
TD-3 MICROWAVE RADIO
J68386G AND J68386H TRANSMITTER-RECEIVER BAYS
RECEIVER TESTS
TRANSMISSION

This section contains the procedures for measuring and adjusting the gain and amplitude response of the radio receivers in the J68386G and J68386H radio bays. The in-service checks in Section 411-500-501 should be performed prior to performing the tests in this section. The results may then be used as a guide to possible sources of trouble. The preliminary checks in Section 411-502-500 must be completed before performing the tests in this section when required by the Equipment Test List. The IF return-loss tests in Section 411-504-502, when required by the Equipment Test List, must be completed prior to performing these tests or when replacing units in the receiver with spares.

This section is reissued to add information for bays equipped with hot standby or hot standby/space diversity switching and J68387AB IF main amplifiers. This reissue does not affect the Equipment Test List. For location of components in the bay, refer to Fig. 1.

Caution 1: *These tests are performed on an out-of-service basis. Obtain a release from the designated control office and remove the channel from service as directed by local practice.*

Caution 2: *When removing and replacing waveguide units, care should be taken to prevent foreign matter from entering the waveguide. Handle waveguide sections with care to prevent damage to flange mating surfaces. All open waveguide sections should be capped.*

CHART	PAGE
J68392A Test Set	
1—Overall Transmission Test	3
2—Receiver Modulator and IF Preamplifier Adjustment	11
3—IF Main Amplifier Adjustment	14
J68428A Test Set	
4—Overall Transmission Test	17
5—Receiver Modulator and IF Preamplifier Adjustment	25
6—IF Main Amplifier Adjustment	26

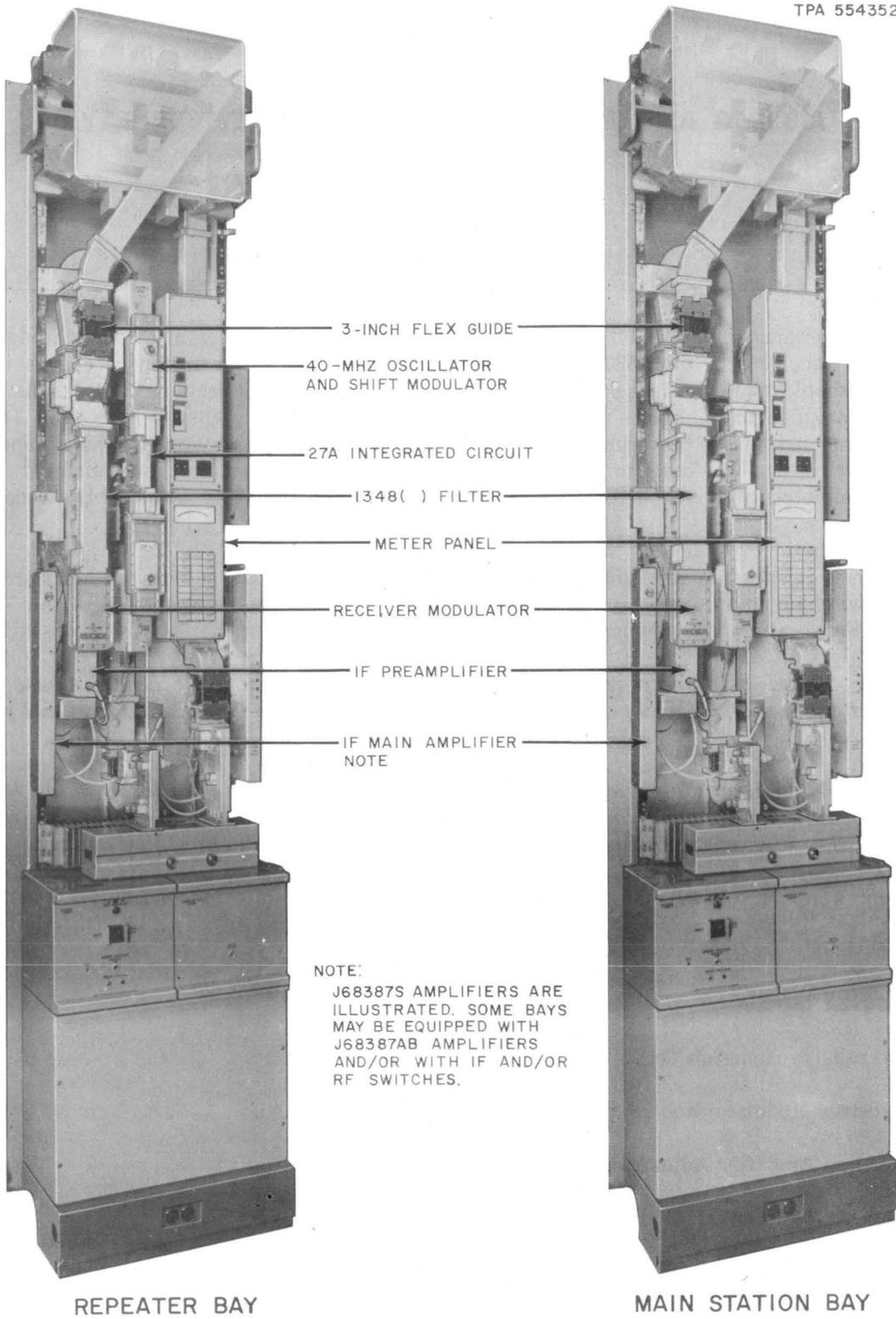


Fig. 1—J68386G and J68386H Transmitter-Receiver Bays

CHART 1

OVERALL TRANSMISSION TEST

APPARATUS:

1—J68392A Transmitter-Receiver Test Set

STEP

PROCEDURE

The following comprises a check of the overall receiver transmission performance.

Note: It is necessary to know the actual or calculated value of received carrier power at the drop arm of the channel dropping network. The typical nonfaded received carrier power will be in the range from -28 dBm through -22 dBm. Powers greater than -22 dBm should not be encountered since SD-50575-01 specifies the use of waveguide pads to prevent the power from exceeding -22 dBm. In the event that neither the calculated nor measured value is available, a reasonable value to use for these tests is -26 dBm. If the received carrier power is less than -28 dBm, use -28 dBm for these tests.

Caution: *If any of the requirements in this chart are not met, go directly to Step 23. Do not attempt adjustments while performing the steps of this chart to bring the transmission response within requirements. Charts 2 and 3 provide the proper sequence of steps for making adjustments on the receiver modulator and IF preamplifier and the IF main amplifier.*

- 1 Connect the test setup and perform the Preparation for Test in accordance with Fig. 2. This ensures that the IF detector is adjusted correctly for the following tests.
- 2 Set up the RF oscillator frequency and output power as shown in Fig. 3.

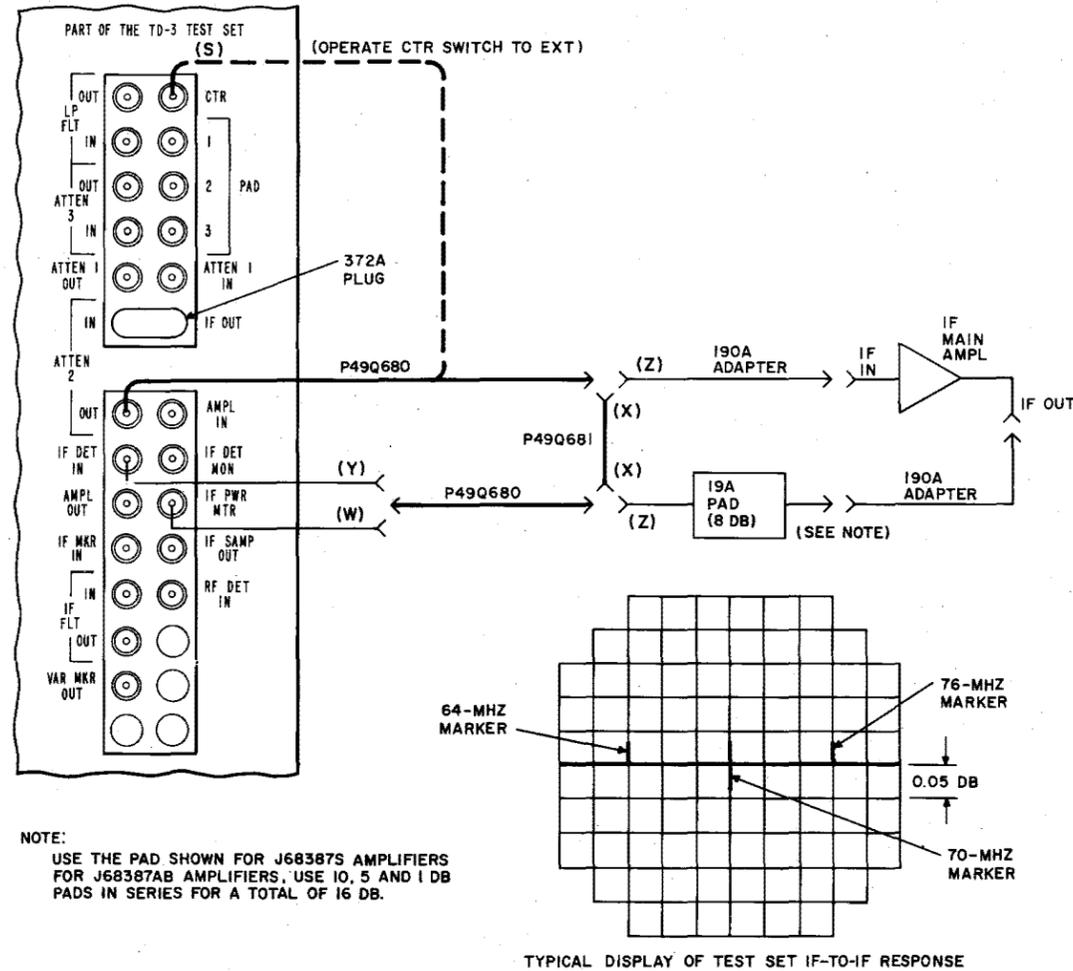
Caution: *If the bay is equipped with hot standby/space diversity switching, it has no frequency allocated for protection. Precautions should be taken not to interrupt service. Force-switch the system to the receiver that is not to be maintained as directed in Section 411-600-500.*

