RADIO TEST EQUIPMENT

MICROWAVE TEST SETS

J68392A TRANSMITTER-RECEIVER TEST SET

OPERATION

1. GENERAL

1.01 This section contains the procedures to be followed for operation of the J68392A transmitter-receiver test set used with TD-3 microwave radio systems. The test set is caster mounted and requires no special installation procedures other than connection to a source of 117 volts ac 60 Hz at approximately 10 amperes. Figure 1 is an illustration of the early model test set. Figure 2 is an illustration of the test set in accordance with SD-50564, Issue 12 and above. A complete description of the test set is contained in Section 104-415-100.

2. OPERATING PROCEDURES

2.01 The charts in this section describe the operating procedures for the transmitter-receiver test set when used for general types of tests on the TD-3 radio repeater equipment. No attempt has been made to describe all types of tests that can be performed; only the tests which are normally considered routine are covered in this section. The charts contain only the general setup and calibration of the test set for each type of test. The specific tests are included in other applicable transmitter-receiver bay sections.

2.02 Most tests require that the unit under test have the normal dc power applied. A jack on the test set (EXT DC PWR) will provide -19 volts at up to 400 milliamperes and may be used to power the unit under test if required.

Note: Except for the microwave generator, the current capacity of this source is sufficient to power the individual units in the transmitter-receiver bay requiring -19 volts.

2.03 While working on the test equipment, observe all general safety precautions outlined in Section 010-110-001.

Warning 1: A number of the voltages employed in this test set are LETHAL.

Warning 2: DO NOT look into an energized waveguide. The RF power density within 3 inches of the open end of a waveguide, which is carrying a power of 1 watt or above, is potentially hazardous to the eyes or body tissue.

2.04 The charts contained in this section are as follows:

Chart 1—Initial Setup of Test Set

Chart 2—IF-to-IF Amplitude Response Test Setup

Chart 3—RF-to-RF Amplitude Response Test Setup

Chart 4—IF-to-RF Amplitude Response Test Setup

Chart 5—RF-to-IF Amplitude Response Test Setup

Chart 6—IF Return-Loss Test Setup

Chart 7—Antenna Waveguide System Return-Loss Test Setup (Only test sets prior to Issue 8B of SD-50564-01 provide the necessary components required to perform this test. To utilize test sets after Issue 8B, a Weinschel 1506 RF power divider must be obtained from the maintenance center.)

Chart 8—IF Carrier Resupply Trip and Restore Test Setup

Chart 9—IF Carrier Resupply Level and Frequency Test Setup

Chart 10—Receiver Noise Figure Measurement Test Setup

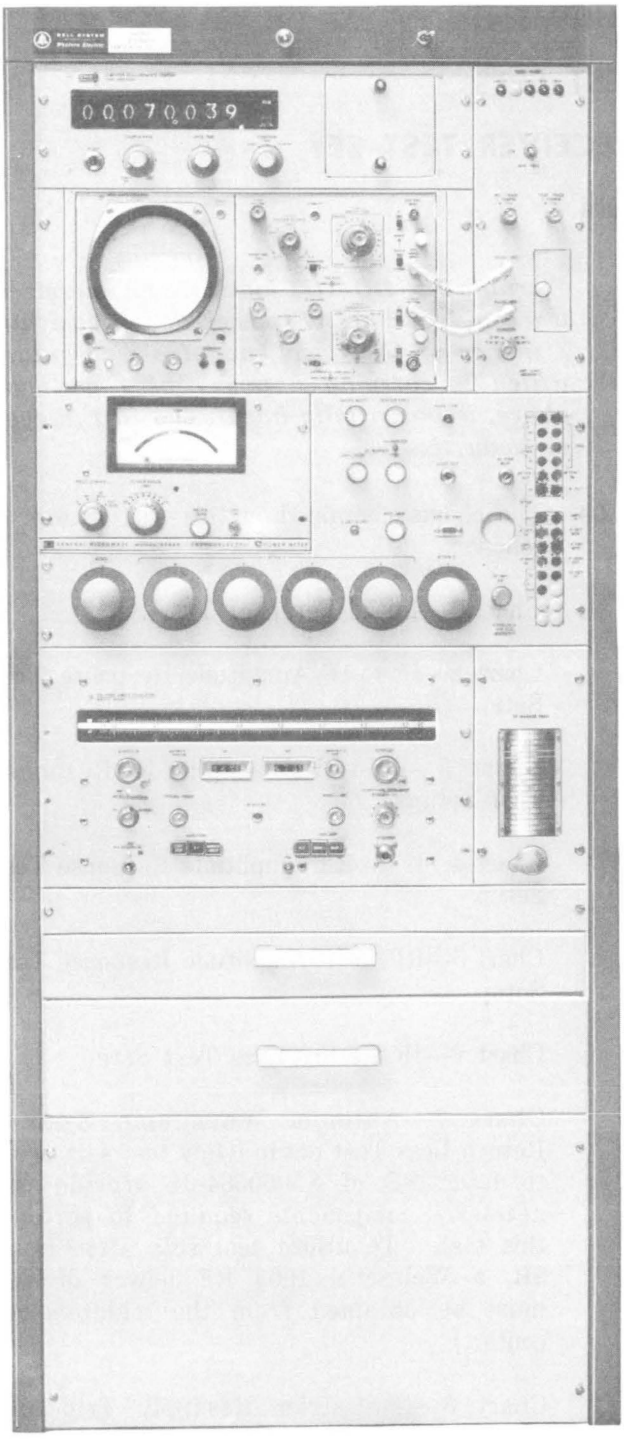


Fig. 1—J68392A Transmitter-Receiver Test Set (Early Model)

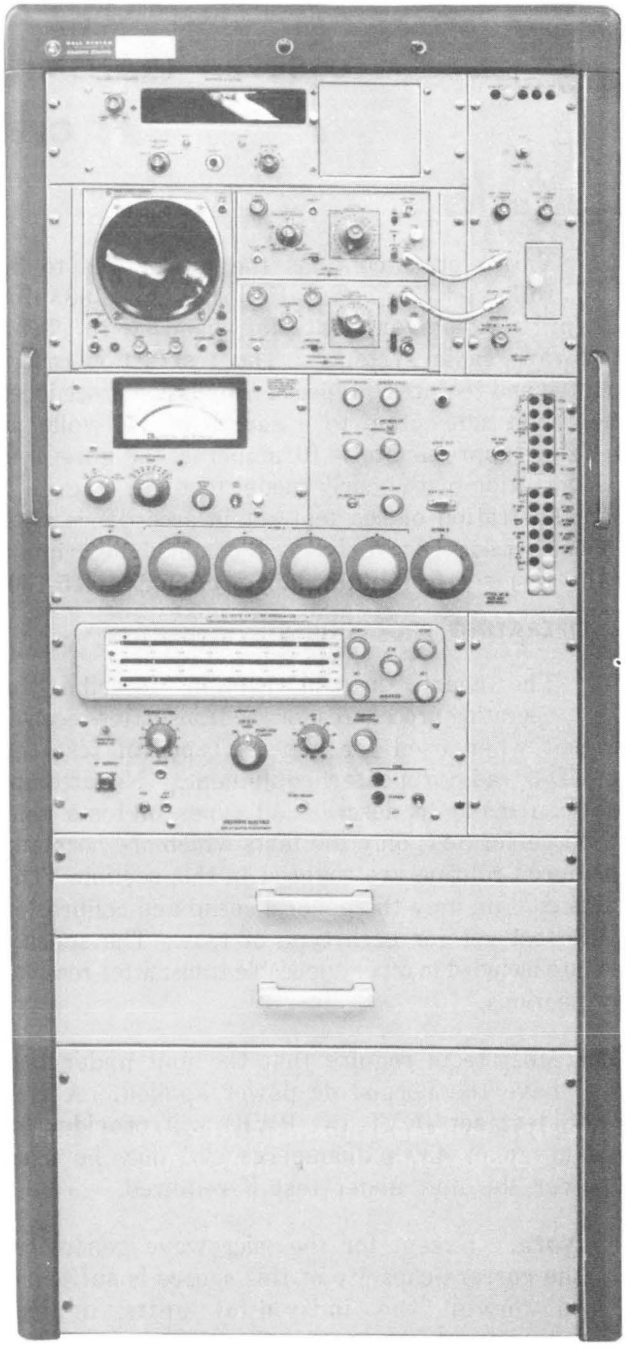
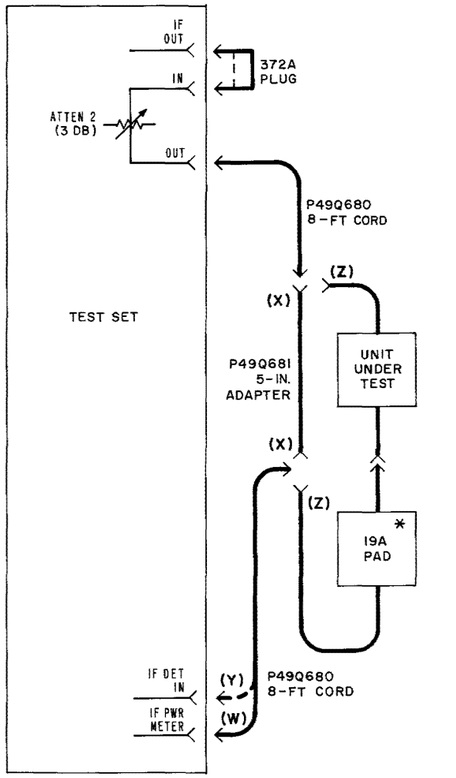


