AT&T 421-500-142, Issue 1
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DR 6/11-135A and 135EC 1×N Frequency Diversity Operation and Maintenance Terminal/Regenerator Test Procedures

Contents Page

Contents

1 Introduction

Procedures for testing a DR 6/11-135 terminal bay or regenerator bay are included in this tab. These procedures may be referenced from any of these other tabs:

- ANNUAL TESTS
- TROUBLE ISOLATION
- DEGRADED PERFORMANCE.

The procedures can also be used on a stand-alone basis.

1.1 Safety Labels

Safety labels are strategically placed symbols and messages that will alert you to potential risks. There are three types of safety labels.

DANGER:
DANGER *indicates the presence of a hazard that* ***will*** *cause death or severe personal injury if the hazard is not avoided.*

WARNING:
WARNING *indicates the presence of a hazard that* ***can*** *cause death or severe personal injury if the hazard is not avoided.*

CAUTION:
CAUTION *indicates the presence of a hazard that* ***will*** *or* ***can*** *cause minor personal injury or property damage if the hazard is not avoided.*

Within the **CAUTION** safety label, the term "property damage" refers also to possible service interruption or impairment.

Please refer to the Safety Labels heading in the **START HERE** tab for additional information about, and examples of, safety labels.

1.2 Service Protection

With no exceptions, service must be protected before any out-of-service tests are performed.

Service protection generally consists of:

- Regular Channel, manually line-switch or span-switch service to Protection
- Protection Channel, manually lock out the Protection channel.

Please refer to the **SERVICE PROTECTION** tab for details on service protection.

1.3 Maintenance Philosophy

This section is made up of individual terminal and regenerator test procedures. Which of the procedures you will perform depends on the "event" that brought you to this section.

There are only two events that initiate digital radio maintenance:

- Annual tests, listed in the **ANNUAL TESTS** tab
- Trouble, in either of two categories;
  - — Equipment Alarms
  - — Degraded Performance.

To perform maintenance, start at the **START HERE** tab where a flowchart will direct you to the **ANNUAL TESTS** tab, **DEGRADED PERFORMANCE** tab, or appropriate **TROUBLE ISOLATION** tab.

After the maintenance has been completed, go to the **END HERE** tab to return the equipment and station to normal operation.

1.4 Test Equipment

You will use the Digital Radio Test System (DRTS) for all maintenance procedures in this section. Refer to the **DRTS** tab for:

- Operating instructions
- Accessory Kit parts (item) list
- Accessory Kit item location.

1.5 Helpful Information

Several methods have been used to make this version of documentation easier and more convenient to use.

a. Most steps and instructions are short, concise statements.

b. In longer procedures, brief summary statements, called comments, are provided to tell you what you are about to do, or have just done. *They are in oblique type like this* and are information only, no action required.

c. Your attention will be directed to specific items of test equipment and/or equipment units using UPPERCASE type.

d. In every procedure that requires the use of the POWER METER, the first appearance includes the statement:

"Calibrate the POWER METER, if necessary."

Power meter calibration is required only when the test set is first turned on, before testing is started each day, or if the display flashes a "PLEASE ZERO" message.

Bypass the calibration if you have already calibrated it.

Within that procedure, any following uses of the power meter will refer only to entering the required OFFSET value.

e. Test setups (figures) use graphic representations of the test set, each test item, and the involved portion of the equipment bay. Circles or rectangles around numbers and letters identify the location of the test item in the DRTS accessory case. Additional test items shown in the figures, but not part of the DRTS, are listed in the **TEST EQUIPMENT and ACCESSORIES** tab.

f. In some procedures, you may be instructed to **record** a value on the RADIO DATA CARD. You may also be asked to **note** a level for use in a later step. A note is a temporary reminder and should not be recorded on the RADIO DATA CARD.

g. When you complete a procedure, look ahead to the test setup figure in the next procedure you are going to do. You will often be able to save time by reusing many of the same connections and test items.

2 Flowcharts

Two flowcharts are provided to direct you through the terminal/regenerator procedures.

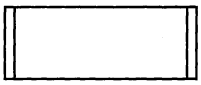
a. Annual Tests

   This is the "flow" you will perform most often.

b. Unit Replacement and Alignment

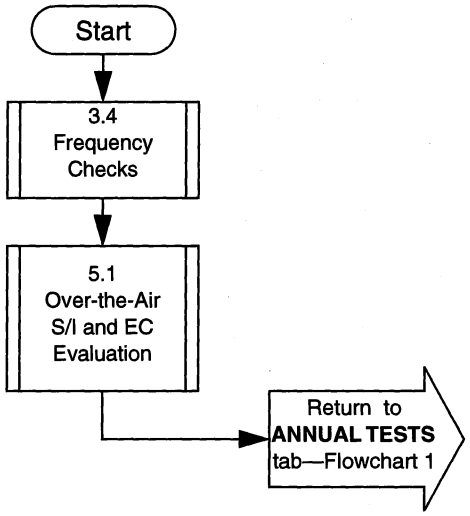
   When most units are replaced, a specific sequence of procedures must be followed. Flowchart 2 will direct you to the required procedures. There are no adjustments on the digital shelves; therefore, alignment will consist of frequency measurements.

Flowchart instructions and symbol explanations can be found in the **START HERE** tab. An important flowchart symbol is this "return to" symbol



(a rectangle with double vertical side lines). It means, "return to this point in the flowchart after you complete the instruction or procedure described within the rectangle".

2.1 Annual Tests (Flowchart 1)



Flowchart 1. Annual Tests

2.2 Unit Replacement and Alignment (Flowchart 2)

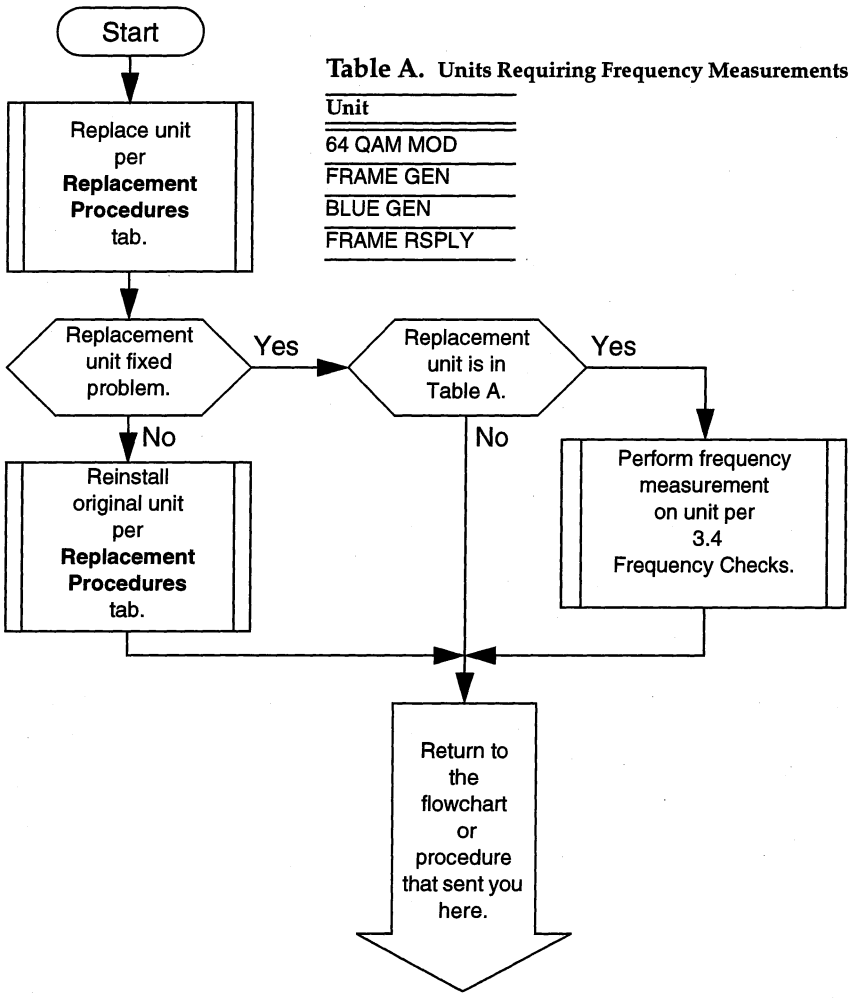


Table A. Units Requiring Frequency Measurements

Unit
64 QAM MOD
FRAME GEN
BLUE GEN
FRAME RSPLY

Flowchart 2. Unit Replacement and Alignment

3 Transmitter and Receiver Checks

3.1 Voltage Checks

Use this procedure to check input and output voltages on any 471- or 474-type power unit installed in any of the following shelves:

- Terminal Transmitter/Receiver (protection or regular)
- Terminal Growth
- Terminal or Regenerator Control and Service Channel
- Regenerator (protection or regular).

All power units within a station will be the same type, either a 471 type or a 474.

- 471-type power units (for a –24 volt supply)
- 474-type power units (for a –48 volt supply).

CAUTION:
ElectroStatic Discharge (ESD) may damage plug-in units. Use proper methods to prevent ESD damage.

Step	Procedure

Comment: *Terminal:*
Power units provide operating voltages for each paired transmitter and receiver. They are located at the right end of the transmitter. Protect service with a manual ***span*** *switch in both directions if it is necessary to replace a power unit.*
Regenerator:
Power units on the right end of each regenerator provide voltages for that regenerator.

1 Use a digital multimeter to measure voltages at the test points listed in Table B.

Table B. Power Unit Voltages

Voltage to Be Checked	Voltage	Test Points	Requirements (V DC)
INPUT	–24 V	V IN + and –	–20.0 to –28.5
	–48 V		–42.0 to –60.0
OUTPUT†	+5 V	V1 + and RTN*	+4.8 to +5.2
	–5 V	V1 – and RTN*	–5.0 to –5.4
	+15 V	V2 + and RTN*	+14.0 to +19.0
	–15 V	V2 – and RTN*	–14.0 to –19.0

*Use V2 RTN test point on any ±15 volt power unit.
†Output voltage is also identified on the shelf label below each power unit.

Requirement: All voltages must be within the requirements listed in Table B.

Were all the requirements met?

YES - Go to Step 2.

NO - Protect service and replace the defective power unit.

Reference: Flowchart 2, Unit Replacement and Alignment—Start.

- Repeat Step 1 for the new power unit.

Comment: A low-voltage reading may be caused by too much of a load on the power unit. For this situation, protect service and pull one plug-in unit at a time to determine which unit is bad and loading down the power unit. At terminal locations, check the receiver, also.

2 Return to the procedure or flowchart that referred you to this procedure.

End of Procedure

3.2 IF Output Level Check

Use this procedure to measure the IF signal level at the output of a digital terminal-transmitter or regenerator.

CAUTION:
This is an Out-of-Service procedure. Service will be interrupted or impaired unless you apply Service Protection measures.

Step	Procedure
1	On the TEST SET: a. Calibrate the POWER METER, if necessary. Reference: **DRTS** tab, 2.2 Calibration. b. Enter the OFFSET (as shown on the POWER SENSOR) for measurement of IF between –30 dBm and +10 dBm (about 35.7 dB). c. Add an additional 0.25 dB to the OFFSET to compensate for loss in the 8-foot BNC - BNC cable. Reference: **DRTS** tab, 2.3 Entering Offset.
2	On the TERMINAL or REGENERATOR bay, perform one of the following: a. (Terminal) Remove the left-front side cover. b. (Regenerator) Remove the right-front side cover.
3	On the ALC NETWORK or 328A AMPL of the associated radio transmitter, operate the **ALC ON/OFF** switch to **OFF**.

CAUTION:
Verify that service is protected and that you are at the correct bay and shelf.

4	On the terminal-TRANSMITTER or REGENERATOR, remove the IF cable from the (TRMT or REGENR) IF OUT jack.
5	Connect the test equipment as shown in Figure 1(Terminal) or Figure 2 (Regenerator). *Comment: In Figure 2 the Regenerator A - C direction is illustrated. The lower jacks are for the B - D direction.* Reference: Maintenance Support manual—Equipment Identification, **REGENERATOR** tab.

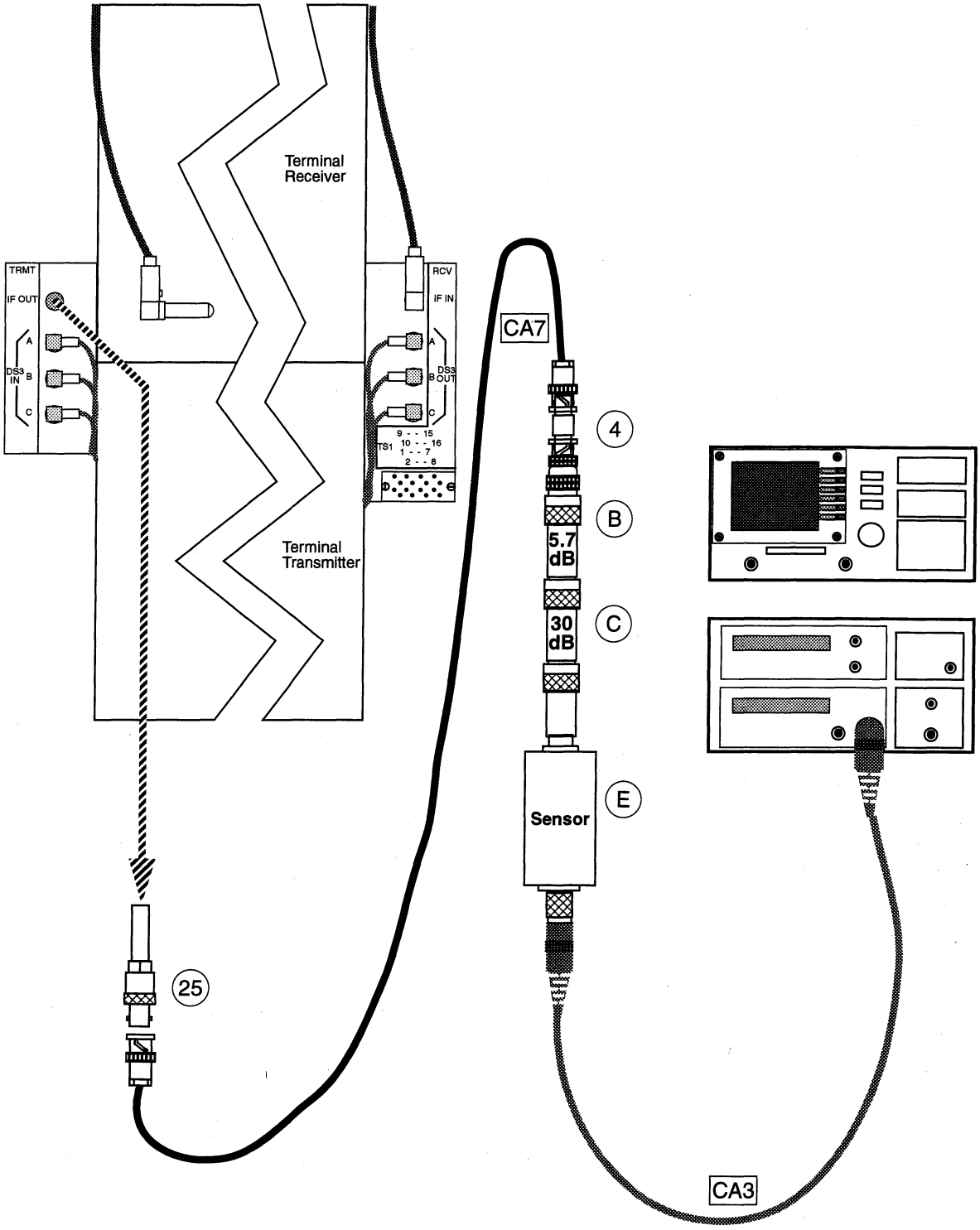


Figure 1. IF OUT Level (Terminal)

6 On the POWER METER,

observe the display.

Requirement:

- –7.1 dBm ± 1.0 dB
  for AMR 27/27B 64QAM MOD cards
  (interconnect cable equal to 50 feet).
- 0.0 dBm ± 1.0 dB
  for AMR 28/28B 64QAM MOD cards
  (interconnect cable greater than 50 feet).

Was the requirement met?

YES - Go to Step 7.

NO - Replace the 64QAM MOD card.

Reference: Flowchart 2, Unit Replacement and Alignment—Start.

- Repeat from Step 5.

7 On the terminal-TRANSMITTER or REGENERATOR:

a. Remove the test connection from the (TRMT or REGENR) IF OUT jack.

b. Reconnect the normal bay cable to the (TRMT or REGENR) IF OUT jack.

8 On the ALC NETWORK or 328A AMPL of the associated radio transmitter,

operate the **ALC ON/OFF** switch to **ON**.

9 On the TERMINAL or REGENERATOR bay, if you are not making more tests that require side-access, perform one of the following:

a. (Terminal) Install the left-front side cover.

b. (Regenerator) Install the right-front side cover.

10 Return to the procedure or flowchart that referred you to this procedure.

End of Procedure

This figure illustrates measurements on a Regenerator shelf for the A - C direction.

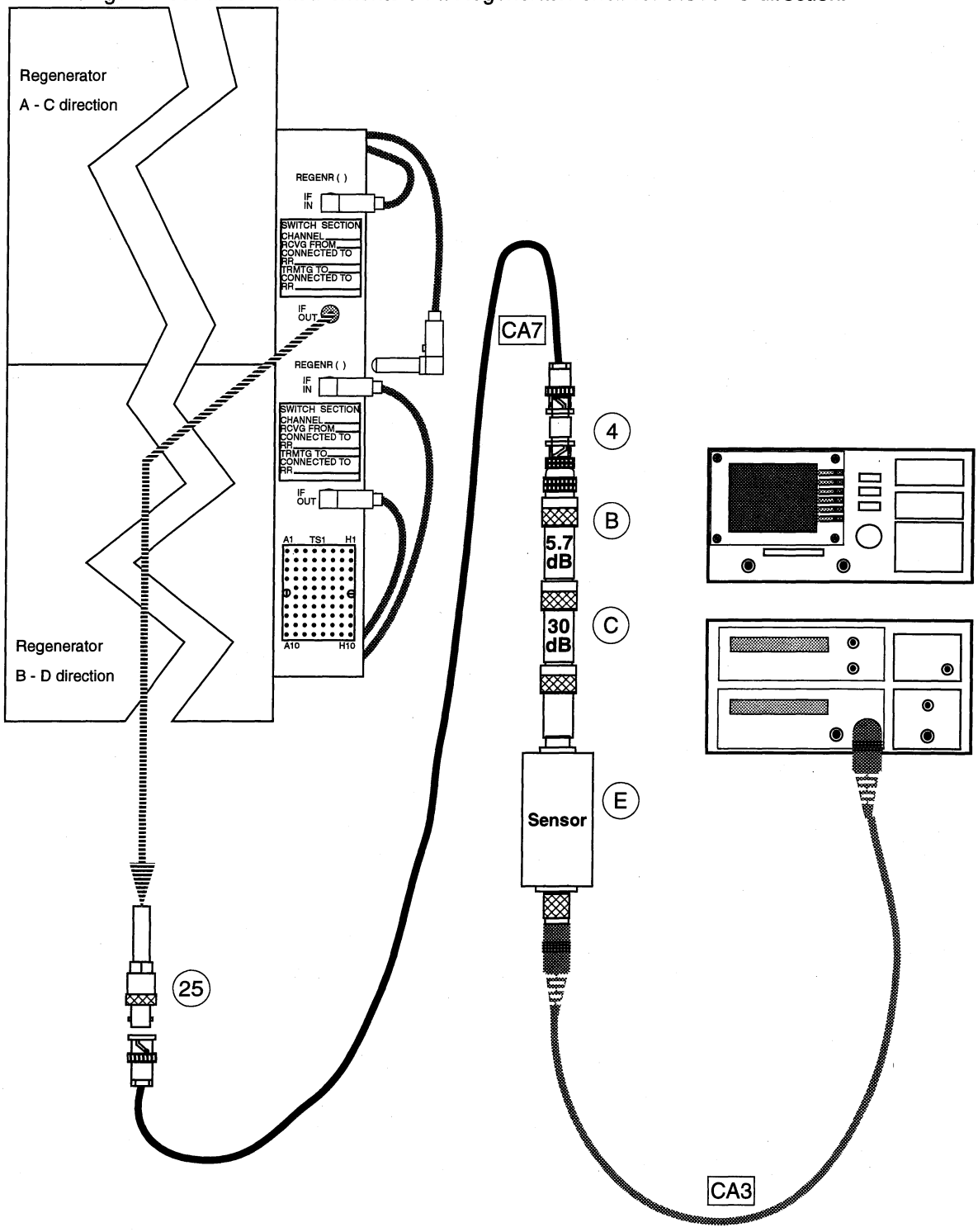


Figure 2. IF OUT Level (Regenerator)

3.3 IF Input Level Check

Use this procedure to measure the IF signal level at the input of a digital terminal-receiver or regenerator.