- 3 Remove the 3-inch piece of flexible waveguide from the receiver. Connect a shorting plate to the exposed port of the drop arm of the 1433() receiver channel network. Connect a 24A transducer to the exposed port going to the 19A isolator.
- 4 Check that the MAN-AGC switch is in the AGC position.
- 5 Connect the test setup shown in Fig. 4, option (Y); and perform the Preparation for Test (Steps 1 and 2). Do not perform the oscilloscope calibration at this time.
- 6 Measure the power.

Requirement: 0 dBm ± 5 dB.

CHART 1 (Cont)

STEP	PROCEDURE
7	Remove the cable from the IF PWR MTR jack and connect it to the CTR jack.
8	Adjust the CW control on the RF oscillator to obtain an indication of 70 ± 0.5 MHz on the counter.
9	Remove the cable from the CTR jack and connect it to the IF PWR MTR jack.
10	Set ATTEN 2 to 8 dB (J68387S IF amplifier) or 17 dB (J68387AB IF amplifier), and measure the power. Note the actual value measured for later use. <i>Requirement:</i> $-7.0 \text{ dBm} \pm 0.75 \text{ dB}$.
11	Select RCVD CARR PWR on the meter panel and note the meter indication. <i>Requirement:</i> 80 ± 3 .
12	Remove connector P1 from the IF OUT jack on the IF preamplifier, and insert a 20-dB pad (19A) between the IF OUT jack and connector P1.
13	Measure the power. <i>Requirement:</i> Within 2 dB of the power measured in Step 10.
14	Remove the 19A 20-dB pad and connect P1 to the IF preamplifier IF OUT jack.
15	Operate the MAN-AGC switch on the IF main amplifier to the MAN position, and note the meter indication for RCVD CARR PWR. <i>Requirement:</i> Same as that for Step 11. If the requirement is not met, adjust the MAN GAIN control to obtain the same indication.
16	Measure the power. <i>Requirement:</i> $-7 \text{ dBm} \pm 1 \text{ dB}$.
17	Connect option (Z) of Fig. 4. Operate the CTR switch to the MKR FREQ position and perform the oscilloscope calibration shown in Fig. 4.
18	Measure the amplitude response as shown by the test trace. <i>Requirement:</i> The trace shall be flat to within 0.25 dB over the 62- through 78-MHz band and to within 0.45 dB over the 60- through 80-MHz band. <i>Note:</i> For receivers equipped with J68387AB IF amplifiers, an additional 0.2 dB of linear slope over the 60- through 80-MHz band is allowed.



PREPARATION FOR TEST

1. Set ATTEN 2 at 3 dB.
2. Make the test connections using options (W) and (X).
3. Set the test set controls as follows.

UNIT	CONTROL	POSITION
Control panel	FUNCTION IF MARKER AMPLITUDE CTR	IF-IF Midrange MKR FREQ
Oscilloscope	INTENSITY	Midrange
Oscilloscope time base unit	POSITION MAGNIFIER SWEEP TIME VERNIER SINGLE-NORMAL	Midrange X10 EXT Midrange NORMAL
Oscilloscope differential amplifier unit	POSITION BANDWIDTH AMPLIFIER VERNIER SENSITIVITY AC-DC-OFF (+ INPUT) AC-DC-OFF (- INPUT)	Midrange 4 DC Midrange 10 MV/CM DC OFF
Power meter	INPUT CHANNEL POWER RANGE DBM	IF (Note) +10

Requirement: The power meter shall indicate $-3.0 \pm 0.1 + 10$ dBm at the IF OUT jack.

4. If the requirement is not met, adjust the OUTPUT control on the IF sweep oscillator (rear of test set). If the requirement still cannot be met, refer to Sections 104-415-501 and 104-415-504.
5. Set ATTEN 2 to 17 dB.
6. Set the POWER RANGE DBM switch on the power meter to -5.
7. Adjust ATTEN 2 for a -2 indication on the power meter (-7 dBm).
8. Change option (W) to option (Y).
9. Adjust the TEST TRACE controls on the control panel to center the trace on the oscilloscope.
10. Adjust the SWEEP TIME (VERNIER) and POSITION controls on the oscilloscope TIME BASE for approximately 10 centimeters horizontal deflection on the oscilloscope.
11. Adjust the IF MARKER FREQ control on the control panel for a 70 ± 0.1 MHz indication on the counter.
12. Adjust the IF SWEEP WIDTH and IF CENTER FREQ controls on the control panel to obtain the oscilloscope display as shown at left.

Note: An extraneous marker appears at 89 MHz.

13. Adjust the REF TRACE control on the control panel to bring the reference trace into coincidence with the test trace at 70 MHz.
14. Adjust the IF DET SLOPE control for coincidence between 60 and 80 MHz.
15. Increase the attenuation of ATTEN 2 by 0.1 dB. Adjust the SENSITIVITY and POSITION controls on the oscilloscope DIFFERENTIAL AMPLIFIER for 2 centimeters deflection between the test trace and the reference trace. Return ATTEN 2 to its original setting. This calibrates the oscilloscope for 0.05 dB per centimeter.

Requirement: The test trace shall be flat to within 0.01 dB between 60 and 80 MHz.

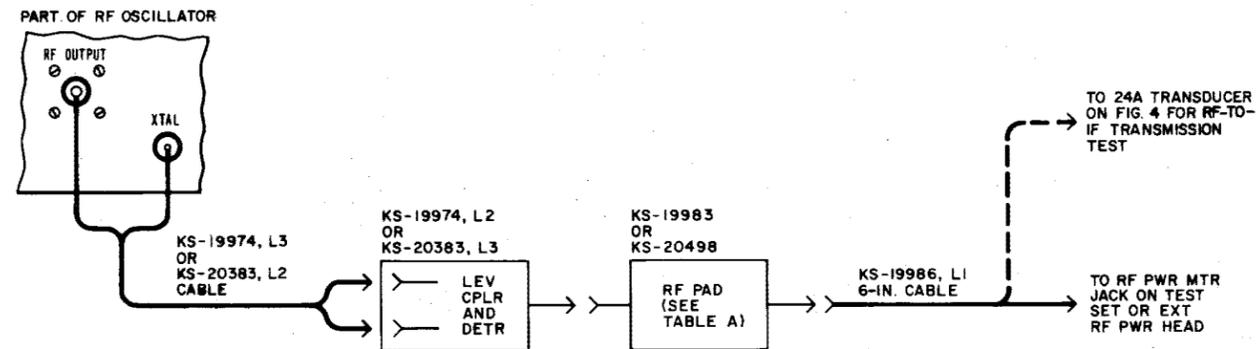
If this requirement is not met, adjust the IF DET SLOPE control on the control panel for a flat test trace. If the requirement cannot be met by adjusting the IF DET SLOPE control, see Section 104-415-504.

Note: With the INPUT CHANNEL switch set to IF, determine that no input is connected; then zero the power meter by setting the POWER RANGE DBM switch to -25 and adjusting the METER ZERO control for an indication of ZERO on the meter. Return the POWER RANGE DBM switch to the position shown in Step 3.

