PERFORMANCE REQUIREMENTS
FOR THE
J68386A AND B TD-3 TRANSMITTER-RECEIVER BAYS
GENERAL EQUIPMENT REQUIREMENTS
TOLL SYSTEMS

CONTENTS PAGE

1. GENERAL

1.01 This section covers the performance requirements which TD-3 transmitter-receiver bays installed by Western Electric Company and tested with the J68392A test set shall meet before turnover to the customer.

1.02 This section is reissued to provide new testing information covering the following changes in the radio bays:

(a) A change in the control panel designations of the repeater station and main station control unit panel.

(b) The addition of the J68387R microwave generator.

(c) A change in the trip point of the microwave generator alarm.

(d) Removal of the J68387C receiver modulator from the receiver bays.

(e) A change in the 61-MHz level of the carrier resupply.

1.03 Refer to Section 806-630-180 for general requirements.

1.04 The tests shall be performed in the order prescribed.

1.05 The requirements are based upon the use of the following testing equipment:

1 – J68392A Test Set
1 – J68835D Traveling-Wave-Tube (TWT) Power Supply Test Load
1 – KS-14510, List 1 Volt-ohm-milliammeter (VOM)
1 – KS-19983, List 1 10-dB RF Pad
1 – KS-19986 Cable
2 – P-48N179 Cables
1 – P-48N180 Cable
1 – P-48N181 Cable

Note: Information will be made available by the line engineer or operating personnel giving the received carrier power at the drop arm of the receiver channel separation network for any given transmitter-receiver bay.

2. COMMON EQUIPMENT TESTS

A. Preliminary Adjustments

Caution: Before opening any transmitter waveguide joints, check that all circuit breakers on the bay are turned off.

2.01 On the transmitter, remove the 1322-type bandpass filter FL4, between the output directional coupler DC3, and the channel-combining network Z4. Place a shorting plate at the waveguide port on the network and a 522A termination at the output of the coupler.

2.02 Remove the bandpass filter FL1 located between the receiver channel separation network Z1 and isolator A1. Place a shorting plate over the waveguide port on the channel separation network and a waveguide-to-coaxial transducer at the input to isolator A1.

2.03 Before operating the circuit breakers on the bay, check the power connections at the bay terminal strips for the proper polarity with a KS-14510, List 1 VOM.

TERMINAL STRIP	TERMINALS		VOLTAGE
	REPEATER STATION BAY	MAIN STATION BAY	
TS1	1	1	−24*
	2	2	Ground
	5	3 5	−24*
	6	4 6	Ground
	7	7	−24*
	8	8	Ground

* This is the nominal voltage, the range is −21 to −26 volts.

B. Turning On Radio Equipment

2.04 Turn on the following circuit breakers:

CIRCUIT BREAKER	LOCATION
Power	Receiver Control Panel
Power (if equipped)	Transmitter Control Panel
Power	Common Alarm Panel
Input	Inverter and Heater Regulator (TWT power supply)

2.05 Measure the voltage at bay terminal strips as follows:

TERMINAL STRIP	TERMINALS		VOLTAGE
	REPEATER STATION BAY	MAIN STATION BAY	
TS1	1	1	−21 to −26
	2	2	Ground
		3	−21 to −26
		4	Ground
	7	7	−21 to −26
	8	8	Ground

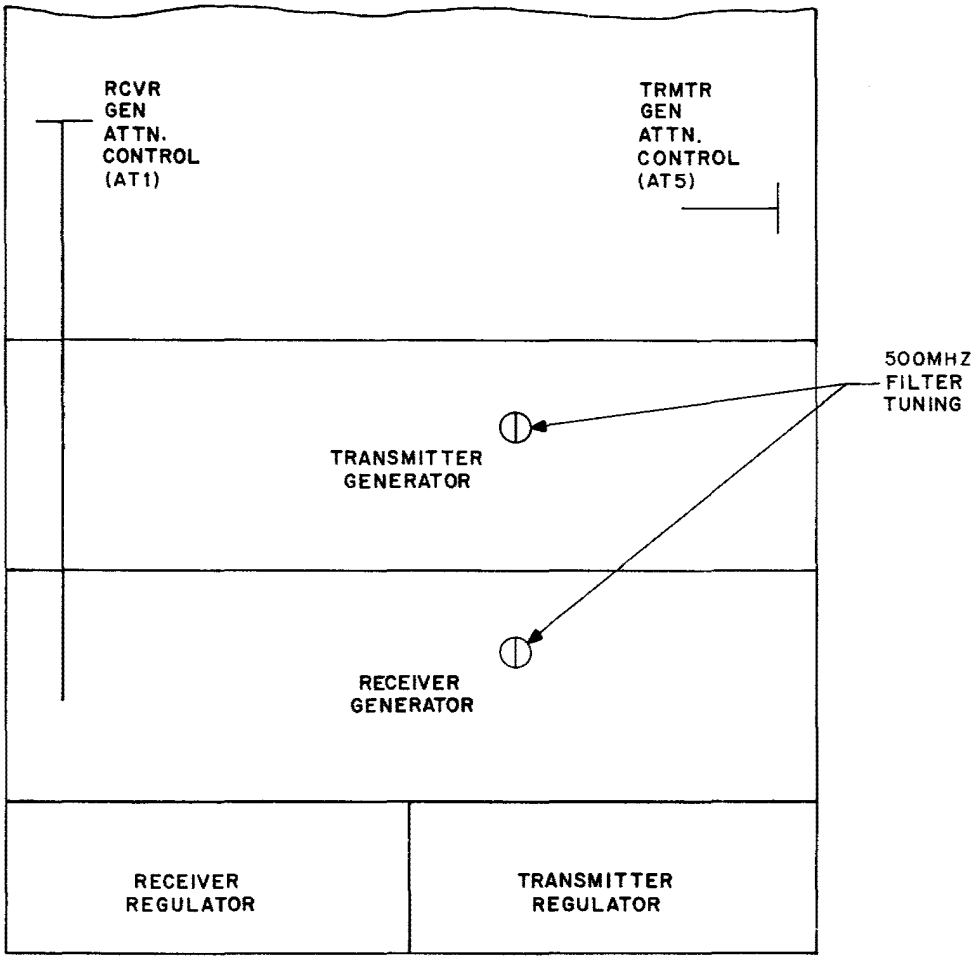

Fig. 1 — Bottom Front of Main Station Bay

2.06 After the pilot light on the front of the TWT power supply extinguishes, measure the voltage at terminals 5 and 6 on TS1. Also, check the cathode current on the TWT power supply and adjust the ANODE VOLTAGE control to obtain a reading of 40 mA, if necessary.

Note: Remove the two plug-in units from the TWT power supply. Locate transformer T5 in the rectifier and helix regulator circuit (right-hand unit). Disconnect the B lead from tap 10 of T5 and connect it to tap 11 of T5. Replace the units in the power supply and turn the INPUT circuit breaker to the ON position.

IF VOLTAGE AT TERMINALS 5 AND 6 ON TS1 IS	REMARKS
Greater than 26 volts	Voltage too high, not acceptable
23 to 26 volts	No change on power supply (leave circuit breaker in ON position)
21 to 23 Volts	Turn INPUT circuit breaker off and see preceding note
Less than 21 volts	Voltage too low, not acceptable

2.07 Operate the −19V CHECK pushbutton(s) on the receiver and/or transmitter control panel(s) and read the appropriate panel meter.

Requirement: The meter shall read on the red line.

