Cy #1

NAVSHIPS 93804(B) *(Non-Registered)*

TECHNICAL MANUAL

for

ANTENNA COUPLER

CU-656/U, CU-656A/U

CU-873/U, CU-874/U

THIS SUPERSEDES NAVSHIPS 93804(A)

VORON ELECTRONICS CORPORATION
PHILADELPHIA 18, PENNA.

WESTINGHOUSE ELECTRIC CORPORATION
ELECTRONICS DIVISION
P.O. BOX 1897
FRIENDSHIP PLANT
BALTIMORE 3, MARYLAND

DEPARTMENT OF THE NAVY
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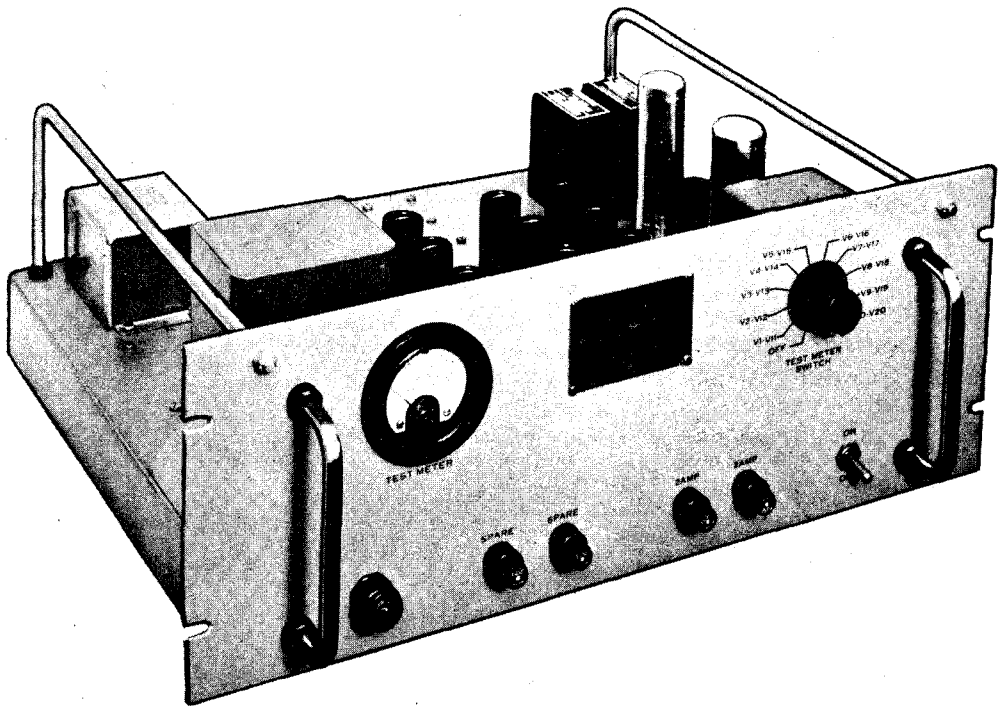


Figure 1-1. Antenna Coupler CU-656/U

SECTION 1

GENERAL INFORMATION

1-1. SCOPE.

This manual covers the description, installation, operation and maintenance for Antenna Coupler CU-656/U, CU-656A/U, CU-873/U, and CU-874/U. Unless otherwise indicated all reference in the manual to Antenna Coupler CU656/U applies equally to Antenna Coupler CU-656A/U, CU-873/U and Antenna Coupler CU-874/U. Antenna Coupler CU-656/U is shown in figure 1-1. Instructions for government furnished materials are not discussed in this manual.

1-2. FUNCTIONAL DESCRIPTION.

Antenna Coupler CU-656/U provides optimum coupling between a single antenna and as many as eight receivers. Design considerations include selection of circuits and cnoice of components providing a low voltage standing wave ratio, a wide frequency range (2.0 mc through 32 mc), a high attenuation of out of band frequencies, a minimum noise figure, minimum intermodulation, a high degree of isolation between individual outputs, an overall power gain and high reliability.

1-3. FACTORY OR FIELD CHANGES.

At the time of this publication no factory or field changes have been accomplished on this equipment.

1-4. QUICK REFERENCE DATA.

a. FREQUENCY RANGE. -Antenna Coupler CU-656/U provides a wide frequency range between the values of 2.0 mc and 32 mc.

b. INPUT AND OUTPUT CHARACTERISTICS. -Antenna Coupler CU-656/U and CU-656A/U have a 70-ohm input and output impedance. A single type C connector located at the rear of the unit provides for the antenna input connection. Eight type C connectors located at the rear of the unit provide for output connections. Antenna Coupler CU-873/U also has a 70-ohm input and output impedance. However, type N connectors are used for input connections and output connections. Antenna Coupler CU-874/U has a balanced 150-ohm input circuit. Two type N connectors provide for the antenna input connection. The output impedance is 72-ohms. Eight type N connectors provide for output connections.

c. NUMBER OF OUTPUTS. -Eight outputs are provided for at the rear of the unit.

d. INTERMODULATION. -The intermodulation products of two 0.25-volt signals applied at the input are down 60 db.

e. ISOLATION OF OUTPUTS. -Minimum isolation between any two outputs is 40 db.

f. GAIN. -Gain to each output is 0 to 3 db.

g. ANTENNA CHARACTERISTICS. -The antenna (GFM) should have a VSWR of less than 3:1 over the band of 2.0 to 32 mc for best performance.

h. AMBIENT TEMPERATURE LIMITATIONS. -The ambient temperature limitations range from -40°C. (-40°F.) to +50°C. (+122°F.)

i. POWER SUPPLY CHARACTERISTICS. -Antenna Coupler CU-656/U requires a voltage supply of 115 ±11.5 volts or 230 ±23 volts, 48 to 62 cps, single phase, 125 watts (approximate).

j. NOISE FIGURE. -Antenna Coupler CU-656/U has a noise figure of 6 db or better.

k. CASCADE OPERATION. -Additional antenna connections may be obtained by connecting the antenna couplers in cascade with a resultant increase in signal gain of 0 to 3 db. The effective noise figure of two cascaded antenna couplers will be 7.7 db or better.

1-5. EQUIPMENT LISTS.

Equipment supplied for the Antenna Coupler CU-656/U are listed in table 1-1. Equipment and publications required but not supplied are listed in table 1-2. Shipping data is provided in table 1-3. Electron tube complement is listed in table 1-4.

TABLE 1-1. ANTENNA COUPLER CU-656/U, EQUIPMENT SUPPLIED

Quant. per Equip.	Nomenclature		Overall Dimensions*			Volume*	Weight*
	Name	Designation	Height	Width	Depth		
1	Antenna Coupler	CU-656/U	$6\frac{31}{32}$	19	$16\frac{1}{2}$	1.27	33
9	▲Connectors	UG-573/U	$\frac{3}{4}$	$\frac{3}{4}$	$1\frac{31}{64}$		
9	◓Connectors	UG-573B/U					
1	Connector	AN3106A-145S-7S	$1\frac{1}{8}$	$1\frac{1}{8}$	$1\frac{7}{16}$		
1	Technical Manual	NAVSHIPS 93804(A)	$11\frac{1}{2}$	9			

* Unless otherwise stated, dimensions are in inches, volume in cubic feet, weight is in pounds.

▲ Supplied only with Antenna Coupler CU-656/U.

◓ Supplied only with Antenna Coupler CU-656A/U.

TABLE 1-2. ANTENNA COUPLER CU-656/U, EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED

Quant. per Equip.	Nomenclature		Required Use	Required Characteristics
	Name	Designation		
1	*Adapter	UG-566/U	Provides for simultaneous connection of signal generator and vacuum-tube voltmeter to ANTENNA INPUT connector J9.	Type C
1	Adapter	UG-107B/U	Provides for simultaneous connection of signal generator and vacuum-tube voltmeter to ANTENNA INPUT connector J9.	Type N
1	RF Signal Generator Set and Technical Manual	AN/URM-25 Series NAVSHIPS 91283	Supplies a test signal for determination of output isolation.	Must generate signals between 2.0 mc and 32 mc.
1	Multimeter and Technical Manual	AN/USM-116 Series or AN/USM-34	Monitors output voltage of RF Signal Generator Sets.	Must measure r-f, a-c and d-c voltages.

*Used only with Antenna Coupler CU-656/U, and CU-656A/U.

TABLE 1-2. ANTENNA COUPLER CU-656/U, EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED (Concluded)

Quant. per Equip.	Nomenclature		Required Use	Required Characteristics
	Name	Designation		
1	Radio Interference Measuring Set and Technical Manual	AN/URM-47 Series NAVSHIPS 92147	Serves as a selective r-f voltmeter.	Must be selective over the 20-mc to 32-mc band.
Up to 8	Radio Receivers			
1	Antenna		To provide input to antenna coupler.	Must operate with a vswr of less than 3:1.

TABLE 1-3. ANTENNA COUPLER CU-656/U, SHIPPING DATA

Box No.	Nomenclature		Overall Dimensions*			Volume*	Weight*
	Name	Designation	Height	Width	Depth		
1	Antenna Coupler	CU-656/U	10	21	19	2.3	40

*Unless otherwise noted, dimensions are in inches, volume in cubic feet and weight in pounds; equipment crated and ready for shipment.

TABLE 1-4. ANTENNA COUPLER CU-656/U, ELECTRON TUBE COMPLEMENT

UNIT	Number of Tubes of Types Indicated		
	6922	OB2WA	TOTAL
Antenna Coupler CU-656/U	20	1	21

1-6. EQUIPMENT SIMILARITIES.

