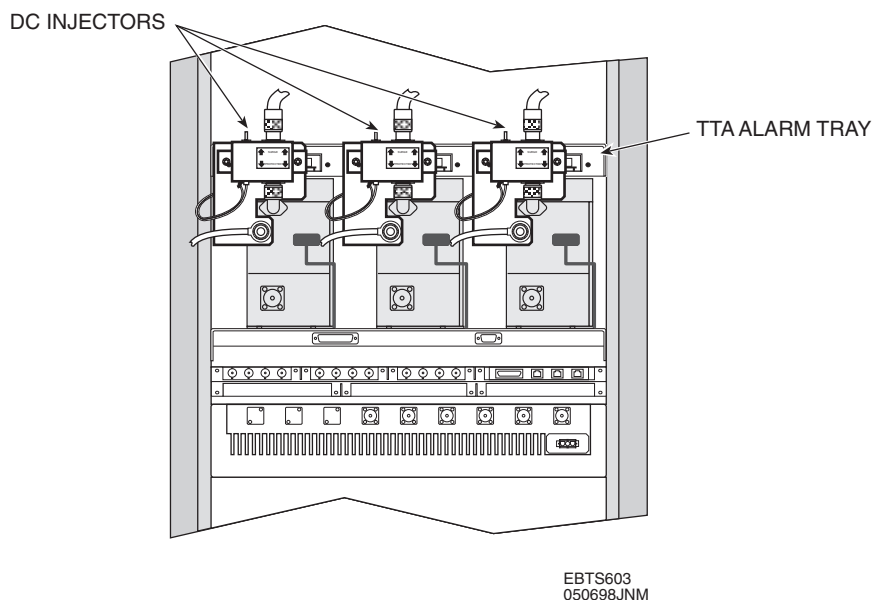


Figure 12 **Duplexed TTA FRUs/Assemblies**



## Tx/Rx Signal Flow

Figure 13 shows the incorporation of the Duplexed TTAs into the Tx/Rx signal flow path of a 800 MHz Duplexed RFDS. For each Tx/Rx antenna branch, a Duplexed TTA is inserted into the Tx/Rx path. DC injectors receive +24V power from the power supplies in the Rx Tray. Using the DC injectors, the existing Tx/Rx coaxial cables carry the Tx/Rx signals, along with the injected +24V operating power, to the Duplexed TTAs.

The tower-mounted Duplexed TTA assembly consist of the following:

- ❑ Three Low-Noise Amplifiers (LNAs) which increase receive path gain
- ❑ A test port which allows calibration signal injection into the LNA input
- ❑ Three duplexing devices which isolate the LNA s from the Tx signals

The Duplexed TTA assembly contains duplexers which provide isolation of the TX and Rx signals. The Tx signal is coupled directly to the antenna. However, the Rx signal is diverted by the duplexer and then fed to an LNA before being recoupled to the main RF Tx/Rx cable that connects to the RFDS. The duplexed TTA TEST PORT allows for the injection of a calibration reference signal into the receive path. The reference signal is applied to a four-way splitter; three of the splitter outputs serve as inputs to the LNAs. The reference signal is used in calculating the EBTS receive path gain.

## DC Injectors

The DC injectors are two-port devices with an additional DC injection terminal. The antenna-side port (labeled “SURGE”) allows injection of the DC power onto the coaxial connection. This port is also capable of discharging to ground a high-energy pulse received over the antenna connection (as in the case of a lightning strike). The opposite port (labeled “PROTECTED”), which is connected to the RFDS, is isolated from the injected DC as well as any high-energy entering through the SURGE (antenna) port.

## TTA Alarm Interface

The TTA power / alarm interface modules contain circuitry which monitors the operation of the TTAs for both TTA current draw and surge-protect tripping of a DC injector.

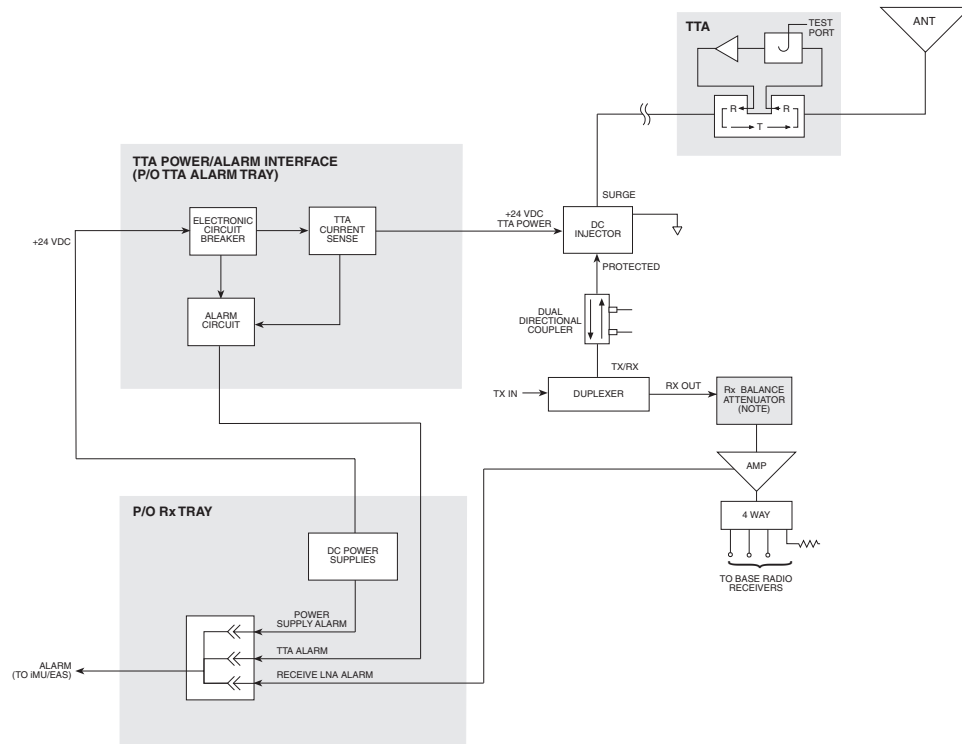
The TTA power / alarm interface module monitors the current draw of the TTA. If the current draw exceeds or dips below a pre-defined threshold window, an alarm is generated.

In the case of a high-energy discharge through a DC injector, the DC injector dumps the energy to ground. Unfortunately, this mode also momentarily shorts the injected DC power to ground, in turn shorting the TTA power feed from the Rx Tray power supply. To handle this condition, the TTA power / alarm interface module is equipped with an electronic circuit breaker which detects this condition.

**RFDS Theory of Operation**

Upon detection of a short-circuit, the electronic circuit breaker opens to remove the power supply from the short circuit imposed by the DC injector. The electronic circuit breaker waits an ample amount of time, at which point the high-energy event is expected to have ceased and the DC injector should have recovered (i.e., no short circuit). At this point, the electronic circuit breaker re-applies RFDS power to the DC injector. The electronic breaker repeats this cycle indefinitely until the DC injector recovers. If a DC injector will not recover, the repeated cycling will manifest itself as a persistent alarm, thereby indicating a shorted DC injector at the site.

The TTA power/alarm interface module alarm circuits are wired such that when any combination of TTA amplifiers experience an over/under current failure, or the electronic breaker indicates failure to properly reset, an alarm is sent to the Rx Tray I/O board. In turn, the alarm is then forwarded to the Environmental Alarm System.

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**NOTE 1:** Terminated for SRSC, Goes to Base Radio 4 Receiver for SRSC4.

**NOTE 2:** Balance attenuator value is determined using field equalization procedure. Attenuators are field-procured and not supplied with TTA FRUs.

Figure 13 **Duplexed TTA Block Diagram**

## Power Supplies

The RFDS uses two Power Supply boards (power supply A and power supply B) in a dual-redundant arrangement. The Power Supply boards are located in the Rx Tray. The power supplies convert the -48 VDC (hot) site power to +12 VDC and +24 VDC. The +12 VDC is used for the Rx Tray receive multicouplers, and the isolator deck fan assemblies. The +24 VDC is used for the Duplexer power monitors and (where applicable) tower top amplifiers.

**RFDS Theory of Operation**

Each Power Supply board is equipped with green and red LED indicators which indicate when the board is receiving power and properly functioning. The RFS1 and RFS2 circuit breakers on the AC/DC Power System breaker panel control the application of -48 VDC power to the A and B Power Supply boards.

**Connectors, Pinouts, and Wiring****Power Monitor Wiring Harness**

(See Figure 14.) The GEN 4 Duplexed RFDS contains 25-pin power monitor connector (P4) that interconnects the Power Monitor (sometimes called “external wattmeter”) FWD and REF signals to BR1 through BR3 for the SRSC system. For the SRSC4 system, the FWD and REF signals are applied to BR1 and BR2 through another cable harness that connects to P4. No plug connection is made to BR3.

The GEN 4 Duplexed RFDS also contains monitor power connector P5 that interconnects the power monitors on each duplex with DC power from the Rx Tray assembly. The power monitors interconnect with connectors P4 and P5 through duplexers P1 through P3, which respectively connect to the ANT1 through ANT3 duplexers.

Table 5 is a wire-run list that correlates the connections from connectors P4 and P5 to the P1 through P3 duplexer connectors.

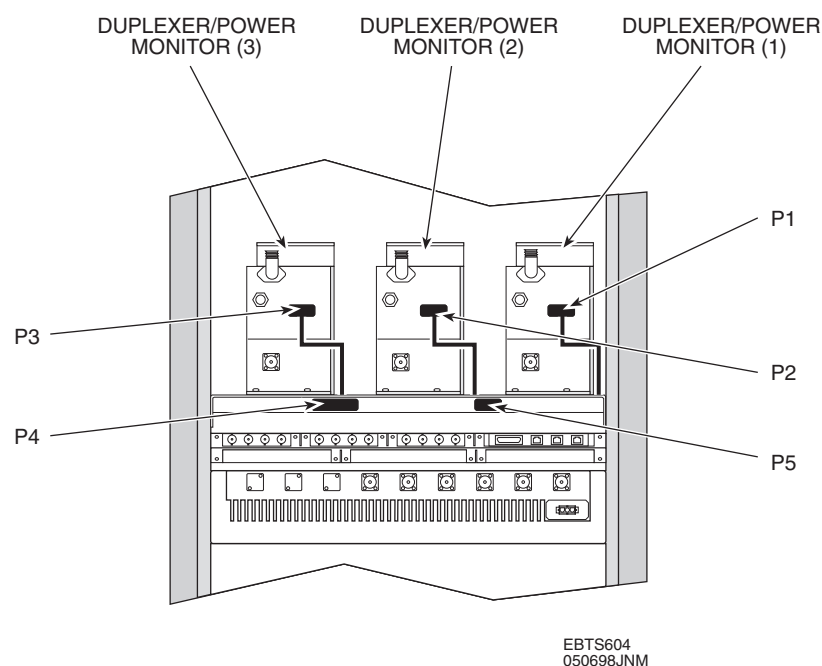


Figure 14 **GEN 4 RFDS Alarm/Monitor Connections**

Table 5 **GEN 4 Duplexed RFDS Alarm/Monitor Harness Wire Run List**

| From  | To   | Function                            |
|-------|------|-------------------------------------|
| P4-1  | —    | no connection                       |
| P4-2  | —    | no connection                       |
| P4-3  | —    | no connection                       |
| P4-4  | P1-3 | GND                                 |
| P4-5  | P1-5 | ANT A (antenna 1) FWD power monitor |
| P4-6  | P1-1 | Antenna A REF power monitor         |
| P4-7  | P2-3 | GND                                 |
| P4-8  | P2-5 | ANT B (antenna 2) FWD power monitor |
| P4-9  | P2-1 | ANT B (antenna 2) REF power monitor |
| P4-10 | P3-3 | GND                                 |
| P4-11 | P3-5 | ANT C (antenna 3) FWD power monitor |
| P4-12 | P3-1 | ANT C (antenna 3) REF power monitor |
| P4-13 | —    | no connection                       |
| P4-14 | —    | no connection                       |
| P4-15 | —    | no connection                       |
| P4-16 | —    | no connection                       |
| P4-17 | —    | no connection                       |
| P4-18 | P1-4 | GND (power monitor return)          |
| P4-19 | P2-4 | GND (power monitor return)          |
| P4-20 | P3-4 | GND (power monitor return)          |
| P4-21 | —    | no connection                       |
| P4-22 | —    | no connection                       |
| P4-23 | —    | no connection                       |
| P4-24 | —    | no connection                       |
| P4-25 | —    | no connection                       |
| P5-1  | P1-2 | +24 VDC (monitor 1)                 |
| P5-2  | P1-7 | GND (monitor 1)                     |
| P5-3  | P1-9 | no connection                       |
| P5-4  | P2-2 | +24 VDC (monitor 2)                 |
| P5-5  | P2-7 | GND (monitor 2)                     |
| P5-6  | P2-9 | no connection                       |
| P5-7  | P3-2 | +24 VDC (monitor 3)                 |
| P5-8  | P3-7 | GND (monitor 3)                     |
| P5-9  | P3-9 | no connection                       |

## I/O Board Version

Two versions of the I/O Board currently exist: CTF6220A and CTF6220B. The two versions are functionally identical, but do use different pinouts for the RJ-45 ALARM STANDARD connector that connects the cabinet alarms to the EAS.

The SRSC and SRSC4 systems are shipped using version CTF6220B, which eliminates the need for an extra, second cable to be connected between the I/O Board and the EAS. However, if the I/O Board is replaced with an A-version, the cabling must be considered. Refer to I/O Board Alarm Output Cabling in the *800 MHz GEN RF Distribution System* section of this manual for more information.

### NOTE

The CTF6220A and CTF6220B I/O boards are totally interchangeable. However, appropriate cabling must be used for the version being used. If cabling does not correspond to version, false alarms will result.

## I/O Board Rear Panel Connector Pinouts

The I/O Board rear panel connectors provide the cabinet alarm interface to the I/O board and a diagnostics connector. (Figure 7 shows and identifies the connectors.) The connectors are as follows:

- ☐ **Diagnostics** – 36-pin SCSI-style connector (reserved for future use)
- ☐ **Breaker Status (Alarm Expansion)** – Not used in the SRSC and SRSC4 systems. Breaker status is sent directly from the AC/DC Power System to the iMU.
- ☐ **Alarm Standard** – RJ-45 connector sends cabinet alarm status to the EAS.
- ☐ **Alarm Auxiliary** – RJ-45 connector receives additional, auxiliary alarm signals (reserved).

Table 6 lists the connector pinout for I/O Board CTF6220B.

Table 6 I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220B)

| Pin | Function/Connector  |                       |                                |                           |
|-----|---------------------|-----------------------|--------------------------------|---------------------------|
|     | Diagnostics         | Breaker Status Alarm  | Alarm Standard                 | Alarm Auxiliary           |
| 1   | MC #2 Alarm         | Breaker               | RFDS Power Supply Alarm return | Fan Alarm return          |
| 2   | MC #3 Alarm         | Breaker return        | RFDS TTA Alarm return          | not used                  |
| 3   | not used            | RFDS MC Alarm         | RFDS Multicoupler Alarm return | MC Alarm return           |
| 4   | not used            | RFDS TTA Alarm        | RFDS Power Supply Alarm        | Fan Alarm                 |
| 5   | not used            | RFDS PS Alarm         | RFDS TTA Alarm                 | not used                  |
| 6   | not used            | RFDS MC Alarm return  | RFDS Multicoupler Alarm        | MC Alarm                  |
| 7   | TTA #1 Alarm        | RFDS TTA Alarm return | Breaker Alarm return           | PS Alarm Expansion return |
| 8   | TTA #2 Alarm        | RFDS PS Alarm return  | Breaker Alarm                  | PS Alarm Expansion        |
| 9   | TTA #3 Alarm        |                       |                                |                           |
| 10  | TTA Alarm Expansion |                       |                                |                           |
| 11  | Fans #1 Alarm       |                       |                                |                           |
| 12  | Fans #2 Alarm       |                       |                                |                           |
| 13  | PS#1 +12VDC Alarm   |                       |                                |                           |
| 14  | PS#1 +24VDC Alarm   |                       |                                |                           |
| 15  | PS#2 +12VDC Alarm   |                       |                                |                           |
| 16  | PS#2 +24VDC Alarm   |                       |                                |                           |
| 17  | PS Alarm Expansion  |                       |                                |                           |
| 18  | N/C                 |                       |                                |                           |
| 19  | MC #1 Alarm         |                       |                                |                           |
| 20  | GND                 |                       |                                |                           |
| 21  | GND                 |                       |                                |                           |
| 22  | GND                 |                       |                                |                           |
| 23  | GND                 |                       |                                |                           |
| 24  | GND                 |                       |                                |                           |
| 25  | N/C                 |                       |                                |                           |

**RFDS Theory of Operation****Table 6 I/O Board Rear Panel Connector Pinouts (I/O Board CTF6220B) (Continued)**

| Pin | Function/Connector |                      |                |                 |
|-----|--------------------|----------------------|----------------|-----------------|
|     | Diagnostics        | Breaker Status Alarm | Alarm Standard | Alarm Auxiliary |
| 26  | N/C                |                      |                |                 |
| 27  | +24 VDC            |                      |                |                 |
| 28  | +24 VDC            |                      |                |                 |
| 29  | +24 VDC            |                      |                |                 |
| 30  | +24 VDC            |                      |                |                 |
| 31  | N/C                |                      |                |                 |
| 32  | N/C                |                      |                |                 |
| 33  | +12 VDC            |                      |                |                 |
| 34  | +12 VDC            |                      |                |                 |
| 35  | +12 VDC            |                      |                |                 |
| 36  | +12 VDC            |                      |                |                 |

**I/O Board Power Connectors**

The I/O Board power connectors provide the I/O board power interface from the AC/DC Power System -48 VDC power feed to the RFDS and isolator deck fans. (The I/O Board power connectors are mounted on the printed circuit board surface and are identified in Figures 25 and 30.) The connectors are as follows:

- ❑ **-48 VDC input** – 8-pin Mate-N-Lok header connector P1008. Receives -48 VDC feed from RFS1 & RFS2 connector on the breaker panel.
- ❑ **Fan Power output** – 8-pin Mate-N-Lok header connector P1007. Sends +12 VDC to the isolator deck fans.
- ❑ **RFDS Power output (power monitor interface)** – Mate-N-Lok header connector which terminates to 9-pin submini-D connector P5 (located on the duplexer shelf). Refer to Table 5 for pinout and signal functions.
- ❑ **TTA Power output/Alarm input** – 16-pin Mini Mate-N-Lok header connector P1006. Only used on systems with TTA interface. Sends +24 VDC to TTA Alarm Tray. Receives alarm signals from TTA Alarm Tray.

Table 7 lists the power connector pinouts for the I/O Board.



Table 7 I/O Board Power Connector Pinouts

| Pin | Function/Connector                 |                        |                         |
|-----|------------------------------------|------------------------|-------------------------|
|     | TTA Power/Alarm Interface<br>P1006 | -48 VDC Input<br>P1008 | Fan Power<br>P1007      |
| 1   | TTA #1 +24 VDC                     | -48 VDC ('A' side)     | N/C                     |
| 2   | TTA #1 GND                         | Return ('A' side)      | Return ('A' side)       |
| 3   | TTA #1 alarm enable                | N/C                    | Alarm enable ('A' side) |
| 4   | TTA #1 alarm                       | N/C                    | +12 VDC ('A' side)      |
| 5   | TTA #1 alarm return                | -48 VDC ('B' side)     | N/C                     |
| 6   | TTA #2 +24 VDC                     | Return ('B' side)      | Return ('B' side)       |
| 7   | TTA #2 GND                         | N/C                    | Alarm enable ('B' side) |
| 8   | TTA #2 alarm enable                | N/C                    | +12 VDC ('B' side)      |
| 9   | TTA #2 alarm                       |                        |                         |
| 10  | TTA #2 alarm return                |                        |                         |
| 11  | TTA #3 +24 VDC                     |                        |                         |
| 12  | TTA #3 GND                         |                        |                         |
| 13  | TTA #3 alarm enable                |                        |                         |
| 14  | TTA #3 alarm                       |                        |                         |
| 15  | TTA #3 alarm return                |                        |                         |
| 16  | N/C                                |                        |                         |

**Removal/Replacement Procedures**

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## Removal/Replacement Procedures

### Replacement of AC/DC Power System FRUs

Field maintenance of the AC/DC Power System is limited to replacement of failed Rectifier Module(s). A Rectifier Module failure is indicated by an illuminated red MODULE ALARM indicator and/or an extinguished green MODULE POWER indicator.

Instructions are provided below for replacing a Rectifier Module. Replace suspected FRUs with known non-defective FRUs to restore the power system to proper operation.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

In cases of minor power system alarm (MIN alarm) Rectifier Modules are designed for “hot pull” replacement. There is no need to shut down any equipment for field replacement of Rectifier Modules.

---

Where multiple modules indicate alarms, remove and replace only one module at a time.

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### Removal

Remove Rectifier Module as follows:

1. Remove the four Phillips-head screws which secure Rectifier Module to power system chassis. Save screws for reuse.
2. Grasp handle on Rectifier Module and slide module from power system chassis.

### Installation

Install Rectifier Module as follows:

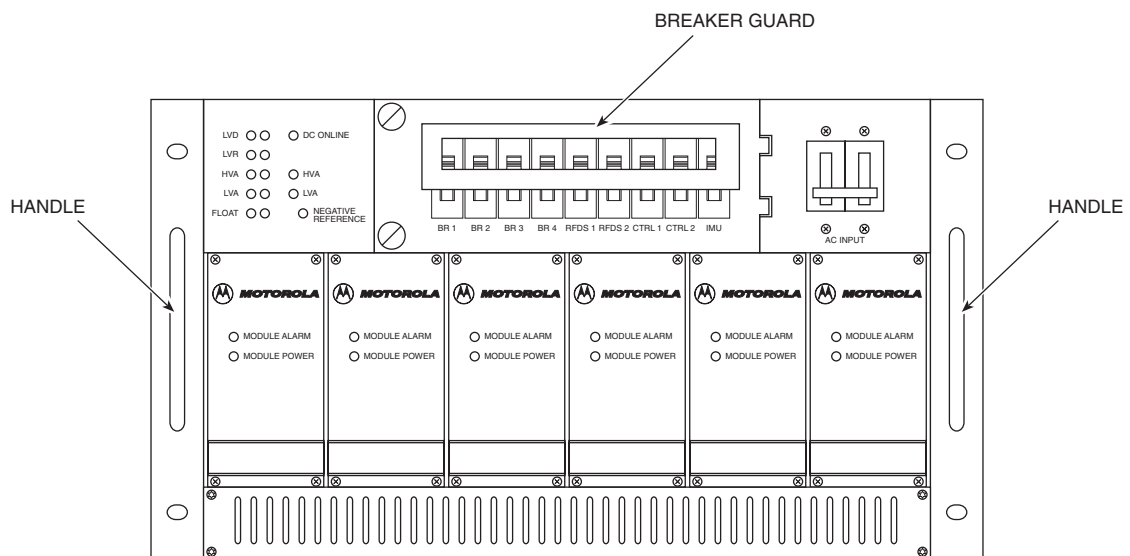
1. Align Rectifier Module with mating slot in power system chassis.
2. Gradually slide Rectifier Module into chassis until module front panel is flush with adjacent modules.
3. Check indicators on Rectifier Module just installed. Green indicator should be lit, and red indicator should be unlit.

**NOTE**

If Rectifier Module indications are not OK with known-good module, another problem exists. AC/DC Power System will require replacement (along with site shutdown) at earliest convenient time.

**! CAUTION**

The AC/DC Power System weighs 45 lbs. Use extreme caution when lifting or removing it from the rack. Handles are provided on front panel to assist in lifting the chassis. DO NOT use the breaker guard (located on the front of the Power System) as a handle.



EBTS673  
101298JNM

Figure 15 AC/DC Power System - Front Panel

4. Secure Rectifier Module to power system chassis using four screws (saved during removal).

**Removal/Replacement Procedures****Replacement of Gen 3 SC/iSC FRUs**

Instructions for replacing the Gen 3 SC FRUs are provided in the appropriate supplement to this manual.

**Generation 3 Site Controller  
System Manual 68P808101E30**

**Replacement of RFDS FRUs**

Instructions are provided below for replacing FRUs within the GEN 4 Duplexed RFDS. Figure 4 identifies the GEN 4 Duplexed RFDS assemblies and FRUs. Figure 16 identifies the Rx Tray assemblies and attaching hardware.

Replace suspected FRUs with known non-defective FRUs to restore the RFDS to proper operation.

 **CAUTION**

The RFDS contains static-sensitive modules. Take precautionary measures to prevent static discharge damage when servicing the RFDS.

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## 4-Way Multicoupler Board Replacement Procedure

Perform the following steps to replace a 4-Way Multicoupler Board.

### Removal

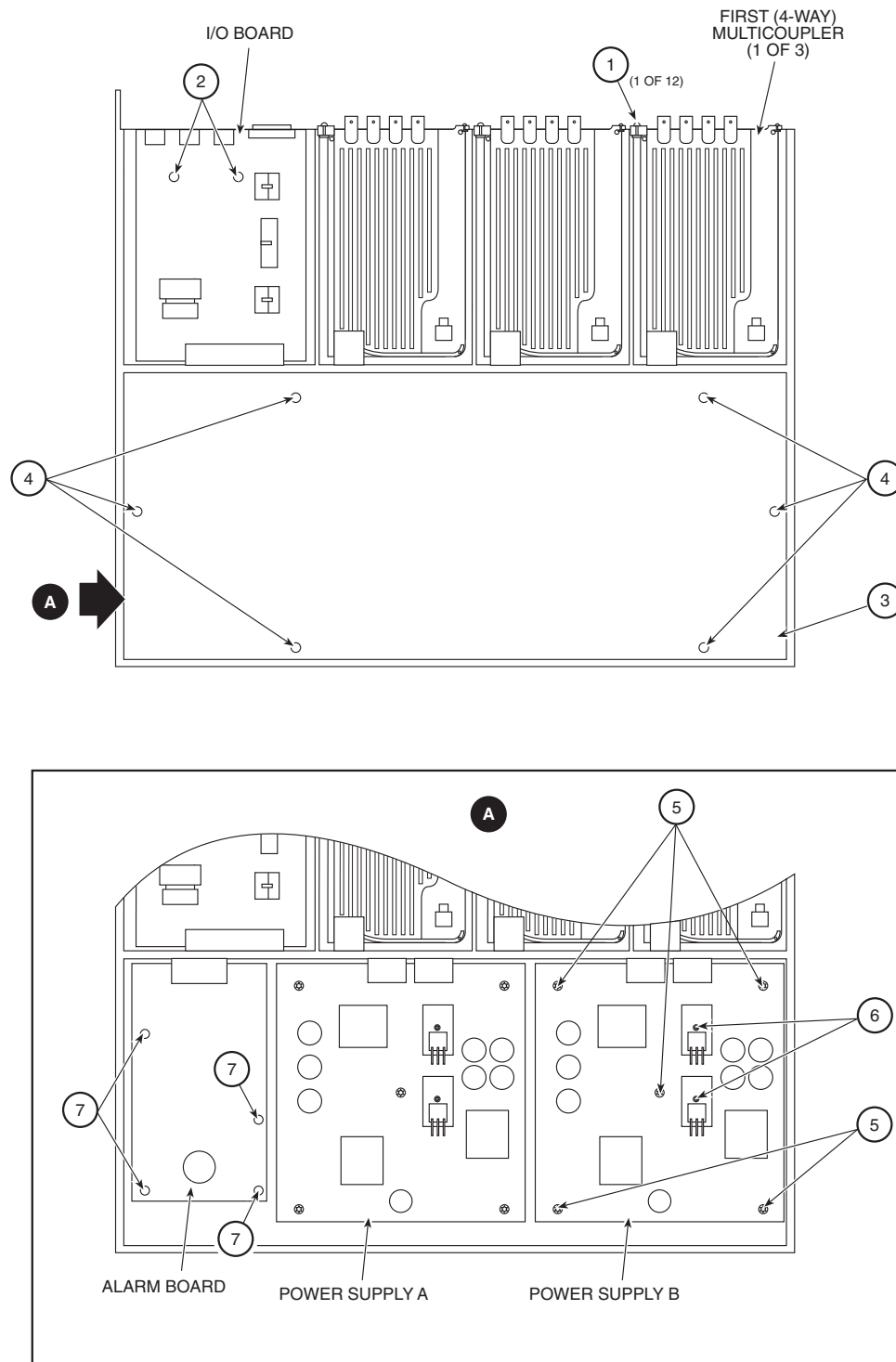
(See Figure 16.) Remove 4-Way Multicoupler Board as follows:

1. Tag and remove all BNC connections at the **R1** through **R3** BNC connectors on the 4-Way Multicoupler Board, and remove the 50 $\Omega$  termination from the **R4** BNC connector. Save 50 $\Omega$  termination for reuse.
2. Remove two M3.5 TORX™ screws (1, Figure 16) which secure board assembly to Rx Tray chassis (one screw on each side of board). Save screws for reuse.
3. Partially draw board assembly out of Rx Tray until blindmate connector at front of board is disengaged.
4. Remove board from slot enough to gain access to input port SMA cable termination on top of board. Disconnect SMA cable from board connector.
5. Remove board fully from Rx Tray slot.

### Installation

(See Figure 16.) Install 4-Way Multicoupler Board as follows:

1. Align 4-Way Multicoupler Board with Rx Tray board slot. Partially slide board into slot enough to allow Rx input SMA cable to mate with SMA connector on top of board.
2. Connect SMA cable to SMA connector on top of board. Using a breaking-type 5/16" torque wrench, torque the SMA connector to 5 in-lb.
3. Carefully slide board fully into slot, making certain blindmate connection at front of board is fully mated to Rx Tray chassis midplane connector.
4. Install two M3.5 TORX screws (1, Figure 16), one on each side of assembly, (saved during removal) which secure board assembly to Rx Tray chassis.
5. Connect cabling to the **R1** through **R3** BNC connectors on the 4-Way Multicoupler Board as tagged during removal. Connect the 50 $\Omega$  termination (saved during removal) to the **R4** BNC connector.

**Removal/Replacement Procedures**EBTS490  
123197JNMFigure 16 **Rx Tray FRU/Assembly Replacement**

## I/O Board Replacement Procedure

Perform the following steps to replace an I/O Board.

### NOTE

During I/O Board replacement, the site will become inoperative due to loss of alarm and certain power functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

### NOTE

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

## Removal

(See Figure 16.) Remove I/O Board as follows:

1. Remove four M3.5 TORX screws which secure Rx Tray chassis to front panel. (Do not remove the four M6 TORX screws which secure front panel to equipment cabinet.) Save screws for reuse.
2. From rear of cabinet, carefully slide Rx Tray chassis from cabinet enough to access two M3.5 TORX screws (2, Figure 16) that secure I/O Board to Rx Tray chassis.
3. Remove two M3.5 TORX screws that secure I/O Board to Rx Tray chassis. Save screws for reuse.
4. Slide I/O Board away from Rx Tray midplane until connector at front of board is disengaged.
5. With board still connected to RJ45 alarm and Mate-N-Lok power connectors, tag wiring connections. Position board aside with all connections intact.

**Removal/Replacement Procedures****Installation**

(See Figure 16.) Install I/O Board as follows:

6. Disconnect connection on board being replaced. Connect harness to replacement I/O Board noting tagged position.
7. Place new I/O Board in mounting position.
8. Align connector at front of board with mating connector on Rx Tray chassis midplane. Gently slide board toward front of Rx Tray chassis until connectors are fully mated.
9. Secure board using two M3.5 TORX screws (2, Figure 16) saved during removal.
10. Carefully slide Rx Tray chassis toward front panel until chassis is flush with front panel. Make certain no wiring is pinched between Rx Tray chassis and front panel.
11. Start four M3.5 TORX screws that secure Rx Tray chassis to Rx Tray front panel. Tighten all four screws evenly.
12. Reactivate site via OMC.

**Power Supply Board Replacement Procedure**

The Rx Tray Power Supply boards are located in the Rx Tray as shown in Figure 16. Because two Power Supply boards are used in a redundant arrangement, a defective Power Supply board can be replaced without taking the system out of operation.

 **CAUTION**

Power Supply board opposite to board being replaced remains energized. When replacing board, use care to prevent accidental contact of tools with components and/or surfaces of energized board. Failure to adhere to caution may result in damage to equipment.

**Removal**

(See Figure 16.) Perform the following steps to determine and replace a defective Power Supply board.

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 16).



3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.
4. Determine which Power Supply board has failed by observing the green and red LED indicators on each board. (On properly functioning supply, green LED is lit and red LED is off.)
5. Noting the Power Supply board that has failed, on AC/DC Power System breaker panel turn off power for the defective power supply as follows:

| Power Supply Board                   | AC/DC Power System<br>Circuit Breaker |
|--------------------------------------|---------------------------------------|
| A (left board as viewed from front)  | RFDS 1                                |
| B (right board as viewed from front) | RFDS 2                                |

6. On failed board, remove five M3.5 TORX screws (5) that secure board to Rx Tray chassis. Save screws for reuse.
7. Remove two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis.

#### NOTE

Observe if TO-220 devices use plastic insulator collars along with each screw. If collars are used, save screws and collars for possible reuse. Plastic insulating collars and insulator pads are not needed when replacing newer-version power supply that uses plastic-encased TO-220 devices.

8. Slide board towards front of Rx Tray chassis until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

## Installation

(See Figure 16.) Install Power Supply board as follows:

1. Place Power Supply board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane. Gently slide board toward rear of chassis until connectors are fully mated.
3. Start (but do not tighten) five M3.5 TORX screws (5, Figure 16) that secure board to Rx Tray chassis.

**Removal/Replacement Procedures** **CAUTION**

In following step, if TO-220 devices on replacement Power Supply Board have **metal tabs**, plastic insulator collar and insulator pad must be used with retaining screws. If TO-220 devices on replacement power supply are **plastic encased** (encapsulated TO-220), collars are not used.

Failure to use insulator collars on metal-tab device will result in damage to replacement power supply.

---

4. Note the TO-220 devices (D120 and D122) on the board, each secured by a screw (6) in the device mounting tabs. If devices have a metal mounting tab, make certain that a plastic insulator collar (saved during removal) is properly installed in each mounting tab on TO-220 devices, D120 and D122.
5. Start (but do not tighten) two M3 TORX screws (6) that secure board, along with D120 and D122 TO-220 devices, to Rx Tray chassis.
6. Tighten five screws (5) and two screws (6) evenly.
7. Apply power to board being replaced by resetting appropriate breaker on AC/DC Power System breaker panel. Verify proper operation by observing green LED indicator on board.
8. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
9. Secure cover using six M3.5 TORX screws (4).
10. Carefully slide Rx Tray fully into cabinet.
11. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).

## Alarm Board Replacement Procedure

Perform the following steps to replace an Alarm Board.

### NOTE

During Alarm Board replacement, the site will become inoperative due to loss of alarm functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

### NOTE

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

## Removal

(See Figure 16.) Remove Alarm Board as follows:

1. Remove the four M6 TORX screws which secure the Rx Tray front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
2. From front of cabinet, gradually slide the Rx Tray from cabinet enough to gain access to cover (3, Figure 16).
3. Remove six M3.5 TORX screws (4) that secure cover to Rx Tray chassis (save screws for reuse.) Remove cover.
4. Remove four M3.5 TORX screws (7) that secure Alarm Board to Rx Tray chassis. Save screws for reuse.
5. Using the finger hole in the Alarm Board, place finger in hole and pull board forward until connector at rear of board disengages mating connector on Rx Tray chassis midplane. Remove board from chassis.

## Installation

(See Figure 16.) Install Alarm Board as follows:

1. Place Alarm Board in mounting position on Rx Tray chassis floor.
2. Align connector at rear of board with mating connector on Rx Tray chassis midplane.

---

**Removal/Replacement Procedures**

3. Using finger hole in board, gently slide board toward rear of Rx Tray chassis until connector is fully mated.
4. Secure board using four M3.5 TORX screws (7, Figure 16) saved during removal.
5. Place cover (3) in mounting position, making certain any adjacent wiring is not pinched under cover.
6. Secure cover using six M3.5 TORX screws (4) saved during removal.
7. Carefully slide Rx Tray fully into cabinet.
8. Secure the Rx Tray to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
9. Reactivate site via OMC.

**Triple Isolator Deck Replacement Procedure**

Perform the following steps to replace a Triple Isolator Deck.

 **CAUTION**

Triple isolator deck surfaces are hot. Allow combiner deck to cool before proceeding to prevent injury.

---

 **CAUTION**

RF Energy hazard. Be sure the **dekey** command sequence (see Set the transmit power to 40 watts. Key the BR in the Software Commands section for details) has been issued to all base radios that connect to the isolator deck to prevent injury or damage to equipment while disconnecting or connecting transmit cabling.

---

**NOTE**

During Triple Isolator Deck replacement the site will become inoperative.

---

## Removal

Remove Triple Isolator Deck as follows:

1. Make certain the **dekey** command sequence (see Set the transmit power to 40 watts. Key the BR in the Software Commands section for details) has been issued to all base radios that connect to the Triple Isolator Deck being removed.
2. At rear of Triple Isolator Deck, disconnect Mate-N-Lok fan power connector.
3. Tag and disconnect N-connector RF cables from Triple Isolator Deck rear panel connectors.
4. Remove the four M6 TORX screws which secure the Triple Isolator Deck front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
5. While supporting the Triple Isolator Deck, carefully remove the Triple Isolator Deck from the Equipment Cabinet by sliding it from the front of cabinet.

## Installation

Install Triple Isolator Deck as follows:

1. While supporting the Triple Isolator Deck, carefully lift and slide the Triple Isolator Deck into the pre-installed side rails in the Equipment Cabinet mounting position.
2. Secure the Triple Isolator Deck to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
3. Connect cabling to the Triple Isolator Deck rear panel connectors as tagged during removal.
4. Reactivate system as follows:
  - On an up-and-running system which was deactivated with a **dekey** command sequence (see Set the transmit power to 40 watts. Key the BR in the Software Commands section for details), reset the Base Radio Controller on Base Radios where the command was issued.
  - On a system that was completely shut down, perform activation in accordance with the System Testing section of this manual.

## Dual 2-Way Combiner Replacement Procedure

Perform the following steps to replace a Dual 2-Way Combiner.

**Removal/Replacement Procedures** **CAUTION**

Dual 2-Way Combiner surfaces are hot. Contact can cause burns. allow Combiner surfaces to cool before proceeding to prevent injury.

---

 **CAUTION**

Be sure the **dekey** command has been issued to all base radios that connect to the Dual 2-Way Combiner to prevent injury or damage to equipment while disconnecting or connecting transmit cabling.

---

**NOTE**

During Dual 2-Way Combiner replacement, the site will become inoperative.

---

**Removal**

Remove Dual 2-Way Combiner as follows:

1. Make certain the **dekey** command sequence (see Set the transmit power to 40 watts. Key the BR in the Software Commands section for details) has been issued to all base radios that connect to the Dual 2-Way Combiner being removed.
2. At rear of Dual 2-Way Combiner, disconnect Mate-N-Lok fan power connector.
3. Tag and disconnect N-connector RF cables from Dual 2-Way Combiner rear panel connectors.
4. Remove the four M6 TORX screws which secure the Dual 2-Way Combiner front panel to the Equipment Cabinet mounting rails. Save screws for reuse.
5. While supporting the Dual 2-Way Combiner, carefully remove the Dual 2-Way Combiner from the Equipment Cabinet by sliding it from the front of cabinet.

## Installation

Install Dual 2-Way Combiner as follows:

1. While supporting the Dual 2-Way Combiner, carefully lift and slide the Dual 2-Way Combiner into the pre-installed side rails in the Equipment Cabinet mounting position.
2. Secure the Dual 2-Way Combiner to the Equipment Cabinet mounting rails using four M6 TORX screws. Tighten the screws to 40 in-lb (4.5 Nm).
3. Connect cabling to the Dual 2-Way Combiner rear panel connectors as tagged during removal.
4. Reactivate system as follows:
  - On an up-and-running system which was deactivated with a **dekey** command sequence (see Set the transmit power to 40 watts. Key the BR in the Software Commands section for details), reset the Base Radio Controller on Base Radios where the command was issued.
  - On a system that was completely shut down, perform activation in accordance with the System Testing section of this manual.

## TTA Alarm Module Replacement

The location of the Duplexed TTA FRUs are shown in Figure 17. Perform the following steps to replace a TTA Alarm Module.

### NOTE

During TTA Alarm Module replacement, the site will become inoperative due to loss of TTA functions. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

### NOTE

To prevent alarm reports while the replacement procedure is performed, the site should be taken down via the Operations and Maintenance Center (OMC).

**Removal/Replacement Procedures****Removal**

Remove TTA Alarm Module as follows:

1. On front of TTA Alarm Tray, remove the two TORX screws which secure TTA Alarm Module being removed to tray. Save screws for reuse.
2. Draw TTA Alarm Module away from front panel enough to access cabling at rear of module.
3. At rear of TTA Alarm Module, tag and disconnect the two harnesses which connect to module.
4. Remove TTA Alarm Module from front of tray.

**Installation**

Install TTA Alarm Module as follows:

1. From front of TTA Alarm Tray, position the TTA Alarm Module for installation into tray.
2. Noting tagged wiring positions, connect two wiring harnesses to replacement TTA Alarm Module.
3. Place replacement TTA Alarm Module in mounting position and start two TORX screws (removed during removal) which secure module to tray.
4. Tighten two TORX screws to 8 in-lb.
5. Reactivate site via OMC.



---

## Field Retrofit of Duplexed TTA Interface (CLN1403)

**NOTE**

During field retrofit, the site will become inoperative. When followed as written, this procedure keeps the amount of downtime to a minimum.

Motorola recommends performing this procedure during off-peak periods.

**NOTE**

To prevent alarm reports while the retrofit procedures are being performed, the site should be taken down via the Operations and Maintenance Center (OMC).

Figures 17 and 18 show the Duplexed TTA interface FRUs. Field retrofit of the CLN1403 Duplexed TTA interface consists of installing the following TTA hardware:

- ☐ TTA Alarm Tray
- ☐ DC Injectors (3 used)
- ☐ DC Injector Mounting Hardware
- ☐ TTA Tray Cabling

When all of the field retrofit procedures have been completed, perform receive branch equalization in accordance with the “Duplexed TTA Receive Branch Equalization” procedure in the *800 MHz GEN 4 Duplexed RF Distribution System* section of this manual.

**NOTE**

The tower-mounted TTA assemblies themselves are not part of the FRU described herein. The tower-mounted TTA assemblies are drop-shipped to the customer site.

**Field Retrofit of Duplexed TTA Interface (CLN1403)****TTA Alarm Tray Installation**

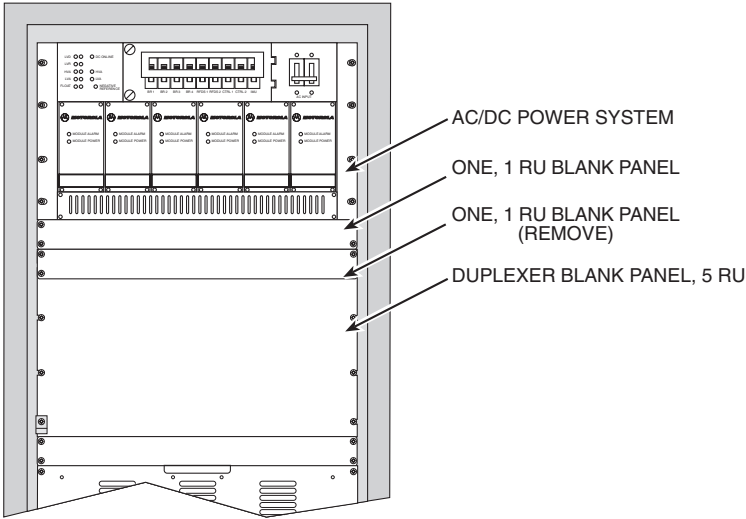
The TTA Alarm Tray interfaces alarm monitoring and operating power for the Duplexed TTAs via the DC injectors. The TTA Alarm Tray occupies one rack unit above the RFDS front panel.

(See Figure 17.) Install TTA Alarm Tray as follows:

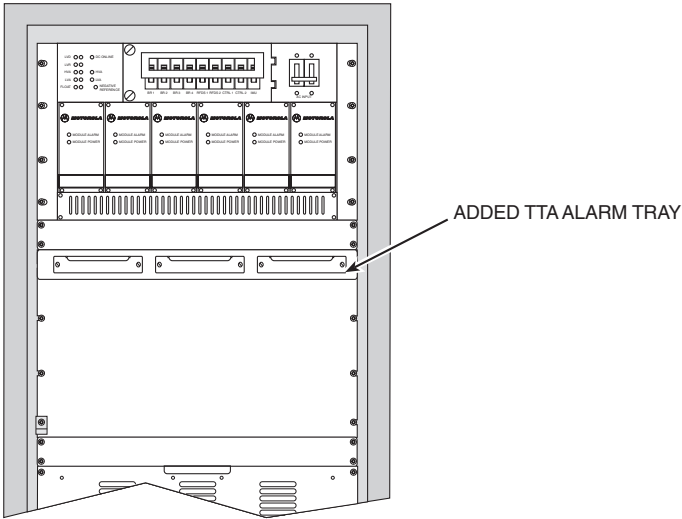
1. Unpack the TTA Alarm Tray and record the bar code number in the site records.
2. On equipment cabinet, remove the 1-RU blank panel directly above the RFDS front panel blank. Save screws for reuse.
3. Insert the TTA Alarm Tray into the rack in the location shown in Figure 17.
4. Secure the TTA Alarm Tray to the front of the cabinet using four TORX screws. Torque the screws to 40 in.-lbs.
5. Proceed to DC Injector Installation procedure (see page 52).

Field Retrofit of Duplexed TTA Interface (CLN1403)

EXISTING FRONT PANEL LAYOUT



TTA ALARM TRAY INSTALLATION



EBTS695  
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Figure 17 TTA Alarm Tray Installation

**Field Retrofit of Duplexed TTA Interface (CLN1403)****DC Injector Installation**

The DC injectors allow the Duplexed TTA +24V operating power to be fed to the Duplexed TTA LNAs via the Tx/Rx coaxial feed cable. A DC injector must be installed at the antenna port of each duplexer.

(See Figure 18.) Install DC injectors as follows:

1. On Antenna 1 duplexer antenna port, disconnect antenna cable.
2. On Antenna 1 duplexer, remove nut that secures ground cable to duplexer. Disconnect cable and position aside.
3. Place DC injector mounting bracket over duplexer ground stud.
4. Place ground cable over stud. Start (but do not tighten) hex nut that secures ground cable along with bracket.

**NOTE**

In next step, DC Injector must be oriented properly.

5. Orientate DC Injector such that port labeled "PROTECTED" is facing duplexer port. Connect PROTECTED port on DC Injector to duplexer port.
6. Align mounting holes in bracket with mounting holes on DC injector. Secure DC injector to bracket using two M4 screws.
7. Fully tighten ground cable hex nut.
8. Connect the antenna cable to DC injector port labeled "SURGE".
9. Repeat steps 1 through 8 for antenna branch 2 and branch 3.
10. Perform cabling in accordance with Duplexed TTA Cabling (provided in Cabling Information later in this section).
11. Reactivate site via OMC.
12. Proceed to Duplexed TTA Receive Branch Equalization procedure later in this section.

## Field Retrofit of Duplexed TTA Interface (CLN1403)

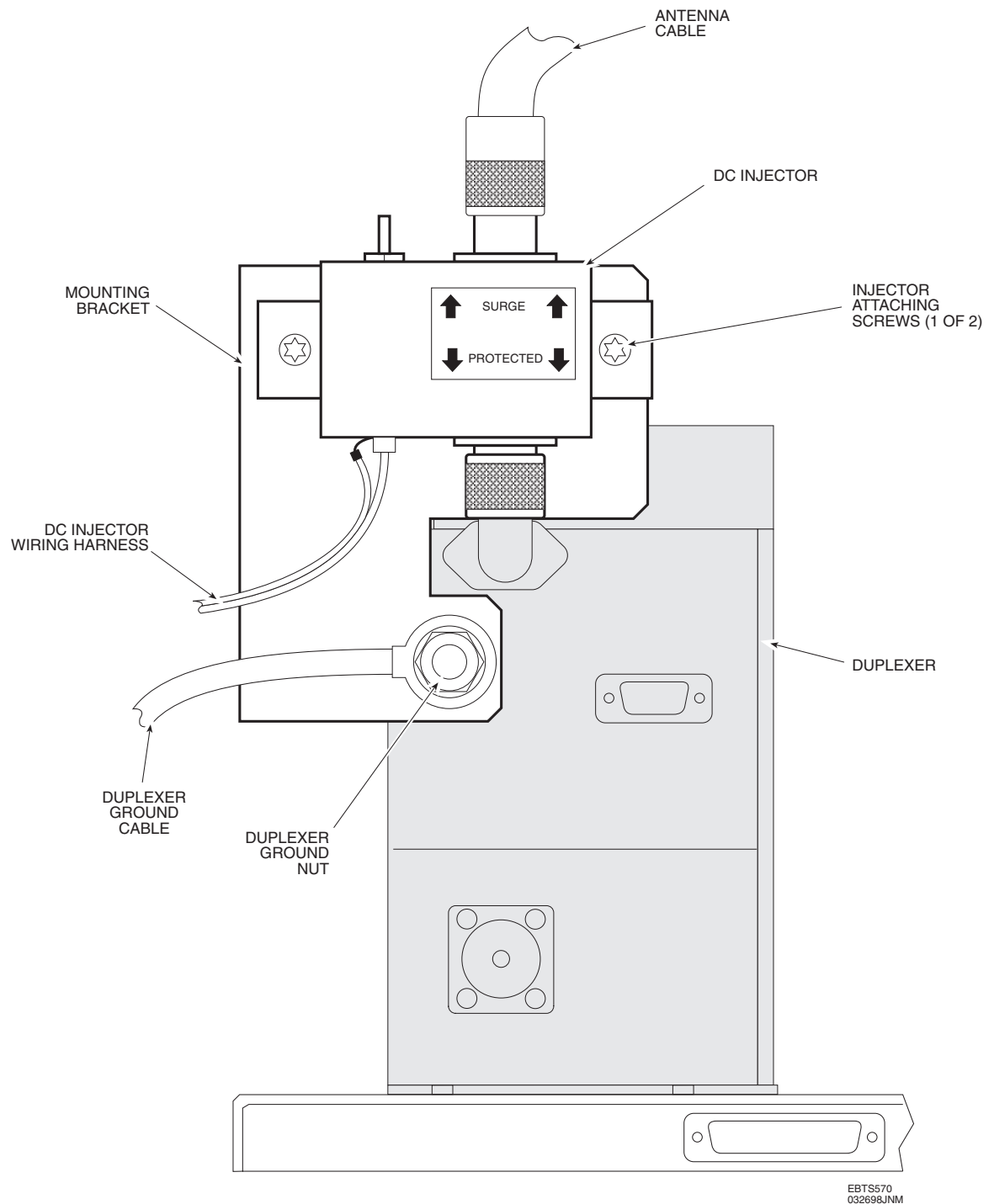


Figure 18 **DC Injector Installation**

**Cabling Information**


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## Cabling Information

The illustrations and corresponding tables within this section identify cabling part numbers and point-to-point connections. The illustrations show the location and connections of the cables. Each cable is identified by an index number. The corresponding tables identify the point-to-point connection, function, and part number of the cables. Connections appearing in **bold** are labeled accordingly on the equipment.

The cabling diagrams included in this section are listed in the following table.

| Section                              | Page | Description                                                                                                                                                         |
|--------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Duplexer-To-Rx Tray Cabling          | 55   | Provides cabling information for the receive connections between the Duplexers and the Rx Tray                                                                      |
| Receiver Cabling                     | 57   | Provides cabling information for the Rx Tray-to-Base Radio Rx input connections                                                                                     |
| Chassis Grounding- Gen3 SC/EAS Units | 59   | Provides chassis ground connection information for components within the SRSC and SRSC4 cabinets                                                                    |
| 5 MHz/1 PPS Cabling                  | 61   | Provides information for the 5 MHz/1 PPS cabling connections within the SRSC and SRSC4 cabinets                                                                     |
| Ethernet Cabling                     | 63   | Provides information for the Ethernet connections within the SRSC and SRSC4 cabinets                                                                                |
| Gen 3 SC/EAS Interconnections        | 65   | Provides information for connections between the Gen3 SC and SRSC/SRSC4 cabinets.                                                                                   |
| Power Cabling (SRSC4 System)         | 70   | Provides information for alarm and power monitor interconnection for various components within the SRSC and SRSC4 cabinets                                          |
| AC/DC Power System Alarm Connections | 73   | Provides information for AC/DC Power System alarm connections to the EAS/iMU within the SRSC and SRSC4 cabinets                                                     |
| Transmit Power Out Cabling           | 75   | Provides cabling information for the Base Radio transmit output connections to the RFDS within the SRSC and SRSC4 cabinets                                          |
| Duplexed TTA Cabling                 | 77   | Provides information for cabling between the Rx Tray, TTA Alarm Tray, and DC injectors within the SRSC and SRSC4 cabinets for systems equipped to operate with TTAs |

## Duplexer-To-Rx Tray Cabling

**NOTE**

Duplexer-to-Rx Tray cabling is factory configured. This information is provided as a reference for performing maintenance.

Duplexer-to-Rx Tray cabling routes the Rx output from the Duplexers to the 4-way multicouplers in the SRSC and SRSC4 cabinets Rx Tray. Table 8 identifies and Figure 19 shows the Duplexer cabling and connecting points.

Table 8 **Duplexer-To-Rx Tray Cabling**

| Index | Part Number | From                                                 | To                                                                  | Notes |
|-------|-------------|------------------------------------------------------|---------------------------------------------------------------------|-------|
| 1     | 3012028G17  | Duplexer Rx output port<br>(see detail A in Fig. 19) | Input port on 4-Way Multicoupler Board<br>(see detail B in Fig. 19) |       |

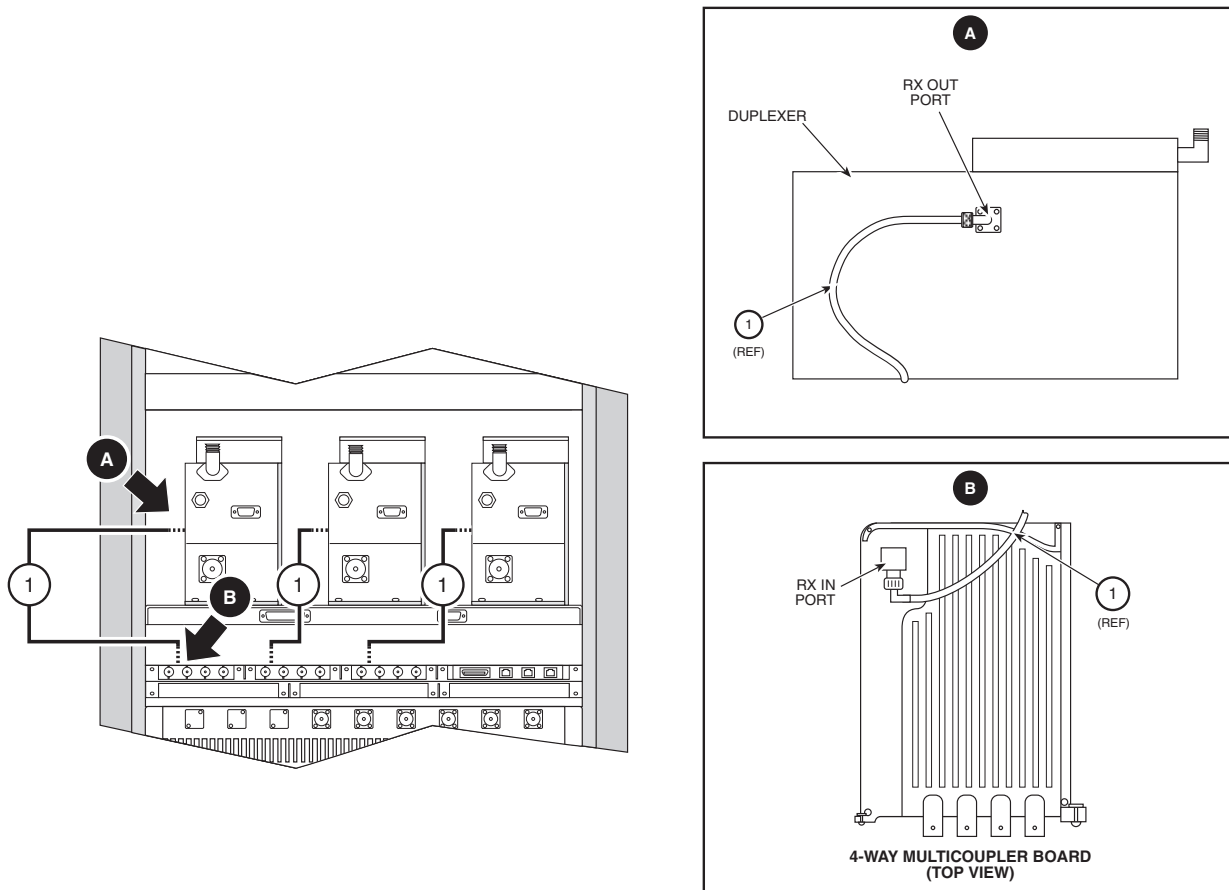
**Cabling Information**EBTS592  
050198JNM

Figure 19 **Duplexer-To-Rx Tray Cabling (SRSC and SRSC4 Systems)**



## Receiver Cabling

Receiver cabling refers to the cabling within the cabinet(s) from the Rx Tray to the Base Radios, and intercabinet receive cabling for expansion systems.

Table 9 lists receiver cabling information and Figure 20 shows the receiver cabling connections.

