TD-3 MICROWAVE RADIO

J68386A AND J68386B TRANSMITTER-RECEIVER BAYS

TRANSMITTER TESTS

USING KRUSE 52011 IF/RF TEST SET

TRANSMISSION

This appendix describes the procedures used to measure and adjust, if necessary, the gain and amplitude response of a TD-3 microwave radio transmitter. Procedures to check and adjust the IF carrier resupply are also included.

This appendix provides instructions for operating the transmitter at an output power of +37 dBm for channels carrying 1200 telephone message circuits or between +37 dBm and +38.5 dBm which is recommended for channels carrying 1500 telephone message circuits. This increase is desirable to help offset the increased thermal noise inherent in 1500 circuit loading.

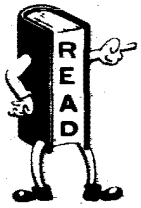
Section 411-400-501 should be performed prior to this appendix and the results used as a guide to possible sources of trouble. The preliminary checks in Section 411-402-500 must be completed before performing the tests in this appendix. The IF return loss tests in Section 411-406-502, when required by the Equipment Test List, must be completed prior to these tests.

For location of components in the transmitter section, refer to Fig. 5 in the main section.

Charts A through F must be performed in numerical order unless otherwise directed.

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: These tests must be performed with the transmitter disconnected from the antenna system. Refer to Section 411-402-500 for the proper procedure for terminating the transmitter.



Warning: Do not open waveguide joints in the transmitter without first removing the IF carrier at the transmitter modulator.

CHART — PAGE

CHART A

IF CARRIER RESUPPLY CHECKS

APPARATUS:

1—Kruse 52011 IF/RF Test Set

STEP	PROCEDURE
	Frequency and Output Power Checks
1	Remove the cable from the IF IN jack of the limiter and connect the cable to a 19A 20-dB pad.
2	Prepare for test in accordance with Exhibit 1. Connect option (X) and measure the output power of the carrier resupply. *Requirement:* –8.0 dBm ±0.2 dB This corresponds to a power at the IF OUT jack of —7.0 dBm ±0.2 dB. If the requirement is not met, adjust the 70 MC LEV control on the carrier resupply. If the requirement still is not met, replace the carrier resupply with a spare unit.
3	Change connections from option (X) to option (Y) on Exhibit 1, and measure the frequency. *Requirement:* Between 69.996 and 70.004 MHz If this requirement is not met, replace the carrier resupply with a spare unit.
4	Connect option (X), Exhibit 2.
5	On the IF carrier resupply, note the number in the window labeled MC and perform the following: (a) If the number in the window is 61, measure the power. *Requirement:* —15.0 dBm ±0.5 dB (b) If the number in the window is 63, measure the power.

CHART A (Contd)

STEP	PROCEDURE

Requirement: —8.0 dBm ±0.5 dB

If the requirement is not met, adjust the 61-63 MC LEV control on the carrier resupply.

If the requirement still is not met replace the carrier resupply with a spare unit.

6 Connect option (Y), Exhibit 2 and measure the frequency.

Requirement:

For a 61-MHz resupply: between 60.996 and 61.004 MHz.

For a 63-MHz resupply: between 62.996 and 63.004 MHz.

If the requirement is not met, replace the carrier resupply with a spare unit.

7 Return the carrier resupply connections to normal.

Carrier Resupply Trip and Restore Point Check

8 Prepare test set in accordance with Exhibit 3.

9 Press the CRS SW VOLTS pushbutton on the transmitter control panel and note the panel meter indication.

Requirement: Within 5 units of the recorded indication

10 Slowly increase the 24A or 24B ATTEN until the panel meter indication drops to 0. Measure the power.

Requirement: —16 dBm ±0.5 dB

If the requirement is not met, adjust the 24A or 24B ATTEN for —16 dBm and adjust the TRIP control clockwise until the meter indicates upscale, then counterclockwise until the meter indicates 0 (trips).

11 Slowly decrease the attenuation of the 24A or 24B ATTEN until the panel meter indicates upscale (restores) and measures the power.

Requirement: —15.0 dBm to —13.5 dBm

If this requirement is not met, adjust the RESTORE control clockwise if the power is less than —15.0 dBm or counterclockwise if the power is greater than —13.5 dBm. Repeat Steps 10 and 11 until the requirements are met.

CHART A (Contd)

STEP	PROCEDURE
	If the requirements still are not met, replace the carrier resupply and repeat all carrier resupply tests.
12	Increase the 63A pad to 20 dB and note the power meter indication.
13	Remove the cable from the limiter MON jack. *Requirement:* The power shall drop by at least 20 dB from that noted in Step 12 If this requirement is not met, the trouble could be in either the carrier resupply or the limiter; try replacing the limiter first.
14	Reconnect the cable to the limiter MON jack.
15	Note the panel meter indications for positions CRS 70 MC LEV and CRS 61-63 MC LEV. *Requirement:* Between 45 and 75 If this requirement is not met, remove the carrier resupply cover on the side nearest the power plug. Adjust R38 (70 MHz) or R21 (61-63 MHz) for an indication of 60 on the panel meter. Replace cover.
16	Reconnect the cable from the limiter IF OUT jack to the carrier resupply IF IN jack. Depress and hold the ALM RESET switch and note that no alarm is present. Remove the cable from the IF IN jack on the limiter and hold the ALM RESET switch depressed until the TRMTR ALM lamp lights. *Requirement:* A TRMTR alarm shall occur between 40 and 60 seconds after the cable is removed. If this requirement is not met, adjust the DELAY ADJ control. Clockwise rotation increases the time delay. If the requirement still is not met, replace the carrier resupply.

CHART B

OVERALL TRANSMISSION TEST

APPARATUS:

1—Kruse 52011 IF/RF Test Set

CHART B (Contd)

STEP	PROCEDURE
1	Observe the CATHODE CURRENT meter on the TWT power supply. *Requirement:* 40 ±0.5 mA Proceed with Step 2 even if this requirement is not met. However, observe the note associated with Step 2.
2	Prepare for test in accordance with Exhibit 4. Remove the MON 2 or MON 3 detector from the 24B directional coupler at the output of the TWT (Fig. 5 in the main section) and measure the transmitter output power by connecting option (Y), of Exhibit 4. Adjust, if necessary, the 31A attenuator AT3 or AT4 ahead of the TWT to meet whichever of the following requirements for transmitter output power is applicable. *Requirement 1:* +37.0 dBm if (a) the channel is carrying 1200-message circuits, or (b) this power is specified for the transmitter. *Requirement 2:* Maximum available between +37.0 dBm and +38.5 dBm if (a) the channel is carrying 1500-message circuits, and/or (b) this power is specified for the transmitter. Required power meter indication: *Requirement 1:* +26.0 dBm ±0.2 dB minus the calibrated loss of the 24B directional coupler. *Requirement 2:* +27.5 dBm ±0.2 dB minus the calibrated loss of the 24B directional coupler. Minimum required power meter indication = Required power meter indication specified for Requirement 1 Desired power meter indication = Up to 1.5 dB greater than minimum power meter indication If the applicable requirement cannot be met, perform Charts C, D, E, and F in sequence. *Note:* If the requirement of Step 1 is not met, first adjust the TWT voltages in accordance with Step 5 of Chart E to obtain 40 mA of cathode current; then check that the output power meets the applicable requirement above.
3	Perform an amplitude response test in accordance with Exhibit 5, options (X) and (Y). The test trace displays the combined amplitude response of the limiter, carrier resupply, transmitter modulator, and TWT amplifier. *Requirement 1:* Flat to within 0.06 dB over the ±6 MHz band with the rolloff at ±10 MHz not to exceed 0.10 dB.

