

**OPERATION AND MAINTENANCE  
1×N FREQUENCY DIVERSITY  
DR6/11-135A AND 135EC  
RADIO RECEIVER PROCEDURES**

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## 1. INTRODUCTION

This practice is used to test and adjust a DR6/11-135 radio receiver. The procedures in this practice are referred to from the RADIO RCVR TROUBLE ISOLATION, REPAIR VERIFICATION, and ANNUAL FCC TESTS tabs in this manual.

### 1.1 UPDATE INFORMATION

This practice is reissued to combine all test procedures into one practice. The practice is used in binders 421-102-090, 421-102-100, 421-103-090, and 421-103-100.

### 1.2 ADMONISHMENTS

Admonishments are strategically-placed reminders to assure safety of personnel (**DANGER**), to minimize or prevent service interruptions (**Caution**), and to prevent equipment damage (**Warning**). The technician should read and become familiar with the admonishments in the MAINTENANCE tab.

#### Personal Injury

Whenever a condition exists that may result in personal injury, a **DANGER** statement is provided. Two potential dangers involved with maintaining the radio system are:

- **DANGER 1: Looking directly into an open radio transmitter RF port may result in eye injury from RF radiation.**
- **DANGER 2: Working with or near the -24 V DC battery supply voltage may result in electrical shock and/or burns.**

Do not mistake the -24 V battery supply as being harmless. Under the right conditions, -24 V can cause a severe shock. Also, since the battery supply provides a high current, there is potential for arcing. Always be careful with instruments such as screwdrivers and test equipment probes.

#### Service Protection

Manual service protection is necessary before performing most of the procedures. Any procedure containing the **Caution** statement below requires that a manual protection switching operation be performed before doing that procedure or step; otherwise, the system performance could be degraded or interrupted. Procedures or steps that are not service-affecting will be identified with the **Note** below.

- **Caution: This procedure is service-affecting unless the proper manual protection switching operation has been performed.**
- **Note:** This is an in-service procedure.

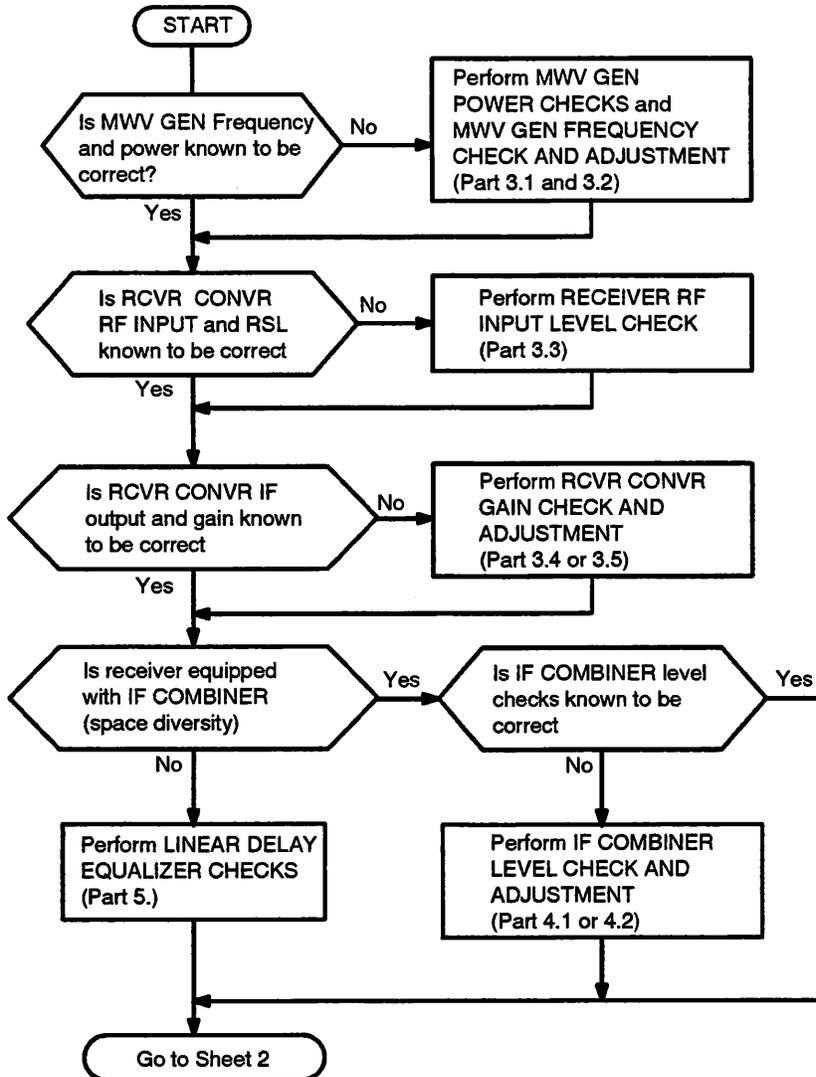
Generally, if testing a regular channel, manually switch service to the protection channel for the direction under test (even if an automatic switch exists). If testing the protection channel, manually lock out the protection channel for the direction(s) under test. Refer to the OPERATION tab for information on service protection.

#### Equipment Damage

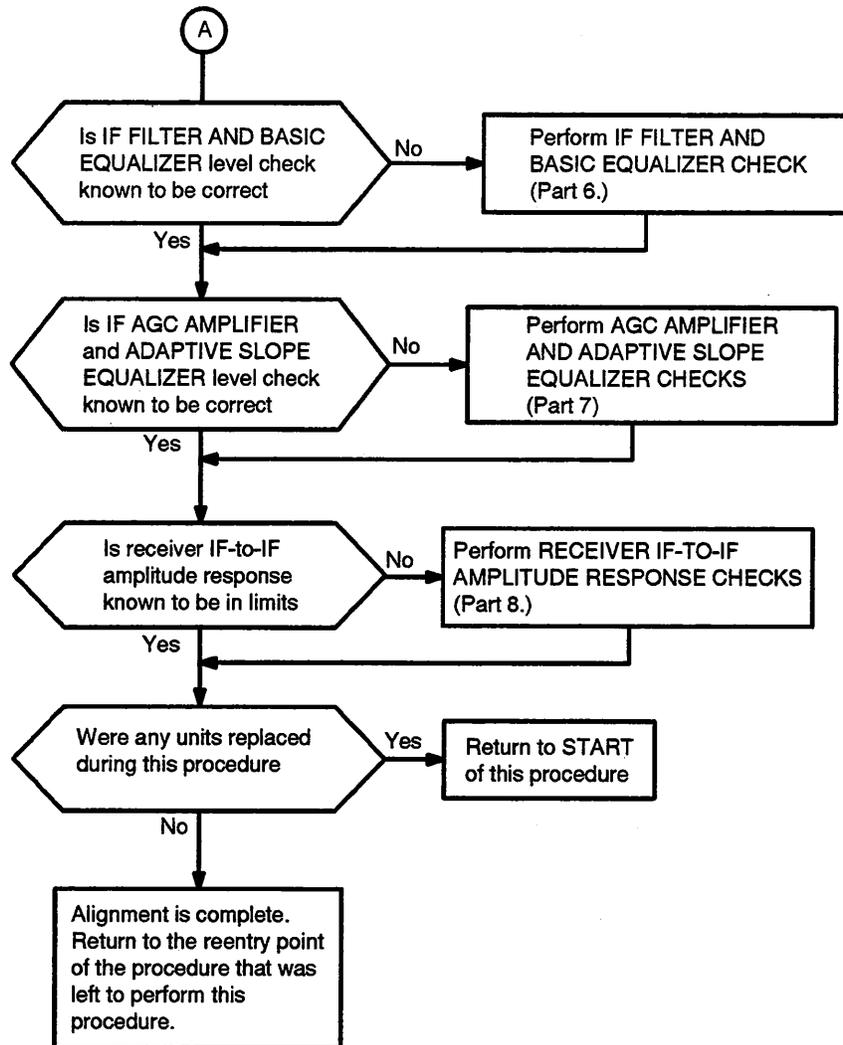
If there is a possibility of equipment damage when performing a test, replacement, etc., a **Warning** statement will be provided.

## 2. RECEIVER ALIGNMENT PROCEDURES

Flowchart 1 is used as an outline to perform a complete RF to IF alignment of the radio receiver. These procedures are necessary when a unit that affects the radio receiver adjustments has been replaced. The units involved are the Receiver Down-Converter and Microwave Generator, Linear Delay Equalizer, IF Combiner, IF Filter and Basic Equalizer, IF AGC Amplifier, and Adaptive Slope Equalizer.



Flowchart 1- Receiver Alignment Procedures Sequence (Sheet 1 of 2)



Flowchart 1 - Receiver Alignment Procedures Sequence (Sheet 2 of 2)

### 3. MICROWAVE GENERATOR CHECKS

These procedures are used to check the 4300 Series and 4400 Series RECEIVER DOWN CONVR & MWV GEN (RCVR CONVR) units.

#### 3.1 MWV GEN POWER CHECK

This procedure is used to check the power level of the microwave generator in the RCVR CONVR unit.

**Note:** This is an in-service procedure.

**Warning:** *The SMA connectors should be tightened ONLY with a torque wrench to prevent damage to the connectors.*

#### TEST EQUIPMENT

- Refer to Figure 1.

#### PROCEDURE

1. On the RCVR CONVR unit, remove the termination on the GEN MON jack.
2. Condition the power meter to measure the expected RF power level (normally -14 to 0 dBm), and connect it to the GEN MON jack (Figure 1).

**Requirement 1:**

4384 RCVR CONVR	-1.0 to -9.0 dBm
4385 RCVR CONVR	-4.5 to -12.5 dBm
4391 RCVR CONVR	0.0 to -6.0 dBm
4392 RCVR CONVR	-4.0 to -10.0 dBm
4470 RCVR CONVR	-5.0 to -13.0 dBm
4471 RCVR CONVR	-5.0 to -13.0 dBm
4472 RCVR CONVR	-4.0 to -14.0 dBm
4473 RCVR CONVR	-4.0 to -14.0 dBm

**Requirement 2:** No GEN OVEN lamp lighted.

**If the requirement is met,** update the RADIO DATA CARD.

**If the requirement is not met,** replace the RCVR CONVR. Refer to the REPLACEMENT PROCEDURES tab and repeat this procedure.

If the RCVR CONVR is replaced, go to Flowchart 1 for additional tests that must be performed.

3. Disconnect the power meter. If the frequency is to be measured, go to part 3.2; otherwise, reinstall the termination on the GEN MON jack and tighten with a torque wrench.
4. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

#### END OF PROCEDURE

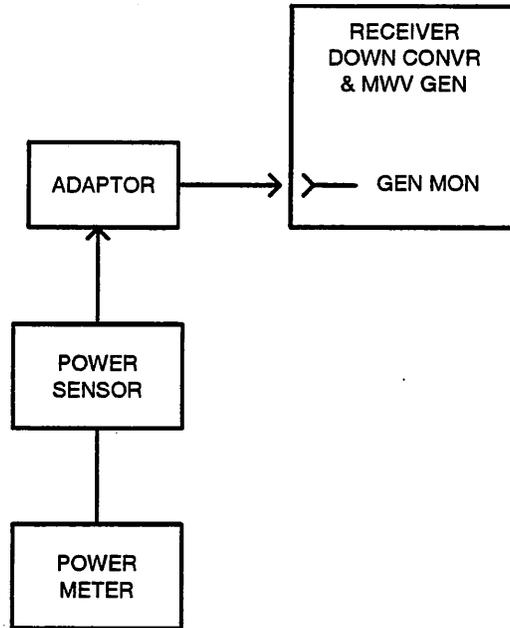


Figure 1-Microwave Generator Power Check

### 3.2 MWV GEN FREQUENCY CHECK AND ADJUSTMENT

This procedure is used to check the microwave generator frequency of the RCVR CONVR unit. The GEN MON jack is used for this test.

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

**Warning:** *The SMA connectors should be tightened ONLY with a torque wrench to prevent damage.*

#### TEST EQUIPMENT

- Refer to Figure 2.

#### PROCEDURE

1. Verify that service is protected.
2. On the RCVR CONVR unit, remove the termination from the GEN MON jack.
3. Determine the correct center frequency ( $f_c$ ) for this microwave generator by matching the plug-in code printed on the latch label with the code and letters listed on Table A, B, C, or D (also found on the RADIO DATA CARD).
4. Condition the test equipment to measure the appropriate center frequency, and connect it to the GEN MON jack (Figure 2).

**Note:** The microwave generator unit must be warmed up for at least 1 hour before proceeding.

**6-GHz Requirement:**  $\pm 120$  kHz and no GEN OVEN lamp lighted.

**11-GHz Requirement:**  $\pm 240$  kHz and no GEN OVEN lamp lighted.

**If the requirement is met** and the frequency is within  $\pm 15$  kHz (6 GHz) or  $\pm 30$  kHz (11 GHz), no adjustment is required, go to Step 6. Otherwise, go to Step 5 and adjust the frequency to the correct value.

**If the requirement is NOT met** and the frequency measured in Step 3 has drifted more than  $\pm 120$  kHz (6 GHz) or  $\pm 240$  kHz (11 GHz) within the past 12 months, replace the RCVR CONVR. Refer to the REPLACEMENT PROCEDURES tab.

5. On the RCVR CONVR unit, adjust the GEN FREQ ADJ control for the following requirements:

**6-GHz Requirement:**  $\pm 3$  kHz of  $f_c$ .

**11-GHz Requirement:**  $\pm 5$  kHz of  $f_c$ .

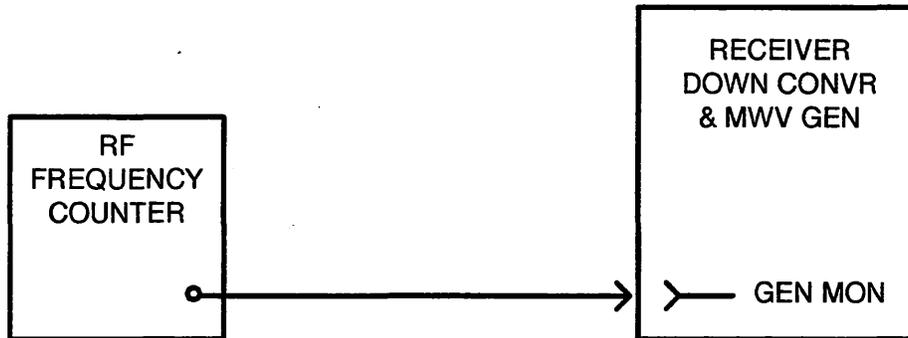
**If the requirement is NOT met**, suspect test set, faulty unit, or bad test cable. Replace the faulty unit and repeat this procedure. Refer to the REPLACEMENT PROCEDURES tab.