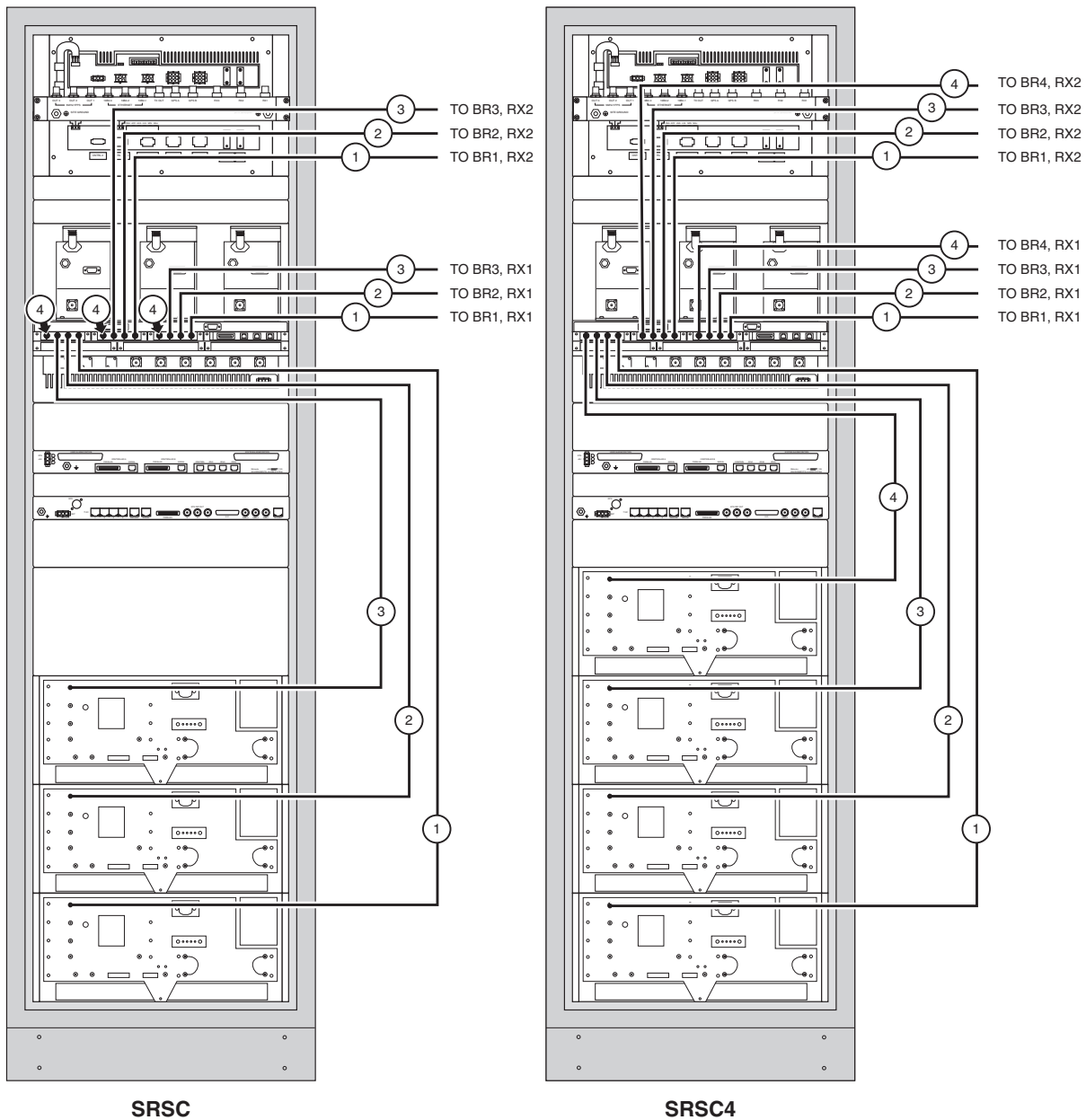
Table 9 **Receiver Cabling (SRSC System)**

| Index | Part Number | From                                     | To                                                                                                                              |
|-------|-------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1     | 3013943C38  | R1 connector on 4-Way Multicoupler Board | RX connector on BR1                                                                                                             |
| 2     | 3013943C38  | R2 connector on 4-Way Multicoupler Board | RX connector on BR2                                                                                                             |
| 3     | 3013943C38  | R3 connector on 4-Way Multicoupler Board | RX connector on BR3                                                                                                             |
| 4     | 0909906D01  | —                                        | 50 $\Omega$ termination connected to R4 connectors on Rx1, Rx 2, and Rx3 4-Way Multicoupler Boards. (3 total terminations used) |

Table 10 lists receiver cabling information and Figure 20 shows the receiver cabling connections.

Table 10 **Receiver Cabling (SRSC4 System)**

| Index | Part Number | From                                     | To                  |
|-------|-------------|------------------------------------------|---------------------|
| 1     | 3013943C38  | R1 connector on 4-Way Multicoupler Board | RX connector on BR1 |
| 2     | 3013943C38  | R2 connector on 4-Way Multicoupler Board | RX connector on BR2 |
| 3     | 3013943C33  | R3 connector on 4-Way Multicoupler Board | RX connector on BR3 |
| 4     | 3013943C28  | R4 connector on 4-Way Multicoupler Board | RX connector on BR4 |

**Cabling Information**Figure 20 **Receiver Cabling (SRSC and SRSC4 Systems)**

## Chassis Grounding- Gen3 SC/EAS Units

Chassis grounding refers to the ground cable connections between the equipment modules within the equipment cabinet and the cabinet frame. Chassis grounds help prevent interference and damage to equipment in the event of a lightning strike.

Table 11 identifies and Figure 21 shows the SRSC and SRSC4 cabinet ground cabling.

Table 11 **Ground Straps (SRSC and SRSC4 Systems): Gen3 SC/EAS**

| Index | Part Number | From                  | To                                                |
|-------|-------------|-----------------------|---------------------------------------------------|
| 1     | 3082000X04  | Ground Bus Bar        | <b>GROUND</b> stud on Base Radio 1                |
| 2     | 3082000X04  | Ground Bus Bar        | <b>GROUND</b> stud on Base Radio 2                |
| 3     | 3082000X04  | Ground Bus Bar        | <b>GROUND</b> stud on Base Radio 3                |
| 4     | 3082000X04  | Ground Bus Bar        | <b>GROUND</b> stud on Gen3 SC)                    |
| 5     | 3082000X12  | Ground Bus Bar        | <b>GROUND</b> stud on EAS                         |
| 6     | 3082000X12  | Ground Bus Bar        | <b>GROUND</b> stud on BR4 (on SRSC4 Systems only) |
| 7     | 3082000X02  | Ground Bus Bar        | ground lug on Dual Two Way Combiner               |
| 8     | 3082000X02  | Ground Bus Bar        | Ground lug on RX Tray                             |
| 8     | 3082000X04  | Ground junction panel | ground stud on Antenna 1 Duplexer                 |
| 9     | 3082000X05  | Ground junction panel | ground stud on Antenna 2 Duplexer                 |
| 10    | 3082000X05  | Ground junction panel | ground stud on Antenna 3 Duplexer                 |
| 11    | 3082000X02  | Ground Bus Bar        | ground stud on Rectifier                          |
|       |             |                       |                                                   |

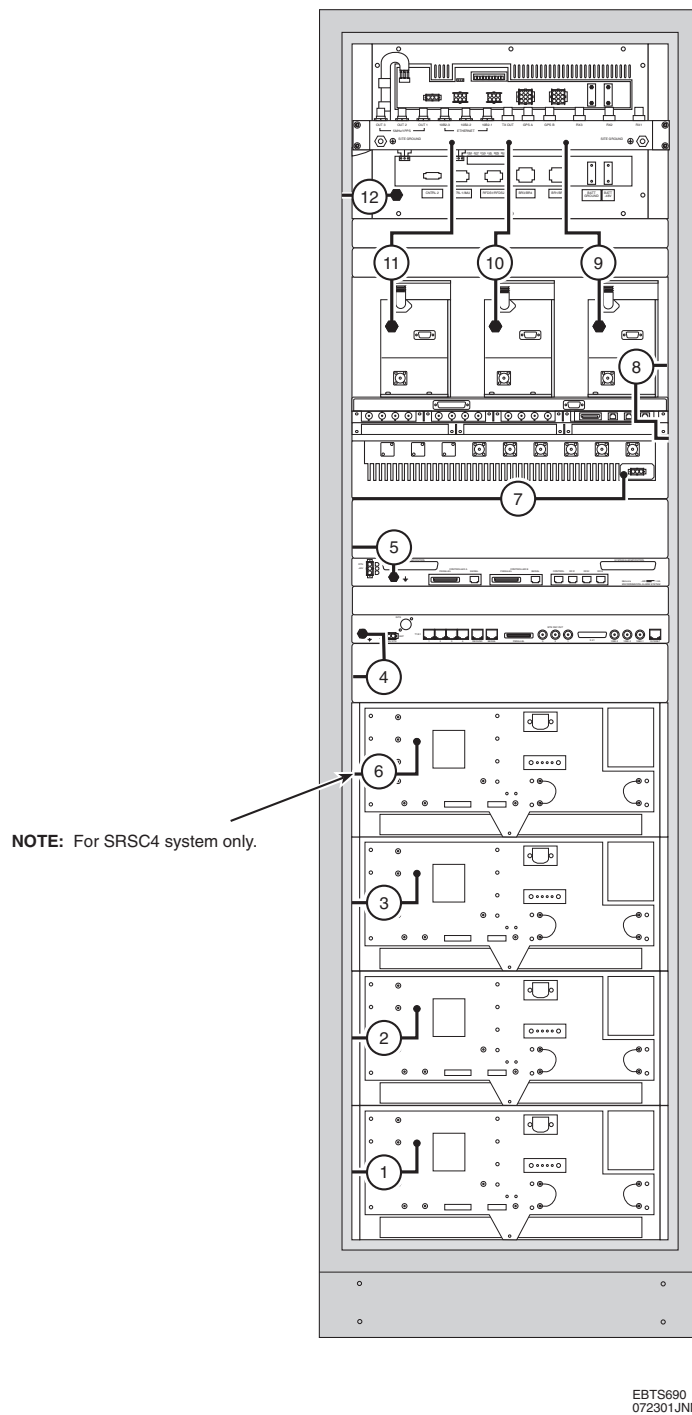
**Cabling Information**

Figure 21 **Chassis Grounding Diagram (SRSC and SRSC4 Systems): Gen3 SC/EAS**

## 5 MHz/1 PPS Cabling

5 MHz / 1 PPS cabling routes the time frequency reference signal between the Gen 3 SC and each Base Radio.

Table 12 identifies and Figure 22 shows the 5 MHz / 1 PPS cabling.

Table 12 **5 MHz/1 PPS Cabling (SRSC System)**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Part Number | From                                                              | To                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0909906D01  | —                                                                 | <b>5 MHz/1 PPS OUT</b> connector on Junction Panel (50 $\Omega$ termination)                                  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3082363Y03  | Underside of <b>5 MHz/1 PPS OUT-1</b> connector on Junction Panel | BNC T-adapter on Base Radio 1                                                                                 |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3013943N19  | BNC T-adapter on Base Radio 1                                     | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3<br>BNC T-adapter on Base Radio 4               |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3013943N22  | BNC T-adapter on Base Radio 3                                     | <b>OUT 1</b> connector on Gen 3 SC                                                                            |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0909906D01  | —                                                                 | BNC T-adapter on Base Radio 4, <b>OUT-2, OUT-3</b> , connectors on Gen3 SC (Note 3) (50 $\Omega$ termination) |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3013942P34  | Underside of <b>GPS A</b> connector on Junction Panel             | <b>GPS ANT</b> connector on Gen 3 SC                                                                          |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. Cables are connected between BNC T-adapters (P/N 0909907D01), which are connected to the appropriate BR connector.</li> <li>2. Cabinet is equipped with cables (index no. 3) and T-adapters for connection to three BRs regardless of BR complement. Unused T-adapters are left unconnected.</li> <li>3. 50 <math>\Omega</math> terminations are required on both 5 MHz OUT-2 and OUT-3 connectors in the SRSC system. A 50 <math>\Omega</math> termination is only needed on the OUT-3 connector in the SRSC4 system</li> </ol> |             |                                                                   |                                                                                                               |

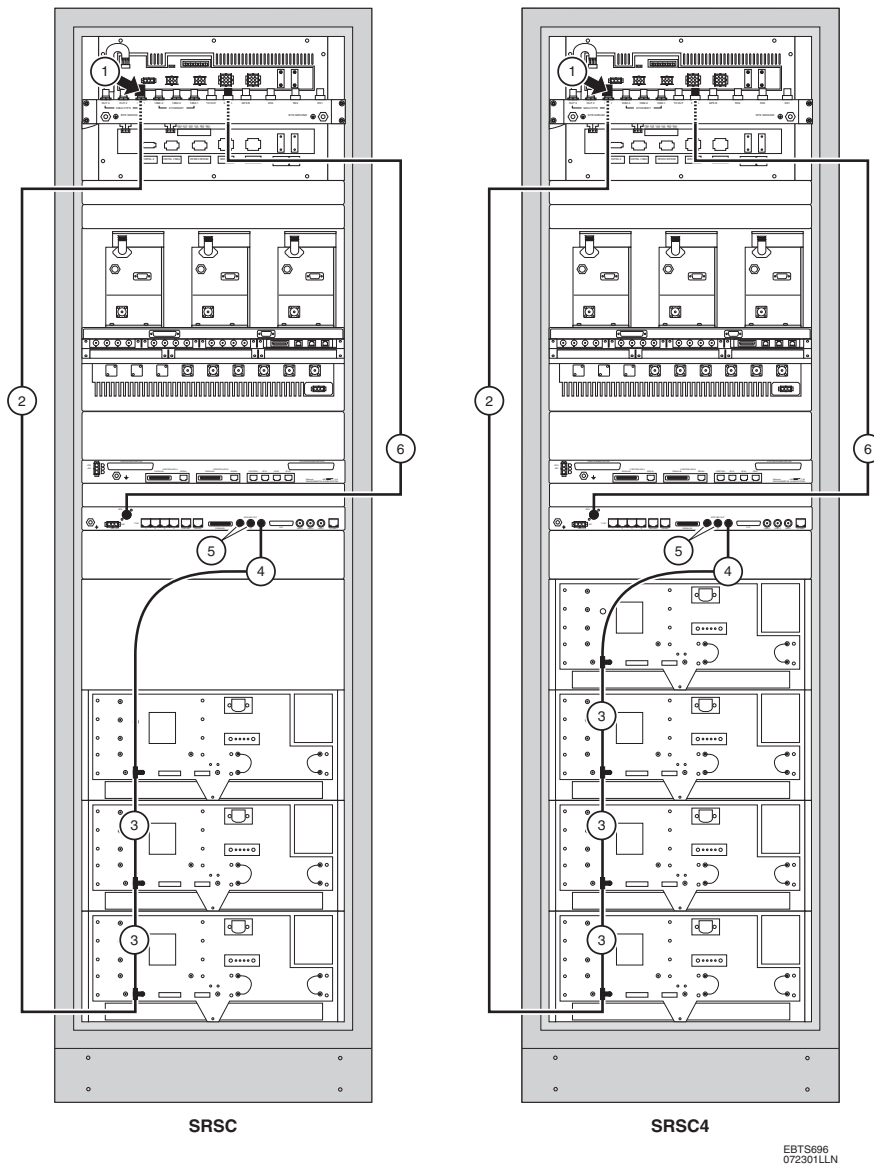
**Cabling Information**

Figure 22 5 MHz/1 PPS Cabling (SRSC and SRSC4 Systems)

## Ethernet Cabling

Ethernet cabling routes the Ethernet network between the Junction Panel and each Base Radio.

Table 13 identifies and Figure 23 shows the Ethernet cabling.

Table 13 **Ethernet Cabling (SRSC and SRSC4 Systems)**

| Index                                                                                                                                                                                                                                                                                                      | Part Number | From                                                         | To                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                          | 0909906D01  | —                                                            | ETHERNET (GROUNDED) connector on Junction Panel                                                 |
| 2                                                                                                                                                                                                                                                                                                          | 3082004X03  | Underside of ETHERNET (GROUNDED) connector on Junction Panel | BNC T-adapter on Base Radio 1                                                                   |
| 3                                                                                                                                                                                                                                                                                                          | 3013943N19  | BNC T-adapter on Base Radio 1                                | BNC T-adapter on Base Radio 2<br>BNC T-adapter on Base Radio 3<br>BNC T-adapter on Base Radio 4 |
| 4                                                                                                                                                                                                                                                                                                          | 3013543N22  | BNC T-adapter on Base Radio 4                                | BNC Y-adapter on <b>10B2-1</b> connector on Gen 3 SC                                            |
| 5                                                                                                                                                                                                                                                                                                          | 0909906D01  | —                                                            | 50Ω termination                                                                                 |
| 6                                                                                                                                                                                                                                                                                                          | 5882669Y01  | —                                                            | BNC Y-adapter                                                                                   |
| <b>NOTES:</b><br>1. Cables are connected between BNC T-adapters (P/N 0909907D01), which are connected to the appropriate BR connector.<br>2. Cabinet is equipped with cables (index no. 3) and T-adapters for connection to three BRs regardless of BR complement. Unused T-adapters are left unconnected. |             |                                                              |                                                                                                 |

Cabling Information

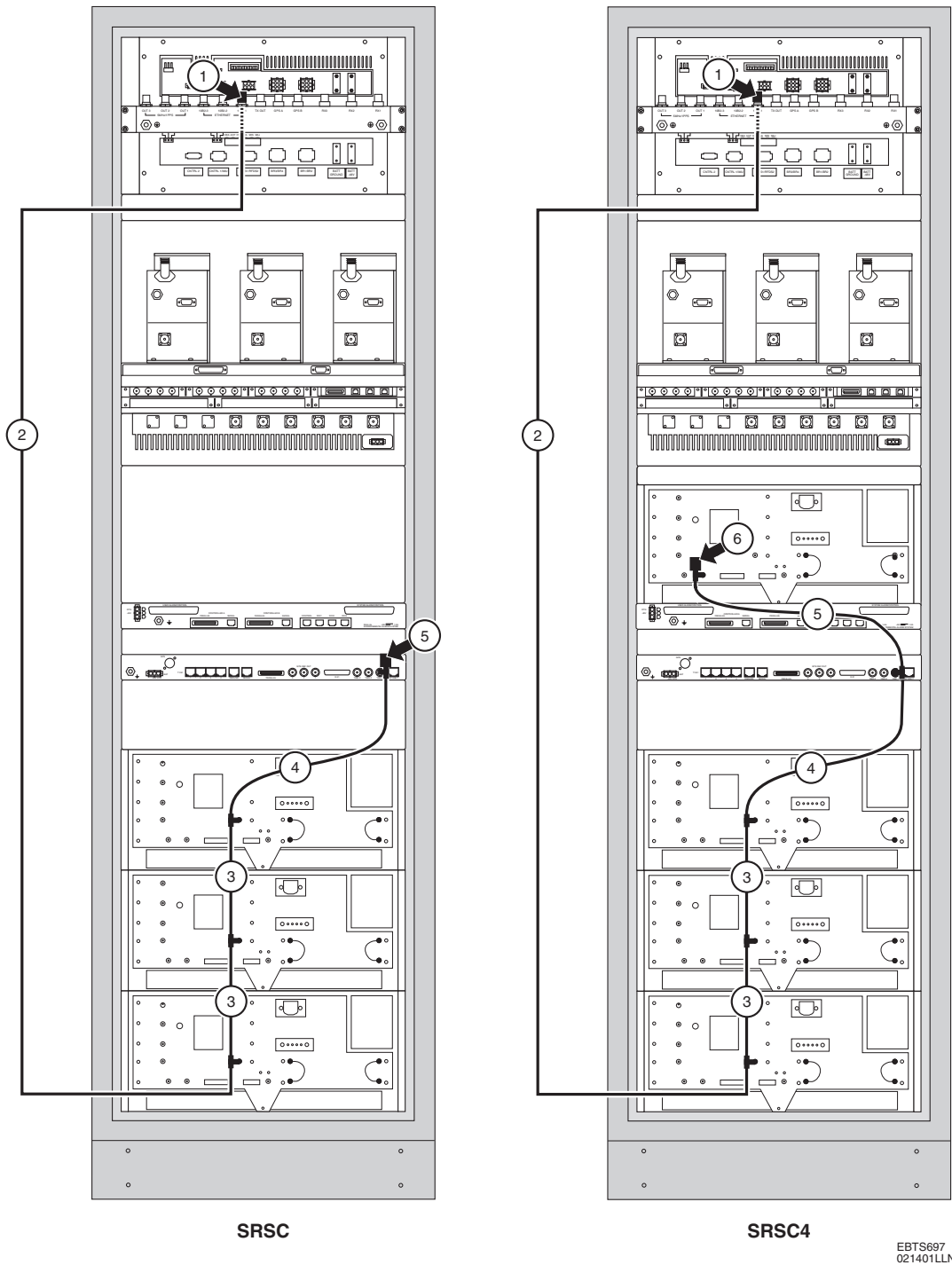


Figure 23 Ethernet Cabling (SRSC and SRSC4 Systems)



## Gen 3 SC/EAS Interconnections

Gen 3 SC/EAS interconnections refer to the connections between the Gen 3 SC and the EAS.

Table 14 identifies and Figure 24 shows the Gen 3 SC-to-EAS connections.

Table 14 **Gen 3 SC/EAS Interconnections**

| Index                                                                                                                                                                                                                  | Part Number | From                                   | To                             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------|--------------------------------|
| 2                                                                                                                                                                                                                      | 3083499X01  | CONTROLLER A PARALLEL connector on EAS | PARALLEL connector on Gen 3 SC |
| <b>NOTES:</b><br>1. Refer to Gen 3 SC Supplement to this manual, 68P80801E30, for Gen 3 SC-to-network (T1/E1) cabling.<br>2. Refer to Gen 3 SC Supplement to this manual, 68P80801E30, for EAS USER ALARM connections. |             |                                        |                                |

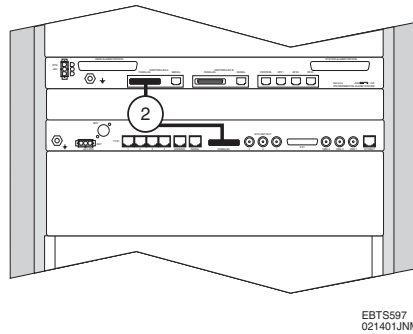
**Cabling Information**

Figure 24 **Gen 3 SC/EAS Interconnections (SRSC and SRSC4 Systems)**

## Power Cabling

Power cabling refers to the AC mains power connection, and the DC power connections between the power distribution panel on the AC/DC Power System and the components within the cabinet. Table 15 identifies and Figure 25 shows the power connections. Figure 30 shows the connections for the SRSC system. Figure 31 shows the connections for the SRSC4 system.

### WARNING

BATTERY TERMINALS CAN SUPPLY HIGH CURRENT. AVOID CONTACT WITH CONDUCTIVE OBJECTS. TURN OFF POWER TO THE POWER SUPPLY SYSTEM AND DISCONNECT BATTERY BACKUP SYSTEM BEFORE SERVICING TO AVOID INJURY TO PERSONNEL.

---

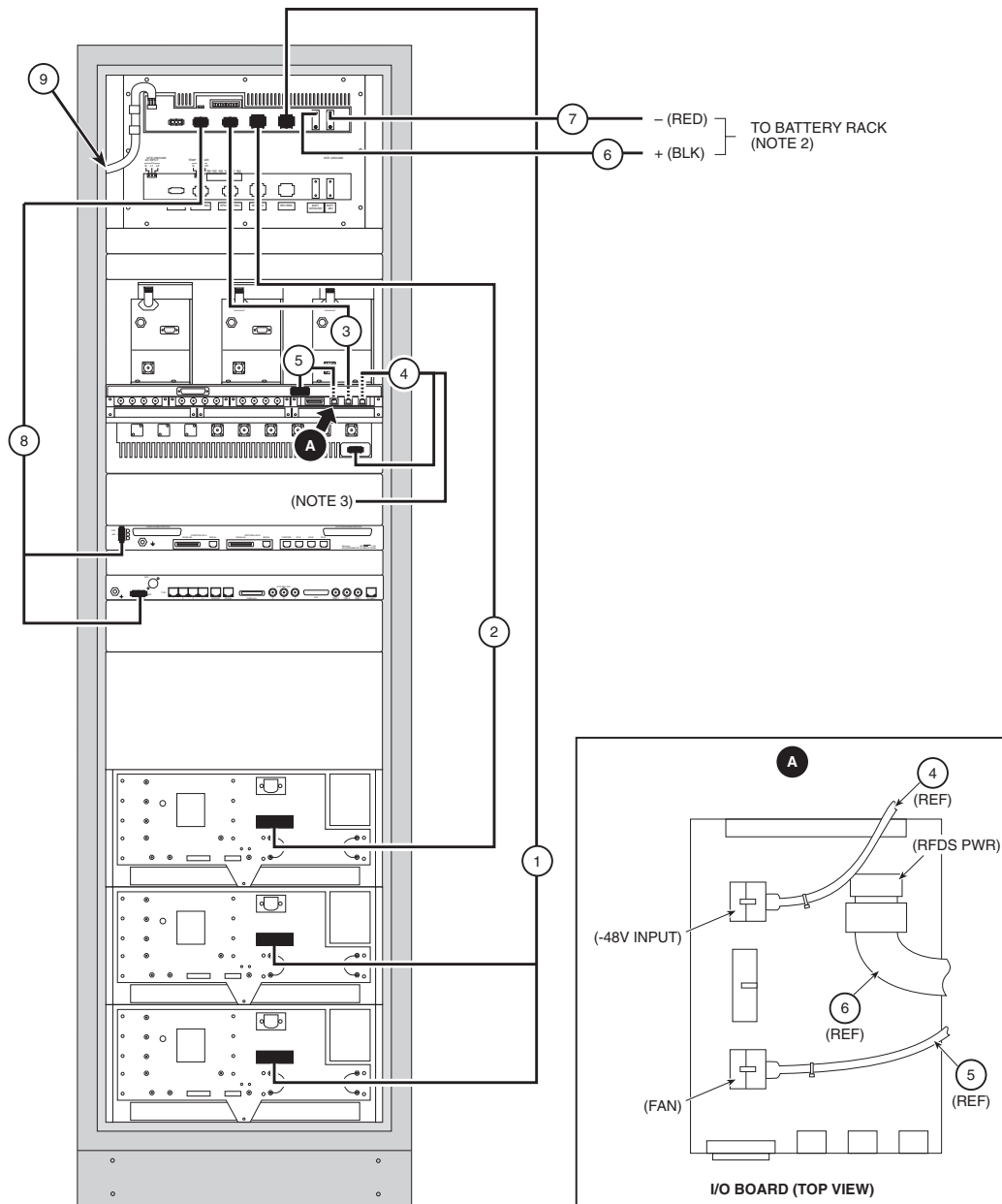
### WARNING

TYPICAL BATTERY INSTALLATION UTILIZES A SPECIAL BATTERY RACK. IF BATTERIES ARE INSTALLED IN SRSC OR SRSC4 CABINET, THE CONSIDERATIONS SPECIFIED IN MOTOROLA STANDARDS AND GUIDELINES FOR COMMUNICATION SITES "R56" (6881089E50) MUST BE OBSERVED. FAILURE TO PROPERLY INSTALL BATTERY SYSTEM CAN RESULT IN AN EXPLOSION HAZARD TO PERSONNEL AND SITE, AND POSSIBLE EQUIPMENT DAMAGE DUE TO ELECTROLYTE LEAKAGE AND/OR OUTGASSING.

---

**Cabling Information****Table 15 Power Cabling (SRSC and SRSC4 Systems)**

| Index                                                                                                                                                                                                                                                                                                                                                                                                                                     | Part Number | From                                                              | To                                                                                                                              | Notes                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3082050X02  | <b>BR1/BR2</b> connector on AC/DC Power System                    | <b>DC POWER</b> connector on Base Radio 1 and 2                                                                                 | Y-cable assembly                          |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3082050X01  | <b>BR3/BR4</b> connector on AC/DC Power System                    | <b>DC POWER</b> connector on Base Radio 3 (and Base Radio 4 on SRSC4 systems)                                                   |                                           |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3082129X04  | <b>RFDS1/RFDS2</b> connector on AC/DC Power System                | <b>-48 VDC</b> Mate-N-Lok input connector on Rx Tray I/O board                                                                  | See detail A in Fig. 25                   |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3082129X02  | <b>FAN POWER</b> output Mate-N-Lok connector on Rx Tray I/O board | Mate-N-Lok input connector on Triple Isolator Deck (NOTE 3)                                                                     | Y-cable assembly see detail A in Fig. 25  |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3082056X03  | RFDS power output Mate-N-Lok connector on Rx Tray I/O board       | 9-pin submini D connector (P5) on RFDS duplexer shelf                                                                           | See detail A in Fig. 25                   |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                         | —           | <b>BATT GROUND</b> terminal lug on AC/DC Power System             | Backup battery rack (NOTE 2)                                                                                                    |                                           |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                         | —           | <b>BATT -48V</b> terminal lug on AC/DC Power System               | Backup battery rack (NOTE 2)                                                                                                    |                                           |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3083609X01  | <b>CTRL 1/EAS</b> connector on AC/DC Power System                 | <ul style="list-style-type: none"> <li><b>BATTERY</b> connector on EAS</li> <li><b>BATTERY</b> connector on Gen 3 SC</li> </ul> | Y-cable assembly                          |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                         | —           | Site 240 VAC, 30 A receptacle                                     | AC/DC Power System AC input                                                                                                     | Power cord is part of AC/DC Power System. |
| <b>NOTES:</b> <ol style="list-style-type: none"> <li>1. In Figs. 25 and 31, Junction Panel is omitted for clarity.</li> <li>2. Refer to battery backup cabling information in Cabinet-to-Site Cabling Procedures (Installation section of this manual) for wire size, fusing, and other information.</li> <li>3. Unused end of index 4 is cable-tied out of way.</li> <li>4. Cabinet is equipped with full 3-BR power cabling.</li> </ol> |             |                                                                   |                                                                                                                                 |                                           |



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**NOTES:**

1. Junction Panel has been omitted for clarity.
2. Refer to battery backup cabling information in Cabinet-to-Site Cabling Procedures (Installation section of this manual) for wire size, fusing, and other information.
3. Unused end of index 4 is cable-tied out of way.

Figure 25 **Power Cabling (SRSC System)**

## Cabling Information

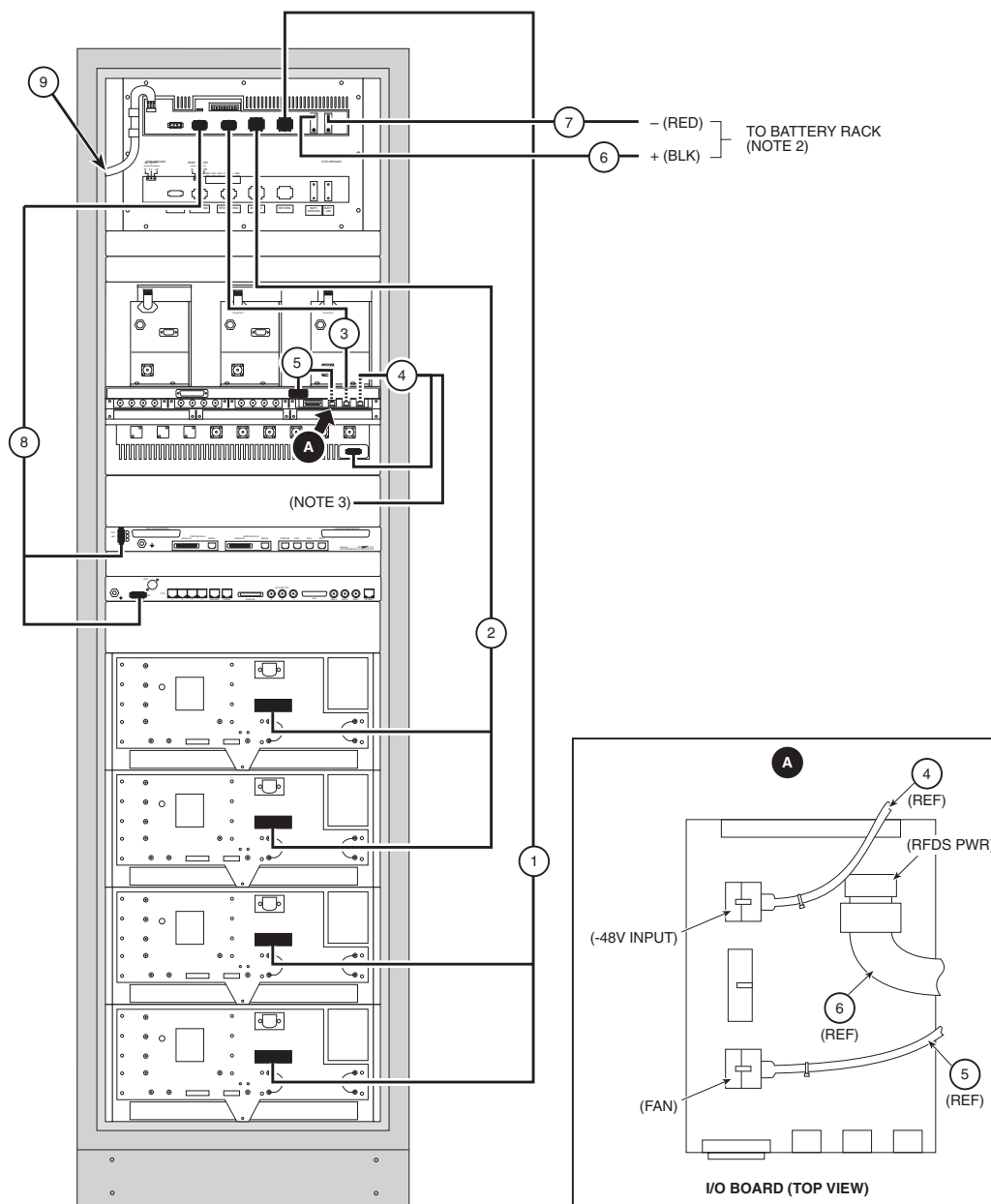


Figure 26 Power Cabling (SRSC4 System)

## Cabinet Alarm/Power Monitor Harness Connections

The cabinet alarm connections use a multi-connector wiring harness assembly that provides for daisy-chain connection of the various components.

Table 16 identifies and Figure 27 shows the harness connecting points.

Table 16 **Cabinet Alarm/Power Monitor Harness Connections (SRSC System)**

| Index | Part Number | From                                                   | To                                                                                                                                                                                                                                                                                          |
|-------|-------------|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 3082053X05  | 25-pin submini-D connector (P4) on RFDS duplexer shelf | Power monitor multi-connector harness. From top-to-bottom, connects to: <ul style="list-style-type: none"> <li>• 25-pin <b>ALARM</b> connector on Base Radio 3</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 2</li> <li>• 25-pin <b>ALARM</b> connector on Base Radio 1</li> </ul> |
| 2     | 3082733X02  | —                                                      | Shorting plug. Connects to <b>CONTROL</b> connector on EAS.<br><b>CAUTION: If shorting plug is not used, false alarms will result.</b>                                                                                                                                                      |
| 3     | 3084225N02  | RJ45 STANDARD alarm connector on I/O board             | <b>RF#1</b> connector on EAS                                                                                                                                                                                                                                                                |
| 4     | 3082733X02  | —                                                      | Shorting plug. Connects to RJ45 BREAKER STATUS ALARM connector on I/O board.<br><b>CAUTION: If shorting plug is not used, false alarms will result.</b>                                                                                                                                     |

Cabling Information

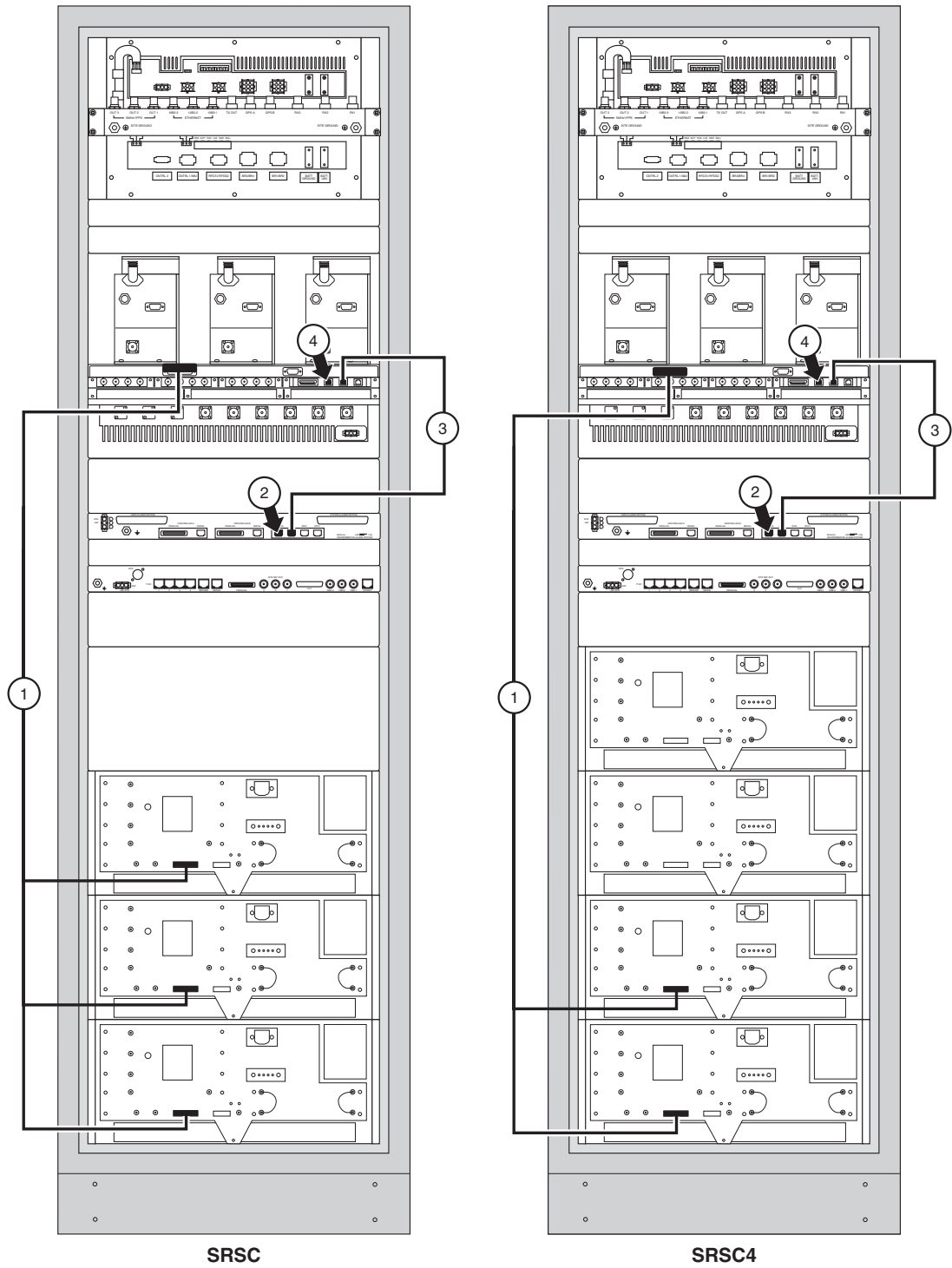


Figure 27 **Cabinet Alarm/Power Monitor Harness Connections (SRSC and SRSC4 Systems)**

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## AC/DC Power System Alarm Connections

Wiring for six power supply alarm contact pairs is connected from the AC/DC Power System to the EAS SYSTEM ALARM punchblock.

Table 17 identifies and Figure 28 shows the harness connecting points.

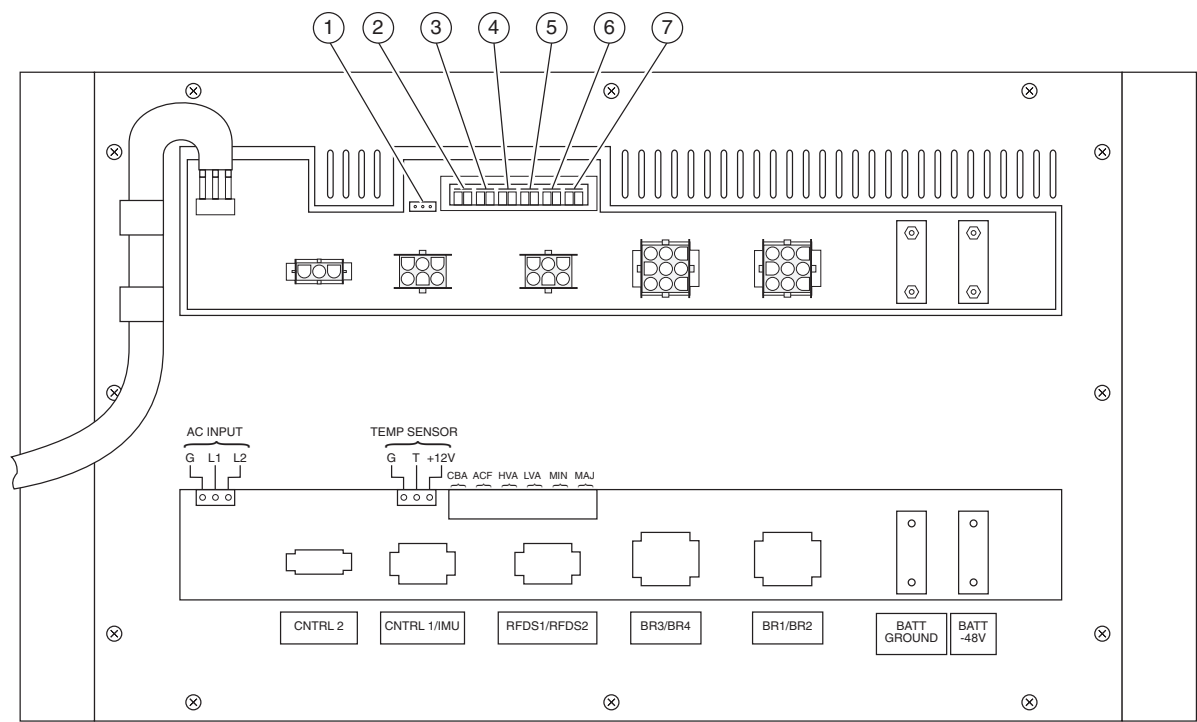
### NOTE

Refer to Alarm Wiring in *Gen 3 SC Supplement 68P80801E30 (Chapter 3 – Pre-Installation)* for punchblock details.

Table 17 **AC/DC Power System Alarm Connections (SRSC and SRSC4 Systems)**

| Index | From                                          | To                               | Function                                                                                                                   |
|-------|-----------------------------------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1     | TEMP SENSOR connector on AC/DC Power System   | Battery temperature sensor probe | Battery temperature monitoring.<br><b>NOTE:</b> Battery temperature sensor probe and cable are part of AC/DC Power System. |
| 2     | CBA terminal block pair on AC/DC Power System | Punchblock pair 15, 40           | Circuit Breaker Alarm (indicates breaker has tripped)                                                                      |
| 3     | ACF terminal block pair on AC/DC Power System | Punchblock pair 12, 37           | AC Failure Alarm (loss of AC mains)                                                                                        |
| 4     | HVA terminal block pair on AC/DC Power System | Punchblock pair 14, 39           | High DC Voltage Alarm (upper threshold limit of -48VDC output exceeded)                                                    |
| 5     | LVA terminal block pair on AC/DC Power System | Punchblock pair 13, 38           | Low DC Voltage Alarm (lower threshold limit of -48 VDC output exceeded)                                                    |
| 6     | MIN terminal block pair on AC/DC Power System | Punchblock pair 16, 41           | Minor rectifier module failure                                                                                             |
| 7     | MAJ terminal block pair on AC/DC Power System | Punchblock pair 17, 42           | Major rectifier failure                                                                                                    |

Cabling Information



EBTS602  
051998LLN

**NOTE:** Junction Panel has been omitted for clarity.

Figure 28 **AC/DC Power System Alarm Connections  
(SRSC and SRSC4 Systems)**

## Transmit Power Out Cabling

Transmit power output cabling routes the Base Radio RF output to the transmit inputs on the RFDS.

Table 18 identifies and Figure 29 shows the SRSC Tx cabling.

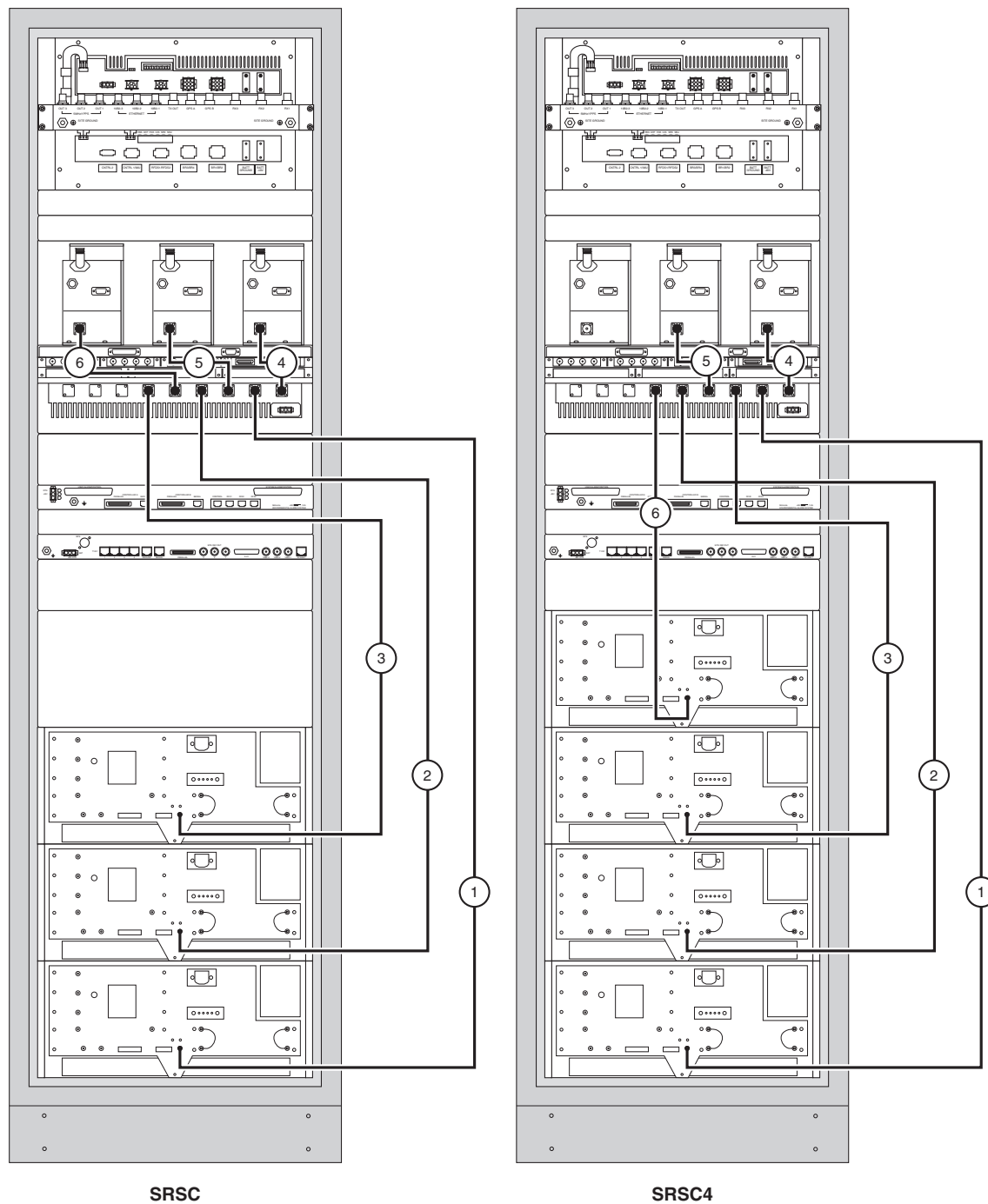
**Table 18** *Transmit Power Out Cabling (SRSC System)*

| Index | Part Number | From                                  | To                                |
|-------|-------------|---------------------------------------|-----------------------------------|
| 1     | 0112004K14  | PA OUT connector on BR 1              | Triple Isolator Deck T2 (IN) port |
| 2     | 0112004K14  | PA OUT connector on BR 2              | Triple Isolator Deck T4 (IN) port |
| 3     | 0112004K14  | PA OUT connector on BR 3              | Triple Isolator Deck T6 (IN) port |
| 4     | 0112004B03  | T1 (OUT) port on Triple Isolator Deck | Antenna 1 Duplexer Tx input port  |
| 5     | 0112004B03  | T3 (OUT) port on Triple Isolator Deck | Antenna 2 Duplexer Tx input port  |
| 6     | 0112004B03  | T5 (OUT) port on Triple Isolator Deck | Antenna 3 Duplexer Tx input port  |

Table 19 identifies and Figure 29 shows the SRSC4 Tx cabling.

**Table 19** *Transmit Power Out Cabling (SRSC4 System)*

| Index | Part Number | From                                 | To                               |
|-------|-------------|--------------------------------------|----------------------------------|
| 1     | 0112004K14  | PA OUT connector on BR 1             | Dual 2-Way Combiner T2 (IN) port |
| 2     | 0112004K14  | PA OUT connector on BR 2             | Dual 2-Way Combiner T5 (IN) port |
| 3     | 0112004K14  | PA OUT connector on BR 3             | Dual 2-Way Combiner T3 (IN) port |
| 4     | 0112004K08  | PA OUT connector on BR 4             | Dual 2-Way Combiner T6 (IN) port |
| 4     | 0112004B03  | T1 (OUT) port on Dual 2-Way Combiner | Antenna 1 Duplexer Tx input port |
| 5     | 0112004B03  | T4 (OUT) port on Dual 2-Way Combiner | Antenna 2 Duplexer Tx input port |

**Cabling Information**EBTS700  
072301JNM**Figure 29 Transmit Power Out Cabling (SRSC System)**

## Duplexed TTA Cabling

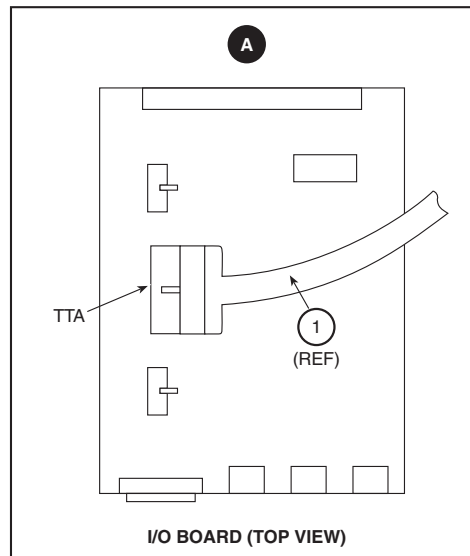
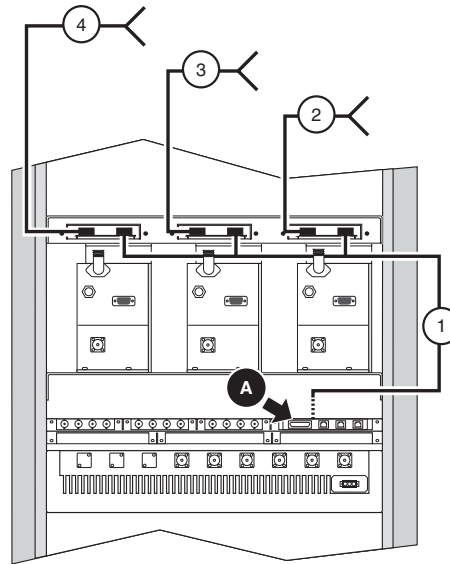
Table 20 lists and Figure 30 shows the cabling for the TTA Alarm Tray and DC Injectors within the SRSC and SRSC4 cabinets.

Table 20 ***Duplexed TTA Cabling***

| Index | Part Number | From                                                                        | To                                                                                     | Notes                                                |
|-------|-------------|-----------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------|
| 1     | 3082136X02  | TTA Mate-N-Lok connector on Rx Tray I/O Board<br>(See detail A in Fig. 30.) | Right-side connector on rear of TTA power/alarm interface card<br>(3 places, as shown) | Multi-branch wiring harness                          |
| 2     | —           | Duplexer 1 DC injector                                                      | Left-side connector on rear of TTA #1 power/alarm interface card                       | Cable is integral part of DC Injector P/N 8082223Y01 |
| 3     | —           | Duplexer 2 DC injector                                                      | Left-side connector on rear of TTA #2 power/alarm interface card                       | Cable is integral part of DC Injector P/N 8082223Y01 |
| 4     | —           | Duplexer 3 DC injector                                                      | Left-side connector on rear of TTA #3 power/alarm interface card                       | Cable is integral part of DC Injector P/N 8082223Y01 |

### NOTE

Index 1 and index 2 (and respective connectors on TTA power/alarm interface cards) are identically keyed. However, if connections are interposed TTA will not function.

**Cabling Information**

**NOTE:** DC INJECTORS OMITTED FOR CLARITY.

EBTS601  
043098JNM

Figure 30 **Duplexed TTA Cabling (SRSC and SRSC4 Systems)**

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## Duplexed TTA Receive Branch Equalization

**NOTE**

The procedures referenced below apply only to systems using the Duplexed TTA option.

On systems equipped with (or retrofitted with) Duplexed TTAs, the receive branches of the system must be equalized to a gain of  $8.5 \pm 0.5$  dB. Refer to “Duplexed TTA Receive Branch Equalization” in the *800 MHz GEN 4 Duplexed RF Distribution System* section of this manual for more information and required procedures.

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# ***Multi Sector Expansion Rack***

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## **Overview**

This chapter provides installation and reference information for the Multi-Sector Expansion Rack (MSER). It provides installation and reference information. This section provides general information about the manual, including the topics listed below.

| Section                   | Page | Description                                                                                                                           |
|---------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------|
| Overview                  | 1    | Provides general information about this manual including the intended audience, organization, related manuals, and other information. |
| Reference Materials       | 2    | Provides information on related technical manuals.                                                                                    |
| Technical Support Service | 3    | Provides important information needed to repair and service the equipment covered in this manual.                                     |
| Description               | 4    | Provides general information about the multi-sector RF expansion rack.                                                                |

## **Organization and Content**

This chapter is organized into two primary sections; System Description and Installation. The System Description section serves as reference information about the MSER. The Installation section provides detailed instructions for installing the MSER. Additional reference material is provided in the appendices to supplement the Installation and System Description sections.

## Reference Materials

The following technical manuals are related to the MSER and may be needed for installation or maintenance.

| Publication | Title                                                      | Description                                                                                                                                                                                                                                                                                                                                 |
|-------------|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 68P81099E10 | Enhanced Base Transceiver System (EBTS) - System Manual    | Provides detailed information about the EBTS including a description of major subsystems, components, installation, testing, trouble-shooting, and other information.                                                                                                                                                                       |
| 68P80801E30 | Generation 3 Site Controller (Gen3 SC)- System Manual      | Provides detailed information about the Gen3 SC including a description of major subsystems, components, installation, troubleshooting, testing, and other information.                                                                                                                                                                     |
| 68P81098E05 | Integrated Site Controller (iSC) - System Manual           | Provides detailed information about the iSC including a description of major subsystems, components, installation, testing, troubleshooting, and other information.                                                                                                                                                                         |
| 68P81089E50 | Motorola Standards and Guidelines for Communications Sites | A useful reference for the installation of fixed network equipment. This manual provides guidelines and procedures to ensure the quality of Motorola radio equipment installation, integration, optimization, and maintenance. Field service personnel should be familiar with the guidelines and procedures contained in this publication. |

### Motorola Literature Distribution Center

To order hard copies of the publications listed above, please contact:

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### iDEN Online

This manual is available from iDEN online (<http://AccessSecure.mot.com>). iDEN online is a secured web site that provides Motorola customers with critical information about iDEN subscriber and infrastructure.

Some of the features of this web site include:

- ☐ Quick reference to the iDEN organization, answers to frequently asked questions, and definitions to iDEN acronyms.
- ☐ Product training information; including course descriptions, prerequisites, training planning tools, schedules, pricing, and registration information.
- ☐ New product announcements and marketing bulletins.
- ☐ System product performance and customer satisfaction.

To request an account for iDEN online, please call **847.576.9541**.

## MSER FRUs

The major MSER assemblies containing replaceable FRUs are listed below. All MSER FRUs were taken from previously designed EBTS components. Please refer to the EBTS System Manual (68P81099E10) for specific part numbers and descriptions.

- ☐ **System General** – Various FRUs used throughout the system, including the junction panels, cables, and other hardware.
- ☐ **Base Radio** – FRUs contained within a Base Radio, including the Low Noise Exciter, power amp, receivers, and others.
- ☐ **800 MHz Duplexed RFDS** – FRUs used within the MSER RFDS, including power amps, receive multicouplers, and transmit combiners.

Each FRU has a bar code label attached to its front panel that identifies the tracking number. Record the tracking number whenever calling for assistance. For complete information on ordering replacement FRUs, or instructions on how to return faulty FRUs for repair, please contact the Motorola Customer Support Center.

## Technical Support Service

Motorola provides technical support services for installation, optimization, and maintenance of its fixed network equipment. Before calling the Motorola Customer Support Center, please note the following information:

- ☐ Where the system is located.
- ☐ The date the system was put into service.
- ☐ A brief description of problem.
- ☐ Any other unusual circumstances.

**Description**

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## Description

A standard Enhanced Base Transceiver System (EBTS) site contains anywhere from one to three sectors of RF coverage. EBTS sites can be configured for different RF coverage patterns. Sites containing a single-sector provide omni-directional RF coverage. Sites containing more than a single sector provide are known as multi-sector sites.

The Multi-Sector Expansion Rack (MSER) is designed to expand both coverage and capacity of existing 800 MHz, multi-sectored EBTS sites. Expanded coverage is accomplished by adding additional transmit and receive carriers to the primary system. Expanded capacity is a direct result of the expanded coverage.

The MSER offers several advantages:

- ❑ Provides a single rack of radio equipment required to expand existing, multi-sectored EBTS sites.
- ❑ Offers flexibility in expansion configurations of existing, multi-sectored EBTS sites.
- ❑ Consumes less square-footage than individual expansion racks needed to expand individual sectors.
- ❑ Realizes reduced costs associated with shipping and installation.

