DEPARTMENT OF THE ARMY TECHNICAL MANUAL

R. F. SIGNAL GENERATOR
SET AN/URM-25B

This copy is a reprint which includes current pages from change 1.

DEPARTMENT OF THE ARMY JANUARY 1954

R. F. SIGNAL GENERATOR SET AN/URM-25B

CHANGE No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 19 November 1963

TM 11-5551B, 25 January 1954, is changed as follows:

Page 1-1. Add paragraphs 1.1 and 1.2 after paragraph 1.

1.1. Index of Publications

Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes or additional publications pertaining to the equipment. DA Pam 3104 is an index of current technical manuals, technical bulletins, Supply manuals (types 4, 6, 7, 8, and 9), supply bulletins, lubrication orders, and modification work orders available through publications supply channels. The index lists the individual parts (-10, -20, -35P, etc) and the latest changes to and revisions of each equipment publication.

1.2. Forms and Records

a Reports of Maintenance and Unsatisfactory Equipment. Use equipment forms and records in accordance with instructions in TM 38-750.

b Report of Damaged or Improper Shipment. Fill out and forward DD Form 6 (Report of Damaged or Improper Shipment) as prescribed in AR 700-58 (Army), NAVASANDA Publication 378 (Navy), and AFR 71-4 (Air Force).

c Reporting of Equipment Manual Improvements. The direct reporting by the individual user of errors, omissions, and recommendations for improving this manual is authorized and encouraged. DA Form 2028 (Recommended changes to DA technical manual parts lists or supply manual 7, 8, or 9) will be used for reporting these improvements. This form will be completed in triplicate using pencil, pen, or typewriter. The original and one copy will be forwarded direct to Commanding Officer, U. S. Army Electronics Material Support Agency, ATTN: SELMS-MP, Fort Monmouth, N. J. 07703. One information copy will be furnished to the individual's immediate supervisor (officer, noncommissioned officer, supervisor, etc).

Page 5-1. Delete paragraph 1 and substitute:

1. Scope of Maintenance

The maintenance duties assigned to the operator and organizational repairman of the equipment are listed below together with a reference to the paragraphs covering the specific maintenance functions.

a Daily preventive maintenance checks and services (par. 1.3).
b Weekly preventive maintenance checks and services (par. 1.4).
c Monthly preventive maintenance checks and services (par. 1.5).
d Quarterly preventive maintenance checks and services (par. 1.6).
e Cleaning (par. 1.7).
f Touchup painting (par. 1.8).
g Routine check (table 5-1).

Add paragraphs 1.1 through 1.8 after paragraph 1.

1.1. Preventive Maintenance

Preventive maintenance is the systematic care, servicing, and inspection of equipment to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable.

a Systematic Care. The procedures given in paragraphs 1.3 through 1.7 cover routine systematic care and cleaning essential to proper upkeep and operation of the equipment.

b. Preventive Maintenance Checks and Services. The preventive maintenance checks and services charts (par. 1.3-1.6) outline functions to be performed at specific intervals. These checks and services are to maintain Army electronic equipment in a combat serviceable condition; that is, in good general (physical) condition and in good operating condition. To assist operators in maintaining combat serviceability, the charts indicate what to check, how to check, and what the normal conditions are; the references column lists the tables or manuals that contain detailed repair or replacement procedures. If the defect cannot be remedied by performing the corrective actions listed, higher echelon maintenance or repair is required. Records and reports of these checks and services must be made in accordance with the requirements set forth in TM 38-750.

1.2. Preventive Maintenance Checks and Services Periods

Preventive maintenance checks and services of the equipment are required daily, weekly, monthly and quarterly.

a Paragraph 1.3 specifies the checks and services that must be accomplished daily (or at least once each week if the equipment is maintained in standby condition).

b. Paragraphs 1.4, 1.5, and 1.6 specify additional checks and services that must be performed on a weekly, monthly, and quarterly basis, respectively.

1.3. Daily Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Completness	See that the equipment is complete	Table 1-1
2	Exterior surface	Clean the exterior surfaces, including the panel, dial windows, and meter glass (par. 1.7). Check all glass and indicator lens for cracks.	
3	Connectors	Check the tightness of all connectors	
4	Controls and indicators	While making the operating checks (item 5), observe that the mechanical action of each knob, dial, and switch is smooth and free of external or internal binding, and that there is no excessive looseness. Also, check the meter for sticking or bent pointer.	
5	Operation	Operate the equipment according to table 5-1	Table 5-1

1.4. Weekly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Cables	Inspect or, cables and wires for chafed, cracked, or frayed insulation. Replace connectors that are broken, arced, stripped, or worn excessively.	None
2	Handles and latch	Inspect handles and latches for looseness. Replace or tighten as necessary.	None
3	Metal surfaces	Inspect exposed metal surfaces for rust and corrosion. Touchup paint as required (par. 1.8).	None

1.5. Monthly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Pluckout items	Inspect seating of pluckout items. Make certain that tube clamps grip tube bases tightly	None
2	Jacks	Inspect jacks for snug fir and good contact	None
3	Transformer terminals	Inspect the terminals on the power transformer. All nuts must be tight. There should be no evidence of dirt or corrosion.	None
4	Terminal blocks	Inspect terminal blocks for loose connections and cracked of broken insulation	None
5	Resistors and capacitors	Inspect the resistors and capacitors for cracks, blistering, or other determental defects	None
6	Gaskets and insulators	Inspect gaskets, insulators, bushings, and sleeves for cracks, chipping, and excessive wear.	None
7	Variable capacitors	Inspect variable capacitors for dirt, corrosion and deformed plates.	None
8	Interior	Clean interior of chassis and cabinet	None

1.6. Quarterly Preventive Maintenance Checks and Services Chart

Sequence No.	Item	Procedure	References
1	Publications	See that all publications are complete, serviceable, and current	DA Pam 310-4
2	Modifications.........................	Check DA Pam 310-4 to determine if new applicable MWO's have been published. All urgent MWO's must be applied immediately. All normal MWO's must be scheduled.	TM 38-750

1.7. Cleaning

Inspect the exterior of the equipment. The exterior surfaces should be clean, and free of dust, dirt, grease, and fungus.

a Remove dust and loose dirt with a clean soft cloth.

Warning: Cleaning compound is flammable and its fumes are toxic. Provide adequate ventilation Do not use near a flame.

b Remove grease, fungus, and ground-in dirt from the case; use a cloth dampened (not wet) with cleaning compound (Federal stock No. 7930-395-9542).

c Remove dust or dirt from plugs and jacks with a brush.

Caution: Do not press on the dial windows or meter face (glass) when cleaning; the dial windows and meter may become damaged.

d Clean .he front panel, dial windows, meter, and control knobs; use a soft clean cloth. If necessary, dampen the cloth with water; mild soap may be used for more effective cleaning.

1.8. Touchup Painting Instructions

Remove rust and corrosion from metal surfaces by lightly sanding them with fine sandpaper. Brush two thin coats of paint on the bare metal to protect it from further corrosion. Refer to the applicable cleaning and refinishing practices specified in TM 9-213.

Page 7-0. Delete section 7 and substitute the following appendix:

APPENDIX
REFERENCES

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (types 4, 6, 7, and 9) Supply Bulletins, Lubrication Orders, and Modification Work Orders.
TM 9-213	Painting Instructions for Field Use.
TM 11-5527	Multimeters TS-352/U, TS-352A/U, and TS-352B/U.
TM 38-750	The Army Equipment Record System and Procedures.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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USAMC (5)
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LOGCOMD (2)
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Armies (2)
Corps (2)
USA Corps (3)
1st FA Mal Bde (2)
Instl (2) except
    Ft Monmouth (63)
    Ft Lee (5)
    Ft Holabird (5)
USMA (2)
Svc Colleges (2)
Br Svc Sch (2) except
    ARADSCH (5)
USATC FA (8)
USATC AD (2)
USATC Armor (2)
USATC Engr (2)
USATC Inf (3)
USATC (2)
Army Dep (2) except
    Lexington (12)
    Sacramento (28)
    Tobyhanna (12)
    Ft Worth (8)
    Granite City (5)
    Columbus (5)
    Letterkenney (5)
    Utah (5)
Sig Dep (OS) (12)
GENDEP (OS) (2)
Sig Sec, GENDEP (OS) (5)
USA Trans Tml Comd (1)
Army Tml (1)
USASCC (4)
USAECDA (1)
USACBRCDA (2)
USACECDA (2)
USAMSCDA (1)
USAOCDA (1)
USAQMCDA (1)
USATCDA (1)
USAADCDA (1)
USAARMCDA (1)
USAAVNCDA (1)
USAARTYCDA (1)
USASWCDA (2)
USAOSA (1)
USA Elct Mat Agcy (25)
USARSOUTHCOM Sig Agcy (1)
White House Army Comm Agcy (2)
WRAMC (1)
Army Pic Cen (2)
USA Mob Spt Cen (1)
USARPRDC (2)
USA Sp Warfare Cen (2)
USACDEC (2)
Chicago Proc Dist (1)
AMS (1)
APP (1)
USA Engr RD Agcy (Pt Huachuca) (2)
USA Engr RD Agcy (White Sands) (18)
USAERDL (2)
USASATSA (2)
POE (1)
Sig Fld Maint Shops (3)
Yuma PG (2)
WSMR (5)
USARMIS: Venezuela (2)
    Paraguay, Ecuador (2)
JUSMMAT (2)
Edgewood Arsenal (5)
Jefferson PG (2)
USAEPG (2)
USAMTMSA (2)
MAAG Iran (2)
ARMIS (2)
GENMIS (2)
KMAG (2)

NG: State AG (3); Div (1).

USAR: None.

For explanation of abbreviations used, see AR 320-50.

TECHNICAL MANUAL
No. 11-5551B

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., *25 January 1954*

R. F. SIGNAL GENERATOR SET AN/URM-25B

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS(Continued)

SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the Bureau of Ships Manual or superseding instructions on the subject of radio-safety precautions to be observed.

This equipment employs voltage which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS:

Operating personnel must at all time observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

DON'T SERVICE OR ADJUST ALONE:

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS:

Do not depend upon door switches or interlocks for protection but always shut down motor generators or other power equipment. Under no circumstances should any access gate, door, or safety interlock switch be removed, short-circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltages from the equipment.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR, OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

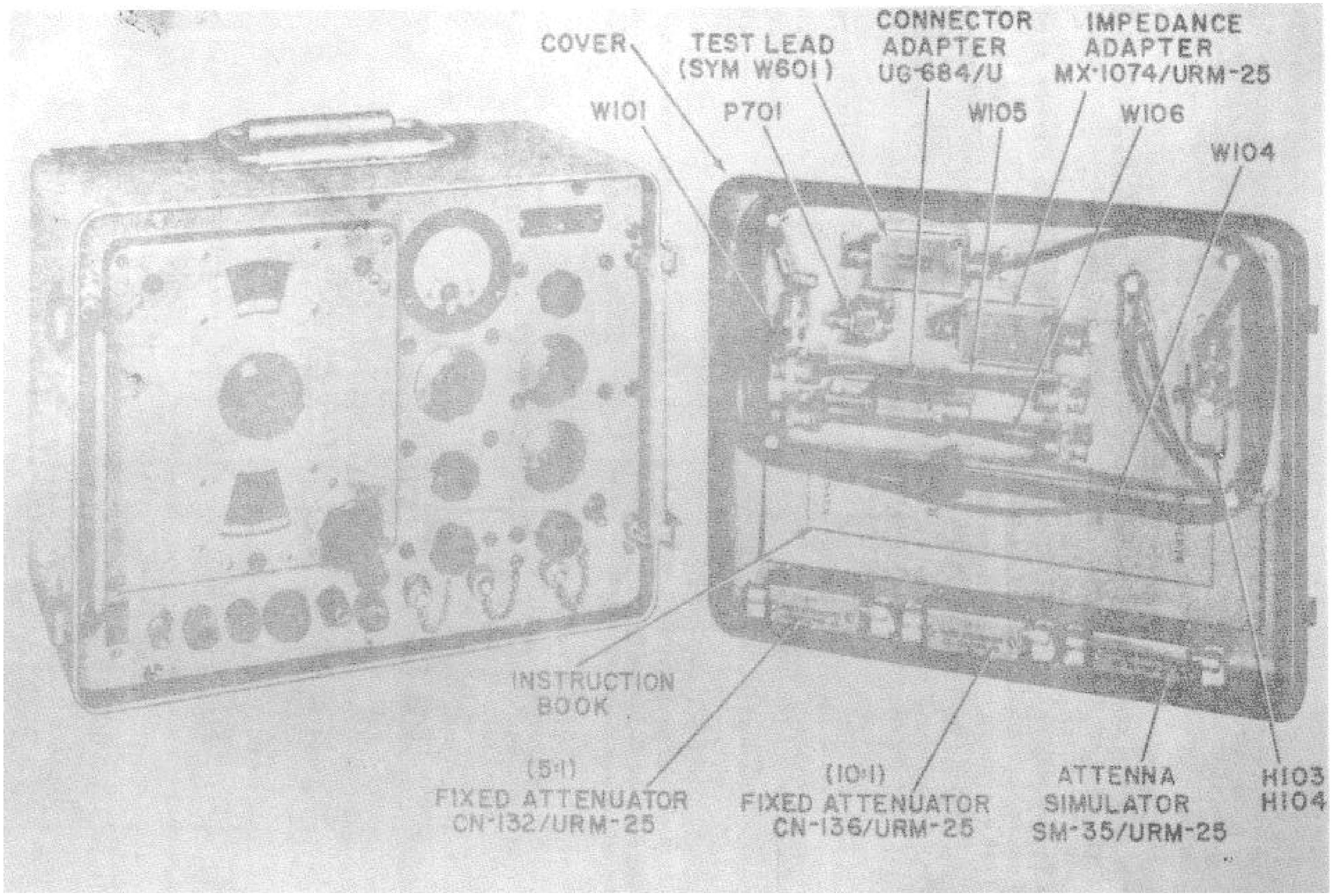


Figure 1-1. RF Signal Generator Set AN/URM-25B, Complete Equipment

SECTION 1
GENERAL DESCRIPTION

1. Introduction.

a. The RF Signal Generator Set AN/URM-25B is a test instrument for generating radio frequency signals, either modulated or unmodulated, over a continuous range of frequencies from 10 to 50, 000 kilocycles. It has been miniaturized physically without any loss of accuracy or applicability.

b. All units including the power supply, are incorporated in a single portable cabinet (See figure 1-1). The units supplied with their corresponding weights are shown in Table 1-1.

c. The AN/URM-25B operates from a source potential of approximately 103 to 126 volts, 50 to 1000 cycles, single phase AC. The equipment is so constructed and shielded that an approximately accurate known radio frequency voltage is obtainable at its output terminals in varying strength as indicated by a meter and associated multiplier indicator. The unit includes a self contained 1 mc crystal calibrator that is capable of establishing an accuracy within ± .05% at frequencies above 1 mc.

d. The complete equipment consists of the following units:

(1) RF Signal Generator SG-44B/URM-25
(2) Power Supply PP-562A/URM-25
(3) Impedance Adapter MX-1074/URM-25
(4) Antenna Simulator SM-35/URM-25
(5) (5:1) Fixed Attenuator CN-132/URM-25
(6) (10:1) Fixed Attenuator CN-136/URM-25
(7) Test Lead CX-1363/U
8) RF Cable Assembly CG-409A/U (4'0")
(9) RF Cable Assembly CG-409A/U (7")-qty 2
(10) Coaxial Adapter UG-201/U
(11) AC Line Cable Assembly
(12) Connector, Adapter UG-684/U

2. REFERENCE DATA

a. Nomenclature RF Signal Generator Set AN/URM-25B
b. Contract-NObsr 52099, 8 December 1950
c. Contractor-Federal Manufacturing & Engineering Corporation, 199 Steuben Street, Brooklyn 5, New York *d.* Cognizant Naval Inspector - Inspector of Naval Material, New York, N. Y.
e. Number Of Packages Involved Per Complete Shipment-one package, consisting of one equipment and one carton of equipment spares.
f. Total Cubical Contents--see Table 1-1
g. Total Weight--see Table 1-1
h. Frequency Range - 10 kilocycles to 50, 000 kilocycles ± .5%; ± .05% from 1 mc to 50 mc when calibrated against integral crystal.
i. Tuning Bands And Range Of Each Band--

(1) Band A --10 to 27 kc
(2) Band B 27 to 80 kc
(3) Band C-80 to 230 kc
(4) Band D 230 to 680 kc
(5) Band E -.68 to 2 mc
(6) Band F 2 to 8.3. mc
(7) Band G 8.3 to 18 mc
(8) Band H -18 to 50 mc

j. Types Of Modulation-

(1) Amplitude modulation -O to 80%, (indicated accuracy within ±10%).
(2) Internal modulation frequencies
(a) 400 cycles per second ± 5%.
(3) External modulation frequency 100 to 15, 000 cycles per second.

k. Output Voltage (RF).

(1) C.1 to 100, 000 microvolts (±_ 10C7() continuously variable (across a 53.5 ohm external load).
(2) Approximately 2 volts-adjustable (across a high load impedance).

l. Output Voltage (audio).

(1) Frequency-400 or 1000 cycles.
(2) Voltage to approx. 4 v (adjustable); across approx. 100, 000 ohms).
(3) Adjustment-voltage varied by front panel control.
(4) Voltage Calibration-proportional to reading of % Modulation.

m. Output Impedance.

(1) 53.5 ohms at the X MULT RF OUTPUT jack (J-102).
(2) 500 ohms at the X 20, 000 RF OUTPUT jack (J-101).
(3) 0 to 90, 000 ohms at audio output jack J-103.

n. Power Supply PP-562A/URM-25.

(1) Power source requirements--115 volts AC (1±10%) 50 to 1000 cycles per second, single phase.
(2) Power consumption of equipment is approximately 45 watts.

3. DETAILED DESCRIPTION.

a. The rated frequency range is 10 kilocycles to 50, 000 kilocycles per second. This range is covered in eight bands by a band selector switch located on the front panel. Within each band the frequency is varied by means of a straight line frequency capacitor. Percentage frequency change is therefore proportional to capacitor dial rotation. The frequency generated can be read from a main frequency scale, which is geared to this variable capacitor.

b. The RF output is continuously variable from 0.1 to 100, 000 microvolts and is determined by a meter reading in association with a multiplier and external attenuator settings. An adjustable two volt, open circuit, output is also available.

c. The RF output may be either modulated or unmodulated. Modulation. is adjustable between 0 and 80 percent. An internal modulation source of either 400 or 1000 cycles per second is provided. Provision is also made for external modulation.

d. A 1 mc crystal calibrator is incorporated in the set for purposes of frequency calibration and is effective between I mc and 50 mc. The frequency accuracy of the signal generator is within + .05% when calibrated against this integral calibrator.

e. An adjustable 400 or 1000 cycle audio voltage is made available at the EXT MOD IN jack. This voltage can be varied from 0 to approximately 4.0 volts by means of the same control that adjusts % modulation. The audio output is proportional to the % modulation reading on the front panel meter. The details of operation and characteristics are discussed in other sections of the instruction book.

4. ELECTRON TUBE COMPLEMENT.

The quantities and types of electron tubes used with the AN/URM-25 B are listed in Table 1-3.

TABLE 1-1. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY TYPE OR A-N DESIGNATION	OVER-ALL DIMENSIONS (INCHES			VOLUME (CU. IN.)	WEIGHT (LBS.)
			HEIGHT	WIDTH	DEPTH		
1	RF Signal Generator Set	AN/URM-25B	10-1/4	13	10-1/4	1300	35
1	a. RF Signal Generator	SG-44b/URM-25					
1	b. Power Supply	PP-562A/URM-25					
1	c. Impedance Adapter	MX-1074/URM-25					
1	d. Antenna Simulator	SM-35/URM-25					
1	e. (5:1) Fixed Attenuator	CN-132/URM-25					
1	f. (10:1) Fixed Attenuator	CN-136/URM-25					
1	g. Test Lead	CX-1363/U					
1	h. RF Cable Assembly (sym W104)	CG-409A/U (4'0")					
1	i. RF Cable Assembly (sym W105, W106)	CG-409A/U (7")					
1	j. AC Line Cable Assembly (sym W101)						
1	k. Coaxial Adapter (sym P701)	UG-201/U					
1	l. Connector, Adapter	UG-684/U					
*1	Equipment Spares Box		6	9	12	648	8

*Dimensions 3" x 4" x 8" for Marine Corps shipments

TABLE 1-2. SHIPPING DATA

NUMBER OF BOXES	CONTENTS NAME	DESIGNATION	OVER-ALL DIMENSIONS (INCHES			VOLUME (CU. IN.)	WEIGHT (LBS.)
			HEIGHT	WIDTH	DEPTH		
1	RF Signal Generator Set	AN/URM-25B	17	20	17	5780	50
*1	Equipment Spares		7	10	13	910	10

*Dimensions 4" x 5" x 9" for Marine corps shipments.

TABLE 1-3. ELECTRON TUBE COMPLEMENT

NUMBER REQUIRED	TUBE TYPE	SYMBOL DESIG.	FUNCTION	LOCATION
1	12AU7	V101	Voltmeter Bridge	Audio Compartment
1	12AU7	V102	Modulation Oscillator	Audio Compartment
1	6AL5	V103	Modulation Diode	Audio Compartment
1	6J4	V104	Buffer-Amplifier	Buffer-Amplifier Compartment
1	9006	V105	RF Diode	Buffer-Amplifier Compartment
1	6J6	V106	Carrier Oscillator	Carrier Oscillator Compartment
1	6BE6	V-108	Crystal Calibrator	Audio Compartment
1	6X4	V201	B+ Rectifier	Power Supply PP-562A/URM-25
1	0D3/VR-150	V202	B+ Regulator	Power Supply PP-562A/URM-25

5. SIMILARITIES BETWEEN EQUIPMENTS.

The AN/URM-25B is basically similar to the AN/URM-25 and AN/URM-25A except that a crystal calibrator has been incorporated for calibrating frequency. In addition, an adjustable 400 and 1000 cycle audio output is made available at the front panel. Table 1-4 lists the basic differences between these models.

TABLE 1-4. BASIC DIFFERENCES IN AN/URM-25 SERIES EQUIPMENTS

MODEL	LINE CORD	EXT MOD IN FILTER	FREQUENCY SCALE LAMP FILTER	CRYSTAL CALIBRATOR	RF PEAK ING COIL	POWER SUPPLY PP-562/URM-25	OTHER ITEM DIFFERENCES
AN/URM-25	CORD-FILTER CX-1595 URM-25	Single section unshielded	none	none	one peaking coil for Band H (L - 114)	L-201, T-201 Non JAN types	
AN/URM-25	Line cord Sym No. W-101	Triple section shielded	Triple section shielded	none	one peaking coil for Band H (L - 114)	Rf by-passes C-205, C-206 added: L-201 T-201 JAN types	RF bypasses C-147, C-148 added to line filter
AN/URM-25	Line cord Sym No. W-101	Triple section shielded in addition to an unshielded choke	Triple section shielded	V-108 (6BE6) crystal calibrator	two peaking coils (L-121, L-122), effective from 16 mc to 50 mc	RF by-passes C-205, C-206, added; L-201, T-201 JAN types	C-108 (.5 mf) removed, Adapter Connector UG-684/U added, C-149, C-156 E-131 and C-118 added, C-113 changed from 10, 000 mmf tp 6200 mmf, other wiring changes

SECTION 2
THEORY OF OPERATION

1. GENERAL DESCRIPTION OF CIRCUITS.

(See figure 2-1).

a. The purpose of this section is to give the Electronics Technician a better understanding of the RF Signal Generator Set AN/URM-25B so that he can apply himself to the operation and maintenance problems that may arise.

b. The functional principal of the AN/URM-25B is similar to that of a radio frequency transmitter. This association will become more apparent as the technician reads and studies this section. A carrier oscillator (par. 2) generates a variable RF signal which is applied to the control grid of a buffer-amplifier (par. 3). A modulation oscillator (par. 4) generates an audio voltage (400 or 1000 cycles) which is also applied to the control grid of the buffer-amplifier to grid modulate the RF signal. The modulated signal is then taken from the buffer.-amplifier and fed to a step attenuator circuit (par. 6) where the desired output amplitude is selected. An electron tube voltmeter, consisting of an RF diode, modulation diode and voltmeter bridge, is provided for measuring the carrier output and percentage modulation. Provision is also made for external modulation.

The output of the modulation oscillator is available. at the "EXT MOD IN-AUDIO OUT jack. A crystal calibrating circuit is also provided to calibrate RF frequency from 1 mc to 50 mc. When this calibrator is used, the frequency error can be made less than .05 at these frequencies.

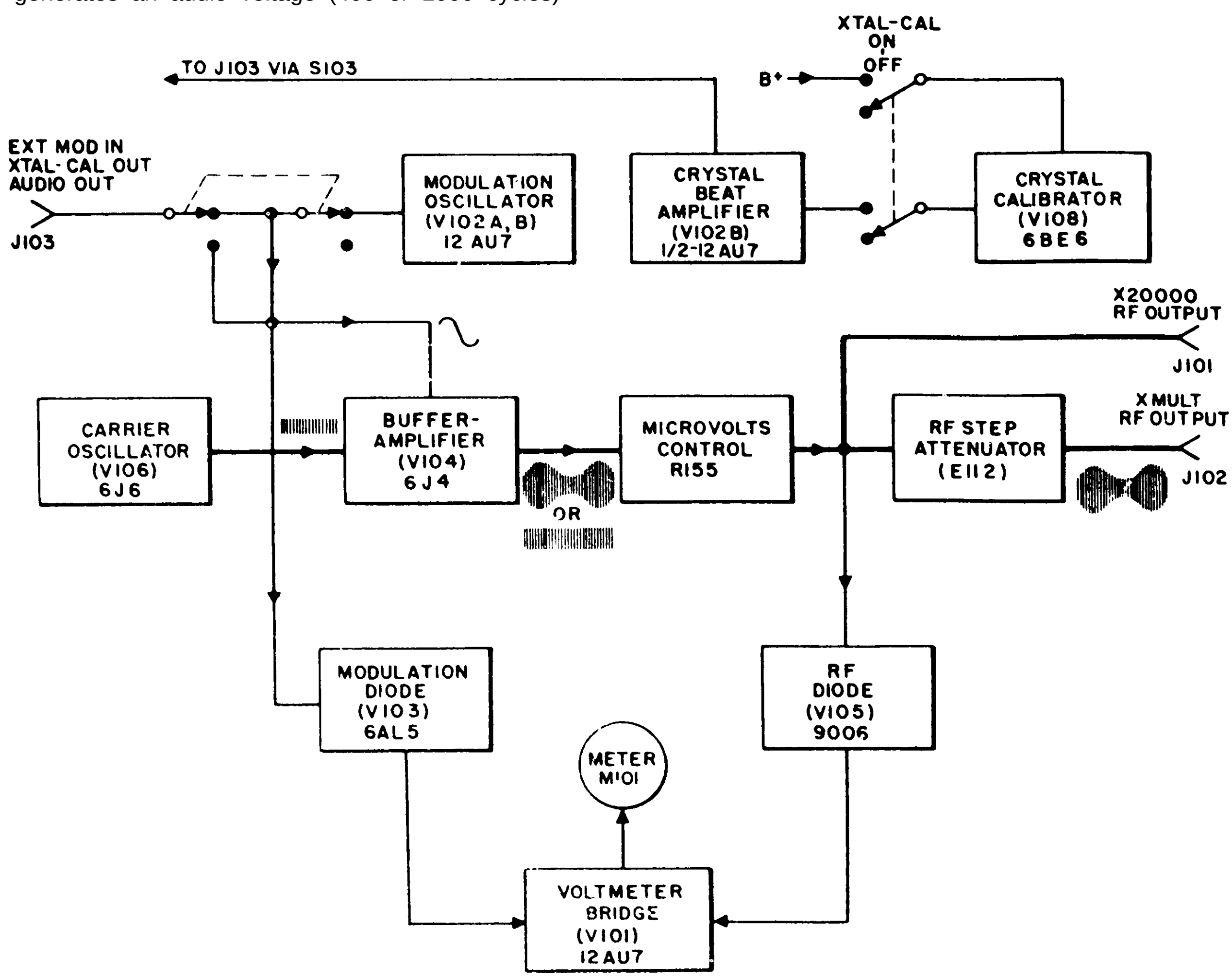


Figure 2-1. RF Signal Generator SG-44B/URM-25, Functional Block Diagram

c. A detailed analysis of the principle circuit assemblies is covered in this section under the following headings and paragraphs.

2. CARRIER OSCILLATOR.

(See figure 2-2).

a. With the exception of plate choke L-103, filament choke L-104, capacitor C-122, and CARRIER CONTROL R-123, the carrier oscillator circuit is completely enclosed in a shielded compartment located on the left side of the signal generator unit. It is of the conventional Hartley type with adjustable high Q iron core inductances (L-105 through L-111) and trimmer capacitors (C-128 through C-134) provided for frequency ranges A through G. There is no trimmer capacitor or adjustable inductance provided for the highest frequency range (band H). The frequency accuracy will be within ± .05%, from I mc to 50 mc when checked against oscillator-mixer V-108. At lower frequencies, the accuracy is within ± .5%.. This frequency check should be made by interpolation and does not require any iron core or trimmer adjustments. The method for maintenance calibration (using an external standard) is discussed in Section 6, par. 9.

b. The range of frequencies covered is from 10 kilocycles to 50 megacycles per second in 8 bands with an overlap of at least 3%7, . The desired band (A through H) is selected by the FREQUENCY BAND SWITCH (S-105) (See figure 6-23). This switch is of the rotary selector, shorting type and serves three functions as follows:

(1) Selects applicable "inductance-capacitance" combination.

(2) Selects proper grid leak resistance and blocking capacitance combination for V-106.

(3) Shorts to ground "inductance-capacitance" combinations not utilized at the selected frequency band.

The alternate shorting of "inductance-capacitance" combinations is necessary in eliminating stray inductance and capacitance at the frequency range selected.

c. The principal electrical features of the carrier oscillator are shown in the simplified schematic diagram, figure 2-2. For purposes of simplifying the circuit analysis, the mechanics of the FREQUENCY BAND SWITCH (S-105) have ot been included in this figure. M and N represent the contact positions of the FREQUENCY BAND SWITCH (S-105) when set at band E. The details of the carrier oscillator are covered in the overall schematic diagram (figure 6-23) near the end of Section 6.

d. The oscillator tube (V-106) is a type 6J6 dual triode with both sections connected in parallel. The frequency of the oscillations is determined by the L-C constant of the resonant tank circuit. The main tuning capacitor (C-127) is of the straight line frequency type, designed to give a linear frequency change with rotation except at the extreme ends of the frequency range. All frequency bands, with the exception of the highest band (H), can be calibrated by adjustment of the associated trimmer capacitor and variable iron core inductance. If necessary, band H can be calibrated by varying the spacing between the turns of L-105. This is discussed in Section 6, par. 9.

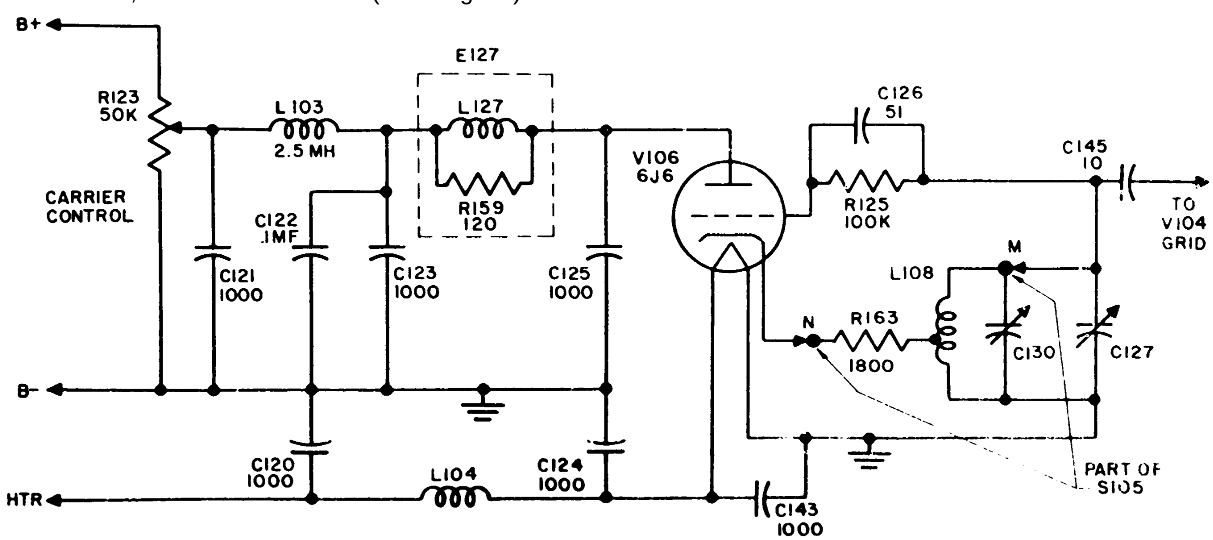


Figure 2-2. Simplified Schematic Diagram of the Carrier Oscillator

e. Bias for the oscillator tube (V-106) is provided by grid current 'which charges the grid blocking capacitor (C-126) through the cathode to grid resistance(R-125). The resistor (R-125) in parallel with the capacitor (C-126) allows this capacitor to discharge during the portion of the RF cycle when the grid is not positive with respect to the cathode. The net result is a bias on the grid which is proportional to the amplitude of the RF voltage across the grid tank circuit. When the FREQUENCY BAND SWITCH (S-105) is set for bands G or H, a 2200 ohm resistor (R124) shunts the 100, 00 ohm grid leak resistor (R-125) presenting an effective grid leak resistance of 2220 ohm for these bands. 'This is shown in the schematic diagram, figure 6-23 near the end of Section 6.

f. A parasitic suppressor (E-127) consisting of an inductance (L-113) wound around a resistor (R-159) serves to suppress spurious oscillations which are apt to be more pronounced at the highest frequency range (18 to 50 mc) of the signal generator. The filter network in the plate circuit, consisting of an inductance (L-103) and three capacitors (C-121, C-122, C-123) serves to eliminate stray RF currents from the oscillator compartment and interconnecting leads. Feedthru capacitor C-21 permits the entry of the lead from the CARRIER CONTROL. (R-123) into the filter network also bypass stray RF currents along this Iead.

g. The carrier amplitude is adjusted to the required value by means of the CARRIER CONTROL. (R-123) which is a linear potentiometer that varies the voltage applied to the plate of the oscillator tube (V-106). A different V-106 cathode resistor (R158, R-160 R-162, R-163) is switched into the circuit for bands A, B, D and E to improve output voltage linearity of R-123 on these ranges.

h. In changing frequency bands, the main tuning capacitor (C-127) is shunted b) the corresponding inductance and trimmer capacitance and is connected between the grid leak resistor and ground. This tuning capacitor is geared to the frequency scale (N-101, see figure 4-1). The scale rotates through 180 degrees and is divided into eight frequency ranges, (bands A thru, H).

i. The FREQUENCY BAND SWITCH (S-105) has a scale mask (H-101)) connected to it, so that only the frequency range or band selected can be viewed through the front panel of the signal generator. A more complete discussion of the frequency adjusting system is given in Section 4, par. 4.

3. BUFFER-AMPLIFIER.

(See figure 2-3).

a. The buffer-amplifier is an untuned RF amplifier inserted electrically and physically between the carrier oscillator and audio compartments and is completely enclosed in a shielded compartment. It consists of a triode type 6J4 (V-10)4) and associated circuit. This circuit serves the dual function of isolating the carrier oscillator from output terminal loading and introducing the amplitude modulation.

b. As a buffer stage, the buffer-amplifier makes the carrier oscillator independent of the setting of either the MICROVOLTS control (R-155) or MULTIPLIER (E-112-Step Attenuator), as well as independent of any load that may be presented to the output of the signal generator. (See figure 6-23).

c. Modulation is accomplished by introducing the audio voltage from the modulation oscillator (V-102) or from an external source to the grid of the buffer-amplifier tube (V-104). Due to the nature of the circuit, the amplitude of this audio voltage is directly correlated to the degree of modulation and adjustable by means of the %, MODULATION control (R-111). A portion of this audio voltage is also applied to the plate circuit of the

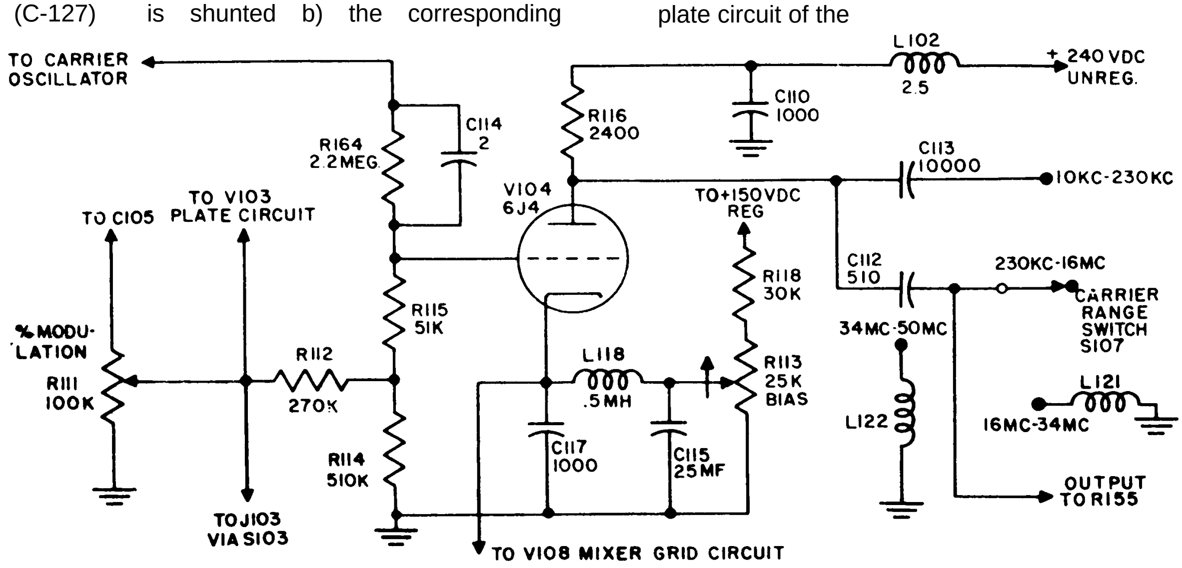


Figure 2-3. Simplified Schematic Diagram of the Buffer-Amplifier

modulation diode (V-105) where it is rectified and fed to the voltmeter bridge circuit for indication of % Modulation on M-101 (see Section 2, par. 5).

d. A decoupling network consisting of C-114 and R-164 serves to minimize the presence of incidental frequency modulation effects on the carrier oscillator circuit.

e. The plate supply voltage of V-104 is unregulated at + 240 volts DC. The grid bias is preset b) adjustment of the cathode BIAS resistor (R-113) to introduce a DC grid voltage of approximately 2.8 volts. This voltage is critical and is selected to maintain a minimum of both carrier and audio distortion (see Table 6-4, par. 4).

f. The output of V-104 is coupled to the attenuator circuit through a network selected by the CARRIER RANGE switch (S-107). When operating the signal generator at frequency bands A thru C, this switch should be set to the "10 kc-230 kc" position. In this position, the RF output is taken from the plate of V-104 through two parallel capacitors (C-112, C-113) which offer a total capacitance of 6710 micro-microfarads. These capacitors present a low enough reactance to permit sufficient RF output at low carrier frequencies (below 230 kc). These low frequencies should not be modulated by audio signals above 1000 cycles to avoid the presence of appreciable audio in the output. More effective audio filtering is accomplished at higher RF frequencies, by switching S-107 to one of the other three positions where C-113 is eliminated. and the output coupling capacity is only 510 mmf.

g. CARRIER RANGE switch S-107 serves an additional function above 16 mc where one of two RF peaking coils is placed in parallel with the AC load of V-104. One coil (L-121) boosts the RF gain of V-104 between 16 mc and 34 mc, whereas the second coil (L-122) boosts the gain between 34 mc and 50 mc. The inductance of these coils compensates for the output capacity in the plate circuit of V-104. A single coil does not provide sufficient gain over this frequency range. By increasing the gain of V-104, RF distortion from 16 mc to 50 mc is kept at a minimum. In order to obtain full output without these coils, the grid RF signal of V-104 would have to be increased by advancing CARRIER CONTROL R-123 in a clockwise direction. This larger grid signal would result in increased RF distortion, Peaking coils are not necessary at lower frequencies where the gain of the Buffer-Amplifier circuit is sufficiently high to keep RF distortion at a minimum.

h. A small portion of the RF energy is tapped from cathode bypass C-117 and coupled to the grid of crystal oscillator-mixer V-108 via isolation resistor R-167 and blocking capacitor C-150. Although the cathode of V-104 is well by-passed, sufficient RF energy will be available at the grid of V-108 to crystal calibrate the signal generator. The crystal calibrator is discussed, in detail, in paragraph 7 of this section.

i. V-104 cathode RF choke L-118 is inserted to eliminate high frequency RF currents from audio bypass electrolytic C-1 15. This coil serves to minimize the radiations that might be set up in an electrolytic such as C-115 at higher frequencies of the signal generator.

4. MODULATION OSCILLATOR.

(See figure 2-4).

a. GENERAL-The modulation oscillator is contained in the audio compartment and is a standard Wien-bridge oscillator, utilizing a type 12AU7 dual triode (V-102). It is capable of generating an audio signal of either 400 or 1000 cycles, depending upon the position of the MOD SELECTOR switch (S-103). When this switch is in the "EXT" position, the oscillator section (V-102A) is inoperative and an external modulating voltage (100 to 10, 000 cycles) may be applied to the EXT MOD IN jack (J-103). The external audio signal is fed via a three section filter (Z-101), RF choke (L-117) and MOD SELECTOR s-witch (S-103) to the grid circuit of buffer-amplifier V-104. The degree of modulation can be varied by % MODULATION control R-111. The filter and choke are shown in the overall schematic, Figure 6-23 near the end of Section 6.

b. AUDIO OUTPUT-When the MOD SELECTOR switch (S-103) is in the 400 or 1000 cycle position, the corresponding audio signal is applied to the grid of V-104 via %o MODULATION control R-ll. In these positions of S-103, the audio voltage will also be available at EXT MOD IN jack (J-103) for external applications. The audio voltage at J-103 can be varied by 7o0 Modulation control R-I 1. The impedance at J-103 is .high (depending upon position of R111 arm), and the audio voltage available will be proportional to the % Modulation reading on MI-101 when fed to a high impedance (approx. 100k) load. When a low impedance load is connected at J-103, the audio output at J-103 will decrease, but the meter reading will still be proportional to the audio output voltage. The maximum available open circuit audio voltage at J-103 will be approximately 4 volts. This voltage will be represented by a reading of "100" on the % MOD scale of the meter. To avoid audio frequency shifts that may occur in the extreme clockwise position of R-111, the % Modulation reading should never be advanced to an indication beyond "100". The operational procedure for obtaining audio output is discussed in Section 4, OPERATION. The complete circuit will be found in Figure 6-23 near the end of Section 6.

c. CRYSTAL CAL OUTPUT-Besides functioning as an internal and external audio source, the amplifier section (V-102B) of the modulation oscillator also serves as an amplifier for the audio beat of the crystal calibrator (V-108). When XTAL-CAL switch (S-106) is in the ON position, B+ is applied to V-108 and the beat output of the crystal calibrator (V-108) is fed to the grid of V-102B where it is amplified. When calibrating against the internal crystal (Y-101), the MOD SELECTOR switch (S-103) should be set to XTAL. This is the same as the EXT position of the switch. In this position, the crystal beat can be monitored at the EXT MOD in jack (J-103) with a set of crystal earphones. Connector, Adapter UG684/U is provided to adapt BNC jack J-103 to a

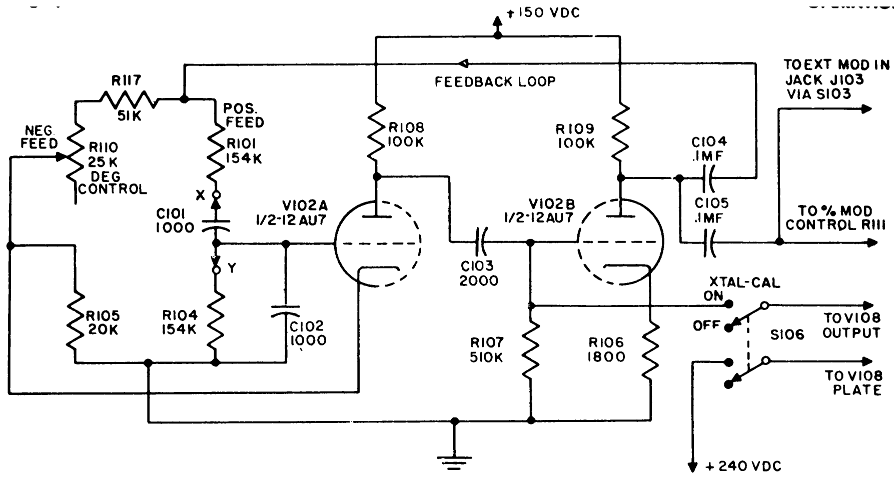


Figure 2-4. Simplified Schematic Diagram of the Modulation Oscillator

standard phone plug. High impedance crystal earphones must be used since the impedance at J-103 is high.

d. CIRCUIT ANALYSIS OF MODULATION OSCILLATOR.

(1) Tube section V-102B acts as an amplifier and in verter. Even without the Wien-bridge circuit, this system could oscillate since any signal that appears on the grid of V-102A is amplified and inverted by both V-102A and V-102B. The voltage fed back to the grid of V-102A then must reinforce the initial signal and cause oscillations to be set up and maintained. This type of system, however, would amplify voltages of a very wide range of frequencies. The bridge circuit is used to eliminate feedback voltages of all frequencies except the single frequency desired in the output. The bridge allows a voltage of only one frequency to be effective in the circuit because of the degeneration and phase shift provided. Oscillations can take place only at the frequency which permits the voltage across resistor R-104 (input signal to V-102A) to be in phase with the output voltage from V-102B, and for which the positive feedback voltage exceeds the negative feedback voltage. Voltages of any other frequency cause a phase shift between the output signal of V-102B and the input to V-102A. Undesired frequencies are thus attenuated by a high degree of degeneration so that the feedback voltage is insufficient to sustain oscillations at frequencies other than the desired frequency.

(2) The degenerative or negative feedback voltage is provided by the voltage divider network consisting of the cathode resistor (R-105), a potentiometer (R-110) and series resistor (R-117). Since there is no phase shift across this voltage divider, and since the resistances are practically constant for all frequencies, the amplitude of the negative feedback voltage is constant for all audio frequencies that may be present at the output of V-102B. The degeneration control potentiometer (R-1 10) is preset to sustain oscillation at both 400 and 1000 cycles per second, with minimum distortion.

