



**DR 6/11-135A and 135EC
1×N Frequency Diversity
Operation and Maintenance
Radio Receiver
Test Procedures**

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1 Introduction

Procedures for testing and adjusting a DR 6/11-135 radio receiver are included in this tab. These procedures may be referenced from any of these other tabs:

- ANNUAL TESTS
- TROUBLE ISOLATION
- DEGRADED PERFORMANCE.

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 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 radio receiver 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 the Equipment-Alarm Trouble Isolation flowchart.

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.

1.6 ANT DIV Configurations

The phrase "antenna diversity" replaces previously used terms "space diversity" and "angle diversity". A receiver equipped with antenna diversity can be identified by two sets of waveguide networks above the receiver shelf and/or by two semirigid cable inputs (REG and DIV) to the RECEIVER DOWN CONVR & MWV GEN.

An antenna-diversity radio receiver will have one of three cabling configurations associated with the different Intermediate Frequency (IF) Differential Absolute Delay Equalization (DADE) arrangements. They are as follows:

a. Configuration 1

Installer Interface Panel (IIP) DADE jacks are used in the diversity path.

This configuration is used when the diversity (DIV) path was electrically shorter than the regular (REG) path.

b. Configuration 2

IIP DADE jacks are used in the Regular path.

This configuration is used when the regular path was electrically shorter than the diversity path.

c. Configuration 3

IIP DADE jacks are not used in either path.

This configuration can be used when 0 to about 12 feet of DADE cable was required. Any DADE cable is inside the Linear Delay Equalizer plug-in.



CAUTION:

Improper DADE will cause service impairments during fading activity. The test set-up figures in these procedures illustrate Configuration 3. It is important that you retain the appropriate configuration for your bay throughout these test procedures.

DADE cabling involves all the cable connections between the down-converter IF OUT and the linear delay equalizer IF IN, both REG and DIV. The ANT DIV configurations may be different for radio receivers in the same four-channel bay grouping. DADE cable may be inserted in place of the hairpin on the IIP or within the Linear Delay Equalizer plug-in unit.

Reference: O & M Maintenance Support manual—
TESTS tab, 421-101-028.

2 Flowcharts

Three flowcharts are provided to direct you through the receiver procedures.

a. Annual Tests

This is the "flow" you will perform most often. There are two required radio receiver procedures:

- MWV GEN Frequency
- IF Combiner Performance Checks
(if equipped with antenna diversity).

If both requirements are met, you are done with this receiver.

b. Receiver Alignment

Receiver Alignment is the process of performing all the tests necessary to ensure correct signal levels within the radio receiver.

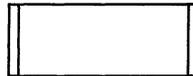
While performing a receiver alignment, you will not need to work directly from the flowchart. All the "flow" information and possible variations from the direct path are written into the individual procedures. A shaded instruction block will direct you to the next procedure in the Receiver Alignment Flowchart. For abnormal conditions you will be directed to other flowcharts.

c. Unit Replacement and Alignment

When most units are replaced, a specific sequence of procedures must be followed. Flowchart 3 will direct you to the required procedures.

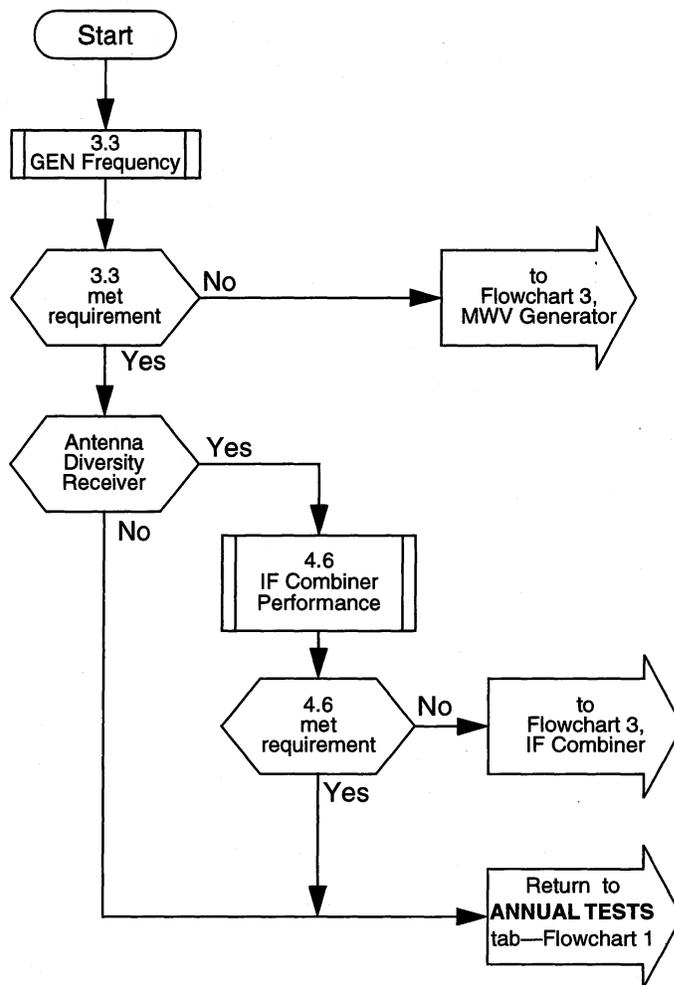
A fourth flowchart (Flowchart 4) will guide you to what needs to be done next.

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".

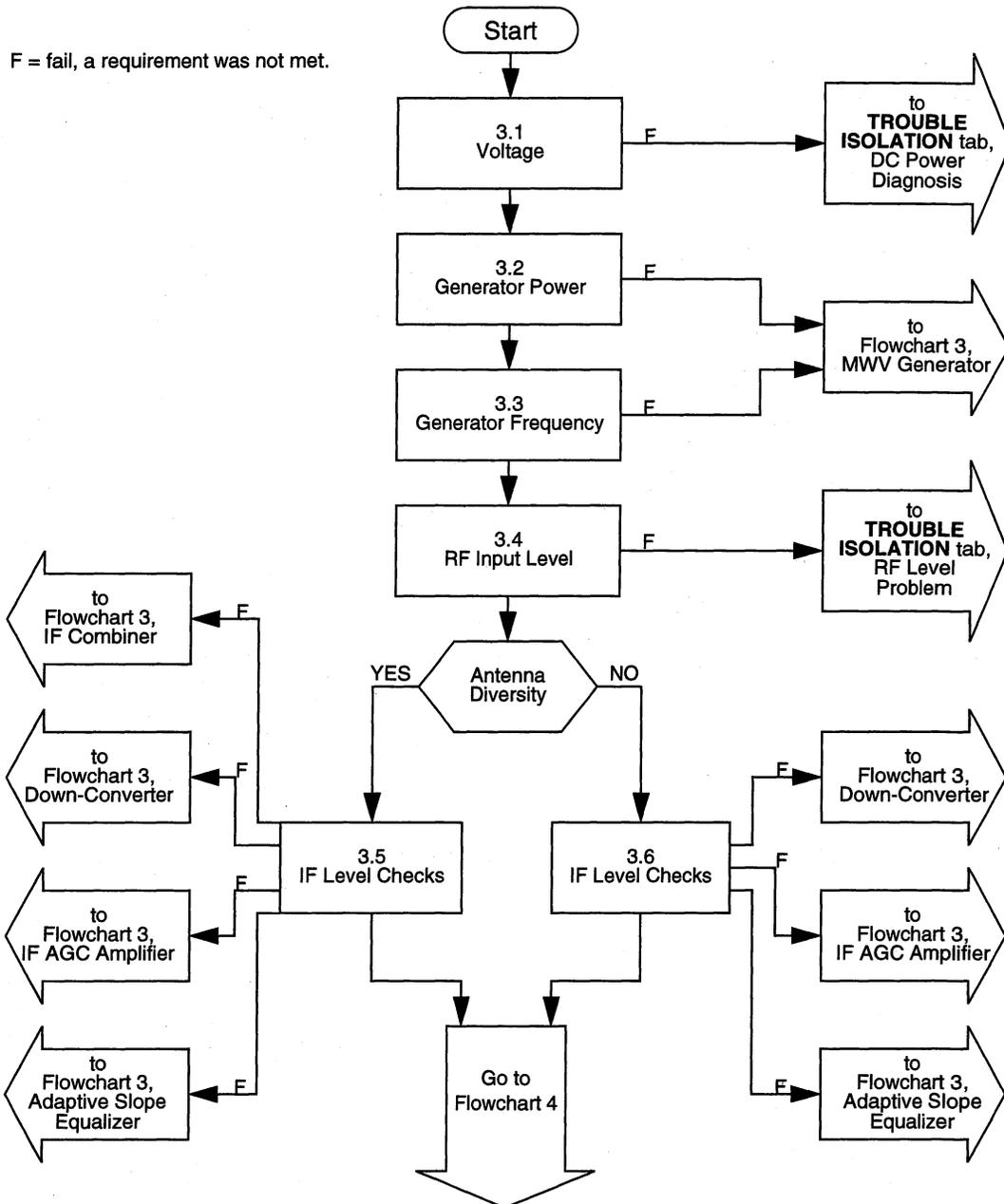
2.1 Annual Tests (Flowchart 1)



Flowchart 1. Annual Tests

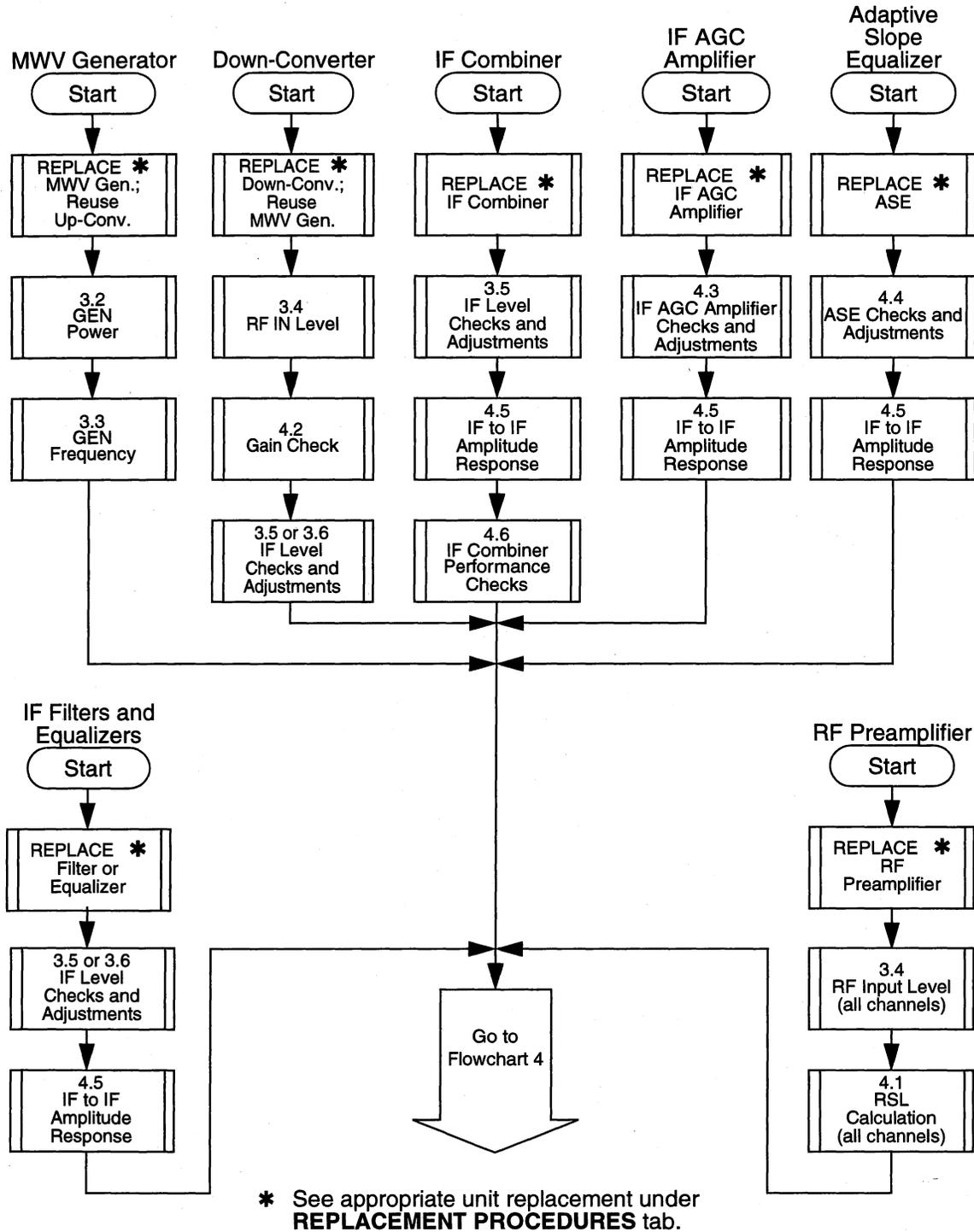
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2.2 Receiver Alignment (Flowchart 2)



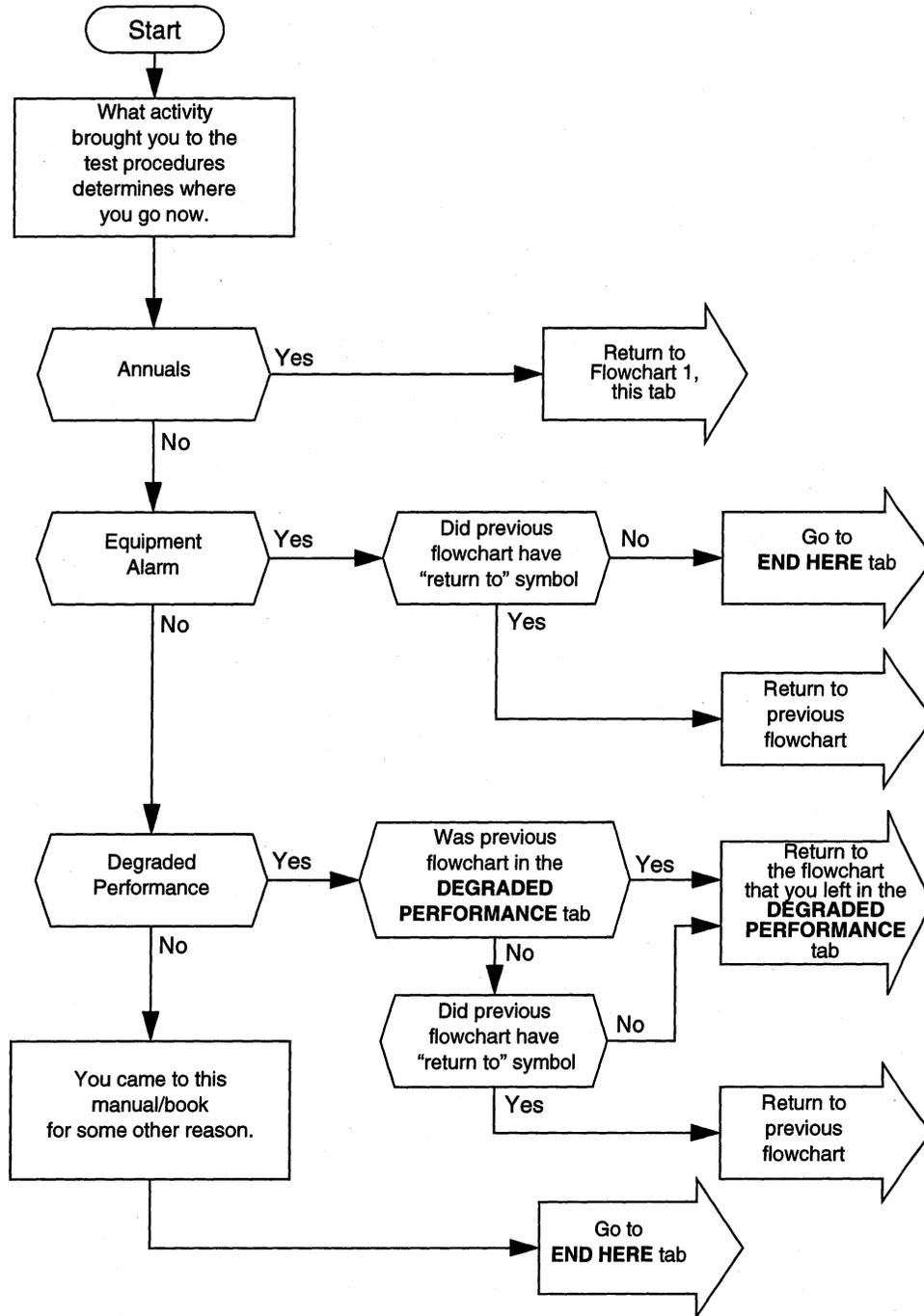
Flowchart 2. Receiver Alignment

2.3 Unit Replacement and Alignment (Flowchart 3)



Flowchart 3. Unit Replacement and Alignment

2.4 Where to Go From Here (Flowchart 4)



Flowchart 4. Where to Go From Here

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3 Alignment

3.1 Voltage Checks



CAUTION:

Service will be interrupted or impaired if you operate any AUTO/MAN switch or make any adjustment on an in-service radio bay.

Step	Procedure
1	<p>On the ALARM AND METER unit:</p> <p>a. Operate the selector switch to RCVR +5V.</p> <p><i>Requirement:</i> Display indicates 5.00 ±0.30.</p> <p>b. Operate the selector switch to RCVR +15V.</p> <p><i>Requirement:</i> Display indicates 15.00 ±0.40.</p> <p>c. Operate the selector switch to RCVR -15VA.</p> <p><i>Requirement:</i> Display indicates -15.00 ±0.40.</p> <p>d. Operate the selector switch to RCVR -15VB.</p> <p><i>Requirement:</i> Display indicates -15.00 ±0.40.</p> <p>e. Operate the selector switch to TRMTR OFF.</p> <p>Were all requirements met?</p> <p>NO - Go to TROUBLE ISOLATION tab, 2.1 DC Power Diagnosis.</p> <p>YES - Test completed.</p> <p><i>Receiver Alignment path</i></p> <div style="border: 1px solid black; padding: 2px; text-align: center;"> <p>Go to Procedure 3.2, MWV GEN Power.</p> </div>

End of Procedure

3.2 MWV GEN Power

This procedure is used to check the output power of the microwave generator portion of the RECEIVER DOWN CONV & MWV GEN unit.

**CAUTION:**

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

**CAUTION:**

SMA connectors damage easily. Finger-start SMA connections for several turns, then use only a torque wrench to tighten.

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 RF between -30 dBm and +10 dBm (about 30 dB). Reference: DRTS tab, 2.3 Entering Offset.
2	On the RECEIVER DOWN CONV & MWV GEN, remove the termination from the GEN MON jack.

3 Connect the test equipment as shown in Figure 1.

Requirement:

- a. RCVR—GEN OVEN indicator not lighted on the ALARM AND METER unit
- b. Power meter display meets Table A level requirement.

Table A. Generator Level Requirements

6-GHz Down-Converter Type	11-GHz Down-Converter Type	GEN MON Level Requirement
4391()		0.0 to -6.0 dBm
4392()		-4.0 to -10.0 dBm
4470()		-5.0 to -13.0 dBm
4471()		-5.0 to -13.0 dBm
	4384()	-1.0 to -9.0 dBm
	4385()	-4.5 to -12.5 dBm
	4472()	-4.0 to -14.0 dBm
	4473()	-4.0 to -14.0 dBm

Are the requirements met?

- NO - Go to Flowchart 3, Unit Replacement and Alignment—MWV Generator.
- YES - Update the RADIO DATA CARD—RCVR “GEN MON PWR”, if necessary.

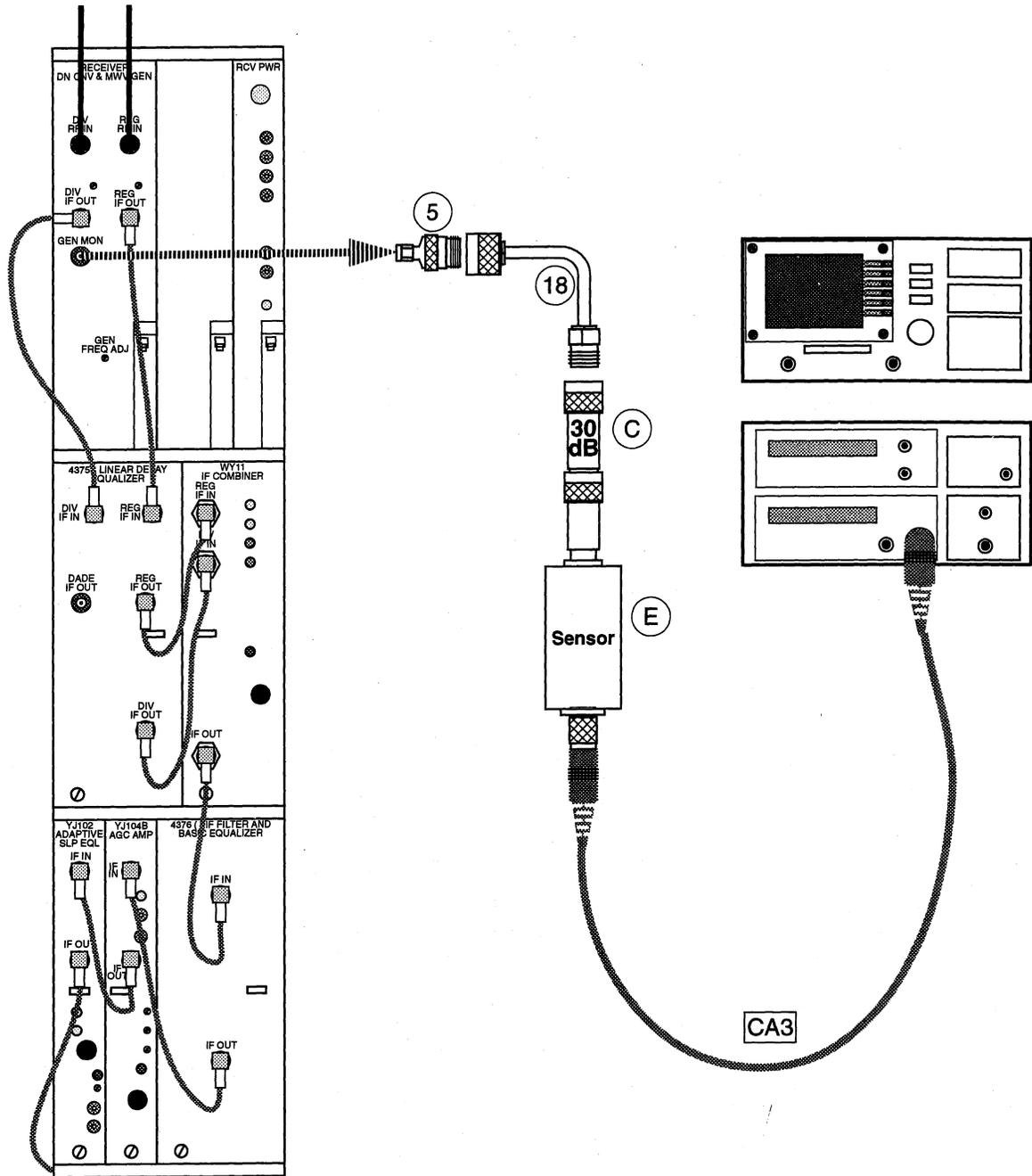
4 Return to the flowchart or procedure that sent you here.

Receiver Alignment path

Go to Procedure 3.3, MWV GEN Frequency.

End of Procedure

This figure illustrates ANT DIV Configuration 3. (Reference: 1.6 ANT DIV Configurations.)



Note:
 This is an antenna-diversity receiver shelf.
 Refer to Figure 2 if you need to see a
 view of a non-diversity shelf.

Figure 1. MWV GEN Power Check

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3.3 MWV GEN Frequency ("Annual")

This procedure is used to check and adjust the output frequency of the microwave generator portion of the RECEIVER DOWN CONVR & MWV GEN.

Prerequisite: RCVR—GEN OVEN indicator not lighted on the ALARM AND METER unit.



CAUTION:

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



CAUTION:

SMA connectors damage easily. Finger-start SMA connections for several turns, then use only a torque wrench to tighten.



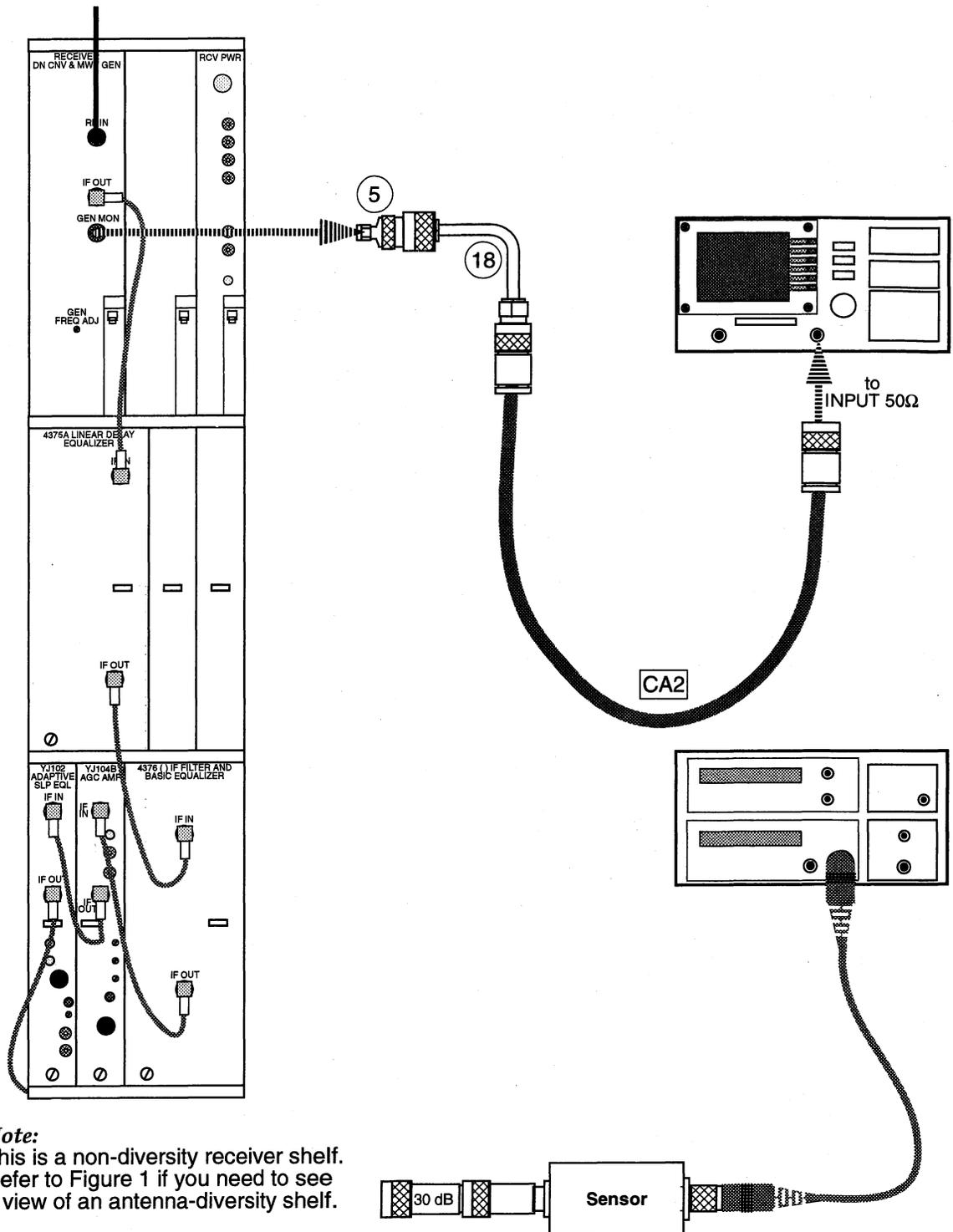
NOTE:

The microwave generator must be warmed up at least 1 hour before making any frequency measurements.

Step	Procedure
1	Connect the test equipment as shown in Figure 2.
2	On the SPECTRUM ANALYZER: <ol style="list-style-type: none"> a. Press the green PRESET key. <p><i>Comment: FREQ COUNTER softkey should be displayed on screen; if it is not, load "GROUP 1" menu.</i></p> <p style="text-align: center;">Reference: DRTS tab, 1.6 Downloading User Programs.</p> <ol style="list-style-type: none"> b. Press FREQ COUNTER softkey. c. Press FREQ 2.9 22 softkey once to select (underline) 22. This will take about 5 seconds. d. Press Resoln softkey. e. Press 1 KHz softkey. f. Read the frequency.

To determine the Oscillator Frequency (f_o) of the microwave generator being tested, match the letter designation on the latch label of the RECEIVER DOWN CONV & MWV GEN with the Latch Label Code column of Table B, C, D, or E and read the frequency from the Oscillator Frequency column.

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Note:
 This is a non-diversity receiver shelf.
 Refer to Figure 1 if you need to see
 a view of an antenna-diversity shelf.

Figure 2. MWV GEN Frequency Check

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Requirement:

- 6 GHz: frequency within ± 15 kHz (± 0.015 MHz) of f_o
- 11 GHz: frequency within ± 30 kHz (± 0.030 MHz) of f_o .

Is the requirement met?

YES - No adjustment is required.

- Go to Step 4.

NO - Go to Step 3.

- 3 On the RECEIVER DOWN CONVR & MWV GEN,
adjust the GEN FREQ ADJ control to meet the following requirements.

Requirement:

- 6 GHz: frequency within ± 3 kHz of f_o
- 11 GHz: frequency within ± 5 kHz of f_o .

Is the requirement met?

YES - Go to Step 4.

NO - Go to Flowchart 3, Unit Replacement and Alignment—MWV Generator.

- 4 Disconnect the test equipment.
- 5 On the RECEIVER DOWN CONVR & MWV GEN,
replace the termination on the GEN MON jack.
- 6 Update the RADIO DATA CARD—RCVR "GEN MON FREQ", if necessary.
- 7 Return to the flowchart or procedure that sent you here.

Receiver Alignment path

Go to Procedure 3.4, RF Input Level.

End of Procedure

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Table B. 6-GHz Regular Frequency Plan

Channel			Up-Converter, Down-Converter, and Microwave Generator		
Number	Center Frequency f_c (kHz)	Sideband	1502() RF Filter, Latch Label, and 141() Gen Code	1503() RF Filter Code	Oscillator Frequency f_o (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 C. 6-GHz Staggered Frequency Plan

Channel			Up-Converter, Down-Converter, and Microwave Generator		
Number	Center Frequency f_c (kHz)	Sideband	1502() RF Filter, Latch Label, and 141() Gen Code	1503() RF Filter Code	Oscillator Frequency f_o (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

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Table D. 11-GHz Regular Frequency Plan

Radio Channel			Up-Converter, Down-Converter, and Microwave Generator	
Number	Center Frequency f_c (kHz)	Sideband	RF Filter, Latch Label, and 142() Gen Code	Oscillator Frequency f_o (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

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Table E. 11-GHz Alternate Frequency Plan

Radio Channel			Up-Converter, Down-Converter, and Microwave Generator	
Number	Center Frequency f_c (kHz)	Sideband	RF Filter, Latch Label, and 142() Gen Code	Oscillator Frequency f_o (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

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3.4 RF Input Level

This procedure is used to check the radio frequency (RF) input level to the down-converter and compare it to the level recorded on the RADIO DATA CARD as CONV RF IN.