The MSER is compatible with many 800 MHz, multi-sectored EBTS sites. Refer to System Compatibility on page 21 for detailed information on compatible EBTS systems and configurations.

## Theory of Operation

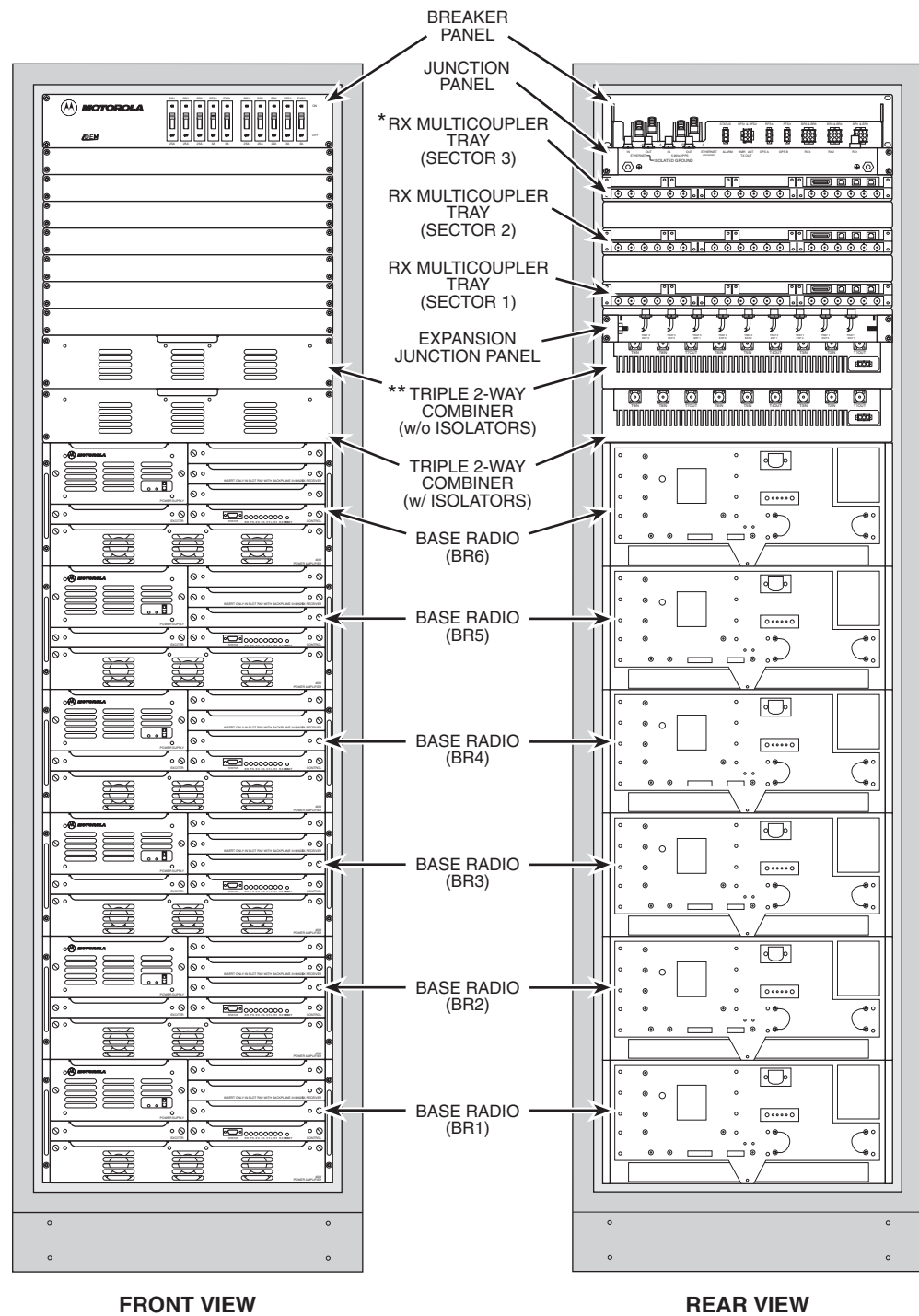
All transmit and receive signals of the MSER are interfaced with the primary EBTS. The expansion transmit and receive cable connections are made directly to the appropriate sector in the primary RF Distribution System.

The BR positions and sector assignments within the MSER reflect a standard manufacturing convention that may vary from customer sector assignments. BRs are labeled BR1 through BR6, as mounted from the bottom towards the top of the rack. The default sector assignment for each BR position, as shipped from the factory, are as follows:

The theory of operation section reflects the factory configurations previously discussed. There are many variations and many possibilities for expanding the primary system. The sector assignments and BR positioning discussed here is for example only and may not reflect the actual sector assignments and BR positions utilized in the primary system.

Detailed instructions for the connection of the MSER transmit paths for various sector base radio loadings and sector configurations, including GEN 4, v03, and v06 configurations, are provided in the V03 & V06 Expansions on page 113.

## Description



\* The receive multicoupler tray for Sector 3 is always installed within the MSER cabinet, but it is only utilized in 3 sector expansion configurations.

\*\* The triple 2-way combiner (without isolators) is needed whenever more than two transmit signals are combined within the MSER.

MSER001  
061699JNM

Figure 1 **MSER Cabinet**

**Description**

| <b>BR Position</b> | <b>3-Sector Assignment</b> | <b>2-Sector Assignment</b> |
|--------------------|----------------------------|----------------------------|
| BR6                | Sector 3                   | Sector 2                   |
| BR5                | Sector 2                   | Sector 1                   |
| BR4                | Sector 1                   | Sector 1                   |
| BR3                | Sector 3                   | Sector 2                   |
| BR2                | Sector 2                   | Sector 1                   |
| BR1                | Sector 1                   | Sector 1                   |

**Transmit Operation**

A triple 2-way combiner with isolators provides combining and isolation of multiple transmit signals from the Base Radios mounted in the MSER. In the standard configuration, the triple 2-way combiner with isolators allows for up to two transmit signals to be combined for any given sector. An optional configuration adds an additional triple 2-way combiner without isolators for situations where more than two transmit signals must be combined for a given sector.

The combiner is divided into three sections, each section providing combining functions for a dedicated sector. Each section of the combiner contains a microstrip / groundplane printed circuit that provides filtering and combining functions. Harmonic filters are used in each transmit signal path to prevent undesired inter-modulation products as a result of processing simultaneous transmit signals. In the standard configuration, the triple 2-way combiner also contains discrete isolator devices.

The transmit signals in the MSER (TX1 through TX6) are derived from BR1 through BR6, respectively. These transmit signals are combined by being connected to the appropriate inputs of the triple 2-way combiner deck. Each of the three individual sections of the combiner is capable of combining two transmit input signals into a single transmit output signal which is then fed to the appropriate connection in the primary system.

**Tx Signal Flow - Standard 3-Sector Configuration**

Refer to Figure 2 for a diagram of the typical transmit signal flow in a standard 3-sector, six Base Radio, configuration. In this configuration, a triple 2-way combiner with isolators is used to combine the transmit signals.

The transmit signals (TX1 and TX4) of BR1 and BR4 within the MSER are used to expand the transmit capability of Sector 1 in the primary system. The transmit out for each BR is applied to the appropriate input on the transmit combiner. Each signal is routed through a single-stage isolator and then through a harmonic filter. Both transmit signals are then combined by a Wilkinson two-input combiner.

During the installation of the MSER, a 1/2" diameter 12' long, low-loss inter-cabinet cable (3082296Y01) is used to connect the output of the Wilkinson combiner to Sector 1 of the primary system. The cable for Sector 1 connects directly to the respective input of the duplexer located in the primary rack.

The transmit signals (TX2 and TX5) of BR2 and BR5 within the MSER are used to expand the transmit capability of Sector 2 in the primary system. The transmit signals for each BR are combined in the same manner as Sector 1 and then routed to the appropriate expansion input of the duplexer located in the primary rack for Sector 2.

The transmit signals (TX3 and TX6) of BR3 and BR6 within the MSER are used to expand the transmit capability of Sector 3 in the primary system. The transmit signals for each BR are combined in the same manner as Sector 1 and then routed to the appropriate expansion input of the duplexer located in the primary rack for Sector 3.

### **Tx Signal Flow - Optional 2-Sector Configuration**

Refer to Figure 3 for a diagram of the typical transmit signal flow of an optional 2-sector configuration. In this configuration, two of the output segments from the standard triple 2-way combiner with isolators are combined through the optional triple 2-way combiner without isolators in the MSER. This allows for 4-way transmit signal combining for one of the sectors.

The transmit signals (TX1, TX2, TX4, and TX5) of BR1, BR2, BR4, and BR5 within the MSER are used to expand the transmit capability of Sector 1 in the primary system. The transmit out for BR1 and BR4 are applied to the first set of inputs on the standard transmit combiner. The transmit out for BR2 and BR5 are applied to the second set of inputs on the standard combiner. All signals are routed through a single-stage isolator and then through a harmonic filter. Each set of transmit signals are then combined by a Wilkinson two-input combiner, resulting in two separate outputs.

The combined set of outputs is then connected to two of the inputs on the optional triple 2-way combiner without isolators in the MSER. The combined transmit signals are then combined again through a dual input, hybrid combiner. This results in a 4-way combined transmit signal for Sector 1.

The transmit signals (TX3 and TX6) of BR3 and BR6 within the MSER are used to expand the transmit capability of Sector 2 in the primary system. The transmit out for each BR is applied to the third set of inputs on the standard transmit combiner. Each signal is routed through a single-stage isolator and then through a harmonic filter. Both transmit signals are then combined by a Wilkinson two-input combiner, resulting in a single output.

During the installation of the MSER, an inter-cabinet cable (3082296Y01) is used to connect the output from the optional triple 2-way combiner without isolators to Sector 1 of the primary system. Another inter-cabinet cable (3082296Y01) is used to connect the output from the standard triple 2-way combiner with isolators to Sector 2 of the primary system. Both cables for Sector 1 and Sector 2 connect directly to their respective inputs of the duplexers located in the primary racks.

### **Receive Operation**

The receive signal flow theory is based on factory configurations for sector assignments and BR positioning. Because there are so many variations for

**Description**

expansion configurations, the cable lengths for all receive branches within the MSER allow for branch/sector reassignment. The sector assignments and BR positioning discussed here are for example only and may not reflect the sector assignments and BR positions utilized in the actual system.

The MSER provides expanded triple-diversity reception for the receive signals in any given sector of the primary system. Triple-diversity allows each sector to process three branches of each receive signal (RX1, RX2, and RX3).

Within the primary system, each receive branch is fed to the first multicoupler amplifier/4-way splitter for that branch. The receive signal is split into as many as four individual receive signals; one primary output (R1) and three expansion outputs (R2, R3, and R4).

The primary output (R1) of the first 4-way splitter is used to feed the Base Radios within the primary system. The expansion outputs (R2, R3, and R4) are used to feed the Base Radios within an expansion system, such as the MSER.

For the primary system, the receive signal is fed into an expansion multicoupler amplifier/6-way splitter. The receive signal is amplified and split into as many as six individual receive signals. The outputs of the 6-way splitter (E-R1 through E-R6) are then routed to the appropriate receive branch input of each Base Radio within the primary system.

When the MSER is used to expand a given sector, the receive signal is routed through inter-cabinet cabling from one of the expansion outputs (R2, R3, or R4) of the first 4-way splitter within the primary system to the appropriate branch/sector input connector on the receive junction panel of the MSER cabinet.

All receiver inputs for the MSER are made through the expansion junction panel located at the rear of the MSER cabinet. From the expansion junction panel, the receive signals are routed to the input of the multicoupler tray for the corresponding receive branch and sector.

Within the MSER, each sector is provided with a dedicated multicoupler tray. The standard factory configuration of the MSER always includes a total of three individual multicoupler trays. By default, the bottom multicoupler tray is assigned to Sector 1, the middle multicoupler tray is assigned to Sector 2, and the top multicoupler tray is assigned to Sector 3.

Each multicoupler tray provides three multicoupler-amplifiers/6-way splitters for each receive branch (RX1, RX2, or RX3) for a given sector. Since there are three sectors and three receive branches per sector, there are a total of nine corresponding sector/branch connections provided on the expansion junction panel.

Each receive signal input from the primary system is fed to the input of the appropriate multicoupler-amplifier/6-way splitter. The receive signal is amplified and split into six individual buffered outputs. The outputs of the 6-way splitter (E-R1 through E-R6) are then routed to the appropriate receive branch input of the Base Radio within the MSER rack.



## Sample Rx Signal Flow - RX1/Sector 1

Refer to Figure 2 for a diagram of the typical receive signal flow in a standard configuration. For this example, the signal flow of the first receive branch (RX1) of Sector 1 is described. The same concept applies to signal flow for other receive branches and other sectors.

During installation, the first receive branch (RX1) for Sector 1 is derived from an expansion output (R2) of the first multicoupler amplifier / 4-way splitter in the primary system. The receive signal is then routed through a twelve-foot long RG-400 or RG-142 inter-cabinet cable (3012029E37) to the expansion junction panel located on the rear of the MSER cabinet. The cable is connected to the BRANCH 1/SECTOR 1 connector on the expansion junction panel where a connection is made with the intra-cabinet cabling.

From the expansion junction panel, the RX1 receive signal is routed through an intra-cabinet cable (3012028E23) to the input of the appropriate multicoupler for that sector. For this example, this would be the RX1 multicoupler for Sector 1 (bottom-most multicoupler tray).

The RX1 receive signal is buffered and split into the appropriate number of signals needed to connect the Base Radios which support that particular branch and sector. In this example, the RX1 receive signal is routed from the output (E-R1) of the 6-way splitter to the RX1 SMA connector input on BR1 through an RG-400 or RG-142 cable.

If more than one Base Radio is assigned to a given sector, a similar connection for the RX1 receive signal is made from the next available output (E-R2 through E-R6) of the appropriate multicoupler to the appropriate receive branch input of the Base Radio that supports that sector. All unused outputs of the multicouplers are terminated with a 50 ohm load (0909906D01).

Connections of all remaining receive branch/sector cabling are connected in the same manner with the following considerations:

- ☐ Receive signal connections made to the MSER are derived from the appropriate expansion port on the first multicoupler for their respective branches on the primary system.
- ☐ Inter-cabinet cabling to the MSER cabinet is made to the respective branch/sector connection on the expansion junction panel.
- ☐ Intra-cabinet cabling within the MSER cabinet is made from the respective branch/sector connection on the expansion junction panel to the respective branch/sector input of the multicoupler trays.
- ☐ Intra-cabinet cabling within the MSER cabinet is made from the respective branch/sector outputs (E-R1 through E-R6) of the multicoupler trays to the respective branch/sector inputs of the Base Radios.

## Alarms

There are three individual alarms from the three multicoupler trays that are summed and delivered to the iMU/iSC through a single four-pair (eight-conductor) Telco inter-cabinet cable. The three alarms include:

**Description**

- ☐ Breaker continuity
- ☐ Multicoupler amplifier
- ☐ Multicoupler power supply

**Alarm Signal Flow - Standard 3-Sector Configuration**

The multicoupler tray for Sector 1 (bottom-most) receives a breaker continuity alarm signal from the STATUS connector on the breaker panel through an intra-cabinet cable (3082129X03). The breaker continuity signal is fed into the RJ45 ALARM EXPANSION jack (J1002) on the Input/Output (IO) Board (CTF6220B).

The alarms from this multicoupler tray are output from the ALARM STANDARD jack (J1003) on the IO Board. Another intra-cabinet cable (3084225N24) feeds the alarm signals from the multicoupler tray for Sector 1 into the multicoupler tray for Sector 2. The signal is fed into the RJ-45 ALARM EXPANSION jack (J1002) on the IO Board of the Sector 2 multicoupler tray. The alarms from the multicoupler tray Sector 2 are summed with the alarms from Sector 1 and then output from the ALARM STANDARD jack (J1003) of the Sector 2 multicoupler tray.

The summed alarms from the Sectors 1 and 2 are routed through another intra-cabinet cable (3084225N24) from of the Sector 2 multicoupler tray into the multicoupler tray for Sector 3. The signal is fed into the RJ-45 ALARM EXPANSION jack (J1002) on the IO Board of the Sector 3 multicoupler tray. The alarms from Sector 3 are summed with the alarms from Sectors 1 and 2 and then output from the ALARM STANDARD jack (J1003) of the Sector 3 multicoupler tray.

Finally, the summed alarms for all sectors are routed through an inter-cabinet cable (3084225N42) to the primary system. In the primary system, the other end of the cable is connected to the iMU Modular Adapter (2882174W03) used on Punch Block 2 which ultimately connects to the iMU for the site.

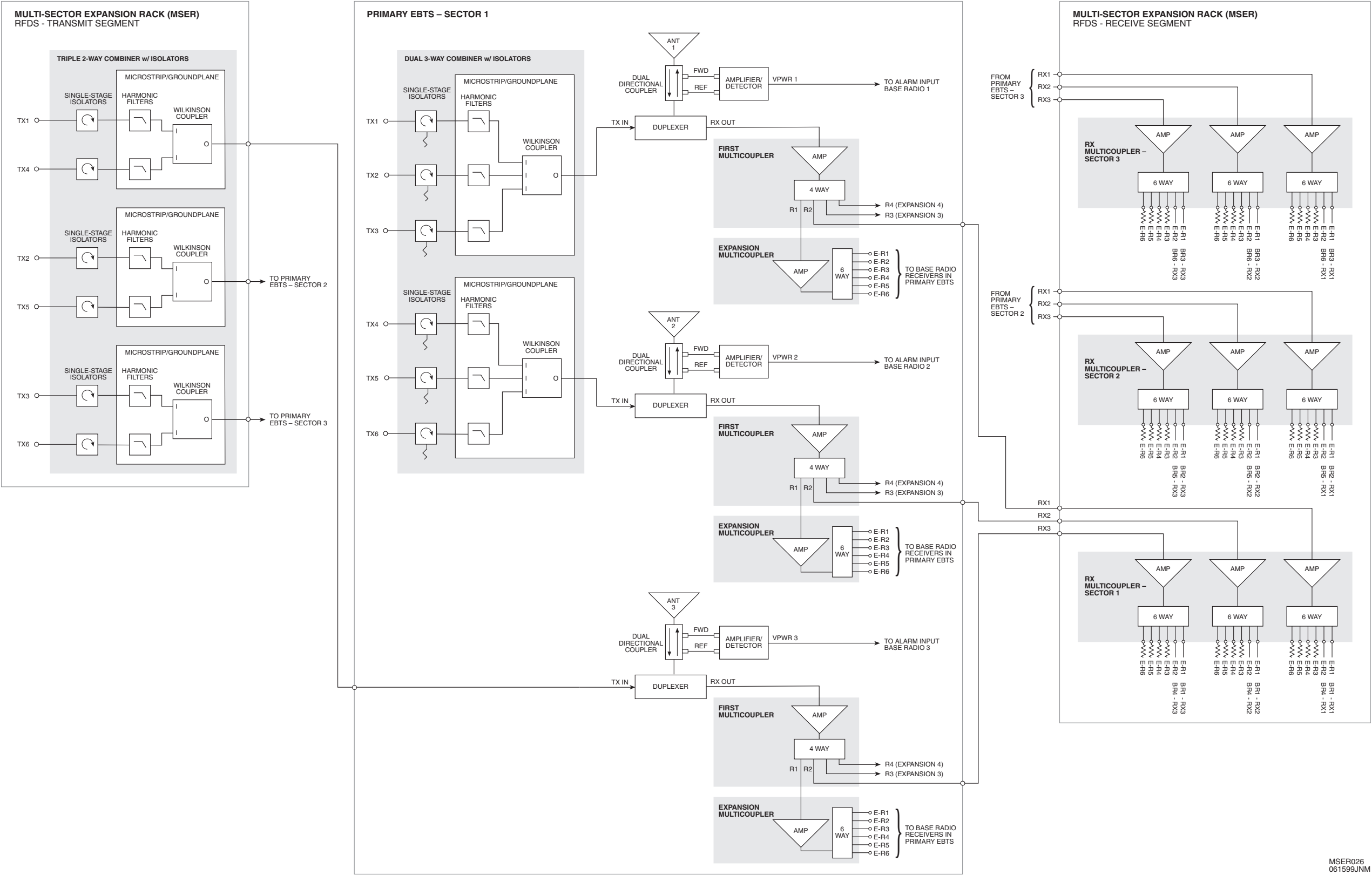
In order for the Sector 2 and Sector 3 multicoupler trays to properly sum the external alarms from other sectors with their own alarms, a shorting jumper (0984728L01) must be placed over pins 1 & 2 on P3001 of the Alarm Card (CLN7061A) on the multicoupler trays for Sector 2 and Sector 3. The Alarm Card is located in the power supply compartment of the multicoupler tray. The breaker continuity alarm is always summed whether or not the jumper is installed.

### **Alarm Signal Flow - Optional 2-Sector Configuration**

For the optional 2-sector configuration, the alarms for Sector 1 and Sector 2 are summed in the same manner as the standard configuration. The summed alarms are then routed to through an inter-cabinet cable (3084225N42) to the primary system. In the primary system, the other end of the cable is connected to the iMU Modular Adapter (2882174W03) used on Punch Block 2 which ultimately connects to the iMU for the site.

In order for the Sector 2 multicoupler tray to properly sum external alarms with their own alarms, a shorting jumper (0984728L01) must be placed over pins 1 & 2 on P3001 of the Alarm Card (CLN7061A) on the multicoupler tray for Sector 2. The Alarm Card is located in the power supply compartment of the multicoupler tray. The breaker continuity alarm is always summed whether or not the jumper is installed.

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MSER026  
061599JNM

Figure 2 Standard 3-Sector Configuration Block Diagram

**MULTI-SECTOR EXPANSION RACK (MSER)**  
RFDS - TRANSMIT SEGMENT

**PRIMARY EBTS – SECTOR 1**

**MULTI-SECTOR EXPANSION RACK (MSER)**  
RFDS - RECEIVE SEGMENT

MSER027  
06159JUN

14

## Equipment Cabinet

The MSER components are housed within a 43-Rack Unit (RU) equipment rack. Each component within the rack is assigned a specific slot that uses a certain number of rack units.



MSER002  
051199JNM

Figure 4 **MSER Equipment Cabinet**

| Component             | Rack Units (RU) |
|-----------------------|-----------------|
| Breaker panel         | 2 RU            |
| Rx multicoupler trays | 1 RU            |
| Tx Combiners          | 2 RU            |
| Base Radios           | 5 RU            |

Like standard EBTS cabinets, the MSER is shipped in a standard configuration as an open frame cabinet with four corner posts, and a top and bottom assembly that

## Equipment Cabinet

tie the corner posts together. Optional side panels and louvered doors are available.

Refer to the EBTS System Manual for additional information on available options.

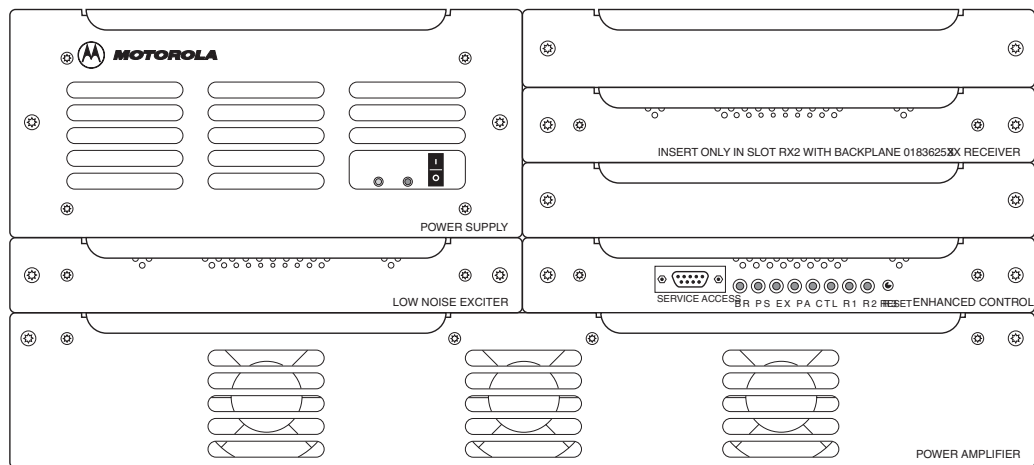
## Major Components

The MSER is primarily comprised of Base Radios, an abbreviated RF Distribution System (RFDS), and other hardware and cabling. It is available in variety of configurations that are designed to meet various expansion needs of existing EBTS systems. Each component of the MSER is described in more detail in the sections that follow.

## Base Radio

The MSER accommodates up to six Base Radios (BR) that can be distributed among the sectors. The MSER is shipped from the factory with cabling to accommodate six BRs and three expansion receive multicoupler trays.

The primary function of the MSER is to expand the sector coverage and system capability of the EBTS to support more iDEN subscribers. The Base Radio provides this basic functionality. All BRs contained within the MSER should be of the same transmit power rating (40W or 70W) as those BRs installed in the primary EBTS system.



EBTS282  
101497JNM

Figure 5 **Generation 2 Base Radio (front view)**



The Base Radio sends and receives both control information and compressed voice data. Each Base Radio handles one 800 MHz carrier that is 25 kHz wide and divided into six time slots. This allows six voice or data signals for every 25 kHz signal. This is accomplished using voice compression or encoding techniques.

Inbound control slots are used by mobile units for channel requests and other call controls. Outbound control slots are used to page mobile units from the network and also for call assignments.

The Base Radio is also capable of handling one 25 kHz, 800 MHz carrier with three time slots. The advantage of three time slots versus six times slots results in improved voice quality.

## RF Distribution System

The MSER contains an abbreviated RF Distribution System (RFDS) comprised of the following components:

- ❑ Three receive multicoupler trays, each consisting of the following FRUs:
  - Three 6-way expansion LNA/multicoupler assemblies
  - Two power supplies
  - One alarm board
  - One input/output interface board
- ❑ One standard triple 2-way combiner deck with isolators
- ❑ One optional triple 2-way combiner deck without isolators

Since the MSER is an expansion system, its RFDS does not include duplexers. The outputs of the transmit combiners are connected via inter-cabinet cabling to the duplexers of the primary RFDS.

### Transmit Combiners

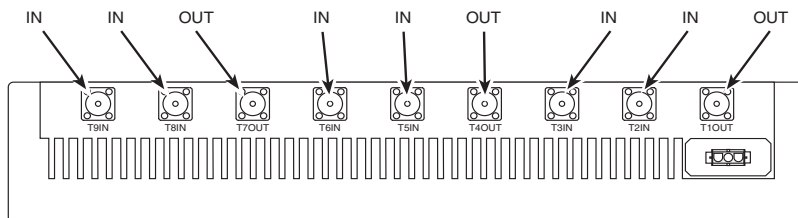
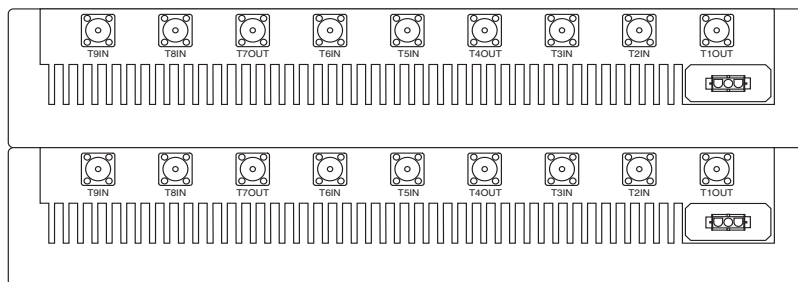
The standard MSER configuration supports up to two additional carriers of expanded coverage per sector. A triple 2-way combiner with isolators is utilized in the standard configuration to allow for either 1 or 2 additional carriers in any given sector. The combiner is similar to the dual 2-way combiner with isolators found in the SRSC configuration, except that there are three combiners versus two.

If the expansion calls for more than two additional carriers of expanded coverage per sector, an optional triple two-way combiner without isolators is integrated with the standard triple two-way combiner with isolators. This allows two of the transmit outputs from the standard combiner to be combined, resulting in a four-way combiner.

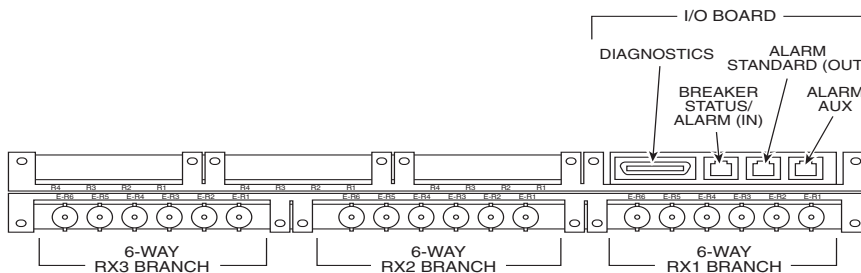
### Receive Multicouplers

The MSER contains three receive multicoupler trays, unlike the single multicoupler tray found in the standard single-sector GEN 4 RFDS expansion

## Equipment Cabinet

MSER005  
061599JNMFigure 6 **Standard Triple-Two Way Combiner (with isolators)**MSER006  
051199JNMFigure 7 **Optional Triple-Two Way Combiner without isolators  
(shown with standard Triple-Two Way Combiner)**

rack. Each multicoupler tray contains three 6-way expansion multicouplers that accommodate the three receive diversity branches (Rx1 - Rx3). Each multicoupler tray distributes the receive signals for a dedicated sector. The third multicoupler is not used in the optional two-sector configuration.

MSER007  
051199JNMFigure 8 **Receive Multicoupler (1-Sector Only)**

NOTE

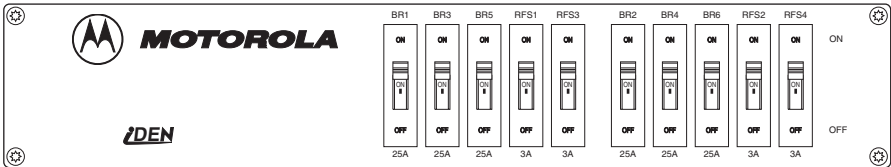
The receive multicoupler trays used in the MSER do not include the 4-way expansion LNA / multicoupler assemblies.

Power System

The MSER requires the same external power source (-48 VDC) that the primary EBTS uses. Power is provided by a separate power supply (rectifier) rack. Connections from the power system are made to the MSER power distribution system. The power distribution system can be found by locating the breaker panel located at the top of the MSER cabinet. The power supply rack is not considered part of the EBTS system.

Breaker Panel

The MSER uses the standard breaker panel used in the RF Cabinet for most primary systems, as shown in Figure 9. The breakers provide on/off control and overload protection for the components mounted within the MSER cabinet. The components that each breaker controls and protects is listed in the following table.



MSER045  
061599JNM

Figure 9 Typical MSER Breaker Panel

**Equipment Cabinet**

| <b>Label</b> | <b>Rating<br/>(Amps)</b> | <b>Use</b>                           |
|--------------|--------------------------|--------------------------------------|
| BR1          | 25 A                     | Base Radio #1 (bottom-most)          |
| BR3          | 25 A                     | Base Radio #3                        |
| BR5          | 25 A                     | Base Radio #5                        |
| RFS1         | 3 A                      | RX Multicoupler tray (Sector 1)      |
| RFS3         | 3 A                      | RX Multicoupler tray (Sectors 2 & 3) |
| BR2          | 25 A                     | Base Radio #2                        |
| BR4          | 25 A                     | Base Radio #4                        |
| BR6          | 25 A                     | Base Radio #6 (upper-most)           |
| RFS2         | 3 A                      | RX Multicoupler tray (Sector 1)      |
| RFS4         | 3 A                      | RX Multicoupler tray (Sectors 2 & 3) |

---

## System Compatibility

The MSER is compatible with 800 MHz, duplexed EBTS configurations. Specifically, this includes any Stand-Alone Control and RF Cabinet (SCRF) or Single-Rack, Redundant Controller (SRRC) configurations that contain any one of the following RF Distribution Systems:

- ❑ V03 (P/N 0182020V03); also known as GEN 2
- ❑ V06 (P/N 0182020V06); also known as GEN 3
- ❑ GEN 4

### Non-Compatible Systems

The MSER is not compatible with the Single-Rack, Single Controller (SRSC) configuration or any other EBTS containing V01 (P/N 0182020V01) duplexed, 800 MHz RF Distribution Systems. It is not compatible with the SRSC because this system does not support system expansion. It is not compatible with systems utilizing V01 RFDS due to an incompatibility with the transmit combiners.

## System Configurations

The MSER supports various sector configurations of the compatible system identified above. Examples of how these configurations may be expanded using the MSER is provided in the paragraphs that follow.

### SCRF Configuration

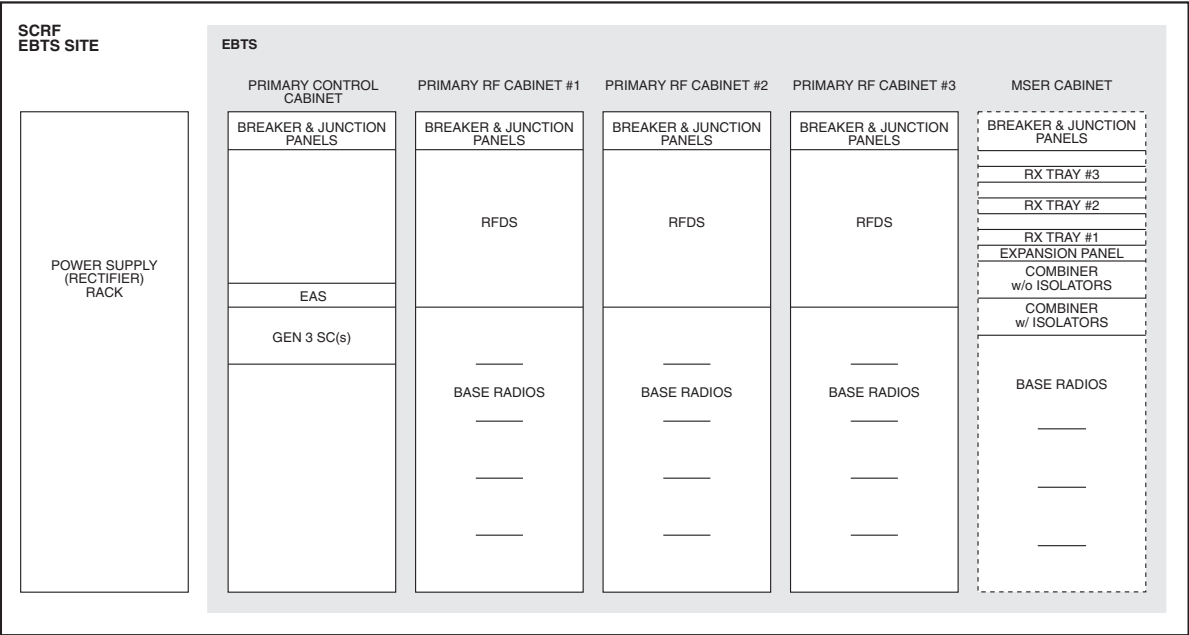
The Stand-Alone Control and RF Cabinet (SCRF) configuration is the standard EBTS configuration. It consists of a single control cabinet and one or more primary RF cabinets. Typically, this configuration uses up to three primary RF cabinets each containing the necessary radio equipment (BRs and RFDS) to provide RF coverage an individual sector.

For example, an SCRF system containing two RF cabinets typically provides coverage for two sectors. RF Cabinet #1 provides coverage for sector 1 and RF Cabinet #2 provides coverage for sector 2. The addition of the MSER allows for increased coverage within one, or both, of these sectors. Figure 10 shows a typical SCRF configuration with the addition of the MSER.

### SRRC Configuration

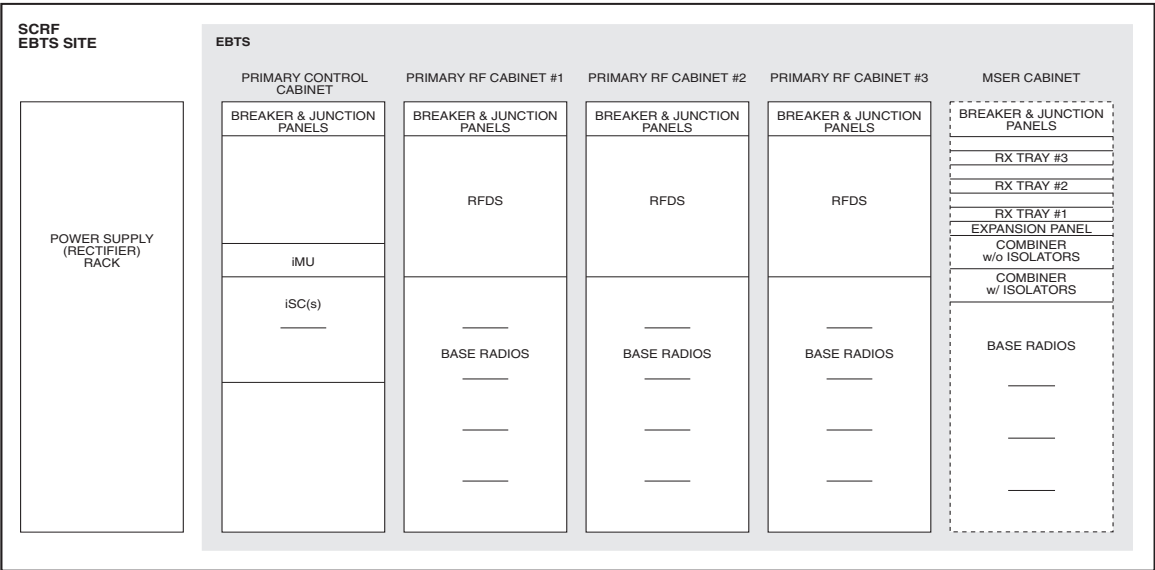
The Single-Rack, Redundant Controller (SRRC) configuration consists of a single cabinet that combines the components of the control and RF cabinet found in the SCRF system. Typically, this configuration consists of a single SRRC cabinet containing the necessary radio equipment (BRs and RFDS) to provide RF coverage for as many as three sectors. Additional primary RF cabinets may be added to this system to provide coverage for sector 2 and 3.

System Compatibility



MSER012  
040401JNM

Figure 10 SCRF Configuration: Gen3 SC/EAS



MSER012  
052799JNM

Figure 11 SCRF Configuration: iSC/iMU

**System Compatibility**

For example, an SRRC system containing the primary rack plus two additional primary RF cabinets typically provides coverage for three sectors. The SRRC primary rack provides coverage for sector 1, RF Cabinet #2 provides coverage for sector 2, and RF Cabinet #3 provides coverage for sector 3.

When the MSER is added to an SRRC configuration, it allows for increased coverage within each of these sectors. Figure 12 shows a typical SRRC configuration with the addition of the MSER.

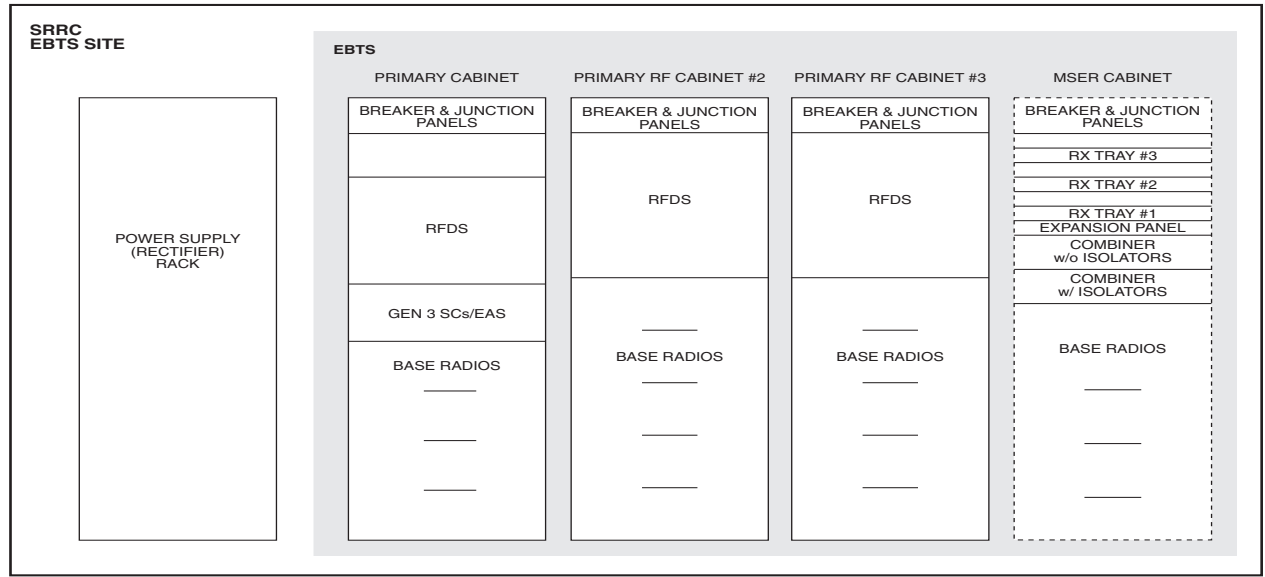
MSER017  
040401JNM

Figure 12 **SRRC Configuration: Gen3 SC/EAS**

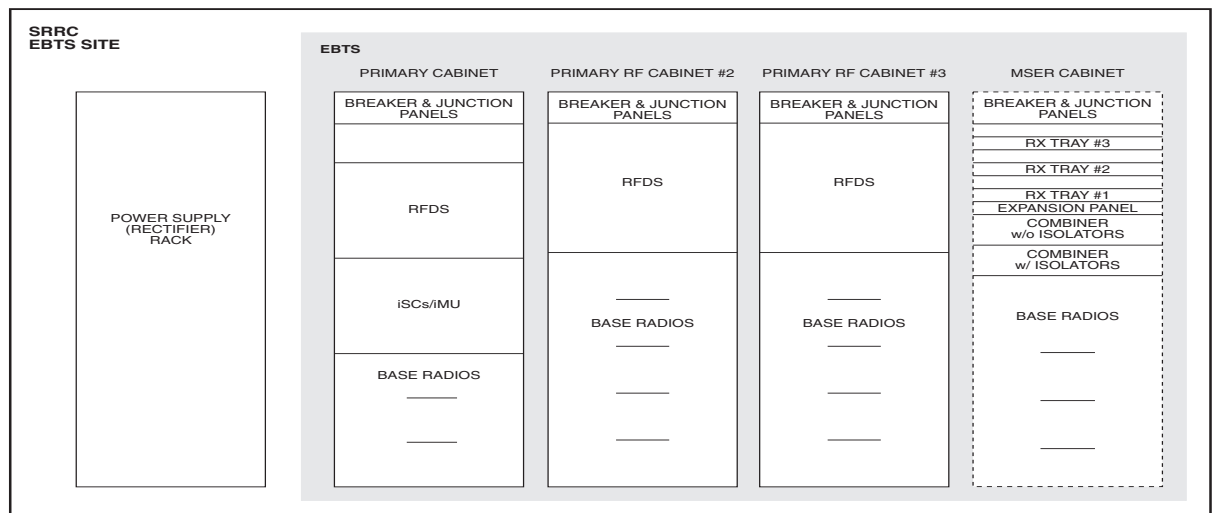
MSER017  
070199JNM

Figure 13 **SRRC Configuration: iSC/iMU**

**Configuration Information**


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## Configuration Information

The MSER is available in a standard two or three sector expansion configuration. An optional configuration is available that extends the capacity by adding an optional triple-two way combiner (without isolators) for two sector expansion. The optional configuration should be used whenever more than two transmit signals within the MSER system need to be combined.

The MSER contains as many as six base radios and an abbreviated RF distribution system to interface transmit and receive signals between the MSER and the primary EBTS.

### Standard Configurations

The standard MSER configuration expands a multi-sectored site. It is comprised of the following components:

- ☐ Up to six Base Radios (for a three sector site)
- ☐ Up to four Base Radios (for a two sector site)
- ☐ One multicoupler tray for each sector
- ☐ Transmit Combiner with isolators

*Table 1   **Standard Three Sector Configurations***

| <b>Configuration</b> | <b>Description</b>                                                                                |
|----------------------|---------------------------------------------------------------------------------------------------|
| 1-1-1                | Comprised of a total of three BRs; equally distributed to include one BR per sector.              |
| 1-1-2                | Comprised of a total of four BRs; one BR each for sectors 1 and 2, and two BRs for sector 3.      |
| 1-2-2                | Comprised of a total of five BRs; one BR each for sector 1, and two BRs each for sectors 2 and 3. |
| 2-2-2                | Comprised of a total of six BRs; equally distributed to include two BRs per sector.               |

*Table 2   **Standard Two Sector Configuration***

| <b>Configuration</b> | <b>Description</b>                                                                   |
|----------------------|--------------------------------------------------------------------------------------|
| 1-1                  | Comprised of a total of two BRs; equally distributed to include one BR per sector.   |
| 1-2                  | Comprised of a total of three BRs; one BR for sector 1, and two BRs for sector 2.    |
| 2-2                  | Comprised of a total of four BRs; equally distributed to include two BRs per sector. |



## Optional Configuration

Optional MSER configurations allow extended two sector expansion through the use of an optional triple-two way combiner (without isolators). Optional configurations are comprised of the following components:

- ☐ Up to six Base Radios (two sectors only)
- ☐ One multicoupler tray for each sector
- ☐ Transmit Combiner with isolators
- ☐ Transmit Combiner without isolators

Table 3 **Optional Two Sector Configuration**

| Configuration | Description                                                                 |
|---------------|-----------------------------------------------------------------------------|
| 3-2           | Comprised of a total of five BRs; three for sector 1, and two for sector 2. |
| 4-2           | Comprised of a total of six BRs; four for sector 1, and two for sector 2.   |
| 3-1           | Comprised of a total of four BRs; three for sector 1, and one for sector 2. |
| 4-1           | Comprised of a total of five BRs; four for sector 1, and one for sector 2.  |

## System Specifications

## System Specifications

The following table presents the technical specifications for the MSER system:

| Description                                                          | Specification                                                                    |
|----------------------------------------------------------------------|----------------------------------------------------------------------------------|
| <b>General Specifications</b>                                        |                                                                                  |
| Cabinet dimensions                                                   | Height - 85" (215.9 cm)<br>Width - 23.62" (60 cm)<br>Depth - 23.62" (60 cm)      |
| Maximum load                                                         | 840 lbs. (381 kg)                                                                |
| EIA rack units (RU)                                                  | 43 RU (total)                                                                    |
| Frequency range                                                      | 851 to 866 MHz - transmit<br>806 to 821 MHz - receive                            |
| Tx - Rx frequency spacing                                            | 45 MHz                                                                           |
| Channel spacing                                                      | 25 kHz (minimum)                                                                 |
| RF port impedance                                                    | 50 $\Omega$ (nominal)                                                            |
| Input power supply potential                                         | -41 to -60 VDC (-48 VDC nominal)                                                 |
| Input current (fully loaded - 6 BRs)                                 | A-Side - 50 Amps max (41 Amps nominal)<br>B-Side - 50 Amps max (41 Amps nominal) |
| <b>Transmit Specifications</b>                                       |                                                                                  |
| PA power                                                             | +48.45 dBm (70 Watts)                                                            |
| MSER output power                                                    | 43.5 dBm (22.4 Watts) minimum<br>39.5 dBm (8.9 Watts) minimum                    |
| RF port impedance                                                    | 50 $\Omega$ (nominal)                                                            |
| Combiner loss                                                        | 3.95 dB (2-way combining) maximum<br>7.95 dB (4-way combining) maximum           |
| Rack cabling loss                                                    | -1 dBm maximum                                                                   |
| Total loss                                                           | 4.95 dB (2-way combining) maximum<br>8.95 dB (4-way combining) maximum           |
| <b>Receive Specifications</b>                                        |                                                                                  |
| Sensitivity (@ 8% BER)                                               | -109.5 dBm maximum                                                               |
| Gain (806 to 821 MHz)<br>$T_A$                                       | 2 dB typical<br>(MSER expansion panel to input of Base Radio)                    |
| RF port impedance                                                    | 50 $\Omega$ (nominal)                                                            |
| $T_A = 77^\circ \text{ F } (25^\circ \text{ C})$ ambient temperature |                                                                                  |

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## Installation

The installation of the Multi-Sector Expansion Rack (MSER) consists of planning activities, cabinet installation, site and intercabinet cabling, and a checkout procedure. This section contains detailed information for installing the MSER, including the topics listed below.

| Section                   | Page | Description                                                                                              |
|---------------------------|------|----------------------------------------------------------------------------------------------------------|
| Pre-Installation          | 28   | Provides general information for the installation procedures.                                            |
| Cabinet Installation      | 34   | Describes how to install the MSER cabinet.                                                               |
| Inter-Cabinet Connections | 36   | Provides step-by-step procedures and diagrams to interconnect the MSER with the "primary" EBTS cabinets. |
| Site Connections          | 47   | Provides step-by-step procedures and diagrams for installing cabling between the MSER and the EBTS site. |

## Installation

### Pre-Installation

The actual installation of the MSER consists of installation of the cabinet, inter-cabinet cabling, and a checkout procedure. However, there are several assumptions and considerations relating to the MSER installation that should first be reviewed. Those assumptions and considerations are presented in this section. Be sure to review them before attempting to install the MSER.

#### Assumptions

The following assumptions apply to the installation of the MSER:

- ❑ The installer or field technician who is installing the MSER must be knowledgeable of the standards contained in the *Quality Standards Fixed Network Equipment - Installation Manual*. See the “Reference Materials” for information on ordering related manuals.
- ❑ The MSER is being added to an existing, multi-sectored EBTS site.
- ❑ The MSER may ship without Base Radios installed. A fully functional MSER must contain at least one Base Radio. All Base Radios added to the MSER should be installed at the bottom-most position of the MSER cabinet.
- ❑ The MSER is being added to a compatible EBTS configuration, including the SCRF and SRRC.
- ❑ All power, electrical, antenna, and permanent fixtures for the site have been previously installed.
- ❑ The power supply rack, battery system rack, and “primary” EBTS cabinets have been previously installed.
- ❑ The term *cabinet* refers to Fixed Network Equipment (FNE), such as the MSER, that is mounted in various types of framed cabinets. In this manual, the term cabinet does not refer to building electrical cabinets, outdoor utility cabinets, or other types of equipment shelters.

#### Basic Considerations

There are several basic considerations that can be useful in the planning of an MSER installation. Many of the basic considerations have been highlighted below for your convenience. These and other MSER-specific considerations are discussed in greater detail in the sections that follow.

- ❑ Review the site planning information provided in the EBTS System Manual (68P80801E35-O).
- ❑ Record the current sectorization of the primary site, then determine the expanded sectorization by adding the MSER. Once this has been determined, refer to the Transmit Cabling Configurations on page 50 to ensure proper transmit cabling for the expanded sectorization.

- ❑ When installing cabinets, be sure to allow enough open floor space in front and behind the cabinet for easy access to the mounted equipment.
- ❑ The ceiling height of the installation site should be no lower than 8'-6" (259 cm) to allow enough space above the cabinet for inter-cabinet cabling.
- ❑ The interior environment of the installation site should be capable of maintaining a constant 78°F (25.6° C).
- ❑ The MSER equipment is not approved or recommended for outdoor use.

### Cabinet Dimensions

The MSER cabinet is a non-wheeled cabinet that has the same dimensions as the primary EBTS cabinets. The MSER cabinet is 23.625" (59.045 cm) in width, 23.625" (59.045 cm) in depth, and 85" (215.9 cm) in height.

The loading eyelets mounted on the top of the cabinet add an additional 1.75" (4.45 cm) to the cabinet height for a total of 86.75" (220.35 cm).

Figure 14 shows the cabinet footprint of the MSER.

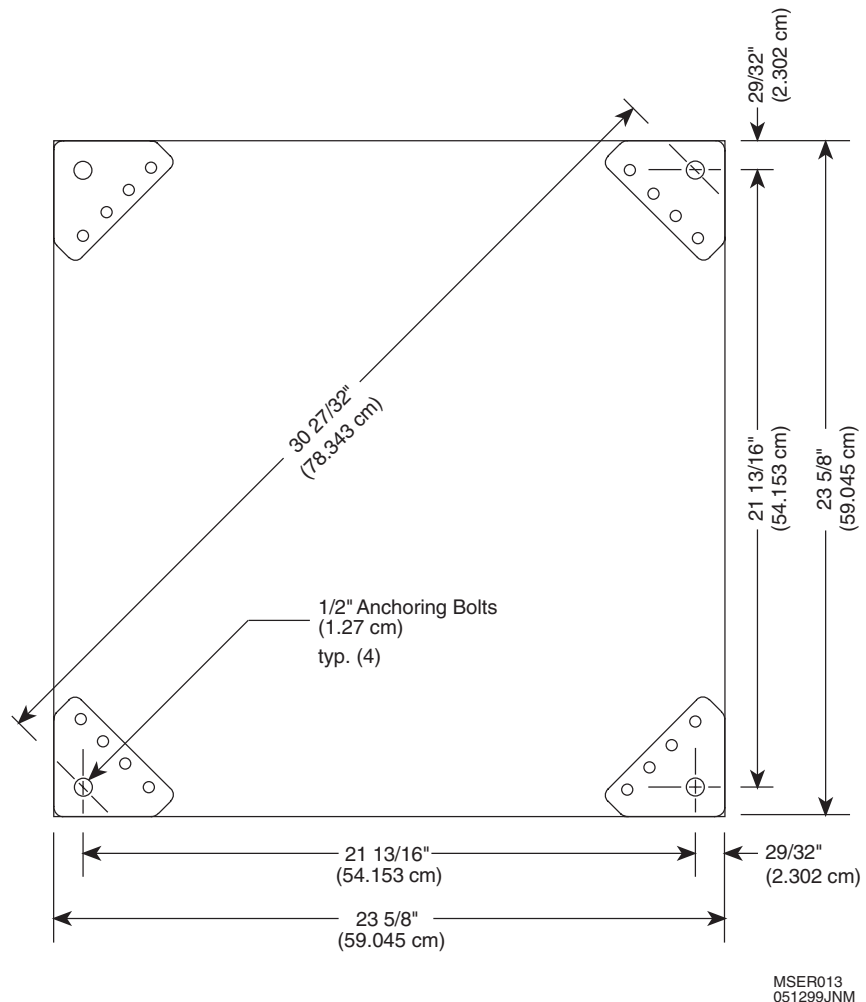


Figure 14 **MSER Cabinet Footprint**

**Installation****Cabinet Access**

At least 2' (60.96 cm) of open space should be allowed in front and behind the MSER cabinet to permit access for installation and maintenance. Although most maintenance is performed from the front of the cabinet, access to the rear is required for inter-cabinet cabling and antenna connections.

Figure 15 shows a typical cabinet layout for a standard EBTS site. This cabinet layout is referenced in the installation procedure.

**Weight and Floor Loading**

Table 4 provides weight and equivalent floor loading information for various MSER configurations. The actual weight varies depending on the number of Base

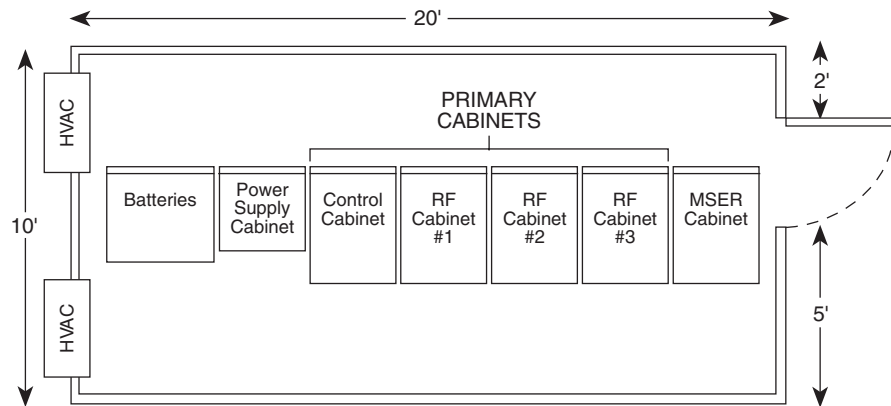
*Table 4 MSER Weight and Floor Loading*

| <b>Configuration</b>                                                                                                  | <b>Number of BRs</b> | <b>Weight lbs. (kg)</b> | <b>Equivalent Floor Loading lbs./sq. ft. (kg/cm<sup>2</sup>)</b> |
|-----------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------|------------------------------------------------------------------|
| Standard 2-Sector (1-1)                                                                                               | 2                    | 404 (183)               | 104 (.052)                                                       |
| Standard 3-Sector (1-1-1) & Standard 2-Sector (1-2)                                                                   | 3                    | 492 (223)               | 127 (.064)                                                       |
| Standard 3-Sector (1-1-2) & Standard 2-Sector (2-2)                                                                   | 4                    | 580 (263)               | 149 (.075)                                                       |
| Standard 3-Sector (1-2-2)                                                                                             | 5                    | 668 (303)               | 172 (.087)                                                       |
| Standard 3-Sector (2-2-2)                                                                                             | 6                    | 756 (343)               | 195 (.098)                                                       |
| *Optional 2-Sector (3-1)                                                                                              | 4                    | 600 (272)               | 155 (.078)                                                       |
| *Optional 2-Sector (3-2 & 4-1)                                                                                        | 5                    | 688 (311)               | 177 (.089)                                                       |
| *Optional 2-Sector (4-2)                                                                                              | 6                    | 776 (351)               | 200 (.101)                                                       |
| Optional Cabinet Doors                                                                                                | -                    | 25 (11)                 | 6 (.003)                                                         |
| <b>NOTE:</b> Optional MSER configurations contain an additional transmit combiner (triple-two way without isolators). |                      |                         |                                                                  |

Radios installed and whether or not an optional transmit combiner is being used. Total weight may also be affected by the addition of optional cabinet doors and side panels.

**Cabinet Bracing**

The MSER cabinet is secured to the site floor during the installation procedure. Additional cabinet bracing is possible by joining the MSER cabinet to the primary EBTS cabinets through the use of ganging hardware. A ganging hardware kit (THN6718A) is available from Motorola for use with the MSER. Refer to Parts and Suppliers for information on how to order parts.



Note: Double lines on above units indicate front of equipment.