If this requirement is not met, adjust the ADJ VOLTS control R17 on the appropriate regulator for a red line reading.

2.08 Using the test set, apply an RF carrier, −28.5 dBm at the channel center frequency, to the transducer connected to isolator A1. Operate the AGC switch to the MANUAL position.

2.09 Operate the MWV GEN OUT pushbutton(s) on the control panel(s) and adjust the appropriate attenuator to obtain the recorded reading.

TABLE A

REPEATER STATION CONTROL UNIT PANEL METER READINGS

(FOR BAYS EQUIPPED WITH J68387B GENERATORS)

PUSHBUTTON DESIGNATION	RECEIVER CONTROL METER UNIT MARKED VALUE	TRANSMITTER CONTROL METER UNIT MARKED VALUE
SHIFT MOD 1	±6 Units	
SHIFT MOD 2	±6 Units	
SHIFT OSC	±2 Units	
RCVR MOD 1	±6 Units	
RCVR MOD 2	±6 Units	
MWV GEN 1	±2 Units	
MWV GEN 2	±2 Units	
MWV GEN 3	±2 Units	
MWV GEN 4	±2 Units	
MWV GEN 5	±2 Units*	
MWV GEN 6	±2 Units*	
MWV GEN 7	±2 Units*	
MWV GEN LF LEV	±2 Units	
MWV GEN OUT	±2 Units	
AGC REF	±2 Units	
RCVD SIG LEV	±2 Units	
CRS 70 MC LEV		±2 Units
CRS 61-63 MC LEV		±2 Units
CRS SWV		±2 Units
TRMTR MOD 1		±2 Units
TRMTR MOD 2		±2 Units
TRMTR OUT		±2 Units

Note: These meter readings are to be used as a guide in determining a trouble condition in the bay. If any gross differences are found, they should be noted, and in the tests to follow, the unit associated with the incorrect reading should be readjusted or replaced if necessary.

*These three readings shall agree with each other within 5 units.

TABLE B REPEATER STATION CONTROL UNIT PANEL METER READINGS (FOR BAYS EQUIPPED WITH J68387R GENERATORS)		
PUSHBUTTON DESIGNATION	RECEIVER CONTROL METER UNIT MARKED VALUE	TRANSMITTER CONTROL METER UNIT MARKED VALUE
SHIFT MOD 1	±6 Units	
SHIFT MOD 2	±6 Units	
SHIFT OSC	±2 Units	
RCVR MOD 1	±6 Units	
MWV GEN 1	±2 Units	
MWV GEN 2	±2 Units	
MWV GEN 3	±2 Units	
MWV CURR MON	±2 Units	
MWV GEN OUT	±2 Units	
AGC REF	±2 Units	
RCVD SIG LEV	±2 Units	
CRS 70 MC LEV		±2 Units
CRS 61-63 MC LEV		±2 Units
CRS SWV		±2 Units
TRMTR MOD 1		±2 Units
TRMTR MOD 2		±2 Units
TRMTR OUT		±2 Units

Note: These meter readings are to be used as a guide in determining a trouble condition in the bay. If any gross differences are found, they should be noted, and in the tests to follow, the unit associated with the incorrect reading should be readjusted or replaced if necessary.

TYPE OF RADIO BAY	ADJUST ATTENUATOR
Repeater and Main Station Receiver	AT1
Main Station Transmitter-Receiver	AT5 and AT1, respectively
Main Station Transmitter	AT5

2.10 Operate the control panel pushbuttons in the sequence shown in Tables A,B,C, and D.

Requirement: The readings shall be within the range indicated.

2.11 Operate the ALARM RESET button on the front of the alarm panel.

Requirement: Both the TRMTR and RCVR ALARM lamps shall extinguish.

If this requirement is not met, check to see whether the trouble appears in the receiver or transmitter by reviewing the meter readings that were just taken.

3. −19 VOLT REGULATOR AND MICROWAVE GENERATOR CHECKS

A. Regulator Alarm Trip Point Check

3.01 When the ALARM lamps are extinguished, set the regulator alarm trip points as follows:

(a) Operate the −19V CHECK button on the control panel. Operate the ADJ VOLTS control on the regulator clockwise until the

TABLE C

MAIN STATION CONTROL UNIT PANEL METER READINGS

(FOR BAYS EQUIPPED WITH J68387B GENERATORS)

PUSHBUTTON DESIGNATION	RECEIVER CONTROL METER UNIT MARKED VALUE	TRANSMITTER CONTROL METER UNIT MARKED VALUE
MWV GEN 1	±2 Units	±2 Units
MWV GEN 2	±2 Units	±2 Units
MWV GEN 3	±2 Units	±2 Units
MWV GEN 4	±2 Units	±2 Units
MWV GEN 5	±2 Units*	±2 Units
MWV GEN 6	±2 Units*	±2 Units
MWV GEN 7	±2 Units*	±2 Units
MWV GEN LF LEV	±2 Units	±2 Units
MWV GEN OUT	±2 Units	±2 Units
SHIFT MOD 1	±6 Units	
SHIFT MOD 2	±6 Units	
SHIFT OSC	±2 Units	
RCVR MOD 1	±6 Units	
RCVR MOD 2	±6 Units	
AGC REF	±2 Units	
RCVD SIG LEV	±2 Units	
CRS 70 MC LEV		±2 Units
CRS 61-63 MC LEV		±2 Units
CRS SWV		±2 Units
TRMTR MOD 1		±2 Units
TRMTR MOD 2		±2 Units
TRMTR OUT		±2 Units

* See note for Table A.

panel meter indicates 74 (see Fig. 1 for main station).

(b) Adjust the HV ALM ADJ control until the ALARM lamp just lights. (For a repeater bay, the RCVR ALARM lamp will light; for a main station bay, the appropriate RCVR or TRMTR lamp will light.)

(c) Operate the ADJ VOLTS control counterclockwise until the panel meter for the 19V CHECK positions reads 66. Adjust the LV ALM ADJ control until the appropriate ALARM lamp just lights as specified in (b).

(d) Depress the ALARM RESET button.

Requirement: The ALARM lamp shall remain lighted.

(e) Restore the −19V CHECK meter reading to the red line with the ADJ VOLTS control.

Requirement: The alarm lamp shall be off with the ALARM RESET button depressed.

B. Microwave Generator Check

Note: For J68387B generators use 3.02 through 3.04, for J68387R generators use 3.05 through 3.07.

TABLE D

MAIN STATION CONTROL UNIT PANEL METER READINGS

(FOR BAYS EQUIPPED WITH J68387R GENERATORS)

PUSHBUTTON DESIGNATION	RECEIVER CONTROL METER UNIT MARKED VALUE	TRANSMITTER CONTROL METER UNIT MARKED VALUE
MWV GEN 1	±2 Units	±2 Units
MWV GEN 2	±2 Units	±2 Units
MWV GEN 3	±2 Units	±2 Units
MWV CURR MON	±2 Units	±2 Units
MWV GEN OUT	±2 Units	±2 Units
SHIFT MOD 1	±6 Units	
SHIFT MOD 2	±6 Units	
SHIFT OSC	±2 Units	
RCVR MOD 1	±6 Units	
AGC REF	±2 Units	
RCVD SIG LEV	±2 Units	
CRS 70 MC LEV		±2 Units
CRS 61-63 MC LEV		±2 Units
CRS SWV		±2 Units
TRMTR MOD 1		±2 Units
TRMTR MOD 2		±2 Units
TRMTR OUT		±2 Units

3.02 With the test set, measure the frequency at the microwave generator FREQ MON jack using the P-49N180 cable.

Requirement: The frequency shall be as specified in Tables E, F, and G.