Fig. 2—J68392A Transmitter-Receiver Test Set (SD-50564, Issue 12 and Above)

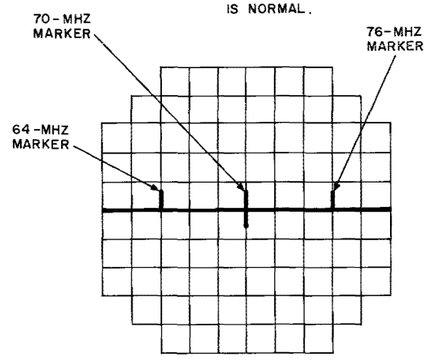
CHART 1

INITIAL SETUP OF TEST SET

STEP	PROCEDURE
1	If any problems are encountered in the initial setup of the test set as outlined in this chart, refer to Section 104-415-501, Chart 1.
2	Connect the AC power cord between either P55 or P56 at the top or bottom rear of the test set and a convenient 117-volt ac power source.
3	Observe the pilot lamp at the top front of the test set. If the pilot lamp is not lighted, operate the adjacent toggle switch to the opposite position and the lamp will light.
4	Observe that no fuse alarm lamps are lighted.
5	Energize the electronic counter, the oscilloscope, the power meter, and the RF sweep oscillator.
6	Allow the equipment to warm up for at least 30 minutes.
7	Set the INPUT CHANNEL switch on the power meter to IF. Determine that no input is connected, then zero the power meter by setting the POWER RANGE DBM switch to -25 and by adjusting the METER ZERO control for an indication of "ZERO" on the meter.
8	Set the FUNCTION switch on the counter to TEST. Press the RESET button and determine that the counter indicates 1 MHz ±1 count on the last digit; then set the FUNCTION switch to the FREQ position. The test set is now ready for operation. ***Caution: Never apply more than +10 dBm to the power meter.***



* THIS PAD IS SELECTED TO PROVIDE -7 DBM INPUT TO THE TEST SET WHEN THE OUTPUT OF THE UNIT UNDER TEST IS NORMAL.



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:

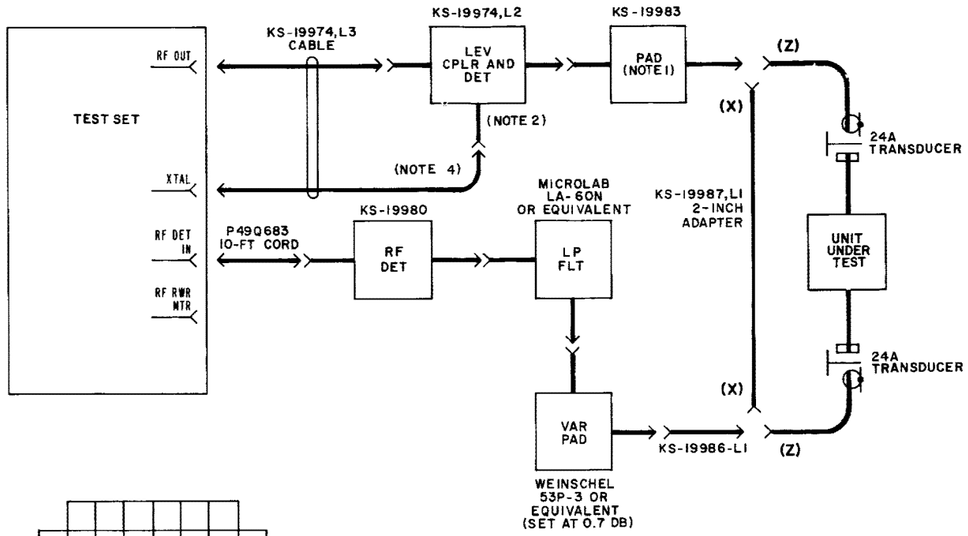
UNIT	CONTROL	POSITION
CONTROL PANEL	FUNCTION IF SWEEP WIDTH IF CENTER FREQ IF MARKER AMPLITUDE IF MARKER FREQ CTR	IF-IF MIDRANGE MIDRANGE MIDRANGE MIDRANGE MKR FREQ
SCOPE TIME BASE	POSITION MAGNIFIER SWEEPTIME VERNIER SINGLE-NORMAL	MIDRANGE X10 EXT MIDRANGE NORMAL
SCOPE DIFFERENTIAL AMPLIFIER	POSITION 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 +10

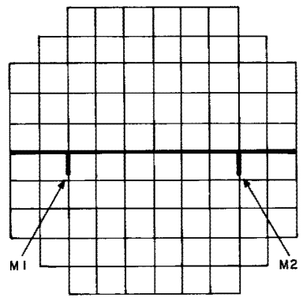
REQUIREMENT: THE POWER METER SHALL INDICATE -3.0±0.1 (+10 DBM AT THE IF OUT JACK).

4. IF THE REQUIREMENT CANNOT BE MET, ADJUST THE OUTPUT CONTROL ON THE IF SWEEP OSCILLATOR (REAR OF TEST SET). IF THE REQUIREMENT STILL CANNOT BE MET, REFER TO BSP 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 AND POSITION CONTROLS ON THE SCOPE 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.
    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. INCREASE THE ATTENUATION OF ATTEN 2 BY 0.1 DB. ADJUST THE SENSITIVITY AND POSITION CONTROLS ON THE SCOPE 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 104-415-504.
15. CHANGE OPTION (X) TO OPTION (Z).
16. SET THE PROPER POWER INTO THE UNIT UNDER TEST BY ADJUSTING ATTEN 2. THE POWER AT THE ATTEN 2 OUT JACK IS EQUAL TO +10 MINUS THE SETTING OF ATTEN 2 DBM.
17. SET THE PROPER POWER INTO THE TEST SET BY SELECTING THE 19A PAD* TO GIVE -7.0 DBM INTO THE IF DET IN JACK.

CHART 2—IF-to-IF Amplitude Response Test Setup





NOTES:

1.

PAD REQUIRED	
WHEN OPTION (X) IS USED	20 DB
WHEN THIS LEVEL IS REQUIRED INTO THE UNIT UNDER TEST	USE THIS PAD
-30 TO -20 DBM	40 DB
-20 TO -10 DBM	30 DB
-10 TO 0 DBM	20 DB
0 TO +10 DBM	10 DB
+10 TO +30 DBM	0 DB

2. IF A HEWLETT-PACKARD LEVELING COUPLER IS USED, INSERT A MICROLAB, LA60N OR EQUIVALENT, LOW PASS FILTER IN FRONT OF THE DETECTOR.

3. SOME EARLIER UNITS ARE DESIGNATED CW± ΔF.

4. USE NJ8505 9-1/4 INCH AN CONNECTOR PLIERS (BOKER & CO) TO TIGHTEN ALL N-TYPE CONNECTORS.

5. TEST SETS AFTER LIST 3 ENABLE DIRECT CONNECTION TO THE RF POWER HEAD. IN THIS CASE, THE KS-19987,L1 2-INCH ADAPTER IS REQUIRED AFTER THE 20-DB PAD.

PREPARATION FOR TEST

1. MAKE THE TEST CONNECTIONS USING OPTION (X).

2. SET THE TEST SET CONTROLS AS FOLLOWS:

UNIT	CONTROL	POSITION
CONTROL PANEL	FUNCTION	RF-RF
SCOPE TIME BASE	POSITION MAGNIFIER SWEEP TIME VERNIER SINGLE-NORMAL	MIDRANGE X10 EXT MIDRANGE NORMAL
SCOPE DIFFERENTIAL AMPLIFIER	POSITION BANDWIDTH AMPLIFIER VERNIER SENSITIVITY AC-DC-OFF(+ INPUT) AC-DC-OFF(- INPUT)	MIDRANGE 4 DC MIDRANGE 2MV/CM DC OFF
POWER METER	INPUT CHANNEL POWER RANGE DBM	RF 0
ALFRED RF SWEEP OSCILLATOR KS-19974	LINE FUNCTION-SWEEP SELECTOR MARKER AMPLITUDE (IF PROVIDED) CW ΔF	RF ΔF (NOTE 3) MIDRANGE CHANNEL CENTER FREQ 20
HEWLETT PACKARD RF SWEEP OSCILLATOR KS-19974	LINE SWEEP SELECTOR FUNCTION AMPL MOD (IF PROVIDED) START/CW STOP/ΔF	RF AUTO ΔF MARK 1 MARK 2 CHANNEL CENTER FREQ 20

3. CONNECT THE OUTPUT OF THE KS-19983 -20-DB PAD TO THE RF PWR MTR JACK ON THE TEST SET. (NOTE 5). ADJUST THE POWER LEVEL CONTROL ON THE RF OSCILLATOR FOR AN INDICATION OF 2.5 ON THE POWER METER.