Fig. 2—IF-to-IF Amplitude Response Test Setup—J68392A Test Set

TABLE C

KS-19974 RF OSCILLATOR USING KS-19983 OR KS-20498 PADS		KS-20383 RF OSCILLATOR USING KS-20498 PADS	
FOR THIS POWER INTO UNIT UNDER TEST (dBm)	USE THIS PAD (dB)	FOR THIS POWER INTO UNIT UNDER TEST (dBm)	USE THIS PAD (dB)
-40 to -30	40 + 10	-37 to -32	40 + 5
-30 to -20	40	-32 to -27	40
-20 to -10	30	-27 to -22	30 + 5
-10 to 0	20	-22 to -17	30
		-17 to -12	20 + 5
		-12 to -7	20
		-7 to -2	10 + 5
		-2 to +3	10



PREPARATION FOR TEST

1. The test set shall have been checked in accordance with Section 104-415-000 to ensure proper operation for the RF-to-RF mode.
2. Operate the test set controls to the following positions.

UNIT	CONTROL	POSITION
Power Meter	INPUT CHANNEL POWER RANGE DBM	RF (Note) 0
RF Sweep Oscillator (Alfred) KS-19974	LINE FUNCTION-SWEEP SELECTOR MARKER AMPL ΔF	RF CW Max CCW 20
RF Sweep Oscillator KS-20383	BAND SELECTOR LINE MODE ΔF	3.7 - 4.2 GHz RF CW 20
RF Sweep Oscillator Hewlett-Packard KS-19974	LINE SWEEP SELECTOR FUNCTION ALC MARKER AMPL STOP/ ΔF	RF CW ΔF PRESS (on) Max CCW 20

3. Set the RF oscillator CW control to the desired channel center frequency.
4. Obtain the value of the calculated or measured received carrier power referred to the drop arm of the 1433 () receiver channel network for the bay under test.
5. Adjust the RF sweep oscillator output to obtain the power determined in Step 4 as follows:
 - (a) Using Table C, select the pad to be used. For most installations the power will fall between -30 to -20 dBm so that a 40-dB pad will be required.
 - (b) Since it is desirable to measure powers in the range of 0 to -15 dBm with the power meter, use a 20-dB pad at the output of the LEV CPLR, connect to the power meter, and adjust the POWER OUTPUT control for the power of Step 5 (a) increased by 20 dB.
 - (c) Remove the 20-dB pad and insert the pad value selected in Step 5(a). Disconnect from the power meter.

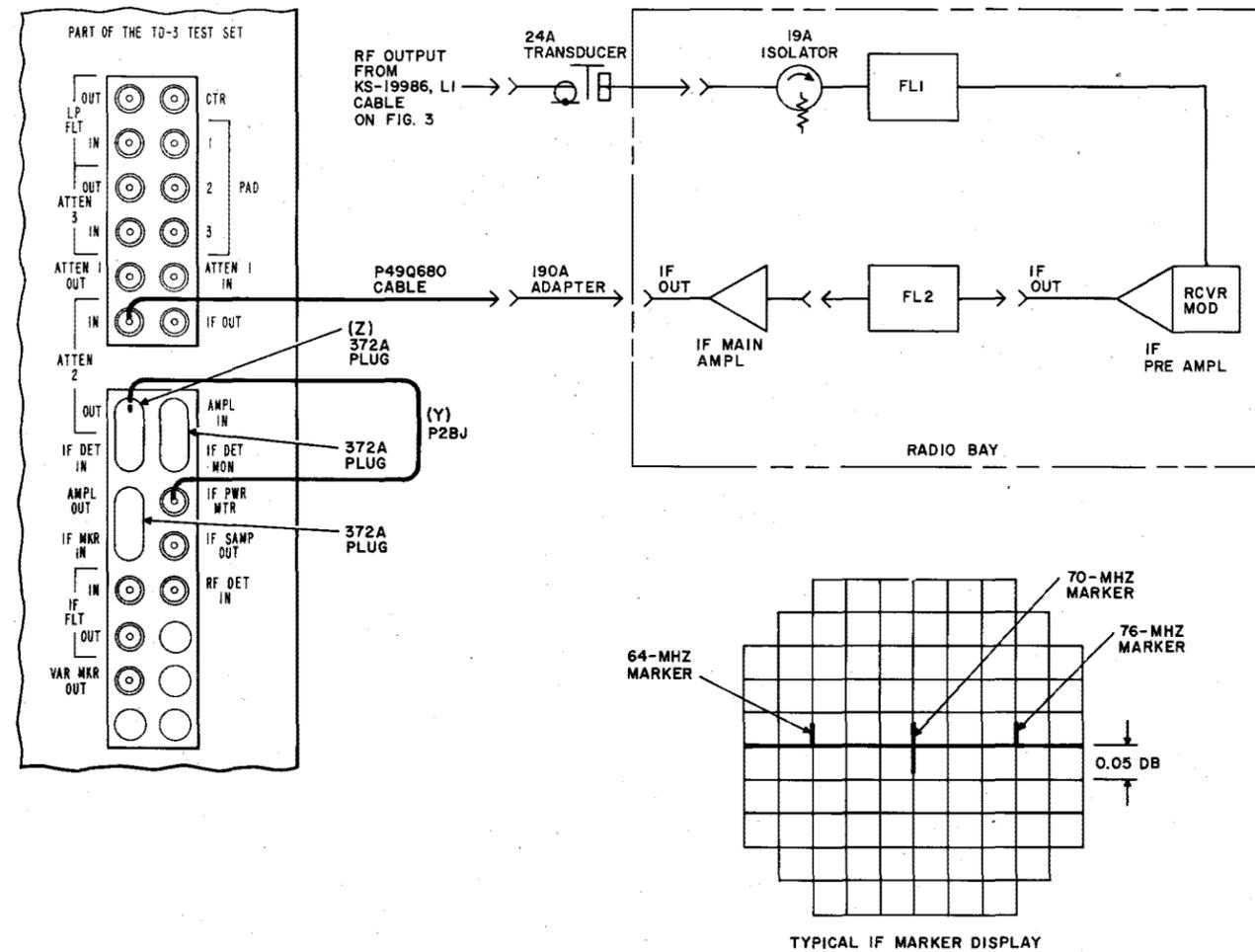
Example: Let the power required in Step 4 be -28 dBm. The pad required will be 40 dB from Step 5(a). Using a 20-dB pad, adjust the POWER OUTPUT control for $-28 + 20 = -8$ dBm per Step 5(b). Remove the 20-dB pad and insert the 40-dB pad and the power will be -28 dBm.

Note: With the INPUT CHANNEL switch set to RF, determine that no input is connected; then zero the power meter by setting the POWER RANGE DBM switch to -25 and adjusting the METER ZERO control for an indication of ZERO on the meter. Return the POWER RANGE DBM switch to the position shown in Step 2.

Fig. 3—RF Oscillator Setup—J68392A Test Set

PREPARATION FOR TEST

1. Set ATTEN 2 at 0 dB (J68387S amplifiers) or 10 dB (J68387AB amplifiers).
2. Set the test set controls as follows.



UNIT	CONTROL	POSITION
Control panel	FUNCTION RF MKR AM IF MARKER AMPLITUDE CTR	RF-IF Max CCW Midrange EXT
Oscilloscope	INTENSITY	Midrange
Oscilloscope time base unit	POSITION MAGNIFIER SWEEP TIME VERNIER SINGLE-NORMAL	Midrange X10 EXT Midrange NORMAL
Oscilloscope differential amplifier unit	POSITION BANDWIDTH AMPLIFIER VERNIER SENSITIVITY AC-DC-OFF (+ INPUT) AC-DC-OFF (- INPUT)	Midrange 4 DC Midrange 2 MV/CM DC OFF
Power meter	INPUT CHANNEL POWER RANGE DBM	IF (Note 2) +5

Oscilloscope Calibration

1. Adjust the TEST TRACE controls on the control panel to center the trace on the oscilloscope.
2. Adjust the SWEEP TIME (VERNIER) and POSITION controls on the oscilloscope TIME BASE for approximately 10 centimeters horizontal deflection on the oscilloscope.
3. Adjust the IF MARKER FREQ control on the control panel for a 70 ± 0.1 MHz indication on the counter, and set the RF SWEEP SELECTOR to ΔF -AUTO or the MODE switch to ΔF .
4. Adjust the CW control on the RF sweep oscillator to center the 70-MHz marker as shown at left.
5. Adjust the ΔF control on the RF sweep oscillator to place the 64- and 76-MHz markers as shown at left. Disregard any slope in the test trace.
6. Adjust the REF TRACE control on the control panel to bring the reference trace into coincidence with the test trace at 70 MHz.
7. Increase the attenuation of ATTEN 2 by 0.1 dB. Adjust the SENSITIVITY and POSITION controls on the oscilloscope DIFFERENTIAL AMPLIFIER for 2 centimeters deflection between the test trace and the reference trace. Return ATTEN 2 to its original setting. This calibrates the oscilloscope for 0.05 dB per centimeter.

Note 1: The frequency scale on the oscilloscope will be reversed for receivers on channels 1, 2, 7, and 8.

