TECHNICAL MANUAL

GENERAL SUPPORT MAINTENANCE MANUAL

RADIO SETS AN/GRC-103(V)1

(NSN 5820-00-935-4931),

AN/GRC-103(V)2 (NSN 5820-00-116-6029),

AN/GRC-103(V)3 (NSN 5820-00-116-6030),

AN/GRC-103(V)4 (NSN 5820-01-081-8866),

AND

EXTENSION KIT, MAST

MK-1009/GRC-103(V)

(NSN 5985-00-179-7767)

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HEADQUARTERS, DEPARTMENT OF THE ARMY

1 OCTOBER 1989

WARNING

READ AND OBSERVE ALL WARNINGS AT BEGINNING OF THIS MANUAL

A REVIEW OF TB 385-4, SAFETY PRECAUTIONS FOR MAINTENANCE OF ELECTRICAL/ELECTRONIC EQUIPMENT, IS RECOMMENDED

5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1 DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL

2 IF POSSIBLE, TURN OFF THE ELECTRICAL POWER

3 IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL.

4 SEND FOR HELP AS SOON AS POSSIBLE

5 AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

WARNINGS

Be careful when working on the 115-volt ac line connections. SERIOUS INJURY OR DEATH may result from contact with these terminals.

DON'T TAKE CHANCES!

EXTREMELY DANGEROUS VOLTAGES EXIST IN THE FOLLOWING

UNITS OF RADIO SETS AN/GRC-103(V)	**1, 2, 3, and 4**
TRANSMITTER, RADIO 5TR1	**800 volts dc**
AMPLIFIER-FREQUENCY MULTIPLIERS	**600 volts dc**

DANGEROUS RADIO FREQUENCY VOLTAGES EXIST AT THE ANTENNA TERMINALS

Be careful when working around the antenna or the antenna terminals. High voltages exist at these points.

Operator and maintenance personnel should be familiar with the requirements of TB 43-0129 before attempting installation or operation of the equipment covered in this manual. Failure to follow requirements of TB 43-0129 could result in injury or DEATH.

Whenever the antenna (with or without the parabolic reflector) is used in a room, the 50-foot coaxial cable must be utilized and connected to the antenna output of the transmitter. This will eliminate the potential radiation hazard when power is applied.

Technical Manual
No. 11-5820-540-40-2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 1 October 1989

GENERAL SUPPORT MAINTENANCE MANUAL

RADIO SETS AN/GRC-103(V)1 (NSN 5820-00-935-4931), AN/GRC-103(V)2 (NSN 5820-00-116-6029), AN/GRC-103(V)3 (NSN 5820-00-116-6030), AN/GRC-103(V)4 (NSN 5820-01-081-8866), AND EXTENSION KIT, MAST MK-1009/GRC-103(V) (NSN 5985-00-179-7767)

This series consists of three manuals. This manual contains chapter 4, TM 11-5820-540-40-1 contains chapters 1, 2, and 3. TM 11-5820-540-40-3 contains chapters 5 and 6, appendix A and Index.

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-LC-ME-PS, Fort Monmouth, NJ 07703-5000.

In either case a reply will be furnished direct to you.

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CHAPTER 4

TEST AND REPAIR PROCEDURES (RF HEADS, ANTENNAS AND MISCELLANEOUS COMPONENTS, ALL BANDS) SRA ACTIVITIES ONLY

NOTE

Only activities authorized in the use of the AN/GRC-95(V)2 will perform this phase of maintenance. All other activities will not perform this phase of maintenance, but shall forward unserviceable units to a higher category of maintenance activity.

Section I. BAND I TRANSMITTER AND RECEIVER RF HEADS

4-1. Amplifier-Converter AM-4316/GRC-103(V) or AM-4316 A/GRC-103(V)

NOTE

Reference is to both units unless otherwise stated.

a. Test Equipment Required.

Equipment	*Common Name*
Test Facility, Receiver TS-2867(V)2/(RM-95(V)2	Receiver test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)-2	Accessory kit
Accessory Kit, Test Facility MK-l985(V)2/(GRM-95(V)2	Accessory kit
Generator, Signal, HP 864013	Signal generator
Generator, Sweep, Wiltron 61011 W/RF Plug-in 61084D	Sweep generator
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Oscilloscope, AN/USM-281C	Oscilloscope
Signal Source, RF Power A.I.L. 125A	High power source
Frequency Counter, Microwave TD-1225(V)l/U	Frequency counter
Calibrated Mismatch, TRM 1-3150F	Termination
Voltmeter, Digital, AN/USM-451	Digital voltmeter
Voltmeter, Electronic, ME-459/U	VTVM
Attenuator, 3 dB, 50 W, Weinschel 25-3-34	Attenuator, 3 dB
Power Amplifier, EN1 603L	Power amplifier

b. Test Procedures.

(1) Test equipment calibration.

(a) High power attenuators (CN-1533/U plus CN-1534/U).

1. Connect equipment as shown in A, figure 4-1.

2. Tune the signal generator to 220 MHz and adjust the output level to +10 dBm as indicated by the power meter.

3. Connect equipment as shown in B, figure 4-1.

4. Subtract the power meter indication from +10 dBm and record the difference in attenuator column of chart below.

5. Repeat *1.* through *4.* at 300 and 400 MHz.

(b) Coupling loss (CU-1879/U plus CN-1286/U).

1. Repeat *(a)1.* through 5. above using test set-up as shown in figure 4-2. Record the difference in coupler column of chart below.

Frequency (MHz)	*Attenuator*	*Coupler*
220		
300		
400		

NOTE

The attenuators, CN-1533/U and CN-1534/U, and coupler, CU-1879/U and attenuator, AN-1286/U, must remain connected as shown for use in succeeding tests.

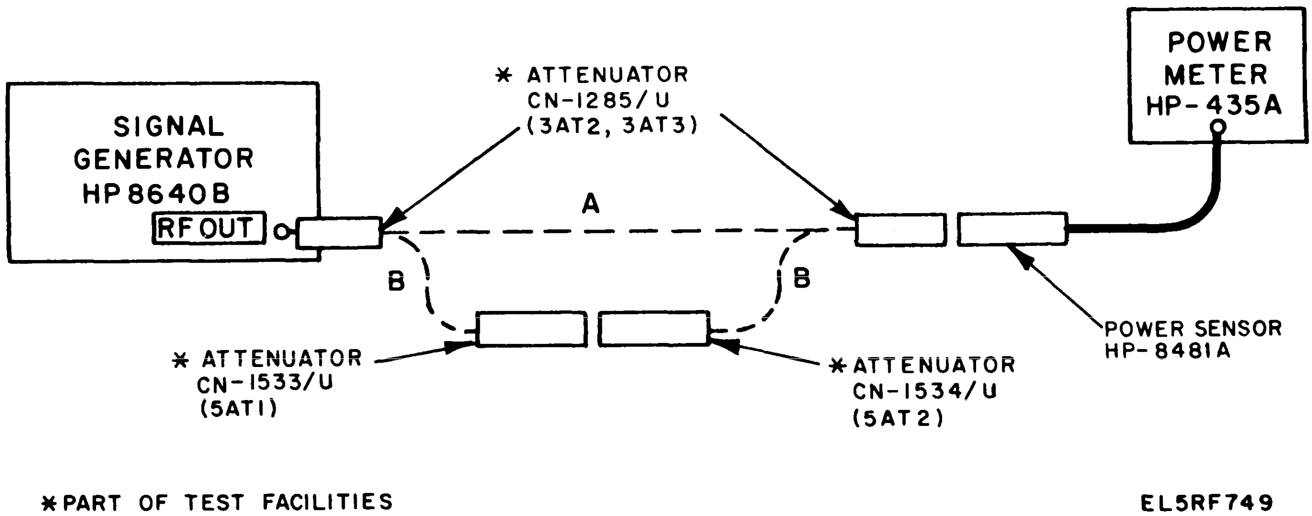


Figure 4-1. High Power Attenuators, CN-1533/U and CN-1534/U, Attenuation Check, Test Setup.

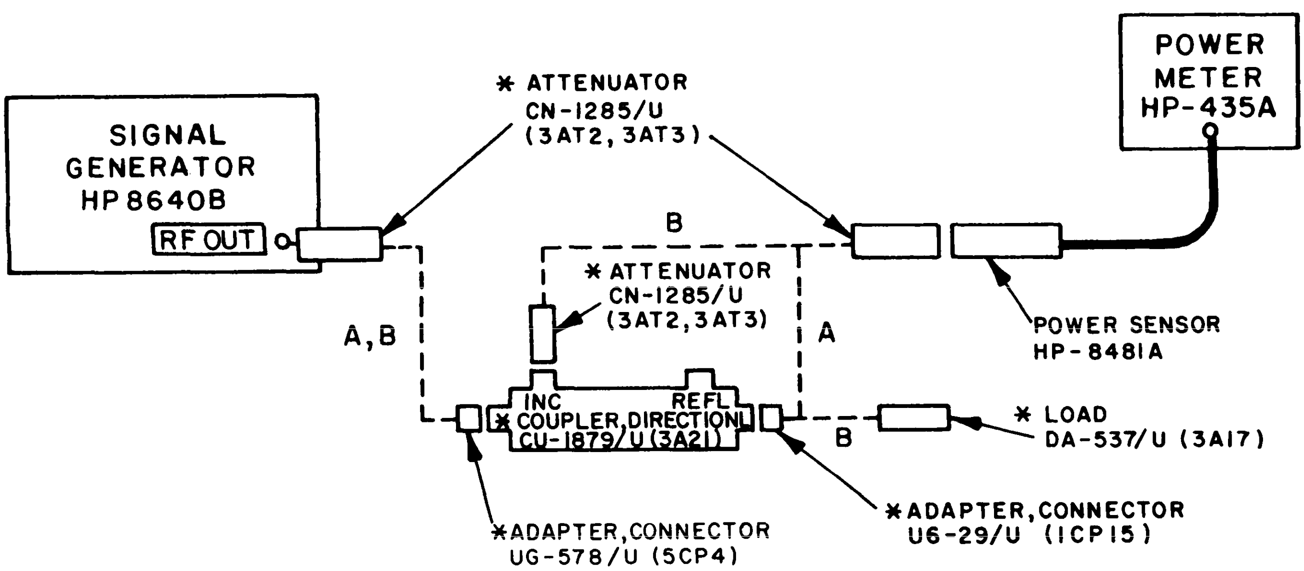


Figure 4-2. Coupler/Attenuator Combination, CU-1879/U and CN-1286/U, Coupling Loss Check, Test Setup.

(2) *Signal level control monitor leakage test.*

(a) Disconnect the rigid rf cables from J1 and J2 of signal level control monitor 2A4 and remove it from the rf head chassis, leaving the power cable connected.

(b) Connect the equipment as shown in figure 4-3.

(c) Set the receiver test facility switches as follows:

Switch	*To position*
S1	ON
S5	S6
S6	REFL POWER
S7	AGC
S8	OFF

(d) Set the power signal source meter switch to the low power position.

CAUTION

Do not allow the output level of the power signal source to exceed a full scale indication on the panel meter while tuning.

(e) Tune the power signal source to a nominal frequency of 220 MHz.

(f) Set the power signal source meter switch to the high power position.

(g) S1owly increase the output level from the power signal source to 50 watts as indicated on its panel meter while observing the power meter indication. The power meter indication should not exceed –3 dBm (+17 dBm output level). The high signal lamp on the test facility should be lit,

(h) Repeat *(d)* through *(g)* above at nominal frequencies of 300 MHz and 405 MHz.

(i) Turn off the power signal source and reinstall the signal level control monitor.

(3) *Power monitor operation test.*

(a) Connect the test equipment as shown in B, figure 4-4.

(b) Tune the RCVR SIG control to channel 400, and tune XMTR DUPL control to channel 200.

(c) Tune the high power source to 300 MHz and adjust the output level for 50 watts as indicated by the panel meter.

(d) Set the test facility switch S6 to XMTR DUPL. Fine tune the XMTR DUPL control to maximize the test facility meter indication. Adjust the power signal source for a 42.6 dBm (18 watts) unit under test output (power meter indication plus the calibrated attenuation from chart in *(1)(a)* above). The test facility meter shall indicate not less than 45% full scale deflection.

WARNING

High radio frequency energy exists at the ANT. connector of the unit under test. Use caution when disconnecting or reconnecting the attenuators.

(e) Set test facility switch S6 to REFL PWR. Temporarily disconnect the attenuators from the RF HEAD ANT connector. The test facility meter should indicate not less than 30% .

(f) Reconnect the attenuators to RF HEAD ANT connector. The test facility meter should indicate less than 15%.

(4) *Transmitter duplexer loss test.*

(a) Connect the test equipment as shown in B, figure 4-4. Support directional couplers to avoid damage to connectors.

(b) Tune the RCVR SIG control to channel 100.

(c) Tune the XMTR DUPL to channel 40.

(d) Tune the high power source to 220 MHz, as indicated on the frequency counter, and adjust the output to 50 watts as indicated by the panel meter.

(e) Adjust the XMTR DUPL control for a maximum indication on the power meter. Note this indication.

(f) Add the attenuator value recorded in (1) *(a)* above to the indication noted in (e) above. Record this result.

(g) Connect the test equipment as shown in A, figure 4-4.

(h) Note the power meter indication. Add the coupler value recorded in (1) *(b)* above to the power meter indication. Record this result.

(i) Subtract the result of *(f)* above from that of *(h)* above. The difference shall not be greater than 1.5 dB.

(j) Repeat *(a)* and *(c)* through *(i)* above for XMTR DUPL channel settings of 200 and 400, and corresponding high power source frequencies of 300 and 400 MHz.

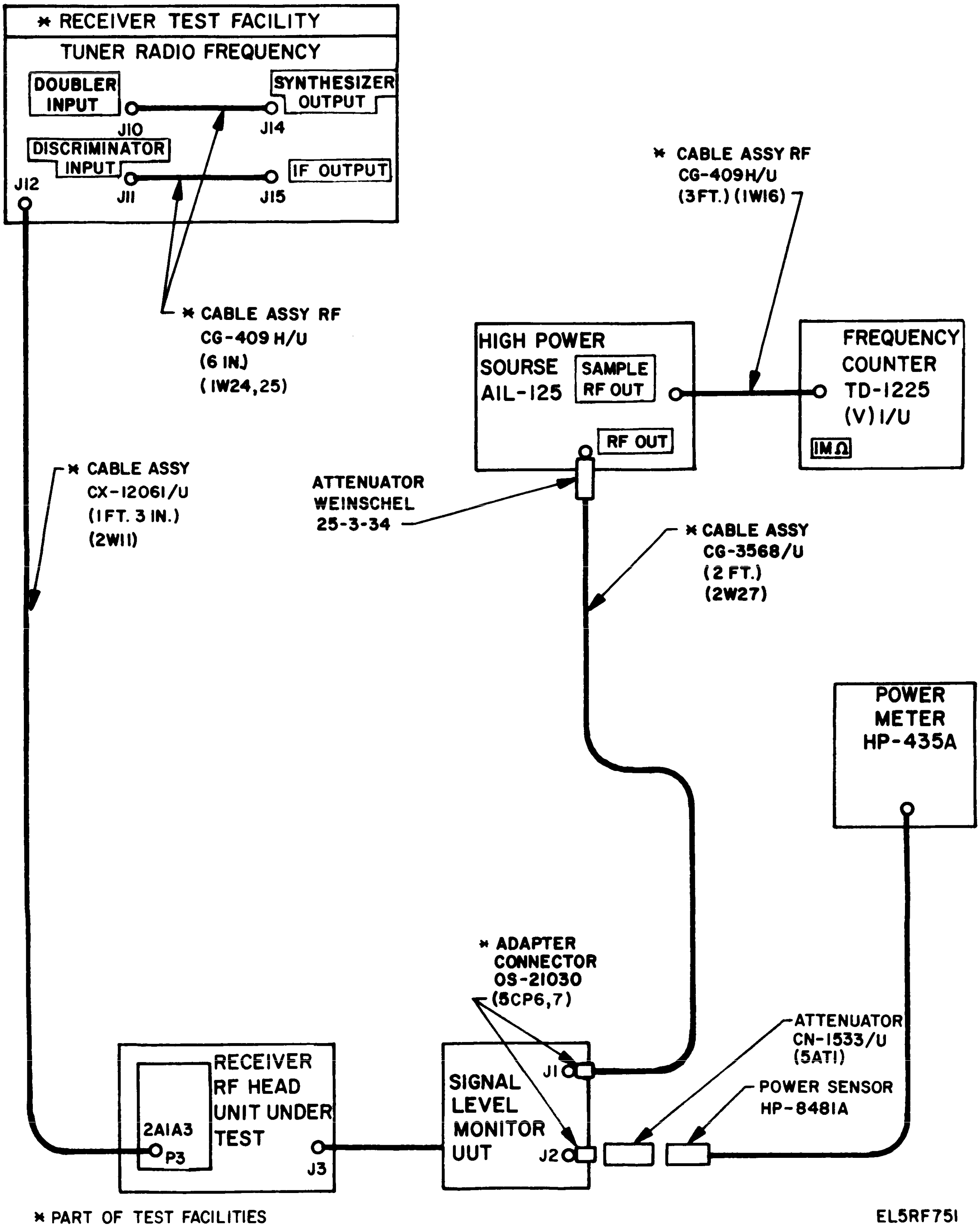


Figure 4-3. Receiver Rf Head Signal Level Control Monitor, Leakage, Test Setup.

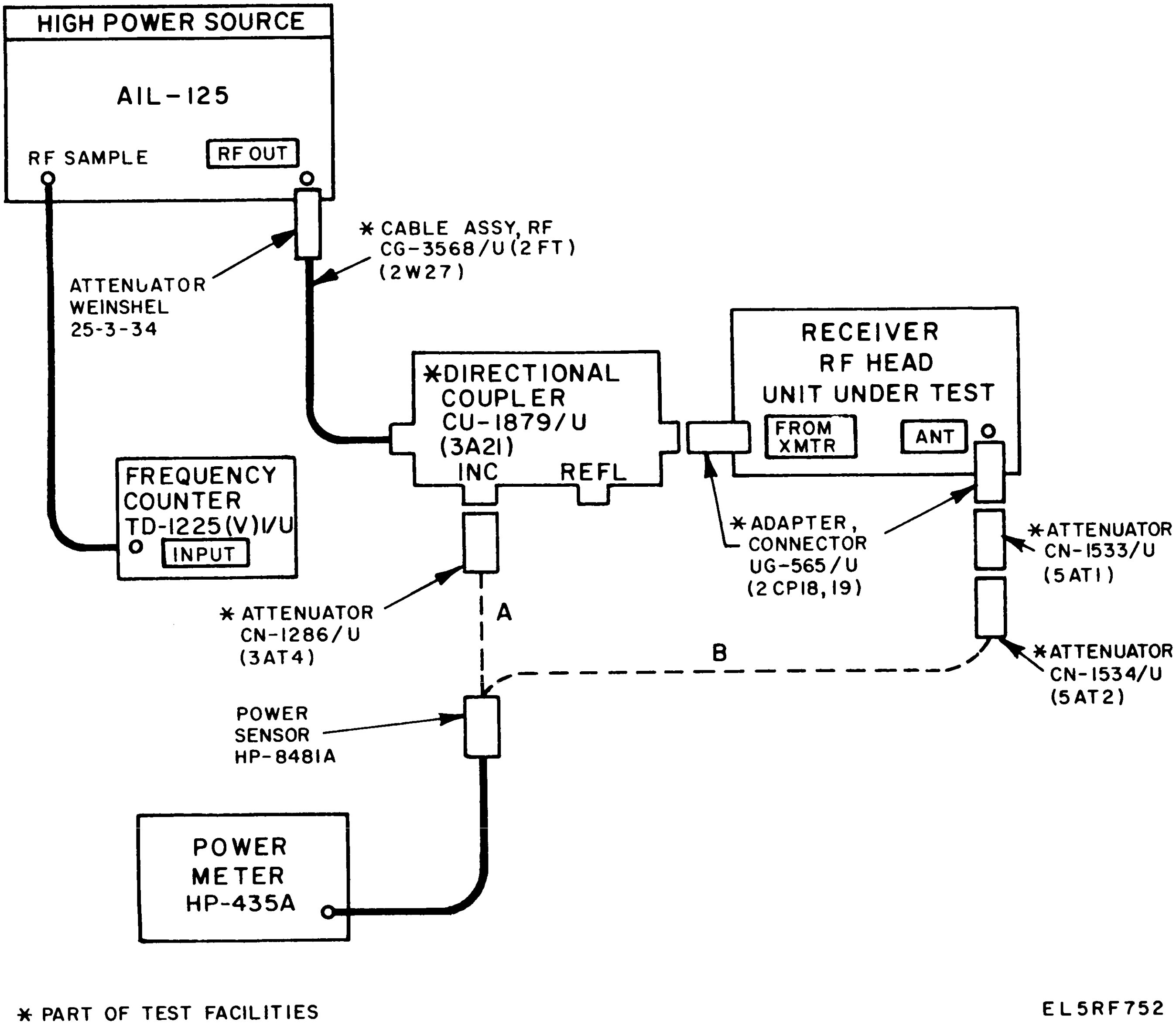


Figure 4-4. Receiver Rf Head Transmitter Duplexer Loss, Test Setup.

(5) *Input VSWR test.*

(a) Connect the test equipment as shown in A, figure 4-5.

(b) Adjust the sweep generator to sweep between 220 and 405 MHz at an output level of –10 dBm.

(c) Adjust the oscilloscope vertical sensitivity for a convenient trace deflection of the 2.00:1 VSWR response. Record this reference.

(d) Connect the equipment as shown in C, figure 4-5.

(e) Set the sweep generator from a ΔF sweep width of 10 MHz centered on 405 MHz (use internal markers).

(f) Set the unit under test RCVR SIG control to channel 40 and tune the XMTR DUPL control to center the duplexer VSWR response on the oscilloscope display. The VSWR bandwidth as measured at the VSWR reference line (step (c) above) should not be less than 2 MHz or greater than 7 MHz. The XMTR CHANNEL indication for channel 410 shall be within ±0.5 inch of the calibration mark at the center of the window.

(g) Slowly tune the sweep generator down to 220 MHz while tracking the VSWR response by tuning the XMTR DUPL control. The response must meet the requirements of *(f)* above over the entire tuning range of the XMTR DUPL control (channel number = (frequency minus 200 MHz) times 2).

NOTE

Set the RCVR SIG control to channel 410 for XMTR DUPL control settings below channel 200.

(h) Connect the test equipment as shown in B, figure 4-5.

(i) Repeat *(b)* through *(d)* above for a 3.50:1 VSWR reference.

(j) Connect the test equipment as shown in C, figure 4-5.

(k) Repeat *(e)* through *(g)* for the RCVR SIG control.

NOTE

At channel 40, a minimum bandwidth of 1.8 MHz at the VSWR reference line is permissible.

(6) *High signal alarm and noise output test.*

(a) Remove the dust cover from the unit under test. Connect the equipment as shown in figure 4-6.

(b) Set the test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
W	AGC
S8	OFF
S6	MULTIPLIER

(c) Set the unit under test RCVR CHANNEL and RCVR SIG controls to channel 40 and the XMTR DUPL control to 70.

(d) Tune the signal generator to 220 MHz and adjust the output level to —74 dBm.

(e) Adjust the MULT PEAK control on the unit under test for a peak indication on test facility meter Ml. The meter shall indicate between 20% and 90% of full scale.

(f) Set test facility switch S6 to REC SIG position and adjust the unit under test for a maximum indication on test facility meter M 1. Test facility meter Ml indication shall not be less than 40%.

(g) Fine tune the unit under test RCVR SIG control for a minimum indication on the VTVM. The appropriate channel number shall be within 1/2 inch from the calibration mark in the center of the RCVR CHANNEL window and the VTVM shall indicate not more than —44 dBm. Note the VTVM indication.

(h) Slowly increase the signal generator output level to – 15 dBm while observing the VTVM indication. The VTVM indication should remain below the level noted in *(g)* above.

(i) Continue to increase the signal generator output level until the test facility HIGH SIGNAL lamp lights. The signal generator output level should be between – 15 dBm and +20 dBm.

(j) Slowly decrease the signal generator output level until the HIGH SIGNAL lamp extinguishes. The output level shall not be less than – 15 dBm.

(k) Repeat *(c)* through *(j)* above for the remaining channels and frequencies listed below.

RCVR CHANNEL and RC VR SIG channel setting	*Signal generator frequency (MHz)*	*XMTR DUPL channel setting*
40	220	70
80	240	110
120	260	150
160	280	190
200	300	230
240	320	210
280	340	250
320	360	290
360	380	330
409	404.5	379

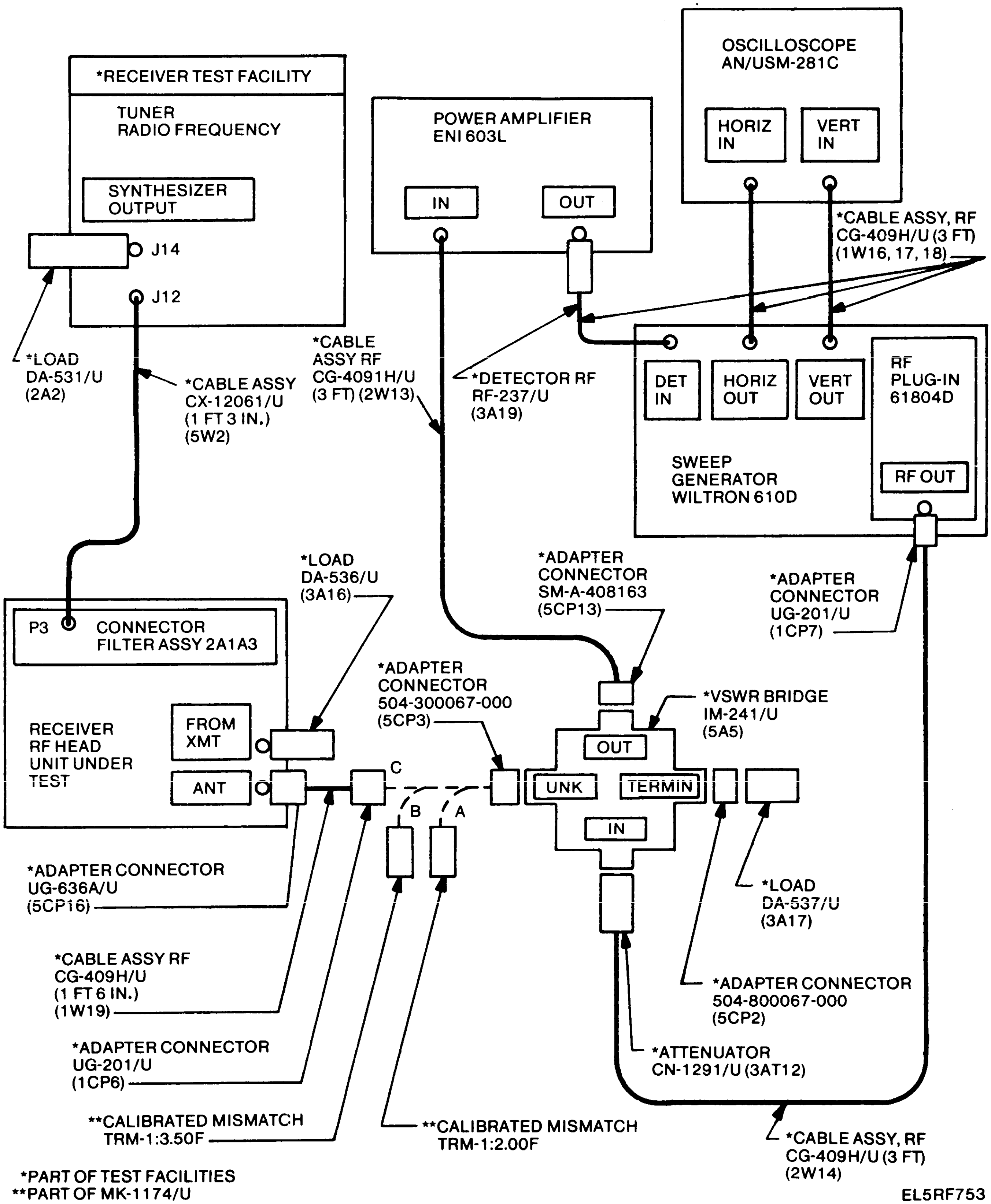


Figure 4-5. Reciever Rf Head Input VSWR, Test Setup.

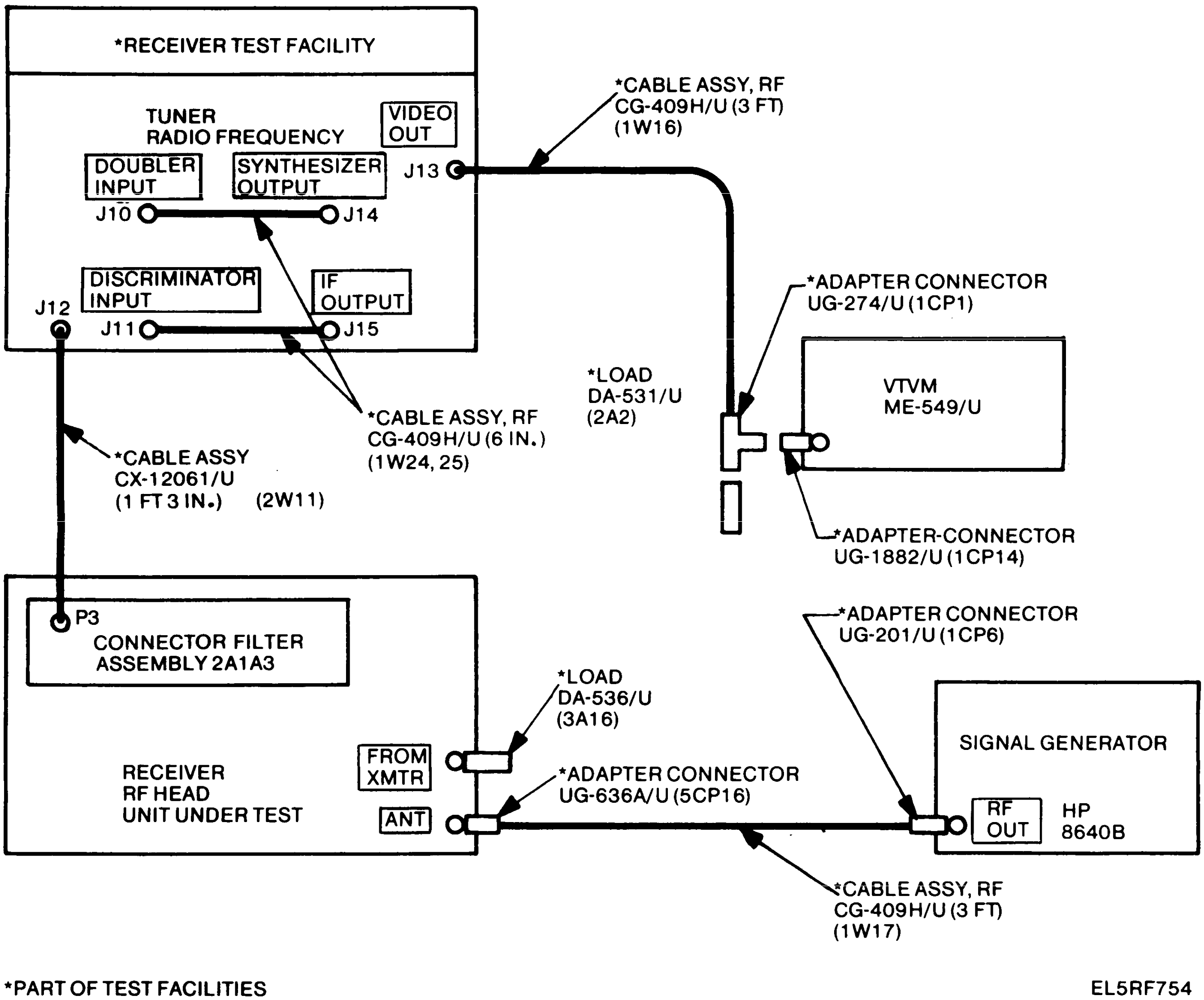


Figure 4-6. Receiver Rf Head High Signal Alarm and Noise Output Check, Test Setup.

c. Troubleshooting (FO-3 or FO-4 as applicable).

Symptom	*Probable cause*	*Checks and corrective measures*
1. Power meter indication exceeds +17 dBm, para. *b(2)(d).*	Defective Signal Level Control Monitor 2A4.	Test per para. 4-7.
2. Abnormal test facility M 1 indication, para. *b(3)(d).*	*a.* Defective wiring.	*a.* Check continuity from pin 1 of 2A1W4J2 (fig. 4-8) to pin 25 of 2A1A3P3 (fig. 4-7) and from pin 3 of 2A1W4J2 to pin 26 of 2A1A3P3.
	b. Defective Power Monitor 2A1A5.	*b.* Test by substituting a known good 2A1A5.
3. Transmitter Duplexer loss exceeds 1.5 dBm, para. *b(4)(i).*	Defective Duplexer 2A1A1.	Higher category maintenance required.
4. Input VSWR exceeds limit at one or more frequencies, para. *b(5)(e), (f)* and *(j).*	Defective Duplexer 2A1A1.	Higher category maintenance required.
5. Channel number not within 1/2 inch of the appropriate calibration mark. All other indications normal.	Defective channel indicator 2A1A1A1DS2, (2A1A1DS2, A model).	Replace channel indicator, para. 2-29 or 2-30.
6. Meter Ml indication below normal, para. *b (6) (e).*	*a.* Defective control indicator 2A2	*a.* Disconnect P2 from J1 (2A1A3P2) (fig. 4-7) and check for an on frequency indication and +14 dBm output at connector P2. If indication is abnormal, test control indicator per para. 4-11.
	b. Defective wiring.	*b.* Check continuity between 2A1W4J4 (fig. 4-8) and 2A1A3P3 (fig. 4-7). Check continuity of metering circuit, pin 4 of J2 (X2A1A2A2P1) or J2 (2A1A2A2P1, A model) and pin 24 of 2A1A3P3.
	c. Defective electronic frequency converter 2A1A2.	*c.* Test per para. 4-2.
7. Meter M1 indication below normal, para. *b (6)(f).* VTVM indication exceeds –44 dBm, para. *b (6)(g).*	*a.* Defective Signal Level Control Monitor 2A4.	*a.* Test per para. 4-7.
	b. Defective RF amplifier 2A1AR1	*b.* Higher category maintenance required.
	c. Defective electronic frequency converter 2A1A2.	*c.* Test per para. 4-7.
8. Channel number not within 1/2 inch of the appropriate calibration mark. Meter M1 and VTVM indications normal.	Defective channel indicator 2A1A1A1DS1, (2A1A1DS1, A model).	Replace channel indicator, para. 2-29 or 2-30.
9. VTVM indication abnormal, para. *b (6)(h).*	Rf amplifler 2A1AR1 going into oscillation.	Higher category maintenance required,
l0. High signal lamp indication beyond limits, para. *b (6) (i) or (j).*	Defective signal level control monitor 2A4.	Test per para. 4-7.

4-2. Electronic Frequency Converter Assembly 2A1A2

a. Test Equipment Required.

Equipment	*Common name*
Test Facility, Receiver, TS-2867(V)2/GRM-95(V)2	Receiver test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Generator, Signal, HP-8640B	Signal generator
Power Meter, HP-435A	Power meter
Power Sensor, HP-8484A	Power sensor
RF Head, AM-4316	Rf head
Voltmeter, RF, ME-426/U	Rf voltmeter

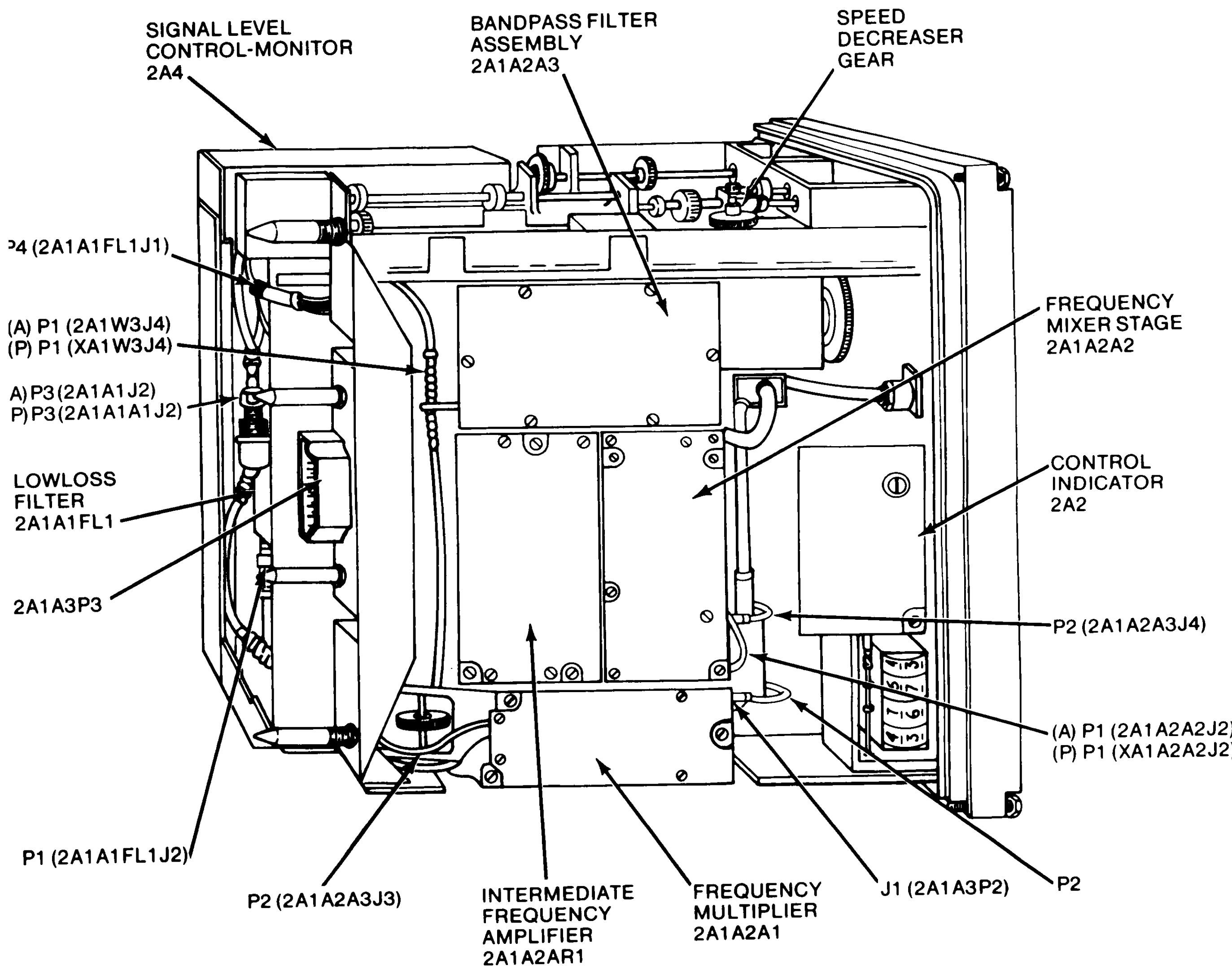
b. Test Procedure.

(1) Connect test equipment as shown in A, figure 4-9.

(2) Set rf head RCVR CHANNEL and RCVR SIG controls to CHANNEL 410 and the XMTR DUPL control to CHANNEL 40.

(3) Tune the signal generator to 405.00 MHz and adjust output level to –57 dBm as indicated by the power meter.

(4) Connect the test equipment as shown in B, figure 4-9.



(A) DESIGNATES A MODEL ONLY.
(P) DESIGNATES PLAIN MODEL ONLY.

EL5RF755

Figure 4-7. Receiver Rf Head, Top and Rear View (AM-4316/GRC-103(V) or AM-4316A/GRC-103(V)).

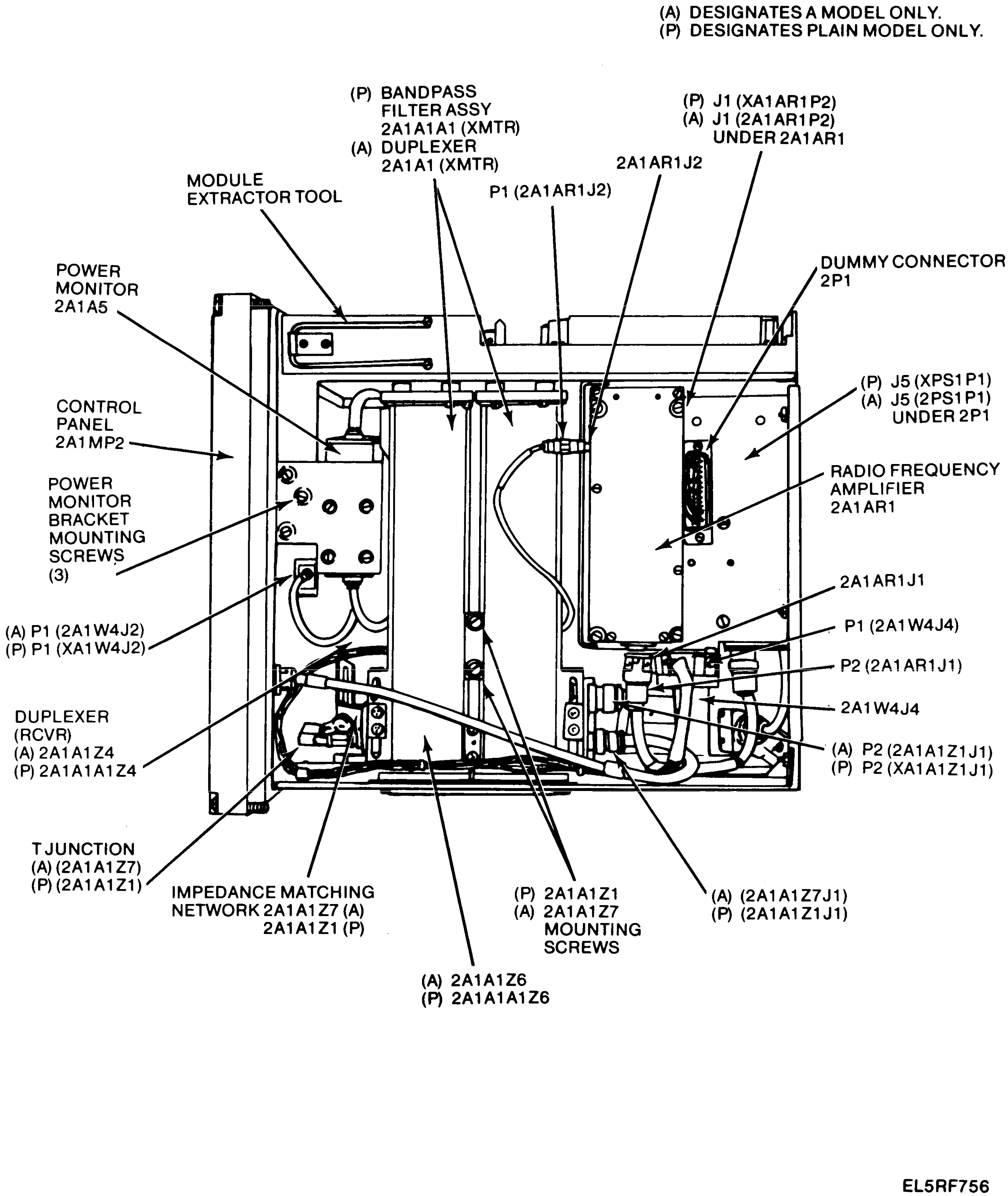


Figure 4-8. Receiver Rf Head Bottom View (AM-4316/GRC-103(V) or AM-4316A/GRC-103(V).

(5) Set the test facility switches as follows:

Switch	Switch position	Normal indication
S1	ON	—
S5	S6	—
S7	AGC	—
S6	OSC	Ml should indicate between 20% and 90% of full scale.
S6	DBLR	M1 should indicate between 20% and 90% of full scale.
S6	MULTIPLIER	Ml should indicate between 20% and 90% of full scale. (Adjust MULT PEAK on rf head for a peak indication.)

(6) The rf voltmeter should indicate −24 ±6 dBm.

(7) Repeat (2) through (6) above for each of the remaining channels and signal generator frequencies listed below.

RCVR CHANNEL	RCVR SIG	Signal generator frequency (MHz)
410	410	405.00
390	390	395.00
368	368	384.00
344	344	372.00
318	318	359.00
288	288	344.00
256	256	328.00
222	222	311.00
186	186	293.00
152	152	276.00
120	120	260.00
119	119	259.50
96	96	248.00
73	73	236.50
54	54	227.00
40	40	220.00

4-3. Bandpass Filter 2AlA2A3/Frequency Multiplier 2A1A2A1

a. Test Equipment Required.

Equipment	Common name
Test Facility, Receiver, TS-2867(V)2/GRM-95(V)2	Receiver test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Generator, Signal, HP-8640B	Signal generator

b. Test Procedure.

(1) Remove frequency mixer stage 2A1A2A2 from frequency converter assembly 2A1A2.

(2) Connect the test equipment as shown in A, figure 4-10.

(3) Set the test facility switches as follows:

Switch	Position	Normal indication
S1	ON	—
S5	S6	—
S7	AGC	—
S6	OSC	Ml should indicate between 20% and 90% of full scale.
S6	DBLR	Ml should indicate between 20% and 90% of full scale.

(4) Set rf head RCVR CHANNEL and RCVR SIG controls to channel 410.

c. Troubleshooting (FO-3 or FO-4 as applicable).

Symptom	Probable cause	Checks and corrective measures
1. No output, MULTIPLIER indication abnormal.	*a.* No input from doubler in test facility.	*a.* Check for doubler signal at P2 (2A1A3). Level should beat least +14 dBm.
	b. Defective bandpass filter/frequency multiplier combination.	*b.* If *a.* above was normal, test per para. 4-3.
	c. Defective frequency mixer 2A1A2A2.	*c.* Test per para. 4-4.
2. No output, MULTIPLIER indication normal.	*a.* Defective wiring.	*a.* Check wiring harness 2A1W3, P10 bandpass filter assembly, 2A1A2A3.
	b. Defective intermediate frequency amplifier, 2A1A2AR1.	*b.* Remove if. amplifier and test per para. 4-5.
	c. Defective frequency mixer, 2AlA2A2.	*c.* Remove frequency mixer and test per para. 4-4.
3. Output out of tolerance, MULTIPLIER indication normal.	*a.* No AGC applied to if. amplifier 2A1A2AR1.	*a.* See 1. *a.* above.
	b. Defective if. amplifier 2A1A2AR1.	*b.* See *2.b.* above.
	c. Defective frequency mixer, 2A1A2A2.	*c.* See 2.c. above.
	d. Defective bandpass filter/freequency multiplier combination.	*d.* If *a.* thru *c.* above indications are normal, higher category maintenance is required.
4. Output out of tolerance, MULTIPLIER indication abnormal.	*a.* Defective frequency mixer, 2AlA2A2.	*a,* Remove and test per para. 4-4.
	b. Defective bandpass filter/frequency multiplier combination.	*b.* If *a.* above indication is normal, higher category maintenance is required.

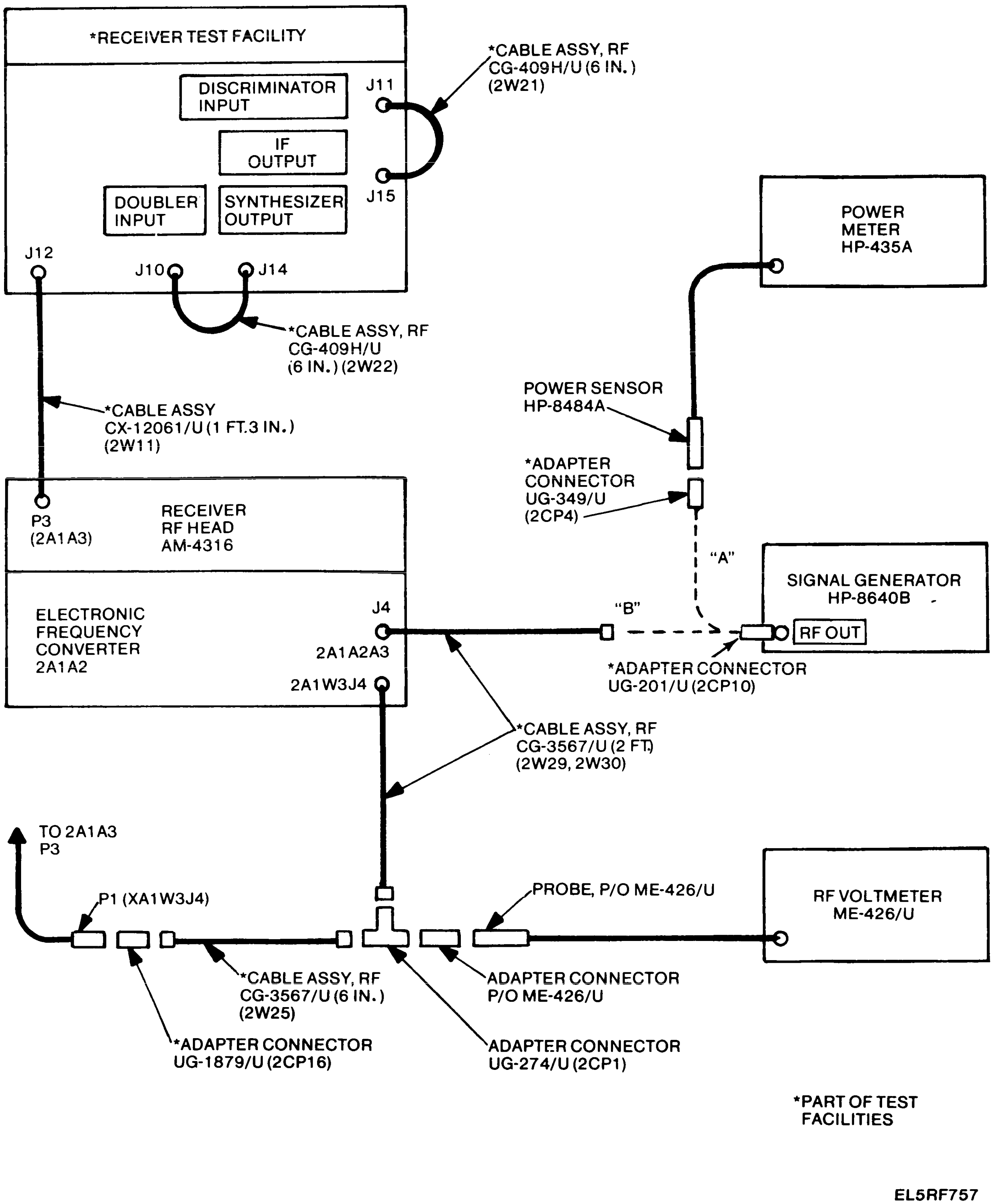


Figure 4-9. Electronic Frequency Converter 2A1A2 Operational Check, Test Setup.

(5) Adjust MULT PEAK control for a peak indication on the power meter. The power meter should indicate at least +1.0 dBm.

(6) Connect equipment as shown in B, figure 4-10.

(7) Set the signal generator to 405 MHz at an output level of 0 dBm as indicated on the power meter.

(8) Connect equipment as shown in C, figure 4-10.

(9) Adjust the signal generator around 405 MHz for a peak indication on the power meter. The signal generator frequency should be 405 ±1 MHz and the power meter should indicate not less than –1 dBm.

(10) Repeat (2) through (9) above at remaining RCVR CHANNEL and RCVR SIG settings listed below.

CHANNEL	*Signal generator frequency*	*CHANNEL*	*Signal generator frequency*
410	405	186	293
390	397	152	276
368	384	120	260
344	372	119	259.5
318	359	96	248
288	344	73	236.5
256	328	54	227
222	311	40	220

C. Troubleshooting.

Symptom	*Probable cause*	*Checks and corrective measures*
Abnormal indication, *b.(5)* or b. (9).	*a.* Doubler input to frequency multiplier 2A1A2A1 low.	*a.* Check doubler input to frequency multiplier. The level should not be less than +14 dBm.
	b. Frequency multiplier 2A1A2A1 output too low or high insertion loss in bandpass falter 2AlA2A3.	*b.* If indication in *a.* above is normal, return bandpass filter/frequency multiplier (2A1A2A312A1A2A1) to higher category maintenance.

44. Frequency Mixer Stage 2AM2A2

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Receiver, TS-2867(V)2/ GRM-95(V)	Receiver test facility
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-94 (V)2	Accessory kit
Generator, Signal, HP-8640B	Signal generator
Generator, Sweep, Wiltron 610D	Sweep generator
Plug-in Wiltron 61084D	Plug-in
Oscilloscope, AN/USM-281 C	Oscilloscope
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Multimeter, Digital, AN/USM-451	Digital multimeter

b. Test Procedure.

(1) 30 *MHz gain calibration.*

(a) Connect the test equipment as shown in A, figure 4-11.

(b) Adjust the signal generator frequency to 30 MHz.

(c) Adjust the signal generator output level for an output of – 1.5 dBm.

(d) Set the 60 dB variable attenuator to 30 dB.

(e) Set the test facility switches as indicated in the table below.

Switch	*Position*
S1	ON
S4	ON
S5	S4

(f) Adjust GAIN control on test facility RF AMPLIFIER-MIXER CONVERTER ASSY for – 10 dBm indication on the power meter (adjustment of signal generator output level may be necessary).

(g) Connect oscilloscope to receiver test facility J7 (B, fig. 4-11). Set 10 dB variable attenuator to 0 dB.

(h) Mark the position of the baseline display on the oscilloscope graticule. This is the – 10 dBm calibration mark.

(i) Set the 10 dB variable attenuator to 1 dB and mark the new position of the baseline display on the graticule. This is the – 11 dBm calibration mark.

(j) Set the 10 dB variable attenuator to 2 dB and mark the new position of the baseline display on the graticule. This is the – 12 dBm calibration mark.

(k) Set test facility switch S4 to OFF.

(l) Do not disturb test facility or oscilloscope control settings until remaining tests are completed.

(2) *Frequency response calibration.*

(a) Set the sweep generator controls for 320 MHz CW MKR operation.

(b) Connect the test equipment as shown in figure 4-12.

(c) Set the variable attenuators to 0 dB.

(d) Adjust the sweep generator output level for a 0 dBm indication on the power meter.

(e) Set the two variable attenuators for a total attenuation of 43 dB.

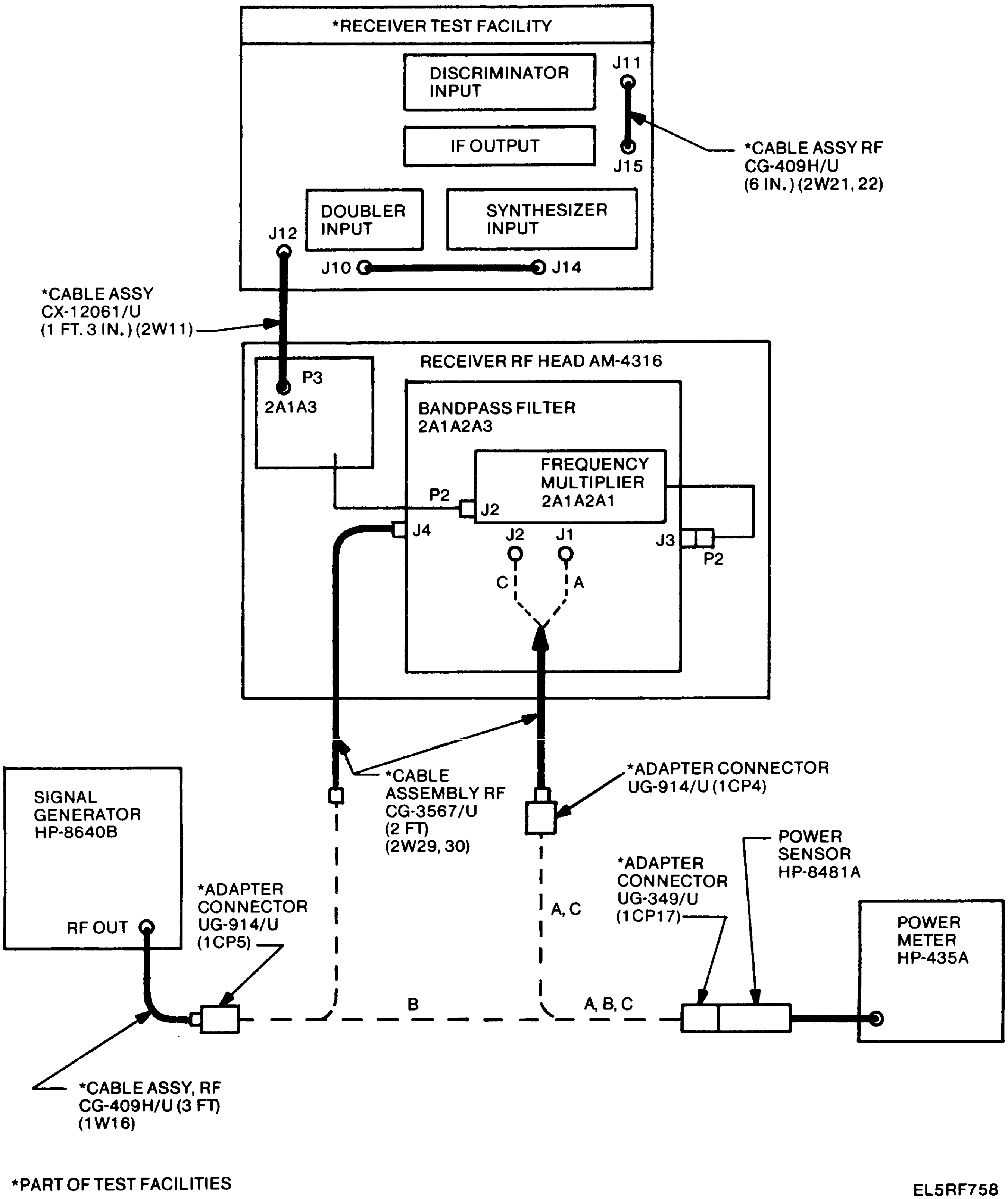


Figure 4-10. Bandpass Filter 2A1A2A3/Frequency Multiplier 2A1A2A1 Combination, Output Level and Insertion Loss Check, Test Setup.

(3) *Gain, frequency response and metering checks.*

(a) Connect the test equipment as shown in A, figure 4-13.

(b) Tune the signal generator to 350 MHz and adjust the output level to +5 dBm as indicated on the power meter.

(c) Connect the test equipment as shown in B, figure 4-13.

(d) On the test facility, set switch S4 to ON.

(e) Adjust the sweep generator for Δ sweep operation between 319 and 321 MHz.

(f) The oscilloscope display should be greater than the –12 dBm calibration mark recorded on the oscilloscope screen in *b.* (1) *(j)* above.

(g) Flatness of the response from 319 MHz to 321 MHz should be less than 1 dB. Use the 1 MHz markers for reference.

(h) Keeping the output level constant at +5 dBm, change the frequency of the signal generator in 10 MHz steps over the frequency range of 250 MHz to 435 MHz. Test facility meter Ml should indicate between 20 percent and 60 percent of full scale deflection.

(4) *Input VSWR checks.*

(a) Connect the test equipment as shown in A, figure 4-14.

(b) Set frequency selector to F1 TO F2 position. Adjust the output level and sweep width controls of the sweep generator for a flat response over the frequency range of 220 MHz to 405 MHz as viewed on the oscilloscope.

(c) Connect the power meter to the rf output of the sweep generator (B, fig. 4-14).

(d) Set the sweep generator to manual sweep mode and adjust its rf attenuator for —4 dBm as indicated on the power meter.

(e) Reconnect the rf output of the sweep generator to the VSWR detector (A, fig. 4-14).

(f) Adjust the oscilloscope controls for a convenient display of the VSWR curve. For example, position the baseline of the display on the bottom line of the graticule and the VSWR curve near the top of the graticule. Record the resultant VSWR curve between 220 MHz and 405 MHz.

(g) Replace the 1.75:1 calibrated mismatch with the unit under test (C, fig. 4-1 4). The resultant VSWR curve displayed on the oscilloscope, at any frequency between 220 MHz and 405 MHz, should not exceed that recorded in *(f)* above.

(h) Disconnect the unit under test from the VSWR detector and in its place connect the 2:1 calibrated mismatch (D, fig. 4-14).

(i) Repeat paragraph (3) *(b)* above for frequencies from 250 to 435 MHz.

(j) Set the sweep generator to manual sweep mode and adjust its output level to +13 dBm as indicated on the power meter (B, fig. 4-14).

(k) Disconnect the sweep generator from the power meter and connect the sweep generator to the VSWR detector (A, fig. 4-14).

(l) Repeat *(f)* above, over the frequency range of 250 MHz to 435 MHz.

(m) Replace the 2:1 calibrated mismatch with the 1.75:1 calibrated mismatch (A, fig. 4-14). Record the resultant VSWR curve displayed on the oscilloscope over the frequency range of 250 MHz to 435 MHz.

(n) Replace the 1.75:1 calibrated mismatch with the unit under test (E, fig. 4-14). The resultant VSWR curve displayed on the oscilloscope at any frequency between 250 MHz and 415 MHz should not exceed that recorded in *(l)* above, and at any frequency between 415 MHz and 435 MHz, the VSWR curve should not exceed that recorded in (1) above.

c. Troubleshooting (fig. 2-61, TM 11-5820-540-30). Remove the four screws securing the top and bottom covers of frequency mixer stage 2A1A2A2 before proceeding with the troubleshooting described in the table below.

Symptom	*Checks and corrective measures*
Poor VSWR at P3.	*a.* Check resistance of Q1, (fig. 4-15). Replace if defective. *b.* Check components in Q1 emitter circuit. Replace defective components.
Poor VSWR at P2.	*a.* Check resistance of Q1. Replace if defective. *b.* Check components in Q1 base circuit. Replace defective components.
Poor VSWR at P2 and P3.	*a.* Check resistance of Q1. Replace if defective. *b.* Check components in Q1 collector circuit. Replace defective components.
Poor gain or no output.	*a.* Check all components in rf path. Replace defective components. *b.* Check dc supply at Q1 (dc voltage) measurement table in para. *d* (1) below).
No MULT indication on meter.	Check components in metering circuit. Replace defective components.

d. Voltage and Resistance Measurements (fig. 4-15 and 4-16).

NOTE

Use the allocated multimeter for voltage and resistance measurements.

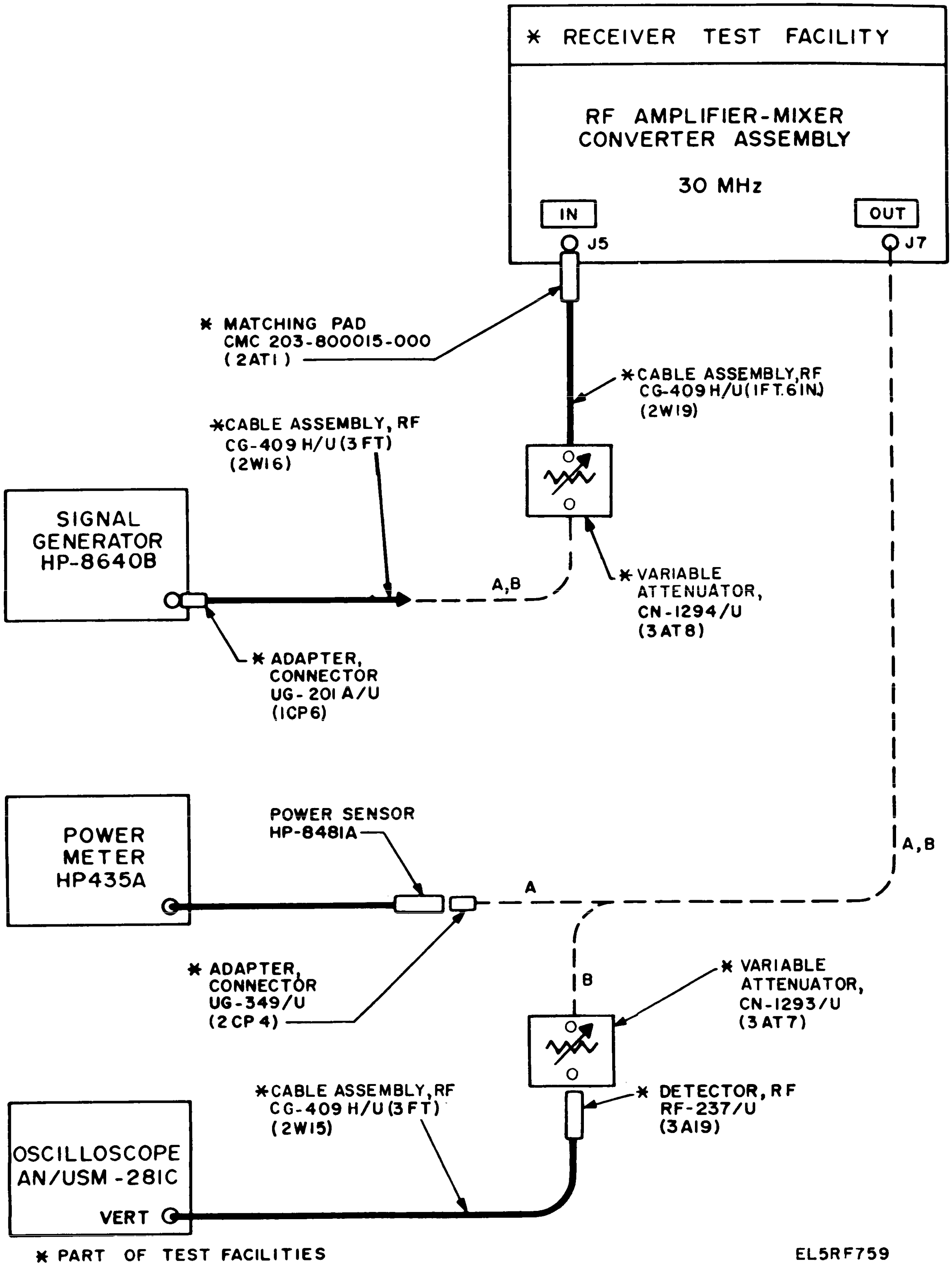


Figure 4-11. Frequency Mixer Stage 2A1A2A2, 30 MHz Gain, Test Equipment Calibration Setup.

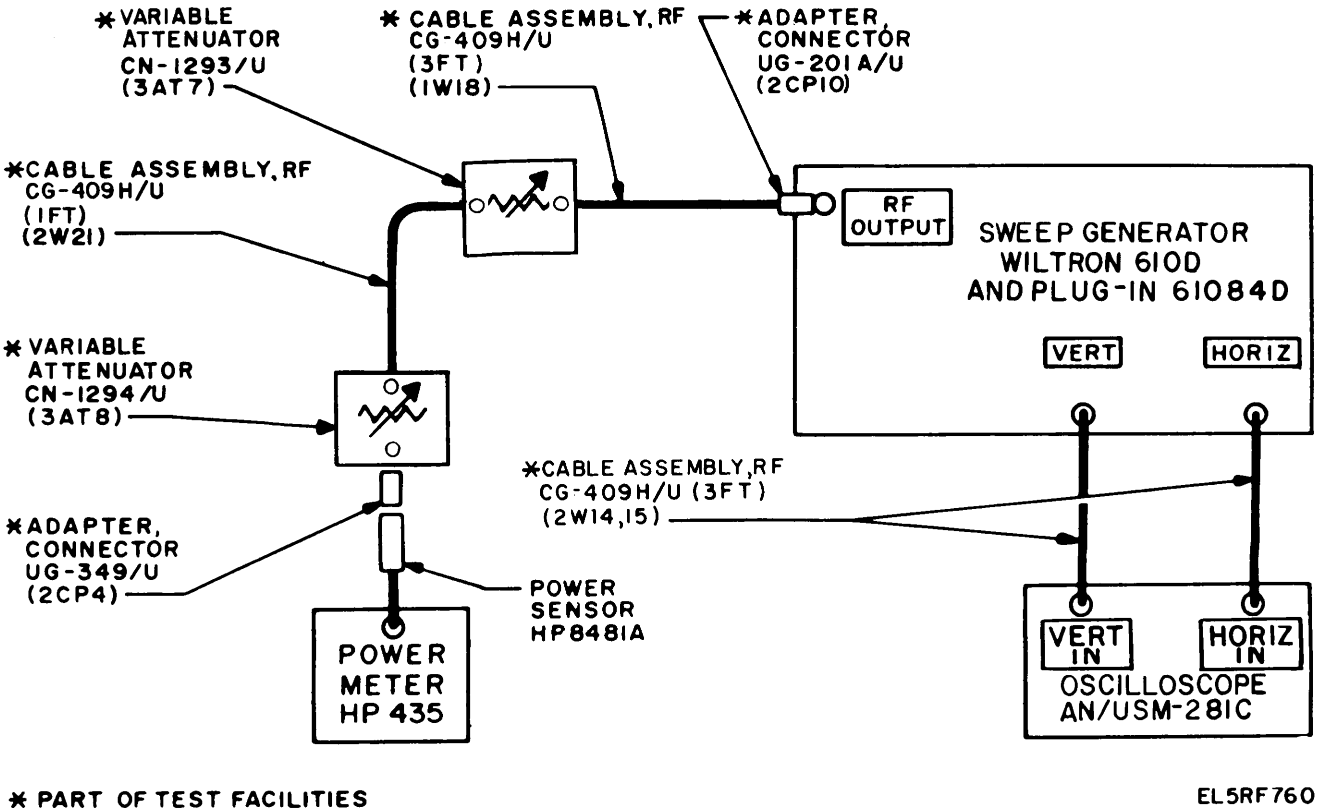


Figure 4-12. Frequency Mixer Stage 2A1A2A2, Frequency Response, Test Equipment Calibration Setup.

(1) *Dc voltage measurements referenced to ground.*

Test points	*Typical indication (volts dc)*
Q1 -emitter	–0.73
Q1-base	0
Q1-collector	6.13

(2). *Resistance measurements.*

Test points	*Typical indication (ohms)*
Q1 base (–) to emitter	460k
Q1 base (–) to collector (+)	1k
Q1 base (+) to emitter (–)	1.1k
Q1 base (+) to collector (–)	850

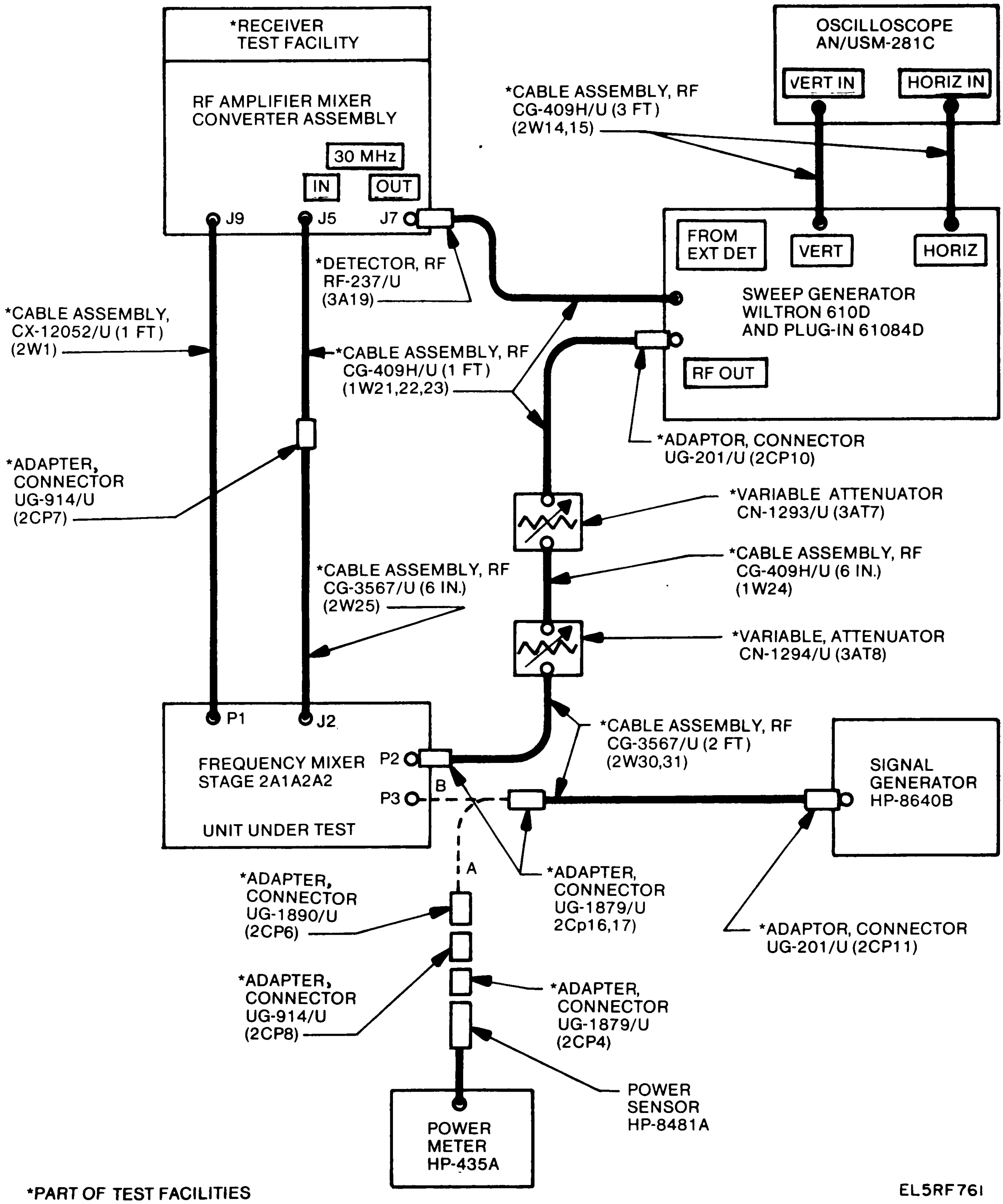


Figure 4-13. Frequency Mixer Stage 2A1A2A2, Frequency Response, Gain and Metering Check, Test Setup.

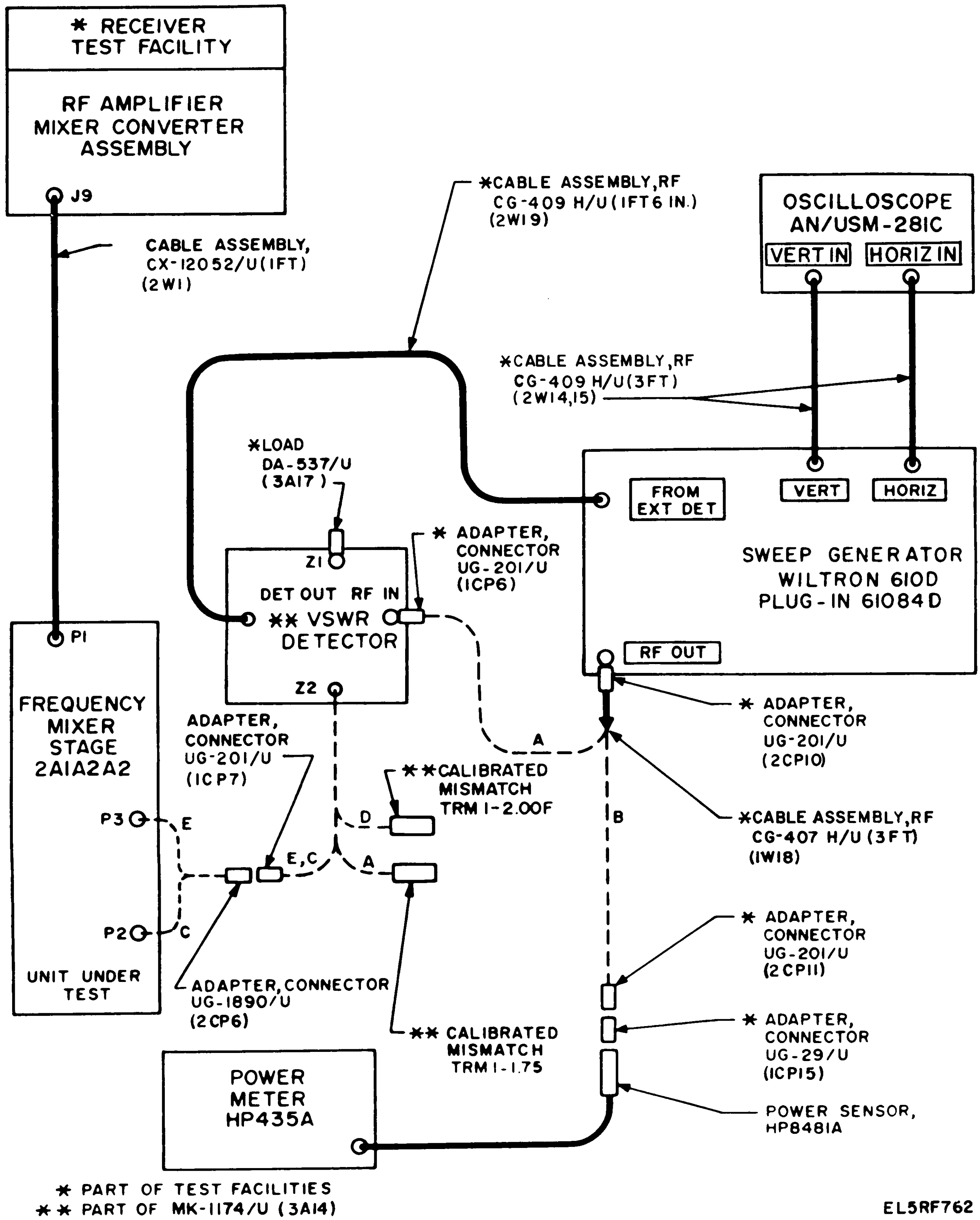


Figure 4-14. Frequency Mixer Stage 2A1A2A2, Input VSWR Check, Test Setup.

4-5. Intermediate Frequency Amplifier 2A1A2AR1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Receiver, TS-2867(V)2/GRM-95(V)2	Receiver test facility
Accessory Kit, Tet Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Digital Multimeter, AN/USM - 451	Digital multimeter
Oscilloscope, AN/USM-281C	Oscilloscope

b. Test Procedure.

(1) Connect the test equipment as shown in figure 4-17.

(2) Set the test facility switches as follows:

Switch	*Position*
S12	AMPL IF
S9	30 MHz
S14	30 MHz
Attenuator AT1	60 dB
S13	MAN
IF GAIN	Fully (’W

(3) Set test facility switch S 1 to ON. The power meter should indicate –24 dBm +6 dB.

(4) Turn GAIN potentiometer fully clockwise. Set attenuator AT1 to 40 dB.

(5) Adjust the IF. GAIN control for a -22 dBm indication on the power meter.

(6) Set test facility switch S14 to 29 MHz and 31 MHz in turn. The power meter indications at the two positions should not vary more than 1.2 dB from each other or from the —22 dBm indication in (5) above.

NOTE

If the variation of the power meter indications should exceed the above specfication, check the output level from the 30 MHz modem at connector J52 with attenuator AT1 at 0 dB. Since the output may vary at 29 MHz and 31 MHz, this variation should be taken into consideration.

c. Troubleshooting.

Symptom	*Checks and corrective measures*
Low or no output	*a* Set the test facility AGC GAIN control to minimum (fully CCW). Check for –11 vdc at E2 (2A1A2AR1A6) (fig. 4-18), E6 and E3 (2A1A2AR1AR4) and E3 (2A1A2AR1AR2). Replace the cordwood module through which agc is not being passed. *b.* Set test facility attenuator AT1 tQ 30 dB and the AGC GAIN control to approximately mid range. With the oscilloscope and a 10X probe, check the signal at E4 (2A1A2AR1AR1); it should be approximately 566 mv p-p. If abnormal replace 2A1A2AR1AR1. *c.* Disconnect the power meter from connector J34 and set attenuator AT1 to 40 dB. Check the signal at the following points: *Test point* — *Normal indication* E5 *(2A1A2AR1AR2)* — *1.8* V p-p E4 (2A1A2AR1AR3) — 2.8 V p-p E5 (2A1A2AR1AR4) — 21 mv p-p Replace the cordwood module with the abnormal indication.
Low or no output (receiver equipped with AM-4316AI GRC-103(V)).	a. Check for –12 vdc at E3, R4, and junction of C7 and R7 (fig. 4-19). *b.* Adjust voltage at E2 to –9.7 vdc using GAIN control on AMPLIFIER IF. AMPL FREQ MULT section of test facility. The voltage at junction of R6 and R8 should be approximately –7.5 vdc (fig. 4-19). *c.* Set attenuator AT1 on 30 MHz MODEM section of test facility to 30 dB. Check for a –6 dBm reading on the power meter. *d.* Using the GAIN control on AMPLIFIER IF FRE Q MULT section of test facility, vary the voltage at E2 between –9.7 and – 10 vdc. The power meter indication should vary between –6 dBm and no outDut.

4-6. Connector-Filter Assembly 2A1A3

a. Test Equipment and Material Required.

Equipment	*Common name*
Multimeter, Digital, AN/USM-451	Digital multimeter

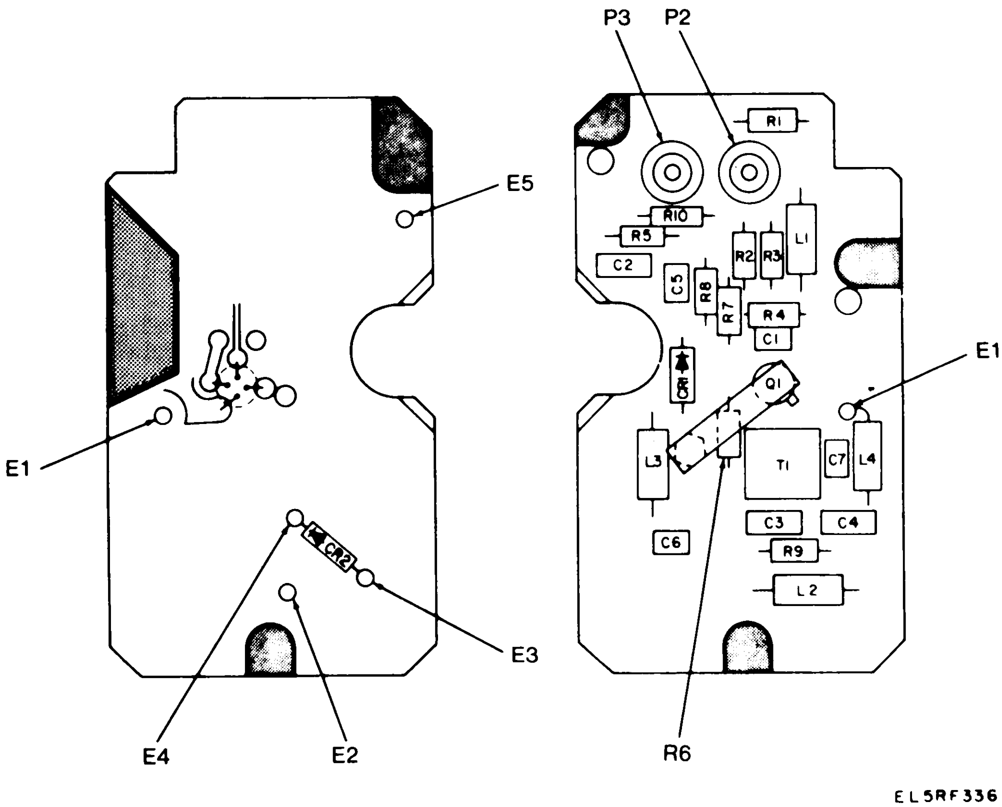


Figure 4-15. Frequency Mixer Stage 2A1A2A2, Parts Location.

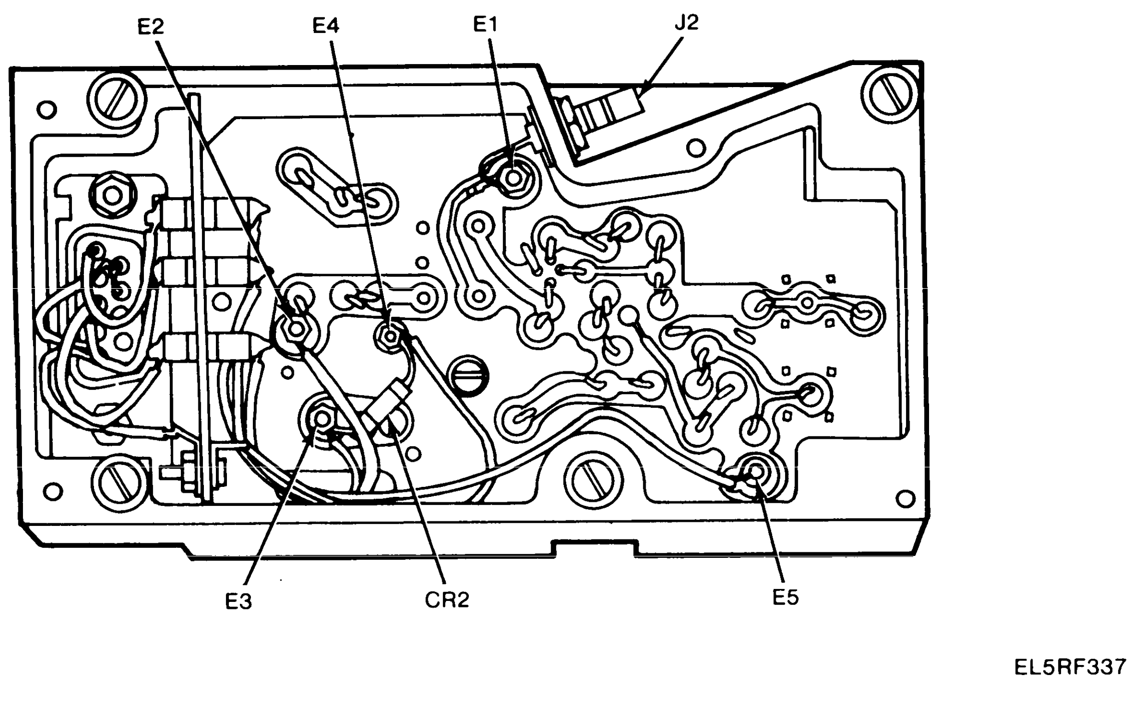


Figure 4-16. Frequency Mixer Stage 2A1A2A2, Cover Removed.

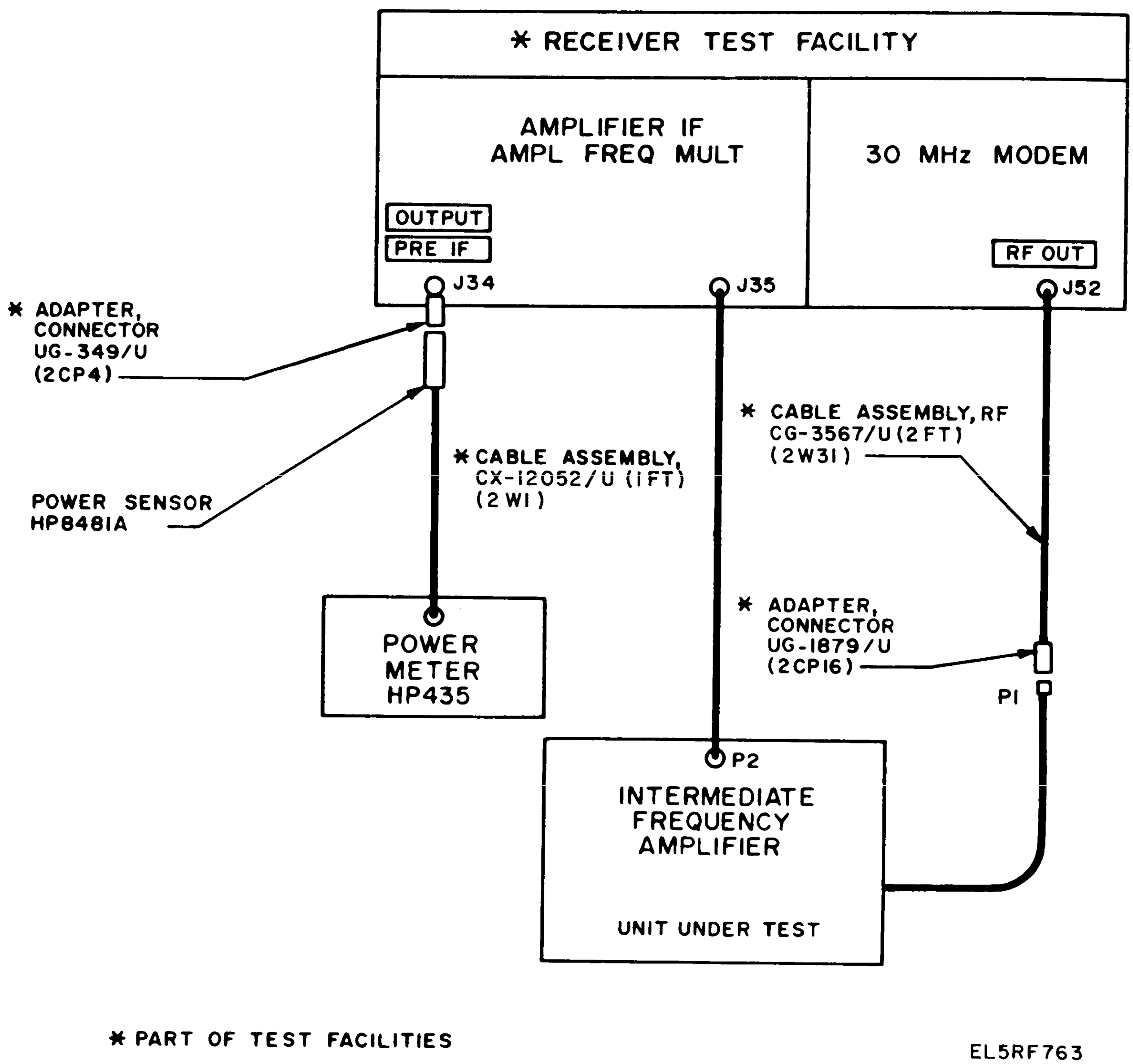


Figure 4-17. Intermediate Frequency Amplifier 2A1A2AR1, Operational Check, Test Setup.

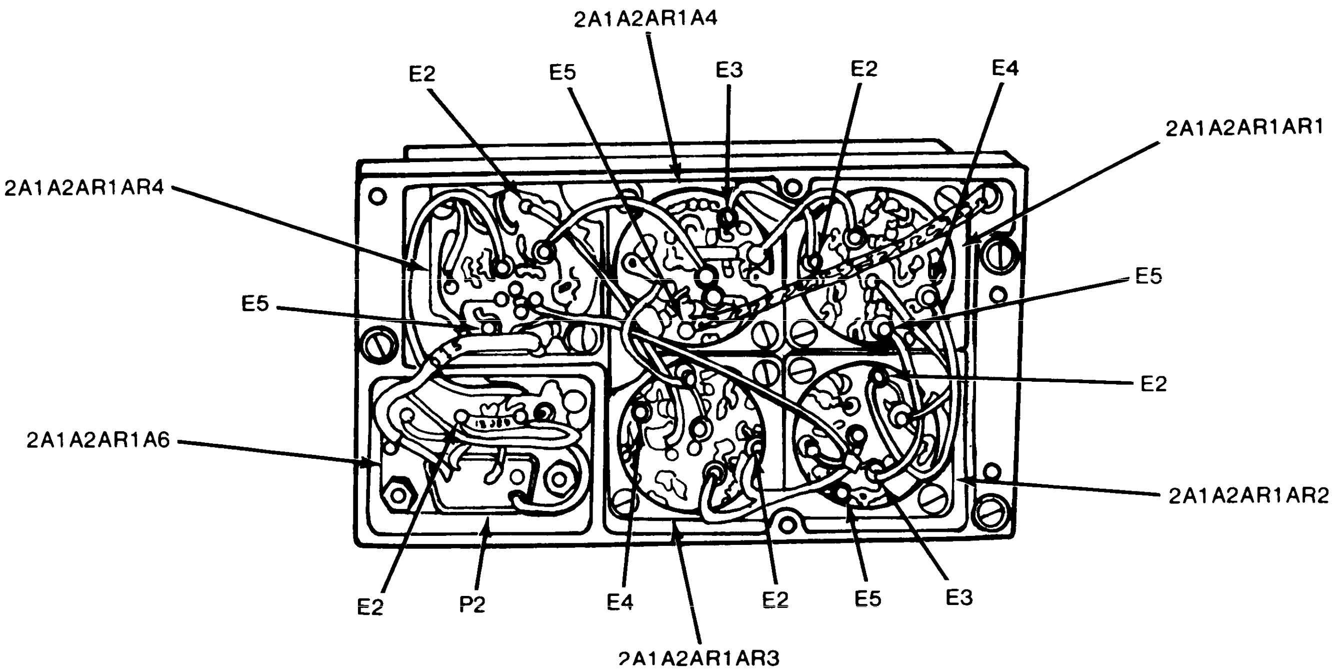


Figure 4-18. Intermediate Frequency Amplifier 2A1A2ARI, Cover Removed.

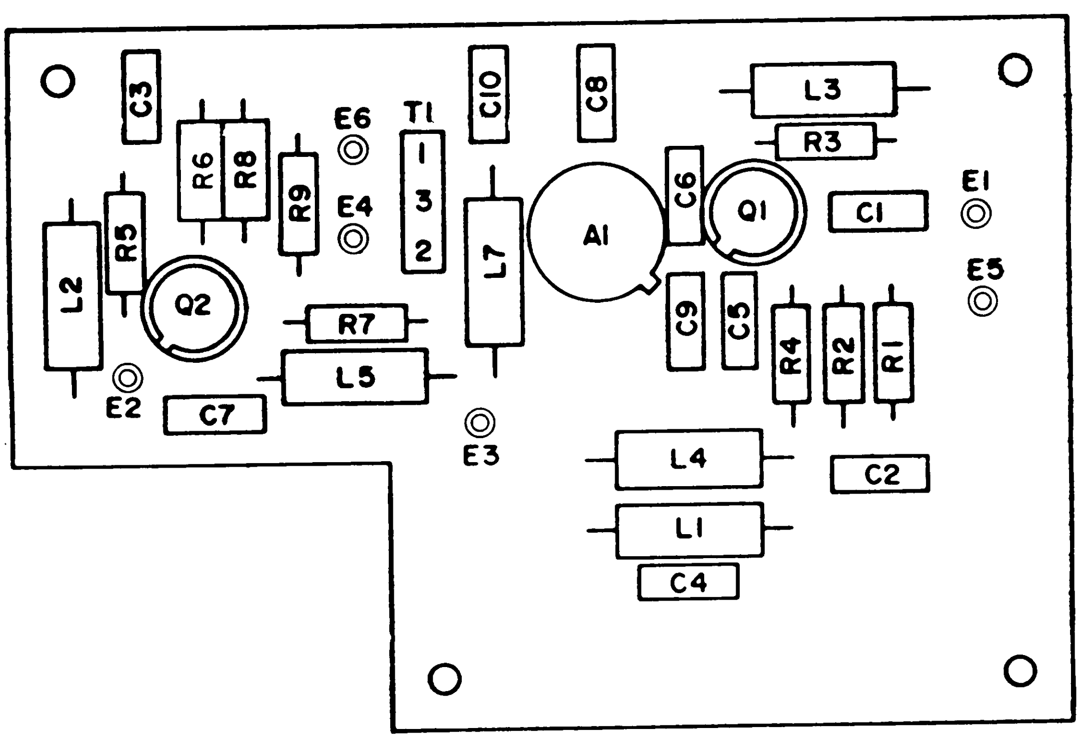


Figure 4-19. Intermediate Frequency Amplifier 2A1A2AR1, Parts Location.

b. Test Procedure. This assembly includes plugs 2A1A3P1, 2A1A3P2, 2A1A3P3, and associated filter connectors. Check each circuit as follows (FO-3 or FO-4 as applicable):

(1) Check continuity between each pin of 2A1A3P3 and its associated filter connector, and between rf connectors A1 and A2 of 2A1A3P3 and 2A1A3P1 and 2A1A3P2.

(2) Check for short circuits between all pins and between rf connectors of 2A1A3P3 and ground.

c. Repairs.

(1) If the tests above indicate that a filter or connector requires replacement, refer to paragraph 2-28.

(2) If one or more of the small connecting pins of 2A1A3P3 are broken, remove 2A1A3 and replace 2A1A3P3. Refer to paragraph 2-10 for replacement of connectors.

(3) The rf connectors in 2A1A3P3 can be replaced as follows:

(a) Force the rf connectors back onto the connector-filter assembly.

(b) Slide the insulating sleeve back along the cable and unsolder the faulty connector.

(c) Install the new connector on the rf cable (para. 2-10).

(d) Push the new connector into the mounting hole in 2A1A3P3 until the retaining springs snap into place, holding the connector firmly.

(e) If 2A1A3P1 or 2A1A3P2 requires repairs or replacement, refer to paragraph 2-10.

4-7. Signal Level Control Monitor 2A4

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Receiver, TS-2867(V)2/GRM-95(V)2	Receiver test facility
Accessory Kit, Test Facilities Set, MK-1173(V)WGRM-95(V)2	Accessory kit
Accessory Kit, Test Facilities Set, MK-1985(V)l/GRM-95(V)2	Accessory kit
Generator, Sweep, Wiltron 610D plus plug-in 61084D	Sweep generator
Generator, Signal, HP-8640B	Signal generator
Multimeter, AN/USM-451	Multimeter
Meter, Power, HP-435A plus Power Sensor, 8481A	Power meter and sensor
Oscilloscope, AN/USM-281C with 7A22 Differential Amplifer plug-in	Oscilloscope
Drive Generator, Airborne Instrument Labs-125	Power signal source
Voltmeter, RF, ME-426/U	Rf voltmeter
Attenuator, 3 dB, Weinschel 25-3-34	3 dB high power attenuator

b. Test Procedures.

(1) *Alarm level setting.*

(a) Connect the test equipment as shown in A, figure 4-20.

(b) Set the variable attenuator to 1 dB. Set the signal generator as follows: frequency to 300 MHz; OUTPUT LEVEL range to +10 dBm; meter select to LEVEL VOLTS. Adjust the signal generator OUTPUT LEVEL vernier for a +10 dBm indication on the power meter. Note the signal generator panel meter indication.

(c) Connect the test equipment as shown in B, figure 4-20.

(d) Set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S6	REFL PWR

(e) If necessary, adjust R3 (fig. 4-21) of the unit under test so that the HIGH SIGNAL ALARM lamp on the receiver test facility is OFF.

(f) Readjust R3 of the unit under test so that the HIGH SIGNAL ALARM lamp just comes on.

(g) Increase the variable attenuator to 10 dB and if necessary decrease the signal generator output level with the OUTPUT LEVEL vernier control (do not use step attenuator) until the HIGH SIGNAL alarm lamp just extinguishes. The signal generator panel meter indication should not have decreased more than 11 dB below the level noted in *(b)* above.

(h) Reset the variable attenuator and signal generator OUTPUT LEVEL vernier control for +10 dBm as noted in (b) above. The HIGH SIGNAL lamp should light.

(i) If the requirements of (g) and *(h)* are not met, readjust R3 until requirements are met.

(j) Repeat *(a)* through *(c)* and *(g)* through *(i)* above for frequencies of 220 and 405 MHz.

(k) If R3 was adjusted in *(j)* above, repeat the above procedures until requirement are met at all test frequencies.

(2) *Input VSWR check.*

(a) Connect the test equipment as shown in A, figure 4-22.

(b) Set the receiver test facility switch S1 to ON and turn switch S6 to REFL PWR.

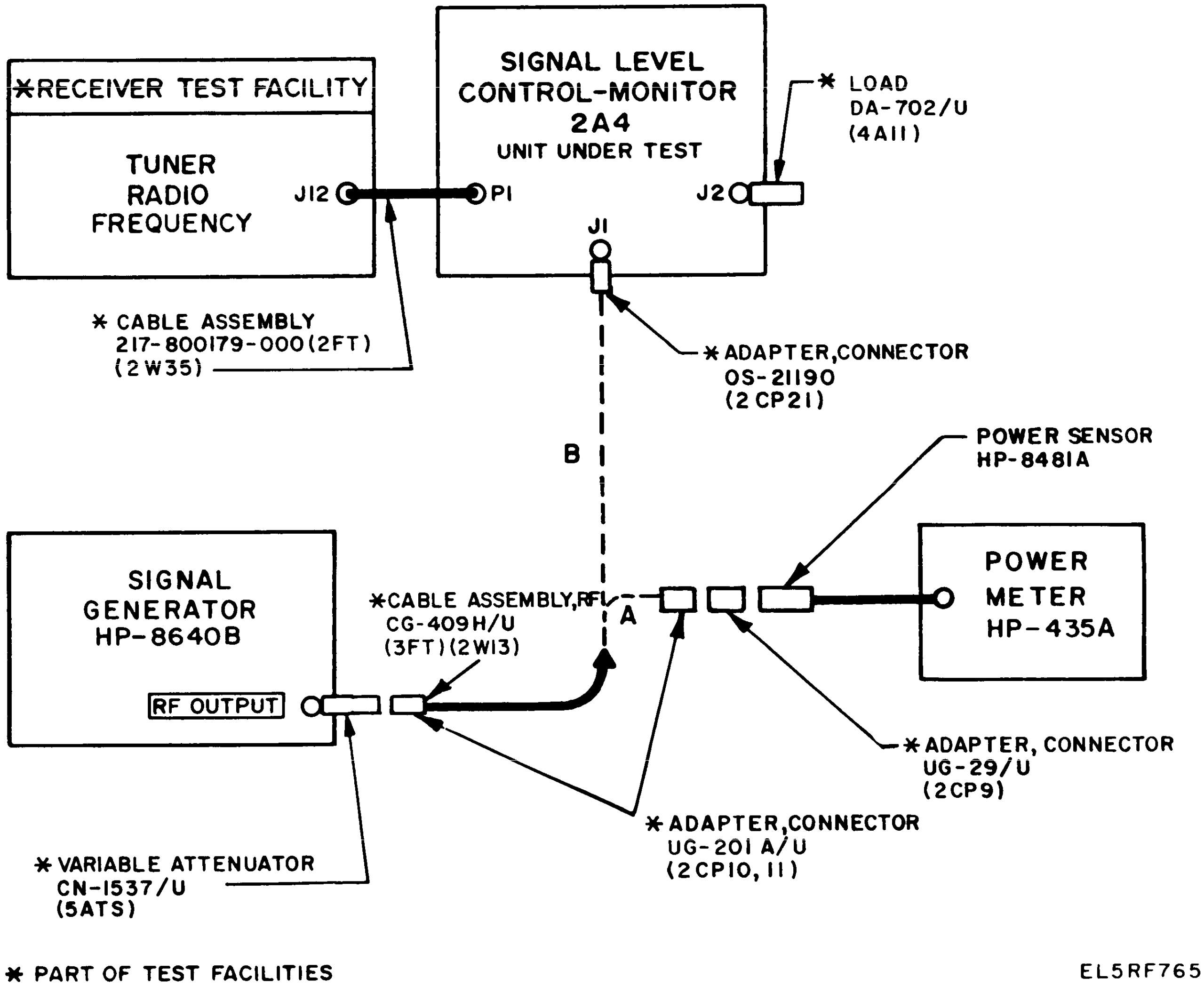


Figure 4-20. Signal Level Control Monitor 2A4, Alarm Level Setting, Test Setup.

(c) Set the sweep generator for a flat response over the frequency range of 220 to 405 MHz to deliver a sweep output at a level of -20 dBm as indicated on the power meter.

(d) Disconnect power meter, and connect the 1.30:1 calibrated mismatch load as shown in B, figure 4-22.

(e) Calibrate the oscilloscope for a VSWR of 1.30:1 over the frequency range 220 to 405 MHz.

(f) Connect the test equipment as shown in C, figure 4-22. The VSWR of the unit under test should not exceed 1.30:1 over the frequency range 220 to 405 MHz.

(3) Insertion loss check.

(a) Connect the test equipment as shown in A, figure 4-23.

(b) Set the signal generator controls to deliver 405 MHz at – 10 dBm as indicated on the signal generator attenuator dial.

(c) Set the variable attenuator to 1.0. Note the power meter indication.

(d) Connect the equipment as shown in B, figure 4-23.

(e) Adjust the variable attenuator to obtain the same indication as that noted in *(c)* above. The difference between this variable attentutor setting and 1.0 is the insertion loss and should not exceed 0.8 dB.

(4) *Isolation check.*

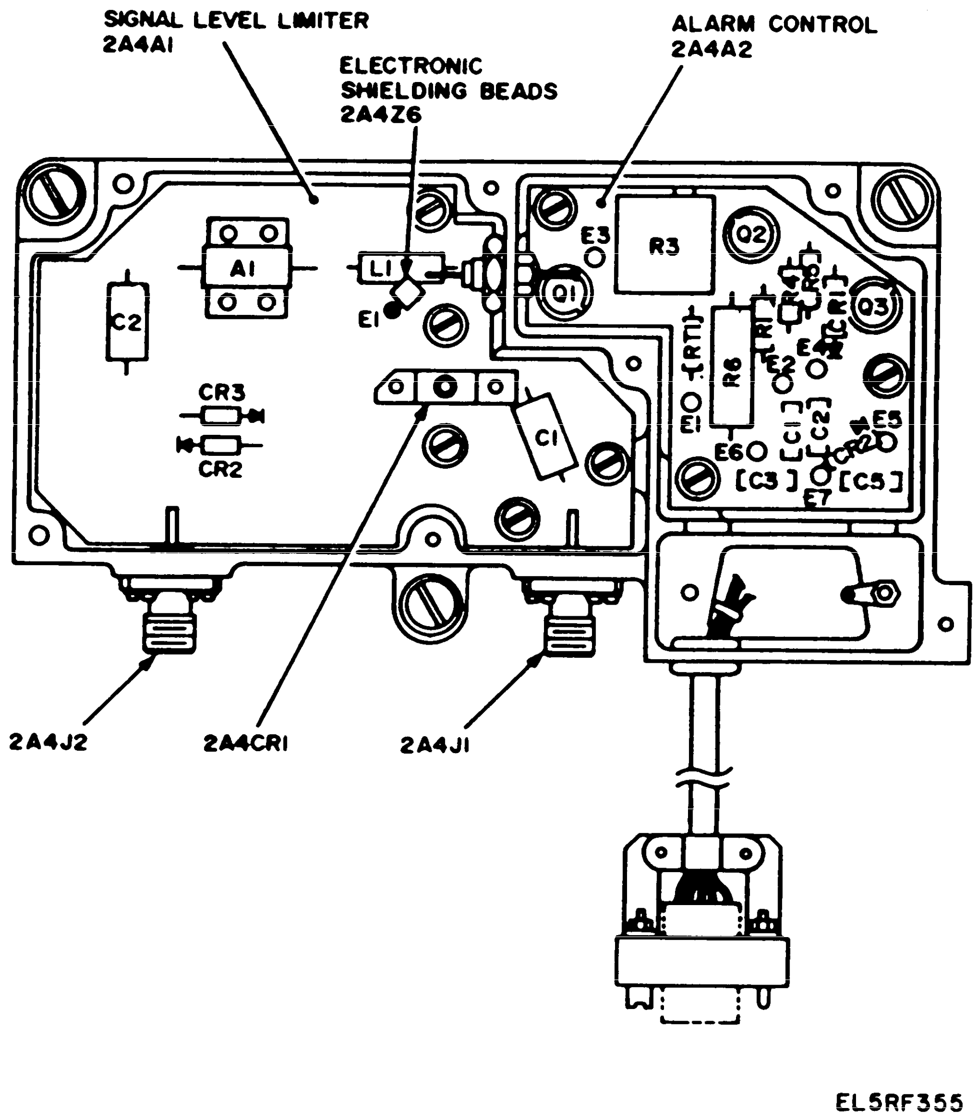


Figure 4-21. Signal Level Control Monitor 2A4, Top View, Cover Removed, Component Location

(a) Connect the test equipment as shown in figure 4-24. Set coaxial switch to position 1.

(b) Set test facility switches S1 to ON and S6 to REFL PWR.

(c) Adjust the power signal source to 220 MHz.

(d) Using the power meter, adjust the rf level at the input to the directional coupler to +43 dBm (20 watts). Take into account the calibrated values of the two 20 dB attenuators and the coupling factor of the directional coupler.

(e) Set the coaxial switch to position 2 and note the reading on the power meter, the rf leakage level must not exceed +17 dBm from J2 on the unit under test (– 13 dBm power meter indication).

c. Troubleshooting (FO-28).

(1) Remove the seven screws securing the 2A4 cover and remove the cover.

(2) Remove the three screws securing 2A4A2 and turn the board over to perform voltage checks described in paragraph *d.* Ensure 2A4A2 components do not short out against the 2A4 chassis.

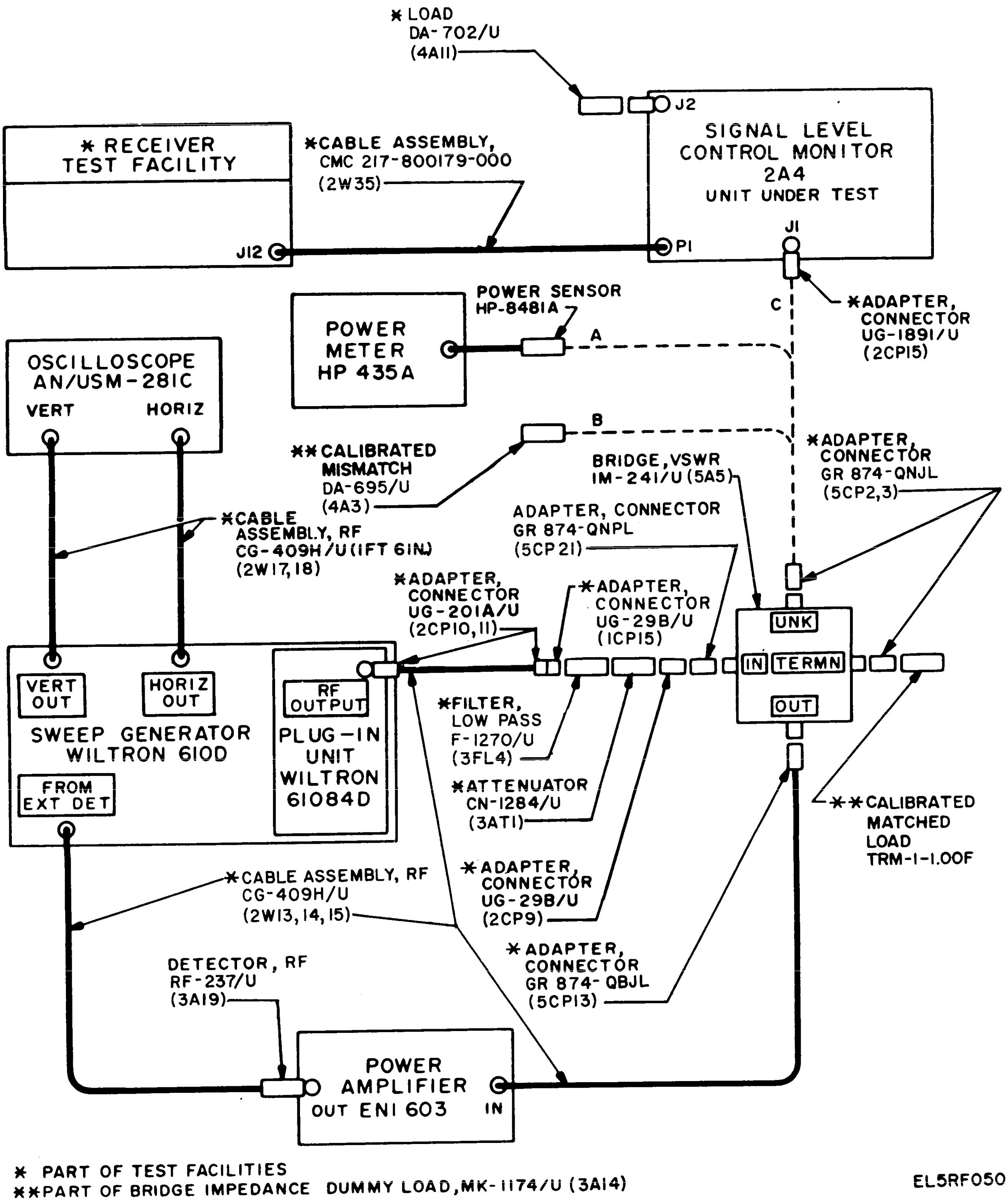


Figure 4-22. Signal Level Control Monitor 2A4, Input VSWR Check, Test Setup.

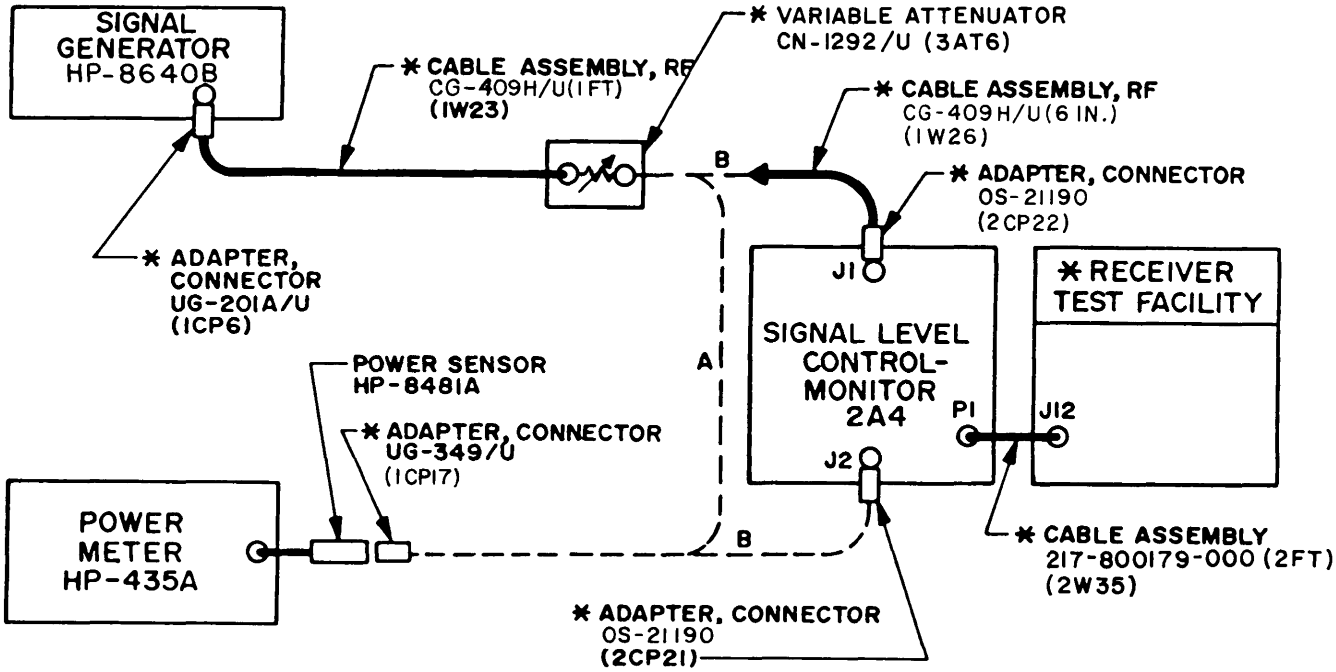


Figure 4-23. Signal Level Control A40 Monitor 2A4, Insertion Loss Check, Test Setup.

c. Troubleshooting. – Continued

Symptom	*Checks and corrective measures*
1. High signal alarm lamp does not light.	*a.* Check the rf signal level at the junction of 2A4CR1 and Al of 2A4A1 (fig. 4-21) using the allocated rf voltmeter to ascertain that signal is present to switch on the alarm control subassembly. This level should be 0.4 volts rms. Check components and replace if required.
	b. Check the voltages on transistors (fig. 4-2 1) as established in *d.* below. Investigate any abnormal indication. Replace defective components.
	c. If Q1 base voltage requirement is not met, check for defective pin diode 2A4CR1 and/or rf limiter Al of 2A4A1 (fig. 4-21).
2. High VSWR.	*a.*. Check the wiring and components in the rf path from J1 to J2.
	b. Replace defective components. Rf limiter 2A4A1Al is probable cause.
3. High insertion loss and/or poor isolation.	*a.* Check the wiring and components in the rf path from J1 to J2.
	b. Replace defective component, CR1, CR2, CR3 or Al.

d. Voltage and Resistance Measurements (fig. 4-21).

NOTE

Use the allocated digital multimeter for voltage and resistance measurements.

(1) Dc voltage measurements are referenced to ground.

(a) Connect test equipment as shown in figure 4-20. Switch coaxial switch to POSITION 1.

(b) Adjust sweep generator output for +10 dB at 300 MHz to measure ALARM ON voltages, and for –10 dB at 300 MHz to measure ALARM OFF voltages.

Test points		*Typical indication (volts dc)*	
		Alarm on	*Alarm off*
2A4A2Ql	– base	–0.3	+ 0.2
	– emitter	+0.35	+ 0.4
	– collector	+0.01	–11.75
2A4A2Q2	– base	0	–11.75
	– emitter	–0.65	–11.87
	– collector	–0.6	–26.5
2A4A2Q3	– base	–0.65	+27.0
	– emitter	+0.12	+26.5
	– collector	+0.4	()

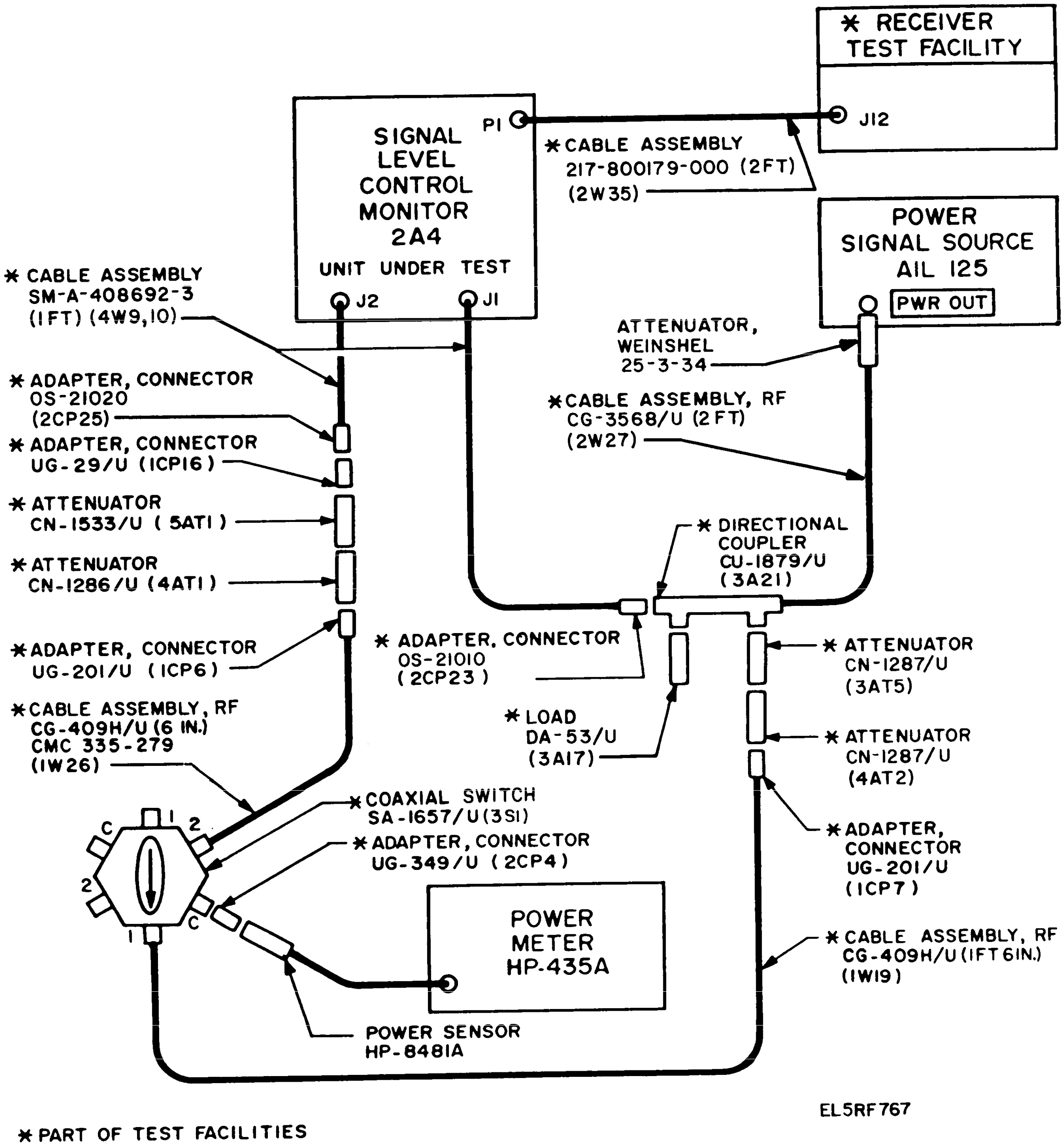


Figure 4-24. Signal Level Control Monitor 2A4, Isolation Check, Test Setup.

(2) *Resistance measurement.*

Transistor	Base (–)				Base (+)			
	Emitter (+)		Collector (+)		Emitter (–)		Collector (–)	
	Resistance (kΩ	Range (kΩ)	Resistance (kΩ)	Range (kΩ)	Resistance (kΩ)	Range (kΩ)	Resistance (kΩ)	Range (kΩ)
Q1	105	200	100	200	—	200	—	200
Q2	95	200		200	—	200	93	200
Q3	90	200	95	200	100	200	—	200

4-8. Amplifier-Frequency Multiplier AM-4320/GRC-103(V),AM-4320A/GRC-103(V) or AM-4320B/GRC-103(V)

NOTE

Reference is to all units unless otherwise specified.

a. Test Equipment Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(V)2/GRM-95 (V)2	Transmitter test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95 (V)2	Accessory kit
Frequency Counter, TD-1225(V)l/U	Frequency counter
Multimeter, Digital, AN/USM-451	Digital multimeter
Wattmeter, AN/USM-298	Wattmeter
Element, Wattmeter, BIRD Model 50D	200-500 MHz element
Megohmmeter, GR- 1864	Megohmmeter

b. Test Procedure (figs. 4-25 through 4-31).

(1) *Preliminary check (AM-4320B/GRC-103(V), only).*

NOTE

Before connecting the unit under test to the transmitter test facility, a resistance check of the temperature sensor (fig. 4-31) is required.

(a) Connect the digital multimeter between pins 17 and 43 of connector P1 of the connector filter assembly, 6AR1A2A3. The resistance measured should be within the limits shown in figure 4-25 for the temperature of the output tube heat radiator.

WARNING

High voltages are accessible at the test leads and connections when the megohmmeter is used. Switch to “OFF” and “DISCHARGE” before connecting or disconnecting test leads.

(b) Short pins 17 and 43 together and connect the megohmmeter between the shorting wire (pins 17 and 43) and pin 1 (H.V. connection).

(c) Turn the megohmmeter power switch on, and set its voltage control to 600 volts.

(d) Set the “DISCHARGE - CHARGE - MEASURE” switch to “CHARGE” and then “MEASURE”. The resistance indicated on the megohmmeter should be greater than 50 megohms.

(e) Return switches to “DISCHARGE” and “OFF”.

(f) Disconnect megohmmeter and the short between pins 17 and 43.

(2) *Preliminary power output adjustments.*

NOTE

Note the plating used on the output cavity assembly. For gold plated assembly, resistor R2 (A, fig. 4-27) should be 5.1 ohms. For nickel plated assembly, R2 should be 4.7 ohms. Verify or install the correct value as in paragraph 4-13d., step (7) *(c).*

(a) Remove the dust cover from the unit to be tested. Connect the test equipment as shown in A, figure 4-26.

(b) Direct cooling air from the AIR OUTLET of the transmitter test facility to the rear of the unit under test. Use hose assembly air duct MX-8414/GRM-95(V) (IMP2).

(c) Set the XMTR TUNE and XMTR CHANNEL controls on the unit under test to channel 40.

(d) Set the test facility switches as follows:

Switch	*Position*	*Normal indication*
S1	ON	—
S17	ON	—
S20	S12	—
S12	OSC	Test facility meter Ml indicates between 20% and 90% full scale deflection. LOW PWR lamp on the test facility should light.

(e) Ensure that the power supply is set as 115 vat. Adjust if necessary.

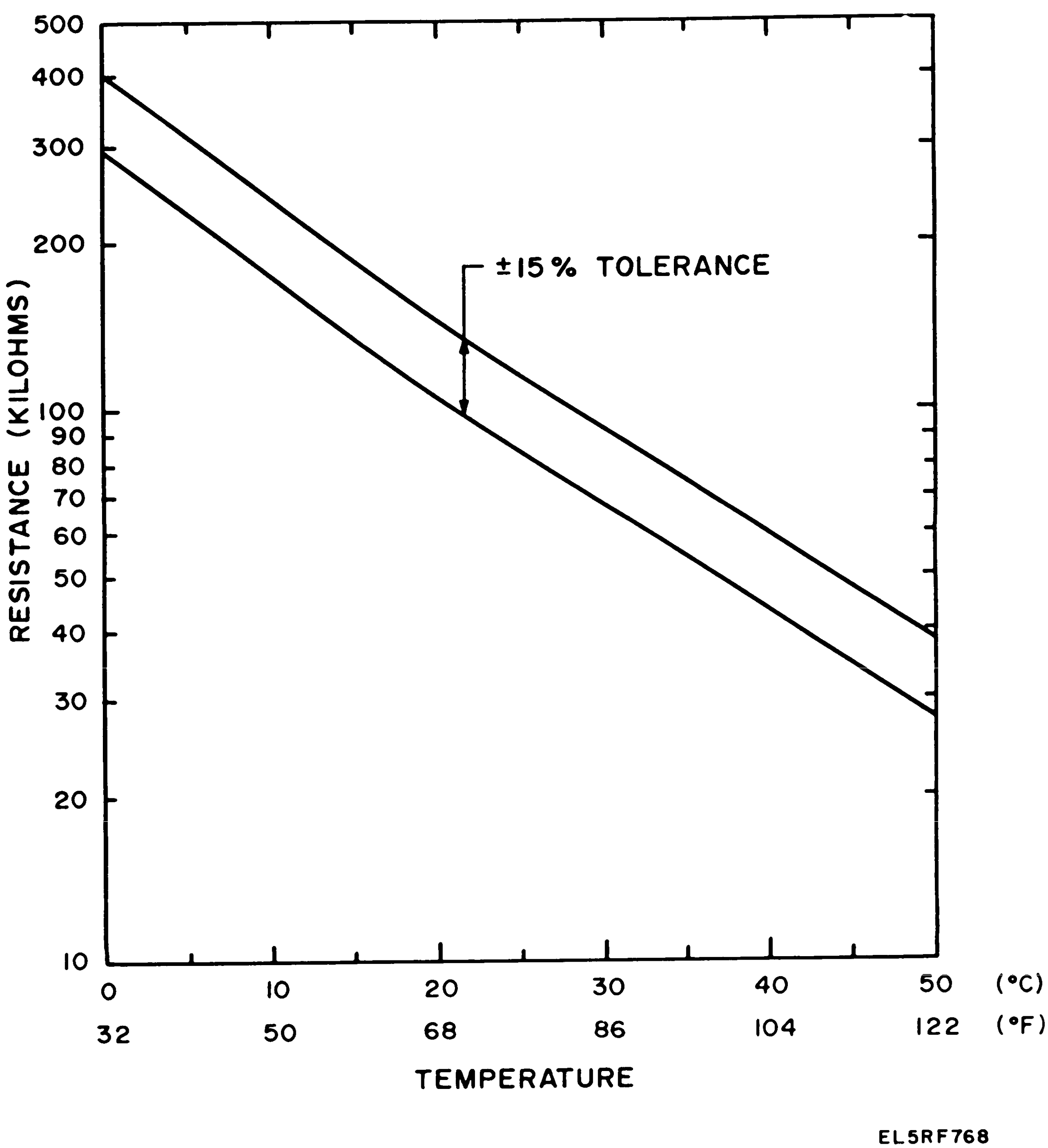


Figure 4-25. Amplifier-Frequency Multiplier AM-4320, Temperature Sensor, Temperature vs. Resistance Chart.

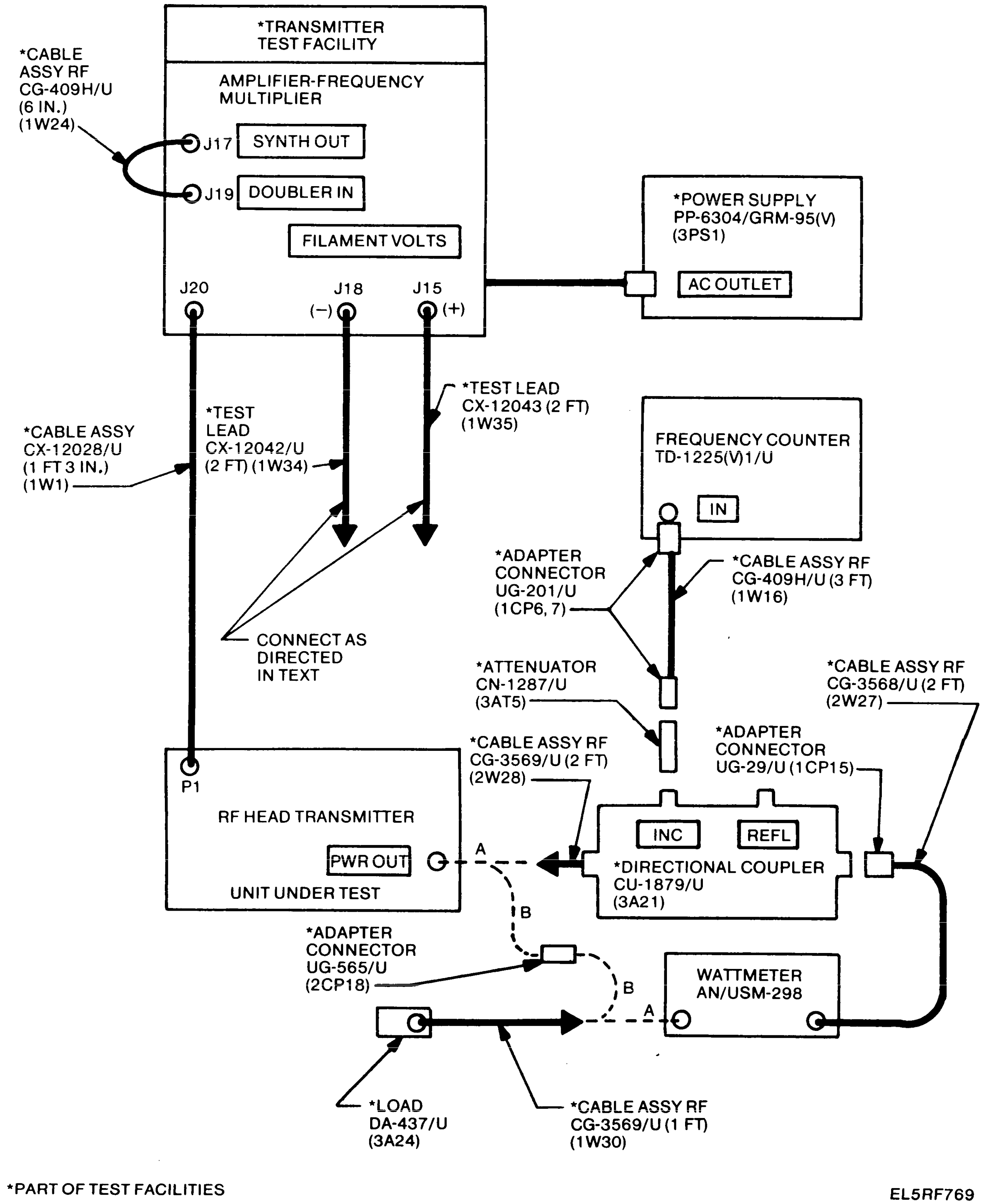
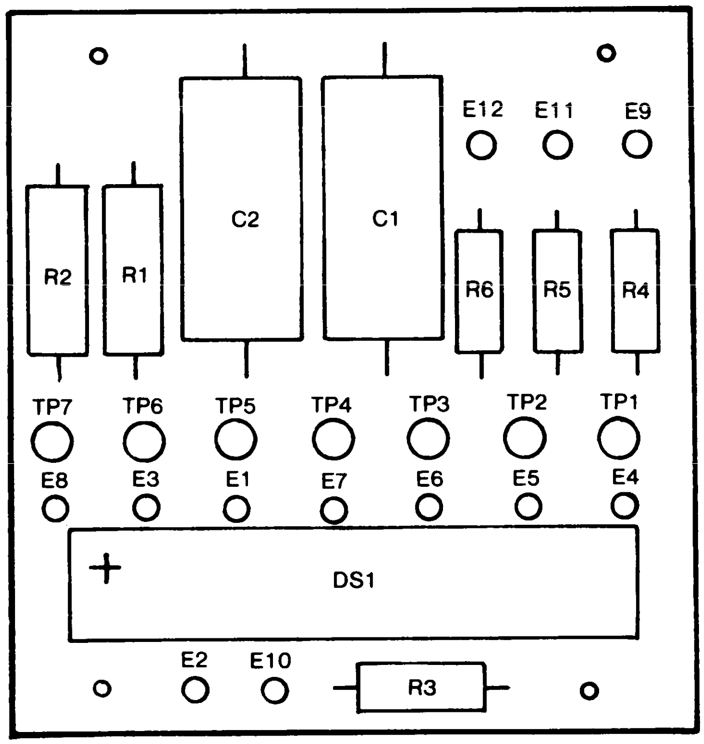


Figure 4-26. Amplifer-Frequency Multiplier AM-4320, Test Setup.

A



CIRCUIT CARD ASSEMBLY GAR1A2A2

B

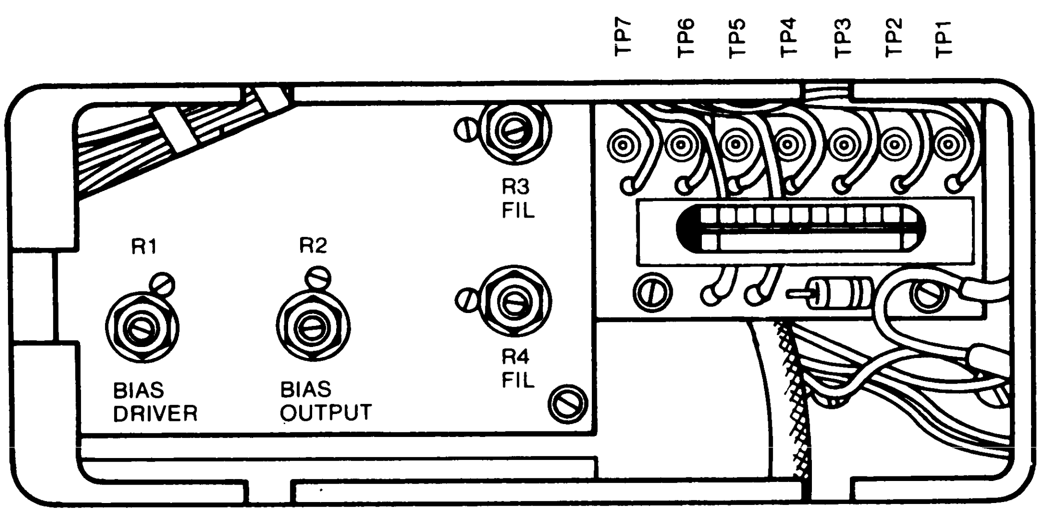


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Figure 4-27. Amplifier-Frequency Multiplier AM-4320, Test Points and Adjustment Controls.

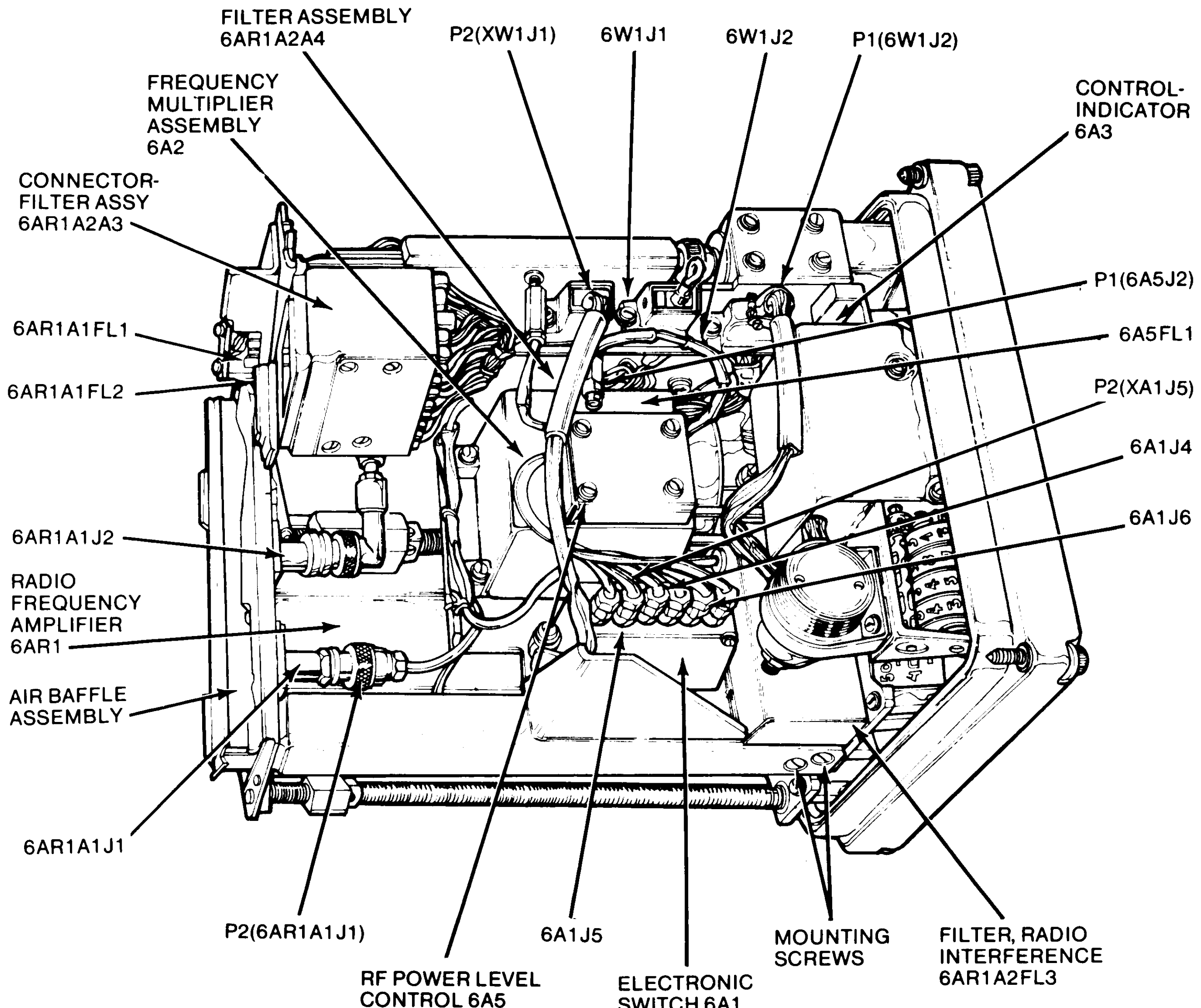


Figure 4-28. Amplifier-Frequency Multiplier AM-4320, Top View, Left

(f) Set the test facility stitches as follows:

Switch	*Position*	*Normal indication*
S12	DBLR	Ml indicates between 10% and 90% of full scale (20% and 90% on AM-4320 plain model).
S12	MULT	Ml indicates between 20% and 90% of full scale, after tuning is completed,

(g) Set switch S13 to ON. Recheck for 115 vac on the power supply. Readjust if necessary.

(h) Set test facility switch S12 to the DRIVER position. Push in the PWR OUT PEAK knob on the unit under test and tune for a peak indication on meter Ml. The meter should indicate between 20% and 90% of full scale deflection.

(i) Set test facility switch S12 to the PWR OUT position. Pull out the PWR OUT PEAK knob and tune for a peak indication on Ml. The meter should indicate between 20% and 90% of full scale. The test facility LOW PWR lamp should go out.

(j) Set test facility switch S12 to REFL OUT. Meter Ml should indicate less than 5% of full scale.

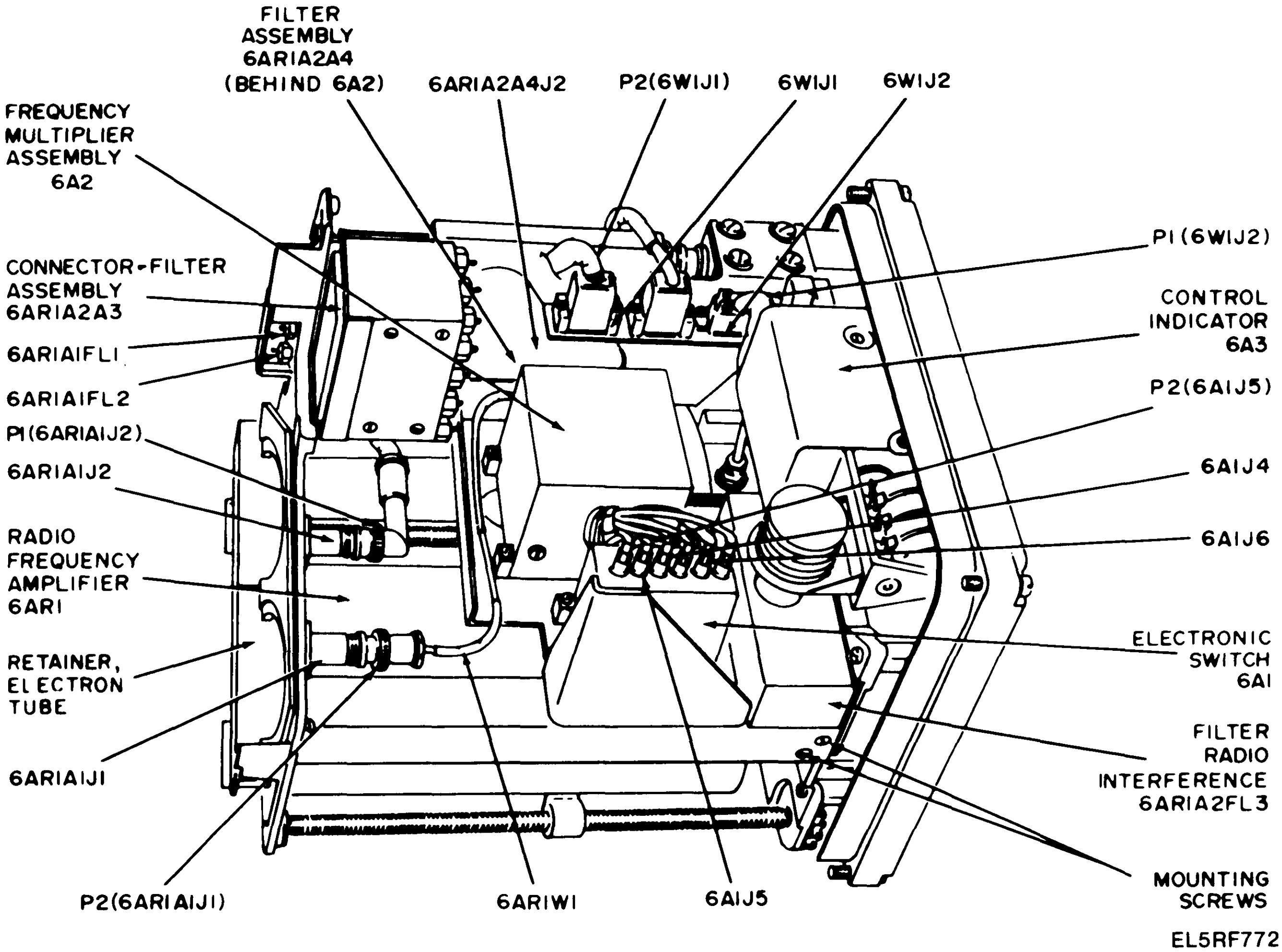


Figure 4-29. *Amplifier-Frequency Multiplier AM-4320A, Top and Left View.*

NOTE

If the requirements of *(j)* above are not met, connect the equipment as shown in B, figure 4-26. Meter Ml should indicate less than 5% of full scale. Reconnect the equipment as shown in A, figure 4-26.

(3) *Cathode and heater voltage adjustments and tube emission check.*

(a) On the unit under test, connect test points TP3 and TP4, on circuit card assembly 6AR1A2A2 (A, fig. 4-27), to test facility connectors J15 and J18 (FILAMENT VOLTS) respectively.

(b) Set switch S12 to position FIL V. Adjust R3 FIL (B, fig. 4-27) on 6AR1 until meter M1 indicates exactly 50% of full scale.

(c) Connect test points TP1 and TP2 of assembly 6AR1A2A2 (A, fig. 4-27) to test facility connectors J18 and J15 (FILAMENT VOLTS) respectively.

(d) Set switch S12 to FIL V. Adjust R4 FIL (B, fig. 4-27) until meter Ml indicates exactly 50% of full scale. Allow a 60-second warm-up period before continuing.

(e) Set switch S12 to DRIVER CUR. Adjust R1 BIAS DRIVER (B, fig. 4-27) until meter Ml indicates exactly 50% of full scale.

(f) Connect the digital multimeter to test points TP7 (+) and TP5 (–) on assembly 6AR1A2A2 (fig. 4-27). Set multimeter range to 1 VOLT DC. Adjust R2 BIAS OUTPUT (B, fig. 4-27) for a 0.75 Vdc reading on the multimeter.

(g) Set switch S12 to EMISSION and switch S15 to OUTPUT.

(h) Press test facility EMISSION switch S14 for 15 seconds and observe meter Ml. The meter should indicate in the green band or above and remain constant for the duration of the test.

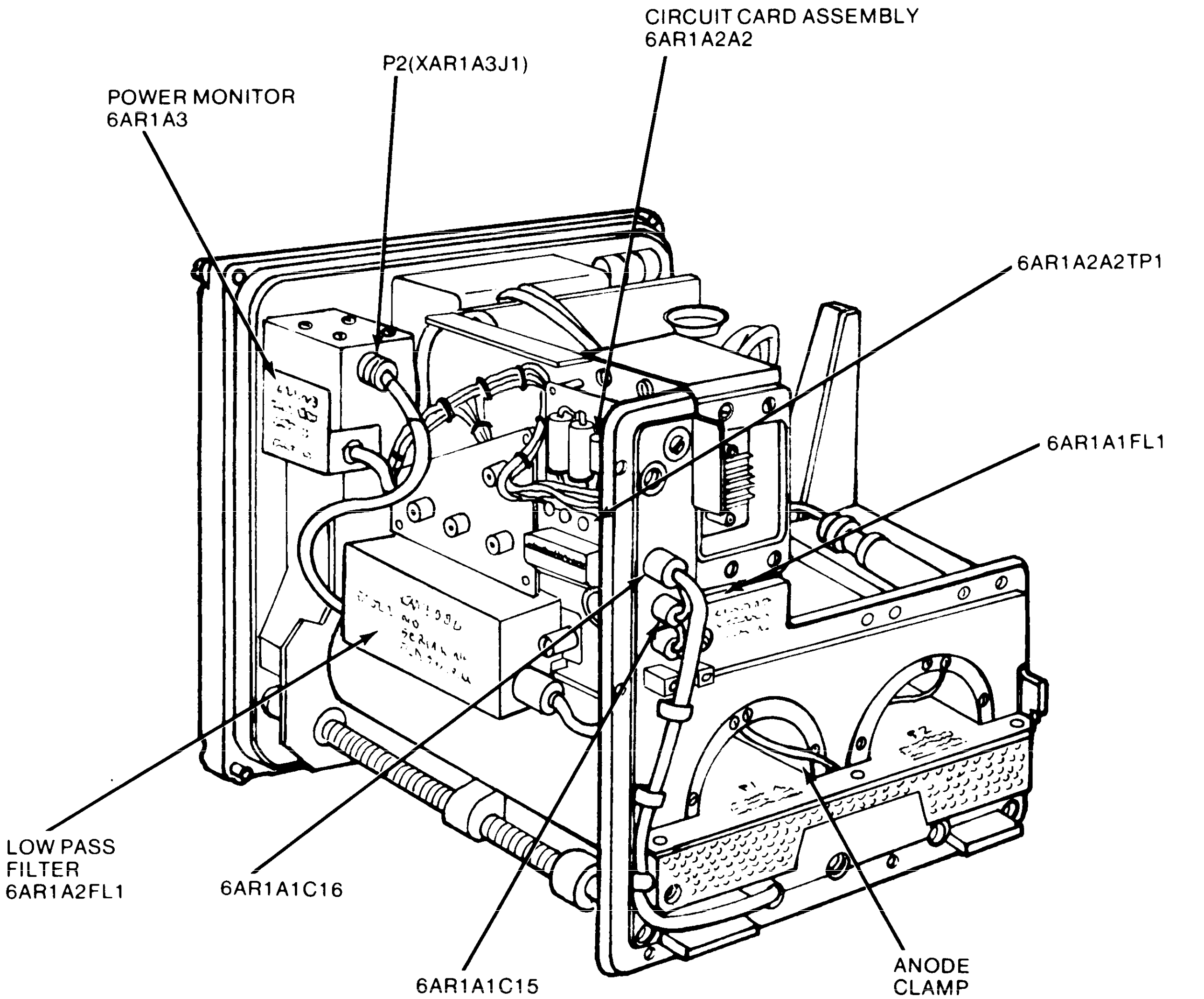


Figure 4-30. Amplifier-Frequency Multiplier AM-4320, Side View.

NOTE

Meter indication will automatically drop off after approximately 15 seconds. If the meter indication slowly reduces below the green band, replace the output tube and repeat *(c)* and *(d)* and *(f)* and *(g)* above.

(i) Set switch S15 to DRIVER. Press EMISSION switch S14 for 15 seconds and observe meter Ml. The meter should indicate in the green band or above and remain constant for the duration of the test.

NOTE

If meter indication reduces by more than 10% of full scale, replace the driver tube and repeat *(a), (b), (e),* and *(h).*

(j) Repeat *(2)(g)* and *(h)* above. The level indicated by the wattmeter should be at least 30 watts.

(k) Disconnect the CG-3569/U from the PWR OUT connector. Set switch S12 to PWR OUT, then to REFL OUT. Meter Ml should indicate between 20% and 90% of full scale in both positions.

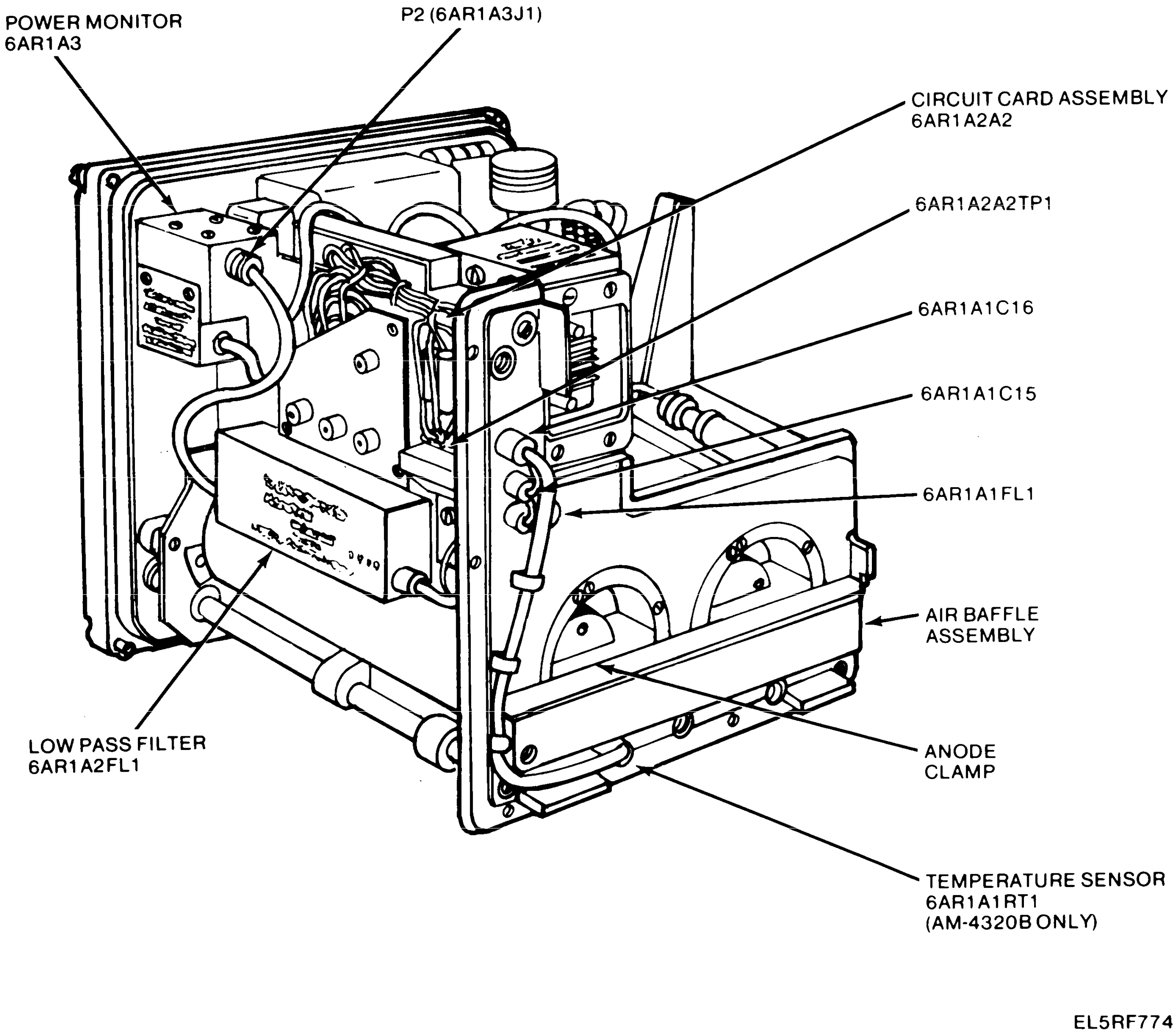


Figure 4-31. Amplifier-Frequency Multiplier AM-4320A or 4320B, Side View.

(l) Reconnect the CG-3569/U to the PWR OUT connector.

(m) Set switch S12 to PWR OUT.

(n) Rotate the XMTR TUNE control on the unit under test until meter M1 indicates zero. The test facility LOW POWER lamp should light.

(4) *Power output, frequency, and tracking check.*

(a) Connect the test equipment as shown in A, figure 4-26. Set the XMTR TUNE and XMTR CHANNEL controls to channel 40.

(b) Repeat (2)(g) and *(h)* above. The wattmeter should indicate at least 35 watts. The frequency counter should read 220 MHz ± 2.2 kHz.

(c) If necessary, vary the XMTR TUNE control and repeat (2) *(g)* and *(h)* above to obtain the required output power. The channel number must be within ±1/2 inch of the display window marker.

(d) Repeat *(a)* through *(c)* above for the remaining channels in the table below.

XMTR TUNE and XMTR CHANNEL	*Power output (watts,)*	*Frequency (MHz ± kHz)*
60	35	230 + 2.3
80	35	240 ± 2.4
100	*32*	*250 ± 2.5*
111	30	255.5 ± 2.55
112	30	256 ± 2.56
120	30	260 ± 2.6
140	30	270 ± 2.7
160	30	280 ± 2.8
179	30	289.5 ± 2.89
180*	30	290 ± 2.90
200	30	300 ± 3.0
220	30	310 ± 3.1
240	30	320 ± 3.2
260	30	330 ± 3.3
280	30	340 ± 3.4
300	30	350 ± 3.5
320	30	360 ± 3.6
340	30	370 ± 3.7
360	30	380 ± 3.8
380	30	390 ± 3.9
400	30	400 ± 4.0
409	30	404.5 ± 4.04

*Crossover point for synthesizer. May require 20-30 seconds to desynchronize when switched to this channel.

(e) Set switch S13 to OFF and disconnect unit under test from test setup.

(5) *28 volt interlock check.* Connect the digital multimeter between pins 11 and 12 of the power connector (6 AR1A2A3P1) of the unit under test. The resistance indicated should be less than 1 ohm.

c. Troubleshooting (FO-29, FO-30,or FO-31).

Symptom	*Probable cause*	*Checks and corrective measures*
1. DRIVER metering greater than 100 percent full scale (AM-432Q/GRC-103(V) only).	Faulty rf power level control 6A5 or loss of control voltage to 6A5 (fig. 4-28).	Measure voltage at 6A5FL1; it should be between 7.2 and 9.5 vdc. If low or high, remove 6A5 and troubleshoot (para. 4-12). If zero volt at 6A5FL1, check 6A5P2, 6W2J1, and wiring to 6ARIA2A2.
2. LOW POWER lamp does not go out within 60 seconds after test facility switch S13 is set to ON. Low level at PWR OUT connector, and low meter indication with test facility switch S12 at PWR OUT.	*a.* Defective power monitor 6AR1A3 (high insertion loss) (fig. 4-30).	a. Measure the power at P2 (XAR1A3J1). Use test setup shown in B, figure 4-26. If level is normal replace 6AR1A3.
	b. Defective low pass filter 6AR1A2FL1 (fig. 4-30).	*b.* Measure the power at 6AR1A1J2 (fig. 4-28). If normal, check continuity of 6AR1A2FL1 connectors P1 and P2. If open or shorting, repair connectors. If connectors are normal, replace 6AR1A2FL1.
	c. Defective amplifier subassembly 6AR1A1.	*c.* Measure the power at 6ARIA2A4J2 (fig. 4-29). If a normal reading (not less than 4 watts) is obtained, check the output amplifier stage as shown in para. 4-13.
3. LOW POWER lamp does not go out within 60 seconds after S13 is set to ON. Low meter indication with S 12 at PWR OUT. Level at PWR OUT connector normal.	*a.* Defective power monitor 6AR1A3 (fig. 4-30). *b.* Defective wiring 6 W1J3 to connector filter assembly 6AR1A2A3 (fig. 4-28).	*a.* Replace power monitor 6AR1A3 per TM 11-5820-540-30. *b.* Check continuity of wires from 6W1J3 to 6AR1A2A3 pins 26 and 27. Repair or replace FL26 or FL27 as required.
4. No REFL OUT reading *(b(3)(l)* above).	Defective power monitor 6AR1A3 (fig. 4-30).	See 3a. above.
5. LOW POWER lamp does not go out within 60 seconds after S13 is set to ON. Low meter indication with S12 at positions PWR OUT and DRIVER.	*a.* Defective output amplifier stage of 6ARlA1.	*a.* Measure the power at 6AR1A2A4J2. If normal set S 13 to OFF and disconnect the transmitter freed head. Measure the resistance between TP1 and TP2 of 6AR1A2A2 fig. 4-27 (should be 1.5 ohm approx.). If the TP1 to TP2 test indicates open circuit, check circuit continuity of TP1 through to 6ARlA2A4J2. If continuity testis normal, replace the output tube (TM 11-5820-540-12). Test the troubleshoot 6AR1 output stage as described in para. 4-13.

c. *Troubleshooting.* -Continued

Symptom	*Probable cause*	*Checks and corrective measures*
	b. Defective filter assembly 6AR1A2A4 (fig. 4-29).	*b. If* power at 6AR1A2A4J2 is abnormal, measure power at P1 (6AR1A2A4J3). If normal, remove 6AR1A2A4 and test as described in para. 4-18.
	c. Defective drive amplifier stage of 6ARlA1.	*c.* Measure the power at 6AR1A2A4J4. If normal, set test facility switch S13 to OFF and disconnect the transmitter rf head. Measure the resistance between TP3 and TP4 of 6AR1A2A2 fig. 4-27 (should be 1.5 ohm approx.). If TP3 to TP4 test indicates open circuit, check continuity of circuit TP4 through to 6AR1A2A4J4. If continuity testis normal, replace the driver tube (TM 11-5820-540-12). Test and troubleshoot the driver stage as described in para. 4-13.
	d. Defective filter assembly 6AR1A2A4 (fig. 4-29).	*d.* If power at 6AR1A2A4J4 is abnormal, measure power at P2 (6AR1A2A4J1). If normal, remove 6AR1A2A4 (refer to para. 2-42) and test as shown in para. 4-18.
	e. Defective rf power level control 6A5 (fig. 4-28).	*e.* If power at P2 (6AR1A2A4J1) is abnormal, measure the power at 6A1J6. If normal, replace 6A5.
6. LOW POWER lamp illuminated at channel 111 or 112.	Defective wiring 6W1J2 to 6AR1A2A3P1 or 6W1J1.	Check continuity between 6W1J2 to 6ARlA2-A3P1 and 6WJ1.
7. No DRIVER CUR indication *(b(3)(f)* above).	*a.* V2 filament circuit shorting to ground.	*a.* Check Cl4 of 6AR1 Al; replace if necessary.
	b. C2 of 6AR1A2A2 shorting.	*b.* Check C2; replace if necessary.
	c. V2 cathode circuit shorting to ground through C7, C8 or Cl0 of 6ARlA1.	*c.* Remove driver amplifier tube V2. Check from center conductor of P2 of 6AR1Al to chassis ground.
8. No OUTPUT CUR indication *(b(3)(g)* above).	*a.* V1 filament circuit shorting to ground.	*a.* Check C13 of 6AR1A1; replace if necessary.
	b. Cl of 6AR1A2A2 shorting.	*b.* Check C1; replace if necessary.
	c. V1 cathode circuit shorting to ground through C7, C8, or C4 of 6ARlA1.	*c.* Remove output tube V1. Check for short circuit to ground on center conductor of P1 of 6ARlA1.
9. Incorrect frequency *(b(4)(b)* above).	Defective control indicator 6A3.	Remove 6A3 (TM 11-5820-540-12) and test as described in para. 4-11. Repair or replace as indicated. If 6A3 tests (para. 4-11) are normal, refer to FO-32 and measure the voltage across each coded switch to the ground bus. The measured voltage should be essentially zero for any coded control line. Readjust or replace defective switch.
10. High resistance *(b(5)* above).	Defective wiring on connector filter assembly 6AR1A2A3.	Check resistance on 6AR1A2A3 between: *a.* FL1l and FL12. *b.* FL1l and pin 11. c. FL12 and pin 12. Repair as indicated (para. 2-40).

4-9. Electronic Switch 6A1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(V)2/ GRM-95(V)2	Transmitter test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Power Meter, HP-435A	Power meter
Power sensor, HP-8481A	Power sensor
Signal Generator, HP-8640B	Signal generator
RF Amplifier, ENI-603L	Rf amplifier
Multimeter, Digital,AN/[lSM-451	Digital multimeter

b. Test Procedure.

(1) *Relay check.*

(a) Connect the unit under test to test facility connector J34.

(b) Set test facility switch S1 to ON and switch S26 to 20 V.

(c) Set test facility switch S27 to position A; test facility lamp A should light.

(d) Set switch S27 to position B; lamp B should light.

(e) Set switch S26 to OFF.

(2) *Input switching circuit check.*

(a) Connect the test equipment as shown in A, figure 4-32. Refer to step 1 for unit under test connections.

(b) Set the 1 dB variable attenuator to 0 dB.

(c) Set the signal generator to 120 MHz at –30 dBm.

(d) Set test facility switch S26 to ON and switch S27 to position A.

(e) Adjust the signal generator output to obtain a +10 dBm indication on the power meter.

(f) Set switch S27 to position B. The signal level measured on the power meter should be less than –10 dBm, indicating a rejection greater than 20 dB.

(g) Return the power meter range switch to +10 dBm and test facility switch S27 to position A.

(h) Connect the test equipment as shown in B, figure 4-32.

(i) Adjust the 1-dB variable attenuator to bring the power meter indication back to +10 dBm. The increase in attenuation, as indicated by the setting of the variable attenuator, represents the insertion loss of the module under test. The insertion loss should be less than 0.75 dB.

(j) Set switch S26 to position OFF. Reset the 1-dB variable attenuator to 0 dB.

(k) Connect the equipment as shown in A, figure 4-32. Refer to step 2 for unit under test connections.

(l) On the test facility, set S26 to ON and S27 to position B.

(m) Repeat step *(e)* above.

(n) Set S27 to position A. The signal level measured on the power meter should be less than -10 dB, indicating a rejection greater than 20 dB.

(o) Return the power meter range switch to +10 dBm.

(p) Connect the test equipment as shown in B, figure 4-32.

(q) Adjust the 1 -dB variable attenuator to bring the power meter indication back to +10 dBm. The increase in attenuation, as indicated by the setting of the l-dB variable attenuator, should be less than 0.75 dB.

(r) Set switch S26 to OFF. Reset the l-dB variable attenuator to 0 dB.

(3) *Output switching circuit check.*

(a) Connect the equipment as shown in A, figure 4-32. Refer to step 3 for unit connections.

(b) Tune the signal generator to 250 MHz and repeat *(2)(d)* through *(j)* above.

(c) Repeat *(b)* above with the signal generator tuned to 350 MHz and 400 MHz.

(d) Set test facility switch S26 to OFF and connect the equipment as shown in A, figure 4-32. Refer to step 4 for unit connections.

(e) Repeat (2)(1) through *(r)* above at 250 MHz, 350 MHz, and 400 MHz.

(f) Set switch S26 to OFF.

(4) *Meter circuit check.*

(a) Connect the test equipment as shown in figure 4-33.

(b) Tune the signal generator to 400 MHz and reduce the output to zero.

(c) Set switch S27 to position B; S20 switch to position S26; and S26 switch to ON.

(d) Increase the output of the signal generator for +3 dBm indication on the power meter. The test facility meter Ml should indicate at least 20 percent of full scale.

c. Troubleshooting (FO-33).

(1) *Relay check.*

Symptom	*Checks and corrective meaures*
Lamp A or B does not light.	Check the operation of relay K1 (fig. 4-34); check relay contacts for open circuit. Replace relay if necessary.

(2) Input Switching circuit check.

Symptom	*Checks and corrective measures*
Steps *(e)* and/or *(f);* no output.	S27 switched to A: Check CR2 for open circuit. Check continuity of circuit wiring from J5 to J4. S27 switched to B: Check CR4 for open circuit. Check continuity of circuit wiring from J5 to J2. Replace CR4 or repair wiring as required.
Step *(f);* low rejection.	S27 switched to B: Check diode CR2 for short circuit. Check continuity of control line from relay contact A2 through L1 to CRW. Replace CR2 or repair wiring as required.
Step *(n);* low rejection.	*S27* switched *to* A: Check diode CR4 for short circuit. Check continuity of control line from relay contact B2 through L2 to CR4.

c. Troubleshooting. – Continued

Symptom	*Checks and corrective measures*
CAUTION If CR2 short circuits Ll, CR4 and L2 will burn out when unit is switched to tripler circuit (S27 position B). Similarly, if CR1 short circuits L1, CR2 and L2 will burn out with S27 in position A.	
Step *(i);* high insertion loss.	S27 switched to A: Check diode CR2 forward and reverse resistance. Replace diode if necessary.
Step *(q);* high insertion loss.	S27 switched to B: Check diode CR4 forward and reverse resistance. Replace diode if necessary.

(3) Output switching circuit test.

Symptom	*Checks and corrective measures*
No output	S27 switched to A: Check CR3 for open circuit. Check continuity of circuit wiring from J3 to J6. Replace CR3 or repair wiring as required. S27 switched to B: Check CR5 for open circuit. Check continuity of circuit wiring from J1 to J6. Replace CR5 or repair wiring as required.
Low rejection	S27 switched to B: Check diode CR3 for short circuit. Check continuity of control line from relay contact B2 through L3 to CR3. Replace CR3 or repair break in continuity. S27 switched to A: Check diode CR5 for short circuit. Check continuity of control line from relay contact A2 through L4 to CR5. Replace CR5 or repair break in continuity.
High insertion loss	S27 switched to A: Check diode CR3 forward and reverse resistance. Replace diode if necessary. S27 switched to B: Check diode CR5 forward and reverse resistance. Replace diode if necessary.

(4) *Metering circuit check.*

Symptom	*Checks and corrective measures*
No indication on test facility meter Ml.	Check diode CR1 for open or short circuit. Replace diode if necessary. Check the continuity of meter circuit from C1 to P2 pin 4. Restore connection if necessary.

4-10. Frequency Multiplier Assembly 6A2

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Multimeter, Digital, AN/USM-451	Digital multimeter

NOTE

If unit is being removed from the transmitter rf head, set the XMTR CHANNEL control to channel 340.

b. Test Procedure.

(1) *Preliminary check.*

(a) Remove the cover from the unit under test.

(b) Check for broken or loose wires, or dirt inside variable air-dielectric capacitors C4, C8, and C3 (fig. 4-35). Check the three gears on the capacitor tuning shafts to ensure that their setscrews are secure.

(c) Place the unit under test on the test facility frequency multiplier test stand (part of the accessory kit) and engage the shaft of the module to the mechanical counter.

(d) Turn the mechanical counter knob until capacitors C4 and C8 are in their maximum capacitance position (fully meshed) as shown in A, figure 4-36. Should capacitors C4 and C8 not he in their fully-meshed position together, proceed as follows:

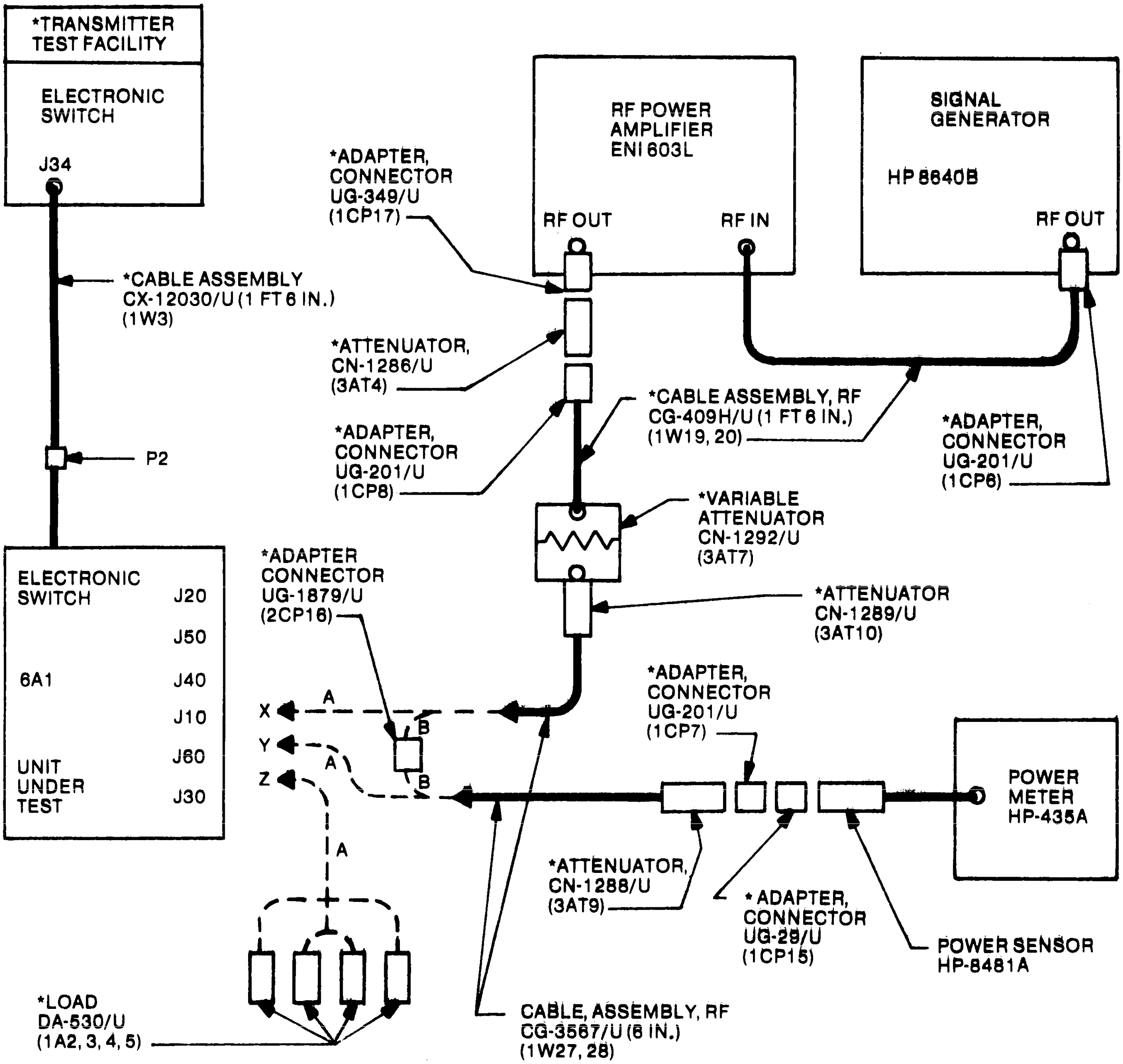
NOTE

One setscrew on each C4 and C8 gear shaft should be accessible from the side of the module.

1. Remove the module from the frequency multiplier test stand if necessary. Loosen the setscrews on the gear shaft adapter of the capacitor not fully meshed.

2. Set the rotor of the capacitor to the fully-meshed position and tighten the setscrews.

3. Turn the drive shaft back and forth and check to see that C4 and C8 go through their maximum capacitance together.



UNIT UNDER TEST CONNECTIONS

STEP NO.	CONNECTION X (INPUT)	Y (OUTPUT)	Z (DUMMY LOADS)
1	J5	J4	J1, J2, J3, J6
2	J5	J2	J1, J3, J4, J6
3	J3	J6	J1, J2, J4, J5
4	J1	J6	J2, J3, J4, J5

*PART OF TEST FACILITIES

EL5RF776

Figure 4-32. Electronic Switch 6A1, Insertion Loss and Rejection Check, Test Setup,

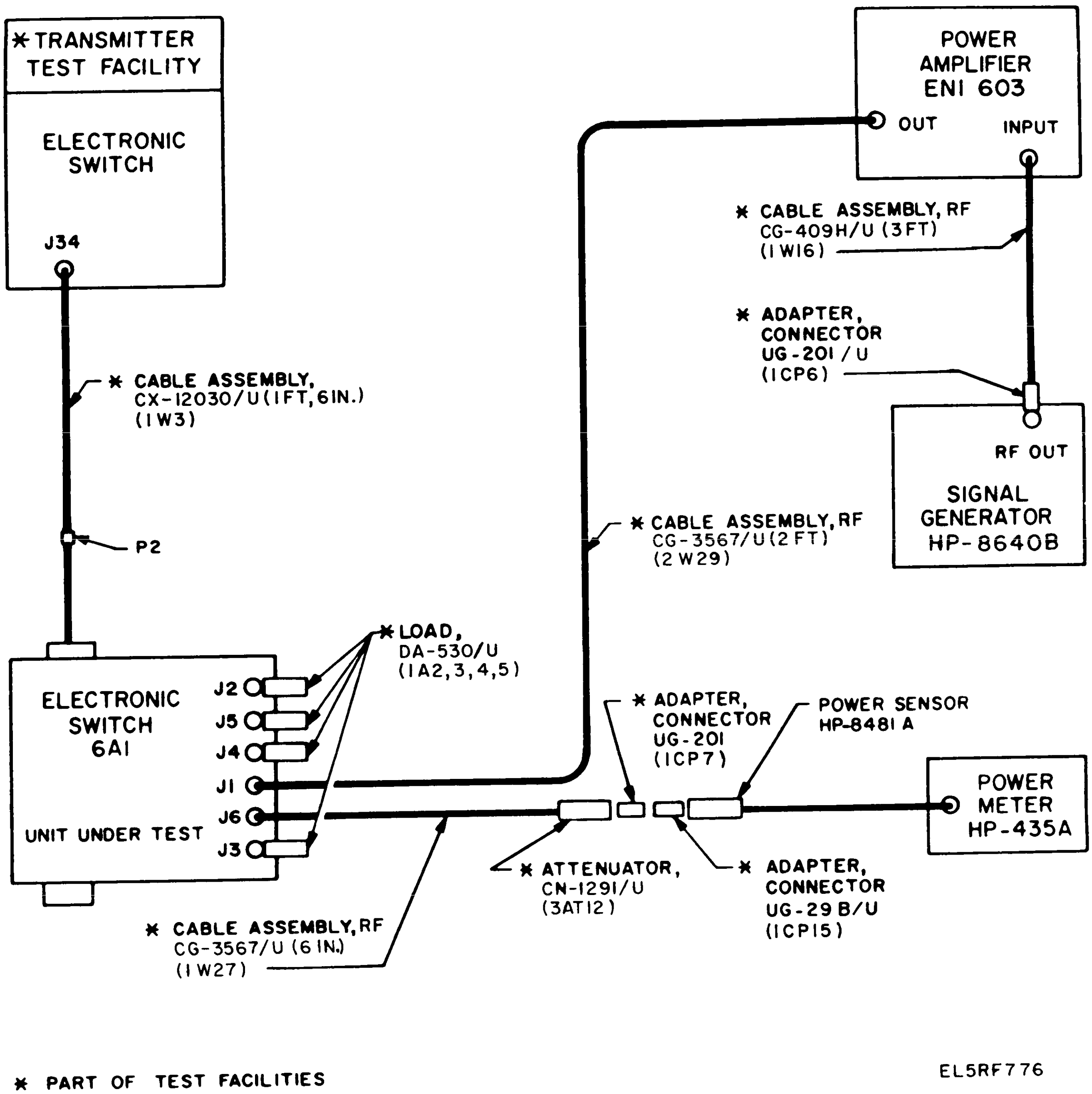


Figure 4-33. Electronic Switch 6Al, Power Monitoring Check, Test Setup.

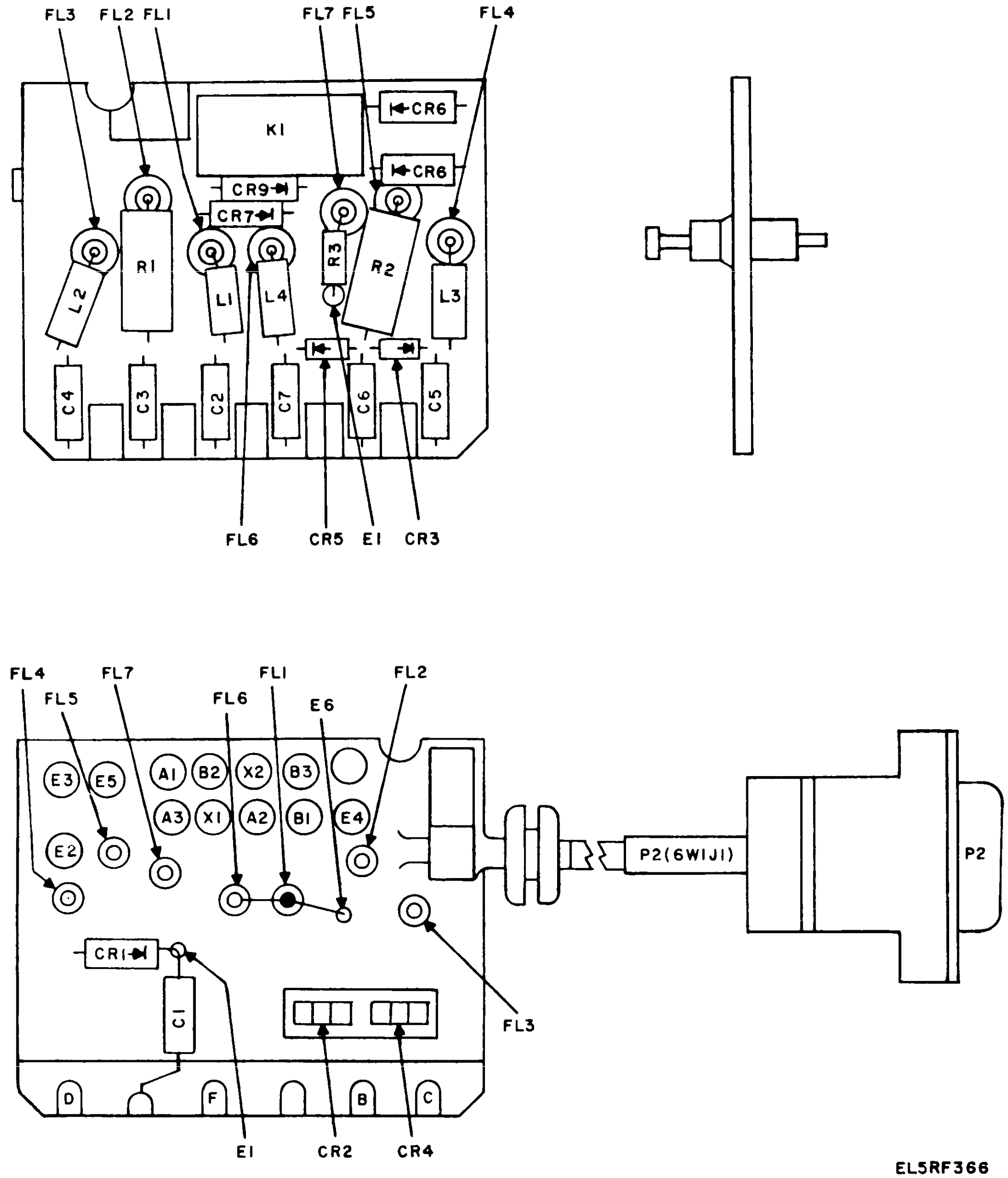


Figure 4-34. Electronic Switch 6A1, Parts Location.

(e) Turn the drive shaft 21/2 turns ccw from the maximum capacitance position of C4 and C8. Capacitor C3 should be at its minimum capacitance (fully open) position as shown in B, figure 4-36. If C3 requires adjustment, proceed as follows:

1. Loosen the setscrews.

2. Set the rotor to its fully open position and tighten the setscrews.

(f) If C4, C8, and/or C3 required adjustment, proceed with adjustment procedures as described in *d.* below.

(2) *Performance checks.*

(a) Reset capacitors C4 and C8 to their maximum capacitance position.

(b) Remove the unit under test from the frequency multiplier test stand and set the counter to 99918.0.

(c) Replace the unit on the frequency multiplier test stand. Do not rotate the drive shaft while engaging the counter.

(d) Connect the four coaxial cables from the unit to the corresponding connectors on the frequency multiplier test stand.