4. RE-MAKE THE TEST CONNECTIONS USING OPTION (X).

5. ADJUST THE TEST TRACE CONTROL ON THE CONTROL PANEL TO CENTER THE TEST TRACE ON THE OSCILLOSCOPE.

6. ADJUST THE SWEEP TIME AND POSITION CONTROLS ON THE SCOPE TIME BASE UNIT FOR APPROXIMATELY 10 CENTIMETERS HORIZONTAL DEFLECTION ON THE OSCILLOSCOPE.

7. ADJUST THE CW CONTROL TO THE DESIRED FREQUENCY. ADJUST THE ΔF CONTROL FOR A 20-MHZ SWEEP. IF THE OSCILLATOR IS EQUIPPED WITH MARKERS, ADJUST M1 TO 10 MHZ LESS THAN THE CENTER FREQUENCY. ADJUST M2 TO 10 MHZ OVER THE CENTER FREQUENCY. ADJUST THE ΔF CONTROL TO PLACE THE MARKERS AS SHOWN.

8. ADJUST THE REF TRACE CONTROL ON THE CONTROL PANEL TO BRING THE REFERENCE TRACE INTO COINCIDENCE WITH THE TEST TRACE AT CENTER FREQUENCY.

9. INCREASE THE ATTENUATION OF THE VARIABLE PAD BY 0.5 DB. ADJUST THE SENSITIVITY AND POSITION CONTROLS ON THE SCOPE DIFFERENTIAL AMPLIFIER FOR 10 CENTIMETERS DEFLECTION BETWEEN THE TEST TRACE AND THE REFERENCE TRACE. RETURN THE VARIABLE PAD TO ITS ORIGINAL SETTING. THIS CALIBRATES THE OSCILLOSCOPE FOR .05 DB PER CENTIMETER.

REQUIREMENT: THE TEST TRACE SHALL BE FLAT TO WITHIN 0.02 DB OVER THE 20-MHZ BAND.

10. DISCONNECT OPTION (X).

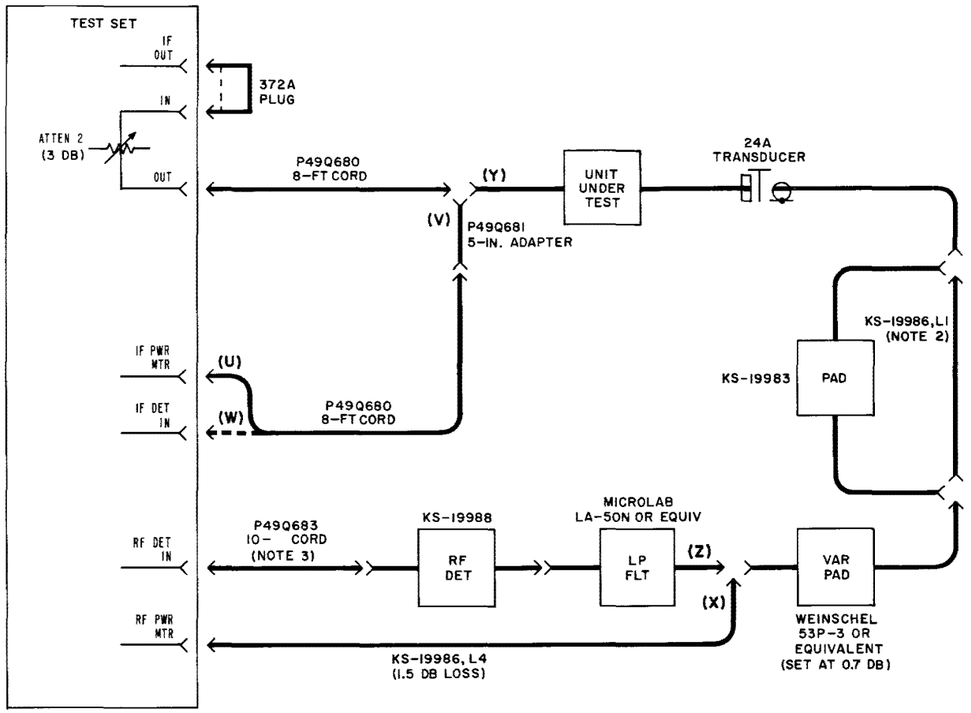
11. DETERMINE THE PROPER POWER TO THE UNIT UNDER TEST.

12. USING THE TABLE, SELECT THE PROPER PAD.

13. MEASURE THE OUTPUT OF THE SELECTED PAD, AND, IF NECESSARY, ADJUST THE POWER LEVEL CONTROL TO ACHIEVE THE PROPER INPUT TO THE UNIT UNDER TEST.

14. CONNECT OPTION (Z). IT MAY BE NECESSARY TO PAD THE OUTPUT OF THE UNIT UNDER TEST TO ENSURE APPROXIMATELY -2.5 DBM INTO THE VARIABLE PAD.

CHART 3—RF-to-IF Amplitude Response Test Setup



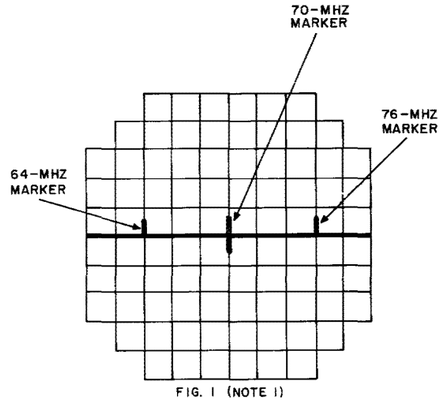


FIG. 1 (NOTE 1)

NOTES:

1. THE FREQUENCY SCALE ON THE OSCILLOSCOPE MAY BE REVERSED FOR SOME UNITS UNDER TEST CAUSING THE 64- AND 76-MHZ MARKERS TO BECOME REVERSED ON THE OSCILLOSCOPE DISPLAY IN FIG 1.
2. SEE STEP 16.
3. USE NJ8505 9-1/4 INCH AN CONNECTOR PLIERS TO TIGHTEN ALL N-TYPE CONNECTORS.

PREPARATION FOR TEST

1. SET ATTEN 2 AT 3 DB.
2. MAKE THE TEST CONNECTIONS USING OPTIONS (U) AND (V).
3. SET THE TEST SET CONTROLS AS FOLLOWS:

UNIT	CONTROL	POSITION
CONTROL PANEL	FUNCTION IF SWEEP WIDTH IF CENTER FREQ IF MARKER AMPLITUDE IF MARKER FREQ CTR	IF-IF MIDRANGE MIDRANGE MIDRANGE MIDRANGE MKR FREQ
SCOPE TIME BASE	POSITION MAGNIFIER SWEEP TIME VERNIER SINGLE-NORMAL	MIDRANGE X10 EXT MIDRANGE NORMAL
SCOPE DIFFERENTIAL AMPLIFIER	POSITION BANDWIDTH AMPLIFIER VERNIER SENSITIVITY AC-DC-OFF(+ INPUT) AC-DC-OFF(- INPUT)	MIDRANGE 4 DC MIDRANGE 2MV/CM DC OFF
POWER METER	INPUT CHANNEL POWER RANGE DBM	IF +10

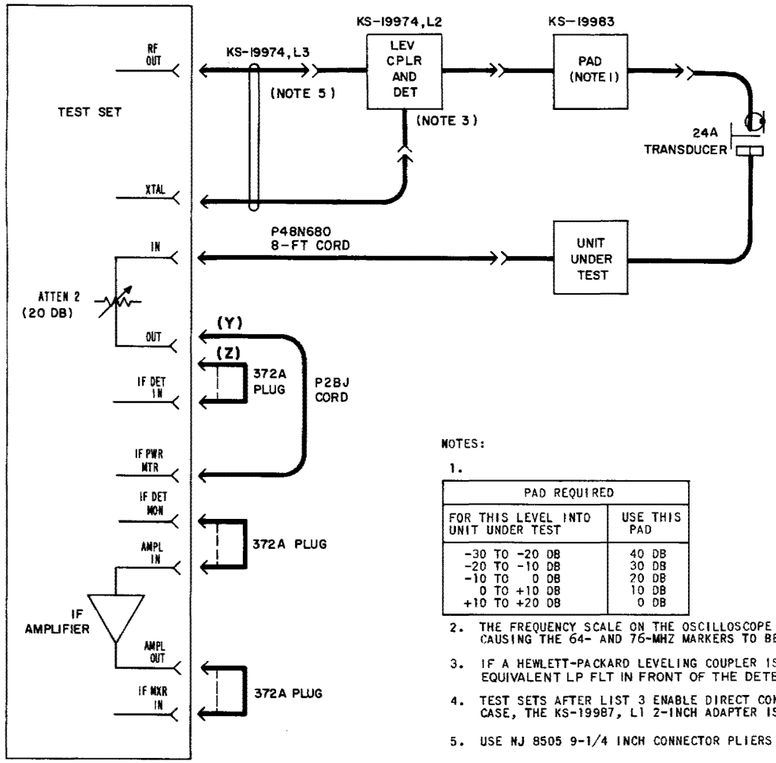
REQUIREMENT: THE POWER METER SHALL INDICATE -3.0±0.1. (+10DBM AT IF OUT JACK.)