MSER014  
052799JNM

Figure 15 **Typical EBTS Cabinet Layout**

To ensure optimum stability of the cabinet, especially in areas subject to seismic activity, additional bracing may also be required. Any additional bracing hardware used to secure the MSER cabinet must be locally procured. This manual does not provide procedures for the installation of such hardware.

If the MSER is not secured to the “primary” EBTS cabinets through the use of ganging hardware, the cabinet spacing cannot exceed more than 5" (12.7 cm) due to the length of interconnecting cabling. See *Inter-Cabinet Cabling* below for additional information.

## ⚠ WARNING

EQUIPMENT CABINETS ARE HEAVY AND MAY TIP. USE EXTREME CAUTION WHEN MOVING EQUIPMENT. LIFT THE CABINET USING ALL FOUR TOP EYE BOLTS WHEN AN APPROPRIATE APPARATUS OR SECURE THE CABINET FROM FLIPPING IF LIFTING FROM THE BOTTOM. FAILURE TO DO SO COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH, OR EQUIPMENT DAMAGE

**Installation****Inter-Cabinet Cabling**

Inter-cabinet cabling refers to the connections between equipment cabinets. In the MSER, inter-cabinet cabling is used to connect the expansion cabinet to the “primary” EBTS cabinets.

The cables used for inter-cabinet cabling are manufactured in predetermined lengths which impose a height restriction for the site cable tray of no more than 6” (15.24 cm) above the equipment cabinets. This also results in a limitation of spacing between equipment cabinets to no more than 5” (12.7 cm).

The inter-cabinet cabling shipped with the MSER is based on a cabinet layout configuration similar to the one shown in Figure 15. If the site cannot accommodate one of this layout configurations, custom intercabinet cables may need to be used. Refer to Parts and Suppliers for information on manufacturing custom cables, if necessary.

**Cabinet Ground Connection**

The MSER cabinet requires a dedicated connection to the master ground bar within the site. The connecting wire must be a #2 AWG green-insulated copper wire. The ground wire will be connected to the grounding hardware located on the duplexers within the MSER cabinet. Refer to “Cabinet Ground Connections” on page 134 for additional information about MSER cabinet ground connections.

**DC Power Connection**

The recommended color for wires considered “hot” is red. If the recommended color is not used or is not available, be sure to mark each end of the “hot” leads using red electrical tape or another type of labeling.

The actual wire gauge used to connect the DC power source to the MSER can vary depending on the loop length. The “loop length” refers to the combined length of both the hot (-48 VDC) and return leads. For example, if distance between the power supply rack and the MSER is 16’ (4.88 meters), the total loop length would be 32’ (9.76 meters).

In a typical installation, the MSER cabinet is located adjacent to last RF cabinet, resulting in a loop length of approximately 35’ (10.675 meters) or less. Before installing the MSER cabinet, measure the required loop length between it and the power supply rack. Refer to Table 5 to determine the proper wire gauge to use during installation.

**NOTE**

Under no circumstances should the wire for the DC power supply wiring be smaller than #6 AWG. Cable loop voltage drop shall not exceed 500 mV for cabling of the -48 VDC (hot) and DC return leads.



Table 5 **Determining DC Power Wire Gauge**

| Total Loop Length                               | Wire Gauge |
|-------------------------------------------------|------------|
| Less than 25' (7.625 meters)                    | #6 AWG     |
| Between 25' (7.625 meters) to 40' (12.2 meters) | #4 AWG     |
| Between 40' (12.2 meters) to 60' (18.3 meters)  | #2 AWG     |
| Between 60' (18.3 meters) to 130' (39.65)       | 1/0 AWG    |

The screws required to connect the DC power cables to the Power Supply rack are not provided and must be locally procured. The standard screw size used on a typical power supply breaker panel is 3/8-16 x 3/4. Be sure to verify the connection screws are available before attempting to connect the DC power supply. Refer to Equipment Cabinet Power Connections on page 138 for related information on power connections.

### AC Power and Backup Power

Be sure both the AC service and battery backup are capable of handling the additional normal and startup loads that the MSER will add to the overall EBTS. Please refer to the *EBTS System Manual* for additional information on electrical service requirements.

### Environmental Considerations

The MSER has the same environmental requirements as the “primary” EBTS for temperature, humidity, and air cleanliness. Be sure the HVAC system is capable of compensating for the added BTUs the MSER will generate.

### Special Considerations

The following are special considerations that could affect the MSER installation, especially if it is not being installed in a site with a typical equipment cabinet layout. Please note that these considerations also apply to the primary EBTS.

### Breaker Panel Access

The National Electric Code (NEC) requires a minimum 36" (91.44 cm) clearance for electrical service access, including all fuse panels, breaker panels, etc. NEC also requires that all cabinet doors open at least 90°.

### Disabled Personnel

Please note that the Americans with Disabilities Act (ADA) of 1990 requires certain clearances for handicapped personnel. The customer is responsible for determining the applicable ADA requirements that may affect the installation of the MSER.

**Installation****Receipt of Equipment**

The MSER is shipped with all components securely fastened within the equipment cabinet. Upon receipt of the MSER, be sure to:

- ☐ Inventory equipment against itemized packing list.
- ☐ Check for loose or damaged equipment.
- ☐ Check for dents, scratches, or other damage to the mounted equipment or cabinet panels (if used).
- ☐ Verify all intra-cabinet cable connections are securely connected.
- ☐ Check for physical damage to connectors or other controls.

If the MSER is damaged, contact the shipping company immediately to file a complaint, then contact your Motorola representative. If there are missing items in the shipment, contact your Motorola representative immediately.

**Cabinet Installation**

This procedure describes how to mount the MSER in an existing EBTS site. Be sure to read all of the procedures carefully before performing the installation of the cabinet to ensure a quality installation.

The MSER is a non-wheeled cabinet that must be secured to the floor for optimum stability. Due to the weight of the cabinet, this procedure has been written to minimize the amount movement of the cabinets during the installation process.

**NOTE**

Motorola recommends installing expansion cabinets next to the "primary" EBTS cabinets. See *Installation Considerations* for a typical cabinet layout.

1. Measure the mounting location for the MSER.  
Use the measurements of the cabinet footprint, as shown in Figure 14.
2. Carefully mark the mounting holes with a pencil, as indicated on the appropriate cabinet footprint.
3. Drill the marked mounting holes to the appropriate depth of the mounting hardware with a hammer drill and bit.  
Refer to Cabinet Mounting Hardware on page 134 for the recommended mounting hardware.
4. Insert an anchor into the drilled hole.  
If necessary, tap the anchor into place using a hammer.

5. Remove the four screws securing the bottom kick panel to the front and back of the cabinet.

Remove the kick panel and set aside during installation.

6. Carefully move the cabinet into the position indicated by the holes in the floor.

Adjust and level the cabinet as necessary to position the cabinet mounting holes with the pre-drilled holes.

7. Secure the cabinet to the site floor with the locally procured mounting hardware.

8. If required, connect adjacent cabinets to each other using the ganging hardware kit (THN6718A).

9. If required, install additional cabinet bracing using locally procured parts and materials.

**Inter-Cabinet Connections**


---

## Inter-Cabinet Connections

Inter-cabinet connections refer to those connections between the MSER and external components, such as the power supply rack or the primary EBTS. The procedures presented in this section include those listed in the following table.

| Procedure                     | Page | Description                                                                            |
|-------------------------------|------|----------------------------------------------------------------------------------------|
| 5 MHz / 1 PPS Connection      | 38   | Connection of the 5 MHz / 1 PPS timing reference signal provided by the primary EBTS   |
| Ethernet Connection           | 39   | Connection of Ethernet connection from the primary EBTS                                |
| Alarm Connection              | 41   | Connection of cabinet alarm cabling between the MSER and primary EBTS                  |
| DC Power (-48 VDC) Connection | 43   | Connection of -48 VDC power wiring from power supply rack to MSER                      |
| Transmit Cabling Connection   | 46   | Connection of the transmit cabling from the MSER to the primary RF Distribution System |
| Receive Cabling Connection    | 46   | Connection of the receive cabling from the primary RF Distribution System to the MSER  |

The installation procedure assumes the MSER includes at least one Base Radio. If there no Base Radios installed in the MSER cabinet, you must install one or more the MSER to become functional. Base Radios should be installed from the bottom (BR1) position of the cabinet and progress upward.

Connect one DC power harness, one 5-MHz / 1 P.P.S. cable, one Ethernet cable, one transmit cable, three receive cables, and one ground cable per Base Radio according to the cabling instructions. Base Radios are heavy and require two people to safely lift.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

The procedures in this section describe the inter-cabinet cabling - *between cabinets*. Refer to “Intra-Cabinet Cabling Reference” on page 73 for reference information concerning intra-cabinet cabling - *within the MSER cabinet*.

---

### Cable Routing

All inter-cabinet cabling is routed through the top of the MSER cabinet, through the site cable tray, and to the appropriate connection. Most connections within the MSER cabinet have been connected during manufacturing, however some may have been repeated within to ensure proper cabling of the MSER.

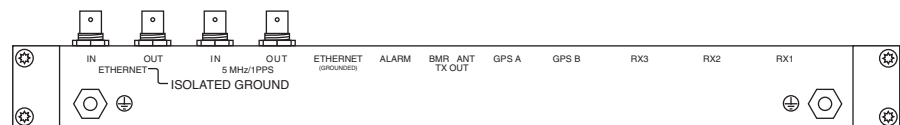
## Cable Connections

Inter-cabinet cabling is accomplished by simply connecting the free end of each cable to the appropriate connection as described within the procedure. Part numbers of all inter-cabinet cables are referenced within the procedures.

Most inter-cabinet cabling for the MSER is accomplished through equipment cabinet junction panels. The MSER contains two junction panels; a standard junction panel and an expansion panel. The standard junction panel is the same junction panel used for inter-cabinet cabling on the primary EBTS cabinet. The expansion junction panel is used to connect the receive branches to the MSER.

## Standard Junction Panel Connections

The standard junction panel, shown in Figure 16, is used to connect the 5 MHz/1 PPS and Ethernet inter-cabinet cable connections between the MSER and primary system.

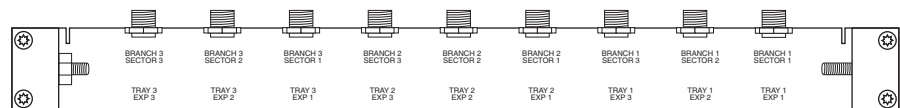


MSER010  
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Figure 16 **Standard Junction Panel**

## Expansion Junction Panel Connections

The expansion junction panel, or expansion panel, shown in Figure 17, is used to connect the receiver branch inputs to the multicoupler trays within the MSER cabinet.



MSER011  
051299JNM

Figure 17 **Expansion Panel**

## Other Connections

The transmit, alarm, and DC power connections between the MSER and primary EBTS system do not use the junction panels, but are connected directly to the

**Inter-Cabinet Connections**

appropriate components. The transmit cabling is made directly from the MSER RF Distribution System to the duplexer input ports of the primary RF Distribution System. The MSER alarm cabling is made directly from the modular adaptor on the iMU within the primary cabinet to the appropriate multicoupler tray (Sector 2 or Sector 3) within in the MSER cabinet. The DC power connections are made directly between the power supply rack and the power distribution panel on the MSER cabinet.

**5 MHz/1 PPS Connection**

The 5 MHz/1 PPS cable connection connects the MSER to the timing reference signal provided by the Gen 3 SC /iSC in the primary EBTS. The actual signal is generated by the Gen 3 SC/iSC (in the case of the iSC, the signal is generated by the Site Reference ISA [SRI] card located in the iSC). The inter-cabinet connection for the signal is made from the junction panel of the primary EBTS cabinet to the standard junction panel of the MSER cabinet.

Be sure to follow these general guidelines relating to the distribution of the timing reference signal:

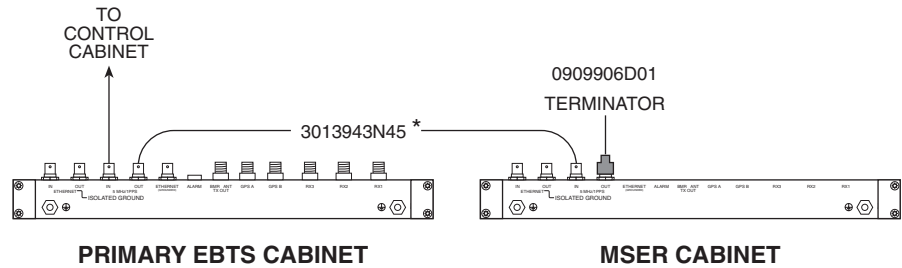
- ☐ Distribute the load as evenly as possible between the primary EBTS and MSER system.
- ☐ Terminate the far-end of each daisy-chain with a 50  $\Omega$  load.

 **CAUTION**

Powered-down BRs connected to the 5 MHz/1 PPS system can degrade the 5 MHz/1 PPS signal which could result in malfunctions. Be sure to disconnect the BR from the 5 MHz/1 PPS system before powering-down a BR. Please note that 5 MHz/1 PPS "T" connections do not need to be terminated.

Noting the general guidelines discussed above, perform 5 MHz/1 PPS cabling between cabinets as follows:

1. Remove the 50  $\Omega$  BNC Terminator on the **5 MHz/1 PPS OUT** connector of the junction panel on the primary EBTS cabinet.
2. Connect one end of the timing reference cable (3013943N45) to the **5 MHz/1 PPS OUT** connector on the junction panel.
3. Route the cable through the site cable trays to the MSER cabinet. Use cable ties to secure the cable in place.
4. Connect the other end of the timing reference cable to **5 MHz/1 PPS IN** connector on the junction panel of the MSER system.



\* 0112004Z29 is an alternate cable that may be shipped with some systems.

MSER018  
062899JNM

**Figure 18 5 MHz/1 PPS Inter-Cabinet Cabling Connection**

- Verify that a 50  $\Omega$  BNC Terminator (0909906D01) is installed on the **5 MHz/ 1 PPS OUT** connector of the junction panel on the MSER system.

## Ethernet Connection

The Ethernet cable connection connects the MSER to the 10BaseT connection of the primary EBTS. The Ethernet connection allows the Gen 3 SC in the primary system to provide data and control information to and from the Base Radios in the MSER system. The inter-cabinet connection for the Ethernet connection is made from the junction panel of the primary EBTS cabinet to the junction panel of the MSER cabinet.

1. Remove the 50  $\Omega$  BNC Terminator on the **ETHERNET OUT (ISOLATED GROUND)** connector of the junction panel on the primary EBTS system.
2. Connect one end of the Ethernet cable (3013943N45) to the **ETHERNET OUT (ISOLATED GROUND)** connector on the junction panel.
3. Route the cable through the site cable trays to the MSER cabinet. Use cable ties to secure the cable in place.
4. Connect the other end of the Ethernet cable to **ETHERNET IN (ISOLATED GROUND)** connector on the junction panel of the MSER system.
5. Verify that a 50  $\Omega$  BNC Terminator (0909906D01) is installed on the **ETHERNET OUT (ISOLATED GROUND)** connector of the junction panel on the MSER system.





## Alarm Connection

The alarm cable connection connects the MSER to the alarm system provided by the primary EBTS. The alarm system consists of the Environmental Alarm System (EAS)/iDEN Monitor Unit (iMU) which is functionally part of the Gen 3 SC/iSC.

The EAS/iMU monitors alarms from the Base Radios, abbreviated RF Distribution System, and breaker status signals of the MSER system. The Gen 3 SC, in turn, communicates alarm status information to the OMC.

The alarm signals for the receive multicoupler trays in the MSER are cascaded together. The inter-cabinet connection for the alarm system connection is made from the modular adapter, as shown in Figure 20, located on EAS/iMU of the primary EBTS cabinet to either the Sector 2 or Sector 3 multicoupler tray of the MSER cabinet.

## Inter-Cabinet Connections

1. Connect one end of the alarm cable (3084225N42) to the appropriate connector on the modular adaptor located in the primary EBTS system.

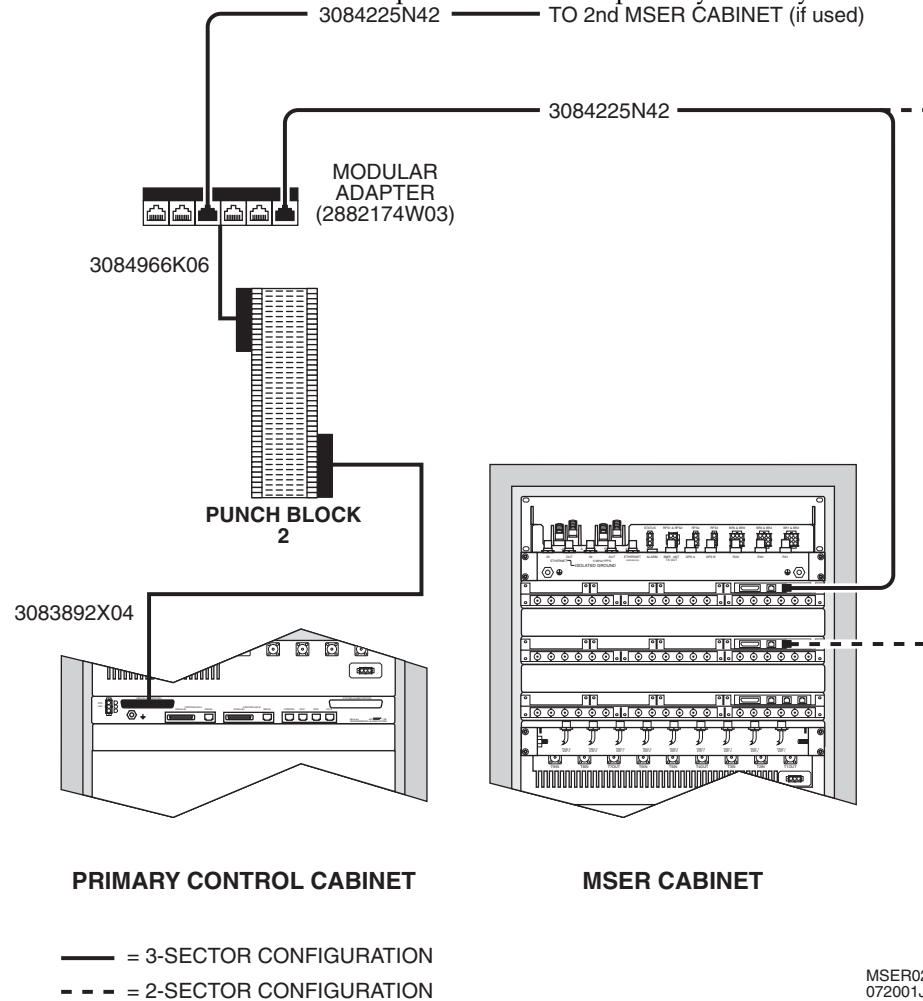
MSER02I  
072001J1

Figure 20 Alarm Inter-Cabinet Cabling Connection

The first MSER cabinet alarm cable connects to jack #1 of the modular adapter. If a second MSER cabinet is used, its alarm cable connects to jack #4 of the modular adapter.

2. Route the cable through the site cable trays to the MSER cabinet. Use cable ties to secure the cable in place.
3. Connect the other end of the alarm cable to **ALARM STANDARD** connector on the appropriate multicoupler tray within the MSER cabinet.

The multicoupler trays are mounted and labeled from bottom-up (Sector 1 through Sector 3) within the MSER cabinet. For 2 sectored sites, connect the alarm cable to the Sector 2 multicoupler tray. For 3 sectored sites, connect the alarm cable to the Sector 3 multicoupler tray.

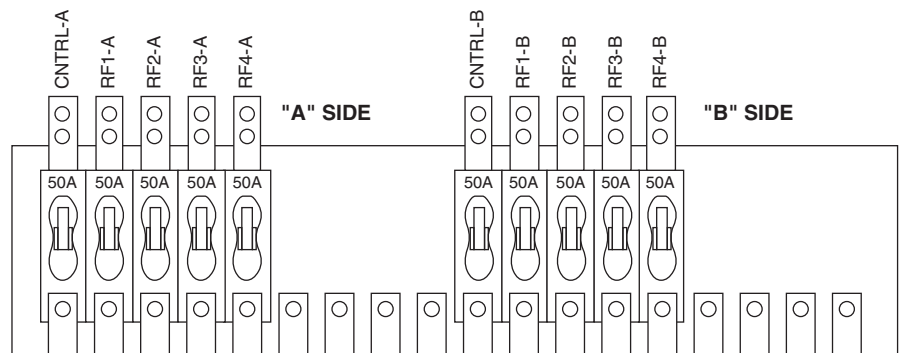
## DC Power (-48 VDC) Connection

The DC power connection connects the MSER to the power supply rack which supplies the required -48 VDC for the system. Because the power supply rack is not considered part of the overall EBTS, this procedure cable connection is described in a “generic sense.”

The power supply rack contains a breaker panel that is divided into two sections; A and B. Both sides of the panel are connected to the same power source and have the same potential. This provides power redundancy for increased system reliability.

The circuit breakers for the power supply are typically located on the front of the power supply rack. A typical breaker panel layout is shown in Figure 21. When viewed from the front, the A-side circuit breakers are on the left and the B-side breakers are on the right.

Like the primary EBTS cabinets, there are two separate power feeds that provide the DC power to the A and B sides of the MSER. Two -48 VDC (hot) wires from individual breakers on the power supply are connected to the A and B sides of the -48 VDC MSER cabinet breaker panel. Additionally, two DC return wires from the power supply are connected to the A and B sides of each return MSER cabinet breaker panel. The following procedure reflects the connection of both the hot (-48 VDC) and return leads.



MSER046  
061599JNM

Figure 21 **Typical Power Supply Rack Breaker Panel (Front View)**

Figure 22 shows a rear view of the MSER power distribution panel. The power distribution panel distributes the -48 VDC (hot) through individual power circuits for each module in the MSER cabinet.

The power distribution panel within the MSER is accessed from the rear of the cabinet on the breaker panel. The layout of the MSER breaker panel is similar to the breaker panel of the power supply rack, with the A-side on the left and the B-side on the right as viewed from the front.

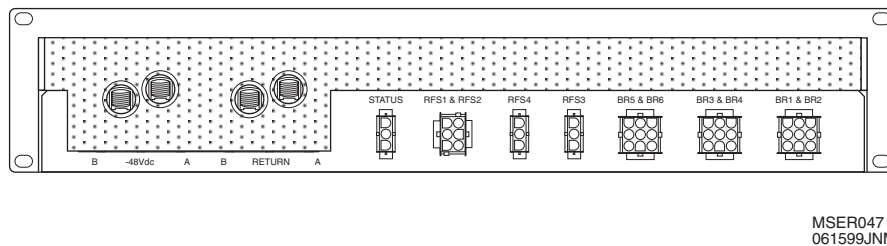
**Inter-Cabinet Connections**

Figure 22 **Typical Equipment Cabinet Power Distribution Panel (Rear View)**

The DC power connections for the power supply rack are made from the front. The DC power connections for the MSER cabinet are made from the rear of the equipment cabinet. Refer to “Equipment Cabinet Power Connections” on page 138 for additional information on DC power connections.

**Preparation**

Before connecting the DC power source to the MSER, be sure all pre-installation preparations have been made concerning the connection lugs, wire color, and wire gauge. Refer to “DC Power Connection” on page 32 for additional information.

## ⚠ WARNING

MAKE SURE ALL POWER TO THE POWER SUPPLY  
RACK IS OFF TO PREVENT INJURY TO PERSONNEL.

**-48 VDC Power Connections**

Each equipment cabinet requires two wires for -48 VDC power (hot). Perform the hot DC power supply connection as follows.

1. Each MSER cabinet requires two runs of appropriate-gauge bulk wiring between the -48 VDC (hot) A and B side connections on the equipment cabinet and power supply rack.

Make certain wire runs are properly routed through cabinets and cable tray assembly, allowing adequate slack.

2. Add the appropriate wire lugs to the wire, as determined in the pre-installation section.

Double-hole crimp lugs should be used on all power supply rack wiring. The size of the lugs will vary depending upon wire gauge used.

**Inter-Cabinet Connections**

3. Connect the first power wire lug to breaker 2A (RF4-A) of the Power Supply rack, as shown in Figure 21.

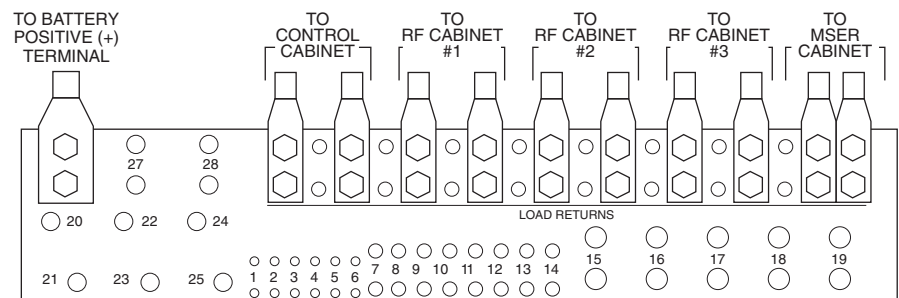
If a second MSER cabinet is used, connect the first power wire to breaker 2A (RF5-A).

4. On the equipment cabinet power distribution panel, strip and insert free end of wire coming from power supply into **-48 VDC** terminal block **A** on power distribution panel, as shown in Figure 22. Be sure to securely tighten this connection.
5. Connect the second power wire lug to breaker 2B (RF4-B) of the Power Supply rack, as shown in Figure 21.
6. On equipment cabinet power distribution panel, strip and insert free end of wire coming from power supply into **-48 VDC** terminal block **B** on power distribution panel, as shown in Figure 22. Be sure to securely tighten this connection.
7. If necessary, repeat steps 1 through 6 for additional MSER cabinets.

**-48 VDC Return Connections**

Each equipment cabinet requires two wires for -48 VDC return. Perform the return DC power supply connection as follows.

1. On the Power Supply rack, access the ground bus. Refer to the Power Supply manual supplied with the Power Supply cabinet for the location and access information for the ground bus.



MSER048  
061599JNM

Figure 23 **Typical Power Supply Rack DC Return Bus (Front View)**

2. Using appropriate gauge wire, route two runs of bulk wiring between **A** and **B** side **RETURN** connections on equipment cabinet and Power Supply rack **RETURN** connections.

Make certain wire runs are properly routed through cabinets and cable tray assembly, allowing adequate slack.

## Inter-Cabinet Connections

3. Depending on wire gauge used, terminate the two wire ends at the Power Supply rack using appropriate double-hole crimp lugs.
4. Connect the first DC return wire lug to the DC return bus bar on the Power Supply rack, as shown in Figure 23.
5. On the MSER cabinet power distribution panel, strip and insert free end of wire coming from power supply A-side return into **RETURN** terminal block **A**, as shown in Figure 22. Be sure to securely tighten this connection.
6. Connect the second DC return wire lug to the DC return bus bar on the Power Supply rack.
7. On the MSER cabinet power distribution panel, strip and insert free end of wire coming from power supply B-side return into **RETURN** terminal block **B**. Be sure to securely tighten this connection.

## Receive Cabling Connection

The inter-cabinet receiver cabling from the primary EBTS is made from the first receive multicoupler amplifier outputs in the primary system to the MSER expansion panel. The MSER can support up to three receiver branch inputs per sector (3 branch inputs x 3 sectors) for a total of nine receiver branch inputs.

All inter-cabinet receiver cabling is made using a cable (3012029E37) that is approximately 144" (366 cm) in length. The number of receiver cabling connections made to the MSER expansion panel depends upon the configuration of the system being expanded and the desired expansion configuration.

Refer to "Theory of Operation" on page 4 or "Receiver Cabling" on page 74 for additional information on receive cabling.

## Transmit Cabling Connection

The transmit inter-cabinet cabling is made from the MSER transmit combiner (output ports) to the primary RFDS system. Due to the variety of expansion configurations that the MSER can be used in, there are many possibilities to connect the MSER transmit cabling to the primary system. Please refer to the "Theory of Operation" on page 4 or "Transmit Cabling Configurations" on page 50 for additional information on transmit cabling.

### CAUTION

To prevent injury, Be sure the "dickey" command sequence has been issued to all base radios within the MSER cabinet while making transmit cabling antenna connections.

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## Site Connections

Site connections refer to the connections between the MSER and the EBTS site. The only connection that the MSER has to the actual site is the cabinet ground connection.

### Cabinet Ground Connection

Intra-cabinet grounding wires which ground the MSER components to the equipment cabinet are made during manufacturing. However, the MSER cabinet must be connected to the site ground for an effectively grounded system.

Before you begin this procedure, please refer to the “Cabinet Ground Connection” on page 32.

#### NOTE

Single-point ground method (where each cabinet or rack is grounded to master ground using its own ground wire) shall be used. Equipment cabinet shall use green-insulation #2 AWG (or larger) for ground wire.

During installation of cabinet ground wires, be sure to check any factory-installed internal ground connections for tightness.

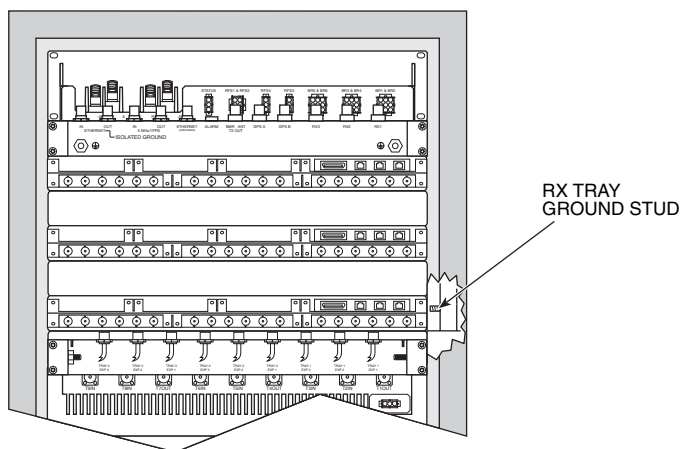
On the MSER, the cabinet ground cable is connected to the grounding hardware located by each multicoupler tray, as shown in Figure 24.

Perform the following steps to ground the chassis of the cabinet to the master ground bar of the installation site:

#### NOTE

A hex nut is secured to the Junction Panel of each cabinet during manufacturing. This nut is used to make ground connections on the Junction Panel. It may also be removed from the Junction Panel and used for the ground connections on the RF Distribution System.

1. Remove the nut and star washer from the ground hardware and set it aside.
2. Strip the end of the wire to be connected to the cabinet ground.

**Site Connections**

MSER049  
061599JNM

Figure 24 **MSER Cabinet Grounding Stud**

3. Using appropriate tool, attach a crimp lug onto the cabinet ground wire. Make certain lug is securely fastened to wire.
4. Route the cabinet ground wire through the top of the cabinet.
5. Place the lug over the ground hardware and secure it with the nut removed in step 1.
6. Route the other end of the cabinet ground wire to the master ground bar.
7. Strip the end of the wire for connection to the master ground bar.
8. Using appropriate tool, attach a dual-hole crimp lug onto the wire. Make certain lug is securely fastened to wire.

**NOTE**

If necessary, refer to Cabinet Ground Connections on page 134 for recommended crimp lugs.

9. Secure the ground wire lug to the master ground bar using the appropriate tools and hardware.



## **System Testing**

Perform system testing upon completion of the MSER installation. Refer to the “System Testing” section of the EBTS System Manual (68P80801E35-O).

**Transmit Cabling Configurations**


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## Transmit Cabling Configurations

This section provides reference information for various field configurations of the MSER transmit cabling. The information presented here is not intended to serve as a definitive guide for transmit cabling, but should provide a good representation of the configuration possibilities available by adding an MSER to an existing site. Refer to Theory of Operation on page 4 for additional information on transmit cabling configurations within the MSER.

This section provides transmit cabling reference information for the following types of primary sites:

- ☐ GEN4 Configurations
- ☐ V03 & V06 Configurations

### Base Radio Designations

Base Radios within the MSER are labeled BR4n or BR5n, where “4” or “5” represents the MSER cabinet number and “n” represents the relative BR position (BR1 through BR6) within that cabinet. BRs are numbered consecutively from the bottom-most mounting position within the cabinet, upward.

For example, BR43 represents BR3 in cabinet #4 (or the first MSER expansion cabinet). Please note that cabinet and BR positioning may differ among the various configurations represented in this section.

### Base Radio Sector Assignments

Please note the following sector and Base Radio assignments for the MSER. These assignments are designated during the manufacturing process and may not represent actual sector and Base Radio designations after deployment.

| BR Position | Default Sector Assignments | Possible Sector Assignments (Field) |            |            |            |
|-------------|----------------------------|-------------------------------------|------------|------------|------------|
|             |                            | Example #1                          | Example #2 | Example #3 | Example #4 |
| BR6         | Sector 3                   | Sector 3                            | Sector 3   | Sector 3   | Sector 2   |
| BR5         | Sector 2                   | Sector 3                            | Sector 2   | Sector 2   | Sector 1   |
| BR4         | Sector 1                   | Sector 2                            | Sector 1   | Sector 2   | Sector 1   |
| BR3         | Sector 3                   | Sector 2                            | Sector 1   | Sector 3   | Sector 2   |
| BR2         | Sector 2                   | Sector 1                            | Sector 1   | Sector 1   | Sector 3   |
| BR1         | Sector 1                   | Sector 1                            | Sector 1   | Sector 1   | Sector 3   |

### Combiner Designations

Transmit combiners within the MSER are labeled An through Fn, where “A” or “F” represents the combiner input and “n” represents the MSER cabinet number (1 for the first MSER cabinet and 2 for the second MSER cabinet). It should be noted that the 3 input pairs on the standard transmit combiner with isolators are

**Transmit Cabling Configurations**

labeled A1 through C1 and that the 3 input pairs on the optional transmit combiner without isolators are labeled D1 through F1.

| Input Pair | Combiner                       | MSER Cabinet       |
|------------|--------------------------------|--------------------|
| A1         | Triple 2-Way with isolators    | First (Cabinet #4) |
| B1         | Triple 2-Way with isolators    | First (Cabinet #4) |
| C1         | Triple 2-Way with isolators    | First (Cabinet #4) |
| D1         | Triple 2-Way without isolators | First (Cabinet #4) |
| E1         | Triple 2-Way without isolators | First (Cabinet #4) |
| F1         | Triple 2-Way without isolators | First (Cabinet #4) |
| A2         | Triple 2-Way with isolators    | First (Cabinet #5) |
| B2         | Triple 2-Way with isolators    | First (Cabinet #5) |
| C2         | Triple 2-Way with isolators    | First (Cabinet #5) |

For example, “BR41, BR42 - A1” means the transmit outputs of BR1 and BR2 in the first MSER cabinet are combined on the first pair of inputs (A1) on the triple 2-way combiner with isolators.

Another example, “BR41, BR42 -A1 /E1 BR43, BR44 - B1 /E1” means the transmit outputs of BR1 and BR2 in the first MSER cabinet are combined on the first pair of inputs (A1) on the triple 2-way combiner with isolators and the transmit outputs of BR3 and BR4 (also in the first MSER cabinet) are combined on the second pair of inputs (B1) on the triple 2-way combiner with isolators. Both pairs of combined signals are then combined again on the first pair of inputs (E1) on the triple 2-way combiner without isolators.

**Transmit Cabling Configurations****GEN4 Configurations**

The transmit cabling configurations described in this section illustrate triple diversity sites using GEN4 configurations. All configurations described here assume each primary cabinet has a maximum complement of six Base Radios. The total complement for GEN4 systems is 24 Base Radios per site, representing all sectors.

For triple branch diversity sites, it is assumed that the BRs in each primary cabinet (or sector) are split among Antennas 1 and 2; leaving Antenna 3 available for the MSER. For two branch diversity sites, it is assumed that the Base Radios in each primary cabinet (or sector) are combined on Antenna 1; leaving Antenna 2 available for the MSER.

The table below, and associated illustrations (Figure 25 and Figure 26), define how the transmit signals for the Base Radios mounted within the MSER cabinet can be combined for GEN4 configurations.

| Expansion Configuration | Sector 1<br>Ant 2 or 3 | Sector 2<br>Ant 2 or 3 | Sector 3<br>Ant 2 or 3               | Reference     |
|-------------------------|------------------------|------------------------|--------------------------------------|---------------|
| 0 - 0 - 1               |                        |                        | BR41 -A1                             |               |
| 0 - 0 - 2               |                        |                        | BR41,BR42 -A1                        |               |
| 0 - 0 - 3 (Note 1)      |                        |                        | BR41,BR42 -B1/D1<br>BR43 -A1/D1      |               |
| 0 - 0 - 4 (Note 1)      |                        |                        | BR41,BR42 -B1/D1<br>BR43,BR44 -A1/D1 |               |
| 0 - 0 - 5 (Note 2)      |                        |                        |                                      |               |
| 0 - 0 - 6 (Note 2)      |                        |                        |                                      |               |
| 0 - 1 - 1               |                        | BR41 -B1               | BR42 -A1                             |               |
| 0 - 1 - 2               |                        | BR41 -B1               | BR42,BR43 -A1                        |               |
| 0 - 1 - 3 (Note 1)      |                        | BR41 -C1               | BR42,BR43 -B1/D1<br>BR44 -A1/D1      |               |
| 0 - 1 - 4 (Note 1)      |                        | BR41 -C1               | BR42,BR43 -B1/D1<br>BR44,BR45 -A1/D1 |               |
| 0 - 2 - 2               |                        | BR41,BR42 -B1          | BR43,BR44 -A1                        |               |
| 0 - 2 - 3 (Note 1)      |                        | BR41,BR42 -C1          | BR43,BR44 -B1/D1<br>BR45 -A1/D1      |               |
| 0 - 2 - 4 (Note 1)      |                        | BR41,BR42 -C1          | BR43,BR44 -B1/D1<br>BR45,BR46 -A1/D1 | See Figure 25 |
| 1 - 1 - 1               | BR41 -C1               | BR42 -B1               | BR43 -A1                             |               |
| 1 - 1 - 2               | BR41 -C1               | BR42 -B1               | BR43,BR44 -A1                        |               |
| 1 - 2 - 2               | BR41 -C1               | BR42,BR43 -B1          | BR44,BR45 -A1                        |               |
| 2 - 2 - 2               | BR41,BR42 -C1          | BR43,BR44 -B1          | BR45,BR46 -A1                        | See Figure 26 |

**Notes:**

1. The standard Multi-Sector Expansion Rack (MSER) includes a triple 2-way combiner with isolators. Connections to the three input ports of the triple 2-way combiner with isolators are designated as A1/B1/C1. When more than 2 BRs are used for any one sector in the multi-sector cabinet, an optional triple 2 way hybrid combiner without isolators (D1/E1/F1) is required.
2. The 0 - 0 - 1 indicates the configuration of the expansion BRs for different sectors in the multi-sector cabinet, however these sectors can be interchangeable by simply changing the sector labeling. For example 2 - 3 - 7 (S1-S2-S3) is the same as 2 - 7 - 3 (S1-S2-S3) or 7 - 2 - 3 (S1-S2-S3) etc., which allows for all the various combinations. Therefore, if you had a 2 - 7 - 3, the configuration of 7 BR shown in this chart for Sector 3 should now be used for Sector 2, 6. For configurations with 5 or 6 BRs in a sector, the GEN4 Expansion cabinet is recommended instead of the Multi-Sector Expansion Rack (MSER).

## Transmit Cabling Configurations

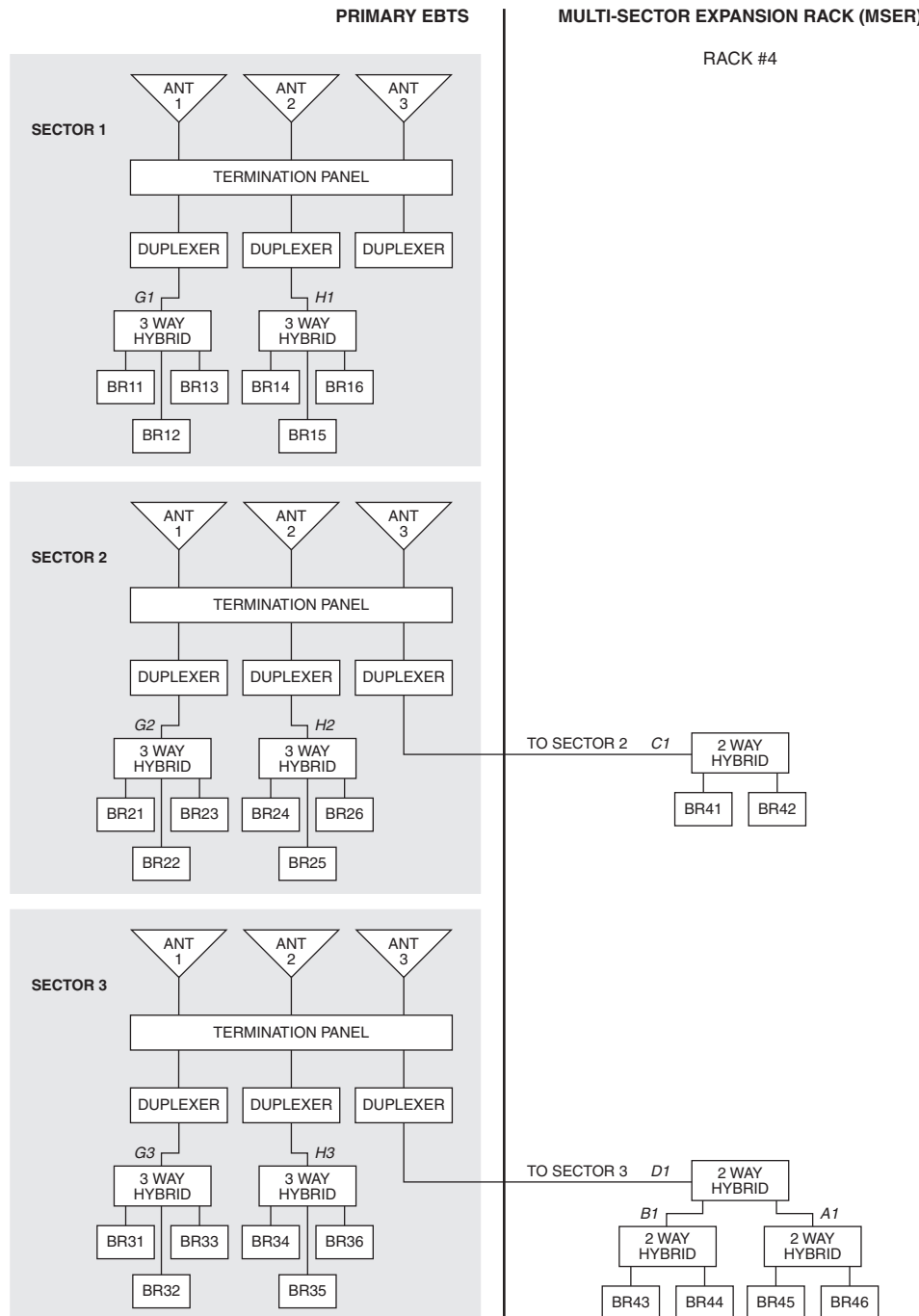


Figure 25 6-8-10 Configuration (0-2-4 Expansion)

## Transmit Cabling Configurations

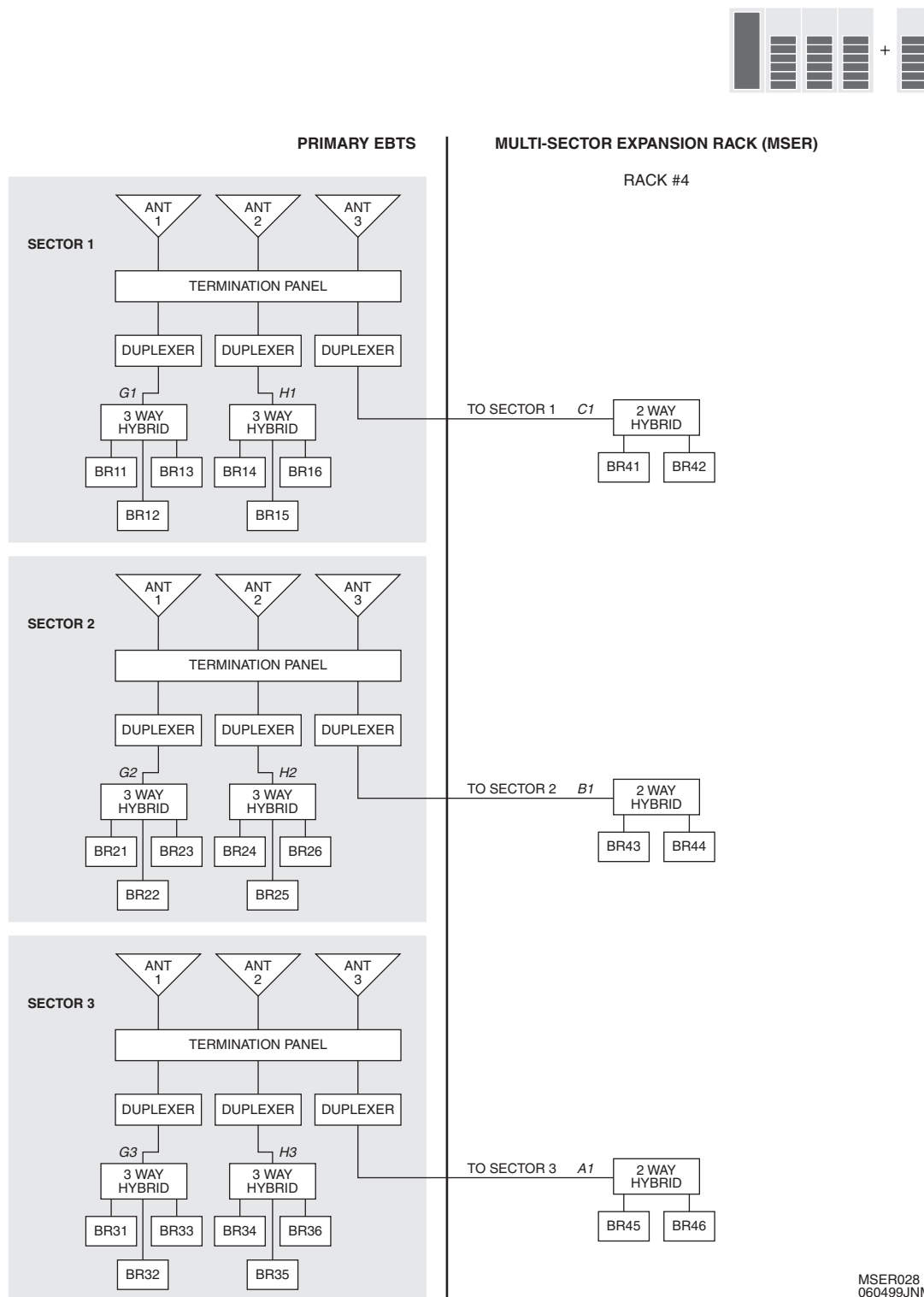


Figure 26 8-8-8 Configuration (2-2-2 Expansion)

## V03 & V06 Expansions

The transmit cabling configurations described in this section illustrate triple diversity sites using V03 and V06 configurations. All configurations described here assume each primary cabinet has a maximum complement of four Base Radios. The total complement for V03 and V06 systems are 24 Base Radios per site, representing all sectors.

For two branch diversity sites, it is assumed that the BRs in each primary cabinet (or sector) are combined on Antenna 1. For three branch diversity sites, it is assumed that the Base Radios in each primary cabinet (or sector) are combined on Antenna 1; leaving Antennas 2 and 3 available for the MSER.

The table below, and associated illustrations (Figure 27 through Figure 38), define how the transmit signals for the Base Radios mounted within the MSER cabinet can be combined for V03 and V06 configurations.

The expansion configuration listed in the following table indicates the loading of Base Radios for each sector within the MSER. These sector designations are interchangeable and can be changed by simply changing the sector labeling and ensuring the proper cabling is in place.

| Expansion Configuration | Sector 1      | Sector 2 |                   | Sector 3 |                                             | Reference     |
|-------------------------|---------------|----------|-------------------|----------|---------------------------------------------|---------------|
|                         | Ant 2 or 3    | Ant 2    | Ant 2 or 3        | Ant 2    | Ant 3                                       |               |
| 0 - 0 - 1               |               |          |                   |          | BR41 -A1                                    |               |
| 0 - 0 - 2               |               |          |                   |          | BR41,BR<br>42 -A1                           |               |
| 0 - 1 - 1               |               |          | BR41 -B1          |          | BR42 -A1                                    |               |
| 0 - 1 - 2               |               |          | BR41 -B1          |          | BR42,BR<br>43 -A1                           |               |
| 0 - 2 - 2               |               |          | BR41,BR<br>42 -B1 |          | BR43BR4<br>4 -A1                            |               |
| 1 - 1 - 1               | BR41 -C1      |          | BR42 -B1          |          | BR43 -A1                                    |               |
| 1 - 1 - 2               | BR41 -C1      |          | BR42 -B1          |          | BR43,BR<br>44 -A1                           |               |
| 1 - 2 - 2               | BR41 -C1      |          | BR42,BR<br>43 -B1 |          | BR44,BR<br>45 -A1                           |               |
| 2 - 2 - 2               | BR41,BR42 -C1 |          | BR43,BR<br>44 -B1 |          | BR45,BR<br>46 -A1                           | See Figure 27 |
| 0 - 0 - 3 (Note 1)      |               |          |                   |          | BR41,BR<br>42-B1/D1<br>BR43<br>-A1/D1       |               |
| 0 - 0 - 4 (Note 1)      |               |          |                   |          | BR41,BR<br>42-B1/D1<br>BR43,BR<br>44 -A1/D1 |               |
| 0 - 1 - 3 (Note 1)      |               |          | BR41 -C1          |          | BR42,BR<br>43-B1/D1<br>BR44<br>-A1/D1       |               |
| 0 - 1 - 4 (Note 1)      |               |          | BR41 -C1          |          | BR42,BR<br>43-B1/D1<br>BR44,BR<br>45 -A1/D1 |               |

**Transmit Cabling Configurations**

| Expansion Configuration | Sector 1        | Sector 2 |                    | Sector 3       |                                              | Reference     |
|-------------------------|-----------------|----------|--------------------|----------------|----------------------------------------------|---------------|
|                         | Ant 2 or 3      | Ant 2    | Ant 2 or 3         | Ant 2          | Ant 3                                        |               |
| 0 - 2 - 3 (Note 1)      |                 |          | BR41,BR 42 -C1     |                | BR43,BR 44 -B1/D1<br>BR45 -A1/D1             |               |
| 0 - 2 - 4 (Note 1)      |                 |          | BR41,BR 42 -C1     |                | BR43,BR 44 -B1/D1<br>BR45,BR 46 -A1/D1       | See Figure 28 |
| 1 - 1 - 3               | BR41 - B1       |          | BR42 - A1          |                | BR51,<br>BR52-B2/<br>D1 BR53<br>-A2/D1       |               |
| 1 - 1 - 4               | BR41 - B1       |          | BR42 - A1          |                | BR51,<br>BR52-B2/<br>D1<br>BR53,BR 54 -A2/D1 |               |
| 1 - 2 - 3               | BR41 - B1       |          | BR42,<br>BR43 - A1 |                | BR51,<br>BR52-B2/<br>D1 BR53<br>-A2/D1       |               |
| 1 - 2 - 4 (Note 1)      | BR41 - B1       |          | BR42,BR 43 -A1     |                | BR51,<br>BR52-B2/<br>D1<br>BR53,BR 54 -A2/D1 |               |
| 2 - 2 - 3 (Note 1)      | BR41, BR42 - B1 |          | BR43,BR 44 -A1     |                | BR51,<br>BR52-B2/<br>D1 BR53<br>-A2/D1       |               |
| 2 - 2 - 4 (Note 1)      | BR41, BR42 - B1 |          | BR43,BR 44 -A1     |                | BR51,<br>BR52-B2/<br>D1<br>BR53,BR 54 -A2/D1 | See Figure 29 |
| 0 - 0 - 5 (Note 1)      |                 |          |                    | BR41,BR 42 -C1 | BR43,BR 44-B1/D1<br>BR45 -A1/D1              |               |
| 0 - 0 - 6 (Note 1)      |                 |          |                    | BR41,BR 42 -C1 | BR43,BR 44-B1/D1<br>BR45,BR 46 -A1/D1        |               |
| 0 - 1 - 5 (Note 1)      |                 |          | BR41 -A1           | BR51,BR 52 -C2 | BR53,BR 54-B2/D1<br>BR55<br>-A2/D1           |               |
| 0 - 1 - 6 (Note 1)      |                 |          | BR41 -A1           | BR51,BR 52 -C2 | BR53,BR 54-B2/D1<br>BR55,BR 56 -A2/D1        |               |
| 0 - 2 - 5 (Note 1)      |                 |          | BR41,BR 42 -A1     | BR51,BR 52 -C2 | BR53,BR 54-B2/D1<br>BR55<br>-A2/D1           |               |
| 0 - 2 - 6 (Note 1)      |                 |          | BR41,BR 42 -A1     | BR51,BR 52 -C2 | BR53,BR 54-B2/D1<br>BR55,BR 56 -A2/D1        |               |



## Transmit Cabling Configurations

| Expansion Configuration | Sector 1      | Sector 2 |                   | Sector 3                                     |                                             | Reference     |
|-------------------------|---------------|----------|-------------------|----------------------------------------------|---------------------------------------------|---------------|
|                         | Ant 2 or 3    | Ant 2    | Ant 2 or 3        | Ant 2                                        | Ant 3                                       |               |
| 1 - 1 - 5 (Note 1)      | BR41 -B1      |          | BR42 -A1          | BR51,BR<br>52 -C2                            | BR53,BR<br>54-B2/D1<br>BR55<br>-A2/D1       |               |
| 1 - 1 - 6 (Note 1)      | BR41 -B1      |          | BR42 -A1          | BR51,BR<br>52 -C2                            | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 1 - 2 - 5 (Note 1)      | BR41 -B1      |          | BR42,BR<br>43 -A1 | BR51,BR<br>52 -C2                            | BR53,BR<br>54-B2/D1<br>BR55<br>-A2/D1       |               |
| 1 - 2 - 6 (Note 1)      | BR41 -B1      |          | BR42,BR<br>43 -A1 | BR51,BR<br>52 -C2                            | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 2 - 2 - 5 (Note 1)      | BR41,BR42 -B1 |          | BR43,BR<br>44 -A1 | BR51,BR<br>52 -C2                            | BR53,BR<br>54-B2/D1<br>BR55<br>-A2/D1       |               |
| 2 - 2 - 6 (Note 1)      | BR41,BR42 -B1 |          | BR43,BR<br>44 -A1 | BR51,BR<br>52 -C2                            | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 | See Figure 30 |
| 0 - 0 - 7 (Note 1)      |               |          |                   | BR41<br>-A1/E1<br>BR51,BR<br>52 -C2/E1       | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 0 - 0 - 8 (Note 1)      |               |          |                   | BR41,BR<br>42 -A1/E1<br>BR51,BR<br>52 -C2/E1 | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 0 - 1 - 7 (Note 1)      |               |          | BR41 -B1          | BR42<br>-A1/E1<br>BR51,BR<br>52 -C2/E1       | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 0 - 1 - 8 (Note 1)      |               |          | BR41 -B1          | BR42,BR<br>43 -A1/E1<br>BR51,BR<br>52 -C2/E1 | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 0 - 2 - 7 (Note 1)      |               |          | BR41,BR<br>42 -B1 | BR43<br>-A1/E1<br>BR51,BR<br>52 -C2/E1       | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 0 - 2 - 8 (Note 1)      |               |          | BR41,BR<br>42 -B1 | BR43,BR<br>44 -A1/E1<br>BR51,BR<br>52 -C2/E1 | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 1 - 1 - 7 (Note 1)      | BR41 -C1      |          | BR42 -B1          | BR43<br>-A1/E1<br>BR51,BR<br>52 -C2/E1       | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 1 - 1 - 8 (Note 1)      | BR41 -C1      |          | BR42 -B1          | BR43,BR<br>44 -A1/E1<br>BR51,BR<br>52 -C2/E1 | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |
| 1 - 2 - 7 (Note 1)      | BR41 -C1      |          | BR42,BR<br>43 -B1 | BR44<br>-A1/E1<br>BR51,BR<br>52 -C2/E1       | BR53,BR<br>54-B2/D1<br>BR55,BR<br>56 -A2/D1 |               |