Prerequisite: No RCVR—RF PREAMP alarm indicator lighted on the ALARM AND METER unit.



CAUTION:

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



CAUTION:

SMA connectors damage easily. Finger-start SMA connections for several turns, then use only a torque wrench to tighten.

Step	Procedure
	<p><i>Comment: Both types of receivers, antenna-diversity (with antenna diversity) and non-diversity (without antenna diversity), are included in this procedure. Instructions that apply only to antenna-diversity receivers are identified by (ANT DIV). Instructions that apply only to non-diversity receivers are identified by (non-DIV).</i></p>
1	<p>On the RECEIVER DOWN CONVR & MWV GEN:</p> <ul style="list-style-type: none"> ■ (ANT DIV) Remove both semirigid cables between the: <ul style="list-style-type: none"> a. DIV RF IN jack and the OUTPUT jack on the diversity path Isolator/Transducer. b. REG RF IN jack and the OUTPUT jack on the regular path Isolator/Transducer. ■ (non-DIV) Remove the semirigid cable between the RF IN jack and the OUTPUT jack on the Isolator/Transducer.
2	<p>On the TEST SET:</p> <ul style="list-style-type: none"> a. Calibrate the POWER METER, if necessary. <p style="text-align: center;">Reference: DRTS tab, 2.2 Calibration.</p> <ul style="list-style-type: none"> b. Enter the OFFSET (as shown on the POWER SENSOR) for measurement of RF between -30 dBm and +10 dBm (about 30 dB). <p style="text-align: center;">Reference: DRTS tab, 2.3 Entering Offset.</p>

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Comment: In Steps 3 and 4, you will measure the RF input signal level of the REGULAR path (ANT DIV), or the only path (non-DIV).

3 Connect the test equipment as shown in Figure 3.



NOTE:

Do not change the CONV RF IN value recorded on the RADIO DATA CARD unless it is determined necessary. The recorded value was measured during system turnup tests and it matched the calculated down-converter RF IN level. Examples of a condition that might make it necessary to change the recorded CONV RF IN value include the following:

- The RF Preamplifier was replaced with one having different gain.
- The RF Preamplifier was removed when 4300-series down-converters were replaced by 4400 series.
- The output power of the preceding transmitter was permanently changed.

4 On the POWER METER,
observe the display.

Requirement: ± 3.0 dB of the level recorded on the RADIO DATA CARD as RCVR "CONV RF IN" in the REG column.

Was the requirement met?

YES - Note the displayed level as "down-converter RF IN (REG)" for use in the next procedure.

- Go to Step 5.

NO - Go to **TROUBLE ISOLATION** tab,
3.1 RF Level Problem (Receiver).

5 For an antenna-diversity receiver, go to Step 6.
For a non-diversity receiver, go to Step 8.

This figure illustrates ANT DIV Configuration 3. (Reference: 1.6 ANT DIV Configurations.)

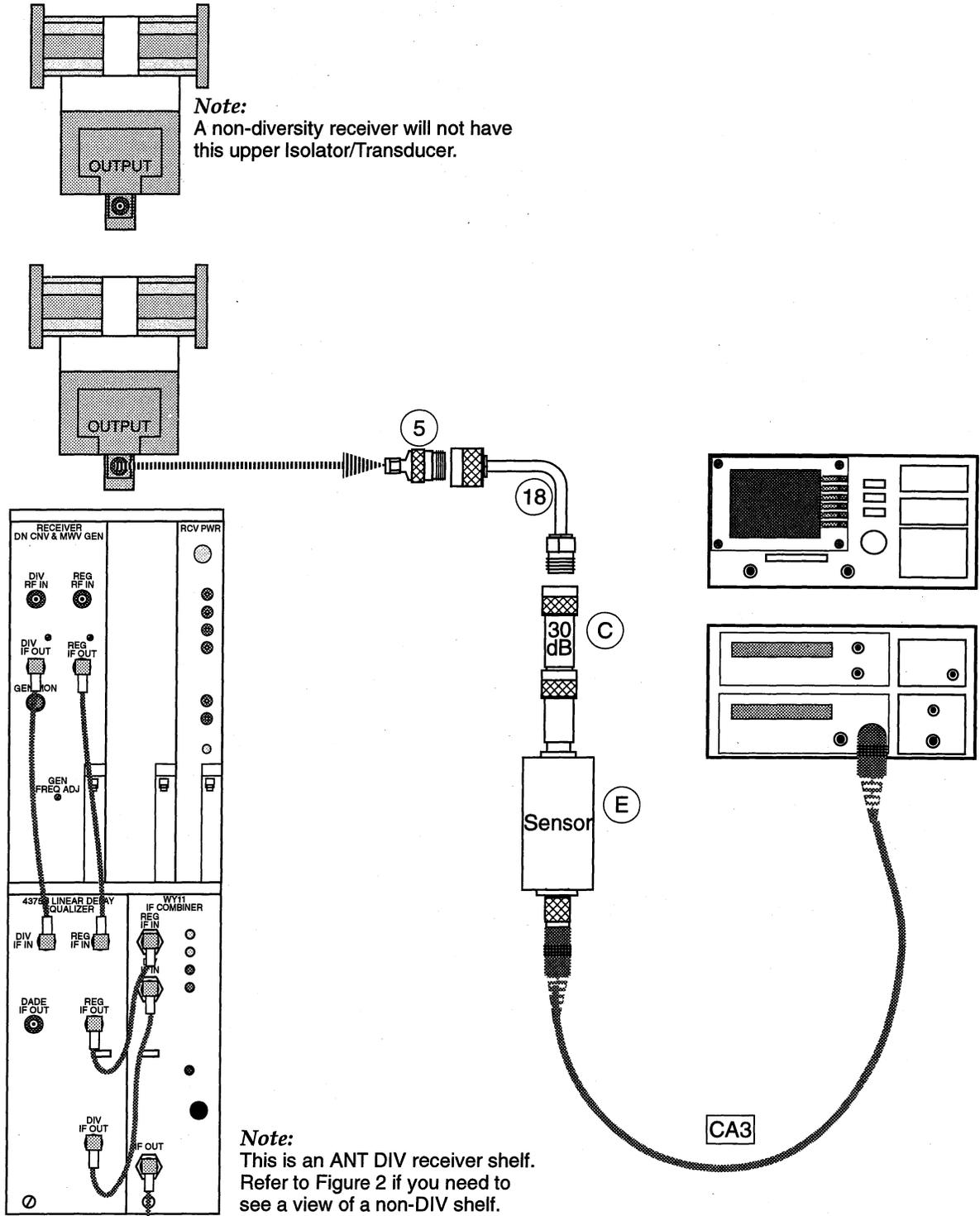


Figure 3. RF Input Level Check

Comment: In Steps 6 and 7, you will measure the RF input signal level of the diversity path.

6 Make the following test connection change to Figure 3:

Move the power meter test connection:

- a. From the OUTPUT jack of the regular path (lower) Isolator/Transducer
- b. To the OUTPUT jack of the diversity path (upper) Isolator/Transducer.

7 On the POWER METER,
observe the display.

Requirement: ± 3.0 dB of the level recorded on the RADIO DATA CARD as RCVR "CONV RF IN" in the DIV column.

Was the requirement met?

YES - Note the displayed level as "down-converter RF IN (DIV)" for use in the next procedure.

- Go to Step 8.

NO - Go to **TROUBLE ISOLATION** tab,
3.1 RF Level Problem (Receiver).

8 Remove the test connection from the radio bay.

9 On the RECEIVER DOWN CONVR & MWV GEN:

- (ANT DIV) Reconnect both semirigid cables between the:
 - a. DIV RF IN jack and the OUTPUT jack on the diversity-path Isolator/Transducer.
 - b. REG RF IN jack and the OUTPUT jack on the regular-path Isolator/Transducer.
- (non-DIV) Reconnect the semirigid cable between the RF IN jack and the OUTPUT jack on the Isolator/Transducer.

10 Return to the flowchart or procedure that sent you here.

Receiver Alignment path (with antenna diversity)

Go to Procedure 3.5,
IF Level Checks and Adjustments.

Receiver Alignment path (without antenna diversity)

Go to Procedure 3.6,
IF Level Checks and Adjustments.

End of Procedure

3.5 IF Level Checks and Adjustments (Antenna Diversity)

This procedure is used on an antenna-diversity radio receiver to check the following IF output levels and, if necessary, update these lines on the RADIO DATA CARD:

- CONV IF OUT
- LIN DEL EQL IF OUT (IF Combiner Input)
- IF COMB IF OUT
- IF FLT BASIC EQL IF OUT
- IF AGC AMPL IF OUT
- ADPT SL EQL IF OUT.

Prerequisite: Procedure 3.4, RF Input Level.



CAUTION:

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

Step	Procedure
1	<p>On the TEST SET:</p> <p style="margin-left: 40px;">a. Calibrate the POWER METER, if necessary.</p> <p style="margin-left: 80px;">Reference: DRTS tab, 2.2 Calibration.</p> <p style="margin-left: 40px;">b. Enter the OFFSET (as shown on the POWER SENSOR) for measurement of IF between -30 dBm and +10 dBm (about 35.7 dB).</p> <p style="margin-left: 40px;">c. Add an additional 0.25 dB to the OFFSET to compensate for loss in the 8-foot BNC - BNC cable.</p> <p style="margin-left: 80px;">Reference: DRTS tab, 2.3 Entering Offset.</p>
2	<p>On the LINEAR DELAY EQUALIZER,</p> <p style="margin-left: 40px;">remove the bay cables connected to:</p> <ul style="list-style-type: none"> ■ The DIV IF OUT jack ■ The REG IF OUT jack.
3	<p>Connect the test equipment as shown in Figure 4.</p>

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This figure illustrates ANT DIV Configuration 3. (Reference: 1.6 ANT DIV Configurations.)

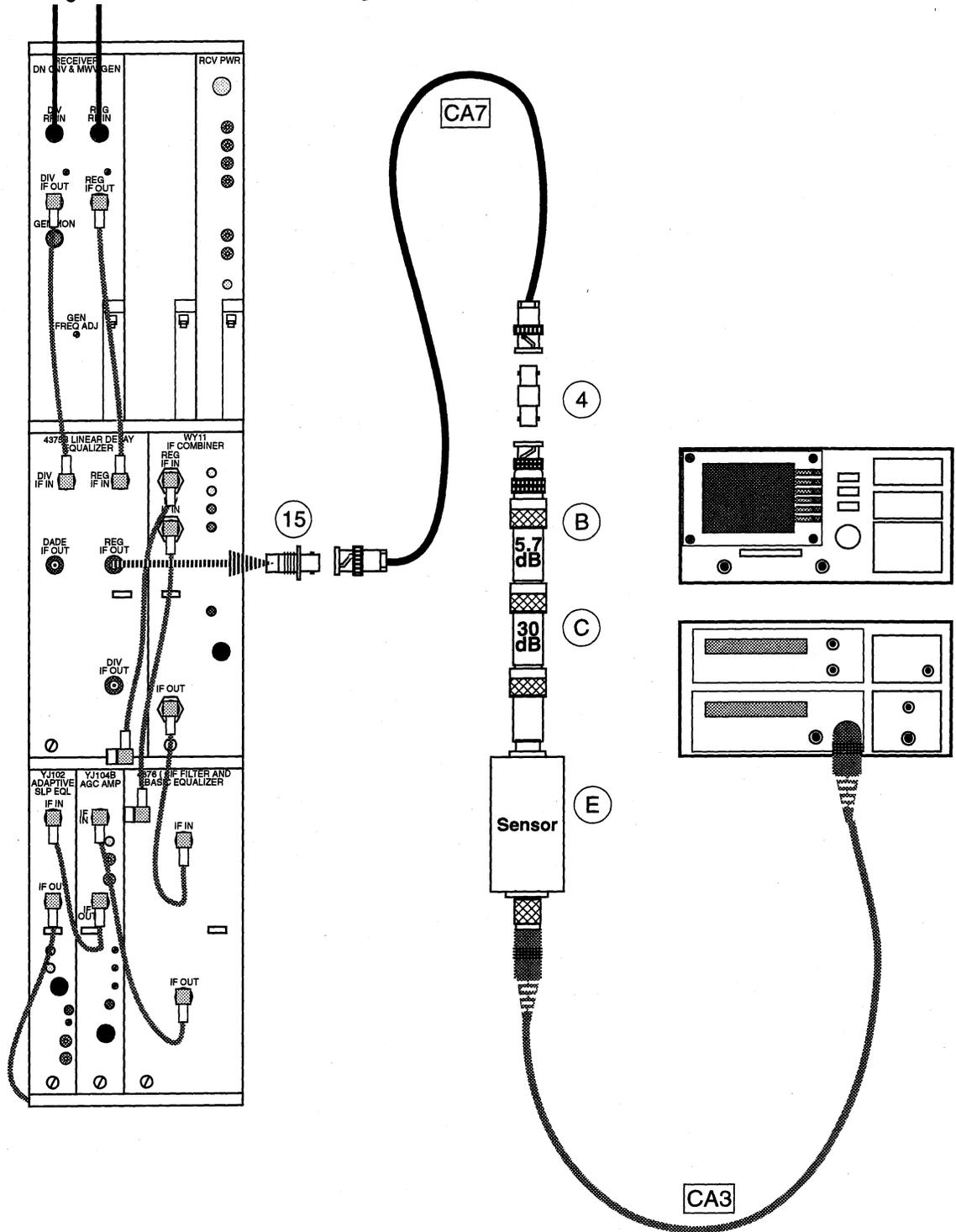


Figure 4. Linear Delay Equalizer IF OUT Level (ANT DIV)

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Comment: Steps 4 through 10 will establish proper levels at the input to the IF COMBINER (linear delay equalizer outputs), for both the REG and DIV paths, by adjusting the down-converter IF LEV ADJ. You will determine the path with the higher level, and adjust it down to match the lower-level path.

- 4 On the RECEIVER DOWN CONVR & MWV GEN:
- a. Read the Latch Label code and proceed according to that code:
 - 4471 (6 GHz) or 4473 (11 GHz):
 1. Verify AGC MAN/AUTO switch is in AUTO.
 2. Go to sub-step b.
 - 4392 (6 GHz) or 4385 (11 GHz):

Go to sub-step b.
 - b. Adjust both IF LEV ADJ controls (REG and DIV) clockwise for at least ten turns.

Comment: There is no stop on the IF LEV ADJ controls, but ten turns of clockwise rotation will increase the level to maximum.

- 5 On the POWER METER,
note the display as "max IF OUT (REG)".
- 6 On the LINEAR DELAY EQUALIZER:
- a. Move the power meter connection to the DIV IF OUT jack.
 - b. Note the power meter display as "max IF OUT (DIV)".
 - c. Connect the power meter to the IF OUT jack on the path with the higher level, if it is not already there.
- 7 Compare the two levels noted as "max IF OUT (REG)" and "max IF OUT (DIV)".
- Are the two levels within 10 dB of each other?
- YES - Go to Step 8.
- NO - Go to Step 9.
- 8 On the RECEIVER DOWN CONVR & MWV GEN:
- a. On the path with the lower level,
leave the IF LEV ADJ control set at maximum.
 - b. On the path with the higher level,
adjust the IF LEV ADJ control for a power meter display within ± 1 dB of the lower level.
 - c. Go to Step 10.

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- 9 On the RECEIVER DOWN CONVR & MWV GEN:
- a. On the path with the lower level,
leave the IF LEV ADJ control set at maximum.
 - b. On the path with the higher level,
adjust the IF LEV ADJ control to reduce the level by 10 dB.
 - c. Go to Step 10.

- 10 On the LINEAR DELAY EQUALIZER:
- a. Connect the power meter to the DIV IF OUT jack and
record the displayed level on the RADIO DATA CARD as
RCVR "LIN DEL EQL IF OUT" in the DIV column.
 - b. Move the power meter connection to the REG IF OUT jack and
record the displayed level on the RADIO DATA CARD as
RCVR "LIN DEL EQL IF OUT" in the REG column.
 - c. Remove the test connection.
 - d. Reconnect the normal bay cables to the IF OUT jacks.

Comment: In Steps 11 through 18, you will check the input-to-output gain, or loss, of each path through the IF Combiner. Next, you will compare the output level with a single input, then compare the output level with both inputs connected.

- 11 On the IF COMBINER:
- a. Verify that the AUTO/MAN switch is set to AUTO.
 - b. Remove the bay cable connected to the DIV IF IN jack.
 - c. Terminate the DIV IF IN jack with a 75-ohm termination.
 - d. Remove the bay cable from the IF OUT jack.

- 12 Connect the test equipment as shown in Figure 5.
- 13 On the POWER METER,
note the displayed level as "combiner IF OUT (REG)".

Requirement: The combiner IF OUT level must meet the requirement of Table F.

On Table F, IF IN (REG or DIV) is the level recorded on the RADIO DATA CARD as RCVR "LIN DEL EQL IF OUT" (REG or DIV column).

Was the requirement met?

YES - Go to Step 14.

NO - Go to Flowchart 3, Unit Replacement and Alignment—IF Combiner.

Table F. IF Combiner Characteristics (Automatic Mode—One Input)

IF IN (REG or DIV)	IF OUT Requirement
+5 dBm	-5.0 dBm \pm 5 dB
0 dBm	-5.0 dBm \pm 5 dB
-5 dBm	-5.0 dBm \pm 5 dB
-10 dBm	-5.0 dBm \pm 5 dB
-15 dBm	-5.0 dBm \pm 5 dB
-17 dBm	-5.0 dBm \pm 5 dB
-18 dBm	-5.5 dBm \pm 5 dB
-19 dBm	-6 dBm \pm 4 dB
-20 dBm	-7 dBm \pm 4 dB
-25 dBm	-11 dBm \pm 4 dB
-30 dBm	-15 dBm \pm 4 dB
-35 dBm	-19 dBm \pm 4 dB
-40 dBm	-23 dBm \pm 4 dB
-45 dBm	-27 dBm \pm 4 dB

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This figure illustrates ANT DIV Configuration 3. (Reference: 1.6 ANT DIV Configurations.)

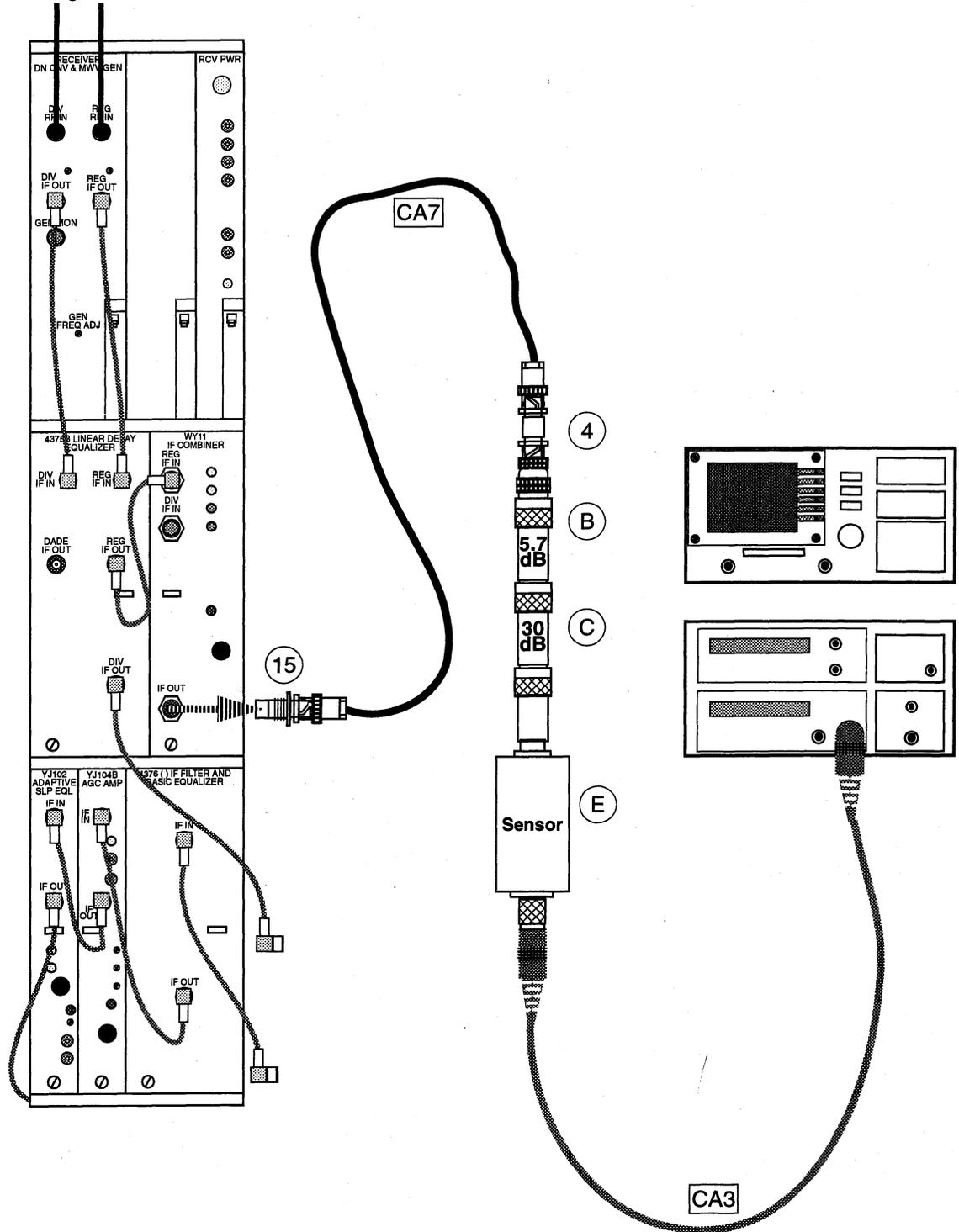


Figure 5. IF Combiner IF OUT Level (ANT DIV)

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- 14 On the IF COMBINER:
- Remove the bay cable from the REG IF IN jack.
 - Move the termination from the DIV IF IN jack to the REG IF IN jack.
 - Connect the normal bay cable to the DIV IF IN jack.
- 15 On the POWER METER,
- note the displayed level as "combiner IF OUT (DIV)".

Requirement: The combiner IF OUT level must meet the requirement of Table F.

IF IN (REG or DIV) is the level recorded on the RADIO DATA CARD as RCVR "LIN DEL EQL IF OUT" (REG or DIV column).

Was the requirement met?

YES - Go to Step 16.

NO - Go to Flowchart 3, Unit Replacement and Alignment—IF Combiner.

- 16 On the IF COMBINER:
- Remove the termination from the REG IF IN jack.
 - Connect the normal bay cable to the REG IF IN jack.
- 17 On the POWER METER,
- observe the display.

Requirement: The level displayed in this step shall be within 6 dB of the higher of the levels noted as "combiner IF OUT (REG or DIV)" in Steps 13 and 15.

Was the requirement met?

YES - Record the displayed level on the RADIO DATA CARD as RCVR "IF COMB IF OUT".

- Go to Step 18.

NO - Go to Flowchart 3, Unit Replacement and Alignment—IF Combiner.

- 18 On the IF COMBINER:
- Remove the power meter test connection from the IF OUT jack.
 - Connect the normal bay cable to the IF OUT jack.

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Comment: With the adjustments completed and all the checks performed, you are ready to measure the levels of both paths at the output of the receiver down-converter and record them on the RADIO DATA CARD.

- 19 On the RECEIVER DOWN CONVR & MWV GEN:
- a. Remove the bay cable and connect the power meter to the REG IF OUT jack as shown in Figure 6.
 - b. Record the level displayed on the power meter as RCVR "CONV IF OUT" in the REG column of the RADIO DATA CARD.
 - c. Remove the bay cable and connect the power meter to the DIV IF OUT jack.
 - d. Reconnect the normal bay cable to the REG IF OUT jack.
 - e. Record the level displayed on the power meter as RCVR "CONV IF OUT" in the DIV column of the RADIO DATA CARD.
 - f. Remove the power meter test connection from the DIV IF OUT jack and reconnect the normal bay cable.

- 20 Compare RCVR "CONV IF OUT" DIV and REG, individually, with the following requirement.

Requirement: RCVR "CONV IF OUT", DIV and REG, levels recorded in Step 19 must meet the requirement listed in Table G for the appropriate down-converter code on the same RF IN line as the level measured in Procedure 3.4, RF Input Level and noted as "down-converter RF IN (REG or DIV)".

Example:

CONV IF OUT levels measured in Step 19 must be $-6.0 \text{ dBm} \pm 6 \text{ dB}$ if the RF IN level measured and noted in Procedure 3.4 was -16 dBm , and the down-converter code is 4392.

Were the requirements met?

YES - Go to Step 21.

NO - Go to Flowchart 3, Unit Replacement and Alignment—Down-Converter.

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Table G. IF OUT vs. RF IN for Receiver Down-Converters (ANT DIV)

RF IN (dBm)	IF OUT Requirement (dBm)			
	6-GHz Units		11-GHz Units	
	4392	4471	4385	4473
0	-6.0 ±6	-3.2 ±6	-6.0 ±6	-4.0 ±8
-5	-6.0 ±6	-3.4 ±6	-6.0 ±6	-4.2 ±8
-10	-6.0 ±6	-3.7 ±6	-6.0 ±6	-4.5 ±8
-15	-6.0 ±6	-3.9 ±6	-6.0 ±6	-4.8 ±8
-20	-6.0 ±6	-4.1 ±6	-6.0 ±6	-5.0 ±8
-24	-6.0 ±6	-4.2 ±6	-6.0 ±6	-5.4 ±8
-25	-7.0 ±6	-4.3 ±6	-7.0 ±6	-5.5 ±8
-26	-8.0 ±3.5	-4.4 ±6	-8.0 ±3.5	-5.6 ±8
-28	-9.0 ±3.5	-4.5 ±6	-9.0 ±3.5	-5.7 ±8
-30	-11.0 ±3.5	-4.6 ±6	-11.0 ±3.5	-5.8 ±8
-32	-13.0 ±3.5	-4.7 ±6	-13.0 ±3.5	-5.9 ±8
-34	-15.0 ±3.5	-4.8 ±6	-15.0 ±3.5	-6.0 ±8
-36	-17.0 ±3.5	-4.8 ±6	-17.0 ±3.5	-6.2 ±8
-38	-19.0 ±3.5	-4.9 ±6	-19.0 ±3.5	-7.0 ±7.5
-40	-21.0 ±3.5	-5.0 ±6	-21.0 ±3.5	-7.5 ±7
-42	-23.0 ±3.5	-5.1 ±6	-23.0 ±3.5	-8.5 ±6
-44	-25.0 ±3.5	-5.2 ±6	-25.0 ±3.5	-9.5 ±5
-46	-27.0 ±3.5	-6.0 ±6	-27.0 ±3.5	-11.0 ±4
-48	-29.0 ±3.5	-7.0 ±5	-29.0 ±3.5	-12.5 ±4
-50	-31.0 ±3.5	-8.0 ±4	-31.0 ±3.5	-14.0 ±4

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This figure illustrates ANT DIV Configuration 3. (Reference: 1.6 ANT DIV Configurations.)

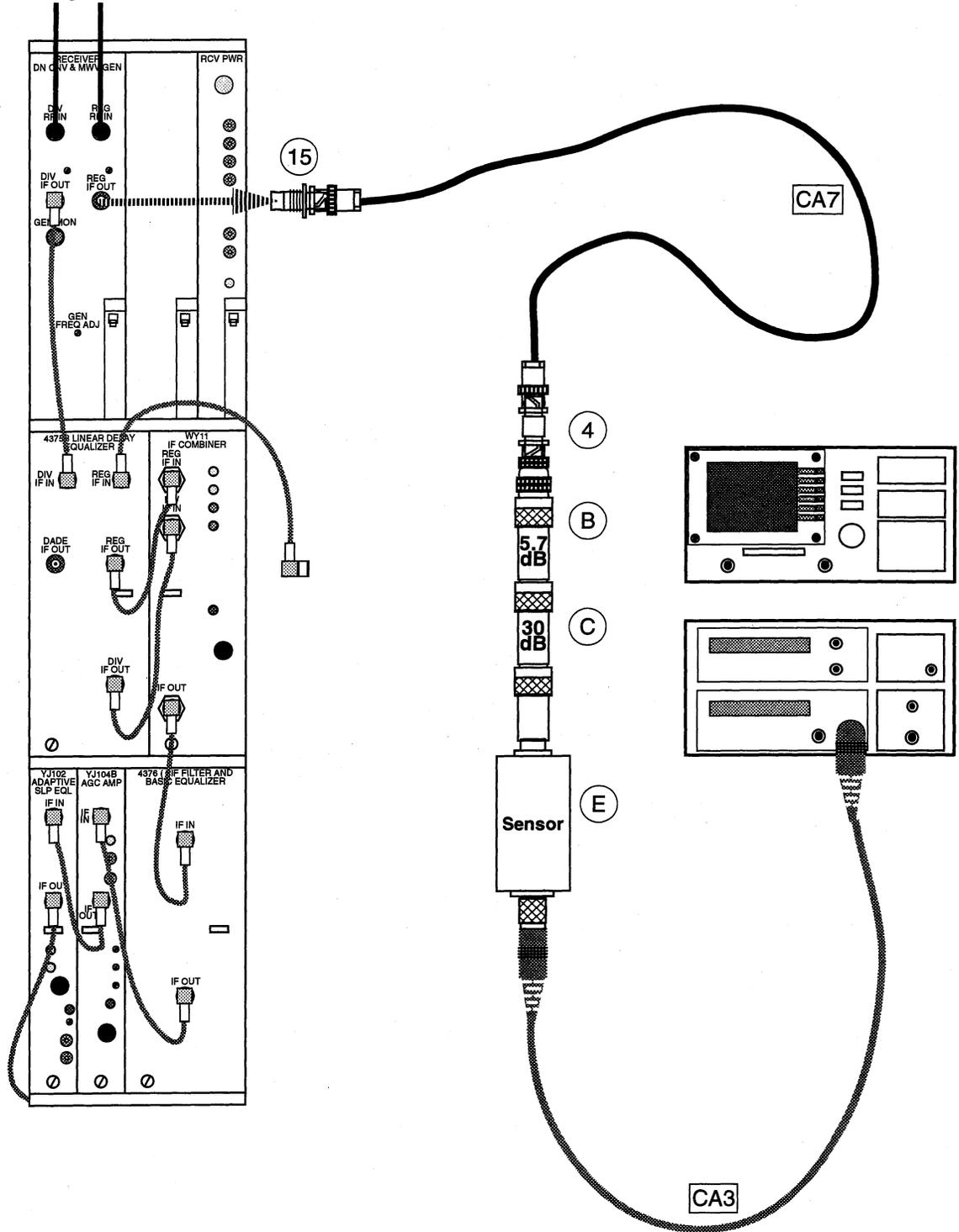


Figure 6. Down-Converter IF OUT Level (ANT DIV)

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Comment: Step 21 will check for the proper losses between the down-converter outputs and the IF Combiner inputs.