4. IF THE REQUIREMENT CANNOT BE MET, ADJUST THE OUTPUT CONTROL ON THE IF SWEEP OSCILLATOR (REAR OF TEST SET). IF THE REQUIREMENT STILL CANNOT BE MET, REFER TO BSP 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 (-7DBM).
8. CHANGE OPTION (U) TO OPTION (W).
9. ADJUST THE TEST TRACE CONTROLS ON THE CONTROL PANEL TO CENTER THE TRACE ON THE OSCILLOSCOPE.
10. ADJUST THE SWEEP TIME AND POSITION CONTROLS ON THE SCOPE TIME BASE UNIT 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 OSCILLOSCOPE DISPLAY SHOWN.

    NOTE: AN EXTRANEOUS MARKER APPEARS AT 89 MHZ.

13. DETERMINE THAT THE IF DETECTOR IS FLAT IN ACCORDANCE WITH CHART 2, STEPS (13) AND (14).
14. CHANGE THE TEST CONNECTIONS TO OPTIONS (X) AND (Y). ADJUST ATTEN 2 TO PROVIDE THE CORRECT POWER INTO THE UNIT UNDER TEST.
15. SET THE POWER METER INPUT CHANNEL TO RF AND THE POWER RANGE DBM SWITCH TO 0.
16. THE FOLLOWING CALIBRATION STEPS REQUIRE A KNOWLEDGE OF THE OUTPUT POWER OF THE UNIT UNDER TEST.
17. SELECT A KS-19983 FIXED PAD WHICH WHEN PLACED IN SERIES WITH THE VARIABLE PAD SET AT 0.1 DB WILL GIVE A POWER METER INDICATION OF -2.5.
18. CHANGE OPTION (X) TO OPTION (Z).
19. SET THE FUNCTION SWITCH ON THE CONTROL PANEL TO IF-RF.
20. ADJUST THE TEST TRACE AND REFERENCE TRACE CONTROLS ON THE CONTROL PANEL SO THE TRACES ARE COINCIDENT AT 70 MHZ.
21. INCREASE THE ATTENUATION OF THE VARIABLE PAD BY 0.5 DB AND ADJUST THE SENSITIVITY AND POSITION CONTROLS ON THE SCOPE DIFFERENTIAL AMPLIFIER FOR 10 CENTIMETERS DEFLECTION BETWEEN THE TEST TRACE AND THE REFERENCE TRACE. RETURN THE PAD TO ITS ORIGINAL SETTING. THIS CALIBRATES THE OSCILLOSCOPE FOR 0.05 DB PER CENTIMETER. IF RIPPLE IS ENCOUNTERED MOVING IN THE TEST TRACE, A 936A NOISE SUPPRESSOR SHOULD BE INSERTED BETWEEN THE RF DET AND THE LP FLT.

CHART 4—IF-to-RF Amplitude Response Test Setup



NOTES:

1.

PAD REQUIRED	
FOR THIS LEVEL INTO UNIT UNDER TEST	USE THIS PAD
-30 TO -20 DB	40 DB
-20 TO -10 DB	30 DB
-10 TO 0 DB	20 DB
0 TO +10 DB	10 DB
+10 TO +20 DB	0 DB

2. THE FREQUENCY SCALE ON THE OSCILLOSCOPE MAY BE REVERSED FOR SOME UNITS UNDER TEST CAUSING THE 64- AND 76-MHZ MARKERS TO BE REVERSED ON THE OSCILLOSCOPE DISPLAY IN FIG. 1.

3. IF A HEWLETT-PACKARD LEVELING COUPLER IS USED, INSERT A MICROLAB LA-5ON, LA-6ON, OR EQUIVALENT LP FLT IN FRONT OF THE DETECTOR.

4. TEST SETS AFTER LIST 3 ENABLE DIRECT CONNECTION TO THE RF POWER HEAD. IN THIS CASE, THE KS-19987, L1 2-INCH ADAPTER IS REQUIRED AFTER THE KS-19983 FIXED PAD.

5. USE NJ 8505 9-1/4 INCH CONNECTOR PLIERS TO TIGHTEN ALL N-TYPE CONNECTORS.

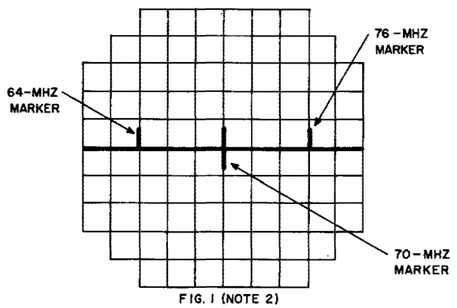


FIG. 1 (NOTE 2)

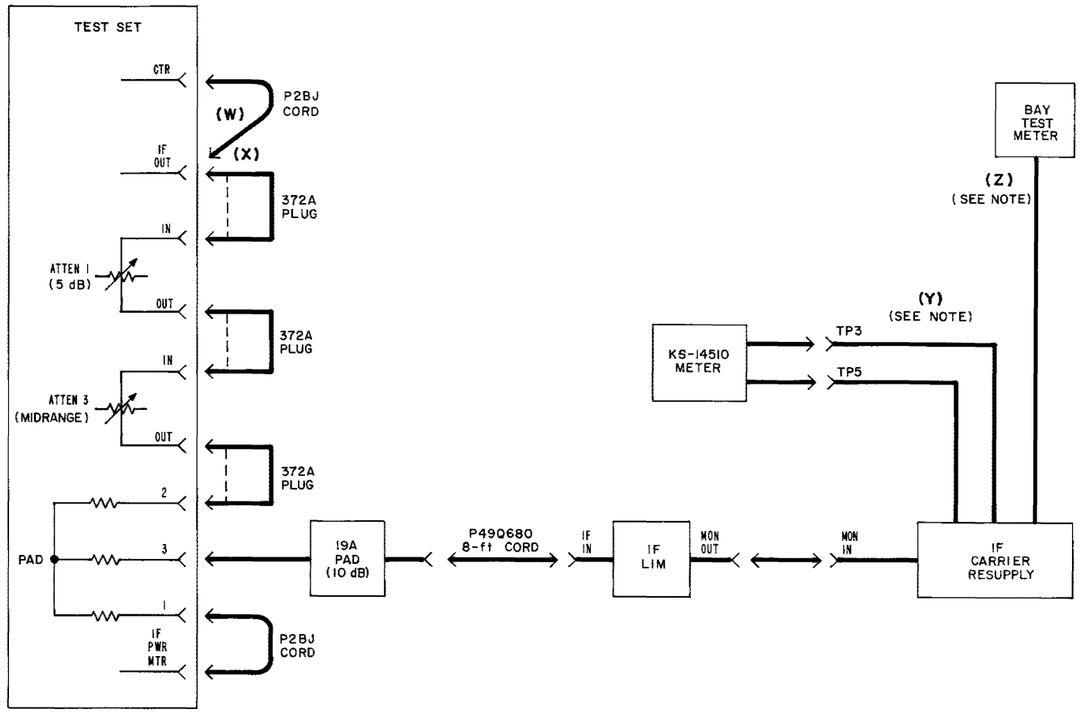
PREPARATION FOR TEST

1. DETERMINE THAT THE RF SWEEP OSCILLATOR IS FLAT IN ACCORDANCE WITH CHART 3.
2. DETERMINE THAT THE IF DETECTOR IS FLAT IN ACCORDANCE WITH CHART 2, STEPS 1 THROUGH 11, WITH THE FOLLOWING CHANGES:
   STEP 2: CONNECT ATTEN 2 OUT THROUGH ONE P490680 8-FT CORD TO THE IF POWER METER JACK.
   STEP 5: CONNECT ATTEN 2 OUT THROUGH ONE P490680 8-FT CORD TO THE IF DET IN JACK.
3. SET ATTEN 2 TO 20 DB.
4. MAKE THE TEST CONNECTIONS USING OPTION (Y).
5. SET THE TEST SET CONTROLS AS FOLLOWS:

UNIT	CONTROL	POSITION
CONTROL PANEL	FUNCTION IF MARKER AMPLITUDE CTR IF AMPL GAIN	RF-IF MIDRANGE MARKER FREQ. MIDRANGE
SCOPE TIME BASE	POSITION MAGNIFIER SWEEP TIME VERNIER SINGLE-NORMAL	MIDRANGE X10 EXT MIDRANGE NORMAL
SCOPE DIFFERENTIAL AMPLIFIER	POSITION BANDWIDTH AMPLIFIER VERNIER SENSITIVITY AC-DC-OFF (+ INPUT) AC-DC-OFF (- INPUT)	MIDRANGE 4 DC MIDRANGE 2MV/CM DC OFF
POWER METER	INPUT CHANNEL POWER RANGE DBM	RF -5
ALFRED SWEEP OSCILLATOR KS-19974	LINE FUNCTION SWEEP SELECTOR MARKER AMPLITUDE (IF PROVIDED) CW ΔF	RF CW ± Δ MAX CCW CHAN CENTER FREQ 20
HEWLETT-PACKARD RF SWEEP OSCILLATOR KS-19974	LINE SWEEP SELECTOR FUNCTION ALC MARKER AMPL (IF PROVIDED) START/CW STOP/ΔF	RF AUTO AF PRESS MAX CCW CHAN CENTER FREQ 20

6. DETERMINE THE PROPER RF INPUT POWER FOR THE UNIT UNDER TEST AND SELECT THE APPROPRIATE PAD PER NOTE 1. CONNECT THE OUTPUT OF THE PAD TO THE PWR MTR JACK ON THE FRONT PANEL. (SEE NOTE 4).
7. ADJUST THE POWER LEVEL CONTROL ON THE RF OSCILLATOR FOR THE PROPER INPUT TO THE UNIT UNDER TEST. RECONNECT OPTION (Y).
8. SET THE INPUT CHANNEL CONTROL ON THE POWER METER TO IF.
9. ADJUST ATTEN 2 FOR AN INDICATION OF -2 ON THE POWER METER (-7 DBM).
10. CHANGE THE TEST CONNECTIONS TO OPTION (Z).
11. ADJUST THE TEST TRACE CONTROL ON THE CONTROL PANEL TO CENTER THE TEST TRACE ON THE OSCILLOSCOPE.
12. ADJUST THE SWEEP TIME AND POSITION CONTROLS ON THE SCOPE TIME BASE UNIT FOR A HORIZONTAL TEST TRACE DISPLAY OF APPROXIMATELY 10 CENTIMETERS.
13. ADJUST THE IF MARKER FREQ CONTROL ON THE CONTROL PANEL FOR A 70±0.1 MHZ INDICATION ON THE COUNTER.
14. ADJUST THE CW CONTROL ON THE RF SWEEP OSCILLATOR TO CENTER THE 70-MHZ MARKER AS SHOWN IN FIG. 1.
15. ADJUST THE ΔF CONTROL ON THE RF SWEEP OSCILLATOR TO PLACE THE 64- AND 76-MHZ MARKERS AS SHOWN IN FIG. 1.
16. ADJUST THE REF TRACE CONTROL ON THE CONTROL PANEL TO BRING THE REFERENCE TRACE INTO COINCIDENCE WITH THE TEST TRACE AT 70 MHZ.
17. INCREASE THE ATTENUATION OF ATTEN 2 BY 0.1 DB. ADJUST THE SENSITIVITY AND POSITION CONTROLS ON THE SCOPE DIFFERENTIAL AMPLIFIER FOR 2 CENTIMETERS DEFLECTION BETWEEN THE TEST TRACE AND THE REFERENCE TRACE. RETURN ATTEN 2 TO ITS PREVIOUS SETTING. THIS CALIBRATES THE OSCILLOSCOPE FOR 0.05 DB PER CENTIMETER.

CHART 5—RF-to-IF Amplitude Response Test Setup



NOTE:

WHEN USING OPTION (Y) IF THE TEST IS MADE WITH THE UNIT REMOVED FROM THE RADIO BAY, POWER MUST BE APPLIED FROM THE TEST SET. EXT dc PWR JACK METERING MUST BE SUPPLIED BY THE KS-14510 METER AS SHOWN.

WHEN USING OPTION (Z) IF THE TEST IS MADE WITH THE UNIT INSTALLED IN THE RADIO BAY, POWER AND METERING (PRESS CRS SWITCH VOLTS) IS PROVIDED BY THE BAY WIRING.

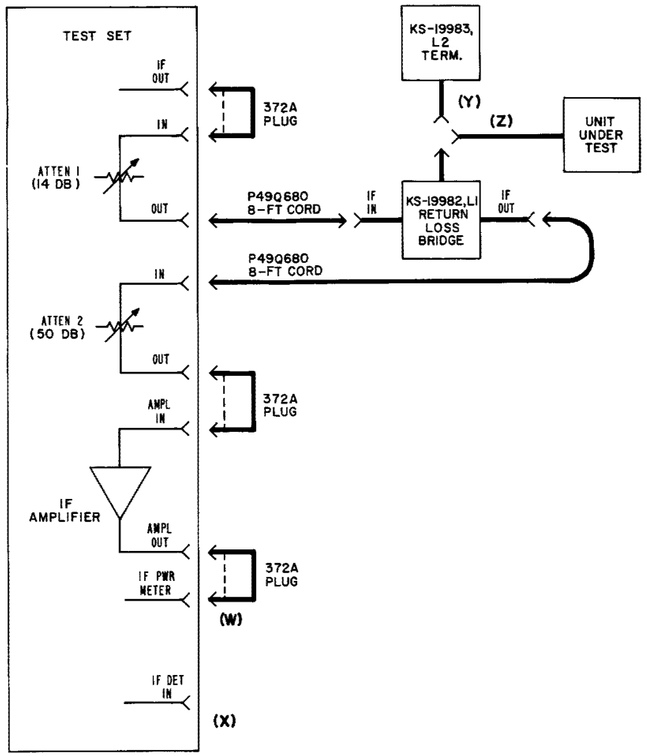
PREPARATION FOR TEST

1. SET ATTEN 1 AT 5 dB AND ATTEN 3 AT APPROXIMATELY MIDRANGE.
2. MAKE THE TEST CONNECTIONS USING OPTION (W).
3. SET THE TEST SET CONTROLS AS FOLLOWS:

UNIT	CONTROL	POSITION
CONTROL PANEL	IF SWEEP WIDTH IF CENTER FREQ CTR	MAX CCW MIDRANGE EXT
POWER METER	INPUT CHANNEL POWER RANGE dBm	IF -10

4. ADJUST THE IF CENTER FREQ CONTROL ON THE CONTROL PANEL FOR A 70±0.1 MHz INDICATION ON THE COUNTER.
5. CHANGE THE TEST CONNECTIONS TO OPTIONS (X) AND (Y) OR (X) AND (Z).
6. AN INDICATION OF ZERO ON THE KS-14510 METER OR ON THE BAY TEST METER INDICATES THAT THE IF CARRIER RESUPPLY HAS TRIPPED. AN INDICATION OF APPROXIMATELY 1/4 SCALE ON THE KS-14510 METER OR 2/3 SCALE ON THE BAY TEST METER INDICATES THAT THE CARRIER RESUPPLY HAS RESTORED.

