TD-3 MICROWAVE RADIO
J68386G AND J68386H TRANSMITTER-RECEIVER BAYS
TESTS USING THE KRUSE 52011 IF/RF TEST SET
NOISE FIGURE

This appendix supplements Section 411-504-505.

It is reissued to add a caution to be observed when working on systems equipped with Hot Standby/ Space Diversity Switching.

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 test in this appendix.

The noise figure is measured without a calibrated noise source. The method used is based on the assumption that the gain and effective noise bandwidth of the receiver is known. In this case the receiver input is terminated as follows:

$$P_{RCVR\ OUT} = -174 + BW + NF + G_{RCVR} \quad (1)$$

Where $P_{RCVR\ OUT}$ = receiver output power in dBm

BW = effective noise bandwidth in dB

NF = noise figure of receiver in dB

G_{RCVR} = receiver gain in dB

The measurement procedure is as follows:

Set $P_{RCVR\ OUT} = -10$ dBm with the receiver terminated

Then, from (1)

$$G_{RCVR} = 164 - BW - NF \quad (2)$$

Measure $P_{MEAS} = P_{IN}$ applied to the input of the receiver and

55-dB attenuation added in the receiver

$$P_{MEAS} = P_{IN} - 55\ dB + G_{RCVR} \quad (3)$$

Then, from (2) and (3)

$$P_{MEAS} = P_{IN} + 109 - BW - NF \quad (4)$$

If P_{IN} = –28.0 dBm while the equivalent noise bandwidth of the 687A filter is 22.0 MHz; therefore

$$BW = 10 \log 22.0 \times 10^6 = 73.4 \text{ dB}$$

So that, from (4), $P_{MEAS} = 7.6 - NF$

and $NF = 7.6 - P_{MEAS}$

REQUIREMENTS

TEST SET FILTER TYPE		NF	
		4.0	9.0
P_{MEAS}	687A	3.6	-1.4

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 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.

Caution 3: 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.

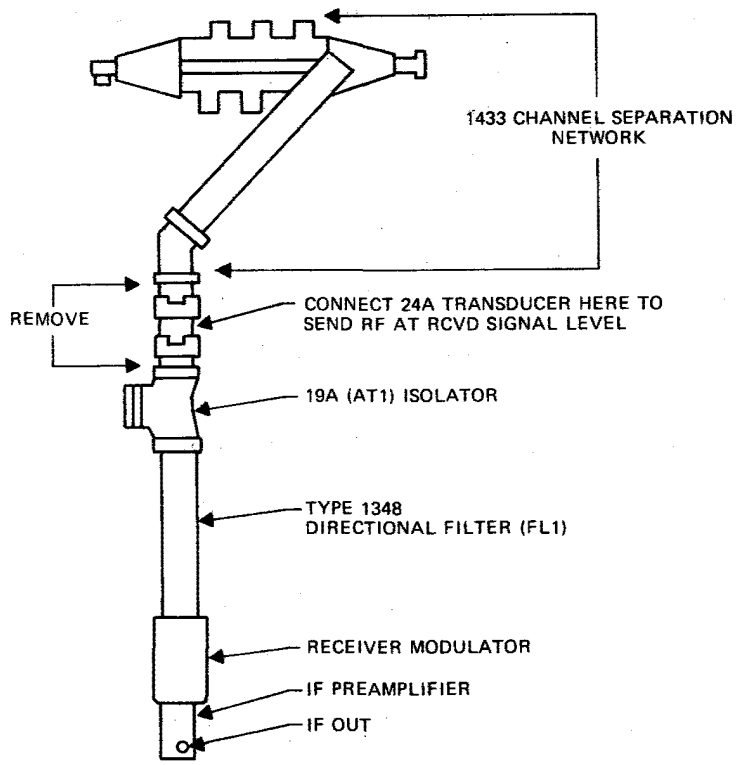
RECEIVER NOISE FIGURE TEST

The noise figure test provides a measure of the amount of noise added by receiver to the signal received from preceding station during normal in-service operation.