Antenna Couplers CU-656/U, CU-656A/U, CU-873/U and CU-874/U are electrically similar. Antenna Coupler CU-656/U, CU-656A/U and CU-873/U have a 70-ohm input. However, Antenna Coupler CU-874/U has a 150-ohm balanced input. The units are physically similar except that Antenna Coupler CU-656/U and CU-656A/U utilize type-C input connectors and output connectors while Antenna Coupler CU-873/U and CU-874/U utilize type-N input connectors and output connectors.

1-7. CLASSIFIED INFORMATION.

This technical manual contains no classified information.

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING.

This unit has been packed at the factory and prepared for domestic shipment. This equipment should be stored in an upright position. Care should be exercised while unpacking and handling to prevent damage. No special tools are required to open the packing case.

CAUTION

DO NOT USE HOOKS WHILE HANDLING THIS UNIT. DO NOT REMOVE THE PROTECTIVE PACKING AROUND THE CONTROLS AND METER UNTIL THE UNIT HAS BEEN SECURED.

2-2. POWER REQUIREMENTS.

Antenna Coupler CU-656/U requires 115 volts or 230 volts, 50 to 60 cps, single phase, 125 watts (approximate).

2-3. INSTALLATION LAYOUT.

The unit is designed to be placed in a standard 19 inch rack. The choice of location is not critical but it is advisable that the unit be at a distance from any high power equipment. The outline drawings for Antenna Couplers CU-656/U, CU-873/U and CU-874/U are shown in figures 2-1 through 2-3 respectively.

2-4. INTERCONNECTION.

Interconnections of this unit are shown in figure 2-4. It should be noted that no terminating caps are required on the output connectors in the event that less than the maximum number of receivers are used (eight receivers). All connections should be made carefully in order to obtain maximum coupling.

2-5. CABLE ASSEMBLY.

a. The interconnection diagram, figure 2-4 shows the type of coaxial connector termination necessary for all coaxial cable interconnection. For proper assembly of connectors to coaxial cables, follow the procedures in Armed Forces Index of R. F. Transmission Lines and Fittings, NAVSHIPS 900102B.

b. The termination of the power cable is accomplished in the following procedure:

Step 1. Determine the radius on which the conductors are to be fanned out and cut away armor and outer cover to a distance of the fanning plus approximately 0.75 inches.

Step 2. Slide on the cable clamp, brass nickel plated washer, rubber washer, back shell and retainer ring in successive order.

Step 3. Put leads through the holes in the socket rear insert.

Step 4. Strip wires to the exact length of the soldering section of the socket contact and solder in place.

Step 5. Attach the socket front insert and the front shell.

Step 6. Screw the cable clamp and back shell together.

Step 7. Attach the cable clamp cap to the cable clamp by means of the clamp screw and lock washers.

NOTES

1 WEIGHT: 33 LBS.
2 POWER INPUT: 115V OR 230V, 48-62CPS, SINGLE PHASE, 125 WATTS APPROX.
3 AMBIENT TEMP. RANGE: -40°C TO +50°C
-40°F TO +122°F
4 HEAT DISSIPATION: 125 WATTS
5 ALL DIMENSIONS ARE IN INCHES

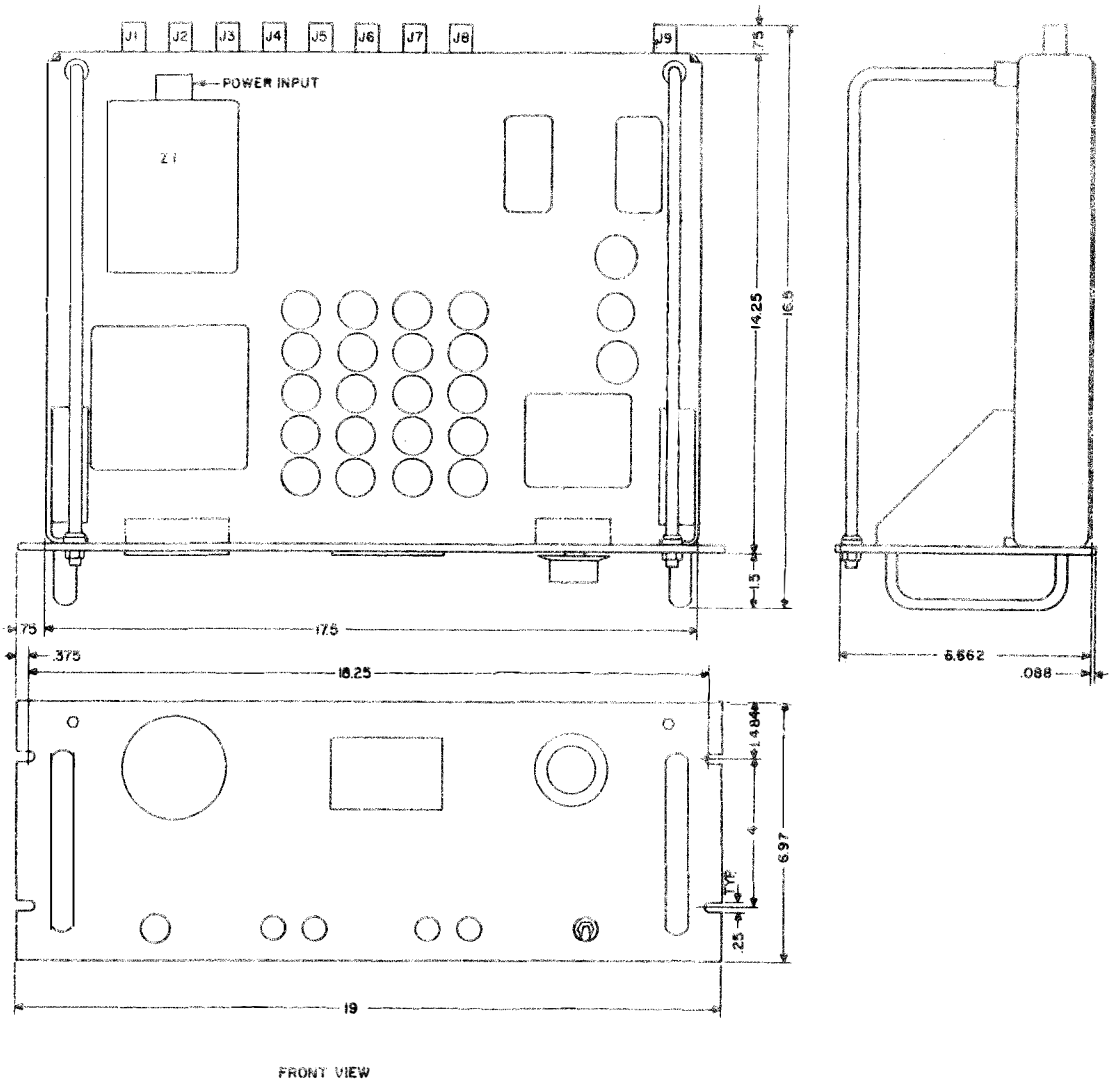


Figure 2-1. Antenna Coupler CU-656/U, CU-656A/U Outline Drawing

NOTES

1. WEIGHT: 33 LBS.
2. POWER INPUT: 115V OR 230V, 48-62CPS, SINGLE PHASE, 125 WATTS APPROX.
3. AMBIENT TEMP. RANGE: -40°C TO +50°C
   -40°F TO +122°F
4. HEAT DISSIPATION: 125 WATTS
5. ALL DIMENSIONS ARE IN INCHES