- 21 On the RADIO DATA CARD, subtract the level recorded as RCVR "LIN DEL EQL IF OUT" from the level recorded as RCVR "CONV IF OUT" for both the REG and DIV paths.

Requirement: The difference for each path shall be within ± 1 dB of the combined calculated losses of:

- a. All IF DADE cable in that path, consisting of the following:

- KS-19224,L2 cable. (Loss is 6.0 ± 0.6 dB per 100 feet.)

This is the small, white mini-coaxial cable.

In ANT DIV configurations 1 and 2 (refer to 1.6 ANT DIV configurations), there is about 12 feet of this cable from the CONV IF OUT to the DADE hairpin (at the installer interface panel) then to the DADE IF OUT (on the Linear Delay Equalizer unit) and finally to the IF IN, REG or DIV (also on the Linear Delay Equalizer unit). In configuration 3, some of this cable may be coiled inside the Linear Delay Equalizer.

- 731 B cable. (Loss is 3.0 ± 0.3 dB per 100 feet.)

This is the large, gray coaxial cable.

Any length of this cable can be used in place of the DADE hairpin in ANT DIV configurations 1 and 2 (refer to 1.6 ANT DIV configurations). If the length is not recorded, estimate it.

- 728 B or 734 A cable. (Loss is 2.2 ± 0.22 dB per 100 feet.)

This gray cable may be used in place of the 731 B (listed above) in ANT DIV configurations 1 and 2.

- b. Any equalizer(s) in each path, per Table H.

Was the requirement met?

YES - Go to Step 22.

NO - Recheck codes of each delay equalizer.

- Recheck DADE cable lengths.

- Resolve the level discrepancy.

- Go to Step 22.

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Table H. Linear Delay Equalizer Loss

Equalizer Code	Insertion Loss (dB)
2001A	1.1 ±0.2
2001B	1.1 ±0.2
2001C	1.7 ±0.4
2001D	1.2 ±0.4
2001E	1.7 ±0.4
2001F	1.4 ±0.4
2001G	1.4 ±0.4
2001H	0.4 ±0.2
2001J	1.5 ±0.4
2001K	0.4 ±0.2
2001L	1.5 ±0.4
2001M	0.6 ±0.2
2001N	3.2 ±0.4
2001P	0.8 ±0.2

You may have to remove the Linear Delay Equalizer plug-in to determine which, if any, equalizers are installed.

Comment: Steps 22 through 24 will check the IF output level of the IF FILTER AND BASIC EQUALIZER.

- 22 On the IF FILTER AND BASIC EQUALIZER:
- a. Remove the bay cable connected to the IF OUT jack.
 - b. Connect the power meter to the IF OUT jack as shown in Figure 7.
- 23 On the POWER METER,
- note the displayed level as "IF FLT BASIC EQL IF OUT".
- 24 Compare the level noted as "IF FLT BASIC EQL IF OUT" with the level recorded on the RADIO DATA CARD as RCVR "IF COMB IF OUT".

Requirement: The difference shall be within ± 1 dB of the Combined Loss listed below in Table I for the equipped equalizer and filter.

Table I. Basic Equalizer and IF Filter Losses

Equalizer Code	Insertion Loss (dB)	Filter Code	Insertion Loss (dB)	Combined Loss (dB)
2002C	4.4 \pm 0.5	1603B	7.0 \pm 0.5	11.4
2002D	4.1 \pm 0.5	1603B	7.0 \pm 0.5	11.1
2002E	5.6 \pm 0.5	1603B	7.0 \pm 0.5	12.6

You may have to remove the IF FILTER AND BASIC EQUALIZER plug-in to determine which equalizer and filter are installed.

Was the requirement met?

- YES - Update the RADIO DATA CARD—RCVR "IF FLT BASIC EQL IF OUT".
- Go to Step 25.
- NO - Recheck the codes of the equalizer and filter.
- Resolve the level discrepancy.
 - Update the RADIO DATA CARD—RCVR "IF FLT BASIC EQL IF OUT".
 - Go to Step 25.

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This figure illustrates ANT DIV Configuration 3. (Reference: 1.6 ANT DIV Configurations.)

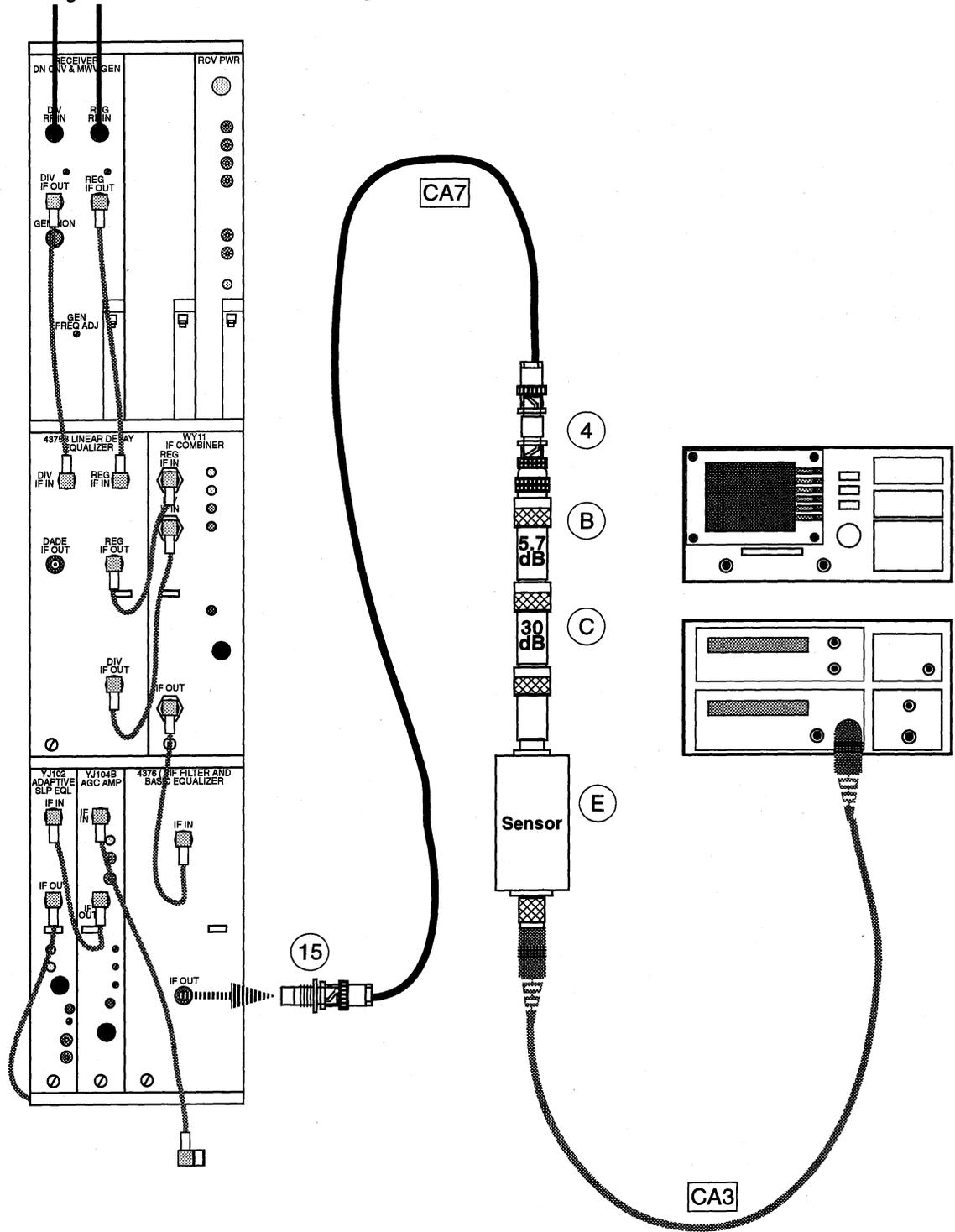


Figure 7. IF Filter and Basic Equalizer IF OUT Level (ANT DIV)

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- 25 On the IF FILTER AND BASIC EQUALIZER:
- Remove the power meter test connection from the IF OUT jack.
 - Connect the normal bay cable to the IF OUT jack.

Comment: Step 26 will check and adjust the IF output level of the IF AGC AMPL.

- 26 On the IF AGC AMPL:
- Remove the bay cable from the IF OUT jack.
 - Verify that the MAN/AUTO switch is in the AUTO position.
 - Connect the power meter to the IF OUT jack as shown in Figure 8.
 - While observing the power meter display, adjust the AUTO GAIN control for the following requirement.

Requirement: $-2.0 \text{ dBm} \pm 0.2 \text{ dB}$.

Was the requirement met?

YES - Update the RADIO DATA CARD—RCVR
"IF AGC AMPL IF OUT".

- Go to Step 27.

NO - Go to Flowchart 3, Unit Replacement and
Alignment—IF AGC Amplifier.

- 27 On the IF AGC AMPL:
- Remove the power meter test connection from the IF OUT jack.
 - Connect the normal bay cable to the IF OUT jack.

- 28 On the ALARM AND METER unit:
- Set the selector switch to RCVR—AGC V.
 - Update the RADIO DATA CARD—RCVR "AGC V NORMAL" with the displayed voltage.
 - Set the selector switch to TRMTR—OFF.

This figure illustrates ANT DIV Configuration 3. (Reference: 1.6 ANT DIV Configurations.)

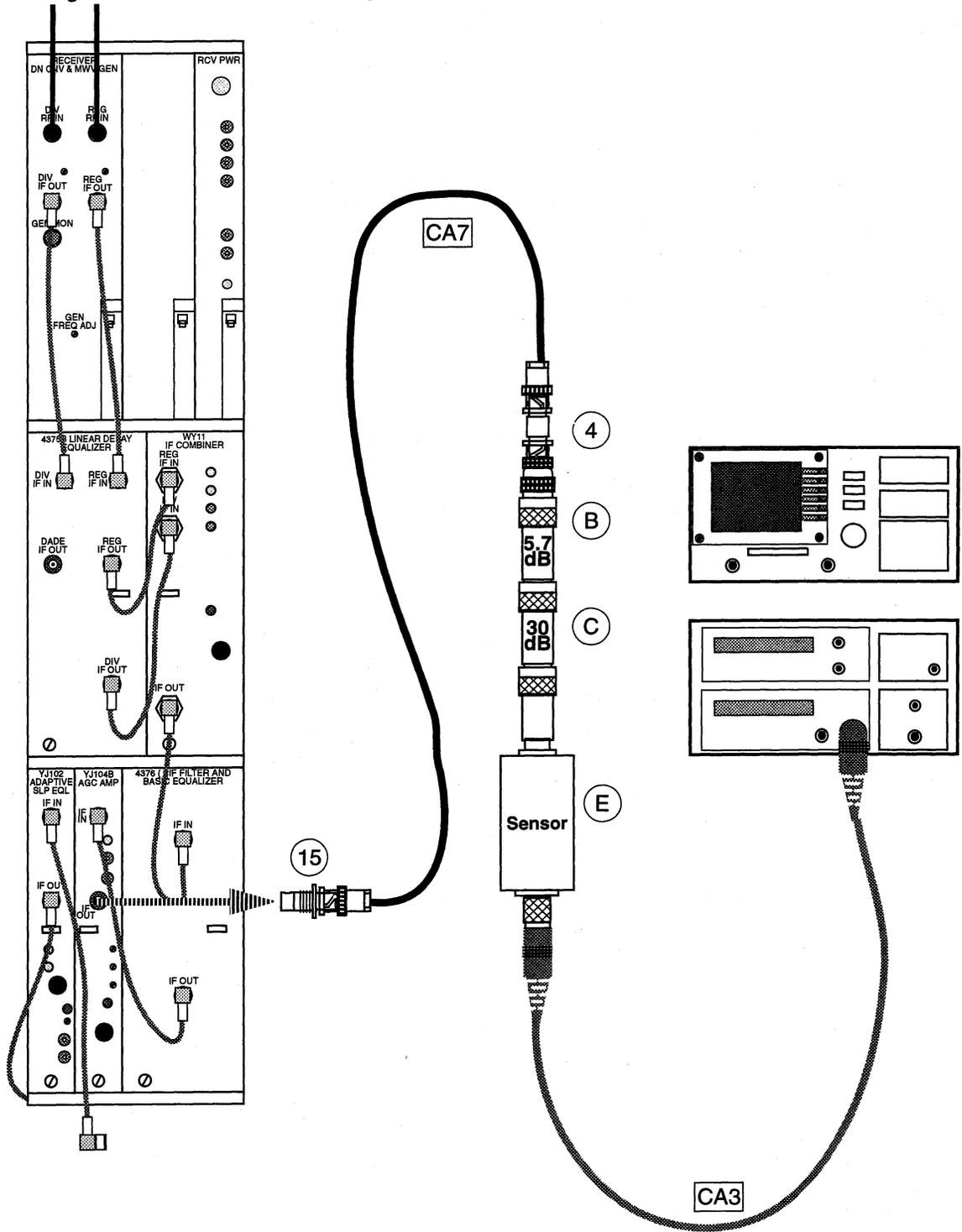


Figure 8. IF AGC Amplifier IF OUT Level (ANT DIV)

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Comment: Steps 29 and 30 will check the IF output level of the adaptive slope equalizer.

- 29 On the ADAPTIVE SLOPE EQL:
- a. Remove the bay cable connected to the IF OUT jack.
 - b. Verify that the MAN/AUTO switch is in the AUTO position.
 - c. Connect the power meter to the IF OUT jack as shown in Figure 9.

- 30 On the POWER METER,
observe the display.

Requirement: $-2.0 \text{ dBm} \pm 0.5 \text{ dB}$.

Was the requirement met?

YES - Update the RADIO DATA CARD—
RCVR "ADPT SL EQL IF OUT".

- Go to Step 31.

NO - Go to Flowchart 3, Unit Replacement and
Alignment—Adaptive Slope Equalizer.

- 31 On the ADAPTIVE SLOPE EQL:
- a. Remove the power meter test connection from the IF OUT jack.
 - b. Connect the normal bay cable to the IF OUT jack.
- 32 Go to Flowchart 4 (this tab).

Receiver Alignment path (with antenna diversity)

Receiver Alignment completed.

End of Procedure

This figure illustrates ANT DIV Configuration 3. (Reference: 1.6 ANT DIV Configurations.)

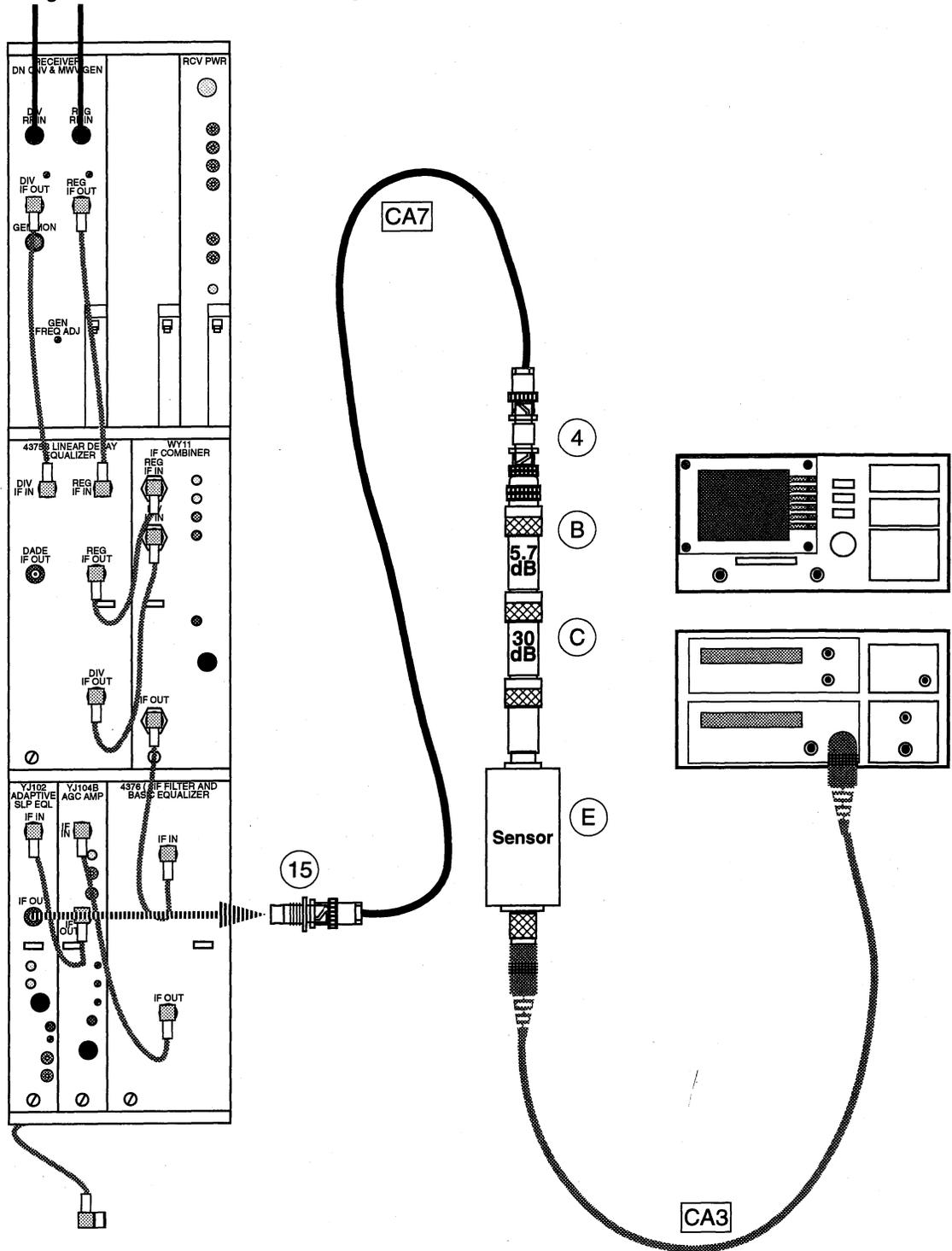


Figure 9. Equalizer IF OUT Level (ANT DIV)

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3.6 IF Level Checks and Adjustments (Non-Diversity)

This procedure is used on a non-diversity radio receiver to check the following IF output levels and, if necessary, update these entries on the RADIO DATA CARD.

- CONV IF OUT
- LIN DEL EQL IF OUT
- IF FLT BASIC EQL IF OUT
- IF AGC AMPL IF OUT
- ADPT SL EQL IF OUT.

Prerequisite: Procedure 3.4, RF Input Level.



CAUTION:

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

Step	Procedure
1	<p>On the TEST SET:</p> <ul style="list-style-type: none"> a. Calibrate the POWER METER, if necessary. <p style="text-align: center;">Reference: DRTS tab, 2.2 Calibration.</p> <ul style="list-style-type: none"> 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. <p style="text-align: center;">Reference: DRTS tab, 2.3 Entering Offset.</p> <p><i>Comment: Steps 2 through 5 will check the IF output level of the down-converter.</i></p>
2	<p>On the RECEIVER DOWN CONVR & MWV GEN, remove the bay cable from the IF OUT jack.</p>
3	<p>Connect the test equipment as shown in Figure 10.</p>

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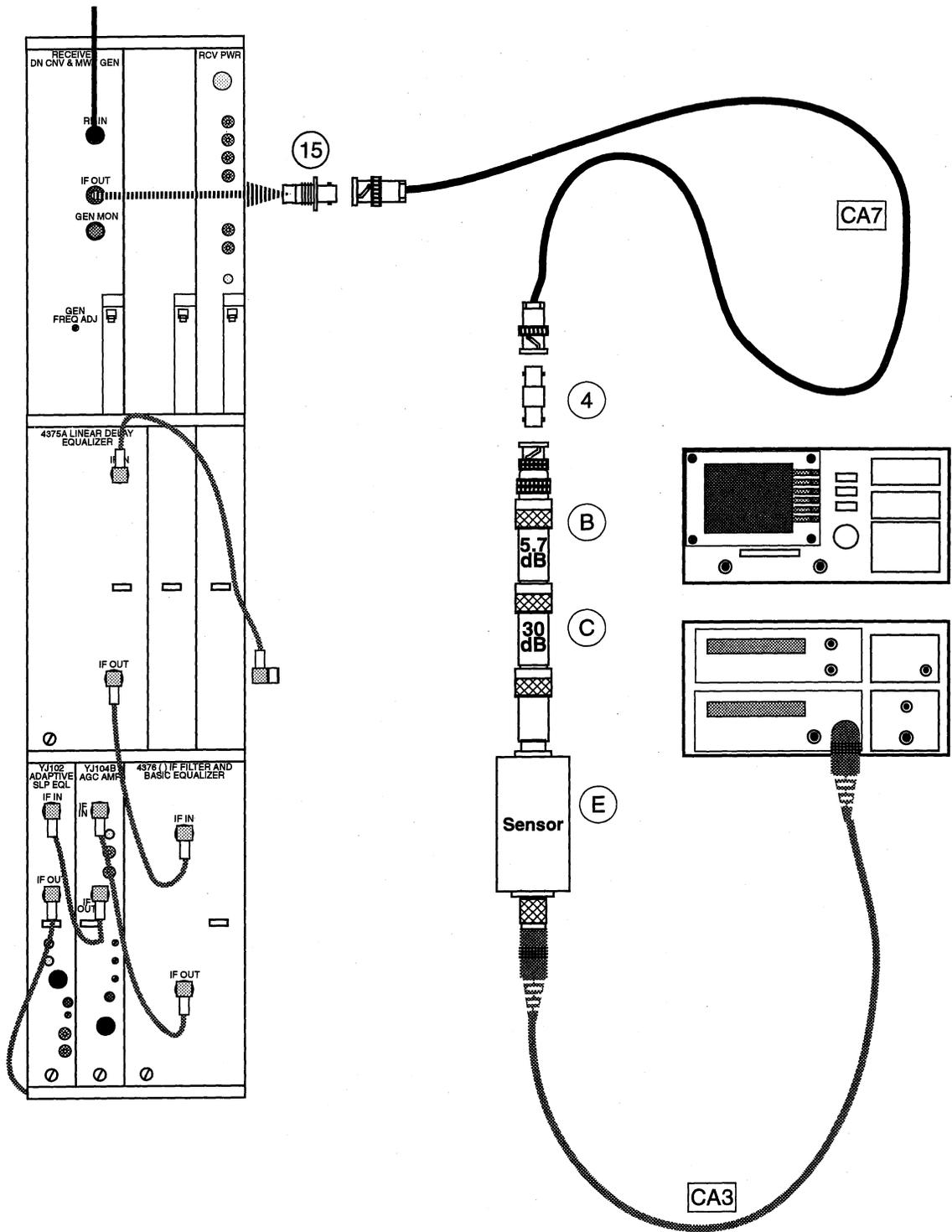


Figure 10. Down-Converter IF OUT Level (Non-DIV)

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- 4 On the RECEIVER DOWN CONVR & MWV GEN,
- check the Latch Label code and proceed with the appropriate unit.
- 4391 (6 GHz) or 4384 (11 GHz) unit:
 - a. Observe the power meter display.
- Requirement:** The displayed IF level must be within the range shown on Table J for the appropriate down-converter and on the same RF IN line as the level measured and noted as "down-converter RF IN (REG)" in Procedure 3.4, RF Input Level.
- b. Go to Step 5.
- 4470 (6 GHz) or 4472 (11 GHz) unit:
 - a. Verify the AGC MAN/AUTO switch is in AUTO.
 - b. Adjust the IF LEV ADJ control for maximum output on the power meter display.
- Requirement:** The displayed IF level must be within the range shown on Table J for the appropriate down-converter and on the same RF IN line as the level measured and noted as "down-converter RF IN (REG)" in Procedure 3.4, RF Input Level.
- 4470 (6 GHz) unit:

Readjust the IF LEV ADJ control for -5 dBm on the power meter display, but if -5 dBm cannot be obtained, set the control for maximum output.
 - 4472 (11 GHz) unit:

Readjust the IF LEV ADJ control for -11 dBm on the power meter display, but if -11 dBm cannot be obtained, set the control for maximum output.
- c. Go to Step 5.
- 5 Were the requirements met?
- YES - Update the RADIO DATA CARD—RCVR "CONV IF OUT".
- Go to Step 6.
- NO - Go to Flowchart 3, Unit Replacement and Alignment—Down-Converter.
- 6 On the RECEIVER DOWN CONVR & MWV GEN:
- a. Remove the power meter test connection from the IF OUT jack.
 - b. Connect the normal bay cable to the IF OUT jack.

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Table J. IF OUT vs. RF IN for Receiver Down-Converters (Non-DIV)

RF IN (dBm)	IF OUT Requirement (dBm)			
	6-GHz Units		11-GHz Units	
	4391	4470	4384	4472
0	-3.0 ±6	-3.2 ±6	-3.0 ±6	-4.0 ±8
-5	-3.0 ±6	-3.4 ±6	-3.0 ±6	-4.2 ±8
-10	-3.0 ±6	-3.7 ±6	-3.0 ±6	-4.5 ±8
-15	-3.0 ±6	-3.9 ±6	-3.0 ±6	-4.8 ±8
-20	-3.0 ±6	-4.1 ±6	-3.0 ±6	-5.0 ±8
-24	-3.0 ±6	-4.2 ±6	-3.0 ±6	-5.4 ±8
-25	-4.0 ±6	-4.3 ±6	-4.0 ±6	-5.5 ±8
-26	-5.0 ±3.5	-4.4 ±6	-5.0 ±3.5	-5.6 ±8
-28	-6.0 ±3.5	-4.5 ±6	-6.0 ±3.5	-5.7 ±8
-30	-8.0 ±3.5	-4.6 ±6	-8.0 ±3.5	-5.8 ±8
-32	-10.0 ±3.5	-4.7 ±6	-10.0 ±3.5	-5.9 ±8
-34	-12.0 ±3.5	-4.8 ±6	-12.0 ±3.5	-6.0 ±8
-36	-14.0 ±3.5	-4.8 ±6	-14.0 ±3.5	-6.2 ±8
-38	-16.0 ±3.5	-4.9 ±6	-16.0 ±3.5	-7.0 ±7.5
-40	-18.0 ±3.5	-5.0 ±6	-18.0 ±3.5	-7.5 ±7
-42	-20.0 ±3.5	-5.1 ±6	-20.0 ±3.5	-8.5 ±6
-44	-22.0 ±3.5	-5.2 ±6	-22.0 ±3.5	-9.5 ±5
-46	-24.0 ±3.5	-6.0 ±6	-24.0 ±3.5	-11.0 ±4
-48	-26.0 ±3.5	-7.0 ±5	-26.0 ±3.5	-12.5 ±4
-50	-28.0 ±3.5	-8.0 ±4	-28.0 ±3.5	-14.0 ±4

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Comment: Steps 7 through 9 will check the IF output level of the Linear Delay Equalizer. You will subtract the measured output level from the recorded CONV IF OUT level, and compare the difference with the calculated loss of the installed Linear Delay Equalizer(s).

- 7 On the LINEAR DELAY EQUALIZER:
- a. Remove the bay cable from the IF OUT jack.
 - b. Connect the power meter to the IF OUT jack as shown in Figure 11.
- 8 On the POWER METER,
- observe the displayed level.
- 9 Compare the level displayed in Step 8 with the level recorded on the RADIO DATA CARD as "CONV IF OUT".

Requirement: The difference shall be within ± 1 dB of the calculated loss listed in Table K for the equipped equalizer(s).

Table K. Linear Delay Equalizer Loss

Equalizer Code	Insertion Loss (dB)	Equalizer Code	Insertion Loss (dB)
2001A	1.1 \pm 0.2	2001H	0.4 \pm 0.2
2001B	1.1 \pm 0.2	2001J	1.5 \pm 0.4
2001C	1.7 \pm 0.4	2001K	0.4 \pm 0.2
2001D	1.2 \pm 0.4	2001L	1.5 \pm 0.4
2001E	1.7 \pm 0.4	2001M	0.6 \pm 0.2
2001F	1.4 \pm 0.4	2001N	3.2 \pm 0.4
2001G	1.4 \pm 0.4	2001P	0.8 \pm 0.2

You may have to remove the Linear Delay Equalizer plug-in to determine which equalizers are installed.

Was the requirement met?

- YES** - Update the RADIO DATA CARD—RCVR "LIN DEL EQL IF OUT".
- Go to Step 10.
- NO** - Recheck codes and losses of each delay equalizer.
- Resolve the level discrepancy and update the RADIO DATA CARD—RCVR "LIN DEL EQL IF OUT".
 - Go to Step 10.

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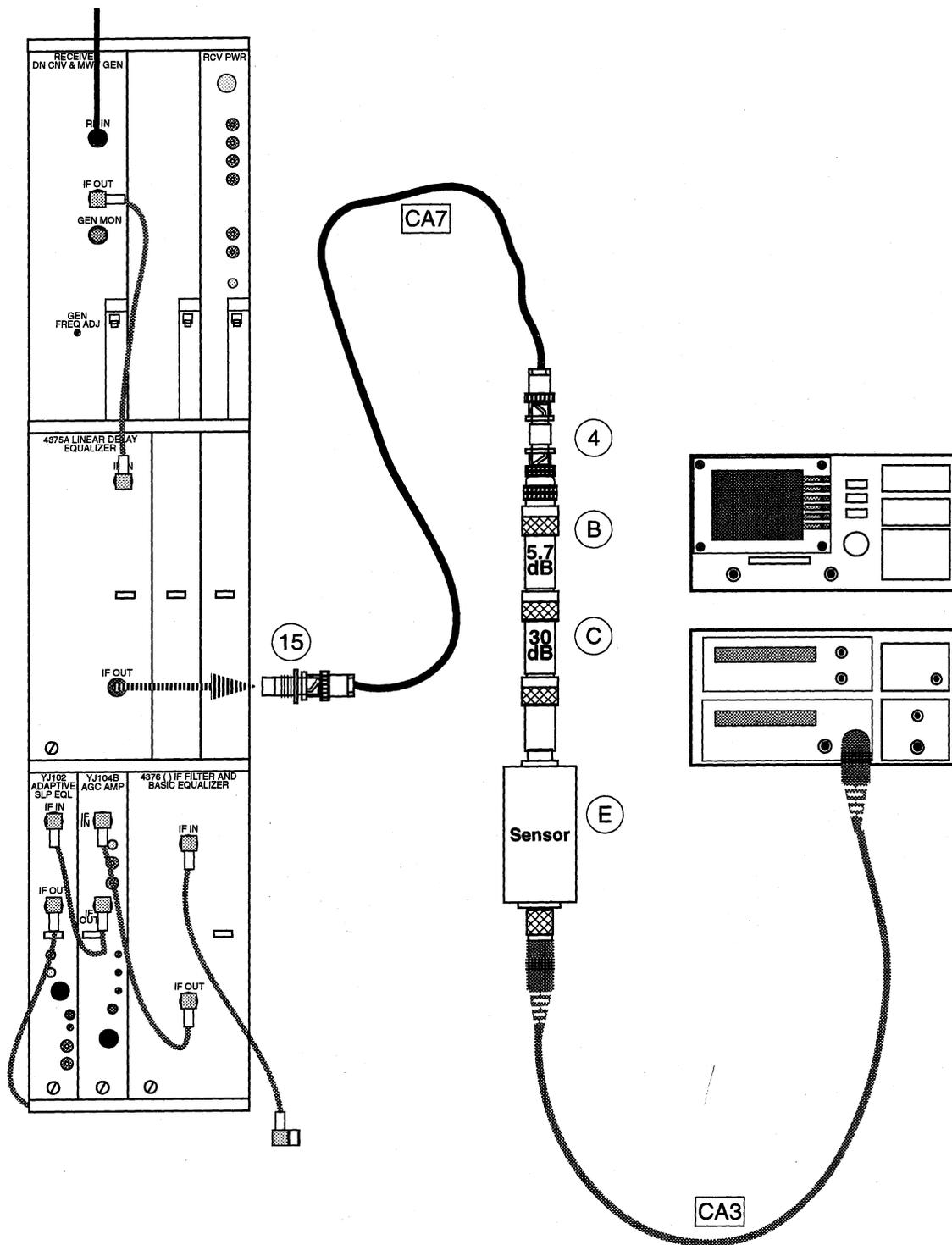


Figure 11. Linear Delay Equalizer IF OUT Level (Non-DIV)

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- 10 On the LINEAR DELAY EQUALIZER:
- a. Remove the power meter test connection from the IF OUT jack.
 - b. Reconnect the bay cable to the IF OUT jack.
- Comment: Steps 11 through 13 will check the IF output level of the IF FILTER AND BASIC EQUALIZER.*
- 11 On the IF FILTER AND BASIC EQUALIZER:
- a. Remove the bay cable connected to the IF OUT jack.
 - b. Connect the power meter to the IF OUT jack as shown in Figure 12.
- 12 On the POWER METER,
- observe the displayed level.
- 13 Compare the level displayed in Step 12 with the level recorded on the RADIO DATA CARD as RCVR "LIN DEL EQL IF OUT".
- Requirement:* The difference shall be within ± 1 dB of the COMBINED LOSS listed in Table L for the equipped equalizer and filter.