CAUTION:
This is an Out-of-Service procedure. Service will be interrupted or impaired unless you apply Service Protection measures.

CAUTION:
ESD may damage plug-in units. Use proper methods to prevent ESD damage.

Step	Procedure
1	On the TEST SET: a. Calibrate the POWER METER, if necessary. Reference: **DRTS** tab, 2.2 Calibration. b. Enter the OFFSET (as shown on the POWER SENSOR) for measurement of IF between –30 dBm and +10 dBm (about 35.7 dB). c. Add an additional 0.25 dB to the OFFSET to compensate for loss in the 8-foot BNC - BNC cable. Reference: **DRTS** tab, 2.3 Entering Offset.
2	On the TERMINAL or REGENERATOR bay, remove the right-front side cover.

CAUTION:
Verify that service is protected and that you are at the correct bay and shelf.

3	On the terminal-RECEIVER or REGENERATOR, remove the IF cable from the (RCV or REGENR) IF IN jack.
4	Connect the test equipment as shown in Figure 3 (Terminal) or Figure 4 (Regenerator). *Comment: In Figure 4 the Regenerator A - C direction is illustrated. The lower jacks are for the B - D direction.* Reference: Maintenance Support manual—Equipment Identification, **REGENERATOR** tab.

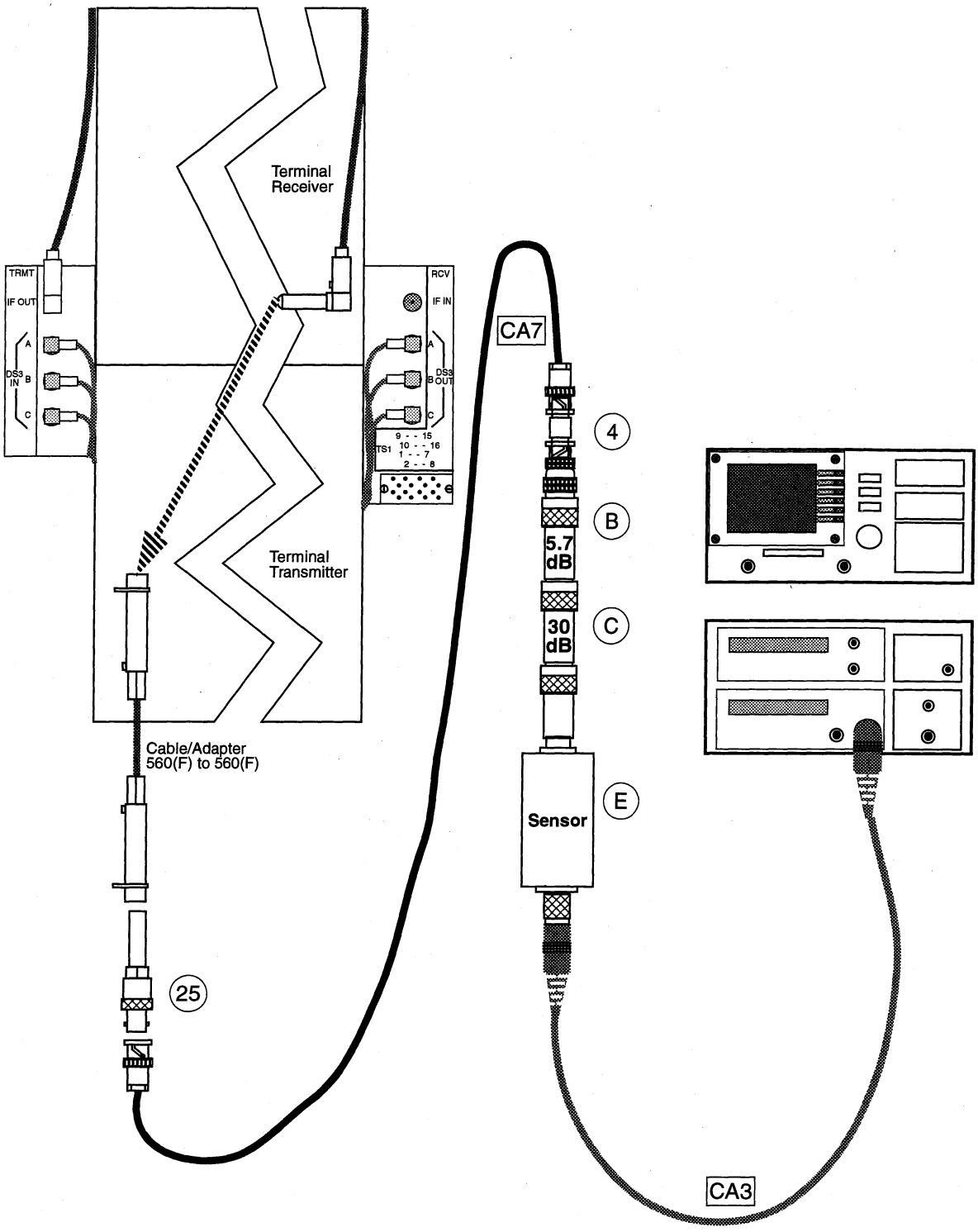


Figure 3. IF IN Level (Terminal)

5 On the POWER METER,

observe the display.

Requirement:

- –8.2 dBm ± 1.0 dB
  for AMR 30 or AMR 230 64QAM DEMOD cards
  (interconnect cable equal to 50 feet).
- –11.7 dBm ± 1.2 dB
  for AMR 29 or AMR 229 64QAM DEMOD cards
  (interconnect cable greater than 50 feet).
- –10.0 dBm ± 3.0 dB
  for AMR 180 64QAM DEMOD cards.

Was the requirement met?

YES - Go to Step 6.

NO - Suspect either an IF signal level problem in the associated radio receiver or a trouble in the interconnect cabling.

- Go to the **TROUBLE ISOLATION** tab—
  4.1 IF Level Problem.

6 On the terminal-RECEIVER or REGENERATOR:

a. Remove the test connection from the normal (RCV or REGENR) IF IN bay cable.

b. Reconnect the normal bay cable to the (RCV or REGENR) IF IN jack.

7 On the TERMINAL or REGENERATOR bay, if you are not making more tests that require side-access,

reinstall the right-front side cover.

8 Return to the procedure or flowchart that referred you to this procedure.

End of Procedure

This figure illustrates measurements on a Regenerator shelf for the A - C direction.

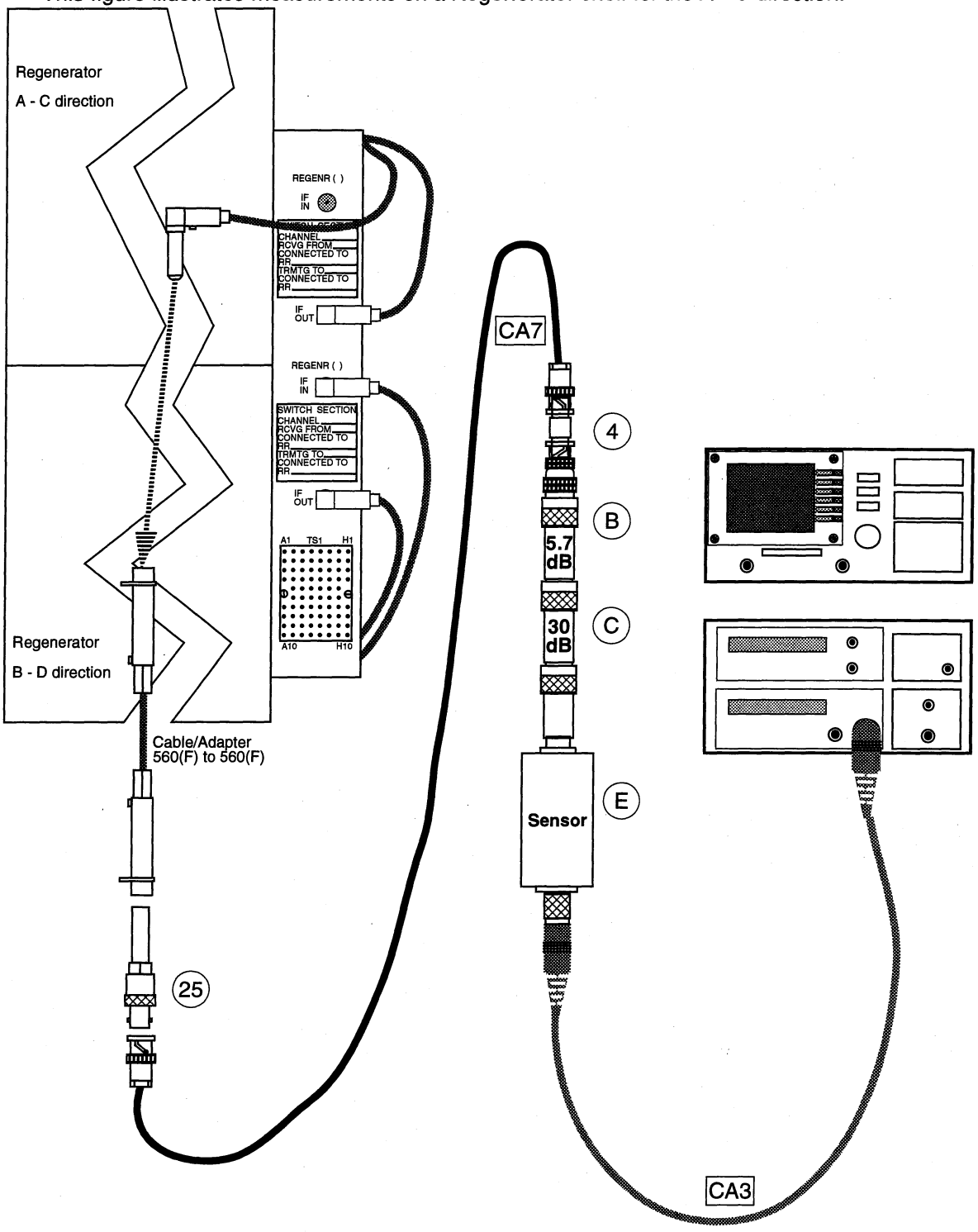


Figure 4. IF IN Level (Regenerator)

3.4 Frequency Checks ("Annual")

Use this procedure to perform the following annually required frequency checks:

- Modulator Carrier (Terminal and Regenerator)
- Frame Generator Clock (Terminal only)
- Blue Generator Clock (Terminal only)
- Frame Resupply Clock (Regenerator only).

CAUTION:
ESD may damage plug-in units. Use proper methods to prevent ESD damage.

Step	Procedure

1 On the SPECTRUM ANALYZER:

a. Press the green PRESET key.

Comment: *FREQ COUNTER softkey should be displayed on the screen; if it is not,* load "GROUP 1" menu.

Reference: **DRTS** tab, 1.6 Downloading User Programs.

b. Press FREQ COUNTER softkey.

Verify that 2.9 is selected (underlined) on the FREQ 2.9 22 softkey (default value).

c. Press Resoln softkey.

d. Press 1 Hz softkey.

e. Press Main Menu softkey.

Comment: *At 1-Hz resolution, it takes several seconds to display a frequency reading.*

2 Connect the test equipment as shown in Figure 5.

3 To perform required annual checks, go to Step 4 and proceed as directed.

To perform an individual measurement, refer to the following step number:

- Modulator Carrier (Terminal and Regenerator)—Step 4
- Frame Generator Clock (Terminal only)—Step 8
- Blue Generator Clock (Terminal only)—Step 11
- Frame Resupply Clock (Regenerator only)—Step 15.

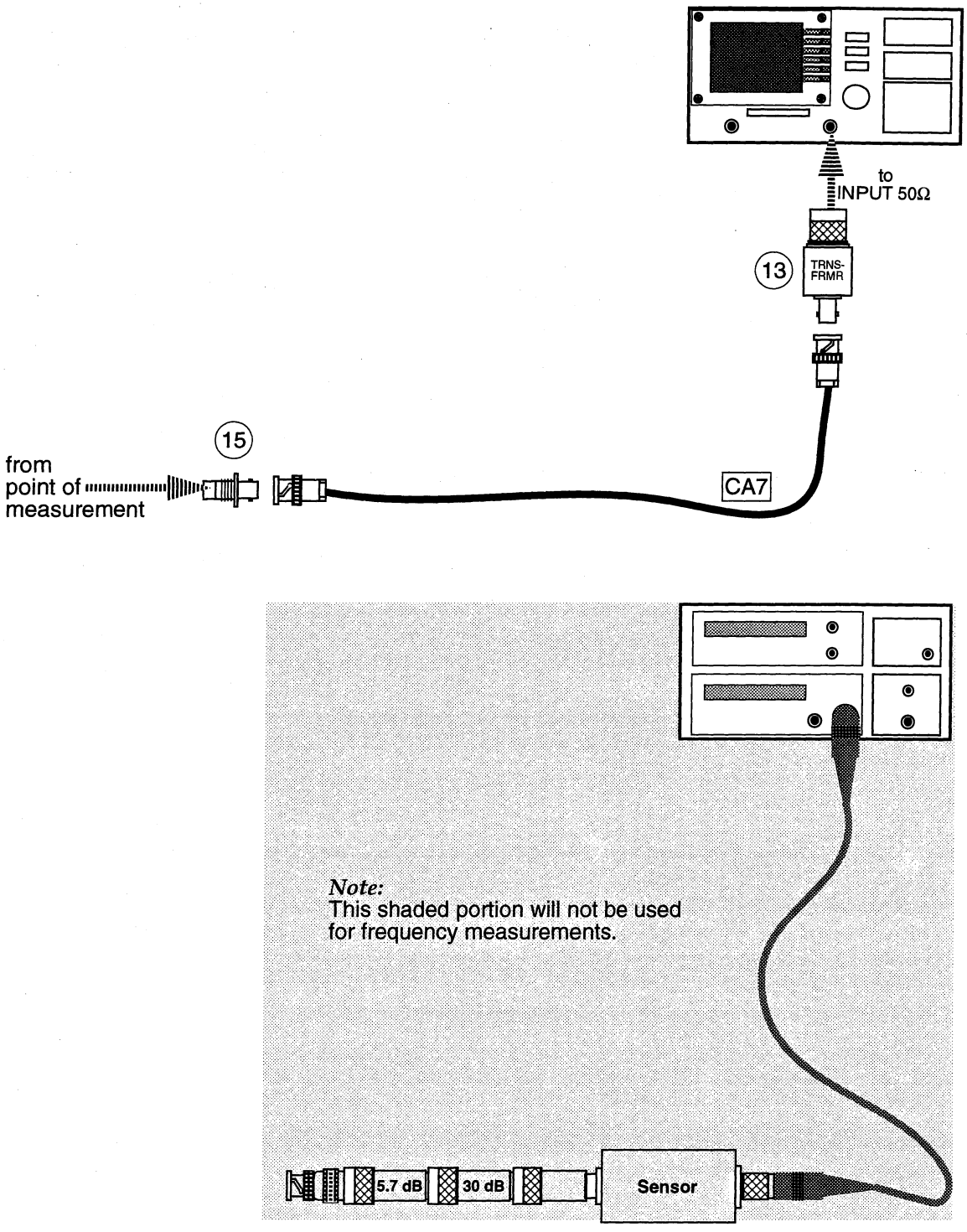


Figure 5. Frequency Measurements

Modulator Carrier Frequency Check (Terminal or Regenerator)

4 On the 64QAM MOD card of the terminal-transmitter or regenerator, make the test connection to the CARRIER FREQ jack.

5 On the SPECTRUM ANALYZER:

a. Press the RESET softkey.

Reset may take up to 1 minute.

b. Read the displayed frequency.

Requirement: 69,993,000 to 70,007,000 Hz.

Was the requirement met?

YES - Go to Step 6.

NO - Remove the transmitter from service.

- Replace the 64QAM MOD card.

Reference: Flowchart 2, Unit Replacement and Alignment—Start.

- Repeat from Step 4.

6 On the 64QAM MOD card, remove the test connection from the CARRIER FREQ jack.

7 For Terminal measurements, go to Step 8.

For Regenerator measurements, go to Step 15.

Frame Generator Clock Frequency Check (Terminal Only)

8 On the FRAME GEN card of the transmitter,

make the test connection to the FRAME CLK jack.

9 On the SPECTRUM ANALYZER:

a. Press the RESET softkey.

Reset may take up to 1 minute.

b. Read the displayed frequency.

Requirement:

- Error-Corrected (135EC) system:
  - Regular channel: 24,031,300 to 24,033,700 Hz.
  - Protection channel: 24,033,950 to 24,036,350 Hz.
- Non-Error-Corrected (135A) system:
  - Regular channel: 22,766,300 to 22,768,700 Hz.
  - Protection channel: 22,769,300 to 22,771,700 Hz.

Was the requirement met?

YES - Go to Step 10.

NO - Remove the transmitter from service.

- Replace the FRAME GEN card.

Reference: Flowchart 2, Unit Replacement and Alignment—Start.

- Repeat from Step 8.

10 On the FRAME GEN card,

remove the test connection from the FRAME CLK jack.

Blue Generator Clock Frequency Check (Terminal Only)

Comment: Not all terminal receivers are equipped with this card. If unequipped, skip Steps 11 through 13.

11 On the BLUE GEN card of the receiver,

make the test connection to the MONITOR jack.

12 On the SPECTRUM ANALYZER:

a. Press the RESET softkey.

Reset may take up to 1 minute.

b. Read the displayed frequency.

Requirement: 44,735,105 to 44,736,895 Hz.

Was the requirement met?

YES - Go to Step 13.

NO - Replace the BLUE GEN card.

Reference: Flowchart 2, Unit Replacement and Alignment—Start.

- Repeat from Step 11.

13 On the BLUE GEN card,

remove the test connection from the MONITOR jack.

14 Go to Step 18.

Frame Resupply Clock Frequency Check (Regenerator Only)

15 On the FRAME RSPLY card of the regenerator,

make the test connection to the FRS CLK jack.

16 On the SPECTRUM ANALYZER:

a. Press the RESET softkey.

Reset may take up to 1 minute.

b. Read the displayed frequency.

Requirement:

- Error-Corrected (135EC) system: 24,031,300 to 24,034,000 Hz.
- Non-Error-Corrected (135A) system: 22,766,000 to 22,769,000 Hz.

Was the requirement met?

YES - Go to Step 17.

NO - Remove the regenerator from service.

- Replace the FRAME RSPLY card.

Reference: Flowchart 2, Unit Replacement and Alignment—Start.

- Repeat from Step 15.

17 On the FRAME RSPLY card,

remove the test connection from the FRS CLK jack.

18 Return to the procedure or flowchart that referred you to this procedure.

End of Procedure

3.5 On-Site Performance Monitoring

During trouble isolation procedures, you may need to monitor digital performance on-site. With one test setup, you can monitor performance at several points in a digital terminal-receiver or regenerator by counting errors and/or frame losses.

CAUTION:
ESD may damage plug-in units. Use proper methods to prevent ESD damage.

Step	Procedure

Comment: *With the Spectrum Analyzer in the following configuration, you will have two counters, an Event counter and an Interval counter.*

Comment: *Specific applications are listed after the test set preparation.*

1 Connect the test equipment as shown in Figure 6.

2 On the SPECTRUM ANALYZER:

a. Press the green PRESET key.

Comment: *EVENT COUNTER softkey should be displayed on the screen; if it is not,* load "GROUP 1" menu.

Reference: **DRTS** tab, 1.6 Downloading User Programs.

b. Press the EVENT COUNTER softkey.

c. Press the GATE TIME softkey.

Verify that GATE TIME 1.000000 sec is displayed in the active function block.

Comment: *The counters will reset and start a new count at the end of each gate time. You can see a square box on each counter display flash when the counters update.*
Other gate times can be selected by pressing the appropriate softkey.