**Note:** If the RCVR CONVR is replaced, go to Flowchart 1 for additional tests that must be performed.

6. Disconnect the test equipment. If the microwave generator power is to be measured, go to Part 3.1. Otherwise, reinstall the termination on the GEN MON jack and tighten with a torque wrench.

7. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**



**Figure 2-Microwave Generator Frequency Check and Adjustment**

TABLE A 6-GHz REGULAR FREQUENCY PLAN					
CHANNEL			TRANSMITTER UP/RECEIVER DOWN CONVERTER AND MICROWAVE GENERATOR		
NUMBER	CENTER FREQUENCY (kHz)	SIDEBAND	1502( ) RF FILTER CODE	1503( ) RF FILTER CODE	GEN MON CENTER FREQUENCY (kHz)
11T	5,945,198	Lower	B	CB	6,015,198
12T	5,974,850	Lower	D	CD	6,044,850
13T	6,004,502	Lower	F	CF	6,074,502
14T	6,034,154	Lower	H	CH	6,104,154
15T	6,063,805	Upper	K	CK	5,993,805
16T	6,093,457	Upper	M	CM	6,023,457
17T	6,123,109	Upper	P	CP	6,053,109
18T	6,152,761	Upper	S	CS	6,082,761
21T	6,197,239	Lower	AB	DB	6,267,239
22T	6,226,891	Lower	AD	DD	6,296,891
23T	6,256,542	Lower	AF	DF	6,326,542
24T	6,286,194	Lower	AH	DH	6,356,194
25T	6,315,846	Upper	AK	DK	6,245,846
26T	6,345,498	Upper	AM	DM	6,275,498
27T	6,375,150	Upper	AP	DP	6,305,150
28T	6,404,802	Upper	AS	DS	6,334,802

TABLE B 6-GHz STAGGERED FREQUENCY PLAN					
CHANNEL			TRANSMITTER UP/RECEIVER DOWN CONVERTER AND MICROWAVE GENERATOR		
NUMBER	CENTER FREQUENCY (kHz)	SIDEBAND	1502( ) RF FILTER CODE	1503( ) RF FILTER CODE	GEN MON CENTER FREQUENCY (kHz)
11S	5,960,024	Lower	C	CC	6,030,024
12S	5,989,676	Lower	E	CE	6,059,676
13S	6,019,328	Lower	G	CG	6,089,328
14S	6,048,979	Upper	J	CJ	5,978,979
15S	6,078,631	Upper	L	CL	6,008,631
16S	6,108,283	Upper	N	CN	6,038,283
17S	6,137,935	Upper	R	CR	6,067,935
18S	6,167,587	Upper	T	CT	6,097,587
20S	6,182,413	Lower	AA	DA	6,252,413
21S	6,212,065	Lower	AC	DC	6,282,065
22S	6,241,717	Lower	AE	DE	6,311,717
23S	6,271,368	Lower	AG	DG	6,341,368
24S	6,301,020	Upper	AJ	DJ	6,231,020
25S	6,330,672	Upper	AL	DL	6,260,672
26S	6,360,324	Upper	AN	DN	6,290,324
27S	6,389,976	Upper	AR	DR	6,319,976

**TABLE C**  
**11-GHz REGULAR FREQUENCY PLAN**

RADIO CHANNEL			TRANSMITTER UP/RECEIVER DOWN CONVERTER AND MICROWAVE GENERATOR	
NUMBER	CENTER FREQUENCY (kHz)	SIDEBAND	FILTER CODE	GEN MON JACK CENTER FREQUENCY (kHz)
1P	10,755,000	UPPER	PB	10,685,000
10P	10,795,000	UPPER	PC	10,725,000
11P	10,835,000	UPPER	PD	10,765,000
6P	10,875,000	UPPER	PE	10,805,000
7P	10,915,000	UPPER	PF	10,845,000
2P	10,955,000	UPPER	PG	10,885,000
3P	10,995,000	UPPER	PH	10,925,000
12P	11,035,000	UPPER	PJ	10,965,000
9P	11,075,000	UPPER	PK	11,005,000
8P	11,115,000	UPPER	PL	11,045,000
5P	11,155,000	UPPER	PM	11,085,000
9J	11,245,000	LOWER	JA	11,315,000
12J	11,285,000	LOWER	JB	11,355,000
5J	11,325,000	LOWER	JC	11,395,000
8J	11,365,000	UPPER	JD	11,295,000
1J	11,405,000	UPPER	JE	11,335,000
4J	11,445,000	UPPER	JF	11,375,000
11J	11,485,000	UPPER	JG	11,415,000
10J	11,525,000	UPPER	JH	11,455,000
7J	11,565,000	UPPER	JJ	11,495,000
6J	11,605,000	UPPER	JK	11,535,000
3J	11,645,000	UPPER	JL	11,575,000

TABLE D 11-GHz ALTERNATE FREQUENCY PLAN				
RADIO CHANNEL			TRANSMITTER UP/RECEIVER DOWN CONVERTER AND MICROWAVE GENERATOR	
NUMBER	CENTER FREQUENCY (kHz)	SIDEBAND	FILTER CODE	GEN MON JACK CENTER FREQUENCY (kHz)
4E	10,735,000	UPPER	EA	10,665,000
1E	10,775,000	UPPER	EB	10,705,000
10E	10,815,000	UPPER	EC	10,745,000
11E	10,855,000	UPPER	ED	10,785,000
6E	10,895,000	UPPER	EE	10,825,000
7E	10,935,000	UPPER	EF	10,865,000
2E	10,975,000	UPPER	EG	10,905,000
3E	11,015,000	UPPER	EH	10,945,000
12E	11,055,000	UPPER	EJ	10,985,000
9E	11,095,000	UPPER	EK	11,025,000
8E	11,135,000	UPPER	EL	11,065,000
12D	11,265,000	LOWER	DB	11,335,000
5D	11,305,000	LOWER	DC	11,375,000
8D	11,345,000	LOWER	DD	11,415,000
1D	11,385,000	UPPER	DE	11,315,000
4D	11,425,000	UPPER	DF	11,355,000
11D	11,465,000	UPPER	DG	11,395,000
10D	11,505,000	UPPER	DH	11,435,000
7D	11,545,000	UPPER	DJ	11,475,000
6D	11,585,000	UPPER	DK	11,515,000
3D	11,625,000	UPPER	DL	11,555,000
2D	11,665,000	UPPER	DM	11,595,000

### 3.3 RECEIVER RF INPUT LEVEL CHECK

This procedure is used to check the RF input power at the isolator/transducer OUTPUT jack.

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

**Warning:** *The SMA connectors should be tightened ONLY with a torque wrench to prevent damage.*

#### TEST EQUIPMENT

- Refer to Figure 3.

#### PROCEDURE

**Note:** If the receiver has space diversity (dual down-converters), repeat this procedure for both the regular and diversity paths. The path not under test must be disconnected and terminated.

1. Verify that service is protected.
2. Remove the semirigid cable between the isolator/transducer OUTPUT jack and the RF IN jack on the RCVR CONVR.
3. Condition the power meter to measure the expected power level (normally -13 to -23 dBm), and connect the meter to the isolator/transducer OUTPUT jack (Figure 3).

**Requirement:** Within  $\pm 3.0$  dB of the RCVR REG : CONVR RF IN or RCVR DIV : CONVR RF IN value recorded on the RADIO DATA CARD.

**If the requirement is not met,** suspect RF preamplifier (verify the NORM indicator is lighted), filter networks, low transmit power, and/or waveguide or antenna problems.

**Note:** Before replacing any components, ensure that the problem is not the result of fading activity (levels fluctuating more than 4 dB). If necessary, request assistance from the technical support group.

4. If an RSL calculation is desired, go to Step 5. Otherwise, go to Step 7.
5. Using the measured RF IN as a reference, calculate the RSL via the following equation.

$$RSL = RF\ IN - (Gain - Loss)$$

RF IN = Measured RCVR CONVR input level

Gain = Gain of waveguide RF preamplifier, if equipped

Loss = Nominal loss of waveguide networks before the RCVR CONVR (Table E).

**Example:**

$$RSL = -15 - (11.3 - 1.5 \text{ [second channel]})$$

$$RSL = -15 - (9.8)$$

$$RSL = -15 - 9.8$$

$$RSL = -24.8$$

6. Compare the RSL calculated in Step 5 with the previously measured RSL recorded on the RADIO DATA CARD.

**Requirement:**

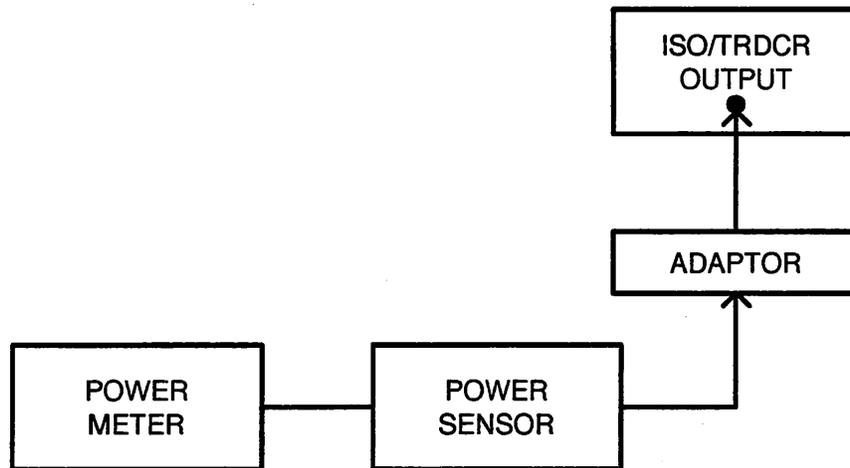
If equipped with a waveguide preamplifier that has a single gain label:  $\pm 5$  dB of the RADIO DATA CARD value.

If *not* equipped with a waveguide preamplifier or if equipped with a waveguide preamplifier that has a 3-gain label:  $\pm 3$  dB of the RADIO DATA CARD value.

**If the requirement is not met**, clear problem using information provided in Step 3.

7. Disconnect the test equipment. Reconnect the semirigid cable and torque the connections.
8. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**



**Figure 3-RF Input Level Check**

<b>TABLE E</b>		
<b>RECEIVER WAVEGUIDE ASSEMBLY NETWORK LOSSES</b>		
<b>RECEIVER POSITION IN A LINEUP RELATIVE TO RECEIVING ANTENNA</b>	<b>NOMINAL "LOSS" VALUES BETWEEN INPUT TO BAY LINEUP RF INPUT TO DOWN-CONVERTER</b>	
	<b>6 GHz</b>	<b>11 GHz</b>
Closest to receiving waveguide input	1.2	2.1
Next equipped	1.5*	2.5*
Next equipped	1.8*	2.9*
Next equipped	2.1*	3.3*
Next equipped	Not applicable	3.7*
Next equipped	Not applicable	4.1*
<p>* Add a factor of <math>n \times 0.2</math> dB, when applicable, where <math>n</math> = the number of channels that are ahead in the lineup of the channel being evaluated and that are exactly 60 MGz (6 GHz) or 80 MHz (11 GHz) above or below the frequency of the channel being evaluated.</p>		

### 3.4 RECEIVER DOWN CONVERTER GAIN CHECKS, 4400 SERIES RCVR CONVR

This procedure is used to check the gain of the 4470 (6 GHz without space diversity), 4471 (6 GHz with space diversity), 4472 (11 GHz without space diversity), and 4473 (11 GHz with space diversity) RCVR CONVR units.

**Prerequisite:** Part 3.3 must be completed before this procedure.

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

#### TEST EQUIPMENT

- Refer to Figure 4.

#### PROCEDURE

**Note:** If the receiver has space diversity (dual down-converters), repeat this procedure for both the regular and diversity paths. The RF IN of the path not under test must be disconnected and terminated.

1. Verify that service is protected.
2. Set the RCVR CONVR AGC AUTO/MAN switch to the AUTO position.
3. Condition the power meter to measure the expected power level (normally +5 to -15 dBm), and connect it to the IF OUT jack on the RCVR CONVR (Figure 4).
4. Set the IF LEV ADJ control fully CW (maximum output level) and record level.

**Requirement:** For the RF input (RF Pin) measured, verify that the IF output (IF Pout) falls within the acceptable range of Figure 5 (6 GHz) or Figure 6 (11 GHz).

**If the requirement is not met,** replace the RCVR CONVR unit and repeat this procedure.

5. For non-space diversity, go to Step 6.  
For space diversity, go to Step 8.
6. Set the IF LEV ADJ control in accordance with (a) or (b) below:
  - (a) 6 GHz — If the maximum IF OUT measurement is greater than -5 dBm, adjust to -5 dBm. If less than -5 dBm, leave at maximum.  
**Note:** -4 dBm is greater than -5 dBm; -6 dBm is less.
  - (b) 11 GHz — If the maximum IF OUT measurement is greater than -11 dBm, adjust to -11 dBm. If less than -11 dBm, leave at maximum.  
**Note:** -10 dBm is greater than -11 dBm; -12 dBm is less.
7. Set the RCVR CONVR AGC to MAN, and adjust the MAN GAIN ADJ to provide an IF OUT equal to that measured in the AUTO mode. Go to Step 10.
8. For Space Diversity applications, set the REG and DIV IF LEV ADJ in accordance with (a) or (b) below.

- (a) 6 GHz — If the maximum IF OUT measurement for both regular and diversity is greater than  $-5$  dBm, set both to  $-5$  dBm.