Note 2: With the INPUT CHANNEL switch set to IF, determine that no input is connected; then zero the power meter by setting the POWER RANGE DBM switch to -25 and adjusting the METER ZERO control for an indication of ZERO on the meter. Return the POWER RANGE DBM switch to the position shown in Step 2 of the preparation for test.

Fig. 4—RF-to-IF Transmission Test Setup—J68392A Test Set

CHART 1 (Cont)

STEP	PROCEDURE
19	Remove the test connectors from the IF OUT jack of the IF main amplifier and restore the bay connection to that jack. ♦For HS or HS/SD bays, omit Steps 20 through 22.♦
20	Connect the P49Q680 IF test cable to the output connector of the DADE cable (P12 for a repeater station receiver and J3 for a main station receiver). Use the appropriate adapter to make the connections.
21	Set the RF SWEEP SELECTOR or MODE switch to the CW position. Set ATTEN 2 to 0 dB. Make the connections shown in Fig. 4, option (Y).
22	Measure the power. <i>Requirement:</i> $-7.0 \text{ dBm} \pm 2 \text{ dB}$.
23	If the requirements in Steps 1 through 19 cannot be met, it will be necessary to align the receiver modulator—IF preamplifier and the IF main amplifier as directed in Charts 2 and 3. After performing Charts 2 and 3, repeat Chart 1, Steps 1 through 19.
24	♦ If the requirements in Steps 1 through 19 still cannot be met, check for defective cables or a defective 1042A filter. <i>Note:</i> The insertion loss of the 1042A filter at 70 MHz should be between 6.5 and 7.5 dB. Its amplitude response should be flat to within 0.15 dB between 62 and 78 MHz and to within 0.35 dB between 60 and 80 MHz.
25	If the requirement in Step 22 cannot be met, check for a defective or incorrect DADE cable, 63E pad, or equalizer, if used.
26	If all the requirements are met, remove the test equipment. Restore all bay connections to normal.
27	Operate the MAN-AGC switch on the IF main amplifier to the AGC position.
28	If further tests or alignments are not scheduled, restore the channel to service as directed by local practice.

CHART 2
RECEIVER MODULATOR AND IF PREAMPLIFIER ADJUSTMENT

APPARATUS:

1—J68392A Transmitter-Receiver Test Set

CHART 2 (Cont)

APPARATUS(Cont):

1—KS-20114, L2 Adjusting Tool

STEP

PROCEDURE

Caution: *◆If the bay is equipped with hot standby/space diversity switching, it has no frequency allocated for protection. Precautions should be taken not to interrupt service. Force-switch the system to the receiver that is not to be maintained as directed in Section 411-600-500.◆*

1 Note the REF BIAS value stamped on the modulator. Operate the RCVR MOD BIAS pushbutton on the meter panel.

2 Note the frequency of the receiver.

Requirement: The RCVR MOD BIAS indication shall equal the bias value determined by Table A from the appropriate receiver frequency and REF BIAS. Make any necessary adjustment with the DIODE BIAS control on the IF preamplifier. Record the RCVR MOD BIAS indication on the meter panel pushbutton.

3 Connect the P-49Q680 cable, shown in Fig. 4, to the IF OUT jack of the IF preamplifier.

4 Connect option (Y) in Fig. 4 and perform the Preparation for Test. Do not perform the oscilloscope calibration at this time.

5 Adjust the LEVEL control on the IF preamplifier to set the IF output power.

Requirement: -1 dBm.

6 Set the RF SWEEP SELECTOR to ΔF -AUTO or the MODE switch to ΔF . If the oscilloscope calibration in Fig. 4 has not been previously performed, calibrate it at this time.

7 Set ATTEN 2 to 6 dB.

8 Change from option (Y) to option (Z) in Fig. 4 and measure the transmission response as shown by the test trace.

Requirement: The trace should be flat to within 0.07 dB over the 60- through 80-MHz band.

If the requirement is not met, adjust the SHAPE and SLOPE controls while keeping the test and reference traces coincident at 70 MHz with the LEVEL control. If any of the requirements cannot be met, refer to Section 411-504-503 for troubleshooting procedures.

TABLE A

RECEIVER FREQUENCY MHz	RCVR MOD BIAS INDICATION
3710	REF BIAS +7.0
3730	REF BIAS +6.0
3870	
3750	REF BIAS +5.0
3890	
3770	REF BIAS +4.0
3910	
3790	REF BIAS +3.0
3930	
3810	REF BIAS +2.0
3950	
3830	REF BIAS +1.5
3970	
3850	REF BIAS +0.5
3990	
4010	REF BIAS +0
4030	REF BIAS -1.0
4050	REF BIAS -2.0
4070	REF BIAS -3.0
4090	REF BIAS -4.0
4110	REF BIAS -5.0
4130	REF BIAS -6.0
4150	REF BIAS -7.0
4170	REF BIAS -8.0

CHART 3

IF MAIN AMPLIFIER ADJUSTMENT

APPARATUS:

- 1—J68392A Transmitter-Receiver Test Set
- 1—KS-20114, L2 Adjusting Tool

STEP

PROCEDURE

A. Gain and Amplitude Response

The following procedure is used for adjusting the gain and amplitude response of the IF main amplifier. The objective is to establish a gain of 9 dB with an input of -8.0 dBm and an output of $+1.0$ dBm. The amplitude response should be flat to within 0.03 dB over the 60- through 80-MHz band. J68387AB amplifiers will have an 18-dB gain with a -8 dBm input and a $+10.0$ dBm output. The amplitude response deviation will be the same, but there may be an additional 0.2-dB linear slope over the 60- through 80-MHz band.

Caution: *If the bay is equipped with hot standby/space diversity switching, it has no frequency allocated for protection. Precautions should be taken not to interrupt service. Force-switch the system to the receiver that is not to be maintained as directed in Section 411-600-500.*

- 1 Prepare the test set in accordance with Fig. 2.
- 2 Disconnect the cables from the IF IN and IF OUT jacks on the IF main amplifier.

Note: To make access to the J68387S amplifier connectors easier, remove the amplifier together with its mounting bracket from the bay frame by loosening the two screws that fasten the mounting bracket to the bay. Hang the assembly on the post provided on the bay frame above the amplifier by hooking the post through the hole in the bracket. (See Fig. 5.) The J68387AB amplifier IF IN and IF OUT jacks are accessible without removing the amplifier.
- 3 Connect options (Y) and (Z) in Fig. 2.
- 4 Increase the setting of ATTEN 2 by 1 dB to reduce the input to the IF main amplifier to -8 dBm.
- 5 Set the MAN-AGC switch on the IF main amplifier to the MAN position, and adjust the MAN GAIN control to coincidence of the test and reference traces at 70 MHz. The test trace displays the amplitude response of the IF main amplifier. Measure the flatness of the test trace.

