TD-3 MICROWAVE RADIO
J68386G AND J68386H TRANSMITTER-RECEIVER BAY
RECEIVER TESTS
NOISE FIGURE

This section describes the procedures for measuring the noise figure of a radio receiver. The noise figure test should be performed in accordance with the Equipment Test List. However, if trouble has been experienced with the receiver modulator and IF preamplifier, necessitating diode changes, modulator, and/or preamplifier replacement, the noise figure should be measured.

The preliminary checks in Section 411-502-500 should be completed before performing the tests in this section. The recommended maintenance interval for the tests in this section is given in the Equipment Test List.

This section is reissued to add a chart for the J68428A Test Set and a caution to be observed when working on systems equipped with Hot Standby/Space Diversity Switching.

This reissue does not affect the Equipment Test List.

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: ◗Before working on Hot Standby/Space Diversity equipped bays, consult Section 411-600-500 for forced switching procedures to be followed to remove service from the desired receiver. Exercise extra caution during tests since the transmitter in this bay may be carrying service.◖

Caution 3: When removing and replacing waveguide units, care should be exercised to prevent foreign matter from entering the waveguide. Handle all types of waveguide carefully in order to prevent damage to flange mating surfaces. When connecting waveguide units, flange mating surfaces must be carefully aligned and all screws must be replaced and tightened securely to prevent RF leakage.

CHART **PAGE**

CHART 1

RECEIVER NOISE FIGURE TEST
(USING THE J68392A TEST SET NOT EQUIPPED WITH A NOISE LAMP)

In the following procedure, the receiver noise figure is measured without the use of a noise lamp. The receiver is set up in conjunction with the IF amplifier, IF bandpass filter, and power meter in the test set so that the inherent noise in the receiver, in the absence of any signal, will give a prescribed indication on the power meter. The gain of the overall test setup is then checked by inserting into the receiver a known RF carrier power and measuring the resulting IF output power. An out-of-limit noise figure is indicated by an out-of-limit power indication when the RF carrier is inserted.

APPARATUS:

1—J68392A Transmitter-Receiver Test Set (not equipped with a noise lamp)

STEP	PROCEDURE
1	Remove the KS-19748, L3 flexible waveguide ahead of the 19A isolator and install a 24A transducer ahead of the isolator. Terminate the 1433 receiver channel network with the shorting plate supplied with the test set, making sure that all connections are tight.
2	Connect the test setup as shown in Fig. 1.
3	Set the RF oscillator to the CW mode and set the frequency to the receiver channel frequency.
4	Note the calibrated loss of the 30-dB RF pad supplied with the test set at 4 GHz. Add the calibrated loss to −28.0 dBm and adjust the RF output of the oscillator to obtain the resultant power.