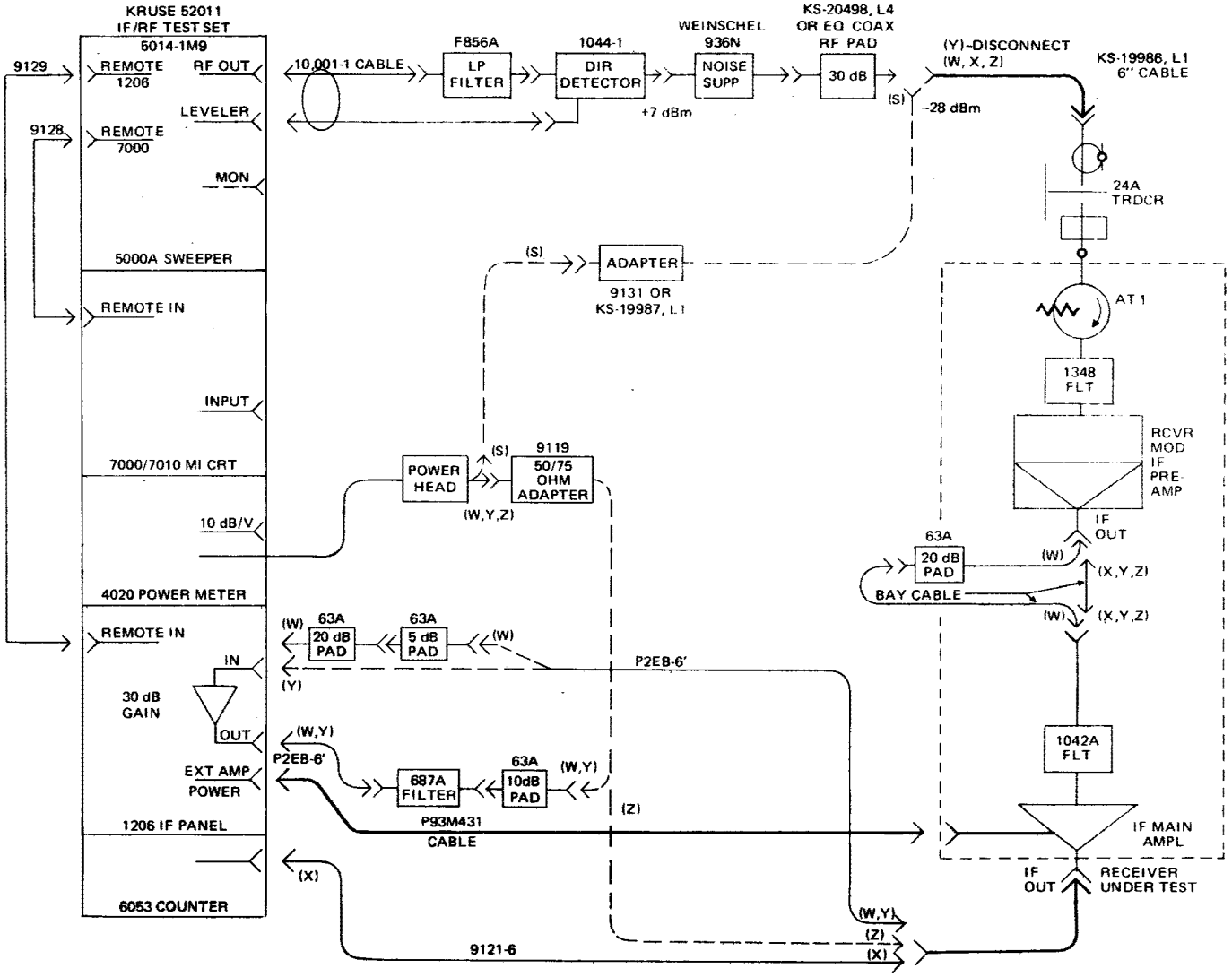
APPARATUS:

1—Kruse 52011 IF/RF Test Set

STEP	PROCEDURE
1	Remove 3-inch waveguide piece between 1433 channel separation network and 19A (AT1) isolator in receiver. Connect a 24A transducer to the AT1 isolator so that test signals can be sent into receiver. (See Fig. 1.)

STEP	PROCEDURE
	 **Preparation of Receiver For Test** **Fig. 1**
2	Set up the test set in accordance with Exhibit 1.
3	Position the IF main amplifier MAN-AGC switch to MAN.
4	Connect option (X).
5	Position RF oscillator to deliver a CW signal and adjust its frequency until counter indicates 70 ±0.5 MHz.
6	Connect option (Z). Depress power meter DBM 75 ohm key. Record power meter reading for later use.
7	Disconnect RF oscillator. Connect option (Y). Adjust external amplifier GAIN control on IF test panel to obtain a -10 dBm power level. (Power meter reading of -20 dBm.)
8	Connect option (W). Read power meter directly. This time include the loss of the 10 dB pad. *Requirement:* Between +5.6 dBm and +0.6 dBm (4 dB and 9 dB noise figure, respectively).

STEP	PROCEDURE
	POWER dBm = NF dB; POWER dBm = NF dB +3.6 = 4; +0.6 = 7 +2.6 = 5; –0.4 = 8 +1.6 = 6; –1.4 = 9 If the requirement is met, proceed with Step 9. If the requirement is not met, perform the following, in the sequence given, until the requirement is met. (a) Verify that all waveguide units in the receiver are properly aligned and the screws tightened securely. (b) Verify that the test apparatus is arranged properly and that the levels are correct. (c) Replace receiver modulator diode CR1 and perform the tests in accordance with Section 411-504-503. (d) Replace the receiver modulator–IF preamplifier and retune as directed in Section 411-504-503. (e) If the completion of (d) above does not result in meeting the requirement, reinstall the original receiver modulator–IF preamplifier and replace the IF main amplifier.
9	Connect option (X) and adjust sweeper for 70 MHz on counter.
10	Connect option (Z) and readjust IF amplifier MAN GAIN control to obtain proper power level recorded in Step 6. Operate IF main amplifier MAN-AGC switch to AGC position.
11	Restore all connections to normal.



PREPARATION FOR TEST

1. Operate controls on the test set as follows, allowing 15 minutes warm-up.

UNIT	CONTROL	POSITION
5000A SWEEPER WITH 5014-1 RF PLUG-IN	MARKER 2-Fc	DESIRED CENTER FREQUENCY
	VERNIER	MAX CCW
	RF LEVEL	+3 dBm
	1 KHz	OFF
	LEVELER	EXT
	RETRACE	ON
	MARKERS	OFF
	MODE	CW
	EXT/INT'L SWEEP (REAR)	INT'L
4020 POWER METER	LEVEL	10 DB/V
	GROUNDING	INT
	OFFSET	MIDSCALE
6053-305 COUNTER	ATTENUATOR	X1
	RESOLUTION	1K
	EXT/INT (REAR)	INT

2. Connect power meter head to CAL OUT jack. Depress DBM CAL key and adjust its control for +10.00 dBm reading. Depress ZERO key and adjust its control for 00.00 ± .01 reading. Depress DBM 50 ohm key.

3. Connect option (S). Adjust RF oscillator to receiver frequency.

4. Adjust RF oscillator output level to a value (in the vicinity of +3 dBm) which will result in a level of -28.0 dBm being applied to the 1B transducer.

Test Setup For Noise Figure Test
Exhibit 1