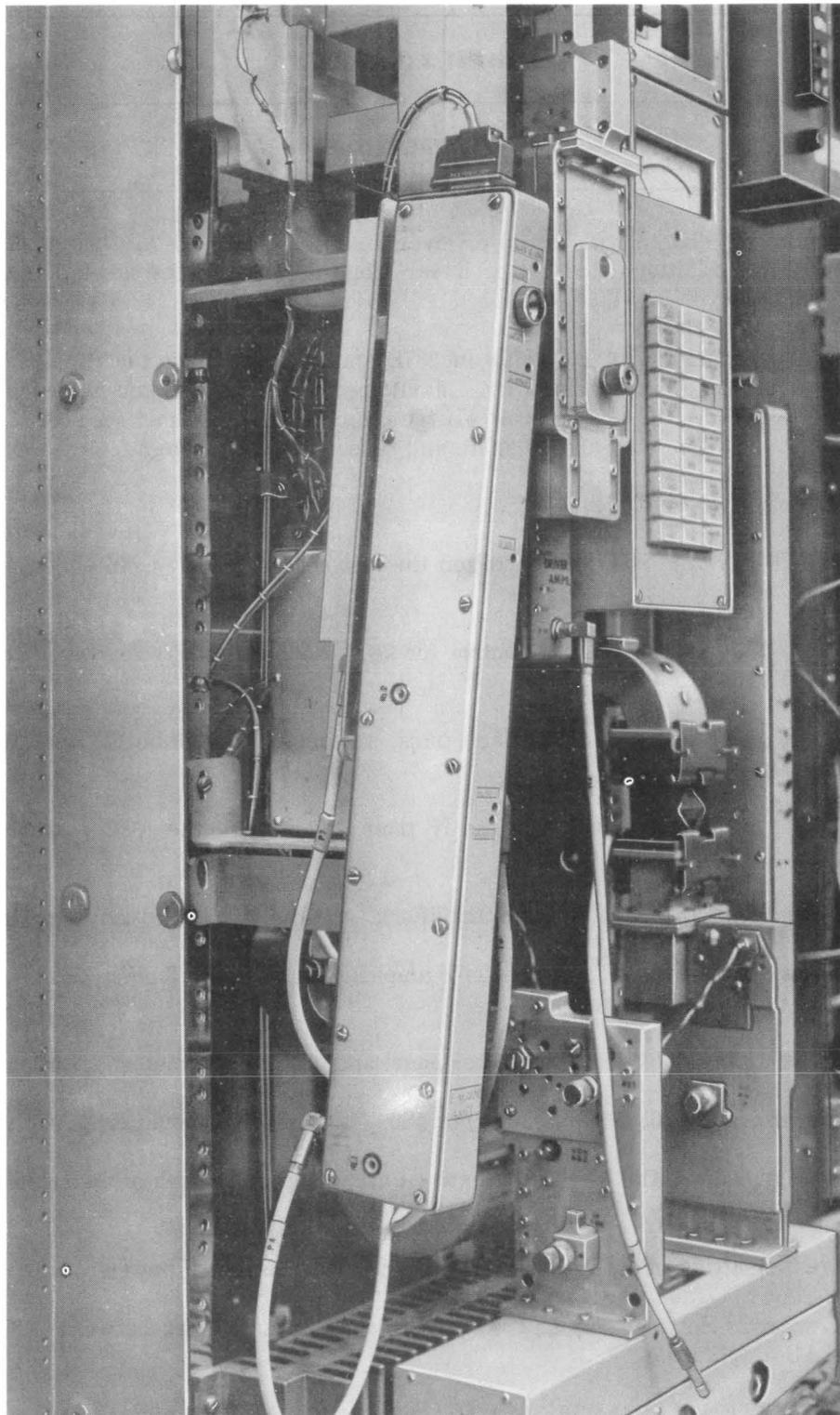


Fig. 5—Mounting Arrangement for J68387S IF Main Amplifier Test

CHART 3 (Cont)

STEP

PROCEDURE

Requirement: Flat to within 0.03 dB over the 60- through 80-MHz band. For J68387AB amplifiers, an additional 0.2 dB of linear slope across the 60- through 80-MHz band is permissible.

If the requirement is not met for J68387S amplifiers, adjust the SLOPE 1 and SLOPE 2 controls on the IF main amplifier. Maintain coincidence between the test and reference traces with the MAN GAIN control. If the requirement is not met for J68387AB amplifiers, replace the amplifier with a good spare and repeat Steps 3 through 5.

- 6 Connect option (S) to Fig. 2.
- 7 Turn the IF SWEEP WIDTH control on the test set completely counterclockwise (minimum sweep width).
- 8 Adjust the IF CENTER FREQ control for 70 ± 0.5 MHz. (The counter CTR switch must be in the EXT position.)
- 9 Remove the option (S) and (Y) connections, and make the option (Z) and (W) connections shown in Fig. 2.
- 10 Operate the MAN-AGC switch on the IF main amplifier to the AGC position and measure the power.

Requirement: -7 dBm (J68387S amplifier); -6 dBm (J68387AB amplifier).

If necessary, adjust the IF LEV (J68387S amplifier) or OUTPUT PWR (J68387AB amplifier) control to meet the requirement.

- 11 Select RCVR CARR PWR on the meter panel and observe the meter indication.

Requirement: 80 (J68387S amplifier) or 80 ± 3 (J68387AB amplifier).

If necessary, adjust the M SENS control until the requirement is met (J68387S amplifier only).

- 12 Increase the setting of ATTEN 2 by 40 dB and measure the IF power.

Requirement: Between -9 and -5 dBm (J68387S amplifier); between -8 and -4 dBm (J68387AB amplifier).

Note: If ATTEN 2 of the J68392A test set is equipped with only three drums, the 40-dB increase in attenuation may be obtained by connecting a 20-dB 19A pad in series with ATTEN 2 and increasing the setting of ATTEN 2 by 20 dB.

- 13 If the requirements cannot be met, replace the IF main amplifier with a spare and repeat the tests in this chart.

CHART 3 (Cont)

STEP	PROCEDURE
14	Return the defective unit to a maintenance center.
15	◆ For J68387S amplifiers in frequency diversity or HS only bays, remove the test connections and restore the normal bay connections to the IF main amplifier. For J68387S amplifiers, in HS/SD bays or J68387AB amplifiers, proceed with Step 16.
B. HS/SD Trip Adjustment	
<i>Note 1:</i> In bays equipped with J68387S amplifiers, the TRIP ADJ control is located on the right-hand side of the bay on a mounting bracket. The AGC lamp is located on the bay alarm panel.	
<i>Note 2:</i> The CRS PLT PWR control on the J68387AB IF main amplifier must always be in the full counterclockwise position in order to disable the carrier resupply.	
16	Return the input level to -8 dBm, and then increase the attenuation of ATTEN 2 by 35 dB.
17	Turn the HS/SD TRIP control (J68387AB) or TRIP ADJ control (J68387S) <i>clockwise</i> until the TRIP lamp (J68387AB) or AGC lamp (J68387S) is just extinguished.
18	Slowly adjust the HS/SD TRIP control (J68387AB) or TRIP ADJ control (J68387S) <i>counterclockwise</i> until the TRIP lamp (J68387AB) or AGC lamp (J68387S) just lights.
19	Decrease the attenuation in ATTEN 2 (increase the input signal) to a point where the TRIP lamp (J68387AB) or AGC lamp (J68387S) extinguishes.
20	Slowly increase the attenuation of ATTEN 2 until the TRIP lamp (J68387AB) or AGC lamp (J68387S) lights.
21	Remove the test connections, and restore the normal bay connections to the IF main amplifier.◆

CHART 4
OVERALL TRANSMISSION TEST

APPARATUS:

1—J68428A Transmitter-Receiver Test Set

CHART 4 (Cont)

STEP

PROCEDURE

The following comprises a check of the overall receiver transmission performance.

Note: It is necessary to know the actual or calculated value of received carrier power at the drop arm of the channel dropping network. The typical nonfaded received carrier power will be in the range from -28 dBm through -22 dBm. Powers greater than -22 dBm should not be encountered since SD-50575-01 specifies the use of waveguide pads to prevent the power from exceeding -22 dBm. In the event that neither the calculated nor measured value is available, a reasonable value to use for these tests is -26 dBm. If the received carrier power is less than -28 dBm, use -28 dBm for these tests.

Caution: *If any of the requirements in this chart are not met, go directly to Step 21. Do not attempt adjustments while performing the steps of this chart to bring the transmission response within requirements. Charts 5 and 6 provide the proper sequence of steps for making adjustments on the receiver modulator and IF preamplifier and the IF main amplifier.*

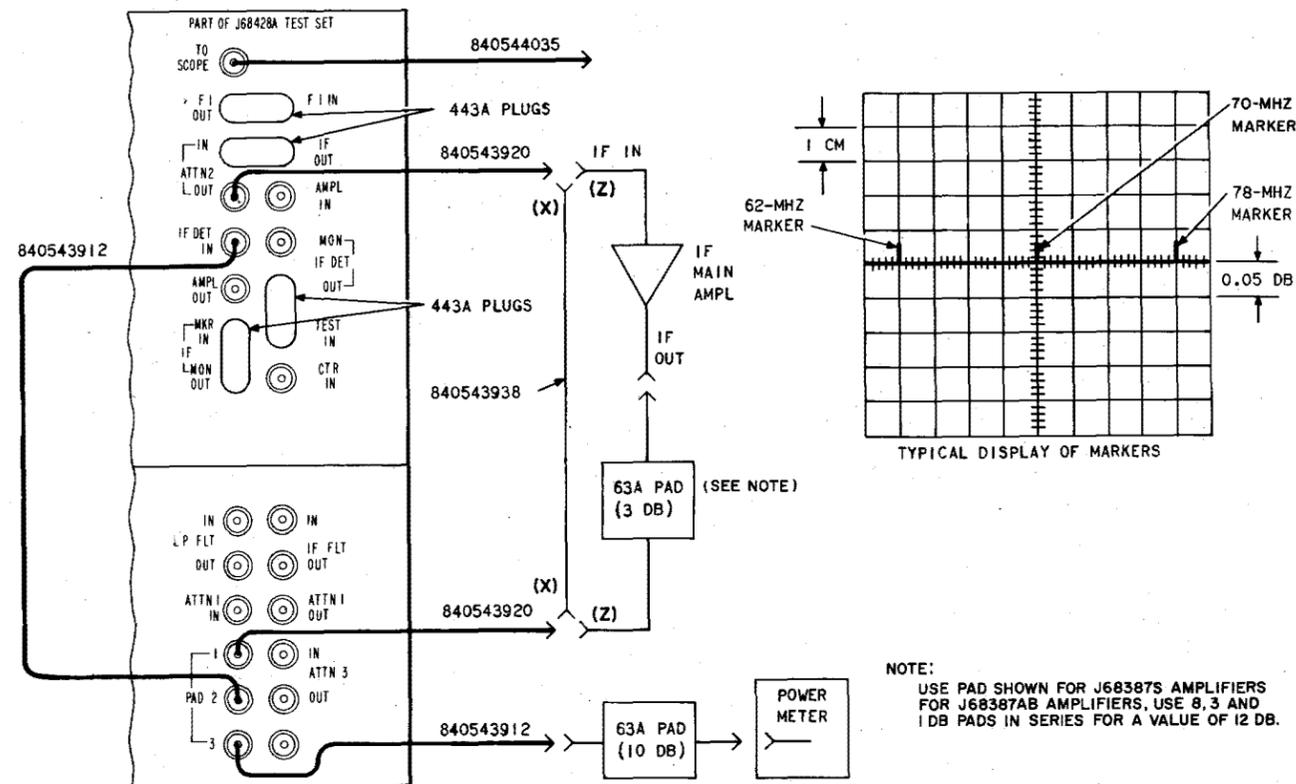
- 1 Connect the test setup and perform the Preparation for Test in accordance with Fig. 6. This ensures that the IF detector is adjusted correctly for the following tests.
- 2 Set up the RF oscillator frequency and output power as shown in Fig. 7.

