TD-3 MICROWAVE RADIO
J68386G AND J68386H TRANSMITTER-RECEIVER BAYS
RECEIVER TESTS USING ED-50996-10 PORTABLE TEST EQUIPMENT
TRANSMISSION

This appendix supplements Section 411-504-501

It is reissued to:

- Delete Exhibit 1 and renumber Exhibit 2 and 3
- Change Steps 2, 3, 4, 7 and 8 in Exhibit 2
- Change Steps 1, 4, 9, 10, 11, 12, 14, 16, 19, 20 and 21 in Chart A
- Change Steps 3, 4, 5, 7 and 8 in Chart B
- Change Steps 1, 2, 6, 7, 8, 13 and 15 in Chart C.

Note: Marginal arrows are used to denote changes within paragraphs.

It contains:

- Procedures for measuring and adjusting gain and amplitude response of the radio receivers in the J68386G and J68386H radio bays using the ED-50996-10 portable test equipment.
- Information for bays equipped with Hot Standby or Hot Standby/Space Diversity switching and J68387AB IF main amplifiers.

The in-service checks in Section 411-500-501 should be performed prior to the tests in this appendix. 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 appendix when required by the Equipment Test List (ETL). The IF return loss tests in Section 411-504-502 must be completed when replacing units in the receiver with spares.

For location of components in the bay, refer to Fig. 1 in main section.

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: When removing and replacing waveguide units, care should be taken to prvent 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 A

OVERALL TRANSMISSION TEST

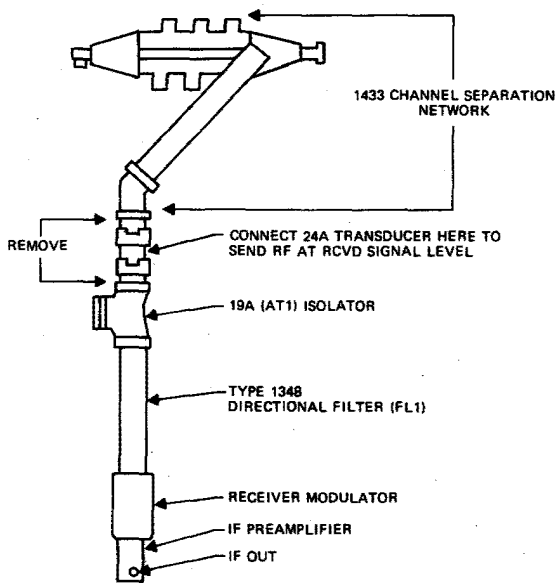
APPARATUS:

1—ED-50996-10 Portable Test Arrangement

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 to −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. ***Caution: If any of the requirements in this chart are not met, go directly to Step 24. Do not attempt adjustments while performing the steps of this chart to bring the transmission response within requirements. Charts B and C provide the proper sequence of steps for making adjustments on the receiver modulator and IF preamplifier and the IF main amplifier.***
→ 1	Setup RF oscillator frequency and output power as shown in Exhibit 1. ***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.***
2	Remove the 3-inch piece of the 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. (See Fig. 1.)
3	Check that MAN-AGC switch is in AGC position.

CHART A (Contd)

STEP	PROCEDURE



Preparing Receiver For Test
Fig. 1

4 Connect test setup shown in Exhibit 2, option (A), (Y) and (W), perform the preparation for test (Steps 1 and 3). Do not perform oscilloscope calibration at this time. ←

5 Adjust sweeper MARKER 2-FC control to obtain an indication of 70 ±0.5 MHz on counter.

6 Connect test setup option (B). Set IF test panel ATTEN to 8 dB and power meter RANGE control to −5 dB if the bay is equipped with a J68387S amplifier or +5 dB if equipped with a J68387AB amplifier.

7 Measure power. (Note actual value measured for later use.)

Requirement: −7.0 dBm ±0.75 dB for J68387S
+2.0 dBm ±0.75 dB for J68387AB

8 Select RCVD CARR PWR on the meter panel and note the meter indication.

Requirement: 80±3.