If one of the maximum IF OUT measurements for regular or diversity is less than  $-5$  dBm, leave the one at maximum and adjust the other to the same value.

**Note:**  $-4$  dBm is greater than  $-5$  dBm.

- (b) 11 GHz — If the maximum IF OUT measurement for both REG and DIV is greater than  $-11$  dBm, set both to  $-11$  dBm.

If one of the maximum IF OUT measurements for regular or diversity is less than  $-11$  dBm, leave the one at maximum and adjust the other to the same value.

**Note:**  $-10$  dBm is greater than  $-11$  dBm.

9. Set the RCVR CONVR AGC to MAN, and adjust the MAN GAIN ADJ to provide an IF OUT equal to that measured in the AUTO mode.
10. Reset the AGC to AUTO.
- Note:** If the RCVR CONVR is replaced, go to Flowchart 1 for additional tests that must be performed.
11. Disconnect all test equipment and return all connections to normal.
12. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**

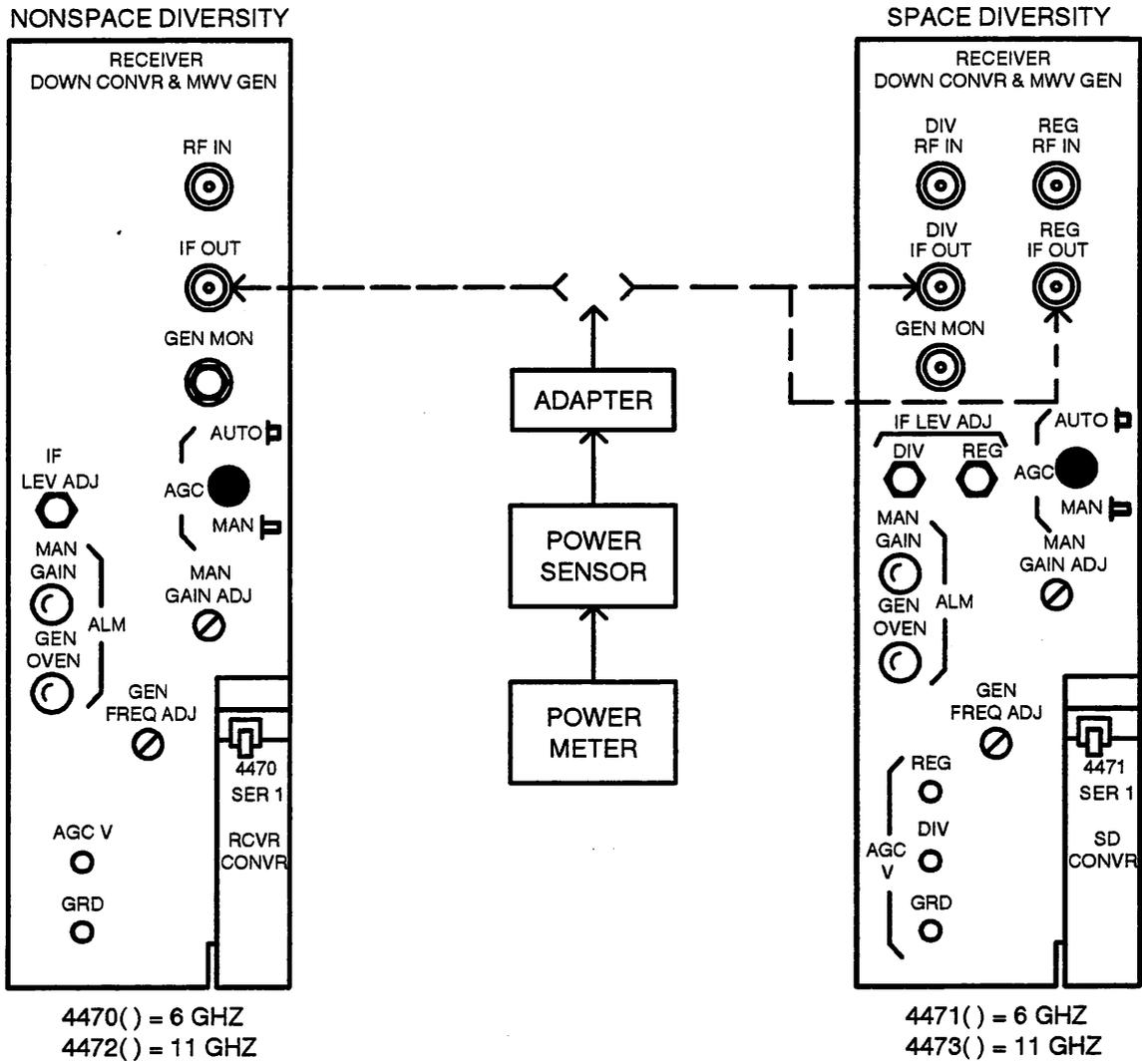


Figure 4- Receiver Down-Converter IF Output Level Check (4400 Series)

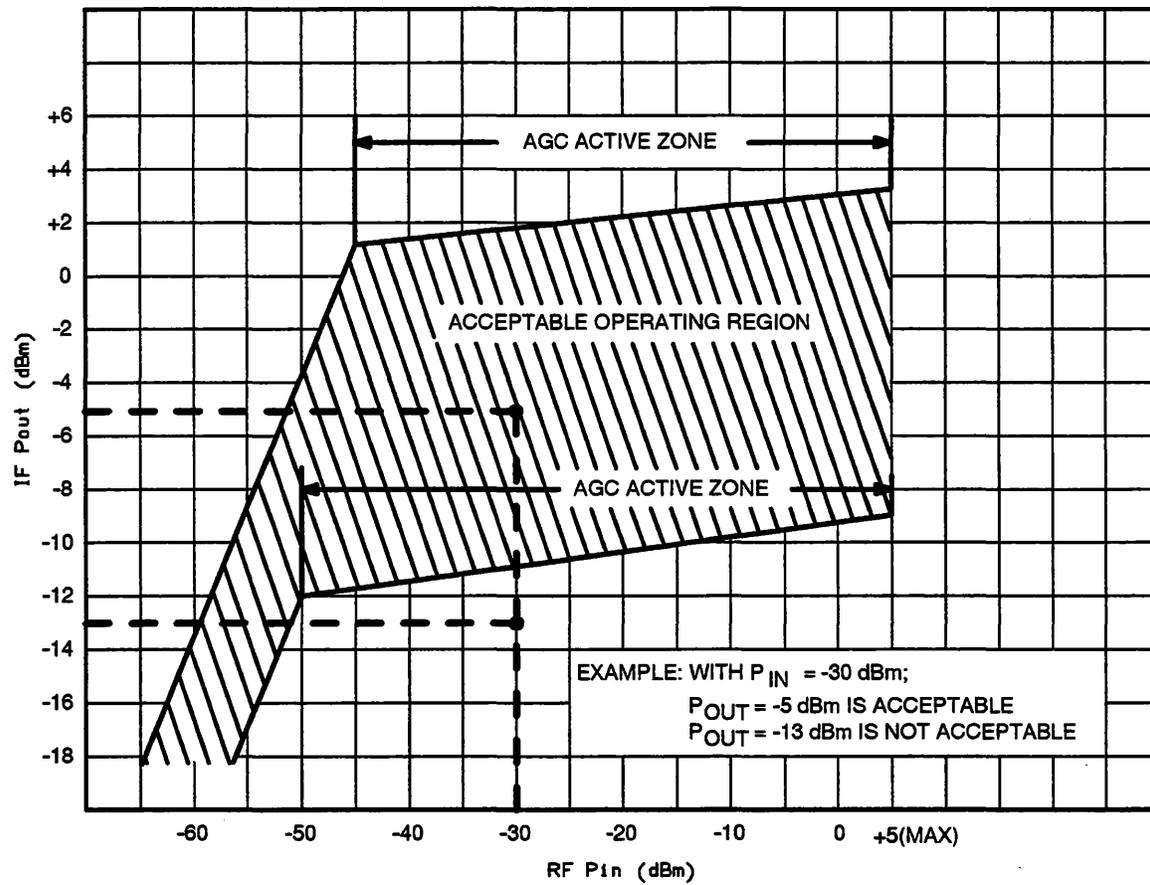


Figure 5-6-GHz Receiver Acceptable IF (P<sub>out</sub>) vs RF (P<sub>in</sub>)

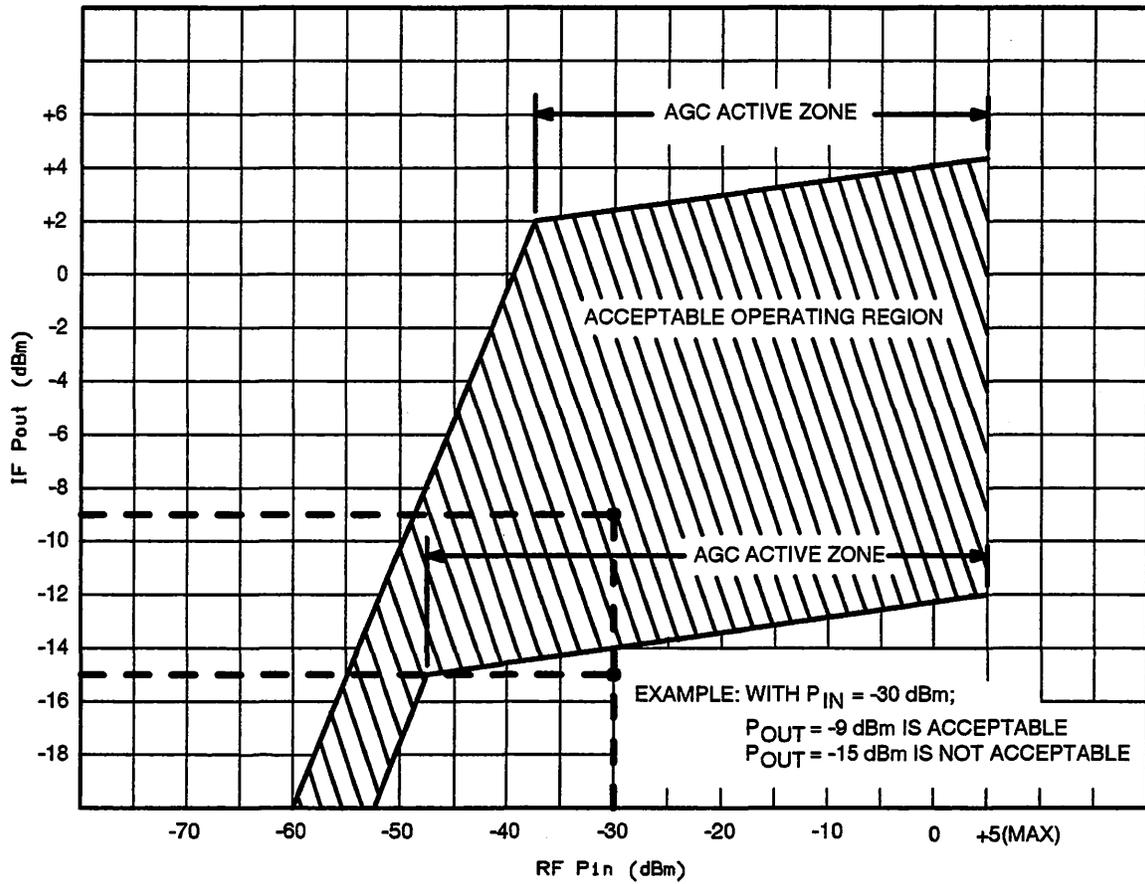


Figure 6-11-GHz Receiver Acceptable IF (Pout) vs RF (Pin)

### 3.5 RECEIVER DOWN CONVERTER GAIN CHECKS, 4300 SERIES RCVR CONV

This procedure is used to check the gain of the 4391 (6 GHz without space diversity), 4392 (6 GHz with space diversity), 4384 (11 GHz without space diversity), and 4385 (11 GHz with space diversity) RCVR CONVR units.

**Prerequisite:** Part 3.3 must be completed before this procedure.

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

#### TEST EQUIPMENT

- Refer to Figure 7.

#### PROCEDURE

**Note:** If the receiver has space diversity (dual down-converters), repeat this procedure for both the regular and diversity paths. The RF IN of the path not under test must be disconnected and terminated.

1. Verify that service is protected.
2. Remove the semirigid cable between the RF IN on the RCVR CONVR unit and the isolator/transducer OUTPUT jack.
3. Connect a 1-foot flexible RF coaxial cable in series with a 20-dB pad between the isolator/transducer and the RF IN on the RCVR CONVR unit.
4. Condition the power meter to measure the expected power level (normally -15 to -25 dBm), and connect it to the RCVR CONVR IF OUT jack (Figure 7). Record this level.
5. Set the IF LEV ADJ control fully CW (maximum output level). Record this level (IF OUT).

**Note:** The 4384 and 4391 RCVR CONVRs do not have an IF LEV ADJ.

6. Calculate the gain of the RCVR CONVR unit (see Note and Example).

**Note:** The RF IN is measured in Part 3.3. The 20 is the RF pad value.

**Example:**

$$\begin{aligned}\text{Gain} &= \text{IF OUT} - (\text{RF IN} - 20) \\ \text{Gain} &= -15 - (-13 - 20) \\ \text{Gain} &= -15 - (-33) \\ \text{Gain} &= -15 + 33 \\ \text{Gain} &= 18\end{aligned}$$

**Requirement:**

- 18 ± 2 dB for 4392 and 4385 RCVR CONVRs.
- 21 ± 2 dB for 4391 and 4384 RCVR CONVRs.