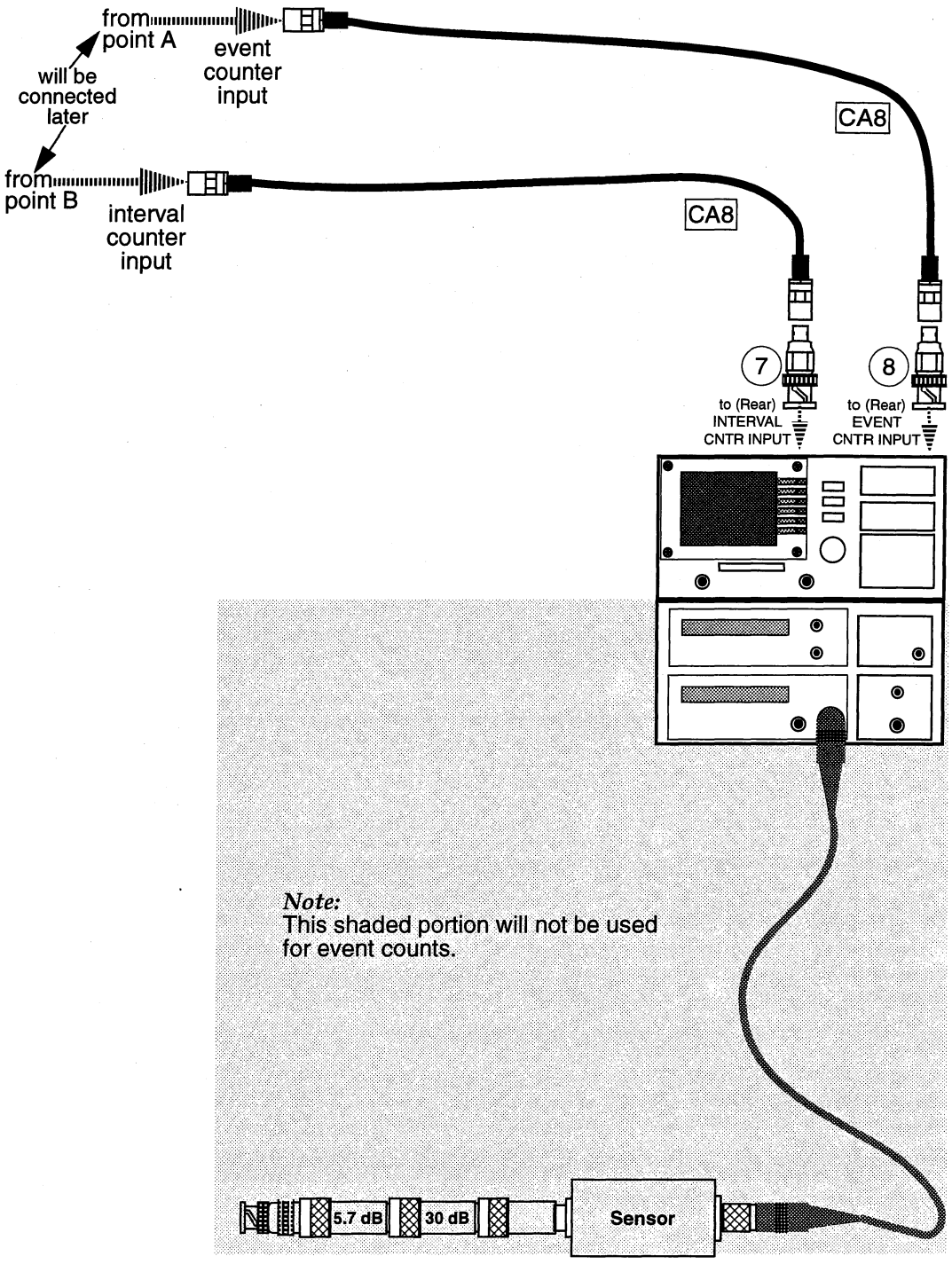


Figure 6. Event Counts

d. Press the Main Menu softkey.

e. Press the TOTALIZE ON OFF softkey to underline ON.

Comment: With TOTALIZER ON, the counters will count continuously. You may use the clock in the upper-left corner of the display to time a test interval.
To start a test interval, press the RESET CNTRS softkey. To stop the test interval and display counter contents, press the STOP CNTRS softkey.

3 On the terminal-RECEIVER or REGENERATOR:

- To monitor DS3 performance at a terminal location, go to Step 13.
- To monitor the 64 state Quadrature Amplitude Modulation (64QAM) system signal, go to Step 4.

4 To monitor the system signal (64QAM), connect the Figure 6 test connections for the desired measurement per the following step number:

- Pseudo errors—Step 5
- Hop Cyclic Redundancy Check (CRC) errors—Step 7
- Section CRC errors—Step 9
- Frame loss—Step 11.

64QAM Pseudo Errors

5 On the indicated card:

- For **analog** Transversal Equalizers/Filters:
  a. Connect Point A (event counter) to the PSEUDO ERRORS jack on one 64QAM DECSN card.
  b. Connect Point B (interval counter) to the PSEUDO ERRORS jack on the other 64QAM DECSN card.
- For **digital** Transversal Equalizers:
  a. Connect Point A (event counter) to the "I" PSEUDO ERRORS jack on the MON card.
  b. Connect Point B (interval counter) to the "Q" PSEUDO ERRORS jack on the MON card.

6 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the displayed count on the associated counter.

64QAM Hop CRC Errors

7 On the TERM FRMR or REGEN FRMR card,

connect Point A (event counter) to the HOP CRC ERRS jack.

8 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the displayed count on the associated counter.

64QAM Section CRC Errors (Terminals Only)

9 On the TERM FRMR card,

connect Point A (event counter) to the SECT CRC ERRS jack.

10 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the displayed count on the associated counter.

64QAM Frame Loss

11 On the TERM FRMR or REGEN FRMR card,

connect Point A (event counter) to the FR LS jack.

Comment: To count frame loss simultaneously with CRC errors, use Point B (interval counter).

12 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the displayed count on the associated counter.

13 To monitor DS3 performance at a terminal location, connect the Figure 6 test connections for the desired measurement per the following step number:

- Parity errors—Step 14
- Frame loss—Step 16.

DS3 Parity Errors (Terminals Only)

14 On one VMR& CODER card,

connect Point A (event counter) to the PTY jack.

15 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the displayed count on the associated counter.

DS3 Frame Loss (Terminals Only)

16 On one VMR& CODER card,

connect Point A (event counter) to the FR jack.

Comment: To count DS3 frame loss simultaneously with parity errors, connect Point B (interval counter) *to the same VMR& CODER card as the parity connection.*

17 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the displayed count on the associated counter.

18 For any requirements or suggestions about the results of previous steps, return to the procedure or flowchart that referred you to this procedure.

End of Procedure

4 Loopback Tests

4.1 Loopback Performance Check

Use this trouble-isolation test procedure to check the digital terminal or regenerator performance with the digital equipment isolated from the radio.

The test consists of looping the digital terminal or regenerator transmitter/receiver pair back-to-back and measuring the Bit Error Rate (BER) performance.

CAUTION:
This is an Out-of-Service procedure. Service will be interrupted or impaired unless you apply Service Protection measures.

At Terminals: Line switch (regular channel) or lock out (protection channel) in both directions.

At Regenerators: Line switch (regular channel) or lock out (protection channel) in the direction under test.

Step	Procedure
1	On the TERMINAL or REGENERATOR bay: a. (Terminal) Remove the right-front and left-front side covers. b. (Regenerator) Remove the right-front side cover.
2	On the ALC NETWORK or 328A AMPL of the associated radio transmitter, operate the **ALC ON/OFF** switch to **OFF**.

CAUTION:
Verify that service is protected and that you are at the correct terminal or regenerator transmitter and receiver.

3	On the terminal-RECEIVER or REGENERATOR, remove the cable from the (RCV or REGENR) IF IN jack.
4	On the terminal-TRANSMITTER or REGENERATOR: a. Remove the cable from the (TRMT or REGENR) IF OUT jack. b. Regenerator only: On the FRAME RSPLY card: 1. Operate the MAN FRS push button to the in position. 2. Verify both the red, MAN FRS ON and the yellow, FRS ON indicators light.

5 Connect the test equipment as shown in Figure 7 (Terminal) or Figure 8 (Regenerator).

Comment: In Figure 8 the Regenerator A - C direction is illustrated. The lower jacks are for the B - D direction.

Reference: Maintenance Support manual—Equipment Identification, **REGENERATOR** tab.

6 On the SPECTRUM ANALYZER,

condition the test set for an event counter (continuous counting, 1-second gate time).

Reference: Procedure 3.5, On-Site Performance Monitoring.

7 On the terminal-RECEIVER or REGENERATOR:

a. Observe the BER bar graph on the CHAN CONTR.

b. Connect the event counter input to the following jacks and measure error performance:

- PSEUDO ERRORS (both I and Q) for 64QAM hop pseudo errors
- HOP CRC ERRS for 64QAM hop CRC errors
- SECT CRC ERRS (terminal only) for 64QAM section CRC errors
- FR LS for 64QAM frame loss.

Requirement:

- FAIL—DIG RCV or DIG TRMT not lighted on CHAN CONTR unit.
- Zero errors indicated on the bar graph display.
- Zero errors for each event counter measurement.

Was the requirement met?

YES - Go to Step 8.

NO - Isolate and repair the trouble.

- It is probably a defective plug-in unit. The following cards can be removed without impairing service.

  Regenerator: Any card.

  Terminal receiver: 64QAM DEMOD through TERM FRMR.

  Terminal transmitter: EC CODER through 64QAM MOD.

- Contact Technical Support Group (TSG) for assistance, if necessary.

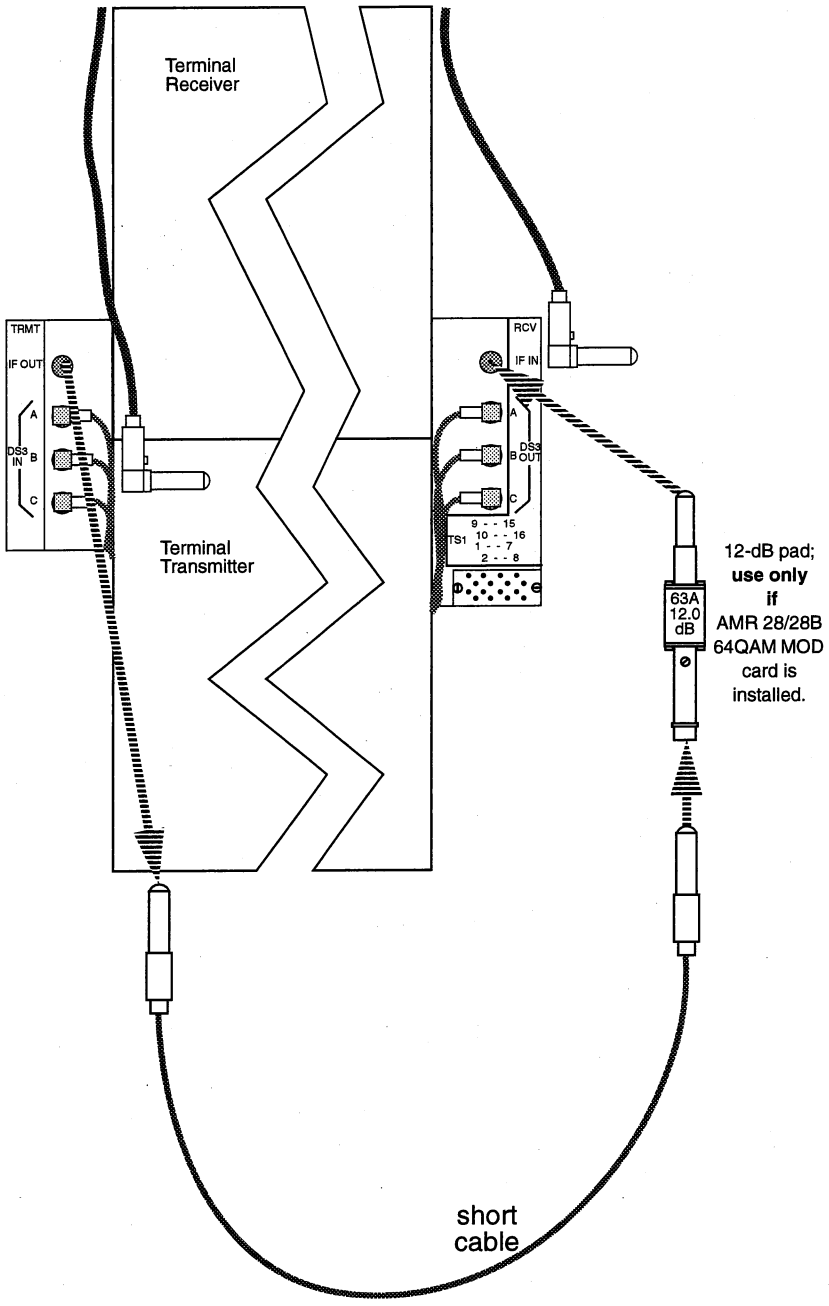


Figure 7. Terminal Loopback

8 Do you want to check DS3 performance (terminal only)?

YES - Go to Step 9.

NO - Go to Step 11.

CAUTION:
The following span switching will cause momentary service impairments.

9 Perform a span switch (over the existing line switch) for both directions if this is a regular channel.

10 On the terminal-RECEIVER:

a. Observe the BER bar graph on the CHAN CONTR.

b. Connect the event counter input to the following jacks and measure error performance:

- SECT CRC ERRS for 64QAM section CRC errors
- FR LS for 64QAM frame loss
- PTY (TRIB A, B, and C) for DS3 parity errors
- FR (TRIB A, B, and C) for DS3 frame loss.

Requirement:

- Zero errors indicated on the bar graph display.
- Zero errors for each event counter measurement.

Was the requirement met?

YES - Go to Step 11.

NO - Isolate and repair the trouble.

- It is probably a defective plug-in unit. Any card in the transmitter and receiver shelf loopback pair can be removed without impairing service.

Reference: Flowchart 2, Unit Replacement and Alignment—Start.

- Contact TSG for assistance, if necessary.

This figure illustrates measurements on a Regenerator shelf for the A - C direction.

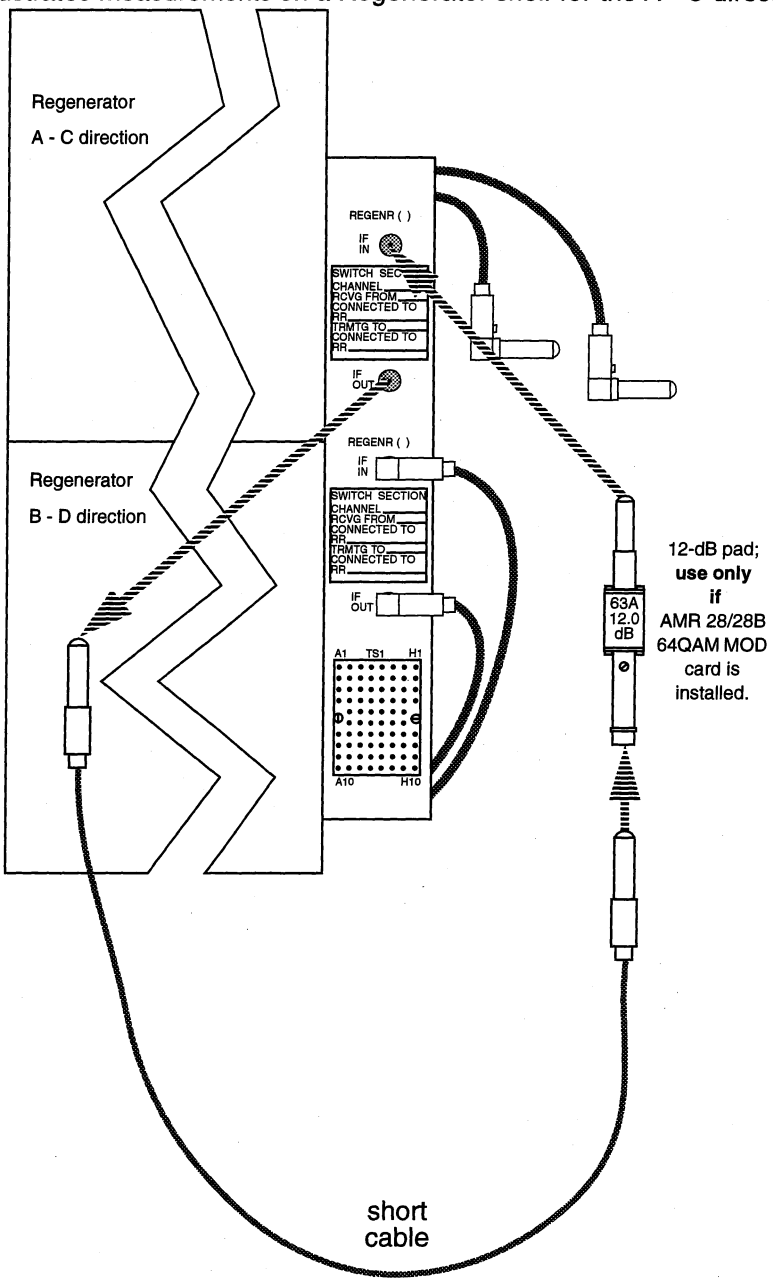


Figure 8. Regenerator Loopback

11 Remove the test connections and loopback cable.

12 On the terminal-TRANSMITTER or REGENERATOR:

a. Reconnect the normal bay cable to the (TRMT or REGENR) IF OUT jack.

b. Regenerator only:
On the FRAME RSPLY card:

1. Operate the MAN FRS push button to the out position.

2. Verify both the red, MAN FRS ON and the yellow, FRS ON indicators extinguish.

13 On the terminal-RECEIVER or REGENERATOR,

reconnect the normal bay cable to the (RCV or REGENR) IF IN jack.

14 On the ALC NETWORK or 328A AMPL of the associated radio transmitter,

operate the **ALC ON/OFF** switch to **ON**.

15 On the TERMINAL or REGENERATOR bay, if further access is not required:

a. (Terminal) Replace the right-front and left-front side covers.

b. (Regenerator) Replace the right-front side cover.

16 Return to the procedure or flowchart that referred you to this procedure.

End of Procedure

4.2 Loopback S/I and EC Evaluation

Use this trouble-isolation test procedure to stress-check the digital terminal or regenerator performance with the digital equipment isolated from the radio path.

At Regenerator stations, you will perform only the IF loopback Signal to Interference (S/I) stress check. The Error Correction (EC) evaluation (Terminals only) is included in this procedure because it uses the same test setup.

The tests consist of inserting an interfering tone, at a specific level, to "stress" digital performance through the back-to-back digital terminal or regenerator transmitter/ receiver pair.

Prerequisite: Procedure 4.1, Loopback Performance Check.

CAUTION:
This is an Out-of-Service procedure. Service will be interrupted or impaired unless you apply Service Protection measures.
At Terminals: Line [or span if one already exists] switch (regular channel) or lock out (protection channel) in both directions.

At Regenerators: Line switch (regular channel) or lock out (protection channel) in the direction under test.

CAUTION:
ESD may damage plug-in units. Use proper methods to prevent ESD damage.

Step	Procedure
1	On the TERMINAL or REGENERATOR bay: a. (Terminal) Remove the right-front and left-front side covers. b. (Regenerator) Remove the right-front side cover.
2	On the TEST SET: a. Calibrate the POWER METER, if necessary. Reference: **DRTS** tab, 2.2 Calibration. b. Enter the OFFSET (as shown on the POWER SENSOR) for measurement of IF between –30 dBm and +10 dBm (about 35.7 dB). c. Add an additional 0.25 dB to the OFFSET to compensate for loss in the 8-foot BNC - BNC cable. Reference: **DRTS** tab, 2.3 Entering Offset.

3 On the ALC NETWORK or 328A AMPL of the associated radio transmitter, operate the **ALC ON/OFF** switch to **OFF**.

Comment: In Steps 4 through 6, you will measure the level of the signal that will be the receiver input signal during the test. You will note it as "S" for use in a later step.

Comment: The 64R UNEQUAL LOSS SPLIT-PAD has low loss (about 0.6 dB) between ports 1 and 3 (end ports) but about 24-dB loss between port 2 (center) and either of the end ports. Port numbers may not be designated on the 64R pad.

CAUTION:
Verify that service is protected and that you are at the correct terminal or regenerator transmitter and receiver.

4 On the terminal-TRANSMITTER or REGENERATOR:

a. Remove the cable from the (TRMT or REGENR) IF OUT jack.

b. Regenerator only:
On the FRAME RSPLY card:

1. Operate the MAN FRS push button to the in position.
2. Verify both the red, MAN FRS ON and the yellow, FRS ON indicators light.

5 Connect the test equipment as shown in Figure 9 (Terminal) or Figure 10 (Regenerator).

Comment: In Figure 10 the Regenerator A - C direction is illustrated. The lower jacks are for the B - D direction.

Reference: Maintenance Support manual—Equipment Identification, **REGENERATOR** tab.