**Transmit Cabling Configurations**

| Expansion Configuration | Sector 1      | Sector 2 |                                      | Sector 3                             |                                      | Reference     |
|-------------------------|---------------|----------|--------------------------------------|--------------------------------------|--------------------------------------|---------------|
|                         | Ant 2 or 3    | Ant 2    | Ant 2 or 3                           | Ant 2                                | Ant 3                                |               |
| 1 - 2 - 8 (Note 1)      | BR41 -C1      |          | BR42,BR43 -B1                        | BR44,BR45 -A1/E1<br>BR51,BR52 -C2/E1 | BR53,BR54 -B2/D1<br>BR55,BR56 -A2/D1 |               |
| 2 - 2 - 7 (Note 1)      | BR41,BR42 -C1 |          | BR43,BR44 -B1                        | BR45 -A1/E1<br>BR51,BR52 -C2/E1      | BR53,BR54 -B2/D1<br>BR55,BR56 -A2/D1 |               |
| 2 - 2 - 8 (Note 1)      | BR41,BR42 -C1 |          | BR43,BR44 -B1                        | BR45,BR46 -A1/E1<br>BR51,BR52 -C2/E1 | BR53,BR54 -B2/D1<br>BR55,BR56 -A2/D1 | See Figure 31 |
| 1 - 3 - 3 (Note 1)      | BR41 -C1      |          | BR42,BR43 -B1/E1<br>BR44 -A1/E1      |                                      | BR51,BR52 -B2/D1<br>BR53 -A2/D1      |               |
| 1 - 3 - 4 (Note 1)      | BR41 -C1      |          | BR42,BR43 -B1/E1<br>BR44 -A1/E1      |                                      | BR51,BR52 -B2/D1<br>BR53,BR54 -A2/D1 |               |
| 1 - 4 - 4 (Note 1)      | BR41 -C1      |          | BR42,BR43 -B1/E1<br>BR44,BR45 -A1/E1 |                                      | BR51,BR52 -B2/D1<br>BR53,BR54 -A2/D1 |               |
| 2 - 3 - 3 (Note 1)      | BR41,BR42 -C1 |          | BR43,BR44 -B1/E1<br>BR45 -A1/E1      |                                      | BR51,BR52 -B2/D1<br>BR53 -A2/D1      |               |
| 2 - 3 - 4 (Note 1)      | BR41,BR42 -C1 |          | BR43,BR44 -B1/E1<br>BR45 -A1/E1      |                                      | BR51,BR52 -B2/D1<br>BR53,BR54 -A2/D1 |               |
| 2 - 4 - 4 (Note 1)      | BR41,BR42 -C1 |          | BR43,BR44 -B1/E1<br>BR45,BR46 -A1/E1 |                                      | BR51,BR52 -B2/D1<br>BR53,BR54 -A2/D1 | See Figure 32 |
| 1 - 3 - 5 (Note 1)      | BR41 -C1      |          | BR42,BR43 -B1/E1<br>BR44 -A1/E1      | BR51, BR52-C2                        | BR53,BR54 -B2/D1<br>BR55 -A2/D1      |               |
| 1 - 3 - 6 (Note 1)      | BR41 -C1      |          | BR42,BR43 -B1/E1<br>BR44 -A1/E1      | BR51, BR52-C2                        | BR53,BR54 -B2/D1<br>BR55,BR56 -A2/D1 |               |
| 1 - 4 - 5 (Note 1)      | BR41 -C1      |          | BR42,BR43 -B1/E1<br>BR44,BR45 -A1/E1 | BR51, BR52-C2                        | BR53,BR54 -B2/D1<br>BR55 -A2/D1      |               |
| 1 - 4 - 6 (Note 1)      | BR41 -C1      |          | BR42,BR43 -B1/E1<br>BR44,BR45 -A1/E1 | BR51, BR52-C2                        | BR53,BR54 -B2/D1<br>BR55,BR56 -A2/D1 |               |
| 2 - 3 - 5 (Note 1)      | BR41,BR42 -C1 |          | BR43,BR44 -B1/E1<br>BR45 -A1/E1      | BR51, BR52-C2                        | BR53,BR54 -B2/D1<br>BR55 -A2/D1      |               |
| 2 - 3 - 6 (Note 1)      | BR41,BR42 -C1 |          | BR43,BR44 -B1/E1<br>BR45 -A1/E1      | BR51, BR52-C2                        | BR53,BR54 -B2/D1<br>BR55,BR56 -A2/D1 |               |

## Transmit Cabling Configurations

| Expansion Configuration | Sector 1                               | Sector 2 |                                        | Sector 3       |                                        | Reference     |
|-------------------------|----------------------------------------|----------|----------------------------------------|----------------|----------------------------------------|---------------|
|                         | Ant 2 or 3                             | Ant 2    | Ant 2 or 3                             | Ant 2          | Ant 3                                  |               |
| 2 - 4 - 5 (Note 1)      | BR41, BR42 -C1                         |          | BR43, BR44 -B1/E1<br>BR45, BR46 -A1/E1 | BR51, BR52-C2  | BR53, BR54 -B2/D1<br>BR55 -A2/D1       |               |
| 2 - 4 - 6 (Note 1)      | BR41, BR42 -C1                         |          | BR43, BR44 -B1/E1<br>BR45, BR46 -A1/E1 | BR51, BR52-C2  | BR53, BR54 -B2/D1<br>BR55, BR56 -A2/D1 | See Figure 33 |
| 3 - 3 - 3 (Note 1)      | BR41, BR42 -C1/F1<br>BR43 -B1/F1       |          | BR44, BR45 -A1/E1<br>BR51 -C2/E1       |                | BR52, BR53 -B2/D1<br>BR54 -A2/D1       |               |
| 3 - 3 - 4 (Note 1)      | BR41, BR42 -C1/F1<br>BR43 -B1/F1       |          | BR44, BR45 -A1/E1<br>BR51 -C2/E1       |                | BR52, BR53 -B2/D1<br>BR54, BR55 -A2/D1 |               |
| 3 - 4 - 4 (Note 1)      | BR41, BR42 -C1/F1<br>BR43 -B1/F1       |          | BR44, BR45 -A1/E1<br>BR51, BR52 -C2/E1 |                | BR53, BR54 -B2/D1<br>BR55, BR56 -A2/D1 |               |
| 4 - 4 - 4 (Note 1)      | BR41, BR42 -C1/F1<br>BR43, BR44 -B1/F1 |          | BR45, BR46 -A1/E1<br>BR51, BR52 -C2/E1 |                | BR53, BR54 -B2/D1<br>BR55, BR56 -A2/D1 | See Figure 34 |
| 0 - 3 - 3 (Note 1)      |                                        |          | BR41, BR42 -B1/E1<br>BR43 -A1/E1       |                | BR51, BR52 -B2/D1<br>BR53 -A2/D1       |               |
| 0 - 3 - 4 (Note 1)      |                                        |          | BR41, BR42 -B1/E1<br>BR43 -A1/E1       |                | BR51, BR52 -B2/D1<br>BR53, BR54 -A2/D1 |               |
| 0 - 4 - 4 (Note 1)      |                                        |          | BR41, BR42 -B1/E1<br>BR43, BR44 -A1/E1 |                | BR51, BR52 -B2/D1<br>BR53, BR54 -A2/D1 | See Figure 35 |
| 0 - 3 - 5 (Note 1)      |                                        |          | BR41, BR42 -B1/E1<br>BR43 -A1/E1       | BR51, BR52 -C2 | BR53, BR54 -B2/D1<br>BR55 -A2/D1       |               |
| 0 - 3 - 6 (Note 1)      |                                        |          | BR41, BR42 -B1/E1<br>BR43 -A1/E1       | BR51, BR52 -C2 | BR53, BR54 -B2/D1<br>BR55, BR56 -A2/D1 |               |

**Transmit Cabling Configurations**

| Expansion Configuration | Sector 1   | Sector 2          |                                                  | Sector 3                                       |                                                  | Reference     |
|-------------------------|------------|-------------------|--------------------------------------------------|------------------------------------------------|--------------------------------------------------|---------------|
|                         | Ant 2 or 3 | Ant 2             | Ant 2 or 3                                       | Ant 2                                          | Ant 3                                            |               |
| 0 - 4 - 5 (Note 1)      |            |                   | BR41, BR<br>42 -B1/E1<br>BR43,<br>BR44<br>-A1/E1 | BR51, BR<br>52 -C2                             | BR53, BR<br>54 -B2/D1<br>BR55<br>-A2/D1          |               |
| 0 - 4 - 6 (Note 1)      |            |                   | BR41, BR<br>42 -B1/E1<br>BR43,<br>BR44<br>-A1/E1 | BR51, BR<br>52 -C2                             | BR53, BR<br>54 -B2/D1<br>BR55, BR<br>56 -A2/D1   | See Figure 36 |
| 0 - 3 - 7 (Note 1)      |            |                   | BR41, BR<br>42 -C1/F1<br>BR43<br>-B1/F1          | BR44, BR<br>45 -A1/E1<br>BR51, BR<br>52 -C2/E1 | BR53, BR<br>54 -B2/D1<br>BR55<br>-A2/D1          |               |
| 0 - 3 - 8 (Note 1)      |            |                   | BR41, BR<br>42 -C1/F1<br>BR43<br>-B1/F1          | BR44, BR<br>45 -A1/E1<br>BR51, BR<br>52 -C2/E1 | BR53, BR<br>54 -B2/D1<br>BR55, BR<br>56 -A2/D1   |               |
| 0 - 4 - 7 (Note 1)      |            |                   | BR41, BR<br>42 -C1/F1<br>BR43, BR<br>44 -B1/F1   | BR45, BR<br>46 -A1/E1<br>BR51, BR<br>52 -C2/E1 | BR53, BR<br>54 -B2/D1<br>BR55<br>-A2/D1          |               |
| 0 - 4 - 8 (Note 1)      |            |                   | BR41, BR<br>42 -C1/F1<br>BR43, BR<br>44 -B1/F1   | BR45, BR<br>46 -A1/E1<br>BR51, BR<br>52 -C2/E1 | BR53, BR<br>54 -B2/D1<br>BR55, BR<br>56 -A2/D1   | See Figure 37 |
| 0 - 5 - 5 (Note 2)      |            | BR41,<br>BR42 -C1 | BR43, BR<br>44 -B1/E1<br>BR45<br>-A1/E1          | BR51,<br>BR52 -C2                              | BR53, BR<br>54 -B2/D1<br>BR55<br>-A2/D1          |               |
| 0 - 5 - 6 (Note 2)      |            | BR41,<br>BR42 -C1 | BR43, BR<br>44 -B1/E1<br>BR45<br>-A1/E1          | BR51,<br>BR52 -C2                              | BR53, BR<br>54 -B2/D1<br>BR55,<br>BR56<br>-A2/D1 |               |
| 0 - 6 - 6 (Note 2)      |            | BR41,<br>BR42 -C1 | BR43, BR<br>44 -B1/E1<br>BR45, BR<br>46 -A1/E1   | BR51,<br>BR52 -C2                              | BR53, BR<br>54 -B2/D1<br>BR55,<br>BR56<br>-A2/D1 | See Figure 38 |

**Notes:**

1. The basic multi-sector rack includes a triple 2 way combiner (A1/B1/C1) with isolators. When more than 2 BRs are used for any one sector in the multi-sector rack, an optional triple 2 way hybrid combiner without isolators (D1/E1/F1) is required. To get to 24 BR capacity with V03 and V06 a second expansion rack is required which includes a triple 2 way combiner (A2/B2/C2) with isolators.
2. For configurations with 5 or 6 BRs in a sector, the GEN4 Expansion rack is recommended instead of the Multi-sector Rack.

## Transmit Cabling Configurations

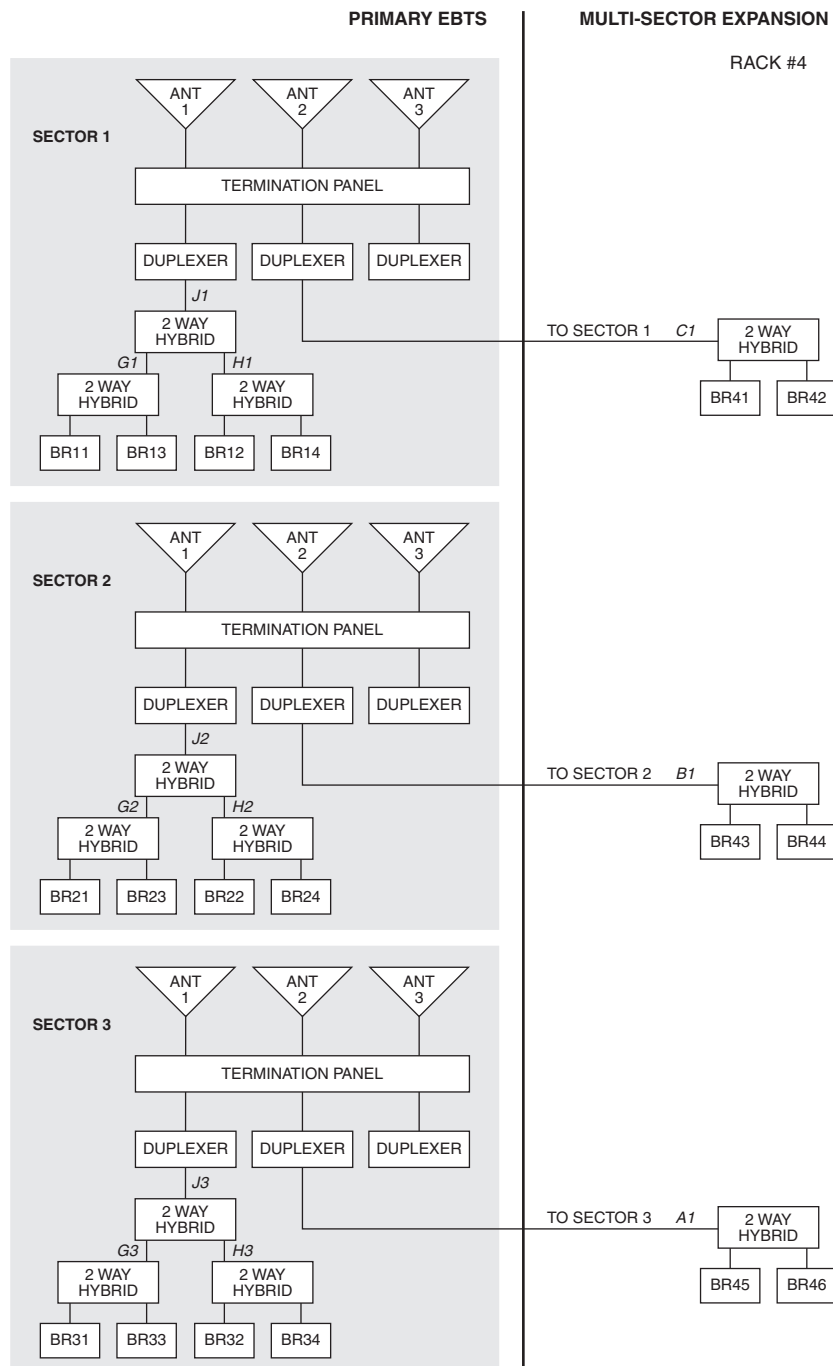


Figure 27 6-6-6 Configuration (2-2-2 Expansion)

## Transmit Cabling Configurations

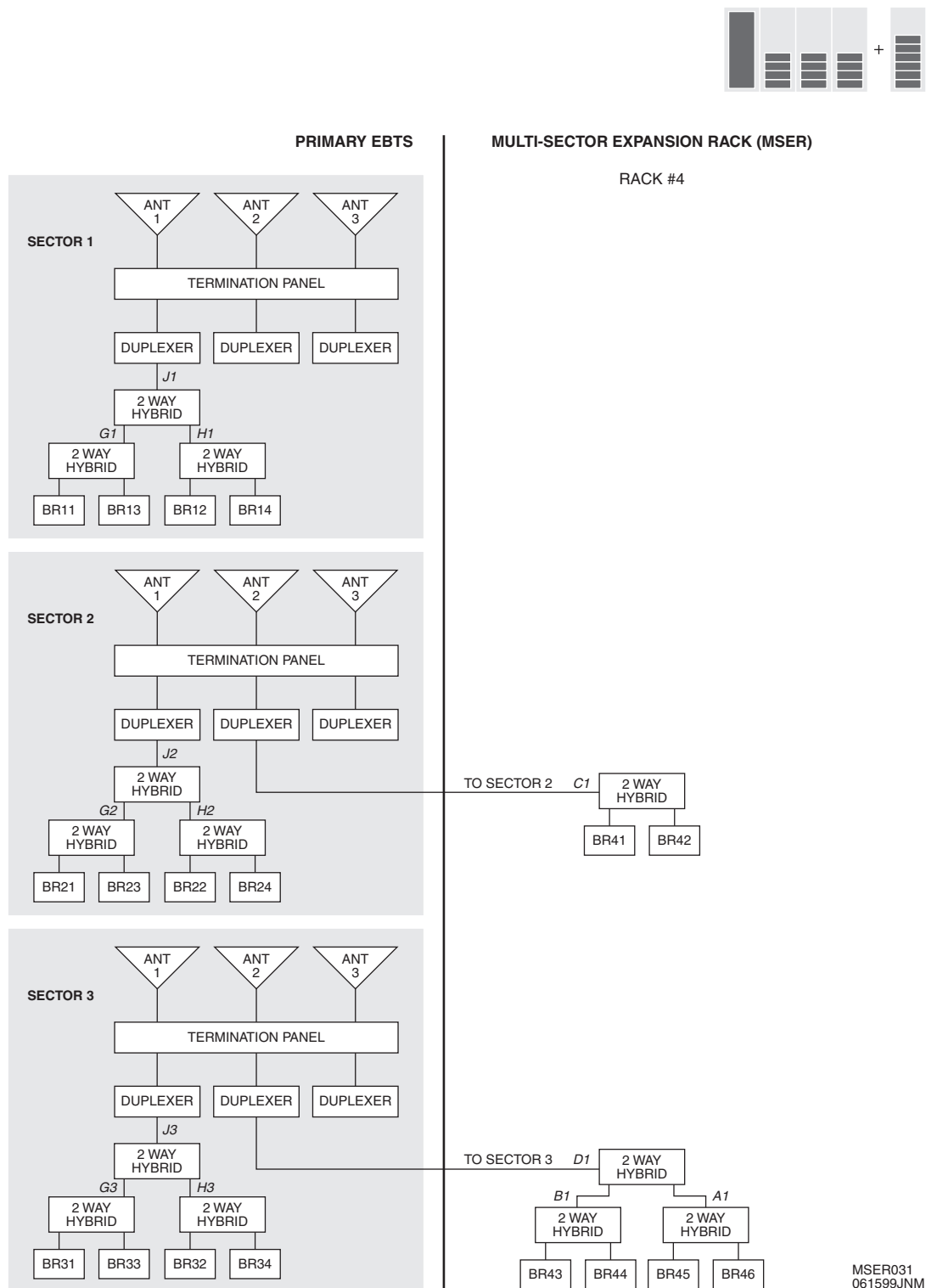


Figure 28 4-6-8 Configuration (0-2-4 Expansion)

## Transmit Cabling Configurations

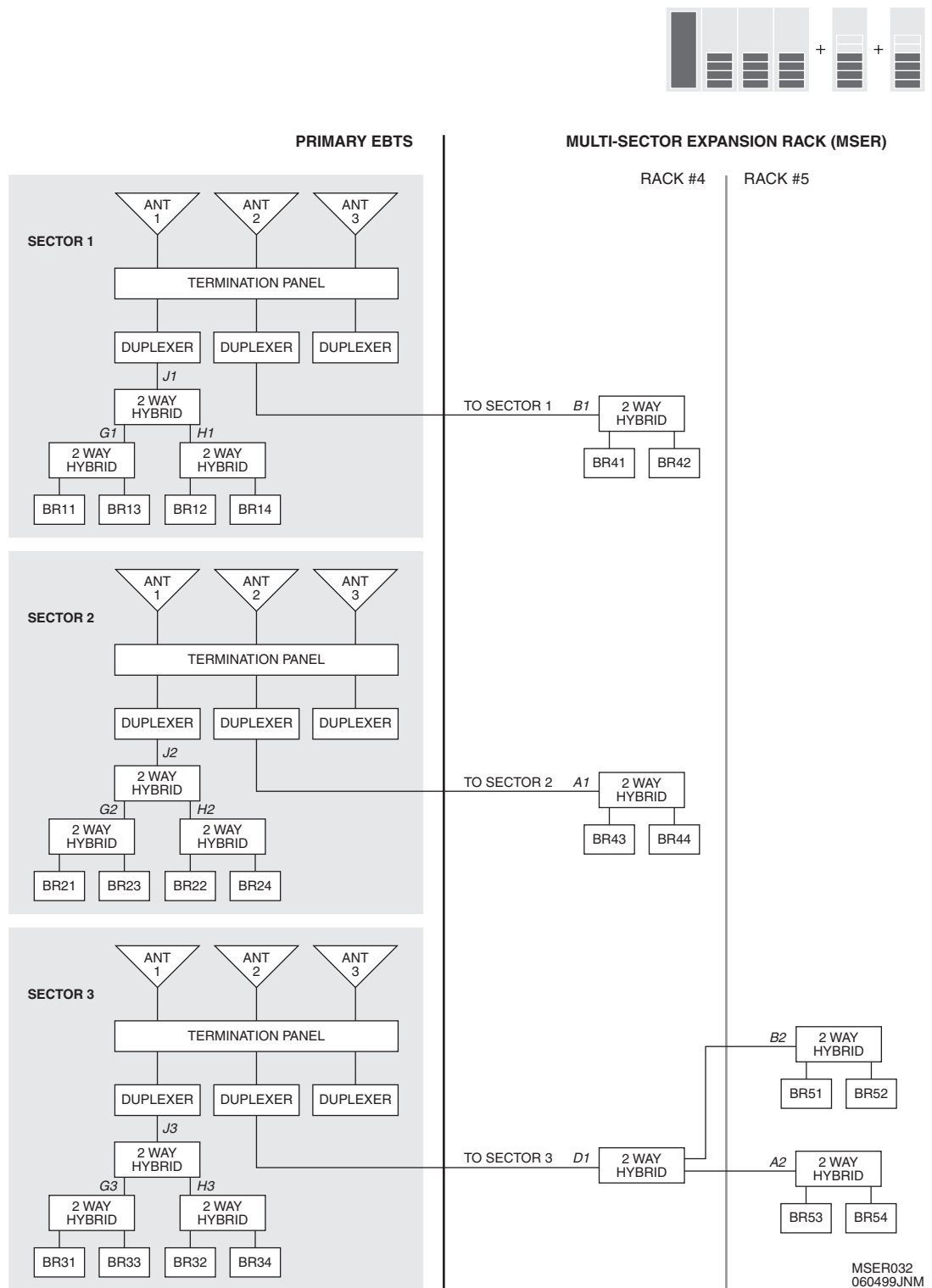


Figure 29 6-6-8 Configuration (2-2-4 Expansion)

## Transmit Cabling Configurations

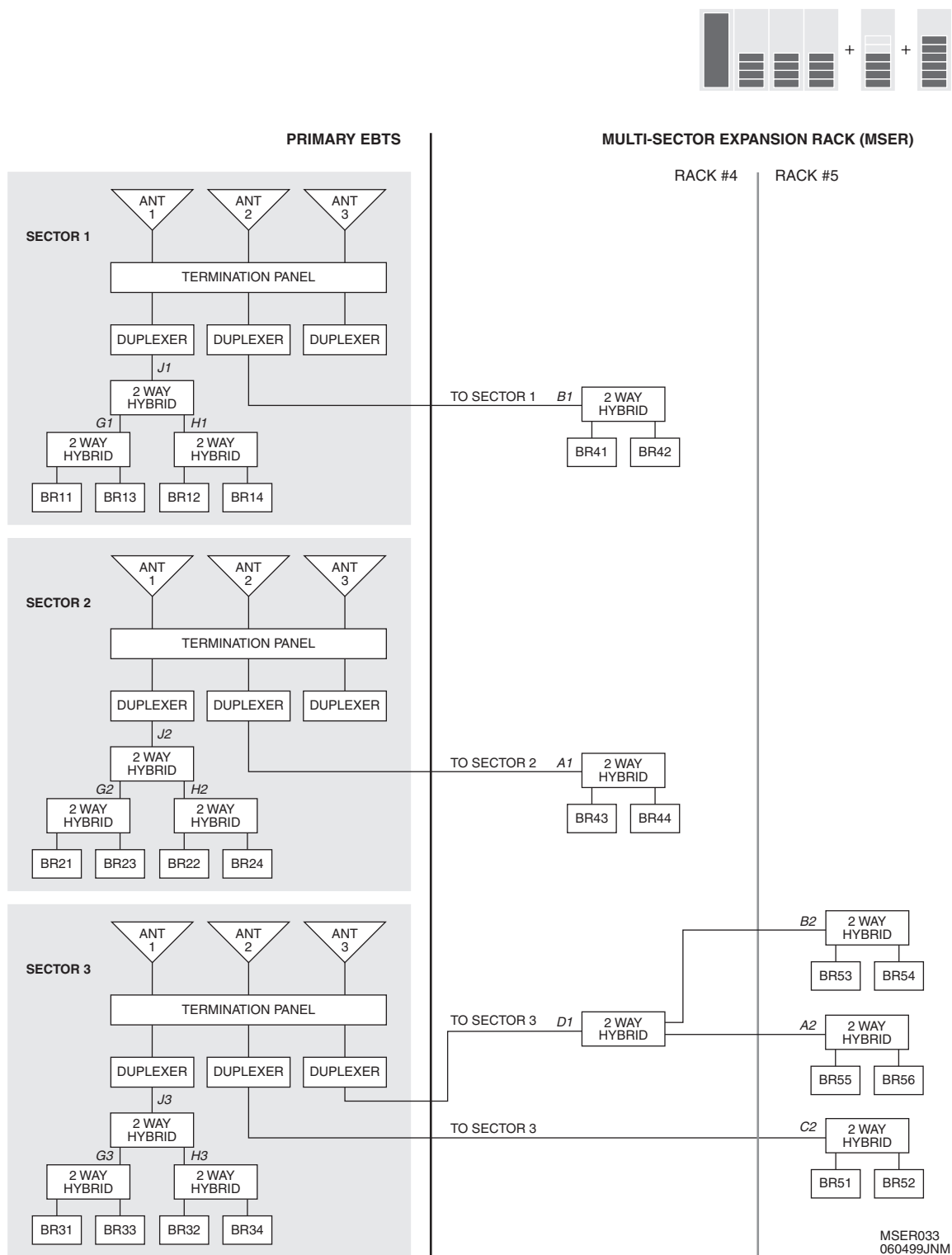


Figure 30 6-6-10 Configuration (2-2-6 Expansion)



## Transmit Cabling Configurations

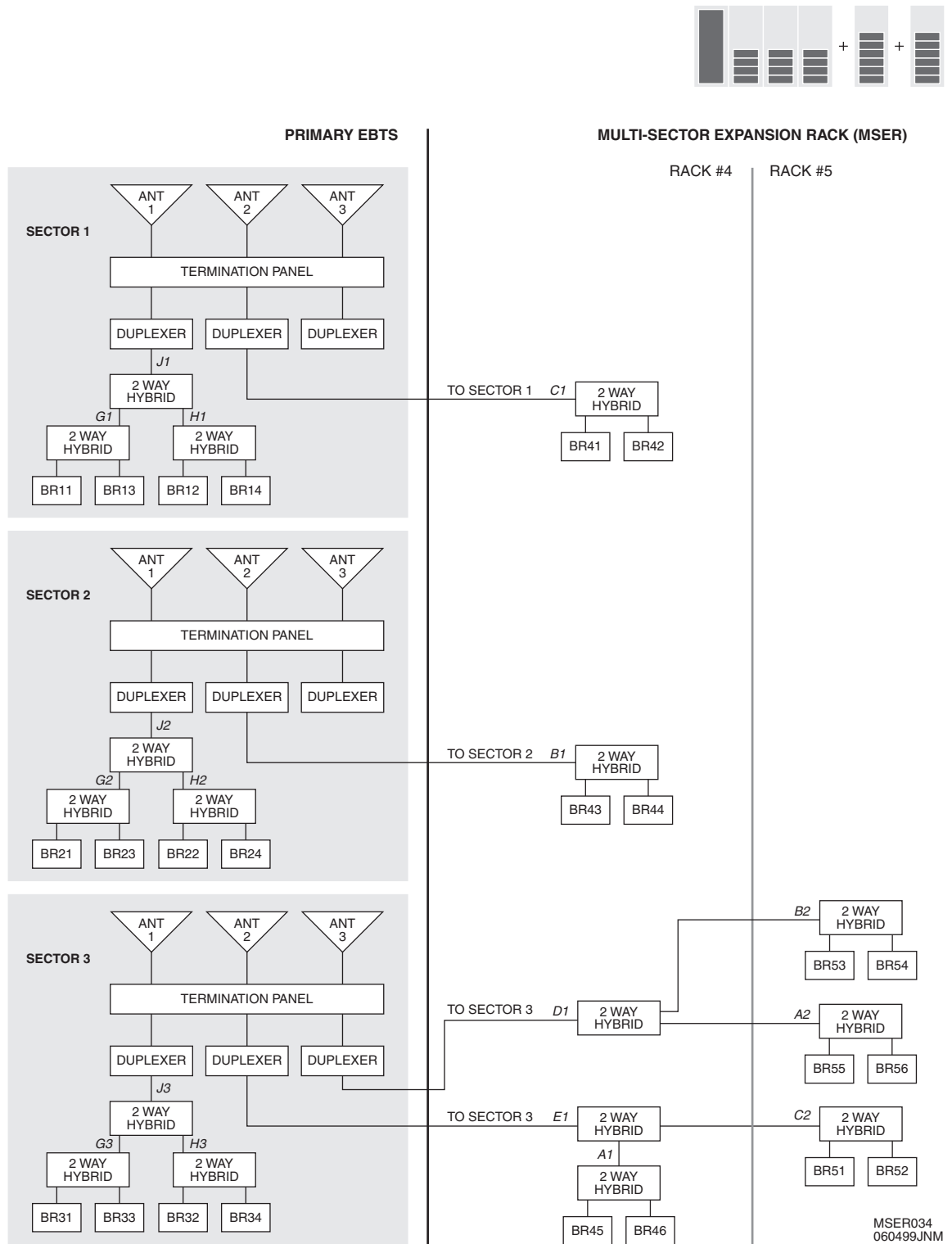


Figure 31 6-6-12 Configuration (2-2-8 Expansion)

## Transmit Cabling Configurations

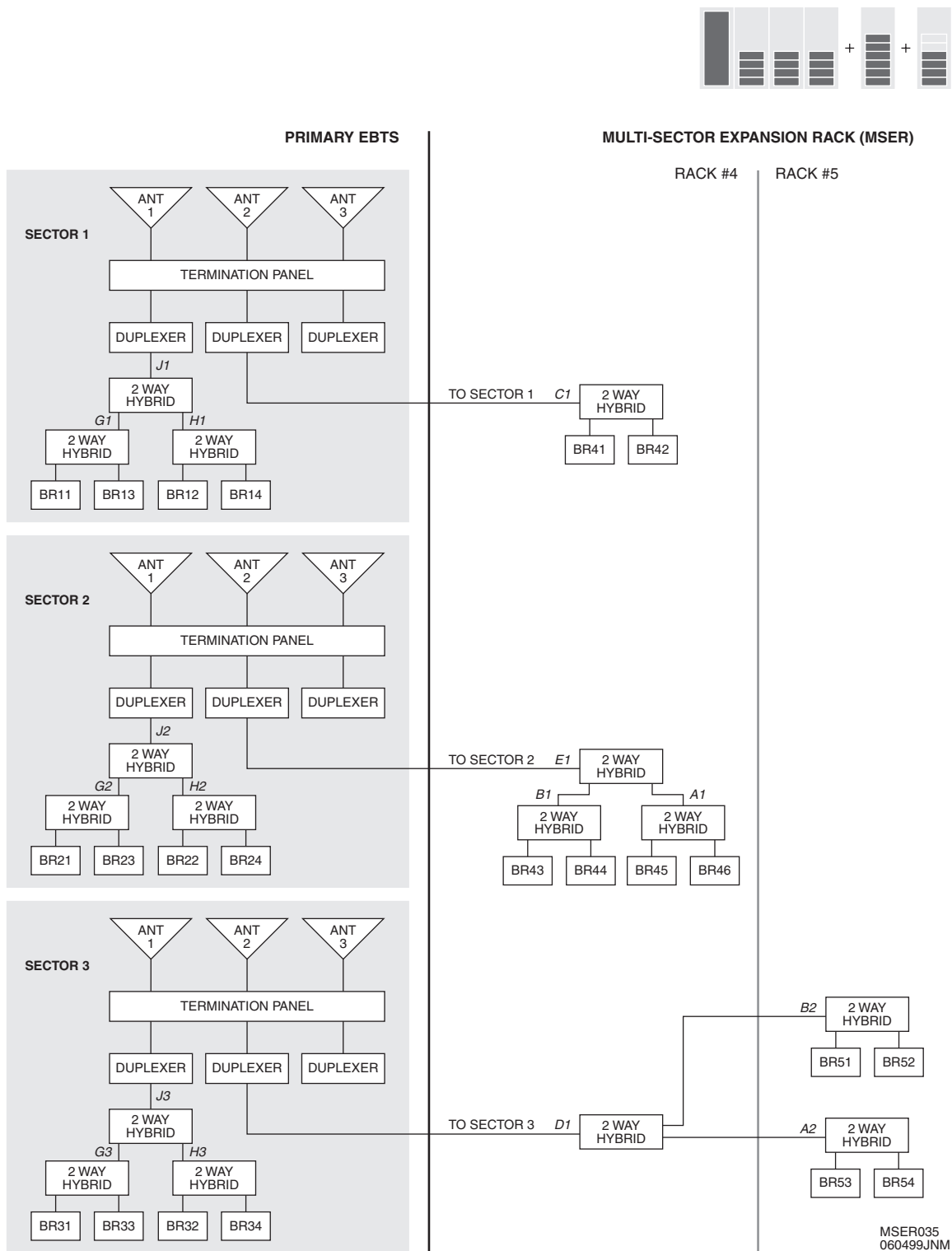


Figure 32 6-8-8 Configuration (2-4-4 Expansion)

## Transmit Cabling Configurations

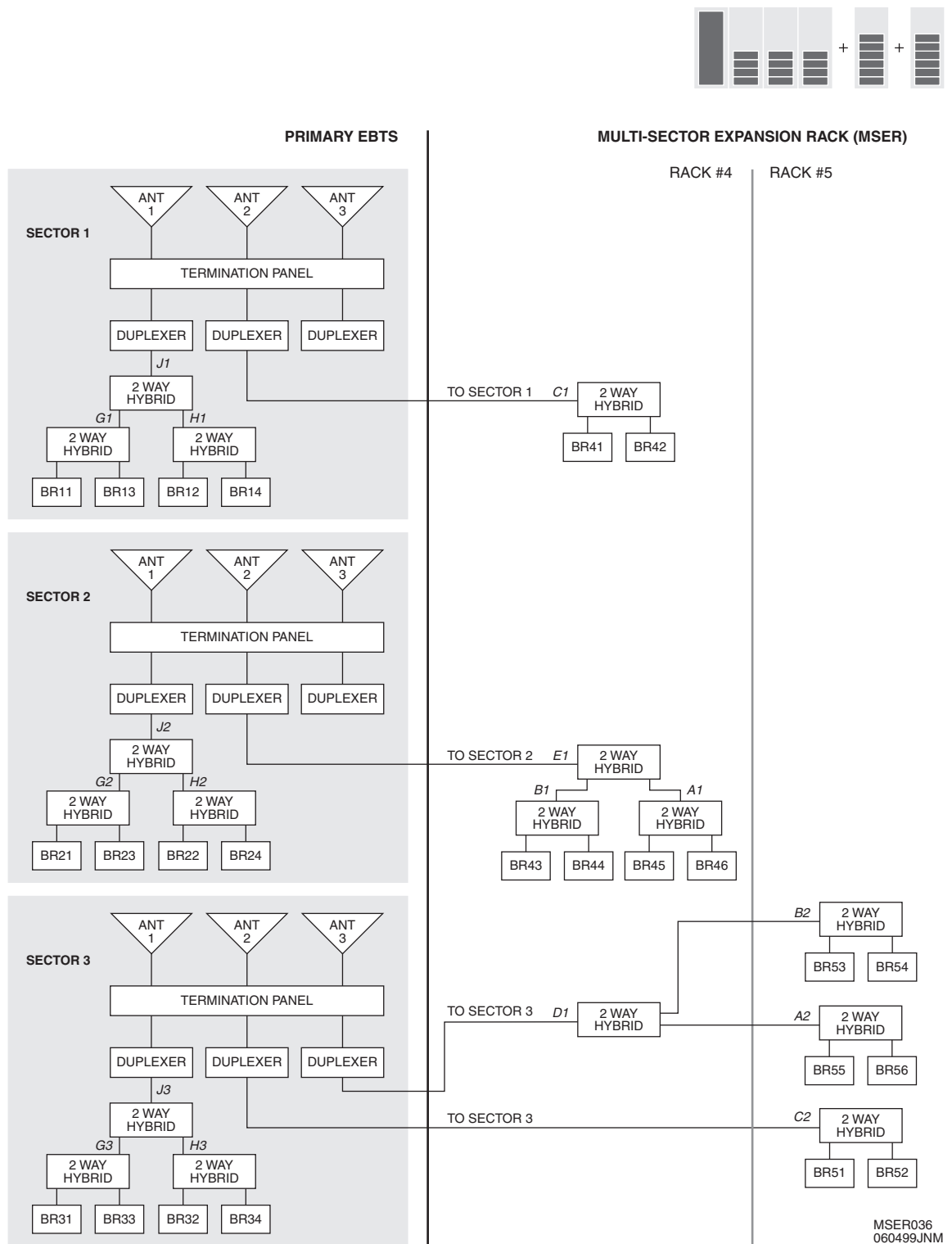


Figure 33 4-10-10 Configuration (2-4-6 Expansion)

## Transmit Cabling Configurations

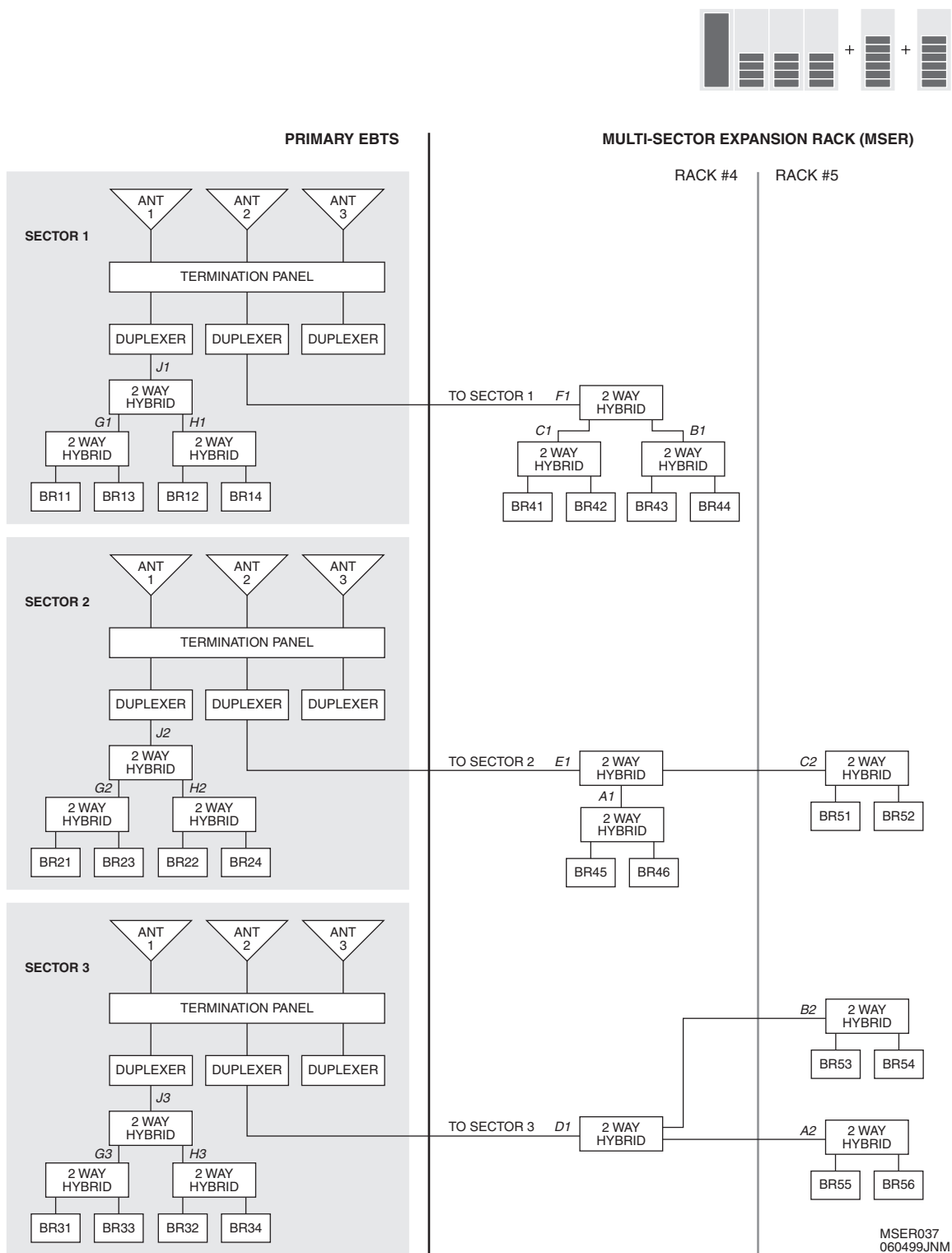


Figure 34 8-8-8 Configuration (4-4-4 Expansion)

## Transmit Cabling Configurations

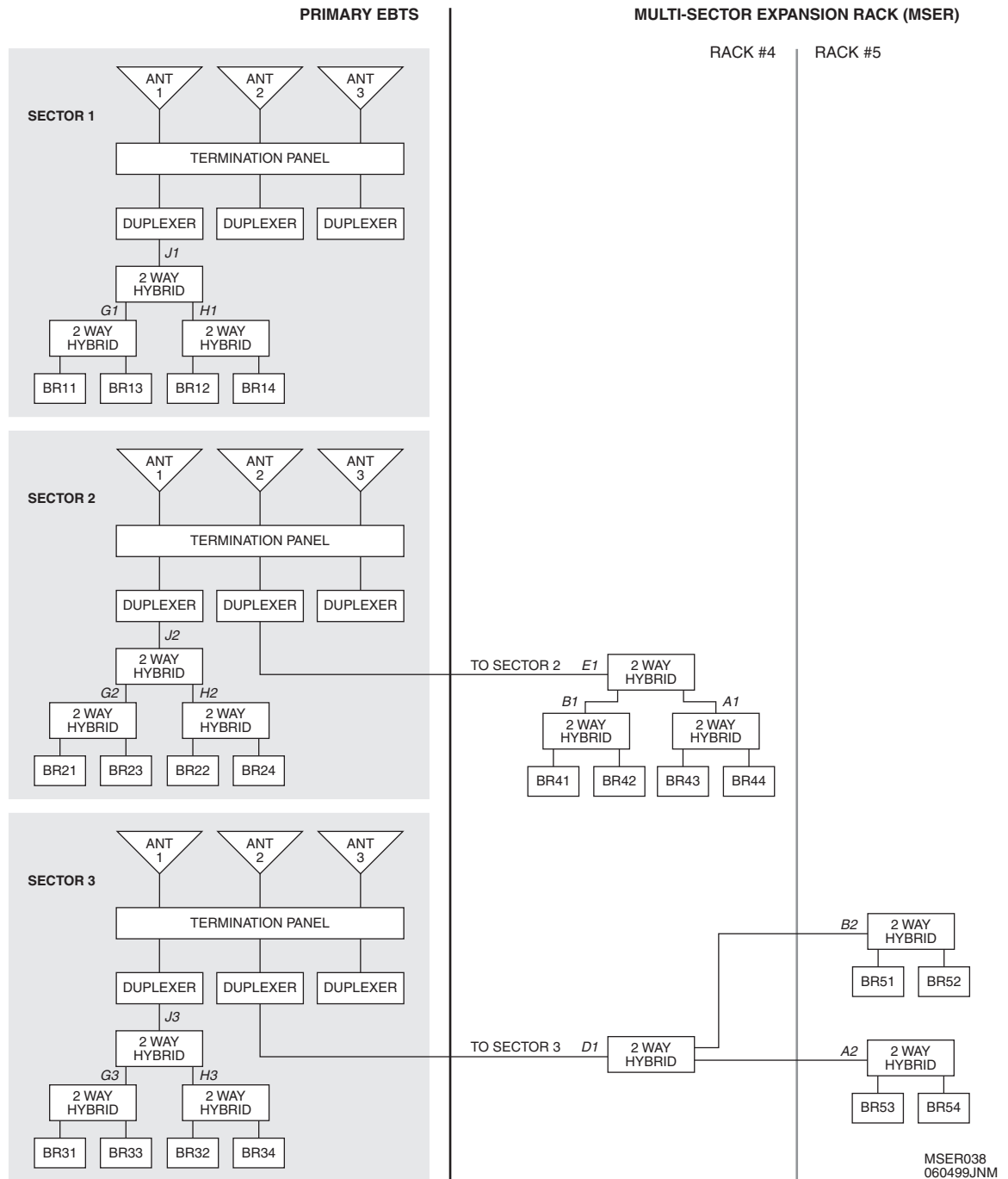


Figure 35 4-8-8 Configuration (0-4-4 Expansion)

## Transmit Cabling Configurations

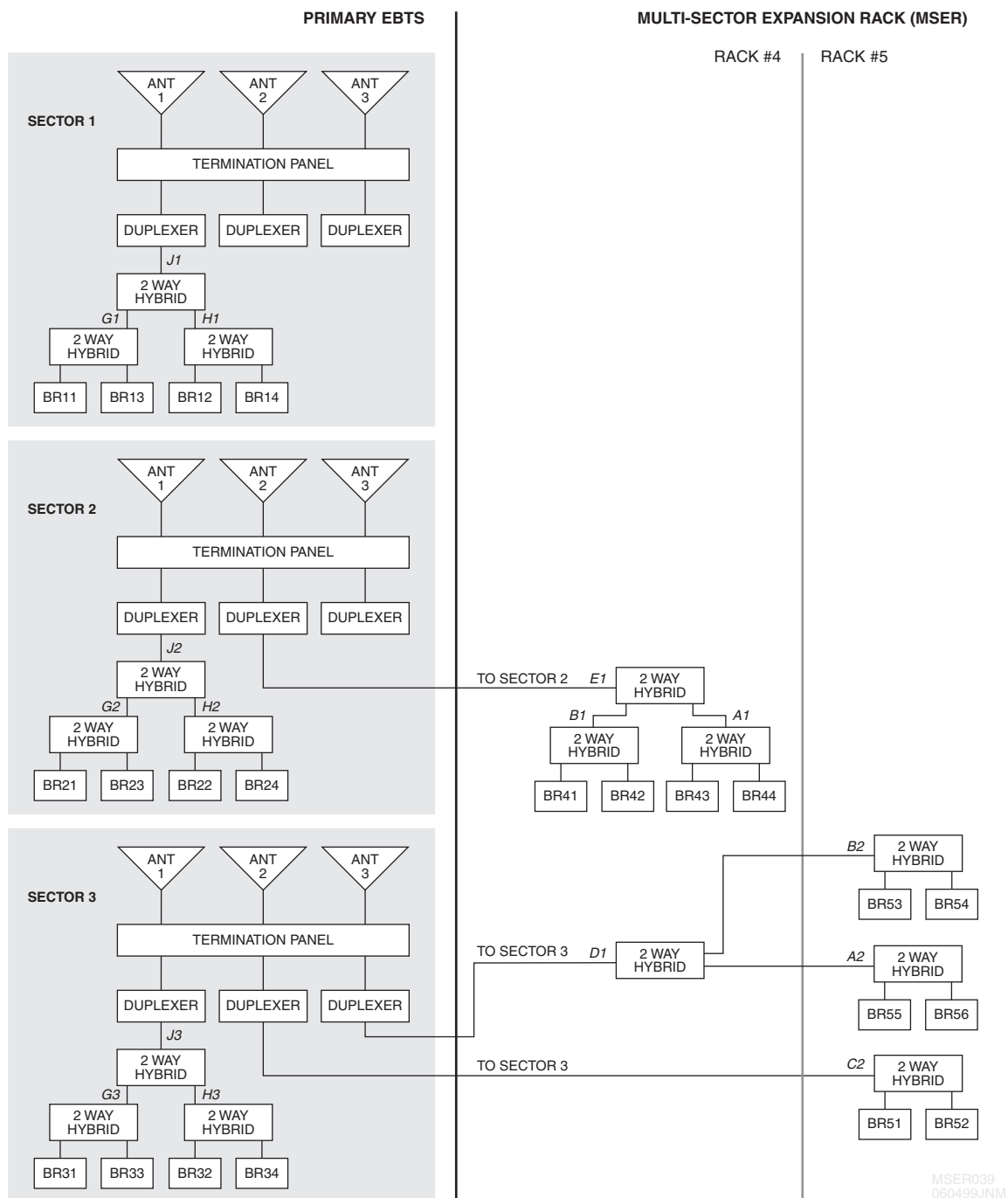


Figure 36 4-8-10 Configuration (0-4-6 Expansion)

## Transmit Cabling Configurations

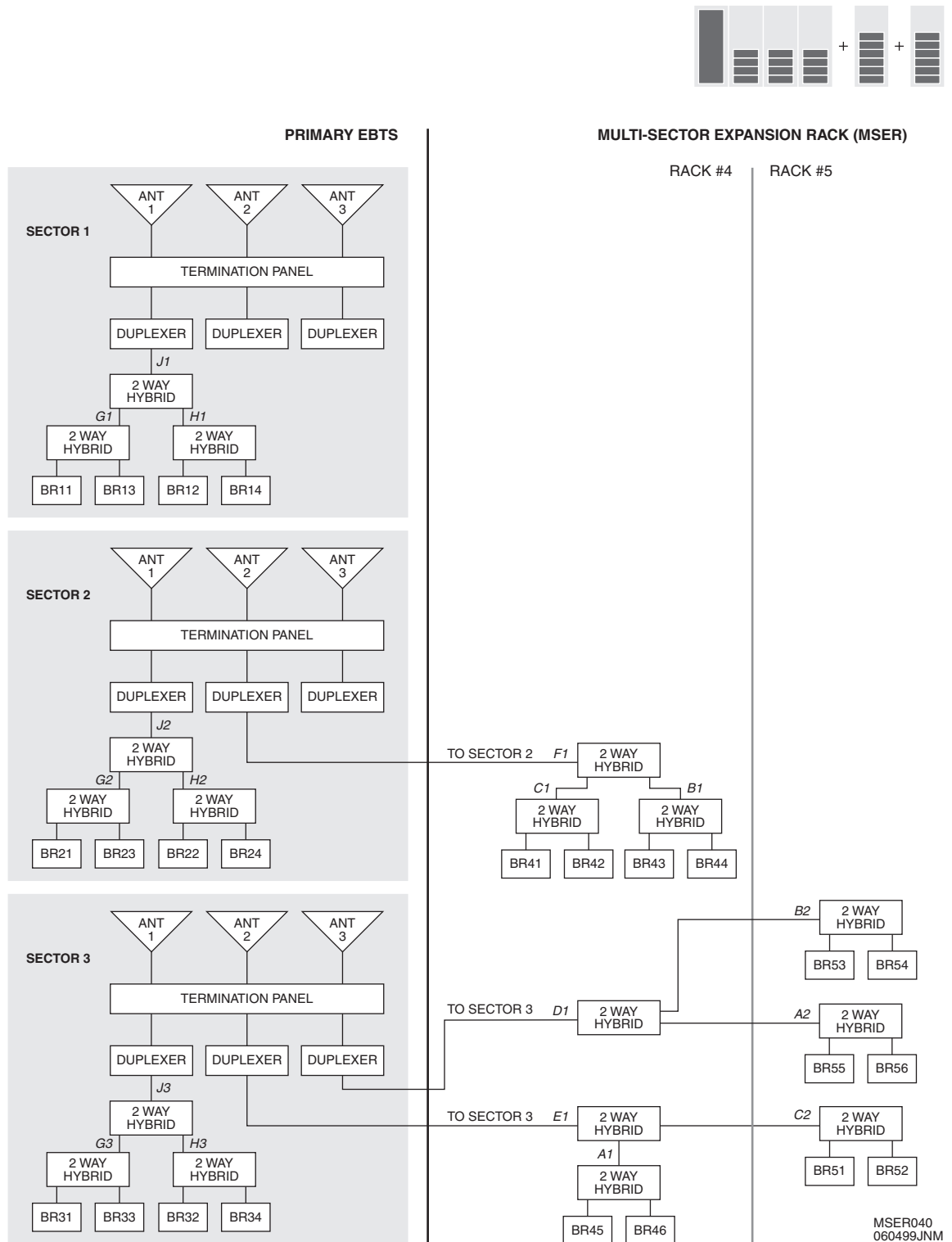


Figure 37 4-8-12 Configuration (0-4-8 Expansion)

## Transmit Cabling Configurations

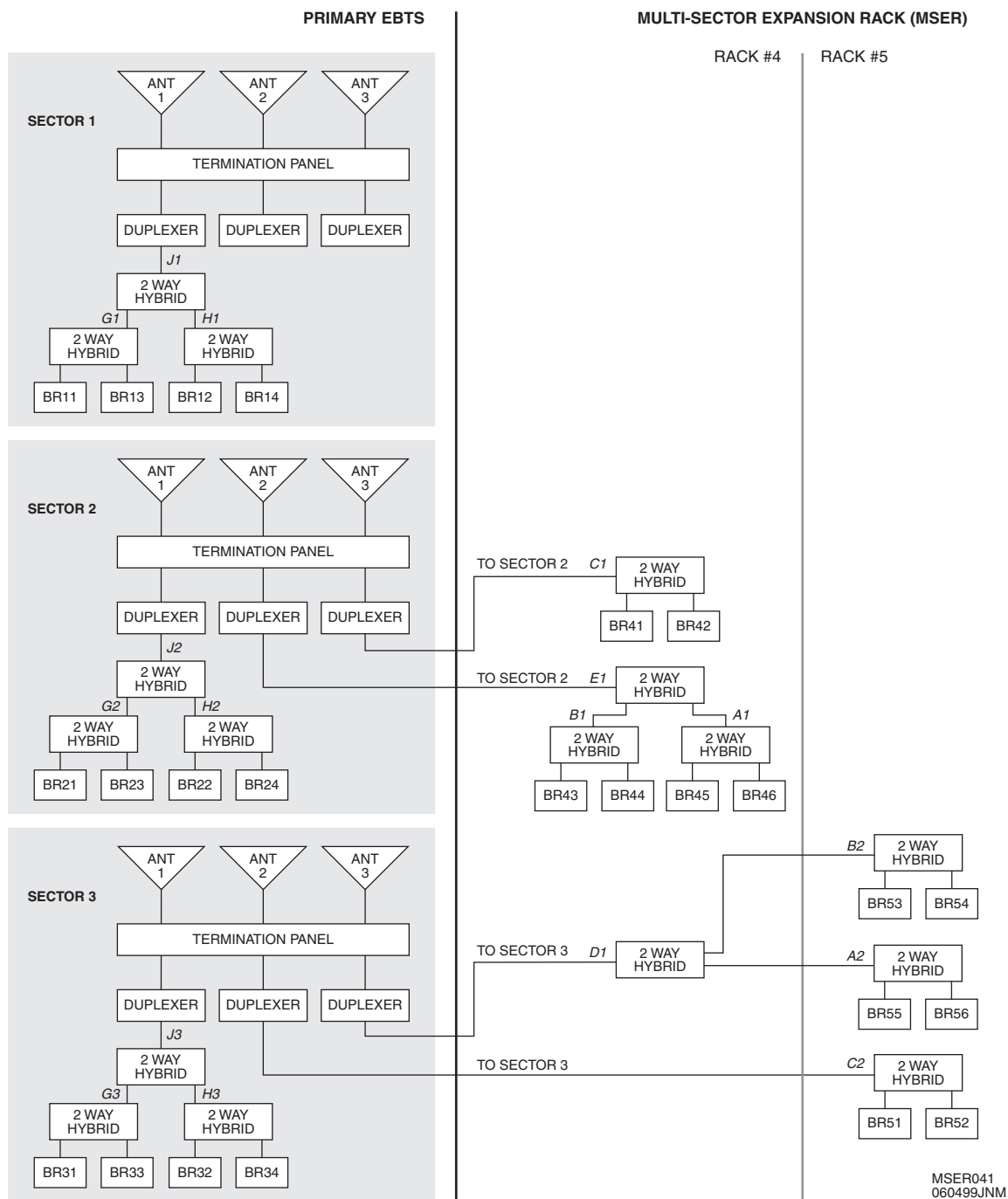


Figure 38 4-10-10 Configuration (0-6-6 Expansion)



## Intra-Cabinet Cabling Reference

This section provides reference information for the MSER intra-cabinet cabling. The word “intra” means *within*. The intra-cabinet cabling referenced in this section refers to the cabling within the MSER equipment made during the manufacturing process. Intra-cabinet cable connections are provided here for reference only and **are not** part of the installation procedure.

Refer to the Installation section of this manual for information related to inter-cabinet and site cabling procedures.

| Section             | Page | Description                                                                                                                                                                   |
|---------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Receiver Cabling    | 74   | Provides reference information for receiver cable connections between the receive expansion panel and multicoupler trays, and between the multicoupler trays and Base Radios. |
| 5 MHz/1 PPS Cabling | 76   | Provides reference information for 5 MHz/1 PPS cable connections between the Base Radios and junction panel.                                                                  |
| Ethernet Cabling    | 78   | Provides reference information for Ethernet cable connections between the Base Radios and junction panel.                                                                     |
| Alarm Cabling       | 80   | Provides reference information for the alarm cabling within the MSER cabinet.                                                                                                 |
| DC Power Cabling    | 82   | Provides reference information for the DC power (-48 VDC) cabling within the MSER cabinet.                                                                                    |
| Transmit Cabling    | 86   | Provides reference information for the transmit cable connections between the BRs and the transmit combiners.                                                                 |

## Intra-Cabinet Cabling Reference

## Receiver Cabling

Intra-cabinet receiver cabling varies significantly depending on the configuration used. The number of sectors and branch diversity used can have a significant impact on how the receiver inputs are routed and connected within the MSER cabinet. This section should provide a good understanding of the basic concepts by identified the sectorization and receive branch connections.