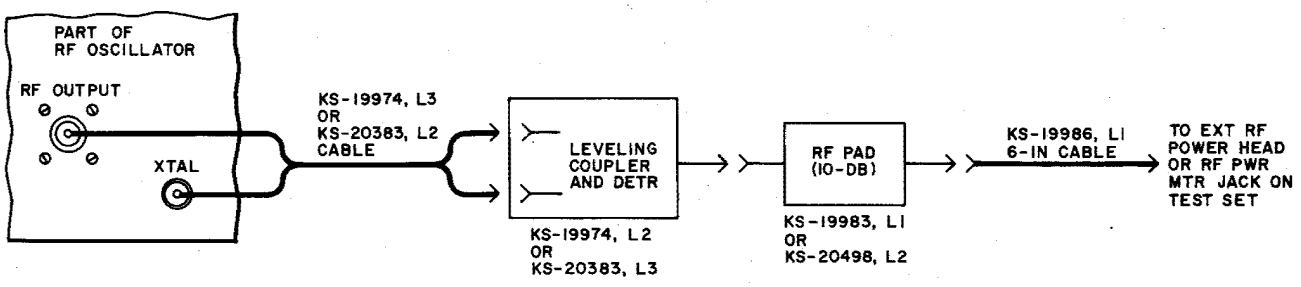
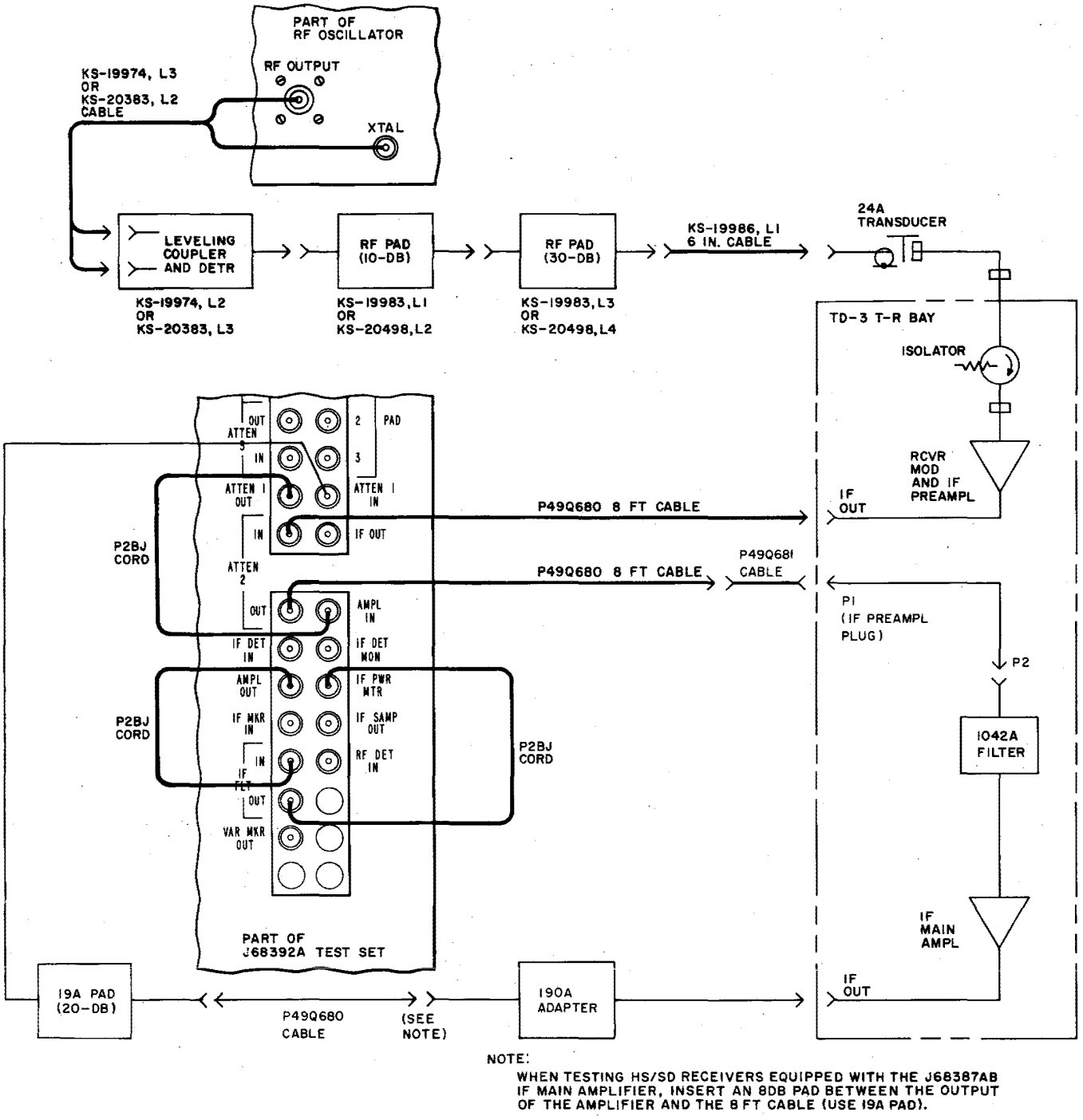


Fig. 1—RF Oscillator-Output Power Adjustment—Using J68392A Test Set

CHART 1 (Cont)