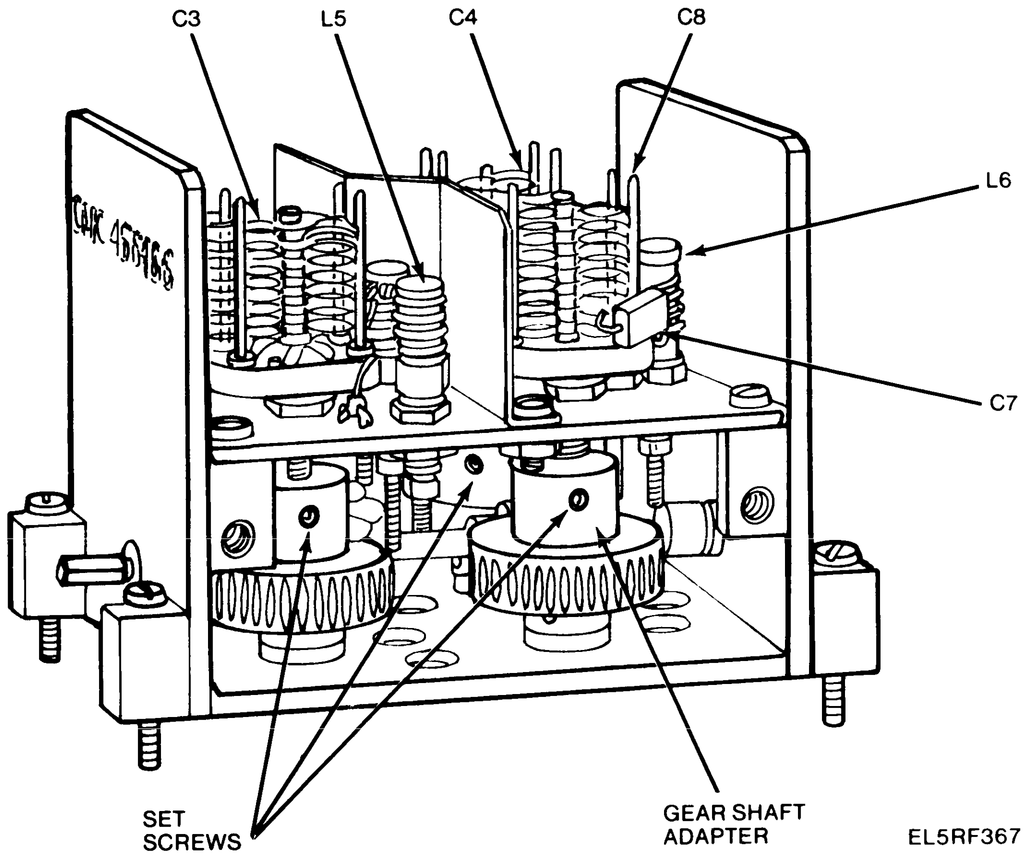


Figure 4-35. Frequency Multiplier Assembly 6A2, Side View (Cover Removed)

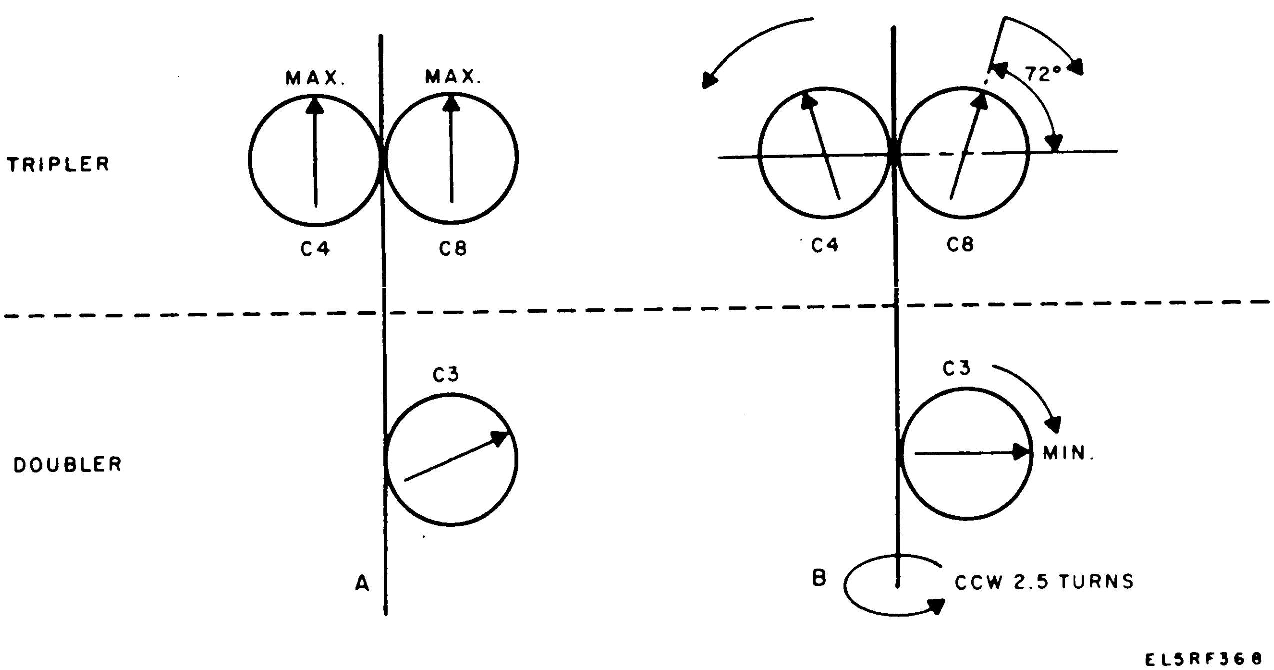


Figure 4-36. Preliminary Setting of Variable Air Dielectric Capacitors.

(e) Connect the test equipment as shown in figure 4-37.

(f) Set the test facility switches as follows:

Switch	Switch position	Normal indication
S1	ON	
S20	S12	
S17	ON	
S18	61.66	
SL2	OSC	Meter Ml reads 20% to 90% fullscale.
S12	DBLR	Meter Ml reads 20% to 90% fullscale.
S26	ON	
S27	B	B lamp lights.

(g) Turn the shaft until the counter indicates 99827.6 (corresponding to channel 340).

(h) Tune the filter to 370 MHz; adjust slightly to obtain a maximum indication on the power meter.

NOTE

- 'There are two variations of frequency multiplier 6A2. Frequency multipliers used with the plain model AM-4320 AGC configuration have mounting posts on the top of the chassis cover to secure level control 6A5 and those used with the A and B model ALC configuration do not.
- The two variations are identical except for covers and output level requirements.

(i) Turn the shaft until the power meter indicates maximum. The shaft counter shall indicate 99827.6 ± 10.0 and the power meter shall indicate +6.4 dBm minimum (greater than 440 mw, plain model) or 4.8 dBm minimum (greater than 300 mw, A and B model configuration).

(j) Repeat procedures described in steps *(g)* through *(i)* above for the remaining channels shown in the table below.

(k) If normal indications are obtained in the preceding tests turn the counter knob until the counter indicates 99827.6 (corresponding to channel 340 and frequency of 370 MHz).

(l) Carefully remove the unit under test from the frequency multiplier test stand and secure the shaft with clamp, figure 4-38.

(m) Replace the cover on the unit under test.

c. Troubleshooting (FO-33).

Symptom	Checks and corrective measures
Step *b. (2)(h)* above: no output, tripler circuit.	Check diode CR2 (fig. 4-39) for short or open circuit; replace diode if necessary. Check for short or open circuit at P3 or P4 connectors. Replace the defective component or restore connections as required.
Step *b. (2)(j)* above: no output, doubler circuit.	Check diode CR1 for short or open circuit; replace diode if necessary. Check for short or open circuit at P1 or P2 connectors. Replace the defective component or restore connections as required.
Step *b. (2)(h)* and/or *(m):* low output, tripler or doubler circuit.	Check the alinement of the module under test as described in *d* and *e* below.

d. Tuning Procedures, Tripler Circuit.

(1) Reset capacitors C4 and C8 to their maximum capacitance position.

(2) Remove the unit under test from the frequency multiplier test stand and set the counter to 99918.0.

(3) Replace the unit under test on the frequency multiplier test stand. Do not rotate the drive shaft while engaging the counter.

(4) Connect the four coaxial cables from the unit under test to the corresponding connectors on the frequency multiplier test stand.

(5) Connect the test equipment as shown in figure 4-37.

Channel	S18	S27	Tune filter to (MHz)	Counter setting	Power meter indication (min.) Plain model	Power meter indication (min.) A and B model
340	61.66	B	370	99827.6	+6.4 dBm	+4.8 dBm
410	67.50	B	405	99807.7	+8.1 dBm	+6.5 dBm
260	54.98	B	330	99858.7	+6.4 dBm	+4.8 dBm
180	48.33	B	290	99897.9	+6.4 dBm	+4.8 dBm
179	72.50	A	290	99898.8	+6.4 dBm	+4.8 dBm
140	67.50	A	270	99921.1	+6.4 dBm	+4.8 dBm
40	54.98	A	220	99999.9	+6.4 dBm	+4.8 dBm

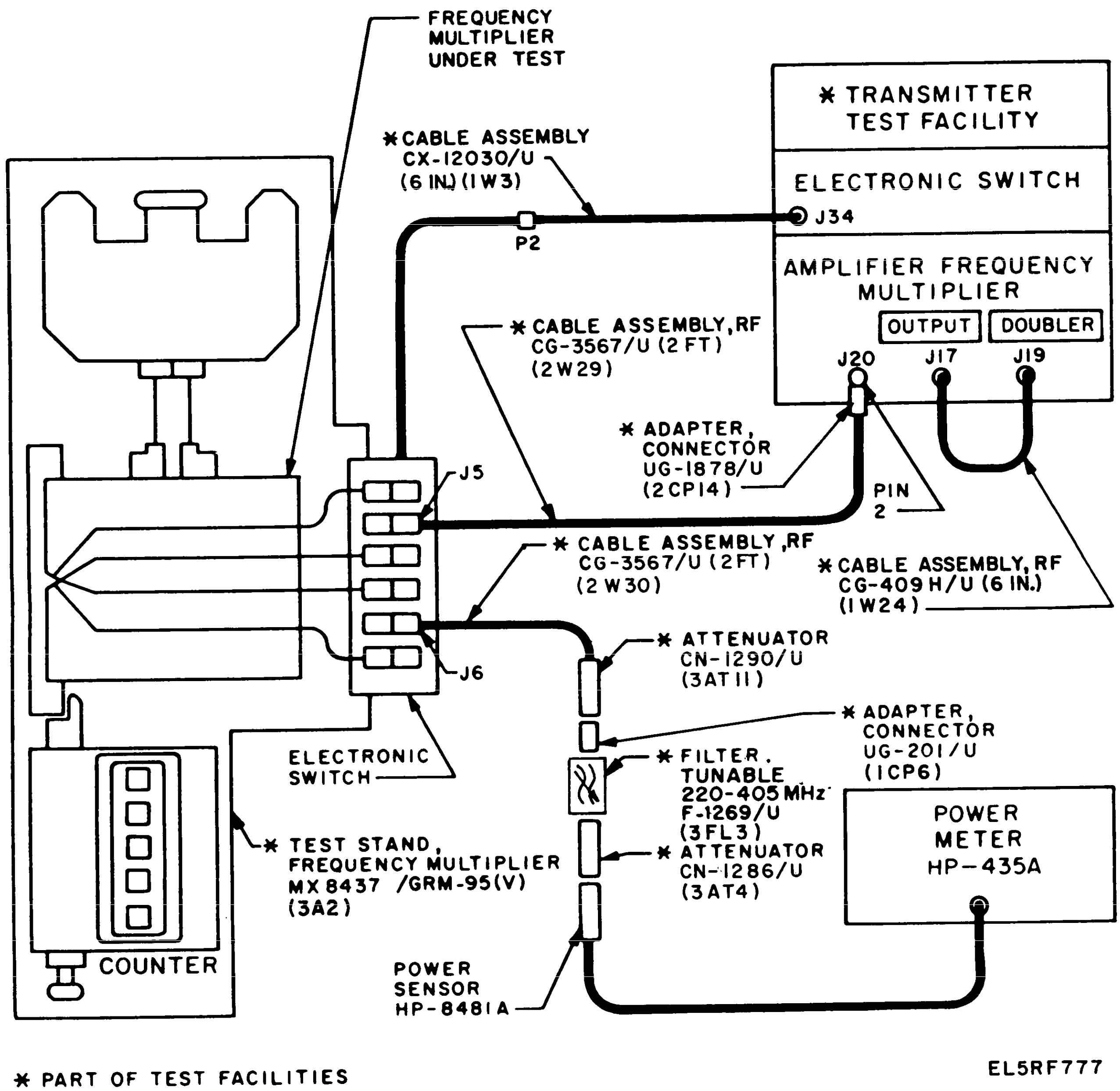


Figure 4-37. Frequency Multiplier Assembly 6A2, Performance Check, Tuning Procedures, Test Setup.

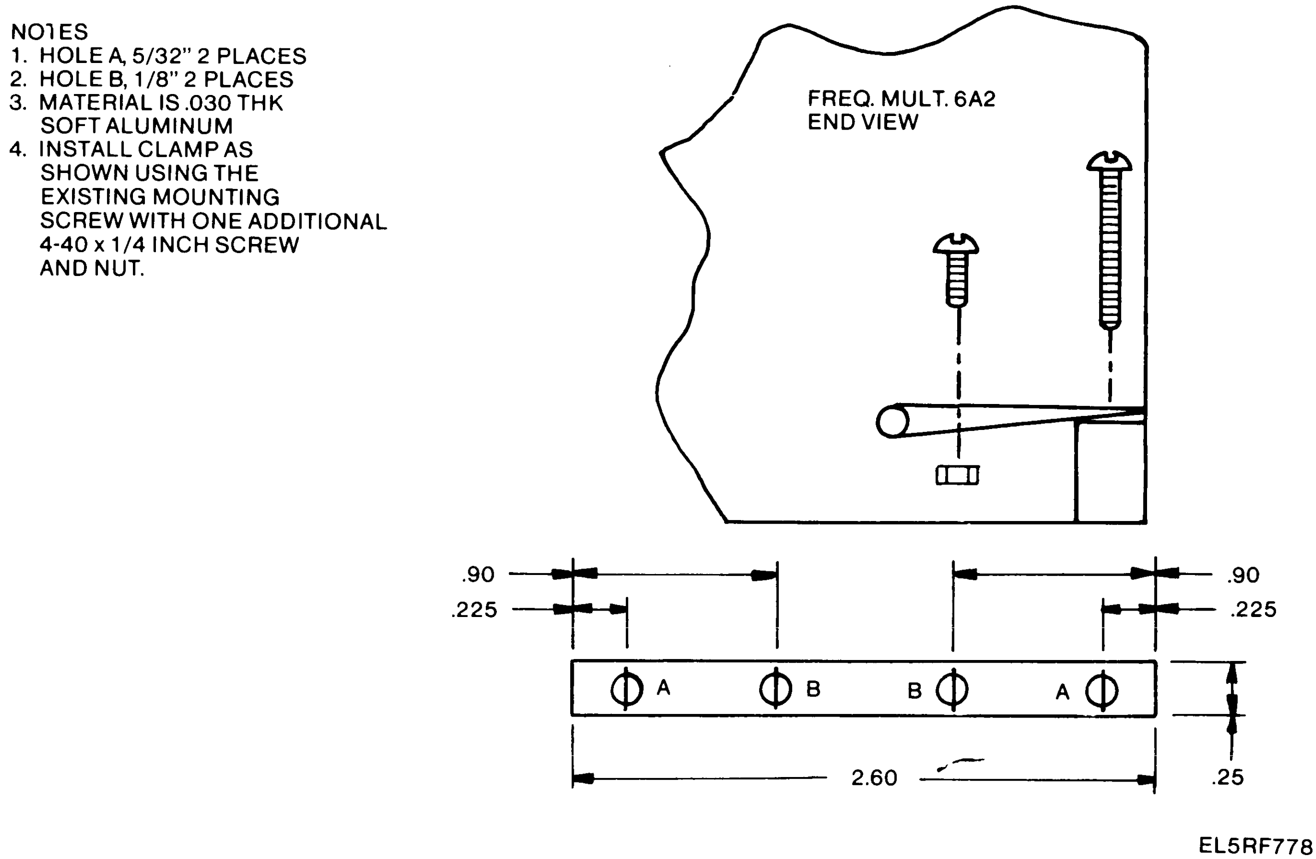


Figure 4-38. Clamp Fabrication and Installation.

(6) Set the test facility switches as follows:

Switch	*Switch position*	*Normal indication*
S1	ON	—
S17	ON	—
S20	S12	—
S18	61.66	—
S12	OSC	Meter M1 should indicate 20% to 90% of full scale.
S12	DBLR	Meter M1 should indicate 20% to 90% of full scale.
S26	ON	—
S27	B	Lamp B should light.

(7) Turn the shaft until the counter indicates 99827.6 (corresponding to channel 340).

(8) Tune the filter to 370 MHz and adjust slightly to obtain a maximum indication on the power meter. The power meter indication should not be less than +6.4 dBm (440 mw, plain model) or +4.8 dBm (300 mw, A or B model).

(9) Adjust L2-L4 and L8-L9 (fig. 4-39) for maximum indication on the power meter. L2-L4 and L8-L9 are matching pairs and must be adjusted together. The power meter indication should be greater than +6.4 dBm (440 mw, plain model) or +4.8 dBm (300 mw, A or B model).

(10) Adjust the counter on the frequency multiplier test stand to indicate 99807.7 and set test facility switch S18 to position 67.5.

(11) Tune the filter to 405 MHz.

(12) If the power meter indication is below 650 mw (+8.1 dBm, plain model) or 450 mw (+6.5 dBm, A or B model), readjust L2-L4, L6, and L8-L9 slightly until a 650 mw (450 mw) indication is obtained.

(13) Repeat steps (9) through (12) above for the remaining channels listed in the following chart. Check and record the power.

NOTE

Occasionally a slight adjustment of coils may be necessary to bring the power within specifications.

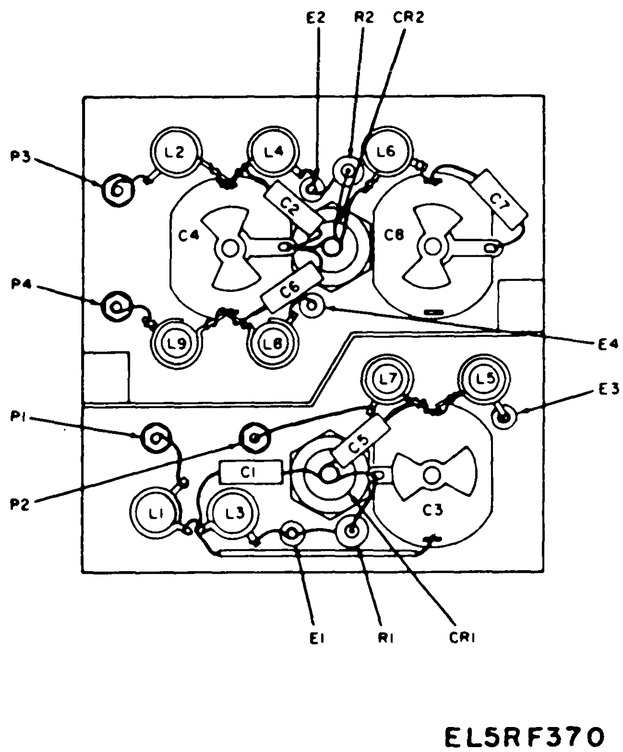


Figure 4-39. Frequency Multiplier Assembly 6A2A1, Parts Location.

Tuning Law of Tripler Circuit: Tuning Range 290-405 MHz

channel *number (ref only)*	*output freq (MHz)*	*Counter setting*	*Test facility switch S18*	*Filter setting (MHz)*	*Required output power* Plain (dBm)	A or B (dBm)
180	289.98	99897.9	48.33	289.98	+6.4	+4.8
208	303.90	99883..1	50.65	303.90	+6.4	+4.8
228	313.86	99873.5	52.31	313.86	+6.4	+4.8
260	329.88	99859.0	54.98	329.88	+6.4	+4.8
299	349.50	99842.7	58.25	349.50	+6.4	+4.8
340	369.96	99827.6	61.66	369.96	+6.4	+4.8
360	380.76	99820.4	63.46	380.76	+7.0	+5.4
392	396.00	99812.2	66.00	396.00	+7.7	+6.1
410	405.00	99807.7	67.50	405.00	+8.1	+6.5

NOTE

Occasionally, it may happen that the specification at two or more points along the band cannot be met at the same time; that is, meeting the specifications at one channel makes it impossible to meet the specifications at the other channels. If such a case occurs, proceed as follows:

(a) Disconnect the drive shaft of the unit under test from the counter; turn the counter one turn clockwise and reconnect the drive shaft to the counter.

(b) Turn the shaft until the counter indicates 99827.6 (corresponding to channel 340).

(c) Repeat the complete tuning procedures above, adjusting the coils as necessary. If the improvement is not sufficient, turn the counter one more turn cw and repeat the complete alinement procedure. Alternately, if the setting procedure in *(a)* above made things worse, turn the counter two turns ccw (one turn ccw from its original setting) and repeat the complete alinement procedure.

e. Tuning Procedure, Doubler Circuit.

(1) Using the test setup shown in figure 4-37, adjust the test stand counter to 99921.1 (corresponding to channel 140).

(2) Set test facility switch S27 to position A; test facility lamp A should light.

(3) Tune the filter to 270 MHz and adjust slightly to obtain maximum indication on the power meter; the level should not be less than +6.4 dBm (440 mw, plain model) or +4.,8 dBm (300 mw, A or B).

(4) Set the test equipment as shown in the chart below.

(5) Adjust coils L1-L3 and L5-L7 on the module under test for maximum power as indicated on the power meter. L1-L3 and L5-L7 are matching pairs and must be adjusted together.

(6) Record the power meter indication; it should be greater than +6.4 dBm (440 mw, plain model) or +4.8 dBm (300 mw, A or B model).

(7) Repeat (3) through (6) above for the remaining channels listed in the chart above.

NOTE

Occasionally a slight adjustment of coils may be necessary to bring the power within specifications.

(8) Balance the power as closely as possible between channels 40 and 179.

NOTE

The output power drops very rapidly from about channel 160 to 179, therefore it may not be possible to balance the power output between channels 40 and 179.

(9) If it is not possible to meet the above specifications, proceed as follows:

(a) Remove the cover of the unit under test and loosen the setscrews on the shaft corresponding to the C3 capacitor.

(b) Turn the rotor of capacitor C3 cw by approximately 5 degrees.

(c) Tighten the setscrews and replace the cover.

(d) Repeat the complete tuning procedure above and adjust the coils slightly.

Tuning Law of Doubler Circuit: Tuning Range 220 to 290 MHz

Channel number (ref only)	*output freq (MHz)*	*Counter setting*	*Test facility switch S18*	*Filter setting (MHz)*
40	219.92	99999.9	54.98	219.92
66	233.00	99978.0	58.25	233.00
94	246.64	99955.9	61.66	246.64
108	253.84	99943.8	63.46	253.84
128	264.00	99928.7	66.00	264.00
140	270.00	99921.1	67.50	270.00
179	289.50	99898.5	72.50	289.50

(e) If this adjustment does not result in some improvement, remove the cover of the unit under test, loosen the shaft, and turn the C3 rotor 10 degrees ccw (5° ccw from its original setting), Repeat the complete tuning procedure above.

(f) Adjust the rotor of capacitor C3 until the power output is within specifications.

(10) Typical final settings of the variable air dielectric capacitors are shown in figure 4-40.

NOTE

Adjust the test stand counter to 99827.6 before removing unit.

(11) Carefully remove the unit under test from the frequency multiplier test stand, and secure shaft with clamp (fig. 4-38).

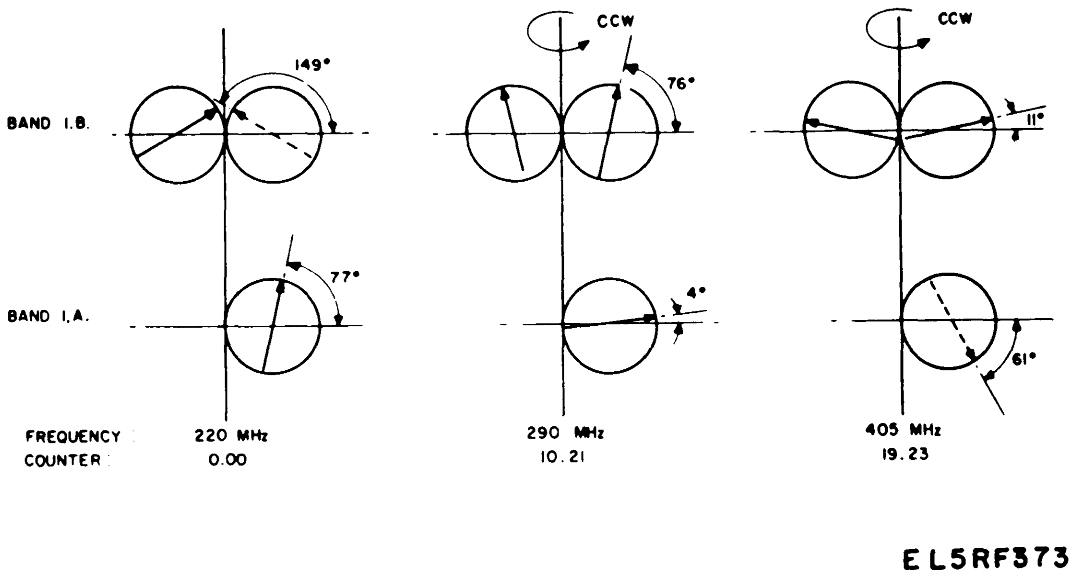


Figure 4-40. Final Setting (Typical) of Variable Air Dialectic Capacitors.

4-11. Control-Indicator 6A3 or 2A2

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(V)2/ GRM-95(V)2	Transmitter test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Gage, Thickness, 0.003 in.	Feeler gauge
Wrench, Torque	Torque wrench

b. Test Procedure.

(1) Connect the test equipment as shown in figure 4-41.

(2) Set test facility switches S1 and S6 to ON.

(3) Perform the following preliminary checks.

NOTE

The unit number of the control-indicator must correspond to the unit number displayed in the left hand window of the control-indicator test set. Unit 6A3 type number is SM-E-763711, Unit 2A2 type number is SM-E-763667.

(a) Turn the thumbwheel on the control-indicator test set until channel 40 is displayed in the window.

(b) Turn the tuning control shaft on the unit under test so that the numeral counter indicates channel 40.

(c) Observe the light display on the control-indicator test set. Lamps not illuminated should correspond to the dots on the tape display.

(d) Repeat *(a)* through *(c)* above for the remaining channels shown on the tape for that type unit.

(4) Perform the following final operational check:

NOTE

The following procedure checks for intermittent switch operation through a complete revolution of each control cam.

(a) Set the control indicator to the first channel indicated in step 1 (6A3) or step 2 (2A2) of control indictor lamp indications (fig. 4-42).

(b) Gently charge back and forth between the channels indicated in the step several times. The coding of the test set lamps should agree with the coding shown for that channel in figure 4-42 after each transition and should not indicate erratic operation (only the coding from the cam and switches being checked is shown).

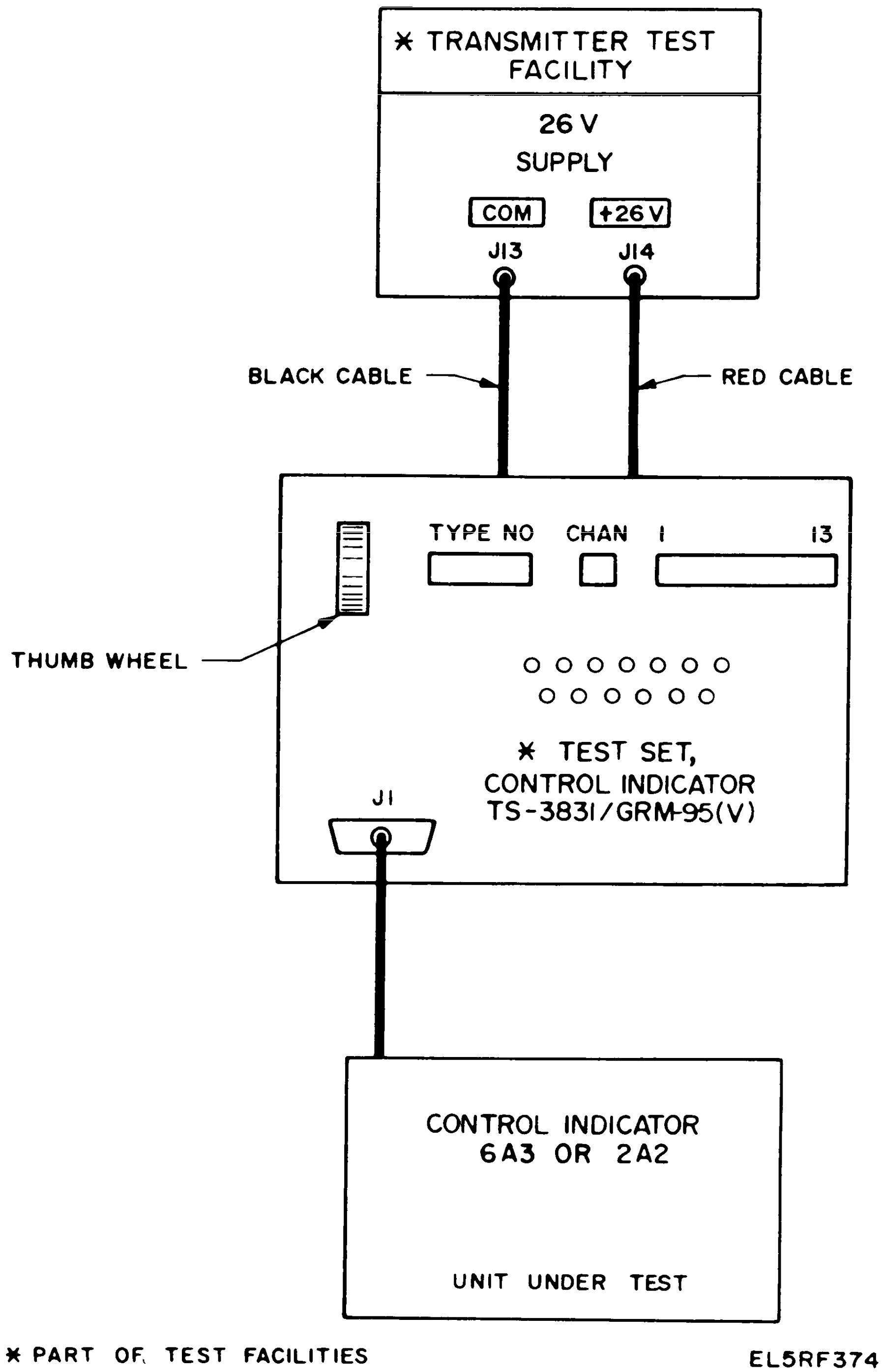


Figure 4-41. Control Indicator 6A3 or 2A2, Test Setup.

STEP	SET INDICATOR TO CHANNEL		CHECK TS-3831 LAMP NO'S (● = OFF, ○ = ON)													
	6A3	2A2	0	1	2	3	4	5	6	7	8	9	10	11	12	13
1	47	—				●	●	●	●	●	●	○	●	●		●
	48	—				○	○	○	○	○	○	●	●	●		●
2 a	111	51				●	●	●	●	●	●	●	●	●	○	●
b	112	52				○	○	○	○	○	○	○	○	○	●	●
c	113	53				●	○	○								●
d	114	54				○	●	○								●
e	115	55				●	●	○								●
f	116	56				○	○	●								●
g	117	57				●	○	●								●
h	118	58				○	●	●								●
i	119	59				●	●	●	○							●
	120	60				○	○	○	●	○	○					●
3	127	67							●	○	○					●
	128	68							○	●	○					●
4	135	75							○	●	○					●
	136	76							●	●	○					●
5	143	83							●	●	○					●
	144	84							○	○	●					●
6	151	91							○	○	●					●
	152	92							●	○	●					●
7	159	99							●	○	●					●
	160	100							○	●	●					●
8	167	107							○	●	●					●
	168	108							●	●	●					●
9	175	115							●	●	●	○				●
	176	116							○	○	○	●	○	○		●
10	179	119				●	●	○	○	○	○	●	○	○	●	●
	180	120				○	○	●	○	○	○	●	○	○	●	○
11	239	179										●	○	○		○
	240	180										○	●	○		○
12	303	243										○	●	○		○
	304	244										●	●	○		○
13	367	307										●	●	○		○
	368	308										○	○	●		○
14	—	371										○	○	●		○
	—	372										●	○	●		○

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Figure 4-42. Control Indicator 6A3 or 2A2 Lamp Indications.

(c) Repeat *(a)* and *(b)* above for each remaining applicable step of figure 4-42. Test set lamp number 13 should not flicker while tuning between channels. Test lamp 13 may flicker momentarily when switched between the channels listed below.

6A3	*2A2*
111 to 112	51 to 52
175 to 176	115 to 116
183 to 184	123 to 124
191 to 192	131 to 132
207 to 208	167 to 168
239 to 240	179 to 180
367 to 368	307 to 308

(5) Check the stop mechanism by turning the tuning control shaft to the limits past channel 40 and channel 410. At these points, the slipping clutch should operate to stop further movement of the gears.

CAUTION

Do not exert undue force on the mechanism if the clutch does not slip. Readjust the clutch nut as described in *d.* below.

c. Troubleshooting (FO-29).

Symptom	*Checks and corrective measures*
Faulty indication: one or more lamps No. 3 thru 13 not illuminated.	Remove the cover of the unit under test. Manually operate the switch corresponding to the nonoperating lamp; this can be done by gently pushing the ball associated with the switch (fig. 4-43). If the lamp lights while manually operated, readjust the switch operating point as described in para. *d.* below. If the lamp does not light while manually operated, replace the faulty switch and adjust the operating point as described in para. *d.* below.

NOTE

Lamps 0, 1, and 2 should always be lit.

Symptom	*Checks and corrective measures*
Faulty indication: one or more lamps No. 3 thru 13 permanently illuminated.	Check for a sticking ball associated with the permanently lit lamp. Check adjustment of the switch opersting point.

Symptom	*Checks and corrective measures*

NOTE

Lamps 0, 1, and 2 should always be lit.

Symptom	*Checks and corrective measures*
Lamp No. 13 permanently on or not illuminating.	Replace command signal decoder 2A2A1A1 or 6A3A1A1.
All indications normal when tested using TS-3831. Lower level maintenance activity cited failure at a specific channel(s).	Set the channel selector to the defective channel. Refer to FO-32 and measure the voltage drop across each coded switch to the ground bus with the digital multimeter. The digital multimeter should read essentially zero. If a substantial voltage is measured, readjust or replace the defective switch.

d. Switch and Tuning Control Adjustments.

(1) Check to see that the spring lockwasher under the mounting screw (fig. 4-43, section A-A) is not fully compressed.

(2) Adjust the contact points of switches by rotating the adjusting screw clockwise or counterclockwise (loosen the mounting screw slightly, as necessary) until the switch contact is just operating (lamp illuminated) with the ball resting on the crest of the cam. Tighten the mounting screw at this position.

(3) Rotate the adjusting screw 2 turns counterclockwise and then tighten the mounting screws again.

(4) Check to see that the ball has a minimum of 0.003 in. residual travel clearance from the crest of the cam by inserting a feeler gauge between the ball and the cam; there should be no undue resistance to the movement of the ball.

NOTE

This check is done with the switch in the operate position.

(5) Perform the tests in paragraph *b.(4)* above that check the operation of the adjusted switch. If necessary, slightly readjust the contact point of the switch(es) to ensure operation at all positions of the related control cam. Lock the screws with liquid sealant (para. 2-13 *d.).*

(6) Use a torque wrench and check to see that the slip torque between the helical gear and the tuning control shaft is between 30 to 80 ounce/inches. Adjust the clutch nut if required.

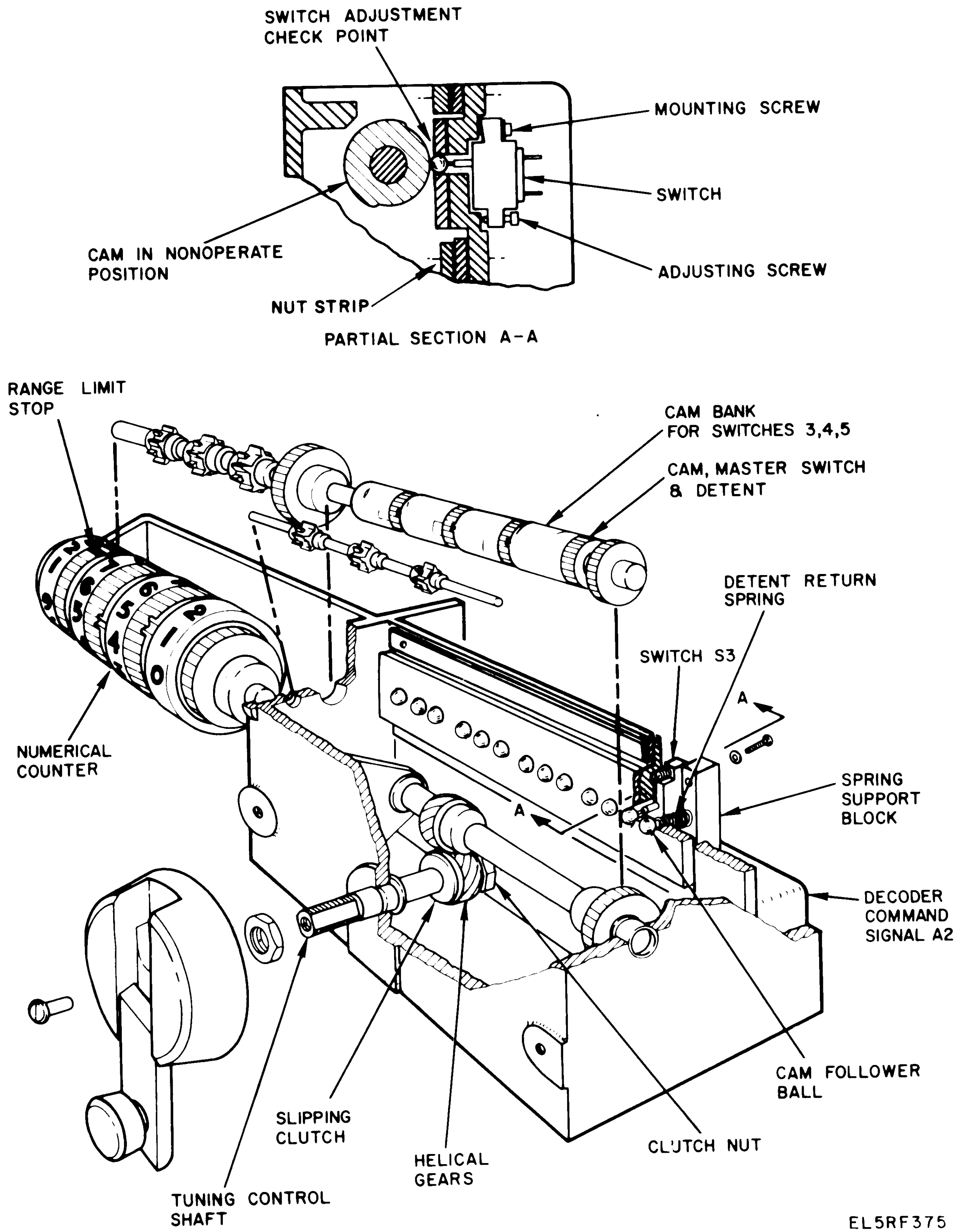


Figure 4-43. Control Indicator 6A3 or 2A2, Cutaway View.

4-12. Rf Power Level Control 6A5 (Used in AM-4320 Plain Model)

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(Y)2/ GRM-95(V)2	Transmitter test facility
Accessory Kit, Test Facilities Set, MK-1173(Y)2/GRM-95 (V)2	Accessory kit
Generator, Sweep, Wiltron 61011	Sweep generator
Plug-In, Wiltron 610841)	Plug-in
Oscilloscope AN/USM-281C	Oscilloscope
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Multimeter, AN/llSM-451	Multimeter

b. Test Procedure.

(1) *Insertion loss check.*

(a) Connect the test equipment as shown in figure 4-44. Do not connect the unit under test to the test facility.

(b) Set the coaxial switch to position No. 1

(c) Set the sweep generator to 220 MHz cw and adjust for maximum output. Note the reference output level on the dB scale of the power meter.

(d) Set the coaxial switch to position No. 2. The power meter should indicate 3.0 dB ± 0.75 dB less than the reference reading obtained in *(c)* above.

(e) Connect the black plug of the test cable from the unit under test to connector J13 of the test facility and connect the red plug to connector J 14 as shown in figure 4-44.

(f) Set test facility switches S1 and S6 to ON. The power meter indication should drop by more than 10 dB. Lower the RANGE on the power meter by 10 dB. Return the power meter RANGE switch to the same position as in step *(c)* above.

(g) Remove the red plug from test facility connector J 14; the power meter indication should return to the level observed in *(d)* above.

(h) Connect the red plug to test facility connector J59; the power meter indication should not change.

(i) Repeat *(a)* through *(h)* above at 310 MHz and 405 MHz.

(j) Set test facility switches S1 and S6 to OFF.

(2) *VSWR check, diodes turned off.*

(a) Connect the test equipment as shown in A, figure 4-45. Do not connect the unit under test to the test facility.

(b) Adjust the sweep generator to sweep between 220 MHz and 405 MHz.

(c) On the sweep generator adjust the level connector for 1 mw at the unit under test port of the VSWR detector as indicated on the power meter.

(d) Disconnect the power meter from the unit under test port of the VSWR detector and replace it with the 1.75:1 calibrated mismatch (B, fig. 4-45).

(e) Set the oscilloscope horizontal sweep controls for external AMPL, DC coupler operation. Set the vertical amplifier AC-GND-DC switch to DC.

(f) Observe the oscilloscope screen and adjust the scope controls for a suitable display of the VSWR trace. The vertical displacement of the oscilloscope display is the 1.75:1 VSWR limit. Note this limit.

(g) Disconnect the calibrated mismatch from the unit under test port of the VSWR detector and connect connector P 1 of the unit under test to the unit under test port (C, fig. 4-45).

(h) The VSWR displayed on the oscilloscope should not exceed the 1.75 limit.

(3) *VSWR check, diodes turned on.*

(a) Connect the unit under test to the test facility as shown in figure 4-45. Connect the black plug to connector J13 and the red plug to connector J14.

(b) Connect the 2.5:1 calibrated mismatch at the unit under test port of the VSWR detector (B, fig. 4-45).

(c) Repeat step *(2)(f)* above to establish a vertical displacement limit corresponding to a VSWR of 2.5, with the sweep generator tuned to sweep between 220 MHz and 405 MHz.

(d) Remove the 2.5:1 calibrated mismatch and reconnect connector P 1 of the unit under test to the unit under test port of the VSWR detector (C, fig. 4-45).

(e) Set test facility switches S1 and S6 to ON.

(f) Observe the VSWR variations displayed on the oscilloscope. There should be no peaks exceeding the 2.5:1 limit.

(g) Set test facility switch S6 to OFF.

c. Troubleshooting (fig. 2-41, TM 11-5820-540-30).

(1) *Insertion loss check.*

Symptom	*Checks and corrective measures*
Step *(1)(d):* high insertion loss	Check CR1 (fig. 4-46) forward and reverse resistances. Replace diode if necessary.
	Check circuit wiring from P1 through J2 for loose connections or partially shorted cables. Repair as required.
Step *(1)(d):* no output	Check for short circuit at Pl, Rl, CR1, Cl C2, and J2. Replace as required.
Step *(1)(f):* no signal control	Check CR2 for open circuit. Replace if necessary.
	Check continuity of circuit from CR1 to P2. Repair as required.
Step *(1)(f):* no output	Check CR2 for short circuit. Replace if necessary.

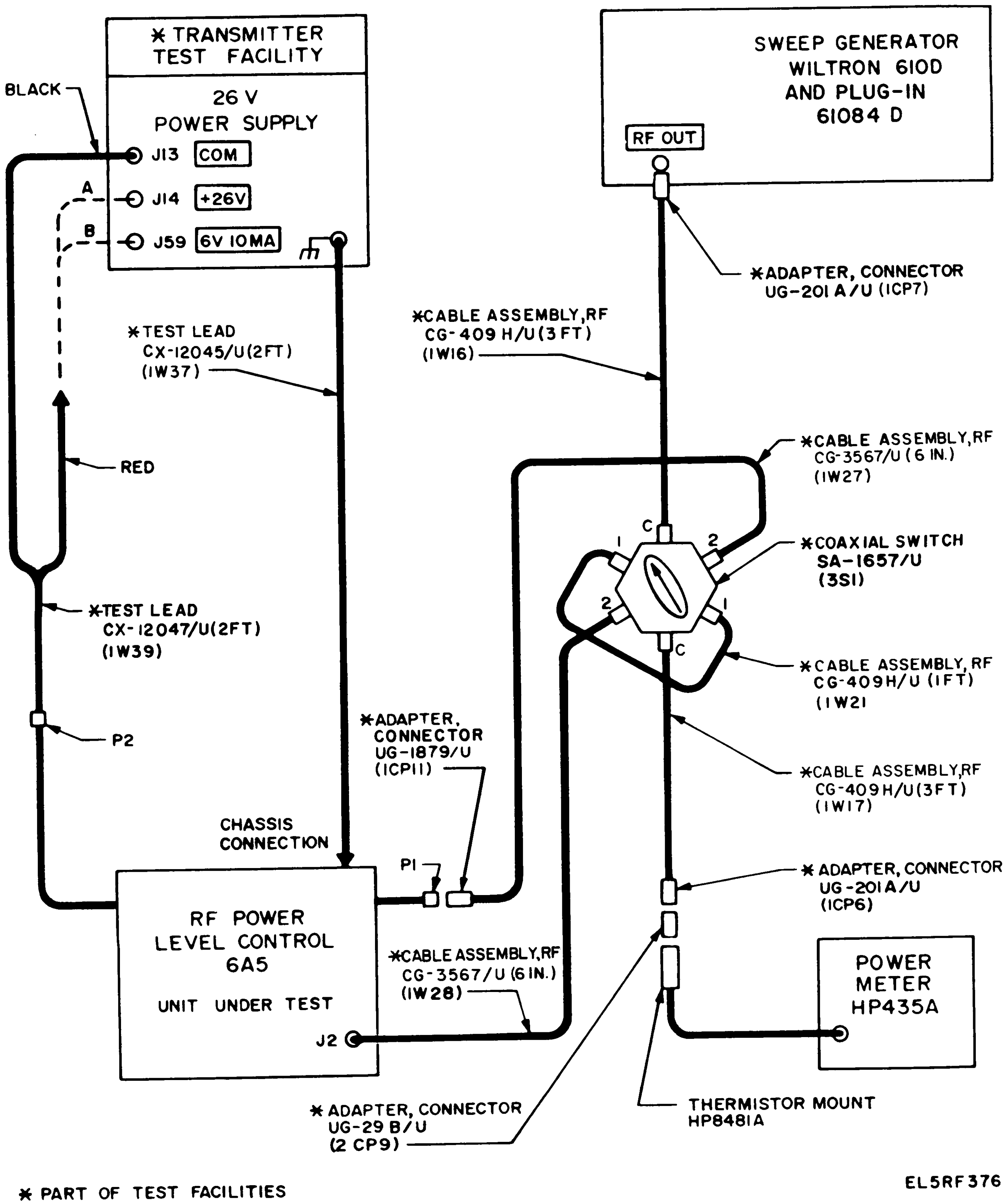


Figure 4-44. Rf Power Level Control 6A5, Insertion Loss Check, Test Setup.

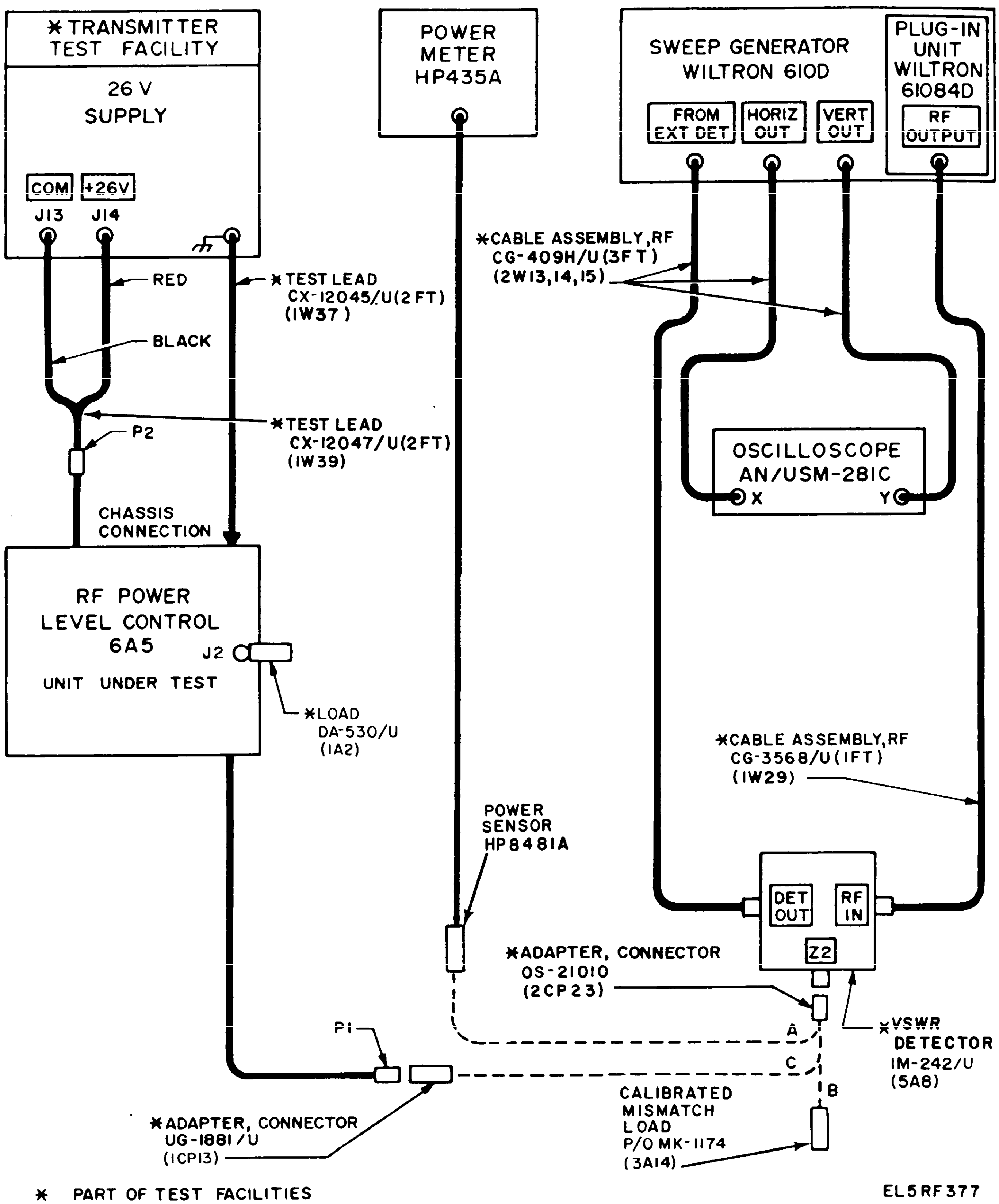


Figure 4-45. Rf Power Level Contro1 6A5, Input VSWR Check, Test Setup.

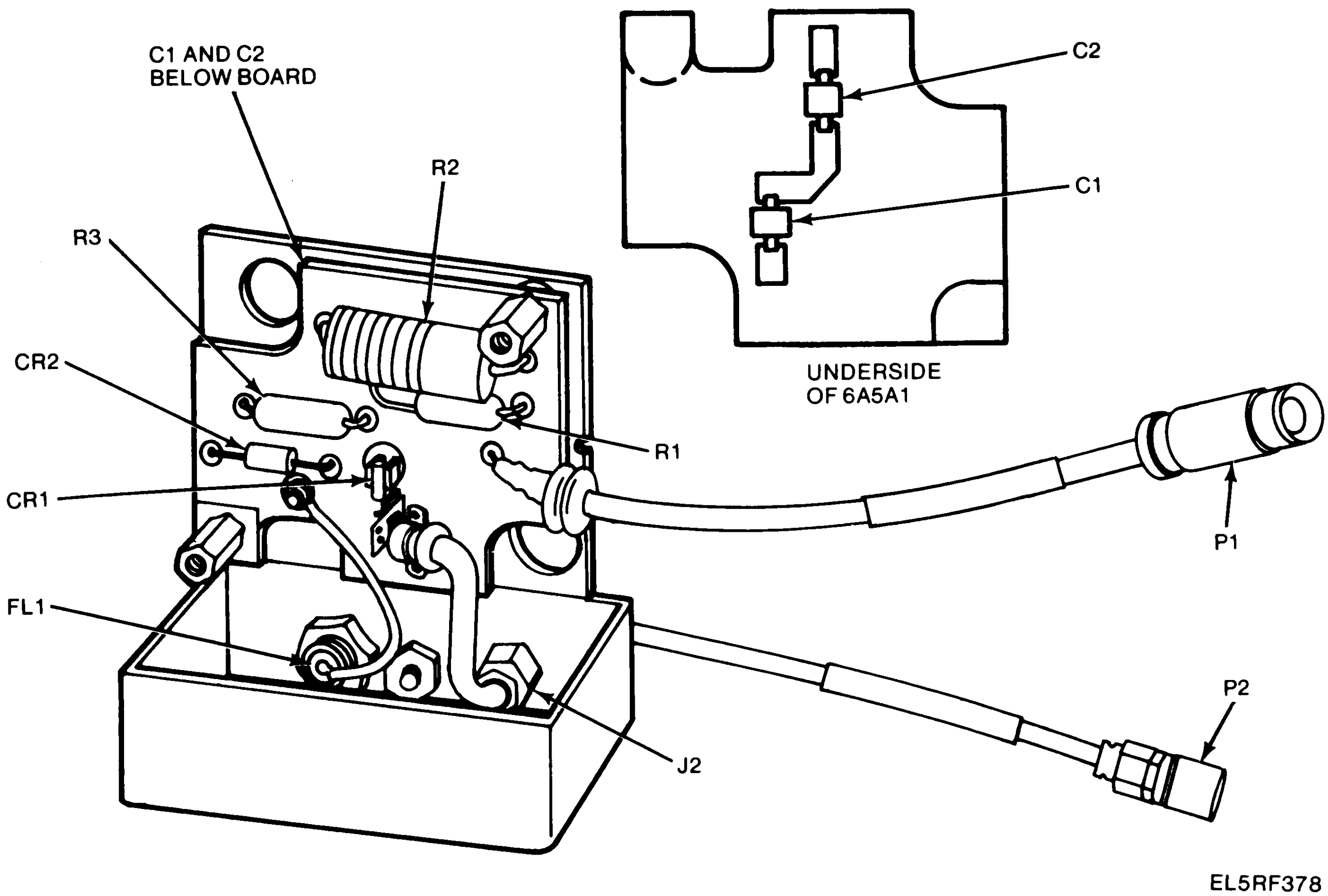


Figure 4-46. Rf Power Level Control 6A5, Parts Location

c. Troubleshooting. – Continued

(2) *VSWR check.*

Symptom	*Checks and corrective measures*
Step *(2)(h):* diodes turned off high VSWR	Check P1 and its cable, Rl, R2, and Cl. Replace or repair as required.

4-13. Radio Frequency Amplifier 6AR1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Counter, Electronic Digital Readout, TD-1225(V)l/U	Counter
Multimeter, Digital,AN/USM-451	Multimeter
Drive Generator, AIL- 125	Power signal source
Wattmeter, AN/USM-298	Wattmeter
Element, Wattmeter, BIRD 50 D	Element

b. Test Procedure.

NOTE

There are three types of 6AR1 units. The procedures described below refer to CMC 407-056 (plain model), SM-E-763712 (A model) and SM-E-978738 (B model) unless stated otherwise.

(1) *Preliminary checks.*

(a) For SM-E-978738 (B model), perform the preliminary procedure given in paragraph *4-8b.* (1).

(b) For CMC 407-056 (plain model), note the plating used on the output cavity assembly. For gold or nickel plated assembly, resistor R2 (A, fig. 4-27) should be 5.1 or 4.7 ohms, respectively. Verify or install the correct value as in *d.,* step 7.c, this paragraph.

(c) Disconnect cable 6AR1W1 from J1 connector of 6AR1A1 and J3 connector of 6AR1A2A4 (fig. 4-29).

(d) Connect the test equipment as shown in A, figure 4-47 but do not connect the power signal source at this time.

(e) Direct cooling air from the AIR OUTLET of the transmitter test facility to the rear of the unit under test. Use hose assembly air duct MX-8414/GRM-95(V) (IMP2).

(f) Set the test facility switches as follows:

Switch	*Position*	*Normal indication*
S1	ON	
S16	OUTPUT NORMAL	
S12	Away from OFF	
S13	ON	LOW PWR lamp should light.
S20	+12 V	Meter M1 should indicate in green band.
S20	+28 V	Meter M1 should indicate in green band.
S20	+600 V	Meter Ml should indicate in green band.

(2) Filament voltage and emission check.

(a) Set the digital multimeter to measure 20 Vdc.

(b) Connect the digital multimeter to TP1 (+) and TP2 (–) on circuit card 6AR1A2A2 (fig. 4-27).

(c) The digital multimeter should indicate +6.3 V ± 0.1 Vdc.

(d) Connect the digital multimeter to TP3 (–) and TP4 (+) on circuit card 6AR1A2A2 (fig. 4-27).

(e) The digital multimeter shall indicate +6.3 V ±0.1 Vdc.

(f) On the test facility, set switch S12 to EMISSION and S15 to OUTPUT.

NOTE

- Tube warm-up time is at least 60 seconds.
- Meter Ml indication will drop to zero approximately 15 seconds after S14 EMISSION is pressed (automatic function of AN/GRM-95).

(g) Press switch S14 EMISSION for 15 seconds and observe that meter Ml indicates in the green band during the test.

(h) Set switch S15 to DRIVER, then press S14 EMISSION for 15 seconds. Meter Ml should indicate in the green band.

(i) Return switch S15 to OUTPUT.

(3) *Output amplifier.*

CAUTION

Do not allow the power signal source output to exceed 6 watts (27.4 dBm power meter indication when connected as in A, fig. 4-47). Damage to the unit under test may result.

(a) Set the XMTR TUNE control on the unit under test to channel 320.

(b) Connect the equipment as shown in A, figure 4-47.

(c) Adjust the power signal source for 360 MHz ±0.1% as indicated on the frequency counter at an output level of +36 dBm (4 watts) (power meter indication plus 20 dB attenuator plus 0.4 dB lowpass filter insertion loss).

(d) Connect the equipment as shown in B, figure 4-47.

(e) Tune the XMTR TUNE control for a peak indication on the wattmeter.

(f) Pu1l out the PWR OUT PEAK control on the unit under test and adjust for a peak indication on the wattmeter.

(g) Repeat steps *(e)* and *(f)* above until a maximum power output indication is obtained.

(h) Set the digital multimeter to measure 1 volt dc.

(i) Connect the multimeter to TP5 (–) and TP7 (+) on circuit card 6AR1A2A2 (fig. 4-27).

(j) The multimeter should read 0.75 ±0.01 Vdc. If necessary, adjust R2 (fig. 4-27) on component assembly 6AR1A2, for above requirement.

(k) Repeat steps *(e)* through *(g)* until no further increase in output power can be obtained on the wattmeter.

(l) The wattmeter should indicate not less than 35 watts and channel number 320 should be within ±1/4-inch of the center of the channel window.

(m) Adjust the XMTR TUNE control to indicate 380 at the calibration mark.

(n) Repeat *(b)* through *(g)* for a frequency of 390 MHz ±0.1%. The wattmeter should indicate not less than 30 watts and channel number 380 should be within ±l/2-inch of the center of the window.

(o) Repeat *(n)* above at 405 MHz ±0.1% and channel 410.

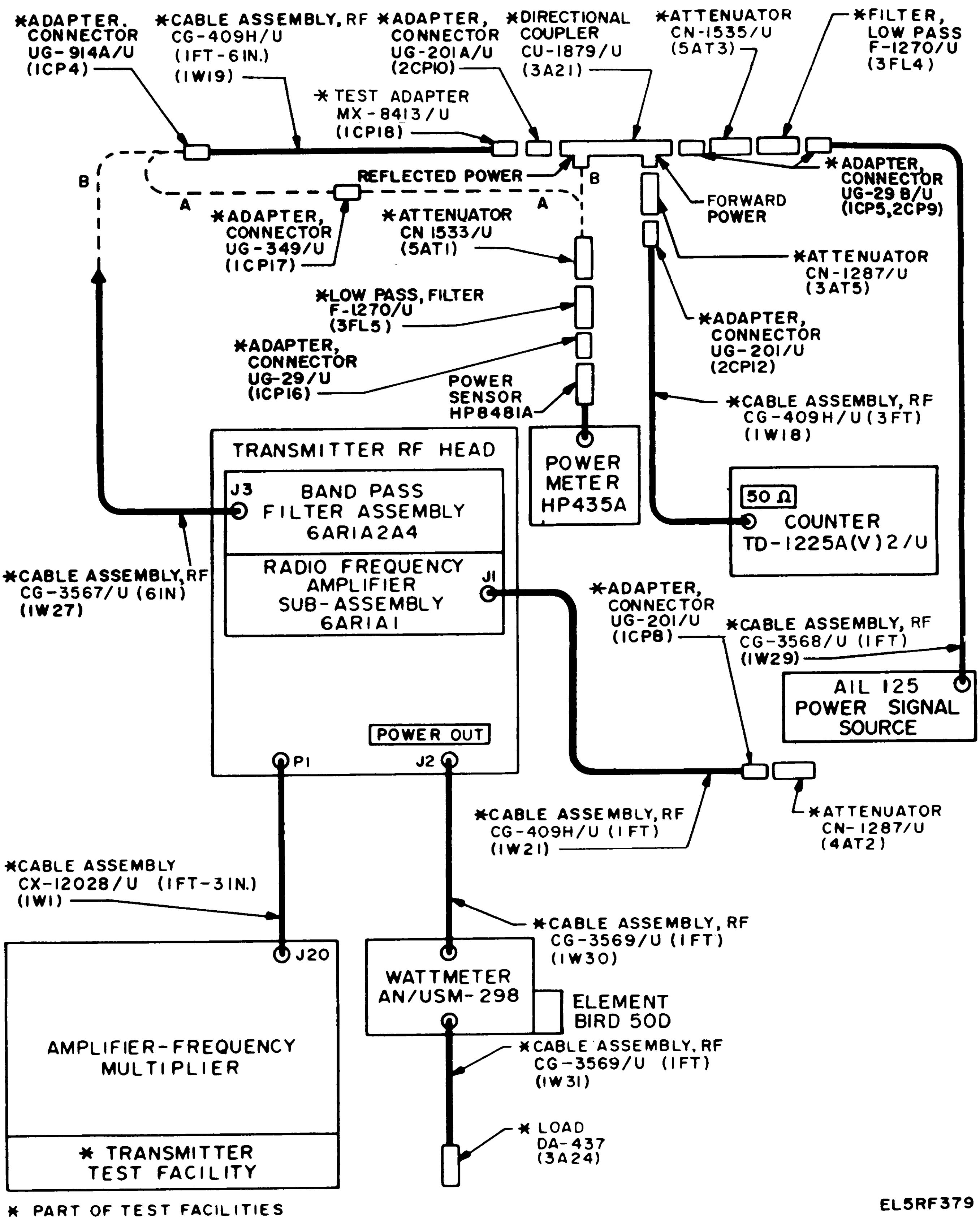


Figure 4-47. Radio Frequency Amplifier 6AR1, Output Power Measurement Test Setup.

(p) The reflected power as measured on the power meter should not exceed +29 dBm (power meter indication plus 20 dB attenuator plus 0.4 dB filter insertion loss plus coupling factor obtained from the hi-directional coupler calibration chart).

(q) If channel number tolerance in *(l)*, *(n)*, and *(o)* above was not met, adjust channel tape as described in paragraph *c.* (1) below.

(4) *Driver amplifier.*

(a) Disconnect P1 (6AR1A1J2) from J2 (6ARlAl) and P2 (6AR1A2A4J1) from J1 (6AR1A2A4). Connect the equipment as shown in A, figure 4-48.

(b) On the test facility, set switch S16 to DRIVER TEMPORARY.

(c) Adjust the power signal source frequency to 360 MHz ±0.1% at 4 watts as described in step (3) *(c)* above.

(d) On the unit under test, set the XMTR TUNE control to indicate 320 at the calibration mark.

(e) Connect the test equipment as shown in B, figure 4-48.

(f) Set test facility switch S13 to ON. Push in the PWR OUT PEAK control and adjust for a peak indication on the wattmeter.

(g) The wattmeter should indicate not less than 35 watts. If necessary, adjust the driver stage output tuning as described in paragraph *c.* (2) below.

(h) Set the XMTR TUNE control to indicate 410 at the calibration mark.

(i) Connect the test equipment as shown in A, figure 4-48.

(j) Tune the power signal source frequency to 405 MHz ±0.1% as described in step (3) *(c)* above.

(k) Connect the test equipment as shown in B, figure 4-48.

(l) Adjust the PWR OUT PEAK control (pushed in position), and the XMTR TUNE control if necessary, for a peak indication on the wattmeter. The wattmeter should indicate not less than 30 watts.

(m) Connect the power meter to the reflected power port on the bidirectional coupler (C, fig. 4-48). The reflected power should be less than +29 dBm (800 mw) (power meter indication, plus 20 dB attenuator plus 0.4 dB filter insertion loss plus coupling factor from the directional coupler calibration chart).

(5) *Tuning and power output check.*

(a) Modify the test setup shown in A, figure 4-48 as follows:

1. Using cable 6AR1W1, reconnect 6AR1A1J1 to 6AR1A2A4J3.

2. Connect P1 (6AR1A1J2) (from 6AR1A2FL1) to 6AR1A1J2.

CAUTION

Do not exceed the specified drive level as damage to the unit under test may result.

(b) Set test facility switch S12 to DRIVER, S16 to OUTPUT NORMAL and S13 to ON.

(c) Set the XMTR TUNE control to channel 40.

(d) Adjust the power signal source for 220 MHz ±0.1% as indicated on the frequency counter at an output level of +23 dBm (200 mw) (power meter indication plus 20 dB attenuator plus 0.4 dB filter insertion loss).

CAUTION

Meter Ml indication must not exceed 90% for the following tests. Damage to the unit under test may result. Reduce the power signal source output level, as necessary.

(e) On the unit under test, adjust the PWR OUT PEAK (pushed in) for maximum indication on test facility meter Ml (ensure that a peak is obtained).

(f) Set switch S12 to PWR OUT. Adjust the PWR OUT PEAK (pulled out) for a peak indication on meter M1 and the wattmeter.

(g) Peak the XMTR TUNE control and the PWR OUT PEAK (pulled out) control for maximum indication on the wattmeter.

(h) Set the digital multimeter to measure 1 volt dc.

(i) Connect the multimeter to TP5 (–) and TP6 (+) on circuit card 6AR1A2A2 (fig. 4-27).

(j) The multimeter should indicate 0.72 ±0.01 Vdc. If necessary, on electronic component assembly 6AR1A2, adjust R1 (fig. 4-27) for an indication of +0.72 ±0.01 Vdc on the multimeter.

(k) Set test facility switch S12 to DRIVER. Push in the PWR OUT PEAK control on the unit under test and adjust for a peak indication on test facility meter Ml.

(l) Repeat step *(f)* above. The wattmeter shall indicate not less than 35 watts. The channel indicator tape shall be within ±0.5 inch of the channel (40) being tested.

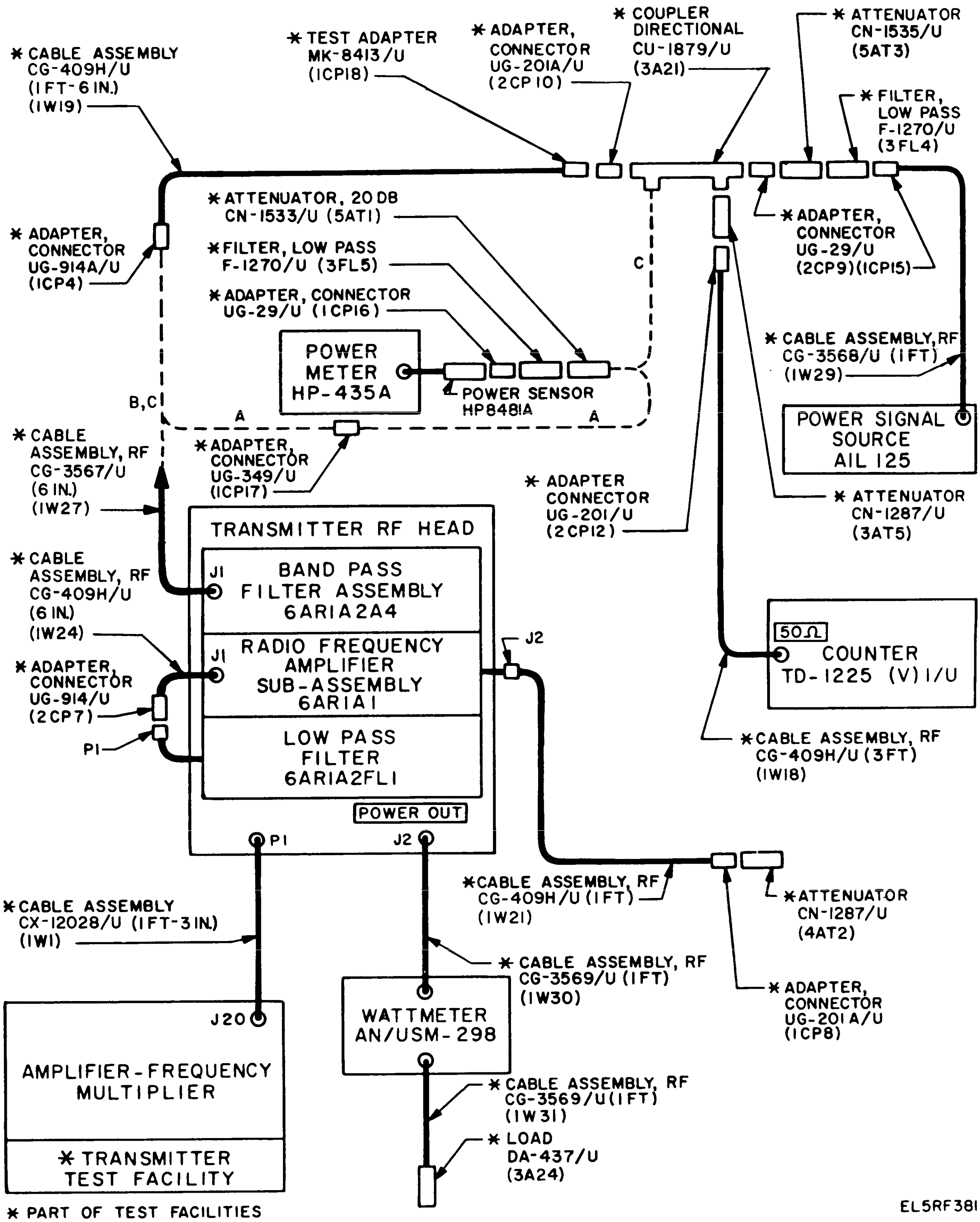


Figure 4-48. Radio Frequency Amplifier 6AR1, Driver Amplifier Check, Test Setup.

(m) Set test facility switch S12 to DRIVER and repeat steps *(c)* through (g) and *(k)* through *(l)* above for the remaining channels indicated in the chart below.

Channel	*Frequency (MHz)*	*Output (watts)*
40	220	35
100	250	32
200	300	40
300	350	35
380	390	30
410*	405	30

*If necessary at channel 410, the power signal source output level may be increased to +25 dBm (316 mw) when set as in *(d)* above.

(n) Set test facility switch S13 to OFF.

c. *Adjustments.*

(1) *Output amplifier* (fig. 4-49). If channel 320 is not within ±1/4 inch of the calibration mark in step (3) *(l)* above, aline the display tape as follows:

(a) Remove front panel 6MP1 of the unit under test, as described in paragraph 2-45.

NOTE

The tape is spring loaded and will turn if not held firmly.

(b) Hold the display tape firmly and remove the four red-circled mounting screws.

(c) Remove the display tape by carefully sliding the unit sideways without rotating the flexible shaft.

(d) Rotate the flexible shaft until the number 320 is in line with the calibration mark (notch) at the side of the display tape.

(e) Hold the tape and carefully slide the flexible shaft over the hexagonal shaft.

(f) Secure the display tape with the four screws removed in step *(b)* above.

(g) Restore the front panel into position on the unit under test.

(h) Repeat the procedure in paragraphs (3)(b) through (g) at channel 40 (220 MHz), channel 380 (390 MHz), and channel 410 (405 MHz) to ensure that the channel number indications are within ±1/2 inch of the calibration mark.

(2) Driver amplifier (fig. 4-49). If the specification in paragraph *b.(4)(g)* cannot be met, proceed as follows:

(a) With the equipment connected and tuned as described in paragraphs *(4)(a)* through *(g)*, tune the XMTR TUNE control for a maximum indication on the wattmeter.

(b) Tune the PWR OUT PEAK control (pushed in) for a maximum indication on the wattmeter.

(c) Repeat *(a)* and *(b)* above until a maximum power output indication is obtained. The wattmeter should indicate greater than 35 watts.

NOTE

If the required output was not obtained in *(c)* above, refer to paragraph *d.* troubleshooting and correct the deficiency before proceeding to *(d)* below.

(d) Reset the XMTR TUNE control to indicate 320 at the calibration mark.

(e.) Loosen the setscrews in the driver lead screw nuts on the unit under test (AM-4320 plain model, A of fig. 4-50) or in the center driver lead screw nut (AM-4320A or AM-4320B, B of fig. 4-50).

(f) On AM-4320A and AM-4320B model 6AR1 units:

1. Remove the drive chain idler assembly (items (1), (2) and (3), B, fig. 4-50) to slacken the drive chain. Do not allow the sprockets to turn.

2. Pull the chain free from the outside driver lead screw sprocket (item (4), B fig. 4-50).

3. Adjust the center lead screw nut, and outside driver sprocket, and PWR OUT PEAK control (pushed in) for maximum power indication on the wattmeter (see NOTE and CAUTION below). Do not allow center lead screw to turn.

4. Replace and secure the drive chain and drive chain and drive chain idler assembly as shown in B, figure 4-50.

(g) On AM-4320 plain model 6AR1 units, adjust the lead screw nuts and PWR OUT PEAK control (in the pushed in position) for maximum power indication on the wattmeter.

CAUTION

Maintain equal rotation of the adjustable driver lead screw nuts, otherwise the driver plate plunger will be misaligned.

NOTE

Try to obtain the required output with the PWR OUT PEAK control near the center of its operating range.

(h) Tighten the setscrews on the driver lead screw nuts and seal with liquid sealant (Locktite Grade C).

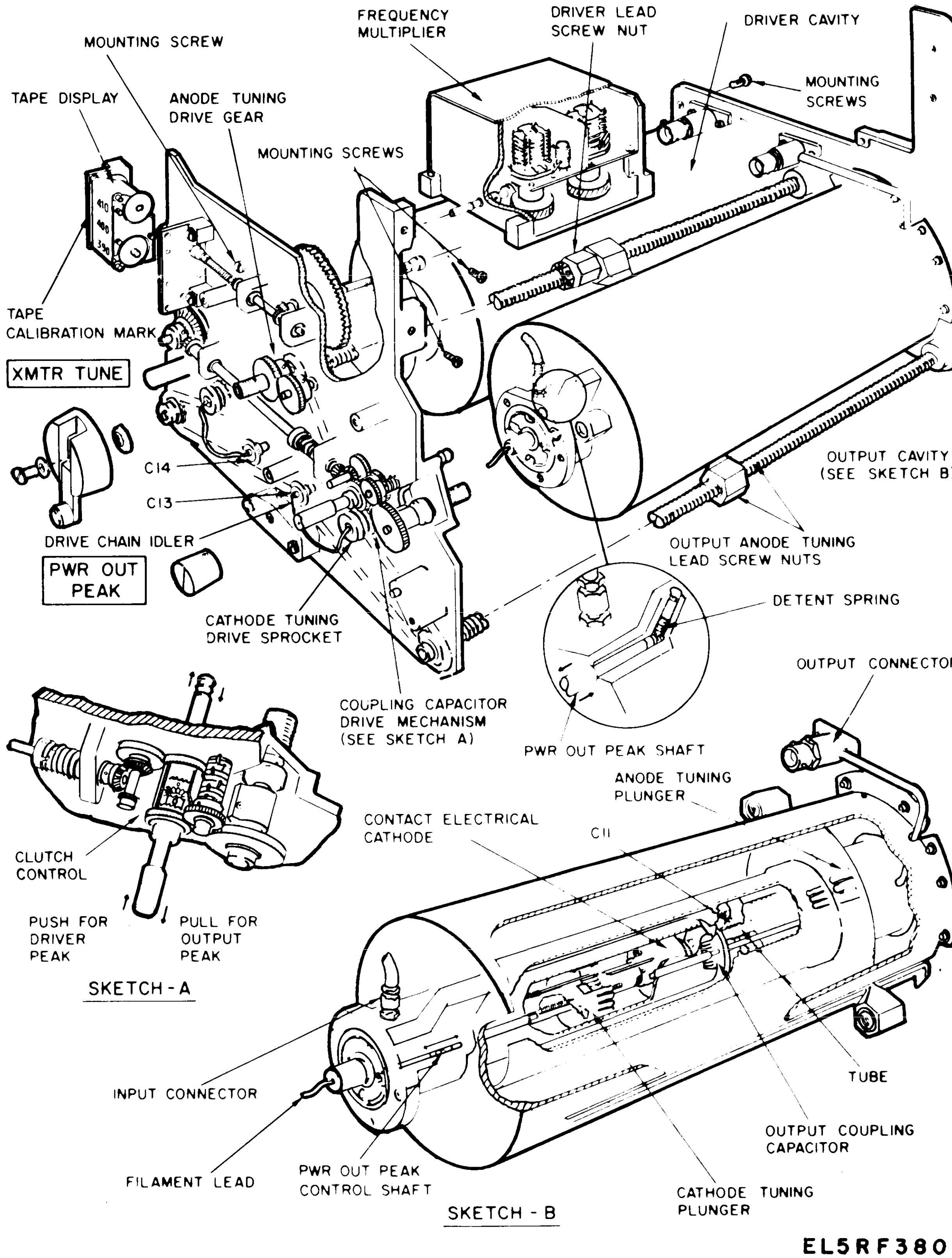
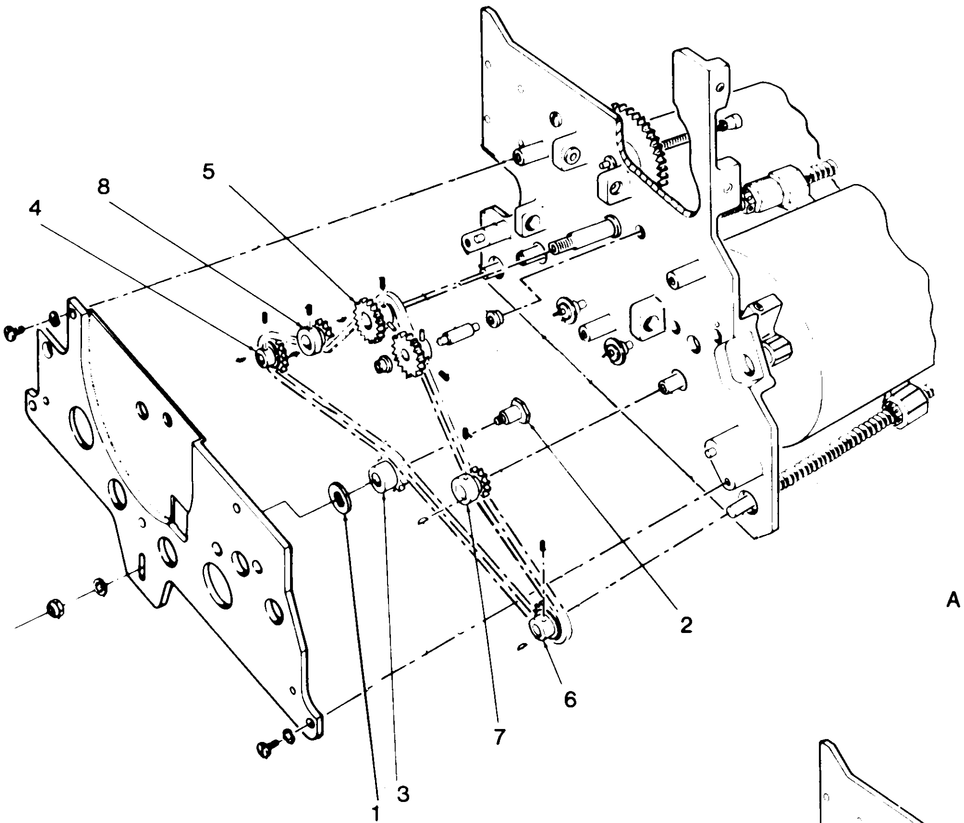


Figure 4-49. Radio Frequency Amplifier Subassembly 6AR1A1, Cutaway View of Power Amplifier Tubes.



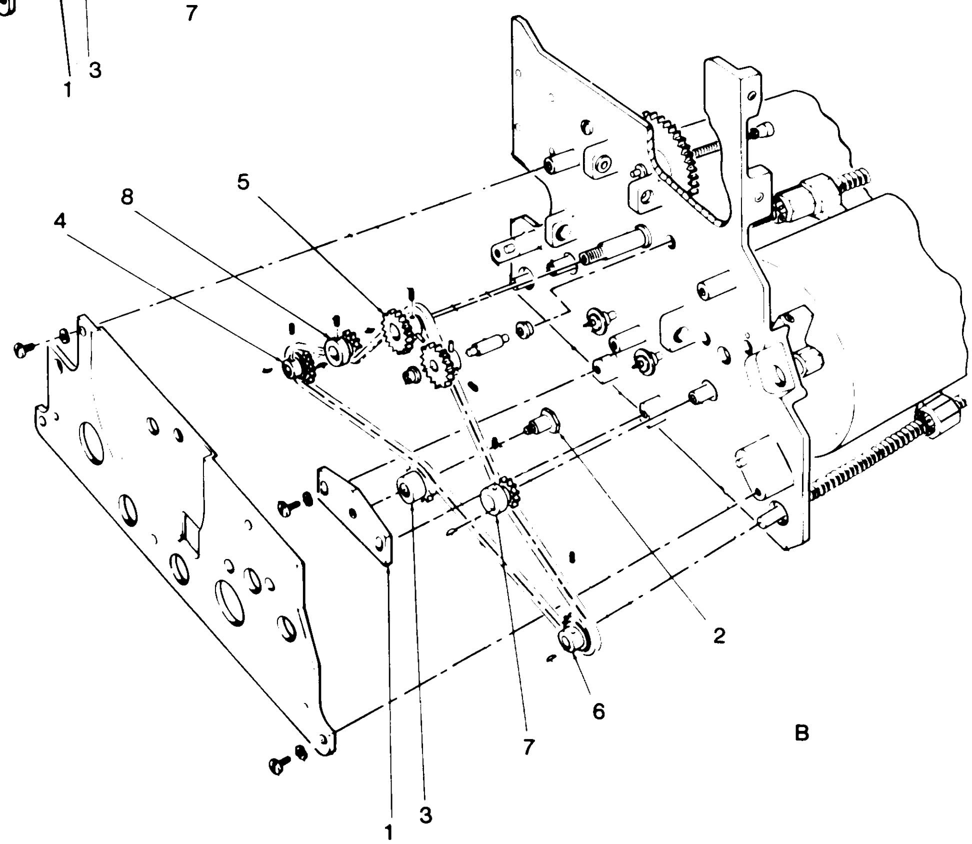


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Figure 4-50. Amplifier 6AR1 Tuning Mechanism.

(3) *Cathode assembly and stop mechanism.*

(a) Set unit under test XMTR TUNE control to its clockwise stop above channel 410.

(b) Remove the drive chain idler assembly (items (1), (2), and (3), figure 4-50) to slacken the chain.

NOTE

Do not release the chain from the three anode sprockets (items (4), (5), and (6), fig. 4-50). Pull the chain free from the two tenter cathode sprockets (items (7) and (8), fig. 4-50).

(c) Rotate the right hand released cathode sprocket counterclockwise until a stop position is reached. Back off the sprocket three turns from this stop.

(d) Repeat *(c)* above for the left-hand cathode sprocket.

(e) Replace the chain over the cathode sprocket, install the drive chain idler assembly, and secure in place.

(f) Recheck output and driver amplifiers as described in paragraphs *b.(3)* and (4) above.

(g) Replace control panel 6MP1 as described in paragraph 2-45.

d. Troubleshooting (figs. 2-46 and 2-47, TM 11-5820-540-30).

Symptom	*Probable cause*	*Checks and corrective measures*
1. Step *b.(1)(c)* (unit 245-800195-001, AM-4320B, only): resistance not within tolerance.	Temperature sensor thermistor faulty.	Replace temperature sensor thermistor.
2. Step *b.(1)(h):* no indication obtained on Ml with test facility switch S20 in positions +12 V, +28 V and 600 V *(b.(1)(d)).*	*a.* 600 V line shorting to ground.	*a.* Set switches S13 and S1 to OFF. Disconnect the 600V line to C5 and Chat C15 and C 16. Check for short-circuit to ground on the 600 V line to C5 and C11. Replace C5 or Cl1 if necessary as described in *d.* below.
	b. Defective radio interference falter 6AR1A2FL3.	*b.* Disconnect the 600 V line to 6 AR1A2FL3 at C15. Check and replace 6 AR1A2FL3 if shorting to ground.
	c. C15 or C16 to ground.	*c.* Check C15 and C16 for short to ground. Replace as required.
	d. 600 V arcing to C50 or C11.	*d.* If above check is normal, set switches S20 to 600V, Sl to ON, and S13 to ON. If 600 V is present but fails when Ml reading approaches the green band, proceed as follows: (1) Set S13 to OFF. (2) Disconnect the 600 V line from C5 to C11 in turn. (3) Set S13 to ON. Check the 600 V reading on M1. (4) If the 600 V reading does not fail, reconnect the capacitor and repeat the test above. Replace as required.
3. Step *b.(2)(c)* or *(e):* filament voltage abnormal.	Resistor R4, para. *(c),* or R3, para *(e),* on 6AR1 A2A2 incorrectly adjusted or faulty.	*a.* Adjust R3 or R4 for a digital multimeter indication of 6.3 volts dc. *b.* Perform resistance checks on 6ARlA2A2.
4. Step *b.(2)(g):* meter M1 indication reduces.	Defective output tube V1.	Replace output tube V1 as described in TM 11-5820-540-12.
5. Step *b.(2)(h):* meter Ml indication reduces.	Defective driver tube V2.	Replace driver tube V2 as described in TM 11-5820-540-12.
6. Step *b.(3)(e)* through *(g)* or *(k):* erratic tuning or arcing during tuning.	Defective output stage inner cavity assembly.	Replace output stage inner cavity assembly as described in para. *f* below.
7. Step *b.(3)(l):* output power low.	*a.* Power monitor 6AR1A3 or low-pass filter 6AR1A2FL1 faulty.	*a.* Remove plug P1 (6AR1A1J2) from J2 of 6AR1A1 and connect wattmeter to J2 (use CG-409H/U and adapter UG-201). If output power is normal, check 6AR1A3 and 6AR1A2FL1 (TM 11-5820-540-30).
	b. Tube V2 weak.	*b.* Replace V2 as described in TM 11-5820-540-12. Repeat para. *b.(2)* and (3).

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
	c. Resistor R2 (fig. 4-27) on circuit board 6AR1A2A2 wrong value or faulty.	*c.* Check resistance between TP5 and TP7 (fig. 4-27) with unit disconnected. Digital multimeter should indicate 5.1 ohms ±1%, if gold-plated cavity is used, or 4.7 ohms ±1% if nickel-plated cavity is used. (If necessary, on nickel-plated cavity models, replace 5.1 ohm resistor R2, part number RW69V5R1 or RWR89S5R11FS, NSN 5905-01-173-8930, with a 4.7 ohm resistor, part number RWR89S4R70DR, NSN 5905 -01-009-1878.) Replace as required and readjust voltage as in para. *b.* (3) *(a)* through *(j)* above.
	d. Improper cathode adjustment.	*d.* Measure VSWR as in para b. (3) *(p).*
8. Step *b. (3)(p)* or b. *(4)(m):* reflected power exceeds +29 dBm.	*a.* Cathode tuning assembly misadjusted.	*a.* Adjust cathode assembly as described in para. *c.* (3) above.
	b. Filter assembly 6AR1A2A4 faulty.	*b.* Disconnect leads from 6AR1A2A4 and test per para. 4-18. If defective, replace as described in para. 2-42.
9. Step *b. (4)(g):* erratic tuning or arcing while tuning.	Defective driver stage inner cavity assembly.	Replace driver stage inner cavity assembly as described in para *f* below.
10. Step *b. (4)(g):* driver power remains low after preadjustment check in para. *c. (2)(a)* through *(c).*	*a.* Tube V1 weak.	*a.* Replace V1. Repeat para. *b.(2)* and (4).
	b. Improper cathode adjustment.	*b.* Measure VSWR as in para *(4)(m).*
11. Step *b. (5)(1):* amplifier 6AR1 output low at channel 380.	Driver and output stage mismatched.	Readjust driver stage as described in para. *c.(2)(e)* through *(h)* at the channel indication noted in para *b.(3)(r)* and connected as in para. *b.(5).*
12. Step *b. (5)(1):* amplfler 6AR1 output low with +23 dBm (or +25 dBm, channel 410) input drive level.	Driver stage gain low.	Disconnect 6AR1W1 from J1 of 6AR1A1 and connect wattmeter to J1. Wattmeter should indicate not less than 4 watts. If less than 4 watts, refer to fig. 4-27 and check the resistance between TP5 and TP6 of 6AR1A2A2. The digital multimeter should indicate 12.2 ohms ±1%. If necessary, replace 6AR1A2A2R1.

e. Replacement of C5 or C11.

(1) Loosen the two captive screws and remove the air baffle assembly.

CAUTION

On unit 245-800159-001 (AM-4320B), be sure that the heat sensing assembly is not damaged during the following procedures.

(2) Insert the tube puller prong into the holes in the top of the required tube and use a suitable lever to carefully pry the tube straight out from its socket. Carefully detach the heat sensing assembly (if used) from the tube.

(3) Loosen and remove the four screws that secure the tube anode clamp. Remove the tube anode clamp.

(4) Grasp the 600 V wire and lift C5 or Cl1 straight up. Unsolder the capacitor.

(5) Solder the replacement capacitor to the 600 V wire. Slide the capacitor back into position.

CAUTION

Be sure that the slot in the capacitor is centered around the rigid cable to the output connector.

(6) Replace the tube anode clamp and secure it with the four screws removed in (3) above.

(7) For unit 245-800159-001 (AM-4320B) only, apply heat sink compound (such as DOW CORNING 340) and reattach heat sensing assembly to tube in its original position.

(8) Replace the tube by pressing the cathode end into the tube socket. Check to see that the tube is fmly seated in the contact ring.

(9) Replace and secure the air baffle assembly.

f. Removal, inspection, and replacement procedure, driver and output stages, inner cavity assemblies (fig. 4-51).

(1) Set the XMTR TUNE control fully cw.

(2) Set the PWR OUT PEAK control fully cw in both the pushed-in and pulled-out positions.

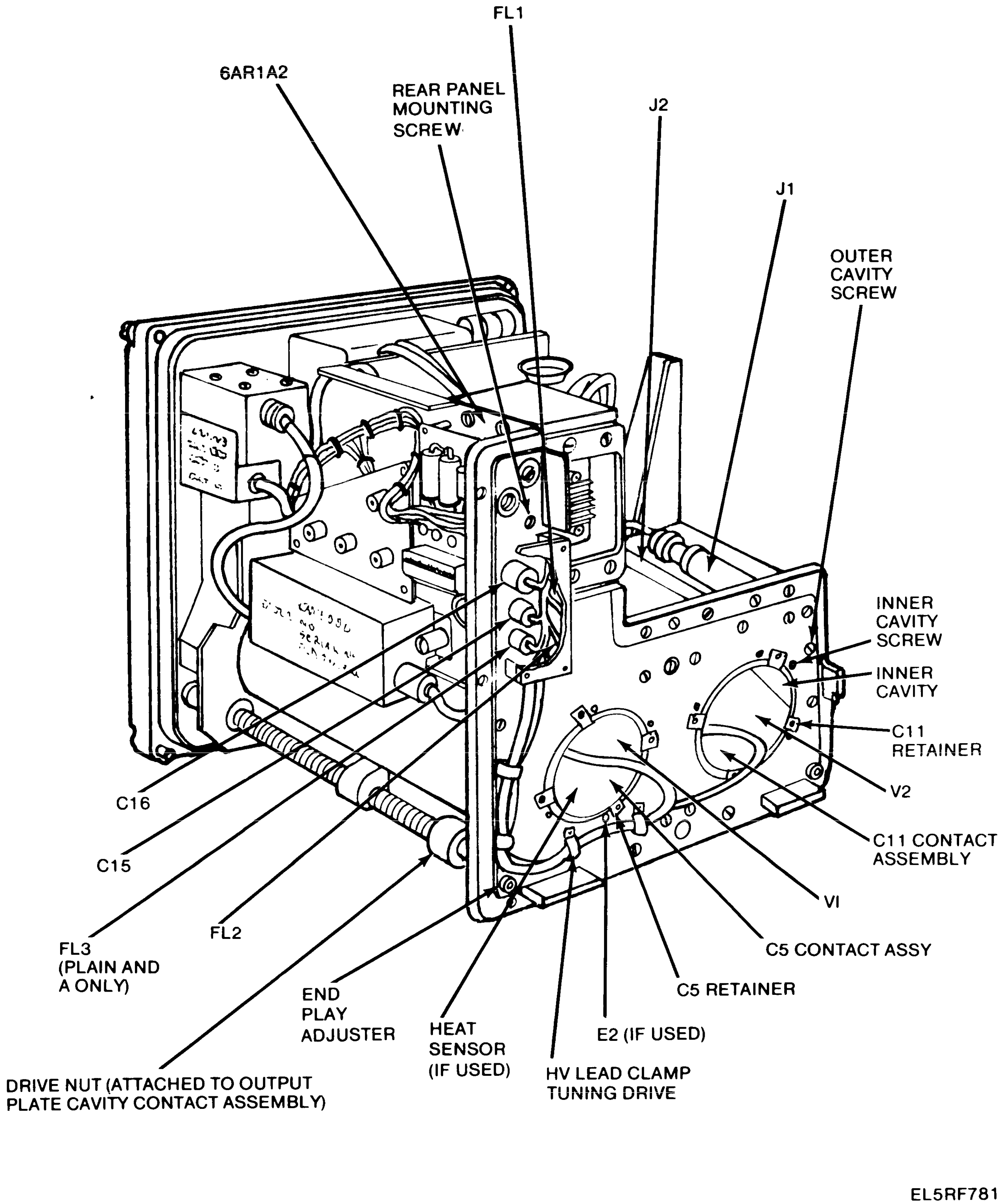


Figure 4-51. Amplifier Subassembly 6AR1A1, Inner Cavity Removal and Replacement (Air Deflector Removed).

(3) Unsolder, disconnect and tag the four wires and the jumper from C 15, C 16, and FL1 through FL3 (FL1 and FL2 on B model 6AR1A1 units) on the front side of the unit rear panel.

(4) Remove the tube retainer (air deflector assembly).

CAUTION

On B model 6AR1 units, be sure that the temperature sensing assembly (heat sensor) is not damaged during the following procedures.

(5) Using a suitable lever inserted through the tube puller, carefully pry the driver and output amplifier tubes straight out from the cavities. Note the position of the heat sensor assembly (if used) and carefully pry it free from the output amplifier tube.

(6) Remove the screws that secure the outer cavities to the unit rear panel (not the inner cavities, J1 or J2).

(7) Remove the screws that secure the unit rear panel to chassis 6AR1A2.

CAUTION

Be sure that the fingers on the plate cavity contact (tuning) assemblies are not damaged while removing the inner cavity tube assemblies.

(8) Carefully pull the assembled rear panel and inner cavities straight out from the amplifier cavity assembly.

(9) On B model 6AR1A1 units, unsolder and disconnect the high voltage leads from terminal E2 on the rear panel. Remove terminal E2.

(10) Remove the screws that secure capacitor (C5 and C11) retainers and high voltage lead clamps. Remove the capacitor retainers.

(11) Remove capacitor contact assemblies C5 and C1l.

(12) Inspect both inner cavity assemblies for evidence of arcing, solder faults, corrosion, excessive wear, broken or damaged parts, or other abnormalities. Replace known or suspected defective inner cavity tube assemblies. Install, but do not tighten, inner cavity mounting screws at this time.

(13) Reinstall capacitor contact assemblies C5 and C1l.

CAUTION

Be sure that the slot in the capacitor contact assembly is centered around the rigid rf cable leading to the stage output connector (Jl or J2).

(14) Install and secure the capacitor retainers and terminal E2 (if used).

(15) Inspect the high voltage lead clamps for broken lead shield connections. Secure the high voltage lead clamps.

(16) On B model 6AR1A1 units, reconnect and solder the output cavity high voltage leads to E2.

(17) Carefully position and press the assembled inner cavities and rear panel into the amplifier cavities assembly. Be sure that the tuning drive screws are properly seated in the end play adjustors.

(18) Aline the amplifier outside cavity mounting holes and loosely install the screws removed in (6) above. Do not tighten the screws at this time.

(19) Aline the rear panel mounting holes with the chassis 6AR1A2 mounting holes. Secure the rear panel to 6AR1A2 with the screws previously removed.

(20) Tighten the screws securing the inner and outer cavity assemblies to the rear panel.

(21) On B model 6AR1A1 units, position and secure the heat sensor assembly onto the output amplifier tube as noted in (5) above. Use an appropriate heat sink compound, such as Dow Corning 340.

(22) Install both tubes. Be sure that the tubes are properly seated in the contact assemblies (C5 and C1l).

(23) Slip a suitable length of heat shrinkable tubing over the ends of the wire and the jumper and reconnect and solder the tagged wires to C15 and C16 on the front side of the rear panel. Position the tubing over the terminals of C15 and C16 and shrink it with a thermogun.

(24) Reconnect and solder the tagged wires to FL1 through FL3 (FL1 and FL2 on B model 6AR1A1 units).

(25) Operate the XMTR TUNE control and the PWR OUT PEAK control (pushed-in and pulled-out positions) throughout their range. The controls should operate smoothly without dragging or binding.

(26) On plain model 6AR1 units, if a gold-plated inner cavity was replaced by a nickel-plated cavity, resistor 6AR1A2A2R2 (5.1 ohms) should be replaced with a 4.7 ohm resistor, part number RW69V4R7, NSN 5905-00-080-3218.

(27) Reinstall air deflector assembly.

(28) Test the assembled rf amplifier 6AR1 as described in paragraph *b.* above.

4-14. Rf Amplifier Subassembly 6AR1A1

a. The rf amplifier subassembly includes the driver and output resonator cavities, the driver and output tubes, and associated tuning mechanism.

b. The rf amplifier subassembly is part of radio frequency amplifier 6AR1. Refer to paragraph 4-13 for electrical testing, troubleshooting procedures, and repair instructions. For repairs not covered in paragraph 4-13, refer complete rf head AM-4320(*)/GRC-103(V) to higher echelon maintenance.

4-15. Electronic Component Assembly 6AR1A2

Electronic component assembly 6AR1A2 includes circuit card assembly 6AR1A2A2, connector-filter assembly 6AR1A2A3, filter assembly 6AR1A2A4, lowpass filter 6AR1A2FL1, and radio interference filter 6AR1A2FL3. For testing and troubleshooting procedures of the above subassemblies, refer to paragraphs 4-8,4-13,4-16,4-17, and 4-18.

4-16. Circuit Card Assembly 6AR1A2A2

a. Test Equipment and Material Required.

Equipment	*Common name*
Digital Multimeter, AN/USM-451	Digital multimeter
Bridge, Impedance, ZM-7l/U	Impedance bridge

b. Test Procedure.

(1) Use the digital multimeter to check the resistance between terminals as listed below (refer to fig. 4-52 for component connections).

Resistance

From	*To*	*Component tested*	*Performance standard (ohms)*
E l	E3	R1	10.59 to 12.81
E l	E8	R2	4.46 to 4.94 (4.84 to 5.36 plain model)
E10	DS1(–)	R3	9meg to 11meg
E4	E9	R4	180k to 220k
E4	E l l	R5	216k to 264k
E4	E12	R6	198k to 242k

Continuity

From	*To*	*Performance standard (ohms)*
TP1	E4	Less than 0.2
TP2	E5	Less than 0.2
TP3	E6	Less than 0.2
TP4	E7	Less than 0.2
TP5	E l	Less than 0.2
TP6	E3	Less than 0.2
TP7	E8	Less than 0.2

(2) Use the ZM-7l/U to test capacitors Cl and C2 as listed below.

Capacitance

From	*To*	*Component tested*	*Performance standard*
El(–)	E4(+)	Cl	24 to 36 μfd with a dissipation factor of not more than 0.10.
El(–)	E7(+)	C2	24 to 36 μ fd with a dissipation factor of not more than 0.10.

4-17. Connector-Filter Assembly 6AR1A2A3

a. Test Equipment and Material Required.

Equipment	*Common name*
Digital Multimeter, AN/USM-451	Multimeter

b. Test Procedure. This assembly comprises plug 6AR1A2A3P1 and associated filter connectors. Check each circuit as follows (FO-29, FO-30, or FO-31).

(1) Check continuity between each pin and rf connector of 6AR1A2A3P1 and its associated filter connector.

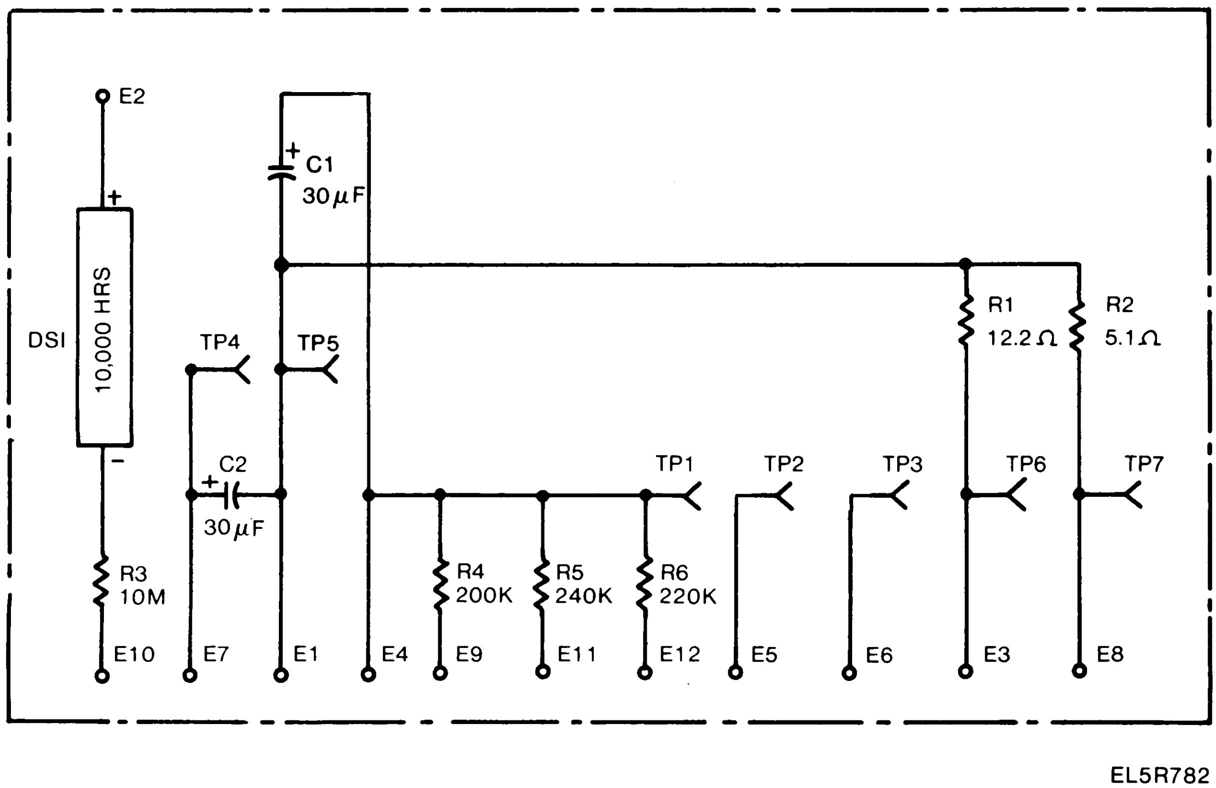


Figure 4-52. Circuit Card 6AR1A2A,2, Schematic.

(2) Check for a short circuit between any pin or center conductor of 6AR1A2A3P1 and ground.

c. Repairs.

(1) If tests above indicate that a filter or 6AR1A2A3P 1 requires replacement, refer to paragraph 2-40.

(2) If one or more of the small connecting pins of 6AR1A2A3P1 are broken, remove 6AR1A2A3 and replace 6AR1A2A3P1. Refer to paragraph 2-10 for replacement of connectors.

(3) The rf connectors in 6AR1A2A3P1 can be replaced as follows:

(a) Force the rf connector back into the connector-filter assembly.

(b) Slide the insulating sleeve back along the cable and unsolder the faulty connector.

(c) Install the new connector to the rf cable (para. 2-10).

(d) Push the new connector into the mounting hole in 6AR1A2A3P1 until the retaining springs snap into place, holding the connector firmly.

4-18. Filter Assembly 6AR1A2A4

a. Test Equipment and Material Required.

Equipment	*Common name*
Accessories, part of	
Transmitter Test Facility, TS-2866/(V)2/GRM-95(V)2	Transmitter test facility
Receiver Test Facility, TS-2867(V)2/GRM-95(V)2	Receiver test facility
Accessory Kit MK-1173(V)2/ GRM-95(V)2	Accessory kit
Rf Modules Test Facility, TS-3837(V)2/GRM-95(V)2	Module test facility
Generator, Sweep, Wiltron,610 D	Sweep generator
Plug-In, Wiltron, 61084D	Plug-in
Oscilloscope, AN/USM-281 C	Oscilloscope
Insulation Tester, GR-1864	Megohmmeter
Digital Multimeter, AN/USM-451	DMM (digital multimeter)

b. Test Procedure.

NOTE

Remove and replace the module as shown in paragraph 2-42, if necessary.

(1) *Preliminary checks..*

WARNING

HIGH VOLTAGE is accessible at the connectors and test leads of the megohmmeter. Ensure that the test switch is in the DISCHARGE position before handling test connections.

(a) Connect the "+" and "ground" terminals (strapped together) of the megohmmeter to the chassis of the unit under test and the "-" terminal to the center conductor of J1 as shown in A, figure 4-53.

(b) Set megohmmeter to 500 V and then to MEASURE. The megohmmeter indication should be not less than 500 megohms. Set megohmmeter to DISCHARGE.

(c) Repeat *(a)* and *(b)* above for J2.

(d) Connect the equipment as shown in B, figure 4-53 or connect test lead 267-800015-000 tip directly to FL1 or FL2 as required and measure the resistance between the points indicated below.

From	*To*	*Minimum resistance*
J2	J3	1.0
J2	FL2	2.0
J4	J1	1.0
J4	FL 1	2.0

(2) *VSWR measurements.*

(a) Connect the test equipment as shown in A, figure 4-54.

(b) Adjust sweep generator to sweep between 220 and 405 MHz. Adjust generator and oscilloscope controls for a suitable display of the 1.3:1 VSWR.

(c) Note the oscilloscope deflection. This is the reference line.

(d) Connect connector J1 on the unit under test to port 22 as shown in B, figure 4-54.

(e) Connect a 50-ohm matched load to connector J4 on the unit under test. The VSWR displayed on the oscilloscope screen shall not exceed the 1.3:1 reference line.

(f) On the unit under test, remove the cable from connector J1 and connect it to J3 (fig. 4-54).

(g) On the unit under test, disconnect the 50-ohm matched load from connector J4 and connect it to J2.

(h) The VSWR as displayed on the oscilloscope shall not exceed the 1.3:1 reference line.

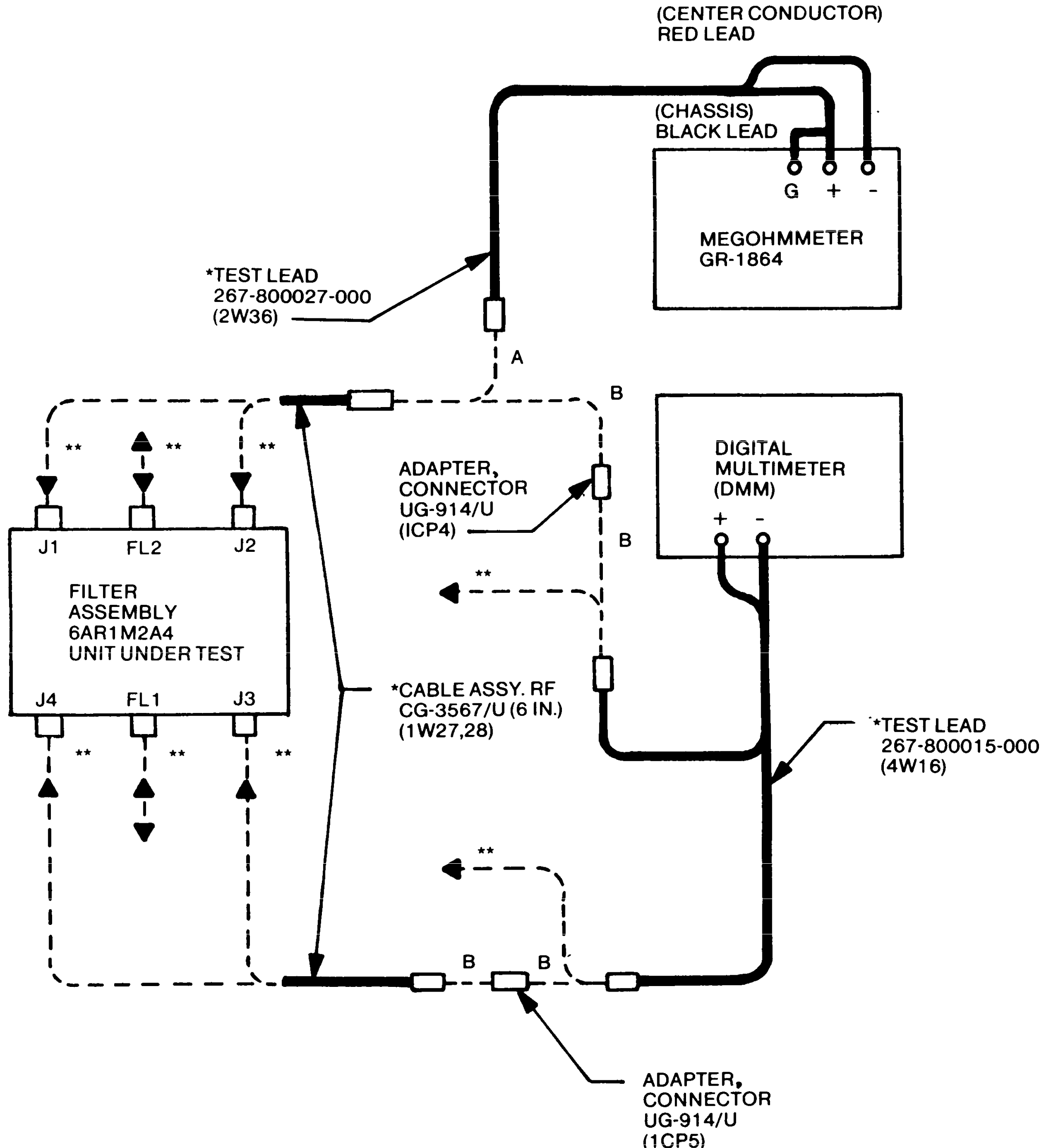
(i) If necessary, adjust Cl on the unit under test to meet the specifications given in paragraph *(2)(e)*. Recheck the insulation resistance as in *(1)(a)* through *(c)* above.

(j) If necessary, adjust C2 on the unit under test to meet the specifications given in paragraph *(2)(h)*. Recheck the insulation resistance as in *(1)(a)* through *(c)* above.

(k) Seal all adjusted controls on the unit under test as described in paragraph 2-12.

c. Troubleshooting (fig. 4-55).

Symptom	*Checks and corrective measures*
Center conductor of J2 shorting to chasis.	*a.* Check J3 and J2 connectors and repair connectors if necessary.
	b. Check to see that L2 leads are properly insulated from chassis.
	c. Check to see that C2 is properly insulated from chassis.
Center conductor of J1 shorting to chassis.	*a.* Check J1 and J4 connectors; repair connectors if necessary.
	b. Check to see that L1 leads are properly insulated from chassis.
	c. Check to see that C1 is properly insulated from the conductor.
High resistance, J3 to J2.	Check from J3 to J2 for loose connections; resolder if necessary.
High resistance, J1 to J4.	Check J1 to J4 for loose connection; *resolder* if necessary.
High resistance J2 to FL2.	Check for loose or open FL2.
High resistance J4 to FL1.	Check for loose or open FL1.



*PART OF TEST FACILITIES SET
**CONNECT AS INSTRUCTED IN TEXT

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Figure 4-53. Filter Assembly 6AR1A2A4, Preliminary Checks, Test Setup.

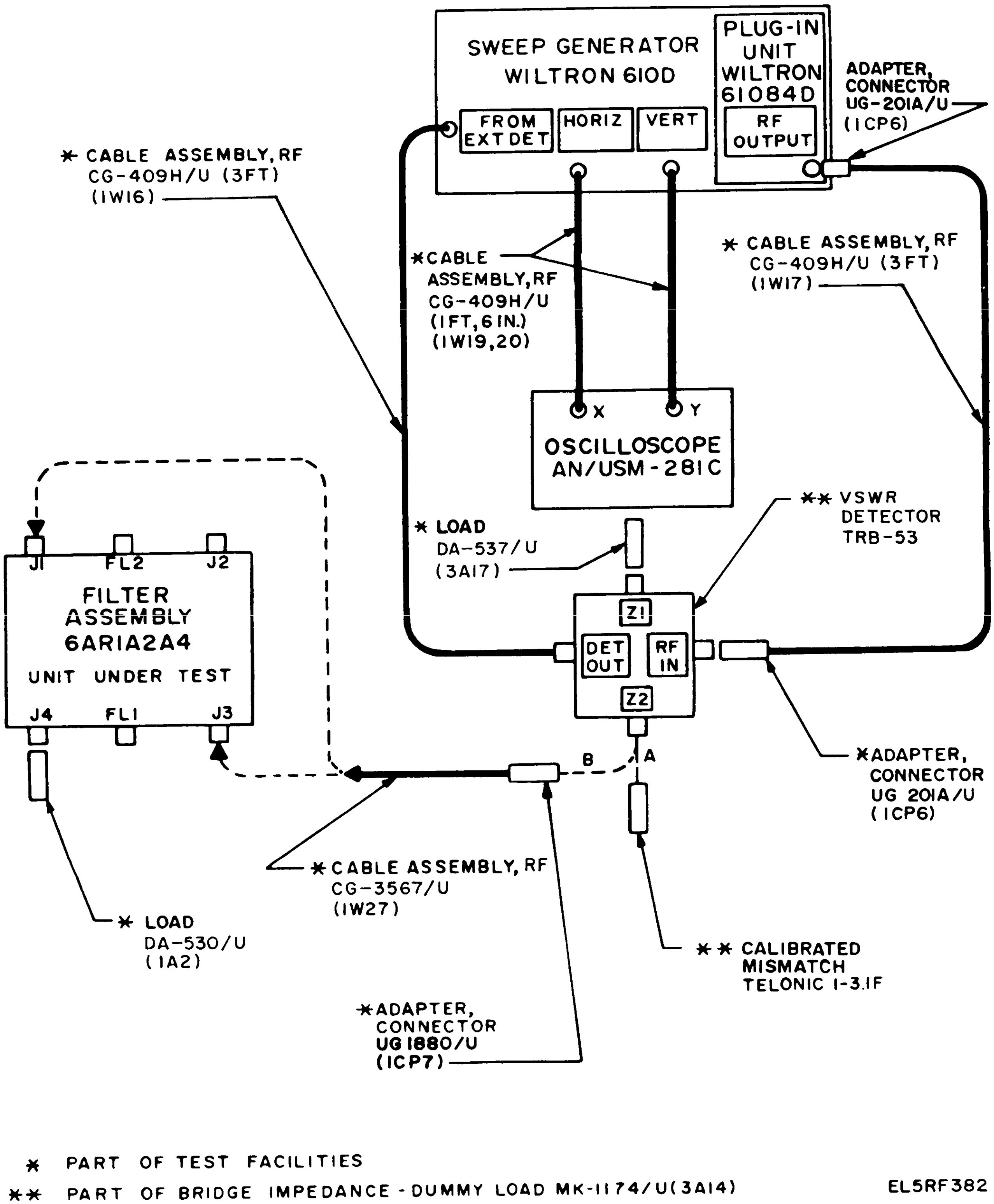
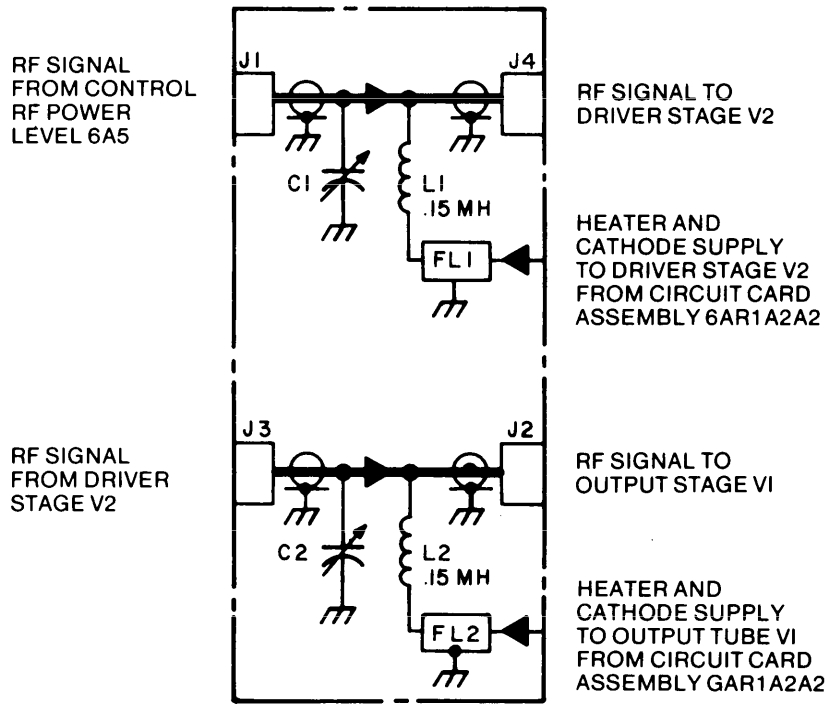
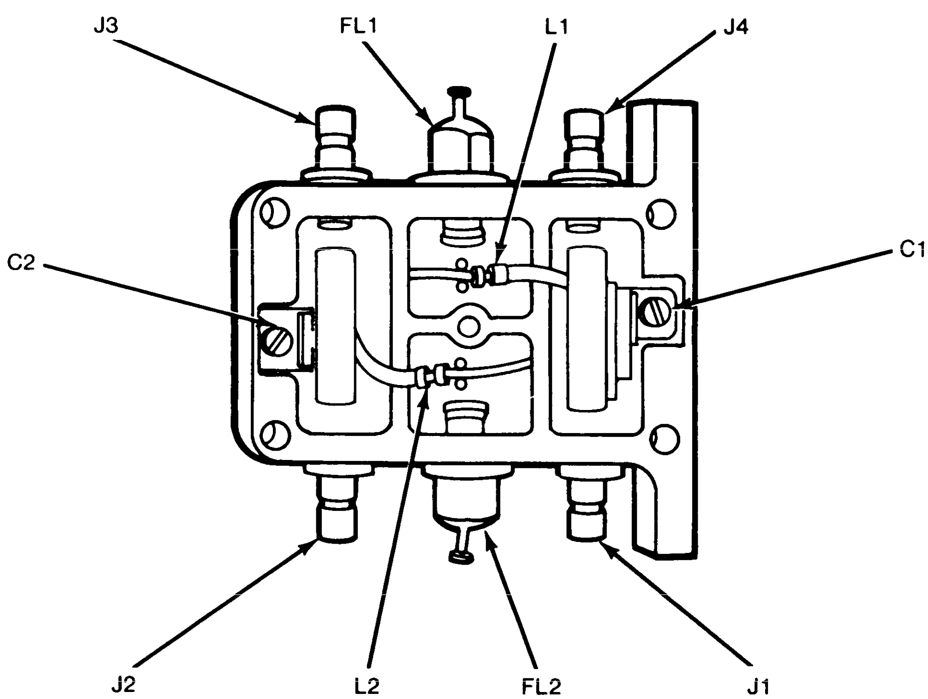


Figure 4-54. Filter Assembly 6AR1A2A4, VSWR Check, Test Setup.



A



B

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Figure 4-55. Filter Assembly 6AR1A2A4, Schematic Diagram and Parts Location.

Section II. BAND II TRANSMITTER AND RECEIVER RF HEADS

4-19. Amplifier-Converter AM-4317/GRC-103(V) (Band II Receiver Rf Head)

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/GRM-95(V)	Test facility receiver
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Modules, TS-3837(V)2/GRM-95(V)2	Test facility radio frequency modules
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Frequency Counter, TD-1225(V) l/U	Frequency counter
Electronic Voltmeter, ME-459/U	VTVM
Digital Multimeter, AN/USM-451	Digital multimeter (DMM)
Sweep Generator, Wiltron 610D	Sweep generator
Plug-in Unit, Wiltron 61048D	Plug-in unit
Oscilloscope, AN/USM-281 C	Oscilloscope
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Drive Generator, Airborne Instruments Labs, Model 125	Power signal source
Signal Generator, HP-8640B	Signal generator
Windband Rf Amplifier, EN1603L	Rf amplifier
Attenuator, 3 dB, 50 Watt, Weinschel Model 25-3-34	Power attenuator
Termination, Mismatch Telonic, TRM-1-3.50F	3.50 calibrated mismatch
Rf Voltmeter, ME-426/U	Rf voltmeter

b. Test Procedures.

NOTE

- There are two variations of AM-4317 mixer stage 33A7. The early type uses voltage tunable mixer 33A7 (SM-D-696335), power supply 33PS1 (SM-D-696339) and voltage control assembly 33A1A2 (CMC 245-800044-000). The later type uses wideband mixer 33A7 (SM-D-696296) and does not require power supply or voltage control assembly. Mixer (33A7) SM-D-696296 may be used in place of mixer SM-D-696335 without realinement or change to the AM-4317. The following procedures, apply equally to both variations except where noted.
- The gain and age levels of if amplifier 33ARl should be set as described in paragraph *4-34b.* (2) before performing the following tests.

(1) *Functional check.*

(a) Remove the dust cover from the unit to be tested. Connect the test equipment as shown in A, figure 4-56.

(b) Set the power supply to 115 Vac as indicated on the panel voltmeter and set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S7	AGC
S8	OFF
S6	MULTIPLIER

(c) Set the unit under test RCVR CHANNEL and RCVR SIG control to channel 390 and the XMTR DUPL control to channel 490.

(d) Set the signal generator to 395 MHz ± 10 kHz at a cw output level of –74 dBm.

(e) Adjust the MULT PEAK control on the unit under test for maximum indication on the test facility meter Ml. The meter shall read between 20% and 90%.

(f) Set S6 to RCVR SIG position. Adjust the RCVR SIG control on the unit under test for maximum indication on test facility meter Ml. Observe the VTVM and carefully tune RCVR SIG control for a minimum indication. The VTVM shall indicate –43 to –51 dBm (SM-D-969296) or less than –43 dBm (SM-D-696335) and the appropriate channel number shall be ±0.5 inch from the calibration mark of the RCVR CHANNEL window. Note the VTVM indication.

(g) Increase the signal generator output level until the HIGH SIGNAL lamp lights. The signal generator level should be between –10 dBm and +15 dBm. Observe the VTVM as the signal generator output level is increased to –10 dBm. The VTVM indication should not exceed the level noted in step (H above.

(h) Slowly decrease the signal generator output level until the high signal lamp extinguishes. The signal generator level shall be NLT –10 dBm.

(i) Repeat *(c)* through *(f)* above for the remaining channels listed below. Repeat *(g)* and *(h)* above only at frequencies marked by an asterisk (*).

RCVR channel and RCVR sig	*Signal generator frequency (MHz)*
*390**	*395*
430	*415*
470	*435*
510	*455*
550	*475*

RCVR channel and RCVR sig	*Signal generator frequency (MHz)*
590*	*495*
630	*515*
670	*535*
710	*555*
750	*575*
790*	*595*
830	*615*
870	*635*
910	*655*
950	*675*
990*	*695*
1010	*705*

(2) Signal level control monitor leakage test.

(a) Disconnect the rigid rf cables from J1 and J2 of signal level control monitor 33A5 and remove it from the rf head chassis.

(b) Connect the equipment as shown in figure 4-57.

(c) Set the receiver test facility switches as follows:

Switch	*To position*
S1	ON
S5	S6
S6	REFL POWER
S7	AGC
S8	OFF

(d) Set the power signal source meter switch to the low power position.

CAUTION

Do not allow the output level of the power signal source to exceed a full scale indication on the panel meter while tuning.

(e) Tune the power signal source to a nominal frequency of 395 MHz.

(f) Set the power signal source meter switch to the high power position.

(g) Slowly increase the output level from the power signal source to 50 watts as indicated on its panel meter while observing the power meter indication. The power meter indication should not exceed –3 dBm (+17 dBm output level). The high signal lamp on the test facility should be lit.

(h) Repeat *(d)* through (g) above at nominal frequencies of 550 MHz and 695 MHz.

(i) Turn off the power signal source and reinstall the signal level control monitor.

(3) *Power monitor operation test.*

(a) Connect the equipment as shown in A, figure 4-58.

(b) Set the signal generator to 395 MHz (nominal) at a level of +10 dBm as indicated on the power meter.

(c) Connect the equipment as shown in B, figure 4-58.

(d) Subtract the power meter indication from +10 dBm (step *(b)* above). Record the calculated attenuation.

(e) Repeat *(a)* through *(d)* above at frequencies of 550 MHz and 695 MHz (nominal).

(f) Connect the equipment as shown in D, figure 4-59.

(g) Set the RCVR SIG control to channel 850 and the XMTR DUPL control to channel 390.

(h) Adjust the power signal source to 395 MHz (nominal) at approximately 50 watts as indicated on its panel meter.

(i) Tune the XMTR DUPL control for a peak power meter indication and adjust the power signal source for an output from the unit under test of 15 watts (41.75 dBm minus the attenuation from *(d)* above = power meter indication).

(j) Set test facility switch S6 to XMTR PWR. Meter Ml should indicate not less than 40 percent full scale deflection.

WARNING

RADIO FREQUENCY ENERGY is accessible at the ANT. connector of the unit under test. Use caution when disconnecting or reconnecting rf cable assembly.

(k) Set S6 to REFL PWR and disconnect the rf cable assembly from the ANT. connector on the unit under test. Test facility meter Ml should indicate not less than 30 percent. Reconnect the rf cable to the ANT. connector. Meter Ml should indicate not more than 5 percent.

(l) Repeat *(g)* through *(k)* above at 550 (channel 700) and 695 MHz (channel 990).

(4) Transmitter duplexer insertion loss.

(a) Connect the test equipment as shown in B, figure 4-59.

(b) Adjust the high power source to a nominal 700 MHz and an output of 50 watts as indicated on its panel meter. Note the power meter indication in dB.

(c) Connect the test equipment as shown in A, figure 4-59. Note the power meter indication in dB.

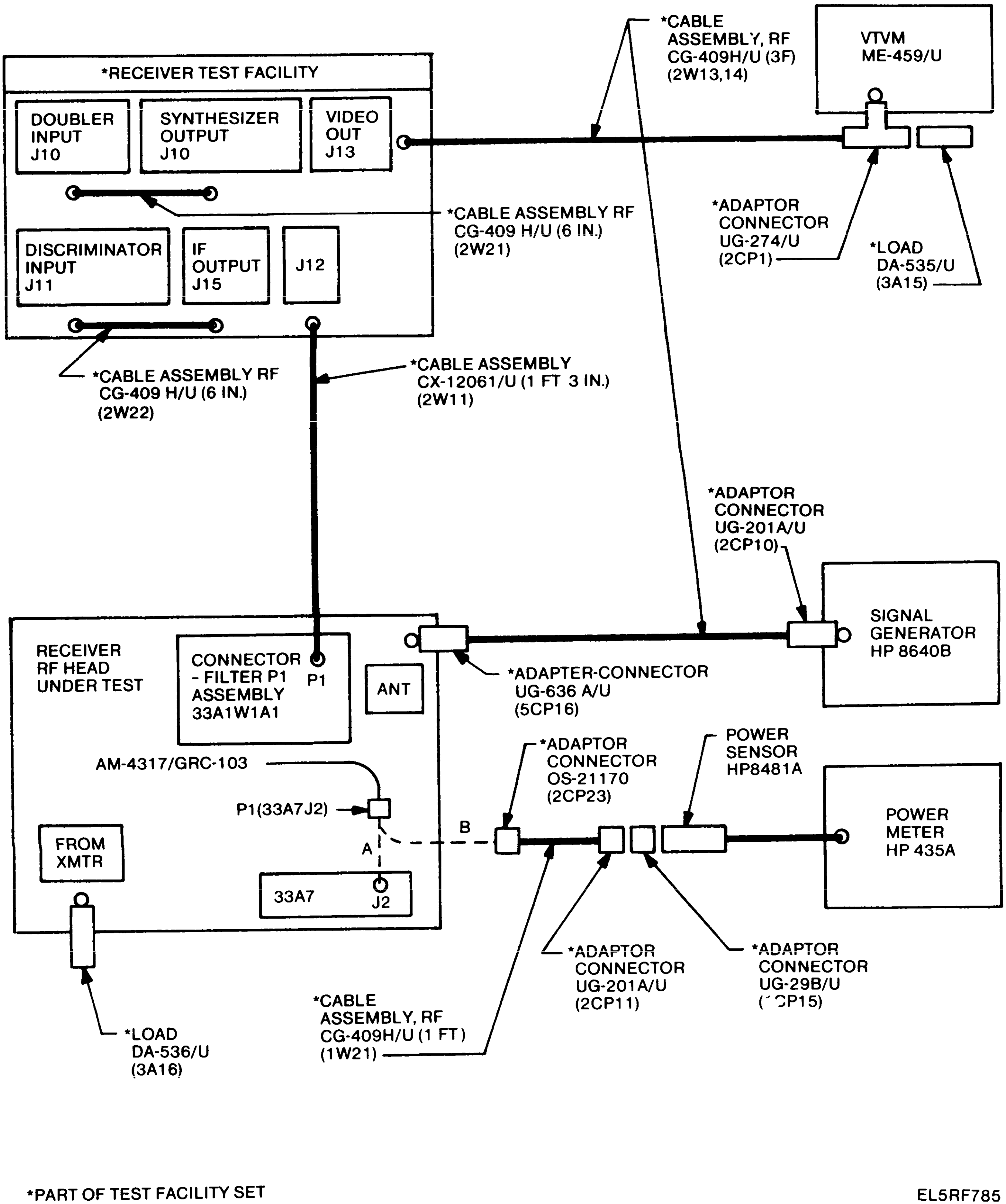


Figure 4-56. Receiver Rf Head AM-4317/GRC- 103, Functional Check and Alignment Test Setup.

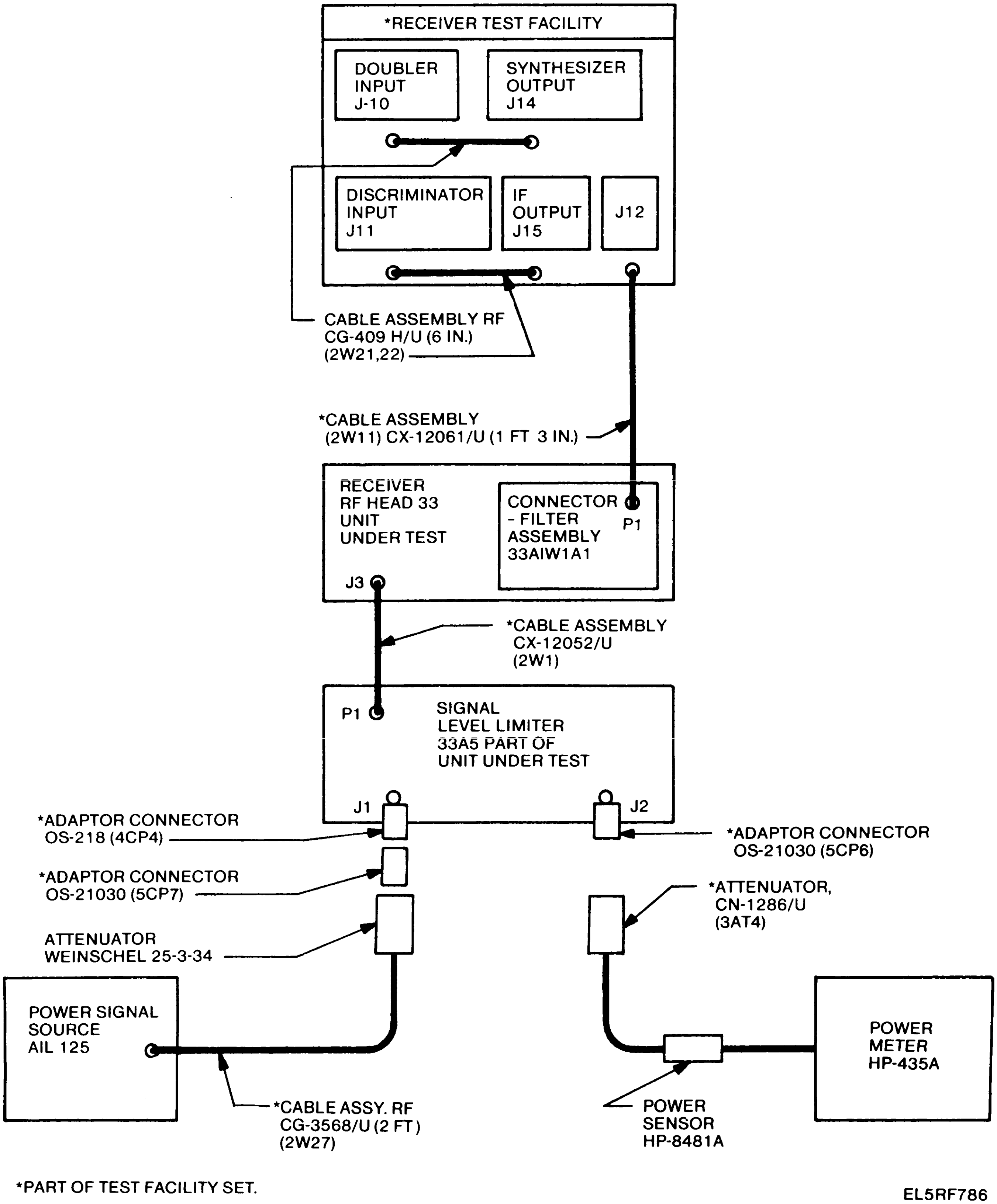


Figure 4-57. Receiver Rf Head Unit 33, Receiver Protection Circuit Check, Test Setup.

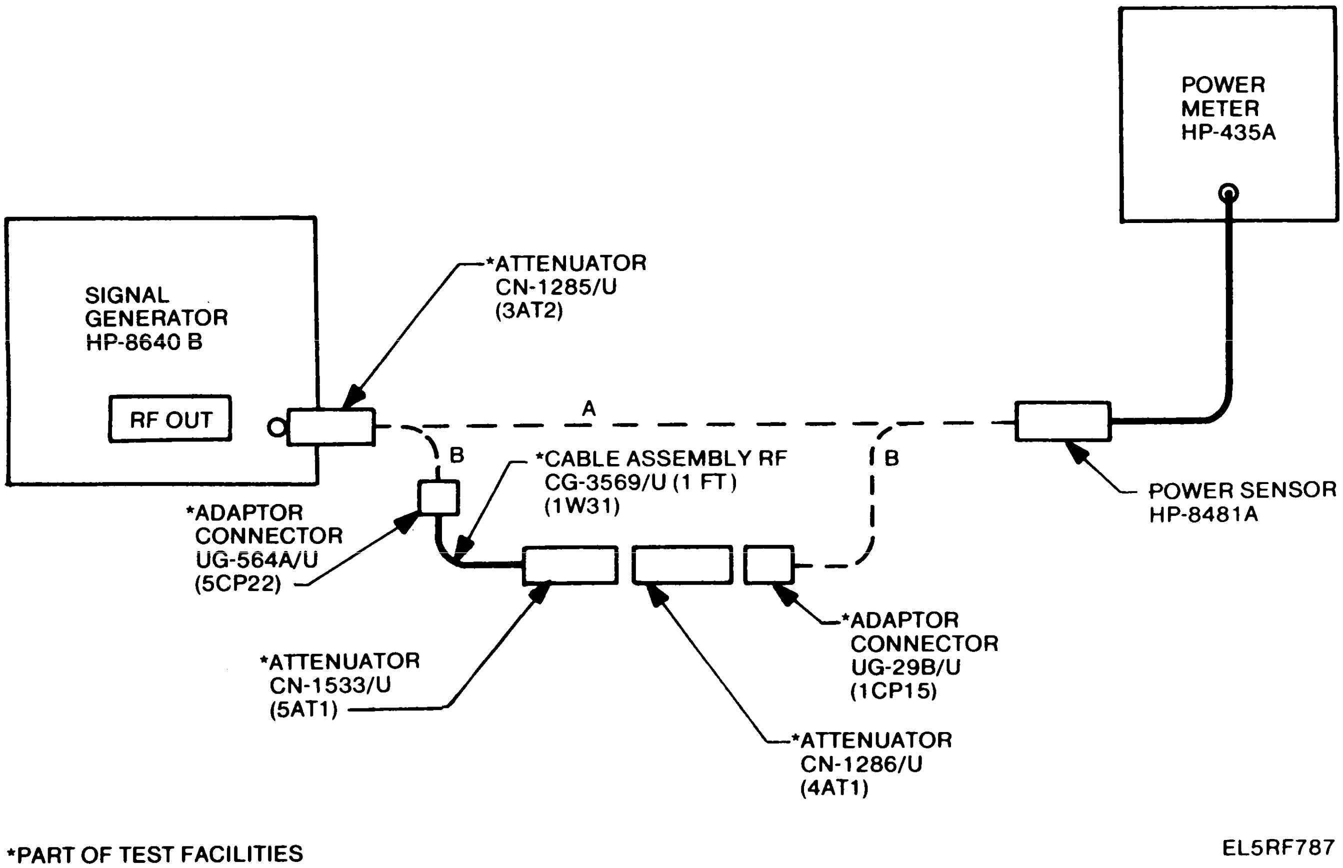


Figure 4-58. Attenuator Calibration Test Setup.

(d) Subtract the indication noted in *(b)* above from the indication noted in *(c)* above, the result is the net insertion loss of the test set up at this frequency. Record this insertion loss (may be a negative value).

(e) Connect the test equipment as shown in D, figure 4-59.

(f) Tune the RCVR SIG control to channel 500.

(g) Tune the XMTR DUPL control to channel 390.

(h) Maximize the power indicated on the power meter by slight readjustment of the XMTR DUPL control.

(i) Record the power meter indication.

(j) Connect the equipment as shown in G, figure 4-59.

(k) Record the power meter indication.

(l) Calculate the unit under test insertion loss as follows: subtract the level recorded in step *(j)* above from the level recorded in step *(k)* above then subtract the test set up insertion loss calculated and recorded in step *(d)* above. The calculated unit under test insertion loss shall be NMT 2.0 dB.

(m) Repeat steps *(a)* through *(l)* above for XMTR DUPL channel settings of 700 and 1000, corresponding to high power source output frequencies of 550 MHz and 700 MHz respectively.

(5) *Input VSWR test.*

(a) Connect the equipment as shown in A, figure 4-60.

(b) Set the test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S7	AGC
S8	OFF
S6	Multiplier

(c) Adjust the sweep generator controls for a leveled cw output of "0" dBm over the frequency range of 395 MHz to 705 MHz.

(d) Connect the equipment as shown in B, figure 4-60, and adjust the sweep generator to sweep between 395 MHz and 705 MHz (Fl to F2 mode).

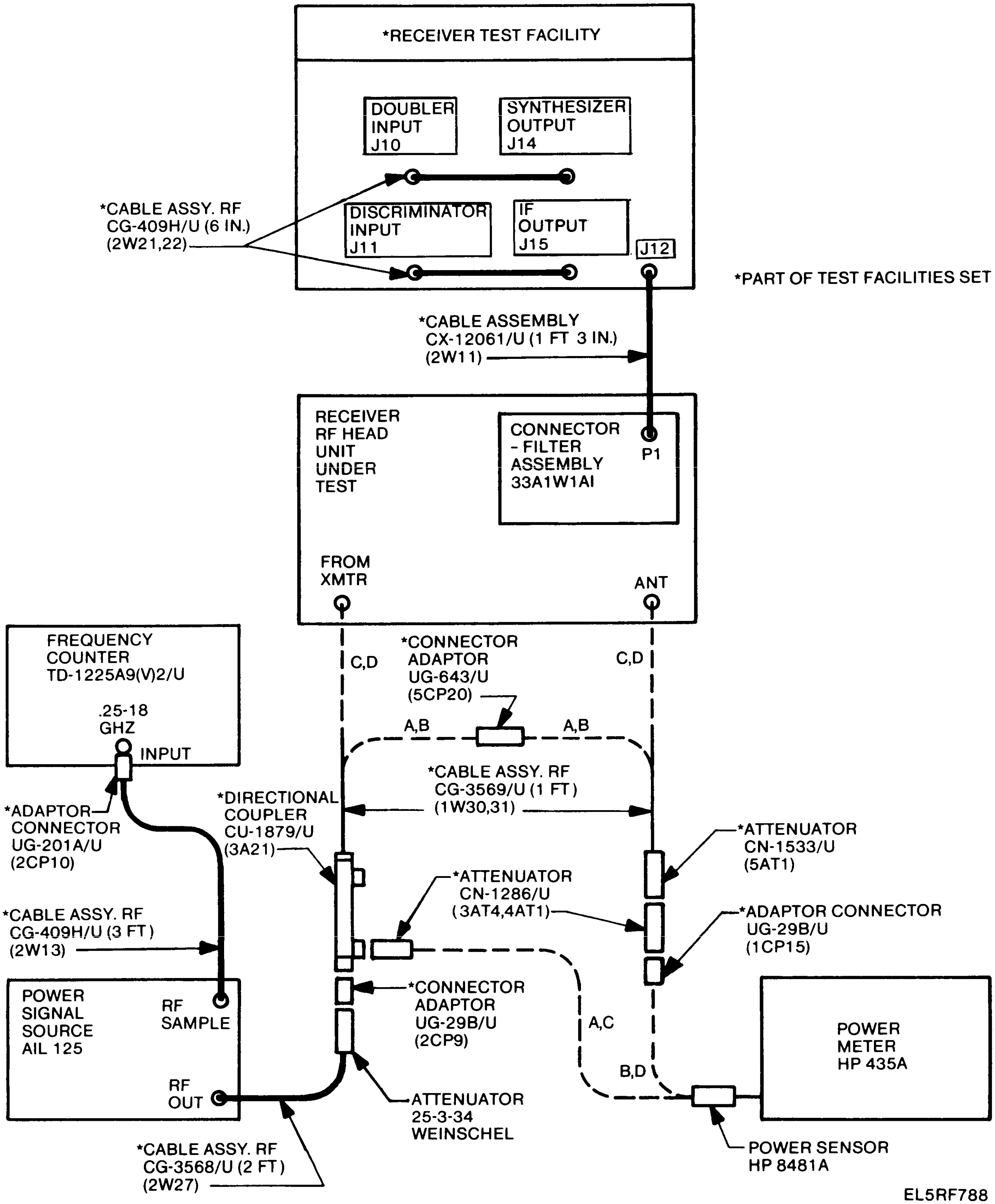


Figure 4-59. Receiver Rf Head Unit 33, Power Monitor and XMTR DUPL Insertion Loss Checks, Test Setup.

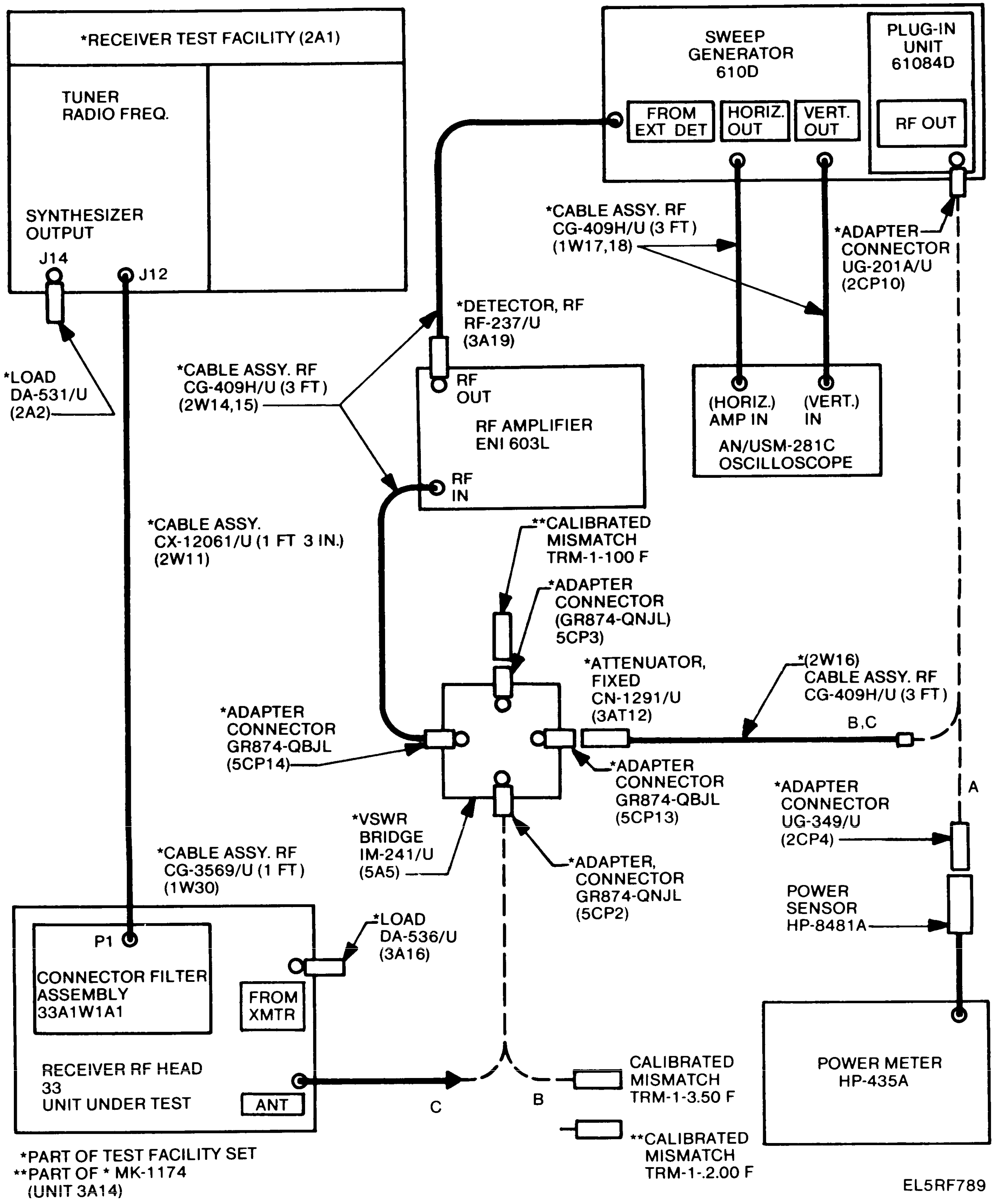
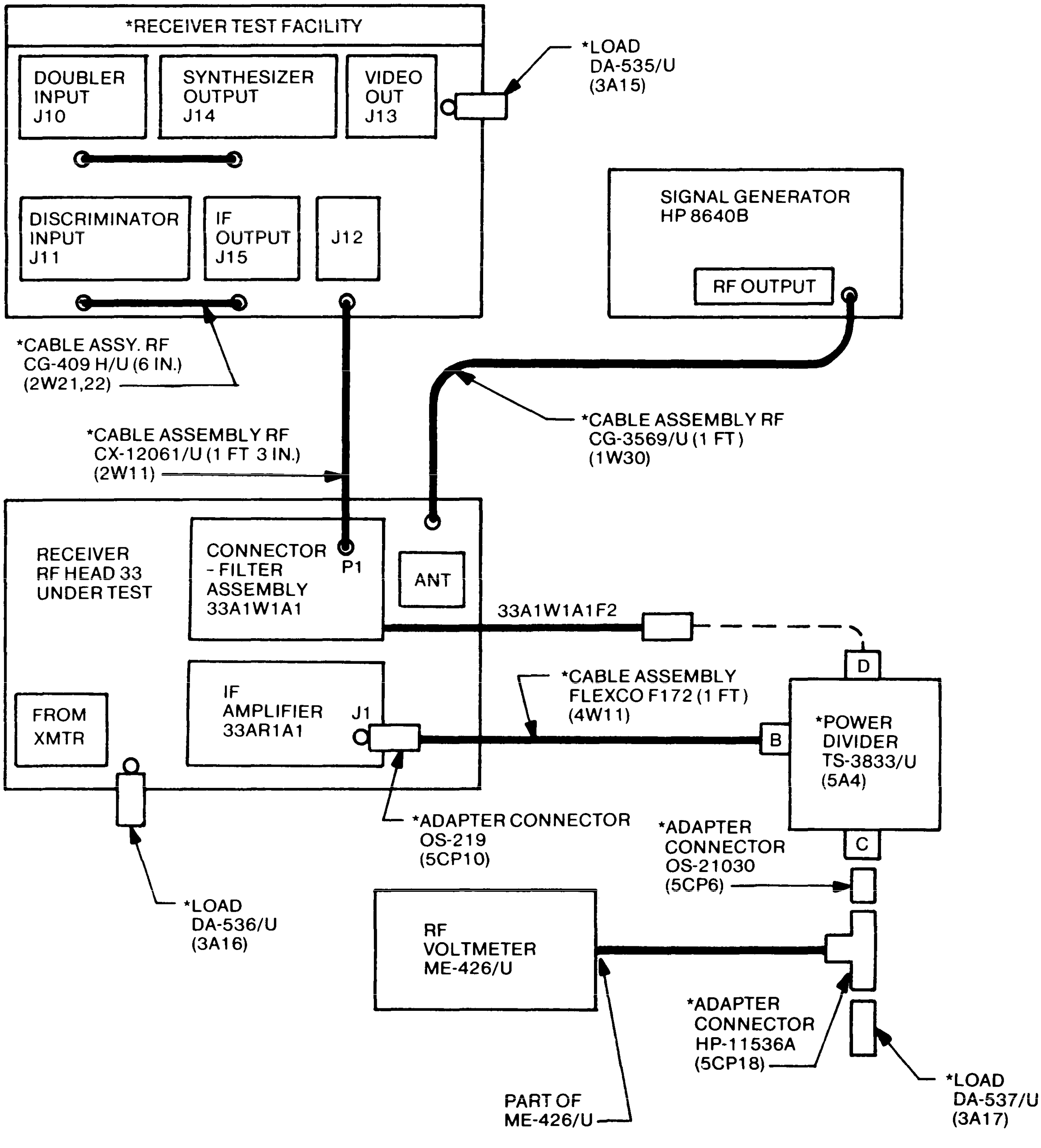


Figure 4-60. Receiver Rf Head, Unit 33, Input VSWR Check Test Setup.



*PART OF TEST FACILITIES SET.

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Figure 4-61. Receiver Rf Head Unit 33, AGC Check, Test Setup.

(e) Adjust the oscilloscope controls for a convenient display of the VSWR curve; for example, the baseline of the display on the top line of the oscilloscope graticule, and the VSWR curve on the bottom line of the graticule. Record the resultant VSWR curve between 395 MHz and 705 MHz.

(f) Connect the equipment as shown in C, figure 4-60. Set the sweep generator to Δ F mode at a sweep width of 10 MHz (use internal markers) with the response centered on the first frequency listed after paragraph (1) *(i).*

(g) Tune the unit under test RCVR SIG control to center the duplexer response on the oscilloscope display (set the XMTR DUPL control at least 100 charnels away from the RCVR CHANNEL setting). The VSWR curve displayed on the oscilloscope should not exceed the 3.5:1 calibration line within a minimum bandwidth of 3.0 MHz as measured at the 3.5:1 calibration line (use internal HARMONIC MARKERS).

(h) Reset the sweep generator frequency (step (B above) and repeat step *(g)* above for the remaining channels and frequencies listed after paragraph (l) *(i).*

(i) Repeat paragraphs *(d)* through *(h)* above except use the 1-2.00 calibrated mismatch and use the XMTR DUPL control in place of the REC SIG control. The VSWR curve displayed on the oscilloscope should not exceed the 2.00:1 calibration line within a minimum bandwidth of 2.0 MHz as measured at the 2.00:1 calibration line. The XMTR CHANNEL indication for the appropriate channel number shall be within ±0.5 inch from the calibration mark at the center of the window.

(6) *AGC test.*

(a) Connect the equipment as shown in figure 4-61.

(b) Set the unit under test RCVR CHANNEL and RCVR SIG controls to channel 1000. Tune the XMTR DUPL control at least 100 channels away from channel 1000. Set the signal generator frequency to 700 MHz at an output level of –74 dBm.

(c) Set test facility S6 to multiplier. Adjust the unit under test MULT PEAK control for a maximum indication on the test facility meter M1.

(d) Carefully tune the signal generator frequency for a minimum indication on the VTVM (approximately 40 dB). Reduce the signal generator level to –80 dBm, observe the reading on the rf voltmeter, then increase the signal generator output to –50 dBm, the rf voltmeter indication shall not increase more than 10 dB.

c. Troubleshooting (FO-34).

Symptom	*Probable cause*	*Checks and corrective measures*
1. Test facility meter Ml below normal, para. b. (1) *(e).*	*a.* Incorrect local oscillator frequency.	*a.* Test 33A4 as described in para. 4-38. Check continuity between 33A1W1J5 and 33A1WAP1. Repair as required.
	b. Defective local oscillator metering circuit.	*b.* Check LO metering circuit of 33A7 as described in para. 4-33. Check continuity between pin 4 of 33A1W1J6 and pin 24 of 33A1W1A1P1. Repair or replace as required.
	c. Local oscillator tracking improper.	*c.* Adjust local oscillator tracking as described in para. *d.* below.
2. VTVM indication abnormal, para. *b.* (l) *(f).*	*a.* Defective or misadjusted voltage control 33A1A2 (used with mixer stage 33A7, SM-D-696355).	*a.* Adjust voltage control 33A1A2 tracking as described in para. *d.* below.
	b. Defective mixer 33A7.	*b.* Test 33A7 as described in para. 4-33. Replace or repair as required.
	c. Defective if. amplifier 33AR1.	c. Test 33AR1 as described in para. 4-34. Repair as required.
	d. Excessive insertion loss through receiver duplexer.	*d.* Disconnect P1 of 33W4 from J2 of 33A1A1Z5 and connect the signal generator set to –77 dBm to 33W4P1. (1) If VTVM indication is abnormal, test 33A5 (para. 4-31) and 33FL1. Repair or replace as indicated. (2) If VTVM indication in (1) above is normal, reconnect P1 of 34W4 to J2 of 33A1AlZ5 and substitute (in turn) ANT. connector 33CP1 and power monitor 33A3 with known good parts. Retest as in para. *b.(1).* If VTVM indication is still abnormal, duplexer (receiver filter) will require repair. Refer complete rf head to higher category maintenance level.

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
3. High signal alarm abnormal, para. *b.(1)(g)* and *(h).*	Defective or misadjusted signal level limiter 33A5.	Test and adjust 33A5 as described in para. 4-31.
4. Power meter indication exceeds limit, para. *b.(2)(h).*	Defective signal level limiter 33A5.	Test 33A5 as described in para. 4-31.
5. Test facility meter M1 indication abnor-real, para. b. (3)(c) and *(d).*	*a.* Defective XMTR DUPL.	*a.* Check XMTR DUPL insertion loss *(b. (4)* above).
	b. Defective power monitor 33A3.	*b.* Replace 33A3.
6. Excessive XMTR DUPL insertion loss, para *b. (4)(m).*	*a.* Defective power monitor 33A3 or panel connectors 33CP1 or 33CP2.	*a.* Substitute (in turn) 33A3, 33CP1 and 33CP2 with known good parts, retest. Replace parts as indicated.
	b. Defective XMTR DUPL.	*b.* Return complete rf head to higher category maintenance.
7. Receiver duplexer VSWR display abnormal para. *b. (5)(g).*	Defective rf components.	Disconnect P1 of 33W4 from J2 or 33A1A1Z5 and connect dummy load DA-702/U (4A11) to J2 of 33A1A1Z5. Test as in *b.(5)(e)* through *(g)* using the TRM –1 – 2.00F calibrated mismatch. (1) If the VSWR display is normal, check module 33A7 (para. 4-33), 33A5 (para. 4-31) and 33FL1. Repair or replace as indicated. (2) If the display is abnormal, check 33A3 and 33CP1 by substitution. Replace as indicated. If still abnormal, refer complete rf head to higher category maintenance.
8. XMTR DUPL VSWR display abnormal, para. *b. (5)(i).*	*a.* Defective power monitor 33A3 or panel connectors 33CP1 or 33CP2.	*a.* Test 33A3, 33CP1 and 33CP2 by substitution, replace as indicated.
	b. Defective XMTR DUPL.	*b.* Refer complete rf head to higher category maintenance.
9. Rf voltmeter indication changes more than 10 dB, para. *b. (6)(d).*	AGC control (R2 of 33AR1) not adjusted to match rf head.	Slightly readjust R2 of 33AR1 to meet requirement.

d Tracking Adjustments.

(1) *Local oscillator tracking.*

(a) Disconnect P1 (33A7J2) from 33A7J2 and connect the test equipment as shown in B, figure 4-56.

(b) Set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S6	MULTIPLIER
S7	AGC
S8	OFF

(c) Set the RCVR CHANNEL and RCVR SIG controls on the unit under test to channel 700. Set the XMTR DUPL control at least 100 channels away from the RCVR CHANNEL setting.

NOTE

While adjusting the frequency multiplier group gear in the following steps, do not permit the duplexer gears to move.

(d) Loosen the clamp of gear A (fig. 4-62). Do not disengage gear. Adjust the MULT PEAK control so that the power meter indication goes through a peak and then decreases at least 1.5 dB below the peak level (allow gear A to rotate).

(e) Tighten the clamp on gear A while ensuring that the power meter indication does not change.

(f) Adjust the MULT PEAK control for a peak power meter indication. The power meter should indicate a multiplier group 33A2 output level of not less than +3 dBm.

(g) Rotate the MULT PEAK control in both directions to ensure that the power meter indication will go through a peak and decrease at least 1.5 dB without moving gear A in either direction.

(h) Repeat *(f)* and *(g)* above with RCVR SIG and RCVR CHANNEL control settings every 40 channels from channel 990 to channel 390 (in decreasing order). If necessary, repeat *(d)* and *(e)* above until a peak power meter indication can be obtained at all channel settings.

(i) Reconnect P1 (33A7J2) to 33A7J2.

(j) Repeat functional check (para. *b.* (1) above).

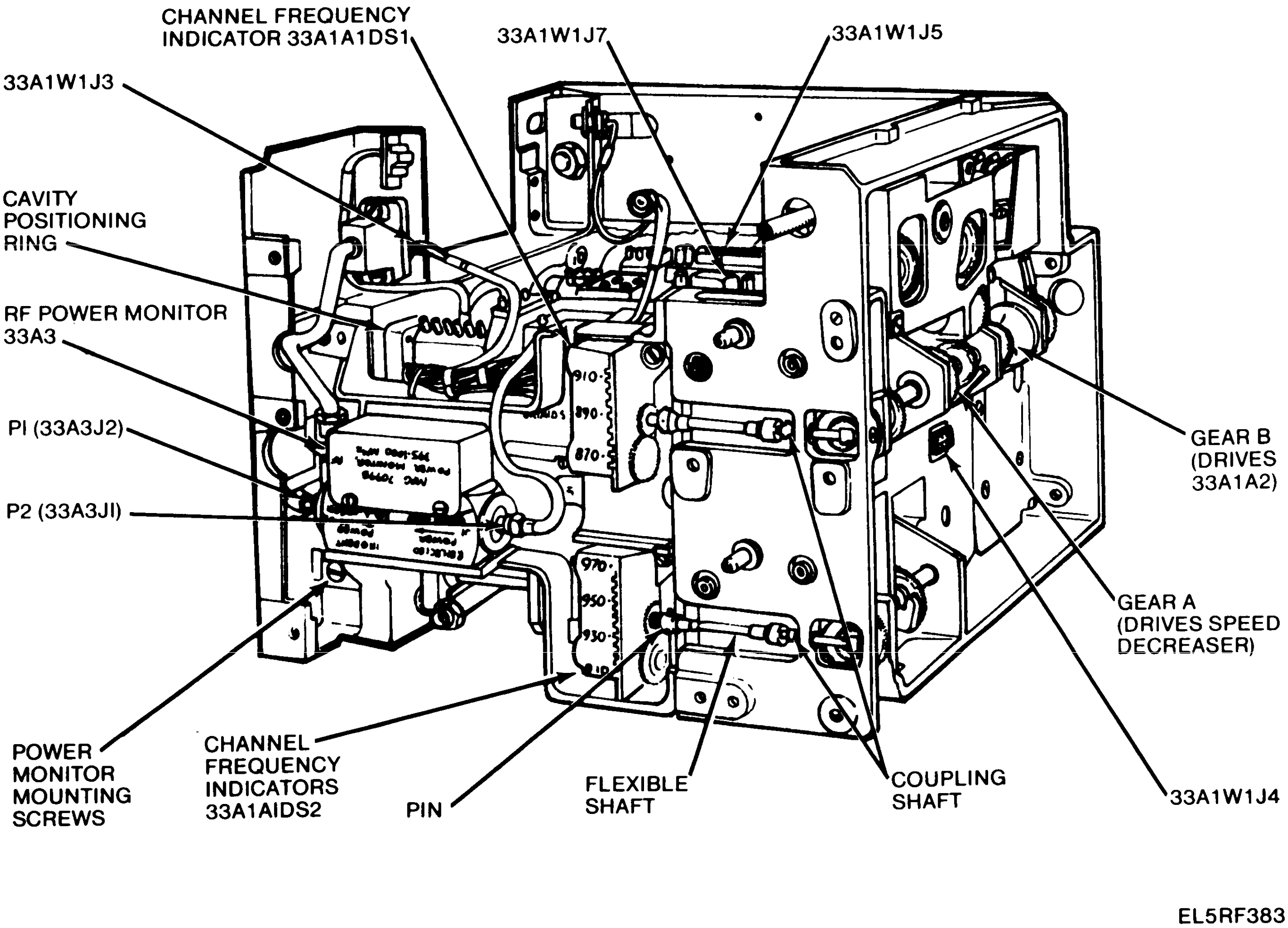


Figure 4-62. Receiver Rf Head, Unit 33, Front View, Front Panel Removed.

(2) *Voltage control 33A1A2 tracking adjustment (units using mixer SM-D-696335 (33A7), voltage control 33A1A2 and power supply 33PS1, only).*

(a) Connect and tune the rf head to channel 700 (XMTR DUPL channel 450) as described in *b.(1)(a)* though *(e)* above. If Ml indication is low *(b.(1)(e)),* adjust local oscillator tracking as described in *d.* (1) above.

(b) Fine tune the rf head as described in *b.(1)(f).* If necessary, increase the signal generator output level to obtain a VTVM indication of less than –40 dBm.

NOTE

Do not permit the duplexer gears to move while adjusting gear B (voltage control drive).

(c) Loosen the clamp on gear B (fig. 4-62). Rotate gear B to obtain a minimum indication on the VTVM (reduce signal generator output level, as necessary, to maintain a VTVM indication between –40 dBm and –50 dBm).

(d) Connect the digital multimeter between E2 of voltage control 33A1A2 and ground. The digital multimeter should read 15.8 ±1.3 Vdc.

(e) Tighten the clamp on gear B.

(f) Perform the functional check as described in paragraph *b.(l)(a)* through *(f)* for all channels listed after paragraph *b.(1)(i).* If necessary, slightly readjust gear B *(d.(2)(d)* through *(f)* above) to obtain optimum VTVM indications for all channels.

(g) If satisfactory adjustment cannot be achieved, check 33A1A2 (para. e. below), 33PS1 (para. *f.* below), and 33A7 (para. 4-33).

e. Test of Voltage Control Assembly 33A1A2 (Used Only on AM-4317 Units with Mixer SM-D-696335).

(1) Connect the digital multimeter between E1 and E3 of voltage control assembly 33A1A2. The resistance should be 20,000 ohms ± l%.

(2) Connect the DMM between E1 and E2 of 33A1A2 or 34A1A2 and operate the unit under test drive gear throughout its range. The resistance should vary smoothly and the drive gear should move smoothly without binding.

(3) If the unit under test does not meet the requirements of (1) and (2) above, replace 33 A1A2. If replacement 33A1A2 is not available, replace mixer SM-D-696335 with mixer SM-D-696296, NSN 5820-00-631-4568.

f. Test of Power Supply 33PS1 or 34PS1.

(1) Remove mixer 33A7.

(2) Connect digital multimeter between pins 5 and 7 of 33A1W1J8.

(3) Connect the rf head as shown in figure 4-56.

(4) Set the receiver test facility switches as shown in *b.* (1)(b) above.

(5) Set R10 on the unit under test fully counter-clockwise. The digital multimeter should indicate +67 volts or less.

(6) Set R10 on the unit under test fully clockwise. The digital multimeter should indicate 73 volts or more.

(7) Set R10 on the unit under test for a digital multimeter indication of 70 volts ±0.05 volts.

(8) Reinstall mixer stage 33A7.

(9) Connect the oscilloscope (using cable CG-409H/U (3 ft) (2W15) and CMC 267-800028-000 (2W37) adaptor cable) between E1 of voltage control assembly 33A1A2 (red lead) and a convenient chassis ground (black lead).

(10) Set the oscilloscope vertical controls for ac; 5 mV/div sensitivity and the sweep time to 50 µ s/div. The peak to peak ripple voltage displayed on the oscilloscope should be 30 mV or less.

(11) If the above requirements cannot be met, replace mixer stage SM-D-696355 with SM-D-696296, NSN 5820-00-631-4568.

4-20. Duplexer 33A1

This assembly comprises duplexer subassembly 33A1A1 (para 4-21), speed decreaser gear assembly 33 A1MP1 (para 2-50), branched wiring harness 33A1W1 (FO-8 or FO-35) and voltage control assembly 33A1A2 (para 4-19d.), used with mixer stage SM-D-696355 only. There is no overall test for the duplexer. Refer to the appropriate paragraphs or figure for testing and/or replacement procedures for the individual units which make up the duplexer.

4-21. Duplexer Subassembly 33A1A1

This subassembly is tested as part of the overall rf head AM-4317/GRC-103(V).

4-22. Connector-Filter Assembly 33A1W1A1

a. Test Equipment and Material Required.

Equipment	*Common name*
Multimeter, Digital, AN/USM-451	Digital multimeter

b. Test Procedures. This assembly comprises plugs 33A1W1A1P1, 33A1W1A1P2, and 33A1W1A1J2. Check each circuit as follows (FO-7):

(1) Check continuity between each pin of 33A1W1A1Pl and its associated filter connector and between rf connectors Al and A2 of 33A1W1A1P1 and 33A1W1A1P2 and 33A1W1A1J2.

(2) Check for short circuits between all pins and center conductors of rf connectors and ground.

c. Repairs. Refer to paragraph 2-48 for repair or replacement procedures.

4-23. Frequency Multiplier Group 33A2

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)/2 GRM-95(V)2	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/ GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Test Facility Radio Frequency Module, TS-3837(V)2/GRM-95(V)2	Test facility radio frequency module
Sweep Generator, Wiltron610D (with Plug-in Unit, Wiltron61084D)	Sweep generator
Oscilloscope, AN/USM-281 C	Oscilloscope
Power Amplifier, ENI 603L	Power amplfier
Generator, Signal, HP-8640B	Signal generator
Frequency Counter, TD-1225(V)l/U	Frequency counter
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor

b. Test Procedures.

(1) *Input VS WR check.*

(a) Connect the test equipment as in A, figure 4-63.

(b) Set the signal generator controls to 97.5 MHz ±0.01 MHz.

(c) Adjust the signal generator RF POWER LEVEL control for an output level of +l7 dBm indication on the power meter.

(d) Connect the test equipment as in B, figure 4-63.

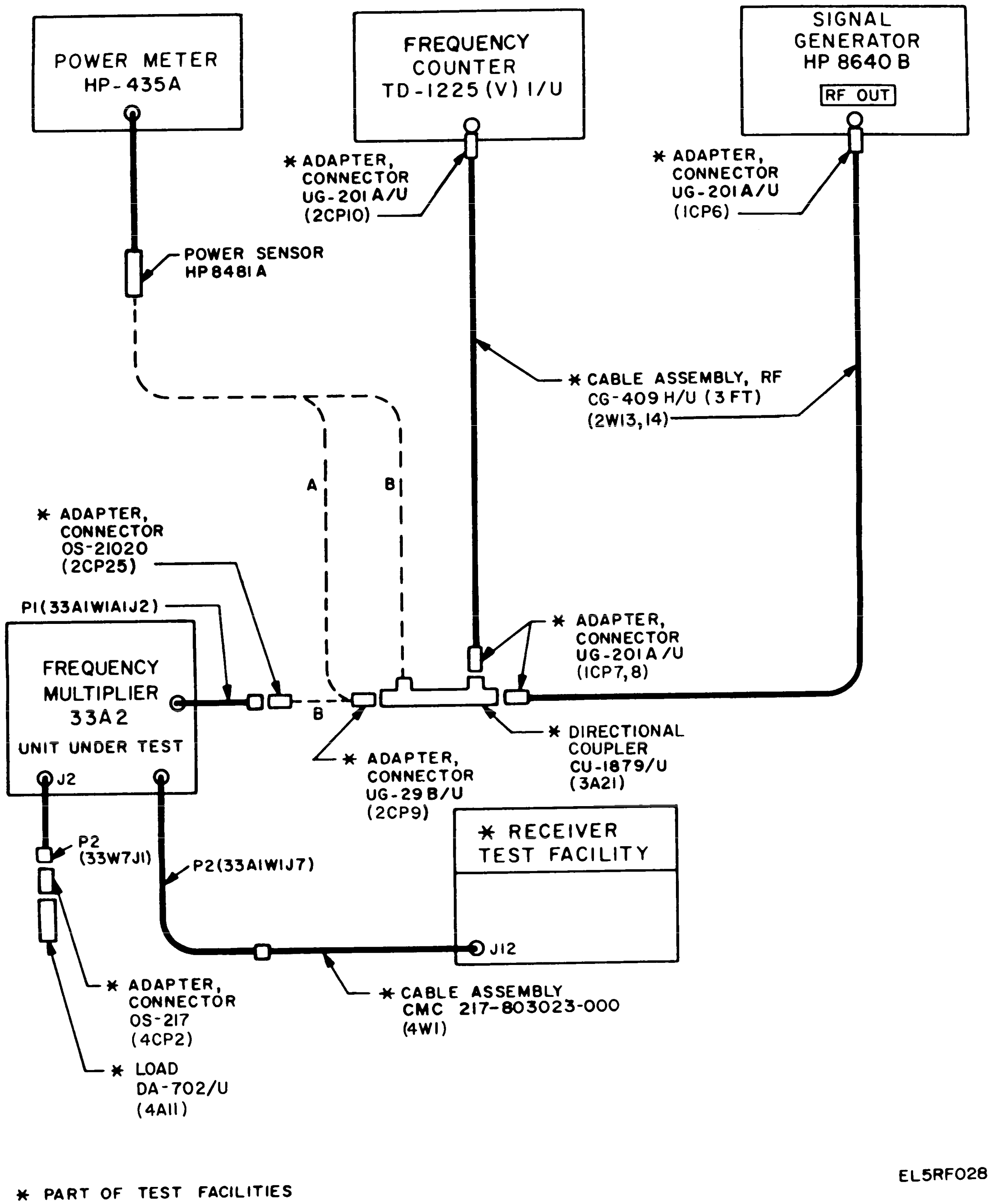


Figure 4-63. Frequency Multiplier Group 33A2, Input VSWR Check, Test Setup.

(e) Attach tuning knob CMC 610-800006-000 to the tuning shaft of the unit under test.

(f) Set power Supply for 115 Vac as indicated on the panel voltmeter and set receiver test facility switch S1 to ON and S6 to any position except OFF.

(g) Record the power meter indication.

(h) Reverse the input and output connections of the directional coupler, leaving the power meter connected to the coupled port. Note the indication. The level of reflected power recorded in *(g)* above must be at least 11.3 dB lower than that noted above. This represents a VSWR of better than 1.75:1.

(i) Repeat *(g)* and *(h)* above for the following signal generator frequencies (MHz): 100, 110, 120, 130, and 145.

(2) *Output check.*

(a) Connect the test equipment as in A, figure 4-64.

(b) Set signal generator to 106.25 MHz ±15 kHz and adjust the signal generator output level for a reading of +13 dBm on the power meter.

(c) Set receiver test facility switch S1 to ON and S6 to MULTIPLIER.

(d) Connect the test equipment as in B, figure 4-64.

(e) Using the tuning knob, tune the unit under test for the maximum power meter reading and a frequency counter reading of 425 MHz ±60 kHz.

NOTE

To determine the correct starting position for this tuning check, remove the cover of Bandpass Filter 33A2FL1 and turn the tuning shaft to fully mesh the capacitor vanes. Tracking of the unit under test between 425 MHz and 735 MHz is checked by turning the tuning shaft clockwise (viewed from the tuning knob end) from the 425 MHz position established in *(c)* above.

(f) Adjust the trombone line for the lowest reading on the power meter. The power meter reading shall exceed +2.3 dBm (+6 dBm (multiplier output), minus 3 dB (2:1 load), minus 0.7 dB (trombone line and directional coupler loss)).

(g) Repeat *(a)* through *(f)* above for the following frequencies.

Signal generator frequency (MHz)	*Output frequency (MHz)*
106.25	425
109.75	439
112.25	449
114.75	459
117.50	470
120.25	481
123.25	493
126.75	507
130.50	522
134.50	538
139.00	556
143.75	575
99.16	594.96
103.00	618
107.50	645
112.23	674
117.63	707
122.50	733

(3) *Tracking alinement.*

(a) Loosen the setscrews on gear A (fig. 4-65) and rotate shaft C until the red mark on the multiplier drive gear coincides with the corresponding red mark on the multiplier casting.

(b) Turn gear B (figure 4-65) until the red mark on gear B coincides with the red mark on the casting.

(c) Connect the test equipment as in A, figure 4-66 but do not connect the sweep generator to the power amplifier.

(d) Set receiver test facility switch S1 to ON and S6 to any position except OFF.

(e) Tune the signal generator to 425 MHz with the output level set for 0 dBm.

(f) Temporarily connect the sweep generator to the frequency counter.

(g) Set sweep generator FREQ SELECTOR control to CW F1 followed by CW F2, and set the sweep generator to 100 MHz and 110 MHz, respectively.

(h) Connect sweep generator OUTPUT to power amplifier INPUT.

(i) Adjust sweep generator for a +15 dBm indication on the power meter.

(j) Connect unit under test to power amplifier as in B, figure 4-64.

(k) Set sweep generator FREQ SELECTOR control to F1 TO F2.

(l) Adjust the oscilloscope controls for a convenient display.

(m) Tune bandpass filter FL1 by turning gear B counterclockwise 1/4 turn and then slowly clockwise for the maximum response at the 425 MHz marker. Adjust the size of marker by adjusting the rf output level control of the signal generator.

(n) Turn shaft C clockwise 1/4 turn and then slowly counterclockwise to adjust frequency multiplier 33A2A1 for the maximum response at 425 MHz. Slightly readjust gear B for the maximum response at the 425 MHz marker.

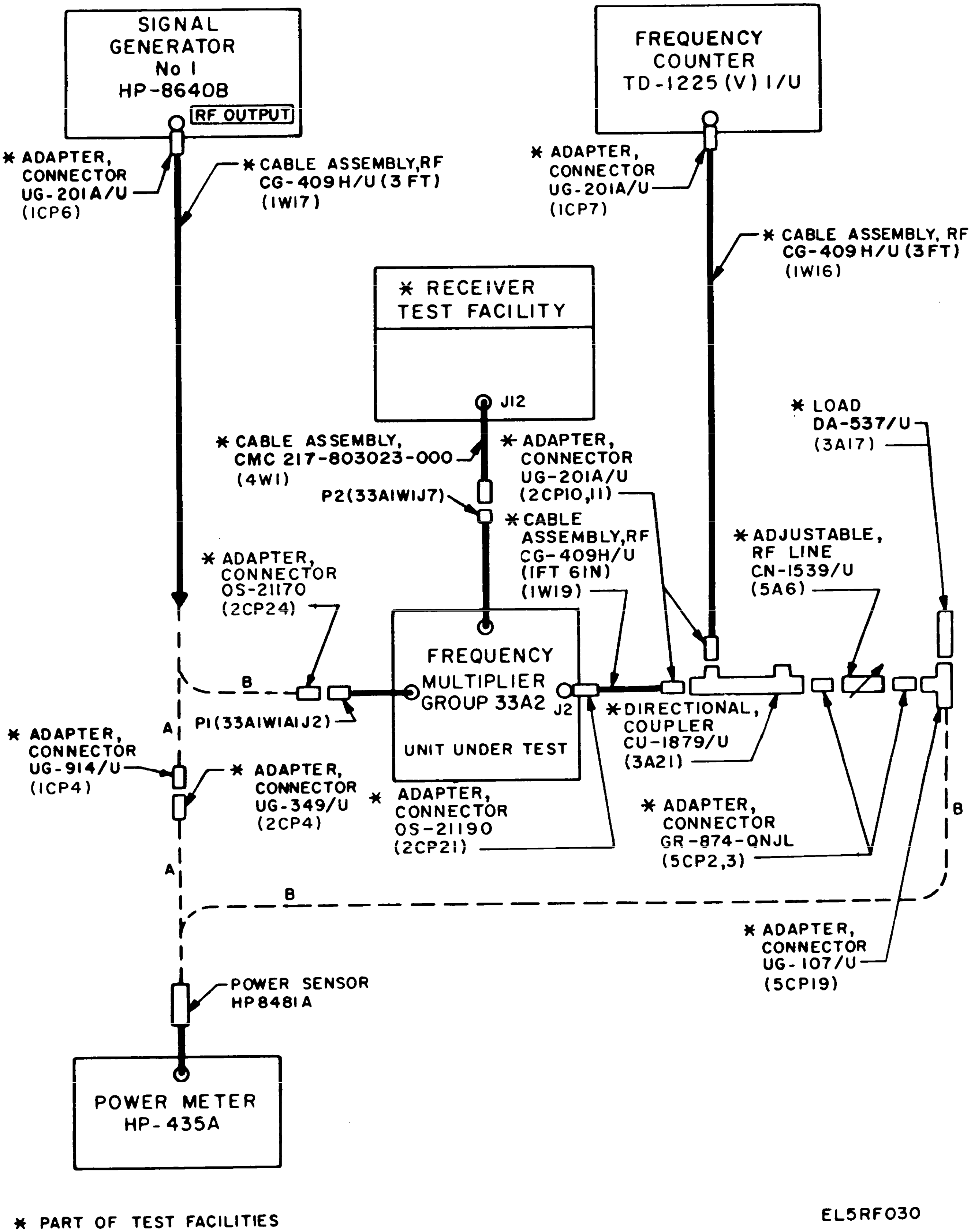


Figure 4-64. Frequency Multiplier Group 33A2, Output Check, Test Setup.

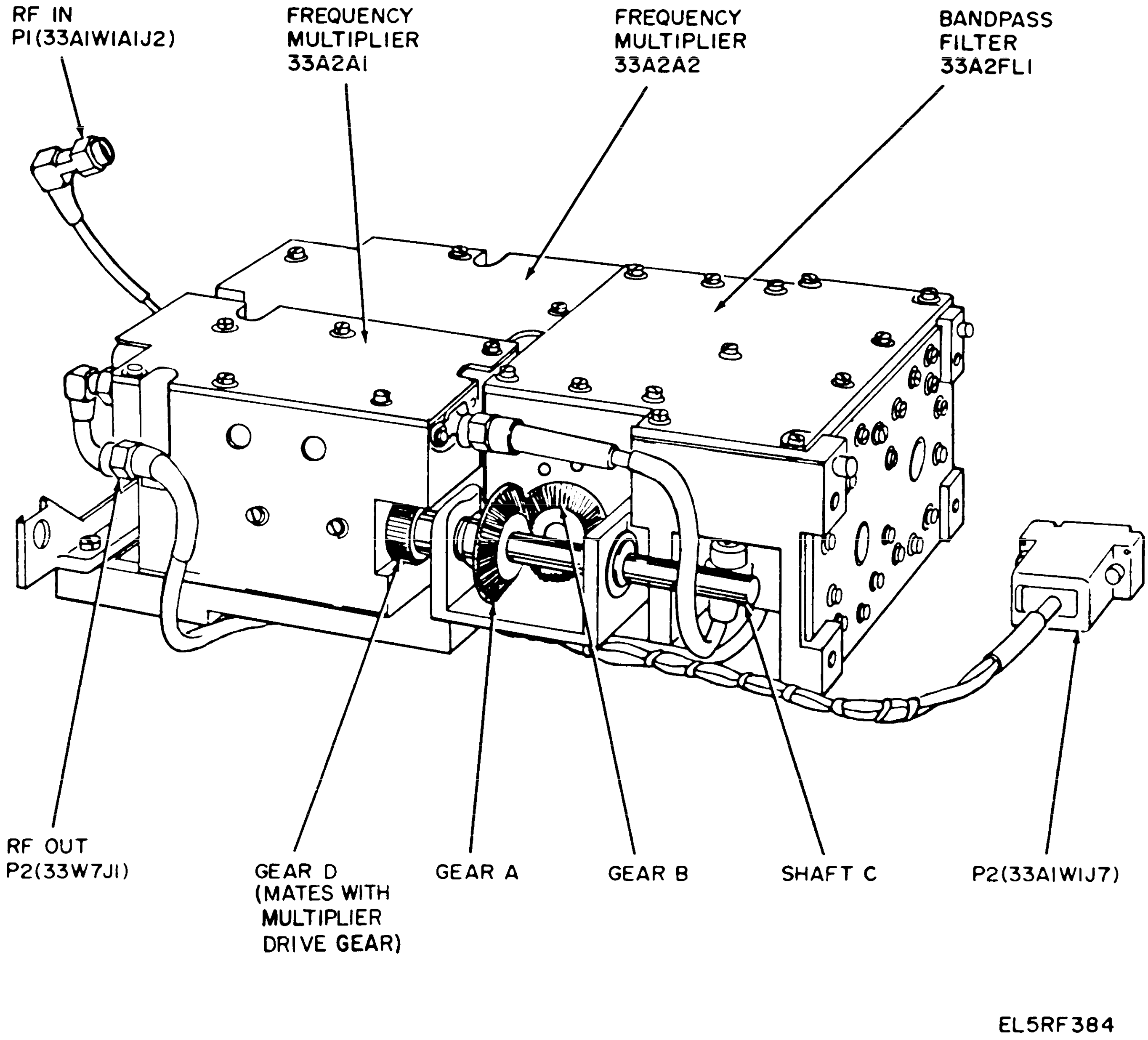


Figure 4-65. Frequency Multiplier Group 33A2, Top View.