Caution: *◆If the bay is equipped with hot standby/space diversity switching, it has no frequency allocated for protection. Precautions should be taken not to interrupt service. Force-switch the system to the receiver that is not to be maintained as directed in Section 415-600-500.◆*

- 3 Remove the 3-inch piece of flexible waveguide from the receiver. Connect a shorting plate to the exposed port of the drop arm of the 1433() receiver channel network. Connect a 24A transducer to the exposed port going to the 19A isolator.
 - 4 Check that the MAN-AGC switch is in the AGC position.
 - 5 Connect the test setup shown in Fig. 8, option (X); and perform Steps 1 and 2 of the Preparation for Test. Do not perform the remaining steps at this time.
 - 6 Measure the power.
- Requirement:** -18 dBm ± 5 dB.
- 7 Adjust the RF CENTER FREQ control on the RF oscillator to obtain an indication of 70 ± 0.5 MHz on the counter.
 - 8 Measure the power. Note the actual value measured for later use.

Requirement: -17.5 through -19.0 dBm.

PREPARATION FOR TEST

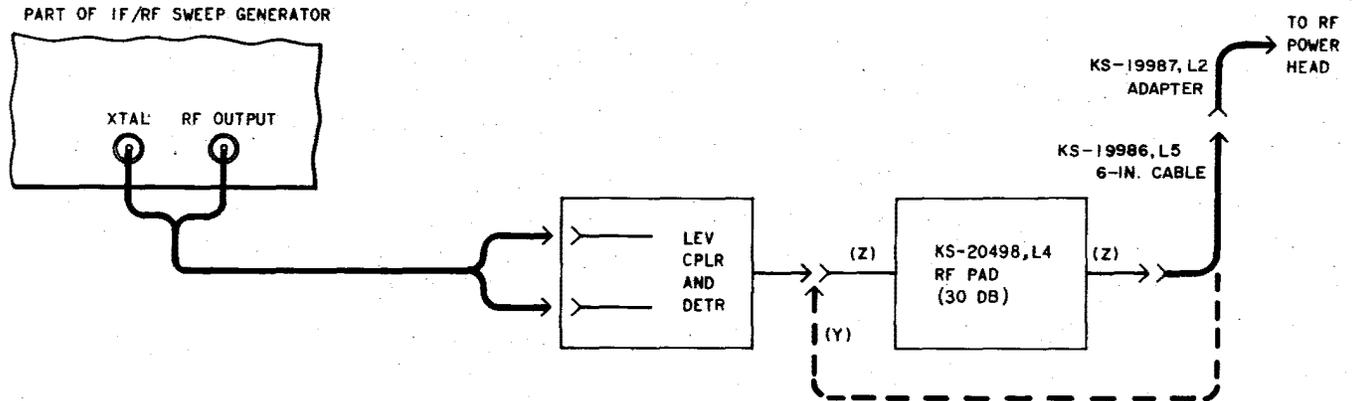


1. Energize the test set by operating the main POWER switch and the power switches on the oscilloscope, counter, power meter, and IF/RF sweep oscillator.
2. On the power meter, set the INPUT switch to IF.
3. With the IF input cable removed, zero the power meter by setting the MODE switch to ZERO and adjusting the ZERO control for 000 indication on the digital display. Then set the MODE switch to the POWER METER position.
4. Make the test connections shown using option (X) for the IF detector calibration.
5. Adjust ATTEN on the control panel for a power meter indication of -18.3 dBm. (*Note:* On test sets equipped with J68428 C and D panels, use ATTEN 2.)
6. On the frequency counter, set:
 - FUNCTION to 135 MHZ MAX
 - SAMPLE RATE to counterclockwise*
 - DISPLAY BLANKING pushbutton on the extreme right pushed in.

*On some units the power switch is combined with the SAMPLE RATE control. Make sure the power is on.
7. On the control unit, set COUNTER INPUT to F1 and adjust MARKERS F1 control for 62 MHz on the counter.
8. Set COUNTER INPUT to F2 and adjust MARKERS F2 control for 78 MHz on the counter.
9. On the sweep oscillator, set IF CENTER FREQ to 70, IF MODE to ΔF , and IF ΔF to 20.
10. Remove the input cable from the oscilloscope and adjust the vertical POSITION control to center the trace. Replace the cable. *Do not change the vertical POSITION control during this test.*
11. Set the oscilloscope VOLTS/DIV switch to 1 m.
12. Align the trace with the center of the graticule as shown. Use the TEST TRACE control on the control panel for adjustment.
13. Adjust the MARKERS — AMPLITUDE control on the control panel for satisfactory marker height.
14. Adjust the horizontal POSITION, DISPLAY WIDTH, IF ΔF , and IF CENTER FREQ controls to position the markers as shown in the display.
15. Insert 0.1-dB attenuation with ATTEN and observe trace. (See note in Step 5.)
16. Adjust the vertical VERNIER control on the oscilloscope for a trace deflection of 2 major divisions (2 cm). The oscilloscope is now calibrated for 0.05 dB per major division (cm).

Note: On some test sets, the VERNIER control may be designated CAL.
17. Adjust the IF DET SLOPE control on the control unit for a flat test trace. Keep the trace centered by adjusting the TEST TRACE control on the control unit.

Fig. 6—IF-to-IF Amplitude Response and IF Detector Calibration Test Setup



PREPARATION FOR TEST

1. Set the controls on the IF/RF sweep oscillator as follows.
 - BAND SELECTOR switch to 3.65-4.25 GHz
 - RF CENTER FREQ control to the desired frequency
 - RF ΔF (MHz) to 20
 - RF MODE to CW
 - RF POWER LEVEL to midrange
2. On the power meter, set the INPUT switch to RF.
3. With the RF input cable removed, zero the power meter by setting the MODE switch to ZERO and adjusting the ZERO control for 000 indication on the digital display. Then set the MODE switch to the POWER METER position.
4. Make the test connections shown using option (Y).
5. Obtain the value of the calculated or measured received carrier power at the drop arm of the 1433 () receiver channel network for the bay under test.
6. Obtain the calibrated value from the KS-20498, L4 30-dB RF pad and add it to the received carrier power value determined in Step 5.

Example:

received carrier power	=	-28.0 dBm
calibrated RF pad	=	<u>30.2 dB</u>
		+ 2.2 dBm

7. Adjust the RF POWER LEVEL control on the sweep oscillator to produce a meter indication of the value determined in Step 6.
8. Make the test connections using option (Z).

Fig. 7—RF Oscillator Setup—J68428A Test Set

CHART 4 (Cont)

STEP	PROCEDURE
9	Select RCVD CARR PWR on the meter panel and note the meter indication. <i>Requirement:</i> 80 ± 3 .
10	Remove the cable from the IF IN jack on the IF main amplifier and insert a 63A 20-dB pad. Reconnect the cable to the pad.
11	Measure the power. <i>Requirement:</i> Within 2 dB of the power measured in Step 8.
12	Remove the 63A 20-dB pad and connect the cable to the main amplifier.
13	Operate the MAN-AGC switch on the IF main amplifier to the MAN position, and note the meter indication for RCVD CARR PWR. <i>Requirement:</i> The same as Step 9. If the requirement is not met, adjust the MAN GAIN control to obtain the same indication.
14	Measure the power. <i>Requirement:</i> $-18.0 \text{ dBm} \pm 1 \text{ dB}$.
15	Perform Steps 3 through 11 shown in Fig. 8, Preparation for Test.
16	Measure the amplitude response as shown by the test trace. <i>Requirement:</i> The trace shall be flat to within 0.25 dB over the 62- through 78-MHz band and to within 0.45 dB over the 60- through 80-MHz band. <i>Note:</i> For receivers equipped with J68387AB IF amplifiers, an additional 0.2 dB of linear slope over the 60- through 80-MHz band is allowed.
17	Remove the test cable from the IF OUT jack of the IF main amplifier and restore the bay connection to that jack. For HS or HS/SD bays, omit Steps 18 through 20.
18	Connect the 840543920 test cable to the output connector of the DADE cable (P12 for a repeater station receiver and J3 for a main station receiver). Use the appropriate adapter to make the connections.
19	Set the RF MODE switch to the CW position.
20	Measure the power. <i>Requirement:</i> $-26.0 \text{ dBm} \pm 2 \text{ dB}$.