(3) Regeneration or positive feedback is provided by voltage divider consisting of two resistors (R-101, R-104) and two capacitors (C-101, C-102), when the MOD SELECTOR switch is set for 1000 cycle operation. At very high frequencies the reactance of C-102 is low and any positive feedback voltage applied to the grid of V-102A will be at a minimum. At very low frequencies, the reactance of C-101 will be high and the positive feedback voltage applied to the grid of V-102A .will subsequently be low. It can also be shown that for maximum regeneration at the desired frequency, the voltage across resistor R-104 will be in phase with the output from V-102B when: R-101 X C-101 = R-104 X C-102.

5. ELECTRON TUBE VOLTMETER.

The electron tube voltmeter consists of three fundamental circuits, namely, the RF diode (V-105), the modulation diode (V-103) and the voltmeter bridge (V-101). The voltmeter bridge tube (V-101) and modulation diode (V-103) circuits are contained in the audio compartment: whereas the RF diode (V-105) circuit is located in the buffer-amplifier compartment. A meter (M-101) Is provided on the front panel of the signal generator to give the appropriate voltage indication. This voltmeter circuit makes it possible to determine both the carrier output strength and percentage of modulation.

a. RF DI)ODE. (See figure 2-5).

(1) The RF diode (V-105) rectifies the carrier output signal of the buffer-amplifier (V-104) which is then applied to the voltmeter bridge (V-101) circuit. The strength of this RF signal is indicated on the meter (M-101).

(2) V-105 is a type 9006 tube. The RF voltage is taken from the plate circuit of the buffer-amplifier (V-104) and applied across V-105 through a T pad described in paragraph 6i of this section.

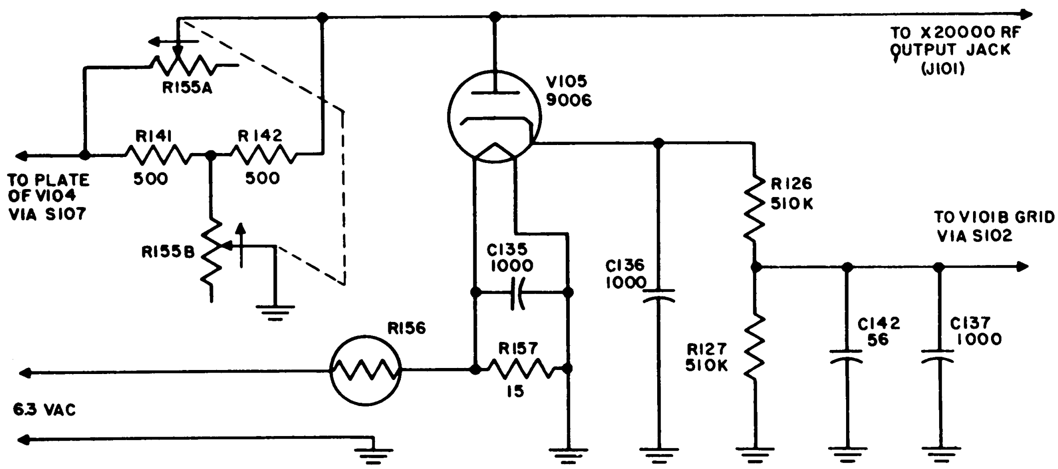


Figure 2-5. Simplified Schematic Diagram of the RF Diode

(3) The rectified RF signal appears across the cathode resistors R-126 and R-127. A 56 micromicrofarad capacitor (C-142) and' a 1000 micromicrofarad capacitor (C-136) serve to bypass the RF energy from the voltmeter bridge circuit. An additional feedthru type RF bypass capacitor (C-137) permits the entry of the RF diode (V-105) output into the audio compartment. The bypass capacitor C-135 'filters the RF energy from the filament lead to V-105. A part of the rectified RF signal voltage is taken across R-127 and applied to the grid of the bridge tube (V-101B) when the METER READS switch (S-102) is in the RF position. The RF voltage is read from the upper scale of the meter (M-101). This scale is calibrated from 0 to 100 microvolts. When the meter indicates 100 microvolts, two volts output, open circuit, is present at the X 20, 000 RF OUTPUT jack (J-101). When J-101 is terminated in its characteristic impedance (500 ohms) a meter reading of 100 microvolts represents an output of one volt. Similarly, if the output is taken from the X MULT RF OUTPUT jack (J-102), and this jack is terminated in its characteristic impedance (53.5 ohms), the voltage at J-102 is determined by multiplying the MULTIPLIER dial (I-104) setting by the meter reading. (See Section 2 par. 6 and par. 8).

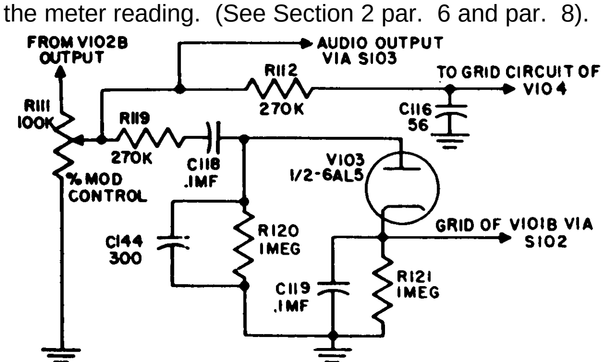


Figure 2-6. Simplified Schematic Diagram of the Modulation Diode

(4) A ballast regulator lamp (R-156) connected in series with the filament of V-105 minimizes the effects of varying line voltage on the contact potential of the tube . This contact potential is an emission characteristic which is prevalent in diodes. Its static effects are eliminated by adjustment of the RF COMP control (R-128), a screwdriver adjustment located on the audio compartment (See figure 2-7). The filament shunt resistor (R-157) improves the regulation characteristics of the ballast lamp by decreasing the cold to hot resistance change of the ballast load.

b. MODULATION DIODE. (See figure 2-6).

(1) The modulation diode (V-103) is a type 6AL5 dual diode with only one tube section used. It rectifies the modulating voltage. This rectified voltage is then applied to the grid of the voltmeter bridge tube (V-101B) for determination of percentage modulation. The same voltmeter bridge is used for reading percentage modulation as is used for determining carrier output strength. The principal features of the modulation diode are shown in Figure 2-6.

(2) The percentage modulation of the carrier frequency is determined by the modulation voltage applied to the control grid of the buffer-amplifier (V-104). This modulation voltage is taken from the 100, 000 ohm % MODULATION potentiometer (R-111) and applied across the modulation diode (V-103) circuit where it is rectified. Resistors R-119 and R-121 serve as a voltage divider. A part of this rectified audio voltage is taken across R-121 and applied to V-101B when the METER READS switch (S-102) is in the v/o MOD position. Capacitor C-1 18 blocks the DC grid voltage of V-104 from V-103. Due to the modulation characteristic of the buffer-amplifier circuit, the degree of modulation is a function of audio voltage and independent of the carrier amplitude. This is true in such a grid modulating system when the RF signal amplitude is small with respect to the amplitude of the audio voltage. In this type of circuit, the degree of modulation is a function of the change in

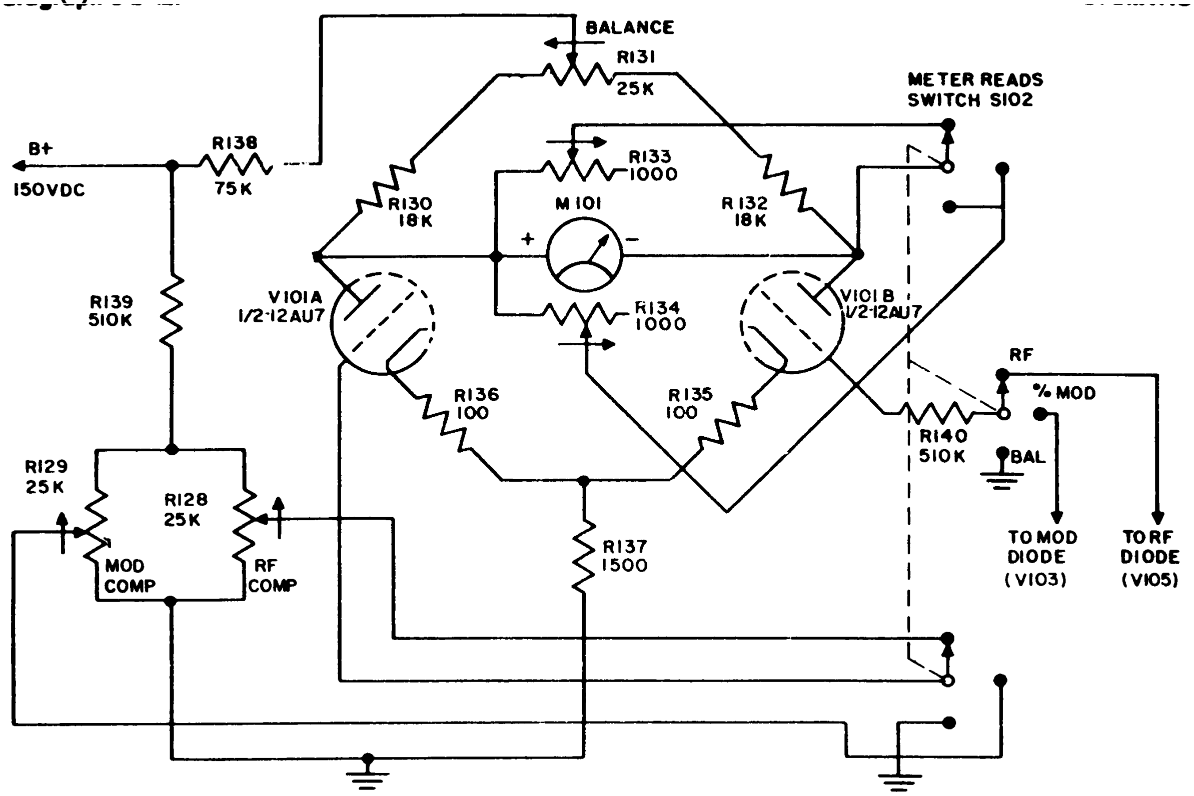


Figure 2-7. Schematic Diagram of the Voltmeter Bridge Circuit

gain of the modulating stage (buffer-amplifier) brought about by the audio voltage. This can be seen from an analysis of the Eg-Ip (grid voltage-plate current) curve of the tube. As the audio voltage on the grid swings up and down, the instantaneous operating point of the RF signal is changed. When this swing occurs over the nonlinear region of the Eg-Ip curve, the instantaneous gain of the tube, with respect to the RF signal, also changes. When this gain varies from zero to twice the gain at the quiescent point, 100% modulation will result. Similarly, degree of modulation will be 50%/, when the gain varies from 1/2 to 11/2 times the gain at the quiescent point. The degree of modulation, therefore, depends only on the audio amplitude. A proportional part of this audio voltage is fed to the meter circuit and the percentage of modulation is read directly from the lower scale of M-101.

c. VOLTMETER BRIDGE CIRCUIT. (See figure 2-7).

(1) The voltmeter bridge (V-101) circuit provides a means for applying the rectified signals from either the RF or modulation diodes to the meter (M-101). The bridge circuit utilizes a tube type 12AU7 (V-101) dual triode and is located in the audio compartment. The principal electrical features of the voltmeter bridge circuit are shown in figure 2-7.

(2) The fundamental principle of the voltmeter bridge is that of a Wheatstone bridge in which the DC plate resistances of the triode sections form two of the 2-6 arms. When the bridge is balanced, the DC plate resistances of both triode sections are equal and no current flows through the meter (M-101). The movement of this meter is such that 100 microamperes gives full scale deflection. Tube section V-101B is the "unbalancing" part of the bridge, its I)C plate resistance varying in accordance with the bias supplied by the rectified voltage from the RF diode (V-105) or modulation diode (V-103). The degree of unbalance is determined by the strength of the carrier signal or modulation voltage and is indicated by a reading on M-101

d. VOLTMETER BRIDGE ADJUSTMENTS.

(1) The RF COMP (R-128) and MOD COMP (R-129) controls are located on the audio compartment. They are provided to compensate for the contact potential of V-105 and V-103. This contact potential is due to the static emission present when the heated tube filaments create electrostatic fields in these diodes resulting in some flow of current. The effects of contact potential can be detected by first adjusting R-131 for zero meter reading with the METER READS switch (S-102) in the BAL position. Resistor R-131 varies the relative B+ voltage applied to the plates of both sections of V-101 until the bridge is balanced. With the MICROVOLTS control (R-155) and o/o MODULATION control (R-111) set fully counterclockwise M-101 should read zero in either the RF or % MOD positions of S-102. A

residual meter reading in either switch position indicates the presence of contact potential at the grid of V-101B. Adjustment of R-128 places a balancing potential on the grid of V-101A to compensate for this effect in the RF position of S-102. Resistor R-129 has a similar effect for the % MOD position of S-102.

(2) R-133 and R-134 are the meter sensitivity controls for the RF and % MODULATION scales of M-101. These potentiometers are adjusted whenever it is suspected that either meter range is incorrect. This procedure is discussed in Section 6 par. 10.

6. VARIABLE RF ATTENUATOR.

(See figure 2-8).

a. The RF attenuator circuit consists of a step attenuator (E-112) and dual potentiometer MICROVOLTS control (R-155), both located in the shielded buffer-amplifier compartment. Both controls vary the carrier voltage applied to the X MULT RF OUTPUT jack (J-102) but only the MICROVOLTS control (R-155) affects the voltage at the X 20, 000 RF OUTPUT jack (J-101). The value of the voltage at the X MULT RF OUTPUT jack (J-102) is determined by multiplying the meter (M-101) reading by the indicated position of the MULTIPLIER dial (1-104). The entire circuit is effectively resistive so that the attenuation introduced is substantially independent of frequency within the limits of the instrument. The output impedance of the attenuator system as taken from the X MULT RF jack (J-102) is constant at 53.5 ohms for any position of the attenuator MULTIPLIER dial (1-104). The attenuator (E-112) and associated circuit are shown, schematically in figure 2-8.

b. The X 20, 000 RF OUTPUT jack (J-101) voltage is taken from the dual potentiometer MICROVOLT control (R-155) and is not attenuated by the step attenuator (E-112). The voltage developed across this jack depends upon the setting of the CARRIER CONTROL (R-123) and MICROVOLT control (R-155) and its output impedance is constant at 500 ohms. When this jack is terminated in its characteristic impedance (500 ohms), the output voltage is determined by multiplying the meter (M-101) reading by 10, 000. When it is not terminated (open circuited), the output voltage will be 20, 000 times the indicated reading on the meter (M-101).

c. Whenever the frequency of the signal generator is changed, reset the X 20, 000 RF OUTPUT jack (J-101) voltage for a meter (M-101) reading of "100, " by rotating the MICROVOLT control (R-155) fully clockwise and then rotating the CARRIER CONTROL (R-123) in a clockwise direction until the meter reads "100." This represents two volts open circuit output from J-101 and one volt output when this jack is terminated in its characteristic impedance (500 ohms).

d. The step attenuator (E-112) attenuates the output from the X MULT RF OUTPUT jack ()-102) in steps of ten as indicated on the dial plate (I-104). The voltage at J-101 will not be affected by the position of this dial.

e. The useful output voltage from the X MULT RF OUTPUT jack (J-102) is always based on terminating this jack in its characteristic impedance (53.5 ohms); thus, when the output from J-102 is fed to a receiver under test, with the impedance properly matched, the reading on the signal generator meter will indicate the input voltage to the receiver under test. This is discussed more fully in section 2, paragraph 8, TERMINATING THE SIGNAL GENERATOR.

f. When the voltage from the X 20, 000 RF OUTPUT jack (J-101) is set at "100" on the meter, the maximum output from the X MULT RF OUTPUT jack (J-102), when correctly terminated (53.5 ohms) will be 0.1 volts. Within each step of the attenuator (E-112), the output from the X MULT RF OUTPUT jack (1-102) is varied

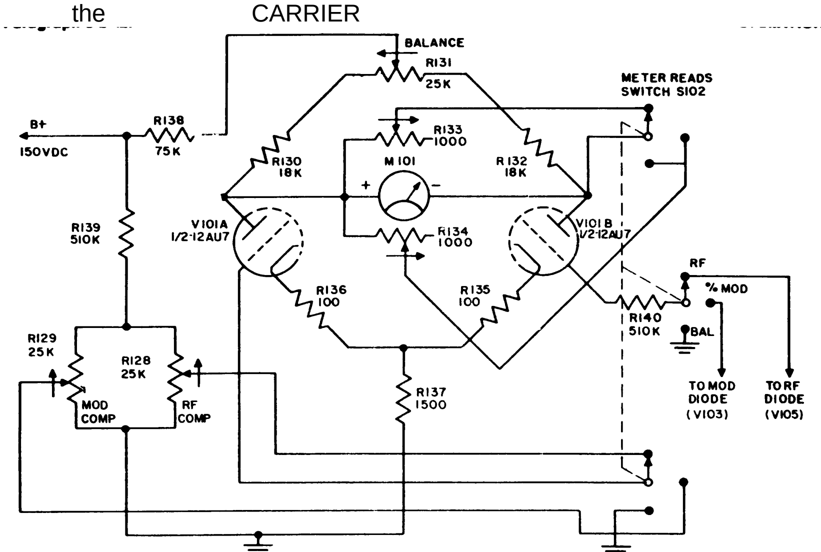


Figure 2-8. Schematic Diagram of the Variable RF Attenuator Circuit

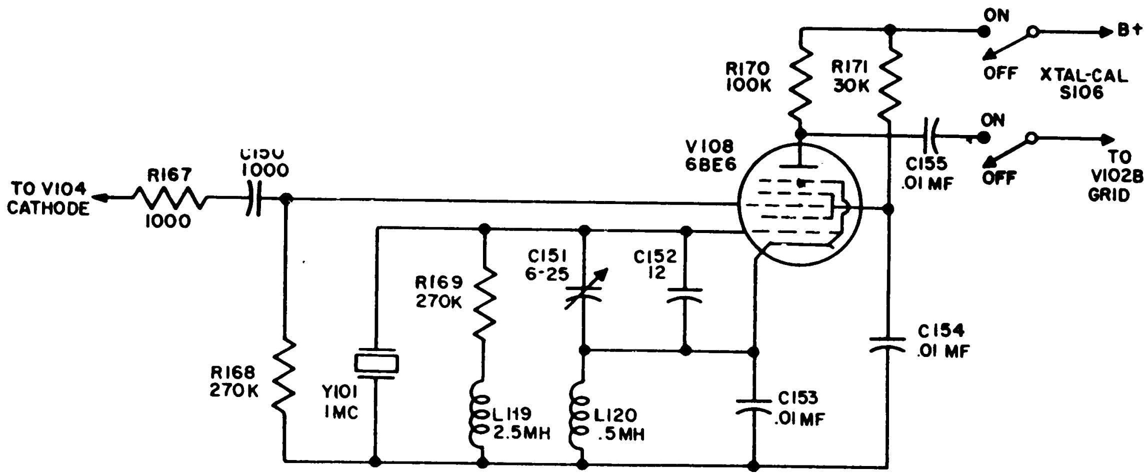


Figure 2-9. Schematic Diagram of Crystal Calibrator

by rotating R-155. The output voltage from this jack is determined in microvolts by multiplying the meter CM-101) reading by the corresponding position of the MULTIPLIER dial (I-104). Since the accuracy of all meters is expressed in terms of percentage error for full scale deflection, the technician should avoid using the meter calibrations below "20." Use the (5:1) FIXED ATTENUATOR CN-132/URM-25 whenever a meter voltage indication in this range is required. This attenuator is discussed more fully in paragraph 9 of this section.

g. For any particular carrier frequency, once the CARRIER CONTROL (R-123) has been rotated to give the required "100" meter indication, its setting should never be changed. The output from each attenuated step and from the X 20, 000 RF OUTPUT jack (J-101) is varied by adjusting the MICROVOLTS control (R-155). Whenever the generator frequency is changed, however, the CARRIER CONTROL must be reset to give the required '.'100" meter indication. This adjustment is made only after R-155 has again been rotated to the fully clockwise position.

h. When R-123 and R-155 have been adjusted to introduce a two volt signal (M-I101 reads "100" and J-101 unterminated) to the step attenuator (E-112), the series voltage dropping resistor (R-143) reduces this voltage to 0.2 volts. The maximum output voltage available from the X MULT RF OUTPUT jack (.J-102) when this jack is terminated in 53.5 ohms, will, therefore,

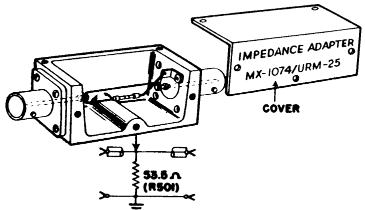


Figure 2-10. Impedance Adapter MX-1074/URM-25

be 0.1 volts. This will also be the maximum input voltage from this jack to a properly matched receiver under test. (See Section 2 par. 8). It is this voltage, under terminated conditions, that is actually indicated on M-101.

i. The MICROVOLTS control (R-155) is a two section potentiometer connected with two 500 ohm resistors (R-141, R-142) in the form of a T pad. It provides a smooth control of the voltage applied to the step attenuator, at the same time maintaining a constant impedance (500 ohms) across the output of the buffer-amplifier (V-104) and across the X 20, 000 RF OUTPUT jack ()-101).

j. The step attenuator (E-112) is a six section ladder resistive network and its output is attenuated in six steps. With the MICROVOLTS control (R-155) and the attenuator (E-112) in combination, any desired voltage

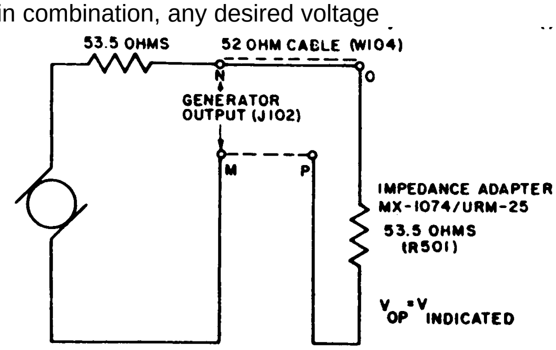


Figure 2-11. Equivalent Circuit of X MULT RF OUTPUT (J-102) with Impedance Adopter MX-1074/URM-25 Added

between zero and 100, 000 microvolts can be obtained at the X MULT RF OUTPUT jack (J-102) when J-1C is terminated in its characteristic impedance (53.5 ohms). The input voltage to the receiver under test is thus determined by multiplying the meter (M-101) reading (upper scale) by the decimal multiplier indicated by the position of the MULTIPLIER dial (1-104). The lowest calibrated output voltage is 0.1 microvolts.

7. CRYSTAL CALIBRATOR.

See figure 2-9).

a. GENERAL-The RF Signal Generator Set AN/ URM-25B contains a crystal calibrator, incorporated in the audio compartment. This circuit provides crystal check points from I mc to 50 mc for purposes of interpolative calibration of the signal generator in this frequency range. The frequency accuracy of the crystal check points, at room temperature, and at the moment of checking is within ± .001% or better. The overall frequency accuracy of the equipment (1 mc to 50 mc) when checked against the crystal calibrator, including all variations of operating conditions, is within + .050/'. No provision is made for integral calibration below 1 mc where the accuracy is that of the direct reading frequency scale (± .5%).

b. CIRCUIT ANALYSIS--(see figure 2-9). The crystal calibrator consists of a I mc crystal (Y-101) and an oscillator-mixer circuit utilizing a type 6BE6 pentagrid converter (V-108). A portion of the RF signal is fed from the cathode of buffer-amplifier V-1C4 to the mixer grid of V-108 via isolation resistor R-167 and coupling capacitor C-150. Although the cathode of V-104 is bypassed for RF, sufficient RF energy is available to operate the crystal calibrator. The oscillator section of V-108 is analagous to a Colpitts oscillator with 1 mc crystal Y-101 serving as the tuned circuit and the screen grid acting as the plate. Grid resistor R-169 is the grid leak DC return for the oscillator grid. Trimmer C-151 is provided for adjusting the I mc frequency of the oscillator against a primary standard. RF chokes L-119 and L-120 serve to increase the harmonic generation of the crystal oscillator and thereby extend the useful range of the calibrator to 50 mc. When XTAL-CAL switch S-106 is in the ON position, B+ is fed to the plate via plate load R-170 and to the screen via load resistor R-171. When calibrating, the output of V-108 will be the audio beat difference between the signal generator frequency and the crystal harmonic frequency. This audio beat is fed to the grid of V-102B via switch S-106. V-102B amplifies this beat and the resultant signal is fed to the EXT MOD IN jack J-103 when MOD SELECTOR switch S-103 is in the XTAL (EXT) position. Connector, Adapter UG-684/U is provided to adapt BNC type jack J-103 to a standard phone jack when monitoring for zero beat. Crystal earphones should be used when calibrating since the impedance at J-103 is high.

8. TERMINATING THE SIGNAL GENERATOR.

a. The termination principles herein discussed are based on the assumption that the load is essentially sistive in nature. This is true for most applications for which this equipment is used in the field. In cases where the load is not resistive, it will be necessary for the technician to interpret these principles with respect to the nature of the load.

b. A CG-409A/U (4'0") coaxial output cable assembly (W-104) consisting of a four foot length of RG58A/U cable and terminated at each end with a type UG-88/U connector is supplied with the signal generator. This cable is intended for use with the X MULT RF OUTPUT jack (J-102) and has a characteristic impedance of 52 ohms.

c. Cable W-104 has a capacitance of 28.5 mmf/ft or a total capacitance of 114 micromicrofarads for the entire four foot length. The resultant reactance would have no appreciable effect on the output of J-102 at frequencies below I mc and therefore, standing waves do-not introduce a termination problem at these frequencies.

d. At frequencies greater than one megacycle, the decrease in cable reactance begins to introduce a pronounced shunting effect on the 53.5 ohm generator terminal (J-102) impedance and it becomes necessary to correctly terminate the receiving end of W-104 in order to eliminate standing waves. There is no need to terminate the signal generator end of the cable since its characteristic impedance of 52 ohms is approximately the same as the characteristic impedance across J-102.

e. The characteristic impedance across the X 20, 000 RF OUTPUT jack (J-101) is 500 ohms and the cable assembly W-104 should not be used with this jack. An accessory seven inch CG-409A/U (7") cable assembly (W-105)consisting of RG58A/U cable and one UG-88/U connector at each end is provided for use with J-101. Since this cable is much shorter than the four foot cable assembly, the effects of a mismatch at the X 20, 000 RF OUTPUT jack (J-101) are negligible.

f. When the 52 ohm cable assembly (W-104) is plugged into the X MULT RF OUTPUT jack (J-102), and terminated properly (53.5 ohms -no standing waves will be present. An IMPEDANCE ADAPTER MX-1074/URM-25 consisting of a 53.5 ohm composition resistor (R-501) contained in a rectangular aluminum case (See figure 2-10) is supplied with the equipment. This unit has one UG-185/U connector at each end and is inserted between the receiver under test and the receiver end of cable W-104 when the receiver load impedance is at least ten times the generator output impedance (i.e. approximately 500 ohms).

It is apparent from figure 2-11 that the voltage appearing across this terminating resistor at points OP will be one half the open circuit voltage across the generator output at J-102 represented by points MN. However, since the meter (M-101) was calibrated with respect to a correctly terminated load, the reading on the meter will actually reflect the input voltage to the receiver under test.

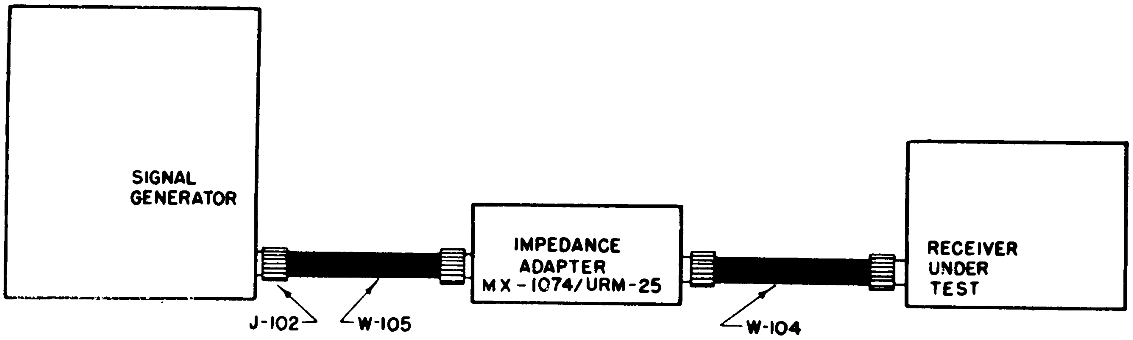


Figure 2-12. Method for Inserting Impedance Adapter MX-1074/URM-25 at J-102

Figure 2-12 illustrates the method for inserting the impedance adapter.

g. When the load impedance is less than 53.5 ohms, the impedance adapter cannot be used. In this case, a non-inductive composition resistor should be added in series with the input element at the receiver under test, so that the sum of the receiver input impedance and this receiver under test, so that this resistor will be 53.5 ohms (See figure 2-13). The total load impedance will then match the signal generator impedance at J-102 and standing waves will be minimized. The actual receiver input voltage can then be calculated from the formula indicated in figure 2-13. W/hen applying this procedure, it will probably be necessary to file down a larger standard resistor to get the precise value required. Use the Resistance Bridge ZM-4/U or equivalent to measure the resistance. For example; if the load impedance of the receiver (Z) is equal to 30 ohms, a series resistor (R) of 23.5 ohms must be .added in series with the receiver. A meter (M-101) indication of 10, 000 microvolts will then represent an actual receiver input as follows:

$$E\ load = \frac{Z}{53.5} \times M = \frac{30}{53.5} \times 10{,}000 = 5607 \text{ microvolts}$$

To minimize leakage and other losses this series resistance should be inserted as closely as possible to the input element of the receiver or instrument under test.

h. If the load impedance is considerably less than 500 ohms, but more than 53.5 ohms, the impedance adapter is replaced by a non-inductive composition resistor which shunts the load (see figure 2-14). The equivalent impedance of the shunt and load should equal the generator impedance (53.5 ohms). The receiver input voltage will then be equal to the meter indication. For example; if the receiver input impedance (Z) is 120 ohms, select the correct shunt resistor (R) as follows:

$$R = \frac{53.5 \times Z}{Z - 53.5} = \frac{53.5 \times 120}{120 - 53.5} = \frac{6420}{66.5}$$

$$R = 96.05 \text{ ohms}$$

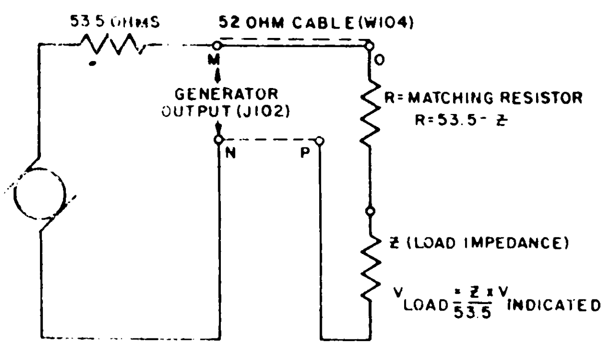


Figure 2-13. Equivalent Circuit of X MULT RF OUTPUT (J-102) with Series Matching Resistor Added

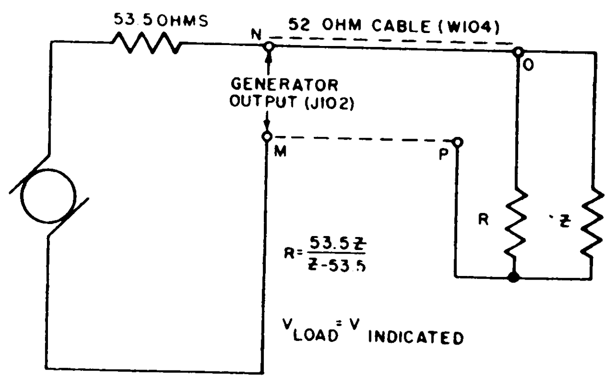


Figure 2-14. Equivalent Circuit of X MULT RF OUTPUT (J-102) with Shunt Resistor Added.

TABLE 2-1. METHODS FOR CORRECTLY TERMINATING THE SIGNAL GENERATOR AT J-102

LOAD IMPEDANCE	METHOD	FIGURES	PARAGRAPH
Less than 53.5 ohms	Series Resistor	2-12	8g
53.5 ohms to approximately 500 ohms	Parallel Resistor	2-13	8h
500 ohms or greater	Impedance Adapter MX-1074/URM-25	2-10;2-11;2-12	8f

It is apparent that the meter (M-101) indication will be the same as the actual input voltage to the receiver. If an accurate voltage indication is required, it will be necessary to file down a standard resistor until the desired value is obtained. Use the Resistance Bridge ZM-4/U or equivalent to determine when this value has been reached.

i. Table 2-1 shows the most desirable type of termination for any particular load impedance.

9. (5:1) FIXED ATTENUATOR CN-132/URM-25.

(See figure 2-15).

a. The (5:1) Fixed Attenuator CN-132/URM-25 consists of a' two section rectangular aluminum case approximately 2" long x 1" high x I" wide. A type UG-185/U connector is provided at each end to fit W-104 output cable CG-409A, /U (4'0"), and W-106 output cables CG-409A/U (7"). These cables are used as required(to make the necessary connections.

b. The schematic diagram and outline draping of the 5:1 fixed attenuator is shown in figure 2-15. It is designed to be used when the input impedance of the receiver under test is 53.5 ohms and consists of four resistors (R-303, R-304, R-, 05, R-306) connected in parallel to give an equivalent resistance of 22.3 ohms. These parallel resistors are then connected with two 35.6 ohms resistors to form a "T" network. It can readily be calculated that the output terminal voltage of this attenuator unit will be one fifth its input voltage when the CN-132/URM-25 is properly terminated in 53.5 ohms. It therefore follows that the voltage output from the fixed attenuator will be one fifth the voltage indicated by M-101.

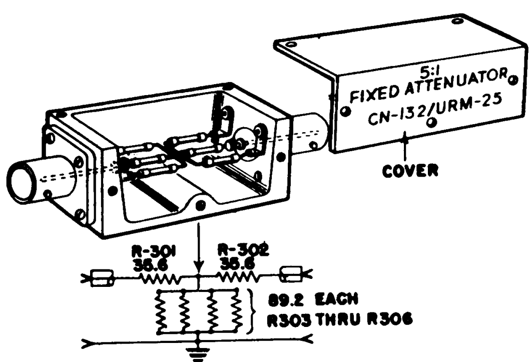


Figure 2-15. (5:1) Fixed Attenuator CN-132/URM-25 with Schematic Diagram Shown

c. The 5:1 fixed attenuator is designed for a 53.5 ohm terminating impedance and should be used in conjunction with the X MULT RF OUTPUT jack (J-102), never with the X 20, 000 RF OUTPUT jack (J-101).

d. Although this unit was designed primarily for use with a load impedance of 53.5 ohms, it ma)y also be used when the receiver under test presents an impedance other than 53.5 ohms. In such case, it will be necessary to apply the terminating principles as outlined in paragraph 8 and in Table 2-1 of this section. For example;

(1) If the load impedance is 1000 ohms, connect one end of W-104 to J-102 on the signal generator. Connect the other end of W-104 to the fixed attenuator and terminate the fixed attenuator with the impedance adapter. This assembly is then connected to the load. A meter indication of 10i, 000 microvolts now reflects an actual load input voltage of 2000 microvolts.

(2) If the load impedance is 30 ohms do not use the impedance adapter. Insert a 23.5 ohm non-inductive resistor in series with the output of the fixed attenuator and then connect to the 30 ohm load. A meter indication of 10, 000 microvolts now represents an actual load voltage as follows:

$$E\ load = \frac{Z}{53.5} \times \frac{M}{5} = \frac{30}{53.5} \times \frac{10.000}{5}$$

$$E\ load = \frac{60,000}{53.5} = 1122\ \text{microvolts}$$

e. A coaxial adapter UG-201/U is also provided with the equipment to allow for adapting the output cables type BNC connectors (i.e. UG-88/U) to a type N connector found on many receivers.

10. (10:1) FIXED ATTENUATOR CN-136/URM-25.

a. The (10:1) Fixed Attenuator CN-136/'URM-25 is physically identical to the (5:1) Fixed Attenuator CN-132/URM-25. It consists of four 43.2 ohm resistors (R-803 thru R-806) connected in parallel to give an equivalent resistance of 10.8 ohms. These parallel resistors are connected with two 43.8 ohm resistors (R-801, R-802) to form a "T" network. This unit is the same in principle as the 5:1 attenuator (see Section 2, par. 9) but introduces a voltage attenuation of 10:1 instead of 5:1 when terminated in 53.5 ohms.

b. This 10:1 fixed attenuator is provided for use at frequencies above 18 mc (band H) when extremely accurate low level signal generator outputs are required. This applies only to the last two steps (X.01, X.1) of the step attenuator (E-112), where the presence of some residual leakage voltage or faulty grounds might effect the output accuracy at these higher signal generator frequencies. For example; if it is desired to select an accurate 6 microvolt output at 30 mc, the MULTIPLIER dial (I-104) should be set at XI with the output meter (M-101) adjusted for a reading of "60." Insert the 10:1 fixed attenuator at J-102 and terminate it in 53.5 ohms as

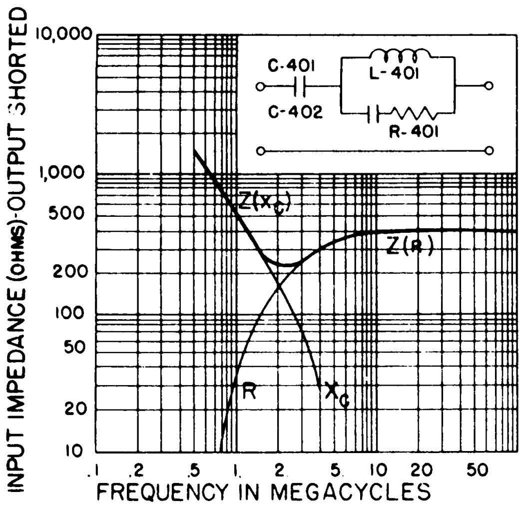


Figure 2-16. Schematic Diagram of the Antenna Simulator SM-35/URM-25 with Input Impedance-Frequency Curve

as described in paragraph 8 of this section. The output across the 53.5 ohm load will then have an accurate value of 6 microvolts.

11. ANTENNA SIMULATOR SM-35/URM-25.

(See figure 2-16).

a. Antenna Simulator SM-35/URM-25 is contained in an aluminum case of the same type and physical dimensions as the impedance adapter and fixed attenuator units. One type UG-185/U connector is provided it each end for connecting to any one of output cables 'W-104, W-105, or W-106.

b. The circuit consists of a 200 micromicrofarad capacitor (C-401) in series with a series-parallel arrangement consisting of a 400 micromicrofarad capacitor (C-402), a 400 ohm resistor (R-401), and a 20 microhenry inductor (L-401). At frequencies above 2.5 megacycles, the antenna simulator unit acts like a pure resistance of from 220 ohms to 400 ohms. Below 1.6 megacycles, the circuit acts like a capacitance of 200 micromicrofarads in series with an inductance of 20 microhenries and a resistance of 15 ohms.

c. From the impedance curve (figure 2-16), it can be seen that the minimum impedance of the antenna simulator will be a)proximately 220 ohms When using this unit, first connect one end of the Impedance Adapter MX-1074/URM-25 to the output cable (W-104) and plug the other end of W-104 into J-102 on the signal generator. Using the auxiliary cable (W-105), connect the antenna simulator to the impedance adapter. If necessary, the second auxiliary cable ('-106) may then be used to connect the antenna simulator to the receiver under test.

d. In using the antenna simulator, it should be realized that the significant voltage is the input and not output voltage of the antenna simulator. The reason for this is that the antenna simulator approximates a standard antenna which forms a part of the overall sensitivity measurement of a receiver designed for use with it. For example; if the output frequency of the signal generator is 20 mc, it can be seen, from figure 2-16 that the series impedance of the antenna simulator will be approximately 400 ohms resistive. Make the necessary connections as indicated in paragraph 11c of this section. A meter indication of 10, 000 microvolts represents an input voltage of 10, 000 microvolts to the antenna simulator.

e. For accurate receiver output voltage indication, it should be remembered that the total load impedance represented by the antenna simulator in series with the load of the instrument under test should be at least 500 ohms. From figure 2-16, it is apparent that the accuracy will be sufficiently good at frequencies above 5mc. Below 5mc, the impedance falls off to approximately 220 ohms and the receiver input load should be sufficiently high (approximately 280 ohms or greater) to maintain the accuracy.

12. TEST LEAD CX-1363/U.

(See figure 2-17)

a. The Test Lead CX-1363/U should be used for making interstage receiver measurements. It consists of a 0.1 microfarad capacitor (C-601) in parallel with a 510 micromicrofarad capacitor (C-602) enclosed in an aluminum case similar to the antenna simulator and fixed attenuator units. One end of this case is terminated in a type UG-185/U connector. Two 18" long clip leads extend from the other end. The capacitor network is in series with the red lead, whereas the black lead is grounded to the case.

b. The capacitor network is inserted to protect the attenuator (E-112) of the signal generator from accidental test probing at points of B + potential and should always be used when making interstage receiver tests.

c. The reactance of the test lead capacitors should not normally affect the accuracy of the meter (M-101) voltage indication since, in most cases, the impedance at receiver interstage measurement points will be high. It must be realized, however, that when the CX-1363/U is used at test points of low impedance (below 400 ohms) the meter indication can no longer be depended upon to reflect the actual signal voltage applied.

13. POWER SUPPLY PP-562A/URM-25.

(See figure 2-18).

a. The power supply is an integral part of the RF Signal Generator Set AN/URM-25B and is completely contained in a separate sub-chassis located to the rear of the RF signal generator unit SG-44B/URM-25. It employs a full wave rectifier type 6x4 tube (V-201). The interconnecting power cable (W-102) is a two conductor cable with a two prong connector (P-101) on one end.

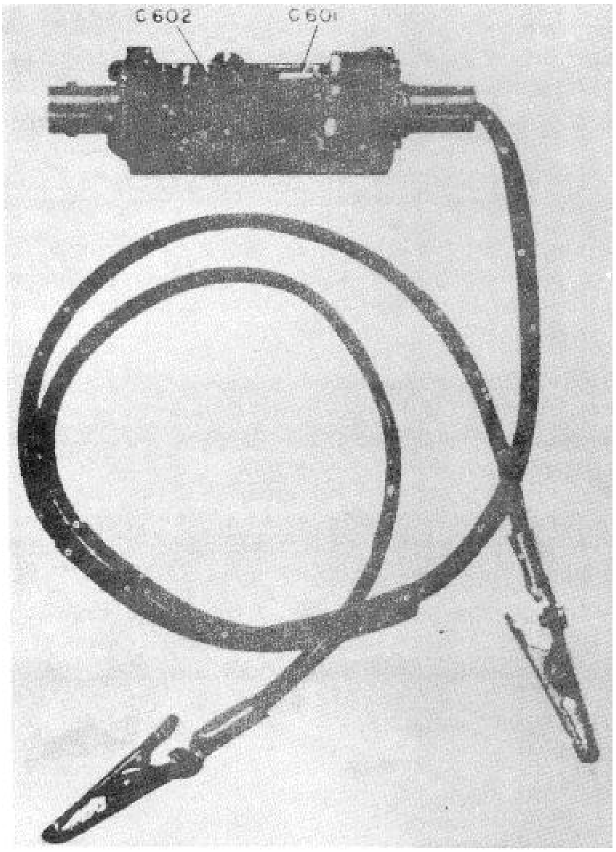


Figure 2-17. Test Lead CX-1363/U

The other end of this cable is soldered to the AC input fuses (F-101, F-102) located on the front panel of the signal generator. When the connector (P-101) is plugged into the power supply input power receptacle (J-201), this cable assembly (W-102) transfers AC power from the front panel to the rectifier sub-chassis. This interconnecting cable is connected in place and need not be installed prior to using the signal generator. A type OD_3 (V-202) regulator tube is used for maintaining a regulated 150 volt DC output to all tubes except the buffer-amplifier (V-104) and crystal calibrator V-108. The principal electrical features of the rectifier power unit are Section 2 Paragraph 13 shown in figure 2-18.

b. The power transformer (T-201) has a 450 volt center tapped high voltage secondary and a 6.3 volt filament secondary. It is so designed to permit satisfactory operation from a 115V (±10%), single phase AC source of from 50 to 1600 cycles per second. Each side of the input AC line is fused (F-101, F-102). An RF filter network consisting of two 1000 micromicrofarad capacitors (C-138, C-139) and two RF chokes (L-115, L-116) enclosed in a metal shield is mounted on the rear of the front panel of the RF Signal Generator SG-44B/URM-25 (see figure 6-12). This network by-passes stray RF currents from the power line.

c. The plate supply voltage derived from the high voltage secondary and rectifier tubes (points PQ on figure 2-18) is approximately 240 %volts DC and must be reduced to the required 150 volts DC regulated supply for all tubes except V-104 and V-108. This voltage drop is achieved by the DC series dropping network (L-201, R-201). A PI filter consisting of a choke (L-201) and three 4 microfarad capacitors (C-201, C-202, C-203) is provided as a ripple filter. The two 4 microfarad capacitors (C-202, C-203) are connected in parallel to increase the effective capacitance. A single 8 microfarad capacitor would introduce a problem of physical location. An additional .15 microfarad capacitor (C-204) is inserted in parallel with L-201 to form a 120 cycle resonant filter. This resonant filter lowers the 120 cycle power supply hum level.

d. In a regulator tube such as the OD_3 (V-202), the voltage across the tube (150vDC) remains constant over a fairly wide range of current (5 to 40 ma) through the tube. This property exists because the degree of ionization of the gas in the tube varies with the amount of current that the tube conducts. When a large current is passed, the gas is highly ionized and the internal impedance of the tube is low. When a small current is passed, the gas is ionized to a lesser degree and the internal impedance is high. Over the operating range of the tube, the product (I x R) of the current through the tube and the internal impedance of the tube is practically constant. If the supply voltage (points PQ on figure 2-18) drops, the voltage across the glow tube (V-202)

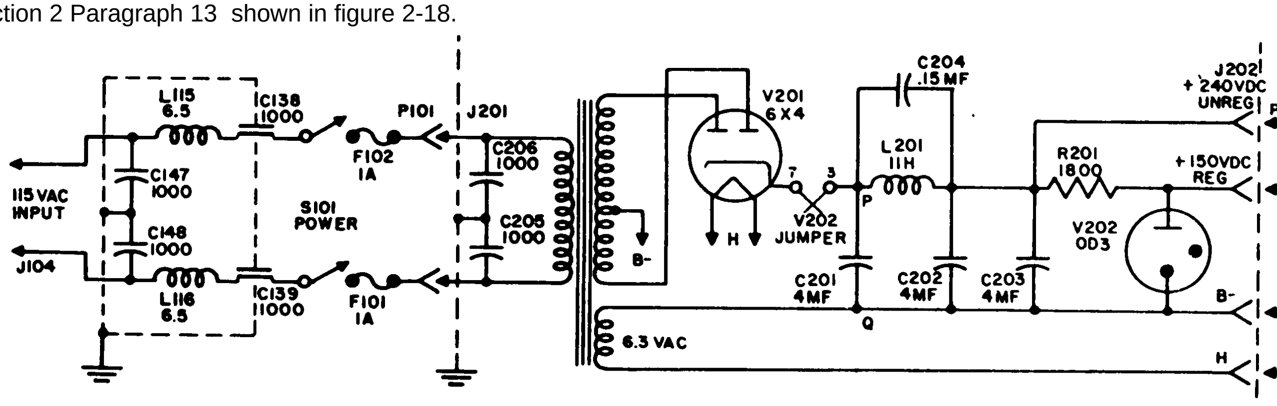


Figure 2-18. Schematic Diagram of the Power Supply PP-562A/URM-25.

would tend to drop. However, the gas in the glow tube deionizes slightly and less current passes through the tube. The current passing through the series DC dropping network (L-201, R-201) is also decreased by the amount of this current decrease in the glow tube. This would develop sufficiently) smaller voltage drops across the series DC network to maintain the required stable 150 volts drop across the glow tube. A rise in supply voltage is similarly compensated for.

e. The regulator glow tube (V-202) also provides for a stable output voltage when the load impedance varies. If the load increased, more current would flow through the dropping network (L-201, R-201). This would tend to drop the 150vDC output voltage across the glow tube. Instead this voltage drop tendency slightly deionizes the glow tube resulting iii an increase in its internal impedance. This increase in glow tube impedance, relative to the DC impedance of the series dropping network, again raises the power unit output voltage to the required 150vDC.

f. The 6.3 volt filament supply (one side B-) and the 150vDC output and 240vDC outputs are connected to the power unit output receptacle (J-202). These-voltages are transferred to the signal generator sub-chassis through power cable W-103. The B-lead from J-202 is not grounded to the power supply chassis but is carried to a single ground point in the audio compartment. The power supply chassis, however, is grounded to the other units of the signal generator. The reason for this separate B-ground is to eliminate RF leakage due to ground voltage gradients. Whenever the power supply is tested separately from the signal generator, voltage measurements should, therefore, be made between the test voltage point and B- not to the chassis.

