TM11-6625-586-45

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

GS, AND DEPOT

MAINTENANCE MANUAL

GENERATOR, SIGNAL

AN/URM-103

HEADQUARTERS, DEPARTMENT OF THE ARMY

NOVEMBER 1969

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

Be careful when working on this equipment or on the 115-volt/230-volt ac line connections. Be careful not to contact any power connections when using this equipment. Discharge all high-voltage capacitors by short-circuiting them after the power has been turned off before making any test connections or working inside the equipment. Serious injury or death may result from contact with these points.

DON'T TAKE CHANCES!

CHANGE No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *19 August 1975*

General Support and Depot Maintenance Manual
GENERATOR, SIGNAL AN/URM-103

TM 11-6625-586-45, 28 November 1969, is changed as follows:

1. New or changed material is indicated by a vertical bar.
2. Remove old pages and insert new pages as indicated below:

Remove	*Insert*
i	i/(ii blank)
1-1 through 1-3	1-1 through 1-3
5-1 and 5-2	5-1 and 5-2
5-7 thru 5-12	5-7 thru 5-12
6-1 thru 6-6	6-1 thru 6-6
6-9 and 6-10	6-9 and 6-10
Figure 6-8 (2)	Figure 6-8 (2)
None	A-1
I-1 and Authentication page	Index 1 and Authentication page

3. File this sheet in front of the manual for reference purposes.

By Order of the Secretary of the Army:

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TECHNICAL MANUAL
No. 11-6625-586-45

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *28 November* 1969

General Support and Depot Maintenance Manual

GENERATOR, SIGNAL AN/URM-103

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*This manual supersedes TM 11-6625-586-45, 6 November 1968, including all changes.

CHAPTER 1
FUNCTIONING

Section I. GENERAL

1-1. Scope

a. This manual contains general support and depot maintenance instructions for Generator, Signal AN/URM-103. It includes instructions appropriate to general support and depot maintenance for troubleshooting, testing, calibrating, and repair of the equipment. It also lists test equipment required for general support and depot maintenance. Functional analysis of the equipment is covered in this chapter.

b. The complete technical manual for this equipment includes two other publications, TM 11-6625-586-12 and TM 11-6625-586-25P.

1-2. Indexes of Publications.

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to this equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO'S) pertaining to the equipment.

NOTE

For other applicable forms and records, refer to paragraph 1-3, TM 11-6625-586-12.

1-2.1. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this manual by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commander, US Army Electronics Command, ATTN: AMSEL-MA-Q, Fort Monmouth, NJ 07703.

Section II. BLOCK DIAGRAM FUNCTIONING

1-3. Block Diagram

The AN/URM-103 consists of Generator, Signal SG 297/U housed in Case, Signal Generator CY-4695/ URM-103. Generator, Signal SG-297/U (signal generator) consists of a panel-chassis assembly in an aluminum dust cover. The front panel has two handles to facilitate movement of the equipment and to protect the controls. All operating controls, power cable, and receptacles for interconnecting the signal generator are front-panel mounted. The signal generator is a portable, all-transistorized FM signal generator which provides both modulated and unmodulated RF signals over the frequency range from 18 to 80 MHz. It produces power level outputs from 0.05 microvolt to 500,000 microvolt across the output impedance matching network in use, which provides a nominal 50-ohm output impedance. The generator has provisions for internal or external sine wave modulation. The deviation from the center frequency produced by the modulating signal can be controlled and measured by the deviation metering section. The generator also produces IF alignment frequencies which are crystal controlled. The unit is equipped with crystals for operation at 4.3, 5.60, 5.625, 5.65, 10.00, and 11.50 MHz. Two additional crystal positions are provided for other IF's. A direct-reading RF' attenuator dial is provided for power level outputs from 0.05 to 10,000 microvolt. Fixed RF power level outputs of 62,500; 125,000; 250,000; and 500,000 microvolt are also provided. Fixed IF power level outputs from 10 microvolt to 1.0 volts in decade steps are provided. A power monitor bridge is used to calibrate the RF and IF power level outputs by setting a constant power reference level. A 1 MHz crystal calibrator provides precise frequency calibration of the RF signals at 1 MHz intervals throughout the frequency range of 18 to 80 MHz. Signal paths are shown in the block diagram (fig. 6-7) and are discussed in *a* through *p* below. For complete circuit details, refer to the over-all schematic diagram (fig. 6-8).

a. AF Oscillator. The AF oscillator, transistors Ql, Q14, and Q15, supplies the internal modulating frequencies for the RF oscillator. The FUNCTION switch S1 selects the desired internal modulation frequency, a frequency calibration function, no modulation or external modulation, or an IF function. The selected function determines the input to the modulation amplifler.

b. Modulation Amplifier. When internal or external modulation is selected, the modulation amplifier transistors Q3 and Q4, amplify the selected modulation frequency. The external modulation frequency is applied to the modulation amplifier. When the internal modulation is used, it is available at INT MOD OUT jack J4, at a level set by DEVIATION

INT MOD VOL control R23. The output of the modulation amplifier is also provided to the meter amplifier-detector and the isolation amplifier.

c. Deviation Metering. The meter amplifier, transistor Q5, and the full-wave rectifier, diodes CR3 and CR4, supply a rectified dc voltage to DEVIATION meter M1 that is proportional to the frequency modulation. The DEVIATION meter has three ranges and the extent of the deviation is controlled by the DEVIATION control R23, which also serves as INT MOD VOL control for the INT MOD OUT audio frequency output available at J4.

d. Isolation Amplifier. The isolation amplifier, transistors Q6 and Q17, serves to isolate the deviation metering circuit and the modulation amplifier from the shaping network and RF oscillator that follows it.

e. Shaping Network. The shaping network, diodes A1A1CR1 through A1A1CR8, serves to shape the modulation of the RF oscillator has the proper characteristics.

f. RF Oscillator. The RF oscillator, transistor A1A1Q1, generates the radio frequency selected by the RF TUNING control and the BAND SWITCH. The oscillator is located in a constant temperature oven to minimize frequency changes due to temperature variations. A turret contains the four tuning coils for the four frequency bands of the generator, and the operation of the BAND SWITCH selects the proper tuning coil and positions a dial mask to expose the frequency scale for the selected band. The RF TUNING control provides two ratios of tuning control, a fast tuning ratio when the knob is pushed in, and a fine tuning ratio coupled to a mechanical counter of 20:1 when the knob is out. The CAL CORRECT knob moves the dial cursor for exact calibration at the cardinal 1 MHz divisions in the frequency calibration function.

g. Low RF Output. The RF output of the RF oscillator is inductively coupled to piston attenuator A1A2, which provides an RF output at the LO RF output jack, J1 of 0.05 to 10,000 microvolts. The RF oscillator output is also applied to the low RF detector A1A2A2CR1, which supplies a detected signal used to set a constant power reference level on the RF-IF meter M2. At the constant power reference level the LO RF UV dial reads directly in microvolt.

h. RF Amplifier. The RF amplifier, transistors A1A1Q2 and A1A1Q3, amplifies the RF oscillator output and provides a maximum level of 500,000 microvolt. The high RF detector A4GR 1 provides a means of setting the constant power reference level, in the manner described for the low RF output.

i. High RF Output. With the constant power reference level maintained, the HI RF output at jack J2 can be set at 62,500; 125,000; 250,000; or 500,000 microvolt by RF OUTPUT switch A4S1.

j. 1 MHz Crystal Oscillator. The 1 MHz crystal oscillator, transistor A6A1A1Q1, provides a ±0.00375% or better frequency accuracy at 1 MHz intervals in each of the four frequency bands. The crystal-controlled oscillator is located in constant temperature oven to minimize frequency changes due to temperature variations. The precise 1 MHz output is applied to a harmonic generator.

k. Harmonic Generator. The 1 MHz output of the crystal oscillator is applied to a harmonic generator, transistors A6A1Q1 and A6A1Q2, which produces harmonically-related signals throughout the frequency range of the generator. The harmonic spectrum is applied to a mixer.

l. Beat Note Mixer and Amplifier. The beat note mixer A6A1CR1 receives the harmonic spectrum from the harmonic generator and the signal frequency from the RF oscillator. When the signal frequency is at any 1 MHz increment in the entire frequency range, a zero beat between the 1 MHz crystal oscillator and the signal frequency will occur. If the frequencies differ, a beat note will occur. The beat not is amplified by transistors A6A1Q3, A6A1Q4, Q7 and Q2 and is reproduced by loudspeaker LS1 if it is within the audible range. When the beat note is reduced to zero, the RF oscillator is tuned to a 1 MHz increment and the CAL CORRECT knob can be adjusted to correct the dial reading.

m. IF Crystal-Controlled Oscillator. The IF crystal-controlled oscillator, transistors A2A1Q1 and A2A1Q2, provides a choice of six crystal-controlled IF's, with an accuracy of ±0.005%. Two additional switch positions are provided for additional IF's in the frequency range from 4 to 15 MHz. The IF UV control adjusts the IF power level applied to the IF amplifier.

n. IF Amplifier. The IF amplifier, transistors A2A1Q3 and A2A1Q4, amplifies the IF crystal oscillator output sufficiently to provide a maximum power level of 1.0 volt. The IF detector A2AlCR1 provides a means of setting the constant power reference level, in the manner described for the low RF output.

o. IF Output. With the constant power reference level maintained, the IF output jack J3 can be set at 10; 100; 1000; 10,000; 100,000; or 1,000,000 microvolts with IF OUTPUT switch A3S1.

p. Power Supplies. The 12-volt power supply, bridge rectifier CR9 through CR 12 and associated transistors provides +12 volts dc and —12 volts dc. The 25-volt power supply, rectifier bridge CR5 through CR8 and associated transistors provides +25 volts dc.

CHAPTER 2
TROUBLESHOOTING

Section I. GENERAL TROUBLESHOOTING INFORMATION

WARNING

When servicing the signal generator be extremely careful because of the high voltages present in the unit. Voltages as high as 230 volts exist at the power connections. Death or serious injury can result from contact with any of these voltages. Always disconnect the power cord when performing maintenance which does not require power. Be extremely careful when handling or testing any part of the signal generator with the power turned on.

CAUTION

Before connecting the signal generator to the ac power source, check the position of 115V–240V switch S3. Set this switch to the 115V or 230V position depending upon the ac power source available. Operation of the signal generator from a 230-volt ac power source with switch S3 in the 115V position may cause serious damage to the unit.

2-1. General Instructions

a. Troubleshooting at general support and depot maintenance level includes all the techniques outlined for organizational maintenance and any special or additional techniques required to isolate a defective part. The general support and depot maintenance procedures are not complete in themselves but supplement the procedures described in TM 11–6625–586-12. The systematic troubleshooting procedure for general support and depot maintenance begins with the operational checks that can be performed at the organizational level, and is completed by means of localizing and isolating techniques.

b. The signal generator may be removed from its dust cover by removing the four screws at the rear of the case and sliding out of the case by pulling on the panel-mounted handles.

2-2. Organization of Troubleshooting

a. General. The first step in servicing a defective signal generator is to localize the fault. Localization means tracing the fault to the stage or circuit responsible for the abnormal operation of the signal generator. The second step is to isolate the fault. Isolation means tracing the fault to the defective part or parts responsible for the abnormal conditions. Some defective parts, such as burned resistors, arcing, and shorted transformers, can often be located by sight, smell, and hearing. Most defective parts, however, must be isolated by checking voltages and resistances.

b. Localization. The signal generator consists of one physical unit that contains several subassemblies. The first step when tracing a trouble is to locate the stage or circuit in the sub-assembly that is at fault by the following methods:

(1) *Visual inspection.* Visual inspection will locate faults without testing or measuring circuits. Meter readings or other visual signs should be observed, and an attempt made to sectionalize the fault to a particular stage.

(2) *Operational tests.* Operational tests frequently indicate the general location of trouble. In many instances, the tests will help in determining the exact nature of the fault. The preventive maintenance checks and services chart (TM 11–6625–586-12) is a good operational test.

(3) *Troubleshooting chart.* The troubleshooting chart (para 2–5) lists symptoms of common troubles and gives (or references) corrective measures. Such a chart obviously cannot include all trouble symptoms that may occur. The repairman should use this chart as a guide in analyzing symptoms that may not be listed.

c. Isolution. Procedures for isolating troubles are given in paragraph 2–6.

d. Techniques. In performing the localization and isolation procedures, one or more of the techniques below may be applied. Apply these techniques only as indicated, and observe all cautions.

(1) *Voltage measurements.* This equipment is transistorized. When measuring voltages, use tape or sleeving (spaghetti) to insulate the entire test prod, except for the extreme tip. A momentary short can damage a transistor. Use the same or equivalent electronic multimeter specified in the voltage charts.

(2) *Intermittent troubles*. In all the tests, the possibility of intermittent troubles should not be overlooked. If present, this type of trouble often may be made to appear by tapping or jarring the equipment. Make a visual inspection of the wiring and connections to the unit. Check that no external connection causes the trouble. Test wiring for loose connections by moving wires and components with an insulated tool.

(3) *Resistor and capacitor color-code diagrams.* Color-code diagrams for resistors, capacitors, and diodes (figs. 6-5 and 6-6) provide pertinent resistance, voltage rating, and tolerance information.

2-3. Test Equipment Required

The following chart lists the test equipment required for troubleshooting the signal generator. The chart also lists the associated technical manuals and the assigned common names. Observe Warning and Cautions following the chart.

Test equipment	Technical manual	Common name
Multimeter TS-352B/U	TM 11-6625-366-15	Multimeter
Oscilloscope AN/USM–281A	TT 11-6625-1703-15	Oscilloscope
Voltmeter, Electronic AN/URM-145	TM 11-6625-524-14	VTVM

WARNING

Dangerous voltages are exposed when operating the signal generator removed from its case.

CAUTIONS

1. Do not tighten screws more than required when assembling mechanical parts.
2. Always replace the lockwashers when assembling mechanical parts.
3. Careless reassembly of parts may cause new faults. Observe the following:
   a. Note the position of all leads before unsoldering a part. If a part with multiple connections is unsoldered, such as a transformer, tag each lead.
   b. Do not damage contacts or leads when pushing or pulling them out of the way.
   c. Do not use a large soldering iron to solder small resistors, diodes, transistors, or ceramic capacitors. Overheating may change the value of these parts.
   d. Do not allow solder drops to fall into the chassis as this may cause short circuits.
   e. Make careful solder connections. Poor solder joints are poor conductors and are difficult to locate.
   f. Reassemble all parts of the high frequency circuits in the exact position formerly occupied. A replaced part with the same nominal electrical parameters but with a different physical size from the original part may cause problems in a high frequency circuit. Failure to observe these precautions may result in a decreased output or in parasitic oscillations.
   g. Give particular attention to proper grounding. Use the same ground as in the original wiring.
4. Do not make adjustments unless it has been positively determined that the fault is caused by a maladjustment.
5. Never connect test equipment (other than multimeters and vtvm's) directly to a transistor circuit. Use a coupling capacitor.
6. Make test equipment connections with care so that short-circuits will not be caused by exposed test equipment connectors. Use tape or sleeving (spaghetti) to insulate the entire test prod or clip, except for the extreme tip making contact with the circuit under test.

Section II. TROUBLESHOOTING GENERATOR, SIGNAL SG-297/U

2-4. Test Setup

Bench tests of the signal generator require connection to a 115- or 230-volt ac power source and to various test equipments. Ac power must be connected to the signal generator for all dynamic servicing procedures.

CAUTION

Before connecting the signal generator to a power source, read the CAUTION preceding paragraph 2–1.

The test equipment connections vary from test to test. Remove the signal generator from its case (para 2-1) and make a test setup as outlined below.

a. Power Supply Connections. There are no external power supply connections required except for prime excitation power. All power supplies are in integral part of the signal generator.

b. Test Equipment. Connect the test equipment as specified for the particular tests. All test connections vary from test to test.

2-5. Localizing Troubles

a. General. In the troubleshooting chart below procedures are outlined for sectionalizing troubles to the power supplies, modulator, RF oscillator, or meters, and for localizing troubles to a stage within the various sections. Parts locations are indicated in figures 2–1 through 2–21. Voltage measurements are given in paragraph 2–12. Depending upon the nature of the operational symptoms, one or more of the localizing procedures will be necessary. When trouble has been localized to a particular stage, use voltage and resistance measurements to isolate the trouble to a particular part (para 2–7).

b. Use of Troubleshooting Chart. When an abnormal symptom has been observed in the equipment, look for a description of this symptom in the "Symptom" column and perform the corrective measure shown in the "Corrective Measures" column. If no operational symptoms are known, begin with the Preventive Maintenance and Services Charts (TM 11–6625–586–12) and proceed until a trouble symptom appears.

c. *Conditions to Tests.* All checks in the chart are to be conducted with signal generator connected to a power source as described in paragraph 2-4.

d. Troubleshooting Chart.

NOTE

Perform the operations in the equipment performance check list (TM 11-6625-586-12) before using this chart, unless trouble has already been localized.

Symptom	Probable Trouble	Correction
1. OPERATE and STANDBY indicators do not light when OPERATE-OFF-STANDBY switch is turned to OPERATE and STANDBY, respectively.	No ac power is being supplied.	Check that input ac voltage is available.
	Open fuse F1 or F2.	Replace fuse. If replaced fuse blows, check for shorts. Refer to figures 2-2 and 6-8(1).
	Switch S3, switch S4, capacitor C36 or capacitor C37 defective.	Repair or replace defective part. Refer to figures 2-2 and 6-8(1).
2. STANDBY indicator does not light when OPERATE-OFF-STANDBY switch is turned to STANDBY.	STANDBY indicator DS2 or lamp socket defective.	Repair or replace defective part. Refer to figure 6-8 (1).
	Resistor R63 or R65 defective.	Repair or replace defective part. Refer to figures 2-2 and 6–8(1).
3. OPERATE indicator and two dial illuminating indicators do not light when OPERATE-OFF-STANDBY switch is turned to OPERATE.	Transformer T1 defective.	Repair or replace defective part. Refer to figures 2-1 and 6-8 (1).
4. OPERATE indicator does not light when OPERATE-OFF-STANDBY switch is turned to OPERATE.	OPERATE indicator DS5 or lamp socket defective.	Repair or replace defective part. Refer to figure 6–8 (1).
	Resistor R68 defective.	Check and replace if necessary. Refer to figure 2-8 and 6-8(1).
5. OPERATE indicator lights but all signal generator functions are inoperative.	25-volt power supply defective.	Check for +44 volts dc at TP1 (fig 2-3). If no voltage is present, check bridge rectifier CR5 through CR8 (fig. 2–2). If +44 volts dc is present, check for +25 volts dc, at TP2. If no voltage is present, check transistors Q9 and A5Q10 through A5Q13. Repair or replace defective part. Refer to figure 6-8 (1).
	12-volt power supply defective.	Check for +18 volts dc at TP3 (fig 2–3). If no voltage is present, check bridge rectifier CR9 through CR12 (fig 2-2). If +18 volts dc is present,

Symptom	Probable Trouble	Correction
5. Cont.		check for 12 volts dc between TP5 (+) and TP6 (-). If no voltage is present, check transistors Q8 and Q16 and associated components. Repair or replace defective part. Refer to figure 6-8(1).
6. No signals available at both HI-RF and LO–RF output jacks.	Board A1A1 defective.	Perform voltage and resistance measurements to find defective part. (para 2-7). Refer to figures 2-8 and 6-8(3).
7. No output at LO-RF jack, output at HI-RF jack normal.	Coil A1A2L1, A1A2L2 or board A1A2A1 defective.	Check and replace defective part. Refer to figure 6-8(3).
8. No output at HI-RF jack, output at LO-RF jack normal.	Transistor A1A1Q2 or A1A1Q3 defective.	Check for RF signal at A1J1. If absent, check and replace defective part. Refer to figures 2-11 and 6-8(3).
	RF OUTPUT switch A4S1 defective.	Check operation of switch with multimeter. Repair or replace defective part. Refer to figures 2-18, 2-19, and 6-8(3).
9. Normal output at LO-RF jack, no indication on IF UV RF SET TO LINE meter.	Diode A1A2A1CR1 defective.	Check for negative dc voltage at junction of A1A2A1CR1 and A1A2A1C1 (fig 2-12). If absent, replace defective part. Refer to figure 6-8 (3).
	Resistor R61 or switch A4S1 defective.	Check and replace defective part. Refer to figures 2-4 and 6-8 (3).
10. Normal output at HI-RF jack, no indication on IF UV RF SET TO LINE meter.	Diode A4CR1 defective.	Check for negative dc voltage at junction of A4CR1 and A4C1. If absent replace defective part. Refer to figures 2-18 and 6-8 (3).
	Resistor A4R1 or switch A4S1 defective.	Check and replace defective part. Refer to figures 2-18 and 6-8(3).
11. With FUNCTION switch turned to 150 HZ, 400 HZ, 1000HZ position, no output appears on DEVIATION meter.	DEVIATION meter Ml or meter amplifier-detective Q5 defective.	Check for output at INT MOD OUT jack J4. If present, repair or replace defective part. Refer to figures 2-7 and 6-8(2).
	Modulation amplifier Q3, Q4 or AF oscillator Q1, Q14, Q15 defective.	Connect external modulation signal to EXT MOD jack. Turn FUNCTION switch to EXT MOD. If indication appears on DEVIATION meter, repair or replace AF oscillator Q1, Q14, Q15. If no indication appears on DEVIATION meter, replace modulation amplifier Q3, Q4.
12. DEVIATION meter indication normal, output RF signal not being modulated.	Isolation amplifier Q6, Q17 defective.	Repair or replace defective part. Refer to figures 2-6 and 6-8 (2).
13. With FUNCTION switch turned to IF, no output appears at IF output jack for any position of IF MHZ switch.	IF attenuator assembly A3.	Check for IF signal at P3. If present, IF attenuator assembly defective; check and replace defective part. Refer to figures 2-16, 2-17, and 6-8 (4).
	Amplifier A2A1Q3 A2A1Q4 defective.	Check for IF signal across A2A1T3. If present, repair or replace amplifier A2A1Q3, A2A1Q4. Refer to figure 2-15 and 6-8(4).
	Crystal-controlled oscillator A2A1Q1 A2A1 Q2 defective.	Check for IF signal across A2A1T2. If absent, repair or replace A2A1Q1, A2A1Q2.
14. Loss of audio beat notes at 1 MHZ intervals.	Oven A6A1A1 defective.	Check for 1.000 MHZ signal at A6TP1. If absent, replace A6A1A1. Refer to figures 2-1 and 2-20.

Symptom	Probable Trouble	Correction
14. cont.	Harmonic generator A6A1Q1, A6A1Q2 defective.	Check for harmonic spectrum signal at junction of A6A1C5 and A6A1C8. If absent, check and replace A6A1Q1 or A6A1Q2. Refer to 2-21 and 6-8(3).
	Beat Note mixer A6A1CR1 or amplifier A61Q3, A6A1Q4, Q2 or Q7 defective	Check and replace defective part. Refer to figure 6-8.

2-6. Isolating Trouble Within a Transistor Stage

When trouble has been localized to a transistor stage, either through operational checks, or troubleshooting charts (para 2–5), isolate the defective part by voltage measurements (para 2–7).

CAUTION

Before attempting to perform voltage measurements review paragraph 2-4. Carefully follow instructions. Carelessness may cause additional troubles in the equipment and make the troubleshooting job more difficult. Never remove or connect a transistor with voltage applied to the circuit.

a. The transistors used in the signal generator are wired into the circuit. Every effort should be made to troubleshoot the equipment without physically unsoldering and removing the transistors.

b. If all checks fail to indicate a defective part, check the alignment of the signal generator.

c. Use the schematic diagram (figure 6-8) to trace circuits and to isolate the faulty part.

2-7. In-Circiut Transistor Tests

a. General. Chart *b* below provides voltage measurements taken with the transistors connected in the circuit. All measurements are made with the vtvm connected between the listed point and chassis ground.

b. Transistor Voltage Checks

NOTE

Transistors or diodes omitted from the following do not require voltage checks, either because access requires extensive disassembly or because checks would be meaningless.

Transistor Scope	and Type	Voltage (volts) Emitter or Anode		Collector	Notes
Q1	2N930	1.13	1.7	14.8	2,6
Q2	2N1613	1.1	1.8	13.4	2,6
Q3	2N930	.8	1.6	11.8	3,4,5
Q4	2N1613	11	11.8	23	3,4,5
Q5	2N930	0	0.64	8.8	3,4,5
Q6	2N930	12.0	12.6	23	3,4,5
Q7	2N706	0	.64	1.55	3,4,5
Q8	2N1490	12.0	13.0	18.0	
Q9	2N1490	25	26	48	
Q10	2N1893	26	26.5	48	
Q11	2N2905	43.5	43	26.5	
Q12	2N760A	4.4	5	13	
Q13	2N760A	4.4	5	26.5	
Q14	2N760A	.48	1.13	12.4	3,4,5
Q15	2N1613	1.7	2.5	10	3,4,5
Q17	2N1613	12.4	13.0	23.5	
A1Q1	2N2857	8.8	8.2	23	1,2
A1Q2	2N2857	.2	.9	6.95	1,2
A1Q3	2N3866	5.0	5.6	16.5	1,2
A2Q3	2N2219	0.8	‘1.6	11.8	3,4,5
A2Q4	2N2219	11.0	11.8	23	3,4,5
A6Q1	2N706	2.3	3	3.5	1,2
A6Q2	2N706	2.3	2.13	6.2	1,2
A6Q3	2N930	0	0.62	1.3	1,2
A6Q4	2N930	0.66	1.3	25	1,2
Junction CR6-CR7	1N1614	44	–	–	
Junction CR10-CR11	1N1614	18	–	–	

Notes.
1. RF OUTPUT to 62.5 KUV
2. FUNCTION to FREQ CAL
3. FUNCTION to 400 HZ
4. DEVIATION RANGE -KHZ to 10
5. DEVIATION fully counterclockwise
6. AUDIO VOL fully counterclockwise

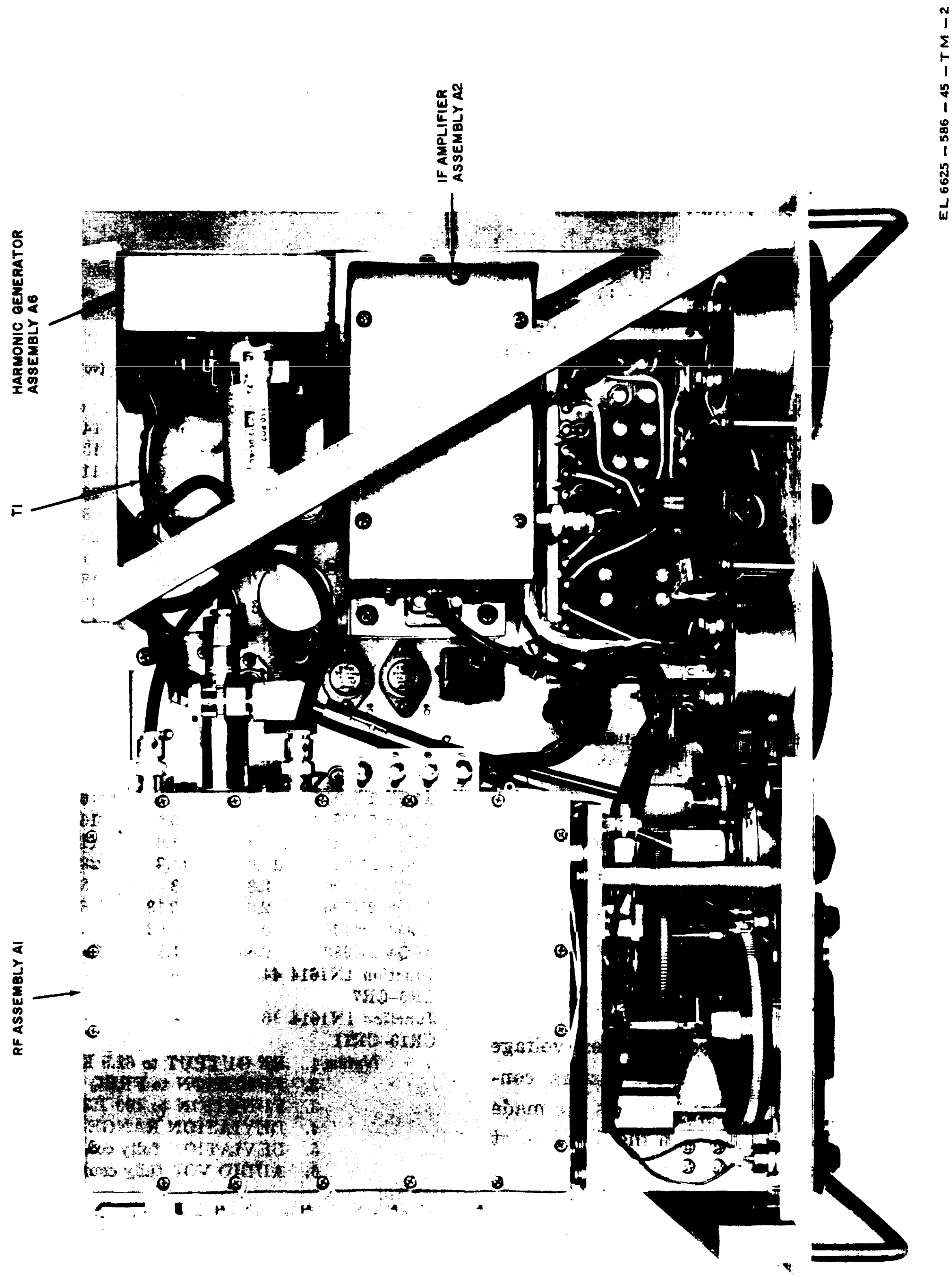


Figure 2-1. Generator, Signal SG-297/U, top view.