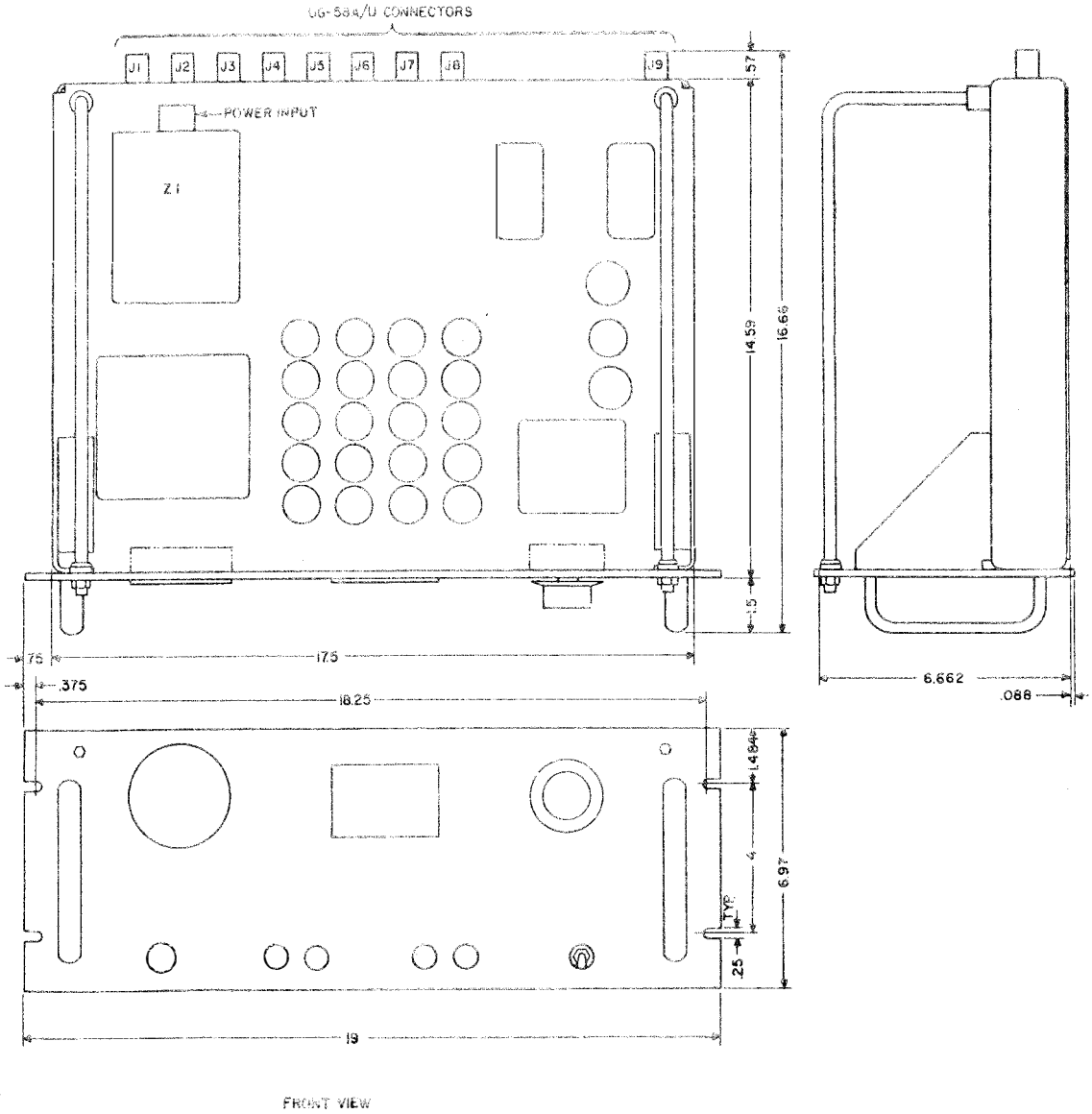


Figure 2-2. Antenna Coupler CU-873/U, Outline Drawing

NOTES

1. WEIGHT: 33 LBS.
2. POWER INPUT: 115V OR 230V, 48-62CPS, SINGLE PHASE, 125 WATTS APPROX.
3. AMBIENT TEMP. RANGE: -40°C TO +50°C
   -40°F TO +122°F
4. HEAT DISSIPATION: 125 WATTS
5. ALL DIMENSIONS ARE IN INCHES

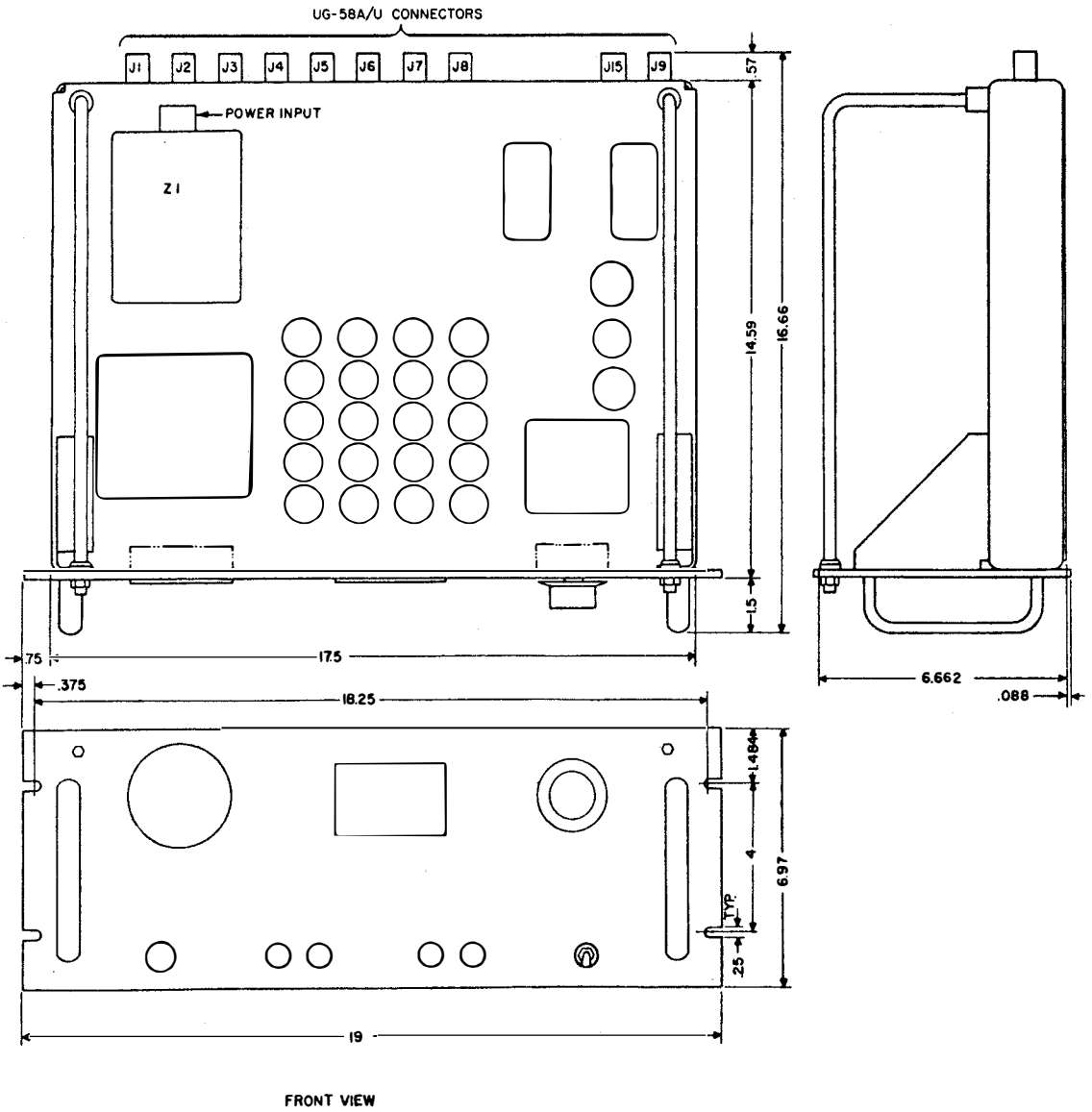


Figure 2-3. Antenna Coupler CU-874/U, Outline Drawing

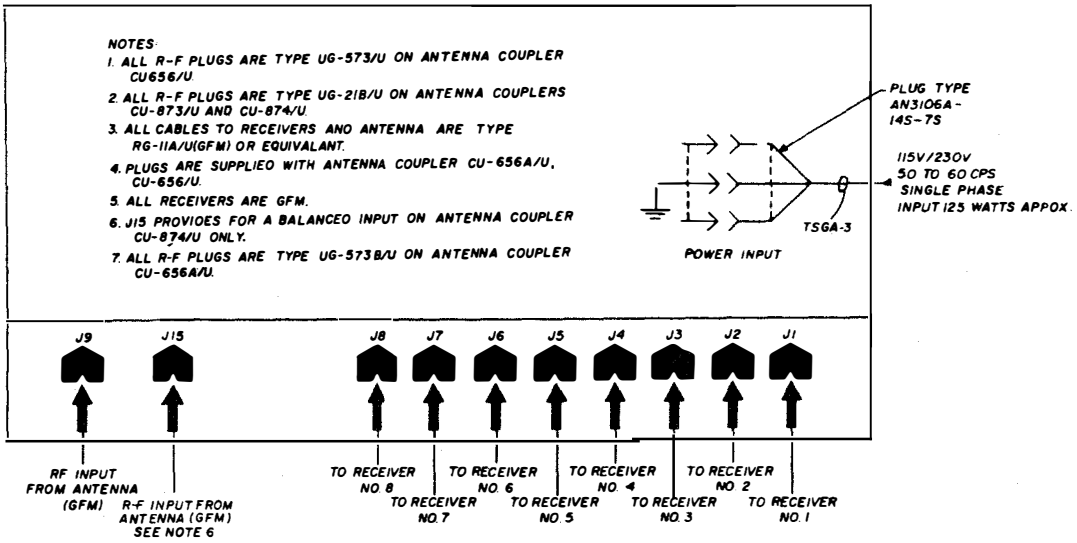


Figure 2-4. Antenna Coupler CU-656/U, Interconnection Diagram

2-6. INSPECTION AND ADJUSTMENTS.

a. Before inspection make sure that the unit is deenergized. Then make the following inspections.

Step 1. Check all coaxial cables to see whether they are in the proper connector and that all connections are secure.

Step 2. Check the ON-OFF switch and the TEST METER SWITCH for damage and the TEST METER for a broken glass cover or signs of damage. Make sure that the two fuses on the front panel and the indicating lamp are intact and not open.

Step 3. Check all tubes for signs of damage and proper seating in sockets.

b. Set for proper line voltage by use of the 115/230-volt jumper.

2-7. INTERFERENCE REDUCTION.

In order to reduce interference the unit should be moderately shielded and located at a distance from high power equipment.

2-8. PREPARATION FOR RESHIPMENT.

Disconnect all external connections. Remove all connectors from the coaxial cables and power cord. Place the connectors in a bag and tie it to the chassis. Place unit in container along with the two technical manuals; add packing material to prevent the unit from shifting and seal the container.

SECTION 3

OPERATOR'S SECTION

3-1. FUNCTIONAL OPERATION.

Antenna Coupler CU-656/U can provide optimum coupling between a single antenna and as many as eight receivers. Additional antenna connections may be obtained by connecting the antenna couplers in cascade. No operating procedure other than energizing the unit is required. Each of the eight receivers (GFM) may be tuned to any frequency within the pass band (2.0 mc to 32 mc) of the antenna coupler. Due to a design feature of this unit, terminating caps on the output terminals are not required if less than eight outputs are used.