CHART 8—IF Carrier Resupply Trip and Restore Test Setup



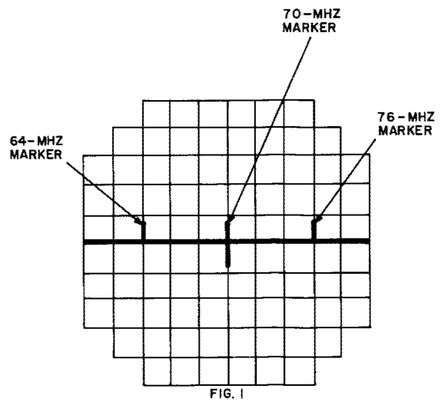


FIG. 1

PREPARATION FOR TEST

1. MAKE TEST CONNECTIONS LEAVING OPTIONS (W) AND (X) DISCONNECTED.
2. SET ATTEN 1 AT 14 DB, THE POWER METER INPUT CHANNEL AT IF, AND THE POWER RANGE AT 0. MEASURE THE POWER AT THE END OF THE P49Q680 8-FT CORD THAT CONNECTS TO THE IF IN JACK OF THE RETURN-LOSS BRIDGE. ADJUST ATTEN 1 FOR A-4 READING ON THE POWER METER.
3. MAKE THE TEST CONNECTIONS USING OPTION (W).
4. SET THE TEST SET CONTROLS AS FOLLOWS:

UNIT	CONTROL	POSITION
CONTROL PANEL	FUNCTION IF SWEEP WIDTH IF CENTER FREQ IF MARKER AMPLITUDE IF MARKER FREQ CTR IF AMPLIFIER GAIN	IF-IF MIDRANGE MIDRANGE MIDRANGE MIDRANGE MARKER FREQ MIDRANGE
SCOPE TIME BASE	POSITION MAGNIFIER SWEEP TIME VERNIER SINGLE-NORMAL	MIDRANGE X10 EXT MIDRANGE NORMAL
SCOPE DIFFERENTIAL AMPLIFIER	POSITION BANDWIDTH AMPLIFIER VERNIER SENSITIVITY AC-DC-OFF(+ INPUT) AC-DC-OFF(- INPUT)	MIDRANGE 4 DC MIDRANGE 10MV/CM DC OFF
POWER METER	INPUT CHANNEL POWER RANGE DBM	IF -5

5. ADJUST THE AMPL GAIN CONTROL ON THE CONTROL PANEL FOR AN INDICATION OF -2 ON THE POWER METER (-7 DBM).
6. CHANGE THE TEST CONNECTIONS TO OPTION (X).
7. ADJUST THE TEST TRACE CONTROL ON THE CONTROL PANEL TO CENTER THE TEST TRACE ON THE OSCILLOSCOPE.
8. ADJUST THE SWEEP TIME AND POSITION CONTROLS ON THE SCOPE TIME BASE UNIT FOR A HORIZONTAL TEST TRACE DISPLAY OF APPROXIMATELY 10 CENTIMETERS.
9. ADJUST THE IF MARKER FREQ CONTROL ON THE CONTROL PANEL FOR A 70±0.1 MHZ INDICATION ON THE COUNTER.
10. ADJUST THE IF SWEEP WIDTH AND IF CENTER FREQ CONTROLS ON THE CONTROL PANEL TO OBTAIN THE OSCILLOSCOPE DISPLAY AS SHOWN.

    NOTE: AN EXTRANEOUS MARKER WILL APPEAR AT 89 MHZ.
11. ADJUST THE REF TRACE CONTROL ON THE CONTROL PANEL TO BRING THE REFERENCE TRACE INTO COINCIDENCE WITH THE TEST TRACE AT 70 MHZ.
12. INCREASE THE ATTENUATION OF ATTEN 2 BY 1 DB. ADJUST THE SENSITIVITY AND POSITION CONTROLS ON THE SCOPE 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 0.5 DB PER CENTIMETER.
13. CONNECT OPTION (Y).
14. SET ATTEN 2 AT 0 DB.

    REQUIREMENT: THE TEST TRACE SHALL BE BELOW THE REFERENCE TRACE BETWEEN 60 AND 80 MHZ.
15. CHANGE OPTION (Y) TO OPTION (Z).
16. ADJUST ATTEN 2 UNTIL THE TEST TRACE AND REFERENCE ARE COINCIDENT. SUBTRACT THE SETTING OF ATTEN 2 FROM 50. THE RESULT IS THE RETURN LOSS IN DB.

CHART 6—IF Return-Loss Test Setup

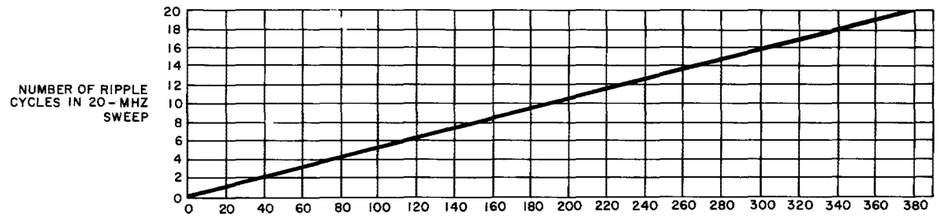
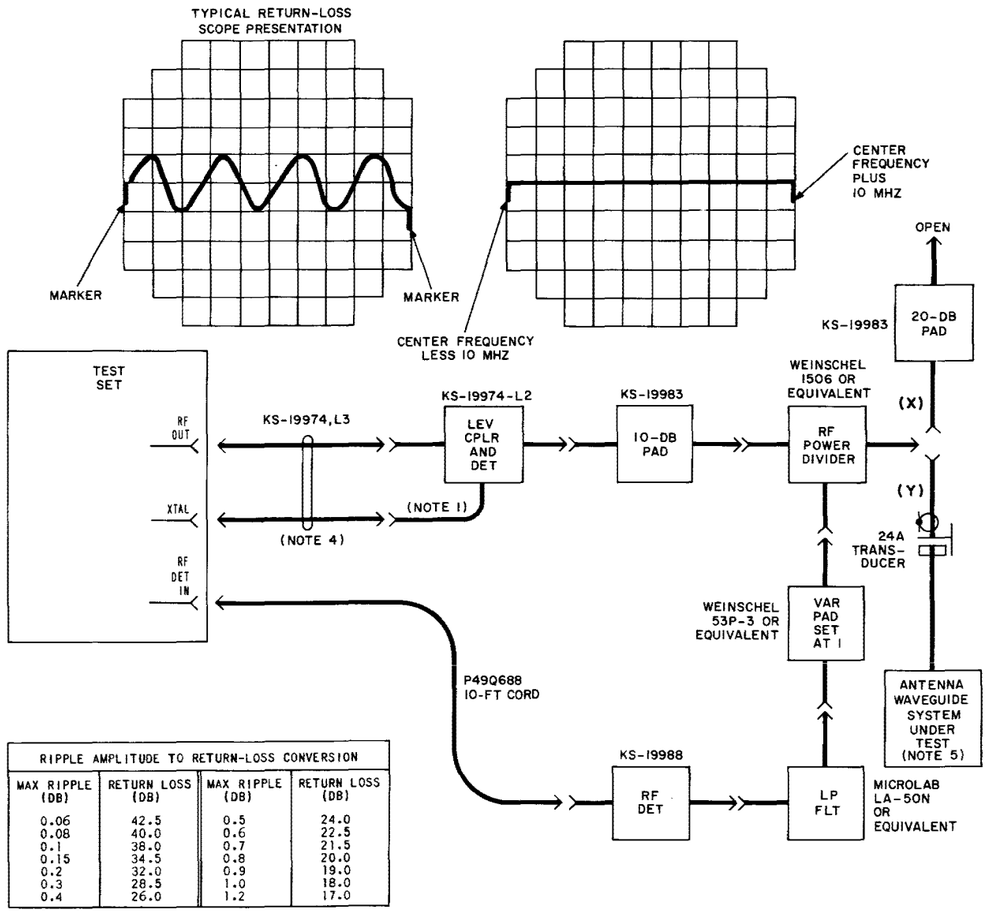


FIG. 1—DISTANCE TO MISMATCH IN FEET



RIPPLE AMPLITUDE TO RETURN-LOSS CONVERSION			
MAX RIPPLE (DB)	RETURN LOSS (DB)	MAX RIPPLE (DB)	RETURN LOSS (DB)
0.06	42.5	0.5	24.0
0.08	40.0	0.6	22.5
0.1	38.0	0.7	21.5
0.15	34.5	0.8	20.0
0.2	32.0	0.9	19.0
0.3	28.5	1.0	18.0
0.4	26.0	1.2	17.0

NOTES:

1. IF A HEWLETT-PACKARD LEVELING COUPLER IS USED, INSERT A MICROLAB LA-50N, OR EQUIVALENT LOW-PASS FILTER IN FRONT OF THE DETECTOR.
2. SOME EARLIER UNITS ARE DESIGNATED CW ±ΔF.
3. ONLY TEST SETS DESIGNATED LIST 1 PROVIDE THE NECESSARY COMPONENTS TO PERFORM THIS TEST. TO UTILIZE TEST SETS ABOVE LIST 1, A WEINSCHEL MODEL 1506 RF POWER DIVIDER MUST BE OBTAINED FROM THE MAINTENANCE CENTER.
4. USE NJ 8505 9-1/4 INCH CONNECTOR PLIERS TO TIGHTEN ALL N-TYPE CONNECTORS.
5. IF THE RETURN-LOSS MEASUREMENT IS TO BE MADE THROUGH A CHANNEL DROPPING NETWORK OF A TRANSMITTER-RECEIVER BAY, REMOVE BANDPASS FILTER FL1 (RECEIVER) OR FL4 (TRANSMITTER) AND CONNECT THE 24A TRANSDUCER TO THE WAVEGUIDE GOING TO THE DROPPING NETWORK.
6. DETAILED INFORMATION ON THE THEORY AND METHOD OF MEASURING THE RETURN LOSS OF THE ANTENNA WAVEGUIDE SYSTEM MAY BE FOUND IN SECTIONS 402-400-100 AND 402-400-501.
7. THE LOSS OF THE WEINSCHEL MODEL 1506 POWER DIVIDER IS ABOUT 6.5 DB. THIS HAS BEEN TAKEN INTO ACCOUNT IN COMPUTING THE RETURN LOSS CORRESPONDING TO EACH RIPPLE AMPLITUDE GIVEN IN FIG. 4. THE 6.5-DB LOSS IN THE DIVIDER CAUSES THE INDICATED RIPPLE AMPLITUDE, AS VIEWED ON THE OSCILLOSCOPE, TO BE ABOUT 0.47 TIMES THE ACTUAL RIPPLE AMPLITUDE IN THE WAVEGUIDE. (RETURN-LOSS VALUES GIVEN IN SECTION 402-400-501 ARE BASED ON 6-DB LOSS IN THE POWER DIVIDER.)