PREPARATION FOR TEST

1. Set the controls on the units as follows.

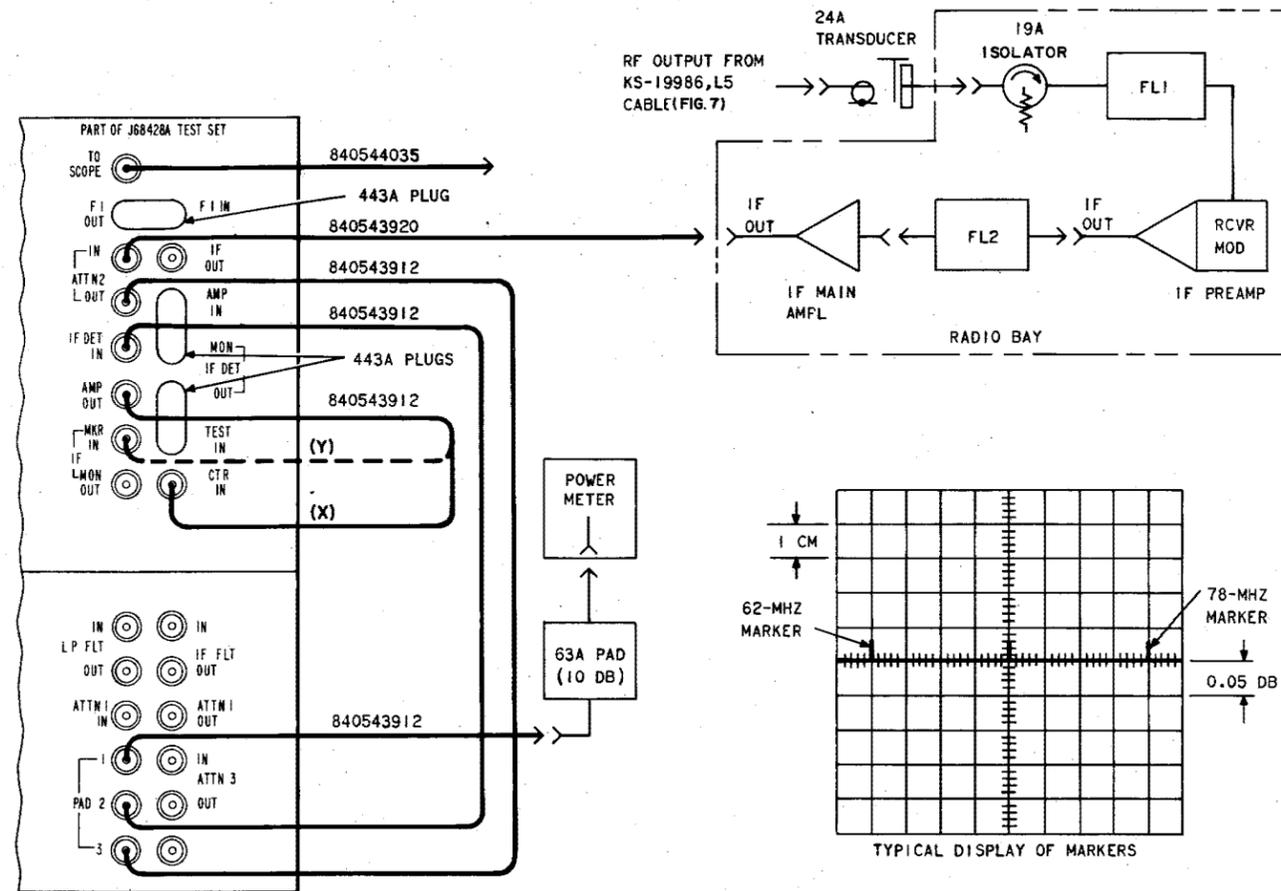
UNIT	CONTROL	POSITION
Oscilloscope	VOLTS/DIV	1m
Counter	FUNCTION SAMPLE RATE DISPLAY BLANKING	135 MHZ MAX Counterclockwise* Depress the pushbutton at the extreme right
Power Meter	INPUT	IF
Control Unit	ATTEN† COUNTER INPUT IF AMPL GAIN	3 dB (J68387S) 12 dB (J68387AB) 135 MHZ MAX CCW

* On some units the power switch is combined with the SAMPLE RATE control. Make sure the power is on.

† Use ATTN 2 on test sets equipped with J68428 C and D control panels.

2. With the input cable removed from the power meter, zero the power meter by setting the MODE switch to ZERO and adjusting the ZERO control for 000 indication on the digital display. Then set the MODE switch to the POWER METER position.
 3. On the control unit, set the COUNTER INPUT to F1. Observe the counter and adjust MARKERS F1 control for a 62-MHz indication on the counter. Similarly, set COUNTER INPUT to F2 and adjust MARKER F2 for 78 MHz.
 4. On the sweep oscillator, set RF MODE to ΔF .
 5. Remove the input cable from the oscilloscope, and adjust the vertical POSITION control to center the trace. Replace the cable.
- Do not change the vertical POSITION control during the test.*
6. Align the trace with the center of the graticule as shown, using the TEST TRACE control on the control unit.
 7. Make the test connections shown using option (Y).
 8. Adjust the MARKERS — AMPLITUDE control for the desired marker height.
 9. Adjust the horizontal POSITION, DISPLAY WIDTH, RF ΔF , and RF CENTER FREQ controls to position the markers as shown in the figure.
 10. Insert 0.1-dB attenuation with ATTN and observe the trace.
 11. Adjust the vertical VERNIER control on the oscilloscope for a trace deflection of 2 major divisions (2 cm). The oscilloscope is now calibrated for 0.05 dB per major division (cm). Disregard slope.

Note: On some test sets, the VERNIER control may be designated CAL.



A. USING J68428C AND D PANELS

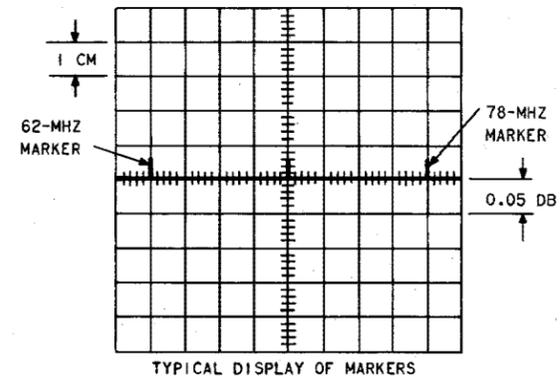
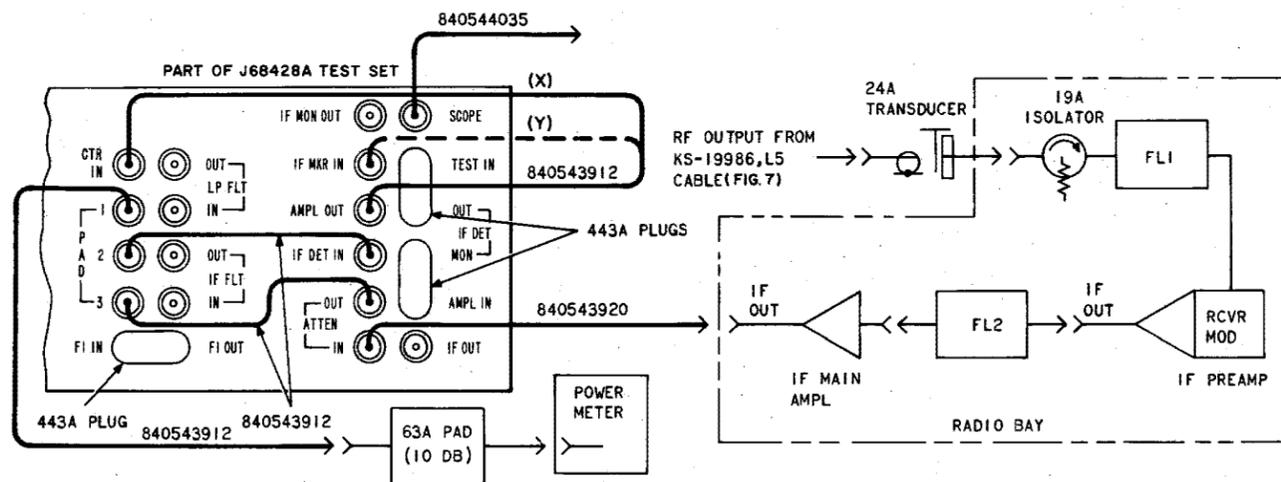


Fig. 8—RF-to-IF Transmission Setup—J68428A Test Set

CHART 4 (Cont)

STEP	PROCEDURE
21	If the requirements in Steps 1 through 16 cannot be met, it will be necessary to align the receiver modulator—IF preamplifier and the IF main amplifier as directed in Charts 5 and 6. After performing Charts 5 and 6, repeat Chart 4, Steps 1 through 16.
22	If the requirements in Steps 1 through 16 still cannot be met, check for defective cables or a defective 1042A filter. <i>Note:</i> The insertion loss of the 1042A filter at 70 MHz should be between 6.5 and 7.5 dB. Its amplitude response should be flat to within 0.15 dB between 62 and 78 MHz and to within 0.35 dB between 60 and 80 MHz.
23	If the requirement in Step 20 cannot be met, check for a defective or incorrect DADE cable, 63E pad, or equalizer, if used.
24	If all the requirements are met, remove the test equipment. Restore all bay connections to normal.
25	Operate the MAN-AGC switch on the IF main amplifier to the AGC position.
26	If further tests or alignments are not scheduled, restore the channel to service as directed by local practice.