Table L. Basic Equalizer and IF Filter Losses

Equalizer Code	Insertion Loss (dB)	Filter Code	Insertion Loss (dB)	Combined Loss (dB)
2002C	4.4 \pm 0.5	1603B	7.0 \pm 0.5	11.4
2002D	4.1 \pm 0.5	1603B	7.0 \pm 0.5	11.1
2002E	5.6 \pm 0.5	1603B	7.0 \pm 0.5	12.6

You may have to remove the IF FILTER AND BASIC EQUALIZER plug-in to determine which equalizer is installed.

Was the requirement met?

- YES - Update the RADIO DATA CARD—RCVR "IF FLT BASIC EQL IF OUT".
- Go to Step 14.
- NO - Recheck the codes of the equalizer and filter.
- Resolve the level discrepancy and update the RADIO DATA CARD—RCVR "IF FLT BASIC EQL IF OUT".
 - Go to Step 14.

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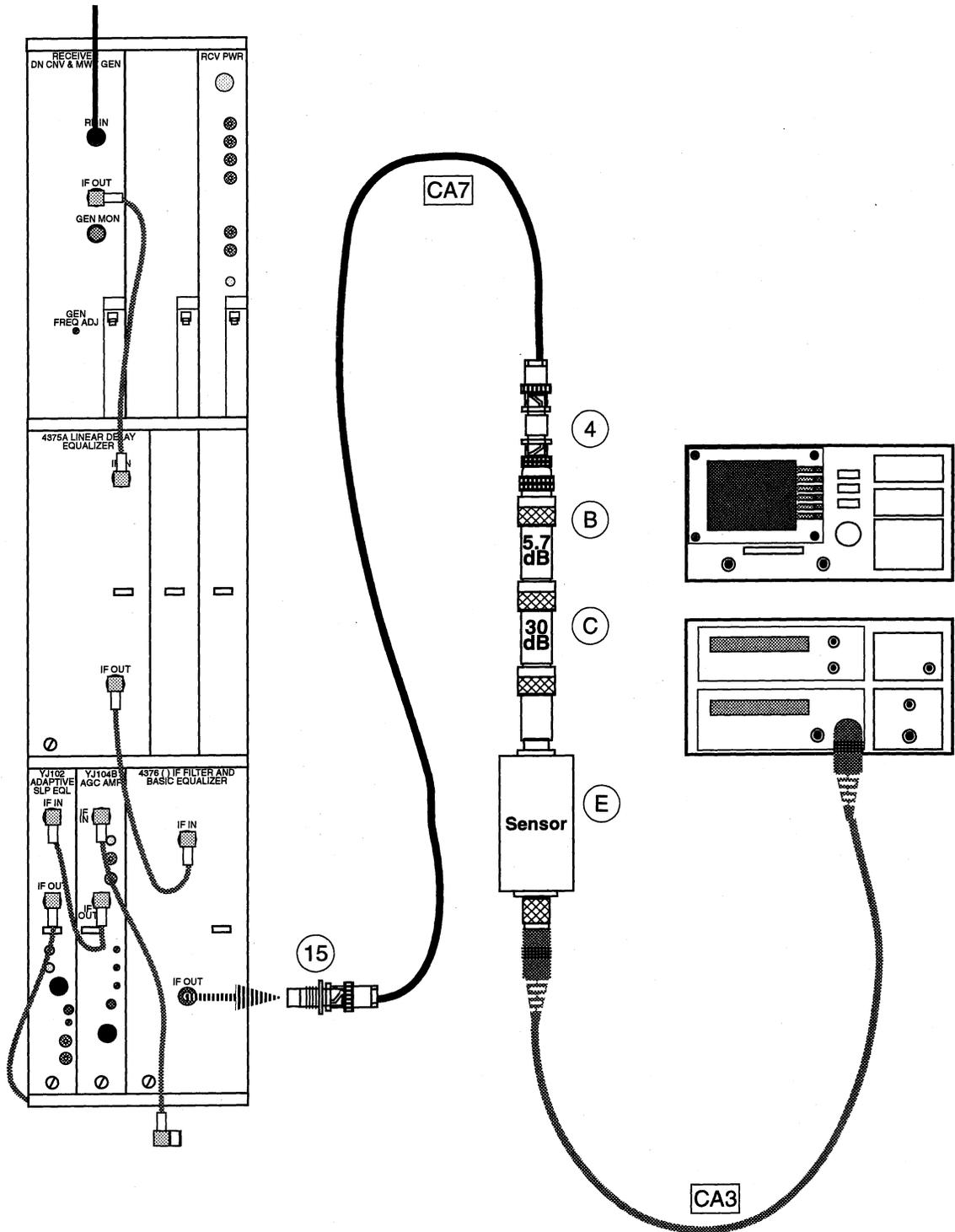


Figure 12. IF Filter and Basic Equalizer IF OUT Level (Non-DIV)

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- 14 On the IF FILTER AND BASIC EQUALIZER:
- a. Remove the test connection from the IF OUT jack.
 - b. Reconnect the bay cable to the IF OUT jack.

Comment: Step 15 will check and adjust the IF output level of the IF AGC AMPL.

- 15 On the IF AGC AMPL:
- a. Remove the bay cable from the IF OUT jack.
 - b. Verify that the MAN/AUTO switch is in the AUTO position.
 - c. Connect the power meter to the IF OUT jack as shown in Figure 13.
 - d. Adjust the AUTO GAIN control for the following requirement.

Requirement: $-2.0 \text{ dBm} \pm 0.2 \text{ dB}$ on the power meter display.

Was the requirement met?

YES - Update the RADIO DATA CARD—RCVR
"IF AGC AMPL IF OUT".

- Go to Step 16.

NO - Go to Flowchart 3, Unit Replacement and
Alignment—IF AGC Amplifier.

- 16 On the IF AGC AMPL:
- a. Remove the power meter connection from the IF OUT jack.
 - b. Reconnect the bay cable to the IF OUT jack.

- 17 On the ALARM AND METER unit:
- a. Set the selector switch to RCVR—AGC V.
 - b. Update the RADIO DATA CARD—RCVR "AGC V NORMAL" with the displayed voltage.
 - c. Set the selector switch to TRMTR—OFF.

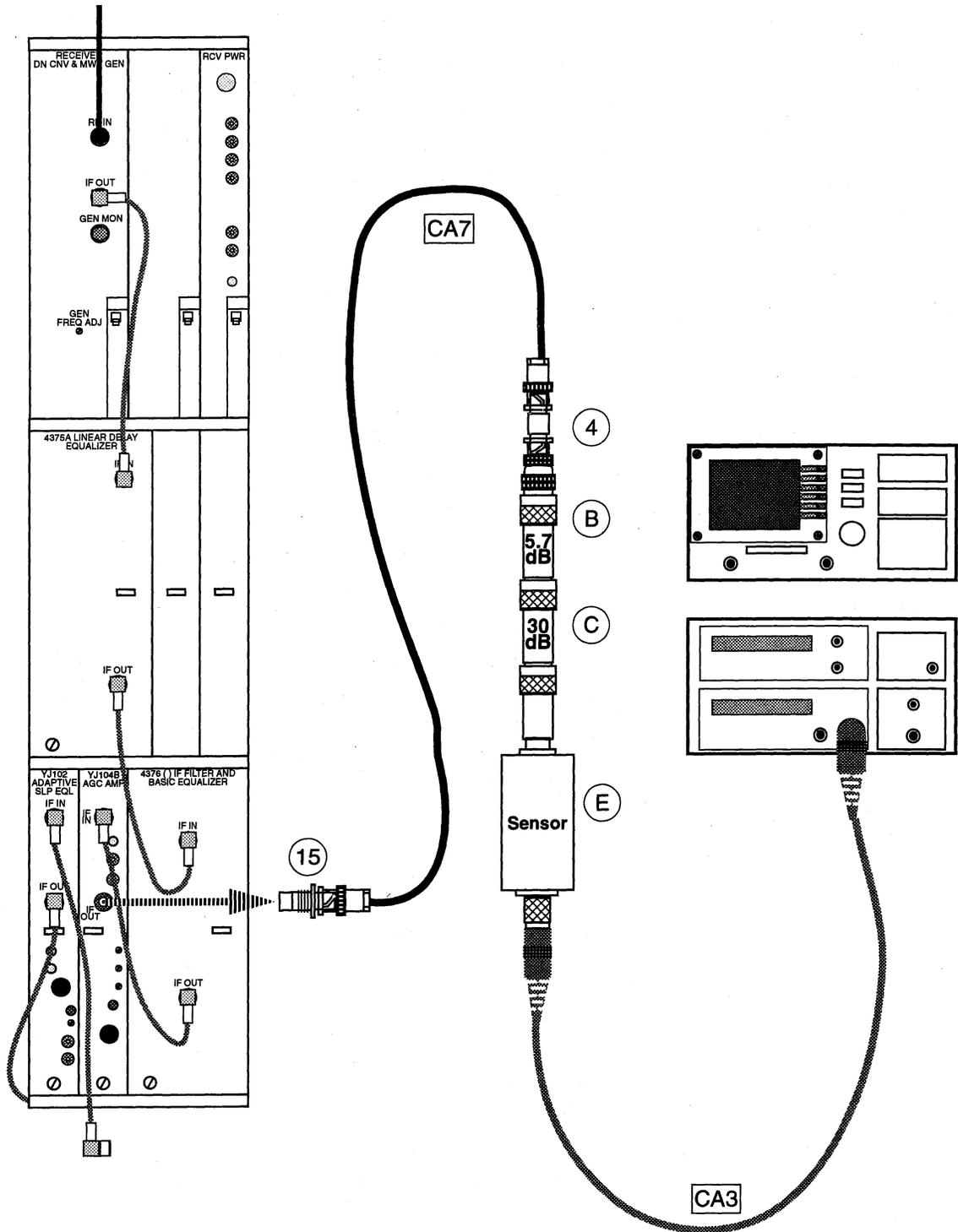


Figure 13. IF AGC Amplifier IF OUT Level (Non-DIV)

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Comment: Steps 18 and 19 will check the IF output level of the adaptive slope equalizer.

- 18 On the ADAPTIVE SLOPE EQL:
- a. Remove the bay cable from the IF OUT jack.
 - b. Verify that the MAN/AUTO switch is in the AUTO position.
 - c. Connect the power meter to the IF OUT jack as shown in Figure 14.

- 19 On the POWER METER,
observe the display.

Requirement: $-2.0 \text{ dBm} \pm 0.5 \text{ dB}$.

Was the requirement met?

YES - Update the RADIO DATA CARD—RCVR
"ADPT SL EQL IF OUT".

- Go to Step 20.

NO - Go to Flowchart 3, Unit Replacement and
Alignment—Adaptive Slope Equalizer.

- 20 On the ADAPTIVE SLOPE EQL:
- a. Remove the power meter connection from the IF OUT jack.
 - b. Reconnect the bay cable to the IF OUT jack.
- 21 Go to Flowchart 4 (this tab).

Receiver Alignment path (without antenna diversity)

Receiver Alignment completed.

End of Procedure

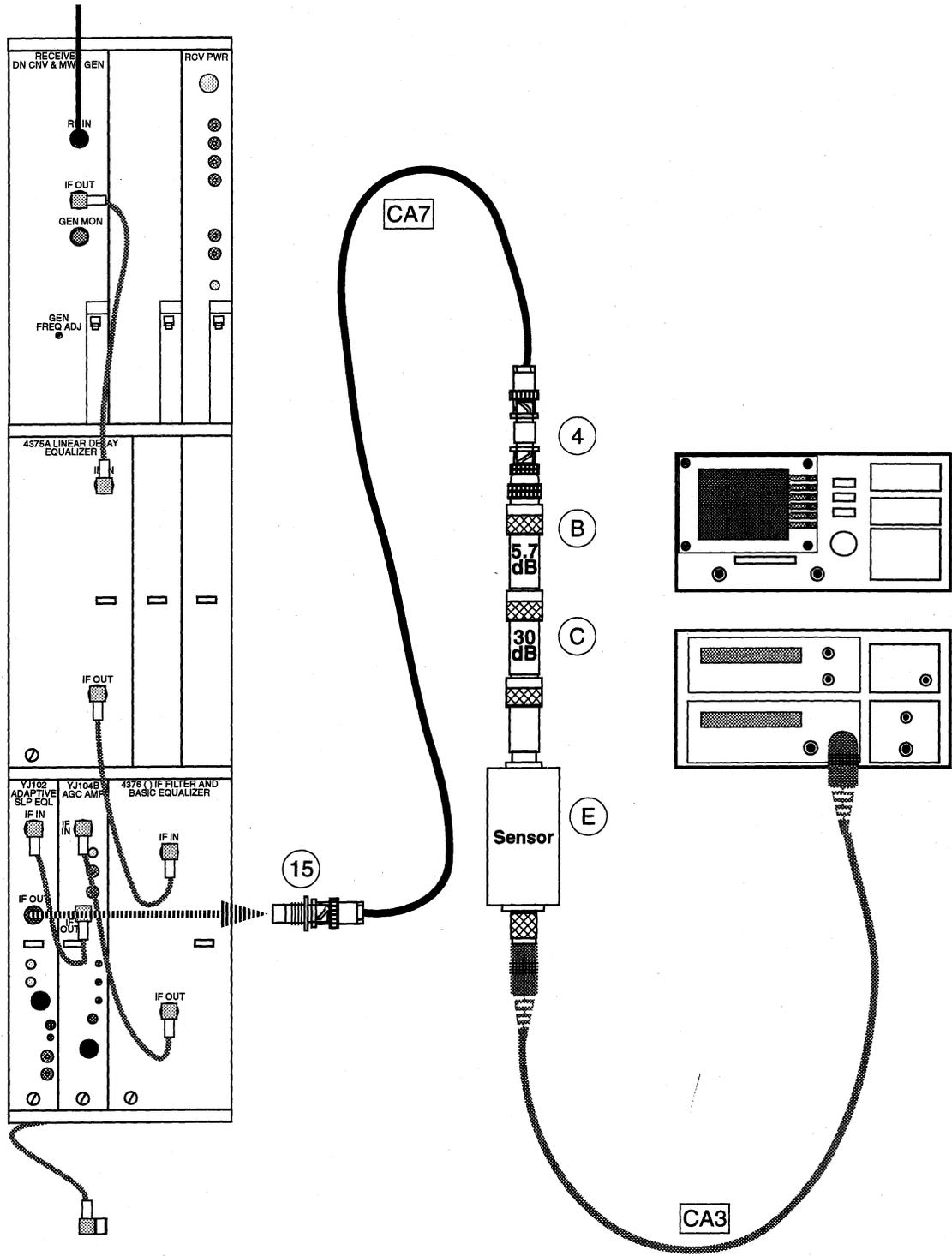


Figure 14. Adaptive Slope Equalizer IF OUT Level (Non-DIV)

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4 Unit Tests

4.1 Received Signal Level Calculation

Use this procedure to calculate the current Received Signal Level (RSL) for comparison with the originally specified RSL. You will perform this calculation only if you suspect that a path, RF Preamplifier, or network problem has changed the current RSL from the original RSL recorded on the RADIO DATA CARD as RECEIVED SIGNAL LEVEL.

Prerequisite: Procedure 3.4, RF Input Level

Step	Procedure
	<p><i>Comment:</i> RSL is the signal level at the input of the RF Preamplifier. If there is no RF Preamplifier, RSL is the signal level at the input at the top of the bay.</p> <p><i>Comment:</i> On an in-service system, measurement of the Received Signal Level is not possible so the RSL has to be calculated from measurements made in Procedure 3.4, RF Input Level.</p>



NOTE:

The RSL recorded on the RADIO DATA CARD should be the engineered level based on system characteristics. It can be verified by your Technical Support Group (TSG) contact.

- 1 Calculate RSL with this formula and example:

RSL = A –(B –C) with these representations:

- a. A is the CONV RF IN level noted as “down-converter RF IN (REG or DIV)” in Procedure 3.4, RF Input Level.
- b. B is the gain (dB) of the RF preamplifier recorded on the RADIO DATA CARD as RCVR “RF PREAMPL GAIN”. For receivers without an RF preamplifier, B = 0.
- c. C is the loss (dB) of the networks (Table M).

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Table M. Receiver Waveguide Assembly Network Losses

Receiver Position in a Lineup, Relative to Receiving Antenna	Nominal "Loss" Values in dB Between Input to Bay Lineup and RF Input to Down-Converter	
	6 GHz	11 GHz
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

Example:

(Values used in this example are for illustration only.)

- a. $RSL = A - (B - C)$:
 - (A) Down-converter RF Input level of -19 dBm.
 - (B) RF Preamplifier gain of 11 dB.
 - (C) Network loss of 1.8 dB (third receiver in the bay).
- b. $RSL = -19 - (11 - 1.8)$. (Do the math inside the bracket first.)
- c. $RSL = -19 - (9.2)$.
- d. $RSL = -19 - 9.2$.
- e. $RSL = -28.2$ dBm.
- f. For antenna-diversity receivers, perform Step 1 for each path.

Requirement: For receivers equipped with an RF Preamplifier with a three-gain label,

calculated RSL within ± 3 dB of the RECEIVED SIGNAL LEVEL (REG or DIV) recorded on the RADIO DATA CARD.

Requirement: For receivers equipped with an RF Preamplifier with a single-gain label,

calculated RSL within ± 5 dB of the RECEIVED SIGNAL LEVEL (REG or DIV) recorded on the RADIO DATA CARD.

Requirement: For receivers not equipped with an RF Preamplifier,

calculated RSL within ± 3 dB of the RECEIVED SIGNAL LEVEL (REG or DIV) recorded on the RADIO DATA CARD.

Was the requirement met?

YES - Go to Step 2.

NO - Go to **TROUBLE ISOLATION** tab,
3.1 RF Level Problem (Receiver).

Comment: Do not change the RECEIVED SIGNAL LEVEL recorded on the RADIO DATA CARD. The recorded level was measured or calculated when the channel was installed and it must be kept as a reference.

Comment: Refer to the Microwave Station Records (MSR) listing for the Engineered RSL value if you suspect the value recorded on the RADIO DATA CARD is in error. Your Radio TSG contact has access to the MSR listing.

2 Return to the flowchart or procedure that sent you here.

End of Procedure

4.2 Receiver Down-Converter Gain Checks

There are a total of eight different types of DR 6/11 receiver down-converters in the field. Determine the equipment Code from the Latch Label of the RECEIVER DOWN CONVR & MWV GEN and select the appropriate procedure from Table N.

Table N. Down-Converter Procedures

Code	Frequency	Antenna Diversity	Procedure
4384	11 GHz	No	4.2.2
4385	11 GHz	Yes	4.2.1
4391	6 GHz	No	4.2.2
4392	6 GHz	Yes	4.2.1
4470	6 GHz	No	4.2.4
4471	6 GHz	Yes	4.2.3
4472	11 GHz	No	4.2.4
4473	11 GHz	Yes	4.2.3

Comment: The phrase "antenna diversity" replaces previously used terms "space diversity" and "angle diversity". A receiver equipped with antenna diversity can be identified by two sets of waveguide networks above the receiver shelf or by the two semirigid cable inputs to the RECEIVER DOWN CONVR & MWV GEN.

Comment: Most radio receivers are equipped with RF Preamplifiers. They have, in the past, been called "Waveguide Amplifiers". If the receiver is equipped with an RF Preamplifier, you will find it in the waveguide run near, or just above, the top of the radio bay.

Comment: The gain of each RF Preamplifier is marked on a label attached to the amplifier. Some RF Preamplifiers are marked with the gain at just one point in its bandwidth. It is a "single-gain" label. "Three-gain" labels show the gain at three points across the bandwidth.

Comment: In antenna-diversity receivers, there are two separate signal paths, REGULAR and DIVERSITY. Each path must be tested separately and the input of the path not being tested should be terminated.

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4.2.1 4300 Series (Antenna Diversity); 4392 (6 GHz), 4385 (11 GHz)

This procedure checks the maximum gain of both paths (diversity and regular) through either of these down-converters.

Prerequisite: Procedure 3.4, RF Input Level.



CAUTION:

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



CAUTION:

SMA connectors damage easily. Finger-start SMA connections for several turns, then use only a torque wrench to tighten.

Step	Procedure
1	On the RECEIVER DOWN CONVR & MWV GEN, verify that the Latch Label Code is 4392 (6 GHz) or 4385 (11 GHz).
2	On the TEST SET: <ol style="list-style-type: none"> 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. <p><i>Comment: In steps 3 through 6, you will insert 20 dB of loss in both paths to drive the Automatic Level Control (ALC) circuits to full gain.</i></p>
3	On the RECEIVER DOWN CONVR & MWV GEN: <ol style="list-style-type: none"> a. Remove both semirigid cables and replace each with a 1-foot flexible RF coaxial cable in series with a 20-dB pad between: <ul style="list-style-type: none"> ■ The DIV RF IN jack and the OUTPUT jack on the diversity (upper) Isolator/Transducer ■ The REG RF IN jack and the OUTPUT jack on the regular (lower) Isolator/Transducer. b. Remove the bay cables from the IF OUT jacks.
4	Connect the test equipment as shown in Figure 15.

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This figure illustrates ANT DIV configuration 3. (Reference: 1.6 ANT DIV configurations.)

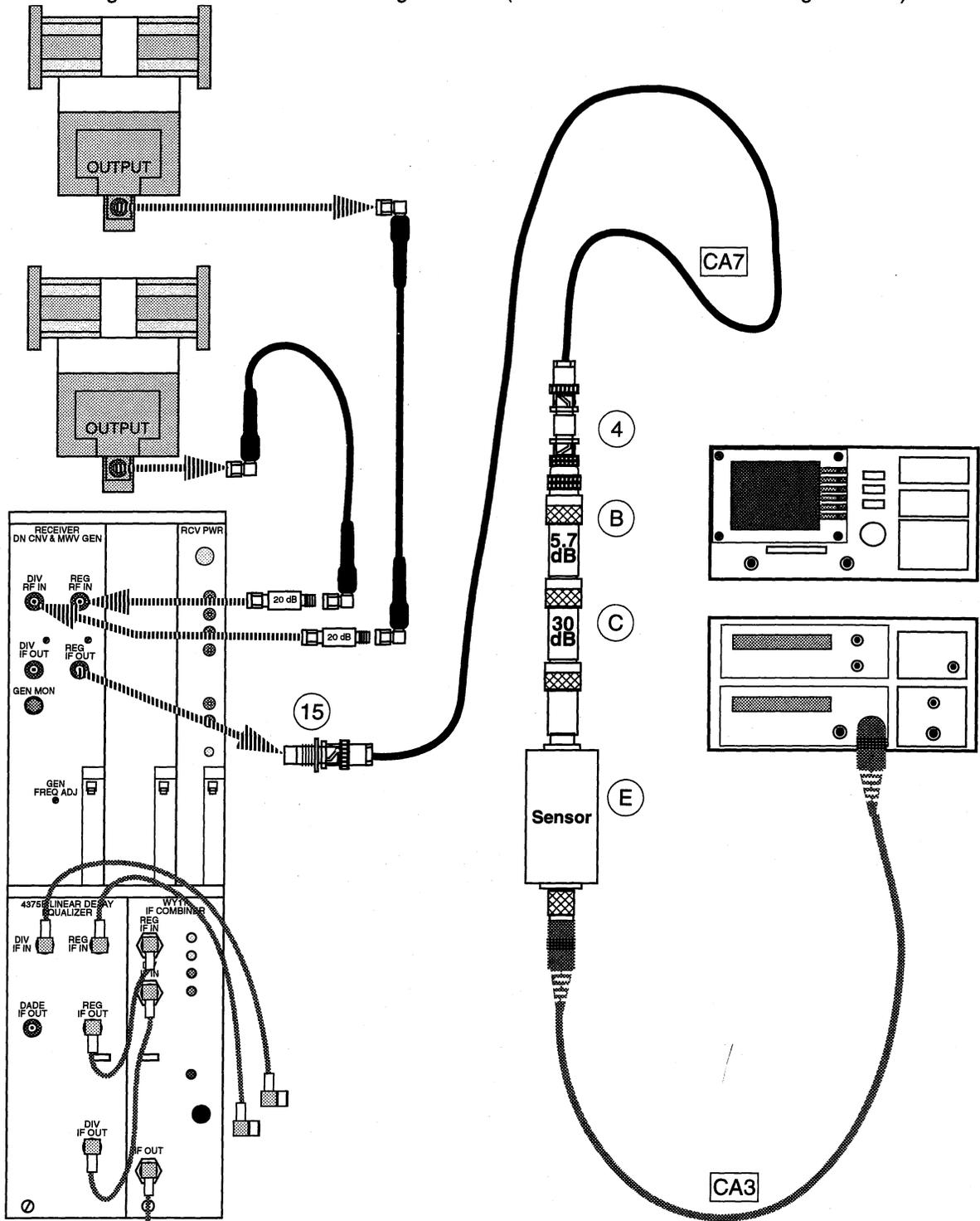


Figure 15. Down-Converter Gain (4300 Series, ANT DIV)

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- 5 On the RECEIVER DOWN CONVR & MWV GEN:
- a. Adjust the IF LEV ADJ (REG) control clockwise for maximum output on the power meter display.
(There is no stop on this control.)

Note the displayed level as "max IF OUT (REG)".

- b. Connect the power meter to the DIV IF OUT jack.
- c. Adjust the IF LEV ADJ (DIV) control clockwise for maximum output on the power meter display.
(There is no stop on this control.)

Note the displayed level as "max IF OUT (DIV)".

- 6 Calculate the gain for each path with the following formulas:

- a. REG gain = max IF OUT (REG) –(REG RF IN –20), where:
 - "max IF OUT (REG)" is from Step 5.
 - REG RF IN is the level noted as "down-converter RF IN (REG)" in Procedure 3.4, RF Input Level.
 - 20 is the loss of the attenuator connected to the input.

Example:

$$\text{Gain} = \text{IF OUT} - (\text{RF IN} - 20).$$

$$\text{Gain} = -15 - (-13 - 20). \text{ (Do math inside the bracket first.)}$$

$$\text{Gain} = -15 - (-33). \text{ (Minus a minus equals a plus.)}$$

$$\text{Gain} = -15 + 33.$$

$$\text{Gain} = 18 \text{ dB.}$$

Requirement: REG gain = 18 dB \pm 2 dB.

- b. DIV gain = max IF OUT (DIV) –(DIV RF IN –20), where:
 - "max IF OUT (DIV)" is from Step 5.
 - DIV RF IN is the level noted as "down-converter RF IN (DIV)" in Procedure 3.4, RF Input Level.
 - 20 is the loss of the attenuator connected to the input.
 - Refer to the above example, if necessary.

Requirement: DIV gain = 18 dB \pm 2 dB.

Were both (REG & DIV) gain requirements met?

YES - Go to Step 7.

NO - Go to Flowchart 3, Unit Replacement and Alignment—Down-Converter.

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Comment: In Steps 7 through 9, you will temporarily set the down-converter IF OUT levels. You will make a final adjustment later when you perform Procedure 3.5.

- 7 Compare the two levels noted as "max IF OUT (REG)" and "max IF OUT (DIV)" from Step 5.
- Are the two levels within 10 dB of each other?
- YES - Go to Step 8.
- NO - Go to Step 9.
- 8 On the RECEIVER DOWN CONVR & MWV GEN:
- On the path with the lowest level,
leave the IF LEV ADJ control set at maximum.
 - On the path with the higher level:
 - Connect the power meter to the IF OUT jack.
 - Adjust the IF LEV ADJ control for a power meter display within ± 1 dB of the lower level.
 - Go to Step 10.
- 9 On the RECEIVER DOWN CONVR & MWV GEN:
- On the path with the lower level,
leave the IF LEV ADJ control set at maximum.
 - On the path with the higher level:
 - Connect the power meter to the IF OUT jack.
 - Adjust the IF LEV ADJ control to reduce the displayed level by 10 dB.
 - Go to Step 10.
- 10 On the RECEIVER DOWN CONVR & MWV GEN:
- Remove the test connection.
 - Reconnect bay cables to the (REG and DIV) IF OUT jacks.
 - Remove the 1-foot flexible RF coaxial cables and 20-dB pads.
 - Reconnect the semirigid cables between:
 - DIV RF IN jack and the OUTPUT jack on the diversity (upper) Isolator/Transducer.
 - REG RF IN jack and the OUTPUT jack on the regular (lower) Isolator/Transducer.
- 11 Return to the procedure or flowchart that sent you here.

End of Procedure

4.2.2 4300 Series (Non-Diversity); 4391 (6 GHz), 4384 (11 GHz)

This procedure checks the maximum gain of either of these down-converters.

Prerequisite: Procedure 3.4, RF Input Level.



CAUTION:

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



CAUTION:

SMA connectors damage easily. Finger-start SMA connections for several turns, then use only a torque wrench to tighten.