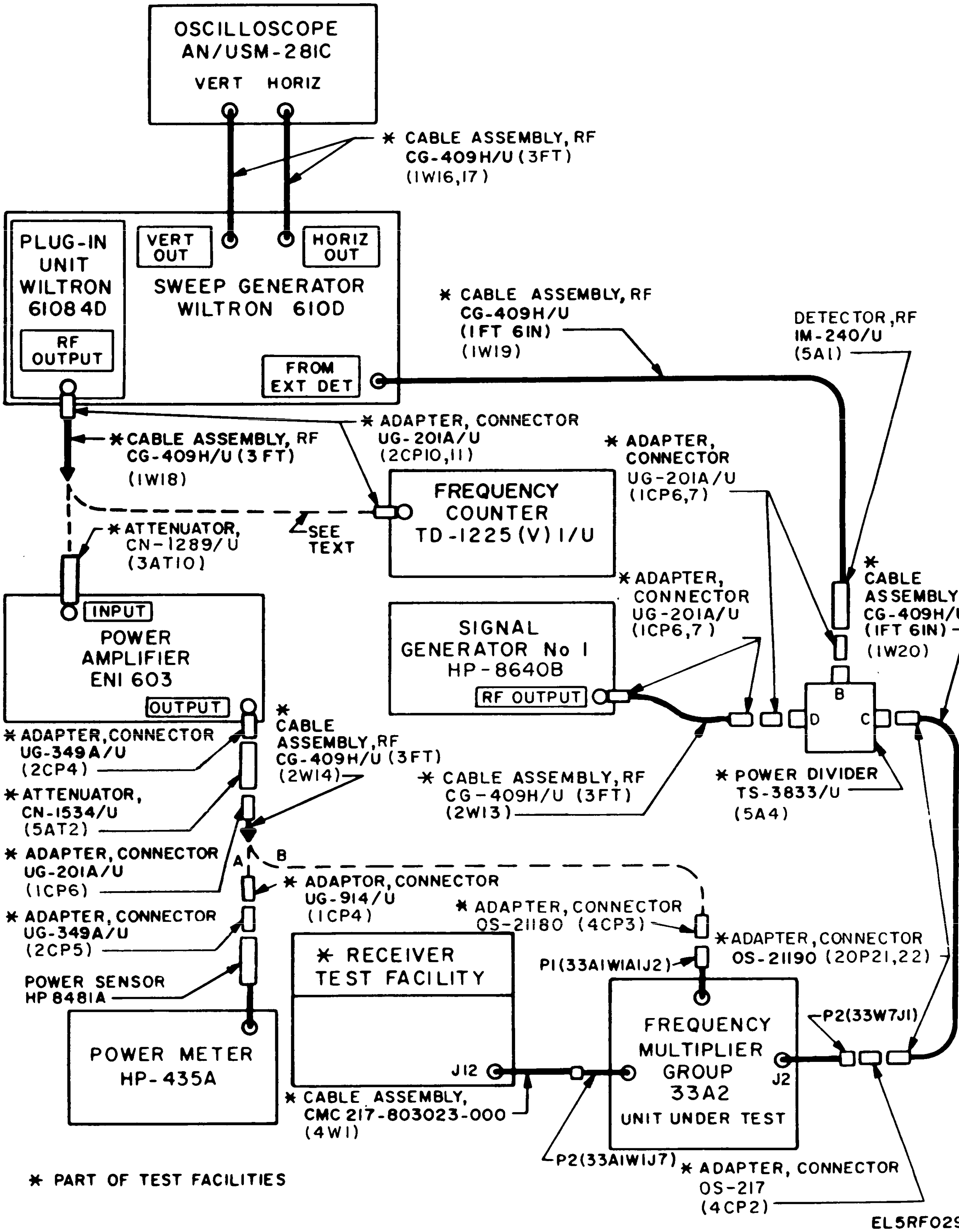


Figure 4-66. Frequency Multiplier Group 33A2, Tracking Alinement Test Setup.

(o) Tighten the setscrews on gear A, ensuring that the response remains maximized at 425 MHz.

NOTE

When tightening gear A, take care to adjust for minimum backlash.

(p) Adjust the sweep generator controls for a sweep between 95 and 145 MHz as described in *(f)* through *(l)* above.

(q) Tune the unit under test slowly with shaft C, while monitoring the oscilloscope display with markers from the signal generator, throughout the frequency range of 425 to 735 MHz.

NOTE

Amplitude changes must be smooth, and not abrupt or irregular.

(r) If the requirements of *(q)* above cannot be met, slacken the setscrews on gear A and detune the bandpass filter slightly. Retighten the setscrews and repeat *(q)* above.

(s) Repeat output power check, steps *(2)(a)* through (g) above.

(t) Remove tuning knob CMC 610-800006-000 from the tuning shaft.

c. Troubleshooting (FO-34).

4-24. Frequency Multiplier 33A2A1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Module, TS-3837(V)2/GRM-95(V)2	Test facility radio frequency module
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator, Wiltron610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Power Amplifier, ENI603L	Power amptiler
Oscilloscope, AN/USM-281 C	Oscilloscope
Frequency Counter, TD-1225(V)l/U	Frequency counter
Generator, Signal, HP-8640B	Signal generator
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Multimeter, AN/USM-451	Digital multimeter
Voltmeter, Electronic, ME-426/U	Rf voltmeter

b. Test Procedures.

(1) *Input VSWR check.*

(a) Connect the test equipment as in A, figure 4-67.

Symptom	*Probable cause*	*Checks and corrective measures*
1. High VSWR.	Defective frequency multiplier 33A2A2 (fig. 4-88).	Replace frequency multiplier 33A2A2 (TM 11-5820-540-30) and test defective unit as shown in para. 4-25.
2. Power output low or zero.	*a.* Defective frequency multiplier 33A2A2.	*a.* Disconnect P2 (33A2A2J1) from J1 of the frequency multiplier 33A2A2 (TM 11-5820-540-30) and connect the power meter to J1. Power meter should indicate +17 dBm ±2 dB. If output is abnormal, replace frequency multiplier 33A2A2 (TM 11-5820-540-30) and test defective unit as shown in para. 4-25.
	b. Defective variable frequency multiplier 33A2Al.	*b.* If power at J1 is normal, reconnect J1 to P2. Disconnect P1 (33A2A1J2) from J2 of frequency multiplier 33A2A1 and connect the power meter to J2. Power meter should indicate at least +8 dBm. If output is abnormal, replace frequency multiplier 33A2A1 (para. 2-52) and test defective unit as shown in para. 4-24.
	c. Defective bandpass falter 33A2FLI.	*c.* If power at J2 of the frequency multiplier (33A2A1) is normal, test bandpass filter 33A2FL1 as shown in para. 4-28.
	d. Misalinement	*d.* If misalinement is suspected refer to para. b.(3) above for complete alinement procedures.

(b) Set the sweep generator controls as follows:

Control	*Position*
FREQ SELECTOR	CW F2 (at 290 MHz)
LEVELING	INTERNAL
RF OUTPUT	Midposition
SWEEP MODE	MANUAL

(c) Turn on the wideband rf amplifier.

(d) Adjust the sweep generator RF OUTPUT control for a nominal +7 dBm indication on the power meter (+17 dBm at input of unit under test).

(e) Set the sweep generator FREQ SELECTOR control to F1 TO F2, with F1 and F2 set to 190 MHz and 290 MHz, respectively.

(f) Using the MANUAL sweep control, check that the power remains at +7 dBm ±0.5 dB over the sweep range as indicated on the power meter.

(g) Connect the test equipment as in B, figure 4-67.

(h) Adjust the oscilloscope for a convenient display.

(i) Calibrate the oscilloscope for a VSWR of 1.75:1 between 190 and 290 MHz. Note the 1.75:1 VSWR display.

(j) Connect the test equipment as in C, figure 4-67.

(k) Set the power supply to 115 Vac as indicated on the panel voltmeter. Set receiver test facility switch S1 to ON and S6 to MULTIPLIER.

(l) The VSWR display of the unit under test should not exceed the reference 1.75:1 VSWR display noted in *(i)* above. If necessary, adjust C1 and L1 (fig. 4-68) for a minimum VSWR display between 190 MHz and 290 MHz.

(m) Turn off the wideband rf amplifier.

(2) *Tuning law.*

NOTE

The following test requires the unit under test be mounted in test fixture TS-3824/GRM-95(V).

(a) Loosen the middle locking knob on the test fixture so that the drive shaft can be rotated independently of the calibrated dial.

(b) Place the unit under test on the test fixture. Engage the shaft of the variable capacitor with the coupling on the test fixture.

(c) Tighten the two screws on the coupling. Clamp the unit under test to the test fixture.

(d) Using the dial control knob, rotate the calibrated dial until 425 coincides with index marker. Make sure the dial locks in the detent at 425.

(e) Connect the test equipment as in A, figure 4-69.

(f) Set the sweep generator RF OUTPUT control to minimum. Turn on the power amplifier.

(g) Set the sweep generator FREQ SELECTOR control to CW MKR.

(h) Set the VAR FREQ MKR control to 210.0 MHz on the dial. Adjust the RF OUTPUT control to obtain a level of +19 dBm as indicated on the power meter.

(i) Set sweep generator FREQ SELECTOR control to Δ F, and adjust the Δ F FREQ control for a sweep width of approximately 5 MHz centered at 212.5 MHz, using the internal markers.

(j) Set receiver test facility switch S1 to ON and S6 to MULTIPLIER.

NOTE

Do not alter the sweep generator level controls during the operations which follow.

(k) Connect the test equipment as in B, figure 4-69.

(l) Set variable attenuator No. 1 to 2 dB, and variable attenuator No. 2 to MIN.

(m) Adjust variable capacitors C2 and C3 on the unit under test for maximum capacitance as determined visually (capacitor vanes fully meshed). Use the adjusting knob on the test fixture, removing the capacitor cover plate if necessary.

(n) Adjust the oscilloscope controls for a convenient response curve.

(o) Adjust the signal generator to 425 MHz.

NOTE

The signal generator frequency introduces an external marker on the output swept response of the unit under test. Adjust the output level as necessary to obtain a usable marker.

(p) Loosen the test fixture locking knob. Using the tuning shaft control knob, adjust variable capacitors C2 and C3 of the unit under test for maximum capacitance as determined by the oscilloscope display. (Maximum capacitance is indicated by the maximum horizontal displacement of the response curve to the left of the oscilloscope face.) With the variable capacitors held carefully in this position, and the dial locked at the 425 MHz position, tighten the locking knob so that the variable capacitors of the unit under test will turn with the calibrated dial. Turn off the power amplifier.

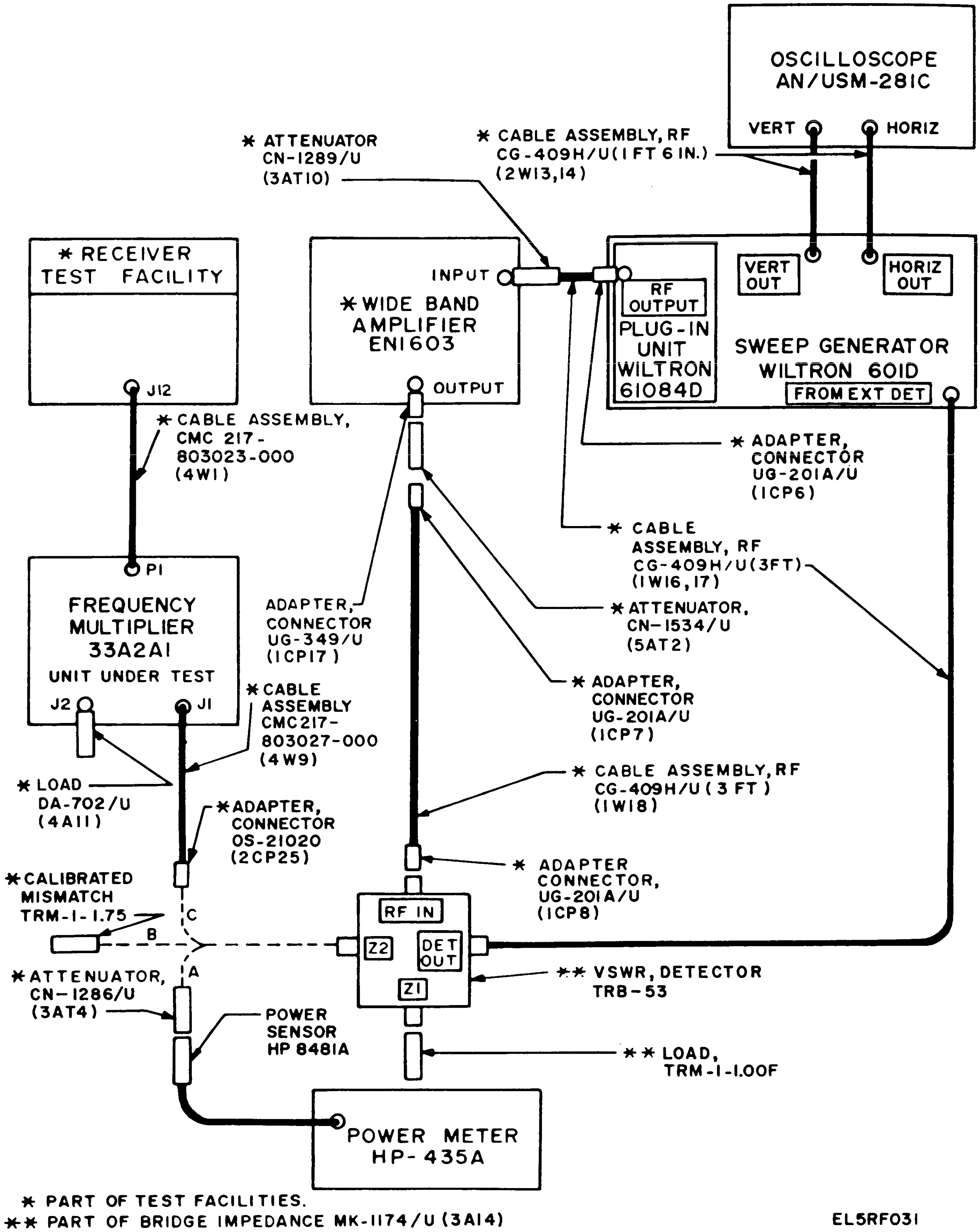
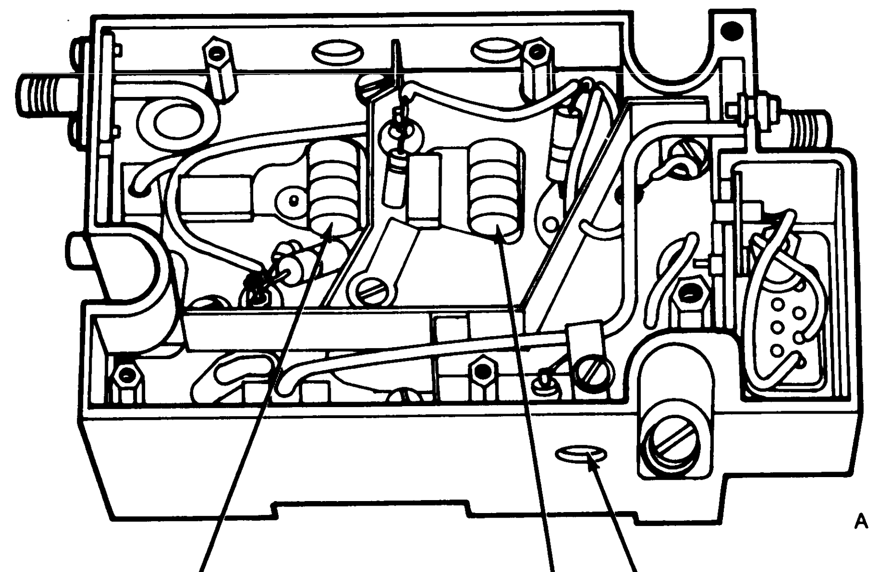


Figure 4-67. Frequency Multiplier 33A2A1, input VSWR Check, Test Setup.



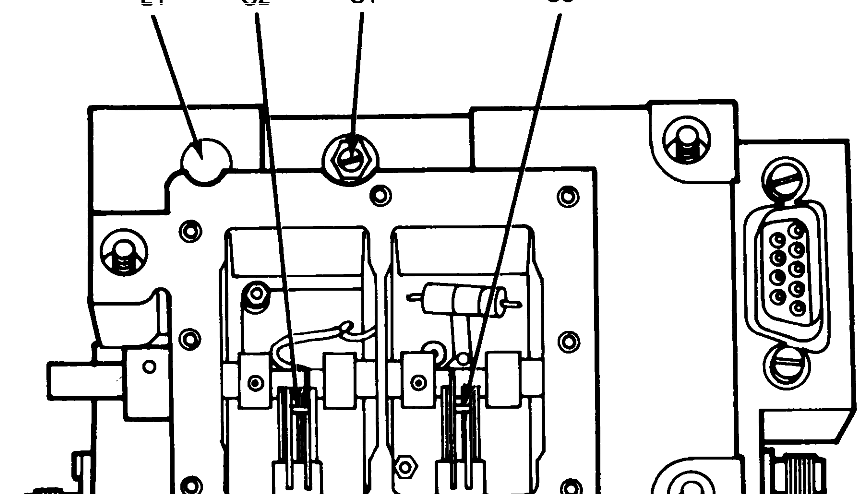


Figure 4-68. Frequency Multiplier 33A2A1, Top and Bottom View.

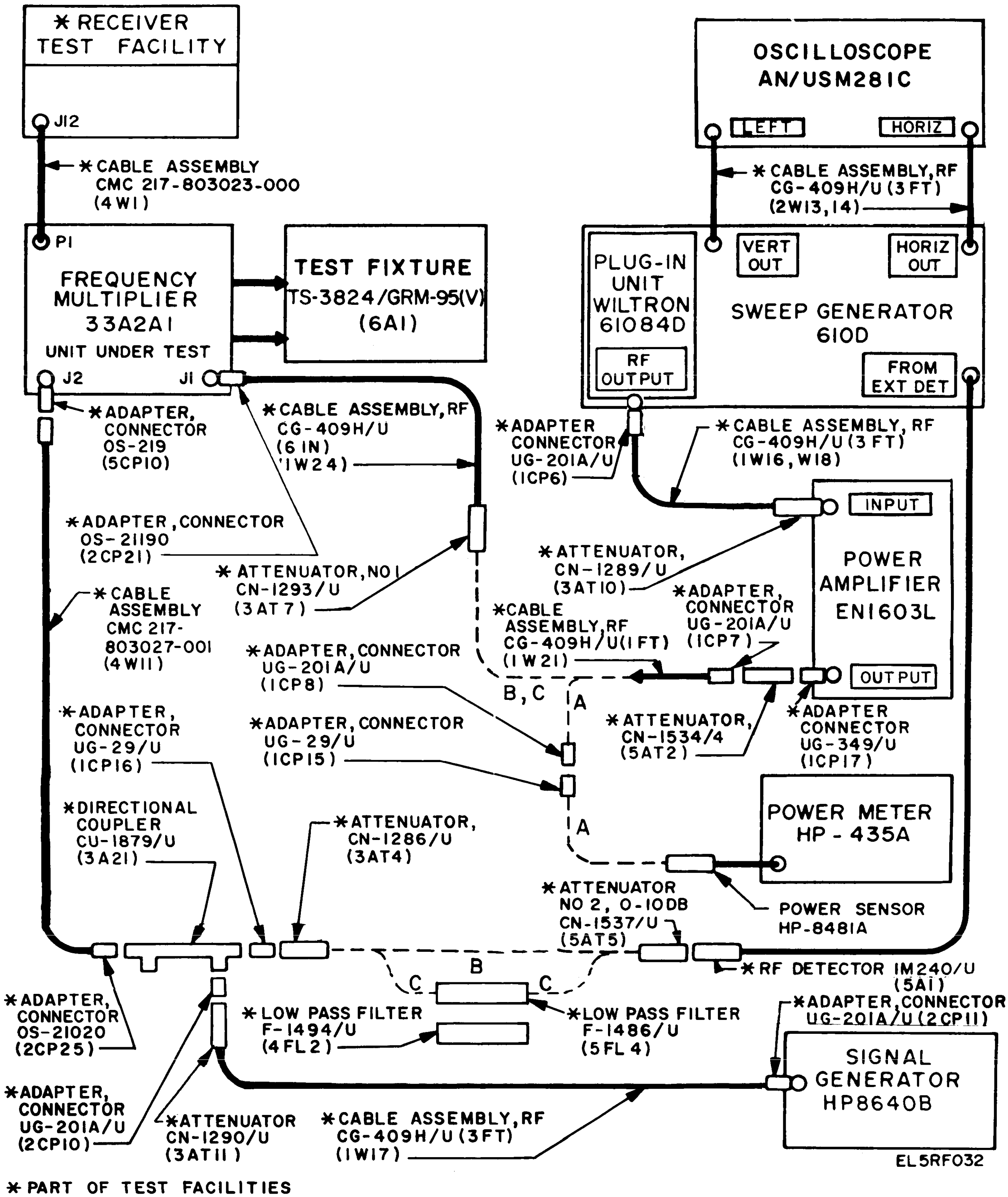


Figure 4-69. Frequency Multiplier 33A2A1, Tuning Law, Preliminary Test Setup.

(q) Connect the test equipment as in A, figure 4-70.

(r) Turn on the power amplifier. Set the signal generator to 235 MHz at +7 dBm as indicated on the power meter (+17 dBm at input of the unit under test).

(s) Connect the test equipment as in B, figure 4-70.

(t) Rotate the test future calibrated dial until 470 coincides with the index mark. Make sure that the dial locks in the detent at 470. The frequency counter should read 470 MHz (input frequency X2).

(u) Loosen the test fixture locking knob, and peak the power meter reading with a slight adjustment of the tuning shaft control knob on the test fixture. Tighten the test fixture locking knob, without disturbing the variable capacitors of the unit under test.

(v) Repeat *(q)* through *(s)* above, for a signal generator frequency of 245 MHz.

(w) Rotate the test fixture calibrated dial until 735 coincides with the index mark. Make sure that the dial locks in the detent at 735. The frequency counter should read 735 MHz (input frequency X3).

(x) Adjust the signal generator for a frequency counter reading 1 MHz above and below 735 MHz. The power meter indication should not be less than –1.9 dBm (+8.1 dBm at the output of the unit under test).

(y) Repeat *(q)* through *(t)* and *(u)* through *(x)* for all frequencies listed below.

Test fixture frequency (MHz)*	*Signal generator frequency (MHz)*	*Test fixture frequency* (MHz)*	*Signal generator frequency (MHz)*
735	245.00	522	261.00
707	235.66	507	253.50
674	224.66	493	246.50
645	215.00	481	240.50
618	206.00	470	235.00
595	198.33	459	229.50
575	287.50	449	224.50
556	278.00	439	219.50
538	269.00	425	212.50

* Operating frequency of unit under test.

(z) Connect the equipment as in A, figure 4-70.

(aa) Adjust the signal generator to 193 MHz at a level of +7 dBm as shown on the power meter.

(ab) Reconnect the equipment as in B, figure 4-70.

(ac) Set the test fixture calibrated dial to 580. As there is no detent for this frequency, press and hold the detent knob and adjust dial for a peak indication on the power meter.

(ad) Tune the signal generator for a reading of 580 MHz on the frequency counter. While still holding the detent knob, adjust the dial for a peak indication on the power meter.

(ae) Tune the signal generator for a reading of 579 MHz on the frequency counter. Note the power meter indication.

(af) Tune the signal generator for a reading of 581 MHz on the frequency counter. The power meter indication should be within ±0.4 dB of the power meter indication noted in *(ae)* above.

(ag) Connect the test equipment as in A, figure 4-70.

(ah) Adjust the signal generator to 290 MHz at a level of +7 dBm as shown on the power meter.

(ai) Reconnect the test equipment as in B, figure 4-70.

(aj) Repeat steps *(ac)* through *(af)*.

(3) *Bandwidth.*

NOTE

The following test requires the unit under test be mounted and alined in test fixture TS-3824/GRM-95(V) according to the tuning law test in step (2) above.

(a) Connect the test equipment as in A, figure 4-70.

(b) Set the signal generator to 245 MHz. Adjust the output level for a +7 dBm indication on the power meter (+17 dBm to the unit under test).

(c) Connect the test equipment as in B, figure 4-70.

(d) Set receiver test facility switch S1 to ON and S6 to MULTIPLIER. Set the test fixture dial to 735.

(e) Adjust the signal generator frequency for a reading of 735 MHz on the frequency counter. Take note of the power meter reading.

(f) Adjust the signal generator frequency below 735 MHz until the power meter reading drops by 3 dB. Take note of the frequency counter reading.

(g) Adjust the signal generator frequency above 735 MHz until the power meter reading drops by 3 dB. Take note of the frequency counter reading. The difference in frequency counter readings must be between 7.5 MHz and 52 MHz.

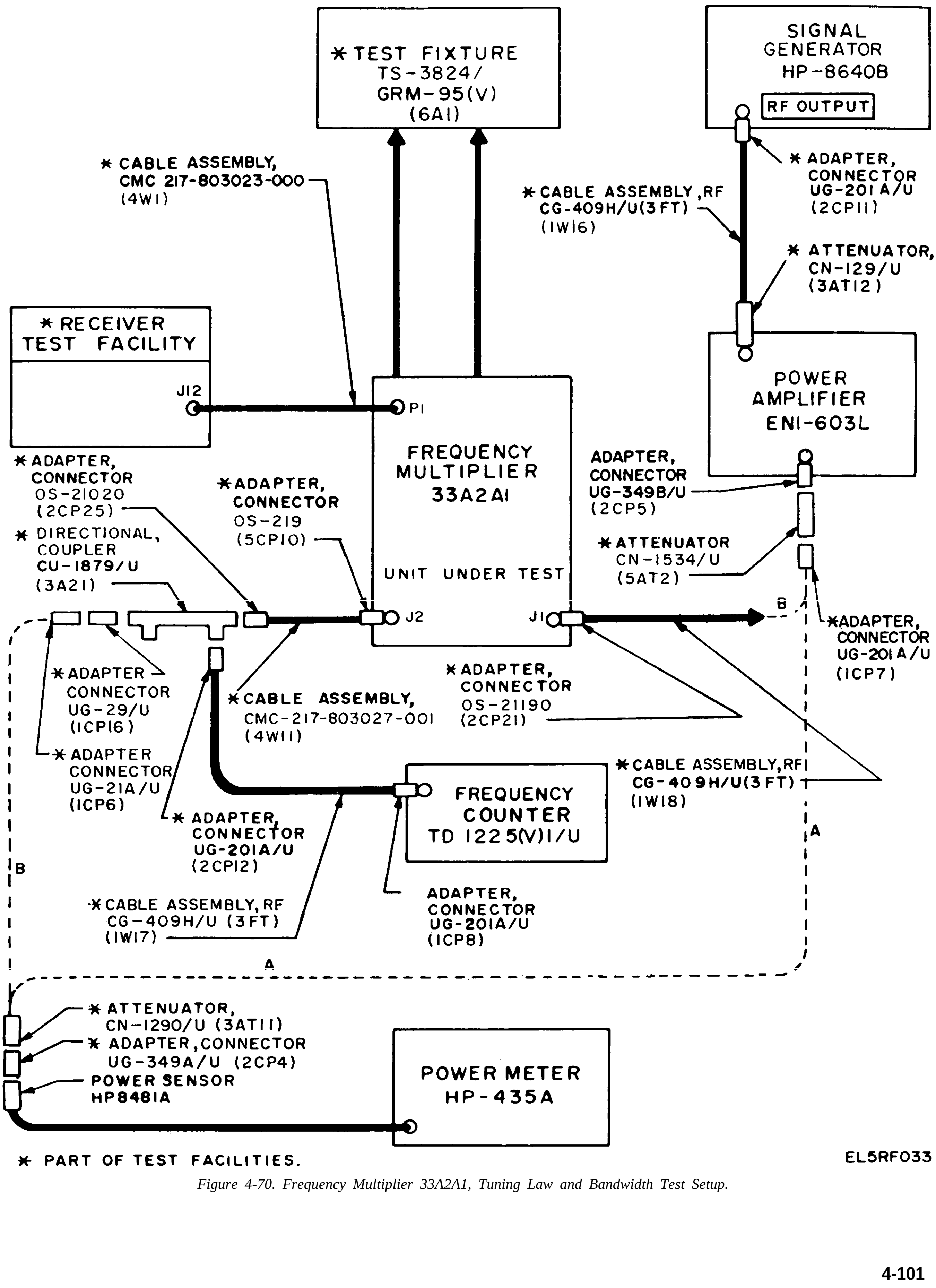


Figure 4-70. Frequency Multiplier 33A2A1, Tuning Law and Bandwidth Test Setup.

(h) Repeat *(a)* through *(g)* above for the following frequencies.

Signal generator frequency (MHz)	Test fixture setting	Bandwidth (MHz) Minimum	Maximum
206	618	6.1	43.3
287.5	575	5.7	40.3
278	556	5.5	39.9
212.5	425	4.2	29.8

(4) *Output power.*

NOTE

The following test requires the unit under test be mounted in test fixture TS-3824/GRM-95(V).

(a) Connect the test equipment as in A, figure 4-71.

(b) Adjust the signal generator frequency to 245 MHz.

(c) Adjust the signal generator level for +15 dBm (+5 dBm on the power meter) at the output of power amplifier.

(d) Connect the test equipment as in B, figure 4-71.

NOTE

Step *(e)* below assumes that the test fixture is still calibrated for the tuning law test, step (2) above.

(e) Set the test fixture to 735 MHz.

(f) Set receiver test facility switch S1 to ON and S6 to MULTIPLIER.

NOTE

If necessary, slightly readjust the signal generator frequency for a peak indication on power meter while adjusting the trombone line for minimum to obtain the optimum setting.

(g) Adjust the trombone line for a minimum reading on the power meter. The level should not be less than –5 dBm.

(h) Repeat *(a)* through *(g)* above with a level of +19 dBm (+9 dBm as indicated on the power meter) at the input of the unit under test.

(i) Repeat *(a)* through *(h)* above at the signal generator frequencies listed below. The output level for all frequencies must not be less than –5.0 dBm on the power meter.

Sig gen. No. 1 frequency (MHz)	*Test fixture setting*
224.66	674
206.00	618
287.50	575
253.50	507
229.50	459
212.50	425

(j) Return the unit under test to 735 MHz.

(k) Turn OFF the power amplifier.

c. Alinement.

(1) Perform steps *(2)(e)* through *(p)* of the tuning law test above.

(2) Connect lowpass filter F-1486/U (5FL4) as shown in C, figure 4-69.

(3) Set the test fixture dial to 735 and set signal generator to 735 MHz.

(4) Set the sweep generator frequency to 245 MHz and set sweep width to approximately 5 MHz, using the internal markers. Adjust the oscilloscope and the sweep generator for a convenient display.

(5) Set signal generator output level as required to obtain a usable marker.

(6) Adjust capacitors C2, C5 and C10 of the unit under test for the maximum amplitude of response curve at 735 MHz marker.

NOTE

C2 in this step refers to the trimmer capacitor, not the variable vane capacitor.

(7) Press the detent mechanism and rotate the dial about the 735 position. (Maximum response should occur at the 735 position.) If necessary, loosen the locking knob on the fixture drive shaft and tune the adjusting knob to meet this requirement. Retighten the locking knob. Recheck the maximum capacitance dial position (step *b. (2)(p)* above). The dial position should be 425 or lower. If necessary, reset the dial as in *b. (2)(e)* through (p) above.

(8) Set the test fixture dial to 674 and set signal generator to 674 MHz.

(9) Set the sweep generator to 224 MHz. Set the sweep width to approximately 5 MHz.

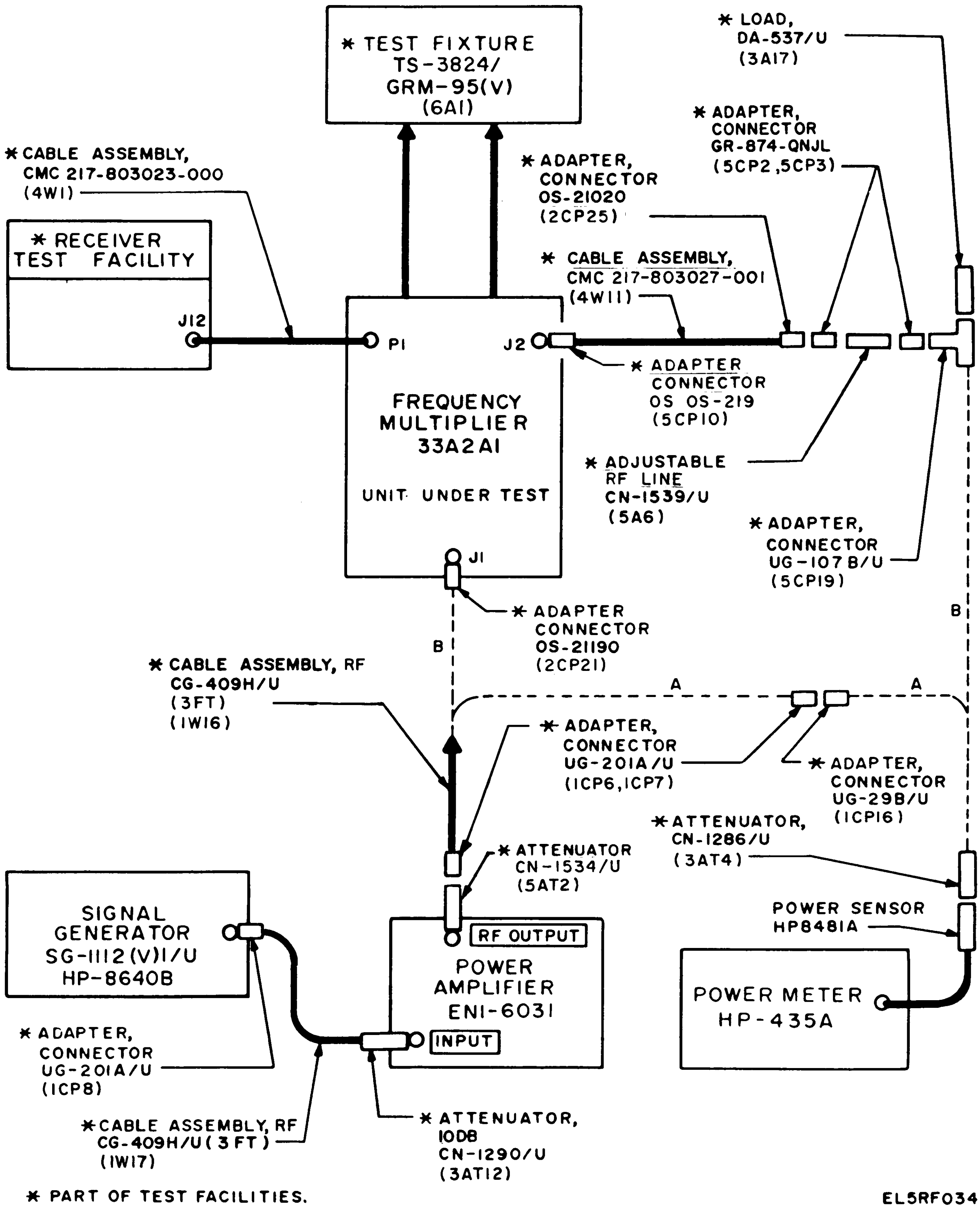


Figure 4-71. Frequency Multiplier 33A2A1, Output Power Check, Test Setup.

(10) Adjust the vanes of capacitors C2 and C3, figure 4-68, for maxirnum amplitude with the peak of the response curve centered at 674 MHz.

NOTE

The rotors of capacitors C2 and C3 consist of three vanes. The center vane is freed while the two outside vanes are split into a number of sections. To adjust the capacitors, those sections of the split vanes that are meshed with the stator are bent as required.

(11) Return the test fixture dial to 735 and signal generator to 735 MHz.

(12) Reset the sweep generator as in step (4) above.

(13) Readjust the vanes of capacitors C2 and C3 for maximum amplitude with the peak of the response curve centered at 735 MHz.

(14) Repeat (6) through (13) above for the best results at both frequencies.

NOTE

Use lowpass filter F-1486/U (5FL4) (connection C, fig. 4-69) at 674 MHz and above. Use lowpass filter F-1494/U (4FL2) at 674 MHz and below.

(15) Connect lowpass filter F-1494/U. Set the test fixture dial to 618 and signal generator to 618 MHz. Set the sweep generator to 206 MHz, sweep width still at approximately 5 MHz. Adjust the vanes of capacitors C2 and C3 for optimum results at 618 MHz.

(16) Recheck the response at 674 MHz, and readjust the capacitor vanes, if necessary.

(17) Continue in this manner for every second frequency listed below. Adjust for optimum results between the new frequency and the previous frequency checked, until every second frequency has been checked and the required adjustments have been made.

Test future frequency (MHz)*	*Sweep genemtor frequency (MHz)*	*Test fixture frequency* (MHz)*	*Sweep generator frequency (MHz)*
735	*245.00*	*522*	*261.00*
707	*235.66*	*507*	*253.50*
674	*224.66*	*493*	*246.50*
645	*215.00*	*481*	*240.50*
618	*206.00*	*470*	*235.00*
595	*198.33*	*459*	*229.50*
575	*287.50*	*449*	*224.50*
556	*278.00*	*439*	*219.50*
538	*269.06*	*425*	*212.50*

* Operating frequency of unit under test.

(18) Return the test fixture and signal generator to 735 MHz. Reset the sweep generator to 245 MHz.

(19) Check the response at every frequency in the above listing. Little or no adjustment should be required for the remaining frequencies. However, if adjustments are required for a given frequency, the remaining frequencies will be affected to some extent. Therefore, all other frequencies must be rechecked and adjustments made where necessary.

(20) Set the test fixture dial to 425, and lock the dial. Mark the white gear wheel and the unit housing with red paint at the approximate 12 o'clock position. This will permit the 425 MHz output frequency position of the unit under test to be easily determined.

NOTE

Do not mark the teeth of the gear wheel.

d. Troubleshooting (FO-36 and fig. 4-72).

NOTE

The stators of both variable capacitors (C2 and C3) must be completely unsoldered from the p.c. board before the p.c. board is removed to replace components.

Symptom	*Checks and corrective measures*
1. High VSWR.	Check the resistance of Q1 and components in Q1 base circuit and replace as required.
2. No output indication.	*a.* Check the dc voltages as established in e below. *b.* Check the rf signal path using the allocated rf voltmeter. Refer to table below for typical indications. Check components in isolated gate and replace as required. c. Check for shorted plates on variable ganged capacitors C2 and C3 (fig. 4-68). Check C2 and C3 stator connection to p.c. board. *d.* Check connectors and cables for damage and wiring for continuity. Repair or replace as required.
3. Low output.	Check the gain of transistor stages Q1, Q2 and Q3 using allocated rf voltmeter. Refer to table below for typical indications. Replace components in isolated stage as required.

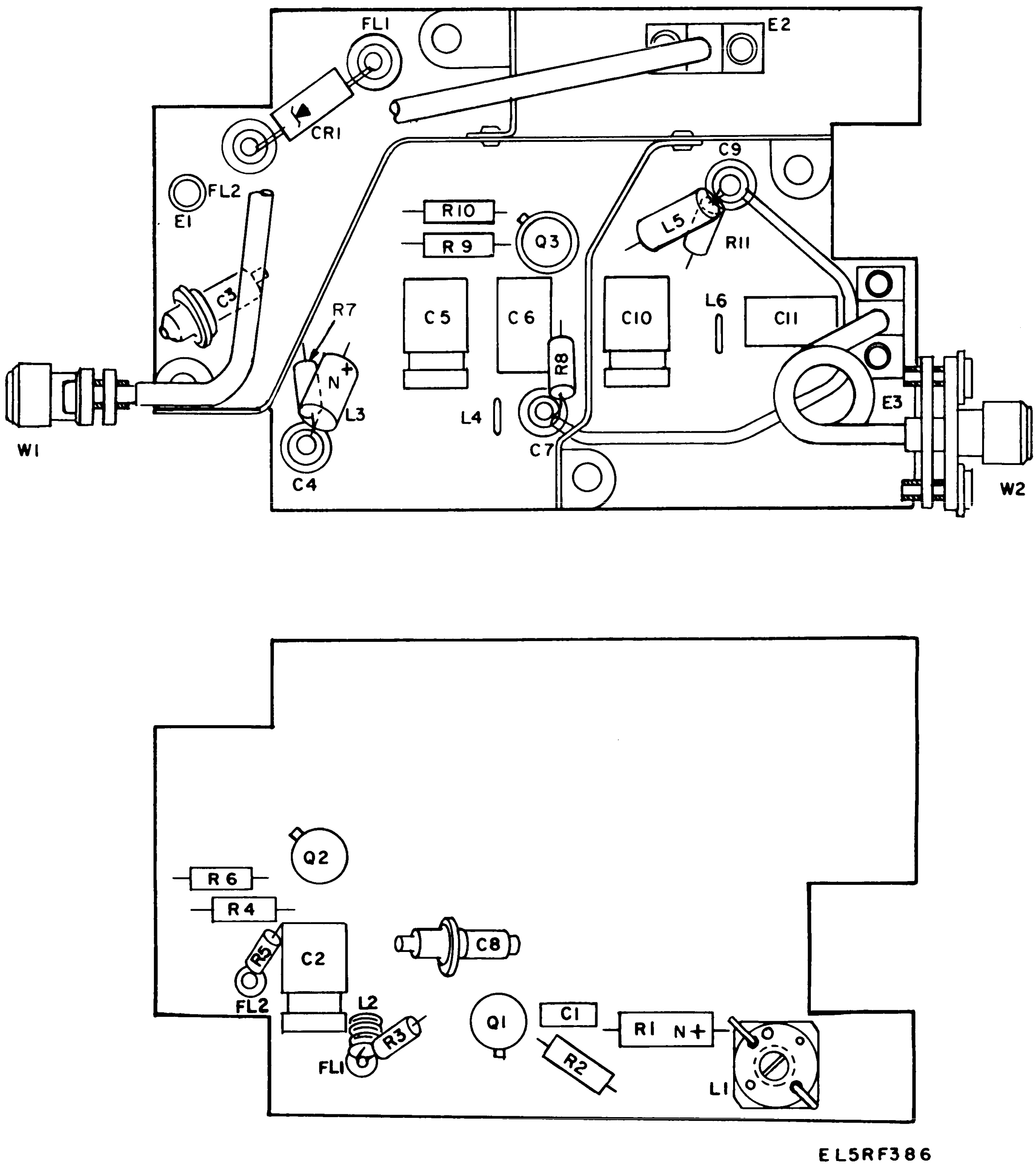


Figure 4-72. Frequency Multiplier 33A2A1A1, Parts Location.

e. Voltage and Resistance Measurements (fig. 4-71).

(1) *Dc voltage measurements referenced to ground.*

NOTE

Use rf Voltmeter ME-426/U to measure voltages below.

Test points	*Typical indication (volts rms)*
33A2A1A1Q1 – base	0.48 V
– collector	130 mV
33A2AlAlQ2 – base	14 mV
– collector	50 mV
33A2AlAlQ3 - base	13 mV
– collector	50 mV

NOTE

Use Digital Multimeter AN/USM- 451 to measure voltages below.

Test points	*Typical indication (volts dc)*
33A2A1A1Q1 – base	+0.5
– emitter	0
33A2A1A1Q2 - base	+4.4
– emitter	+3.6
33A2A1A1Q3 – base	+3.2
– emitter	+2.4

(2) *Transistor resistance measurements.*

NOTE

All resistance measured with the allocated digital multimeter.

4-25. Frequency Multiplier 33A2A2 or 34A2A2

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/ GRM-95(V)2	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/ GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Module, TS-3837(V)2/GRM-95(V)2	Test facility radio frequency module
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator, Wiltron 610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Power Amplifier, ENI 603L	Power amplifier
Signal Generator, HP-8640B	Signal generator
Oscilloscope, AN/USM-281 C	Oscilloscope
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Frequency Counter, TD-1225(V)l/U	Frequency counter
Voltmeter, Electronic, ME-426/U	Rf voltmeter
Multimeter, Digital,AN/USM-451	Digital multimeter

b. Test Procedures and Alinement.

(1) *Input VS WR check.*

(a) Connect the test equipment as shown in A, figure 4-73.

(b) Turn on the power amplifier.

(c) Set the sweep generator controls as follows:

Control	*Position*
FREQ SELECTOR	F1TOF2
RETRACE RF	OFF
Frequency Control F1	95 MHz (on dial)
Frequency Control F2	145 MHz (on dial)
LEVELING	INT
SWEEP MODE	AUTO

Stage	*Transistor*		*Base (−)*				*Base (+)*			
			Emitter (+)		*Collector (+)*		*Emitter (−)*		*Collector (−)*	
	Ref	*Type*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*
	Q1	2N2857	465	Rx 100	3100	Rx 100	465	Rx 100	1050	Rx 100
	Q2	2N2857	1050	Rx 100	800	Rx 100	975	Rx 100	800	Rx 100
	Q3	2N2857	830	Rx 100	1000	Rx 100	830	Rx 100	890	Rx 100

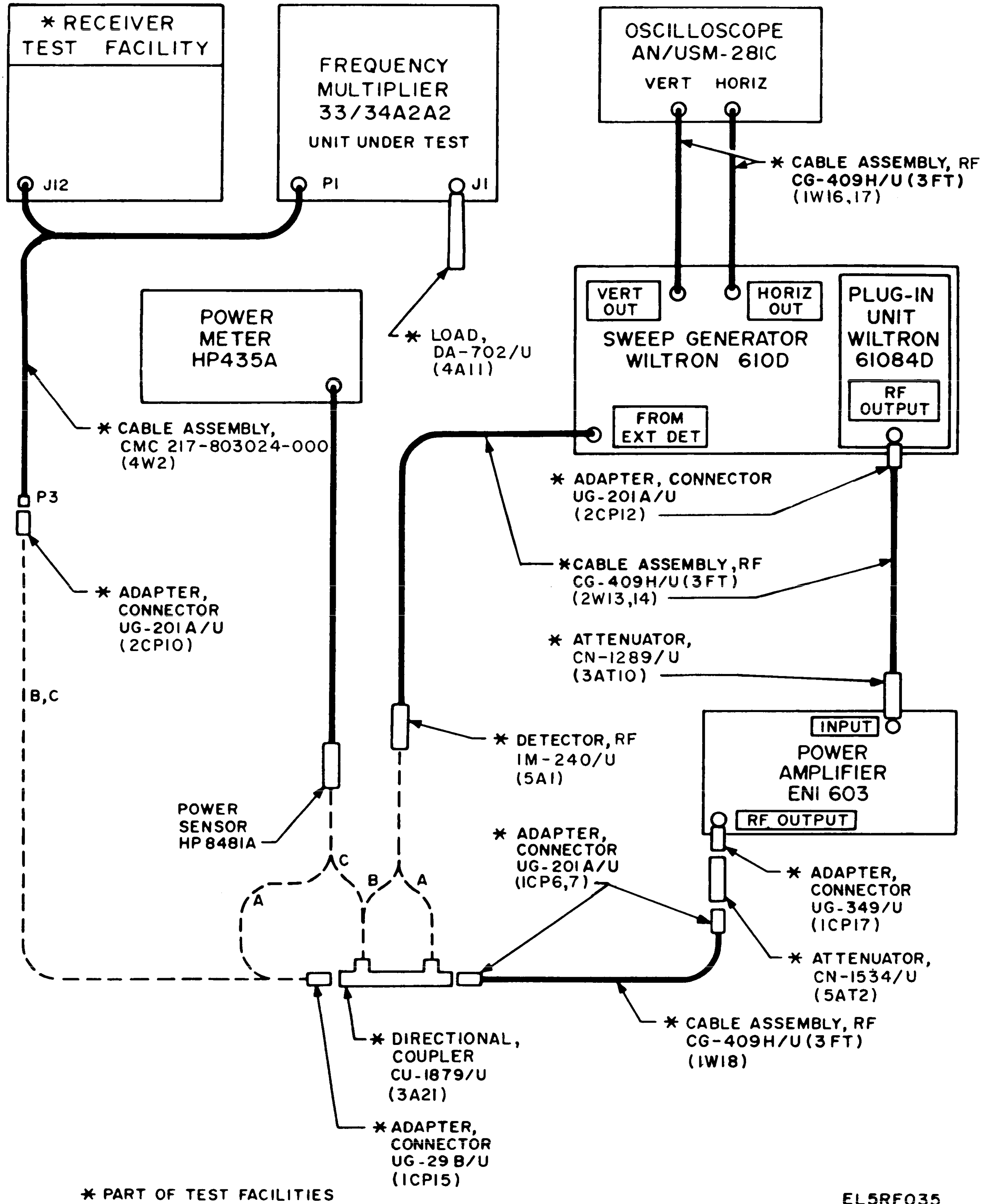


Figure 4-73. Frequency Multiplier 33A2A2 or 34A2A2 Input VSWR Check, Test Setup.

(d) Adjust the sweep generator (use INT markers) to sweep from 95 MHz to 145 MHz. With SWEEP MODE temporarily set to MANUAL, adjust the output controls for a nominal +17 dBm as indicated on the power meter. Reset the SWEEP MODE to AUTO.

(e) Connect the test equipment as in B, figure 4-73.

(f) Set the power supply to 115 Vac as indicated on the panel voltmeter. Set receiver test facility switch S1 to ON and S6 to any position except OFF.

(g) Adjust the oscilloscope controls for a convenient display of the reflected power. Set the sweep generator SWEEP MODE to MANUAL. Turn the MANUAL sweep control to the frequency of the highest level of reflected power between 95 MHz and 145 MHz.

(h). Connect the test equipment as in C, figure 4-73.

(i) Record the power meter indication.

(j) Reverse the input and output connections to the directional coupler, with the power meter remaining connected to the same coupling port of the directional coupler as in *(h)* above. The power meter should indicate more than 11.3 dB above the level recorded in *(i)*. corresponding to input VSWR to 1.75:1 or less.

(k) If the requirement of *(j)* above is not met, perform *(l)* through *(o)* below before proceeding.

(l) Remove the cover of unit 33A2A2 on the side opposite P1. Then remove the three retaining screws on lowpass filter 33A2A2FL1.

(m) Extend the falter (FL1) from unit 33A2A2 as shown in figure 4-74.

(n) Reconnect the test equipment as in B, figure 4-73. Set sweep generator SWEEP MODE to AUTO.

(o) Remove the capacitor caps and make a slight adjustment of Cl and C5 of FL1 to obtain the best compromise of minimum reflected power over the frequency range (fig. 4-76).

(p) Replace the capacitor caps, filter 33A2A2FL1 and the cover of unit 33A2A2.

(q) Repeat *(f)* through *(j)* above.

(2) *Output power checks.*

(a) Connect the test equipment as in A, figure 4-75.

(b) Turn on the power amplifier.

(c) Set the sweep generator controls as follows:

Control	*Position*
FREQ SELECTOR	F1 TO F2
RETRACE RF	OFF
Frequency Control F1	95 MHz (on dial)
Frequency Control F2	145 MHz (on dial)
SWEEP MODE	AUTO

(d) Adjust sweep generator output as described in paragraph *(1)(d)*.

(e) Connect the test equipment as in B, figure 4-75.

(f) Set receiver test facility switch S1 to ON and S6 to any position except OFF.

(g) Note the frequency of minimum amplitude on the oscilloscope.

(h) Set the sweep generatnr SWEEP MODE control to MANUAL and adjust tQ obtain the frequency noted in *(g)* above.

(i) Connect the test equipment as in C, figure 4-75.

(j) Adjust the trombone line for a minimum power meter indication (ensure that the trombone line can be adjusted in both directions from this minimum position). The power meter indication should be +14 dBm ±2.5 dB.

NOTE

If it is not possible to achieve a minimum at any position of the trombone line, add a one-foot length of cable CG-3568/U and adapter connector UG-298/U between T-connectcm UG- 107 B/U and the end of the trombone line.

(k) Repeat *(j)* above for sweep generator frequencies of 97.5, 110, 120, 130, and 145 MHz.

(l) If the requirements of *(j)* and *(k)* are not met, perform *(m)* and *(n)* below and, if necessary, *(o)* through *(t)*.

(m) Reconnect the test equipment as in B, figure 4-75 and switch the sweep generator to AUTO SWEEP.

(n) Remove the capacitor caps and make a slight adjustment of C4, C6 and C7 on board Al to obtain the best compromise of flatness and maximum response over the frequency range. Replace capacitor caps and repeat (g) through *(k)* above.

(o) Remove the cover of unit 33A2A2 on the side opposite P1. Then remove the three retaining screws on lowpass filter 33A2A2FL2.

(p) Extend the falter from unit 33A2A2 as shown in figure 4-74.

(q) Reconnect the test equipment as in B, figure 4-75 and set the sweep generator to AUTO SWEEP.

(r) Remove the capacitor caps and make a slight adjustment of C2, C4, C6 and C8 on board FL2 to obtain the best compromise of flatness and maximum response over the frequency range. Replace the capacitor caps.

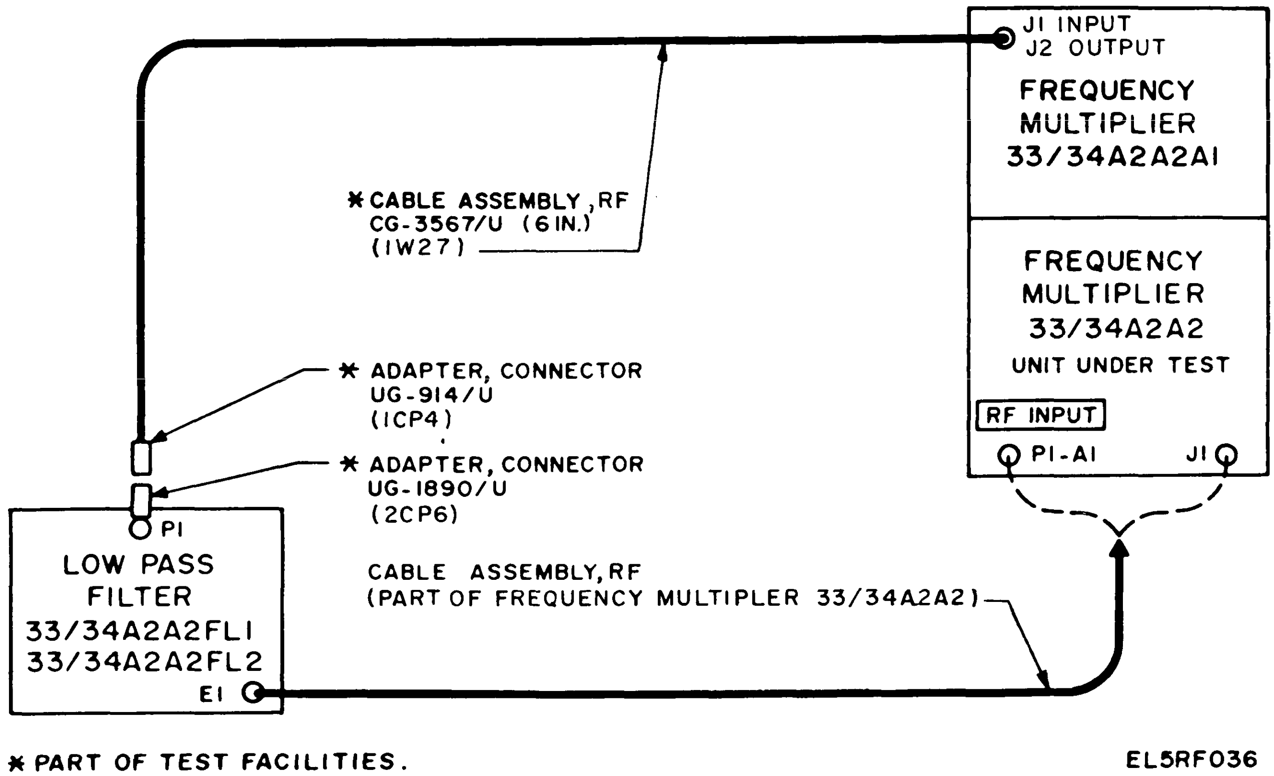


Figure 4-74. Frequency Multiplier 33A2A2 or 34A2A2, FL1 and FL2 Alignment Check, Showing Filters Extended.

(s) Replace falter 33A2A2FL2 capacitor caps and the cover of 33A2A2.

(t) Repeat *(g)* through *(k)* above.

(3) *Harmonic rejection check.*

(a) Connect the test equipment as in A, figure 4-77.

(b) Set receiver test facility switch Sl to ON and S8 to any position except OFF.

(c) Adjust the signal generator frequency to 98 MHz (f_o) ±50 kHZ.

(d) Adjust the signal generator output level for +17 dBm as indicated on the power meter.

(e) Connect the test equipment as in B, figure 4-77.

(f) Set filter No. 1 (F-1491/U) to 196 MHz (f_oX 2). Note the power meter indication.

(g) Set filter No. 1 to 294 MHz (f_oX 3).

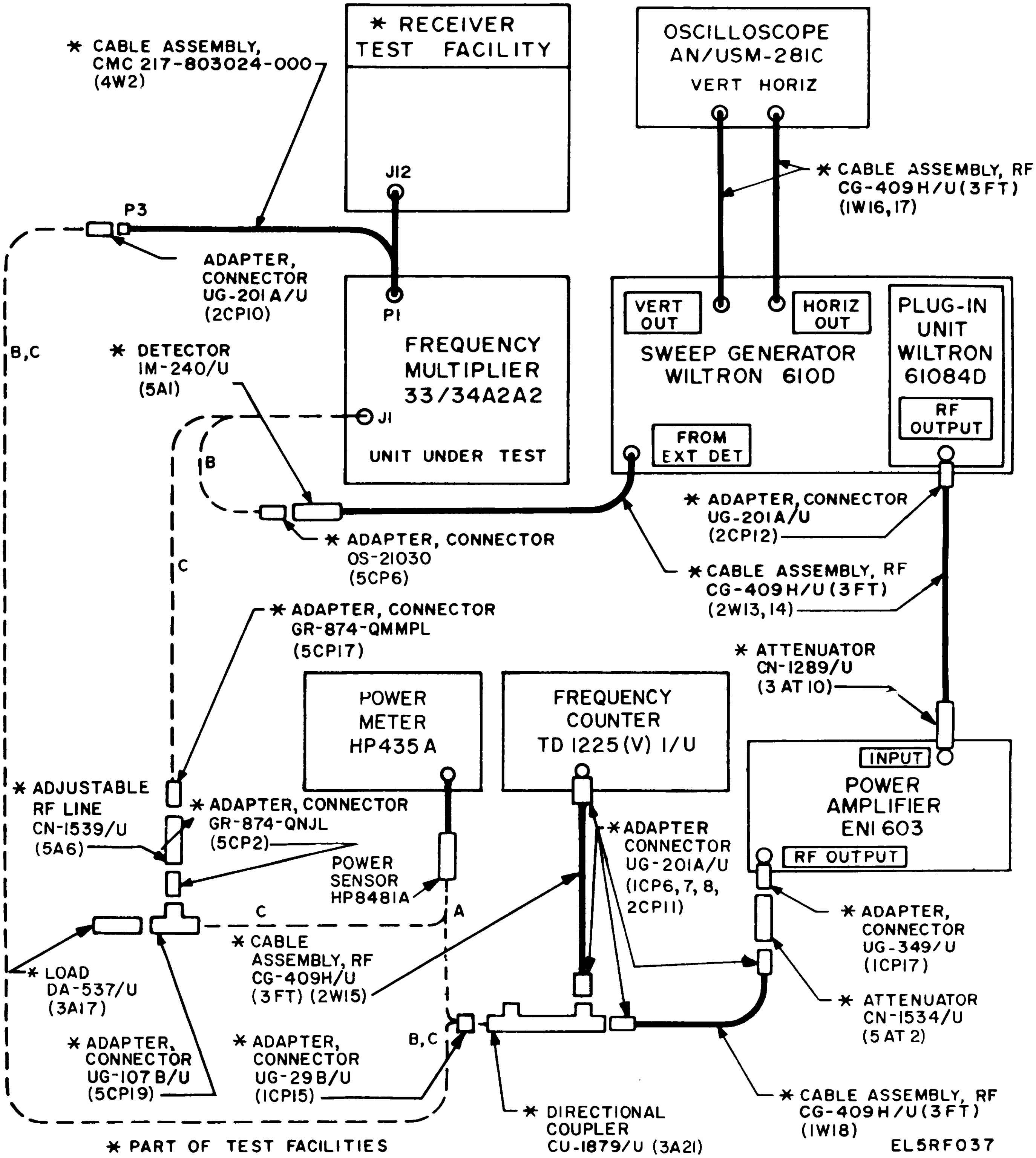


Figure 4-75. Frequency Multiplier, 33A2A2 or 34A2A2, Output Power Check, Test Setup.

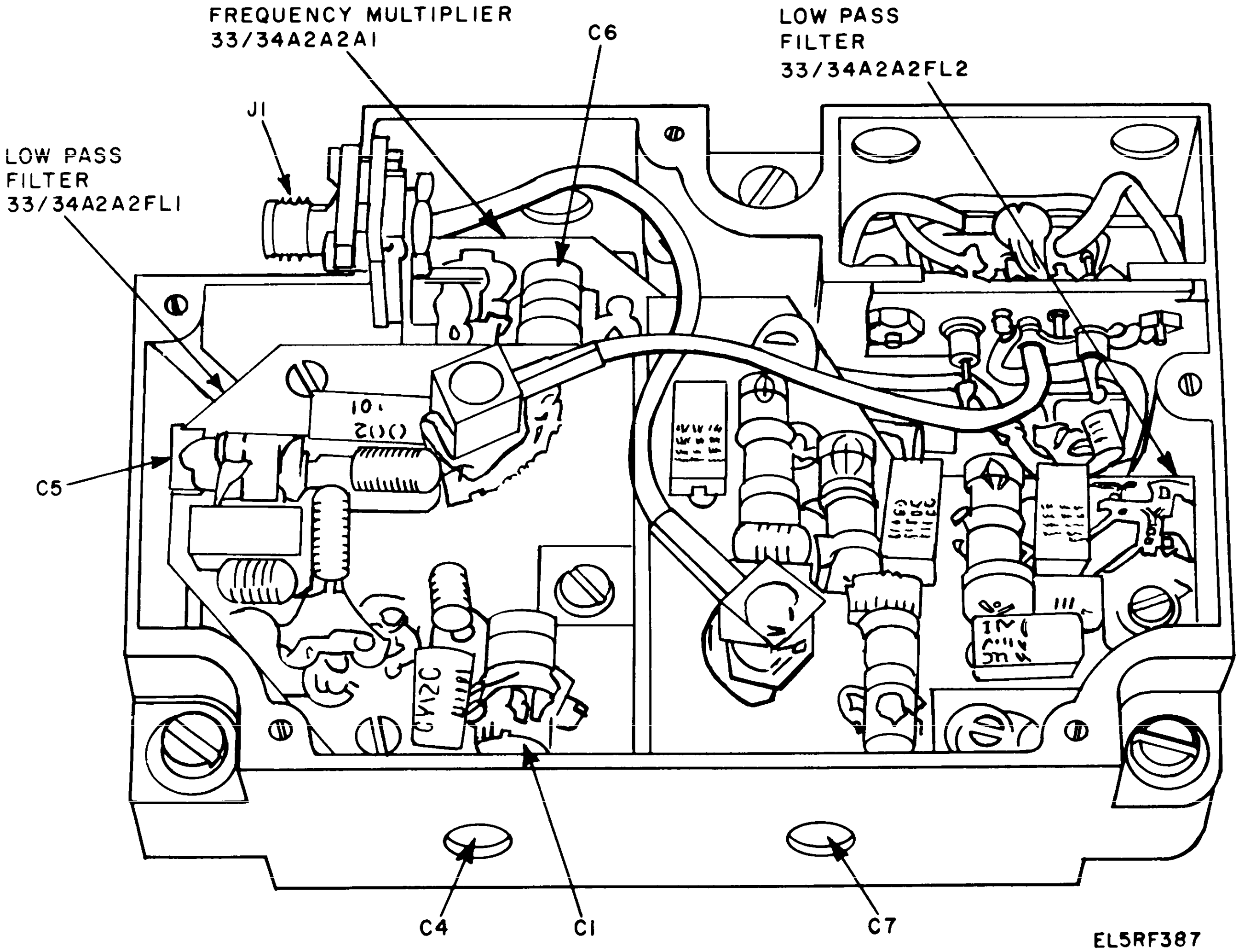


Figure 4-76. Frequency Multiplier 33A2A2 or 34A2A2, Top View, Cover Removed

(h) The power meter should indicate at least 20 dB below the level noted in *(f)* above.

(i) Replace filter No. 1 with filter No. 2 (F-1487/U).

(j) Set filter No. 2 to 392 MHz (f_o X 4). The power meter should indicate at least 20 dB below the level noted in step *(f)* above.

(k) Repeat the test procedure above for the remaining signal generator frequencies listed below, using the appropriate filter.

(l) If above requirements are not met, repeat steps (c) through (h) and adjust C1 on the unit under test for minimum indication on the power meter.

NOTE

A slight readjustment of Cl may be necessary to meet the requirements for each test frequency.

		Harmonic output frequencies (fil&r setting)		
Signal generator frequency (f_o) MHz	*Unit under test output frequency (f_o X 2) MHz*	*(f_o) MHz*	*(f_o x 3) MHz*	*(f_o x 4) MHz*
98.0	*196.0*	*98.0*	*294.0*	*392.0*
110.0	220.0	110.0	330.0	440.0
120.0	240.0	120.0	360.0	480.0
130.0	260.0	130.0	390.0	520.0
140.0	280.0	140.0	420.0	560.0
145.0	290.0	145.0	425.0	580.0

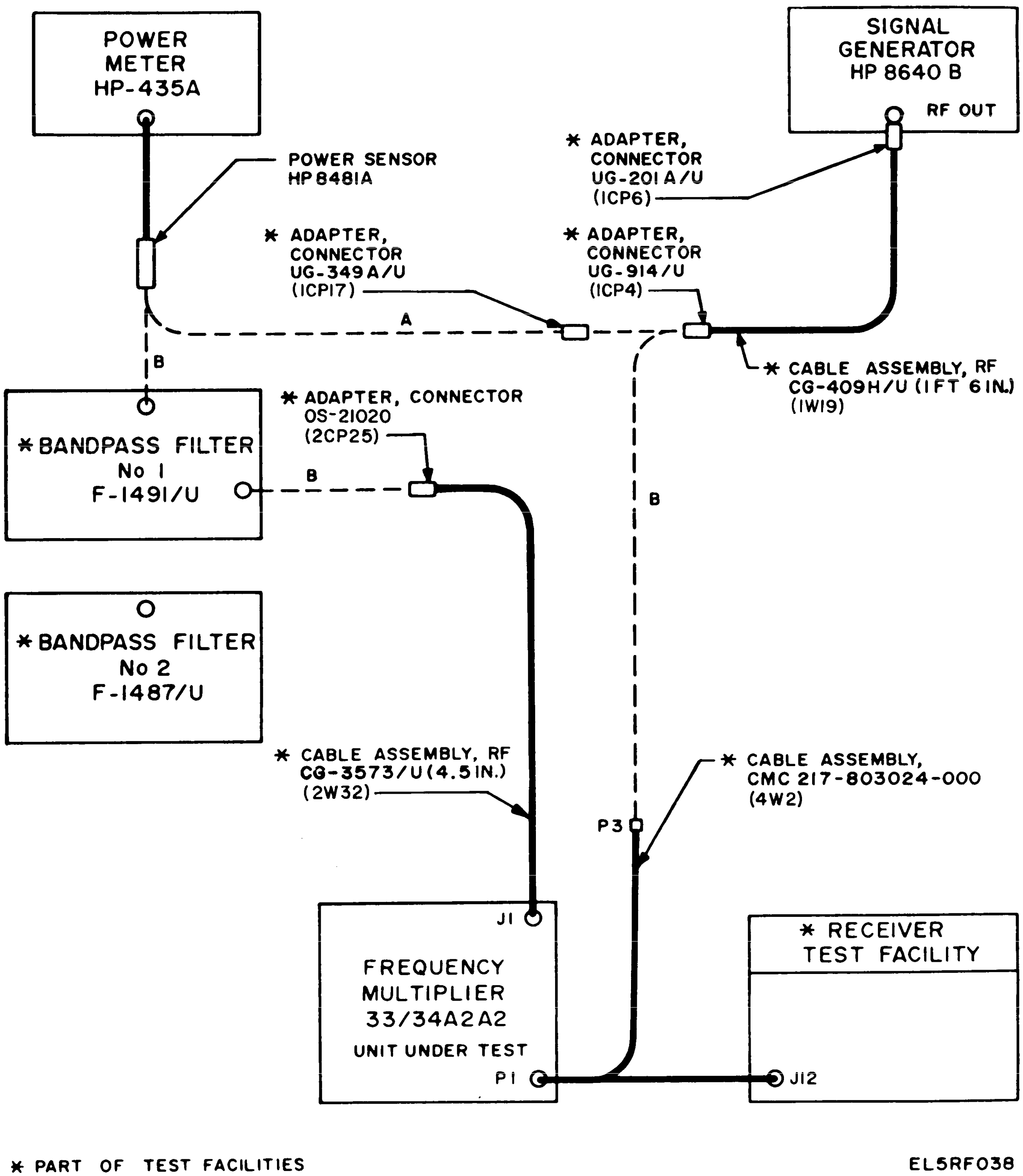


Figure 4-77. Frequency Multiplier 33A2A2 or 34A2A2, Harmonic Rejection Check, Test Setup.

c. Troubleshooting (FO-37).

Symptom	Checks and corrective measures
1. High VSWR.	Extend lowpass filter 33/34A2A2FLl (fig. 4-76) and test as shown in para. 4-26.
2. Output power low or zero.	*a.* Perform resistance and voltage measurements contained in *d.* below. Investigate any abnormal indication. Replace components as required.
	b. Check the rf signal path using the allocated voltmeter. Refer to table in *d.* below for typical indications. Check components and replace if required.
	c. Check for damaged cables or connectors and broken wires. Replace or repair if required.
3. Poor rejection.	*a.* Extend lowpass filter 33/34A2A2FLl and test as shown in para. 4-26.
	b. Extend lowpass filter 33/34A2A2FL2 and test as shown in para. 4-27.
	c. Check Cl on circuit card assembly 33/34A2A2A1 (fig. 4-78), and replace if required.

d. Voltage and Resistance Measurements (fig. 4-78).

NOTE

Use the allocated digital multimeter for dc voltage and resistance measurements. Use the allocated rf voltmeter for rf voltage measurements.

(1) *Dc and rf voltage measurements referenced to ground.*

Test points	Typical indication volts dc	volts rrns
33/34A2A2A1Q1 – emitter	+ 6.5	
– base	+ 6.6	0.5
– collector	+12.0	0.5
33/34A2A2A1Q1 – emitter	+ 1.5	
– base	+ 2.25	0.2
– collector	+12.0	1.0
33/34A2A2A1Q3 – emitter	+ 7.8	
– base	+ 7.0	0.12
– collector	+12.0	0.4

(2) *Resistance measurements.*

NOTE

All resistances measured with the allocated digital multimeter.

Stage	Transistor		Base (−)				Base (+)			
			Emitter (+)		Collector (+)		Emitter (−)		Collector (−)	
	Ref	Type	Res (ohms)	Multimeter range	Res (ohms)	Multimeter range	Res (ohms)	Multimeter range	Res (ohms)	Multimeter range
	Q1		200k	X 2 Meg	600	2k	650	2k	500	2k
	Q2		200k	X 2 meg	1k	2k	700	2k	650	2k
	Q3		550	2k	400	2k	550	2k	240	2k

4-26. Lowpass Filter 33A2A2FL1 or 34A2A2FL1

a. Test Equipment and Material Required.

Equipment	Common name
Test Facility Transmitter, TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Sweep Generator, Wiltron 610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Oscilloscope, AN/USM-281 C	Oscilloscope
Indicator, Standing Wave Ratio, AN/USM-261	VSWR indicator
Generator, Signal, HP-8640B	Signal generator

b. Test Procedures and Alinement

(1) *VSWR check.*

(a) Connect the test equipment as shown in A, figure 4-79.

(b) Set the variable attenuator to MIN. Adjust the sweep generator controls to provide a sweep between 97.5 and 145 MHz (use INT markers).

(c) Set rf switch to position 1.

(d) Adjust the oscilloscope controls and the sweep generator RF POWER LEVEL attenuator dial for a convenient oscilloscope display. Mark the display on the graticule of the oscilloscope. This represents a VSWR of 1.4:1.

(e) Connect the test equipment as shown in C, figure 4-79.

(f) The VSWR curve displayed on the oscilloscope between 97.5 and 145 MHz must not exceed the 1.4:1 calibration mark on the oscilloscope graticule.

(g) If the VSWR is excessive, adjust the unit under test as described in paragraph c.

(2) *Bandpass response check.*

(a) Connect the test equipment as shown in B, figure 4-79.

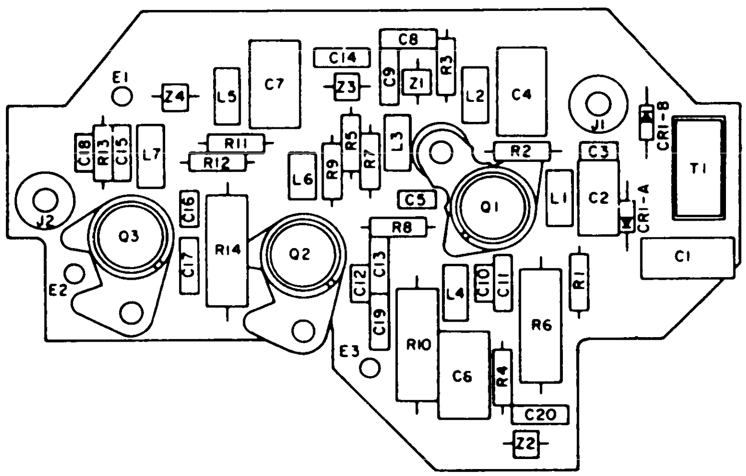


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Figure 4-78. Circuit Card Assembly 33A2A2A1 or 34A2A2A1 Parts Location.

(b) Adjust the sweep generator controls to provide a sweep between 97.5 and 145 MHz (use INT markers). Set the variable attenuator dial to 2.8 dB.

(c) Set the rf switch to position 2.

(d) Adjust the oscilloscope controls for a convenient indication of the response and mark the oscilloscope at the point of minimum deflection across bandwidth. This is the 0.8 dB reference level.

(e) Connect the test equipment as shown in C, figure 4-79.

(f) Set the variable attenuator dial to 2 dB.

(g) The deflection of the displayed response should not be less than the 0.8 dB reference level marked in *(d)* above.

(h) If necessary, adjust the unit under test as in paragraph *c.*

(3) *Out-of-band rejection check.*

(a) Connect the test equipment as shown in A, figure 4-81.

(b) Adjust signal generator No. 1 controls to provide a 190 MHz signal modulated with 1000 Hz at a level of 30 percent and set the output level to 0 dBm.

(c) Set the variable attenuator dials to 0 dB.

(d) Adjust the VSWR indicator controls for a convenient indication. Note the indication..

(e) Connect the test equipment as shown in B, figure 4-81.

(f) Set the variable attenuator to 30 dB. The indication on the VSWR indicator should be greater than or equal to that noted in *(d)* above. If necessary, adjust unit under test as described in paragraph c.

c. Alinement.

(1) Remove the dust caps from Cl and C5 (figure 4-80).

(2) Connect and calibrate the equipment as described in paragraphs *b. (1)(a)* through *(e).*

(3) Adjust Cl and C5 for minimum possible VSWR at 145 MHz. Note the level of the response minimum.

(4) Slightly readjust Cl and C5 to obtain optimum response flatness from 97.5 to 135 MHz and to maintain the response level (noted in (3) above) near 145 MHz. The response level from 97.5 to 135 MHz should be greater than the level noted in (3) above.

(5) The VSWR response displayed on the oscilloscope between 97.5 MHz and 145 MHz should not exceed the 1.4:1 calibration mark on the oscilloscope graticule.

(6) Replace the dust caps onto Cl and C5.

(7) Perform the tests in paragraphs *b.* (2) and *b.(3).*

(8) If the unit under test cannot be adjusted to meet the requirements of paragraph *b.:*

(a) Check solder connections and component values.

(b) Replace or repair components or filter, as appropriate.

4-27. Lowpass Filter 33A2A2FL2 or 34A2A2FL2

a. Test Equipment and Material Required.

(1) *Major items, including test facilities.*

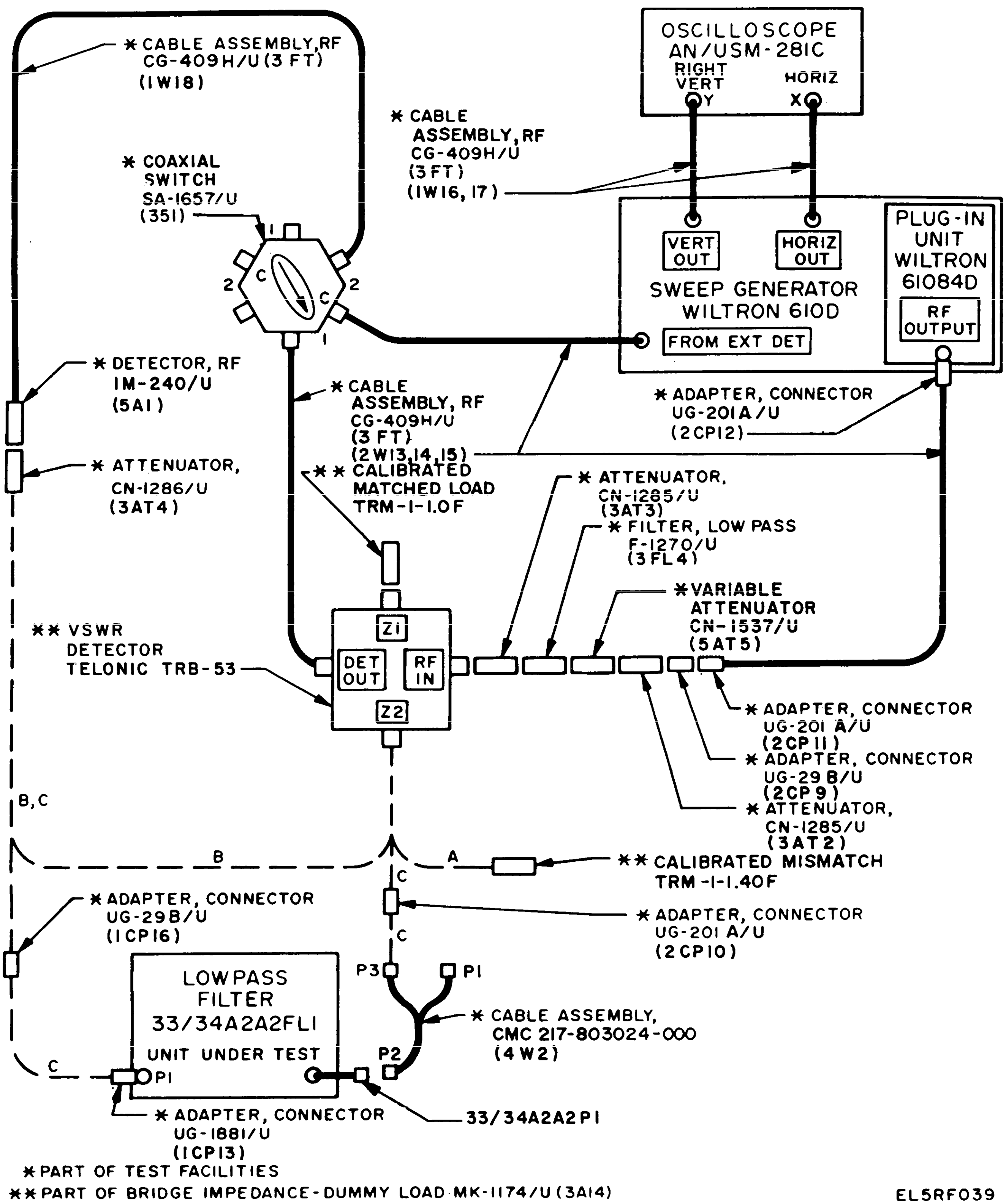

Figure 4-79. Lowpass Filter 33A2A2FL1 or 34A2A2FL1, WSWR and Bandpass Insertion Loss Check, Test Setup.

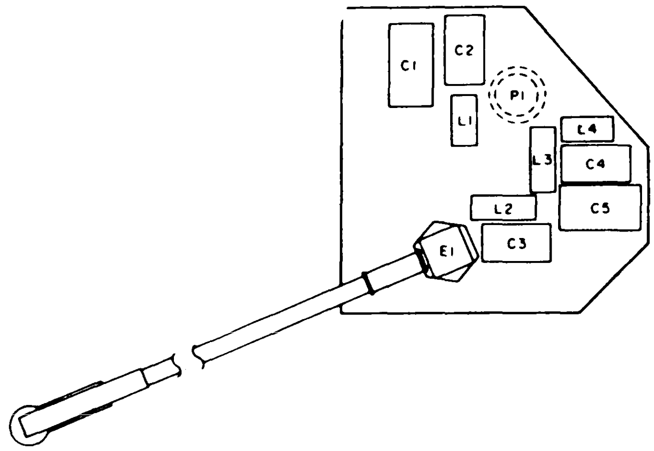

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Figure 4-80. Lowpass Filter 33A2A2FL1 or 34A2A2FL1, Parts Location

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/ GRM-95(V)2	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/ GRM-95(V)2	Test facility receiver
Accessory Kit Test Facilities Set MK-1173(V)2/GRM-95 (V)2	Accessory kit, test facilities set
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator, Wiltron 610D (with Plug-in Unit Wiltion 61084D)	Sweep generator
Indicator, Standing Wave Ratio, AN/USM-261	VSWR indicator
Oscilloscope, ABVUSM-281C	Oscilloscope
Generator, Signal, HP-8640B	Signal generator No. 1

b. Test Procedures.

(1) *VSWR and passband response check.*

(a) Connect the equipment as shown in A, figure 4-82.

(b) Calibrate the test setup for frequency response as follows:

1. Adjust the sweep generator for a leveled sweep between 190 MHz and 400 MHz (use internal markers) with the RF POWER LEVEL controls set for maximum output.

2. Adjust the oscilloscope controls (and the sweep generator SLOPE ADJUST control) for a convenient right vertical channel response display (approximately 7 divisions deflection) with the MAG control set the X1 and the response level at 190 MHz equal to the response level at 380 MHz. Mark the horizontal position of 190 MHz, 300 MHz and 380 MHz.

3. Reduce the sweep generator output level by 1 dB. Mark the response from 190 to 300 MHz. This is the 1 dB insertion loss reference level.

4. Increase the sweep generator output level by 1 dB.

(c) Connect the 1.25:1 calibrated mismatch load as shown in B, figure 4-82.

(d) Without disturbing the sweep generator or oscilloscope right vertical channel settings, calibrate the left vertical channel for a convenient VSWR display (display may not be level). Mark this 1.25:1 VSWR reference level display.

(e) Connect the unit under test as shown in C, figure 4-82.

(f) The VSWR response level from 190 MHz to 300 MHz (left channel display) shall not exceed the 1.25:1 VSWR reference marked in *(d)* above.

(g) The passband response level from 190 MHz to 300 MHz (right channel display) shall not be less than the 1 dB insertion loss reference level marked in *(b)3* above.

(2) ***Out-of-band rejection check.***

(a) Connect the test equipment as shown in A, figure 4-84.

(b) Adjust signal generator No. 1 controls to provide a 380 MHz signal modulated with 1000 Hz at a level of 30 percent and set the output level to 0 dBm.

(c) Set the variable attenuator dials to 0.

(d) Adjust the VSWR indicator controls for a convenient indication. Note this indication.

(e) Connect the test equipment as shown in B, figure 4-84.

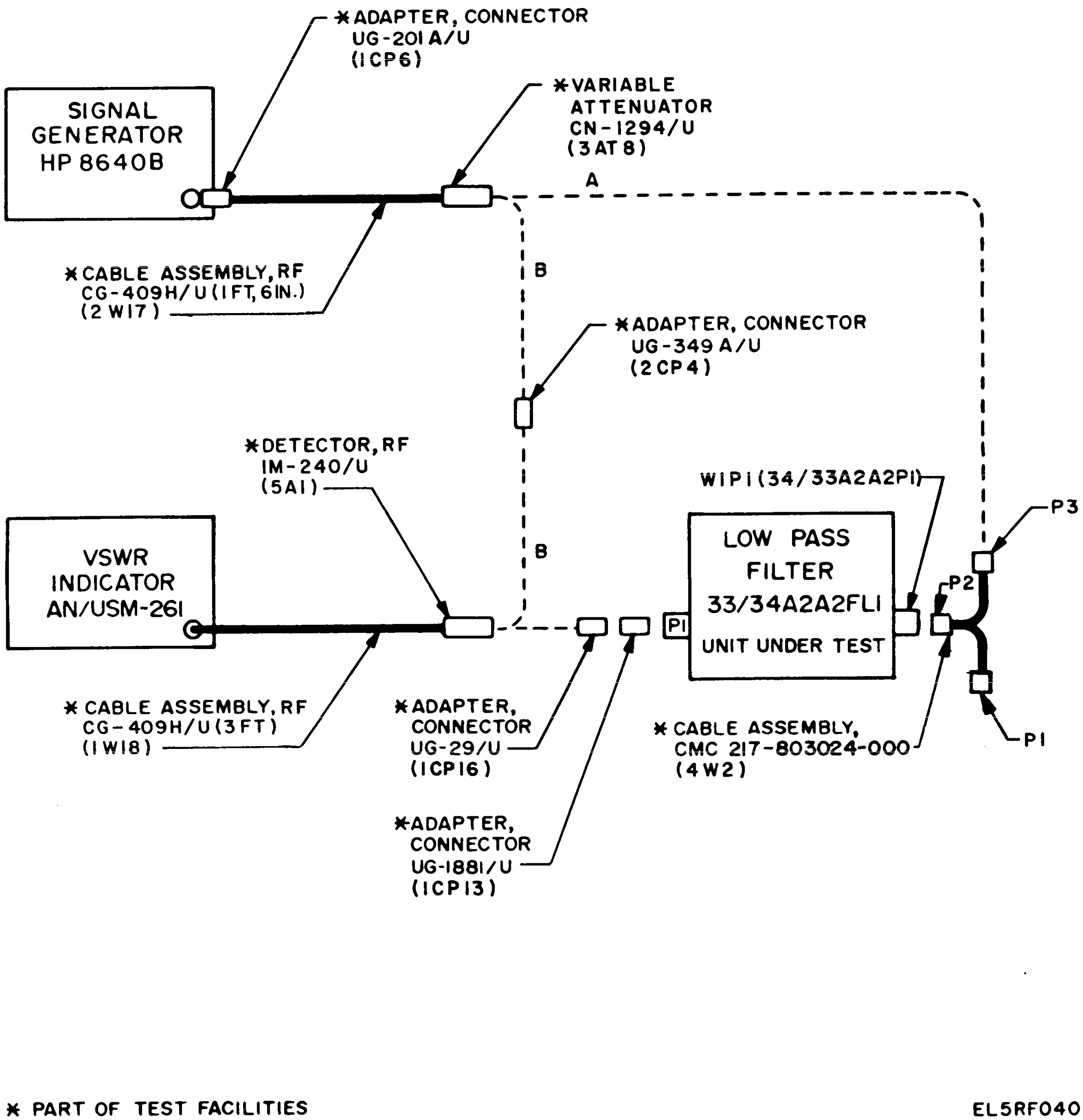


Figure 4-81. Lowpass Filter 33A2A2FL1 or 34A2A2FL1, Out-of-Band Rejection Check, Test Setup.

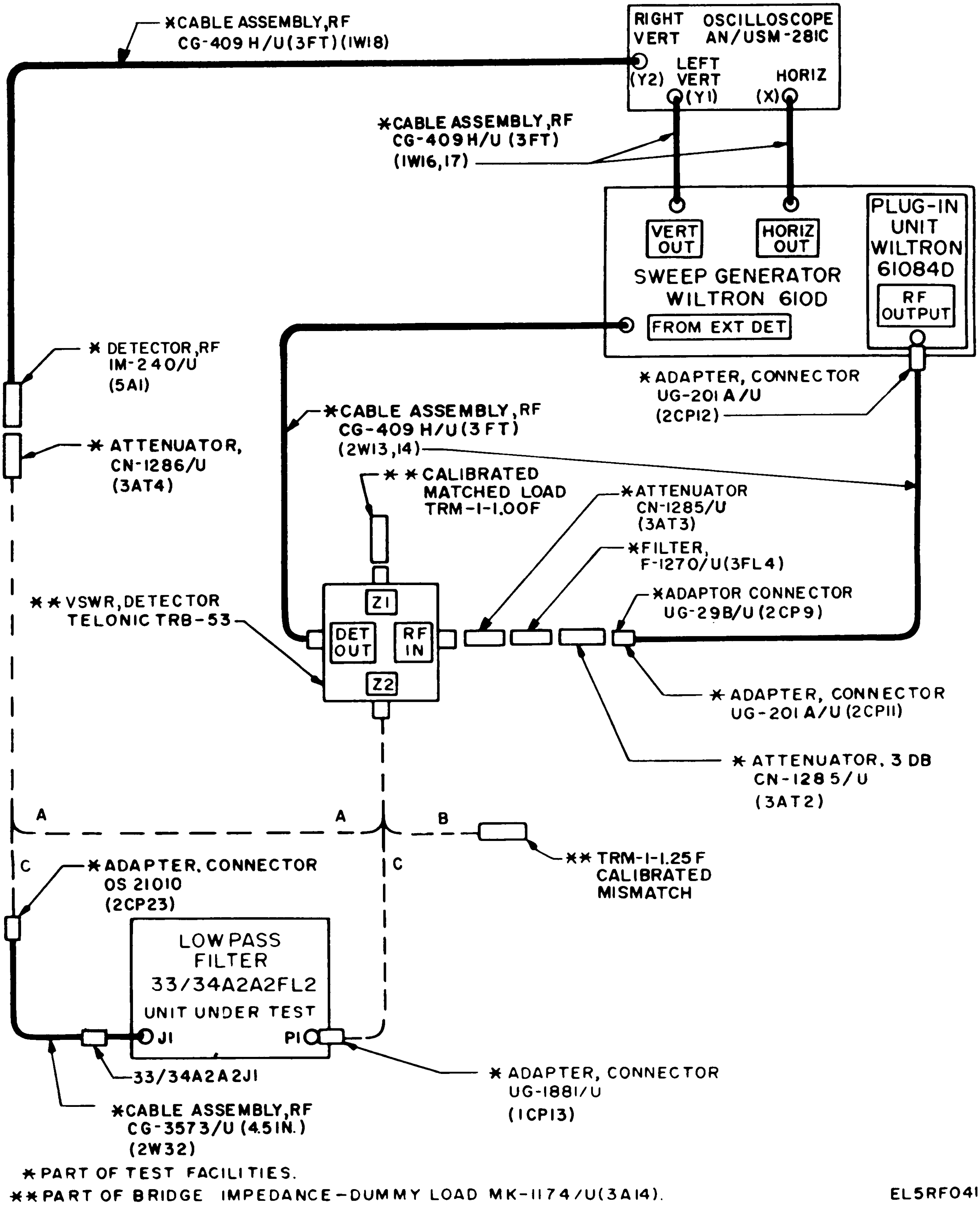


Figure 4-82. Lowpass Filter 33A2A2FL2 or 34A2A2FL2, VSWR and Bandpass Insertion Loss Check, Test Setup.

(f) Adjust the variable attenuators to obtain the same indication on the VSWR indicator as noted in *(d)* above. The attenuation required must be 13 dB or greater.

c. Alinement. If the unit under test fails to meet the requirements of paragraph *b.,* aline the filter as described below.

(1) Remove the dust caps from C2, C4, C6 and C8 (figure 4-83).

(2) Connect and calibrate the equipment as described in paragraph *b.* (1 *)(a)* through *(e).*

(3) Decrease the sweep generator output level by 13 dB and increase the oscilloscope right channel sensitivity by 10 (set MAG control to X10).

(4) Note the level of the right channel response at 190 MHz. This is the 13 dB rejection reference level.

(5) Increase the sweep generator output level by 13 dB.

(6) Adjust the unit under test for the best obtainable VSWR response, from 190 MHz to 300 MHz (left channel display), which yields a rejection response level at 380 MHz (right channel display) that is less than the rejection reference level noted in (4) above. The VSWR response level between 190 MHz and 300 MHz should not exceed the 1.25:1 VSWR reference level marked in step *b.(1)(d).*

(7) Decrease the oscilloscope right channel sensitivity by 10 (return the MAG control to X1). The right channel response from 190 MHz to 300 MHz should not be less than the 1 dB insertion loss reference marked in step *b. (1)(b)3.*

(8) Replace the dust cap on C2, C4, C6, and C8.

(9) Repeat the tests in paragraph *b*.

(10) If the filter cannot be adjusted to meet the requirements of paragraph *b.*, repair or replace filter 33/34A2A2FL2 as appropriate.

4-28. Bandpass Filter 33A2FL1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Test Facility, Radio Frequency Module, TS-3837(V)2/GRM-95(V)2	Test facility, radio frequency module
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator, Wiltron 610D (with P1ug-in Unit, Wiltron 61084D)	Sweep generator
Oscilloscope, AN/USM-281C	Oscilloscope
Test Fixture, TS-3825/GRM-95(V)	Test fixture

b. Test Procedures.

(1) *Bandwidth and tuning law check.*

NOTE

If any of the following requirements are not within specified limits refer to the alinement test in *d.* below.

(a) Install the bandpass filter on test fixture TS-3825/GRM-95(V), and clamp securely into position. Attach and tighten the drive extension of the test fixture to the drive shaft of the falter.

(b) Connect the test equipment as shown in C, figure 4-85.

(c) Set the rf switch to position No. 2 and the variable attenuator dial to 2 dB.

(d) Adjust the sweep generator controls for a Δ F sweep of approximately 15 MHz centered on 735 MHz, using the internal markers. Set the output to a convenient level.

(e) Adjust the oscilloscope controls for a convenient display.

(f) Connect the test equipment as shown in D, figure 4-85.

(g) Slacken the test fixture knurled locking screw. Rotate the center knob clockwise until a response centers around 735 MHz on the oscilloscope.

(h) Adjust vertical sensitivity of the oscilloscope to observe a convenient transmission response of the bandpass filter under test centered around 735 MHz (at least 6 cm vertical deflection).

(i) In order to eliminate or reduce the effect of backlash, further rotate the center knob in a clockwise direction so that the response moves down (temporarily increase sweepwidth) to approximately 700 to 710 MHz. Then turn the center knob counterclockwise until the response centers at 735 MHz.

(j) Carefully position the test fixture dial to 735. Without disturbing any settings, tighten the knurled locking knob.

(k) Set the variable attenuator dial to 5 dB and mark a horizontal line on the oscilloscope graticule at the response curve peak. This is the 3 dB bandwidth reference level.

(l) Set the variable attenuator dial to 2 dB.

(m) Center the response on the oscilloscope by adjusting the sweep generator center frequency. The bandpass response center frequency must be 735 MHz ±1.5 MHz as shown in figure 4-86.

(n) The 3 dB bandwidth, calculated using the sweep generator markers, must be between 5 and 12 MHz.

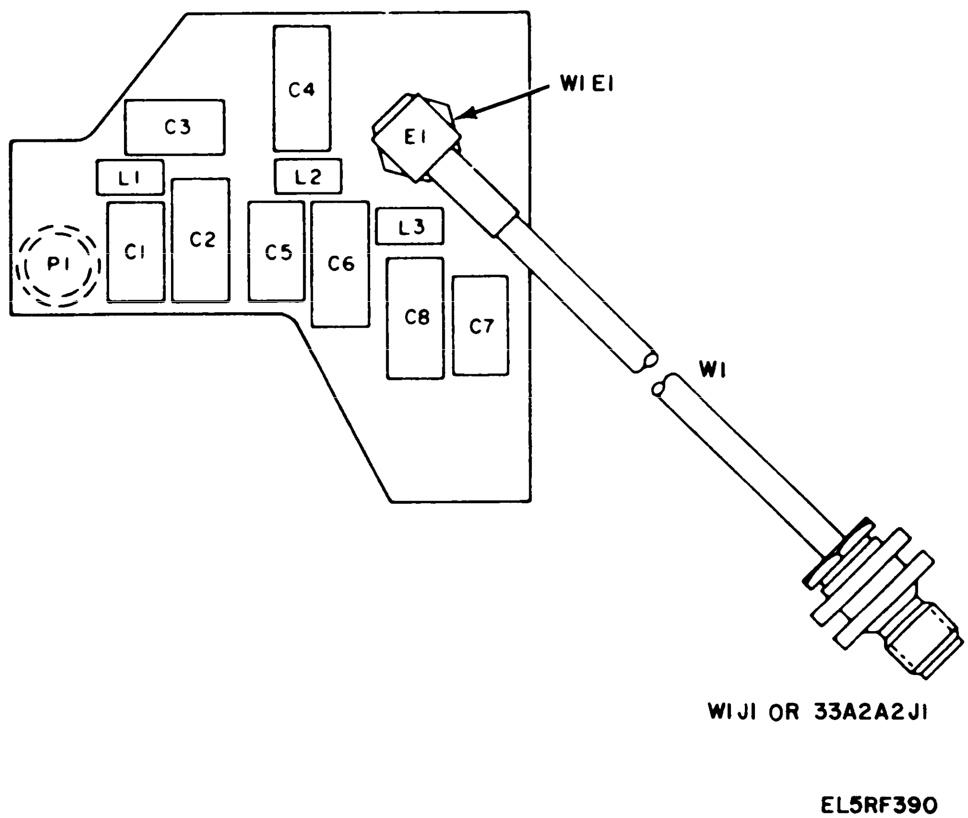


Figure 4-83. Lowpass Filter 33A2A2FL2 or 34A2A2FL2, Parts Location.

(o) Repeat *(j)* through *(m)* above for the following frequencies and test fixture settings. For each test fixture setting, turn the test fixture dial clockwise past the setting and then counterclockwise to the required setting.

Test fixture index position (cover closed)	*Response center frequency MHz*	
	Min.	*Max.*
735.0	*733.5*	736.5
695.2	*693.5*	696.5
662.0	*660.5*	663.5
631.7	*630.5*	633.5
605.7	*604.0*	607.0
582.0	*580.5*	583.5
561.0	*559.5*	562.5
541.8	*540.5*	543.5
523.9	*522.5*	525.5
508.0	*506.5*	509.5
492.6	*491.0*	494.0
480.0	*478.5*	481.5
467.3	*466.0*	469.0
457.0	*455.5*	458.5
445.6	*444.0*	447.0
434.5	*433.0*	436.0
425.0	*423.5*	426.5

(2) *Input VSWR and insertion loss.*

(a) Connect the test equipment as shown in B, figure 4-85.

(b) Set the rf switch to position No. 1

(c) Adjust the sweep generator controls for a F1 TO F2 sweep between 425 and 735 MHz, using the internal markers at a convenient output level.

(d) Set the variable attenuator dial to 2 dB.

(e) Adjust the oscilloscope controls for a convenient display.

(f) Calibrate the oscilloscope for a VSWR of 1.6:1 from 425 to 735 MHz. Mark the display on the. oscilloscope graticule.

(g) Connect the test equipment as shown in A, figure 4-85.

NOTE

Verify any out of tolerance indication (para. *(h)* or *(m)* below) by repeating the test using a 15 MHz sweep generator sweepwidth centered at the frequency of the out of tolerance indication.

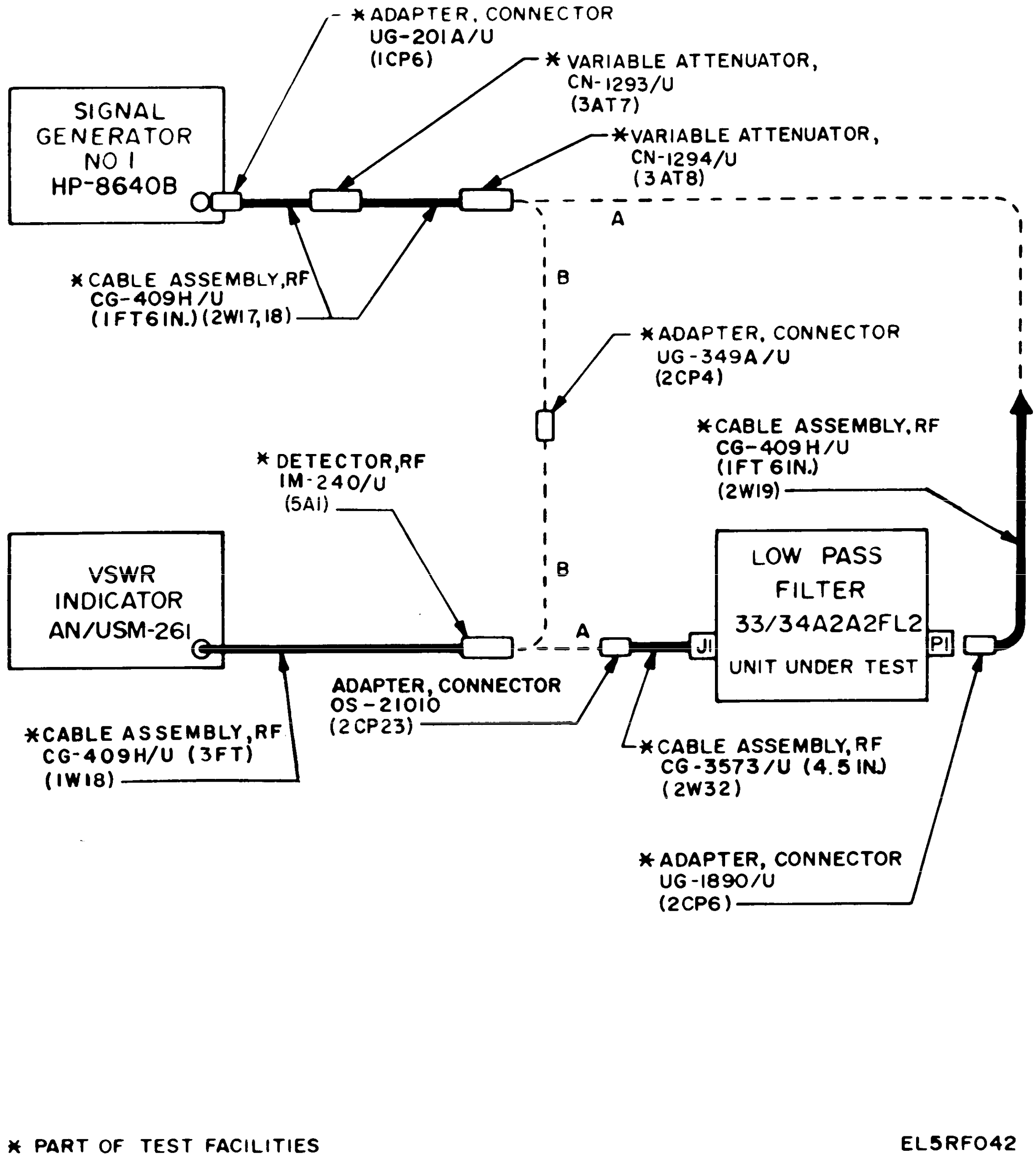


Figure 4-84. Lowpass Filter 33A2A2FL2 or 34A2A2FL2, Out-of-Band Rejection Check, Test Setup.

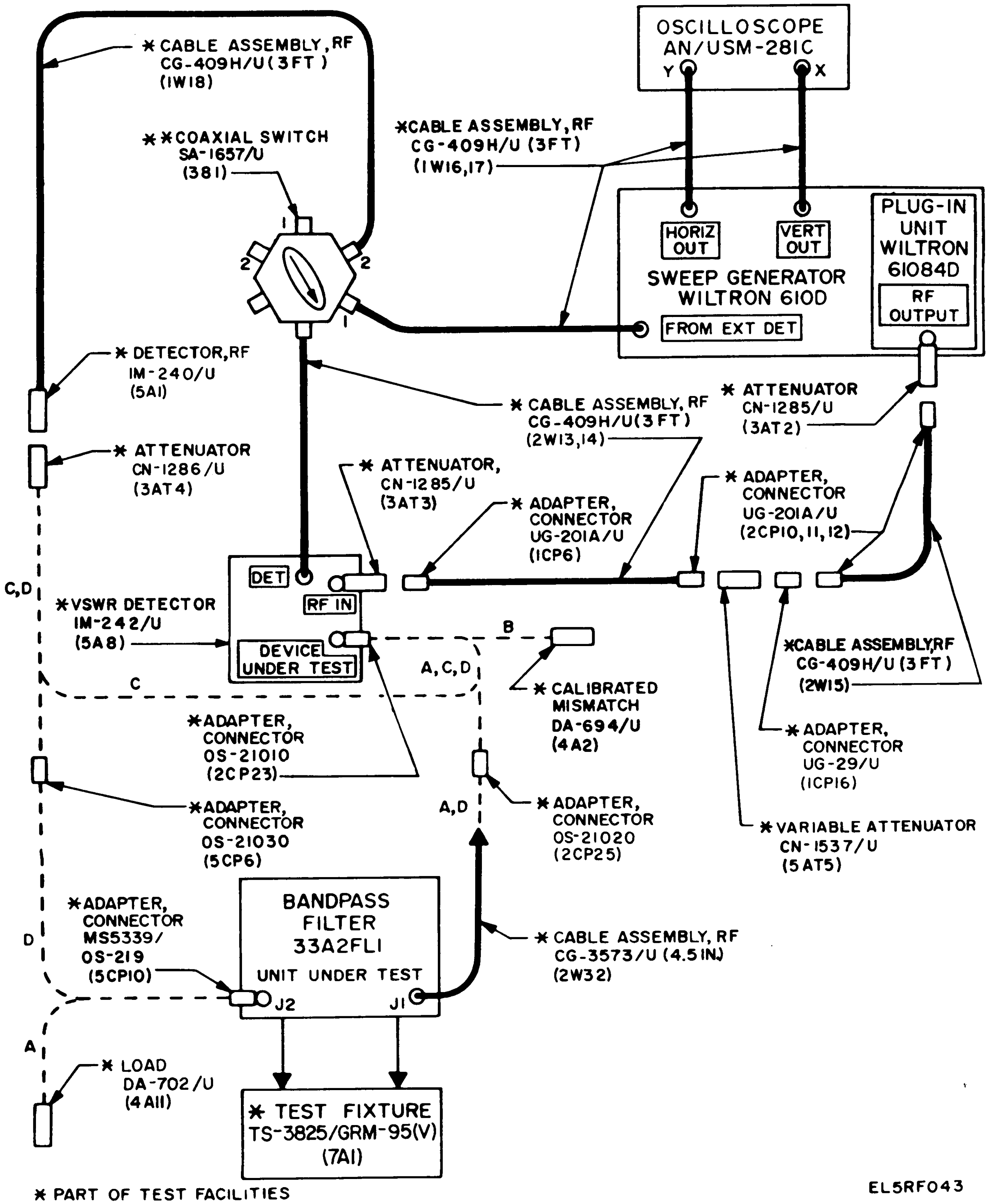


Figure 4-85. Bandpass Filter 33A2FL1, Bandwidth, Tuning Law, VSWR and Insertion Loss Checks, Test Setup.

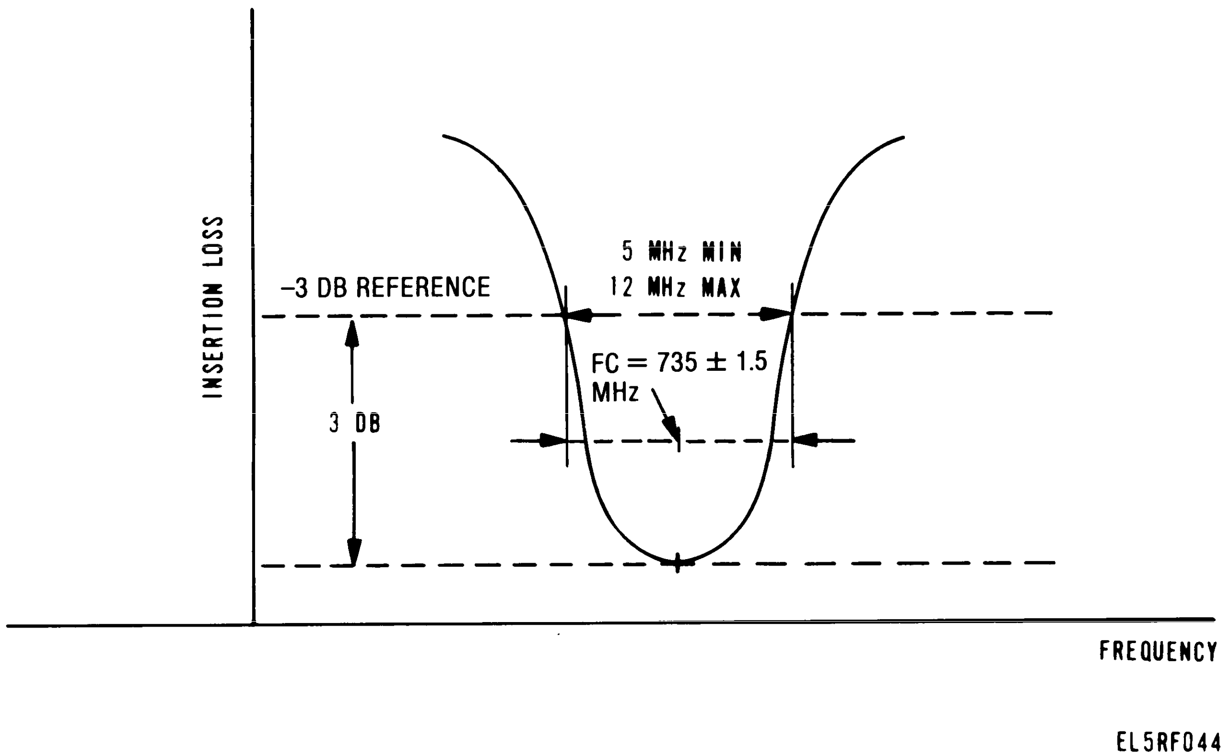


Figure 4-86. Bandpass Filter 33A2FL1, Bandpass Response, Center Frequency.

(h) Rotate the test fixture dial over the frequency range and verify that the response peak extends above the 1.6:1 VSWR calibration mark on the oscilloscope.

(i) Connect the test equipment as shown in C, figure 4-85. Set the rf switch to position 2.

(j) Set the variable attenuator dial to 4 dB and mark the oscilloscope graticule at the level of the response. This is the 2 dB reference level.

(k) Reset the variable attenuator dial to 2 dB.

(l) Connect the test equipment as shown in D, figure 4-85.

(m) Tune the unit under test through the frequency range, observing that the peak of the response equals or exceeds the –2 dB reference level, indicating an insertion loss of 2 dB or less.

(n) Tune the filter to 735 MHz.

(o) Turn off the test equipment.

(p) Remove the filter from the test fixture.

c. *Troubleshooting (FO-34).*

Symptom	*Checks and corrective measures*
1. High VSWR and/or insertion loss.	*a.* Check all components in rf path.
	b. Ground contacts on variable capacitors C 1 and C5 should be clean and maintain good tension (fig. 4-87).
	c. Deterioration of coil form and/or adjustable tuning cores. Replace if required.
	d. Alinement maybe required as described in *d.* below.
2. Bandwidth or tuning law not as specified.	Aline as described in *d.* below.

d. Alinement.

(1) Install the bandpass filter on test fixture TS-3825/GRM-95(V), and clamp securely in position. Attach and tighten the drive extension of the test fixture to the drive shaft of the filter.

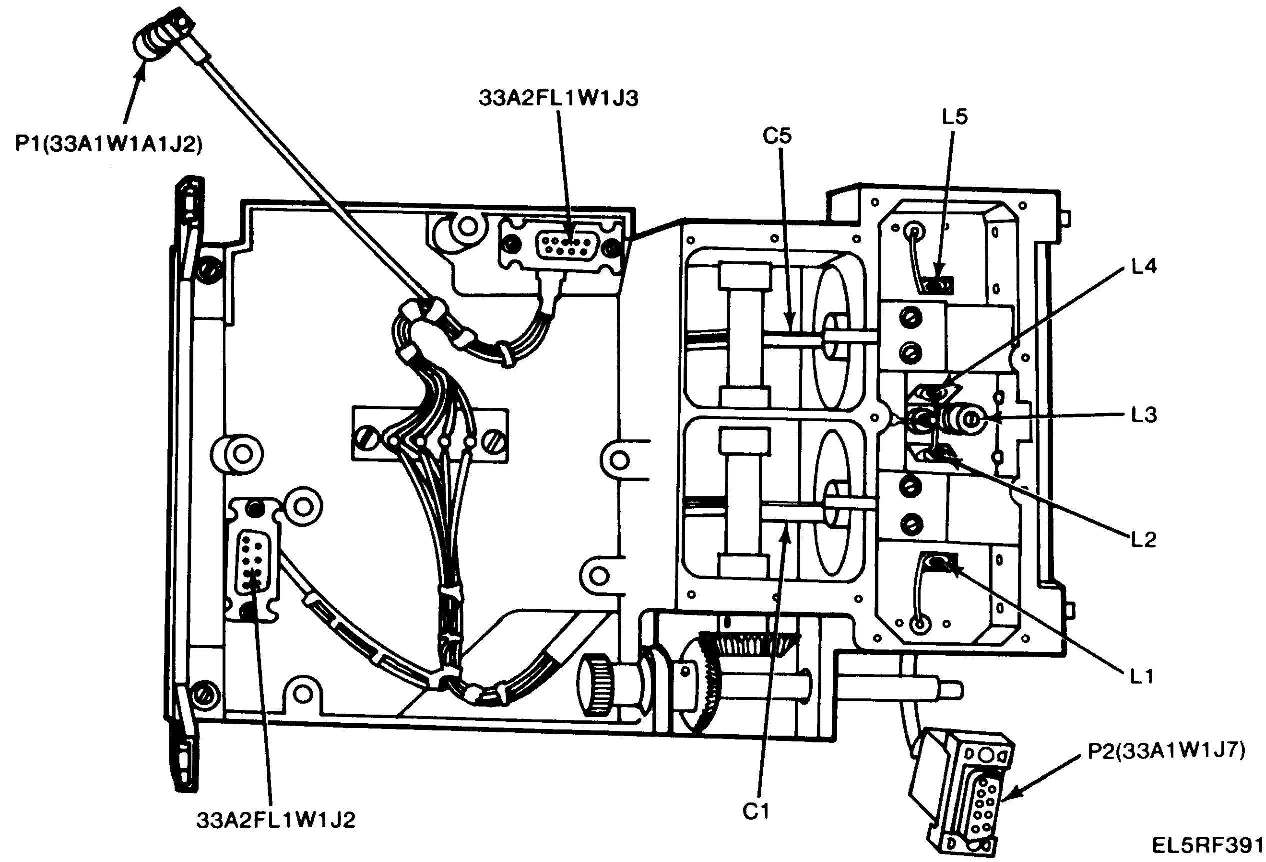


Figure 4-87. BandPass Filter 33A2FLI, Top View, Cover Removed.

(2) Remove the filter cover plate and visually check that the ganged capacitors C1 and C5 are in alinement with each other and that the vanes are parallel (fig. 4-87).

(3) Connect the test equipment as in A, figure 4-88. Turn on the test equipment.

(4) Set the sweep generator output attenuators to 0 dB, and adjust the frequency and level controls for a maximum leveled output over the frequency range of 425 to 737 MHz. Calibrate the oscilloscope to display this output on the graticule at a convenient level (6 divisions or more).

(5) Connect the test equipment as in B, figure 4-88.

(6) Set the sweep generator center frequency to 737 MHz with a sweepwidth of approximately 15 MHz (use markers).

(7) Slacken the test fixture knurled locking screw. Rotate the center knob to adjust Cl and C5 (fig. 4-87) for a peak response at 737 MHz as viewed on the oscilloscope.

(8) Add 3 dB of attenuation to the sweep generator output attenuator. Mark the nominal —3 dB reference level on the graticule of the oscilloscope (fig. 4-86).

(9) Remove the 3 dB attenuation.

(10) Adjust L5 and L1 (fig. 4-87) for a 3 dB bandwidth of at least 5.0 MHz, using the sweep generator markers.

NOTE

The optimum condition is a 3 dB bandwidth of 5.0 MHz minimum at all frequencies.

(11) For a final adjustment, with the test equipment still connected as in B, figure 4-88, set the sweep generator center frequency to 737 MHz and rotate the test fixture center knob to adjust C1 and C5 for a peak response at 737 MHz.

(12) Bend the first vane of the capacitor rotor vanes which are meshed with the stator vanes to achieve the best tracking results.

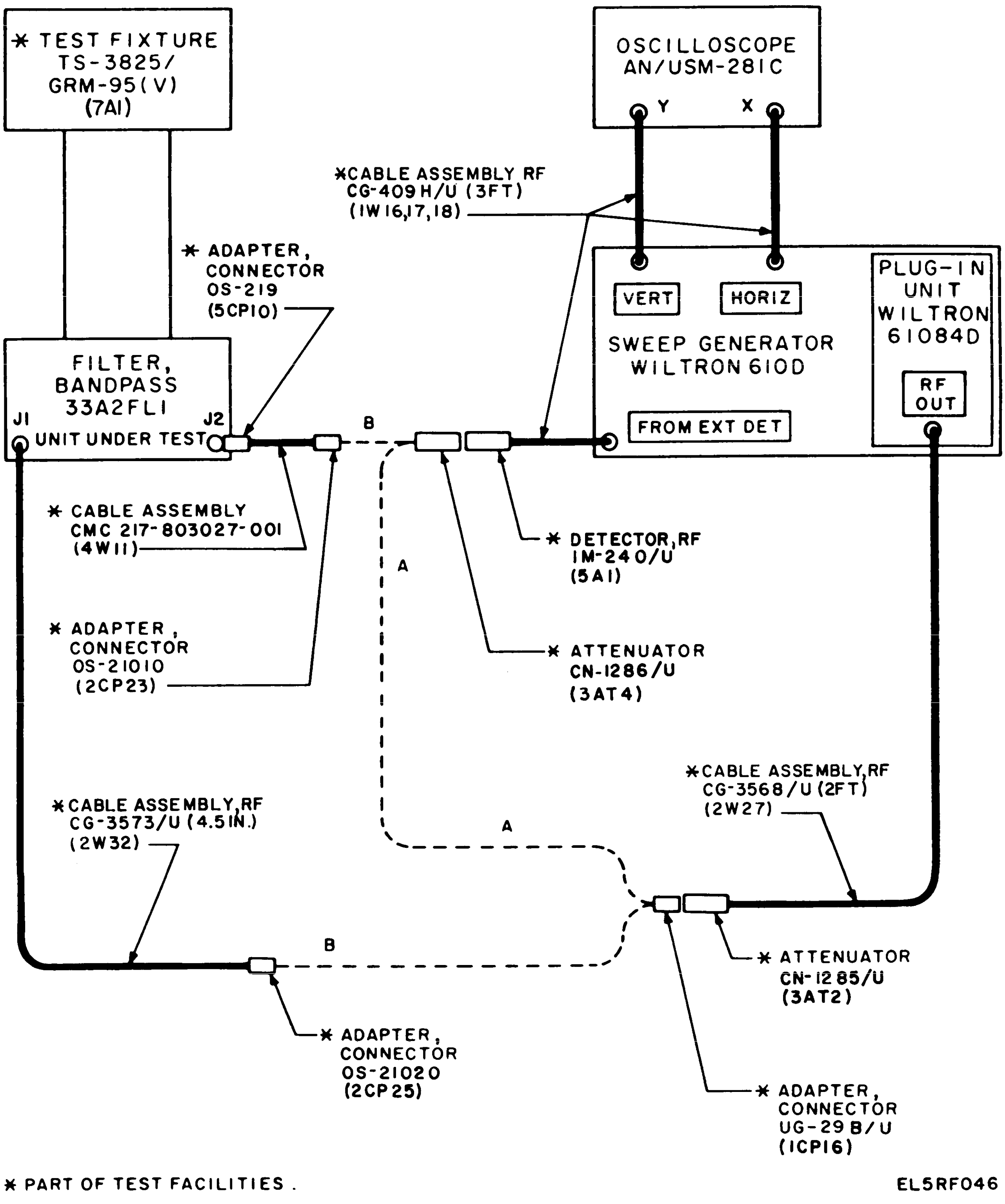


Figure 4-88. Bandpass Filter 33A2FL1, Alinement Procedure, Test Setup.

NOTE

In conjunction with the procedures below, C1 and C5 capacitor rotor vanes should be adjusted to achieve a response similar to the waveform display shown in figure 4-86. The response should be smooth over its passband (not significantly over- or under-coupled). The response should also be relatively symmetrical about its center frequency, which should correspond to the sweep generator center frequency setting listed below for the test fixture index being adjusted.

(13) Adjust L2, L3 and L4 to flatten the response and acquire a 3 dB bandwidth of 5 to 12 MHz.

(14) Set the dial on the test fixture to 735, and securely lock the center knob so that the indexed dial moves with the drive shaft of the unit under test.

(15) Rotate the test fixture dial clockwise until the displayed response moves off of the graticule of the oscilloscope and then return the dial to the 735 index detent. The unit under test response display should be centered on 737 MHz ±1.5 MHz. If necessary, unlock the center knob and repeat steps (11), (14) and (15) until this requirement is met.

NOTE

For each test fixture setting, turn the test fixture dial clockwise past the setting and then counterclockwise to the required setting.

(16) Set the sweep generator center frequency to 662 MHz, position the test fixture to index 662, and bend the second vane of the capacitor vanes for the best response.

NOTE

Return to the previous frequency (steps (14) and (15) above) and check the response. Adjust the capacitor vanes to obtain the best response.

(17) Repeat (16) above for the frequencies and index positions listed below. Bend the capacitor vane indicated for the best response centered at the indicated frequency.

Sweep gen center freq (cover open)	Test fixture index	Capacitor vane adjustment
737	735	First
662	662	Second
604	605.7	Third
559	561	Fourth
522	523.9	Fifth
491	492.6	Sixth
466	467.3	Seventh
444	445.6	Eighth
424	425	Ninth

(18) At index 425, establish that the 3 dB bandwidth is between 5 and 12 MHz.

(19) If necessary, readjust L2, L3, and L4 to meet the 3 dB bandwidth requirement. If L2, L3, and L4 are readjusted, recheck the 3 dB bandwidth at 737 MHz.

(20) Replace the cover on the unit under test.

(21) Repeat the checks in paragraph *b.* above.

4-29. Rf Power Monitor 33A3

The rf Power Monitor is not repairable and is tested as part of the overall band II receiver rf head AM-4317 in paragraph 4-19.

4-30. Control-Indicator 33A4 or 34A4

Control-indicator 33A4 is physically and electrically identical to control-indicator 37A2. Refer to paragraph 4-38 for testing and troubleshooting. Control-indicator 34A4 is electrically and physically identical to control-indicator 38A2. Refer to paragraph 4-63 for testing, troubleshooting, and alinement procedures. Use the channel numbers listed in the (33/34A4) channel No. column of the lamp display coding chart.

4-31. Signal Level Control-Monitor 33A5 or 34A5

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Receiver, TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Seeep Generator,Wiltron 610D (with Plug-in Unit, Wiltron 61084D)	Sweep generator
Element, Wattmeter, BIRD Model 50D	200-500 MHz element
Element Wattmeter, BIRD Model 50E	500-1000 MHz element
Generator, Signal, HP-8640B w/OPT 001,002,003	Signal generator
Indicator, Standing Wave Ratio, AN/USM-261	VSWR indicator
Multimeter, Digital, AN/USM-451	Digital multimeter

Equipment	*Common name*
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Voltmeter, Electronic, ME-426/U	Rf voltmeter
Oscilloscope, AN/USM-28lC	Oscilloscope
Wattmeter, AN/USM-298	Wattmeter
Drive Generator, Airborne Instruments Labs, Type 125	Power signal source
Frequency Counter, TD-1225(V) l/U	Frequency counter

b. Test Procedure.

(1) *Alarm level setting.*

(a) Connect the test equipment as shown in A, figure 4-89.

(b) Set the signal generator frequency to 650 MHz. Set the variable attenuator to 1 dB and adjust the signal generator output level to +10 dBm as indicated on the power meter. Note the signal generator panel meter indication.

(c) Connect the test equipment as shown in B, figure 4-89.

(d) Set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S6	REFL PWR

(e) If necessary, adjust R3 of the unit under test, so that the HIGH SIGNAL ALARM lamp on the receiver test facility is off.

(f) Readjust R3 of the unit under test so that the HIGH SIGNAL ALARM lamp just comes on.

(g) Increase the variable attenuator to 10 dB and if necessary decrease the signal generator output level with the OUTPUT LEVEL vernier control (do not use step attenuators) until the HIGH SIGNAL ALARM lamp just extinguishes. The signal generator panel meter indication should not have decreased more than 11 dB below the level noted in *(b)* above.

(h) Reset the variable attenuator and signal generator OUTPUT LEVEL vernier control for +10 dBm as noted in *(b)* above. The HIGH SIGNAL lamp should light.

(i) If the requirements of *(g)* and *(h)* are not met, readjust R3 until requirements are met.

(j) Repeat *(a)* through *(c)* and *(g)* through *(i)* above for frequencies of 450 and 900 MHz.

(k) If R3 was adjusted in *(j)* above, repeat above procedures until requirements are met at all test frequencies.

(2) *Input VSWR check.*

(a) Connect the test equipment as in A, figure 4-90.

(b) Set receiver test facility switch S1 to ON and S6 to REFL PWR.

(c) Set the sweep generator to deliver –20 dBm output power at 395 MHz.

(d) Set the sweep generator FREQ SELECTOR switch to F1 TO F2, and obtain a sweep over the range of 395 to 1000 MHz using the internal markers.

(e) Connect the 1.3:1 calibrated mismatch to the UNKNOWN port of the VSWR bridge (B, fig. 4-90).

(f) Calibrate the oscilloscope for a VSWR of 1.3:1 over the frequency range of 395 to 1000 MHz.

(g) Connect the test equipment as in C, figure 4-90.

(h) The VSWR of the unit under test should not exceed 1.3:1 over the frequency range of 395 to 1000 MHz.

(i) If the VSWR requirements in paragraph *(h)* are not met, proceed as described in paragraphs *(j)* and *(k)* below.

(j) Short the capacitance pads (fig. 4-94) to the main through-line, one at a time, while observing the VSWR response. Solder a short piece of hook-up wire between the through-line and the pad(s) which produces the greatest improvement in the VSWR response.

(k) Repeat paragraph *(j)* until the requirements of paragraph *(h)* are met.

(3) *Insertion loss* check.

(a) Connect the equipment as in A, figure 4-91.

(b) Set the signal generator to indicate approximately 1000 MHz on the dial. Set output level to —10 dBm.

(c) Set the signal generator MOD. SELECTOR switch to 1000, and adjust the MOD LEVEL control for 30 percent modulation on the signal generator meter.

(d) Set the variable attenuator to 4.0 dB.

(e) Adjust the VSWR indicator for a convenient indication, and note the reading.

(f) Connect the equipment as in B, figure 4-91.

(g) Adjust the variable attenuator to obtain the same indication as noted in *(e)* above. The difference between this attenuator setting and 4.0 dB is the insertion loss. It should not exceed 0.8 dB.

(4) *Isolation check.*

(a) Connect the test equipment as in A, figure 4-92.

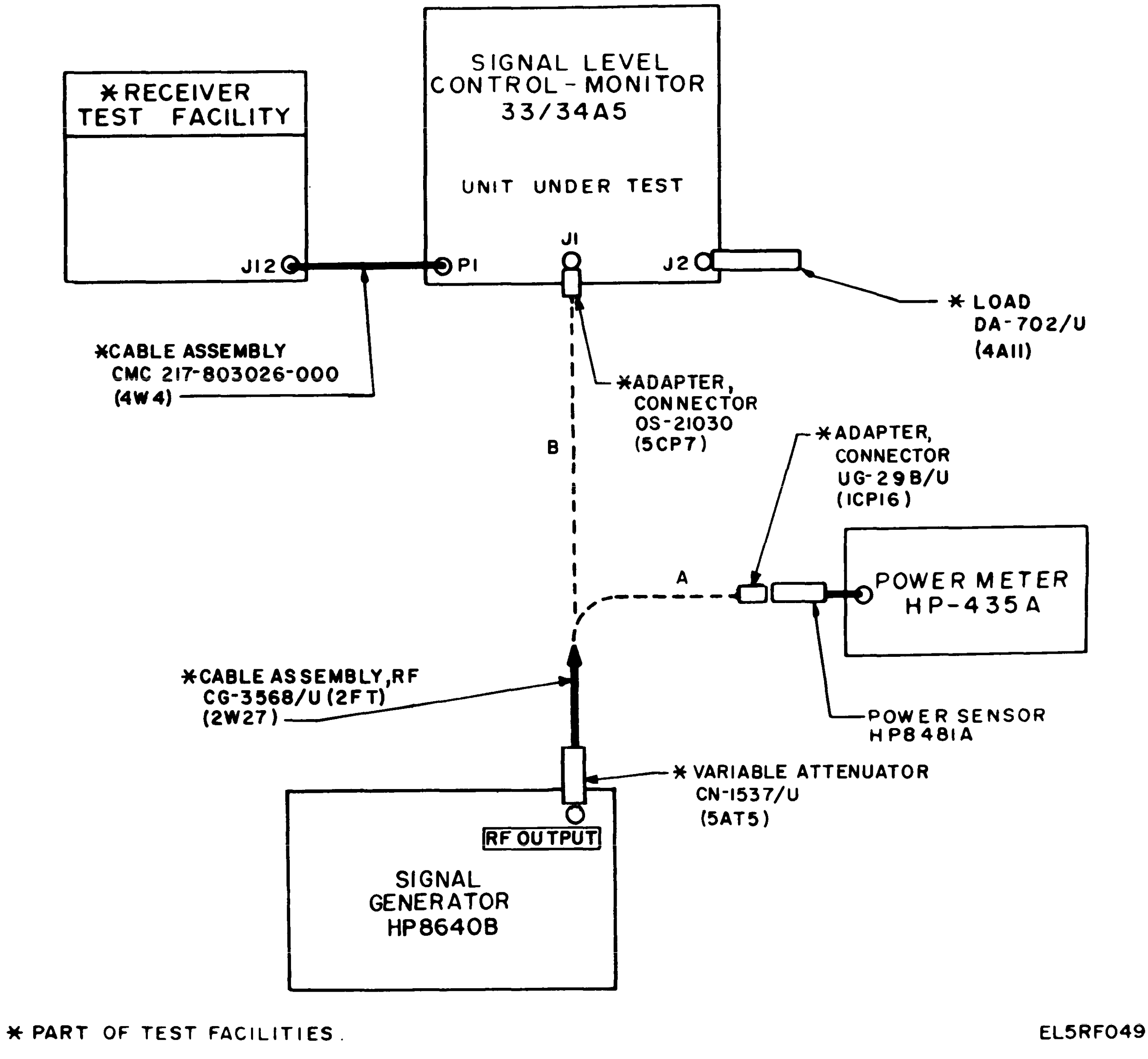


Figure 4-89. Signal Level Control-Monitor 33A5 or 34A5, Alarm Level Setting, Test Setup.

(b) Set receiver test facility switch Sl to ON and S6 to REFL PWR.

(c) Set the power signal source controls as follows:

Control	*Setting*
FREQ RANGE	MID
MODULATION	Cw
RF OUTPUT ATTENUATOR	Maximum counterclockwise

(d) Turn on the power signal source, and wait for the POWER lamp to light.

(e) The power signal source is ready to operate when the POWER lamp is on.

(f) From the frequency card on the power signal source front panel, set the corresponding PLATE and CATHODE counters to 395 MHz on the middle range.

(g) Adjust the RF OUTPUT ATTENUATOR for an indication of 35 watts on the wattmeter.

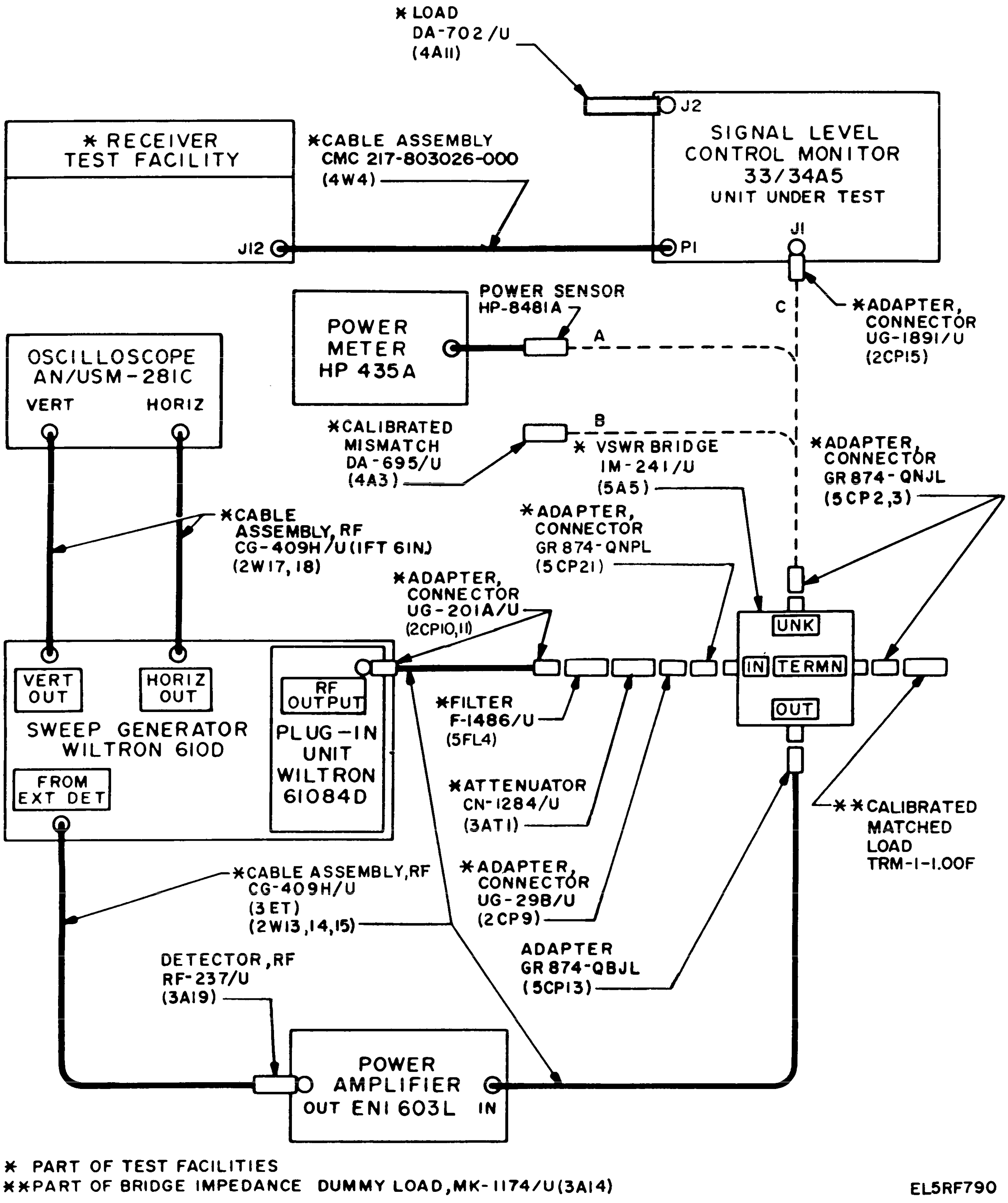


Figure 4-90. Signal Level Control-Monitor 33A5 or 34A5, Input VSWR Check, Test Setup.

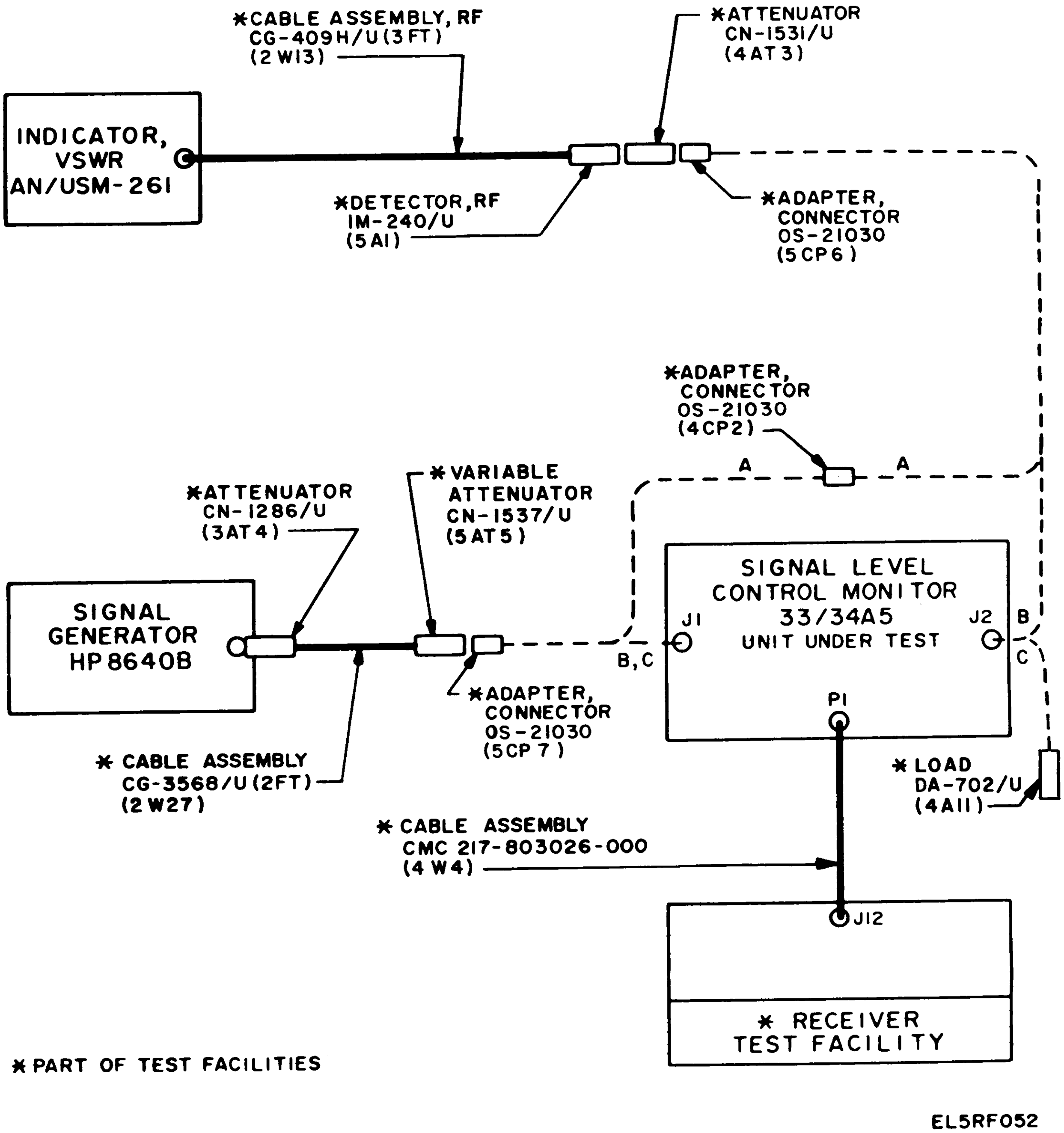


Figure 4-91. Signal Level Control-Monitor 33A5 or 34A5, Insertion Loss Check, Test Setup.

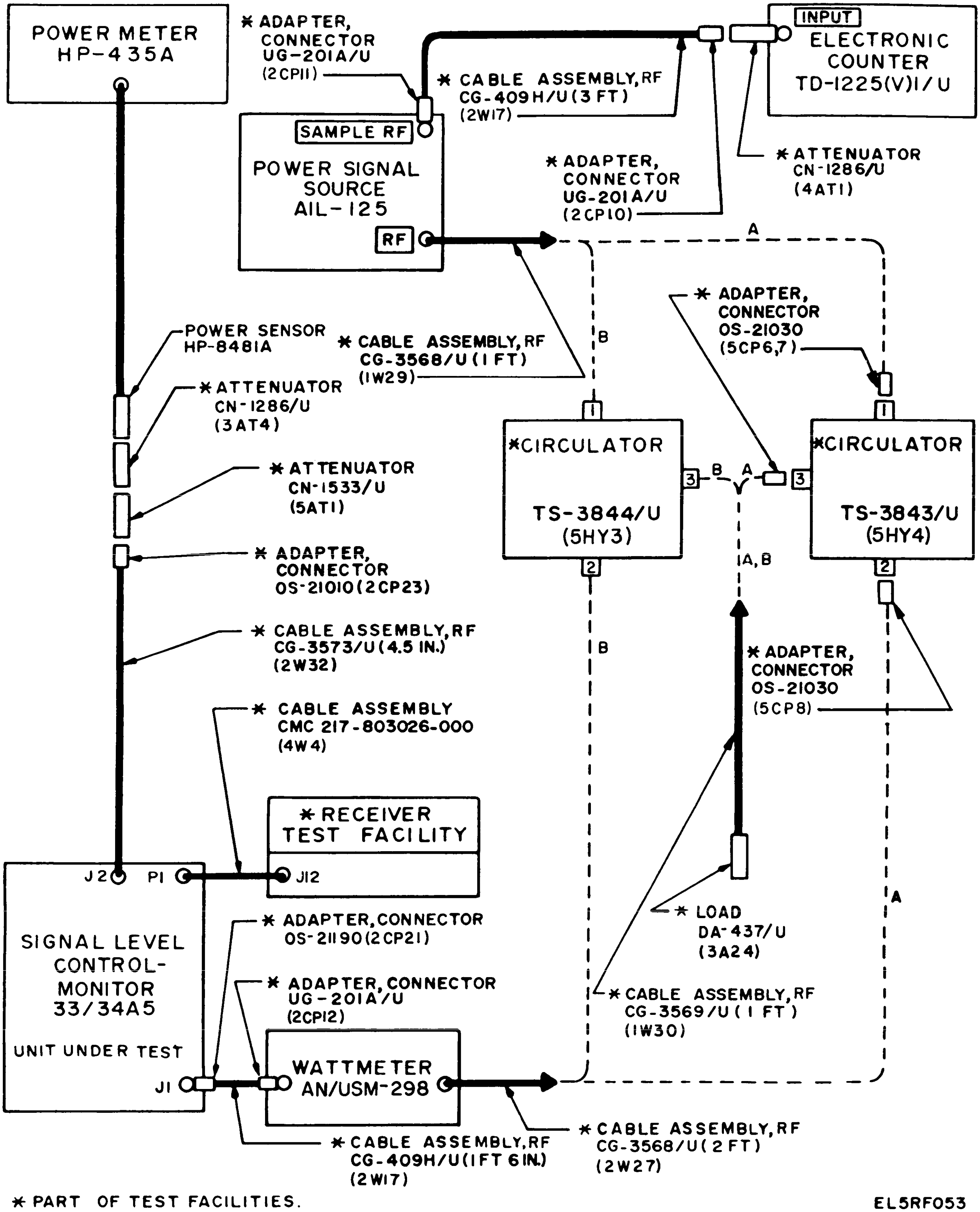


Figure 4-92. Signal Level Control-Monitor 33A5 or 34A5, Isolation Check, Test Setup.

(h) Monitor the frequency counter reading. If necessary, adjust the PLATE and CATHODE counters slightly, to obtain a nominal output frequency of 395 MHz.

NOTE

Adjustment of the PLATE and CATHODE tuning controls and the RF OUTPUT ATTENUATOR should provide the +45.5 dBm (35 w) output at the desired frequency.

(i) The power level at the output of the unit under test should not exceed 50 milliwatts (+17 dBm), a maximum power meter indication of – 13 dBm.

(j) Connect the test equipment as in B, figure 4-92.

(k) Repeat *(b)* through *(i)* above for power signal source frequencies of 700 and 1000 MHz nominal.

c. Troubleshooting (FO-38).

Symptom	*Check and corrective measures*
1. High signal alarm lamp does not light	*a.* Check the rf signal level at the junction of 33/34A5CRl (fig. 4-93) and Al of 33/34A5Al (fig. 4-94) using the allocated rf voltmeter to ascertain that signal is present to "switch on" the alarm control subassembly. This level should be 0.4 Volts rms. Check components. and replace 33/34A5Al if required. *b.* Check the voltage on transistors (fig. 4-95) as established in d below. Investigate any abnormal indication. Replace 33/34A5A2 if required. *c.* If Q1 dc base voltage requirement is not met check for defective pin 33/34A5CRl (fig. 4-93) and/or rf limiter Al of 33/34A5A1 (fig. 4-94). Replace 33/34 A5CRl or 33/34A5A1 if required.
2. High VSWR.	Check the wiring and components in the rf path from Jl to J2. Rf limiter 33A5A1Al is probable cause; replace 33134A5AI if required.
3. High insertion loss and/ or poor isolation.	Check the wiring and components in the rf path from Jl to J2. CR1, CR2, CR3 or Al suspected; replace 33/ 34A5A1 if required.

d. Voltage and Resistance Measurements (fig. 4-95).

NOTE

Use the allocated digital multimeter for voltage measurements.

(1) *Dc voltage measurements referenced to ground* (+10 dBm input level to unit under test).

Test points		*Typical indication (volts dc)*	
		Alarm on	*Alarm off*
33/34A5A2Ql	– base	–0.3	0.1
	– emitter	+0.25	+ 0.2
	– collector	–0.08	+12.0
33134A5A2Q3	– base	–0.1	–12.0
	– emitter	–0.66	–12.0
	– collector	–0.6	+25.9
33134A5A2Q3	– base	–0.57	+25.9
	– collector	+0.08	+0.01

(2) *Resistance measurements.*

NOTE

All resistances measured with the allocated digital multimeter.

Transistor		*Base (–)*				*Base (+)*			
		Emitter (+)		*Collector (+)*		*Emitter (–)*		*Collector (–)*	
Ref	*Type*	*Res (ohms)*	*Mulimeter range*	*Res (ohms)*	*Mulimeter range*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*
Q1	2N2907	lk	2k	lk	2k	600k	20M	Infinity	20M
Q2	2N2222A	120k	200k	Infinity	20M	840k	2k	810	2k
Q3	2N2907	Ik	2k	Ik	2k	100k	200k	Infinity	20M

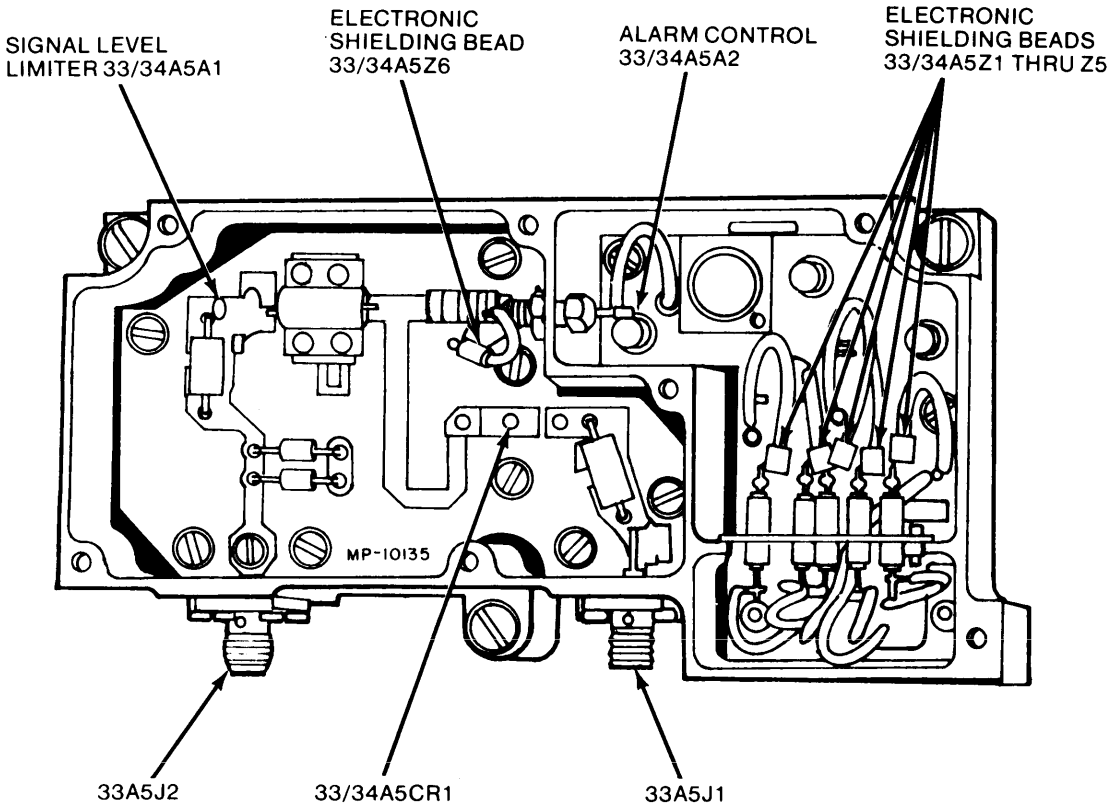


Figure 4-93. Signal Level Control-Monitor 33A5 or 34A5, Top View, Cover Removed.

4-32. Control Panel 33A6 or 34A6

This is the front panel of the receiver rf head. Power from the transmitter passes through the panel at the FROM XMTR connector into the transmit portion of the duplexer. Transmitted power to the antenna, and receiver power from the antenna, passes through the panel at the ANT. connector. Control-indicator 33A4 or 34A4 is mounted on the panel. No testing is required.

4-33. Frequency Mixer Stage 33A7

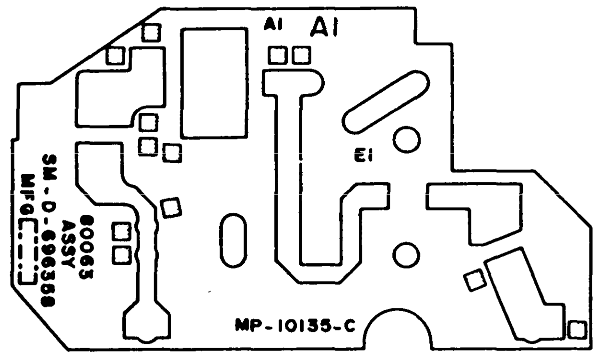
NOTE

There are two variations of mixer 33A7, SM-D-696296 (new) and SM-D-696335 (old). See paragraph *d.* below for SM-D-696335 test procedures.

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Receiver, TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Modules, TS-3837(V)2/GRM-95(V)2	Test facility radio frequency modules
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator, Wiltron 610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Oscilloscope, AN/USM-281C	Oscilloscope
Generator, Signal, HP-8640B	Signal generator
Generator, Thermal Noise, HP-346B, Option 1	Noise generator
Unit IF. Amplifier, AM-4822/U	Unit if. amplifier
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Power Supply, HP-6002A	Power supply
Voltmeter, RF, ME-426/U	Rf voltmeter
Frequency Counter, TD-1225(V)l/U	Frequency counter
RF Power AmplMer, EN1 603L	Power amplifier
Receiver, RF Head, AM-4317/GRC-103(V)	Receiver rf head

(See paragraph *d.(1)(a)* below; used with mixer SM-D-696335 only.)



12 CAPACITANCE PADS SHOWN THUS □

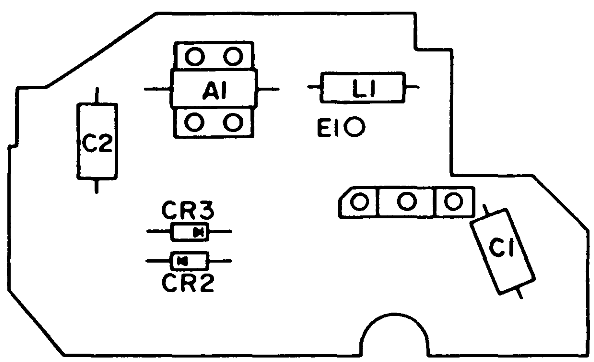


Figure 4-94. Signal *Level Limiter 33A5A1 or 34A5A1, Parts Location and Capacitance Pads Position.*

b. Test Procedures (Mixer SM-D-696296).

(1) *Rf input VSWR and local oscillator level metering checks.*

(a) Connect the test equipment as in A, figure 4-96 with power amplifier set to OFF.

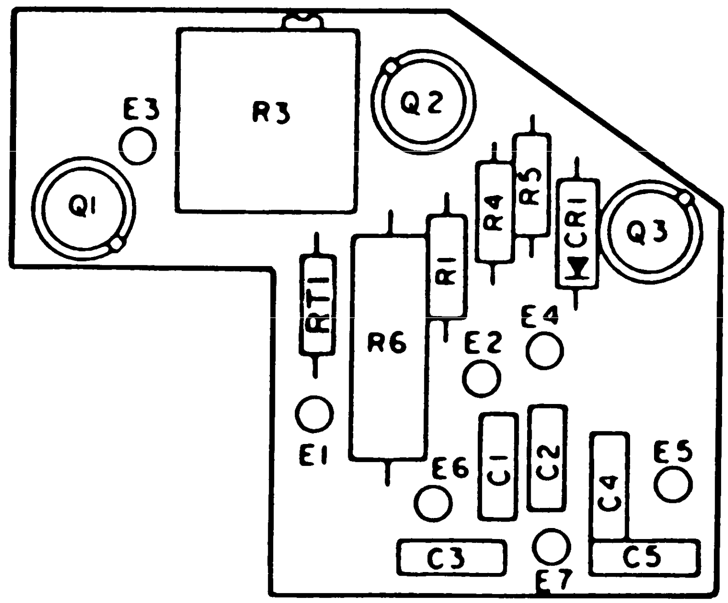
(b) Set power supply PP-6304/GRM-95 to 115 Vac and the receiver test facility switches as follows:

Control	*Position*
S1	ON
S6	MULTIPLIER
S5	S6

(c) Set switch S7 (rf modules test facility) to NORMAL.

(d) Adjust the sweep generator to sweep between 395 and 705 MHz. Temporarily set the SWEEP MODE control to MANUAL, adjust the manual frequency control to midrange and adjust the sweep generator output for a 0 dBm indication on the power meter. Decrease the sweep generator output level by 40 dB.

(e) Connect the equipment as shown in B, figure 4-96. Reset the SWEEP MODE control to AUTO and set the power amplifier to ON.



EL5RF394

Figure 4-95. Alarm Control 33A5A2 or 34A5A2, Parts Location.

(f) Calibrate the oscilloscope for a convenient display of the 2:1 VSWR reference. Note this reference.

(g) Connect the equipment as shown in C, figure 4-96. The VSWR of the unit under test shall be less than the 2:1 reference noted in *(f)* above.

(h) Connect the test equipment as in D, figure 4-96.

(i) Adjust signal generator to 425 MHz CW and the output level for a +6 dBm indication on the power meter.

(j) Set switch S7 (rf modules test facility) to MULT METER 1.

(k) Connect the test equipment as in E, figure 4-96.

(l) Meter Ml on the receiver test facility should read greater than 20 percent.

(m) Repeat *(h)* through *(l)* above at signal generator frequencies of 580 and 735 MHz.

(2) *Conversion gain and image rejection test.*

(a) Connect the equipment as shown in A, figure 4-97.

(b) Set receiver test facility switch S1 to ON and S6 to MULTIPLIER and set power supply PP-6304/GRM-95 to 115 Vac.

(c) Set switch S7 (rf modules test facility) to NORMAL.

(d) Set the sweep generator FREQ SELECTOR control to CW F1 and frequency control F1 to 395 MHz on the dial.

(e) Adjust the sweep generator controls for an output of – 10 dBm as indicated on the power meter at a frequency of 395 MHz on the frequency counter.

(f) Set signal generator 30 MHz higher than the sweep generator in *(e)* above (425 MHz).

(g) Connect the power meter as in B, figure 4-97, using lowpass filter F-1494/U.

(h) Adjust the output level of signal generator for a +7 dBm indication on the power meter.

(i) Connect the test equipment as in C, figure 4-97.

(j) Note the rf voltmeter indication. Subtract this indication from –40 dBm (the rf input at J1 of the unit under test). The result is the conversion gain, which should be 14 dB (±4 dB).

(k) Connect the test equipment as in A, figure 4-97.

(l) Set the sweep generator 60 MHz higher than in *(d)* above (455 MHz),

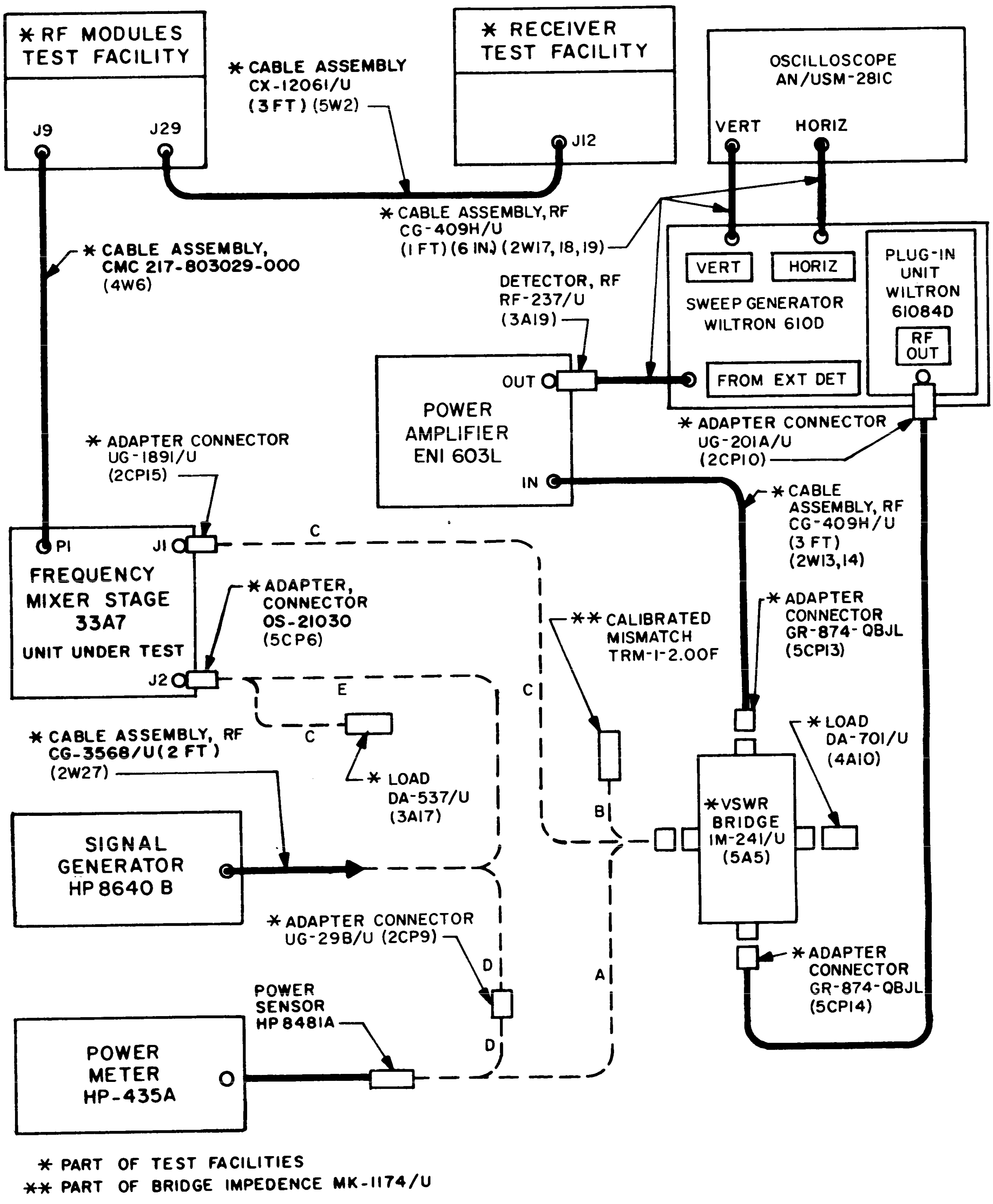


Figure 4-96. Frequency Mixer Stage 33A7, Rf Input VSWR and Local Oscillator Level Metering Check, Test Setup.

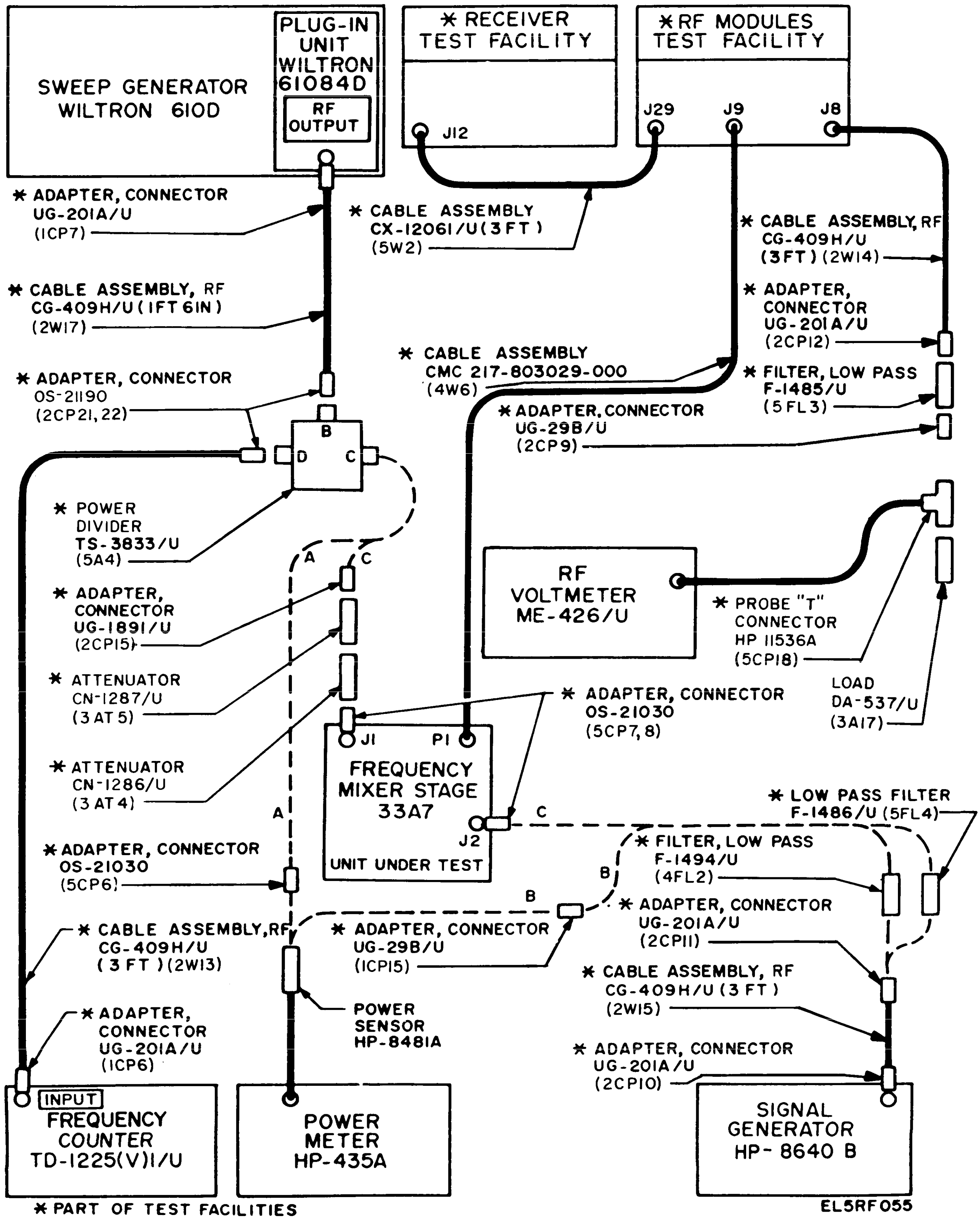


Figure 4-97. Frequency Mixer Stage 33A7, Conversion Gain and Image Rejection Check, Test Setup.

(m) Adjust the output level for a –10 dBm indication on the power meter. Reconnect the equipment as in C, figure 4-97.

(n) Note the rf voltmeter indication in dBm. Subtract this indication from the one noted in *(j)* above to obtain the image rejection. The result should be 15 dB minimum.

(o) Repeat *(d)* to *(n)* above, starting with a sweep generator frequency of 550 MHz.

(p) Substitute lowpass filter F-1486/U for low pass falter F-1494/U. Repeat *(d)* to *(n)* above, starting with a sweep generator frequency of 705 MHz.

(3) Noise figure check.

CAUTION

The noise generator power. supply should be set to 28 volts and then turned OFF until called for in the following procedures.

(a) Connect the test equipment as in A, figure 4-98 and set power supply PP-6304/GRM-95(V) to 115 vat.

(b) Set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S6	MULTIPLIER

(c) Set the switches on the rf modules test facility as follows:

Switch	*Position*
S7	NORMAL
S12	ON

(d) Set signal generator to 425 MHz.

(e) Adjust the output level of signal generator for a +6 dBm indication on the power meter.

(f) Connect the equipment as in B, figure 4-98.

(g) Adjust the attenuation control on unit if. amplifier for a meter indication on the dB scale. Note this indication.

(h) Switch the noise generator power supply to ON.

(i) Note the indication on the unit if. amplifier. The change in dB's constitutes the Y-factor.

(j) Calculate the noise figure, using the Y-factor obtained in *(i)* above and referring to figure 4-99. Use the reference noise source output from the noise source calibration label at the rf input frequency.

NOTE

The attenuation versus frequency data stamped on the 6 dB calibrated attenuator connected to the noise generator should be used in calculating the noise figure.

(k) Subtract the attenuation at J1 from this noise figure. The result is the true noise figure, and should not exceed 4.5 dB.

(l) Substitute falter F-1486/U for filter F-1494/U.

(m) Repeat *(a)* through *(k)* above for signal generator frequencies of 600 to 735 MHz.

c. Troubleshooting (FO-39) (SM-D-696296).

Symptom	*Probable cause*	*Checks and corrective measures*
1. No 30 MHz if. output (b.(2) above).	*a.* Faulty rf amplifier 33A7A 1 AR 1 (fig. 4- 100).	*a.* Check rf amplifier input VSWR *(b(l)* above). If outside limits, replace faulty 33A7A1AR1.
	b. Faulty local oscillator input circuits.	*b.* Check local oscillator input VSWR; if higher than 3.0:1, check for broken connection in the rigid cable. Replace faulty I/C monitor-power 33A7A1A1.
	c. Broken wires, unsoldered joints, loose connections.	*c.* Visually check for open connections.
	d. Both balanced mixers faulty.	*d.* Replace both balanced mixers 33A7A1A2 and 33 A7AIA3.
2. Low conversion gain *(b.(2)* above).	One faulty balanced mixer.	Check image rejection *(b.* (2) above). If image level is high, check for faulty mixer as follows. Apply a ground to the junction of L1-A and C 1, while observing the 30 MHz output *(b. (2)(j)).* If a 5 to 6 dB drop in level is observed, 33A7A1A3 is faulty. If no drop in level is observed, than 33A7A1A2 is faulty. Apply a ground to the junction of L1-B and C2 and confirm the faulty mixer.

c. Troubleshooting. - Continued

Symptom	*Probable cause*	*Checks and corrective measures*
3. High noise figure across the band *(b.(2)* above.	Faulty rf amplifier 33A7A1AR1.	Replace faulty 33A7A1AR1 module.
4. No local oscillator metering voltage.	Faulty I/C monitor-power 33A7A1AR1.	Replace faulty 33A7A1A1 module.

d. Test Procedure (SM-D-696335).

NOTE

If mixer 33A7 (SM-D-696335 cannot be made serviceable by minor adjustment, replace with mixer 33A7 (SM-D-696296). When this change is made, power supply 33PS1 and voltage control assembly 33A1A2 are no longer used but may be retained as repair parts.

(1) Perform VSWR, metering, conversion gain and image rejection checks as described in paragraphs *b.* (1) and (2) above, except:

(a) Use the receiver rf head, in which the mixer 33A7 is to be installed, in place of the rf modules test facility. The if amplifier 33AR1 should meet the requirements of paragraph 4-34, voltage control 33A1A2 and power supply 33PS1 should meet the requirements of paragraph 4-19e. and *f.* ,respectively. See figure 4-101 for connection of rf head.

(b) Tune mixer, with rf head RCVR SIG control, for peak output for conversion gain and image rejection checks.

(c) Disregard rf modules test facility switch settings.

(d) Meter Ml indication *(b.(1)(l)* above) should read greater than 20 percent.

(e) Conversion gain *(b. (2)(j)* above) should be 8 dB ±3 dB.

(f) Image rejection *(b.(2)(n)* above) should be 10 dB minimum.

(2) *Noise figure check.*

(a) Set the power supply to 28 Vdc and then turn it OFF.

(b) Connect the equipment as shown in A, figure 4-102.

(c) Set receiver test facility switch S 1 to ON and switch S6 to MULTIPLIER and power supply PP-6304/GRM-95(V) for 115 Vac.

(d) Set the signal generator to 425 MHz at an output level of +6 dBm as indicated on the power meter.

(e) Connect the equipment as shown in B, figure 4-102.

(f) Set the sweep generator controls to a 0 dBm output level at a cw frequency 30 MHz below the signal generator frequency as indicated on the frequency counter. Note this frequency.

(g) Set the rf head RCVR SIG control to the channel indication corresponding to the sweep generator frequency using the formula: channel number = (frequency – 200 MHz) X 2.

(h) Adjust the RCVR SIG control to tune the mixer for a peak indication on the unit if amplifier (adjust the sweep generator output level and unit if amplifier controls as required to maintain an on-scale indication).

(i) Connect the equipment as shown in C, figure 4-102.

(j) Adjust the attenuation control on the unit if amplifier for a meter indication on the dB scale. Note this indication (including attenuator setting).

(k) Set the noise generator power supply to ON.

(l) Note the indication on the unit if amplifier (if necessary, readjust the attenuation control for an on-scale meter indication). The difference between this indication (including attenuator setting) and the indication noted in *(j)* above is the Y-factor.

(m) Determine the noise figure from the NOISE FIGURE graph (fig. 4-99) using the reference noise source level from the noise source calibration label at the frequency noted in *(f)* above.

(n) Subtract the calibrated attenuation of the attenuator connected to the noise source from the noise figure determined in *(m)* above. The result is the true noise figure and should not exceed 6.0 dB.

(o) Repeat steps *(a)* through *(n)* above at signal generator frequencies of 600 MHz and 735 MHz. Substitute lowpass filter F-1486/U for filter F-1494/U.

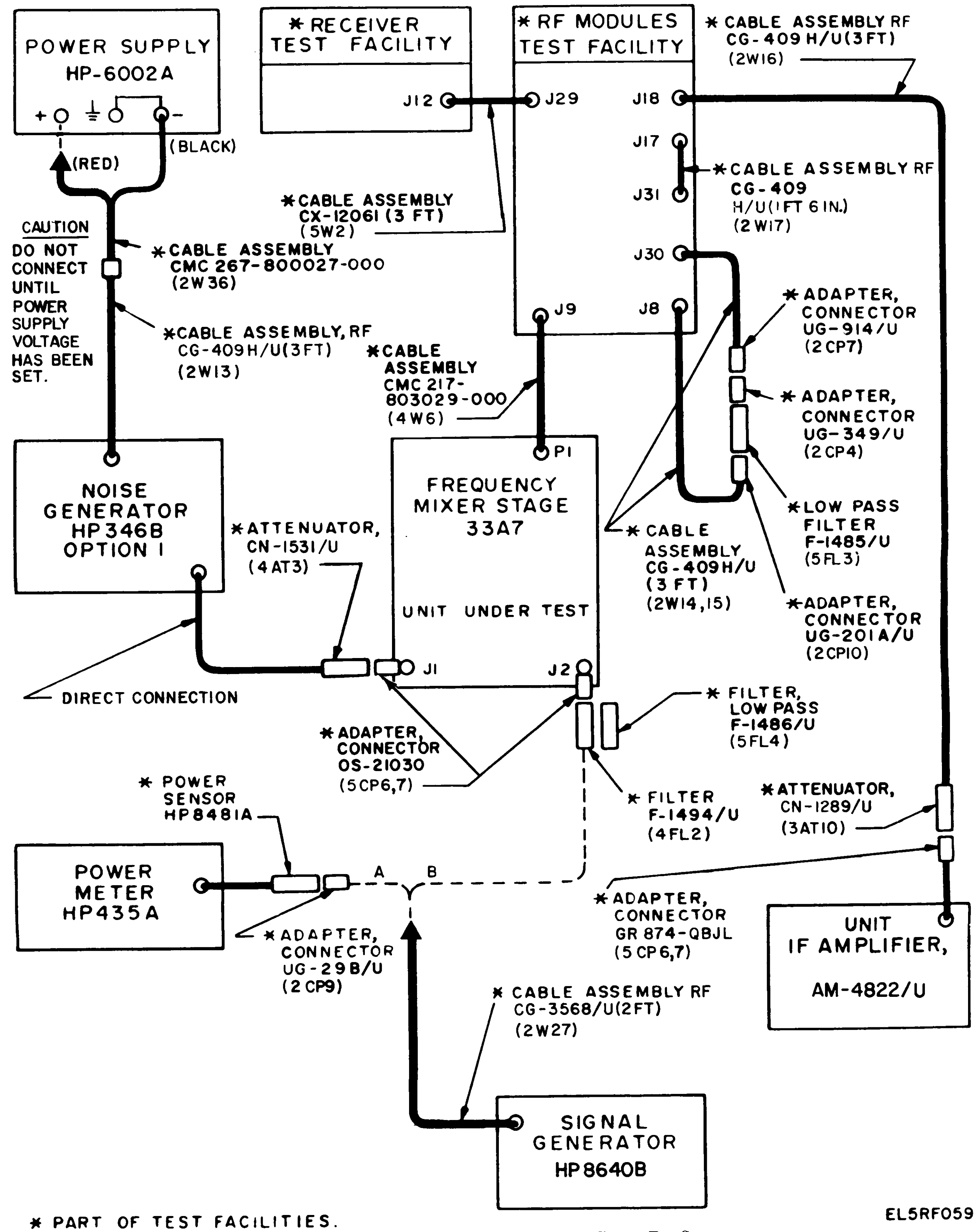


Figure 4-98. Frequency Mixer Stage 33A7, Noise Figure, Test Setup.

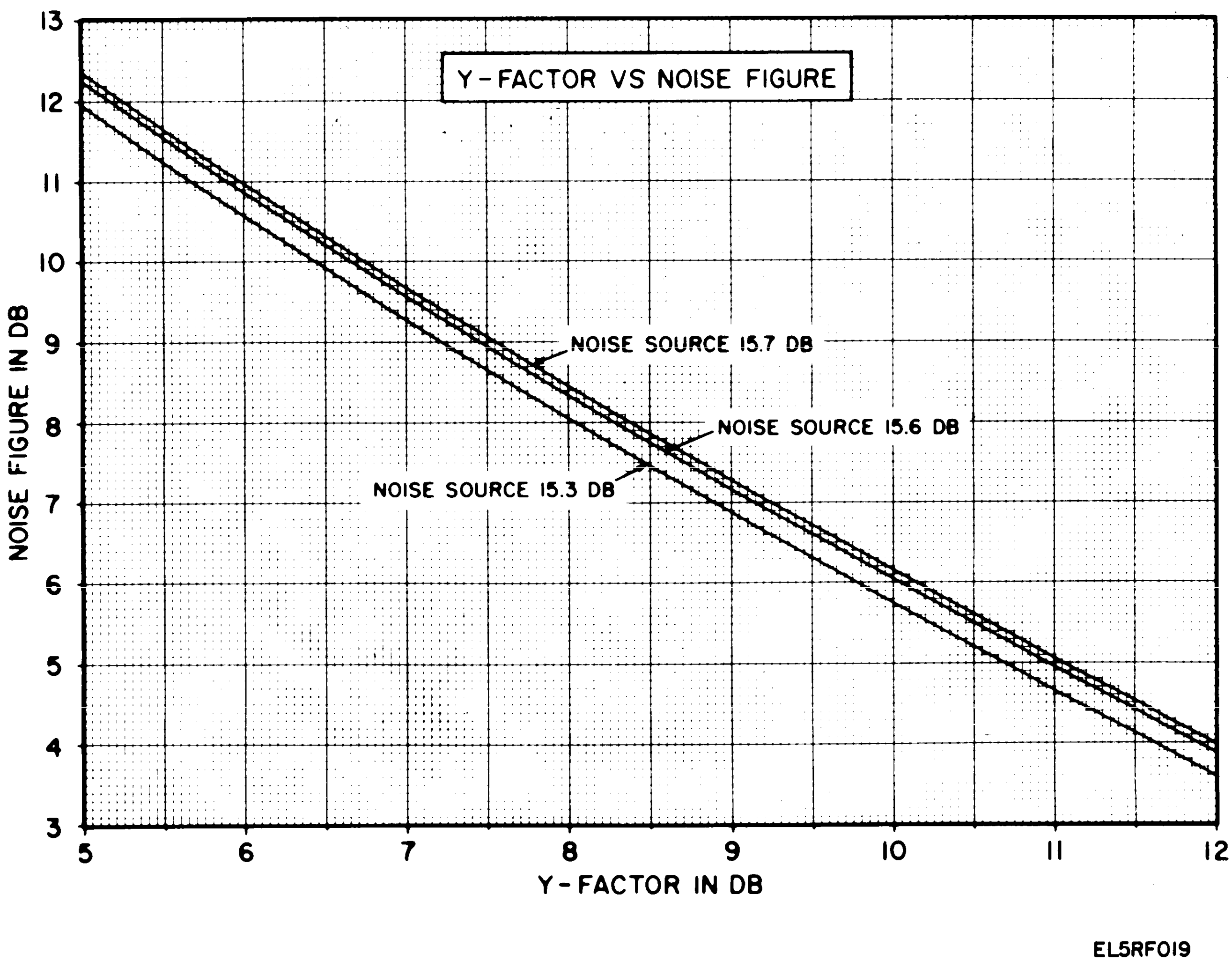


Figure 4-99. Noise Figure Chart, Y Factor Chart , Noise Figure Calculaion

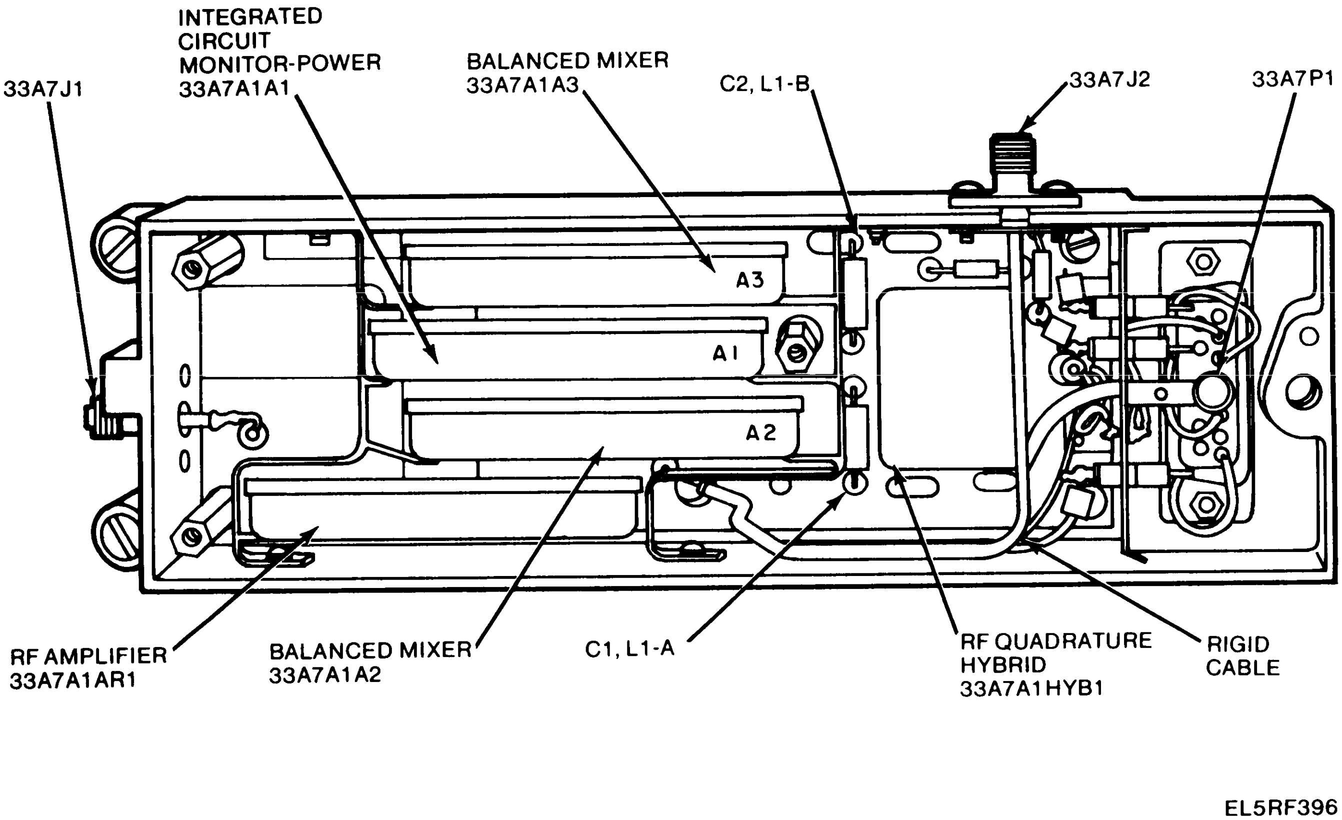


Figure 4-100. Frequency Mixer Stage 33A7 (SM-D-696296), With Cover Removed.

(3) Adjustment controls (fig.4-103).

Control	*Adjustment effects*	*Adjustment conditions*
33A7R1	Frequency tracking (low end)	Preset: set for 2.5 Vdc at terminal 3 of 33A1A2. Adjustment: adjust for peak output at 395 MHz input frequency with RCVR SIG at channel 390 and L.O. input at 425 MHz (interacts with R2).
33A7R2	Frequency tracking (high end)	Preset: 60 Vdc at terminal 1 of 33A1A2 (interacts with Rl). Adjustment adjust for peak output at 705 MHz input frequency with RCVR SIG at channel 1010 and L.O. input at 735 MHz.
33A7AR1C3	VSWR (overall)	Adjust during test.
33A7AR1C8	Gain (overall)	Adjust during test.
33A7AR1L12, L16	Bandpass, frequency and image rejection	Adjust at 705 MHz input and 735 L.O. input frequency with RCVR SIG at channel 1010.
33A7AR1L13, L14	Bandpass and frequency	Adjust in conjunction with L12 and L16.