If this requirement is not met, adjust the FINE FREQ control until the requirement is met.

If the frequency cannot be adjusted to requirements with the FINE FREQ control refer to Part 6 for retuning procedure.

3.03 Measure the microwave generator output power by connecting the 30-dB RF pad, KS-19986, List 4 cable and KS-19987, List 1 adapter between the test set RF POWER MTR jack and plug P19 on the generator.

Requirement: The power meter shall read −5.0 dBm ±0.5 dB for a list 1 or list 1 and 21 generator; and −6.5 dBm ±0.5 dB for a list 1 and 20 or a list 1, 20, and 21 generator.

Note: The list 21 generators may not meet the ±0.5 dB requirement, but the power meter shall read −6.5 dBm or greater.

If this requirement is not met, refer to Part 6.

3.04 Record all microwave generator readings on the control panel.

3.05 With the test set, measure the frequency at the microwave generator FREQ MON jack using the P-48N180 cable.

Requirement: The frequency shall be as specified in Tables E, F, and G.

TABLE E

REPEATER TRANSMITTER-RECEIVER BAY

CHANNEL FREQUENCY		MICROWAVE GENERATOR LOW-FREQUENCY OSCILLATOR	
RECEIVER	TRANSMITTER		
MHz		MHz	±Hz
3730	3770	120.0000	±120
3770	3730	118.7500	±119
3810	3850	122.5000	±122
3850	3810	121.2500	±121
3890*	3930*	120.6250	±121
3930*	3890*	119.3750	±119
3970	4010	123.1250	±123
4010	3970	121.8750	±122
4050	4090	125.6250	±126
4090	4050	124.3750	±124
4130	4170	128.1250	±128
4170	4130	126.8750	±127
3710	3750	119.3750	±119
3750	3710	118.1250	±118
3790	3830	121.8750	±122
3830	3790	120.6250	±121
3870*	3910*	120.0000	±120
3910*	3870*	118.7500	±119
3950	3990	122.5000	±122
3990	3950	121.2500	±121
4030	4070	125.0000	±125
4070	4030	123.7500	±124
4110	4150	127.5000	±128
4150	4110	126.2500	±126

*Since these frequencies were changed on a class B basis, some early bays will have the following generator frequencies.

CHANNEL FREQUENCY		J68387B MICROWAVE GENERATOR LOW-FREQUENCY OSCILLATOR	
RECEIVER	TRANSMITTER		
MHz		MHz	±Hz
3890	3930	125.0000	±125
3930	3890	123.7500	±124
3870	3910	124.3750	±124
3910	3870	123.1250	±123

TABLE F

MAIN STATION TRANSMITTER

TRANSMITTER CHANNEL FREQUENCY	MICROWAVE GENERATOR LOW-FREQUENCY OSCILLATOR	
MHz	MHz	±HZ
3770	120.0000	±120
3730	118.7500	±119
3850	122.5000	±122
3810	121.2500	±121
3930*	120.6250	±121*
3890*	119.3750	±119*
4010	123.1250	±123
3970	121.8750	±122
4090	125.6250	±126
4050	124.3750	±124
4170	128.1250	±128
4130	126.8750	±127
3750	119.3750	±119
3710	118.1250	±118
3830	121.8750	±122
3790	120.6250	±121
3910*	120.0000	±120*
3870*	118.7500	±119*
3990	122.5000	±122
3950	121.2500	±121
4070	125.0000	±125
4030	123.7500	±124
4150	127.5000	±128
4110	126.2500	±126

*Since these frequencies were changed on a class B basis, some early bays will have the following generator frequencies.

TRANSMITTER CHANNEL FREQUENCY	J68387B MICROWAVE GENERATOR LOW-FREQUENCY OSCILLATOR	
MHz	MHz	±Hz
3890	123.7500	±124
3930	125.0000	±125
3870	123.1250	±123
3910	124.3750	±124

If this requirement is not met, adjust the FREQ ADJ control until the requirement is met.

If the frequency cannot be adjusted to requirements with the FREQ ADJ control, refer to Part 7 for retuning procedure.

TABLE G

MAIN STATION RECEIVER

RECEIVER CHANNEL FREQUENCY	MICROWAVE GENERATOR LOW-FREQUENCY OSCILLATOR FOR BAYS NOT EQUIPPED WITH A SHIFT MODULATOR	
MHz	MHz	±Hz
3730	118.7500	±119
3770	120.0000	±120
3810	121.2500	±121
3850	122.5000	±122
3890	119.3750	±119
3930	120.6250	±121
3970	121.8750	±122
4010	123.1250	±123
4050	124.3750	±124
4090	125.6250	±126
4130	126.8750	±127
4170	128.1250	±128
3710	118.1250	±118
3750	119.3750	±119
3790	120.6250	±121
3830	121.8750	±122
3870	118.7500	±119
3910	120.0000	±120
3950	121.2500	±121
3990	122.5000	±122
4030	123.7500	±124
4070	125.0000	±125
4110	126.2500	±126
4150	127.5000	±128

3.06 Measure the microwave generator output power by connecting the 30-dB RF pad, KS-19986, List 4 cable and KS-19987, List 1 adapter between the test set RF POWER MTR jack and plug P16 on the generator.

Requirement: The power meter shall read greater than −5.0 dBm.

If this requirement is not met, refer to Part 7.

3.07 Record all microwave generator readings on the control panel.

C. Repeater Station Microwave Generator Alarm Check

3.08 Operate the ALARM RESET button on the front of the alarm circuit in order to reset the alarm Sensitrols. Adjust attenuator AT1 to obtain the recorded reading for MWV GEN OUT position.

3.09 Remove the 61A detector MON 1 from directional coupler DC2 and measure the power at this point.

Requirement: The power shall read +20.6 dBm ±0.2 dB minus the calibrated coupling loss of DC2 at the frequency nearest the microwave generator frequency.

If this requirement is met, reconnect the detector.

If this requirement is not met, the adjustment procedure in Part 3, E. Microwave Generator Alarm Adjustment, should be followed.

D. Main Station Microwave Generator Alarm Check

3.10 Operate the ALARM RESET button on the front of the alarm circuit in order to reset the alarm Sensitrols. Adjust attenuator AT1 and/or AT5 to obtain the recorded reading(s) for the MWV GEN OUT position(s).

3.11 Remove the 61A detector(s) from their respective directional couplers DC1 and DC2 and measure the powers at these points.

Requirement: The power shall be +20.6 dBm ±0.2 dB for the transmitter and receiver minus the coupling loss of the coupler.

If this requirement is met, reconnect the detector(s).

If this requirement is not met, the procedure in Part 3, E. Microwave Generator Alarm Adjustment, should be followed.

E. Microwave Generator Alarm Adjustment

Note: Perform only if 3.09 or 3.11 is not met.

3.12 Remove the 61A detector from its associated directional coupler and connect the test set power meter. Adjust the attenuator associated with the detector in question (repeater station, AT1 for MON 1; main station, AT1 for MON 1, and AT5 for MON 2) for +18.6 dBm minus the calibrated coupling loss of DC1 or DC2.

3.13 Remove the power meter and reconnect the detector. Release the MWV GEN OUT pushbutton on the control panel by operating another pushbutton. Adjust the MWV GEN ALM SET control (on the rear of the control panel) until the associated Sensitrol just trips as determined visually.