14. INCIDENTAL FREQUENCY MODULATION.

a. Some incidental frequency modulation is present in the RF Signal Generator Set AN/URM-25B, as in other amplitude modulated type signal generators. Figures 2-19 through 2-22 were taken at the Naval Research Laboratories in Washington, D. C., and show the carrier and side bands of a previous model of this signal generator at the frequencies indicated when 30-/o modulated at 400 cycles. Figure 2-19 shows the carrier and a single pair of sidebands. This condition of low incidental FM is generally characteristic of the AN/URM-25B for most carrier frequencies at low degrees of modulation. As a slight degree of frequency modulation develops, the two side bands become unequal in amplitude. This is shown in Figures 2-20 and 2-21. With the presence of increasing degrees of incidental frequency modulation, additional side bands develop. This is represented in Figure 2-22.

b. For greatest accuracy in all amplitude modulated signal generators, sensitivity, selectivity, image ratio, AVC characteristics, and other receiver measurements (except audio response) should be made with an unmodulated carrier signal. This method is discussed in Section 4, par. 14b. When the technician uses a modulated carrier signal the degree of modulation should be kept as low and the audio frequency as high as will serve the purpose of the measurement. In addition, make use of the frequency band overlap by setting the signal generator at the low (maximum capacitance) end of the band wherever possible.

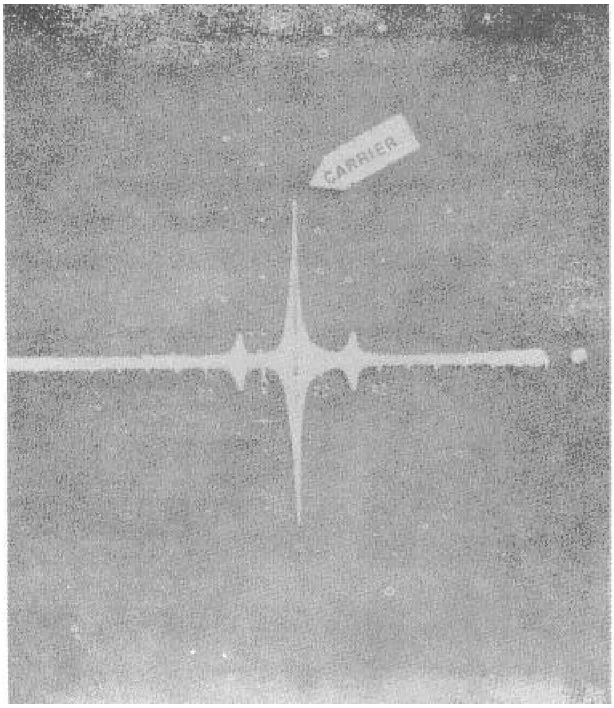


Figure 2-19. Frequency Spectrum with 400 Cycle 30 % Modulation at 240 kc on Band D

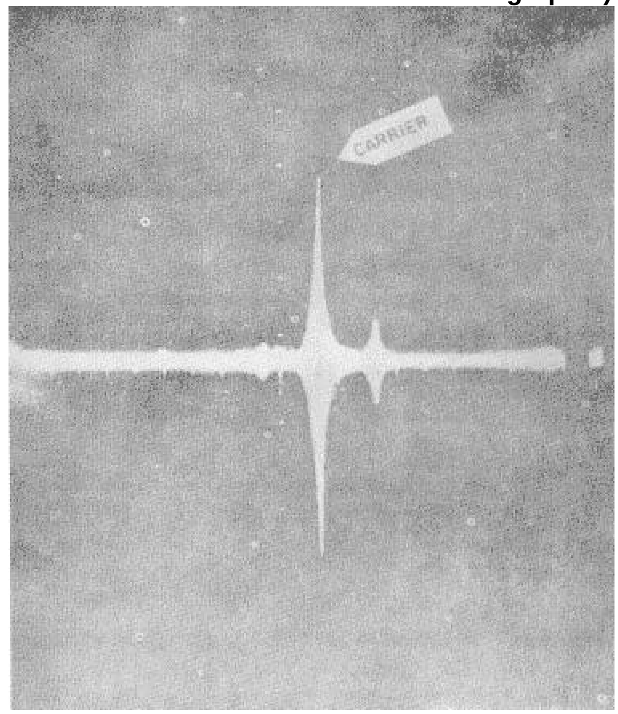


Figure 2-20. Frequency Spectrum with 400 Cycle 30% Modulation at 660 kc on Band D

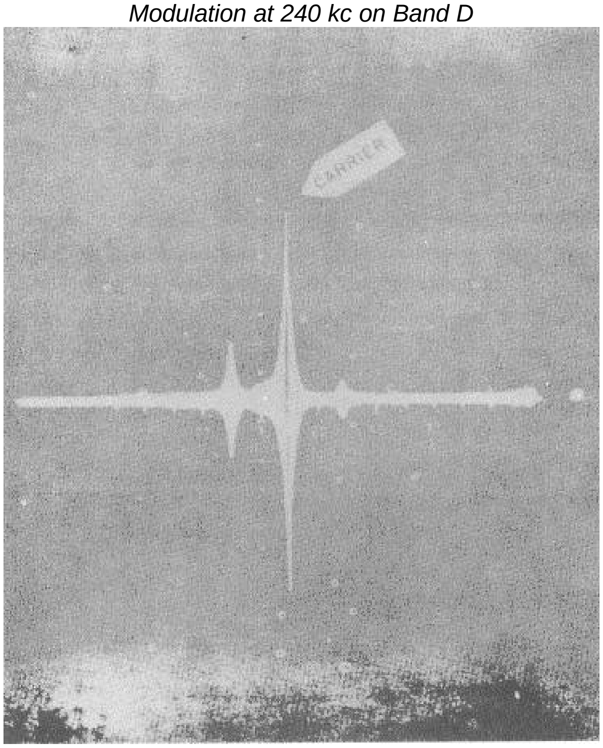
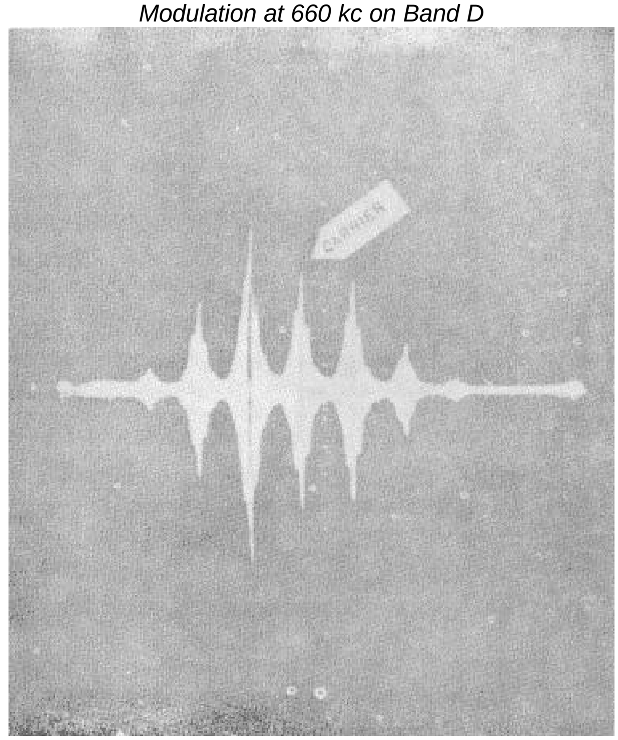


Figure 2-21. Frequency Spectrum with 400 Cycle 30% Modulation at 16 mc on Band H



(NOTE: This is beyond specified range of Bond G)

Figure 2-22. Frequency Spectrum with 400 Cycle 30% Modulation at 19 mc on Band G

SECTION 3

INSTALLATION

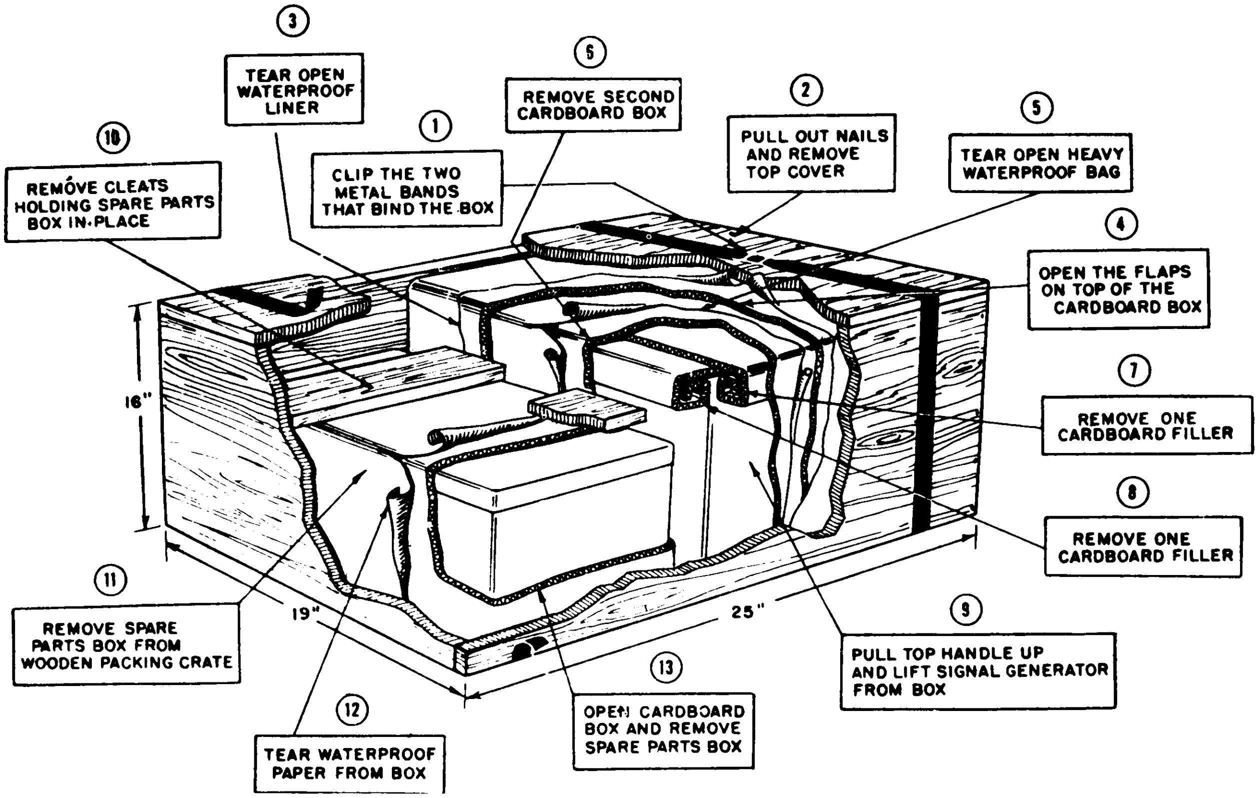


Figure 3-1. RF Signal Generator Set AN/URM-25B, Unpacking Procedure

1. UNPACKING

a. The AN/URM-25B is packed in a wooden box together with a set of equipment spares. Electron tubes are shipped in place. The signal generator with accessories, and the set of spares are, in turn, enclosed in separate, specially cushioned cardboard cartons. Exercise great care in removing these items (See figure 3-1).

b. The location of the accessories, in the signal generator carton, are as follows: (See Section 1, figure 1-1).

(1) Antenna Simulator SM-35/URM-25, (5:1) Fixed Attenuator CN-132/URM-25, (10:1) Fixed Attenuator CN-136/URM-25, Impedance Adapter MX-1074/URM-25, Test Lead CX-1363/U, Coaxial Adapter UG-201/U, Connector Adapter UG-684/U, and Instruction Book will be found on the inside of the panel cover. An aluminum plate with ferrule clips is provided for mounting these units.

(2) Power cable W-101 and output cables W-104, W-105, W-106 are also mounted on this aluminum plate.

c. Dimensions of the signal generator are shown in Figure 3-2.

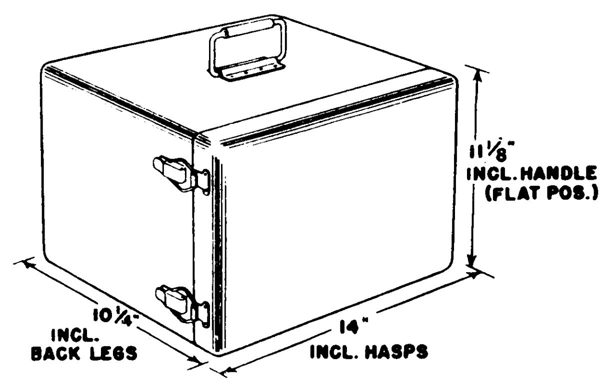


Figure 3-2. RF Signal Generator Set AN/URM-25B, Outline Dimensional Drawing

2. INSTALLATION.

a. The AN/URM-25B is a portable signal generator and does not require permanent installation.

b. The equipment is intended to be operated with the panel in the vertical position. Rubber supporting feet are provided for the cabinet. These feet protect the finished surface and serve to insulate the cabinet from a grounded desk. This insulation precaution, however, is not normally required.

c. The following preliminary settings and checks are required prior to placing the equipment in operation (See figure 4-1).

(1) Turn POWER switch (S-101) to OFF position

(2) Turn CARRIER CONTROL E-101 to the fully counterclockwise position.

(3) Plug power cable W-101 into power receptacle J-104

(4) Insert other end of power cable W-101 into 115 volt AC source

3. ADJUSTMENTS.

a. All operating adjustments are described in Section 4 OPERATION

b. The following preliminary checks and adjustments may be required in zero setting the meter (M-101). All symbols designations in this paragraph refer to Section 4, figure 4-1.

(1) Turn CARRIER CONTROL E-101 and % MODULATION control E-104 to the fully counterclockwise positions.

(2) Turn the signal generator on by placing POWER switch S-101 to the ON position. (Allow a 15 minute warm-up period).

(3) Set METER READS dial I-105 first in the RF position and then in % MOD and BAL positions. Meter M-101 should read zero. in all positions.

(4) If the meter does not read zero, follow the meter calibration procedure outlined in Section 6, par. 10.

SECTION 4

OPERATION

1. GENERAL.

a. It is the purpose of the OPERATION section to instruct personnel in the proper use of the AN/URM 25B as a test instrument. To be thoroughly familiar with the method of operation, it is suggested that both , and this section be read and studied.

b. In the development of this section, an attempt has been made to present each step in the logical sequence necessary to place the equipment in operation. If these steps are carefully adhered to, the operator will not only avoid damaging the signal generator but will be assured of a correct interpretation of the data as prescribed by the instrument. Table 4-1 is an operational summary of all front panel controls.

c. The essential details of operation and the necessary precautions to be taken are covered in this section under the following headings and paragraphs:

NOTE

All reference to symbol designations in this section apply to the front panel diagram Figure 4-1 unless otherwise specified. Primary reference is made to the symbol designation of the front panel knob (i.e. E-101) applicable to the specific circuit element (i.e. R-123). The association between the knob and circuit part is shown on Figure 4-1 by indicating the corresponding circuit element designation following the knob symbol (i.e. E-101 (R-123)).

TABLE 4-1. OPERATIONAL SUMMARY OF FRONT PANEL CONTROLS (See figure 4-1)

SYM. NR.	PANEL CONTROL	FUNCTION
E-101	CARRIER CONTROL.	Set carrier level.
E-102	CARRIER RANGE switch.	Set to indicated frequency range.
E-103	MICROVOLTS control.	Adjust output.
E-104	% MODULATION control.	Adjust percentage modulation.
E-10	FREQUENCY BAND SWITCH knob.	Select desired frequency band (A thru H).
H-101	Dial Mask.	Makes visible only frequency band selected.
I-103	Main Tuning dial.	Selects desired frequency.
I-104	MULTIPLIER dial.	Attenuates output from J-102 in steps of 10.
I-105 n	METER READS dial.	Select desired meter indication.
I-107	MOD SELECTOR - XTAL SELECTOR dial	Select type of modulation or crystal beat output.
J-101	RF OUTPUT X 20, 000	.500 ohms, 2 volts open circuit RF output.
J-102	RF OUTPUT X MULT.	53.5 ohm step attenuator output.
J-103	EXTERNAL MOD INPUT.	Input for external modulation, audio output, crystal beat output
N-102	Frequency scale.	Indicates output frequency.
S-106	XTAL CAL	Turns Crystal Calibrator ON or OFF.

2. POWER CIRCUIT.

a. The CARRIER CONTROL knob (E-101) should be turned fully counterclockwise before turning the POWER switch (S-101) to the ON position.

b. Plug the power cable (W-101) into the power receptacle (J-104). Insert the other end of the power cable into the 115 volt AC source.

c. Turn the POWER switch (S-101) to the ON position. Line voltage is now applied through the interconnecting power cable (W-102) to the primary of the power transformer (T-201). This is shown schematically in Figure 6-23.

d. No other power switches are provided and the signal generator is now in operating condition. A minimum 15 minute warm up period should then be allowed prior to setting the generator for use. This period permits the instrument to reach a stable operating state.

3. CALIBRATING THE ELECTRON TUBE VOLTMETER.

NOTE

Meter M-101 is an hermetically sealed unit and the screw zero set adjustment has been covered with solder. Due to variations in the temper of the meter movement spring, M-101 may not always read zero (meter needle on first line to the left) before the signal generator is turned on. If this condition exists, apply a hot soldering iron to this screw and make the necessary zero setting before applying power to the signal generator.

a. Although the electron tube voltmeter is calibrated at the factory, physical agitation, changes in tube characteristics and environmental conditions may make it necessary to recalibrate the meter circuit before the signal

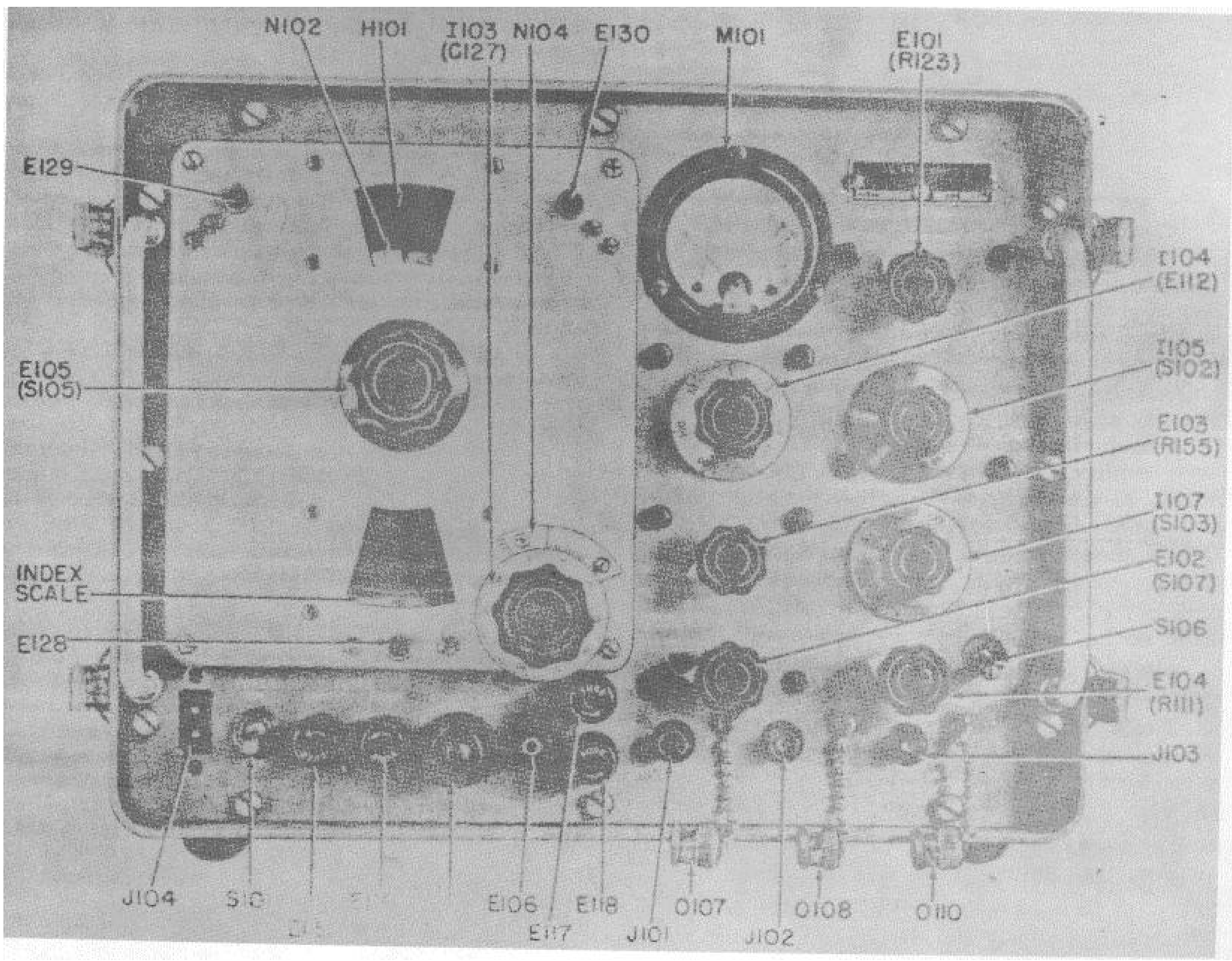


Figure 4-1. RF Signal Generator SG-448/URM-25, Front Panel Diagram

generator is used as a test instrument. Since this involves removing the signal generator sub-chassis from the cabinet (see Section 6, par. 4), non-technical personnel should not attempt to calibrate the instrument. For use by the Electronics Technician, a complete discussion of the method for calibrating the voltmeter is given in Section 6, par. 10. The following checks should be made to determine if calibration is necessary:

(1) Set the CARRIER CONTROL (E-101) and the % MODULATION control (E-104) fully counterclockwise.

(2) Turn the POWER switch (S-101) to ON. Allow a 15 minute warm-up period.

(3) The meter (M-101) should read zero in all three positions of the METER READS dial (I-105).

b. If the meter (M-101) does not read zero in all positions of METER READS dial (I-105), the technician should follow the calibrating procedure outlined in Section 6, par. 10.

4. ADJUSTING CARRIER FREQUENCY.

a. Whenever changing the frequency of the signal generator, be sure that the METER READS dial (I-105) is set to the RF position and the CARRIER CONTROL (E-101) is turned fully counterclockwise. The CARRIER RANGE knob (E-102) should be set to the corresponding frequency range selected.

NOTE

For greatest accuracy, always approach the selected frequency by rotating tuning dial I-103 in a counterclockwise direction. This eliminates errors due to gear assembly back-lash.

b. The desired frequency is set by selecting the applicable carrier oscillator L-C-R network with the FREQUENCY BAND switch (E-105) and turning the main frequency tuning dial (I-103). The frequency is then read from the frequency scale (N-102). If greater accuracy is required, this reading may be interpolated by utilizing the index scale of N-102, and the reading indicated on the tuning dial I-103 (see par. 5).

c. Eight frequency bands (A through H) are available and can be selected by E-105. A scale mask (H-101) is linked to this switch so that only the band scale selected will be made visible. Bands A through D will be made visible through the upper aperture whereas bands E through H will appear through the lower aperture.

d. The index scale is located at the bottom of the frequency scale (N-102) and is visible in all positions of the FREQUENCY BAND SWITCH (E-105). This scale is calibrated over a range of 180°.

e. The tuning dial (I-103) is calibrated from 0 to 100. One complete revolution of this dial will move the frequency scale (N-102) 100 divisions on the index scale. This index scale and tuning dial interpolation is discussed in paragraph 5 of this section.

f. The following procedure should be followed for selecting the operating frequency of the signal generator.

(1) Turn the CARRIER CONTROL (E-101) to the fully counterclockwise position.

(2) Set the FREQUENCY BAND SWITCH (E-105) to the desired frequency band.

(3) Turn the tuning dial (I-103) until the desired value on the frequency scale (N-102) coincides with the hair-line indicator.

g. A double hairline is provided for eliminating parallax frequency errors. The operator should read the frequency on a straight line of vision so that both hairlines appear to merge as a single line.

5. CRYSTAL CALIBRATOR.

a. GENERAL. An integral crystal calibrator (V-108) is provided for checking RF frequency of the signal generator between 1 mc and 50 mc. This calibrator should be used whenever it is desired to obtain an accuracy within ñ.05%. For best results, closely follow the below procedure:

b. PROCEDURE.

(1) Set the signal generator to the approximate desired frequency (see par. 4f).

(2) Set MOD SELECTOR dial I-107 to EXT (XTAL).

(3) Connect a pair of high impedance earphones to EXT MOD IN jack J-103, using 7" cable W-105 and Connector, Adapter UG-684/U.

(4) Throw XTAL-CAL switch S-106 to ON position. A number of zero beats will be heard in the vicinity of the frequency selected.

(5) Select the nearest half megacycle beats (1 mc on band H) on either side of the desired signal and record the vernier dial (I-103) readings at these points. Always approach the frequency setting by rotating TUNING dial I-103 in a counter-clockwise direction.

(6) Set I-103 to the accurate frequency (ñ.05%) by interpolating between the two calibration points (See example).

c. EXAMPLE OF FREQUENCY INTERPOLATION (See figure 4-2).

(1) Assume that it is necessary to obtain a signal at 34.3 mc ñ.05%.

(2) Select the zero beat closest to 34 mc. This might indicate a reading slightly less than "600" on the index scale. From figure 4-2, we see that the arrow on N-104 points to somewhere between "93" and "94". We also see from this figure that the third line on N-104 lines up with a marker on I-103. The numerical setting at this crystal check point is therefore "593.3".

(3) Rotate TUNING dial I-103 counterclockwise, passing the 34 mc marking, until the next zero beat is heard. This will appear 1 mc away from the first check point. Let us assume that this will occur at a vernier reading of 614.5. This represents a vernier difference of 21.2 for a 1 mc spread. A setting of 34.3 therefore represents an advance of .3 x 21.2 or 6.36 from the "593.3" setting.

(4) Set the vernier reading to 599.7 = (593.3 + 6.36). This represents a frequency of 34.3 mc ñ.05%.

NOTE

At frequencies below band H, frequency check points at I mc, 0.5 mc and 0.25 mc may be available. To avoid confusion, check points less than 0.5 mc should never be used when calibrating. On band H, 0.5 mc check points will not be available and I mc intervals must be used.

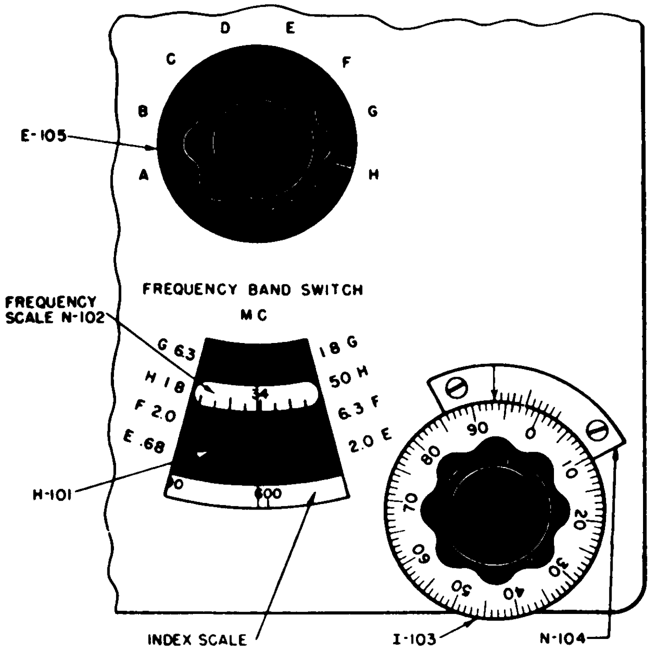


Figure 4-2. Diagram Showing Vernier Reading of Frequency Scale.

6. ADJUSTING OUTPUT VOLTAGE.

a. PRELIMINARY SETTINGS. Before adjusting the output voltage, the signal generator controls should be set in the following positions:

(1) CARRIER CONTROL (E-101) fully counterclockwise.

(2) METER READS dial (I-105) set at RF.

(3) MOD SELECTOR dial (I-107) set at OFF.

(4) CARRIER RANGE knob (E-102) to the appropriate position.

(5) MICROVOLTS control (E-103) fully clockwise.

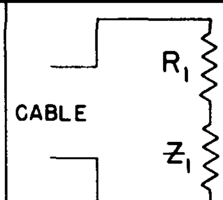
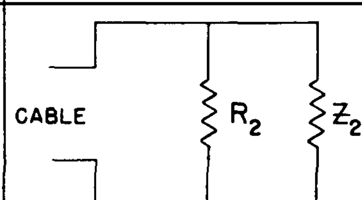
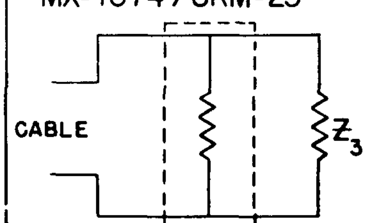
NOTE

Due to the nature of the signal generator voltmeter circuit, the presence of modulating voltage may introduce an error in the output voltage indication of M-101. For most accurate results, always select and read the RF output voltage before applying modulation.

b. ADJUSTMENTS.

(1) Advance the CARRIER CONTROL in a clockwise direction until M-101 reads "100" on the upper (RF) scale. When using the X MULT RF OUTPUT

TABLE 4-2. METHODS FOR CORRECTLY TERMINATING THE SIGNAL GENERATOR AT J102

TYPE OF INPUT	LOAD IMPEDANCE	CIRCUIT	ACCESSORY RESISTOR	VOLTAGE APPLIED TO LOAD IS:
I	LESS THAN 53.5 OHMS. Z_1		$R_1 = 53.5 - Z_1$	$V_{INDICATED} \times \frac{Z_1}{53.5}$
II	FROM 53.5 OHMS TO APPROXIMATELY 500 OHMS. Z_2		$R_2 = \frac{53.5\ Z_2}{Z_2 - 53.5}$	$V_{INDICATED}$
III	500 OHMS OR MORE Z_3	MX-1074/URM-25 	IMPEDANCE ADAPTER	$V_{INDICATED}$

(J-102), select the attenuation range with the MULTIPLIER dial (I-104) and adjust the MICROVOLTS control (E-103) for the desired output voltage. This voltage is determined in microvolts by multiplying the meter reading by the indicated position of I-104 when J-102 is terminated in its characteristic impedance of 53.5 ohms.

(2) Whenever changing frequency, readjust the CARRIER CONTROL (E-101) for a meter reading of "100" with the MICROVOLTS control (E-103) returned so the fully clockwise position. Select the desired output voltage by rotating the MICROVOLTS control. Do not use the CARRIER CONTROL for this purpose.

(3) To avoid leakage, the X RF OUTPUT jack (J-101) and the EXTERNAL MOD INPUT jack (J-103) should be covered by caps O-107 and O-110. Similarly, the X MULT RF OUTPUT jack (J-102) should be covered by cap O-108 when not in use.

c. VOLTAGE CORRECTION AT HIGH FREQUENCIES. Due to output jack reactance and increased RF distortion at frequencies above 30 mc, the actual output voltage at these frequencies is somewhat less than the voltage indicated by the meter. This can be adjusted by selecting the correction factor from Figure 4-3. Multiply this factor by the meter indication to get the actual output voltage.

For example; to correct an indicated output of 60 microvolts at 50 mc, multiply the correction factor at 50 mc (.85) by the meter indication (i.e. .85 X 60 = 51). A meter indication of 60 mv at 50 mc thus represents an actual output of 51 microvolts.

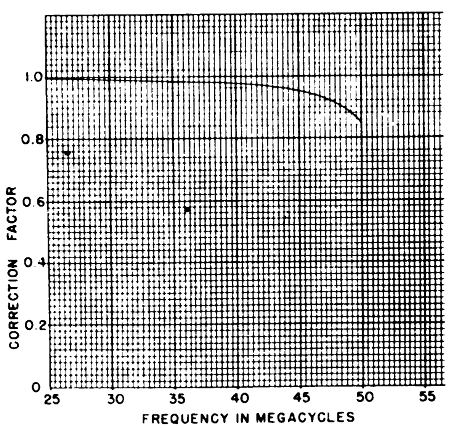


Figure 4-3. Correction Factor - Frequency Curve for Output Voltage on Band H

7. INTERNAL MODULATION AND AUDIO OUTPUT.

a. INTERNAL MODULATION.

(1) Set MOD SELECTOR dial I-107 to the 400 or 1000 cycle position.

(2) Set METER READS dial I-105 to % MOD position.

(3) Adjust % MODULATION knob E-104 until the meter reads the desired percent modulation.

b. AUDIO OUTPUT (400 or 1000 cycles).

(1) (1) Follow steps for internal modulation.

(2) Advance % MODULATION knob E-104 until meter reads "100" (with no load at J-103).

(3) Audio voltage is available at EXT MOD IN jack J-103.

(4) Connect load to I-103 and attenuate audio voltage with E-104 as required. Audio output is proportional to reading on M-101.

NOTE

The audio output impedance at EXT MOD IN jack J-103 is high. For maximum available audio output, J-103 should be connected to a high impedance load (approx. 100k). An impedance of less than 100k will load the audio circuit and greatly reduce the audio output. When the meter reads "100", approximately 4 volts open circuit, will be available at J-103.

8. EXTERNAL MODULATION.

a. Set MOD SELECTOR dial (I-107) to EXT.

b. Connect an external audio frequency source to the EXTERNAL MOD INPUT jack (J-103). Do rot modulate with frequencies above 1000 cycles for frequency bands A, B, or C.

NOTE

Due to the nature of the signal generator voltmeter circuit, the presence of modulating voltage may introduce an error in the output voltage indication of M-101. For most accurate results, always select and read the RF output voltage before applying modulation.

9. COUPLING TO THE RECEIVER UNDER TEST.

a. X MULT RF OUTPUT JACK (J-102). The technician will find that the X MULT RF OUTPUT at J-102 is much more useful than the higher output at J-101 in making receiver measurements. For best results, the terminations principles outlined in Table 4-2 should be followed when using the 53.5 ohm output from J-102. Cables W-104, W-105 and W-106 are provided for making the necessary connections between units and should be used as required. Coaxial adapter UG-201/U is also supplied for use in adapting the BNC connectors on the signal generator cables to a type N connector found on man), receivers.

(1) Connect a common ground between the receiver under test and the signal generator using ground terminal G (E-106) or the ground connection in the output cable. At low RF levels it may be necessary to orient the ground connection to obtain best results.

(2) Table 4-2 lists the correct methods for terminating the signal generator at J-102. These methods apply to loads which are fundamentally resistive in nature. The application principles are discussed in Section 2, par. 8.

b. X 20,000 RF OUTPUT JACK (J-101). The impedance at this jack is a resistance of 500 ohms shunted by the capacitance of the jack (approximately 4 mmf). Below 8 megacycles, this jack shunt reactance has no appreciable effect on the voltage obtainable from J-101. At 40 megacycles, however, the reactance due to the shunt capacitance is only 1000 ohms and a 30% attenuation of signal voltage will be present at this frequency. In any event, a maximum 2 volts across a high impedance load should be available at J-101 for all frequencies. It is reemphasized at this point that the termination methods outlined in Table 4-2 do not apply to this jack since the impedance at J-101 is 500 ohms. When using the X 20,000 RF output, the output voltage in microvolts is determined by multiplying the meter (M-101) reading by 20,000. This will be the actual voltage across a high impedance load (5000 ohms or more).

CAUTION

Care must be taken to prevent the introduction of voltages back into the attenuators or impedance adapter from the circuit under test. Currents greater than 20 milliampere may burn out the resistances incorporated within these units. Always insert the Test Lead CX'1363/U whenever making point to point measurements in a receiver. This precaution is not necessary when using the antenna simulator since it contains a series capacitor.

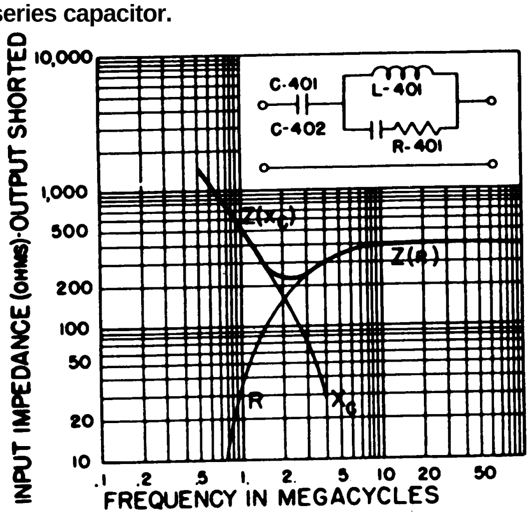


Figure 4-4. Schematic Diagram of the Antenna Simulator SM-35/URM-25 with Input Impedance-Frequency Curve

10. USE OF ANTENNA SIMULATOR SM 35/URM-25. (See figure 4-4).

a. The Antenna Simulator SM-35/URM-25 is used when making overall measurements or tests on a receiver designed for use with a standard antenna (see Section 4, par. 14f). The antenna simulator merely approximates the conditions that would exist had we applied our signal to the antenna circuit of the receiver and, therefore, the significant voltage is the input voltage to the simulator and not the input voltage to the receiver.

b. Connect the output cable (W-104) to the X MULT RF OUTPUT jack (J-102) and terminate this cable with the Impedance Adapter MX-1074/URM-25. Connect the antenna simulator to the impedance adapter with cable W-105 and to the receiver under test with cable W-106.

c. It can be seen from figure 4-4 that the minimum impedance of the antenna simulator will be approximately 220 ohms at 2 megacycles. This impedance becomes extremely high at lower frequencies and approaches 400 ohms at higher frequencies. In using the meter (M-101) of the signal generator it should be realized that a 20 percent maximum error may be introduced at 2 megacycles. If greater meter accuracy is required when using the antenna simulator, the actual impedance of this unit should be calculated from figure 4-4 at the frequency selected.

NOTE

Figure 4-4 in this section is the same as figure 2-16 in section 2 but bas been repeated here to assist the operator in applying the procedures herein outlined for use o£ the antenna simulator.

11. USE OF (5:1) FIXED ATTENUATOR CN-132/URM-25.

a. The (5:1) Fixed Attenuator CN-132/URM-25 attenuates the output at J-102 in a ratio of 5:1 when terminated in 53.5 ohms. It is very useful when using the meter (M-101) at output levels below "20" where the instrument accuracy falls off. This applies to microvolt ranges below 20,000 mv, 2000 mv, 200 mv, 20 mv, 2 mv, or .2 mv as selected by the MULTIPLIER dial (I-104) and MICROVOLTS control (E-103). In these cases, insert the (5:1) fixed attenuator at the X MULT RF OUTPUT jack (J-102) and terminate it as outlined in Table 4-2 for the required 53.5 ohms. The terminated output voltage is 1/5 the voltage indicated by M-101. The actual load voltage, however, will be 1/5 the meter indication only when the load impedance is exactly 53.5 ohms or greater than 500 ohms. For example; if a signal generator output of 20,000 microvolts into a 600 ohm load is desired, insert the fixed attenuator as follows:

(1) Connect the fixed attenuator to J-102 using cable W-104.

(2) Terminate the (5:1) fixed attenuator with the impedance adapter.

(3) Set the MULTIPLIER dial (I-104) to X 1000.

(4) Set MICROVOLTS (F-103) and CARRIER (E-101) control for "100" meter reading.

(5) The input to the load will be 20,000 microvolts.

b. If the load impedance is less than 53.5 ohms, it can be seen from Table 4-2 that the impedance adapter cannot he used, but the output from the (5:1) fixed attenuator must be fed to the load in series with the necessary resistor. The actual load voltage will then be something less than 1/5 the meter indication. For example; if a voltage of approximately 1200 microvolts with a load of 40 ohms is desired, insert a 13.5 ohm non-inductive resistor in series with the load and (5:1) fixed attenuator. The meter setting should be:

$$V\ meter = \frac{53.5}{Z} \times M \times 5 = \frac{53.5}{40} \times 1200 \times 5 =$$

$$150 \times 53.5 = \text{approx. } 8000 \text{ microvolts.}$$

12. USE OF (10:1) FIXED ATTENUATOR CN-36/URM-25.

a. The (10:1) Fixed Attenuator CN-432/URM-25 attenuates the output at J-102 in a ratio of 10:1 when terminated in 53.5 ohms. This unit can be used when a high degree of voltage accuracy is desired for low level outputs on band H. There is no need for using the 10:1 fixed attenuator on other bands or steps higher than X.1 on the MULTIPLIER dial (I-104).

Example (1) - Selecting an accurate output of 8 microvolts at 30 mc into a load of 500 ohms or greater.

(*a*) Set signal generator at 30 mc and MULTIPLIER dial (I-104) at X1 range.

(*b*) Adjust MICROVOLTS control (E-103) for reading of "80" on M-101.

(*c*) Insert the 10:1 fixed attenuator at J-102.

(*d*) Terminate 10:1 fixed attenuator with Impedance Adapter MX-1074/URM-25.

(*e*) Feed the output from the impedance adapter to the receiver under test.

(*f*) Input voltage to receive below 8 microvolts.

Example (2) Correcting a .8 microvolts output at 45 mc into a load of 500 ohms or greater:

(*a*) Set signal generator at 45 mc and MULTIPLIER dial (I-104) at X.1 range.

(*b*) Select meter correction factor for 45 mc from Figure 4-2 (i.e. .92).

(*c*) Multiply 80 by correction factor (i.e. 80 X .92 = 73.6).

(*d*) Adjust the MICROVOLTS control (E-103). for a reading of "80" on M-101. This represents an actual output of 7.36 microvolts at J-102.

(*e*) Insert the 10:1 fixed attenuator at J-102.

(*f*) Terminate the 10:1 fixed attenuator with the Impedance Adapter MX-1074/URM-25.

(*g*) Feed the output from the impedance adapter to the receiver under test.

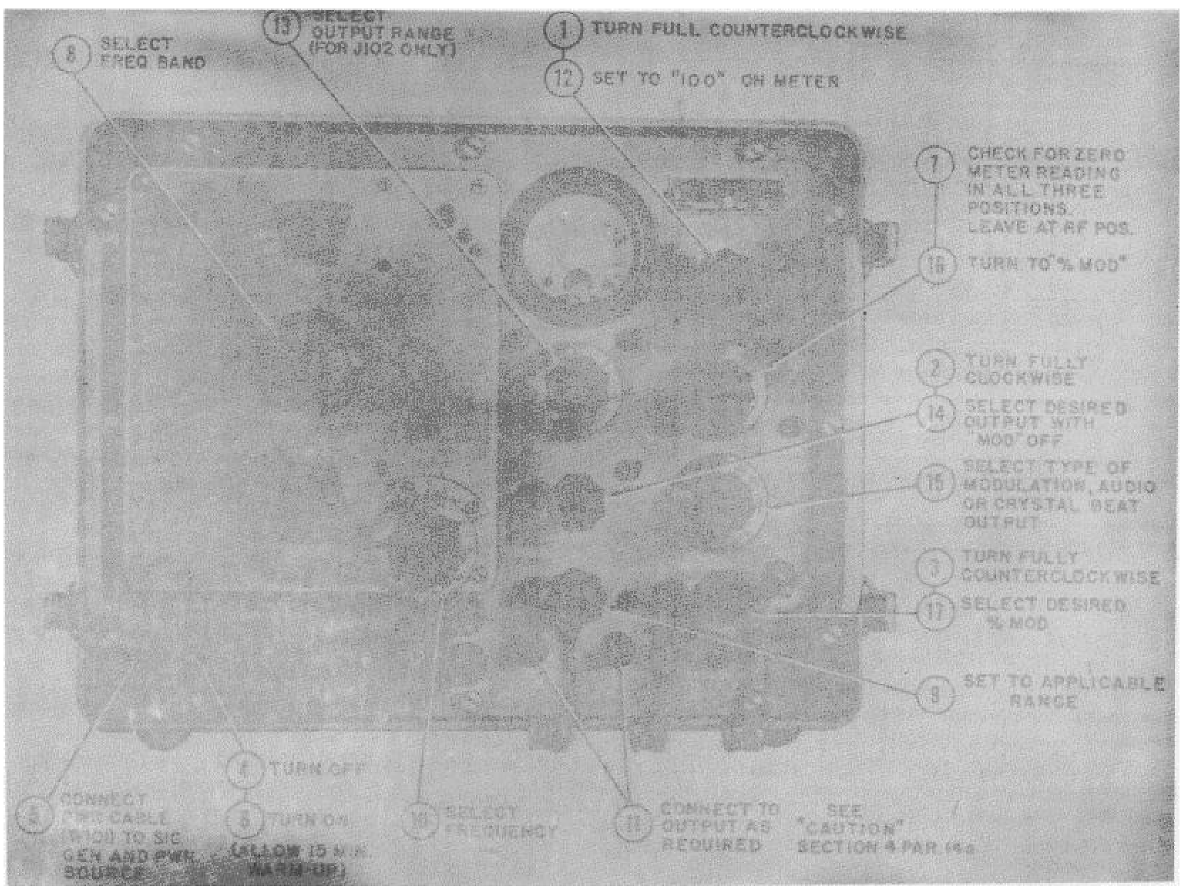


Figure 4-5. Simplified Procedure for Operating the RF Signal Generator Set AN/URM-258

(*b*) Input voltage to the receiver is now .736 microvolts.