3-2. OPERATING PROCEDURE.

a. DESCRIPTION OF CONTROLS. -The function of the various controls and connectors located on the Antenna Coupler CU-656/U are tabulated in table 3-1. Location of the various controls and connectors are shown in figure 3-1.

TABLE 3-1. ANTENNA COUPLER CU-656/U, FUNCTION OF CONTROLS

NAME	FUNCTION
ON-OFF (Switch)	Applies 115/230-volts a-c power to Antenna Coupler CU-656/U when placed in the ON position.
ON (Lamp)	Lights to indicate that power is applied to the unit.
2 AMP (Fuse)	Protects primary winding of transformer T11.
ANTENNA INPUT (Connector)	Input connection for 70-ohm antenna.
*ANTENNA INPUT BALANCED (Connectors)	Balanced input connection for 150-ohms antenna.
OUTPUTS 1-8 (Connectors)	Output connections for as many as eight receivers.
TEST METER SWITCH	V1-V11 through V10-V20 positions: applies the self-bias voltage of the named tubes to the TEST METER. B+ position: applies power supply output voltage to the TEST METER.
TEST METER	Monitors either the self-bias voltages of the cascode amplifier or the power supply output voltage depending on the position of the TEST METER SWITCH.

*USED ON ANTENNA COUPLER CU-874/U ONLY.

b. OPERATION. -Normal operation requires only that the unit be energized by placing the ON-OFF switch in the ON position.

c. TUNING ADJUSTMENTS. -There are no tuning adjustments.

3-3. SUMMARY OF OPERATING PROCEDURES.

Energize the unit by placing the ON-OFF switch in the ON position. Periodically record readings on the TEST METER through all positions of the TEST METER SWITCH.

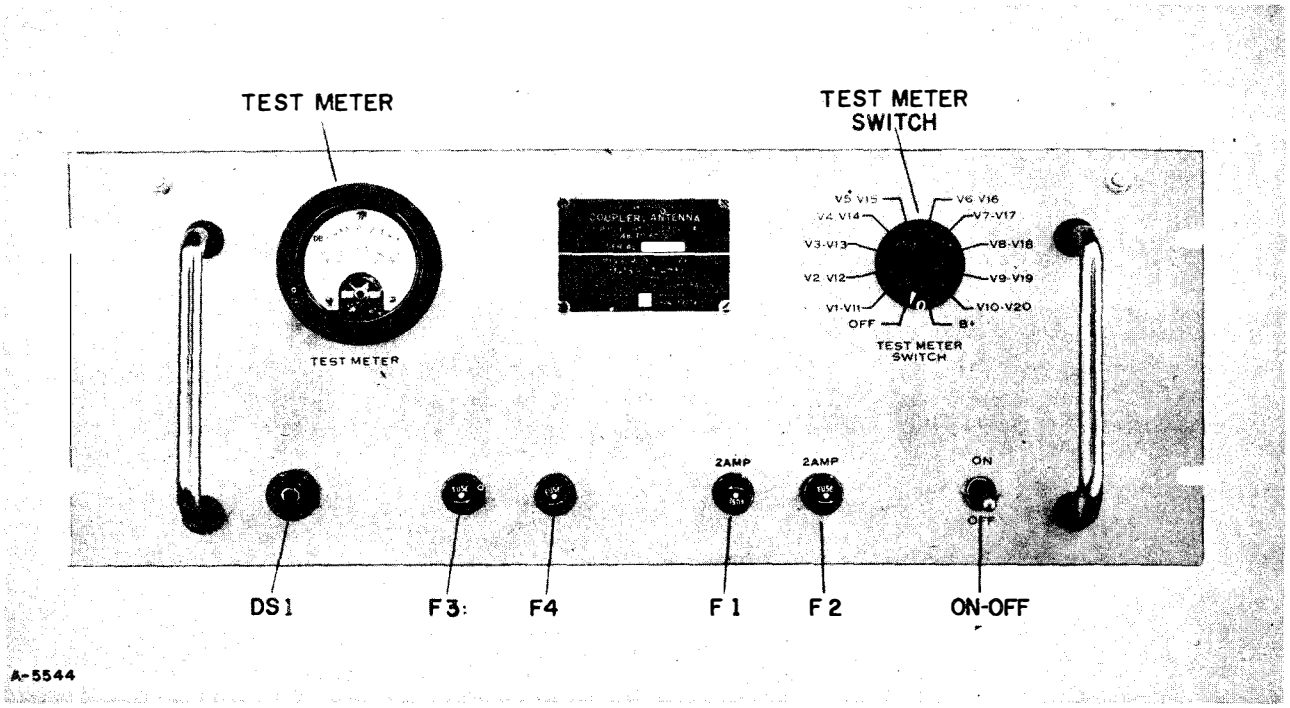


Figure 3-1. Antenna Coupler CU-656/U, Location of Controls

3-4. EMERGENCY OPERATION.

In the event of tube failure, rotate the TEST METER SWITCH through positions V1-V11 through V-10-V20 to locate the defective stage. Remove one of the two tubes which relate to the particular stage and replace with one known to be good. If stage is still defective, replace the tube removed, and interchange the new tube with the second tube of the stage. For example: if the TEST METER SWITCH indicated that the defective stage is V2-V12, remove tube V2 and replace with a new tube. Then, if necessary, return the old V2 to its socket and replace V12 with the new tube. Location of tubes are shown in figure 3-2.

3-5. OPERATOR'S MAINTENANCE.

a. GENERAL. - All tubes can be removed, checked and replaced if necessary. Fuses can be checked and replaced if necessary. If the TEST METER readings are logged periodically many troubles can be located before the unit is rendered inoperative.

b. OPERATING CHECKS AND ADJUSTMENTS. - It is recommended that certain routine checks be performed by the operating personnel as part of the operational maintenance program. The TEST METER SWITCH should be periodically placed in each of the eleven monitoring positions and corresponding indications on the TEST METER observed and recorded. The indications for positions V1-V11 through V10-V20 should be 33 ±3 microamperes, and the indication in the B+ position should be 28 ±3 microamperes. Upon completion of the prescribed checks, the results should be logged. These entries are of prime importance for they indicate whether or not the equipment is operating at maximum efficiency. Comparison of a given reading with previous readings will quickly reveal any significant change. It is expected that the reading will show nominal variations from time to time. This does not necessarily mean that the unit is operating improperly. If, however, a particular reading varies progressively in the same direction every time a check is made, it is an indication of improper operation or impending failure; and corrective measures should be taken.

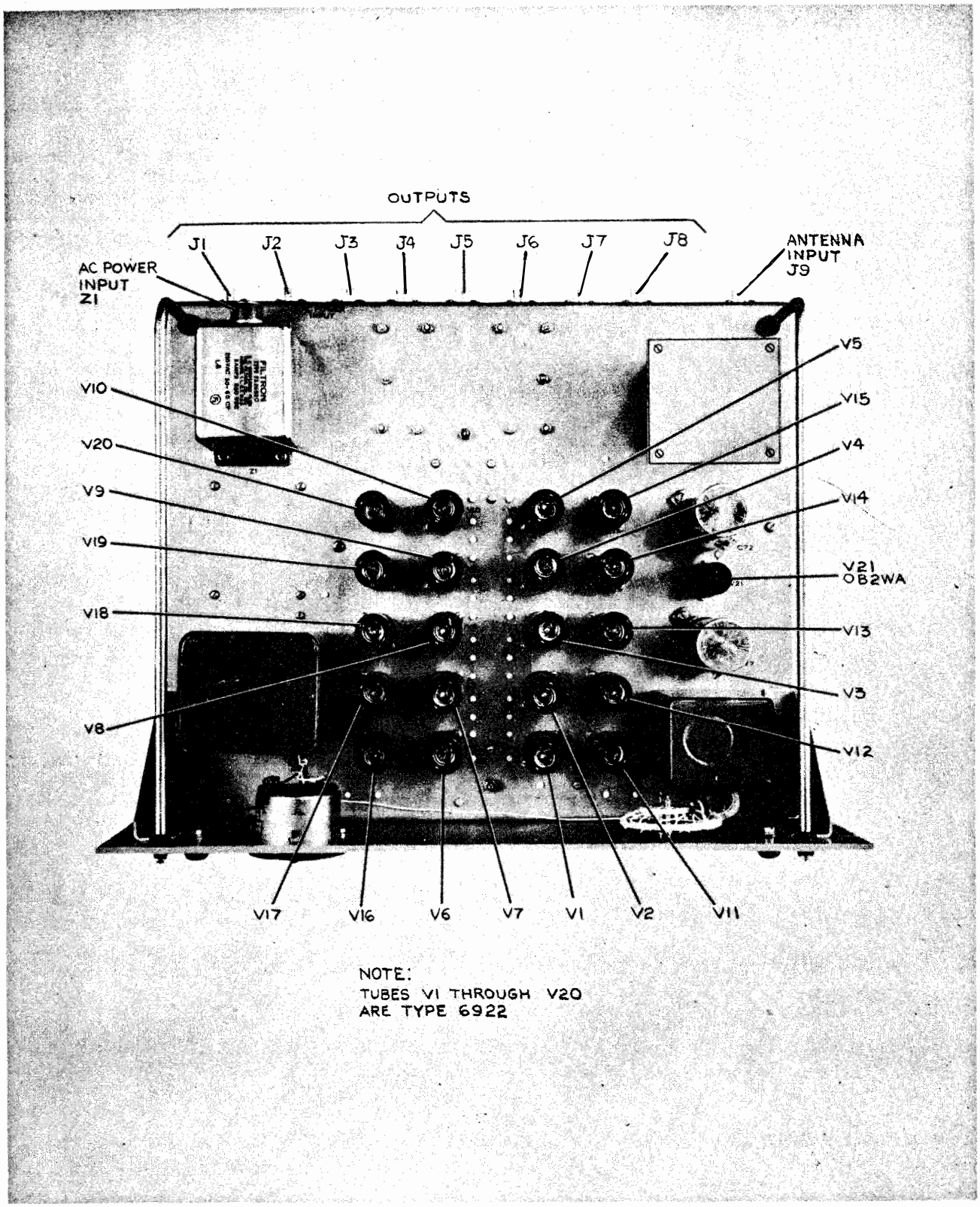


Figure 3-2. Antenna Coupler CU-656/U, Location of Tubes and Connectors

c. EMERGENCY MAINTENANCE. - The various emergency maintenance operations are tabulated in table 3-2.