3.14 Remove the detector and reconnect the power meter and adjust the appropriate attenuator to obtain +20.6 dBm minus the calibrated coupling loss of DC1 or DC2.

3.15 Press the MWV GEN OUT pushbutton on the front of the control panel, press the ALARM RESET button, and record in pencil the front panel meter reading(s) in the space provided.

4. RECEIVER TESTS

A. Shift Modulator Check

4.01 Measure the frequency and level of the shift oscillator at the OSC MON jack. For level measurements, use the P-49Q680 8-foot cable and 10-dB pad ahead of the IF power meter.

Requirement: The frequency shall be 40 MHz ±400 Hz and the level shall be −2.5 dBm ±0.4 dB (the corresponding power meter reading shall be −12.5 ±0.4 dB).

If this requirement is not met, turn the LEV control fully clockwise. Adjust the OSC TUN and AMPL TUN controls for maximum power output. Adjust the FREQ ADJ control for 40 MHz ±20 Hz. Adjust the LEV control for −2.5 dBm. Repeat the frequency adjustment. Replace the 368A termination in the OSC MON jack, and adjust the CAL control for a reading of 50 on the panel meter in the SHIFT OSC position. Record SHIFT MOD 1 and SHIFT MOD 2 readings.

B. IF Amplifier and AGC Amplifier Check

4.02 Prepare the test set for IF-to-IF amplitude response measurements. Adjust the test set IF DET SLOPE control for flat response using two P-49Q680 cables and a P-49Q681 cable at a −7.0 dBm level. With the AGC switch on MANUAL, adjust the MANUAL GAIN control for a meter reading of 70 on position AGC REF. Insert the 70-MHz IF signal at the IF AMP IF IN jack at −8.0 dBm for a bay containing the J68387P unbalanced modulator. Adjust the MANUAL GAIN control to obtain +1 dBm at the IF OUT jack of the IF main amplifier or −7 dBm at the output of the 8-dB pad.

4.03 Check the amplitude response between the IF AMP IF IN jack and the IF AMP IF OUT jack over the 60- to 80-MHz band.

Requirement: The response shall be flat to within 0.01 dB from 60 to 80 MHz.

If this requirement is not met, adjust SLOPE 1, SLOPE 2, and MAN GAIN, as required.

4.04 Change the input signal to −43 dBm at 70 MHz. Adjust the MANUAL GAIN control fully counterclockwise; then adjust the AGC RANGE control to obtain +1.0 dBm at the IF OUT jack.

4.05 Repeat the amplitude response test over the 60- to 80-MHz band.

Note: Recalibrate the oscilloscope for 0.1 dB per cm for the remaining tests in 4.05 through 4.13.

Requirement: The response shall be flat to within 0.5 dB over the 60- to 80-MHz band.

4.06 Adjust the MAN GAIN control clockwise for a reading of approximately 70 in the AGC REF position. Restore the input power to the level indicated in 4.02, and trim the MAN GAIN control for +1.0 dBm output at 70 MHz. Record the AGC REF reading on the front panel.

4.07 Operate the AGC switch to AGC, and with a single-frequency 70-MHz signal at the IF AMP IF IN jack, adjust the IF LEV control for +1.0 dBm output using the proper input of −8 dBm, as indicated in 4.02.

4.08 With a 60- to 80-MHz swept signal at the level used in 4.07, observe the AGC filter characteristic on the oscilloscope.

Requirement: The AGC filter characteristic shall be symmetrical and centered about 70 MHz with the 64- and 76-MHz points at equal levels, and within 1.5 dB of the 70-MHz level.

If this requirement is not met, adjust C6 and C7. Recheck the level as in 4.07.

4.09 With a single-frequency 70-MHz signal at −8 dBm as in 4.02, adjust the RCVD SIG LEV ADJ control for a meter reading of 70 for position RCVD SIG LEV.

4.10 Reduce the input to −43 dBm at 70 MHz, and check that the output is +1.0 dBm ±0.2 dB.

4.11 Operate the AGC switch to the MANUAL position. The output should be at +1 dBm at the IF OUT jack.

4.12 Reconnect jack J2 of the 747A filter to the IF AMP IF IN jack, using the bay cable provided. Insert a 70-MHz −8 dBm signal as in 4.02, at jack J1 of the 745A filter, and measure the power at the IF MAIN AMP IF OUT jack.

Requirement: The power shall be +1.0 dBm ±1 dB.

4.13 Replace the 747A filter, equalizer EQ2, and 745A filter with an 8-dB pad between the IF preamplifier IF OUT jack and the IF main amplifier IF IN jack.

C. Receiver Modulator Check

4.14 It is necessary to know the received signal level before performing the following tests. The normal level should lie between −28.5 and −22 dBm. Levels above −22 dBm should not be encountered since SD-50575-01 specifies waveguide pads to prevent the received signal level from exceeding −22 dBm. If levels below −28.5 dBm are found, the GAIN or LEVEL control (depending on the modulator) should be adjusted for the correct output if possible; or if not, adjust for maximum output.

4.15 ***Repeater Station Receivers:*** Measure the power at DC6 and adjust attenuator AT2 for +6.3 dBm minus the calibrated loss of DC6.

4.16 ***Main Station Receivers:*** Adjust attenuator AT1 for the MWV GEN OUT meter reading.

4.17 Operate the RCVR MOD 1 pushbutton and adjust the DIODE BIAS control to obtain the following meter reading. The meter reading is the REF BIAS number, stamped on the modulator, corrected as shown in Table H.

4.18 Set the RF sweeper at the channel receiver frequency (single frequency) and at a level which is the normal received signal level at the drop arm of the channel separation network Z1 decreased by 0.5 dB. With the bay prepared as in 2.02, insert the signal at the transducer connected to isolator A1. Adjust the LEVEL control on the IF PREAMP for +1 dBm at the IF AMP IF OUT jack.

4.19 Adjust the test set IF detector for flat response at −7 dBm on IF-to-IF transmission using two P-48Q680 cables. Connect one cable from the IF main amplifier IF OUT jack to ATTEN 2 IN (set for 8 dB) and a 372A patch plug from ATTEN 2 OUT to the IF DET IN jack. Adjust the RF sweeper for a ±10 MHz

sweep about the channel center frequency and measure the RF-to-IF amplitude response.

TABLE H	
BO FREQUENCY MHz	ACTUAL METER READING
3780	REF BIAS +7.0
3800	REF BIAS +6.0
3820	REF BIAS +5.0
3840	REF BIAS +4.0
3860	REF BIAS +3.0
3880	REF BIAS +2.0
3900	REF BIAS +1.5
3920	REF BIAS +0.5
3940	REF BIAS +0
3960	REF BIAS −1.0
3980	REF BIAS −2.0
4000	REF BIAS −3.0
4020	REF BIAS −4.0
4040	REF BIAS −5.0
4060	REF BIAS −6.0
4080	REF BIAS −7.0
4100	REF BIAS −8.0
4120	REF BIAS −9.0

Requirement: The amplitude response shall be flat to within 0.03 dB over the 70 ±6 MHz band and flat to within 0.05 dB over the 70 ±10 MHz band.

If this requirement is not met, adjust the SHAPE, SLOPE, and LEVEL controls for the proper amplitude response while keeping the output of the IF main amplifier at +1.0 dBm.

D. AM Noise Figure

4.20 If trouble was experienced with the receiver modulator which resulted in diode changes, modulator or preamplifier replacement, a noise figure test is necessary.