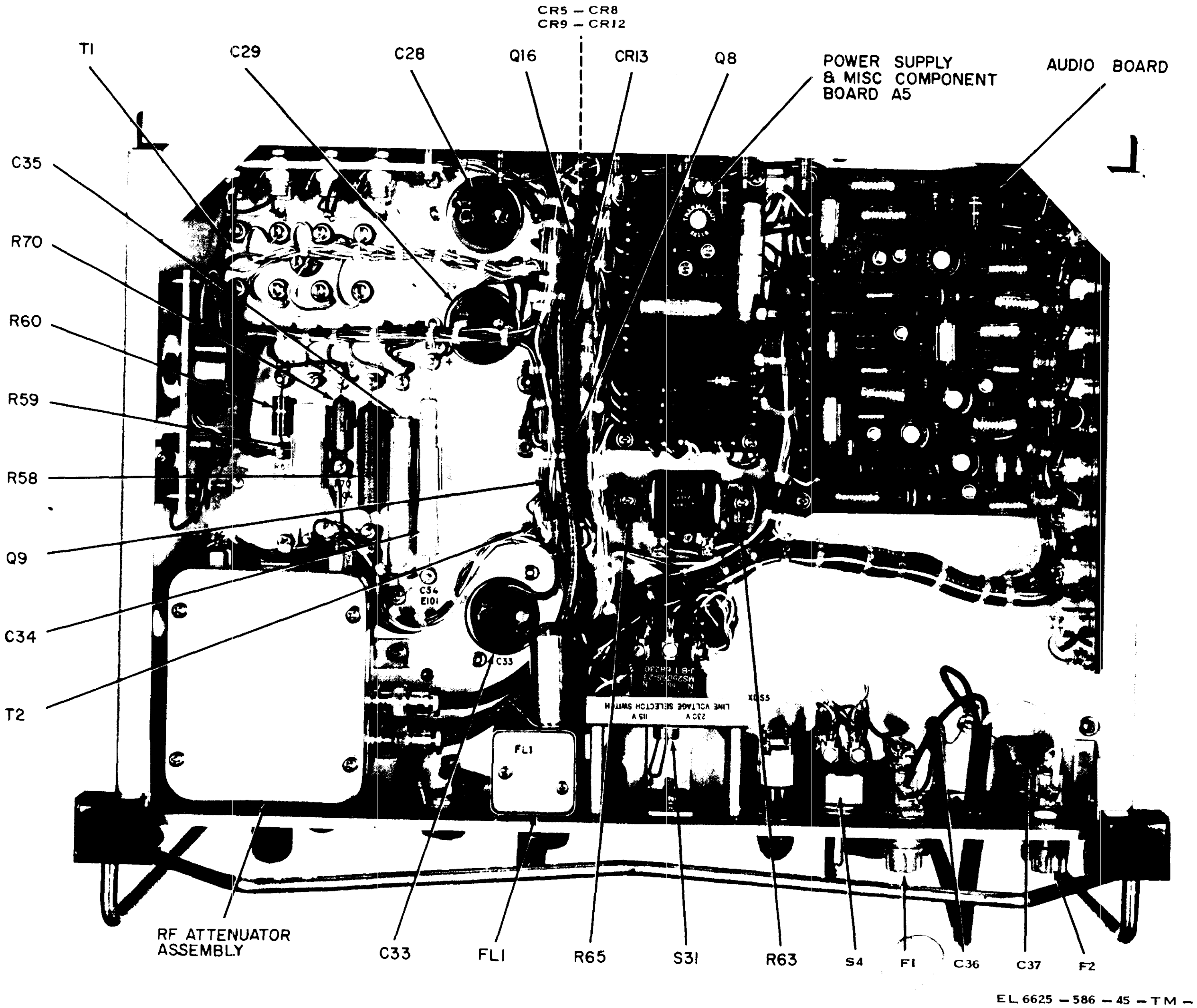


Figure 2-2 Generator, Signal SG-297/U, bottom view.

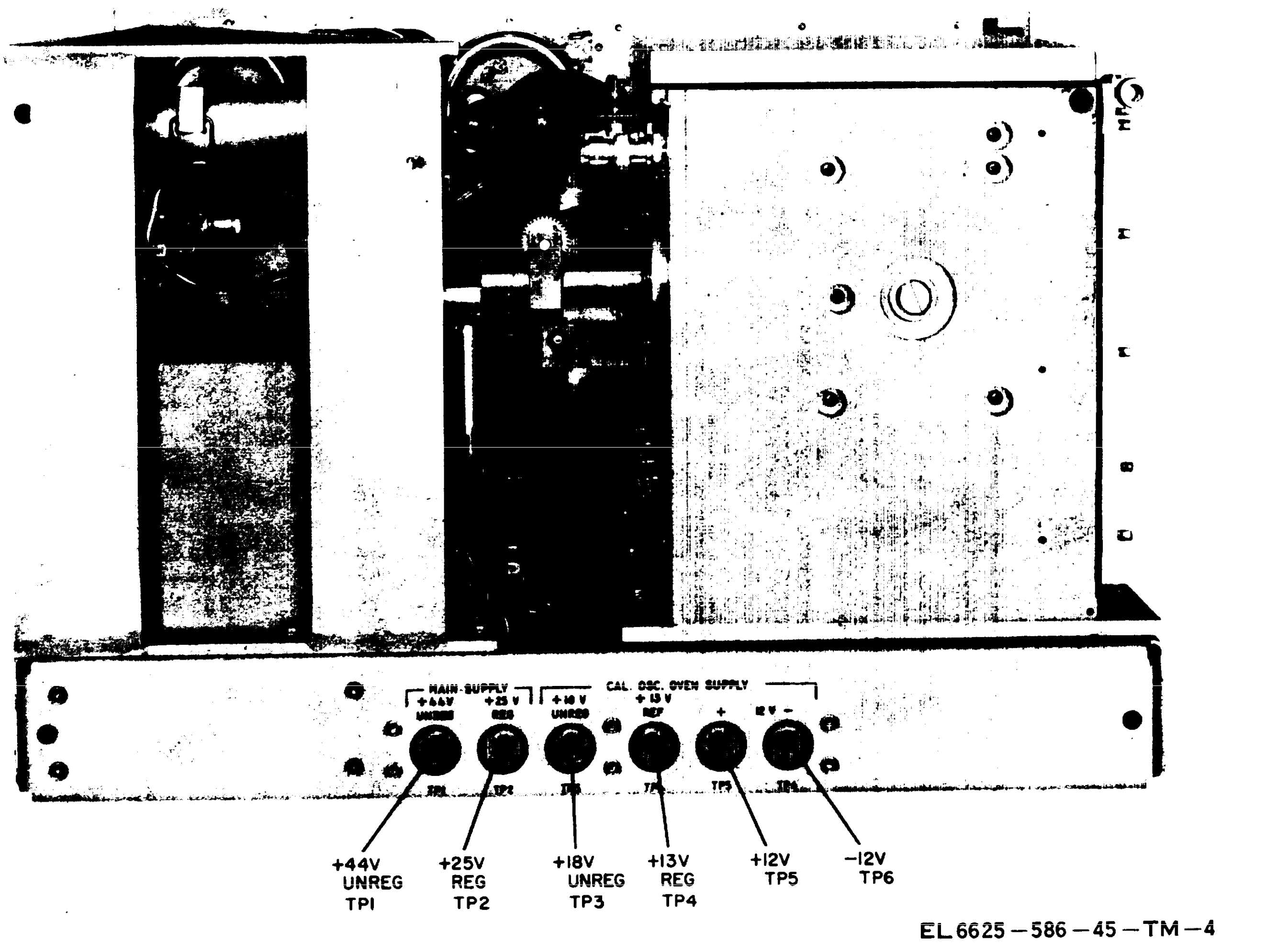


Figure 2-3. Generator, Signal SG-297/U, rear view.

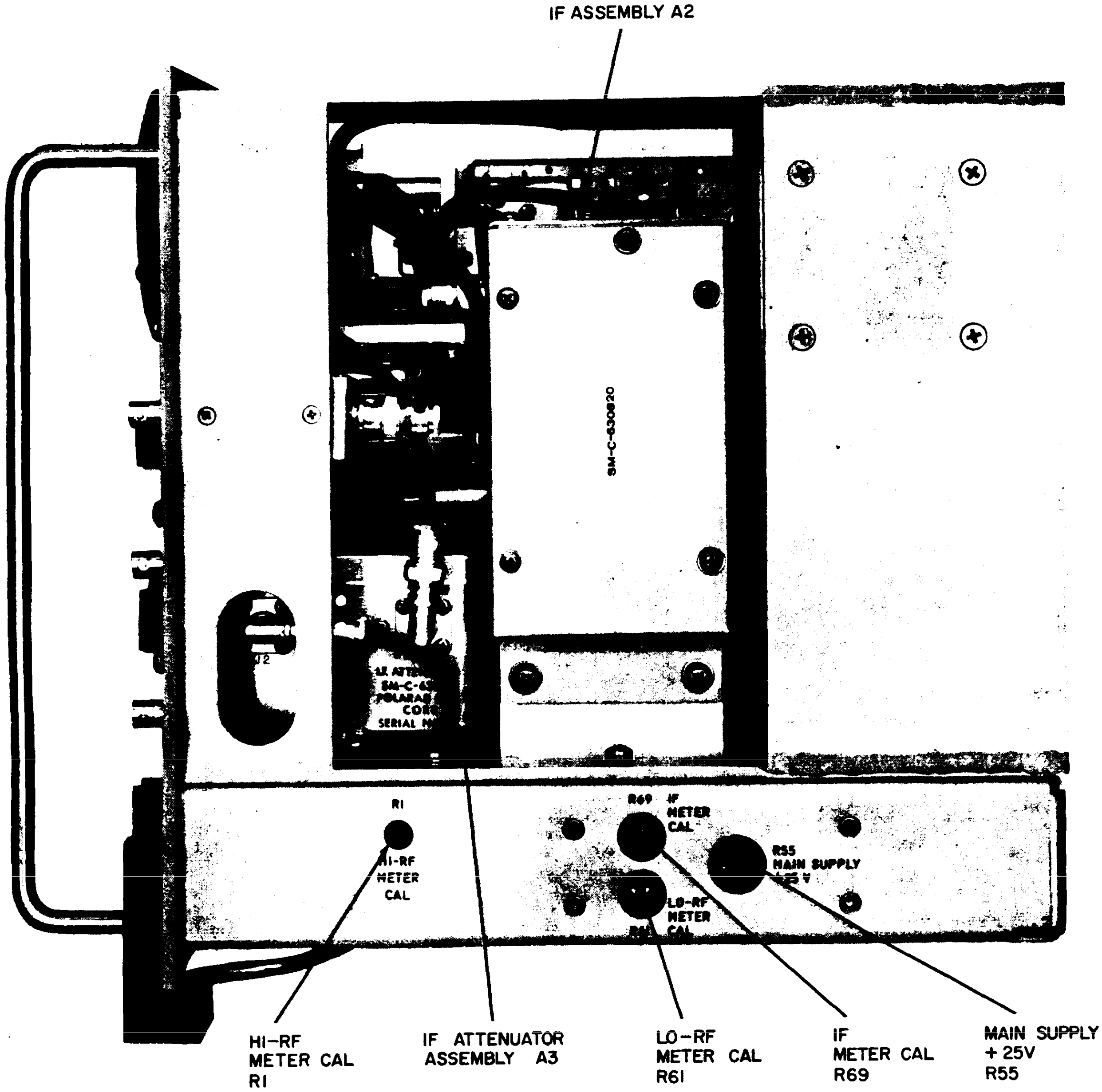


Figure 2-4. Generator, Signal SG-297/U, right side view.

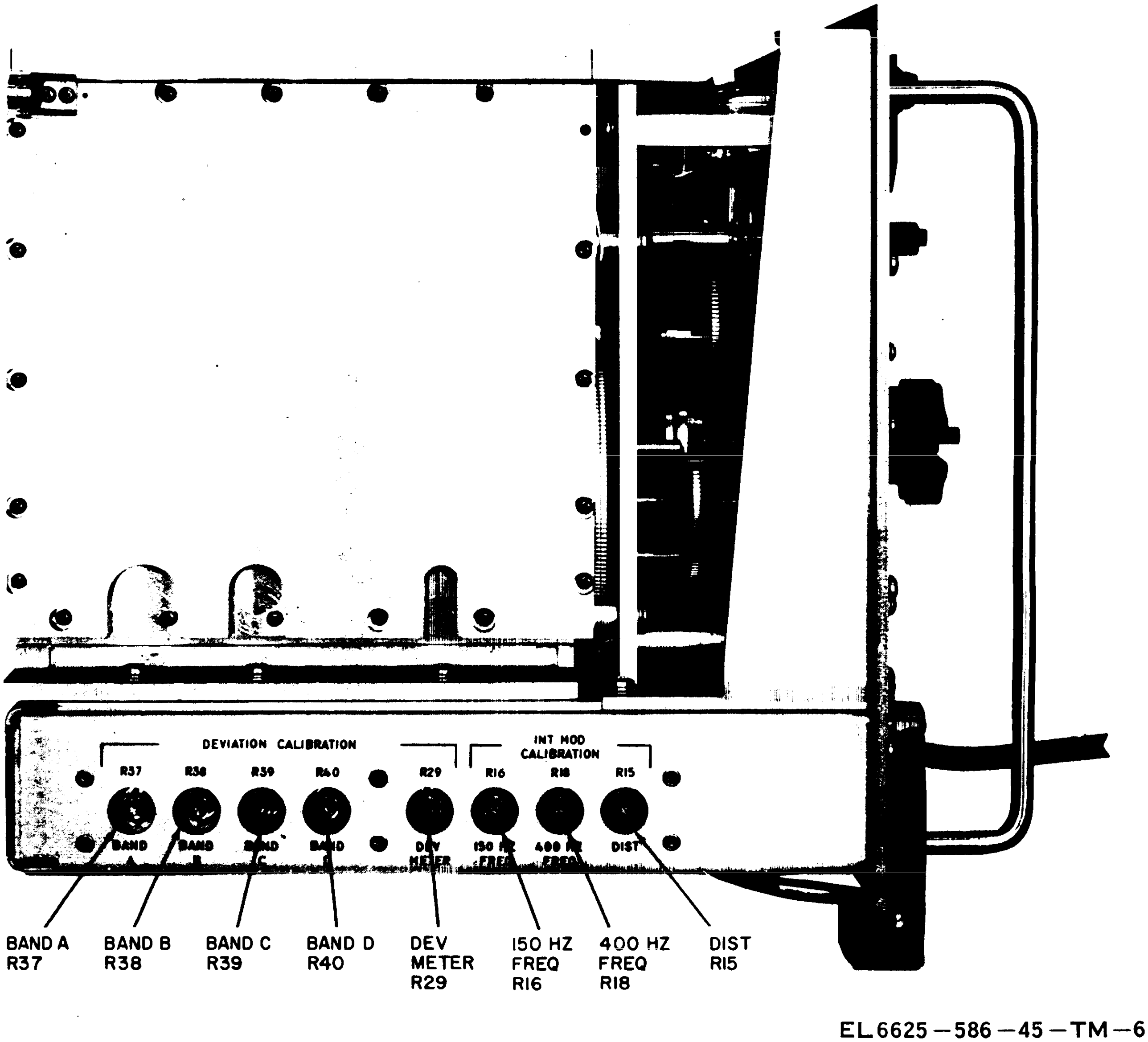


Figure 2-5. Generator, Signal SG-297/U, left side view.

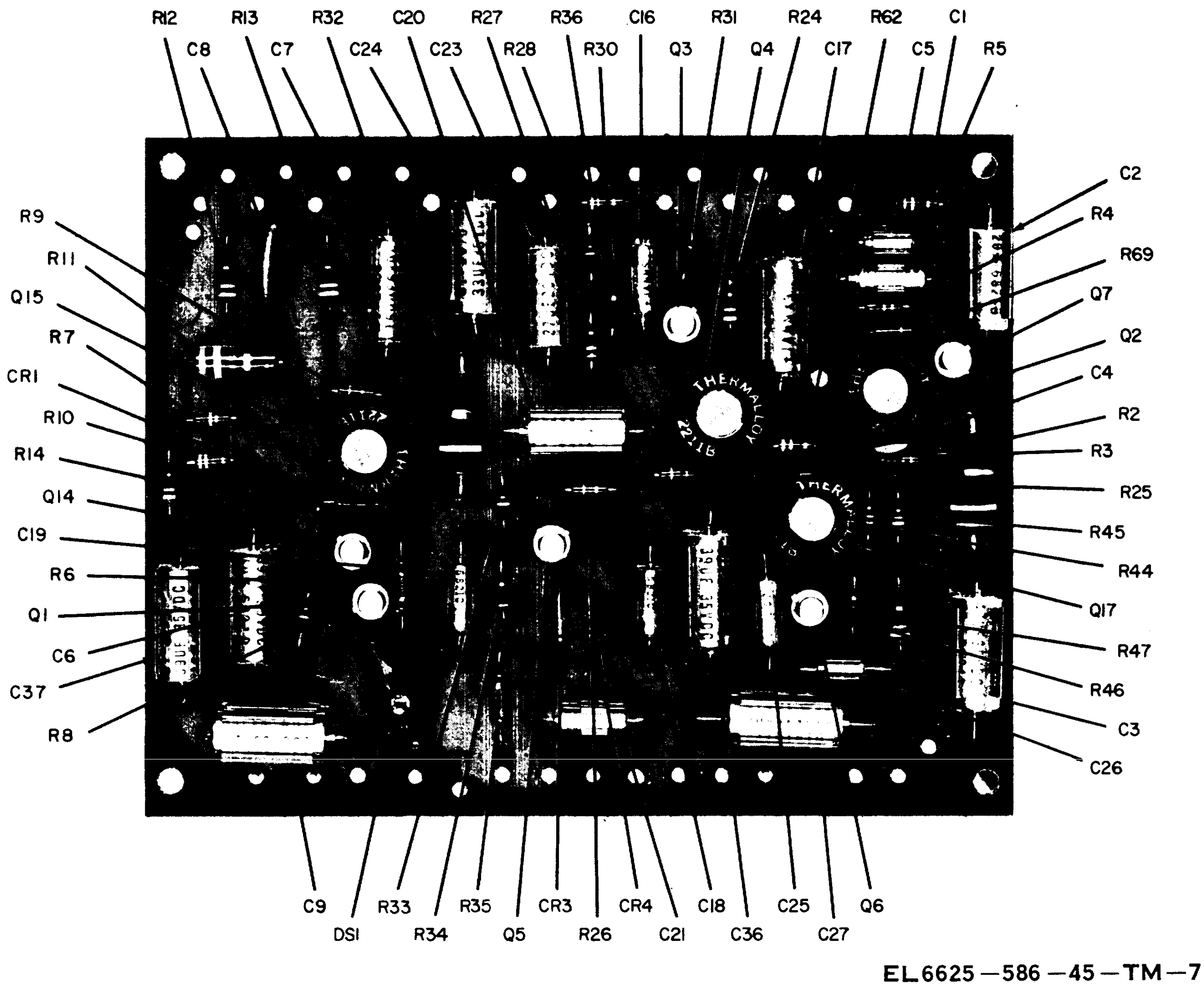


Figure 2-6. Audio board.

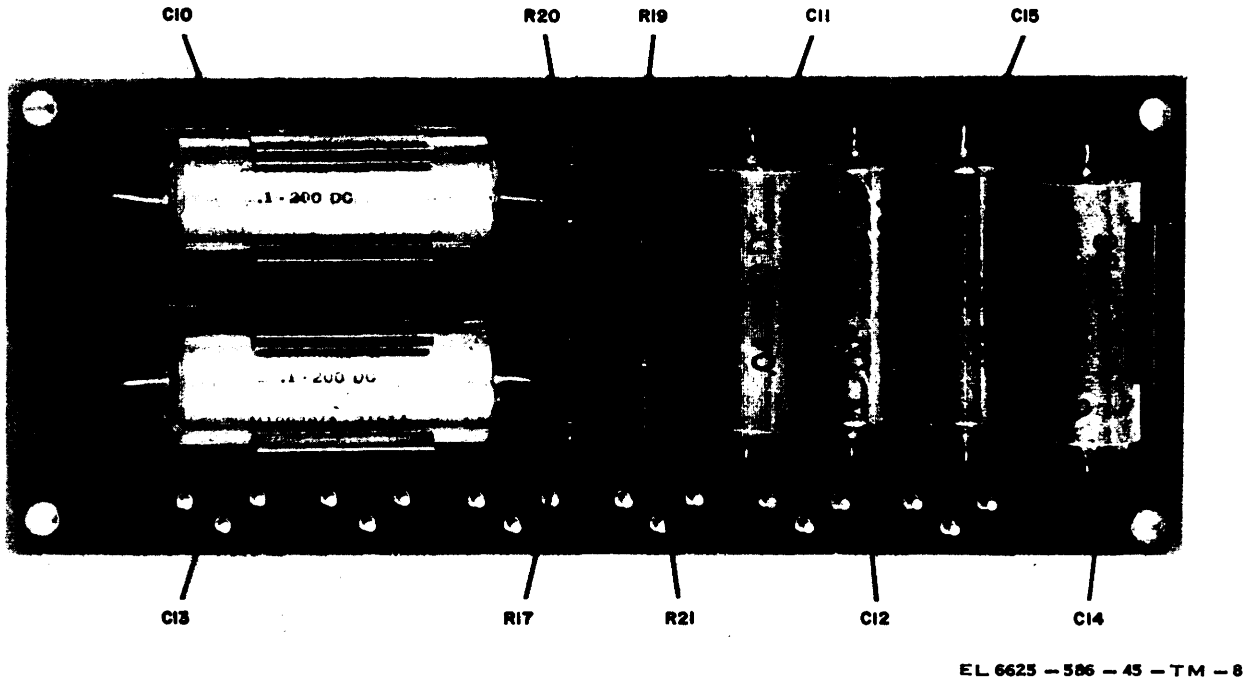


Figure 2-7. Wein bridge board.

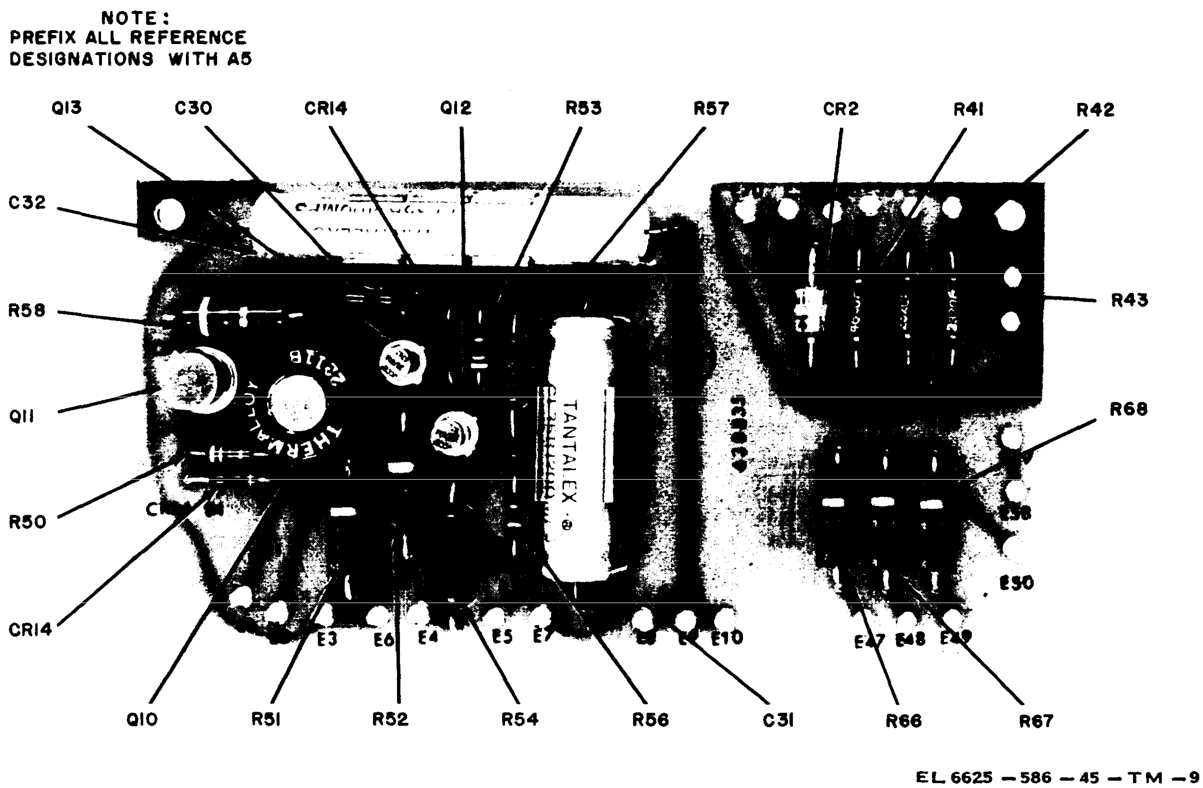
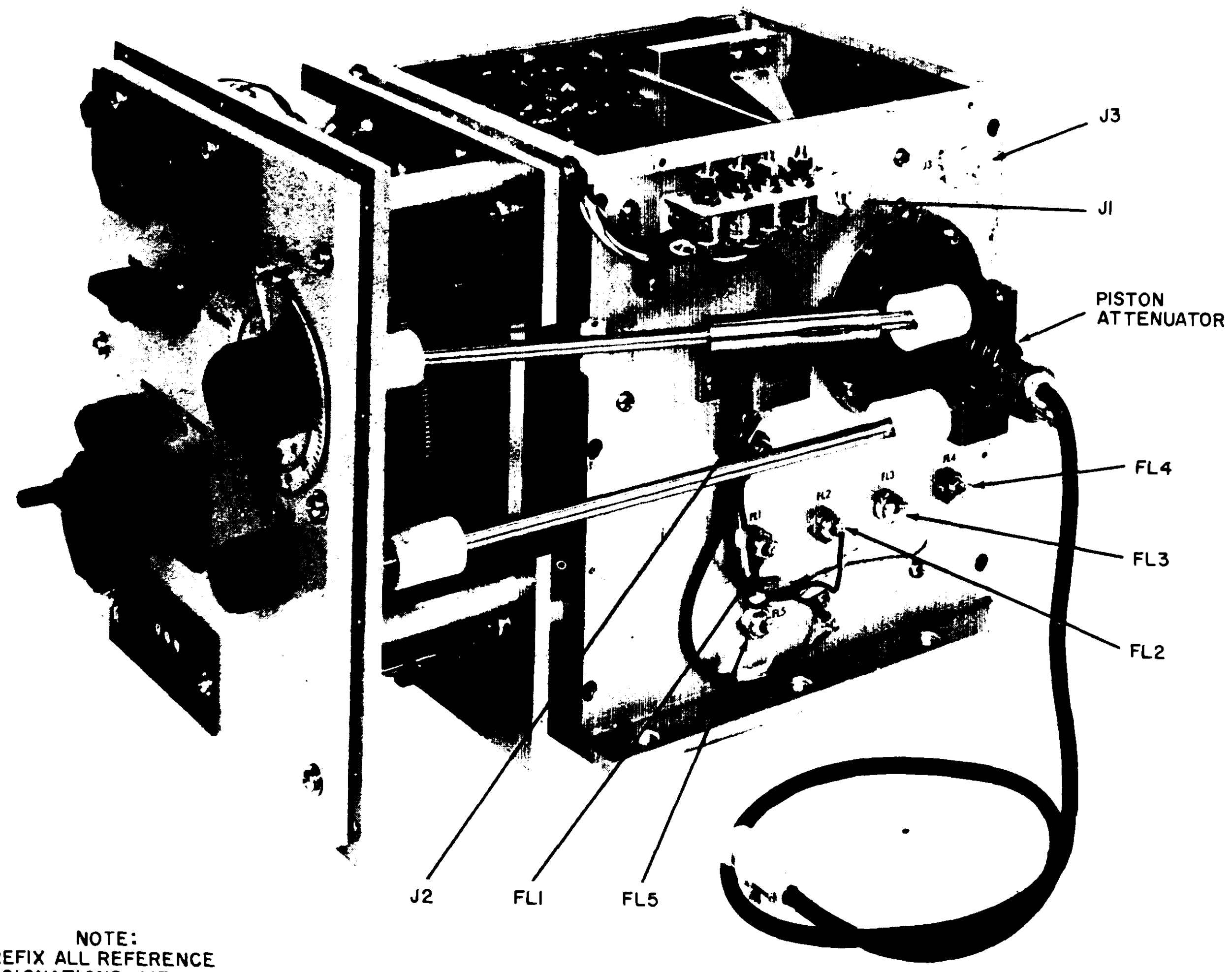


Figure 2-8. Power supply and miscellaneous components board A5.