9 Remove connector P1 from the IF OUT jack on the IF preamplifier and insert Exhibit 2, option (Z) between the IF OUT jack and connector P1. ←

10 Measure power.

Requirement: Within 2 dB of the power measured in Step 7. ←

CHART A (Contd)

STEP	PROCEDURE
→ 11	Remove Exhibit 2, option (Z) and connect P1 to the IF preamplifier IF OUT jack.
12	Operate MAN-AGC switch to the IF main amplifier to MAN position and note meter indication for RCVD CARR PWR.
→	*Requirement:* Same as that for Step 8. If the requirement is *not* met, adjust MAN GAIN control to obtain the same indication.
13	Measure power. *Requirement:* −7 dBm ±1 dB for J68387S +2 dBm ±1 dB for J68387AB
→ 14	Connect option (C) of Exhibit 2 and perform the oscilloscope calibration shown in Exhibit 2.
15	Measure the amplitude response as shown by the test trace. *Requirement:* The trace shall be flat to within 0.45 dB over 60- to 80-MHz band. *Note:* For receivers equipped with J68387AB IF amplifiers, an additional 0.2 dB of linear slope over the 60- through 80-MHz band is allowed.
→ 16	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 17 and 18.
17	Connect the P2EB 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. Set sweeper MODE control to CW. Set power meter RANGE control to −5 dBm. Set IF test panel ATTEN to 0. Make connections shown in Exhibit 2, option (B).
18	Measure the power. *Requirement:* −7.0 dBm ±2 dB for J68387S +2.0 dBm ±2 dB for J68387AB
→ 19	If unable to meet the requirements in Steps 1 through 16, it will be necessary to align the receiver modulator-IF preamplifier and the IF main amplifier as directed in Charts B and C. After performing Charts B and C, repeat Chart A, Steps 1 through 16.
→ 20	If still unable to meet the requirements in Steps 1 through 16, check for defective cables or a defective 1042A filter. *Note:* 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.

CHART A (Contd)

STEP	PROCEDURE
21	If unable to meet the requirement in Step 18, check for defective or incorrect DADE cable, 62E pad or equalizer, if used. ←
22	If all requirements are met, remove test equipment. Restore all bay connections to normal.
23	Operate MAN-AGC switch on the IF main amplifier to the AGC position.
24	If further tests or alignments are not scheduled, restore the channel to service as directed by local practice.

CHART B

RECEIVER MODULATOR AND IF PREAMPLIFIER ADJUSTMENT

APPARATUS:

1—ED-50996-10 Portable Test Arrangement

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 RCVR MOD BIAS pushbutton on the meter panel.
2	Note frequency of the receiver.
	Requirement: The RCVR MOD BIAS indication shall equal the bias value determined from 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	Set up RF oscillator frequency and output power in accordance with Exhibit 1. ←

CHART B (Contd)

STEP	PROCEDURE
→ 4	Connect the P2EB cable, shown in Exhibit 2, to the IF OUT jack of the IF preamplifier. Set sweeper MODE control to CW.
→ 5	Connect option (B) in Exhibit 2 and perform the preparation for test. Do not perform oscilloscope calibration at this time.
6	Adjust LEVEL control on the IF preamplifier to set the IF output power. *Requirement:* −1 dBm
→ 7	If oscilloscope calibration in Exhibit 2 has not been previously performed, calibrate it at this time.
→ 8	Change from option (B) to option (C) in Exhibit 2 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- to 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 C

IF MAIN AMPLIFIER ADJUSTMENT

APPARATUS:

1—ED-50996-10 Portable Test Arrangement

1—KS-20114, L2 Adjusting Tool

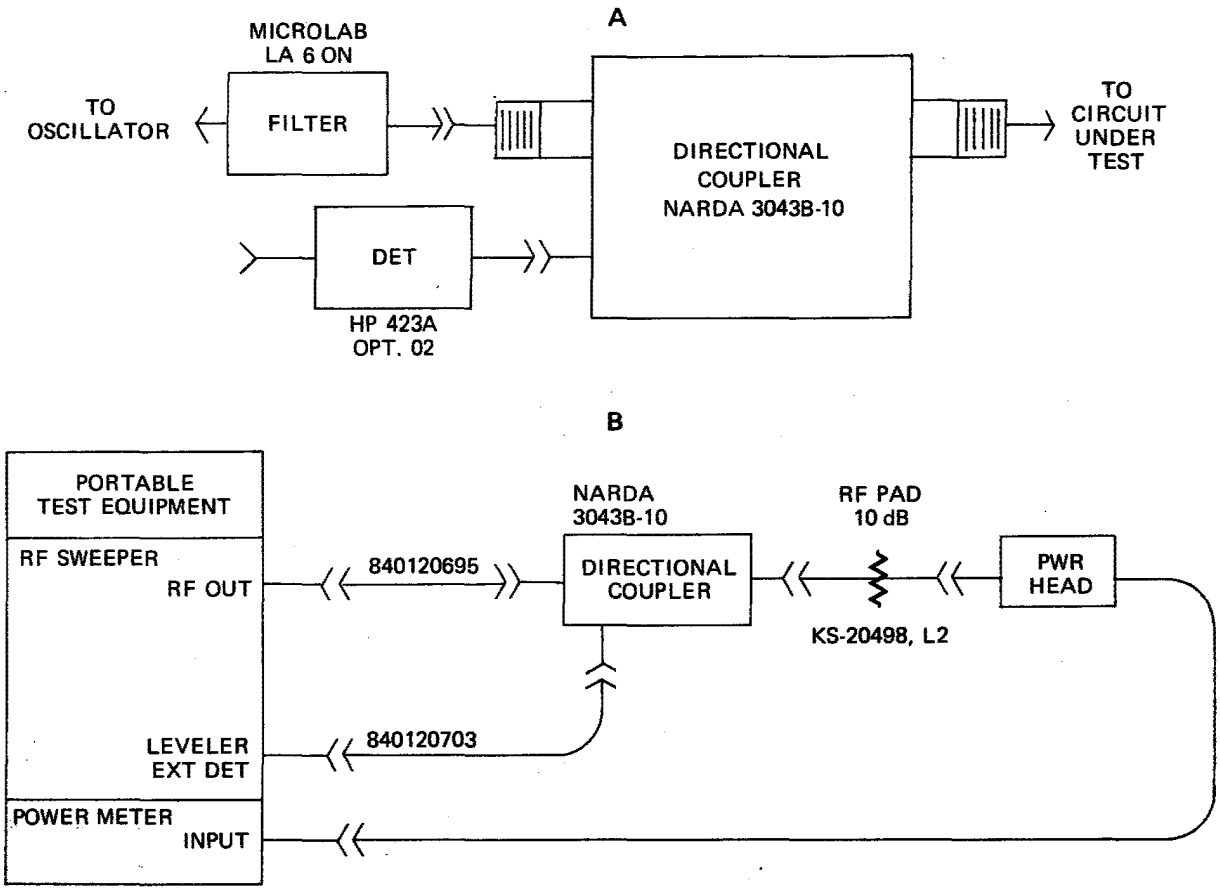
STEP	PROCEDURE
	Gain and Amplitude Response The following procedure is used for adjusting the gain and amplitude response of the IF main amplifier. The objective is to establish a gain of 9 dB with an input of −8.0 dBm and an output of +1.0 dBm. The amplitude response should be flat to within 0.03 dB 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	Set up RF oscillator frequency and output power in accordance with Exhibit 1. ←
	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. The J68387AB amplifier IF IN and IF OUT jacks are accessible without removing the amplifier.
2	Connect options (B) and (X) in Exhibit 2 in accordance with preparation for test, Steps 1 to 3. ←
3	Set power meter RANGE control to −5 dBm if bay is equipped with a J68387S amplifier or to +5 dBm for J68387AB amplifier. Set IF ATTEN control to 8 dBm.
4	Set MAN-AGC switch on the IF main amplifier to MAN position.
5	Adjust J68387S IF main amplifier MAN GAIN control for a −7 dBm. (Meter scale reading of −2 dBm.) For the J68387AB amplifier adjust MAN GAIN control for +2 dBm (meter scale reading of −3 dBm). If requirement cannot be met, check that IF main amplifier AGC-MAN switch is set to MAN. Remove bay fuse panel cover and check that IF main amplifier power plug is in position. Check that all setup connections are tight and have been accurately followed. Recheck output of IF preamplifier. If requirement is still not met, replace the IF main amplifier.
6	Connect options (X) and (C) in Exhibit 2. Perform oscilloscope calibration shown in Exhibit 2. ←

CHART C (Contd)

STEP	PROCEDURE
7	Measure flatness of test trace. *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 −7 dBm (J68387S) or +2 dBm (J68387AB) on the power meter with the MAN GAIN control. If the requirement is not met for J68387 amplifiers, replace the amplifier with a good spare and repeat Steps 1 through 3.
	1042A FILTER LOSS CHECK
8	Connect options (W), (Y) and (A) in Exhibit 2. Set sweeper MODE control to CW and power meter RANGE control to −5 dBm (J68387S) or +5 dBm (J68387AB).
9	Measure power. *Requirement:* −7 dBm, ±0.5 dBm (J68387S) +2 dBm, ±0.5 dBm (J68387AB) If requirement is *not* met, inspect filter and equalizer connections and replace units, if necessary.
	ATC TESTS
10	Operate MAN-AGC switch on IF main amplifier to AGC.
11	Adjust IF LEV control on the J68387S amplifier to −7 dBm or OUTPUT PWR control on the J68387AB amplifier to +2 dBm.
12	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).
13	Reduce IF level by 40 dB at input of IF main amplifier by changing test setup from option (W) to (Z) in Exhibit 2.
14	Measure IF power. *Requirement:* Between −9 and −5 dBm (J68387S) Between 0 and +4 dBm (J68387AB)