STEP	PROCEDURE
	Example: If the calibrated loss is 29.6 dB, adjust the output to obtain −28.0 dBm +29.6 dB = +1.6 dBm.
5	Remove the RF carrier by turning the RF oscillator line switch to the STANDBY position, if provided, or to the OFF position.
6	Insert the 30-dB pad between the 10-dB pad and the 6-inch cable and complete the test setup in Fig. 2. Make sure that all coaxial connections are tight.
7	Set attenuators ATTEN 1 and ATTEN 2 to 0 dB.
8	Operate the bay AGC-MAN switch on the IF main amplifier to the AGC position.
9	Adjust the test set AMPL GAIN control to obtain −10.0 dBm. ***Note:*** If this power is varying, check the coaxial connections and waveguide joints for tightness in the receiver front-end section.
10	Set ATTEN 1 to ▶10◀ dB and ATTEN 2 to ▶50◀ dB and turn the RF oscillator line switch to the ON position.
11	Remove the P2BJ cord from the IF PWR MTR jack and plug it into the CTR jack. Operate the CTR switch to the EXT position.
12	Adjust the RF oscillator frequency control to obtain 70 ±0.5 MHz on the counter.
13	Remove the P2BJ cord from the CTR jack and plug it into the IF PWR MTR jack.
14	Measure the power. ***Requirement:*** ▶Between −6.4 dBm and −2.4 dBm. ***Note:*** These powers correspond to maximum and minimum noise figures of 9 dB and 5 dB, respectively.
15	If the requirement is met, proceed with Step 16. If the measured power is greater than −2.4 dBm, recheck the test setup. If the measured power is less than −6.4 dBm, perform the following, in the sequence given, until the requirement is met. (a) Perform the troubleshooting tests on the receiver modulator-IF preamplifier as directed in Section 411-504-503, Chart 2. (b) If the completion of (a) does not result in meeting the requirement, reinstall the original receiver modulator—IF preamplifier unit. Replace the IF main amplifier unit and repeat Chart 1 starting with Step 5. If the noise figure requirement is now met, repeat the transmission tests for the receiver specified in Section 411-504-501.



NOTE:
WHEN TESTING HS/SD RECEIVERS EQUIPPED WITH THE J68387AB IF MAIN AMPLIFIER, INSERT AN 8DB PAD BETWEEN THE OUTPUT OF THE AMPLIFIER AND THE 8 FT CABLE (USE 19A PAD).

Fig. 2—Receiver Noise Figure Measurement—Using J68392A Test Set Not Equipped With Noise Lamp

CHART 1 (Cont)

STEP	PROCEDURE
16	Restore all connections to normal.