CHART B (Contd)

STEP	PROCEDURE
	Requirement 2: There shall be no evidence of carrier resupply switching between 60 and 80 MHz. If these requirements are not met, perform Charts C, D, E, and F in sequence. *Do not* be tempted to adjust any unit in order to meet the requirements because it may be compensating for some other trouble.
4	Reconnect the MON 2 or MON 3 detector and press the TRMTR OUT pushbutton. *Requirement:* The meter reading shall be the same as that previously recorded on the control panel. If this requirement is not met, erase the previously recorded reading, record the new reading, and perform the transmitter output alarm adjustment in Chart F, Steps 3 through 7.
5	If all requirements in this chart have been met, remove the IF cable from the IF IN jack of the IF DRIVER-AMP to remove the transmitted carrier. Remove the 522A termination and shorting plate and replace the 1322- or 1336-type filter in the transmitter output circuit. Restore the IF cable connections to the IF DRIVER-AMP and IF limiter. The transmitter can be placed in service.

CHART C

IF-TO-IF AMPLITUDE RESPONSE

APPARATUS:

1—Kruse 52011 IF/RF Test Set

STEP	PROCEDURE
1	Prepare for test in accordance with Exhibit 6. *Note:* Somewhat different test procedures are required for checking the amplitude response of the J68387H, L1 and L1A IF limiters. Proceed with Step 2 if the transmitter is equipped with a J68387H, L1 IF limiter or with Step 5 if the transmitter is equipped with a J68387H, L1A IF limiter. (The L1 limiter is the unit furnished originally with the transmitter and is equipped with a GAIN control. The L1A limiter is the L1 unit modified for reduced noise figure. In the L1A limiter, the GAIN control has been removed and a plastic rivet has been used to plug the GAIN control hole.)

CHART C (Contd)

STEP	PROCEDURE
	J68387H, L1 IF Limiter
2	Remove the normal connections from the IF IN jack of the IF limiter and the IF OUT jack on the IF carrier resupply. Make the option (V) and (Y) connections of Exhibit 6 and observe the test trace on the oscilloscope. This trace represents the amplitude response of the IF limiter and carrier resupply combination. *Requirement 1:* The test trace shall coincide with the reference trace at 70 MHz and shall be flat to within 0.05 dB between 60 and 80 MHz. *Requirement 2:* There shall be no evidence of carrier resupply switching between 60 and 80 MHz. See Exhibit 6 for an example of this condition. If there is evidence of in-band switching, replace the carrier resupply. If these requirements are met, proceed to Step 9. If Requirement 1 is not met, adjust the GAIN, SLOPE 1, or SLOPE 2 control on the IF limiter to bring the test trace within limits. (GAIN controls the output power and is adjusted for trace coincidence at 70 MHz. SLOPE 1 controls the high-end slope. SLOPE 2 controls the slope across the band.) If Requirement 1 still is not met, proceed with Step 3.
3	Establish test connections as in Exhibit 6, option (Z), and measure the amplitude response. *Requirement:* The test and reference traces shall coincide at 70 MHz. (If not, adjust the IF limiter GAIN control.) The test trace shall be flat to within 0.03 dB between 60 and 80 MHz. If the requirement is met, proceed to Step 4. If the requirement cannot be met by adjustment of the controls as in Step 2, replace the IF limiter with a spare and repeat Step 2.
4	Change option (Z) to option (V) to determine the effect of adding the IF carrier resupply to the circuit. Note the separation between test and reference traces at 70 MHz. Compare the amplitude response to that obtained in Step 3. *Requirement 1:* The separation of traces at 70 MHz shall be less than 4 cm (0.2 dB). *Requirement 2:* The amplitude response shall not differ from that of Step 3 by more than 0.02 dB between 60 and 80 MHz. If either of these requirements is not met, replace the cable between the limiter IF OUT jack and the carrier resupply IF IN jack and retest as in Step 2. If either requirement still is not met, replace the carrier resupply and repeat Step 2.

CHART C (Contd)

STEP	PROCEDURE
	J68387H, L1A IF Limiter
5	Remove the normal connections from the IF IN jack of the IF limiter and the IF OUT jack on the IF carrier resupply. Connect options (V) and (Y) of Exhibit 6 and measure the power. *Requirement:* Between −7.1 and −8.8 dBm If this requirement is met, proceed to Step 6. If this requirement is not met, disconnect the 19D pad and measure the power at the IF OUT jack of the IF limiter. *Requirement:* Between −1.0 and −2.5 dBm If this requirement is not met, replace the limiter with a spare and repeat Step 5. If this requirement is met, the tests indicate that the insertion loss of the 19D pad assembly (nominally 6.0 ±0.1 dB) or the IF carrier resupply (nominally less than 0.2 dB) is too high. Using the same test set-up, measure the insertion loss of the pad assembly and the IF carrier resupply (from the IF IN jack to the IF OUT jack). Replace the defective unit and repeat Step 5.
6	Using the power meter OFFSET control, set the test trace coincident with the reference line at 70 MHz. The test trace represents the overall amplitude response of the IF limiter, 19D pad, and IF carrier resupply. *Requirement 1:* The test trace shall be flat to within 0.05 dB between 60 and 80 MHz. *Requirement 2:* There shall be no evidence of carrier resupply switching between 60 and 80 MHz. See Exhibit 6 for an example of this condition. If there is evidence of in-band switching, replace the carrier resupply. If these requirements are met, proceed with Step 9. If Requirement 1 is not met, adjust the SLOPE 1 or SLOPE 2 control on the IF limiter to bring the test trace within limits at the highest possible power. SLOPE 1 controls the high-end slope. SLOPE 2 controls the slope across the band. These adjustments affect the output power. The objective is to set the controls for the maximum output power at which the flatness requirement can be met. It is not necessary to maintain coincidence of the test and reference traces while making these adjustments. However, after adjustment, check that the output power requirement specified in Step 5 is still being met. If Requirement 1 cannot be met while still maintaining proper output power, proceed to Step 7.
7	Connect options (Z) and (Y) of Exhibit 6. Using the TEST TRACE control, set the test trace coincident with the reference line at 70 MHz. The test trace represents the amplitude response of the IF limiter and 19D pad combination. *Requirement:* The test trace shall be flat to within 0.03 dB between 60 and 80 MHz.