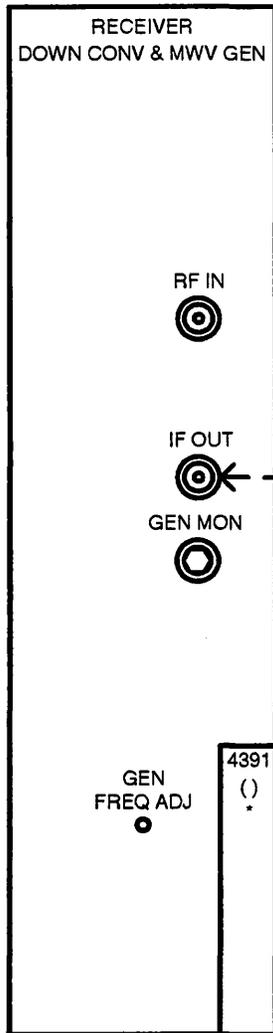
**If the requirement is not met,** replace the RCVR CONVR unit and repeat this procedure.

**Note:** If the RCVR CONVR unit is replaced, go to Flowchart 1 for additional tests that must be performed.

7. Readjust the IF LEV ADJ to the level recorded in Step 4.
8. If the combiner IF input level checks are to be made, go to Part 4.1.
9. Remove the 20-dB pad and reconnect the semirigid cable to the RF IN jack and the isolator/transducer. Torque the connectors.
10. Disconnect all test equipment and return all connections to normal.
11. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

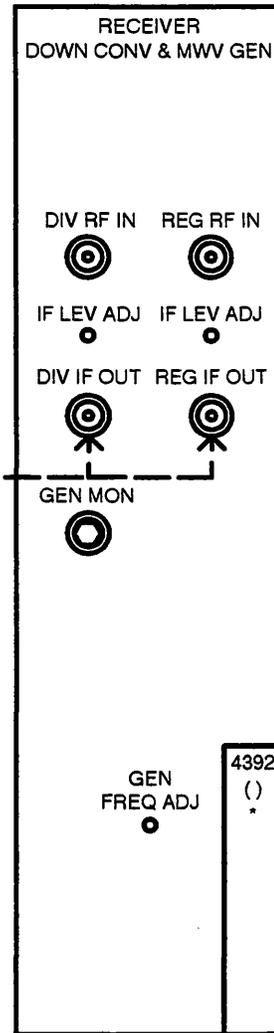
**END OF PROCEDURE**

NONSPACE DIVERSITY



\* 4391( ) = 6 GHZ  
 4384( ) = 11 GHZ

SPACE DIVERSITY



\* 4392( ) = 6 GHZ  
 4385( ) = 11 GHZ

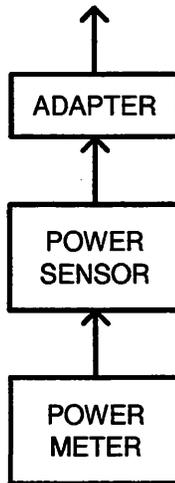


Figure 7-Receiver Down-Converter IF Output Level Check (4300 Series)

## 4. IF COMBINER CHECKS

These procedures are used to check and adjust the IF levels into the IF combiners to ensure proper combining action. The adjustments are made using the IF LEV ADJ on the RCVR CONVR unit. Note if you are equipped with a 4300 Series RCVR CONVR unit or 4400 Series RCVR CONVR unit; perform the desired procedure.

### 4.1 IF COMBINER LEVEL CHECK AND ADJUSTMENT, 4300 SERIES RCVR CONVR

**Prerequisites:** The receiver equalization and differential absolute delay equalization (DADE) procedures are complete. The RCVR CONVR RF input and gain are within limits (Parts 3.3 and 3.5).

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

**Warning:** *The SMA connectors should be tightened ONLY with a torque wrench to prevent damage.*

### TEST EQUIPMENT

- Refer to Figure 8.

### PROCEDURE

1. Verify that service is protected.
2. IF not previously done, remove both semirigid cables between the RF IN jacks on the RCVR CONVR unit and the isolator/transducer OUTPUT jacks.
3. Connect 1-foot flexible RF coaxial cables in series with 20-dB pads between the isolator/transducer OUTPUT and RF IN jacks on the RCVR CONVR unit, both regular and diversity.
4. Remove the normal cables from the regular and diversity IF OUT jacks on the LINEAR DELAY EQUALIZER unit.
5. Condition the power meter to measure the expected power level (nominal is  $-7$  dBm), and connect it to the IF OUT jacks on the LINEAR DELAY EQUALIZER unit (Figure 8, Option A).
6. Adjust the IF LEV ADJ on the RCVR CONVR unit for maximum output for both regular and diversity. Record each measurement.
7. Leave the IF LEV ADJ control on the RCVR CONVR unit with the lowest output level set for maximum. Adjust the IF LEV ADJ control on the RCVR CONVR unit with the highest output level per the following:
  - a. If the two levels are within 10 dB of each other, leave the lower level set at maximum and reduce the higher level to equal to or within 1 dB of the lower.
  - b. If the difference between the two levels is more than 10 dB, leave the lower level set at maximum and reduce the higher level by 10 dB only.
8. Record the difference between the REG and DIV IF OUT.

9. Remove the 20-dB pads and reinstall the semirigid cables to the RF IN jacks and the isolator/transducer OUTPUTs. Torque all connectors.
10. Measure the IF OUT levels (REG and DIV) of the LINEAR DELAY EQUALIZER again (Figure 8, Option A).

**Requirement:** The difference in Step 10 shall be within 4 dB of the difference that was recorded in Step 8.

**Example:** Step 8 = 1 dB (-13 dBm REG (-) -14 dBm DIV)  
Step 10 = 5 dB (-16 dBm REG (-) -11 dBm DIV)

The difference between Step 8 and 10 is 4 ( $5 - 1 = 4$ ).

**Note:** The IF OUT levels may increase or decrease.

**If the requirement is not met,** replace the RCVR CONVR unit; then perform the Receiver Alignment Procedures (Part 2).

Record the LINEAR DELAY EQUALIZER IF OUT levels on the RADIO DATA CARD.

11. If necessary, set the AUTO/MAN switch on the IF COMBINER to AUTO.

**Requirement:** The MAN indicator shall be extinguished.

**If the requirement is not met,** suspect the IF COMBINER unit, DC voltages, wiring problem, or connector problem. Refer to the applicable drawings and manuals or request assistance from the technical support group.

12. Reconnect the normal cable to REG IF IN jack on the combiner and terminate the DIV IF IN jack.
13. Connect the power meter to the IF OUT jack on the IF COMBINER (Figure 8, Option B).
14. Observe the power meter indication and record this level as Pout.

**Requirement:** For the measured value Pin (Step 9, LINEAR DELAY EQUALIZER OUT level regular), the Pout should fall within the acceptable range shown in Figure 9.

**If the requirement is not met,** replace the IF COMBINER unit; then repeat this procedure.

15. Repeat Steps 11 through 13 with the diversity input connected and the regular input terminated.
16. Connect both IF inputs to the IF COMBINER and observe the power meter indication.

**Requirement:** The difference between Pout measured with both IF inputs connected and Pout with only the highest input connected shall not exceed 6 dB.

**Note:** The combiner may have loss or gain due to the relative phase of the unit.

**If the requirement is not met,** replace the IF COMBINER unit; then repeat this procedure.

Record the IF COMBINER IF OUT level on the RADIO DATA CARD.

17. Condition the power meter to measure the expected power level (normally +5 to -15 dBm), and connect to the RCVR CONVR IF OUT jack (Figure 8, Option B).

18. Measure the regular and diversity IF outputs of the RCVR CONVR unit (Figure 8, Option C), and record on the RADIO DATA CARD plug-in REG - CONV IF OUT and DIV - CONV IF OUT lines.

**Note:** If any units were replaced, go to the REPAIR VERIFICATION tab for any additional tests that must be performed.

19. Disconnect all test equipment and return all connections to normal.
20. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**

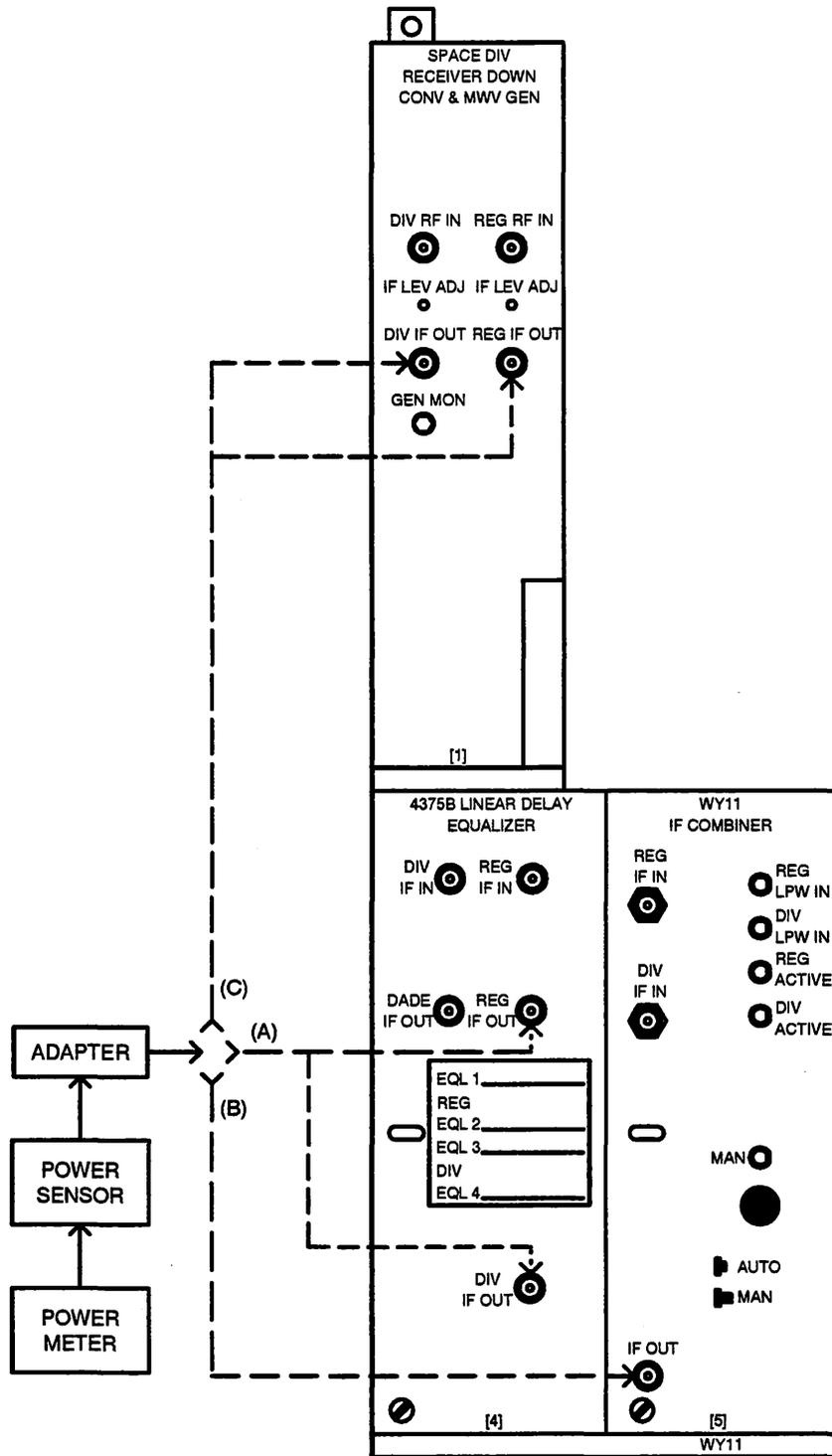
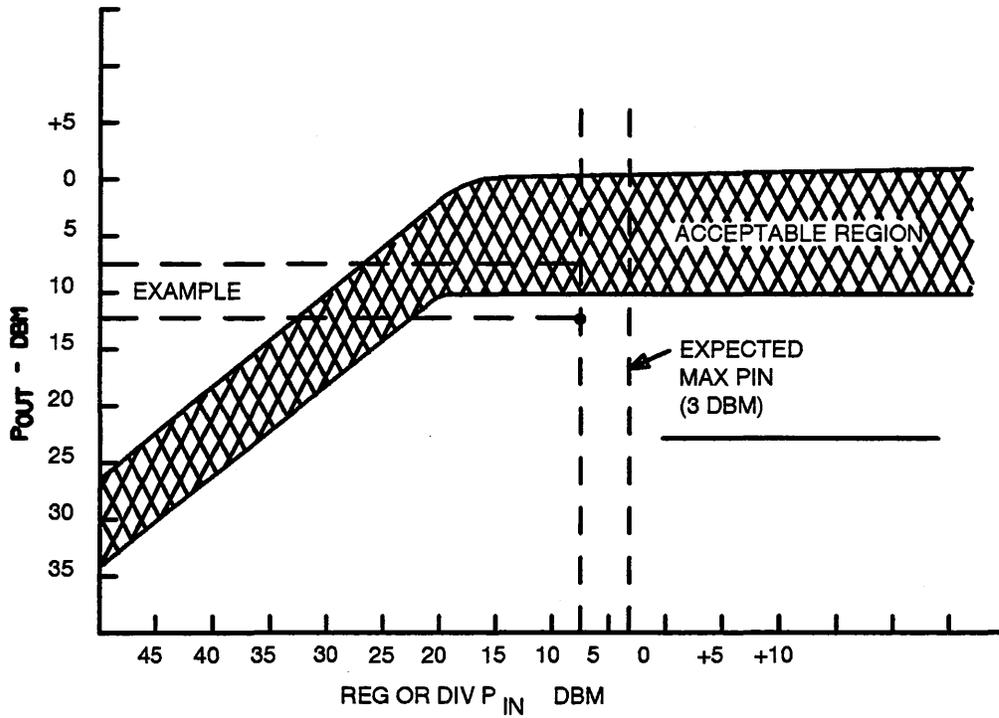


Figure 8-IF COMBINER Level Checks



NOTES:

1. A PIN/POUT POINT FOR EACH SIDE MUST FALL IN CROSS-HATCHED AREA OR COMBINER IS DEFECTIVE
2. INPUT TO SIDE NOT UNDER TEST IS REPLACED WITH TERMINATION

EXAMPLE WITH PIN IF 7 DBM:

- POUT OF 12 DBM IS NOT ACCEPTABLE
- POUT OF 8 DBM IS ACCEPTABLE

**Figure 9-WY11 Pout vs Pin Characteristics in Automatic Mode With Input to Regular or Diversity Only**

#### 4.2 IF COMBINER LEVEL CHECK AND ADJUSTMENT, 4400 SERIES RCVR CONVR

This procedure is used to check and adjust the IF levels into the IF COMBINER to ensure proper combining action. The adjustment is made by the IF LEV ADJ on the RCVR CONVR unit. The combiner IF output level is also checked.