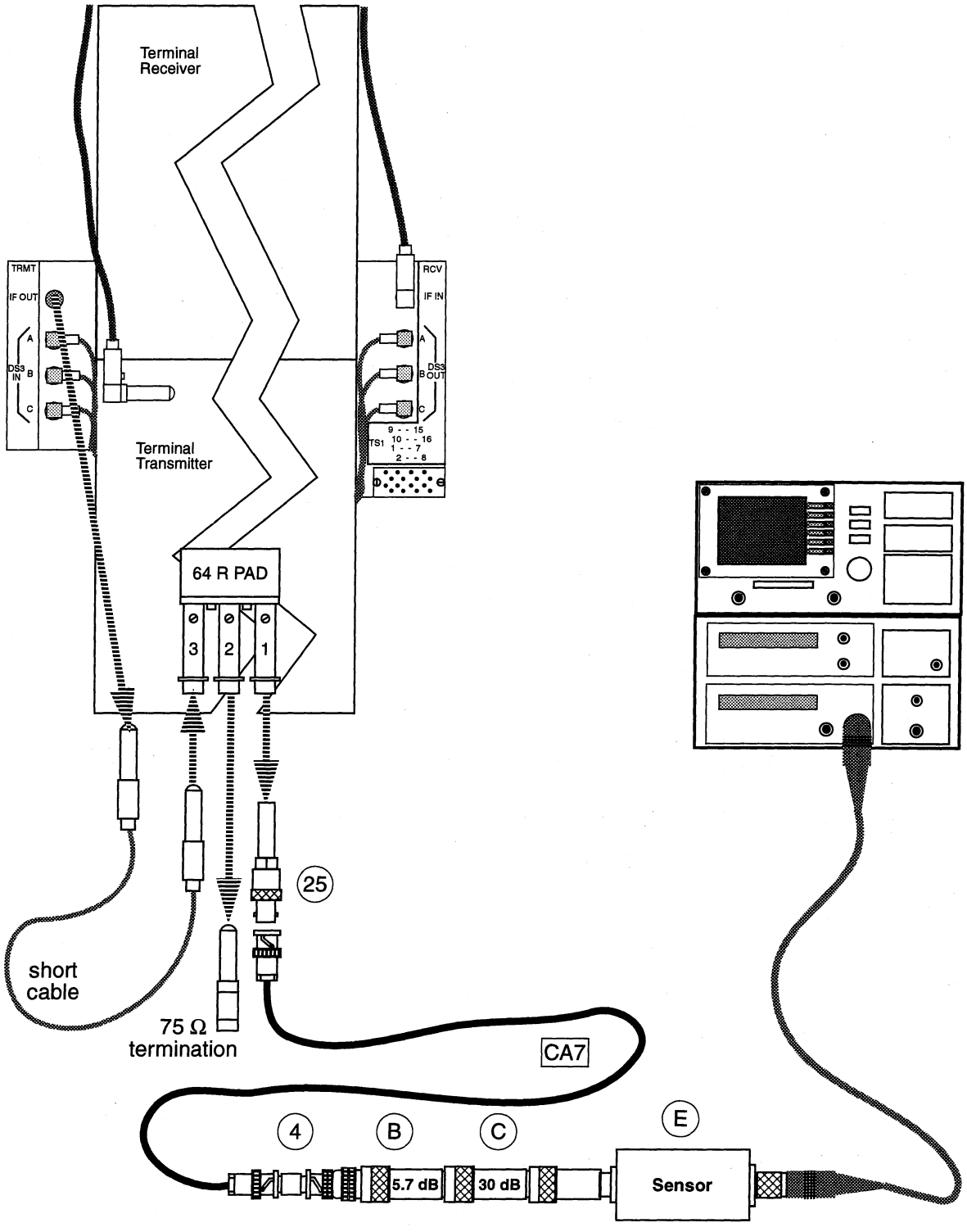


Figure 9. Terminal Loopback—Measure "S"

6 On the POWER METER,

observe the display.

Comment: The following requirement includes 0.6 dB loss for the 64 R pad.

Requirement:

- –7.7 dBm ± 1.0 dB
  for AMR 27/27B 64QAM MOD cards
  (interconnect cable equal to 50 feet).
- –0.6 dBm ± 1.0 dB
  for AMR 28/28B 64QAM MOD cards
  (interconnect cable greater than 50 feet).

Was the requirement met?

YES - Note the displayed level as "S" (Signal) for use in a later step.

- Go to Step 7.

NO - Verify the test connections.

- Check the output signal level of the associated terminal-transmitter or regenerator.

Reference: Procedure 3.2, IF Output Level Check.

- Repeat from Step 4.

Comment: In Steps 7 through 11, you will create an interfering tone ("I") at 74 MHz and at a specified level below the previously noted "S" level.

7 On the SPECTRUM ANALYZER:

a. Press the green PRESET key.

Comment: EVENT COUNTER softkey should be displayed on the screen; if it is not, load "GROUP 1" menu.

Reference: **DRTS** tab, 1.6 Downloading User Programs.

b. Press the EVENT COUNTER softkey.

This figure illustrates measurements on a Regenerator shelf for the A - C direction.

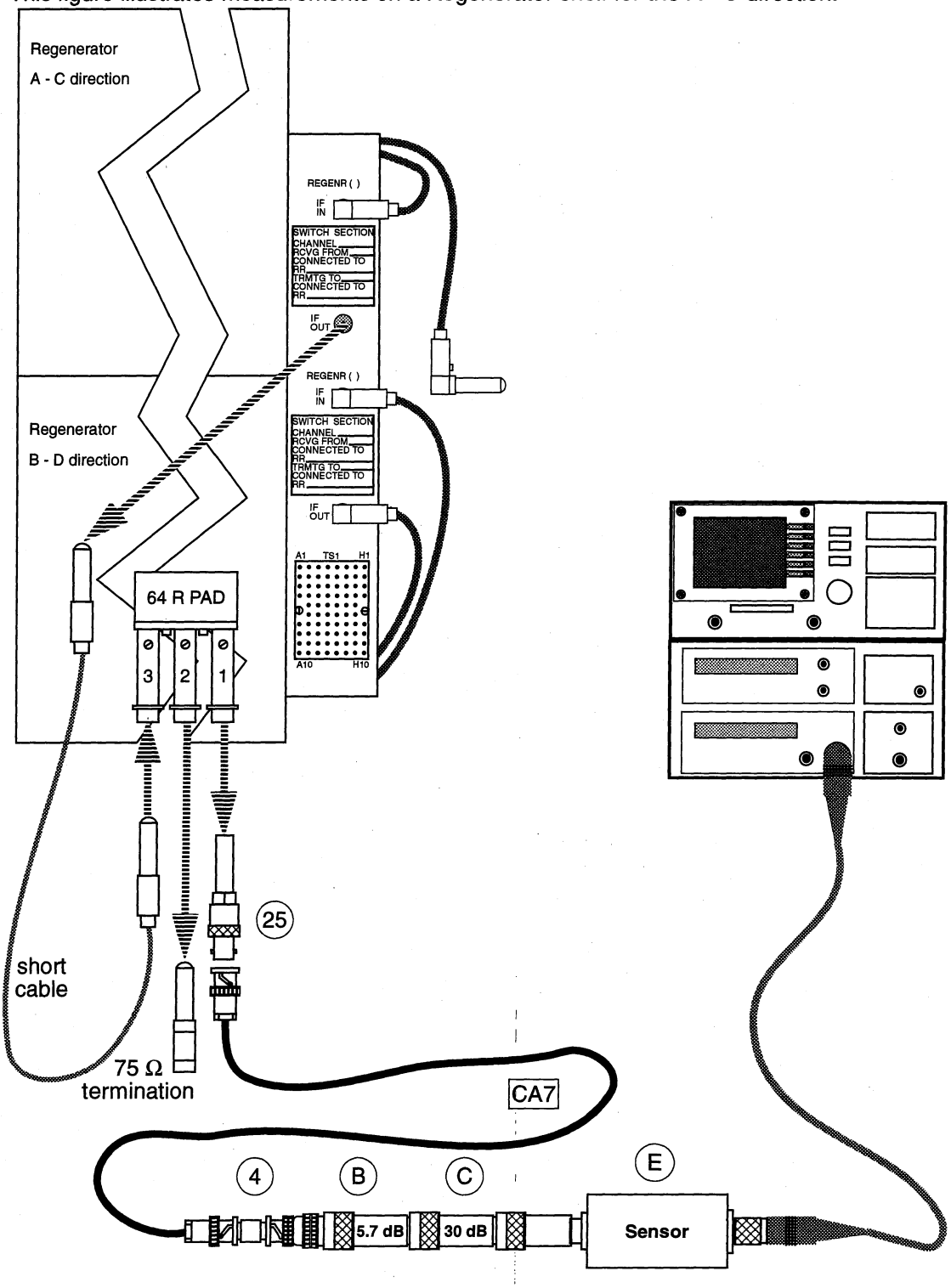


Figure 10. Regenerator Loopback—Measure "S"

Comment: Using the IF source under the event counter menu allows us to use the event counter and sources simultaneously.

On the SPECTRUM ANALYZER (Step 7 continued):

c. Press the More 1 of 2 softkey.

d. Press the Sources softkey.

Verify that IF SOURCE PWR .0 dBm is displayed in the active function block (default value).

Reference: **DRTS** tab, 3.2.2 Active Function Block.

e. Press the CENTER FREQ softkey.

f. Use the DATA keys to enter 74 MHz.

Verify that CENTER 74.00 MHz is displayed in the active function block.

Reference: **DRTS** tab, 3.2.5 Entering Data.

g. Press the SPAN softkey.

h. Use the DATA keys to enter 0 Hz.

Verify that SPAN 0 Hz is displayed in the active function block.

i. Press the SRC PWR ON OFF softkey to select source power (SRC PWR highlighted).

j. Press the SRC PWR ON OFF softkey (a second time) to underline ON.

k. Press the Main Menu softkey.

l. Press the GATE TIME softkey.

Verify that GATE TIME 1.000000 sec (default value) is displayed in the active function block.

m. Press the HOLD key to extinguish the active function block.

8 On the 64 R SPLIT PAD:

a. Remove the cable from the port 3 jack.

b. Move the 75-ohm termination from port 2 to port 3.

9 Connect the test equipment as shown in Figure 11.

Notice that the 30-dB attenuator (item C) was removed.

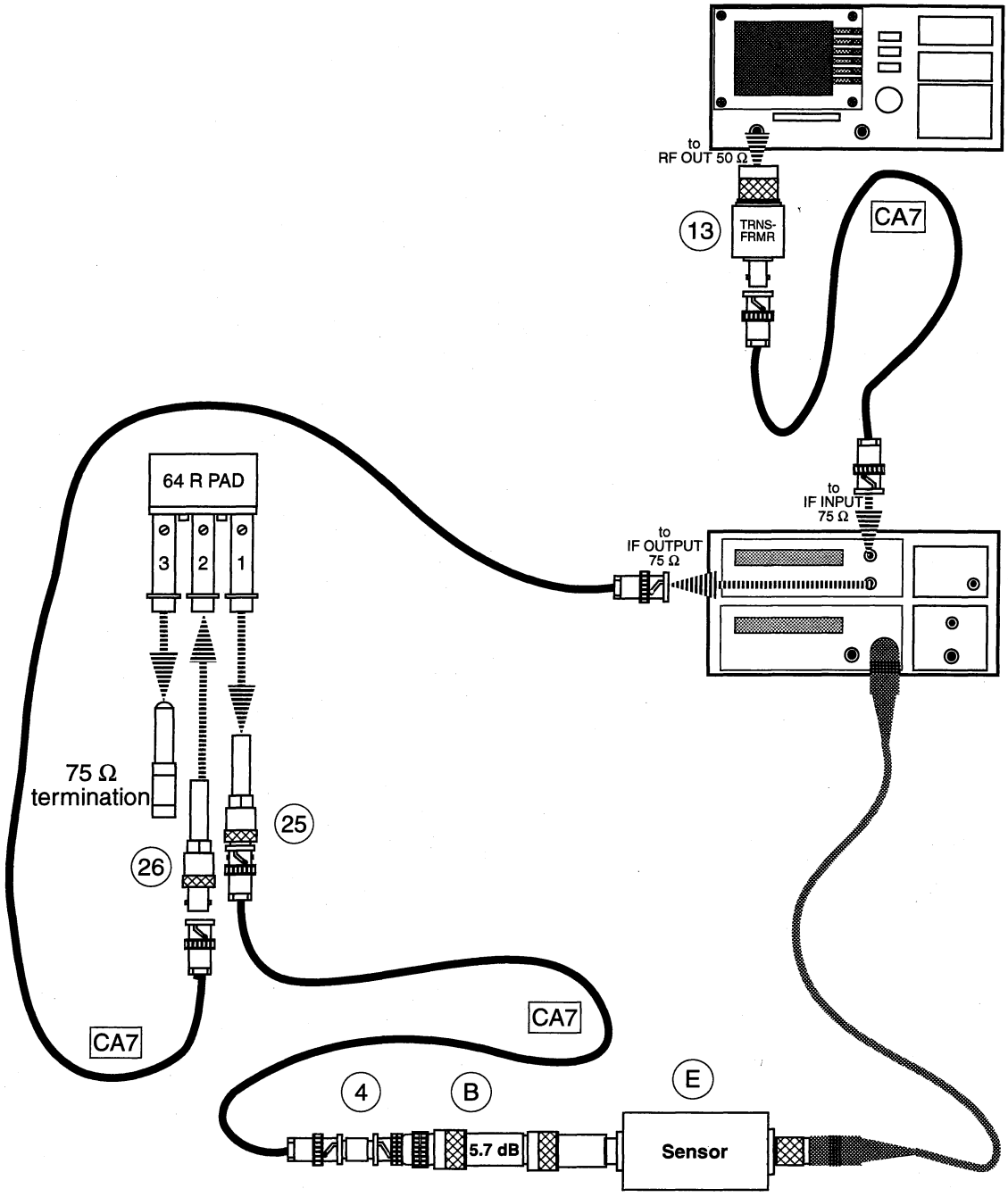


Figure 11. Establishing "I"

10 On the POWER METER,

enter the OFFSET for an IF measurement below –20 dBm (about 5.7 dB), plus an additional 0.25 dB to compensate for loss in the test cable.

11 On the MULTIPATH FADING SIMULATOR (MFS):

a. Press the green PRESET/LOCAL key.

b. Press the ENTER key.

c. Press the ATTEN key (you now have a variable attenuator).

d. Use the arrow keys to adjust attenuator loss for a **power meter** display of:

- For a 135EC bay:
  29 dB below the "S" level noted in Step 6.
- For a 135A bay:
  28 dB below the "S" level noted in Step 6.

Example for a 135EC bay:

If you noted an "S" level of –8 dBm in Step 6, set the "I" level to –37 dBm [(–8) + (–29) = –37].

e. Press the ENTER key.

Comment: You have established an Interfering tone at 74 MHz. For an Error Corrected (EC) system, the "I" level is 29 dB below the "S" level. Next, you will combine the "S" and the "I" signals in the split pad and connect them to the digital receiver. You will use the bar graph BER to measure the performance.

12 On the terminal-TRANSMITTER or REGENERATOR,

remove the cable from the (RCV or REGENR) IF IN jack.

13 On the 64 R SPLIT PAD:

a. Remove the 75-ohm termination from port 3 jack.

b. Remove the power meter test connection from port 1.

14 Connect the test equipment as shown in Figure 12 (Terminal) or Figure 13 (Regenerator).

a. Note that the 12-dB pad is needed only if AMR 28/28B 64QAM MOD card is installed.

b. Terminal only:
You will be directed to connect the event counter input to a measurement jack during EC evaluation.

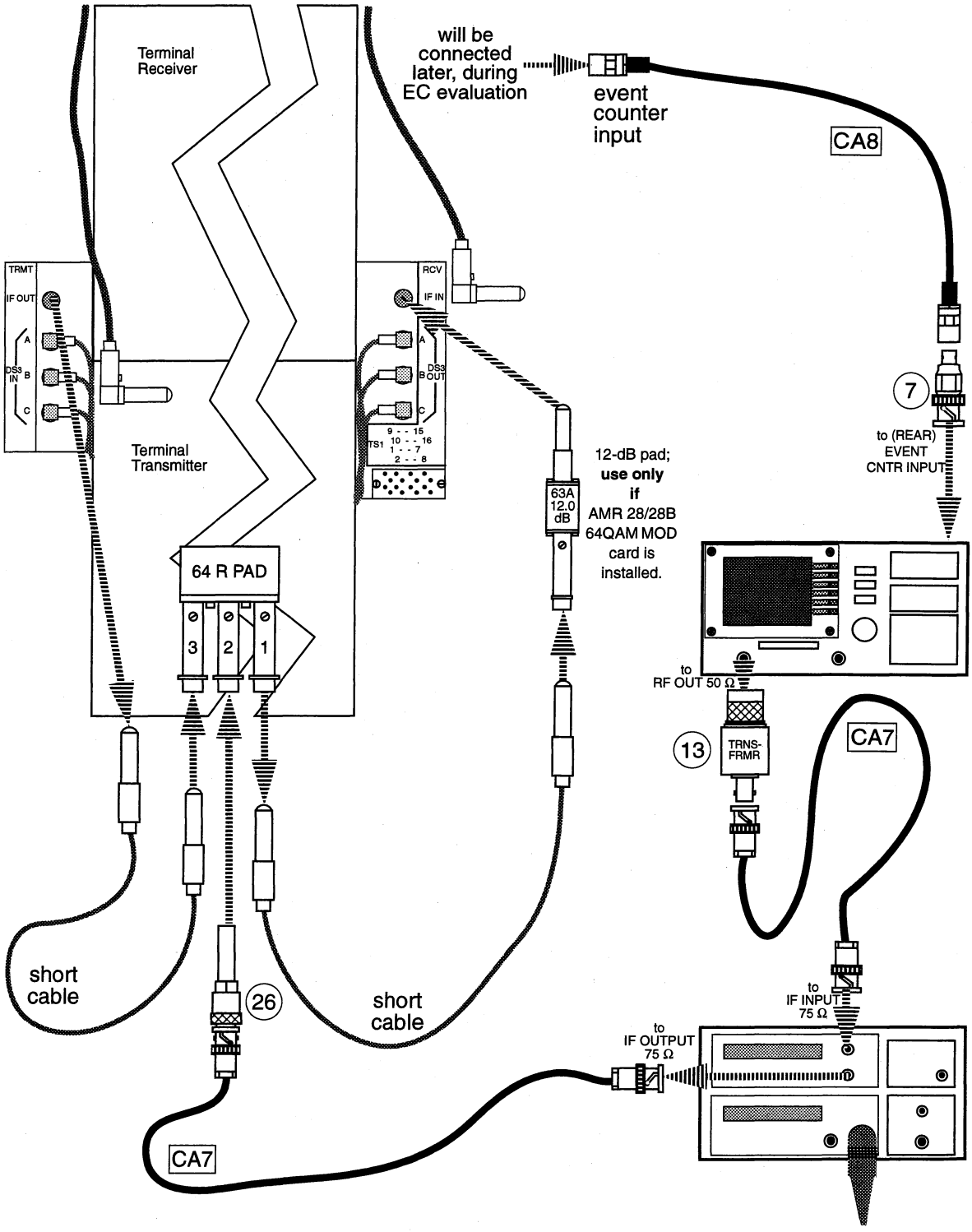


Figure 12. Terminal Loopback "S/I"

15 Receivers are equipped with either of two types of Transversal Equalization (TE). Which type does the receiver under test have?

*Comment: An **analog** TE equipped receiver has two TRNSV FLT cards located in the second and third card slots from the left end.*

*A **digital** TE equipped receiver will have one TE card located in the sixth card slot from the left end.*

- Analog TE:

  Go to Step 16.

- Digital TE:

  Go to Step 20.

16 On the CHAN CONTR card of the terminal-receiver or regenerator,

observe the ERR RATE bar graph for at least 1 minute.

Requirement: The bar graph display will not light above (upward on unit) the line between the 7 and 8 segments.

Was the requirement met?

YES - Go to Step 17.

NO - Isolate and repair the trouble.

- It is probably a bad card (DEMOD through FRMR).
- Contact TSG for assistance, if necessary.

CAUTION:
ESD may damage plug-in units. Use a wrist strap as you remove cards and place the removed units on an ESD-protective surface.

17 On the terminal-RECEIVER or REGENERATOR:

a. Remove the two TRNSV FLT (AMR 32/49) cards.

Reference: **REPLACEMENT PROCEDURES** tab.

b. Install two TRNSV PATCH (AMR 47) cards into the TRNSV FLT positions.

Comment: TRNSV PATCH cards are nearly blank circuit boards used to replace the Transversal Filters that would otherwise mask the test results.