Step	Procedure
1	On the RECEIVER DOWN CONVR & MWV GEN, verify that the Latch Label Code is 4391 (6 GHz) or 4384 (11 GHz).
2	On the TEST SET: <ol style="list-style-type: none"> 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. <p><i>Comment: In Steps 3 through 6, you will insert 20 dB of loss ahead of the down-converter to drive the ALC circuit to full gain. After you measure the output level, you will then calculate the maximum gain of the down-converter.</i></p>
3	On the RECEIVER DOWN CONVR & MWV GEN: <ol style="list-style-type: none"> a. Remove the semirigid cable between the RF IN jack and the OUTPUT jack on the Isolator/Transducer. b. Connect a 1-foot flexible RF cable in series with a 20-dB pad between the RF IN jack and the OUTPUT jack on the Isolator/Transducer. c. Remove the bay cable from the IF OUT jack.
4	Connect the test equipment as shown in Figure 16.

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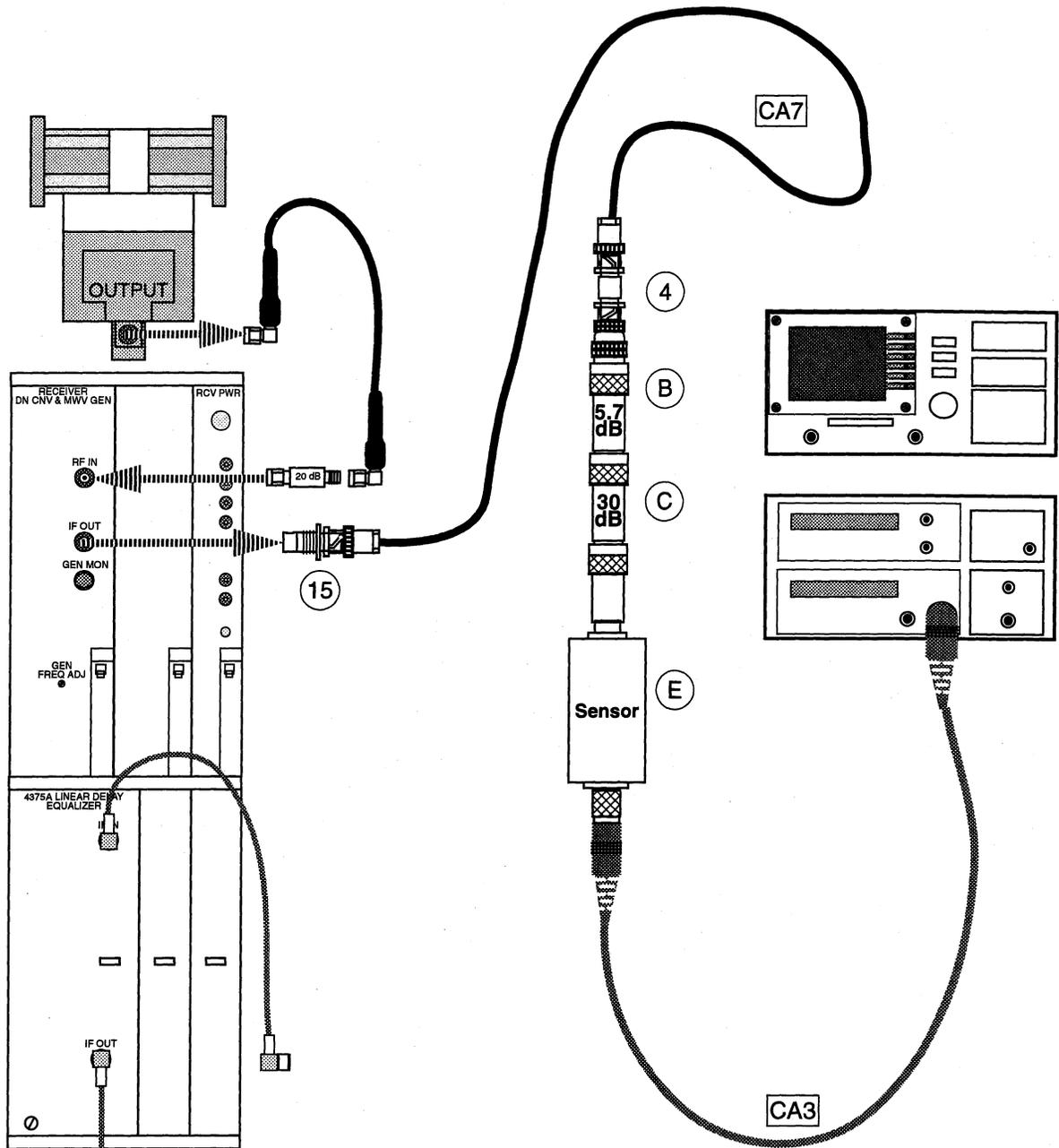


Figure 16. Down-Converter Gain (4300 Series, Non-DIV)

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- 5 On the POWER METER,
note the displayed level as "IF OUT" for the next step.
- 6 Calculate the gain using the following formula:
Gain = IF OUT - (RF IN - 20), where:
- IF OUT is the level noted in Step 5.
 - RF IN is the level noted as "down-converter RF IN (REG)" in Procedure 3.4, RF Input Level.
 - 20 is the loss of the attenuator added to the input.
- Example:
- Gain = -15 - (-16 - 20). (Do math inside the bracket first.)
Gain = -15 - (-36). (Minus a minus equals a plus.)
Gain = -15 + 36.
Gain = 21 dB.
- Requirement:** Gain = 21 dB \pm 2 dB.
- Was the requirement met?
- YES - Go to Step 7.
- NO - Go to Flowchart 3, Unit Replacement and Alignment—Down-Converter.
- 7 On the RECEIVER DOWN CONVR & MWV GEN:
- Remove the test connection.
 - Reconnect the normal bay cable to the IF OUT jack.
 - Remove the 1-foot flexible RF coaxial cable and 20-dB pad between the RF IN jack and the OUTPUT jack on the Isolator/Transducer.
 - Reconnect the semirigid cable between the RF IN jack and the OUTPUT jack on the Isolator/Transducer.
- 8 Return to the procedure or flowchart that sent you here.

End of Procedure

4.2.3 4400 Series (Antenna Diversity); 4471 (6 GHz), 4473 (11 GHz)

This procedure checks the maximum gain of both paths (diversity and regular) through either of these down-converters.

Prerequisite: Procedure 3.4, RF Input Level.



CAUTION:

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



CAUTION:

SMA connectors damage easily. Finger-start SMA connections for several turns, then use only a torque wrench to tighten.

Step	Procedure
------	-----------

Comment: In this procedure, you will measure the maximum gain of each path, REG and DIV. After you have measured maximum gain of each, you will set the output power of each to a nominal level.

- | | |
|---|--|
| 1 | <p>On the RECEIVER DOWN CONVR & MWV GEN:</p> <ol style="list-style-type: none"> a. Verify that the Latch Label Code is 4471 (6 GHz) or 4473 (11 GHz). b. Verify that the AGC AUTO/MAN switch is set to AUTO. c. Remove the semirigid cable between the DIV RF IN jack and the OUTPUT jack on the DIV (upper) Isolator/Transducer. d. Attach a 50-ohm termination to the DIV RF IN jack. e. Remove the bay cables from: <ul style="list-style-type: none"> ■ The DIV IF OUT jack ■ The REG IF OUT jack. |
| 2 | <p>On the TEST SET:</p> <ol style="list-style-type: none"> a. Calibrate the POWER METER, if necessary. <p style="margin-left: 40px;">Reference: DRTS tab, 2.2 Calibration.</p> 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. <p style="margin-left: 40px;">Reference: DRTS tab, 2.3 Entering Offset.</p> |

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- 3 Connect the test equipment as shown in Figure 17.
- 4 On the RECEIVER DOWN CONVR & MWV GEN:
- Adjust the IF LEV ADJ (REG) control clockwise for maximum output on the power meter display.
(There is no stop on this control.)
 - Note this level as "max IF OUT (REG)".

Requirement: "max IF OUT (REG)" must be within the range shown on Table G for the appropriate down-converter and on the same line as the CONV RF IN level measured and recorded in Procedure 3.4, RF Input Level.

Was the requirement met?

YES - Go to Step 5.

NO - Go to Flowchart 3, Unit Replacement and Alignment—Down-Converter.

- 5 On the RECEIVER DOWN CONVR & MWV GEN:
- Remove the semirigid cable from between the REG RF IN jack and the OUTPUT jack on the Isolator/Transducer.
 - Move the 50-ohm termination from the DIV RF IN jack to the REG RF IN jack.
 - Reconnect the semirigid cable between the DIV RF IN jack and the OUTPUT jack on the Isolator/Transducer.
 - Move the power meter test connection from the REG IF OUT jack to the DIV IF OUT jack.
 - Adjust the IF LEV ADJ (DIV) control clockwise for maximum output on the power meter display.
(There is no stop on this control.)
 - Note this level as "max IF OUT (DIV)".

Requirement: "max IF OUT (DIV)" must be within the range shown on Table G for the appropriate down-converter and on the same line as the CONV RF IN level measured and recorded in Procedure 3.4, RF Input Level.

Was the requirement met?

YES - Go to Step 6.

NO - Go to Flowchart 3, Unit Replacement and Alignment—Down-Converter.

This figure illustrates ANT DIV configuration 3. (Reference: 1.6 ANT DIV configuration.)

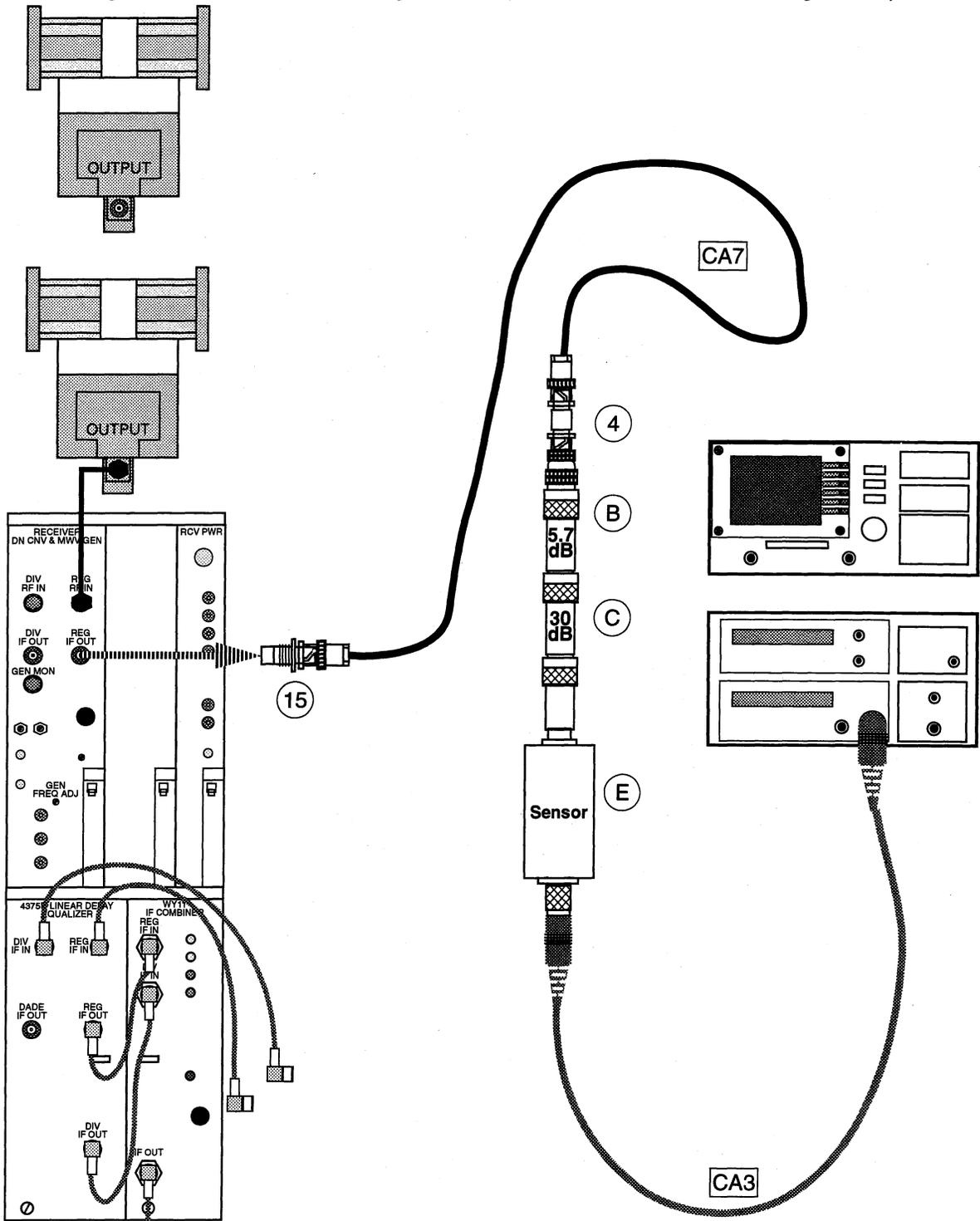


Figure 17. Down-Converter Gain (4400 Series, ANT DIV)

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See notice on first page

Comment: In Steps 6 through 8, you will temporarily set the down-converter IF OUT levels. You will make a final adjustment later when you perform Procedure 3.5.

- 6 Compare the two levels noted as "max IF OUT (REG)" and "max IF OUT (DIV)".
- Are the two levels within 10 dB of each other?
- YES - Go to Step 7.
- NO - Go to Step 8.
- 7 On the RECEIVER DOWN CONVR & MWV GEN:
- Remove the 50-ohm termination from the REG RF IN jack.
 - Reconnect the semirigid cable between the REG RF IN jack and the OUTPUT jack on the Isolator/Transducer.
 - On the path with the lowest level,
leave the IF LEV ADJ control set at maximum.
 - Connect the power meter to the path with the higher level.
 - Adjust the IF LEV ADJ control for a power meter display within ± 1 dB of the lower level.
 - Go to Step 9.
- 8 On the RECEIVER DOWN CONVR & MWV GEN:
- Remove the 50-ohm termination from the REG RF IN jack.
 - Reconnect the semirigid cable between the REG RF IN jack and the OUTPUT jack on the Isolator/Transducer.
 - On the path with the lower level,
leave the IF LEV ADJ control set at maximum.
 - Connect the power meter to the path with the higher level.
 - Adjust the IF LEV ADJ control to reduce the higher level by 10 dB.
 - Go to Step 9.

Comment: Next, you will set the MAN GAIN control for the same output level as in the AUTO GAIN mode. There is just one MAN GAIN ADJ control, but it controls both paths when AGC is switched to MAN.

- 9 On the RECEIVER DOWN CONVR & MWV GEN:
 - a. Note the level displayed on the power meter display as "AUTO".
 - b. Set the AGC AUTO/MAN switch to MAN.
 - c. Adjust the MAN GAIN ADJ control for the same power meter display noted above as "AUTO".
 - d. Disconnect the power meter test connection.
 - e. Reconnect the bay cables normally connected to the IF OUT jacks.
 - f. Set the AGC AUTO/MAN switch to AUTO.
- 10 Return to the procedure or flowchart that sent you here.

End of Procedure

4.2.4 4400 Series (Non-Diversity); 4470 (6 GHz), 4472 (11 GHz)

This procedure checks the maximum gain of either of these down-converters.

Prerequisite: Procedure 3.4, RF Input Level.

**CAUTION:**

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

**CAUTION:**

SMA connectors damage easily. Finger-start SMA connections for several turns, then use only a torque wrench to tighten.

Step	Procedure
1	<p>On the RECEIVER DOWN CONVR & MWV GEN:</p> <ol style="list-style-type: none"> Verify that the Latch Label Code is 4470 (6 GHz) or 4472 (11 GHz). Verify that the AGC AUTO/MAN switch is set to AUTO. Remove the bay cable from the IF OUT jack.
2	<p>On the TEST SET:</p> <ol style="list-style-type: none"> Calibrate the POWER METER, if necessary. <p style="text-align: center;">Reference: DRTS tab, 2.2 Calibration.</p> <ol style="list-style-type: none"> Enter the OFFSET (as shown on the POWER SENSOR) for measurement of IF between -30 dBm and +10 dBm (about 35.7 dB). Add an additional 0.25 dB to the OFFSET to compensate for loss in the 8-foot BNC - BNC cable. <p style="text-align: center;">Reference: DRTS tab, 2.3 Entering Offset.</p>
3	<p>Connect the test equipment as shown in Figure 18.</p>

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See notice on first page

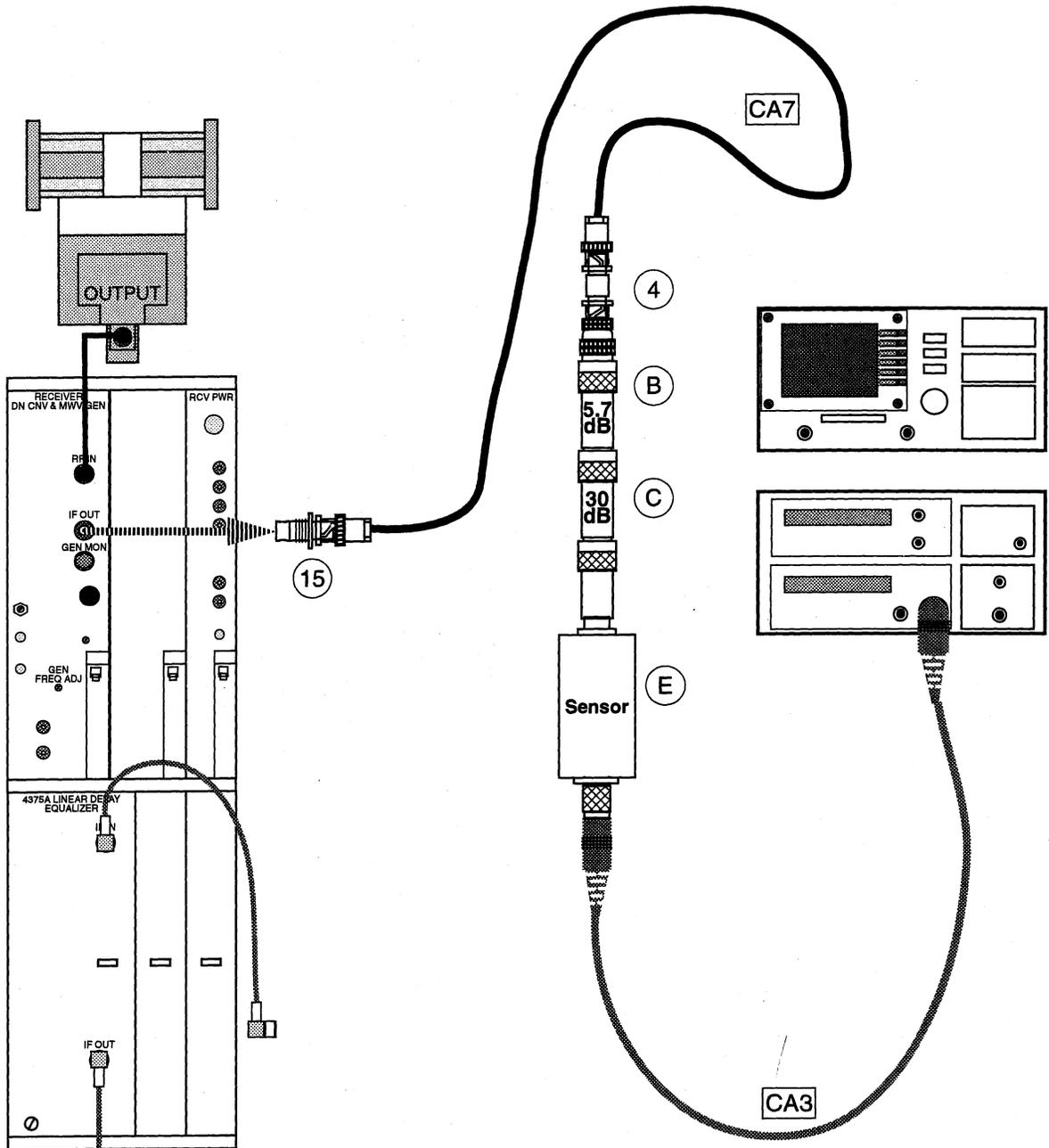


Figure 18. Down-Converter Gain (4400 Series, Non-DIV)

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See notice on first page

- 4 On the RECEIVER DOWN CONVR & MWV GEN,
adjust the IF LEV ADJ control clockwise for maximum output on the power meter display.

Requirement: The displayed IF level must be within the range shown on Table J for the appropriate down-converter and on the same RF IN line as the level measured and noted as "down-converter RF IN (REG)" in Procedure 3.4, RF Input Level.

Was the requirement met?
YES - For a 4470 (6 GHz) down-converter, go to Step 5.
- For a 4472 (11 GHz) down-converter, go to Step 6.
NO - Go to Flowchart 3, Unit Replacement and Alignment—Down-Converter.
- 5 Readjust the IF LEV ADJ control for -5 dBm on the power meter display or, if -5 dBm cannot be obtained, set the control for maximum output.
- 6 Readjust the IF LEV ADJ control for -11 dBm on the power meter display or, if -11 dBm cannot be obtained, set the control for maximum output.
- 7 On the POWER METER,
note the displayed level.
- 8 On the RECEIVER DOWN CONVR & MWV GEN:
 - a. Set the AGC AUTO/MAN switch to MAN.
 - b. Adjust the MAN GAIN ADJ control for the same level noted in Step 7.
 - c. Remove the power meter test connection.
 - d. Reconnect the bay cable to the IF OUT jack.
 - e. Set the AGC AUTO/MAN switch to AUTO.
- 9 Return to the procedure or flowchart that sent you here.

End of Procedure

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4.3 IF AGC Amplifier Checks and Adjustments

This procedure is used to adjust the following controls on the IF AGC Amplifier:

- AUTO GAIN
- MAN GAIN
- LPW IN TRIP.



CAUTION:

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

Step	Procedure
1	<p>On the TEST SET:</p> <ul style="list-style-type: none"> a. Calibrate the POWER METER, if necessary. <p style="padding-left: 40px;">Reference: DRTS tab, 2.2 Calibration.</p> <ul style="list-style-type: none"> 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. <p style="padding-left: 40px;">Reference: DRTS tab, 2.3 Entering Offset.</p> <p><i>Comment: We will first check to see that the input level to the AGC amplifier is correct.</i></p>
2	<p>On the IF FILTER AND BASIC EQUALIZER,</p> <p style="padding-left: 40px;">remove the bay cable from the IF OUT jack.</p>
3	<p>Connect the test equipment as shown in Figure 19.</p>
4	<p>On the POWER METER,</p> <p style="padding-left: 40px;">observe the display.</p>

Requirement: The level must be within ± 3.0 dB of the level recorded on the RADIO DATA CARD as RCVR "IF FLT BASIC EQL IF OUT".

Was the requirement met?

YES - Go to Step 5.

NO - Go to **TROUBLE ISOLATION** tab,
3.2 IF Level Problem.

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See notice on first page

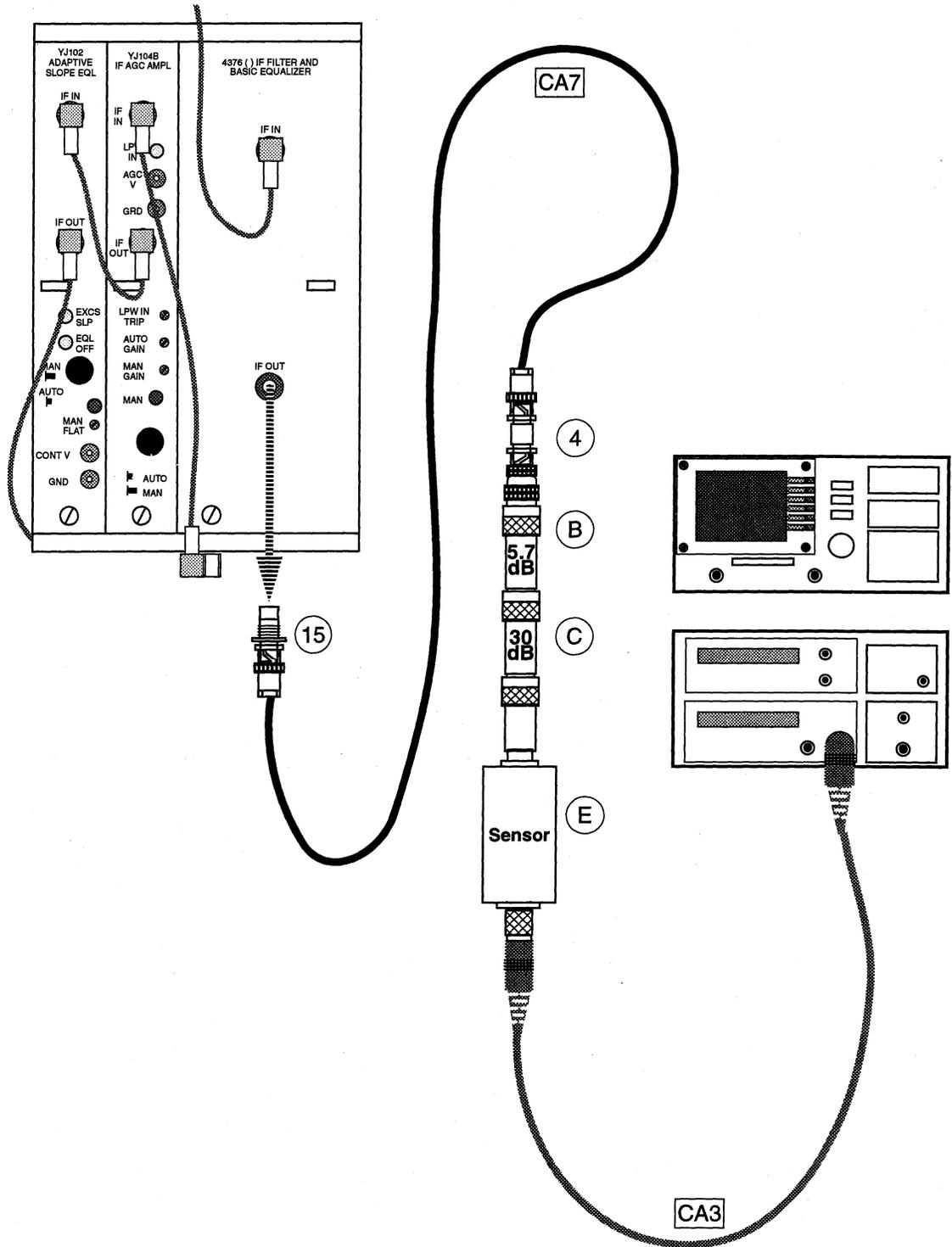


Figure 19. IF AGC Amplifier Measurements

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See notice on first page

- 5 On the IF FILTER AND BASIC EQUALIZER:
- Remove the power meter connection from the IF OUT jack.
 - Reconnect the normal bay cable to the IF OUT jack.
- 6 On the IF AGC AMPL:
- Remove the cable from the IF OUT jack.
 - Set the AUTO/MAN switch to MAN.
Verify that the MAN indicator lights.
 - Connect the power meter to the IF OUT jack.
 - Adjust the MAN GAIN control while observing the power meter display.
- Requirement:** $-2.0 \text{ dBm} \pm 0.2 \text{ dB}$.
- Set the AUTO/MAN switch to AUTO.
Verify that the MAN indicator extinguishes.
 - Adjust the AUTO GAIN control while observing the power meter display.
- Requirement:** $-2.0 \text{ dBm} \pm 0.2 \text{ dB}$.
- Were the requirements met?
- YES - Go to Step 7.
- NO - Go to Flowchart 3, Unit Replacement and Alignment—IF AGC Amplifier.
- 7 On the IF AGC AMPL:
- Remove the power meter connection from the IF OUT jack.
 - Reconnect the normal bay cable to the IF OUT jack.
- 8 On the ALARM AND METER unit:
- Set the selector switch to RCVR—AGC V.
 - Record the displayed AGC voltage on the RADIO DATA CARD on the RCVR "AGC V NORMAL" line.
- 9 On the IF AGC AMPL:
- Remove the cable from the IF IN jack.
 - Connect a short cable (SMB-F to SMB-F) to the IF IN jack.
 - Connect a 30-dB pad, type 19-H or equivalent, between the two cables.

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Comment: You have inserted 30-dB loss in series with the input to the IF AGC Amplifier and now you will carefully set the trip point.

- 10 On the IF AGC AMPL,
is the LPW IN indicator lighted?
YES - Go to Step 11.
NO - Go to Step 12.
- 11 On the IF AGC AMPL,
adjust the LPW IN TRIP control counterclockwise until
the LPW IN indicator goes off (extinguishes).
- 12 On the IF AGC AMPL,
adjust the LPW IN TRIP clockwise until the
LPW IN indicator just lights.
- Requirement:** The LPW IN indicator lights.
- Was the requirement met?
YES - Go to Step 13.
NO - Go to Flowchart 3, Unit Replacement and
Alignment—IF AGC Amplifier.
- 13 On the ALARM AND METER unit:
a. Set the selector switch to RCVR—AGC V.
b. Record the displayed AGC voltage on the RADIO DATA CARD
on the RCVR "AT LPW IN" line (located directly below the AGC V
NORMAL entry).
c. Set the selector switch to TRMTR—OFF.
- 14 On the IF AGC AMPL:
a. Remove the short cable and 30-dB pad between the IF OUT jack
and the normal bay cable.
b. Reconnect the normal bay cable to the IF OUT jack.
- 15 Return to the flowchart or procedure that sent you here.

End of Procedure

4.4 Adaptive Slope Equalizer Checks and Adjustments

This procedure will, among other things:

- a. Measure the output level of the Adaptive Slope Equalizer (ASE).
- b. Determine and record control voltages (CONT V) for two amplitude response conditions; CONT V MAN for a flat response in the MANUAL mode, and CONT V AUTO for 0.5 dB of positive slope in the AUTO mode.

You will use the CONT V MAN voltage to condition the ASE (in the MAN mode) for a flat response during transmission tests involving swept signals [Envelope Delay Distortion (EDD), etc.]. In normal operation (AUTO), CONT V AUTO voltage presets the amplitude response of the ASE for 0.5 dB of positive slope. This positive slope offsets the negative slope of connected cable.

Comment: In the AUTO mode of operation, an ASE is unable to equalize a "swept" test signal, one in which a constantly changing, single-frequency tone sweeps across the bandwidth. Therefore, the CONT V voltage that establishes the 0.5 dB of positive slope must be determined with the ASE in the MANUAL mode of operation; then CONT V AUTO is set to the same value.



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: <ul style="list-style-type: none"> 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. <p><i>Comment: In Steps 2 through 4, you will measure the output level of the ASE.</i></p>
2	On the ADAPTIVE SLOPE EQL, remove the cable from the IF OUT jack.
3	Connect the test equipment as shown in Figure 20.