CHART C (Contd)

STEP	PROCEDURE

If this requirement is met, proceed to Step 8. If this requirement is not met, adjust the SLOPE 1 and SLOPE 2 controls, as described in Step 6, to obtain the required flatness. The test trace does not have to remain coincident with the reference trace. However, the power at the IF OUT jack of the IF limiter should remain within the limits specified in Step 5. If these requirements cannot be met, replace the IF limiter with a spare unit and repeat Steps 5 and 6.

8 With the TEST TRACE control, adjust the test trace for coincidence with the reference line at 70 MHz. Connect options (V) and (Y) of Exhibit 6 to determine the effect of adding the IF carrier resupply to the circuit. Note the separation between the test and reference traces at 70 MHz. Compare the amplitude response displaced by the test trace with that obtained in Step 7.

Requirement 1: The separation of the traces at 70 MHz shall be less than 4 cm (0.2 dB).

Requirement 2: The amplitude response shall not differ from that of Step 7 by more than 0.02 dB between 60 and 80 MHz.

If either requirement is not met, replace the IF carrier resupply with a spare unit and repeat Steps 5 and 6.

IF Limiter Compression Test

9 Using test setup in Exhibit 6, option (X), calibrate the oscilloscope for 1 dB/div sensitivity. Reconnect option (V) and recoincide the traces with the offset control. Change the 10 dB 63A pad to 20 dB. Observe the position of the test trace.

Requirement: The test trace shall be within 3 cm (3 dB) of the reference trace at 70 MHz.

10 Remove the test set connections. Restore the normal connection to the limiter IF OUT jack and the IF IN and IF OUT jacks on the carrier resupply.

CHART D

TRANSMITTER MODULATOR ADJUSTMENT

APPARATUS:

1—Kruse 52011 IF/RF Test Set

CHART D (Contd)

STEP	PROCEDURE
1	Prepare for test in accordance with Exhibit 4. The adjustment procedure for main and repeater station bays is the same; however the filter, isolator, and attenuator designations are different. (See Fig. 5 in the main section.)
2	Disconnect and remove isolator A7 (main) or A6 (repeater) and the flexible waveguide connected to tuner Z2. (See Fig. 5 in the main section.) *Note:* Cover Z2 to prevent foreign objects from entering.
3	Attach a 24A transducer to the output for attenuator AT4 (main) or AT3 (repeater) (Fig. 5 in the main section.) Connect option (X) and perform Preparation for Test Steps 3 and 4 in Exhibit 4.
4	On the transmitter control panel, record (in pencil in the space provided) the meter indications obtained for the TRMTR MOD 1 and TRMTR MOD 2 pushbuttons. *Requirement:* Between 0 and 35. If greater than 35, refer to Section 411-406-503.
5	Adjust AT4 (main) or AT3 (repeater) for a power meter indication of −3.5 dBm when using Requirement 1 or −2.0 dBm when using Requirement 2 in Step 2 of Chart B. If this condition is not met, refer to Section 411-406-503.
	Transmitter Modulator Amplitude Response
6	Prepare for the test in accordance with Exhibit 4.
7	Connect option (Y), Exhibit 4. Measure the amplitude response displayed by the test trace. This is the combined amplitude response of the limiter, carrier resupply, and transmitter modulator. *Requirement:* Flat within 0.05 dB over ±10 MHz about the RF channel center frequency with irregularities being less than 0.02 dB over ±6 MHz. The objective here is to obtain the same amplitude response as seen at the output of the carrier resupply, Step 2, Chart C. If the requirement is not met, adjust the HIGH SLOPE, LOW SLOPE, and GAIN controls on the IF driver amplifier. It may be necessary to adjust AT4 (main) or AT3 (repeater) to maintain coincidence of the traces. If the requirement still is not met, refer to Section 411-406-503. *Note:* For channels 3 and 9 (early production), 1, 2, 7, and 8, the left half of the oscilloscope trace represents frequencies above the RF channel center frequency. For channels 3 and 9 (late production), 4, 5, 6, 10, 11, and 12, the left half of oscilloscope trace represents frequencies below the RF channel center frequency. The early and late production channel 3 and 9 bays can be determined from the microwave generator frequencies in Section 411-402-500.
8	Remove the transducer connected to AT4 or AT3 and reconnect the isolator and flexible waveguide.

CHART E

TWT AMPLIFIER ADJUSTMENT

APPARATUS:

1—Kruse 52011 IF/RF Test Set

STEP	PROCEDURE
	Note 1: The TWT should have been on for at least 30 minutes in order that it be at normal operating temperature before performing any test in this chart.
	Note 2: Fig. 4 of the main section is a flow diagram for routine testing of the TWT amplifier.
1	Press the TRMTR OUT pushbutton and, if necessary, adjust the 31A attenuator AT3 or AT4 (Fig. 5 in the main section) ahead of the TWT to obtain the recorded meter indication. If the recorded meter indication cannot be obtained, proceed with Step 4.
2	Read the CATHODE CURRENT meter on the TWT power supply. *Requirement:* 40 ±0.5 mA If the requirement is not met, proceed with Step 4.
3	Make an amplitude response test in accordance with Exhibit 4, options (X) and (Y). The test trace displays the combined amplitude response of the limiter, carrier resupply, transmitter modulator, and TWT amplifier. *Requirement:* Flat to within 0.06 dB over the ±6 MHz band and the rolloff shall not exceed 0.09 dB at the ±10 MHz points. The objective here is that the TWT shall be flat to within 0.02 dB over the ±6 MHz band. Since the output of the transmitter modulator was flat to within 0.03 dB, the combination of transmitter modulator and TWT should at least be flat to 0.05 dB. The ideal characteristic at this point would be the same response as was obtained at the output of the transmitter modulator. If this requirement is met, proceed with Step 9. If the requirement is not met, proceed with Step 4.
4	Connect option (Y) in Exhibit 4. Connect option (Z) and adjust input tuner Z2 and output tuner Z3 (Fig. 5 in main section) for maximum power output.
5	Adjust the HELIX ADJ control on the inverter and heater regulator unit for maximum power output, while simultaneously adjusting the ANODE VOLTAGE ADJ control to keep the CATHODE CURRENT meter at 40 mA.

CHART E (Contd)

STEP	PROCEDURE

Note: For some tubes, the ANODE VOLTAGE ADJ control may run out of range against the counterclockwise stop during this adjustment. In these cases, it is recommended that the ANODE VOLTAGE ADJ control be left in the maximum counterclockwise position and the HELIX ADJ control be used to obtain a CATHODE CURRENT meter reading of 40 mA. This may not result in peak power output from the tube but will give the maximum power available under these conditions.

If the conditions of this step are not met, refer to Section 411-406-504 for TWT power supply test information. A check of the TWT power supply will permit determining whether the power supply or the TWT amplifier is at fault.

6 Adjust attenuator AT4 (main) or AT3 (repeater) to obtain (+26 —L) dBm when using +37 dBm output power or (+27.5 — L) dBm when using +38.5 dBm output power. L is the calibrated loss of DC3.