4-34. Intermediate Frequency Amplifier 33AR1 or 34AR1 or 39AR2

NOTE

The following test applies equally to if amplifier 34AR1 and 39AR2. Prior to testing, remove the cover plate of the unit under test and install electrical shield plate CMC 656-800076-000 with the cover-plate screws. On completion of the final test, replace the cover plate.

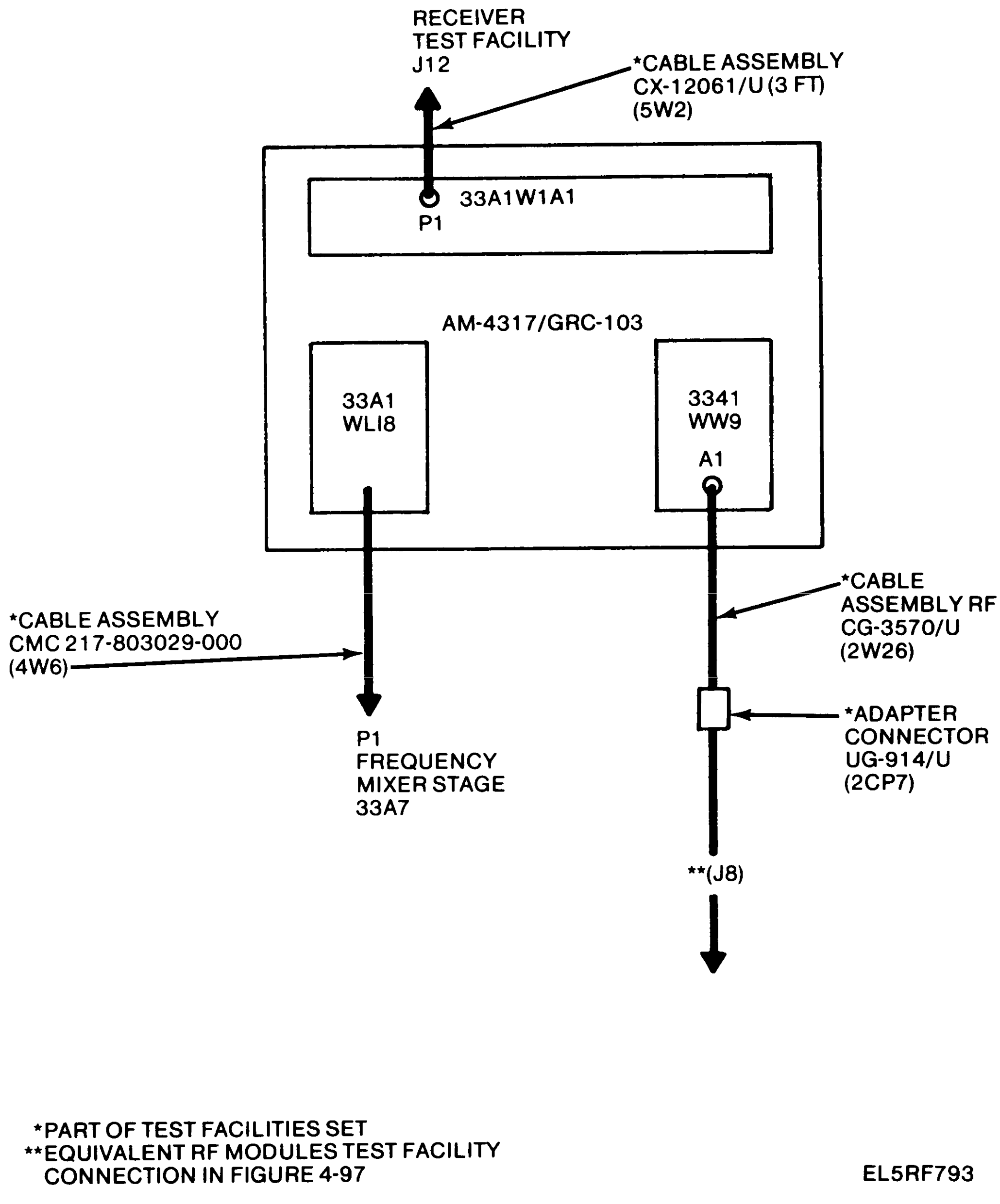


Figure 4-101. Equivalent Connections, AM-4317 Substituted for Rf Modules Test Facility.

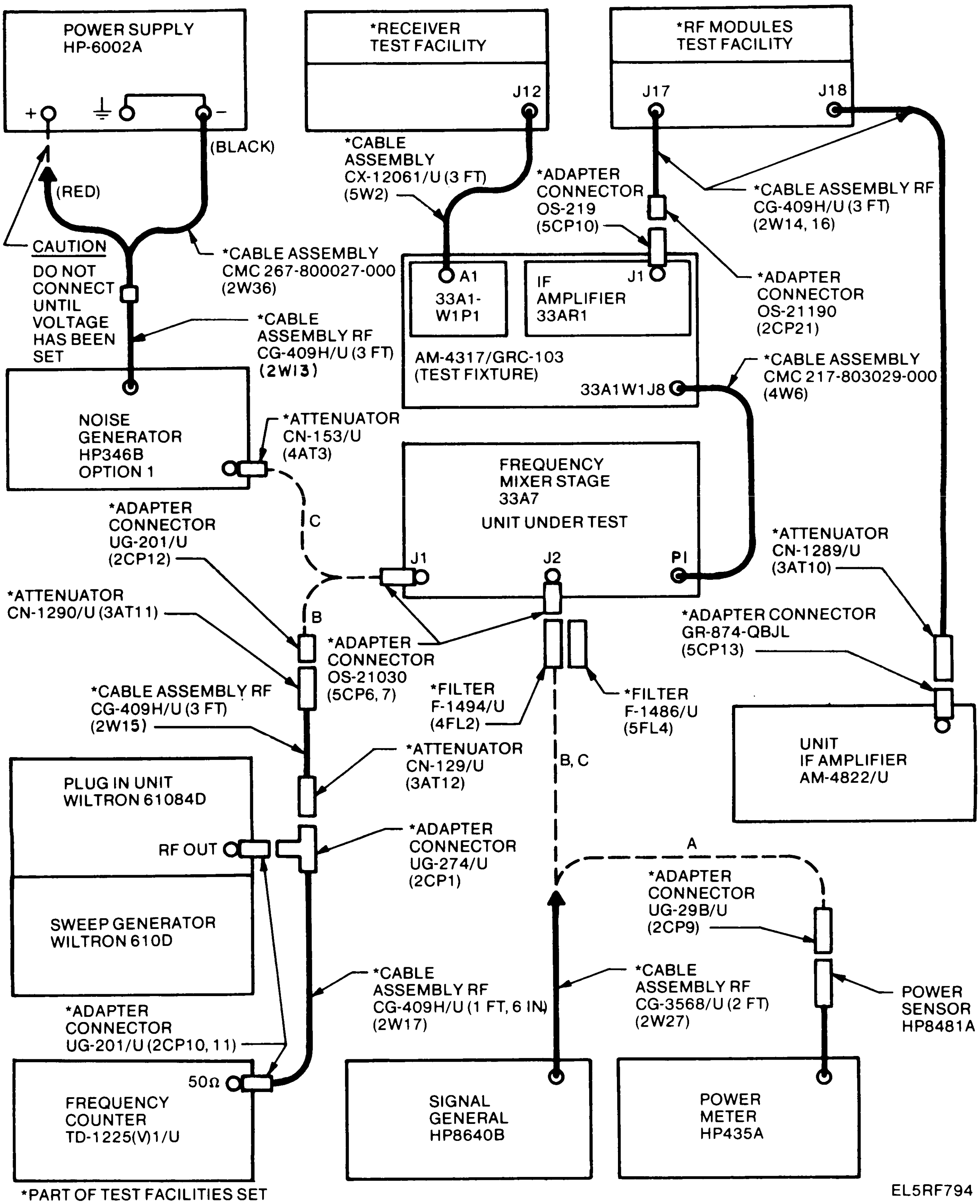


Figure 4-102. Frequency Mixer Stage 33A7, Noise Figure, Test Setup Using AM-4317/GRC-103 as Test Fixture.

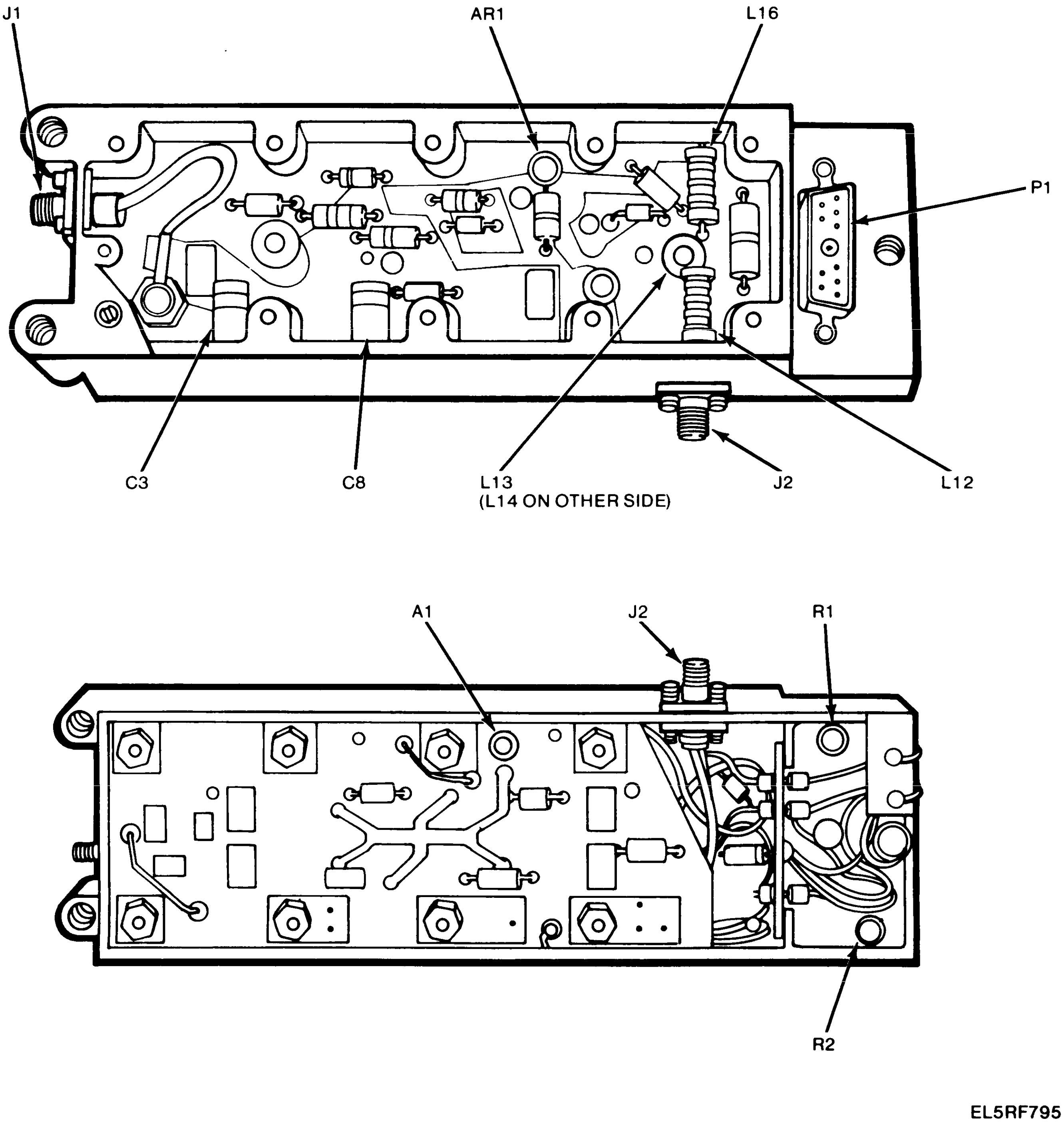


Figure 4-103. Mixer Stage 33A7 (SM-D-696335) Adjustment Control Locations.

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Receiver, TS-2867(V)2/ GRM-95(V)2	Test facility receiver
Acessory Kit, T,est Facilities Set, NK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Module, TS-3837(V)2/GRM-95(V)2	Test facility radio frequency module
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator, Wiltron 61OD with Plug-In Unit, Wiltron 61084D	Sweep generator
Oscilloscope, AN/USM-281 C	Oscilloscope
Generator, Thermal Noise, HP-346B, Option 1	Noise generator
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Multimeter, Digital,AN/USM-451	Multimeter
Power Supply, HP-6002A	Power supply
Test Facility, Transmitter, TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Unit IF. Amplifier, AM-4822/U	Unit if amplifier

b. Test and Alinement Procedures.

(1) *Input and output VSWR checks.*

(a) Connect the test equipment as in A, figure 4-104.

(b) Set the sweep generator controls as follows:

Control	*Setting*
FREQ SELECTOR	CW MKR
VARIABLE FREQ MKR	30 MHz on the dial

(c) Adjust the sweep generator rf output level for a 0 dBm indication on the power meter.

(d) Connect the test equipment as in B, figure 4-104.

(e) Set the power supply to 115 Vac and the receiver test facility controls as follows:

Control	*Position*
S1	ON
S6	OSC
S12	AMPL IF.
Sl3	AGC

(f) Set switch S12 (rf module test facility) to ON.

(g) Set the sweep generator FREQ SELECTOR switch to Δ F. Adjust the Δ F FREQ CONTROL for a sweep of 28 to 32 MHz.

(h) Calibrate the oscilloscope for a VSWR of 1.5:1 over the frequency range of 28 to 32 MHz.

(i) Connect the test equipment as in C, figure 4-104.

(j) The input VSWR viewed on the oscilloscope shall not exceed 1.5:1 over the frequency range of 28 to 32 MHz.

(k) If necessary, adjust L1, L2, and L3 on if amplifier board 33AR1AR1 (fig. 4-108) of unit under test for the minimum VSWR in the frequency range of 28 to 32 MHz.

(l) Set receiver test facility switch S13 to MAN. Vary the GAIN control (AMPLIFIER IF AMPL FREQ MULT section of the test facility) from the fully counterclockwise to the fully clockwise position. The VSWR response shall not exceed 1.5:1.

(m) Set the GAIN control fully counterclockwise.

(n) Connect the test equipment as in D, figure 4-104.

(o) The output VSWR from 28 to 32 MHz shall not exceed 1.5:1 on the oscilloscope. If necessary, adjust L11 on if amplifier board 33AR1AR1 (fig. 4-108) on unit under test.

(p) Turn test equipment OFF.

(2) *Gain and AGC checks.*

(a) Connect the test equipment as in figure 4-105.

(b) Set the receiver test facility controls as follows:

Control	Position
S1	ON
S9	30 MHz
S12	AMPL IF
S13	MAN
S14	30 MHz

(c) On receiver test facility, set AT1 to 60 and adjust GAIN control for a reading of 10.00 volts on digital multimeter. Power meter indication shall be between –7 and – 13 dBm. If the power level requirement cannot be met proceed to steps *(e)*, *(f)*, and *(g)* below.

(d) On receiver test facility adjust GAIN control for a reading of 10.70 volts on digital multimeter and set AT1 to 20. Power meter indication shall be – 10 dBm or lower. If this power level requirement cannot be met, set AT1 to 60 and adjust GAIN control for a reading of 10.00 volts on digital multimeter, and proceed to steps *(e)*, *(f)*, and *(g)* below.

NOTE

If the requirements of steps *(c)* and *(d)* above are met, omit steps *(e)*, *(f)* and *(g)* below.

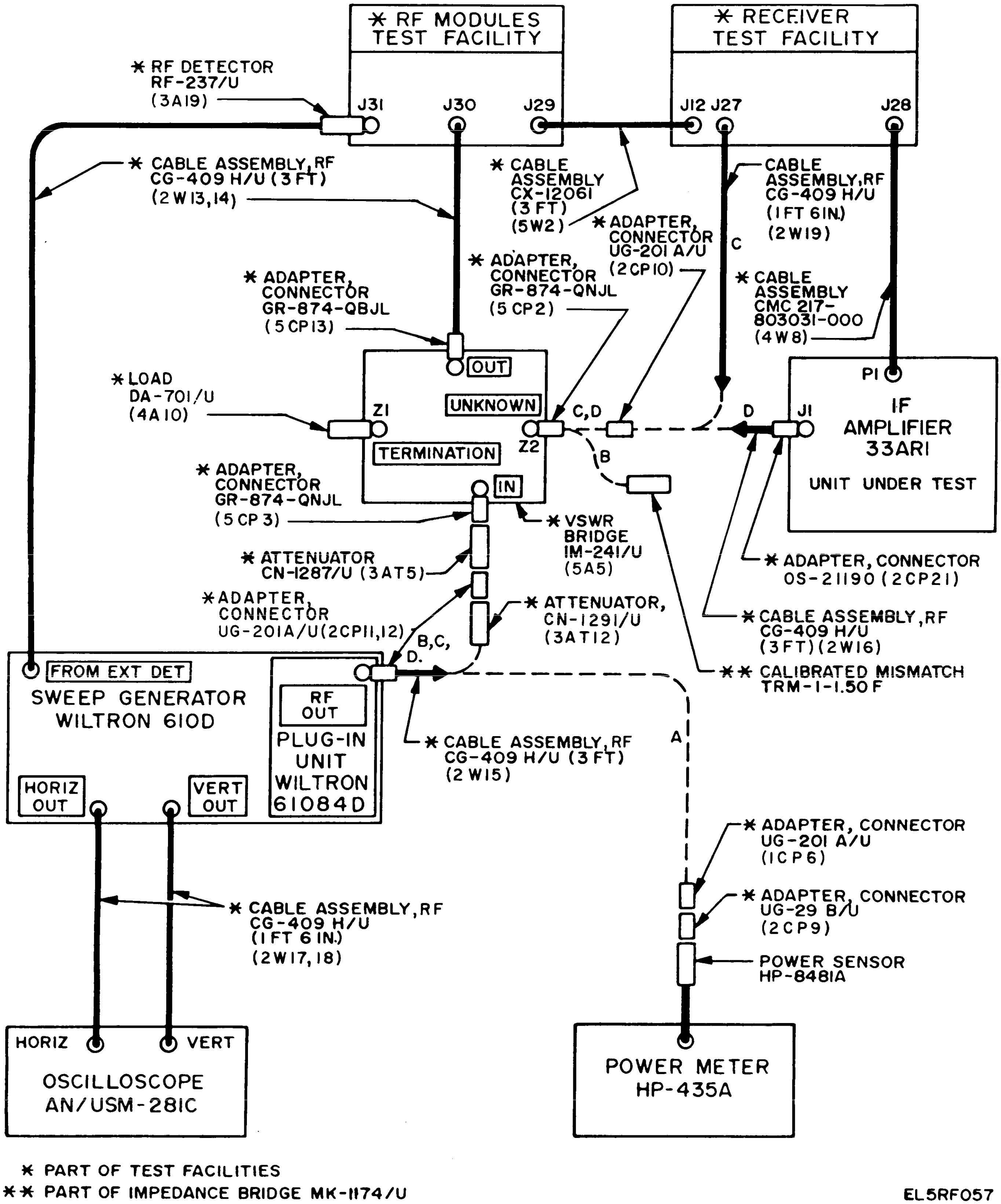


Figure 4-104. Intermediate Frequency Amplifier 33AR1, VSWR Checks, Test Setup.

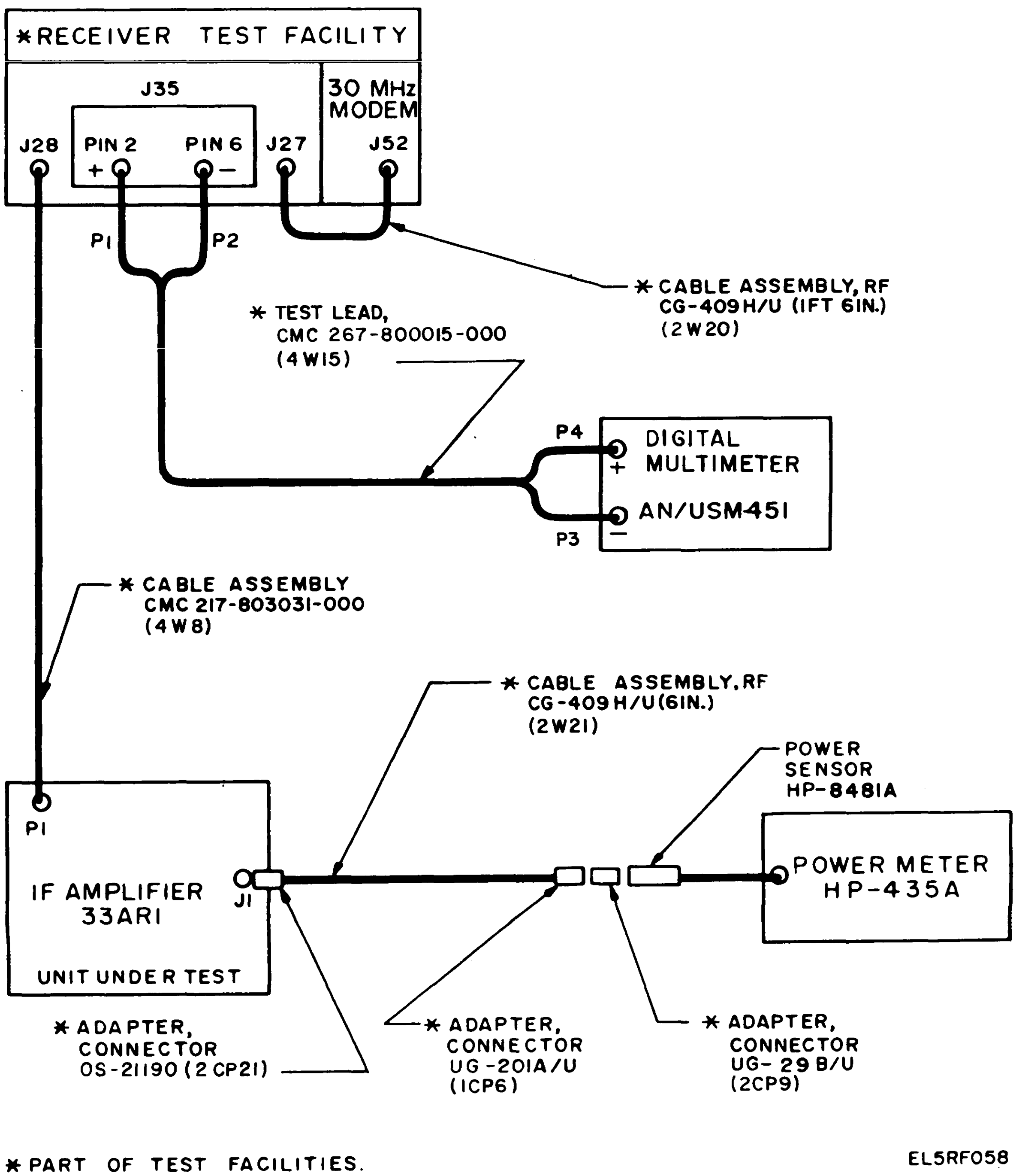


Figure 4-105. Intermediate Frequency Amplifier 33AR1, Gain and agc Checks, Test Setup.

(e) On unit under test, set R2 fully clockwise and set R4 fully counterclockwise. Power meter indication shall be between –7 and –13 dBm. If necessary, adjust R4 for an indication on the power meter as close to – 10 dBm as possible.

(f) Adjust receiver test facility GAIN control for a reading of 10.70 volts on the digital multimeter and set AT1 to 20. Adjust R2 on the unit under test for a power meter indication between –10 dBm and –13 dBm.

NOTE

The power meter indication may decrease for approximately 1 minute after GAIN control is adjusted. The following measurements and adjustments should be made within 5 seconds after 10.70 volts MAN AGC is applied. If necessary set receiver test facility switch S13 to AGC, wait approximately 30 seconds, and then reset S13 to MAN to continue measurements.

(g) Repeat the checks in *(a)* through *(d)* above and readjust R2 as necessary. Final adjustment of R2 is made after unit under test is installed in receiver rf head.

(3) *Bandwidth checks.*

(a) Connect the test equipment as in A, figure 4-106.

(b) Set the sweep generator attenuators to 0 dB. Adjust for a sweep output of 29 to 33 MHz at an output level of 0 dBm on the power meter. (Use MANUAL setting to achieve power level.)

(c) Set the sweep generator attenuators for 50 dB. Connect the test equipment as in B, figure 4-106. Set the variable attenuator to 0 dB.

(d) Set the receiver test facility controls as follows:

Control	*Position*
S1	ON
S6	OSC
S12	AMPL IF.
S13	AGC

(e) Adjust the oscilloscope for a suitable display.

(f) Adjust the variable attenuator to 1 dB. Draw a line through the peak response between 28 MHz and 32 MHz (use internal markers) as displayed on the oscilloscope.

(g) Adjust the variable attenuator to 0 dB. The response between 28 MHz and 32 MHz displayed on the oscilloscope shall exceed the 1 dB reference line established in *(f)* above.

(4) *Noise figure measurement.*

(a) Set power supply HP 6002A for 28 Vdc output and then turn it OFF.

(b) Connect the test equipment as in figure 4-107.

(c) Set the receiver test facility controls as follows:

Control	*Position*
S1	ON
S6	MULTIPLIER
S12	AMPL IF
S13	AGC

NOTE

The noise generator power Supply should be in the OFF position.

(d) Adjust the unit if amplifier ATTENUATION control for a meter indication on the dB scale. Note the meter indication and ATTENUATION setting.

(e) Switch the noise generator power supply ON and, if necessary, adjust the unit if amplifier ATTENUATION for an indication on the dB scale of the meter.

(f) Note the indication on the unit if amplifier (including ATTENUATION). The change in dB s constitutes the Y-factor.

(g) Determine the noise figure using the Y-factor obtained in *(f)* above and referring to figure 4-99 (use the noise source reference line corresponding to the 30 MHz output level from the noise source calibration chart).

NOTE

The attenuation versus frequency data stamped on the 6 dB calibrated attenuator connected to the noise generator should be used in calculating the noise figure.

(h) Subtract the attenuation at the noise generator from this noise figure. The result is the true noise figure and should not exceed 4.0 dB.

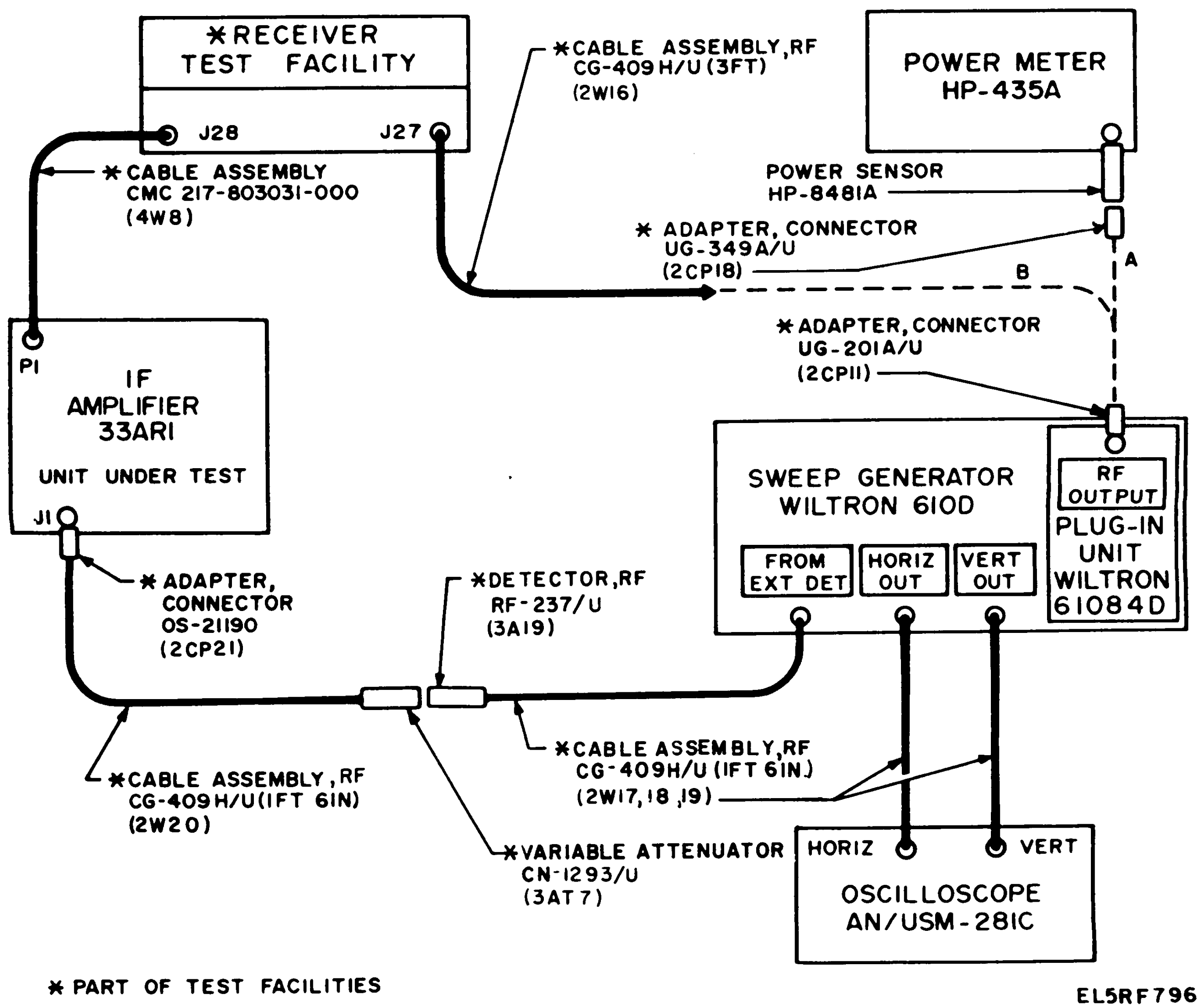


Figure 4-106. Intermediate Frequency Amplifier 33AR1, Bandwidth Check, Test Setup.

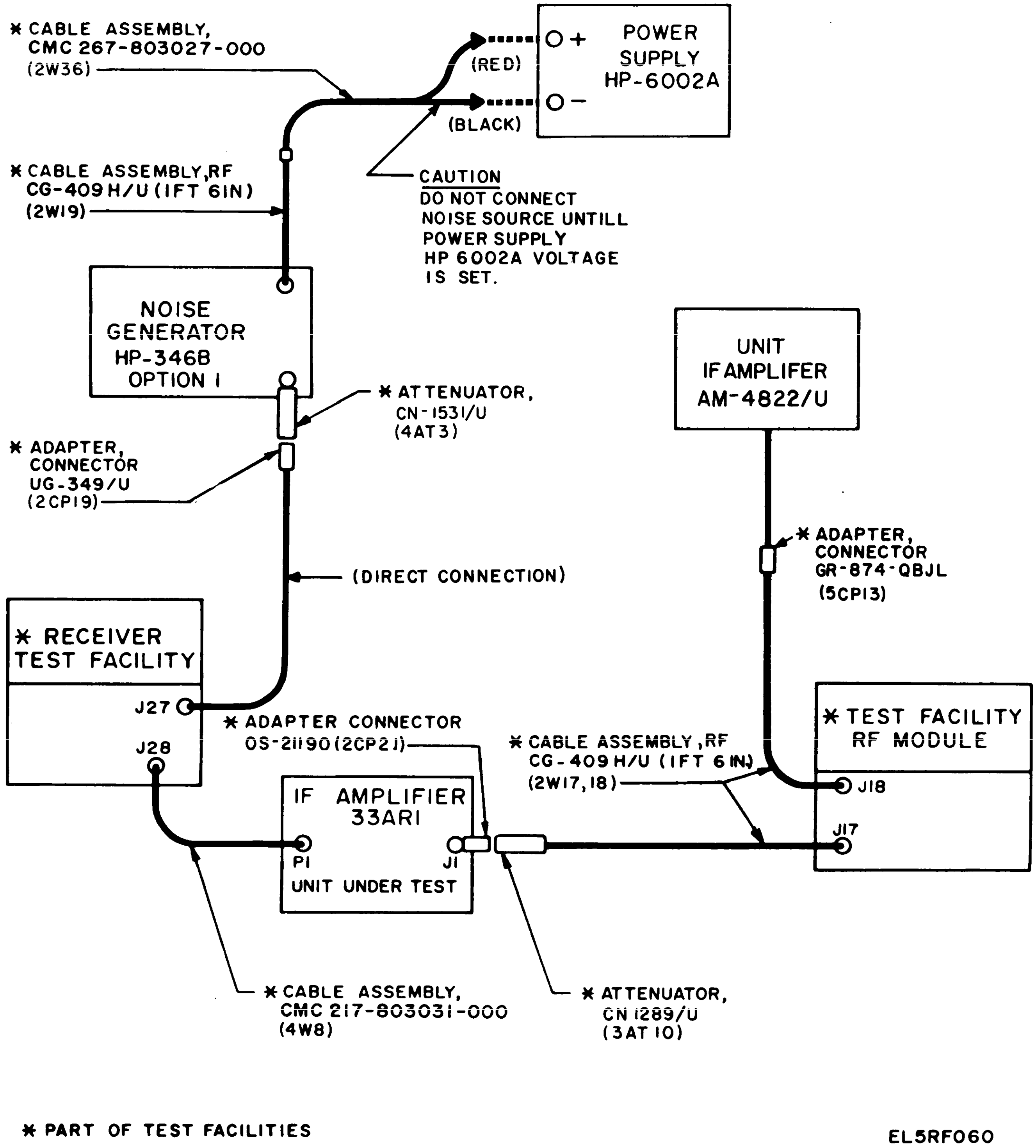


Figure 4-107. Intermediate Frequency Amplifier 33AR1, Noise Figure Check, Test Setup.

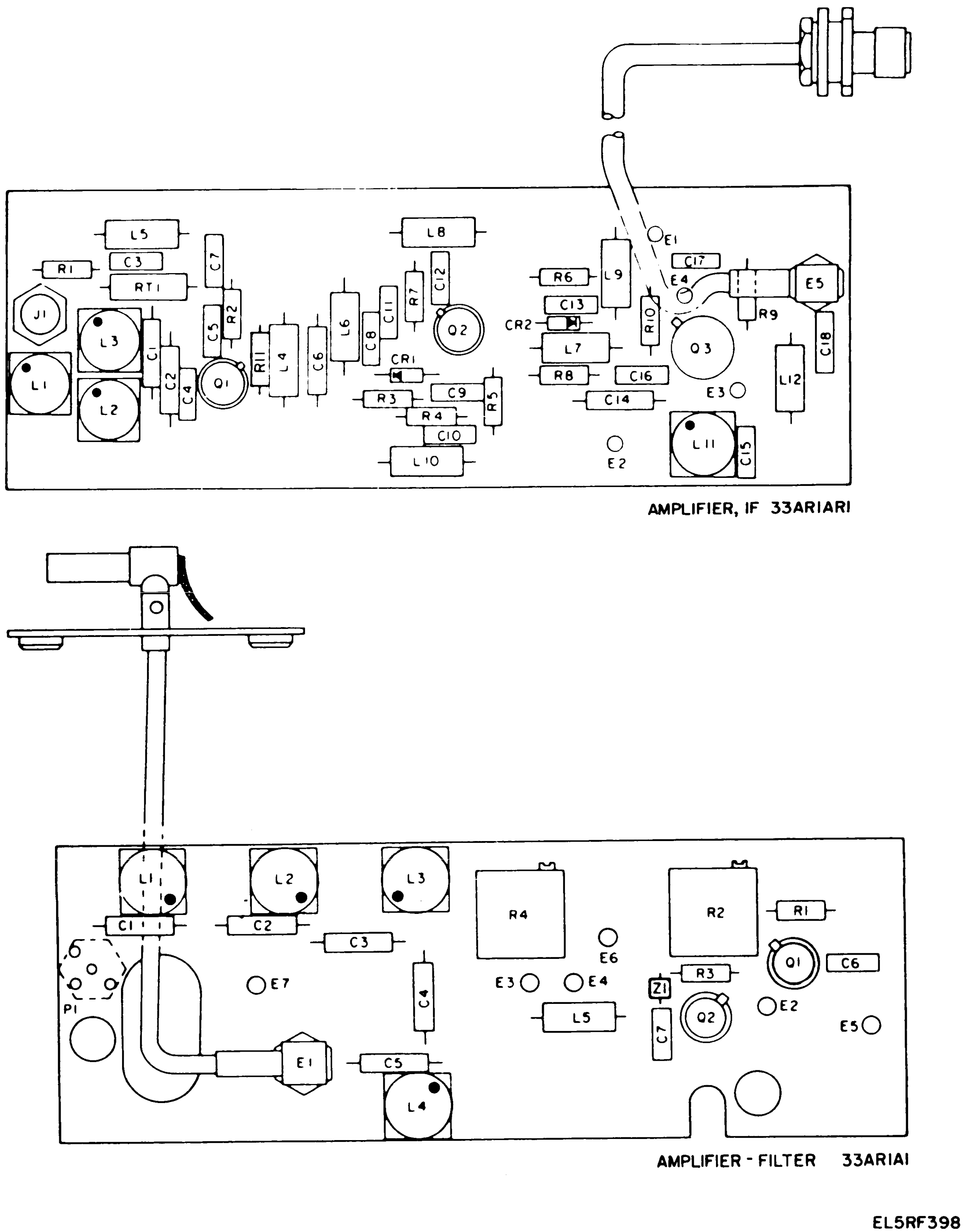


Figure 4-108. Intermediate Frequency Amplifier 33AR1, Parts Location.

c. Troubleshooting (FO-35).

Symptom	*Checks and corrective measures*
High input VSWR	*a.* Check amplifier-filter 33AR1A1 as described in paragraph 4-35. Adjust or repair as required. *b.* Check the resistance of Q1 (fig. 4- 108) (33AR1AR1Q1) and components of Q1 base circuit. Replace components as required.
High output VSWR	Check the resistance of Q3 and components of Q3 collector circuit. Replace components as required.
Low gain or no Output *(b. (2)(e)* above	*a.* Check the dc voltages in *d.* below. Investigate any abnormal indication. Replace components as required. *b.* Check for damaged cables or connectors and broken wires. Repair or replace as required. *c.* Check the forward and reverse resistance of diodes CR1 and CR2. Replace if required. *d.* Set the test facility attenuator AT1 to 60 dB and the GAIN control to indicate 10.0 Vdc on the DVM. Check the signal at test points indicated below.

Test points		*Typical indication (volts rms)*
33AR1AR1Q1	– base	0.004
	– collector	0.01
33AR1AR1Q2	– base	o
	– collector	1.7
33AR1AR1Q3	– base	o
	– collector	0.08

Check components in isolated stage and replace as required.

Symptom	*Checks and corrective measures*
Signal requirements not met in step *b. (2)(f)* above (abnormal AGC action)	Set the test facility attenuator AT1 to 20 dB and adjust GAIN control for 10.7 Vdc indication on the DVM. Check the dc voltages at Q1 and Q2 (33AR1A1) and the cathodes of CR1 and CR2 as established in *d.* below. Check the components in isolated stage and replace as required.
Excessive noise	Check for poor solder joints and/or ground connections on the printed circuit boards. Replace 33AR1AR1Q1 and/or 33AR1AR1Q2.

d. Voltage and Resistance Measurements (fig. 4-108).

(1) *Voltage measurements.*

NOTE

Use the allocated multimeter for voltage and resistance measurements. Dc voltage measurements referenced to ground. (Test facility attenuator set to 20 dB and GAIN control adjusted for 10.7 Vdc indication on digital multimeter as in *(b)(2)* above.)

Test points		*Typical indications (volts dc)*
33AR1AlQl	–base	–10.10
	– emitter	– 6.20
	– collector	0
33AR1A1Q2	- base	– 5.60
	– emitter	– 6.20
33AR1ARlQl	–base	– 5.65
	– emitter	– 6.40
33AR1AR1Q2	- base	– 8.70
	– emitter	– 9.43
33AR1ARlQ3	–base	– 8.63
	- emitter	– 9.52

(2) *Transistor in-circuit resistance measurements.*

NOTE

All resistances measured with the allocated multimeter.

Stage	*Base (–)*				*Base (+)*			
	Emitter (+)		*Collector (+)*		*Emitter (–)*		*Collector (–)*	
	Res (ohms)	*Multimeter range*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*
33AR1A1Q1	925	2k	Inf	20M	730	2k	750	2k
33AR1A1Q2	Inf	20M	Inf	20M	860	2k	820	2k
33AR1AR1Q1	7.2k	20k	2.1k	20k	1.1k	2k	l.1k	2k
33AR1AR1Q2	4.4k	20k	4.8k	20k	1.16k	2k	l.1k	2k
33AR1AR1Q3	2.2k	20k	3.0k	20k	925	2k	900	2k

4-35. Amplifier-Filter 33AR1A1, 34AR1A1, or 39AR2A1.

a. Test Equipment and Material Required.

Equipment	*Common name*
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Generator, Sweep, Wiltron 6 10D, with Plug-In Unit, Wiltron 61084D	Sweep generator
Generator, Signal, HP-8640B	Signal generator
Oscilloscope, AN/USM-281C	Oscilloscope
Voltmeter, RF, ME-426/U	Rf voltmeter
Test Facility, Receiver, TS-2867(V)2/GRM-95(V)2	Receiver test facility
Test Facility, RF Modules, TS-3837(V)2/GRM-95(V)2	Rf modules test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Impedance Bridge, ZM-7l/U	Universal bridge

b. Test Procedures.

(1) *VS WR check.*

(a) Place the unit under test into the filter shield assembly (CMC 617-800429-000). Connect the test equipment as in A, figure 4-109.

(b) Set the sweep generator controls as follows:

Control	*Setting*
FREQ SELECTOR	F1 TO F2
SWEEP MODE	AUTO
LEVELING	INT
Frequency Control F1	27 MHz (on dial)
Frequency Control F2	33 MHz (on dial)

(c) Adjust the sweep generator output level control to maximum for a sweep between 27 and 33 MHz. Use the internal markers.

(d) Calibrate the oscilloscope for a VSWR of 1.10:1.

(e) Connect the test equipment as in B, figure 4-109.

(f) The filter input VSWR displayed on the oscilloscope should be less than 1.10:1.

(g) Connect the test equipment as in C, figure 4-109.

(h) The filter output VSWR displayed on the oscilloscope should be less than 1.10:1.

(i) If necessary, make a slight adjstment of Ll, L2, L3, and L4. Repeat *(e)* through *(i)* above to meet the input and output VSWR requirements.

(2) *Insertion loss and rejection check.*

(a) Connect the test equipment as in A, figure 4-110.

(b) Not used.

(c) Set the rf switch to position No. 2 and the variable attenuator to 0.

(d) Set the signal generator to 30 MHz. Adjust the output level for an indication of –10 dBm on rf voltmeter.

(e) Turn the rf switch to position No. 1.

(f) Adjust the variable attenuator for a -10 dBm indication on rf voltmeter. The insertion loss as indicated on the variable attenuator should be 0.6 dB or less.

(g) Repeat *(c)* through *(f)* above for signal generator frequencies of 27 and 33 MHz. The insertion loss should be 0.9 dB or less.

(h) Connect the test equipment as in B, figure 4-110.

(i) Reset the variable attenuator to 0 dB, and turn the rf switch to position No. 1.

(j) Set the signal generator to 15 MHz. Adjust the level control to obtain a -10 dBm indication on rf voltmeter.

(k) Turn the rf switch to position No. 2. The rf voltmeter indication should be -55 dBm or lower, indicating a filter rejection of 45 dB or greater.

c. Troubleshooting and Alinement Procedures. Check capacitors Cl, C2, C3, C4 and C5 and coils L1, L2, L3 and L4 (fig. 4-108) using a universal bridge. If any component is changed, do the following preliminary alinement procedure before repeating *b.(1)* above.

(1) Connect the test equipment as shown in A, figure 4-109.

(2) Adjust the sweep generator controls for maximum output level between 20 and 40 MHz.

(3) Connect the test equipment as shown in B, figure 4-109.

(4) Adjust the sweep generator to display a sweep of ±3 MHz centered on 30 MHz.

(5) Adjust coils Ll, L2, L3 and L4 such that the cores are flush with the top of the coils.

(6) Adjust coils L3 and Ll, then L2 and L4 for a VSWR response of 1.1:1 or less between 27 MHz and 33 MHz.

NOTE

The coil adjustments are interdependent and therefore must be continued until the desired response is achieved (VSWR of 1.1:1 or better between 27 MHz and 33 MHz).

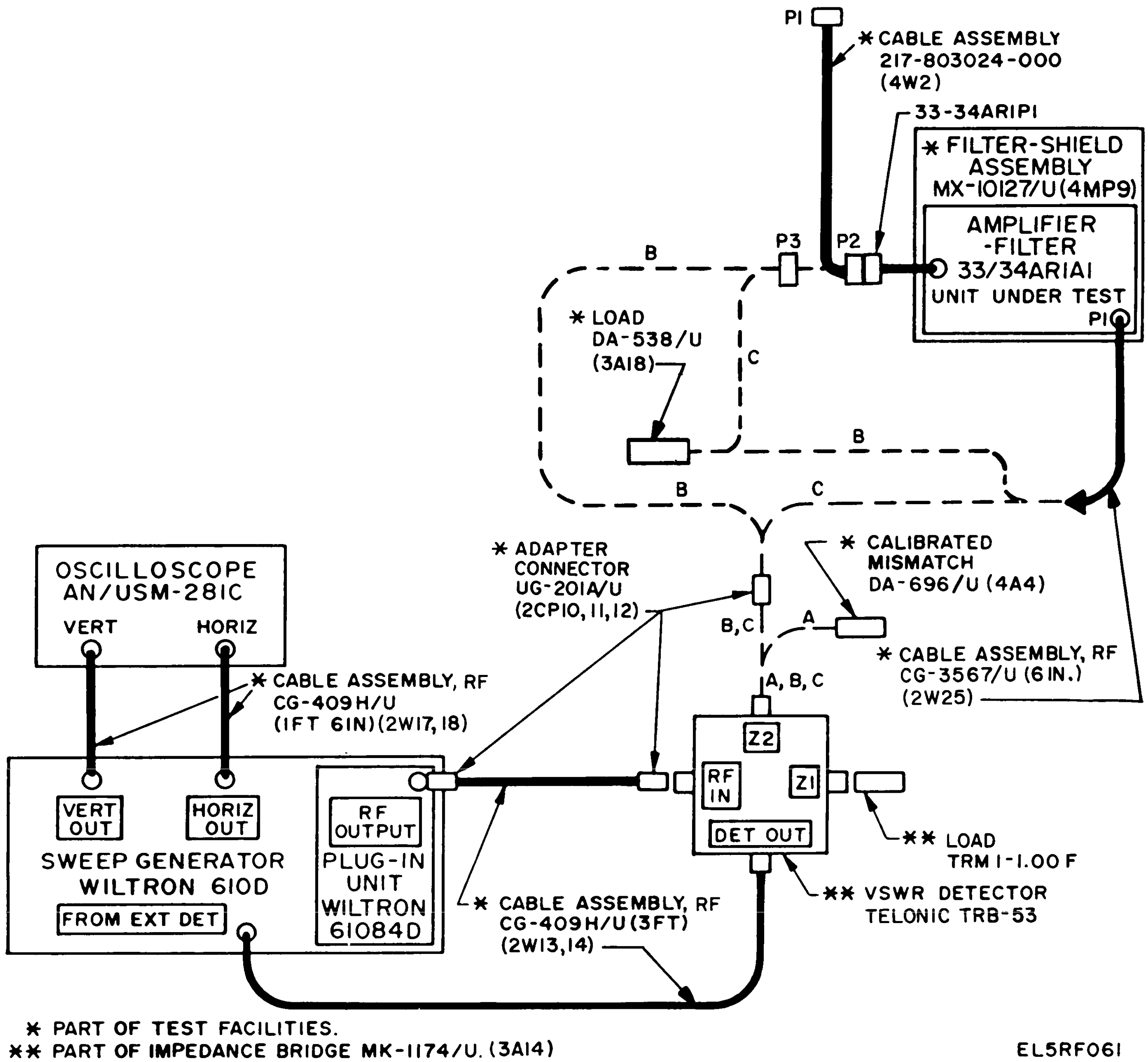


Figure 4-109. Amplifier-Filter 33AR1A1, 34AR1A1, and 39AR2A1 VSWR Check, Test Setup.

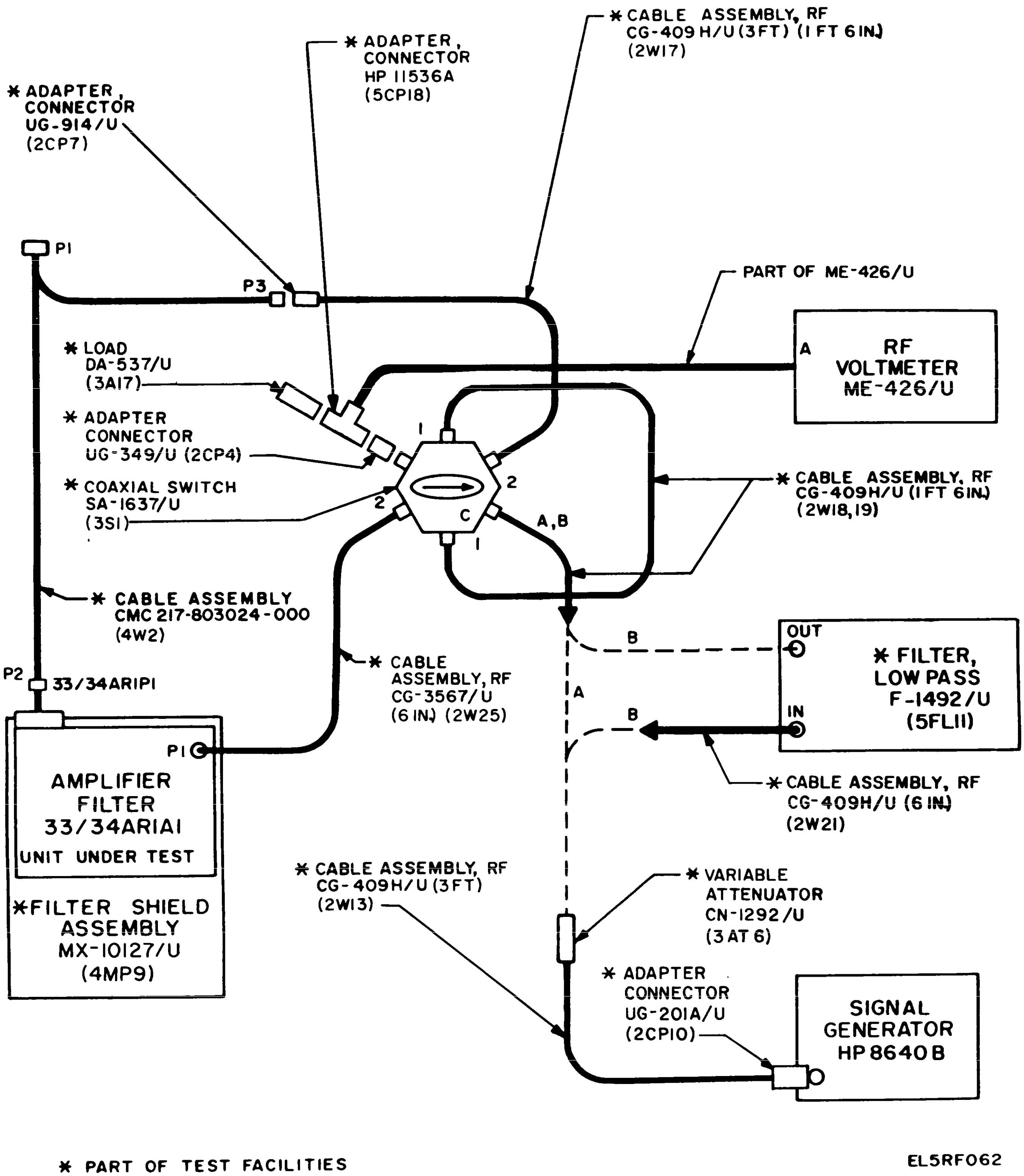


Figure 4-110. Amplier-Filter 33AR1A1, 34AR1A1, and 39AR2A1 Insertion Loss and Rejection Check Test Setup.

4-36. Amplifier-Frequency Multiplier AM-4321( )/GRC-103(V) (Band II Transmitter Rf Head)

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver, TS-28617(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, facilities set
Test Facility Radio Frequency Modules, TS-3837(V)2/GRM-95(V)2	Test facility frequency modules
Frequency Counter, TD-1225(V)1/U	Frequency counter
Multimeter, Digital, AN/USM-451	Multimeter
Wattmeter, AN/USM-298	Wattmeter
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Element, Bird No. 50D, 200-500 MHz	Wattmeter element
Element, Bird No. 50E, 500-1000 MHz	Wattmeter element

b. Test Procedure.

(1) Preliminary checks.

(a) For AM-4321B/GRC- 103 only, before connecting the unit under test to the test setup, a resistance check on the temperature sensor is required. Check the temperature sensor as follows:

1. Connect the digital multimeter between pins 17 and 43 of connector P1 of the connector filter assembly 37AR1AW1A1. The resistance measured should be within the limits shown on the "Temp/Resistance" chart for the temperature of the heat radiator of the unit under test output tube (fig. 4-111).

2. Connect the multimeter between pin 17 and pin 1 (H.V. connection). The multimeter should indicate an open circuit.

3. Repeat 2. above for pins 43 and 1.

WARNING

High voltages are accessible at the test leads and connections when the megohrnmeter is used. Switch to "OFF" and "DISCHARGE" before connecting or disconnecting test leads.

4. Short pins 17 and 43 together and connect the megohmmeter between the shorting wire (pins 17 and 43) and pin 1.

5. Turn the megohmmeter power switch on, and set its voltage control to 600 volts.

6. Set the "DISCHARGE - CHARGE - MEASURE" switch to "CHARGE" and then "MEASURE". The resistance indicated on the megohmmeter should be greater than 50 megohms.

7. Return switches to "DISCHARGE" and "OFF".

8. Disconnect megohmmeter and the short between pins 17 and 43.

(b) Preliminary checks are as follows:

1. Remove the dust cover from the unit under test and connect the test equipment as shown in A, figure 4-112. Set power supply PP-6304/GRM-95(V) to 115 Vat.

2. Direct cooling air from the AIR OUTLET of the transmitter test facility to the rear of the unit under test. Use hose assembly air duct MX-8414/GRM-95(V)(IMP2).

3. Set the XMTR TUNE and XMTR CHANNEL controls on the unit under test to channel 1010.

4. Set the transmitter test facility switches as follows:

Switch	*Swiitch position*	*Normal indications*
S13	ON	
S1	ON	
S18	OFF	
S17	ON	
S20	S12	
S12	OSC	Test facility meter M1 indicates between 20 and 90 percent of full scale. LOW PWR lamp on test facility may light.

5. Set transmitter test facility switch S12 to the following positions:

Swiitch position	*Normal indication*
DBLR	Ml indicates between 10% and 90% of full scale.
MULT	Ml indicates between 20% and 90% of full scale after completion of tuning.
DRIVER	Ml indicates between 20% and 90% of full scale after completion of tuning.

6. Set transmitter test facility switch S 12 to PWR OUT and adjust the XMTR TUNE and the PWR OUT PEAK controls on the unit under test for a peak indication on meter Ml. The LOW POWER lamp on the test facility should go out, the wattmeter should indicate 25 watts minimum and M1 should indicate 40 percent minimum. The XMTR TUNE channel indication should be within ±0.5 inch of the center of the display window.

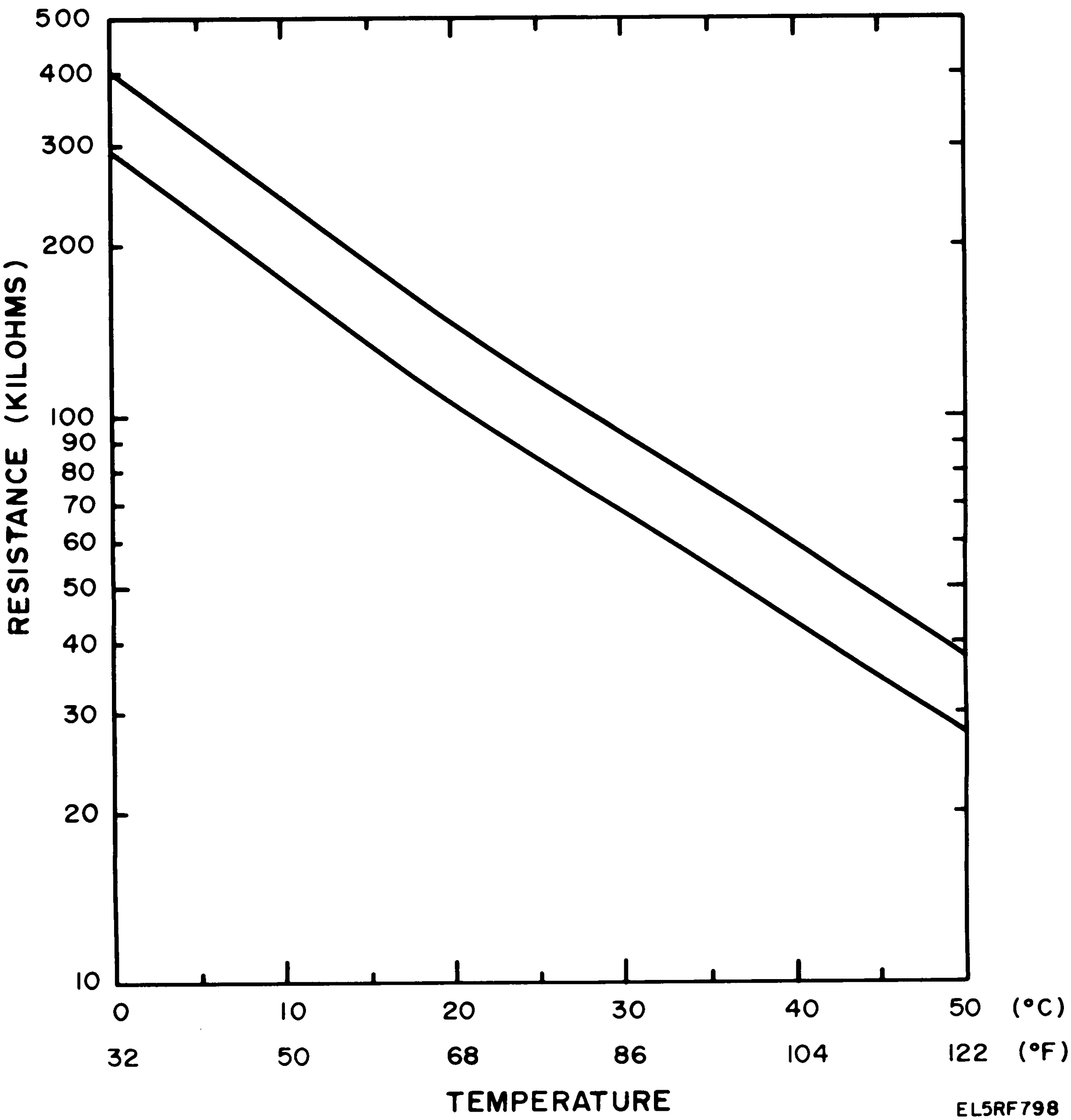


Figure 4-111. Rf Amplifier 37AR1, Temperature Sensor Resistance Values.

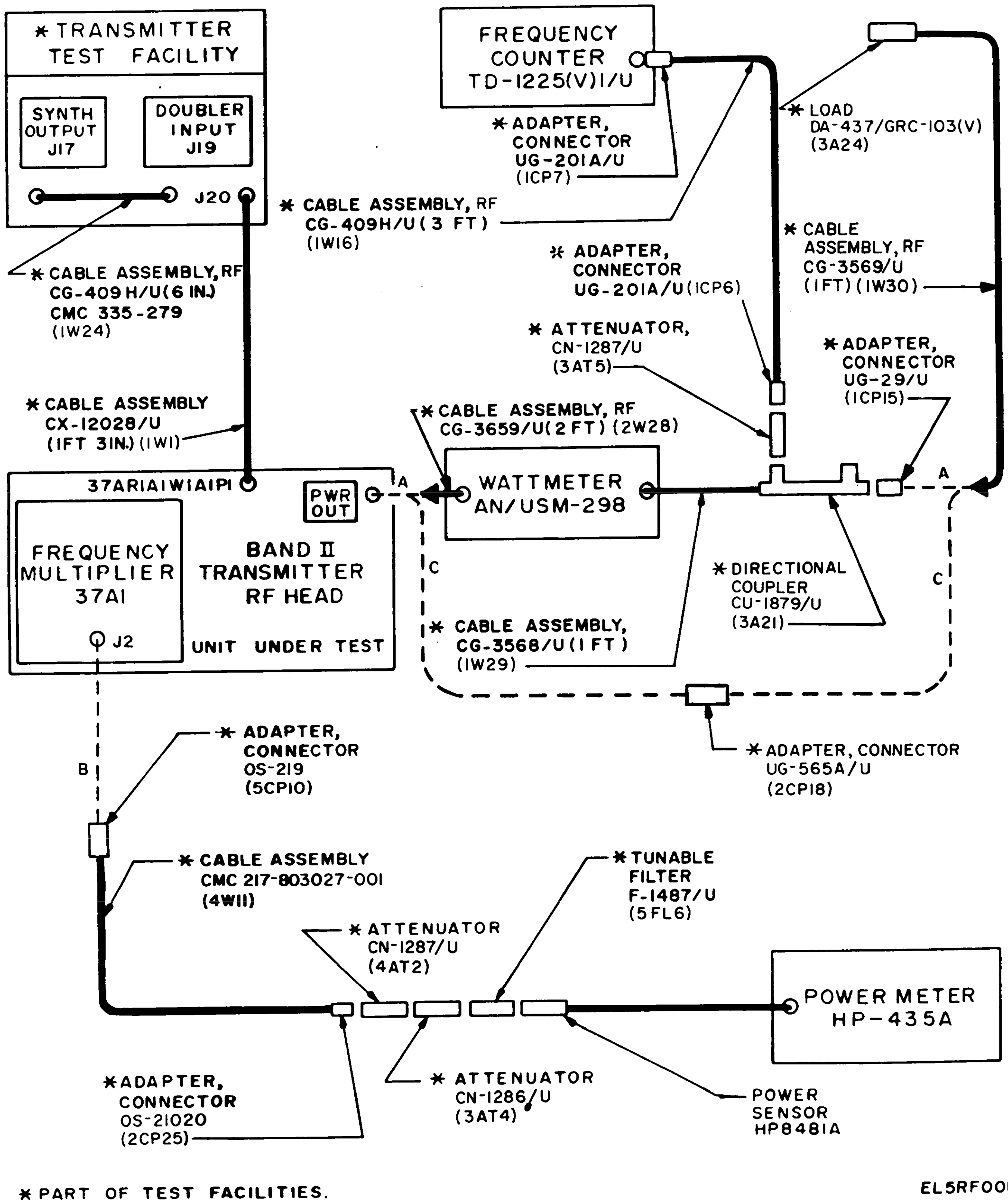


Figure 4-112. Transmitter Rf Head 37, Test Setup.

7. Set transmitter test facility switch S12 to REFL PWR. The indication on meter Ml should not exceed 5% of full scale.

NOTE

If the REFL PWR requirement of 7. above cannot be met, connect the dummy load directly to the PWR OUT connector as in C, figure 4-112. The REFL PWR indication should now be less than 5%. Reconnect the equipment as in A, figure 4-112.

8. Temporarily disconnect the cable from the PWR OUT connector of the unit under test. The indication on meter Ml should be between 20% and 90% of full scale.

(2) *Cathode and heater voltage measurement check.*

(a) Check for the following voltages at voltage regulator assembly 37AR1A1A1 (fig. 4-113) using the digital multimeter:

Test points	*Voltage (volts dc)*
TP2(-) and TP4(+)	6.0 to 6.4
TPl(-) and TP3(+)	6.0 to 6.4
TP9(-) and TP4(+)	19 maximum
TP9(-) and TP8(+)	0.65 to 0.85
TP9(-) and TP7(+)	0.65 to 0.85

(3) Power output and tracking check.

(a) Set the XMTR TUNE and XMTR CHANNEL controls on the unit under test to channel 390.

(b) Adjust the XMTR TUNE and the PWR OUT PEAK controls for a peak indication on the test facility meter Ml with switch S12 at PWR OUT. The power meter should indicate at least 25 watts, the frequency meter should indicate 395 MHz ±7.90 kHz and the XMTR TUNE channel indication should be within 0.5 inch of the center of the display window.

(c) Repeat *(a)* and *(b)* above for the channels listed below.

Channel	***Frequency (MHz)***	***Tolerance (±kHz)***
400	400	8.0
480	440	8.8
560	480	9.6
640	520	10.4
720	560	11.2
759	579.5	11.6
760	580	11.6
800	600	12.0
880	640	12.8
960	680	13.6
1000	700	14.0
1010	705	14.1

(4) *Alinement.*

(a) Remove the dust cover from the transmitter rf head, and remove 37W1P1 from 37A1J2.

(b) Connect the test equipment as shown in B, figure 4-111.

(c) Set the XMTR TUNE and XMTR CHANNEL controls on the unit under test to channel 390 (395 MHz).

(d) Set the transmitter test facility switches as follows:

Switch	*Position*
S1	ON
S12	OSC
S17	ON
S18	OFF

(e) Set the tunable filter to 395 MHz and peak for a maximum indication on the power meter.

(f) Adjust the XMTR TUNE control for a peak indication. The power level at J2 of the frequency multiplier should be at least +23 dBm (–8 dBm as indicated on the power meter).

(g) If the power level is not as specfied, loosen the four mounting screws for control-indicator 37A2 and place the control-indicator by the side of the transmitter rf head. Do not disconnect P1 (37AR1A1W1J3) (TM 11-5820-540-30).

(h) Remove frequency multiplier 37A1 (para. 2-56) then replace 37A1, leaving the flexible drive shaft disconnected.

(i) Reconnect the equipment as shown in B, figure 4-111.

(j) Turn the flexible shaft manually until the output power from the frequency multiplier reaches a maximum as indicated on the power meter.

(k) Secure the shaft temporarily in this position with adhesive tape. Do not reconnect the flexible shaft to the tuning drive mechanism at this time.

(l) Connect P1 (37W1) to 37A1J2 (TM 11-5820-540-30) and connect the test equipment as shown in A, figure 4-111.

(m) Set the PWR OUT PEAK control to mid range and adjust the XMTR TUNE control for a peak indication on the power meter.

NOTE

Do not move the XMTR TUNE control after the rf amplifier has been peaked.

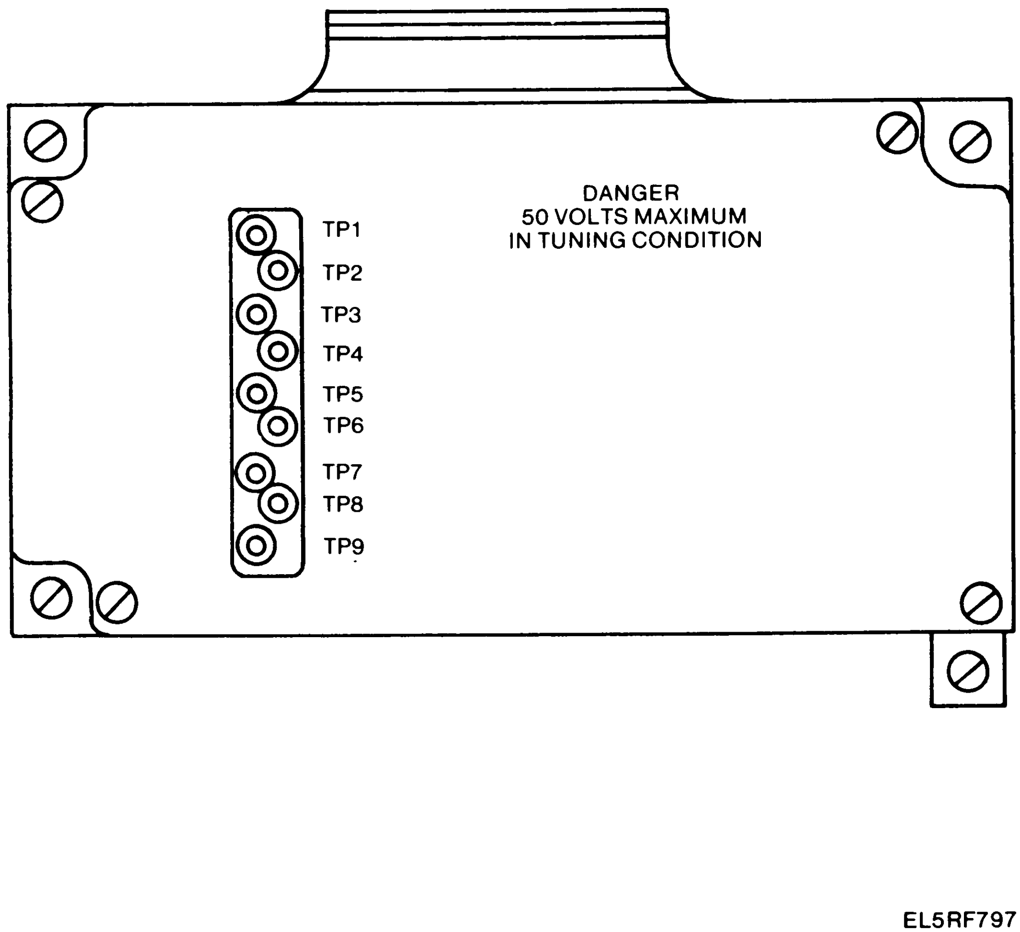


Figure 4-113. Voltage Regulator Assembly 37/38AR1A1A1, Test Point Location.

(n) Observe the XMTR TUNE display window. If necessary, to position the channel-frequency indication 37AR1AR1DS1 at the correct channel number, remove the channel-frequency indicator as described in paragraph 2-59.

(o) Turn the flexible shaft on the channel-frequency indicator until channel number 390 is in line with the calibration mark (notch) on the body of the channel-frequency indicator.

(p) Replace the channel-frequency indicator as described in paragraph 2-59.

(q) Reconnect the frequency multiplier flexible shaft to the tuning drive mechanism.

(r) Check that the output power is at least 25 watts at the channels listed in *b.* (3)(c) above.

(s) If the power level drops, disconnect the frequency multiplier flexible shaft from the tuning drive mechanism and re-peak the frequency multiplier output using the flexible shaft.

(t) Repeat steps *(q)* and *(r)* above.

(u) Install dust cover.

c. Troubleshooting (FO-40 or FO-41, and FO-57).

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
1. DBLR meter indication zero in *b. (l)(i)* above.	+28 V interlock open circuit.	Check for continuity between 37AR1AW1 A1P1 pins 11 and 12 (TM 11-5820-540-30).
2. MULT meter indication low or zero in *b.(1)(i)* above.	*a.* Defective frequency multiplier 37A1.	*a.* Check that at least 100 mw (+20 dBm) is present at 37A1J2 (TM 11-5820-540-30). If power level at 37A1J2 is abnormal, check that at least 2w (+33 dBm) is present at 37AR1A1W1A1P2. If this is normal, remove 37A1 (para. 2-56) and test as described in para. 4-37.
	b. Wiring.	*b.* If input level to 37A1 is abnormal, check the continuity of cable connected to 37A1J1 (TM 11-5820-540-30). If input and output levels at 37A1 are normal, check the metering circuit.
3. DRIVER meter indication low or zero in *b.(1)(i)* above.	*a.* Open circuit in driver filament line.	*a.* Check resistance between 37 AR1A1W1J5 (TM 11-5820-540-30) pins 11 and 12; it should be 1.5 ohm nominal. Driver tube must be inserted for this check.
	b. Defective cable 37W1.	*b.* Check cable with multimeter and replace if necessary.
	c. Defective cable 37AR1AR1W1.	*c.* Check with ohmmeter and replace if necessary.
	d. Tracking misalinement between 37A1 and 37AR1.	*d.* Check tracking as described in *b.(3)(d)* above.
	e. Excessive voltage drop across 37AR1A1FL2.	*e.* Check voltage at E2 of 37AR1A1FL2 which should be not more than 3 V lower than voltage at El of 37AR1A1FL2 (630 Vdc nominal).
	f Rf amplifier 37AR1.	*f.* Check 37AR1 as described in para. 4-39.
	g. Resistor assembly 37AR1AlA2.	*g.* Disconnect wire at E1 of 37ARlA1A2. Resistance between E1 and ground should be 440k ohms.
4. PWR OUT meter indication zero in *b.(1)(j)* above. Output power normal as indicated on wattmeter.	*a.* Metering circuit.	*a.* Check metering circuit.
	b. Defective power monitor 37AR1A2.	*b.* Replace power monitor (TM 11-5820-540-30).
5. PWR OUT meter indication low or zero in *b. (1)(j)* above. Output power low or zero as indicated on wattmeter.	*a.* Excessive voltage drop across 37AR1A1FL2.	*a.* Check voltage at E2 of 37AR1A1FL2 which should not be more than 3 V lower than voltage at El of 37AR1A1FL2 (630 Vdc nominal.
	b. Resistor assembly 37AR1AlA2.	*b.* Disconnect wire at E1 of 37AR1A1A2. Resistance between E1 and ground should be 440k ohms.
	c. High insertion loss in low pass filter 37AR1AlFL1.	*c.* Remove 37AR1A1FL1 and test as described in para. 4-41.
6. Voltage not as specified in *b. (2)* above.	Defective voltage regulator assembly 37AR1A1A1.	Remove voltage regulator assembly and test as described in para. 4-40.
7. Incorrect frequencies.	Control line(s) open circuit.	Check for continuity of control lines between 37ARIAlWlJ3 and 37ARlAlWlAlPl (TM 11-5820-540-30).
8. Incorrect frequencies at channel 760 and up, in *b.(3)(c)* above.	Control line 13 open circuit.	Check for continuity between 37AR1A1W1 A1P1 pin 45 and 37ARlA1W1J3 pin 13 and between 37AR1A1W1J3 pin 13 and 37AR1A1W1J2 (TM 11-5820-540-30) pin 9.
9. Wattmeter or power meter indications below normal at some frequencies in *b.(3)(b)* and *(c)* above.	Misalinement.	Perform tracking alinement as described in *b.* (4) above.

4-37. Frequency Multiplier 37A1.

a. Test Equipment and Material Required,

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/ GRM-95(V)2	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/ GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Modules, TS-3837(V)2/GRM-95(V)2	Test facility radio frequency modules
Accessory Kit, Test Facility Set, MK-1985(V)l/GRM-95(V)2	Accessory kit, test facility set
Generator, Signal, HP-8640B	Signal generator
Power Meter, HP-435A	Power meter
Power Sensor, HP-8481A	Power sensor
Test Fixture Frequency Multiplier, TS-3826/GRM-45(V)	Test fixture
Multimeter, Digital, AN/USM-451 (2 required)	Digital multimeter
Frequency Counter, TD-1225(V)l/U	Frequency counter
Clamp, 702-800013-000	Clamp
Voltmeter, Rf, Me-426/U	Rf voltmeter

b. Test Procedures.

CAUTION

To avoid damage to the transmitter test facility doubler, prior to changing connections at rf modules test facility J26, set transmitter test facility switch S12 to OFF then to MULT position after connections are made.

NOTE

Test Fixture TS-3826/GRM-95(V) must be removed from the case when used. During removal and replacement, make sure the crank knob is in the closed position to prevent damage to the fixture.

(1) *Preliminary setup.*

(a) Connect the test equipment as shown in A, figure 4-114.

(b) Set signal generator to provide 60 MHz cw with rf output level at minimum.

(c) Set transmitter test facility switch S1 to ON and S12 to OSC.

(d) Set radio frequency module test facility switch S 13 to OFF.

(e) Increase signal generator rf level to +15 dBm.

(f) Note the power meter indication.

(g) Connect the power meter as in B, figure 4-114. Note power meter indication.

(h) Calculate the coupling factor of port 2 of the directional coupler by noting the difference in the power meter indications in *(f)* and *(g)* above and adding 20 dB to the result. Record this coupling factor.

(i) Leave the signal generator controls undisturbed for the following automatic level control (ALC) tests.

NOTE

ECP CMC 4R1-0522 replaced CR1 with R2 and revised the ALC circuits of 37A1. See figure 4-115 to determine if ECP has been applied.

(2) ALC *checks for unit 37A1 (SM-D-696417 without ECP CMC 4Rl-0522).*

(a) Connect the test equipment as shown in figure 4-115. Set multimeter No. 1 to 1A DC range, and multimeter No. 2 to 20 Vdc range.

NOTE

Supply current to unit under test, as monitored by multimeter No. 1, must never exceed 1 amp.

(b) Remove the capacitor Cl inspection cover plate near connector J1 (4 screws) and ensure that C1 is set at or near minimum capacitance (fully open). See figure 4-116.

NOTE

It is important to ensure that the spring on the unit under test C1 shaft is not excessively tightened when mounted on the test fixture.

(c) Maintain the unit under test tuning shaft position and mount the unit under test to the test future. Engage the test fixture drive shaft.

(d) Set the transmitter test facility switches as follows:

Switch	*Position*
S1	ON
S12	OSC

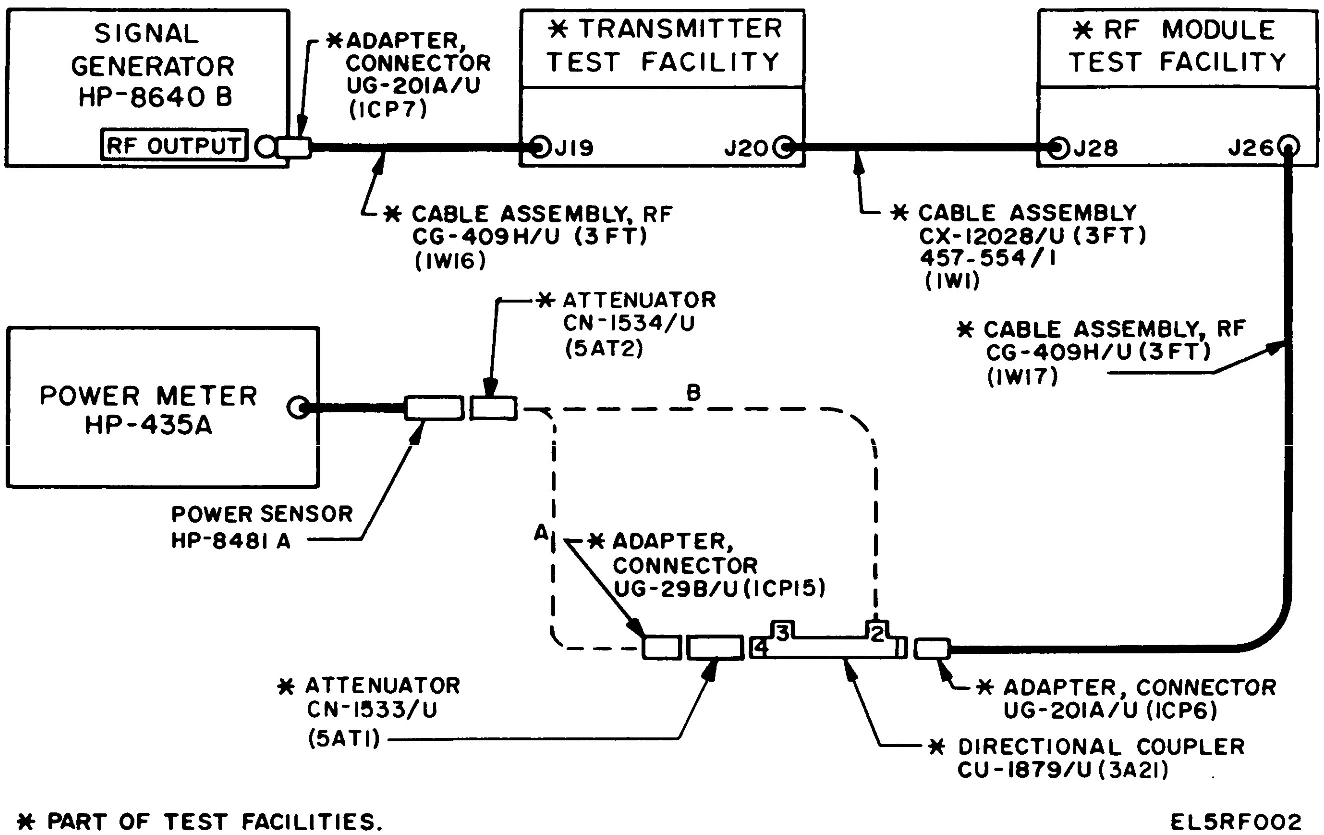


Figure 4-114. Frequency Multiplier 37A1, Test Setup Calibration.

(e) Set the radio frequency modules test facility controls as follows:

Switch	*Position*
S13	ALC2x4
ALC 2 ADJ	Fully clockwise

(f) On Al of the unit under test, adjust R3 (fig. 4-116) for a power level of +33 dBm into the unit under test. (Power meter indication of +33 dBm, minus the coupling factor for 120 MHz as calculated in *(1)(h)* above, minus 10 dB.)

(g) On the radio frequency module test facility, set switch S13 to ALC 1 and adjust control ALC 1 ADJ for +31.5 dBm into unit under test (power meter indication of +31.5 dBm, minus the coupling factor for 120 MHz, minus 10 dB). Multimeter No. 2 should indicate greater than 8.0 V.

(h) Repeat step *(g)* for a power meter indication of +34.0 dBm (minus the coupling factor, minus 10 dB). Multimeter No. 2 should indicate not less than 9.0 v.

(3) ALC check for unit 37A1 (SM-D-696417 with ECP CMC4R1-0522 or SM-D-865053).

(a) Connect the test equipment as shown in figure 4-115. Set multimeter No. 1 to 1A DC range.

NOTE

Supply current to unit under test, as monitored by multimeter No. 1 must never exceed 0.9 amp.

(b) Perform the preliminary setup as in paragraph *b.(2)(b)* through *(e)* above.

(c) On Al of the unit under test, adjust R3 (fig. 4-11 6) for a power level of 34 dBm into the unit under test. (Power meter indication of +34 dBm, minus the coupling factor for 120 MHz as calculated in *(1)(h)* above, minus 10 dB.)

(d) Ensure that the supply current does not exceed 0.9 amp.

(4) *Output power and tracking checks.*

(a) Connect the test equipment as in A, figure 4-117.

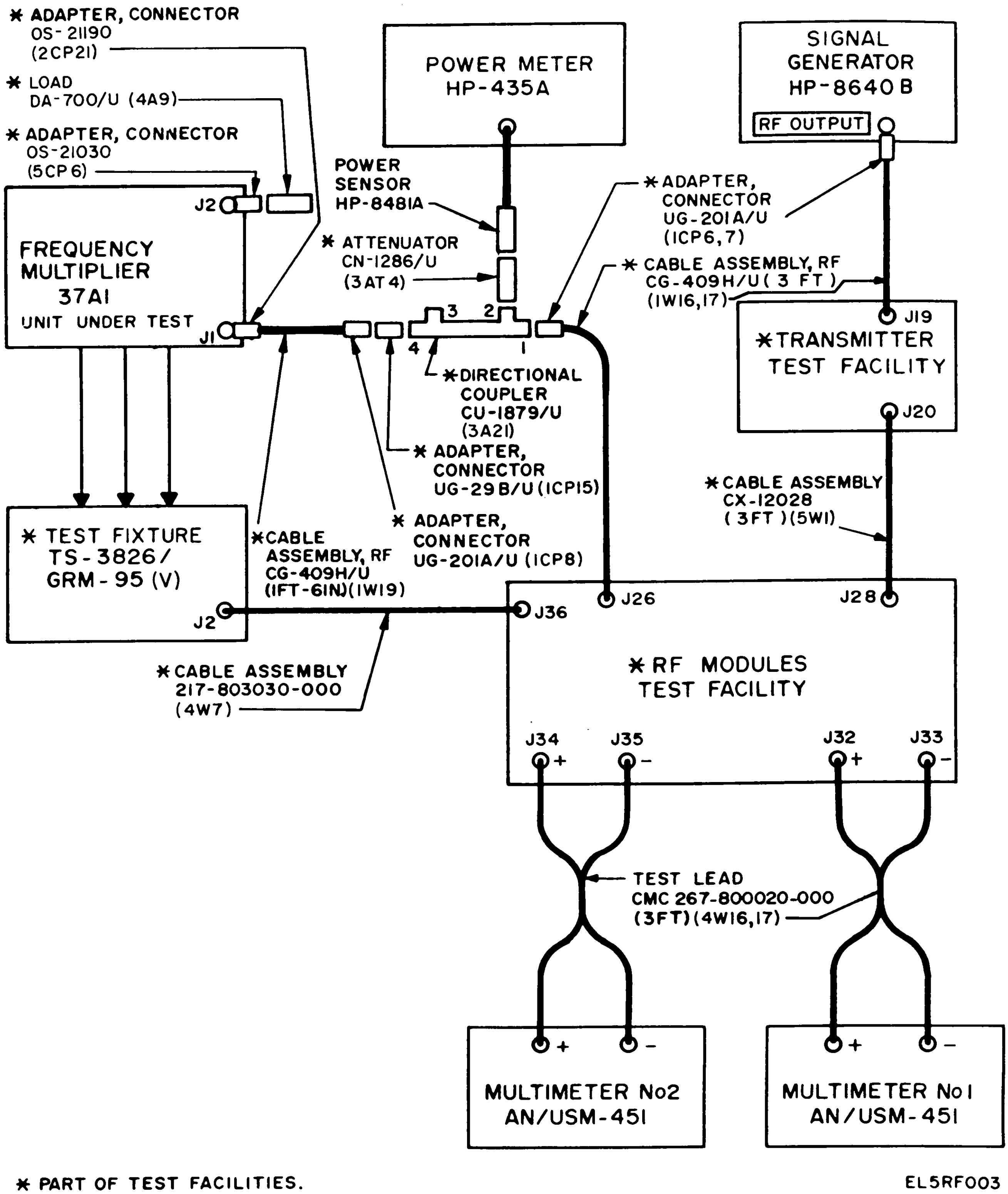


Figure 4-115. Frequency Multiplier 37A1, ALC Checks, Test Setup.

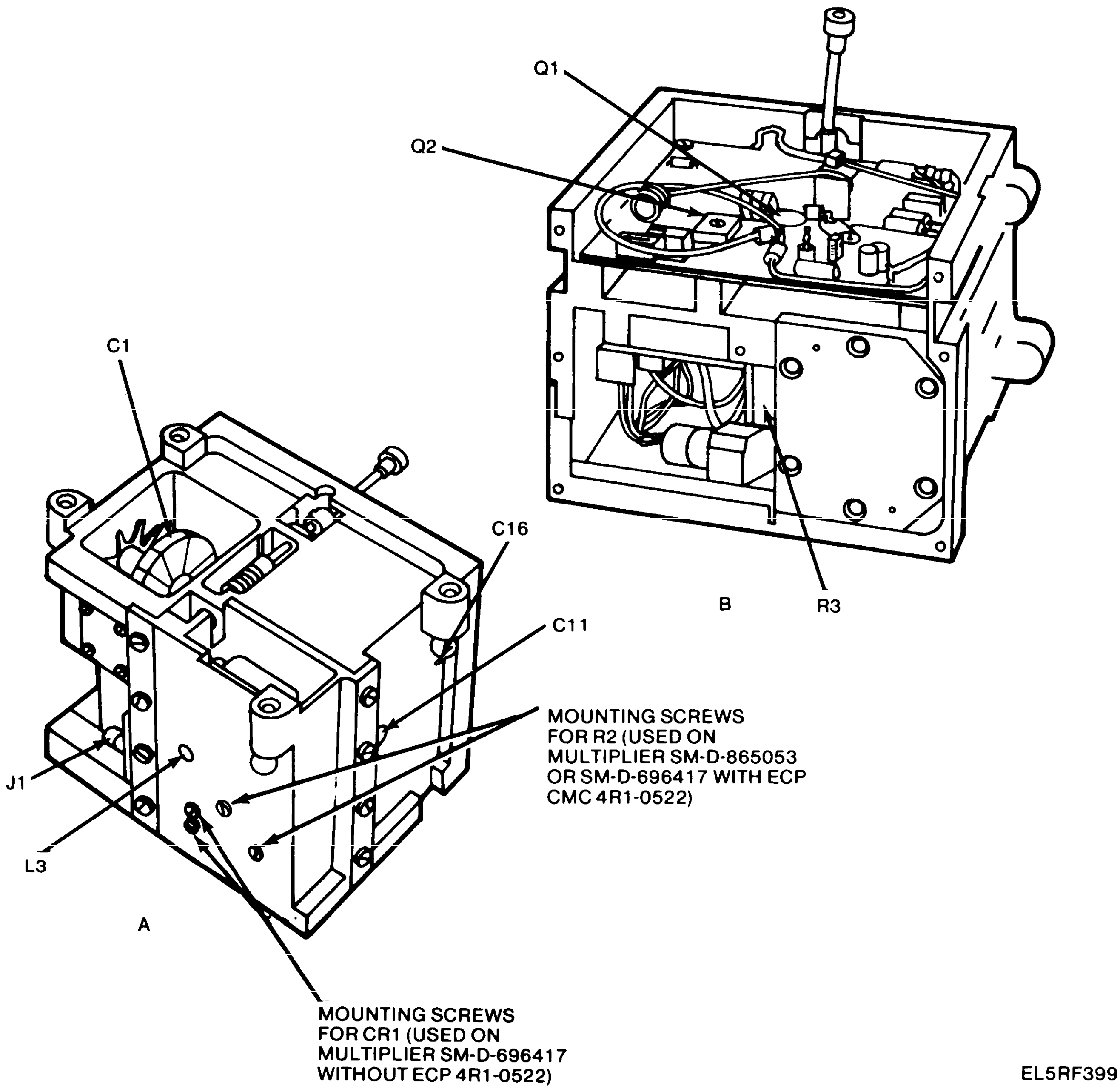


Figure 4-116. Frequency Multiplier 37A1, Top and Bottom View

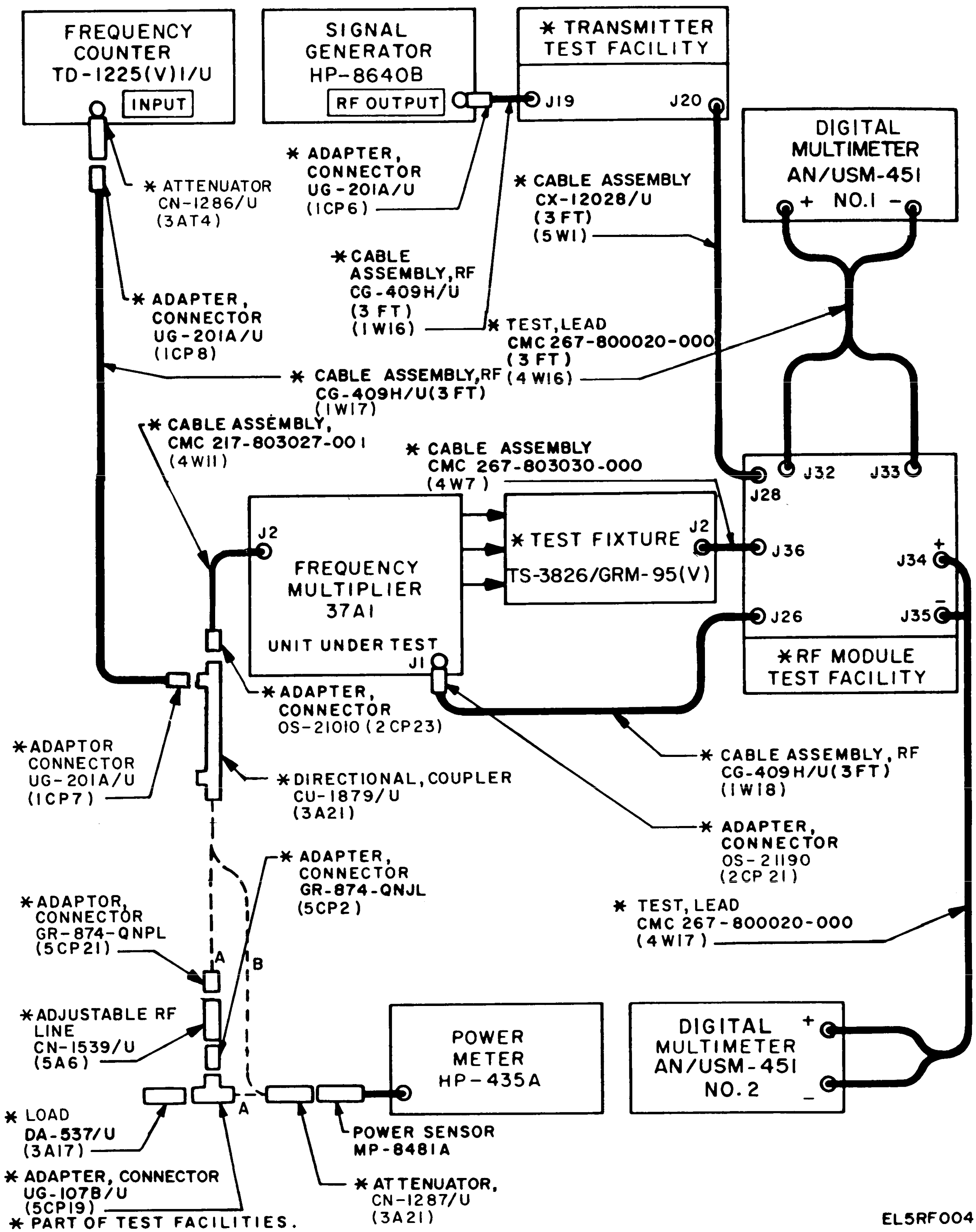


Figure 4-117. Frequency Multiplier 37A1, Power Output and Tracking Checks, Test Setup.

(b) Set the transmitter test facility switches as follows:

Switch	*Position*
S1	ON
S12	OSC

(c) Set the radio frequency module test facility controls as follows:

Control	*Position*
S13	ALC2X6
ALC 1 ADJ	Fully clockwise
ALC 2 ADJ	Fully clockwise

(d) Adjust the signal generator output frequency to 58.75 MHz ±10 kHz.

(e) Turn the mechanical counter control clockwise to obtain the maximum output power indication on the power meter at 705 MHz (as indicated on the frequency counter).

(f) Reset the mechanical counter to 0000 without moving the drive shaft of the unit under test.

NOTE

If minimum power meter indication cannot be achieved, additional FLEXCO F-172 cable may be added using Adapter Connector OS-217 (4CP2).

(g) Adjust the trombone line for minimum indication on the power meter. The power meter should indicate –3.6 dBm minimum. This output power is calculated by first summing the test setup losses, 3 dB mismatch loss, 20 dB loss from the attenuator, 0.1 dB loss from the directional coupler and a 0.5 dB loss from the trombone line and cables, etc. and then subtracting this total from minimum output requirement of +20 dBm.

(h) Adjust the ALC 2 ADJ control for a +6.5 Vdc indication on digital multimeter No. 2. The power meter should indicate at least 3 dB below the power meter indication in *(g)* above. Reset the ALC 2 ADJ control fully clockwise.

(i) Repeat steps *(g)* and *(h)* above for the frequencies listed in the table below.

NOTE

In the following table, the input frequency of unit under test is two times the signal generator output frequency and the output frequency is indicated on the frequency counter.

Input (MHz)	*Sig gen freq (MHz)*	*Switch S13 setting*	*Counter setting*	*Output (MHz)*
117.50	58.75 ±10 kHz	ALC 2 x 6	0000.0	*705
116.66	58.33 ±10 kHz	ALC 2 x 6	9999.0	700
113.33	56.66 ±10 kHz	ALC 2 x 6	9993.5	680
110.00	55.00 ±10 kHz	ALC 2 x 6	9987.5	*660
106.66	53.33 ±10 kHz	ALC 2 x 6	9982.0	640
103.33	51.66 ±10 kHz	ALC 2 x 6	9975.0	620
100.00	50.00 ±10 kHz	ALC 2 x 6	9967.5	*600
96.66	48.33 ±10 kHz	ALC 2 x 6	9960.0	*580
145.00	72.50 ±10 kHz	ALC 2 x 4	9960.0	*580
140.00	70.00 ±10 kHz	ALC 2 x 4	9951.5	560
135.00	67.50 ±10 kHz	ALC 2 x 4	9942.5	540
130.00	65.00 ±10 kHz	ALC 2 x 4	9933.0	520
125.00	62.50±10 kHz	ALC 2 x 4	9922.5	*500
120.00	60.00±10 kHz	ALC 2 x 4	9911.0	480
115.00	57.50 ±10 kHz	ALC 2 x 4	9897.0	460
110.00	55.00 ±10 kHz	ALC 2 x 4	9883.0	440
105.00	52.50 ±10 kHz	ALC 2 x 4	9868.0	420
100.00	50.00 ±10 kHz	ALC 2 x 4	9855.5	*400
98.75	49.37 ±10 kHz	ALC 2 x 4	9846.0	*395

* Frequencies marked with an asterisk (*) are used in metering checks in steps *(j)*, *(k)* and *(l)* following.

(j) With the unit under test peaked at 395 MHz and radio frequency module test facility switch S 13 set to ALC 2 x 4, adjust the ALC 2 ADJ control to reduce the power output of the unit under test to –3.6 dBm (equivalent to a power output of the unit under test of +20 dBm on the power meter).

(k) Set transmitter test facility switches S12 to MULT and S20 to S12. Test facility meter Ml should indicate between 45 percent and 55 percent.

(l) Repeat *(j)* and *(k)* above for the output frequencies marked with an asterisk in the table above.

(5) *Bandwidth check.*

(a) Connect the test equipment as shown in B, figure 4-117.

(b) Set the transmitter test facility switches as follows:

Switch	*Position*
S1	ON
S12	OSC

(c) Set the radio frequency module test facility controls as follows:

Control	*Position*
S13	ALC 2X6
ALC 1 ADJ	Fully clockwise
ALC 2 ADJ	Fully clockwise

(d) Set the signal generator to indicate 58.75 MHz output frequency, and set the output level to +15 dBm.

(e) Rotate the test fixture tuning knob until the test fixture mechanical counter indicates 0000.

(f) Adjust the signal generator frequency to indicate 705 MHz ±125 kHz on the frequency counter.

(g) Note the unit under test output power indicated on the power meter.

(h) Rotate the signal generator frequency control clockwise until the output power drops by 3 dB. Record the frequency indicated on the frequency counter.

(i) Return signal generator to the 705 MHz indication on the frequency counter (*(f)* above).

(j) Rotate the signal generator frequency control counterclockwise until the output power drops by 3 dB. The difference between the frequency indicated on the frequency counter and that recorded in step *(h)* above should be 8 MHz ±4 MHz.

(k) Repeat steps *(e)* through *(j)* above for all frequencies marked with an asterisk in the table in paragraph b. *(4)(i)* above.

(l) Rotate the test fixture tuning knob until the test fixture mechanical counter indicates 0000.0. Use the clamp (CMC-702-800013) to lock the unit under test tuning shaft in place. Remove the unit under test from the test fixture.

c. Tracking Alinement.

(1) Remove both the large sheet metal cover (17 screws) and the small plate covering C 1 (6 screws) from the unit under test.

(2) Turn the tuning shaft until capacitor Cl is set for minimum capacitance (fully open).

(3) Mount the unit under test to the test fixture TS-3826/GRM-95(V). Engage the mechanical counter drive shaft. Engage J1 of the unit under test with P1 of the test fixture and secure the unit under test using the captive screws.

(4) Connect the equipment as shown in B, figure 4-117. Set the transmitter test facility switches as follows:

Switch	*Position*
S1	ON
S12	OSC

(5) Set the radio frequency module test facility controls as follows:

Control	*Position*
S13	*ALC2X6*
ALC 1 ADJ	Fully clockwise
ALC 2 ADJ	Fully clockwise

(6) Adjust the signal generator frequency to 58.75 MHz ±10 kHz with an output of +15 dBm. This will result in an output frequency from the unit under test of 705 MHz (58.75 MHz X 12).

(7) Turn the mechanical counter control clockwise to obtain maximum output from the unit under test as indicated on the power meter. Set the mechanical counter to 0000 without moving the drive shaft of the unit under test.

(8) Set the signal generator frequency and switch S13 as indicated in the table in paragraph *b. (4)(i)* above.

(9) Set the mechanical counter to the appropriate frequency and bend capacitor C 1 plates to center the response on the respective output frequency (within ±2 MHz).

NOTE

Access to Cl is provided in the base of the test jig.

d. Power Output Alinement.

(1) Adjust the mechanical counter to 0000, set the signal generator to 58.75 MHz ±10 kHz, and set S13 to ALC 2 x 6. The output frequency should be 705 MHz ±125 kHz.

(2) Adjust capacitor C 16 (fig. 4-116) for maximum response amplitude and, if necessary, capacitor C1 to peak the response on the power meter.

NOTE

The correct position of C16 is the first maximum encountered when turning counterclockwise from the fully clockwise position.

(3) On the radio frequency module test facility, set switch S13 to ALC 2 x 4. Adjust Cl until the mechanical counter indicates 9911.0.

(4) Adjust the signal generator frequency until the frequency counter indicates 480 MHz ±125 kHz.

(5) Adjust Cl 1 and L3 for maximum response amplitude.

(6) Set radio frequency module switch S13 to ALC 2 x 6 and adjust the mechanical counter to 0000.

(7) Adjust the signal generator frequency until the frequency counter indicates 705 MHz ±125 kHz. Note the output power; it should not be less than +20 dBm.

(8) Repeat step (7) above for the remaining signal generator frequencies in the ALC 2 x 6 range listed below. Note the frequencies at which the output power is less than +20 dBm.

Input (MHz)	*Sig gen freq* (MHz)	*Switch S13* setting	*Counter* setting	*Output (MHz)*
117.50	*58.75* +10 kHZ	ALC2x6	0000.0	705
116.66	58.33 ±10 kHZ	ALC2x6	9999.0	700
113.33	56.66 ±10 kHZ	ALC2x6	9993.5	680
110.00	55.00 ± l0 kHz	ALC2x6	9987.5	660
106.66	53.33 ± l0 kHz	ALC2x6	9982.0	640
103.33	51.66 ± 10 kHZ	ALC2x6	9975.0	620
100.00	50.00 ± l0 kHz	ALC2x6	9967.5	600
96.66	48.33 ± 10 kHZ	ALC2x6	9960.0	580

(9) For any of the above output frequencies at which the output power is less than +20 dBm, proceed as follows:

(a) Set the signal generator to the corresponding frequency in the listing.

(b) Tune the multiplier to the corresponding output frequency by adjusting the counter to the corresponding setting.

(c) Adjust Cl 1 on the unit under test for +20 dBm output power.

(d) Repeat (6) through (8) above until all requirements are met.

(10) Set switch S13 (rf modules test facility) to ALC2X4.

(11) Repeat (7) through (9) for the following input frequencies. The output power should not fall below +20 dBm. Adjust Cl1 and C16 if necessary. If Cl1 is readjusted, repeat (6) through (8) above.

Input (MHz)	*Sig gen freq (MHz)*	*Switch S13 setting*	*Counter setting*	*Output (MHz)*
145.00	72.50 ±10 kHz	ALC2x4	9960.0	580
140.00	70.00 ± l0 kHz	ALC2x4	9951.5	560
135.00	67.50 ± 10 kHz	ALC2x4	9942.5	540
130.00	65.00 ±10 kHZ	ALC2x4	9933.0	520
125.00	62.50 ±10 kHz	ALC2x4	9922.5	500
120.00	60.00 ±10 kHZ	ALC2X4	9911.0	480
115.00	57.50 ± 10 kHz	ALC2X4	9897.0	460
110.00	55.00 ± 10 kHz	ALC2X4	9883.0	440
105.00	52.50 ± 10 kHz	ALC2X4	9868.0	420
100.00	50.00 ± 10 kHz	ALC2X4	9855.5	400
98.75	49.37 ± 10 kHz	ALC2X4	9846.0	395

(12) Repeat *b.(5)(a)* through *(l)* to recheck the bandwidth.

c. Troubleshooting (FO-42 or FO-43).

Symptom	Checks and corrective measures
1. ALC 1 requirements not met.	Higher category maintenance required.
2. ALC requirements not met.	Higher category of maintenance required.
3. Abnormal output.	*a.* Check for damaged cables or connectors and broken wires. Repair or replace as required. *b.* Check for shorted plates on ganged variable capacitor C 1 (fig. 4-1 16). *c.* If output is low only at certain frequencies, perform alinement procedures in paras c. and d. above. *d.* Higher category of maintenance required.

4-38. Control-Indicator 37A2 or 33A4.

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Gage, Thickness, 0.003 in.	Feeler gauge
Wrench, Torque	Torque wrench

b. Test Procedure.

(1) Connect the test equipment as shown in figure 4-118.

(2) Set transmitter test facility switches S1 and S6 to ON.

(3) Perform the following preliminary checks:

NOTE

The control-indicator unit number must correspond with the unit number displayed in the left hand window of the control-indicator test set. For unit 37A2 the type number is CMC 245-800045-000 and for unit 33A4 the type number is CMC 245-407270-000.

a. Turn the thumbwheel on the control-indicator test set until channel 390 is displayed.

(b) Turn the tuning control shaft on the unit under test so that the numerical counter indicates channel 390.

(c) Observe the lamp display on the control-indicator test set. Extinguished lamps must correspond to the dots on the tape display.

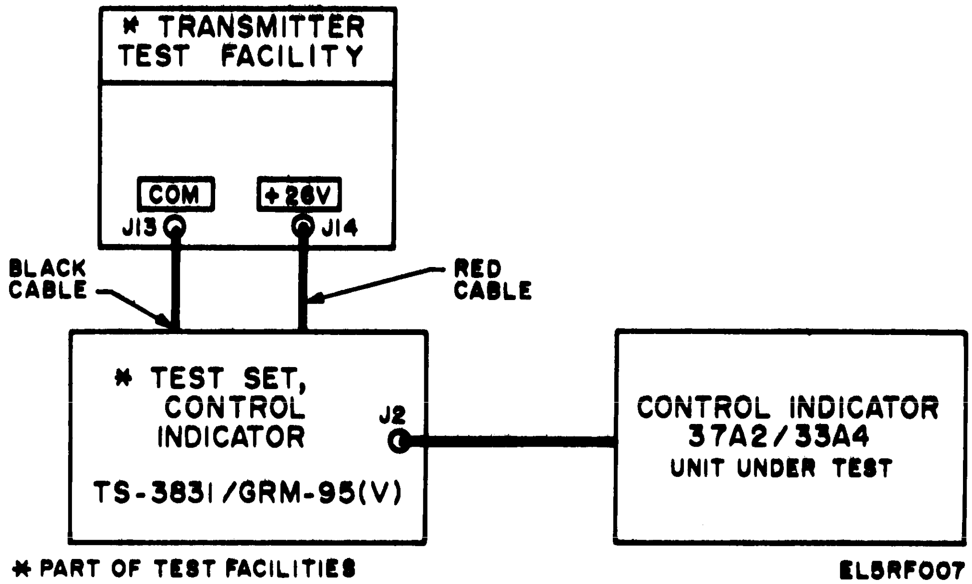


Figure 4-118. Control Indicator 37A2 or 33A4, Test Setup

(d) Repeat *(a)* and *(b)* above for the remaining channels shown on the tape for that type unit,

(4) Perform the following final operational check:

NOTE

The following procedure checks for intermittent switch operation through a complete revolution of each control cam.

(a) Set the control indicator to the first channel indicated in step 1 of figure 4-119.

(b) Gently change back and forth between the channels indicated in the step several times. The coding of the test set lamps should agree with the coding shown for that channel in the table after each transition and should not indicate erratic operation (only the coding for the cam and switches being checked is shown),

(c) Repeat *(a)* through *(b)* above for each remaining step of figure 4-119, Test set lamp number 13 should not flicker while tuning between channels, except for the channels listed below.

37A2	*33A4*
From 623 to 624	From 663 to 564
767 to 768	707 to 708
783 to 704	793 to 724
816 to 816	765 to 780
879 to 880	819 to 820

(d) Check the stop mechanism by turning control shaft to the limits past channel 300 and channel 1099. At these points, the slipping clutch should operate to atop further movement of the gears.

Do not exert undue force on the mechanism if the clutch does not slip, Readjust clutch nut as described in paragraph 4-11d (6).

c. Troubleshooting (FO-40 (schematic) and FO-44 (coding table)).

Symptom	*Checks and corrective measure*
One or more lamps, No. 2 thru 12 permanently Illuminated	Remove cover of unit under list, Manually operate switch corres-pending to permanently illuminated lamp; this can be done by gently pushing the ball associated the switch (fig, 4-43), If the lamp does not extinguish while manually operating the switch, replace the faulty switch. Adjust the operating point as described in para, *4.11d* If the lamp extinguishes, check that the bell is not sticking, Check adjustment of the switch operating point (para, 4.11d.(4)),
One or more lamps, No. 2 thru 12 not illuminated	Check for a sticking ball associated with nonoperating lamp, If lamp doe a not light with witch in released position, replace switch,
Lamp No, 13 permanently on or not illuminating	Replace command signals decoder (fig, 4-48),

d. Switch and Tuning Control Adjustments, Refer to paragraph 4-11 *d.*

STEP NUMBER	SET INDICATOR TO CHANNEL		CHECK TS-3831 LAMP NUMBERS (● = OFF, ○ = ON, BLANK = NOT CHECKED)															
	37A2	33A4		0	1	2	3	4	5	6	7	8	9	10	11	12	13
1 a	495	435				●	●	●	●	●	●	●	○	●	●	○	●
b	496	436				○	○	○	○	○	○	○	●	●	●	○	●
c	497	437				●	○	○									●
d	498	438				○	●	○									●
e	499	439				●	●	○									●
f	500	440				○	○	●									●
g	501	441				●	○	●									●
h	502	442				○	●	●									●
i	503	443				●	●	●	○	○	○						●
j	504	444				○	○	○	●	○	○						●
2	511	451							●	○	○						●
	512	452							○	●	○						●
3	519	459							○	●	○						●
	520	460							●	●	○						●
4	527	467							●	●	○						●
	528	468							○	○	●						●
5	535	475							○	○	●						●
	536	476							●	○	●						●
6	543	483							●	○	●						●
	544	484							○	●	●						●
7	551	491							○	●	●						●
	552	492							●	●	●						●
8	559	499							●	●	●	○	●	●			●
	560	500							○	○	○	●	●	●			●
9	623	563				●	●	●	●	●	●	●	●	●	●	○	●
	624	564				○	○	○	○	○	○	○	○	○	○	●	●
10	687	627										○	○	○			●
	688	628										●	○	○			●
11	751	691										●	○	○			●
	752	692										○	●	○			●
12	759	699				●	●	●	○	○	○	○	●	○	○	●	●
	760	700				○	○	○	●	○	○	○	●	○	○	●	○
13	815	755										○	●	○			○
	816	756										●	●	○			○
14	879	819										●	●	○			○
	880	820										○	○	●			○
15	943	883										○	○	●			○
	944	884										●	○	●			○
16	1007	947										●	○	●			○
	1008	948										○	●	●			○

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Figure 4-119. Control Indicator 37A2 or 33A4, Lamp Indication.

4-39. Radio Frequency Amplifier 37AR1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/ GRM-95(V)	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/ GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facility Set, MK-1173(V)2/GRM-95(V)2	Accessory kit, test facility set
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Test Facility, Radio Frequency Modules, TS-3837(V)2/GRM-95(V)2	Test facility frequency modules
Drive Generator, Airborne Instrument Labs, Model 125A	Power signal source
Counter, Frequency, TD-1225(V)l/U	Frequency counter
Meter, Power, HP-435A	Power meter
Sensor, Power, JP-8481A	Power sensor
Multimeter, Digital, AN/USM-451	Digital multimeter
Wattmeter, AN/USM-298	Wattmeter
Element, Bird No. 50D, 200-500 MHz	Wattmeter element
Element, Bird No. 50E, 500-100 MHz	Wattmeter element

b. Test Procedure.

(1) *Preliminary checks.*

(a) For AM-4321B/GRC-103 only, before connecting the unit under test to the test setup, a resistance check on the temperature sensor is required:

1. Connect the digital multimeter between pins 17 and 43 of connector P1 of the connector filter assembly 37AR1A1W1A1. The resistance measured should be within the limits shown on the "Temp/ Resistance" chart for the temperature of the heat radiator of the unit under test output tube (fig. 4-113).

2. Connect the multimeter between pin 17 and pin 1 (H.V. connection). The multimeter should indicate an open circuit.

3. Repeat 2. above for pins 43 and 1.

WARNING

High voltages are accessible at the test leads and connections when the megohmmeter is used. Switch to "OFF" and "DISCHARGE" before connecting or disconnecting test leads.

4. Short pins 17 and 43 together and connect the megohmmeter between the shorting wire (pins 17 and 43) and pin 1.

5. Turn the megohmmeter power switch on, and set its voltage control to 600 volts.

6. Set the "DISCHARGE - CHARGE - MEASURE" switch to "CHARGE" and then "MEASURE". The resistance indicated on the megohmmeter should be greater than 50 megohms.

7. Return switches to "DISCHARGE" and "OFF".

8. Disconnect megohmmeter and the short between pins 17 and 43.

(b) Preliminary checks are as follows:

WARNING

LETHAL 630 Vdc present at tube plate radiators.

CAUTION

Do not switch on the power signal source with its output unterminated.

1. Turn power signal source output level control to minimum (fig. 4-120).

2. Connect the test equipment as shown in A, figure 4-120. Set power supply PP-6304/GRM-95(V) to 115 Vac.

3. Direct cooling air from the AIR OUTLET of the transmitter test facility, to the rear of the unit under test, using Hose Assembly, Airduct, MX-8414/ GRM-95(V)(IMP2).

4. Set the XMTR TUNE control on the unit under test to channel 1010.

5. Switch on the test equipment and set the transmitter test facility switches as follows:

Switch	*Position*
S1	ON
S16	OUTPUT NORMAL
S20	S12
S12	OSC
S17	ON

(2) *Filament voltage and tube current checks.*

(a) Set the transmitter test facility controls as follows:

Control	*Function*
S13	600 V ON

(b) Turn the power signal source function switch to CW and tune the frequency control to 705 MHz ±0.7 MHz as indicated on the frequency counter.

(c) Adjust the output level of the power signal source to +34 dBm (2.5 watts) (power meter indication of +34 dBm minus coupling factor minus 10 dB). If necessary, adjust the PLATE and CATHODE tuning controls, as well as the RF OUTPUT ATI'ENUATOR, to obtain the +34 dBm at 705 MHz.

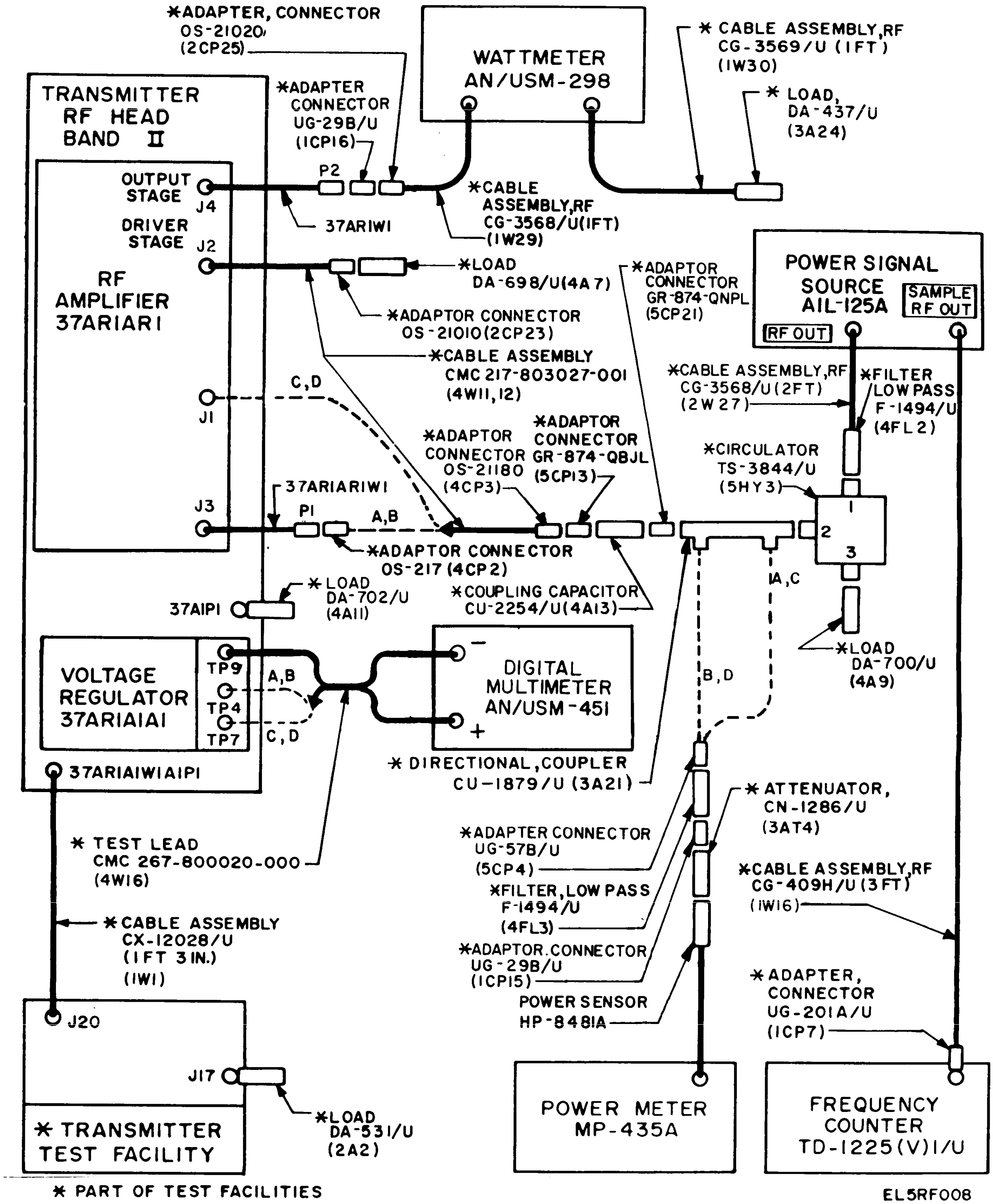


Figure 4-120. Radio Frequency Amplifier 37AR1, Output and Driver Amplifier Check, Test Setup.

(d) Use the multimeter to check the voltage on the voltage regulator assembly 37AR1A1A1 (TM 11-5820-540-30) at the test points listed below.

Test points Neg	Pos	Voltage (Vdc)
TP2	TP4	6.0 to 6.4
TP1	TP3	6.0 ta 6.4
TP9	TP8	0.65 to 0.85
TP9	TP4	15 V maximum

(e) Check the voltage between TP4 and TP9 throughout the test and adjust the drive level from the power signal source as required to maintain the voltage at + 14Vdc ±1V.

(f) Set the transmitter test facility switch S20 to +600 V. Meter M1 should indicate within the green band.

(g) Set switch S20 to S12 and set switch S12 to OUTPUT CUR. Meter Ml should indicate approximately 30% of full scale.

(h) Set switch S12 to DRIVER CUR. Meter Ml should indicate within the green band.

(3) *Output amplifier power output and input match checks.*

(a) With the test equipment connected as in A, figure 4-120, set the XMTR TUNE control on the unit under test to channel 1010. Tube the UUT for maximum output. If necessary adjust the PWR OUT PEAK control and trimmer capacitor 37AR1AR1C11 situated at the rear of the unit (TM 11-5820-540-30) for maximum indication on the wattmeter. The level should not be less than 32 watts (+45 dBm).

NOTE

37AR1AR1C11 should only be adjusted by 1/8 turn either side of its normal center. Ascertain that the PWR OUT PEAK control provides the highest power output at its mid-position (or nearly equal lower outputs at its fully clockwise and counterclockwise positions). If not, loosen the set screw on the bevel gear and reset the limit mechanism.

(b) The input level to the output stage shall be less than +36 dBm (power meter indication of +36 dBm minus 10 dB minus coupling factor), for an indication of +14 Vdc ±1V on multimeter. Note the power meter indication in dBm.

(c) Connect the power meter to the reflected port of the directional coupler (B, fig. 4-120). The power meter should indicate at least 14 dB less than the level recorded in *(b)* above.

(d) If unit under test does not meet requirement of *(c)* above, proceed as follows:

1. Remove the control panel 37MP1 (front panel) of the unit under test (para. 2-58).

2. Loosen the drive chain idler (fig. 4-121) and slacken the chain.

3. Pull the chain free from the output tube cathode sprocket.

4. Rotate the freed sprocket until minimum reflected power is obtained on the power meter.

5. Recheck the cathode voltage as in step *(2)(e)* above and readjust drive level if required.

6. Replace the chain over the sprocket and tighten the drive chain idler.

7. Repeat steps *(a)* through *(c)* above.

(e) Reduce the power signal source output level to 100 mw (power meter indication of +20 dBm minus 10 dB minus coupling factor (A, fig. 4-120).

(4) *Driver amplifier power output and input match checks.*

(a) Set the power signal source output to minimum and connect the test equipment to the driver amplifier as shown in C, figure 4-120. Do not change the position of the XMTR TUNE control (channel 1010 exactly).

(b) Adjust the power signal source frequency to 705 MHz ±700 kHz as indicated on the frequency counter. Adjust the signal source for a power level of +20 dBm (power meter indication of +20 dBm, minus 10 dB, minus coupling factor). Record the level indicated.

(c) Set the transmitter test facility switch S12 to DRIVER CUR. Meter Ml should indicate within the green band.

(d) Observe the multimeter connected to voltage regulator assembly 37AR1A1A1 (TM 11-5820-540-30). The multimeter should indicate 0.75 Vdc ± 0.1 V.

(e) Connect the power meter to the reflected power port (D, fig. 4-120). The power meter should indicate at least 14 dB less than the level noted in *(b)* above.

(f) If the required level (return loss) in *(e)* above is not obtained proceed as follows:

1. Remove the control panel 37MP1 (front panel) of the unit under test (para. 2-58).

2. Loosen the drive chain idler (fig. 4-121) and slacken the chain.

3. Pull the chain free from the driver tube (left hand) cathode sprocket.

4. Rotate the freed sprocket until a minimum reflected power indication is obtained on the power meter.

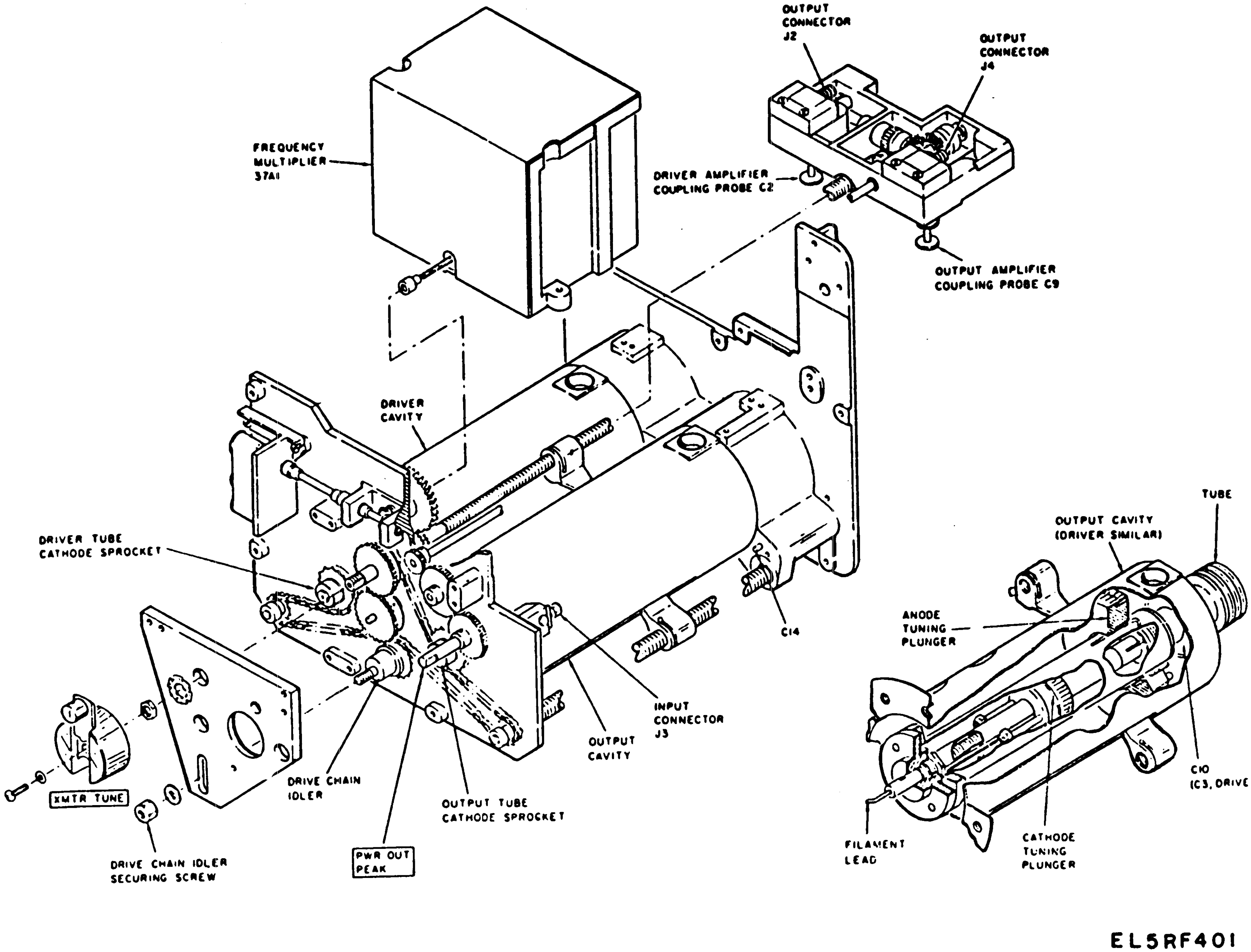


Figure 4-121. Radio Frequency Amplifier 37AR1, Tuning Mechanism and Cutaway View of Resonator.

5. Replace the chain over the sprocket and tighten the drive chain idler.

6. Repeat steps *(b)* and *(e)* above.

(5) *Tuning and power output checks.*

(a) Reconnect all signal leads within the amplifier under test that were previously disconnected. Set XMTR TUNE control to indicate channel 1010.

(b) Adjust the power signal source output to minimum and connect the test equipment as shown in A, figure 4-122.

(c) Check and reset if necessary, the frequency from the power signal source. The frequency should be 705 MHz +700 kHz.

(d) Adjust the output level of the power signal source to +17 dBm. (A power meter indication of +17 dBm minus the coupling factor at 705 MHz.)

(e) Adjust the PWR OUT PEAK and XMTR TUNE controls for maximum output power. Readjust the power signal source output level to maintain 14 Vdc ±1 V between TP4 and TP9 of 37 AR1A1A1. The input level to the unit under test should not exceed +20 dBm.

(f) The output power as indicated on the wattmeter should be more than 25 watts (+44 dBm). Set the transmitter test facility switch S 12 to PWR OUT. Meter Ml should indicate at least 40% of full scale.

(g) Rotate XMTR TUNE clockwise and check that the tuning limit mechanism stops in a position above channel 1010. Rotate XMTR TUNE counterclockwise and check that the tuning limit mechanism stops in a position below channel 390. If adjustment is required, set the mechanism for the first possible position above channel 1010.

(h) Set S12 to REFL OUT. Meter Ml should indicate less than 5 percent of full scale.

(i) Disconnect the wattmeter from the PWR OUT connector. Meter Ml should indicate between 20 percent and 90 percent of full scale.

(j) Reconnect the wattmeter to the PWR OUT connector and repeat *(c)* through *(f)* above for the channels listed below. Check that the required drive level does not exceed +20 dBm (a power meter indication of +20 dBm minus the coupling factor), that the tape indication is within ±0.5 inch of the window center, and that the voltage level between TP4/TP9 does not exceed 15 V.

NOTE

For frequencies below 500 MHz use circulator, TS-3843/U(5HY4).

Channel	*Frequency (MHz)*	*Drive power (14 V) (typical mw)*	*Output power (watt) Min*	*Typical*
390	395	90	25	37
400	400	100	25	37
480	440	100	25	43
560	480	100	25	35
640	520	110	25	40
720	560	100	25	33
800	600	80	25	38
880	640	70	25	34
960	680	60	25	35
1000	700	60	25	35

(6) *Metering and ALC checks.*

(a) Set the XMTR TUNE control to channel 1010 and tune power signal source frequency to 705 MHz.

(b) Connect multimeter (set to 20 Vdc range) to TP4(+) and TP9(–) of voltage regulator assembly 37AR1A1A1.

(c) Adjust power signal source output level for +14 Vdc indicated on the multimeter.

(d) Set the test facility switch S12 to DRIVER; meter Ml should indicate between 40 percent and 60 percent full scale.

(e) Increase power signal source output level for +15 Vdc indicated on the multimeter.

(f) Connect the multimeter (set to 10 MA DC range) to TP5(+) and TP9(-). Multimeter should indicate no less than 1 ma.

(g) Adjust the power signal source output level for an output power of 25 w from the unit under test, indicated on the wattmeter.

(h) Set the transmitter test facility switch S12 to PWR OUT. Meter M1 should indicate between 40 percent and 60 percent full scale. Note Ml indication.

(i) Set S12 to REFL OUT. Meter Ml should indicate less than 5 percent of full scale.

(j) Connect cable from PWR OUT connector of assembly under test to the unterminated trombone line, CN-1539/U (B, fig. 4-122).

(k) Set the transmitter test facility switch S12 to PWR OUT. Adjust trombone line for M 1 indication noted in *(h)* above.

(l) Set S12 to REFL OUT. Meter Ml should indicate between 67 percent and 87 percent full scale.

(7) *Output VSWR check.*

(a) Disconnect trombone line and restore test setup as shown in A, figure 4-122.

(b) Repeat *(6)(a)* through *(c)* above and adjust PWR OUT PEAK, on assembly under test for maximum output power, and readjust power signal source output level, if necessary, for +14 Vdc indication on the multimeter.

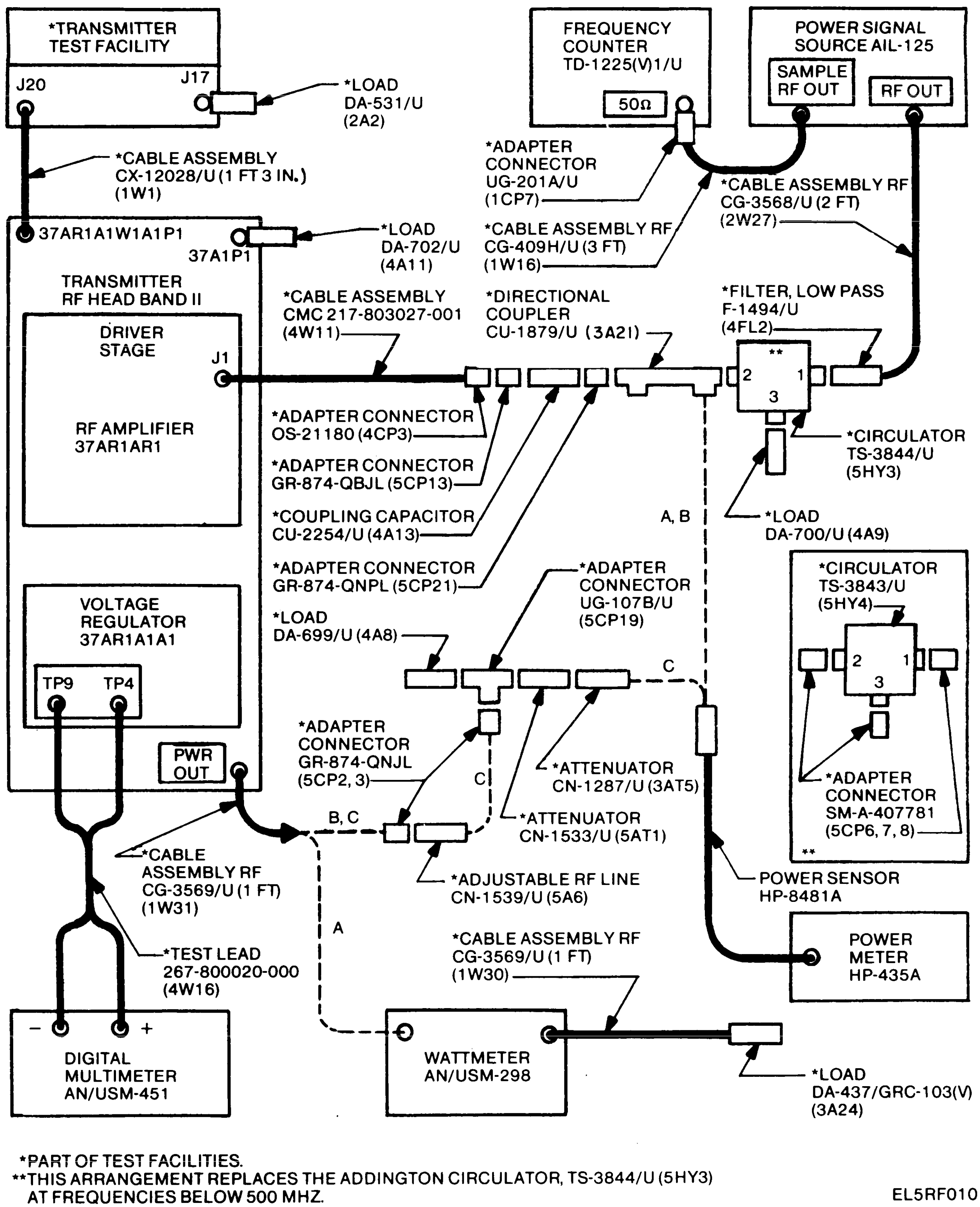


Figure 4-122. Radio Frequency Amplifier 37AR1, Tuning and Power Output Checks, Test Setup.

(c) Connect power meter and trombone line to the assembly under test as shown in C, figure 4-122.

(d) Adjust the trombone line for maximum power meter indication. Note this indication.

(e) Adjust the trombone line for minimum power meter indication. The power meter should indicate no more than 1.9 dB (2.0:1 VSWR) below the value noted in *(d)* above.

(f) Repeat steps *(a)* through *(e)* above for channels 720 and 400 with power signal source frequencies of 560 MHz and 400 MHz respectively.

(g) Set the transmitter facility switch S13 to the off position and S1 to OFF.

c. Troubleshooting (FO-40, FO-41, or FO-45 and TM 11-5820-540-30, fig. 2-81).

Symptom	*Probable cause*	*Checks and corrective measures*
Abnormal indication in *b. (2)(d)* above.	*a.* Defective wiring.	a. Check the continuity between 37AR1A1-W1A1P1 and 37AR1A1W1J5.
	b. Defective voltage regulator assembly 37ARlAlAl.	*b.* Test 37AR1A1A1 as described in para. 4-40.
Meter Ml indication low or zero in *b. (2)(f)* above.	*a.* Defective resistor assembly 37AR1A1A2.	*a.* Set switches S13 and S1 to OFF. Disconnect the 600 V line from E1 of resistor assembly 37AR1A1A2. Check and replace 37AR1A1A2 if shorting to ground (44k ohms) (para. 2-60).
	b. Defective radio interference filter 37AR1A1FL2.	*b.* Remove the 600 V line from E2 and E 1 of 37AR1A1FL2. Check and replace 37AR-1A1FL2 if shorting to ground (para. 2-57).
	c. 600 V line shorting to ground.	*c.* Check and replace 37ARlAlWlAlFLl if shorting to ground.
	d. C3, C10, *C7* or C14 shorting to ground (fig. 4-123).	d. Check C3, C10, C7 and C14 for short circuit to ground. Replace as required.
Meter Ml indication out of specified limits in *b. (2)(g)* above.	Defective output tube 37AR1AR1V1.	Replace output tube.
Low power meter indication in *b. (3)(a)* above.	Defective output tube 37AR1AR1V2.	Replace driver tube.
Indication out of specified limits in *b. (4)(d)* and *(e)* above.	Defective driver tube 37AR1AR1V1.	Replace driver tube.
Abnormal indication in *b. (5)(f)* above.	*a.* Defective low pass filter 37AR1A1FL1.	*a.* Test 37AR1A1FL1 as described in para. 4-41.
	b. Defective rf power monitor 37AR1A2.	*b.* Replace per TM 11-5820-540-30.
Meter Ml indication out of specified limits when transmitter test facility switch S12 is set to PWR OUT or REFL OUT.	*a.* Defective wiring.	*a.* Check the continuity between pin 3 of 37AR1A1W1J4 and pin 27 of 37 ARIAl-WIA1P1 (TM 11-5820-540-30). Check the continuity between pin 1 of 37AR1A1W1J4 and pin 26 of 37 A1lA1-W1A1P1.
	b. Defective power monitor 37ARlA2.	*b.* Replace per TM 11-5820-540-30.
ALC voltage indication abnormal in *b. (6)(f)* above.	Defective voltage regulator assembly 37AR1A1A1.	Test 37AR1A1A1 as described in para. 4-44.
Abnormal VSWR indication in *b. (7)(e)* and *(f)* above.	*a.* Defective cable connections between stages (FO-14).	*a.* Check cable connections and then cable connectors if necessary.
	b. Transmitter not peaked	*b.* Retune transmitter.

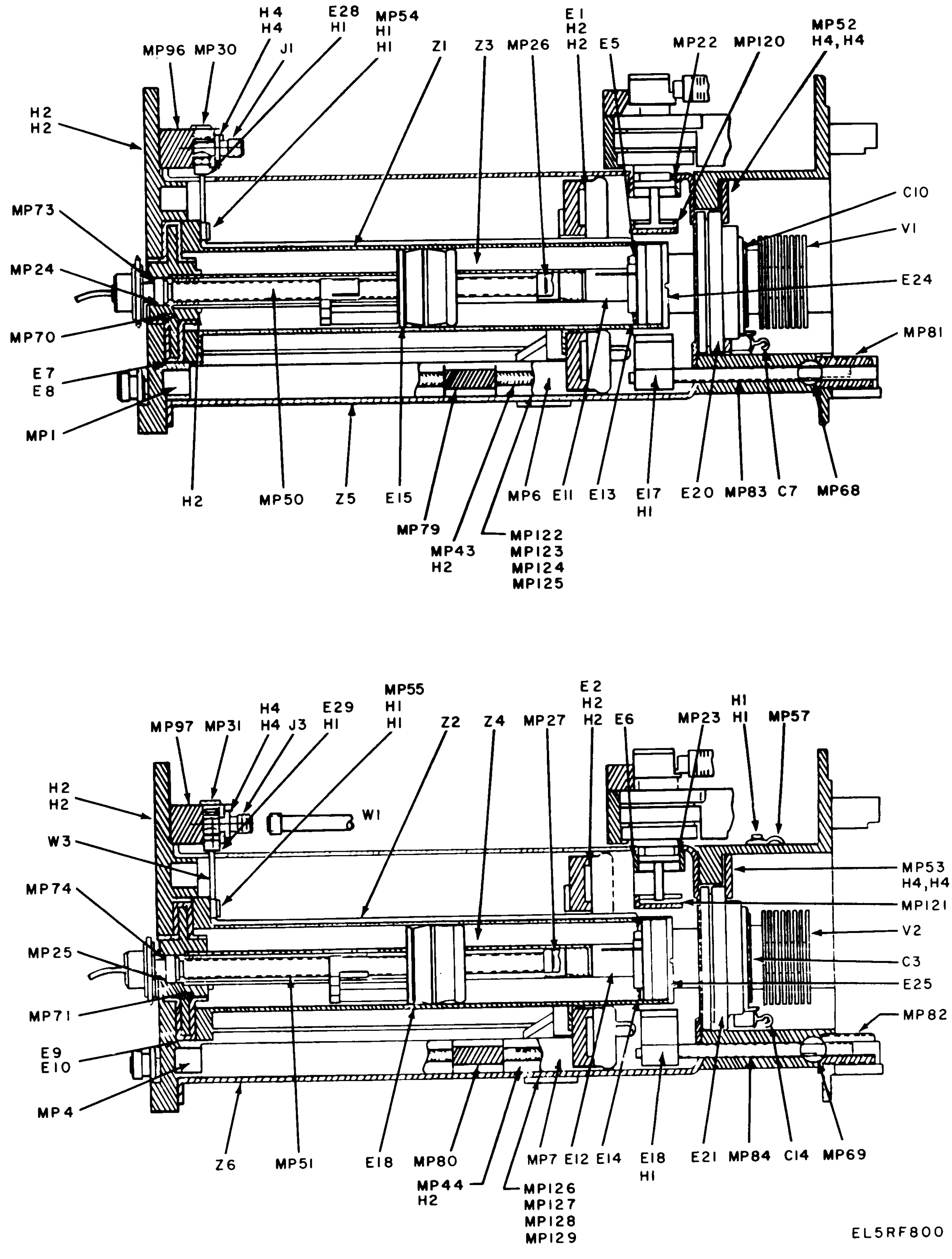


Figure 4-123. Radio Frequency Amplifier 37AR1.

4-40. Voltage Regulator Assembly 37AR1A1A1 or 38AR1A1A1.

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility, Radio Frequency Modules, TS-3837(V)2/GRM-95(V)2	Test facility radio frequency modules
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Multimeter, Digital, AN/USM-451 (two required)	Multimeter No. 1 and No. 3
Multimeter, Digital, AN/USM-486	Multimeter No. 2
Power Supply, H-6002A	Variable power supply

b. Test Procedure.

NOTE

Remove red plastic cover from unit under test.

(1) *Calibration.*

(a) Connect the test equipment as in figure 4-124 but with multimeter No. 2 unconnected.

(b) Set the test facility radio frequency module as follows:

Control	*Function*
S2	6.4 V
S3	INPUT V
S4	OFF
S5	O OHM
S1	ON

(c) Set power supply PP-6304/GRM-95(V) to 115 Vat.

(d) Switch on power supply HP-6002A and adjust to approximately 13 V. Set current limit to maximum.

(e) Press and hold 6.4 V ADJUST switch, and adjust INPUT V ADJ control for an indication of 6.4 V on multimeter No. 1. Release the 6.4 V ADJUST switch.

(2) *Driver regulator checks.*

(a) Connect the test equipment as in A, figure 4-124. (Multimeter No. 2 connected.)

(b) Reset the following controls of the test facility rf modules to the positions indicated.

Control	*Position*
S2	7.2 V
S3	DRIVER
S4	NOM
S5	O OHM

(c) Multimeter No. 2 should indicate between 1.7 and 4.7 Vdc, while multimeter No. 1 should indicate between 5.8 and 6.4 Vdc.

(d) If the indication on multimeter No. 2 is not in accordance with *(c)* above, adjust the collector resistance of transistor 37/38ARlAlAlAlQ3 with one of the following three strapping options.

CAUTION

E27 and E28 should never be connected together.

1. No connection between E26, E27, or E28; resistors R16 and R17 in the circuit.

2. A shorting link between E26 and E27; R17 in the circuit and R16 out of the circuit.

3. A shorting link between E26 and E28; R1 in the circuit and R17 out of the circuit.

(e) If the indication on multimeter No. 1 is not within the limits specified in *(c)* above, adjust the base resistance of 37/38ARlA1Al AlQ4 with one of the following four strapping options.

1. No connection between E29, E30, or E31; resistors R21 and R23 in the circuit.

2. A shorting link between E29 and E31; R23 in the circuit and R21 out of the circuit.

3. A shorting link between E30 and E31; R21 in the circuit and R23 out of the circuit.

4. A shorting link between E29 and E30; R21 and R23 short-circuited.

(f) Set S2 to 6.4 V and S4 to NOM MIN. Connect multimeter No. 2 between TP3(+) and TP1 (–). The voltage measured should exceed +5.6 V. If the voltage is below 5.6 V, add a shorting link between E26 and E27. If E26 and E27 have link already installed, remove it and add link between E26 and E28 unless already installed.

CAUTION

Do not connect link between E27 and E28.

(g) Repeat paragraphs *(2)(a)* through *(f).*

(3) *Output regulator checks.*

(a) Connect the test equipment as shown in B, figure 4-124.

(b) Set the radio frequency modules test facility switch S3 to OUTPUT and S2 to 7.2 V.

(c) Multimeter No. 2 should indicate between 1.7 and 4.7 Vdc.

(d) Multimeter No. 1 should indicate between 5.8 and 6.4 Vdc.

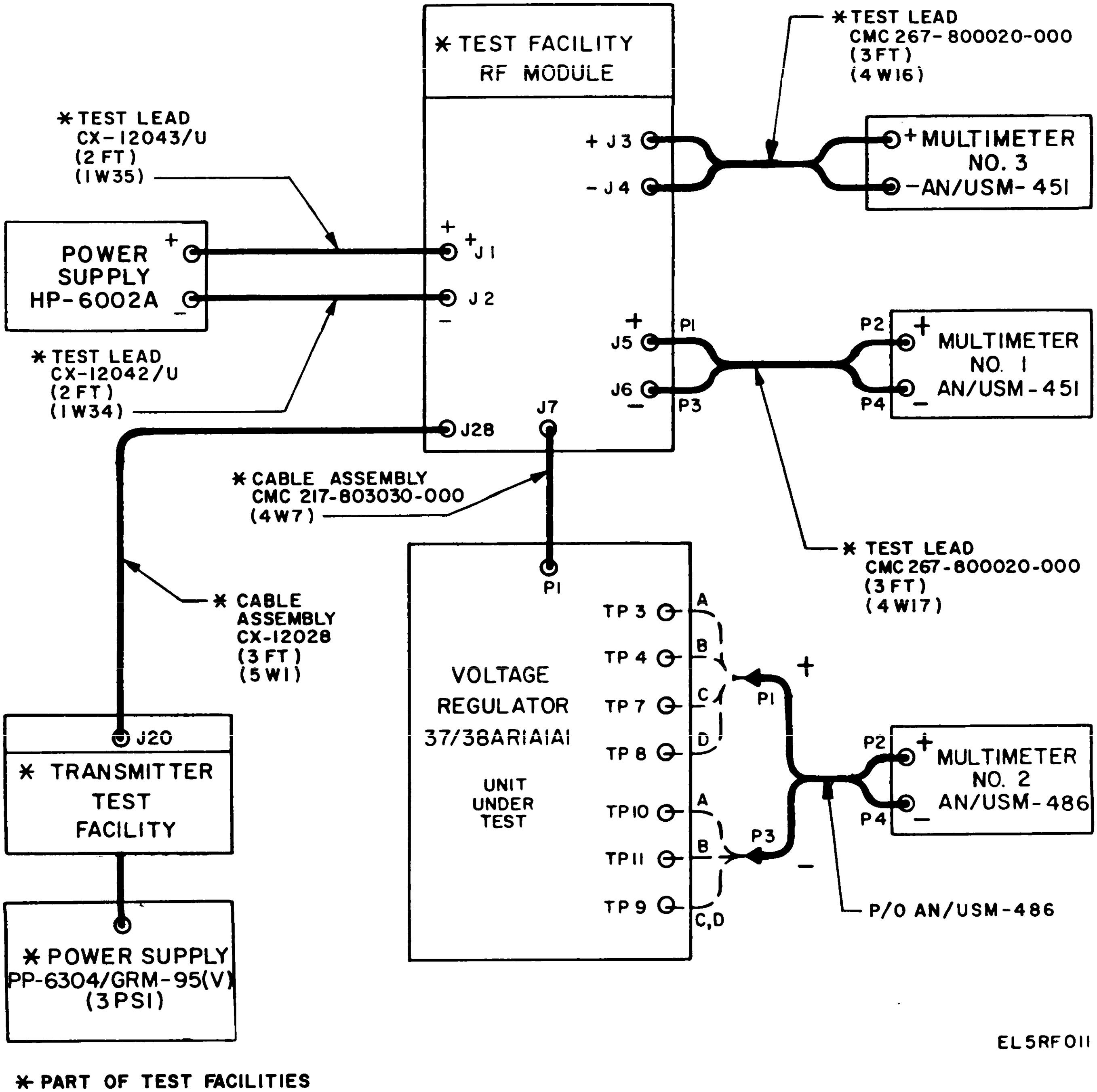


Figure 4-124. Voltage Regulator Assembly 37AR1A1A1 or 38AR1A1A1, Test Setup.

(e) If multimeter No. 2 indication is not within the limits specfled in *(c)* above, adjust the collector resistance of transistor 37/38ARlA1A1A1Q1. The three strapping options are:

CAUTION

E15 and E16 should never be connected together.

1. No connections between E14, E15, or E 16 (both R8 and R9 in circuit).

2. A shorting link between E14 and E15 (R9 only in circuit).

3. A shorting link between E14 and E 16 (R8 only in circuit).

(f) If the multimeter No. 1 indication is not within the limits specified in (d) above, adjust the base resistance of 37/38ARlAlAlAlQ2. The four strapping options are:

1. No connection between E17, E18, or E19 (both R13 and R15 in circuit).

2. A shorting link between E17 and E19 (R15 only in circuit).

3. A shorting link between E17 and E19 (R13 only in circuit).

4. A shorting link between E17 and E18 (both R13 and R15 short-circuited).

(g) Set S2 to 6.4 V and S4 to NOM MIN. Connect multimeter No. 2 between TP2(-) and TP4(+). Voltage measurement should exceed 5.6 V. If the voltage is less than 5.6 V, add a shorting link between E14 and E15. If E14 and E15 have link already installed, remove it and add link between E 14 and E 16 unless already installed.

CAUTION

Do not connect link between E 15 and E 16.

(h) Repeat paragraphs *(3)(a)* through *(e)*.

(4) *Output line and load regulation checks.*

(a) Connect the test equipment as shown in B, figure 4-124.

(b.) Set the following controls of test facility rf modules to the positions indicated.

Control	*Position*
S2	6.4 V
S3	OUTPUT
S4	NOM MAX
S5	0 OHM

(c) Multimeter No. 1 should indicate between 5.6 and 6.6 Vdc.

(d) Set switch S2 (test facility rf modules) to 8.0 V; multimeter No. 1 should indicate between 5.6 and 6.6 Vdc.

(e) Set switch S4 (test facility rf modules) to NOM MIN; multimeter No. 1 should indicate between 5.6 and 6.6 Vdc.

(f) Set switch S2 (test facility rf modules) to 6.4 V; multimeter No. 1 should indicate between 5.6 and 6.6 Vdc.

(5) *Driver line and load regulation checks.*

(a) Connect the test equipment as shown in A, figure 4-124.

(b) Set the following controls of the test facility rf modules to the positions indicated.

Control	*Position*
S2	8.0 V
S3	DRIVER
S4	NOM MIN
S5	0 OHM

(c) Multimeter No. 1 should indicate between 5.6 and 6.6 Vdc.

(d) Set switch S2 (test facility rf modules) to 6.4 V; multimeter No. 1 should indicate between 5.6 and 6.6 Vdc.

(e) Set switch S4 (test facility rf modules) to NOM MAX; multimeter No. 1 should indicate between 5.6 and 6.6 Vdc.

(f) Set switch S2 (test facility rf modules) to 8.0 V; multimeter No. 1 should indicate between 5.6 and 6.6 Vdc.

(6) *Short circuit protection check.*

(a) Connect the test equipment as shown in figure 4-124 but with multimeter No. 2 not connected. Set the multimeter No. 3 to the 10 A dc range.

(b) Set the following controls of the test facility rf modules to the positions indicated.

Control	*Position*
S2	6.4 V
S3	DRIVER
S4	SHORT
S5	1 OHM

(c) The multimeter No. 3 should indicate between 1.0 and 3.5 amperes.

(d) Set switch S2 (test facility rf modules) to 8.0 V; the multimeter No. 3 should indicate between 1.0 and 3.5 amperes.

(e) Set switch S3 (test facility rf modules) to OUTPUT; the multimeter No. 3 should indication between 1.0 and 3.5 amperes.

(f) Set switch S2 (test facility rf modules) to 6.4 V; the multimeter No. 3 should indicate between 1.0 and 3.5 amperes.

(7) *Maximum current check.*

(a) Connect the test equipment as shown in figure 4-124. But with multimeter No. 2 not connected, set the multimeter No. 3 to the 10 A dc range.

(b) Set the MAX CUR potentiometer completely counterclockwise.

(c) Set the following controls of the test facility rf modules to the position indicated.

Control	Position
S2	8.0 V
S3	DRIVER
S4	MAX
S5	0 OHM

NOTE

All the switch and potentiometer controls referred to in the following test are all located on the test facility rf modules.

(d) Turn the MAX CUR potentiometer clockwise for the maximum current indication on the multimeter No. 3. This indication should not exceed 4 amperes.

(e) Turn the MAX CUR potentiometer completely counterclockwise.

(f) Set switch S3 to OUTPUT.

(g) Turn the MAX CUR potentiometer clockwise for the maximum indication on the multimeter No. 3. This indication should not exceed 4 amperes.

(h) Reset the MAX CUR potentiometer fully counterclockwise.

(i) Set switch S2 to 6.4 V.

(j) Set multimeter No. 3 to 2000 mA dc range.

(k) Adjust the MAX CUR potentiometer for an indication of 1600 mA on the multimeter No. 3.

(l) Multimeter No. 1 should indicate 5.5 Vdc or greater.

(m) Reset MAX CUR potentiometer to fully counterclockwise.

(n) Set switch control S3 to DRIVER.

(o) Adjust the MAX CUR potentiometer for an indication of 1600 mA on the multimeter No 3.

(p) Repeat steps *(l)* and *(m)* above.

(8) *Automatic level control voltage check*

(a) Connect the test equipment as shown in figure 4-124, but with multimeter No. 2 not connected.

(b) Set the following controls of the test facility rf modules to the positions indicated.

Control	Position
S1	ON
S3	ALC
S4	OFF

(c) Set transmitter test facility switch S1 to ON and S 12 to OSC; multimeter No. 1 should indicate between 13 and 15 Vdc.

(9) *Output and driver current limiter resistor.*

(a) Connect the test equipment as shown in C, figure 4-124.

(b) Set the following controls of the test facility rf modules to the positions indicated.

Control	Position
S3	R1/R2
S4	OFF

(c) Set the multimeter No. 3 to the 200 mA dc range, and adjust the 100 mA SET control on the test facility rf modules for an indication of 100 mA on the multimeter.

(d) Multimeter No. 1 should indicate 3.4 ±0.22 Vdc, and multimeter No. 2 should indicate 1.2 ± 0.08 Vdc.

(e) Connect the test equipment as in D, figure 4-124.

(f) On the test facility rf modules set control S3 to R3/R4 and adjust the 100 mA SET control for an indication of 100 mA on the multimeter No. 3.

(g) Multimeter No. 1 should indicate in the range 1.11 to 1.26 Vdc. Multimeter No. 2 should indicate in the range 0.47 to 0.54 Vdc.

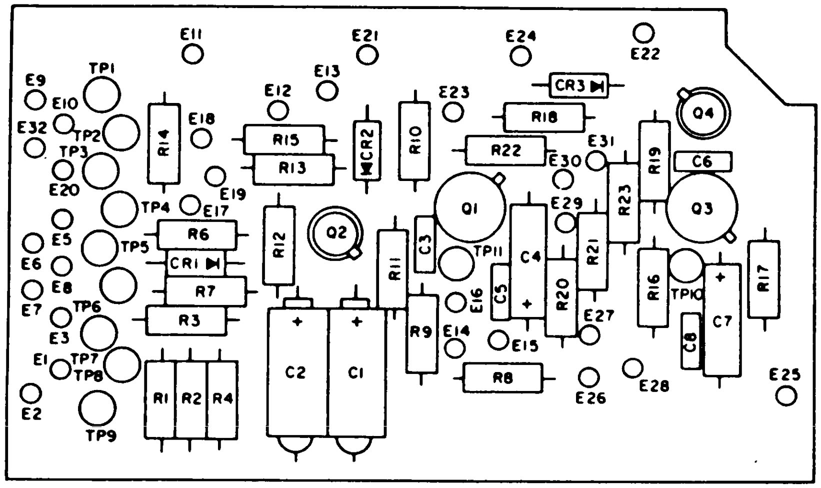
(10) *Metering resistance check.*

(a) Turn off the test facilities and disconnect the assembly under test ‘from the test facility rf modules.

(b) Measure the resistance between TP4 and TP6 of the voltage regulator with the multimeter No. 1.

(c) The multimeter No. 1 should indicate 270 kilohms (+5 percent).

(d) Replace the plastic cover on the unit under test.



EL5RF402

Figure 4-125. Voltage Regulator Subassembly 37AR1A1A1A1 or 38AR1A1A1A1, Parts Location.

c. Troubleshooting (TM 11-5820-540-30, fig. 2-82).

Symptom	*Probable cause*	*Checks and corrective measures*
1. No driver filament voltage in *b. (2)(c)* above (multimeter No. 1).	*a.* Transistor 37/38ARlAlAlQ2 open circuit (fig. 4-126). *b.* Transistors 37/38ARlAlAlAlQ3 and Q4 short circuit (fig. 4-125). *c.* Diode 37/38ARlAlAlAlCR3 short circuit (fig. 4-1 25).	*a.* Check transistor according to resistance charts in *d.* below. Replace if necessary. *b.* Check transistors according to resistance charts in *d.* below. Replace if necessary. *c.* Check for short circuit using multimeter on resistance scale. Replace if necessary.
2. Driver filament voltage high or low in *b. (2)(c)* above (multimeter No. 1).	Driver regulator transistors 37/ 38AR1A1A1A1Q3 and Q4 defective (fig. 4-125).	Check transistors according to resistance charts in *d.* below and check associated circuitry using multimeter on resistance scale. Replace if necessary.
3. No output filament voltage in *b. (3)(d)* above.	*a.* Transistor 37/38AR1A1A1Ql open circuit (fig. 4-126). *b.* Transistors 37/38ARlAlAlAlQl and Q2 short circuit (fig. 4-125). *c.* Diode 37/38ARlAlAlAlCR2 short circuit (fig. 4-125).	*a.* Check transistor according to resistance chart in *d.* below. Replace if necessary. *b.* Check transistors according to resistance chart in *d.* below. Replace if necessary. *c.* Check diode using multimeter on resistance scale. Replace if necessary.
4. Output filament voltage high or low in *b. (3)(d)* above.	Output regulator transistors 37138AR1A1A1A1Q1 and Q2 faulty (fig. 4-1 25).	Check transistors according to resistance chart in *d.* below and check associated circuitry using multimeter on resistance scale. Replace if necessary.
5. Output line regulation poor in *b. (4)(d)* and *(f)* above.	Transistor 37/38AR1A1A1A1Q1 faulty (fig. 4-125).	Check transistor according to resistance chart in *d.* below and check associated circuitry using multimeter on resistance scale.
6. Output load regulation poor in *b. (4)(d,)* and *(f)* above.	*a.* Transistor 37/38ARlAlAlAlQ2 faulty (fig. 4-125). *b.* Diode 37/38AR1A1A1A1CR2 faulty (fig. 4-125).	a. Check transistor according to resistance chart in *d.* below. *b.* Check voltage drop across zener diode using multimeter on voltage scale. Voltage indication should be 4.7 Vdc ± 5%. Replace diode if necessary.
7. Driver line regulation poor in *b. (5)(e)* and *(f)* above.	Transistor 37/38AR1A1A1A1Q3 faulty (fig. 4-125).	Check transistor according to resistance chart in *d.* below and check associated circuitry using multimeter on resistance range.

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
8. Driver load regulation poor *b. (5)(d)* and *(f)* above.	*a.* Transistor 37/38ARlAlAlAlQ4 defective (fig. 4-125).	*a.* Check transistor according to resistance chart in *d.* below and check associated circuitry using multimeter on resistance range.
	b. Diode 37/38ARlA1AlAlCR3 defective (fig. 4-1 25).	*b.* Check voltage drop across diode using multimeter on voltage scale. Voltage should be 4.7 Vdc +5%. Replace diode if necessary.
9. Driver short circuit current too high in *b.(6)(d)* above.	*a.* Transistor 37/38ARlA1AlAlQ4 defective (fig. 4-125).	*a.* Check transistor according to resistance chart in *d.* below and associated circuitry using multimeter on resistance scale.
	b. Diode 37/38ARlAlAlAlCR3 defective (fig. 4-1 25).	*b.* Check voltage drop across diode using multimeter on voltage scale. Multimeter indication should be 4.7 Vdc ±5%. Replace diode if necessary.
10. Output short circuit current too high in *b.(6)(e)* above.	*a.* Transistor 37/38AR1A1A1AlQ2 defective (fig. 4-125).	*a.* Check transistor according to resistance chart in *d.* below and check associated circuitry using multimeter on resistance scale.
	b. Diode 37/38ARlAlAAlCR2 defective (fig. 4-1 25).	*b.* Check voltage drop across diode. Voltage should be 4.7 Vdc ±5%. Replace diode if necessary.
11. Output maximum current high in *b. (7)(g)* above.	*a.* Resistor 37/38ARlA1AlRl short circuit (fig. 4-126).	*a.* Check R1 using multimeter on resistance scale. Replace R1 if necessary.
	b. Transistor 37/38ARlA1AlQl short circuit (fig. 4-126).	*b.* Check Q1 according to resistance chart in *d.* below. Replace if necessary.
12. Driver maximum current high in *b. (7)(d)* above.	*a.* Resistor 37/38ARlAlAlR2 short circuit (fig. 4-126).	*a.* Check R2 using multimeter on resistance scale. Replace if necessary.
	b. Transistor 37/38ARlA1AlQ2 short circuit (fig. 4-126).	*b.* Check Q1 according to resistance chart in *d.* below. Replace if necessary.
13. Automatic level control voltage incorrect in *b. (8)(c)* above.	*a.* Diode 37/38AR1A1AlAlCRl defective (fig. 4-125).	*a.* Check voltage drop across CR1 using multimeter on voltage scale. Multimeter indication should be 13 Vdc ±5%. Replace if necessary.
	b. Resistor 37/38ARlAlA1AlR6 open circuit (fig. 4-125).	*b.* Check voltage using multimeter on resistance scale. Replace if necessary.

d. Transistor Resistance Measurements.

NOTE

All resistances measured with AN/USM-451 digital multimeter. (Transistors removed from circuit board.)

Transistor		*Base(−)*				*Base(+)*			
		Emitter(+)		*Collector(+)*		*Emitter(−)*		*Collector(−)*	
Ref	*Type*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*
Q1	2N1724	265	2k	260	2k	265	2k	260	2k
Q2	2N1724	265	2k	260	2k	265	2k	260	2k
Q1	2N697	Infinity	20M	Infinity	20M	805	2k	750	2k
Q2	2N2907	885	2k	885	2k	1200	2k	Infinity	20M
Q3	2N697	Infinity	20M	Infinity	20M	805	2k	755	2k
Q4	2N2907	870	2k	870	2k	1200	2k	Infinity	20M

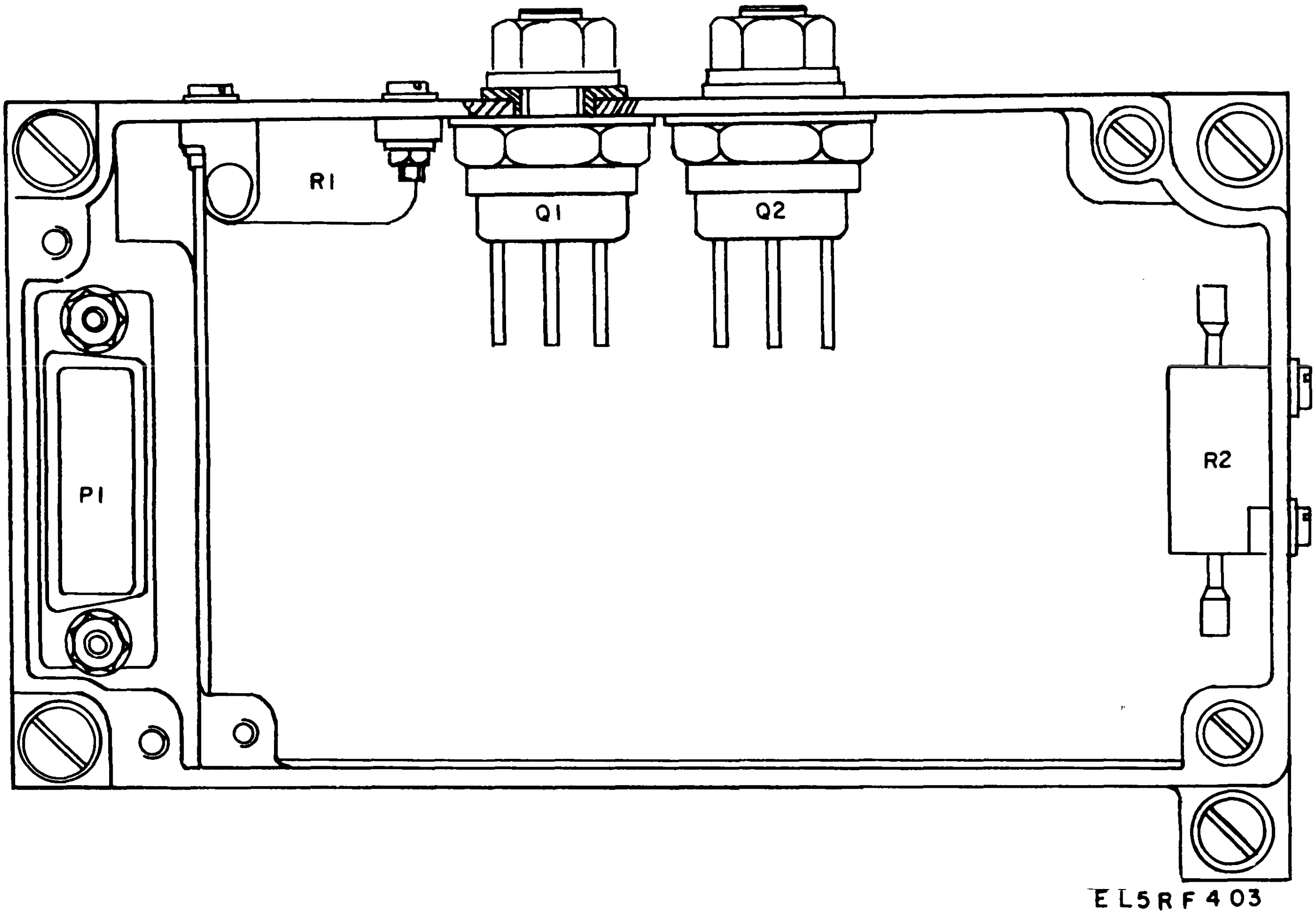


Figure 4-126. Voltage Regulator Assembly 37AR1A1A1 or 38AR1A1A1, Parts Location

4-41. Lowpass Filter 37AR1A1FL1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/ GRM95(V)2	Test facility transmitter
Test Facility Receiver, TS-2867(V)2/ GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Test Facility Radio Frequency Module, TS-2837(V)2/GRM-95(V)2	Test facility radio frequency module
Accessory Kit, Test Facilities Set MK-1985(V)2/GRM-95(V)2	Accessory kit
Oscilloscope, AN/USM-281C	Oscilloscope
Generator, Signal, HP-8640B	Signal generator
Generator, Signal, AN/USM-213	Signal generator
Powder Meter, HP-435A	Power meter
Power Sensor, HP-8484A	Power sensor
Generator, Sweep, Wiltron 610D with Plug-in Unit, Wiltron 61084D	Sweep generator

b. Test Procedures.

(1) *VSWR check.*

(a) Connect the test equipment as shown in A, figure 4-127.

(b) Adjust the sweep generator controls to obtain a sweep between 395 and 705 MHz.

(c) Adjust the oscilloscope controls and the sweep generator output level control to obtain a convenient display on the oscilloscope.

(d) Mark the resultant display on the graticule of the oscilloscope. The display represents a VSWR of 1:1.40.

(e) Connect the test equipment as shown in B, figure 4-127. The VSWR displayed on the oscilloscope should not exceed the line marked *(d)* above.

(f) Reverse the unit under test (i.e., connect the dummy load to J1 and connect J2 to VSWR detector IM-242/U). The VSWR displayed on the oscilloscope should not exceed the line marked in *(d)* above.

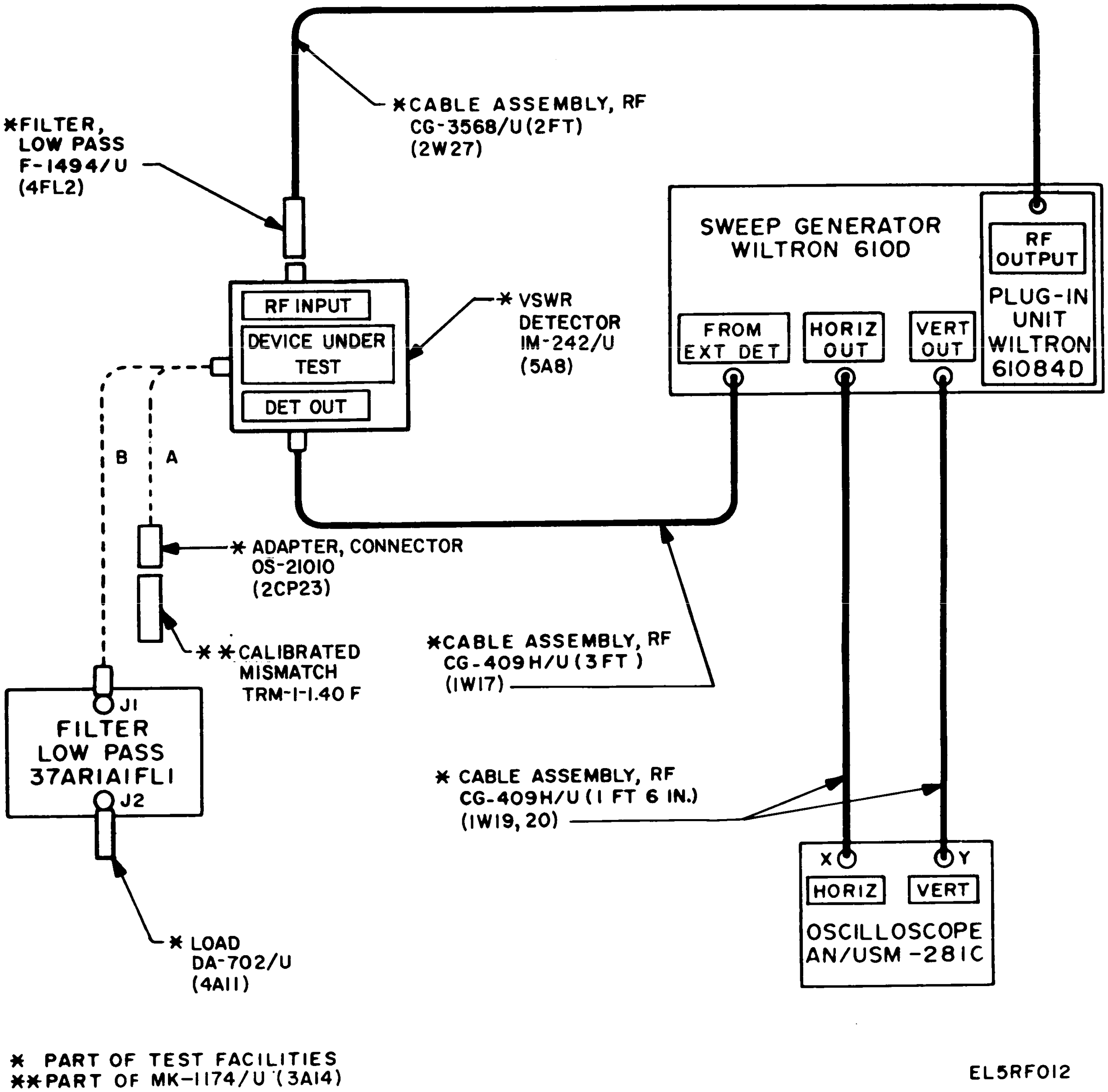


Figure 4-127. Lowpass Filter 37AR1A1FL1 VSWR Check, Test Setup.

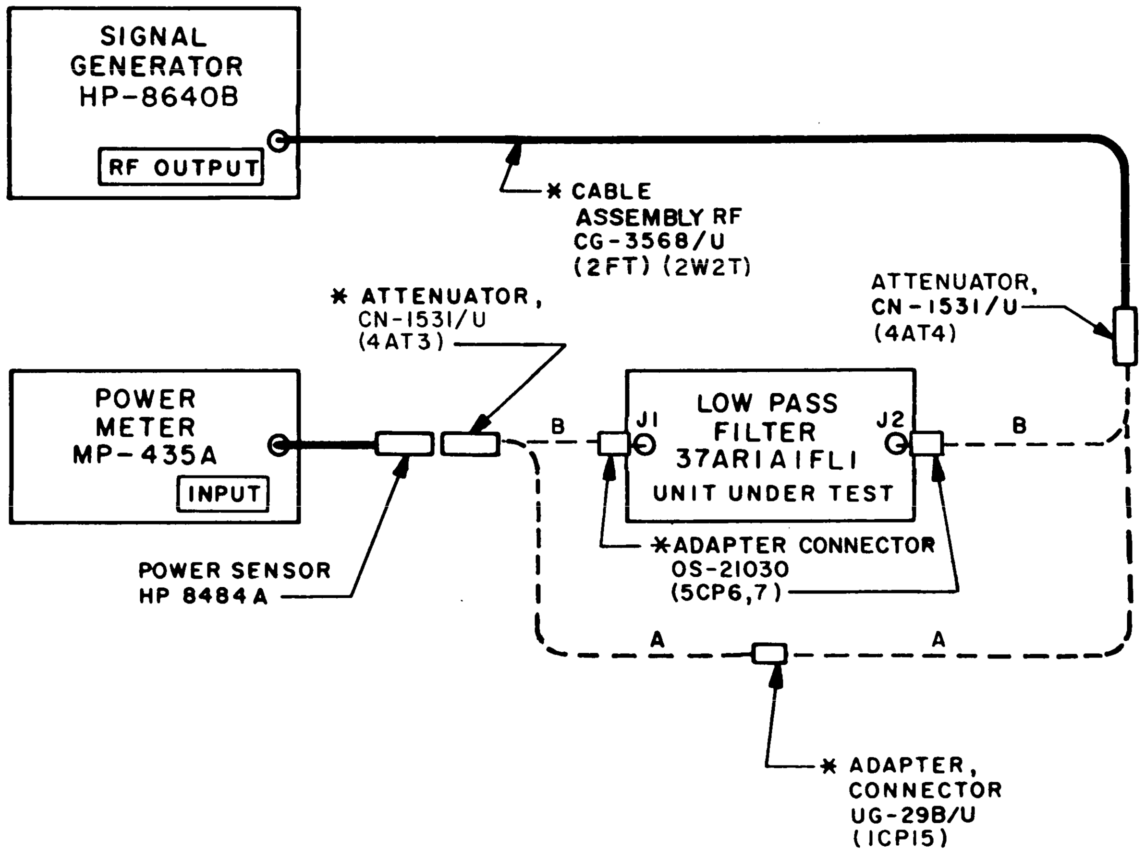


Figure 4-128. Lowpass Filter 37AR1A1FL1 Insertion Loss Check, Test Setup.

(2) *Insertion loss in passback check.*

(a) Connect the test equipment as shown in A, figure 4-128.

(b) Set signal generator to 395 MHz and adjust the level control to indicate –5 dBm on the power meter.

(c) Connect the test equipment as shown in B, figure 4-128.

(d) The insertion loss should not exceed 0.8 dB (power meter indication of –5.8 dBm).

(e) Repeat *(a)* through *(d)* above for signal generator frequency of 705 MHz.

(3) *Rejection check.*

(a) Connect the test equipment as shown in A, figure 4-129.

(b) Adjust signal generator frequency to 1400 MHz with an output level setting of –35 dBm. Note the indication obtained on the power meter.

(c) Connect the test equipment as shown in B, figure 4-129.

(d) Set the signal generator output level to 0 dBm.

(e) The power meter indication should be lower than the indication recorded in *(b)* above.

4-42. Radio Interference Filter 37AR1A1FL2 or 38AR1A1FL2

a Test Equipment and Material Required

Equipment	*Common name*
Multimeter, Digital, AN/USM-451	Multimeter
Megohmmeter, GR-1864	Megohmmeter
Bridge, Impedance, ZM-7l/U	Impedance bridge

b. Test Procedure.

(1) *850 volts breakdown test.*

(a) Connect terminal 3 to filter case and connect megohmmeter between pins 1 and 3 of radio interference filter 37/38ARlAlFL2.

(b) Test the unit for breakdown at 850 volts.

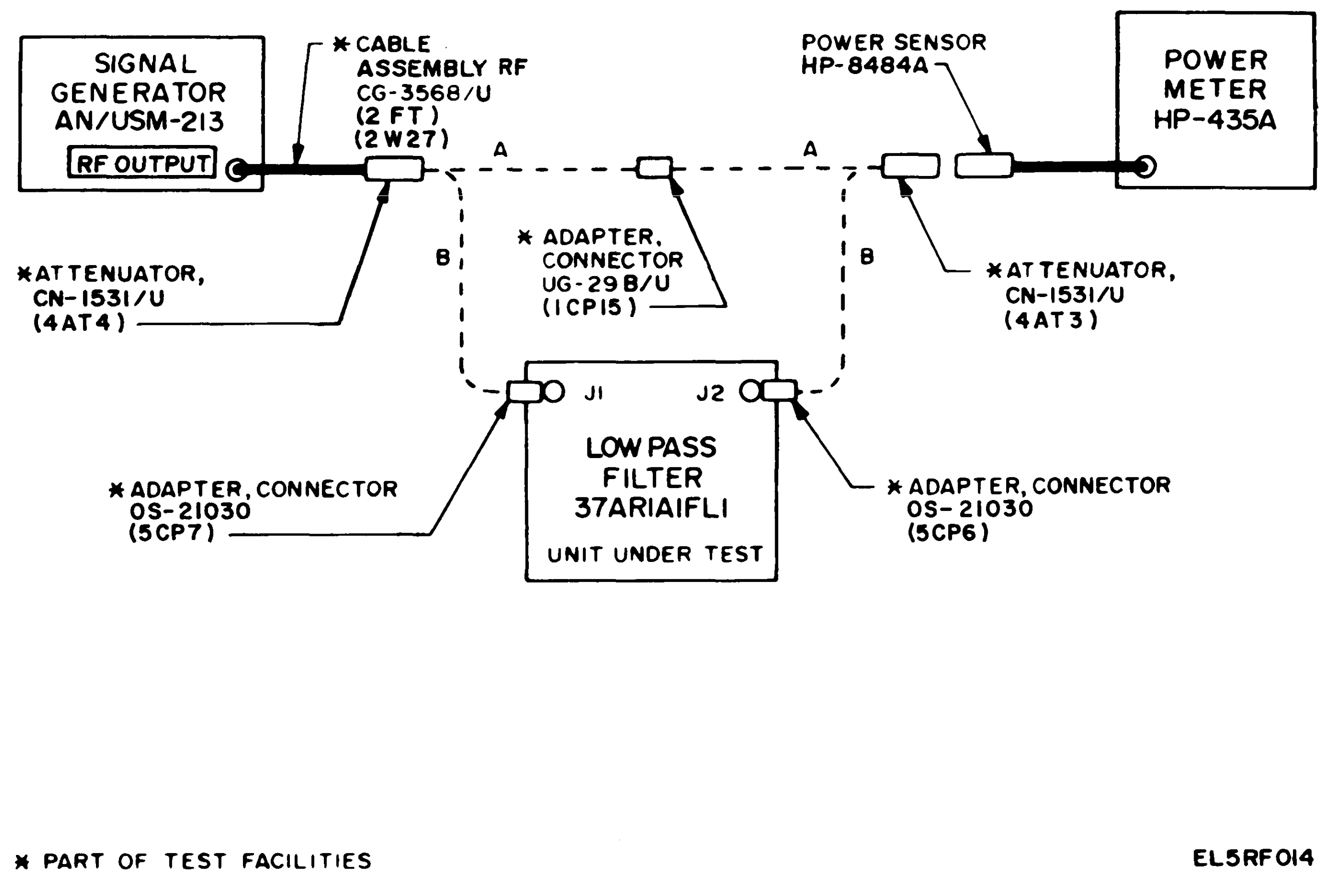


Figure 4-129. Lowpass Filter 37AR1A1FL1 Rejection Check, Test Setup.

(c) Connect the megohmmeter between pins 2 and 3 of the unit under test, and test it for breakdown at 850 volts.

(2) *Continuity test.* Using the multimeter set to ohms, measure between pins 1 and 2 of the unit under test. The multimeter shall read approximately 7 ohms.

(3) *Capacitance test.* Using the impedance bridge, measure the capacitance between pins 2 and 3 of the unit under test; it should not be less than 0.9μf.

4-43. Connector-Filter Assembly 37AR1A1W1A1 or 38AR1A1W1A1

a. Test Equipment and Material Required.

Equipment	*Common name*
Multimeter, Digital, AN/USM-451	Multimeter

b. Test Procedure. This assembly contains plugs 37/38AR1A1W1A1P1 and 37/38ARlAlWlAlP2 (TM 11-5820-540-30). Check each circuit as follows (FO-40 or FO-46).

(1) Check continuity between each pin of 37/38AR1A1WA1P1 and its associated falter connector and between rf connector pin 2 of 37/38AR1A1W1A1P1 and center conductor of 37/38AR1A1W1A1P2.

(2) Check that no short circuit exists between any pin or center conductor and ground.

c. Repairs.

(1) The rf connector in 37/38 AR1A1W1A1P1 can be replaced as follows:

(a) Force rf connector back into the connector-filter assembly.

(b) Slide the insulating sleeve back along the cable and unsolder the faulty connector.

(c) Install the new connector on the rf cable (para. 2-10).

(d) Push the new connector into the mounting hole in 37/38ARlAlWlAlPl until the retaining springs snap into place, holding the connector firmly.

(2) If tests indicate that a filter or connector requires replacement, refer to paragraph 2-61.

Section III. BAND III TRANSMITTER AND RECEIVER RF HEADS

4-44. Amplifier-Converter AM-4318/GRC-103(V) (Band III Receiver Rf Head)

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit Test Facilities Set MK-1173(V)2/ GRM-95(V)2	Accessory kit test facilities set
Test Facility Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility radio frequency modules
Accessory Kit Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit test facility set
Frequency Counter TD-1225(V)l/U	Frequency counter
Electronic Voltmeter ME-459/U	VTVM
Digital Multimeter AN/USM-451	Digital multimeter
Sweep Generator Wiltron 610D	Sweep generator
Plug-in Unit Wiltron 61048D	Plug-in unit
Oscilloscope AN/USM-281C	Oscilloscope
Power Meter HP-435A	Power meter
Power Sensor HP-8481A	Power sensor
Drive Generator, Airborne Instruments Labs, Model 125	Power signal source
Signal Generator, HP8640B	Signal generator
Wideband Rf Amplifier ENI 603L	Rf amplifier
Attenuator, 3 dB, 50 watt Weinschel model 25-3-34	Power attenuator
Termination, Mismatch Telonic TRM-1-3.50F	3.50 calibrated mismatch
Rf Voltmeter ME-426/U	Rf voltmeter

b. Test Procedures.