This figure illustrates measurements on a Regenerator shelf for the A - C direction.

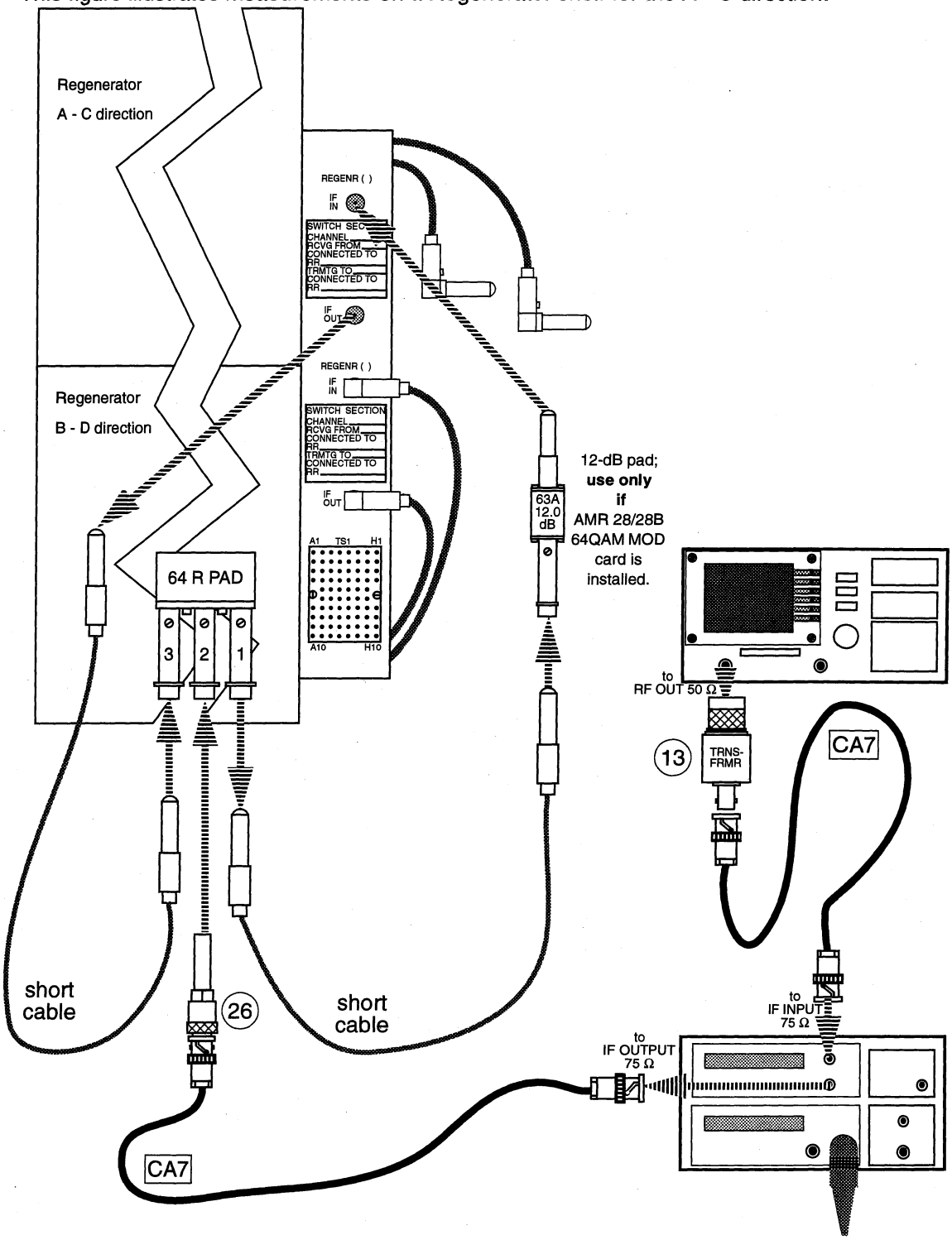


Figure 13. Regenerator Loopback "S/I"

18 On the CHAN CONTR card of the terminal-receiver or regenerator,

observe the ERR RATE bar graph for at least 1 minute.

Requirement: The bar graph display will not light above (upward on unit) the line between the 7 and 8 segments.

Was the requirement met?

YES - The S/I test is completed for analog TE application.
- Do not make any test equipment or connection changes.
- Go to Step 19.

NO - Isolate and repair the trouble.
- It is probably a bad card (DEMOD through FRMR).
- Contact TSG for assistance, if necessary.

19 On the terminal-RECEIVER or REGENERATOR:

a. Remove the two TRNSV PATCH cards.
b. Reinstall the two TRNSV FLT cards.
c. Go to Step 31.

20 On the TE card of the terminal-receiver or regenerator,

verify that the TE push-button switch is in the NORM position (in).

21 On the CHAN CONTR card of the terminal-receiver or regenerator,

observe the ERR RATE bar graph for at least 1 minute.

Requirement: The bar graph shall not light above the 8 segment.

Was the requirement met?

YES - Go to Step 22.

NO - Isolate and repair the trouble.
- It is probably a bad card (DEMOD through FRMR).
- Contact TSG for assistance, if necessary.

22 On the CHAN CONTR card of the terminal-receiver or regenerator,

is the 8 segment of the bar graph lighted?

YES - Go to Step 23.

NO - Go to Step 24.

23 On the MULTIPATH FADING SIMULATOR:

a. Note the value, in dB, shown in the ATTEN display for later reference.

b. Go to Step 25.

Comment: In Step 24, you will reduce the Multipath Fading Simulator (MFS) attenuator loss (increase the level of the interfering "I" tone) until the 8 segment on the bar graph lights (but no segments above 8 lighted). This will be the starting point for the next test.

24 On the MULTIPATH FADING SIMULATOR:

a. Press the ATTEN key.

b. Use the arrow keys to reduce the loss until the 8 segment on the bar graph lights (but not the 7 segment).

c. Press the ENTER key.

d. Note the value, in dB, shown in the ATTEN display for later reference.

Comment: In Steps 25 and 26, you will prepare and connect the event counter to count pseudo errors. Because pseudo errors occur several 100 times more frequently than CRC errors, the higher count makes a more accurate test.

25 On the SPECTRUM ANALYZER:

a. Press the 1 s softkey.

Verify that GATE TIME 1.000000 sec is displayed in the active function block.

b. Press the HOLD key to extinguish the active function block.

26 Connect the event counter input cable (shaded portion of Figure 12) to the "I" PSEUDO ERRORS jack on the MON card.

27 On the SPECTRUM ANALYZER:

a. Observe the EVENT CNTR display for at least ten 1-second intervals.

b. Note the average count per 1-second interval.

28 On the TE card of the receiver or regenerator:

a. Operate the push-button switch to OFF (out).

b. Verify that the TE OFF indicator lights.

29 On the MULTIPATH FADING SIMULATOR:

a. Press the ATTEN key.

b. Use the arrow keys to increase the loss until the EVENT CNTR (on the spectrum analyzer) displays about the same pseudo errors as you noted in Step 27.

The count will vary quite a bit but over several 1-second intervals, but you should be able to adjust the attenuation for an average counter display close to the count noted in Step 27.

c. Press the ENTER key.

d. Compare the value, in dB, shown in the ATTEN display with the value previously noted in Step 23 or Step 24.

Requirement: There shall be 3 dB, or less, between the two ATTEN values.

Was the requirement met?

YES - The S/I test is completed for digital TE application.

- Do not make any test equipment or connection changes.
- Go to Step 30.

NO - Isolate and repair the trouble.

It is probably a bad TE card.

- Contact TSG for assistance, if necessary.

30 On the TE card in the terminal-receiver or regenerator:

a. Operate the push-button switch to NORM.

b. Verify that the TE OFF indicator extinguishes.

CAUTION:
*An error correction check on a regular channel requires a service-affecting **span** switch. Perform the check **only** if you suspect an error correction problem.*

31 Are you going to perform an Error Correction check?

YES - Terminal receiver only.

- Leave all test connections and equipment as they are.
- Go to Step 32.

NO - Go to Step 41.

32 Is this a regular channel?

YES - Protect service with a **span** switch in the receive direction if one does not already exist.

NO - Keep the present protection channel lockout.

33 On the terminal-RECEIVER:

Comment: The digital TE is turned off for the EC evaluation test. The 74-MHz interfering signal causes the TE to generate intermittent error bursts which cannot be corrected by EC.

a. Digital TE only:

1. On the TE card:

(a) Operate the push button switch to OFF (out).

(b) Verify that the TE OFF indicator lights.

2. On the MON card, disconnect the event counter input cable from the "I" PSEUDO ERROR jack.

b. On the TERM FRMR card, connect the event counter input cable to the SECT CRC ERRS jack.

34 On the MULTIPATH FADING SIMULATOR:

a. Press the ATTEN key.

b. Use the arrow keys to lower the ATTEN (dB) value until the EVENT CNTR (on the spectrum analyzer) displays about 70 (60 to 80).

c. Press the ENTER key.

35 On the terminal-RECEIVER:

a. Disconnect the event counter input cable from the SECT CRC ERRS jack on the TERM FRMR card.

b. Connect the event counter input cable to the DS 3 PTY jack on the VMR& CODER (AMR 72/72B) card on TRIB A.

36 On the SPECTRUM ANALYZER:

a. Press the Main Menu softkey.

b. Press the GATE TIME softkey.

c. Enter 60 seconds using the data keys.

d. Press the Main Menu softkey.

e. Press the RESET CNTRS softkey.

f. Observe the EVENT CNTR for 1 interval.

Comment: The counter indicator (square block) will flash at the end of each 60-second interval.

Requirement: Two counts, or less, over the 60-second interval.

g. Defer any action until later.

37 On the terminal-RECEIVER,

move the event counter input cable as follows:

a. From the DS 3 PTY jack on the VMR& CODER card on TRIB A

b. To the DS 3 PTY jack on the VMR& CODER card on TRIB B.

38 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the EVENT CNTR for 1 interval.

Requirement: Two counts, or less, over the 60-second interval.

c. Defer any action until later.

39 On the terminal-RECEIVER,

move the event counter input cable as follows:

a. From the DS 3 PTY jack on the VMR& CODER card on TRIB B

b. To the DS 3 PTY jack on the VMR& CODER card on TRIB C.

40 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the EVENT CNTR for 1 interval.

Requirement: Two counts, or less, over the 60-second interval.

Were the requirements for all TRIBs met?

YES - Go to Step 41.

NO - Isolate and repair the trouble.

It is probably one of the four error correction cards.

- Contact TSG for assistance, if necessary.

41 Remove all test connections from the terminal or regenerator bay.

42 On the terminal-RECEIVER or REGENERATOR:

a. Reconnect the normal bay cable to the (RCV or REGENR) IF IN jack.

b. Digital TE only:
On the TE card:

1. Operate the push-button switch to NORM (in).

2. Verify that the TE OFF indicator extinguishes.

43 On the terminal-TRANSMTTER or REGENERATOR:

a. Reconnect the normal bay cable to the (TRMT or REGENR) IF OUT jack.

b. Regenerator only:
On the FRAME RSPLY card:

1. Operate the MAN FRS push button to the out position.

2. Verify both the red, MAN FRS ON and the yellow, FRS ON indicators extinguish.

44 On the ALC NETWORK or 328A AMPL of the associated radio transmitter, operate the **ALC ON/OFF** switch to **ON**.

45 On the TERMINAL or REGENERATOR bay
(if you are not making more tests that require side access):

a. (Terminal) Reinstall the right-front and left-front side covers.

b. (Regenerator) Reinstall the right-front cover.

46 On the CONTROL and SERVICE CHANNEL shelf:

a. (Terminal) Press the ALM RST push button on the RCV STAT card.

b. (Regenerator) Press the ALM RST push button on the REGEN CONTR card.

Requirement: No alarms or diagnostic code present.

Were the requirements met?

YES - Go to Step 47.

NO - Isolate the problem.

Reference: **START HERE** tab.

47 Return to the procedure or flowchart that referred you to this procedure.

End of Procedure

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4.3 Loopback Propagation Distortion Checks

Use this trouble-isolation test procedure to check the performance of countermeasures for fade-induced distortion in the radio and digital (terminal or regenerator) receivers.

In this procedure, the receivers are removed from the radio path to determine whether performance problems are in the receivers or the radio path.

There are three tests within this procedure:

- Adaptive Slope Equalizer (ASE)
- Transversal Equalizer (TE)
- Digital Receiver Recovery.

In the Loopback, the IF signal from a digital transmitter is looped back through the IF AGC amplifier and Adaptive Slope Equalizer of the opposite-direction radio receiver to the digital receiver.

You will add simulated propagation distortion to the digital signal in the loopback path to check the capability of the ASE and the TE to reduce the effects of the inserted distortion.

Prerequisite: Procedure 4.1, Loopback Performance Check.

CAUTION:
This is an Out-of-Service procedure. Service will be interrupted or impaired unless you apply Service Protection measures.

At Terminals: Line [or span if one already exists] switch (regular channel) or lock out (protection channel) in both directions.

At Regenerators: Line switch (regular channel) or lock out (protection channel) in the direction under test.

CAUTION:
ESD may damage plug-in units. Use proper methods to prevent ESD damage.

Step	Procedure

Establish and Verify IF Loopback

1 On the TERMINAL or REGENERATOR bay:

a. (Terminal) Remove the left-front side cover.

b. (Regenerator) Remove the right-front side cover.

2 On the ALC NETWORK or 328A AMPL of the associated radio transmitter, operate the **ALC ON/OFF** switch to **OFF**.

CAUTION:
Verify that service is protected and that you are at the correct terminal or regenerator transmitter and receiver. Verify correct radio bay and receiver shelf.

3 On the terminal-TRANSMITTER or REGENERATOR:

a. Remove the cable from the (TRMT or REGENR) IF OUT jack.

b. Regenerator only:
On the FRAME RSPLY card:

1. Operate the MAN FRS push button to the in position.
2. Verify both the red, MAN FRS ON and the yellow, FRS ON indicators light.

4 On the radio bay and on the IF AGC AMP of the associated radio receiver, remove the bay cable from the IF IN jack.

5 Connect the test equipment as shown in Figure 14 (Terminal) or Figure 15 (Regenerator).

a. You will be directed to connect the counter inputs (shaded portion) to a measurement jack later in this procedure.

b. If there is a large distance between the radio and terminal or regenerator bays, a longer cable will be required from the MFS to the radio bay.

Comment: In Figure 15 the Regenerator A - C direction is illustrated. The lower jacks are for the B - D direction.

Reference: Maintenance Support manual—Equipment Identification, **REGENERATOR** tab.

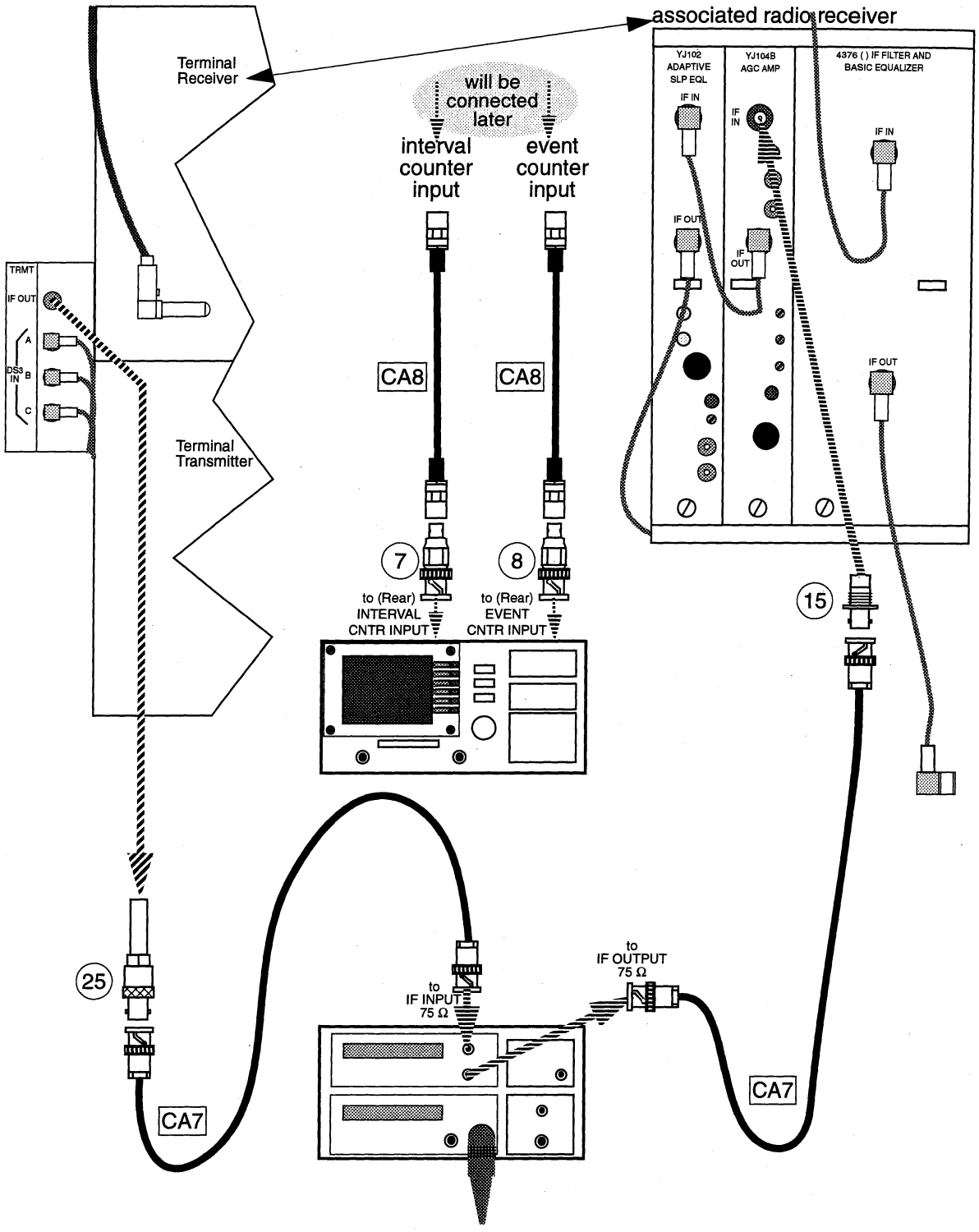

Figure 14. Terminal Loopback Propagation Distortion

6 On the MULTIPATH FADING SIMULATOR (MFS):

a. Press the green PRESET /LOCAL key.

b. Press the ENTER key.

c. Press the ATTEN key (you now have a variable attenuator).

d. Use the arrow keys to adjust attenuator loss for 20 dB.

e. Press the ENTER key.

f. Verify that the display window indicates the following:

- FREQ (MHz) 70.0
- DEPTH (dB) 0.0
- ATTEN (dB) 20.0
- PHASE marker (▼) MIN.

7 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE bar graph on the CHAN CONTR card.

Requirement: No lighted segments on the bar graph.

Was the requirement met?

YES - There is continuity through the test connections.

- Go to Step 8.

NO - Recheck the test connections of Figure 14 or 15.

- If necessary, check continuity by measuring levels through the test arrangement.

- Repeat from Step 5.

This figure illustrates measurements on a Regenerator shelf for the A - C direction.