**NOTE**

The cabling configuration represented in the following table and illustration represents the factory default configurations. Be sure the receive cabling configuration used coincides with the transmit cabling configuration used.

| Index | P/N        | From                                                                            | To                                                                   | Notes                                                                                                                                                                                       |
|-------|------------|---------------------------------------------------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 3012028E23 | Rx Expansion Panel - Branch 1/Sector 1 through Branch 3/Sector 3 (see Detail B) | Input of Rx Multicouplers - Sector 1 through Sector 3 (see Detail C) | Quantity of cables is configuration dependent.<br>All active branches (Rx1 through Rx3) for each Rx multicoupler tray (Sector 1 through Sector 3) require an input from the primary system. |
| 2     | 3013943C28 | Output of Rx Multicouplers - Sector 2 and Sector 3 (see Detail A)               | BR6 and BR5 - Rx branch inputs (Rx1 through Rx3)                     | One cable is required for each Rx branch (Rx1 through Rx3) connection for every Base Radio.<br>BR numbers (BR1 through BR6) refer to position within the equipment rack.                    |
| 3     | 3013943C38 | Output of Rx Multicouplers - Sector 1 and Sector 3 (see Detail A)               | BR4 and BR3 - Rx branch inputs (Rx1 through Rx3)                     | One cable is required for each Rx branch (Rx1 through Rx3) connection for every Base Radio.<br>BR numbers (BR1 through BR6) refer to position within the equipment rack.                    |
| 4     | 3013943C41 | Output of Rx Multicouplers - Sector 1 and Sector 2 (see Detail A)               | BR2 and BR1 - Rx branch inputs (Rx1 through Rx3)                     | One cable is required for each Rx branch (Rx1 through Rx3) connection for every Base Radio.<br>BR numbers (BR1 through BR6) refer to position within the equipment rack.                    |

## Intra-Cabinet Cabling Reference

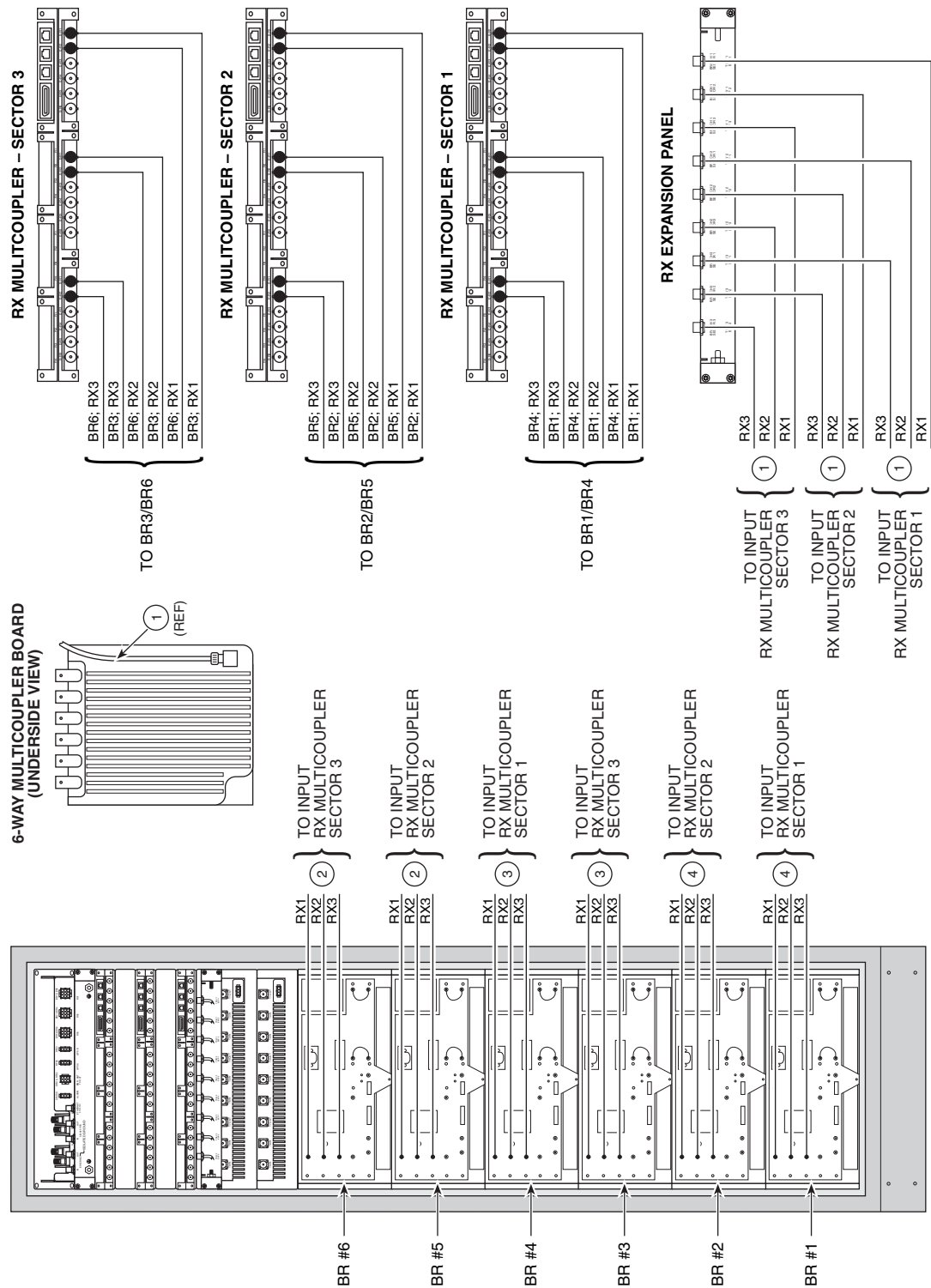
MSER025  
052799JNM

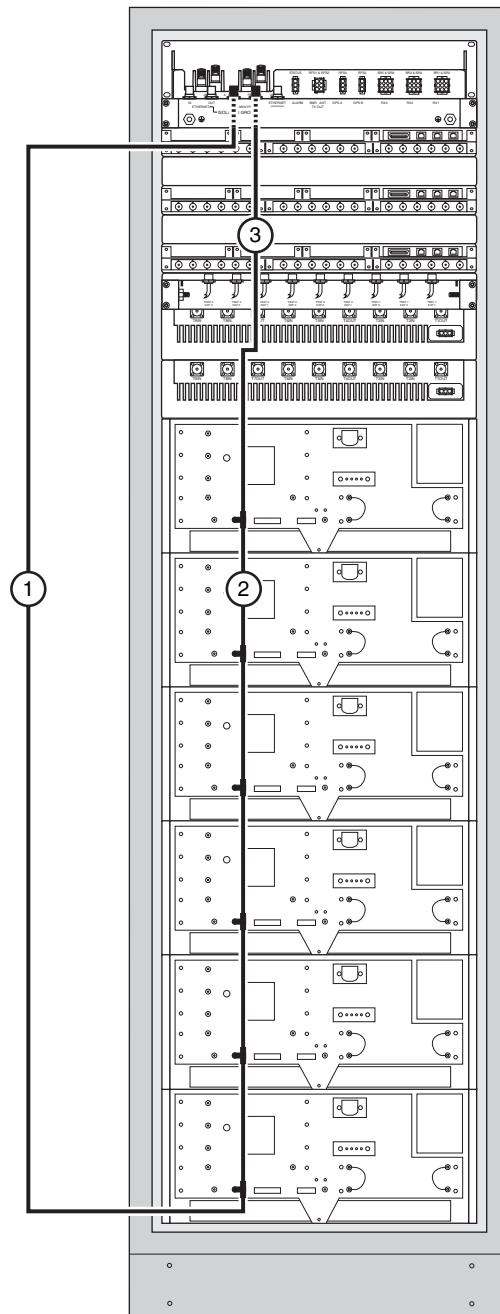
Figure 39 Intra-Cabinet Receiver Cabling

## Intra-Cabinet Cabling Reference

## 5 MHz/1 PPS Cabling

The 5 MHz/1 PPS cabling provides a timing reference signal to the Base Radios in the MSER. The signal is generated from the Gen 3 SC/iSC within the primary EBTS system and is fed to the MSER by way of the 5 MHz/1 PPS cabling. The 5 MHz/1 PPS cabling is routed from the primary EBTS cabinet to the junction panel on the MSER. This section provides information on the intra-cabinet cabling that supplies the MSER base radios with the timing reference signal.

| Index | P/N                              | From                                                                                                                       | To                                                                                                                         | Notes                                                                                                                                                             |
|-------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 3082004X03                       | Junction panel -<br>5 MHz/1 PPS IN connector                                                                               | BNC T-Adapter of (5MHZ/<br>1PPS A connector) BR1                                                                           |                                                                                                                                                                   |
| 2     | 0112004Z17<br>(or<br>3013943N19) | BNC T-Adapter (5MHZ/<br>1PPS A connector) of Base<br>Radio <i>n</i> -<br>(where " <i>n</i> " is the position of the<br>BR) | BNC T-Adapter of (5MHZ/<br>1PPS A connector) Base Radio<br><i>n</i> -<br>(where " <i>n</i> " is the position of the<br>BR) | This cable is used as a daisy-<br>chain between each BR. If<br>fewer than six BRs are used,<br>there are still six of these<br>cables daisy- chained<br>together. |
| 3     | 3082004X02                       | BNC T-Adapter of (5MHZ/<br>1PPS A connector) BR6                                                                           | Junction panel -<br>5 MHz/1 PPS OUT connector                                                                              | 5 MHz/1 PPS OUT<br>connector is terminated at<br>junction panel.                                                                                                  |

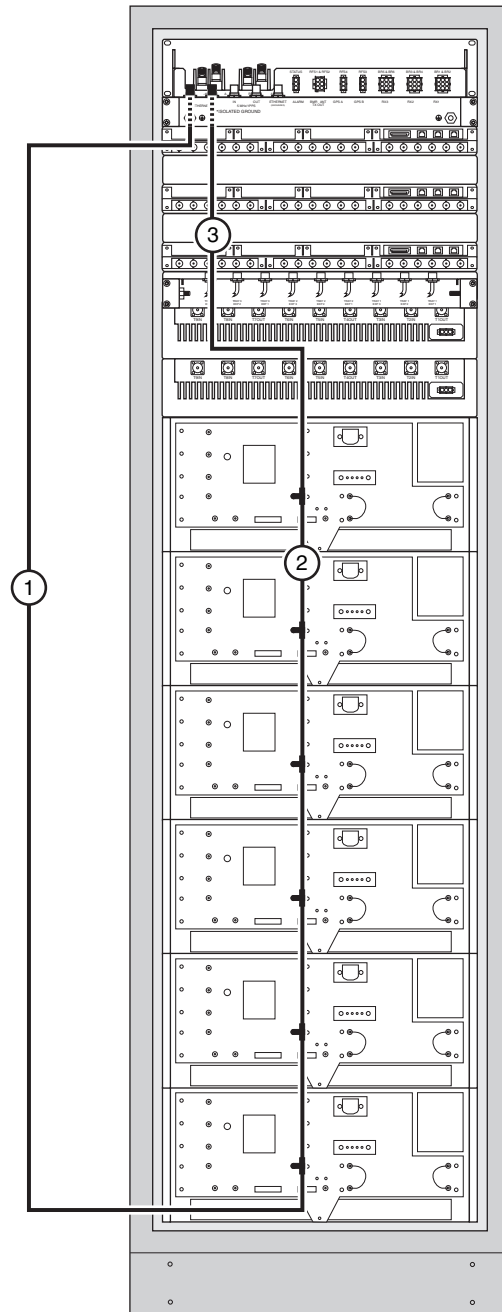


MSER023  
061599JNM

Figure 40 **Intra-Cabinet 5 MHz/1 PPS Cabling**

## Intra-Cabinet Cabling Reference

## Ethernet Cabling



MSER042  
061599JNM

Figure 41 **Intra-Cabinet Ethernet Cabling**

**Intra-Cabinet Cabling Reference**

The Ethernet cabling provides network connectivity to the Base Radios in the MSER. The MSER is connected to the primary network by way of the Ethernet inter-cabinet cabling. The Ethernet cabling is routed from the primary EBTS cabinet to the junction panel on the MSER. This section provides information on the intra-cabinet cabling that supplies the MSER base radios with network connectivity.

| Index | P/N                              | From                                                                                                                        | To                                                                                                                          | Notes                                                                                                                                                             |
|-------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 3082004X03                       | Junction panel -<br>ETHERNET IN connector                                                                                   | Base Radio -<br>BNC T-Adapter<br>(ETHERNET A connector)                                                                     |                                                                                                                                                                   |
| 2     | 0112004Z17<br>(or<br>3013943N19) | BNC T-Adapter<br>(ETHERNET A connector) of<br>BR <sub><i>n</i></sub> -<br>(where " <i>n</i> " is the position of the<br>BR) | BNC T-Adapter of<br>(ETHERNET A connector)<br>BR <sub><i>n</i></sub> -<br>(where " <i>n</i> " is the position of the<br>BR) | This cable is used as a daisy-<br>chain between each BR. If<br>fewer than six BRs are used,<br>there are still six of these<br>cables daisy- chained<br>together. |
| 3     | 3082004X02                       | BNC T-Adapter of<br>(ETHERNET A connector)<br>BR6                                                                           | Junction panel -<br>ETHERNET OUT connector                                                                                  | ETHERNET OUT connector<br>is terminated at junction<br>panel.                                                                                                     |

**Intra-Cabinet Cabling Reference****Alarm Cabling**

The alarm cabling within the MSER cabinet allows the EAS/iMU within the primary system to monitor the status of the MSER components. The alarms fed to the primary system are related to the performance of the RF components within the MSER rack, since it is comprised primarily of Base Radios, combiners, and multicouplers.

**3-Sector Configurations**

| Index | P/N        | From                                          | To                                                                                                           | Notes                                                                                                                                                                                                                                     |
|-------|------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 3082129X03 | Breaker panel - STATUS connector              | Multicoupler tray (Sector 1) - BREAKER STATUS ALARM connector                                                |                                                                                                                                                                                                                                           |
| 2     | 3084225N24 | Multicoupler tray (Sector 1) - ALARM STANDARD | Multicoupler tray (Sector 2) - BREAKER STATUS ALARM connector                                                | In order to sum the alarms from Sector 1 with Sector 2, a shorting jumper must be present on the Alarm card for the Sector 2 multicoupler tray.<br><br>Install the jumper (0984728L01) across pins 1 & 2 on P3001 of the alarm card.      |
| 3     | 3084225N24 | Multicoupler tray (Sector 2) - ALARM STANDARD | Multicoupler tray (Sector 3) - BREAKER STATUS ALARM connector                                                | In order to sum the alarms from Sectors 1 & 2 with Sector 3, a shorting jumper must be present on the Alarm card for the Sector 3 multicoupler tray.<br><br>Install the jumper (0984728L01) across pins 1 & 2 on P3001 of the alarm card. |
| 4     | 3084225N42 | Multicoupler tray (Sector 3) - ALARM STANDARD | External - RJ45 EXPANSION alarm input connector on Environmental Alarm System (EAS)/iDEN Monitor Unit (iMU)- | Use connector block (2882174W03), if necessary.                                                                                                                                                                                           |

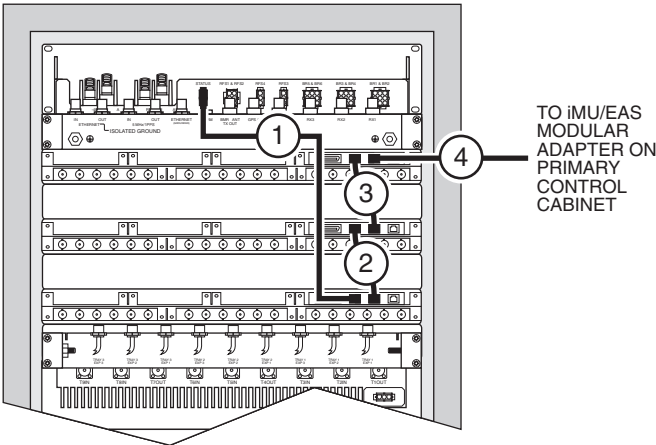
**2-Sector Configurations**

| Index | P/N        | From                                          | To                                                            | Notes                                                                                                                                                                                                                                |
|-------|------------|-----------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 3082129X03 | Breaker panel - STATUS connector              | Multicoupler tray (Sector 1) - BREAKER STATUS ALARM connector |                                                                                                                                                                                                                                      |
| 2     | 3084225N24 | Multicoupler tray (Sector 1) - ALARM STANDARD | Multicoupler tray (Sector 2) - BREAKER STATUS ALARM connector | In order to sum the alarms from Sector 1 with Sector 2, a shorting jumper must be present on the Alarm card for the Sector 2 multicoupler tray.<br><br>Install the jumper (0984728L01) across pins 1 & 2 on P3001 of the alarm card. |



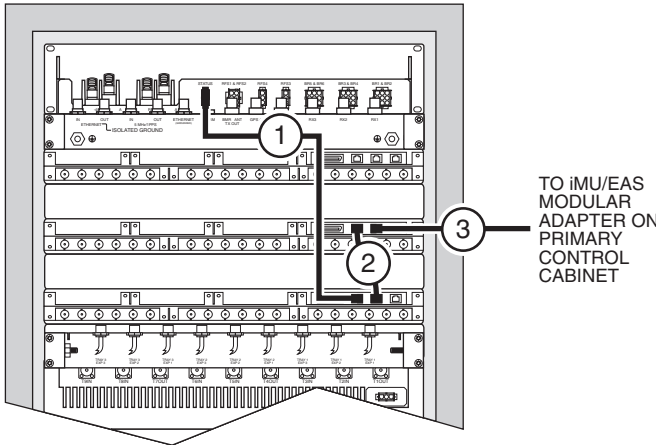
Intra-Cabinet Cabling Reference

| Index | P/N        | From                                          | To                                                                                  | Notes                                           |
|-------|------------|-----------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------|
| 3     | 3084225N42 | Multicoupler tray (Sector 2) - ALARM STANDARD | External - RJ45 EXPANSION alarm input connector on Environmental Alarm System (EAS) | Use connector block (2882174W03), if necessary. |



3-SECTOR CONFIGURATION

MSER021  
040401JNM



2-SECTOR CONFIGURATION

MSER022  
040401JNM

Figure 42 Intra-Cabinet Alarm Cabling

**Intra-Cabinet Cabling Reference****DC Power Cabling**

DC power cabling within the MSER cabinet is used to feed power to the multicoupler trays, fans, and base radios.

| Index | P/N        | From                                    | To                                                                                                                               | Notes            |
|-------|------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------|
| 1     | 3082050X02 | Power Distribution Panel - BR1 & BR2    | BR1 & BR2 - DC POWER connector                                                                                                   | Y-cable assembly |
| 2     | 3082050X01 | Power Distribution Panel - BR3 & BR4    | BR3 & BR4 - DC POWER connector                                                                                                   | Y-cable assembly |
| 3     | 3082050X01 | Power Distribution Panel - BR5 & BR6    | BR5 & BR6 - DC POWER connector                                                                                                   | Y-cable assembly |
| 4     | 3082129X04 | Power Distribution Panel - RFS1 & RFS2  | Multicoupler tray (Sector 1) - -48 VDC Mate-N-Lok connector                                                                      |                  |
| 5     | 3082565Y01 | Power Distribution Panel - RFS3 & RFS4  | 1) Multicoupler tray (Sector 2) - -48 VDC Mate-N-Lok connector<br>2) Multicoupler tray (Sector 3) - -48 VDC Mate-N-Lok connector |                  |
| 6     | 3082129X02 | Multicoupler tray "Fan Power" connector | Combiner tray fans                                                                                                               |                  |

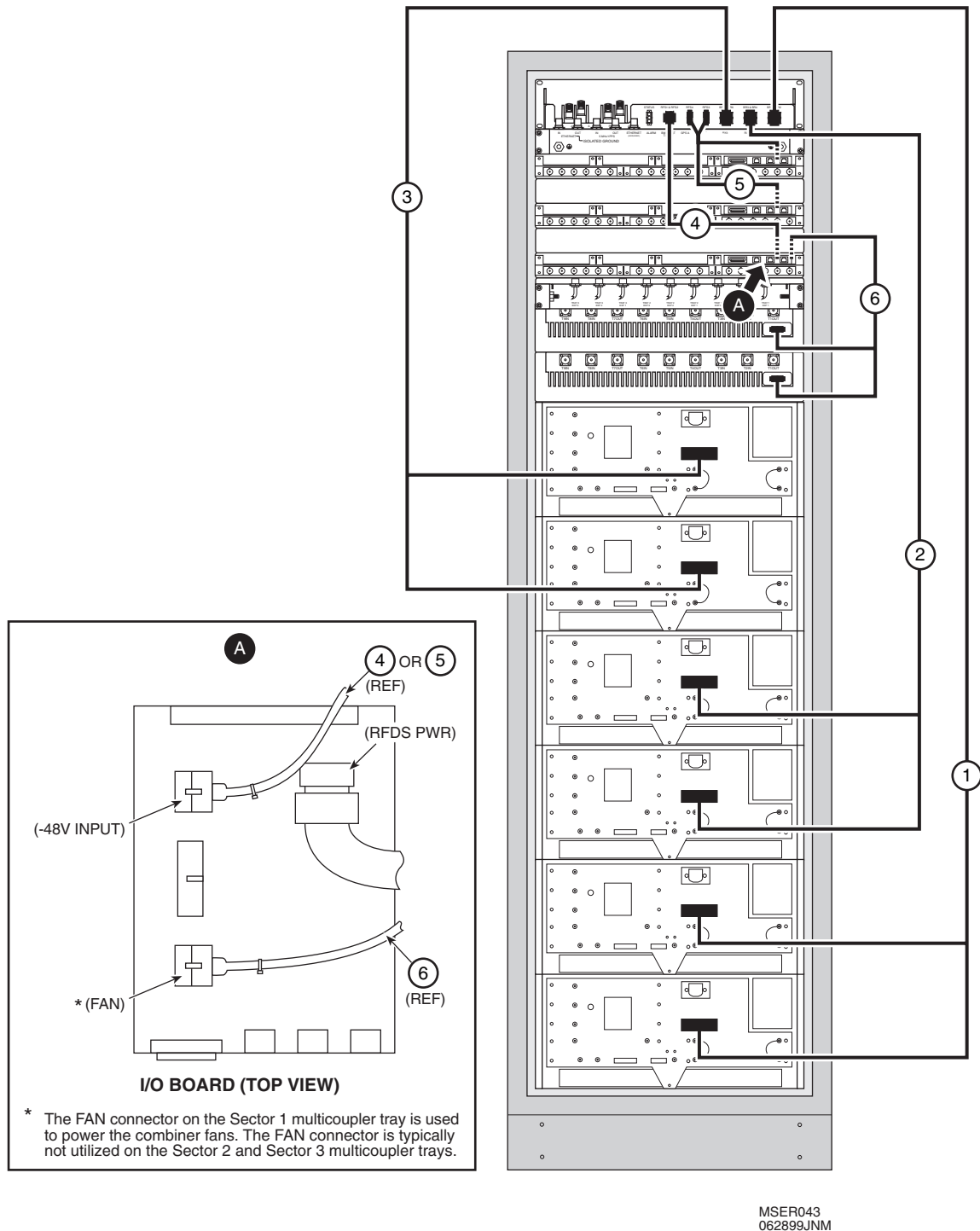
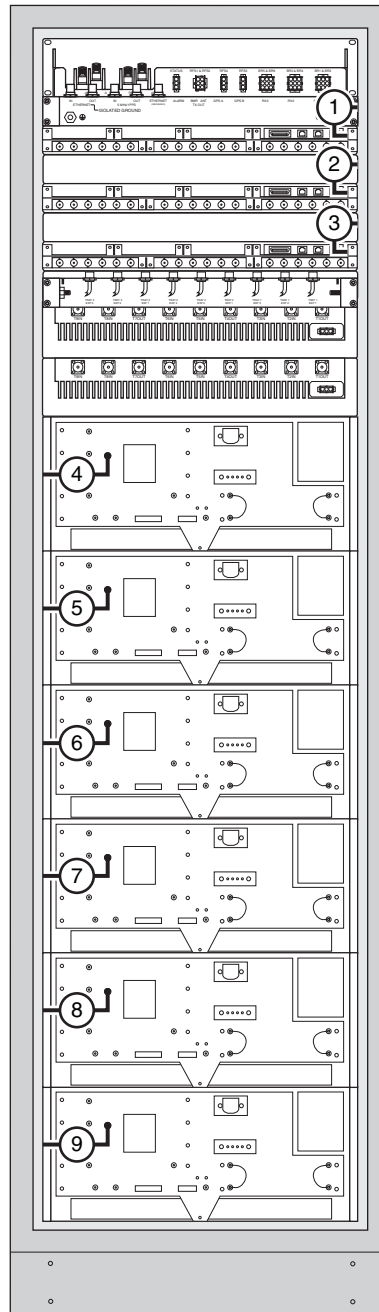


Figure 43 Intra-Cabinet DC Power Cabling

**Intra-Cabinet Cabling Reference****Cabinet Ground**

Each component mounted within the MSER cabinet must be grounded to the equipment cabinet chassis. The ground connections identified here are made during manufacturing are listed here for reference only. The MSER equipment cabinet is connected to the site ground during the installation procedure.

| Index | P/N       | From                                                | To                                     | Notes                                          |
|-------|-----------|-----------------------------------------------------|----------------------------------------|------------------------------------------------|
| 1     | 308200X02 | Rx Multicoupler Tray (Sector 3)<br>-<br>ground stud | Equipment cabinet - grounding hardware | Applies only to configurations using Sector 3. |
| 2     | 308200X02 | Rx Multicoupler Tray (Sector 2)<br>-<br>ground stud | Equipment cabinet - grounding hardware | Applies only to configurations using Sector 2. |
| 3     | 308200X02 | Rx Multicoupler Tray (Sector 1)<br>-<br>ground stud | Equipment cabinet - grounding hardware |                                                |
| 4     | 308200X04 | BR6 -<br>GROUND connector                           | Equipment cabinet - grounding hardware | Applies only to configurations using BR6.      |
| 5     | 308200X04 | BR5 -<br>GROUND connector                           | Equipment cabinet - grounding hardware | Applies only to configurations using BR5.      |
| 6     | 308200X04 | BR4 -<br>GROUND connector                           | Equipment cabinet - grounding hardware | Applies only to configurations using BR4.      |
| 7     | 308200X04 | BR3 -<br>GROUND connector                           | Equipment cabinet - grounding hardware | Applies only to configurations using BR3.      |
| 8     | 308200X04 | BR2 -<br>GROUND connector                           | Equipment cabinet - grounding hardware | Applies only to configurations using BR2.      |
| 9     | 308200X04 | BR1 -<br>GROUND connector                           | Equipment cabinet - grounding hardware |                                                |



MSER024  
052699JNM

Figure 44 **Intra-Cabinet Ethernet Cabling**

## Intra-Cabinet Cabling Reference

## Transmit Cabling

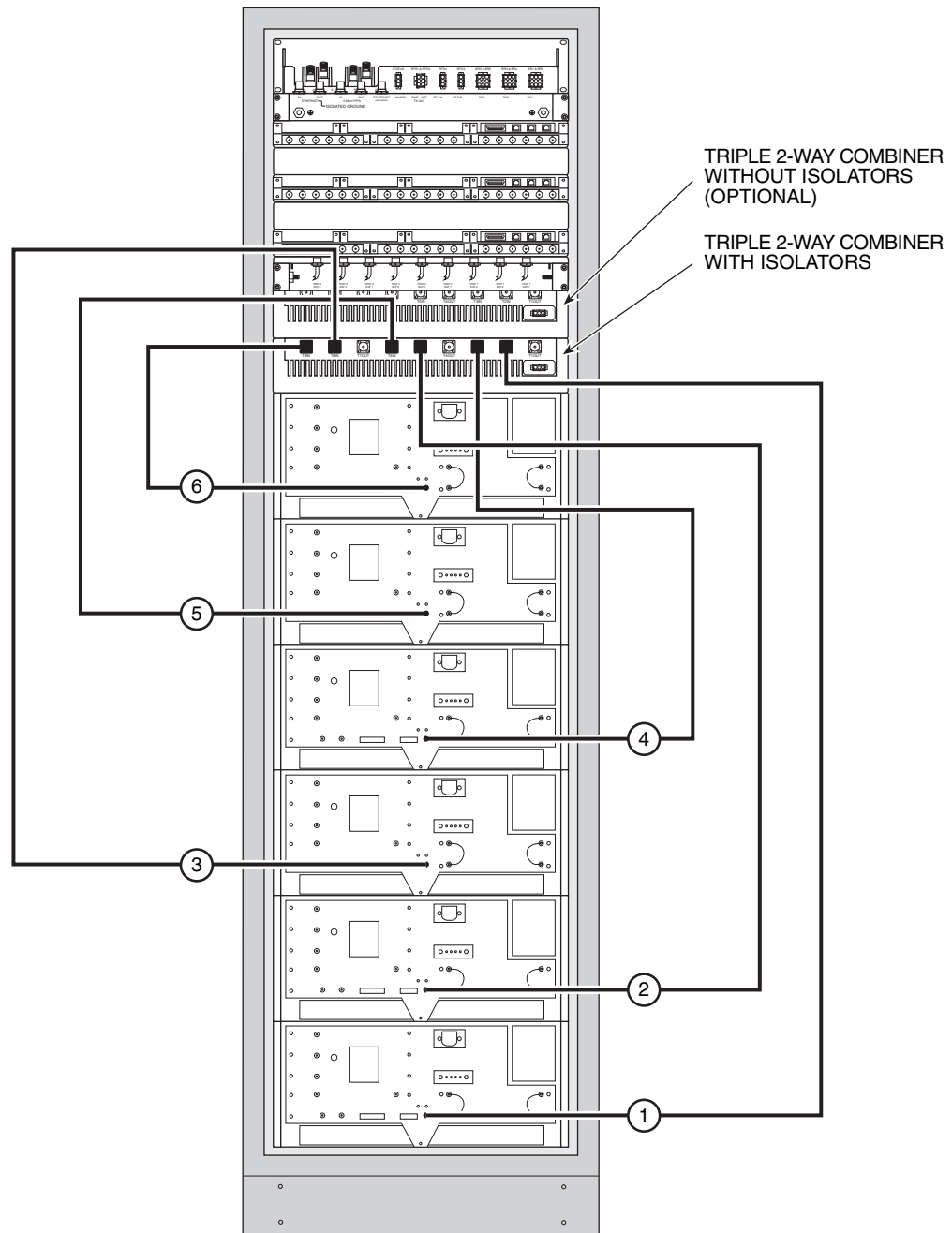
Intra-cabinet transmit cabling, like the intra-cabinet receiver cabling, varies significantly depending on the configuration used. The number of sectors and Base Radio loading within each sector can have a significant impact on how the intra-cabinet cabling connections are made within the MSER cabinet. All intra-cabinet transmit cabling is connected between the power amplifier outputs of each Base Radio to the appropriate combiner. Depending on the configuration of the primary and expansion systems, either one or two combiners may be involved in those connections.

This section provides general information concerning the intra-cabinet transmit cabling. Transmit Cabling Configurations on page 50 provides examples of various field configurations that may be utilized.

**NOTE**

The cabling configuration represented in the following table and illustration represents the factory default configuration. Be sure the transmit cabling configuration used coincides with the receive cabling configuration used.

| Index | P/N        | From                   | To                                                                                                    | Notes                                                                                                    |
|-------|------------|------------------------|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| 1     | 3013942K40 | BR1 - PA OUT connector | Appropriate input port on the standard combiner (with isolators) - Default factory connection = T2 IN | See Transmit Cabling Configurations on page 50 for detailed information on configuring transmit cabling. |
| 2     | 3013942K40 | BR2 - PA OUT connector | Appropriate input port on the standard combiner (with isolators) - Default factory connection = T5 IN | See Transmit Cabling Configurations on page 50 for detailed information on configuring transmit cabling. |
| 3     | 3013942K37 | BR3 - PA OUT connector | Appropriate input port on the standard combiner (with isolators) - Default factory connection = T8 IN | See Transmit Cabling Configurations on page 50 for detailed information on configuring transmit cabling. |
| 4     | 3013942K37 | BR4 - PA OUT connector | Appropriate input port on the standard combiner (with isolators) - Default factory connection = T3 IN | See Transmit Cabling Configurations on page 50 for detailed information on configuring transmit cabling. |
| 5     | 3013942K32 | BR5 - PA OUT connector | Appropriate input port on the standard combiner (with isolators) - Default factory connection = T6 IN | See Transmit Cabling Configurations on page 50 for detailed information on configuring transmit cabling. |
| 6     | 3013942K32 | BR6 - PA OUT connector | Appropriate input port on the standard combiner (with isolators) - Default factory connection = T9 IN | See Transmit Cabling Configurations on page 50 for detailed information on configuring transmit cabling. |



MSER044  
062899JNM

Figure 45 **Intra-Cabinet Transmit Cabling**

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**Intra-Cabinet Cabling Reference**



## Cabinet Bracing

The MSER cabinet is secured to the site floor during the installation procedure. Additional cabinet bracing is possible by joining the MSER cabinet to the primary EBTS cabinets through the use of ganging hardware. A ganging hardware kit (THN6718A) is available from Motorola for use with the MSER. Refer to Cabinet Mounting Hardware on page 134 for information on how to order parts.

To ensure optimum stability of the cabinet, especially in areas subject to seismic activity, additional bracing may also be required. Any additional bracing hardware used to secure the MSER cabinet must be locally procured. This manual does not provide procedures for the installation of such hardware.

If the MSER is not secured to the "primary" EBTS cabinets through the use of ganging hardware, the cabinet spacing cannot exceed more than 5" (12.7 cm) due to the length of interconnecting cabling. See *Inter-Cabinet Cabling* below for additional information.

### **WARNING**

EQUIPMENT CABINETS ARE HEAVY AND MAY TIP. USE EXTREME CAUTION WHEN MOVING EQUIPMENT. LIFT THE CABINET USING ALL FOUR TOP EYE BOLTS WITH APPROPRIATE APPARATUS OR SECURE THE CABINET FROM TIPPING IF LIFTING FROM THE BOTTOM. FAILURE TO DO SO COULD RESULT IN SERIOUS PERSONAL INJURY, DEATH OR EQUIPMENT DAMAGE.

---

## Inter-Cabinet Cabling

Inter-cabinet cabling refers to the connections between equipment cabinets. In the MSER, inter-cabinet cabling is used to connect the expansion cabinet to the "primary" EBTS cabinets.

The cables used for inter-cabinet cabling are manufactured in predetermined lengths which impose a height restriction for the site cable tray of no more than 6" (15.24 cm) above the equipment cabinets. This also results in a limitation of spacing between equipment cabinets to no more than 5" (12.7 cm).

The inter-cabinet cabling shipped with the MSER is based on a cabinet layout configuration similar to the one shown in Figure 1. If the site cannot accommodate one of this layout configurations, custom intercabinet cables may need to be used. Refer to Inter-Cabinet Cabling on page 137 for information on manufacturing custom cables, if necessary.

## Cabinet Ground Connection

The MSER cabinet requires a dedicated connection to the master ground bar within the site. The connecting wire must be a #2 AWG green-insulated copper

wire. The ground wire will be connected to the grounding hardware located on the duplexers within the MSER cabinet. Refer to "Cabinet Ground Connection" on page -103 for additional information about MSER cabinet ground connections.

### DC Power Connection

The recommended color for wires considered "hot" is red. If the recommended color is not used or is not available, be sure to mark each end of the "hot" leads using red electrical tape or another type of labeling.

The actual wire gauge used to connect the DC power source to the MSER can vary depending on the loop length. The "loop length" refers to the combined length of both the hot (-48 Vdc) and return leads. For example, if distance between the power supply rack and the MSER is 16' (4.88 meters), the total loop length would be 32' (9.76 meters).

In a typical installation, the MSER cabinet is located adjacent to last RF cabinet, resulting in a loop length of approximately 35' (10.675 meters) or less. Before installing the MSER cabinet, measure the required loop length between it and the power supply rack. Refer to Table 6 to determine the proper wire gauge to use during installation.

#### NOTE

Under no circumstances should the wire for the DC power supply wiring be smaller than #6 AWG. Cable loop voltage drop shall not exceed 500 mV for cabling of the -48 Vdc (hot) and DC return leads.

Table 6 **Determining DC Power Wire Gauge**

| Total Loop Length                               | Wire Gauge |
|-------------------------------------------------|------------|
| Less than 25' (7.625 meters)                    | #6 AWG     |
| Between 25' (7.625 meters) to 40' (12.2 meters) | #4 AWG     |
| Between 40' (12.2 meters) to 60' (18.3 meters)  | #2 AWG     |
| Between 60' (18.3 meters) to 130' (39.65)       | 1/0 AWG    |

The screws required to connect the DC power cables to the Power Supply rack are not provided and must be locally procured. The standard screw size used on a typical power supply breaker panel is 3/8-16 x 3/4. Be sure to verify the connection screws are available before attempting to connect the DC power supply. Refer to DC Power (-48 Vdc) Connection on page 98 for related information on power connections.

### **AC Power and Backup Power**

Be sure both the AC service and battery backup are capable of handling the additional normal and startup loads that the MSER will add to the overall EBTS. Please refer to the *EBTS System Manual* for additional information on electrical service requirements.

### **Environmental Considerations**

The MSER has the same environmental requirements as the "primary" EBTS for temperature, humidity, and air cleanliness. Be sure the HVAC system is capable of compensating for the added BTUs the MSER will generate.

## **Special Considerations**

The following are special considerations that could affect the MSER installation, especially if it is not being installed in a site with a typical equipment cabinet layout. Please note that these considerations also apply to the primary EBTS.

### **Breaker Panel Access**

The National Electric Code (NEC) requires a minimum 36" (91.44 cm) clearance for electrical service access, including all fuse panels, breaker panels, etc. NEC also requires that all cabinet doors open at least 90°.

### **Disabled Personnel**

Please note that the Americans with Disabilities Act (ADA) of 1990 requires certain clearances for handicapped personnel. The customer is responsible for determining the applicable ADA requirements that may affect the installation of the MSER.

## **Receipt of Equipment**

The MSER is shipped with all components securely fastened within the equipment cabinet. Upon receipt of the MSER, be sure to:

- ☐ Inventory equipment against itemized packing list.
- ☐ Check for loose or damaged equipment.
- ☐ Check for dents, scratches, or other damage to the mounted equipment or cabinet panels (if used).
- ☐ Verify all intra-cabinet cable connections are securely connected.
- ☐ Check for physical damage to connectors or other controls.

If the MSER is damaged, contact the shipping company immediately to file a complaint, then contact your Motorola representative. If there are missing items in the shipment, contact your Motorola representative immediately.

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## Cabinet Installation

This procedure describes how to mount the MSER in an existing EBTS site. Be sure to read all of the procedures carefully before performing the installation of the cabinet to ensure a quality installation.

The MSER is a non-wheeled cabinet that must be secured to the floor for optimum stability. Due to the weight of the cabinet, this procedure has been written to minimize the amount movement of the cabinets during the installation process.

|             |
|-------------|
| <b>NOTE</b> |
|-------------|

|                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motorola recommends installing expansion cabinets next to the "primary" EBTS cabinets. See <i>Installation Considerations</i> for a typical cabinet layout. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|

1. Measure the mounting location for the MSER.  
Use the measurements of the cabinet footprint, as shown in Figure 14.
2. Carefully mark the mounting holes with a pencil, as indicated on the appropriate cabinet footprint.
3. Drill the marked mounting holes to the appropriate depth of the mounting hardware with a hammer drill and bit.  
Refer to Cabinet Mounting Hardware on page 134 for the recommended mounting hardware.
4. Insert an anchor into the drilled hole.  
If necessary, tap the anchor into place using a hammer.
5. Remove the four screws securing the bottom kick panel to the front and back of the cabinet.  
Remove the kick panel and set aside during installation.
6. Carefully move the cabinet into the position indicated by the holes in the floor.  
Adjust and level the cabinet as necessary to position the cabinet mounting holes with the pre-drilled holes.
7. Secure the cabinet to the site floor with the locally procured mounting hardware.
8. If required, connect adjacent cabinets to each other using the ganging hardware kit (THN6718A).
9. If required, install additional cabinet bracing using locally procured parts and materials.

## Inter-Cabinet Connections

Inter-cabinet connections refer to those connections between the MSER and external components, such as the power supply rack or the primary EBTS. The procedures presented in this section include those listed in the following table.

| Procedure                     | Page | Description                                                                            |
|-------------------------------|------|----------------------------------------------------------------------------------------|
| 5 MHz / 1 PPS Connection      | 95   | Connection of the 5 MHz / 1 PPS timing reference signal provided by the primary EBTS   |
| Ethernet Connection           | 96   | Connection of Ethernet connection from the primary EBTS                                |
| Alarm Connection              | 97   | Connection of cabinet alarm cabling between the MSER and primary EBTS                  |
| DC Power (-48 Vdc) Connection | 98   | Connection of -48 Vdc power wiring from power supply rack to MSER                      |
| Transmit Cabling Connection   | 102  | Connection of the transmit cabling from the MSER to the primary RF Distribution System |
| Receive Cabling Connection    | 102  | Connection of the receive cabling from the primary RF Distribution System to the MSER  |

The installation procedure assumes the MSER includes at least one Base Radio. If there no Base Radios installed in the MSER cabinet, you must install one or more the MSER to become functional. Base Radios should be installed from the bottom (BR1) position of the cabinet and progress upward.

Connect one DC power harness, one 5-MHz / 1 P.P.S. cable, one Ethernet cable, one transmit cable, three receive cables, and one ground cable per Base Radio according to the cabling instructions. Base Radios are heavy and require two people to safely lift.

### NOTE

The procedures in this section describe the inter-cabinet cabling - *between cabinets*. Refer to “Intra-Cabinet Cabling Reference” on page -73 for reference information concerning intra-cabinet cabling - *within the MSER cabinet*.

## Inter-Cabinet Connections

### Cable Routing

All inter-cabinet cabling is routed through the top of the MSER cabinet, through the site cable tray, and to the appropriate connection. Most connections within the MSER cabinet have been connected during manufacturing, however some may have been repeated within to ensure proper cabling of the MSER.

### Cable Connections

Inter-cabinet cabling is accomplished by simply connecting the free end of each cable to the appropriate connection as described within the procedure. Part numbers of all inter-cabinet cables are referenced within the procedures.

Most inter-cabinet cabling for the MSER is accomplished through equipment cabinet junction panels. The MSER contains two junction panels; a standard junction panel and an expansion panel. The standard junction panel is the same junction panel used for inter-cabinet cabling on the primary EBTS cabinet. The expansion junction panel is used to connect the receive branches to the MSER.

#### Standard Junction Panel Connections

The standard junction panel, shown in Figure 46, is used to connect the 5 MHz/ 1 PPS and Ethernet inter-cabinet cable connections between the MSER and primary system.

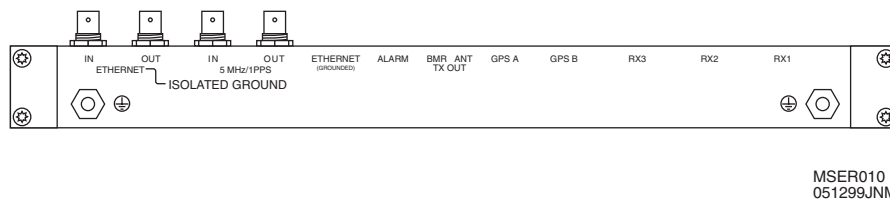


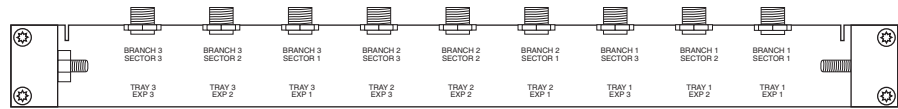
Figure 46 **Standard Junction Panel**

#### Expansion Junction Panel Connections

The expansion junction panel, or expansion panel, shown in Figure 47, is used to connect the receiver branch inputs to the multicoupler trays within the MSER cabinet.

#### Other Connections

The transmit, alarm, and DC power connections between the MSER and primary EBTS system do not use the junction panels, but are connected directly to the appropriate components. The transmit cabling is made directly from the MSER RF Distribution System to the duplexer input ports of the primary RF Distribution System. The MSER alarm cabling is made directly from the modular adaptor on

MSER011  
051299JNMFigure 47 **Expansion Panel**

the iMU within the primary cabinet to the appropriate multicoupler tray (Sector 2 or Sector 3) within in the MSER cabinet. The DC power connections are made directly between the power supply rack and the power distribution panel on the MSER cabinet.

## 5 MHz/1 PPS Connection

The 5 MHz/1 PPS cable connection connects the MSER to the timing reference signal provided by the iSC in the primary EBTS. The actual signal is generated by the Site Reference ISA (SRI) card located in the iSC. The inter-cabinet connection for the signal is made from the junction panel of the primary EBTS cabinet to the standard junction panel of the MSER cabinet.

Be sure to follow these general guidelines relating to the distribution of the timing reference signal:

- ☐ Distribute the load as evenly as possible between the primary EBTS and MSER system.
- ☐ Terminate the far-end of each daisy-chain with a 50  $\Omega$  load.

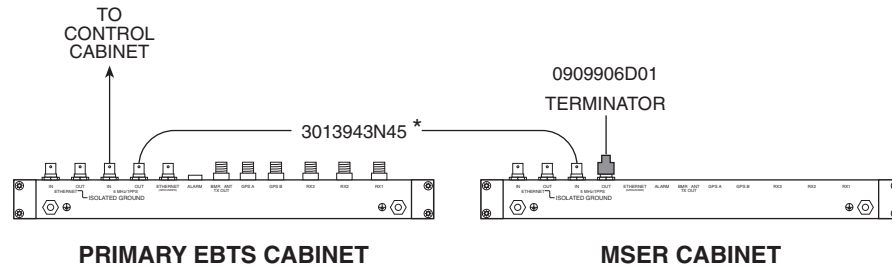
### ▲ CAUTION

Powered-down BRs connected to the 5 MHz/1 PPS system can degrade the 5 MHz/1 PPS signal which could result in malfunctions. Be sure to disconnect the BR from the 5 MHz/1 PPS system before powering-down a BR. Please note that 5 MHz/1 PPS "T" connections do not need to be terminated.

Noting the general guidelines discussed above, perform 5 MHz/1 PPS cabling between cabinets as follows:

1. Remove the 50  $\Omega$  BNC Terminator on the **5 MHz/1 PPS OUT** connector of the junction panel on the primary EBTS cabinet.

## Inter-Cabinet Connections



\* 0112004Z29 is an alternate cable that may be shipped with some systems.

MSER018  
062899JNM

Figure 48 **5 MHz/1 PPS Inter-Cabinet Cabling Connection**

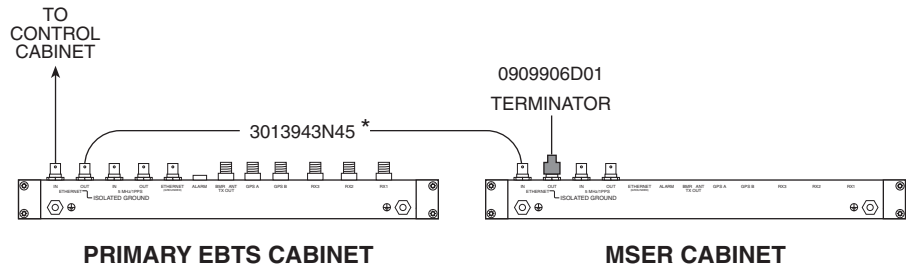
2. Connect one end of the timing reference cable (3013943N45) to the **5 MHz/1 PPS OUT** connector on the junction panel.
3. Route the cable through the site cable trays to the MSER cabinet. Use cable ties to secure the cable in place.
4. Connect the other end of the timing reference cable to **5 MHz/1 PPS IN** connector on the junction panel of the MSER system.
5. Verify that a 50  $\Omega$  BNC Terminator (0909906D01) is installed on the **5 MHz/1 PPS OUT** connector of the junction panel on the MSER system.

## Ethernet Connection

The Ethernet cable connection connects the MSER to the 10BaseT connection of the primary EBTS. The Ethernet connection allows the iSC in the primary system to provide data and control information to and from the Base Radios in the MSER system. The inter-cabinet connection for the Ethernet connection is made from the junction panel of the primary EBTS cabinet to the junction panel of the MSER cabinet.

1. Remove the 50  $\Omega$  BNC Terminator on the **ETHERNET OUT (ISOLATED GROUND)** connector of the junction panel on the primary EBTS system.
2. Connect one end of the Ethernet cable (3013943N45) to the **ETHERNET OUT (ISOLATED GROUND)** connector on the junction panel.
3. Route the cable through the site cable trays to the MSER cabinet. Use cable ties to secure the cable in place.
4. Connect the other end of the Ethernet cable to **ETHERNET IN (ISOLATED GROUND)** connector on the junction panel of the MSER system.





\* 0112004Z29 is an alternate cable that may be shipped with some systems.

MSER019  
062899JNM

Figure 49 **Ethernet Inter-Cabinet Cabling Connection**

5. Verify that a 50  $\Omega$  BNC Terminator (0909906D01) is installed on the **ETHERNET OUT (ISOLATED GROUND)** connector of the junction panel on the MSER system.

## Alarm Connection

The alarm cable connection connects the MSER to the alarm system provided by the primary EBTS. The alarm system consists of the iDEN Monitor Unit (iMU) which is functionally part of the iSC. The iMU monitors alarms from the Base Radios, abbreviated RF Distribution System, and breaker status signals of the MSER system. The iSC, in turn, communicates alarm status information to the OMC.

The alarm signals for the receive multicoupler trays in the MSER are cascaded together. The inter-cabinet connection for the alarm system connection is made from the modular adapter, as shown in Figure 50, located on iMU of the primary EBTS cabinet to either the Sector 2 or Sector 3 multicoupler tray of the MSER cabinet.

1. Connect one end of the alarm cable (3084225N42) to the appropriate connector on the modular adaptor located in the primary EBTS system.

The first MSER cabinet alarm cable connects to jack #1 of the modular adapter. If a second MSER cabinet is used, its alarm cable connects to jack #4 of the modular adapter.

2. Route the cable through the site cable trays to the MSER cabinet. Use cable ties to secure the cable in place.



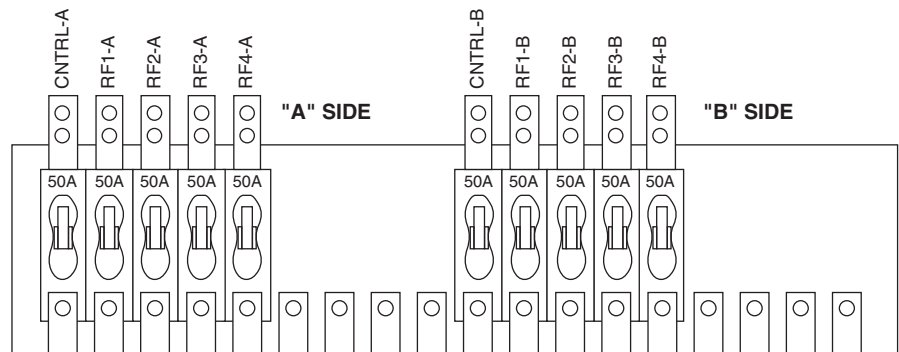
- The multicoupler trays are mounted and labeled from bottom-up (Sector 1 through Sector 3) within the MSER cabinet. For 2 sectoried sites, connect the alarm cable to the Sector 2 multicoupler tray. For 3 sectoried sites, connect the alarm cable to the Sector 3 multicoupler tray.

The DC power connection connects the MSER to the power supply rack which supplies the required -48 Vdc for the system. Because the power supply rack is not considered part of the overall EBTS, this procedure cable connection is described in a "generic sense."

The power supply rack contains a breaker panel that is divided into two sections; A and B. Both sides of the panel are connected to the same power source and have the same potential. This provides power redundancy for increased system reliability.

The circuit breakers for the power supply are typically located on the front of the power supply rack. A typical breaker panel layout is shown in Figure 51. When viewed from the front, the A-side circuit breakers are on the left and the B-side breakers are on the right.

Like the primary EBTS cabinets, there are two separate power feeds that provide the DC power to the A and B sides of the MSER. Two -48 Vdc (hot) wires from individual breakers on the power supply are connected to the A and B sides of the -48 Vdc MSER cabinet breaker panel. Additionally, two DC return wires from the power supply are connected to the A and B sides of each return MSER cabinet breaker panel. The following procedure reflects the connection of both the hot (-48 Vdc) and return leads.



MSER046  
061599JNM

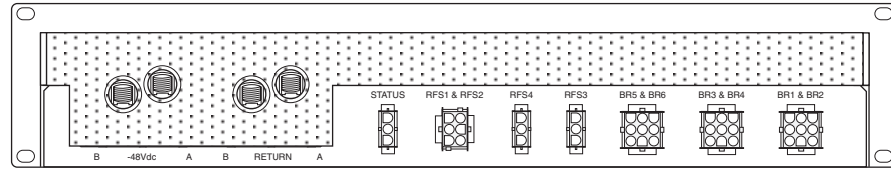
Figure 51 **Typical Power Supply Rack Breaker Panel (Front View)**

Figure 52 shows a rear view of the MSER power distribution panel. The power distribution panel distributes the -48 Vdc (hot) through individual power circuits for each module in the MSER cabinet.

The power distribution panel within the MSER is accessed from the rear of the cabinet on the breaker panel. The layout of the MSER breaker panel is similar to the breaker panel of the power supply rack, with the A-side on the left and the B-side on the right as viewed from the front.

The DC power connections for the power supply rack are made from the front. The DC power connections for the MSER cabinet are made from the rear of the equipment cabinet. Refer to "Power Supply Rack Connection Lugs" on page -136 for additional information on DC power connections.

## Inter-Cabinet Connections

MSER047  
061599JNMFigure 52 **Typical Equipment Cabinet Power Distribution Panel (Rear View)****Preparation**

Before connecting the DC power source to the MSER, be sure all pre-installation preparations have been made concerning the connection lugs, wire color, and wire gauge. Refer to “DC Power Connection” on page -90 for additional information.

 **WARNING**

MAKE SURE ALL POWER TO THE POWER SUPPLY  
RACK IS OFF TO PREVENT INJURY TO PERSONNEL.

**-48 Vdc Power Connections**

Each equipment cabinet requires two wires for -48 Vdc power (hot). Perform the hot DC power supply connection as follows.

1. Each MSER cabinet requires two runs of appropriate-gauge bulk wiring between the -48 Vdc (hot) A and B side connections on the equipment cabinet and power supply rack.

Make certain wire runs are properly routed through cabinets and cable tray assembly, allowing adequate slack.

2. Add the appropriate wire lugs to the wire, as determined in the pre-installation section.

Double-hole crimp lugs should be used on all power supply rack wiring. The size of the lugs will vary depending upon wire gauge used.

3. Connect the first power wire lug to breaker 2A (RF4-A) of the Power Supply rack, as shown in Figure 51.

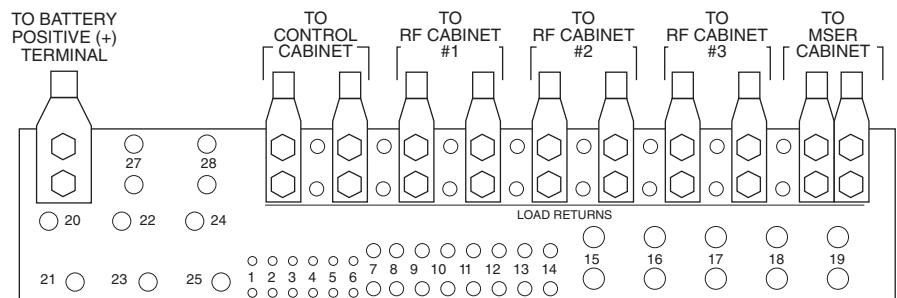
If a second MSER cabinet is used, connect the first power wire to breaker 2A (RF5-A).

4. On the equipment cabinet power distribution panel, strip and insert free end of wire coming from power supply into **-48 Vdc** terminal block **A** on power distribution panel, as shown in Figure 52. Be sure to securely tighten this connection.
5. Connect the second power wire lug to breaker 2B (RF4-B) of the Power Supply rack, as shown in Figure 51.
6. On equipment cabinet power distribution panel, strip and insert free end of wire coming from power supply into **-48 Vdc** terminal block **B** on power distribution panel, as shown in Figure 52. Be sure to securely tighten this connection.
7. If necessary, repeat steps 1 through 6 for additional MSER cabinets.

### -48 Vdc Return Connections

Each equipment cabinet requires two wires for -48 Vdc return. Perform the return DC power supply connection as follows.

1. On the Power Supply rack, access the ground bus. Refer to the Power Supply manual supplied with the Power Supply cabinet for the location and access information for the ground bus.



MSER048  
061599JNM

Figure 53 **Typical Power Supply Rack DC Return Bus (Front View)**

2. Using appropriate gauge wire, route two runs of bulk wiring between **A** and **B** side **RETURN** connections on equipment cabinet and Power Supply rack **RETURN** connections.  
  
Make certain wire runs are properly routed through cabinets and cable tray assembly, allowing adequate slack.
3. Depending on wire gauge used, terminate the two wire ends at the Power Supply rack using appropriate double-hole crimp lugs.
4. Connect the first DC return wire lug to the DC return bus bar on the Power Supply rack, as shown in Figure 53.

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**Inter-Cabinet Connections**

5. On the MSER cabinet power distribution panel, strip and insert free end of wire coming from power supply A-side return into **RETURN** terminal block **A**, as shown in Figure 52. Be sure to securely tighten this connection.
6. Connect the second DC return wire lug to the DC return bus bar on the Power Supply rack.
7. On the MSER cabinet power distribution panel, strip and insert free end of wire coming from power supply B-side return into **RETURN** terminal block **B**. Be sure to securely tighten this connection.

**Receive Cabling Connection**

The inter-cabinet receiver cabling from the primary EBTS is made from the first receive multicoupler amplifier outputs in the primary system to the MSER expansion panel. The MSER can support up to three receiver branch inputs per sector (3 branch inputs x 3 sectors) for a total of nine receiver branch inputs.

All inter-cabinet receiver cabling is made using a cable (3012029E37) that is approximately 144" (366 cm) in length. The number of receiver cabling connections made to the MSER expansion panel depends upon the configuration of the system being expanded and the desired expansion configuration.

Refer to "Theory of Operation" on page -4 or "Receiver Cabling" on page -74 for additional information on receive cabling.

**Transmit Cabling Connection**

The transmit inter-cabinet cabling is made from the MSER transmit combiner (output ports) to the primary RFDS system. Due to the variety of expansion configurations that the MSER can be used in, there are many possibilities to connect the MSER transmit cabling to the primary system. Please refer to the "Theory of Operation" on page -4 or "Transmit Cabling Configurations" on page -50 for additional information on transmit cabling.

 **WARNING**

TO PREVENT INJURY, BE SURE THE "DEKEY"  
COMMAND HAS BEEN ISSUED TO ALL BASE RADIOS  
WITHIN THE MSER CABINET WHILE MAKING TRANSMIT  
CABLING ANTENNA CONNECTIONS.

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## Site Connections

Site connections refer to the connections between the MSER and the EBTS site. The only connection that the MSER has to the actual site is the cabinet ground connection.