13. SUMMARY OF OPERATION.

In using the AN/URM-25B as a test oscillator, it will not always be necessary to apply all the procedures outlined in this section. The technician will determine by use, the precision requirements of the equipment under test. Figure 4-5 is a simplified procedure summary for the operation of the signal generator.

14. GENERAL INSTRUCTIONS FOR USE.

a. DETAILS for additional details of proper signal testing techniques, the technician is referred to the basic equipment instruction book and also standard commercial texts. However, since most commercial test procedures refer to original broadcast type receivers which differ in principle and test values from standard Naval equipments, certain details of Naval values and methods are included herein.

CAUTION

Always use the Test Lead CX-1363/U when making point to point tests on a receiver. Failure to do so may result in burning out a resistor in the step attenuator (E-112) or in one of the accessory units.

b. RECEIVER TESTS.

(1) GENERAL. The presence of incidental frequency modulation in an A-M signal generator may introduce asymmetry in the apparent selectivity curve of the receiver being tested. This is particularly true for very sharply tuned circuits. The effects of frequency modulation have been kept at a minimum in the RF Signal Generator Set AN/URM-25B and should introduce no problem in receiver testing. For best results, however, the technician should perform all of the following receiver tests (except audio response) by using the unmodulated carrier signal. In order to eliminate the need for modulation, insert a high impedance DC voltmeter such as Multimeter ME-25/U or equal across the load of the second detector of the receiver. Adjustments can then be made with the meter response giving the necessary indication.

(2) SENSITIVITY. At high radio frequencies, antenna characteristics cannot easily be reproduced, and considerable care must be taken in making receiver sensitivity tests. The voltage available at the signal generator unit output jack (J-102) is always known, but not the voltage at the receiver input terminals a few feet away. This latter voltage is proportional to the signal generator output voltage, but it may be larger or smaller due to the characteristics and the termination of the "transmission line" between the instruments. (See Section 2, par. 8.).

(3) SELECTIVITY. The selectivity of a radio receiver is that characteristic which determines the extent to which the receiver is capable of distinguishing between the desired signal and disturbances of other frequencies. Selectivity is expressed in the form of a curve that gives the signal strength required to produce a given receiver output at various frequencies, with the response at resonance taken as the reference. This selectivity curve is normally obtained by disabling the automatic volume control system of the receiver, setting the signal generator to the desired frequency, tuning the receiver to this frequency, and modulating the carrier signal 30 percent at 400 cycles. The carrier frequency output of the signal is then varied by progressively increasing amounts from the frequency to which the receiver is tuned, and the signal generator voltage increased as necessary to maintain a controlled receiver output. The unmodulated carrier method as described in paragraph 14 b(1) of this section can also be used. Unless otherwise specified, the normal output is usually taken as 6 milliwatts into 600 ohms.

(4) AUDIO RESPONSE. The audio response of a receiver shows the manner in which the electrical output at a dummy load depends upon the modulation frequency. In making this test connect an audio oscillator, such as the Navy Model LAJ Series, to the EXTERNAL MOD INPUT (J-103). Set the MOD SELECTOR switch (I-107) to EXT. Set the signal generator to the desired carrier frequency and tune the receiver under test to this signal. Adjust the signal generator until a convenient output is obtained. Observe the variation in receiver output as the modulation frequency of the signal generator is varied from 400 cycles, while keeping the degree of modulation constant at 30 percent. The results of an audio response test are expressed in the form of a curve with the ratio of actual output to 400 cycles output plotted vertically, and each corresponding audio frequency plotted horizontally. In making this test, care must be taken to avoid applying so great a signal to the receiver as to overload the output. In the event that the noise and hum level in the receiver output is appreciable, it will be necessary to supply) a strong enough signal from the generator to override this interfering effect.

(5) MEASURING RECEIVER GAIN PER STAGE.

--The RF Signal Generator Set AN/URM-25B is also a useful device for measuring the gain of any particular receiver stage. This is accomplished by applying a signal to the input and output points of the stage in question and recording the signal generator voltage required, in either case, to give the same receiver output. The gain in db is then calculated by applying the formula: GAIN

$$\text{(db)} = 20 \log \frac{\text{V out}}{\text{V in}}$$

(6) RECEIVER ALIGNMENT. The alignment of the intermediate frequency amplifier system of a simple receiver is usually carried out by setting up the signal generator at the proper frequency and working step by step backward through the IF circuits from the second detector to the first detector.

CAUTION

Consult the particular receiver's instruction book for details of the method applicable to that receiver. This is particularly important for

wide band RF or IF amplifiers where over coupled, regenerative or stagger tuning is used. Be sure the aligning frequency is correct. Check with a heterodyne frequency meter such as Navy Model LM or LR series to obtain greater frequency accuracy than obtainable with the signal generator below 1 mc. Above 1 mc, the crystal calibrator in the AN/URM-25B can be used to obtain an accuracy within ñ.05%.

Always apply the signal generator to the grid immediately preceding the circuit under adjustment and adjust the trimmers (or variable inductances) for maximum output. In carrying out this procedure, it will of course be necessary to reduce the output of the signal generator each time the signal is applied to the grid of a tube at lower power level. The next step is to align the radio frequency and oscillator circuits of the receiver. This is accomplished by setting the receiver dial near the high end of the band in question and applying a signal of the proper frequency from the generator to the antenna input terminals of the receiver. First adjust the RF stage shunt trimmer capacitors (or iron core inductances) for maximum receiver output and then adjust the oscillator shunt trimmer until the receiver output is maximum. The receiver dial and signal generator are then set at the low frequency end of the receiver dial and the oscillator series padder capacitor is adjusted for maximum output. Recheck the high frequency end of the band and repeat the above procedure as necessary.

(7) RECEIVER ALIGNMENT ABOVE 50 MEGACYCLES. --The RF Signal Generator Set AN/URM-25B can also be used for aligning receivers above 50 mc by using the second harmonic of the frequency selected. Although harmonic distortion has been kept to about 10%, this still allows approximately 10,000 microvolts of second harmonics to be introduced at the X MULT RF OUTPUT jack (J-102). It must be realized, that, when the second harmonic is used, the signal generator meter can no longer be used as an indication of output.

c. MODULATED OPERATION. In using the equipment with modulated output, it should be realized that three waves are emitted, one at the carrier frequency and two "side bands." While either pure or modulated CW signals can he obtained from the signal generator, considerable discretion must be used in employing the modulated method of receiver testing, based on the selectivity of the receiver and the frequency of test, since the carrier and both side bands must be received in true proportion in order to obtain accurate measurements.

d. RECEIVER OUTPUT. In aligning or testing a receiver, a voltmeter, or output meter should be connected across the output terminals, in parallel with the proper resistance output load.

e. RECEIVER OVERALL SENSITIVITY. Some radio receivers have an excess of sensitivity. such that at certain frequencies, the inherent noise level is sufficient to saturate the detector or audio tubes, if the sensitivity, volume or gain control is advanced too far. Accordingly, all receivers are measured and rated for both CW and MCW sensitivity on the basis of the sensitivity, volume or gain control being adjusted so that not more than 60 microwatts of noise is present in the output with no input signal impressed. When measuring receiver overall sensitivities obtainable on the first step of the attenuator, it should be remembered that the output of the signal generator may not be attenuated equally at all frequencies to an absolute value of zero when the MULTIPLIER dial (I-104) is set at X.01 and the MICROVOLTS control (E-103) is set fully counterclockwise. The effects of stray or leakage disturbances caused by circulating currents in the case or between panel and case may be minimized by properly orienting the signal generator and using the (10:1) Fixed Attenuator CN-136/URM-25 (see Section 4, par. 12). Proper orientation of the generator with respect to the receiver will also limit the presence of undesired stray voltages. These stray effects can be ascertained by comparing the output of the receiver with the signal generator turned on and turned off.

f. STANDARD ANTENNA ELECTRICAL CONSTANTS. A standard antenna at low frequencies (below 1600 kilocycles) has essentially the same impedance as a series circuit of 20 microhenries, 200 micromicrofarads and 29 ohms. The resonant frequency is about 2500 kilocycles. The high frequency impedance is approximately 400 ohms resistive. The Antenna Simulator SM-35/URM-25 closely approximates the standard antenna (see Section 4, par. 10, also Section 2, par. 11).

g. STANDARD LEVELS. Standard levels are as follows:

(1) Standard output level of reference 6 milliwatts.

(2) Standard noise level -60 microwatts.

(3) Standard output load 600 ohms for low impedance output, or 20,000 ohms for high impedance output, unless special impedances are provided in the receivers and noted in their instruction books.

h. VOLTMETER USED AS AN OUTPUT METER. --In making measurements when a voltmeter is used as an output meter, the following approximate wattages correspond to the voltages at the load impedances noted:

(1)	1.9 volts at 600 ohms 11.0 volts at 20,000 ohms	6 milliwatts
(2)	0.19 volts at 600 ohms 1.1 volts at 20,000 ohms	60 microwatts
(3)	.77 volts at 600 ohms 4.5 volts at 20,000 ohms	1 milliwatts

(4) For receivers provided with output meters having a zero level of 6 milliwatts 20 decibels equal 60 microwatts.

(5) For receivers provided with output meters having a zero level of 60 microwatts 20 decibels equal to 6 milliwatts.

SECTION 5
PREVENTIVE MAINTENANCE

1. ROUTINE MAINTENANCE CHECK CHART.

The construction of the RF Signal Generator Set AN/URM-25B is such that preventive maintenance measures will be limited. Periodic testing of the equipment to determine if it is in proper working order, should be performed in accordance with the step-by-step procedure given in Table 5-1 ROUTINE CHECK CHART. If the signal generator is used frequently (several times a week), these checks should be made prior to use, otherwise they should be made weekly. All symbol designations given in Table 5-1 refer to Front Panel Diagram, Figure 4-1 in Section 4 OPERATION unless otherwise specified.

NOTE

THE ATTENTION OF MAINTENANCE PERSONNEL IS INVITED TO THE REQUIREMENTS OF CHAPTER 67 OF THE BUREAU OF SHIPS MANUAL, OF THE LATEST ISSUE.

2. FUSE FAILURE.

Symptoms of fuse failure and fuse locations are given in Tables 5-2 and 5-3. Spare fuses are provided in the spare fuseholders (E-117, E-118) located on the front panel.

3. LUBRICATION.

No maintenance lubrication will be required by personnel using the signal generator.

CAUTION

Never replace a fuse with one of higher rating unless continued operation of the equipment is more important than probable damage. If a fuse burns out immediately after replacement, do not replace it a second time until the cause has been corrected.

TABLE 5-1. ROUTINE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS AND REMARKS
1. Installation.	Before connecting the power cable (W101) to the signal generator, make sure the equipment is properly set up in accordance with instructions given in Section 3 - INSTALLATION. *a.* POWER switch (S-101) in OFF position. *b.* CARRIER CONTROL (E-101) fully counterclockwise. *c.* MICROVOLTS control (E-103) fully clockwise.	See that all cables and wires are in good condition and electrical connections properly made.
2. Power Supply.	Set controls as follows: *a.* CARRIER CONTROL (E-101) fully counterclockwise. *b.* POWER switch (S-101) to ON position.	The indicator lamp (I-101) and frequency scale lamps (E-128 thru E-130) should light. If they do not, check front panel fuses (see table 5-3) and lamp.
3. Voltmeter Check (M-101).	*a.* Throw POWER switch (S-101) to ON position. *b.* Allow 15 minutes warm up period. *c.* Set METER READS dial (I-105) to BAL position. *d.* Meter should read zero.	If the meter does not read zero in the BAL position R-131 requires adjustment (See Section 6, figure 6-9). This procedure is outlined in Section 6, par. 10.

TABLE 5-2. SYMPTOMS OF FUSE FAILURE

INDICATOR (I-101) AND SCALE (E-128 THRU E-130) LAMPS OF SIGNAL GENERATOR	ALL ELECTRON TUBES	METER M-101	OPEN FUSE	VALUE (AMPS)	COMMENTS
None Light	Filaments Off	No Reading	F-101	1	Check also power supply cables, connectors, etc. and the POWER switch (S-101).
None Light	Filaments OFF	No Reading	F-102	1	

TABLE 5-3. FUSE LOCATIONS

SYMBOLS	LOCATION	PROTECTS	AMPS	VOLTS	NUMBER
F-101	1. Physically located in signal generator front panel fuse-holders (E-115 and E-116). See figure 4-1.	Primary of power transformer (T-201).	1.0	250	FUS-10
F-102	2. Electrically located in primary of power transformer T-201. See figure 6-23.		1.0	250	FUS-10

SECTION 6
CORRECTIVE MAINTENANCE

CAUTION

This section is written primarily for use by the Electronics Technician. A non-technical operator should make no attempt to apply the procedures herein prescribed. Failure to comply with this suggestion may result in considerably greater damage to the signal generator than had originally been incurred by some performance failure.

1. GENERAL.

a. The fundamental principle of the RF Signal Generator Set AN/URM-25B is similar to that of any radio frequency transmitter. A study of Section 2, THEORY OF OPERATION will make this analogy more obvious. Like any RF transmitter, the AN/URM-25B has an RF oscillator, RF amplifier and provision for modulation. If the technician will bear this in mind, it may simplify his trouble shooting procedures.

b. The first step in maintenance or repair is to definitely determine that a defective condition exists. If the equipment is not operated correctly, certain indications of trouble might be presented when there is actually nothing wrong with the equipment. The technician should be thoroughly familiar with Section 4 OPERATION of this book before attempting to analyze the indicated defect.

c. After a positive determination is made that the generator is defective, the first step in trouble shooting is to localize the trouble, that is, decide which circuit of the complete system is not functioning as it should. Once the analysis has been narrowed down to the defective circuit, it becomes a relatively simple process of making voltage and resistance checks to locate the faulty circuit part (i.e. resistor, capacitor, etc.). The same system should be followed as is used in trouble shooting a radio frequency transmitter.

2. PRINCIPAL MAINTENANCE PROBLEMS.

The chief parts of the signal generator which are subject to wear or deterioration are electronic tubes and the FREQUENCY BAND SWITCH (S-105). In addition, and as a result of aging or excessive temperature variations, the carrier oscillator inductances may vary slightly and require recalibration (See Table 6-1 FREQUENCY CALIBRATION DATA).

3. TEST EQUIPMENT FOR MAKING REPAIRS.

The technician may find a wide variation of applicable test equipment in making repairs on the RF Signal Generator Set AN/URM-25B. However, to achieve the best results in accordance with the characteristics of the signal generator, the following test equipments or their equivalents are recommended for use:

a. Navy Model LM Series Crystal Calibrated Frequency Indicating Equipment (125 kc to 20 mc).

b. Navy Model LR Series Combined Heterodyne Frequency Meter and Crystal Controlled Calibration Equipment (160 kc to 30 mc ñ..003%).

c. Signal Generator TS-535/U (7 to 160 kc).

d. Resistance Bridge ZM-4/U.

e. Multimeter ME-25/U Series.

f. Oscilloscope OS-8/U, Navy Model OBL or OBT Series Cathode Ray Oscilloscope.

g. Multimeter TS-352/U, Navy Model OE Series Receiver Analyzing Equipment.

4. REMOVING THE SIGNAL GENERATOR AND POWER SUPPLY FROM THE CABINET.

a. REMOVING THE RF SIGNAL GENERATOR SG-44B/URM-25.-Since this is a precision instrument, great care should be taken in removing the RF Signal Generator SG-44B/URM-25 from the cabinet to make repairs. Before attempting to disassemble the unit, be sure that the equipment is disconnected from the power source. Adhere carefully to the following procedure:

(1) Remove the power cable (W-101).

(2) Loosen the twelve captive screws located around the outer edge of the panel (See figure 6-2).

(3) Gently pull the generator chassis about eight inches from the cabinet, using the lifting handles provided on the front panel. The generator unit cannot be completely removed since the interconnecting power cable (W-102) and output power cable (W-103) are still connected to the power supply sub-chassis.

(4) Remove the output power supply connector (P-102) and the AC input connector (P-101) from the

THIS PAGE MISSING NOT AVAILABLE FOR DIGITIZATION.

Figure 6-1.

power supply sub-chassis. The generator sub-assembly can now be removed. The power supply sub-chassis will remain in the cabinet.

b. REMOVING THE POWER SUPPLY PP-562A/URM-25.

(1) To remove the power supply, take out the four binding head screws located on the bottom of the cabinet. There are also four screws on the rear of the cabinet which must be removed. (See figure 6-3).

(2) With the signal generator and power supply sub-assemblies removed from the cabinet, the equipment can again be connected for use and testing by applying the following procedure (See figure 6-4).

(*a*) Insert interconnecting power cable plug (P-101) into the power supply input receptacle (J-201) and P-102 into J-202.

(*b*) Insert one end of the power cable (W-101) into the front panel input receptacle (J-104) and plug the other end into the AC source.

WARNING

Voltages up to 450v will be exposed when the signal generator is being tested outside the cabinet. Exercise great care in handling the instrument under these conditions.

5. REMOVAL AND REPLACEMENT OF PARTS.

a. Whenever repairs are made involving the removal or replacement of any component part, the part removed should be marked or tagged for identification and its exact position in the equipment carefully noted and recorded so that when the same or new part is replaced the equipment will be precisely as before.

NOTE: LOOSEN CAPTIVE SCREWS MARKED "X" TO REMOVE RF SIGNAL GENERATOR SG44B/URM-25 FROM CABINET

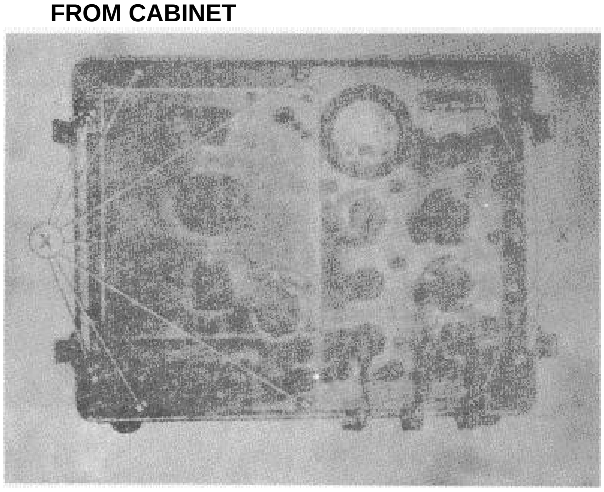


Figure 6-2. Front Panel View for Removal of RF Signal Generator SG-44B/URM-2S from Cabinet

This precaution is particularly necessary when replacing RF components, such as coils and capacitors. The location of these parts with respect to associated components will play an important role in the performance of the equipment.

b. Whenever any parts are replaced by new one, always use the identical type listed and described in Section 7 PARTS LIST, Table 7-4. If such parts cannot be obtained, substitute only similar parts with equivalent electrical and mechanical characteristics. If precision parts are not available and it is absolutely necessary to use the equipment, a temporary substitute of approximate value may be inserted. This is not recommended as a normal procedure and the exact replacement should be ordered. The unsatisfactory substitute should be removed as soon as the exact replacement is received.

6. REPLACING RF OSCILLATOR CIRCUIT COMPONENTS.

a. The RF oscillator frequency determining components L-105 through L-112 and C-127 through C-134 should not normally be replaced in the field unless the necessary calibrating instruments are available. These instruments include RF heterodyne frequency meters that cover from 10 kc to 30 mc with an accuracy of at least .05%o (e.g. Navy Model LR and Signal Generator TS-535/U).

b. Changing the oscillator tube should not normally cause much error in calibration. However, when replacing the oscillator tube, the signal generator should be recalibrated as soon as the necessary test equipment is available (i.e. Navy Model LR and Signal Generator TS-535/U).

NOTE: TAKE OUT SCREWS MARKED '"Y TO REMOVE POWER SUPPLY PP-562A/URM-25 FROM CABINET

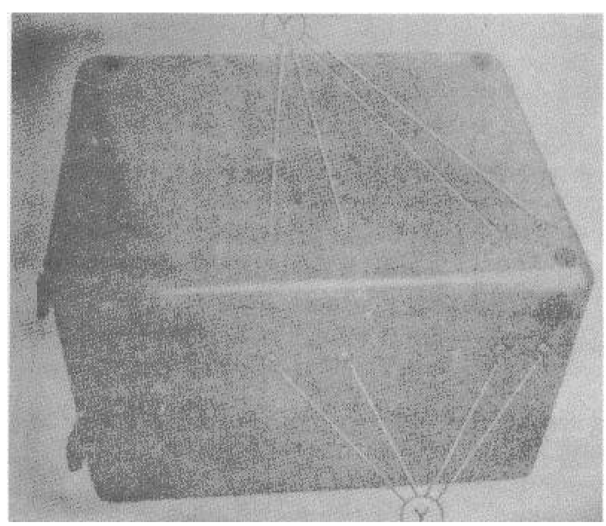


Figure 6-3. Rear-Bottom View for Removal of Power Supply PP-562A/URM-25 from Cabinet

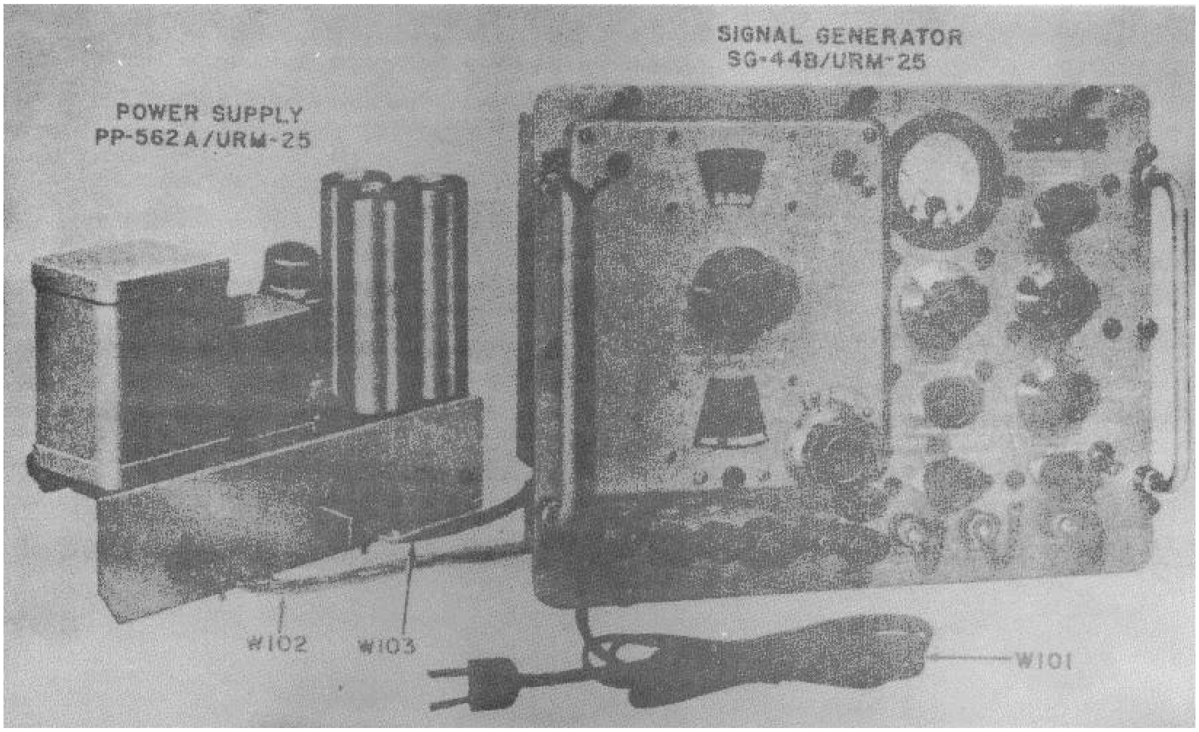


Figure 6-4. RF Signal Generator SG-44B/URM-25 and Power Supply PP 562A/URM-25 Connected Outside Cabinet for Testing

7. REPLACING BUFFER-AMPLIFIER CIRCUIT COMPONENTS. (See figures 6-5 and 6-6).

The buffer-amplifier compartment is located between the carrier oscillator and audio compartments. It contains the buffer-amplifier (V-104) and RF diode (V-105) circuits in addition to the step attenuator (E-112), MICROVOLTS control (R-155), and CARRIER RANGE switch (S-107). The RF diode, buffer-amplifier circuits and MICROVOLTS control are located on a separate shelf. It is sometimes necessary to remove this shelf when making repairs on the buffer-amplifier compartment. This removal should be accomplished in the following manner (See figures 6-5 and 6-6). Label all leads before unsoldering.

a. Remove the buffer-amplifier compartment cover plate.

b. Unsolder leads to the six feed thru capacitor (C-110, C-111, C-116, C-117, C-135, and C-137), and the lead to the step attenuator (E112).

c. Unsolder lead to J-101 and lead to grid of V-104.

d. Unsolder the leads going to the CARRIER RANGE switch (S-107).

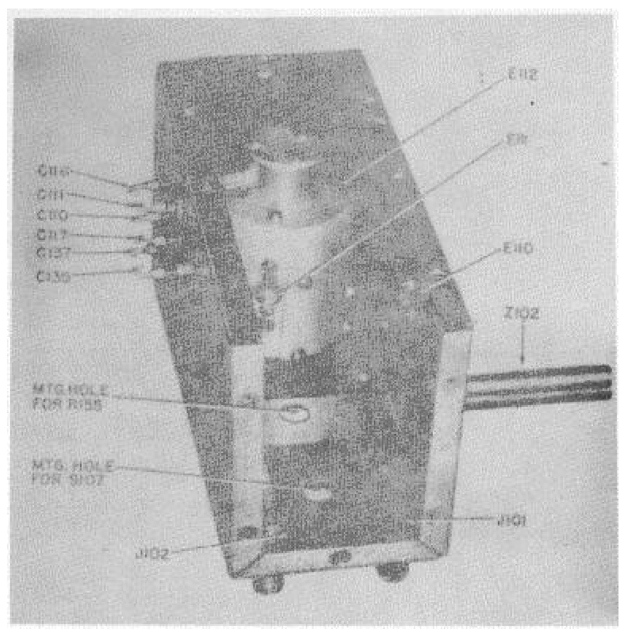


Figure 6-5. Interior View of Buffer Amplifier with Tube Shelf and CARRIER RANGE Switch (S-107) Removed

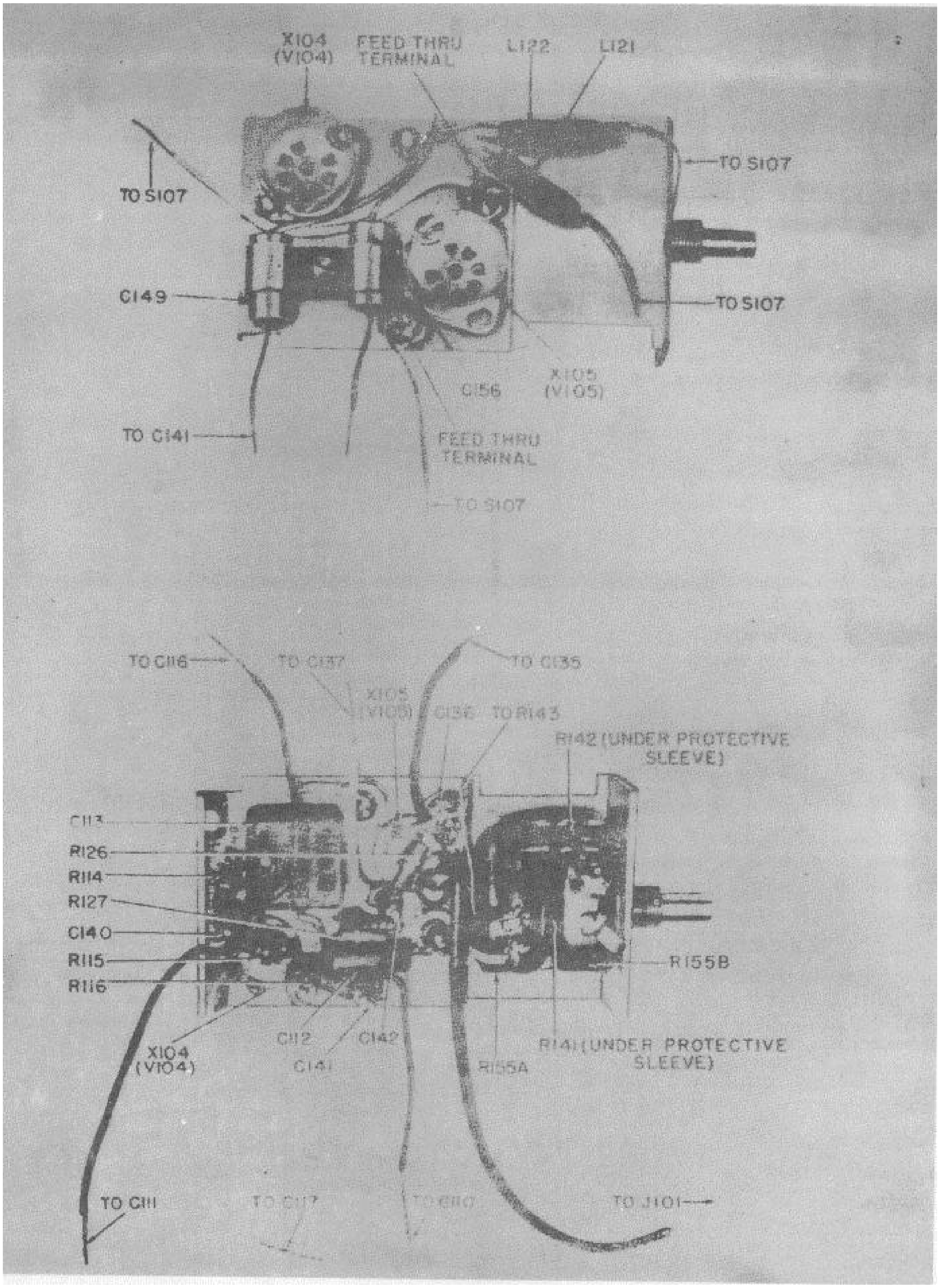


Figure 6-6. Top and Bottom Views of Buffer-Amplifier Tube Shelf

e. Remove the MICROVOLTS control knob (E-103) and bushing nut.

f. The buffer-amplifier RF diode shelf can now be removed.

8. READJUSTMENT OF FREQUENCY CALIBRATION.

(See figure 6-7)

a. WHEN TO CALIBRATE. The signal generator should be recalibrated whenever oscillator coils or capacitors are replaced, and whenever it's suspected that the frequency error is in excess of + 1%. This recalibration is accomplished by adjusting the applicable coils and trimmers as discussed in paragraph 9 of this section.

b. LIMITATIONS OF CRYSTAL CALIBRATOR V-108 FOR FREQUENCY RECALIBRATION. The use of the integral crystal calibrator for interpolative calibration was discussed in Section 4, paragraph 5. When used in this manner, the accuracy of the signal generator is increased from the rated ±.5% to ±.05% at frequencies above 1 mc. Since the crystal calibrator operates on the harmonic generation principle, it is limited as a recalibrating device when some circuit defect or replacement introduces a frequency error greater than 1%. For example, if for some reason, the frequency error at 50 mc is -2%, the frequency scale will read 50 mc when the actual frequency is 51 mc. Since zero beats occur at both 50 mc and 51 mc (1 mc apart), it will be difficult to determine which point corresponds to 50 mc. Similarly, at lower frequencies, (down to 1 mc), the combination of signal generator and crystal calibrator harmonics may introduce beats at intervals closer than .5 mc. Since the accuracy of the signal generator is better than ±.5%, there will be no problem in determining the applicable beat for interpolative calibration. When recalibrating the instrument because of errors greater than 1%, however, the instruments recommended in the following paragraph should be used to avoid any possible confusion.

c. RECOMMENDED TEST EQUIPMENT FOR RECALIBRATING.

(1) Navy Model LR Frequency Meter (160 kc to 30 mc).

(2) Signal Generator TS-535/U (7 to 160 kc).

NOTE

Figure 6-7 shows the locations of the trimmers and inductances that may require readjustment. Make sure that only the parts relevant to the frequency band being calibrated are adjusted. Follow the calibration procedure and do not turn screws indiscriminately.

9. FREQUENCY CALIBRATION PROCEDURE. (See figures 6-7 and table 6-1)

a. GENERAL

(1) When the frequency error of the signal generator is in excess of 1%, it will be necessary to recalibrate the instrument. In making the necessary adjustments, the RF Signal Generator SG-44B/URM-25 must first be removed from the cabinet. Interconnecting cables are of sufficient length as not to require the removal of the Power Supply PP-562A/URM-25 subchassis. Follow the procedure outlined in Section 6, par. 4, for removing the signal generator unit.

(2) Over the frequency range covered by Bands A through G (10 kc through approx. 18 mc), each oscillator coil has connected across it a trimmer capacitor for adjusting the total capacitance associated with it. Each corresponding coil also has a movable iron core by means of which the inductance of that coil can be adjusted to the required value. The recalibration process on these bands is therefore a simple matter of (a) adjusting the inductance for frequency calibration at the low-frequency end of the range, (b) adjusting the corresponding trimmer capacitor for a calibration point at the high end of the range, and (c) checking the center portion of the range selected.

(3) There is no trimmer capacitor or adjustable core for band H. If absolutely necessary, the inductance may be varied by adjusting the space between the coil (L-105) windings. This adjustment is made with the LR Frequency Meter at 30 mc (approximately mid scale on band H of the RF Signal Generator Set AN/URM-25B).

TABLE 6-1. FREQUENCY CALIBRATION DATA

FREQUENCY RANGE	LOW END -- ADJUST INDUCT.		HIGH END -- ADJUST CAP.	
	FREQ.	COIL	FREQ.	COIL
A	10 Kc	L111	20 Kc	C136
B	30 Kc	L110	80 Kc	C135
C	100 Kc	L109	200 Kc	C134
D	250 Kc	L108	650 Kc	C133
E	700 Kc	L107	2 Mc	C132
F	3 Mc	L106	6 Mc	C131
G	7 Mc	L105	18 Mc	C130
H	MAKE CENTER BAND ADJUSTMENT AT 30 Mc			

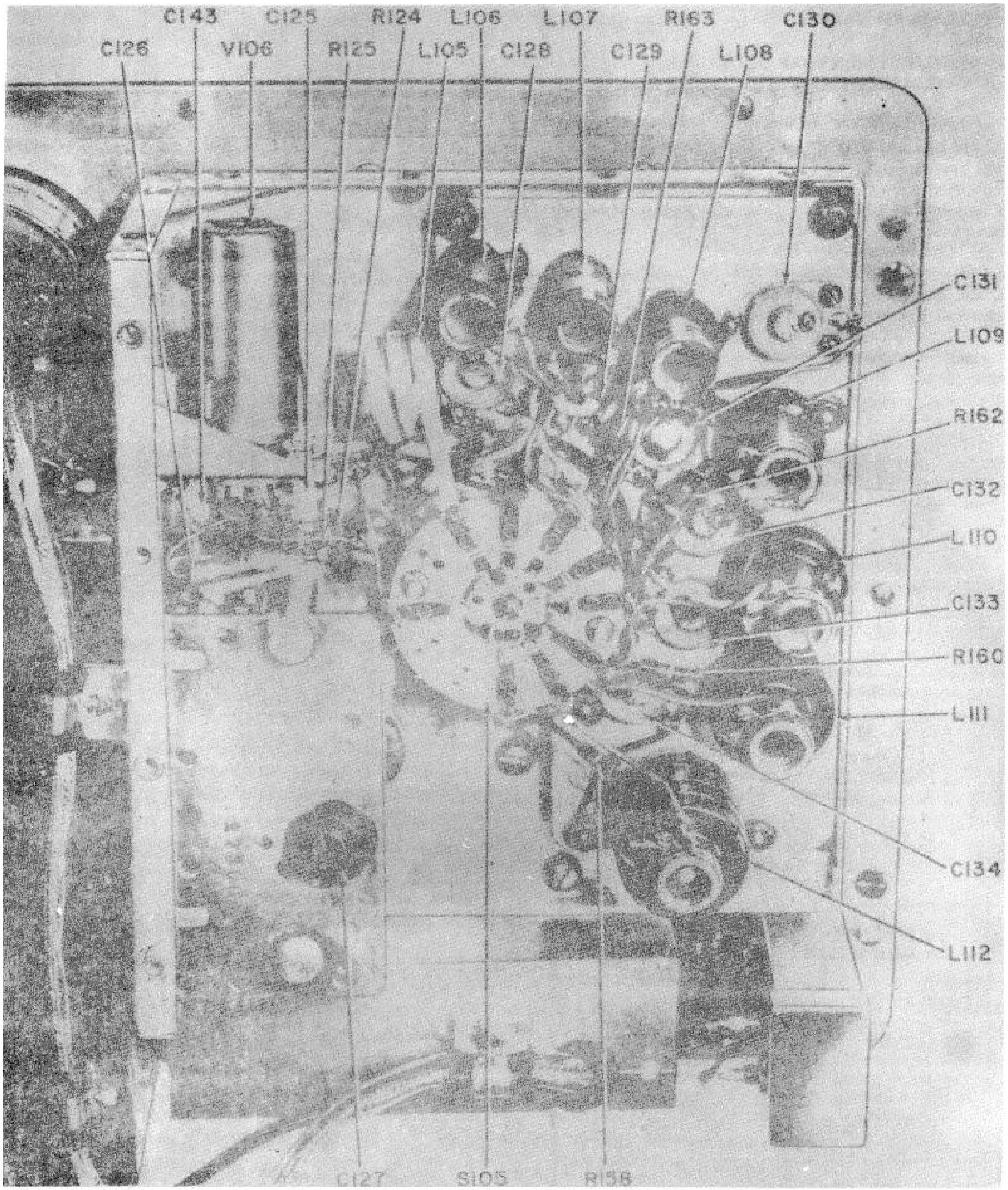


Figure 6-7. Interior View of Carrier Oscillator Compartment

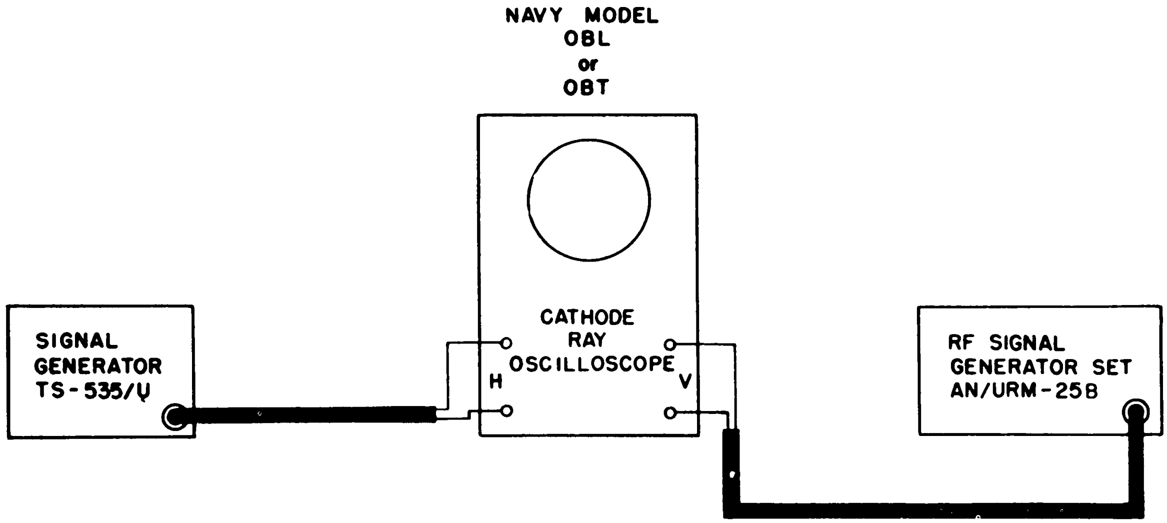


Figure 6-8. Method for Calibrating the RF Signal Generator Set AN/URM-25B at Frequencies Below 100 Kilocycles

(4) In using the heterodyne frequency meters referred to in paragraph 8 of this section, connect the output test cable (W-104) to the heterodyne frequency meter. Place a pair of earphones across the output of the frequency meter. Make the necessary capacitance and inductance adjustments while listening for a zero beat on the earphones.

(5) For calibrating frequency ranges below 100 kc, use the Signal Generator TS-535/U. Feed the output from the RF Signal Generator Set AN/URM-25B and Signal Generator TS-535/U to the horizontal and vertical inputs of an oscilloscope such as Oscilloscope OS-8/U, Navy Models OBL or OBT series (See figure 6-8). Adjust the frequency of the Signal Generator TS-535/U and the frequency of the RF Signal Generator Set AN/URM-25B to the same value. Be sure to calibrate the Signal Generator TS-535/U according to its instruction book before using it as a standard in this procedure.

NOTE

To make the necessary RF trimmer and coil adjustments, it will be necessary to remove the top shield plate from the carrier oscillator compartment. After the adjustment has been made, replace this plate and recheck calibrations. If the calibrations have been changed when this plate is replaced, readjust the applicable trimmer or core to compensate for this effect.

b. FREQUENCY CALIBRATION CHART. Table 6-1 is a chart for calibrating frequency and the necessary adjustment to be made on all bands. When calibrating frequency, follow the points and procedures therein contained.

c. ADJUSTING THE RF COILS. (See figure 6-7 and table 6-1)

(1) Identify the coil that must be readjusted (See figure 6-7).

(2) Set the main tuning dial (I-103) at the selected calibration point for the range in question.

(3) Note the original position of the core slot in the coil form. Move the core slightly in the required direction.

(*a*) Out or counterclockwise to reduce inductance and increase frequency.

(*b*) In or clockwise to increase inductance and reduce frequency.

(4) Replace the oscillator compartment shield and recheck the frequency scale for correction of calibration. (Sec note in par. 9a(5) of this section).

d. ADJUSTING THE TRIMMER CAPACITORS.

(1) Access to the trimmer capacitor is made by removing the 6scillator compartment shield.

(2) Set the main tuning dial (I-103) at the required calibration point for the range in question.

CAUTION

After the necessary adjustments have been made, on the upper and lower ends of the band being calibrated, the corresponding calibrations should be correct throughout the frequency range. If not, the main tuning capacitor (C-127) may be defective. One common way that this variable capacitor becomes defective is through "plate bending." Never bend the plates of the main tuning capacitor (C-127) in attempting to make an adjustment.

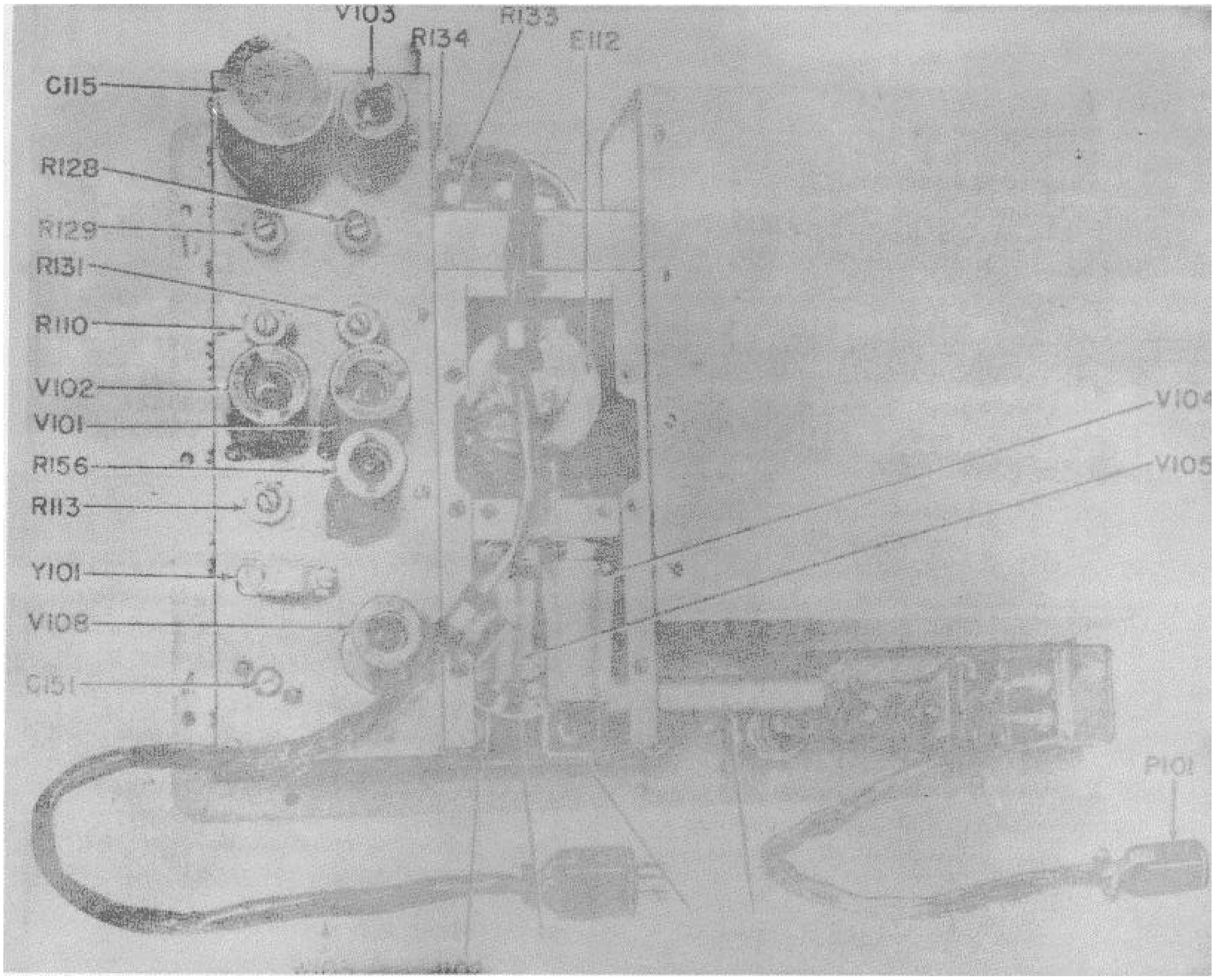


Figure 6-9. Rear View of RF Signal Generator SG-44 B/URM-25 with Buffer-Amplifier Cover Plate Removed

10. CALIBRATING THE ELECTRON TUBE VOLTMETER. (See Figure 6-9)

a. GENERAL. In the course of operating the equipment, it may be discovered that the meter (M-101) does not indicate what it should. This can readily be determined by applying the procedures outlined in Section 5 Table 5-1 ROUTINE CHECK CHART and making the necessary adjustments outlined in this paragraph.

NOTE

All voltmeter adjustments (R-128, R-129, R-131 and R-134) are of the screwdriver type and are located in the audio compartment. Figure 6-9 identifies these controls.