**Prerequisites:** The receiver equalization and DADE procedures are complete. The RCVR CONVR RF input and gain are within limits (Parts 3.3 and 3.4).

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

#### TEST EQUIPMENT

- Refer to Figure 8.

#### PROCEDURE

1. Verify that service is protected.
2. On the RCVR CONVR unit, verify that the AGC AUTO/MAN switch is in the AUTO mode.
3. Remove the normal cables from the REG and DIV IF OUT jacks on the LINEAR DELAY EQUALIZER unit.
4. Condition the power meter to measure the expected power level (nominal is  $-7$  dBm), and connect it to the IF OUT jacks on the LINEAR DELAY EQUALIZER unit (Figure 8, Option A).
5. Adjust the IF LEV ADJ on the RCVR CONVR unit for maximum output for both regular and diversity. Record each measurement.
6. Leave the IF LEV ADJ control on the RCVR CONVR unit with the lowest level set for maximum. Adjust the IF LEV ADJ control on the RCVR CONVR unit with the highest output level per the following:
  - a. If the two output levels are within 10 dB of each other, leave the lower level set at maximum and reduce the higher level to be equal to, as close as possible, the lower signal level.
  - b. If the two levels are more than 10 dB apart, leave the lower level set at maximum and reduce the higher level by 10 dB only. If the IF LEV ADJ range is not adequate, reduce the level of the higher signal level to minimum, and note the difference between the two for future reference.

Record the LINEAR DELAY EQUALIZER IF OUT levels on the RADIO DATA CARD.

7. Set the AUTO/MAN switch on the IF COMBINER to AUTO.

**Requirement:** The MAN indicator shall be extinguished.

**If the requirement is not met,** suspect the IF COMBINER unit, DC voltages, wiring problem, or connector problem. Refer to the applicable drawings and manuals or request assistance from the technical support group.

8. Reconnect the normal cable to REG IF IN jack on the combiner and terminate the DIV IF IN jack.

9. Connect the power meter to the IF OUT jack on the IF COMBINER (Figure 8, Option B).
10. Observe the power meter indication and record this level as Pout.  
**Requirement:** For the measured value Pin (Step 7, LINEAR DELAY EQUALIZER OUT level regular), the Pout should fall within the acceptable range shown in Figure 9.  
**If the requirement is not met,** replace the IF COMBINER unit; then repeat this procedure.
11. Repeat Steps 8 through 10 with the diversity input connected and the regular input terminated.
12. Connect both IF inputs to the IF COMBINER and observe the power meter indication.  
**Requirement:** The difference between Pout measured with both IF inputs connected and Pout with only the highest input connected shall not exceed 6 dB.  
**Note:** The combiner may have loss or gain due to the relative phase of the unit.  
**If the requirement is not met,** replace the IF COMBINER unit; then repeat this procedure. Perform the IF COMBINER Performance Check (Part 9).
13. Record the IF COMBINER IF OUT level on the RADIO DATA CARD.
14. Condition the power meter to measure the expected power level (normally +5 to -15 dBm), and connect to the RCVR CONVR IF OUT jacks (Figure 8, Option C).
15. Measure and record the regular and diversity IF outputs of the RCVR CONVR unit; also record the outputs on the RADIO DATA CARD plug-in REG : CONV IF OUT and DIV : CONV IF OUT lines.  
**Note:** If any units were replaced in this procedure, go to the REPAIR VERIFICATION tab for any additional tests that must be performed.
16. Disconnect all test equipment and return all connections to normal.
17. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**

## 5. LINEAR DELAY EQUALIZER CHECK

This procedure is used to check the IF output levels of the LINEAR DELAY EQUALIZER.

**Prerequisites:** The RCVR CONVR IF output must be within limits.

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

### TEST EQUIPMENT

- Refer to Figure 10.

### PROCEDURE

1. Verify that service is protected.
2. Remove the cable normally connected to the IF OUT jack(s) of the LINEAR DELAY EQUALIZER unit.
3. Condition the power meter to measure the expected power level (nominal is  $-7$  dBm), and connect it to the IF OUT jack(s) on the LINEAR DELAY EQUALIZER unit (Figure 10).
4. Record the power meter indication.
5. Using Table F, determine the expected losses of any Linear Delay Equalizer(s) and any DADE cabling that is being used.

**Requirement:** The difference between the RCVR CONVR IF OUT and the LINEAR DELAY IF OUT shall be within  $\pm 1$  dB of the calculated loss determined by using Table F.

**If the requirement is NOT met,** suspect the LINEAR DELAY EQUALIZER unit, DADE cable, or interconnecting cable. Replace the defective component and repeat this procedure.

For non-space diversity channels, record the power level on the REG : LIN DEL EQL IF OUT line of the RADIO DATA CARD.

Do not record the levels measured for space diversity applications. This is done in Parts 4.1 and 4.2.

6. Repeat Steps 2 through 5 for diversity path, if equipped.
7. Disconnect all test equipment and return all connections to normal.
8. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

### END OF PROCEDURE

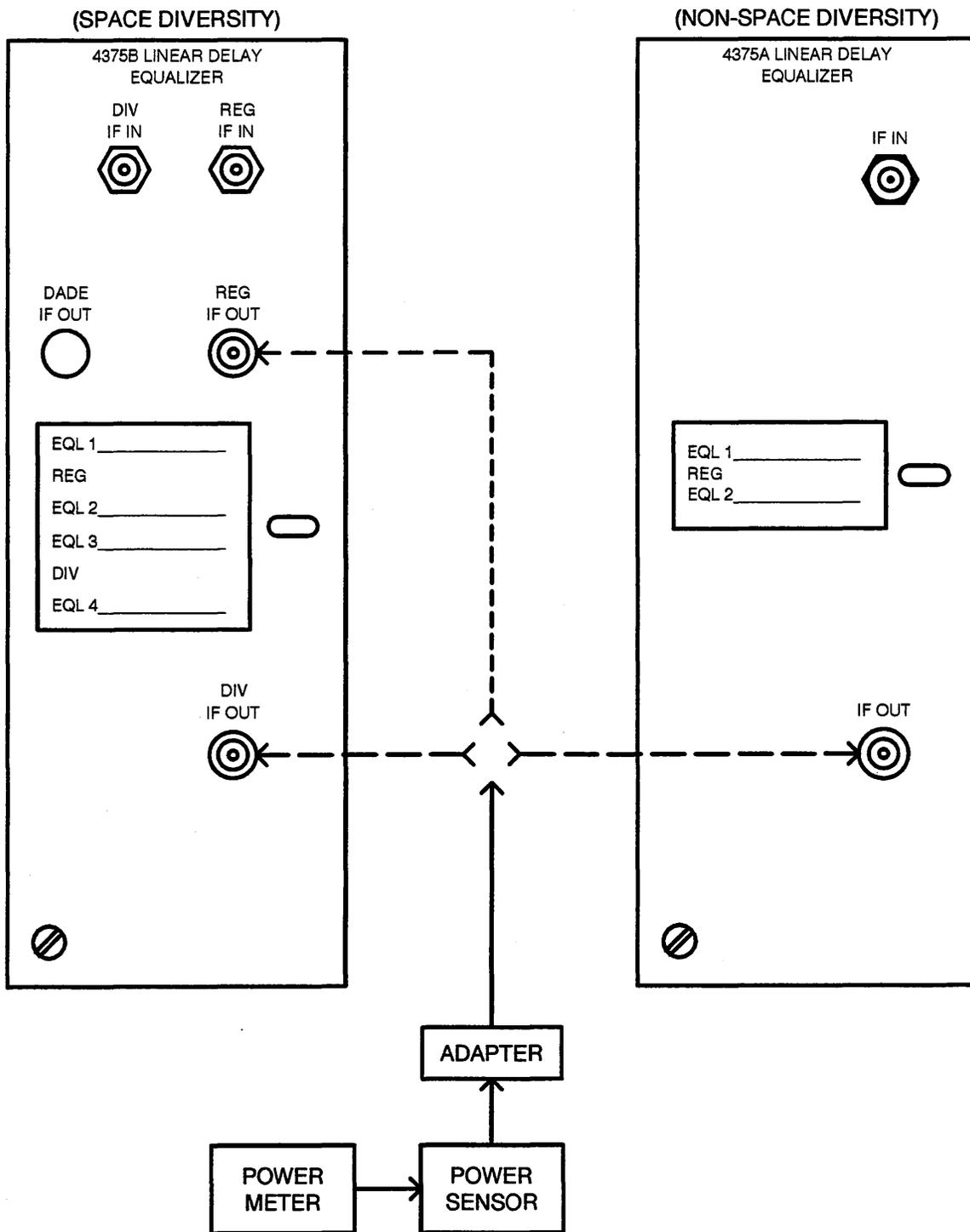


Figure 10-Linear Delay Equalizer Checks

<b>TABLE F TYPICAL IF UNIT LOSSES</b>	
<b>CODE</b>	<b>INSERTION LOSS (dB) AT 70 MHz</b>
<b>LINEAR DELAY EQUALIZER (<math>\pm 0.5</math> dB)</b>	
2001A	1.1
2001B	1.1
2001C	1.7
2001D	1.2
2001E	1.7
2001F	1.4
2001G	1.4
2001H	0.38
2001J	1.5
2001K	0.43
2001L	1.5
2001M	0.57
2001N	3.2
2001P	0.7
<b>BASIC EQUALIZER (<math>\pm 0.5</math> dB)</b>	
2002C	4.4
2002D	4.1
2002G	5.6
<b>IF FILTER (<math>\pm 0.5</math> dB)</b>	
1603B	7.0
<b>CABLES (dB per 100 ft)</b>	
KS-19224,L2	$6.0 \pm 0.6$
731B	$3.0 \pm 0.3$
728B	$2.2 \pm 0.22$

## 6. IF FILTER AND BASIC EQUALIZER CHECK

This procedure is used to check the IF output levels of the IF FILTER AND BASIC EQUALIZER units.

The IF FILTER AND BASIC EQUALIZER unit should have  $11 \text{ dB} \pm 1 \text{ dB}$  loss for 6 GHz and  $13 \text{ dB} \pm 1 \text{ dB}$  for 11 GHz. **Example:** With  $-7 \text{ dBm}$  input, the output will be  $-18 \text{ dBm}$  (6 GHz).

**Prerequisites:** The outputs of the preceding units must be within limits (Part 4.1 or 4.2 for space diversity channels; Part 5 for non-space diversity).

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

### TEST EQUIPMENT

- Refer to Figure 11.

### PROCEDURE

1. Verify that service is protected.  
For space diversity applications, go to Step 5.
2. Remove the cable normally connected to the IF OUT jack of the LINEAR DELAY EQUALIZER unit.
3. Condition the power meter to measure the expected power level (normally  $-7 \text{ dBm}$ ), and connect it to the IF OUT jack on the LINEAR DELAY EQUALIZER unit (Figure 11, Option A). Record the power meter indication.
4. Disconnect the power meter and reconnect the cable. Go to Step 8.
5. Remove the cable normally connected to the IF OUT jack of the IF COMBINER unit.
6. Condition the power meter to measure the expected power level (nominal is  $-7 \text{ dBm}$ ), and connect it to the IF OUT jack of the IF COMBINER unit (Figure 11, Option B). Record the power meter indication.
7. Disconnect the power meter and reconnect the cable.
8. Remove the cable normally connected to the IF OUT jack of the IF FILTER AND BASIC EQUALIZER unit.
9. Condition the power meter to measure the expected power level (nominal is  $-18 \text{ dBm}$ ), and connect it to the IF OUT jack of the IF FILTER AND BASIC EQUALIZER unit (Figure 11, Option C).
10. Observe the power meter indication.

**Requirement:** The level shall be  $11 \text{ dB} \pm 1 \text{ dB}$  for 6 GHz and  $13 \text{ dB} \pm 1 \text{ dB}$  for 11 GHz less than the IF OUT level of the preceding unit [that is, IF COMBINER (space diversity), or LINEAR DELAY EQUALIZER (non-space diversity)].

**If the requirement is not met,** suspect the IF FILTER AND BASIC EQUALIZER unit or an interconnecting cable. Replace the defective component and then repeat this procedure.

**Note:** If the IF FILTER AND BASIC EQUALIZER is replaced, go to Flowchart 1 for any additional tests that must be performed.

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Record the power level on the IF FLT BASIC EQL IF OUT line on the RADIO DATA CARD.