CHART C (Contd)

STEP	PROCEDURE
	If unable to meet the requirements, replace the IF main amplifier with a spare and repeat the tests in this chart.
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 to J68387AB amplifiers, proceed with Step 16. ←
	HS/SD Trip Adjustment
	Notes:
	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.
	2. The CRS PLT PWR control on the J68387AB amplifier must always be in the full counter-clockwise 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) *clockwise* 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) *counter-clockwise* 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.



PREPARATION FOR TEST

1. Insert 5013-3 RF plug-in, and associated scale into Kruse 5000A sweeper.
2. Position test equipment controls.

UNIT	CONTROL	POSITION
SWEEPER	PUSH ON-OFF	ON
	SWEEP SECONDS	0.01
	SWEEP SECONDS VERNIER	MAX CLOCKWISE
	RECUR TRIG LINE	RECUR
	VERNIER	0
	MODE	CW
	MODE VERNIER	CALIB
	EXT'L/INT'L SWEEP (REAR)	INT'L
RF PLUG-IN	MARKERS	OFF
	RETRACE	OFF
	LEVELER	LEVELER
	1 kHz	OFF
	RF LEVEL	FULLY CCW
POWER METER	LINE	ON
	RANGE	0 dBm
	SCALE ILLUM	MID-RANGE
PWR HEAD	% EFF	FOR 4 GHz (REFER TO CHART ON POWER HEAD)

3. Adjust sweeper MARKER 2-FC control to the frequency of receiver under test.
4. Obtain 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 RF sweep oscillator output to obtain the power obtained in Step 4 as follows:
   (a) Connect detector and filter to directional coupler as shown in A part of drawing.
   (b) Connect test setup as shown in B part of drawing. (See warning note.)

   Warning: Do not connect output of leveling coupler to power meter or circuit under test when the loop from sweeper LEVELER EXT DET is open. Excessive levels may exist at leveling coupler output when loop is open.

   (c) Temporarily remove power head from 10 dB pad. Set power meter RANGE control to −25 dB. Zero power meter METER ZERO control. Set power-meter RANGE control to 0 dBm and reconnect power head to 10 dB pad.
   (d) Set power meter RANGE control.

RECEIVED SIGNAL LEVEL	SUBTRACT THIS AMOUNT	POWER METER RANGE POSITION
−20 TO −25 dBm	20 dB	0
−25 TO −30 dBm	25 dB	−5
−30 TO −35 dBm	30 dB	0
−35 TO −40 dBm	35 dB	−5

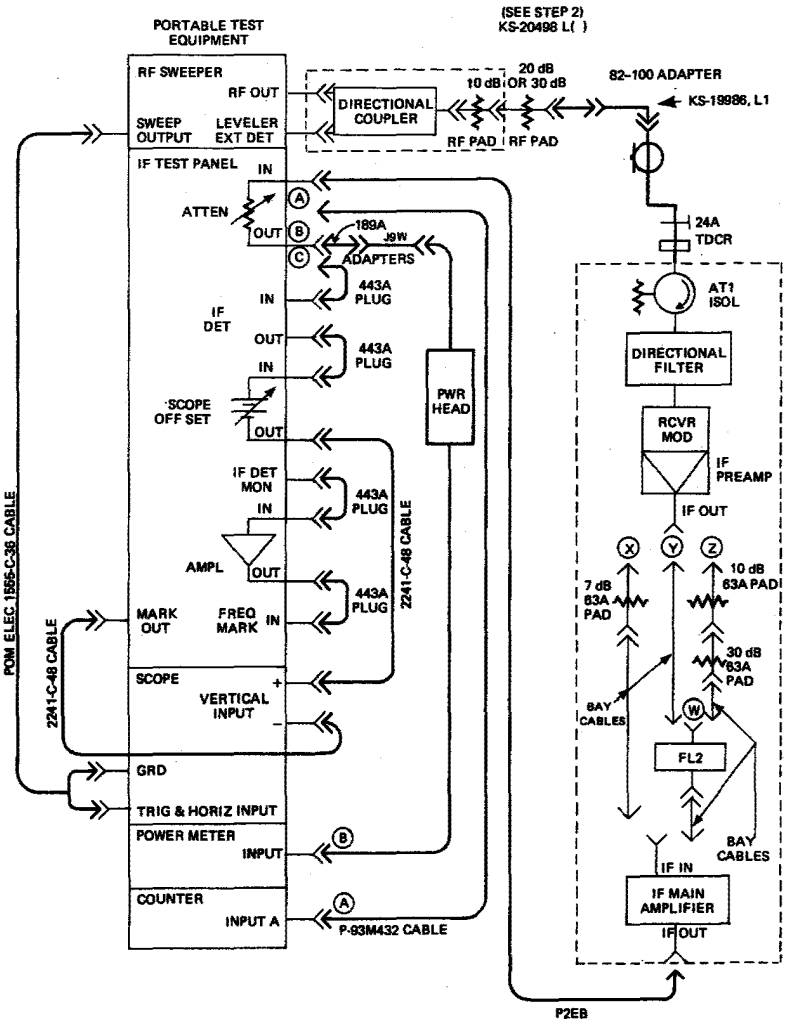
   (e) Adjust RF oscillator RF LEV control for received signal level.