NOTE

There are two variations of AM-4318 mixer stage 34A7. The early type uses voltage tunable mixer 34A7 (SM-D-696462), power supply 34PS1 (SM-D-696339) and, voltage control assembly 34A1A2 (CMC 245-800044-000). The latter type uses wideband mixer 34A7 (SM-D-696297) and does not require power supply or voltage control assembly. Mixer (34A7) SM-D-696297 may be used in place of mixer SM-D-696462 without realinement or other change to the AM-4318. The following procedures apply equally to both variations except where noted. The gain and agc levels of if amplifier 34AR1 should be set as described in paragraph 4-34 *b(2)* before performing the following tests.

(1) *Functional check.*

(a) Remove the dust cover from the unit to be tested. Connect the test equipment as shown in A, figure 4-130.

(b) Set the power supply to 115 Vac as indicated on the panel voltmeter and set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S7	AGC
S8	OFF
S6	MULTIPLIER

(c) Set the unit under test RCVR CHANNEL and RCVR SIG control to channel 990 and the XMTR DUPL control to channel 890.

(d) Set the signal generator to 695 MHz +10 kHz for a CW output level of –74 dBm.

(e) Adjust the MULT PEAK control on the unit under test for maximum indication on the test facility meter Ml. The meter shall read between 20% and 90%.

(f) Set S6 to RCVR SIG position. Adjust the RCVR SIG control on the unit under test for maximum indication on test facility meter Ml. Observe the VTVM indication, carefully tune RCVR SIG control for a minimum indication on the VTVM. The VTVM shall indicate - 43 to - 51 dBm (SM-D-696297) or less than - 43 dBm (SM-D-696462) and the appropriate channel number shall be ± 0.5 inch from the calibration mark of the RCVR CHANNEL window. Note the VTVM indication.

(g) Increase the signal generator output level until the HIGH SIGNAL lamp lights. The signal generator level should be between - 10 dBm and +15 dBm. Observe the VTVM as the signal generator output level is increased to - 10 dBm. The VTVM shall indicate not more than the indication recorded in step *(f)* above.

(h) Slowly decrease the signal generator output level until the high signal lamp extinguishes. The signal generator level shall be not less than - 10 dBm.

(i) Repeat *(c)* through *(f)* above for the remaining channels listed below. Repeat *(g)* and *(h)* above at frequencies marked by asterisk* only.

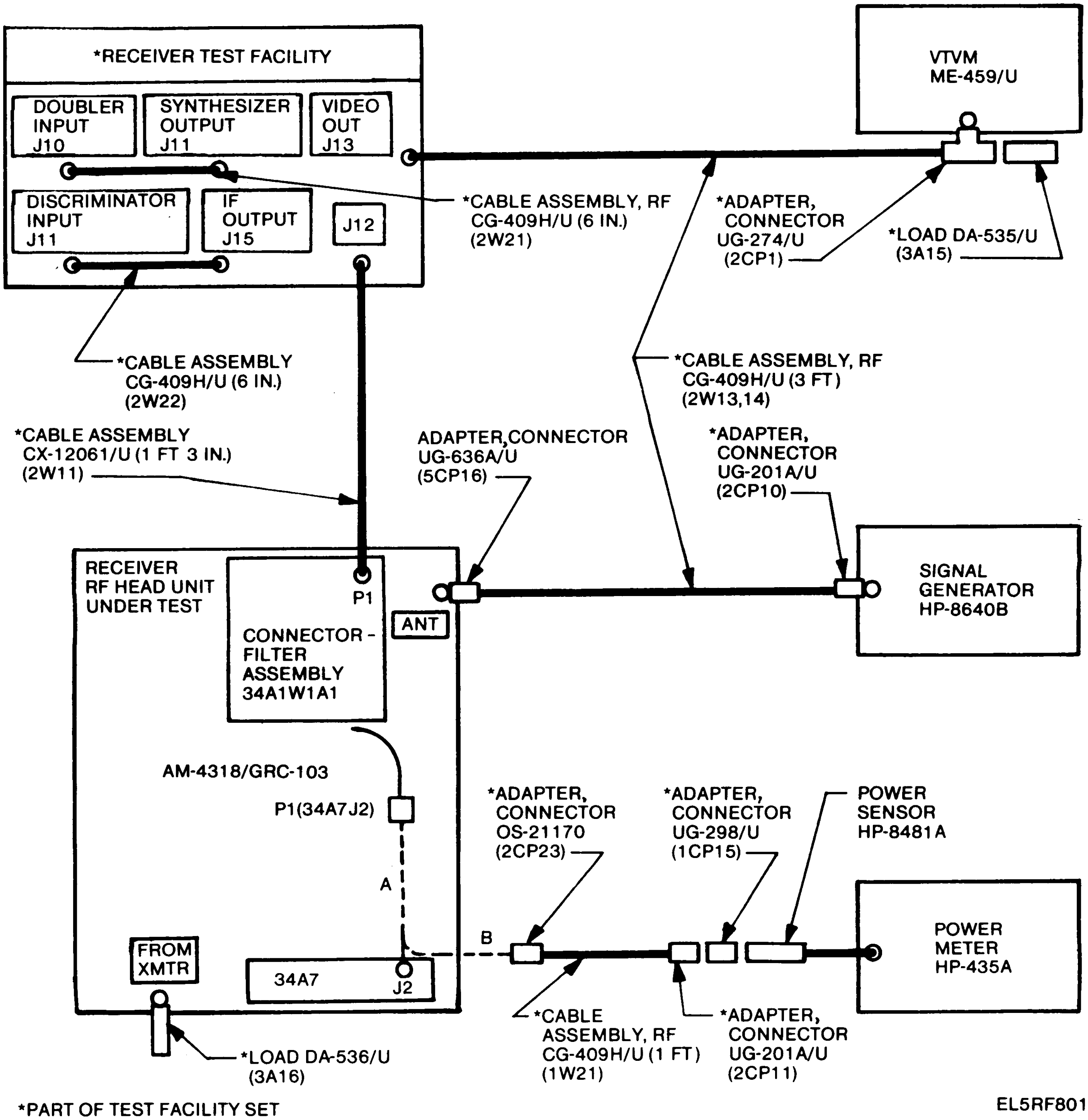


Figure 4-130. Receiver Rf Head AM-4318/GRC-103, Functional Check and Alinement, Test Setup.

RCVR channel and RCVR sig	*Signal generator frequency (MHz)*
* 990	695
* 1020	710
1200	800
* 1400	900
* 1540	970
1600	1000

(2) *Signal level control monitor leakage test.*

(a) Disconnect the rigid rf cables from J1 and J2 of signal level control monitor 34A5 and remove it from the rf head chassis.

(b) Connect the equipment as shown in figure 4-131.

(c) Set the receiver test facility switches as follows:

Switch	*To position*
S1	ON
S5	S6
S6	REFL POWER
S7	AGC
S8	OFF

(d) Set the power signal source meter switch to the low power position.

CAUTION

Do not allow the output level of the power signal source to exceed a full scale indication on the panel meter while tuning.

(e) Tune the power signal source to a nominal frequency of 695 MHz.

(f) Set the power signal source meter switch to the high power position.

(g) S1owly increase the output level from the power signal source to 25 watts as indicated on its panel meter while observing the power meter indication, The power meter indication should not exceed –3 dBm (+17 dBm output level). The high signal lamp on the test facility should be lit.

(h) Repeat *(d)* through *(g)* above at nominal frequencies of 850 MHz and 1000 MHz.

(i) Turn off the power signal source and reinstall the signal level control monitor.

(3) *Power monitor operation test.*

(a) Connect the equipment as shown in A, figure 4-132.

(b) Set the signal generator to 695 MHz (nominal) at a level of +10 dBm as indicated on the power meter.

(c) Connect the equipment as shown in B, figure 4-132.

(d) Subtract the power meter indication from +10 dBm (step *(b)* above). Record the calculated attenuation.

(e) Repeat *(a)* through *(d)* above at frequencies of 850 MHz and 1000 MHz (nominal).

(f) Connect the equipment as shown in D, figure 4-133.

(g) Set the RCVR SIG control to channel 1500 and the XMTR DUPL control to channel 990.

(h) Adjust the power signal source to 695 MHz (nominal) at approximately 25 watts as indicated on its panel meter.

(i) Tune the XMTR DUPL control for a peak power meter indication and adjust the power signal source for an output from the unit under test of 13 watts (41. 15 dBm minus the attenuation from *(d)* above = power meter indication).

(j) Set test facility switch S6 to XMTR PWR. Meter Ml should indicate not less than 35 percent full scale deflection.

WARNING

RADIO FREQUENCY ENERGY is accessible at the ANT connector of the unit under test. Use caution when disconnecting or reconnecting rf cable assemblies.

(k) Set S6 to REFL PWR and disconnect the rf cable assembly from the ANT connector on the unit under test. Test facility meter Ml should indicate not less than 35 percent. Reconnect the rf cable to the ANT connector. Meter M1 should indicate not more than 5 percent.

(l) Repeat *(g)* through *(k)* above at 850 MHz (channel 1300) and 1000 MHz (channel 1600).

(4) *Transmitter duplexer insertion loss.*

(a) Connect the test equipment as shown in B, figure 4-133.

(b) Adjust the high power source to a nominal 695 MHz and an output of 20 watts (+13 dBm power meter indication) (b. *(2)(c)* through *(g)* above). Note the power meter indication in dB.

(c) Connect the test equipment as shown in A, figure 4-133. Note the power meter indication in dB.

(d) Subtract the indication noted in *(b)* above from the indication noted in *(c)* above, the result is the net insertion loss of the test set up at this frequency. Record this insertion loss (may be a negative value).

(e) Connect the test equipment as shown in D, figure 4-133.

(f) Tune the RCVR SIG control to channel 1500.

(g) Tune the XMTR DUPL control to channel 990.

(h) Maximize the power indicated on the power meter by slight readjustment of the XMTR DUPL control.

(i) Record the power meter indication.

(j) Connect the equipment as shown in C, figure 4-133.

(k) Record the power meter indication.

(l) Calculate the unit under test insertion loss as follows: Subtract the level recorded in step *(l)* above from the level recorded in step *(k)* above then subtract the test set up insertion loss calculated and recorded in step *(d)* above. The calculated unit under test insertion loss shall be not more than 2.0 dB (2.5 dB above channel 1540).

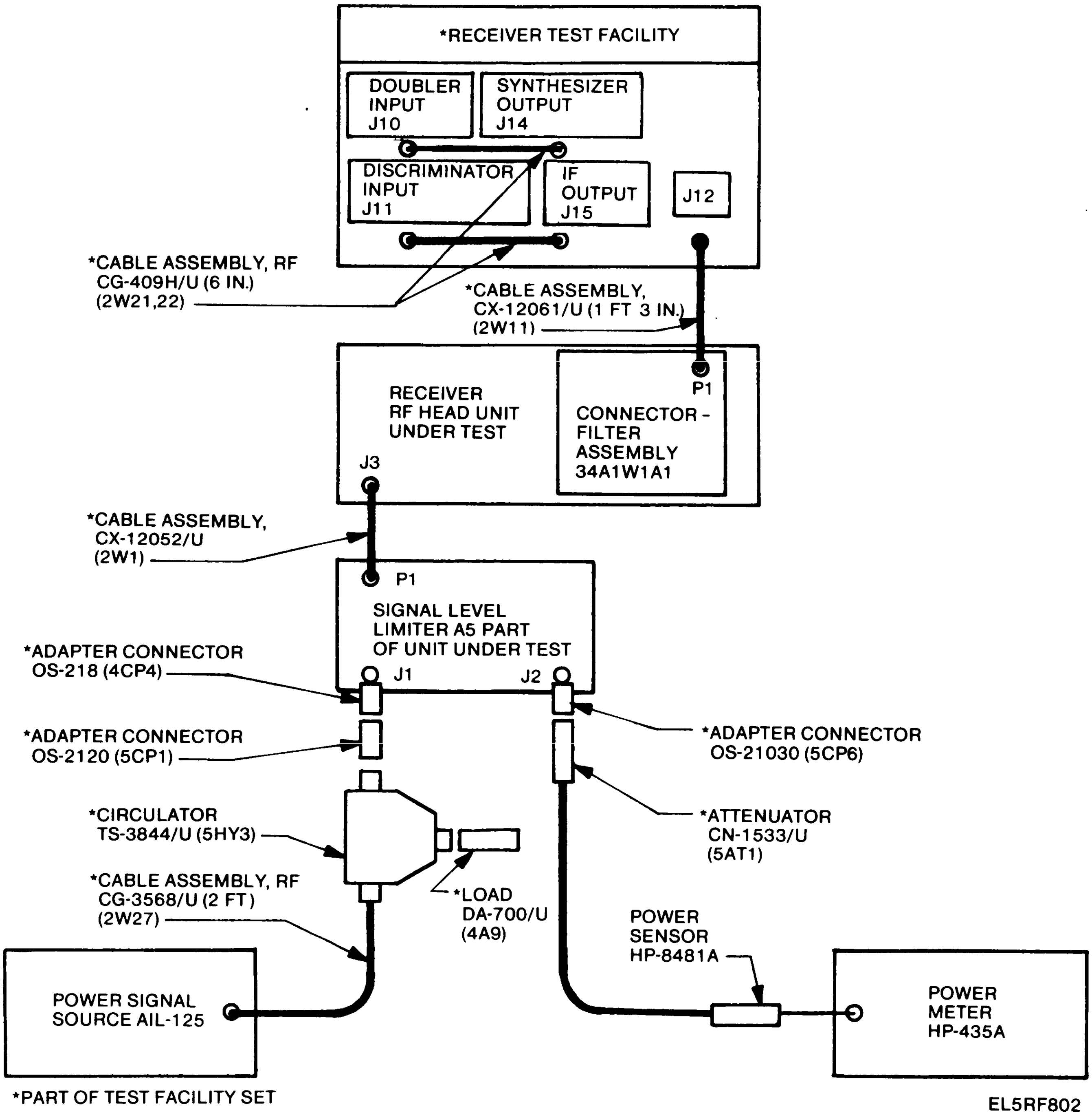


Figure 4-131. Receiver Rf Head AM-4318/GRC-103, Receiver Protection Circuit Check, Test Setup.

(m) Repeat steps *(a)* through *(l)* above for XMTR DUPL channel settings of 1300 and 1600, corresponding to high power source output frequencies of *850* MHz and 1000 MHz respectively.

(5) *Input VSWR Test.*

(a) Connect the equipment as shown in A, figure 4-134.

(b) Set the test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S7	AGC
S8	OFF
S6	Multiplier

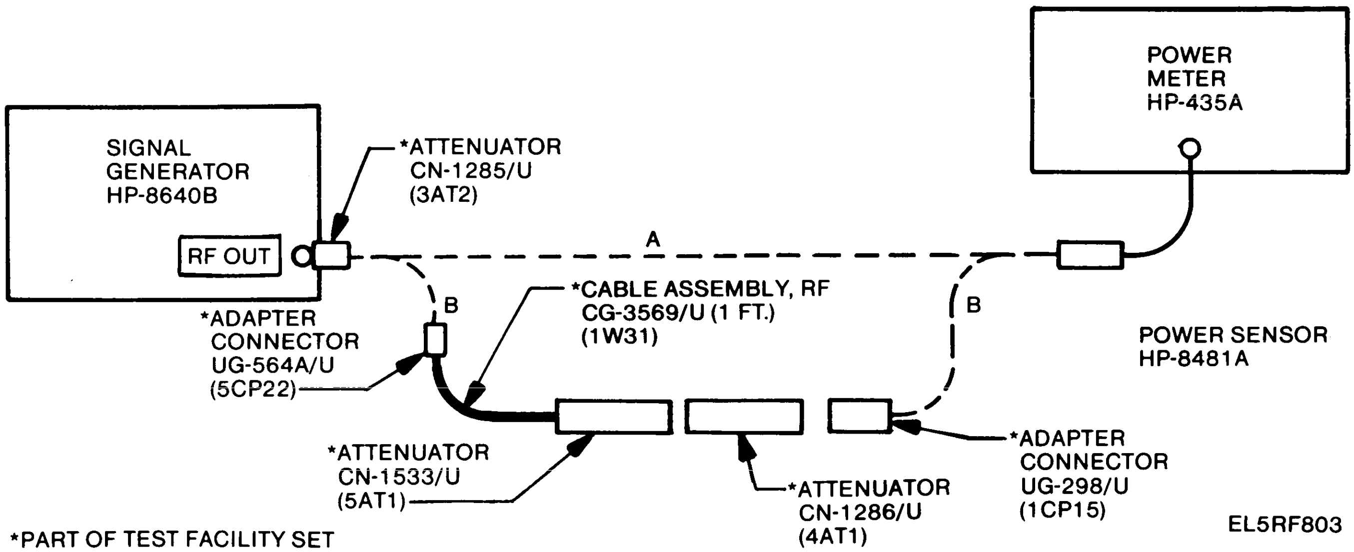


Figure 4-132. Attenuator Calibration, Test Setup.

(c) Adjust the sweep generator controls for a leveled CW output of “0” dBm over the frequency range of 695 to 1000 MHz.

(d) Connect the equipment as shown in B, figure 4-134. Adjust the sweep generator (use INT markers) to sweep between 695 MHz and 1000 MHz (Fl to F2 mode).

(e) Adjust the oscilloscope controls for a convenient display of the VSWR curve; for example, the baseline of the display on the top line of the oscilloscope graticule, and the VSWR curve on the bottom line of the graticule. Record the resultant VSWR curve between 695 MHz and 1000 MHz.

(f) Set the sweep generator to AF mode at a sweep width of 10 MHz. Adjust the frequency controls to center the response on the oscilloscope at 695 MHz.

(g) Connect the equipment as shown in C, Figure 4-134. Set the XMTR DUPL control to channel 1600.

(h) Tune the unit under test RCVR SIG control to center the VSWR response on the oscilloscope display. The VSWR curve displayed on the oscilloscope should not exceed the 3.5:1 calibration line within a minimum bandwidth of 3.0 MHz as measured at the 3.5:1 calibration line.

(i) Slowly tune the sweep generator to 1000 MHz while tracking the VSWR response by tuning the RCVR SIG control. The response must meet the requirements of *(h)* above, over the entire tuning range of the RCVR SIG control (channel number = frequency minus 200 X 2).

NOTE

Set the XMTR DUPL control to channel 990 for RCVR SIG settings above channel 1300.

(j) Repeat paragraphs *(d)* through *(i)* above using the TRM-1-2.00F calibrated mismatch instead of the TRM-1-3.50F mismatch and the XMTR DUPL control instead of the RCVR SIG control. The VSWR curve displayed on the oscilloscope should not exceed the 2.0:1 calibration line within a minimum bandwidth of 2.0 MHz as measured at the 2.0:1 calibration line. The XMTR CHANNEL indication should be within ±0.5 inch of the calibration mark at the center of the window.

(6) *AGC test.*

(a) Connect the equipment as shown in figure 4-135.

(b) Set the unit under test RCVR CHANNEL and RCVR SIG controls to channel 1000. Tune the XMTR DUPL control at least 100 channels away from charnel 1000. Set the signal generator frequency to 700 MHz at an output level of –74 dBm.

(c) Set test facility S6 to Multiplier. Adjust the unit under test MULT PEAK control for a maximum indication on the test facility meter Ml.

(d) Carefully tune the signal generator frequency for a minimum indication on the VTVM (approximately 40 dB). Reduce the signal generator level to –80 dBm, observe the reading on the rf voltmeter, then increase the signal generator output to –50 dBm, the rf voltmeter indication shall increase by not more than 10 dB.

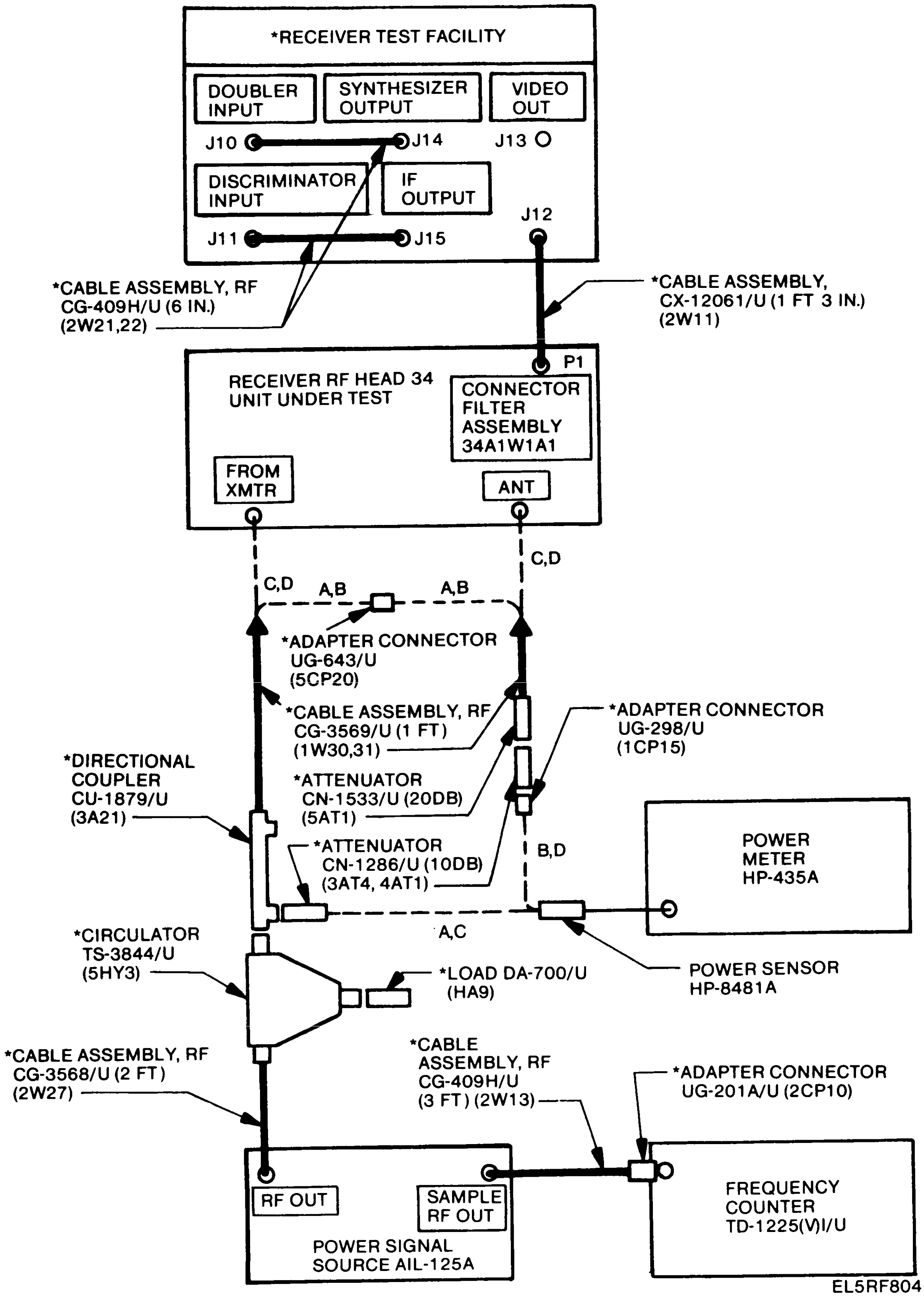


Figure 4-133. Receiver Rf Head AM-4318/GRC-103, Power Monitor and XMTR DUPL Insertion Loss Checks, Test Setup.

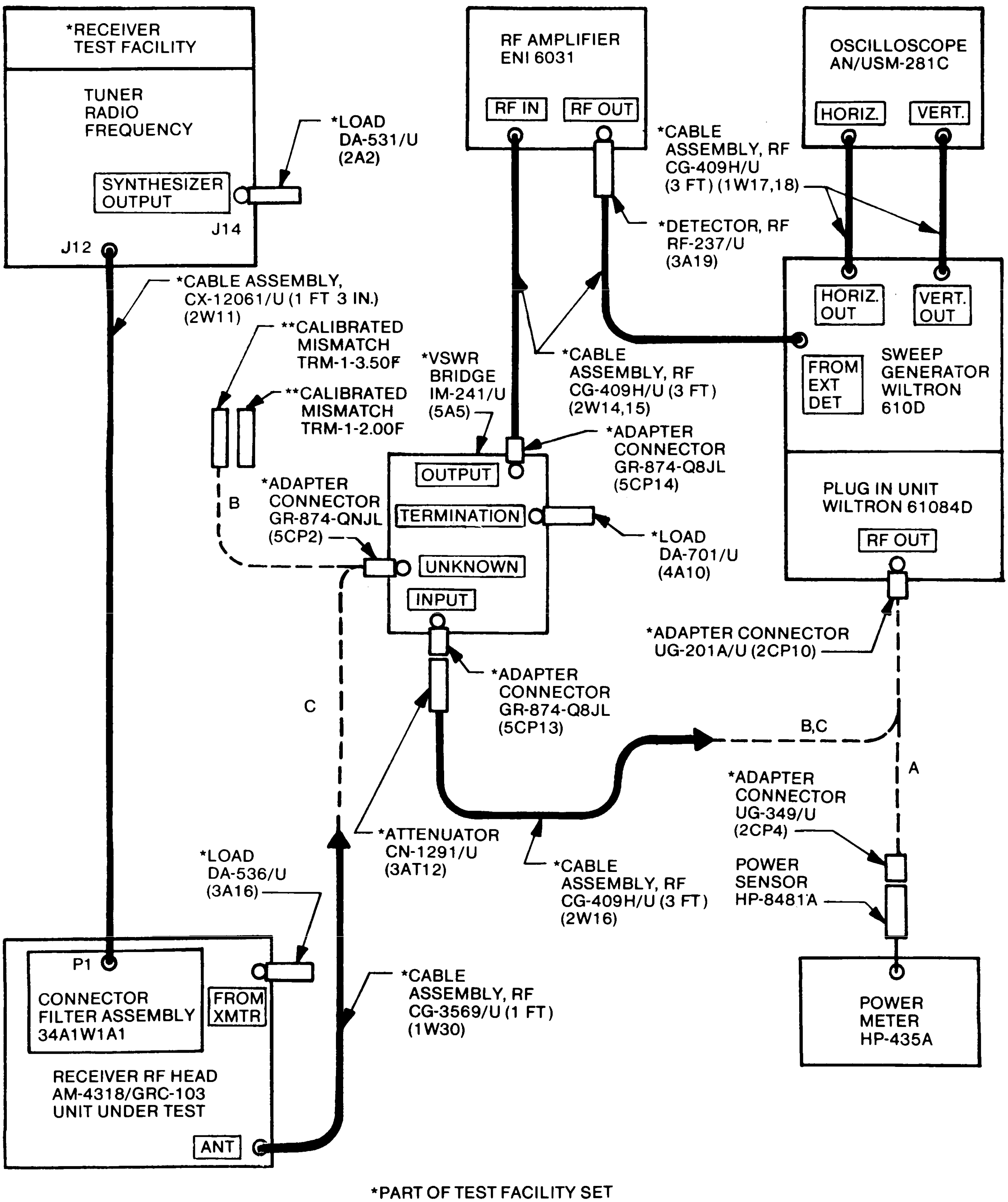


Figure 4-134. Receiver Rf Head AM-4318/GRC-103, Input VSWR Check, Test Setup.

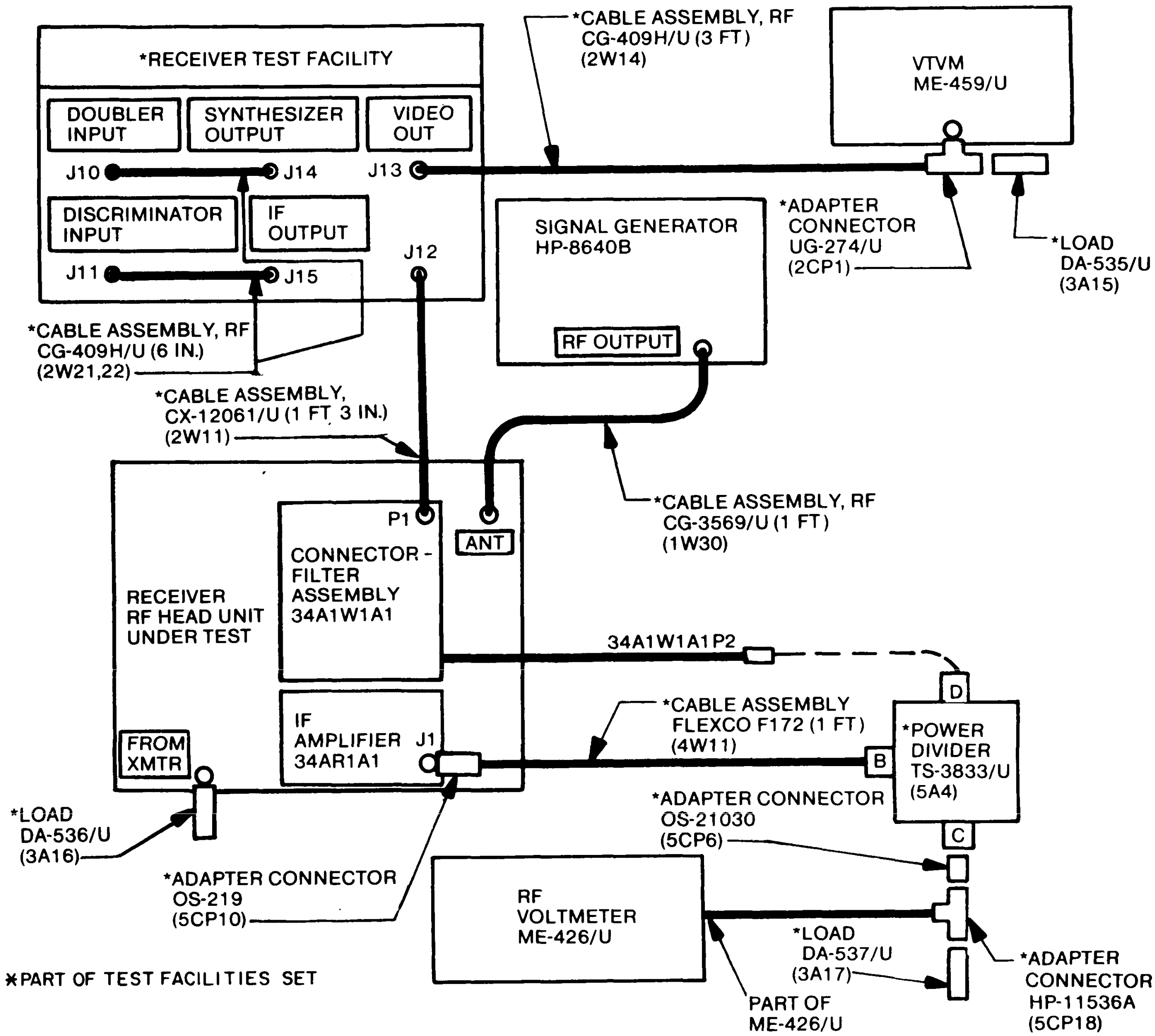


Figure 4-135. Receiver Rf Head AM-4318/GRM- 103, AGC Check, Test Setup

c. Troubleshooting (FO-47 and FO-48).

Symptom	*Probable cause*	*Checks and corrective measures*
1. Test facility meter Ml indication below normal, *b(l)(e)* above.	*a.* Incorrect local oscillator frequency.	*a.* Test 34A4 as described in paragraph 4-63. Check continuity between 34A1W1J5 and 34A1W1A1P1. Repair as required.
	b. Defective local oscillator metering circuit.	*b.* Check L.O. metering circuit of 34A7 as described in paragraph 4-58. Check continuity between pin 4 of 34A1W1J6 and pin 24 of 34A1W1A1P1. Repair or replace as required.
	c. Local oscillator tracking improper.	*c.* Adjust local oscillator tracking as described in paragraph *d.*
	d. Defective multiplier group 34A2.	*d.* Check multiplier group 34A2 as described in paragraph 4-48.

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
2. VTVM indication abnormal, *b.* (1)(f) above.	*a.* Defective or misadjusted voltage control 34AIA2 (used with mixer 34A7, SM-D-696462, only).	*a.* Adjust voltage control 34A1A2 tracking as described in paragraph *d.*
	b. Defective mixer 34A7.	*b.* Test 34A7 as described in paragraph 4-58. Replace or repair as required.
	c. Defective if. amplifier 34AR1.	*c.* Test 34AR1 as described in paragraph 4-34. Repair as required.
	d. Excessive insertion loss through receiver duplexer.	*d.* Disconnect P1 of 34W4 from J2 of 34A1A1Z5 and connect the signal generator set to –77 dBm to 34W4P1. *1.* If VTVM indication is abnormal test 34A5 (para. 4-31) and 34FL1 (TM 11-5820-540-30). Repair or replace as indicated. 2. If VTVM indication is normal, reconnect P1 of 34W4 to J2 of 34A1A1Z5 and substitute (in turn) ANT connector 34CP1 and power monitor 34A3 with known good parts. Retest as in paragraph *b.(1)*. If VTVM indication is still abnormal, duplexer (receiver filter) will require repair. Refer complete rf head to higher category maintenance level
3. High signal alarm abnormal *b. (l)(g)* and *(h)* above.	Defective or misadjusted signal level control monitor 34A5.	Test and adjust 34A5 as described in paragraph 4-31.
4. Power meter indication exceeds limit, *b. (2)(g)* above.	Defective signal level control monitor 34A5.	Test 34A5 as described in paragraph 4-31.
5. Test facility meter Ml indication abnormal, *b. (3)(j)* or *(k)* above.	*a.* Defective XMTR DUPL.	*a.* Check XMTR DUPL insertion loss *(b.* (4) above). If defective, return complete rf head to higher category maintenance.
	b. Defective power monitor 34A3.	*b.* Replace 34A3.
6. Excessive XMTR DUPL insertion loss, *b.(4)(l)* above.	*a.* Defective power monitor 34A3 or panel connectors 34CP1 or 34CP2.	*a* Substitute (in turn) 34A3, 34CP1 and 34CP2 with known good parts, retest. Replace parts as indicated.
	b. Defective XMTR DUPL.	*b.* Return complete rf head to higher category maintenance.
7. Receiver duplexer VSWR display abnormal, *b.(5)(g)* above.	*a.* Defective rf components.	*a* Disconnect P1 of 34W4 from J2 of 34A1A1Z5 and connect dummy load DA-702/U(4A11) to J2 of 34A1A1Z5. Test as in *b. (5)(e)* through *(i)* using the TRM-1-2.00F calibrated mismatch. 2. If the VSWR display is normal, check module 34A7 (para. 4-58), 34A5 (pars. 4-31) and 34FL1 (TM 11-5820-540-30. Repair or replace as indicated. 2. If the display is abnormal check 34A3 and 34CP1 by substitution. Replace as indicated. If still abnormal, refer complete rf head to higher category maintenance.
8. XMTR DUPL VSWR display abnormal, *b.(5)(j)* above.	*a.* Defective power monitor 34A3 or panel connectors 34CP1 or 34CP2.	*a* Test 34A3, 34CP1 and 34CP2 by substitution, replace as indicated.
	b. Defective XMTR DUPL.	*b.* Refer complete rf head to higher category maintenance.

c. Troubleshooting.-Continued

Symptom	*Probable cause*	*Checks and corrective measures*
9. Rf voltmeter indication changes more than 10 dB, b. (6)(cf) above.	AGC control (R2 of 34AR1) not adjusted to match rf head	Slightly readjust AGC control (R2 of 34AR1) to meet requirement.

d. Tracking Adjustments.

(1) *Local oscillator tracking.*

(a) Disconnect P1 (34A7J2) from 34A7J2 and connect the test equipment as shown in B, figure 4-130.

(b) Set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S6	MULTIPLIER
S7	AGC
S8	OFF

(c) Set the RCVR CHANNEL and RCVR SIG controls on the unit under test to channel 1600. Set the XMTR DUPL control at least 100 channels away from the RCVR CHANNEL setting.

NOTE

While adjusting the frequency multiplier group gear in the following steps, do not permit the duplexer gears to move.

(d) Loosen the clamp of gear A (fig. 4-136). Do not disengage gear. Adjust the MULT PEAK control so that the power meter indication goes through a peak and then decreases at least 1.5 dB below the peak level (allow gear A to rotate).

(e) Tighten the clamp on gear A while ensuring that the power meter indication does not change.

(f). Adjust the MULT PEAK control for a peak power meter indication. The power meter should indicate a multiplier group 34A2 output level of not less than +3 dBm.

(g) Rotate the MULT PEAK control in both directions to ensure that the power meter indication will go through a peak and decrease at least 1.5 dB in either direction.

(h) Repeat *(f)* and *(g)* above with RCVR .SIG and RCVR CHANNEL control settings every 40 channels from channel 990 to channel 1600 (in decreasing order). If necessary, repeat *(d)* and *(e)* above until a peak power meter indication can be obtained at all channel settings.

(i) Turn the RCVR SIG control fully clockwise and then turn the MULT PEAK control fully clockwise. Return the RCVR SIG (and RCVR CHANNEL) control(s) to channel 1600 and repeat *(f)* and *(g)* above. If the requirements of *(f)* and *(g)* above are not met, frequency multiplier group 34A2 has become misalined during the test and must be realined (para. *4-48d.).* The local oscillator tracking must also be rechecked (steps *(f)* through *(h)* above.

(j) Reconnect P1 (34A7J2) to 34A7J2.

(k) Repeat functional check *(b.* (1) above).

(2) Voltage control 34A1A2 Tracking Adjustments (units using mixer SM-D-696462 (34A7), voltage control 34A1A2 and power supply 34PS1, only).

(a) Connect and tune the rf head to channel 1300 (set XMTR DUPL to channel 990) as described in *b.(1)(a)* through *(e)* above. If M1 indication is low *(b.(1)(e)* above), adjust local oscillator tracking as described in *d.* (1) above.

(b) Fine tune the rf head as described in *b. (1)(f)* above. If necessary, increase the signal generator output level to obtain a VTVM indication of less than –40 dBm.

NOTE

Do not permit the duplexer gears to move while adjusting gear B (voltage control drive).

(c) Loosen the clamp on gear B (fig. 4-136). Rotate gear B to obtain a minimum indication on the VTVM (reduce signal generator output level, as necessary, to maintain a VTVM indication between -40 dBm and –50 dBm).

(d) Connect the digital multimeter between chassis ground and E2 of voltage control assembly 34A1A2. The digital multimeter should read 16.1 Vdc ±1.3 Vdc.

(e) Tighten the clamp on gear B.

(f) Perform the functional check as described in paragraph *b. (1)(a)* through *(f)* for all channels listed after paragraph *b. (1)(i).* If necessary, slightly readjust gear B (as in *(c)* through *(e)* above) to obtain optimum VTVM indications for all channels.

(g) If satisfactory adjustment cannot be achieved, check 34A1A2 (para. e. below), 34PS1 (para. *f.* below) and 34A7 (para. 4-58).

e. Test of voltage control assembly 34A1A2 (used only on AM-4318 units with mixer SM-D-696462).

(1) Connect the DMM between El and E3 of voltage control assembly 34A1A2. The resistance should be 20,000 ohms ±1%.

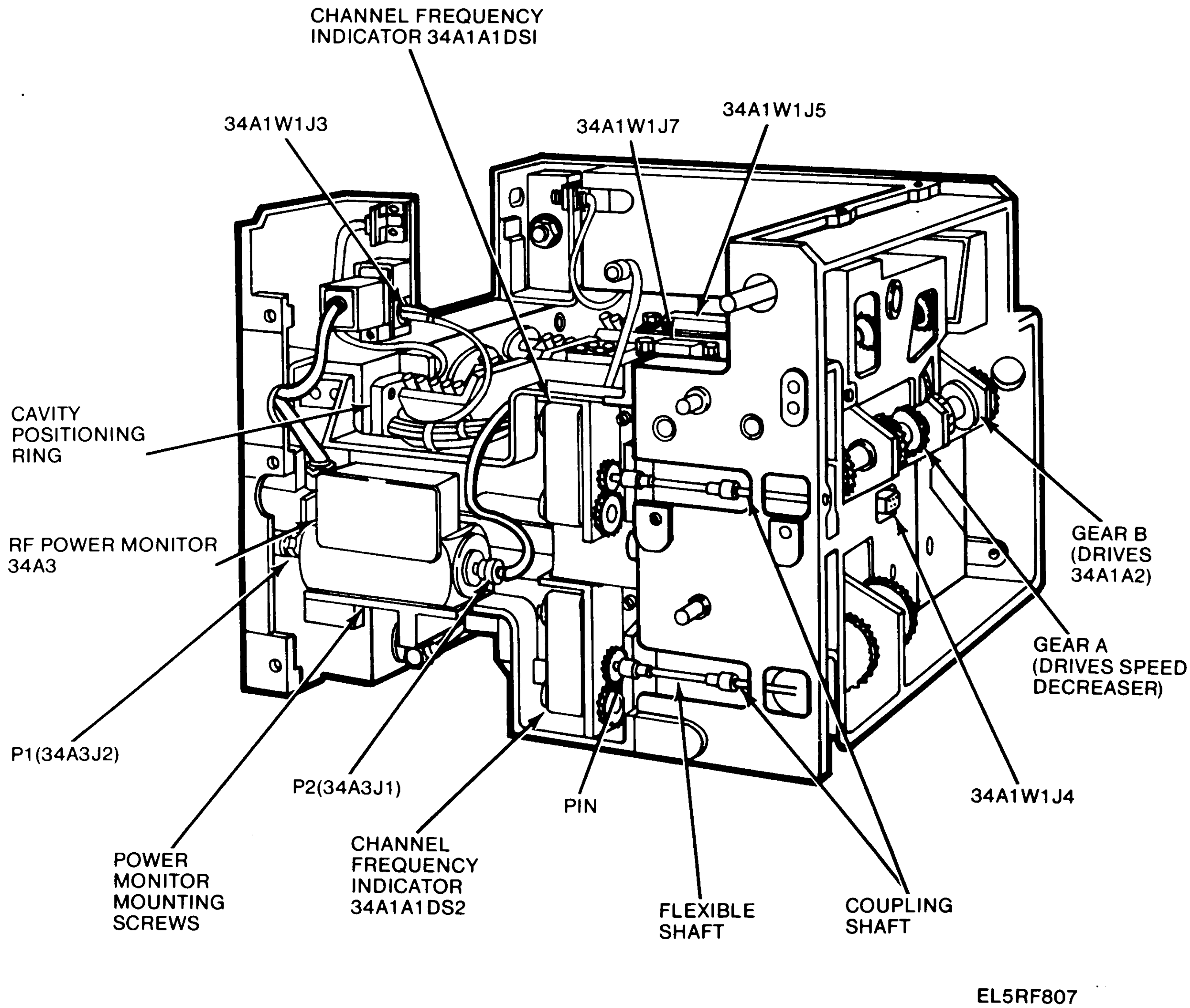


Figure 4-136. Receiver Rf Head AM-4318/GRC-103, Front View, Front Panel Removed.

(2) Connect the DMM between El and E2 of 34A1A2 and operate the unit under test drive gear throughout its range. The resistance should vary smoothly and the drive gear should move smoothly without binding.

(3) If the unit under test does not meet the requirements of (1) and (2) above, replace mixer SM-D-696462 with mixer SM-D-696297, NSN 5820-01-069-4081, (see note 1. following b. above).

f. Test of power supply 34PS1. Power supply 34PSl is identical to power supply 33PS1. Test unit as described in paragraph 4-19 *f.* (1) through (10). If repair cannot be accomplished, replace mixer stage (34A7) SM-D-696462 with mixer stage SM-D-696297, NSN 5820-01-069-4081.

4-45. Duplexer 34A1

This assembly comprises duplexer subassembly 34A1A1 (para. 4-46), speed decreaser gear assembly 34A1MP1 (para. 2-64), branched wiring harness 34A1W1 (F0-8 or F0-49) and voltage control assembly 34A1A2 (para. 4-44d.), used with mixer stage SM-D-696462 only. There is no overall test for the duplexer. Refer to the appropriate paragraphs or figure for testing and/or replacement procedures for the individual units which make up the duplexer.

4-46. Duplexer Subassembly 34A1A1

This subassembly is tested as part of the overall rf head, AM-4318/GRC-103(V).

4-47. Connector-Filter Assembly 34A1W1A1

a. Test Equipment and Material Required.

Equipment	Common name
Multimeter, Digital AN/USM-451	Digital multimeter

b. Test Procedure. This assembly comprises plugs 34A1W1A1P1, 34A1W1A1P2 and 34A1W1A1J2 (TM 11-5820-540-30). Check each circuit as follows (FO-8 or FO-49):

(1) Check continuity between each pin of 34A1W1A1P1 and its associated falter connector and between rf connectors A1 and A2 of 34A1 W1A1P1 and 34A1W1A1P2 and 34A1W1A1J2.

(2) Check for short circuits between all pins and center conductors of rf connectors and ground.

c. Repairs. Refer to paragraph 2-63 for repair or replacement procedures.

4-48. Frequency Multiplier Group 34A2

a. Test Equipment and Material Required.

Equipment	Common name
Test Facility Transmitter TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set MK-l173(V)2/ GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Module TS-3837(V)2/ GRM-95(V)2	Test facility radio frequency module
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accemory kit, test facility set
Sweep Generator, Wiltron 610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Generator, Signal HP 8640B	Signal generator
Oscilloscope AN/USM-281C	Oscilloscope
Power Meter HP-435A	Power meter
Power Sensor HP-8481A	Power sensor
Power Amplifier ENI 603	Power amplitler

b. Test Procedures.

(1) *Output checks.*

CAUTION

Ensure that power amplifier is turned off.

(a) Connect the test equipment as shown in A, figure 4-137.

(b) Set the sweep generator controls as follows:

Control	Position
FREQ SELECTOR	F1 TO F2
LEVELING	INT
SWEEP MODE	MANUAL
Frequency Control F1	105 MHz (on the dial)
Frequency Control F2	140 MHz (on the dial)
Rf power level	Minimum power out

(c) Turn on the power amplifier.

(d) Using the MANUAL sweep control, adjust the sweep generator rf POWER LEVEL control for an output level indication of +3 dBm ±0.5 dB on the power meter, over the sweep range.

(e) Attach the knob (CMC 610-800006-000) to the tuning shaft of the unit under test.

(f) Turn the tuning shaft (fig. 4-138) until the bandpass falter and frequency multiplier 34A2A1 cavity plungers are fully in the cavities.

(g) Connect the test equipment as in B, figure 4-137.

(h) Set the power supply to 115 Vac as indicated on its panel voltmeter.

(i) Set the receiver test facility switches S1 to ON and S6 to OSC.

(j) Adjust the oscilloscope controls for a convenient display of the unit under test response.

(k) Set the sweep generator SWEEP MODE control to AUTO. Adjust F1 and F2 controls for a leveled sweep between 105 and 140 MHz. Use the internal markers on the sweep generator.

(l) Set the signal generator to 725 MHz and adjust its output level (and frequency, if necessary,) for a suitable marker at the peak of the response displayed on the oscilloscope.

NOTE

A marker will appear only when there is a unit under test output at the signal generator frequency.

(m) Simultaneously turn the tuning shaft of the unit under test and tune the signal generator (used as a marker generator) from 725 to 1030 MHz. Record the output frequencies of the lowest and the highest power level as displayed on the oscilloscope. Determine the corresponding input frequencies by dividing the signal generator frequency by six for frequencies of 840 MHz and below, and by eight for frequencies of 840 MHz and above.

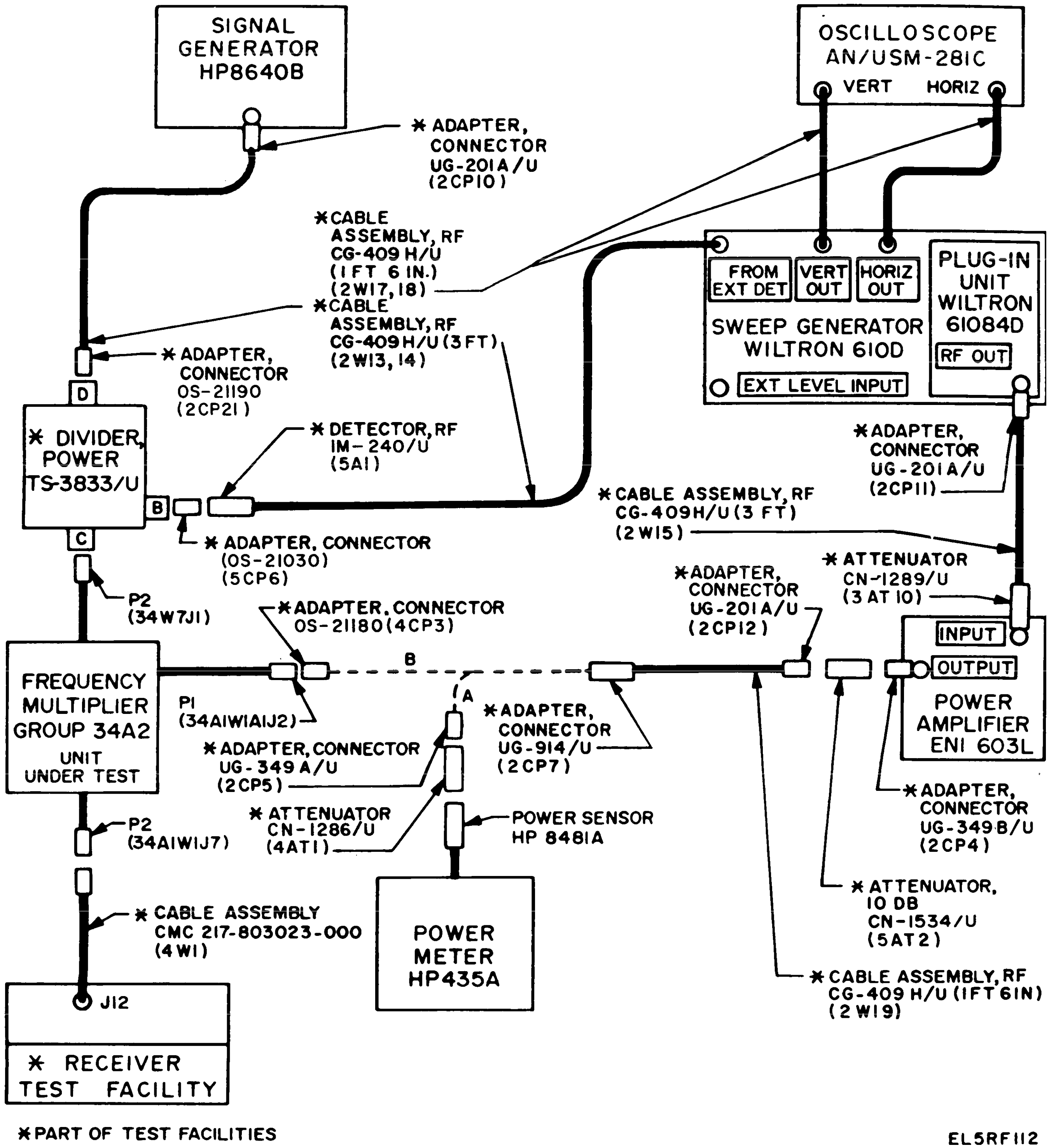


Figure 4-137. Frequency Multiplier Group 34A2, Output Check and Alinement, Test Setup.

NOTE

Changes in response amplitude must be smooth, and not abrupt or irregular.

(n) Without disturbing the sweep generator controls as set for figure 4-137 connect the test equipment as shown in figure 4-139.

(o) Tune the signal generator to the frequency of the lowest output recorded in *(m)* above.

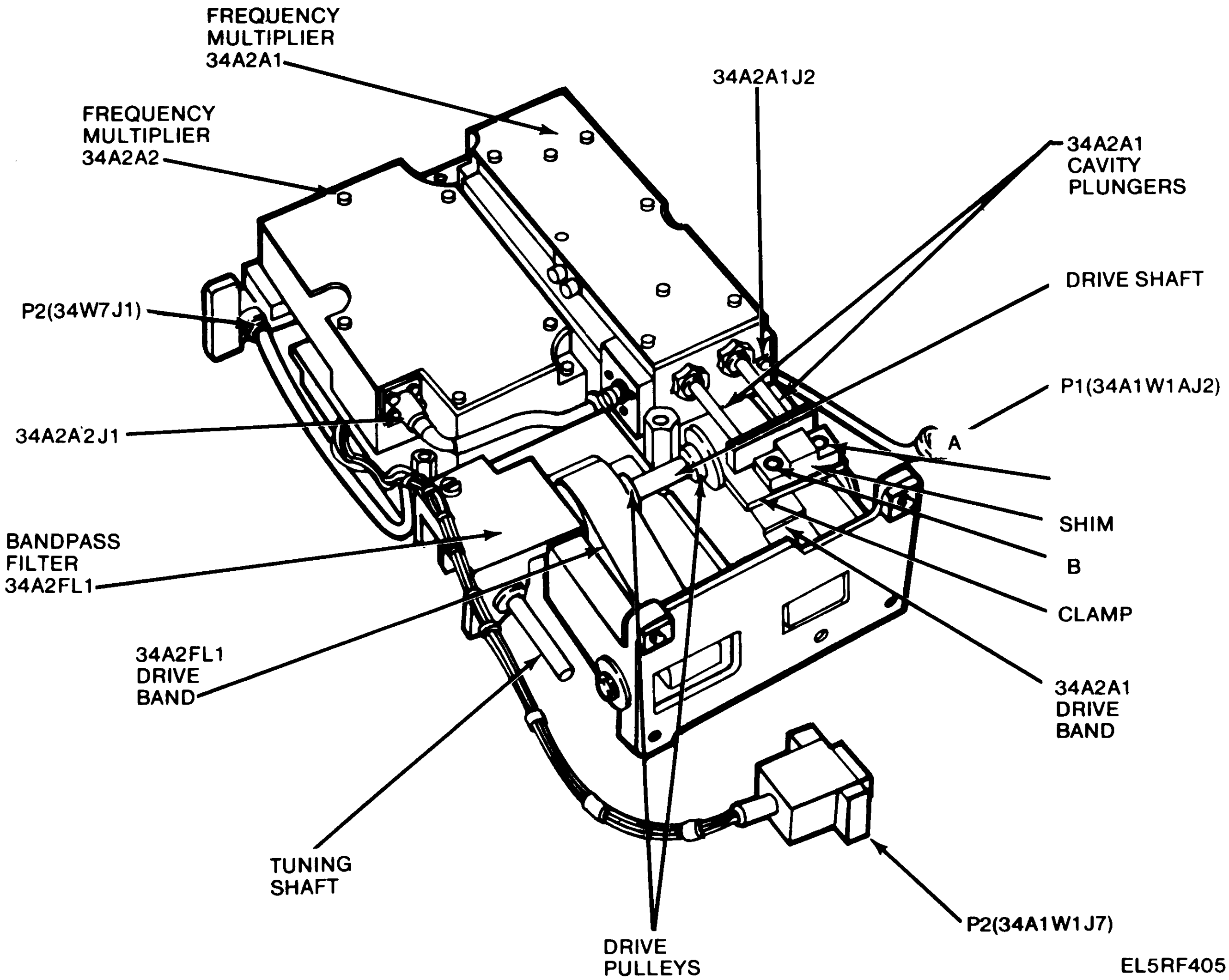


Figure 4-138. Frequency Multiplier Group 34A2, Top View.

(p) Adjust the sweep generator to provide the corresponding input frequency with a sweep width of 10 MHz.

(q) Tune the unit under test, by turning the tuning shaft (fig. 4-138), for a peak response on the oscilloscope at the signal generator frequency.

(r) Using the MANUAL sweep control, adjust frequency to the frequency of the signal generator marker.

(s) Adjust the trombone line for a minimum indication on the power meter. The power output must be at least +6.0 dBm (–0.5 dBm power meter indication.

(t) Tune the signal generator to the frequency of highest output as noted in step *(m)* above.

(u) Repeat steps *(p)* through *(r)* above.

(v) Adjust the trombone line for a maximum indication on the power meter. The power output must not exceed +14 dBm (+7.5 dBm power meter indication).

(2) *Input VSWR check.*

(a) Connect the test equipment as shown in A, figure 4-140.

(b) Set the sweep generator sweep width to sweep between 105 MHz and 140 MHz. Adjust the RF POWER LEVEL control to –10 dBm.

(c) Turn on the power amplifier.

(d) Using the MANUAL sweep control to sweep between 105 MHz and 140 MHz, adjust the RF POWER LEVEL control on the sweep generator for an output level of +17 dBm ±0.5 dB as indicated on the power meter.

(e) Connect the test equipment as shown in B, figure 4-140.

(f) Set the sweep generator SWEEP control to AUTO.

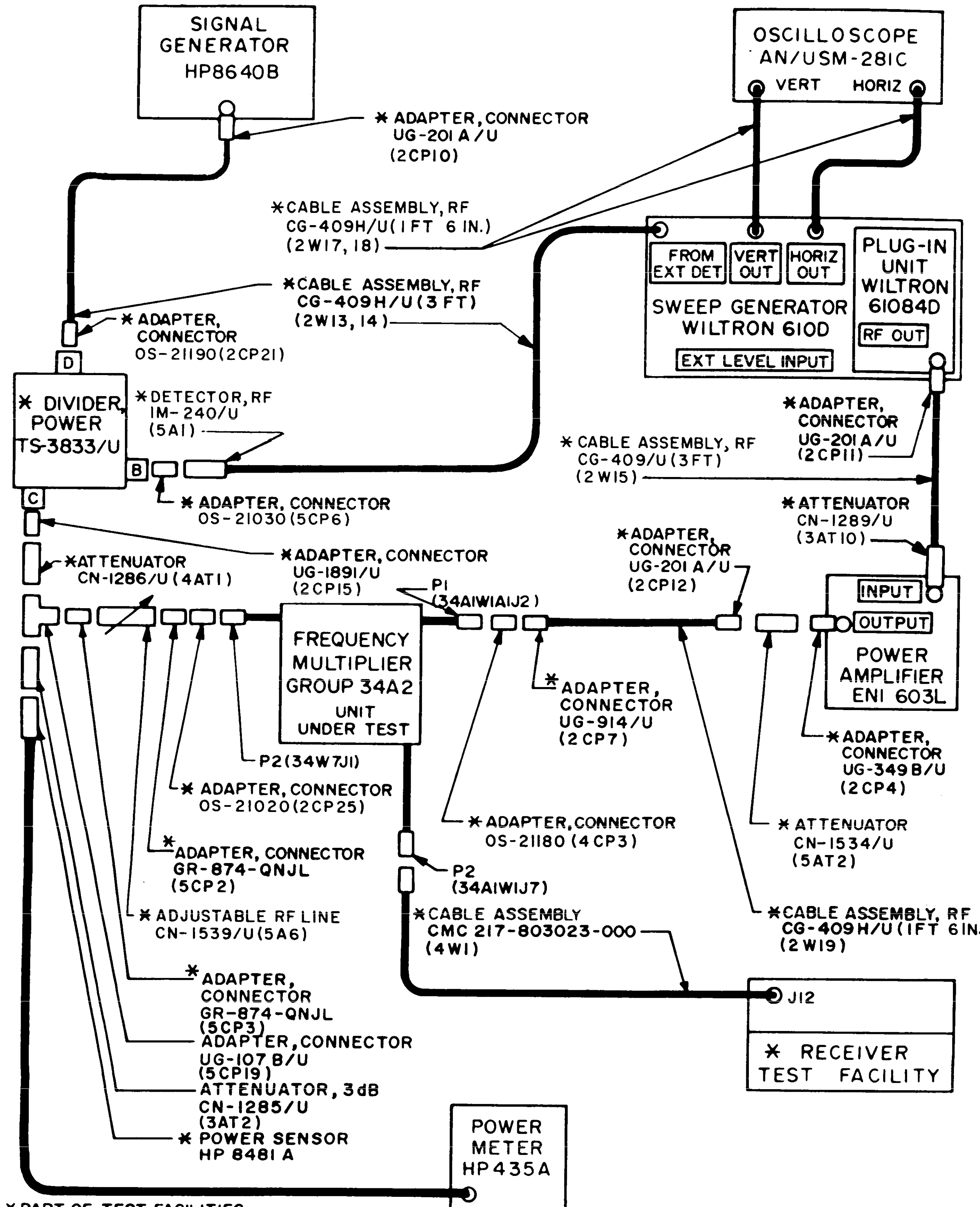


Figure 4-139. Frequency Multiplier Group 34A2, Output Power Check, Test Setup.

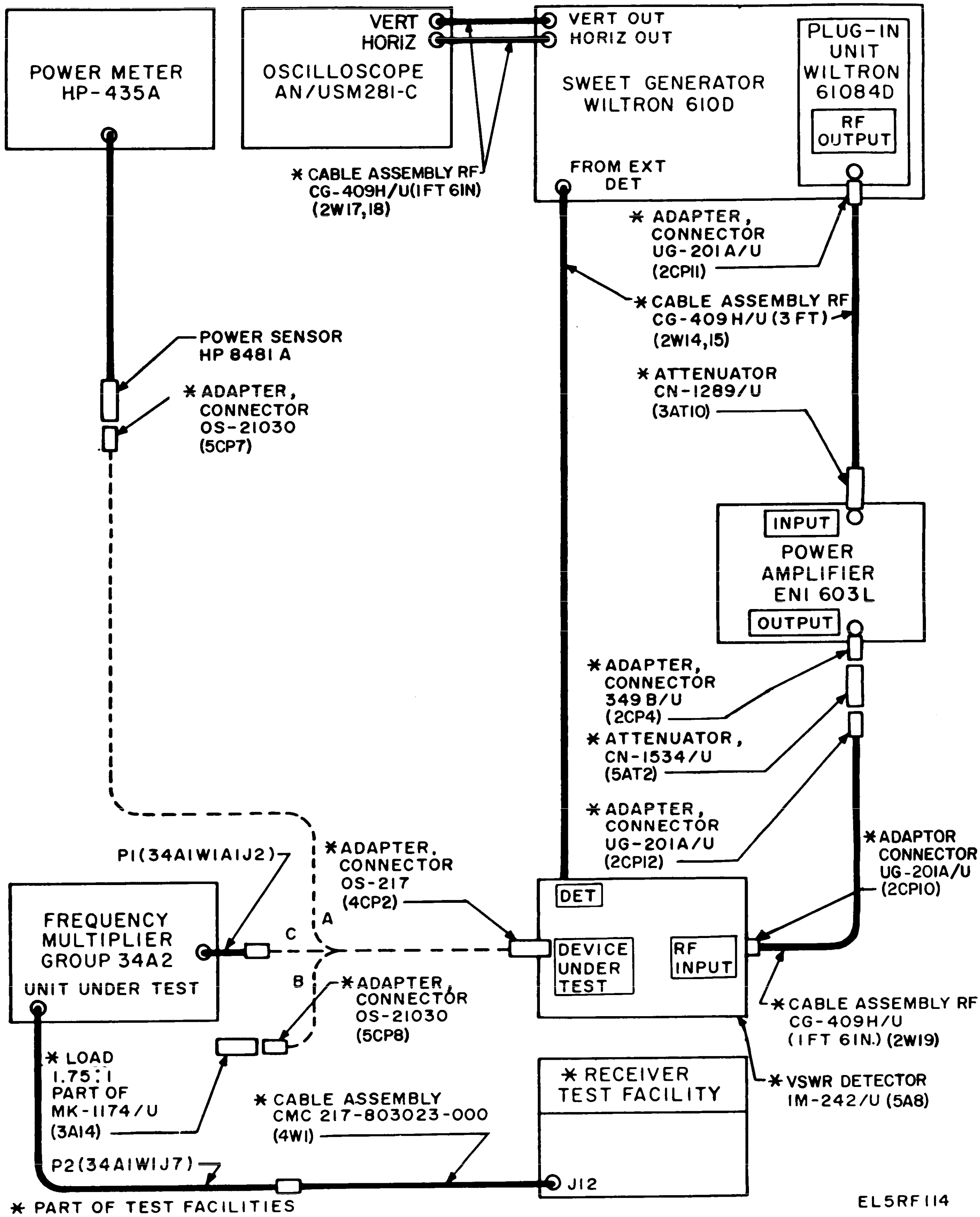


Figure 4-140. Frequency Multiplier Group 34A2, Input VSWR Check, Test Setup.

(g) Adjust the oscilloscope for a convenient display.

(h) Calibrate the oscilloscope for a VSWR of 1.75:1 between 105 MHz and 140 MHz.

(i) Connect the test equipment as shown in C, figure 4-140.

(j) Set the test facility switches S1 to ON and switch S6 to OSC.

(k) The VSWR display observed on the oscilloscope should not exceed 1.75:1.

c. Troubleshooting (FO-47 or FO-48).

d. Alinement Procedure.

(1) Turn the tuning shaft (fig. 4-138) until the cavity plungers are fully in the cavities.

(2) Check that the two clamps on the drive bands (fig. 4-138) are in line. If required, readjust the pulleys on the drive shaft (fig. 4-138).

(3) Loosen screws A and B on the clamp at the end of 34A2A1 cavity plungers.

(4) Connect the test equipment as shown in A, figure 4-137.

(5) Adjust the sweep generator controls to provide 122 MHz cw and an input level to the unit under test of +15 dBm (+5 dBm power meter indication). If necessary, refer to the output checks, *b.(1)(a)* through *(d)* above.

(6) Tune signal generator to 730 MHz.

Symptom	*Probable cause*	*Checks and corrective measures*
1. High VSWR.	Defective frequency multiplier 34A2A2 (fig. 4-138).	Remove frequency multiplier 34A2A2 and test defective unit as shown in paragraph 4-50.
2. Low or no power output.	*a.* Defective frequency multiplier 34A2A2.	*a.* Disconnect P1 (34A2W1P1) from J1 of frequency multiplier 34A2A2 (fig. 4-138) and connect the power meter to J1. Power meter should indicate +l 7 dBm ±2 dB. If output is abnormal, remove frequency multiplier 34A2A2 and test defective unit as shown in paragraph 4-50.
	b. Alinement.	*b.* If misalinement is suspected, refer to *d.* below for complete alinement procedures.
	c. Defective frequency multiplier 34A2A1 (fig. 4-138).	*c.* If power at J1 is normal, reconnect P1 to J1. Disconnect P1 (34A2FL1P1) from J2 of frequency multiplier 34A2A1 and connect the power meter to J2 (fig. 4-138). Power meter should indicate at least +8 dBm. If output is abnormal, replace frequency multiplier 34A2A1 (para. 2-67) and test defective unit as shown in paragraph 4-49.
	d. Defective bandpass filter 34A2FL1 (fig. 4-138).	*d.* If power at J2 of frequency multiplier 34A2A1 is normal, test bandpass filter 34A2FL1 as shown in paragraph 4-53.

(7) Connect the test equipment as shown in B, figure 4-137).

(8) Adjust the sweep generator controls for 122 MHz with a sweep width of 10 MHz.

(9) Set the test facility switches S1 to ON and S6 to Osc.

(10) Adjust the oscilloscope controls for a suitable display.

(11) Slowly turn the tuning shaft on the unit under test until the output peaks on the signal generator frequency (external marker).

(12) Readjust frequency multiplier 34A2A1 by moving its cavity plungers in or out. Simultaneously maintain the highest output from the bandpass filter (at 730 MHz) by adjusting the tuning shaft.

(13) Tighten screws A and B without changing the position of the plungers,

(14) Repeat the test in paragraph *b.* (1) above. If necessary, slightly readjust 34A2A1 as described in steps (3), (11), (12) and (13) above until the requirements of paragraph *b.* (1) are obtained from 725 MHz to 1030 MHz.

4-49. Frequency Multiplier 34A2A1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter TS-2866(V)2/GRM-95(V)2	Test facility transmitter

Equipment	*Common name*
Test Facility Receiver TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set MK-l173(V)2/ GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility radio frequency modules
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator Wiltron 610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Power Amplifier EN1603L	Power amplifier
Power Meter HP-435A	Power meter
Power Sensor HP-8481A	Power sensor
Generator, Signal HP 8640B	Signal generator
Frequency Counter TD-1225(V)l/U	Frequency counter
Oscilloscope AN/USM-281C	Oscilloscope
Inside Vernier Calipers, Mitutoyo P-52	
Feeler Gages, Ludell	

NOTE

Set power supply PP-6304/GRM-95(V) for an output of 115 Vac as indicated on its panel voltmeter. Maintain this output level throughout the following procedures.

b. Test Procedures.

(1) Input VSWR check.

(a) Connect the test equipment as shown in A, figure 4-141.

(b) Turn on the test equipment except, do not turn on the power amplifier at this time.

(c) Set the sweep generator controls as follows:

Control	*Setting*
FREQ SELECTOR	CWF1
RETRACE RF	OFF
LEVELING	INT
Rf POWER LEVEL	–20
Frequency Control F1	190 MHz (on dial)
Frequency Control F2	290 MHz (on dial)
SWEEP MODE	AUTO

(d) Set the power amplifier to ON and adjust the sweep generator rf POWER LEVEL control for a reading of +17 dBm on the power meter.

(e) Set the FREQ SELECTOR control to F1 TO F2.

(f) Set the F1 and F2 controls to sweep between 190 MHz and 290 MHz. Use the internal markers.

(g) Connect the test equipment as shown in B, figure 4-141.

(h) Calibrate the oscilloscope for a VSWR of 2.0:1 between 205 and 285 MHz.

(i) Connect the test equipment as show-n in C, figure 4-141. Set the receiver test facility switch S1 to ON and S6 to any position except OFF.

(j) If necessary, adjust C9 (fig. 4-142) on the unit for minimum reflected power over the frequency range. VSWR of unit under test should not exceed 2.0:1 over the frequency range 210 to 280 MHz.

(2) *Turning law check.*

NOTE

- The tuning law of the assembly under test is such that a displacement of 1.498 inch of the resonator must tune the assembly over the required frequency range of 725 to 1030 MHz. The maximum possible displacement of the resonator is greater than 1.498 inch and will vary from one assembly to another.

NOTE

- Use vernier calipers for measurements greater than 0.080 inch and use feeler gages for smaller dimensions.

(a) Turn the rf amplifier OFF and connect the test equipment as shown in A, figure 4-143.

(b) Adjust signal generator frequency fm 241.66 MHz ±30 kHz at a calibrated output level of –5 dBm.

(c) Adjust the output level of signal generator for +17 dBm on the power meter.

(d) Connect the test equipment as shown in B, figure 4-143.

(e) On the unit under test, fully withdraw the tuning plungers and measure the maximum displacement as shown in F, figure 4-144. From this measurement subtract the tuning range displacement of 1.498 inch (E, fig. 4-1 44). Divide the result by two and record this result as the end play (D, fig. 4-144).

(f) Adjust the depth of the tuning plungers as shown in D, figure 4-144.

(g) Set test facility switches S1 to ON and S6 to OSC.

(h) Carefully adjust the depth of the tuning plungers slightly for a maximum indication on the power meter.

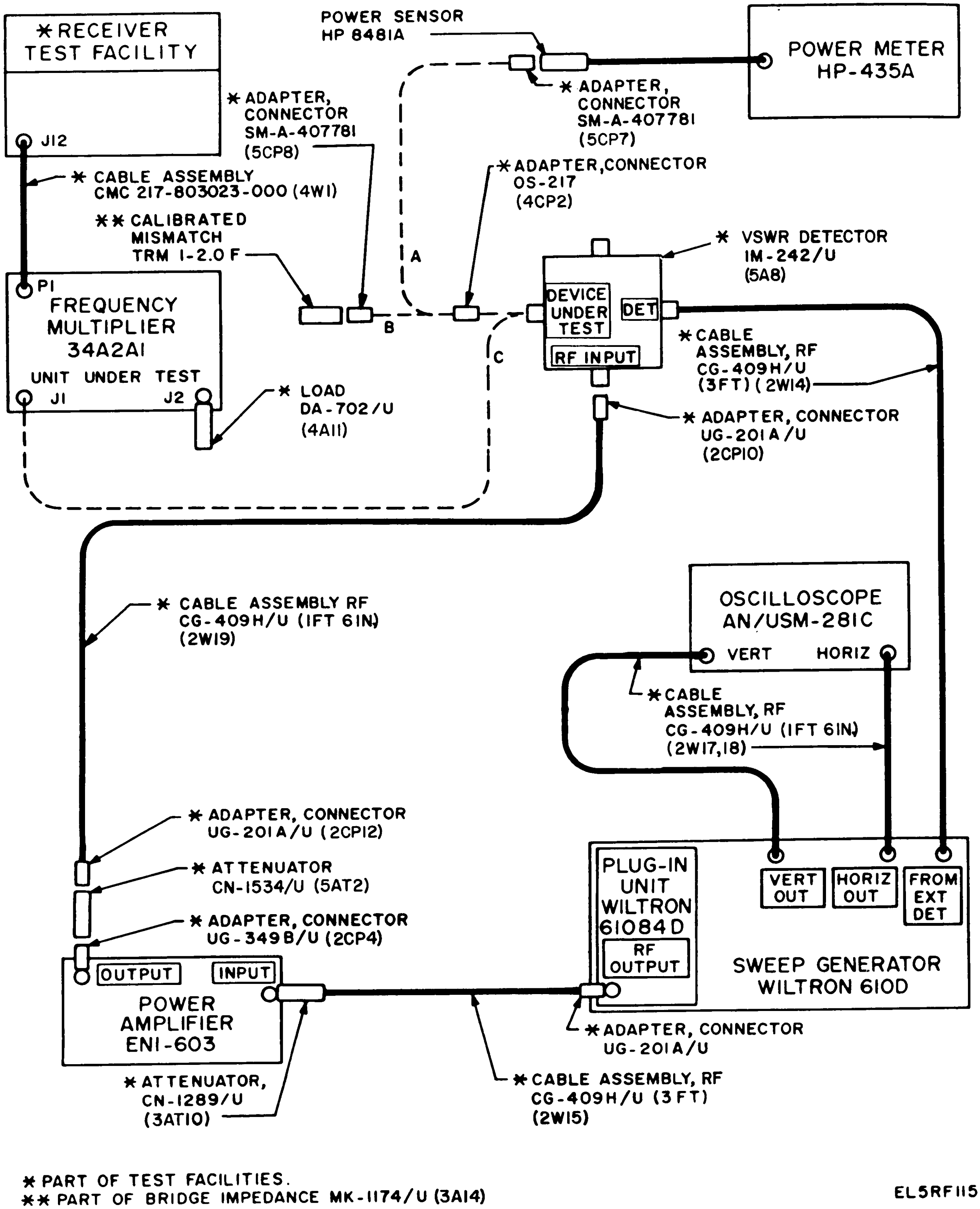


Figure 4-141. Frequency Multiplier 34A2A1, VSWR Check, Test Setup.

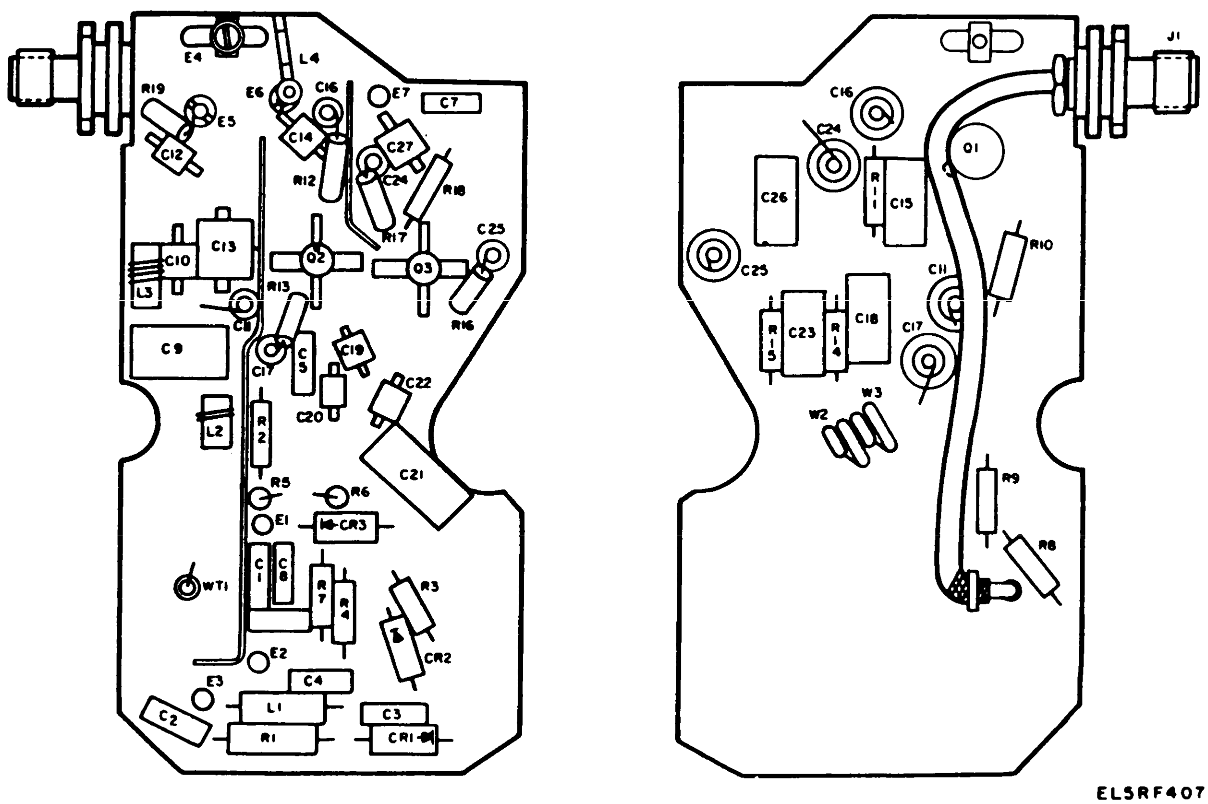


Figure 4-142. Frequency Multiplier 34A2A1, Parts Location.

(i) Connect the test equipment as shown in C, figure 4-143. The frequency indicated on the frequency counter should be 725 MHz ±100 kHz.

(j) Connect the test equipment as shown in B, figure 4-143.

(k) Adjust the depth of the tuning plungers for maximum indication on the power meter. Measure the exact plunger displacement position (to within ±0.001 inch) and record the result. This is the end play (C, fig. 4-144) at 725 MHz.

(l) Adjust signal generator frequency for 257.5 MHz ±30 kHZ.

(m) Extend the tuning plungers to 1.498 inch plus the end play recorded in *(k)* above. Adjust the signal generator slightly for a maximum indication on the power meter. The power output should be +8.8 dBm minimum (-1.2 dBm indicated on the power meter).

(n) Connect the test equipment as shown in C, figure 4-143. The frequency indicated on the frequency counter should be 1030 MHz ±4 MHz.

(o) Reconnect test equipment as in B, figure 4-143.

(p) Repeat *(m)* and *(n)* above for the remaining frequencies in the table below. The power output and displacement of the tuning plungers should be as listed in the table below.

Output frequency (MHz)	*Input frequency (MHz)*	*Power output (+ dBm) min.*	*Resonator displacement inches from reference (para. (k) above)*
1030 ± 4.0	257.5	8.8	1.498
950 ± 4.0	237.5	8.8	1.148
900 ± 4.0	225.0	8.8	0.916
840 ±4.0	210.0	8.8	0.604
840 ±4.0	280.0	7.8	0.604
780 ± 2.5	260.0	7.8	0.258
725 ± 1.0	241.7	7.8	0.000 (ref.)

(q) Vary the signal generator frequency from 241.7 MHz to 280 MHz while tracking the plunger for maximum power output. Note the signal generator frequency where minimum power output occurs (X3 multiplier).

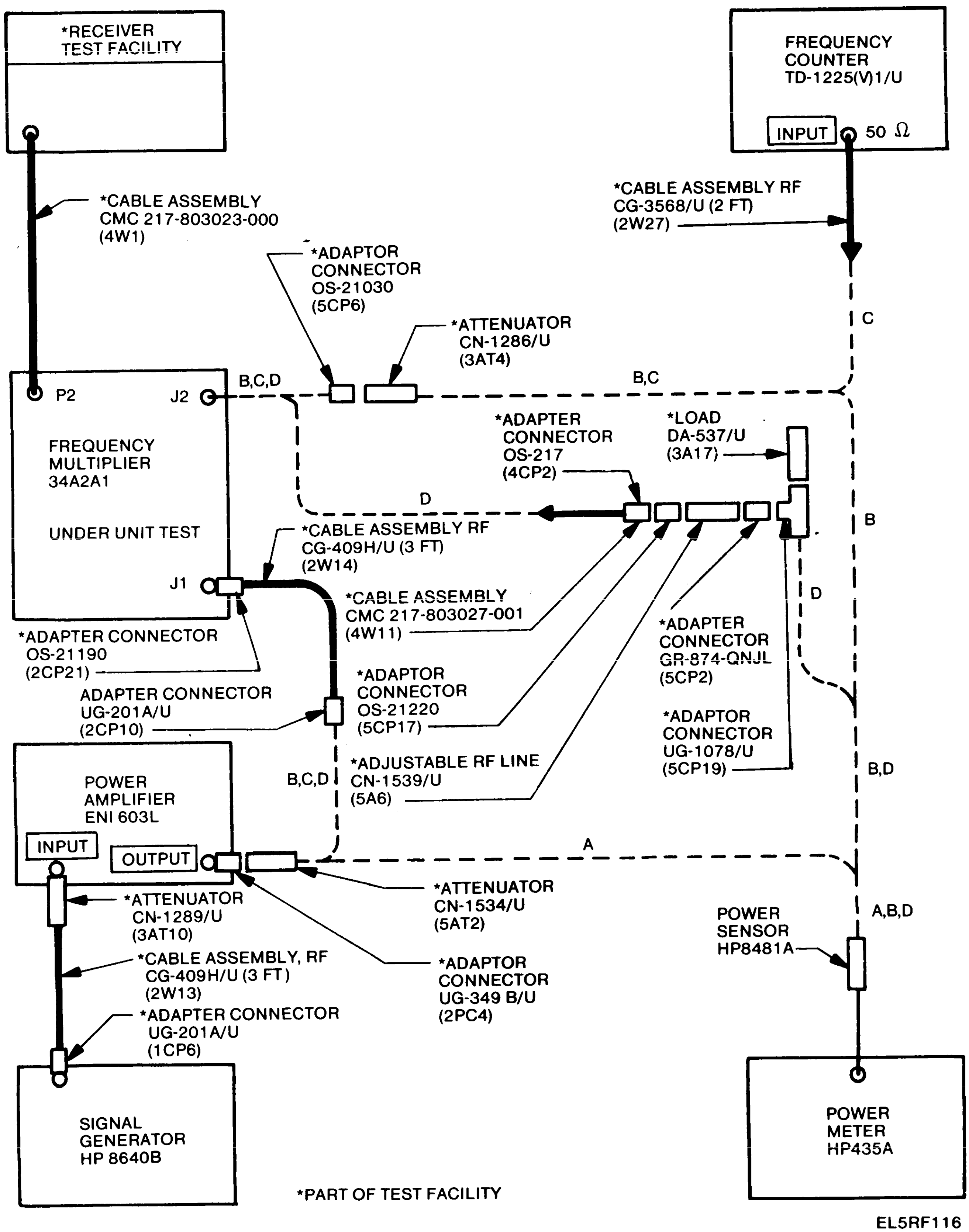


Figure 4-143. Frequency Multiplier 34A2A1, Tuning Law Check and Output Power Check, Test Setup.

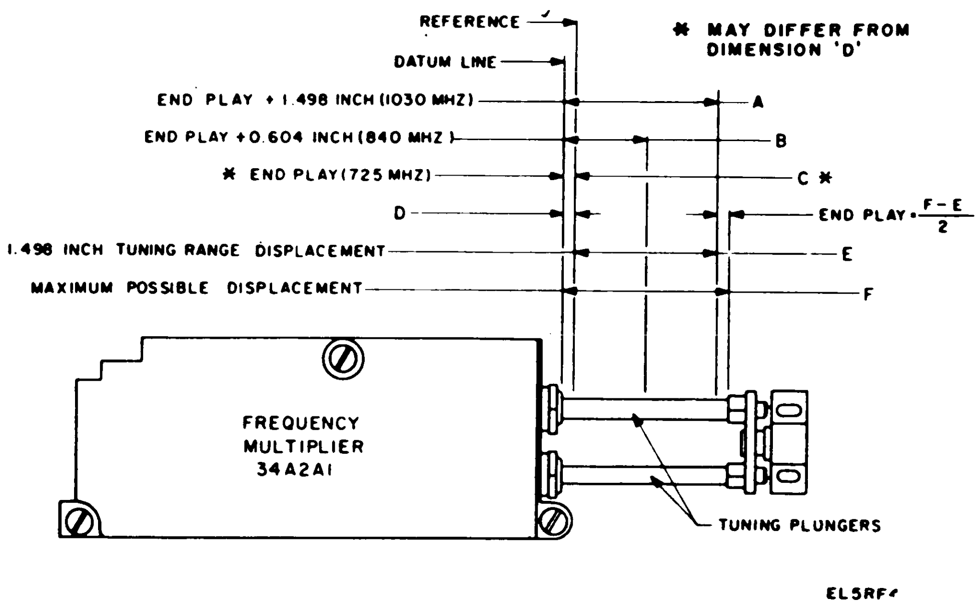


Figure 4-144. Frequency Multiplier 34A2A1, Tuning Plunger Displacement Measurement.

(r) Repeat *(q)* above for signal generator frequencies between 210 MHz and 257.5 MHz (X4 multiplier).

(3) *Output power.*

(a) Connect the test equipment as shown in A, figure 4-143.

(b) Tune the signal generator to the input frequency corresponding to the lowest output power between 1030 MHz and 840 MHz recorded in *(2)(q)* above and adjust its output level for +15 dBm on the power meter.

(c) Connect the test equipment as shown in D; figure 4-143.

(d) Set the tuning plungers on the unit under test to the displacement position corresponding to the frequency determined in step *(b)* above and adjust for maximum power meter indication by slight movement of the tuning plungers.

(e) Adjust the trombone line for minimum power meter indication. The output power should be +8.3 dBm (minimum). This corresponds to a power meter indication of +5.0 dBm, which is calculated as follows: +8.3 dBm output minus 3 dB (2:1 mismatch), minus 0.3 dB (trombone line).

(f) Repeat *(a)* through *(d)* above for the lowest output power recorded in *(2)(q)* above for the power frequency region (840 MHz – 725 MHz).

(g) Adjust the trombone line for minimum power meter indication. The output power should be +7.3 dBm minimum. This corresponds to a power meter indication of +4.0 dBm, which is calculated as follows: +7.3 dBm output minus 3 dB (2:1 mismatch), minus 0.3 dB (trombone line).

NOTE

If power output is low at 840 MHz, replace Cl2 (5.6 pF) with a 6.8 pF capacitor (fig. 4-142).

(4) *Bandwidth.*

(a) Connect the test equipment as shown in A, figure 4-145.

(b) Set the signal generator to 257.5 MHz, then set the signal generator output level for a reading of +7 dBm on the power meter (+17 dBm input to the unit under test).

(c) Connect the equipment as shown in B, figure 4-145.

(d) Adjust the depth of the tuning plunger for the maximum indication on the power meter.

(e) Adjust the signal generator frequency below 257.5 MHz until the power meter indication drops by 3 dB. Record the output frequency.

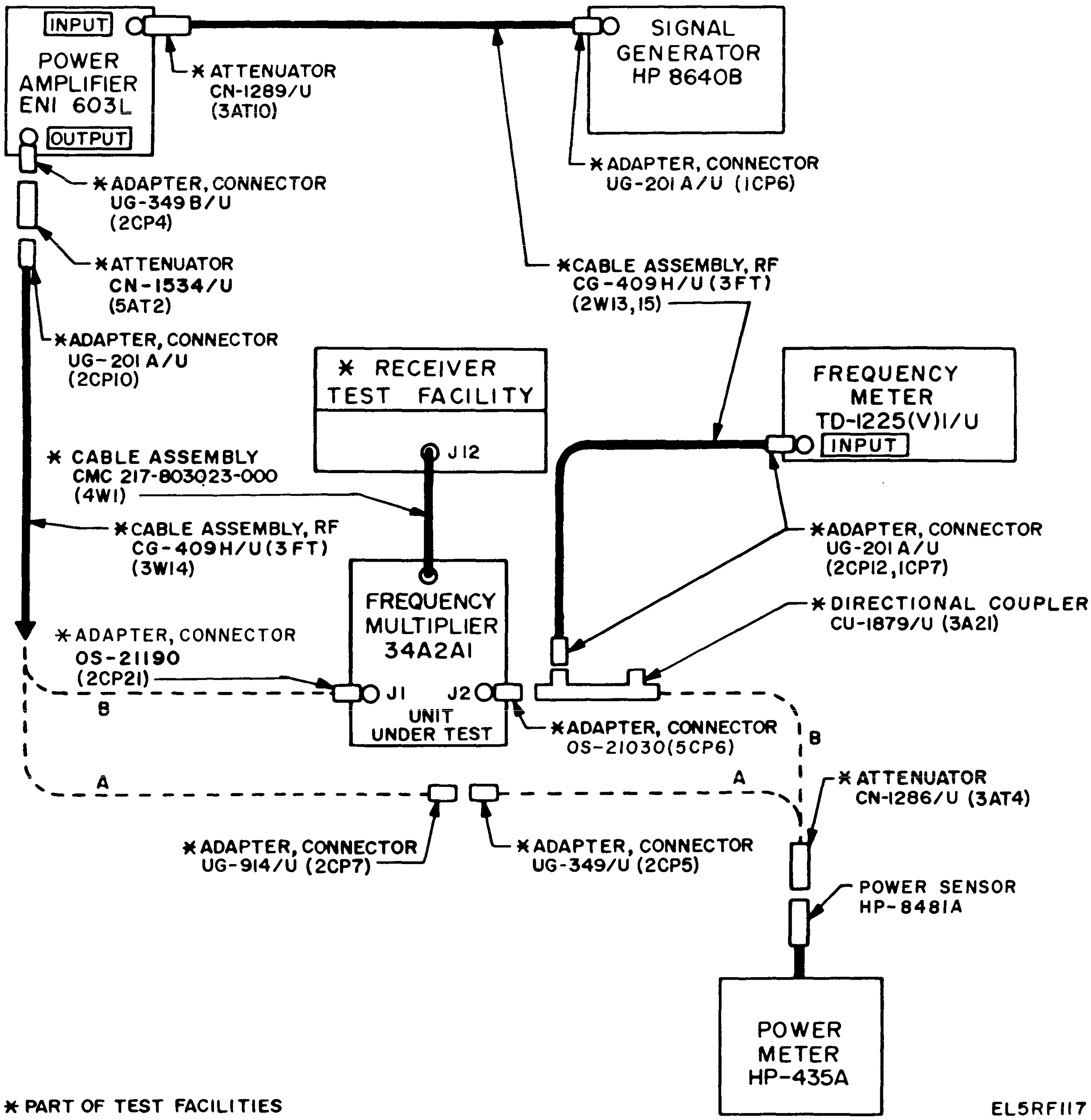


Figure 4-145. Frequency Multiplier 34A2Al1 Bandwidth Check, Test Setup.

(f) Adjust the signal generator frequency above 257.5 MHz until the power meter indication drops by 3 dB. Record the output frequency.

(g) The 3 dB bandwidth is the difference between the readings recorded in *(e)* and *(f)* above, and should lie between 8.2 and 30.9 MHz.

(h) Repeat *(a)* through (g) above for the following equipment settings.

Signal generator Freq. (MHz)	*Output Freq. (MHz)*	*Bandwidth at–3dB points (MHz)*	
		Min	*Max*
280	840	6.7	25.2
210	840	6.7	25.2
241.66	725	5.8	21.8

c. Troubleshooting (FO-50).

Symptom	*Checks and corrective measures*
1. High VSWR (b. *(1)(j)* above).	*a.* Check resistors R8 and R9 (fig. 4-142) and input connector J1. *b.* Check components in Q1 base circuit
2. No output indication *(b.* (2)(m) above).	*a.* Check the dc voltages as established in cf below. Investigate any abnormal indication. Replace components as required *b.* Check for damaged cables or connectors and broken wires. Repair or replace as required.
3. Low output tuning law or bandwidth outside specified limits.	Realine unit as shown in *e.* below.

d. Voltage and Resistance Measurements (FO-50).

NOTE

Use the allocated multimeter for resistance and voltage measurements and allocated rf voltmeter for rf voltage measurements.

(1) DC voltage measurements referenced to ground.

Test points	*Typical indication (volts dc)*
34A2A1AlQ1-base	–6.3
-collector	–5.8
34A2A1A1Q2–base	+0.62
-collector	+5.4
34A2A1A1Q3–base	+0.62
-collector	+5,4

(2) *Rf voltage measurements referenced to ground.*

Test points	*Typical indication (volt-s rms)*
34A2AlAlQl–base	0.475
-collector	0.13
34A2AlAlQ2–base	0.14
-collector	0.5
34A2AlAlQ3–base	0.13
–collector	0.5

(3) *Resistance measurements.*

Stage	*Transistor*		*Base (−)*				*Base (+)*			
			Emitter (+)		*Collector (+)*		*Emitter (−)*		*Collector (−)*	
	Ref.	*Type*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*
Frequency Multiplier 34A2A1A1.	Q1	2N2857	450	2k	3.1k	20k	455	2k	1.05k	2k
	Q2	5762	860	2k	1.125k	2k	1.05k	2k	960	2k
	Q3	5762	880	2k	1.1k	2k	1.0k	2k	960	2k

e. Alinement.

NOTE

- The tuning law of the assembly under test is such that a displacement of 1.498 inch of the resonator must tune the assembly over the required frequency range of 725 to 1030 MHz. The maximum possible displacement of the resonator is greater than 1.498 inch and will vary from one assembly to another. It is therefore necessary to measure this maximum possible displacement and arrange for the 1.498 inch tuning displacement to fall provisionally in the center of this maximum resulting in equal end play. Electrical alinement will then be performed to make the assembly conform to the tuning law. Should this not be possible, the 1.498 inch tuning displacement may be offset from the center of maximum possible displacement and alinement repeated to meet the tuning law.

- Use vernier calipers for measurements greater than 0.080 inch and use feeler gages for smaller dimensions.

(a) On the unit under test, remove the cover from the plug PI side and fully withdraw the tuning plungers. Measure the maximum displacement as shown in F, figure 4-144. From this measurement subtract 1.498 inch (tuning range displacement). Divide the result by two and record as the end play (D, fig. 4-144).

(b) Add 1.498 inch to the end play recorded in *(a)* above and set the plungers to this displacement (A, fig. 4-144).

(c) Turn the power amplifier OFF, and connect the test equipment as shown in A, figure 4-146.

(d) Set the sweep generator FREQ SELEC TOR control to CW MKR. Set the RF POWER LEVEL controls to –20 dBm and adjust the output frequency to a nominal 257.7 MHz on the dial.

(e) Set the power amplifier to ON and adjust the sweep generator rf level controls for +17 dBm (+7 dBm indication on the power meter).

(f) Connect the test equipment as shown in B, figure 4-146.

(g) Set the sweep generator FREQ SELECTOR control Δ F, the Δ F FREQ control to maximum clockwise and adjust the sweep width and the oscilloscope controls to display the output response curve.

NOTE

- The marker produced by the signal generator will appear, only when there is an output from the unit under test at that frequency.
- The signal generator output level may affect the output response display. Note the marker position, then turn the signal generator RF OFF for final adjustment.

(h) Adjust the signal generator output level and frequency controls to display a marker at 1030 MHz.

(i) Adjust Cl, C3 and C21 (fig. 4-147) for maximum response centered on 1030 MHz.

(j) Add 0.604 inch to the end play recorded in (a) above and set the tuning plungers to this displacement (B, fig. 4-144).

(k) Set the sweep generator frequency controls to center the response on the oscilloscope (nominal 280 MHz on the dial). Adjust the signal generator output level and frequency controls to display a marker at 840 MHz.

(l) Observe the position of the 840 MHz marker. Adjust E4 (fig. 4-142) for optimum response amplitude and frequency (within ±4 MHz).

NOTE

E4 adjustment will change the response frequency by approximately ±1 MHz only.

(m) Readjust test equipment and tuning plungers to operate at 1030 MHz.

(n) Observe the marker position. Slightly adjust the position of C1 and C3 for the best possible compromise for tracking at the two frequencies. E4 may have to be readjusted in order to obtain the best compromise.

(o) This compromise tuning adjustment is used to divide the tracking error between 1030 and 840 MHz. The error should not exceed ±4 MHz as noted in the table *b.(2) (p)* above.

(p) Set the tuning plungers to the end play recorded in *(a)* above and repeat steps *(c)* through *(h)* above for a signal generator frequency of 725 MHz ±125 kHz and sweep generator center frequency of 261.7 MHz.

(q) Adjust C4 and C2 (fig. 4-147) for maximum response at 725 MHz.

(r) Perform the tuning law check in *b.* (2) above. If the power output or the resonator displacement are not as specified, the tuning range displacement should be offset from the center of maximum possible displacement by slightly altering the end play recorded in *(a)* above.

(s) Repeat *(b)* through *(r)* above until the requirements are met.

(t) Replace the cover on the unit under test.

4-50. Frequency Multiplier 34A2A2

Frequency multiplier 34A2A2 is identical to frequency multiplier 33A2A2. Refer to paragraph 4-25 for complete test and alinement procedures.

4-51. Lowpass Filter 34A2A2FL1

Lowpass filter 34A2A2FL1 is identical to Iowpass filter 33A2A2FL1. Refer to paragraph 4-26 for complete test and alinement procedures.

4-52. Lowpass Filter 34A2A2FL2

Lowpass filter 34A2A2FL2 is identical to Iowpass filter 33A2A2FL2. Refer to paragraph 4-27 for complete test and alinement procedures.

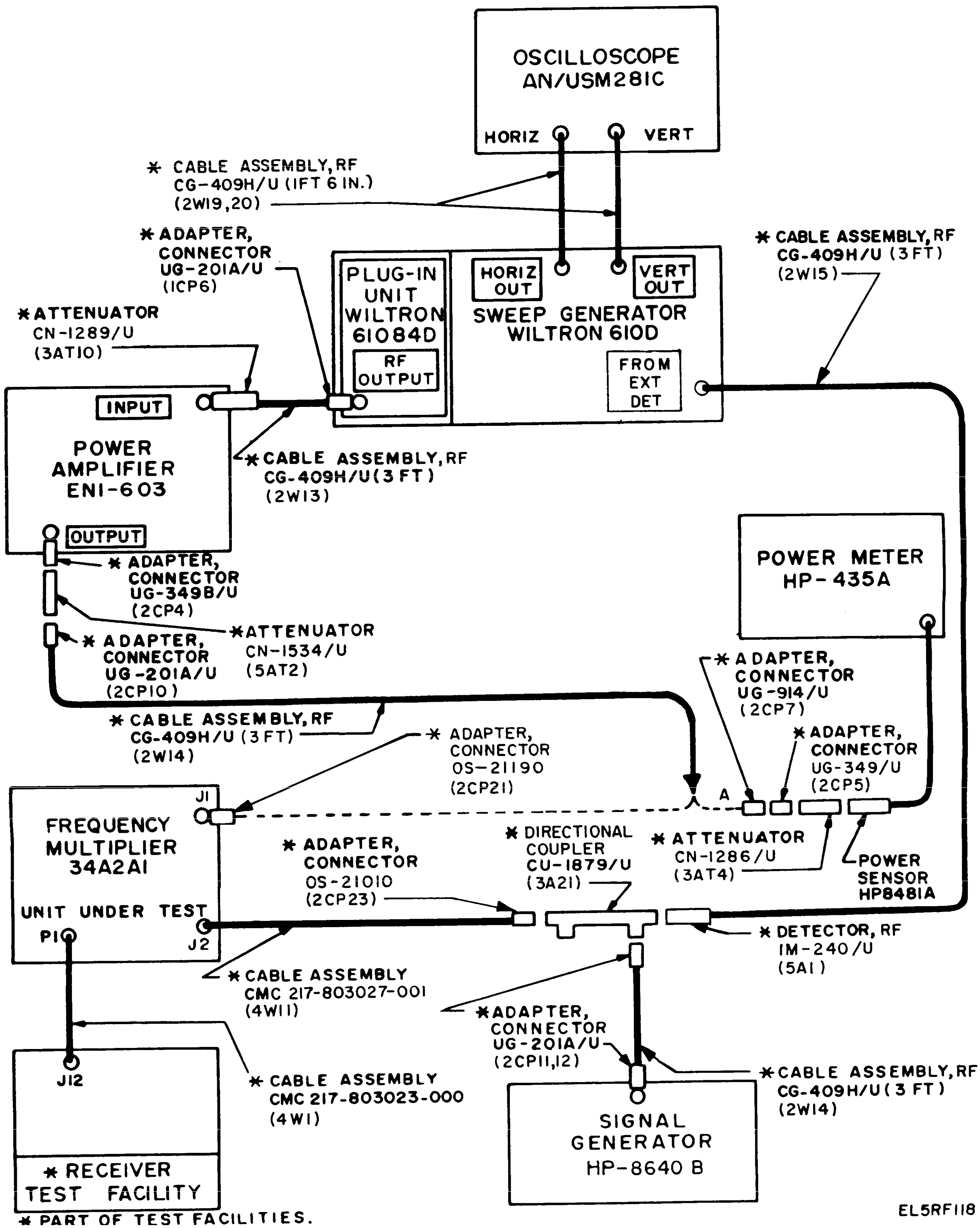


Figure 4-146. Frequency Multiplier 34A2A1, Alinement Test Setup.

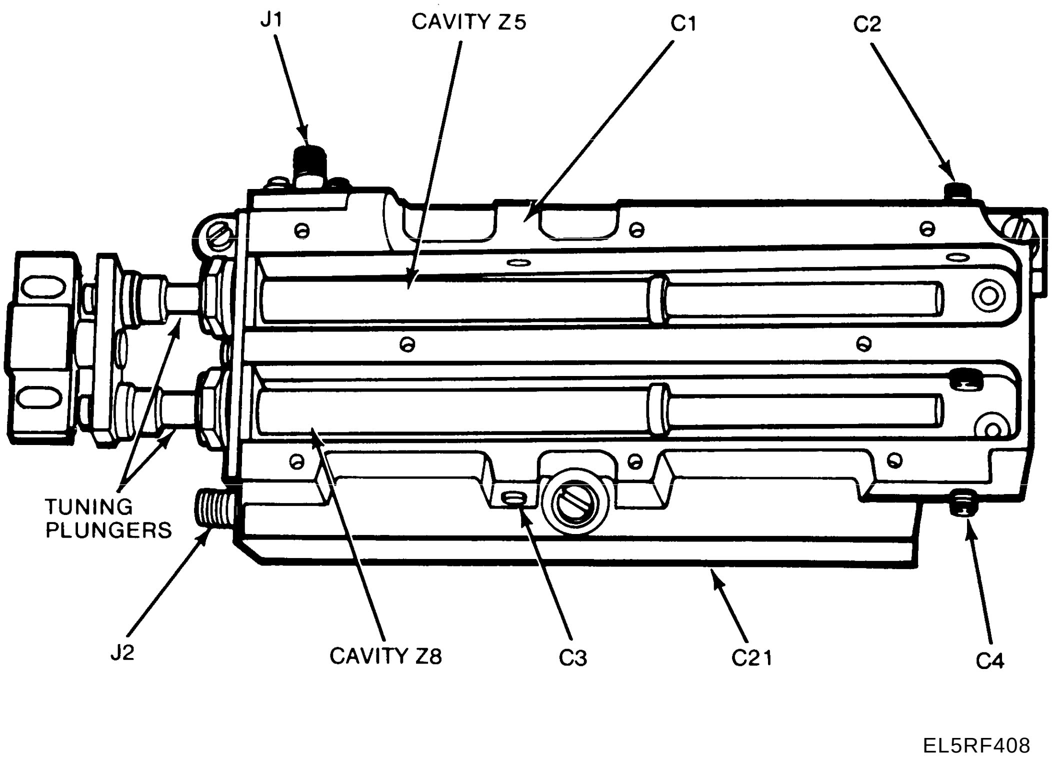


Figure 4-147. Frequency Multiplier 34A2A1, Showing Tuned Cavities with Cover Removed.

4-53. Bandpass Filter 34A2FL1

a. Test Equipment and Materials Required.

Equipment	*Common name*
Test Facility Transmitter TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit, test facilities set
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator Wiltron 610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Oscilloscope AN/USM-281C	Oscilloscope

b. Test Procedures.

NOTE

If any of the following requirements are not met, proceed to the alinement procedures in c. below.

(1) *Bandwidth check.*

(a) Lift the hinged gage of test fixture TS-3827/GRM-95(V) and install the unit to be tested in the fixture, engaging the test fixture drive shaft with the tuning shaft (fig. 4-150) of the unit under test. Secure with appropriate retaining screws.

(b) Connect P_2(34W7J1) and P_1(34A2A1J2) on the unit under test to the input and output connectors of the test fixtures as shown in figure 4-148.

(c) Adjust the tuning knob on the test fixture so that the crossbar connecting the cavity plungers bears against the calibrated stop on the text fixture hinged gage (when lowered into position) at the 725 MHz calibration.

(d) Connect the test equipment as shown in A, figure 4-148.

(e) Set the coaxial switch to position No. 2.

(f) Adjust the sweep generator controls to provide sufficient output at 725 MHz with a sweep of sufficient width to view the response curve.

(g) Adjust the oscilloscope controls for a convenient display. Using the sweep generator markers, check the response is centered on 725 MHz ±1 MHz.

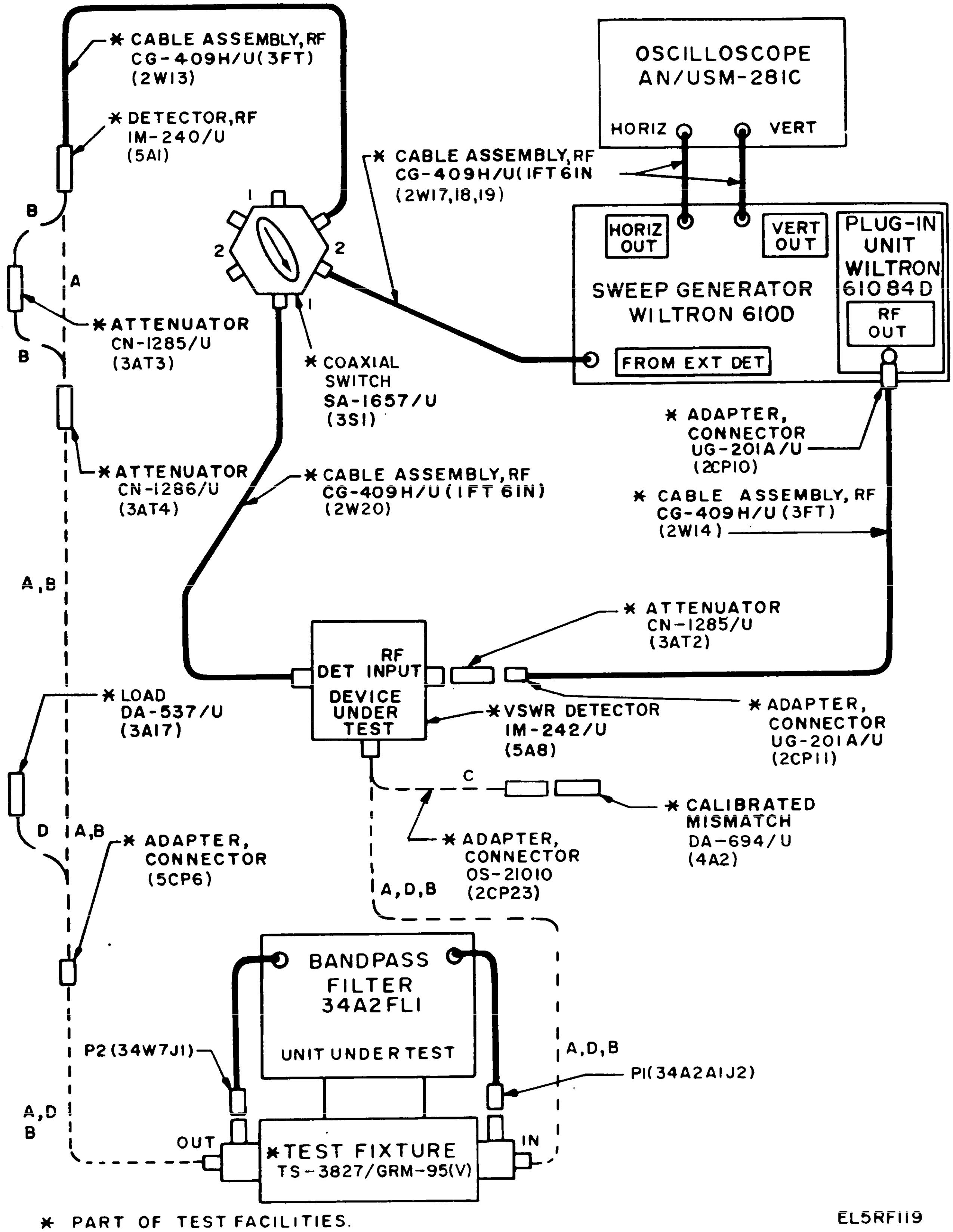


Figure 4-148. Bandpass Filter 34A2FL1, Bandwidth and VSWR Check, Test Setup.

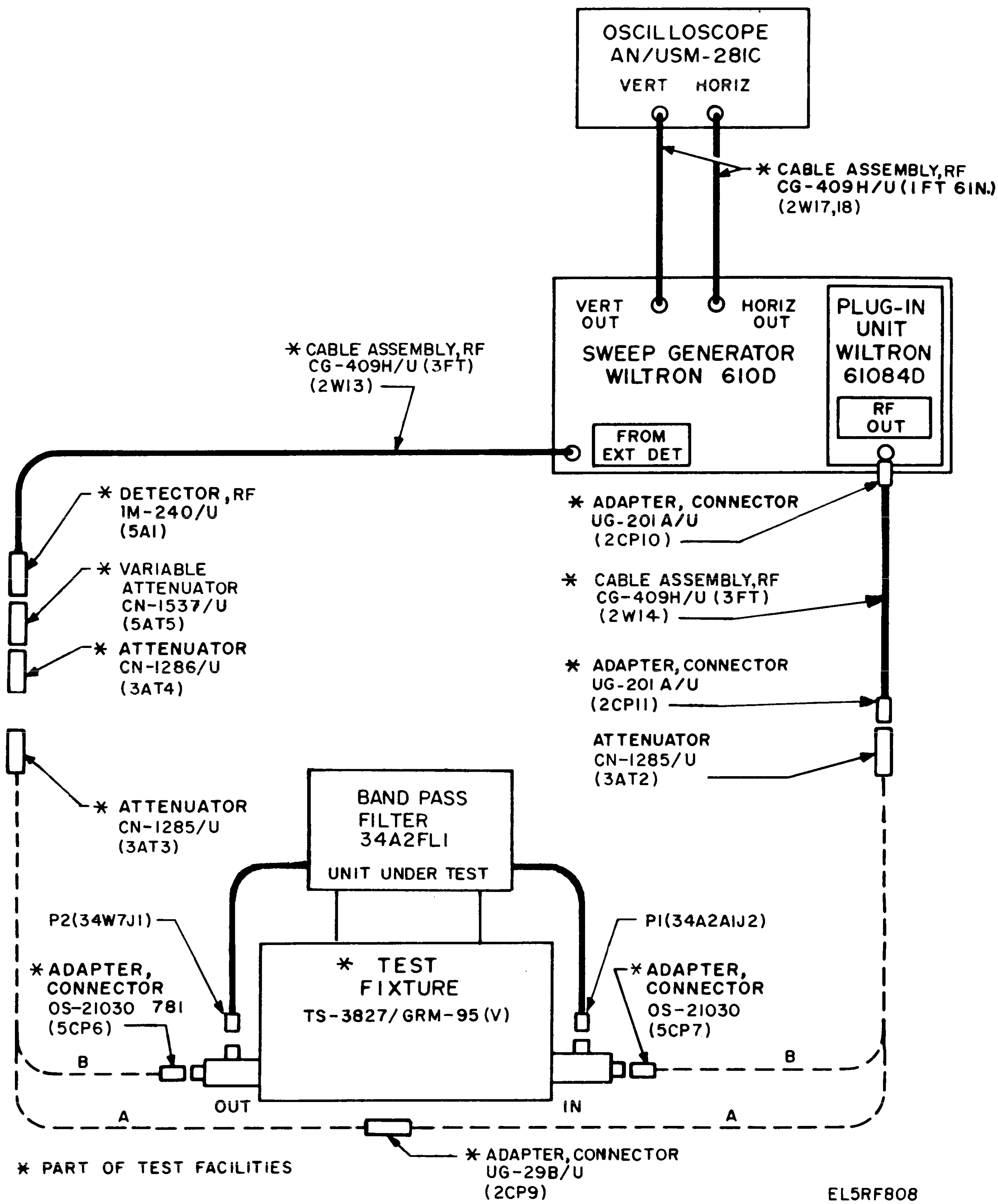


Figure 4-149. Bandpass Filter 34A2FL1, Insertion Loss Check, Test Setup.

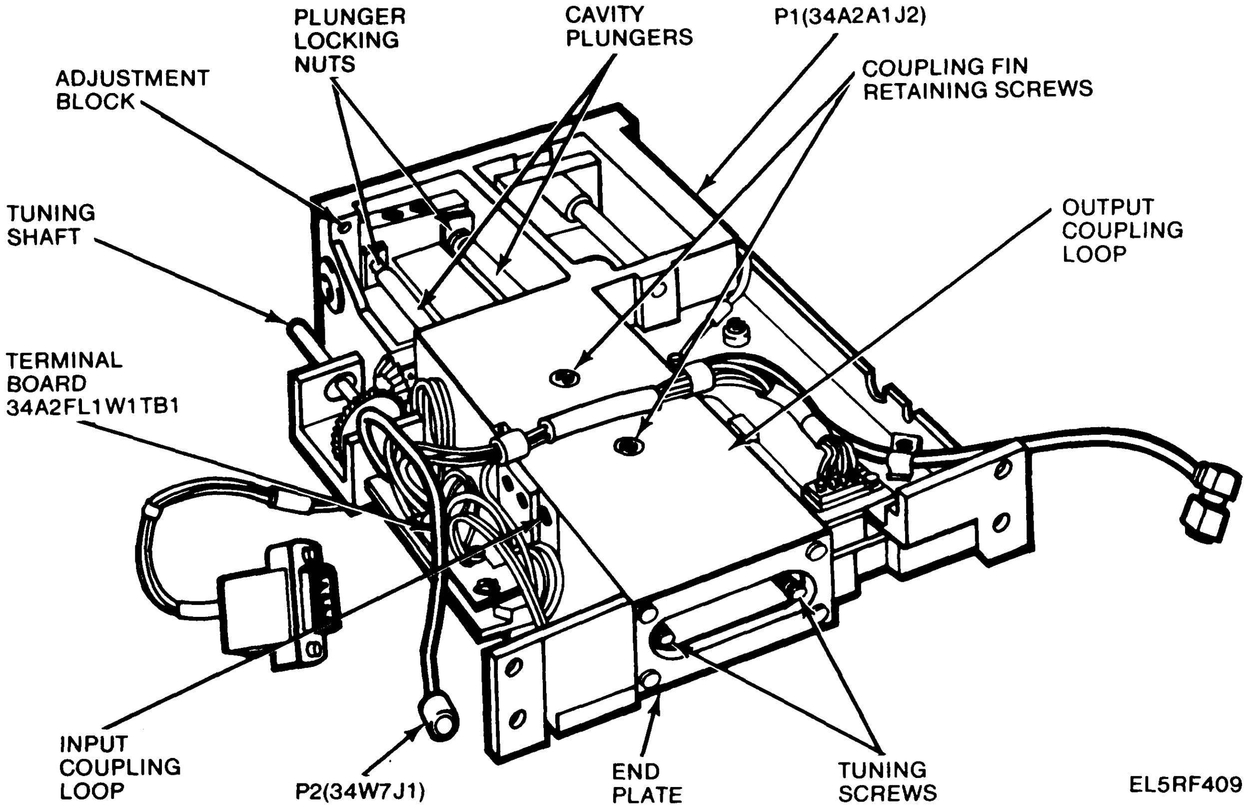


Figure 4-150. Bandpass Filter 34A2FL1, Bottom View.

(h) Insert a 3 dB attenuator as shown in B, figure 4-148, and mark the new peak amplitude of the response curve on the graticule of the oscilloscope. This is the –3 dB reference line.

(i) Remove the 3 dB attenuator and reconnect the equipment as shown in A, figure 4-148.

(j) Measure the bandwidth at the points where the response curve crosses the –3 dB bandwidth reference line, using the sweep generator markers. The bandwidth should be between 5 and 10 MHz.

(k) Repeat *(c)* through *(j)* above for sweep generator and test fixture frequencies of 880 and 1030 MHz. Lift the hinged gage to reposition the tuning shaft to the correct position for each frequency.

(2) *VSWR check.*

(a) Connect the test equipment as shown in C, figure 4-148. Secure the hinged gage in the lifted position.

(b) Set the coaxial switch to position No. 1.

(c) Adjust the sweep generator controls to provide a sweep between 725 and 1030 MHz at sufficient output level (use internal markers).

(d) Adjust the oscilloscope controls for a convenient display.

(e) Calibrate the oscilloscope for a VSWR of 1.6:1 between 725 and 1030 MHz.

(f) Connect the test equipment as shown in D, figure 4-148.

(g) Tune the unit under test through the 725 to 1035 MHz frequency range and note that the peak of the response remains below the 1.6:1 VSWR calibration line.

(3) *Insertion loss check.*

(a) Connect the test equipment as shown in A, figure 4-149.

(b) Adjust the F1 TO F2 sweep generator controls to sweep between 725 MHz and 1030 MHz, using a low speed sweep rate.

(c) Set the variable attenuator to 4 dB.

(d) Adjust the oscilloscope for a convenient display. Note the position of the response curve.

(e) Connect the test equipment as shown in B, figure 4-149.

(f) Set the variable attenuator to 2 dB.

(g) Tune the unit under test through the 725 MHz to 1030 MHz frequency range. The filter response should be the same as or greater than the response noted in *(d)* above throughout the range.

c. Alinement Procedures.

CAUTION

The coupling loops will be damaged or distorted if the adjustment nut does not move freely.

NOTE

Use a suitable solvent to remove the sealant from adjustment hardware and ensure free movement before attempting adjustment.

(1) *Initial adjustment.*

(a) Remove the end plate (fig. 4-150) from the unit under test. Adjust the input and output coupling loops (fig. 4-150) to the mechanical center of their tuning range.

(b) Connect the test equipment as shown in C, figure 4-148.

(c) Set the coaxial switch to position No. 1.

(d) Set the sweep generator for a convenient output and calibrate the oscilloscope for 1.6:1 VSWR between 725 MHz and 1030 MHz.

(e) Connect the test equipment as shown in D, figure 4-148.

(f) Set the unit under test to the 1030 MHz calibrated stop of the test fixture hinged gage.

(g) Set the sweep generator center frequency to 1030 MHz, using internal markers, and adjust the sweep width for a convenient display of the response curve.

(h) Loosen the two plunger locking nuts (fig. 4-150) and independently adjust the plungers to obtain maximum amplitude and center the response on the 1030 MHz marker. Tighten the locking nuts.

NOTE

Make sure that the plungers slide freely in and out of the cavity.

(i) Set the sweep generator center frequency to 880 MHz.

(j) Set the unit under test to the 880 MHz calibrated stop of the test fixture hinged gage.

(k) Adjust the input and output coupling loops and the coupling fin for minimum VSWR (less than 1.6:1).

NOTE

The coupling fin is adjusted by loosening the coupling fin retaining screws and sliding the retaining screws to the desired position. Do not remove the retaining screws.

(l) Repeat steps *(f)* and *(g)* above and measure the VSWR. If necessary, slightly readjust the input and output coupling loops and the coupling fin for a compromise to meet the requirements of 1.6:1 maximum VSWR at 1030 MHz and 880 MHz.

(m) Simultaneously tune the sweep generator center frequency and the unit under test from 1030 MHz to 880 MHz. The VSWR should not exceed 1.6:1.

(2) *Final adjustments.*

(a) Install the end plate on the unit under test.

(b) Set the unit under test to the 725 MHz calibrated stop of the test fixture hinged gage.

(c) Set the sweep generator center frequency to 725 MHz.

(d) Adjust the two end plate tuning screws to obtain maximum amplitude and center the response on the 725 MHz markers.

(e) Set the sweep generator center frequency to 880 MHz.

(f) Set the unit under test to the 880 MHz calibrated stop of the test fixture hinged gage.

(g) If necessary, slightly readjust the input and output coupling loops to center the response on the 880 MHz marker.

(h) Set the sweep generator center frequency to 1030 MHz.

(i) Set the unit under test to the 1030 MHz calibrated stop of the test fixture hinged gage. If necessary, slightly readjust the input and output coupling loops to center the response on the 1030 MHz marker.

(j) Repeat final adjustments above for best compromise of response centering.

(k) Set the unit under test to the 1030 MHz calibrated stop of the test fixture hinged gage, and to the 880 MHz and 725 MHz calibrated stop, in turn. Measure the VSWR at each frequency. The VSWR should be 1.6:1 maximum.

NOTE

It maybe necessary to readjust the coupling loops and coupling fin for a compromise to meet the requirements of *(a)* through *(k)* above.

(l) Check the unit under test as described in *b.(1)* through (3) above.

(m) Lock and/or seal the adjustment hardware.

4-54. RF Power Monitor 34A3

Rf power monitor 34A3 is not repairable and is tested as part of the overall receiver rf head AM-4318 in paragraph 4-44.

4-55. Control-Indicator 34A4

Control-indicator 34A4 is similar to control-indicator 38A2. For test and troubleshooting procedures, refer to paragraph 4-63.

4-56. Signal Level Control-Monitor 34A5

Signal level control-monitor 34A5 is identical to signal level control-monitor 33A5. For test and troubleshooting procedures, refer to paragraph 4-31.

4-57. Control Panel 34A6

Control panel 34A6 is similar to control panel 33A6. Refer to paragraph 4-32.

4-58. Frequency Mixer Stage 34A7

NOTE

There are two variations of mixer 34A7, SM-D-696297 (new) and SM-D-696462 (old). See paragraph *d.* below for SM-D-696462 test procedures.

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set MK-1173(V)2/ GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Module TS-3837(V)2/ GRM-95(V)2	Test facility radio frequency module
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Voltmeter, Rf ME-426/U	Rf voltmeter
Generator, Signal HP 8640B	Signal generator
Power Meter HP-435A	Power meter
Power Sensor HP-8481A	Power sensor
Sweep Generator, Wiltron 610D with Plug-in Unit Wiltron 61084D	Sweep generator
Frequency Counter TD-1225(V)l/U	Frequency counter
Generator, Noise HP-346B Option 1	Noise generator
If. Amplifier 30 MHz AM-48221U	If amplifier
Power Supply, HP-6002A	Power supply
Rf Power Amplifier ENI603L	Power amplifier
Receiver Rf Head AM-4318/ GRC - 103(V) (See paragraph *d.* (1)(a) below)	Receiver rf head

b. Test Procedures (Mixer SM-D-696297).

(1) Rf input VSWR and local oscillator level metering checks.

(a) Connect the test equipment as in A, figure 4-151 with power amplifier set to OFF.

(b) Set power supply PP-6304/GRM-95(V) to 115 Vac and set the receiver test facility switches as follows:

Control	*Position*
S1	ON
S6	MULTIPLIER
S5	S6

(c) Set switch S7 (rf modules test facility) to NORMAL.

(d) Adjust the sweep generator to sweep between 695 and 1000 MHz. Temporarily set the SWEEP MODE control to MANUAL, adjust the manual frequency control to midrange and adjust the sweep generator output for a 0 dBm indication on the power meter. Decrease the sweep generator output level by 40 dB.

(e) Connect the equipment as shown in B, figure 4-151. Reset the SWEEP MODE control to AUTO and set the power amplifier to ON.

(f) Calibrate the oscilloscope for a convenient display of the 2:1 VSWR reference. Note this reference.

(g) Connect the equipment as shown in C, figure 4-151. The VSWR of the unit under test shall be less than the 2:1 reference noted in *(f)* above.

(h) Connect the test equipment as in D, figure 4-151.

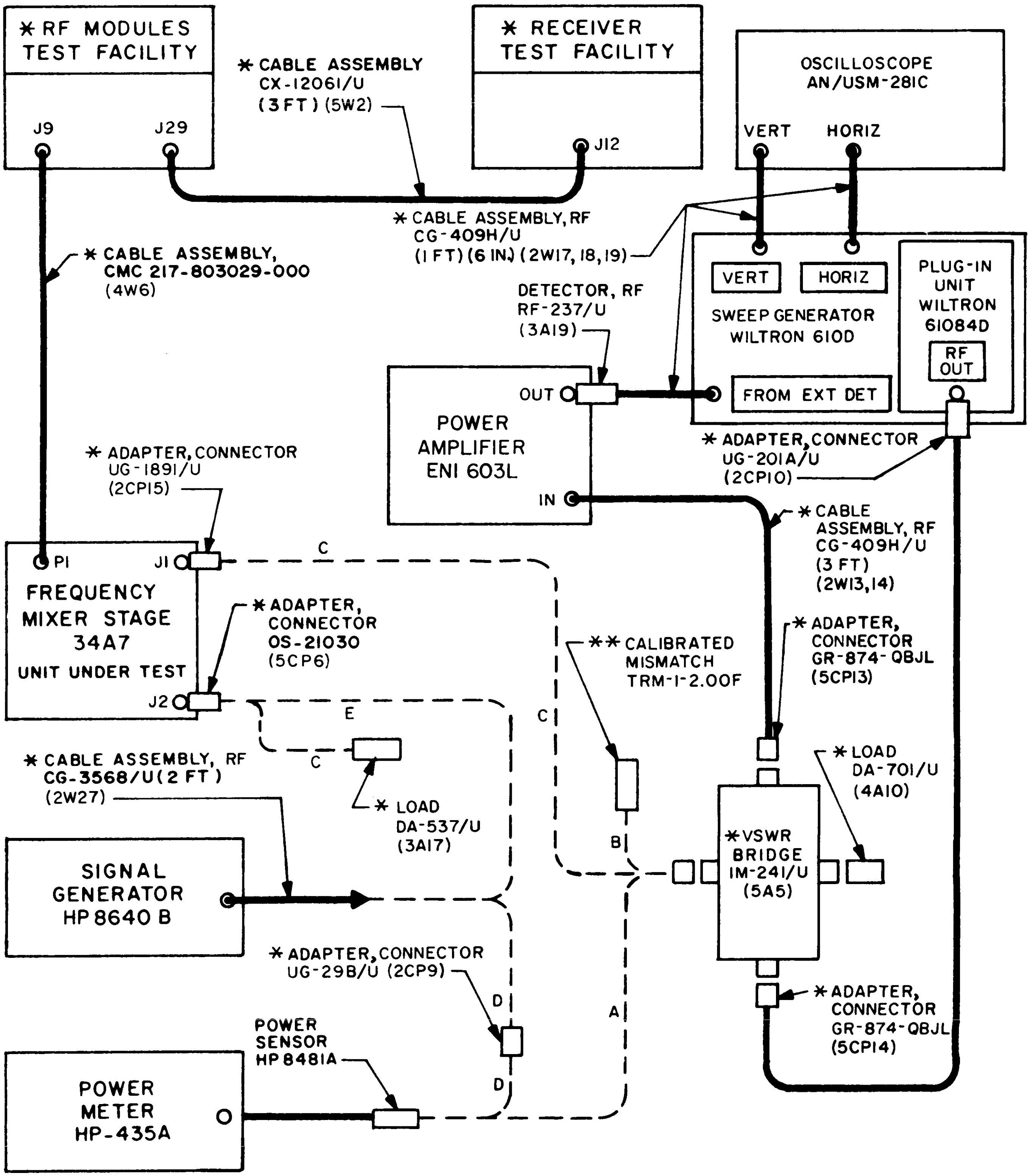
(i) Adjust signal generator to 725 MHz CW and the output level for a +6 dBm indication on the power meter.

(j) Set switch S7 (rf modules test facility) to MULT METER 1.

(k) Connect the test equipment as in E, figure 4-151.

(l) Meter Ml on the receiver test facility should read greater than 20 percent.

(m) Repeat *(h)* through *(l)* above at signal generator frequencies of 840 and 1030 MHz.



* PART OF TEST FACILITIES
** PART OF BRIDGE IMPEDENCE MK-1174/U(3A14)

EL5RF809

Figure 4-151. Frequency Multiplier 34A2A1, Bandwidth Check, Test Setup.

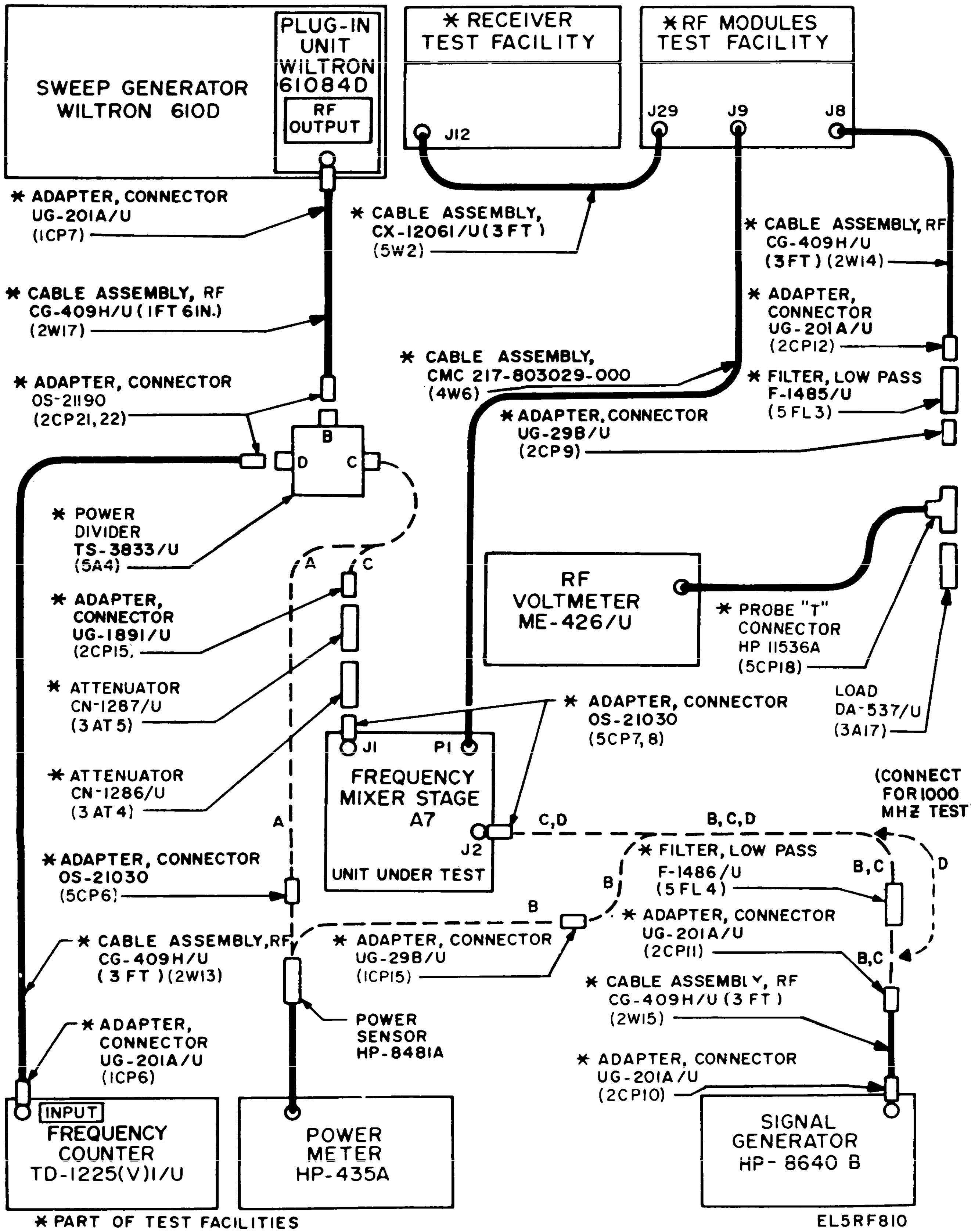


Figure 4-152. Frequency Mixer Stage 34A7, Conversion Gain and Image Rejection Check, Test Setup.

(2) *Conversion gain and image rejection test.*

(a) Connect the equipment as shown in A, figure 4-152.

(b) Set receiver test facility switch S1 to ON and S6 to MULTIPLIER and set the power supply to 115 Vat.

(c) Set switch S7 (rf modules test facility) to NORMAL.

(d) Set the sweep generator FREQ SELECTOR control to CW F1 and frequency control F1 to 695 MHz on the dial.

(e) Adjust the sweep generator controls for an output of 0 dBm as indicated on the power meter at a frequency of 595 MHz on the frequency meter.

(f) Set signal generator 30 MHz higher than the sweep generator in *(e)* above (725 MHz).

(g) Connect the power meter as in B, figure 4-152.

(h) Adjust the output level of signal generator for a +6 dBm indication on the power meter.

(i) Connect the test equipment as in C, figure 4-152.

(j) Note the rf voltmeter indication. Subtract this indication from –30 dBm (the rf input at J1 of the unit under test). The result is the conversion gain, which should be 14 dB (±4 dB).

(k) Connect the test equipment as in A, figure 4-152.

(l) Set the sweep generator 60 MHz higher than in *(d)* above (755 MHz).

(m) Adjust the output level for a 0 dBm indication on the power meter. Reconnect the equipment as in C, figure 4-152.

(n) Note the rf voltmeter indication in dBm. Subtract this indication from the one noted in *(j)* above to obtain the image rejection. The result should be 15 dB minimum.

NOTE

For frequencies above 1000 MHz, replace filter F-1486/U as shown in D, figure 4-152.

(o) Repeat *(d)* to *(n)* above starting with sweep generator frequencies of 850 MHz and 1000 MHz.

(3) *Noise figure check.*

CAUTION

The noise generator power supply should be set to 28 volts ±1 volt and then turned OFF until called for in the following procedures.

(a) Connect the test equipment as in A, figure 4-153 and set power supply PP-6304/GRM-95(V) to 115 Vac.

(b) Set the receiver test facility switched as follows:

Switch	*Position*
S1	ON
S6	MULTIPLIER

(c) Set the switches on the rf modules test facility as follows:

Switch	*Position*
S7	NORMAL
S12	ON

(d) Set signal generator to 725 MHz as indicated on the frequency counter on its panel.

(e) Adjust the output level of signal generator for a +6 dBm indication on the power meter.

(f) Connect the equipment as in B, figure 4-153.

(g) Adjust the attenuation control on unit if. amplifier for a meter indication on the dB scale. Note this indication.

(h) Switch the noise generator power supply to ON.

(i) Note the indication on the unit if. amplifier (adjust the attenuation control, if necessary, to keep the indication on scale). The change in dB's constitutes the Y-factor.

(j) Calculate the noise figure, using the Y-factor obtained in *(i)* above and referring to figure 4-154. Use the reference noise source output from the noise source calibration label at the rf input frequency.

NOTE

The attenuation versus frequency data stamped on the 6 dB calibrated attenuator connected to the noise generator should be used in calculating the noise figure.

(k) Subtract the attenuation at J1 from this noise figure. The result is the true noise figure, and should not exceed 3.6 dB.

(l) Repeat *(a)* through *(k)* above for signal generator frequencies of 880 and 1030 MHz (for check at 1030 MHz, replace falter F-1486/U as shown in C, figure 4-153).

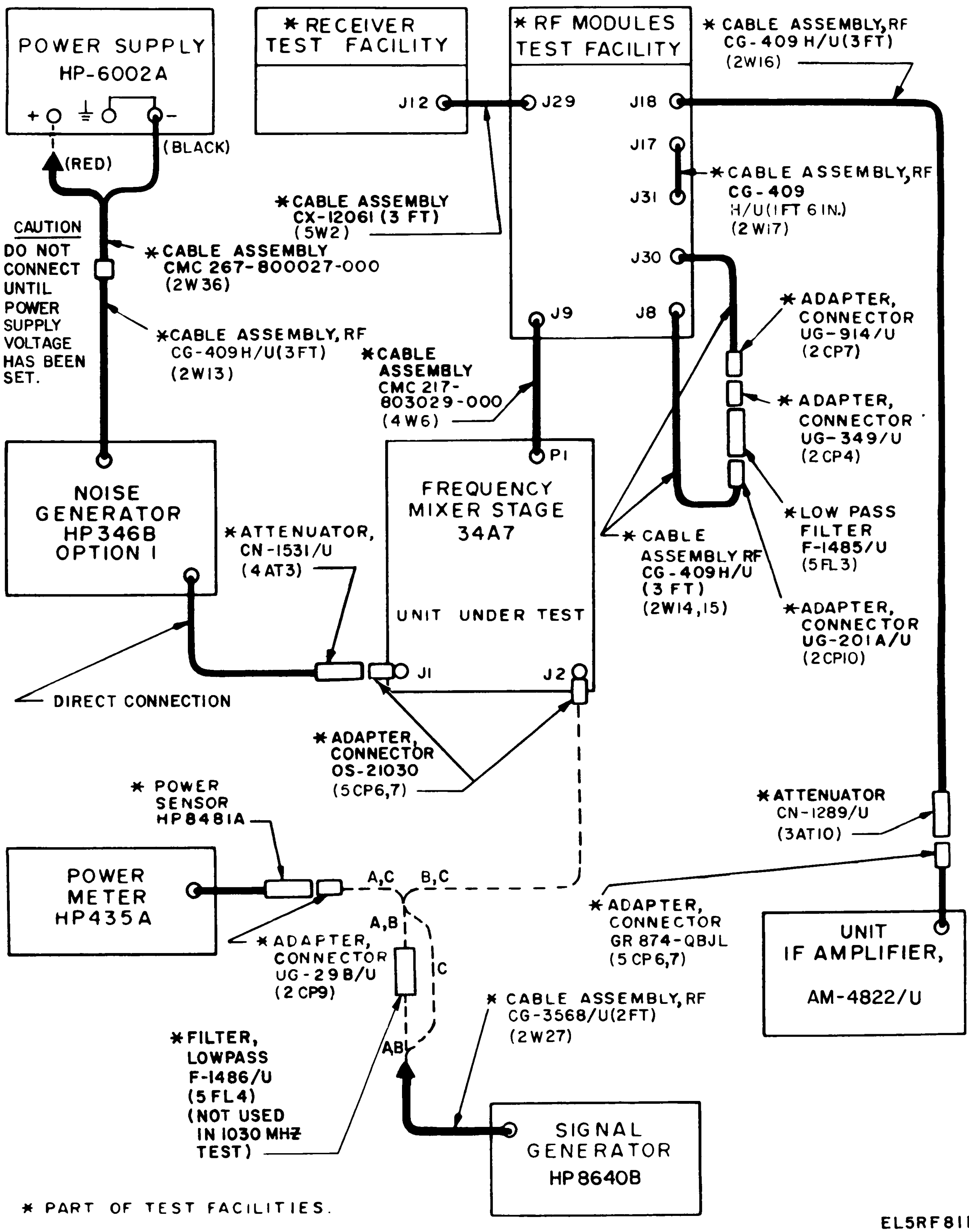


Figure 4-153. Frequency Mixer Stage 34A7, Noise Figure, Test Setup.

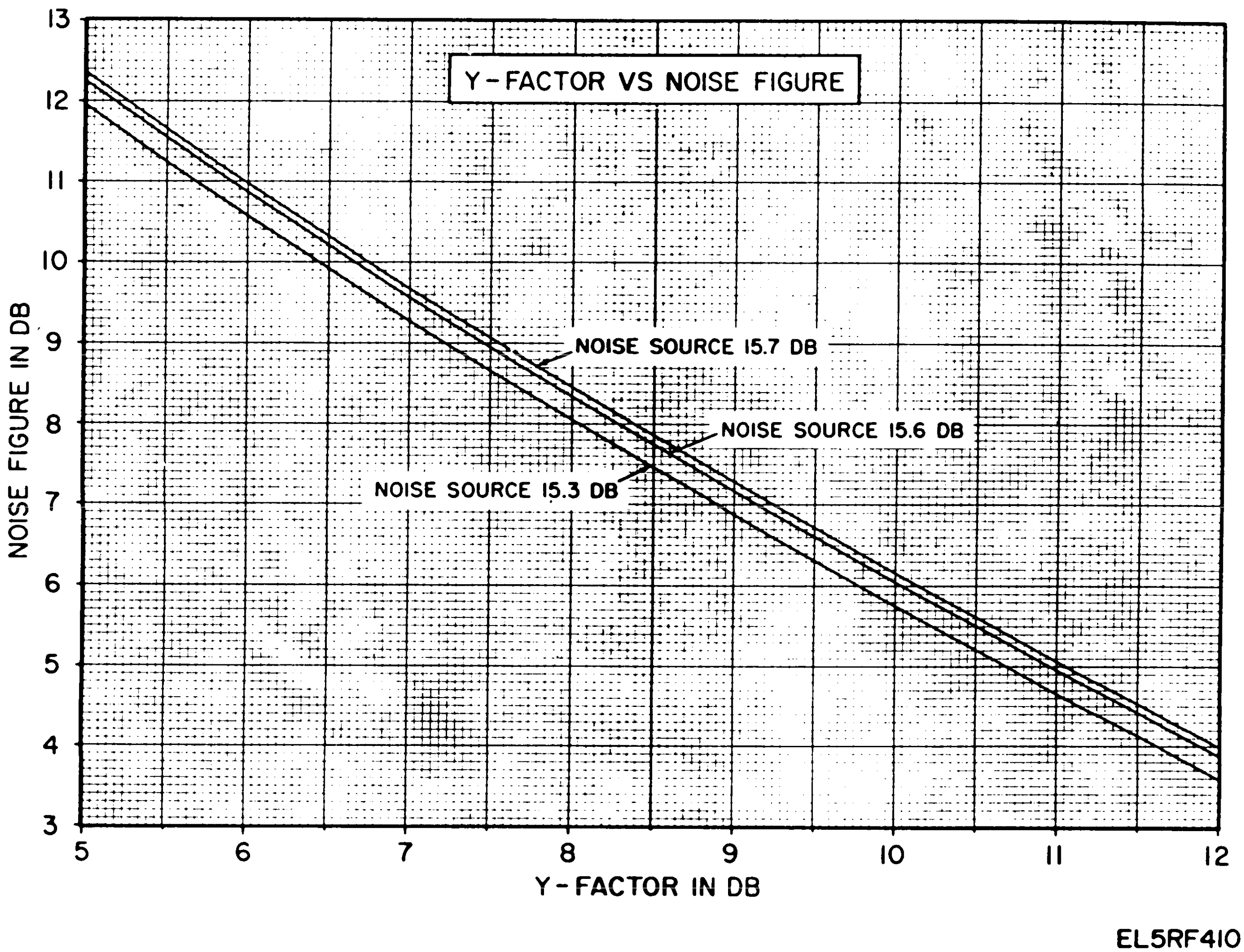


Figure 4-154. Y-Factor to Noise Figure Conversion Chart for Frequency Mixer Stage 34A7.

c. Troubleshooting (FO-39) (MIXER SM-D-696297).

Symptom	*Probable cause*	*Checks and corrective measures*
1. No 30 MHz if output (b(2) above).	*a.* Faulty rf amplifier 34A7A1AR1 (fig. 4-155).	*a.* Check rf amplifler input VSWR *(b(1)* above). If outside limits, replace faulty 34A7A1AR1.
	b. Faulty local oscillator input circuits.	*b.* Check local oscillator input VSWR; if higher than 3.0:1, check for broken connection in the rigid cable. Replace faulty I/C monitor-power 34A7A1Al.
	c. Broken wires, unsoldered joints, loose connections.	*c.* Visually check for open connections.
	d. Both balanced mixers faulty.	*d.* Replace both balanced mixers 34A7A1A2 and 34A7A1A3.

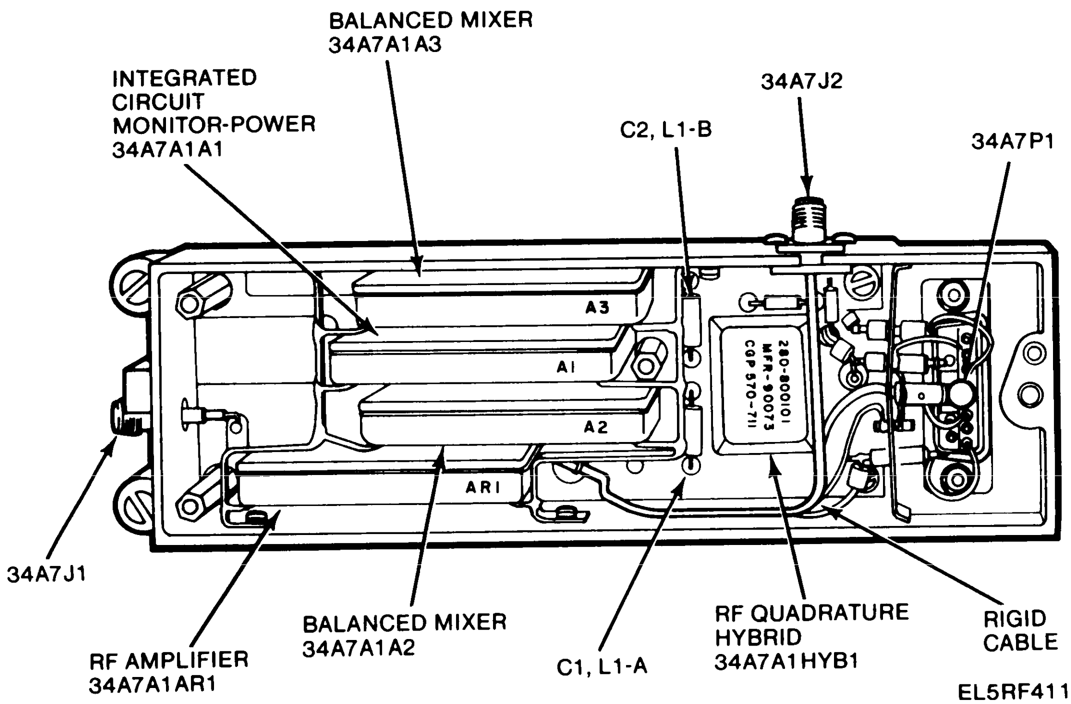


Figure 4-155. Frequency Mixer Stage 34A7 (SM-D-696297), with Cover Removed.

c. Troubleshooting – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
2. Low conversion gain (b(2) above).	a. One faulty balanced mixer.	*a.* Check image rejection *(b(2)* above). If image level is high, check for faulty mixer as follows. Apply a ground to the junction of L1-A and Cl (Fig. 4-155) while observing the 30 MHz output *(b(2)(j)). If* a 5 to 6 dB drop in level is observed, 34A7AlA3 is faulty. If no drop in level is observed then 34A7A1A2 is faulty. Apply a ground to the junction of L1-B and C2 (fig. 4-155) and conform the faulty mixer.
3. High noise figure across the band *(b(2)* above).	Faulty rf amplifier 34A7A1AR1.	Replace faulty 34A7A1AR1 module.
4. No local oscillator metering voltage.	Faulty I/C monitor-power 34A7A1Al.	Replace faulty 34A7A1A1 module.

d. Test procedure (SM-D-696462).

NOTE

If mixer 33A7 (SM-D-696462) cannot be made serviceable by minor adjustment, replace with mixer 33A7 (SM-D-696297). When this change is made, power supply 34PS1 and voltage control assembly 34A1A2 are no longer used but may remain on rf head AM-4318.

(1) Perform VSWR, metering, conversion gain and image rejection checks as described in paragraphs *b.* (1) and (2) above, except:

(a) Use the receiver rf head, in which the mixer 34A7 is to be installed, in place of the rf modules test facility. The if. amplifier 34AR1 should meet the requirements of paragraph 4-34, voltage control 34A1A2, and power supply 34PS1 should meet the requirements of paragraph 4-44 *e.* and *f,* respectively. See figure 4-156 for connection of rf head.

(b) Tune mixer, with rf head RCVR SIG control, for peak output for conversion gain and image rejection checks.

(c) Disregard rf modules test facility switch settings.

(d) Meter Ml indication *(b.(1)(l)* above) should read greater than 20 percent.

(e) Conversion gain *(b. (2)(j)* above) should be 8 dB ±3 dB.

(f) Image rejection *(b.(2)(n)* above) should be 10 dB minimum.

(2) *Noise figure check.*

(a) Set the power supply to 28 Vdc and then turn it OFF.

(b) Connect the equipment as shown in A, figure 4-157.

(c) Set receiver test facility switch S1 to ON and switch S6 to MULTIPLIER and power supply PP-6304/GRM-95(V) for 115 Vat.

(d) Set the signal generator to 725 MHz at an output level of +6 dBm as indicated on the power meter.

(e) Connect the equipment as shown in B, figure 4-157.

(f) Set the sweep generator controls to a 0 dBm output level at a cw frequency 30 MHz below the signal generator frequency as indicated on the frequency counter. Note this frequency.

(g) Set the rf head RCVR SIG control to the channel indication corresponding to the sweep generator frequency using the formula: channel number = (frequency – 200 MHz) X 2.

(h) Adjust the RCVR SIG control to tune the mixer for a peak indication on the unit if. amplifier (adjust the sweep generator output level and unit if. amplifier controls as required to maintain an on-scale indication).

(i) Connect the equipment as shown in C, figure 4-157.

(j) Adjust the attenuation control on the unit if. amplifier for a meter indication on the dB scale. Note this indication (including attenuation setting).

(k) Set the noise generator power supply to ON.

(l) Note the indication on the unit if. amplifier (if necessary, readjust the attenuation control for an on-scale meter indication). The difference between this indication (including attenuation setting) and the indication noted in *(j)* above is the “Y-factor.”

(m) Determine the noise figure from the NOISE FIGURE graph (fig. 4-154) using the reference noise source level from the noise source calibration label at the frequency noted in *(f)* above.

(n) Subtract the calibrated attenuation of the attenuator connected to the noise source from the noise figure determined in *(m)* above. The result is the true noise figure and should not exceed 6.0 dB.

(o) Repeat steps *(a)* through *(n)* above at signal generator frequencies of 880 MHz and 1030 MHz (for 1030 MHz check, replace filter F-1486/U as shown in D, figure 4-157).

(3) *Adjustments* (figures 4-158 and 4-159).

Control	*Affects*	*Adjustment conditions*
34A7R1	Frequency Tracking	Preset for 2.5 Vdc between terminal 3 (34A1A2) and chassis. Adjust for peak output with 695 MHz rf input, 725 MHz L.O. (local oscillator) input and RCVR SIG control at channel 990.
34A7R2	Frequency Tracking	Preset for 60 Vdc between terminal 1 and chassis. Adjust for peak output with 1000 MHz rf input 1030 MHz L.O. input and RCVR SIG control at channel 1600. R1 and R2 interact.
Cl, C2, C3 and Ll	VSWR	Adjust for best compromise of VSWR from 695 MHz to 1000 MHz rf input.

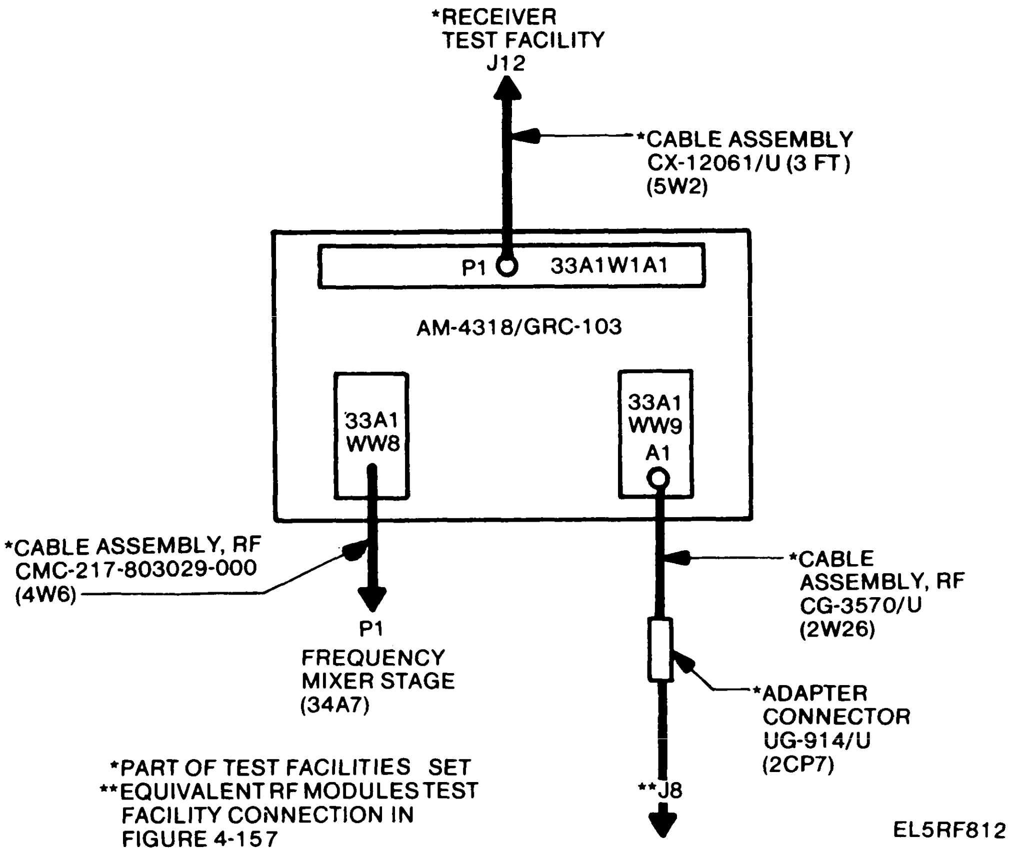


Figure 4-156. Equivalent Connections, AM-43 18 Substituted for Rf Modules Test Facility.

(3) *Adjustments* - Continued

Control	*Affects*	*Adjustment conditions*
C6	gain	Adjust during test
L5, L8	Tracking, gain and response symmetry at high end.	Adjust during test for 1 dB bandwidth center and symmetry at 976 MHz rf input, 1006 MHz L.O. input and RCVR SIG control at channel 1552.
Cl0, Cll	Tracking, gain and response symmetry at low end.	Adjust during test for 1 dB bandwidth center and symmetry at 707 MHz rf input, 737 MHz L.O. input and RCVR SIG control at charnel 1014.

4-59. Intermediate Frequency Amplifier 34AR1

Intermediate frequency amplifier 34AR1 is identical to intermediate frequency amplifier 33AR1. For test and troubleshooting procedures refer to paragraph 4-34.

4-60. Amplifier-Filter 34AR1A1

Amplifer-filter 34AR1Al is identical to amphfier-filter 33AR1Al. For test procedures, refer to paragraph 4-35.

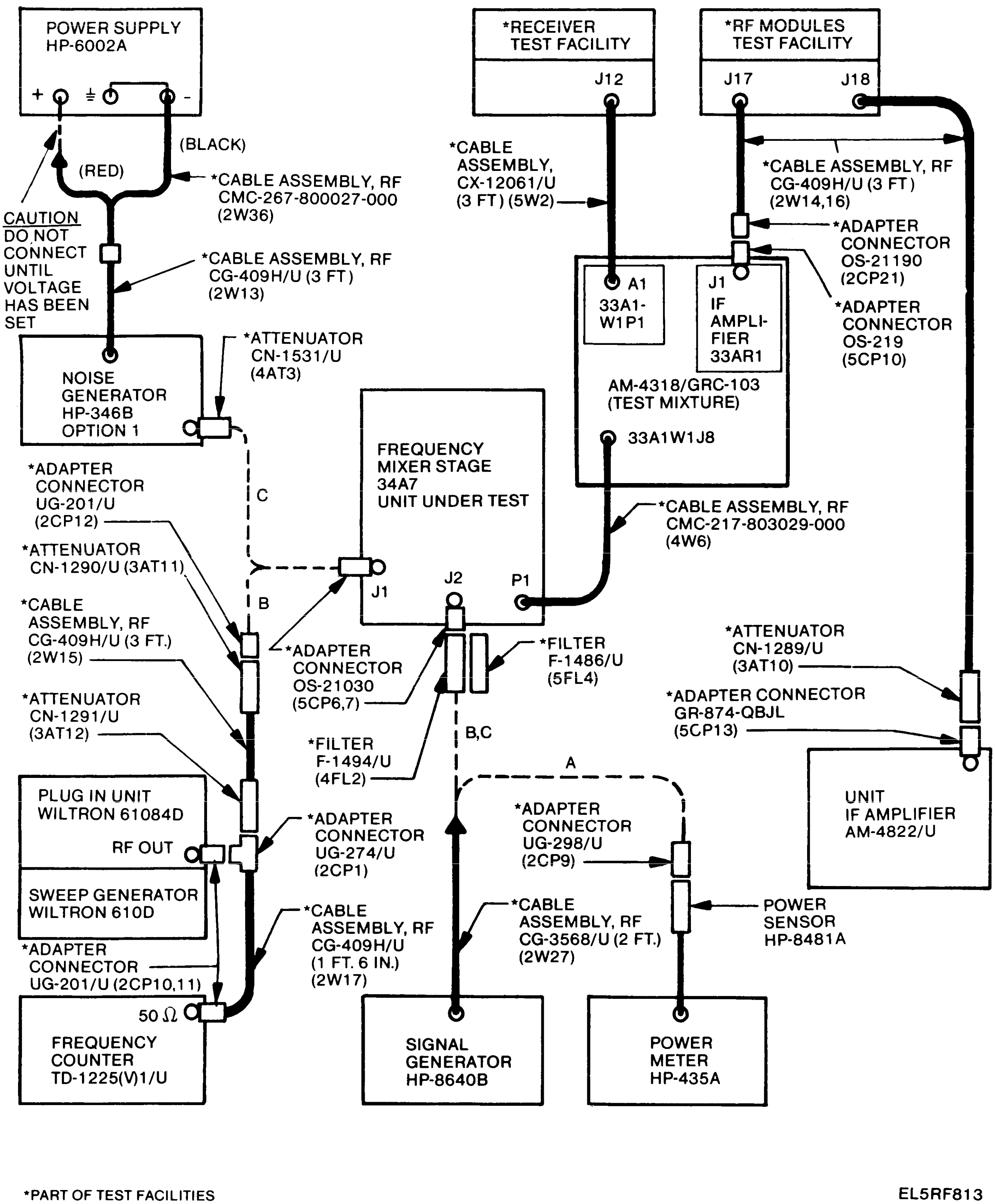


Figure 4-157. Frequency Mixer Stage 34A7, Noise Figure, Test Setup Using AM-4318/GRC-103 as Test Fixture.

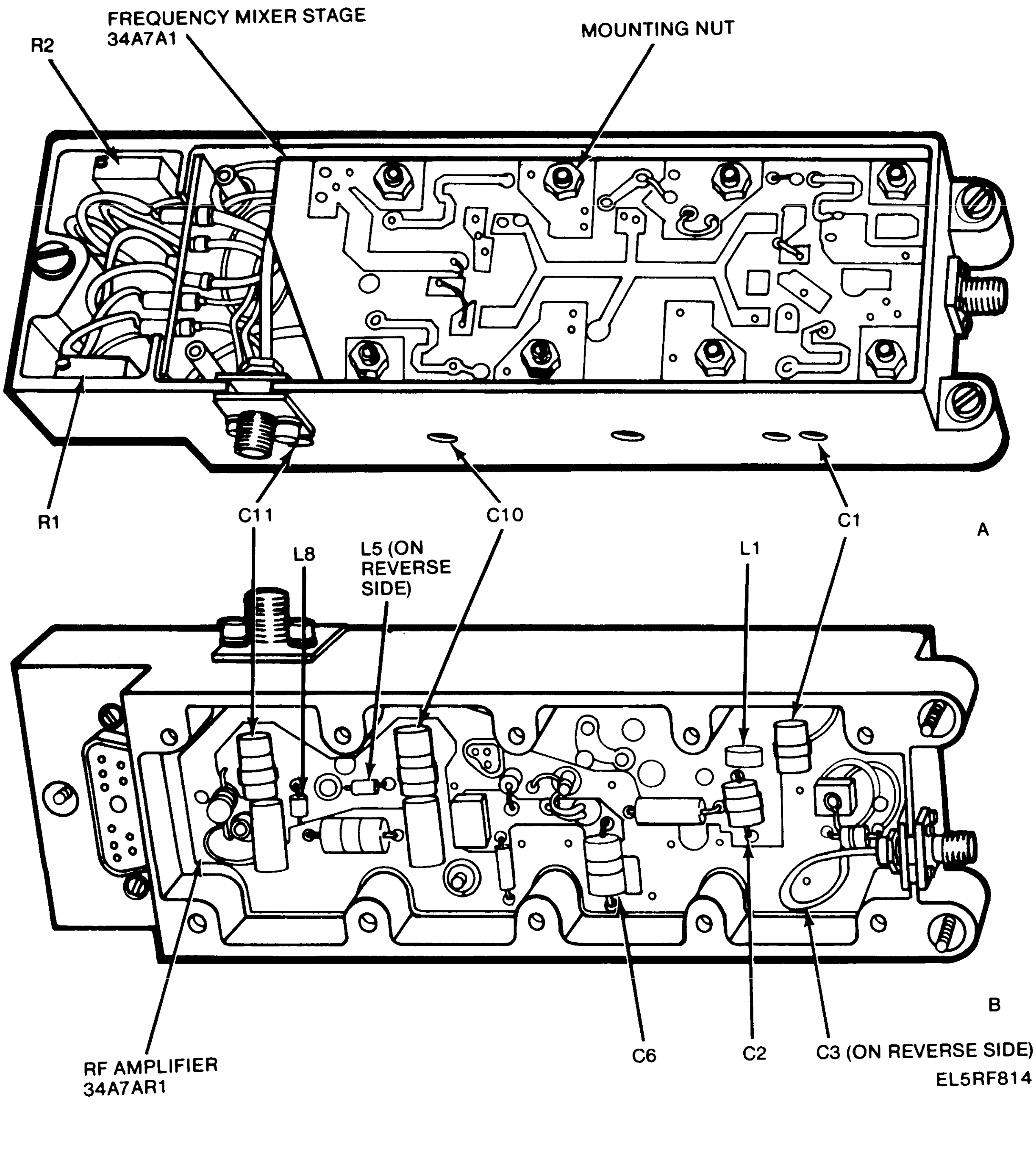


Figure 4-158. Frequency Mixer Stage 34A7 (SM-D-696462), Top and Bottom Views.

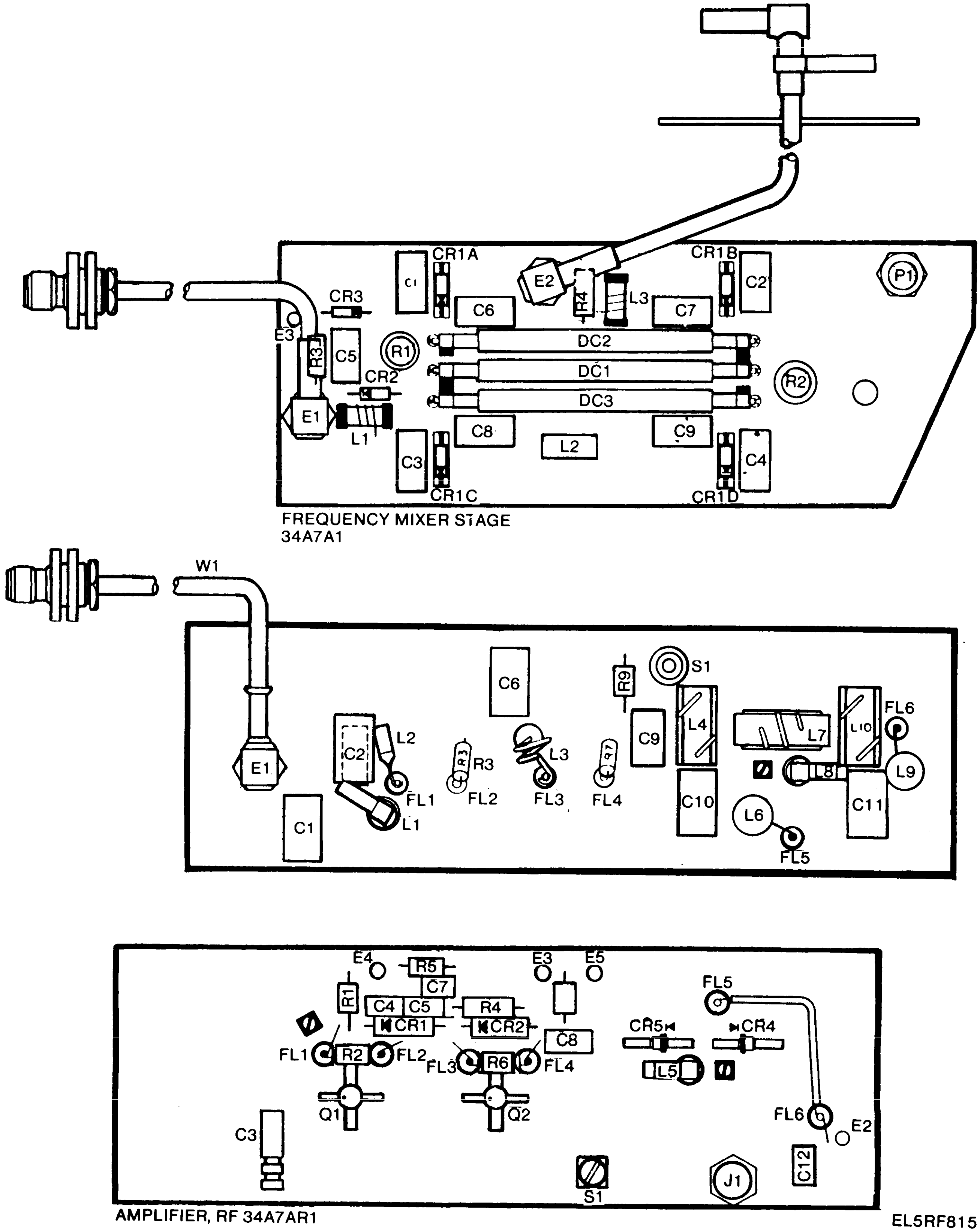


Figure 4-159. Frequency Mixer Stage 34A7A1 and Rf Amplifier 34A7AR1 (Part of SM-D-696462), Parts Location.

4-61. Amplifier-Frequency Multiplier AM-4322/ GRM-103(V) or AM-4322A/GRC-103(V) (Band III Transmitter Rf Head)

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Test Facility, Receiver TS-2867(V)2/GRM-95(V)2	Receiver test facility
Accessory Kit, Test Facilities Set MK-l173(V)2/ GRM-95(V)2	Accessory kit, test facilities set
Accessory Kit, Test Facilities Set MK-1985(V)2/ GRM-95(V)2	Accessory kit, test facilities set
Test Facility, Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility, frequency modules
Counter, Frequency TD-1225(V)l/U	Frequency counter
Multimeter, Digital AN/USM-451	Multimeter
Wattmeter AN/USM-298	Wattmeter
Element Bird No. 50E 500-1000 MHz	Wattmeter element
Voltmeter, Electronic ME-426/U	Rf voltmeter
Power Meter HP-435A	Power meter
Power Sensor HP-8481A	Power sensor
Megohmmeter GR-1864	Megohmmeter

b. Test Procedures.

(1) *Preliminary checks.*

(a) For AM-4322A/GRC-103(V) only, prior to preliminary checks and before connecting the Unit Under Test to the transmitter test facility, a resistance check of the temperature sensor is required as follows:

1. Connect the digital multimeter between pins 17 and 43 of connector PI of the connector filter assembly 38AR1A1W1A1P1. The resistance measured should be within the limits shown on the "Temp/ Resistance" chart for the temperature of the heat radiator of the unit under test output tube (see figure 4-160).

2. Connect the multimeter between pin 17 and pin 1 (H.V. connection). The multimeter should indicate an open circuit.

3. Repeat 2. above for pins 43 and 1.

WARNING

High voltages are accessible at the test leads and connections when the megohmmeter is used. Switch to "OFF" and "DISCHARGE" before connecting or disconnecting test leads.

4. Short pins 17 and 43 together and connect the megohmmeter between the shorting wire (pins 17 and 43) and Pin 1.

5. Turn the megohmmeter power switch on, and set its voltage control to 600 volts.

6. Set the "DISCHARGE - CHARGE - MEASURE" switch to "CHARGE" and then "MEASURE". The resistance indicated on the megohmmeter should be greater than 50 megohms.

7. Return switches to "DISCHARGE" and "OFF".

8. Disconnect megohmmeter and the short between pins 17 and 43.

(b) Perform the following preliminary checks:

1. Remove the dust cover from the unit under test and connect the test equipment as shown in A, figure 4-161.

2. Direct cooling air from the AIR OUTLET of the transmitter test facility to the rear of the unit under test. Use hose assembly air duct MX-8414/ GRM-95(V).

3. Set the XMTR TUNE and XMTR CHANNEL controls on the unit under test to channel 1600.

4. Set the transmitter test facility switches as follows:

Switch	*Switch position*	*Normal indications*
S13	ON	
S17	ON	
S1	ON	
S20	S12	
S18	OFF	
S12	OSC	Test facility meter Ml indicates between 20% and 90% of full scale.

5. Adjust the VOLTAGE control on the accessory kit power supply for 115 Vac ±2 V on the VOLTS meter.

6. Set the transmitter test facility switch S12 to the following positions:

NOTE

The meter should read as shown after completion of tuning procedure.

Switch position	*Normal indications*
DBLR	Ml indicates between 10% and 90%i of full scale.
MULT	Ml indicates between 20% and 90% of full scale.
DRIVER	Ml indicates between 20% and 90% of full scale.

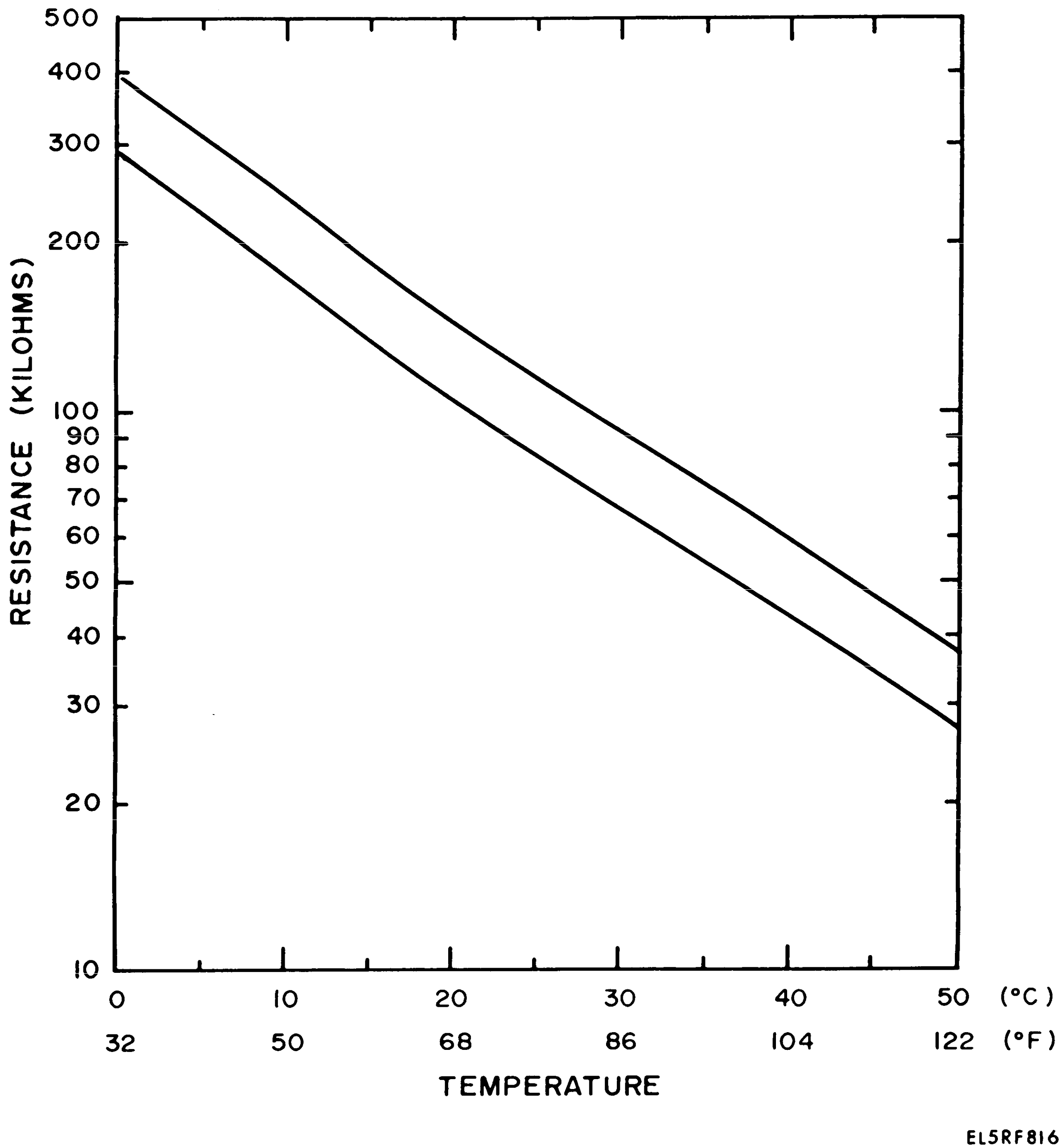


Figure 4-160. Rf Amplifier 38AR1, Temperature Sensor Resistance Value.

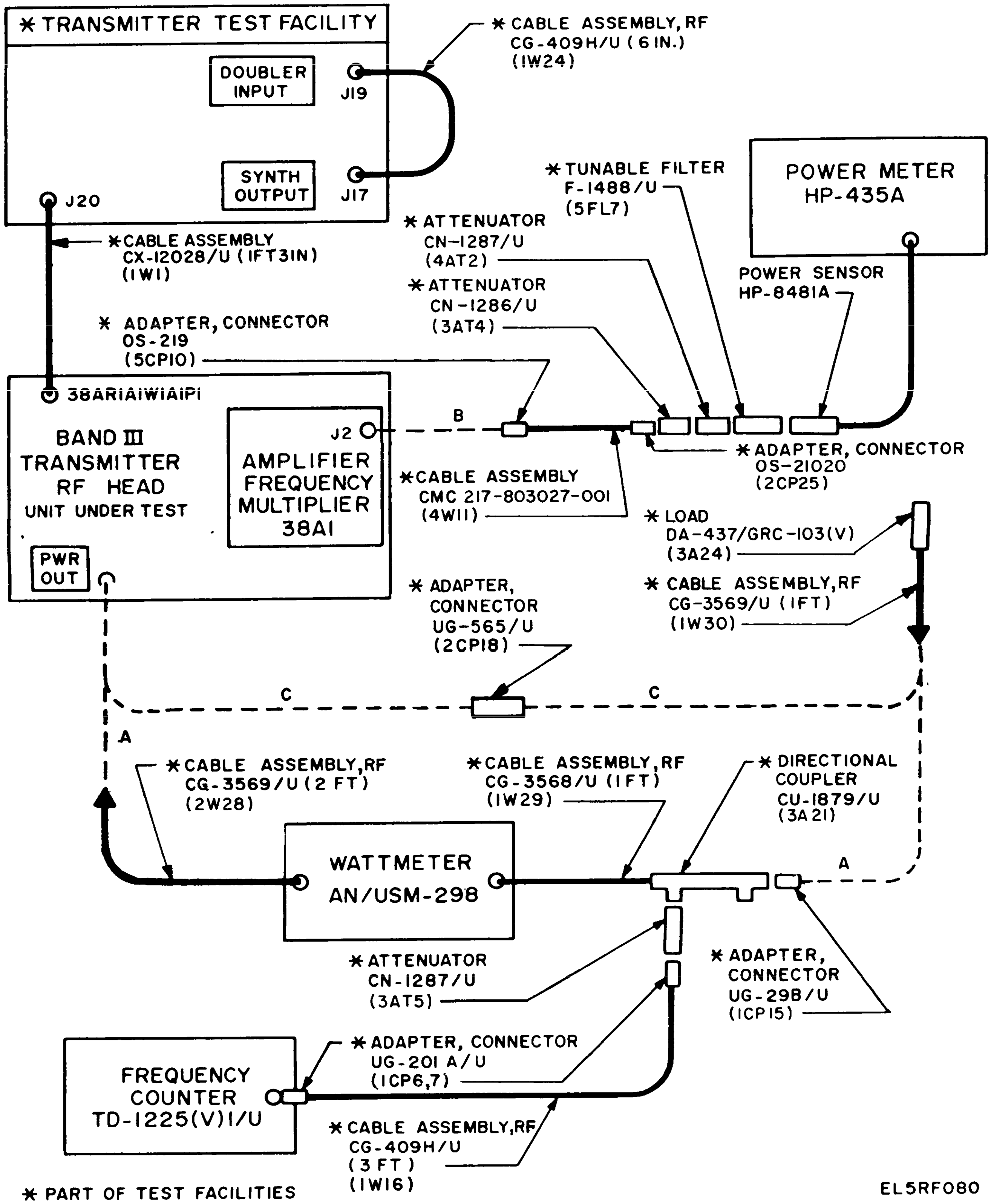


Figure 4-161. Transmitter Rf Head 38, Test Setup.

7. Set the transmitter test facility switch S12 to PWR OUT and adjust the XMTR TUNE control on unit under test for a peak indication on meter Ml. The LOW POWER lamp on the test facility should go out, the wattmeter should indicate 20 watts minimum and Ml should indicate 40 percent minimum. The XMTR TUNE channel indication should be within ±0.5 inch of the center of the display window.

8. Set transmitter test facility switch S12 to REFL PWR. The indication on meter Ml should not exceed 5% of full scale.

NOTE

If the REFL PWR requirement of 8. above cannot be met, connect the dummy load directly to the PWR OUT connector as in C, figure 4-161. The REFL PWR indication should now be less than 5%. Reconnect the equipment as in A, figure 4-161.

9. Temporarily disconnect the cable from the PWR OUT connector of the unit under test. The indication on meter Ml should be between 20% and 90% of full scale.

(2) *Cathode and heater voltage measurement check.*

(a) Check for the following voltages at voltage regulator assembly 38AR1A1A1 (fig. 4-113) using the digital multimeter.

Test points	*Voltage (volts dc)*
TP2 (–) and TP4 (+)	6.0 to 6.4
TP1 (–) and TP3 (+)	6.0 to 6.4
TP9 (–) and TP4 (+)	18 maximum
TP9 (–) and TP8 (+)	0.65 to 0.85
TP9 (–) and TP7 (+)	0.65 to 0.85

(3) *Power output and tracking check.*

(a) Set the XMTR TUNE and XMTR CHANNEL controls on the unit under test to channel 990.

(b) Adjust the XMTR TUNE control for a peak indication on the transmitter test facility meter M1 with switch S12 at PWR OUT. The power meter should indicate 695 MHz ±13.9 kHz and the XMTR TUNE channel indication should be within 0.5 inch of the center of the display window.

(c) Repeat *(a)* and *(b)* above for the channels listed below.

Channel	*Frequency (MHz)*	*Tolerance (= kHz)*
990	695	13.9
1000	700	14.0
1080	740	14.8
1160	780	15.6
1240	820	16.4
1279	839.5	16.8
1280	840	16.8
1360	880	17.6
1440	920	18.4
1520	960	19.2
1600	1000	20.0

(d) Remove the hose assembly MX-8414/GRM-95(V).

c. Troubleshooting (FO-9 or FO-51).

NOTE

This chart supplements the troubleshooting procedures contained in TM 11-5820-540-12 and TM 11-5820-540-30.

Syrnptom	*Probable cause*	*Checks and corrective measures*
1. DBLR meter indication zero in *b(1)(f)* above.	+*28* V interlock open circuit.	Check for continuity between 38AR1A1W1A1P1 pins 11 and 12 (TM 11-5820-540-30).
2. MULT meter indication low or zero in *b(1)(f)* above.	*a.* Defective frequency multiplier 38A1.	*a.* Check that at least 125 mW (+21 dBm) is present at 38A1J2 (TM 11-5820-540-30). If power level at 38A1J2 is abnormal, check that at least 2W (+33 dBm) is present at 38AR1A1W1A1P2 (TM 11-5820-540-30). If this is normal, remove 38A1 (para. 2-71) and test as described in paragraph 4-62.
	b. Wiring.	*b.* If input level to 38A1 is abnormal, check the continuity of cable connected to 38A1J1 (TM 11-5820-540-30). If input and output. levels at 38A1 are normal, check the MULT metering circuit

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Check and corrective measures*
3. DRIVER meter indication low or zero in *b(1)(f)* above.	*a.* Open circuit in driver filament line.	*a.* Check resistance between 38ARlAlW1J5 (TM 11-5820-540-30) pins 11 and 12 which should be 1.5 ohms nominal. Driver tube must be inserted for this check.
	b. Defective cable 38W1.	*b.* Check cable with ohmmeter and replace if necessary.
	c. Defective cable 38AR1AR1W1.	*c.* Check cable with ohmmeter and replace if necessary,
	d. Tracking misalignment between 38A1 and 38AR1.	*d.* Check tracking as described in *d.* below.
	e. Excessive voltage drop across 38AR1A1FL2.	*e.* Check voltage at E2 of 38AR1A1FL2; it should be not more than 3 V lower than the voltage at E1 of 38AR1A1FL2 (630 Vdc nominal).
	f. Resistor assembly 38AR1AlA2.	*f.* Disconnect wire at E1 of 38AR1A1A2. Resistance between E1 and ground should be 440K ohms.
	g. Rf amplifier 38AR1.	*g.* Check 38AR1 as described in paragraph 4-64.
4. PWR OUT meter indication zero in *b(l)(g)* above. Output power normal as indicated on wattmeter.	*a.* Metering circuit.	*a.* Check PWR OUT metering circuit.
	b. Power monitor 38AR1A2.	*b.* Replace power monitor (TM 11-5820-540-30).
5. PWR OUT meter indication low or zero in *b(1)(g)* above. Output power low or zero as indicated on wattmeter.	*a.* Excessive voltage drop across 38AR1A1FL2.	*a.* Check voltage at E2 of 38AR1A1FL2; it should be not more than 3 V lower than voltage at El of 38AR1A1FL2 (63 Vdc nominal).
	b. Resistor assembly 38AR1AlA2.	*b.* Disconnect wire at El of 38AR1A1A2. Resistance between E1 and ground should be 440K ohms.
	c. High insertion loss in low-pass filter 38AR1A1FL1.	*c.* Remove 38AR1A1FL1 and test as described in paragraph 4-66.
	d. High insertion loss in circulator 38AR1HY1.	*d.* Test circulator as described in paragraph 4-70.
6. Voltages not as specified in *b(2){a)* above.	Defective voltage regulator assembly 38AR1A1A1.	Remove voltage assembly and test as described in paragraph 4-40.
7. Incorrect frequencies.	Control line(s) open circuit.	Check for continuity of control lines between 38ARlAlWlJ3 and 38AR1A1W1A1P1.
8. Incorrect frequencies at channel 1280 and above *(b(3)(c)* above).	Control line 13 open circuit.	Check for continuity between 38AR1A1W1A1P1 pin 45 and 38AR1A1W1J3 pin 13 and between 38AR1A1W1J3 pin 13 and 38AR1A1W1J2 pin 9.
9. Wattmeter or power meter indications below normal at some frequencies *(b(3)(b)* and *(c)* above).	Misalignment.	Perform tracking alinement in *d.* below.

d. Tracking Alinement.