4.21 Early J68392A test sets incorporated a noise figure test facility and the test method is described in Section 104-415-300. A portable noise generator, the KS-20388, can also be used for this purpose and the test instructions are also in Section 104-415-300.

4.22 The noise figure shall be measured at the input to the bandpass filter FL1, with the IF signal taken from the IF OUT jack of the IF main amplifier.

Requirement: The maximum noise figure shall be 8.5 dB for bays containing the J68387P modulator.

Caution: Turn the RF sweep oscillator to STANDBY or OFF during this test.

5. TRANSMITTER TESTS

A. IF Limiter—Carrier Resupply Amplitude Response Check

5.01 Connect the IF sweeper, adjusted for a 60- to 80-MHz sweep at a level of −7.0 dBm, to the IF DET IN jack through two P-49Q680 cables. Adjust the IF DET SLOPE control for flat response at −7.0 dBm as detailed in Section 104-415-300. Connect one cable between the test set jack IF DET IN and the IF OUT jack of the carrier resupply. Connect the sweeper output at −7.0 dBm to the IF IN jack on the limiter and measure the amplitude response.

Requirement: The amplitude response shall be flat to within 0.03 dB over the 60- to 80-MHz band with an output level of −7.0 dBm ±0.15 dB at 70 MHz

If this requirement is not met, adjust the IF limiter SLOPE 1, SLOPE 2, and GAIN controls.

5.02 Adjust the IF sweeper to deliver a level of −17.0 dBm at 70 MHz.

Requirement: The output level shall not be less than −10 dBm at 70 MHz.

B. Carrier Resupply Check

5.03 Check the frequency option of the carrier resupply circuit by observing the frequency marking appearing in the window at the front of the unit.

Requirement: For regular channels, the marking shall indicate 61 MHz, and for protection channels, the marking shall indicate 63 MHz.

Note: If the frequency should have to be changed, remove the left cover and change the plug position on the oscillator board and the window indicator to show the new frequency.

5.04 Measure the level and frequency of the 70-MHz and of the 61- or 63-MHz signals as shown in Section 104-415-300.

Requirement: The level and frequency shall be:

OUTPUT	LEVEL		FREQUENCY	
MHz	dBm	±dB	MHz	±kHz
70	−7.0	0.2	70	4.0
61	−42.0	0.2	61	4.0
63	−35.0	0.2	63	4.0

5.05 Measure the trip and restore points using the procedure specified in Section 104-415-300.

Requirement: The trip and restore point shall be as follows with a tolerance of ±0.2 dB.

BAY CONTAINS	TRIP	RESTORE
J68387P Unbalanced Modulator	−23.0	−21.0

If this requirement is not met, adjust the TRIP and RESTORE controls.

5.06 Reconnect the cable from the IF OUT jack of the carrier resupply to the IF IN jack of the transmitter modulator.

5.07 Reduce the sweep to zero and set the frequency and level for 70 MHz, −7.0 dBm. Check and record the meter readings for the 70 MC LEV, 61-63 MC LEV, and CRS SW V positions on the receiver control panel.

Requirement: At the 70 MC LEV and 61-63 MC LEV positions, 60 ±5 units, and at the CRS SW V position, 60 ±15 units.

If this requirement is not met, remove the carrier resupply cover on the side nearest the power connector. Adjust R38 (70 MHz) or R21 (61-63 MHz) for an indication on the panel meter.

5.08 Operate the ALARM RESET pushbutton on the alarm panel.

Requirement: The TRMTR LAMP shall extinguish.

5.09 Remove the signal from the limiter IF IN jack.

Requirement: Approximately 45 ±3 seconds later, the TRMTR ALARM lamp shall light.

If this requirement is not met, adjust the DELAY control.

C. Transmitter Modulator Check

5.10 Insert a 70-MHz, −7.0 dBm signal at the IF limiter IF IN jack.

5.11 Using the test set RF power meter, measure the level at the output of AT3 at a repeater station or AT4 at a main station. Set AT3 or AT4 at minimum attenuation.

Note: Since this level can be greater than +10 dBm, use a 10-dB pad at the power meter input.

Requirement: The level shall be greater than +8.0 dBm and less than or equal to +14.0 dBm.

5.12 Set AT3 or AT4 for 0 dBm at the output of attenuator AT3 or AT4.

5.13 With the test set adjusted for IF-to-RF response, connect the IF sweep oscillator using ±10 MHz sweep at −7.0 dBm level to the limiter IF IN jack. Connect the test set RF detector to the output of AT3 or AT4 as in 5.11.

Requirement: The response shall be flat to within 0.05 dB at ±10 MHz about the channel center frequency.

If this requirement is not met, adjust the HIGH SLOPE, LOW SLOPE, and GAIN controls.

Note: For channels 1, 2, 7, and 8, the ***left*** half of the oscilloscope trace represents frequencies ***above*** the RF channel frequency. For channels 4, 5, 6, 10, 11, 12, 3, and 9, the ***left*** half of the oscilloscope trace represents frequencies ***below*** the RF channel frequency. (Early bays had channels 3 and 9 grouped with channels 1, 2, 7, and 8.)

5.14 Check the level at AT3 or AT4 with the attenuator set at minimum, if either AT3 or AT4 was adjusted in 5.13.

Requirement: The level shall be greater than +8.0 dBm and less than or equal to +14.0 dBm with a 70-MHz, −7.0 dBm signal into the limiter.

If this requirement is met, set the attenuator for maximum loss and proceed to 5.18.

If this requirement is not met, it will be necessary to adjust the diode tuning as follows in 5.15 through 5.17.

5.15 Perform this only if 5.14 is not met. Insert a 70-MHz, −7.0 dBm signal at the modulator IF IN jack; disconnect and remove isolator A6 at a repeater station, or A7 at a main station, and the flexible waveguide. Connect the power meter to the output of attenuator AT3 at a repeater station or AT4 at a main station and set the attenuator for half attenuation. Adjust the tuning screws on the modulator diode holders Z1 and Z2 for maximum power output.

Note: For those diode holders with two tuning screws, the screw positions after adjustment shall be approximately equal.

5.16 Disconnect the bandpass filter FL4 and attenuator AT3 or AT4 from isolator A5 and connect the 1331A tunable filter and power meter to the output of isolator A5. Remove the 70-MHz signal and tune the filter for maximum power output.

Note: If there is insufficient signal to allow for filter tuning, remove diode holder Z1, tune the 1331A filter for maximum power output, and then replace Z1. Reconnect the 70-MHz signal, then adjust the tuning screw on Z1 for minimum power output.

Requirement: The power shall be less than −(5 plus the 1331A loss) dBm.

5.17 Remove the 1331A filter and reconnect the bandpass filter FL4 and attenuator AT3 or AT4. Repeat the transmission measurements in 5.13 and 5.14.

5.18 Record the TRMTR MOD 1 and TRMTR MOD 2 front panel readings.

Requirement: They shall be between 0 and 35.

D. Traveling-wave-tube Check

5.19 Reconnect the waveguide to tuner Z2 and connect the power meter to directional coupler DC3. Set the IF sweeper for CW at 70 MHz, at a level of −7.0 dBm and connect to the limiter input. Adjust attenuator AT3 or AT4 for +37.5 dBm less the calibrated coupling loss of DC3 at DC3. Measure the amplitude response from IF limiter input to DC3 output.

Requirement: Over the ±6 MHz band the response shall be flat to within 0.05 dB; however, the limit can be relaxed linearly from 6 to 10 MHz so that at 10 MHz it is 0.09 dB.