11. Disconnect all test equipment and return all connections to normal.
12. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**

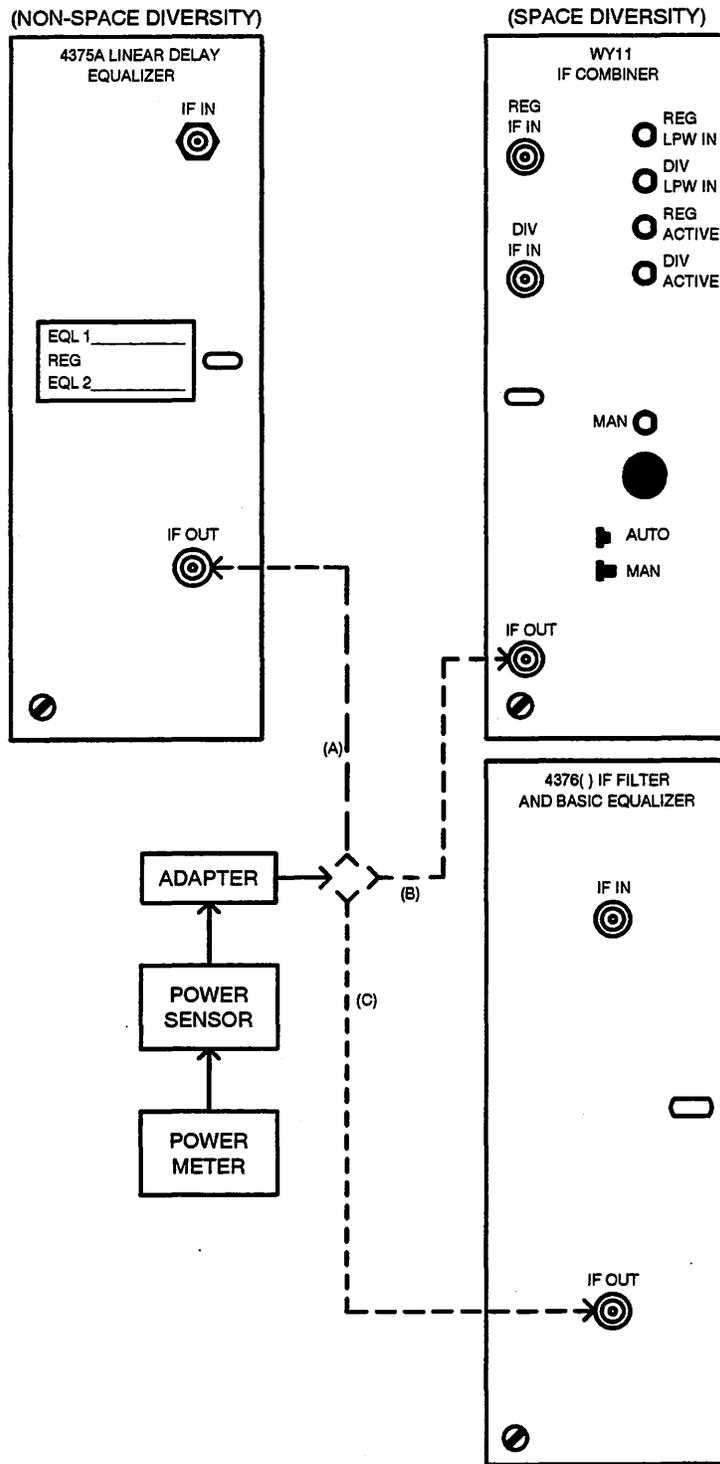


Figure 11 - IF Filter and Basic Equalizer Check

## 7. AGC AMPLIFIER AND ADAPTIVE SLOPE EQUALIZER CHECKS

### 7.1 IF AGC AMPLIFIER AND ADAPTIVE SLOPE EQUALIZER LEVEL CHECKS

This procedure is used to check and adjust the IF output levels of the IF AGC AMPL and to check the ADAPTIVE SLOPE EQL output levels. The AGC AMPL is first checked in the MAN mode and then the AUTO mode. Adjustments are for a  $-2.0 \text{ dBm} \pm 0.2 \text{ dBm}$ . The ADAPTIVE SLOPE EQL is then checked for a  $-2.0 \pm 0.5 \text{ dBm}$  output. The level is then adjusted for  $-7.1$  or  $-3.5 \text{ dBm} \pm 0.2 \text{ dBm}$  (depends on cable length) at the installer interface.

**Prerequisites:** The IF FILTER AND BASIC EQUALIZER unit IF OUT must be within limits (Part 6).

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

#### TEST EQUIPMENT

- Refer to Figure 12.

#### PROCEDURE

1. Verify that service is protected.
2. Remove the cable from the IF OUT jack on the IF AGC AMPL.
3. Set the AUTO/MAN switch on the IF AGC AMPL to MAN.
4. Condition the power meter to measure the expected power level (normally  $-2 \text{ dBm}$ ), and connect it to the IF OUT jack (Figure 12, Option A).
5. Observe the power meter and adjust the MAN GAIN control for  $-2.0 \pm 0.2 \text{ dBm}$ .
6. Set the AUTO/MAN switch on the IF AGC AMPL unit to AUTO.

**Requirement:** The MAN indicator shall extinguish.

**If the requirement is not met,** suspect the IF AGC AMPL, DC voltages, wiring, or connector problem. Refer to applicable drawings or manuals or request assistance from technical support group.

7. Measure the power and adjust the AUTO GAIN control for  $-2.0 \pm 0.2 \text{ dBm}$ .

**If the adjustment is made,** disconnect the power meter and reconnect the normal cable.

**If the adjustment cannot be made,** replace the IF AGC AMPL unit and repeat this procedure.

8. Remove the cable from the IF OUT jack on the ADAPTIVE SLOPE EQL unit.
9. Verify that the AUTO/MAN switch on the ADAPTIVE SLOPE EQL is in the AUTO position.

**Requirement:** The EQL OFF indicator shall extinguish.

**If the requirement is not met,** suspect the ADAPTIVE SLOPE EQL, DC voltages, wiring, or connector problem. Refer to applicable drawings or manuals or request assistance from technical support group.

10. Connect the power meter to the IF OUT jack on the ADAPTIVE SLOPE EQL unit (Figure 12, Option B).
11. Measure the power.  
**Requirement:**  $-2.0 \pm 0.5$  dBm.  
**If the requirement is met,** disconnect the power meter and reconnect the normal cable; update the RADIO DATA CARD, if necessary.  
**If the requirement is not met,** replace the ADAPTIVE SLOPE EQL unit and repeat this procedure.
12. Remove the cable connected to the IF OUT jack on the installer interface panel.
13. Connect the power meter to the IF OUT jack on the installer interface panel (Figure 12, Option C).
14. Observe the power meter indication.  
**Requirement:**  
Standard interconnect cable,  $-7.1 \pm 0.5$  dBm  
Interconnect cables greater than 50 feet,  $-3.5 \pm 0.5$  dBm  
**If the requirement is not met,** suspect the cables, pad, or connectors. Isolate and correct problem.
15. Adjust the AUTO GAIN on the AGC AMPL unit for  $-7.1 \pm 0.2$  dBm or  $-3.5 \pm 0.2$  dBm.
16. Set the AGC AMPL and ADAPTIVE SLOPE EQL units to MAN.
17. Adjust the MAN GAIN on the AGC AMPL unit for  $-7.1 \pm 0.2$  dBm or  $-3.5 \pm 0.2$  dBm.
18. Set the AGC AMPL and ADAPTIVE SLOPE EQL units to AUTO.
19. Using either the ALARM AND METER unit or a digital multimeter at the AGC V test point, measure the AGC voltage. Update the RADIO DATA CARD if necessary.  
**Note:** If any units are replaced, go to Flowchart 1 for any additional tests that must be performed.
20. Disconnect all test equipment and return all connections to normal.
21. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**

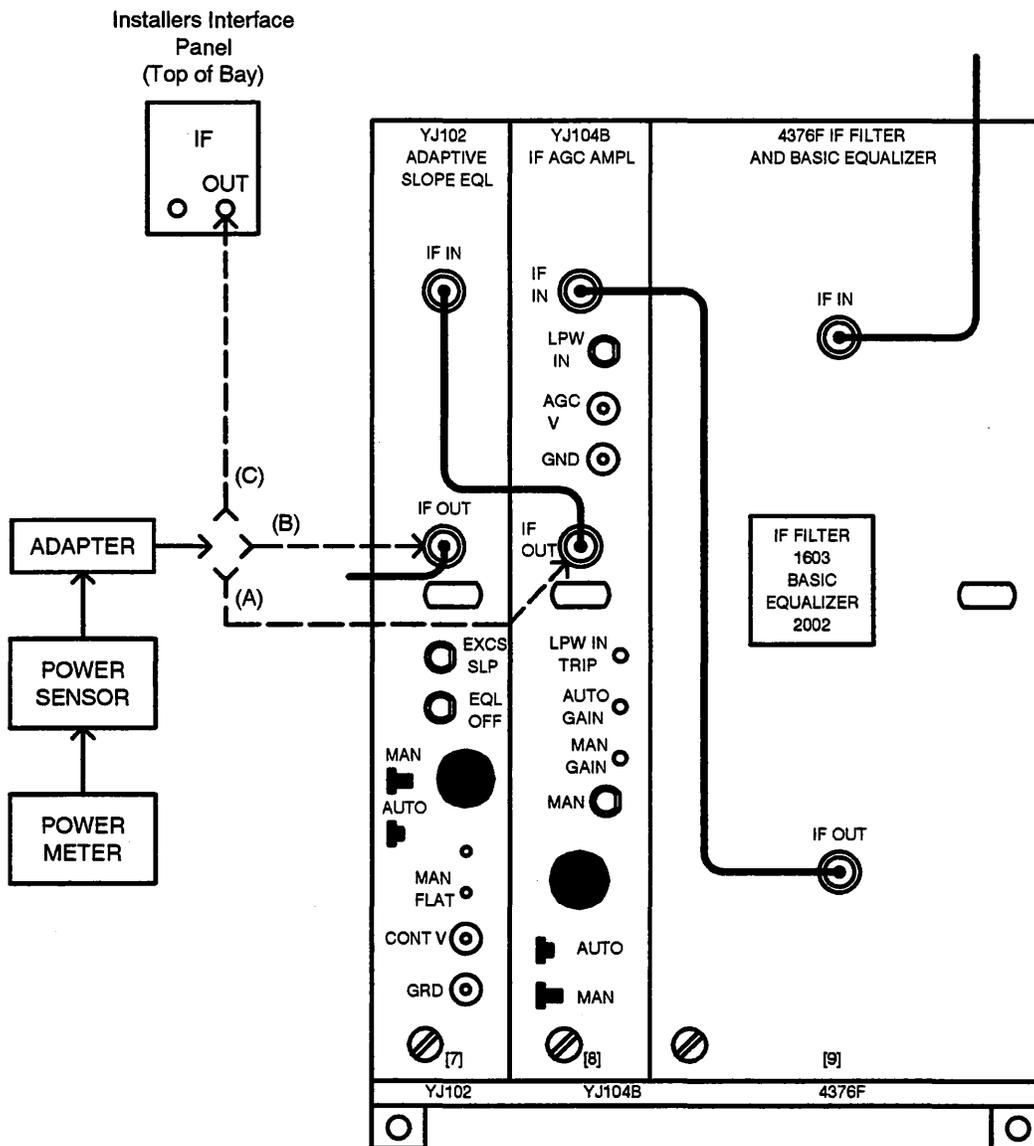


Figure 12-IF AGC Amplifier and Adaptive Slope Equalizer Level Checks

## 7.2 AGC AMPLIFIER LOW POWER TRIP POINT ADJUSTMENT

This procedure is used to adjust the low power trip of the IF AGC amplifier unit.

**Prerequisites:** The AGC AMPL automatic gain adjustment must be within limits.

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

### TEST EQUIPMENT

- 1 - Digital multimeter, if not equipped with an ALARM AND METER unit
- 1 - 30 dB IF pad.

### PROCEDURE

1. Verify that service is protected.
2. Verify that the IF AGC AMPL and ADAPTIVE SLOPE EQL are in the AUTO mode.
3. Remove the cable from the IF IN jack on the IF AGC AMPL.
4. Connect a 30-dB IF pad and a short cable in series with the cable removed in Step 3 and the IF IN jack on the AGC AMPL.
5. On the AGC AMPL, adjust the LPW IN TRIP control ccw until the LPW IN indicator is extinguished; then cw until the indicator just lights.

**Requirement:** The LPW IN indicator just lights.

**If the requirement cannot be met,** replace the IF AGC AMPL unit.

**If the requirement still cannot be met,** suspect a faulty replacement unit or a DC voltage, wiring, or connector problem. Isolate and clear problem.

6. Measure the AGC voltage (use ALARM AND METER unit or digital multimeter and AGC V jack) at the low power trip level and update the LPW IN voltage on the RADIO DATA CARD.

**Note:** If any units are replaced, go to Flowchart 1 for any additional tests that must be made.

7. Disconnect all test equipment and return all connections to normal.
8. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**

### 7.3 ADAPTIVE SLOPE EQUALIZER AMPLITUDE RESPONSE CHECK

This procedure is used to verify that the ADAPTIVE SLOPE EQUALIZER has a flat amplitude response when the unit is in the manual mode, AUTO/MAN set to MAN, and in the automatic (AUTO) mode.

**Prerequisites:** The IF AGC AMPL and ADAPTIVE SLOPE EQL level checks are within limits (Part 7.1).

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

#### TEST EQUIPMENT

- Refer to Figure 13.

#### PROCEDURE

1. Verify that service is protected.
2. Set the AUTO/MAN switch on the ADAPTIVE SLOPE EQL to MAN.
3. Condition the link analyzer for a transmit signal with a level of  $-2.0$  dBm, a center frequency of 70 MHz and a sweep width of 24 MHz ( $\pm 12$  MHz). Observe the amplitude display and, if adjustable, adjust the trace to be flat at the + and  $-12$ -MHz end points.
4. Condition the link analyzer for a scope presentation at a 70-MHz center frequency and a sweep width  $\pm 12$  MHz. Set the sensitivity to 0.2 dB/DIV.
5. Connect the test equipment per Figure 13, Option A.
6. Observe the amplitude display.

**Requirement:** The amplitude response shall be flat within  $\pm 0.02$  dB between the + 12 and  $-12$ -MHz points.

**If the requirement is not met,** adjust the MAN FLAT control on the ADAPTIVE SLOPE EQL unit.

**If the requirement is still not met,** replace the ADAPTIVE SLOPE EQL unit, perform Part 7.1, and repeat this procedure.

7. Using a digital multimeter, measure the voltage at the CONT V jack; update the CONT V MAN on the RADIO DATA CARD.
8. Condition the link analyzer for a transmit signal with a level of  $-8.0$  dBm, a center frequency of 70 MHz, and a sweep width of 24 MHz ( $\pm 12$  MHz). Observe the amplitude display, and if adjustable, adjust the trace to be flat at the + and  $-12$ -MHz end points.
9. Connect the test equipment per Figure 13, Option B.
10. Set the AUTO/MAN switch on the AGC amplifier to MAN.
11. Observe the amplitude display, and if necessary, adjust the MAN FLAT control on the ADAPTIVE SLOPE EQL for a 0.5 dB positive slope measured between the + and  $-12$ -MHz points.