If the required power output cannot be obtained with the attenuator at minimum and the requirements of Chart D have been met, either the TWT amplifier gain is too low or the power supply is at fault. Refer to Section 411-406-504 for TWT power supply test information and for the TWT amplifier replacement procedure.

Note 1: If the power output cannot be reduced to this value, repeat the test in Chart D with the following change: decrease the transmitter modulator output power as low as possible with the GAIN control while still maintaining the required transmission flatness using the HIGH SLOPE and LOW SLOPE controls.

Note 2: If the attenuator has to be set to minimum to obtain this power output, it may not be possible to meet the final power output setting specified in Step 8. In some cases it may be possible to defer the replacement of a low gain TWT by obtaining more power output from the transmitter modulator. To do this, readjust the transmitter modulator as in Note 1, in this case using the GAIN control to increase the power output.

7 Set up for amplitude response tests as shown in Exhibit 4, options (Y) and (X). Using the TEST TRACE control, make the traces coincident at the band center. Adjust output tuner Z3 to flatten the test trace.

Note: This adjustment will reduce the output power. Since the oscilloscope is calibrated for 0.05 dB per centimeter, the decrease in output power can be determined by the separation between the test and reference traces.

Requirement 1: The output power shall not be reduced by more than 1 dB.

Requirement 2: The flatness requirement of Step 3 shall be met.

If either of these requirements is not met, replace the TWT amplifier in accordance with Section 411-406-504 and repeat the tests of this chart.

CHART E (Contd)

STEP	PROCEDURE
8	Using AT3 (repeater) or AT4 (main), adjust the transmitter output power to the applicable requirement. *Requirement 1:* +37.0 dBm. (Power meter indication for +37 dBm equal to +26.0 dBm minus the calibrated loss of the 24B directional coupler; for +38.5 dBm +27.5 dBm minus the calibrated loss of the 24B directional coupler.) *Requirement 2:* Maximum available between +37.0 and +38.5 dBm. (Minimum power meter indication same as for Requirement 1; up to 1.5 dB greater whenever possible.)
9	Disconnect option (X). Perform the transmitter output alarm adjustment in Chart F starting with Step 3.

CHART F

TRANSMITTER OUTPUT ALARM ADJUSTMENT

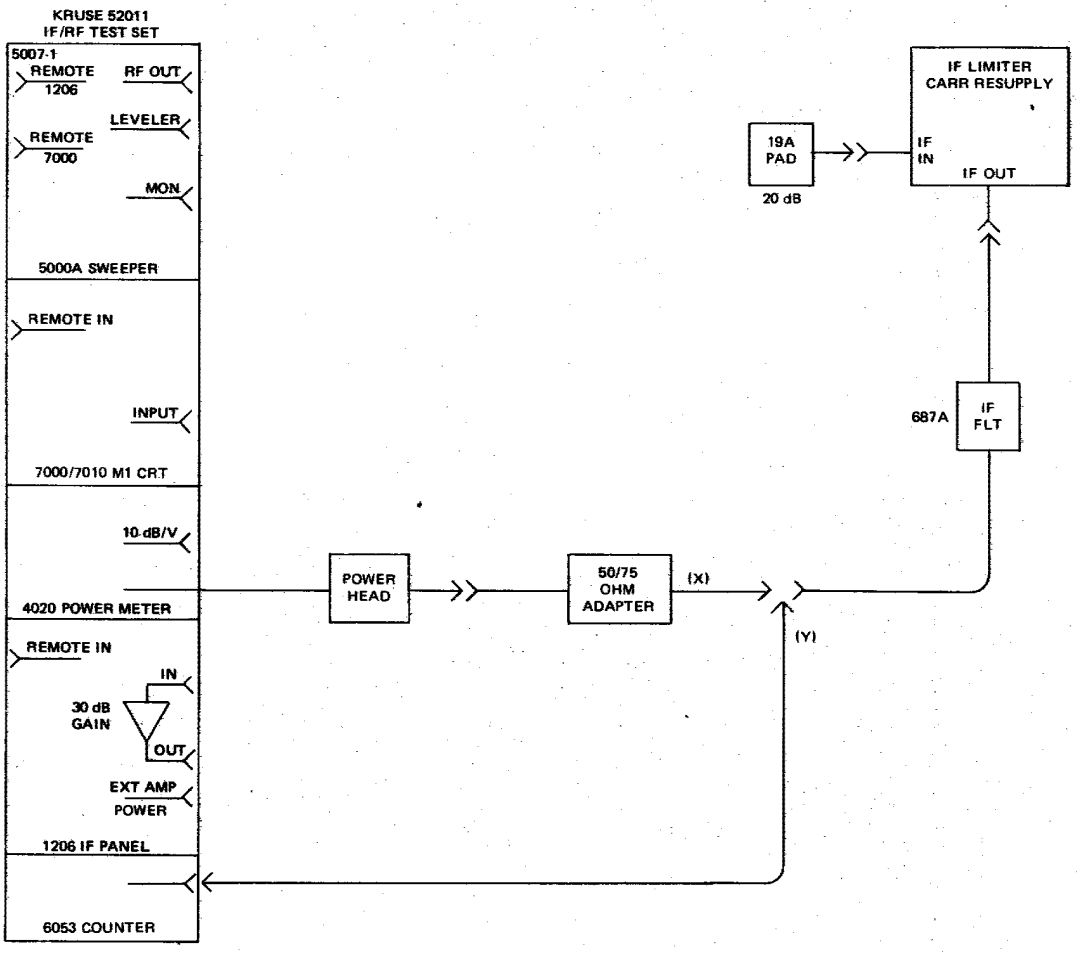
APPARATUS:

1—Kruse 52011 IF/RF Test Set

STEP	PROCEDURE
1	Replace the MON 2 or MON 3 detector on the 24B directional coupler DC3 (refer to Fig. 5 in the main section). Connect option (Z) of Exhibit 4. Adjust AT3 (repeater) or AT4 (main) to obtain the recorded meter indication for the TRMTR OUT position.
2	Remove the MON 2 or MON 3 detector from directional coupler DC3. Connect option (Y) in Exhibit 4 and measure the power. *Requirement 1:* For transmitters specified to operate at +37.0 dBm output, the required power meter indication is: +26.0 dBm ±0.2 dB minus the calibrated loss of the 24B directional coupler. *Requirement 2:* For transmitters specified to operate at the maximum available power between +37.0 and +38.5 dBm, the required power meter indication is: Minimum indication: same as indication specified for Requirement 1. Desired indication: up to 1.5 dB greater than minimum indication.