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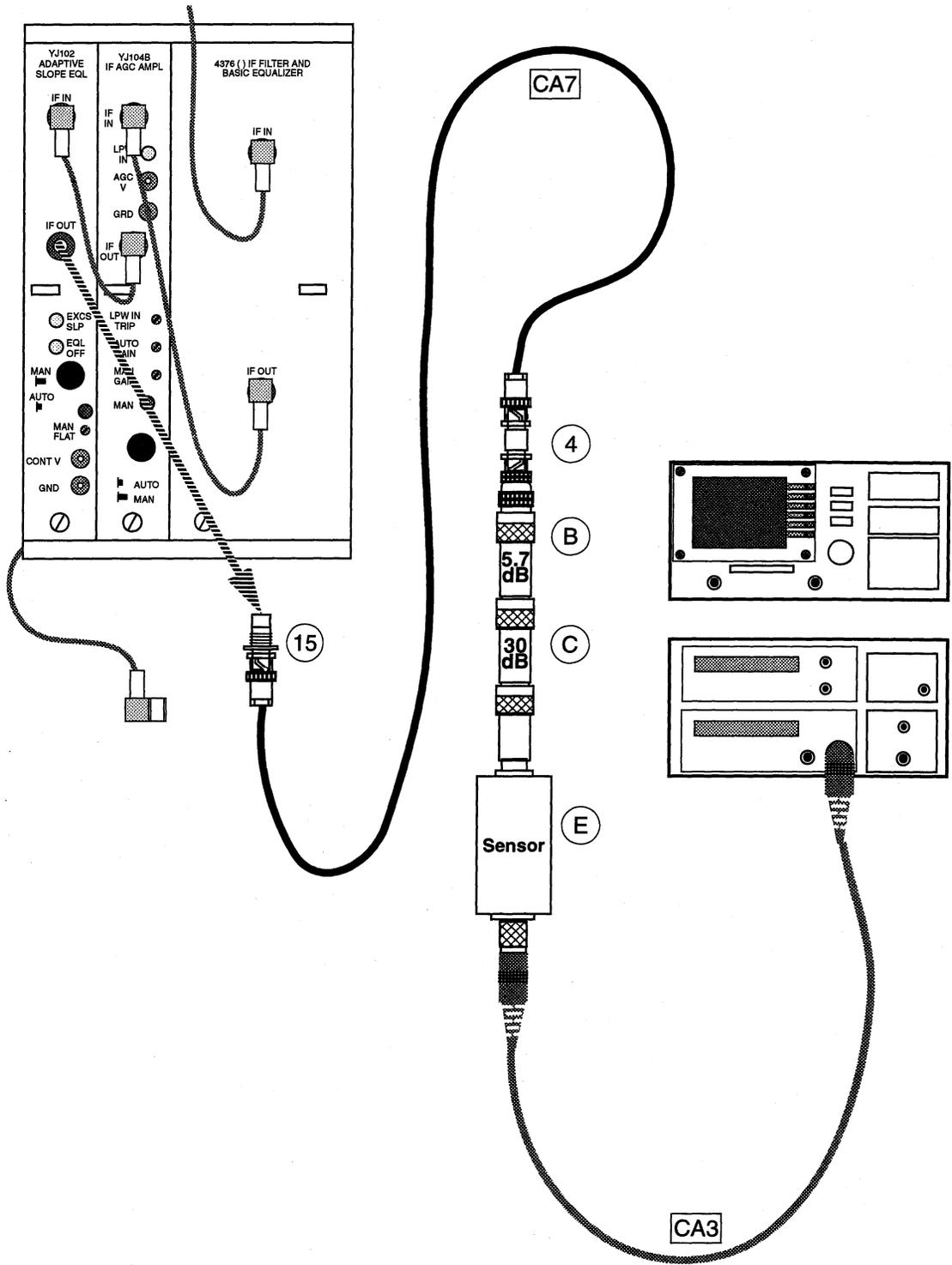


Figure 20. Adaptive Slope Equalizer IF OUT Level

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- 4 On the POWER METER,
observe the display.

Requirement: $-2.0 \text{ dBm} \pm 0.5 \text{ dB}$.

Was the requirement met?

YES - Update the RADIO DATA CARD—RCVR “ADPT SL EQL IF OUT”, if necessary.

- Go to Step 5.

NO - Go to **TROUBLE ISOLATION** tab,
3.2 IF Level Problem.

- 5 On the ADAPTIVE SLOPE EQUALIZER:
- Remove the power meter connection from the IF OUT jack.
 - Remove the bay cable from the IF IN jack.

Comment: Steps 6 through 10 establish the level of the IF test signal.

- 6 Connect the test equipment as shown in Figure 21.

- 7 On the SPECTRUM ANALYZER:

- Press the green PRESET key.
- Press the FLATNESS & SOURCES softkey.
- 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.

- Press the CENTER FREQ softkey.

Verify that CENTER 70.00 MHz is displayed in the active function block (default value).

- Press the SPAN softkey.
- Use the DATA keys to enter 0 Hz.

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

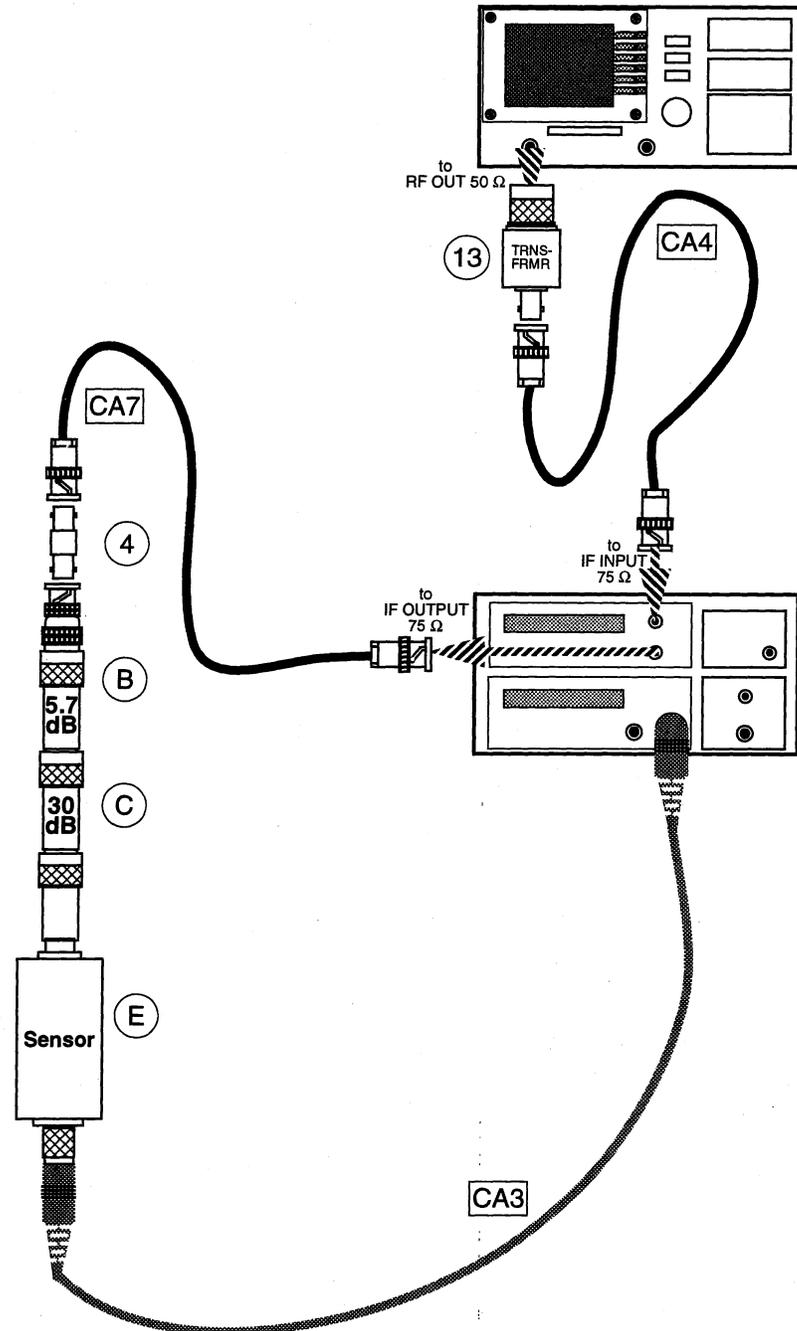


Figure 21. Establish IF Test Signal Level and Center Frequency

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

If SRC PWR ON OFF softkey was not displayed, you probably pressed the SPAN key rather than the SPAN softkey. If this is the case, press the MODE key two times to return to the FLATNESS & SOURCES main menu; then press the Sources softkey (SRC PWR will be highlighted) and go to sub-step h.

- h. Press the SRC PWR ON OFF softkey to underline ON.
- i. Press the HOLD key to close the active function block.

8 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.)

9 On the POWER METER,

observe the display as you perform the next step.

10 On the MULTIPATH FADING SIMULATOR:

- a. Use the arrow keys to adjust ATTEN (dB) for a power meter display of $-2.0 \text{ dBm} \pm 0.1 \text{ dB}$.
 - 1. Verify that the MFS display indicates a positive ATTEN (dB) value (about 1.7 ± 1.0).

Comment: You should never have a negative ATTEN (dB) value because negative attenuation is amplification (gain), not loss.

- 2. Verify that the power meter display indicates $-2.0 \text{ dBm} \pm 0.1 \text{ dB}$.

- c. Press the ENTER key (on MFS) to lock the attenuator value.

Comment: Steps 11 and 12 calibrate the back-to-back amplitude response of the test equipment and cables.

11 Change the test connections to those shown in Figure 22.

12 On the SPECTRUM ANALYZER:

- a. Press the SPAN softkey.
- b. Use the DATA keys to enter 24 MHz.

Verify that SPAN 24.00 MHz is displayed in the active function block.

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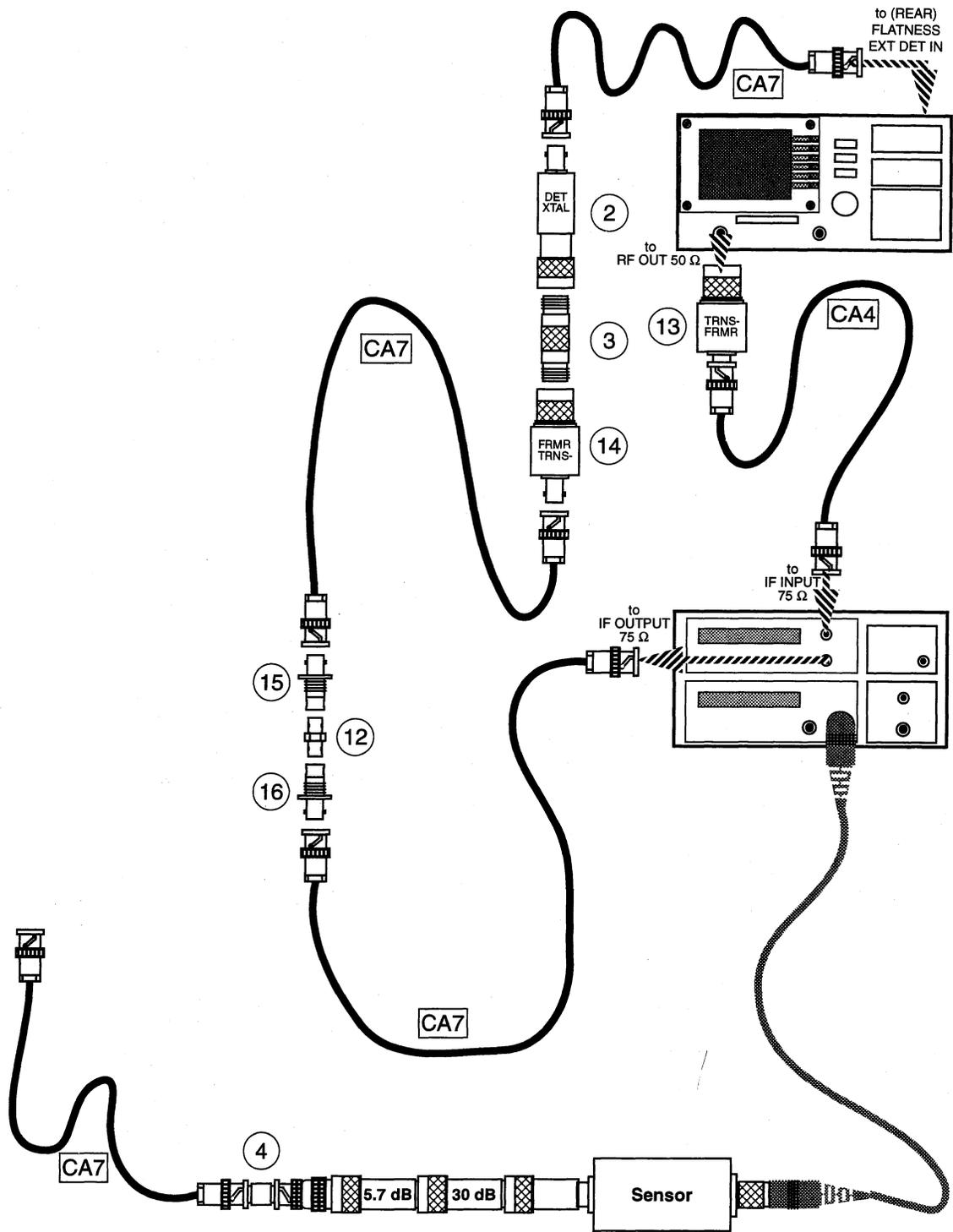


Figure 22. Calibrate Test Equipment Back-to-Back

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- c. Press the Main Menu softkey.

If the Main Menu softkey was not displayed, you probably pressed the SPAN key rather than the SPAN softkey. If this is the case, press the MODE key two times to return to the FLATNESS & SOURCES main menu; then go to sub-step d.

- d. Press the Cal softkey.

- e. Press the CAL TRANS softkey.

Verify that Connect THRU, Store when ready is displayed in the active function block.

- f. Press the STORE THRU softkey.

Wait for
THRU cal stored, Normalization ON
to appear in the active function block.

- g. Press the Main Menu softkey.

- h. Press the Meas softkey.

- i. Press the AMPL TRK ON OFF softkey to underline ON.

- j. Press the SCALE LOG softkey.

- k. Use the DATA keys to enter 0.1 dB (per div).

Verify that LOG .1 dB/ is displayed in the active function block.

- l. Press HOLD key to extinguish active function block.

Requirement: A *flat* response should be observed on the screen display.
(If the requirement is not met, recheck the test setup.)

Comment: *In Steps 13 through 19, with the ADAPTIVE SLOPE EQUALIZER (ASE) in the MAN mode, you will verify the flatness of the trace. If necessary, you will adjust it to flat. You will then record the CONT V voltage that produced that flatness.*

- 13 On the ADAPTIVE SLOPE EQL,
 set the AUTO/MAN switch to MAN.

Comment: *Step 14 consists of removing item 12 (an adapter) from the existing test setup (Figure 22) and replacing it with the ASE.*

- 14 Connect the test equipment as shown in Figure 23.

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See notice on first page

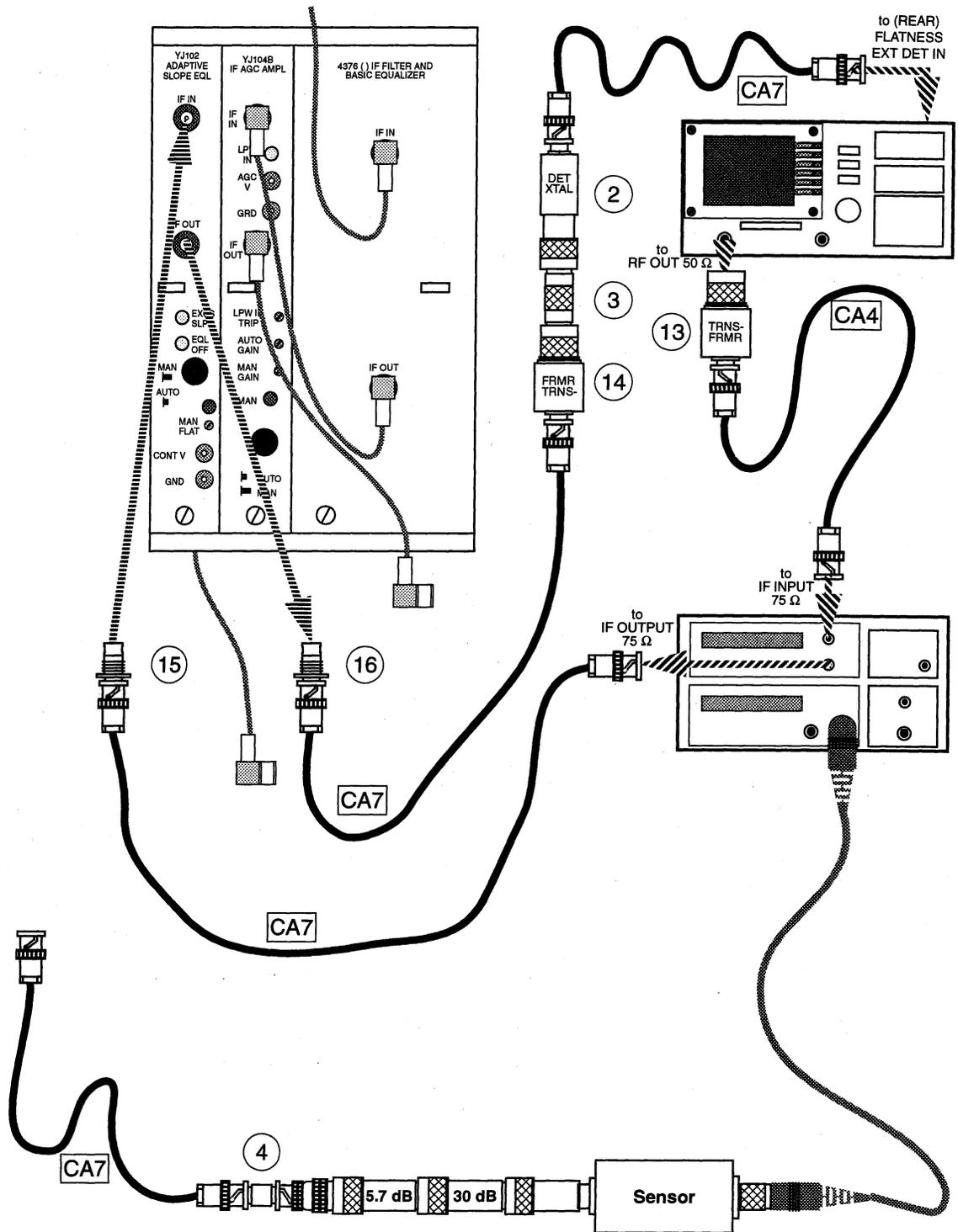


Figure 23. ASE Amplitude vs. Frequency Response

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- 15 On the SPECTRUM ANALYZER,
 observe the amplitude variations of the display between
 the +12 and -12 MHz end points.
- Comment:* *In this step, you are concerned only with the amplitude
 levels at the ends of the 24-MHz span (at 58 MHz and at 82 MHz)
 which are the +12 and -12 MHz points. Right now, you do not
 care what might be between those points.*
- Requirement:** The +12 and -12 MHz end points must be equal level,
 within ± 0.02 dB.
- Was the requirement met?
- YES - Go to Step 17.
 NO - Go to Step 16.
- 16 On the ADAPTIVE SLOPE EQL,
 adjust the MAN FLAT control to meet the requirement of Step 15.
- Is the requirement met now?
- YES - Go to Step 17.
 NO - Go to Flowchart 3, Unit Replacement and
 Alignment—Adaptive Slope Equalizer.
- 17 On a digital MULTIMETER,
 condition it to measure 10 volts.
- 18 Which series Adaptive Slope Equalizer does this receiver have?
 (You will need to know this for later steps.)
- SER 1, 2, or 3 should be stamped on the faceplate of the ASE.
- a. Series 1 and Series 2 ASE's have a CONT V voltage in the
 0.3-volt range.
- b. Series 3 ASE CONT V voltage is in the 3.0-volt range.
- For example, typical measurements might be:
- Series 1 or 2:
 0.334 volts
- Series 3:
 -3.34 volts.

- 19 On the ADAPTIVE SLOPE EQUALIZER:
- a. Connect the voltmeter between the CONT V and the GND jacks.
 - b. Measure the voltage.

For a Series 1 or 2 ASE,
include three places to the right of the decimal point.

For a Series 3 ASE,
include two places to the right of the decimal point.
 - c. Update the RADIO DATA CARD—
RCVR "CONT V MAN", if necessary.

Comment: Back in Step 10, you set enough attenuation in the MULTIPATH FADING SIMULATOR for a test signal level of -2.0 dBm. Now you need a test signal level of -8.0 dBm. Rather than repeat that process, you will, in Step 20, simply add an additional 6 dB of loss to the amount already showing on the MFS display.

- 20 On the MULTIPATH FADING SIMULATOR:
- a. Note the attenuation displayed (about 1.7 dB).
 - b. Press the ATTEN key.
 - c. Use the arrow keys to increase ATTEN by 6 dB, for a new display of about 07.7 dB, which is an additional 6 dB of attenuation.
 - d. Press ENTER to lock the attenuator value.

Comment: Next, you will rearrange the test setup to include the IF filter & basic equalizer, the AGC amplifier, and the adaptive slope equalizer. With the AGC amplifier and the adaptive slope equalizer in the MAN mode, you will temporarily adjust the MAN FLAT control on the adaptive slope equalizer for a 0.5 dB positive slope. After you note the CONT V for that amount of positive slope, you will readjust CONT V back to the value recorded in Step 19 for a flat response.

21 Connect the test equipment as shown in Figure 24.

22 On the IF AGC AMPL:

- a. Set the AUTO/MAN switch to MAN.

Comment: Since we put the IF AGC amplifier in manual gain, we need to verify that the IF OUT level is correct.

- b. Remove the bay cable from the IF OUT jack.
- c. Connect the power meter test connection to the IF OUT jack.

Requirement: $-2.0 \text{ dBm} \pm 0.5 \text{ dB}$ on the power meter display.

Comment: The power meter display will be varying, but this level is not critical. For a stable display, the SPAN can be set to 0 Hz for the adjustment and then returned to 24 MHz.

If the requirement is not met, adjust the MAN GAIN control on the IF AGC amplifier for the required level.

- d. Remove the power meter test connection from the IF OUT jack.
- e. Reconnect the normal bay cable to the IF OUT jack.

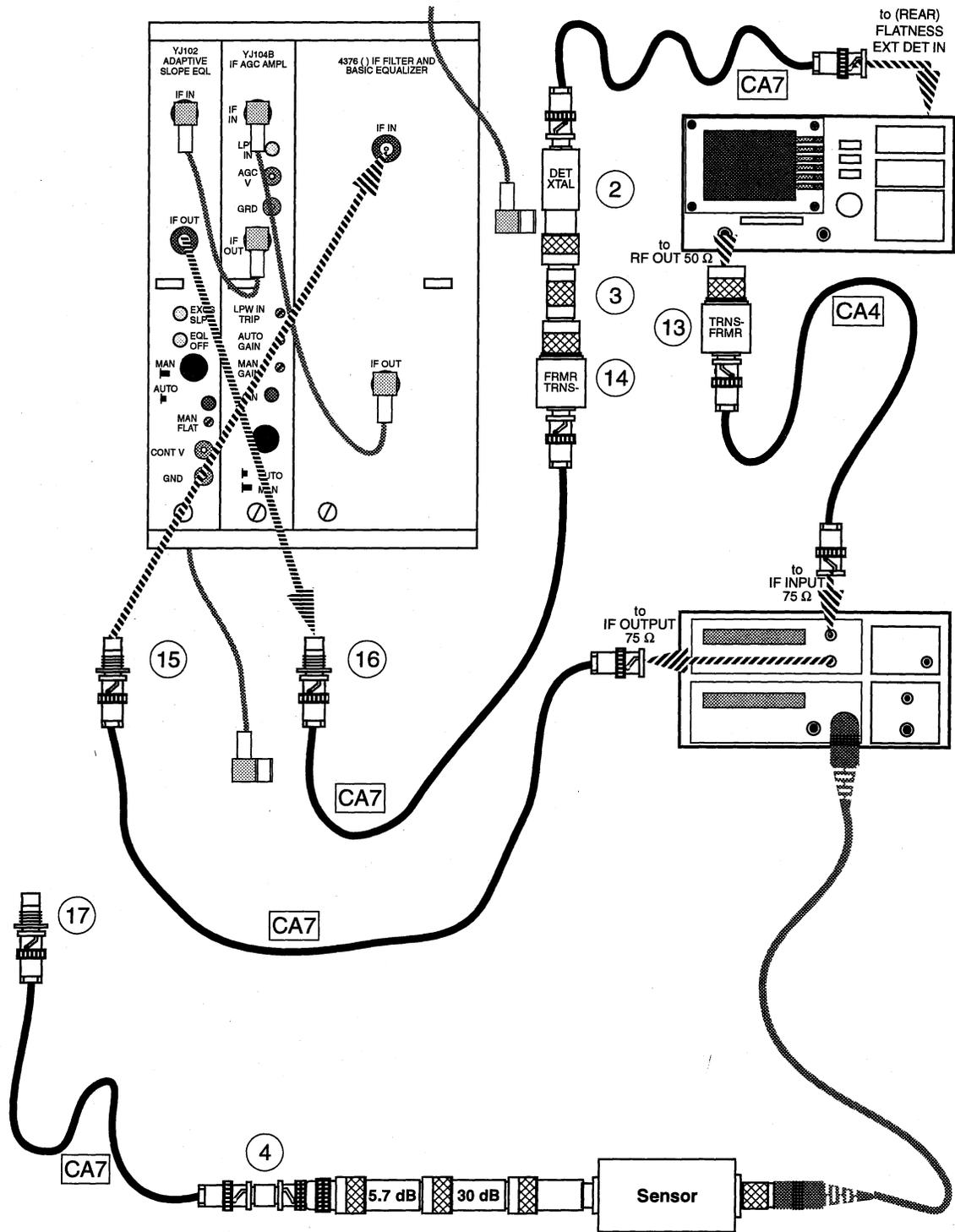
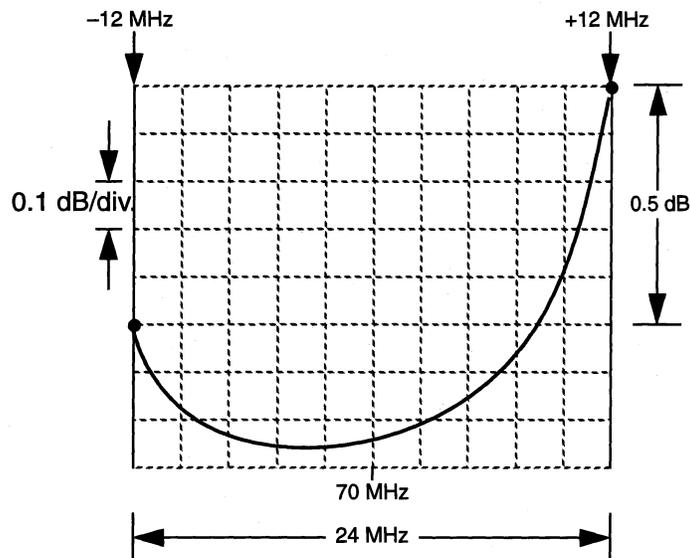


Figure 24. ASE + AGC Amp. + Flt/Eql Amplitude vs. Frequency Response

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Comment: We are now ready to look at the amplitude response.

- 23 On the SPECTRUM ANALYZER,
observe the +12 and -12 MHz end points on the spectrum display.
If the display is vertically unstable, press the AMPL TRK softkey to underline OFF. (It may be necessary to alternate between ON and OFF during the following steps.)
- 24 On the ADAPTIVE SLOPE EQUALIZER:
a. Adjust the MAN FLAT control for 0.5 dB of positive slope between the +12 and -12 MHz points.
Verify that the display trace at +12 MHz is 0.5 dB higher than the trace at -12 MHz, as shown below.



- b. Measure CONT V and note it as "CONT V (0.5-dB positive slope)" for later use.

For example, typical measurements might be:

- Series 1 or 2:
0.334 volts
 - Series 3:
-3.34 volts.
- c. Readjust the MAN FLAT control to the same CONT V MAN value recorded on the RADIO DATA CARD in Step 19.

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- 25 On the ADAPTIVE SLOPE EQUALIZER:
- a. Leave the voltmeter connected to CONT V and GND jacks.
 - b. Remove the test connection from the IF OUT jack.
 - c. Reconnect the normal bay cable to the IF OUT jack.

Comment: Here is the problem: we want 0.5-dB positive slope in the ASE in AUTO mode, but the ASE will not regulate on a swept test signal. We will use a 64-Quadrature Amplitude Modulation (QAM) signal and set the CONT V for the same voltage that produced 0.5-dB positive slope in the MAN mode using a swept test signal.

Comment: Because of accumulated transmission impairments, the received 64-QAM signal is not "clean" enough for an accurate slope measurement. For that measurement, we will "borrow" the input signal to the radio transmitter in the opposite direction. It has just left the terminal or regenerator transmitter and has not accumulated any transmission impairments.

**CAUTION:**

To avoid any service interruption, work with the Transport Service Center (TSC) to release from service a radio transmitter in the opposite direction of transmission.

- 26 On the selected and service-protected RADIO TRANSMITTER:
- a. Operate the **ALC ON/OFF** switch to **OFF**.
 - b. Remove the bay cable from the IF IN jack of the IF Predistorter.
If the radio transmitter is not equipped with an IF Predistorter, remove the cable from the IF IN jack of the up-converter.
- 27 On the IF FILTER AND BASIC EQUALIZER:
- a. Remove the test cable from the IF IN jack.
 - b. Connect the 64-QAM signal from the cable removed in Step 26 to the IF IN jack.
You will need to use a test cable and appropriate adapters, but use less than 20 feet of cable.
- 28 On the IF AGC AMPL,
- set the AUTO/MAN switch to AUTO.

- 29 On the ADAPTIVE SLOPE EQUALIZER:
- a. Set the AUTO/MAN switch to AUTO.
 - b. Measure the voltage at the CONT V jack.
 - c. Compare the measured voltage with the voltage noted as "CONT V (0.5-dB positive slope)" in Step 24.

Requirement: The measured voltage and the voltage noted as "CONT V (0.5-dB positive slope)" in Step 24 shall be within:

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

Was the requirement met?

YES - Go to Step 31.

NO - Go to Step 30.

- 30 On the ADAPTIVE SLOPE EQUALIZER:
- a. Remove the cables from the IF IN and IF OUT jacks.
 - b. Remove the ADAPTIVE SLOPE EQL from the receiver shelf.

Reference: **REPLACEMENT PROCEDURES** tab.

- c. Insert a card extender (ED-54785-30, GRP 2) into the ADAPTIVE SLOPE EQL slot on the receiver shelf.
- d. Insert the ADAPTIVE SLOPE EQL into the extender.
- e. Reconnect normal bay cables to the IF IN and IF OUT jacks using adapters and short test cables.

Comment: The following adjustment control is located through a hole on the right side of the ASE. The control is unlabeled, but we will call it "AUTO CONT V ADJ" because it adjusts the control voltage in the AUTO mode.

- f. Through the hole on the right side, adjust the "AUTO CONT V ADJ" control to meet the requirement of Step 29.

Requirement:

- The Step 29 requirement is met.
- The EXCS SLP indicator is extinguished.

Were the requirements met?