### Cabinet Ground Connection

Intra-cabinet grounding wires which ground the MSER components to the equipment cabinet are made during manufacturing. However, the MSER cabinet must be connected to the site ground for an effectively grounded system.

Before you begin this procedure, please refer to the “Cabinet Ground Connection” on page -89.

#### NOTE

Single-point ground method (where each cabinet or rack is grounded to master ground using its own ground wire) shall be used. Equipment cabinet shall use green-insulation #2 AWG (or larger) for ground wire.

During installation of cabinet ground wires, be sure to check any factory-installed internal ground connections for tightness.

On the MSER, the cabinet ground cable is connected to the grounding hardware located by each multicoupler tray, as shown in Figure 54.

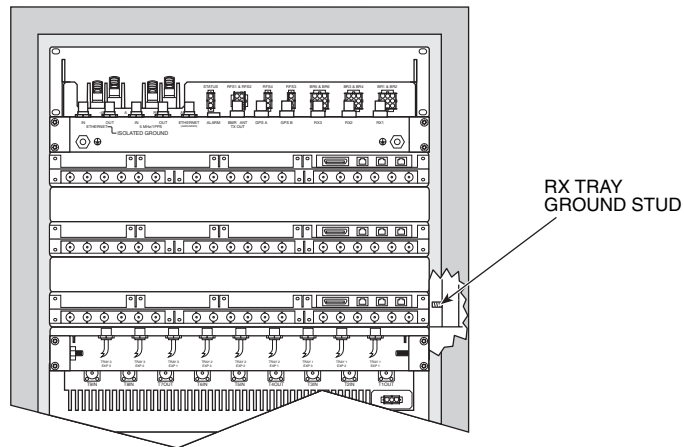
Perform the following steps to ground the chassis of the cabinet to the master ground bar of the installation site:

#### NOTE

A hex nut is secured to the Junction Panel of each cabinet during manufacturing. This nut is used to make ground connections on the Junction Panel. It may also be removed from the Junction Panel and used for the ground connections on the RF Distribution System.

1. Remove the nut and star washer from the ground hardware and set it aside.
2. Strip the end of the wire to be connected to the cabinet ground.

## Site Connections

MSER049  
061599JNMFigure 54 **MSER Cabinet Grounding Stud**

3. Using appropriate tool, attach a crimp lug onto the cabinet ground wire. Make certain lug is securely fastened to wire.
4. Route the cabinet ground wire through the top of the cabinet.
5. Place the lug over the ground hardware and secure it with the nut removed in step 1.
6. Route the other end of the cabinet ground wire to the master ground bar.
7. Strip the end of the wire for connection to the master ground bar.
8. Using appropriate tool, attach a dual-hole crimp lug onto the wire. Make certain lug is securely fastened to wire.

**NOTE**

If necessary, refer to Cabinet Ground Connection on page 47 for recommended crimp lugs.

9. Secure the ground wire lug to the master ground bar using the appropriate tools and hardware.



## System Testing

Perform system testing upon completion of the MSER installation. Refer to the “System Testing” section of the EBTS System Manual (68P81099E10).

## Site Connections

## 68P80801E35-CTransmit Cabling Configurations

This section provides reference information for various field configurations of the MSER transmit cabling. The information presented here is not intended to serve as a definitive guide for transmit cabling, but should provide a good representation of the configuration possibilities available by adding an MSER to an existing site. Refer to Theory of Operation on page 4 for additional information on transmit cabling configurations within the MSER.

This section provides transmit cabling reference information for the following types of primary sites:

- ☐ GEN4 Configurations
- ☐ V03 & V06 Configurations

### Base Radio Designations

Base Radios within the MSER are labeled BR4n or BR5n, where “4” or “5” represents the MSER cabinet number and “n” represents the relative BR position (BR1 through BR6) within that cabinet. BRs are numbered consecutively from the bottom-most mounting position within the cabinet, upward.

For example, BR43 represents BR3 in cabinet #4 (or the first MSER expansion cabinet). Please note that cabinet and BR positioning may differ among the various configurations represented in this section.

### Base Radio Sector Assignments

Please note the following sector and Base Radio assignments for the MSER. These assignments are designated during the manufacturing process and may not represent actual sector and Base Radio designations after deployment.

| BR Position | Default Sector Assignments | Possible Sector Assignments (Field) |            |            |            |
|-------------|----------------------------|-------------------------------------|------------|------------|------------|
|             |                            | Example #1                          | Example #2 | Example #3 | Example #4 |
| BR6         | Sector 3                   | Sector 3                            | Sector 3   | Sector 3   | Sector 2   |
| BR5         | Sector 2                   | Sector 3                            | Sector 2   | Sector 2   | Sector 1   |
| BR4         | Sector 1                   | Sector 2                            | Sector 1   | Sector 2   | Sector 1   |
| BR3         | Sector 3                   | Sector 2                            | Sector 1   | Sector 3   | Sector 2   |
| BR2         | Sector 2                   | Sector 1                            | Sector 1   | Sector 1   | Sector 3   |
| BR1         | Sector 1                   | Sector 1                            | Sector 1   | Sector 1   | Sector 3   |

## Combiner Designations

Transmit combiners within the MSER are labeled An through Fn, where “A” or “F” represents the combiner input and “n” represents the MSER cabinet number (1 for the first MSER cabinet and 2 for the second MSER cabinet). It should be noted that the 3 input pairs on the standard transmit combiner with isolators are labeled A1 through C1 and that the 3 input pairs on the optional transmit combiner without isolators are labeled D1 through F1.

| Input Pair | Combiner                       | MSER Cabinet          |
|------------|--------------------------------|-----------------------|
| A1         | Triple 2-Way with isolators    | First<br>(Cabinet #4) |
| B1         | Triple 2-Way with isolators    | First<br>(Cabinet #4) |
| C1         | Triple 2-Way with isolators    | First<br>(Cabinet #4) |
| D1         | Triple 2-Way without isolators | First<br>(Cabinet #4) |
| E1         | Triple 2-Way without isolators | First<br>(Cabinet #4) |
| F1         | Triple 2-Way without isolators | First<br>(Cabinet #4) |
| A2         | Triple 2-Way with isolators    | First<br>(Cabinet #5) |
| B2         | Triple 2-Way with isolators    | First<br>(Cabinet #5) |
| C2         | Triple 2-Way with isolators    | First<br>(Cabinet #5) |

For example, “BR41, BR42 - A1” means the transmit outputs of BR1 and BR2 in the first MSER cabinet are combined on the first pair of inputs (A1) on the triple 2-way combiner with isolators.

Another example, “BR41, BR42 - A1 / E1 BR43, BR44 - B1 / E1” means the transmit outputs of BR1 and BR2 in the first MSER cabinet are combined on the first pair of inputs (A1) on the triple 2-way combiner with isolators and the transmit outputs of BR3 and BR4 (also in the first MSER cabinet) are combined on the second pair of inputs (B1) on the triple 2-way combiner with isolators. Both pairs of combined signals are then combined again on the first pair of inputs (E1) on the triple 2-way combiner without isolators.

## GEN4 Configurations

The transmit cabling configurations described in this section illustrate triple diversity sites using GEN4 configurations. All configurations described here assume each primary cabinet has a maximum complement of six Base Radios. The total complement for GEN4 systems is 24 Base Radios per site, representing all sectors.

For triple branch diversity sites, it is assumed that the BRs in each primary cabinet (or sector) are split among Antennas 1 and 2; leaving Antenna 3 available for the MSER. For two branch diversity sites, it is assumed that the Base Radios in each primary cabinet (or sector) are combined on Antenna 1; leaving Antenna 2 available for the MSER.

The table below, and associated illustrations (Figure 55 and Figure 56), define how the transmit signals for the Base Radios mounted within the MSER cabinet can be combined for GEN4 configurations.

| Expansion Configuration | Sector 1<br>Ant 2 or 3 | Sector 2<br>Ant 2 or 3 | Sector 3<br>Ant 2 or 3                 | Reference |
|-------------------------|------------------------|------------------------|----------------------------------------|-----------|
| 0 - 0 - 1               |                        |                        | BR41 -A1                               |           |
| 0 - 0 - 2               |                        |                        | BR41, BR42 -A1                         |           |
| 0 - 0 - 3 (Note 1)      |                        |                        | BR41, BR42 -B1/D1<br>BR43 -A1/D1       |           |
| 0 - 0 - 4 (Note 1)      |                        |                        | BR41, BR42 -B1/D1<br>BR43, BR44 -A1/D1 |           |
| 0 - 0 - 5 (Note 2)      |                        |                        |                                        |           |
| 0 - 0 - 6 (Note 2)      |                        |                        |                                        |           |
| 0 - 1 - 1               |                        | BR41 -B1               | BR42 -A1                               |           |
| 0 - 1 - 2               |                        | BR41 -B1               | BR42, BR43 -A1                         |           |

## GEN4 Configurations

| Expansion Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Sector 1<br>Ant 2 or 3 | Sector 2<br>Ant 2 or 3 | Sector 3<br>Ant 2 or 3                  | Reference     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------|-----------------------------------------|---------------|
| 0 - 1 - 3 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        | BR41 -C1               | BR42, BR43 -B1/D1<br>BR44 -A1/D1        |               |
| 0 - 1 - 4 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        | BR41 -C1               | BR42, BR43 -B1/D1<br>BR44, BR45 -A1/D1  |               |
| 0 - 2 - 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        | BR41, BR42<br>-B1      | BR43, BR44 -A1                          |               |
| 0 - 2 - 3 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        | BR41, BR42<br>-C1      | BR43, BR44 -B1/D1<br>BR45 - A1/D1       |               |
| 0 - 2 - 4 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        | BR41, BR42<br>-C1      | BR43, BR44 -B1/D1<br>BR45, BR46 - A1/D1 | See Figure 55 |
| 1 - 1 - 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | BR41 -C1               | BR42 -B1               | BR43 -A1                                |               |
| 1 - 1 - 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | BR41 -C1               | BR42 -B1               | BR43, BR44 -A1                          |               |
| 1 - 2 - 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | BR41 -C1               | BR42, BR43<br>-B1      | BR44, BR45 -A1                          |               |
| 2 - 2 - 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | BR41, BR42<br>-C1      | BR43, BR44<br>-B1      | BR45, BR46 -A1                          | See Figure 56 |
| <p>Notes:</p> <p>1. The standard Multi-Sector Expansion Rack (MSER) includes a triple 2-way combiner with isolators. Connections to the three input ports of the triple 2-way combiner with isolators are designated as A1/B1/C1. When more than 2 BRs are used for any one sector in the multi-sector cabinet, an optional triple 2 way hybrid combiner without isolators (D1/E1/F1) is required.</p> <p>2. The 0 - 0 - 1 indicates the configuration of the expansion BRs for different sectors in the multi-sector cabinet, however these sectors can be interchangeable by simply changing the sector labeling. For example 2 - 3 - 7 (S1-S2-S3) is the same as 2 - 7 - 3 (S1-S2-S3) or 7 - 2 - 3 (S1-S2-S3) etc., which allows for all the various combinations. Therefore, if you had a 2 - 7 - 3, the configuration of 7 BR shown in this chart for Sector 3 should now be used for Sector 2, 6. For configurations with 5 or 6 BRs in a sector, the GEN4 Expansion cabinet is recommended instead of the Multi-Sector Expansion Rack (MSER).</p> |                        |                        |                                         |               |

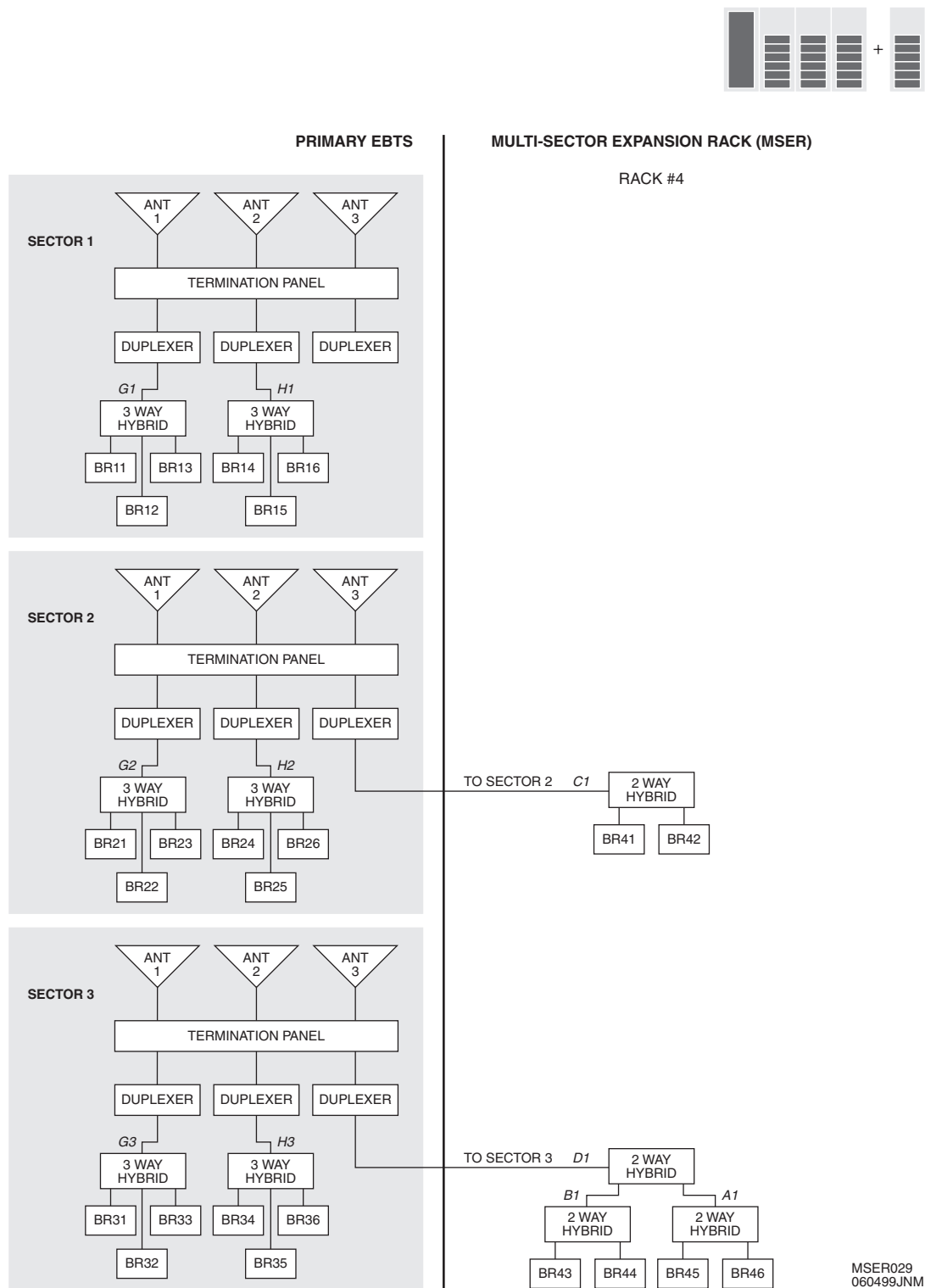


Figure 55 6-8-10 Configuration (0-2-4 Expansion)

## GEN4 Configurations

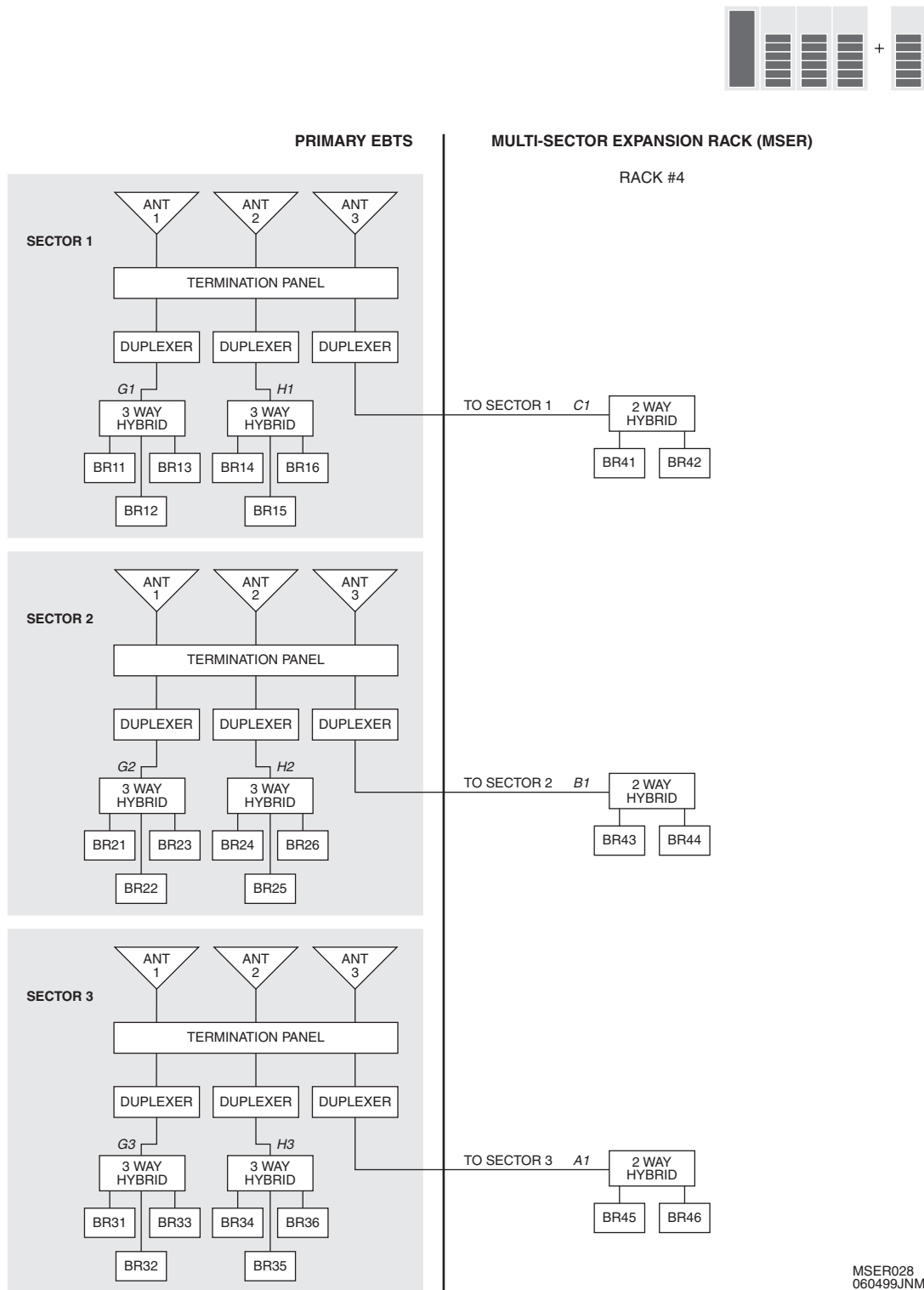


Figure 56 8-8-8 Configuration (2-2-2 Expansion)



## V03 & V06 Expansions

The transmit cabling configurations described in this section illustrate triple diversity sites using V03 and V06 configurations. All configurations described here assume each primary cabinet has a maximum complement of four Base Radios. The total complement for V03 and V06 systems are 24 Base Radios per site, representing all sectors.

For two branch diversity sites, it is assumed that the BRs in each primary cabinet (or sector) are combined on Antenna 1. For three branch diversity sites, it is assumed that the Base Radios in each primary cabinet (or sector) are combined on Antenna 1; leaving Antennas 2 and 3 available for the MSER.

The table below, and associated illustrations (Figure 57 through Figure 68), define how the transmit signals for the Base Radios mounted within the MSER cabinet can be combined for V03 and V06 configurations.

The expansion configuration listed in the following table indicates the loading of Base Radios for each sector within the MSER. These sector designations are interchangeable and can be changed by simply changing the sector labeling and ensuring the proper cabling is in place.

| Expansion Configuration | Sector 1      | Sector 2 |                   | Sector 3 |                                           | Reference     |
|-------------------------|---------------|----------|-------------------|----------|-------------------------------------------|---------------|
|                         | Ant 2 or 3    | Ant 2    | Ant 2 or 3        | Ant 2    | Ant 3                                     |               |
| 0 - 0 - 1               |               |          |                   |          | BR41 -A1                                  |               |
| 0 - 0 - 2               |               |          |                   |          | BR41,B<br>R42 -A1                         |               |
| 0 - 1 - 1               |               |          | BR41 -B1          |          | BR42 -A1                                  |               |
| 0 - 1 - 2               |               |          | BR41 -B1          |          | BR42,B<br>R43 -A1                         |               |
| 0 - 2 - 2               |               |          | BR41,<br>BR42 -B1 |          | BR43BR<br>44 -A1                          |               |
| 1 - 1 - 1               | BR41 -C1      |          | BR42 -B1          |          | BR43 -A1                                  |               |
| 1 - 1 - 2               | BR41 -C1      |          | BR42 -B1          |          | BR43,B<br>R44 -A1                         |               |
| 1 - 2 - 2               | BR41 -C1      |          | BR42,<br>BR43 -B1 |          | BR44,B<br>R45 -A1                         |               |
| 2 - 2 - 2               | BR41,BR42 -C1 |          | BR43,<br>BR44 -B1 |          | BR45,B<br>R46 -A1                         | See Figure 57 |
| 0 - 0 - 3 (Note 1)      |               |          |                   |          | BR41,B<br>R42-B1/<br>D1<br>BR43<br>-A1/D1 |               |

## V03 &amp; V06 Expansions

| Expansion Configuration | Sector 1        | Sector 2 |                       | Sector 3 |                                                     | Reference     |
|-------------------------|-----------------|----------|-----------------------|----------|-----------------------------------------------------|---------------|
|                         | Ant 2 or 3      | Ant 2    | Ant 2 or 3            | Ant 2    | Ant 3                                               |               |
| 0 - 0 - 4 (Note 1)      |                 |          |                       |          | BR41,B<br>R42-B1/<br>D1<br>BR43,B<br>R44<br>-A1/D1  |               |
| 0 - 1 - 3 (Note 1)      |                 |          | BR41<br>-C1           |          | BR42,B<br>R43-B1/<br>D1<br>BR44<br>-A1/D1           |               |
| 0 - 1 - 4 (Note 1)      |                 |          | BR41<br>-C1           |          | BR42,B<br>R43-B1/<br>D1<br>BR44,B<br>R45<br>-A1/D1  |               |
| 0 - 2 - 3 (Note 1)      |                 |          | BR41,<br>BR42<br>-C1  |          | BR43,B<br>R44 -B1/<br>D1<br>BR45<br>-A1/D1          |               |
| 0 - 2 - 4 (Note 1)      |                 |          | BR41,<br>BR42<br>-C1  |          | BR43,B<br>R44 -B1/<br>D1<br>BR45,B<br>R46<br>-A1/D1 | See Figure 58 |
| 1 - 1 - 3               | BR41 - B1       |          | BR42 -<br>A1          |          | BR51,<br>BR52-B<br>2/D1<br>BR53<br>-A2/D1           |               |
| 1 - 1 - 4               | BR41 - B1       |          | BR42 -<br>A1          |          | BR51,<br>BR52-B<br>2/D1<br>BR53,B<br>R54<br>-A2/D1  |               |
| 1 - 2 - 3               | BR41 - B1       |          | BR42,<br>BR43 -<br>A1 |          | BR51,<br>BR52-B<br>2/D1<br>BR53<br>-A2/D1           |               |
| 1 - 2 - 4 (Note 1)      | BR41 - B1       |          | BR42,<br>BR43<br>-A1  |          | BR51,<br>BR52-B<br>2/D1<br>BR53,B<br>R54<br>-A2/D1  |               |
| 2 - 2 - 3 (Note 1)      | BR41, BR42 - B1 |          | BR43,<br>BR44<br>-A1  |          | BR51,<br>BR52-B<br>2/D1<br>BR53<br>-A2/D1           |               |
| 2 - 2 - 4 (Note 1)      | BR41, BR42 - B1 |          | BR43,<br>BR44<br>-A1  |          | BR51,<br>BR52-B<br>2/D1<br>BR53,B<br>R54<br>-A2/D1  | See Figure 59 |

| Expansion Configuration | Sector 1       | Sector 2 |                      | Sector 3          |                                                    | Reference |
|-------------------------|----------------|----------|----------------------|-------------------|----------------------------------------------------|-----------|
|                         | Ant 2 or 3     | Ant 2    | Ant 2 or 3           | Ant 2             | Ant 3                                              |           |
| 0 - 0 - 5 (Note 1)      |                |          |                      | BR41,B<br>R42 -C1 | BR43,B<br>R44-B1/<br>D1<br>BR45<br>-A1/D1          |           |
| 0 - 0 - 6 (Note 1)      |                |          |                      | BR41,B<br>R42 -C1 | BR43,B<br>R44-B1/<br>D1<br>BR45,B<br>R46<br>-A1/D1 |           |
| 0 - 1 - 5 (Note 1)      |                |          | BR41<br>-A1          | BR51,B<br>R52 -C2 | BR53,B<br>R54-B2/<br>D1<br>BR55<br>-A2/D1          |           |
| 0 - 1 - 6 (Note 1)      |                |          | BR41<br>-A1          | BR51,B<br>R52 -C2 | BR53,B<br>R54-B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |           |
| 0 - 2 - 5 (Note 1)      |                |          | BR41,<br>BR42<br>-A1 | BR51,B<br>R52 -C2 | BR53,B<br>R54-B2/<br>D1<br>BR55<br>-A2/D1          |           |
| 0 - 2 - 6 (Note 1)      |                |          | BR41,<br>BR42<br>-A1 | BR51,B<br>R52 -C2 | BR53,B<br>R54-B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |           |
| 1 - 1 - 5 (Note 1)      | BR41 -B1       |          | BR42<br>-A1          | BR51,B<br>R52 -C2 | BR53,B<br>R54-B2/<br>D1<br>BR55<br>-A2/D1          |           |
| 1 - 1 - 6 (Note 1)      | BR41 -B1       |          | BR42<br>-A1          | BR51,B<br>R52 -C2 | BR53,B<br>R54-B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |           |
| 1 - 2 - 5 (Note 1)      | BR41 -B1       |          | BR42,<br>BR43<br>-A1 | BR51,B<br>R52 -C2 | BR53,B<br>R54-B2/<br>D1<br>BR55<br>-A2/D1          |           |
| 1 - 2 - 6 (Note 1)      | BR41 -B1       |          | BR42,<br>BR43<br>-A1 | BR51,B<br>R52 -C2 | BR53,B<br>R54-B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |           |
| 2 - 2 - 5 (Note 1)      | BR41, BR42 -B1 |          | BR43,<br>BR44<br>-A1 | BR51,B<br>R52 -C2 | BR53,B<br>R54-B2/<br>D1<br>BR55<br>-A2/D1          |           |

## V03 &amp; V06 Expansions

| Expansion Configuration | Sector 1       | Sector 2 |                | Sector 3                                  |                                          | Reference     |
|-------------------------|----------------|----------|----------------|-------------------------------------------|------------------------------------------|---------------|
|                         | Ant 2 or 3     | Ant 2    | Ant 2 or 3     | Ant 2                                     | Ant 3                                    |               |
| 2 - 2 - 6 (Note 1)      | BR41, BR42 -B1 |          | BR43, BR44 -A1 | BR51, B R52 -C2                           | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 | See Figure 60 |
| 0 - 0 - 7 (Note 1)      |                |          |                | BR41 -A1/E1<br>BR51, B R52 -C2/ E1        | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 |               |
| 0 - 0 - 8 (Note 1)      |                |          |                | BR41, B R42 -A1/E1<br>BR51, B R52 -C2/ E1 | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 |               |
| 0 - 1 - 7 (Note 1)      |                |          | BR41 -B1       | BR42 -A1/E1<br>BR51, B R52 -C2/ E1        | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 |               |
| 0 - 1 - 8 (Note 1)      |                |          | BR41 -B1       | BR42, B R43 -A1/E1<br>BR51, B R52 -C2/ E1 | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 |               |
| 0 - 2 - 7 (Note 1)      |                |          | BR41, BR42 -B1 | BR43 -A1/E1<br>BR51, B R52 -C2/ E1        | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 |               |
| 0 - 2 - 8 (Note 1)      |                |          | BR41, BR42 -B1 | BR43, B R44 -A1/E1<br>BR51, B R52 -C2/ E1 | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 |               |
| 1 - 1 - 7 (Note 1)      | BR41 -C1       |          | BR42 -B1       | BR43 -A1/E1<br>BR51, B R52 -C2/ E1        | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 |               |
| 1 - 1 - 8 (Note 1)      | BR41 -C1       |          | BR42 -B1       | BR43, B R44 -A1/E1<br>BR51, B R52 -C2/ E1 | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 |               |
| 1 - 2 - 7 (Note 1)      | BR41 -C1       |          | BR42, BR43 -B1 | BR44 -A1/E1<br>BR51, B R52 -C2/ E1        | BR53, B R54-B2/ D1<br>BR55, B R56 -A2/D1 |               |

| Expansion Configuration | Sector 1       | Sector 2 |                                                    | Sector 3                                            |                                                     | Reference     |
|-------------------------|----------------|----------|----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|---------------|
|                         | Ant 2 or 3     | Ant 2    | Ant 2 or 3                                         | Ant 2                                               | Ant 3                                               |               |
| 1 - 2 - 8 (Note 1)      | BR41 -C1       |          | BR42,<br>BR43<br>-B1                               | BR44,B<br>R45<br>-A1/E1<br>BR51,B<br>R52 -C2/<br>E1 | BR53,B<br>R54-B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1  |               |
| 2 - 2 - 7 (Note 1)      | BR41, BR42 -C1 |          | BR43,<br>BR44<br>-B1                               | BR45<br>-A1/E1<br>BR51,B<br>R52 -C2/<br>E1          | BR53,B<br>R54-B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1  |               |
| 2 - 2 - 8 (Note 1)      | BR41, BR42 -C1 |          | BR43,<br>BR44<br>-B1                               | BR45,B<br>R46<br>-A1/E1<br>BR51,B<br>R52 -C2/<br>E1 | BR53,B<br>R54-B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1  | See Figure 61 |
| 1 - 3 - 3 (Note 1)      | BR41 -C1       |          | BR42,<br>BR43<br>-B1/E1<br>BR44<br>-A1/E1          |                                                     | BR51,B<br>R52 -B2/<br>D1<br>BR53<br>-A2/D1          |               |
| 1 - 3 - 4 (Note 1)      | BR41 -C1       |          | BR42,<br>BR43<br>-B1/E1<br>BR44<br>-A1/E1          |                                                     | BR51,B<br>R52 -B2/<br>D1<br>BR53,B<br>R54<br>-A2/D1 |               |
| 1 - 4 - 4 (Note 1)      | BR41 -C1       |          | BR42,<br>BR43<br>-B1/E1<br>BR44,<br>BR45<br>-A1/E1 |                                                     | BR51,B<br>R52 -B2/<br>D1<br>BR53,B<br>R54<br>-A2/D1 |               |
| 2 - 3 - 3 (Note 1)      | BR41, BR42 -C1 |          | BR43,<br>BR44<br>-B1/E1<br>BR45<br>-A1/E1          |                                                     | BR51,B<br>R52 -B2/<br>D1<br>BR53<br>-A2/D1          |               |
| 2 - 3 - 4 (Note 1)      | BR41, BR42 -C1 |          | BR43,<br>BR44<br>-B1/E1<br>BR45<br>-A1/E1          |                                                     | BR51,B<br>R52 -B2/<br>D1<br>BR53,B<br>R54<br>-A2/D1 |               |
| 2 - 4 - 4 (Note 1)      | BR41, BR42 -C1 |          | BR43,<br>BR44<br>-B1/E1<br>BR45,<br>BR46<br>-A1/E1 |                                                     | BR51,B<br>R52 -B2/<br>D1<br>BR53,B<br>R54<br>-A2/D1 | See Figure 62 |
| 1 - 3 - 5 (Note 1)      | BR41 -C1       |          | BR42,<br>BR43<br>-B1/E1<br>BR44<br>-A1/E1          | BR51,<br>BR52-C<br>2                                | BR53,B<br>R54 -B2/<br>D1<br>BR55<br>-A2/D1          |               |
| 1 - 3 - 6 (Note 1)      | BR41 -C1       |          | BR42,<br>BR43<br>-B1/E1<br>BR44<br>-A1/E1          | BR51,<br>BR52-C<br>2                                | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |               |

## V03 &amp; V06 Expansions

| Expansion Configuration | Sector 1                               | Sector 2 |                                                    | Sector 3             |                                                     | Reference     |
|-------------------------|----------------------------------------|----------|----------------------------------------------------|----------------------|-----------------------------------------------------|---------------|
|                         | Ant 2 or 3                             | Ant 2    | Ant 2 or 3                                         | Ant 2                | Ant 3                                               |               |
| 1 - 4 - 5 (Note 1)      | BR41 -C1                               |          | BR42,<br>BR43<br>-B1/E1<br>BR44,<br>BR45<br>-A1/E1 | BR51,<br>BR52-C<br>2 | BR53,B<br>R54 -B2/<br>D1<br>BR55<br>-A2/D1          |               |
| 1 - 4 - 6 (Note 1)      | BR41 -C1                               |          | BR42,<br>BR43<br>-B1/E1<br>BR44,<br>BR45<br>-A1/E1 | BR51,<br>BR52-C<br>2 | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |               |
| 2 - 3 - 5 (Note 1)      | BR41, BR42 -C1                         |          | BR43,<br>BR44<br>-B1/E1<br>BR45<br>-A1/E1          | BR51,<br>BR52-C<br>2 | BR53,B<br>R54 -B2/<br>D1<br>BR55<br>-A2/D1          |               |
| 2 - 3 - 6 (Note 1)      | BR41, BR42 -C1                         |          | BR43,<br>BR44<br>-B1/E1<br>BR45<br>-A1/E1          | BR51,<br>BR52-C<br>2 | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |               |
| 2 - 4 - 5 (Note 1)      | BR41, BR42 -C1                         |          | BR43,<br>BR44<br>-B1/E1<br>BR45,<br>BR46<br>-A1/E1 | BR51,<br>BR52-C<br>2 | BR53,B<br>R54 -B2/<br>D1<br>BR55<br>-A2/D1          |               |
| 2 - 4 - 6 (Note 1)      | BR41, BR42 -C1                         |          | BR43,<br>BR44<br>-B1/E1<br>BR45,<br>BR46<br>-A1/E1 | BR51,<br>BR52-C<br>2 | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 | See Figure 63 |
| 3 - 3 - 3 (Note 1)      | BR41, BR42 -C1/F1<br>BR43 -B1/F1       |          | BR44,<br>BR45<br>-A1/E1<br>BR51<br>-C2/E1          |                      | BR52,B<br>R53 -B2/<br>D1<br>BR54<br>-A2/D1          |               |
| 3 - 3 - 4 (Note 1)      | BR41, BR42 -C1/F1<br>BR43 -B1/F1       |          | BR44,<br>BR45<br>-A1/E1<br>BR51<br>-C2/E1          |                      | BR52,B<br>R53 -B2/<br>D1<br>BR54,B<br>R55<br>-A2/D1 |               |
| 3 - 4 - 4 (Note 1)      | BR41, BR42 -C1/F1<br>BR43 -B1/F1       |          | BR44,<br>BR45<br>-A1/E1<br>BR51,<br>BR52<br>-C2/E1 |                      | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |               |
| 4 - 4 - 4 (Note 1)      | BR41, BR42 -C1/F1<br>BR43, BR44 -B1/F1 |          | BR45,<br>BR46<br>-A1/E1<br>BR51,<br>BR52<br>-C2/E1 |                      | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 | See Figure 64 |
| 0 - 3 - 3 (Note 1)      |                                        |          | BR41,<br>BR42<br>-B1/E1<br>BR43<br>-A1/E1          |                      | BR51,B<br>R52 -B2/<br>D1<br>BR53<br>-A2/D1          |               |

| Expansion Configuration | Sector 1   | Sector 2 |                                                    | Sector 3          |                                                     | Reference     |
|-------------------------|------------|----------|----------------------------------------------------|-------------------|-----------------------------------------------------|---------------|
|                         | Ant 2 or 3 | Ant 2    | Ant 2 or 3                                         | Ant 2             | Ant 3                                               |               |
| 0 - 3 - 4 (Note 1)      |            |          | BR41,<br>BR42<br>-B1/E1<br>BR43<br>-A1/E1          |                   | BR51,B<br>R52 -B2/<br>D1<br>BR53,B<br>R54<br>-A2/D1 |               |
| 0 - 4 - 4 (Note 1)      |            |          | BR41,<br>BR42<br>-B1/E1<br>BR43,<br>BR44<br>-A1/E1 |                   | BR51,B<br>R52 -B2/<br>D1<br>BR53,B<br>R54<br>-A2/D1 | See Figure 65 |
| 0 - 3 - 5 (Note 1)      |            |          | BR41,<br>BR42<br>-B1/E1<br>BR43<br>-A1/E1          | BR51,B<br>R52 -C2 | BR53,B<br>R54 -B2/<br>D1<br>BR55<br>-A2/D1          |               |
| 0 - 3 - 6 (Note 1)      |            |          | BR41,<br>BR42<br>-B1/E1<br>BR43<br>-A1/E1          | BR51,B<br>R52 -C2 | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |               |

## V03 &amp; V06 Expansions

| Expansion Configuration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Sector 1   | Sector 2             |                                                    | Sector 3                                            |                                                     | Reference     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|---------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Ant 2 or 3 | Ant 2                | Ant 2 or 3                                         | Ant 2                                               | Ant 3                                               |               |
| 0 - 4 - 5 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                      | BR41,<br>BR42<br>-B1/E1<br>BR43,<br>BR44<br>-A1/E1 | BR51,B<br>R52 -C2                                   | BR53,B<br>R54 -B2/<br>D1<br>BR55<br>-A2/D1          |               |
| 0 - 4 - 6 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                      | BR41,<br>BR42<br>-B1/E1<br>BR43,<br>BR44<br>-A1/E1 | BR51,B<br>R52 -C2                                   | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 | See Figure 66 |
| 0 - 3 - 7 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                      | BR41,<br>BR42<br>-C1/F1<br>BR43<br>-B1/F1          | BR44,B<br>R45<br>-A1/E1<br>BR51,B<br>R52 -C2/<br>E1 | BR53,B<br>R54 -B2/<br>D1<br>BR55<br>-A2/D1          |               |
| 0 - 3 - 8 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                      | BR41,<br>BR42<br>-C1/F1<br>BR43<br>-B1/F1          | BR44,B<br>R45<br>-A1/E1<br>BR51,B<br>R52 -C2/<br>E1 | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 |               |
| 0 - 4 - 7 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                      | BR41,<br>BR42<br>-C1/F1<br>BR43,<br>BR44<br>-B1/F1 | BR45,B<br>R46<br>-A1/E1<br>BR51,B<br>R52 -C2/<br>E1 | BR53,B<br>R54 -B2/<br>D1<br>BR55<br>-A2/D1          |               |
| 0 - 4 - 8 (Note 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                      | BR41,<br>BR42<br>-C1/F1<br>BR43,<br>BR44<br>-B1/F1 | BR45,B<br>R46<br>-A1/E1<br>BR51,B<br>R52 -C2/<br>E1 | BR53,B<br>R54 -B2/<br>D1<br>BR55,B<br>R56<br>-A2/D1 | See Figure 67 |
| 0 - 5 - 5 (Note 2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            | BR41,<br>BR42<br>-C1 | BR43,<br>BR44<br>-B1/E1<br>BR45<br>-A1/E1          | BR51,<br>BR52<br>-C2                                | BR53,B<br>R54 -B2/<br>D1<br>BR55<br>-A2/D1          |               |
| 0 - 5 - 6 (Note 2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            | BR41,<br>BR42<br>-C1 | BR43,<br>BR44<br>-B1/E1<br>BR45<br>-A1/E1          | BR51,<br>BR52<br>-C2                                | BR53,B<br>R54 -B2/<br>D1<br>BR55,<br>BR56<br>-A2/D1 |               |
| 0 - 6 - 6 (Note 2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            | BR41,<br>BR42<br>-C1 | BR43,<br>BR44<br>-B1/E1<br>BR45,<br>BR46<br>-A1/E1 | BR51,<br>BR52<br>-C2                                | BR53,B<br>R54 -B2/<br>D1<br>BR55,<br>BR56<br>-A2/D1 | See Figure 68 |
| Notes:<br>1. The basic multi-sector rack includes a triple 2 way combiner (A1/B1/C1) with isolators. When more than 2 BRs are used for any one sector in the multi-sector rack, an optional triple 2 way hybrid combiner without isolators (D1/E1/F1) is required. To get to 24 BR capacity with V03 and V06 a second expansion rack is required which includes a triple 2 way combiner (A2/B2/C2) with isolators.<br>2. For configurations with 5 or 6 BRs in a sector, the GEN4 Expansion rack is recommended instead of the Multi-sector Rack. |            |                      |                                                    |                                                     |                                                     |               |



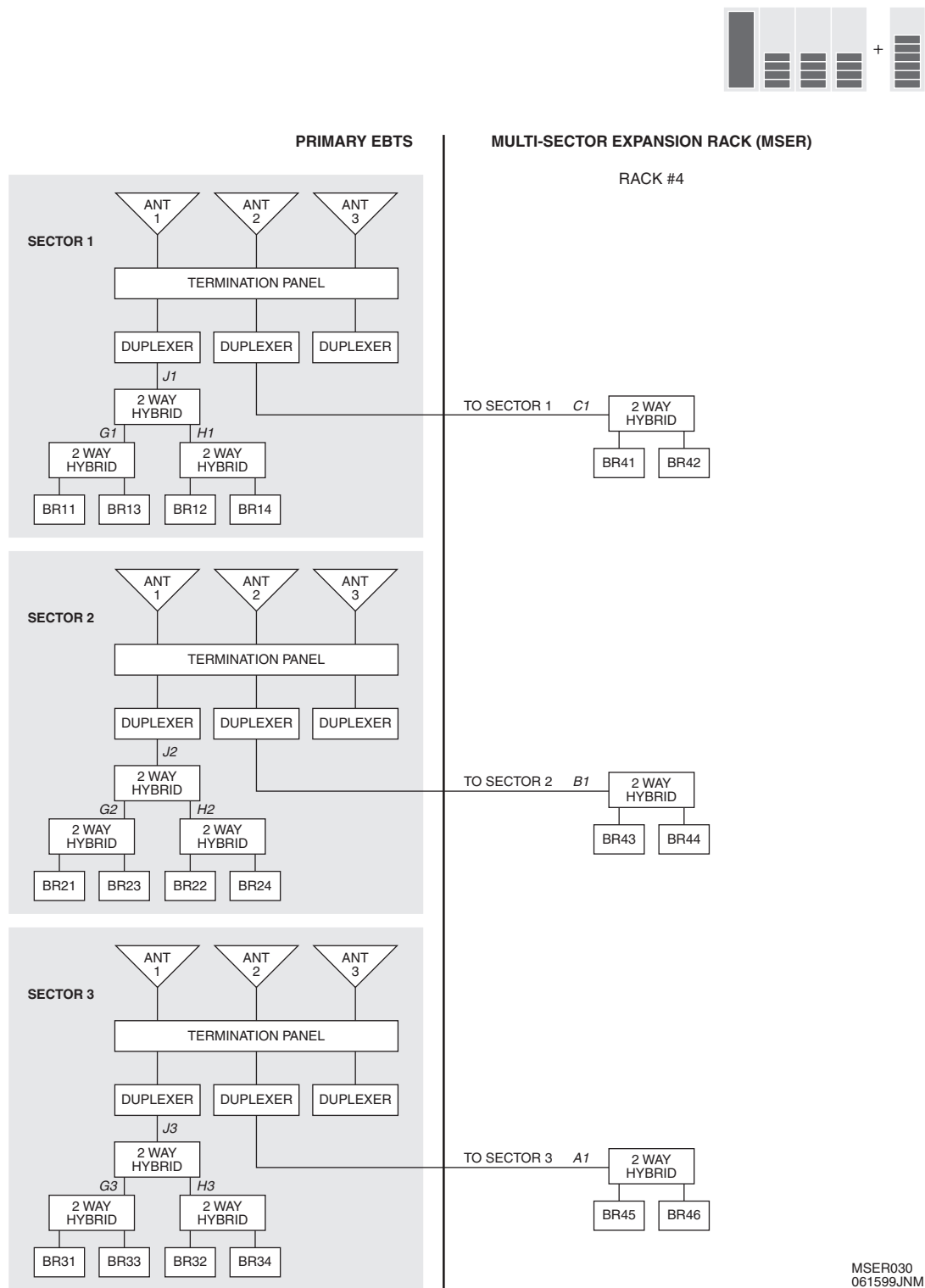


Figure 57 6-6-6 Configuration (2-2-2 Expansion)

## V03 &amp; V06 Expansions

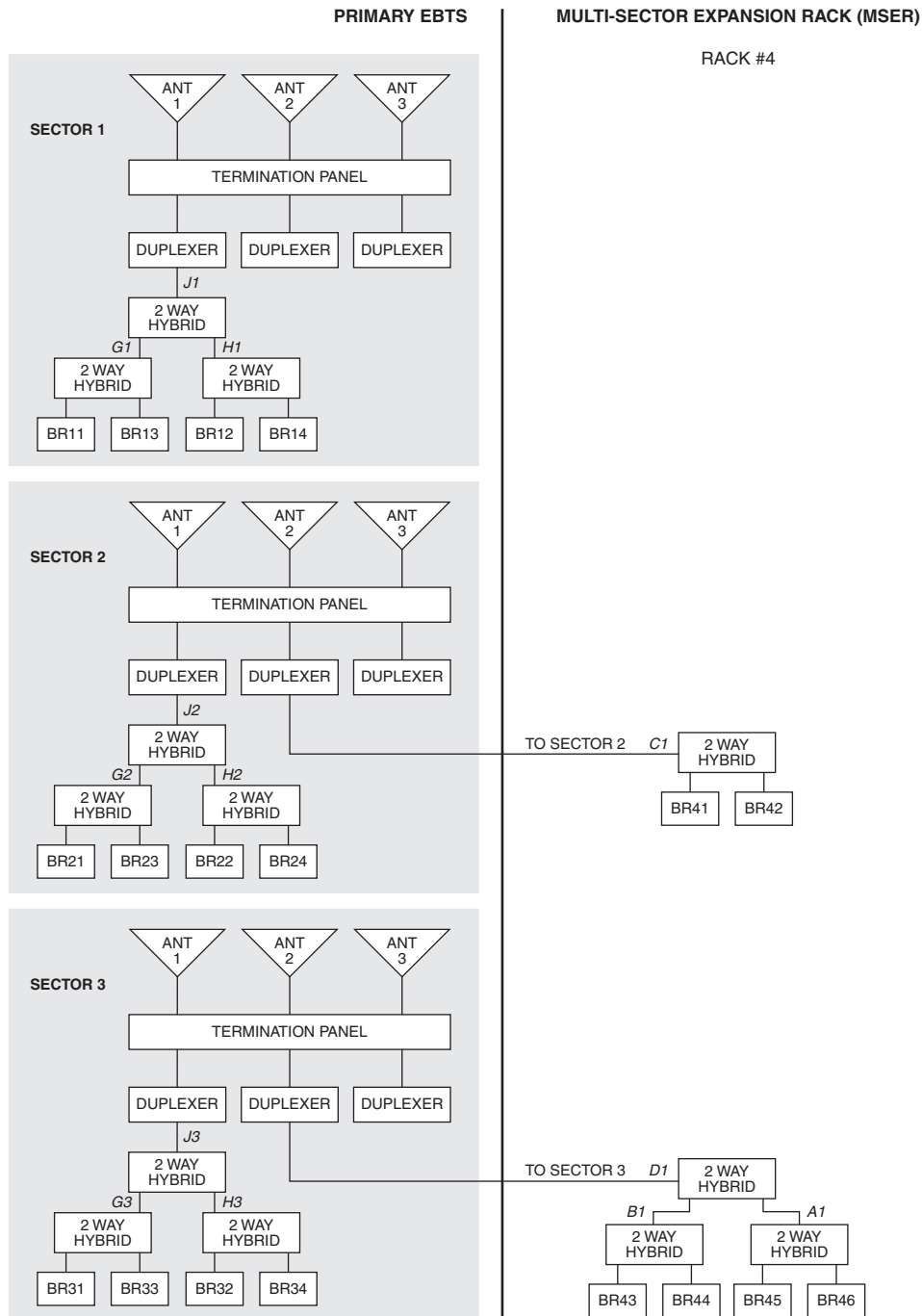


Figure 58 4-6-8 Configuration (0-2-4 Expansion)

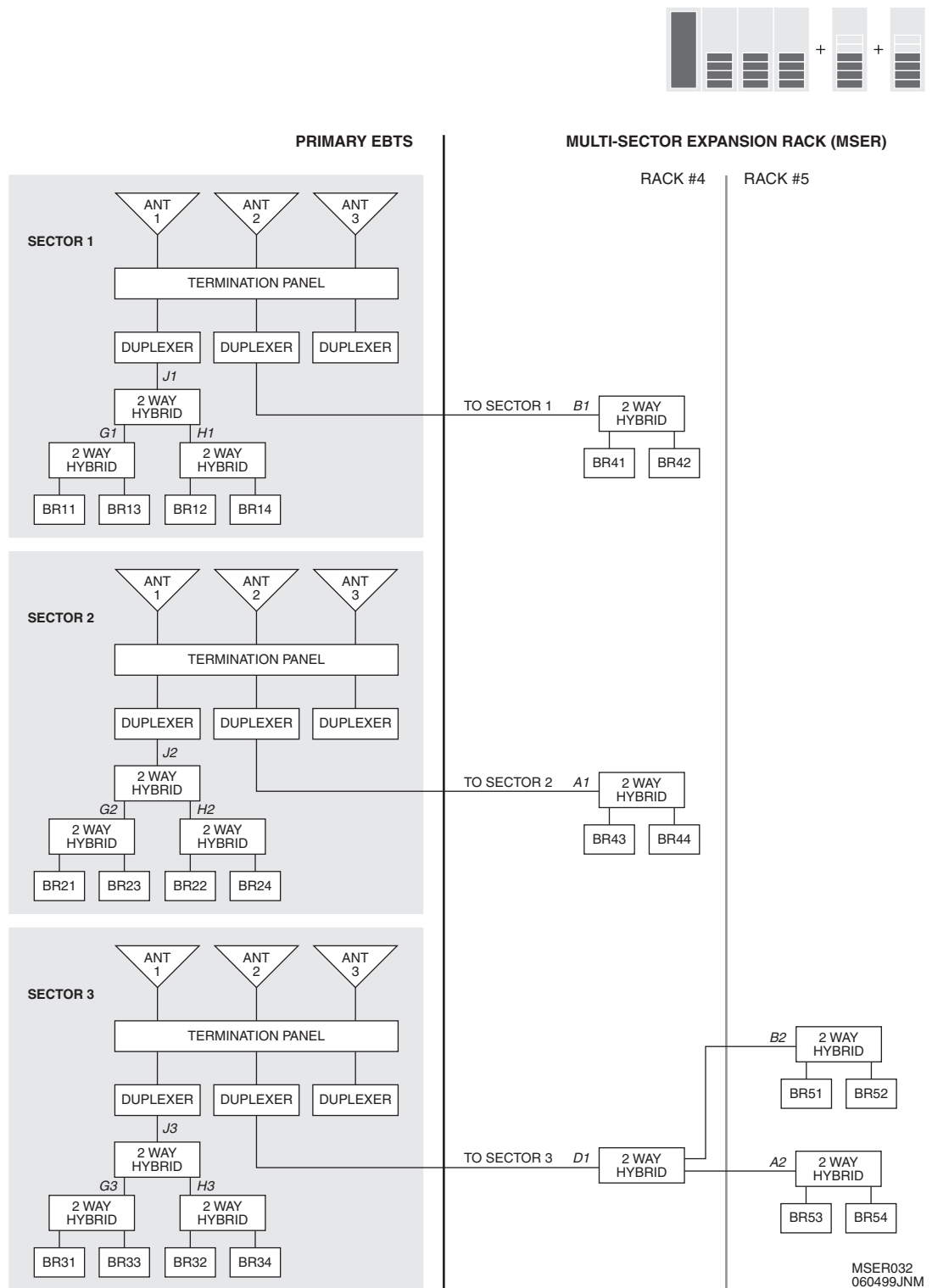


Figure 59 6-6-8 Configuration (2-2-4 Expansion)

## V03 &amp; V06 Expansions

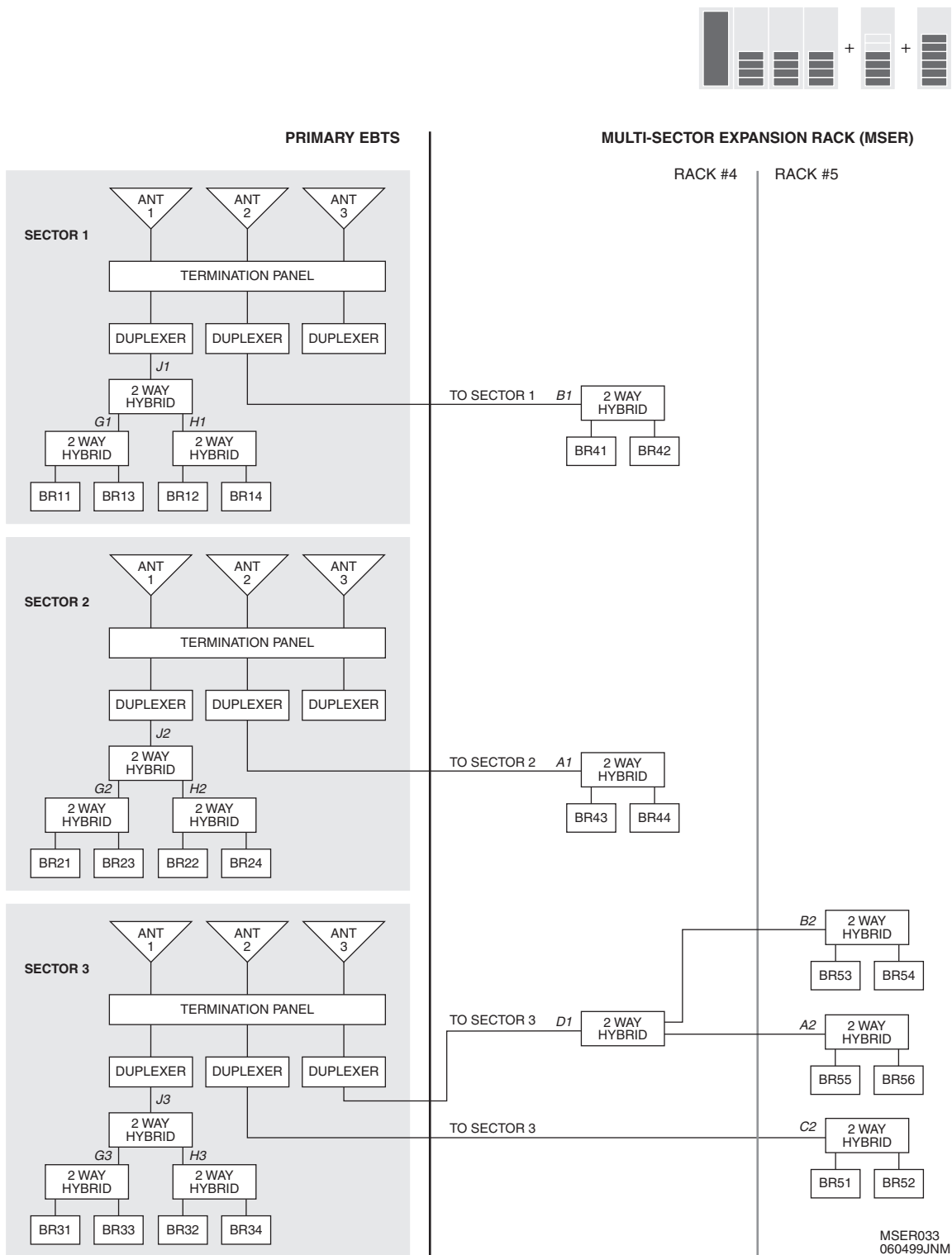


Figure 60 6-6-10 Configuration (2-2-6 Expansion)

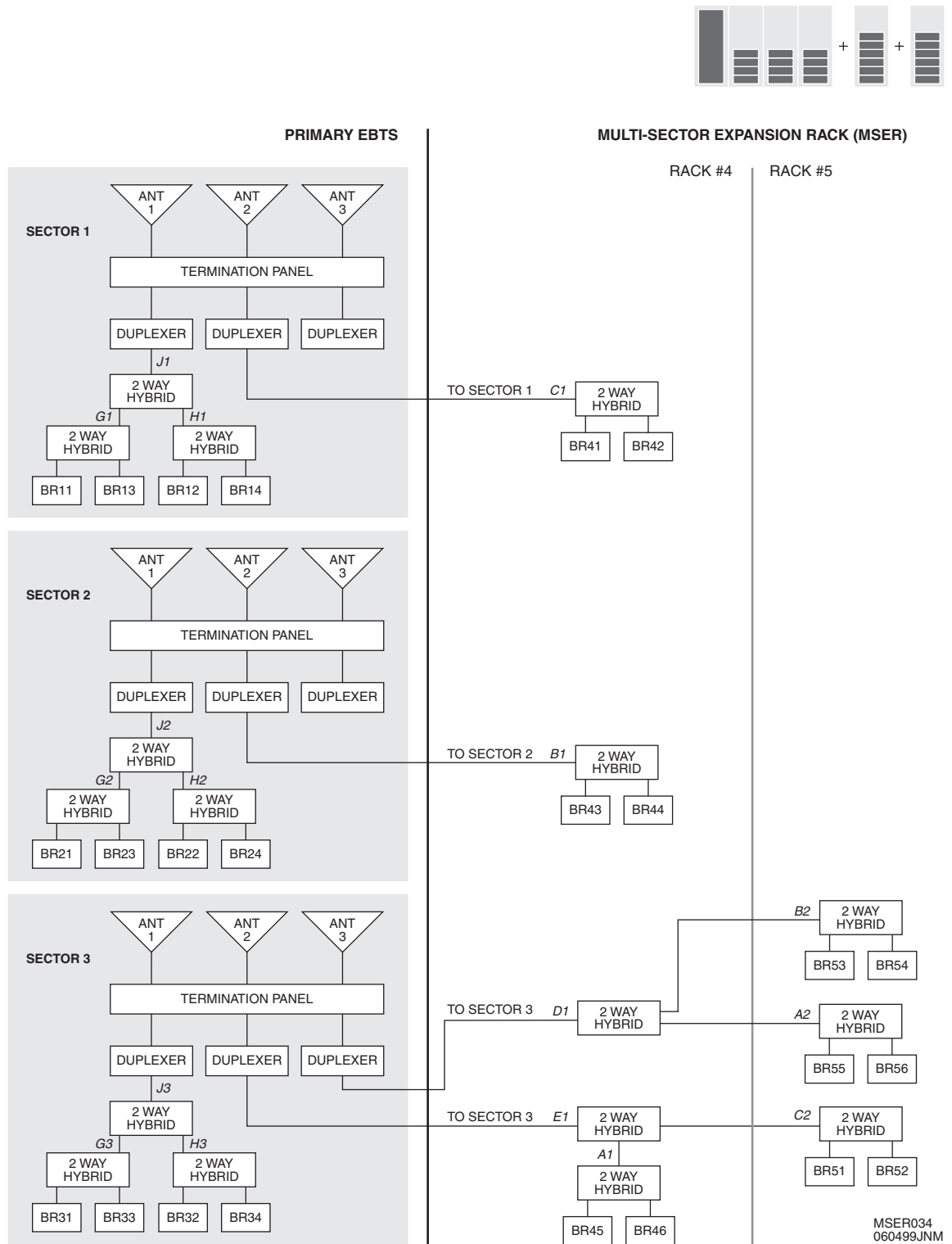


Figure 61 6-6-12 Configuration (2-2-8 Expansion)