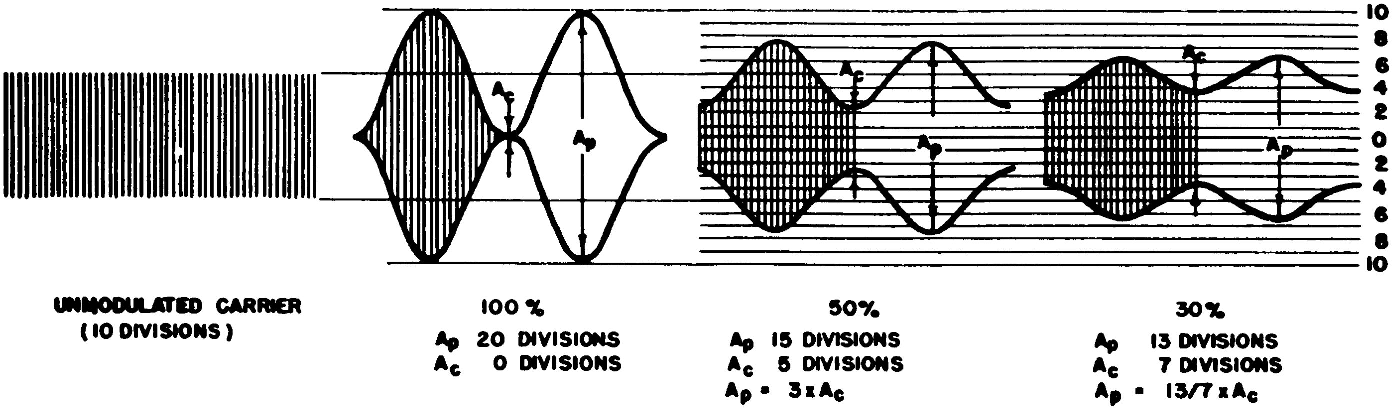
b. ZERO ADJUSTMENT. Make this adjustment if the meter (M-101) does not read zero in ill positions of the METER READS switch (S-102) when the CARRIER CONTROL (R-123) and %0 MODULATION control (R- 11) are set fully counterclockwise.

(1) Set CARRIER CONTROL (R-123) and % MODULATION control (R-111) to the fully counterclockwise positions (zero carrier and zero modulation voltage).

(2) Set METER READS switch (S-102) to the BAL position.

(3) Adjust the BALANCE control (R-131) for zero meter reading. This potentiometer (R-131) varies the relative B4voltage applied to the plates of the bridge tube (V-101) until a balance is obtained in the two arms of the bridge; When both branches are thus balanced, no current flows through the meter (M-101) and it indicates zero.

(4) Set the METER READS switch (S-102) to the RF position. The output from the RF diode (V-105) is now applied to the grid of the bridge tube (V-105B). Since the CARRIER CONTROL (R-123) was set for zero signal output (fully counterclockwise), there should be no voltage applied to the grid of the tube (V-101B) and the meter (M-101) should still indicate zero. However, if a reading other than zero is reflected by the meter,



$$\% \text{ MODULATION} = \frac{A_p - A_c}{A_p + A_c} 100$$

Figure 6-10. Percentage Modulation Chart

adjust the RF COMP control (R-128) until a zero meter reading is obtained. This adjustment compensates for the contact potential that may be present across the RF diode (V-105).

(5) Set the METER READS switch (S-102) to the N MOD position. The output from the modulation diode (V-103) is now applied to the bridge tube (V-101B). Since the %o MODULATION control (R111) was set to the fully counterclockwise position, there should be no voltage applied to the grid of the bridge tube (V-101B). Here again, the contact potential of the modulation diode (V-103) may cause a reading other than zero to be indicated on the meter (M-101). Adjust the MOD COMP control (R-129) for zero meter reading.

c. RF OUTPUT VOLTAGE CALIBRATION (upper meter scale).

(1) Turn the MICROVOLTS control (R-155) to the fully clockwise position.

(2) Set the CARRIER CONTROL (R-123) to the fully counterclockwise position.

(3) Set METER READS switch (S-102) to the RF position.

(4) Turn MODSELECTOR switch (S-103) to OFF.

(5) Set frequency at 100 kc.

(6) Place an electronic voltmeter such as Multimeter ME-25/U or equal between one center contact of the X 20,000 RF OUTPUT jack (J-101) and ground.

(7) Rotate the CARRIER CONTROL (R-123) in a clockwise direction until 2.0 volts are indicated on the test meter. The signal generator meter (M-101) should read "100" on the upper scale. This represents 2.0 volts output when the X 20,000 RF OUTPUT jack (J-101) is open circuited.

(8) Adjust the RF Sens control (R-133) until the signal generator meter (M-101) reads "100" on the upper scale when the test meter reads 2.0 volts.

(9) To maintain a calibrated output voltage from the X MULT RF OUTPUT jack (J-102), when operating the signal generator, first rotate the CARRIER CONTROL potentiometer (R-123) to the fully counterclockwise position.

Turn the CARRIER CONTROL in a clockwise direction until the meter (M-101) reads "100." The output from this jack can now be varied by rotating the MICROVOLTS potentiometer (R-111) in a counterclockwise direction and by selecting the desired attenuation with the MULTIPLIER dial (I-104). Once the carrier level has been set at "100," the CARRIER CONTROL (R-123) should never be used to vary the output from the X MULT RF OUTPUT jack (J-102). Before changing frequency, the CARRIER CONTROL (R-123) should first be returned to the fully counterclockwise position and then advanced to the carrier level of "100," after the desired frequency has been selected.

d. PERCENTAGE MODULATION CALIBRATION (lower meter scale). (See figure 6-10)

(1) Set carrier frequency at 100 kc.

(2) Set METER READS switch (S-102) to the % MOD. position.

(3) Set MOD SELECTOR switch (S-103) for 400 cycles per second.

(4) Set CARRIER RANGE switch (S-107) to the "10 kc-230 kc" position.

(5) Feed the output from the X MULT RF OUTPUT jack (J-102) to the vertical input of a test oscilloscope.

(6) Place a graduated celluloid screen over the face of the oscilloscope.

(7) With the MULTIPLIER dial (I-104) and MICROVOLTS control (R-155), adjust the modulated signal amplitude to cover approximately) 75 per cent of the face of the oscilloscope.

(8) Adjust the % MODULATION control (R-111) on the front panel until 50 percent modulation is indicated on the oscilloscope (See figure 6-10.)

(9) Adjust the Mod Sens control (R-134) until the

meter (M-101) also indicates 50 percent on the modulation scale (lower scale).

(10) Adjust the % MODULATION control (R-111) on the front panel until 30 percent modulation is indicated on the oscilloscope.

(11) Check the reading of the meter.

(12) If necessary, readjust R-134 until 30 percent and 50 percent readings are both as accurate as possible, favoring the 30 percent adjustment since this value is used most often.

11. CALIBRATING THE STEP ATTENUATOR (E-112).

a. The voltage attenuation of the step attenuator (E-112) should be checked whenever a resistor in this unit is replaced. Use the (10: 1) Fixed Attenuator CN-136/URM-25 and a radio receiver such as Navy Model RBA Series or equivalent for making this check as follows:

(1) Set the RF Signal Generator Set AN/URM-25B for 100 kc carrier frequency with 30% modulation at 400 cycles.

(2) Connect the (10:1) Fixed Attenuator CN-136/URM-25 to J-102 and terminate it with the Impedance Adapter MX-1074/URM-25.

(3) Connect the impedance adapter output to the RBA (or equivalent) receiver.

(4) Adjust the output of the signal generator for a reading of "100" on M-101.

(5) Set the MULTIPLIER dial (I-104) one range above the range in which the resistor was replaced.

(6) Connect a voltmeter such as the Multimeter ME-25/U series or equivalent across the output of the RBA receiver.

(7) Tune the receiver to the frequency (100 kc) of the signal generator and record a reference receiver output as indicated by the rmultimeter.

(8) Reset the MULTIPLIER dial (I-104) to the attenuation range in question (next lower range).

(9) Remove the (10:1) Fixed Attenuator CN-136/URM-25 and connect the signal generator output at J-102 to the Impedance Adapter MX-1074/URM-25.

(10) Advance the MICROVOLTS control (E-103) in a clockwise direction for a meter reading of "100."

(11) The receiver output should be the same now as was indicated in step 7 above. If it is not, the resistor on this range should be replaced.

NOTE

Use a very hot soldering iron when replacing resistors in the step attenuator (E-112). Apply the iron to the solder surface for a very short period of time. Too long a period of heating may cause the precision resistors to change in value.

b. Whenever it is suspected that the step attenuator j ratios are not correct, the procedures outlined in paragraph 11a above may be used as a check. A more complete analysis of step attenuator troubles is given in Table 6-4 CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE, paragraph 7.

12. TROUBLE SHOOTING CHARTS.

a. In employing any systematic method for trouble shooting, the methods and procedures followed by the technician will vary greatly. Any method employed is satisfactory as long as it will produce accurate results with the greatest expediency.

b. To assist the Electronics Technician in applying himself to the maintenance problems of the RF Signal Generator Set AN/URM-25B a trouble symptoms chart and two trouble shooting tables are listed near the end of this section. The first, Table 6-2 TROUBLE SYMPTOM CHART is a listing of some common trouble symptoms with suggested checks for locating the defect; the second, Table 6-3 GENERAL TEST PROCEDURES FOR LOCALIZING TROUBLE is a systematic procedure for determining the unit or component which is the source of trouble; the third, Table 6-4 SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE gives some hints that .may be applied in finding the specific part that may be defective.

13. TUBE OPERATING VOLTAGES AND CURRENTS.

Elect on tube operating voltages and currents under normal operating conditions are given in Table 6-5 TUBE OPERATING VOLTAGES AND CURRENTS, located near the end of this section. The measurements indicated in this table were made with the signal generator set for 100 kc operation and the METER READS switch (S-102) in the BAL position. Readings that vary with the position of the CARRIER CONTROL (R-123) are also indicated.

14. TUBE SOCKET ELECTRICAL MEASUREMENTS.

(*a*) As a further aid in maintenance work figure 6-11 SIGNAL GENERATOR VOLTAGE AND RESISTANCE CHART will be found near the end of this section. This chart lists diagramatically, the voltage and resistances measured from all tube socket connections to ground.

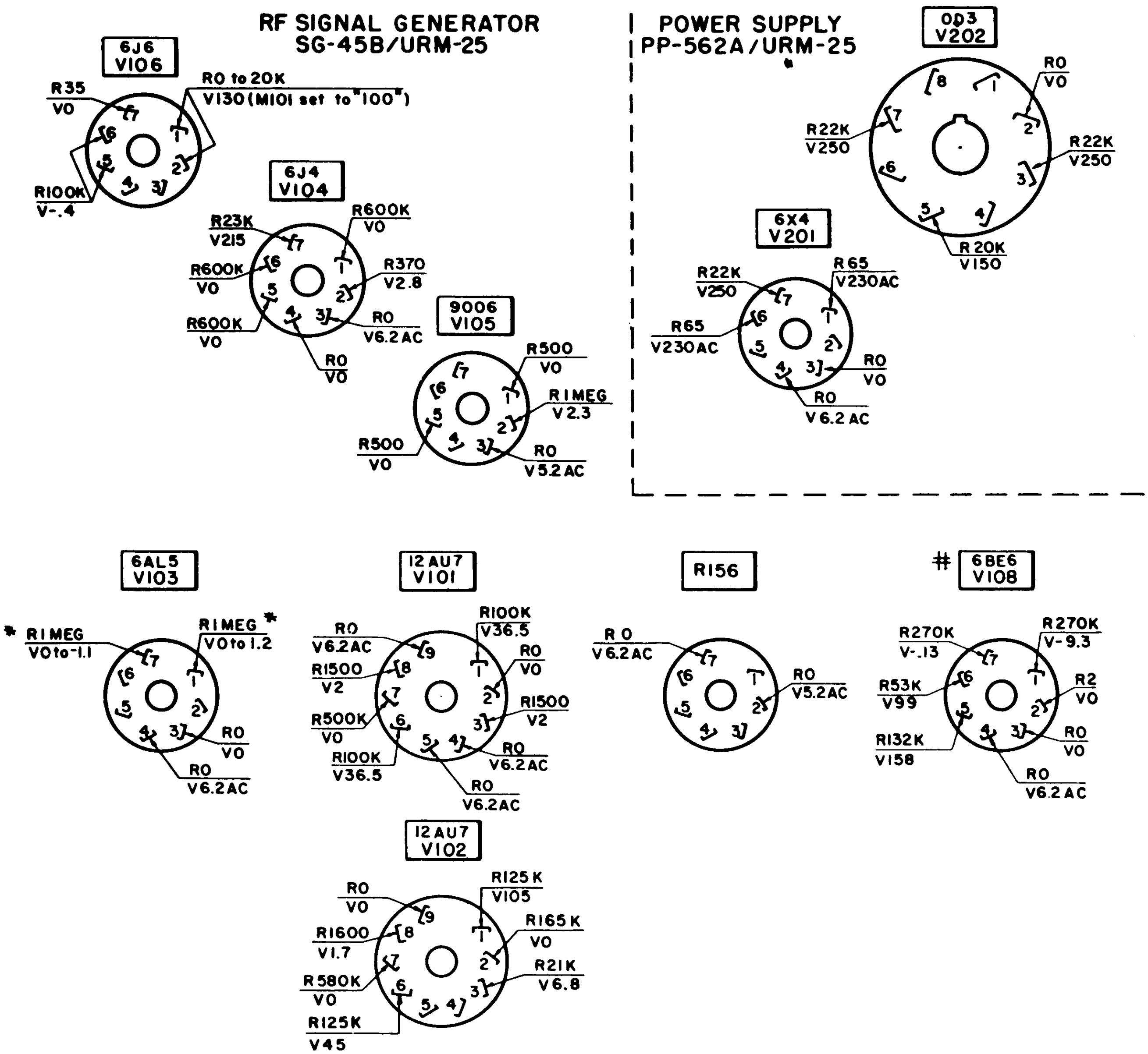
(*b*) As is indicated by the footnotes to this chart, all measurements were made with 20,000 ohms per volt DC meter such as in the Navy Model OE Series Analyzing Equipment.

15. WINDING DATA.

Complete winding data for all wire-wound units (except resistors) in the AN/URM-25B is given in Table 6-7 WINDING DATA.

16. EXTERIOR AND INTERIOR VIEWS OF UNITS.

To assist the technician doing maintenance work in locating the positions of the various coils, capacitors, resistors, switches, etc., comprising the signal generator, there will be found at the back of this section additional photographic illustrations. They show every part of the RF Signal Generator Set AN/URM-25B with the corresponding symbol designation indicated. These will facilitate the easy and quick identification of all parts. Table 6-8 CROSS REFERENCE BETWEEN SYMBOL NUMBER AND FIGURE LOCATION gives the figure in which these parts are identified.



NOTES:
All DC readings taken with a 20,000 ohms/volt meter
All AC readings taken with a 1,000 ohms/volt meter
Readings made with signal generator in following operating conditions:
1. Carrier frequency 100 kc
2. Meter set to full scale for RF
3. S102 in BAL position
4. S103 at 1000 cycles
5. S106 (XTAL-CAL) OFF
6. All voltage readings DC unless followed by AC
*** Voltage depends on position of R111**
 # Switch S106 (XTAL-CAL) "ON" for V108 voltage measurements

Figure 6-11. Signal Generator Voltage and Resistance Chart.

TABLE 6-2. TROUBLE SYMPTOM CHART

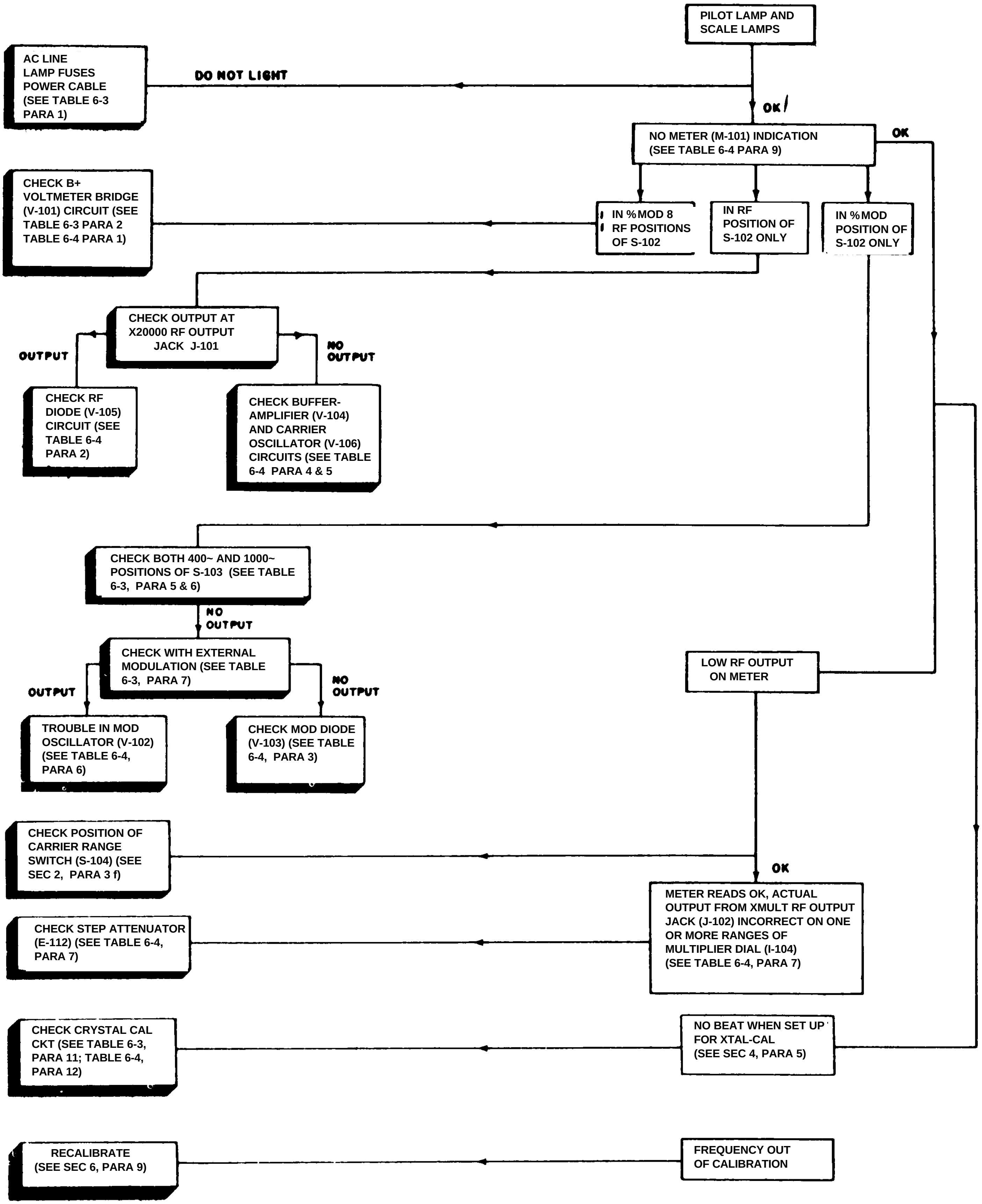


TABLE 6-3. CHART OF GENERAL TEST PROCEDURE FOR LOCALIZING TROUBLE

Note: The CARRIER (R-123) and % MODULATION (R-111) controls should always be turned fully counterclockwise before turning power on.

LOCATION AND TYPE OF TROUBLE	SUGGESTED METHOD FOR LOCALIZING TROUBLE
POWER SUPPLY. (See par. 11 for additional check.)	Make sure the indicating lamp (I-101) or scale lamps (E-128 thru E-130) have been made to light, as evidence that the 115 volt supply mains, fuses, and at least a part of the power supply system, is in working order. If none of these lamps light, see Table 6-4, par. 8 on POWER SUPPLY.
VOLTMETER BRIDGE. (See par. 10 for additional checks.)	**1.** Set the signal generator controls in the following position: *a.* POWER switch (S-101) OFF. *b.* MOD SELECTOR switch (S-103) OFF. *c.* METER READS switch (S-102) at RF. *d.* CARRIER RANGE switch (S-107) at applicable range. *e.* CARRIER CONTROL (R-123) in extreme counterclockwise position. *f.* % MODULATION control (R-111) in extreme counterclockwise position. *g.* FREQUENCY BAND SWITCH (S-105) set for any one of the eight ranges.
CARRIER OSCILLATOR, RF DIODE, BUFFER-AMPLIFIER.	**2.** Turn the POWER switch (S-101) ON. The meter needle should be at the first line on the left. If it is not, see Table 6-4, par. 1 on VOLTMETER BRIDGE CIRCUIT TROUBLE. **3**. Advance the CARRIER CONTROL (R-123) slowly in a clockwise direction. The meter needle should correspondingly move up scale. If it does, the voltmeter bridge, RF diode, carrier oscillator (at least one range) buffer-amplifier, and power supply are functioning. **4.** Set the FREQUENCY BAND SWITCH (S-105) successively for each range to see if operation (as in Par. 3 above) is obtained for all ranges. If it is, the carrier oscillator and buffer-amplifier are probably functioning. Operation on some bands and not on others probably indicates a defect in the carrier oscillator (see Table 6-4, par. 5 on CARRIER OSCILLATOR), since the buffer- amplifier is untuned and should respond at all frequencies if it responds at one. **5**. If, in Par. 3 and 4 above, the meter does not move up scale, turn the METER READS switch (S-102) to the % MOD position. Set MOD SELECTOR switch (S-103) to the 400 cycle position. Slowly advance the % MODULATION control (R-111) in a clockwise direction. If the meter now moves up scale, it indicates that there is trouble in the carrier oscillator, RF diode, or Buffer- amplifier circuits (see Table 6-4 Sections on CARRIER OSCILLATOR, RF DIODE, BUFFER- AMPLIFIER.) This also indicates that the modulation oscillator, modulation1diode and voltmeter bridge circuits are functioning.
MODULATION OSCILLATOR.	**6**. If the meter responds to the tests in par. 4, but not in par. 5 above, the trouble is in the modu- lation oscillator or modulation diode. **7.** With the METER READS switch (S-102) in the % MOD position; MOD SELECTOR switch (S-103) at EXT, CARRIER RANGE switch (S-104) at applicable range, apply an external audio signal (1000 cycles) to the EXT MOD IN jack (J-103). Slowly advance the % MODULATION control (R-111) in a clockwise direction. If the meter now moves up scale, it indicates that the trouble is in the modulation oscillator.
MODULATION	**8.** If the meter still does not respond to the % MODULATION control, feed the output signal DIODE. from the X MULT RF OUTPUT jack (J-102) to a test oscilloscope. Set the carrier frequency at 100 kc. Place the METER READS switch (S-102) in the RF position. Advance the CARRIER CONTROL (R-123) in a clockwise direction until a reading of "100" is obtained on the upper meter scale. With the external modulation applied as in par. 7 above, the modulated pattern should appear on the oscilloscope (see figure 6-10). If it does, the trouble was in the modulation diode circuit.
STEP ATTENUATOR (E-112) OR OUTPUT CABLES	**9**. If the meter responds to the above tests in a satisfactory manner, but there is still no output voltage at the end of the output cable (W-104), the trouble is in the attenuator (E-112) or output test cable (see Table 6-4 Sections on STEP ATTENUATOR and OUTPUT CABLES).

TABLE 6-3. CHART OF GENERAL TEST PROCEDURE FOR LOCALIZING TROUBLE- Continued

LOCATION AND TYPE OF TROUBLE	SUGGESTED METHOD FOR LOCALIZING TROUBLE
VOLTMETER BRIDGE.	**10**. If no meter response, whatsoever, is obtained, but it is determined that output voltage is available, the trouble is probably in the voltmeter bridge circuit (see Table 6-4, par. 1 on VOLTMETER BRIDGE).
POWER SUPPLY.	**11.** If no meter response or output voltage is obtained from the foregoing tests, the trouble is probably in the power supply (see Table 6-4, par. 8 on POWER SUPPLY).
CRYSTAL CALIBRATOR.	**12.** Turn MOD SELECTOR switch (S-103) to EXT and the XTAL-CAL switch (S-106) to ON. Connect a set of high impedance earphones to EXT MOD IN jack J-103 using 7" cable W-105 and Connector, Adapter UG-684/U. Tune signal generator to some even multiple of I mc and listen for zero beat. **13**. If it is determined, from previous steps, that RF output is present at J-101 and if no zero beat is heard at J-103, then the crystal calibrator circuit (V-108) is defective. (See Table 6-4 par 12).

TABLE 6-4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE

Note: The CARRIER (R-123) and % MODULATION (R-111) controls should always be turned fully counter clock-wise before turning power on.

TYPE OF TROUBLE	SUGGESTED METHOD OF TEST AND REPAIR
1. VOLTMETER BRIDGE CIRCUIT (V-101). *a.* INOPERATIVE.	If preliminary tests have indicated that the voltmeter bridge circuit (V-101) is inoperative, remove the RF signal Generator Unit SG-44B/URM-25 from the cabinet and proceed with the following tests (see Section 6, par. 4a). (1) Test voltage of bridge tube V-01 with the POWER switch (S-101) ON and METER READS switch (S-102) in BAL position. Heater Voltage -- 6.3v AC Plate Voltage (V-101A) -- 36.5v DC (ñ 5V) Plate Voltage (V-101B) -- 36.5v DC (ñ 5V) Grid Voltage (V-101B) -- 0 Grid Voltage (V-101B) -- 0 Cathode Voltage (V-101A) -- 2v DC Cathode Voltage (V-101B) -- 2v DC **NOTE** **DC voltages measured from tube socket connections to ground with a 20,000 ohms per volt voltmeter.** (2) If voltages are correct, disconnect power cable and make circuit continuity check with an ohmmeter until the defect is located (see figure 6-11).
b. METER (M-101) ZERO ADJUSTMENT	(1) Turn the POWER switch (S-101) to ON position. Both the CARRIER CONTROL (R-123) and the % MODULATION control (R-111) should be in the fully counterclockwise position. Apply the following procedure: (*a*) Set the METER READS switch (S-102) in the BAL position. The meter (M-101) should read zero. If it does not, adjust the BALANCE control (R-131) screw driver adjustment (located on the audio compartment) for zero reading. (*b*) Place METER READS switch (S-102) in the RF position. If the meter does not read zero, adjust the RF COMP control (R-128) screwdriver adjustment (located on the audio compartment) for zero reading. (*c*) Place METER READS switch (S-102) in the % MOD position. If the meter does not read zero, adjust the MOD COMP control (R-129) screwdriver adjustment (located on the audio compartment) for zero reading. (2) Repeat the procedure outlined in paragraphs a, b and c, above until the meter reads zero in all positions of the METER READS switch. (3) If unable to set meter to zero in all positions of the METER READS switch, one of the associated circuit parts is probably defective. Make continuity checks accordingly.

TABLE 6-4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE - Continued

TYPE OF TROUBLE	SUGGESTED METHOD OF TEST AND REPAIR
2. RF DIODE INOPERATIVE (V-105).	*a.* The RF diode (V-105) rectifies the RF signal which is applied to the voltmeter bridge (V-101) circuit and read on the upper scale of the meter (M-101) when the METER READS switch (S-102) is in the RF position. If it is determined that this circuit is defective the first and simplest thing to do is to replace the tube (V-102). When doing this, it will he necessary to readjust the RF COMP control (R-128) for zero meter reading. *b.* If replacing the RF diode (V-105) does not alleviate the trouble, make continuity checks within the circuit.
3. MODULATION DIODE INOPERATIVE (V-103). throughout the circuit.	*a.* The modulation diode (V-103) rectifies the modulation signal which is applied to the voltmeter bridge (V-101) circuit and read on the lower scale of the meter (M-101) when the METER READS switch (S-102) is in the % MOD position. If it is determined that this circuit is defective, the first and simplest thing to do is to replace the tube (V-103). When doing this it will he necessary to readjust the MOD COMP control (R-129) for zero meter reading. *b.* If replacing the modulation diode does not cure the trouble, make continuity checks
4. BUFFER-AMPLIFIER INOPERATIVE (VA104)	*a.* If preliminary tests have indicated that the buffer-amplifier is inoperative, remove the signal generator from the cabinet and proceed with the following tests (see Section 6, par. 4). *b.* Test DC voltages with the tube (V-104) in the socket; M-101 set for "100" and MOD SELECTOR switch (S-103) OFF (see figure 6-11). Carrier frequency should be set to 100 kc. Heater Voltage - 6.3v AC Plate Voltage - 215, DC Cathode Voltage - 2.8vDC (Adjust to this value with R-l 13) Control Grid Voltage - O DC measurements made from socket terminals to chassis with a 20,000 ohms per volt voltmeter. *c.* If she voltages are correct, but the buffer-amplifier is still inoperative, make a circuit continuity test with an ohmmeter until the defect is located. **NOTE** **It is a good idea to check the tube with a tube checker even though voltage checks are correct. Change in tube characteristics (i.e. transconductance etc.) may not show up in voltage checks but may actually be the source of trouble.**
5. CARRIER OSCILLATOR (V-106). *a.* INOPERATIVE.	(1) If preliminary tests have indicated that the carrier oscillator is inoperative in all ranges, remove the signal generator from its cabinet and proceed with the following tests: *(a).* Set the POWER switch (S-101) in ON position and the frequency to 100 kc with the carrier oscillator tube (V-106) in its socket, test the tube voltages. Heater Voltage: 6.3v AC Plate Voltage: Varies between 0 and 150v DC depending on setting of CARRIER CONTROL (R-123). (Checking this may or may not cause circuit to stop oscillating.) Grid Voltage: 0 to --.5v DC (Varies with rotation of CARRIER CONTROL R-123). Cathode Voltage: 0. *(b)* Turn the POWER switch (S-101) to OFF position and make the following resistance checks from grid to ground and grid to cathode, setting the FREQUENCY BAND SWITCH (S-105) to each corresponding position:

SWITCH POSITION	RESISTANCE (grid to ground)	RESISTANCE (grid to cathode)
Band A	100,000 ohms	175,000 ohms
B	100,000 ohms	118,000 ohms
C	100,000 ohms	100,000 ohms
D	100,000 ohms	104,700 ohms
E	100,000 ohms	101,800 ohms
F	100,000 ohms	100,000 ohms

TABLE 6-4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE - Continued

TYPE OF TROUBLE	SUGGESTED METHOD OF TEST AND REPAIR
	G 2,200 ohms 2,200 ohms H 2,200 ohms 2,200 ohms (*c*) If the ohmmeter reads "open" in any position of the FREQUENCY BAND SWITCH. either the corresponding coil, grid resistor or cathode resistor is open. Since Bands A through F have a common grid leak resistor, the exact open element can easily be determined. (*d*) If all voltage and continuity checks are correct, replace the tube and check results.
b. ERRATIC PERFORMANCE.	(1) Erratic performance of the carrier oscillator in a given band position is often difficult to trace. As a remedy, the following may be tried: (*a*) Substitute a new tube. (*b*) Check contacts of FREQUENCY BAND SWITCH (S-105). (*c*) Check for a dirty or faulty CARRIER CONTROL (R-123). (*d*) Make visual inspection of main tuning capacitor (C-127) for dirt, bent plates, etc. (2) Make visual inspection of the oscillator coil for the range in question.
c. EXCESSIVE VOLTAGE NEEDED ON CARRIER CONTROL (R-123).	(1) Often, defects in the resonant system (oscillator coils, capacitors and grid leak resistors) can be suspected if a greater than normal amount of plate voltage is necessary in order to develop the required voltage output. (2) Check normal voltages between the slider (center lug) of the CARRIER CONTROL (R-123) and ground, in the following manner. (The CARRIER CONTROL should be set in the fully counterclockwise position.) (*a*) POWER switch (S-101) ON. (*b*) CARRIER RANGE switch (S-107) to applicable range. (*c*) MOD SELECTOR switch (S-103) OFF. (*d*) METER READS switch (S-102) at RF. (*e*) Main tuning dial (1-103) set at beginning of all bands. (*f*) Oscillator plate voltages required for "100" meter leading. (1) Bands A through F -- less than 50v DC. (2) Band G and H -- less than 150v DC.
6. MODULATION OSCILLATOR. *a.* INOPERATIVE ON BOTH 400 AND 1000 CYCLES.	(1) If it is indicated that the modulation oscillator is inoperative on both frequencies (400 and 1000 cycles) the probable defective part is some element common to both frequency position of the METER READS switch (S-102). (2) One possible trouble is too high a degree of degeneration. This degeneration is dependent upon the resistance ratio of (R-105 and R-110). Although the DEGEN control (R-110) is a locking type potentiometer, vibration may have charged its value. If its resistance is too small, the degeneration will be too great and oscillations v ill be inhibited. Sometimes increasing the resistance (R-110) will assist the oscillator in breaking into oscillation. If this is the case, set this resistor at the point where oscillations just begin. (3) If a spare tube is available, it is sometimes most expedient to replace the old tube. (4) If replacing the tube does not solve the problem continuity and voltage checks should be made. In making these voltage checks, refer to Table 6-5 TUBE OPERATING VOLTAGES AND CURRENTS.
b. INOPERATIVE ON ONLY ONE FRE-QUENCY (400 OR OR 1000 CYCLES).	(1) If the modulation oscillator is inoperative on only one frequency, the solution is relatively simple. (2) The defective element is probably one of the bridge resistors (R-101, R-102, R-103, or R-104). (3) Make the necessary resistance checks.
c. ERRATIC OPERA-TION OR PRESENCE OF AMPLITUDE DISTORTION.	(1) If the locking device on the degeneration resistor (R-110) is loosened, mechanical vibration may cause a variation of resistance and hence degeneration. This may result in erratic operation or amplitude distortion. Check this control and tighten the locknut.

TABLE 6-4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE - Continued

TYPE OF TROUBLE	SUGGESTED METHOD OF TEST AND REPAIR
7. STEP ATTENUATOR (E-112). *a.* NO OUTPUT ON ALL STEPS	(1) If there is output from J-101 but no output from J-102 in all steps of E-112, the 482 ohm resistor (R-143) is probably burned out. (2) Disconnect one lead of R-143 and check its resistance with an ohmmeter.
b. NO OUTPUT ON ONE OR MORE, BUT NOT ALL STEPS.	(1) One of the step attenuator series resistors (R-144 through R-148) is probably burned out. (2) Check the series resistor preceding the step where there is no output. Always check these resistors with one lead disconnected to avoid shunting resistance paths.
c. APPROXIMATELY **???** OR LESS INSTEAD OF 10:1 ATTENUATION BETWEEN TWO SUCCESSIVE STEPS.	(1) One of the step attenuator shunt resistors (R-149 through R-154) is probably burned out. (2) Check the impedance of J-102 at the step attenuator position in question, using a multimeter ME-25/U series or equivalent. If the shunt resistor is burned out, an impedance of about 250 ohms instead of 53.5 ohms will be present.
d. REPLACING STEP ATTENUATOR RESISTORS	(1) Recalibrate step attenuator ratios for range in which resistor was replaced, using the (10:1) Fixed Attenuator CN-136/URM-25 and a radio receiver such as Navy Model RBA series or equivalent. Follow the procedure outlined in Section 6, par.11. **CAUTION** **Resistance measurements at J-102 should be made with a resistance bridge such as the type ZM-4/U or equivalent to avoid burning out one of the step attenuator resistors. If the Electronics Technician uses an ordinary ohmmeter great care must be exercised to see that this ohmmeter does not place a current in excess of 20 milliamperes through the attenuator circuit while testing.**
8. POWER SUPPLY PP-562A/URM-25 *a.* INOPERATIVE	(1) Check line fuses F-101 and F-102. (2) Check interconnecting cables W-102 and W-103 for continuity with an ohmmeter. (3) Check power transformer T-201. (4) If no B+, check rectifier tube V-201, filter choke L-201 and series resistor R-201.
b. OVERHEATING.	(1) Check short circuited turns on T-201. (2) Check for partial breakdown of C-201, C-202 and C-203. It is sometimes best to replace one or all of these capacitors, if it is suspected that one of them is defective. A voltage or ohmmeter check will not always identify this trouble.
c. LOSS OF REGULATION.	(1) Check with a variac or variable voltage source. Change the line voltage from 103v to 126v AC. The + 150v DC output should not change. This does not apply to the unregulated + 240v DC supply.- (2) Replace regulator V-202 if the B+ does not remain steady at 150v DC.
9. HUM MODULATION	*a.* Listen for power line hum (impressed on carrier frequency). *b.* Check for unshielded leads between signal generator and receiver. All leads between these units should be shielded. *c.* Check for mechanical vibrations of T-201. Tightly secure the transformer mounting.
10. ACCESSORY UNITS. *a.* IMPEDANCE ADAPTER MX-1074/URM-25 *b.* ANTENNA SIMULATOR SM-35/URM-25	If it is suspected that any one of these accessory units is defective, a simple continuity check will readily indicate the source of trouble. **CAUTION** **When making a resistance check on the Impedance Adapter MX-1074/URM-25 be sure the lowest ohmmeter resistance range is used. Ohmmeters with internal batteries larger than 1.5v may burn out the resistor in the impedance adapter. Where great accuracy is desired, resistance measurements should be made with the Resistance Bridge ZM-4/U or equivalent.**

TABLE 6-4. CHART OF SUGGESTED TESTS FOR LOCATING THE SPECIFIC TROUBLE - Continued

TYPE OF TROUBLE	SUGGESTED METHOD OF TEST AND REPAIR
c. (5:1) FIXED ATTENUATOR CN-132/URM-25. *d.* (10:1) FIXED ATTENUATOR CN-136/URM-25. *e.* TEST LEAD CX-1363/U.	
11. OUTPUT CABLES.	Check leakage resistance with a megger (high resistance ohmmeter).
12. CRYSTAL CALIBRATOR (V-108) *d.* INOPERATIVE	If the check in Table 6-3 under CRYSTAL CALIBRATOR indicates that this unit is defective, the following tests should be made to localize the trouble. **NOTE** **The output beat of the Crystal Calibrator is amplified by V-102B of the modulation oscillator (V-102). Make sure that this audio oscillator is functioning (Table 4-3 under MODULATION OSCILLATOR) before deciding that the V-108 circuit is defective.** (1) Replace crystal Y-101, then tube V-108 if available. These parts are the most common source of trouble in the crystal calibrator. (2) If a substitute tube and crystal are not available, check V-108 in a tube checker. (3) Make circuit continuity and voltage tests. Figure 6-11 indicates the normal socket to ground voltages and resistors for V-108. The following readings from socket pins to ground indicate that either the tube (6BE6) or crystal is defective. Measurements should be made with a 20,000 ohm/VDC and 1000 ohm/VAC meter.

PIN	CORRECT	CRYSTAL (Y-101) DEFECTIVE	TUBE (V-108) DEFECTIVE (NOT CONDUCTING)
1--	--9.3VDC	--0.2VDC	0
2--	0.02VDC	0.02 VDC	0
3--	0	0	0
4--	6.2VAC	6.2 VAC	0 if filaments are open;5.9 VAC if filaments are not open
5--	158VDC	7.3 VDC	240 VDC
6--	99VDC	45 VDC	240 VDC
7--	0.1VDC	0.175 VDC	0

TYPE OF TROUBLE	SUGGESTED METHOD OF TEST AND REPAIR
b. FREQUENCY CALIBRATION	(1) Provision is made for calibrating the 1 mc frequency of the crystal calibrator, if it is suspected that its accuracy has fallen off in excess of ñ.05%. The calibration should be accomplished in the following manner. *(a)* Remove RF Signal Generator SG-44B/URM-25 (See par. 4a). *(b)* Connect the signal generator unit to Power Supply PP-562A/URM-25. *(c)* Tune a receiver such as Navy Model RBC series to the 5 mc signal of Navy station WWV. *(d)* Turn the signal generator on and CARRIER CONTROL fully counterclockwise. *(e)* Turn XTAL-CAL switch S-106 to ON and connect a lead from the X20,000 RF OUT-PUT jack J-101 to the antenna input of the RBC. Sufficient crystal output will be available at J-101 to drive the receiver. *(f)* With the receiver tuned to WWV, adjust crystal trimmer C-151 (See figure 6-9) for zero beat (fifth harmonic of 1 mc crystal) against WWV. A set of earphones or speaker can be used for monitoring this beat.

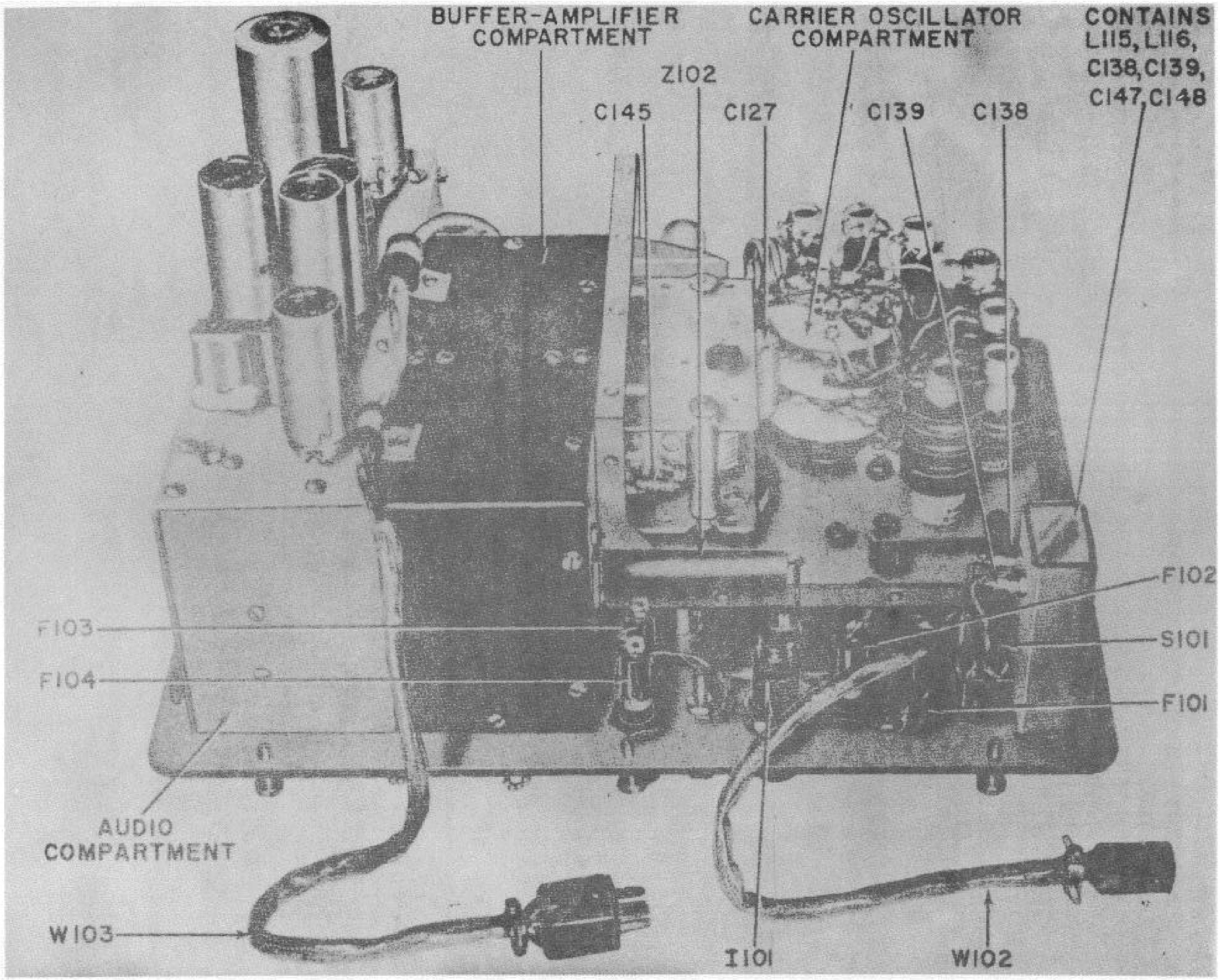


Figure 6-12. Bottom View of RF Signal Generator SG-448/URM-25

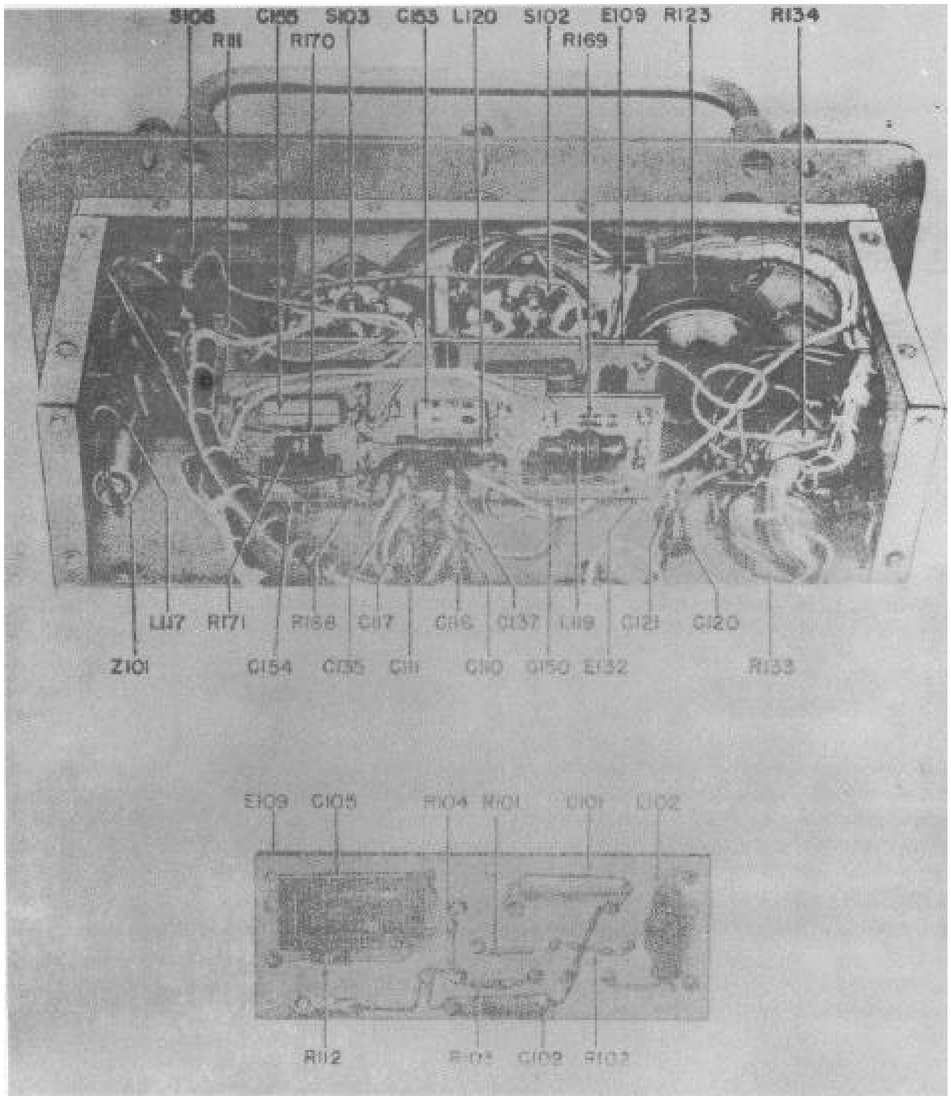


Figure 6-13. Interior View of Audio Compartment with Top View of Terminal Board E-109 shown.