TABLE 3-2. OPERATOR'S MAINTENANCE

MALFUNCTION	INDICATION	REMEDY
Power Failure	ON light is not illuminated. No power to receiver.	1. Check power at the source. 2. Check ON lamp. Replace if necessary. 3. Place ON-OFF switch in OFF position. 4. Check fuses on front panel. Replace if necessary with same value fuse.
Tube Failure	TEST METER reading varies progressively in one direction.	1. Locate defective stage by use of the TEST METER SWITCH. 2. Replace each tube, in turn, with a new tube. See paragraph 3-4.

SECTION 4

PRINCIPLES OF OPERATION

4-1. OVERALL FUNCTIONAL DESCRIPTION.

Antenna Coupler CU-656/U is designed to provide optimum coupling between a single antenna and as many as eight receivers in communications systems. Additional outputs are possible by connecting antenna couplers in cascade. A functional block diagram of the Antenna Coupler CU-656/U is shown in figure 4-1. Antenna Couplers CU-656/U, CU-656A/U and CU-873/U provide a 70-ohm impedance to match a 70-ohm antenna. Antenna Coupler CU-874/U provides a balanced 150-ohm input impedance to match a 150-ohm antenna. From the input connector the signal is fed to low pass-high pass filters. These filters pass only the frequencies in the spectrum between 2.0 mc and 32 mc. Transformer T1 in the output circuit of the low pass-high pass filters provides a transition between the low impedance unbalanced input circuits and a relatively high impedance balanced line. Each side of the balanced line drives one section of the push-pull distributed amplifier.

Tubes V1 through V5, tubes V11 through V15 and their associated circuitry comprise one-half of the push-pull distributed amplifier. Tubes V6 through V10, tubes V16 through V20 and their associated circuitry comprise the other half of the push-pull distributed amplifier. The distributed amplifier sections employ cascode stages along artificial transmission lines to obtain amplification over a wide bandwidth. The cascode amplifiers aid in reducing intermodulation by minimizing odd harmonic distortion. Additionally, employement of the distributed amplifier results in an improved signal-to-noise ratio. The distributed amplifier sections drive transformer T2 in a push-pull manner, thereby reducing intermodulation by minimizing even harmonic distortion. The resulting signal developed across the secondary winding of transformer T2 is applied to a cascaded hybrid network which distributes the amplified signal to eight isolated outputs.

4-2. DISTRIBUTED AMPLIFIER.

a. A low-loss artificial transmission line (consisting of odd numbered inductors L1 through L21 and odd numbered capacitors C41 through C59) is connected in the grid circuits of cascode amplifiers V1 through V5. The odd numbered capacitors C41 through C59 are shunted by the interelectrode capacitance from grid-to-cathode of the respective tube sections. The value of the inductors, and capacitors and the interelectrode capacitance from grid to cathode determines the impedance and cut-off frequency of the line. Resistor R93 terminates the line in its characteristic impedance. Capacitor C62 provides an r-f ground for the termination and d-c isolation for the grid circuits. A second low-loss artifical transmission line is formed in the plate circuit of the cascode amplifier by making use of their plate-to-cathode capacitance and inductors L27 through L37. Since the transmission lines are designed to have identical velocities of propagation, the individual sections of each transmission line shift the phase of signals equal amounts. The input signal appearing across the balanced secondary winding of transformer T1 is propagated along the artificial transmission line located in the grid circuits of the cascode amplifiers. As the signal arrives at the grids of each stage it influences the plate current of the tubes, resulting in the transmission of the signal in both directions along the plate artificial line. Waves traveling in the reverse direction are absorbed by terminating resistor R92. Waves traveling in the forward direction tend to add in phase. As a result the signal voltage at the output, which is equal to the sum of the in-phase signals, is proportional to the number of cascode amplifier stages; therefore, the signal power is proportional to the square of the number of cascode amplifier stages.

b. The signal-to-noise ratio is improved in the following manner. Noise due to shot effect is independently generated within each tube. The resulting noise voltages appearing along the plate artifical line add randomly; hence, the total noise power is proportional to the number of tubes. Since the output signal power is proportional to the square of the number of tubes, there is an overall improvement in noise figure over that of a single section. As a result, the distributed amplifier improves the signal-to-noise ratio.

c. Since the circuits of the five push-pull distributed amplifier sections shown in figure 6-1 are identical, only the section consisting of tubes V5, V15, V10, V20 and their associated circuits will be discussed. A simplified schematic of the fifth section of the distributed amplifier is shown in figure 4-2.