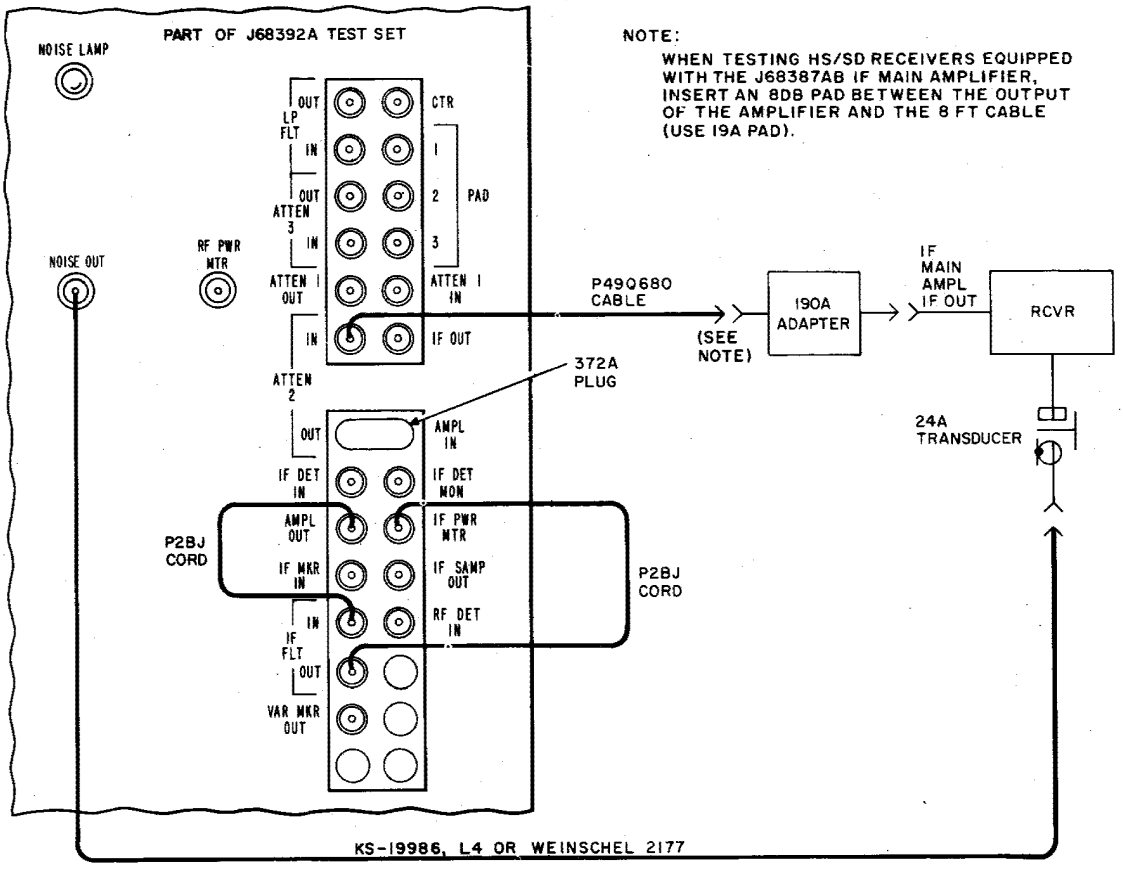
CHART 2

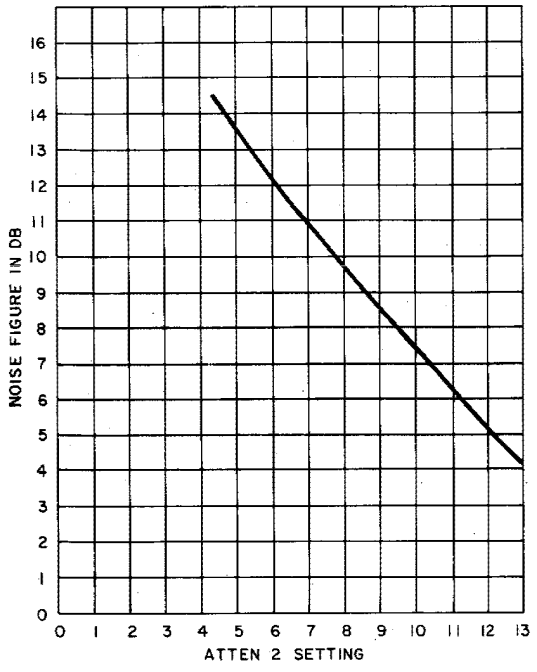
RECEIVER NOISE FIGURE TEST
(USING THE J68392A TEST SET EQUIPPED WITH A NOISE LAMP)

APPARATUS:

1—J68392A Transmitter-Receiver Test Set (equipped with a noise lamp)

STEP	PROCEDURE
1	Set the MAN-AGC switch on the IF main amplifier to the MAN position. ***Note:*** Disregard the alarm indication.
2	Remove the flexible waveguide section (KS-19748, L3) located between the 1433 receiver channel network and the 19A isolator. Connect a 24A transducer ahead of the 19A isolator and terminate the drop arm of the 1433 receiver network with a shorting plate supplied with the test set.
3	Remove the cable from the IF OUT jack of the IF main amplifier.
4	Prepare the test set in accordance with Fig. 3.
5	On the test set control panel, adjust the AMPL GAIN control for a power meter indication of −10 dBm.
6	Press the NOISE LAMP pushbutton. (It lights to indicate ON.)
7	Increase the setting of ATTEN 2 until the power meter again indicates −10 dBm.
8	Note the setting of ATTEN 2. ***Requirement:*** 8.5 dB minimum. ***Note:*** This minimum corresponds to a maximum noise figure of 9 dB. The actual noise figure can be found using the curve in Fig. 3, if desired.