NOTE:
PREFIX ALL REFERENCE
DESIGNATIONS WITH A1

EL6625-586-45-TM-10

Figure 2-9. RF assembly A1, side view.

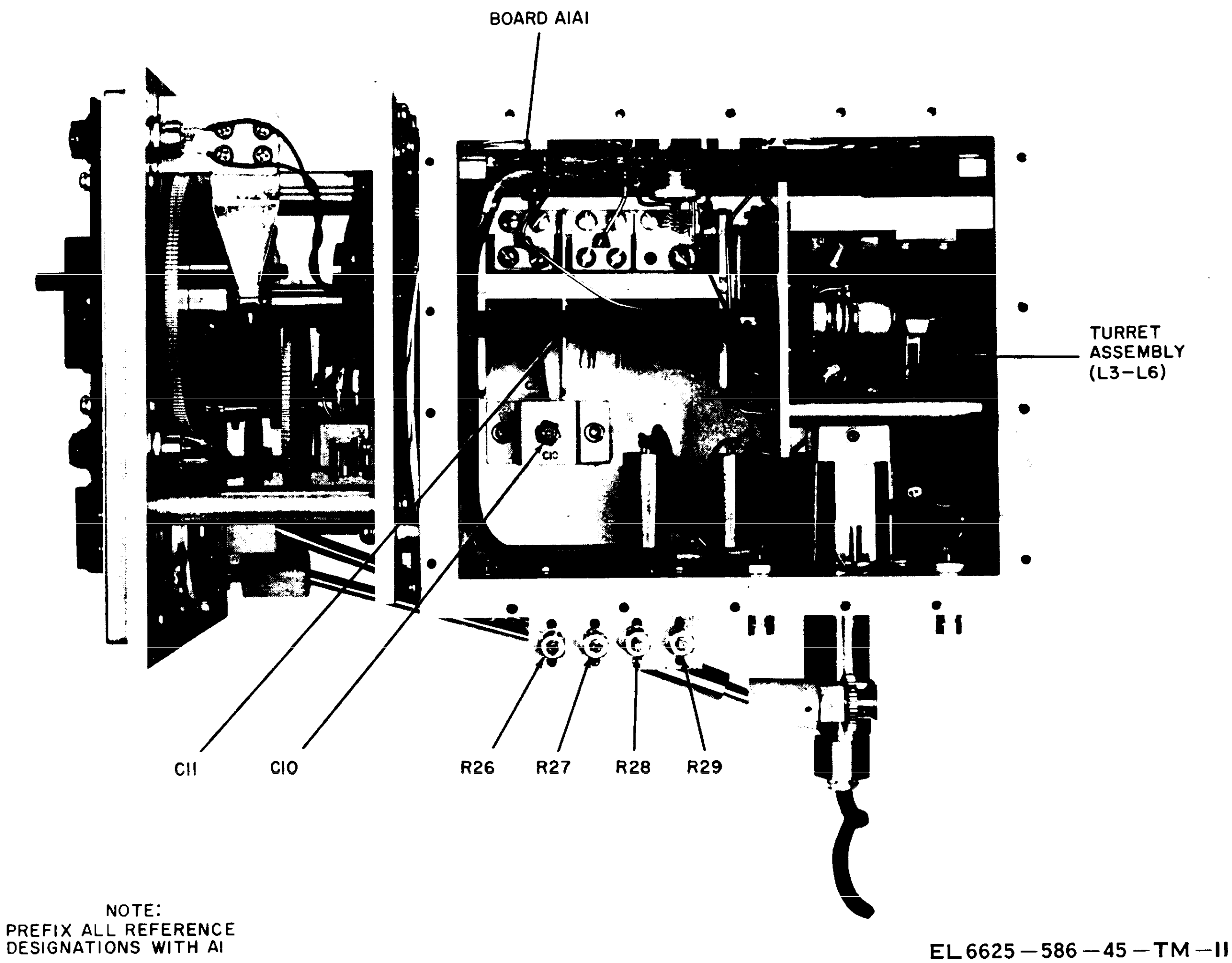


Figure 2-10. RF assembly A1, top view.

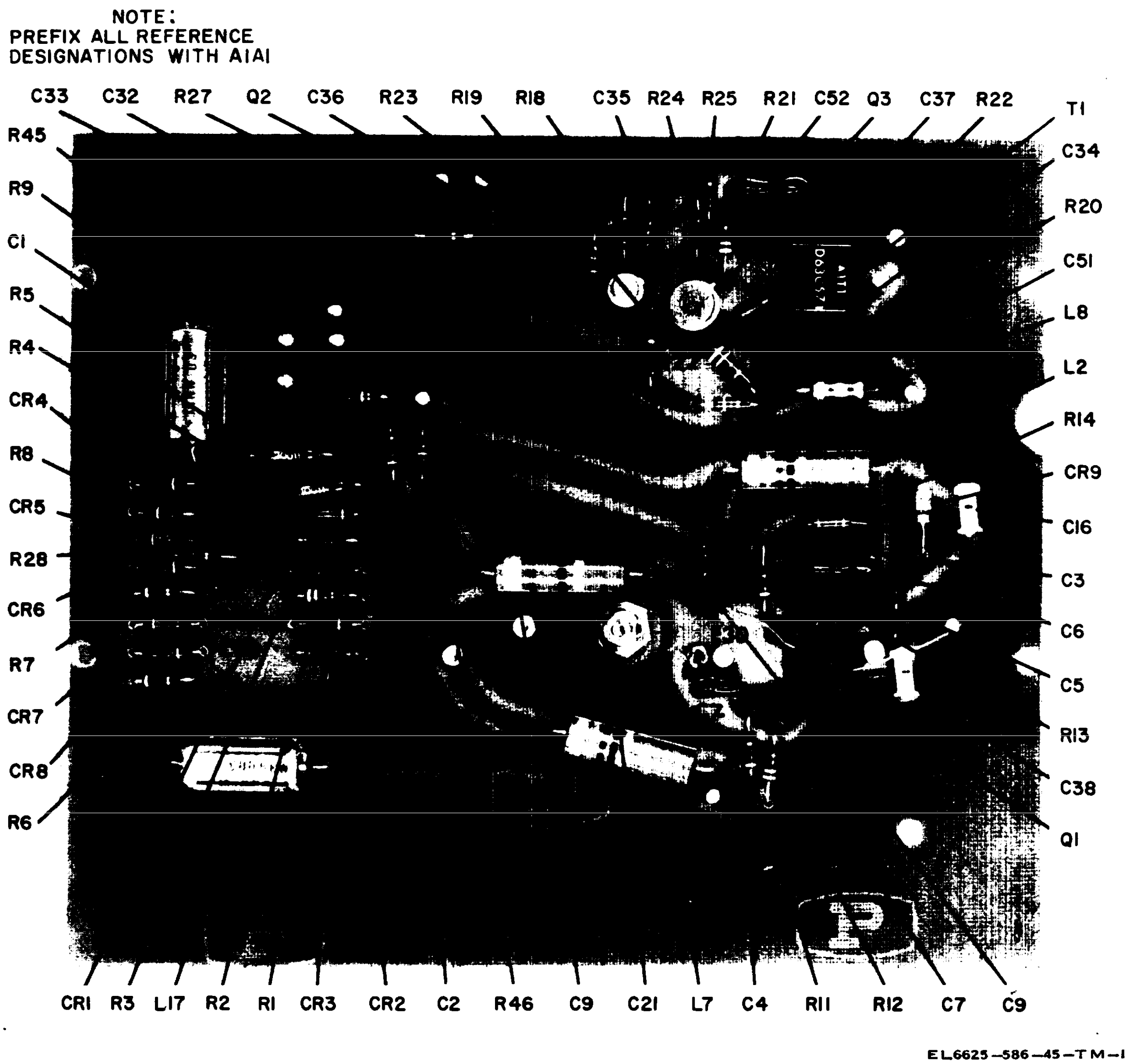


Figure 2-11. Board A1A1.

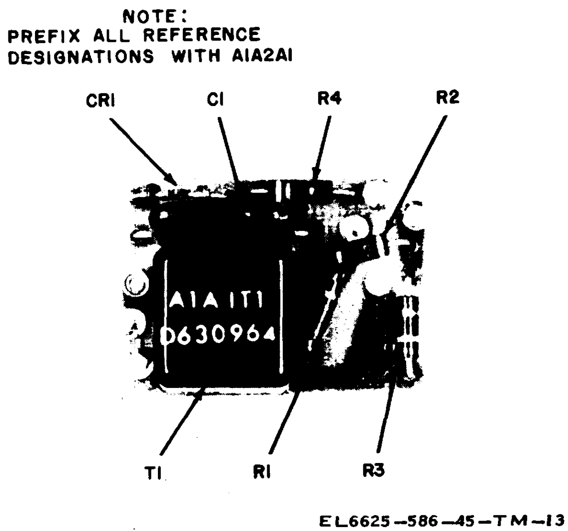


Figure 2-12. Board A1A2A1.

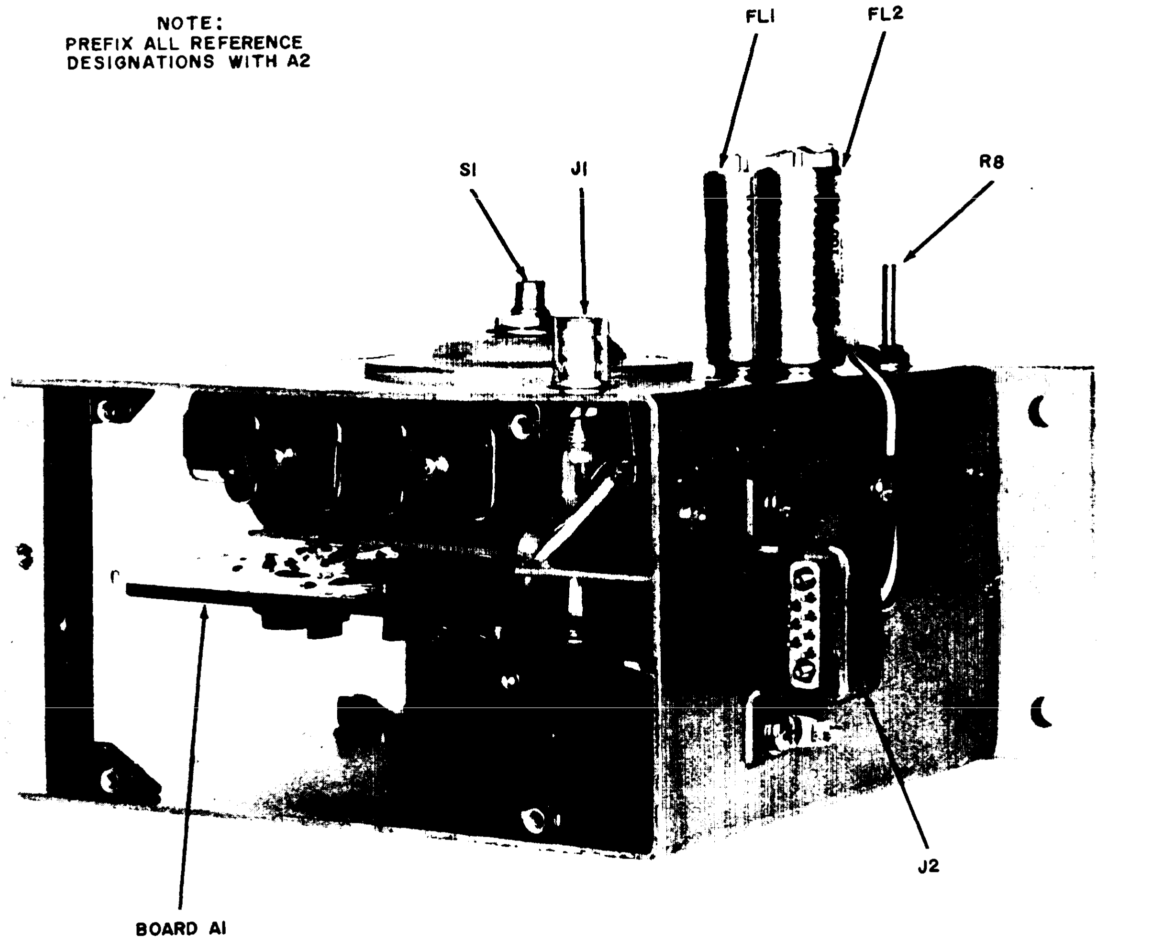


Figure 2–13. IF assembly A2, side view.

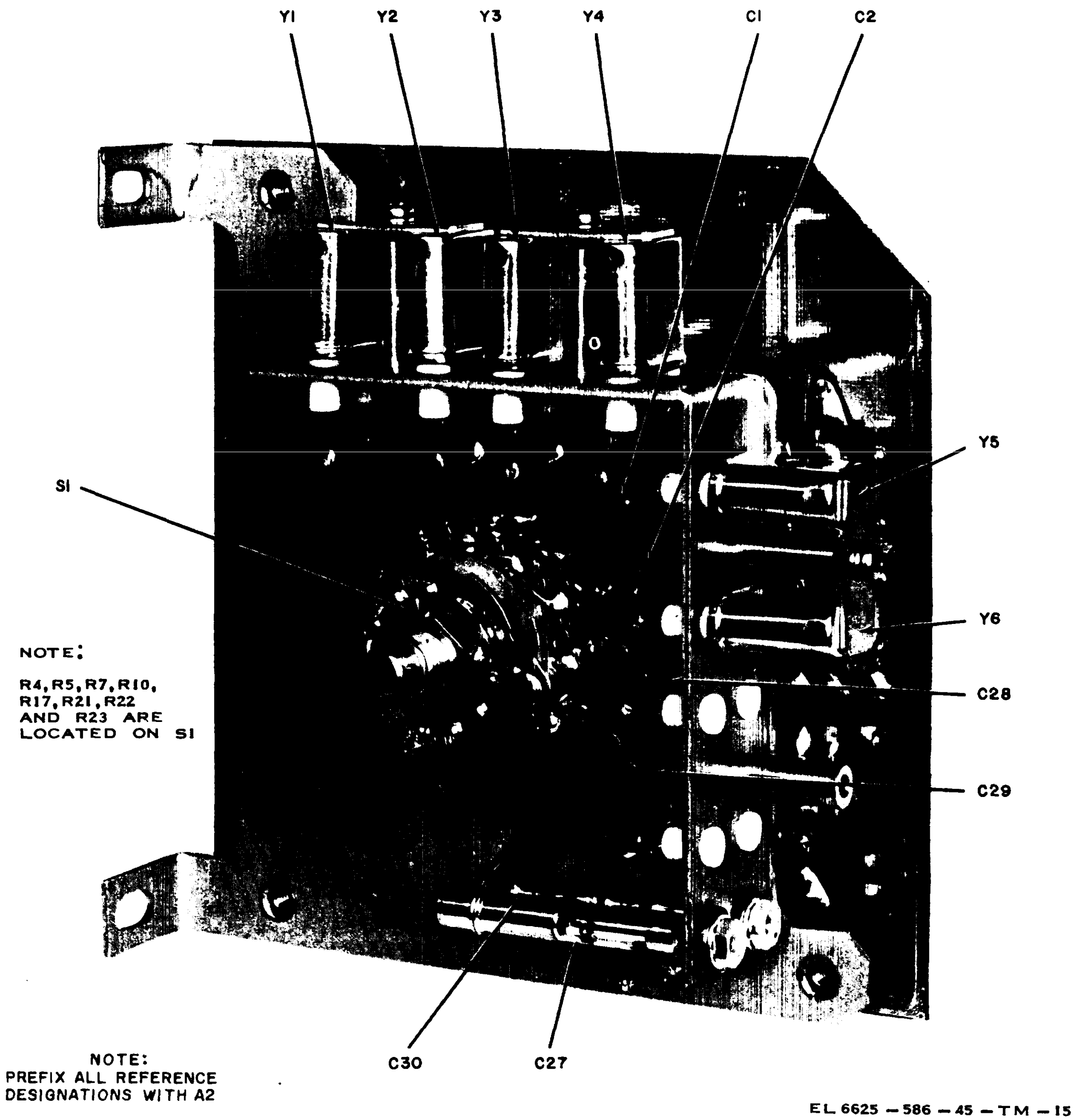


Figure 2-14. IF assembly A2, bottom view, cover and board A2A1 removed.

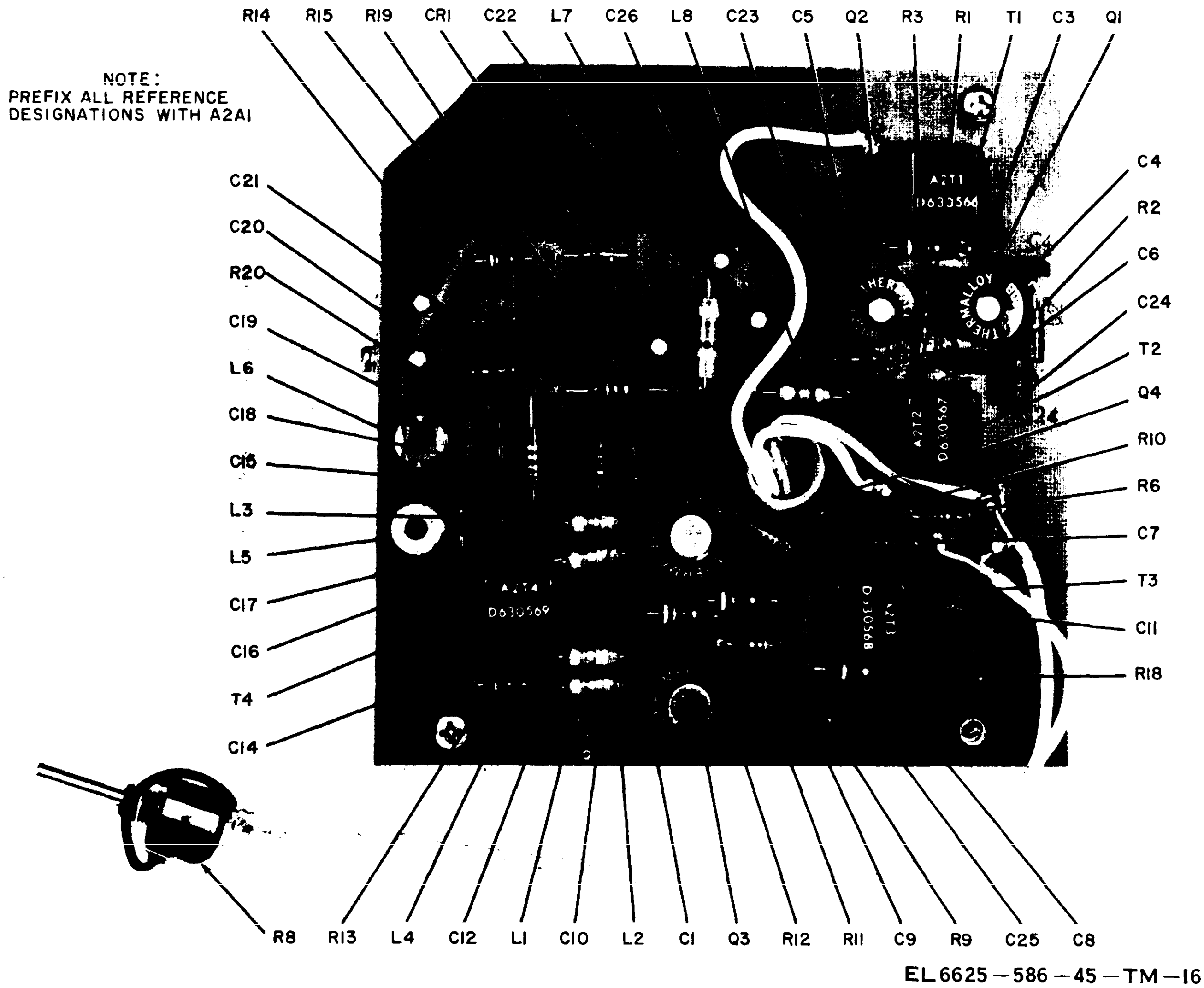


Figure 2-15. Board A2A1.

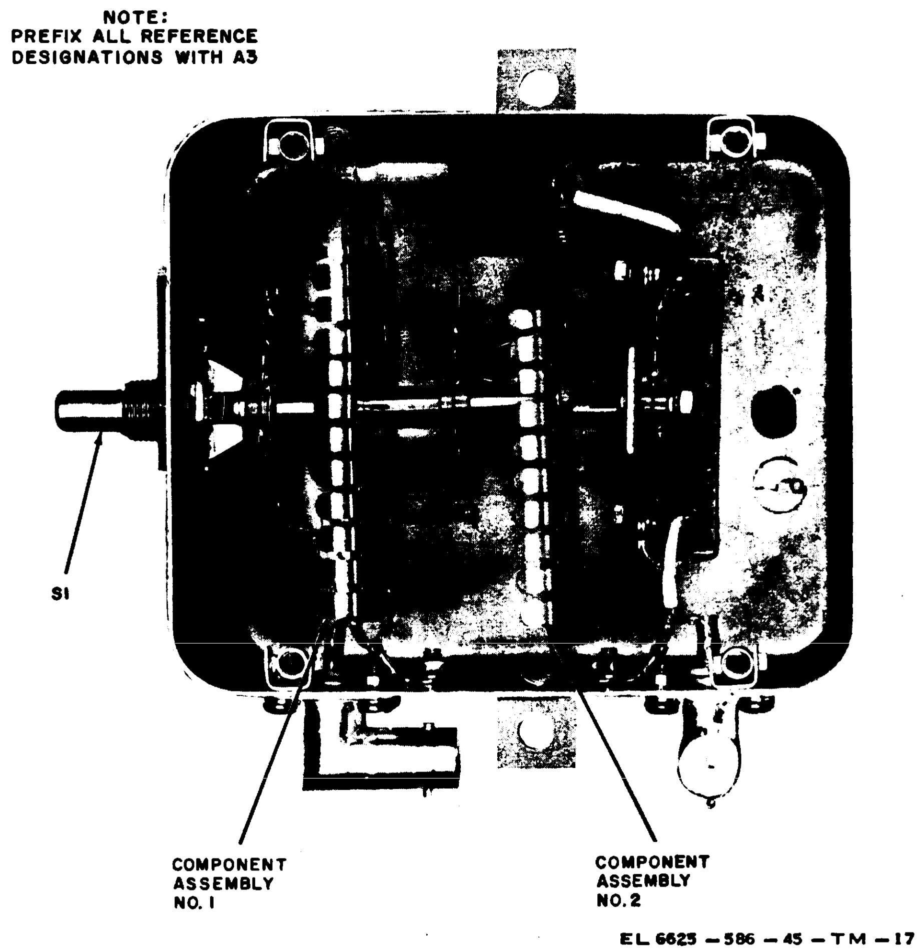


Figure 2-16. IF attenuator assembly A3, cover removed.

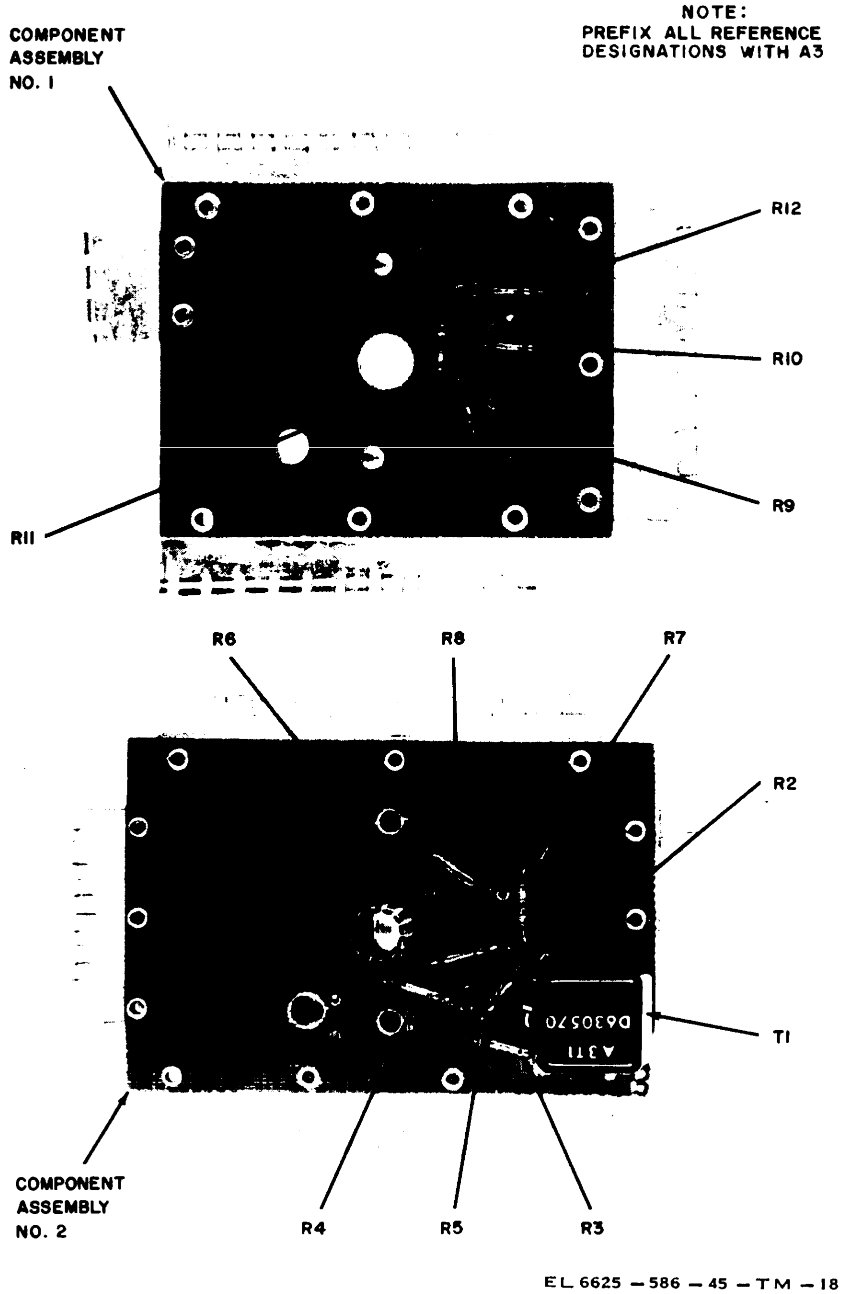


Figure 2-17. IF attenuator assembly A3, component assemblies.