YES - Remove the card extender and insert the ASE unit into its slot.

- Go to Step 31.

NO - Go to Flowchart 3, Unit Replacement and Alignment—Adaptive Slope Equalizer.

- 31 Disconnect the test equipment.
- 32 Restore all connections to normal.
- 33 On the selected RADIO TRANSMITTER,
operate the **ALC ON/OFF** switch to **ON**.
- 34 Restore the selected radio transmitter to service.
- 35 Return to the flowchart or procedure that sent you here.

End of Procedure

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4.5 IF to IF Amplitude Response

This procedure checks the IF Amplitude vs. Frequency response of a radio receiver.



CAUTION:

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

Step	Procedure
1	<p>On the TEST SET:</p> <p>a. Calibrate the POWER METER, if necessary.</p> <p style="padding-left: 40px;">Reference: DRTS tab, 2.2 Calibration.</p> <p>b. Enter the OFFSET (as shown on the POWER SENSOR) for measurement of IF between -30 dBm and $+10$ dBm (about 35.7 dB).</p> <p style="padding-left: 40px;">Reference: DRTS tab, 2.3 Entering Offset.</p> <p><i>Comment: Steps 2 through 6 will establish the test signal level and frequency.</i></p>
2	Connect the test equipment as shown in Figure 25.
3	<p>On the SPECTRUM ANALYZER:</p> <p>a. Press the green PRESET key.</p> <p>b. Press the FLATNESS & SOURCES softkey.</p> <p>c. Press the Sources softkey.</p> <p style="padding-left: 40px;">Verify that IF SOURCE PWR .0 dBm is displayed in the active function block (default value).</p> <p style="padding-left: 40px;">Reference: DRTS tab, 3.2.2 Active Function Block.</p> <p>d. Press the CENTER FREQ softkey.</p> <p style="padding-left: 40px;">Verify that CENTER 70.00 MHz is displayed in the active function block (default value).</p> <p>e. Press the SPAN softkey.</p> <p>f. Use the DATA keys to enter 0 Hz.</p> <p style="padding-left: 40px;">Verify that SPAN 0 Hz is displayed in the active function block.</p>

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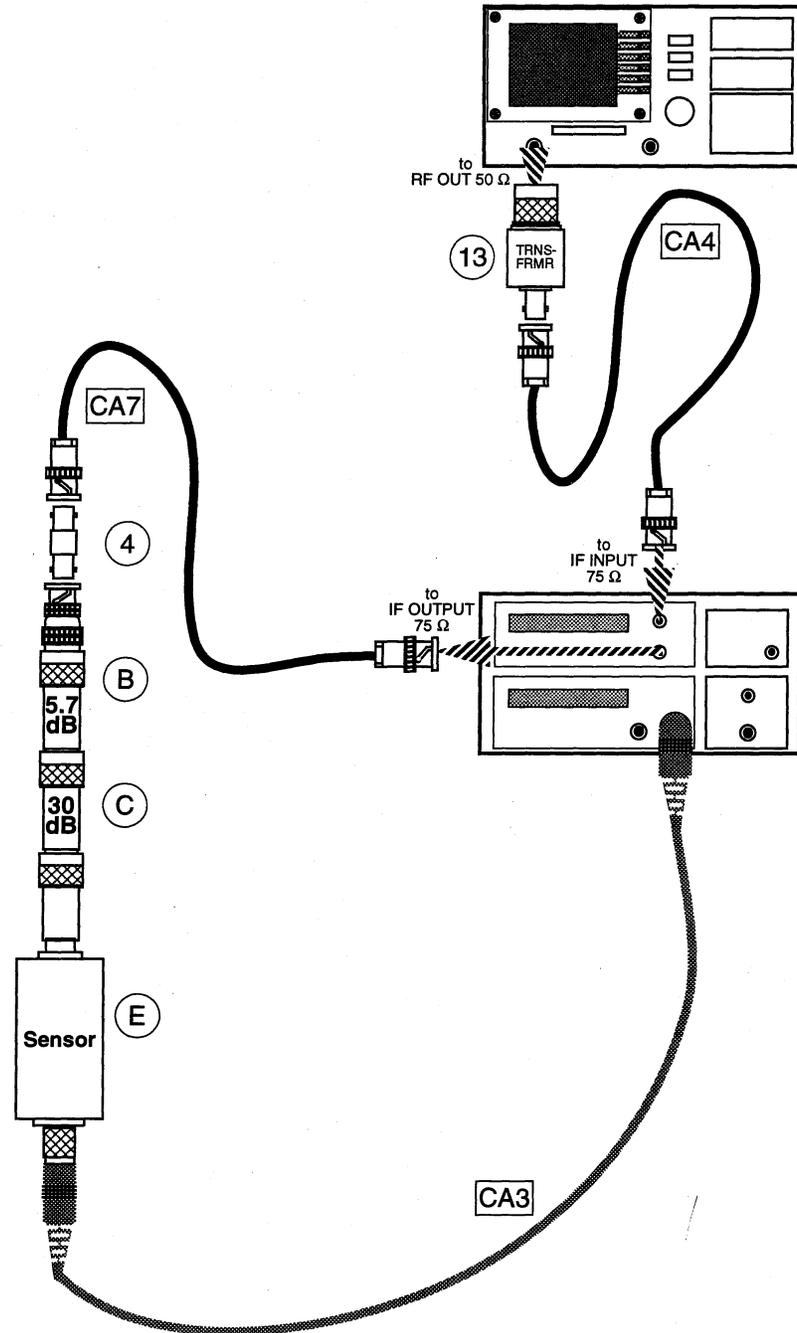


Figure 25. Establish IF Test Signal Level and Center Frequency

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

If SRC PWR ON OFF softkey was not displayed, you probably pressed the SPAN key rather than the SPAN softkey. If this is the case, press the MODE key two times to return to the FLATNESS & SOURCES main menu; then press the Sources softkey (SRC PWR will be highlighted) and proceed to sub-step h.

- h. Press the SRC PWR ON OFF softkey (a second time) to underline ON.
- i. Press the HOLD key to close the active function block.

4 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.)

5 On the POWER METER,

observe the display as you perform the next step.

6 On the MULTIPATH FADING SIMULATOR:

- a. Use the arrow keys to adjust ATTEN (dB) for a power meter display of approximately the same level recorded on the RADIO DATA CARD as "CONV IF OUT" (REG column).

For antenna diversity, use an average of the REG and DIV columns as the test level for both paths.

- b. Press ENTER on the MFS to lock the attenuator value.

Comment: Steps 7 and 8 calibrate the back-to-back amplitude response of the test equipment and cables.

7 Change the test connections to those shown in Figure 26.

8 On the SPECTRUM ANALYZER:

- a. Press the SPAN softkey.
- b. Use the DATA keys to enter 24 MHz.

Verify that SPAN 24.00 MHz is displayed in the active function block.

- c. Press the Main Menu softkey.

If Main Menu softkey was not displayed, you probably pressed the SPAN key rather than the SPAN softkey. If this is the case, press the MODE key two times to return to the FLATNESS & SOURCES main menu; then proceed to sub-step d.

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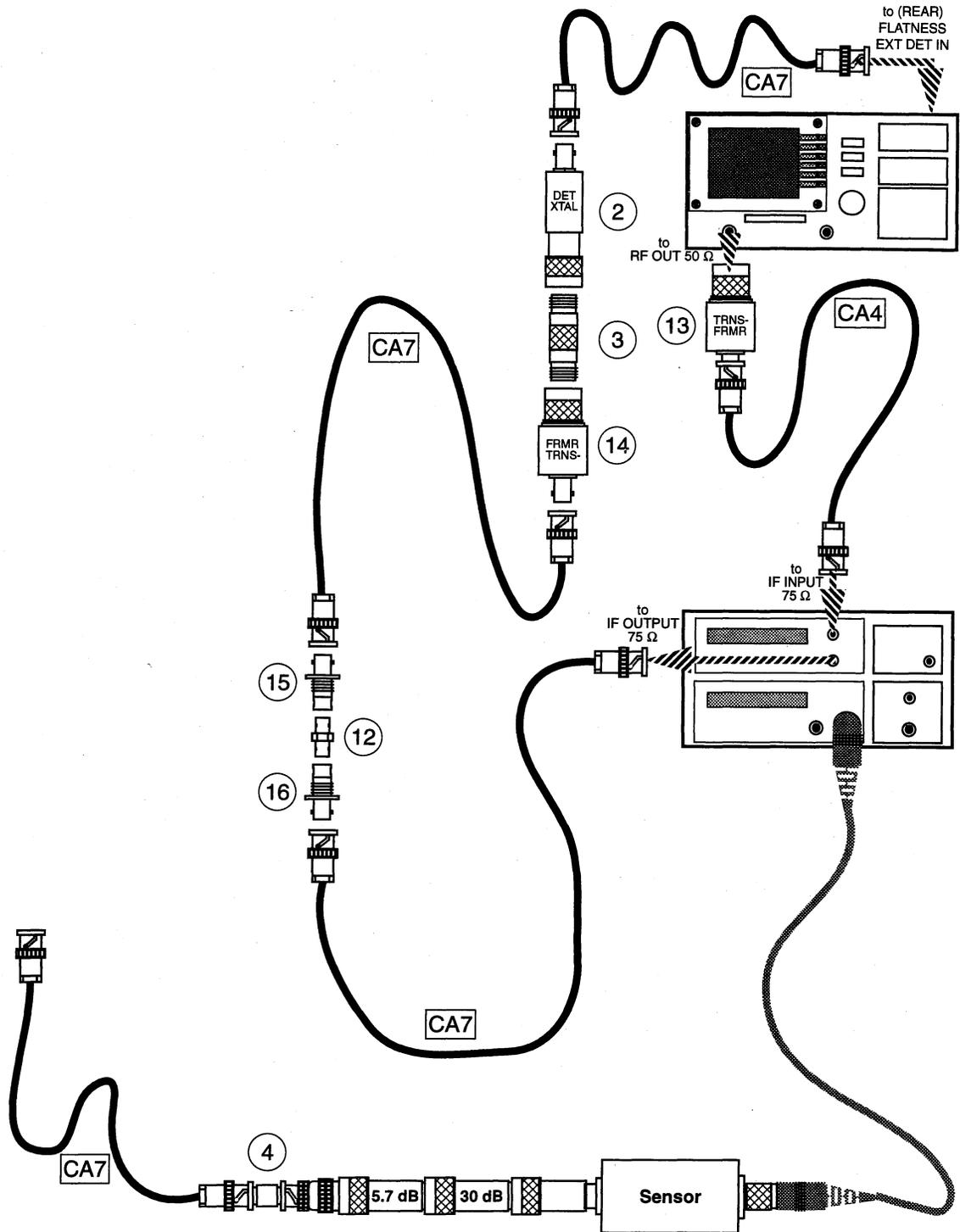


Figure 26. Calibrate Test Equipment Back-to-Back

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- d. Press the Cal softkey.
- e. Press the CAL TRANS softkey.
Verify that Connect THRU, Store when ready is displayed in the active function block.
- f. Press the STORE THRU softkey.
Wait for
THRU cal stored, Normalization ON to appear in the active function block.
- g. Press the Main Menu softkey.
- h. Press the Meas softkey.
- i. Press the AMPL TRK ON OFF softkey to underline ON.
- j. Press the SCALE LOG softkey.
- k. Use the DATA keys to enter 0.2 dB (per div).
Verify that LOG .2 dB/ is displayed in the active function block.
- l. Press HOLD key to close the active function block.

Requirement: A flat response should be observed on the screen display.
(If the requirement is not met, recheck the test setup.)

- 9 On the ADAPTIVE SLOPE EQL:
- a. Set the AUTO/MAN switch to MAN.
 - b. Connect a digital voltmeter (conditioned to read 10 volts) between CONT V and GRD test points.
 - c. Adjust the MAN FLAT control to obtain the same voltage recorded on the RADIO DATA CARD as "CONT V MAN".
For a Series 1 or 2 ASE,
include three places to the right of the decimal point.
For a Series 3 ASE,
include two places to the right of the decimal point.
 - d. Remove the bay cable from the IF OUT jack.
- 10 On the LINEAR DELAY EQUALIZER,
remove the bay cable from the IF IN jack.
For antenna diversity, remove both (REG and DIV) IF IN cables.
- Comment:* Step 11 consists of removing item 12 (an adapter) from the existing test setup (Figure 26) and replacing it with the IF portion of the radio receiver.
- 11 Connect the test equipment as shown in Figure 27 (antenna diversity) or Figure 28 (non-diversity).

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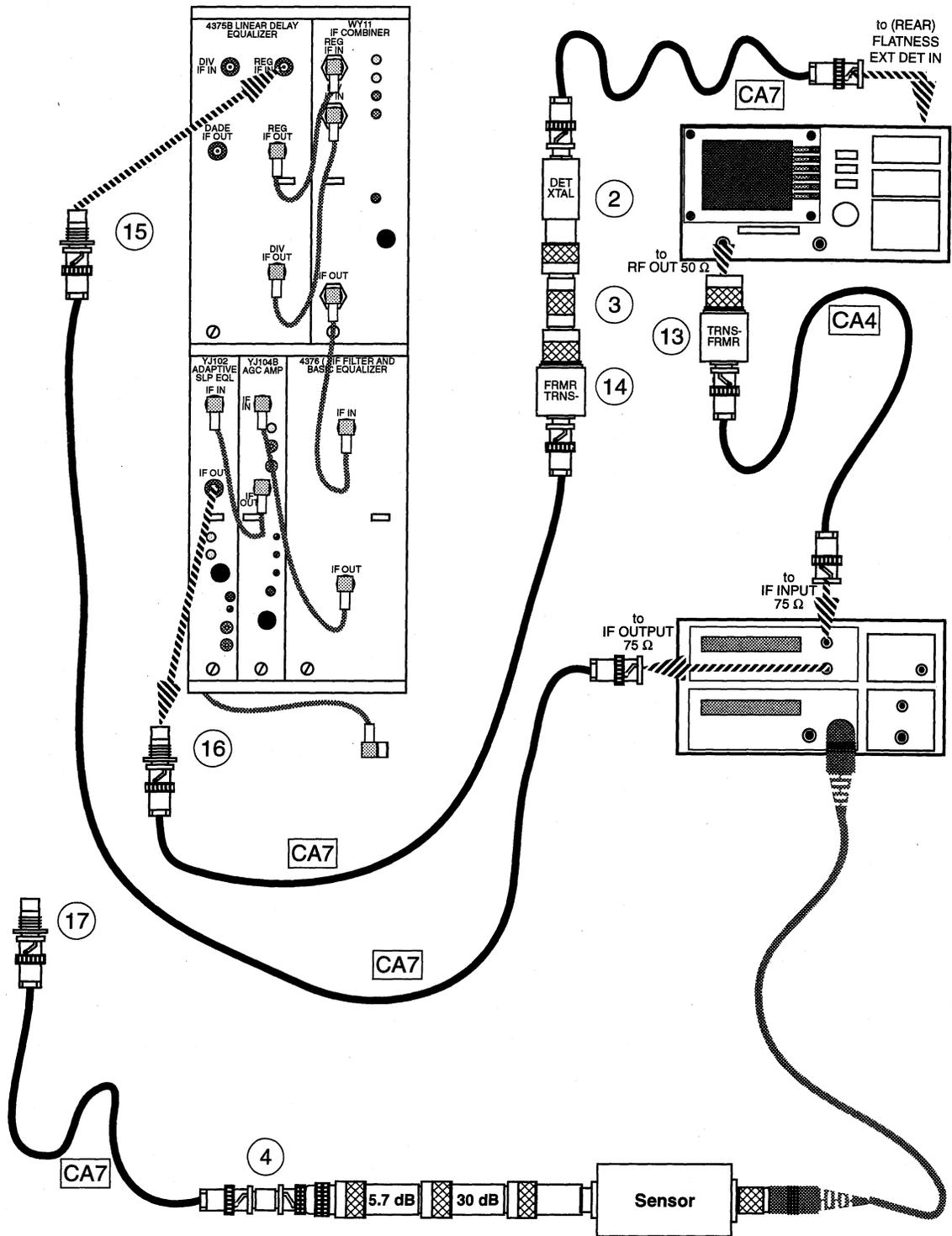


Figure 27. Receiver Amplitude vs. Frequency Response (ANT DIV)

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12 On the IF COMBINER, if equipped,
set the AUTO/MAN switch to MAN.

13 On the IF AGC AMPL:
a. Set the AUTO/MAN switch to MAN.

Comment: Because we put the IF AGC amplifier in manual gain, we need to verify that the IF OUT level is correct.

- b. Remove the bay cable from the IF OUT jack.
- c. Connect the power meter test connection to the IF OUT jack.

Requirement: $-2.0 \text{ dBm} \pm 0.5 \text{ dB}$ on the power meter display.

Comment: The power meter display will be varying, but this level is not critical. For a stable display, the SPAN can be set to 0 Hz for the adjustment and then returned to 24 MHz.

If the requirement is not met, adjust the MAN GAIN control on the IF AGC amplifier for the required level.

- d. Remove the power meter test connection from the IF OUT jack.
- e. Reconnect the normal bay cable to the IF OUT jack.

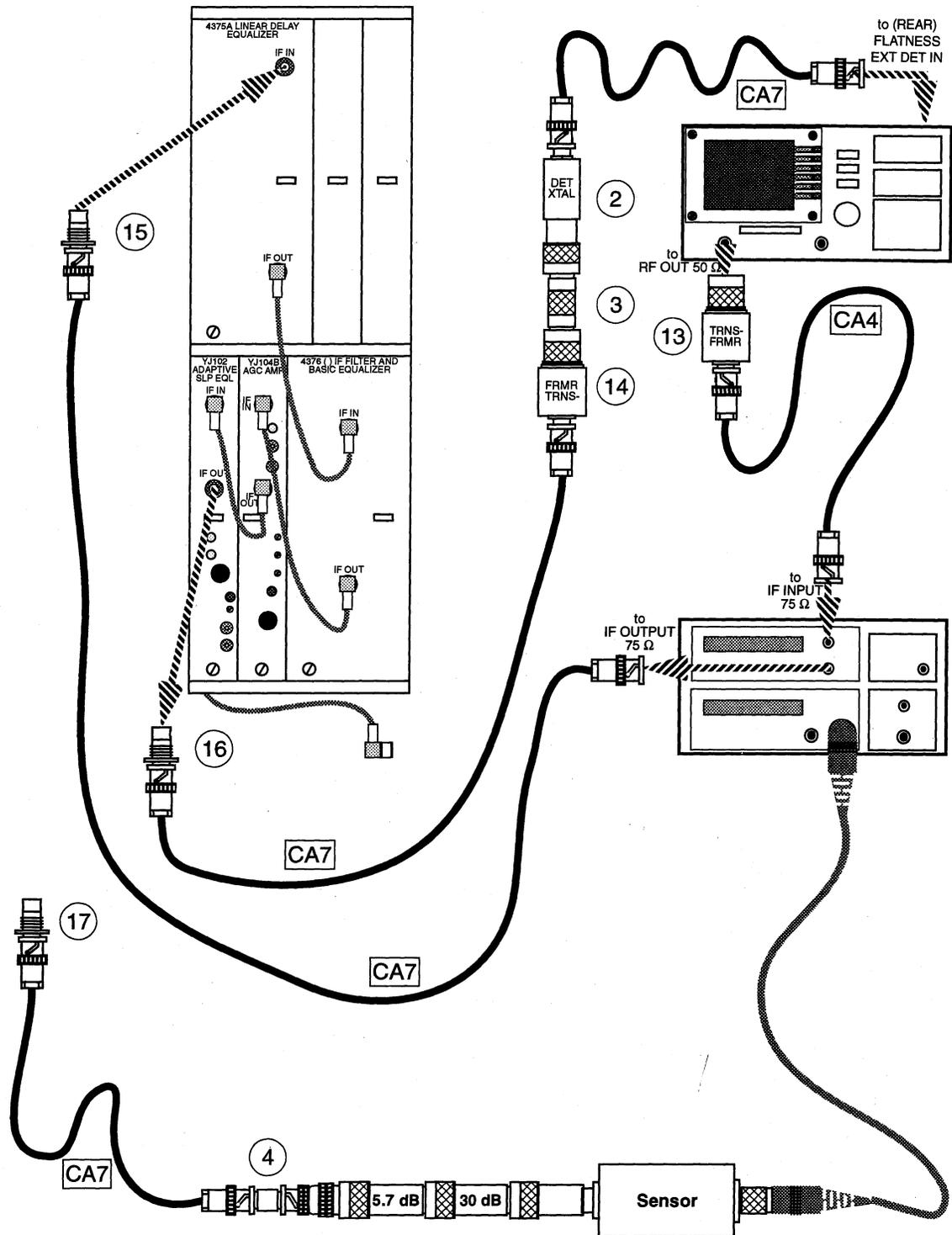


Figure 28. Receiver Amplitude vs. Frequency Response (Non-DIV)

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Comment: We are now ready to look at the amplitude response.

- 14 On the SPECTRUM ANALYZER,
observe the amplitude display.
Refer to Figure 29 for examples and definitions of slope, parabolic,
and ripple shapes.

Requirement 1: Slope component.

- Antenna-diversity receivers:
less than ± 1.5 dB slope across the 24-MHz band
- Non-diversity receivers:
less than ± 1.0 dB slope across the 24-MHz band.

Requirement 2: Parabolic component.

- 6 GHz: positive parabolic (smile) of 0.6 dB ± 0.2 dB
- 11 GHz: positive parabolic (smile) of 0.3 dB ± 0.2 dB.

Requirement 3: Ripple component.

Ripple component must be less than 0.2 dB, peak to peak.

Were all requirements met?

YES - Go to Step 15.

NO - Test each unit individually to locate the defective unit.

Refer to Table O for unit slope requirements.

- Resolve any discrepancy.

- Go to Step 15.

Table O. Typical IF Unit Slope

Unit	Slope (Across 24 MHz)
Linear Delay Equalizer — 2001A,B,C,D,E,F,G,H,J,K,L,M, or P	Less than 0.1 dB
Linear Delay Equalizer — 2001N	Less than 0.2 dB
Basic Equalizer — 2002C,D, or G	Less than 0.2 dB
IF Filter, 1603B	Less than 0.2 dB
IF Combiner * †	Less than 0.2 dB
IF AGC Amplifier *	Less than 0.2 dB
* Operate the AUTO/MAN push button to MAN when testing unit.	
† Sweep through the active input and disconnect the nonactive input when testing unit.	

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- 15 For an antenna-diversity receiver, go to Step 16.
For a non-diversity receiver, go to Step 18.

Comment: In Steps 16 and 17, you will test the diversity path.

- 16 On the LINEAR DELAY EQUALIZER:
- a. Move the test connection from the REG IF IN jack to the DIV IF IN jack.
 - b. Leave the REG IF IN jack open.
- 17 On the SPECTRUM ANALYZER,
observe the amplitude display.

Requirement 1: Slope component.

Less than ± 1.5 dB slope across the 24-MHz band.

Requirement 2: Parabolic component.

- 6 GHz: positive parabolic (smile) of 0.6 dB ± 0.2 dB
- 11 GHz: positive parabolic (smile) of 0.3 dB ± 0.2 dB.

Requirement 3: Ripple component.

Ripple component must be less than 0.2 dB, peak to peak.

Were all requirements met?

YES - Go to Step 18.

NO - Test each unit individually to locate the defective unit.

Refer to Table O for unit slope requirements.

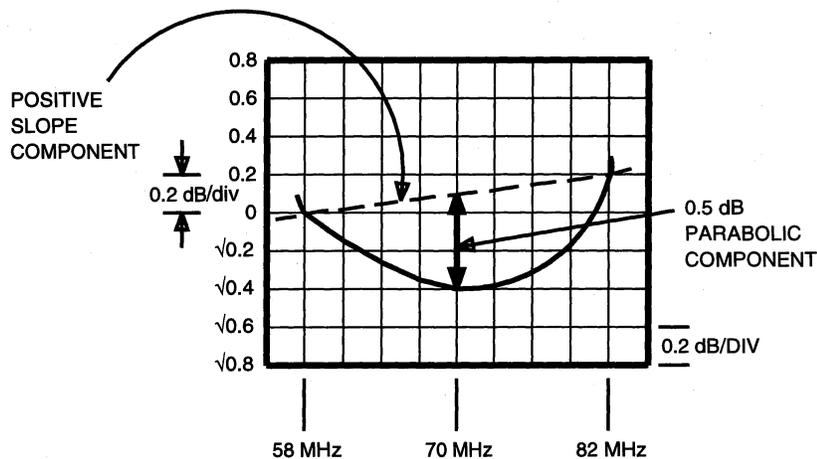
- Resolve any discrepancy.

- Go to Step 18.

- 18 On the LINEAR DELAY EQUALIZER:
- a. Remove the test connection.
 - b. Make the following connection(s):
 - For antenna diversity,
connect normal bay cables to the REG IF IN jack and the DIV IF IN jack.
 - For non-diversity,
connect the normal bay cable to the IF IN jack.

- 19 On the ADAPTIVE SLOPE EQL:
 - a. Remove the test connection from the IF OUT jack.
 - b. Connect the normal bay cable to the IF OUT jack.
 - c. Operate the AUTO/MAN switch to AUTO.
- 20 On the IF AGC AMPL,
 - operate the AUTO/MAN switch to AUTO.
- 21 On the IF COMBINER, if equipped,
 - operate the AUTO/MAN switch to AUTO.
- 22 Return to the flowchart or procedure that sent you here.

End of Procedure



Note: There are no ripple components present.

For help in evaluating the amplitude response, see:

- Figure 30 for examples of component shapes
- Figure 31 to identify and define the components.

Figure 29. Example of Typical Receiver IF-to-IF Amplitude Response

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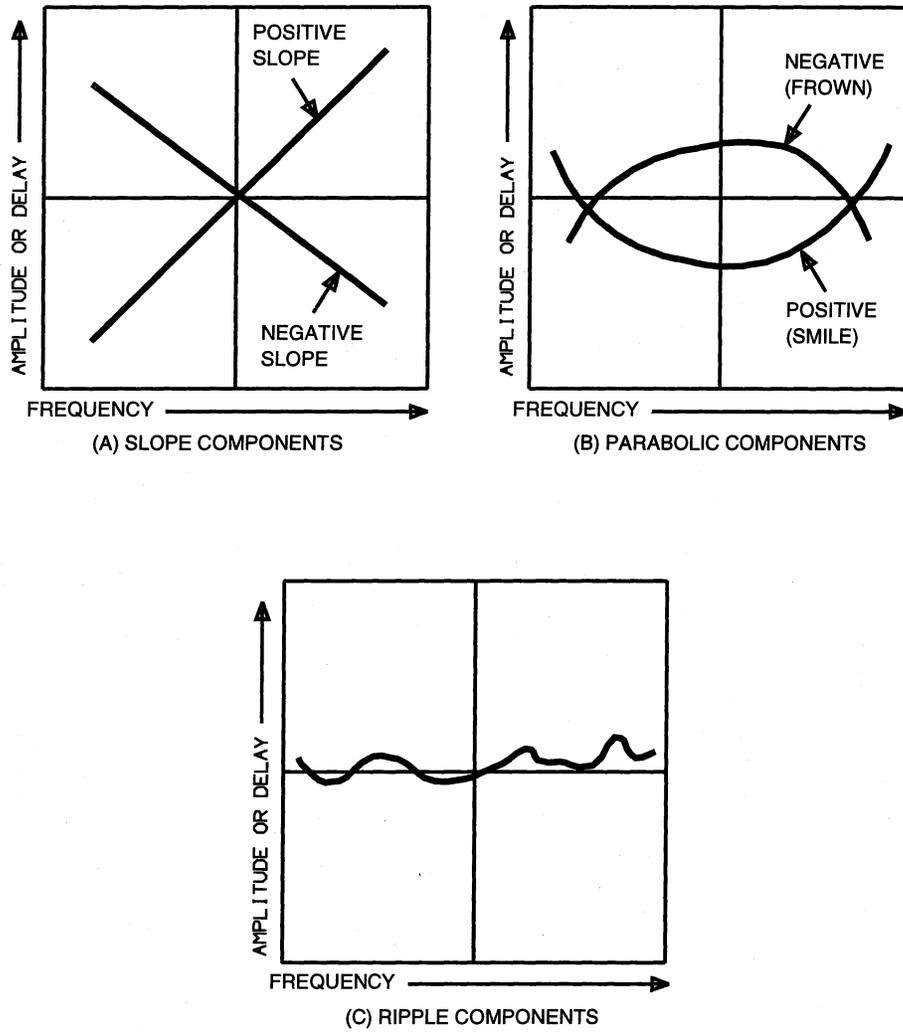
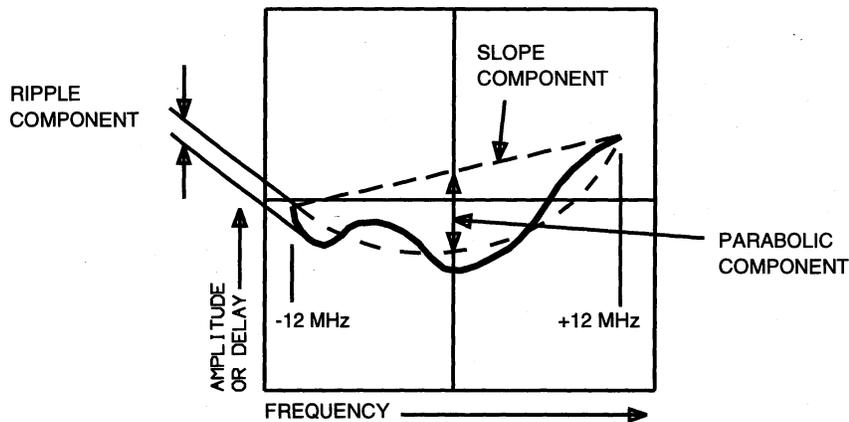


Figure 30. Major Amplitude Distortion Component Shapes

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Response Consisting of:

- Positive Slope
- Positive Parabolic
- Ripple

Figure 31. Example of Amplitude Response

1. 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 this out in determining the slope component. The slope component is then the vertical distance between the + and -12 MHz end points of the imaginary slope line.
2. 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 mentally fitted parabolic curve.
3. Once the slope and parabolic components are separated out, the **ripple** components are determined by the peak-to-peak deviations from the imaginary line.

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4.6 IF Combiner Performance Checks ("Annual")

These checks verify error-free performance as service is switched between the regular and diversity inputs of the IF Combiner. They are performed first with equal length input cables. They are then repeated with an additional eight feet of cable in one input, then the other.

The additional cable adds 12 nanoseconds of delay to that path. Performance checks with unequally delayed input signals simulate combiner switching during fading conditions.