## V03 &amp; V06 Expansions

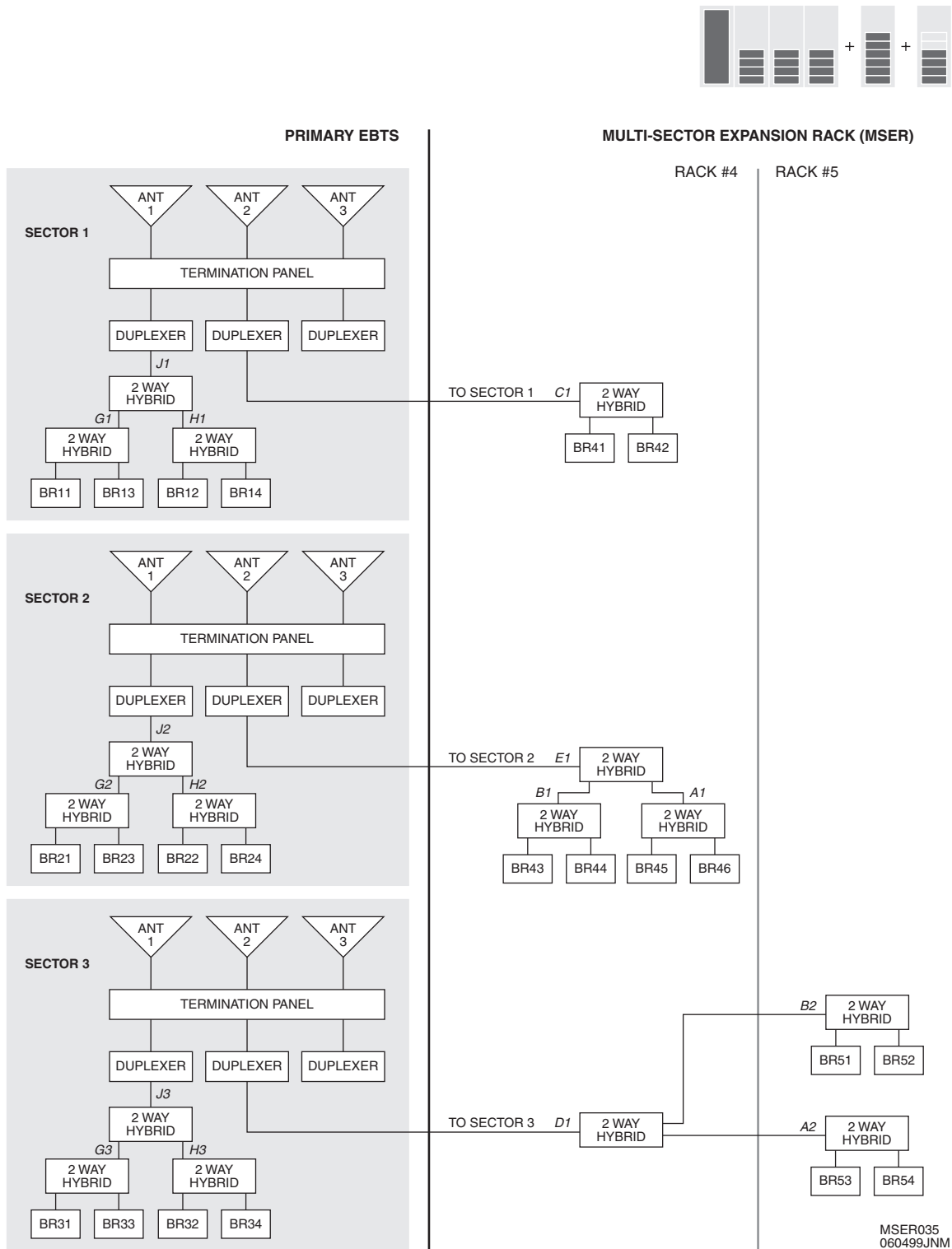


Figure 62 6-8-8 Configuration (2-4-4 Expansion)

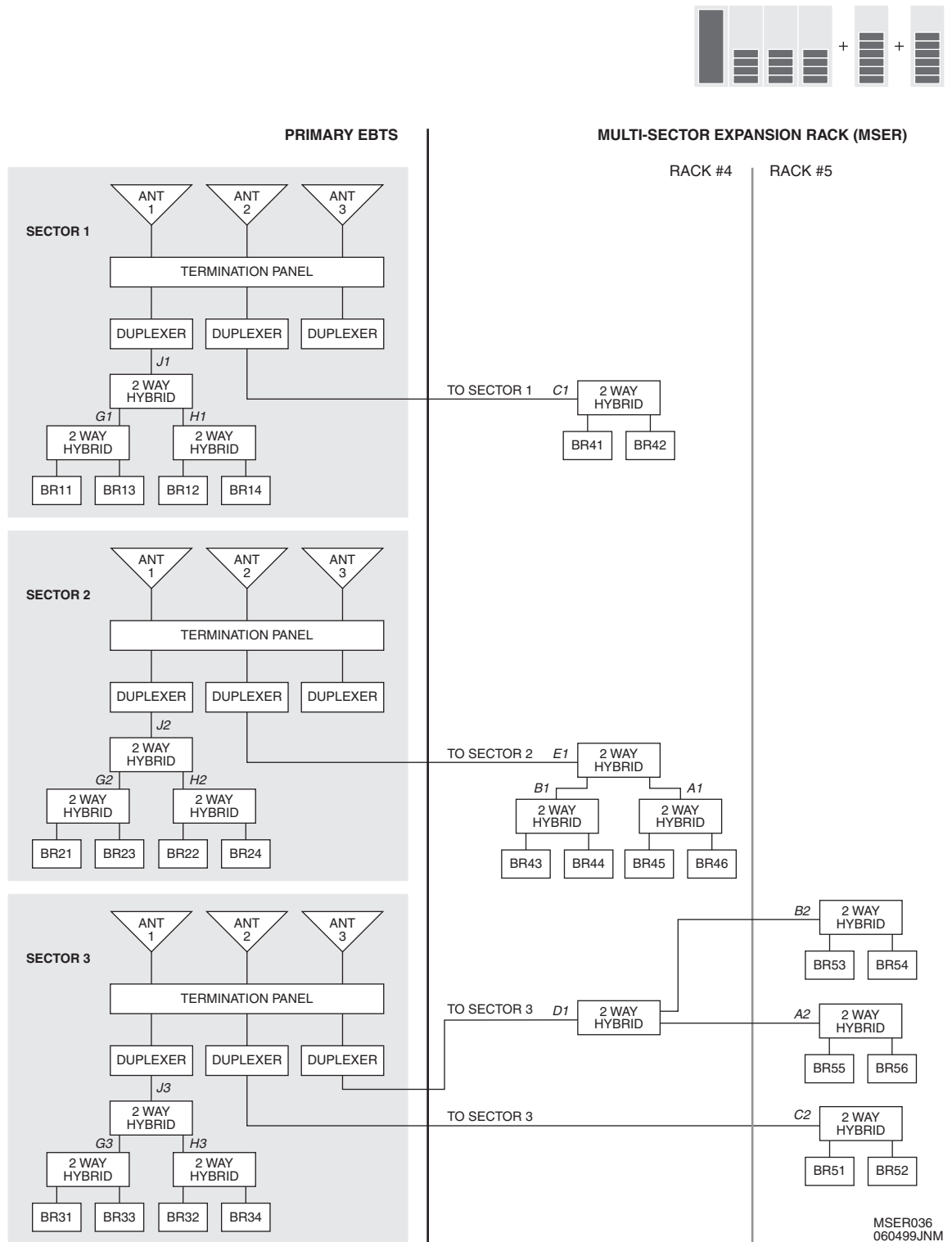


Figure 63 4-10-10 Configuration (2-4-6 Expansion)

## V03 &amp; V06 Expansions

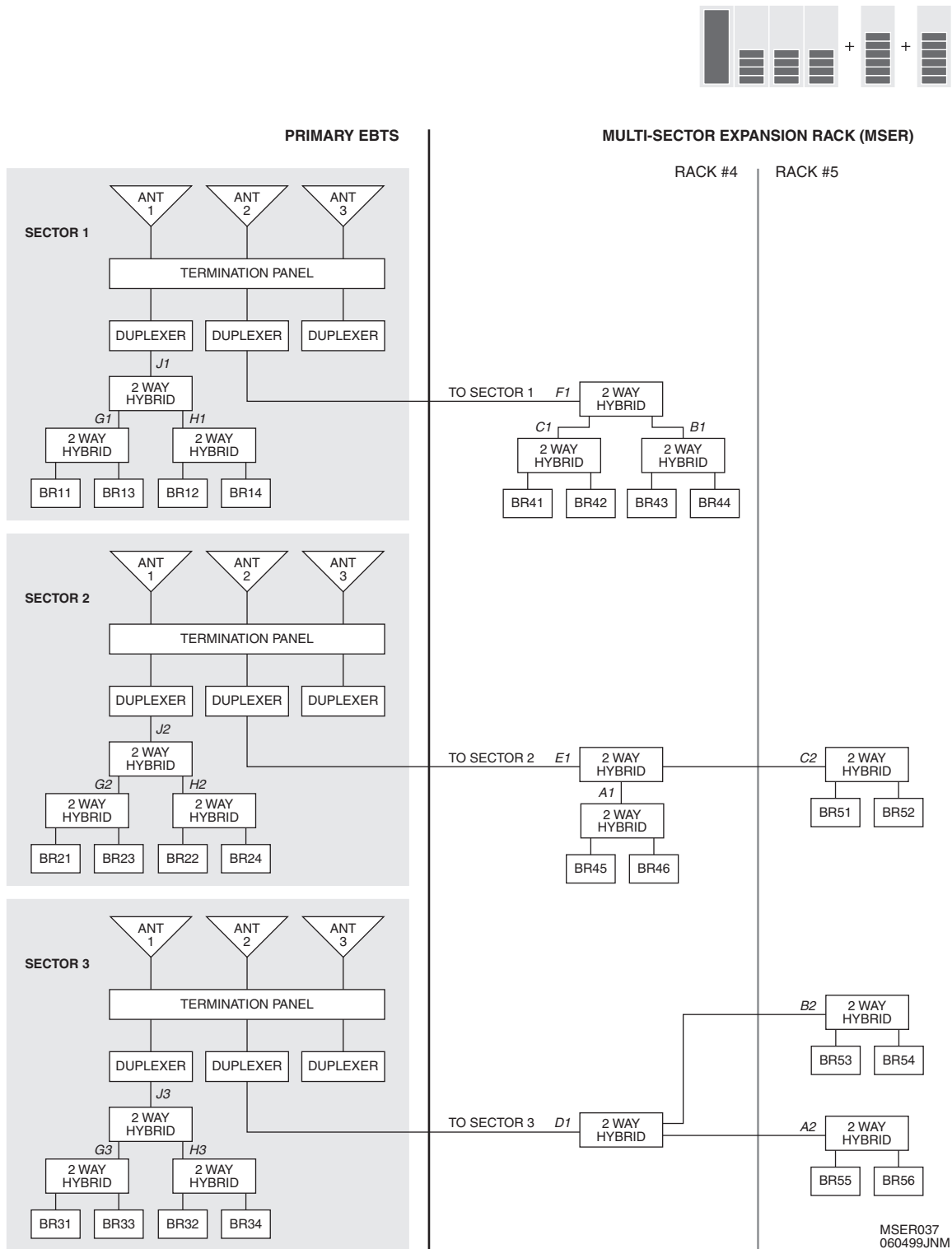


Figure 64 8-8-8 Configuration (4-4-4 Expansion)



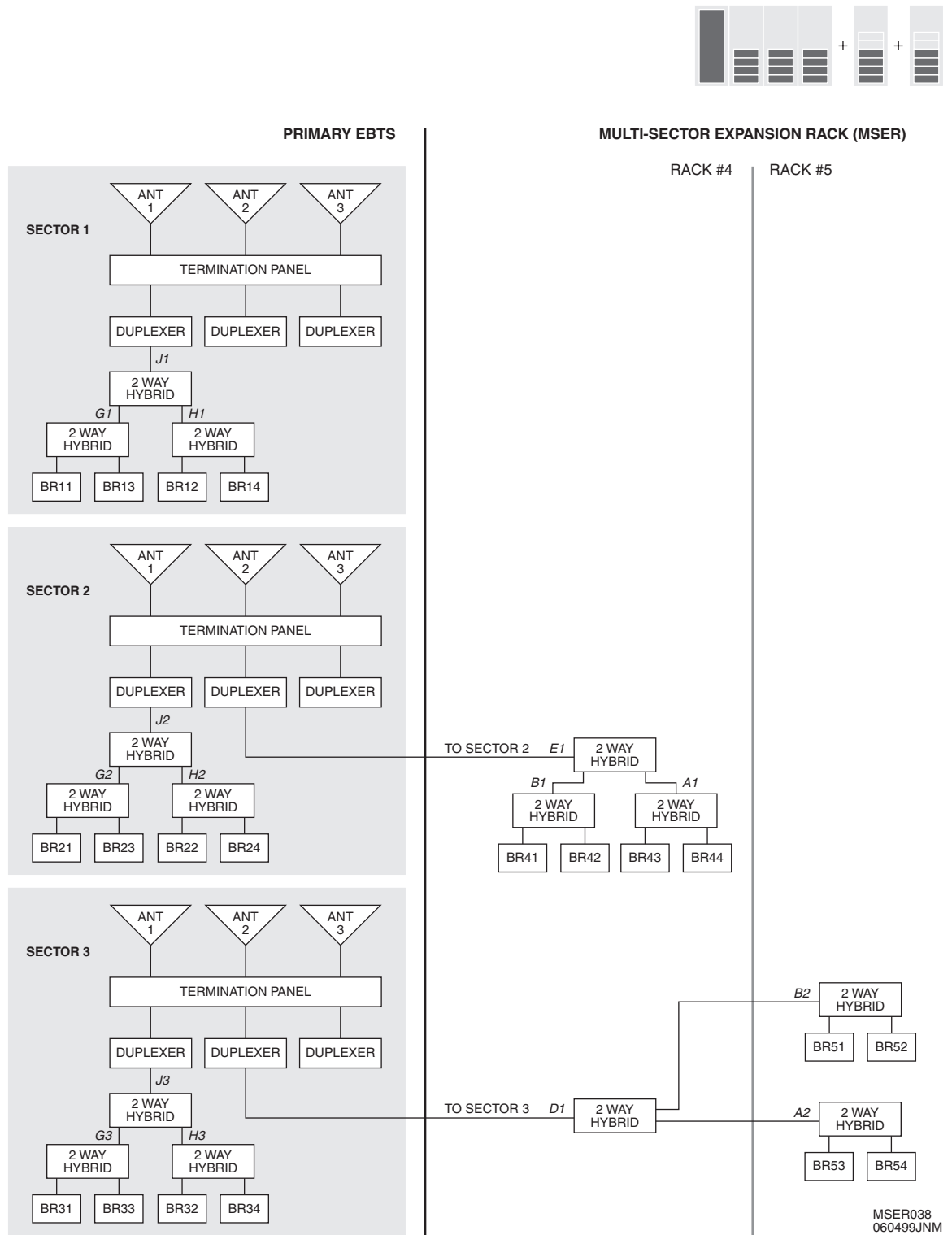


Figure 65 4-8-8 Configuration (0-4-4 Expansion)

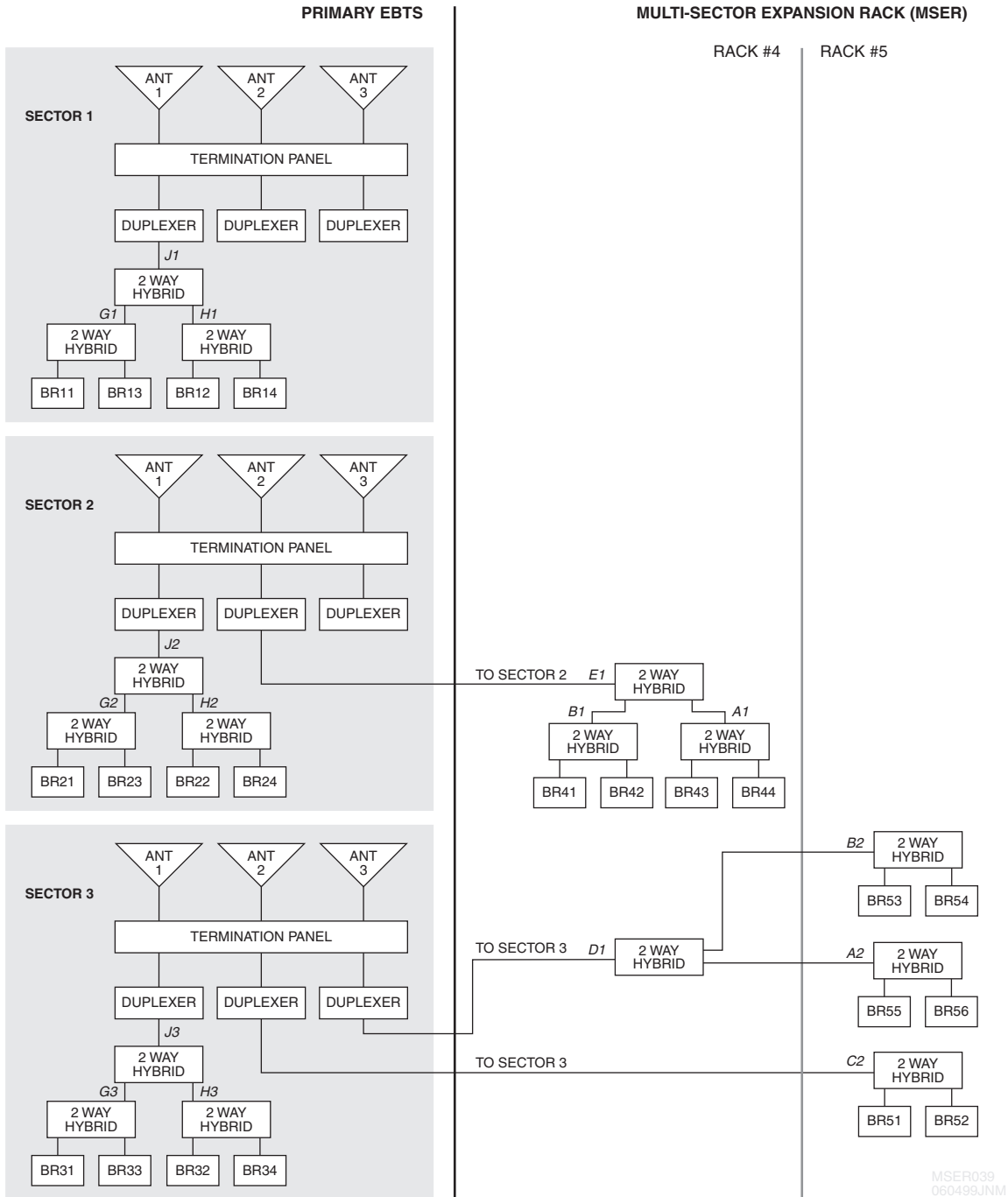


Figure 66 4-8-10 Configuration (0-4-6 Expansion)

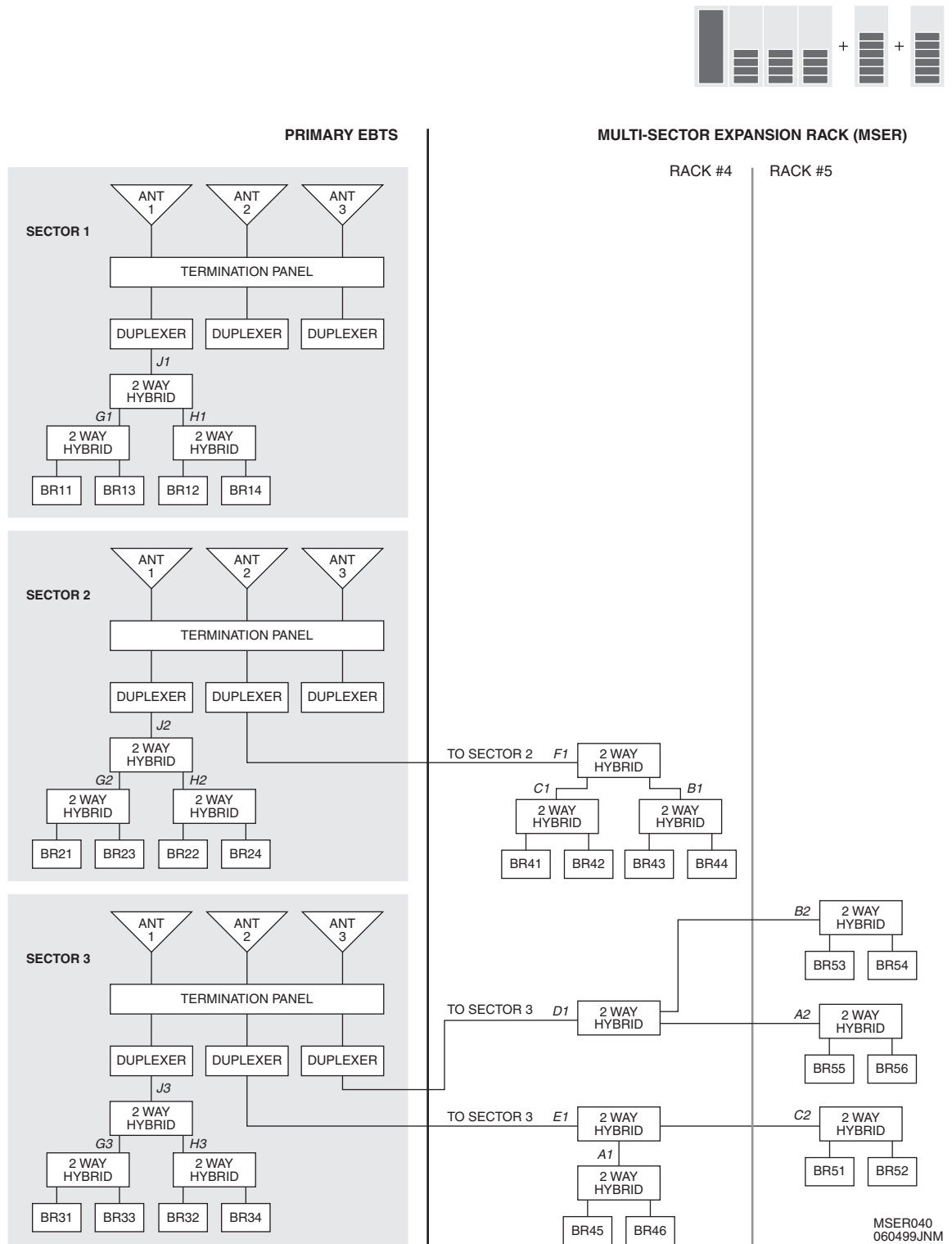


Figure 67 4-8-12 Configuration (0-4-8 Expansion)

## V03 &amp; V06 Expansions

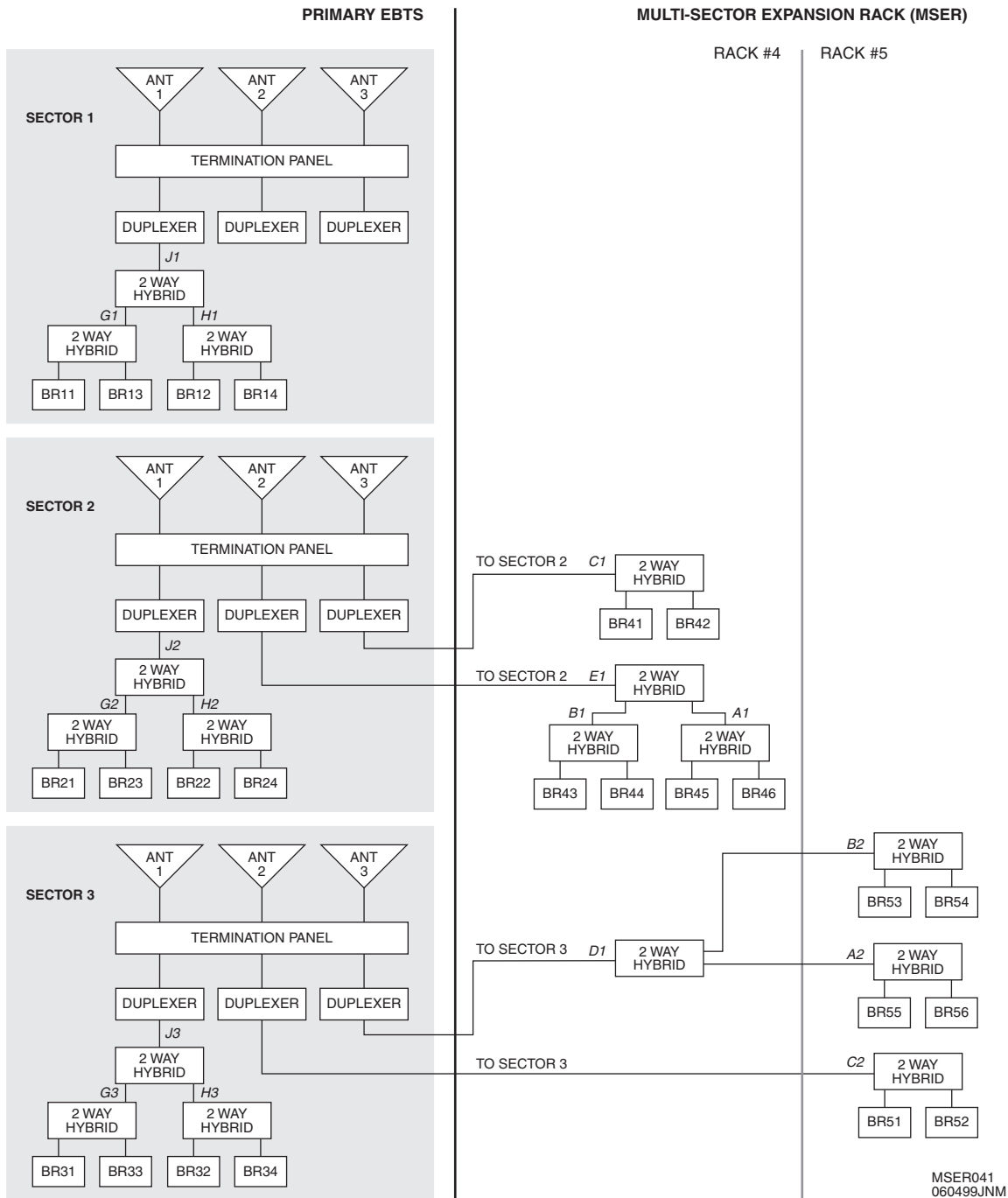


Figure 68 4-10-10 Configuration (0-6-6 Expansion)

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## Parts and Suppliers

This section provides information for selected hardware, tools, and other equipment used during the installation of the Multi-Sector Expansion Rack (MSER).

| Section                             | Page | Description                                                                                       |
|-------------------------------------|------|---------------------------------------------------------------------------------------------------|
| Cabinet Mounting Hardware           | 134  | Provides information regarding cabinet mounting hardware.                                         |
| Cabinet Ground Connections          | 134  | Provides information about cabinet ground connections to the MSER cabinet and master ground bar.  |
| Battery Connections                 | 135  | Provides information about battery system connections to the MSER cabinet.                        |
| Inter-Cabinet Cabling               | 137  | Provides information needed manufacture custom inter-cabinet cables, if needed.                   |
| Equipment Cabinet Power Connections | 138  | Provides wire size and connection lug information to connect the MSER to the Power Supply system. |
| Parts Ordering                      | 140  | Contains contact information for ordering spare or replacement parts from Motorola.               |

Please note that the model and part numbers, and manufactures listed have been recommended due to their proven performance in previous installations. Motorola cannot guarantee the effectiveness of the installation or performance of the system when using models or parts of other manufacturers. Contact information has been supplied for each vendor whenever available.

## Parts and Suppliers

## Cabinet Mounting Hardware

The mounting hardware for the MSER cabinet site dependent and must be procured locally. It should be provide at least 1545 pounds of retention force to secure the cabinet.

- ☐ When securing the cabinet to a concrete floor, use 1/2" grade 8 bolts with anchors.
- ☐ When securing the cabinet to other types of floors, determine the appropriate mounting hardware.

## Cabinet Ground Connections

Thomas & Betts is the recommended vendor of all wire lugs used for the MSER installation. All wire lug part numbers listed are for Thomas & Betts.

### Thomas & Betts

1555 Lynnfield Road

Memphis, TN 38119

Phone: 800-888-0211 (general information)

800-248-7774 (sales/technical support)

### NOTE

Double hole wire lugs are preferred, but single hole wire lugs can be used where mounting requirements dictate their use.

## Master Ground Bar Lugs

Table 7 identifies the recommended wire lugs to connect the cabinet ground wire to the master ground bar for the installation site.

Table 7 **Recommended Master Ground Bar Lugs**

| Wire Size                                                                                                      | Wire Type | Lug Color | Description                            | P/N † |
|----------------------------------------------------------------------------------------------------------------|-----------|-----------|----------------------------------------|-------|
| #2 AWG                                                                                                         | Stranded  | Brown     | Single 1/4" diameter hole              | 54107 |
| #2 AWG                                                                                                         | Stranded  | Brown     | Double 1/4" diameter hole, 5/8" center | 54207 |
| #6 AWG                                                                                                         | Stranded  | Blue      | Single 1/4" diameter hole              | 54105 |
| #6 AWG                                                                                                         | Stranded  | Blue      | Double 1/4" diameter hole, 5/8" center | 54205 |
| <b>NOTE:</b> These lugs require the use of the TBM5-S crimping tool.<br>† All part numbers are Thomas & Betts. |           |           |                                        |       |

## Cabinet Ground Lugs

Table 8 identifies the recommended wire lugs to connect the cabinet ground wire to the MSER cabinet.

*Table 8 Recommended Junction Panel Ground Lugs*

| Wire Size                                                                                                      | Wire Type | Lug Color | Description               | P/N † |
|----------------------------------------------------------------------------------------------------------------|-----------|-----------|---------------------------|-------|
| #2 AWG                                                                                                         | Stranded  | Brown     | Single 1/2" diameter hole | 54145 |
| #6 AWG                                                                                                         | Stranded  | Blue      | Single 3/8" diameter hole | E6-12 |
| <b>NOTE:</b> These lugs require the use of the TBM5-S crimping tool.<br>† All part numbers are Thomas & Betts. |           |           |                           |       |

## Battery Connections

The cable loop length refers to the total length of wire within a given circuit. For example, the combined length of the -48 Vdc (hot) lead and the DC return lead equals the cable loop length. This would mean that a cabinet that needs 16 feet of wire between the batteries and Power Supply Rack has a total loop length of 32 feet.

### Determining Battery System Wire Size

The wire size for the connection between the batteries and the Power Supply Rack is determined by the required wire length and the maximum allowable voltage drop. The voltage drop in the loop must be kept to below 200 mV. The wire selected should be UL approved and contain a high number of strands for flexibility.

For a standard configuration, the Power Supply rack is located directly adjacent to the batteries with a cable loop length of 20 feet or less, which requires the use of a 4/0 wire. Table 9 shows recommended wire sizes for various loop lengths. Larger wire sizes may be used if the recommended sizes are not available. The recommended wire sizes are large enough to allow site expansion to a fully loaded site.

*Table 9 Battery System Wire Size*

| Loop Length | Wire size        |
|-------------|------------------|
| 20 feet     | 4/0 (or 250 MCM) |
| 30 feet     | 350 MCM          |
| 45 feet     | 500 MCM          |

## Selecting Battery System Lugs

Depending on the wire size used and the manufacturer of the Batteries, different wire lugs are crimped onto the power cable ends. After the wire size has been determined from Table 9, verify the manufacturer of the Batteries (*Dynasty* or *Absolyte*).

Two different battery systems are offered with the EBTS. The *Dynasty* system is a low to medium capacity, field expandable system supplied for smaller sites or sites with minimal backup hour requirements. This system is custom designed to Motorola specifications. The *Dynasty* system is manufactured by Johnson Controls:

### C & D Technologies

900 East Keefe Avenue  
P.O. Box 591  
Milwaukee, WI 53212  
Phone: 414-967-6500  
Fax: 414-961-6506

The *Absolute IIP* battery system is a heavy duty, high capacity battery system manufactured by GNB Technologies:

### GNB Technologies

829 Parkview Boulevard  
Lombard, IL 60148  
Phone: 800-872-0471  
630-629-5200  
Fax: 630-629-2635

Refer to Table 10 to determine the proper wire lug for the connection of that wire to the Power Supply rack.

Table 10 **Power Supply Rack Connection Lugs**

| Wire Size                              | Cabinet Lug                 | Crimp Tool | Lug P/N † |
|----------------------------------------|-----------------------------|------------|-----------|
| 4/0                                    | Double 3/8" hole, 1" center | TBM5-S     | 54212     |
| 250 MCM                                | Double 3/8" hole, 1" center | TBM8-S     | 54213     |
| 350 MCM                                | Double 3/8" hole, 1" center | TBM8-S     | 54215     |
| 500 MCM                                | Double 3/8" hole, 1" center | TBM8-S     | 54218     |
| † All part numbers are Thomas & Betts. |                             |            |           |

Refer to Table 11 to determine the proper wire lug for the connection to the batteries, based on the wire size and battery manufacturer. One column lists the selection for *Dynasty* and the other lists the selection for *Absolyte IIP*.



Table 11 **Battery Connection Lugs**

| Wire Size  | Lug Color | Dynasty                     |           | Absolyte IIP     |       |
|------------|-----------|-----------------------------|-----------|------------------|-------|
|            |           | Description                 | P/N       | Description      | P/N   |
| 4/0        | Purple    | Double 3/8" hole, 1" center | 5421<br>2 | Single 1/2" hole | 54170 |
| 250<br>MCM | Yellow    | Double 3/8" hole, 1" center | 5421<br>5 | Single 1/2" hole | 54113 |
| 350<br>MCM | Red       | Double 3/8" hole, 1" center | 5421<br>8 | Single 1/2" hole | 54115 |
| 500<br>MCM | Brown     | Double 3/8" hole, 1" center | 5422<br>0 | Single 5/8" hole | 54118 |

### Anti-Oxidant Greases

Any one of the following anti-oxidant greases are recommended for connections to the positive (+) and negative (-) terminals of the batteries:

- ☐ No-Ox
- ☐ OxGuard
- ☐ Penetrox

## Inter-Cabinet Cabling

Ethernet and alarm cables connecting to the junction panels of each cabinet are supplied with the system. These cables may not be suitable for every EBTS site. It may be necessary to locally manufacture cables for a custom fit. Information is provided for both supplied cables and custom cables.

### Supplied Cables

The cables listed in Table 12 are supplied with the system. The length of these cables should be sufficient if the considerations outlined in the *Installation* section are followed.

### Making Custom Cables

If custom Ethernet or 5 MHz / 1 PPS cables must be locally manufactured, use the part numbers listed in Table 13 for ordering the required materials.

Table 14 lists the part numbers for custom alarm cables.

## Parts and Suppliers

Table 12 **Supplied Inter-Cabinet Cabling**

| Description                                                               | Qty. | P/N †                            |
|---------------------------------------------------------------------------|------|----------------------------------|
| 144" long, BNC type male-to-N type male cable                             | 9    | 3012029E37                       |
| 108" long, BNC Male-to-BNC Male, RG400 cable                              | 2*   | 0112004Z29<br>(or<br>3013943N45) |
| 210" long, 8-pin Modular plug cable                                       | 1*   | 3084225N42                       |
| 144" long, 1/2" diameter N type male-to-N type male cable                 | 3    | 3082296Y01                       |
| † All part numbers are Motorola.<br>*Per RF rack.<br>** Per Control rack. |      |                                  |

Table 13 **Parts for Ethernet and 5 MHz/1 PPS Cables**

| Description                      | Qty.        | P/N †      |
|----------------------------------|-------------|------------|
| Connector, BNC male              | As required | 2884967D01 |
| Cable, RG400                     | As required | 3084173E01 |
| † All part numbers are Motorola. |             |            |

Table 14 **Parts for Alarm Cables**

| Description                      | Qty.        | P/N †            |
|----------------------------------|-------------|------------------|
| Connector, 8-pin modular         | As required | 2882349V01       |
| Cable, 8-wire                    | As required | Locally procured |
| † All part numbers are Motorola. |             |                  |

## Equipment Cabinet Power Connections

### Selecting Power Connection Lugs

Table 15 identifies recommended part numbers for lugs used for power connections between the Power Supply rack and the MSER cabinet. The maximum wire size accepted by the MSER cabinet is 2/0. The MSER cabinet uses screw type compression connectors that do not require lugs.

### Determining Power Connection Wire Size

The cable loop length refers to the total length of wire within a given circuit. For example, the combined length of the -48 Vdc (hot) lead and the DC return lead equals the cable loop length. This would mean that a cabinet which needs 16 feet of wire between the Power Supply rack and cabinet has a total loop length of 32 feet.

Table 15 **Recommended Power Connection Lugs for Power Supply Rack**

| Size                                   | Lug Color | Description                   | P/N † |
|----------------------------------------|-----------|-------------------------------|-------|
| 2/0                                    | Black     | Double 3/8" hole, 1" center   | 54210 |
| #2 AWG                                 | Brown     | Double 1/4" hole, 5/8" center | 54207 |
| #4 AWG                                 | Gray      | Double 1/4" hole, 5/8" center | 54206 |
| #6 AWG                                 | Blue      | Double 1/4" hole, 5/8" center | 54205 |
| † All part numbers are Thomas & Betts. |           |                               |       |

The wire size for the connection between the Power Supply rack and the equipment cabinets is determined by the required wire length and the maximum allowable voltage drop. The voltage drop in the loop must be kept to below 500 mV. The wire selected should be UL approved and contain a high number of strands for flexibility. Table 16 shows the recommended wire sizes for various loop lengths of the RF Cabinet.

For a standard configuration, the equipment cabinets are located adjacent to the Power Supply rack with a cable loop length less than 35'.

Table 16 **Power Connection Wire Size**

| Loop Length                                                                                       | Wire Size |
|---------------------------------------------------------------------------------------------------|-----------|
| 25 feet or less                                                                                   | #6 AWG    |
| 25 to 40 feet                                                                                     | #4 AWG    |
| 40 to 60 feet                                                                                     | #2 AWG    |
| 60 to 130 feet                                                                                    | 1/0 AWG   |
| <b>NOTE:</b> The wire sizes listed are large enough to allow full RF Cabinet Base Radio capacity. |           |

The MSER cabinet has a total of four Power Supply Rack connections; two -48 Vdc (hot) and two DC return. The MSER cabinet contains two separate power distribution systems. A single hot wire and a single return wire are used for each side of the bus. Two return leads provide redundancy and allow a uniform wire size to be used for all 48 Vdc power distribution system connections.

## Parts Ordering

The parts and supplies listed in this section can be ordered from the one of the following vendors:

### **Motorola Inc.**

*Accessories and Aftermarket Division*

Attn: Order Processing

2200 Galvin Drive

Elgin, IL 60123-7834

Phone: 800-422-4210 (sales/technical support)

Fax: 800-622-6210

### **Newark Electronics**

Call for a local phone number in your area to order parts

Phone: 800-463-9275 (catalog sales)

773-784-5100

Fax: 847-310-0275

Internet: [www.newark.com](http://www.newark.com)



# ***QUAD Base Radio Cabling***

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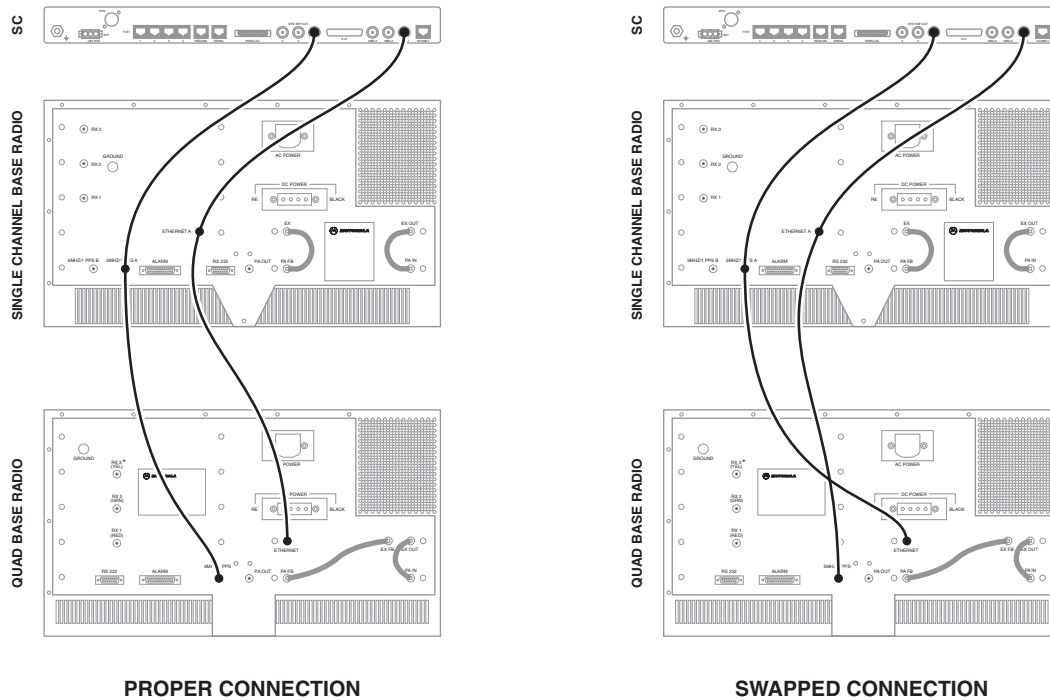
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## **Overview**

This chapter provides technical information for cabling of the 800 Mhz and 900 Mhz QUAD Channel Base Radios.

The topics of this section are listed in the following table.

| Section                                                            | Page | Description                                                              |
|--------------------------------------------------------------------|------|--------------------------------------------------------------------------|
| QUAD BR 5 MHz/Ethernet Cabling for installation in a non-QUAD site | 2    | Diagram for field installation of a QUAD at a previously non-QUAD site.. |



EBTS802  
112501JNM

Figure 1 **QUAD BR 5 MHz/Ethernet Cabling for installation in a non-QUAD site**

|                |                                                             |                |                                                     |
|----------------|-------------------------------------------------------------|----------------|-----------------------------------------------------|
| <b>A/D</b>     | Analog-to-Digital                                           | <b>CC</b>      | Control Cabinet                                     |
| <b>A</b>       | Amperes                                                     | <b>CD</b>      | Carrier Detect                                      |
| <b>AC</b>      | Alternating Current                                         | <b>cd</b>      | change directory                                    |
| <b>ACT</b>     | active                                                      | <b>CLK</b>     | Clock                                               |
| <b>ADA</b>     | Americans with Disabilities Act                             | <b>CLT</b>     | Controller                                          |
| <b>AGC</b>     | Automatic Gain Control                                      | <b>cm</b>      | centimeter                                          |
| <b>AIC</b>     | Ampere Interrupting Capacity                                | <b>CMOS</b>    | Complementary Metal Oxide Semiconductor             |
| <b>AIS</b>     | Alarm Indication Signal (Keep Alive)                        | <b>CPU</b>     | Central Processing Unit                             |
| <b>ANSI</b>    | American National Standards Institute                       | <b>CSMA/CD</b> | Carrier Sense Multiple Access with Collision Detect |
| <b>ASCII</b>   | American National Standard Code for Information Interchange | <b>CTI</b>     | Coaxial Transceiver Interface                       |
| <b>ASIC</b>    | Application Specific Integrated Circuit                     | <b>CTL</b>     | Control (Base Radio Control)                        |
| <b>Aux</b>     | auxiliary                                                   | <b>CTS</b>     | Clear-to-Send                                       |
| <b>avg</b>     | average                                                     | <b>D/A</b>     | Digital-to-Analog                                   |
| <b>AWG</b>     | American Wire Gauge                                         | <b>DAP</b>     | Dispatch Application Processor                      |
| <b>bd</b>      | baud                                                        | <b>DB-15</b>   | 15-pin D-subminiature                               |
| <b>BDM</b>     | Background Debug Mode                                       | <b>DB-9</b>    | 9-pin D-subminiature                                |
| <b>BER</b>     | Bit Error Rate                                              | <b>dB</b>      | Decibel                                             |
| <b>BERT</b>    | Bit Error Rate Test                                         | <b>dBc</b>     | Decibels relative to carrier                        |
| <b>BMR</b>     | Base Monitor Radio                                          | <b>dBm</b>     | Decibels relative to 1mW                            |
| <b>BNC</b>     | Baby "N" Connector                                          | <b>DC</b>      | Direct Current                                      |
| <b>BPV</b>     | Bipolar Variation                                           | <b>DCE</b>     | Data Circuit-Terminating Equipment                  |
| <b>BR</b>      | Base Radio                                                  | <b>DCSPLY</b>  | DC Supply                                           |
| <b>BRC</b>     | Base Radio Controller                                       | <b>DDM</b>     | Dual Device Module                                  |
| <b>BSC</b>     | Base Site Controller                                        | <b>deg</b>     | degree                                              |
| <b>BTU</b>     | British Thermal Unit                                        | <b>DIN</b>     | <i>Deutsche Industrie-Norm</i>                      |
| <b>BW</b>      | bandwidth                                                   | <b>DIP</b>     | Dual In-line Package                                |
| <b>C/N + I</b> | Carrier Power to Noise + Interference Ratio                 | <b>div</b>     | division                                            |

|                 |                                                     |               |                                                  |
|-----------------|-----------------------------------------------------|---------------|--------------------------------------------------|
| <b>DMA</b>      | Direct Memory Access                                | <b>HSMR</b>   | High Elevation Specialized Mobile Radio          |
| <b>DOP</b>      | Dilution of Precision                               | <b>HSO</b>    | High Stability Oscillator                        |
| <b>DRAM</b>     | Dynamic Random Access Memory                        | <b>HVAC</b>   | Heating/Ventilation/Air Conditioning             |
| <b>DSP</b>      | Digital Signal Processor                            | <b>Hz</b>     | Hertz                                            |
| <b>DTE</b>      | Data Terminal Equipment                             | <b>I/O</b>    | Input/Output                                     |
| <b>DTTA</b>     | Duplexed Tower-Top Amplifier                        | <b>IC</b>     | Integrated Circuit                               |
| <b>DVM</b>      | Digital Volt Meter                                  | <b>iDEN</b>   | integrated Dispatch Enhanced Network             |
| <b>E1</b>       | European telephone multiplexing standard            | <b>IEEE</b>   | Institute of Electrical and Electronic Engineers |
| <b>EAS</b>      | Environmental Alarm System                          | <b>IF</b>     | intermediate frequency                           |
| <b>E-NET</b>    | Ethernet                                            | <b>iMU</b>    | iDEN Monitor Unit                                |
| <b>EBTS</b>     | Enhanced Base Transceiver System                    | <b>in</b>     | inches                                           |
| <b>EGB</b>      | Exterior Ground Bar                                 | <b>in</b>     | injection                                        |
| <b>EIA</b>      | Electronics Industry Association                    | <b>ISA</b>    | Industry Standard Architecture                   |
| <b>EMI</b>      | Electro-Magnetic Interference                       | <b>iSC</b>    | integrated Site Controller                       |
| <b>EPROM</b>    | Erasable Programmable Read Only Memory              | <b>kg</b>     | kilogram                                         |
| <b>EEPROM</b>   | Electrically Erasable Programmable Read Only Memory | <b>kHz</b>    | kiloHertz                                        |
| <b>ERFC</b>     | Expansion RF Cabinet                                | <b>LAN</b>    | Local Area Network                               |
| <b>ESI</b>      | Ethernet Serial Interface                           | <b>LANIIC</b> | Local Area Network Interface IC                  |
| <b>ESMR</b>     | Enhanced Special Mobile Radio                       | <b>LAPD</b>   | Link Access Procedure D-Channel                  |
| <b>EX</b>       | Exciter                                             | <b>lbs</b>    | pounds                                           |
| <b>FB</b>       | feedback                                            | <b>LDM</b>    | Linear Driver Module                             |
| <b>FCC</b>      | Federal Communications Commission                   | <b>LED</b>    | Light Emitting Diode                             |
| <b>FIFO</b>     | First-In, First-Out                                 | <b>LFM</b>    | Linear Final Module                              |
| <b>FNE</b>      | Fixed Network Equipment                             | <b>LIU</b>    | Line Interface Unit                              |
| <b>freq</b>     | frequency                                           | <b>LLC</b>    | Link Layer Controller                            |
| <b>FRU</b>      | Field Replaceable Unit                              | <b>LNA</b>    | Low Noise Amplifier                              |
| <b>Gen 3 SC</b> | Generation 3 Site Controller                        | <b>LO</b>     | Local Oscillator                                 |
| <b>GFI</b>      | Ground Fault Interrupter                            | <b>LOS</b>    | Loss of Signal                                   |
| <b>GND</b>      | ground                                              | <b>MAU</b>    | Media Access Unit                                |
| <b>GPS</b>      | Global Positioning System                           | <b>max</b>    | maximum                                          |
| <b>GPSR</b>     | Global Positioning System Receiver                  | <b>MC</b>     | Multicoupler                                     |
| <b>HDLC</b>     | High-level Data Link                                | <b>MGB</b>    | Master Ground Bar                                |
|                 |                                                     | <b>MGN</b>    | Multi-Grounded Neutral                           |



|             |                                    |              |                                                                  |
|-------------|------------------------------------|--------------|------------------------------------------------------------------|
| <b>MHz</b>  | MegaHertz                          | <b>ppm</b>   | parts per million                                                |
| <b>min</b>  | minimum                            | <b>PPS</b>   | Pulse Per Second                                                 |
| <b>min</b>  | minute                             | <b>PS</b>    | Power Supply                                                     |
| <b>MISO</b> | Master In/Slave Out                | <b>PSTN</b>  | Public Switched Telephone Network                                |
| <b>mm</b>   | millimeter                         | <b>PVC</b>   | Polyvinyl Chloride                                               |
| <b>MMI</b>  | Man-Machine-Interface              | <b>pwr</b>   | power                                                            |
| <b>MOSI</b> | Master Out/Slave In                | <b>QAM</b>   | Quadrature Amplitude Modulation                                  |
| <b>MPM</b>  | Multiple Peripheral Module         | <b>QRSS</b>  | Quasi Random Signal Sequence                                     |
| <b>MPS</b>  | Metro Packet Switch                | <b>Qty</b>   | Quantity                                                         |
| <b>MS</b>   | Mobile Station                     | <b>R1</b>    | Receiver #1                                                      |
| <b>ms</b>   | millisecond                        | <b>R2</b>    | Receiver #2                                                      |
| <b>MSC</b>  | Mobile Switching Center            | <b>R3</b>    | Receiver #3                                                      |
| <b>MSO</b>  | Mobile Switching Office            | <b>RAM</b>   | Random Access Memory                                             |
| <b>MST</b>  | Modular Screw Terminals            | <b>RCVR</b>  | Receiver                                                         |
| <b>mV</b>   | milliVolt                          | <b>Ref</b>   | Reference                                                        |
| <b>mW</b>   | milliWatt                          | <b>RF</b>    | Radio Frequency                                                  |
| <b>N.C.</b> | Normally Closed                    | <b>RFC</b>   | RF Cabinet                                                       |
| <b>N.O.</b> | Normally Open                      | <b>RFDS</b>  | RF Distribution System                                           |
| <b>NEC</b>  | National Electric Code             | <b>RFS</b>   | RF System                                                        |
| <b>NIC</b>  | Network Interface Card             | <b>ROM</b>   | Read Only Memory                                                 |
| <b>no.</b>  | number                             | <b>RPM</b>   | Revolutions Per Minute                                           |
| <b>NTM</b>  | NIC Transition Module              | <b>RSSI</b>  | Received Signal Strength Indication                              |
| <b>NTWK</b> | Network                            | <b>RTN</b>   | Return                                                           |
| <b>OMC</b>  | Operations and Maintenance Center  | <b>RU</b>    | Rack Unit                                                        |
| <b>OSHA</b> | Occupational Safety and Health Act | <b>Rx</b>    | Receive                                                          |
| <b>PA</b>   | Power Amplifier                    | <b>RXDSP</b> | Receive Digital Signal Processor                                 |
| <b>PAL</b>  | Programmable Array Logic           | <b>SCI</b>   | Serial Communications Interface                                  |
| <b>PC</b>   | Personal Computer                  | <b>SCON</b>  | VME System Controller                                            |
| <b>PCCH</b> | Primary Control Channel            | <b>SCRF</b>  | Stand-alone Control and RF Cabinet (configuration)               |
| <b>PDOP</b> | Position Dilution of Precision     | <b>SCSI</b>  | Small Computer System Interface                                  |
| <b>pF</b>   | picoFarad                          | <b>sec</b>   | second                                                           |
| <b>PLL</b>  | Phase Locked Loop                  | <b>SGC</b>   | Software Gain Control                                            |
| <b>P/N</b>  | Part Number                        | <b>SINAD</b> | Signal Plus Noise Plus Distortion to Noise Plus Distortion Ratio |
| <b>P/O</b>  | Part Of                            |              |                                                                  |

|              |                                                   |              |                                                     |
|--------------|---------------------------------------------------|--------------|-----------------------------------------------------|
| <b>SMART</b> | Systems Management Analysis, Research and Test    | <b>V</b>     | Volts                                               |
| <b>SPI</b>   | Serial Peripheral Interface                       | <b>VAC</b>   | Volts - alternating current                         |
| <b>SQE</b>   | Signal Quality Estimate                           | <b>VCO</b>   | Voltage Controlled Oscillator                       |
| <b>SRAM</b>  | Static Random Access Memory                       | <b>VCXO</b>  | Voltage Controlled Crystal Oscillator               |
| <b>SRC</b>   | Substrate Controller                              | <b>VDC</b>   | Volts - direct current                              |
| <b>SRI</b>   | Site Reference Industry standard                  | <b>VFWD</b>  | Voltage representation of Forward Power             |
| <b>SRIB</b>  | SMART Radio Interface Box                         | <b>VME</b>   | Versa-Module Eurocard                               |
| <b>SRRC</b>  | Single Rack, Redundant Controller (configuration) | <b>Vp-p</b>  | Voltage peak-to-peak                                |
| <b>SRSC</b>  | Single Rack, Single Controller (configuration)    | <b>VREF</b>  | Voltage representation of Reflected Power           |
| <b>SS</b>    | Surge Suppressor                                  | <b>VSWR</b>  | Voltage Standing Wave Ratio                         |
| <b>SSC</b>   | System Status Control                             | <b>W</b>     | Watt                                                |
| <b>SSI</b>   | Synchronous Serial Interface                      | <b>WDT</b>   | Watchdog Timer                                      |
| <b>ST</b>    | Status                                            | <b>WP</b>    | Write Protect                                       |
| <b>STAT</b>  | Status                                            | <b>WSAPD</b> | Worldwide Systems and Aftermarket Products Division |
| <b>Std</b>   | Standard                                          |              |                                                     |
| <b>S/W</b>   | Software                                          |              |                                                     |
| <b>T1</b>    | North american telephone multiplexing standard    |              |                                                     |
| <b>TB</b>    | Terminal Board                                    |              |                                                     |
| <b>TDM</b>   | Time Division Multiplex                           |              |                                                     |
| <b>telco</b> | telephone company                                 |              |                                                     |
| <b>SCON</b>  | VME System Controller                             |              |                                                     |
| <b>TISIC</b> | TDMA Infrastructure Support IC                    |              |                                                     |
| <b>TSI</b>   | Time Slot Interface                               |              |                                                     |
| <b>TSI</b>   | Time Slot Interchange                             |              |                                                     |
| <b>TTA</b>   | Tower-Top Amplifier                               |              |                                                     |
| <b>TTL</b>   | Transistor - Transistor Logic                     |              |                                                     |
| <b>Tx</b>    | Transmit                                          |              |                                                     |
| <b>TXD</b>   | Transmit Data                                     |              |                                                     |
| <b>TXDSP</b> | Transmit Digital Signal Processor                 |              |                                                     |
| <b>Txlin</b> | Tranlin IC                                        |              |                                                     |
| <b>typ</b>   | typical                                           |              |                                                     |
| <b>UL</b>    | Underwriters Laboratories                         |              |                                                     |

## Numerics

**5 MHz/1 PPS cabling (within RF Cabinet) (See appropriate RFDS or EBTS system section)**

### 800 MHz GEN 4 Duplexed RFDS

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