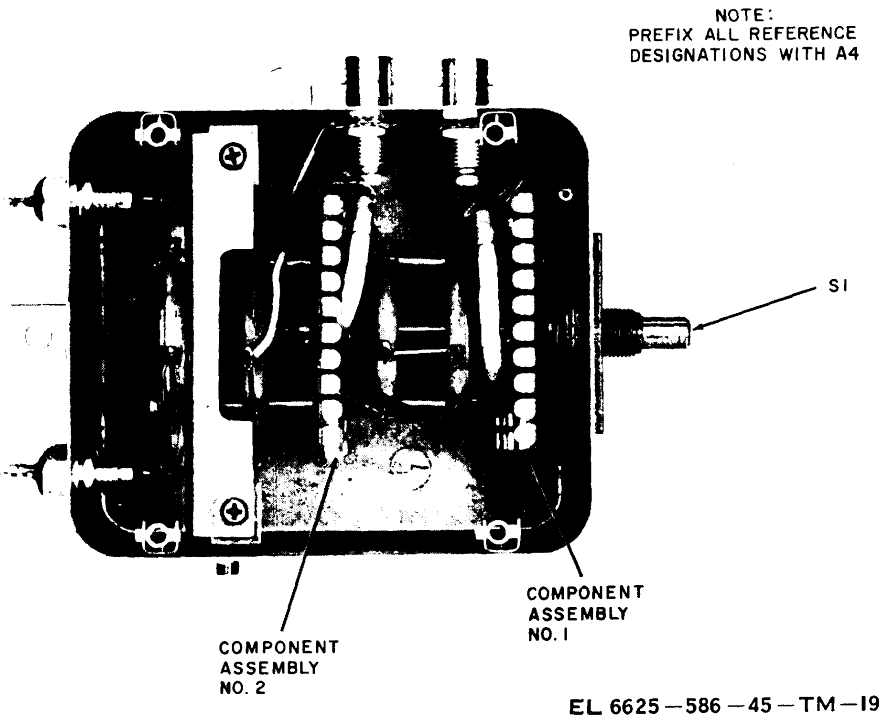


Figure 2-18. RF attenuator assembly A4, cover removed.

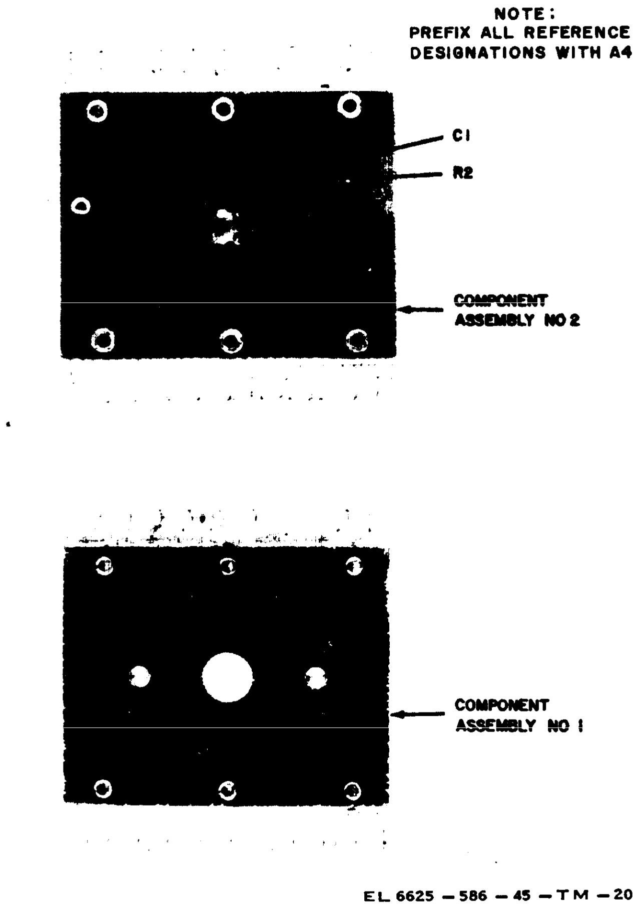


Figure 2-19. RF attenuator assembly A4, component assemblies.

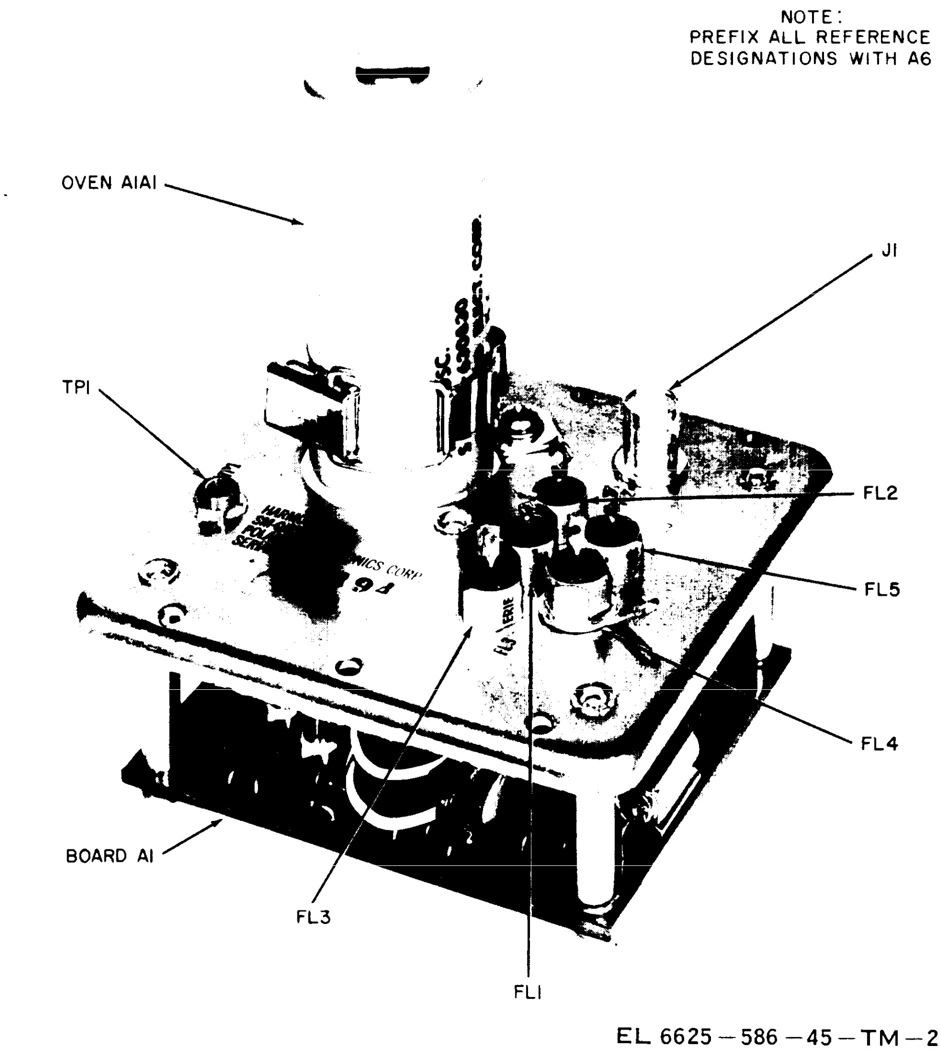


Figure 2-20. Harmonic generator assembly A6.

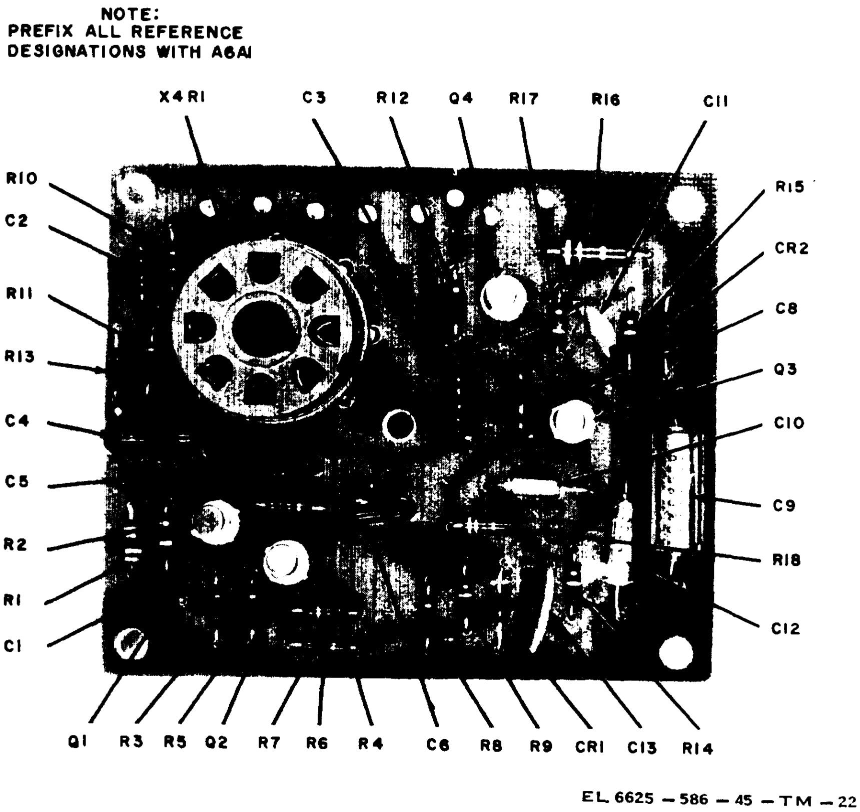


Figure 2-21. Board A6A1.

CHAPTER 3

REPAIRS AND ALIGNMENT

Section I. REPAIRS

3-1. General Parts Replacement Techniques

NOTE

Many of the parts used in the signal generator have precision tolerances greater than those used in most radio equipment. If these parts require replacement, use the exact value of the part removed. If even slightly different values are used, the calibration of the signal generator output will be inaccurate.

a. Most of the parts of the signal generator can be reached and replaced easily without special procedures. The sockets, capacitors, filter chokes, and inductors are mounted securely to the chassis with hexagonal nuts or binding head screws. The power transformers are bolted to the chassis. The nuts can easily be removed with a socket wrench. The dial knobs are removed with Allen wrenches. The thermistor covers are removed by loosening the two screws on the cover plate. If any of the switch wafers or potentiometers require replacement, carefully tag the wires or sketch the connections to avoid disconnection when the new component is installed. Follow this practice whenever replacement requires the disconnection of numerous wires.

b. Use a pencil-type soldering iron with a 25-watt maximum capacity. The signal generator is transistorized. If the iron must be used with ac, use an isolating transformer between the iron and the line. Do not use a soldering gun; damaging voltages can be induced in components.

c. When soldering transistor leads, solder quickly; wherever wiring permits, use a heat sink (such as long-nose pliers) between the soldered joint and the transistor. Use approximately the same length and dress of transistor leads as used originally.

3-2. Disassembly and Reassembly of Gear Train

The gear train is located between the front panel of the RF tuning section and the RF assembly.

a. Disassembly. To disassemble the gear train, proceed as follows (fig. 6-9):

(1) Remove all front panel controls and associated hardware (items 1 through 35, less 16, 17 and 18). When unsoldering connections, carefully tag each lead for future identification.

(2) Remove front panel (36) by removing the seven screws (16), lock washers (17) and flat washers (18) holding it in place.

(3) Follow the sequence given in figure 6-9 to disassemble the remaining items.

b. Reassembly. Follow the sequence given in figure 6-9, to reassemble the gear train.

Section II. ALIGNMENT

3-3. Test Equipment and Special Tools Required for Alignment

The following chart lists test equipment and special tools required for alignment of the signal generator, The chart also lists the associated technical manuals and the assigned common name.

Test equipment	Technical manual	Common name
Counter, Electronic Digital Readout, AN/USM–207	TM 11–6625–700-10	Electronic counter
Multimeter ME-26A/U	TM 11-6625-200-15	Multimeter

3-4. Power Supply Voltage Adjustment

a. Connect multimeter to TP2.

b. Turn signal generator controls to the positions listed below. Allow equipment warm up for 15 minutes before making any adjustments.

Switch	Position
OPERATE-OFF-STAND-BY	OPERATE
FUNCTION	MOD OFF
RF OUTPUT	0-10 KUV

c. Adjust ±25 VOLTS ADJ R55 for 25-volt indication on multimeter.

3-5. RF Frequency Range and Dial Accuracy Adjustment

a. Connect HI-RF terminal of unit under test through impedance matching network Z153 to FREQ A terminal of electronic counter.

b. Turn OPERATE-OFF-STANDBY switch to OPERATE and FUNCTION switch to MOD OFF.

c. With DIAL INDICATOR SET control, set the cursor to the center of the band select mask.

NOTE

Make certain the DIAL INDICATOR SET control is not moved during this procedure.

d. Turn RF OUTPUT switch to 250 KUV.

e. Set the unit to produce the frequencies listed in table 3-1. At each frequency, the electronic counter should indicate within the specification limits given in table 3–1. If unit is not within prescribed tolerances, adjust in accordance with steps *f* through *af*.

f. On board A1A1 adjust capacitor A1A1C10 until its plates are fully meshed.

g. With BAND SWITCH, select band D.

h. Connect AC probe of multimeter to test point A1A1TP1.

i. Adjust potentiometer R26 for a 10.0-volt dc indication on multimeter.

j. With RF TUNING control, select an output frequency of 80 MHz.

k. Adjust capacitor A1A1C21 until the electronic counter indicates 80 MHz.

l. If an 80 MHz electronic counter indication cannot be obtained in step ***k*** above, adjust band D coil A1A2L6 for an 80 MHz indication.

m. With RF TUNING control, select an output frequency of 53.5 MHz. Check electronic counter indication.

n. If electronic counter does not indicate 53.5 MHz, adjust band D coil A1A2L6 for desired indication.

o. Select output frequency of 80 MHz with RF TUNING control. Check electronic counter indication.

p. If electronic counter does not indicate 80 MHz, adjust capacitor A1A1C21 for desired indication.

q. Check tracking over entire band. If off, readjust capacitor A1A1C21 and band D coil A1A2L6.

r. Select band C with BAND SWITCH.

s. Adjust potentiometer R27 for a 10.0-volt dc indication on multimeter.

t. With RF TUNING control, select an output frequency of 54 MHz.

u. If electronic counter does not indicate 54 MHz, adjust band C coil A1A2L5 for desired indication.

v. Check tracking over entire band. If off, readjust band C coil A1A2L5.

w. Select band B with BAND SWITCH.

x. Adjust potentiometer R28 for a 10.7-volt dc indication on multimeter.

y. With RF TUNING control, select an output frequency of 38 MHz.

z. If electronic counter does not indicate 38 MHz, adjust band B coil A1A2L4 for desired indication.

aa. Check tracking over entire band. If off, readjust band B coil A1A2L4.

ab. Select band A with BAND SWITCH.

ac. Adjust potentiometer R29 for a 8.3-volt indication on multimeter.

ad. With RF TUNING control, select an output frequency of 26.5 MHz.

ae. If electronic counter does not indicate 26.5 MHz, adjust band A coil A1A2L3 for desired indication.

af. Check tracking over entire band. If off, readjust band A coil A1A2L3.

Table 3-1. RF Frequency Range and Dial Accuracy

Band	Unit under test frequency dial setting, MHz	Specification limits, MHz	
		Minimum	Maximum
A	18.5	18.4075	18.5925
	20.0	19.9000	20.1000
	24.4	24.2780	24.5220
	26.0	25.8700	26.1300
B	26.6	26.4670	26.7330
	30.4	30.2480	30.5520
	34.0	33.8300	34.1700
	37.6	37.4120	37.7880
C	37.6	37.4120	37.7880
	43.0	42.7850	43.2150
	47.0	46.7650	47.2350
	53.6	53.3320	53.8680

Table 3-1. RF Frequency Range and Dial Accuracy-Continued.

Band	Unit under test frequency dial setting, MHz	Specification limits, MHz	
		Minimum	Maximum
D	54.0	53.7300	54.2700
	60.0	59.7000	60.3000
	73.0	72.6350	73.3650
	79.6	79.2020	79.9980

3-6. IF Output Frequency Accuracy

a. Set OPERATE-OFF-STANDBY switch to OPERATE.

b. Turn FUNCTION switch to IF, IF MHZ switch to 4.300 and IF OUTPUT switch to 1.0 VOLT.

c. Connect electronic counter AN/USM–207 to IF output jack through impedance matching network ZI07.

d. Observe electronic counter reading and compare with limits specified in table 3-2.

e. Successively, turn IF MHZ switch to 5.600, 5.625, 5.650, 10.00 and 11.50. Repeat step *d* at each IF frequency.

Table 3-2. IF Output Frequency Accuracy.

IF Frequency (MHz)	Specification Limit (kHz)
4.300	± 2.15
5.600	± 2.80
5.625	± 2.81
5.650	± 2.82
10.00	±5.00
11.60	±5.75

CHAPTER 4

GENERAL SUPPORT TESTING PROCEDURES

4-1. General

a. Testing procedure are prepared for use by Electronics Field Maintenance Shops and Service Organizations responsible for general support maintenance of repaired equipment. These procedures set forth specific requirements that repaired equipment must meet before it is returned to the using organization.

b. Comply with the instructions preceding each chart before proceeding to the chart. Perform each step in sequence. For each step, perform all the actions required in the *Control settings* column; then perform each specific test procedure and verify it against its performance standard.

4–2. Test Equipment Required

All the test equipment required to perform the testing procedures given in this section are listed in the chart below, and are authorized under TA 11-17 and TA 11-100(11-17).

Nomenclature	Technical manual
Electronic, Counter, Digital Readout AN/ USM-207	TM 11-6625–700-10

4–3. Modification Work Orders

The performance standard listed in the tests (para 4–4 through 4–9) are based on the assumption that all modification work orders have been performed. A listing of current modification work orders will be found in DA Pamphlet 310–7.

4–4. Physical Tests and Inspections

a. Test Equipment and Materials. None.

b. Test Connections and Conditions.

(1) No connections necessary.

(2) Remove the unit from its case.

c. Procedure.

Step no.	Control Settings: Test equipment	Control Settings: Equipment under test	Test procedure	Performance standard
1	None	Controls may be in any position.	*a.* Inspect case and chassis for damage, missing parts, and condition of paint.	*a.* No damage evident or parts missing. External surfaces intended to be painted will not show bare metal. Panel lettering will be legible.
			Note. Touchup painting is recommended in lieu of refinishing whenever practical. Screw heads, binding posts, receptacles, and other plated parts will not be painted or polished with abrasives.	
			b. Inspect all controls and mechanical assemblies for loose or missing screws, bolts, and nuts.	*b.* Screws, bolts, and nuts will be tight and none missing.
			c. Inspect all connectors, sockets, receptacles, fuseholders and meters for looseness, damage or missing parts.	*c.* No loose parts or damage. No missing parts.
2	None	Controls may be in any position.	*a.* Rotate all panel controls throughout their limits of travel.	*a.* Controls will rotate freely without binding or excessive looseness.
			b. Inspect dial stops for damage or binding and for proper operation.	*b.* Stops will operate properly without evidence of damage.
			c. Operate all switches.	*c.* Switches will operate properly.

4–5. Operational Test

a. Test Equipment and Materials. None.

b. Test Connection and Conditions. Connect cables and impedance matching networks as follows:

Output connector	Cable	Impedance matching network
LO–RF	CG–546G/U	Z105
HI–RF	CG–530G/U	Z153
IF	CG–546G/U	Z107

c. Procedure.

Step no.	Control Settings: Test equipment	Control Settings: Equipment under test	Test procedure	Performance standard
1	None	*a.* OPERATE-OFF-STANDBY: STANDBY	*a.* None	*a.* STANDBY indicator lights.
2	None	*a.* OPERATE-OFF-STANDBY: OPERATE	*a.* None	*a.* OPERATE indicator lights.
3	None	*a.* FUNCTION: FREQ CAL *b.* BAND SWITCH: D *c.* RF TUNING: 62 MHz *d.* AUDIO VOL: clockwise	*a.* Slowly turn RF TUNING control.	*a.* Audio zero beat obtained.
4	None	*a.* FUNCTION: MOD OFF *b.* RF OUTPUT: 0-10 KV	*a.* Turn LO-HI RF SET TO LINE control.	*a.* Red line indicator on IF UV RF SET TO LINE meter is obtained.
5	None	*a.* RF OUTPUT: 62.5 KUV	*a.* Repeat step 4.	*a.* Same as step 4.
6	None	*a.* FUNCTION: FREQ CAL *b.* BAND SWITCH: C *c.* RF TUNING: 45 MHz	*a.* Repeat step 3.	*a.* Same as step 3.
7	None	*a.* Repeat step 4.	*a.* Repeat step 4.	*a.* Same as step 4.
8	None	*a.* Repeat step 5.	*a.* Repeat step 4.	*a.* Same as step 4.
9	None	*a.* FUNCTION: FREQ CAL *b.* BAND SWITCH: B *c.* RF TUNING: 32 MHz	*a.* Repeat step 3.	*a.* Same as step 3.
10	None	*a.* Repeat step 4.	*a.* Repeat step 4.	*a.* Same as step 4.
11	None	*a.* Repeat step 5.	*a.* Repeat step 4.	*a.* Same as step 4.
12	None	*a.* FUNCTION: FREQ CAL *b.* BAND SWITCH: A *c.* RF TUNING: 22 MHz	*a.* Repeat step 3.	*a.* Same as step 3.
13	None	*a.* Repeat step 4.	*a.* Repeat step 4.	*a.* Same as step 4.
14	None	*a.* Repeat step 5.	*a.* Repeat step 4.	*a.* Same as step 4.
15	None		*a.* Rotate LO RF UV control.	*a.* Operation is smooth.

Step no.	Control Settings: Test equipment	Control Settings: Equipment under test	Test procedure	Performance standard
16	None	*a.* FUNCTION: 150 Hz	*a.* Rotate DEVIATION control.	*a.* Full-scale deflection is obtained on DEVIATION meter.
		b. DEVIATION RANGE kHz: 10		
17	None	*a.* DEVIATION RANGE kHz: 20	*a.* Repeat step 16.	*a.* Same as step 16.
18	None	*a.* DEVIATION RANGE kHz: 40	*a.* Repeat step 16.	*a.* Same as step 16.
19	None	*a.* FUNCTION: 400 Hz	*a.* Repeat step 16.	*a.* Same as step 16.
		b. DEVIATION RANGE KHz: 10		*a.* Same as step 16.
20	None	*a.* Repeat step 17	*a.* Repeat step 16.	*a.* Same as step 16.
21	None	*a.* Repeat step 18.	*a.* Repeat step 16.	*a.* Same as step 16.
22	None	*a.* FUNCTION: 1000 Hz	*a.* Repeat step 16.	*a.* Same as step 16.
		b. DEVIATION RANGE KHz: 10		
23	None	*a.* Repeat step 17	*a.* Repeat step 16.	*a.* Same as step 16.
24	None	*a.* Repeat step 18	*a.* Repeat step 16.	*a.* Same as step 16.
25	None	*a.* FUNCTION: IF	*a.* Turn IF MHZ to each frequency position.	*a.* For each switch position check that full-scale indication can be obtained on IF UV RF SET TO LINE meter with IF UV control.

4–6. RF Frequency Range and Dial Accuracy Test

a. Test Equipment and Materials. Counter, Electronic Digital Readout AN/USM–207.

b. Test Connections and Conditions. Connect the equipment as shown in figure 4–1.

c. Procedure.

Step no.	Control Settings: Test equipment	Control Settings: Equipment under test	Test procedure	Performance standard
1	*a.* DISPLAY: Desired display time.	*a.* OPERATE-OFF-STANDBY: OPERATE	*a.* Turn on equipment and allow a few minutes to warm up before proceding.	*a.* None
	b. SENSITIVITY: 100V	*b.* FUNCTION: MOD OFF		
	c. Time Base: GATE TIME (Sec $-^{1}$)-10^{6}	*c.* Cursor to center of mask with DIAL INDICATOR SET control		
	d. FUNCTION: FREQ	*d.* RF OUTPUT: 250 KUV		
	e. POWER: STORE			
2			*a.* Select the following frequencies and check that they are within specified limits:	

Step no.	Test equipment	Equipment under test	Test procedure: Band	Test procedure: Frequency (MHz)	Performance standard: Limits, MHz Minimum	Performance standard: Limits, MHz Maximum
			A	18.5	18.4075	18.5925
				20.0	19.9000	20.1000
				24.4	24.2780	24.5220
				26.0	25.8700	26.1300
			B	26.6	26.4670	26.7330
				30.4	30.2480	30.5520
				34.0	33.8300	30.1700
				37.6	37.4120	37.7880
			C	37.6	37.4120	37.7880
				43.0	42.7850	43.2150
				47.0	46.7650	47.2350
				53.6	53.3320	53.8680
			D	54.0	53.7300	54.7200
				60.0	59.7000	60.3000
				73.0	72.6350	73.3650
				79.6	79.2020	79.9980

4–7. Resettability Test

a. Test Equipment and Materials. Counter, Electronic Digital Readout AN/USM–207.

b. Test Connections and Conditions. Connect the equipment as shown in figure 4–1.

c. Procedure.

Step no.	Control Settings: Test equipment	Control Settings: Equipment under test	Test procedure	Performance standard
1	*a.* SENSITIVITY: 100V	*a.* OPERATE-OFF-STANDBY	*a.* Turn on equipment and allow a few minutes to warm up before proceeding.	*a.* None
	b. FUNCTION: FREQ	*b.* FUNCTION: MOD OFF	*b.* Select frequency of 22.5 MHz with RF TUNING control.	*b.* None
	c. Time Base: GATE TIME (SEC $-^{1}$) -10^{6}	*c.* RF OUTPUT: 500 KUV	*c.* With ZERO SET control, zero the units/MHz counter.	*c.* None
	d. DISPLAY: desired display time		*d.* Record frequency on electronic counter for future reference.	*d.* None
	e. POWER: STORE			
2			*a.* Pull out RF TUNING control to engage units/MHz counter and increase frequency 0.1 MHz as indicated on units/MHz counter. Then, with RF	*a.* None

Step no.	Control Settings: Test equipment	Control Settings: Equipment under test	Test procedure	Performance standard
			TUNING control, tune through 0000 and decrease the frequency 0.1 MHz as indicated on the units/MHz counter. *b.* Tune to a 0000 reading on units/MHz counter with RF TUNING control.	*b.* Frequency indicated on electronic counter should be within ±0.1 percent of the frequency recorded in 1*d* above.

4–8. Carrier Frequency Shift Test

a. Test Equipment and Materials. Counter, Electronic Digital Readout AN/USM–207.

b. Test Connections and Conditions. Connect the equipment as shown in figure 4–1.

c. Procedure.

Step no.	Control Settings: Test equipment	Control Settings: Equipment under test	Test procedure	Performance standard
1	*a.* SENSITIVITY: 100V *b.* FUNCTION: FREQ *c.* Time Base: GATE TIME (SEC $^{-1}$) –10^6 *d.* DISPLAY: desired display time *e.* POWER: STORE	*a.* OPERATE-OFF-STANDBY: OPERATE *b.* FUNCTION: MOD OFF *c.* RF OUTPUT: 250 KUV	*a.* Allow equipment to warm up for two (2) hours.	*a.* None
2			*a.* Set signal generator to produce output frequency of 22 MHz. *b.* Record electronic counter reading for future reference.	*a.* None *b.* None
		Note. After selecting a RF frequency, allow at least five minutes for stabilization before performing a measurement		
3		*a.* DEVIATION: fully counterclockwise *b.* DEVIATION RANGE: 40 *c.* FUNCTION: 1000 Hz	*a.* Adjust deviation control for 25 kHz indication on DEVIATION meter.	*a.* The electronic counter should indicate within ±1.265 kHz of frequency recorded in step 2*b*.