If this requirement is met, proceed to 5.23.

If this requirement is not met, proceed to 5.20.

5.20 Adjust the HELIX ADJUST control on the TWT power supply for maximum power output while simultaneously adjusting the ANODE VOLTAGE ADJUST control to keep the CATHODE CURRENT meter at 40 mA. Adjust the input and output tuners Z2 and Z3 for maximum power output.

5.21 Readjust attenuator AT3 or AT4 to obtain +37.5 dBm minus the coupling loss of DC3 at the output of DC3. Check the amplitude response.

Requirement: The amplitude response shall be flat to within 0.2 dB over the ±10 MHz band. The HELIX CURRENT shall be less than or equal to 1.5 mA.

Note: If trouble is experienced, refer to Part 8 for TWT power supply tests.

5.22 Adjust the output tuner Z3 for maximum transmission flatness without dropping more than 1 dB in output power.

Requirement: Over the ±6 MHz band the response shall be flat to within 0.06 dB; however, the limit can be relaxed linearly from 6 to 10 MHz so that at 10 MHz it is 0.09 dB.

5.23 Apply a 70-MHz signal at −7.0 dBm to the limiter IF IN jack. Adjust attenuator AT3 or AT4 for +37.5 dBm minus the DC3 coupling loss at the output of DC3.

E. Transmitter Output Alarm Check

5.24 Operate the ALARM RESET button on the alarm panel.

Requirement: The TRMTR ALARM lamp shall extinguish.

5.25 Increase the attenuation of AT3 or AT4 until the TRMTR ALARM lamp lights. Remove the detector from directional coupler DC3 and connect the power meter.

Requirement: The level shall be 3.0 ±0.5 dB lower than the level in 5.22.

If this requirement is not met, adjust the level for 3.0 dB down and reconnect the detector. Adjust the TRMTR OUT ALM SET control to cause the Sensitrol to just trip. Reconnect the power meter and restore the level to that of 5.22. Reconnect the detector.

5.26 Restore the level at DC3 to that required in 5.22, and record the meter reading for the TRMTR OUT position on the panel meter.

5.27 Restore all connections to normal; ie, waveguide, filters, DADE cable, pads, clamps, etc.

6. J68387B MICROWAVE GENERATOR TUNING PROCEDURE

Note: This part is to be used only if indicated by tests specified in Part 3.

6.01 This procedure can be used for retuning a generator or for tuning a spare generator. The J68387B, List 1 microwave generator consists of common equipment. Lists 2 through 19 consist of the frequency-determining crystals and the ED-50442-( ) W1 spacers. Table I shows the list numbers, corresponding generator and crystal frequencies, and spacer group numbers.

TABLE I

LIST NO.	GENERATOR FREQUENCY MHz	W1 SPACER ED-50442-( ), GROUP	CRYSTAL FREQUENCY MHz
2	3780	1	118.1250
3	3800	1	118.7500
4	3820	1	119.3750
5	3840	1	120.0000
6	3860	1	120.6250
7	3880	2	121.2500
8	3900	2	121.8750
9	3920	2	122.5000
10	3940	2	123.1250
11	3960	2	123.7500
12	3980	2	124.3750
13	4000	2	125.0000
14	4020	2	125.6250
15	4040	2 or 3	126.2500
16	4060	3	126.8750
17	4080	3	127.5000
18	4100	3	128.1250
19	4120	3	128.7500

6.02 Later version generators are labeled list 1 and 20 or list 1, 20, and 21. The list 20 is the same as list 1 except adjusted for an output of +25.0 dBm and is identified by a label "This generator is tuned for +25.0 dBm output". The list 21 generator has a modified low-frequency oscillator unit which affects some of the adjustments. This results in four versions of microwave generators, and each is covered below.

A. Power

6.03 Power is applied to the generator by using the P-49Q684 4-foot extension cable supplied with the J68392A test set connected to a spare radio bay or the bay for which the generator is intended.

B. Oscillator Tuning

6.04 Insert crystal, lists 2 through 19, into the crystal socket. Adjust capacitors C5, C7, and C9 for maximum power at jack J1, using a 10-dB RF pad, power meter, and KS-19986, List 4 cable. Use the following values for the loss introduced by the cable:

FREQUENCY	LOSS
MHz	dB
125	0.2
500	0.4
1000	0.6
4000	1.5

Requirement: The level shall be at least +10 dBm at jack J1.

6.05 Measure the frequency at jack J1.

Requirement: The frequency shall be within ±1000 Hz of the crystal frequency.

C. Amplifier Tuning

6.06 Connect the INPUT port of the Narda 3060-20 directional coupler to J1 of the microwave generator.

6.07 Connect the −20 dB port of the directional coupler to the ATTEN 2 jack of the test set.

6.08 Set ATTEN 2 to 30 dB.

6.09 Connect the ATTEN OUT jack to the AMP IN jack.

6.10 Connect the AMP OUT jack to the IF PWR MTR jack.

6.11 Set the RANGE switch on the power meter to 0 DBM.

6.12 Terminate the OUTPUT port of the directional coupler with a 10-dB RF pad.

6.13 Adjust R23 on the list 1 or list 1 and 20 generator fully clockwise.

6.14 Adjust the AMP GAIN control for 0-dBm reading on the power meter.

6.15 Remove the 10-dB pad from the coupler OUTPUT, connect the OUTPUT of the coupler to jack J1 of the generator, and the INPUT of the coupler to jack J2 of the generator.

6.16 Adjust capacitors C10 and C11 for minimum power on the power meter (at least 20 dB below the previous readings) and adjust capacitors C19, C21, C30, C31, C37, C38, C39, C40, C50, and C51 for maximum power output at plug P5 using the 2288 (16-watt, 40-dB) Weinschel pad at the input to the power meter. Capacitor C30 is only on list 21 generators.

Requirement: The minimum power output shall be:

GENERATOR	MINIMUM POWER OUTPUT
List 1	+40 dBm
List 1 and 20	+38 dBm
List 1, 20, and 21	+40 dBm
List 1 and 21	+40 dBm

6.17 Remove the directional coupler and replace the coaxial jumper between J1 and J2.

6.18 Measure the frequency at the FREQ MON jack J4 using the P-48N180 cable, and adjust capacitor FINE FREQ to bring the frequency to within 10 Hz of the crystal frequency.

6.19 Reduce the output power to the level shown with the appropriate control.

GENERATOR	CONTROL AND DIRECTION	OUTPUT POWER
List 1	R23 CCW	+38.5 dBm
List 1 and 20	R23 CCW	+36.5 dBm
List 1, 20, and 21	C31 CW	+40 dBm
List 1 and 21	C31 CW	+40 dBm

6.20 Peak the output power by adjusting capacitors C12, C21, C31, C37, C50, and C51 for the list 1 and 20 generators; list 21 generators have an additional capacitor, C30. Adjust capacitors C38, C39, and C40 to balance the currents to within five divisions as indicated by the control panel meter on the MWV GEN 5, MWV GEN 6, and MWV GEN 7 positions.

D. 125- to 500-MHz Multiplier Tuning

6.21 Connect plug P5 to filter FL1.

6.22 Adjust capacitors C54, C55, and C56 for maximum power output at port 2 of AT1.

Note: Disregard tuning combinations that give a maximum power lower than +30 for a list 1 or list 1 and 21 generator or +28.5 dBm for a list 1 and 20 generator. Use the first maximum when tuning C56 from its maximum clockwise position.