PREPARATION FOR TEST

1. Establish test connections as shown.
2. Set ATTEN 2 to 0.
3. Operate the controls on the test set to the following positions:

UNIT	CONTROL	POSITION
RF oscillator	LINE	OFF
Control panel	NOISE LAMP AMPL GAIN	Off (unlighted) Midrange
Power meter	INPUT CHANNEL POWER RANGE DBM	IF —10

Fig. 3—Receiver Noise Figure Measurement—Using J68392A Test Set Equipped With Noise Lamp

CHART 2 (Cont)

STEP	PROCEDURE
	If the requirement is met, proceed with Step 9. If this requirement is not met, perform the following, in the sequence given, until the requirement is met. (a) Perform the troubleshooting tests on the receiver modulator—IF preamplifier as directed in Section 411-504-503, Chart 2. (b) ▶If completion of (a) does not result in meeting the requirement, reinstall the original receiver modulator—IF preamplifier unit. Replace the IF main amplifier unit and repeat Chart 2 of this section starting with Step 4. If the noise figure requirement is now met, repeat the transmission tests for the receiver specified in Section 411-504-501.◀
9	Disconnect the test set cables from the transducer and IF OUT jack. Reconnect the bay coaxial cable to the IF OUT jack of the IF main amplifier.
10	Remove the 24A transducer and the shorting plate and reinstall the flexible waveguide.
11	On the IF main amplifier, set the AGC-MAN switch to the AGC position.

▶CHART 3

RECEIVER NOISE FIGURE TEST (USING THE J68428A TEST SET)

In the following procedure, the receiver noise figure is measured without the use of a noise lamp. The receiver is set up in conjunction with the IF amplifier, IF bandpass filter, and power meter in the test set so that the inherent noise in the receiver, in the absence of any signal, will give a prescribed indication on the power meter. The gain of the overall test setup is then checked by inserting into the receiver a known RF carrier power and measuring the resulting IF output power. An out-of-limit noise figure is indicated by an out-of-limit power indication when the RF carrier is inserted.

APPARATUS:

1—J68428A Transmitter-Receiver Test Set

▶CHART 3(Cont)

STEP	PROCEDURE

1 Remove the 3-inch flexible waveguide section (KS-19748, L3) located between the 1433 receiver channel network and the 19A isolator. Connect a 24A transducer ahead of the 19A isolator and terminate the drop arm of the 1433 receiver network with a shorting plate supplied with the test set, making sure that all connections are tight.

2 Operate the test set controls to the following positions:

UNIT	CONTROL	POSITION
Power Meter	INPUT MODE	RF ZERO
Sweep Oscillator	RF BAND SELECTOR RF POWER LEVEL RF MODE RF CENTER FREQ	3.65-4.25 GHz MAX CCW CW Center frequency of receiver under test
Frequency Counter	FUNCTION DISPLAY BLANKING SAMPLE RATE	135 MHz Max. 10 Hz CCW (before detent)
Control Unit	COUNTER INPUT	135 MHz Max.

3 Zero the power meter as follows. With the MODE switch set to ZERO, adjust the ZERO control for an indication of 000 on the digital display. Reset the MODE switch to POWER METER.

4 Connect the test setup as shown in Fig. 4.

5 Note the calibrated loss at 4 GHz of the 30 dB RF pad (KS-20498, L4) supplied with the test set. Add the calibrated loss to −28.0 dBm and adjust the RF POWER LEVEL of the RF oscillator to obtain the resultant power.

Example: If the calibrated loss is 29.6 dB, adjust the output to obtain −28.0 dBm +29.6 dB = +1.6 dBm.

6 Remove the RF carrier by turning the IF/RF oscillator line switch to the EXT DC ONLY position (ie, IF/RF off).

7 Set the INPUT switch on the power meter to IF. With no input connected to the IF power head, zero the IF power meter as follows. Set the MODE switch to ZERO and adjust the ZERO control for an indication of 000 on the digital display. Reset the MODE switch to POWER METER.