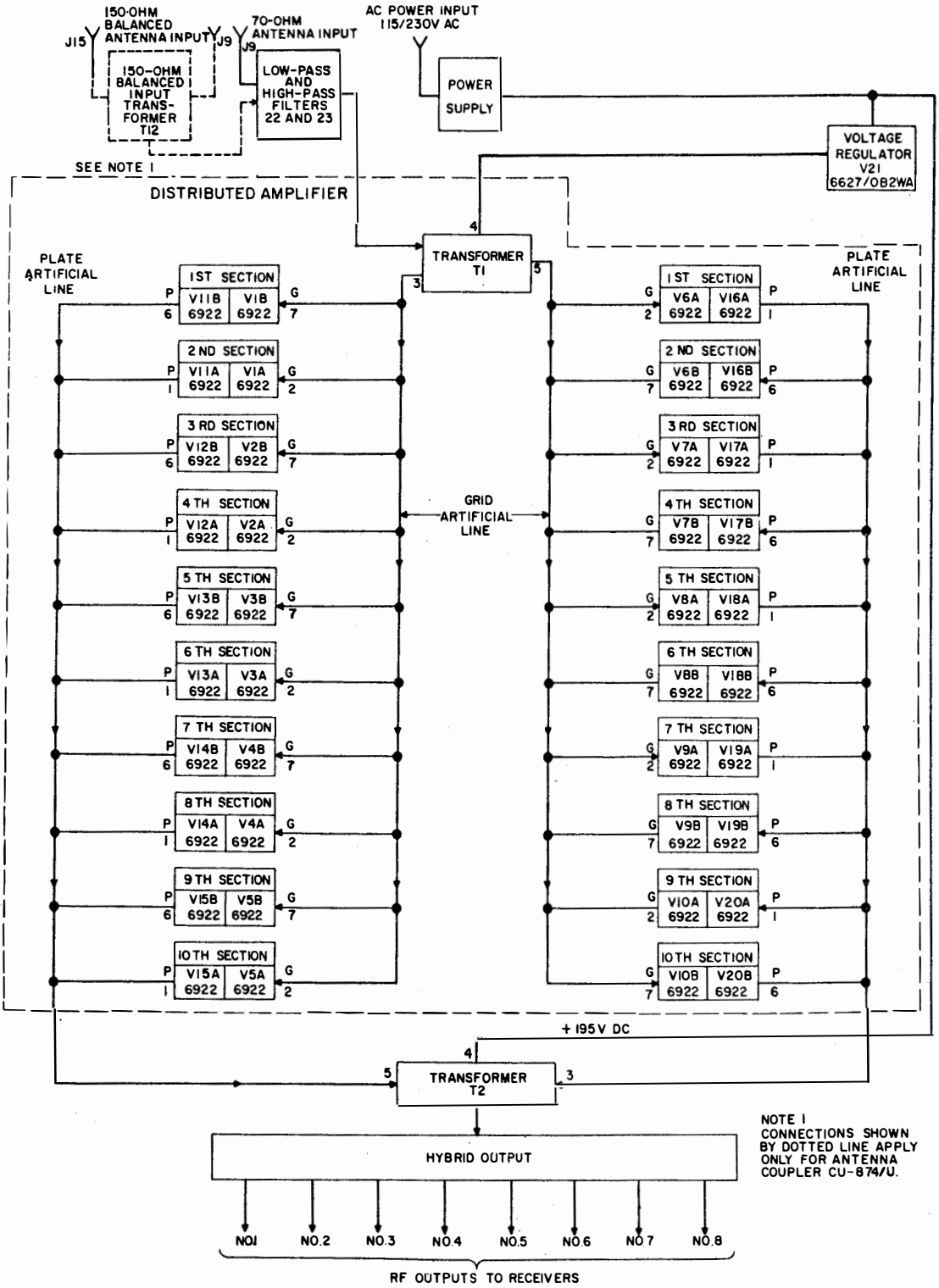


Figure 4-1. Antenna Coupler CU-656/U, Functional Block Diagram

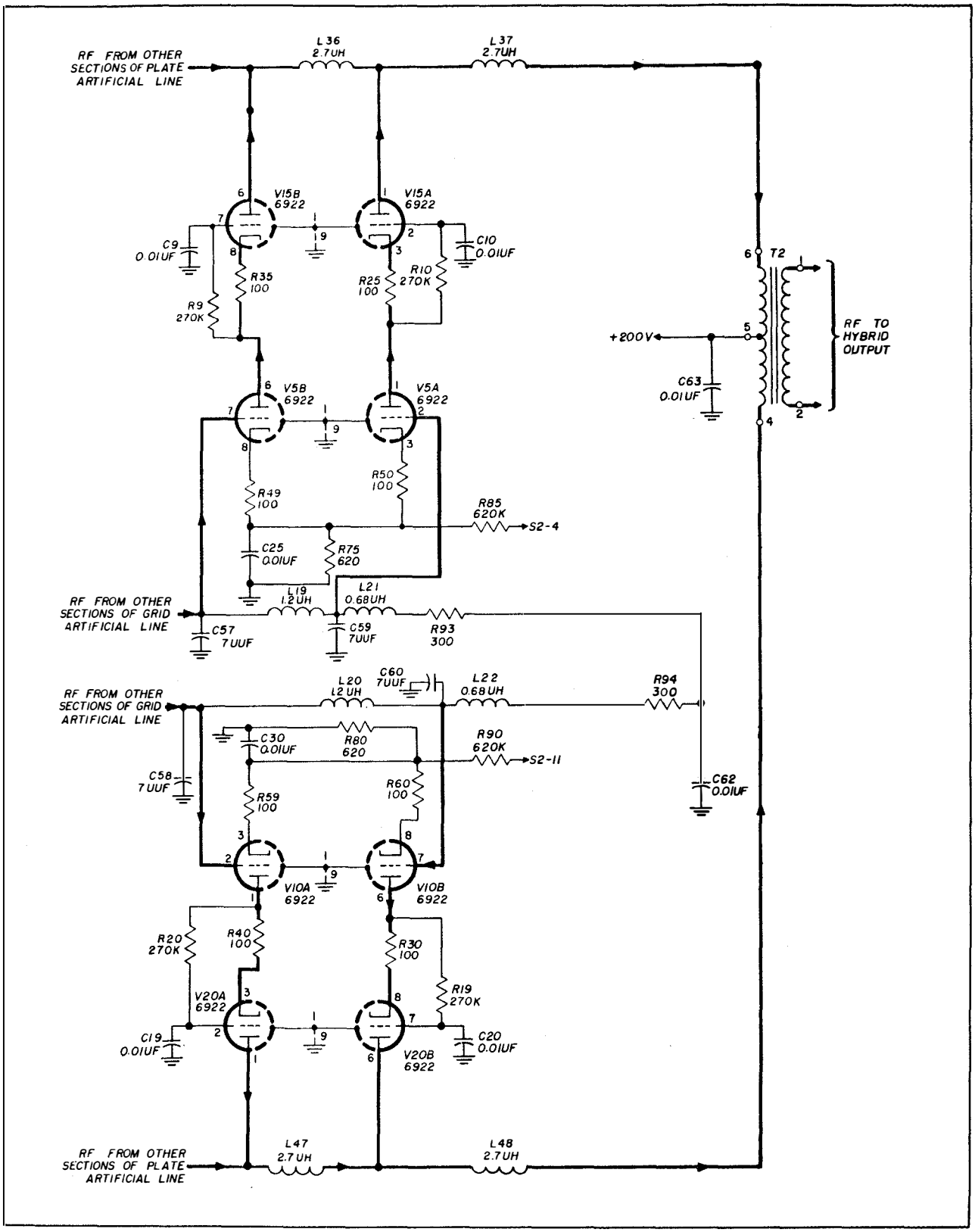


Figure 4-2. Antenna Coupler CU-656/U, Distributed Amplifier Simplified Schematic Diagram

d. Tubes V5 and V15 function as a cascode amplifier. Negative feedback, which increases linearity of the cascode amplifier, is introduced by resistors R49 and R50, located in the cathode circuit of V5. The quiescent operating point of V5 is stabilized by employing a combination of self bias and fixed bias. The fixed bias, applied in opposition to the self bias, allows the use of a self-bias resistor with a relatively high value. The self bias is developed by the paralleled circuit consisting of capacitor C25 and resistor R75. Due to the relatively high resistance of R75, a change in quiescent current is opposed by the consequent bias developed across the resistor. The operation of the preceding stages are identical to that of V5 and V15. Tubes V10 and V20 complete the push-pull circuit of the fifth section distributed amplifier and are identical in operation to tubes V5 and V15. The output is developed across transformer T2 for coupling to the hybrid output.

4-3. OUTPUT CIRCUITS.

a. The outputs are taken from a transformer hybrid resistive terminated network. For clarity, the circuit components of the hybrid output are rearranged into a bridge-bridge network as shown in figure 4-3.

b. The plate artificial lines of each of the distributed amplifier sections provide a push-pull drive for transformer T2. The resulting signal appears across the secondary winding of transformer T2 and is applied to a cascaded hybrid network which effect a power division of eight outputs with a high degree of isolation. The cascaded hybrid is comprised of both resistance hybrids (Wheatstone bridges) and transformer hybrids. Resistors R101 and R102 each serve as an arm of the primary bridge network. Resistor R100 serves as a balance termination. The remaining two arms contain the secondary bridge networks. Resistors R95 and R98 each serve as an arm and resistor R97 serves as the balance termination in one secondary bridge network. The remaining arms of this secondary bridge network are each comprised of a two-core type transformer hybrid. One transformer hybrid consists of transformers T3 and T4 and resistor R99 which serves as the balance termination. The other transformer hybrid consists of transformers T5 and T6 and resistor R96 which serves as the balance termination. The other secondary bridge network has resistors R103 and R106 each serving as an arm and resistor R105 which serves as the balance termination. The remaining two arms are each comprised of a two-core type transformer hybrid. One transformer hybrid contains transformers T7 and T8 and resistor R107 as the balance termination, the other contains transformers T9 and T10 and resistor R104 as the balance termination. The power available at each output is 15 db below the power input. The division of power to eight outputs accounts for a 9-db loss, and a 6-db power loss occurs in the two links of resistance bridges. Each of the eight output circuits has a nominal impedance of 70 ohms. Coils L49, L50, L51, and L52 add inductance to their respective hybrid circuits to maintain the correct impedance matching in the frequency band of 28 to 32 mc. Below 28 mc the inductance of these coils is too small to have any affect on the circuit.

4-4. MONITORING CIRCUITS.

a. Antenna Coupler CU-656/U incorporates circuitry which may be used to monitor the cathode current of each pair of cascode amplifiers and the output voltage of the power supply. The monitoring circuitry consists of TEST METER (M1), the 12-position TEST METER SWITCH (S2), meter multipliers R81 through R90, meter multiplier R115 and a voltage monitoring resistor R114.

b. When the TEST METER SWITCH is placed in any one of the positions V1-V11 through V10-V20, the self-bias voltage developed by the respective amplifier is indicated on the TEST METER. When the TEST METER SWITCH is placed in the B+ position, the relative power supply output voltage is indicated on the TEST METER.

4-5. POWER SUPPLY.

The power supply requires an input of 115 volts or 230 volts, 50 to 60 cps, single phase. The a-c voltage appearing across the secondary winding of transformer T11 is rectified by metallic rectifiers CR1 through CR4 which are connected as a full-wave bridge circuit. The d-c output voltage is applied to an L-section filter consisting of inductor L26 and capacitor C72, which attenuates the a-c ripple component. Voltage regulator V21 maintains a regulated voltage across the voltage divider network, consisting of resistors R110 and R111, which supplies a positive bias voltage of approximately 20 volts dc to the grids of cascode amplifiers V1 through V10.