E. 500-MHz Filter Tuning

6.23 Connect P8 to AT1.

6.24 Measure the power at port 2 of AT2.

6.25 Set the FINE tuning control, screwdriver adjustment, to midrange and adjust the COARSE control, black knob, on the filter for maximum power output.

F. 500- to 1000-MHz Multiplier Circuit

6.26 Connect P12 to AT2.

6.27 Measure the level at the OUTPUT port of AT3 and adjust C57 and C58 for maximum power. Disregard tuning combinations that give an output less than +27 dBm for the list 1, or list 1 and 21, or list 1, 20, and 21 generators; or +25.5 for a list 1 and 20 generator.

G. 1000- to 4000-MHz Multiplier Circuit

6.28 Connect P16 to AT3 and insert the appropriate W1 spacer (see Table I) between filter FL6 and jack J9.

6.29 Measure the levels at the OUTPUT plug P19 and adjust the three controls for maximum power output. Disregard tuning combinations that result in outputs less than +25 dBm for list 1, or list 1 and 21, or list 1, 20, and 21 generators; or +23.5 for list 1 and 20 generators.

Requirement: The output shall be at least:

GENERATOR	OUTPUT
List 1	+26 dBm
List 1 and 20	+24.5 dBm
List 1, 20, and 21	+26.5 dBm
List 1 and 21	+26.5 dBm

H. Final Adjustment

6.30 ***For List 1 Generators:*** Repeak all multiplier controls and the 734A filter, and adjust R23 to obtain +26.5 dBm at P19.

6.31 ***For List 1 and 20 Generators:*** Repeak all multiplier controls and the 734A filter, and adjust R23 to obtain +25.0 dBm at P19.

6.32 ***For List 1 and 21 Generators:*** Repeak all multiplier controls and the 734A filter, and adjust C31 clockwise for minimum power, but not less than +26.5 dBm.

6.33 ***For List 1, 20, and 21 Generators:*** Repeak all multiplier controls and the 734A filter, and adjust C31 clockwise for minimum power, but not less than +25.0 dBm.

6.34 Adjust the FINE FREQ TUN control to set the frequency to within ±10 Hz of the desired frequency.

6.35 Record the new readings for MWV GEN 1 through 7 and LF LEV positions on the control panel.

7. J68387R MICROWAVE GENERATOR TUNING PROCEDURE

Note: This part is to be used only if indicated by tests specified in Part 3.

7.01 This procedure can be used for retuning a generator or for tuning a spare generator. The J68387R, Lists 1 and 2 consists of common equipment. Lists 4 through 20 consist of the frequency-determining crystals. Table J shows the list numbers and corresponding generator and crystal frequencies.

Table J

LIST NO.	GENERATOR FREQUENCY MHz	CRYSTAL FREQUENCY MHz
4	3780	118.12500
5	3800	118.75000
6	3820	119.37500
7	3840	120.00000
8	3860	120.62500
9	3880	121.25000
10	3900	121.87500
11	3920	122.50000
12	3940	123.12500
13	3960	123.75000
14	3980	124.37500
15	4000	125.00000
16	4020	125.62500
17	4040	126.25000
18	4060	126.87500
19	4080	127.50000
20	4100	128.12500

A. Power

7.02 Power is applied to the generator by the bay for which the generator is intended.

B. 500-MHz Generator Adjustment

7.03 Connect a P-48N180 cable between the FREQ MON jack and the ATTEN 2 IN jack on the test set. Set ATTEN 2 for 20 dB. Connect the ATTEN 2 OUT jack to the IF AMP IN jack on the test set. Adjust AMPL GAIN fully counterclockwise. Connect the IF AMPL OUT jack to the ATTEN 1 IN jack. Set ATTEN 1 for 5 dB. Connect the ATTEN 3 OUT jack to IF PWR MTR. Adjust AMPL GAIN to achieve a reading of +2 dBm on the power meter. Remove the connection to the IF PWR MTR and connect to CTR.

Note: CTR must be on EXT.

7.04 Preset the FREQ ADJ control fully clockwise.

7.05 Operate the MWV GEN 1 pushbutton on the bay control panel.

7.06 Adjust the 125 MHZ TUN control for a maximum meter reading.

7.07 Operate the MWV GEN 2 pushbutton on the bay control panel.

7.08 Adjust the 250 MHZ TUN control for a maximum meter reading.

7.09 Adjust the FREQ ADJ control.

Requirement: The frequency shall be equal to fo (crystal frequency) ±10 Hz.

Note: The presence of a tuning adjustment tool inserted in the FREQ ADJ control will cause the frequency to shift. Adjust to the required frequency, fo (crystal frequency), with the adjustment tool. When the adjustment tool is removed, note the change in frequency from fo. Use this information to readjust the FREQ ADJ control such that the frequency is within limits when the adjustment tool is removed. For example, if the frequency shift is 200 Hz high when the adjustment tool is removed, set the frequency 200 Hz low so that when the adjustment tool is removed the frequency will be within limits.

If this requirement is met, proceed to 7.11; if not, replace the crystal per 7.10 and repeat 7.04 through 7.09.

If this requirement cannot be met by replacing the crystal, replace the 500-MHz generator with a spare unit per 7.10 and adjust the replaced generator per 7.04 through 7.09.

7.10 Replace the 500-MHz generator and/or crystal unit as follows:

(a) Disconnect plug P1 supplying power to the 500-MHz generator unit and connector P2 at the OUT jack.

(b) Remove the 500-MHz generator unit from the generator chassis by removing the appropriate retaining screws.

(c) Unscrew and remove the top cover.

(d) Remove the crystal from its socket and replace it with one having the prescribed frequency (value stamped on package).

(e) Replace the top cover on the 500-MHz generator unit.

(f) Reinstall the 500-MHz generator unit in the generator chassis and reconnect power plug P1 and connector P2 at the OUT jack.

7.11 Operate the MWV GEN 3 pushbutton on the bay control panel and adjust the 500 MHZ TUN 1 and 2 controls for a maximum meter reading using the following procedure.

Note: The 500 MHZ TUN 1 and 2 controls interact and, for a given frequency, the same maximum output can be obtained for slightly different combinations. In the following tuning procedure the intent is to first tune 500 MHZ TUN 2 for a maximum meter reading. By repeating this procedure a few times, the circuit can be quickly tuned. The circuit is then adjusted for the required output level by means of the LEV ADJ control.

(a) Adjust 500 MHZ TUN 1 four turns counterclockwise from the fully clockwise position and set the LEV ADJ control to the midrange position.

(b) Adjust 500 MHZ TUN 2 for a maximum meter reading.

(c) Adjust 500 MHZ TUN 1 counterclockwise so that the meter reading drops approximately 3 units.

(d) Adjust 500 MHZ TUN 2 for a maximum meter reading.

(e) If the meter reading obtained in (d) is greater than the one obtained in (b), repeat (c) and (d) until further adjustments no longer cause an increase in the meter reading.

(f) If the meter reading obtained in (d) is less than the one obtained in (b), adjust 500 MHZ TUN 1 clockwise so that the meter reading increases approximately 3 units. Then adjust 500 MHZ TUN 2 for a maximum meter reading. Repeat the adjustments until further minor adjustments no longer cause an increase in output.

7.12 Adjust the LEV ADJ control for a meter reading equal to that stamped on the 500-MHz generator unit.

Note: The 500-MHz generator unit has three meter readings stamped on it which correspond to three crystal frequencies. Choose the reading which is nearest in frequency to that of the generator being adjusted.