Step no.	Test equipment	Control Settings: Equipment under test	Test procedure	Performance standard
4		*a.* FUNCTION: MOD OFF	*a.* Set signal generator to produce output frequency of 32 MHz. *b.* Record electronic counter reading for future reference.	*a.* None *b.* None
5		*a.* Repeat steps 3*a* through 3*c*.	*a.* Repeat step 3*a*.	*a.* The electronic counter should indicate within ±1.425 kHz of frequency recorded in step 4*b*.
6		*a.* FUNCTION: MOD OFF	*a.* Repeat steps 3*a* and 3*b* except set signal generator to produce output frequency of 45 MHz.	*a.* None
7		*a.* Repeat steps 3*a* through 3*c*.	*a.* Repeat step 3*a*.	*a.* The electronic counter should indicate within ±1.635 kHz of frequency recorded in step 6*a*.
8		*a.* FUNCTION: MOD OFF	*a.* Repeat steps 3*a* and 3*b* except set signal generator to produce output frequency of 67 MHz.	*a.* None
9		*a.* Repeat steps 3*a* through 3*c*.	*a.* Repeat step 3*a*.	*a.* The electronic counter should indicate within ±1.990 kHz of frequency recorded in step 8*a*.

4–9. IF Output Frequency Accuracy Test

a. Test Equipment and Materials. Counter, Electronic Digital Readout AN/USM–207.

b. Test Connections and Conditions. Connect the equipment as shown in figure 4–2.

c. Procedure.

Step no.	Control Settings: Test equipment	Equipment under test	Test procedure	Performance standard
1	*a.* SENSITIVITY: 100V *b.* FUNCTION: FREQ *c.* Time Base: GATE TIME (SEC $-^{1}$) -10^{6} *d.* DISPLAY: desired display time	*a.* OPERATE-OFF-STANDBY: OPERATE *b.* FUNCTION: IF *c.* IF OUTPUT 1.0 VOLT	*a.* Allow equipment to warm up for a few minutes before proceeding.	*a.* None

Step no.	Control Settings Test equipment	Equipment under test	Test procedure	Performance standard
	e. POWER: STORE			
2		*a.* IF MHZ: 4.300	*a.* Observe frequency counter reading.	*a.* 4.3000 ±.00215 MHz
		b. IF MHZ: 5.600	*b.* Observe frequency counter reading.	*b.* 5.6000 ±.00280 MHz
		c. IF MHZ: 5.625	*c.* Observe frequency counter reading.	*c.* 5.625 ±.00281 MHz
		d. IF MHZ: 5.650	*d.* Observe frequency counter reading.	*d.* 5.650 ±.00282
		e. IF MHZ: 10.00	*e.* Observe frequency counter reading.	*e.* 10.00 ±.0050 MHz
		f. IF MHZ: 11.50	*f.* Observe frequency counter reading.	*f.* 11.50 ±.00575 MHz

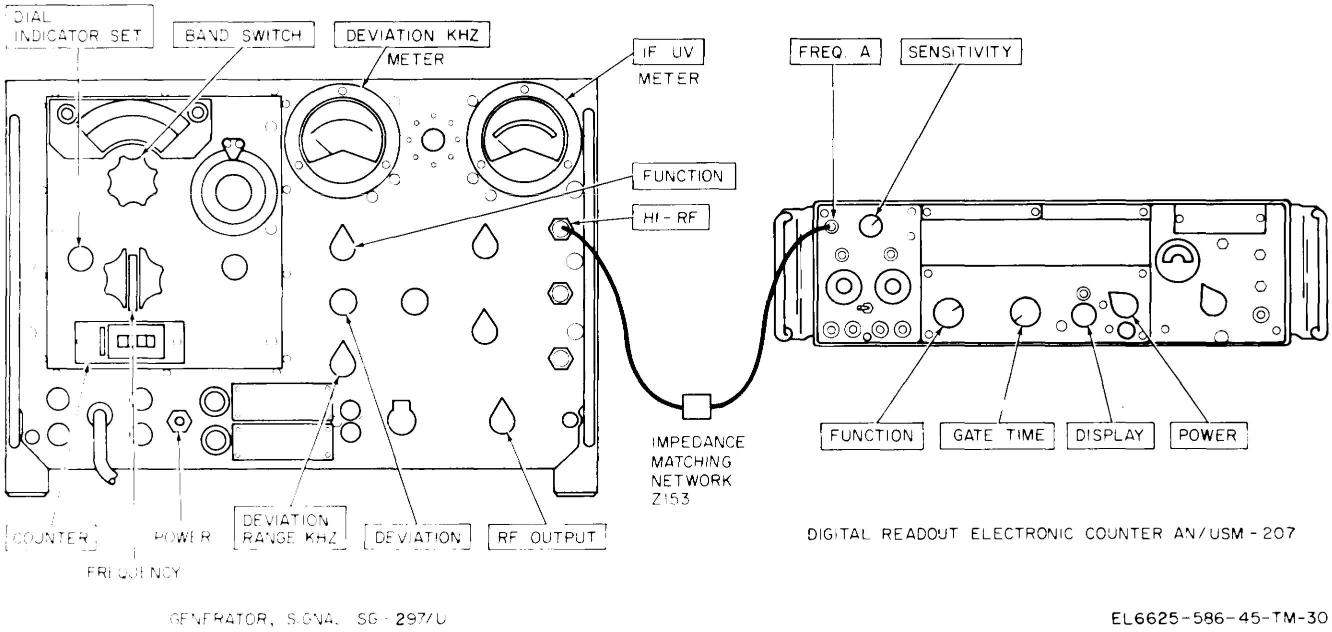


Figure 4-1. RF frequency range, dial accuracy, resettability, and carrier frequency shift test connections.

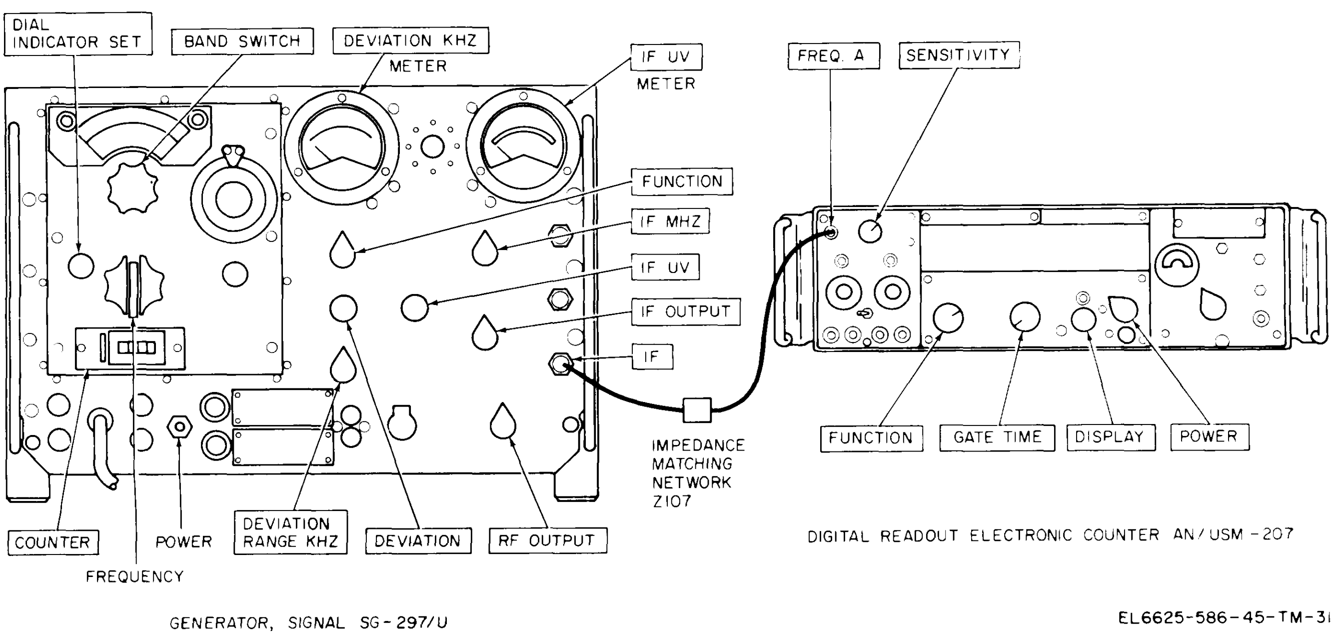


Figure 4-2. If Output Frequency Accuracy Test Connections.

CHAPTER 5

DEPOT MAINTENANCE

5-1. Depot Maintenance Operations

Complete rebuild of the signal generator and/or its individual components may be accomplished by depot maintenance facilities when authorized. Rebuild action will include all repairs, rebuild, and replacement operations necessary to make the equipment suitable for return to DA supply system stocks for re-issue to using organizations as equipment equivalent to new material. Detailed procedures for accomplishing the repairs and adjustments in the preceding portions of this manual and such additional repair and rebuild operations as deemed necessary, will be established by the facility performing the work. Chapter 6 establishes the requirements that must be met by rebuilt *or* repaired equipment before it is returned to DA supply system stocks.

5-2. General Parts Replacement Techniques

Parts replacement techniques applicable to depot maintenance facilities are the same as those applicable to lower maintenance categories. Refer to paragraph 3-1.

5-3. Equipment Alignment

Equipment alignment procedures applicable to depot maintenance facilities are those dictated by the equipment available to the depot and are given in the following paragraphs.

5-4. Test Equipment Required for Depot Maintenance

The following test equipment or their equivalents are required for depot testing:

RF Voltmeter AN/URM-145
Attenuator-Calibrator PRD Model 915B
Mixer PRD type UHF-600
Impedance Bridge General Radio Type 1650B
Radio Interference Measuring Set AN/URM-85
Distortion Analyzer Hewlett-Packard Model 334A
FM Deviation Meter Marconi Model TF 791D
Generator, Signal AN/USM-44
Generator, Signal AN/GRM-50

5-5. Low RF Voltage Range and Accuracy Adjustment

a. Table 5–1 gives the tolerances for the low RF voltage outputs. If an out of tolerance indication is observed, adjust in accordance with step *bq.*

b. Connect unit under test and test equipment as shown in figure 5-1A. Set signal generator controls as follows:

BAND SWITCH	B
RF TUNING	30 MHz
Function Switch	MOD OFF
RF OUTPUT	20, 0-10KUV
IF OUTPUT	OFF

NOTE

Allow all test equipment, except the RF voltmeter a minimum 1/2 hour warm-up period before using. Allow minimum of 5 minutes for RF voltmeter.

c. Turn LO RF UV dial such that 10KUV is under indicator line.

d. Turn LO-HI RF SET TO LINE control such that RF meter reads at “red line.”

e. Read voltage on RF voltmeter and compare with table 5-1.

f. Turn to LO RF UV dial such that 3KUV is under indicator line.

NOTE

RF meter will now read above "red line". Reposition LO-HI RF SET TO LINE control such that meter reads on “red line”.

g. Read voltage on RF voltmeter and compare with table 5-1.

h. Turn to LO RF UV dial such that lKUV is under indicator line.

i. Read voltage on RF voltmeter and compare with table 5-1.

Table 5-1. Low RF Output Voltage Range and Accuracy

LO RF UV setting	Measured output voltage (uv)
10K	8.5K - 11.5K
3K	2.55K - 3.45K
1 K	.85K – 1.15K
300K	255K – 345K
100	85 – 115
30	25.5 – 34.5
10	8.5 – 11.5
3	2.55 - 3.45
1.0	.85 -1.15
0.3	.255 -.345

j. Turn BAND SWITCH and RF TUNING such that signal generator output frequency is 50 MHz.

k. Repeat steps c through i for 50 MHz.

l. Turn BAND SWITCH and RF TUNING such that signal generator output frequency is 80 MHz.

m. Repeat steps *c* through *i* for 80 MHz.

n. Connect unit under test and the test equipment as shown on figure 5–lB.

o. Turn BAND SWITCH and RF TUNING such that signal generator output frequency is 30 MHz.

p. Disengage fast tuning from tuning dial of signal generator.

q. Set to LO RF UV dial such that 10KUV is under indicator line.

r. Turn RF. SET TO LINE CONTROL such that RF meter reads on “red line.”

s. Perform the following set-up procedure on the attenuator calibrator.

(1) Turn reference attenuator until approximately 16 db is displayed in attenuation window.

(2) Turn REF GEN control to mid range.

(3) Turn XTAL-AFC switch to AFC position, and AFC gain to mid range.

(4) Turn AFC switch to ON position.

(5) Turn MIXER switch to internal position.

(6) Turn VIDEO SET knob to zero; NORMAL switch to zero. Turn meter zero for nulls; levels to normal.

(7) On signal generator, turn RF TUNING dial until AFC DEV meter on attenuator calibrator reads zero. Rotation of RF TUNING dial above and below 30 MHz should make meter read above and below zero.

(8) Turn reference attenuator knob until null meter reads zero.

(9) Turn OPERATE-OFF-STANDBY switch on signal generator to OFF position.

(10) Turn power level switch maximum counterclockwise to off position.

(11) Turn NOISE BALANCE knob until NULL meter reads zero. This is a very critical adjustment. Therefore special care must be taken that NULL meter reads zero. Use reference attenuator knob if required to null meter. Once knob is set, be extremely careful not to move it.

(12) Turn power switch on signal generator to OPERATE position.

(13) Turn power level clockwise to mid range. Then turn knob to peak NULL meter or until meter reads maximum.

NOTE

NULL meter peaks when needle deflects to the left. This indicates that the power level is increasing. Maximum power is indicated by greatest deflection to left.

(14) Repeat step (7) above.

(15) On attenuator calibrator set ZERO SET-NORMAL switch to ZERO SET. Set meter to zero. Set switch back to NORMAL.

(16) Check Video Level meter. Indicator should be on set line. Adjust VIDEO SET knob if required.

(17) Recheck signal generator that RF meter reads on “red line”, adjust if required.

(18) On attenuator calibrator, reset. reference attenuator knob such that NULL meter reads exactly zero. Read value of attenuation through window on attenuation counters. Record this value (in db) as reference A.

NOTE

Reference A is the attenuation level which corresponds with approximately 10KUV or -27 dbm out of the signal generator.

(19) Disconnect attenuator calibrator from Z105 and connect RF voltmeter. Place RANGE switch in .01 position.

(20) Read voltmeter in volts and record as reference B. If voltage is exactly 10KUV, record reference C as –27 dbm. If voltage is not exactly 10KUV read db difference on meter from 10KUV reading. If reading is below 10KUV, add a negative db difference to –27 dbm and record as reference C.

Example. Meter reads .95 on .01 range. On db scale this corresponds to –.5 db, then (-27 + -.5) = –27.5. Record –27.5 dbm as reference C. If reading is above 10KUV, add a positive db difference to –27 db and record as reference C. For reading above 10KUV switch to .03 range.

Example. Meter reads 1.1 on .03 range. On db scale this corresponds to -9 db (1.0 volts corresponds to –10 db on meter). Therefore

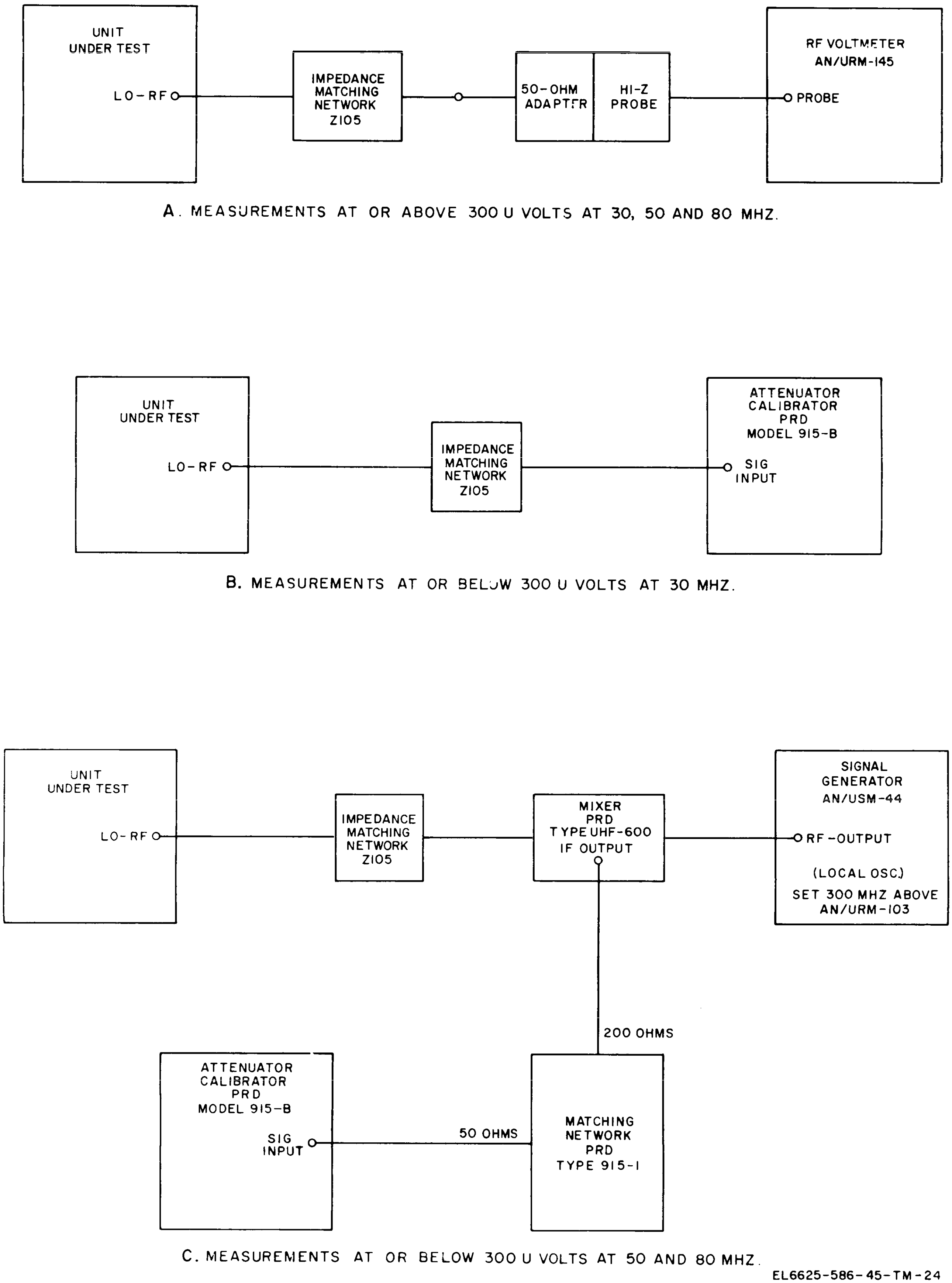


Figure 5-1. Low RF voltage range and accuracy test setup.

reading is +1 db greater 10KUV, then (–27 + + 1) = –26. Record–26 dbm as reference C.

(21) Disconnect RF voltmeter and reconnect circuit as shown in figure 5–1B.

(22) Recheck that reference A attenuator reading is the same as in step (18) above. Null indication should be within ± .1 db of reference A.

t. On signal generator turn LO RF UV until 300 UV is under indicator line. Turn RF SET TO LINE control for "red line" indication on RM meter.

u. On attenuator calibrator, turn reference attenuator until NULL meter reads zero. Check that AFC DEV meter reads zero and VIDEO LEVEL is at set point. Adjust if required.

v. Read value of attenuation through window and record as L_1.

w. Perform the following calculation for the measured value of attenuation, L (in dbm).

L_1 – Reference A + Reference C = –L (where L_1, and Reference A are in db; L and Reference C are dbm).

Example: L_1 = 47.3 db
reference A = 16.2 db
reference C = –27.0 dbm
then 47.3 –16.2 + –27.0 = –L
31.1 + 27 = L
L = -58.1 dbm

x. Convert the value of L above into an absolute voltage as follows:

(1) Refer to table 5-2 for dbm value corresponding to voltage indicated on LO RF UV dial of signal generator. Let dbm value from table 5–2 be M.

Then $|M| - |L| = \Delta$ dbm where dbm = dbm deviation from indicated dial reading.

If $|M| > |L|$, db is positive and represents a gain, and if $|M| < |L|$,Δ db is negative and represents a loss.

(2) From table 5-3 find multiplying factor for value of Δ dbm.

(3) Multiply voltage on LO RF UV dial by multiplying factor and record.

Example. Let L = –58.1 dbm
from table 3-3 300KUV = –57.4 dbm = M
then dbm
57.4 –58.1 = -.7 db (a loss) or .923 (from table 34
then V = 300 UV x (.923) = 276.900UV

Table 5-2. Voltage/dbm Convection

Voltage	dbm
10KUV	-27
3KUV	-37.4
lKUV	-47
300KUV	-57.4
100KUV	-67
30KUV	-77.4
10KUV	-81
3KUV	-97.4
lKUV	-107
.3KUV	–117.4

Table 5-3. Determining Gain or Loss from db Readings

db	Multiplier Gain	Loss	db	Multiplier Gain	Loss
.1	1.01	.989	1.6	1.20	.832
.2	1.02	.977	1.7	1.22	.822
.3	1.03	.966	1.8	1.23	.813
.4	1.05	.955	1.9	1.24	.803
.5	1.06	.944	2.0	1.26	.794
.6	1.07	.933	2.2	1.29	.776
.7	1.08	.923	2.4	1.32	.759
.8	1.10	.912	2.6	1.35	.741
.9	1.11	.902	2.8	1.38	.724
1.0	1.12	.891	3.0	1.41	.708
1.1	1.13	.881	3.2	1.44	.692
1.2	1.15	.871	3.4	1.48	.676
1.3	1.16	.861	3.6	1.51	.661
1.4	1.17	.851	3.8	1.55	.646
1.5	1.19	.841	4.0	1.58	.631

This is the absolute output voltage with LO RF UV dial at 300 UV and RF meter at red line.

y. Repeat steps *t* through *x* for values on the LO RF UV dial of 100, 30, 10, 3, and 1UV and record.

z. On signal generator turn LO RF UV dial such that 3KUV is under indicator line check that RF meter is set to "red line."

aa. Disconnect attenuator calibrator from test set-up and connect RF voltmeter to output of Z105.

ab. Read value of voltage on RF voltmeter and record as VH.

ac. Disconnect RF voltmeter and reconnect attenuator calibrator as shown in figure 5–1B.

ad. On signal generator turn RF SET knob maximum clockwise. RF meter should peg.

ae. On attenuator calibrator, turn reference attenuator knob until null meter reads zero. Check that AFC DEV meter reads zero and VIDEO LEVEL meter is at set point. Make adjustments if needed.

af. Read value of attenuation on attenuation counters and record as L_H.

ag. On signal generator turn LO RF UV dial such that .3UV is under indicator line.

ah. Repeat steps *ae* and *af* and record value of attenuation as L_L.

ai. Perform the following calculation for the output voltage when –80 db attenuation is inserted.

$$V_L = V_H (1 \times 10^{-4})$$

where: V_L and V_H are in volts. (V_H from step *ab)* and (1×10^{-4}) is loss factor far -80 db.

Note. 3KUV = -37.4 dbm
.3UV = –117.4 dbm
-117.4- (-37.4) = -80

aj. Calculate measured db change between settings 3KUV and .3UV on LO RF UV dial.

$$L = L_H - L_L$$

where: L = db change from 3KUV to .3UV settings on dial.

L_H from step *af.*
L_L from step *ah.*

ak. Calculate change in attenuation (in db) as the difference between theoretical value of loss (–80 db) and actual measured value of loss.

$$\Delta db = |L| - 80$$

where: L = measured value of attenuation in db from step *aj.*

al. If Δ db = 0, record output voltage as value of V_L of step *ai* and proceed to step *ao* (multiplying factor = 1).

am. If Δ db is positive, attenuation is greater than 80 db and Δdb is a loss; and if Δdb is negative, attenuation is less than 80 db and Δdb is a gain. From table 5–3 determine multiplying factor for calculated value of Δ db. Remember use loss column if Δdb is positive, and gain column if Δdb is negative.

an. Calculate output voltage record.

$$V = V_L \times \text{(Multiplying factor)}$$

where: V_L and V are in volts.

ao. Disconnect test set-up and connect test set-up as shown in figure 5–lC.

ap. On signal generator, turn BAND SWITCH and RF TUNING such that output frequency is 50 MHz. Place LO RF UV dial such that 10KUV is under indicator line. Turn RF SET TO LINE control such that RF meter reads on “red line.” All other controls remain as is.

aq. Set controls an test oscillator as follows:

Attenuator dial	+5 dbm position
BAND SWITCH	C
TUNING	80 MHz
OUTPUT LEVEL	adjust for set level mark on OUTPUT meter
SELECTOR	CW position

ar. On matching network set trimmer at mid range.

as. On attenuator calibrator, turn reference attenuator knob until NULL meter reads zero; set AFC switch to OFF position.

at. On test oscillator adjust tuning dial until AFC–DEV meter reads zero.

au. On attenuator calibrator, turn AFC switch to ON position. Adjust VIDEO SET for set point reading on VIDEO LEVEL meter.

av. On matching network turn trimmer to peak NULL meter on attenuator calibrator. Keep NULL meter on high sensitivity range by decreasing reading on attenuation counters by turning reference attenuator knob.

aw. On test oscillator trim output level control for peak reading on NULL meter of attenuator calibrator. Keep NULL meter on high sensitivity range as stated in step *av.*

ax. Turn power off on AN/URM–103 test oscillator.

ay. Repeat steps *s* (10) and *s* (11).

az. Turn AN/URM–103 and test oscillator to power on.

ba. Repeat step *s* (13).

bb. Repeat steps *as* through *aw.*

bc. Repeat steps *s* (16) through *s* (21) and record reference A, reference B, and reference C for 50 MHz readings and calculations.

bd. Repeat steps *u* through *y.*

be. Repeat. steps *u* through *y* for values on LO RF UV dial of 100, 30, 10 and 3 UV and record under 50 MHz.

bf. Repeat step *z* except use 1KUV setting.

bg. Repeat steps *aa* and *ab.*

bh. Disconnect RF voltmeter and connect test set up as shown in figure 3–lc.

bi. Repeat steps *ad* through *af.*

bj. On AN/URM-103 turn LO RF UV dial such that lUV is under indicator line.

bk. Repeat steps *ae* and *af* and record value of attenuation as L_L.

bl. Repeat steps *ai* through *an* except in step *ai* use loss factor of (1×10^{-3}) for 60 db. Calculations in this case determine the voltage output with LO RF UV dial at lUV and RF meter set at “red line”, and output frequency of 50 MHz. The procedure is the same as for 30 MHz except measured db step is from lKUV –60 db, instead of a –80 db step as in the 30 MHz case.

bm. On signal generator turn BAND SWITCH and RF TUNING dial such that output frequency is 80 MHz.

bn. On test oscillator turn tuning dial to 50 MHz.

bo. On signal generator set LO RF UV dial such that 10KUV is under indicator Line. Turn RF SET TO LINE control knob such that RF meter reads ton "red line."

bp. Repeat steps *as* through *bl.* Record all data under 80 MHz. Calculations and procedure exactly the same as prescribed for 50 MHz case.

bq. If an out of tolerance voltage is found, adjust as follows:

(1) Connect LO-RF terminal of unit under test through Z105 and 50-ohm adapter to multimeter.

(2) Check that FUNCTION switch is set to MOD OFF and RF OUTPUT switch is set to 0–10KUV.

(3) Loosen the power probe stop on piston attenuator assembly A1A2.

(4) While looking in the front end of the piston attenuator, turn the LO-HI RF SET TO LINE control until the vertical pick-up wire almost comes in contact with the harmonic mode suppressor.

(5) With BAND SWITCH and RF TUNING control select frequency of 80 MHz.

(6) Adjust piston attenuator trimmer capacitor for maximum output on multimeter.

(7) Adjust LO-HI RF SET TO LINE control for red line indication on IF UV RF SET TO LINE meter.

(8) With multimeter on 10 MV scale, adjust piston attenuator with LO RF UV control for 2 db reading.

(9) Tune through band D with RF TUNING control, keeping the IF UV RF SET TO LINE meter set to red line, and observing the db spread on multimeter.