▶CHART 3(Cont)

STEP	PROCEDURE

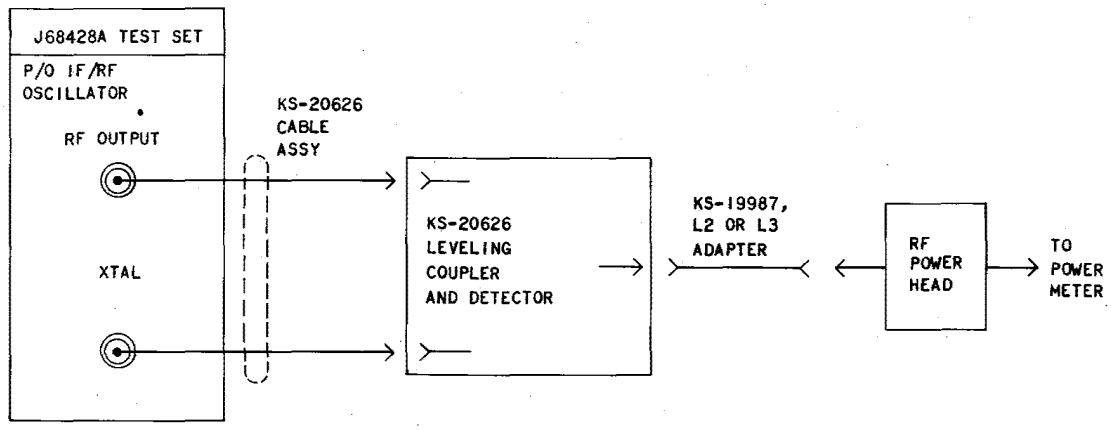


Fig. 4—RF Oscillator-Output Power Adjustment Using J68428A Test Set

8 Insert the 30-dB pad at the output of the leveling coupler and complete the test setup in Fig. 5 using options (X) and (Z). Make sure that all coaxial connections are tight.

9 Set ATTEN (or ATTEN 2) to 0 dB.

10 Operate the bay AGC-MAN switch on the IF main amplifier to the AGC position.

11 Adjust the test set IF AMPL GAIN control to obtain −9.0 dBm.

Note: If this power is varying, check the coaxial connections and waveguide joints for tightness in the receiver front-end section.