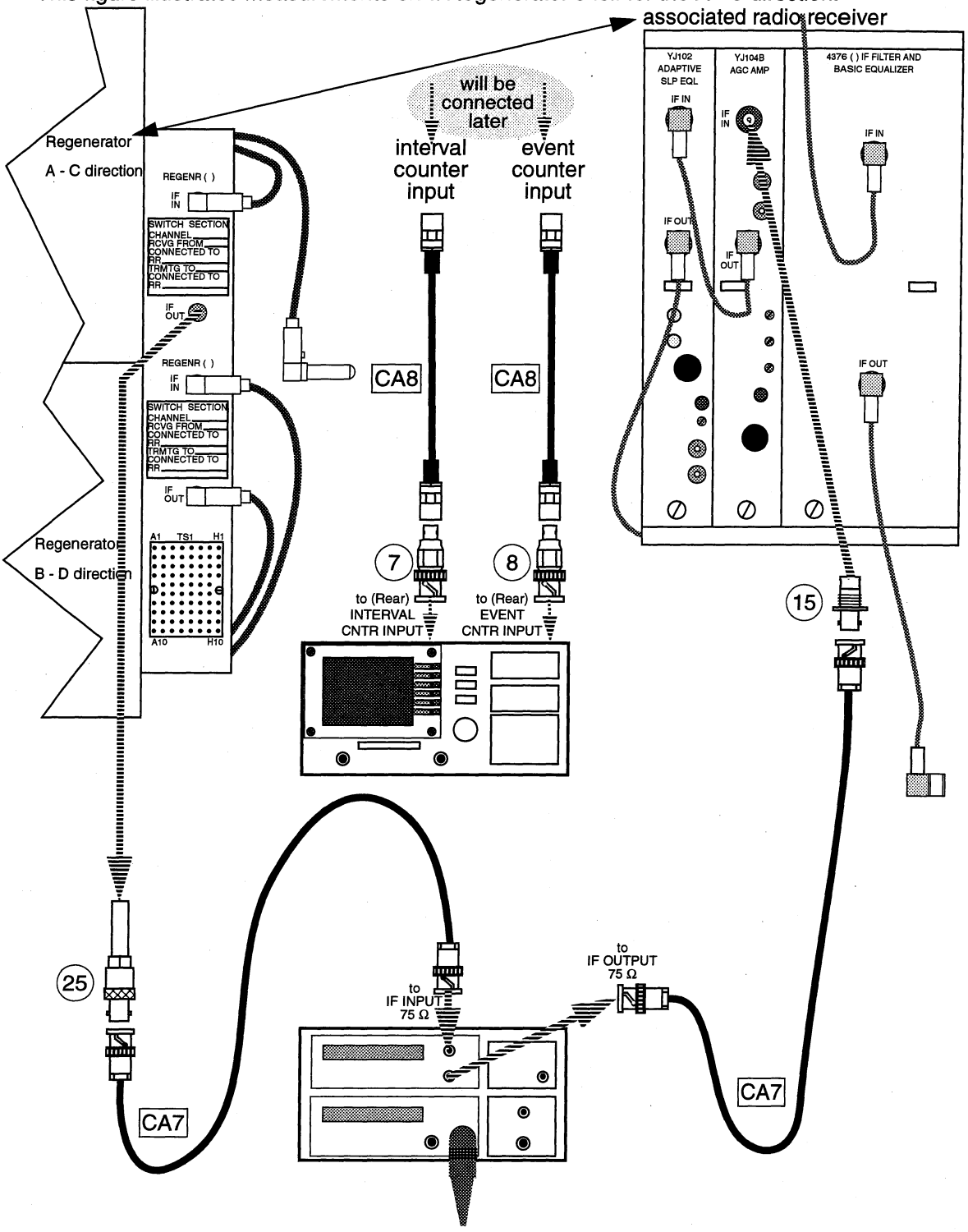

Figure 15. Regenerator Loopback Propagation Distortion

Adaptive Slope Equalizer (ASE) Test

Comment: You will test the ASE by generating a wide notch that simulates slope distortion. You will place the notch first at 76 MHz, then at 64 MHz, and compare error performance between ASE on (AUTO) and ASE off (MAN).

8 On the MFS:

a. Press the green PRESET/LOCAL key.

b. Press the ENTER key.

c. Press the NOTCH FREQ key.

d. Use the arrow keys to set the notch frequency to 76 MHz.

e. Press the NOTCH DEPTH key.

f. Use the arrow keys to set the notch depth to:

- 16.0 dB
  for receivers equipped with an Analog TE.
- 19.0 dB
  for receivers equipped with a Digital TE.

Reference: Determine which type of TE the receiver has by viewing the cards.

— Analog TE receivers have two TRANSV FLT cards in the second and third card slots from the left end (both AMR 32 or both AMR 49).

— Digital TE receivers will have one TE in the sixth card slot from the left end (AMR 184).

g. Press the ENTER key.

h. Verify that the display window indicates the following:

- FREQ (MHz) 76.0
- DEPTH (dB) 16.0 or 19.0
- ATTEN (dB) 00.0
- PHASE marker (▼) MIN.

9 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE display (bar graph) on the CHAN CONTR.

Requirement: No segment above (upward on unit) 6 on the bar graph shall be lighted (6 can be lighted, but not 5).

Was the requirement met?

YES - Go to Step 10.

NO - Isolate and repair the trouble.

The ASE card is probably out of alignment or bad.
Perform:
4.4 Adaptive Slope Equalizer Checks and Adjustments.

Reference: Radio Receiver—**Test Procedures** tab.

- Contact TSG for assistance, if necessary.

10 On the CHAN CONTR,

are any segments lighted?

YES - Note the bar graph indication for later reference.

- Go to Step 11.

NO - Increase the NOTCH DEPTH per Step 8 e, f, and g until one to three segments are lighted.

- Note the bar graph indication for later reference.

- Go to Step 11.

11 On the ADAPTIVE SLOPE EQUALIZER under test (radio bay):

a. Verify that the EXCS SLP indicator is lighted.

b. Operate the AUTO / MAN switch to MAN (out).

1. Verify that the EQL OFF indicator lights.
2. Verify that the EXCS SLP indicator extinguishes.

c. Verify (with voltmeter) that CONT V agrees with the RADIO DATA CARD entry for RCVR "CONT V MAN".

Requirement: The measured voltage and the voltage recorded as "CONT V MAN" shall be within:

- ±0.002 V for Series 1 or 2 ASE
- ±0.02 V for Series 3 ASE.

d. Adjust the MAN FLAT control, if necessary.

12 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE display (bar graph) on the CHAN CONTR.

Requirement: The bar graph shall be lighted at least one segment above the one noted in Step 10.
For example:
If all segments up to and including 6 were lighted in Step 10, all segments up to and including 5 must be lighted now.

Was the requirement met?

YES - Go to Step 13.

NO - Replace and align the ASE.

Reference: Radio Receiver—**TEST PROCEDURES** tab, Flowchart 3 Unit Replacement and Alignment, Adaptive Slope Equalizer.

- Repeat this test procedure.

13 On the ADAPTIVE SLOPE EQUALIZER under test (radio bay):

a. Operate the AUTO / MAN switch to AUTO (in).

b. Verify that the EQL OFF indicator extinguishes.

c. Verify that the EXCS SLP indicator lights.

14 On the MFS:

a. Press the NOTCH FREQ key.

b. Use the arrow keys to set the notch frequency to 64 MHz.

c. Press the NOTCH DEPTH key.

d. If necessary, use the arrow keys to decrease the notch depth to the original value of Step 8 f (16.0 or 19.0).

e. Press the ENTER key.

15 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE display (bar graph) on the CHAN CONTR.

Requirement: No segment above 6 on the bar graph shall be lighted.

Was the requirement met?

YES - Go to Step 16.

NO - Isolate and repair the trouble.

It is probably a bad ASE card.

- Contact TSG for assistance, if necessary.

16 On the CHAN CONTR,

are any segments lighted?

YES - Note the bar graph indication for later reference.

- Go to Step 17.

NO - Increase the NOTCH DEPTH per Step 8 e, f, and g until one to three segments are lighted.

- Note the bar graph indication for later reference.

- Go to Step 17.

17 On the ADAPTIVE SLOPE EQUALIZER under test (radio bay),

operate the AUTO / MAN switch to MAN (out).

18 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE display (bar graph) on the CHAN CONTR.

Requirement: The bar graph shall be lighted at least one segment above the one noted in Step 16.

Was the requirement met?

YES - Go to Step 19.

NO - Replace and align the ASE.

Reference: Radio Receiver—**TEST PROCEDURES** tab, Flowchart 3 Unit Replacement and Alignment, Adaptive Slope Equalizer.

- Repeat this test procedure.

19 On the ADAPTIVE SLOPE EQUALIZER under test (radio bay),

operate the AUTO / MAN switch to AUTO (in).

Transversal Equalizer Test

Comment: To check the distortion-reduction capability of the Transversal Equalizers, or TRNSV FLTs, you will use the FADE EVENT 0 function of the MFS. Fade Event 0 is a digitalized simulation of previously recorded severe fade-related distortion. At the end of the 10-minute test, you will determine whether the distortion was properly reduced by observing the number of Threshold Error Seconds counted.

20 Connect the INTERVAL and EVENT COUNTERS inputs (shown in Figures 14 and 15) to the terminal-RECEIVER or REGENERATOR under test.

a. (Terminal) On the TERM FRMR card connect the:

— interval counter to the FR LS jack.

— event counter to the HOP CRC ERRS jack.

b. (Regenerator) On the REGEN FRMR card connect the:

— interval counter to the FR LS jack.

— event counter to the HOP CRC ERRS jack.

21 On the SPECTRUM ANALYZER:

a. Press the green PRESET key.

Comment: EVENT COUNTER softkey should be displayed on the screen; if it is not, load "GROUP 1" menu.

Reference: **DRTS** tab, 1.6 Downloading User Programs.

b. Press the EVENT COUNTER softkey.

c. Press the GATE TIME softkey.

d. Press the 100 ms softkey.

Verify that GATE TIME 100.000 msec is displayed in the active function block.

Reference: **DRTS** tab, 3.2.2 Active Function Block.

e. Press the Main Menu softkey.

f. Press the TOTALIZE ON OFF softkey to ON.

22 On the MFS:

a. Press the blue SHIFT key.

b. Press the → (right arrow).

Verify that FADE EVENT 0 appears on the MFS display.

23 On the SPECTRUM ANALYZER,

press the RESET CNTRS softkey.

24 On the MFS:

a. Press the ENTER key (the fade simulation will start).

b. Verify that FADING O . . . . appears on the MFS display.

c. Wait until the fade simulation has ended, about 10 minutes.

FADING O . . . . will disappear from the MFS display when the simulation is done.

25 On the SPECTRUM ANALYZER:

a. Observe the THLD ERR SEC count.

Requirement:

- 25 or less
  for Analog TE equipped receivers.
- 18 or less
  for Digital TE equipped receivers.

Was the requirement met?

YES - Go to Step 25 b.

NO - Isolate and repair the trouble.

- Contact TSG for assistance, if necessary.

b. Press the STOP CNTRS softkey (this is required to display all counts when the gate time is less than 1 second).

26 On the RADIO DATA CARD,

record the following counter contents as "loopback" on the blank-back side for future reference:

a. EVENT CNTR cnt

b. INTERVAL CNTR cnt

c. INTERVAL CNTR sec

d. THLD ERR SEC sec.

Digital Receiver Recovery Test

Comment: This test determines the ability of a digital receiver to recover synchronization following the re-connection of an interrupted (open) signal. You will manually interrupt the signal at the output of the digital transmitter, then observe the approximate length of time required for the terminal-receiver or regenerator to acquire synchronization. You will add a 70-MHz notch to stress the 64QAM signal.

27 On the MFS:

a. Press the green PRESET /LOCAL key.

b. Press the ENTER key.

c. Press the NOTCH DEPTH key.

d. Use the arrow keys to set the notch depth to 18.0 dB.

e. Press the ENTER key.

f. Verify that the display window indicates the following:

- FREQ (MHz) 70.0
- DEPTH (dB) 18.0
- ATTEN (dB) 00.0
- PHASE marker (▼) MIN.

28 On the terminal-TRANSMITTER or REGENERATOR,

remove the cable from the (TRMT or REGENR) IF OUT jack.

29 On the terminal-RECEIVER or REGENERATOR:

a. Observe the CARRIER LOCK LOSS indicator on the 64QAM DEMOD card.

b. Estimate the time required for the CARRIER LOCK LOSS indicator to extinguish after the cable has been reconnected in the following step.

30 On the terminal-TRANSMITTER or REGENERATOR,

reconnect the cable to the (TRMT or REGENR) IF OUT jack.

Requirement: The CARRIER LOCK LOSS indicator should extinguish in 1 second or less after the cable is reconnected.

Was the requirement met?

YES - Go to Step 31.

NO - Isolate the trouble.

- Suspect bad card (DEMOD through FRMR).
- Contact TSG for assistance, if necessary.

31 On the MFS:

a. Press the PHASE key.

b. Verify PHASE marker (▼) is NON-MIN in the display window.

32 On the terminal-TRANSMITTER or REGENERATOR,

remove the test cable from the (TRMT or REGENR) IF OUT jack.

33 On the terminal-RECEIVER or REGENERATOR:

a. Observe the CARRIER LOCK LOSS indicator on the 64QAM DEMOD card.

b. Estimate the time required for the CARRIER LOCK LOSS indicator to extinguish after the cable has been reconnected in the following step.

34 On the terminal-TRANSMITTER or REGENERATOR,

reconnect the cable to the (TRMT or REGENR) IF OUT jack.

Requirement: The CARRIER LOCK LOSS indicator should extinguish in 1 second or less after the cable is reconnected.

Was the requirement met?

YES - Go to Step 35.

NO - Isolate the trouble.

- Suspect bad card (DEMOD through FRMR).
- Contact TSG for assistance, if necessary.

35 On the terminal-TRANSMITTER or REGENERATOR:

a. Remove the test connection from the (TRMT or REGENR) IF OUT jack.

b. Reconnect the normal bay cable to the IF OUT jack.

36 On the terminal-RECEIVER or REGENERATOR:

a. Remove the interval and event counter connections from the (TERM or REGEN) FRMR card.

b. Regenerator only:
On the FRAME RSPLY card:

1. operate the MAN FRS push button to off.

2. Verify both the red, MAN FRS ON and the yellow, FRS ON indicators extinguish.

37 On the ALC NETWORK or 328A AMPL of the associated radio transmitter,

operate the **ALC ON/OFF** switch to **ON**.

38 On the TERMINAL or REGENERATOR bay
(if you are not making more tests that require side access):

a. (Terminal) Reinstall the left-front side cover.

b. (Regenerator) Reinstall the right-front side cover.

39 On the radio bay and on the IF AGC AMPL of the associated radio receiver:

a. Remove the test connection from the IF IN jack.

b. Reconnect the normal bay cable to the IF IN jack.

40 On the CONTROL and SERVICE CHANNEL shelf:

a. (Terminal) Press the ALM RST push button on the RCV STAT card.

b. (Regenerator) Press the ALM RST push button on the REGEN CONTR card.

Requirement: No alarms or diagnostic code present.

Were the requirements met?

YES - Go to Step 41.

NO - Isolate the problem.

Reference: **START HERE** tab.

41 Return to the procedure or flowchart that referred you to this procedure.

End of Procedure

5 Over-the-Air Tests

5.1 Over-the-Air S/I and EC Evaluation ("Annual")

The over-the-air Signal to Interference (S/I) stress check portion of this procedure is a required annual test to check performance of the preceding radio transmitter.

At Regenerator stations, you will perform only the over-the-air S/I stress check. Error Correction (EC) evaluation (Terminals only) is included in this procedure because it uses the same test setup. However, EC evaluation does require a span switch that will cause a service impairment. Do NOT perform the EC evaluation unless there is an indication of an EC problem.

The tests are performed at the receive-end of the radio hop and consist of inserting an interfering tone, at a specific level, to "stress" digital performance across the radio hop.

Prerequisite: The hop and section BER performance is satisfactory under normal conditions.

CAUTION:
This is an Out-of-Service procedure. Service will be interrupted or impaired unless you apply Service Protection measures.

At Terminals: Line switch (regular channel) or lock out (protection channel) in the direction under test.

At Regenerators: Line switch (regular channel) or lock out (protection channel) in the direction under test.

CAUTION:
ESD may damage plug-in units. Use proper methods to prevent ESD damage.

Step	Procedure
1	At the TERMINAL or REGENERATOR bay, remove the right-front side cover.

2 On the TEST SET:

a. Calibrate the POWER METER, if necessary.

Reference: **DRTS** tab, 2.2 Calibration.

b. Enter the OFFSET (as shown on the POWER SENSOR) for measurement of IF between –30 dBm and +10 dBm (about 35.7 dB).

c. Add an additional 0.25 dB to compensate for loss in the 8-foot BNC - BNC cable.

Reference: **DRTS** tab, 2.3 Entering Offset.

Comment: In Steps 3 through 5, you will measure the level of the signal that will be the receiver input signal during the test. You will note it as "S" for use in a later step.

Comment: The 64R UNEQUAL LOSS SPLIT-PAD has low loss (about 0.6 dB) between ports 1 and 3 (end ports) but about 24-dB loss between port 2 (center) and either of the end ports. Port numbers may not be designated on the 64R pad.

CAUTION:
Verify that service is protected and that you are at the correct terminal or regenerator transmitter and receiver.

3 On the terminal-RECEIVER or REGENERATOR,

remove the cable from the (RCV or REGENR) IF IN jack.

4 Connect the test equipment as shown in Figure 16 (Terminal) or Figure 17 (Regenerator).

Comment: In Figure 17 the Regenerator A - C direction is illustrated. The lower jacks are for the B - D direction.

Reference: Maintenance Support manual— Equipment Identification, **REGENERATOR** tab.

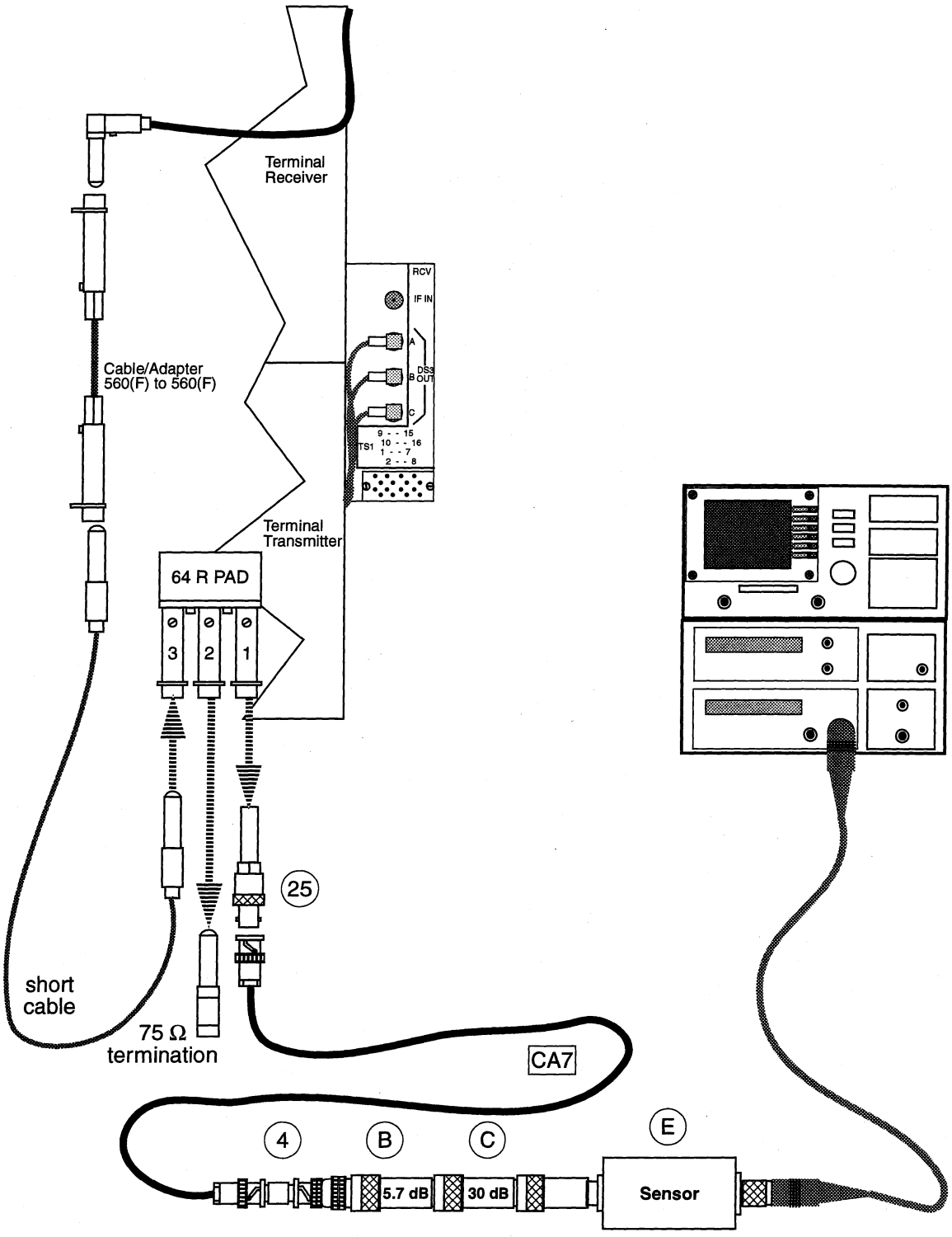

Figure 16. Terminal Over-the-Air—Measure "S"

5 On the POWER METER,

observe the display.

Comment: The following requirement includes 0.6-dB loss for the 64 R pad.

Requirement:

- –8.8 dBm ± 1.0 dB
  for AMR 30 or AMR 230 64QAM DEMOD cards
  (interconnect cable equal to 50 feet).
- –12.3 dBm ± 1.2 dB
  for AMR 29 or AMR 229 64QAM DEMOD cards
  (interconnect cable greater than 50 feet).
- –10.6 dBm ± 3.0 dB
  for AMR 180 64QAM DEMOD cards.