CHART F (Contd)

STEP	PROCEDURE
	If the applicable requirement is met, it can be assumed that the 3 dB drop sensitivity of the alarm circuit has not changed; proceed with Step 8. If the requirement is not met, proceed with Step 3.
3	Adjust AT3 or AT4 to decrease the power meter indication by 3 dB. Disconnect option (Y) and replace the MON 2 or MON 3 detector.
4	Adjust the TRMTR OUT ALM SET control until the Sensitrol just trips.
5	Disconnect the MON 2 or MON 3 detector and reconnect the power meter, option (Y). Adjust AT3 or AT4 to increase the power meter indication by 3 dB. This restores the transmitter output power to normal.
6	Remove the cable connection to DC3 and replace the MON 3 or MON 2 detector. Operate the ALARM RESET button. *Requirement:* The transmitter alarm shall release.
7	Press the TRMTR OUT pushbutton on the transmitter control panel, record the meter indication in the space provided, and remove the test set connections.
8	Remove the transmitted carrier by disconnecting the cable from the IF IN jack of the IF DRIVER AMP. Remove the 522A termination and shorting plate and replace the 1322- or 1336-type filter in the transmitter output circuit.
9	Reconnect the IF cable to the IF driver amplifier and restore the normal connections to the IF limiter input.



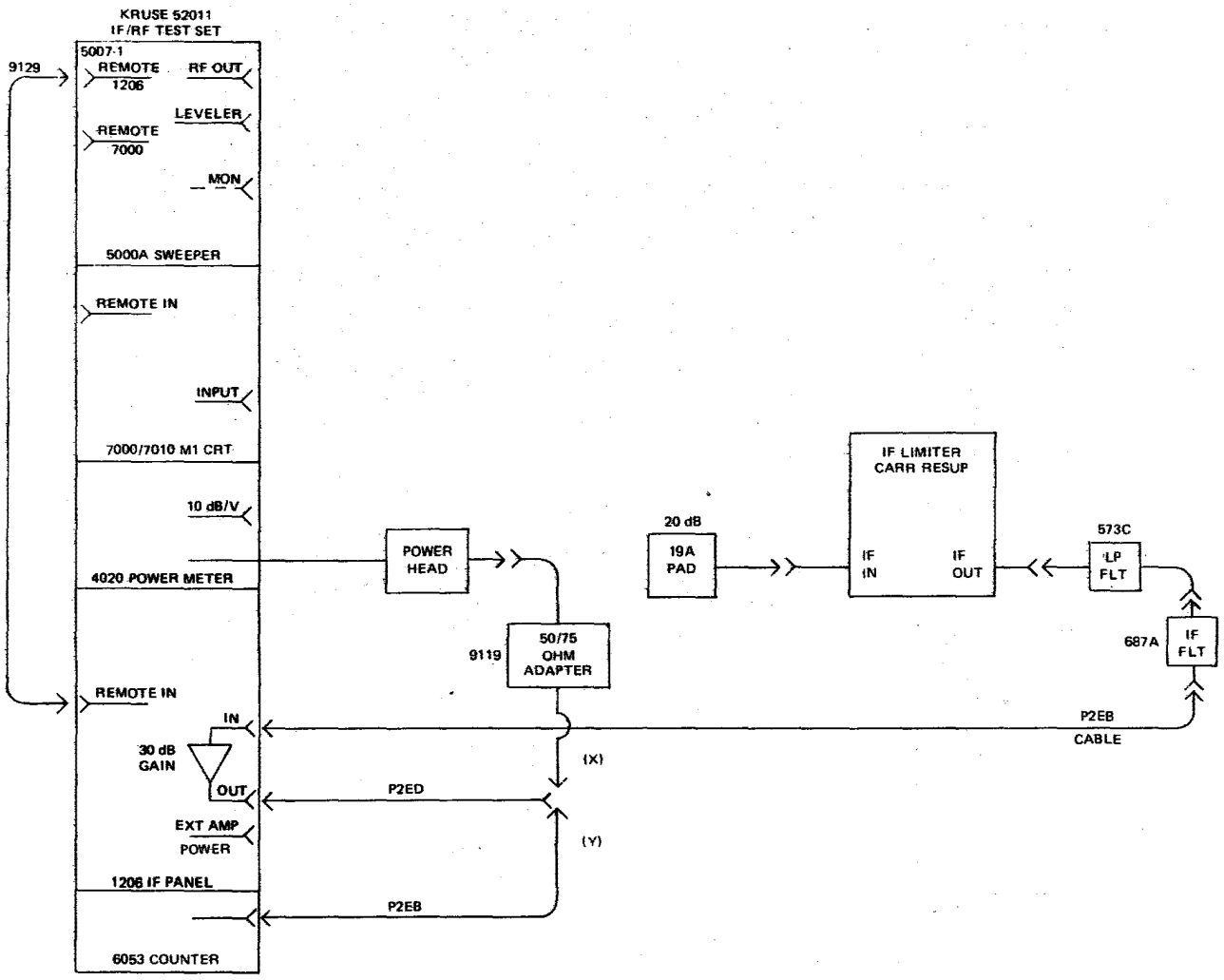
PREPARATION FOR TEST

1. Allow 5 minutes for warm-up, and then operate controls on test set as follows:

UNIT	CONTROL	POSITION
4020 POWER METER	LEVEL	10 DB/V
	GROUNDING	INT
	OFFSET	MID-SCALE
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 75 OHM key.