12 Set ATTEN (or ATTEN 2) to 50 dB and change the test setup from options (X) and (Z) to options (Y) and (W).

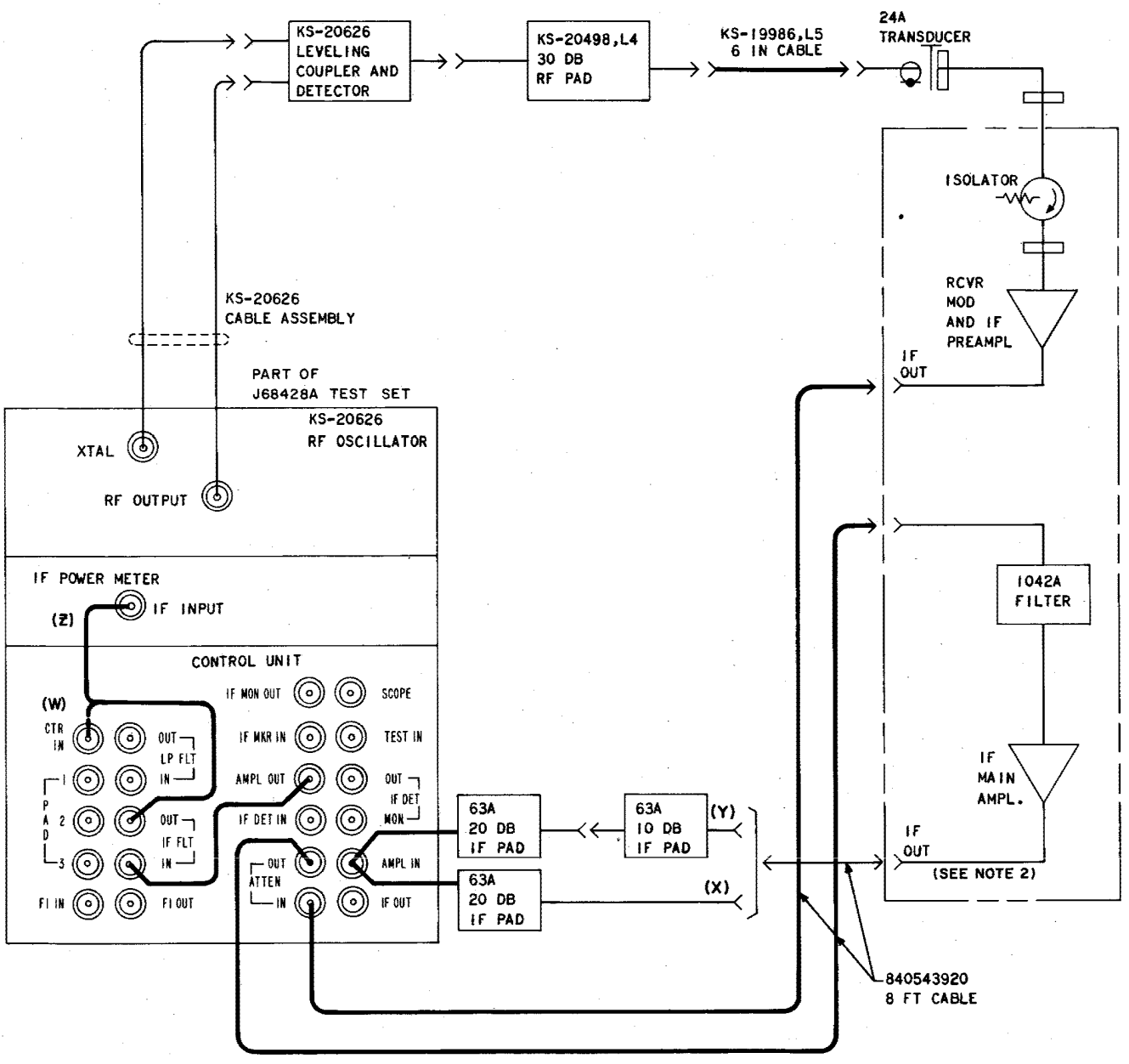
13 Turn the RF oscillator line switch to POWER ON.

14 Adjust the RF oscillator frequency control, RF CENTER FREQ, to obtain 70 ±0.5 MHz on the counter display.

15 Change option (W) to option (Z).

16 Measure the power.

Requirement: Between −5.4 dBm and −1.4 dBm.



NOTES:

1. EARLY VERSIONS OF THIS TEST SET HAD A SLIGHTLY DIFFERENT JACK FIELD ARRANGEMENT. SINCE THE INDIVIDUAL JACK DESIGNATIONS WERE NOT CHANGED (EXCEPTING ATTEN 2 WHICH, CHANGED TO ATTEN). THIS FIGURE CAN BE USED.
2. WHEN TESTING HS/SD RECEIVERS EQUIPPED WITH J68387AB. IF MAIN AMPLIFIERS, INSERT AN 8 AND A 3 DB, 63A PAD BETWEEN THE OUTPUT OF THE AMPLIFIER AND THE 8 FT. TEST CABLE.

Fig. 5—Receiver Noise Figure Measurement—Using J68428A Test Set

CHART 3(Cont)

STEP	PROCEDURE
	Note: These powers correspond to maximum and minimum noise figures of 9 dB and 5 dB, respectively.
17	If the requirement is met, proceed with Step 18. If the measured power is greater than −1.4 dBm, recheck the test setup. If the measured power is less than −5.4 dBm, perform the following, in the sequence given, until the requirement is met: (a) Perform the troubleshooting tests on the receiver modulator—IF preamplifier as directed in Section 411-504-503, Chart 2. (b) If the completion of (a) does not result in meeting the requirement, reinstall the original receiver modulator—IF preamplifier unit. Replace the IF main amplifier unit and repeat Chart 3 starting with Step 6. If the noise figure requirement is now met, repeat the transmission tests for the receiver specified in Section 411-504-501.
18	Restore all connections to normal.