(10) Adjust piston attenuator trimmer capacitor for least amount of db spread over the entire band.

(11) Check db spread on bands A, B, and C. The maximum allowable db spread over any band is ±1.5 db. Readjust piston attenuator trimmer, if required.

(12) Turn LO RF METER CAL control R61 fully clockwise.

(13) Adjust power probe for red line indication on IF UV RF SET TO LINE meter with LO-HI RF SET TO LINE control.

(14) With LO RF UV control adjust piston attenuator for one-half the amount of db spread.

(15) Set piston attenuator and power probe stop.

(16) Adjust the LO RF UV dial until 10K appears under the hairline.

5-6. High RF Voltage Range and Accuracy Adjustment

a. Connect HI–RF terminal of unit under test through impedance matching network Z153 to AC terminal of multimeter.

b. Set OPERATE-OFF-STANDBY switch to OPERATE.

c. Turn FUNCTION switch to MOD OFF and RF OUTPUT switch to 62.5 KUV.

NOTE

If any multimeter reading is not within tolerances, proceed to step *i.*

d. Observe the multimeter reading at the following frequencies: band A 18 and 26 MHz, band B 26 and 37 MHz, band C 38 and 54 MHz, and band D 54 and 80 MHz.

e. At each frequency, the multimeter should indicate between 47 and 78 kuv.

f. Turn RF OUTPUT switch to 125 KUV and repeat step *d.* At each frequency, the multimeter should indicate between 94 and 156 kuv.

g. Turn RF OUTPUT switch to 250 KUV and repeat step *d.* At each frequency, the multimeter should indicate between 187.5 and 312.5 kuv.

h. Turn the RF OUTPUT switch to 500 KUV and repeat step *d.* At each frequency, the multimeter should indicate between 375 and 625 kuv.

i. Turn the RF OUTPUT switch to 250 KUV.

j. Set BAND SWITCH to band A and select a frequency of 18 MHz with RF TUNING control.

k. Adjust the LO-HI RF SET TO LINE control for a 250 kuv indication on the multimeter.

l. On RF attenuator switch board S1, adjust HI-RF METER CAL control S1R1 for a .55 or red line indication on the front panel IF UV RF SET TO LINE meter.

5-7. RF Output Impedance

a. Connect LO-RF terminal of unit under test through impedance matching network Z105 to HI terminal of RX meter.

b. Turn OPERATE-OFF-STANDBY switch to STANDBY.

c. Turn RF OUTPUT switch to 0-10KUV.

d. Measure the output impedance at frequencies of 20 MHz, 50 MHz and 80 MHz.

e. At each frequency, the impedance measured should be 50 ±10 ohms + j 0 ±10 ohms.

f. Connect HI-RF terminal of unit under test through impedance matching network Z153 to HI terminal of RX meter.

g. Successively, select outputs of 62.5 KUV, 125 KUV and 250 KUV with RF OUTPUT switch and repeat step *d* above.

h. At each frequency, the impedance measured should be 50 ±10 ohms +j 0 ±15 ohms.

5-8. External Modulation Input Impedance

a. Set OPERATE-OFF-STANDBY to OPERATE.

b. Turn FUNCTION switch to EXT MOD.

c. Connect the EXT MOD terminal of the unit under test to impedance bridge.

d. Measure the impedance at the EXT MOD terminals. It should be between 510 and 690 ohms.

5-9. IF Output Impedance

a. Set OPERATE-OFF-STANDBY switch to OFF.

b. Set FUNCTION switch to MOD OFF and IF OUTPUT switch to 10UV.

c. Connect the unit under test and the test equipment as shown in figure 5–2.

d. At IF frequencies of 4.300 MHz and 11.50 MHz, measure the IF output impedance at each position of IF OUTPUT switch except OFF and 1.0 VOLT. The IF output impedance should be: 25 ±5, ohms + j 0 ±10 ohms.

5-10. IF Output Level

a. Set OPERATE-OFF-STANDBY switch to OPERATE.

b. Turn FUNCTION switch to IF, IF MHz switch to 4.300 and IF OUTPUT switch to 1.0 VOLT.

c. Connect RF Voltmeter AN/URM-145 to IF output jack through impedance matching network Z107.

d. With IF UV control, maintain 1.0 indication on IF UV RF SET TO LINE meter and observe multimeter reading at the 1.0 VOLT, 10 KUV and 1 KUV positions of IF OUTPUT switch. The meter reading should be within ±25 percent of selected range. If any meter reading is not within prescribed limits, proceed to step *i*.

e. To measure the IF output when the IF OUTPUT switch is in the 100 UV and 0-10UV positions, connect the test setup (fig. 5-3).

f. Calibrate the test oscillator for use as reference and observe the meter reading on the receiver. The meter reading should be between 7.5 and 12.5 uv. If meter reading is not within prescribed limits, proceed to step *i*.

g. Turn IF MHz switch to 10.00 and repeat steps *d, e,* and *f.*

h. Turn IF MHz switch to 11.5 and repeat steps *d, e,* and *f.*

i. Make sure that multimeter is connected to IF output jack through impedance matching network Z107.

j. Turn signal generator controls to the positions listed below.

Switch	Position
FUNCTION	IF
IF MHZ	4.300
IF OUTPUT	1.0 VOLT

k. Adjust IF METER CAL control R69 for 1.0 indication on IF UV RF SET TO LINE meter.

5-11. IF Spurious Outputs

a. Connect the unit under test and the test equipment as shown in figure 5-4.

b. Set OPERATE-OFF-STANDBY to OPERATE and turn FUNCTION switch to IF and IF OUTPUT switch to 1.0 VOLT.

c. Measure the hamonic distortion for each position of the IF MHZ switch: 4.300, 5.600, 5.625, 10.00 and 11.50. The harmonic distortion should be ±10 percent for each switch position.

5-12. Internal Modulation

a. Connect electronic counter AN/USM–207 to INT MOD OUT jack.

b. Set OPERATE-OFF-STANDBY switch to OPERATE.

c. Turn RF OUTPUT switch to 250 KUV.

d. Turn FUNCTION switch to 1000 Hz.

e. Adjust LO-HI RF SET TO LINE control for red line indication on IF UV RF SET TO LINE meter.

f. Turn FUNCTION switch successively to 150 Hz, 400 Hz and 1000 Hz. The electronic counter should indicate within the specified limits given in table 5-4 for each modulating frequency. If any frequency is off, proceed to step *i*.

Table 5–.4 Modulating Frequency Accuracy

FUNCTION switch setting	Frequency counter reading (Hz)	
	Minimum	Maximum
150 Hz	149	151
400 Hz	395	405
1000 Hz	950	1050

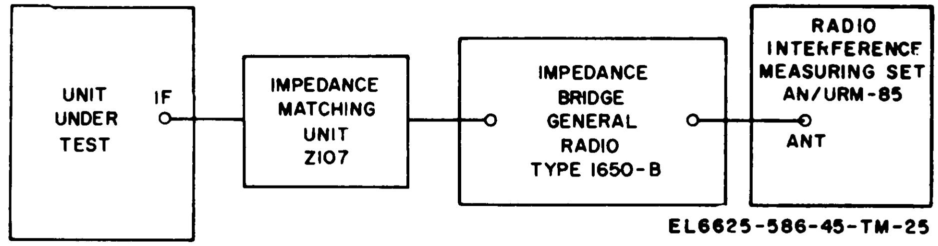


Figure 5-2. IF output impedance, test setup.

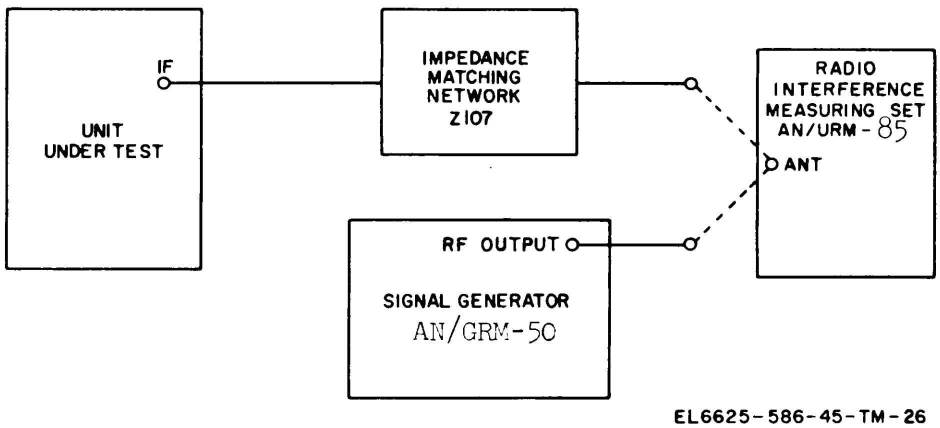


Figure 5-3. IF output level (10 UV), test setup.

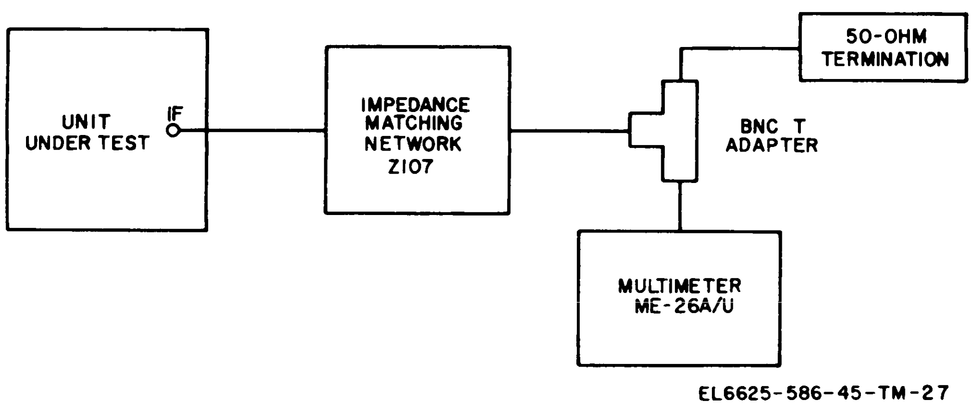


Figure 5-4, IF spurious outputs, test connections.

g. Connect unit under test and the test equipment as shown in figure 5-5.

h. At the RF frequencies given in table 5-5 and with the specified switch settings, check that the deviation and distortion readings are within limits. If distortion readings are out of limits, proceed with step *i* to adjust. If deviation readings are out of limits, proceed to step *q* to adjust.

i. Connect distortion analyzer to E29 on audio board. Connect oscilloscope and electronic counter to INT MOD OUT.

j. Turn FUNCTION switch to 150 HZ and DEVIATION control fully clockwise.

NOTE

The procedure given in steps *k* through *n* below describes how to obtain the lowest possible distortion at the correct frequency with maximum output voltage at E29.

k. Adjust 150 HZ ADJ R16 for 150 Hz indication on electronic counter.

l. Check audio distortion at E29. It should be less than 0.4%. If distortion is greater than 0.4%, slowly turn AUDIO DIST ADJ R15 counterclockwise for 0.4% distortion indication.

m. Again check for 150 Hz indication on electronic counter. If frequency is off, very carefully adjust 150 HZ ADJ R16 for correct frequency.

n. Check output voltage at E29 with oscilloscope. It should be greater than 2.5 volts rms.

o. Turn FUNCTION switch to 400 HZ.

p. Adjust 400 HZ ADJ R18 for 400 HZ indication on electronic counter.

q. Connect test equipment to signal generator as shown in figure 5–5.

r. Set signal generator controls as indicated below.

Switch	Position
DEVIATION RANGE KHZ	40
RF OUTPUT	62.5 KUV
BAND SWITCH	A
RF TUNING	22 MHz

s. Check varactor bias at E31 and adjust if required in accordance with the following chart:

Band	Frequency	Bias	Adjustment
A	22	8.25 ±0.1 volt	R29
B	32	11.05 ±0.1 volt	R28
C	45	10.1 ±0.1 volt	R27
D	67	10.4 ±0.1 volt	R26

t. Turn DEVIATION control fully clockwise.

u. Adjust external signal generator for 1000 Hz output at 2 volts rms.

v. Adjust DEV METER CAL control R29 for 40 kHz indication on DEVIATION meter.

w. Turn DEVIATION control for reading of 35 kHz on DEVIATION meter.

x. Repeat step *v*.

y. Turn BAND SWITCH to B and select frequency of 32 MHz.

z. Turn DEVIATION CAL control R38 fully clockwise.

aa. Check reading on external deviation meter. If greater than 48 kHz; repeat steps *w* and *x*.

ab. Readjust R38 for 38 kHz indication on external deviation meter.

ac. Turn FUNCTION switch to 1000 HZ. Adjust DEVIATION control for DEVIATION metier reading of 40 kHz.

ad. Measure and record for future reference the external deviation meter reading and the distortion at band B center frequency of 32 MHz and end frequencies of 26 and 38 MHz.

ae. If distortion is greater than 3%, increase bias 0.4 volts with R28 and repeat step ad above.

af. Interpret results using guide lines given in table 5-6 and readjust varactor bias, if required.

ag. After a satisfactory bias level has been determined for band B, calibrate bands A, C and D, in that order. The recommended starting points are given in the following chart:

Band	RF frequency	Deviation setting	Adjustment
A	22 MHz	39 kHz	R37
B	32 MHz	38 kHz	R38
C	45 MHz	38 kHz	R39
D	67 MHz	39 kHz	R40

Table 5-5. Internal Modulation Deviation and Distortion Check.

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	FUNCTION switch setting (Hz)	Limits Deviation	Limits Distortion
A	18	10	10kHz	150	±2kHz	4%
				400		
				1000		
		20	20kHz	150	±3kHz	
				400		
				1000		
		40	30kHz	150	±5kHz	
				400		
				1000		
		40	40kHz	150	±5kHz	5%
				400		
				1000		
	22	10	10kHz	150	±2kHz	4%
				400		
				1000		
		20	20kHz	150	±3kHz	
				400		
				1000		
		40	30kHz	150	±5kHz	
				400		
				1000		
		40	40kHz	150	±5kHz	5%
				400		

*Adjusted by DEVIATION control

Table 5-5. Internal Modulation Deviation and Distortion Check —Continued.

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	FUNCTION switch setting (Hz)	Limits Deviation	Limits Distortion
A	26	10	10kHz	150 400 1000	±2kHz	4%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	5%
B	26	10	10kHz	150 400 1000	±2kHz	3%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	4%
	32	10	10kHz	150 400 1000	±2kHz	3%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	4%
	38	10	10kHz	150 400 1000	±2kHz	3%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	4%
C	37	10	10kHz	150 400 1000	±2kHz	2.5%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3.5%

*Adjusted by DEVIATION control

Table 5-5. Internal Modulation Deviation and Distortion Check -Continued.

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	FUNCTION switch setting (Hz)	Limits Deviation	Limits Distortion
C	40	10	10kHz	150 400 1000	±2kHz	2.5%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3.5%
	54	10	10kHz	150 400 1000	±2kHz	2.5%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3.5%
D	54	10	10kHz	150 400 1000	±2kHz	2%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3%
	67	10	10kHz	150 400 1000	±2kHz	2%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3%
	80	10	10kHz	150 400 1000	±2kHz	2%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3%

*Adjusted by DEVIATION control

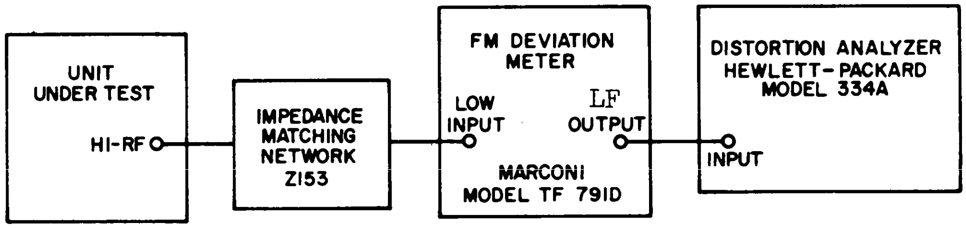


Figure 5-5. Internal modulation, test setup.

Table 5-6. Bias Adjustment Guide

1. Always perform deviation and distortion readings at low, med and high points in a band, even if incorrect, before changing the bias.
2. To adjust bias, begin by raising in 0.3-volt increments (0.5 volt increments for band D) and continue as long as there is improvement in the results. When results deteriorate by raising the bias, lower the bias or try a setting between two previous bias levels.
3. Following a bias readjustment, always reset the true deviation to its optimum value, according to table 5-5.
4. Always set the bias with frequency at mid-band.
5. Hints for band B:
   (a) high distortion at low end - increase bias by 0.4 volt with R28.
   (b) deviation readings are low, distortion good - decrease bias by 0.3 volt.
6. Hints for band A:
   (a) high distortion at high end - increase bias by 0.3 volt
7. Specifications:
   (a) Deviation (all bands)
   40 ±3.5 kHz
   30 ±3 kHz
   20 ±2 kHz
   10 ±1 kHz
   (b) Distortion*

band A	4% maximum
band B	3% maximum
band C	2.5% maximum
band D	2% maximum

*170 greater distortion permitted at 40 kHz

5-13. Spurious RF Outputs

a. Connect LO-RF terminal of unit under test through impedance matching network Z105 to AC terminal of multimeter.

b. Set OPERATE-OFF-STANDBY switch to OPERATE, FUNCTION switch to MOD OFF, RF OUTPUT switch to 0-10 KUV and LO RF UV control to 10 KUV.

c. Adjust LO-HI RF SET TO LINE control for 1.0 indication on IF UV RF SET TO LINE mater.

d. Measure the total harmonic distortion at the following RF frequencies:

Band	Frequency (MHz)
A	22
B	32
C	46
D	70

At each frequency the total harmonic distortion should be less than 8 percent (22 db below reference).

e. Connect HI-RF terminal of unit. under test through impedance matching network Z153 to AC terminal of multimeter.

f. Set RF OUTPUT switch to 62.5 KUV.

g. Repeat step *d,* above.

5-14. Alignment of IF Assembly for Operation in the 1.3 to 4.2 MHz Range

a. The IF assembly is capable of operating at any frequency in the range from 1.3 to 15.0 MHz. In order to operate the oscillator from 1.3 to 4.2 MHz, the procedure below should be followed:

b. Materials Required:

(1) Supply of 1/4 watt, 5% carbon composition resistors from 47 to 1000 ohms. Suggested values 47, 68, 100, 180, 220, 270, 330, 390, 430, 470, 560, 680, 750, 820, 910, 1000 ohms.

(2) In addition to the capacitor value found from the graph (fig. 5–6) for the frequency of interest, three values 10, 20 and 30% higher and three values 10, 20 and 30% lower. (Dipped mica or ceramic, ±10%.)

(3) One capacitor 0.01 uf (±10%).

c. Test Setup

(1) Remove IF amplifier assembly from signal generator.

(2) Remove sinews holding the circuit board A2A1 and pull this unit out of the IF assembly.

NOTE

Do not unsolder any wires.

(3) Set the printed circuit board on a bench taking care to avoid a short circuit. between the IF assembly and the printed circuit board when the units are energized.

(4) Connect oscilloscope to jack A2J1.

(5) Supply 25 volts dc to the IF assembly by connecting TP2 on signal generator (inside, rear, bottom of unit) to A2FL1 on IF assembly, and by connecting a lead between the chassis of the signal generator and the housing or ground plane of the IF assembly.

NOTE

Use alligator clips and always disconnect 25 volts dc (TP2) when making a circuit change.

(6) From figure 5-6, select a value of RA and CA for the desired frequency of operation. *Example:* If the 4.3 MHz crystal is being replaced by a 2.5 MHz crystal, an RA of 220 ohms and a CA of 800 pf would be selected from the homograph.

(7) Resistor RA is installed in place of the 47-ohm resistor on switch A2S1, at the switch position corresponding to the crystal which is being replaced. In the example given in step (6) above, the 220-ohm resistor will be soldered in place of the 47-ohm resistor at the first position of the switch.

(8) Capacitor CA is soldered on one side to the terminal coming out of the crystal socket which goes to A2E3 which, in turn goes to the middle wafer of switch A2S1. The other lead of CA is soldered to the ground plane area on the foil side of the circuit board A2A1. The unit is now ready for test.

d. Testing the Modified IF Assembly.

(1) Connect 25 volts dc.

(2) Turn A2S1 to an unmodified crystal position, to verify that the circuit is operational.

(3) Turn A2S1 to the modified position and observe oscilloscope:

Case I: Waveform observed is at the correct frequency (not a 3rd or 5th harmonic), amplitude is greater than IV rms, and distortion is less than 10%. (This can be judged by the eye.) In this case, make the connections of RA and CA permanent and reassemble the IF assembly.

Case II: An oscillation is observed but at the wrong frequency, too little amplitude or too high distortion.

(a) To correct distortion try increasing RA, and then alternately increasing and decreasing CA.

(b) To correct low amplitude alternately raise and lower CA.

(c) To correct appearance of 3rd or 5th harmonic, increase CA and then, if this is not sufficient, alternately increase and decrease RA.

Case III: Circuit does not oscillate.

(a) Verify once again that circuit is operational by switching to another crystal.

(b) Return to crystal under test and if it is 1.3, 1.4 or 1.5 MHz try attaching one end of a 0.01 uf capacitor to the crystal socket terminal that goes to A2E1 which, in turn, goes to the wafer on the switch furthest from the knob, and the other end to the ground plane area on the foil side of the circuit board A2A1.

(c) Once an oscillation has been obtained proceed as in Case II.

(d) After proper operation at the desired frequency is obtained, insure that the oscillator will oscillate each time B+ is removed and then reapplied. Do this by removing and then connecting the clip lead to TP2 and observing oscilloscope.

(e) If the oscillator does not conform to step (d) above, increase the value of resistor RA and proceed as in Case II.

(f) For other frequencies try varying CA above and below the value obtained from the graph. Then, if unsuccessful, change RA, and again vary CA.

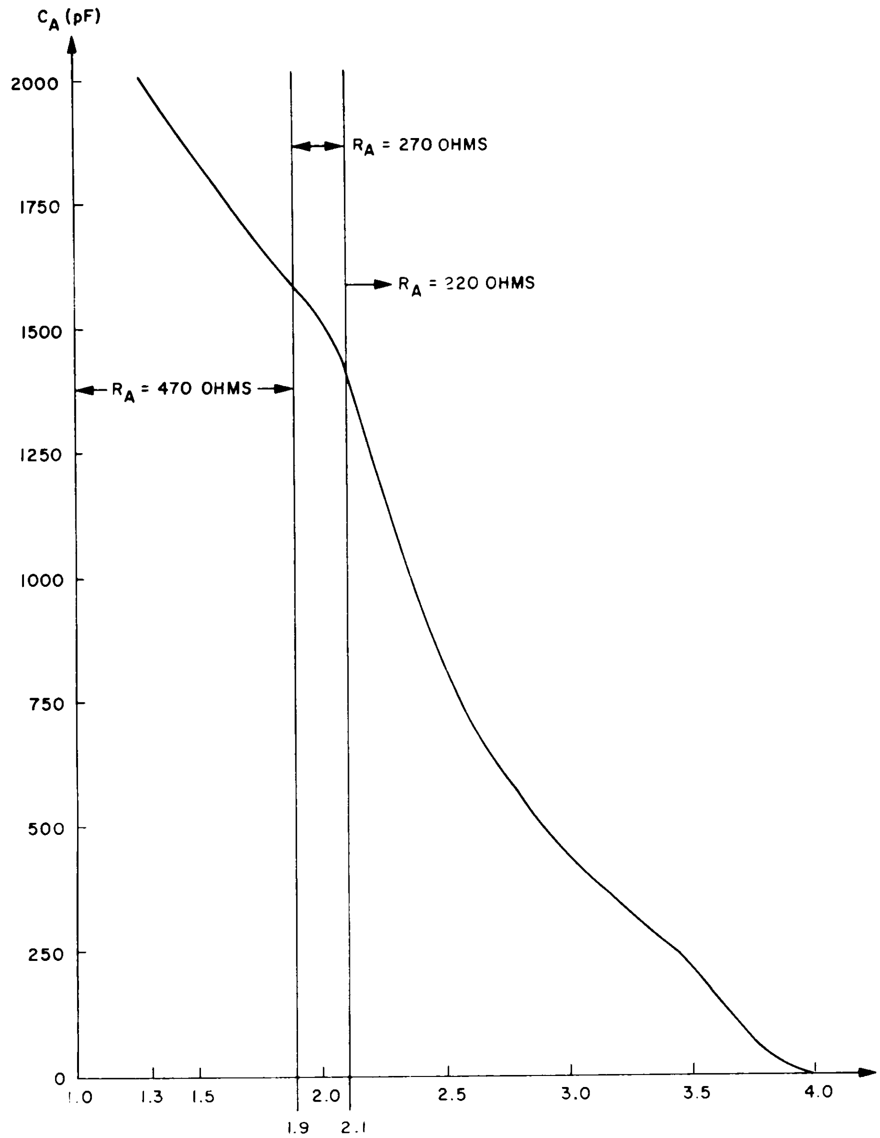


Figure 5-6. Nomograph for modified IF assembly operation.

CHAPTER 6

DEPOT INSPECTION STANDARDS

6-1. Applicability of Depot Inspection Standards

The tests outlined in this section are designed to measure the performance capability of a repaired equipment. Equipment that is to be returned to stock should meet the standards given in these tests.

6-2. Applicable References

a. Repair Standards. Applicable procedures of the depot performing these tests and its general standards for repaired electronic equipment form apart of the requirements for testing this equipment.

b. Technical Publications. The technical publications applicable to the equipment to be tested are TM 11–6625-586-12 and TM 11–586-1633-45.

c. Modification Work Orders. Perform all modification work orders (MWO) applicable to this equipment before making the tests specified. DA Pam 310-4 lists all available MWOs.

6-3. Test Facilities Required

The items listed below are required for depot testing:

Test equipment	Technical Manual	Common Name
Counter, Electronic Digital Readout, AN/USM-207	TM 11-6625-700-10	Electronic counter
Voltmeter, Electronic ME-30/U	TM 11-6625-320-12	Vtvm
Radio Interference Measuring Set AN/URM-85	TM 11-6625-351-12	Receiver
Oscillator, Audio (General Radio type 1310A)		Audio Oscillator
Deviation Meter, FM (Marconi Model TF-791D)		Deviation meter
Bridge, Impedance (General Radio type 1650-B)		Impedance bridge
Generator, Signal AN/USM-44	TM 11-6625–508-10	Signal generator
Generator, Signal AN/GRM-50	TM 11-6625-573-15	Signal generator
Output Power Meter (General Radio type 1840-A)		Power meter
Attenuator, Coax Step (Waveline type 9002)		
Tool Kit, Electronic TK-100G	SM 11-4-5180-S21	Tool kit

6-4. Depot Physical Tests and Inspections

Perform the test given in paragraph 4-4.

6-5. Depot Operational Tests

Perform the test given in paragraph 4-5.

6-6. Depot RF Frequency Range and Dial Test

Perform the test given in paragraph 4-6.

6-7. Depot Resettability Test

Perform the test given in paragraph 4-7.

6-8. Depot Carrier Frequency Shift Test

Perform the test given in paragraph 4-8.

6-9. Depot IF Output Frequency Accuracy Test

Perform the test given in paragraph 4-9.

6-10. Oscillator Beat Note Power and Spurious Beat Notes

a. Connect unit under test and test equipment as shown in figure 6-1.

b. Turn FUNCTION switch to FREQ CAL.

c. Turn RF OUTPUT Switch to 250 KUV.

d. With the LO-HI RF SET TO LINE control, set the needle on the IF UV RF SET TO LINE meter directly over the red line on the meter scale.

e. At each of the frequencies listed in table 6–1, check that an audible beat note is heard within the specified limits. This can be accomplished by slowly tuning through the selected frequency with the RF TUNING control and observing the electronic counter when an audible beat note is heard.

f. Disconnect the speaker and connect the output power meter and electronic counter in its place.

g. Set the output power meter for 12 ohms impedance.

h. At the following frequencies: 22, 24, 28, 34, 42, 51 and 77 MHz, vary the RF TUNING control to vary the beat note frequency from 500 Hz to 2000 Hz as indicated on the electronic counter. The power output at the 500 Hz and 2000 Hz points should be greater than 3 milliwatts.

i. Reconnect the speaker removed in step *f.*

Table 6–1. Oscillator Beat Note Power and Spurious Beat Notes.