CAUTION:

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

Step	Procedure
1	<p>On the digital terminal-RECEIVER or REGENERATOR associated with this radio receiver,</p> <p style="padding-left: 40px;">observe the ERR RATE bar graph on the CHAN CONTR.</p> <p>Requirement: No errors in 30 seconds.</p>
2	<p>On the IF COMBINER:</p> <ol style="list-style-type: none"> a. Determine which indicator is lighted, REG ACTIVE or DIV ACTIVE. b. Remove the bay cable from the IF IN jack of the active path, forcing the combiner to switch and making the other path active.
3	<p>On the digital terminal-RECEIVER or REGENERATOR associated with this radio receiver,</p> <p style="padding-left: 40px;">observe the ERR RATE bar graph on the CHAN CONTR after activity caused by action in Step 2 has cleared.</p> <p>Requirement: No errors in 30 seconds.</p> <p>Were the requirements met?</p> <p>YES - Go to Step 4.</p> <p>NO - There is an existing error-performance problem.</p> <p style="padding-left: 40px;">- Resolve the problem.</p> <p>Reference: DEGRADED PERFORMANCE tab.</p> <p style="padding-left: 40px;">- Go to Step 4.</p>

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This figure illustrates ANT DIV Configuration 3. (Reference: 1.6 ANT DIV configurations.)

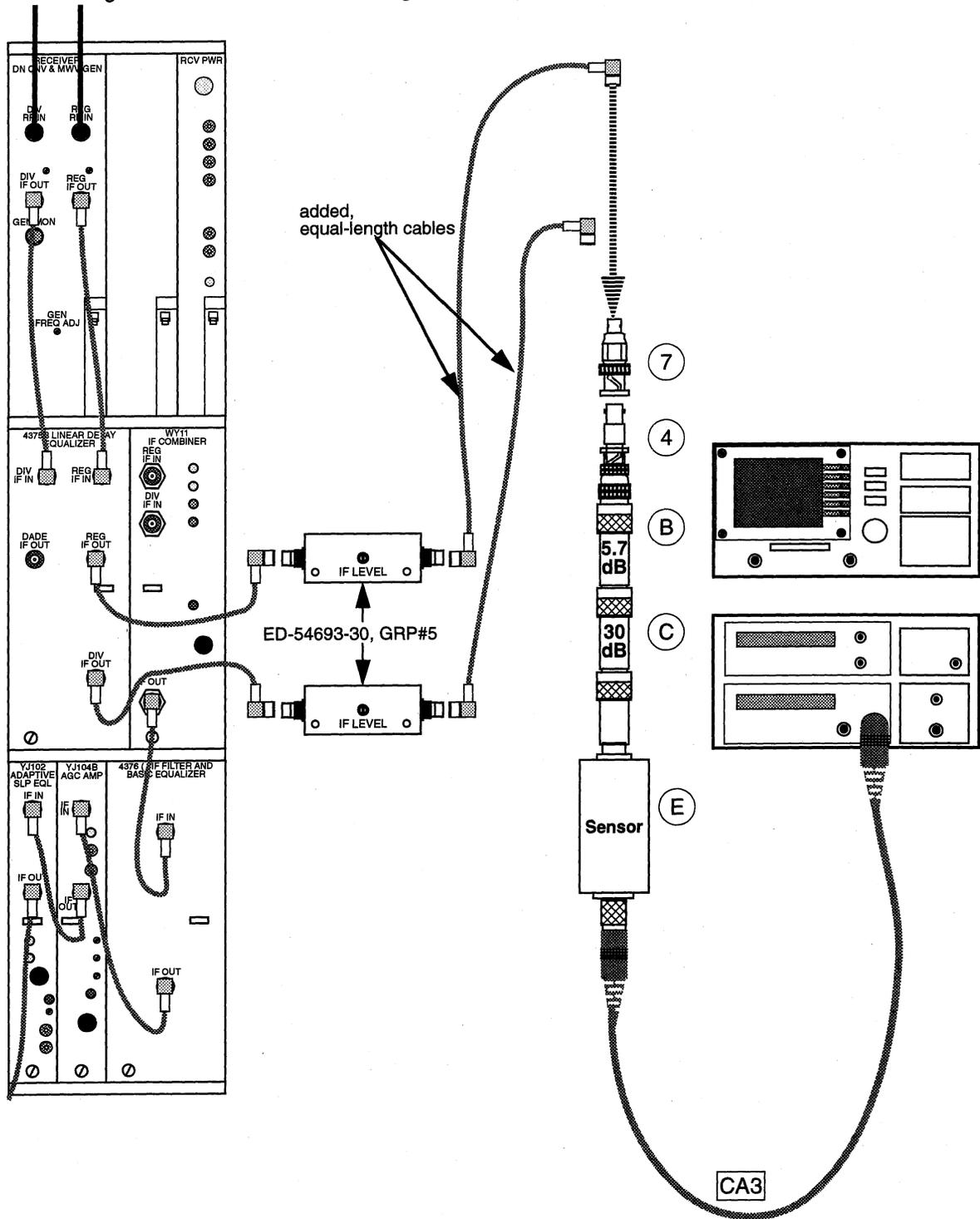


Figure 32. IF Combiner Performance Test

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- 9 Adjust the DIV attenuator control cw for a maximum power meter indication.

Note the displayed level as "DIV level".

Requirement: The levels noted in Step 7, "REG level", and Step 9, "DIV level", shall be within ± 1 dB of each other.

Was the requirement met?

YES - Go to Step 10.

NO - Adjust the attenuator in the higher-level path to within ± 1 dB of the other level.

- Note levels of both paths for later use.

- Go to Step 10.

- 10 On the IF COMBINER,
connect the REG and DIV cables (with attenuators) to their associated IF IN jacks.

- 11 On the associated digital terminal-RECEIVER or REGENERATOR,
observe the bar graph on the CHAN CONTR for errors.

Requirement: No errors in 30 seconds.

Was the requirement met?

YES - Go to Step 12.

NO - There is an existing error-performance problem.

- Resolve the problem.

Reference: **DEGRADED PERFORMANCE** tab.

- Repeat this procedure.

*Comment: Now you will increase the attenuator loss in the active path and cause the combiner to switch; at the time of transfer to the other path, there shall be no errors (a **soft switch**).*

12

On the IF COMBINER:

- a. Determine which indicator is lighted, REG ACTIVE or DIV ACTIVE.
- b. Increase loss in the active-path attenuator (ccw) until the ACTIVE indication moves to the other path.

Requirement: No errors during a transfer.

At the instant of transfer from one path to the other, you must be watching the bar graph. You might have to practice switching the ACTIVE indicator until you have a feel for the range, then repeat the adjustment while you watch the bar graph for any error activity. If the bar graph is not visible from the radio location, you can use the EVENT COUNTER function of the DRTS. Connect it to the HOP CRC ERRS jack on the TERM FRAMER or REGEN FRAMER card.

Reference: TERMINAL/REGENERATOR—
TEST PROCEDURES tab,
3.5 On-Site Performance Monitoring.

- c. Repeat this step for at least three transfers or until you reach the end of the attenuator range.

Were the requirements met?

YES - Proceed to Step 13.

NO - Go to **TROUBLE ISOLATION** tab,
3.3 Combiner or DADE Problem.

Comment: In the previous step, you checked path-transfer functions and error performance when loss in the active path increased. In Step 13, you will do the same except decrease the loss in the inactive path.

13 On the IF COMBINER:

- a. Determine which indicator is lighted, REG ACTIVE or DIV ACTIVE.
- b. Decrease loss of the inactive-path attenuator (cw) until this path is selected (ACTIVE indicator lights).

Requirement: No errors during a transfer.

- c. Repeat this step until you reach the end of the attenuator range (at least two transfers).

Were the requirements met?

YES - Go to Step 14.

NO - Go to **TROUBLE ISOLATION** tab,
3.3 Combiner or DADE Problem.

Comment: You have checked error performance during signal transfers to both paths under conditions of decreasing level and increasing level. Next, you will repeat the process with eight feet of mis-DADE which will delay the signal of one path by 12 nanoseconds.

14 On the IF COMBINER:

- a. Remove the cable from the REG IF IN jack.
- b. Connect an additional eight feet of coaxial cable (CA 7) and adapters (items 4, 7, and 15) between the REG IF IN jack and the cable just removed.

Comment: Now the REG signal is delayed an additional 12 ns with respect to the DIV signal.

15 Use the power meter to reset the REG and DIV attenuators to the approximate levels (minimum loss) noted in Steps 7 and 9.

16 On the IF COMBINER:

- a. Determine which indicator is lighted, REG ACTIVE or DIV ACTIVE.
- b. Increase loss in the active-path attenuator (ccw) until the ACTIVE indication moves to the other path.

Requirement: No errors during a transfer.

- c. Repeat this step for at least three transfers or until you reach the end of the attenuator range.

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- 17 On the IF COMBINER:
- Determine which indicator is lighted, REG ACTIVE or DIV ACTIVE.
 - Decrease loss of the inactive-path attenuator (cw) until this path is selected (ACTIVE indicator lights).

Requirement: No errors during a transfer.

- Repeat this step until you reach the end of the attenuator range (at least two transfers).

Were the requirements of Steps 16 and 17 met?

YES - Go to Step 18.

NO - Go to **TROUBLE ISOLATION** tab,
3.3 Combiner or DADE Problem.

- 18 On the IF COMBINER:
- Remove the additional eight feet of cable from the REG path.
 - Return the REG cable to the REG IF IN jack.
 - Remove the cable from the DIV IF IN jack.
 - Connect the additional eight feet of coaxial cable between the DIV IF IN jack and the cable just removed.

Comment: Now the 12 ns delay is in the DIV path.

- 19 Use the power meter to reset the REG and DIV attenuators to the approximate levels (minimum loss) noted in Steps 7 and 9.

- 20 On the IF COMBINER:
- Determine which indicator is lighted, REG ACTIVE or DIV ACTIVE.
 - Increase loss in the active-path attenuator (ccw) until the ACTIVE indication moves to the other path.

Requirement: No errors during a transfer.

- Repeat this step for at least three transfers or until you reach the end of the attenuator range.

- 21 On the IF COMBINER:
- a. Determine which indicator is lighted, REG ACTIVE or DIV ACTIVE.
 - b. Decrease loss of the inactive-path attenuator (cw) until this path is selected (ACTIVE indicator lights).

Requirement: No errors observed or counted during a transfer.

- c. Repeat this step until you reach the end of the attenuator range (at least two transfers).

Were the requirements of Steps 20 and 21 met?

YES - Go to Step 22.

NO - Go to **TROUBLE ISOLATION** tab,
3.3 Combiner or DADE Problem.

- 22 Disconnect all test equipment.
- 23 Return all connections to normal.
- Return to the flowchart or procedure that sent you here.

End of Procedure

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5 Test Set Configurations

5.1 IF Level Measurements

This procedure can be used to condition the DRTS power meter for radio receiver IF power measurements. Figure 33 illustrates IF test connections for measurements at the following points:

- SMB jack
- SMB cable end
- 440 jack
- 440 cable end.

Using this procedure, quick radio receiver IF level checks can be made by comparing measured levels with the appropriate RADIO DATA CARD entry.

Step	Procedure
1	<p>On the TEST SET:</p> <p>a. Calibrate the POWER METER, if necessary.</p> <p style="padding-left: 40px;">Reference: DRTS tab, 2.2 Calibration.</p> <p>b. Enter the OFFSET (as shown on the POWER SENSOR) for measurement of IF between -30 dBm and $+10$ dBm (about 35.7 dB).</p> <p>c. Add an additional 0.25 dB to the OFFSET to compensate for loss in the 8-foot BNC - BNC cable.</p> <p style="padding-left: 40px;">Reference: DRTS tab, 2.3 Entering Offset.</p>
2	Connect the test equipment as shown in Figure 33 for the desired test connection.
3	Make your power level measurement.

End of Procedure

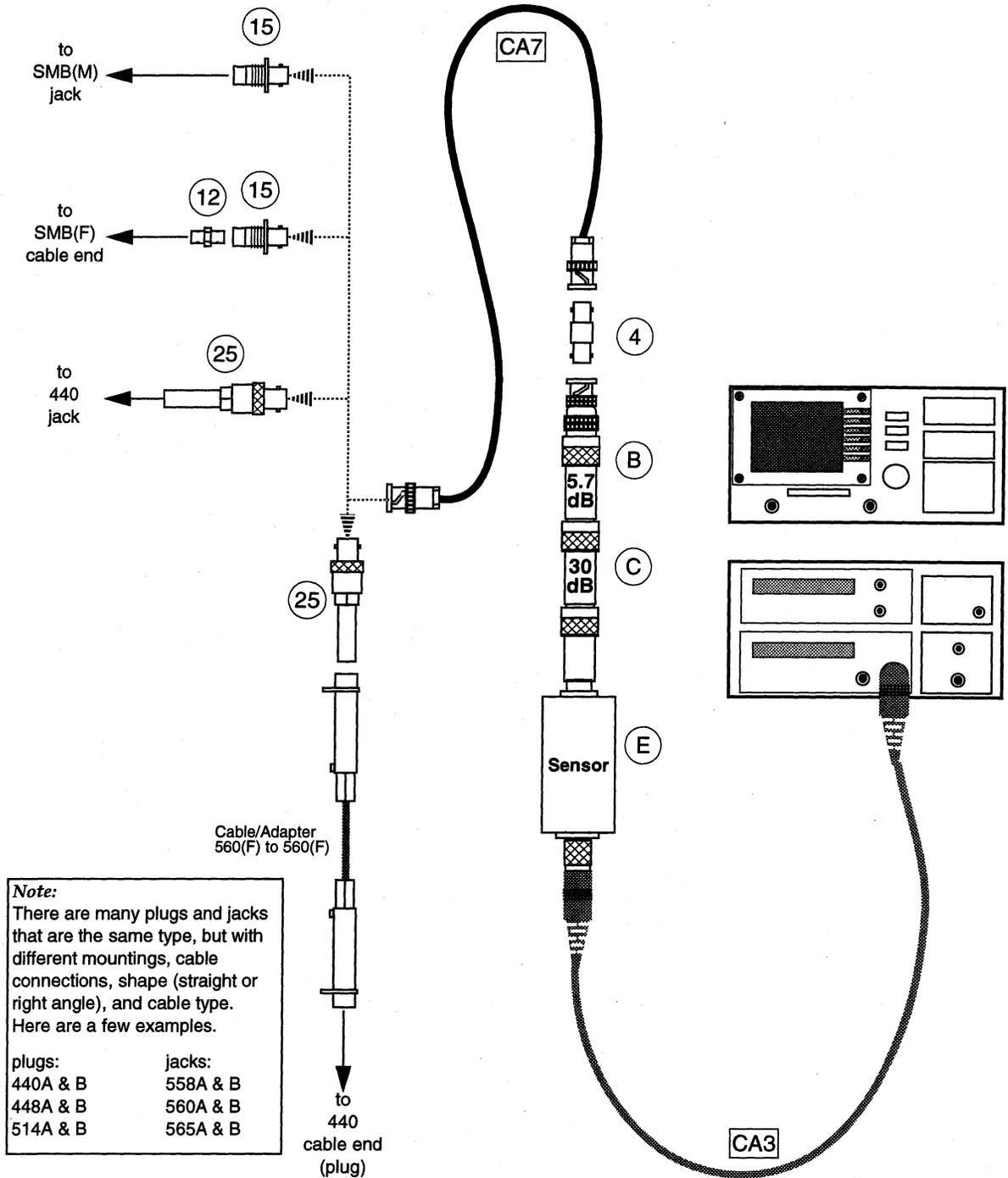


Figure 33. IF Level Measurements

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5.2 IF Spectrum Measurements

This procedure can be used to condition the DRTS spectrum analyzer for IF spectrum observations. Figure 34 illustrates IF test connections for observations at the following points:

- SMB jack
- SMB cable end
- 440 jack
- 440 cable end.

Step	Procedure
1	<p>On the SPECTRUM ANALYZER:</p> <ol style="list-style-type: none"> a. Press the green PRESET key. b. Press the FREQUENCY key. c. Use the DATA keys to enter 70 MHz. Verify that CENTER 70 MHz is displayed in the active function block. Reference: DRTS tab, 3.2.2 Active Function Block. d. Press the SPAN key. e. Use the DATA keys to enter 30 MHz. Verify that SPAN 30.00 MHz is displayed in the active function block. f. Press the BW key. g. Press the RES BW AUTO MAN softkey to underline MAN. h. Use the DATA keys to enter 100 kHz. Verify that RES BW 100 kHz is displayed in the active function block. i. Press the VID BW AUTO MAN softkey twice to underline MAN. j. Use the DATA keys to enter 3 kHz. Verify that VIDEO BW 3 kHz is displayed in the active function block. k. Press HOLD key to close the active function block.
2	<p>Connect the test equipment as shown in Figure 34 for the desired test connection.</p>

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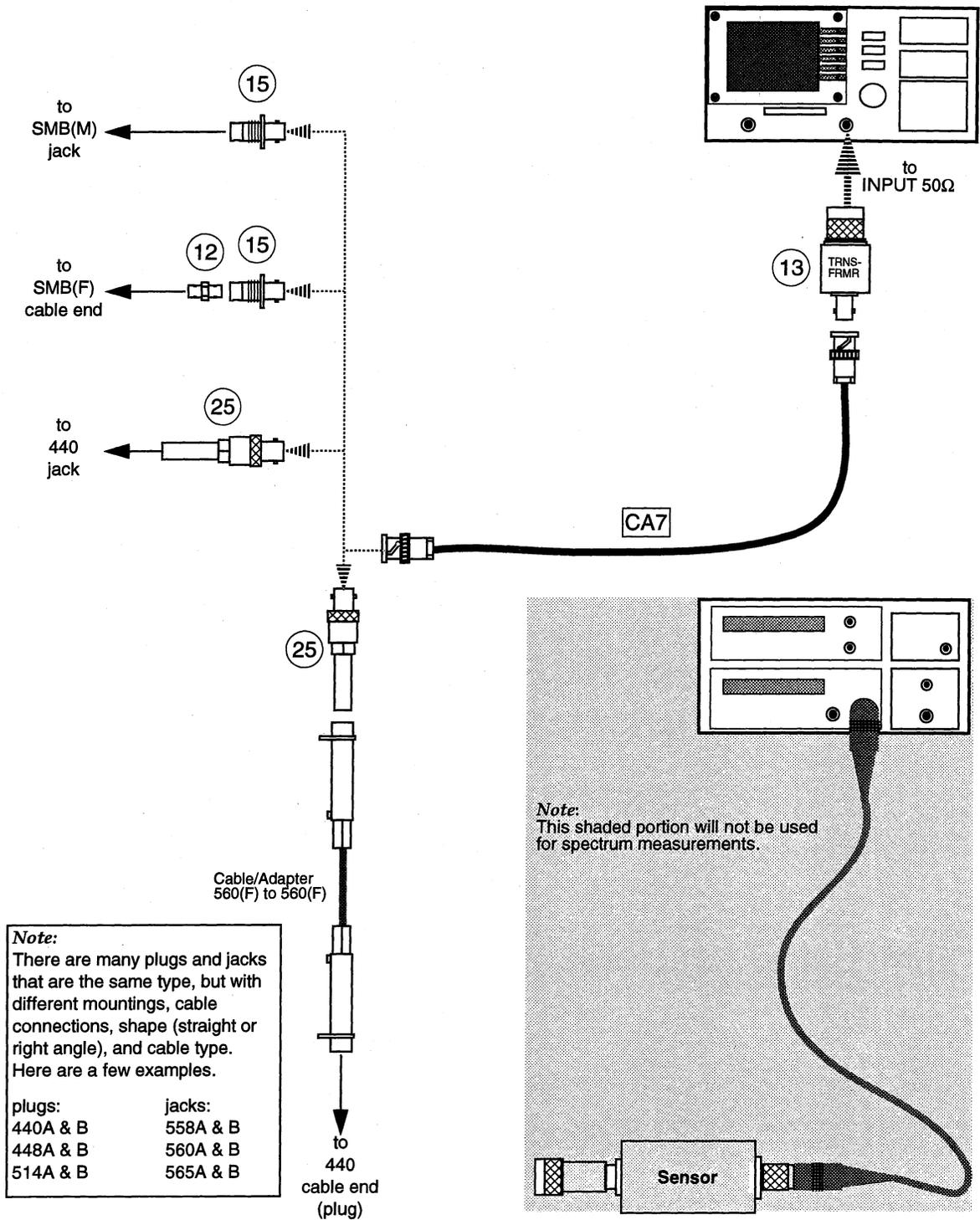


Figure 34. IF Spectrum Measurements

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- 3 On the SPECTRUM ANALYZER:
 - a. Press the AMPLITUDE key.
 - b. Use the data KNOB to position the display vertically.
 - c. Press HOLD key to close the active function block.
- 4 Observe the spectrum display.

End of Procedure

5.3 RF Spectrum Measurements

This procedure can be used to condition the DRTS spectrum analyzer for RF spectrum observations. Figure 35 illustrates RF test connections for observations at an SMA jack.

Step	Procedure
1	<p>On the SPECTRUM ANALYZER:</p> <ul style="list-style-type: none">a. Press the green PRESET key.b. Press the FREQUENCY key.c. Use the DATA keys to enter the RF center frequency (fc). <p style="margin-left: 40px;">Verify that the correct center frequency is displayed in the active function block.</p><p style="margin-left: 40px;">Reference: DRTS tab, 3.2.2 Active Function Block.</p>d. Press the SPAN key.e. Use the DATA keys to enter 30 MHz. <p style="margin-left: 40px;">Verify that SPAN 30.00 MHz is displayed in the active function block.</p>f. Press the BW key.g. Press the RES BW AUTO MAN softkey to underline MAN.h. Use the DATA keys to enter 100 kHz. <p style="margin-left: 40px;">Verify that RES BW 100 kHz is displayed in the active function block.</p>i. Press the VID BW AUTO MAN softkey twice to underline MAN.j. Use the DATA keys to enter 3 kHz. <p style="margin-left: 40px;">Verify that VIDEO BW 3 kHz is displayed in the active function block.</p>k. Press HOLD key to close the active function block.

2. Connect the test equipment as shown in Figure 35 for the desired test connection.
3. On the SPECTRUM ANALYZER:
 - a. Press the AMPLITUDE key.
 - b. Use the data KNOB to position the display vertically.
 - c. Press HOLD key to close the active function block.
 - d. Observe the spectrum display.

End of Procedure

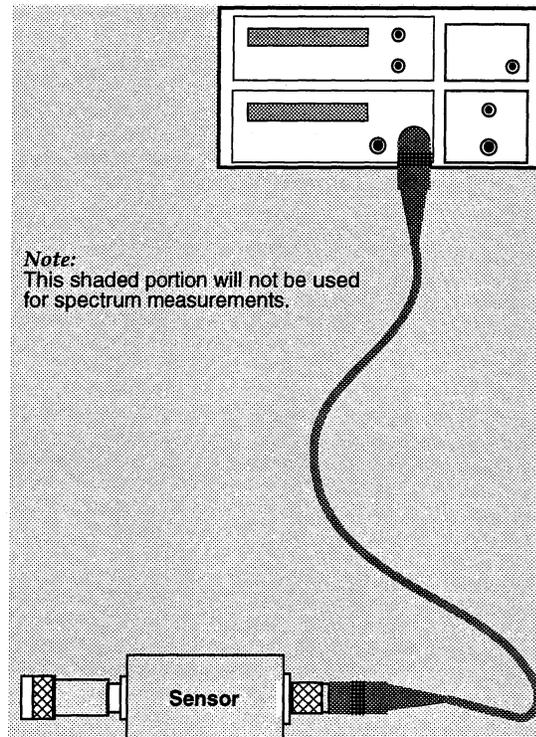
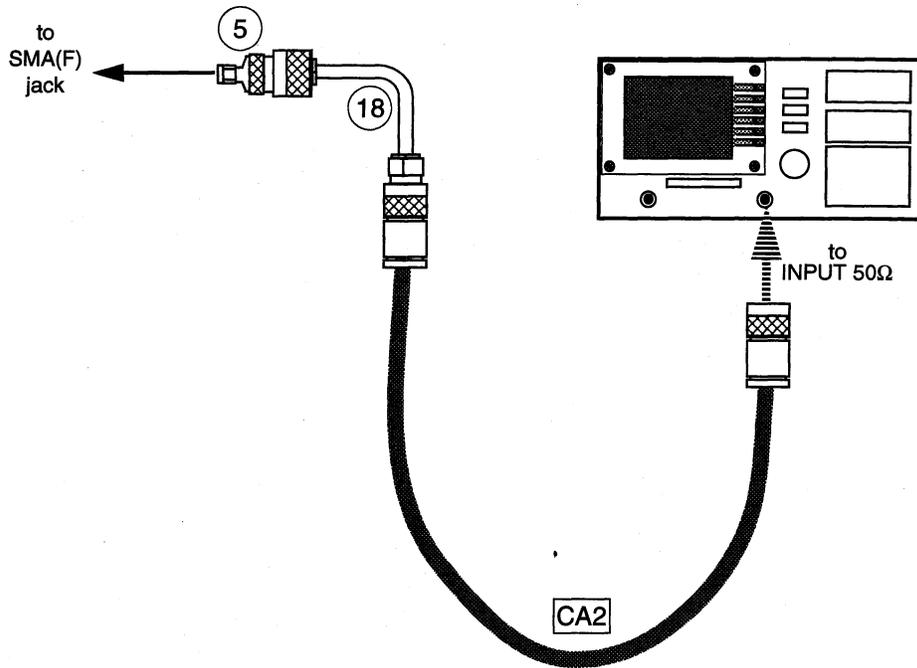


Figure 35. RF Spectrum Measurements

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5.4 XPD Measurement

This procedure is used to check the Cross-Polarization Discrimination (XPD) of an antenna system. We will do this by measuring the adjacent channel interference. This method will give us an approximate value; the actual XPD will be one to two dB worse.



CAUTION:

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



NOTE:

There is no need to perform this procedure if there is no adjacent channel.

Step	Procedure
1	<p>Perform Steps 1 and 2 of Test Procedure 5.2 IF Spectrum Measurements to condition the Spectrum Analyzer as follows:</p> <ul style="list-style-type: none"> a. Center frequency = 70 MHz. b. Resolution bandwidth = 100 KHz. c. Video bandwidth = 3 KHz. d. Test cable connection to a SMB(M) jack (see Figure 34). <p style="text-align: center;">Reference: 5.2 IF Spectrum Measurements, Steps 1 and 2.</p>
2	<p>On the RECEIVER DOWN CONV & MWV GEN of the selected radio receiver:</p> <ul style="list-style-type: none"> a. Remove the cable from the IF OUT jack. b. Connect the Spectrum Analyzer input cable to the IF OUT jack.

- 3 On the SPECTRUM ANALYZER:
- a. Press the SPAN key.
 - b. Use the DATA keys to enter 50 MHz.
Verify that SPAN 50.00 MHz is displayed in the active function block.
 - c. Press the AMPLITUDE key.
Verify that REF LEVEL.0 dBm is displayed in the active function block.
 - d. Use the data KNOB to position the waveform at the top or second graticule line.
 - e. Press HOLD key to close the active function block.
 - f. Measure the difference in dB between the top of the signal (at 70 MHz) and the adjacent channel interference.

Requirement: Difference greater than 30 dB.

Reference: Figure 36 illustrates adjacent channel interferences of 30 dB.

- 4 On the RECEIVER DOWN CONV & MWV GEN of the radio receiver:
- a. Disconnect the test cable from the IF OUT jack.
 - b. Reconnect the bay cable to the IF OUT jack
- 5 Return to the flowchart or procedure that sent you here.

End of Procedure

Vertical Scale: 10 dB per division

Horizontal Scale: 5 MHz per division

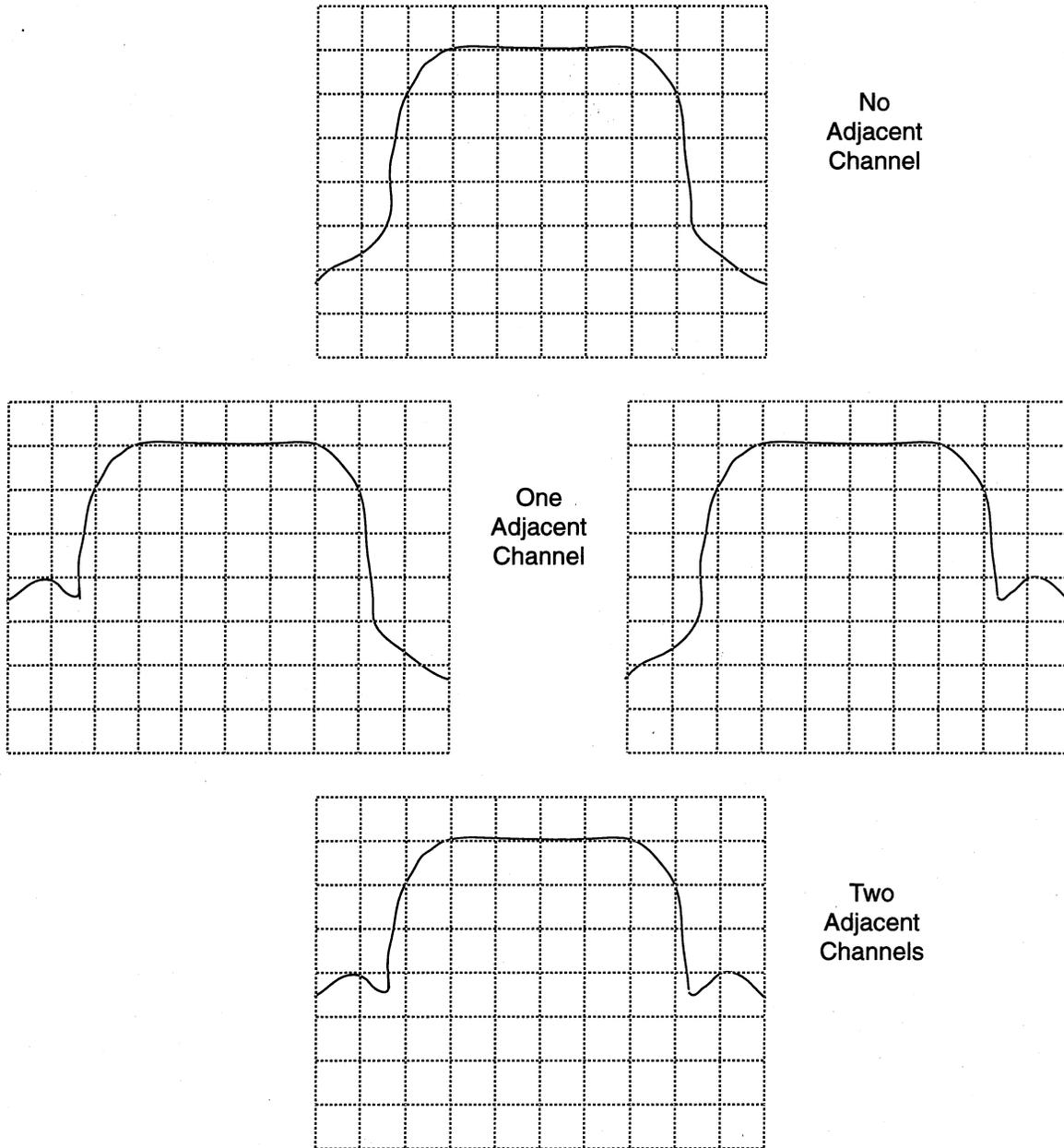


Figure 36. XPD Spectrum Measurement

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