12. Using a digital multimeter, set to 3 decimal places and measure the voltage at the CONT V jack. Record for later use.  
**Note:** Steps 11 and 12 are performed to establish a reference CONT V for use when the 64-QAM (quadrature amplitude modulated) signal is applied.
13. Readjust the MAN FLAT control to obtain the CONT V MAN value recorded on the RADIO DATA CARD in Step 7.
14. Remove the test equipment and reconnect the normal bay cable to the IF OUT on the ADAPTIVE SLOPE EQL unit.
15. Perform the appropriate manual switching operation (LINE SW or PROTECTION LOCKOUT) in order to remove a radio transmitter from service.
16. From the transmitter, connect the QAM signal normally connected to the predistorter or up-converter IF IN jack to the IF IN jack on the IF FILTER AND BASIC EQUALIZER unit.  
**Note:** Keep the cable as short as possible; never exceed 20 feet.
17. Set the AUTO/MAN switches on the ADAPTIVE SLOPE EQL and the IF AGC AMPL to AUTO.
18. Measure the voltage at the CONT V jack on the ADAPTIVE SLOPE EQL unit, compare it to the MAN 0.5 dB positive slope CONT V recorded in Step 12.  
**Requirement:** Within  $\pm 0.002$  V of CONT V recorded in Step 12.  
**If the requirement is met,** go to Step 24.  
**If the requirement is NOT met,** proceed with Step 19.
19. Disconnect all cables and remove the ADAPTIVE SLOPE EQL from the radio bay. See REPLACEMENT PROCEDURES tab if necessary.
20. Insert the extender card into the ADAPTIVE SLOPE EQL slot.
21. Insert the ADAPTIVE SLOPE EQL into the extender card.
22. Using test cables, if necessary, reconnect the IF IN and IF OUT connections on the ADAPTIVE SLOPE EQL unit.
23. Adjust the control through the hole on the right side of the ADAPTIVE SLOPE EQL unit to obtain a CONT V equal to the value recorded in Step 7.  
**Requirement 1:**  $\pm 0.002$  V of the value recorded in Step 7.  
**Requirement 2:** The EXCS SLP indicator shall be off.  
**If the requirements are not met,** replace the ADAPTIVE SLOPE EQL unit, perform Part 7.1, and repeat this procedure.
24. Disconnect the test equipment and restore all connections to normal.
25. Restore the radio transmitter to service.
26. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**

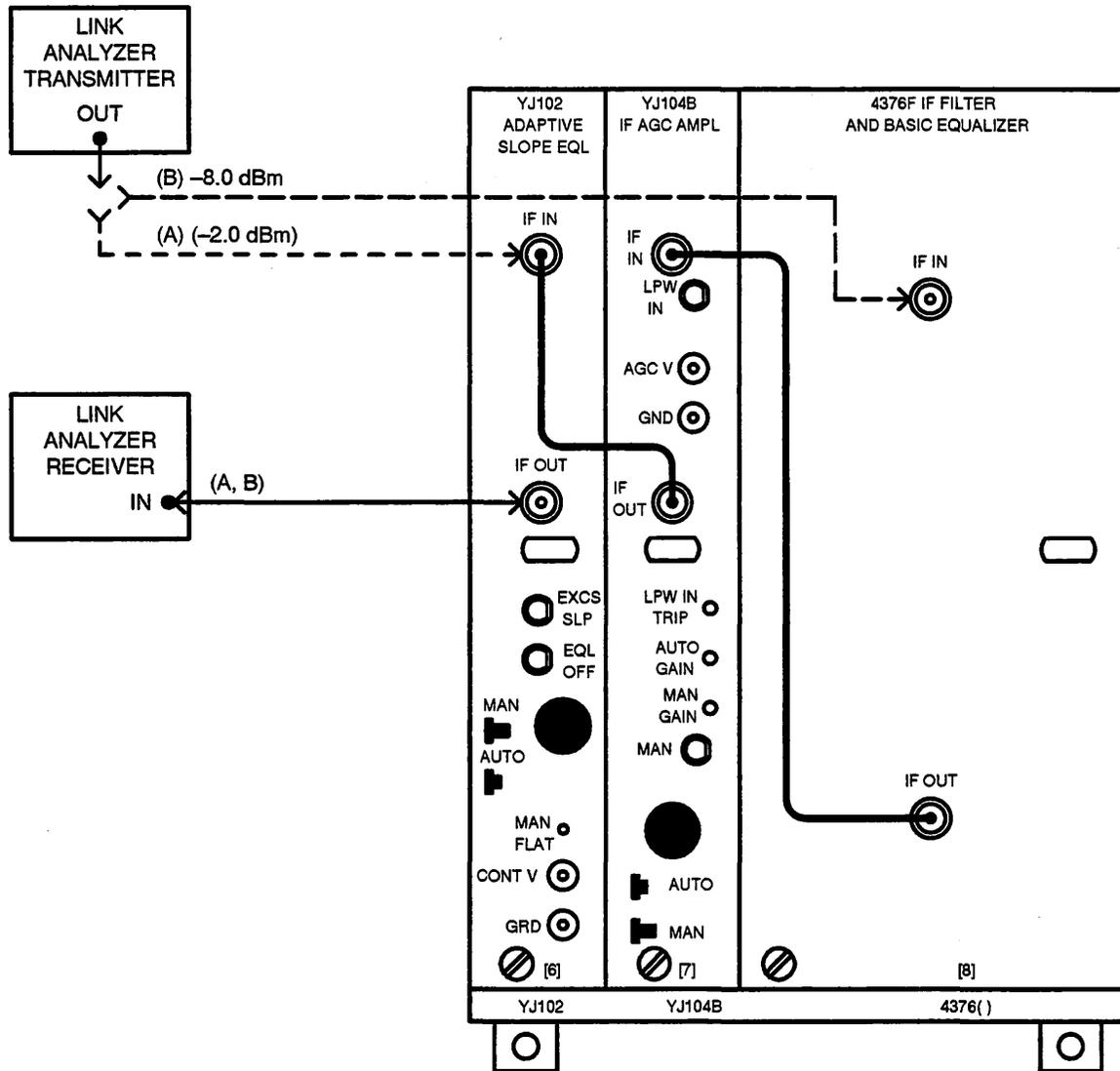


Figure 13- Adaptive Slope Equalizer Checks

## 8. RECEIVER IF TO IF AMPLITUDE RESPONSE CHECK

This procedure is used to check the amplitude response of the receiver IF section. A calibrated flat IF sweep signal is applied to the LINEAR DELAY EQUALIZER input. The output is measured at the ADAPTIVE SLOPE EQL unit IF OUT jack.

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

### TEST EQUIPMENT

- Refer to Figure 14 or 15.

### PROCEDURE

1. Verify that service is protected.
2. Set the AUTO/MAN switches on the IF AGC AMPL and ADAPTIVE SLOPE EQL to MAN.
3. Condition the link analyzer for a transmit signal with an output approximately equal to the level recorded on the RADIO DATA CARD for the RCVR CONVR IF OUT, a center frequency of 70 MHz, and a sweep width of 24 MHz ( $\pm 12$  MHz).
4. Condition the link analyzer for a scope presentation at a 70-MHz center frequency and a sweep width  $\pm 12$  MHz. Set the sensitivity to 0.2 dB/DIV.
5. Connect the test equipment per Figure 14 for space diversity receivers or per Figure 15 for non-space diversity.
6. If this is a space diversity receiver, disconnect the DIV IF IN to the LINEAR DELAY EQUALIZER, and operate the AUTO/MAN switch on the IF COMBINER to MAN.
7. Using a digital multimeter, measure the CONT V voltage on the ADAPTIVE SLOPE EQL. Compare to the CONT V MAN value recorded on the RADIO DATA CARD. Adjust the MAN FLAT control if necessary.
8. Observe the amplitude display (Figures 16, 17, and 18).

**Requirement 1:** For non-space diversity, less than  $\pm 1.0$  dB slope over the 24-MHz band.

**Requirement 2:** For space diversity, less than  $\pm 1.5$  dB slope over the 24-MHz band.

**Requirement 3:** Positive parabolic (smile) equal to  $0.6 \text{ dB} \pm 0.2 \text{ dB}$  (6 GHz) or  $0.3 \text{ dB} \pm 0.2 \text{ dB}$  (11 GHz).

**Requirement 4:** Smooth response, if present, the ripple component shall not exceed 0.2 dB.

**If the requirement is not met,** using Table G for assistance, sweep each unit to identify defective unit. Replace unit and repeat this procedure.

**If the requirement is still not met,** check the amplitude response of the adaptive slope equalizer using Part 7.3.

**Note:** If any units were replaced during this procedure, go to Flowchart 1 for any additional tests.

9. For space diversity receivers, repeat Steps 5 through 8 for the diversity path.
10. Set the AUTO/MAN switches on the ADAPTIVE SLOPE EQL, the IF AGC AMPL, and, if equipped, the IF COMBINER to AUTO.
11. Disconnect all test equipment and return all connections to normal.
12. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**

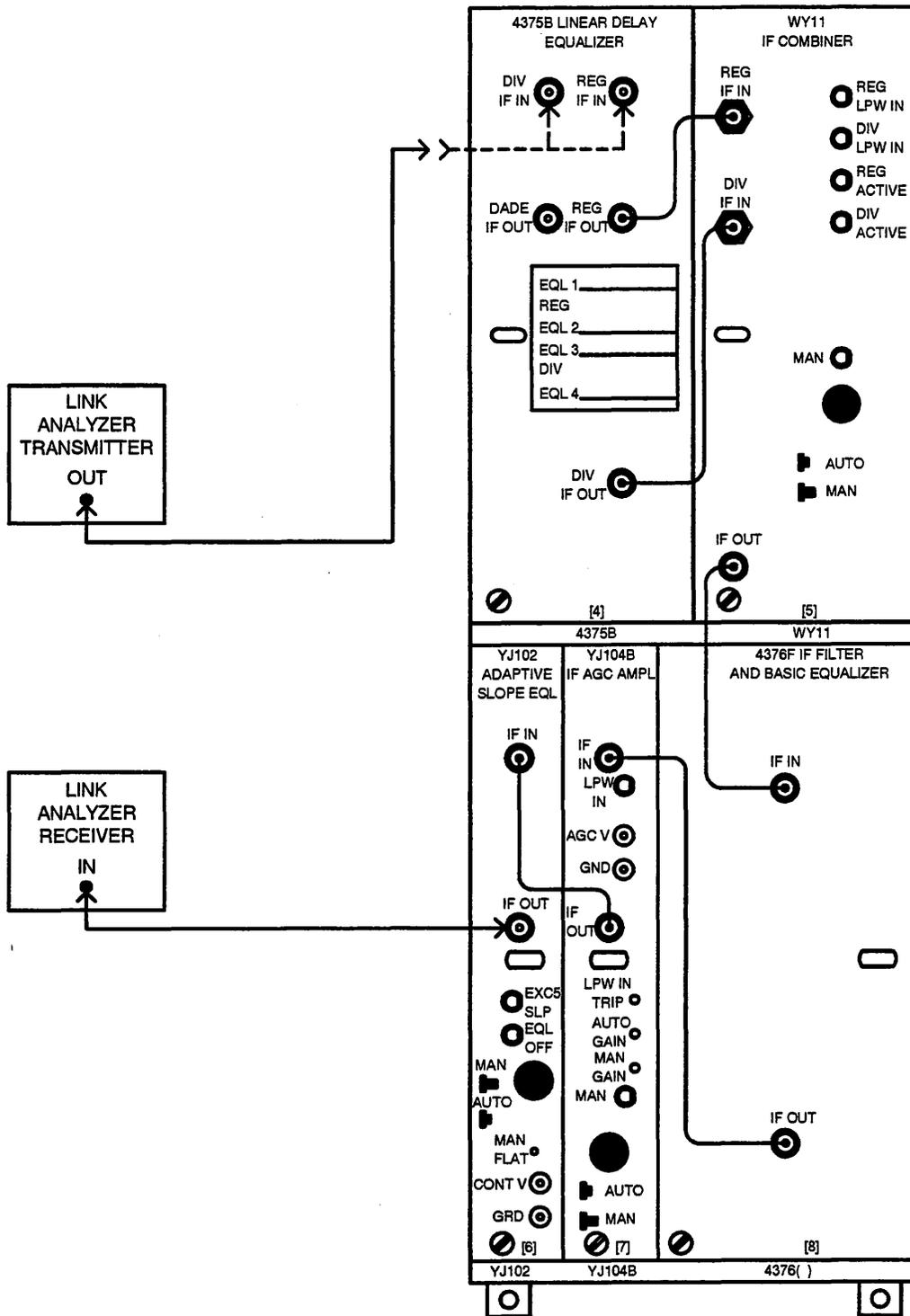
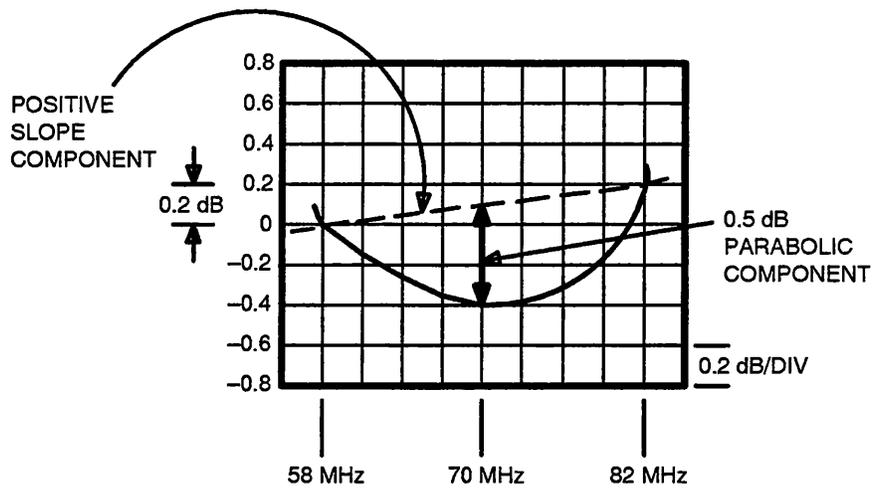