Band	Frequency (MHz)	Specified limits for hearing beat note (Hz)
A	18	± 675
	19	± 713
	25	± 938
	25	± 957
B	26	± 975
	27	±1013
	37	±1388
	38	±1425
C	37	±1388
	38	±1425
	53	±1988
	54	±2025
D	54	±2025
	55	±2063
	79	±2963
	80	±3000

6-11. High RF Output Voltage Range and Accuracy

a. Connect the unit under test and the test equipment as shown in figure 6-2.

b. Turn RF OUTPUT switch to 62.5 KUV.

c. Observe the RF voltmeter reading at the following frequencies: band A 18 and 26 MHz, band B 26 and 37 MHz, band C 38 and 54 MHz, and band D 54 and 80 MHz.

d. At each frequency, the RF voltmeter should indicate between 47 and 78 kuv.

e. Turn RF OUTPUT switch to 125 KUV and repeat step *c.* At each frequency, the RF voltmeter should indicate between 94 and 156 kuv.

f. Turn the RF OUTPUT switch to 250 KUV and repeat step *c.* At each frequency, the RF voltmeter should indicate between 187.5 and 312.5 kuv.

g. Turn the RF OUTPUT switch to 500 KUV and repeat step *c.* At each frequency, the RF voltmeter should indicate between 375 and 625 kuv.

6-12. Internal Modulation

a. Connect unit under test and test equipment as shown in figure

b. Turn RF OUTPUT switch to 250 KUV.

c. Turn FUNCTION switch to 1000 Hz.

d. Adjust LO-HI RF SET TO LINE control for red line indication on IF UV RF SET TO LINE meter.

e. Turn FUNCTION switch successively to 150 Hz, 400 Hz and 1000 Hz. The electronic counter should indicate within the specified limits given in table 6-2 for each modulating frequency.

Table 6-2. Modulating Frequency Accuracy.

FUNCTION switch setting	Frequency counter reading (Hz) Minimum	Maximum
150 Hz	149	151
400 Hz	395	405
1000 Hz	950	1050

f. At the RF frequencies given in table 6-3 and with the specified switch settings, check that the deviation and distortion readings are within limits.

6-13. External Modulation

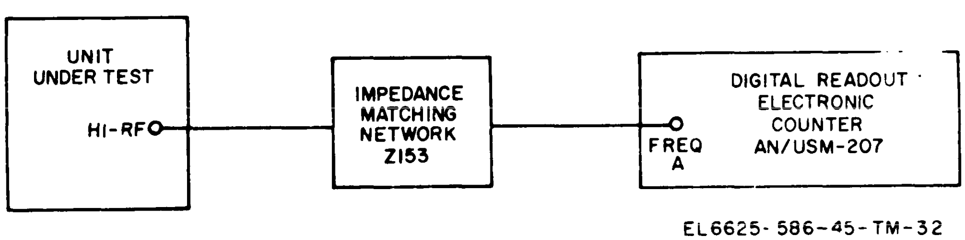
a. Turn FUNCTION switch to EXT MOD and RF OUTPUT switch to 250 KUV.

b. Adjust LO-HI RF SET TO LINE control for red line indication on IF UV RF SET TO LINE meter.

c. Connect an impedance bridge to the EXT MOD terminals of the unit under test.

d. Measure the impedance at the EXT MOD terminals. It should be between 510 and 690 ohms.

e. Connect the unit under test and the test equipment as shown in figure 6-3.



Figiure 6.Oscillator beat not power and spurious beat note, test connections.

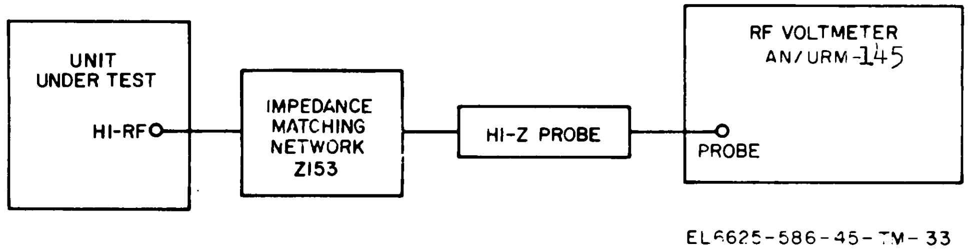


Figure 6-2. High RF voltage range and accuracy, test connections.

Table 6-3. Internal Modulation Deviation and Distortion Check

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	FUNCTION switch setting (Hz)	Limits Deviation	Limits Distortion
A	18	10	10kHz	150 400 1000	±2kHz	4%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	5%
	22	10	10kHz	150 400 1000	±2kHz	4%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	5%
	26	10	10kHz	150 400 1000	±2kHz	4%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	5%
B	26	10	10kHz	150 400 1000	±2kHz	3%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	

*Adjusted by DEVIATION control

Table 6-3. Internal Modulation Deviation and Distortion Check -Continued.

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	FUNCTION switch setting (Hz)	Limits Deviation	Distortion
B	26 (Cont)	40	40kHz	150 400 1000	±5kHz	4%
	32	10	10kHz	150 400 1000	±2kHz	3%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	4%
B	38	10	10kHz	150 400 1000	±2kHz	3%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	4%
C	37	10	10kHz	150 400 1000	±2kHz	2.5%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3.5%
	40	10	10kHz	150 400 1000	±2kHz	2.5%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3.5%
	54	10	10kHz	150 400 1000	±2kHz	2.5%
		20	20kHz	150 400 1000	±3kHz	

*Adjusted by DEVIATION control

Table 6-3. Internal Modulation Deviation and Distortion Check –Continued.

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	External modulation frequency kHz	Limits Deviation	Distortion
C	54 (Cont)	40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3.5%
D	54	10	10kHz	150 400 1000	±2kHz	2%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3%
	67	10	10kHz	150 400 1000	±2kHz	
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3%
	80	10	10kHz	150 400 1000	±2kHz	2%
		20	20kHz	150 400 1000	±3kHz	
		40	30kHz	150 400 1000	±5kHz	
		40	40kHz	150 400 1000	±5kHz	3%

*Adjusted by DEVIATION control

f. At the RF frequencies given in table 6-4 and with the specified switch settings, check that the deviation and distortion are within limits.

g. Turn DEVIATION RANGE switch to 40.

h. Adjust the DEVIATION control fully clockwise.

i. At frequencies of 20 and 80 MHz, measure the external modulating voltage required to obtain a full scale reading on DEVIATION meter at modulating frequencies of 10 and 30 kHz. Table 6-5 gives the specified limits.

j. Turn DEVIATION RANGE switch to 10, and adjust DEVIATION control fully clockwise.

k. Set unit under test to produce output frequency of 20 MHz.

l. Apply a 1 kHz external modulating frequency. Adjust level of this signal to obtain full-scale deviation of 10 kHz as read on DEVIATION meter. Record the amplitude of this signal for future reference.

m. Slowly vary the frequency of the external modulating signal from 100 Hz to 30 kHz adjusting the voltage level when necessary to obtain 10kHz deviation. Observe and record the maximum and minimum voltage levels.

n. For external modulating frequencies of 100 to 15000 Hz, the voltage required to give 10 kHz deviation should be within ±10 percent of the voltage measured in step *l.* For external modulating frequencies above 1500 Hz, the voltage required to give 10 kHz deviation should be within ±20 percent of the voltage measured in step *l.*

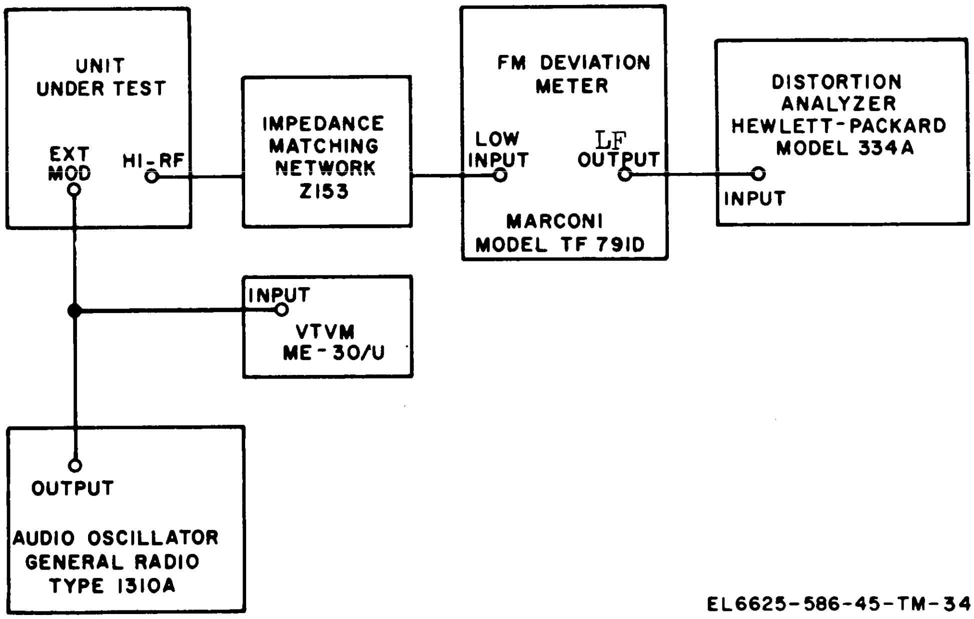


Figure 6-3. External modulution check, test connections.

Table 6-4. External Modulation, Deviation and Distortion Check

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	External modulation frequency kHz	Limits Deviation	Limits Distortion
A	18	10	10kHz	0.1	±2kHz	4%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	5%
				5		
				10		
				30		
	22	10	10kHz	0.1	±2kHz	4%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	5%
				5		
				10		
				30		
	26	10	10kHz	0.1	±2kHz	4%
				5		
				10		
				30		

*Adjusted by DEVIATION control

Table 6–4. External Modulation, Deviation and Distortion Check -Continued.

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	External modulation frequency kHz	Limits	
					Deviation	Distortion
A	26	20	20kHz	0.1	±3kHz	
	(Cont)			5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	5%
				5		
				10		
				30		
B	26	10	10kHz	0.1	±2kHz	3%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	4%
				5		
				10		
				30		
	32	10	10kHz	0.1	±2kHz	3%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	4%
				5		
				10		
				30		
	38	10	10kHz	0.1	±2kHz	3%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	4%
				5		
				10		
				30		

*Adjusted by DEVIATION control

Table 6-4. External Modulation, Deviation and Distortion Check -Continual.

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	External modulation frequency kHz	Limits	
					Deviation	Distortion
C	37	10	10kHz	0.1	±2kHz	2.5%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	3.5%
				5		
				10		
				30		
	40	10	10kHz	0.1	±2kHz	2.5%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	3.5%
				5		
				10		
				30		
	54	10	10kHz	0.1	±2kHz	2.5%
				5		
				10		
				30		
		20	40kHz	0.1	±5kHz	3.5%
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	3.5%
				5		
				10		
				30		
D	54	10	10kHz	0.1	±2kHz	2%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		

*Adjusted by DEVIATION control

Table 6-4. External Modulation, Deviation and Distortion Check —Continued.

Band	Frequency (MHz)	DEVIATION RANGE switch setting	Front panel DEVIATION meter indication*	External modulation frequency kHz	Limits Deviation	Limits Distortion
D	54 (Cont)	40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	3%
				[illegible]		
				10		
				30		
D	67	10	10kHz	0.1	±2kHz	2%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	3%
				5		
				10		
				30		
	80	10	10kHz	0.1	±2kHz	2%
				5		
				10		
				30		
		20	20kHz	0.1	±3kHz	
				5		
				10		
				30		
		40	30kHz	0.1	±5kHz	
				5		
				10		
				30		
		40	40kHz	0.1	±5kHz	3%
				5		
				10		
				30		

*Adjusted by DEVIATION control

Table 6-5. External Modulator Deviation Sensitivity Check

Frequency (MHz)	Deviation	External modulation frequency	External modulation voltage limit (maximum)
20	40kHz	10kHz	2 voltts rms
		30kHz	
80	40kHz	10kHz	2 volts rms
		30kHz	

6-14. RF Frequency Drift Due to Attenuator Settings

a. Connect impedance matching network Z105 to LO RF jack and electronic counter to speaker terminal. Check to ensure ground terminal of electronic counter is connected to ground side of speaker. Connect step attenuator to output connector of Z105. Set step attenuator for 0 db attenuation. It is to be used as a 50-ohm load.

b. Turn FUNCTION switch to FREQ CAL.

c. Turn BAND switch to select band A.

d. With RF TUNING control to select a frequency of 20 MHz.

e. Fine tune around 20 MHz with RF TUNING control to obtain a 4 kHz beat note as indicated on frequency counter. Record this frequency for reference.

f. Adjust LO-HI RF SET TO LINE control for red line indication on IF UV RF SET TO LINE meter.

g. Set LO RF UV control to 10 KUV.

h. Repeat step *e,* above.

i. Set LO RF UV control to 100 UV and record frequency counter reading.

j. The frequency recorded in step *i* should be within ±1032 Hz of the frequency recorded in step *e*.

6-15. IF Output Level

a. Turn FUNCTION switch to IF, IF MHz switch to 4.300 and IF OUTPUT switch to 1.0 VOLT.

b. Connect RF voltmeter to IF output jack through impedance matching network Z107 as shown in figure 64A.

c. With IF UV control, maintain 1.0 indication on IF UV SET TO LINE meter and observe RF voltmeter reading at the 1.0 VOLT, 100 KUV, 10 KUV and 1 KUV positions of IF OUTPUT switch. The meter reading should be within ±25 percent of selected range.

d. To measure the IF output when the IF OUTPUT switch is in the 100 UV and 0-10 UV positions, connect the test setup show in figure 6-4B.

e. Calibrate the signal generator for use as reference and observe the meter reading on the receiver. The meter reading should be between 7.5 and 12.5 uv.

f. Turn IF MHz switch to 10.00 and repeat steps *c, d,* and *e.*

g. Turn IF MHz switch to 11.5 and repeat steps c, *d,* and *e.*

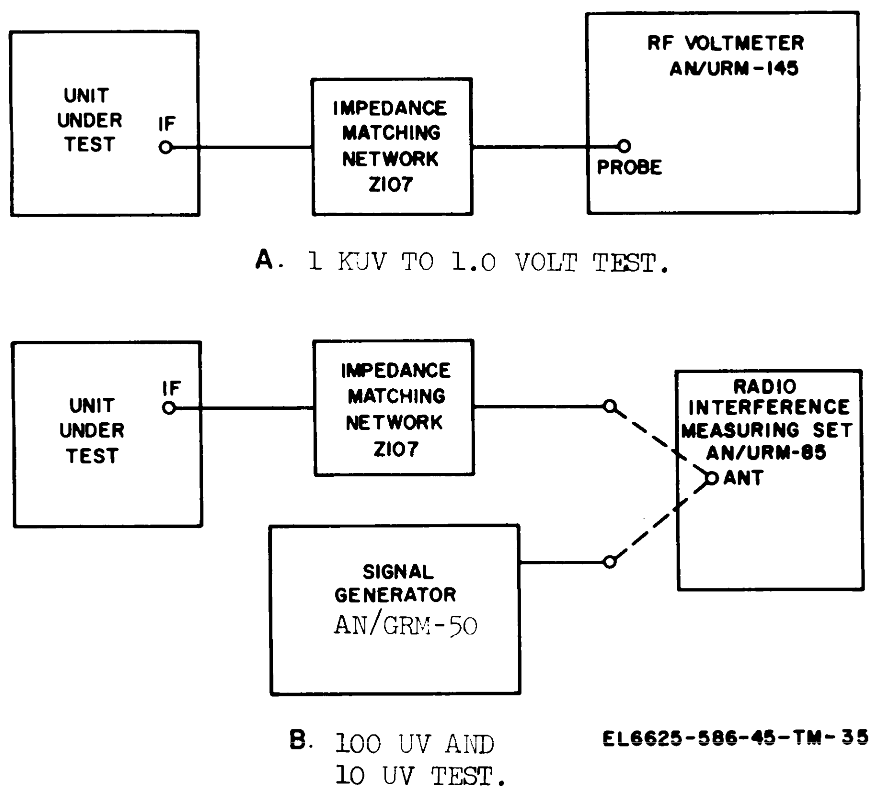
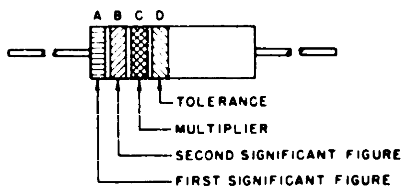


Figure 6-4. If Output level, test connections.

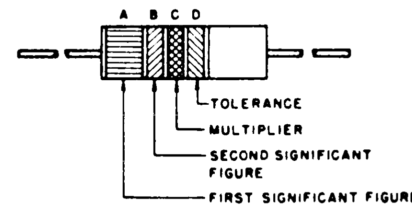
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS

COMPOSITION-TYPE RESISTORS



BAND A— Equal Width Band Signifies Composition-Type

WIREWOUND-TYPE RESISTORS



BAND A— Double Width Signifies Wire-wound Resistor

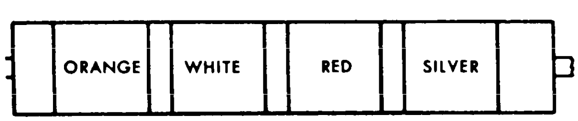
COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING

BAND

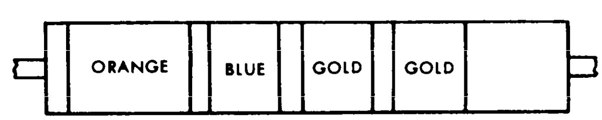
A B C D*



3 9 X100 ± 10%

BAND

A B C D*



3 6 X0.1 ± 5%

NOMINAL RESISTANCE	3,900 Ohms	3.6 Ohms
RESISTANCE TOLERANCE	± 10 percent	± 5 percent

STD-R2

*If Band D is omitted, the resistor tolerance is ± 20%, and the resistor is not Mil-Std.

Figure 6-5. MIL-STD resistor color-code markings.

1 KNOB
2 INDEX LINE
3 SCREW
4 LOCK-SPRING WASHER
5 FLAT WASHER
6 DIAL
7 FLAT-HEAD SCREW
8 KNOB
9 KNOB
10 KNOB
11 KNOB
12 GROOVED PIN
13 SET SCREW
14 LAMP HOLDER
15 LAMP
16 SCREW
17 LOCK-SPRING WASHER
18 FLAT WASHER
19 FRAME
20 SCREW
21 LOCK-SPRING WASHER
22 FLAT WASHER
23 SUB-PANEL WELL
24 FLAT-HEAD SCREW
25 SCREW
26 LOCK-SPRING WASHER
27 FLAT WASHER
28 FLAT-HEAD SCREW
29 ESCUTCHEON
30 SPACER
31 WINDOW
32 CALIBRATION PLATE
33 NUT INSERT
34 THREADED SPACER
35 NUT INSERT
36 SUB-PANEL
37 MASK
38 FLAT-HEAD SCREW
39 HUB
40 SET SCREW
41 GROOVED PIN
42 SECTOR GEAR
43 EYELET
44 CURSOR
45 PIN
46 DIAL
47 FLAT-HEAD SCREW
48 ADAPTER
49 BUSHING
50 BALL PLUNGER
51 HEX NUT
52 PLUNGER HOLDER
53 SCREW
54 LOCK-SPRING WASHER
55 FLAT WASHER
56 EXTERNAL RETAINING RING
57 THRUST WASHER
58 DETENT PLATE
59 BEARING
60 THRUST WASHER
61 EXTERNAL RETAINING RING
62 SPACER
63 SCREW
64 SCREW
65 LOCK-SPRING WASHER
66 FLAT WASHER
67 SPRING DETENT
68 SCREW
69 LOCK-SPRING WASHER
70 MOUNTING PLATE
71 GROOVED PIN
72 DETENT ARM
73 DETENT FOLLOWER
74 GROOVED PIN
75 SPACER
76 POST
77 SCREW
78 LOCK-SPRING WASHER
79 FLAT WASHER
80 SPUR GEAR
81 SET SCREW
82 GROOVED PIN
83 SPUR GEAR
84 SET SCREW
85 GROOVED PIN
86 SPACER
87 SCREW
88 LOCK-SPRING WASHER
89 FLAT WASHER
90 SPACER
91 SCREW
92 LOCK-SPRING WASHER
93 FLAT WASHER
94 DETENT
95 SET SCREW
96 GROOVED PIN
97 SET SCREW
98 SET SCREW
99 FIXED GEAR
100 MOVABLE GEAR
101 HUB
102 SCREW
103 SHAFT
104 HUB
105 WASHER
106 COMPRESSION SPRING
107 CLUTCH PLATE
108 SET SCREW
109 GROOVED PIN
110 CLUTCH PLATE
111 THRUST WASHER
112 CLUTCH PLATE
113 CLUTCH PLATE
114 SET SCREW
115 GROOVED PIN
116 SPACER
117 SCREW
118 LOCK-SPRING WASHER
119 CLUTCH PLATE
120 SHAFT
121 FLAT WASHER
122 BEARING
123 POST
124 SCREW
125 LOCK-SPRING WASHER
126 FLAT WASHER
127 STOP WASHER
128 HUB

129 SET SCREW
130 GROOVED PIN
131 SPUR GEAR
132 SET SCREW
133 GROOVED PIN
134 SPUR GEAR
135 SET SCREW
136 GROOVED PIN
137 SHAFT
138 BALL BEARING
139 BALL BEARING
140 SPACER
141 FLAT SCREW
142 SHAFT EXTENDER
143 GROOVED PIN
144 CONNECTOR
145 ADAPTER
146 SCREW
147 LOCK-SPRING WASHER
148 REDUCTION MECHANISM
149 SCREW
150 LOCK-SPRING WASHER
151 EXTERNAL RETAINING RING
152 THRUST WASHER
153 FLAT WASHER
154 COLLAR
155 SET SCREW
156 GROOVED PIN
157 SPUR GEAR
158 SPUR GEAR
159 SET SCREW
160 GROOVED PIN
161 SHAFT
162 BALL BEARING
163 BEARING
164 EXTERNAL RETAINING RING
165 COLLAR
166 SET SCREW
167 GROOVED PIN
168 SPUR GEAR
169 SET SCREW
170 GROOVED PIN
171 SET SCREW
172 GROOVED PIN
173 GROOVED PIN
174 BEVEL GEAR
175 PINION
176 SHAFT
177 BALL BEARING
178 BALL BEARING
179 COUNTER MOUNTING PLATE
180 SCREW
181 LOCK-SPRING WASHER
182 COUNTER SPACER
183 COUNTER
184 SCREW
185 LOCK-SPRING WASHER
186 FLAT WASHER
187 PINION SHAFT
188 SCREW
189 SPRING WASHER
190 SPACER
191 SPUR GEAR
192 SET SCREW
193 GROOVED PIN
194 THRUST WASHER
195 EXTERNAL RETAINING RING
196 THRUST WASHER
197 SHAFT
198 BEARING
199 PINION GEAR
200 SET SCREW
201 GROOVED PIN
202 THRUST WASHER
203 SHAFT EXTENDER
204 GROOVED PIN
205 EXTERNAL RETAINING RING
206 THRUST WASHER
207 SHAFT
208 BEARING
209 LAMP MOUNTING BASE
210 PIN
211 STANDOFF
212 FRONT PLATE
213 LOOP CLAMP
214 SCREW
215 LOCK-SPRING WASHER
216 SADDLE WASHER
217 BRACKET
218 SCREW
219 LOCK-SPRING WASHER
220 FLAT WASHER
221 SCREW
222 LOCK-SPRING WASHER
223 FLAT WASHER
224 BEARING SUPPORT
225 FLANGED BEARING
226 WAFER
227 SCREW
228 LOCK-SPRING WASHER
229 FLAT WASHER
230 INSULATOR WASHER
231 POST
232 SCREW
233 LOCK-SPRING WASHER
234 GROOVED PIN
235 PLATE

APPENDIX A
REFERENCES

The following publications contain information applicable to the maintenance of Generator, Signal AN/URM-103.