IF Limiter-Carrier Resupply
Exhibit 1



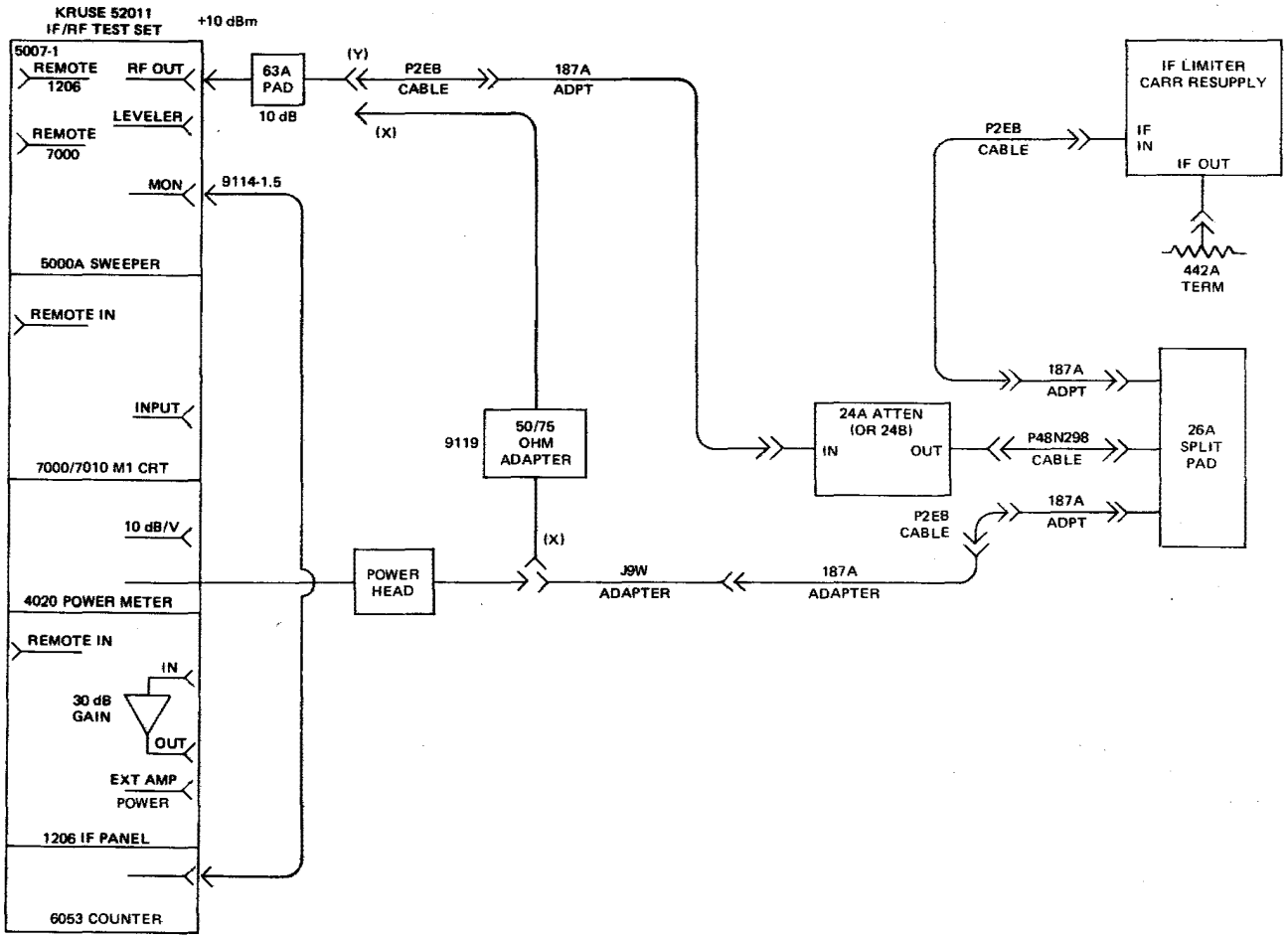
PREPARATION FOR TEST

1. Allow 5 minutes warm-up, then operate controls on the test set as follows:

UNIT	CONTROL	POSITION
4020 POWER METER	LEVEL	10 DB/V
	GROUNDING	INT
	OFFSET	MID-SCALE
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 75 OHM key.

IF Limiter-Carrier Resupply
Output Power and Frequency Test Setup
Exhibit 2



PREPARATION FOR TEST

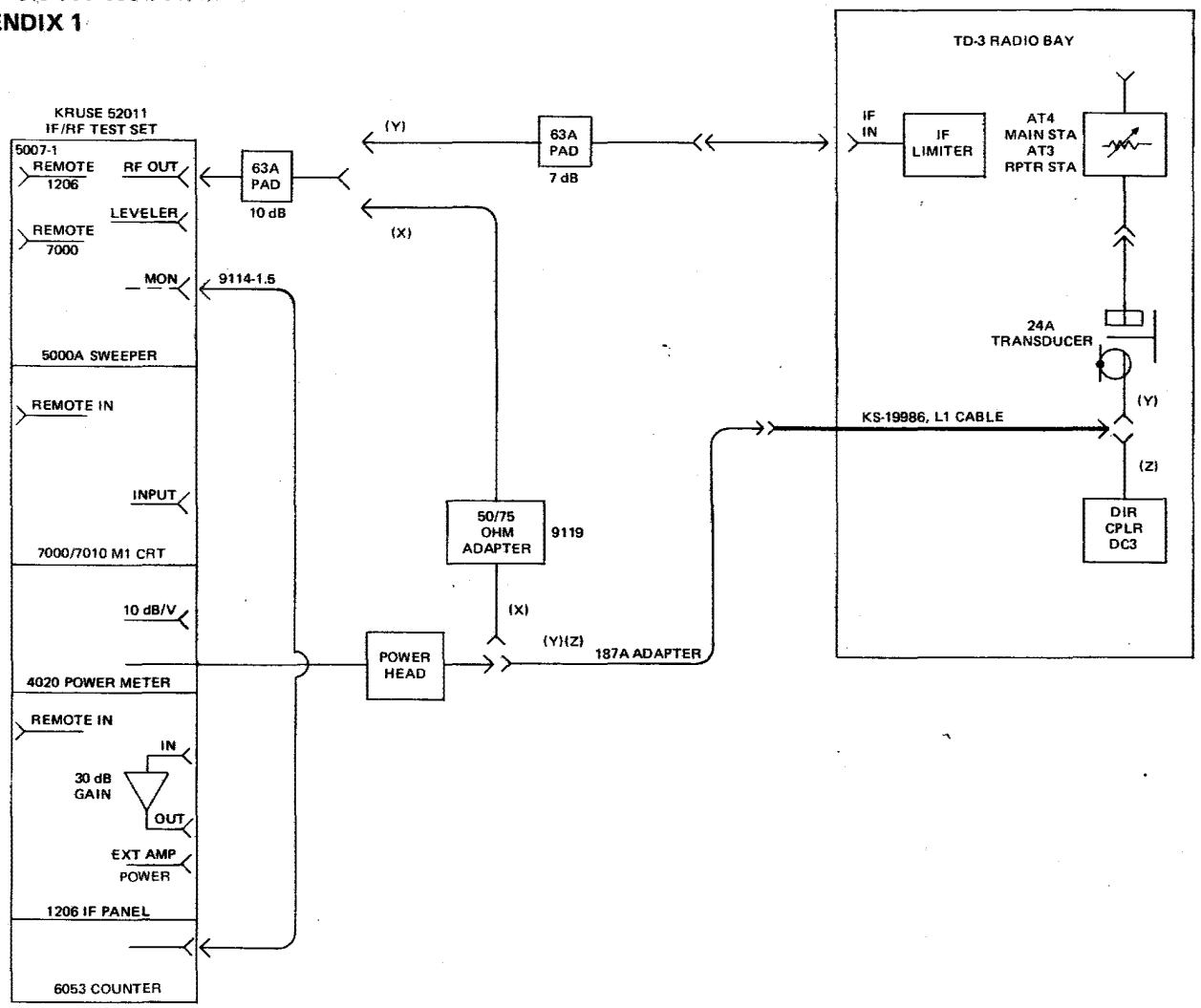
1. Allow 5 minutes warm-up, then operate controls on the test set as follows:

UNIT	CONTROL	POSITION
5000A SWEEPER WITH 50007-1 IF PLUG-IN	F-1 START	55 MHz
	MARKER 1	61 MHz
	MARKER 2-Fc	70 MHz
	MARKER 3	79 MHz
	F-2 STOP	85 MHz
	VERNIER	MAX CCW
	RF LEVEL	CCW
	1 kHz	OFF
	LEVELER	INT
	RETRACE	ON
	RECUR-TRIG-LINE	RECUR
	MODE	CW
	Fc ± ΔF VERNIER	MAX CW
	SWEEP SECONDS	.01
	SWEEP SECONDS VERNIER	MAX CW
	EXT/INT'L SWEEP (REAR)	INT'L

UNIT	CONTROL	POSITION
4020 POWER METER	LEVEL	10 DB/V
	GROUNDING	INT
	OFFSET	MID-SCALE
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 75 OHM key.
3. Establish option (X) and adjust sweeper RF LEVEL control for 0 dBm power meter reading.
4. Set 24A or 24B ATTEN for minimum attenuation (fully counterclockwise).