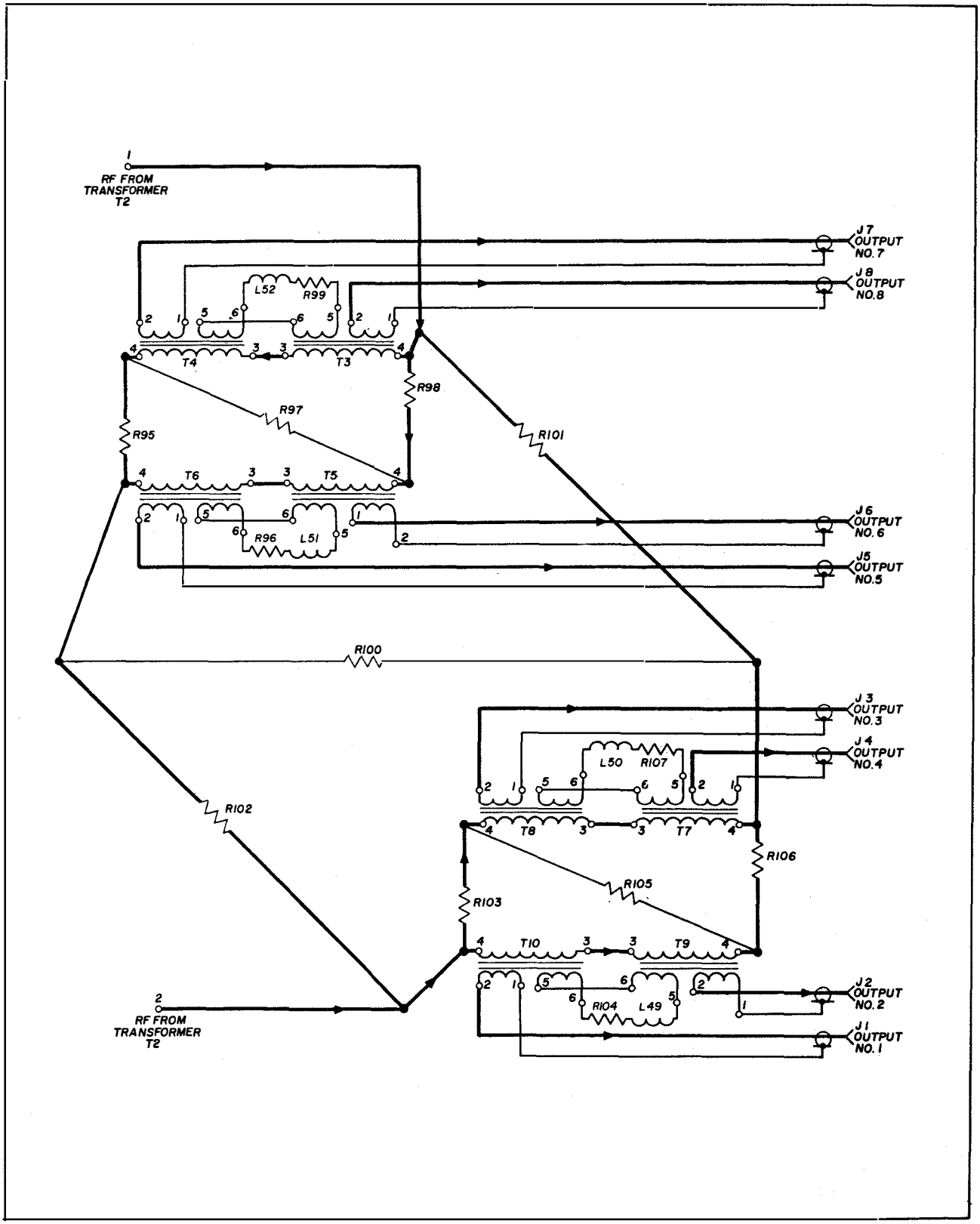


Figure 4-3. Antenna Coupler CU-656/U, Hybrid Output Simplified Schematic Diagram

SECTION 5

TROUBLESHOOTING

5-1. GENERAL.

a. This section presents troubleshooting procedures for Antenna Coupler CU-656/U. In order to aid the technician in localizing troubles quickly the following tables are included:

Table 5-1. Troubleshooting Chart.
Table 5-2. Voltage and Resistance Chart.
Table 5-3. Typical Troubles.

b. The most practical method of localizing troubles in this unit is to use the troubleshooting chart. This chart reveals the preliminary action and normal indication along with the next step. If an abnormal condition is encountered during the outlined procedure, the corrective active can be taken without further reference.

c. A system of test points has been established to facilitate troubleshooting. The test points are shown on the overall schematic figure 6-1, and the physical locations are shown in figure 5-1. The test points fall in two categories: major and secondary. Each major test point is identified by an encircled Arabic numeral enclosed in a star. Starred numerals are used to identify points for checking overall performance including the signal input and output terminals. Each secondary test point is identified by an encircled capital letter. Circled letters are used to identify circuit supply voltage terminals and points for measuring gain.

5-2. TEST EQUIPMENT AND SPECIAL TOOLS.

No special tools are necessary for troubleshooging the antenna coupler. Although specific types of equipment are listed here, the troubleshooting can be accomplished with the use of other test equipment. These specific test equipments are listed because they fall in the category of standard Navy test equipments that are located at most naval locations. The recommended test equipments are:

1. RF Signal Generator Set AN/URM-25 Series (or equivalent).
2. Multimeter AN/USM-116 Series (or equivalent), AN/USM-34 perferred.
3. Radio Interference Measuring Set AN/URM-47 Series (or equivalent).
4. Adapter UG-566/U for use on Antenna Coupler CU-656/U.
5. Adapter UG-107B/U for use on Antenna Couplers CU-873/U and CU-874/U.
6. 20-ohm resistors.

5-3. TROUBLESHOOTING.

a. PRELIMINARY CHECK. -Improper operation of electronic equipment can often be quickly located by visual inspection. Antenna Coupler CU-656/U is equipped with an ON light that should be lighted when the unit is operating. By rotating the TEST METER SWITCH (S2) through its various positions and observing TEST METER (M1), a quick check of all the stages can be made.

b. TEST EQUIPMENT AND SPECIAL TOOLS. -Test equipment and special tools are listed in paragraph 5-2.

c. CONTROL SETTINGS. -The only control required to be set is the ON-OFF switch which is placed in the ON position.

d. TROUBLESHOOTING CHART. - The chart in table 5-1 is a systematic check to be used when trouble arises. The test points appearing in the column marked TEST POINTS are located on figure 5-1.

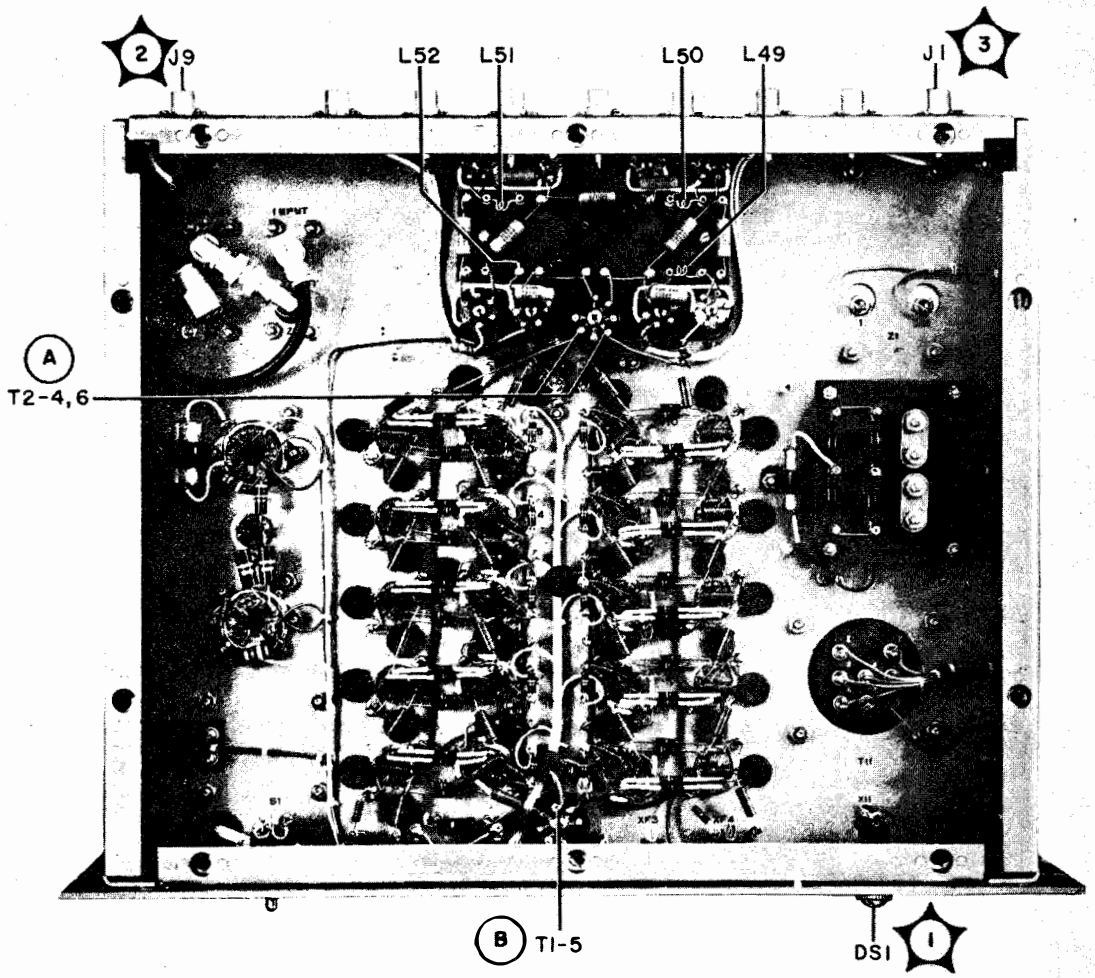


Figure 5-1. Antenna Coupler CU-656/U, Location of Test Points

TABLE 5-1. ANTENNA COUPLER CU-656/U, TROUBLESHOOTING CHART

STEP	TEST POINT	PRELIMINARY ACTION	NORMAL INDICATION	NEXT STEP
1	①	Place ON-OFF switch (S1) in the ON position.	Red indicator light should be lighted.	If not lighted check lamp (DS1) and fuses (F1, F2) on front panel.
2		Rotate TEST METER SWITCH (S2) through all positions.	TEST METER should indicate 33 ±3 ma for positions V1-V11 through V10-V20 and 28 ±3 ma for position B+.	If reading are not normal, check the tubes indicated by TEST METER SWITCH (S2). Refer to table 5-2 for voltage and resistance chart.
3	②	Make the test set-up shown in figure 5-2. Set frequency on the signal generator set to 32 mc and adjust output voltage of signal generator to read 0.1 volt on multimeter.		
4	③	Remove multimeter from Adapter Connector UG-566/U. Connect the multimeter to measure the voltage at OUTPUT NO. 1 jack J1.	Multimeter should read from 0.1 volt to 0.126 volts for Antenna Coupler CU-874/U. Multimeter should read from 0.103 to 0.105 volts for Antenna Couplers CU-656/U and CU-873/U.	If gain is very low check corresponding hybrid transformer.
5		Repeat step 4 for OUTPUT NO. 2 J2 through OUTPUT NO. 8 J8.	Same as step 4.	Same as step 4.
6	(A)	Repeat step 3. Disconnect multimeter from adapter and connect it to measure voltage between pins 4 and 6 of transformer T2 and ground.	Readings on multimeter should be between 0.5 volts and 0.63 volts for Antenna Coupler CU-874/U and between 0.515 volts and 0.525 volts for Antenna Couplers CU-656/U and CU-873/U.	
7	(B)	Disconnect all test equipment. Connect multimeter test probe between pin No. 5 of transformer T1 and ground.	Multimeter reading should be +19 volts dc.	High voltage indicates bad voltage regulator tube. Low voltage indicates trouble in the power supply.