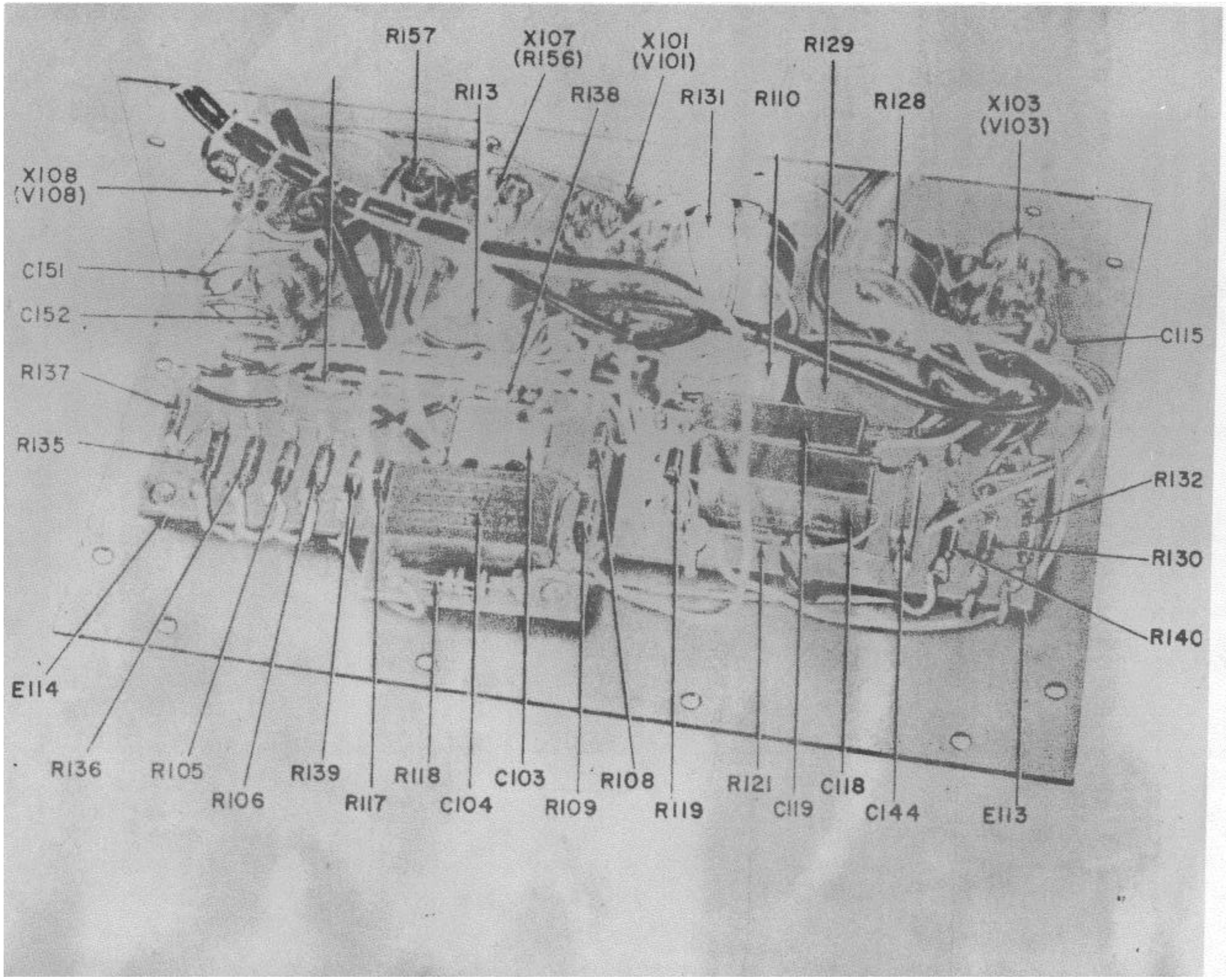


Figure 6-14. Bottom View of Audio Cover Plate.

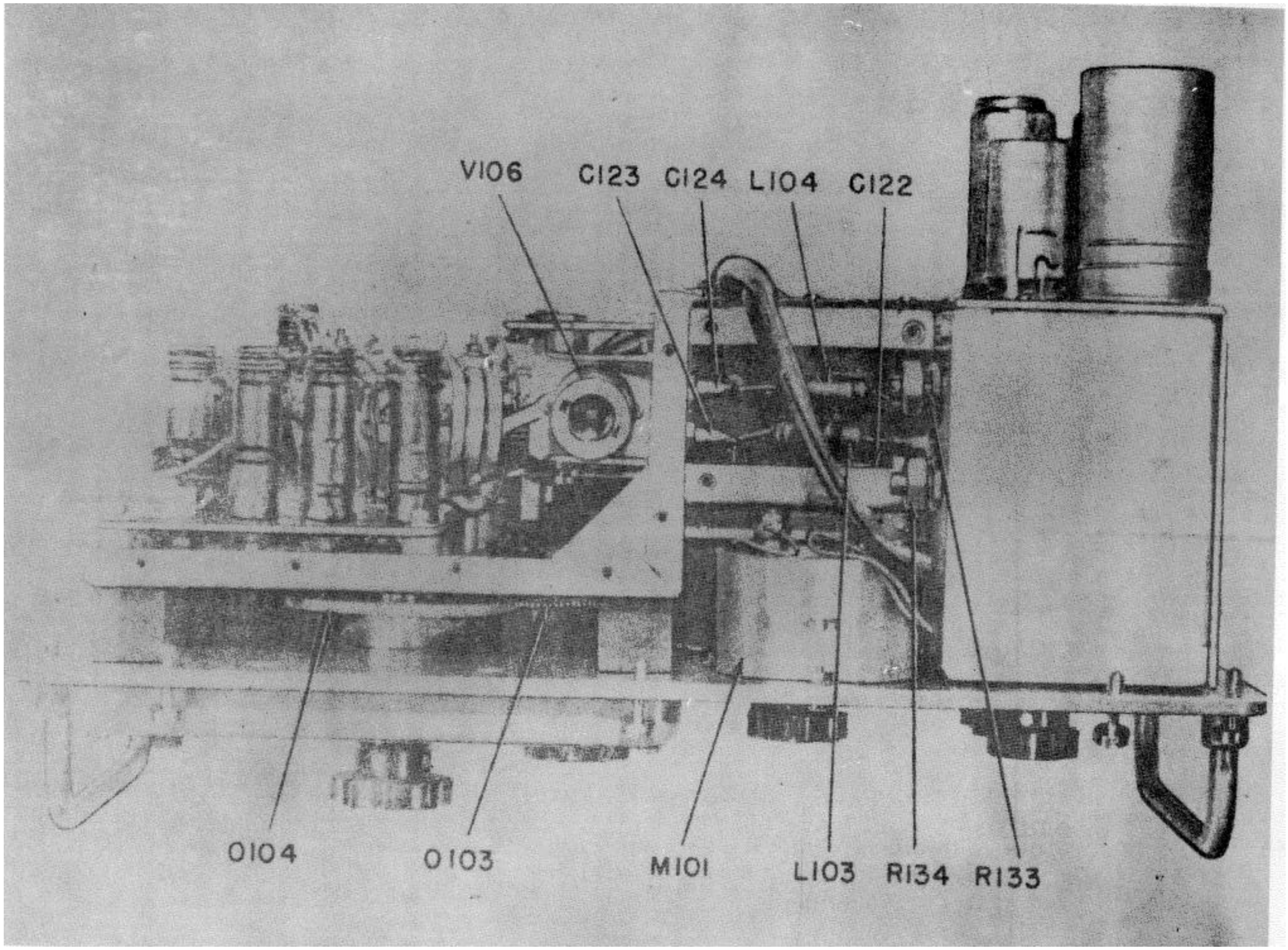


Figure 6-15. Top View of RF Signal Generator SG-448/URM-25.

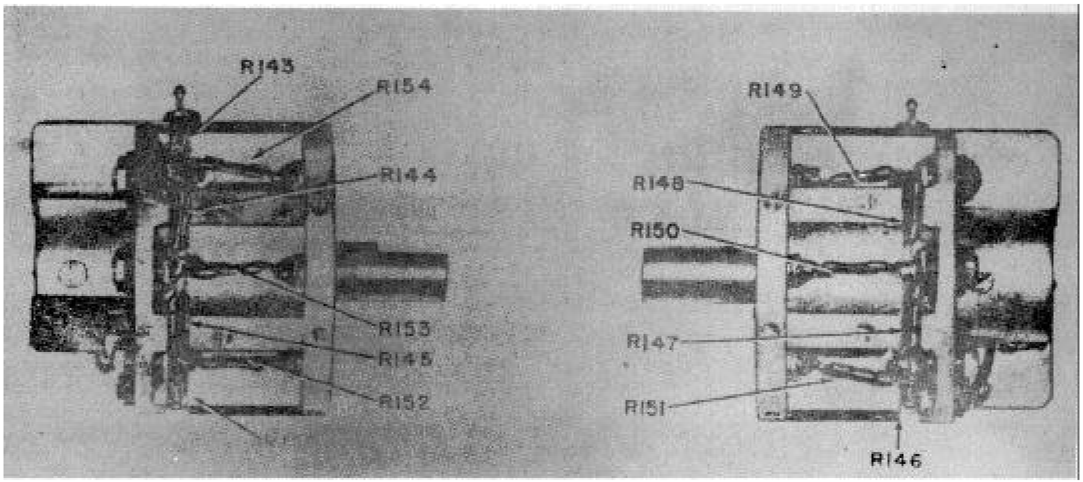


Figure 6-16. Interior Views of the Step Attenuator (E112) with All Resistors Shown.

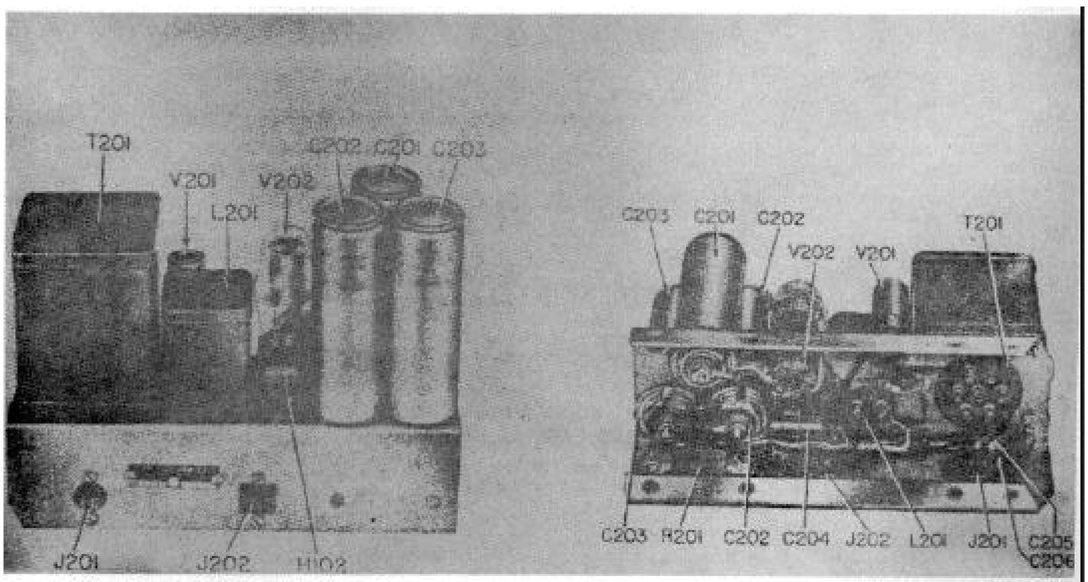


Figure 6-17. Top and Bottom Views of the Power Supply PP-562A/Urm-25.

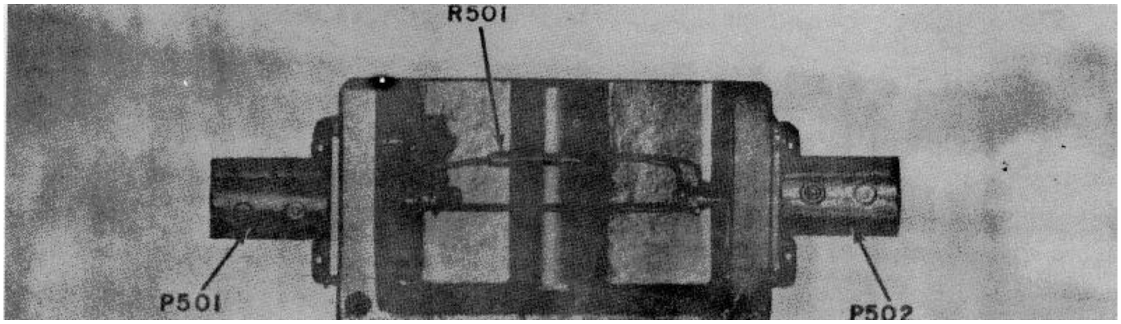


Figure 6-18. Interior View of Impedance Adapter MX-1074/URM-25.

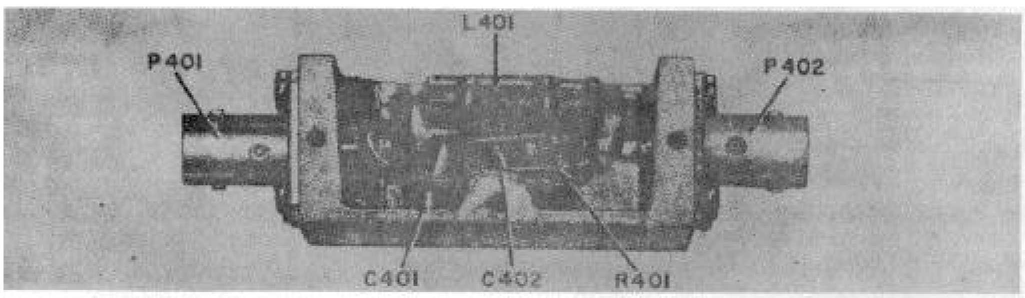


Figure 6-19. Interior View of Antenna Simulator SM-35/URM-25.

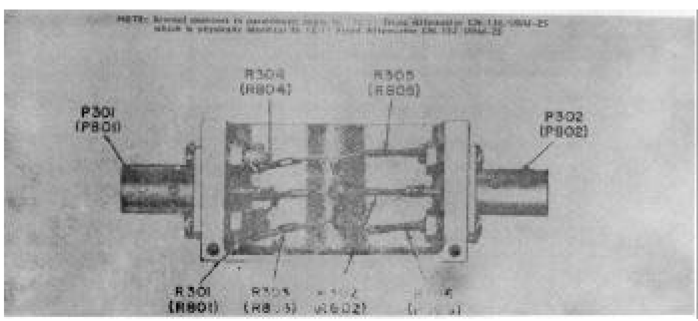


Figure 6-20. Interior View of (5:1) Fixed Attenuator CN-132/URM-25.

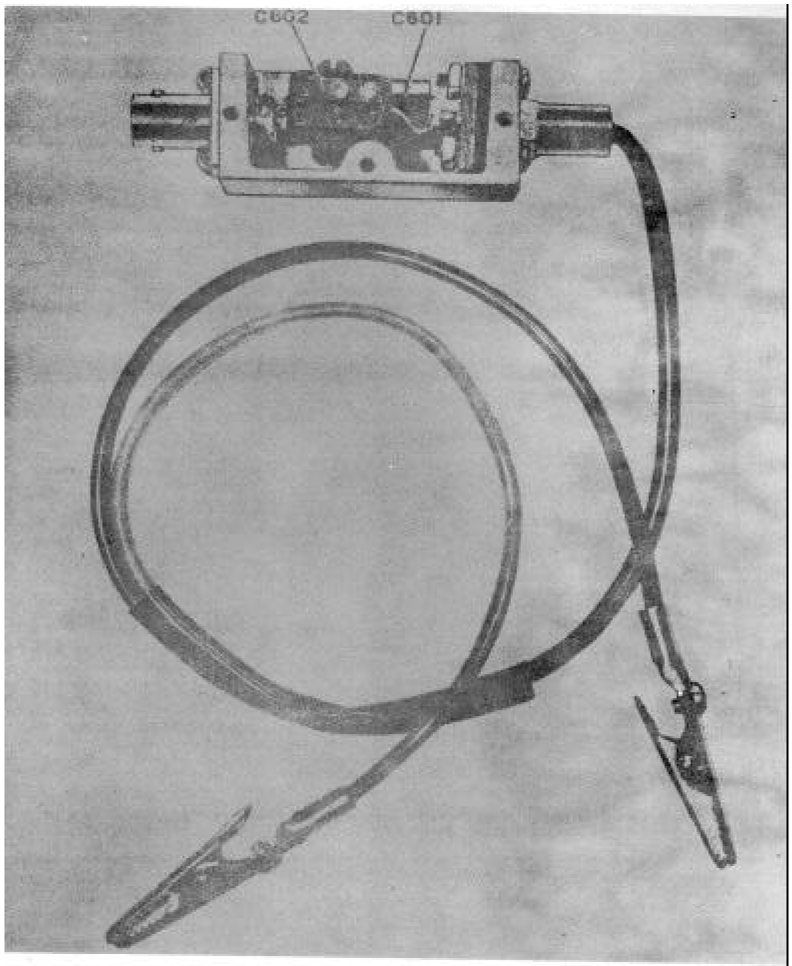


Figure 6-21. Interior View of Test Lead CX-1363/U

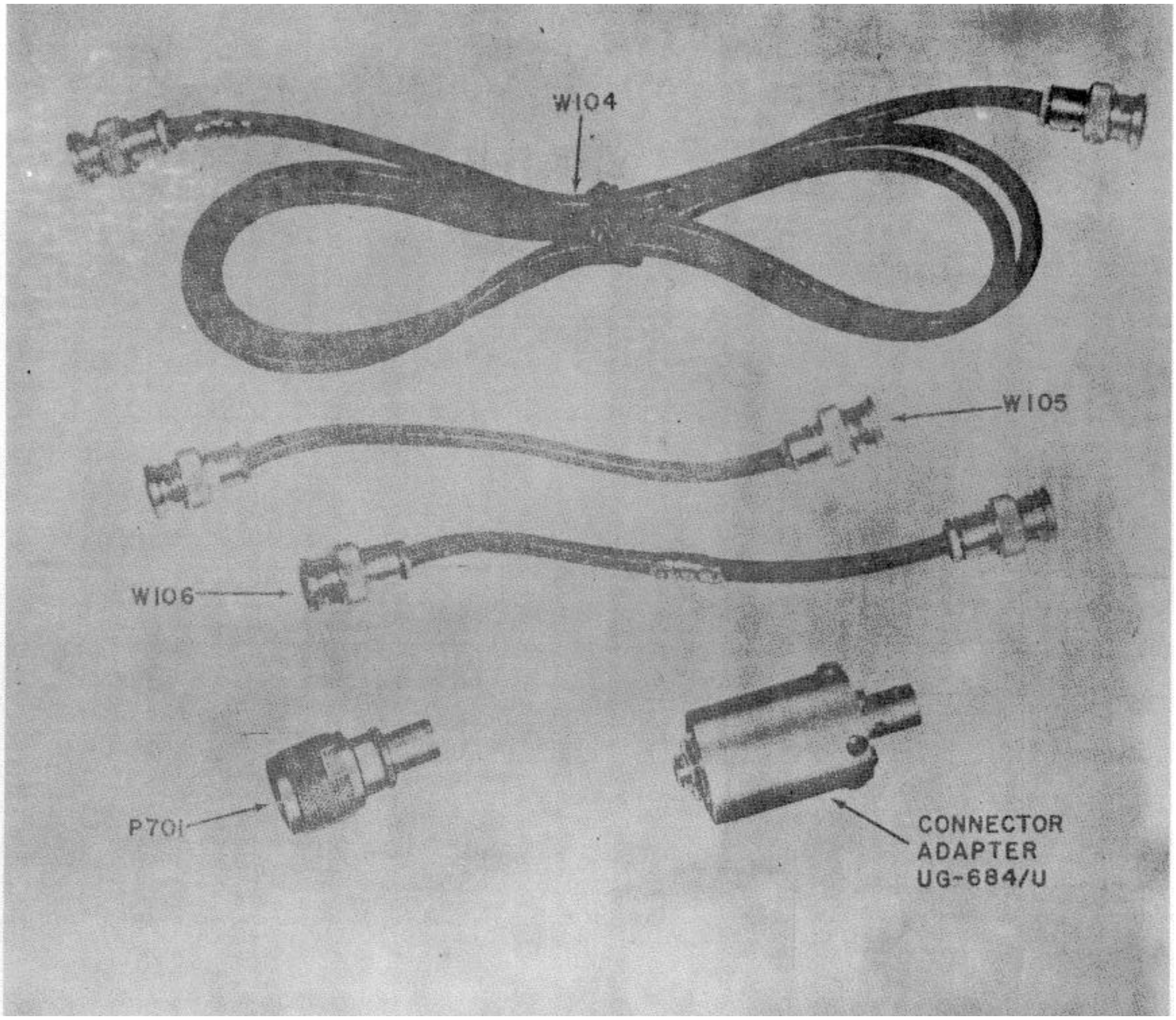


Figure 6-22. Connectors and Cable Assemblies.

TABLE 6-5. TUBE OPERATING VOLTAGES AND CURRENTS

SYMBOL NUMBER	TUBE TYPE	FUNCTION	PLATE P (E)	PLATE (MA)	SCREEN (E)	SCREEN (MA)	SUPP. (E)	CATH.(E)	GRID (E)	HEATHER VAC
V101A	12AU7	Voltmeter Bridge Tube	36.5	1.3				2	0	6.2
V101B	12AU7	Voltmeter Bridge Tube	36 5	1.3				2	0	6.2
V102A	12AU7	Modulation Oscillator	105	.3				6.8	0	6.2
V102B	12AU7	Modulation Oscillator	45	.8				1.7	0	6.2
V103	6AL5	Modulation Diode	0'to-1.1	0 to.001				0 to 1.2		6.2
V104	6J6	Buffer Amplifier	215	1.0				3.8	0	6.2
V105	9006	R.F. Diode	0					2.3		6.2
V106	6J6	Carrier Oscillator	13	app. 1				0	-.4	6.2
V108	6BE6	Crystal Calibrator	158	.9	99	4.3	0	0	-9.3	6.2
V201	6X4	Rectifier	230 VAC					250	-.3	6.2
V202	OD3/VR-150	B+ Regulator	I50					0		6.2

NOTE: All measurements made with a 20, 000 ohm/volt DC and 1000 ohm/volt AC meter with the Signal Generator set in the following operation condition:

1. CARRIER FREQUENCY - 100 kc.
2. METER READS 100 in RF position of S-102.
3. S-102 set to "BAL".2
4. S-103 set to "1000 Cycles.
5. Bias control R- 113 set for 3.8v bias.
6. Power supply voltages should be checked when W-103 is connected to Signal Generator.
7. Oscillator grid.
8. Control grid.

TABLE 6-6. RATED TUBE CHARACTERISTICS

TUBE-TYPE	FILAMENT VOLTAGE (V)	FILAMENT CURRENT (A)	PLATE VOLTAGE (V)	SCREEN VOLTAGE (V)	PLATE CURRENT (MA)	SCREEN(MA)	A-C PLATE RESISTANCE (OHMS)	VOLTAGE AMPLIFICATION FACTOR m	TRANSCONDUCTANCE (MICROMHOS)		EMISSION	
									NORMAL	MINI-MUM	IS (MA)	TEST VOLTS
12AU7-	[1]6.3 (12.6)	[1]3(.15)	250	8.5		14.5	7700	18.5	3100	1750	70	30
6AL5	6.3	.3	[2]150			[3]9	[4]300				40	10
6J4	6.3	.4	150	2		20	5000	55	12000	9000	70	10
9006	6.3	.15	[5]270			[6]5	[4]100				13	20
6J6	6.3	.45	15	10		30	7100	38	5300	3450	40	10
6BE6	6.3	.3	330		110	4.1			[8]500 [9]8000	280 [9]5500	50	15
6X4	6.3	.6	[7]650			70					140	50
OD3/ VR-150			150			5 TO 40-						

NOTES:

1. 6.3v at .3A for parallel filaments; 12.6v at .15A for series 61.
2. A.C plate voltage per plate (RMS.)
3. D.C. output current per plate.
4. Minimum total effective late supply impedance.
5. A.C. plate voltage for typical rectifier operation.
6. D.C. output current.
7. A.C. plate to plate supply voltage (RMS.) for capacitor input.
8. Conversion transconductance.
9. Oscillator transconductance.

Table 6-7. WINDING DATA----Continued

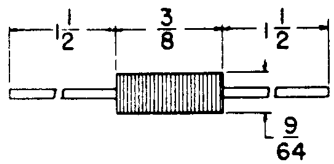
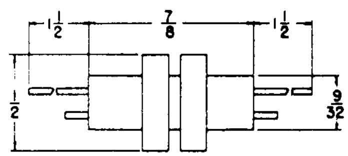
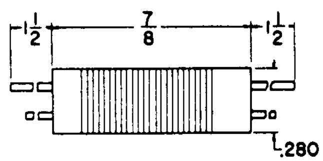
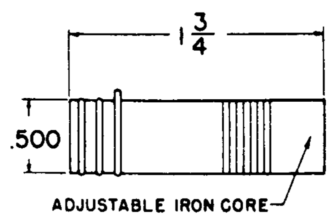
DESIG-NATION SYMBOL	FED. MFG. & ENG. PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	DC RESISTANCE IN OHMS	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
E-127	CHO-3B		Single	#36 Enameled copper wire	38 Close wound				Inductance: 2.7 microhenries ± 10% at 9.7 megacycles. Current: 35 milliamperes. 1 coat HARVEL Varnish #612-C and bake. Coil form 120 ohm 1/2 watt resistor ALLEN BRADLEY Type EB-1211.
L-102, L-103, L-117, L-119	CHO-1B		Universal wound 2 section	#38 Single nylon enameled copper wire		25 ± 20%			Inductance: 2.5 millihenries ± 5% at 1000 cycles. Capacity: 1.5 μμf ± 50%. Current rating: 30 ma. 1 coat HARVEL Varnish #612-C and bake. Coil form STACKPOLE CARBON CO. #A-9456.
L-104	CHO-4B		Single	#22 Enameled copper wire	24 Close wound				Inductance: 1.52 microhenries ± 5% at 10 megacycles. Capacity: .65 μμf. Current: 1.5 amps max. 1 coat HARVEL Varnish #612-C and bake. Coil form STACKPOLE CARBON CO. #DR-3.
L-105	295-62A		Soft copper strip	1/8 wide 1/16 thick	Approx. 3				
L-106	295-67C		Single layer space wound 22 turns per inch tap at 4 turns from RH end	#28 Double nylon covered copper wire	8				Inductance: ground to grid, 1.32 mic h at 20 mc ground to tap, .412 mic h at 20 mc. Capacity: 2.1 μμf ± 20%. 1 coat HARVEL Varnish #612-C and bake.

TABLE 6-7. WINDING DATA

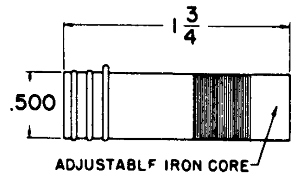
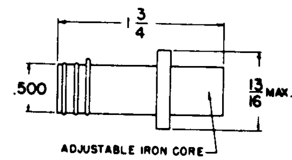
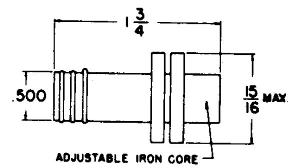
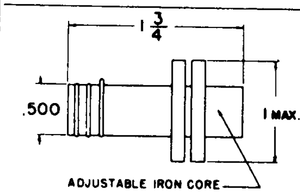
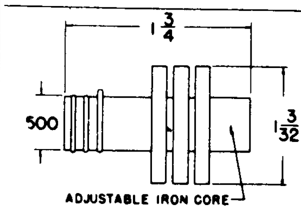
DESIG-NATION SYMBOL	FED. MFG. & ENG. PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	DC RESISTANCE IN OHMS	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
L-107	295-66C		Single	#28 Double nylon covered copper wire	28 Close wound tap at 12 turns from RH end				Inductance: ground to grid, 12.3 mic h at 5 mc. Ground to tap, 2.52 mic h at 5 mc. Capacity: 2.8 μμf ± 20%. 1 coat HARVEL Varnish #612-C and bake.
L-108	295-44B		Universal wound 1 section	#38 Quadruple nylon covered copper wire					Inductance: ground to grid, 120 mic h at 2 mc. Ground to tap, 25.7 mic h at 2 mc. Capacity: 3.2 to 3.4 μμf. 1 coat HARVEL Varnish #612-C and bake.
L-109	295-43B		Universal wound 2 section	#38 Quadruple nylon covered copper wire					Inductance: grid to ground, 1.02 mil h at .5 mc. Ground to tap, .253 mil h at .5 mc. Capacity: 2.8 μμf ± 20%. 1 coat HARVEL Varnish #612-C and bake.
L-110	295-42B		Universal wound 2 section	#38 Double nylon covered copper wire					Inductance: ground to grid, 9.3 mil h at 200 kc. Ground to tap, 1.57 mil h at 200 kc. Capacity: 5 μμf ± 20%. 1 coat HARVEL Varnish #612-C and bake.
L-111	295-41B		Universal wound 3 section	#38 Single nylon enameled copper wire					Inductance: ground to grid, 72.5 mil h at 1 kc. Ground to tap, 13.9 mil h at 1 kc. Capacity: 4.9 μμf ± 20%. 1 coat HARVEL Varnish #612-C and bake.

TABLE 6-7. WINDING DATA---Continued

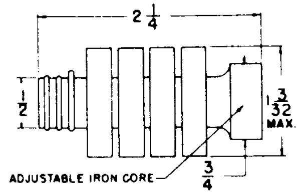
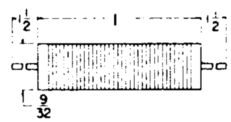
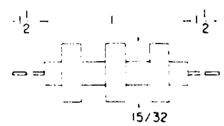
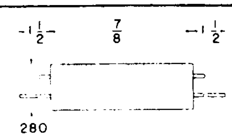
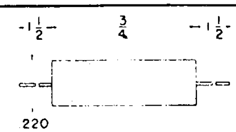
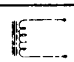
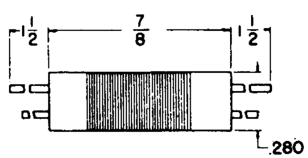
DESIGNATION SYMBOL	FED. MFG. & ENG. PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	DC RESISTANCE IN OHMS	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
L-112	295-69B		Universal wound 4 section	#38 Single nylon enameled copper wire					Inductance: Ground to grid, 570 mil h at 1 kc. Ground to tap, 92 mil h at 1 kc. Capacity: 4.2 μμf ± 20%. 1 coat HARVEL Varnish #612-C and bake.
L-115, L-116	CHO-7		Single						Inductance: 6.5 microhenries ± 10%. Current: 1000 ma. OHMITE Type Z-50.
L-118, L-120	CHO-15		Universal wound 3 section						Inductance: 0.5 mil. h ± 20% at 1 mc. Current: 50 ma Q:25 (min.) DC Resistance: 15 ohms ± 30% Coat with fungus proof varnish
L-121	CHO-18		Single	#22 Enameled copper wire	21 Close wound				Inductance: 1.30 microhenries ± 5% at 10 mc. Capacity: 0.65 μμf. Coat with fungus proof varnish.
L-122	CHO-17		Single	#26 Enameled copper wire	7; 6 Close wound, 1 space wound				Inductance: 0.35 microhenries ± 5% at 35 mc. Capacity: 0.5 μμf. Coat with fungus proof varnish.
L-201	295-7A					400 ± 10%			Inductance: 11 henries min at 75 ma DC.
L-401	295-236		Single	#32 Double silk covered copper wire	38				Inductance: 20 μf ± 10% at 5 mc. Capacity: 1.4 μμf. Current: 100 ma max. 1 coat HARVEL Varnish #612-C and bake.

TABLE 6-7. WINDING DATA----Continued

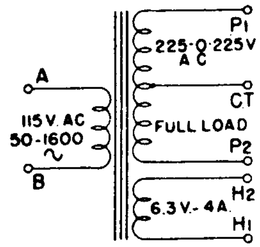
DESIG-NATION SYMBOL	FED. MFG. & ENG. PART NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	DC RESISTANCE IN OHMS	IMPEDANCE RATIO	HIPOT A-C VOLTS	REMARKS
T-201	295-6A								225-0-225V AC. Full load 6.3v at 4A. Coil to be vacuum impregnated. To withstand 1500v RMS — 60 cps from HV windings to ground and from HV windings to all other windings. To withstand 500v RMS — 60 cps from pri windings to ground and from fil windings to ground. Laminations grounded.

TABLE 6-8. CROSS REFERENCE BETWEEN SYMBOL NUMBER AND FIGURE LOCATION

SYMBOL NR.	FIGURE NR.	SYMBOL NR.	FIGURE NR.
C-101	6-13	C-203	6-17
C-102	6-13	C-204, C-205, C-206	6-17
C-103	6-14	C-401	6-19
C-104	6-14	C-402	6-19
C-105	6-13	C-601	6-21
C-106	Not used	C-602	6-21
C-107	Not used	E-101	4-1
C-108	Not used	E-102	4-1
C-109	Not used	E-103	4-1
C-110	6-5	E-104	4-1
C-111	6-5	E-105	4-1
C-112	6-6	E-106	4-1
C-113	6-6	E-110	6-5
C-114	Not shown	E-111	6-5
C-115	6-9	E-112	6-5
C-116	6-5	E-126	4-1, 6-10 (Contained in 1-101)
C-117	6-5		
C-118	6-14	E-128, E-129, E-130	4-1
C-119	6-14	E-132	6-13
C-120	6-13	F-101 thru F-104	4-1 (Contained in E-115 thru E-118)
C-121	6-13		
C-122	6-15	H-101	4-1
C-123	6-15	H-103, H-104	4-1
C-124	6-15	H-105	6-6
C-125	6-7	H-106	6-12
C-126	6-7	I-101	4-1
C-127	6-7	I-102	4-1
C-128 thru C-134	6-7	I-103	4-1
C-135	6-5	I-104	4-1
C-136	6-6	I-105	4-1
C-137	6-5	I-106	4-1
C-138	6-12	J-102	4-1, 6-5
C-139	6-12	J-102	4-1, 6-5
C-140	6-6	J-103	4-1
C-141	6-6	J-104	4-1
C-142	6-6	J-201	6-17
C-143	6-7	J-202	6-17
C-144	6-14	J-301, J-302	6-21
C-145	6-7	J-401, J-402	6-19
C-147, C-148	6-12	J-501, J-502	6-18
C-149	6-6	J-601	6-21
C-150	6-13	L-101	Not used
C-151	6-12	L-102	6-13
C-152 thru C-15	6-13	L-103	6-15
C-201	6-17	L-104	6-15
C-202	6-17	L-105 thru L-112	6-7

TABLE 6-8. CROSS REFERENCE BETWEEN SYMBOL NUMBER AND FIGURE LOCATION -Continued

SYMBOL NR.	FIGURE NR.	SYMBOL NR.	FIGURE NR.
L-117	6-13	R-133	6-9
L-118	6-6	R-134	6-9
L-119, L-120	6-13	R-135	6-14
L-121	6-9	R-136	6-14
L-201	6-17	R-137	6-14
L-401	6-9	R-138	6-14
M-101	4-1	R-139	6-14
N-104	4-1	R-140	6-14
O-103, O-104	6-15	R-141	6-6
O-107, O-108, O-109	4-1	R-142	6-6
P-101	6-12	R-143 thru R-154	6-16
P-102	6-12	R-155A	6-6
P-103 thru	6-22 (part of cable	R-155B	6-6
P-108, P-701	assemblies)	R-156	6-9
R-101	6-13	R-157	6-14
R-102	6-13	R-158	6-7
R-103	6-13	R-160, R-162, R-163	6-7
R-104	6-13	R-164	Not shown
R-105	6-14	R-167 thru R-171	6-1
R-106	6-14	R-201	6-17
R-107	6-14	R-301 thru R-306	6-20
R-108	6-14	R-401	6-19
R-109	6-14	R-501	6-18
R-110	6-9	S-101	4-1
R-111	6-13	S-102	6-13
R-112	6-14	S-103	6-13
R-113	6-9	S-104	6-9
R-114	6-6	S-105	6-7
R-115	6-6	T-201	6-17
R-116	6-6	V-101	6-9
R-117	Not used	V-102	6-9
R-118	6-14	V-103	6-9
R-119	6-14	V-104, V-105	6-9
R-120	Not shown	V-106	6-7
R-121	6-14	V-201	6-17
R-122	Not used	V-202	6-17
R-123	6-13	W-101	6-4
R-124	6-7	W-102	6-4
R-125	6-7	W-103	6-4
R-126	6-6	W-104	6-22
R-127	6-6	W-105	6-22
R-128	6-9	W-106	6-22
R-129	6-9	W-601	6-21
R-130	6-14	Z-101	6-13
R-131	6-9	Z-102	6-5, 6-9
R-132	6-14		

SECTION 7
PARTS LISTS

CAUTION

Navy stock numbers in this parts list have been set in two lines because of tbe length of the stock numbers and the restricted column space. Be certain that the complete stock number is used when ordering parts.

***Items marked with an asterisk in the Symbol No. Column of Table 7-4 can not be requisitioned from Supply. In the event of failure they should be repaired or new items fabricated.**

TABLE 7-1. WEIGHTS AND DIMENSIONS OF SPARE PARTS BOXES

ACTIVITY	EQUIPMENT SPARES					STOCK SPARES				
	Overall Dimensions (Inches)			VOLUME (CU IN)	weight (LBS)	Overall Dimensions (Inches)			VOLUME (CU IN)	weight (LBS)
	Height	Width	Depth			Height	Width	Depth		
BUSHIPS	6	12	9	648	8	•	•	•	•	•
MARINE CORPS	4	6	8	192	5	•	•	•	•	•

***Shipped in bulk quantities**

TABLE 7-2. SHIPPING WEIGHTS AND DIMENSIONS OF SPARE PARTS BOXES

ACTIVITY	EQUIPMENT SPARES					STOCK SPARES				
	Overall Dimensions (Inches)			VOLUME (CU IN)	weight (LBS)	Overall Dimensions (Inches)			VOLUME (CU IN)	weight (LBS)
	Height	Width	Depth			Height	Width	Depth		
BUSHIPS	9	15	12	1620	13	•	•	•	•	•
MARINE CORPS	6	8	10	480	9	•	•	•	•	•

***Weight and dimensions determined as shipped**

TABLE 7-3. LIST OF MAJOR UNITS

SYMBOL GROUP	QUANTITY	NAME OF MAJOR UNIT	NAVY TYPE OR A-N DESIGNATION
101 to 199	1	RF Signal Generator	SG-44B/URM-25
201 to 299	1	Power Supply	PP-562A/URM-25
301 to 399	1	(5:1) Fixed attenuator	CN-132/URA.-25
401 to 499	1	Antenna Simulator	SM-35/URM-25
501 to 599	1	Impedance Adapter	MX- 1074/URM-25
601 to 699	1	Test Lead	CX-1363/U
801 to899	1	(10:1) Fixed Attenuator	CN- 136/URIl1-25
901 to 999	1	Connector, Adapter	UG-64/U
P-701	1	Coaxial Adapter	UG-201/U
W-101	1	AC Line Cable Assembly	
W-104	1	RF Cable Assembly	CG-409A/U(4'0”)
W-105, W-106 2	2	RF Cable Assembly	CG-409A/U(7")

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST-Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON- TRACTOR DRAW- ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	CAPACITORS							
C-101	CAPACITOR, fixed: mica dielectric; 1000 mmf - 2'7c; 500vdcw, characteristic lttr l); 1- 1/16 lg x 15/32" wd x 7/32" thk; molded low loss phenolic case; 2 axial wire leads; spec JAN-C-5.	V-102 bridge capacitor	CM25D102G	N16-C-31080-2522	(13) Pt. # CM2SD102G	Pt. # CPM-603	C101, C02	2
C 102	Same as C-101. V- 102	bridge capacitor						
C-103	CAPACITOR, fixed: mica dielectric; 2000 mmf ± 5%; 500vdcw; characteristic lttr B; 53/64" lg x 53/64" wd x 9/32" thk; molded phenolic case; 2 axial wire leads; spec JAN-C-5.	V-102 coupling capacitor	CM30B202J	N6-C-31797-5484	(13) Pt. # CM30B202J	Pt. # CPM165	C-103	1
C.104	CAPACITOR, fixed: paper dielectric; 100, -000 mmf ± 20%7; 400vdcw; 1-15/32" ig x 49/64" wd x 13/32" thk; 2 axial wire leads; spec JAN-C-91.	V-102 couplings capacitor	CN43E104M	N16-C-45805-6260	(26) Pt. # CN43E104M	Pt. # CPP-5	C104, C105 C118, C119, C122	5
C-105	Same as C-104.	V-102 output coupling capacitor						
C-106	Not used.							
C-107	Not used.							
C-108	Not used.							