   Example: Suppose received signal level is −26.5 dBm. In Step (d) we get:

$$\begin{array}{r} -26.5 \\ 25. \\ \hline -1.5 \end{array}$$

   The power meter RANGE control is set to −5 and the RF LEV is adjusted for a power meter reading of −1.5.

RF Oscillator Setup
➡ Exhibit 1 ⬅



PREPARATION FOR TEST

1. Position Test Set Controls.

UNIT	CONTROL	POSITION
SWEEPER	PUSH ON-OFF	ON
	SWEEP SECONDS	0.01
	SWEEP SECONDS VERNIER	MAX CLOCKWISE
	RECUR TRIG LINE	RECUR
	VERNIER	0
	MODE	CW
	MODE VERNIER	CALIB
	EXT'L/INT'L SWEEP (REAR)	INT'L
RF PLUG-IN	MARKERS	OFF
	RETRACE	OFF
	LEVELER	LEVELER
	1 kHz	OFF
	RF LEVEL	FULLY CCW
COUNTER	FREQUENCY A (kHz)	10ms
	DISPLAY TIME	MINIMUM
	INPUT B INT OSC	INT OSC
	GAIN	MID-RANGE
	AC TEST DC (NORM TEST)	AC (NORM)
POWER METER	LINE	ON
	RANGE	0 dBm
	SCALE ILLUM	MID-RANGE
PWR HEAD	% EFF	FOR 4 GHz (REFER TO CHART ON POWER HEAD)

2. Select KS-20498L3 RF pad, adjust RF sweep oscillator output to same level as the calculated or measured receiver carrier power.
3. Set IF test panel ATTEN to 0. Adjust sweeper MARKER 2-FC control to the frequency of receiver under test.

OSCILLOSCOPE CALIBRATION

4. Position sweeper MODE control to ΔF x 1 and MARKER control to ON. Set sweep MARKER 1 and MARKER 3 to –10 and +10 MHz on the lower scale.
5. Position Oscilloscope controls.

HEWLETT PACKARD 1202A OSCILLOSCOPE	
CONTROL	POSITION
VERTICAL POSITION	MIDRANGE
SENSITIVITY	20 MV/DIV
+ INPUT	DC
– INPUT	DC
BW LIMIT	IN
HORIZONTAL POSITION	MIDRANGE
EXT HORIZ V/DIV	.5
COUPLING	DC

6. IF test panel ATTEN control to 6.
7. Center trace on scope with IF test panel SCOPE OFFSET ADJ control. Adjust scope VERTICAL POSITION control to position test trace on middle horizontal line. Set scope VERTICAL SENSITIVITY control to 2 MV/DIV.
8. Set sweep width for 20 MHz by adjusting sweeper Fc ± ΔF vernier control until only three markers appear on trace, place markers at edge of scope trace.
9. Adjust scope HORIZONTAL POSITION and DEFLECTION SENSITIVITY controls such that two end markers coincide with full horizontal deflection.
10. While switching IF test panel ATTEN control from 7 dB to 6 dB position and back adjust scope VERTICAL POSITION and SENSITIVITY controls for a deflection of 10 divisions. This calibrates scope for .1 dB per division.
11. Set scope VERTICAL SENSITIVITY TO 1 MV/DIV. The scope is now calibrated for .05 dB per division.
12. With scope VERTICAL POSITION control, set 70 MHz point (center marker) on center HORIZONTAL line of scope.

RF to IF Transmission Test Setup
Exhibit 2