(1) Disconnect P1 of 38A1J2 and connect the equipment as shown in B, figure 4-161.

(2) Set the XMTR TUNE and XMTR CHANNEL controls on the unit under test to channel 990 (695 MHz).

(3) Set the test facility switches S1 to ON and S12 to OSC.

(4) Set the tunable filter to 695 MHz and peak for maximum indication on the power meter. The power level at J2 of the frequency multiplier should be at least +23 dBm (–8 dBm as indicated on the power meter).

(5) If the power level is not as specified, loosen the two red-circled screws securing the idler sprocket bracket (fig. 4-162) of the frequency multiplier drive chain. Facing the front panel of the unit, push the bracket toward the right thereby loosening the drive chain.

(6) Remove the chain from the sprocket of the frequency multiplier.

(7) Turn the sprocket of the frequency multiplier manually until the output power from the frequency multiplier reaches a maximum as indicated on the power meter.

(8) Secure the sprocket temporarily in this position with tape. Do not reconnect the chain to the sprocket of the frequency multiplier at this time.

(9) Connect P1 (38A1J2) to 38A1J2 (TM 11-5820-540-30).

(10) Connect the test equipment as shown in A, figure 4-161.

(11) Adjust the XMTR TUNE control for a peak indication on the power meter.

NOTE

Do not move the XMTR TUNE control after the rf amplifier has been peaked.

(12) Observe the XMTR TUNE display window. If necessary to position the channel frequency indicator 38AR1AR1DS1 at the correct channel number, remove the channel frequency indicator as described in paragraph 2-75.

(13) Turn the flexible shaft on the channel frequency indicator until channel number 990 is in line with the calibration mark (notch) on the body of the channel-frequency indicator.

(14) Replace the channel frequency indicator as described in paragraph 2-75.

(15) Reconnect the drive chain to the frequency multiplier sprocket and tighten the idler sprocket bracket.

(16) Check that the output power is at least 20 watts on the channels listed below:

990	1200	1400
1000	1240	1440
1040	1279	1480
1080	1280	1520
l120	1320	1560
1160	1360	1600

(17) If the power level drops, disconnect the drive chain from the frequency multiplier and repeak the frequency multiplier output by turning the frequency multiplier sprocket.

(18) Repeat steps (15) and (16) above.

4-62. Amplifier-Frequency Multiplier 38A1.

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set MK-l173(V)2/ GRM-95(V)2	Accessory kit test facilities set
Test Facility Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility radio frequency modules
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Test Fixture, Amplifier-Frequency Multiplier TS-3826/GRM-95(V)	Multiplier test set
Generator, Signal HP-8640B	Signal generator
Meter, power HP-435A	Power meter
Sensor, Power HP-8481A	Power sensor
Counter, Frequency TD-1225(V)l/U	Frequency counter
Oscilloscope AN/USM-281C	Oscilloscope
Generator Sweep Wiltron 610D with Plug-in Unit Wiltron 61084D	Sweep generator
Multimeter, Digital AN/USM-451 (2 req'd)	Multimeter No. 1 and No. 2
Amplifier, Power ENI-603L	Power amplifier
Pin (CMC-716-800009-000)	Shouldered pin

b. Test Procedure.

(1) Tuning law, bandwidth and power output checks.

CAUTION

To avoid damage to the transmitter test facility doubler, prior to changing connections at rf modules test facility J26, set transmitter test facility switch S12 to OFF and then to MULT position after connections are made,

NOTE

Test fixture TS-3826/GRM-95(V) must be removed from the case when used. During removal and replacement, make sure the crank knob is in the closed position to prevent damage to the fixture.

(a) Remove the cover plate on the amplifier-frequency multiplier 38A1A2 side of the unit under test.

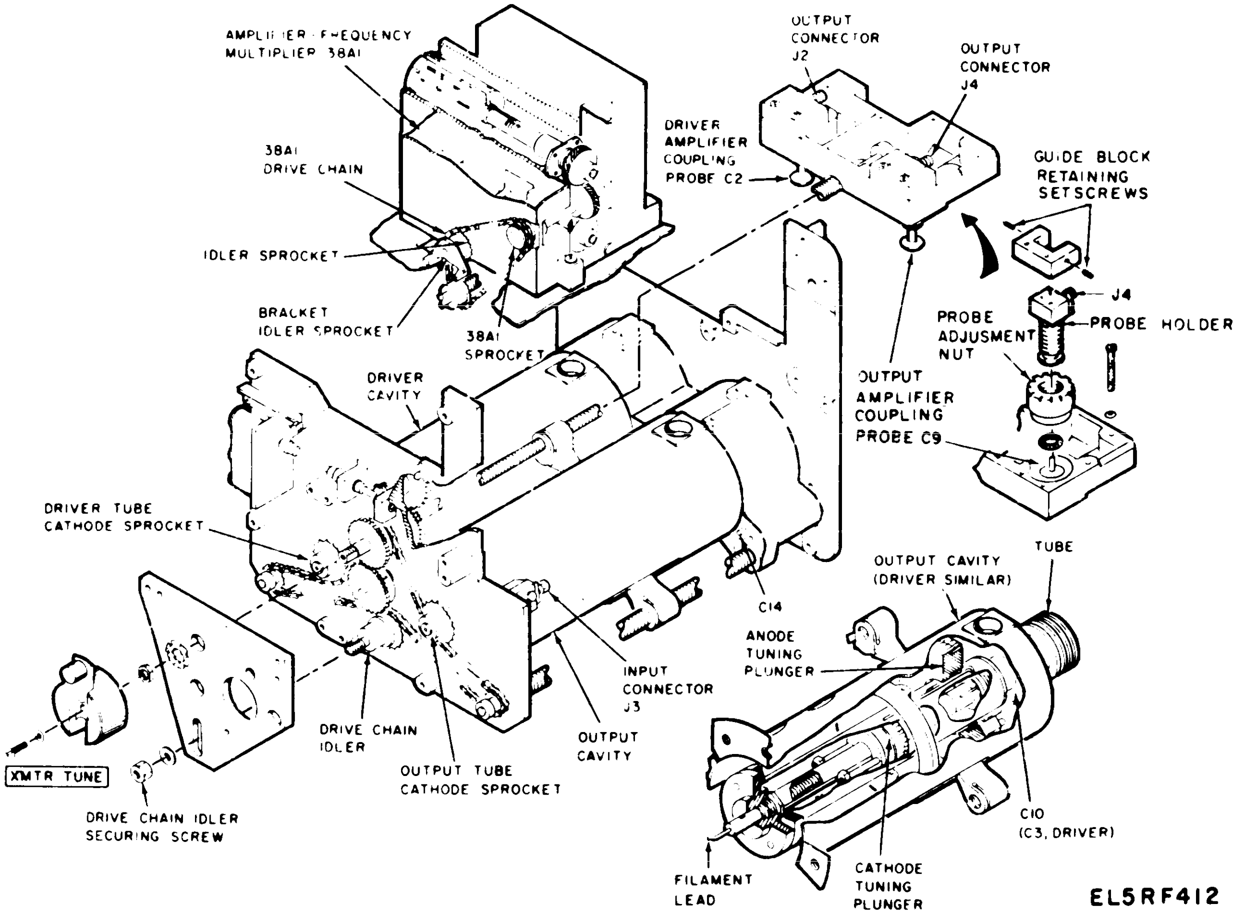


Figure 4-162. Rf Amplifier 38AR1, Tuning Mechanism and Cutaway View of Power Amplifier Tube.

(b) Install and secure the unit under test on test fixture TS-3826/GRM-95(V). Engage the tuning drive sprocket (fig. 4-164) with the test fixture drive shaft. If present, remove the shouldered pin CMC-716-800009-000 from the hole adjacent to the tuning drive sprocket. Prepare the unit under test as follows.

1. On cavity Z2 of the unit under test, remove screw A from end plate (figure 4-164). Turn the tuning drive sprocket counterclockwise to the step position.

2. Insert alinement gauge CMC 920-803037-000 (P/O accessory kit MK-1985(V)2/GRM-95(V)2) in place of screw A. Turn the tuning drive sprocket clockwise until the cavity plunger touches the gauge.

3. Hold the test fixture tuning knob in a fixed position. Adjust the mechanical counter on the test fixture to 0000.0. Remove the gauge and reinstall screw A.

(c) Connect the equipment as in A, figure 4-163. Do not connect the signal generator at this time.

(d) Set the transmitter test facility controls as follows.

Control	*Position*
S1	ON
S12	MULT
S20	S12

(e) Set the test facility rf modules controls as follows.

Control	*Position*
S13	ALC2X4
ALC1ADJ	Fully clockwise
ALC2ADJ	Fully clockwise

(f) Set multimeter No. 1 to the 20-volt dc range and multimeter No. 2 to the 2 amps dc range.

(g) Connect the positive lead of multimeter No. 1 to the junction of L4 and C10 on circuit board 38A1A2. Refer to figure 4-168. Connect the negative lead to the chassis (ground) of the unit under test.

(h) Multimeter No. 1 should indicate +15 V (±0.l V). If necessary, adjust R6 on circuit board 38A1A2. Disconnect multimeter No. 1 and replace the cover plate on the amplifier-frequency multiplier 38A1A2 side of the unit under test.

(i) Connect the test equipment as in B, figure 4-163. Connect the signal generator to test facility J19.

(j) Set the signal generator output level to +15 dBm. Set the output frequency to 52 MHz.

(k) Tune the signal generator from 52 to 72 MHz. The power meter should indicate +4 dBm minimum across the band (+34 dBm minimum at J26, rf modules test facility).

(l) Reconnect the equipment as shown in A, figure 4-163. Connect multimeter No. 1 to rf modules test facility J34 and J35.

NOTE

Output level of signal generator shall not be disturbed from that established in paragraph *(j)* above.

(m) Set the signal generator frequency to 62.5 MHz. Tune the unit under test using the test fixture tuning knob for maximum output as indicated on the power meter. Verify that the output frequency is 1000 MHz (16x input frequency) as measured on the frequency counter.

(n) Tune the unit under test using the test fixture tuning knob for maximum output indication on the power meter. Multimeter No. 2 should not indicate more than 1 amp. If necessary adjust R3 (fig. 4-164). The power meter should indicate at least +2 dBm (+22 dBm output from the unit under test). Note the power meter indication.

(o) Reset if necessary, the test fixture counter to 0000 while holding the test fixture crank knob in a fixed position, corresponding to maximum output power in *(n)* above.

(p) Increase the signal generator frequency until the power meter indication drops by 3 dB. Record the frequency counter indication.

NOTE

Do not disturb signal generator output control from setting in *(j)* above.

(q) Decrease the signal generator frequency until the power meter indication peaks and drops again by 3 dB. Record the frequency counter indication.

NOTE

Do not disturb signal generator output control from setting in *(j)* above.

(r) Subtract the frequency noted in *(p)* above from that noted in *(q)* above to determine the 3 dB bandwidth at 1000 MHz. The bandwidth should be between 5 and 22 MHz.

(s) Set the signal generator frequency of 61.25 MHz (output frequency of 980 MHz).

(t) Adjust tuning knob on test fixture so that the fixture counter indicates 0009.5.

(u) Observe the indication on the power meter. It should be at least +2 dBm (+22 dBm output from the unit under test). Verify the output frequency is 980 MHz as measured on the frequency counter.

(v) Slightly adjust the tuning knob on the test fixture to maximize the output power. Note the power meter indication. Multimeter No. 2 should not indicate more than 1 amp. If necessary readjust R3 (fig. 4-164).

(w) Repeat steps *(p)* through *(r)* above to determine the 3 dB bandwidth at 980 MHz.

(x) Repeat steps *(s)* through *(w)* above for the remaining frequencies and counter settings listed below.

Test fixture counter setting	*Unit under test* output *frequency (MHz)*	*Signal generator freq (MHz)*	*Unit under test input frequency (MHz)*
0000.0	1000	62.50	125.00
0009.5	980	61.25	122.50
0020.0	960	60.00	120.00
0030.5	940	58.75	117.50
0040.5	920	57.50	115.00
0051.5	900	56.25	112.50
0062.5	880	55.00	110.00
0074.5	860	53.75	107.50
0089.0	840	52.50	10.5.00
01O3.O	820	68.34	136.67
0117.0	800	66.67	133.33
0134.5	780	65.00	130.00
0151.5	760	63.34	126.67

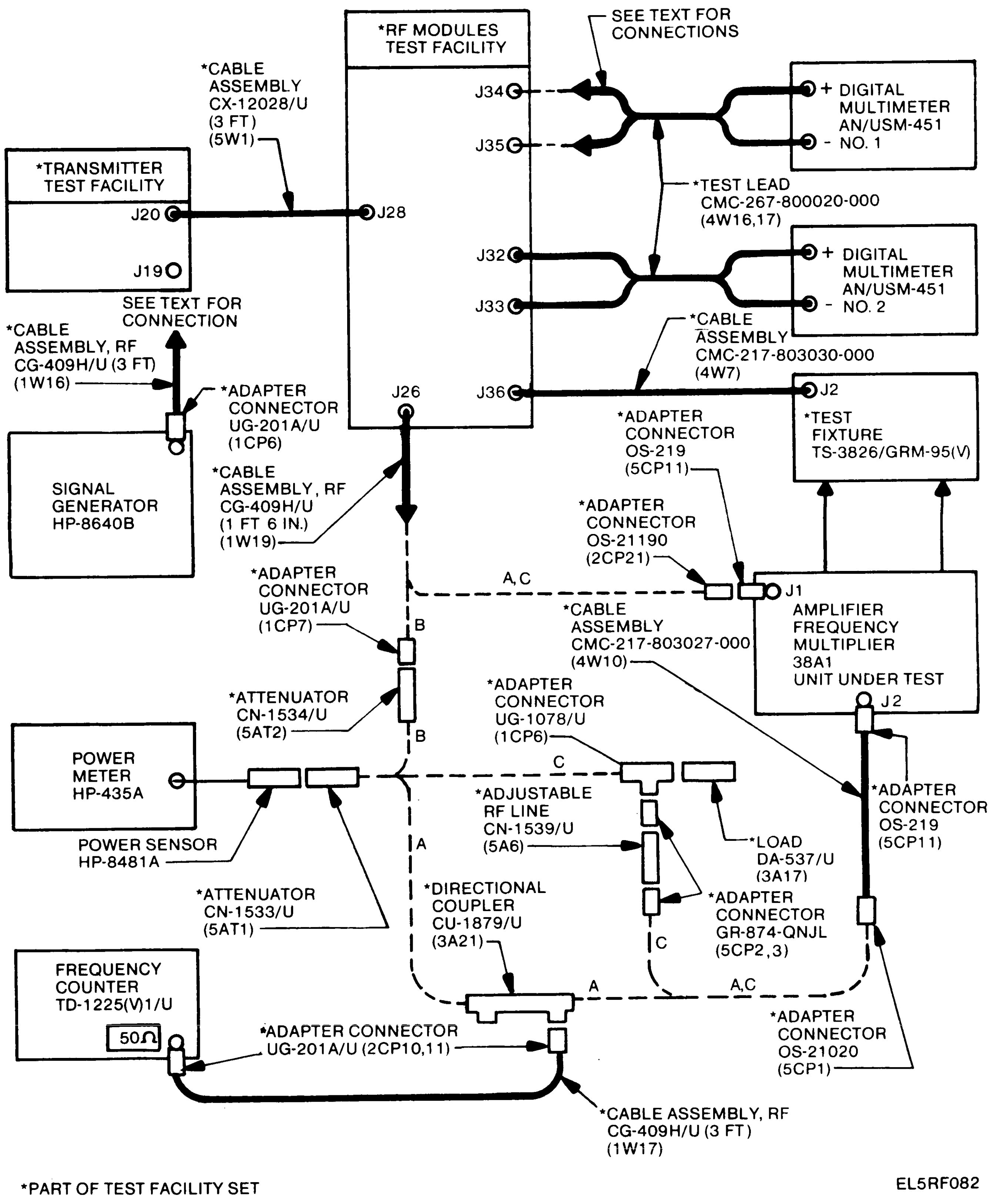


Figure 4-163. Amplifier-Frequency Multiplier 38A1, Tuning Law, Bandwidth, Power Out, and Automatic Level Control (ALC) Checks, Test Setup.

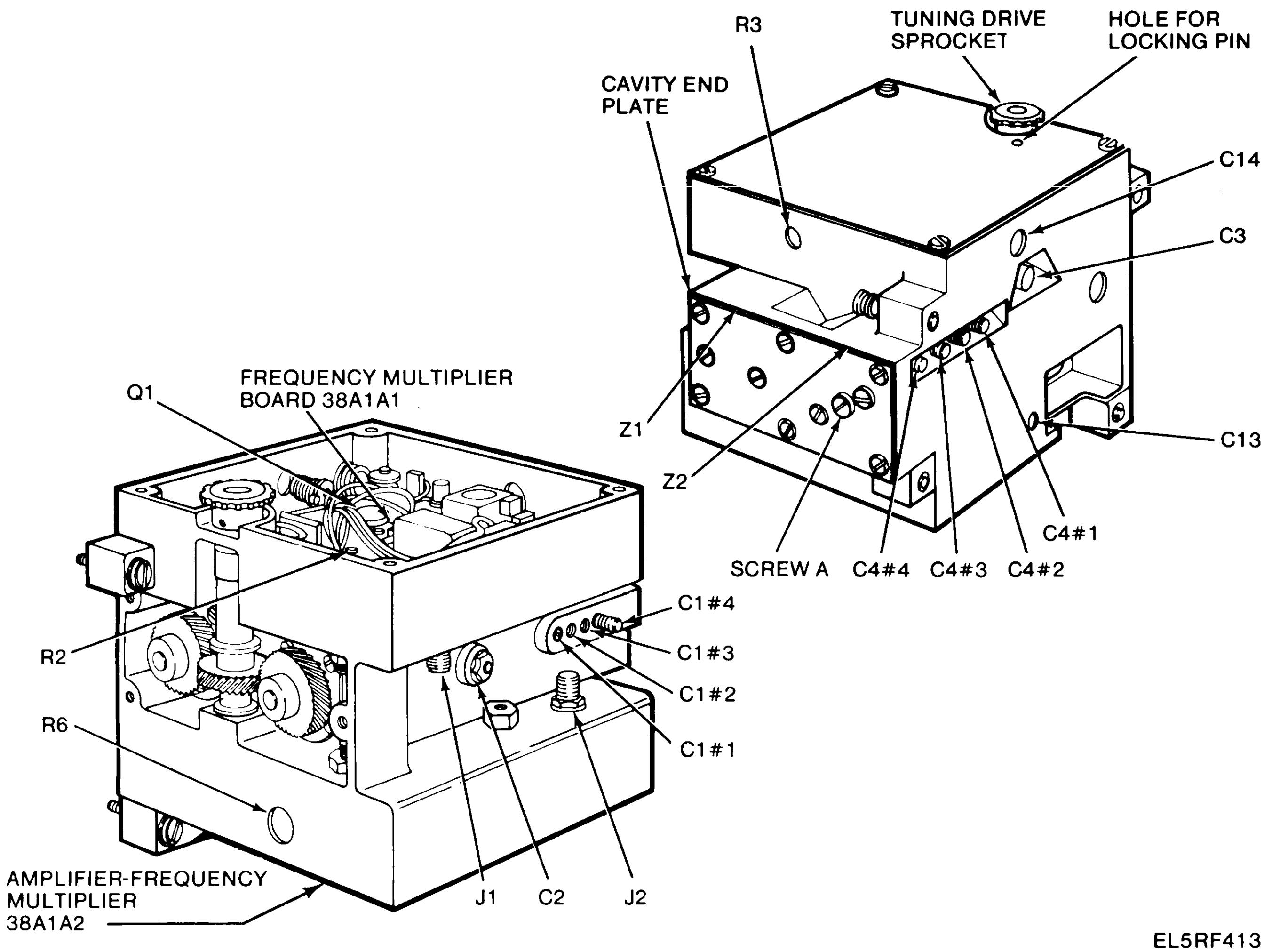


Figure 4-164. Amplifier-Frequency Multiplier 38A1, Top and Bottom Views.

Test fixture counter setting	*Unit under test output frequency (MHz)*	*Signal generator freq (MHz)*	*Unit under test input frequency (MHz)*
0168.0	740	61.67	123.33
0185.5	720	60.00	120.00
0207.5	700	58.33	116.66
0214.5	695	57.92	115.84

(2) *Automatic level control (ALC) checks.*

NOTE

This test assumes that the unit under test is mounted and mechanically engaged in test fixture TS 3826/GRM-95(V) as per paragraph *b(1),* with test equipment as previously set and connected.

(a) Adjust the signal generator frequency to approximately 62.5 MHz. (Input frequency to unit under test of 125 MHz.)

(b) Adjust the tuning knob on the test fixture to provide 0000.0 reading on unit under test.

(c) If necessary, slightly adjust the signal generator frequency to provide maximum reading on power meter.

(d) Connect the test equipment as in C, figure 4-163. Adjust the trombone line (CN-1539/U) for the minimum indication on the power meter. The output from the unit under test shall be +21 dB minimum. This is equivalent to a nominal power meter indication of –2.8 dBm minimum, which is obtained by subtracting the following from +21 dBm:

3 dB (2:1 mismatch loss)
20 dB (nominal attenuator loss)
0.3 dB (cable loss)
0.5 dB (trombone line loss)

(e) Adjust the ALC 2 ADJ control (test facility rf modules) for a –2.8 dBm indication on the power meter, Transmitter test facility meter Ml should indicate between 40 and 60 percent.

(f) Adjust the ALC 2 ADtJ control again for a –6.8 dBm indication on the power meter (+17 dBm output power). Multimeter No. 1 should indicate 3 V maximum.

(g) Repeat *(a)* through *(f)* above for the frequencies and counter settings listed below. Return ALC 2 ADJ fully clockwise.

NOTE

The input frequency in the following list is to the unit under test.

Sig Gen Freq (MHz)	*Output Freq (MHz)*	*Test Fxtr Cntr Set*	*Input Freq (MHz)*
62.5	1000	*0000.0*	125.00
57.5	920	0040.5	115.00
52.5	840	0089.0	105.00
65.0	780	0134.5	130.00
57.92	695	0214.5	115.84

(h) Set the transmitter test facility switch S1 to OFF.

(3) *Input VSWR check.*

NOTE

This test assumes that unit under test is mounted and mechanically engaged as per procedure in paragraph b(l).

(a) Connect the test equipment as shown in figure 4-165.

(b) Adjust the signal generator frequency to 62.5 MHz.

(c) Set the transmitter test facility controls as follows:

Control	*Position*
S1	ON
S12	OSC

(d) Set the test facility rf modules controls as follows:

Control	*Position*
S13	ALC2X4
ALC 2 ADJ	Fully clockwise
ALC 1 ADJ	Fully clockwise

(e) Adjust the test fixture tuning knob until the counter reads 0000.0.

(f) Adjust the signal generator output level for +15 dBm. Record the power meter indication.

(g) Reverse the input and output connections to the directional coupler (do not disconnect the power meter). The reflected power indicated on the power meter should be at least 9.5 dB below the level recorded in *(f)* above, indicating a VSWR of 2:1 or better.

(h) Repeat *(b)* through *(g)* above for the frequencies listed below:

Signal generator frequencies (MHz)	*Test fixture counter setting*
60.0	0020.0
57.5	0040.5
52.5	0089.0
65.0	0134.5
57.9	0214.5

(4) *Relay check.*

(a) Connect the equipment as in figure 4-165.

(b) Mount and secure the unit under test to Test Fixture TS-3826/GRM-95(V) (CMC-617-800424-000).

(c) Set switch S13 (test facility rf modules) to ALC 2 X 4. The AMPL FREQ MULT 12 dB indicator lamp (test facility rf modules) should light, and the 6 dB indicator lamp should remain off.

(d) Set switch S13 (test facility rf modules) to ALC 2 X 6. The AMPL FREQ MULT 6 dB indicator lamp (test facility rf modules) should light, and the 12 dB indicator lamp should remain off.

(e) Adjust the test fixture tuning knob until the mechanical counter reads 0000.0.

(f) Install shouldered pin CMC 716-800009-000 in hole adjacent to the tuning drive sprocket (figure 4-164) to prevent the drive gear and plungers from turning.

c. Troubleshooting (FO-52 or FO-53).

Symptom	*Checks and corrective measures*
Abnormal power output or frequency tracking.	1. Aline unit as described in paragraph *d.* 2. Higher category of maintenance required.

d. Alinement Procedures.

(1) Prepare the unit under test as follows:

(a) On cavity Z2 of the unit under test, remove screw A from end plate (fig. 4-164). Turn the tuning drive sprocket counterclockwise to the stop position.

(b) Insert alinement gage CMC 920-803037-000 (P/O Accessory Kit MK-1985(V)2/GRM-95(V)2) in place of screw A. Turn the tuning drive sprocket clockwise until the cavity plunger touches the gage.

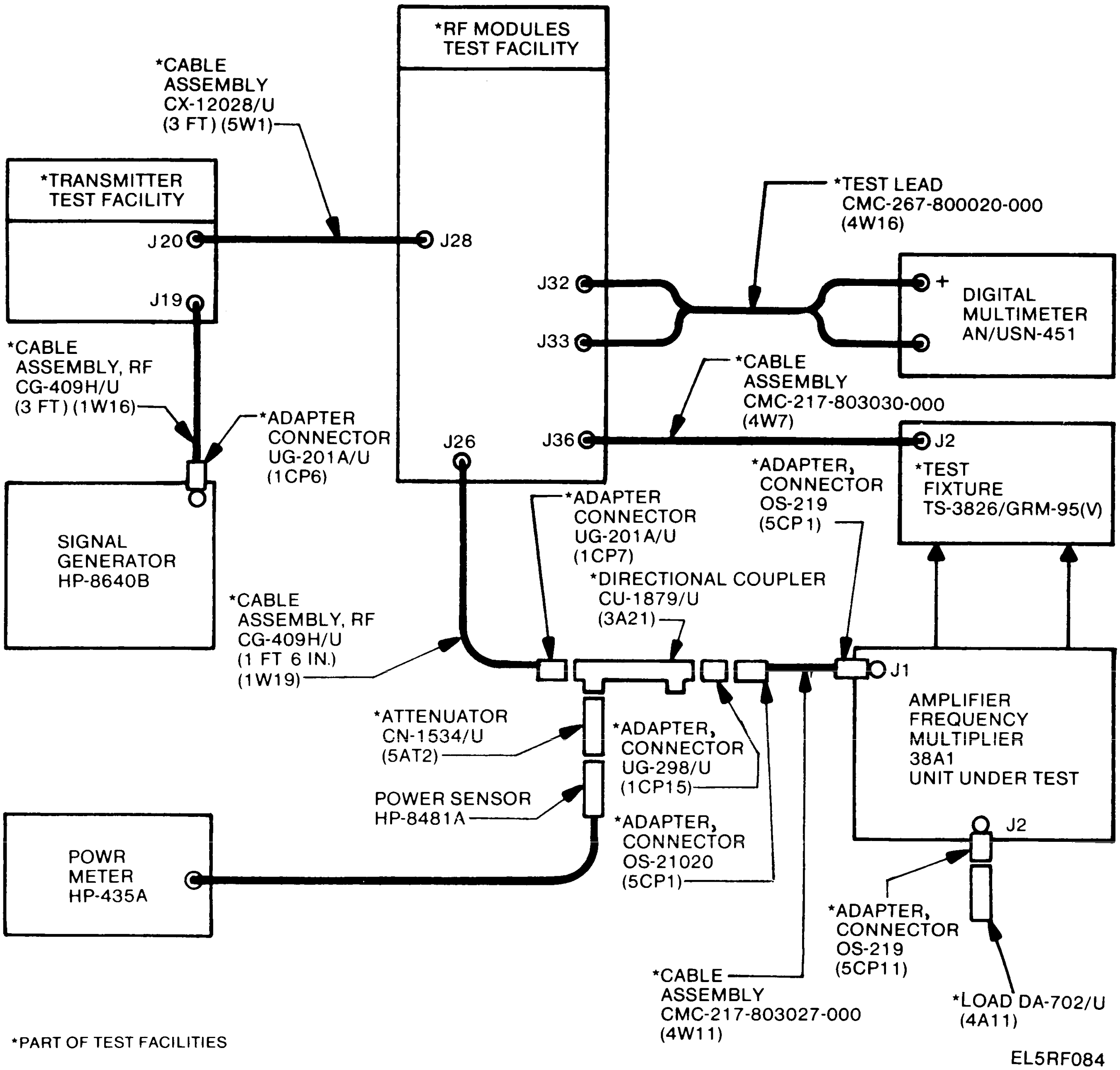


Figure 4-165. Amplifier-Frequency Multiplier 38A1, Input VSWR Check, Test Setup.

(c) Insert shouldered pin CMC 716-800009-000 in the hole adjacent to the tuning drive sprocket (fig. 4-164), to prevent the drive gears and plungers from turning.

(d) Remove the gage and reinsert screw A.

(e) Adjust C13, Cl (No. 1, 2,3 and 4), C2, C3 and C4 (No. 1, 2, 3 and 4) (fig. 4-164) and C15 (fig. 4-166) for minimum capacities (tuning capacitors fully counterclockwise and tuning screws almost out). Adjust C14 for half capacity.

(2) Mount and secure the unit under test on the test fixture, with the tuning drive sprocket engaged to the test fixture counter drive wheel.

(3) Set the counter to 0000 and remove the shouldered pin, to free the tuning drive sprocket.

(4) Connect the test equipment as shown in A, figure 4-167. Set digital multimeter No. 2 to the 2A dc range. Set the sweep generator rf OUTPUT controls to minimum.

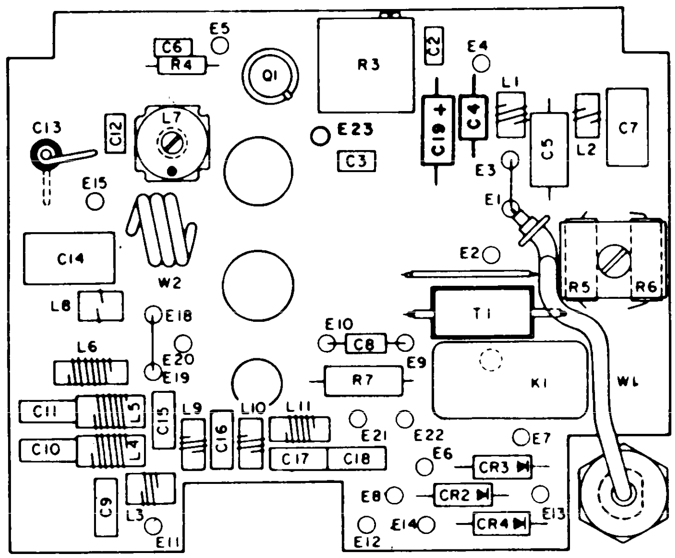


Figure 4-166. Frequency Multiplier 38A1A1, Parts Location.

(5) Set the transmitter test facility controls as follows.

Control	*Position*
S1	ON
S12	MULT

(6) Set the sweep generator controls to sweep from 52 to 70 MHz (use INT markers). Adjust the sweep generator RF OUTPUT controls to obtain a minimum +34 dBm (+14 dBm power meter indication) indication on the power meter over the frequency range of 52 to 72 MHz. This can be verified by using manual sweep.

NOTE

Do not readjust sweep generator attenuator or level settings for remainder of this procedure.

(7) Connect the test equipment as in B, figure 4-167.

(8) Set the test facility rf modules controls as follows.

Control	*Position*
S13	ALC2X6
ALC 1 ADJ	Fully clockwise
ALC 2 ADJ	Fully clockwise

(9) Set the sweep generator RF ON-OFF switch to OFF.

(10) Remove the cover plate on 38A1A2 side of unit under test.

(11) Connect digital multimeter No. 1 between junction of L4-C10 (+) on 38A1A2 (figure 4-168) and chassis ground (-). Adjust R6 for + 15.0 V ±0.1 volts dc on the multimeter. Disconnect the digital multimeter.

(12) Set R3 on board 38A1Al fully clockwise.

(13) Set the sweep generator RF ON-OFF switch to ON. Set sweep mode to AUTO.

NOTE

If the requirements of the following procedures cannot be met as specified, it is permissible to vary the starting point of the counter, not to exceed ±0010.0, and repeat the procedures.

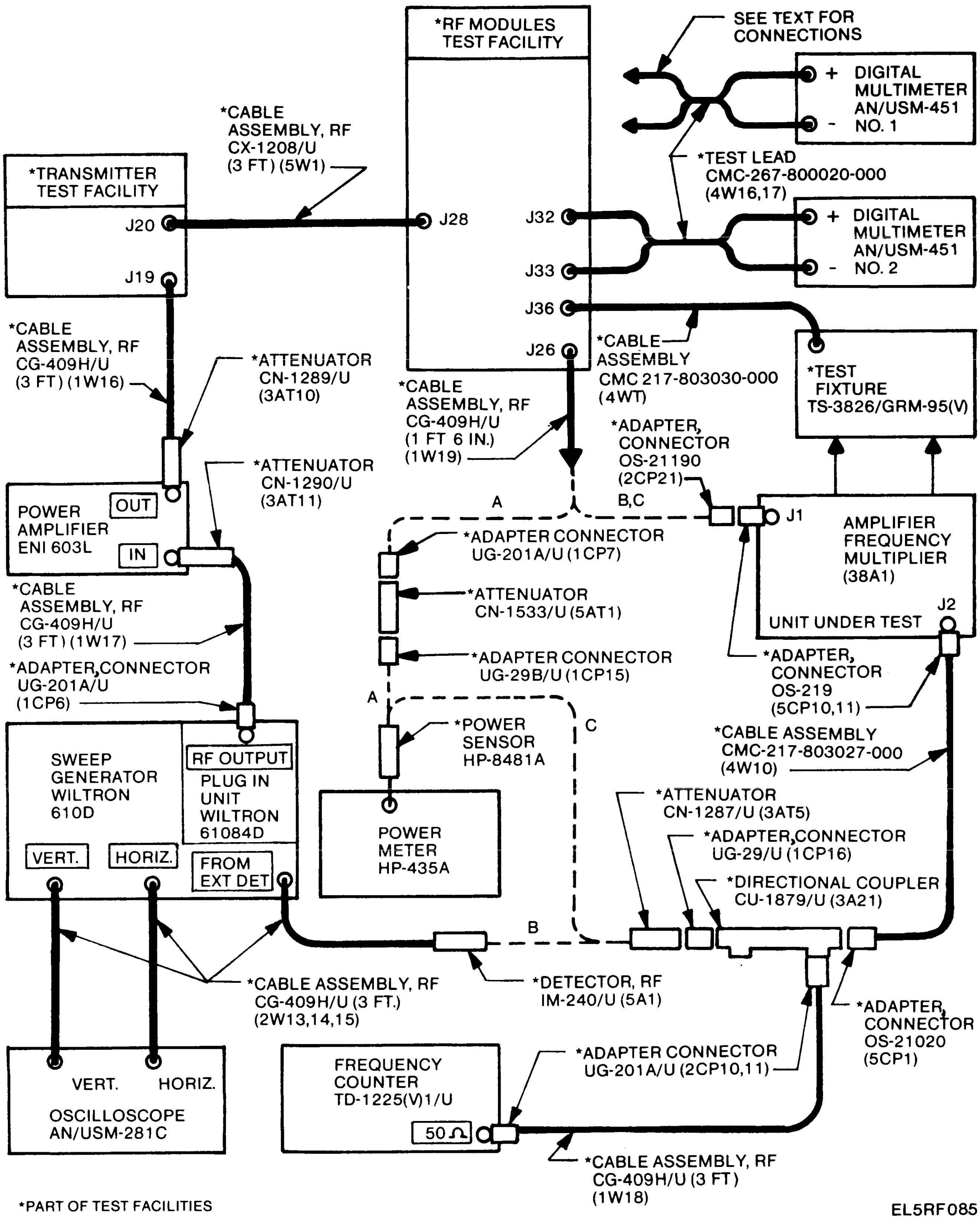


Figure 4-167. Amplifier-Frequency Multiplier 38A1, Alinement, Test Setup.

(14) Rotate the test fixture tuning knob to read 0089.0. Two outputs are displayed on the oscilloscope. By adjusting L1, C14, C15, level the two outputs for a nearly equal response.

NOTE

L1 is increased in value by moving the turns closer together and by positioning the coil away from ground.

(15) Set the sweep generator controls as follows:

Control	*Position*
FREQ SELECTOR	CW MKR
VAR FREQ MKR	62.5 MHz (on dial)

(16) Rotate the test fixture tuning knob to read 0000.0. Set the sweep generator for an output frequency from the unit under test of 1000 MHz.

NOTE

In the following procedures, exact AF center frequency can be determined as follows:

- Set the sweep generator AF FREQ control to display the output response.
- Set the SWEEP MODE to MANUAL and adjust the manual control to center the bright spot at the center oscilloscope graticule.
- Adjust the VAR FREQ MKR control for the desired frequency counter indication.
- Set the sweep generator SWEEP MODE to AUTO. The desired frequency is now represented by the oscilloscope center graticule.

(17) Set the sweep generator FREQ SELECTOR control to D F. Set the D F FREQ control for a convenient response display. Adjust screws C2 and C3 on cavities Z1 and Z2 for a response centered on 1000 MHz.

(18) Adjust C14 on board 38A1A1 (fig. 4-166) and C15 on board 38A1A2 (fig. 4-168) to obtain maximum power output, then adjust C13 on board 38A1A2 until amplitude of response just ceases to increase and the response is symmetrical.

(19) Set sweep generator to manual. Adjust for peak power output from unit under test. Set R3 (fig. 4-166) on 38A1A1 to obtain maximum current consumption, not to exceed 0.95 amperes, as indicated on digital multimeter No. 2.

(20) Set the sweep generator to AUTO. Set the plungers for an indication of 0040.5 on test fixture counter. Adjust Cl No. 1 and C4 No. 1 (fig. 4-164) to obtain a symmetrical response centered on a 920 MHz marker.

NOTE

Check that C4 screw does not protrude beyond mounting face.

(21) Set the sweep generator to manual. Adjust for peak power output from the unit under test. Note digital multimeter No. 2 indication does not exceed 0.95 amperes. If necessary, readjust R3.

(22) Repeat steps (16) through (31) above until the 1000 MHz and 920 MHz markers are centered on their respective responses.

(23) Adjust the plungers for an indication of 0089.0 on the counter and adjust Cl No. 2 and C4 No. 2 on cavities Z1 and Z2 to obtain a symmetrical response centered on 840 MHz. (This corresponds to a sweep generator marker frequency of 52.5 MHz). Current should not exceed 0.95 amperes. If necessary readjust R3 as in (21) above.

(24) Reset the plungers to 0040.5 on test fixture counter. Check that response is centered at 920 MHz. Readjust Cl No. 1 and C4 No. 1 if necessary.

(25) Repeat step (23) above readjusting C1 No. 2 and C4 No. 2 if necessary, to balance frequency when tracking between 840 MHz and 920 MHz points. If adjustments are made, repeat steps (17) through (24) until all requirements are met.

(26) once frequency tracking from 1000 MHz to 840 MHz is achieved, use L7 and C14 on 38A1A1 (fig. 4-166) to balance power output on either side of the cross-over point (i. e.. both the doubled 52.5 MHz input frequency for the times-8 scale and 70 MHz for times-6 scale result in 840 MHz output frequency).

(27) Set the plungers for an indication of 0134.5 on the counter. Adjust C1 No. 3 and C4 No. 3 screws to obtain a symmetrical response centered on 780 MH: (which corresponds to a sweep generator frequency 0. 65 MHz). Current should not exceed 0.95 amperes Readjust R3 if necessary (as in 21) above).

(28) Set the plungers for an indication of 0214.5 on the counter. Adjust C1 No. 4 and C4 No. 4 screws to obtain a symmetrical response centered on 695 MHz (which corresponds to a signal generator frequency of 57.92 MHz). Readjust R3 if necessary for maximum consumption of 0.95 amperes.

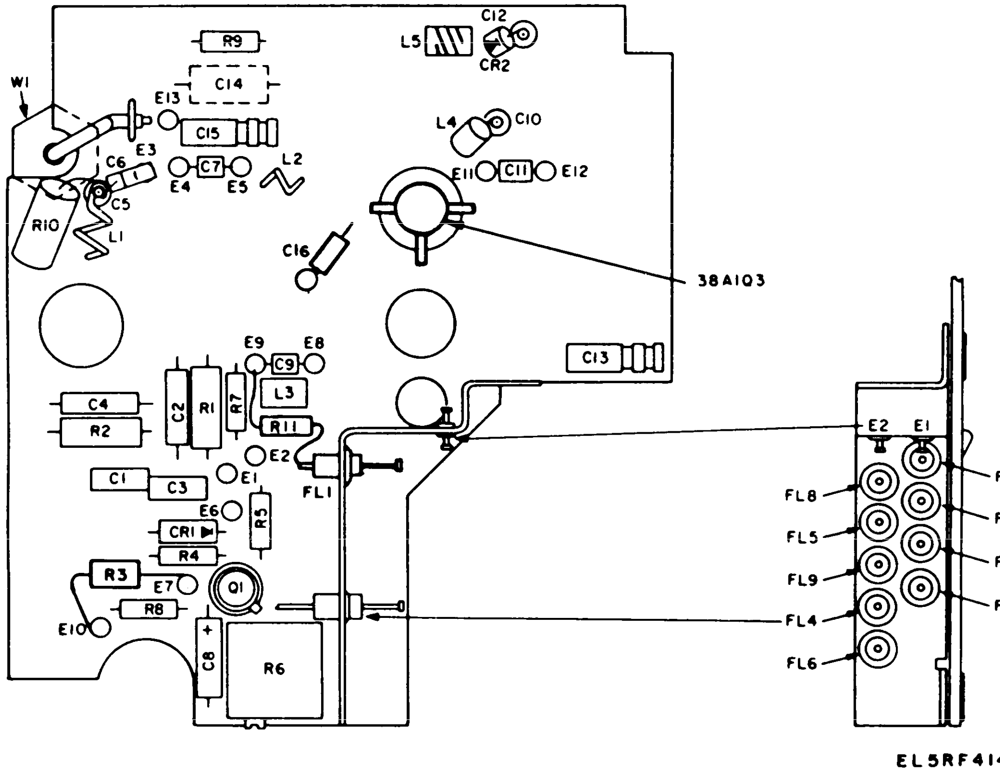


Figure 4-168. Amplifier-Frequency Multiplier 38A1A2, Parts Location.

(29) Set the plungers for an indication of 0168.0 on the counter (740 MHz output frequency). Using Cl No. 4 and C4 No. 4 screws, balance frequency tracking accuracy between 695 MHz and 740 MHz.

(30) Set the plungers for an indication of 0000.0 on the test fixture counter. Set the sweep generator SWEEP MODE control to MANUAL, the FREQ SELECTOR control to AF. Adjust the VAR FREQ MKR control to approximately 62.5 MHz for a reading of 1000 MHz on the frequency meter.

(31) Connect the test equipment as shown in C, figure 4-167. Note output level on the power meter the reading should be greater than +2 dBm (output power +22 dBm less 20 dB (attenuator)).

NOTE

If the +2 dBm reading on the power meter cannot be obtained check the frequency tracking at this point as follows:

- Keep the counter position fixed.
- Manually vary the frequency control of the generator, until a peak power indication is obtained on the power meter.
- If the peak power indication is appreciably higher than the one obtained at the frequency of measurement, repeat steps (13) through (32) above to correct the tracking error at the frequency of measurement.

(32) Adjust the sweep generator VAR FREQ MKR control to shift the 1000 MHz output frequency up to 1000.5 MHz ±50 kHz. Note power meter reading. Repeat for 999.5 MHz ±50 kHz. The difference between the two power meter readings give the frequency response slope at 1000 MHz. The slope must be less than 1 dB/MHz.

(33) Readjust sweep generator frequency for maximum indication on the power meter. Increase frequency until power meter indication drops by 3 dB. Note the frequency. Decrease frequency until indication peaks again then drops by 3 dB from maximum. Note the frequency. The difference between the two frequencies noted above is the 3 dB bandwidth at 1000 MHz and should be 5 to 22 MHz.

(34) Repeat steps (30) through (32) above for all frequencies listed in table below. Repeat step 33 above, only at frequencies marked with an asterisk.

(35) Adjust the plungers to obtain a counter reading of 0000.0. Insert the shouldered pin. (In doing so, do not rotate the gear wheel by more than half a tooth.)

Input req (MHz) Sig gen	Unit tested	Output freq (MHz)	Output power	Counter reading	Adjustment control
*62.50	125.00	1000	+22 dBm min	0000.0	C2, C3
61.25	122.50	980	+22 dBm min	0009.5	
60.00	120.00	960	+22 dBm min	0020.0	
58.75	117.50	940	+22 dBm min	0030.5	
*57.50	115.00	920	+22 dBm min	0040.5	Cl/No. 1, C4/No. 1
56.25	112.50	900	+22 dBm min	0051.5	
55.00	110.00	800	+22 dBm min	0062.5	
53.75	107.50	860	+22 dBm min	0074.5	
*52.50	105.00	840	+22 dBm min	0089.0	Cl/No. 2, C41No. 2
68.34	136.67	820	+22 dBm min	0103.0	
66.67	133.33	800	+22 dBm min	0117.0	
65.00	130.00	780	+22 dBm min	0134.5	Cl/No. 3, C4/No. 3
63.34	126.67	760	+22 dBm min	0151.5	
61.67	123.33	740	+22 dBm min	0168.0	
60.00	120.00	720	+22 dBm min	0185.5	
58.33	116.67	700	+22 dBm min	0207.5	
*57.92	115.83	695	+22 dBm min	0214.5	C1/No. 4, C4/No. 4

4-63. Control-Indicator 38A2 or 34A4

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter TS-2866(V)2/GRM-95 (V)2	Transmitter test facility
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit
Gage, Thickness 0.003 in.	Feeler gauge
Wrench, Torque	Torque wrench

b. Test Procedure.

(1) Connect the test equipment as shown in figure 4-169.

(2) Set test facility switches S1 and S6 to ON.

(3) Perform the following preliminary checks.

NOTE

The unit number of the control-indicator must correspond to the unit number displayed in the left hand window of the control-indicator test set. The unit 34A4 type number is CMC 245-800070-000, and the unit 38A2 type number is CMC 245-800063-000.

(a) Turn the thumbwheel on the control-indicator test set until channel 990 is displayed on the window when testing unit 38A2 (channel 1012 for unit 34A4).

(b) Turn the tuning control shaft on the unit under test so that the numerical counter indicates channel 990 when testing unit 38A2 (channel 1012 for unit 34A4).

(c) Observe the lamp display on the control-indicator test set. Extinguished lamps shall correspond to the dots on the tape display.

(d) Repeat *(a)* through *(c)* above for all the remaining channels of type number CMC 245-800070-000 or CMC 245-800063-000 shown on the tape for that type unit.

(4) Perform the following final operational check.

NOTE

The following procedure checks for intermittent switch operation through a complete revolution of each control cam.

(a) Set the control indicator to the first channel indicated in step 1 of figure 4-170.

(b) Gently change back and forth between the channels indicated in the step several times. The coding of the test set lamps should agree with the coding shown for that channel after each transition and should not indicate erratic operation. (Only the coding for the cam and switches being checked is shown.)

(c) Repeat *(a)* and *(b)* above for each remaining step of figure 4-170. Test set lamp number 13 should not flicker while tuning between channels, except for the channels listed below.

38A2	*34A4*
From l135 to l136	From 1075 to 1076
1263 to 1264	1203 to 1204
1295 to 1296	1235 to 1236
1327 to 1328	1267 to 1268
1391 to 1392	1331 to 1332
	1587 to 1588

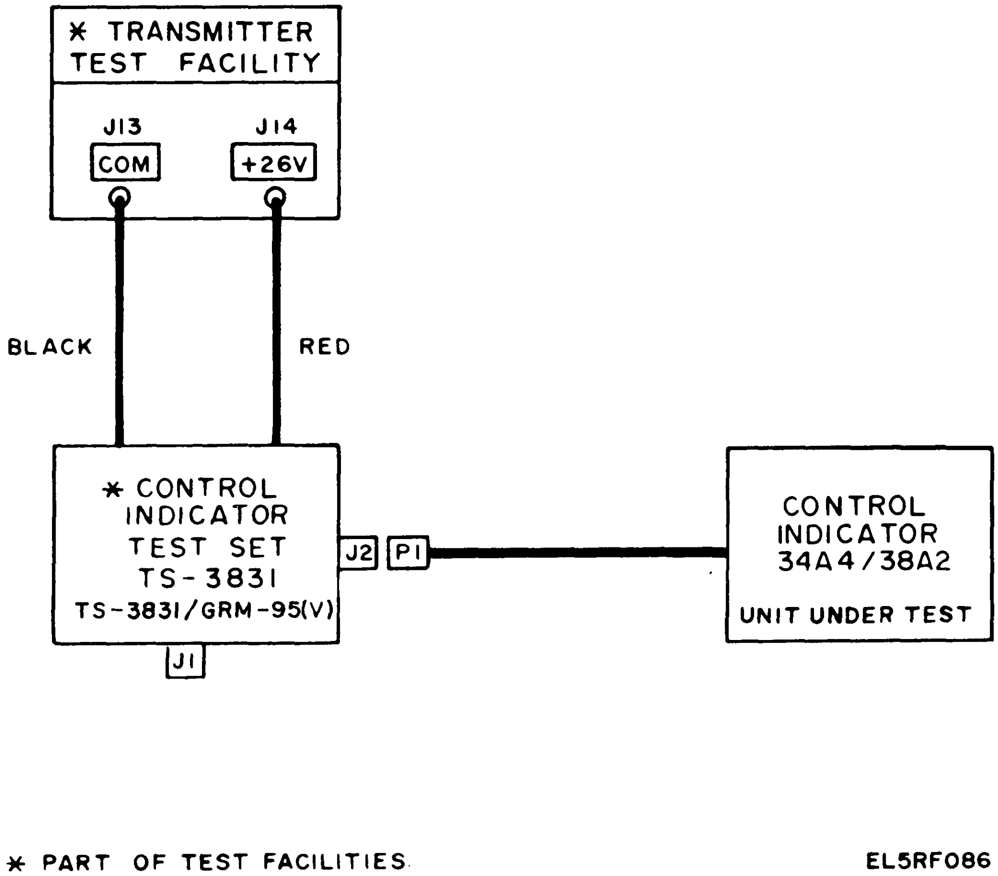


Figure 4-169. Control-Indicator 38A2 or 34A4, Test Setup.

(5) Check the stop mechanism by turning the control shaft to the limit, past channel 900 and past channel 1699. At these points, the slipping clutch shall operate to stop further movement of the gears.

CAUTION

Do not exert undue force on the mechanism if the clutch does not slip. Readjust the clutch nut as described in paragraph 4-11 *d*.

c. Troubleshooting (FO-9 (schematic) and FO-54 (coding table)).

Symptom	*Checks and corrective measures*
1. One or more lamps, No. 2 through 13 permanently illuminated.	*a*. Remove cover of unit under test. Manually operate switch corresponding to permanently illuminated lamp; this can be done by gently pushing the ball associated with the switch (fig. 4-43). *b.* If the lamp does not extinguish while manually operating the switch, replace the faulty switch. Adjust the operating point as described in paragraph 4-11. *c.* If the lamp extinguishes, check that the ball is not sticking. *d.* Check adjustment of the switch operating point (para. 4-1 id).
2. One or more lamps, No. 2 through 13 illuminated.	*a.* Check for a sticking ball associated with nonoperating lamp. *b.* If lamp does not light with switch in released position, replace switch.
3. Lamp No. 13 permanently on or not illuminating.	Replace command signals decoder (fig. 4-43).

STEP NO.	SET INDICATOR TO CHANNEL		CHECK TS-3831 LAMP NUMBERS (● = OFF, ○ = ON, BLANK = NOT CHECKED)													
	38A2	34A4	0	1	2	3	4	5	6	7	8	9	10	11	12	13
1	1055	995		○	●	●	●	●	○	●	○	●	●	○	●	○
	1056	996		○	○	○	○	○	●	●						
	1057	997		○	●	○	○									
	1058	998		○	○	●	○									
	1059	999		○	●	●	○									
	1060	1000		○	○	○	●									
	1061	1001		○	●	○	●									
	1062	1002		○	○	●	●									
	1063	1003		○	●	●	●	○	●	●						
	1064	1004		○	○	○	○	●	●	●						
2	1071	1011		○				●	●	●	○	●	●			
	1072	1012		○				○	○	○	●	●	●			
3	1079	1019		○				○	○	○						
	1080	1020		○				●	○	○						
4	1087	1027		○				●	○	○						
	1088	1028		○				○	●	○						
5	1095	1035		○				○	●	○						
	1096	1036		○				●	●	○						
6	1103	1043		○				●	●	○						
	1104	1044		○				○	○	●						
7	1111	1051		○				○	○	●						
	1112	1052		○				●	○	●						
8	1135	1075		○							●	●	●	○	●	○
	1136	1076		○							○	○	○	●	●	○
9	1199	1139		○							○	○	○			
	1200	1140		○							●	○	○			
10	1263	1203		○							●	○	○			
	1264	1204		○							○	●	○			
11	1279	1219		○	●	●	●	●	○	○	○	●	○	●	●	○
	1280	1220		○	○	○	○	●	○	○	●	○	●	●	○	●
12 *	1281	1221		●	○	○	○	●	○							
	1282	1222		○	●	○	○	●	○							
	1284	1224		○	○	●	○	●	○							
	1288	1228		○	○	○	●	●	○							
	1296	1236		○	○	○	○	○	●							
13	1327	1267		●	●	●	●	●	●	○	●	○				
	1328	1268		○	○	○	○	○	○	●	●	○				
14	1391	1331								●	●	○				
	1392	1332								○	○	●				
15	1455	1395								○	○	●				
	1456	1396								●	○	●				
16	1519	1459								●	○	●				
	1520	1460								○	●	●				
17 **		1587		●	●	●	●	●	●	●	●	●	●	●	○	●
		1588		○	○	○	○	○	○	○	○	○	○	○	●	●
	XMTR	RCVR	0	1	2	3	4	5	6	7	8	9	10	11	12	13

NOTE: Control indicator switch numbers correspond to test set lamp numbers for channel 1219 (34A4) or 1279(38A2), and lower channel settings. For channel settings above 1220(34A4) or 1280(38A2), the controlling switch number is equal to one (1) greater than the test set lamp number. Switch reference number S1 is not used.

** Step 12 checks for proper encoding of switches 2 through 7 to lamps 1 through 6.

** Step 17 applies to control indicator 34A4 only.

EL5RF817

Figure 4-170. Control-Indicator 38A2 or 34A4, Lamp Indications.

d. Switch and Tuning Control Adjustments. Refer to paragraph 4-1ld.

4-64. Radio Frequency Amplifier 38AR1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facility Set MK-1173(V)2/GRM-95(V)2	Accessory kit, test facility set
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Test Facility, Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility frequency modules
Drive Generator Airborne Instrument Labs, Model 125A	Power signal source
Counter, Frequency TD-1225(V)l/U	Frequency counter
Meter, Power HP-435A	Power meter
Sensor, Power HP-8481A	Power sensor
Multimeter, Digital AN/USM-451	Multimeter
Wattmeter AN/USM-298	Wattmeter
Element, Bird No. 50E 500-1000 MHz	Wattmeter element
Generator, Sweep Wiltron 610D With Plug-In Unit Wiltron 61084D	Sweep generator

b. Test Procedure.

(1) *Preliminary checks.*

(a) For AM-4322A/GRC-103 only, before connecting the unit under test to the test setup, a resistance check on the temperature sensor is required:

1. Connect the digital multimeter between pins 17 and 43 of connector P1 of the connector filter assembly 38AR1AlW1Al. The resistance measured should be within the limits shown on the "Temp/ Resistance" chart for the temperature of the heat radiator of the unit under test output tube (figure 4-113).

2. Connect the multimeter between pin 17 and pin 1 (H.V. connection). The multimeter should indicate an open circuit.

3. Repeat 2. above for pins 43 and 1.

WARNING

High voltages are accessible at the test leads and connections when the megohmmeter is used. Switch to “OFF” and “DISCHARGE” before connecting or disconnecting test leads.

4. Short pins 17 and 43 together arid connect the megohmmeter between the shorting wire (pins 17 and 43) and Pin 1.

5. Turn the megohmmeter power switch on, and set its voltage control to 600 volts.

6. Set the “DISCHARGE - CHARGE - MEASURE” switch to “CHARGE” and then “MEASURE”. The resistance indicated on the megohmmeter should be greater than 50 megohms.

7. Return switches to “DISCHARGE” and “OFF”.

8. Disconnect megohmmeter and the short between pins 17 and 43.

(b) Perform the following preliminary checks:

WARNING

LETHAL 630 Vdc present at tube plate radiators.

CAUTION

Do not switch on the power signal source with its output unterminated.

1. Turn power signal source output level control to minimum.

2. Connect the test equipment as shown in A, figure 4-171. Set power supply PP-6304/GRC-95(V) to 115 Vat.

3. Direct cooling air from the AIR OUTLET of the transmitter test facility, to the rear of the unit under test, using hose assembly, Airduct, MX-8414/ GRM-95(V) (1MP2).

4. Set the XMTR TUNE control on the unit under test to channel 1600.

5. Switch on the test equipment and set the transmitter test facility switches as follows:

Switch	*Position*	*Normal indication*
S1	ON	
S16	OUTPUT NORMAL	
S17	ON	
S20	S12	
S12	OSC	

6. Use multimeter to check the voltages on the voltage regulator assembly 38AR1A1Al (TM 11-5820-540-30) at the test points listed below.

Test points		*Voltage (dc)*
Neg.	*Pos.*	
TP2	TP4	6.0 *to* 6.4
TPl	TP3	6.0 to 6.4

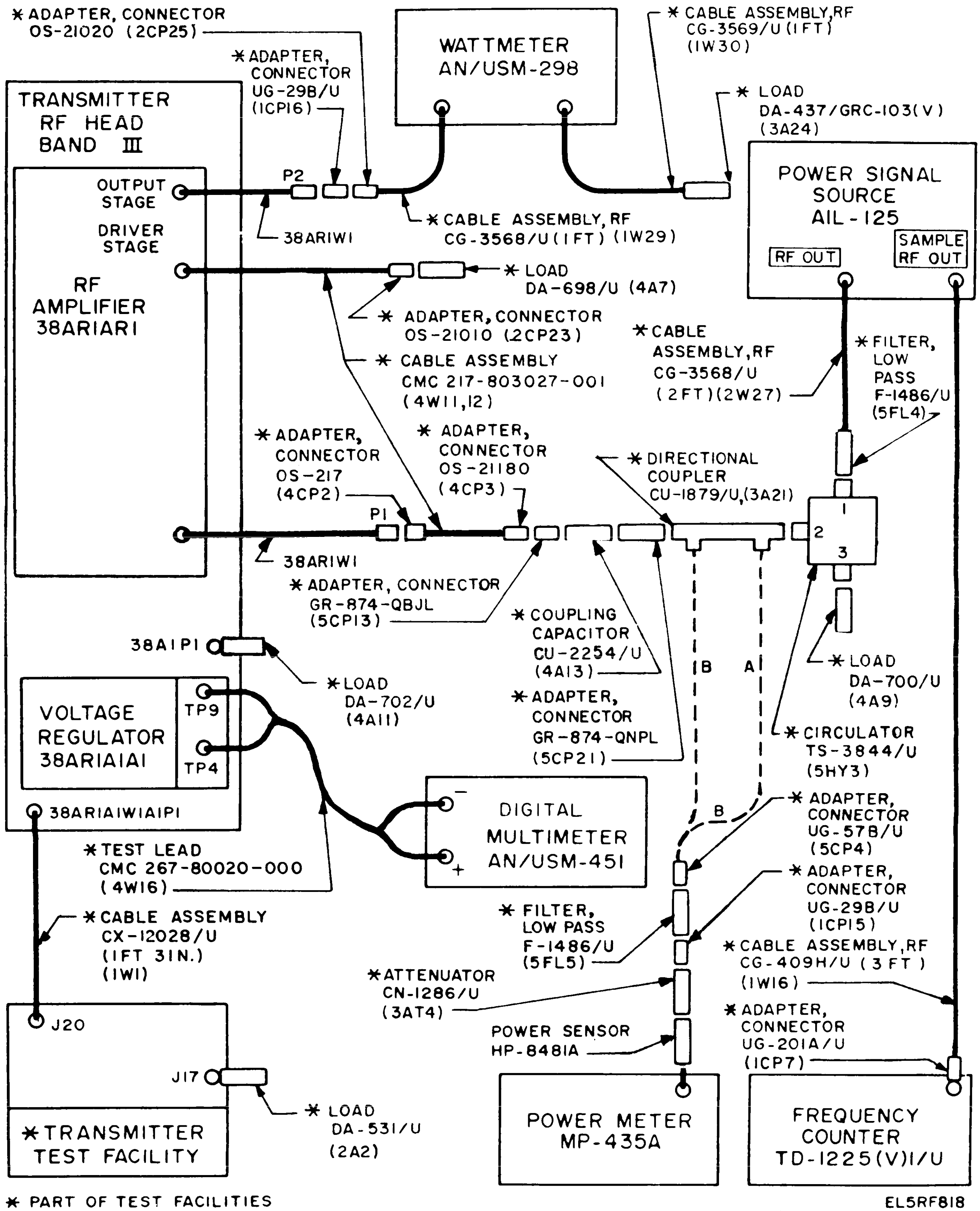


Figure 4-171. Rf Amplifier 38AR1, 0utput Stage, Power Output and Input Match Checks, Test Setup.

(2) *Output amplifier power output and input match checks.*

(a) Connect the test equipment as in A, figure 4-171.

(b) Set the controls of the power signal source as follows:

Control	*Position*
MODULATION	CW
FREQ RANGE	MID
RF OUTPUT ATTENUATOR	MAX CLOCKWISE
PLATE Counter	A reading corresponding to 1000 MHz from the frequency chart.
CATHODE Counter	A reading corresponding to 1000 MHz from the frequency chart.

(c) Adjust the output level of the power signal source to +34 dBm (2.5 watts) at a frequency of 1000 MHz as indicated by the frequency counter. The output power of +34 dBm is calculated as follows: To the power meter indication in dBm, add 10 dB (attenuator) and the coupling factor (dB) of the coupler at 1000 MHz (use calibrated chart on coupler).

NOTE

Adjustment of the PLATE and CATHODE counters, as well as the RF OUTPUT ATTENUATOR may be necessary to achieve +34 dBm at 1000 MHz.

(d) Set the test facility switches S13 to ON and S20 to 600 V. Meter Ml should indicate within the green band.

(e) Monitor the cathode voltage between TP4 (+) and TP9 (–) throughout testing; adjust the power signal source output level as required, to maintain the cathode voltage at 14 Vdc ± 1 V.

(f) Set test facility switch S12 to OUTPUT CUR; meter Ml should indicate approximately 30% of full scale.

(g) Use the multimeter to check the voltage between TP8 (+) and TP9 (–). The multimeter should indicate 0.74 Vdc ± 0.1 V.

(h) Adjust XMTR TUNE for a peak indication on the wattmeter. The wattmeter should indicate 30 watts or greater.

(i) If the output power is low, loosen the two guide block retaining setscrews on the coupling probe C9 assembly (fig. 4-161). Turn the probe adjustment nut fully counterclockwise.

(j) Adjust XMTR TUNE control for maximum indication on the wattmeter. Alternately rotate the probe adjustment nut (fig. 4-161) clockwise and repeak with the XMTR TUNE control until a minimum output of 30 watts is obtained. Final peaking of output power should be within XMTR TUNE control range. Note the wattmeter indication.

(k) Reset the XMTR TUNE control to indicate channel 1600 and peak the output by adjusting trimmer capacitor 38AR1AR1C11 (TM 11-5820-540-30). The power output should be the same as that noted in *(j)* above.

(l) Not used.

(m) Check the cathode and adjust power input as required as in step *(e)*.

(n) Record the level indicated on the power meter (fig. 4-171); it should be +36 dBm maximum, minus 10 dB, minus the directional coupler coupling factor.

(o) Connect the power meter to the reflected port of the directional coupler (C, fig. 4-171).

(p) The power meter should indicate at least 11 dB less than the level noted in *(n)* above. This is the return loss.

(q) If unit under test does not meet requirement of *(p)* above, proceed as follows:

1. Remove the control panel (front panel) (para. 2-77).

2. Loosen the drive chain idler (fig. 4-161) and slacken the chain.

3. Pull the chain free from the output tube cathode sprocket.

4. Rotate the freed sprocket until a minimum reflected power is obtained on the power meter.

5. Recheck the cathode voltage as in step *(e)* above, and readjust drive level if required.

6. Replace the chain over the sprocket and tighten the drive chain idler.

7. Recheck the return loss (steps *(n)* through *(p)* above).

8. Recheck that the power output is 30 watts minimum.

(r) Reduce the power signal source output level to minimum.

(3) *Output amplifier stability check.*

(a) Connect the test equipment as in A, figure 4-172.

(b) Set the sweep generator controls as follows:

Control	*Setting*
FREQUENCY SELECTOR	CW MARKER
VAR FREQ MARKER	1000 MHz (on dial)

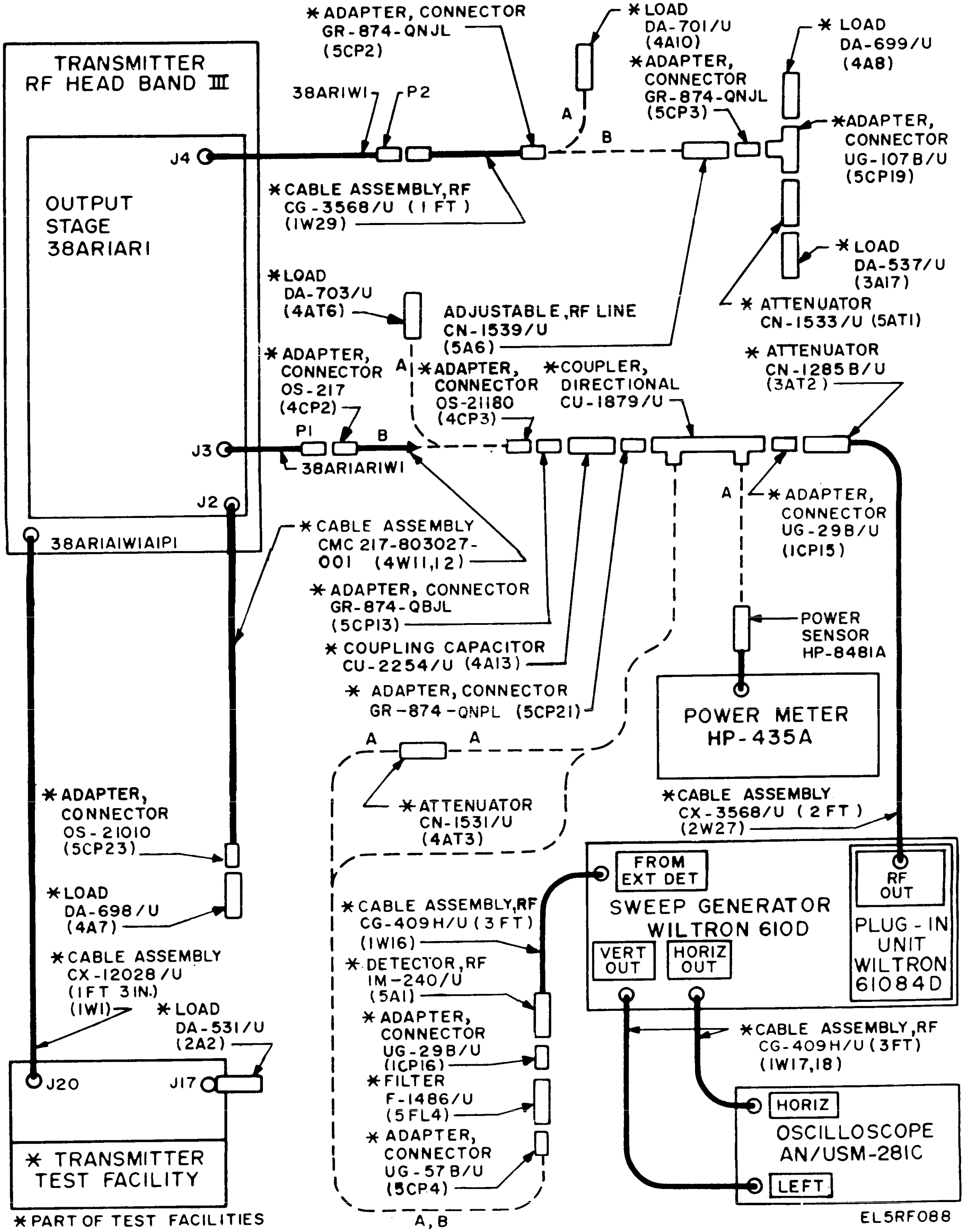


Figure 4-172. Radio Frequency Amplifier 38AR1, Output Stage Stability Check, Test Setup.

(c) Adjust the sweep generator RF POWER LEVEL for a power meter indication of +10 dBm minus the coupling factor of the directional coupler at 1000 MHz.

(d) Set the sweep generator for A frequency operation and adjust the sweep generator control for a sweep width of ±10 MHz centered on the 1000 MHz marker, using the internal markers.

(e) With the RETRACE control in the OFF position, adjust the oscilloscope for a display of 6 cm. Note this display on the graticule for a 3:1 VSWR reference. See A, figure 4-173.

(f) Connect the test equipment as in B, figure 4-172. Temporarily substitute the dummy load DA-701/U for the trombone line (CN-1539/U). Adjust the XMTR TUNE control around channel 1600 until the unit under test response is centered around the 1000 MHz marker. Reconnect the trombone line. Without changing the oscilloscope or sweep generator settings, adjust the trombone line from maximum to minimum while observing the response curve on the oscilloscope. The response should not go below the reference line marked in *(e)* above (B, fig. 4-173).

(g) If the response curve goes below the reference line, continue as follows:

1. Make a slight adjustment of output coupling probe C9 to bring the response peak above the reference line.

NOTE

Response peak should move above the reference line with counterclockwise rotation (increasing coupling) of C9, or vice versa.

2. Temporarily substitute the dummy load DA-70l/U for the trombone line. Rotate the transmitter tune control knob in the direction of channel 1400 until the unit under test response is centered on the 990 MHz marker. Adjust the sweep generator VAR FREQ MKR control to 990 MHz.

3. Reconnect trombone line and repeat steps *(a)* through (g) above at 990 MHz.

4. Repeat steps 2. and 3. above at each 10 MHz sweep marker down to a frequency of 900 MHz.

5. Tighten the guide block retaining setscrews in the coupling probe of the output connector.

(h) If the probe was adjusted in *(g)1.* above, repeat the output amplifier power output and input match test of paragraph (2) above. Adjust only XMTR TUNE control to maximize the power output. Coupling probe must not be loosened or readjusted. Trimmer capacitor C11 may be readjusted should the channel 1600 tape indication at maximum output power not be within +0.5 inch of the window centerline.

(4) Driver amplifier power output and input match check.

(a) Connect the test equipment to the driver amplifier as shown in A, figure 4-174. Set XMTR TUNE control to channel 1600.

NOTE

If step *(3)(h)* above was performed, set the XMTR TUNE control to the position which gave maximum power in step *(3)(h)* above.

(b) Tune the power signal source frequency to 1000 MHz ±1 MHz as indicated on the frequency counter. Use the same setting as in the output amplifier power output and input match checks, *(2)(b),* above.

(c) Adjust the output level of the power signal source to 200 mW (+23 dBm) (power meter indication of +23 dBm minus the coupling factor).

(d) Set the test facility switch S12 to DRIVER CUR; meter Ml should indicate within the green band.

(e) Connect the multimeter positive lead to TP7 and the negative lead to TP9. The multimeter should indicate 0.75 Vdc ±0.1 V.

(f) Connect output J2 to the power meter as shown in C, figure 4-174. The power level should be +34 dBm or more (+4 dBm minimum indication on meter). If the output power is low, proceed as follows:

1. Loosen the two guide block retaining setscrews on the coupling probe C2 assembly (fig. 4-161). Turn the probe adjustment nut fully counterclockwise.

2. Turn the probe adjustment nut clockwise and adjust trimmer capacitor 38AR1AR1C4 (TM 11-5820-540-30) simultaneously for a +34 dBm to +35.5 dBm (+4 dBm to +5.5 dBm indication on the power meter) output power level.

NOTE

Do not adjust XMTR TUNE control from position set in step *(4)(a)* Adjust capacitor 38AR1AR1C4 for final peaking to maximum output power if necessary.

(g) Record the level indicated on the power meter connected to the forward port of the directional coupler (A, fig. 4-174).

(h) Connect the power meter to the reflected port of the directional coupler (B, fig. 4-174). The power meter should indicate 11 dB less than the level noted in *(g)* above. This is the return loss.

(i) If the required level in *(h)* above is not obtained, proceed as follows:

TM 11-5820-540-40-2

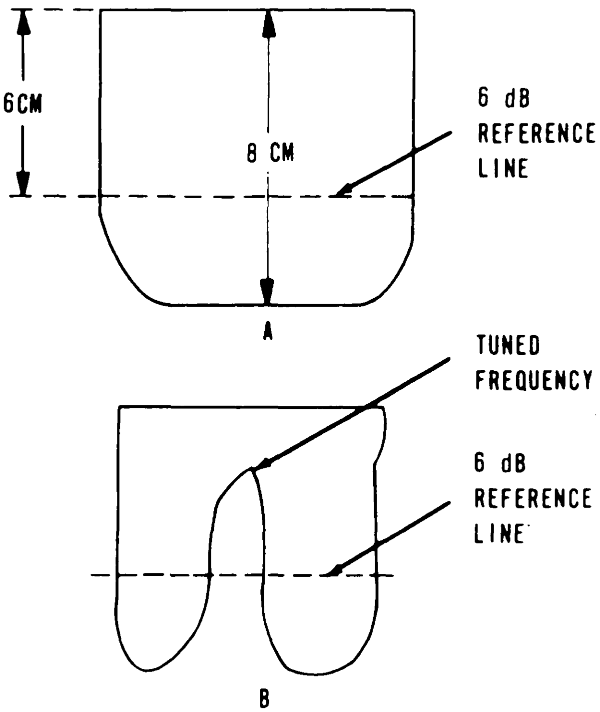


Figure 4-173. Radio Frequency Amplifier 38AR1, Output Stage Stability Check Waveforms.

1. Remove the control panel (front panel) of the unit under test (para. 2-77).

2. Loosen the drive chain idler (fig. 4-161) and slacken the chain.

3. Pull the chain free from the driver tube cathode sprocket.

4. Rotate the freed sprocket until a minimum reflected power indication is obtained on the power meter.

5. Replace the chain over the sprocket and tighten drive chain idler.

6. Connect the power meter to the forward port of the directional coupler and repeat steps *(g)* and *(h)* above.

7. Repeat step *(f)* above.

NOTE

It should not be necessary to readjust coupling probe C2.

(5) *Driver amplifier stability check.*

(a) Connect the test equipment as shown in A, figure 4-175.

(b) Set the sweep generator controls as follows:

Control	*Setting*
FREQ SELECTOR	CW MKR
VAR FREQ MKR	1000 MHz (on dial)

(c) Adjust the sweep generator RF POWER LEVEL for a power meter indication of +10 dBm minus the coupling factor of the directional coupler at 1000 MHz.

(d) Set the sweep generator for Δ sweep operation and adjust the VAR FREQ MKR and Δ FREQ controls for a sweep width of ±10 MHz centered around the 1000 MHz marker. Use internal markers.

(e) With the RETRACE control in the OFF position, adjust the oscilloscope for a display of 6 cm. Note this display on the graticule as the 3:1 VSWR reference. See A, figure 4-173.

(f) Connect the test equipment as in B, figure 4-175. Adjust the XMTR TUNE control around channel 1600 to center the unit under test response around the 1000 MHz marker. Connect the trombone line, C, figure 4-175. Do not adjust the sweep generator or oscilloscope controls.

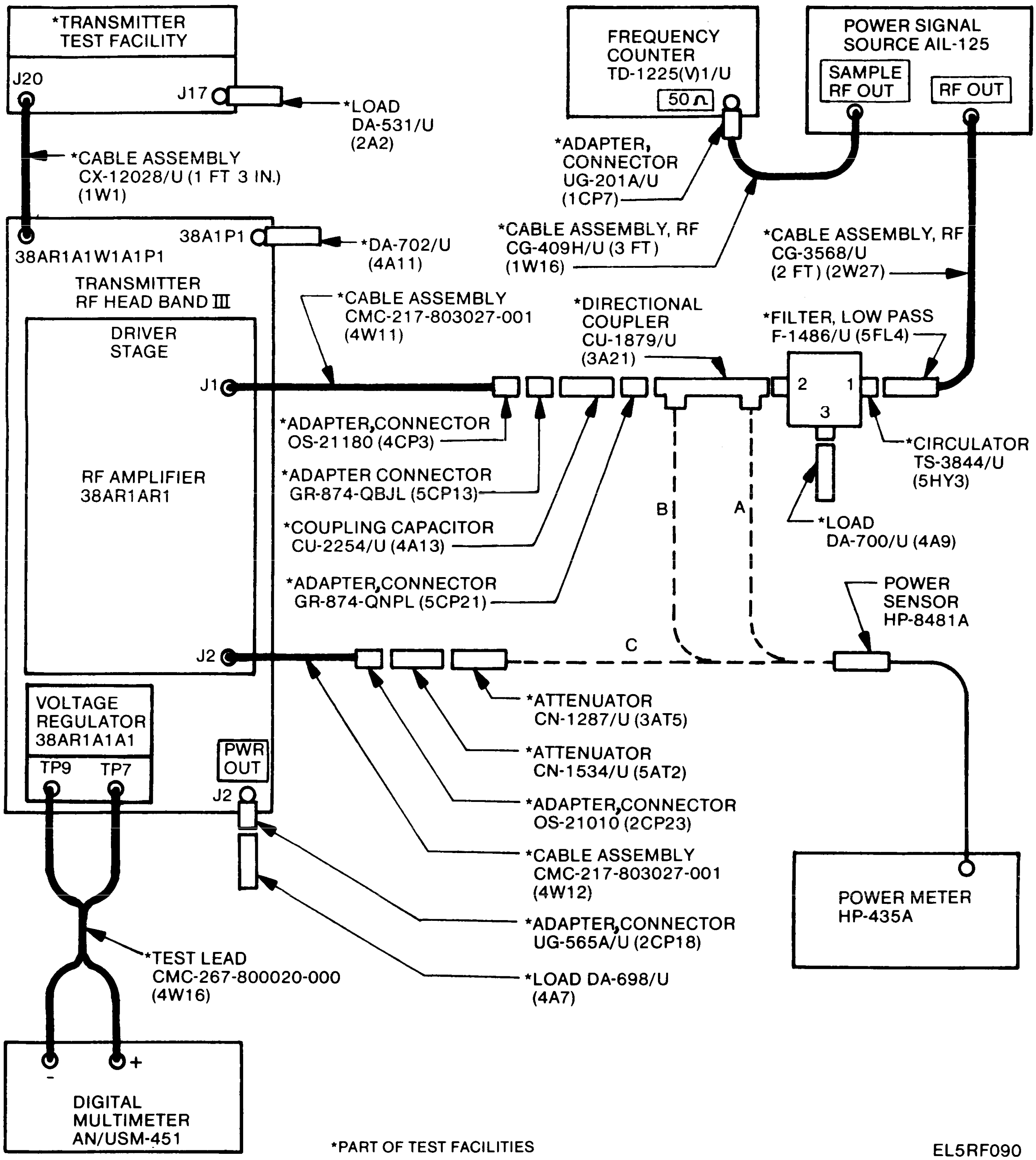


Figure 4-174. Radio Frequency Amplifier 38AR1, Driver Stage, Power Output and Input Match Checks, Test Setup.

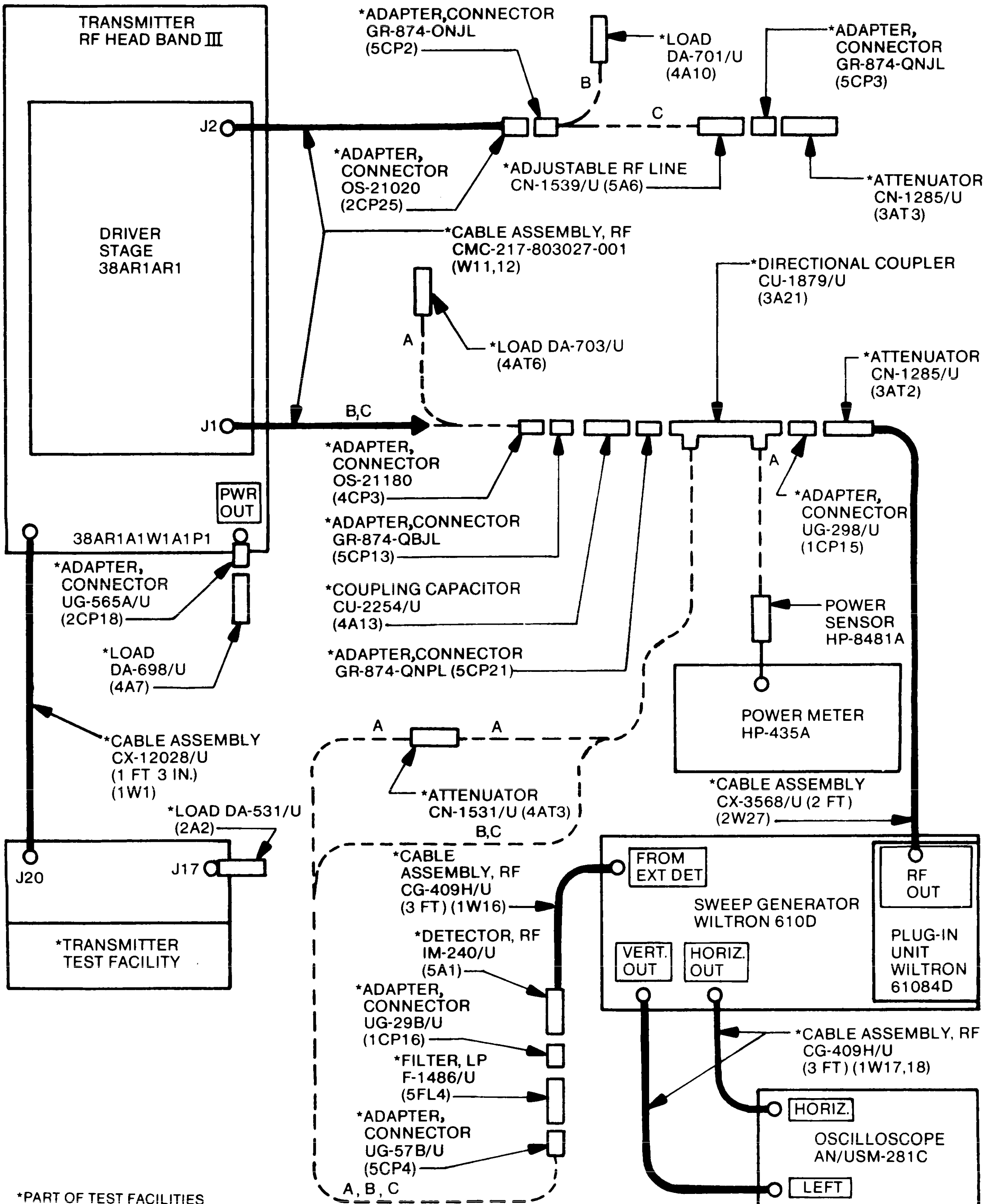


Figure 4-175. Radio Frequency Amplifier 38AR1, Driver Stage Stability Check, Test Setup.

(g) Adjust the trombone line between the maximum and minimum settings while observing the response on oscilloscope. The response should not exceed the reference line marked in *(e)* above (B, figure 4-173).

(h) Should be response be under the reference line at any point, proceed as follows:

1. Make a slight adjustment of driver amplifier output coupling probe C2 to bring the response peak above the reference line.

2. Temporarily substitute the dummy load DA-701/CJ for the trombone line. Rotate the XMTR TUNE control in the direction of channel 1400 to center the unit under test response around the 990 MHz marker. Adjust the sweep generator VAR FREQ MKR control to 990 MHz.

3. Reconnect the trombone line and repeat steps *(a)* through *(g)* above at 990 MHz.

4. Repeat steps *2.* and *3.* above at each 10 MHz sweep marker down to a frequency of 900 MHz.

5. Tighten the guide block retaining setscrews in the driver amplifier coupling probe,

(i) If the probe was adjusted in *(h)* above, repeat the driver amplifier power output and input match test (para. (4) above).

NOTE

Adjust only trimmer capacitor C4 to maximize output power. The coupling probe C2 and the XMTR TUNE control must not be readjusted.

(6) *Tuning and power output checks.*

(a) Connect the test equipment as shown in A, figure 4-176.

(b) Check, and reset if necessary, the frequency from the power signal source; the frequency should be 1000 MHz ±1 MHz.

(c) Adjust the output level of the power signal source to +20 dBm (100 mW) (power meter indication of +20 dBm minus the coupling factor).

(d) Set the XMTR TUNE control if necessary to maximize output power.

(e) Adjust the power signal source output level, if necessary, to obtain 14 Vdc ±1 V between TP4 and TP9 of 38AR1AlAl. Note that the input level to the unit under test should not exceed +21 dBm. The output power as indicated on the wattmeter should be 23 watts (+43.6 dBm) or greater.

(f) Set the transmitter test facility switch S12 to PWR OUT. Meter Ml should indicate at least 35 percent of full scale.

(g) Set S12 to REFL OUT. Meter Ml should indicate less than 5 percent of full scale.

(h) Disconnect the wattmeter from the PWR OUT connector. Meter Ml should indicate between 20 percent and 90 percent of full scale.

(i) Reconnect the wattmeter to the PWR OUT connector and repeat steps *(b)* through *(g)* above for the remaining channels listed below and set the power signal source to the frequency corresponding to the selected channel. Check that the required drive level does not exceed +21 dBm (+1 dBm power meter indication) and that the voltage between TP4 and TP9 does not exceed 15 V. The output power should be greater than 20 watts for all channels and the tape indication shall be within ±0.5 in. of the window centerline.

Test channel	*Frequency (MHz)*	*Typical cathode Vdc*	*Typical input power (mw)*	*Typical input power (+ dBm)*	*Typical input power (w)*	*Typical input power (+ dBm)*
990	695	12	125	21	39	45.9
1080	740	11	125	21	34	45.3
1160	780	14	100	20	35	45.5
1240	820	13	125	21	34	45.3
1320	860	10	125	21	29	44.6
1400	900	11	125	21	28	44.5
1480	940	14	100	20	29	44.6
1540	970	14	100	20	28	44.5
1600	1000	14	100	20	25	44.0

(7) *Metering and ALC checks.*

(a) Set the XMTR TUNE control to channel 1600.

(b) Tune the power signal source frequency to 1000 MHz ±1 MHz.

(c) Connect the rnultimeter (set to the 20 Vdc range) positive lead to TP4 and negative lead to TP9 of voltage regulator assembly 38AR1AlAl.

(d) Adjust the power signal source output level for +14 Vdc indicated on the multimeter.

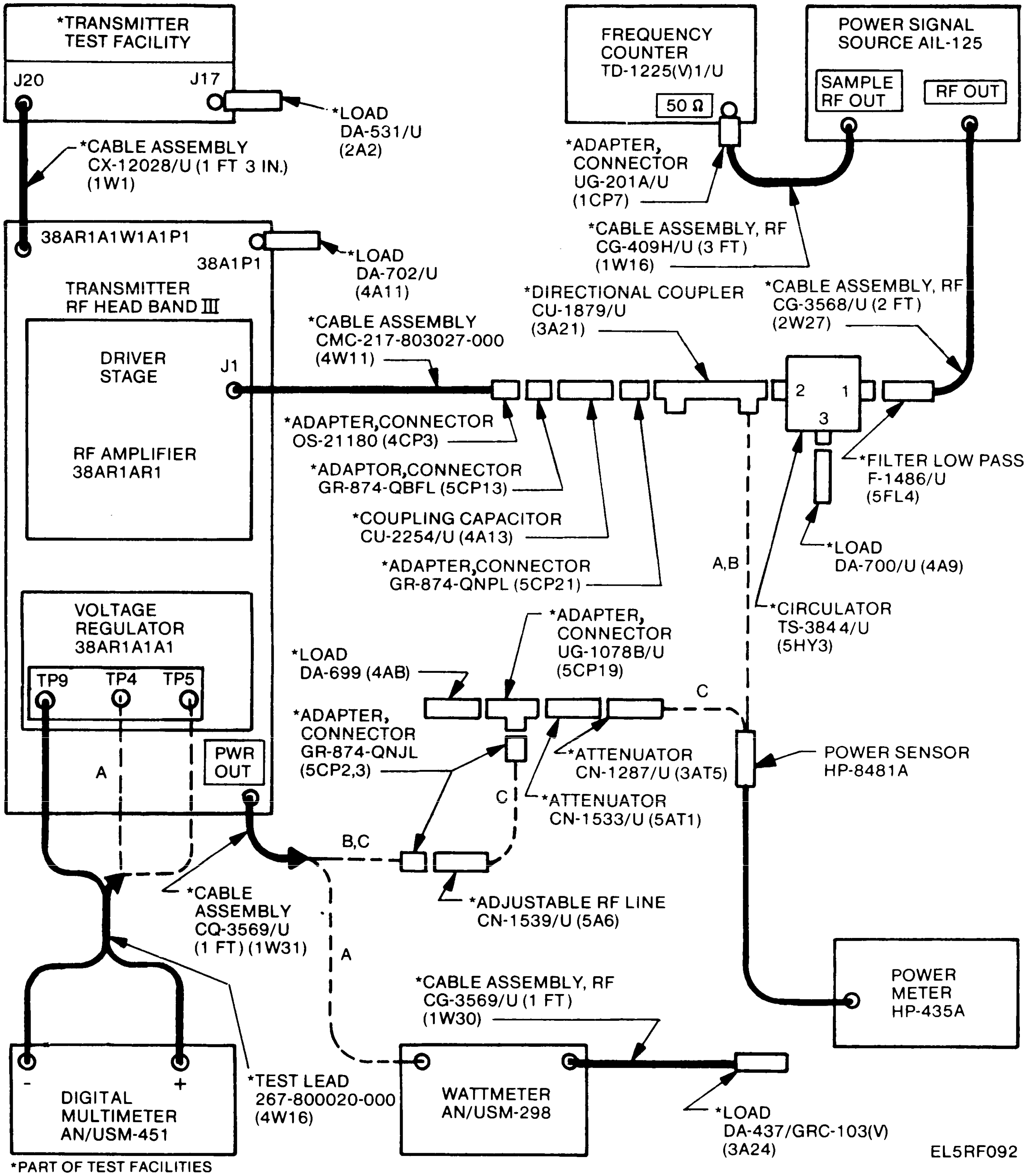


Figure 4-176. Radio Frequency Amplifier 38AR1, Tuning Power Output, ALC, and VSWR Checks, Test Setup.

(e) Set the transmitter test facility switch S12 to DRIVER; meter Ml should indicate between 40 percent and 60 percent of full scale.

(f) Increase the power signal source output level for +15 Vdc indicated on the multimeter.

(g) Connect the multimeter (set to the 10 MA DC range) TP5 (+) and TP9 (–). The multimeter should indicate 1 ma or greater.

(h) Adjust the power signal source output level for an output power of 20 watts from the unit under test, indicated on the wattmeter.

(i) Set the transmitter test facility switch S12 to PWR OUT. Meter Ml should indicate between 30 percent and 60 percent of full scale. Note Ml indication.

(j) Set S12 to REFL OUT. Meter Ml should indicate less than 5 percent of full scale.

(k) Disconnect cable from PWR OUT connector of assembly under test at the wattmeter. Connect the unterminated trombone line to the PWR OUT connector (B, figure 4-176).

(l) Set the transmitter test facility switch S12 to PWR OUT. Adjust the trombone line for Ml meter indication noted in step *(i)* above.

(m) Set S12 to REFL OUT. Meter Ml should indicate between 55 percent and 75 percent of full scale.

(8) *Output VSWR check.*

(a) Disconnect the trombone line and restore the test setup as shown in A, figure 4-176.

(b) Repeat *(7)(a)* through(d) above.

(c) Adjust the XMTR TUNE control for maximum indication on the wattmeter. If necessary, readjust the power signal source output level to maintain +14 Vdc multimeter indication.

(d) Connect the power meter and trombone line to the assembly under test as shown in C, figure 4-176.

(e) Adjust the trombone line for maximum power meter indication. Note this indication.

(f) Adjust the trombone line for minimum power meter indication. The power meter should indicate no more than 1.6 dB below the value noted in *(e)* above (1.8: 1 VSWR).

(g) Repeat steps *(a)* through *(f)* above for channels 1320 and 990 with power signal source frequencies of 860 MHz and 695 MHz respectively.

(h) Set the transmitter test facility switch S13 to the off position.

c. Troubleshooting (FO-9, FO-51, or FO-55 and, Figure 2-91 of TM 11-5820-540-30).

Symptom	*Probable cause*	*Checks and corrective measures*
1. Below normal or no meter Ml indication in *b(2)(d)* above.	*a.* Defective resistor assembly 38AR1A1A2.	*a.* Set switches S13 and S1 on transmitter test facility to off. Disconnect the 600 V line for E1 of resistor assembly 38AR1A1A2. Check and replace 38AR1AlA2 if shorting to ground (440 K ohms).
	b. Defective radio interference filter 38AR1A1FL2.	*b.* Remove the 600 V line from E2 and E1 of 38AR1AlFL2. Check and replace 38AR1A1AFL2 if shorting to ground (para. 2-72).
	c. 600 V line shorting to ground.	c. Check and replace 38AR1A1W1A1FL1 if shorting to ground.
	d. C3, C10 or C14 shorting to ground (fig. 4-161) or 38ARlARlC7.	*d.* Check C3, C10, C7 and C14 for short to ground. Replace as required.
2. Meter indication abnormal in *b(1)(f) above.*	*a.* Defective wiring.	*a.* Check the continuity between 38AR1A1W1A11 and 38AR1A1W1J5.
	b. Defective voltage regulator assembly 38AR1A1A1.	*b.* Test 38AR1A1A1 as described in paragraph 4-65.
	c. Defective driver or output tube (Vl, V2).	*c.* Replace V1 and/or V2 as required.
3. Power level low in *b(2)(h)* above.	Defective output tube V2,	Replace output tube.
4. Meter indication out of specified limits in *b(4)(e)* or *(f)* above.	*a.* Defective driver tube V1.	*a.* Replace driver tube.
	b. Defective voltage regulator assembly 38AR1A1A1.	*b.* Test 38AR1A1Al as described in paragraph 4-65.
5. Low output in *b(6)(e)* above.	*a.* Defective low-pass filter 38AR1AlFL1.	*a.* Test 38AR1A1FL1 as described in paragraph 4-66.
	b. Defective power monitor 38AR1A2.	*b.* Test 38AR1A2 by substitution.

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
6. Meter Ml indication out of specified limits when test facility switch S12 set to PWR OUT or REFL PWR.	Defective power monitor 38AR1A2.	Test 38AR1A2 by substitution.
7. Alc voltage indication abnormal in *b(7)(g)* above.	Defective voltage regulator assembly 38AR1A1A1.	Test 38AR1A1A1 as described in paragraph 4-65.
8. Abnormal VSWR indication in *b(8)(f)* above.	Loose or defective cable connections between stages.	Check cable connections for tightness and then check the cable connectors if necessary.

4-65. Voltage Regulator Assembly 38AR1A1A1

Voltage regulator assembly 38AR1A1A1 is identical to voltage regulator assembly 37AR1AlAl. Refer to paragraph 4-40 for tests and alinement procedures.

4-66. Lowpass Filter 38AR1A1FL1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter, TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set MK-l173(V)2/ GRM-96(V)2	Accessory kit, test facilities set
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator Wiltron 610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Oscilloscope AN/USM-281/C	Oscilloscope
Generator, Signal HP-8640B	Signal generator No. 1
Power Meter HP-435A	Power meter
Power Sensor HP-8484A	Power sensor
Generator, Signal AN/USM-213	Signal generator No. 2
Test Facility, Radio Frequency Module TS-3837(V)2/ GRM-95(V)2	Accessory kit, test facilities set

b. Test Procedures.

(1) *VSWR checks.*

(a) Connect the test equipment as shown in A, figure 4-177.

(b) Adjust the sweep generator controls to obtain a sweep between 695 and 1000 MHz.

(c) Adjust the oscilloscope controls and the sweep generator output level control to obtain a convenient display on the oscilloscope.

(d) Mark the resultant display on the graticule of the oscilloscope, This display represents a VSWR of 1:1.40.

(e) Connect the test equipment as shown in B, figure 4-177. The VSWR displayed on the oscilloscope should not exceed the line marked in *(d)* above.

(f) Reverse the unit under test (i.e., connect the dummy load to J1 and connect J2 to the VSWR indicator, The VSWR displayed on the oscilloscope should not exceed the line marked in *(d)* above,

(2) *Insertion loss in the passband check.*

(a) Connect the test equipment as shown in A, figure 4-178.

(b) Set the signal generator frequency to 695 MHz. Adjust the signal generator rf output for –5 dB as indicated on the power meter.

(c) Connect the test equipment as shown in B, figure 4-178.

(d) The insertion loss should not exceed 0.5 dB, (power meter indication of –5.5 dBm).

(e) Repeat steps *(a)* through *(d)* above for a frequency of 1000 MHz.

(3) Rejection check.

(a) Connect the test equipment as shown in A, figure 4-179.

(b) Adjust the signal generator frequency to 1390 MHz with an output level setting of –40 dBm. Note the indication obtained on the power meter.

(c) Connect the test equipment as shown in B, figure 4-179.

(d) Set the signal generator output level to 0 dBm.

(e) The power meter indication should be lower than the indication recorded in *(b)* above.

(f) Repeat *(a)* through *(e)* above at signal generator frequency of 2350 MHz.

4-67. Radio Interference Filter 38AR1A1FL2

Radio interference filter 38AR1A1FL2 is identical to radio interference filter 37AR1A1FL2. Refer to paragraph 4-42 for test procedures.

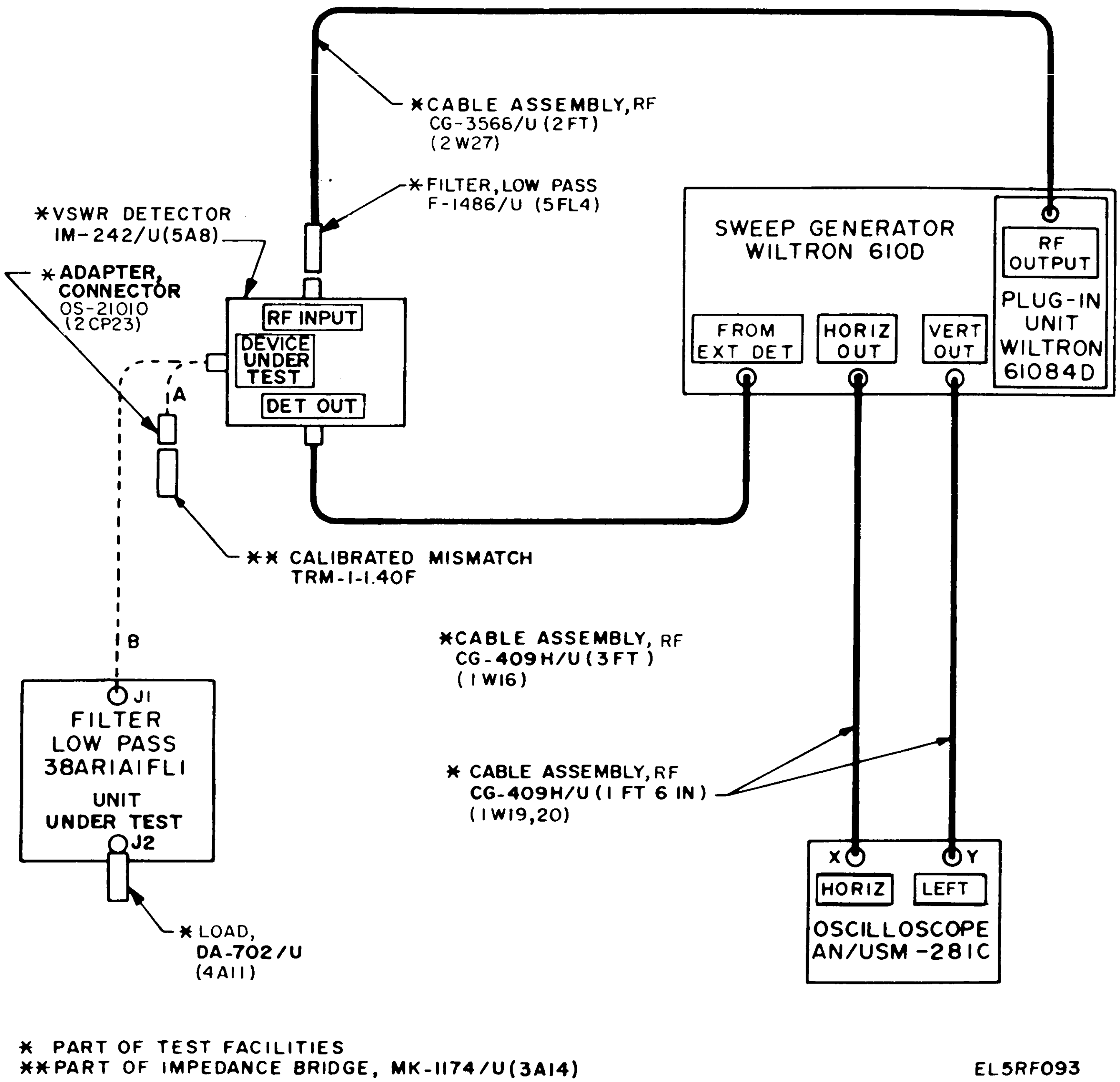


Figure 4-177. Lowpass Filter 38AR1A1FL1, VSWR Check, Test Setup.

4-68. Connector Filter Assembly 38AR1A1WA1

This assembly (TM 11-5820-540-30) is tested in the same manner as connector-filter assembly 6AR1A2A3. Refer to paragraph 4-43 for test and repair procedures.

4-69. Circulator 38AR1HY1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Test Facility Receiver TS-2867(V)2/GRM-95(V)2	Test facility receiver
Accessory Kit, Test Facilities Set MK-l173(V)2/ GRM-95(V)2	Accessory kit, test facilities set
Test Facility Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility radio frequency modules

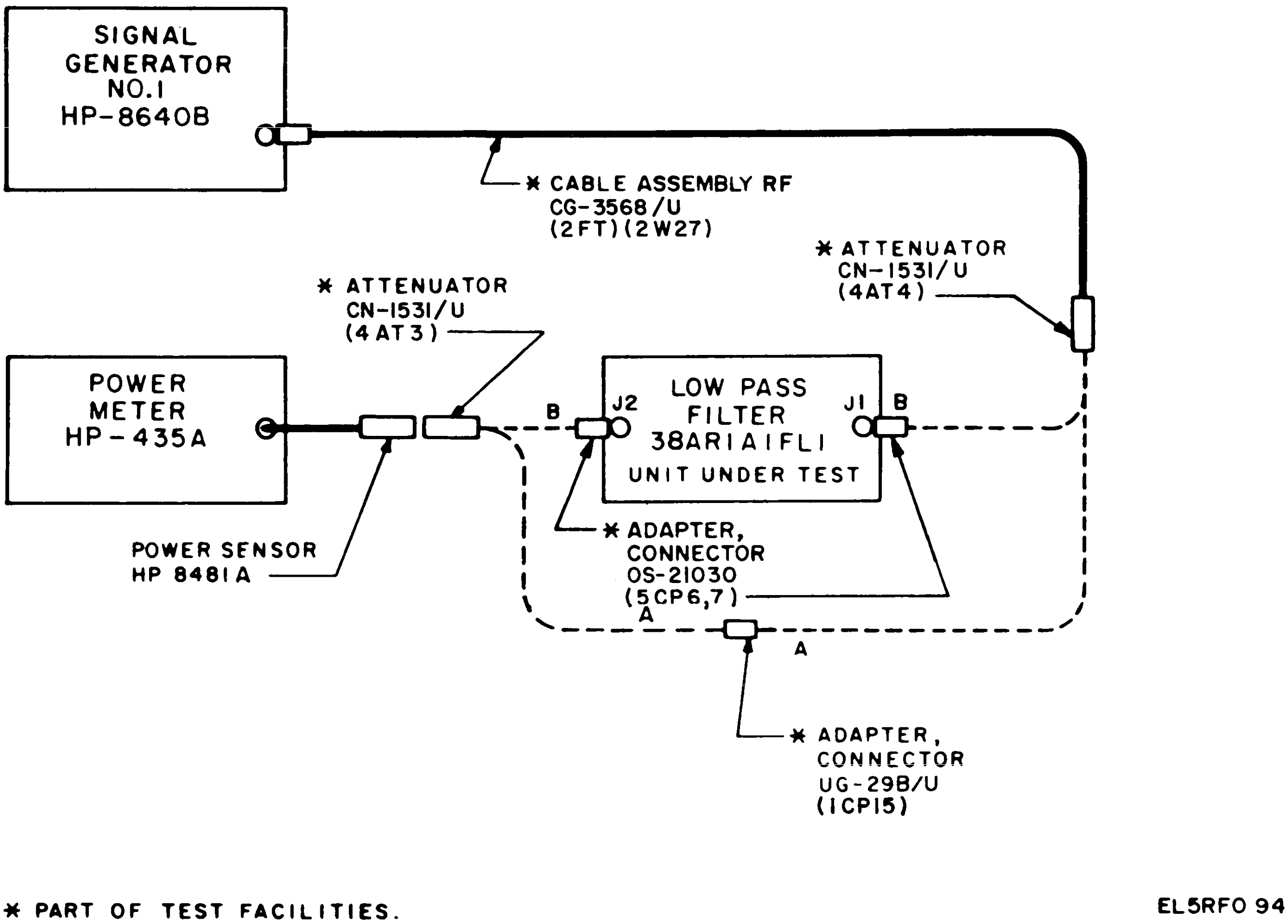


Figure 4-178. Lowpass Filter 38AR1A1FL1, Insertion Loss Check, Test Setup.

Equipment	*Common name*
Accessory Kit,Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator Wiltron 610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Oscilloscope AN/USM-281C	Oscilloscope
Generator, Signal HP-8640B	Signal generator
Power Meter HP-435A	Power meter
Power Sensor HP-8481A	Power sensor

b. Test Procedure.

(1) *VSWR check.*

NOTE

The unit under test should beat least 3/8 inch from any metal.

(a) Connect the test equipment as shown in A, figure 4-180.

(b) Set the sweep generator controls to cover the frequency range 695 to 1000 MHz.

(c) Adjust the oscilloscope controls and the sweep generator output level control to obtain a convenient display.

(d) Mark the resultant display on the graticule of the oscilloscope. This display represents a VSWR of 1:1.50.

(e) Connect the test equipment as shown in B, figure 4-180. The VSWR displayed should not exceed the line marked in *(d)* above.

(f) Disconnect the dummy load from J3 and the VSWR detector from J1 of the unit under test.

(g) Connect the dummy load to J1 and the VSWR detector to J3. The VSWR displayed should not exceed the line marked in *(d)* above.

(h) Disconnect the dummv load from J2 and the VSWR detector from J3.

(i) Connect the dummy load to J3 and the VSWR detector to J2. The VSWR displayed should not exceed the line marked in *(d)* above.

(2) *Insertion loss check.*

(a) Connect the test equipment as shown in A, figure 4-181.

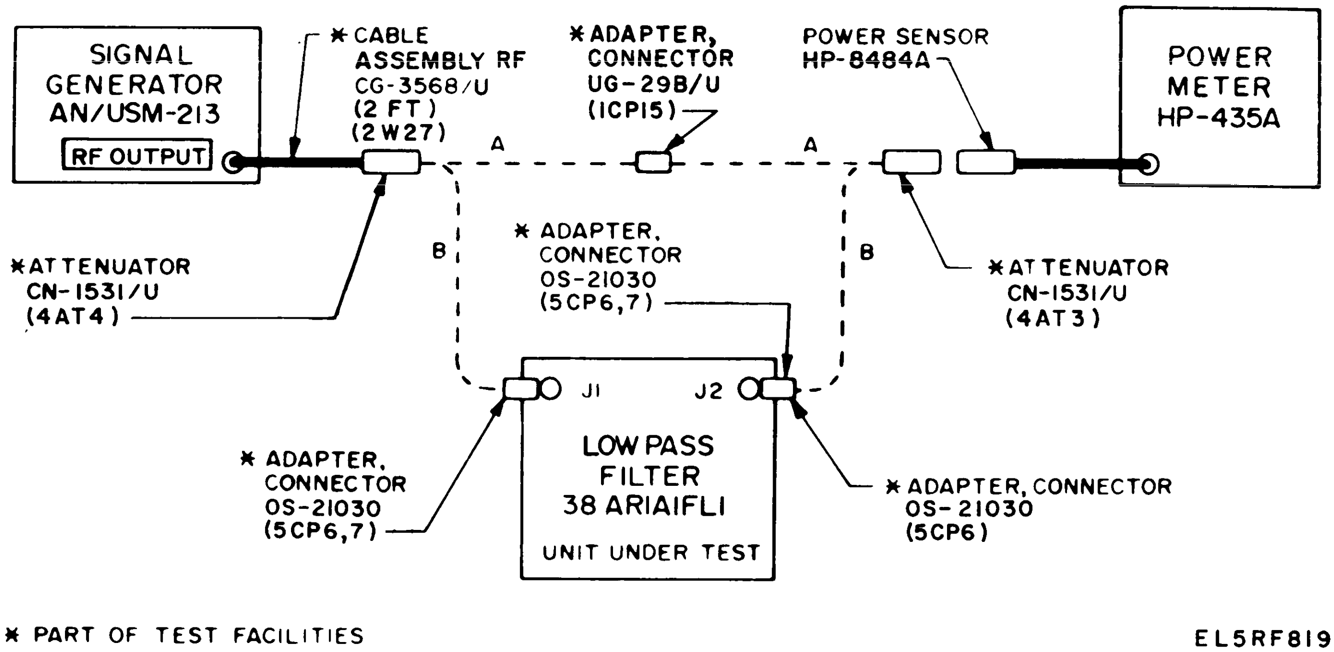


Figure 4-179. Lowpass Filter 38AR1A1FL1, Rejection Check, Test Setup.

(b) Adjust the signal generator controls to provide a frequency of 1000 MHz and adjust the rf power level to indicate 0 dBm on the power meter.

(c) Connect the test equipment as shown in B, figure 4-181. The power meter indication should be within 0.6 dB of the reference level in *(b)* above.

(d) Check the insertion loss between J2 and J3 of the unit under test as follows (modifying test setup, B, fig. 4-181).

1. Connect the dummy load to J1.

2. Connect the signal generator to J2.

3. Connect the power sensor to J3.

4. Repeat step *(c)* above.

(3) *Isolation test.*

(a) Connect the test equipment as shown in A, figure 4-181.

(b) Adjust the signal generator controls to provide a frequency of 1000 MHz and adjust the rf power level for an indication of 0 dBm on the power meter.

(c) Check the isolation between J2 and J1 of the unit under test as follows (modifying test setup, B, fig. 4-181):

1. Connect the signal generator to J2.

2. Connect the power sensor to J1.

(d) The power meter should indicate –12 dBm maximum. (This is equivalent to a unit under test isolation of 12 dB or greater.)

(e) Check the isolation between J1 and J3 of the unit under test as follows (modifying test setup, B, fig. 4-181):

1. Connect the dummy load to J2.

2. Connect the signal generator to J1.

3. Connect the power sensor to J3.

4. Repeat step *(d)* above.

4-70. Electrical Dummy Load 38AR1AT1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility Transmitter TS-2866(V)2/GRM-95(V)2	Test facility transmitter
Accessory Kit Test Facilities Set	Accessory kit, test facilities set
Accessory Kit Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, test facility set
Sweep Generator Wiltron 610D (with Plug-in Unit Wiltron 61084D)	Sweep generator
Oscilloscope AN/USM-281C	Oscilloscope

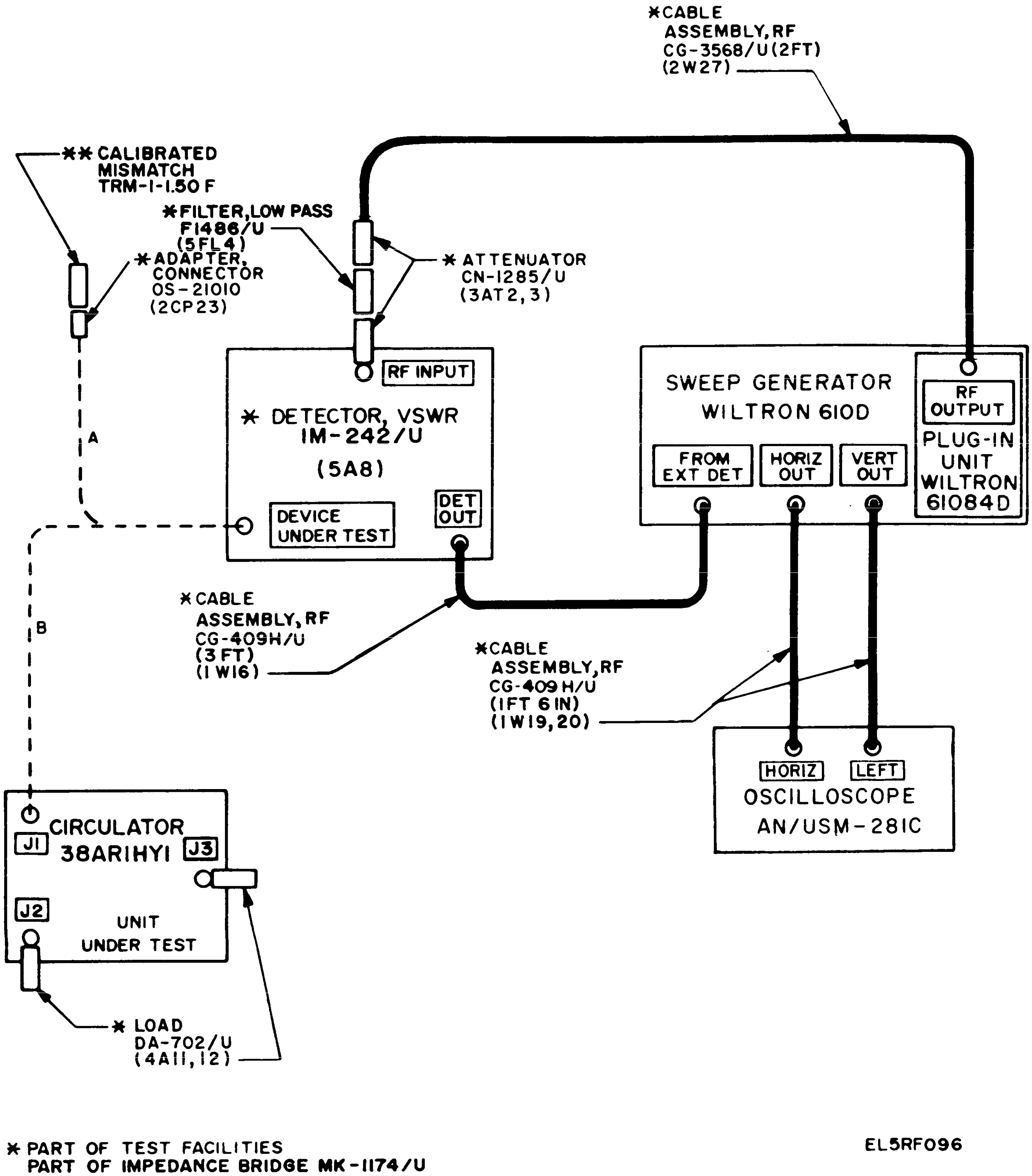


Figure 4-180. Circulator 38AR1HY1, VSWR Check, Test Setup

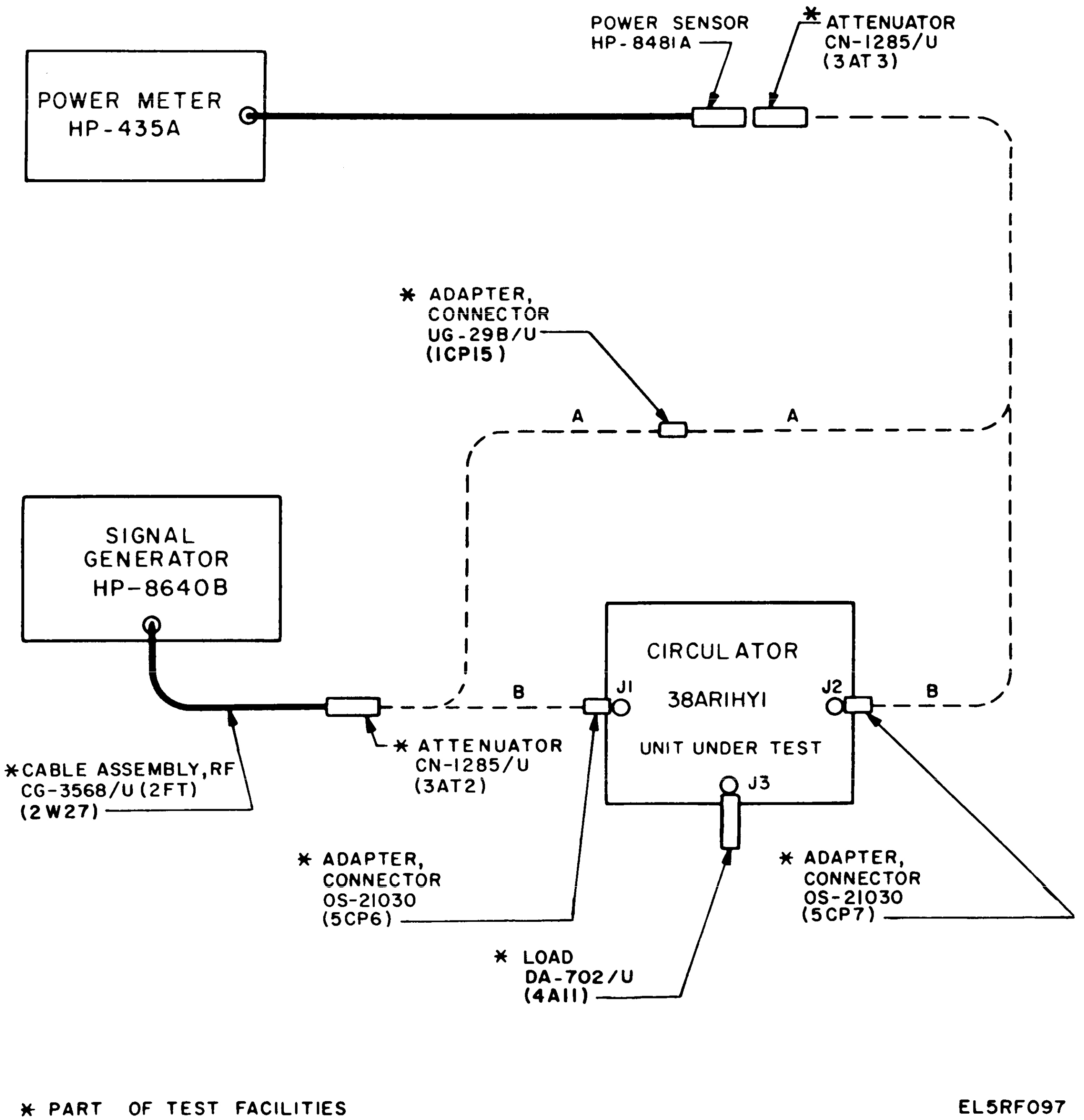


Figure 4-181. Circulator 38AR1HY1, Insertion Loss and Isolation Check, Test Setup,

b. Test Procedure-VSWRCheck.

(1) Connect the test equipment as shown in A, figure 4-182.

(2) Adjust the sweep generator controls to obtain a sweep between 695 MHz and 1000 MHz.

(3) Adjust the sweep generator controls and the oscilloscope output level control to obtain a convenient display on the oscilloscope.

(4) Mark the resultant display on the graticule of the oscilloscope as the l:l.3 VSWR calibration line.

(5) Connect the test equipment as show in B, figure 4-182. The VSWR displayed on the oscilloscope should be less than 1:1.3 (the response should not exceed the calibration line).

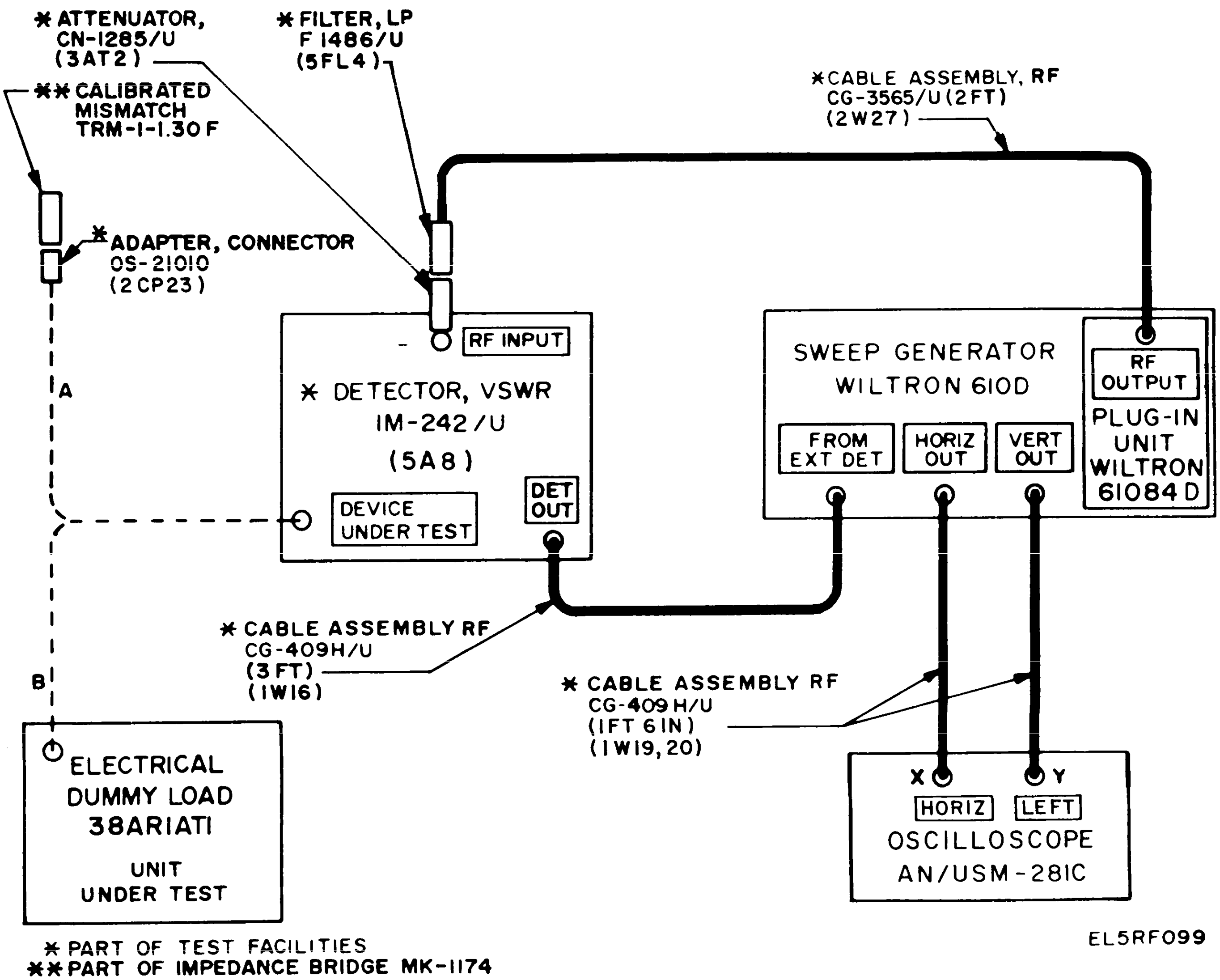


Figure 4-182. Dummy Load Electrical 38AR1AT1, VSWR Check, Test Setup.

Section IV. AMPLIFIER-CONVERTER AM-4319( )/GRC-103(V) AND AMPLIFIER-FREQUENCY MULTIPLIER AM-4323/GRC-103(V)

4-71. Amplifier-Converter AM-4319/GRC-103(V); Band IV Receiver Rf Head (Unit 39)

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Test Facility, Receiver, TS-2867(VJ2/GRM-95(V)2	Receiver test facility
Accessory Kit, Test Facilities Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, band 2,3,4

Equipment	*Common name*
Frequency Counter, TD-1225(V)l/U	Frequency counter
Generator, Signal, AN/USM-213	Signal generator
Generator, Noise, HP-346B, Option 1.	Noise generator
Meter, Power, HP-435A	Power meter
Power Sensor HP-8481A and HP-8484A	Power sensor
Voltmeter, Electronic, ME-459/U	VTVM
Voltmeter, Vector, ME-512/U	Vector voltmeter
Power Signal Source AIL 125	Power source
Power Supply, HP-6205B	Power supply
Power Amplifier, Logmetrics A200L	Power amplifier
Attenuator, 3 dB, 50 W Weinschel MDL 25-3-34	3 dB, 50 W attenuator

NOTE

Set power supply PP-6304/GRM-95(V) to 115 Vac as indicated on its panel voltmeter. Maintain this indication throughout the following procedures.

b. Test Procedures.

(1) *Receiver setability.*

(a) Remove the dust cover from the unit to be tested.

NOTE

Test and adjust if. amplifier 39AR2 as described in paragraph 4-34 before performing the following procedures.

(b) Connect the test equipment as in A, figure 4-183.

(c) Set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S7	AGC
S8	OFF
S6	MULTIPLIER

(d) On the unit under test, set the RCVR CHANNEL and RCVR SIG controls to channel 3299. Set the XMTR DUPL control at least 100 channels away from the RCVR CHANNEL setting.

(e) On the signal generator, press the rf switch and set the frequency control to 1849.5 MHz.

(f) Press the ALC switch on the signal generator, and set the signal generator ALC CAL OUTPUT control for 0 dBm on the internal level meter. Set the variable attenuator clockwise to -74 dBm.

(g) Adjust the MULT PEAK control on the unit under test for the maximum indication on receiver test facility meter Ml. The meter shall indicate at least 20 percent of full scale deflection.

(h) Press and hold the MULT DRIVER switch on the unit under test. Meter Ml on the receiver test facility shall indicate 10 to 90 percent of full scale deflection.

(i) Set switch S6 on the receiver test facility to REC SIG.

(j) Adjust the RCVR SIG control for a maximum indication on meter Ml.

(k) Fine tune the RCVR SIG control for a minimum indication on the VTVM. The VTVM shall indicate less than –44 dBm.

(l) Repeat *(c)* through *(j)* above for the channel settings and signal generator frequencies listed below.

RCVR CHANNEL and RCVR SIG channel settings	*Signal generator frequency (MHz)*
3299	1849.5
3050	1725.0
2904	1652.0
2831	1615.5
2612	1506.0
2577	1488.5
2300	1350.0

(2) *High signal alarm and preliminary protection circuit test.*

(a) Remove the module cover from frequency converter 39A2.

(b) With the unit under test tuned to channel 2300, set the signal generator output level to –74 dBm. Note the VTVM indication.

(c) Using the allocated digital multimeter, adjust the DC power supply to 0.7 Vdc. Connect the negative terminal to the unit under test chassis and the positive terminal to contact E9 on circuit board 39A2A1 (fig. 4-194). The HIGH SIGNAL lamp on the test facility may light.

(d) Increase the signal generator output level until the VTVM indication is the same as the indication noted in *(b)* above. The signal generator output level should be greater than -64 dBm.

(e) Disconnect the DC power supply and replace the cover onto frequency converter 39A2.

CAUTION

Do not press the power amplifier RF POWER switch to ON until the output is connected. Damage to power amplifier may occur.

(f) With variable attenuator CN-1532/U attenuation control set to minimum, connect the equipment as shown in B, figure 4-183. Set power amplifier GAIN control fully clockwise.

(g) Adjust the signal generator for an output level of +5 dBm at 1350 MHz (see *b(1)(e)* and *(f)* above).

(h) Press the power amplifier RF POWER switch ON, and slowly increase the variable attenuator output level until the HIGH SIGNAL lamp on the test facility lights. The power meter should indicate less than +20 dBm.

(i) Slowly decrease the variable attenuator output level until the HIGH SIGNAL lamp goes out. The power meter indication should be greater than – 15 dBm.

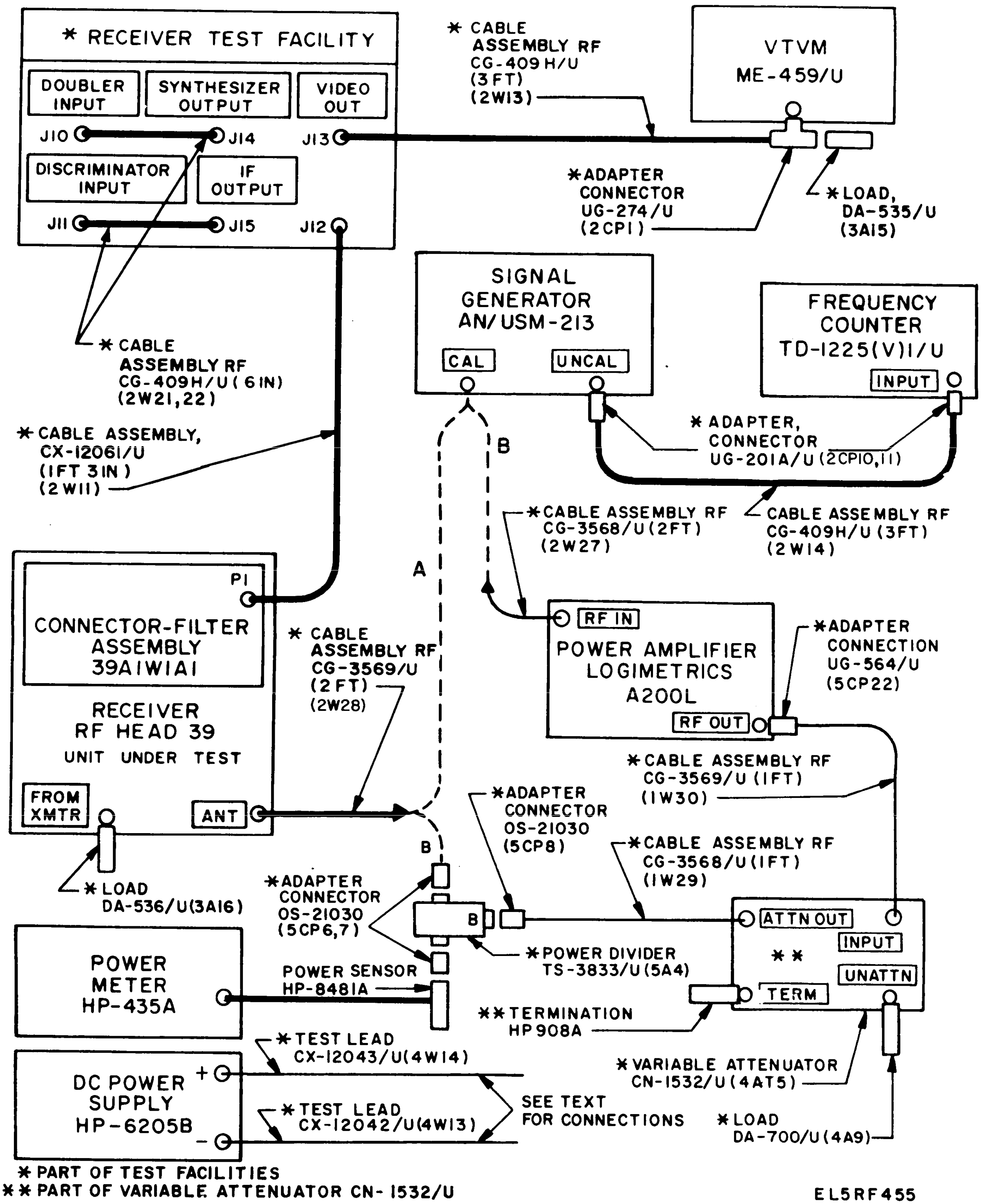


Figure 4-183. Band IV Receiver Rf Head, Receiver Setability Test, Preliminary Protection Circuit Check and High Signal Alarm Check, Test Setup.

(j) Press the power amplifier RF POWER switch to OFF.

(k) Repeat steps *(f)* through *(j)* above with the rf head and signal generator tuned to the channels and frequencies listed below.

Channel	*Frequency*
2800	1600 MHz
3249	**1849.5** MHz

NOTE

Tune the rf head as described in paragraph *b(1)(b)* through *(j)* above.

(3) *Receiver and transmitter duplexer VSWR response test.*

(a) Connect the test equipment as shown in A, figure 4-184.

(b) Adjust the signal generator for a -50 dBm power meter indication at a frequency of 1849.5 MHz.

(c) Connect the test equipment as shown in B, figure 4-184.

(d) Set the RCVR SIG control of the unit under test to channel 3299. Set the XMTR DUPL control at least 100 channels away from the RCVR CHANNEL setting. Fine tune the RCVR SIG control for a minimum indication on the power meter. The power meter should indicate less than -55 dBm (equivalent to a VSWR of 3.5:1).

(e) Turn the RCVR SIG control of the unit under test clockwise until the power meter indicates –55 dBm. Note the position of the RCVR SIG control tuning knob.

(f) Turn the RCVR SIG control of the unit under test counterclockwise until the power meter indicates –55 dBm. Note the position of the RCVR SIG control tuning knob.

(g) Set the RCVR SIG control halfway between the two positions noted in *(e)* and *(f)* above. The RCVR CHANNEL indication should be within 1/2 inch of the centerline of the window.

(h) Set the signal generator to 1849.5 MHz as indicated on the frequency counter.

(i) Slowly increase the signal generator frequency above 1849.5 MHz until the power meter indicates -55 dBm. Record the frequency as indicated on the frequency counter.

(j) Slowly decrease the signal generator frequency below 1849.5 MHz until the power meter indicates -55 dBm. Record the frequency as indicated on the frequency counter. The difference between this frequency and the frequency recorded in *(i)* above should be not less than 3 MHz. Reset the signal generator frequency to 1849.5 MHz as indicated on the frequency counter.

(k) Set the XMTR DUPL control of the unit under test to channel 3299. Set the RCVR SIG control at least 100 channels away from the XMTR DUPL setting. Fine tune the XMTR DUPL control for a minimum indication on the power meter. The power meter should indicate less than –59.5 dBm.

(l) Turn the XMTR DUPL control clockwise until the power meter indicates -59.5 dBm. Note the position of the XMTR DUPL control tuning knob.

(m) Turn the XMTR DUPL control counterclockwise until the power meter indicates –59.5 dBm. Note the position of the XMTR DUPL control tuning knob.

(n) Set the XMTR DUPL control halfway between the two positions noted in *(l)* and *(m)* above. The XMTR CHANNEL indication should be within 1/2 inch of the centerline of the window.

(o) Set the signal generator to 1849.5 MHz as indicated on the frequency counter.

(p) Slowly increase the signal generator frequency above 1849.5 MHz until the power meter indicates –59.5 dBm. Record the frequency as indicated on the frequency counter.

(q) Slowly decrease the signal generator frequency below 1849.5 MHz until the power meter indicates –59.5 dBm. Record the frequency as indicated on the frequency counter. The difference between this frequency and the frequency recorded in *(p)* above should not be less than 2 MHz.

(r) Repeat paragraphs *(a)* through *(q)* above for the following equipment settings:

RCVR SIG, XMTR DUPL (channel)	*Signal generator (MHz)*
2300	*1350*
2400	*1400*
2500	*1450*
2600	*1500*
2700	*1550*
2800	*1600*
2900	*1650*
3000	*1700*
3100	*1750*
3200	*1800*
3299	*1849.5*

(4) *AGC test.*

(a) Disconnect 39A1W1A1P2 from J1 of 39AR2 and connect the test equipment as shown in figure 4-185.

(b) Adjust the signal generator, using the internal level meter and attenuator to obtain a level of -80 dBm at a frequency of 1350 MHz. (See *b(1)(e)* and *(f)* above.)

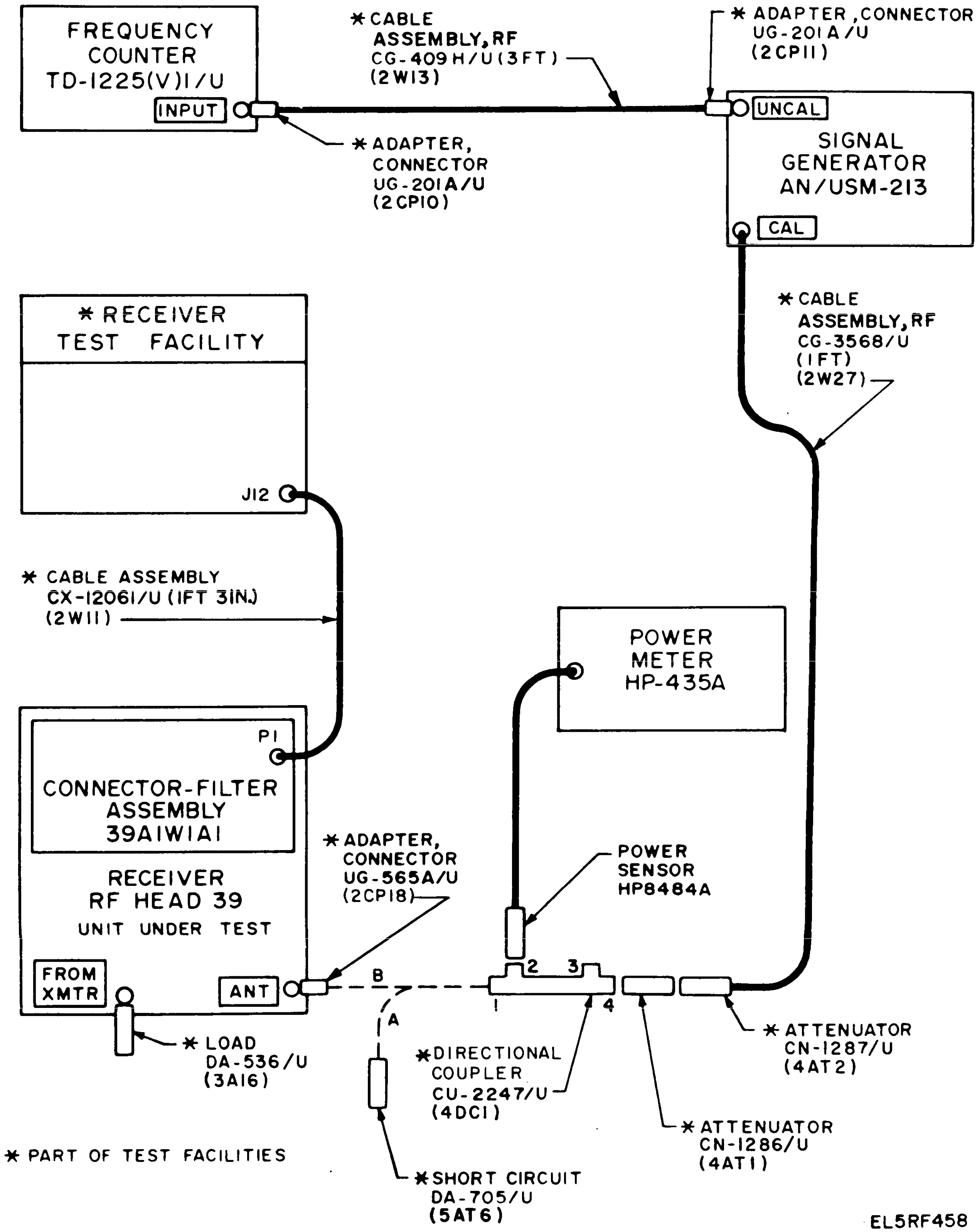


Figure 4-184. Band IV Receiver Rf Head, Receiver and Transmitter Duplexer VSWR Response, Test Setup.

(c) Set the following receiver test facility switches as indicated below:

Switch	*Position*
S1	ON
S5	S6
S 6	MULTIPLIER
S 7	AGC
S 8	OFF

(d) Set the RCVR CHANNEL and RCVR SIG control of the unit under test to channel 2300. Set the XMTR DUPL control at least 100 channels away from the RCVR CHANNEL setting.

(e) Adjust the MULT PEAK control of the unit under test for the maximum indication on receiver test facility meter Ml.

(f) Tune the RCVR SIG control for a minimum indication on the VTVM.

(g) Set the vector voltmeter FREQ RANGE and CHANNEL controls for 30 MHz channel A operation with APC locked.

(h) Note the vector voltmeter AMPLITUDE indication.

(i) Set the signal generator ATTENUATION to 50 dB, while maintaining the frequency at 1350 MHz. Note the vector voltmeter AMPLITUDE indication. The indication shall not be more than 13 dB above the indication noted in *(h)* above.

(j) Repeat *(b)* through *(i)* above for the following equipment settings:

RCVR CHANNEL, RCVR SIG (channel)	*Signal generator (MHz)*
2300	*1350.0*
2612	*1506.0*
2904	*1652.0*
3299	*1849.5*

(k) Disconnect power divider TS-3833/U from the unit under test and reconnect cable 39A1W1A1P2 to J1 of 39AR2.

(5) *Transmitter duplexer loss and power monitor check.*

(a) Connect the equipment as shown in B, figure 4-186.

(b) Set the power signal source controls as follows:

Control	*Position*
FREQ RANGE	HIGH
MODULATION	CW
RF OUTPUT ATTENUATOR	MINIMUM (full CCW)

(c) Set the PLATE and CATHODE counters for 1350 MHz on the power signal source (see chart on front panel).

(d) Switch ON power signal source, and wait for POWER lamp to light.

(e) Adjust the RF OUTPUT ATTENUATOR for an output level indication of +10 dBm on the power meter. If necessary, slightly readjust CATHODE, PLATE and COUPLING controls for a peak output (+11.9 dBm) at 1350 MHz ±0.1% frequency counter indication.

(f) Connect the equipment as shown in A, figure 4-186. Note the power meter indication.

(g) Tune the XMTR DUPL control to channel 2300. Set the RCVR SIG control at least 100 channels away from the XMTR DUPL setting.

(h) Connect the equipment as shown in D, figure 4-186.

(i) Slightly readjust the XMTR DUPL control to obtain a maximum power meter indication. Set the power signal source RF OUTPUT ATTENUATOR for a +10 dBm power meter indication (maintain output frequency at 1350 MHz ±0.1%).

(j) Connect the equipment as shown in C, figure 4-186. The power meter indication should not be greater than 1.9 dB above the indication noted in *(f)* above (less than 1.9 dB insertion loss at 10 W output).

(k) Connect the equipment as shown in D, figure 4-186.

(l) If necessary, reset the power signal source RF OUTPUT ATTENUATOR for a power meter indication of +10 dBm.

(m) Set receiver test facility switch S6 to XMTR PWR. Test facility meter Ml should indicate 40 to 60 percent.

(n) Set receiver test facility switch S6 to REFL PWR. Test facility meter Ml should indicate less than 15 percent.

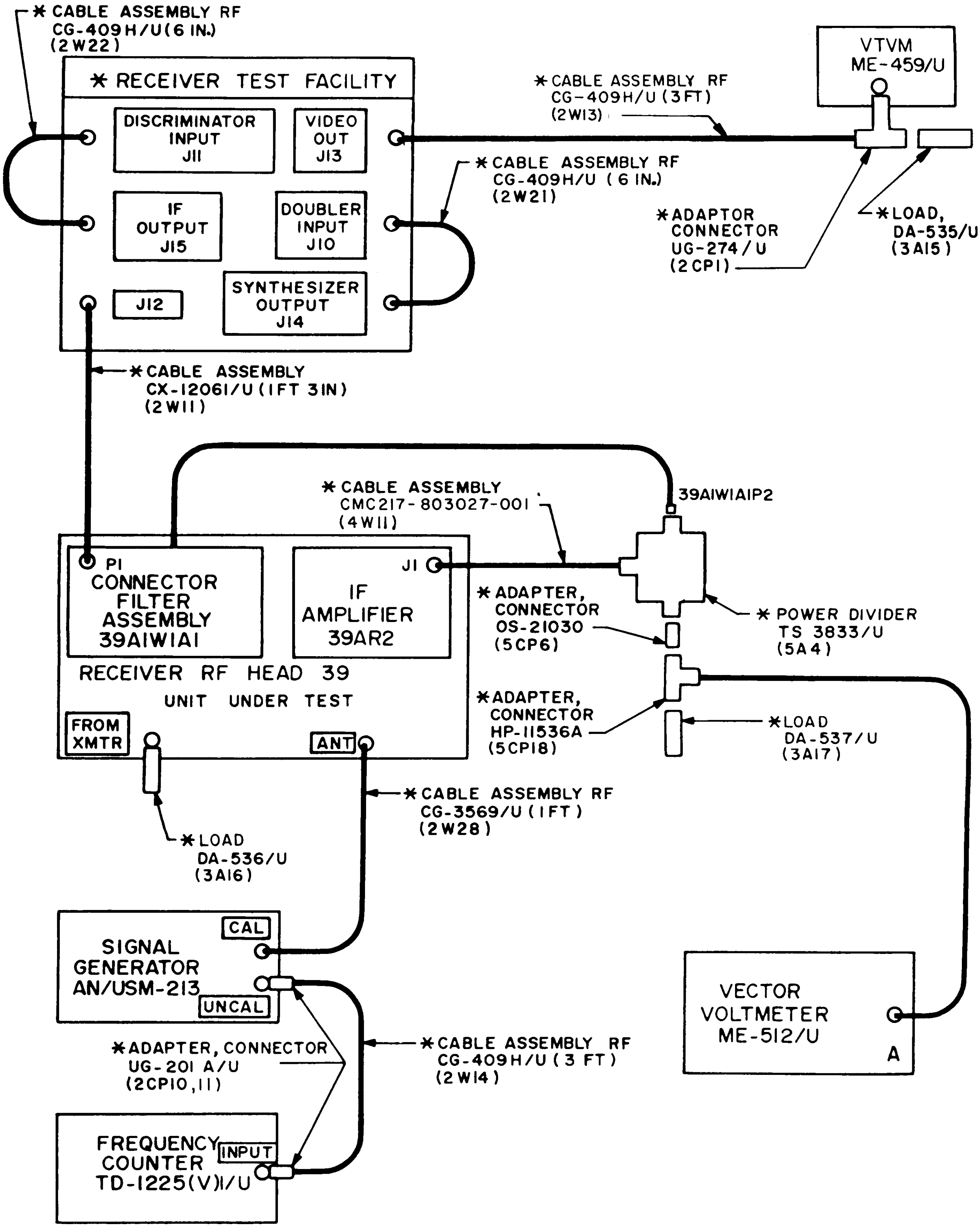
(o) Disconnect the equipment from the ANT connector of the unit under test. Test facility meter Ml should indicate 40-60!%.

(p) Repeat (a) through *(j)* above for the following settings:

XMTR DUPL control (channel)	*Power signal source (MHz)*
2612	*1506.0*
2904	*1652.0*

(q) Repeat (a) through *(o)* at channel 3299 (1849.5 MHz).

(r) Tune the unit under test RCVR SIG control to channel 3299 (same as XMTR DUPL channel). HIGH SIGNAL lamp on test facility should light. Wait for 30 seconds and then turn power signal source OFF.



*PART OF TEST FACILITIES

Figure 4-185. Band IV Receiver Rf Head, AGC Test Setup.

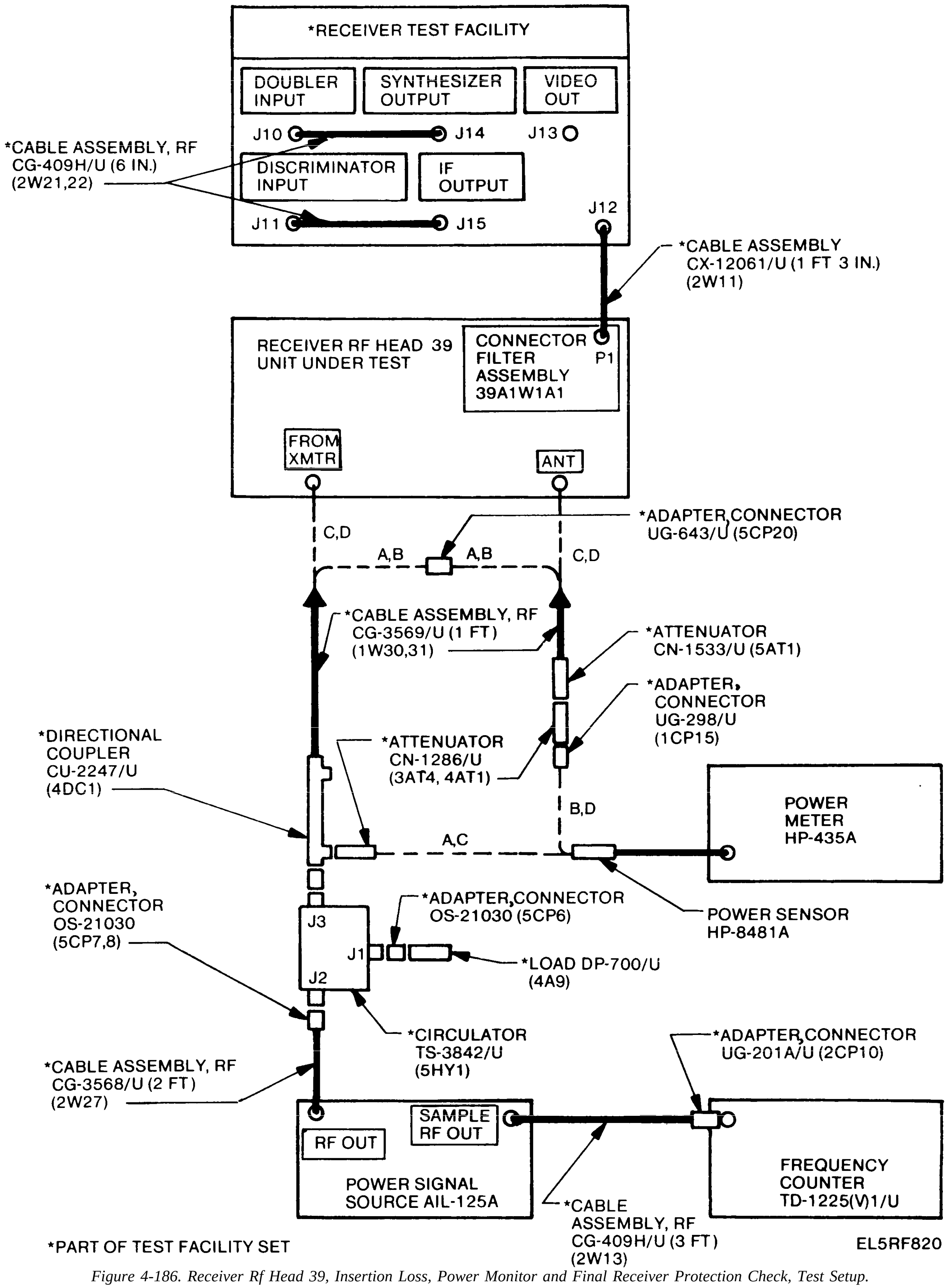


Figure 4-186. Receiver Rf Head 39, Insertion Loss, Power Monitor and Final Receiver Protection Check, Test Setup.

(s) Repeat paragraphs *(1)(b)* through *(k)* above. The VTVM should indicate within ±1 dB of the indication originally recorded for step *(1)(k)*.

(t) Replace the dust cover onto the unit under test.

c. Troubleshooting (FO-10 and FO-11).

Symptom	*Probable cause*	*Checks and corrective measures*
1. Receiver test facility meter Ml indication abnormal in *b(1)(g)* above, but normal in *b(1)(h)* above.	*a.* Defective control indicator 39A4.	*a.* Test 39A4 as described in paragraph 4-76.
	b. Defective or misadjusted frequency multiplier 39A3.	*b.* Test 39A3 as described in paragraph 4-75.
	c. Defective electronic frequency converter 39A2.	*c.* Test metering circuit of 39A2 as described in paragraph 4-74b.(1).
	d. Defective or misadjusted bandpass filter 39FL2.	*d.* Test 39FL2 as described in paragraph 4-80.
2. Receiver test facility meter Ml indication abnormal in *b(1)(g)* and *b(1)(h)* above.	*a.* Defective MULT DRIVER switch 39A1W1S1 or associated wiring.	*a.* Check continuity from pin 24 (39A1W1A1P1) to pin 9 (39A1W1J3) and to pin 9 (39A1W1J4).
	b. Defective rf amplifier 39AR1.	*b.* Test 39AR1 as described in paragraph 4-77.
	c. Defective multiplier 39A3.	*c.* Check 39A3AR1 as described in paragraph 4-75b. (5).
3. VTVM indication abnormal in (b)(1)(k) above, or maximum indication on meter Ml *(b(1)(i)* above) cannot be obtained.	*a.* Incorrect local oscillator frequency.	*a.* Disconnect S9W4P2 from J2 of 39A2 and connect the frequency counter to 39W4P2. The frequency indicated should be 30 MHz above the signal generator frequency, if not, troubleshoot as described in *1.a.* and *b.* above. Check connections between 39AlWlJ2 and 39AlW1AlPl. Reconnect 39W4P2 to J2 of 39A2.
	b. Defective components in receive path.	*b.* Note the VTVM indication. Disconnect P2 (39A2J1) from J1 of 39A2, connect the signal generator to J1 (39A2) and note the new VTVM indication.
	(1) Excessive rf component insertion loss.	*(1)* If the VTVM indication decreases more than 3 dB, test bandpass filter 39FL1 as described in paragraph 4-80. If 39FL1 tests within specifications, check circulator 39A1HY1 as described in paragraph 4-72. If 39AlHYl tests within its tolerances, reconnect the signal generator to the ANT connector, P2 (39A2J1) to J1 of 39A2, and test the remaining receive path rf components (power monitor 39A1A1, connector 39A5CP1, and the rigid coax cables) by substituting known good components (in turn).
	(2) Defective frequency converter 39A2 or rf coax cables.	*(2)* If the VTVM indication *(b.* above) did not decrease to approximately –47 dBm, test 39A2 as described in paragraph 4-74 and check connections (including shields) from 39A1W1J3Al to 39A1W1J6A1 and from 39A1W1P2 to 39A1W1P1A1.
4. Signal generator output level less than –64 dBm in step *b(2)(d)* above.	Defective electronic frequency converter 39A2.	Check receiver protection circuits of 39A2 (para. 4-74).

c. Troubleshooting. – Continued

Symptom	Probable cause	Checks and corrective measures
5. High signal alarm operates outside limits of procedure *b(2)(h)* and *(i)* above.	Defective electronic frequency converter 39A2.	Check high signal alarm circuit of 39A2 (para. 4-74).
6. Abnormal VSWR indications in *b(3)(d)* or *(j)* above.	Defective or misalined bandpass filter 39FL1.	Test 39FL1 (para. 4-80).
7. Channel indication more than 1/2 inch from window centerline in *b(3)(g)* above (or *b(3)(n)* above).	*a.* Indicator 39A1DS1 (or 39DS2) improperly set.	*a.* Turn RCVR SIG (or XMTR DUPL) control clockwise to its stop. The tape alinement marking should be at the calibration mark (see para. 2-78).
	b. Misalined bandpass filter 39FL1 (or 39FL3).	*b.* Test 39FL1 as described in para. 4-80 (or 39FL3 as in para. 4-81).
8. Abnormal VSWR indications in *b(3)(k)* or *(q)* above.	Defective bandpass filter 39FL3.	Test bandpass filter 39FL3 (para. 4-81).
9. Abnormal AGC action in *b(4)(i)* above.	AGC setting not matched to rf head.	Slightly readjust R2 of if. amplifier 39AR2 for a 12 dB change when tested as in para. *b(4)* above.
10. Transmitter duplexer insertion loss exceeds 1.9 dB in para. *b(5)(i).*	*a.* Defective bandpass filter 39FL3.	*a.* Test 39FL3 as described in para. 4-81.
	b. Defective circulator 39A1HY1.	*b.* Test 39A1HY1 as described in para. 4-86.
	c. Defective rf power monitor 39A1Al.	*c.* Test 39A1A1 by substituting known good power monitor and repeating procedure *b(5)* above.
	d. Defective rf cables and connectors.	*d.* Test by substituting known good parts.
11. Abnormal indications on test facility meter M1 in *b(5)(m)* through *(o)* above.	Defective rf power monitor 39A1Al.	Test 39A1A1 by substituting a known good power monitor and repeating procedure *b(5)* above.
12. VTVM indications abnormal in *b(5)(s)* above.	*a.* Connection of connector 39A1W1A1P2 improper or damaged when reconnected in *b(4)(k)* above.	*a* Inspect 39A1W1AlP2 (including should) and J1 of 39AR2 for damage. Ensure connection is properly made.
	b. Electronic frequency converter damaged during test.	*b.* Repair and test 39A2 as described in para. 4-74.

4-72. Circulator 38A1HY1

Refer to paragraph 4-86 for general support maintenance procedures.

4-73. Branched Wiring Harness 39A1W1

a. Test Equipment and Material Required.

Equipment	*Common name*
Multimeter AN/USM-451	Multimeter

b. Continuity Test Procedure.

(1) Remove the modules connected to the branched wiring harness to be tested. See TM 11-5820-540-30 for removal and replacement procedures.

(2) Refer to FO-11 and the wiring list below. Check wire continuity for less than 0.5 ohms between connections listed in the table below.

Connector 39A1W1A1P1 (pin No.)	*Connector or terminal board*
1	39A1W1W1TB1-E9
2	39A1W1W1TB1-E6
3	39A1W1W1TB1-E3
4	39AlWlJ2-Pin 15
5	39AlWlJ2-Pin 14
6	39AlWlJ2-Pin 25
7	39AlWlJ2-Pin 1
11	39A1W1W1TB1-E3
12	39AlWlJ2-Pin 12
13	39AlWlJ2-Pin 3
15	39AlWlJ2-Pin 13
16	39AlWlJ2-Pin 11
17	39AlWlJ2-Pin5
18	39AlWlJ2-Pin6
19	39AlWlJ2-Pin 9
20	39AlWlJ2-Pin 10
21	39AlWlJ2-Pin 2
22	39AlWlJ2-Pin 4
24	39A1W1S1 (Mult Driver)
25	39AlWlJ1-Pin 1

Connector 39A1W1A1P1 (pin No.)	*Connector or terminal board*
26	39A1WlJ1-Pin3
27	39A1W1J2-Pin7
28	39A2WlJ2-Pin8
29	39A1WlJ6-Pin 11
30	39AlWlJ3-Pin6
A2	39A1WIJ4-A2 (Center Conductor)
Al	39A1W1A1P2 (Center Conductor)

(3) Repair defective plugs, jacks, and cables, or replace the connector filter assembly (para. 2-80).

(4) Replace the modules removed in (1) above.

4-74. Electronic Frequency Converter 39A2

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility, rf modules
Test Facility, Receiver TS-2867(V)2/GRM-94(V)2	Receiver test facility
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, band 2,3,4
Amplifier, Unit If. AM-4822/U	Unit if. amplifier
Counter, Electronic, Digital TD-1225-(V)l/U	Frequency counter
Noise Source HP-346B Option 1	Noise source
Generator, Signal AN/USM-213 (2 reqd.)	Signal generator (No. 1,2)
Generator, Signal HP8640B	Signal generator No. 3
Indicator, SWR USM-261	SWR indicator
Meter, Power HP 435A (2 reqd.)	Power meter (No. 1,2)
Digital MultimeterAN/USM-451	Digital multimeter
Power Supply, HP 6205B	Power supply
Sensor, Power HP 8481A	Power sensor
Sensor, Power HP 8484A	Power sensor
Rf Voltmeter ME-426/U	Rf voltmeter
Power Amplifier, Logimetrics A200L	Power amplifler

b. Test Procedures.

CAUTION

Damage level for the HP 8484A power sensor connected to power meter No. 1 is +13 dBm. Be sure that the power level applied to this sensor does not exceed +13 dBm.

NOTE

Set power supply PP-6304/GRM-95W) for an output of 115 Vac as indicated on its panel voltmeter. Maintain this panel meter indication throughout the following procedures.

(1) *Rf input VSWR and local oscillator lerel metering test.*

(a) Connect the test equipment as shown in A, figure 4-187.

(b) Set receiver test facility switch S1 to ON, S5 to S6 and S6 to MULTIPLIER.

(c) Set switch S7 (rf modules test facility) to NORMAL.

(d) Adjust the signal generator frequency to 1350 MHz ±1 MHz and set the rf level control to indicate -50 dBm on power meter No. 1.

(e) Connect the test equipment as shown in B, figure 4-187. The reading on power meter No. 1 shall be at least 10.8 dBm below the reading established in *(d)* above, corresponding to a maximum VSWR of 1.8:1.

(f) Repeat *(a)*, *(d)* and *(e)* above at signal generator frequencies of 1450, 1550, 1650, 1750 and 1850 MHz.

(g) Connect the test equipment as shown in C, figure 4-187. Set the signal generator frequency to 1350 ±1 MHz and set the output level controI to +10 dBm (–10 dBm indication on power meter No. 2).

(h) Set switch S7 (rf modules test facility) to MULT METER NO. 2.

(i) Meter Ml on the receiver test facility shall not read greater than 80 percent of full scale deflection.

(j) Reduce the output power to +6 dBm (–14 dBm on power meter No. 2). Meter Ml of the receiver test facility shall indicate at least 20 percent of full scale deflection.

(k) Repeat *(g)* through *(j)* above for the following signal generator No. 1 frequencies (MHz): 1450, 1550,1650, 1750 and 1850.

(2) *Conversion gain and image rejection test.*

(a) Connect the test equipment as shown in A, figure 4-188.

(b) Set signal generator No. 1 to 1350 MHz as indicated on the frequency counter and set the rf level to indicate – 10 dBm on the power meter, (0 dBm output from the signal generator.)

(c) Connect the test equipment as shown in B, figure 4-188.

(d) Set signal generator No. 2 to 1380 MHz (30 MHz higher than the setting in *(b)* above). Set the rf level to indicate 0 dBm on the power meter (+10 dBm input to the unit under test).

(e) Set receiver test facility switch S1 to ON and S6 to MULTIPLIER, Set switch S7 (rf modules test facility) to NORMAL.

(f) Connect the test equipment as shown in C, figure 4-188.

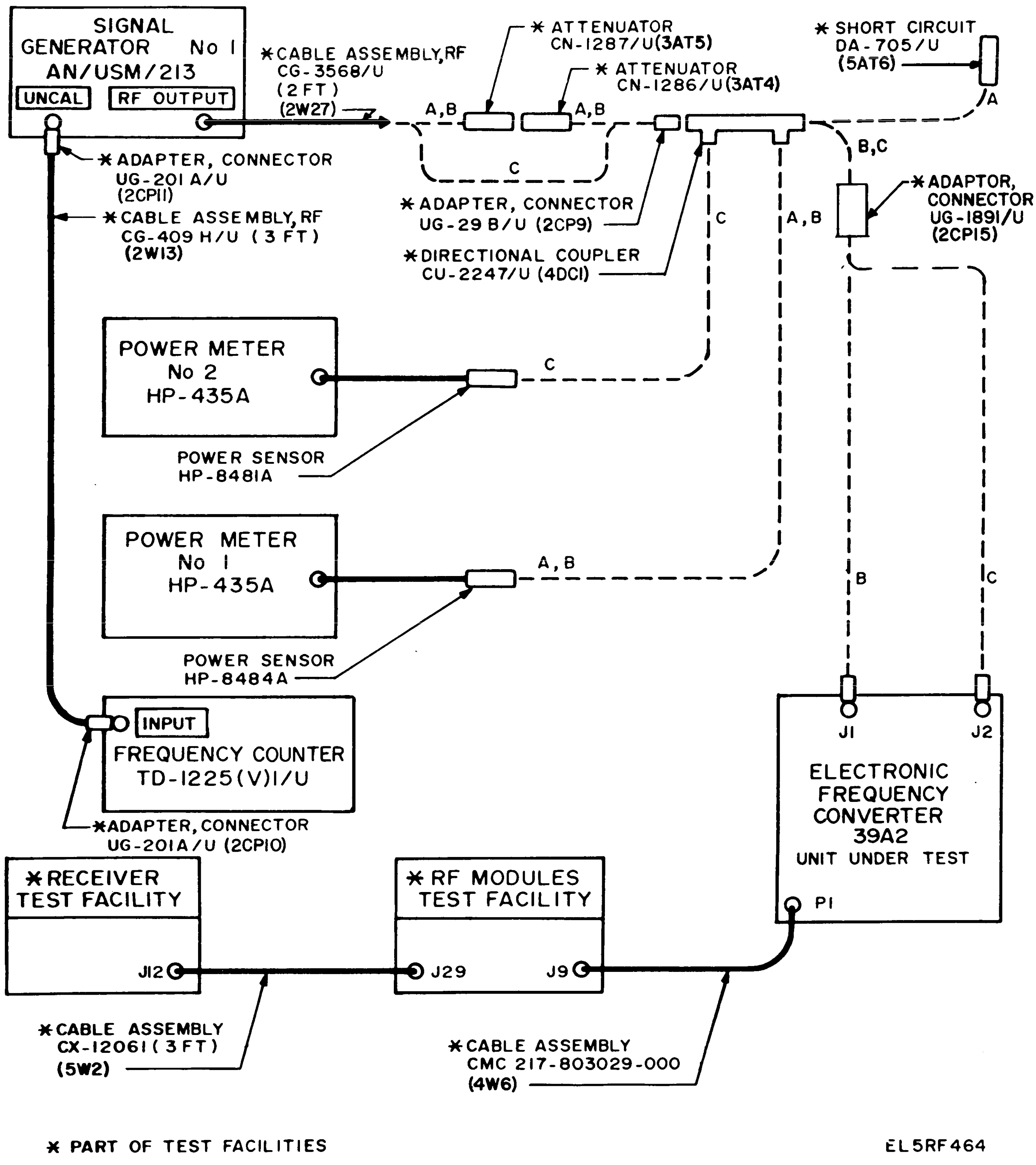


Figure 4-187. Electronic Frequency Converter 39A2, Rf Input VSWR and Local Oscillator Level Metering, Test Setup.

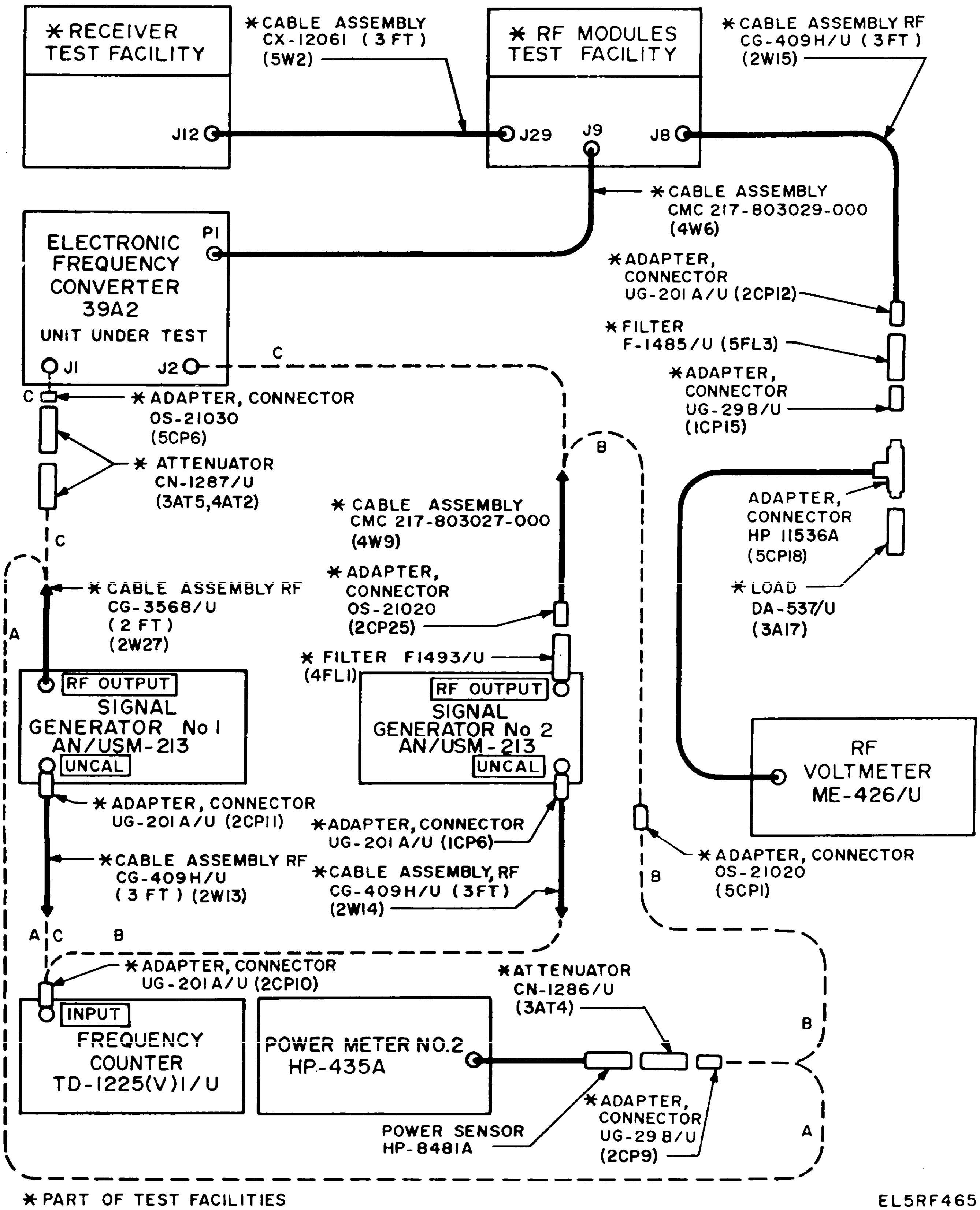


Figure 4-188. Electronic Frequency Converter 39A2, Conversion Gain and Image Rejection, Test Setup.

(g) Note the rf voltmeter indication and subtract it from -40 dBm (the rf input at J1 of the unit under test). The resulting figure is the conversion gain, which shall be between 11 and 16 dB.

(h) Reconnect the test equipment as shown in A, figure 4-188.

(i) Set signal generator No. 1 to 1410 MHz (60 MHz higher than the setting in *(b)* above). Set the rf level to indicate –10 dBm on the power meter.

(j) Reconnect the test equipment as shown in C, figure 4-188.

(k) Note the rf voltmeter indication (for example, –46 dBm), and subtract it from the indication obtained in *(g)* above to obtain the image rejection value. This value shall be a minimum of 18 dB.

(l) Repeat *(a)* through *(k)* above for the following signal generator No. 1 frequencies (MHz): 1450, 1550, 1650, 1750 and 1850. Signal generator No. 2 will be set 30 MHz higher in each case.

(3) *Local oscillator input VSWR and noise figure test.*

(a) Set noise source power supply (HP 6205B) to +28 Vdc and then turn it OFF.

(b) Connect test equipment as shown in A, figure 4-189.

(c) Set receiver test facility switches S1 to ON and S6 to MULTIPLIER. Set switch S7 (rf modules test facility) to NORMAL, and S12 to ON.

(d) Adjust the signal generator frequency to 1380 MHz as indicated on the frequency counter. Set the rf output level to indicate +10 dBm on the power meter.

(e) Connect the test equipment as shown in B, figure 4-189. Note the indication on the power meter.

(f) Connect the test equipment as shown in C, figure 4-189, and note the indication on the power meter. Subtract this value from the indication noted in *(e)* above. The difference between the two indications shall be 10.8 dB minimum, which corresponds to a VSWR of 1.8:1.

(g) Set the variable attenuators to 1.1 dB. Note the meter indication on if. amplfler AM-4822/U (adjust if. amplifier for anon scale indication).

(h) Switch on noise source power supply (set to +28 Vdc). Adjust the variable attenuators for the same if. meter indication noted in *(g)* above.

NOTE

The attenuation added in *(h)* above; i.e., the settings of the attenuators minus 1.1 dB set in *(g)* above, is the Y factor, and is used in conjunction with the appropriate noise source curve in figure 4-190 to calculate the noise figure.

(i) From the noise figure, subtract the total attenuation provided by the CN-1285/U attenuator (nominal 3 dB) as read from the attenuation versus frequency calibration chart provided with each attenuator. The result is the true noise figure, and shall not exceed 3.6 dB.

(j) Repeat *(a)* through *(i)* above for signal generator frequencies of 1430 MHz to 1880 MHz in 50 MHz steps.

(4) *If. output impedance and high signal alarm test.*

(a) Connect the test equipment as shown in A, figure 4-191.

(b) Set receiver test facility switch S1 to ON and S6 to MULTIPLIER.

(c) Set switch S7 (rf modules test facility) to NORMAL.

(d) Adjust signal generator No. 1 to provide +10 dBm output power (indication of 0 dBm on power meter) at a frequency of 1600 MHz as indicated by the frequency meter.

(e) Connect the test equipment as shown in B, figure 4-191.

(f) Set signal generator No. 3 to 30 MHz. Adjust the output level of signal generator No. 3 for a – 10 dBm indication on the power meter (0 dBm output power).

(g) Connect the test equipment as shown in C, figure 4-191, with port Z2 of the impedance bridge open-circuited.

(h) Switch on an amplitude modulation of 1 kHz on signal generator No. 3, and set the modulation level to 50 percent. Set the VSWR indicator for 0 dB on the dB scale. Note the VSWR indicator attenuation setting.

(i) Connect the test equipment as shown in D, figure 4-191. Increase the VSWR indicator attenuation until a scale reading is obtained. The if. output return loss equals the new attenuator settings, minus the setting noted in *(h)* above, plus the scale reading in dB. This value shall be greater than 21 dB, which corresponds to a VSWR of 1.2:1.

(j) Connect the test equipment as shown in figure 4-192.

(k) Adjust power signal source to 1350 MHz as indicated on the frequency counter, and adjust the output level to +13 dBm as indicated on the power meter.

(l) The high signal alarm lamp on the receiver test facility front panel shall illuminate.

(m) Reduce the output level of the power signal source until the high signal alarm lamp extinguishes.

(n) The power level indicated on the power meter should not be less than – 13 dBm.

(o) Continue to reduce the power level down to –13 dBm and verify the alarm remains off.

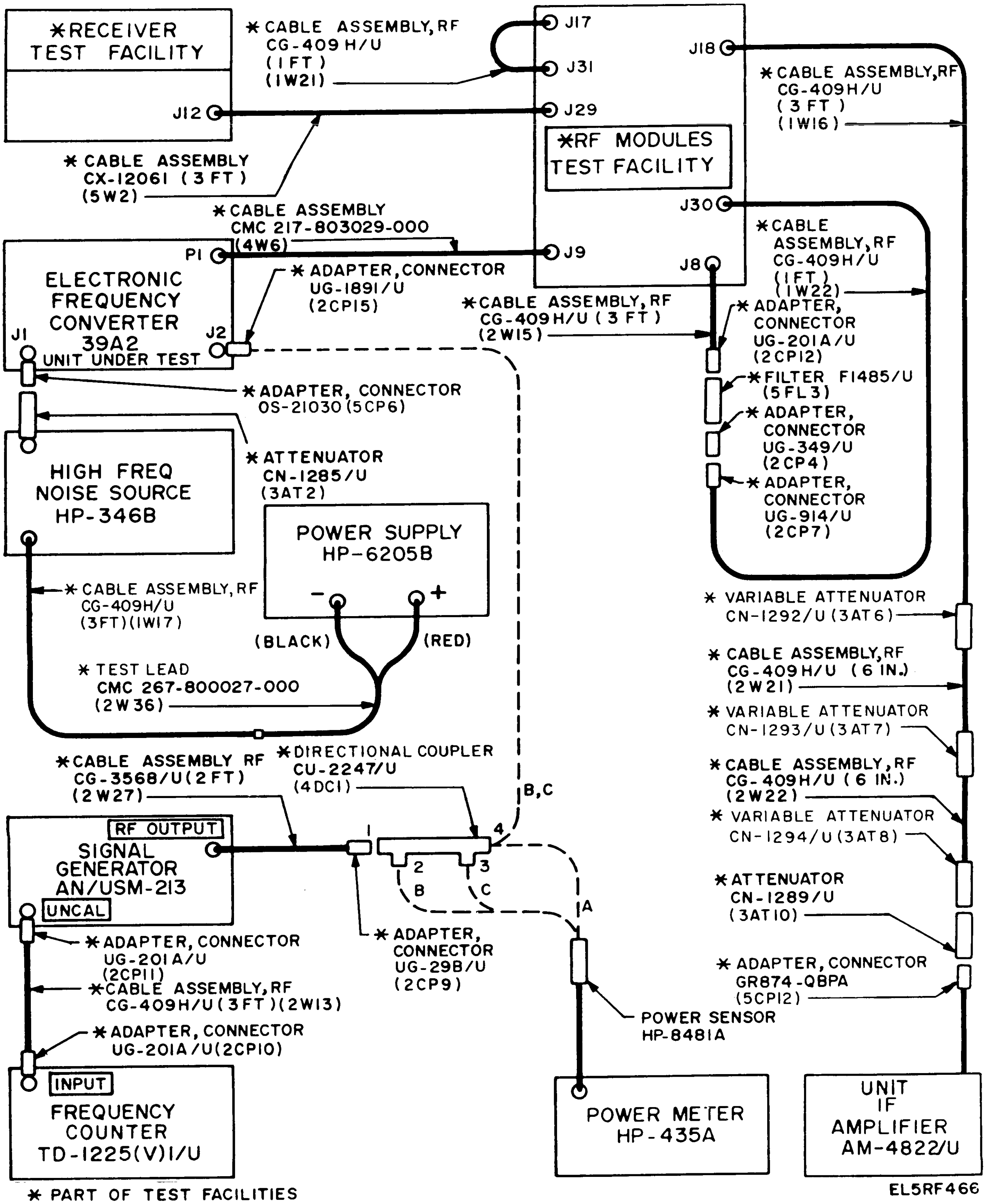


Figure 4-189. Electronic Frequency Converter 39A2, Local Oscillator Input VSWR and Noise Figure, Test Setup.

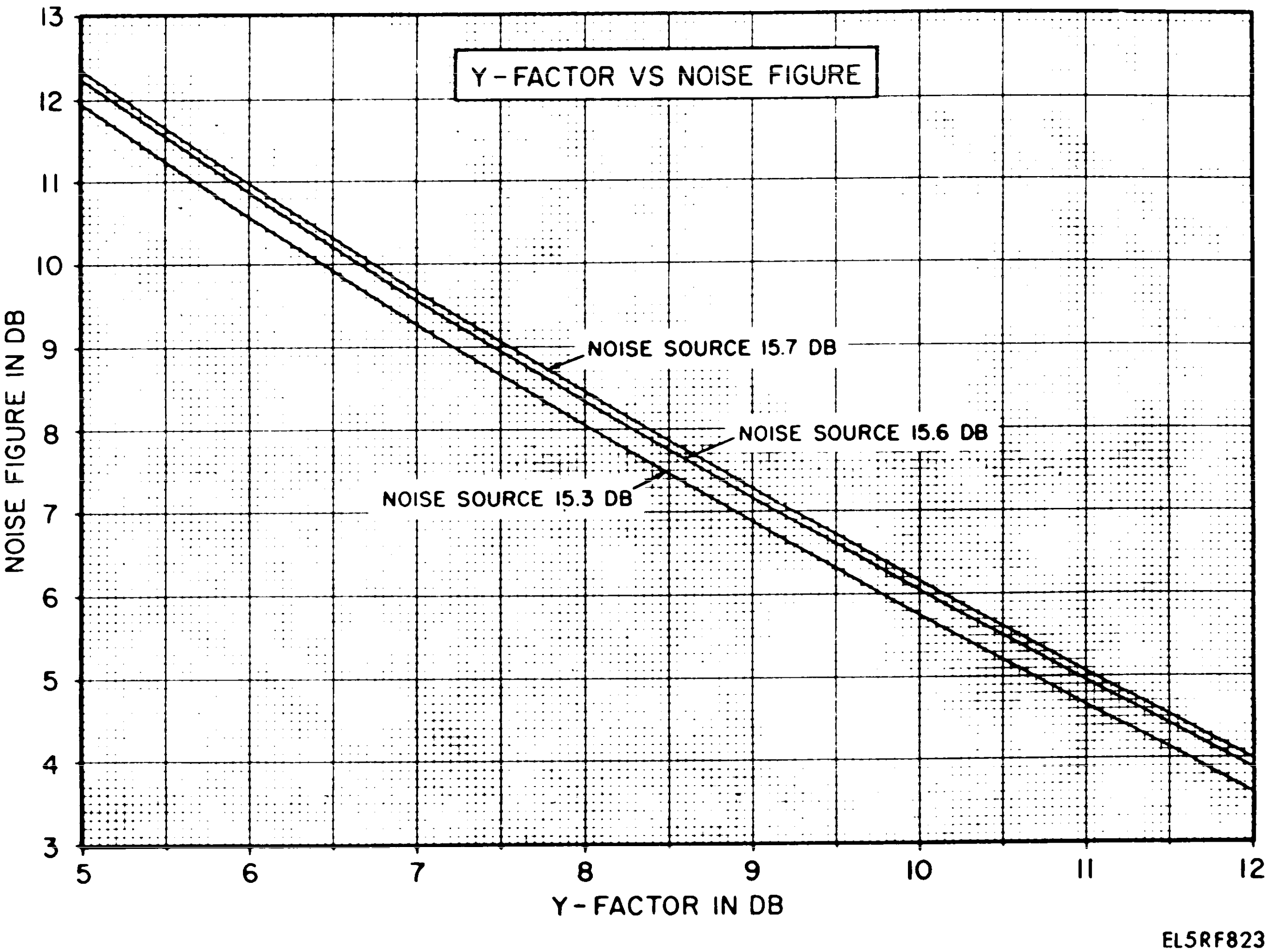


Figure 4-190. Y-Factor to Noise Figure Conversion Chart.

(p) Slowly increase the power level until the high signal alarm operates.

(q) The power level indicated on the power meter should not exceed +13 dBm.