C-109	Not used.							
C-110	CAPACITOR, fixed: ceramic dielectric; 1000 mmf + 20%; var temp coef; 5OOvdcw; 5/8" lg x 5/16" diam; 2 axial wire leads terminated in a 1/8" loop; one #12-28 x 11/32" Ig axial screw for mtg; uninsulated.	V-104 plate RF bypass capacitor (feedthru)		N16-C 18657-8801	(16) Style 357 (HI-K)	Pt. # CPC-21	C110, C111 C117, C120, C121, C123, C124, C135, C138, C139, C-146	11
C-111	Same as C-110.	V-104 heater RF bypass capacitor (feedthru)						
C-112	CAPACITOR, fixed: mica dielectric; 510 mmf - 5%; 500vdc; characteristic Ittr D; 51/64" 1g x 15/32" wd x 7/32" thk; molded phenolic case; 2 axial wire leads; spec JAN-C-5.	V-104 output coupling capacitor	CM20D511J	N16-C 30188-5006	(13) Pt. # CM20D511J	Pt. # CPM-129	C-112, C602	2
C-113	CAPACITOR, fixed: mica dielectric; 6, 200 mmf ± 5%; 500vdcw; characteristic Ittr B; 53/64" lg x 53/64" wd x 11/32" thk, molded phenolic case; 2 axial wire leads; spec JAN-C-5.	V-104 output coupling capacitor	CM135B622J	N16-C-32905-4328	(13) Pt. # CM35B622J	Pt. # CPM-177	C113	1
C-114	CAPACITOR, fixed: ceramic dielectric; 2 mmf .25 mmf; neg temp coef zero (tol + 120-182 mmf/ mf/'C); 500vdcw; .562" Ig x .250" diam; 2 axial wire leads, insulated; spec JAN-C-20A.	V-106 output coupling capacitor	CC21CK020C	N16-C-15432-5867	(16) Pt. # CC21CK020C	Pt. # CPC-184	C114	1
C-115	CAPACITOR, fixed: electrolytic; single section; 25 mf; 150vdcw; working, temp range -40'C to 85'C; 2-1/4" Ig x 1-3/8" diam; hermetically sealed metal can two solder lug term on bottom; both term insulated from can; one 7/8"-16 x 1/2' Ig mtg bshg; spec JAN-C-62.	V-104 cathode bypass capacitor	CE41C250J	N16-C-19788-8925	(1) Pt.# CE41C250J	Pt. # CPE-6	C115	1
C-116	CAPACITOR, Fixed: ceramic dielectric; 56 mmf + 10%; neg temp coef 470 mmf/mf/ 'C; 1000vdcw ; 5/8" Ig x 5'/16" diam; 2 axial wire leads each terminated in a 1/8" Ig loop; one :#12-28 x 11/32" lg axial screw for mtg; uninsulated.	V-104 RF bypass capacitor (feedthru)		N16-C-16672-4681	(16) Type 357	Pt. # CPC-15	C116 C137	2
C-117	Same as C-110.	V-104 cathode bypass capacitor (feedthru)						
C-118	Same as C-104.	V-103 input coupling capacitor '						

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST-Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	CAPACITORS—CONTINUED							
C-119	Same as C-104.	V-103 cathode bypass capacitor						
C-120	Same as C-110.	V-106 heater bypass capacitor (feedthru)						
C-121	Same as C-110.	V-106 plate circuit RF bypass capacitor (feedthru)						
C-122	Same as C-104.	V- 106 plate circuit RF bypass capacitor						
C-123	Same as C-110.	V-106 plate circuit RF bypass capacitor						
C-124	Same as C-110.	V-106 heater bypass capacitor (feedthru)						
C-125	CAPACITOR, fixed: ceramic dielectric; 1000 mmf ± 20%; special temp coef; 500vdcw; .520" lg x .250" diam; one #3-48 x 11/32" lg axial screw terminal; one axial wire terminal .38" lg x .067" diam; uninsulated.	V-106 plate circuit bypass capacitor	18659-	N16-C- Style 319 7701	(16) CPC-82 (HI-K)	Pt. # C143	C125, C136,	3
C-126	CAPACITOR, fixed: ceramic dielectric; 51 mnf + 5%; neg temp coef 300 (± 500) mmf/mf/'C; 500 vdcw; .812'. lg x .250" diam; 2 axial wire leads; spec JAN-C-20A.	V-106 grid blocking capacitor	CC26SL510J	N16-C- 16596- 2514	(16) Pt. # CC26SL510J	Pt. # CPC-164	C126 1	1
C-127	CAPACITOR, variable: air dielectric; plate meshing type; single section; 12.7 mmf to 479.4 mmf; SLF; 29/32" lg x 2-29/32" h x 3-9/16" w; round metal shaft 1/4" diam x 3/8" lg; 27 silver plated plates, 180' clock.	Main tuning capacitor		N16-C- 61910- 9901	(25) #886716 (special)	Dwg # 295-47	C127	1

	wise rotation; two #10-32 front mtg holes on 1" mtg/, c and two #10-32 rear mtg holes on 1" mtg/c.							
C-128	CAPACITOR, variable: ceramic dielectric; compression type. single section; 2.5 mmf to 13 mmf; 500vdcw; .843" lg x .640" wd x 312" h less term; 2 solder lug term; two 120" diam holes on .437" mtg/c for mtg; screwdriver slot adj; ceramic base. t	Carrier Oscillator band G trimmer		N16-C-63960-2508	(10) Type 822BZ	Pt. # CPT-3	C128, C129 C130 C131 C132, C133 C134	7
C-129	Same as C-128.	Carrier Oscillator band F trimmer						
C-130	Same as C-128.	Carrier Oscillator band E trimmer						
C-131	Same as C-128.	Carrier Oscillator band D trimmer						
C-132	Same as C-128.	Carrier Oscillator band C trimmer						
C-133	Same as C-128.	Carrier Oscillator band B trimmer						
C-134	Same as C-128.	Carrier Oscillator band A trimmer						
C-135	Same as C-110.	V-105 heater bypass capacitor (feedthru)						
C-136	Same as C-125.	V-105 cathode bypass capacitor						
C-137	Same as C-116	V-104 voltage divider bypass capacitor (feedthru)						
C-138	Same as C-110.	115 vAC line filter						
C-139	Same as C-110.	115 vAC line filter						
C-140	CAPACITOR, fixed: ceramic dielectric; 2 mmf ± 10%; neg temp coef 330 (±500 mmf/mf/'C: 500vdcw; .520- lg x.250' diam; one #3-48 x 11/32; lg axial screw term, one axial wire term .067" diam x .38' lg; uninsulated.	V-104 RF cathode bypass capacitor		N16-C-15431-5525	(16) Style 319	Pt. # CPC-51	C140	1
C-141	CAPACITOR, fixed: ceramic dielectric; 56 mmf ± 10%; neg temp coef 330 (± 500) mmf/mf/'C; 500vdcw; .520" lg x .250'	V-104 RF bypass capacitor		N6-C-16669-3500	(16) Style 319	Pt. # CPC-68	C141, C142	2

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	CAPACITOR Continued							
	diam; one S3-48 x 11/32'" lg axial screw term, one axial wire term .38" lg x .067" diam; uninsulated.							
C-142	Same as C-141.	V-105 RF bypass capacitor						
C-143	Same as C-125.	V-106 heater bypass capacitor						
C-144	CAPACITOR, fixed: mica dielectric; 300 mmf + 5%; 500vdcw; characteristic Ittr B; 51/64" lg x 15/32" wd x 7/32" thk; molded phenolic case; 2 axial wire leads; spec JAN-C-5	V-103 shunt capacitor	CM20B301J	N16-C-29660-8996	(13) Pt. # CM20B301J	Pt. # CPM-123	C144	1
C-145	CAPACITOR, fixed: ceramic dielectric; 10 mmf ±.5 mmf; neg temp coef 330(±500-718) mmf/mf/'C; .562" Ig x .250" diam; 2 axial wire leads; insulated; spec JAN-C-20A.	V-106 output coupling capacitor	CC21SL100D		(16) Pt. # CC21SL100D	Pt. # CPC-222	C145	1
C-146	Same as C-110.	E-128, E-129, E- 130, feedthru						
C-147	CAPACITOR, fixed: mica dielectric; 1000 mmf 10%; 500vdcw; Characteristic Ittr B; 1-1/16" lg x 15/32" wd x 7 32" thk; molded phenolic case; 2 axial wire leads; spec JAN-C-5.	P/0115 vAC Line Filter	CM25B102K	N16-C-31090-4472	(13) Pt. # CM25B102K	Pt. # CPM-623	C-147, C-148, C-150. C-205 C-206	5
C-148	Same as C-147	P/o115 vAC Line Filter						
C-149	CAPACITOR, fixed: paper dielectric; 100, 000 mmf +- 10%; 400 vdcw; hermetically sealed metal can; 3/4" Ig x 0.40" diam; axial wire term; one term internally grounded to case.	V-104 plate bypass capacitor			(38) Type XG-1816	Pt. # CPP-203	C-149, C-156	2
C-151	Same as C-147.	V-108 RF input coupling capacitor						
C-151	CAPACITOR, variable: ceramic dielectric; rotary type; single section; 6.0 mmf to 25.0 mmf; 500vdcw; 1.22" Ig x 0.9375" wd x 0.703" h less term: two solder lug term; two #4-40 mtg holes on 0.656" mtg/c; screw driver slot adjustment: spec JAN-C-81.	Crystal calibrator V-108 trimmer capacitor	CV12A250	N16-C-64041-4565	(10) Type 823-DZ	Pt. # CPT-33	C-151	1

C-152	CAPACITOR, fixed: ceramic dielectric; 12 mmf ± 5%; zero temp coef; 500 vdcw; 0.562" lg x 0.250" diam; 2 axial wire leads; ceramic insulation; spec JAN-C-20A.	Crystal calibrator V-108 feedback capacitor	CC21CK120J	N16-C-15953-5399	(16) Pt. # CC21CK120J	Pt. # CPC-223	C-152	1
C-153	CAPACITOR, fixed: mica dielectric; 270 mmf ±: 5%; 500 vdcw; characteristic Itter B; 51/64" Ig x 15/32" wd x 7/32" thk; molded bakelite case; 2 axial wire leads; spec JAN-C-5.	Crystal calibrator V-108 feedback capacitor	CM20B271J	N16-C-29608-2196	(13) Pt. # CM20B271J	Pt. # CPM-122	C-153	1
C-154	CAPACITOR, fixed: paper dielectric; single section; 10, 000 mmf ± 20%; 300 vdcw; molded bakelite case; 57/64" Ig x 37/64" wd x 17/64" thk; 2 axial wire leads; spec JAN-C-91.	Crystal calibrator V-108 screen bypass	CN22A103M		(13) CN22A103M	Pt. # CPP-21	C-154 C-155	2
C-155	Same as C-154.	Crystal Calibrator V-108 output coupling capacitor						
C-156	Same as C-149.	V-104 cathode bypass capacitor						
C-201	CAPACITOR, fixed: paper dielectric; single section; 4 mf ± 10%; 60vdcw; hermetically sealed metal can; 4-1/2" lg x 1 -1/2" diam; one terminal internally grounded to case; one 3/4-16 x 1/2' Ig mtg bshg; single screw term; spec JAN-C-25.	Power supply filter capacitor	CP40C2FF405K	N16-C-49958-5145	(13) Pt. # CP400C2FF405K	Pt. # CPP-108	C201, C202, C203	3
C-202	Same as C-201.	Power supply filter capacitor						
C-203	Same as C-201.	Power supply filter capacitor						
C-204	CAPACITOR, fixed: paper dielectric; single section; .15 mf ± 10%; 400vdcw; hermetically sealed tubular metal can; 15/32" diam x 1-1/16" lg; both term ins from case; viny. lite jacket; 2 axial wire leads.	Power supply 120 cycle resonant filter capacitor		Type XFS-1856	(38) CPP-257	Pt. #	C204	1
C-205	Same as C-147	Power Supply RF Bypass						
C-206	same as C-147	Power Supply RF Bypass						
C-401	CAPACITOR, fixed: mica dielectric; 200 mmf ± 5%; 500, dcw; characteristic lttr D; 51/64" lg x 15/32" wd x 7/32" thk; molded low loss phenolic case; 2 axial wire leads; spec JAN-C-5.	Antenna simulator series capacitor	CM20D201J	N16-C-29265-3006	(13) Pt. # CM200D201J	Pt. # CPM-19	C-401	1

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
C402	CAPACITOR, fixed: mica dielectric; 390 mmf ± 2%; characteristic lttr D; 500vdcw; 51/64" lg x 15/32' wd x 7/32" thk; molded low loss phenolic case; 2 axial wire leads; spec JAN-C-5.	Antenna simulator shunting capacitor	CM20D391G	N16-C-29893-2126	(13) Pt. # CM20D391G	Pt. # CPM-604	C402	1
C-601	CAPACITOR, fixed: paper dielectric; single section; 100, 000 mmf + 20-10/0; 400vdcw; tubular metal can; .400" diam x 13/16 lg; both term insulated from case: 2 axial wire leads.	B+ blocking capacitor part of W-601			(38) Type XF-1816	Pt. # CPP-253	C601	1
C-602	Same as C-112	W-601 inductance compensating						
PANEL KNOBS AND MISCELLANEOUS ELECTRICAL ACCESSORIES								
E-101	KNOB: round; black bakelite; for 1/4' diam shaft; two gg-32 set screws; 1' diam x 5/8' Ig overall with 5/8- white vinylite pointer; brass insert; shaft hole 7/16' deep.	CARRIER CONTROL (R-123) knob		N16-K-700302-606	(23) S-619-64-BB with 40275 pointer	Pt # KNB-106	E101, E102, E103, E104	4
E-102	Same as E-101.	CARRIER RANGE (S-104) knob						
E-103	Same as E-101.	MICROVOLTS control (R-155) knob						
E-104	Same as E-101.	%MODULATION control (R-111) knob						
E-105	KNOB: round. skirted; black bakelite; for 1/4' diam shait; two g10-32 set screws; 1-3/4" diam x 27/32- h; brass insert; shaft hole 41/64- deep; white mark on skirt.	FREQUENCY BAND SWITCH (S-103) knob		N16-K-700374-431	(23) S-381-64-L-BB	Pt. # KNB-103	E105	1
E-106	POST, binding: screw type; 5/8 diam x 1-1/ 16' Ig FMS; one g10-32 x 1' ig mtg stud threaded 3/4" black bakelite cap; hole for 512 wire; captive nut type cap with hole for 3/16' diam banana plug.	Front panel ground post		N17-P-69135-6205	(28) Pt. # DF-308BC (nickel plated stud)	Pt. # PBG-1	E106	1
E-107	TERMINAL, stud (style 47): double ended cylindrical shape; brown PBE (LTS-E-4) pbenolic; 1" lg x 9/64" OD overall includ-aing 2 axial silver pitd brass solder lug term;	Feedthru terminal for RF diode - buffer amplifier shelf		N17-T-28244-2501	(9) Pt. # X1795A	Pt. # TER-24	E107, E108	2

	3800 v RMS at 60 cyc breakdown voltage; one integral brass nickel pltd hex flange 3/8" wd across flats, one 1/4-28 x 1/4" lg brass nickel pltd mtg bshg for 1/4" diam hole in 3/16" thk panel; one 1/4-28 hex nut for mtg.							
E-108	Same as E-107.							
E-109	BOARD, terminal: resistor capacitor mounting strip; 18 brass silver pltd solder lug term; non-uniform mtg centers between term brown xxx bakelite board; 4-9/16" lg x 1-5/8" wd x 3/32" thk less term and mtg studs; three mtg holes for #4 screws triangularly located on a 1-7/8" mtg radius, three 1-5/16" lg stainless steel standoff mtg studs.	Audio compartment resistor capacitor mounting strip			(17) **Dwg #:** 315-169	**Dwg #** 315-169	E109	1
E-110	INSULATOR, bushing: cylindrical shape; brown XXX bakelite; 15/32" lg overall; 5/8" OD flange x .245" diam hub x .063" diam hole; three .096" diam mtg holes spaced 120' on 7/32" radius.	Carrier Oscillator to buffer amplifier feedthru		N17-I-49969-8501	(17) **Dwg #** 295-120	**Dwg :#** 295-120	E110	1
E-111	INSULATOR, feedthru; double ended cylindrical shape; brown XXX bakelite; 45/64" lg overall including 2 axial brass silver pltd terminals; .372" OD, fits 1/4" diam x 1/8" thk panel hole.	Input terminal to step attenuator		N-17-T 28271-2501	(17) Dwg # 295-93	Dwg # 295-93	E111	1
E-112	ATTENUATOR, variable: balanced ladder net work; composition; input 53.5 ohms, output 53.5 ohms ± 3%; aluminum silver dipped case 2" diam x 2-3/8" lg overall; flatted metal shaft 3/8" diam x 3/4" lg; 0 to 100 db; 5 steps, 20 db per step, linear taper; 2 solder lug term; two #6-32 mtg holes spaced 1-5/ 16" C to C.	Step attenuator		N16-A-98018 1001	(17) Dwg # 295-81	Dwg # 295-81	E112	1
E-113	BOARD, terminal: resistor-capacitor mounting strip; 17 brass, silver pltd solder lug term; non-uniform mtg center between term brown xxx bakelite board; 3-9/16" lg x 1-1/2' wd x 3/32" thk excluding term; three 4-40 brass mtg inserts triangularly located on a 1-5/16" mtg radius.	Audio compartment resistor-capacitor mounting strip			(17) Dwg # 315-168	Dwg # 315-168	E113	1
E-114	BOARD, terminal: resistor-capacitor mtg strip; 26 brass, silver pltd solder lug term; non-uniform mtg centers between term; brown xxx bakelite board; 3-11/16" lg x 2-3/16" wd x 3/16" h brass mtg inserts triangularly located on a 1-5/8" mtg radius.	Audio compartment resistor-capacitor mounting strip			(17) Dwg # 315-181	Dwg # 315-181	E114	1
E-115	HOLDER, fuse; extractor post type; tor single 3AG cartridge fuse; black bakelite; 250 volts at 15 amp; 2-3/8" lg x 1 / 16" dinm overall; 1/2" - 24 x 1/2" lg threaded bake- g 8bdrll ite body for panel hole mtg; 3/32" hole 4D drilled through cap.	Holder for F-101		N17-F-74267-5701	(8) type HKM-H	Pt. # HOF-4	E115 E116, E117, E118	4

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST-Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
PANEL KNOBS AND MISCELLANEOUS ELECTRICAL ACCESSORIES---CONTINUED								
E-116	Same as E-115.	Holder for F-102						
E-117	Same as E-115.	Holder for F-103						
E-118	Same as E-115	Holder for F-104						
E-119	SHIELD, electron tube: copper, nickel pltd; cylindrical, open top; twist lock mtg to socket saddle; 1-3/8" lg x .810"'diam x .930" diam of flange piece; with compression spring; spec JAN-S-28A.	Tube shield for V-103	TSFOT101	N16-S-34520-3862	(11) TSF0T101	Pt. # SHT-1	E119, E120	2
E-120	Same as E-119.	Tube shield for V-105						
E-121	SHIELD, electron tube: copper nickel pltd; cylindrical open top; twist lock mtg to socket saddle; 1-3/4" lg x .810" diam x .930" diam of flange piece with compression spring; spec JAN-S-28A.	Tube shield for V-104	TSFOT102	N16-S-34557 8350	(11) TSFOT102	Pt. # SHT-2	E121, E125, E131	3
E-122	SHIELD, electron tube: copper nickel pltd; cylindrical open top; twist lock mtg to socket saddle; 2-1/4" lg x .810" diam x .930"diam of flange piece; with compression spring; spec JAN-S-28A.	Tube shield for R-157	TSFOT103	N16-S-34607-8400	(11) TSFOT103	Pt. # SHT-3	E122, E201	2
E-123	SHIELD, electron tube: copper, nickel pltd, cylindrical, open top; twist lock mtd to socket saddle; 1-15/16" lg x .950" diam x 1.050 diam of flange piece; with compression spring; spec JAN-S-28A.	Tube shield for V-101	TSFOT105	N16-S 34576-6513	(11) TSFOT105	Pt. # SHT-5	E123, E124	2
E-124	Same as E-123.	Tube shield for V-102						
E-125	Same as E-121.	Tube shield for V-106						

E-126	LAMP, incandescent: 6-8v .15 amp; bulb T 3-1/4 clear; 1-1/8" Ig overall; miniature bayonet base; tungsten filament; burn any position.	Panel indicator lamp		17-L-6297	(29) No. 47	Pt. # LAI-1	E126	1
E-127	SUPPRESSOR, parasitic; resistor and coil type; .141" diam x 13/32" Ig; 38 turns #36 AWG enameled copper wire wound on 120 ohm, 1/2 watt composition resistor; uncased; two axial wire leads. (consists of L113 and R 159)	V-106 plate parasitic suppressor		N16S-89724-8801	(17) Dwg # CHO-3B	Dwg/Pt. # CHO-3B	E127	1
E-128	LAMP, incandescent: 3v, 190 ma; bulb T-1-1/4 clear, 35/64" Ig overall; special screw base; C-2R tungsten filament; burn any position.	Illuminates frequency scale	Navy Type TS-112	17-L-6543-100	(36) Pt. # LM-32	Pt. # LA1-3	E128, E29, E130	
E-129	Same as E-128.	Illuminates frequency scale						
E-130	Same as E-128.	Illuminates frequency scale						
E-131	Same as E-121.	Tube shield for V-108						
E-132	BOARD, terminal: resistor-capacitor mounting strip; 20 brass silver pltd solder lug term; brown xxx bakelite board; 4 9/1(" Ig x 1 5/8" wd x 3/32" thk less term and mtg studs; three mtg holes for #4 screws, triangularly located on a 1 5/16" radius; three 1 5/16" Ig stainless steel mtg studs.	Crystal calibrator resistor-capacitor mtg strip			(17) Dwg. # 315-353	dwg. # 315-353	E132	1
E-201	Same as E-122.	Tube shield or V-201						
E-202	Same as E-122.	Tube shield for V-202						
		FUSES						
F-101	FUSE, cartridge: 1 amp; open in 1 hr at 135% load; rated continuous at 100% load; 250v; one time; glass body; ferrule term; 1-1/4" Ig x 1, '4" diam o/a; term 5/16" Ig x 1/4 diam; slow blowing.	Line fuse	N.T. 28053-1	N-17-F 14310-380 (3Z2601.16)	(8) MDL-1	Pt. # FUS-20	F101, F102, F103, F104	4
F-102	Same as F-101.	Line fuse						

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST--continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	FUSES -Continued							
F-103	Same as F-101.	Spare fuse I						
F-104	Same as F-101.	Spare fuse						
	HARDWARE AND MECHANICAL ACCESSORIES							
H-101	MASK. dial: for masking and uncovering ranges on the frequency scale; aluminum with black enamel 6nish; round; 5-1/2' diam x .040' thk; mounts by three .093" diam holes spaced 120' apart on .531' radius, 13/16" center hole for shaft bshg; six slots 1/4" w x 1-1/4' average length, located on four different radii.	Frequency scale (N-102) mask		N16-M-16001-1002	(17) Dwg. # 295-59	Dwg. # 295-59B	H101	1
H-102	CLAMP: electron tube; round, closes to 1-1/8" diam; single mtg leg 3/4" h wi!h oblong mtg hole 3/11(" wd x $/16" lg, lock-ing flange 1i/8 wd, 1/4- from mtg hole center.	For securing V-202	Navy type 49496	N16-C-301009-628	(7) Type 926A-14	Pt. #	H102 CLA-4	1
H-103	WRENCH: double open end hex; 1/16" across flats; long arm 13/4" lg, short arm 1/2" ig; nitrides steel; 90° bend; for #6 Allen set screw.	#6 Allen set screw wrench		G41-W-2445 (6R57400-6)	(11)	Pt. # WRE-1	H-103	1
H-104	WRENCH: double open end hex; 5/64" across flats; long arm 21g, short arm 11/16" lg; nitrided steel; 90° bend; for #8 Allen set screw.	#8 Allen set screw wrench		G41-W-2446 (6R57400)	(11)	Pt. # WRE 4	H-104	1
H-105	CLAMP: capacitor; bronze, nickel pltd; 1.173" Lg x 0.375" wd x 0.390" h o/a; one 1/8" diam mtg hole; holds two 0.400" diam capacitors.	Mounts C-149 and C-150			(17) Pt. # CLA-58	Pt. # CLA-58	H-105	1

H-106	CLAMP: crystal; bronze nickel pltd; I 1/16' IS x 23/64" wd x 3/32" h o/a; one /a" diam mtg hole; clamp for 19/32" lg x 21/64" wd crystal. z	Mounts crystal Y-101			(17) Pt # CLA-59	Pt # CLA 59	H-106	1
DIALS AND INDICATING DEVICES								
1-101	LIGHT, indicator: without lens; for miniature bayonet base, T-3-1/4 bulb; enclosed shell; aluminum black nickel pltd mtg bushing; 1-9/16" lg x 7/8' wd overall for mtg in 11/16" diam mtg hole x approx 5/16' max panel thickness; horizontally mtd, replaceable from rear of panel; two solder lug term on opposite sides of socket base.	Indicator lamp (E-126) holder assembly		N17.L-76664. 6500	(33) per Federal dwg./pt. # LGI-3-1	Dwg./pt. # LGI-3-1	I101	1
1-102	LENS, indicator light: red; threaded type; 1/2' diam frosted glass disk lens; 13/16' diam bezel x 9/16"-24 outside thread; aluminum bezel; variable aperture lens adjustable from blackout to maximum light.	Indicator lens (mounts) in 1-101		N17-L-250627-770 LGI-3-2	(33) per Federal dwg./pt. #	Dwg./pt. LGI-3-2	I102	1
1-103	DIAL, frequency tuning: anodized aluminum dial plate and bakelite knob; round; 1-3/4' diam dial plate, 1 -3/8' diam knob, brass insert 1/4" I.D.; two $10-32 holes for attachment to 1/4' diam shift; dial plate marked in 100 equally spaced divisions.	Main tuning dial		N16-D. 46344 4722	(17) Dwg. # 295-264	Dwg. 295-264	I103	1
I-1-100	DIAL, attenuator indicator: anodized aluminum dial plate and black bakelite knob; round; 1-5/8" diam dial plate, 1-1/8" diam knob; brass insert 1/4' ID; two $8-32" holes for attachment to 1/4' diam shaft; dial plate has two stops and is marked "MULTIPLIER, " .01, .1, 1, 10, 100, 1000.	MULTIPLIER dial		N16-D-46339-5524	(17) Dwg. # 295-270B	Dwg. # 295-270B	I104	1
1-105	DIAL; meter selector: anodized aluminum dial plate and bakelite knob; 1-5/8' diam dial plate, 1' dial knob, brass insert 1/4' ID; two :8-32 holes for attachment to 1/4' diam shaft; dial plate marked "METER READS, " "BAL, " "% MOD, " "RF."	METER READS dial		N16D-46338-9301	(17) Dwg. # 295-266	Dwg. # 295-266	I110	1
I-106	Not used.							
1-107	DIAL; modulation selector: anodized aluminum dial plate and bakelite knob; 1-5/8" diam dial plate, 1" diam knob, brass insert I/4- ID; two :8-32 holes for attachment to 1/4- diam shaft; dial plate marked "MOD 2 SELECTOR, " "XTAL SELECTOR, " "1000, " "400, " "EXT, XTAI., " "OFF."	MOD SELFCTOR dial			(17) Dwg. #: 315-268	Dwg. # 315-268	I107	1

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST--Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	CONNECTORS (JACKS AND RECEPTACLES)							
J-101	CONNECTOR, receptacle: I round coaxial female contact; straight; 1-1/16- lg x 3/8' diam with 11/16 square mtg Rflange; 52 ohms impedance; cylindrical brass silver pltd body, locking type; molded polystyrene in-sert; four :3-56 tapped holes on 1/2" x 1/2" mtg centers; spec JAN-C-17.	X 20, 000 RF OUTPUT jack	UG290/U	N17-C-73108-1267	(20) Type # 2700	Pt. # CON-15	J101	1
J-102	CONNECTOR, receptacle: I round coaxial female contact; straight type; 11 / 16" lg x w 11/16wdx l-/32" h; 52 ohms impedance; cylindrical brass silver plated body, locking type; molded polystyrene insert; cable open-ing approx 7/32" diam; four 53-56 tapped holes on 1/2" x 1/2" mtg/c; spec JAN-C-17.	X MULT RF OUTPUT jack	UG291/U	N17-C-73108-1262	(20) Type # 5000	Pt. # CON-19	J102	1
J-103	Same as J-101. (Integral part of, and re placed with Z.-101.	EXTERNAL MOD INPUT jack						
J-104	CONNECTOR, receptacle: two round male contacts; straight -5/8" lg x 5/8wd x /8wd x 1/4 deep less contacts and tern; 7 amp at 125v; 7 amp at 125v; rectangular metal shell; molded bakelite in-sert; two .140" diam mtg holes on 1.250 mtg/c.	AC input receptacle on front panel		N17-C-73439-4929	(11) Pt. # 13056	Dwg./pt. # CON-1	J104	1
J-201	CONNECTOR, receptacle: 2 flat polarized blades; 21/32" diam x 1/2" lg less contacts: 45 volt 5 amps, 115v at 2 amps; cylindrical black bakelite body; flange type metal mtg bracket with two .152" diam mtg holes on 31/32- mtg/c.	AC input receptacle on power supply sub-chassis		N17-C-73425-841	(22) Code P-302-AB	Pt. # CON-8	J201	1
J, 202	CONNECTOR, receptacle; 4 rectangular po-larized female contacts, straight; 3/4" lg x 11/16- wd x 1/2" deep less contacts; 45v at 5 amp or IS0v at I amp; rectangular molded bakelite body; metal mounting bracket with two .152 diam mtg holes on a 1' mtg/c.	Power supply output receptacle		N17-C-73185-1208	(22) Code S-304-AB	Pt. # CON-9	J202	1

CONNECTORS (JACKS AND RECEPTACLES) Continued

J-301	CONNECTOR, receptacle: 1 round coaxial female contact; straight type; 1-1/16" lg x 3/8" diam with 3/4" square mtg flange; 52 ohms impedance; four .136 diam mtg holes on a 1/2" x 1" mtg/c; spec JAN-C-17.	Connector for (5:1) Fixed Attenuator CN-132/URM-25	UG185/U	N17-C-73108-2028	(20) Type4500	Pt. # CON-5	J301, J302, J401, J402, J501, J502, J601, J101, J802, J901	10
J-302	Same as J-301.	Connector for (5:1) Fixed O Attenuator CN-132/URM-25						
J-401	Same as J-301.	Connector for Antenna Simulator SM-35/URM-25						
J-402	Same as J-301.	Connector for Antenna Simulator SM-35/URM-25						
J-501	Same as J-301.	Connector for Impedance Adapter MX-1074/URM-25						
J-502	Same as J-301.	Connector for Impedance Adapter MX-1074/URM-25						
J-601	Same as J-301.	Connector for W-601						
J-801	Same as J-301.	Connector for (10:1) Fixed Attenuator CN-136/URM-25						
J-802	Same as J-301.	Connector for (10:1) Fixed Attenuator CN-136/URM-25						
J-901	Same as J-301.	BNC type connector, p/o Connector, Adapter UG-684/U						
J-902	JACK, telephone: for two cond, 1/4" diam phooe plug; 1-9/16" lg x 3/4" diam exclud-ing term; J-IA contact arrangement; 3/s"-32 bshg; one nickel pltd washer and hex mtg IIII nut; mtg hole 25/64" diam.	Phone jack; p/o Connector, Adapter UG-684/U	SIG-C JK-34A	N17-J-39248-4413 (2Z5534)	(7) Pt. # SC-IA	Pt. # JAT-1	J-902	1

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	INDUCTORS							
L-101	Not used							
L-102	COIL, RF: choke; single winding, 2 pie universal wound;unshielded; 2.5 MH ± 5% at 1000 cycles; 30 ma, 25 ohms + 200o de resistance 7/8" Ig x 1/2" diam; phenolic form, air core: two l-li2" Ig pigtail leads.	V-104 plate RF choke V-106 plate RF choke		N16-C-74661-4082	(19) per Federal dwg./pt.# CHO-1B	Dwg. /pt. # CHO- 1B	L102, L103 L117, L119	4
L-103	Same as L-102							
L-104	COIL, RF: choke; single winding, single layer wound; unshielded; 24 turns 522 AWG enameled wires; .280" OD x 7/8" Ig; solid phenolic form; two 1-1/2" Ig axial pigtail leads.	V-106 filament choke			(19) per Federal dwg./pt. s CHO-4	Dwg./pt. # CHO-4	L104	1
L-105	COIL, RF: oscillator; single winding, single layer wound unshielded; three turns of 1/8 x1/ 16" silver plated copper strip; air core; 15/16- diam x 1/2" Ig, tapped at two turns, mounts to circuit components by three .040" dia holes in body strip. n	Band H oscillator coil		N16-C 71694 3418	(19) per Federal dwg. # 295-62A	Dwg. # 295-62A	L105	1
L-106	COIL, RF: oscillator, single winding, single layer wound, unshielded; 8 turns of 128 double nylon covered copper wire, tapped at 4 turns; 1/2" diam x 2-1/2" Ig; ceramic form, powdered iron core; adjustable iron core; screw driver adjustment; 1/ 14" /28 x 1/4" Ig mtg bushing; three solder lug term at top; coated with varnish.	Band G oscillator coil		N16-C-76284 8840	(19) per Federal dwg. # 315-67 Supersedes and interchangeable with dwg. # . 295-67	Dwg. # 315-67	L106	1

L-107	COIL, RF: oscillator, single winding, single layer wound. unshielded; 28 turns of #28 double nylon covered copper wire, tapped at 12 turns; 1/2' diam x 2-1/4' Ig; ceramic form, powdered iron core; adjustable iron core; screw driver adjustment at bottom of coil; 1/4"-28 x I/4" Ig mtg bushing; three solder lug term at top; coated with varnish.	Band F oscillator coil		N16-C 76433-888n	(19) per Federal dw. # 315-66 Supersedes and interchangeable with dvg. # 295-66	Dwg. :# 315-66	L107	1
L-108	COIL, RF: oscillator; single winding, universal wound; 1/2' diam x 2-1/4" Ig; ceramic form, powdered iron core; adjustable iron core; screw driver adjustment at bottom coil; 1/4"-28 x 1/4' Ig mtg bushing; three solder lug term at top.	Band E oscillator coil		N16-C-76662-8273	(19) per Federal dwg. # 315-44 Supersedes and interchangeable with dwg. # 295-44	Dwg. # 315-44	L108	1
L-109	COIL, RF: oscillator; single winding; 2 pie universal wound; 1/2' diam x 2-1/4" Ig; ceramic form; powdered iron core; adjustable iron core; screw driver adjustment at bottom of coil; 1/4'-28 x 1/4" Ig mtg bushing; three solder iug term at top; coated with varnish. 295-43	Band D oscillator coil		N16-C-76726-2801	(19) per Federal dwg. # 315-43 Supersedes and interchangeable with dwg. #	Dwg. # 315-43	L109	1
L-110	COIL, RF: oscillator; single winding, 2 pie universal wound; 1/2' diam x 2-1/4 Ig; ceramic form, adjustable iron core; screw driver adjustment at bottom of coil; 1/4"-28 x 1/4' Ig mtg bushing; three solder lug term at top; coated with varnish.	Band C oscillator coil		N16-C-76771-5846	(19) per Federal dwg. #315-42 Supersedes and interchangeable with dwg. # 295-42	Dwg. # 315-42	L110	1
L-111	COIL, RF: oscillator, single winding; 3 pie universal wound; 1/2' diam x 2-1/4" Ig; ceramic form, powdered iron core; adjustable iron core; screw driver adjustment at bottom of coil; 1/4"-28 x 1/4" Ig mtg bushing; three solder lug term at top; coated with varnish.	Band B oscillator coil		N16-C-76818-5569	(19) per Federal Dwg. # 315-41 Supersedes and interchangeable with dwg. # 295-41	Dwg. #: 315-41	L111	1
L-112	COIL, RF: oscillator; single winding; 4 pie universal wound; 3/4" diam x 2-3/4' Ig; ceramic form, powdered iron core; adjustable iron core; screw driver adjustment at bottom of coil; 1/4"-28 x 1/4' Ig mtg bushing; three solder lug term at top; coated with varnish.	Band A oscillator coil		N16-C-76858-9469	(19) per Federal Dwg. #315-69 Supersedes and interchangeable with dwg. # 295-69	Dwg.# 315-69	L112	1
L-113	Part of E-127. Inductance element of E-127 ·							
L-114	Not used.							

TABLE 7-4. COMBINED PARTS AND SPARE PARTS

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	INDUCTORS - Continued							
L-115	COIL, RF: choke; single winding; un-shielded; 6.5 uh at 50 mc; 1' lg x 9/32" diam; phenolic form, air core; 2 axial wire leads.	RF line choke		N16-C-73039-9400	(35) Pt. # Z50	Pt. # CHO-7	L115, L116	2
L-116	Same as L115	RF line choke						
L-117	Same as L-102.	EXT MOD IN jack J-103 low frequency RF choke						
L-118	COIL, RF: choke: single winding 3 pie universal wound; unshielded 0.5 millihenries at 50 mc; 1" lg x 15/32" diam; solid phenolic form; 2 axial wire leads.	V-104 cathode RF choke			(17) Pt. # CHO-15	Pt. # CHO-15	L-118 L-120	2
L-119	Same as L-102.	V-108 grid RF choke						
L-120	Same as L-118.	V-108 cathode RF choke						
L-121	COIL, RF: choke: single winding; single layer wound; unshielded; 1.3 uh at 10 mc 0.65 mmf dist capacitance; 7/8" lg x 0.280" diam; phenolic form, air core; 2 axial wire 1 leads.	16 mc-34 mc peaking coil			(17) Pt. # CHO-18	Pt. # CHO-18	L-121	1
L.122	COIL, RF: choke; single winding; single layer wound; .35 uh at 35 mc, .6 mmf dist capacitance; .750" g x .220" diam; 2 axial wire leads.	34mc-50mc peaking coil			(19) per Federal Pt. # CHO17	Pt. # CHO-17	L122	1
L-201	REACTOR: filter choke; 11 hy 75 ma; 400 ohms DC resistance; 500v RMS test; hermetically sealed metal case; 2-1/2" lg x 1-7/8" wd x 1-7/8" h; four # 6-32 mtg	Power supply filter			(39) per Federal dwg. # 307-7A	Dwg. # 307-7A	L-.201	1

	studs on 1-1/2" x 1-1/2" mtg/c; two solder lug term on bottom of case; spec MIL-T-27.							
L-401	COIL, RF: antenna simulator single winding, single layer wound; unshielded; 40 turns #32 AWG DSC copper wire; .280' diam x 7/18' lg; powdered iron core form; two 1-1/2" lg axial wire term.	P/O Antenna Simulator SM-35/URM-25		N16-C 73292-4516	(17) Dwg #. 295-26	Dwg # 295-236	L401	1
	METERS							
M-101	METER multiscale: DC; range 0 to 100 microamps; hermetically sealed round metal flush mtg case; 2-3/16' barrel dism x 1-3/8" deep behind panel, 2-11/16' diam flange; meter accuracy ± 2%; 100 microamps full scale deflection, approx 10, 000 ohms per volt sensitivity; calibrated for non magnetic panel; white background, black numerals, 21 scale divisions upper scale, 20 scale divi-ions lower scale; three 1/8' diam mtg holes on 1.22-R; two stud term #8-32 x 7/16" lg; two scales, upper scale marked 0 to 100 MICROVOLTS, lower scale marked 0 to 100% MODULATION.	RF output and % modulation meter		N17-M 29400 5001	(31) per Federal Dwg. # 295-261B	Dwg # 295-261B	M101	1
	SCALES							
N-101	PLATE, index: dial indicator; clear lucite; 2-3/4'4 lg x 1-1 1/16' wd x 1/16" thk overall; two .149' diam mtg holes on 2.375 mtg/c; black hairline engraved in the center and perpendicular to the long axis.	Hairline indicator for bands A thru D on frequency scale (N-102)		N16-P-403561-116	(17) Dwg. # 295-254	Dwg. # 295-258	N101, N103	2
N-102	SCALE: to read RF output frequency; round 6' diam x 1/16' thk; eight scales covering 180' each in two groups of four, top group in kilocycles covering 10 to 27 kc, 27 to 80 kc, 80 to 230 kc, 230 to 680 kc, bottom group in megacycles covering .68 mc to 2 mc, 2 mc to 6.3 mc, 6.3 mc to 18 mc, 18 mc to 50 mc, additional arbitrary scale marked 0 to 1000 covering 180' on bottom section, 3% scale overlap; 5/16' ID hole for shaft, three 1/8' holes spaced 120' on 1/4' R for mtg to flange.	Frequency scale		N16-S-117101-335	(17) Dwg # 295-57A	Dwg # 295-57A	N102	1
N-103	Same as N-101.	Hairline indicator for bands E thru H on frequency scale (N- 102)						

'TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST--Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	SCALES - Continued							
N-104	SCALE: arbitrary scale for interpolating fre-quency vernier dial; arc shape; aluminum; 1 5/8" lg x 5/16" wd x 3/32" thk; 10 scale divisions; two 5/32" diam mtg holes spaced 66° apart on .1.031" radius.	Vernier for Tuning dial 1-103			(17) Pt. # DIV-1	Pt. # DIV-1	N-104	1
	MECHANICAL PARTS							
0-101	GEAR: spur; brass; tuning dial pinion; straight teeth; 24 teeth; 48 pitch .500' pitch diam; .5416" diam x 1/8" thk; concave face; 1/4" diam x 1-11/ 16 lg steel shaft integrally attached to center bore of gear.	Main tuning dial (1-104) pinion		N16-G-431375. 960	(17) Dwg. # 295-18B	Dwg. # 295-18B	O101	1
0-102	GEAR; spur; brass; frequency tuning; straight teeth; one two section split gear. 96 teeth each section, one single section gear 24 teeth; all sections 48 pitch. split gear 2.000' pitch diameter, single section gear 500" diameter; split gear 2.0416" diam x 3/64' thk each section, single gear .5416" diam x 1/8" thk; straight face;. single gear integral part of 1/4' ID hub; split gear sec-tion held by tension spring, single gear on integral hub approx 7/32" from face of split gear.	Driven by O-101		N16-G. 500001-230	(17) Dwg. # 295-11	Dwg. # 295-11	O102	1
0103	GEAR: spur; brass; tuning capacitor; straight teeth; split three section, 120 teeth each section; 48 pitch, 2.500' pitch diam each section; all sections 2.5416" diam, mtg on common 1/4' ID hub; straight fae; 7/8 diam x 1/4' h common hub; for attaching to 1/4" diam shaft; gear sections held by two tension springs.	Main tuning capacitor (C-127) gear, driven by 0-102		N16-G-50001-231	(17) Dwg. # 295-25	Dwg. # 295-25	O103	1

O-104	GEAR: spur; brass; drives frequency scale; straight teeth; 120 teeth; 48 pitch, 2.500' pitch diam 2.5416" diam x 1/4' ID of integral hub x 1/8' thk; straight face; 3/4' OD x 1/4' ID; mounts on 1/4' diam shaft; hub has three #4-40 holes on upper face	Frequency scale (N-102) drive gear, driven by O-103		N16-G-433296-209	(17) Dwg. # 295-54A	Dwg. # 295-54A	O104	1
O-105	RING, retainer: for securing gear on shaft; stainless steel; for securing to 3/16" shaft.	For securing 0-102 to shaft		N16-R-651091-190	(15) 3/16 series 2	Pt. # RNG-1	O105	1
O-106	RING, retainer: for securing gear on shaft; stainless steel; for securing to 1/4' shaft. bushing	For securing O-101 to panel		N16-R-651091-191	(15) 1/4" series 2	Pt. # RNG-2	O106	1
O-107	CAP: for types UG-290/U and UG-291/U connectors; brass silver plated; round; approx 5/8" lg x 9/16" diam; twist lock mtg; approx 2" Ig chain for securing to panel.	Protective cap for J-101	Army-Navy type CW123/U	N17-C-200964-601	(20) Type 1500	Dwg./pt. # CAC-2	O107, 0108, O110	3
O-108	Same as O-107.	Protective cap for J- 102						
O-109	COUPLING, flexible: couple tuning capacitor to drive gear; nickel plated brass hubs and phosphor bronze flexible arms, ceramic insulation; 6000v breakdown; round; 13/16' Ig x 1-1/4' diam overall; two #6-32 cadmium plated steel set screws for securing coupling to shaft.	Mechanically couples tuning capacity (C-127) to driving gear		N17-C-98378-4107	(18) Code FC-46-S	Dwg./pt. # CUP-1A	0109	1
O-110	Same as O-107.	Protective cap for J-103						
O-111	CLIP: alligator; for test lead; copper, cad pl; 2" Ig x 5/16' wd x 1/2" h overall; one screw connection; 5/16' max jaw opening.	Part of W-601		N17-C-802556.975	(37) Pt. # 60CS (cadmium pl)	Pt. # CLP-3.	O111	1
O-112	Same as O-111.	Part of W-601						
O-113	SPRING: helical compression - extension type; gear back lash spring; .020" diam stainless spring steel; 1/8' OD x 3/8" Ig overall; approx 12 turns; looped ends.	Back-lash spring for O-102		N17-S-46702-2301	(17) Dwg. # 295-23	Dwg. # 295-23	O113, O114 O115	3
O-114	Same as O-113.	Back-lash spring for 0-103						
O-115	Same as O-113.	Back-lash spring 0-103		N16-C-76662-8273	(19) per Federal dwg. #	Dwg. # 295-44B	L108	1
O-116	BUMPER: cabinet bottom bumper; rubber; approx hemi-spherical shape; 7/8" OD x 1/2" h; one center hole for #10 flat head screw.	Cabinet bottom bumper			(43) Pt. # 103	Pt.# BMP-1	O-116	4

TABLE 7-.4. COMBINED PARTS AND SPARE PARTS LIST Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	MECHANICAL PARTS - Continued							
O-117	BUMPER: cabinet rear bumper; rubber; round; 1/2" OD x 1/4" h; one center hole for #6 flat head screw.	Cabinet rear bumper			(5) Pt. # 1308	Pt.# BMP-2	O-117	4
	CONNECTORS (PLUGS)							
P-101	CONNECTOR, plug; 2 rectangular female polarized contacts; straight type; 21/32' diam x 15/16" lg less contacts and cable clamp; 5 amp 45v, 2 amp 115v; cylindrical black crystal finish metal body; molded black bakelite insert; cable opening 3/8" diam max; includes adjustable grip cable clamp.	Part of W-102		N17-C-71126-4813	(22) Code S302 CCT	Dwg./pt.# CON-22	P-101	1
P-102	CONNECTOR, plug; 4 flat polarized blades; straight type; 3/4' wd x 11/16' h x 15/16 Ig less contacts and cable clamp; 5 amp 45v, 1 amp 150v; crystal finish rectangular black metal body; molded black bakelite insert; cable opening 3/8' diam max; includes ad-justable grip cable clamp.	Part of W-103		N17-C-71480-2351	(22) Code P304 CCT	Dwg./pt # CON-23	P-102	1
P-103	CONNECTOR, plug: one round coaxial male contact; straight type; 31/32" lg x 27/64' diam overall; 52 ohms impedance; cylindrical brass, silver pltd, locking type body; molded polystyrene insert; cable open-ing approx 7/32' diam; spec JAN-C-17. O	Part of W-104	UG-88/U	N17-G 71408-4241	(20) Type 1200	Pt. # CON-17	P103, P104, P105, P106,	6
P-104	Same as P-103.	Part of W-104						
P-105	Same as P-103.	Part of W-105						
P-106	Same as P-103.	Part of W-105						

P-107	Same as P-103.	Part of W-106					
P-108	Same as P-103.	Part of W-106					
P-701	CONNECTOR, adapter: male one end, fe-ale other end; coax male type N at ones coax female type BNC other end; straight type; adapts female type N to male type BNC connector; 3/4" diam x 1-9/16" Ig over all; 52 ohms impedance; cylindrical, brass silver pltd; molded polystyrene insert; JAN-C-17.	Coaxial adapter	AN type UG-201/U	N17-C-67990 2447	(20) Type 1400	Pt. # CON-21	P701	1
	RESISTORS						
R-101	RESISTOR, fixed: composition; 154, 000 ohms ± 1%; 1/4 W; characteristic F; 3/8' Ig x 1/16" diam; uninsulated, 2 axial wire Ieads.	V-102 1000 cycle bridge resistor		N16-R-73210-1101	(32) Type CP-1/4	Pt. # RES-1011	R101, R104	2
R-102	RESISTOR, fixed: composition; 393, 000 ohms ±1%; 1/4 W; characteristic F; 3/8' Ig x 1/16" diam; uninsulated; 2 axial wire leads.	V-102 400 cycle bridge resistor		N16-R 73259 5801	(32) Type CP-1/4	Pt. # RES-012	R102, R103	2
R-103	Same as R-102.	V-102 400 cycle bridge resistor						
R-104	Same as R-101.	V-102 1000 cycle bridge resistor						
R-105	RESISTOR, fixed: composition; 20, 000 ohms ±5%; 1/12 W; characteristic F; .468" Ig x .249" diam; insulated; 2 axial wire leads; spec JAN-R-11.	V-102 cathode degeneration resistor	RC20BF203J	†N16-R-50362-0431	(2) Pt. # EB2035	Pt # RES-79	R105	1
R-106	RESISTOR, fixed: composition; 1800 ohms ± 5%; 1/2 W; characteristic F; .468' Ig x .249' diam; insulated; 2 axial wire leads; spec JAN-R-11.	V-102A cathode bias resistor	RC20BFI82J	†N16-R. 49984-0431	(2) Pt. # EB1825	Pt # RES-54	R106, R163 R162	3
R-107	RESISTOR, fixed: composition; 510, 000 ohms ± 5%; 1/2 W; characteristic F; .486" Ig x .249" diam; insulated; 2 axial wire leads; spec JAN-R- 11.	V-102B grid leak resistor	RC20BF514J	†Ni6-R. 50839-0431	(2) Pt. # EB5135	Pt. # RES-113	R107, R114, R126, R127, R39, R140	6
R-108	RESISTOR, fixed: composition; 100, 000 ohms ± 5%; 1/2 W; characteristic F; .468' lg x .249' diam; leads; spec JAN-R-11 .	V-102A plate load resistor	RC2OBFI04J	†N16-R-50632-0431	(2) Pt. # EB1045	Pt. # RES-96	R108 R109 R125	3
R-109	Same R-108.	V-102B plate load resistor						

† For replacement specify maximum size of 9/64" diam. x 3/8" lg.