CHART 5
RECEIVER MODULATOR AND IF PREAMPLIFIER ADJUSTMENT

APPARATUS:

1—J68428A Transmitter-Receiver Test Set

1—KS-20114, L2 Adjusting Tool

STEP	PROCEDURE
------	-----------

Caution: ♦If the bay is equipped with hot standby/space diversity switching, it has no frequency allocated for protection. Precautions should be taken not to interrupt service. Force-switch the system to the receiver that is not to be maintained as directed in Section 411-600-500.♦

CHART 5 (Cont)

STEP	PROCEDURE
1	Note the REF BIAS value stamped on the modulator. Select RCVR MOD BIAS on the meter panel.
2	Note the frequency of the receiver. <i>Requirement:</i> The RCVR MOD BIAS indication shall equal the bias value determined by Table B from the appropriate receiver frequency and REF BIAS. Make any necessary adjustment with the DIODE BIAS control on the IF preamplifier. Record the RCVR MOD BIAS indication on the meter panel.
3	Connect the 840543920 cable shown in Fig. 8, option (Y), to the IF OUT jack of the IF preamplifier. Use a 187A adapter.
4	Set ATTEN to 1 dB. (If the test set is equipped with J68428C and D panels, use ATTEN 2.)
5	Adjust the LEVEL control on the IF preamplifier for -18.3 dBm on the power meter.
6	Set the RF MODE switch to ΔF and adjust the TEST TRACE control on the control unit to center the trace.
7	Measure the transmission response as shown by the test trace.

Requirement: The trace should be flat to within 0.07 dB over the 60- through 80-MHz band.

If the requirement is not met, adjust the SHAPE and SLOPE controls while maintaining a power meter indication of -18.3 dBm with the LEVEL control. If any of the requirements cannot be met, refer to Section 411-504-503 for troubleshooting procedures.

CHART 6
IF MAIN AMPLIFIER ADJUSTMENT

APPARATUS:

1—J68428A Transmitter-Receiver Test Set

1—KS-20114, L2 Adjusting Tool

CHART 6 (Cont)

TABLE B

RECEIVER FREQUENCY MHz	RCVR MOD BIAS INDICATION
3710	REF BIAS +7.0
3730	REF BIAS +6.0
3870	
3750	REF BIAS +5.0
3890	
3770	REF BIAS +4.0
3910	
3790	REF BIAS +3.0
3930	
3810	REF BIAS +2.0
3950	
3830	REF BIAS +1.5
3970	
3850	REF BIAS +0.5
3990	
4010	REF BIAS +0
4030	REF BIAS -1.0
4050	REF BIAS -2.0
4070	REF BIAS -3.0
4090	REF BIAS -4.0
4110	REF BIAS -5.0
4130	REF BIAS -6.0
4150	REF BIAS -7.0
4170	REF BIAS -8.0

CHART 6 (Cont)

STEP	PROCEDURE
------	-----------

A. Gain and Amplitude Response

The following procedure is used for adjusting the gain and amplitude response of the IF main amplifier. The objective is to establish a gain of 9 dB with an input of -8.0 dBm and an output of $+1.0$ dBm. The amplitude response should be flat to within 0.03 dB over the 60- through 80-MHz band. J68387AB amplifiers with SD-51548-01 option W will have an 18-dB gain with a -8 dBm input and $+10$ dBm output. The amplitude response deviation will be the same, but there may be an additional 0.2-dB linear slope over the 60- through 80-MHz band.

Caution: *If the bay is equipped with hot standby/space diversity switching, it has no frequency allocated for protection. Precautions should be taken not to interrupt service. Force-switch the system to the receiver that is not to be maintained as directed in Section 411-600-500.*

- 1 Prepare the test set in accordance with Fig. 6.
- 2 Disconnect the cables from the IF IN and IF OUT jacks on the IF main amplifier.

Note: To make access to the J68387S amplifier connectors easier, remove the amplifier together with its mounting bracket from the bay frame by loosening the two screws that fasten the mounting bracket to the bay. Hang the assembly on the post provided on the bay frame above the amplifier by hooking the post through the hole in the bracket. (See Fig. 5.) The J68387AB amplifier IF IN and IF OUT jacks are accessible without removing the amplifier.

- 3 Connect option (Z) in Fig. 6.
- 4 Increase the setting of ATTEN by 6 dB to reduce the input to the IF main amplifier to -8 dBm.
- 5 Set the MAN-AGC switch on the IF main amplifier to the MAN position, and adjust the MAN GAIN control for -18.3 dBm. Center the trace with the TEST TRACE control.

Requirement: Flat to within 0.03 dB over the 60- through 80-MHz band. For J68387AB amplifiers, an additional 0.2 dB of linear slope across the 60- through 80-MHz band is permissible.

If the requirement is not met for J68387S amplifiers, adjust the SLOPE 1 and SLOPE 2 controls on the IF main amplifier. Maintain an indication of -18.3 dBm on the power meter with the MAN GAIN control. If the requirement is not met for J68387AB amplifiers, replace the amplifier with a good spare and repeat Steps 3 through 5.

- 6 Set the IF MODE switch on the sweep generator to the CW position.

CHART 6 (Cont)

STEP	PROCEDURE
7	Operate the MAN-AGC switch on the IF main amplifier to the AGC position and measure the power. Requirement: -18.0 through -18.6 dBm. If necessary, adjust the IF LEV control (J68387S amplifier) or \blacktriangleright OUTPUT PWR control (J68387AB amplifier) \blacktriangleleft to meet the requirement.
8	Select RCVR CARR PWR on the meter panel and observe the meter indication. Requirement: 80 (J68387S amplifier) or $\blacktriangleright 80 \pm 3$ (J68387AB amplifier) \blacktriangleleft . If necessary, adjust the M SENS control until the requirement is met (J68387S amplifier only).
9	Insert a 63A 20-dB pad between ATTEN OUT and the 840543920 cable, and increase the setting of ATTEN by 20 dB. Measure the IF power. Requirement: Between -20.3 and -16.3 dBm. If the requirements cannot be met, replace the IF main amplifier with a spare and repeat the tests in this chart.
10	Return the defective unit to a maintenance center.
11	\blacktriangleright For J68387S amplifiers in frequency diversity or HS only bays, remove the test connections and restore the normal bay connections to the IF main amplifier. For J68387S amplifiers in HS/SD bays or J68387AB amplifiers, proceed with Step 12.
B. HS/SD Trip Adjustment	
Note 1: On J68387S amplifiers only, the TRIP ADJ control is located on the right-hand side of the bay on a mounting bracket. The AGC lamp is located on the bay alarm panel.	
Note 2: The CRS PLT PWR control on the J68387AB amplifier must always be in the full counterclockwise position in order to disable the carrier resupply.	
12	Return the input level to -8 dBm, and then increase the attenuation of ATTEN 2 by 35 dB.
13	Turn the HS/SD TRIP control (J68387AB) or TRIP ADJ control (J68387S) <i>clockwise</i> until the TRIP lamp (J68387AB) or AGC lamp (J68387S) is just extinguished.
14	Slowly adjust the HS/SD TRIP control (J68387AB) or TRIP ADJ control (J68387S) <i>counterclockwise</i> until the TRIP lamp (J68387AB) or AGC lamp (J68387S) just lights.

CHART 6 (Cont)

STEP	PROCEDURE
15	Decrease the attenuation in ATTEN 2 (increase the input signal) to a point where the TRIP lamp (J68387AB) or AGC lamp (J68387S) extinguishes.
16	Slowly increase the attenuation of ATTEN 2 until the TRIP lamp (J68387AB) or AGC lamp (J68387S) lights.
17	Remove the test connections, and restore the normal bay connections to the IF main amplifier.⚡