If this adjustment is met, proceed to Part C; if not, replace the 500-MHz generator with a spare unit per 7.10.

C. 500-MHz Filter

Note: In the procedure which follows it is assumed that the filter is approximately adjusted for the generator frequency and that only a minor adjustment of the filter fine tuning frequency control may be required.

7.13 Operate the MWV CURR MON pushbutton on the bay control panel.

7.14 If a reading greater than approximately 20 units is observed, proceed to 7.16; if not, proceed to 7.15.

7.15 On the 1-GHz multiplier set the CURR ADJ control fully clockwise and then back off two turns.

7.16 Adjust the 500-MHz filter fine frequency tuning control for a maximum MWV CURR MON meter reading.

7.17 If no meter reading is observed, replace the 1-GHz multiplier with a spare per 7.18 and repeat the tuning procedure outlined in Parts C and D.

7.18 Replace the 1-GHz multiplier as follows:

(a) Disconnect plug P10 supplying power to the 1-GHz multiplier.

(b) Disconnect input connector P9 and output connector P11.

(c) Remove the 1-GHz multiplier from the generator chassis by removing the appropriate retaining screws.

(d) Install the spare 1-GHz multiplier in the generator chassis and reconnect plugs P9, P10, and P11.

D. 1-GHz Multiplier

7.19 Adjust the OUT CPLR control fully counterclockwise.

7.20 Monitoring the MWV CURR MON meter reading, adjust the 1-GHz multiplier tuning controls using the following procedure:

(a) Maximize the meter reading with the IN TUN control.

(b) Minimize the meter reading with the OUT TUN control.

(c) Set the MWV CURR MON meter reading with the CURR ADJ control as close to 50 units as possible.

(d) Repeat (a) through (c) making (b) the last step until no further control interaction is observed.

7.21 If the above tuning procedure cannot be achieved, replace the 1-GHz multiplier per 7.18.

7.22 The final tuning procedure for this multiplier is performed in Part E.

E. 4-GHz Multiplier

7.23 Remove detector MON 1 from directional coupler DC2 on the repeater bay or main station transmitter bay (DC1 on a main station receiver bay).

7.24 Connect directional coupler DC2 to the test set RF power meter (RF PWR jack) using the calibrated test cable (KS-19986, List 4).

7.25 Adjust attenuator AT1 to minimum attenuation in a repeater station bay or main station receiver bay (adjust attenuator AT5 in a main station transmitter bay).

7.26 Adjust the two controls on the 4-GHz multiplier for maximum output power.

7.27 Readjust the 1-GHz multiplier controls using the following procedure:

(a) Adjust the IN TUN and OUT TUN controls for maximum power shown on the power meter.

(b) Adjust the CURR ADJ control for a MWV CURR MON reading of 50 ±2 units.

(c) Repeat (a) and (b) until the adjustments on (a) no longer require a readjustment of (b).

7.28 Readjust the 4-GHz multiplier tuning controls for maximum output power.

Requirement: The power meter indication shall be greater than +25.0 dBm minus the loss of the directional coupler minus the loss in the calibrated test cable.

If the requirement is met, proceed to 7.32.

7.29 If the requirement of 7.28 is not met, adjust the OUT CLPR control of the 1-GHz multiplier three turns clockwise.

Note: If there are no more clockwise turn left, see 7.30.

Monitoring the MWV CURR MON meter indication, adjust the 1-GHz multiplier tuning controls using the following tuning procedure.

(a) Adjust the IN TUN control for a maximum meter indication.

(b) Adjust the OUT TUN control for a minimum meter indication.

(c) Adjust the CURR ADJ control for an indication as close as possible to 50 units on the MWV CURR MON meter.

(d) Repeat (a) through (c), making (b) the last step, until no further control interaction is observed.

(e) Repeat 7.28.

If the requirement is met, proceed to 7.32.

7.30 If the requirement in 7.28 still is not met, replace diode CR4 which is located in the 4-GHz multiplier.

7.31 Adjust the OUT CLPR fully counterclockwise and repeat 7.29. If after replacing diode CR4, the requirement is still not met, replace the 1-GHz multiplier per 7.18.

7.32 Remove the cables from the FREQ MON jack and coupler DC1 or DC2 and reconnect the MON 1 or 2 detector.

7.33 On the appropriate control panel press the MWV GEN 1, MWV GEN 2, MWV GEN 3, MWV CURR MON, and MWV GEN OUT pushbuttons and record the panel meter indications in the space provided.

8. TRAVELING-WAVE-TUBE POWER SUPPLY TESTS WITH TEST LOAD

Note: This part is to be used only if indicated by tests specified in Part 5, D. Traveling-wave-tube Check.

8.01 Operate the INPUT circuit breaker to OFF. Remove the inverter and heater regulator (left-hand unit) from the TWT power supply, and unplug the power connector from the TWT. Place the test load in the slots provided on top of the power supply case. Plug the power connector into the test load socket. Replace the inverter and heater regulator in the normal position. Turn the VOLTAGE SELECTOR switch on the test load to OFF.

8.02 Operate the INPUT circuit breaker on the front of the TWT power supply to ON.

Requirement 1: The HEATER VOLTAGE meter on the test load shall read 9.2 ±0.3 volts.

Requirement 2: After 150 seconds, the HEATER VOLTAGE meter reading shall drop to 7.50 ±0.1 volts.

8.03 Operate the VOLTAGE SELECTOR switch to the COLLECTOR position.

Requirement: The VOLTAGE MON meter shall read 142 $^{+10}_{-8}$ volts.

8.04 Operate the VOLTAGE SELECTOR switch to the HELIX 0.6 MA position. Adjust the HELIX ADJ control on the power supply to obtain a reading of 135 on the VOLTAGE MON meter.

Note: Earlier models of this test load may be designated HELIX 1 for the HELIX 0.6 MA position and HELIX 2 for the HELIX 6 MA position.

8.05 Operate the VOLTAGE SELECTOR switch to the HELIX 6 MA position.

Requirement: The VOLTAGE MON meter shall indicate 135 volts.

8.06 Rotate the HELIX ADJUST potentiometer counterclockwise until the VOLTAGE MON meter indicates 122 volts.

8.07 Operate VOLTAGE SELECTOR switch to the HELIX 0.6 MA position.

Requirement: The VOLTAGE MON meter shall indicate 122 volts.

8.08 Rotate the HELIX ADJUST potentiometer clockwise until the VOLTAGE MON meter indicates 135 volts.

Requirement: The HELIX CURRENT on the test load shall read 0.6 ±0.03 and the HELIX CURRENT on the power supply meter shall read 0.6 ±0.3.

8.09 Operate the VOLTAGE SELECTOR switch to the HELIX 6 MA (or HELIX 2) position.

Requirement: The VOLTAGE MON meter shall indicate 135 ±0.5.

8.10 Operate the VOLTAGE SELECTOR switch to the ANODE position. Adjust the ANODE VOLTAGE control on the power supply for a reading of 150 on the VOLTAGE MON meter.

Requirement 1: The ANODE TO CATHODE VOLTS meter on the power supply shall read 3000±150 volts.

Requirement 2: The CATHODE CURRENT on the test load shall read 42.3 ±4.1 mA, and the CATHODE CURRENT on the power supply shall agree within ±2 mA with the reading on the test load meter.

8.11 Turn the INPUT circuit breaker to OFF, remove the test load, reconnect the power plug to the TWT, insert the plug-in unit, and return to Part 5, D. Traveling-wave-tube Check.