PREPARATION FOR TEST

1. MAKE THE TEST CONNECTIONS USING OPTION (X).
2. SET THE TEST SET CONTROLS AS FOLLOWS:

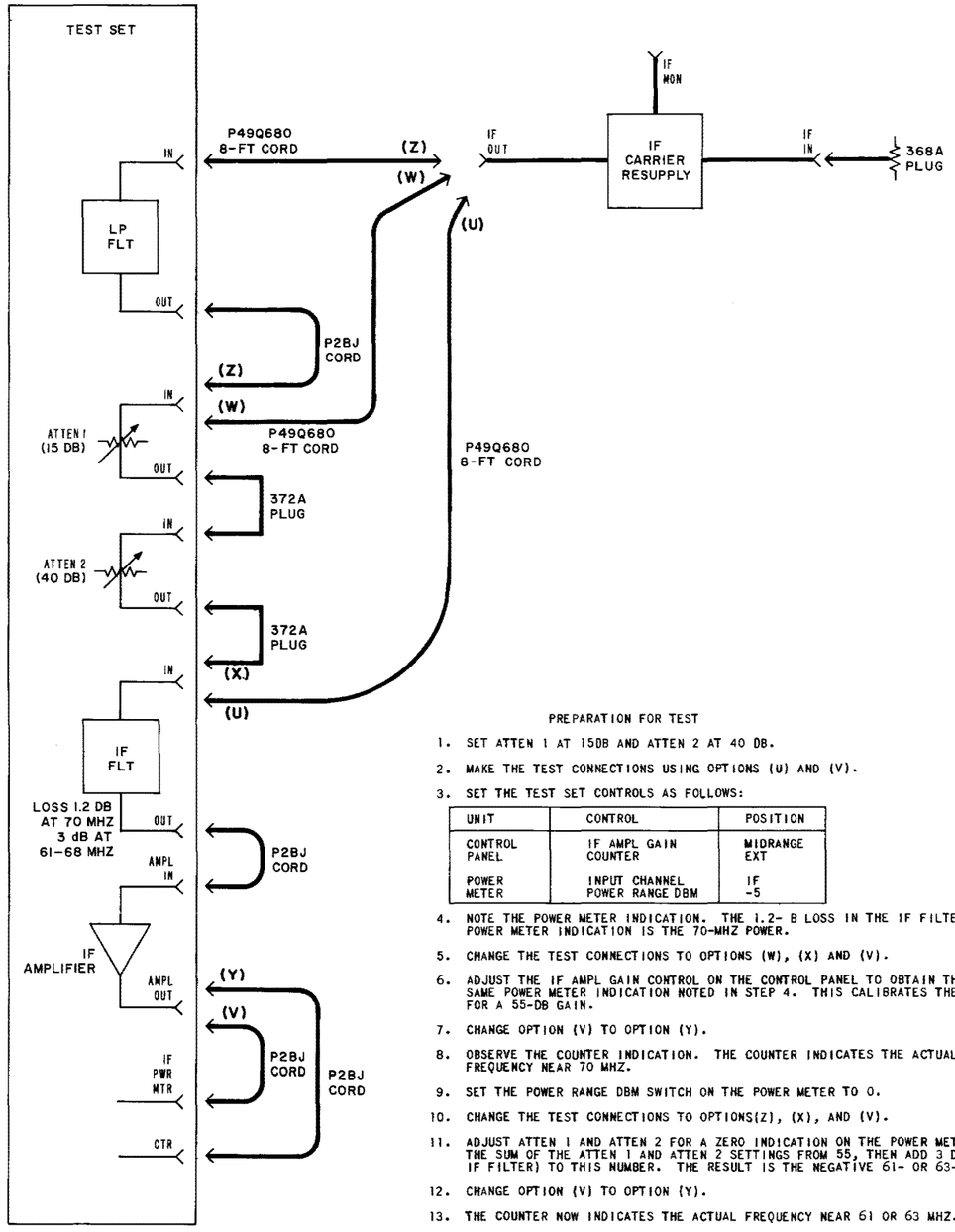
UNIT	CONTROL	POSITION
CONTROL PANEL	FUNCTION	RF-RF
SCOPE TIME BASE	POSITION MAGNIFIER SWEEP TIME VERNIER SINGLE-NORMAL	MIDRANGE X10 EXT MIDRANGE NORMAL
SCOPE DIFFERENTIAL AMPLIFIER	POSITION BANDWIDTH AMPLIFIER VERNIER SENSITIVITY AC-DC-OFF(+ INPUT) AC-DC-OFF(- INPUT)	MIDRANGE 4 DC MIDRANGE 10MV/CM DC OFF
POWER METER	INPUT CHANNEL POWER RANGE DBM	RF +5
ALFRED RF SWEEP OSCILLATOR KS-19974	LINE FUNCTION SWEEP-SELECTOR MARKER AMPLITUDE (IF PROVIDED) CW ΔF	RF ΔF (NOTE 2) MIDRANGE CHANNEL CENTER FREQ 20
HEWLETT-PACKARD RF SWEEP OSCILLATOR KS-19974	LINE SWEEP SELECTOR FUNCTION AMPLITUDE MOD (IF PROVIDED) ALC MARKER AMPL START/CW STOP/ΔF	RF AUTO ΔF MARK 1 & MARK 2 PRESS MIDRANGE CHANNEL CENTER FREQ 20

3. MEASURE THE POWER AT THE OUTPUT OF THE 10-DB PAD. USING THE POWER LEVEL CONTROL ON THE RF OSCILLATOR, OBTAIN A ZERO INDICATION (+5DBM) ON THE POWER METER. RECONNECT THE CIRCUIT.
4. ADJUST THE TEST TRACE CONTROL ON THE CONTROL PANEL TO CENTER THE TEST TRACE ON THE OSCILLOSCOPE. ADJUST THE REF TRACE CONTROL ON THE CONTROL PANEL TO BRING THE REFERENCE TRACE INTO COINCIDENCE WITH THE TEST TRACE.
5. ADJUST THE SWEEP TIME AND POSITION CONTROLS ON THE SCOPE TIME BASE UNIT FOR A HORIZONTAL TEST TRACE DISPLAY OF APPROXIMATELY 10 CENTIMETERS.
6. ADJUST THE CW CONTROL ON THE RF SWEEP OSCILLATOR FOR THE DISIRED FREQUENCY. ADJUST THE ΔF CONTROL FOR A 30-MHZ SWEEP. (IF THE RF OSCILLATOR IS EQUIPPED WITH MARKERS, ADJUST M1 TO THE CENTER FREQUENCY LESS 10 MHZ. ADJUST M2 TO THE CENTER FREQUENCY PLUS 10 MHZ.)
7. ADJUST THE ΔF CONTROL ON THE RF SWEEP OSCILLATOR TO PLACE THE MARKERS AS SHOWN IN FIG. 3.

   NOTE: IT IS IMPORTANT TO LIMIT THE OSCILLATOR SWEEP WIDTH TO ±10 MHZ TO PREVENT INTERFERENCE INTO ADJACENT RADIO CHANNELS WHEN MEASURING THE ANTENNA SYSTEM RETURN LOSS.

8. INCREASE THE ATTENUATION OF THE VARIABLE PAD BY 1 DB. ADJUST THE SENSITIVITY AND POSITION CONTROLS ON THE SCOPE DIFFERENTIAL AMPLIFIER FOR 10 CENTIMETERS DEFLECTION BETWEEN THE TEST TRACE AND THE REFERENCE TRACE. RETURN THE VARIABLE PAD TO ITS PREVIOUS SETTING. THIS CALIBRATES THE OSCILLOSCOPE FOR 0.1 DB PER CENTIMETER.
9. CHANGE THE TEST CONNECTION FROM OPTION (X) TO OPTION (Y). (NOTES 5 AND 6.)
10. DETERMINE THE MAXIMUM RIPPLE AMPLITUDE PRESENT BETWEEN THE TWO END MARKERS. CONVERT THIS RIPPLE AMPLITUDE TO RETURN LOSS BY USING THE CONVERSION CHART IN FIG. 4. (NOTE 7.)
11. DETERMINE THE NUMBER OF RIPPLES PRESENT BETWEEN THE TWO END MARKERS. CONVERT THIS TO FEET BY USING THE GRAPH IN FIG. 1. THIS REPRESENTS THE DISTANCE TO THE MISMATCH IN THE WAVEGUIDE SYSTEM.