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals, (Types 7, 8, and 9), Supply Bulletins and Lubrication Orders.
DA Pam 310-7	US Army Equipment Index of Modification Work Orders.
SB 11-573	Painting and Preservation Supplies Available for Field Use for Electronics Command Equipment.
SB 38-100	Preservation, Packaging, Packing and Marking Materials, Supplies, and Equipment Used by the Army.
TB 43-180	Calibration Requirements for the Maintenance of Army Materiel.
TB 746-10	Field Instructions for Painting and Preserving Electronics Command Equipment.
TM 11-6625-200-15	Operator's, Organizational, DS, GS, and Depot Maintenance Manual; Multimeters ME-26A/U, ME-26B/U, ME-26C/U, and ME-26D/U.
TM 11-6625-320-12	Operator and Organizational Maintenance Manual: Voltmeter, Meter ME-30A/U, and Voltmeters, Electronic ME-30B/U, ME-30C/U, and ME-30E/U.
TM 11-6625-351-12	Operator and Organizational Maintenance Manual: Radio Interference Measuring Set AN/URM-85.
TM 11-6625-366-15	Operator's, Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS-352B/U.
TM 11-6625-508-10	Operator's Manual: Signal Generators AN/USM-44 and AN/USM-44A.
TM 11-6625-524-14	Operator's, Organizational, and Field Maintenance Manual: Voltmeter, Electronic AN/URM-145.
TM 11-6625-539-15	Operator, Organizational, Field and Depot Maintenance Manual: Transistor Test Set TS-1836/U.
TM 11-6625-573-14	Operator, Organizational, Direct Support and General Support Maintenance Manual: Generator, Signal AN/GRM-50 (FSN 6625-868-8353).
TM 11-6625-586-12	Operator, and Organizational Maintenance Manual, Including Repair Parts and Special Tool Lists: Generator, Signal AN/URM-103.
TM 11-6625-683-15	Operator, Organizational, Direct Support, General Support, and Depot Maintenance Manual: Signal Generator AN/URM-127.
TM 11-6625-700-10	Operator's Manual: Digital Readout, Electronic Counter AN/USM-207.
TM 11-6625-1703-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tool Lists: Oscilloscope AN/USM-281A.
TM 38-750	The Army Maintenance Management Systems (TAMMS).
TM 740-90-1	Administrative Storage of Equipment.
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

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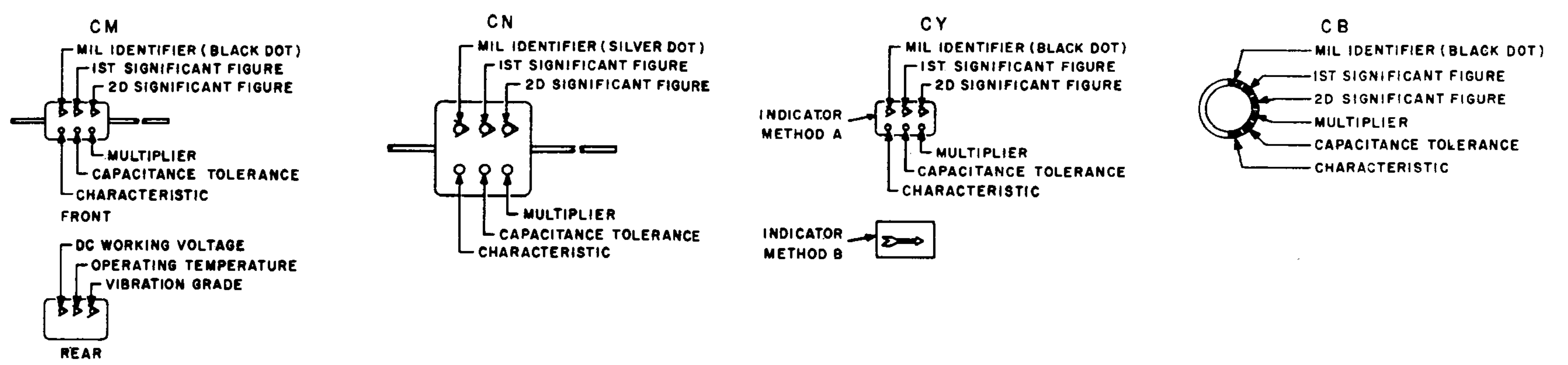
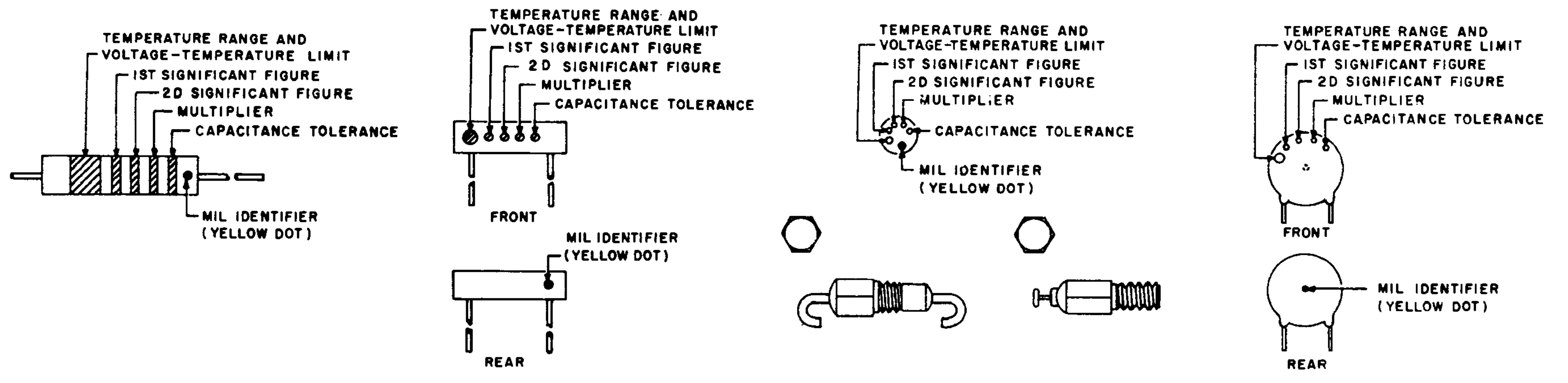
COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



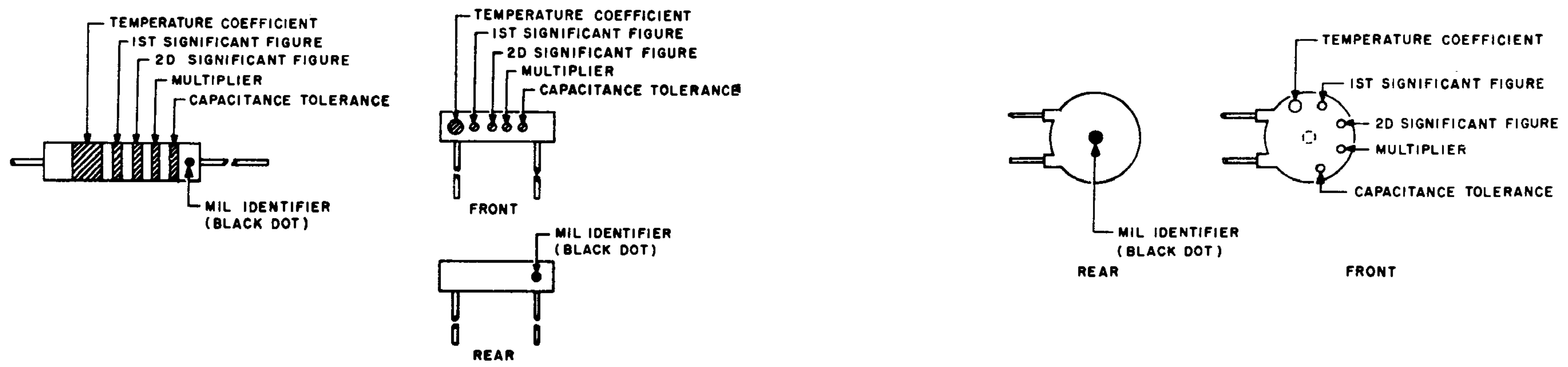
MICA-DIELECTRIC PAPER-DIELECTRIC GLASS-DIELECTRIC, GLASS CASE MICA, BUTTON TYPE

GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK



AXIAL LEAD RADIAL LEAD FEED-THROUGH STAND-OFF DISK-TYPE

GROUP III Capacitors, Fixed, Ceramic-Dieletric (Temperature Compensating) Style CC



AXIAL LEAD RADIAL LEAD DISK-TYPE

COLOR CODE TABLES

TABLE I – For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]				DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CY	CB	CM	CM	CM
BLACK	CM, CY CB	0	0	1			± 20%	± 20%		A				−55° to +70°C	10–55 cps
BROWN		1	1	10					B	E		B			
RED		2	2	100	± 2%		± 2%	± 2%	C		C			−55° to +85°C	
ORANGE		3	3	1,000		± 30%			D			D	300		
YELLOW		4	4	10,000					E					−55° to +125°C	10–2,000 cps
GREEN		5	5		± 5%				F				500		
BLUE		6	6											−55° to +150°C	
PURPLE (VIOLET)		7	7												
GREY		8	8												
WHITE		9	9												
GOLD				0.1			± 5%	± 5%							
SILVER	CN				± 10%	± 10%	± 10%	± 10%							

TABLE II – For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE – TEMP. LIMITS[3]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE	MIL ID
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AX	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AV	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BV	6	6			
PURPLE (VIOLET)		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

TABLE III – For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT[4]	1st SIG FIG	2nd SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	−30	1	1	10	± 1%		
RED	−80	2	2	100	± 2%	± 0.25uuf	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		± 5%	± 0.5uuf	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	+100					± 1.0uuf	
SILVER							

1. The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in uuf.
2. Letters indicate the Characteristics designated in applicable specifications: MIL–C–5, MIL–C–91, MIL–C–11272, and MIL–C–10950 respectively.
3. Letters indicate the temperature range and voltage-temperature limits designated in MIL–C–11015.
4. Temperature coefficient in parts per million per degree centigrade.

Figure 6–6. MIL-STD capacitor color-code markings.

NOTES:

1. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS CAPACITANCES ARE IN UUF.
2. [ ] INDICATES EQUIPMENT PANEL MARKINGS
3. ALL TRANSISTORS WITH * HAVE HEAT SINKS.
4. [: :] INDICATES EQUIPMENT INTERNAL MARKINGS.
5. SWITCH POSITIONS ARE AS SHOWN:

FUNCTION SWITCH
POS NO. 1 = FREQ CAL
POS NO. 2 = MOD OFF
POS NO. 3 = 150 Hz
POS NO. 4 = 400 Hz
POS NO. 5 = 1000 Hz
POS NO. 6 = EXT MOD
POS NO. 7 = IF

IF ATT SWITCH
POS NO. 1 = OFF
POS NO. 2 = 10 UV
POS NO. 3 = 100 UV
POS NO. 4 = 1 KUV
POS NO. 5 = 10 KUV
POS NO. 6 = 100 KUV
POS NO. 7 = 1.0 VOLT

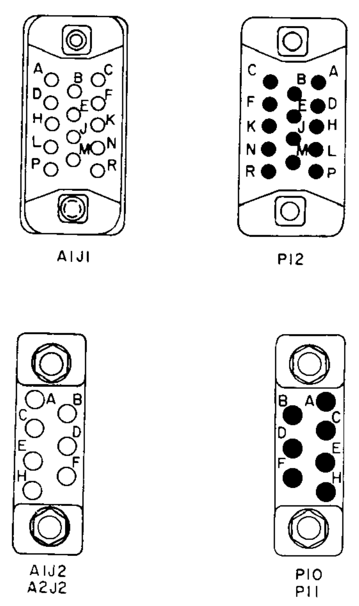
RF ATT SWITCH
POS NO. 1 = 0-10 KUV
POS NO. 2 = 62.5 KUV
POS NO. 3 = 125 KUV
POS NO. 4 = 255 KUV
POS NO. 5 = 500 KUV

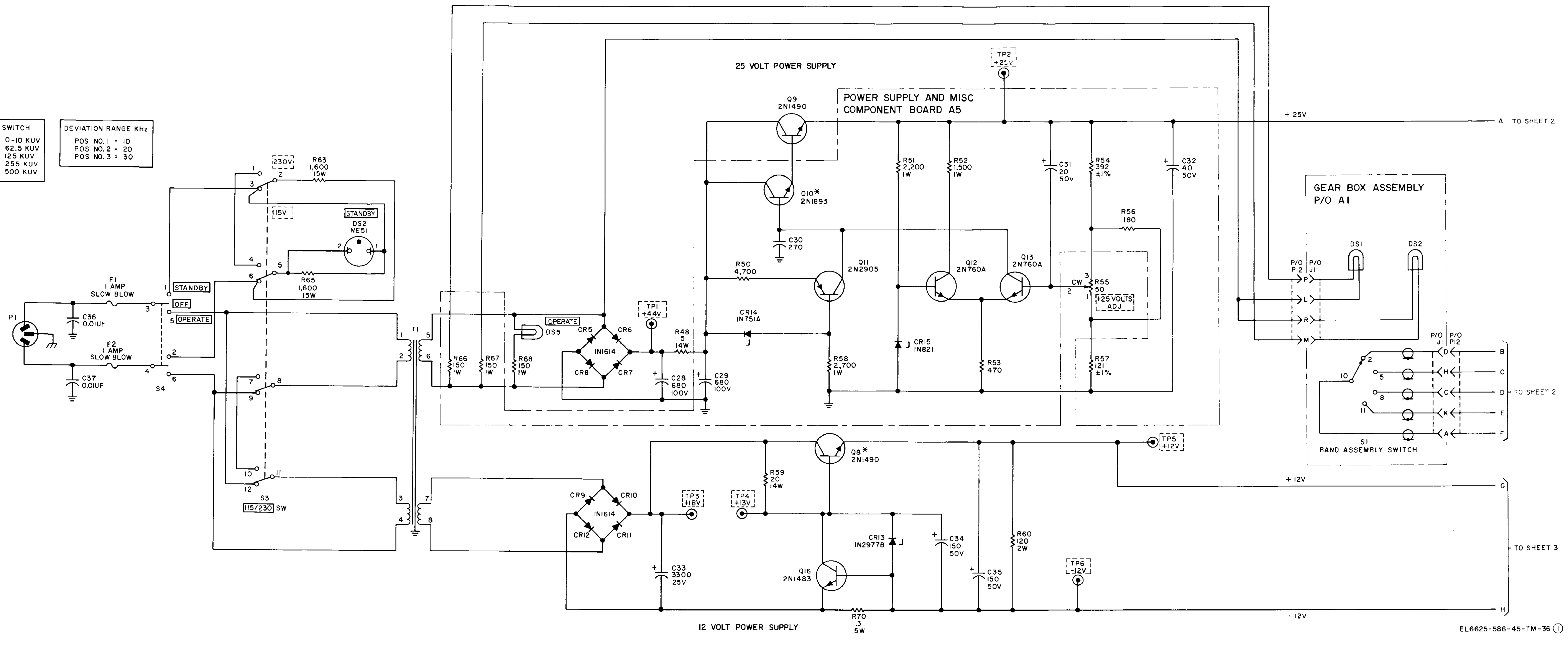
DEVIATION RANGE KHz
POS NO. 1 = 10
POS NO. 2 = 20
POS NO. 3 = 30

6. CAPACITOR VALUES FOR TURRET ARE AS SHOWN:

**REF SYM	BAND	DESCRIPTION
A1A2 C1 A1A2 C2	A A	1.8UUF ±10% N 2200 PPM ±250 PPM 2.2UUF ±10% N 1500 PPM ±250 PPM
A1A2 C3	B	1UUF ±10% N 2200 PPM ±250 PPM
A1A2 C4	C	1UUF ±10% N 1500 PPM ±250 PPM
A1A2 C5	D	1UUF ±10% N 0 PPM ± 30 PPM

7. PREFIX REF DESIG OF COMPONENTS WITH BOARD REF DESIG.
8. PREFIX REF DESIG OF BOARD WITH REF DESIG OF MODULE INTO WHICH IT PLUGS.
9. CONNECTOR VIEWED FROM PIN OR RECEPTACLE SIDE





EL6625-586-45-TM-36 (1)

Figure 6-8 (1). Generator, Signal SG-297/U, schematic diagram (part 1 of 4).

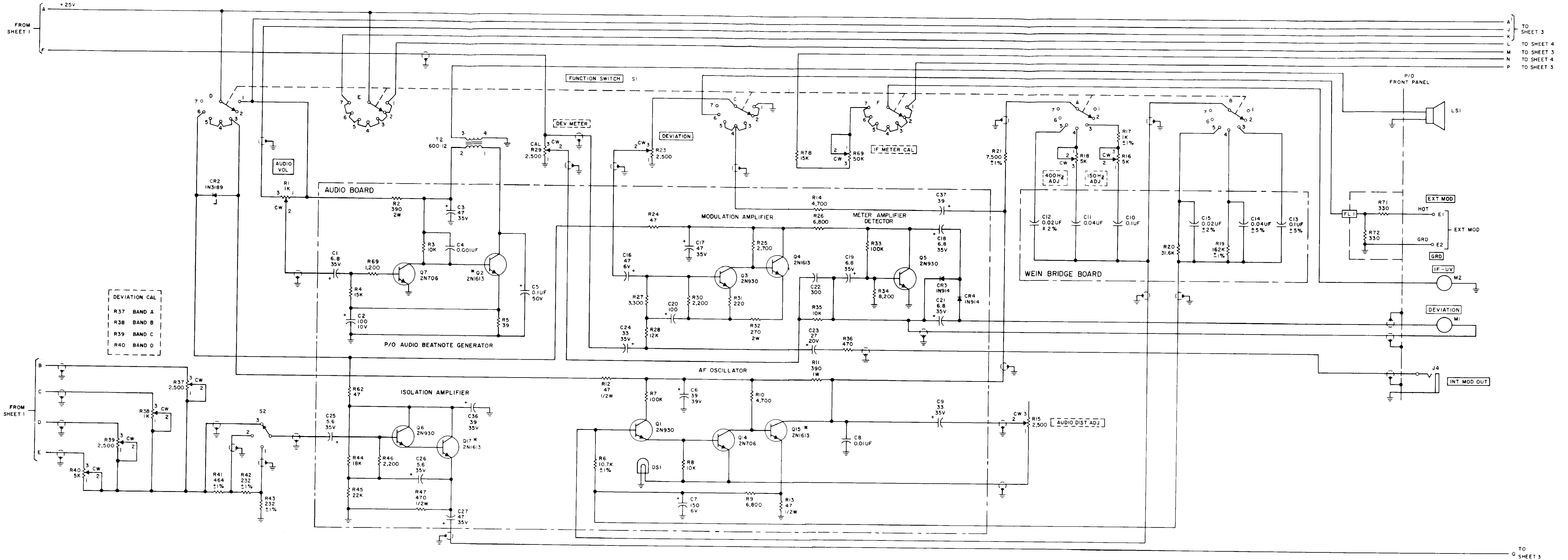


Figure 6-8 (2). Generator, Signal SG-297/U, schematic diagram (part 2 of 4).

EL6625-586-45-TM-36(2)

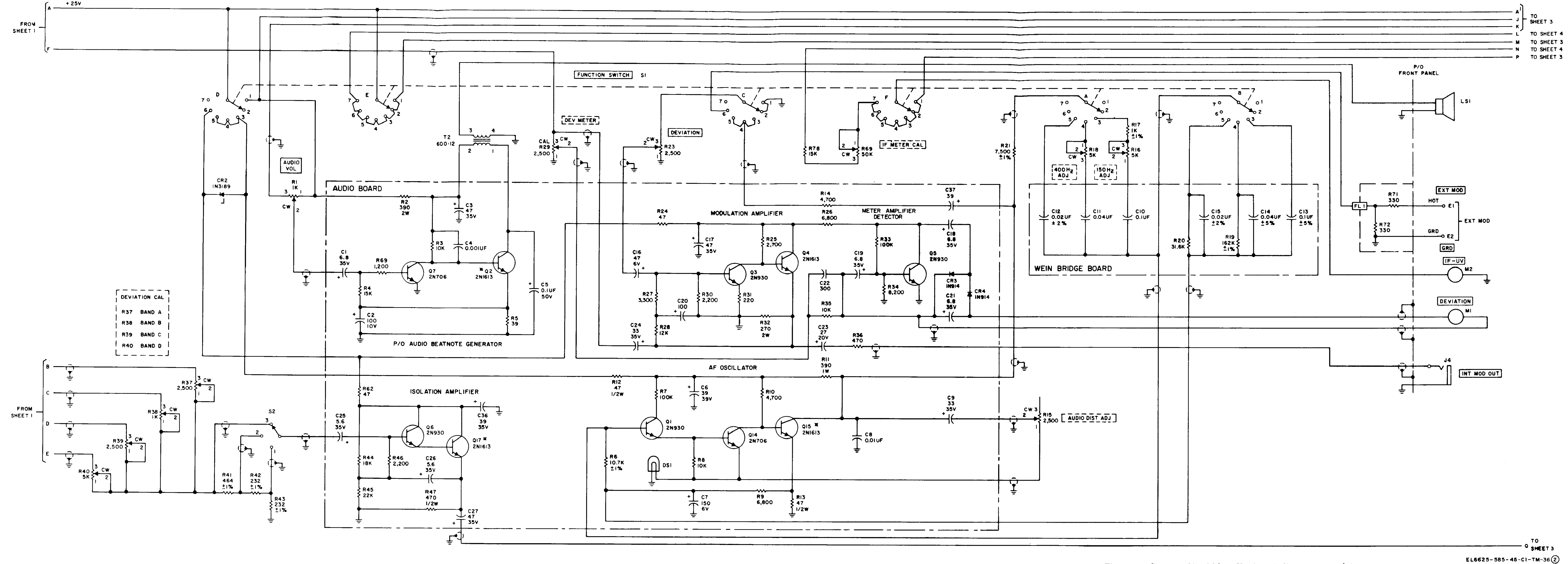
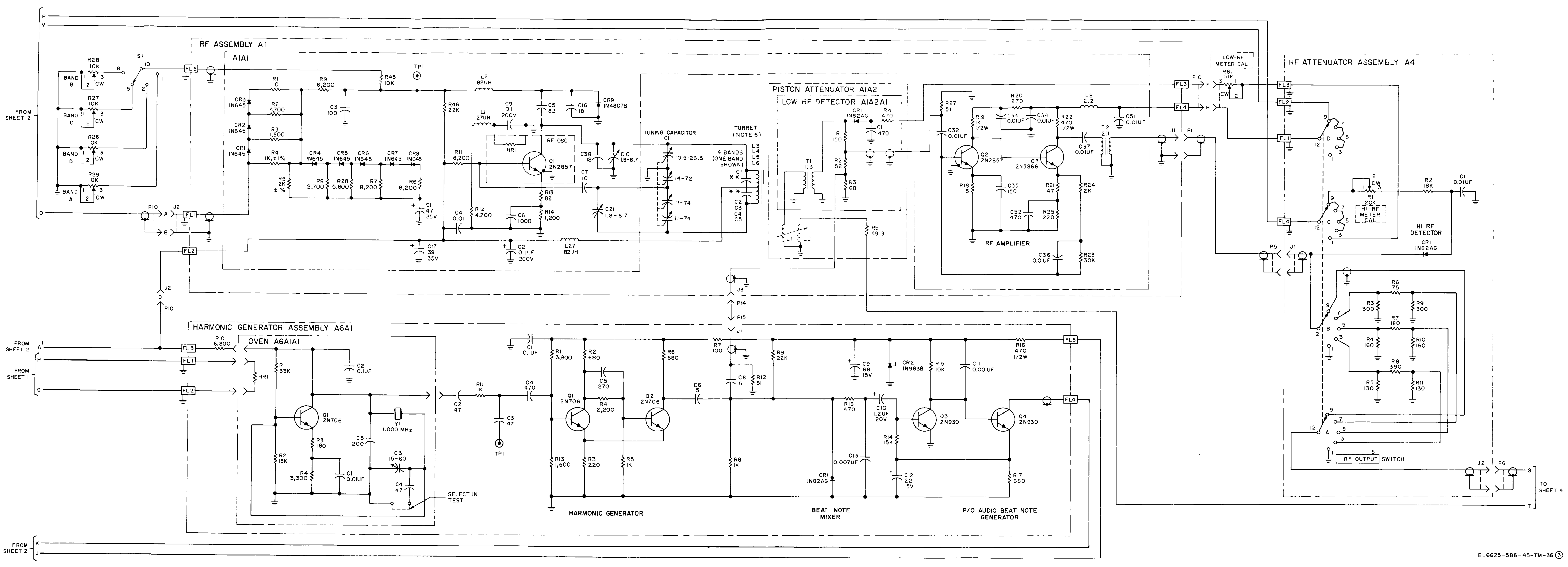


Figure 6-8(2). Generator, Signal SG-297/U, schematic diagram (part 2 of 4).



EL6625-586-45-TM-36 (3)

Figure 6-8 (3). Generator, Signal SG-297/U, schematic diagram (part 3 of 4).

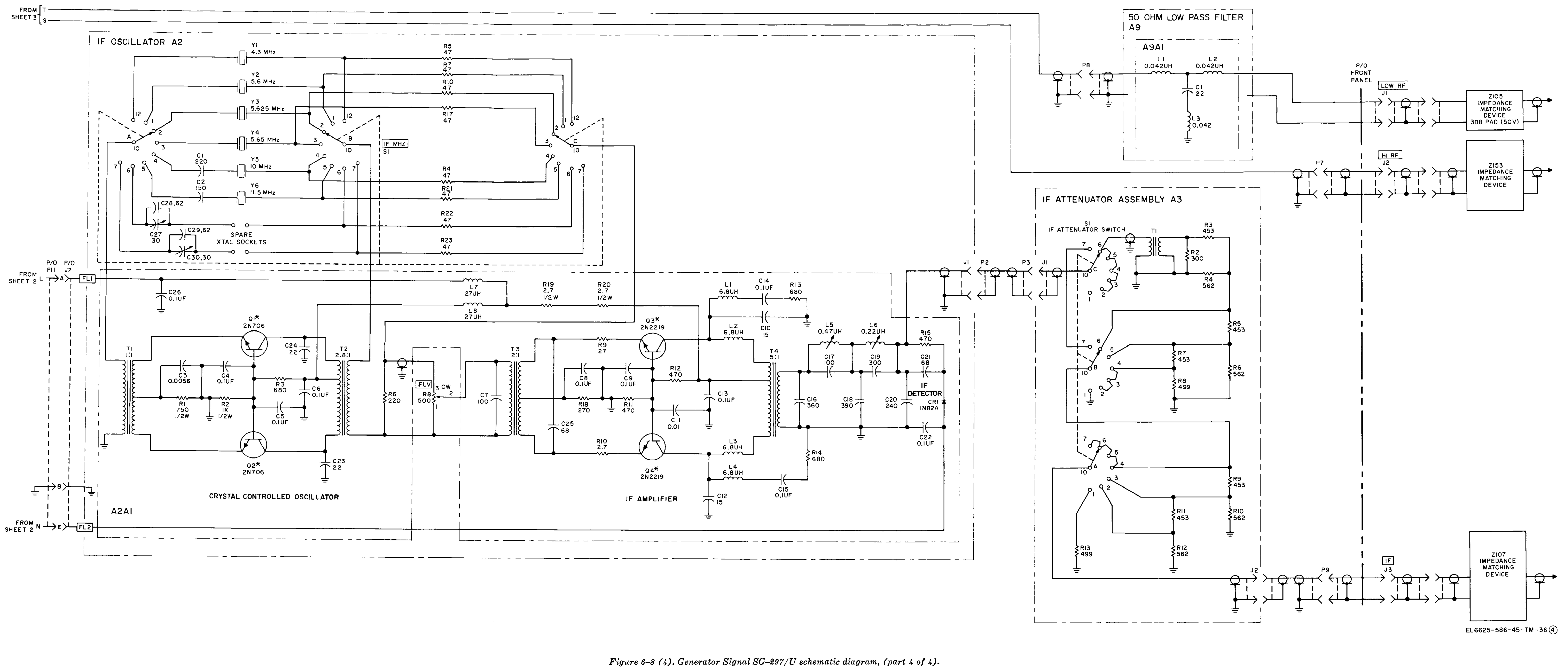
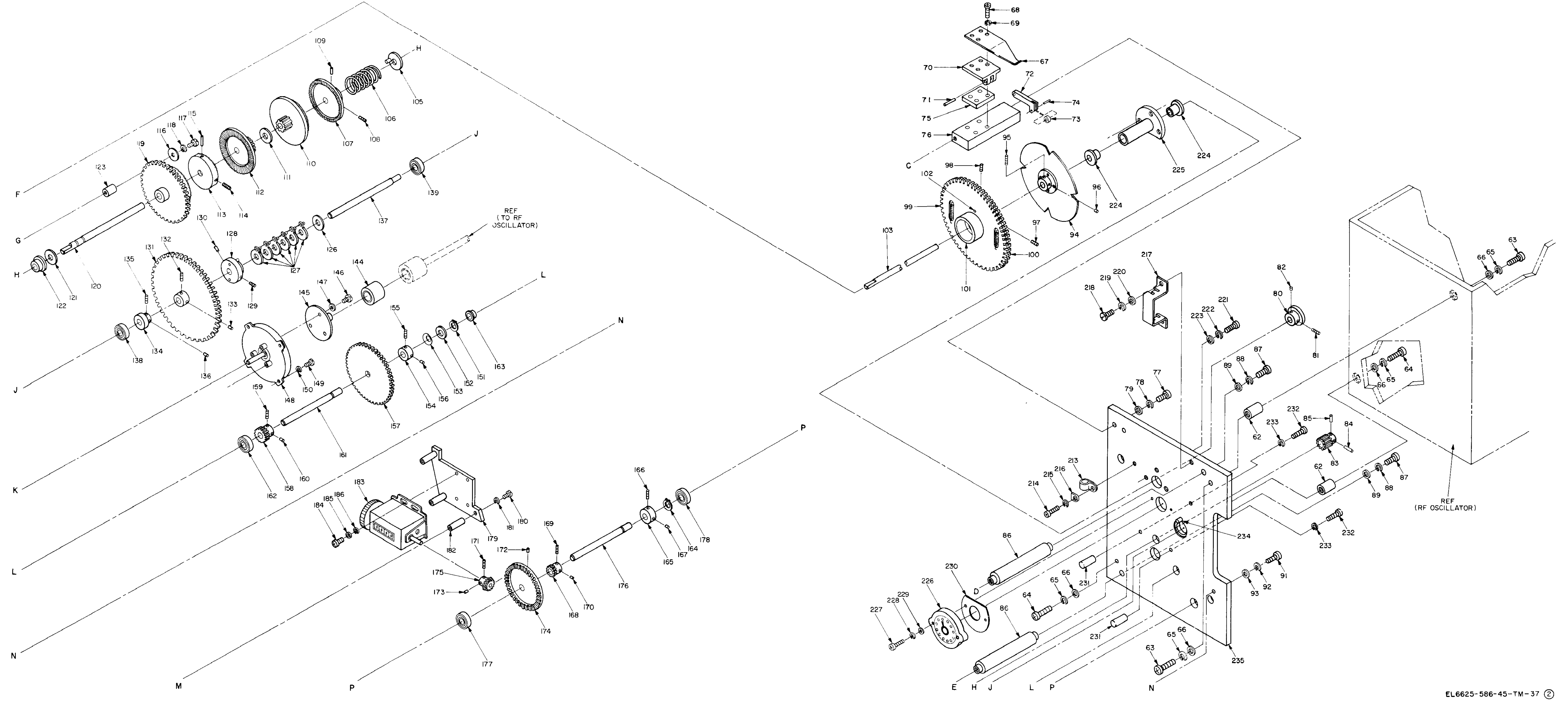


Figure 6-8 (4). Generator Signal SG-297/U schematic diagram, (part 4 of 4).



EL6625-586-45-TM-37 (2)

Figure 6-9 (2). Gear train, exploded view (part 2 of 2).

By Order of the Secretary of the Army:

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General, United States Army,
Chief of Staff.

Official:

KENNETH G. WICKHAM,
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