Was the requirement met?

YES - Note the displayed level as "S" (Signal) for use in a later step.

- Go to Step 6.

NO - Verify the test connections.

- Go to the **TROUBLE ISOLATION** tab— 4.1 IF Level Problem.

Comment: In Steps 6 through 10, you will create an interfering tone ("I") at 74 MHz and at a specified level below the previously noted "S" level.

6 On the SPECTRUM ANALYZER:

a. Press the green PRESET key.

Comment: EVENT COUNTER softkey should be displayed on the screen; if it is not, load "GROUP 1" menu.

Reference: **DRTS** tab, 1.6 Downloading User Programs.

b. Press the EVENT COUNTER softkey.

This figure illustrates measurements on a Regenerator shelf for the A - C direction.

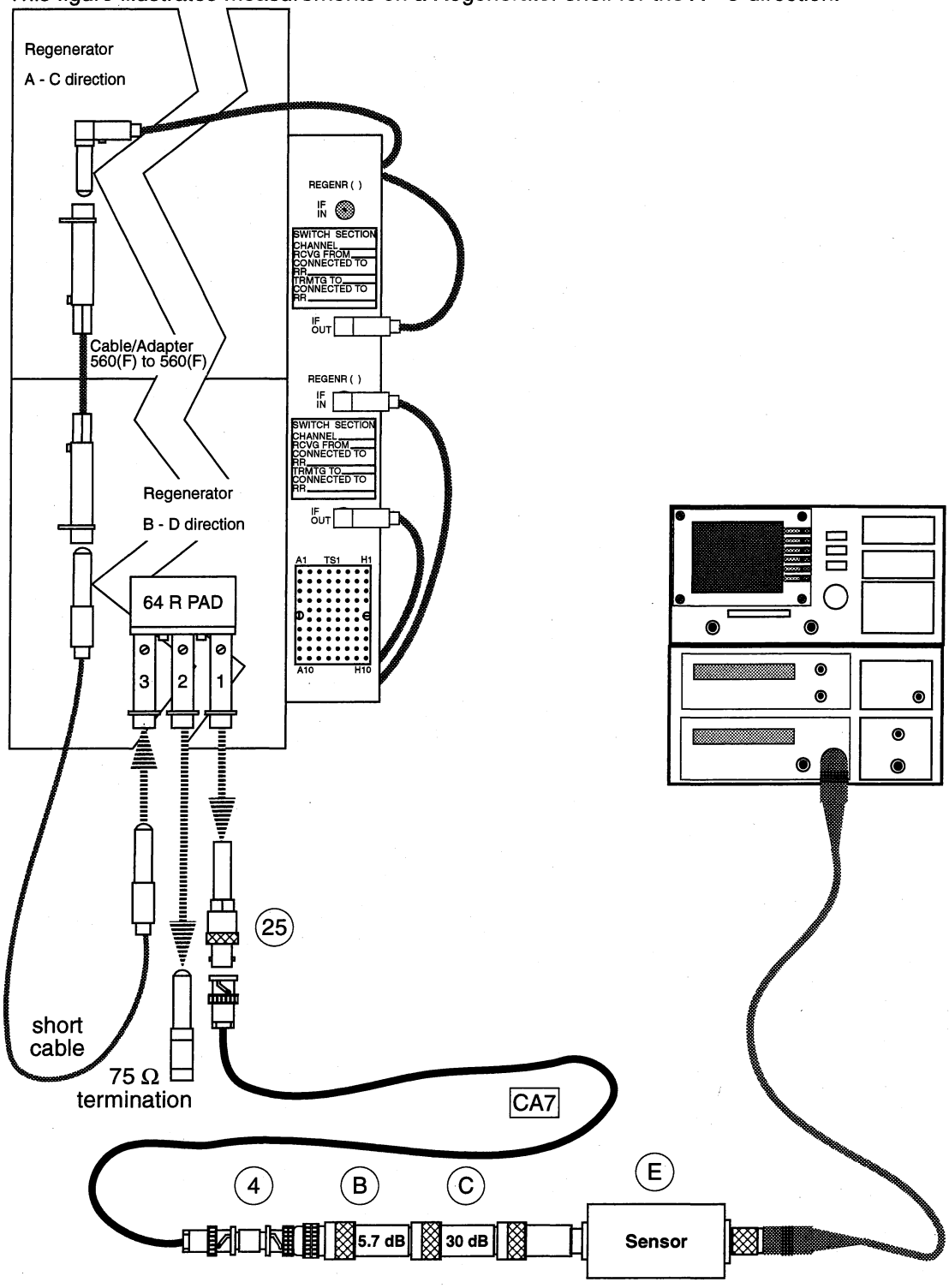

Figure 17. Regenerator Over-the-Air—Measure "S"

Comment: Using the IF source under the event counter menu allows us to use the event counter and sources simultaneously.

On the SPECTRUM ANALYZER (Step 6 continued):

c. Press the More 1 of 2 softkey.

d. Press the Sources softkey.

Verify that IF SOURCE PWR .0 dBm is displayed in the active function block (default value).

Reference: **DRTS** tab, 3.2.2 Active Function Block.

e. Press the CENTER FREQ softkey.

f. Use the DATA keys to enter 74 MHz.

Verify that CENTER 74.00 MHz is displayed in the active function block.

Reference: **DRTS** tab, 3.2.5 Entering Data.

g. Press the SPAN softkey.

h. Use the DATA keys to enter 0 Hz.

Verify that SPAN 0 Hz is displayed in the active function block.

i. Press the SRC PWR ON OFF softkey to select source power (SRC PWR highlighted).

j. Press the SRC PWR ON OFF softkey (a second time) to underline ON.

k. Press the Main Menu softkey.

l. Press the GATE TIME softkey.

Verify that GATE TIME 1.000000 sec (default value) is displayed in the active function block.

m. Press the HOLD key to extinguish the active function block.

7 On the 64 R SPLIT PAD:

a. Remove the cable from the port 3 jack.

b. Move the 75-ohm termination from port 2 to port 3.

8 Connect the test equipment as shown in Figure 18.

Notice that the 30-dB attenuator (item C) was removed.

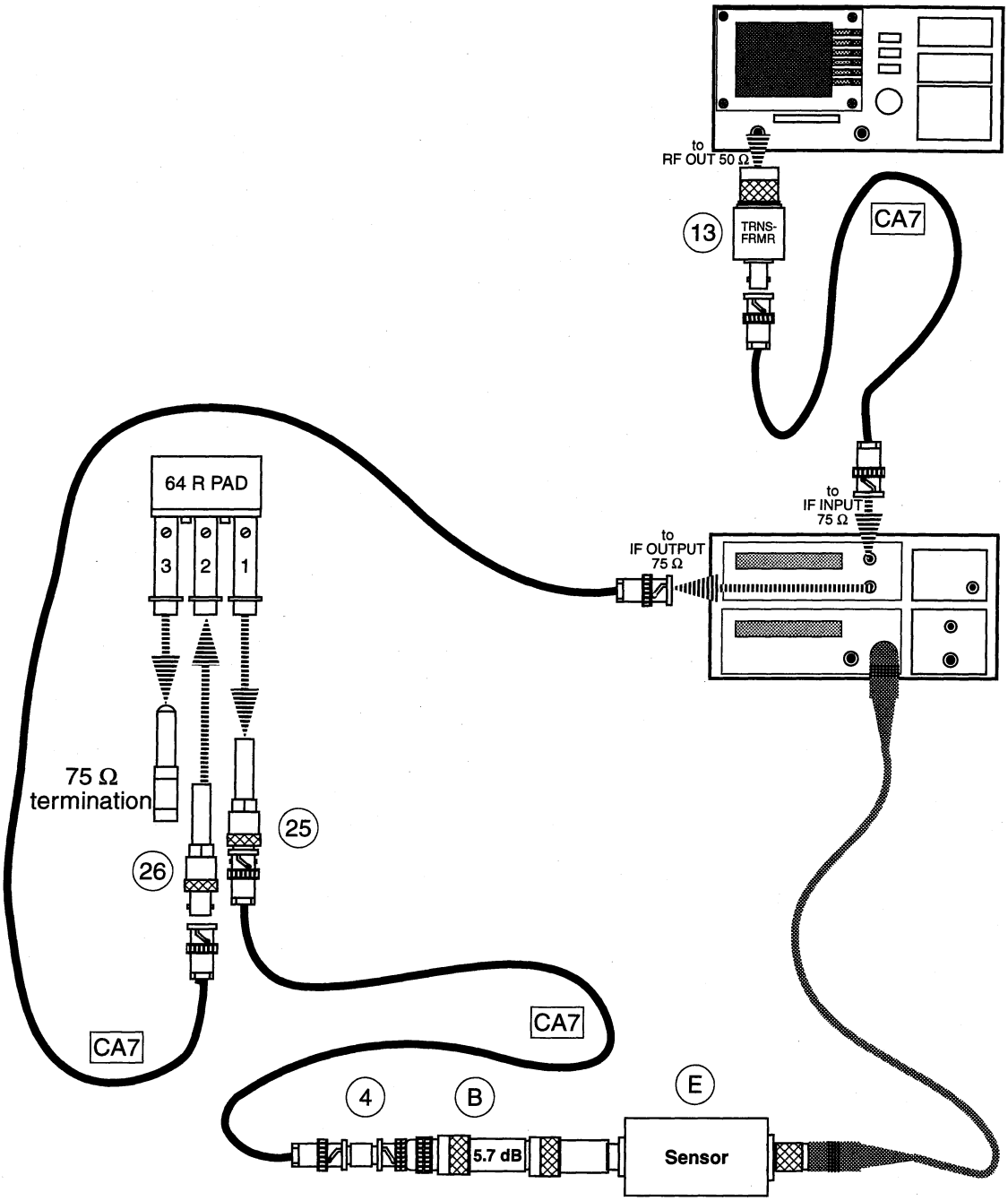

Figure 18. Establishing "I"

9 On the POWER METER,

enter the OFFSET for an IF measurement below –20 dBm (about 5.7 dB), plus an additional 0.25 dB to compensate for loss in the test cable.

10 On the MULTIPATH FADING SIMULATOR (MFS):

a. Press the green PRESET/LOCAL key.

b. Press the ENTER key.

c. Press the ATTEN key (you now have a variable attenuator).

d. Use the arrow keys to adjust attenuator loss for a **power meter** display of:

- For a 135EC bay:
  34.5 dB below the "S" level noted in Step 5.
- For a 135A bay:
  31 dB below the "S" level noted in Step 5.

Example for a 135EC bay:

If you noted an "S" level of –9 dBm in Step 5, set the "I" level to –43.5 dBm
[(–9) + (–34.5) = –43.5].

e. Press the ENTER key.

Comment: You have established an Interfering tone at 74 MHz. For an Error Corrected (EC) system, the "I" level is 34.5 dB below the "S" level. Next, you will combine the "S" and the "I" signals in the split pad and connect them to the digital receiver. You will use the bar graph BER to measure hop performance.

11 On the 64 R SPLIT PAD:

a. Remove the 75-ohm termination from port 3 jack.

b. Remove the power meter test connection from port 1.

12 Connect the test equipment as shown in Figure 19 (Terminal) or Figure 20 (Regenerator).

Terminal only:
You will be directed to connect the event counter input (shaded portion) to a measurement jack during EC evaluation.

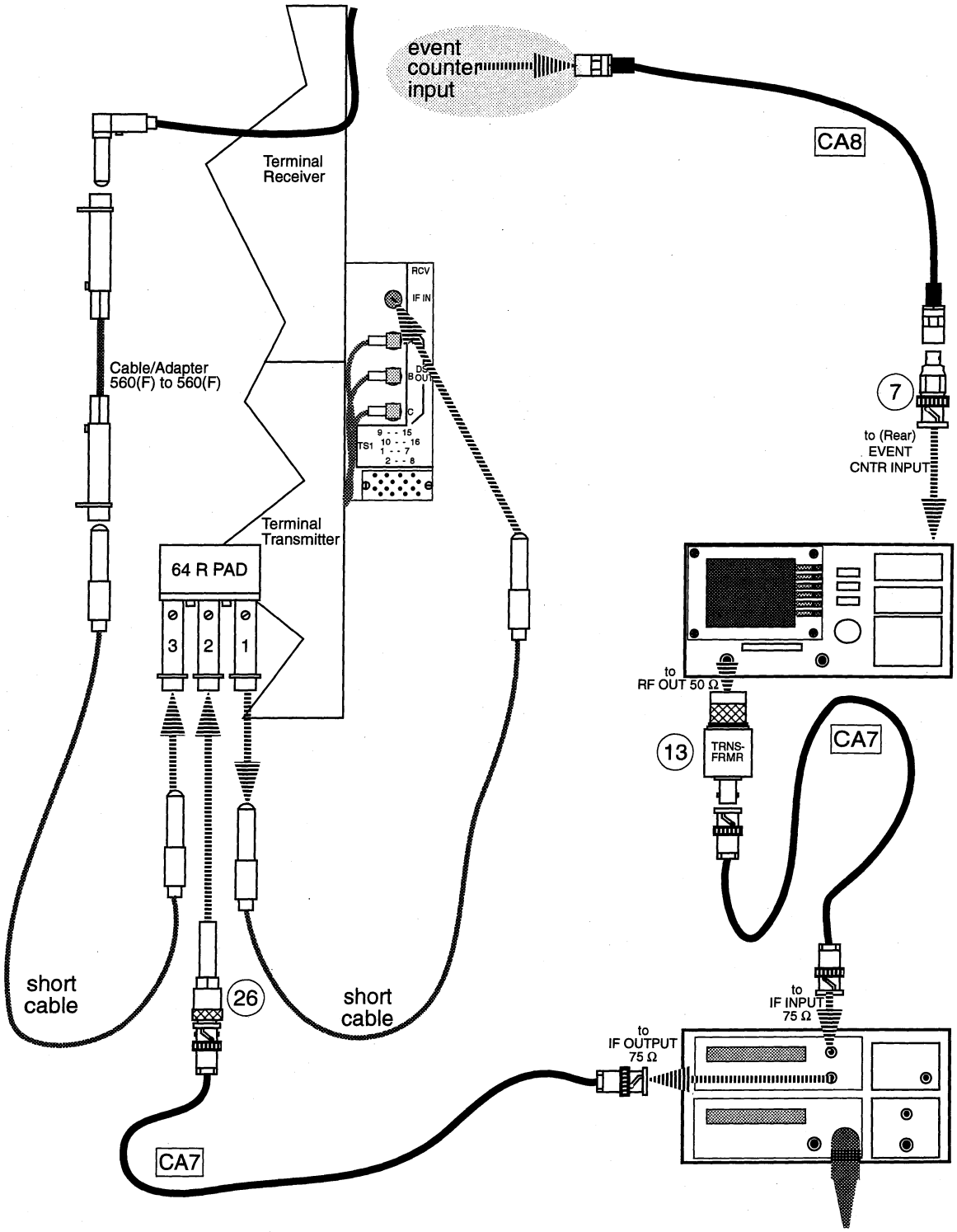

Figure 19. Terminal Over-the-Air S/I

13 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE bar graph display on the CHAN CONTR.

Requirement: The bar graph shall not be lighted above (upward on unit) the line between the 7 and the 8 segments.

Was the requirement met?

YES - For an antenna diversity radio receiver, verify both (REG and DIV) paths are good. If necessary;

a. Force the IF Combiner to the inactive path by removing the IF IN cable for the active path.

b. Repeat Step 13.

- The S/I test is completed.
- Do not make any test equipment or connection changes.
- Go to Step 14.

NO - For an antenna diversity radio receiver, check for trouble condition on other path. (See a. and b. under YES.)

- Go to **TROUBLE ISOLATION** tab, 4.2 Over-the-Air S/I Test Failure.

This figure illustrates measurements on a Regenerator shelf for the A - C direction.

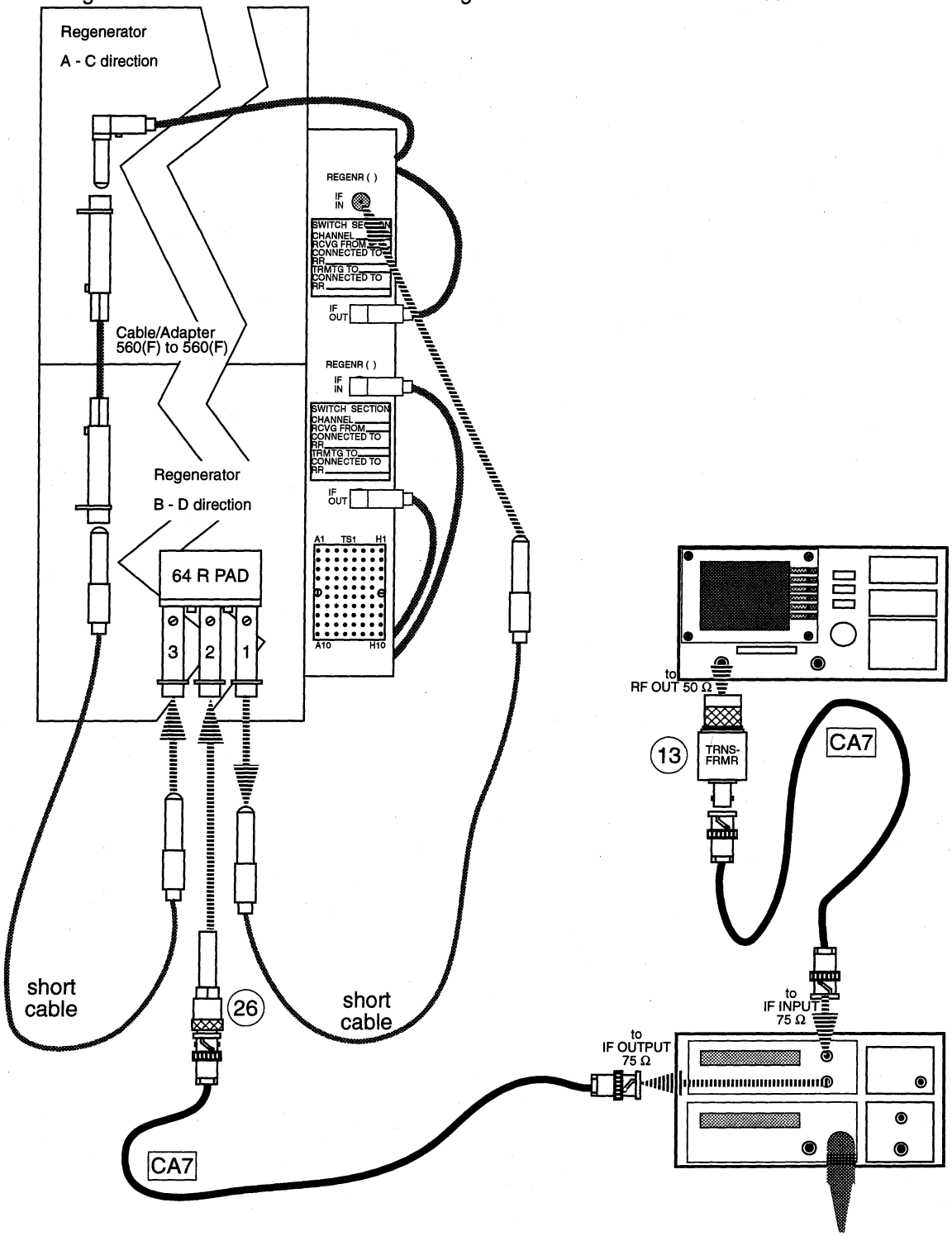

Figure 20. Regenerator Over-the-Air S/I

CAUTION:
*An error correction check on a regular channel requires a service-affecting **span** switch. Perform the check **only** if you suspect an error correction problem.*

14 Are you going to perform an Error Correction check?

YES - Terminal receiver only.
- Leave all test connections and equipment as they are.
- Go to Step 15.

NO - Go to Step 24.

15 Is this a regular channel?

YES - Protect service with a **span** switch in the receive direction if one does not already exist.

NO - Keep the present protection channel lockout.

16 On the terminal-RECEIVER:

Comment: The digital TE is turned off for the EC evaluation test. The 74-MHz interfering signal causes the TE to generate intermittent error bursts which cannot be corrected by EC.

a. On the TERM FRMR card, connect the event counter input cable to the SECT CRC ERRS jack.

b. Digital TE only:
On the TE card:

1. Operate the push-button switch to OFF (out).
2. Verify that the TE OFF indicator lights.

17 On the MULTIPATH FADING SIMULATOR:

a. Press the ATTEN key.

b. Use the arrow keys to lower the ATTEN (dB) value until the EVENT CNTR (on the spectrum analyzer) displays about 70 (60 to 80).

c. Press the ENTER key.