IF Limiter-Carrier Resupply
Trip and Restore Point Test Setup
Exhibit 3



PREPARATION FOR TEST

1. Allow 5 minutes warm-up, then operate controls on the test set as follows:

UNIT	CONTROL	POSITION
5000A SWEEPER WITH 50007-1 IF PLUG-IN	F-1 START	55 MHz
	MARKER 1	60 MHz
	MARKER 2-Fc	70 MHz
	MARKER 3	80 MHz
	F-2 STOP	85 MHz
	VERNIER	MAX CCW
	RF LEVEL	CCW
	1 kHz	OFF
	LEVELER	INT
	RETRACE	ON
	RECUR-TRIG-LINE	RECUR
	MODE	CW
	Fc ± ΔF VERNIER	MAX CW
	SWEEP SECONDS	.01
	SWEEP SECONDS VERNIER	MAX CW
	EXT/INT'L SWEEP (REAR)	INT'L
4020 POWER METER	LEVEL	10 DB/V
	GROUNDING	INT
	OFFSET	MID-SCALE
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 75 OHM key.
3. Establish option (X) and adjust sweeper RF LEVEL control for 0 dBm power meter reading.
4. Connect option (Y) and depress 50 OHM key.

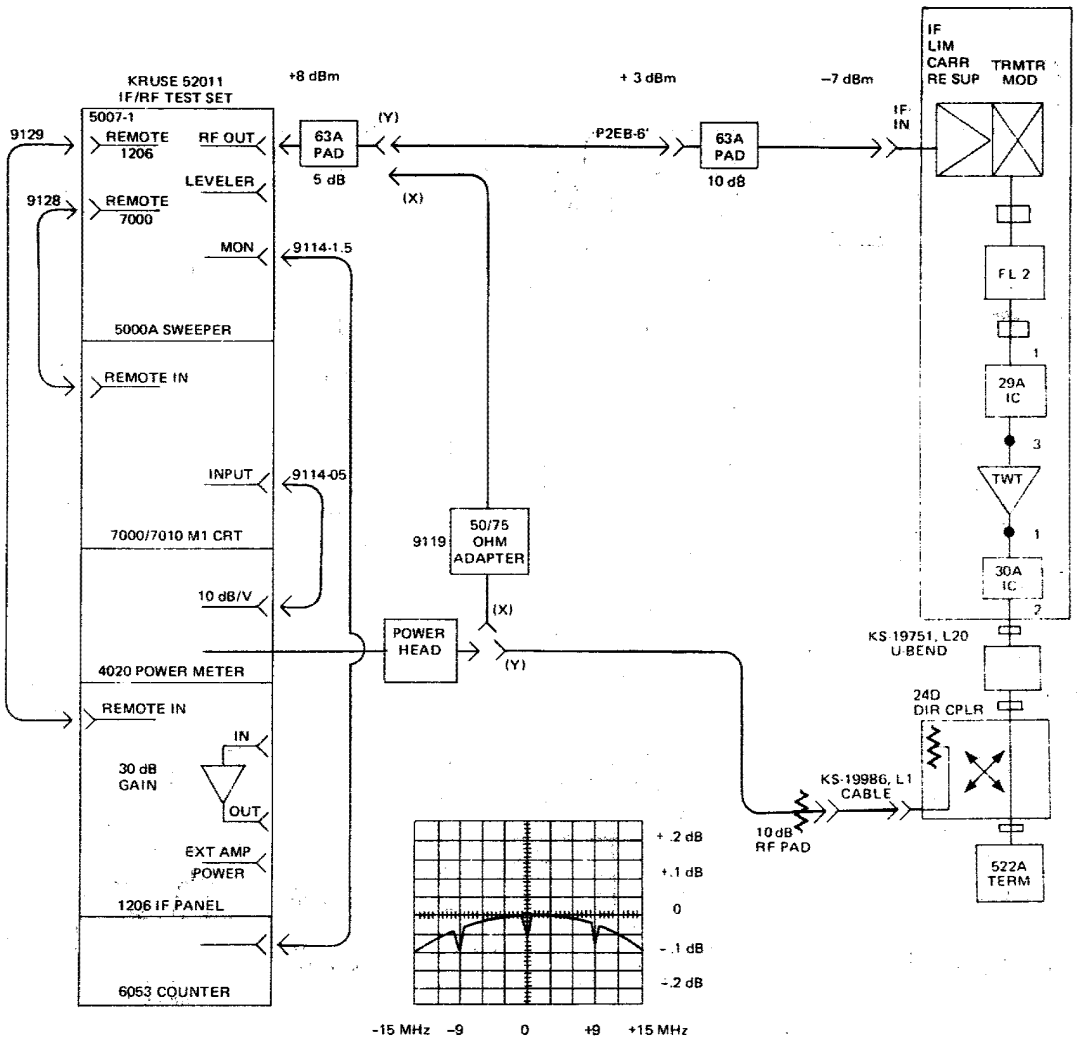
OSCILLOSCOPE CALIBRATION

1. Set scope controls:

CONTROL	POSITION
OFFSET	MID-SCALE (DO NOT READJUST)
GAIN	X1
POLARITY	+UP
BW	30 KHz
INPUT	DC
DB/DIV AT 10 DB/V	.05 DB/DIV - 5 MV/DIV
VARIABLE (RED)	MAX CW DETENT

2. Adjust sweeper MODE control to WIDE F1-F2 position.
3. Adjust power meter OFFSET control to position trace on center of oscilloscope.
4. Adjust HORIZONTAL POS and GAIN controls to position trace ends at each extreme of horizontal scale. The horizontal scale calibration is 3 MHz/div with markers at 60, 70, and 80 MHz.
5. Switch vertical sensitivity control on scope to .05 dB/div - 5 mV/div. (This calibrates scope for 0.05 dB/div.)

Exhibit 4



TYPICAL OVERALL RESPONSE TRACE

PREPARATION FOR TEST

1. Allow 5 minutes warm-up, then operate controls on the test set as follows:

UNIT	CONTROL	POSITION
5000A SWEEPER WITH 50007-1 IF PLUG-IN	F-1 START	55 MHz
	MARKER 1	61 MHz
	MARKER 2-Fc	70 MHz
	MARKER 3	79 MHz
	F-2 STOP	85 MHz
	VERNIER	MAX CCW
	RF LEVEL	+8 dBm
	1 kHz	OFF
	LEVELER	INT
	RETRACE	ON
	RECUR-TRIG-LINE	RECUR
	MODE	CW
	Fc ± ΔF VERNIER	MAX CW
	SWEEP SECONDS	.01
	SWEEP SECONDS VERNIER	MAX CW
	EXT/INT'L SWEEP (REAR)	INT'L
4020 POWER METER	LEVEL	10 DB/V
	GROUNDING	INT
	OFFSET	MID-SCALE
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 75 OHM key.
3. Establish option X and adjust sweeper RF LEVEL control for +3 dBm power meter reading.