(r) Continue to increase the power level up to +13 dBm and verify the alarm remains on.

(s) Repeat steps *(k)* through *(r)* for 1600 MHz and 1850 MHz.

(5) *Protection circuit operational test.*

CAUTION

Do not perform without first verifying that the HIGH SIGNAL ALARM *(b(4)(j)* through *(s)* above) and input attenuator (para. *(d)l.* through 7. below) are functional.

NOTE

The following test checks the ability of the protection circuit (39A2CR1 and 39A2A1CR2) to protect the rf amplifier (39A2A1AR1) against a 10 watt (nominal) input level. This is done by applying a nominal 10 watt rf power level to the input for 30 seconds and then verifying that the frequency converter still functions properly.

(a) Connect test equipment as shown in A, figure 4-193.

(b) Set signal generator No. 2 to 1380 MHz and adjust the output level for +10 dBm (0 dBm indication on the power meter).

(c) Set signal generator No. 1 output attenuator to 40 dB and connect the test equipment as shown in B, figure 4-193.

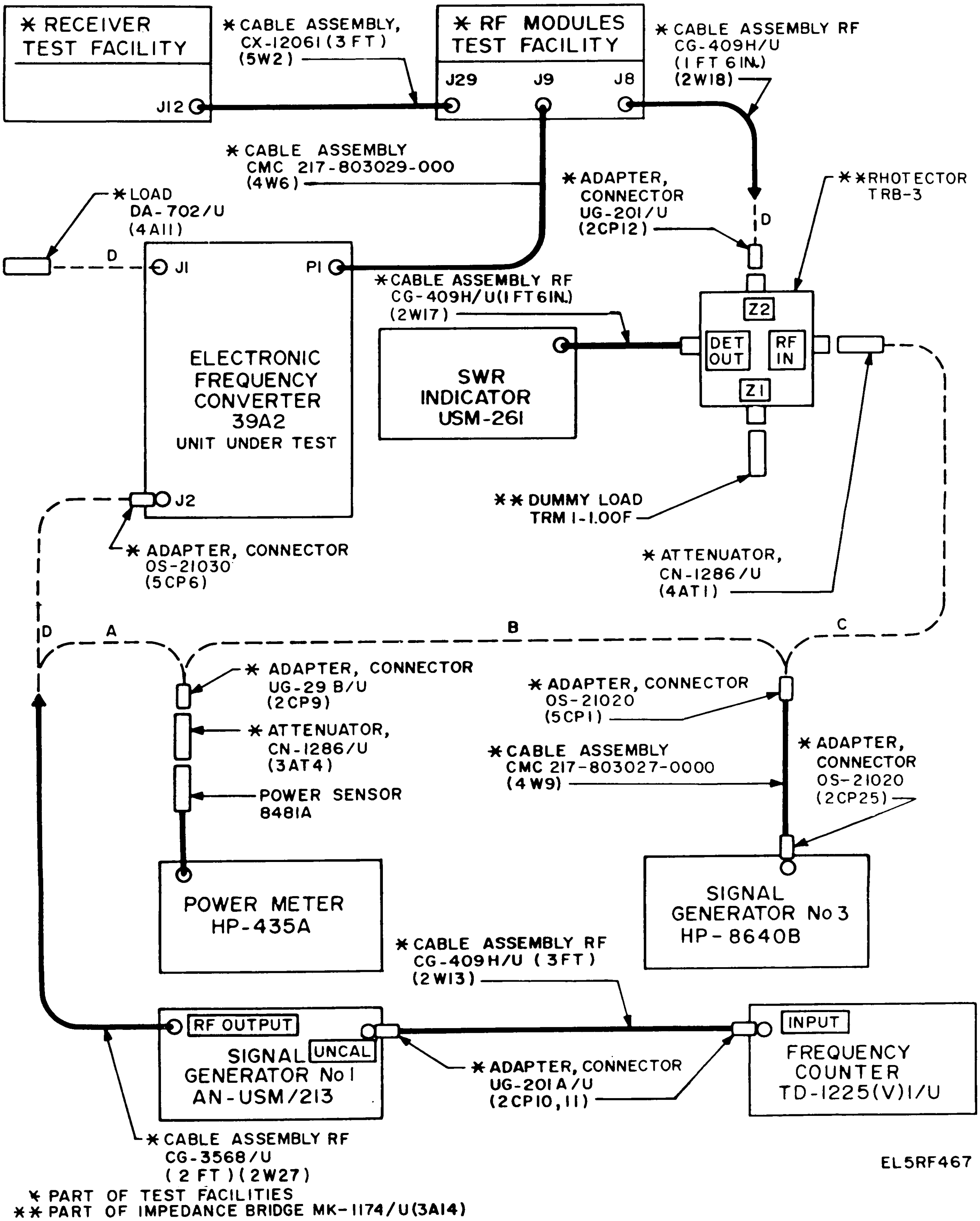


Figure 4-191. Electronic Frequency Converter 39A2, If Output Impedance, Test Setup.

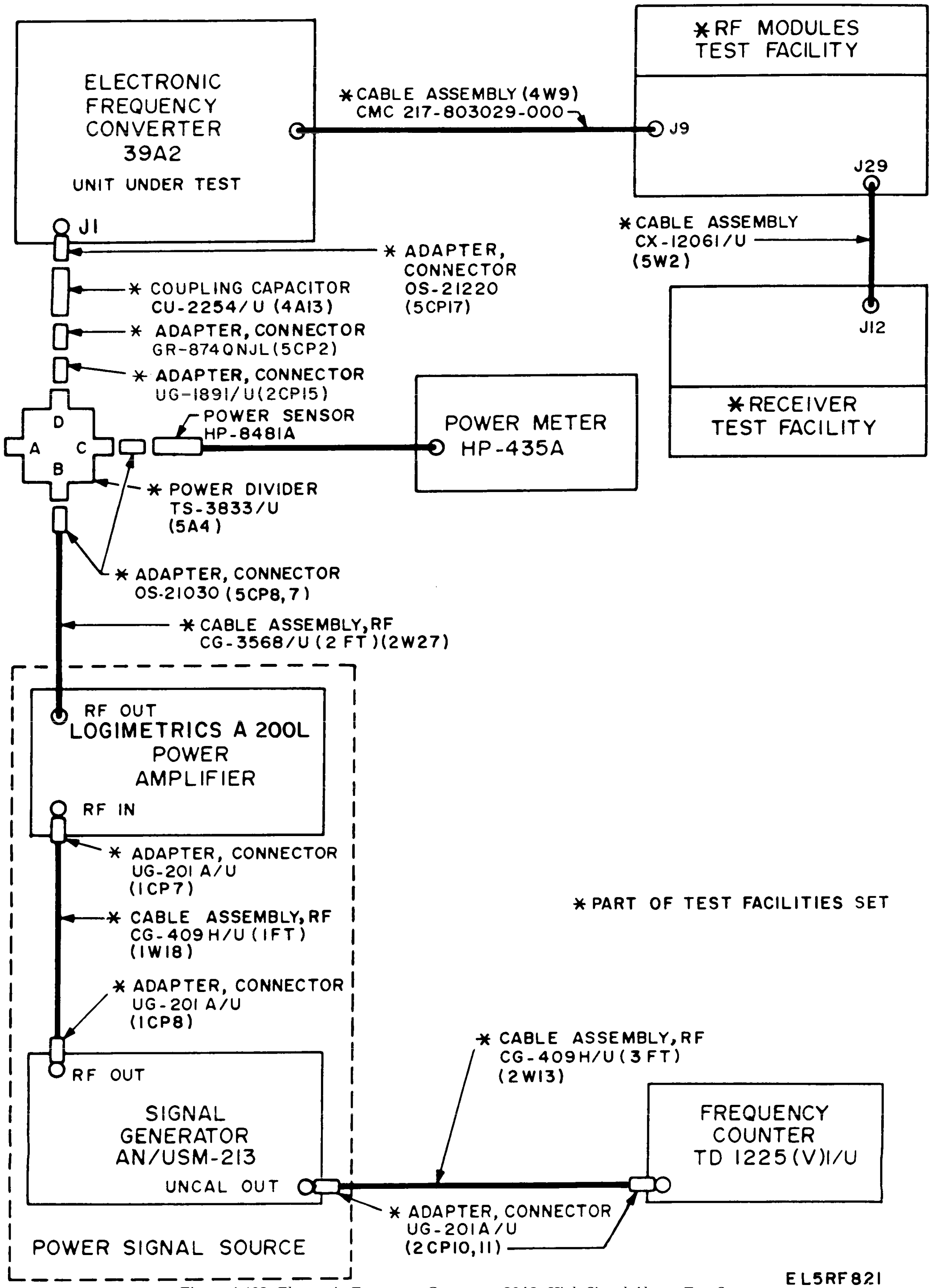


Figure 4-192. Electronic Frequency Converter 39A2, High Signal Alarm, Test Setup.

(d) Set signal generator No. 1 output frequency to 1350 MHz and perform the preliminary functional check as follows:

1. Remove the module cover (item 2, fig. 4-196).

2. Set power supply HP 6205B for minimum output and connect its negative terminal to the chassis of the unit under test and its positive terminal to E9 of 39A2A1 (fig. 4-195).

3. Note the rf voltmeter indication.

4. Using the allocated digital multimeter, adjust the dc power supply to 0.7 Vdc.

5. Increase the signal generator output level to obtain the same rf voltmeter indication as noted in 3. above. The signal generator ATTENUATION dial should indicate 30 dB or less.

6. Reset the ATTENUATION dial to 40 dB and disconnect power supply HP 6205B.

7. Replace the module cover.

(e) Record the rf voltmeter indication (approx. –26 dBm).

(f) Connect the equipment as shown in C, figure 4-193.

(g) Adjust signal generator No. 1 output level for a power meter indication of +10 dBm (+40 dBm input to the unit under test) at 1350 MHz for 30 seconds then reduce the output level to minimum.

(h) Reconnect the equipment as shown in B, figure 4-193 and set signal generator No. 1 ATTENUATION dial to 40 dB. The rf voltmeter indication should be essentially the same as recorded in *(e)* above.

c. Troubleshooting (TM 11-5820-540-30, figure 2-108).

Symptom	*Probable cause*	*Checks and corrective measures*
1. High input VSWR in procedure *b(l)(e)* above.	Faulty rf amplifier 39A2A1AR1.	Replace faulty amplifier 39A2A1AR1 (procedure d below.)
2. Abnormal indication on meter Ml in procedure *b(1)(i)* above.	*a.* Faulty mixer stage 39A2A1A2.	*a.* Replace faulty mixer 39A2A1A2 (procedure d below).
	b. Defective wiring.	*b.* Using multimeter on RX1 scale, check continuity between pin 9 of 39A2P1 and pin Z9 on 39A2A1A2.
3. Low conversion gain reading in procedure *b(2)(g,)* above.	Faulty mixer stage 39A2A1A2	Replace faulty mixer 39A2A1A2 (procedure d. below).
4. Image rejection below normal in procedure *b(2)(k)* above.	Faulty mixer stage 39A2A1A2	Replace faulty mixer 39A2A1A2 (procedure d. below).
5. Local oscillator input VSWR is too high in procedure *b(3)(f)* above.	Faulty mixer stage 39A2A1A2.	Replace faulty mixer 39A2A1A2 (procedure d. below).
6. Noise figure reading is too high in procedure *b(3)(i)* above.	Faulty rf amplifier 39A2A1AR1.	Replace faulty amplifier 39A2A1AR1 (procedure d. below).
7. Abnormal if. output impedance *b(4)(i).*	Faulty quadrature hybrid coupler 39A2A1A1.	Replace faulty coupler 39A2A1Al (procedure d. below).
8. High signal alarm lamp on receiver test facility front panel does not illuminate in procedure *b(4)(l)* above.	*a.* Defective diode 39A2A1CR2.	*a.* With +13 dBm drive at rf input of electronic frequency converter module 39A2, as in *b(4)(k)* above, use a digital multimeter to measure 0.3 Vdc or more between terminal 39A2A1E9 (fig. 4-195) and 39A2 chassis. If less than 0.3 Vdc, replace 39A2A1CR2.
	b. Defective amplifier 39A2A1A3.	*b.* With +13 dBm at rf input of converter 39A2, as in *b(4)(k)* above, measure –9 Vdc between pin 6 of 39A2A1A3 and ground (fig. 4-195). If an abnormal indication is obtained, replace 39A2AlA3.

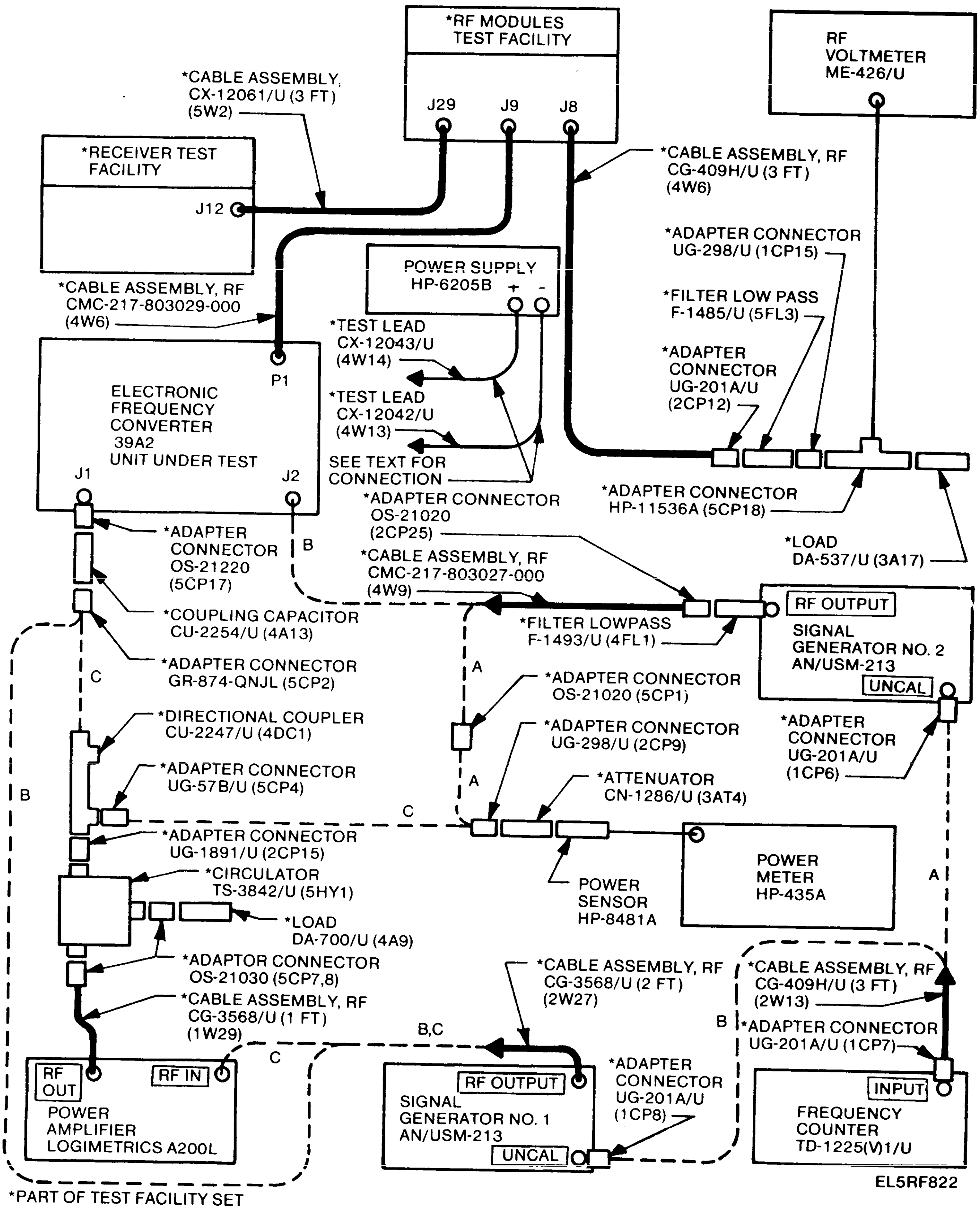


Figure 4-193. Electronic Frequency Converter 39A2, Protection Circuit, Test Setup.

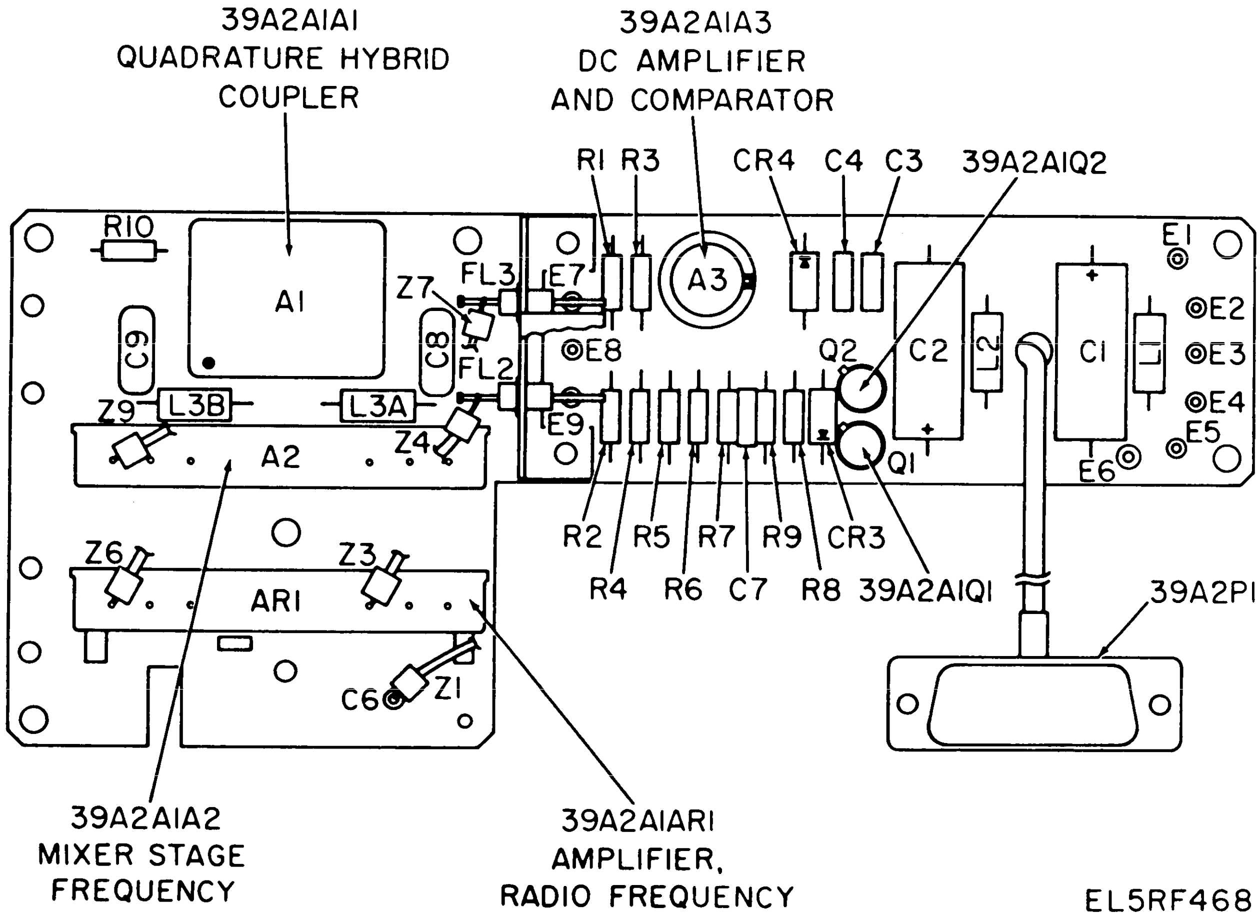


Figure 4-194. Converter Subassembly 39A2A1, Component Side.

c. *Troubleshooting* – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
	c. Defective transistor 39A2A1Q1 or 39A2A1Q2.	*c.* With +13 dBm drive at rf input of converter 39A2, as in *b(4)(k)* above, measure +12 Vdc between the collector and emitter of 39A2A1Q1. Also measure 0 Vdc between the collector and emitter of transistor 39A2A1Q2. If an abnormal indication is obtained, replace 39A2A1Q1 or 39A2AlQ2 as required.
	d. Defective components, high signal alarm circuitry.	*d.* Check all other components of high alarm circuitry. Repair and replace as required.
9. Input level required increased by less than 10 dB in *b(5)(d)5.* above.	Defective 39A2CR1.	Replace 39A2CR1.
10. Abnormal rf voltmeter indication after high power test	Defective 39A2CR1 and rf amplifier module 39A2A1AR1 damaged during test.	Replace 39A2CR1 and 39A2A1AR1.

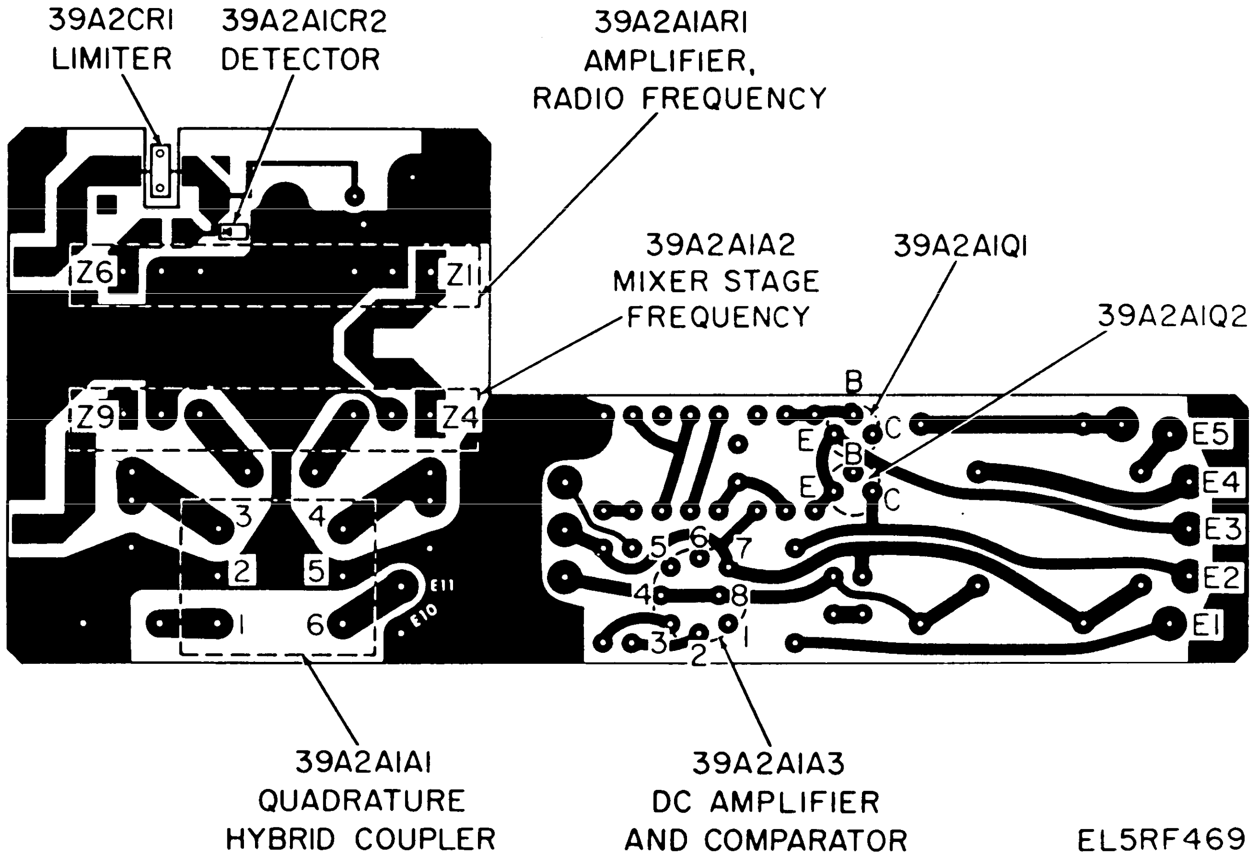


Figure 4-195. Converter Subassembly 39A2A1, Solder Side.

d. Disassembly and removal procedures (fig. 4-196).

(1) Remove screws (3, 5) and detach top and bottom covers (2, 4) from housing (1).

(2) Remove screws (11) and detach plate (10) from housing (1).

(3) Remove screws (8, 14) to free rf screen (9) and rf connectors (12, 13) from housing (1).

(4) Remove screws (17) to free diode 39A2CR1 (18) from housing (1).

(5) Remove screws (15) and spacers (16) and carefully remove converter subassembly 39A2A1.

(6) Remove screws and nuts (7) and remove connector (6).

(7) Disconnect the wires at the top of AR1(Z6, Z3). Unsolder the six pins at the bottom of the board, and remove rf amplifier 39A2A1AR1. (See figs. 4-194, 4-195).

(8) Disconnect the wires at the top of A2. Unsolder the six pins at the bottom of the board, and remove mixer 39A2A1A2 (29, 24).

(9) Unsolder the six pins at the bottom of the board, and remove hybrid 39A2A1A1.

(10) Unsolder the eight pins at the bottom of the board, and remove tdc amplifier 39A2A1A3.

4-75. Frequency Multiplier 39A3

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility, rf modules
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95 (V)2	Accessory kit, test facilities set
Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Test Facility, Receiver TS-2867(V)2/GRM-95(V)2	Receiver test facility
Accessory Kit, Test Facilities Set MK-1985(V)2/GRM-95(V)2	Accessory kit
Amplifier, Rf, Broadband ENI 603L	Power amplifler
Counter, Electronic, Digital TD-1225(V)l/U.	Frequency counter
Generator, Signal AN/USM-213	Signal generator
Generator, Signal HP 8640B	Signal generator

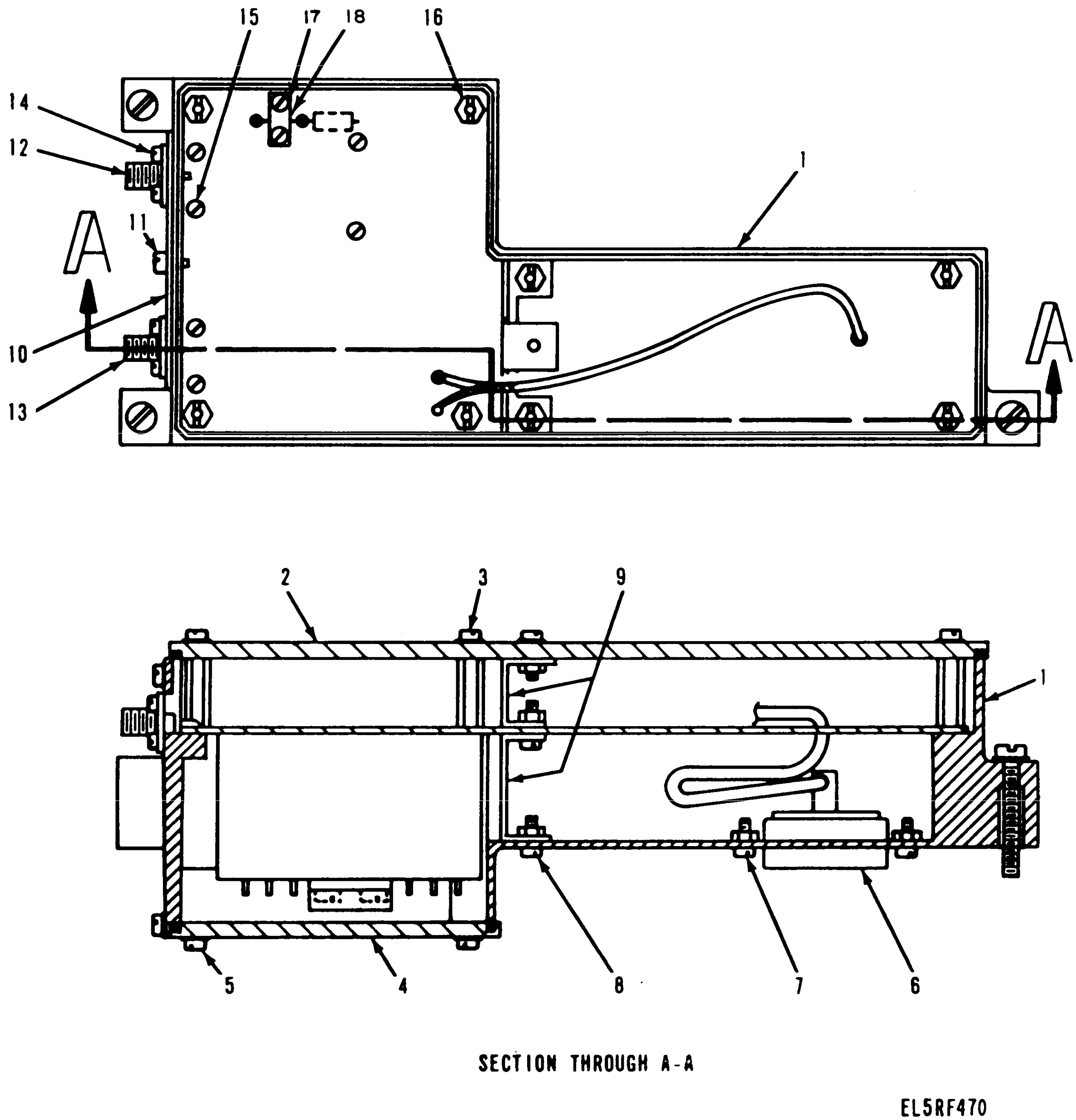


Figure 4-196. Electronic Frequency Converter 39A2, Assembly Details.

Equipment	*Common name*
Meter, Power HP-435A (2 reqd)	Power meter No. 1 and No. 2
Sensor, Power, HP-8481A	Power sensor No. 1
Sensor, Power, HP-8484A	Power sensor No. 2
Multimeter, Digital AN/USM-451	Digital multimeter

NOTE

Set power supply PP-6304/GRM-95(V) to 115 Vac as indicated on its panel voltmeter. Maintain this indication throughout the following procedures.

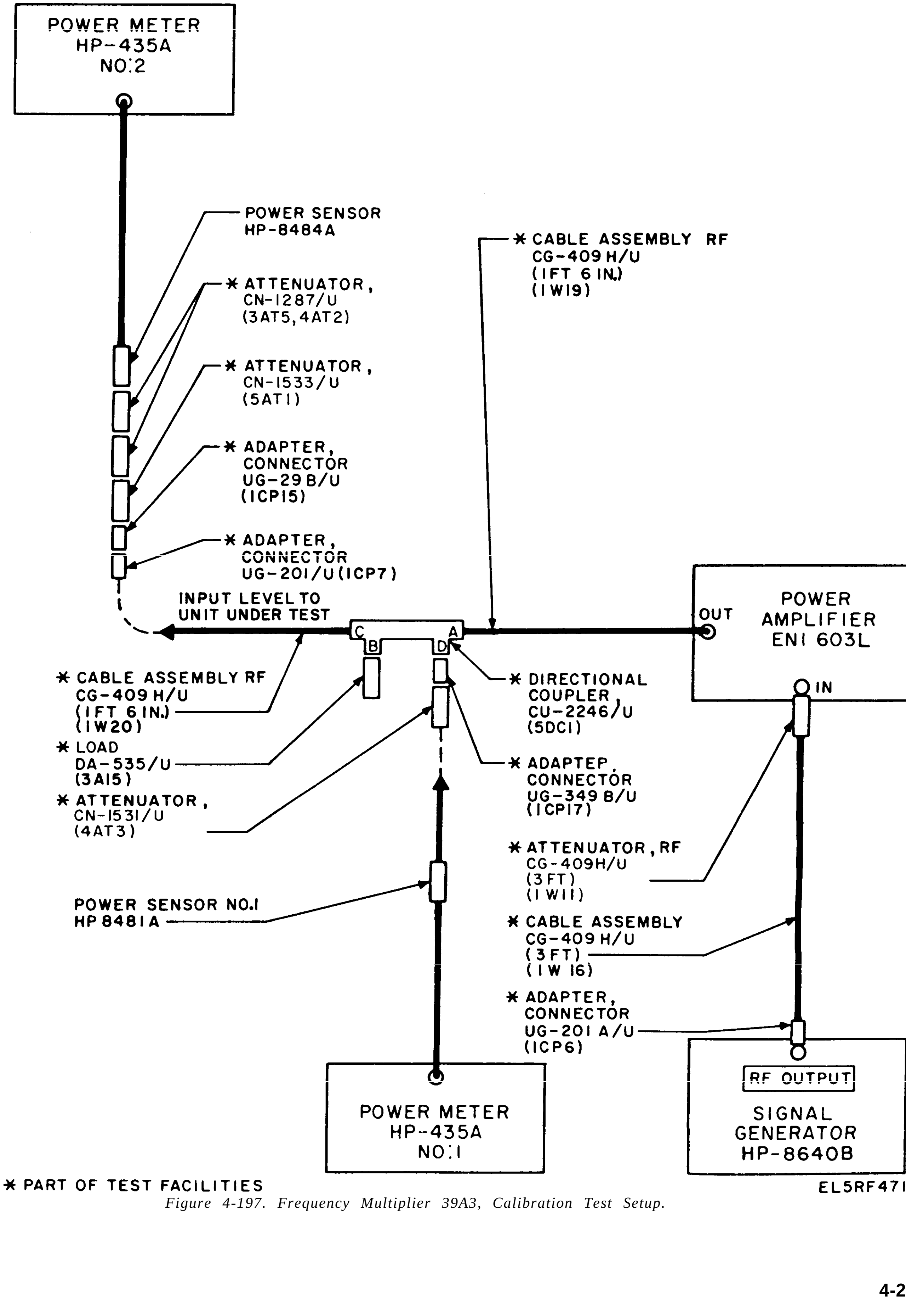


Figure 4-197. Frequency Multiplier 39A3, Calibration Test Setup.

b. Test and Alinement Procedures.

(1) Equipment calibration.

(a) Connect the test equipment as shown in figure 4-197.

(b) Set the signal generator to a CW frequency of 106.250 MHz, and adjust the rf output level control to minimum.

(c) Set the broadband rf amplifier to ON and adjust the signal generator so that the input level to the unit under test is exactly +32 dBm (a nominal indication of –28 dBm on power meter No. 2, depending on the calibrated value of the 20 dB attenuators).

(d) Note the corresponding reading on power meter No. 1 and record the power meter No. 1 indication opposite the corresponding signal generator frequency below.

Signal generator frequency (MHz)	*Power output at Port C coupler No. 1 (dBm)*	*Power meter No. 1 indication (dB)*
106.250	+32.0	
109.375	+32.0	
112.500	+32.0	
114.583	+32.0	
115.625	+32.0	
117.500	+32.0	
120.833	+30.0	
125.000	+30.0	
129.166	+30.0	
133.333	+30.0	
137.500	+30.0	

(e) Repeat *(b)* through *(d)* above for all the other test frequencies and power levels listed above.

(f) Set the broadband amplifier to OFF. Disconnect power meter No. 1 and No. 2 and the 3 attenuators and adapters UG-29B/U and UG20l/U from the test setup. Do not disassemble items connected to power meter No. 1. These will be used in a later setup (fig. 4-199).

(g) Connect the test equipment as shown in A, figure 4-198.

(h) Adjust the output power from the signal generator to +8 dBm at 1880 MHz (+8 dBm indication on power meter No. 1).

(i) Connect the test equipment as shown in B, figure 4-198.

(j) Tune the bandpass filter for maximum reading on power meter No. 2.

(k) Vary the phase shifter for minimum power output on power meter No. 2. The difference between this reading and the one obtained in *(h)* above (+8 dBm) gives the insertion loss of the phase shifter, bandpass filter, attenuators, coupler, connectors, and 2:1 mismatch load loss, etc. Record this value opposite the corresponding signal generator frequency below.

Signal generator No. 2 frequency (MHZ)	*Total dB loss due to phase shifter, bandpass filter, attenuators, coupler, connectors, 2:1 mismatch load etc.*
1880	
1800	
1750	
1700	
1650	
1600	
1550	
1500	
1450	
1375	
1350	

(l) Repeat *(g)* through *(k)* above for all the other test frequencies listed under *(k)* above. When the setup has been calibrated for all the frequencies, retune the bandpass filter to 1350 MHz and leave it undisturbed, as this setting is important when setting up the tracking alinement in (2) below.

(2) *Tracking and outputpower test.*

(a) Turn the test fixture control knob until the counter dial reads 0195 (19.5 turns).

(b) Install the unit under test on test fixture TS-3829/GRM-95(V), and secure it with the tuning shaft engaged to the mechanical counter. At the same time, ensure that the connector on the unit under test is properly mated with the test fixture connector.

(c) Loosen the drive shaft locking clamp (TM 11-5820-540-30) on the unit under test.

(d) Connect the test equipment as shown in A, figure 4-199, using the equipment calibrated in (1) above.

(e) Set receiver test facility switch S1 to ON and S6 to MULTIPLIER.

(f) Set switch S15 (rf modules test facility) to NORMAL.

(g) Set power meter No. 2 to the –30 dBm full scale range.

(h) Set the broadband amplifier to ON.

(i) Set the signal generator frequency to 115.625 MHz. Adjust the power at port C of coupler No. 1 by adjusting the signal generator output level control until power meter No. 1 reads as determined in step *(1)(d)* above at the signal generator frequency being used (equivalent to +32 dBm or +30 dBm input).

(j) Tune the multiplier around the 0195 test fixture counter reading for maximum power meter No. 2 indication at 1850 MHz as indicated on the frequency counter (increase power meter range switch when necessary). Power meter No. 2 should indicate at least –33 dBm and the test fixture counter should read 0195.0 ±0000.5.

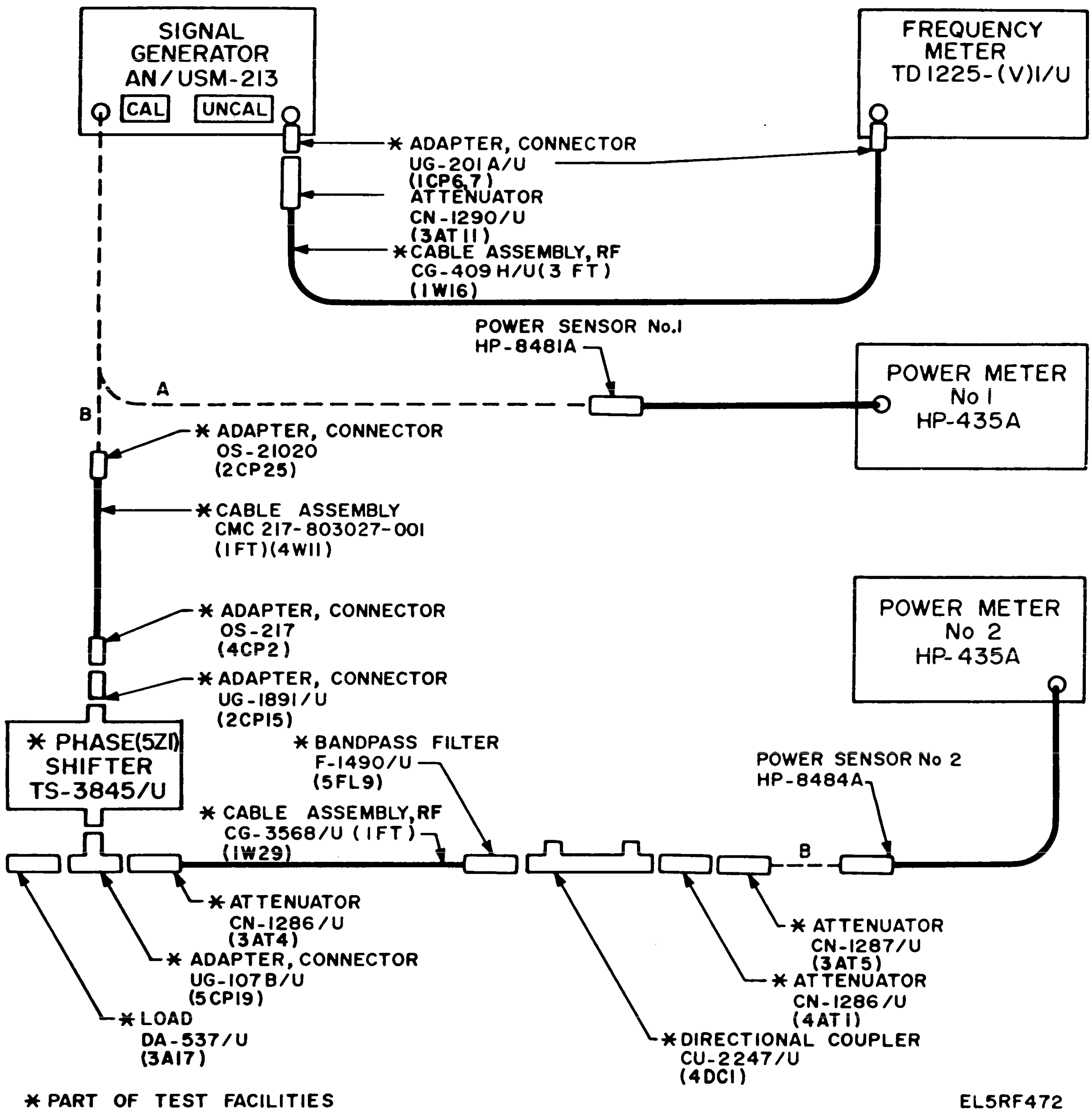


Figure 4-198. Frequency Multiplier 39A3, Calibration of Equipment, Test Setup.

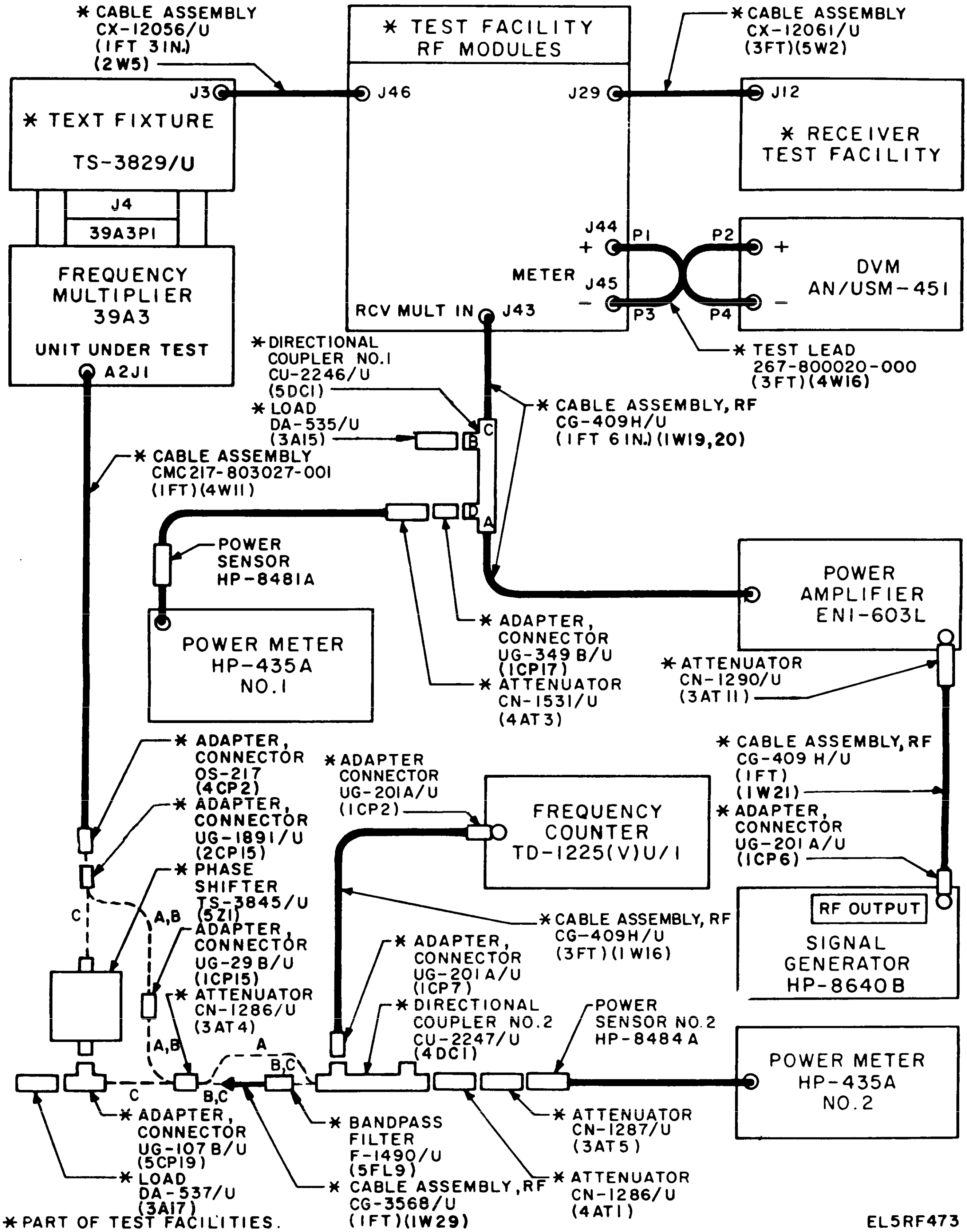


Figure 4-199. Frequency Multiplier 39A3, Output Power, Input Power, VSWR, Harmonic Rejection and ALC, Test Setup.

(k) If necessary, reset the test fixture counter as described below.

1. Lock the clamp on the drive shaft of the unit under test and remove it from the test fixture.

2. Set the test fixture counter to the required reading.

3. Reinstall the unit under test on to the test fixture, ensuring that the counter reading remains within ±00000.5 of the required reading.

4. Loosen the drive shaft locking clamp on the unit under test.

(l) Connect the equipment as shown in B, figure 4-198.

(m) Turn the test fixture clockwise for a counter reading of 0000.0.

(n) Set the signal generator to 112.5 MHz and adjust its output level as described in *(i)* above.

(o) Tune the multiplier around the 0000.0 counter reading for maximum power output at 1350 MHz. The test fixture counter should read 0000.0 ±0.5. If necessary, reset the counter as described in *(k)* above.

(p) Connect the test equipment as shown in C, figure 4-199, and tune the bandpass filter to maximum power output as indicated by power meter No. 2.

(q) Note the minimum power output by varying the phase shifter. The power output shall be at least +8.5 dBm (power meter No. 2 indication plus the loss determined at the same frequency in *(1)(k)* above).

(r) Set the signal generator frequency to 114.583 MHz and repeat step *(i)* above.

(s) Turn the control knob of the test fixture counterclockwise until the dial reads 0010.

(t) Tune the bandpass filter to 1375 MHz for a maximum output power indication on power meter No. 2. The frequency counter should indicate an output frequency of 1375 MHz.

(u) Vary the phase shifter and note the minimum power outputs. Calculate the actual power output as in *(q)* above. The power output shall be at least 8.5 dBm.

(v) Repeat *(r)* through *(u)* above for all other signal generator frequencies, input power levels, and counter settings below.

Signal generator frequency (MHz)	*Minimum output power to unit under test at port C, coupler No. 1 (dBm)*	*Multiplication factor*	*output frequency (MHz)*	*Counter reading*
112.500	+32	X12	1350	0000.0
114.583	+32	X12	1375	0010.0
120.833	+30	X12	1450	*0041.5*
125.000	+30	X12	1500	*0062.0*
129.166	+30	X12	1550	*0082.0*
133.333	+30	X12	1600	*0101.6*
137.500	+30	X12	1650	*0120.8*
106.250	+32	X16	1700	*0139.5*
109.375	+32	X16	1750	*0158.0*
112.500	+32	X16	1800	*0176.0*
117.500	+32	X16	1880	*0207.0*

(3) *Input VSWR test and adjustment.*

(a) Connect the equipment as shown in C, figure 4-199. Make sure the frequency multiplier is tuned to 1880 MHz (f_{IN} at 117.50 MHz), as in *(2)(v)* above.

(b) Connect the power meter No. 1 as shown in figure 4-199, and note the power output as indicated by power meter No. 1 at port D of coupler No. 1.

(c) Interchange the power meter, 6 dB attenuator and dummy load connections at port B and port D of directional coupler No. 1, and note the power reading.

(d) The resultant power in *(c)* above shall be at least 9.5 dB less than that measured in *(b)* above, corresponding to an input return loss of 9.5 dB (VSWR 2.0:1).

(e) Repeat *(b)* through *(d)* above for remainder of output frequencies listed in *(2)(v)* above. If the specification is not met, adjust the input VSWR as outlined in *(f)* through *(j)* below.

(f) Set the signal generator frequency to 137.5 MHz. Adjust the rf level at port C of coupler No. 1 to +30.0 dBm by monitoring the reading on power meter No. 1. See listing under *(1)(d)* above.

(g) Tune the multiplier to the 12th harmonic (1650 MHz), moving the test fixture tuning control clockwise to set the counter reading according to *(2)(v)* above for 1650 MHz. The output frequency of 1650 MHz is indicated by the frequency counter at port No. 2 of coupler No. 2. Power meter No. 2 reads the power output when the bandpass falter is tuned to 1650 MHz.

(h) Measure the power at port D of coupler No. 1 and the corresponding power at port B of the coupler. The input VSWR should be as in *(d)* above, corresponding to a 9.5 dB return loss (input VSWR 2.0:1). If not, adjust C5 (fig. 4-200) of the unit under test for a return loss of 9.5 dB or better at this frequency.

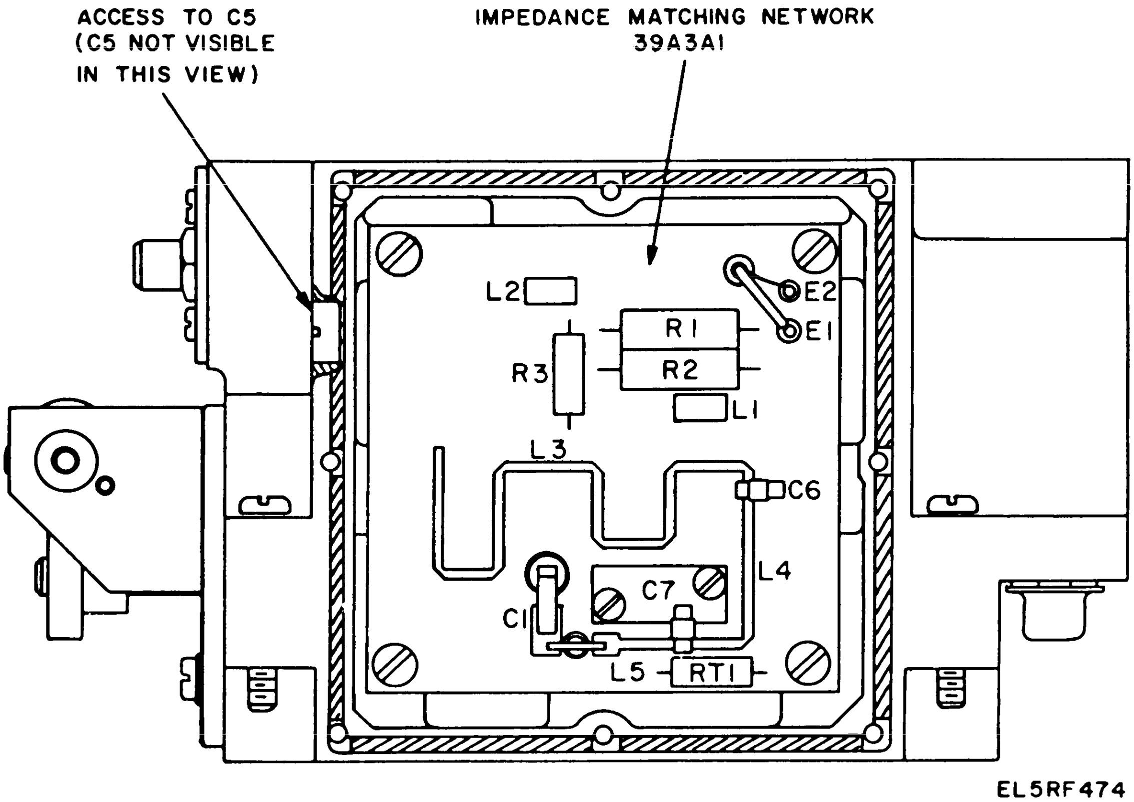


Figure 4-200. Frequency Multiplier 39A3, Side View, Cover Removed

(i) Set the signal generator frequency to l06.25 MHz and adjust rf level at port C of coupler No. 1 for 32.0 dBm. See listing under *(1)(d)* above. Tune the frequency multiplier to set the test set counter for 1700 MHz per *(2)(u)* above, and repeat the return loss measurement as in *(h)* above. If necessary, readjust C5 of unit under test until the minimum return loss is 9.5 dB or greater. Repeat *(f)* through *(i)* above until the minimum return loss is achieved at 106.25 MHz and 137.5 MHz.

NOTE

If it is not possible to achieve the minimum return loss, then C7 on 39A3A1 must be slightly relocated on the board as shown in figure 4-201. Movement is restricted to ±0.12 inch. Repeat *(f)* through *(i)* above for different positions of C7 until the minimum return loss is achieved at both 106.25 MHz . and 137.5 MHz.

(j) Retune the frequency multiplier to an output frequency of 1880 MHz as outlined in *(2)(v)* above. Repeat steps *(3)(a)* through *(e)* above so as to recheck the VSWR across the frequency band.

NOTE

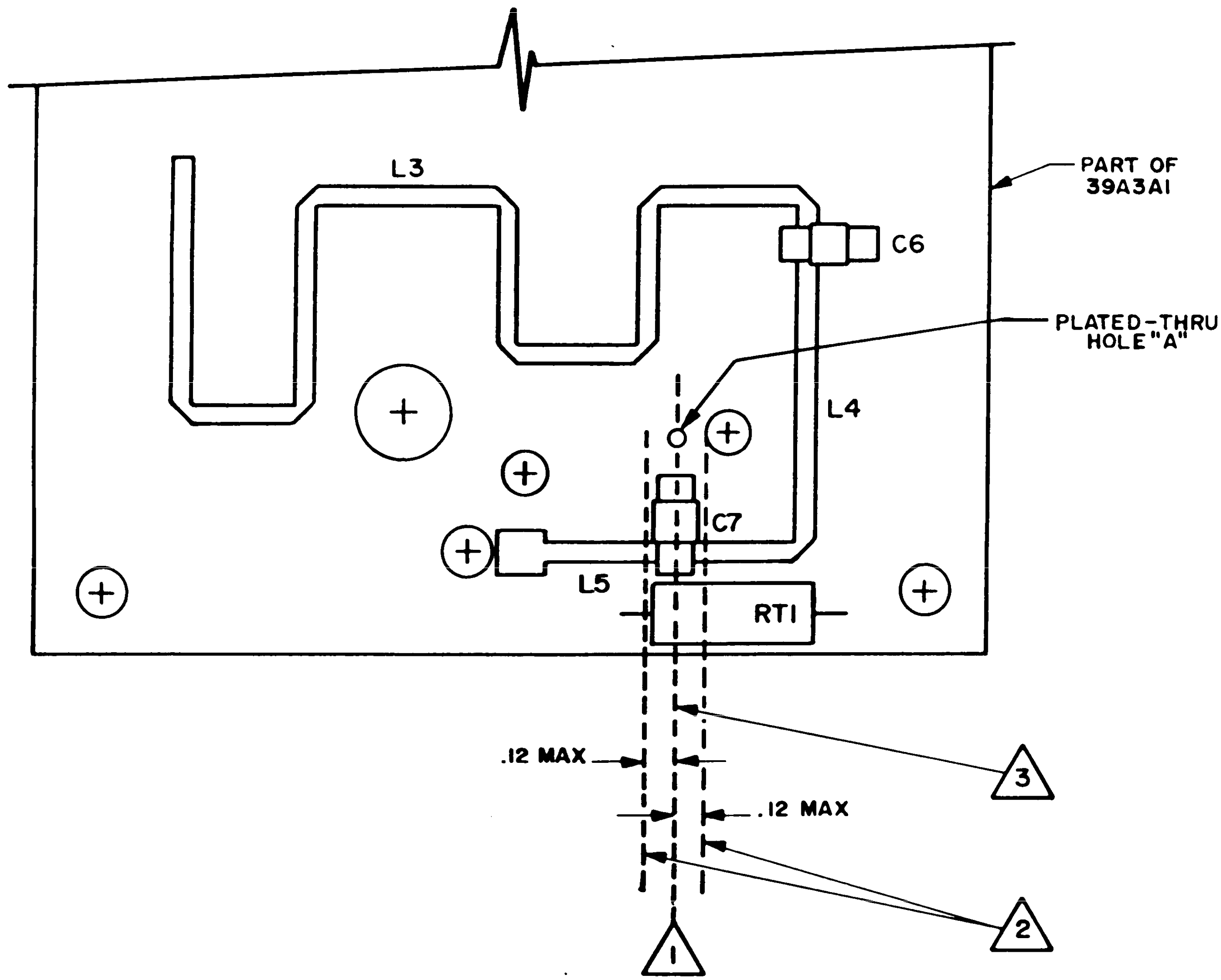
As in the note to *(i)* above, if the 9.5 dB minimum return loss at all frequencies cannot be achieved, it is necessary to reposition C7 together with adjustment to C5 on 39A3A1. Any adjustment at this stage, necessary to achieve minimum return loss at all test frequencies, will require the rechecking of all steps in (2) and (3) above.

(4) *Adjacent harmonics rejection test.*

(a) Make sure the equipment is connected as in C, figure 4-199. Tune the frequency multiplier for an output frequency of 1880 MHz as in *(2)(v)* above. Tune the bandpass filter and phase shifter to indicate maximum output power on power meter No. 2 and note this power level.

(b) Without disturbing the test fixture tuning knob, carefully tune the bandpass filter to the next higher harmonic comb. This comb is spaced exactly by the input frequency. If the output frequency is 1880 MHz (f_{in} = 117.5 MHz X16), the next higher and lowel combs are 1997.5 and 1762.5 MHz respectively.

(c) Note the power output of the higher comb as indicated on power meter No. 2.



NOTES:
1 - HOLE "A" CENTER LINE MAXIMAL ALLOWABLE LATERAL MOVEMENT OF C7 FROM HOLE "A" IS MAX .12 BOTH SIDE.
2 - MAXIMUM ALLOWABLE LATERAL MOVEMENT OF C7.
3 - NORMAL MOUNTING POSITION (CENTER OF C7 IN LINE WITH PLATED-THRU HOLE "A").

EL5RF824

Figure 4-201. Frequency Multiplier 39A3, Location of Capacitor C7.

(d) Tune the bandpass filter to the lower comb by turning the bandpass filter dial and observing the power meter indication. The power meter will first indicate an output when the bandpass filter is tuned to the desired output frequency (1880 MHz). The next position on the bandpass filter which will correspond to an output on the power meter will be on the lower comb (1762.5 MHz).

(e) Note the power output of the lower comb.

(f) The power output of adjacent combs as measured in *(c)* and *(e)* above shall be at least 10 dB less than that measured in *(a)* above for 1880 MHz.

(5) *ALC* test.

(a) Make sure the equipment is connected as in C, figure 4-199.

(b) Retune the bandpass filter to the desired output frequency (1880 MHz).

(c) Adjust the phase shifter for maximum power output and adjust the signal generator OUTPUT LEVEL controls for a unit under test output of +15.5 dBm.

(d) Set rf modules test facility switch S15 to ALC, The digital multimeter should indicate between 7.5 and 9.5 Vdc.

(e) If the requirements of *(d)* above are not met:

1. Turn the power amplifier OFF.

2. Adjust 39A3AR1R2 for maximum indication on the multimeter. The multimeter should indicate +6.2 Vdc ±0.5 V.

3. Set the power amplifier to ON.

4. Adjust R2 for a multimeter indication of 9.5 Vdc.

(f) Readjust signal generator output level control for a unit under test output level of +12 dBm. The multimeter should indicate not more than 7.2 Vdc. If necessary, readjust R2 for 7.2 Vdc and repeat *(c)* and *(d)* above.

(g) Upon completion of the testing of frequency multiplier 39A3, tune the frequency multiplier to an output frequency of 1850 MHz by adjusting the tuning knob for a counter reading of 0195. Lock the clamp on the drive shaft of the unit under test.

c. Troubleshooting (figure 2-113, TM 11-5820-540-30).

Symptom	*Probable cause*	*Checks and corrective measures*
1. No output indication in procedure *b. (2)(j)* above.	*a.* Damaged varactor diode 39A3CR1 (fig. 4-203).	*a.* Check forward and reverse resistance of 39A3CR1. Connect a multimeter between the anode of 39A3CR1 and the chassis ground of the multiplier housing. The forward resistance shall read between 25 and 35 ohms and the reverse resistance shall read between 100 and 130 ohms. If an abnormal indication is obtained, replace CR1 (procedure *d.(1)* below).
	b. Defective matching network 39A3A1.	*b.* Disconnect resistor 39A3A1RT1 (fig. 4-200) and measure the resistance with the multimeter. It shall read between 110 and 130 ohms. If an abnormal indication is obtained, replace 39A3A1RT1. Check other components on 39A3Al. Repair and replace as required.
	c. Damaged resistor probe assembly 39A3R1 (fig. 4-203).	*c.* Using a multimeter, measure the resistance between the top of 39A3R1 and the chassis ground of the multiplier housing. The multimeter shall indicate approximately 1 ohm. If an abnormal indication is obtained replace 39A3R1 (procedure *d.* (2) below).
	d. Defective signal level monitor 39A3A2 (fig. 4-203).	*d.* Replace 39A3A2 (procedure *d.* (3) below).
2. Low power output indication obtained in procedure *b.(2)* above.	*a.* Defective impedance matching network 39A3A1 (fig. 4-200).	*a.* Proceed as in corrective measure *1b.* above.
	b. Defective resistor probe assembly 39A3R1 (fig. 4-203).	*b.* Proceed as in corrective measure *1c.* above.
	c. Defective signal level monitor 39A3A2 (fig. 4-203).	*c.* Proceed as in corrective measure *1d.* above.
3. Adjacent harmonic requirement cannot be met.	*a.* Defective impedance matching network 39A3A1 (fig. 4-200).	*a.* Proceed as in corrective measure *1b.* above.
	b. Defective resistor probe assembly 39A3R1 (fig. 4-203).	*b.* Proceed as in corrective measure *1c* above.
4. ALC requirements not met in procedure *b. (5)(d)* and *(f)* above.	*a.* Defective signal level monitor 39A3A2 (fig. 4-203).	*a.* With 15.5 dBm rf output level from the unit under test, measure the dc voltage pins 3 (+) and 2 (–) of 39.43A2. The voltage shall be between 275 mV and 400 mV. If abnormal indication is obtained, replace 39A3A2 (para. *d.* (3) below).

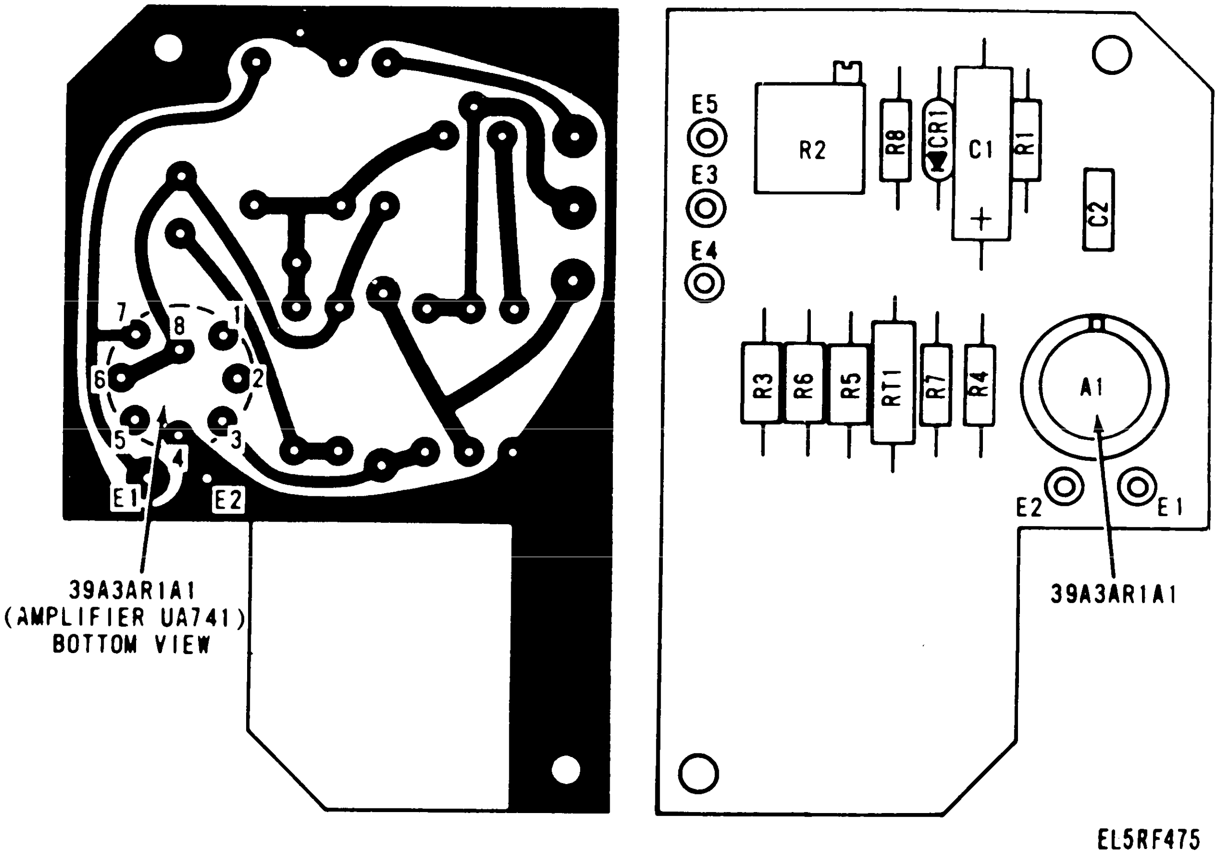


Figure 4-202. Dc Amplifer 39A3ARl, Top and Bottom Views.

c. Troubleshooting – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
	b. Defective dc amplifier 39A3AR1 (fig. 4-203).	*b. (1)* Check 39A3AR1 gain as follows: *(a)* Set the rf amplifier to off and connect the digital voltmeter between E3 and chassis ground (fig. 4-202). Adjust R2 for maximum voltage (6.2 ±0.5 Vdc). Note the digital voltmeter indication. *(b)* Measure the voltage at pin 5 of P1 (approximately 6.2 Vdc). Note the indication. *(c)* Adjust R2 to decrease the indication noted in *(b)* above by 3.2 volts. *(d)* Measure the voltage at E3. The voltage should have decreased by approximately 100 millivolts below that noted in *(a)* above. *(2)* If the indications in *(1)* above are abnormal, check dc amplifier and associated components. Repair or replace components as required.

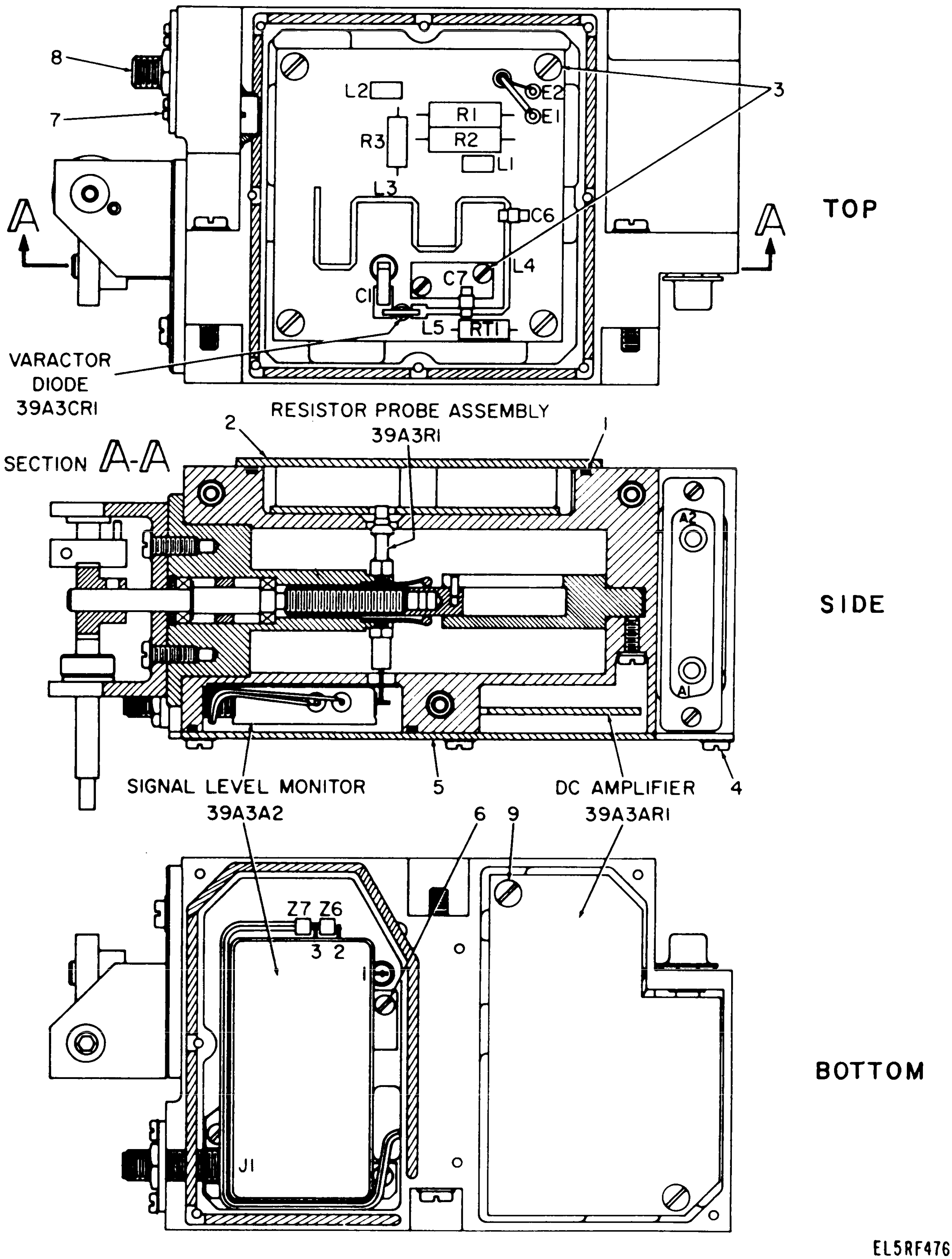


Figure 4-203. Frequency Multiplier 39A3, Assembly Details.

d. Replacement Procedures.

(1) *Varactor diode 39A3CR1* (fig. 4-203).

(a) Remove screws (l), (fig. 4-203), and lift off the top cover (2).

CAUTION

To avoid damaging varactor 39A3CR1 when lifting out circuit board 39A3A1, make sure the locking screw has cleared the varactor beforehand.

(b) Unscrew the retaining screw sufficiently to clear varactor 39A3CR1. Use a counterclockwise motion, and refer to the retaining screw in figure 4-234 for further details.

(c) Unsolder the jumper on 39A3CR1, and disconnect the leads at El and E2.

(d) Unsolder resistor probe assembly 39A3Rl (fig. 4-203), and remove capacitor 39A3A1C1 (fig. 4-200).

(e) Remove screws (3, fig. 4-203), and lift out impedance matching network 39A3A1 (fig. 4-200).

(f) Gently turn varactor diode 39A3CRl counterclockwise with a pair of long-nosed pliers until free of the chassis, and remove it (fig. 4-200).

(g) Install replacement varactor diode in the reverse order of removal.

(2) *Resistor probe assembly.*

(a) Proceed as in *(1)(a)* through(e) above.

(b) Gently turn resistor probe assembly 39A3R1 counterclockwise with a pair of long-nosed pliers until it is free of the cavity.

(c) Install the replacement probe assembly in the reverse order of removal.

(3) *Signal level monitor* 39A3A2 (fig. 4-203).

(a) Remove screws (4), and lift off the bottom cover (5).

(b) Unsolder the leads from pins 1,2, and 3 on 39A3A2, and tag for identification.

(c) Remove the screws (6) which secure assembly 39A3A2.

(d) Remove screws (7) and receptacle A2J1 (8).

(e) Lift module 39A3A2 out of the housing.

(f) Install the replacement module in the reverse order of removal.

(4) *Dc amplifier 39A3AR1* (fig. 4-203).

(a) If necessary, remove screws (4) and bottom cover (5).

CAUTION

When removing circuit board 39A3AR1, take care to avoid damaging the connections at terminals E1 and E5.

(b) Remove screws (9) and lift out circuit board 39A3AR1 gently.

(c) Tag the leads to terminals El to E5 for later identification, and unsolder the terminal connections.

(d) Install the replacement module in the reverse order of removal.

4-76. Control-Indicator 39A4

NOTE

The following instructions also apply to control-indicator 40A4 with the modifications noted therein.

a. Test Equipment and Material Required

Equipment	*Common name*
Accessory Kit Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit
Multimeter, Digital AN/USM-451	Multimeter
Power Supply HP-6002A	Power supply

b. Test Procedures.

(1) Connect the test equipment as shown in figure 4-204.

(2) Turn power supply on.

(3) Turn the thumb wheel on the control-indicator test set to display channel 2319 in the window of control-indicator 39A4 under test (channel 2379 for control-indicator 40A4).

NOTE

The control-indicator type number must correspond with the type number displayed in the left-hand window of the control-indicator test set. For unit 39A4, the type number is CMC 245-801816-001; for unit 40A4, the type number is CMC 245-801816-002.

(4) Turn the tuning control shaft on the unit under test so that the numerical counter indicates channel 2319 (channel 2379 for unit 40A4).

(5) Observe the lamp display on the control-indicator test set. Extinguished lamps must correspond to the dots on the tape display.

(6) Repeat (4) and (5) above for the remaining channels on the tape.

CAUTION

Do not exert undue force on the mechanism if the clutch does not slip. Readjust the clutch nut as described in paragraph 4-lld. (5).

(7) Check the stop mechanism by turning the control shaft to the limit (past channels 2300 and 3299). At these points, the slipping clutch shall operate to stop further movement of the gears.

c. *Troubleshooting.*

NOTE

All of the following voltage measurements are taken at pins 1 through 16 of control-indicator subassembly 39A4A1 (40A4A1). Access to these pins is available when the cover of the unit under test is removed. Control line outputs 1 through 11 correspond to pins 1 through 11 of control-indicator subassembly 39A4A1 (40A4A1) for all channels below 2960.

Symptom	*Probable cause*	*Checks and corrective measures*
1. One or more test set lamps (0 through 13) permanently illuminated.	*a*. Physical obstruction in light path.	*a.* Remove cover of unit under test. Set control-indicator to any channel below 2960. Check that no obstruction or foreign objects exist in light path corresponding to permanently illuminated lamp.
	b. Defective current regulator 39A4VR1 (40A4VR1).	*b.* Check that the following voltages exist at control-indicator subassembly 39A4A1 (40 A4A1): Pin 12 12 V (±3 V) Pin 13 16 V (+1V) Pin 14 19 V (±1V) Pin 15 26 V (±1V) Pin 16 0 V If these voltages are not obtained, replace or repair PCB 39A4VR1140A4VR1 (higher category of maintenance required).
	c. Defective decoder command signal module 40A4A2 (39A4A2) or control-indicator subassembly 40A4A1 (39A4A1).	*c.* Measure voltage at pin of control-indicator subassembly 39A4A1 (40A4A1) which corresponds to illuminated test set lamp(s). If measured voltage is 0.15 V or less, replace decoder command signal module 39A4A2 (40A4A2). If measured voltage exceeds 0.15 V, replace control-indicator subassembly 39A4A1 (40A4A1) category of maintenance required).
2. One or more test set lamps (O through 13) permanently extinguished.	Defective current regulators 39A4VR1 (40A4VR1) control-indicator subassembly 39A4A1 (40A4A1), or decoder command signal module 39A4A2 (40A4A2).	Remove cover of unit under test. Set control-indicator to any channel below 2960. Check that the following voltages exist at control-indicator subassembly 39A4A1 (40 A4A1): Pin 12 12 V(±3V) Pin 13 16 V(±1V) Pin 14 19 V(±1V) Pin 15 26 V(±1V) Pin 16 0 V If these voltages are not obtained, replace current regulator 39A4VR1 (40A4VR1). If these voltages are obtained, measure voltage at control-indicator subassembly pin corresponding to affected control line. If voltage is 0.15 V or less, replace control-indicator subassembly 39A4A1 (40A4A1). If measured voltage exceeds 0.15 V, replace decoder command signal module 39A4A2 (40 A4A2) (higher category of maintenance required).

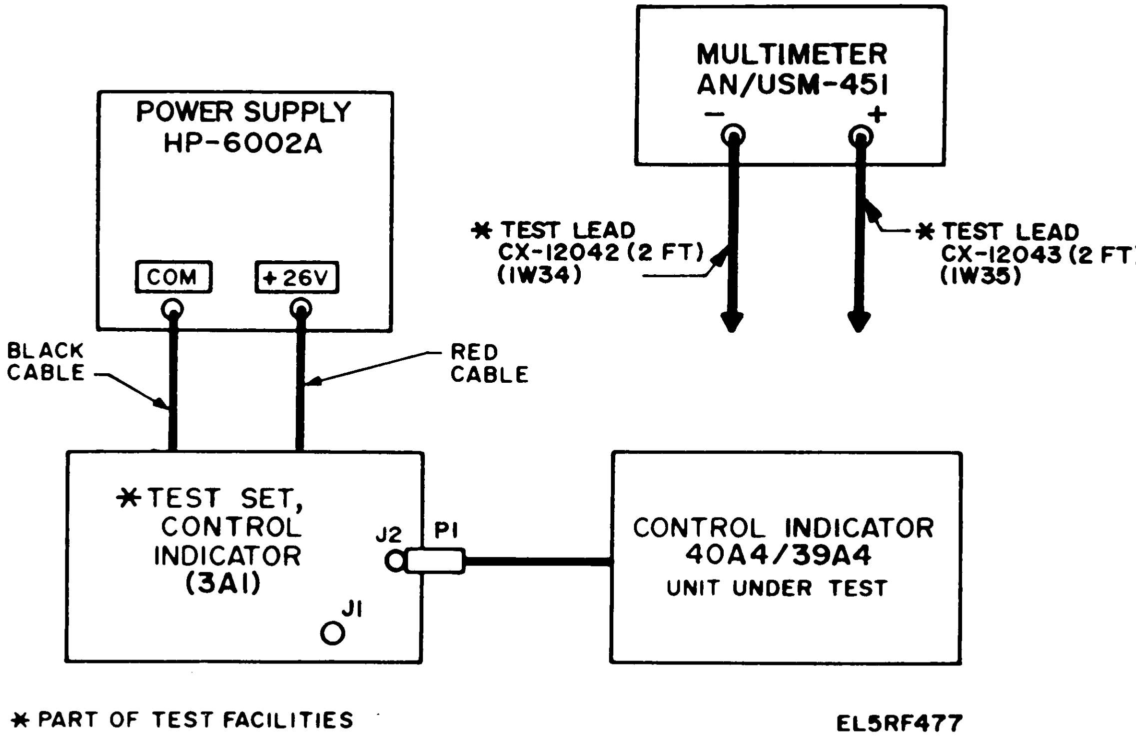


Figure 4-204. Control-Indicator 39A4/40A4, Test Setup.

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
3. Lamp 13 on test set permanently illuminated or permanently extinguished.	Defective decoder command signal module 40A4A2 (39A4A2).	Replace decoder command signal module 39A4A2 (40A4A2) (higher category of maintenance required).

4-77. Rf Amplifier 39AR1.

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility, rf modules
Test Facility, Receiver, TS-2867(V)2/GRM-95(V)2	Receiver test facility
Test facility, Transmitter, TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Accessory Kit, Test Facilities Set, MK-l173(V)2/ GRM-95(V)2	Accessory kit
Accessory Kit Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, band 2,3,4
Amplifier, Power, ENI 603L	Power amplifier
Frequency Unit, Plug-m Wiltron 61084D	Frequency converter, plug-in unit
Generator, Sweep, Wiltron 61OD	Sweep generator
Meter, Power HP-435A	Power meter
Power Sensor HP-8481A	Power sensor
Multimeter AN/USM-451	Multimeter
Oscilloscope AN/USM-281C	Oscilloscope

NOTE

Set power supply PP-6304/GRM-95(V) to 115 Vac as indicated on its panel voltmeter. Maintain this indication throughout the following procedures.

b. Test Procedures.

(1) *Input VSWR test.*

(a) Connect the test equipment as shown in A, figure 4-205.

(b) Set the sweep generator to MANUAL mode, operate F1 to F2 between 105 MHz and 140 MHz at an output level of +17 dBm as indicated on the power meter.

(c) Set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S6	MULTIPLIER

(d) Connect the equipment as shown in B, figure 4-205.

(e) Calibrate the oscilloscope for a convenient display of the 1.65:1 VSWR response between 105 MHz and 140 MHz.

(f) Connect the test equipment as shown in C, figure 4-205.

(g) Set stitch S11 on rf module test facility to NORMAL and set ALC ADJ control fully clockwise.

(h) The VSWR of the unit under test should not exceed 1.65:1 limit calibrated in *(e)* above.

(i) Repeat *(a)* through *(h)* above for an input power level of +13 dBm.

(j) If the requirements of *(h)* and *(i)* above cannot be met, slightly adjust C2, C4 and C7 of the unit under test to obtain a VSWR of 1.65:1 or better over the frequency range.

(2) *Power output test and calibration.*

(a) Calibration.

1. Connect the test equipment as shown in A, figure 4-206.

2. Set the sweep generator to operate F1 to F2 between 105 MHz and 140 MHz.

3. Set the sweep generator to MANUAL mode and set to 140 MHz at an output level of +13 dBm as indicated on the power meter.

4. Connect the test equipment as shown in B, figure 4-206.

5. Note the power meter indication and record the coupler loss.

6. Repeat *1.* through 5. above for frequencies of 130, 120, 110 and 105 MHz and record the coupler loss as indicated on the power meter for each frequency.

(b) Power output test.

1. Connect the test equipment as shown in C, figure 4-206.

2. Set the sweep generator to 105 MHz with an output level to the unit under test of +13 dBm.

3. Set the receiver test facility switches as follows:

Switch	*Position*
S1	ON
S5	S6
S6	MULTIPLIER

4. Adjust the rf module test facility switch S11 to NORMAL and the ALC ADJUST control fully clockwise.

5. Adjust the trombone line for a minimum indication on the power meter. The output power from the unit under test should be at least +31.5 dBm. The coupling loss recorded in *(2)(a)* above at this frequency should be added to the power meter indication.

NOTE

It may be necessary to vary the cable lengths shown in figure 4-206 in order to achieve a minimum indication.

6. Set S11 on the rf module test facility to +12 V CUR and then to –12 V CUR. The current indicated on the multimeter should not exceed 450 mA.

7. Repeat 1. through 6. above for the remaining frequencies listed in *(2)(a)*. The power output should be a minimum of +31.5 dBm for frequencies of 105 MHz to 120 MHz and +29.5 dBm for frequencies of 130 MHz and 140 MHz.

8. Repeat *1.* through *7.* above for an input to the unit under test of +17 dBm.

9. If the requirements of *1.* through *8.* above cannot be met then proceed as follows:

10. Set the sweep generator to 140 MHz CW and set rf module test facility switch S11 to NORMAL.

11. Connect the test equipment as shown in D, figure 4-206. Readjust C17 and C27 of the unit under test to obtain maximum gain. Repeat *1.* through 8. above.

12. If more than 450 mA of current are drawn, decrease slightly the values of C17 and C27 of the unit under test until the amount of current drawn meets the specification. Repeat *1.* through *8.* above.

(3) *Output metering and ale test.*

(a) Set switch S11 (rf module test facility) to NORMAL.

(b) Connect the test equipment as shown in A, figure 4-207.

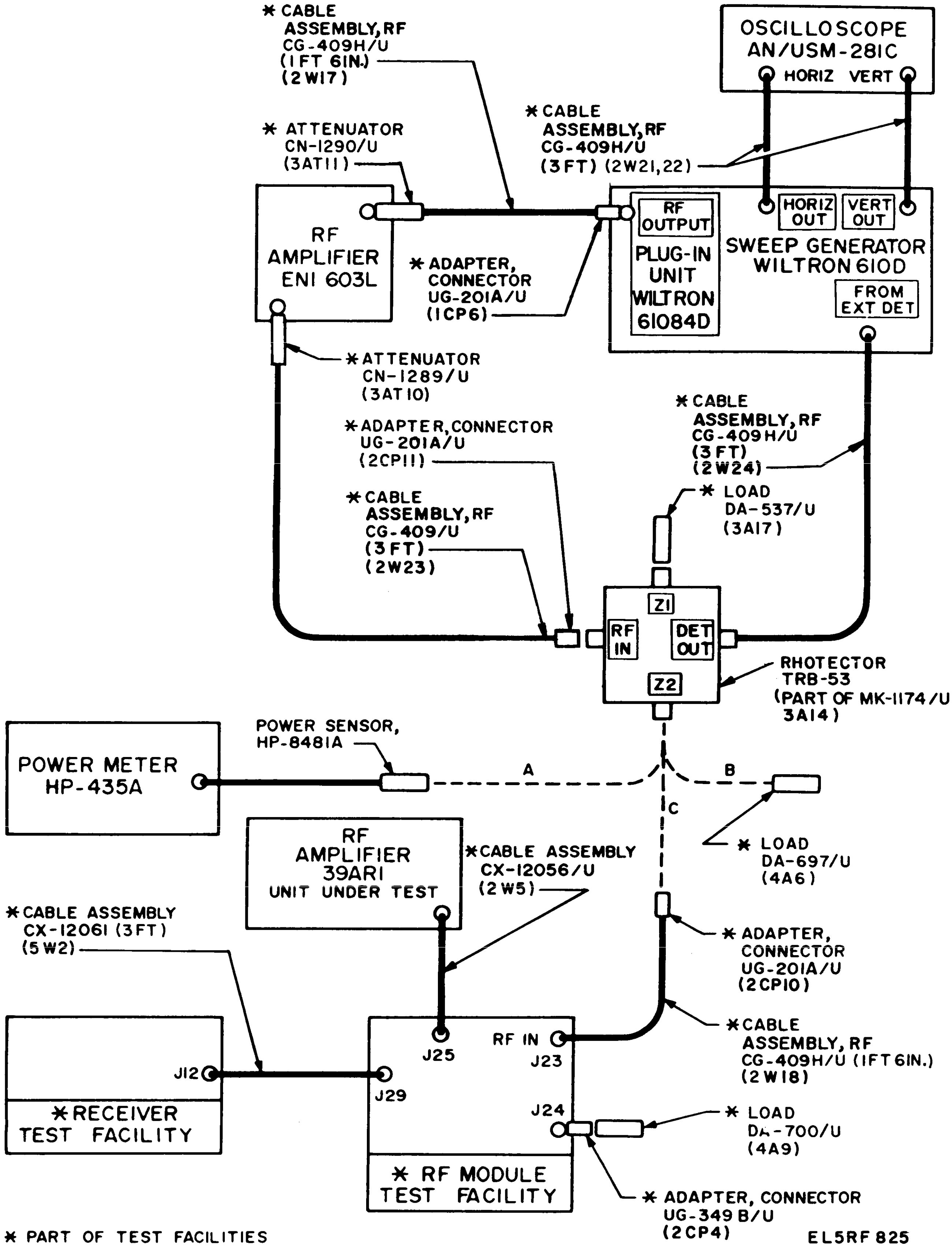


Figure 4-205. Rf Amplier 39AR1, Calibration, Test Setup.

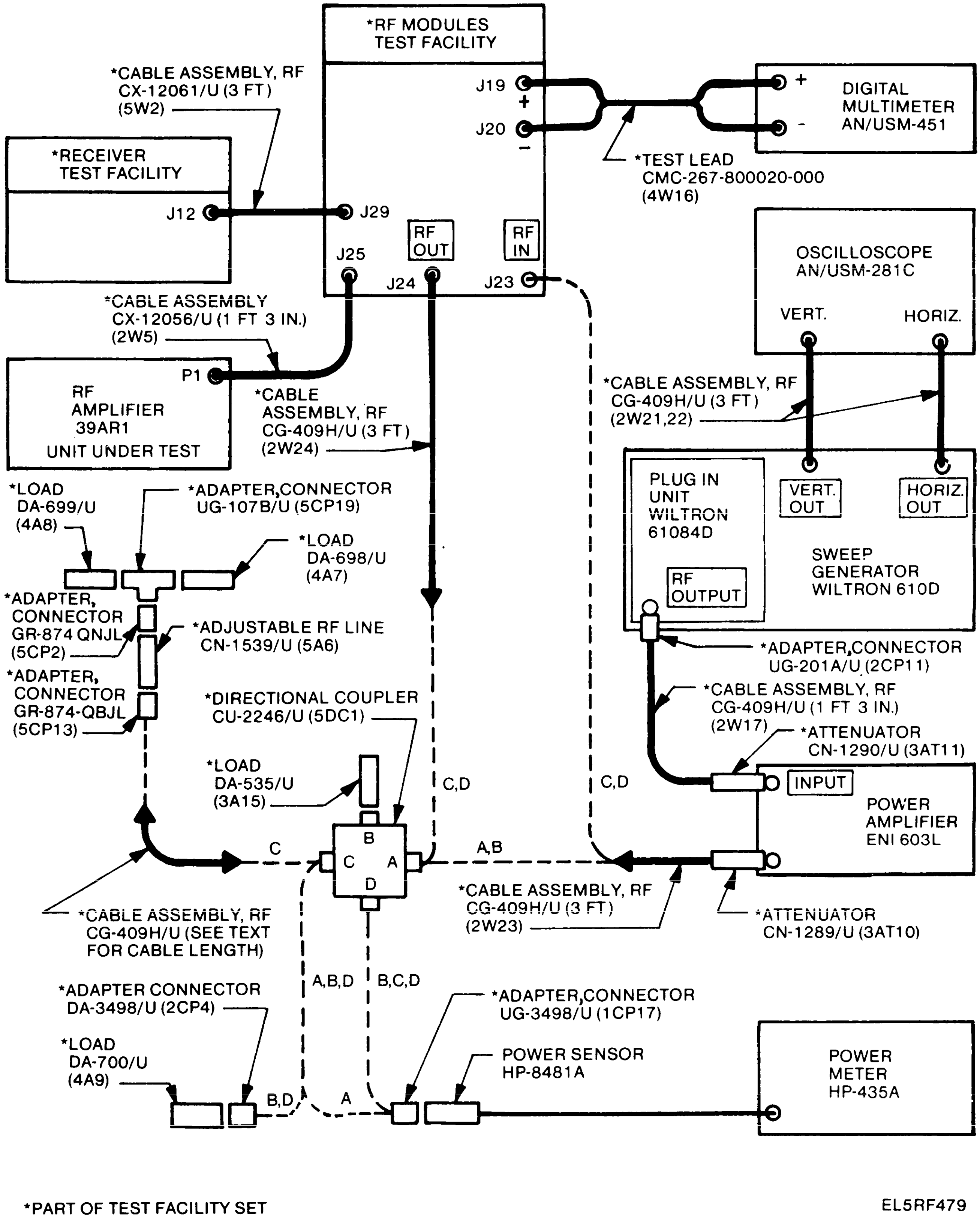


Figure 4-206. Rf Amplifier 39AR1, Output Power, Test Setup.

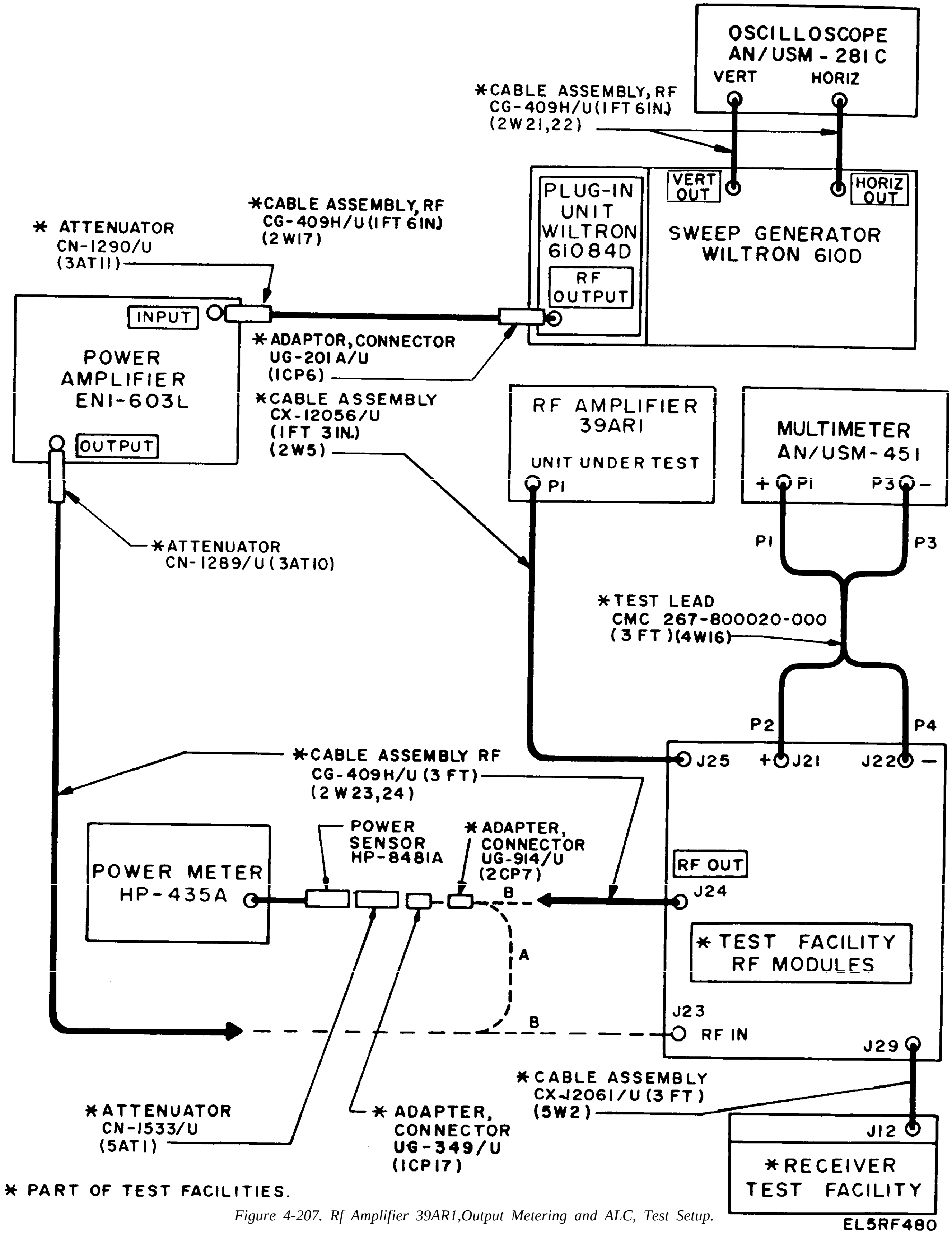


Figure 4-207. Rf Amplifier 39AR1,Output Metering and ALC, Test Setup.

(c) Set the sweep generator to the CW mode (INT LEVELING) and the frequency to 105 MHz using sweep generator markers followed by MANUAL mode setting.

(d) Adjust the rf output level control on the sweep generator until the power meter indicates -3 dBm (equivalent to a power output of +17 dBm).

(e) Connect the test equipment as shown in B, figure 4-207.

(f) Set switch S11 (rf module test facility) to ALC.

(g) Set the ALC ADJ control (rf module test facility) for a reading of 9.5 Vdc on the multimeter. The indication on the power meter should not exceed +7.5 dBm. This corresponds to an output power from the unit under test of +27.5 dBm.

NOTE

In *(g)* above, use calibrated 20 dB attenuator to determine output power.

(h) Reset the ALC ADJ control (rf module test facility) to obtain an output power from the unit under test of exactly +26.5 dBm. Meter Ml on the receiver test facility should indicate a minimum of 15 percent of the metering scale.

(i) Set the ALC ADJ control to obtain an output level of +33 dBm (+13 dBm indication on the power meter). Meter Ml on the receiver test set shall indicate a maximum 85 percent of the metering scale.

NOTE

If +33 dBm output level cannot be achieved in *(i)* above, then slightly adjust the rf output control on the sweep generator until this level is obtained

(j) Repeat *(b)* through *(i)* above for frequencies of 120 MHz and 140 MHz.

c. Troubleshooting (fig. 2-110 in TM 11-5820-540-30).

Symptom	*Probable cause*	*Checks and corrective measures*
1. High input VSWR in procedure *b.* (1)(h) above.	*a.* Defective diode 39AR1AR1CR1.	*a* Check the forward and the reverse resistante of diode 39AR1AR1CR1. Replace if required.
	b. Defective input circuitry components. (39AR1AR1C1, 39AR1AR1C2, 39AR1AR1C4, 39AR1AR1C5, 39AR1AR1C7, 39AR1AR1C9).	*b.* Check and replace as required.
	c. Damaged input connector pin A2 or Al of 39AR1P1. Damaged coaxial cable connecting pin A2 to terminal El or pin Al to E6 of 39AR1AR1.	*c.* Check and repair or replace as required.
2. Output power low or zero in procedure *b.(2)(b)* above.	*a.* Defective diode 39AR1AR1CR1.	*a* See corrective measure *1a* above.
	b. Defective transistor 39AR1AR1Q1.	*b.* Measure the dc voltages to ground on transistor 39AR1AR1Ql, and compare with those listed below. Replace the transistor if voltages do not meet specifications. Emitter: –6.2 Vdc nominal Base: –6.9 Vdc nominal Collector: +12 Vdc nominal
	c. Defective transistor 39AR1AR1Q2.	*c.* Measure the dc voltages to ground on transistor 39AR1AR1Q2 and compare with those listed below. Replace the transistor if voltages do not meet specifications. Emitter: –10.6 Vdc nominal Base: –9.9 Vdc nominal Collector: +12 Vdc nominal
	d. Defective diode 39AR1AR1CR2.	*d.* Check the forward and reverse resistance of diode 39AR1ARlCR2. Replace if necessary.
3. ALC requirement not met in procedure *b.(3)(h)* above.	*a.* Defective diode 39AR1AR1CR2.	*a* See corrective measure 2.d. above.
	b. Defective diode 39AR1AR1CR1.	*b. See* corrective measure 1.a above.

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
4. Metering requirements not met in procedure *b. (3)(i)* and *(j)* above.	*a.* Defective diodes 39AR1ARlCR5 or 39AR1AR1CR4.	*a* Check the forward and reverse resistance of diodes 39AR1AR1CR5 and 39AR1AR1CR4. Replace if required.
	b. Other defective component.	*b.* Check all other components of metering circuitry; repair or replace as required.

d. Replacement of Subassembly 39AR1AR1 (fig. *4-208).*

(1) Loosen screws (3) and remove cover plate (2) from housing (1).

(2) Remove nut (5), which secures the collector stud of transistor 39AR1AR1Q2(4).

(3) Remove screw (7), which retains the heat sink of transistor 39AR1AR1Q1 (6).

(4) Remove screws (9), which secure circuit board (10) of subassembly 39AR1AR1 to housing (l).

(5) Lift out the board carefully, to avoid breaking any of the connections at terminals E 1 to E9 (fig. 4-209).

(6) Remove and replace faulty components.

4-78. If Amplifier 39AR2

General support maintenance of if amplifier 39AR2 is covered in paragraph 4-34.

4-79. Amplifier Filter 39AR2A1

General support maintenance of amplifier filter 39AR2A1 is covered in paragraph 4-35.

4-80. Bandpass Filter 39FL1, 39FL2, 40FL1

NOTE

The following instructions also apply to bandpass filter 40FL1, unless otherwise indicated.

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Test Facility, Receiver, TS-2867(V)2/GRM-95(V)2	Receiver test facility
Test Facility, Radio Frequency Modules TS-3837(V)2/GRM-95(V)2	Test facility, rf modules
Test Fixture Bandpass Filter, TS-3830/GRM-95(V)	Test fixture
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit band 2,3,4
Counter, Electronic, Digital TD-1225-(V)l/U	Frequency counter
Frequency Unit, Plug-in, Wiltron 6110-C	Frequency unit; plug-in unit
Gauge, Depth, Micrometer, Starrett 440A-3P	Depth gauge
Generator, Signal AN/USM-205A	Wide range oscillator
Generator, Signal AN/USM-213	Signal generator
Generator, Sweep Frequency, Wiltron 61OD	Sweep generator
Oscilloscope AN/USM-281C	Oscilloscope

b. Test Procedures.

NOTE

If the results of any of the following test procedures are not within the limits specfled, realine the bandpass falter as described inc. below.

(1) *VSWR and VSWR bandwidth test.*

(a) Before the bandpass filter is removed from the radio, the filter tuning shaft should be locked at channel 3300 (1850 MHz). This is accomplished as described below. In all cases the drive shaft is locked using the locking clamp (figure 4-210).

1. For Unit 40FL1. On amplifier-frequency multiplier (unit 40), tune XMTR TUNE control to indicate channel 3300 exactly. Lock filter 40FLl drive shaft.

2. For Unit 39FL1. On amplfier-converter (unit 39), tune RCVR SIG control to indicate channel 3300 exactly. Lock filter 39FL1 drive shaft.

3. For Unit 39FL2. On amplfler-converter (unit 39), tune RCVR SIG control to indicate channel 3240 exactly. Adjust MULT PEAK control to exactly the mid point of its adjustment range. Lock filter 39FL2 drive shaft.

(b) To preset filter assemblies not mounted in a radio set, set dimension “A” as shown in figure 4-210 to 0.125 inch. This is an approximate start position for 1850 MHz. Ensure that the drive shaft is locked in position with the locking clamp (figure 4-210).

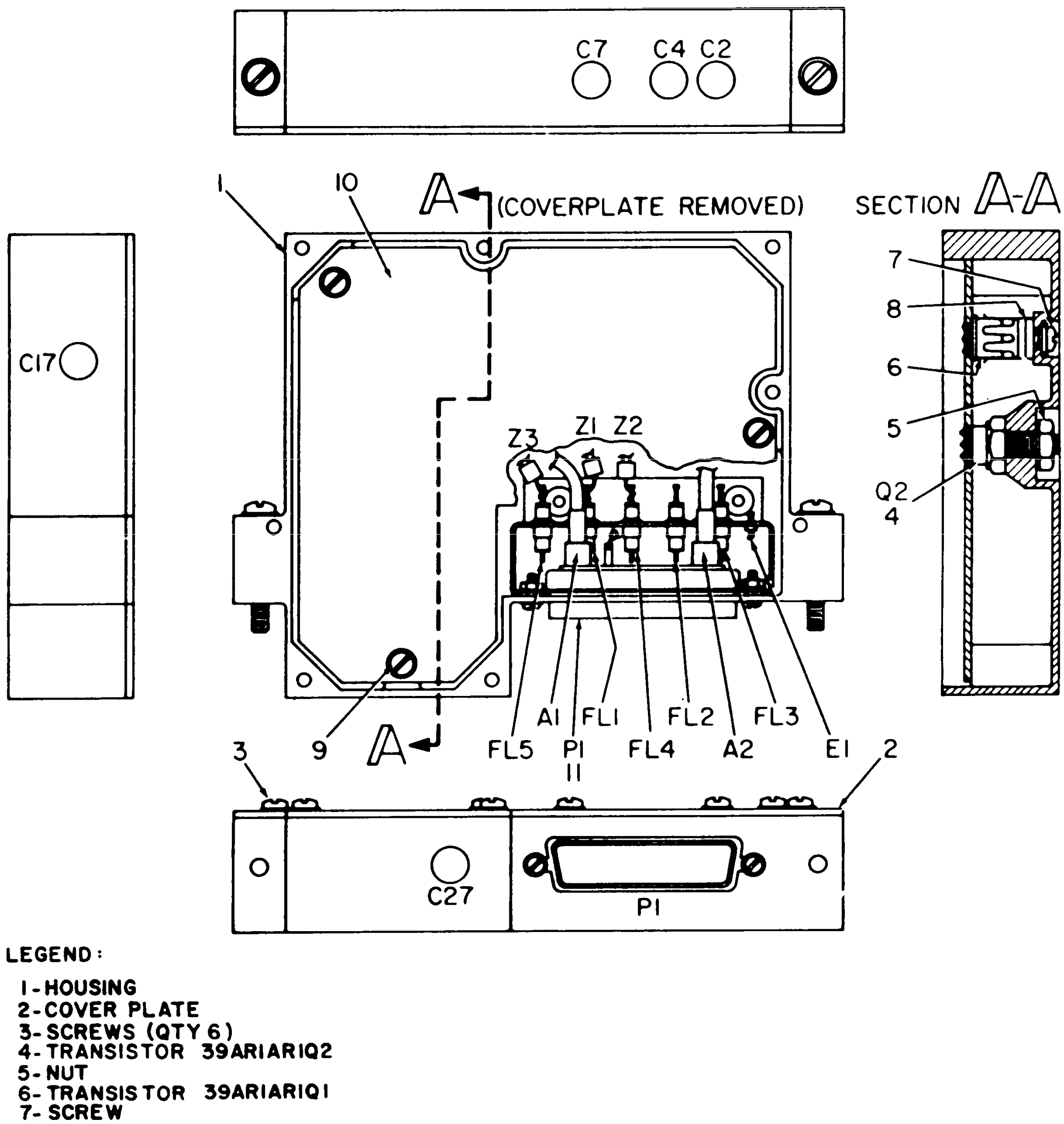
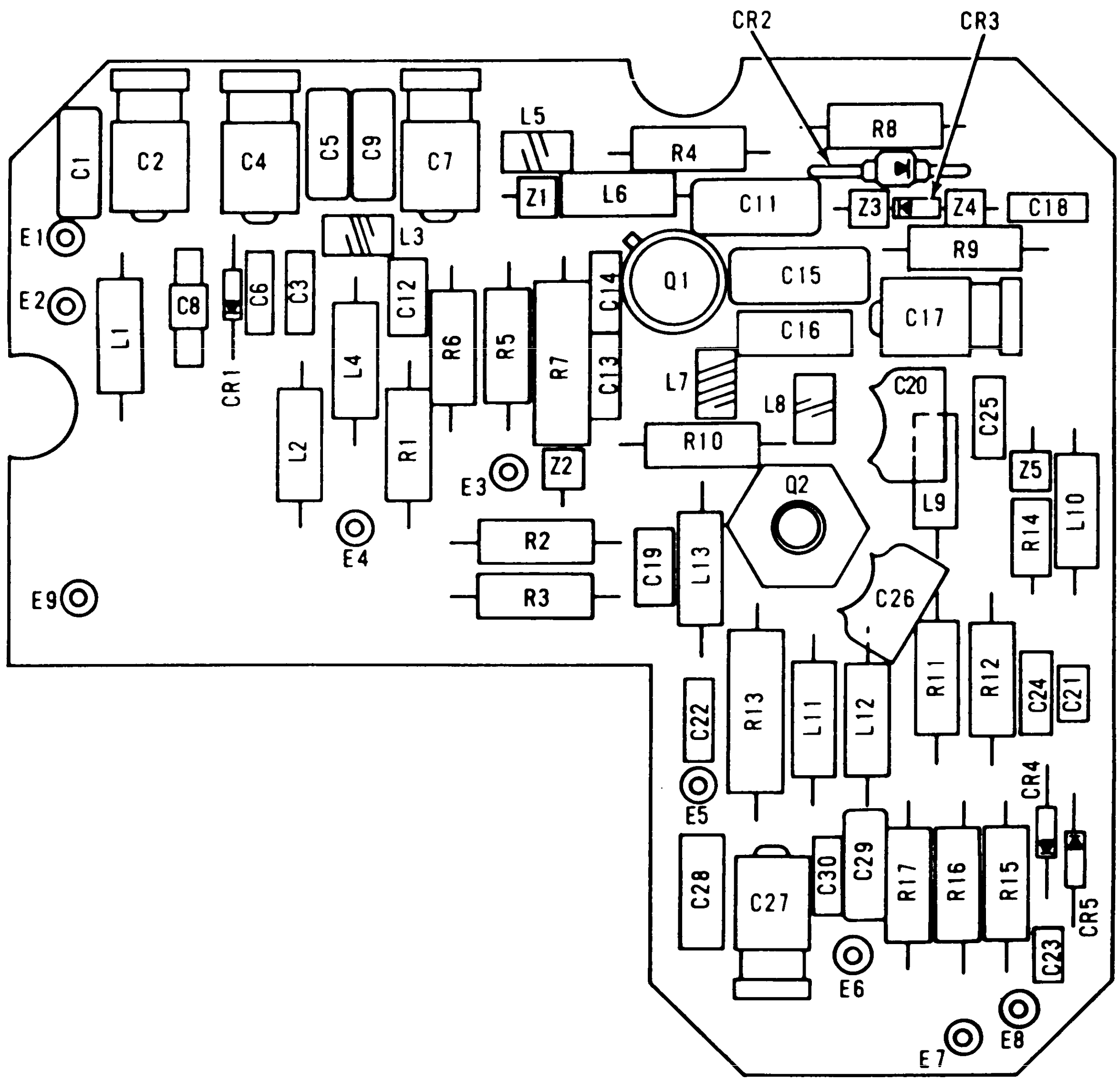


Figure 4-208. Rf Amplifier 39AR1, Mechanical Assembly Details.

(c) Set the test fixture to a counter reading of 0857.4. This reading corresponds to 1850 MHz. Attach post, electrical-mechanical equipment, 718-800080-000 (5MP2, part of AN/GRM-95(V)(2)) to the unit under test as shown in figure 4-210, if not already installed (Unit 40FL1 is mounted in the radio set without the post).

(d) Attach the bandpass falter under test to the test fixture. Engage the drive shaft assembly and secure the unit to the test fixture with the two knurled thumbscrews on the underside of the test fixture. Recheck the counter reading. If it differs from 0857.4, unlock the filter drive shaft and reset the counter to 0857.4.



EL5RF482

Figure 4-209. Rf Amplifier Subassembly 39AR1AR1, Component Side.

(e) Connect the test equipment as in A, figure 4-210; set the oscilloscope for a vertical sensitivity of 1 mV/cm; and adjust the sweep generator controls as follows:

Control	*Position*
FREQ SELECTOR	F1 to F2
RETRACE RF	OFF
VAR FREQ MKR	1850 MHz (on dial)
LEVELING	INT
HARMONIC MARKERS	WIDE
AF FREQ	Maximum clockwise

(f) Adjust the POWER LEVEL and F1/F2 controls of the sweep generator for a 6 cm display on the oscilloscope between 1350 and 1850 MHz. This corresponds to a 16 dB return loss level (1.37:1 VSWR).

(g) Remove the 6 dB attenuator and one 10 dB attenuator. Connect the unit under test to the test setup as shown in B, figure 4-211.

(h) Set the sweep generator FREQ SELECTOR to AF and adjust the VAR FREQ MKR control to center the response at 1850 MHz (use INT markers). Adjust the AF FREQ control for approximately 10 MHz sweep width.

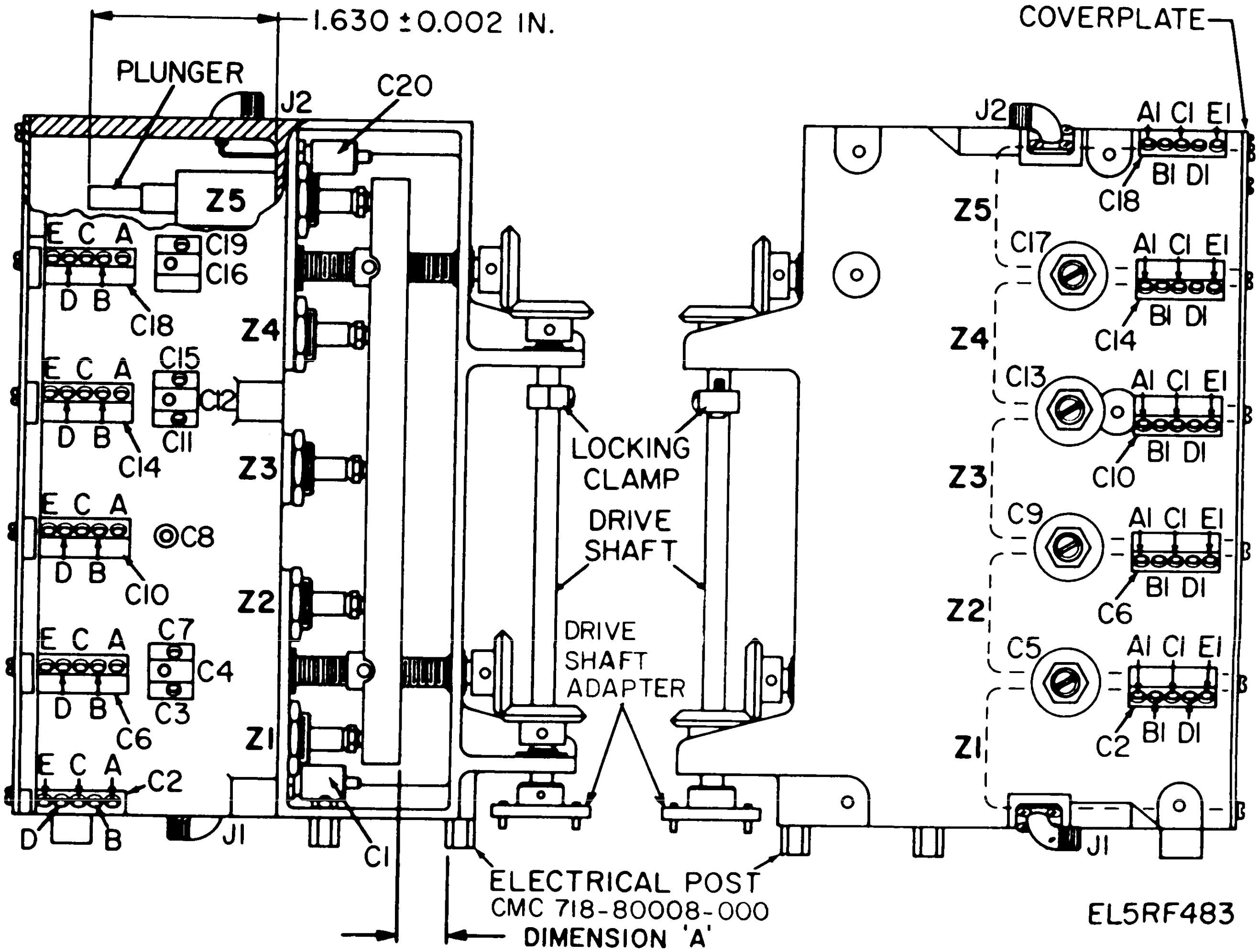


Figure 4-210. Bandpass Filter 39FL1/39FL2/40FL1, Mechanical Assembly.

(i) Tune the signal generator to 1850 MHz, and adjust its output level in conjunction with the sweep generator HARMONIC MARKERS AMPLITUDE control for a marker of suitable size at the center of the response (readjust the signal generator frequency, as necessary). The response curve displayed on the oscilloscope should be approximately as shown in A, figure 4-212, and centered at the 1850 MHz marker, within ±1 MHZ.

NOTE

If above requirement was not met, tune the unit under test to center the response at 1850 MHz. Note the counter reading. If the counter is off by a reading of 23 or multiples of 23, disengage the unit under test, reset the counter to 0857.4 and reinstall the unit under test. Repeat *(g)* above.

(j) Press the EXTERNAL AM control on the signal generator. Adjust the wide range oscillator frequency and level to obtain two sideband markers equidistant from the 1850 MHz center frequency marker at the 16 dB return loss line. If necessary, make a slight adjustment of the signal generator frequency to position both sideband markers on the 16 dB return loss line. The output frequency of the wide range oscillator multiplied by two is the 16 dB return loss bandwidth, and must be 5 MHz minimum.

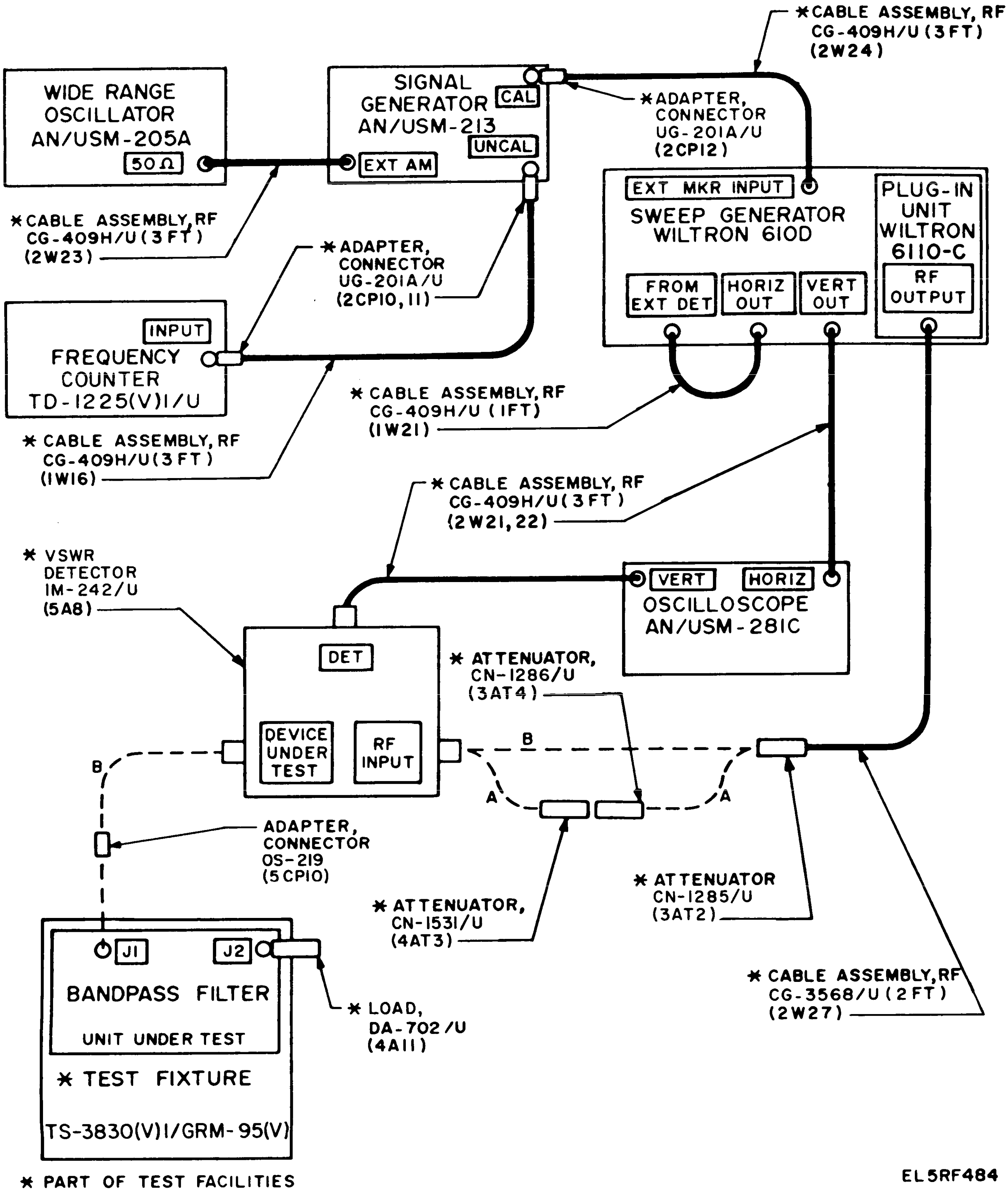
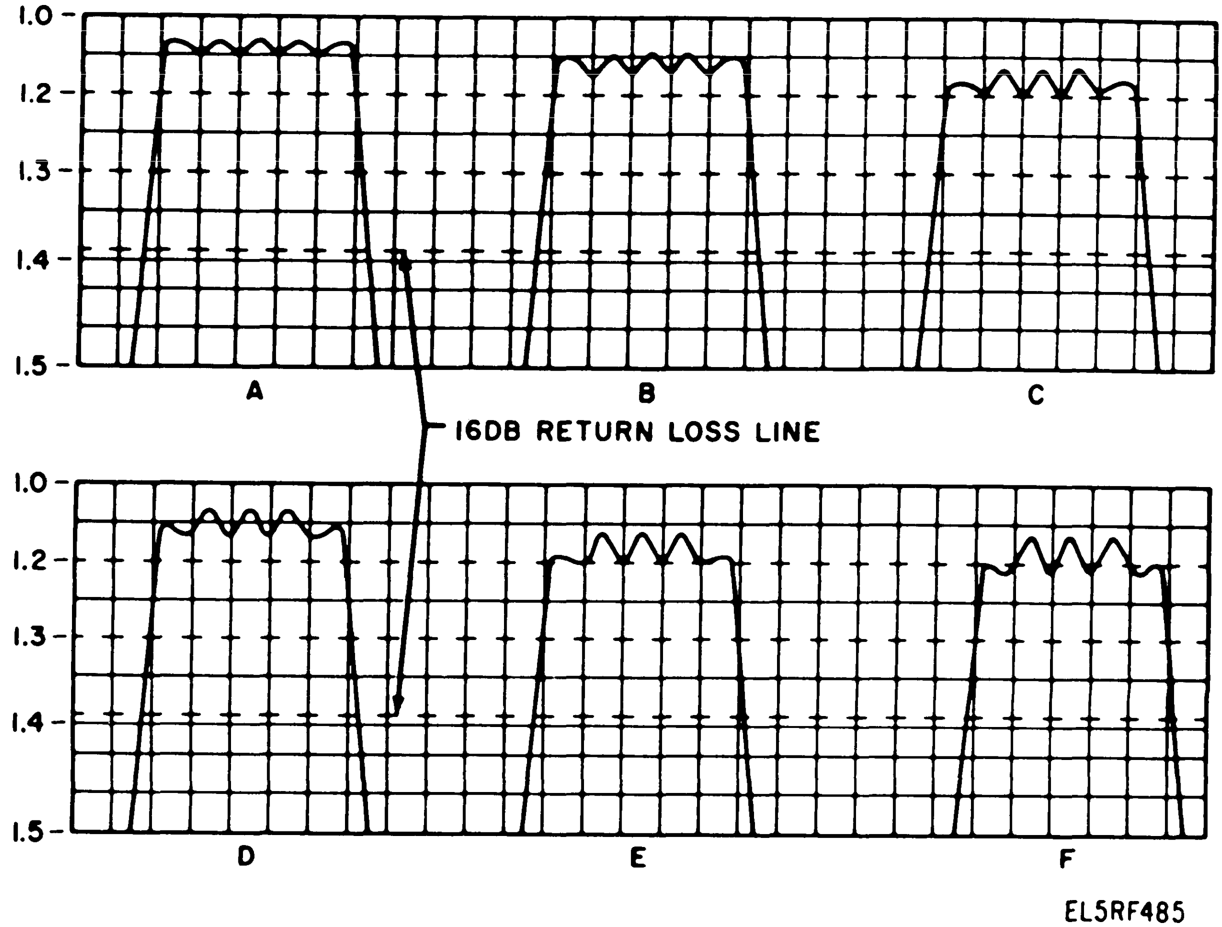


Figure 4-211. Bandpass Filter 39FL1/39FL2/40FL1, VSWR Test Setup



NOTE:

THESE ARE IDEALIZED RESPONSE CURVES. INDIVIDUAL RIPPLE PEAKS MAY VARY OVER THE RANGE BETWEEN ZERO AND FOUR CENTIMETERS ON THE OSCILLOSCOPE.

Figure 4-212. Bandpass Filter 39FL1/39FL2/40FL1, VSWR Response Curves.

(k) Tune the bandpass filter to a counter reading of 0742.0, readjust the sweep generator to center the response with no external AM at 1780 MHz. The oscilloscope should display a symmetrical response of approximate similarity to that shown in B, figure 4-212, and centered on 1780 MHz within ±1 MHz as indicated on the frequency counter.

(l) Measure the 16 dB return loss bandwidth as in *(h)* above at 1780 MHz.

(m) Set the test fixture to each counter reading listed below and repeat *(k)* and *(l)* above.

Center frequency f. (MHz ±1 MHz)	*Test fixture counter reading*	*Reference response*
1850	*0857.4*	Figure 4-212 A
1780	0742.0	Figure 4-212 B
1645	0522.4	Figure 4-212 C
1525	0317.0	Figure 4-212 D
1405	0099.7	Figure 4-212 E
1350	0000.0	Figure 4-212 F

(n) Retune the bandpass filter to a counter reading of 0857.4 (1850 MHz).

(2) *Insertion loss test.*

(a) Connect the test equipment as shown in A, figure 4-213 and set the signal generator to 1850 MHz as indicated on the frequency counter.

(b) Set the oscilloscope vertical sensitivity to 0.2 mV/cm. Tune the sweep generator for a response curve approximately 10 MHz wide, centered on the 1850 MHz external marker, with an amplitude of 8 cm, by adjusting the RF POWER LEVEL control.

(c) Connect the test equipment as shown in B, figure 4-213.

(d) Tune the filter so that the response is centered at 1850 MHz, and measure the response amplitude at 1850 MHz. The amplitude should not be less than 5 cm, which corresponds to a 2.0 dB loss. Note the response amplitude.

(e) Check that the transmission response over f_o (±2 MHz) falls within +0.75 cm –0.65 cm of the amplitude noted in *(d)* above (i. e., within ±0.6 dB of the loss at 1850 MHz). Perform this test by tuning the signal generator ±2 MHz and observing the external marker.

(f) Repeat *(a)* through *(e)* above at 1780, 1645, 1525, 1405, and 1350 MHz.

(3) *Tracking test.*

(a) With the equipment connected as shown in B, figure 4-213, tune the bandpass filter to obtain a response centered on f_o 1850 MHz, and note the test fixture counter reading.

NOTE

To minimize backlash error, tune the filter from one direction only.

(b) Repeat *(a)* above for the frequencies listed in *(1)(l)* above, and note the counter reading at each frequency. Counter readings should be within 0001.7 of the test fixture counter reading in *(1)(l)*.

(c) After testing is complete, tune the bandpass filter for a test fixture counter reading of 0857.4, and secure the filter drive shaft in position with the locking clamp (figure 4-210).

(d) Remove the unit under test from the test fixture and remove post, electrical mechanical equipment (5 MP2), if installed during test.

c. Alinement Procedures.

(1) *Preliminary alinement test setup.*

(a) The test equipment setup shown in figure 4-214 is used. Do not mount the unit under test on the test fixture.

(b) Connect the test equipment as shown in C, figure 4-214. Set the oscilloscope vertical sensitivity to 0.2 mV/cm.

(c) Adjust the sweep generator for a sweep width of 8 MHz centered at 1850 MHz using the internal markers. Then adjust the sweep generator rf output control for a vertical trace deflection of 6 cm amplitude on the oscilloscope.

(d) Remove the coverplate (figure 4-210) from the cavities of the unit under test. Unlock the driveshaft locking clamp. Attach post, electrical-mechanical equipment, 718-800080-000 (5MP2) (part of AN/GRM-95 (V)(2)) to the unit under test as shown in figure 4-210, if not already installed.

(e) Set the screws forming C2, C3, C6, C7, C10, C11, C14, C15, C18, and C19 (fig. 4-210) to protrude six threads beyond the inside wall of the respective cavities.

(f) Set the plunger position in cavity Z1 or Z5 to the dimension shown in figure 4-210. The plunger is set by turning the drive shaft and using the depth gauge to measure the depth of the tuning plunger. This initial setting corresponds to the plunger position required at 1850 MHz.

(g) Carefully slide the locking clamp (fig. 4-210) to the end of the shaft nearest cavity Z5 until the screw protruding from the clamp enters the hole in the chassis. Lock the drive shaft in position by tightening the screw in the locking clamp.

(h) Set the test fixture to a counter reading 0857.4. This reading corresponds to 1850 MHz.

(i) Replace the coverplate removed in *(d)* above.

(j) Attach the filter to the test fixture. Engage the drive shaft carefully, so that the counter setting is not altered. Secure the unit to the test fixture with the two knurled thumbscrews on the underside of the alinement fixture. Slight adjustment of the test fixture counter may be necessary to aline the drive shaft. Note the counter reading if adjustment is necessary. It should be within ±0001.7. If counter was within ±0001.7, loosen the screw in the locking clamp and set the counter to 0857.4.

(2) *Q bandwidth alinement, unloaded 3-dB bandwidth.*

(a) Remove tuning screws from C2A and C2A1 (cavity Zl, fig. 4-210).

(b) Connect waveguide probes No. 1 and 2 to cavity Z1 using screw holes C2A and C2A1 respectively. Connect the test equipment as shown in A, figure 4-214.

NOTE

Do not alter sweep generator output level from that set in *(1)(c)* above.

(c) Turn the screw in C7 in cavity Z2 until it touches the center conductor of cavity Z2.

(d) Adjust the waveguide probes in C2A and C2A1 for a single peak response display with an amplitude of 6 cm (A, fig. 4-215). Adjust C3, if necessary, to center the response at the 1850 MHz marker.

NOTE

Adjust probes so that they penetrate equally into Z1 as determined by visual inspection.

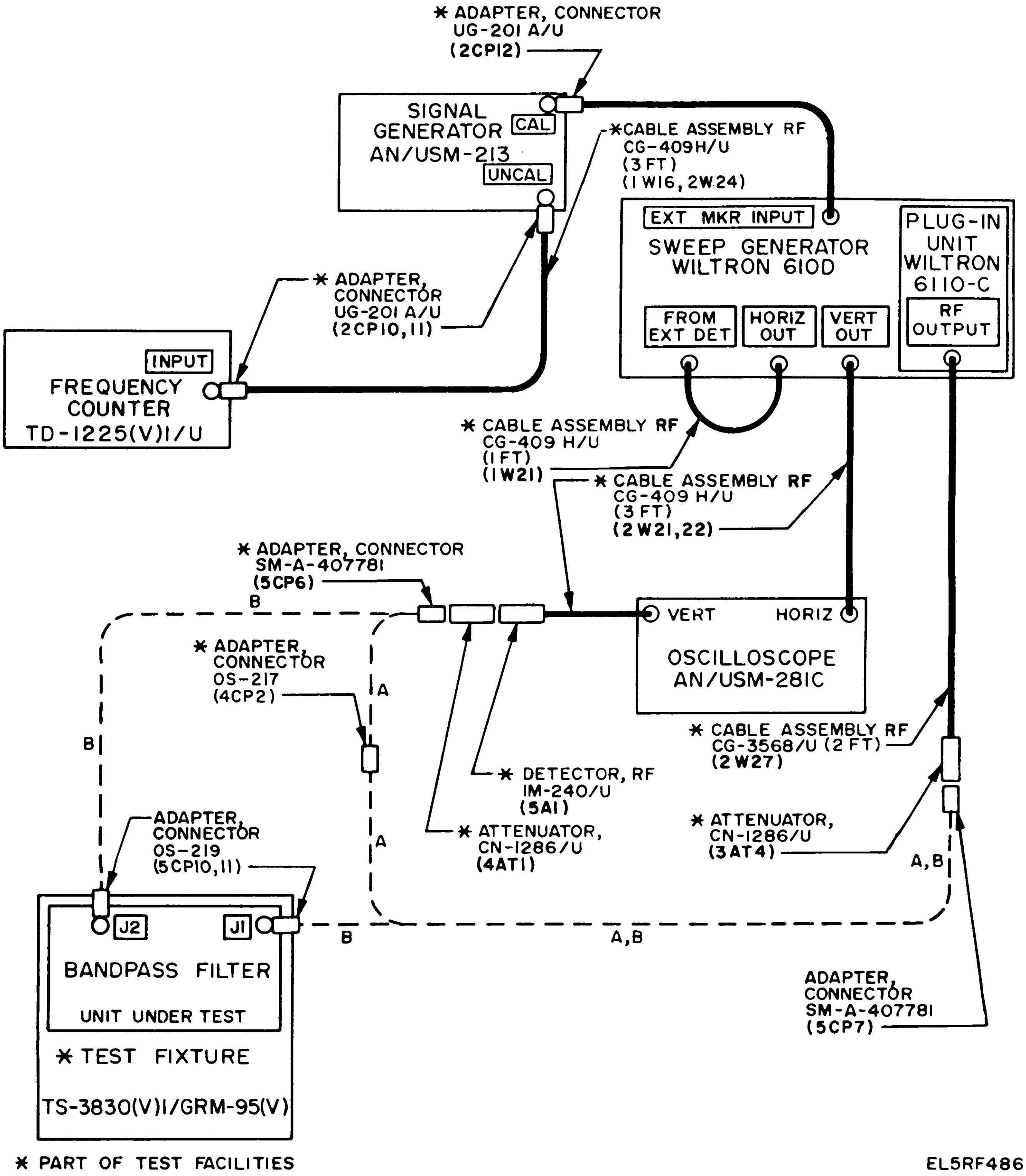


Figure 4-213. Bandpass Filter 39FL1/39FL2/40FL1, Insertion Loss, Test Setup.

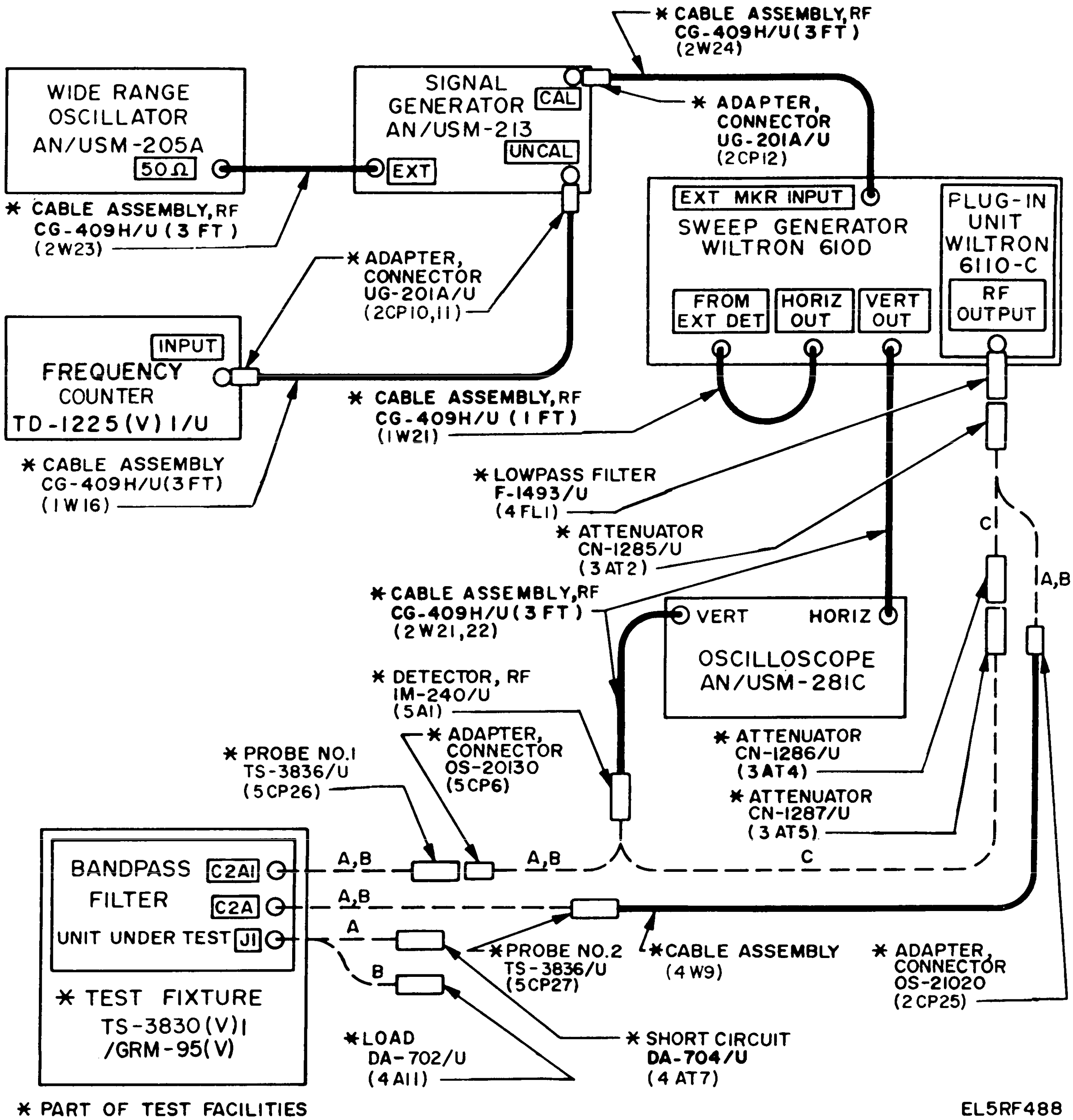


Figure 4-214. Bandpass Filter 39FL1/39FL2/40FL1, QBandwidth and Coupling Bandwidth Alinement Test Setup.

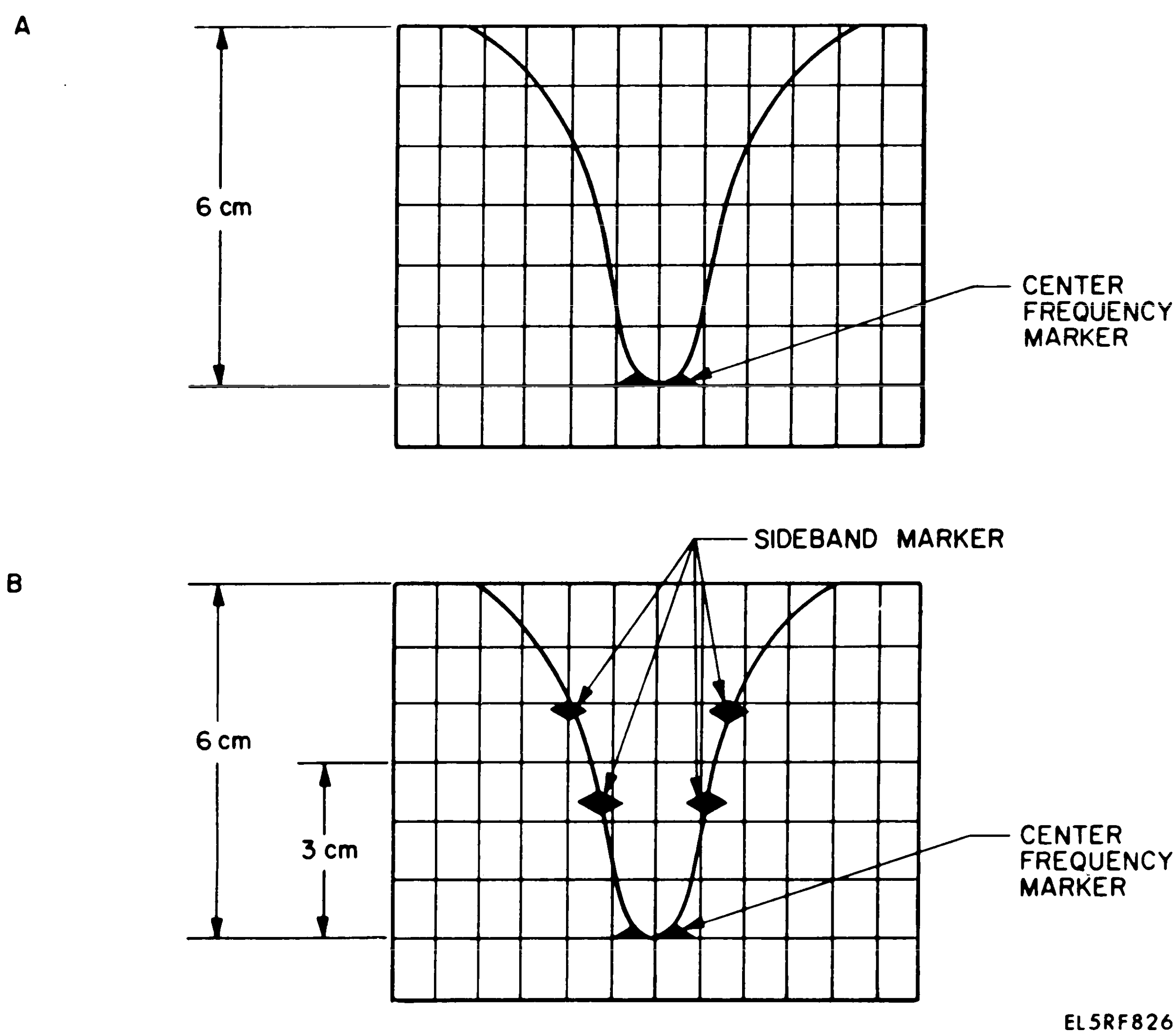


Figure 4-215. Bandpass Filter 39FL1/39FL2/40FLl, Q Bandwidth Response Curves.

(e) Adjust the signal generator output frequency to 1850 MHz (±125 kHz) as measured on the frequency counter. This signal is the external marker on the swept response.

(f) Adjust the wide range oscillator frequency and output level for two sideband markers equidistant from the 3-cm level (B, figure 4-215).

(g) Measure the frequency of the wide range oscillator on the frequency counter. Multiply the frequency noted by two, and record the result. This represents the unloaded 3-dB bandwidth.

(3) *Q bandwidth alinement loaded 3-dB bandwidth.*

(a) Replace the short circuit connected at J1 with a 50 ohm dummy load B, fig. 4-214).

(b) Adjust the waveguide probes in C2A and C2A1 for a single-peak response display of 6 cm amplitude. Adjust C3, if necessary, to center the response at 1850 MHz. See NOTE to *(2)(d)* above.

(c) Adjust the wide range oscillator frequency for two sideband markers equidistant from the 3-cm level (B, fig. 4-215).

(d) Measure the frequency of the wide range oscillator on the frequency counter. Multiply the frequency noted by two and record the result. This represents the loaded 3-dB bandwidth.

(e) Subtract the unloaded 3-dB bandwidth, recorded in *(2)(g)* above, from the loaded 3-dB bandwidth to obtain the Q bandwidth of cavity Z1 at the center frequency (1850 MHz). This must be 7.94 MHz (±0.5 MHz). If necessary, adjust capacitor Cl to obtain the specified Q bandwidth.

(f) Repeat steps from *(2)(a)* above for cavity Z5, using holes C18A and C18A1 for coupling requirements. Terminate J2 in place of J1. Adjust the screws in C15 until it touches the center conductor of cavity Z4.

NOTE

Do not alter the mechanical setting of the unit under test.

(g) If necessary, adjust C19 to center the response on 1850 MHz. Adjust C20 for the Q bandwidth of 7.94 MHz (±0.05 MHz).

(h) After the Q bandwidth alinement of cavities Z1 and Z5, seal Cl and C20.

(4) *Coupling bandwidth alinement cavities Z4 and Z5.*

(a) If necessary, repeat *(1)(b)* and *(1)(c)* above, for sweep generator frequency of 1850 MHz.

(b) Connect the test equipment as shown in A, figure 4-214 but with waveguide probes No. 1 and No. 2 inserted in holes C18A1 and C18A respectively, and with J2 terminated with short-circuit termination DA-704/U.

(c) Turn the screw in Cl1 until it touches the center conductor of cavity Z3.

(d) Adjust the waveguide probes for a 6-cm amplitude display centered on 1850 MHz. See **NOTE** to *(2)(d)* above.

(e) Adjust capacitors C15 and C19 for a double peaked response centered on 1850 MHz (fig. 4-216).

(f) Adjust the wide range oscillator frequency to position the two sideband markers at the response peaks (fig. 4-216).

(g) Measure the frequency of the wide range oscillator on the frequency counter, and multiply the frequency noted by two. The result is the coupling bandwidth at 1850 MHz and must be 6.3 MHz (±0.1 MHz). (Turn Capacitor screws clockwise to increase bandwidth).

(h) Turn the test fixture tuning control until the *counter* indicates 0000.0 (zero corresponds to 1350 MHz). Apply the counter correction figure determined in *(1)(j)*.

(i) Repeat *(1)(b)* and *(1)(c)* above, for a sweep generator frequency of 1350 MHz.

(j) Adjust the signal generator to 1350 MHz (±125 kHz) measured on the frequency counter. Readjust C15 and C19 for double peaked response centered on 1350 MHz.

(k) Measure the coupling bandwidth at 1350 MHz by repeating *(b)* through *(g)* above. In *(g)*, adjust capacitor C17, instead of C16, if necessary, to obtain a coupling bandwidth of 5.65 MHz (±0.1 MHz).

(l) Repeat *(a)* through *(k)* above for the alinement at both 1850 MHz and 1350 MHz, using the following information, until the requirements are satisfied at both frequencies.

Test fixture counter reading	f_o	*Coupling bandwidth*	*Adjustment*
0000.0	1350 MHz	5.65 MHz (±0.1 MHz)	C17
0857.4	1850 MHz	6.30 MHz (±0.1 MHz)	C16

NOTE

Apply the counter correction figure as determined in *(1)(i)* above.

(m) Secure capacitors C16 and C17.

(5) *Coupling bandwidth alinement, cavities Z1 and* Z2.

(a) Reset the test fixture counter to 0857.4 (1850 MHz). Repeat *(1)(b)* and *(1)(c)* for a sweep generator frequency of 1850 MHz.

(b) Reconnect the test equipment as shown in A, figure 4-214, but with waveguide probes No. 1 and No. 2 inserted in holes C2A1 and C2A respectively.

(c) Adjust the probes for a 6-cm amplitude display centered on 1850 MHz. See NOTE to *(2)(d)* above.

(d) Adjust capacitor C7 and C3 for a double-peaked response centered on 1850 MHz (fig. 4-216). Note that Cl1 is still grounded from setting in *(4)(c)* above.

(e) Adjust the wide range oscillator frequency to position the two sideband markers at the response peaks.

(f) Measure the frequency of the wide range oscillator on the frequency counter and multiply by two. The result is the coupling bandwidth at 1850 MHz and must be 6.3 MHz (±0.1 MHz). If required, adjust capacitor C4 to obtain the required bandwidth.

(g) Return the unit under test to 1350 MHz (test fixture counter indicating 0000.0). Apply the counter correction figure determined in *(1)(j)* above.

(h) Repeat *(1)(b)* and *(1)(c)* for sweep generator frequency of 1350 MHz.

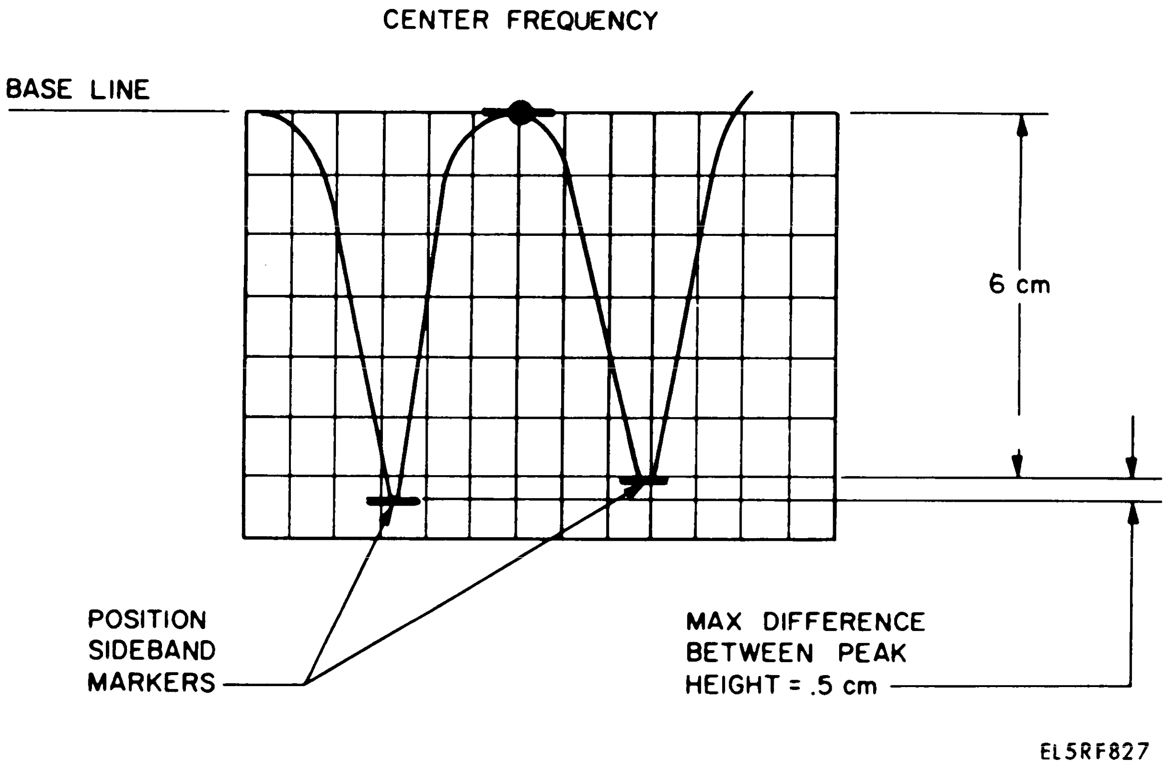


Figure 4-216. Bandpass Filter 39FL1/39 FL2/40FL1, Coupling Bandwidth Response Curves.

(i) Adjust the signal generator to 1350 MHz (±125 kHz), measured on the frequency counter. Readjust C3 and C7 for a double-peaked response centered on 1350 MHz.

(j) Measure the coupling bandwidth at 1350 MHz by repeating *(b)* through *(f)* above. When repeating *(f)*, adjust capacitor C5, instead of C4, if required, to obtain a coupling bandwidth of 5.65 MHz (+0.1 MHz).

(k) Repeat *(a)* through *(j)* above until the requirements are satisfied at both frequencies.

(l) Secure capacitors C4 and C5.

(6) *Coupling bandwidth alinement cavities Z2 and Z3.*

(a) Retune the unit under test to a counter reading of 0857.4 (1850 MHz). Repeat *(1)(b)* and *(1)(c)* for a sweep generator frequency of 1850 MHz.

(b) Turn the screws in C3 and C15 until they touch the center conductor of cavities Z1 and Z4 respectively.

(c) Remove the tuning screws from C6A1 and C6A. Using test setup A, figure 4-214, insert wave-Wide probes No. 1 and No. 2, respectively, in place of these screws.

(d) Adjust probes No. 1 and No. 2 for a 6-cm response centered on 1850 MHz. See NOTE to *(2)(d)* above.

(e) Adjust capacitors Cl1 and C7 for a double-peaked response centered on 1850 MHz (fig. 4-216).

(f) Adjust the wide range oscillator frequency to position the two sideband markers at the response peaks. The output frequency of the wide range oscillator multiplied by two is the coupling bandwidth at 1850 MHz, and must be 4.70 MHz (±0.1 MHz). If necessary, adjust capacitor C8 to obtain the required bandwidth.

(g) Retune the unit under test to a counter reading of 0000.0. Retune the signal generator to 1350 MHz (±125 kHz). Readjust C7 and Cl1 for a double-peaked response centered on 1350 MHz.

(h) Repeat *(1)(b)* and *(1)(c)* for a sweep generator frequency of 1350 MHz.

(i) Repeat *(c)* through *(f)* above. If required, adjust capacitor C9, instead of C8, to obtain a coupling bandwidth of 4.15 MHz (±0.1 MHz) at 1350 MHz.

(j) Repeat *(a)* and *(d)* through *(i)* above, until the requirements are satisfied at both frequencies.

(k) Secure capacitors C8 and C9.

(7) *Coupling bandwidth alinement cavities Z3 and Z4.*

(a) Retune the unit under test to a counter reading of 0857.4. Repeat *(1)(b)* and *(1)(c)* for a sweep generator frequency of 1850 MHz.

(b) Turn the screws in C7 and C19 until they touch the center conductors of cavities 22 and 25 respectively.

(c) Remove the tuning screws from C10A1 and C10A. Using test setup A, figure 4-214, insert wave-guide probes No. 1 and No. 2, respectively, in place of these screws.

(d) Adjust probes No. 1 and No. 2 to obtain a 6-cm response curve centered on 1850 MHz. See NOTE to *(2)(d).*

(e) Adjust capacitor Cl1 and C15 to obtain a double-peaked response centered on 1850 MHz, (figure 4-216).

(f) Adjust the wide range oscillator frequency to position the two sideband markers at the response peaks. The output frequency of the oscillator multiplied by two is the coupling bandwidth at 1850 MHz, and must be 4.70 MHz (±0.1 MHz). If necessary, adjust capacitor Cl2 to obtain the required coupling bandwidth.

(g) Retune the unit under test to a counter reading of 0000.0, Retune the signal generator to 1350 MHz (±125 kHz). Readjust Cl1 and C15 for a double-peaked response centered at 1350 MHz.

(h) Repeat *(1)(b)* and *(1)(c)* for a sweep generator frequency of 1350 MHz.

(i) Repeat *(c)* through *(f)* above. If necessary, adjust capacitor Cl3, instead of Cl2, to obtain a coupling bandwidth of 4.15 MHz (±0.1 MHz) at 1350 MHz.

(j) Repeat *(a)* and *(d)* through *(i)* above, until the requirements are satisfied at both frequencies.

(k) Secure capacitors C12 and C13. Retune the unit under test to a test fixture counter reading of 0857.4.

(l) Remove probes 1 and 2, and replace all screws that were removed from the capacitors.

(8) *VSWR and VSWR bandwidth alinement*

(a) Connect the test equipment as shown in A, figure 4-211.

(b) Set the oscilloscope for a vertical sensitivity of 0.5 mV/cm.

(c) Adjust the sweep generator to obtain a sweep width of approximately 10 MHz centered at 1850 MHz. Set the rf output for a convenient deflection on the oscilloscope. This corresponds to a 16 dB return loss (1.37:1 VSWR).

(d) Remove the 6 dB attenuator and the 10 dB attenuator. Connect the unit under test to the test setup as showing, figure 4-211.

(e) Set the test fixture to a counter reading of 0857.4, corresponding to f_o 1850 MHz, using the internal markers.

(f) Tune the signal generator to f_o 1850 MHz (±125 kHZ).

(g) Adjust capacitors C3, C7, Cl1, C15 and C19 in equal increments to obtain a symmetrical response centered on 1850 MHz (A, fig. 4-212). The positions of capacitor screws C2A.A1, C6A.A1, C10A.A1, C14A.A1 and C18A.A1 also influence the response.

(h) Adjust the wide range oscillator frequency to position the two sideband markers at the 16-dB return loss line. The output frequency of the wide range oscillator multiplied by two is the 16 dB return loss bandwidth, and must be 5 MHz minimum.

(i) Tune the bandpass filter to a counter reading of 0742.0. Readjust the sweep generator to obtain a sweep width of 10 MHz centered at 1780 MHz.

NOTE

To reduce backlash errors, always approach the tuning position from the same direction.

(j) Adjust screws C2A, C2A1, C6A, C6A1, C10A, C10A1, C14A, C14A1, C18A, and C18A1 in equal increments to obtain a symmetrical response centered on 1780 MHz (B, fig. 4-212). The positions of capacitor screws C2B.B1, C6B.B1, C10B, C10B1, C14B.B1 and C18B.B1 also influence the response.

(k) Recheck the 16 dB return loss bandwidth as in *(h)* above.

(l) If an adjustment was performed in *(j)* above, repeat *(e)* through *(k)* above to achieve the specified 16 dB return loss bandwidth of 5 MHz at 1850 MHz and 1780 MHz.

(m) Repeat *(e)* through *(k)* above for the frequencies, counter readings, and capacitance tuning screws listed below.

NOTE

Whenever a pair of capacitance tuning screws has been adjusted, repeat the alinement of the previous frequency (next higher frequency) until the parameters at both frequencies are within specfications.

Frequency (f_o) MHz	*Test fixture counter reading*	*Capacitance screws*	*Reference response*
1850	0857.4	C3, C7, C1l, C15, C19	Figure 4-212A
1780	0742.0	C2A, C2A1, C6A, C6A1, C10A, C10A1, C14A, C14A1, C18A, C18A1	Figure 4-212B
1645	0522.4	C2B, C2B1, C6B, C6B1, C10B, C10B1, C14B, C14B1, C18B, C18B1	Figure 4-212C
1525	0317.0	C2C, C2C1, C6C, C6C1, C10C, C10C1, C14C, C14C1, C18C, C18C1	Figure 4-212D
1405	0099.7	C2D, C2D1, C6D, C6D1, C10D, C10D1, C14D, C14D1, C18D, C18D1	Figure 4-212E
1350	0000.0	C2E, C2E1, C6E, C6E1, C10E, C10E1, C14E, C14E1, C18E, C18E1	Figure 4-212F

(n) Retune the bandpass filter to a counter reading of 0857.4, and seal all screws. There must be no change to the input VSWR at 1850 MHz.

(o) Seal all the screws of the capacitors.

(p) Repeat the insertion loss and tracking tests described in *b.* (2) and (3) above.

4-81. Bandpass Filter 39FL3

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(V)2/GRM-95 (V)2	Transmitter test facility
Test Facility, Receiver, TS-2867(V)2/GRM-95 (V)2	Receiver test facility
Test Facility, Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility, rf modules
Accessory Kit, Test Facility Set MK-1173(V)2/GRM-95(V)2	Accessory kit
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, band 2,3,4
Test Fixture, Bandpass Filter TS-3830(V)l/GRM-95(V)2	Test fixture
Counter, Electronic, Digital TD-1225(V)l/U	Frequency counter
Frequency Unit, Plug-in, Wiltron6110-C	Frequency unifi plug-in unit
Gauge, Depth, Micrometer, Starrett 449A-3P	Depth gauge
Generator, Signal AN/USM-205A	Wide range oscillator
Generator, Signal AN/USM-213	Signal generator
Generator, Sweep Frequency, Wiltron 610D	Sweep generator
Oscilloscope AN/USM-281 C	Oscilloscope

b. Test Procedures.

NOTE

Prior to removal from the radio, and on completion of alinement as well, make sure the tuning shaft of bandpass filter 39FL3 is locked to channel 3300 (1850 MHz). To accomplish this, turn XMTR DUPL control on the amplifier converter (Unit 39) to indicate channel 3300 exactly. Using the locking clamp (fig. 4-219), lock filter 39FL3 drive shaft. If the results of any of the following test procedures are not within the limits specified, realine the bandpass filter per c. below.

(1) *Preliminary set-up.*

NOTE

To preset filter assemblies already removed from radio sets, set Dimension A (fig. 4-219) to 0.125 inches (1/8 inch). This is an approximate start position for 1850 MHz.

(a) Connect the test equipment as in A, figure 4-217.

(b) Set the oscilloscope for a vertical sensitivity of 1 mV/cm.

(c) Set the sweep generator as follows:

Control	*Position*
FREQ SELECTOR	F1 to F2
VAR FREQ MKR	1850 MHz (on dial)
HARMONIC MARKERS	WIDE
RETRACE RF	OFF
LEVELING	INT
AF FREQUENCY	MAXIMUM CLOCKWISE

(d) Adjust the POWER LEVEL and F1/F2 controls of the sweep generator plug-in unit for a convenient leveled display on the oscilloscope between 1350 and 1850 MHz. This corresponds to a 16 dB return loss level (1.37:1 VSWR). Note this level.

(e) Remove the 6 dB attenuator and one 10 dB attenuator. Connect the test setup as shown in B, figure 4-217 but do not attach the unit under test to test fixture TS-3830 at this time.

(f) While observing the oscilloscope display, tune the unit under test to move the response to the end of the trace corresponding to 1850 MHz.

(g) Set the sweep generator to operate at AF and adjust the AF FREQ control for a sweep width of approximately 10 MHz.

(h) Set the signal generator frequency to 1850 MHz ±50 kHz and adjust its output level in conjunction with the sweep generator HARMONIC MARKERS AMPLITUDE control, for a suitable marker on the response display.

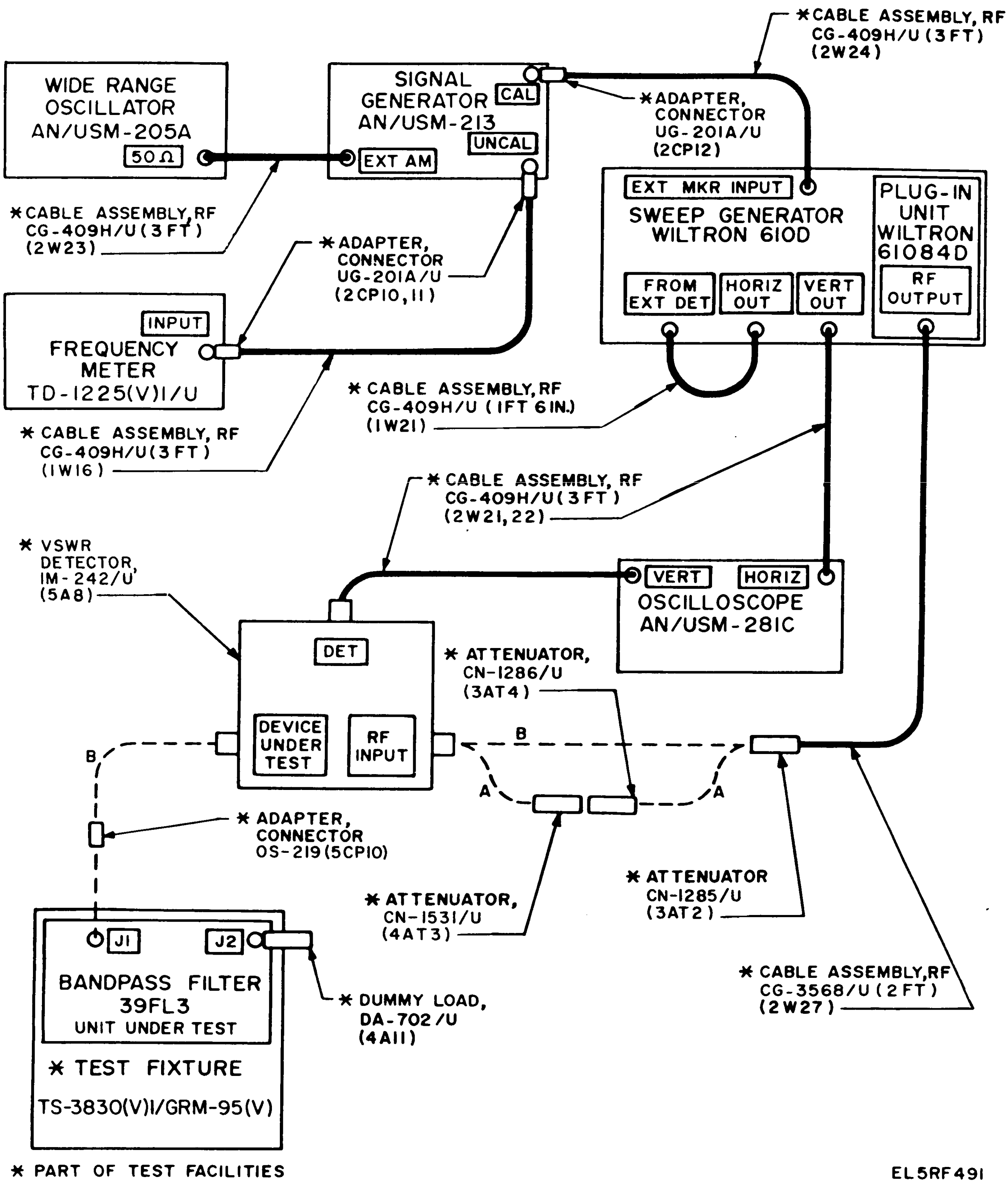


Figure 4-217. Bandpass Filter 39FL3, VSWR Test Setup.

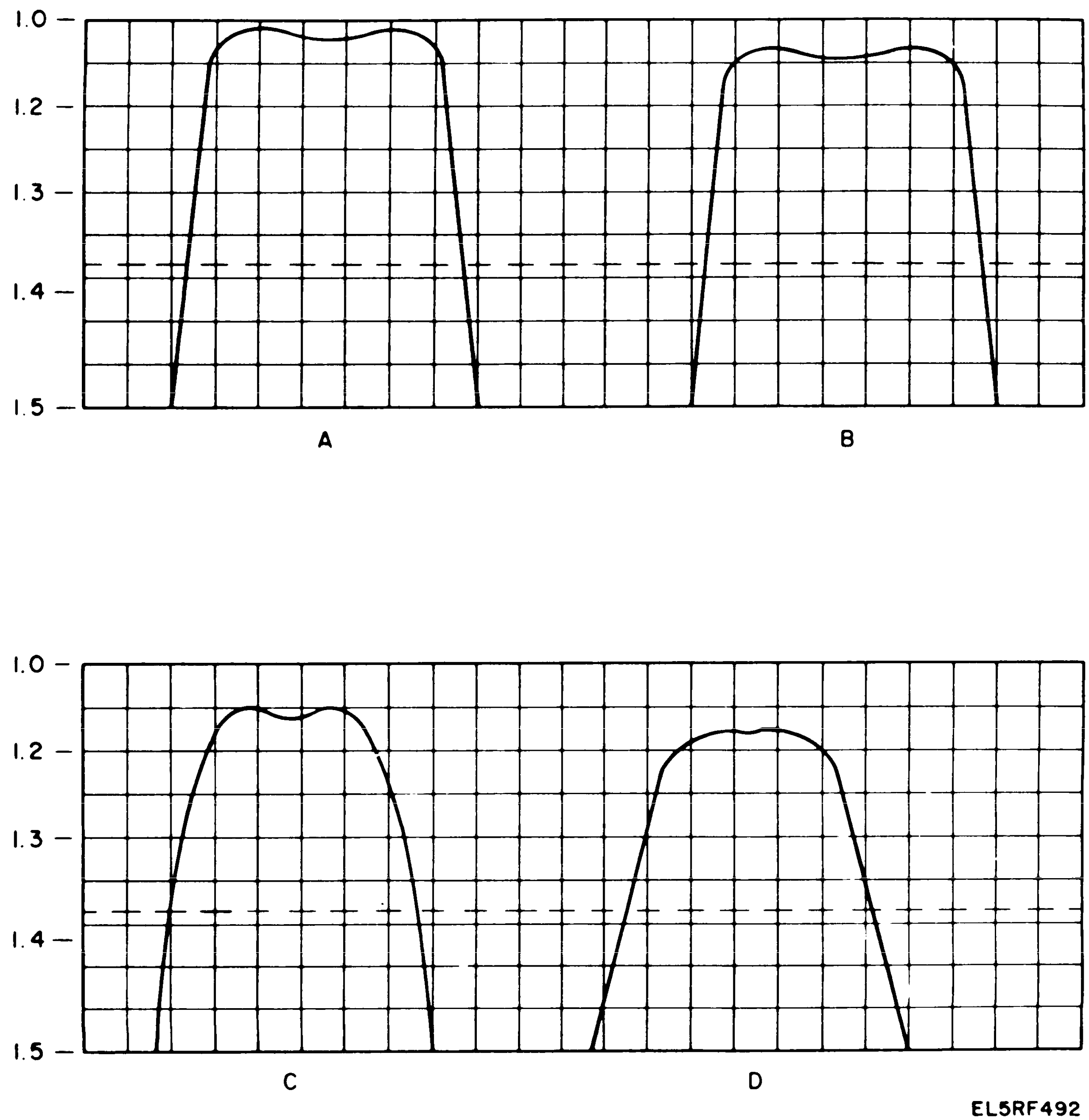


Figure 4-218. Bandpass Filter 39FL3, VSWR Response Curves.

(i) Adjust the tuning control of the unit under test to center the response on the 1850 MHz marker.

(j) Lock the tuning position of the unit under test with the shaft clamp.

(2) *VSWR and VSWR bandwidth test.*

(a) Set the test fixture to a counter reading of 0000.0. This corresponds to 1850 MHz.

(b) Attach the bandpass filter under test to the test fixture. Engage the drive shaft carefully so that the test fixture counter setting is not changed. Secure the unit to the test fixture with the two knurled thumb-screws on the underside of the test fixture. Note the counter reading. The difference between the reading and 0000.0 will be used later as the counter correction figure and may be a positive or negative value.

(c) Press the EXTERNAL AM control on the signal generator.

(d) Adjust the wide range oscillator frequency and level to obtain two suitable sideband markers equidistant from the 1850 MHz center frequency.

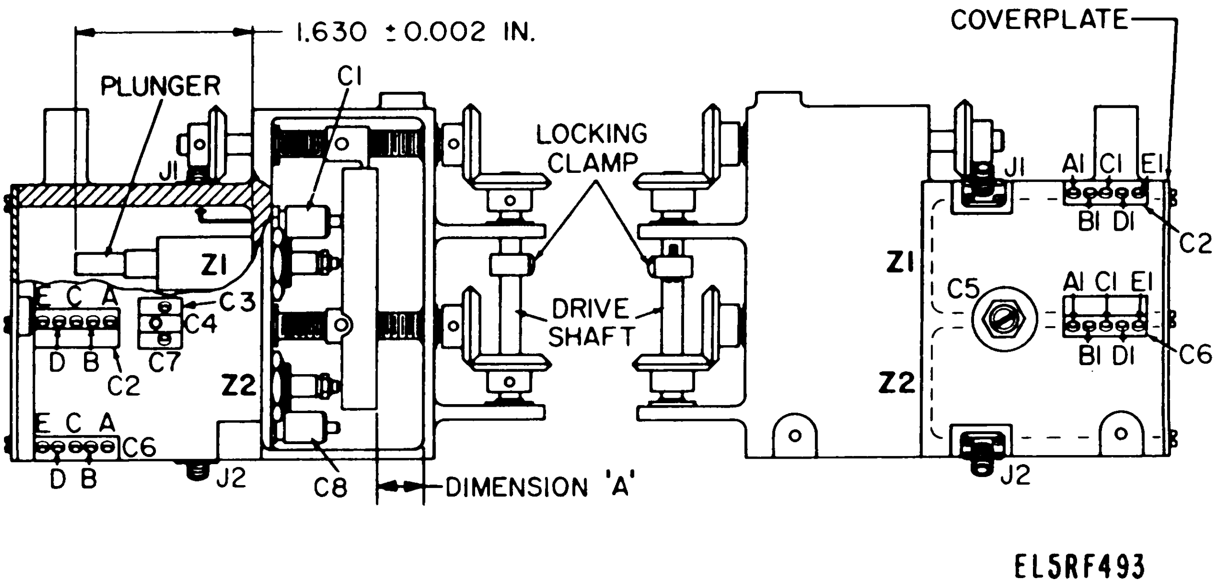


Figure 4-219. Bandpass Filter 39FL3, Mechanical Details.

(e) Adjust the wide range oscillator frequency to position the sideband markers on the 16 dB return loss line (level) noted in *(1)(d)* above (readjust the signal generator frequency as necessary). The output frequency of the wide range oscillator multiplied by two is the 16 dB return loss bandwidth, and must be 4 MHz minimum and the frequency counter indication should be 1850 MHz ±1 MHz.

(f) Unlock the bandpass filter drive shaft locking clamp (figure 4-219).

(g) Tune the filter to a counter reading of 0115.4 (corresponding to 1780 MHz), apply the counter correction figure determined in *(b)* above, and readjust the sweep generator to center the response (at 1780 MHz). The oscilloscope should display a symmetrical response similar to that shown in A, figure 4-218.

(h) Measure the 16 dB return loss bandwidth as in *(e)* above. The indication on the frequency counter should be 1780 MHz ±1 MHz.

(i) Repeat *(g)* above for each counter reading listed below (reset the Δ F FREQ control for a 10 MHz sweep width as necessary). The response curves obtained should be similar to the figure 4-218 response corresponding to the counter reading. Repeat (e) above at each counter setting. The frequency indicated on the frequency counter should be within ±1 MHz of the frequency corresponding to the test fixture counter reading.

Center frequency F_o (MHz ±1 MHz)	*Test fixture counter reading*	*Response (figure 4-218)*
1780	*0115.4*	A
1645	0335.0	B
1525	0540.4	B
1405	0757.7	C
1350	0857.4	D

NOTE

Apply the counter correction figure of *(2)(b)* above.

(j) Retune the bandpass filter counter to a reading of 0000.0 (1850 MHz). Apply the counter correction of *(2)(b)* above.

(3) *Insertion loss test*

(a) Connect the test equipment as shown in A, figure 4-220.

(b) Adjust the sweep generator for a response approximately 10 MHz wide, centered on 1850 MHz (external marker) and 8 cm in amplitude.

(c) Connect the test equipment as shown in B, figure 4-220.

(d) Using the test fixture control, tune the filter until the response is centered at 1850 MHz.

(e) Measure the amplitude of the response at 1850 MHz. It should be 6.6 cm minimum, corresponding to an insertion loss of 0.85 dB.

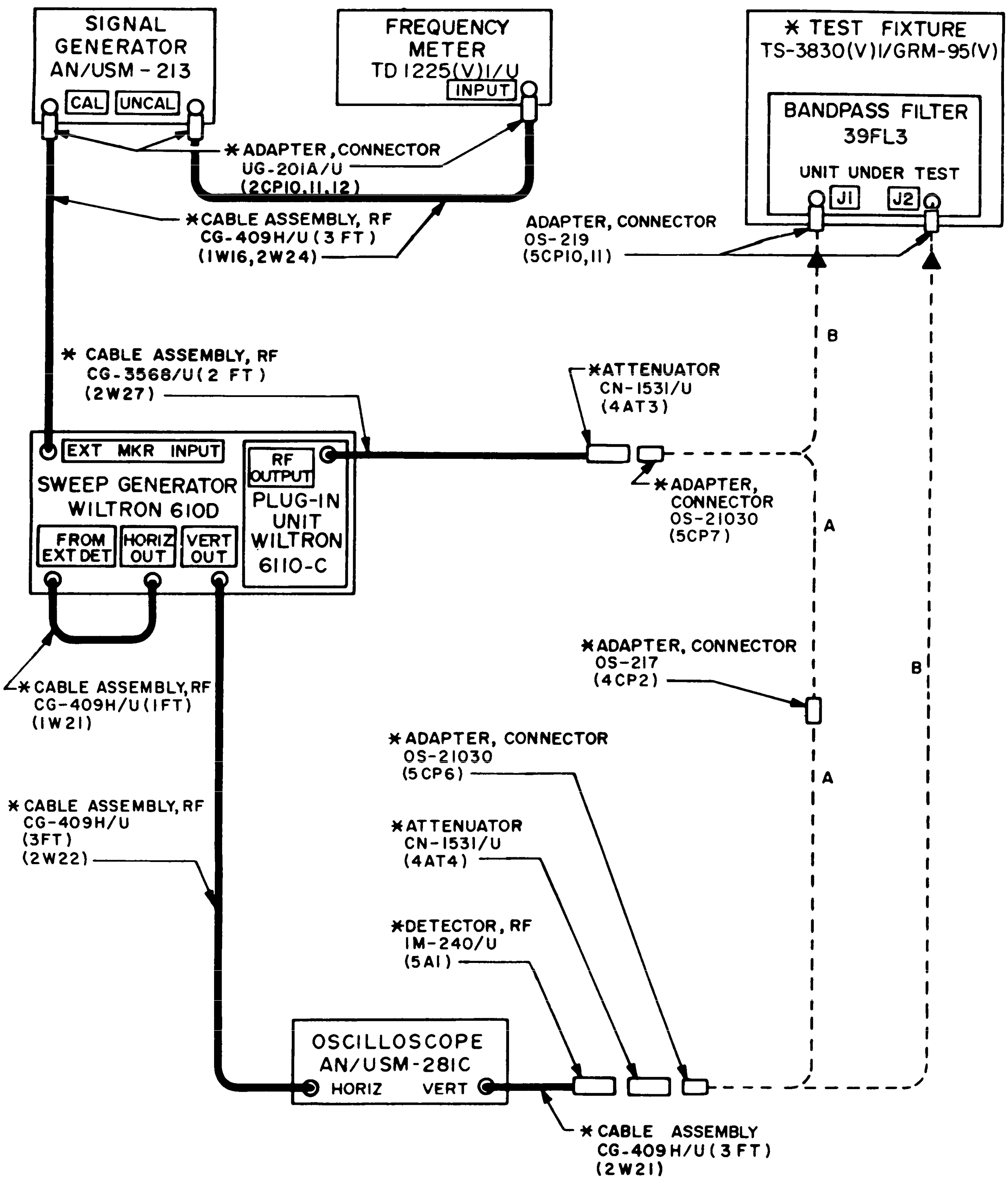


Figure 4-220. Bandpass Filter 39FL3, Insertion Loss and Tracking, Test Setup.

(f) Check that the transmission response over f_o ±2 MHz falls within ±0.9 cm of the response at 1850 MHz (i.e., within ±0.6 dB of the loss at 1850 MHz).

(g) Repeat *(a)* through *(f)* above at frequencies of 1780 MHz, 1645 MHz, 1525 MHz, 1405 MHz, and 1350 MHz. Refer to *(2)(i)* above for counter readings.

(4) *Tracking test.*

(a) Connect the test equipment as shown in B, figure 4-220.

(b) Tune the filter for a response centered on 1850 MHz. Note the test fixture counter reading.

NOTE

To minimize backlash error, tune the filter in one direction only.

(c) Repeat *(b)* above for the frequencies listed under *(2)(i)* above. Note the counter reading at each frequency.

(d) Compare the counter readings noted in *(b)* and *(c)* above. They should correspond to within 0001.5 of the test fixture counter readings in *(2)(i)*, as corrected (para. *(2)(b)* above).

(e) Retune the filter to a counter reading of 0000.0 + correction figure (corresponding to 1850 MHz). Lock the filter drive shaft in that position using the locking clamp, figure 4-219 and disconnect the unit under test from the test fixture.

c. Alinement Procedures.

(1) *Preliminary test setup.*

(a) Connect test equipment as shown in C, figure 4-221, but do not attach the bandpass filter to the test fixture.

(b) Set the oscilloscope sensitivity to 1 mV/cm.

(c) Adjust the sweep generator for a sweep width of 8 MHz centered at 1850 MHz, using the internal markers. Adjust the RF OUTPUT control of the sweep generator to give a vertical trace deflection of 6 cm on the oscilloscope.

(d) Remove the filter coverplate (fig. 4-219) and unlock the drive shaft clamp.

(e) Set the following capacitor tuning screws to project 6 turns into their respective cavities (approximately 5/16ths of an inch):

C3 and C7
C2 A through E
C2 Al through El
C6 A through E
C6 Al through El
C4 should be flush with the outside surface of the unit under test.
C5 should be flush with the top surface of locking nut.

(f) Set the plunger position in cavity Z1 to the dimension shown in figure 4-219 by rotating the drive gear manually and using the depth gauge to measure the depth of the tuning plunger. This dimension corresponds to the plunger position required at 1850 MHz.

(g) Lock the mechanical drive of the filter by tightening the screw in the locking clamp after engaging the clamp with the chassis of the filter.

(h) Set the test fixture to a counter reading of 0000.0 (1850 MHz position).

(i) Replace the filter coverplate removed in *(d)* above.

(j) Attach the filter to the test fixture, taking care not to change the position of either unit. Secure with the knurled thumbscrews. Note the counter reading. The difference between the reading and 0000.0 will be used later as the counter correction figure (may be a positive or negative value).

(2) Q *bandwidth alinement, unloaded 3-dB bandwidth.*

(a) Remove screws C2A and C2A1 from cavity Z1 (fig. 4-219).

(b) Connect probe No. 1 and No. 2 to cavity Z1 using screw holes C2A1 and C2A respectively. Connect the test equipment as shown in A, figure 4-221, Do not alter the sweep generator output level from that set inc. *(1)(c)* above.

(c) Adjust screw C7 in cavity 22 to bottom against the center conductor of the cavity 22.

(d) Adjust the coupling probes in C2A and C2A1 to obtain a single peak response display of 6 cm amplitude (A, fig. 4-222). If necessary, adjust C3 to center the response at the 1850 MHz marker.

NOTE

Adjust the probes so that they penetrate equally into Z1. This can be determined by visual inspection from the outside.

(e) Set the signal generator output to a center frequency of 1850 MHz (±125 kHz) as measured on the frequency counter. Use this signal as an external marker on the swept response.

(f) Adjust the wide range oscillator frequency (and signal generator frequency, as necessary) so that the two sideband markers fall equidistant from the 3 cm line, as shown in B, figure 4-222.

(g) Measure be frequency of the wide range oscillator on the frequency counter.

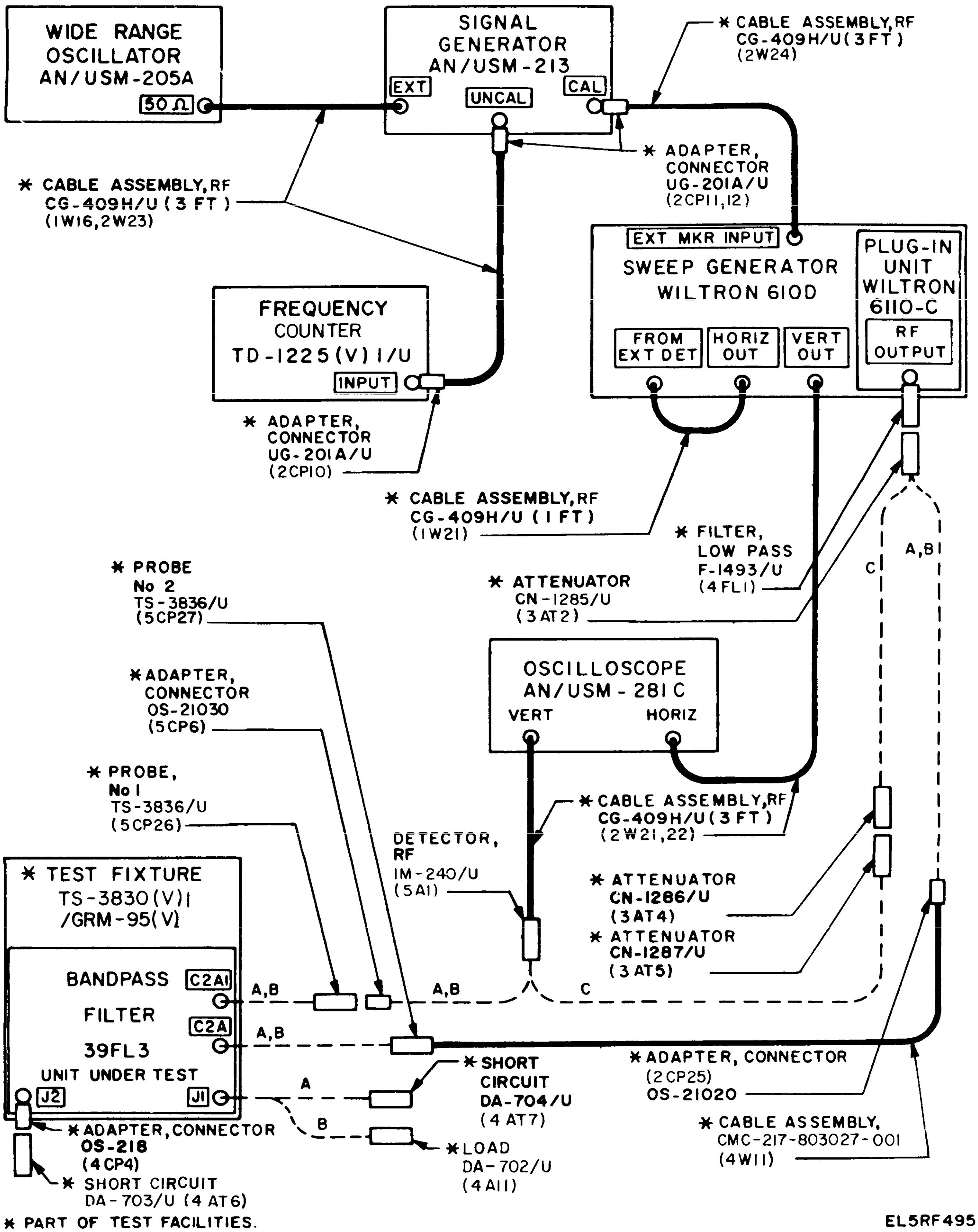


Figure 4-221. Bandpass Filter 39FL3, Q Bandwidth and Coupling Bandwidth Alinement Test Setup.