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST--Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	RESISTORS - Continued							
R-110	RESISTOR, variable: composition; 25, 000 ohms ± 10%; 2 W; 3 solder lug terminals; metal case 1-1/16" diam x 9/16" deep; slotted metal shaft 1/4" diam x 5/8" lg FMS; JAN A taper; #3/8-32 x 1/2" lg mtg bshg; non turn device on 17/32" rad at 3 and 9 o'clock.	V-102 DEGEN control		N16-R-87749-4560	(2) Cat. # JLU-2531	Pt. # RRV-1	R110, R128 R129, R131	4
R-111	RESISTOR, variable: composition; 100, 000 ohms ± 10%; 2 W; 3 solder lug terminals; metal case 1-1/16" diam x 9/16" deep; flatted metal shaft 1/4" diam by 3/4" FMS: JAN A taper; #3/8-32 x 1/4" lg mtg bshg.	% MODULA-TION control		N16-R-88009-4164	(2) Type JU1041	Dwg. # 295-150	R111	
R-112	RESISTOR, fixed: composition; 270, 000 ohms ± 5%; 1/2 w; characteristic F; .468" lg x .249" diam; insulated; 2 axial wire leads; spec JAN-R-11	Audio series dropping resistor	RC20BF274J	†NI6-R-50740-0431	(2) Pt. # EB2745	RES-106	R112, R119, R168, R169	4
R-113	RESISTOR, variable: composition; 2500 ohms ± 10%; 2 W; 70'C; three solder lug term; enclosed metal case 1-11/16" diam x 9/16" d; slotted metal shaft 5/8" lg x 1/4' diam; JAN A taper; contact arm insulated from case; without off position; normal shaft torque with locking device; #3/8-32 x 1/2	V-104 BIAS control		N16-R-87419-4350	(2) Cat. # JLU2521	Pt. # RRV-4	R113	
R-114	Same as R-107.	Part of V-i04 grid leak circuit						
R-115 .	RESISTOR, fixed: composition; 51, 000 ohms ± 5%; 1/2 W; characteristic F; .468 lg x 249" diam; insulated; 2 axial wire leads; spec JAN-R-II1.	Part of V-I04 grid leak circuit	RC20BF513J	†N16-R-50497-04 31	(2) Pt. # EB5135	Pt. # RES-89	R115, R117	2

R-116	RESISTOR, fixed: composition; 2400 ohms ±5%; 1/2 W; characteristic F; .468" lg x .249" diam; insulated; 2 axial wire leads; spec JAN-R-11	V-104 plate load resistor	RC20BF242J	†N16-R-50020-0431	(2) Pt. # EBR2425	Pt #	R116 RES-57	1
R-117	Same as R115.	V-104 degen resistor						
R-118	RESISTOR, fixed: composition; 30,000 ohms ±5%; 1 W; characteristic F; .750" lg x .280" diam; insulated; 2 axial wire leads; spec JAN-R-11.	V-104 voltage dropping resistor	RC30BF303J	N16-R-50407-0751	(2) Pt. # GB-3035	Pt. # RES-383	R118	1
R-119	Same as R-112.	V-103 series dropping resistor						
R-120	RESISTOR, fixed: composition; 1 meg ± ±5%; 1/2 W; characteristic F; .468" lg x .249" diam; insulated; 2 axial wire leads; spec JAN-R-11.	V-103 shunt resistor	RC20BF105J	†N16-R-50974-0431	(2) Pt. # EB1055	Pt. # RES-120	R120, R121	2
R-121	Same as R-120.	V-103 output resistor						
R-122	Not used.							
R-123	RESISTOR, variable: wire wound; 50,000 ohms ± 10%; 4w 40°C max continuous operating temp; 3 solder lug term; encl bakelite case w/metal cover 1-21/32" diam x 15/16" lg; flatted metal shaft 1/4" diam x 3/4" lg FMS; JAN A taper; no off position; normal torque; mtg bushing 3/8-32 thd x 1/4" lg; non-turn device located on 17/32" rad at 9 o'clock.	CARRIER CONTROL		N16-R-91568, 8175	(12) per Federal Dwg. # 295-157A	Dwg. # 295-157A	R123	1
R-124	RESISTOR, fixed: composition; 2200 ohms ±5%; 1/2 W; characteristic F; .468" lg x .249" diam;' insulated; 2 axial wire leads spec JAN-R-11.	V-106 bands G and H grid leak resistor	RC20BF222J	†N16-R-50011-0431	(2) Pt. # EB2225	Pt. # RES-56	R124	1
R-125	Same as R-1i08.	V-106 grid leak resistor						
R-126	Same as R- 17.	V-105 voltage divider resistor						
R-127	Same as R-107.	V-105 voltage divider resistor						
R-128	Same as R-110.	RF COMP control						
R-129	Same as R-110.	MOD COMP control						
R-130	RESISTOR, fixed: composition; 18,000 ohms ±5%; 1/2 W; characteristic F; .486" lg x .249" diam; insulated; 2 axial wire leads; spec JAN-R-11.	V-101A plate load resistor	RC20BF183J	†N16-R-50353-0431	(2) Pt. # EB18335	Pt. # RES-78	R130, R132, R160	3

† For replacement specify maximum size of 9/64" diam. x 3/8" lg.

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST-Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	RESISTORS - Continued							
R-131	Same as R-110.	V-101 BALANCE control						
R-132	Same as R-130.	V-101B plate load resistor						
R-133	RESISTOR, variable: composition 100 ohms ±10% ; 2 W; 3 solder lug terminals; metal case 1-1/16” diam x 9/16" d; slotted metal shaft ¼” diam x 5/8" lg; JAN A taper; #3/8-32 x 1/2" lg mtg bshg; non-turn device on 17/32" rad at 3 and 9 o'clock.	RF SENS control		N16-R-87349-4560	(2) Cat. $ JLU-1021	Pt. # RRV-2	R133, R134	2
R-134	Same as R-133.	MOD SENS control						
R-135	RESISTOR, fixed: composition; 100 ohms ±5%; 1/2 W; characteristic F; .368' lg x .249' diam; insulated; 2 axial wire leads; spec JAN-R-11.	V-101B cathode bias resistor	RC20BF101J	†N16-R-49579-0431	(2) Pt. # EB1015	Pt. # RES-25	R135, R136	2
R-136	Same as R-135.	V101A cathode bias resistor						
R-137	RESISTOR, fixed: composition; 1500 ohms ±5%; 1/2 W; characteristic F; .468' lg x .249” diam; insulated; 2 axial wire leads; spec JAN-R-11.	V-101 cathode bias resistor	RC20BF152J	†N16-R-49966-0431	(2) Pt. # EB1525	Pt. # RES-52	R137	1
R-138	RESISTOR, fixed: composition; 75,000 ohms ±5%; 1/2 W; characteristic F; .468” lg x .249” diam; insulated; 2 axial wire leads; spec JAN-R 11.	V-101 B+ dropping resistor	RC20BF753J	†N16-R-50569 0431	(2) Pt. # EB7535	Pt. # RES-93	R138, R158	2
R-139	Same as R-107.	Voltmeter bridle B+ voltage divider						
R-140	Same as R-107.	V-101B grid leak resistor						

R-141	RESISTOR, fixed: composition; 500 ohms ±1%; ¼ W; characteristic F; 3/8” lg x 1/16” diam; uninsulated; 2 axial wire leads.	Part of output impedance T pad Circuit		N16-R-72953-6911	(32) RES-1004	Pt. #	R141, R142	2
R-142	Same as R-141.	Part of output impedance T pad circuit						
R-143	RESISTOR, fixed: composition; 482 ohms ±1%; 1/4 W; characteristic F; 3/8” lg x 1/16” diam; uninsulated; 2 axial wire leads.	Part of step attenuator E-112		N16-R-72952-3901	(32) Type CP-1/4	Pt. # RES-1000	R143	1
R-144	RESISTOR, fixed: composition; 531 ohms ±1%; 1/4 W; characteristic F; 3/8” lg x 1/16” diam; uninsulated; 2 axial wire leads.	Part of step attenuator E-112		N16-R-72956-3876	(32) Type CP-1/4	Pt. # RES-1001	R144, R145 R146, R147, R148	
R-145	Same as R-144.	Part of step attenuator E-112						
R-146	Same as R-144.	Part of step attenuator E-112						
R-147	Same as R-144.	Part of step attenuator E-112						
R-148	Same as R-144.	Part of step attenuator E-112						
R-149	RESISTOR, fixed: composition; 59 ohms ±1%; 1/4 W; characteristic F; 3/8” lg x 1/16” diam; uninsulated; 2 axial wire leads.	Part of step attenuator E-112		N16-R-72865-7451	(32) Type CP-1/4	Pt. # RES-1002	R149, R154	2
R-150	RESISTOR, fixed: composition; 65.6 ohms ±1%; characteristic F; 3/8” lg x 1/16” diam; uninsulated; 2 axial wire leads.	Part of step attenuator E-112		N16-R-72872-9701	(32) Type CP-1/4	Pt. # RES-1003	R150, R151 R152,R153	4
R-151	Same as R-150..	Part of step attenuator (E-112)						
R-152	Same as R-150.	Part of step attenuator (E-112)						
R-153	Same as R-150.	Part of step attenuator (E-112)						
R-154	Same as R-149.	Part of step attenuator (E-112)						
R-155	RESISTOR, variable: composition; two section, one section 10,000 ohms ±10%, other section 250,000 ohms ±10%; 2 W at 70°C each section; two solder lug term on each section; 1-1/16” diam x 1-3/16" lg; enclosed case; flatted metal shaft ¼” diam x 13/16” lg; special taper each section; contact arm insulated from case; without off position; normal torque, without locking device; one #3/8-32 x 5/16” g mtg bshg.	MICROVOLTS control		N16-R-88915-7601	(2) per Federal Dwg. # 295-138C	Dwg. # 295-138C	R155A, R155B	1

† For replacement specify maximum size of 9/64” diam. x 3/8" lg.

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST-Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON- TRACTOR DRAW- ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	RESISTORS - Continued							
R-155A	Part of R-155 (250,000 ohm section).	Bridge section of MICROVOLTS control (R PAR5)						
R-155B	Part of R-155 (20,000 ohm section).	Shunt section of MICROVOLTS control (R-155)						
R-156	TUBE, ballast: glass; .7 to 1.7 v, .460 to .505 ma; 2-5/16' lg x ¾” diam bulb; 2-1/2” lg overall; 7 contact miniature base.	V-105 heater regulator		N16-R-85001-1676	(4) Pt. # 5T1A	Dwg./pt. # RBR-2C	R156	1
R.-157	RESISTOR, fixed: composition; 15 ohms ± 5%; 2 W; characteristic F; .750 lg x .370” diam; 2 axial wire leads; insulated; spec JAN-R-11.	V-105 filament shunt resistor	RC42BF150J	N16-R-49283-101	(2) Pt. # HB1505	Pt. # RES-604	R157	1
R-158	Same as R-138.	V-106 band A cathode resistor						
R-159	RESISTOR, fixed: composition; 120 ohms ± 5%; 1/2 W; characteristic F; .468” lg x .243” diam; insulated; 2 axial wire leads; spec JAN-R-11.	Part of E-127	RC20BF121J	†N16-R-49597-0431	(2) Pt. # EB1215	Pt. # RES-27	R159	1
R-160	Same as R-130.	V-106 band B cathode resistor						
R-161	RESISTOR, fixed: wire wound; 17 ohms ± 10%; 1-1/2 W; 3-3/5” lg x 5/32” diam; 2 axial wire leads; uninsulated.	E-128 series dropping resistor			(17) Dwg. # 295-324	Dwg. # 295-324	R161,R165, R166	3
R-162	Same as R106	V-106 band D cathode resistor						

R-165	Same as R-106.	V-106 band E cathode resistor						
R-164	RESISTOR, fixed: composition; 2.2 megohms ±5%; 1/2 W; characteristic F; .468" lg x .249" diam; insulated; 2 axial wire leads; spec JAN-R-11.	V-106 output decoupler	RC20BF225J	N16-R-51064-0431	(2) Pt. # EB2255	Pt. # RES-128	R164	1
R-165	Same as R-161.	E-129 series dropping resistor						
R-166	Same as R-161.	E-130 series dropping resistor						
R-167	RESISTOR, fixed: composition; 1000 ohms ±5%; 1/2 w; characteristic F; .468" lg x .249" diam; insulated; 2 axial wire leads;	V-108 mixer grid isolation resistor	RC20BF102J	†N16-R-49921-0431	(2) RC20BF102J	Pt. # RES-48	R-167	1
R-168	Same as R-112.	V-108 mixer grid leak resistor						
R-169	Same as R-112.	V-108 oscillator grid leak resistor						
R-170	Same as R-108.	V-108 plate load resistor						
R-171	Same as R-118.	V-108 screen dropping resistor						
R-201	RESISTOR, fixed: wire wound; 1800 ohms ±5%; 15 W at 25°C; 1-1/4" lg x 1-3/16" wd x 5/8" h; 2 solder lug term; integral mtg bracket with two 0.196" diam mtg holes on 2" mtg/c: spec JAN R-26A.	Power supply series dropping resistor	RW20G182	N16-R-66094-8361	(34) Pt. # RW20G182	Pt. # RWF-9	R201	1
R-301	RESISTOR, fixed: composition; 35.6 ohms ±1%; 1/4 W; characteristic F; 3/8" lg x 1/16" diam; uninsulated; 2 axial wire leads.	Part of (5:1) Fixed Attenuator CN-132/URM-25		N16-R-72843-4301	(22) Type CP-1/4	Pt. # RES-1013	R301, R302	
R-302	Same as R-301.	Part of (5:1) Fixed Attenuator CN-132/URM-25						
R-303	RESISTOR, fixed: composition; 89.2 ohms ±1%; 1/4 W: characteristic F; 3/8" lg x 1/16" diam; uninsulated; 2 axial wire leads.	Part of (5:1) Fixed Attenuator CN-132/URM-25		N16-R-72890-6051	(32) Type CP-1/4	Pt. # RES-1014	R303, R304, R305, R306	
R-304	Same as R-303.	Part of (5:1) Fixed Attenuator CN-132/URM-25						
R-305	Same as R-305.	Part of (5:1) Fixed Attenuator CN-132/URM-25						

† For replacement specify maximum size of 9/64" diam. x 3/8" lg.

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST-Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	RESISTORS - Continued							
R-506	Same as R-303.	Part of (5:1) Fixed Attenuator CN-132/URM-25						
R401	RESISTOR, fixed: composition; 400 ohms ±1%; 1/4 W; characteristic F; 3/8" lg x 1/16" diam; uninsulated moisture resistant; 2 axial wire leads.	Part of Antenna Simulator SM-35/URM-25		N16-R-72943-7721	(32) Type CP-1/4	Pt. # RES-1008	R401	1
R-501	RESISTOR, fixed: composition; .53.5 ohms ±1%; 1/4 W; characteristic F; 3/8" lg x 1/ 16' diam; uninsulated; 2 axial wire leads.	Part of Impedance Adapter MX-1074/URM-25		N16-R-72860-7476	(32) Type CP-1/4	Pt. # RES-1005	R501	1
R-801	RESISTOR, fixed: composition; 43.8 ohms ±1%; 1/4 W; characteristic F; 3/8" lg x 1/16" diam; uninsulated; 2 axial wire leads.	Part of (10:1) Fixed Attenuator CN-136/URM-25		N16-R-72853-2301	(32) Type CP-1/4	Pt. # RES-1006	R801, R802	2
R-802	Same as R801.	Part of (10:1) Fixed Attenuator CN-136/URM-25						
R-803	RESISTOR, fixed: composition; 43.2 ohms ±1%; 1/4 W; characteristic F; 3/8" lg x 1/16" diam; uninsulated; 2 axial wire leads.	Part of (10:1) Fixed Attenuator CN-136/URM-25				Pt. # RES-1007	R803, R804 R805, R806	4
R-804	Same as R803.	Part of (10:1) Fixed Attenuator CN-136/URM-25						
R-805	Same as R803.	Part of (10:1) Fixed Attenuator CN-136/URM-25						
R-806	Same as R803.	Part of (10:1) Fixed Attenuator CN-136/URM-25						

SWITCHES								
S-101	SWITCH, toggle: DPST; 5 amps, 125v dc; phenolic body; 1-9/32" lg x 23/32" wd x 31/32" d; 11/16" lg bat type handle; normally open; solder lug term; single hole mtg bushing 15/32"-32, 15/32" lg; spec JAN-S-23.	POWER ON-OFF switch	ST22K	N17-S-73082-9028	(14) Pt. # ST22K	Pt. # SWT-1	S101 S106	2
S-102	SWITCH, rotary: 3 pole, 3 position; single section; silver alloy contacts; ceramic body; 1-7/8" diam x 29/32" d; shorting type solder lug terminals; single hole mtg bushing 3/8-32" x ¼" lg; ¼" diam flatted metal shaft ¾" lg.	METER READS switch		N17-S-62121-3441	(24) Type HL (special) per Federal Dwg. # 295-171C	Dwg. # 295-171C	S102	1
S-103	SWITCH, rotary: 3 pole, 4 position; single section; silver alloy contacts; ceramic body; 1-7/8" diam x 31/32" d; shorting type; solder lug terminals; single hole mtg; bushing 3/8-32 x ¼" lg, 1/4" diam flatted metal shaft 7/8" lg.	MOD SELECTOR switch		N17-S-62206-1751	(24) Type HL (special) per Federal Dwg. # 295-172A	Dwg. # 295-172A	S103	1
S-104	Not used.							
S-105	SWITCH, rotary: 4 pole 8 position; three section, silver alloy contacts; ceramic body; 2-1/16" diam x 2-17/32" d; shorting type; solder lug term; single, hole mtg; bushing 3/8-32 x 1/4" lg, ¼" dia flatted metal shaft 2" lg.	FREQUENCY BAND SWITCH		N17-S-65463-8001	(24) Type HC (special) per Federal Dwg. # 295-63B	Dwg. # 295-63B	S105	1
S-106	Same as S-101.	XTAL-CAL ON-OFF switch						
S-107	SWITCH, rotary: 1 pole 3 position; single section silver alloy contacts; ceramic body; 1-7/8" diam x 29/32" d, shorting type; solder lug term; single hole mtg; bushing 3/8-32 x 1/4" lg; 1/4" diam flatted metal shaft 3/4" lg.	CARRIER RANGE switch		N17-S-59933 5241	(24) Type HL (special) per Federal Dwg. # 315-137	Dwg. # 315-137	S107	1
TRANSFORMERS								
T-201	TRANSFORMER, power: filament and plate type; 115v 50 to 1600 cyc, single ph; two output windings, secd #1-6.3v at 4 amp, secd #2-450v CT at 75 ma; 1500v RMS ins; vacuum impregnated, sealed in pitch; hermetically sealed rectangular case; 3-3/4" lg x 2-7/8" wd x 3" h less term; four 1/2" h standoff term on irregular mtg/c; four.#8-32 x 1/2" lg mtg bolts on 2-3/8" x 2-3/8" mtg/c; spec MIL-T-27 Grade 1 Class A.	Power transformer			(39) per Federal Dwg. # 307-6A	Dwg. # 307-6A	T-201	1

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST-Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	ELECTRON TUBES							
V-101	TUBE, electron: dual triode.	Voltmeter bridge	JAN I-A 12AU7	N16-T-58241			V101, V102	2
V-102	Same as V-101.	Modulation oscillator						
V-103	TUBE, electron: dual diode.	Modulation diode	JAN I-A 6AL5	N16-T-56195			V103	1
V-104	TUBE, electron: triode.	Buffer-amplifier	JAN I-A 6J4	N16-T-56349			V104	1
V-105	TUBE, electron: diode.	RF diode	JAN I-A 9006	N16-T-79006			V105	1
V-106	TUBE, electron: dual triode.	Carrier oscillator	JAN I-A 6J6	N16-T-56360			V106	1
V-107	Not used.							
V-108	TUBE, electron: pentagrid converter.	Crystal calibrator	JAN I-A, 6BE6	N16-T-56211-50			V108	1
V-201	TUBE, electron: dual diode.	Power supply rectifier	JAN I-A 6X4	N16-T-56840			V201	1
V-202	TUBE, electron: gas regulator type.	B+ regulator	JAN I-A OD3/VR150	N16-T-53060			V202	1
W-101	CABLE ASSEMBLY, power: type POSJ cable; two #18 AWG stranded conductors; 5 ft 10-1/4" lg, less terminations; one male two contact plug molded at one end, one female two contact plug molded at other end.	AC power line cable		N17-C-48225-4590	(6) Pt. # 1777	Pt. # CAB-4	W101	1

W-102 *	CABLE ASSEMBLY, power: two #20 AWG stranded conductors, synthetic resin insulated, 3000v RMS test, skeleton braid, synthetic jacket; 2 ft lg, excluding terminations; Jones type S-302-CCT connector at one end, other end terminated in two 2" lg tinned leads.	Interconnecting AC power cable			(17) Dwg. # 295-240	Dwg. # 295-240	W102	1
W-103 *	CABLE ASSEMBLY, power: three #20 AWG stranded conductors, synthetic resin insulated, 3000v RMS test, skeleton braid, synthetic jacket; 26" lg, excluding terminations; Jones type P-304 CCT connector at one end; other end terminated in one 2" lg and one 6-1/4" lg tinned leads and tinned braid for ground.	Power supply output power cable		N17-C-48614-1071	(17) Dwg. # 295-139	Dwg. # 295-139	W103	1
W-104 *	CABLE ASSEMBLY, RF: JAN type RG-58A/U cable; 46" lg excluding terminations; 4 ft lg overall; one JAN type UG-88/U connector at each end.	RF output cable	CG-409A/U (4'0")		(17) Dwg. # 315-243	Dwg. # 315-243	W104	1
W-105 *	CABLE ASSEMBLY, RF: JAN type RG-S8A/U cable, 5" lg excluding terminals; 7" lg overall; one JAN type UG-88/U connector at each end.	Accessory RF output cable	CG-409A/U (0'7")		(17) Dwg. # 315-247	Dwg. # 315-247	W105	2
W-106 *	Same as W-105.	Accessory RF output cable						
W-601	LEAD, test: one red lead JAN type SRIR-1(7)-20-C-2; one black lead JAN type SRIR-1(7)-20-C-0;'15-3/18" lg each wire less term; one end at each wire term in Mueller type 60 CS alligator clip, other end of red lead connected in series with a parallel combination consisting of one Gudeman type XF-1816 paper capacitor .1 mf and one JAN type CM20D511J capacitor, both capacitors contained in rectangular aluminum case, black lead grounded to case; aluminum capacitor case 3-1/8" lg x 1-1/8" wd x 7/8" h overall, one type UG-185/U connector at one end, 5/32" ID bushing at other end to permit entry of both leads, 1/4" OD vinylite jacks and over both leads extends 9" lg from bushing.	Output test lead with protective capacitor unit	CX-1363/U		(17) Dwg. # 295-183	Dwg. # 295-183	W601	1
	ELECTRON TUBE SOCKETS							
X-101	SOCKET, tube: 9 contact miniature; brass saddle top mounting; two 1/8" mtg/c; round plastic body .940" diam less saddle x 5/8" h.	Tube socket for V-101	TSE9T101	N16-S-64063-6718	(11) Pt. # TSE9T101	Pt. # SKT-5	X101, X102	2

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST-Continued

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	ELECTRON TUBE SOCKETS - Continued							
	including saddle, less contacts; phosphor bronze silver pltd contacts; without shock shield, with 1/8" diam center shield; with brass saddle for mtg socket and twist lock tube shield; spec JAN-S-28A.							
X-102	Same as X-101.	Tube socket for V-102						
X-103	SOCKET, tube: 7 contact miniature, brass saddle top mounting; two 1/8" diam hole on 7/8" mtg/c; round plastic body .800" diam x 5/8" h including saddle less contacts; phosphor bronze silver pltd contacts; with-out shock shield, with 1/8' diam center shield, with brass saddle for mounting socket and for mounting twist lock tube shield; spec JAN-S-28A.	Tube socket for V-103	TSE7101	N16-S-62603-6692	(11) Pt. # TSE7T101	Pt. # SKT-3	X103, X107 X201	3
X-104	SOCKET, tube: 7 contact miniature; brass saddle top mounting; two 1/8" diam holes on a 7/8" mtg/c; round ceramic body .800" diam x ¾" h including saddle less con-tacts; beryllium copper-silver pltd contacts; without shock shield; with .156" OD center shield; with brass saddle for mounting socket and for mounting twist lock shield; spec JAN-S-28A.	Tube socket for V-104	TSE7T102 (Supersedes S010C)		(11) Pt. # TSE7T102	Pt. # SKT-9	X104, X105, X106, X108	4
X-105	Same as X-104.	Tube socket for V-105						
X-106	Same as X-104.	Tube socket for V-106						
X-107	Same as X-103.	Socket for R-156 ballast regulator						
X-108	Same as X-104.	V-108 tube socket						

X-109	SOCKET, crystal: copper, silver pltd; stea. tire insulation: 55/64" lg 3/8" wd x 3/8" h excluding term.	Socket for crystal Y-101			(40) Pt. #9006	Pt. # SKX-1	X-109	1
X-201	Same as X-103.	Tube socket for V-201						
X-202	SOCKET, tube: octal; one piece saddle mtg; two .156" diam holes on 1-1/2" mtg/c; round phenolic body 1-3/8" diam x 5/8" h excluding term; phosphor bronze silver pltd contacts ;spec JAN-S-28A.	Tube socket for V-202	TSB8T101	N16-S-63515-4151	(11) Pt. # TSB8T101	Pt. # SKT-4	X202	1
				CRYSTAL				
Y-101	CRYSTAL UNIT, quartz: one quartz plate, nominal frequency 1 mc; two .05" diam contact pins spaced 0.486" C to C on bottom; rectangular metal body 3/4" lg x 11/32" wd x 25/32" h; not adjustable.	Crystal calibrator (V-108) Crystal	CR-18/U	(2X209-100)	(41) CR-18/U	Pt. # CUQ-3	Y-101	1
				FILTERS				
Z-101	FILTER, Low pass: 1 mc cutoff; 3-5/8" lg x 3/4" wd x 3/4" h; tubular brass silver pltd; four #3-56 tapped holes on 1/2" x 1/2" mtg/c; one integral type UG-290/U connector at one end, one solder lug term at other.	External mod. Input RF Filter		N16-F-44311-7191	(17) Dwg. # 307-348	Dwg. # 307-348	Z-101	1
Z-102	FILTER, low pass: 1 mc cut-off; 2-7/8" lg x 3/4" wd x 3/4" h; tubular, brass silver pltd; four 0.116" diam holes on 0.531" x 0.531" mtg/c; two solder lug term.	RF Filter for E-128 thru E-130		N16-F-44311-7181	(17) Dwg. # 307-345	Dwg. # 307-345	Z-102	1
				ACCESSORY COMPONENTS				
	CONNECTOR, adapter: 1 round female coaxial contact one end, 1 phone jack other end; straight type; 1 13/16" lg x 1 1/16" diam o/a; cylindrical aluminum body, locking type; mounts when locked to JAN UG-88/U connector; marked Connector Adapter UG-684/U.	Adapter from BNC jack (JAN UG-88/U) to phone plug (JAN PJ-055)	A-N type UG-684/U		(17) Pt. # ASB-2	Pt. # ASB-2		
	ADAPTER, connector, (described under Sym No. P-701).	BNC to N adapter	AN type UG-201/U					
	ATTENUATOR, fixed: T network; carbon; input and output impedance 53.5 ohms ± 3%; 14 db attenuation when terminated in 53.5 ohms; enclosed rectangular aluminum case 2" lg x 1 3/16" wd x 7/8" h excluding term; mounts by one type UG-185/U connector at each end; marked (5:1) Fixed Attenuator CN-132/URM-25.	5:1 Fixed Attenuator	AN type CN-132/URM-25		(17) Dwg. # 295-226	Dwg. # 295-226		

TABLE 7-4. COMBINED PARTS AND SPARE PARTS LIST-Continued

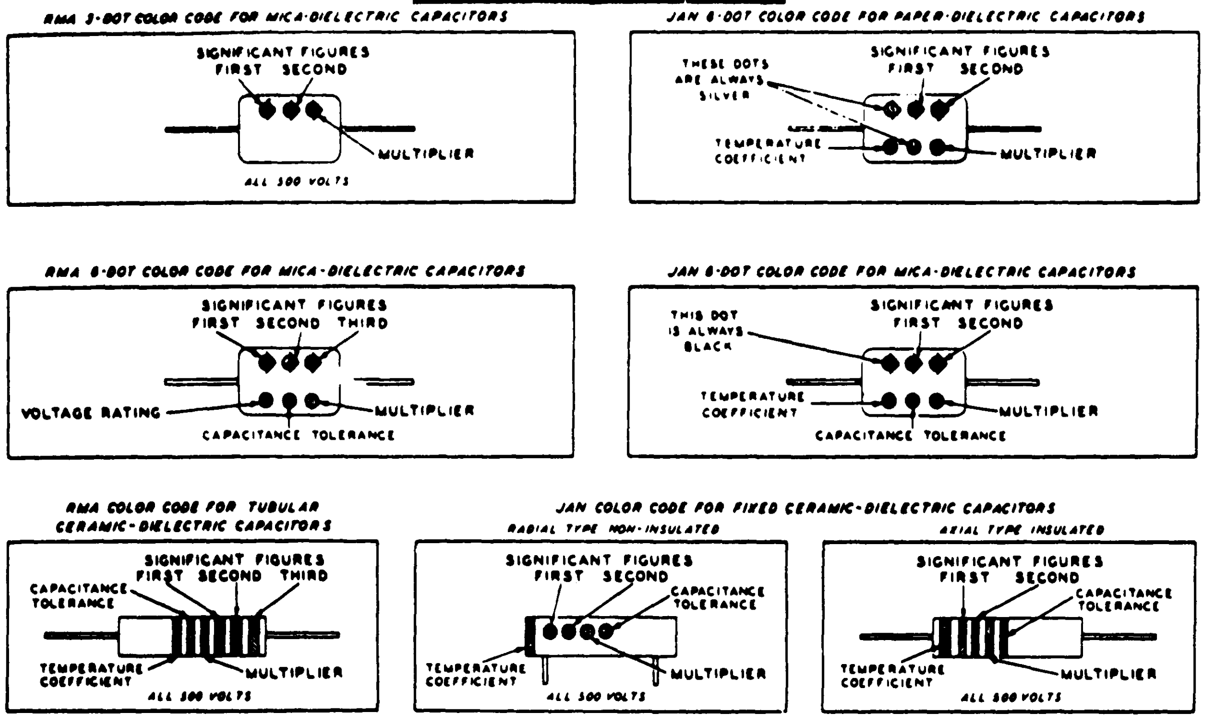
SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN. AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORP.) STOCK NO.	MFGR. AND MFGR'S DESIG. NATION	CON-TRACTOR DRAW-ING AND PART NO.	ALL SYMBOL DESIG. INVOLVED	QUAN PER EQUIP.
	ACCESSORY COMPONENTS -- Continued							
	ATTENUATOR: fixed: T network; carbon; input and output impedance 53.5 ohms ± 3% 20 db attenuation when terminated in 53.5 ohms; enclosed rectangular aluminum case 2" lg x 1 3/16" wd x 7/8" h excluding termination; mounts by one type UG-185/U connector at each end; marked (10:1) Fixed Attenuator CN-136/URM-25.	10:1 Fixed Attenuator	AN type CN-136/ URM-25		(17) Dwg. # 295-307	Dwg. # 295-307		1
	LEAD, test: (described under Sym No. W-601).	Output test lead with protective capacitor unit	AN type CX-1363/U					
	LOAD, dummy: consists of inductance L-401 capacitors C-401 and C-402 and resistor R-401; enclosed rectangular aluminum case 2" lg x 1 3/16" wd x 7/8" h excluding terminations; mounts by one type UG-185/U connector at each end; marked Antenna Simulator SM-35/URM-25.	Dummy Antenna	AN type SM-35/URM-25		(17) Dwg. # 295-233	Dwg. # 295-233		
	MATCHING UNIT, impedance: consists of one 53.5 ohm ± 1%, 1/4 w, composition resistor; enclosed rectangular aluminum case 2" lg x 1 3/16" wd x 7/8" h; mounts by one type UG-185/U connector at each end; marked Impedance Adapter MX-1074/URM-25.	External 53.5 ohm termination unit	AN type MX-1074/ URM-25		(17) Dwg. # 295-230	Dwg. # 295-230		

TABLE 7-5. CROSS REFERENCE PARTS LIST

JAN (OR AWS)	KEY SYMBOL	JAN (OR AWS)	KEY SYMBOL	STANDARD NAVY STOCK NO.	KEY SYMBOL	STANDARD NAVY STOCK NO.	KEY SYMBOL	STANDARD NAVY STOCK NO.	KEY SYMBOL
CC21CK020C	C114	UG-88/U	P103	N16-A-98018-1001	E112	N16-K-700302-606	E101	N16-S-34607-8400	E122
CC21CK120J	C152	UG-185/U	J301	N16-C-11943-2485	W-105	N16-K-700374-431	E105	N16-S-89724-8801	E127
CC21S100D	C145	UG-201/U	P701	N16-C-11944-1750	W-104	N16-M-16001-1002	H101	N16-S-117101-335	N102
CC26SL510J	C126	UG-290/U	J101	N16-C-15431-5525	C140	N16-R-29253-7622	L201	N16-S-89924-7460	E127
CE41C250J	C115	UG-291/U	J102	N16-C-15432-5867	C114	N16-R-403561-116	N101	N16-T-53060	V202
CM20B271J	C153			N16-C-15916-9005	C145	N16-R-49283-101	R801	N16-T-56349	V104
CM20B301J	C144			N16-C-15953-5399	C152	N16-R-49579-0431	R135	N16-T-56360	V106
CM20D120G	C101			N16-C-16596-2514	C126	N16-R-49597-0431	R159	N16-T-56840	V201
CM20D201J	C401			N16-C-16669-3500	C141	N16-R-49921-0431	R167	N16-T-58241	V101
CM20D391G	C402			N16-C-18657-8801	C110	N16-R-49966-0431	R137	N16-T-79006	V105
CM20D511J	C112			N16-C-18659-7701	C125	N16-R-49984-0431	R106	N17-C-48225-4590	W101
CM25B102K	C147			N16-C 19788-8925	C115	N16-R-50011-0431	R124	N17-C-98378-4107	O109
CM30B202K	C103			N16-C-29265-3006	C401	N16-R-50020-0431	R116	N17-C-200964-601	O107
CM35B622J	C113			N16-C-29608-2196	C153	N16-R-50128-0431	R162	N17-C-67990-2447	P701
CN22A103M	C154			N16-C-29660-8996	C144	N16-R-50353-0431	R130	N17-C-71126-4813	P101
CN43E104M	C104			N16-C-29893-2126	C402	N16-R-50362-0431	R105	N17-C-71408-4241	P103
CP40C2FF405K	C201			N16-C-301069-628	H102	N16-R-50407-0751	R118	N17-C-71480-2351	P102
CV12A250	C151			N16-C-30188-5066	C112	N16-R-50497-0431	R115	N17-C-73108-1262	J102
RC20BF101J	R135			N16-C-31080-2522	C101	N16-R-50569-0431	R138	N17-C-73108-1267	J101
RC20BF102J	R167			N16-C-31090-4472	C147	N16-R-50632-0431	R108	N17-C-73108-2028	J301
RC20BF104J	R108		**KEY**	N16-C-32193-2484	C103	N16R-R-50740-0431	R112	N17-C-73185-1208	J202
RC20BF105J	R120	**NAVY TYPE**	**SYMB0L**	N16-C-32905-4328	C113	N16-R-50839-0431	R107	N17-C-73425-8451	J201
RC20BF121J	R159			N16-C-45773-5720	C601	N16-R-50974-0431	R120	N17-C-73439-4929	J104
RC20BF152J	R137			N16-C-45805-6200	C104	N16-R-51064-0431	R164	N17-C-802556-975	O111
RC20BF182J	R106	28053-1	F101	N16-C-45963-8500	C204	N16-R-651091-190	O105	N17-F-14310-380	F101
RC20BF183J	R130	49496	H102	N16-C-49958-5145	C201	N16-R-651091-191	O106	N17-F-74267-5701	E115
RC20BF203J	R105			N16-C-61910-9901	C127	N16-R-72860-7476	R501	N17-I-49969-8501	E110
RC20BF222J	R124			N16-C-63960-2508	C128	N16-R-72865-7451	R149	N17-L-250627-770	I-102
RC20BF225J	R164			N16-C-64041-4505	C151	N16-R-72872-9761	R150	N17-L-76664-6500	I-101
RC20BF242J	R116			N16-C-71694-3418	L105	N16-R-72943-7721	R401	N17-M-29400-5001	M101
RC20BF274J	R112			N16-C-72826-4658	L104	N16-R-72952-3901	R143	N17-P-69135-6205	E106
RC20BF472J	R162			N16-C.73039-9400	L115	N16-R-72953-6911	R141	N17-S-46702-2301	O113
RC20BF513J	R115			N16-C-73292-4516	L401	N16-R-72956-3876	R144	N17-S-59933-5241	S104
RC20BF514J	R107	**ARMY-NAVY**	**KEY**	N16-C-76284-8840	L106	N16-R-73210-1101	R101	N17-S-62121-3441	S102
RC20BF753J	R138	**TYPE**	**SYMB0L**	N16-C-76433-8880	L107	N16-R-73259-5801	R102	N17-S-62206-1751	S103
RC30BF303J	R118			N16-C-76662-8273	L108	N16-R-85001-1676	R156	N17-S-65463-8001	S105
RC42BF150J	R157			N16-C-76726-2801	L119	N16-R-87349-4350	R133	N17-S-73082-9028	S101
RW20G182-	R201	CG-409A/U(4'0")	W104	N16-C-76771-5846	L110	N16-R-87419-4350	R113	G17-L-6297	E126
ST22K	S101	CG-409A/U(0'7")	W100	N16-C-76818-5569	L111	N16-R-87749-4560	R110	G17-L-6543-100	E128
TSB8T101	X202	CR-18/U	Y101	N16-C-76858-9469	L112	N16-R-88009-4164	R111	G41-W-2445	H103
TSE7T101	X103	CW-123/U	O107	N16-D-46338-9301	I105	N16-R-88915-7601	R155	G41-W-2446	H104
TSE7T102	X104			N16-D-46339-5524	I104	N16-R-91568-8175	R123		
TSE9T101	X101			N16-D-46344-4722	I103	N16-S-34520-3862	E119		
TSF0T101	E119			N16-G-431375-960	O101	N16-S-34557-8350	E121		
TSF0T102	E121			N16-G-433296-209	O104	N16-S-34596-6513	E123		
TSF0T103	E122			N16-G-500001-230	O102				
TSF0T105	E123			N16-G-500001-231	O103				

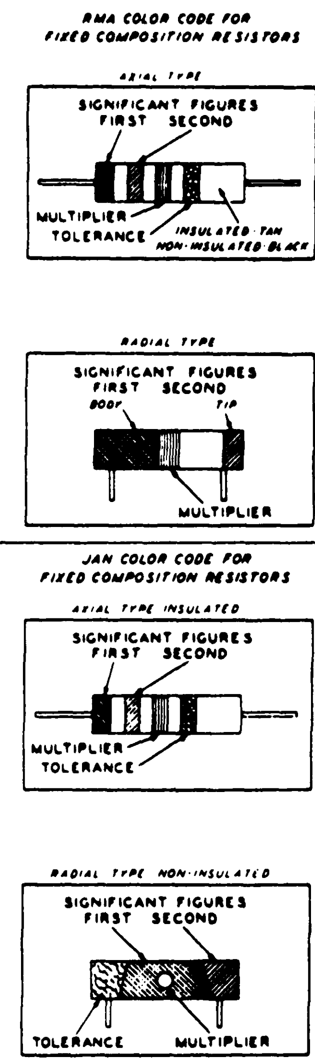
TABLE 7-6. APPLICABLE COLOR CODES AND MISCELLANEOUS DATA

CAPACITOR COLOR CODES



RMA: RADIO MANUFACTURERS ASSOCIATION
JAN: JOINT ARMY-NAVY

RESISTOR COLOR CODES



RESISTORS				CAPACITORS				
				MULTIPLIER				
TOLERANCE	MULTIPLIER	SIGNIFICANT FIGURE	COLOR	RMA MICA AND CERAMIC-DIELECTRIC	JAN MICA AND PAPER-DIELECTRIC	JAN CERAMIC DIELECTRIC	VOLTAGE RATING	TEMPERATURE COEFFICIENT
	1	0	BLACK	1	1	1		A
	10	1	BROWN	10	10	10	100	B
	100	2	RED	100	100	100	200	C
	1,000	3	ORANGE	1,000	1000	1000	300	D
	10,000	4	YELLOW	10,000			400	E
	100,000	5	GREEN	100,000			500	F
	1,000,000	6	BLUE	1,000,000			600	G
	10,000,000	7	VIOLET	10,000,000			700	
	100,000,000	8	GRAY	100,000,000		0.01	800	
	1,000,000,000	9	WHITE	1,000,000,000		0.1	900	
5	0.1		GOLD	0.1	0.1		1000	
10	0.01		SILVER	0.01	0.01		2000	
20			NO COLOR				500	

TABLE 7-7. LIST OF MANUFACTURERS

ABBREVI-ATIONS	PREFIX	NAME	ADDRESS	ABBREVI-ATIONS	PREFIX	NAME	ADDRESS
1	CPH	Aerovox Corp.,	New Bedford, Mass.	22	CJC	Jones, Howard B.	Chicago, Ill.
2	CBZ	Allen-Bradley Co.	Milwaukee, Wisc.	23	CAUP	Kurz-Kasch, Inc.	Dayton, Ohio
5	CPH	American Phenolic Corp.	Chicago, Ill.	24	COC	Oak Mfg. Co.	Chicago, Ill.
4	CAGK	Amperite Co.	New York, N. Y.	25	CRK	Radio Condenser Co.	Camden, N. J.
5		Atlantic India Rubber Works	Chicago, Ill.	26	CSF	Sprague Specialties Co.	N. Adams, Mass.
6	CQG	Belden Mfg.	Chicago, Ill.	27	CSA	Stackpole Carbon Co.	St. Marys, Pa
7	CAIS	Birtcher Corp.	Los Angeles, Calif.	28	CABU	Superior Electric Co.	Bristol, Conn.
8	CFA	Bussman Mfg. Co.	St. Louis, Mo.	29	CHS	Sylvania Electric Products, Inc.	Emporium, Pa.
9	CAMQ	Cambridge Thermionic Corp.	Cambridge, Mass.	30	CUT	United Transformer Corp.	New York, N. Y.
10	CBN	Central Radio Lab. Div. of Globe Union	Milwaukee, Wisc.	31	CV	Weston Electrical Instrument Corp.	Newark, N. J.
11	CMG	Cinch Mfg. Co.	Chicago, Ill.	32	CBIQ	Wilkor Products	Cleveland, Ohio
12	CMC	Clarostat Mfg. Co.	Brooklyn, N. Y.	33	CAYZ	Dial Light Corp.	New York, N. Y.
13	CD	Cornell-Dubilier	South Plainfield, N. J.	34	CAO	Ward Leonard Co.	Mount Vernon, N. Y.
14	CAB	Cutler-Hammer, Inc.	Milwaukee, Wisc.	35	COM	Ohmite Mfg. Co.	Chicago, Ill.
15		Eaton Mfg. Co., Stumping Division	Detroit, Mich.	36		Herzog Miniature Lamp Works	New York, N. Y.
16	CER	Erie Resistor Corp.	Erie, Pa	37	CBIT	Mueller Electric Co.	Cleveland, Ohio
17	CFD	Federal Mfg. & Eng. Corp.	Brooklyn, N. Y.	38	CGF	Gudeman Co.	Chicago, Ill.
18	CHC	Hammerlund Mfg. Co.	New York, N. Y.	39	CFX	Freed Transformer Co.	New York, N. Y.
19	CBEJ	Harnett Electric Corp.	Port Washington, N. Y.	40	CEB	Eby, Hugh, Inc.	Philadelphia, Pa.
20	CARD	Industrial Products Co.	Danbury, Conn.	41	CUR	Reeves-Hoffman Corp.	New York, N. Y.
21	CIR	International Resistance Corp.	Philadelphia Pa.	42	CAYT	Allen Mfg. Co.	Hartford, Conn.
				43		Elastic Tip Co.	

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[AG 413.44 (3 Nov 53)

BY ORDER OF THE SECRETARY OF THE ARMY:

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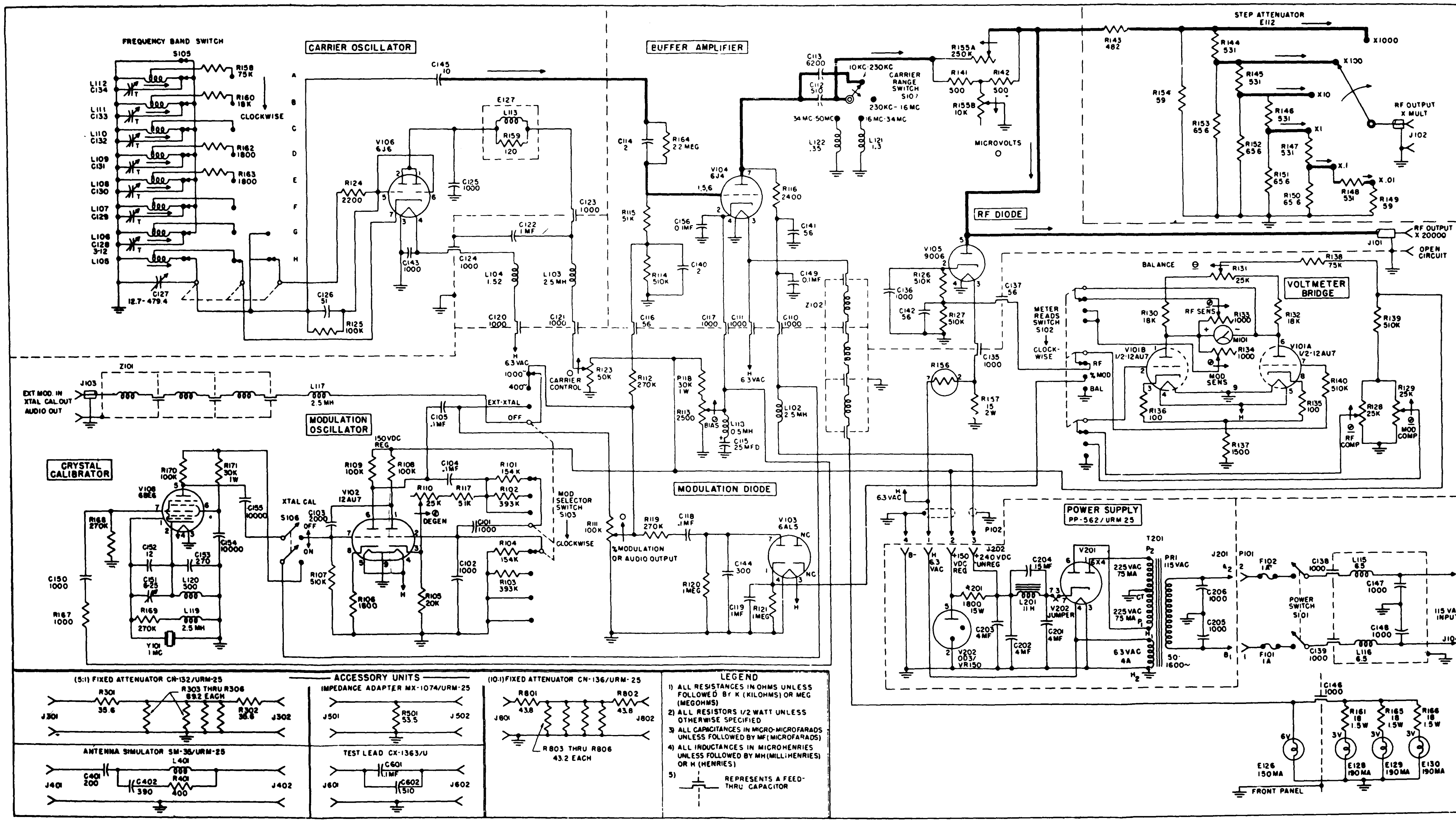
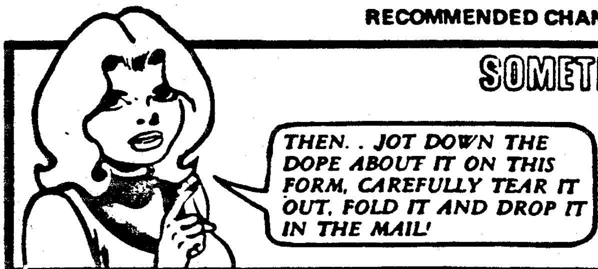


Figure 6-23. RF Signal Generator Set AN/URM-25B, Overall Schematic Diagram.

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



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