CHART 7—Antenna Waveguide System Return-Loss Test Setup



PREPARATION FOR TEST

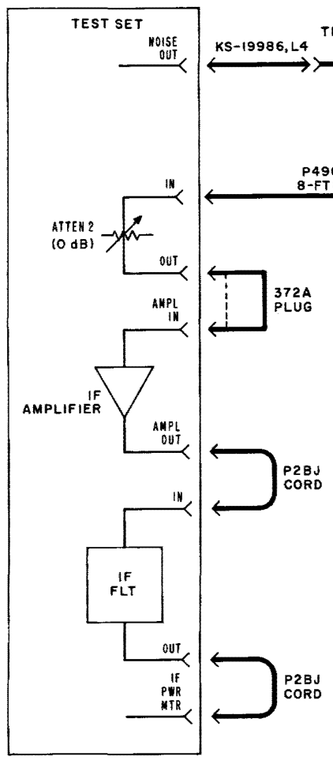
1. SET ATTEN 1 AT 15DB AND ATTEN 2 AT 40 DB.
2. MAKE THE TEST CONNECTIONS USING OPTIONS (U) AND (V).
3. SET THE TEST SET CONTROLS AS FOLLOWS:

UNIT	CONTROL	POSITION
CONTROL PANEL	IF AMPL GAIN COUNTER	MIDRANGE EXT
POWER METER	INPUT CHANNEL POWER RANGE DBM	IF -5

4. NOTE THE POWER METER INDICATION. THE 1.2- B LOSS IN THE IF FILTER PLUS THE POWER METER INDICATION IS THE 70-MHZ POWER.
5. CHANGE THE TEST CONNECTIONS TO OPTIONS (W), (X) AND (V).
6. ADJUST THE IF AMPL GAIN CONTROL ON THE CONTROL PANEL TO OBTAIN THE SAME POWER METER INDICATION NOTED IN STEP 4. THIS CALIBRATES THE IF AMPLIFIER FOR A 55-DB GAIN.
7. CHANGE OPTION (V) TO OPTION (Y).
8. OBSERVE THE COUNTER INDICATION. THE COUNTER INDICATES THE ACTUAL CARRIER FREQUENCY NEAR 70 MHZ.
9. SET THE POWER RANGE DBM SWITCH ON THE POWER METER TO 0.
10. CHANGE THE TEST CONNECTIONS TO OPTIONS(Z), (X), AND (V).
11. ADJUST ATTEN 1 AND ATTEN 2 FOR A ZERO INDICATION ON THE POWER METER. SUBTRACT THE SUM OF THE ATTEN 1 AND ATTEN 2 SETTINGS FROM 55, THEN ADD 3 DB (LOSS IN THE IF FILTER) TO THIS NUMBER. THE RESULT IS THE NEGATIVE 61- OR 63-MH POWER.
12. CHANGE OPTION (V) TO OPTION (Y).
13. THE COUNTER NOW INDICATES THE ACTUAL FREQUENCY NEAR 61 OR 63 MHZ.

CHART 9—IF Carrier Resupply Level and Frequency Test Setup

FIG. 1



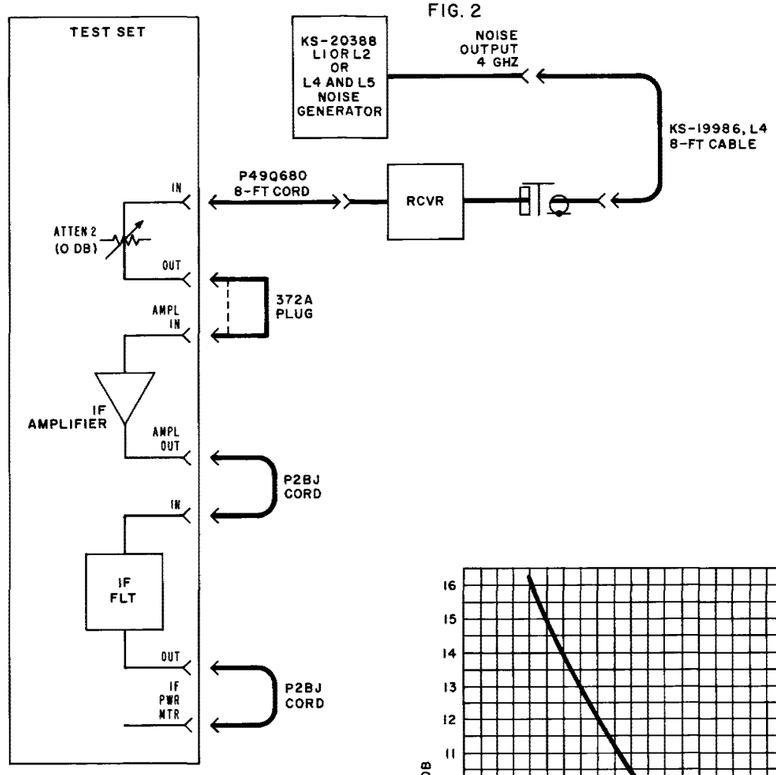
PREPARATION FOR TEST

1. SET ATTEN 2 AT 0 DB.
2. MAKE THE TEST CONNECTIONS AS SHOWN.
3. SET THE TEST SET CONTROLS AS FOLLOWS:

UNIT	CONTROL	POSITION
CONTROL PANEL	NOISE LAMP IF AMPL GAIN	OFF MIDRANGE
POWER METER	INPUT CHANNEL POWER RANGE DBM	IF -10
RF SWEEP OSCILLATOR KS-19974	LINE	OFF

4. ADJUST THE IF AMPL GAIN CONTROL ON THE CONTROL PANEL FOR A ZERO INDICATION ON THE POWER METER (-10 DBM).
5. SET ATTEN 2 TO 10 DB. PRESS THE NOISE LAMP SWITCH ON THE CONTROL PANEL. NOTE THAT THE NOISE LAMP LIGHTS.
6. ADJUST ATTEN 2 FOR A ZERO INDICATION ON THE POWER METER.
7. USING THE GRAPH, CONVERT THE ATTEN 2 SETTING TO THE CORRESPONDING NOISE FIGURE.

FIG. 2



1. REPEAT STEPS 1 THROUGH 4 OF FIG. 1.
2. SET THE ON-OFF SWITCH ON THE NOISE GENERATOR TO ON. SET THE START-STOP SWITCH ON THE NOISE GENERATOR TO START.
3. SET ATTEN 2 TO 10 DB.
4. ADJUST ATTEN 2 FOR A ZERO INDICATION ON THE POWER METER.
5. USING THE GRAPH, CONVERT THE ATTEN 2 SETTING TO THE CORRESPONDING NOISE FIGURE.

NOTE:

PRIOR TO LIST 4, THE TEST SET PROVIDED A BUILD IN NOISE GENERATOR. FOR THESE TEST SETS, EMPLOY THE PROCEDURE OUTLINED IN FIG. 1. ALL TEST SETS DESIGNATED LIST 4 OR HIGHER REQUIRE THE USE OF A PORTABLE NOISE GENERATOR (KS-20388). FOR THESE TESTS, EMPLOY THE PROCEDURE OUTLINED IN FIG. 2.

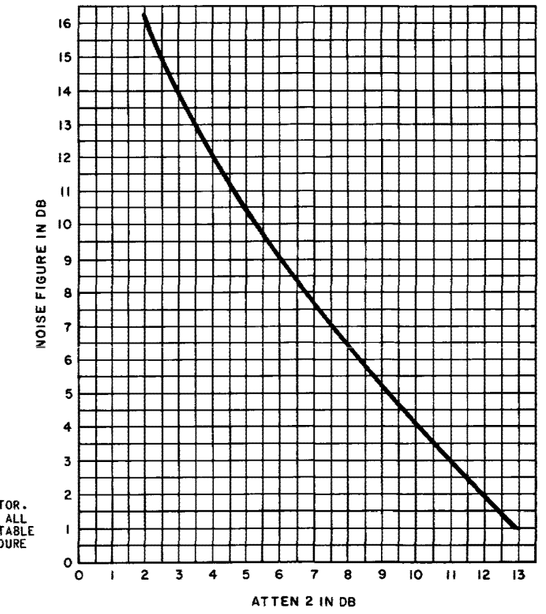


CHART 10—Receiver Noise Figure Measurement Test Setup