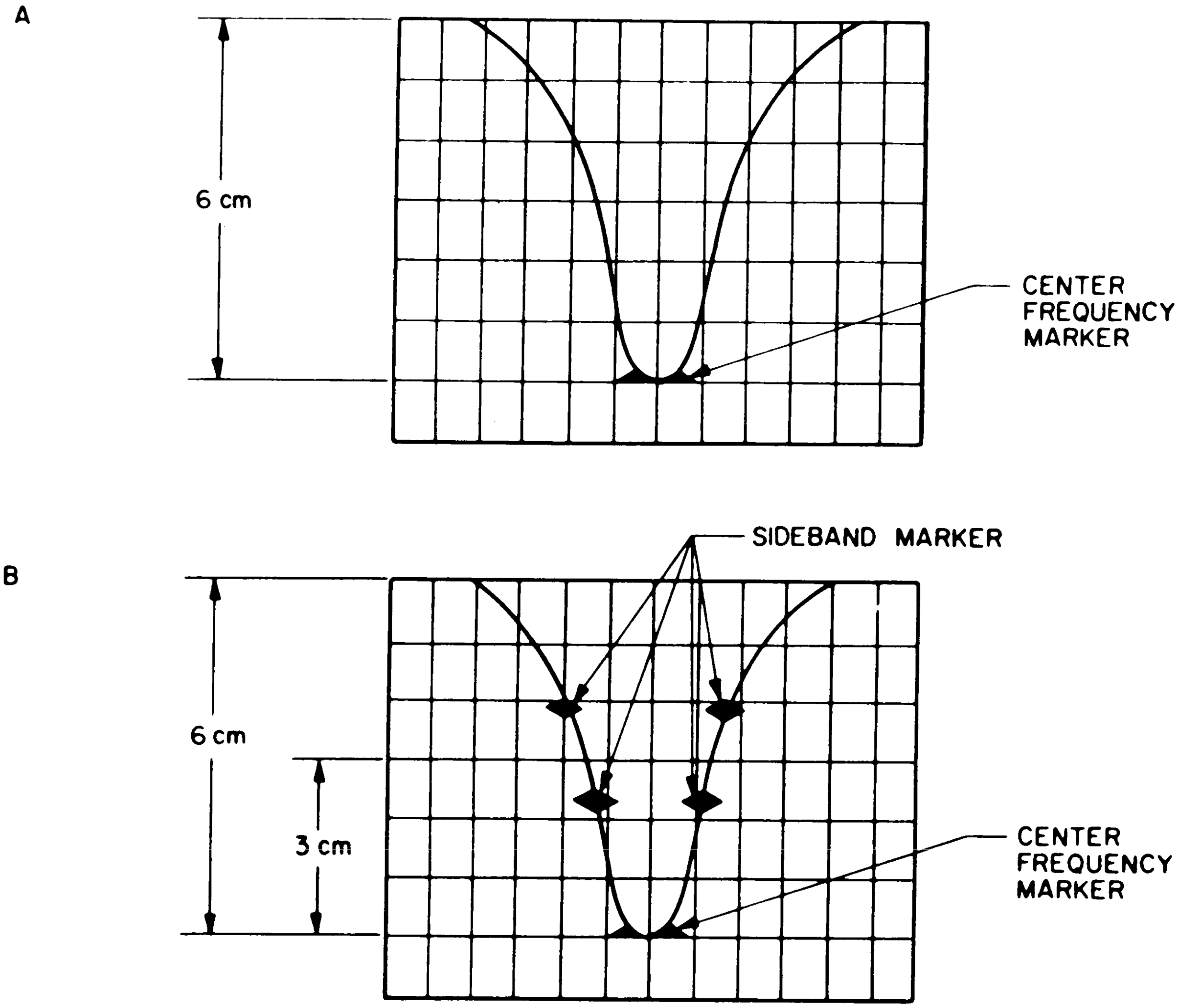


Figure 4-222. Bandpass Filter 39FL3, Q Bandwidth Response Curves.

(h) Multiply the frequency noted by two, and record the result. This represents the unloaded 3 dB bandwidth.

(3) Q *bandwidth alinement loaded 3 dB bandwidth.*

(a) Connect the equipment as in B, figure 4-221. Replace the short circuit at J1 by the 50-ohm dummy load (DA-702/U).

(b) Adjust the probes in C2A and C2A1 to obtain a single-peak response display of 6 cm amplitude centered at 1850 MHz. If necessary, adjust C3 to center the response at 1850 MHz. Refer to NOTE inc. *(2)(d)* above.

(c) If necessary, read just the signal generator frequency to 1850 MHz (±125 kHz).

(d) Adjust the wide range oscillator frequency (slightly readjust signal generator frequency, as necessary) to obtain two sideband markers equidistant from the 3 cm line as shown in B, figure 4-222.

(e) Measure the wide range oscillator frequency on the counter. Multiply the frequency noted by two, and record the answer. This represents the loaded 3 dB bandwidth.

(f) To obtain the Q bandwidth of cavity Z1 at a center frequency of 1850 MHz, subtract the unloaded 3 dB bandwidth recorded in *(2)(h)* above from the loaded 3 dB bandwidth in *(e)* above. The resultant Q bandwidth figure must be 8.39 MHz (±0.05 MHz). If necessary, adjust capacitor C1 to meet this specification.

(g) Repeat the alinement procedure in (2) above and in *(a)* through *(f)* above for cavity Z2. Substitute holes C6A and C6A1, as well as port J2, for C2A, C2A1, and J1 respectively. Adjust capacitor C3 to bottom against the center conductor of cavity Z2. Reset C7 as described in *c. (1)(e)* above.

NOTE

Do not change the mechanical setting of the assembly. Adjust C7 to center the response on 1850 MHz and C8 to obtain the required Q bandwidth *((f)* above).

(h) Seal capacitors Cl and C8 when both cavities have been alined.

(4) *Alinement of coupling bandwidth.*

(a) Repeat *c.(1)(b)* and *c.(1)(c)* above for a sweep generator frequency of 1850 MHz.

(b) Connect the test equipment as in A, figure 4-221, but with coupling probes No. 1 and No. 2 inserted in holes C6A1 and C6A respectively. Terminate J1 and J2 with short-circuit terminations DA-703/U and DA-704/U.

(c) Adjust C3 to the same penetration as C7 as determined visually.

(d) Adjust the coupling probes to obtain a display of 6 cm amplitude centered on 1850 MHz. Refer to **NOTE** in C. *(2)(d).*

(e) Adjust C3 to obtain a double-peaked response centered at 1850 MHz (see fig. 4-223). If necessary, adjust C7.

(f) Adjust the wide range oscillator (and signal generator) frequency to position the sideband markers at the response peaks (see fig. 4-223).

(g) Read the wide range oscillator frequency on the frequency counter, and multiply by 2. This yields the coupling bandwidth at 1850 MHz, which should be 8.4 MHz (±0.1 MHz). Adjust capacitor C4 as required to obtain this bandwidth figure. Slight readjustment of C3 and C7 maybe required.

(h) Repeat *c.(1)(b)* and *c.(1)(c)* above for a sweep generator frequency of 1350 MHz.

(i) Adjust the signal generator to measure 1350 MHz (±125 kHz) on the frequency counter. Disconnect the mechanical lock on the filter drive shaft, and tune the falter to obtain a response at 1350 MHz. Readjust C3 and C7 for a double peaked response centered on 1350 MHz.

(j) Measure the coupling bandwidth at 1350 MHz as described in *(b)* through *(g)* above. The coupling bandwidth should be 7.4 MHz (±0.1 MHz). If required, adjust C5 to obtain this bandwidth.

(k) Repeat *(a)* through *(j)* for the alinement of both 1850 MHz and 1350 MHz until the requirements are satisfied for both frequencies.

(l) Secure capacitors C4 and C5. Remove probes No. 1 and No. 2 from the unit under test.

(m) Replace all screws that have been removed from the capacitors.

(5) *VSWR alinement*

(a) Connect the test equipment as shown in A, figure 4-217.

(b) Set the oscilloscope for a vertical sensitivity of 1 mV/cm and the sweep generator to sweep between 1350 MHz and 1850 MHz.

(c) Adjust the sweep generator output for a convenient deflection on the oscilloscope. This corresponds to a 16 dB return loss (1.37:1 VSWR).

(d) Disconnect the 6 dB attenuator and 10 dB attenuator from the test setup. Connect the unit under test as shown in B, figure 4-217.

(e) Set the test future for a counter reading of 0000.0, corresponding to a center frequency of 1850 MHz. Apply the counter correction figure (para. c. *(1)(j)* above).

(f) Tune the signal generator to a center frequency of 1850 MHz (±125 kHz) as indicated on the frequency counter.

(g) Adjust the sweep generator for a sweep width of approximately 10 MHz centered at 1850 MHz, using the external marker.

(h) Adjust capacitors C3 and C7 for a symmetrical response centered on 1850 MHz (A, fig. 4-218).

(i) Adjust the wide band oscillator frequency to position the sideband markers at the 16 dB return loss line as established in *(c)* above. Measure the frequency of the wide range oscillator on the frequency counter, and multiply by two. The number obtained is the 16 dB return loss bandwidth, and should be a minimum of 4 MHz.

(j) Tune the filter to a counter reading of 0115.4 (corresponding to 1780 MHz), and apply the counter correction figure (See *(1)(j)* above). Repeat *(f)* and *(g)* above for a center frequency of 1780 MHz.

(k) Adjust screws C2A, C2A1, C6A, and C6A1 in equal increments to obtain a symmetrical response similar to A of figure 4-218 and centered on 1780 MHz.

(l) Measure the 16 dB return loss bandwidth as in *(i)* above.

(m) If an adjustment was made in *(k)* above, retune the filter to a counter reading of 0000.0 (1850 MHz), and apply the counter correction figure (See *(1)(j)* above). Repeat the procedure, starting at *(f)* above, to obtain the 4 MHz 16 dB return loss bandwidth at both frequencies.

(n) Repeat *(e)* through *(l)* above to adjust the VSWR response with the capacitor screws indicated for the frequencies given below:

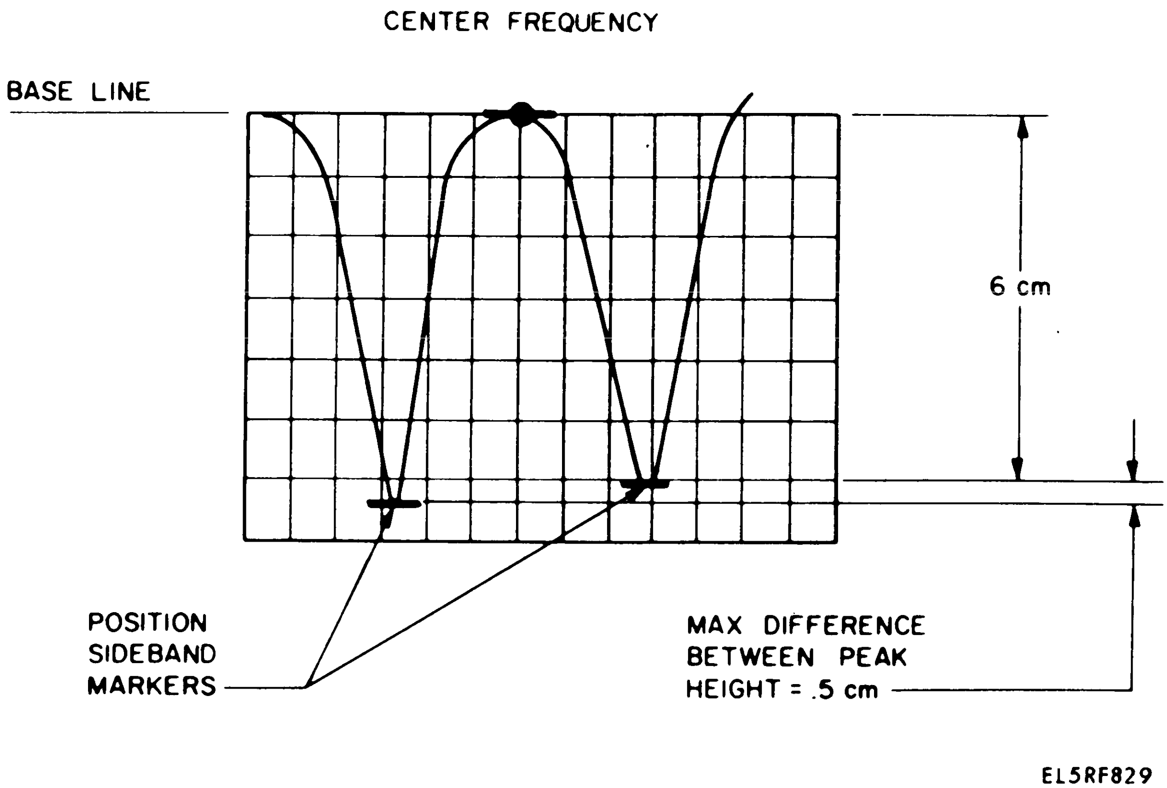


Figure 4-223. Bandpass Filter 39FL3, Coupling Bandwidth Response Curves.

Center frequency (MHz)	*Counter reading*	*Capacitor screws*	*Response (fig. 4-218)*
1850	0000.0	C3, C7	A
1780	0115.4	C2A, C2A1, C6A, C6A1	A
1645	0335.0	C2B, C2B1, C6B, C6B1	B
1525	0540.4	C2C, C2C1, C6C, C6C1	B
1405	0757.7	C2D, C2D1, C6D, C6D1	C
1350	0857.4	C2E, C2E1, C6E, C6E1	D

NOTE

Apply the counter correction figure (see *(1)(j)* above). Whenever a pair of screws has been adjusted, repeat the alinement from the previous (next higher frequency) until the parameters at both frequencies are within specifications.

(o) Reset the filter to the corrected counter reading for 0000.0 (1850 MHz), and seal the screws of capacitors C2, C6, C3, C7, C4, and C5. There should be no change of input VSWR at 1850 MHz.

(p) Repeat the insertion 1oss and tracking tests in *b.* (3) and *b.(4)* above.

4-82. Amplifier-Frequency Multiplier AM-4323( )/GRC-103(V), Band IV Transmitter RF Head (Unit 40)

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter, TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, band 2,3,4
Test Facility, Radio Frequency Modules TS-3847(V)2/ GRM-95(V)2	Test facility, rf modules

Equipment	*Common name*
Counter, Frequency TD-1225 (V)l/U	Frequency counter
Meter, Power HP-435A	Power meter
Sensor, Power HP-8481A	Power sensor
Multimeter, Digital AN/USM-451	Multimeter
Megohmmeter GR-1864	Megohmmeter

b. Test Procedures.

(1) *Preliminary checks.*

(a) Before connecting the unit under test to the transmitter test facility, a resistance check of the temperature sensor is required as follows:

1. Remove the dust cover from the unit under test and connect the digital multimeter between pins 17 and 43 of connector P1 of the connector filter assembly 40A1W1AlP1. The resistance measured should be within the limits shown on the "Temp/ Resistance" chart for the temperature of the heat radiator of the unit under test output tube (see figure 4-240).

2. Connect the multimeter between pin 17 and pin 1 (H.V. connection), The multimeter should indicate an open circuit.

3. Repeat 2. above for pins 43 and 1.

WARNING

High voltages are accessible at the test leads and connections when the megohmmeter is used. Switch to "OFF" and "DISCHARGE" before connecting or disconnecting test leads.

4. Short pins 17 and 43 together and connect the megohmmeter between the shorting wire (pins 17 and 43) and Pin 1.

5. Turn the megohmmeter power switch on, and set its voltage control to 600 volts.

6. Set the "DISCHARGE - CHARGE - MEASURE" switch to "CHARGE" and then "MEASURE". The resistance indicated on the megohmmeter should be greater than 50 megohms.

7. Return switches to "DISCHARGE" and "OFF".

8. Disconnect megohmmeter and the short between pins 17 and 43.

(b) Perform the following preliminary checks:

1. Connect the test equipment as shown in A, figure 4-224.

2. Direct the cooling air from the AIR OUTLET of the transmitter test facility to electrical shield 40MP3 (TM 11-5820-540-30) at the rear of the unit under test. Use hose assembly MX-8414/GRM-95 (V).

3. Set the XMTR TUNE and XMTR CHANNEL controls of the unit under test to channel 3299.

4. Set the accessory kit power supply AC POWER switch to ON. Adjust the voltage control for 115 Vac ± 2 volts on the VOLTS meter. Maintain this adjustment throughout the following tests.

5. Set the transmitter test facility switches as follows:

Switch	*Switch position*	*Normal indication*
S1	ON	None.
S20	S12	None.
S12	OSC	Test facility meter Ml indicates between 20 and 90 percent of full scale. LOW PWR lamp on test facility should light
S13	ON	None.
S15	OUTPUT	None.
S16	NORMAL OUTPUT	None.
S17	ON	None.
S18	OFF	None.

6. Set transmitter test facility switch S12 to the following positions, and observe meter Ml indications.

Position	*Normal indication*
DBLR	Ml indicates between 10 and 90 percent of full scale.
MULT	Ml indicates between 20 and 90 percent of full scale, after completion of tuning.
DRIVER	Ml indicates between 20 and 90 percent of full scale, after completion of tuning.

7. Set transmitter test facility switch S12 to PWR OUT, and adjust the XMTR TUNE and PWR OUT PEAK controls on the unit under test for a peak indication on meter Ml. The LOW PWR lamp on the test facility should go out, and Ml should indicate between 40 and 90 percent of full scale. The XMTR TUNE tape channel indication must be within 14 inch of the center line of the window.

8. Set the transmitter test facility switch S 12 to REFL PWR. Meter Ml should be less than 10 percent of full scale.

NOTE

If REFL PWR indication is greater than 10 percent, connect the 50-ohm dummy load directly to the PWR OUT connector of the unit under test as shown in B, figure 4-224. The REFL PWR indication on the meter should be less than 10 percent. Reestablish connections as in A, figure 4-224.

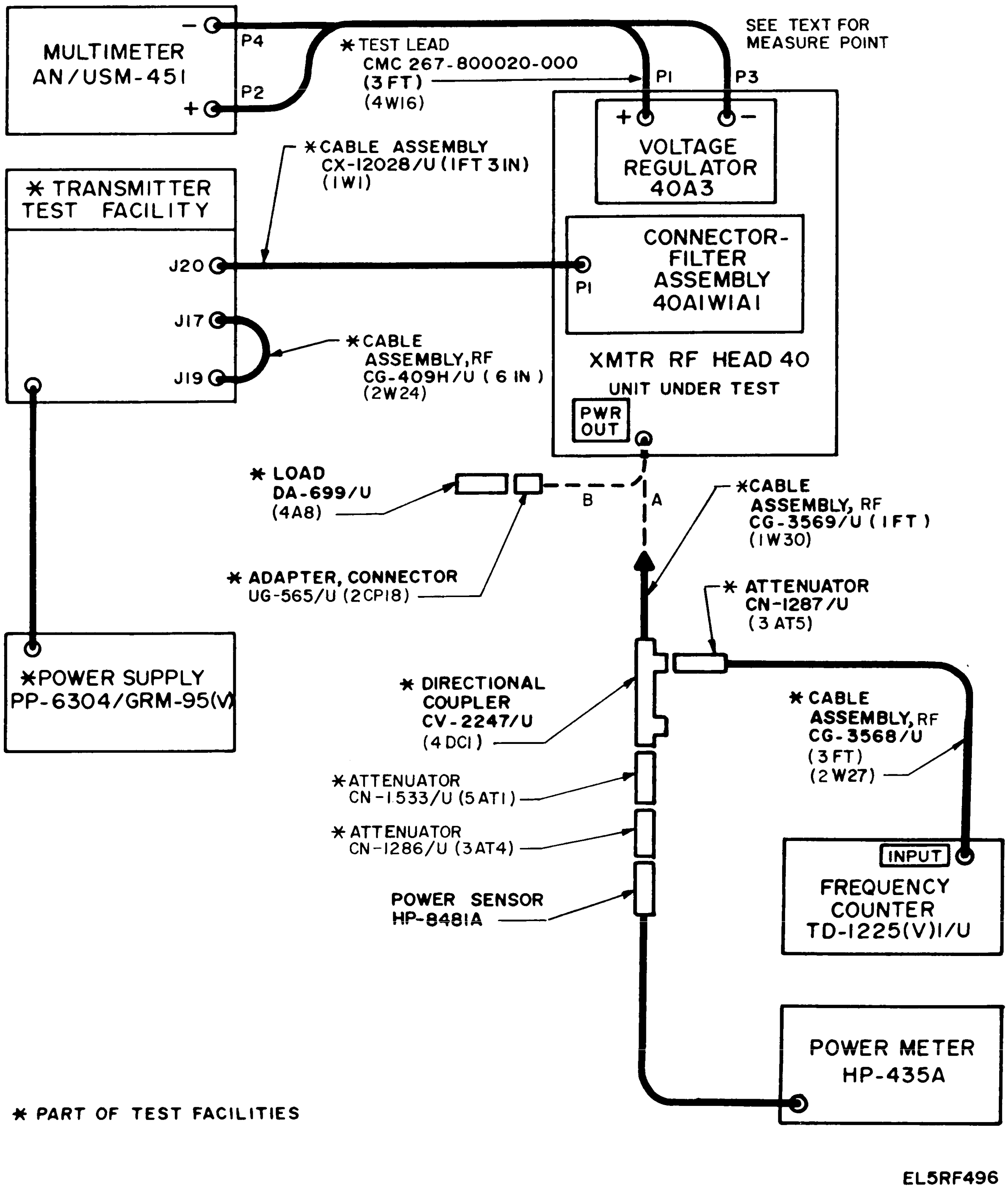


Figure 4-224. Band IV Transmitter Rf Head, Test Setup.

9. Temporarily remove the cable from the POWER OUT connector of the unit under test. Meter Ml should indicate between 20 and 90% of full scale. Reconnect the cable.

10. Note the output level indicated on the power meter. Refer to the calibration charts on the directional coupler and the 20 dB attenuator, and ascertain the correct attenuation of each item at the output frequency (1849.5 MHz for channel 3299).

11. Add the sum of these to the power meter indication in decibels to obtain the output power of the unit under test. The calculated output power shall be +41.7 dBm minimum (15 watts).

(2) *Cathode and heater voltage measurement*

(a) Locate the test points on voltage regulator 40A3.

(b) Check the voltages at the points listed below with the multimeter. Results should be as follows;

Voltage regulator test points	*Multimeter indication (Vdc)*
TP2 (–) and TP4 (+)	5.6 to 6.2
TPl (–) and TP3 (+)	5.6t06.2
TP9 (–) and TP4 (+)	16 V maximum
TP9 (–) and TP8 (+)	0.69 to 0.89
TP9 (–) and TP7 (+)	0.56 to 0.72

(3) Power output and tracking test

(a) Set the XMTR TUNE and XMTR CHANNEL controls on the unit under test to channel 2300.

(b) Adjust the XMTR TUNE and PWR OUT PEAK controls for the maximum indication on test facility meter Ml with switch S12 at PWR OUT. The output power should be 15 watts minimum. See *(1)(j)* and *(k)* above.

(c) Check that the output frequency on the frequency counter indicates 1350 MHz (±27 kHz). The XMTR TUNE channel indication of the selected channel should be within ±0.5 inch of the center of the display window.

(d) Repeat *(a)*, *(b)*, and *(c)* above for the channels listed below

Channel	*Frequency (MH2)*	*Tolerance (±kHz)*
2300	1350.0	27.00
2391	1395.5	27.91
2482	1441.0	28.82
2573	1486.5	29.73
2671	1535.5	30.71
2672	1536.0	30.72
2775	1587.5	31.75
2818	1609.0	32.18
2891	1645.5	32.91
2959	1679.5	33.59
2960	1680.0	33.60
3037	1718.5	34.3'7
3110	1755.0	35.10
3257	1828.5	36.57
3299	1849.5	36.99

c. *Troubleshooting* (FO-12).

NOTE

The following procedures supplement the troubleshooting procedures in TM 11-5820-540-12 and TM 11-5820-540-30.

Symptom	*Probable cause*	*Checks and corrective measures*
1. DBLR meter indication zero in b. *(1)(f)* above.	+28 V interlock open.	Check for continuity at 40A1W1A1P1, pins 11 and 12.
2. MULT meter indication low or zero in *b.(1)(f)* above,	*a*. Defective frequency multiplier 40A2.	*a.* Check that at least +26 dBm is present at 40A2AR2J1. If power level is abnormal, remove 40A2 (para. 2-92), and check for at least 2W (+33 dBm) is present at pin Al of 40A1W1J2. Use cable assembly GG-3570/U(2W26) and appropriate adapters. If power level is normal, test 40A2 as described in paragraph 4-88.
	b. wiring.	*b.* If 40A2 is normal check continuity between 40A1W1A1P1 and 40A1W1J2.
3. DRIVER meter indication low or zero in *b. (1)(f)* above.	*a*. Open circuit in driver filament line.	*a.* Remove voltage regulator 40A3 and check resistance between 40A1W1J4 pins 11 and 12. Resistance should be 1.5 ohms nominal. (Driver tube must be inserted for this check.)
	b. Defective cables 40W1, 40W2 or 40W4.	*b.* Check cables with multimeter, and replace if necessary.
	c. Output power misalinement.	*c.* See alinement procedure *d* below.

c. Troubleshooting. – Continued

Symptom	*Probable cause*	*Checks and corrective measures*
	d. Defective coaxial isolator 40A1AT1.	*d* Check 40A1AT1 as described in paragraph 4-85.
	e. Defective bandpass filter 40FL1.	*e.* Remove 40FL1 as described in paragraph 2-94 and check as described in paragraph 4-80.
	f. Rf amplifier 40AR1.	*f.* Remove 40AR1 as described in paragraph 2-93 and check as described in paragraph 4-91.
4. PWR OUT meter indication zero in *b. (1)(g)* above. Output power normal as indicated by power meter.	Metering circuit	Check PWR OUT metering circuit.
5. PWR OUT meter indication low or zero in preliminary setup *b. (1)(g)* above.	High insertion loss in circulator 40A1HY1 or power monitor 40A1Al.	Test circulator as described in paragraph 4-86 or replace power monitor (TM 11-5820-540-30).
6. Appreciable meter indication with switch at REFL PWR.	PWR OUT load mismatch	Remove dummy load DA-699/U from test setup and connect directly to XMTR OUT using connector UG-565A/U (B, fig. 4-224). Meter reading should be normal, indicating problems in test equipment connections or cables at RF HEAD output.
7. Voltages not as specified in test procedure *b. (2)(b)* above.	Defective voltage regulator 40A3.	Remove voltage regulator (TM 11-5820-540-30) and test as described in paragraph 4-89.
8. Incorrect frequencies.	Control line(s) open circuit.	Check for continuity of lines between 40A1W1J5 and 40A1W1A1P1.
9. Incorrect frequencies at channel 2960 and higher in test procedures *b. (3)(c)* above.	Control line 13 open circuit.	Check continuity between 40A1WlA1P1, pin 13, and 40A1W1J2, pin 10. Also check continuity between 40A1W1A1P1, pins 33 and 45, and 40AlWlJ2, pins 11 and 12, respectively.
10. Output below normal at some frequencies in test procedures *b. (3)(b)* and *(d)* above.	Misalinement of rf amplifier 40AR1.	Aline power output as in alinement procedure *d.* below.
11. Output power and frequency normal, selected channel indication displaced on channel-frequency indicator in test procedures *b. (3)(c)* and *(d)* above.	Defective channel-frequency indicator 40 A1DS1.	Remove and replace 40A1DS1 as described in paragraph 2-90.

d. Power Output Alinement

(1) Connect the test equipment as shown in A, figure 4-224.

(2) Set XMTR TUNE and XMTR CHANNEL controls on the unit under test to channel 3260 (1830 MHz).

(3) Adjust the PWR OUT peak control to midposition.

(4) Set the transmitter test facility switches as follows:

Switch	*Position*
S1	ON
S20	S12
S12	OSC
S13	ON
S15	OUTPUT
S16	OUTPUT NORMAL
S17	ON
S18	OFF

(5) Turn transmitter test facility switch S12 to PWR OUT. Adjust the XMTR TUNE control on the unit under test for the maximum indication on meter M1.

(6) Adjust the tube V1 control (TM 11-5820-540-30), and if necessary the tube V2 control, for the maximum indication on the power meter.

(7) Allow 2 minutes for stabilization. Repeat (6) above if necessary.

(8) Repeat the power output check in *b. (3)(b)* and *(c)* above.

4-83. Electronic Component Assembly 40A1

NOTE

There is no overall test for the electronic component assembly other than the functional test described in TM 11-5820-540-30. Refer to the paragraphs below for individual units of assembly.

Subassembly	*Paragraph*
Rf power monitor 40A1Al	TM 11-5820-540-30
Electrical dummy load 40A1A2	4-84
Isolator 40A1AT1	4-85
Circulator 40A1HY1	4-86
Branched wiring harness 40A1W1	4-87
Indicator, channel frequency 40A1DS1	2-90

4-84. Electrical Dummy Load 40A1A2

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Receiver TS-2867(V)2/GRM-95(V)2	Receiver test facility
Test Facility, Radio Frequency Modules, TS-3847(V)2/GRM-95(V)2	Test facility, rf modules
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95 (V)2	Accessory kit, band 2,3,4
Frequency Unit, Plug-in Wiltron 611O-C	Frequency unit plug-in unit
Generator, Sweep Wiltron 610D	Sweep generator
Oscilloscope, AN/USM-281C	Oscilloscope

b. VSWR Test

(1) Connect the equipment as shown in A, figure 4-225. Adjust the sweep generator to sweep between 1350 and 1850 MHz.

(2) Adjust the vertical sensitivity control of the oscilloscope and the sweep generator output control for a suitable display on the scope. The calibration corresponds to a return loss of 16 dB (VSWR of 1.37:1). Note the deflection on the screen.

(3) Connect the equipment as shown in B, figure 4-225. The deflection on the oscilloscope should be equal to or less than that established in (2) above.

4-85. Coaxial Isolator 40A1AT1

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Receiver TS-2867(V)2/GRM-95(V)2	Receiver test facility
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95 (V)2	Accessory kit
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95 (V)2	Accessory kit, band 2,3,4
Frequency Unit, Plug-in, Wiltron 611O-C	Frequency unit plug-in unit
Generator, Signal AN/USM-213	Signal generator
Generator, Sweep Frequency, Wiltron Model 610D	Sweep generator
Oscilloscope AN/USM-281C	Oscilloscope
Power Meter HP-435A	Power meter
Power Sensor HP-8481A	Power sensor
Test Facility, Radio Frequency Modules, TS-3847(V)2/GRM-95(V)2	Test facility, rf modules

b. Test Procedures.

(1) *VSWR test*

NOTE

The unit under test should beat least 3/8 inch away from any metal.

(a) Connect the test equipment as shown in A, figure 4-226.

(b) Adjust the sweep generator controls to sweep between 1350 and 1850 MHz.

(c) Adjust the vertical sensitivity control of the oscilloscope and the sweep generator RF POWER LEVEL for a suitable display. This represents a VSWR of 1.50:1.

(d) Connect the test equipment as shown in B, figure 4-226. The input VSWR of the unit under test displayed on the oscilloscope should not exceed 1.50:1.

(e) Reverse the J1 and J2 connections to the unit under test. The output VSWR of the unit should not exceed 1.50:1 as described *in (d)* above.

(2) *Insertion loss test*

(a) Connect the test equipment as shown in A, figure 4-227.

(b) Set the signal generator to 1500 MHz. Adjust the RF POWER LEVEL for an indication of –5 dBm on the power meter.

(c) Connect the test equipment as shown in B, figure 4-227.

(d) The indication on the power meter shall be within 0.7 dB of the -5 dBm indication in *(b)* above.

(e) Repeat *(a)* through *(d)* above for signal generator frequencies of 1350 and 1850 MHz.

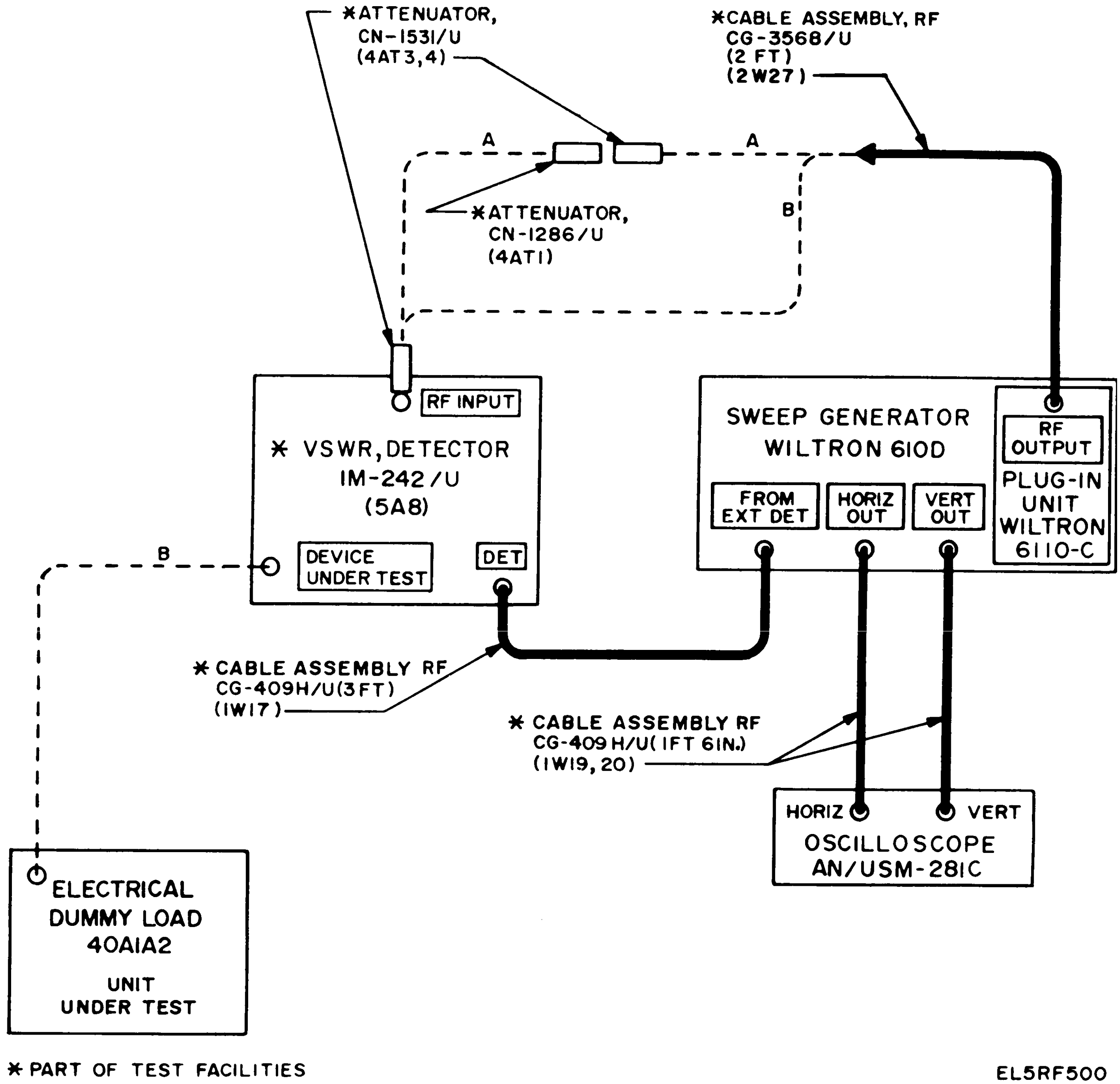


Figure 4-225. Electrical Dummy Load 40A1A2, VSWR Test Setup.

(3) *Isolation test*

(a) Connect equipment as shown in A, figure 4-227.

(b) Set the signal generator to 1500 MHz. Adjust the RF POWER LEVEL for an indication of –5 dBm on the power meter.

(c) Connect the test equipment as showin B, figure 4-227 with the unit under test J1 and J2 connections reversed. The power meter indication should be at least –15 dBm lower than the indication in *(b)* above.

(d) Repeat *(b)* through *(c)* above for signal generator frequencies of 1350 and 1850 MHz.

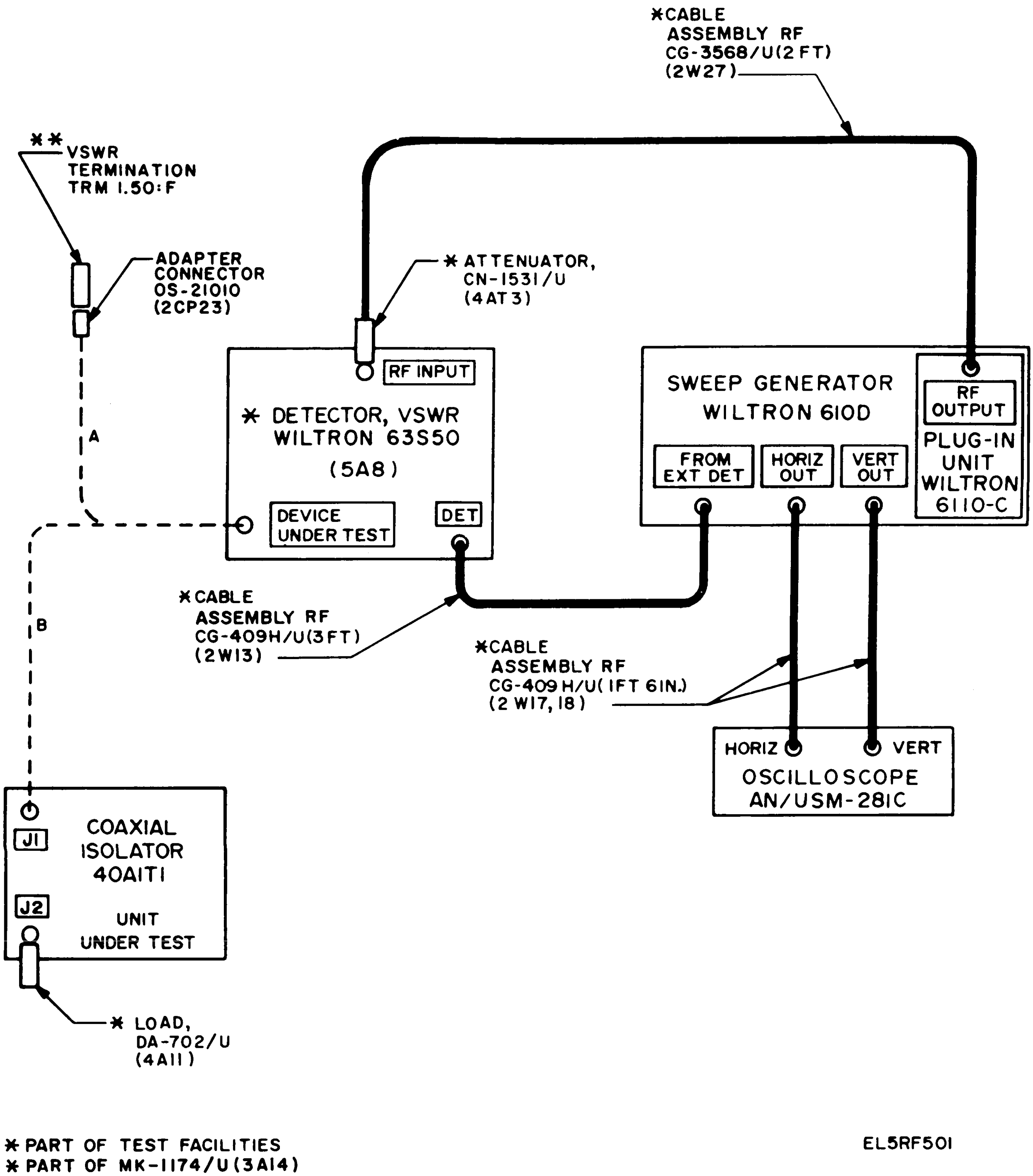


Figure 4-226. Coaxial Isolator 40A1AT1, VSWR Test Setup.

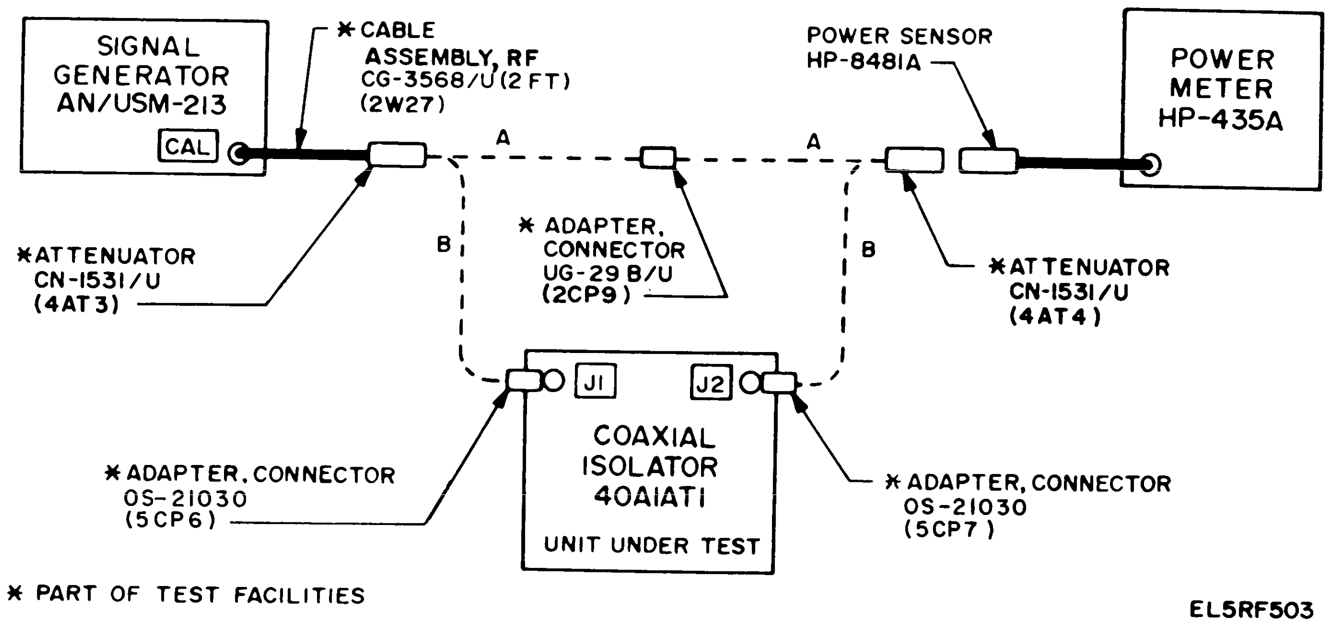


Figure 4-227. Coaxial Isolator 40A1AT1, Insertion Loss, Test Setup.

4-86. Circulator 40A1HY1

NOTE

This procedure on circulator 40A1HY1 applies equally to circulator 39A1HY1, as both are identical in construction.

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Receiver TS-2867(V)2/GRM-95(V)2	Receiver test facility
Test Facility, Radio Frequency Modules, TS-3847(V)2/GRM-95(V)2	Test facility, rf modules
Accessory Kit, Test Facility Set, MK-1173(V)2/GRM-95(V)2	Accessory kit
Accessory Kit, Test Facility Set, MK-1985(V)2/GRM-95(V)2	Accessory kit, band 2,3,4
Frequency Unit, Plug-in, Wiltron 611O-C	Frequency unit; plug-in unit
Generator, Sweep, Wiltron 610D	Sweep generator
Generator, Signal AN/USM-213	Signal generator
Oscilloscope AN/USM-281C	Oscilloscope
Meter, Power HP-435A	Power meter
Sensor, Power HP-8481A	Power sensor

b. Test Procedures.

(1) VSWR test

NOTE

The unit under test should beat least 3/8 inch away from any metal.

(a) Connect the test equipment as shown in A, figure 4-228.

(b) Calibrate the oscilloscope for a return loss of 16 dB (1.37:1 VSWR) between 1350 and 1850 MHz. Adjust the RF POWER level and oscilloscope controls for a suitable display on the screen, Note the deflection.

(c) Connect the test equipment as shown in B, figure 4-228. Vertical deflection on the oscilloscope shall be less than or equal to the calibration mark established in *(b)* above.

(d) Repeat *(c)* above for circulator ports J2 and J3.

NOTE

When checking VSWR at one port, the remaining ports shall be terminated in 50 ohms (DA-702/U).

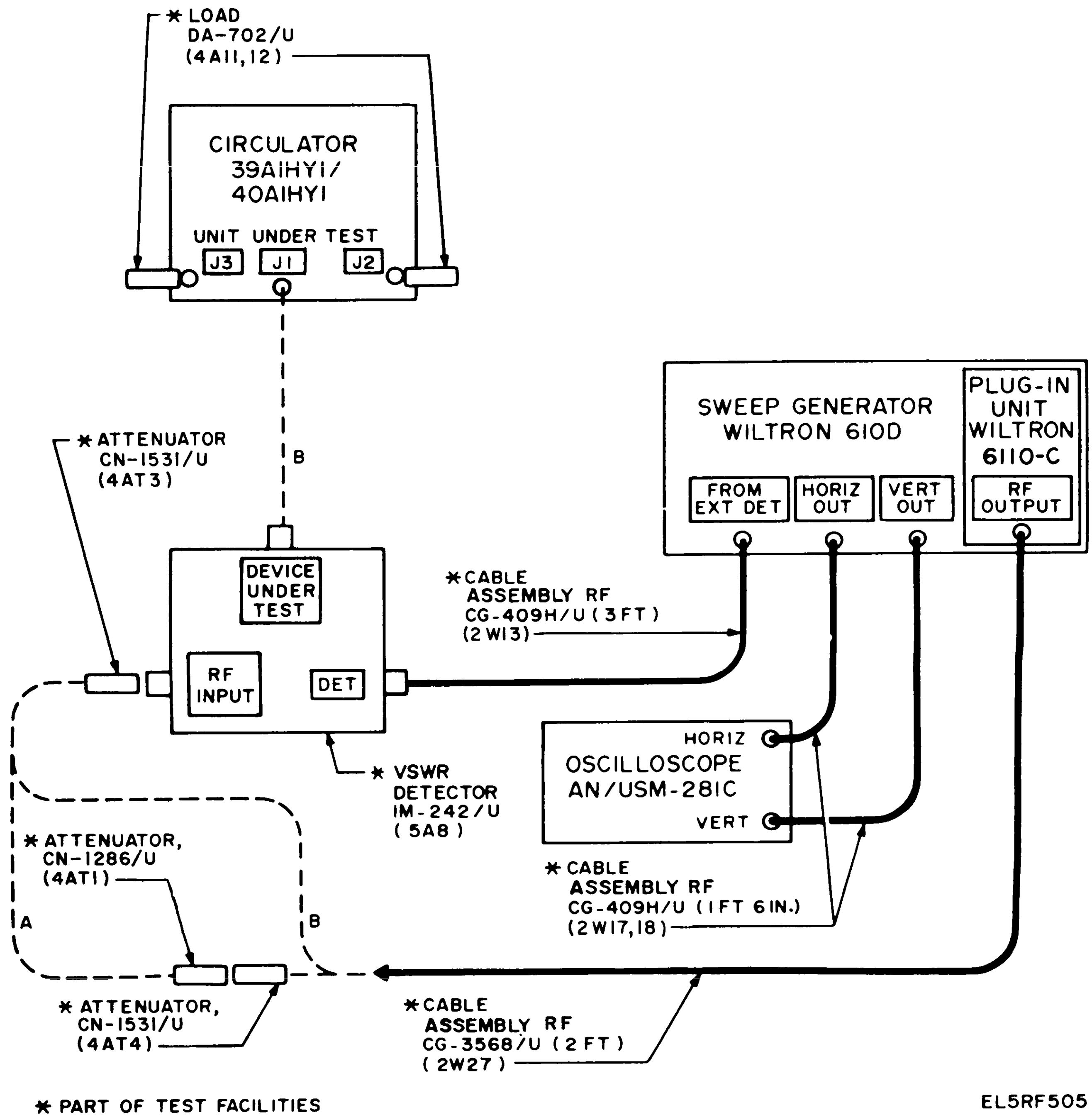


Figure 4-228. Circulator 40A1HY1/39A1HY1, VSWR Test Setup.

(2) *Insertion loss test*

(a) Connect the test equipment as shown in A, figure 4-229.

(b) Set the signal generator for 1500 MHz. Adjust RF POWER level for an indication of –10 dBm on the power meter.

(c) Connect the test equipment as shown in B, figure 4-229.

(d) The indication on the power meter shall be within 0.5 dB of the indication obtained in *(b)* above.

(e) Repeat *(c)* and *(d)* above for ports J2-J3 and J3-J1. Always terminate unused ports with a 50-ohm dummy load (DA-702/U).

(f) Repeat *(b)* through *(e)* above for signal generator frequencies of 1350 and 1850 MHz.

(3) *Isolation test.*

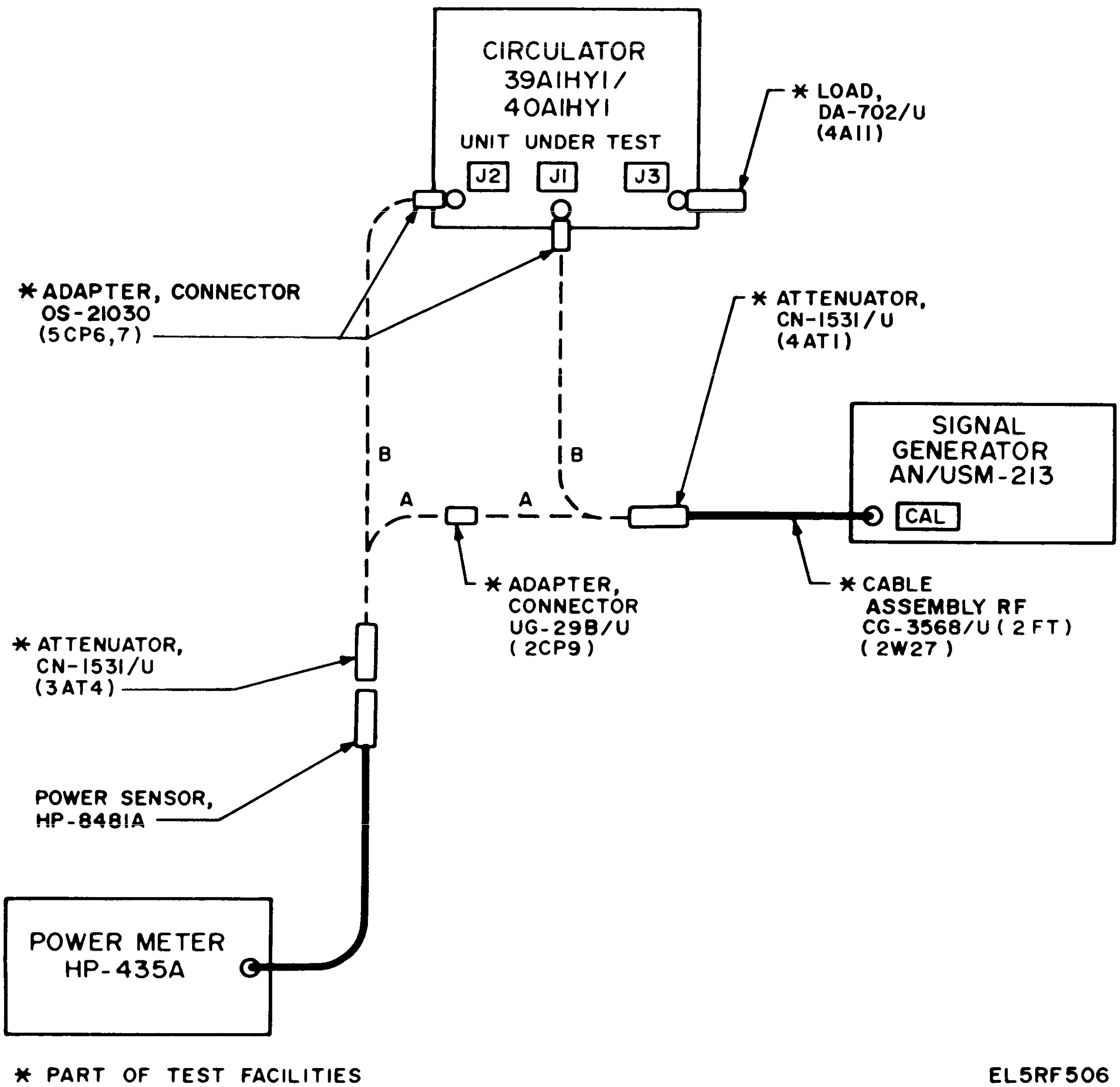


Figure 4-229. Circulator 40A1HY1/39A1HY1, Insertion Loss Test Setup.

(a) Connect the test equipment as shown in A, figure 4-230.

(b) Set the signal generator for 1500 MHz. Adjust RF POWER level for an indication of –5 dBm on the power meter.

(c) Connect the test equipment as shown in B, figure 4-230. The power meter shall indicate at least –20 dBm lower than the indication in *(b)* above (equivalent to an isolation of 15 dB or greater).

(d) Repeat *(c)* above for ports J2-J1 and J3-J2. Always terminate unusedports with a 50-ohm dummy load (DA-702/U).

(e) Repeat *(b)* through *(d)* above for signal generator frequencies of 1350 and 1850 MHz.

4-87. Branched Wiring Harness 40A1W1

a. Test Equipment and Material Required.

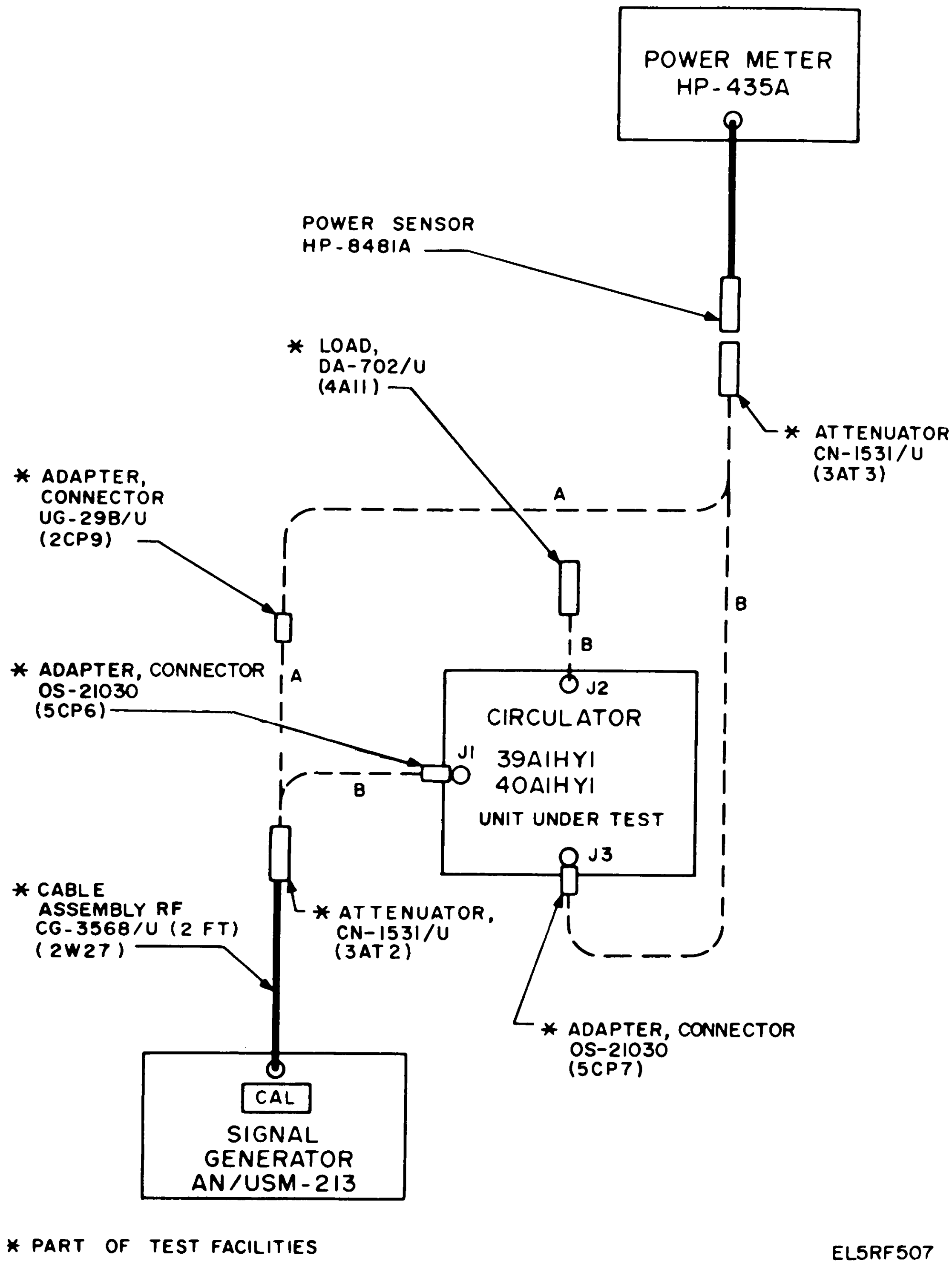


Figure 4-230. Circulator 40A1HY1/39A1HY1, Isolation Test Set.

Equipment	*Common name*
Multimeter, Digital AN/USM-451	Multimeter
Lead, Test CMC 267-800020-000	Test leads

b. Continuity Test Procedures.

(1) Remove the modules connected to the branched wiring harness which is to be tested. See TM 11-5820-540-30 and paragraph 2-91 in chapter 2 for removal and replacement procedures,

(2) Refer to FO-12 and the wiring list below. Check wire continuity in the defective circuit.

NOTE

Reference designations in the following list are to be prefixed with 40A1W1.

Termination point from	*to*	Termination point from	to
J5-1	A1P1-14	W20*	J1-2
-2	A1P1-22	W20*	A1-E2
-3	A1P1-30	A1P1-A2	J2-A1
-4	A1P1-38	A1P1-11	A1P1-12
-5	A1P1-15	J2-1	-12
-6	A1P1-23	-2	W27*
-7	A1P1-31	-3	A1P1-37
-8	A1P1-39	W27*	A1P1-21
-9	A1P1-16	J2-4	Al-El
-l0	A1P1-24	-7	J4-13
-11	A1P1-32	-8	W30*
-12	A1P1-40	W30*	J4-9
-13	J2-10	J2-9	A1P1-35
-14	A1P1-46	J2-11	A1P1-45
-15	A1P1-41	-12	A1P1-33
-24	-E2	-13	A1P1-41
-25	A1P1-25	J2-14	A1P1-46
J1-1	A1P1-26	J4-2	A1P1-7
-3	A1P1-27	-3	A1P1-6
J4-4	J3-1	J4-14	A1P1-8
-5	Al-El	J3-2	A1P1-7
-6	A1P1-9	-3	A1P1-19
-7	A1P1-10	-4	A1P1-18
-8	A1P1-3	-5	A1-E2
-l0	A1P1-5	-7	A1P1-4
-11	J3-6	-Al	A1P1-A1
-12	A1P1-4	A1P1-28	A1P1-29
		A1P1-29	A1P1-44
		A1P1-44	A1-E3

*Shield

(3) Repair defective plugs, jacks and cables, or replace the connector filter (para. 2-91).

(4) Replace the modules removed in (1) above.

4-88. Amplifier-Frequency Multiplier 40A2

a. Test Equipment and Material Required.

Equipment	*Common name*
Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Test Facility, Receiver TS-2867(V)2/GRM-95(V)2	Receiver test facility
Test Facility, Radio Frequency Modules TS-3837(V)2/ GRM-95(V)2	Test facility, rf modules
Accessory Kit, Test Facilities Set MK-1173(V)2/ GRM-95(V)2	Accessory kit
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, band 2,3,4
Counter, Frequency TD-1225(V)l/U	Frequency counter
Generator, Signal HP 8640B	Signal generator
Meter, Power HP-435A(2 reqd)	Power meter No. 1 and No. 2
Sensor, Power HP-8481A (2 reqd)	Power sensor No. 1 and No. 2
Multimeter, Digital AN/USM-451	Digital multimeter (2 ea)

b. Test and Alinement Procedures.

(1) Equipment calibration.

(a) Connect the test equipment as shown in figure 4-231.

(b) Set the signal generator to a frequency of 106.25 MHz.

(c) Adjust the rf level control on the signal generator to obtain +10 dBm of output power as indicated on the power meter No. 2.

(d) Record the level measured on power meter No. 1.

(e) Subtract the indication obtained on power meter No. 1 from the indication measured on power meter No. 2. This is the port A and D coupling factor. Record this calculation in the table below opposite the signal generator frequency.

(f) Repeat steps *(b)* through *(e)* above for all other signal generator frequencies listed below. Coupling between port A and D equals +10 dBm minus the dBm power meter No. 1 indication.

Signal Generator Frequency (MHz)	*Insertion loss of the 6 dB attenuator and the coupling from Port A to Port D of Coupler No. 1 (dB)*
106.250	
112.500	
115.625	
120.833	
129.166	
137.500	

NOTE

Do not disconnect cables CG-409H/U, 6 dB attenuator and power meter No. 1 from directional coupler No. 1. This test setup will be used later.

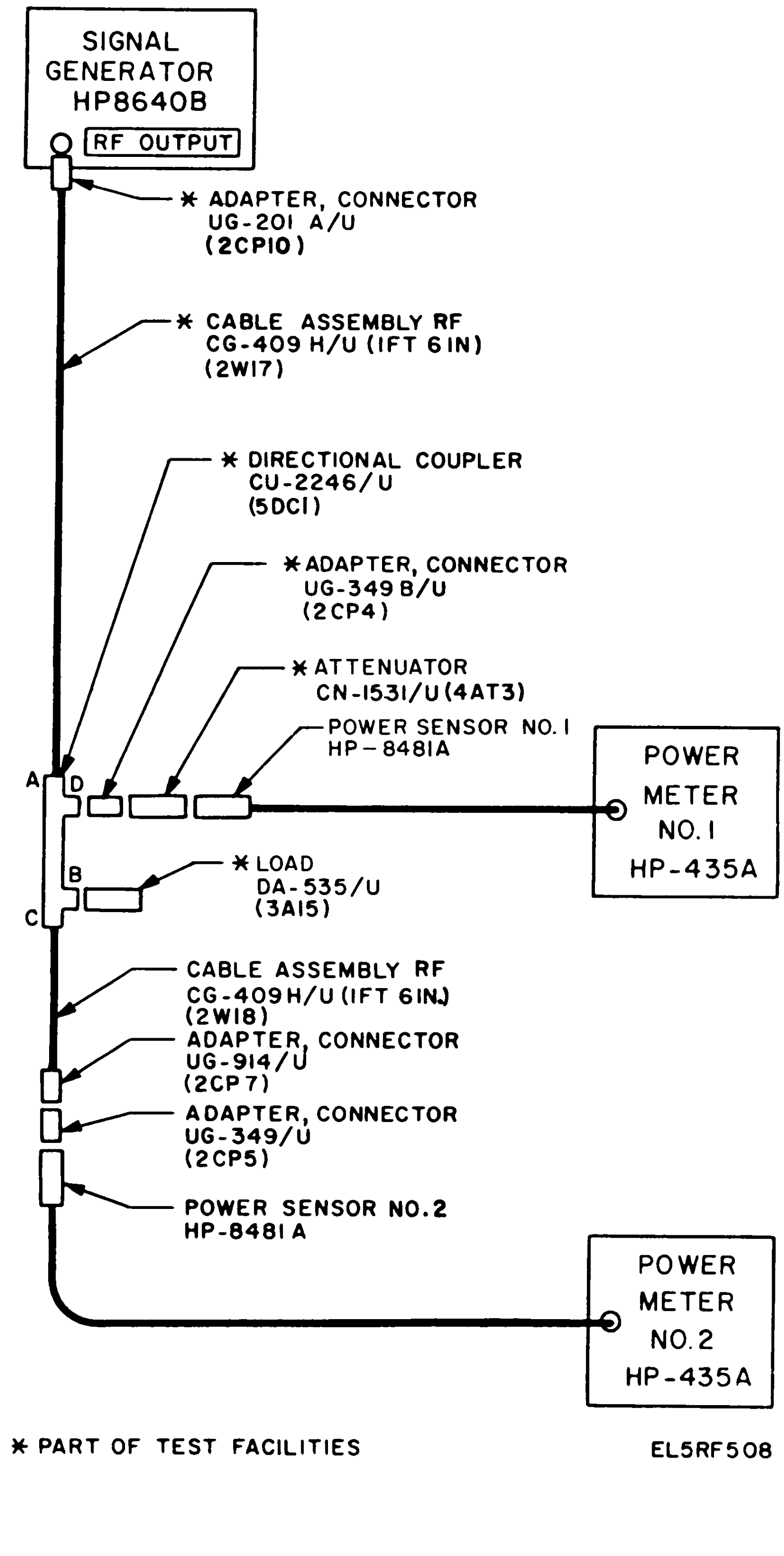


Figure 4-231. Amplifier-Frequency Multiplier 40A2, Calibration on Test Setup.

(g) Remove power meter No. 2 from port C of directional coupler No. 1. Connect the test equipment as shown in A, figure 4-232.

(h) Adjust the signal generator output frequency to 1850 MHz ±30 kHz as indicated on the frequency counter. Adjust the output level to +10 dBm as indicated on the power meter. Note the power meter indication.

(i) Connect the test equipment as shown in B, figure 4-232.

(j) Tune the bandpass filter for the maximum indication on power meter. Note the power meter indication.

(k) The difference between the power meter indication noted in step *(h)* and *(j)* above is the insertion loss of the cable assembly, isolator, directional coupler No. 2, bandpass filter, connectors and the two 10 dB attenuators. Using the following example calculate the insertion loss and record the result in the table below opposite the frequency to which the signal generator is tuned.

Example: the total insertion loss in dB equals +10 dBm (signal generator output), less the power meter indication in dBm obtained in step *(j)* above.

(l) Repeat *(g)* through *(k)* above for other signal generator frequencies listed below.

Signal Generator Frequency (MHz)	*Total insertion loss due to cable assembly, isolator, directional coupler No. 2, bandpass filter and the two 10 dB attenuators (dB)*
1850	
1800	
1700	
1650	
1550	
1450	
1350	

(m) Retune the bandpass filter to 1850 MHz and leave it undisturbed. This setting is important when setting up the tracking law.

NOTE

The cable assembly, isolator, directional coupler No. 2, the two 10 dB attenuators, the bandpass filter and power meter No. 2 must remain connected as above for use in succeeding tests.

(2) Tracking and output power test.

(a) Connect the equipment as shown in figure 4-233. Use the equipment calibrated in (1) above, and refer to the notes following *(1)(f)* and *(m)* above.

(b) Set the counter dial of the test fixture to read 0195 (19.5 turns) by turning the test fixture control knob.

NOTE

Do not disturb the reading of the mechanical counter during the following operations.

(c) Secure the unit under test to the test fixture. Be sure to engage the tuning shaft with the mechanical counter drive mechanism.

(d) Loosen the drive shaft locking clamp on the unit under test

(e) Set switch S14 (rf modules test facility) to NORMAL AND S13 to ALC 1. Set the transmitter test facility switches as follows:

Switch	*Position*
S1	ON
S12	MULT

(f) Tune the signal generator to an output frequency of 57.8125 MHz.

(g) Set power meter No. 2 to the +10 dBm scale. Set bandpass filter F-1490/U to 1850 MHz.

(h) Adjust the ALC 1 ADJ control (rf modules test facility) for an output level of +34.0 dBm at port C of directional coupler No. 1. Calculate this level by adding to the dBm indication of power meter No. 1, the insertion loss of the 6 dB attenuator at port D and the coupling between port A and D as established in *(1)(f)* above.

(i) Power meter No. 2 must indicate the presence of output power. Maximize the output power with a slight adjustment of the test future tuning knob control and bandpass filter F-1490/U. If there is no indication of power, proceed to *(j)* below, otherwise, proceed to *(k)* below.

(j) Rotate the test fixture tuning control very slowly in either direction until maximum indication is obtained on power meter No. 2. Such an indication signifies that the frequency multiplier is tuned to 1850 MHz (the 16th harmonic of the multiplier).

NOTE

Perform *(j)* above with care to avoid tuning beyond the desired output frequency to a point where no further tuning is possible. Should this happen, rotate the tuning control in the opposite direction until a power meter indication is obtained.

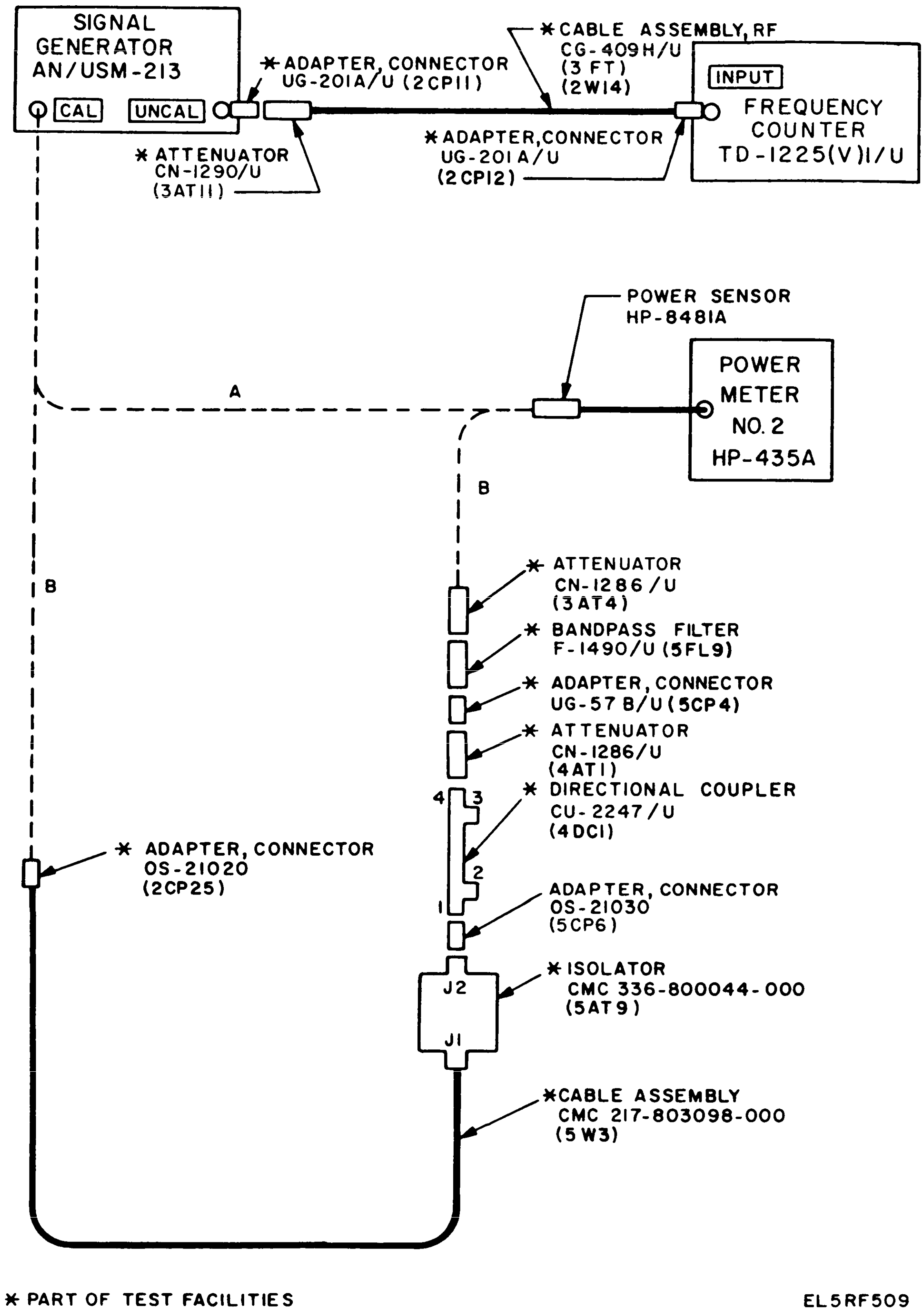


Figure 4-232. Amplifier-Frequency Multiplier 40A2, Calibration of Equipment Test Setup.

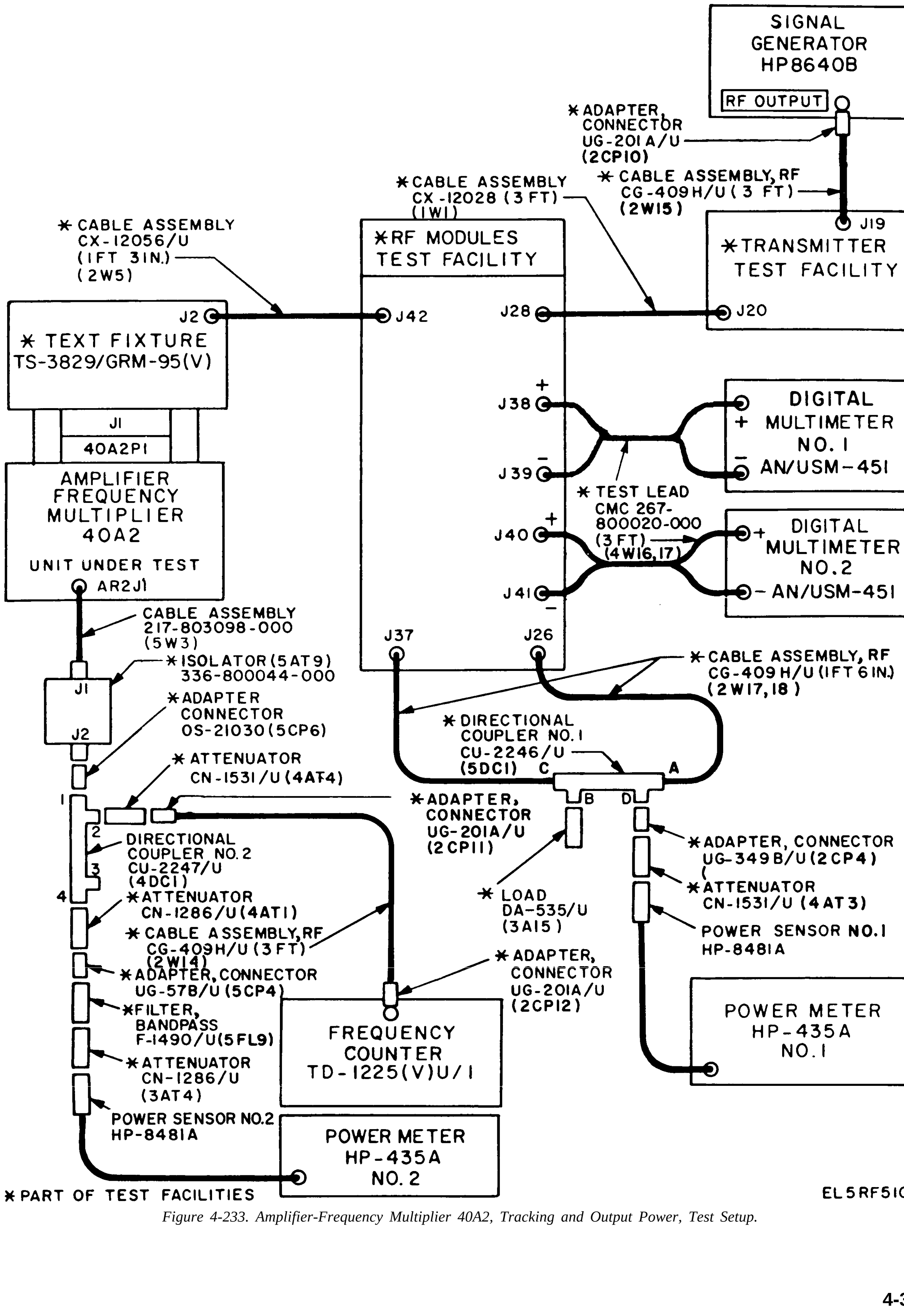


Figure 4-233. Amplifier-Frequency Multiplier 40A2, Tracking and Output Power, Test Setup.

(k) Measure the output frequency of the multiplier at port No. 2 of directional coupler No. 2. The frequency should be 1850 MHz.

(l) The test fixture counter should read 0195 (±0001.0). If the counter meets this requirement, proceed to *(n)* below; if it does not, proceed to *(m)* below.

(m) Switch transmitter test facility S1 to OFF. Lock the drive shaft of the amplifier-frequency multiplier and remove it from the test fixture. Set the counter to read 0195. Carefully reconnect the unit under test to the test fixture without changing the setting of the counter. Loosen the drive shaft locking clamp on the unit under test. Switch transmitter test facility S1 to ON.

(n) It should not be necessary to tune the bandpass filter for maximum output because this has previously been set for 1850 MHz. Note the reading on power meter No. 2.

(o) Determine the output power from the unit under test by adding to the power meter reading in *(n)* above the calibrated insertion loss of the cable assembly, isolator, directional coupler No. 2, bandpass filter, and the two 10 dB attenuators as determined in *(1)(l)* above. The output power from the unit under test shall be +27 dBm minimum. If the minimum dBm cannot be obtained, troubleshoot the unit under test as in paragraph c. below.

(p) Repeat *(f)* through *(i)*, as well as *(k)* and *(n)* through *(o)* above, for the other frequencies and counter settings listed below.

NOTE

When repeating *(i)* above, tune the bandpass filter to the desired output frequency of the unit under test. Set the test fixture tuning knob control so that the test fixture counter readings correspond to that in the table for the desired output frequency.

(3) *Input VSWR test and adjustment.*

(a) Connect the equipment as in figure 4-233, and tune the unit under test for an output frequency of 1850 MHz as in *(2)(p)* above.

(b) Note the indication on power meter No. 1 connected to port D of directional coupler No. 1. Disconnect power meter No. 1 and the 6 dB attenuator.

(c) Connect power meter No. 1 and the 6 dB attenuator to port B of directional coupler No. 1 (fig. 4-233) and connect the dummy load DA-535 to port D.

(d) Note the power meter indication. The power level obtained should be at least 8.1 dB below the level measured in *(b)* above, corresponding to a return loss of 8.1 dB or a VSWR of 2.3:1. If this specification is not met, adjust the input VSWR as outlined in *(e)* through *(l)* below. Repeat *(a)* through *(d)* for remainder of output frequencies listed in table in (2) *(P)* above.

(e) Reconnect the power meter to directional coupler No. 1 port D (figure 4-233).

(f) Tune the signal generator frequency to 68.750 MHz. Adjust the output power to +34 dBm as described in *(2)(h)* above.

(g) Tune the multiplier to 1650 MHz (24th harmonic of 68.750 MHz) by rotating the test fixture tuning control clockwise until the counter reads 0120.8. The frequency meter connected to port No. 2 of directional coupler No. 2 (fig. 4-233) should indicate 1650 MHz.

(h) Measure the return loss as in *(a)* through *(d)* above. If required, adjust variable capacitor 40A2A1C5 (fig. 4-234) for a return loss of 8.1 dB or better.

(i) Tune the signal generator frequency to 53.125 MHz. Adjust the output power to +34 dBm per *(2)(h)* above.

(j) Tune the multiplier to 1700 MHz by rotating the test fixture tuning counter control clockwise until the counter read 0139.5.

Signal generator frequency (MHz)	*UUT Input frequency (MHz)*	*Multiplication factor*	*Amplifier-frequency multiplier Output frequency (port No. 2, coupler No. 2) (MHz)*	*Test fixture counter reading*
56.250	112.500	X12	1350	0000.0
60.416	120.833	X12	1450	0041.5
64.583	129.166	X12	1550	0082.0
68.750	137.500	X12	1650	0120.8
53.125	106.250	X16	1700	0139.5
56.250	112.500	X16	1800	0176.0
57.812	115.625	X16	1850	0195.0

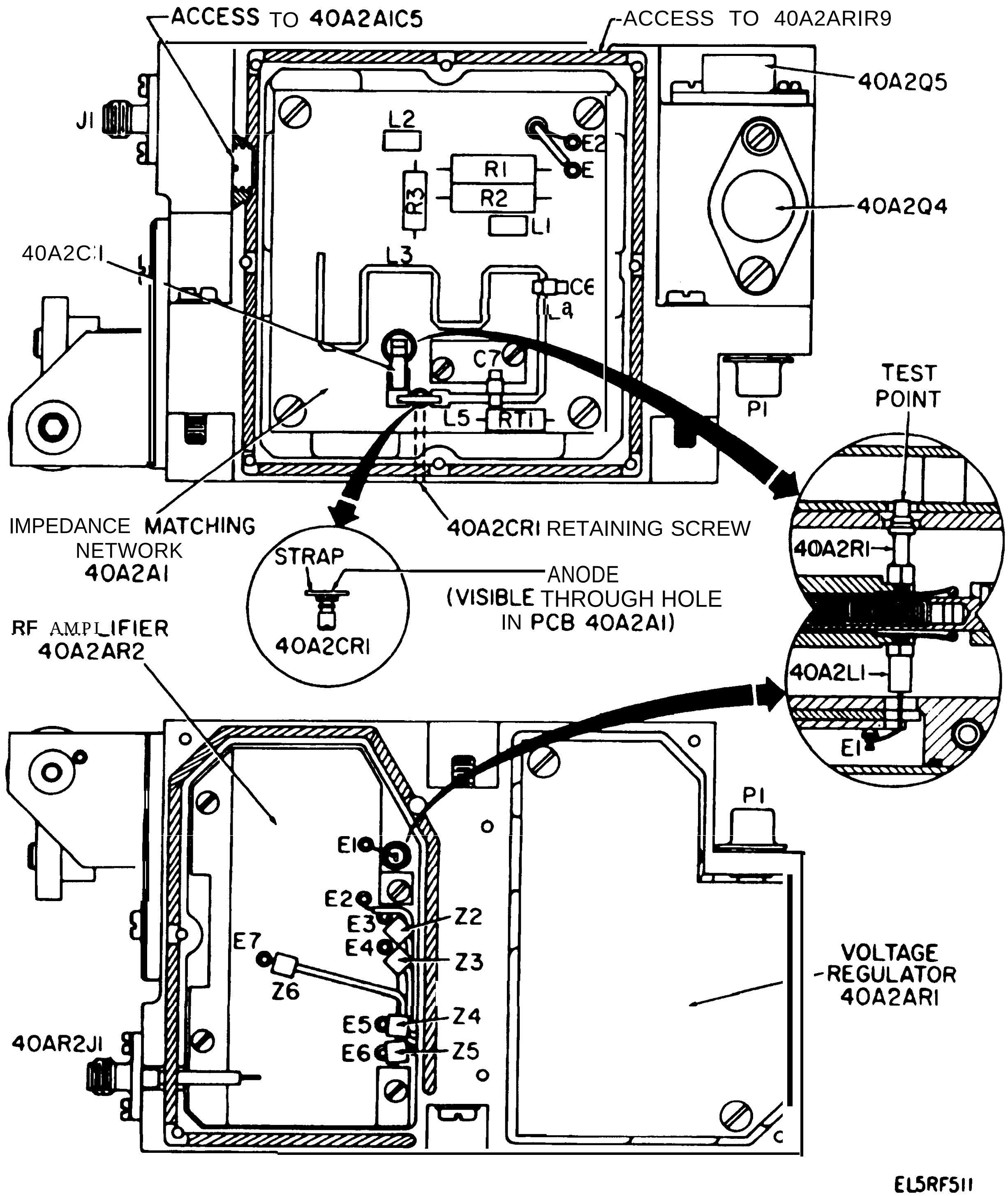


Figure 4-234. Amplifier-Frequency Multiplier 40A2 Side Views.

(k) Repeat the return loss measurement in *(h)* above. Readjust C5 if required. Repeat *(f)* through *(k)* above until 8.1 dB minimum return loss is achieved at both 1650 MHz and 1700 MHz.

NOTE

If it is not possible to achieve the 8.1 dB minimum return loss, then C7 on assembly 40A2A1 may be slightly relocated from its normal mounting position as shown in figure 4-235. This relocation may be tried (together with adjustment of C5) until a position is found where the 8.1 dB minimum return loss is achieved. In no case should C7 be moved more than ±0.12 inch from its normal mounting position.

(l) Retune amplifier-frequency multiplier 40A2 to 1850 MHz. If necessary refer to *(2)(p)* above. Repeat steps *(a)* through *(d)* to recheck VSWR across the frequency band.

NOTE

If unable in step *(l)* above to achieve the 8.1 dB minimum return loss at all test frequencies, then attempt to improve the input return loss across the frequency band by a slight repositioning of C7 and readjustment of C5 on assembly 40A2A1. C7 must not be moved more than as shown in figure 4-235. If any of these readjustments are done, then all tests in (3) must be completely repeated after final VSWR readjustment.

(4) *Adjacent harmonics rejection test.*

(a) Connect the test equipment as in figure 4-233.

(b) Tune the amplifier-frequency multiplier for an output frequency of 1850 MHz as in *(2)(p)* above. Tune bandpass filter F-1490/U to indicate maximum output power on power meter No. 2, and note the level of output power measured.

(c) Tune the bandpass filter very slowly to the next higher harmonic comb frequency. The next higher and lower harmonic comb frequencies are the output frequency of the multiplier, plus and minus the multiplier input frequency respectively. If the output frequency is 1850 MHz, the next higher and lower combs are at frequencies of 1965.625 MHz and 1734.375 MHz respectively.

(d) Note the output power indicated on power meter No. 2. The level of the output power should be at least 12 dB below the level noted in *(a)* above.

(e) Repeat *(b)* and *(d)* above for the next lower harmonic comb frequency.

(5) *ALC control signal and metering test.*

(a) Connect the test equipment as in A, figure 4-233. Tune the bandpass filter for maximum output power at 1850 MHz.

(b) Set switch S14 (rf modules test facility) to ALC.

(c) Set the multimeter to the dc range, 2.5 mA.

(d) Adjust the ALC ADJ control (rf modules test facility) to reduce the output power from the unit under test to +16 dBm. Refer to *(2)(o)* above to calculate reading on power meter No. 2 which corresponds to the +l6 dBm output.

(e) Note the current and voltage indicated on digital multimeter No. 1 and No. 2 respectively. The current should be 1.0 mA maximum, and the voltage should not exceed 4.5 Vdc.

(f) Set switch S20 on the transmitter test facility to S12. Set S12 to MULT. Test facility meter Ml should indicate a minimum of 25 percent full scale deflection.

(g) Set power meter No. 2 to the +10 dBm scale. Turn the ALC ADJ control (rf modules test facility) fully clockwise. Transmitter test facility meter M1 should not indicate more than 80 percent of full scale deflection.

(h) Set switch S14 (rf modules test facility) to NORMAL.

(i) Repeat the test outlined in (4) and (5) for all test frequencies in *(2)(p)* above.

(6) *Switching signal test.*

(a) Set switch S14 (rf modules test facility) to X12. The 3.5 dB lamp should light, and the 6.0 dB lamp should be off.

(b) Set switch S14 (rf modules test facility) to X16. The 6 dB lamp should light, and the 3.5 dB lamp should go off.

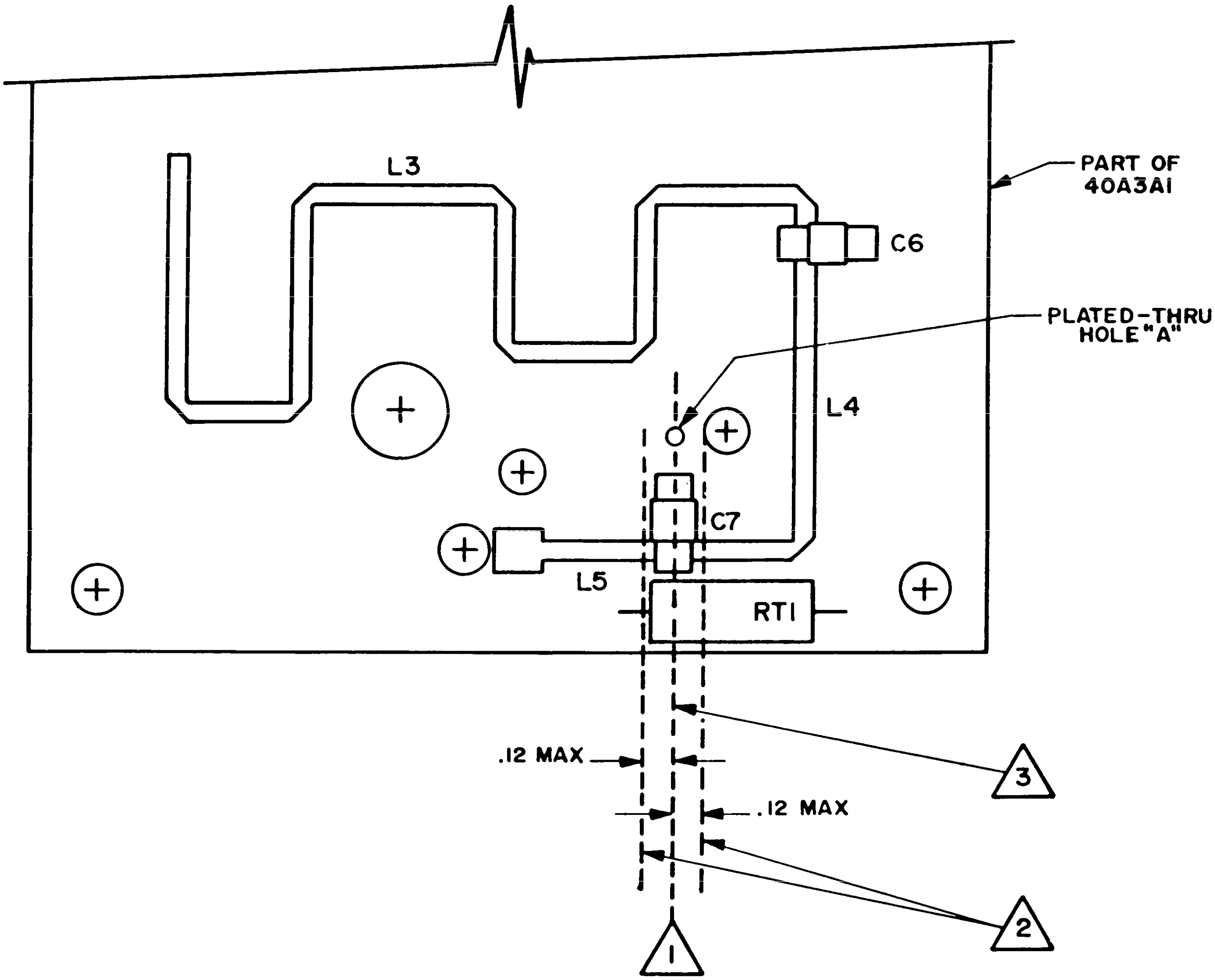
(c) If all requirements were met, tune the multiplier to 1850 MHz as in *(2)(i)* above. Secure the drive shaft locking clamp.

(d) If above requirements were not met, return the unit under test to higher category maintenance.

(e) Remove unit under test from test fixture.

4-89. Voltage Regulator 40A3

a. Test Equipment and Material Required.



NOTES:

1 – HOLE "A" CENTER LINE MAXIMAL ALLOWABLE LATERAL MOVEMENT OF C7 FROM HOLE "A" IS MAX .12 BOTH SIDE.

2 – MAXIMUM ALLOWABLE LATERAL MOVEMENT OF C7.

3 – NORMAL MOUNTING POSITION (CENTER OF C7 IN LINE WITH PLATED -THRU HOLE "A").

EL5RF830

Figure 4-235. Impedance Matching Network 40A2A1, Location of Capacitor C7.

Equipment	*Common name*
Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2	Transmitter test set
Test Facility, Radio Frequency Module TS-3837(V)2/ GRM-95(V)2	Test facility, rf module
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit
Multimeter, Digital AN/USM-451	Multimeter No. 1 and No. 3
Power Supply HP-6002A	Power supply, variable
Multimeter, Digital AN/USM-486	Multimeter No. 2

b. Test Procedures.

(1) *Test setup calibration.*

(a) Connect the test equipment as shown in figure 4-236, but do not connect multimeter No. 2 at this time. Set multimeters No. 1 and No. 2 to the 20 Vdc range, and set multimeter No. 3 to the 10 amperes dc range. Switch on the power supply, adjust the voltage to 13 V approximately, and set the current limit to maximum.

(b) Set the rf module test facility switches as follows:

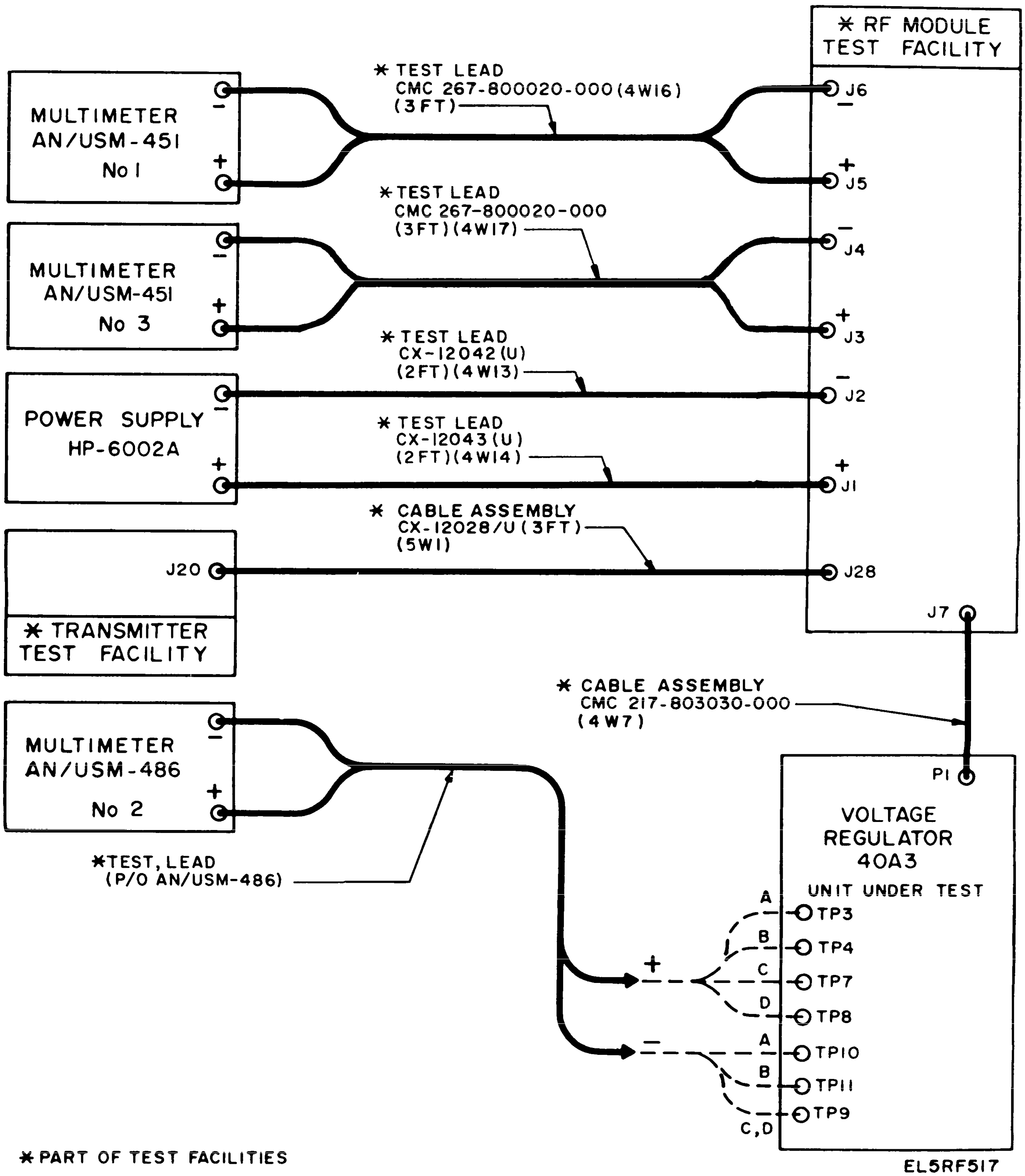


Figure 4-236. Voltage Regulator 40A3, Test Setup.

Switch	*Switch position*
S2	6.4 V
S4	OFF
S3	INPUT V
S5	0 OHM

(c) Press and hold ADJ 6.4 V switch S6 (rf modules test facility), and adjust the INPUT V ADJ control for an indication of 6.4 volts on multimeter No. 1. Release S6.

(2) *Driver regulator test.*

(a) Remove the red plastic cover from the unit under test Connect the test equipment as shown in A, figure 4-236.

(b) Set the rf module test facility switches as follows.

Switch	*Position*
S2	7.2 V
S4	NOM
S3	DRIVER
S5	0 OHM

(c) Multimeter No. 2 should indicate between 1.7 and 4.7 Vdc. Multimeter No. 1 should indicate between 5.4 and 6.2 Vdc.

(d) If the indication on multimeter No. 2 is not in accordance with *(c)* above, adjust the collector resistance of 40A3A1Q3 with one of the following three strapping options (figure 4-237).

CAUTION

Never connect E27 to E28.

Option	*Description*
1	No connections between E26, E27, or E28; resistors R16 and R17 in the circuit.
2	Shorting link connected between E26 and E27; R17 in the circuit R16 out of the circuit.
3	Shorting link connected between E26 and E28; R16 in the circuit R17 out of the circuit.

(e) If the indication on multimeter No. 1 is not in accordance with *(c)* above, adjust the base resistance of 40A3A1Q4 with one of the following strapping options (figure 4-237).

Option	*Description*
1	No connections between E29,E30,or E31; resistors R21 and R23 in the circuit.
2	Shorting link connected between E29 and E31; R23 in the circuit R21 out of the circuit.
3	Shorting link connected between E30 and E3; R21 in circuit R23 out of the circuit.
4	Shorting link connected between E29 and E30; R21 and R23 short circuited.

(f) Set S2 to 6.4 V and S4 to NOM MIN. Connect multimeter No. 2 between TP3(+) and TP1(–). Voltage shall exceed 5.2 V.

(g) If voltage in *(f)* above is below 5.2 V, add a shorting link between E26 and E27. If this link has already been added, remove it and add link between E26 and E28.

CAUTION

Never connect E27 to E28.

(h) Repeat paragraphs *(a)* through *(f)* above if adjustments were made.

(3) *Output regulator test.*

(a) Connect the test equipment as shown in B, figure 4-236.

(b) Set switch S3 (rf module test facility) to OUTPUT, S4 to NOM, and S2 to 7.2 V.

(c) Multimeter No. 2 should indicate between 1.7 and 4.7 Vdc. Multimeter No. 1 should indicate between 5.4 and 6.2 Vdc.

(d) If the indication on multimeter No. 2 is not in accordance with *(c)* above, adjust the collector resistance of 40A3A1Q1 with one of the following three strapping options (fig. 4-237).

CAUTION

Never connect E15 to E16.

Option	*Description*
1	No connections between E14, E15, or E16; resistors R8 and R9 in the circuit.
2	Shorting link connected between E14 and E15; R9 in the circuit R8 out of the circuit.
3	Shorting link connected between E14 and E16; Ml in the circuit R9 out of the circuit

(e) If the indication on multimeter No. 1 is not in accordance with *(c)* above, adjust the base resistance of 40A3A1Q2 with one of the following four strapping options (fig. 4-237).

Option	*Description*
1	No connections between E17, E18, or E19; resistors R13 and R15 in the circuit-
2	Shorting link connected between E 17 and E19; R15 in the circuit, R13 out of the circuit.
3	A shorting link between E18 and E19; R13 is in the circuit R15 out of the circuit
4	Shorting link connected between E17 and E18; R13 and R15 short circuited.

(f) Set S2 to 6.4 V and S4 to NOM MIN. Connect multimeter No. 2 between TP2(–) and TP4(+). The voltage shall exceed 5.2 V.

(g) If voltage in *(f)* above is below 5.2 V, add a shorting link between E14 and F15. If E14 and E15 have already been linked, then remove the link and add a link between E14 and E16.

CAUTION

Never connect E15 to E16.

(h) Repeat paragraphs *(a)* through (f) above.

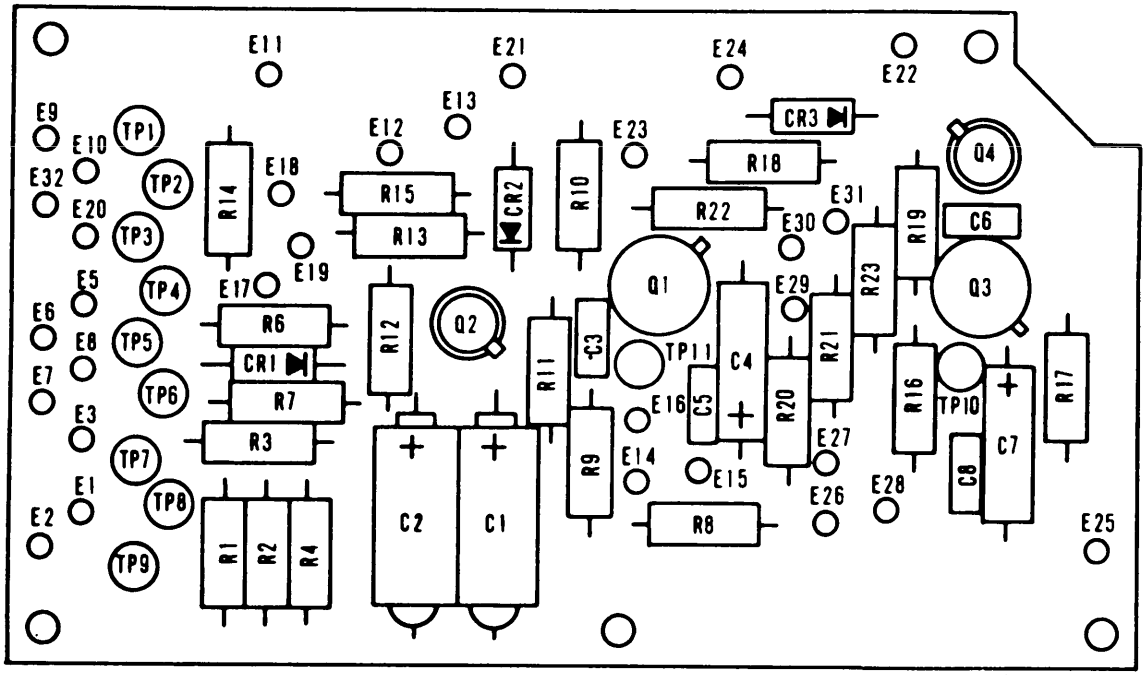


Figure 4-237. Voltage Regulator Subassembly 40A3A1, Parts Location. EL5RF518

(4) *Output line and load regulation test*

(a) Set the rf module test facility switches as follows:

Switch	*Position*
S2	6.4 V
S4	NOM MAX
S3	OUTPUT

(b) Connect the test equipment as shown in B, Figure 4-236.

(c) Multimeter No. 1 should indicate between 5.2 and 6.2 Vdc.

(d) Set switch S2 of the rf module test facility to 8.0 V. Multimeter No. 1 should indicate between 5.2 and 6.2 Vdc.

(e) Set switch S4 of the rf module test facility to NOM MIN. Multimeter No. 1 should indicate between 5.2 and 6.2 Vdc.

(f) Set rf module test facility switch S2 to 6.4 V. Multimeter No. 1 should indicate between 5.2 and 6.2 Vdc.

(5) *Driver line and load regulation test.*

(a) Connect the test equipment as shown in figure 4-236, but do not connect multimeter No. 2.

(b) Set the rf module test facility switches as follows:

Switch	*Position*
S2	8.0 V
S4	NOM MIN
S3	DRIVER
S 5	0 OHM

(c) Multimeter No. 1 should indicate between 5.2 and 6.2 Vdc.

(d) Set switch S2 (rf module test facility) to 6.4 V. Multimeter No. 1 should indicate between 5.2 and 6.2 Vdc.

(e) Set switch S4 (rf module test facility) to NOM MAX. Multimeter No. 1 should indicate between 5.2 and 6.2 Vdc.

(f) Set switch S2 (rf module test facility) to 8.0 V. Multimeter No. 1 should indicate between 5.2 and 6.2 Vdc.

(6) *Short-circuit protection test.*

(a) Connect the test equipment as shown in figure 4-236, leaving multimeter No. 2 disconnected.

(b) Set the rf module test facility switches as follows:

Switch	*Position*
S5	1 OHM
S2	6.4 V
S4	SHORT
S3	DRIVER

(c) Multimeter No. 3 should indicate between 1.0 and 3.5 amperes.

(d) Set switch S2 (rf module test facility) to 8.0 V. Multimeter No. 3 should indicate between 1.0 and 3.5 amperes.

(e) Set switch S3 (rf module test facility) to OUTPUT. Multimeter No. 3 should indicate between 1.0 and 3.5 amperes.

(f) Set switch S2 (rf module test facility) to 6.4 V. Multimeter No. 3 should indicate between 1.0 and 3.5 amperes.

(7) *Maximum current test.*

(a) Connect the test equipment as shown in figure 4-236, leaving multimeter No. 2 disconnected.

(b) Turn MAX CUR potentiometer (rf module test facility) fully counterclockwise.

(c) Set the rf module test facility switches as follows:

Switch	Position
S2	8.0 V
S4	MAX
S3	DRIVER
S5	O OHM

(d) Turn the MAX CUR potentiometer clockwise for the maximum current indication on multimeter No. 3. The indication should not exceed 4.0 amperes.

(e) Turn the MAX CUR potentiometer fully counterclockwise. Set switch S3 (rf module test facility) to OUTPUT.

(f) Turn the MAX CUR potentiometer clockwise for maximum current indication on multimeter No. 3. The indication should not exceed 4.0 amperes.

(g) Reset the MAX CUR potentiometer fully counterclockwise.

(8) *ALC voltage test.*

(a) Connect the test equipment as shown in figure 4-236, leaving multimeter No. 2 disconnected.

(b) Set switch S4 (rf module test facility) to OFF, and S3 to ALC. Set switch S1 (transmitter test facility) to ON, and S12 to OSC.

(c) Multimeter No. 1 should indicate between 13 and 15 Vdc.

(9) *Output and driver current limiter resistor test.*

(a) Connect the test equipment as shown in C, figure 4-236.

(b) Set switch S3 (rf module test facility) to R1/R2, and set multimeter No. 3 to the 200 mA dc scale. Leave S4 set to OFF.

(c) Adjust 100 mA SET potentiometer RI (rf module test facility) for an indication of 100 mA on multimeter No. 3.

(d) Multimeter No. 1 should indicate between 2.10 and 2.33 Vdc. Multimeter No. 2 should indicate 0.9 Vdc (±0.05 Vdc).

(e) Connect the test equipment as shown in D of figure 4-236.

(f) Set stitch S3 (rf module test facility) to R3/R4. Adjust the 100 mA SET potentiometer for an indication of 100 mA on multimeter No. 3.

(g) Multimeter No. 1 should indicate 1.31 Vdc (±0.07 Vdc). Multimeter No. 2 should indicate 0.56 Vdc (±0.03 Vdc).

(10) *Metering resistance test.*

(a) Set POWER switch S1 (transmitter test facility) and S1 (rf module test facility) to OFF.

(b) Disconnect the voltage regulator from the rf module test facility.

(c) Measure the resistance between TP4 and TP6 of the voltage regulator with the multimeter. The multimeter should indicate 270 kilohms (±5 percent).

(d) Replace the plastic cover on the unit under test.

c. Troubleshooting (fig. 2-82, TM 11-5820-540-30).

Symptom	*Probable cause*	*Checks and corrective measures*
1. No driver filament voltage in test procedure *b. (2)(c)* above.	*a.* Transistor 40A3Q2 open circuit (fig. 4-238).	*a.* Check transistor resistance (measurement procedure *d.* below). Replace if necessary.
	b. Transistor 40A3AlQ3 and Q4 short circuit (fig. 4-237).	*b.* Check transistor resistances (measurement procedures *d.* below). Replace if necessary.
	c. Diode 40A3A1CR3 short circuit (fig. 4-237).	*c.* Check for short circuit using multimeter on resistance scale. Replace if necessary.
2. Driver filament voltage high or low in test procedure *b.(2)(c)* above.	Driver regulator transistors 40A3A1Q3 and Q4 defective (fig. 4-237).	Check transistor resistances (measurement procedure *d.* below). Check associated circuitry using multimeter on resistance scale. Replace if necessary.
3. No output filament voltage in test procedure *b.(3)(c)* above.	*a.* Transistor 40A3Q1 open circuit (fig. 4-238).	*a.* Check transistor resistance (measurement procedure *d.* below). Replace if necessary.
	b. Transistor 40A3A1Q1 and Q2 short circuit (fig. 4-237).	*b.* Check transistor resistance (measurement procedure *d.* below). Replace if necessary.
	c. Diode 40A3A1CR2 short circuit (fig. 4-237).	*c.* Check diode using multimeter on resistance scale. Replace if necessary.
4. Output filament voltage high or low in test procedure *b.(3)(c)* above.	Output regulator transistors 40A3A1Q1 and Q2 faulty (fig. 4-237).	Check transistor resistances (measurement procedure cf. below). Check associated circuitry using multimeter on resistance scale. Replace if necessary.
5. Output line regulation poor in test procedures *b. (4)(d)* and (e) above.	Transistor 40A3A1Q1 faulty (fig. 4-237).	Check transistor resistance (measurement procedure *d.* below). Check associated circuitry using multimeter on resistance scale.

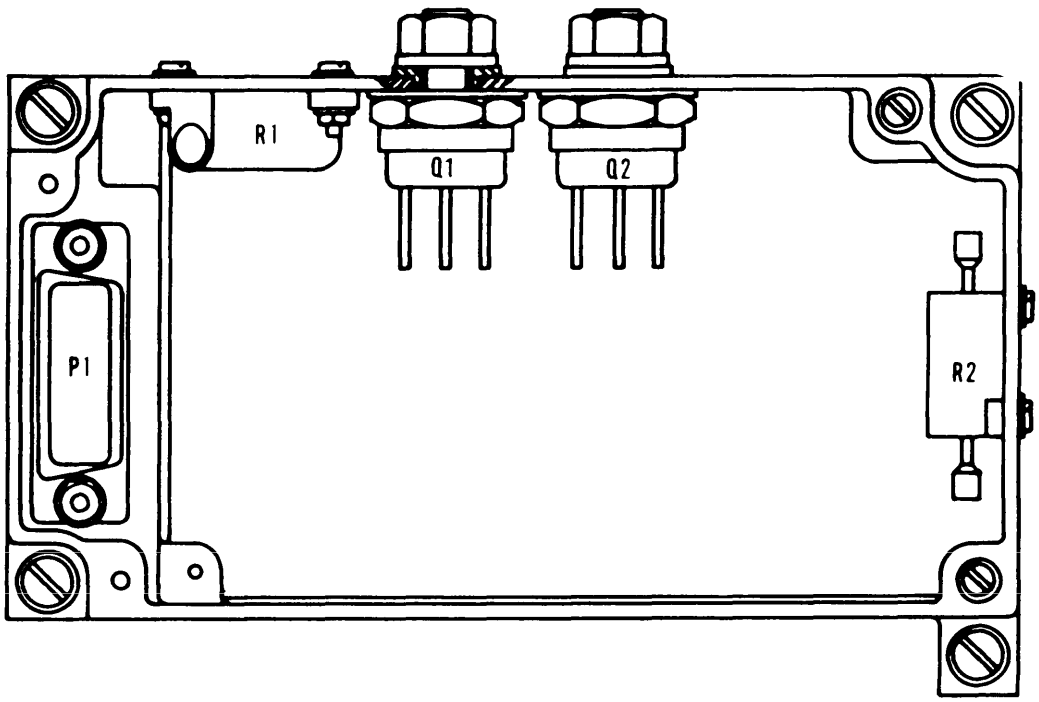


Figure 4-238. Voltage Regulator Assembly 40A3, Parts Location

c. Troubleshooting. Continued

Symptom	*Probable cause*	*Checks and corrective measures*
6. Output load regulation poor in test procedures *b. (4)(c)* and *(f)* above.	*a.* Transistor 40A3A1Q2 faulty (fig. 4-237).	*a.* Check transistor resistance (measurement procedure *d.* below).
	b. Diode 40A3A1CR2 faulty (fig. 4-237).	*b.* Check voltage drop across zener diode using multimeter on voltage scale. Voltage indication should be 4.7 Vdc (±5%). Replace diode if necessary.
7. Drive line regulation poor in test procedures *b. (5)(c)* and *(d)* above.	Transistor 40A3A1Q3 faulty (fig. 4-237).	Check transistor resistance (measurement procedure *d.* below). Check associated circuitry using multimeter on resistance range
8. Driver load regulation poor in test procedures *b. (5)(e)* and *(f)* above.	*a.* Transistor 40A3A1Q4 defective (fig. 4-237).	a. Check transistor resistance (measurement procedure *d.* below). Check associated circuitry using multimeter on resistance scale.
	b. Diode 40A3A1CR3 defective (fig. 4-237).	*b.* Check voltage drop across diode using multimeter on voltage scale. Voltage should be 4.7 Vdc (±5%). Replace if necessary.
9. Driver short circuit current too high in test procedure *b. (6)(c)* above.	*a.* Transistor 40A3A1Q4 defective (fig. 4-237).	*a* Check transistor resistance (measurement procedure *d.* below). Check associated circuitry using multimeter on resistance scale.
	b. Diode 40A3A1CR3 defective (fig. 4-237).	*b.* Check voltage drop across diode using multimeter on voltage scale. Multimeter indication should be 4.7 Vdc (±5%). Replace diode if necessary.

c. ***Troubleshooting.*** **- Continued**

Symptom	*Probable cause*	*Checks and corrective measures*
10. Output short circuit current too high in test procedures *b. (6)(e)* and *(f)* above.	*a.* Transistor 40A3A1Q2 defective (fig. 4-237).	*a.* Check transistor resistance (measurement procedure d. below). Check associated circuitry using multimeter on resistance scale.
	b. Diode 40A3A1CR2 defective (fig. 4-237).	*b.* Check voltage drop across diode. Voltage should be 4.7 Vdc (±5%). Replace diode if necessary.
11. Output maximum current high in test procedure *b. (7)(f)* above.	*a.* Resistor 40A3R1 short circuit (fig. 4-238).	*a.* Check R1 using multimeter on resistance scale. Replace if necessary.
	b. Transistor 40A3Q1 short circuit (fig. 4-238).	*b.* Check Q1 resistance (measurement procedure *d.* below). Replace if necessary.
12. Driver maximum current high in test procedure *b.(7)(d)* above.	*a.* Resistor 40A3R2 short circuit (fig. 4-238).	*a.* Check R2 using multimeter on resistance scale. Replace if necessary.
	b. Transistor 40A3Q2 short circuit (fig. 4-238).	*b.* Check Q2 resistance (measurement procedure *d.* below). Replace if necessary.
13. Automatic level control voltage incorrect in test procedure *(b)(8)(c)* above.	*a.* Diode 40A3A1CR1 defective (fig. 4-237).	*a.* Check voltage drop across CR1 using multimeter on voltage scale. Multimeter indication should be 13 Vdc (±5%). Replace if necessary.
	b. Resistor 40A3A1R6 open circuit (fig. 4-237).	*b.* Check resistance using multimeter on resistance scale. Replace if necessary.

d. Transistor Resistance Measurements.

NOTE

Measure all resistances with the authorized multimeter and with the transistors removed from the circuit.

(1) *Base negative.*

Transistor		*Emitter (+)*		*Collector (+)*	
Ref	*Type*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*
40A3Q1	2N1724	265	2K	260	2K
40A3Q2	2N1724	265	2K	260	2K
40A3A1Q1	2N697	Infinity	20M	Infinity	20M
40A3A1Q2	2N2907	885	2K	885	2K
40A3A1Q3	2N697	Infinity	20M	Infinity	20M
40A3A1Q4	2N2907	870	2K	870	2K

(2) *Base positive.*

Transistor		*Emitter (+)*		*Collector (+)*	
Ref	*Type*	*Res (ohms)*	*Multimeter range*	*Res (ohms)*	*Multimeter range*
40A3Q1	2N1724	265	2K	260	2K
40A3Q2	2N1724	265	2K	260	2K
40A3A1Q1	2N697	805	2K	750	2K
40A3A1Q2	2N2907	1200	2K	Infinity	20M
40A3A1Q3	2N697	805	2K	755	2K
40A3A1Q4	2N2907	1200	2K	Infinity	20M

4-90. Control-Indicator 40A4

General Support maintenance of the control-indicator is covered in paragraph 4-76.

4-91. Rf Amplifier 40AR1

a. *Test Equipment and Material Required.*

Equipment	*Common name*
Test Facility, Radio Frequency Module TS-3837(V)2/ GRM-95(V)2	Test facility, rf module
Test Facility, Transmitter TS-2866(V)2/GRM-95(V)2	Transmitter test facility
Test Facility, Receiver TS-2867(V)2/GRM-95(V)2	Receiver test facility
Accessory Kit, Test Facilities Set MK-1173(V)2/GRM-95(V)2	Accessory kit
Accessory Kit, Test Facility Set MK-1985(V)2/GRM-95(V)2	Accessory kit, band 2,3,4
Test Fixture, Radio Frequency Amplifier TS-3828/GRM-95(V)2	Test fixture
Multimeter, Digital AN/USM-451	Multimeter No. 1, No. 2
Amplifier, Power Logimetrics A200L	Power amplifler
Generator, Sweep Frequency Wiltron 610D	Sweep generator
Frequency Unit, Plug-in Wiltron 6110-C	Frequency unit; plug-in unit
Meter, Power, HP-435A	Power meter
Sensor, Power, HP-8481A	Power sensor
Oscilloscope, AN/USM-281C	Oscilloscope No. 1, No. 2
Torque Wrench, Omni-Spectra Model T-4592 or equivalent	Torque wrench
Vernier Caliper, Starrett Cat 120 or equivalent	Vernier caliper
Megohmmeter, GR- 1864	Megohmmeter
Counter, Frequency TD-1225(V)l/U	Frequency counter

b. Test Procedures.

WARNING

A lethal voltage of 630 Vdc is present at the tube plate radiators.

CAUTION

Temperature sensor attached to tube V2. Use lever with extractor to prevent wires breaking.

CAUTION

Do not switch on the power amplifier, Logometrics A200L, without first terminating the amplifier output.

NOTE

Always connect an output load to a stage of rf amplifier 40ARl before applying the drive signal to that stage.

(1) *Preliminay setup.*

(a) Remove covers of Cl, C5, C6 and C10 (figure 4-239) on the unit under test and replace with electrical shield plates 656-800075-000/GRM-95(V) (5MP6, 7, 8, 9).

(b) Set the tuning control of the test fixture for a counter reading of 0000.0. Remove the shaft adapter from the drive shaft (fig. 4-239), taking care not to dislodge the crescent-shaped drive pin. Take off the plate covering the chain and sprocket drive by removing the eight retaining screws and reinstall the shaft adapter on the drive shaft.

(c) Refer to figure 4-239. Rotate the drive shaft (by turning the shaft adapter) to preset the mechanical position of the actuator. This preset position (dimension "X", fig. 4-239) must be set to 0.677 inch ±.002 inch, by using vernier calipers.

NOTE

Dimension "X" is the distance between the front of the actuator flange and the rear face of the conductor section mounting flange.

(d) After setting the actuator to this position, lock the drive shaft in this position, using the drive shaft lock clamp.

(e) Connect the rf amplifier under test to the test fixture, maintaining the preset mechanical position (fig. 4-239) of *(c)* above.

(f) Connect 40AR1P1 on the unit under test to test fixture connector J2.

(g) Link the rf amplifier shaft adapter to the test fixture drive wheel with a slight adjustment of the tuning knob. Set tuning knob position on the test fixture such that mechanical counter will indicate in the range 0010.0 to 0025.0. When drive shaft is engaged with the unit under test carefully note that exact counter reading. This counter reading is the reference position. After noting this, unlock the drive shaft clamp on the unit under test.

NOTE

When counter reading is at the reference position, the actuator position (dimension X, fig. 4-239) is 0.677 inch ±0.002 inch.

(h) Connect a multimeter between J3 and J4 on the test fixture. The resistance measured should be within the limits shown on the temperature/resistance chart (figure 4-240) for the temperature of the heat radiator of the unit under test output tube.

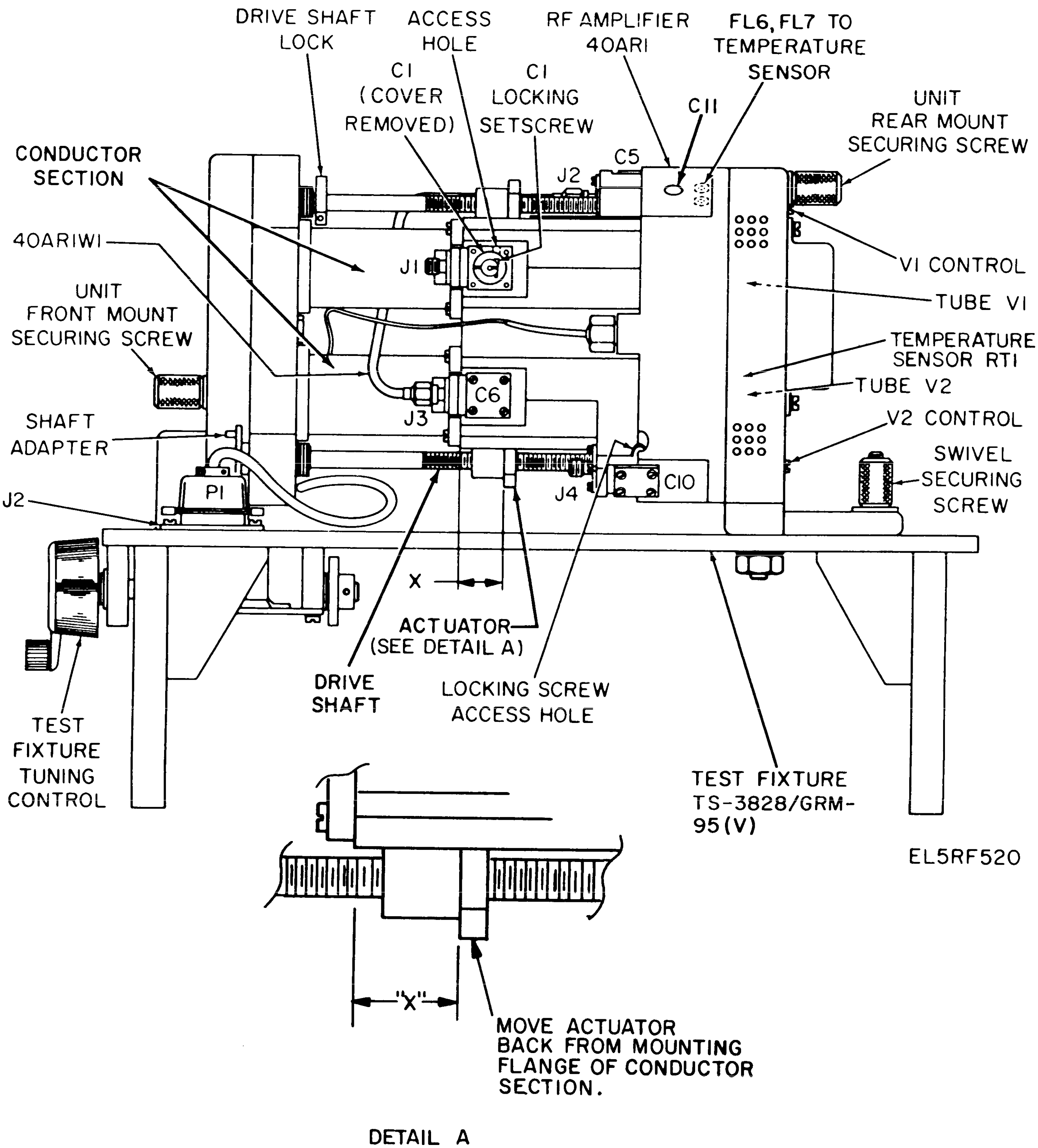


Figure 4-239. Rf Amplifier 40AR1 Mounted on Test Fixture TS-3828/GRM-95(V)

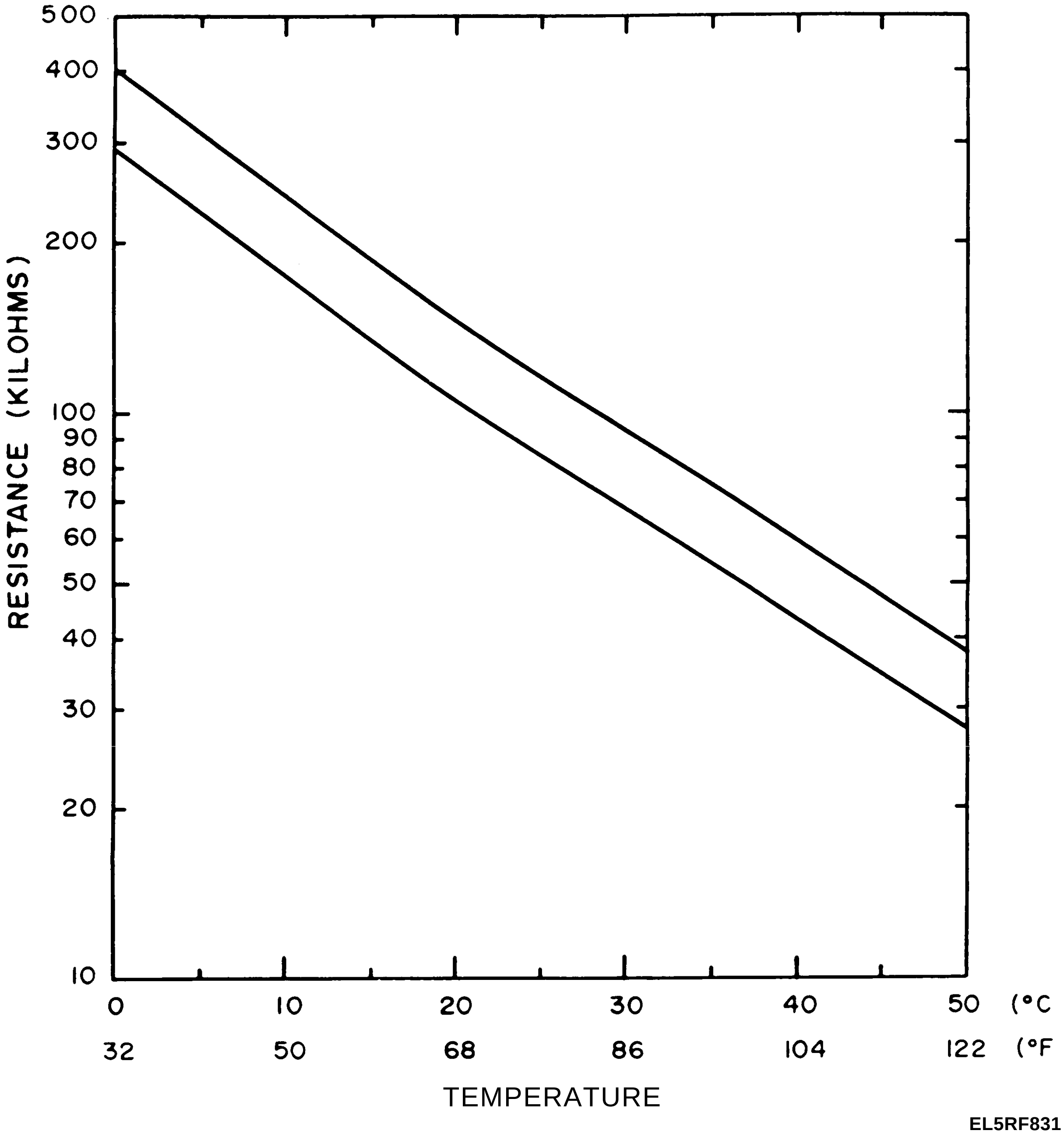


Figure 4-240. Rf Amplifier 40AR1, Temperture Sensor Resistances.

(i) Connect the multimeter between J3 and J5, and then between J4 and J5. The multimeter should read an open circuit. Remove the multimeter.

WARNING

High voltages are accessible at the test leads and connections when the megohmmeter is used. Switch to OFF and DISCHARGE, before connecting or disconnecting test leads.

(j) Short J3 and J4 together and connect megohmmeter between the junction of J3/J4 and J5.

(k) Turn megohmmeter power switch to ON, and set the voltage control to 600 VOLTS.

(l) Set the DISCHARGE-CHARGE-MEASURE switch to CHARGE, and then to MEASURE. The resistance indicated on the megohmmeter should be greater than 100 megohms. Return switch to DISCHARGE position. Set megohmmeter power switch to OFF. Remove the megohmmeter.

(2) *Insertion loss calibration, output power measurement test setup.*

(a) Connect the test equipment as shown in A, figure 4-241.

(b) Set the sweep generator controls as follows.

Control	*Position*
LEVELING (switch)	INT
RETRACE RF	OFF
FREQ SELECTOR	CW MKR

(c) Adjust frequency of sweep generator to 1850 MHz as read on the frequency counter.

(d) Adjust the sweep generator rf power level control for a convenient indication on the power meter. Note the indication.

(e) Connect the test equipment as shown in B, figure 4-241.

(f) Note the power level measured on the power meter.

(g) Subtract the power value noted in *(f)* above from the value set in *(d)* above. Record the result in the listing below. This gives a calibration of the insertion loss between J3 of the circulator and port No. 4 of the directional coupler No. 2, including the 2 ft. of flexible cable, LP filter and adapters.

Frequency (f_0)	*Insertion loss of circulator, lowpass filter No. 2, flexible cable and directional coupler No. 2 (dB)*
1850 *MHz*	
1800 *MHz*	
1700 MHz	
1600 MHz	
1500 MHz	
1400 MHz	
1350 MHz	

(h) Repeat steps *(a)* through *(g)* for the remaining frequencies listed above.

(3) *Output stage, input power and return loss calibration.*

(a) Connect test equipment as shown in A, figure 4-242. Set the OPERATE switch of power amplifier to ON. Set Multimeter No. 1 to 2 Vdc range, and multimeter No. 2 to 2000 mA dc range.

NOTE

Digital Multimeter No. 1 must be floating in relation to all other equipment.

(b) Use sweep generator on external leveling. Adjust sweep generator controls (and power amplifier GAIN control, if necessary) so as to give a levelled output power of +34 dBm ±0.5 dB (–6 dBm +0.5 dB reading on power meter) over frequency range 1350 MHz to 1850 MHz. This can be verifed by using manual sweep. (Use internal markers of sweep generator for frequency verification.)

(c) Establish connection “D”; figure 4-242, using the 6 dB attenuator only.

(d) Set sweep generator to sweep over the frequency range 1350 MHz to 1850 MHz, with RETRACE OFF. Observe the trace on RIGHT vertical channel of oscilloscope No. 1. Choose an oscilloscope vertical scale sensitivity to provide a deflection of at least 5 cm. Record the trace deflection. This deflection corresponds to 6 dB return loss. Record oscilloscope No. 1 LEFT channel deflection. This corresponds to +34 dBm input level for future reference.

(e) Install 6 dB and 3 dB attenuators (9 dB total) as shown in D, figure 4-242.

(f) Repeat step *(d)* above. Record the trace deflection. This corresponds to 9 dB return loss.

(g) Install 10 dB and 3 dB attenuators (13 dB total) as shown in D, figure 4-242.

(h) Repeat step *(d)* above. Record the trace deflection. This corresponds to 13 dB return loss.

(i) Set the OPERATE switch of power amplifier to OFF by depressing STAND BY switch.

(4) *Output stage alinement.*

(a) Ensure that the following two 600 V switches are in the OFF position:

S13 on transmitter test facility.

S9 on rf modules test facility.

(b) On transmitter test facility, set S1 to ON, S12 to OSC. On rf modules test facility set S8 to ON. DRIVER FIL and OUTPUT FIL lamps shall light.

(c) Connect the air hose (CMC 736-800027-000) from the AIR OUTLET of the transmitter test facility to the air inlet of the test fixture (fig. 4-243).

(d) Disconnect interstage coaxial cable 40AR1W1 (fig. 4-239) from J3 of the unit under test Connect test equipment as shown in B, figure 4-242.

(e) Set the transmitter test facility switches as follows.

Switch	*Position*
S13	600 V ON
S20	+600 V

(f) Set the rf modules test facility switches as follows.

Switch	*Switch position*	*Normal indication*
S9	600 V ON	Rf modules test facility 600 V lamp lights. Transmitter test facility meter Ml indicate in GREEN BAND.

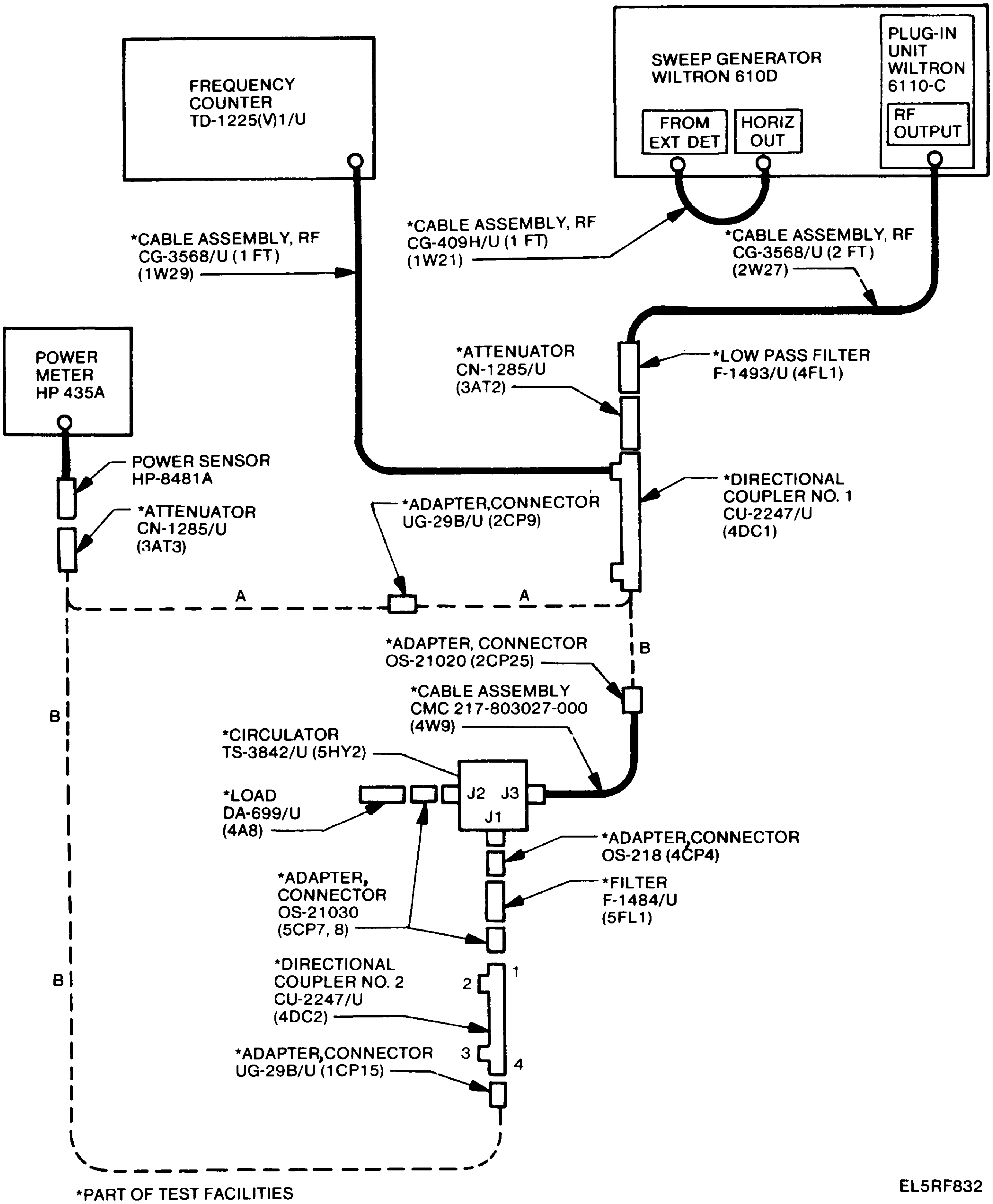
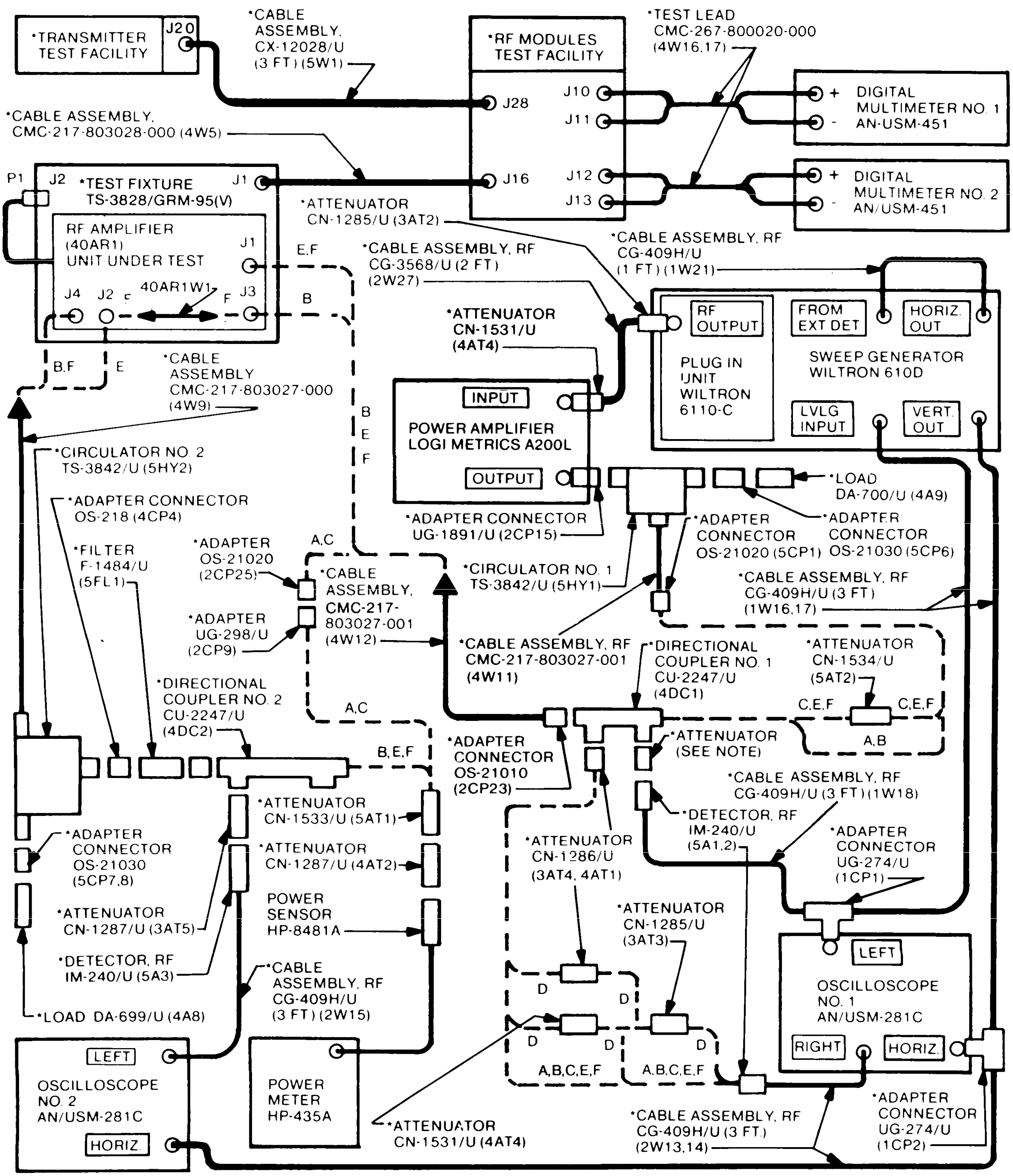


Figure 4-241. Rf Amplifier 40AR1, Test Setup.



*PART OF TEST FACILITIES

NOTE CONNECT ATTENUATOR CN-1532/U(4AT5) IN POSITION SHOWN AND ADJUST AROUND APPROXIMATELY 10DB TO OBTAIN REQUIRED EXTERNAL LEVELED OUTPUT

Figure 4-242. Rf Amplifier 40AR1, Alinement and Overall Test, Test Setup.

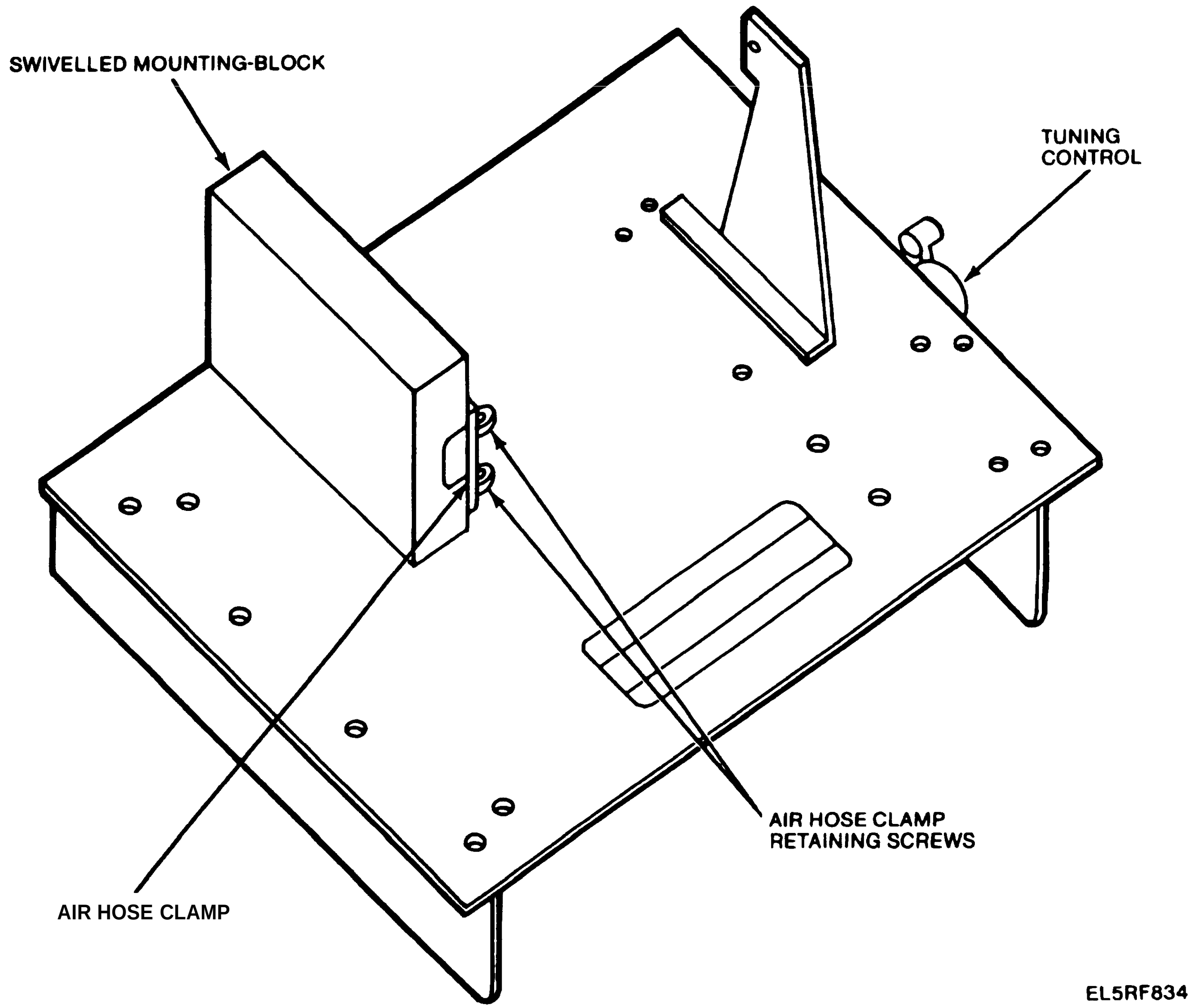


Figure 4-243. Radio Frequency Amplifier Test Fixture TS-382WGRM-95(V).

Switch	*Switch position*	*Normal indication*
Slo	DRIVER FIL CUR	Multimeter No. 1 indicates 130 mV max (corresponds to 1.3 amps)
Slo	OUTPUT FIL CUR	Multimeter No. 1 indicates 130 mV max (corresponds to 1.3 amps)
Slo	DRIVER CUR	Multimeter No. 2 indicates 70 mA max.
Slo	OUTPUT CUR	Multimeter No. 2 indicates 140 mA max.
Slo	OUTPUT CATHODE V	Multimeter No. 1 indicates a low voltage (14 V max).

(g) Set the OPERATE switch of the power amplifier to ON. Set the sweep generator for A SWEEP peration, ±25 MHz sweep width, at F_o = 1850 MHz. (Use internal markers for frequency identification.)

(h) Location the position of the output response on oscilloscope No. 2 using the VAR FREQ MARKER control.

NOTE

The counter reading on test fixture must be at reference position (para b. (l)(c)) above, preliminary setup). Allow the unit under test five minutes to warm-up.

(i) Adjust the output tube V2 control (figure 4-239) to move response to 1850 MHz. (Use internal markers for frequency identification.)

WARNING

To prevent shock, ensure that rf input drive to output stage is removed before tightening set screw on C10 ((j) below).

NOTE

Before Cl, C5, C6 or C10 can be adjusted, the respective locking setscrews must be loosened. See Cl (fig. 4-239) for the typical location of the setscrew and the access hole. Use minimum sweep width centered at 1850 MHz for final adjustment. The final adjustment should be with tube V2 control.

(j) Adjust capacitance probe C10 in conjunction with small adjustments of tube V2 control (fig. 4-239) to obtain maximum deflection on oscilloscope No. 2 at 1850 MHz. Tighten set screw on C10 after final adjustment.

(k) Use sweep generator on F1-F2 sweep range. Set F1 and F2 controls to sweep approximately the range 1850 MHz ±60 MHz. Observe the return loss display on oscilloscope No. 1 RIGHT channel. Adjust capacitance C6 (fig. 4-239) to obtain a response centered on 1850 MHz similar to the one shown in A, figure 4-244. If response cannot be centered by adjusting C6, proceed to step *(l)* below. Otherwise proceed directly to step *(p)* below.

NOTE

The response may be considered centered when the return loss at 10 MHz above and below 1850 MHz is equal (equal oscilloscope vertical deflection of the 1840 and 1860 MHz marks as shown in A, fig. 4-244).

(l) Loosen the drive chain idler sprocket (fig. 4-245). Slacken the chain.

(m) Pull the chain free from the output cathode sprocket. Rotate the output cathode sprocket in either direction and readjust C6 until the response is centered on 1850 MHz. See note to *(k)* above.

NOTE

Before re-engaging the chain, verify that the cathode sprocket can be rotated counter-clockwise at least 0.75 turns before it hits its mechanical stop. Recenter the response about 1850 MHz before re-engaging the chain after this verification.

(n) Replace the chain over the sprocket Adjust the chain tension for minimum backlash using chain drive idler sprocket

NOTE

Verify counter reading for reference position as in preliminary set up *(1)(c)* through *(g)* above.

(o) Set sweep generator to manual sweep, with f_o = 1850 MHz. Peak output power using tuning knob on test fixture. Verify that maximum output power occurs at reference position (b. *(1)(g)* above). If it does not, carefully adjust TUBE V2 control until it does. Measure return loss at 1850 MHz. It should be 13 dB minimum. Multimeter No. 1 indication should not exceed 14 Vdc. If necessary, adjust the input power level for a 14 Vdc indication.

(p) Keeping MANUAL sweep, measure the output power at 1850 MHz on the power meter. Allow for calibrated insertion loss determined in step *(2)(g)* above plus the loss in the two 20 dB attenuators. Output power measured at J4 of the unit under test shall be +43.0 dBm (20 watts) minimum. If input power level was adjusted in *(o)* above, reset the input power to oscilloscope No. 1 LEFT channel deflection corresponding to +34 dBm (para. *(3)(d))*.

(q) Set sweep generator to Δ F sweep range. Tune the unit under test to obtain a response on oscilloscope No. 2 centered on 1600 MHz. Set sweep generator to manual sweep. Tune the amplifier for maximum output power and note and record the counter reading on test fixture for maximum power position. This reading on the counter, normalized to the reference position (b. *(1)(g))* should be within the limits given below.

Tuning Law

Frequency (MHz)	*1850*	*1600*	*1350*
Mechanical counter reading	0000 (ref position)	0230.9 (+0038.0 –0009.5)	0566.2 (+0009.5 –0038.0)

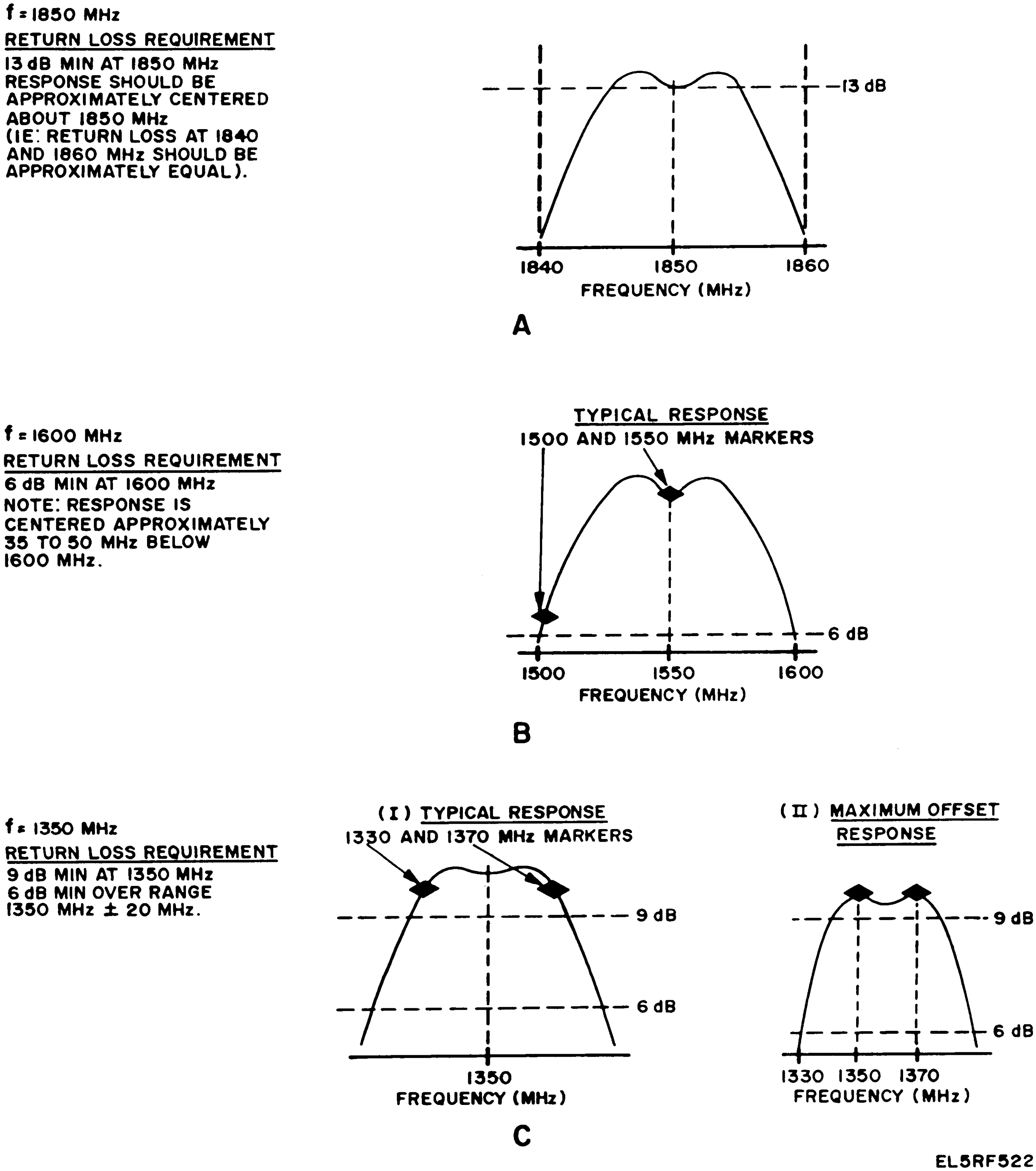


Figure 4-244. Rf Amplifier 40AR1, Return Loss Display Waveform.

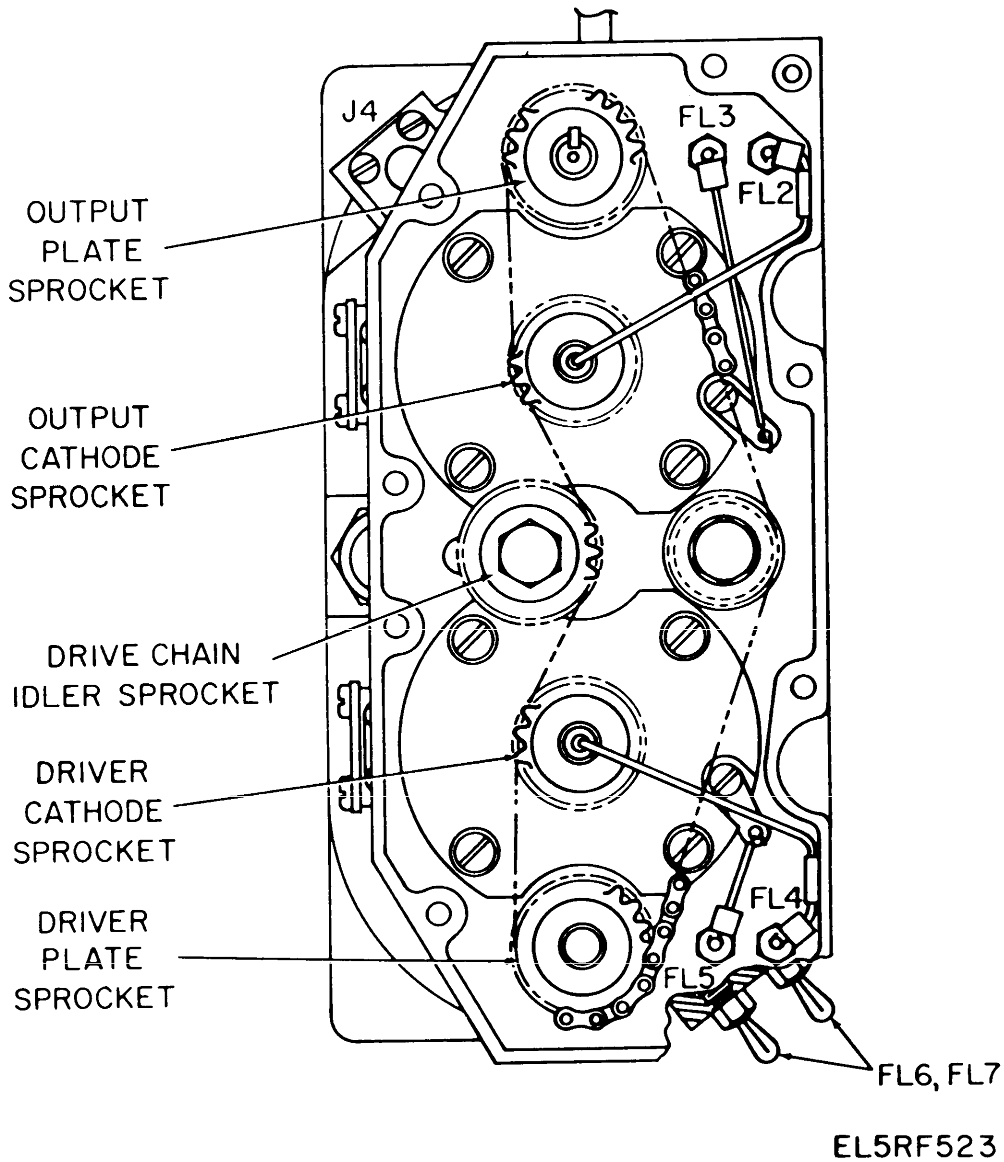


Figure 4-245. Rf Amplifier 40AR1, Alinement Controls.

(r) Repeat step *(q)* above for f_o = 1350 MHz. The reading, normalized to the reference position, should be within the tolerance given.

(s) If the tuning law for the output stage is outside limits, proceed to step *(t)* below. If correct, proceed directly to step *(w)* below.

(t) In order to readjust the output stage to bring the tuning law into tolerance at 1850, 1600 and 1350 MHz, adjust capacitor C12 (fig. 4-246) as described in *(u)* below. Set sweep to MANUAL, set f_o to 1850 MHz, and retune the amplifier to provide the reference position reading (see *(1)(g))* on the test fixture counter.

(u) Make a small arbitrary adjustment to C12 (fig. 4-246), then readjust tube V2 control to peak output power at 1850 MHz. Remeasure the tuning law for 1600 MHz and 1350 MHz by repeating steps *(q)* and *(r)* above. Repeat this procedure for different settings of Cl2 until the setup operates within the prescribed limits *(g)* at all three frequencies. Record the final counter readings at 1850, 1600, 1350 MHz.

NOTE

Turn C12 CCW to INCREASE (lengthen) the tuning law. Ensure that after final adjustment, C12 is at least 0.9 turns CCW from its bottoming position.

(u) Repeat steps *(k)* through *(p)* above.

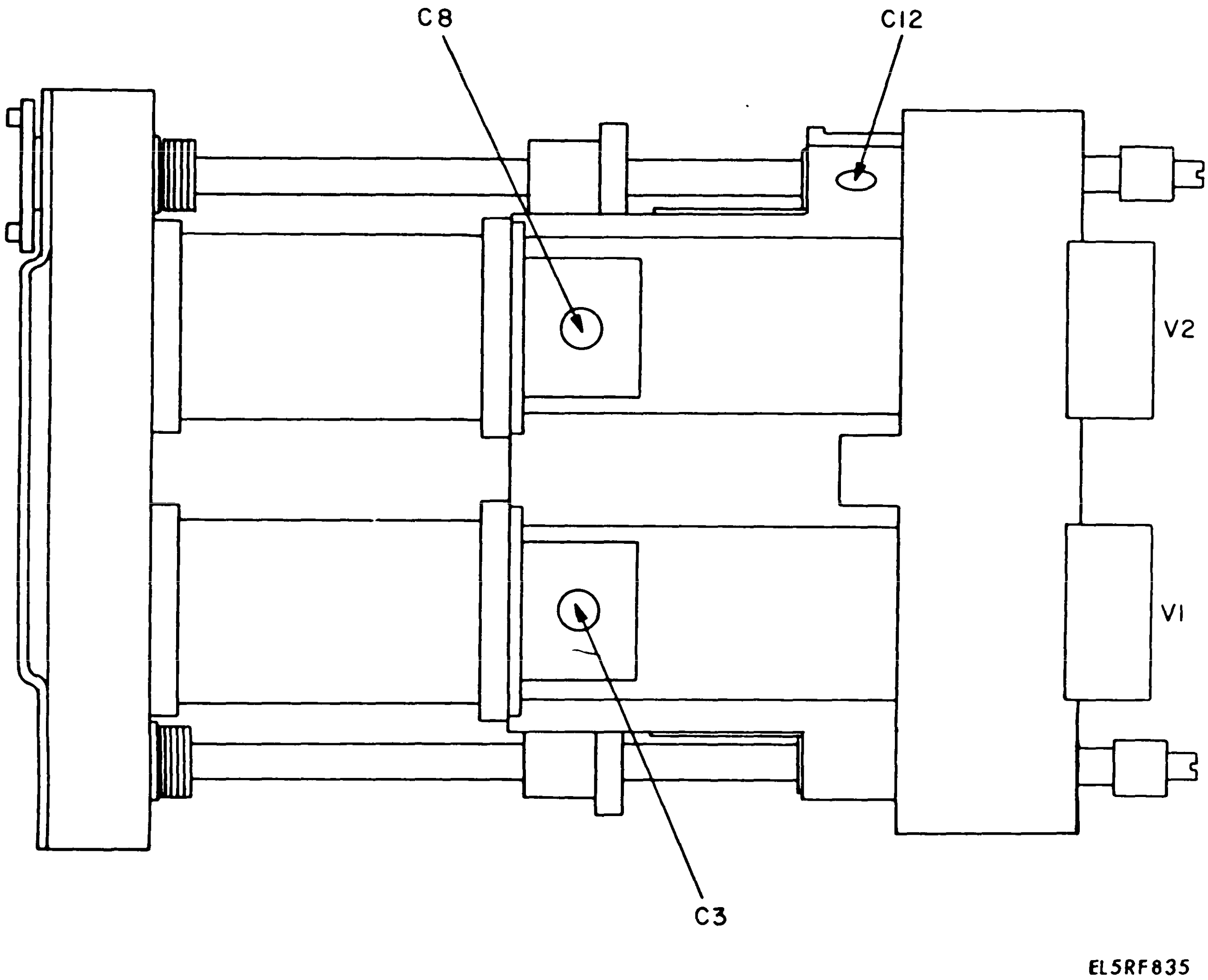


Figure 4-246. Rf Amplifier 40AR1, Showing C3, C8, and C12.

NOTE

No adjustments should normally be necessary.

(w) set sweep generator to Δ F sweep range, with a sweep width of approximately 25 MHz. Tune the amplifier to obtain a response on oscilloscope No. 2 centered on 1600 MHz. Set sweep generator to sweep approximately from 1500 to 1630 MHz using F1 – F2 sweep range. Observe return loss response on oscilloscope No. 1 RIGHT channel. A typical response is shown in B, figure 4-244. Note return loss at 1600 MHz, and the position of the response curve. Reverify the reading using manual sweep. The return loss at 1600 should be 6 dB minimum and the centre of maximum response is typically below 1600 MHz. If not within the 6 dB limit, it will be adjusted in *(x)* below.

(x) Tune the amplifier to obtain a response on oscilloscope No. 2 centered on 1350 MHz. Set sweep generator to sweep approximately from 1330 to 1370 MHz and observe return loss display on oscilloscope No. 1 as in *(w)* above. A typical response is shown in C(I), figure 4-244. Return loss should be 9 dB minimum at 1350 MHz and 6 dB minimum from 1330 to 1370 MHz as shown in C(I) or (II), figure 4-244. If the responses at 1600 and/or 1350 are not within limits, adjust C8 and/or C6 as described in **NOTE** below.

NOTE

Turn C8 CCW to INCREASE center frequency of response. If return loss measured at 1600 MHz in *(w)* above was less than 6 dB and the response was centered below 1600 MHz, then offset the response at 1350 MHz toward the high frequency side by tuning C8 (fig. 4-246) CCW, then check response at 1600 MHz. Do not offset further than the limits shown in C(II), figure 4-244. If adjustment of C8 cannot provide the required minimum return loss at both 1600 and 1350 MHz, then it is necessary to adjust C6.

(y) If C6 and/or C8 require adjustment in *(x)* above, repeat steps from *(k)* through *(x)* above until the correct tuning law and return loss requirements are met.

(z) Lock C8 and tighten setscrew at C6, then verify correct return loss limits.

(aa) Set the OPERATE switch on the power amplifier to OFF by depressing STAND BY switch.

(ab) This completes the output stage alinement.

(5) *Driver stage, input power and return loss calibration.*

(a) Connect the test set-up as shown in C, figure 4-242. Set Multimeter No. 1 to 20 Vdc range and Multimeter No. 2 to 2000 mA dc range.

NOTE

Digital Multimeter No. 1 must be floating in relation to all other equipment.

(b) Set the OPERATE switch of the power amplifier to ON.

(c) Use sweep generator on external levelling. Adjust sweep generator controls to provide a Ievelled output power of +23 dBm ±0.5 dB (–17 dBm ±0.5 dB reading on the power meter) over frequency range 1350 MHz to 1850 MHz. Verify by using manual sweep and noting internal markers of sweep generator indicating frequency.

(d) Establish connection D, figure 4-242, using the 6 dB attenuator only.

(e) Follow the procedure in steps *(3)(d)* through *(h) to* establish the trace deflections corresponding to 6 dB, 9 dB and 13 dB return loss.

(6) *Driver stage alinement.*

(a) Disconnect the 40AR1W1 interstage coaxial cable from J2 of the unit under test and connect the equipment as shown in E, figure 4-242.

(b) Set the sweep generator to a 25 MHz Δ F sweep width at f_o = 1850 MHz. Tune unit under test to provide counter reading at reference position *(b.(1)(g))* on test fixture.

(c) Locate the position of the frequency response on oscilloscope No. 2 using the Δ F swept frequency control only. Allow the unit under test five minutes to warmup.

(d) Adjust the driver tube V1 control (figure 4-239) to move the response to 1850 MHz (use internal markers for frequency identitlcation).

NOTE

Turn CCW to DECREASE frequency.

(e) While maintaining f_o at 1850 MHz, adjust the vertical sensitivity of oscilloscope No. 2 to provide an 8 cm display from 0 volts centered at 1850 MHz. Set sweep generator to manual sweep and with f_o = 1850 MHz, readjust vertical sensitivity if necessary for an 8 cm display from 0 volts with response peak at 1850 MHz.

(f) Observe the power reading on power meter corresponding to the 8 cm from 0 volt deflection. Slightly vary the manual sweep frequency to drop power reading by 3 dB. Note the oscilloscope vertical deflection (typically 5 cm).

(g) Set sweep generator back to Δ F sweep centered at 1850 MHz. Ensure that vertical deflection at oscilloscope No. 2 is at 8 cm from 0 volts and that unit under test is tuned to 1850 MHz. Measure the band width of response using internal markers at 3 dB level (the level noted in *(f))*. The bandwidth should be 16 MHz ±1 MHz. If it is not, adjust C5 (fig. 4-239) to obtain correct bandwidth. Fine adjustment of tube V1 control may be required to recenter response at 1850 MHz. Tighten set screw on C5 after adjustment

(h) Use sweep generator on F1-F2 sweep range. Set F1 and F2 controls to sweep the range 1850 MHz ±60 MHz (approx.). Observe return loss display at oscilloscope No. 1 RIGHT channel. Adjust capacitance Cl to obtain response centered on 1850 MHz similar to A figure 4-244. If the response cannot be centered by adjusting Cl proceed to *(i)* below. Otherwise proceed directly to *(m)* below.

NOTE

The response may be considered centered about 1850 MHz when the return loss at 10 MHz above and below 1850 MHz is equal (oscilloscope vertical deflections at 1840 MHz and 1860 MHz are equal as shown in A fig. 4-244).

(i) Loosen and remove the drive chain from the driver cathode sprocket (fig. 4-245) as described in *(4)(l)* through *(o)* above for the driver cathode sprocket only. Do not change the position of the other sprockets.

(j) Rotate the driver cathode sprocket in either direction, while adjusting C1 to center response on 1850 MHz. See NOTE to step *(h)* above.

NOTE

Before re-engaging the chain after centering the response, verify that the cathode sprocket can be rotated at least 0.75 turns CCW before it hits the mechanical stop. Recenter response if adjustment is necessary.

(k) Replace the chain over the sprocket. Adjust the tension on the chain for minimum backlash and smooth operation. The torque required to rotate the output shaft adapter (fig. 4-239) should be 2 to 4 inch-pounds, as measured with the torque wrench.

(l) Re-engage the unit under test with the test fixture drive mechanism and secure the unit.

NOTE

Verify counter reading at reference position *(1)(g).*

(m) Set sweep generator to manual sweep with f_o = 1850 MHz. Adjust TUNING knob at test fixture to peak output power at 1850 MHz. Ensure peak is at reference position on the counter. If it is not, slightly readjust tube V1 control so that it is. Measure the return loss at 1850 MHz. It should be 13 dB minimum.

(n) Keeping MANUAL sweep, measure the output power at 1850 MHz at the power meter. Allow for calibrated insertion loss of circulator No. 2, LP filter, flexible cable and directional coupler No. 2 determined in *b. (2)(g),* plus the loss from the two 20 dB attenuators. Output power measured at J2 of the unit under test shall be +33.0 dBm (2 watts) minimum.

(o) Repeat steps *(4)(q)* and *(r)* to measure the tuning law of the driver stage. The tuning law should be within ±0.5 turns of the final tuning law measured and recorded for the output stage (step *(4)(u)).* One half turn corresponds to a count of 5 on the counter.

(p) If the tuning law for the driver stage is not within the above limits, proceed with step *(q)* below. If the tuning law is within the limits, then proceed directly to step(r) below.

(q) The tuning law for the driver stage is adjusted at capacitor Cl1 and tube V1 control (fig. 4-239). Repeat steps *(4)(t)* and *(u)* substituting these controls for C12 and V2. The results should be within 0.5 turns of those of the output stage.

NOTE

Ensure that Cl1, when set *((q)* above), is at least 0.9 turns CCW from its bottoming position.

(r) Repeat steps *(h)* through *(n)* above.

NOTE

No adjustment should normally be necessary.

(s) Set sweep generator to Δ F sweep range, with a sweep width of approximately 25 MHz. Tune the amplifier to obtain a response on oscilloscope No. 2 centered on 1600 MHz. Set sweep generator to sweep approximately from 1500 to 1630 MHz using F1-F2 sweep range. Observe return loss response on oscilloscope No. 1 RIGHT channel. A typical response is shown in B, figure 4-244. Note return loss at 1600 MHz, and the position of the response curve. Reverify the reading using manual sweep. The return loss at 1600 should be 6 dB minimum, and the center of maximum response is typically below 1600 MHz. If not within the 6 dB limit, it will be adjusted in *(t)* below.

(t) Tune the amplifier to obtain a response on oscilloscope No. 2 centered on 1350 MHz. Set sweep generator to sweep approximately from 1330 to 1370 MHz and observe return loss display on oscilloscope No. 1 as in *(s)* above. A typical response is shown in C(I), figure 4-244. Return loss should be 9 dB minimum at 1350 MHz and 6 dB minimum from 1330 to 1370 MHz as shown in C(I) or (II), figure 4-244. If the responses at 1600 and/or 1350 are not within limits, adjust C8 and/or C6 as described in **NOTE** below.

NOTE

Turn C3 CCW to INCREASE center frequency of response. If return loss at 1600 MHz in *(s)* above was less than 6 dB, and the response was centered below 1600 MHz, then offset the response at 1350 MHz toward the high frequency side by tuning C3 CCW, then check response at 1600 MHz. Do not offset further than the limits shown in C(II), figure 4-244. If adjustment of C3 cannot provide the required minimum return loss at both 1600 and 1350 MHz, then it is necessary to adjust Cl.

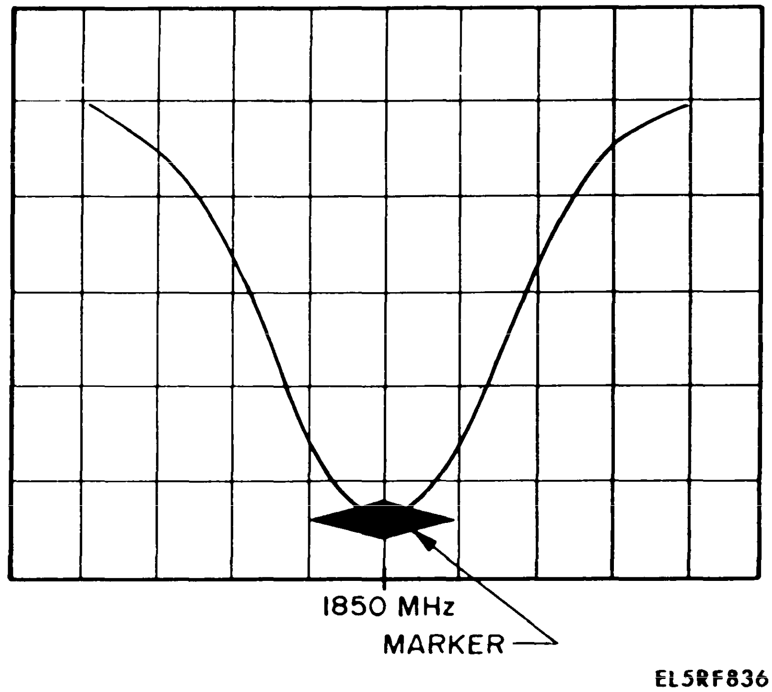


Figure 4-247. Rf Amplifier 40AR1, Output Response.

(u) If Cl and/or C3 require adjustment in *(t)* above, repeat steps from *(h)* through *(t)* above until the correct tuning law and return loss requirements are met.

(v) Lock C3 and tighten the setscrew at Cl, then verify correct return loss limits.

(w) Set OPERATE switch on the power amplifier to OFF by depressing the STAND BY switch.

(x) This completes the driver alinement.

(7) *Amplifier alinement and tests.*

(a) Establish connection C, figure 4-242. Set OPERATE switch of power amplifier to ON. Use manual sweep to verify that sweep generator levelling loop continues to provide a levelled output power to the unit under test of +23 dBm ±0.5 dB over the frequency range 1350 to 1850 MHz *((5)(c)* above). Observe the oscilloscope No. 1 left channel display and note the level of deflection for +23 dBm output power. Depress the power amplifier STANDBY switch.

(b) Establish connection F, figure 4-242. Reconnect the interstage coaxial cable 40ARlWl between J2 and J3 on the unit under test. Depress OPERATE switch on power amplifier.

(c) Tune unit under test to provide counter reading on test fixture at reference position *(b.(1)(g))*. Adjust the sweep generator for a 25 MHz sweep width centered on 1850 MHz.

(d) Monitor the output response on oscilloscope No. 2. Compare shape of response at 1850 MHz to figure 4-247.

(e) Set sweep generator to manual sweep, f_o at 1850 MHz. Observe output power at the power meter.

NOTE

The counter reading at the test fixture must be at the reference (para. b. *(1)(g)*. Multimeter No. 1 reading must not be allowed to exceed +14 volts dc (step *(f)* below). If it does, disable sweep generator levelling loop by switching to internal levelling. Then adjust the rf power control on the sweep generator plug-in head to reduce the indication on Multirneter No. 1 (*(f)* above) to +14 V. On no account should the driver input power exceed +23 dBm as noted on oscilloscope No. 1 in (a) above.

(t) At the rf module test facility, set S10 to OUTPUT CATHODE V. Observe dc voltage level on Multimeter No. 1. This is cathode-to-grid voltage at unit under test output stage, indicative of driver stage output power level Verify that this level peaks at 1850 MHz by making slight adjustments to the manual sweep about the 1850 MHz setting. If it does not adjust DRIVR V1 control.

(g) Keep the sweep generator on manual sweep, f_o at 1850 Hz. Observe the output power from the unit under test on the power meter. Verify that the level peaks at 1850 MHz by making slight adjustments to the manual sweep. If it does not, make necessary slight adjustments to output stage V2 control.

(h) While in manual sweep, measure the unit under test power output at the power meter. Allow for calibrated insertion loss at circulator No. 2, L.P. filter, flexible cable and directional coupler No. 2 (determined in step *(2)(g))* plus the calibrated loss at the two 20 dB attenuators. Output power measured at J4 of the unit under test shall be +43.0 dBm (20 watts) minimum.

NOTE

The input drive level should be +23 dBm, or that level which provides a 14 V indication on Multimeter No. 1, whichever is lower.

(i) While in manual sweep and at the same input level as for step *(7)(h)* above, measure the input return loss of the unit under test at 1850 MHz. Input return loss shall be 6 dB minimum.

NOTE

If input drive level used is less than +23 dBm, then recalibration of oscilloscope No, 1 RIGHT channel trace is necessary at the particular input power level set. (See steps *(5)(c)* through *(e)).*

(j) Tune the unit under test to all frequencies listed below. Tune to the position that provides maximum output power. At each frequency, repeat steps *(7)(h)* through (i), and note readings for output power, Multimeter No. 1 reading when set to OUTPUT CATHODE V at S10 on the rf modules test facility, input return loss, and mechanical counter reading on the test fixture. Output power shall be 20 watts minimum, measured at J4 on unit under test. Input return loss shall be 6 dB minimum. Input drive level shall be the lesser of +23 dBm or that level that provides +14 Vdc at Multimeter No. 1. For tuning law, normalize the mechanical counter readings so that 1850 MHz for this comparison is 0 revolutions. Tuning law shall be within the limits listed below.

NOTE

To avoid effects of unit under test and test fixture drive train backlash on tuning law results, approach the tuned position from the same direction of rotation for all frequencies.

Test frequencies and tuning law,

Frequency (MHz)	*Test fixture mechanical counter reading*
1850	0000.0 (Reference position)
1800	0039.9 ± 009.5
1700	0127.3 +0038.0, –0009.5
1600	0230.9 +0038.0, –0009.5
1500	0348.7 +0038.0, –0009.5
1400	0484.5 ±0023.8
1350	0566.2 +0009.5, –0038.0

(k) Remove electrical shield plates CMC 656-800075-000/GRM-95(V) from Cl, C6, C10, replacing them with covers.

(l) Tune the amplifier for maximum output power at 1850 MHz (a normalized counter reading of approximately 0015.5) using the internal markers. Allow 1 minute for stabilization and repeak the output power, using the test fixture tuning knob. Tighten the drive shaft lock at this position.

(m) Set transmitter test facility switch S13 and rf modules test facility switches S8 and S9 to OFF.

(n) Remove the rf amplifier from the test fixture and the shaft adapter from the amplifier, taking care not to dislodge the crescent-shaped drive pin. Replace the front cover plate with the eight retaining screws, and reinstall the shaft adapter on the drive shaft.

c. Troubleshooting (figure 2-101, TM 11-5820-540-30).

Symptom	*Probable cause*	*Checks and corrective measures*
1. Resistance measurement in test procedure *b. (1)(h)* above, out of tolerance.	*a.* Defective temperature sensor 40AR1AR1RT1.	*a.* Measure across temperature sensor 40AR1AR1RT1 (fig. 4-239). If out of tolerance, replace temperature sensor.
	b. Defective wiring between plug 40AR1P1 and temperature sensor 40AR1AR1RT1.	*b.* Use multimeter to check for continuity from 40AR1P1, pins 8 and 9 to temperature sensor 40AR1AR1RT1 (fig. 2-101, TM 11-5820-540-30).
2. Fails megohmmeter test in *b. (1)(f)* above.	Defective temperature sensor 40AR1AR1RT1.	Replace temperature sensor.

c. Troubleshooting. - Continued

Symptom	*Probable cause*	*Checks and corrective measures*
3. DRIVER FIL lamp fails to light, b. (4)(b) above.	*a*. Open filament of driver tube VI. *b.* Defective driver filament wiring.	*a* Replace V1. *b.* Use multimeter to check for continuity of driver heater circuit (fig. 2-101, TM 11-5820-540-30).
4. OUTPUT FIL lamp fails to light, *b. (4)(b)* above.	*a* Open filament of output tube V2. *b.* Defective output filament wiring.	*a.* Replace V2. *b.* Use multimeter to check for continuity of output heater circuit (fig. 2-101, TM 11-5820-540-30).
5. 600 V lamp fails to light *b. (4)(f).*	Jumper wire on plug 40AR1P1 open.	Use multimeter to check for continuity between 40AR1P1 pins 3 and 4 (fig. 2-101, TM 11-5820-540-30).
6. Unable to aline driver stage and/or meet return loss requirements, *b.* (6) above.	Defective components associated with driver stage.	Refer to figure 2-101, TM 11-5820-540-30.
7. Unable to aline output stage and/or meet return loss requirements, *b.* (4) above.	Defective components associated with output stage.	Refer to figure 2-101, TM 11-5820-540-30.
8. Fails alinement and test of amplifier, *b.* (7) above.	Defective interstage coaxial cable 40AR1W1.	Replace coaxial cable 40AR1W1.

4-92. Bandpass Filter 40FL1

General support maintenance of bandpass filter 40FL1 is covered in paragraph 4-80.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM (PRINT YOUR UNIT'S COMPLETE ADDRESS)
Commander
Stateside Army Depot
ATTN: AMSTA-US
Stateside, N.J. 07703-5007

DATE SENT
10 July 1975

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5840-340-12	23 Jan 74	Radar Set AN/PRC-76

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2^{o} IFF antenna lag rather than 1^{o}. REASON: Experience has shown that with only a 1^{o} lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2^{o} without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure for the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		F03		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

SAMPLE

TEAR ALONG PERFORATED LINE

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE
SSG I. M. DeSpiritof 999-1776	SSG I.M. DeSpiritof

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Fort Monmouth, New Jersey 07703-5000

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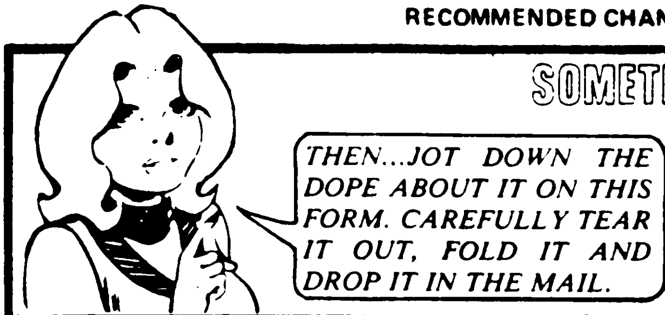

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DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-5820-540-40-2	1 October 1989	Radio Sets AN/GRC-103(V)1-4 and Extension Kit, Mast 1009/GRC-103(V)

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PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

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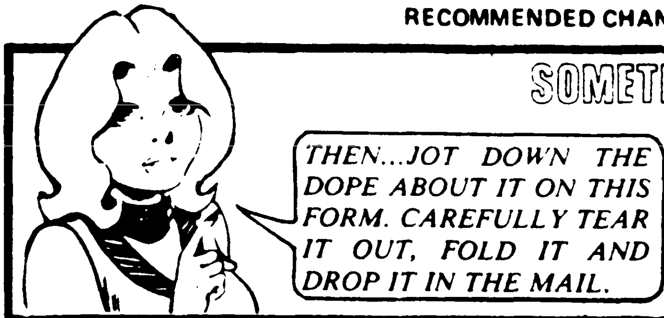

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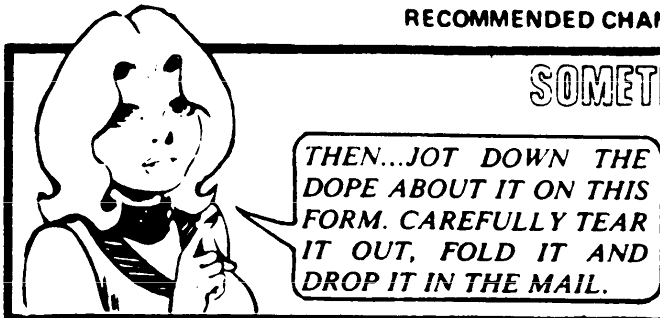

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Brigadier General, United States Army
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