Figure 14-Receiver IF to IF Amplitude Response Checks, Space Diversity





**Note:** There are no ripple components present.

**Figure 16—Example of Typical Receiver IF to IF Amplitude Response**

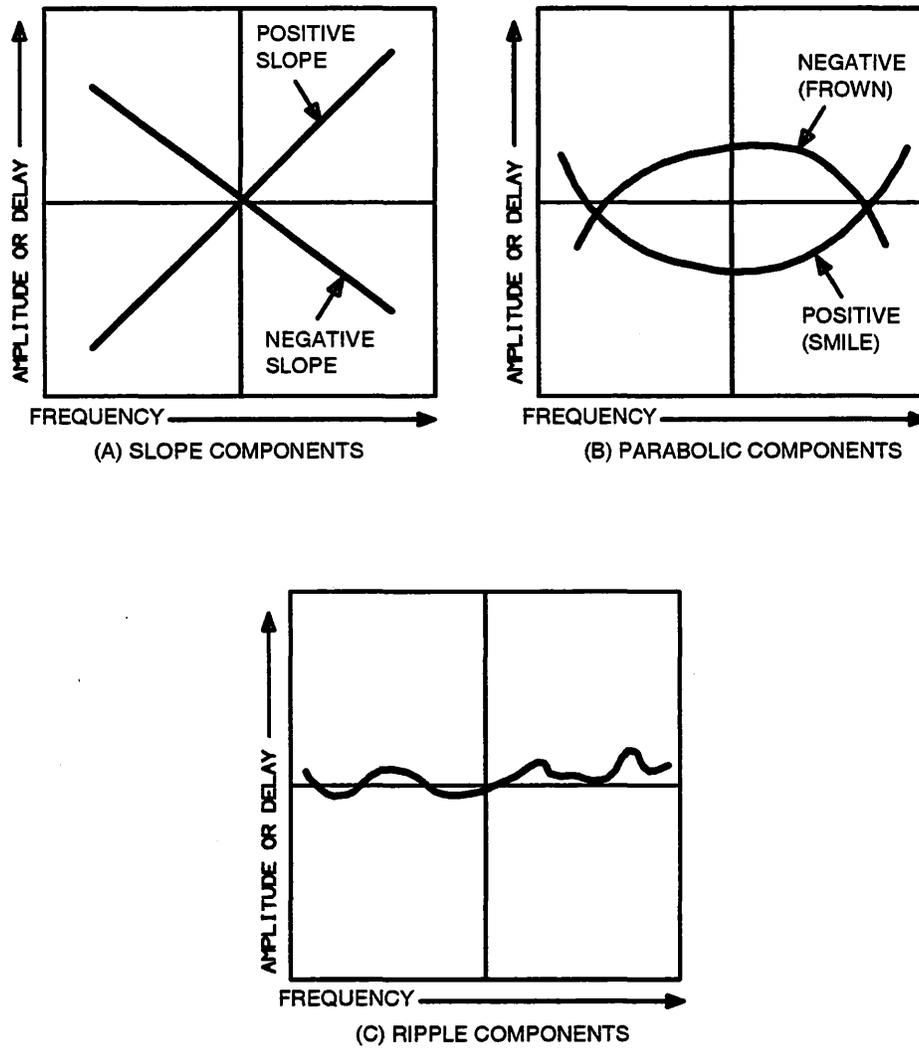
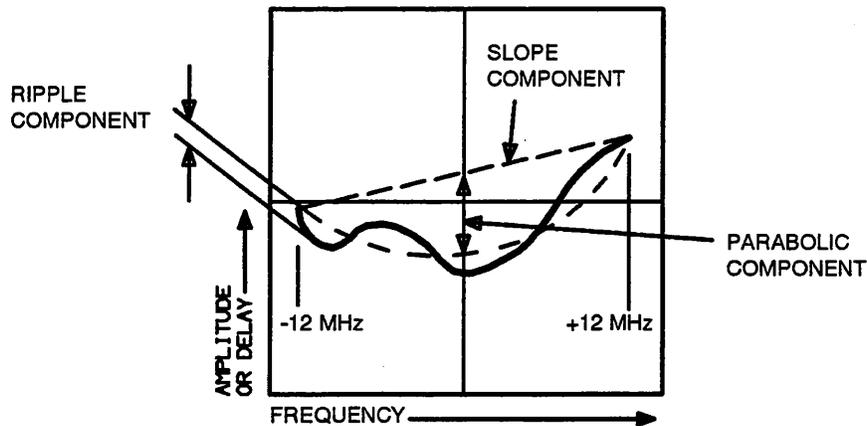


Figure 17-Major Amplitude Distortion Component Shapes



Response Consisting of:

- Positive Slope
- Positive Parabolic
- Ripple

- The **slope** component of a response is determined by drawing an imaginary line between the points of the display at the + and - 12-MHz end points of the swept response. If a ripple or other component happens to peak or dip at the end points, mentally average it out in determining the slope component. The slope component is then the vertical difference between the + and - 12-MHz end points of the imaginary slope line.
- The **parabolic** component is determined by fitting the most likely simple parabolic shape (that is a smile or frown) between the end points of the slope line. When ripple or other distortion components are present, as in this example, the parabolic curve must be mentally averaged through these components. The parabolic content is then the **vertical** distance between the 70-MHz center point on the slope line and the mentally fitted parabolic curve.
- Once the slope and parabolic components are separated out, the **ripple** components are determined by the peak-to-peak deviations from the imaginary line.

**Figure 18—Example of Amplitude Response Defining Slope, Parabolic, and Ripple Components**

<b>TABLE G TYPICAL IF UNIT SLOPE</b>	
<b>CODE</b>	<b>SLOPE LOSS (dB) AT 70 ± 12 MHz</b>
<b>LINEAR DELAY EQUALIZER</b>	
2001A	<0.1
2001B	<0.1
2001C	<0.1
2001D	<0.1
2001E	<0.1
2001F	<0.1
2001G	<0.1
2001H	<0.1
2001J	<0.1
2001K	<0.1
2001L	<0.1
2001M	<0.1
2001N	<0.2
2001P	<0.1
<b>BASIC EQUALIZER</b>	
2002C	<0.2
2002D	<0.2
2002G	<0.2
<b>IF COMBINER*†</b>	
wy11	<0.2
<b>IF FILTER</b>	
1603B	<0.2
<b>IF AGC AMP*</b>	
YJ104B	<0.2
<p>* Operate the AUTO/MAN pushbutton to MAN when testing unit.</p> <p>† Sweep through the active input and disconnect the nonactive input when testing unit.</p>	

## 9. IF COMBINER PERFORMANCE CHECKS

This procedure is used to evaluate the IF COMBINER unit error-free soft switch performance between the regular and diversity inputs. This also checks for the proper DADE between the regular and diversity paths.

To perform this procedure, two continuously variable attenuators are inserted into the regular and diversity paths to the IF COMBINER. The combining and soft-switching features are then checked as follows:

1. **Combining Test:** Equalize the level of the two IF signals, and note the error free performance under steady state conditions.
2. **Soft-Switching Test:** Introduce attenuation in the IF input levels to alternately force the combiner to switch from one side to the other while observing error performance. Then 6-ns delay (4-foot coaxial cable) is inserted in one of the input paths to the combiner. The IF level is again attenuated in the IF input paths, forcing the combiner to switch from one side to the other while observing error performance.

**Prerequisites:** The IF COMBINER level checks are within limits (Parts 4.1 or 4.2).

**Caution:** *This procedure is service-affecting unless the proper manual switching operation has been performed.*

### TEST EQUIPMENT

- Refer to Figure 19.

### PROCEDURE

**Note:** If a combiner fails to meet the requirements of the following tests, either the combiner or the DADEing may be at fault. If replacing the combiner fails to resolve the problem, perform the radio transmission and DADE test in the Maintenance Support manual to help isolate and clear the problem.

1. Verify that service is protected.
2. Establish test connections per Figure 19; ensure both paths are virtually equal.
3. Condition the power meter to measure the expected IF power level (nominal is  $-7$  dBm).
4. Measure and adjust the output power of each attenuator for maximum level (attenuators set at minimum).
5. Increase the attenuation on the path with the highest power to within  $\pm 1$  dB of the other path. Note the values for future reference.
6. Reconnect both the IF IN cables (with test cables and attenuators attached) to the associated IF IN jacks on the IF COMBINER unit (Figure 19).
7. Observe the bar graph performance on the associated digital receiver CHAN CONTR unit.

**Requirement:** No errors in a minimum of 30 seconds.

**If the requirement is not met,** see the note at the start of this procedure.

8. Increase the attenuation at the IF COMBINER input that corresponds to the side that has the green ACTIVE (REG or DIV) indicator lighted.
9. At the point where the ACTIVE indication moves to the other input, observe the error performance on the associated digital receiver CHAN CONTR unit.

**Requirement:** No error activity.

**If the requirement is not met,** see the note at the start of this procedure.

10. Repeat Steps 8 and 9 for the same requirement.
11. Reduce the attenuation on the input that does not have the ACTIVE indicator lighted.
12. At the point where the ACTIVE indication moves to the other input, observe the error performance on the associated digital receiver CHAN CONTR unit.

**Requirement:** No error activity.

**If the requirement is not met,** see the note at the start of this procedure.

13. Repeat Steps 11 and 12 for the same requirement.
14. Connect an additional 4-feet of coaxial cable between the REG IF IN jack on the IF COMBINER and the existing cable and attenuator. This adds 6-ns delay to the REG IF path.
15. Adjust both attenuators to approximately the same positions noted in Step 5.
16. Allow time for the bar graph to stabilize and observe the error performance on the associated CHAN CONTR unit.

**Requirement:** No error activity.

**If the requirement is not met,** see the note at the start of this procedure.

17. Repeat Steps 7 through 13 for the same requirement.
18. Remove the 4-foot cable from the REG IF path and insert it in the DIV IF path. Reconnect the REG IF IN cable.
19. Repeat Steps 7 through 13 for the same requirement.
20. Disconnect all test equipment and return all connections to normal.
21. This test is complete. Return to the reentry point of the procedure that was left to perform this procedure.

**END OF PROCEDURE**

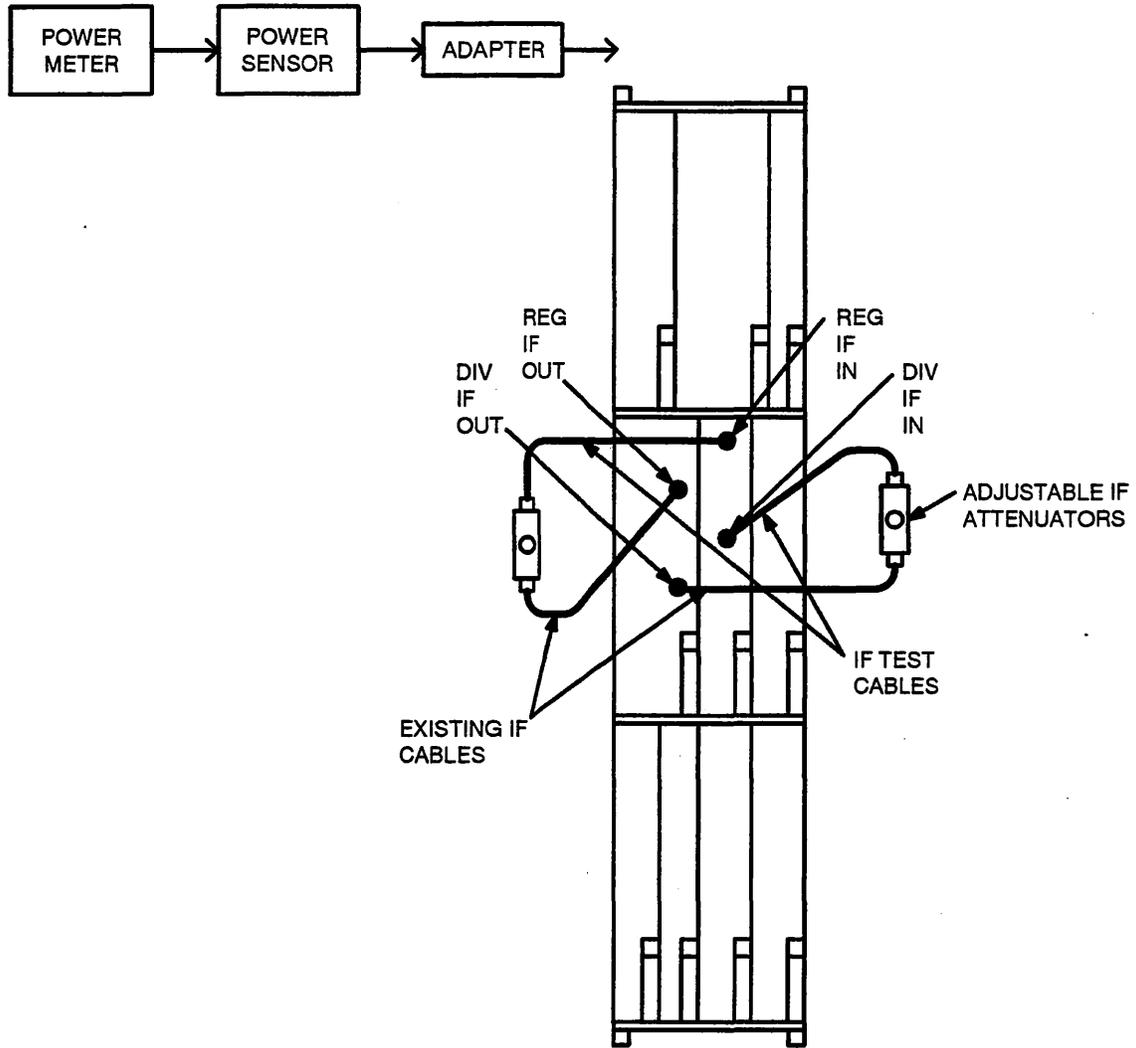


Figure 19-IF COMBINER Performance Test Setup