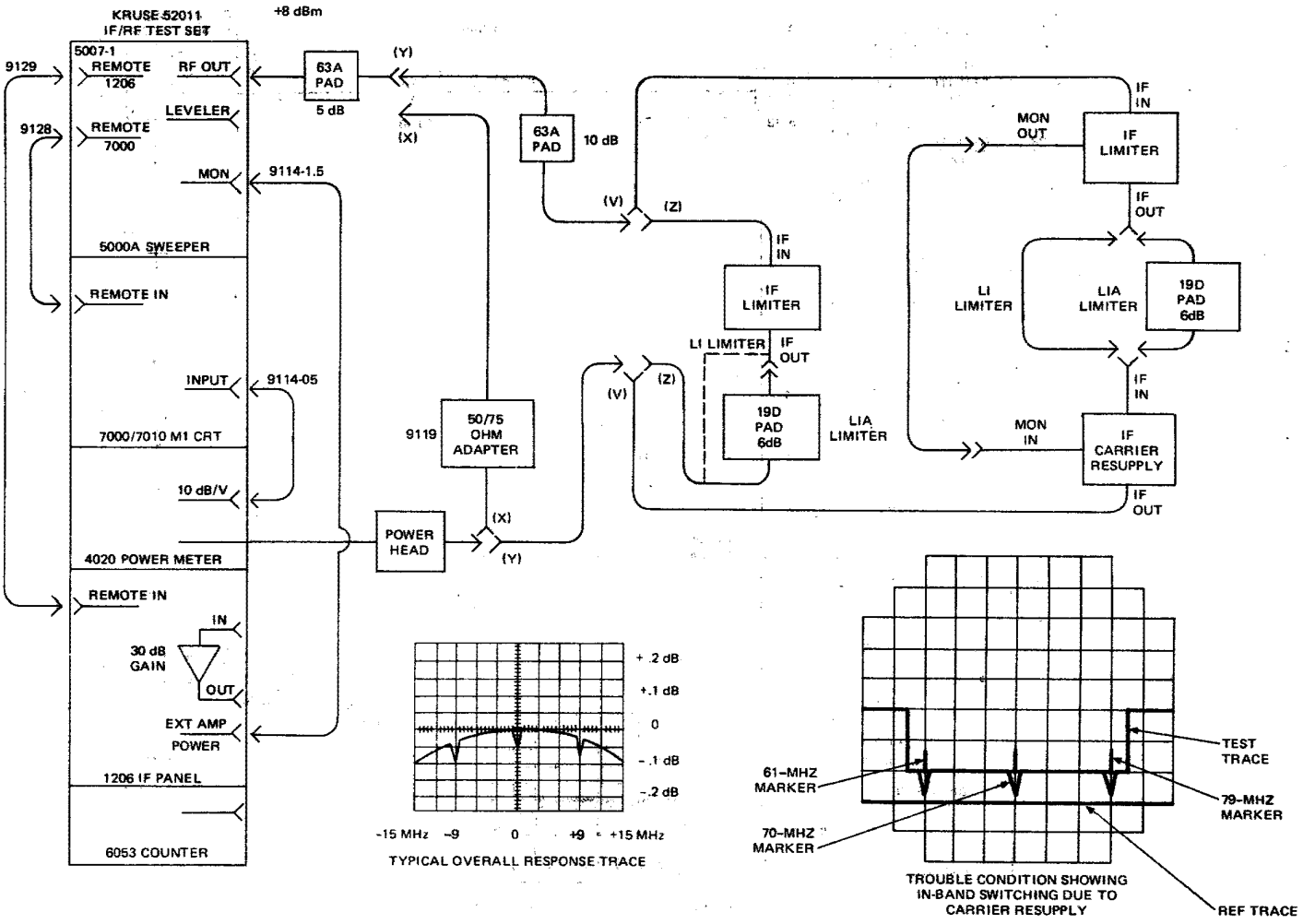
OSCILLOSCOPE CALIBRATION

1. Set scope controls:

CONTROL	POSITION
OFFSET	MID-SCALE (DO NOT READJUST)
GAIN	X1
POLARITY	+UP
BW	30 KHZ
INPUT	DC
DB/DIV AT 10 DB/V	.05 DB/DIV - 5 MV/DIV
VARIABLE (RED)	MAX CW DETENT

2. Adjust sweeper MODE control to WIDE F1-F2 position.
3. Adjust power meter OFFSET control to position trace on center of oscilloscope.
4. Adjust HORIZONTAL POS and GAIN controls to position trace ends at each extreme of horizontal scale. The horizontal scale calibration is 3 MHz/div with markers at 61, 70, and 79 MHz.
5. Switch vertical sensitivity control on scope to .05 dB/div - 5 mV/div. (This calibrates scope for 0.05 dB/div.)

Overall Transmitter
IF to RF Test Setup
Exhibit 5



PREPARATION FOR TEST

1. Allow 5 minutes warm-up, then operate controls on the test set as follows:

UNIT	CONTROL	POSITION
5000A SWEEPER WITH 50007-1 IF PLUG-IN	F-1 START	55 MHz
	MARKER 1	61 MHz
	MARKER 2-Fc	70 MHz
	MARKER 3	79 MHz
	F-2 STOP	85 MHz
	VERNIER	MAX CCW
	RF LEVEL	+8 dBm
	1 kHz	OFF
	LEVELER	INT
	RETRACE	ON
	RECUR-TRIG-LINE	RECUR
	MODE	CW
	Fc ± ΔF VERNIER	MAX CW
	SWEEP SECONDS	.01
	SWEEP SECONDS VERNIER	MAX CW
	EXT/INT'L SWEEP (REAR)	INT'L
4020 POWER METER	LEVEL	10 DB/V
	GROUNDING	INT
	OFFSET	MID-SCALE
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 75 OHM key.
3. Establish option (X) and adjust sweeper RF LEVEL control for +3 dBm power meter reading.

OSCILLOSCOPE CALIBRATION

1. Set scope controls:

CONTROL	POSITION
OFFSET	MID-SCALE (DO NOT READJUST)
GAIN	X1
POLARITY	+UP
BW	30 KHz
INPUT	DC
DB/DIV AT 10 DB/V	.05 DB/DIV – 5 MV/DIV
VARIABLE (RED)	MAX CW DETENT

2. Adjust sweeper MODE control to WIDE F1-F2 position.
3. Adjust power meter OFFSET control to position trace on center of oscilloscope.
4. Adjust HORIZONTAL POS and GAIN controls to position trace ends at each extreme of horizontal scale. The horizontal scale calibration is 3 MHz/div with markers at 61, 70, and 79 MHz.
5. Switch vertical sensitivity control on scope to .05 dB/div – 5 mV/div. (This calibrates scope for 0.05 dB/div.)

Exhibit 6