18 On the terminal-RECEIVER:

a. Disconnect the event counter input cable from the SECT CRC ERRS jack on the TERM FRMR card.

b. Connect the event counter input cable to the DS3 PTY jack on the VMR& CODER (AMR 72/72B) card on TRIB A.

19 On the SPECTRUM ANALYZER:

a. Press the Main Menu softkey.

b. Press the GATE TIME softkey.

c. Enter 60 seconds using the data keys.

Verify that GATE TIME 60.00000 sec is displayed in the active function block.

d. Press the Main Menu softkey.

e. Press the RESET CNTRS softkey.

f. Observe the EVENT CNTR for 1 interval.

Comment: The counter indicator (square block) will flash at the end of each 60-second interval.

Requirement: Two counts, or less, over the 60-second interval.

g. Defer any action until later.

20 On the terminal-RECEIVER,

move the event counter input cable as follows:

a. From the DS3 PTY jack on the VMR& CODER card on TRIB A.

b. To the DS3 PTY jack on the VMR& CODER card on TRIB B.

21 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the EVENT CNTR for 1 interval.

Requirement: Two counts, or less, over the 60-second interval.

c. Defer any action until later.

22 On the terminal-RECEIVER,

move the event counter input cable as follows:

a. From the DS3 PTY jack on the VMR& CODER card on TRIB B.

b. To the DS3 PTY jack on the VMR& CODER card on TRIB C.

23 On the SPECTRUM ANALYZER:

a. Press the RESET CNTRS softkey.

b. Observe the EVENT CNTR for 1 interval.

Requirement: Two counts, or less, over the 60-second interval.

Were the requirements for all TRIBs met?

YES - Go to Step 24.

NO - Go to **TROUBLE ISOLATION** tab,
4.3 Over-the-Air EC Test Failure.

24 Remove all test connections from the terminal or regenerator.

25 On the terminal-RECEIVER or REGENERATOR:

a. Reconnect the normal bay cable to the (RCV or REGENR) IF IN jack.

b. Digital TE only:
On the TE card:

1. Operate the push-button switch to NORM (in).
2. Verify that the TE OFF indicator extinguishes.

26 On the TERMINAL or REGENERATOR bay
(if you are not making more tests that require side access),

reinstall the right-front side cover.

27 On the CONTROL and SERVICE CHANNEL shelf:

a. (Terminal) Press the ALM RST push button on the RCV STAT card.

b. (Regenerator) Press the ALM RST push button on the REGEN CONTR card.

Requirement: No alarms or diagnostic code present.

Were the requirements met?

YES - Go to Step 28.

NO - Isolate the problem.

Reference: **START HERE** tab.

28 Return to the procedure or flowchart that referred you to this procedure.

End of Procedure

5.2 Over-the-Air Propagation Distortion Checks

Use this procedure to check the performance of countermeasures for fade-induced distortion.

There are three tests within this procedure:

- Adaptive Slope Equalizer (ASE)
- Transversal Equalizer (TE)
- Digital Receiver Recovery.

These tests are performed at the receive-end of a radio hop using the normal received 64QAM signal. You will stress the signal by adding simulated propagation distortion and check the capability of the ASE and TE to reduce the effects of the inserted distortion.

Prerequisite: The hop BER performance is satisfactory under normal conditions.

CAUTION:
This is an Out-of-Service procedure. Service will be interrupted or impaired unless you apply Service Protection measures.

At Terminals: Line switch (regular channel) or lock out (protection channel) in the direction under test.

At Regenerators: Line switch (regular channel) or lock out (protection channel) in the direction under test.

CAUTION:
ESD may damage plug-in units. Use proper methods to prevent ESD damage.

Step	Procedure

Establish and Verify the Test Setup

CAUTION:
Verify that service is protected and that you are at the correct terminal or regenerator transmitter and receiver.

1 On the radio bay of the associated radio receiver,

remove the cable connected between the IF IN jack on the IF AGC AMP and the IF OUT jack on the IF FILTER AND BASIC EQUALIZER.

2 Connect the test equipment as shown in Figure 21.

a. You will be directed to connect the event counter and interval counter inputs (shaded portion) to a measurement jack later in this procedure.

b. If there is a large distance between the radio and terminal or regenerator bays, longer cables will be required from the MFS to the radio bay.

3 On the MULTIPATH FADING SIMULATOR (MFS):

a. Press the green PRESET/LOCAL key.

b. Press the ENTER key.

c. Press the ATTEN key (you now have a variable attenuator).

d. Use the arrow keys to enter 20-dB attenuation.

e. Press the ENTER key.

f. Verify that the display window indicates the following:

- FREQ (MHz) 70.0
- DEPTH (dB) 0.0
- ATTEN (dB) 20.0
- PHASE marker (▼) MIN.

4 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE bar graph on the CHAN CONTR card and the alarm indicators on the shelf.

Requirement: After 1 minute, there should be:

a. No lighted segments on the bar graph.

b. No lighted alarm indicators.

Were the requirements met?

YES - There is continuity through the test arrangement.

- Go to Step 5.

NO - Recheck the test connections of Figure 21.

- Verify correct level at output of AGC amplifier.
- If necessary, check continuity by measuring levels through the test arrangement.
- Repeat from Step 2.

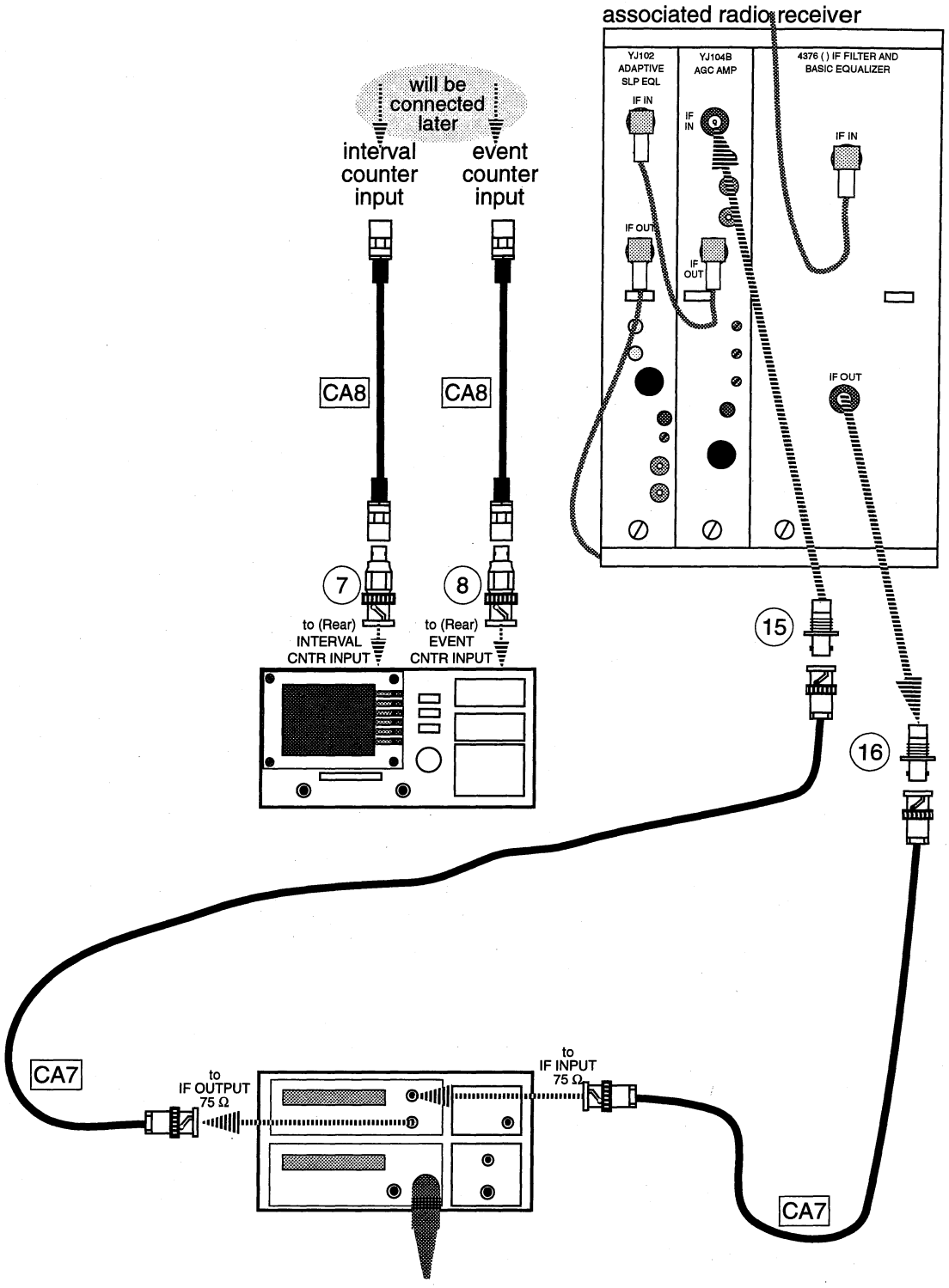

Figure 21. Over-the-Air Propagation Distortion

Adaptive Slope Equalizer (ASE) Test

Comment: You will test the ASE by generating a wide notch that simulates slope distortion. You will place the notch first at 76 MHz, then at 64 MHz, and compare error performance between ASE on (AUTO) and ASE off (MAN).

5 On the MFS:

a. Press the green PRESET/LOCAL key.

b. Press the ENTER key.

c. Press the NOTCH FREQ key.

d. Use the arrow keys to set the notch frequency to 76 MHz.

e. Press the NOTCH DEPTH key.

f. Use the arrow keys to set the notch depth to:

- 16.0 dB
  for receivers equipped with an Analog TE.
- 19.0 dB
  for receivers equipped with a Digital TE.

Reference: Determine which type of TE the receiver has by viewing the cards.

— Analog TE receivers have two TRANSV FLT cards in the second and third card slots from the left end (both AMR 32 or both AMR 49).

— Digital TE receivers will have one TE in the sixth card slot from the left end (AMR 184).

g. Press the ENTER key.

h. Verify that the display window indicates the following:

- FREQ (MHz) 76.0
- DEPTH (dB) 16.0 or 19.0
- ATTEN (dB) 00.0
- PHASE marker (▼) MIN.

6 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE display (bar graph) on the CHAN CONTR.

Requirement: No segment above (upward on unit) 6 on the bar graph shall be lighted (6 can be lighted, but not 5).

Was the requirement met?

YES - For an antenna diversity radio receiver, verify both (REG and DIV) paths are good. If necessary;

a. Force the IF Combiner to the inactive path by removing the IF IN cable for the active path.

b. Repeat Step 6.

- Go to Step 7.

NO - For an antenna diversity radio receiver, check for trouble condition on other path. (See a. and b. under YES.)

- Go to **TROUBLE ISOLATION** tab, 4.4 Over-the-Air PD Test Failure.

7 On the CHAN CONTR,

are any segments lighted?

YES - Note the bar graph indication for later reference.

- Go to Step 8.

NO - Increase the NOTCH DEPTH per Step 5 e, f, and g until one to three segments are lighted.

- Note the bar graph indication for later reference.

- Go to Step 8.

8 On the ADAPTIVE SLOPE EQUALIZER under test (radio bay):

a. Verify that the EXCS SLP indicator is lighted.

b. Operate the AUTO / MAN switch to MAN (out).

1. Verify that the EQL OFF indicator lights.
2. Verify that the EXCS SLP indicator extinguishes.

c. Verify (with voltmeter) that CONT V agrees with the RADIO DATA CARD entry for RCVR "CONT V MAN".

Requirement: The measured voltage and the voltage recorded as "CONT V MAN" shall be within:

- ±0.002 V for Series 1 or 2 ASE
- ±0.02 V for Series 3 ASE.

d. Adjust the MAN FLAT control, if necessary.

9 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE display (bar graph) on the CHAN CONTR.

Requirement: The bar graph shall be lighted at least two segments above the one noted in Step 7.
For example:
If all segments up to and including 6 were lighted in Step 7, all segments up to and including 4 must be lighted now.

Was the requirement met?

YES - Go to Step 10.

NO - Replace and align the ASE.

Reference: Radio Receiver—**TEST PROCEDURES** tab, Flowchart 3 Unit Replacement and Alignment, Adaptive Slope Equalizer.

- Repeat this test procedure.

10 On the ADAPTIVE SLOPE EQUALIZER under test (radio bay):

a. Operate the AUTO / MAN switch to AUTO (in).

b. Verify that the EQL OFF indicator extinguishes.

c. Verify that the EXCS SLP indicator lights.

11 On the MFS:

a. Press the NOTCH FREQ key.

b. Use the arrow keys to set the notch frequency to 64 MHz.

c. Press the NOTCH DEPTH key.

d. If necessary, use the arrow keys to decrease the notch depth to the original value of Step 5 f (16.0 or 19.0).

e. Press the ENTER key.

12 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE display (bar graph) on the CHAN CONTR.

Requirement: No segment above 6 on the bar graph shall be lighted.

Was the requirement met?

YES - For an antenna diversity radio receiver, verify both (REG and DIV) paths are good. If necessary;

a. Force the IF Combiner to the inactive path by removing the IF IN cable for the active path.

b. Repeat Step 12.

- Go to Step 13.

NO - For an antenna diversity radio receiver, check for trouble condition on other path. (See a. and b. under YES.)

- Go to **TROUBLE ISOLATION** tab, 4.4 Over-the-Air PD Test Failure.

13 On the CHAN CONTR,

are any segments lighted?

YES - Note the bar graph indication for later reference.

- Go to Step 14.

NO - Increase the NOTCH DEPTH per Step 5 e, f, and g until one to three segments are lighted.

- Note the bar graph indication for later reference.

- Go to Step 14.

14 On the ADAPTIVE SLOPE EQUALIZER under test (radio bay),

operate the AUTO / MAN switch to MAN (out).

15 On the terminal-RECEIVER or REGENERATOR,

observe the ERR RATE display (bar graph) on the CHAN CONTR.

Requirement: The bar graph shall be lighted at least two segments above the one noted in Step 13.

Was the requirement met?

YES - Go to Step 16.

NO - Replace and align the ASE.

Reference: Radio Receiver—**TEST PROCEDURES** tab, Flowchart 3 Unit Replacement and Alignment, Adaptive Slope Equalizer.

- Repeat this test procedure.

16 On the ADAPTIVE SLOPE EQUALIZER under test (radio bay),

operate the AUTO / MAN switch to AUTO (in).

Transversal Equalizer Test

Comment: To check the distortion-reduction capability of the Transversal Equalizers, or TRNSV FLTs, you will use the FADE EVENT 0 function of the MFS. Fade Event 0 is a digitalized simulation of previously recorded severe fade-related propagation distortion. At the end of the 10-minute test, you will determine whether the distortion was properly reduced by observing the number of Threshold Error Seconds counted. Fade Event 0 also checks the ASE and the digital receiver carrier recovery ability.

17 Connect the interval and event counters inputs (shown in Figure 21) to the terminal-RECEIVER or REGENERATOR under test.

a. (Terminal) On the TERM FRMR card connect the:

— interval counter to FR LS jack.

— event counter to HOP CRC ERRS jack.

b. (Regenerator) On the REGEN FRMR card connect the:

— interval counter to FR LS jack.

— event counter to HOP CRC ERRS jack.

18 On the SPECTRUM ANALYZER:

a. Press the green PRESET key.

Comment: EVENT COUNTER softkey should be displayed on the screen; if it is not, load "GROUP 1" menu.

Reference: **DRTS** tab, 1.6 Downloading User Programs.

b. Press the EVENT COUNTER softkey.

c. Press the GATE TIME softkey.

d. Press the 100 ms softkey.

Verify that GATE TIME 100.000 msec is displayed in the active function block.

Reference: **DRTS** tab, 3.2.2 Active Function Block.

e. Press the Main Menu softkey.

f. Press the TOTALIZE ON OFF softkey to underline ON.

19 On the MFS:

a. Press the blue SHIFT key.

b. Press the → (right arrow).

Verify that FADE EVENT 0 appears on the MFS display.

20 On the SPECTRUM ANALYZER,

press the RESET CNTRS softkey.

21 On the MFS:

a. Press the ENTER key (the fade simulation will start).

b. Verify that FADING O . . . . appears on the MFS display.

c. Wait until the fade simulation has ended, about 10 minutes.

FADING O . . . . will disappear from the MFS display when the simulation is done.

22 On the SPECTRUM ANALYZER:

a. Observe the THLD ERR SEC count.

Requirement:

- 25 or less
  for Analog TE equipped receivers.
- 18 or less
  for Digital TE equipped receivers.

Was the requirement met?

YES - For an antenna diversity radio receiver, verify both (REG and DIV) paths are good. If necessary;

1. Force the IF Combiner to the inactive path by removing the IF IN cable for the active path.
2. Repeat Steps 19 through 22.

- Go to Step 22 b.

NO - For an antenna diversity radio receiver, check for trouble condition on other path. (See 1. and 2. under YES.)

- Go to **TROUBLE ISOLATION** tab, 4.4 Over-the-Air PD Test Failure.

b. Press the STOP CNTRS softkey (this is required to display all counts when the gate time is less than 1 second).

23 On the RADIO DATA CARD,

record the following counter contents as "over-the-air" on the blank-back side for future reference.

a. EVENT CNTR cnt
b. INTERVAL CNTR cnt
c. INTERVAL CNTR sec
d. THLD ERR SEC sec.

Digital Receiver Recovery Test

Comment: This test determines the ability of a digital receiver to recover synchronization following the re-connection of an interrupted (open) signal. You will manually interrupt the signal at the input to the IF AGC AMP, then observe the approximate length of time required for the terminal-receiver or regenerator to acquire synchronization. You will add a 70-MHz notch to stress the 64QAM signal.

24 On the MFS:

a. Press the green PRESET /LOCAL key.
b. Press the ENTER key.
c. Press the NOTCH DEPTH key.
d. Use the arrow keys to set the notch depth to 18.0 dB.
e. Press the ENTER key.
f. Verify that the display window indicates the following:
   - FREQ (MHz) 70.0
   - DEPTH (dB) 18.0
   - ATTEN (dB) 00.0
   - PHASE marker (▼) MIN.

25 On the IF AGC AMPL (Radio Bay),

remove the cable from the IF IN jack.

26 On the terminal-RECEIVER or REGENERATOR:

a. Observe the CARRIER LOCK LOSS indicator on the 64QAM DEMOD card.
b. Estimate the time required for the CARRIER LOCK LOSS indicator to extinguish after the cable has been reconnected in the following step.

27 On the IF AGC AMPL,

reconnect the cable to the IF IN jack.

Requirement: The CARRIER LOCK LOSS indicator will extinguish in 1 second or less after the signal is reconnected.

Was the requirement met?

YES - Go to Step 28.

NO - Go to **TROUBLE ISOLATION** tab, 4.4 Over-the-Air PD Test Failure.

28 On the MFS:

a. Press the PHASE key.

b. Verify PHASE marker (▼) is NON-MIN in the display window.

29 On the IF AGC AMPL,

remove the test cable from the IF IN jack.

30 On the terminal-RECEIVER or REGENERATOR:

a. Observe the CARRIER LOCK LOSS indicator on the 64QAM DEMOD card.

b. Estimate the time required for the CARRIER LOCK LOSS indicator to extinguish after the cable has been reconnected in the following step.

31 On the IF AGC AMPL,

reconnect the cable to the IF IN jack.

Requirement: The CARRIER LOCK LOSS indicator will extinguish in one second or less after the signal is reconnected.

Was the requirement met?

YES - Go to Step 32.

NO - Go to **TROUBLE ISOLATION** tab, 4.4 Over-the-Air PD Test Failure.

32 On the radio-RECEIVER under test:

a. Remove the test connections.

b. Reconnect the bay cable between the IF IN jack on the IF AGC AMP and the IF OUT jack on the IF FILTER AND BASIC EQUALIZER.

33 On the terminal-RECEIVER or REGENERATOR,

remove the interval and event counter connections from the (TERM or REGEN) FRMR card.

34 On the CONTROL and SERVICE CHANNEL shelf:

a. (Terminal) Press the ALM RST push button on the RCV STAT card.

b. (Regenerator) Press the ALM RST push button on the REGEN CONTR card.

Requirement: No alarms or diagnostic code present.

Were the requirements met?

YES - Go to Step 35.

NO - Isolate the problem.

Reference: **START HERE** tab.

35 Return to the procedure or flowchart that referred you to this procedure.

End of Procedure