TABLE 5-2. ANTENNA COUPLER CU-656/U, VOLTAGE AND RESISTANCE CHART

TUBE SOCKET		TUBE SOCKET PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
XV-1	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-2	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-3	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-4	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-5	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-6	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-7	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-8	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-9	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-10	V	+85	+20	+21	6.3AC	0	+85	+20	+21	0
	R	∞	57K	780	0	0	∞	57K	780	0
XV-11	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0
XV-12	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0
XV-13	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0
XV-14	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0
XV-15	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0
XV-16	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0
XV-17	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0
XV-18	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0
XV-19	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0

TABLE 5-2. ANTENNA COUPLER CU-656/U, VOLTAGE AND RESISTANCE CHART (Concluded)

TUBE SOCKET		TUBE SOCKET PIN NUMBERS								
		1	2	3	4	5	6	7	8	9
XV-20	V	+180	+65	+85	0	6.3AC	+180	+65	+85	0
	R	24K	∞	∞	0	0	24K	∞	∞	0
XV-21	V	+105	+0.8	NC	+0.8	+105	+0.8*	+0.8	N/A	N/A
	R	20K	130	∞	130	20K	30K*	130	N/A	N/A

*Before making measurements be sure that TEST METER SWITCH S2 is not in the B+ position. TEST METER M1 will be damaged should the switch be in the B+ position.

CONDITIONS

1. Voltages measured with no signal input.
2. Resistances measured with all external leads removed.
3. All voltages and resistances measured with Multimeter AN/USM-116 series or equivalent.

TABLE 5-3. ANTENNA COUPLER CU-656/U, TYPICAL TROUBLES

TROUBLE	NATURE OF TROUBLE	SYMPTOMS
Low output at a specific frequency.	Receiver outside pass band of antenna circuits.	Low signal to noise ratio-in receiver.
No output from any channel.	Fuse (F1 or F2) defective. Filter capacitor shorted.	Pilot lamp and tubes not lighted.

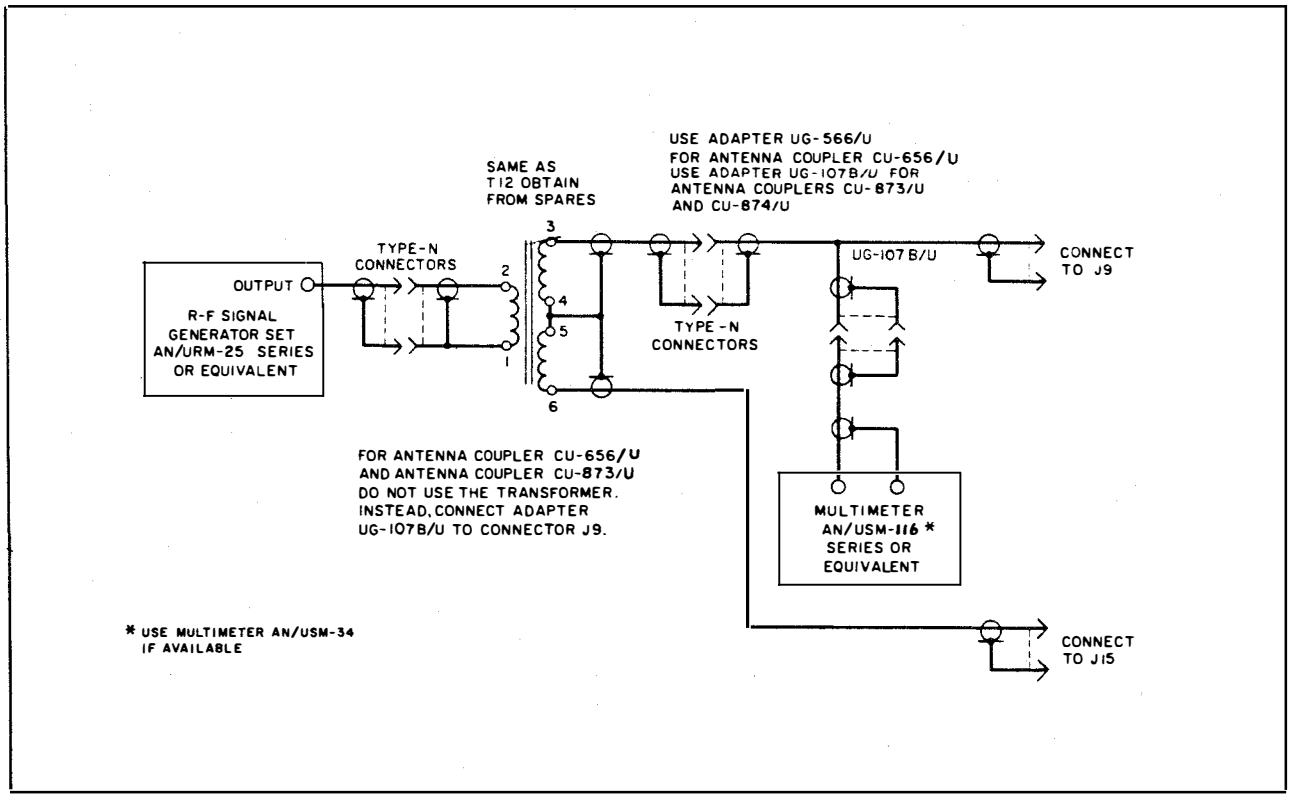


Figure 5-2. Antenna Coupler CU-656/U, Test Set-Up.

SECTION 6

REPAIR

6-1. FAILURE REPORT

Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment identification plate), and the type number and reference designation of the particular defective part (from the technical manual). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember-there are two sides to the failure report.

YOUR SIDE	BUREAU SIDE
Every FAILURE REPORT is a boost for you:	The Bureau of Ships uses the information to:
1. It shows that you are doing your job.	1. Evaluate present equipment.
2. It helps make your job easier.	2. Improve future equipment.
3. It insures available replacements.	3. Order replacements for stock.
4. It gives you a chance to pass your knowledge to every man on the team.	4. Prepare field changes. 5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest District Publications and Printing Office.

6-2. OUTPUT ISOLATION MEASUREMENT.

a. GENERAL. -The following paragraph gives a detailed procedure for determining the output isolation of Antenna Coupler CU-656/U. This is accomplished by determining the difference in decibels between an r-f signal applied directly to a receiver and an r-f signal applied through an output to achieve the same r-f signal level input to the receiver.

b. TEST EQUIPMENT AND SPECIAL TOOLS. -Test equipment required for this measurement consists of the following:

1. R-F Signal Generator Set AN/URM-25 Series, or equivalent.

2. Radio Interference Measuring Set AN/URM-47 Series, or equivalent.

c. SPECIAL JIGS. -Two 20 ±5%-ohm, 1/2-watt resistors, two type N UG-58A/U connectors and two type BNC UG-1094/U connectors are required to fabricate two 20-ohm pads required for measurement of isolation. Make the pads as follows:

Step 1. Using two short lengths of coaxial cable connect one 20-ohm resistor between the two UG-58A/U connectors. Solder a jumper wire between cable shields on each side of the resistor.

Step 2. Using two short lengths of coaxial cable, connect one 20-ohm resistor between the two type UG-1094/U connectors. Solder a jumper wire between cable shields on each side of the resistor.

d. CONTROL SETTINGS.- Place the ON-OFF switch in the ON position and allow a 10-minute warm-up period.

e. PROCEDURE. -The determination of the output isolation for Antenna Coupler CU-656/U. is given in the following step-by-step procedure.

Step 1. Connect the R-F Output Cable CG-409/U to the r-f output terminals of RF Signal Generator Set AN/URM-25 series, or equivalent.

Step 2. Set RF Signal Generator Set AN/URM-25 Series, or equivalent, for any frequency between 20 and 32 mc. Connect the r-f output of the signal generator through two series-connected 20-ohm pads to the input of Radio Interference Measuring Set AN/URM-47 series, or equivalent.

Step 3. Adjust the output level of RF Signal Generator Set AN/URM-25 series, or equivalent, for approximately a mid-scale indication on Radio Interference Measuring Set AN/URM-47 Series, or equivalent.

Step 4. Record the indication on the Radio Interference Measuring Set AN/URM-47 series, or equivalent, for use as a 0-db reference. Do not change the output level of RF Signal Generator Set AN/URM-25 series, or equivalent, during the remainder of this procedure.

Step 5. Disconnect the output of R-F Signal Generator AN/URM-25 Series, or equivalent, to OUTPUTS jack J1 on the antenna coupler through a 20-ohm pad.

Step 6. Connect Radio Interference Measuring Set AN/URM-47 Series, or equivalent, to OUTPUTS jack J2 on the antenna coupler through a 20-ohm pad.

Step 7. An indication should be obtained on Radio Interference Measuring Set AN/URM-47, or equivalent, which is at least 45 db less than the reference level recorded in step 3.

Step 8. In turn, connect Radio Interference Measuring Set AN/URM-47 series, or equivalent, through a 20-ohm resistor to OUTPUTS jacks J3 through J8. In each case the indication on the radio interference measuring set should be at least 40 db less than the 0-db reference recorded in step 3.

6-3. ADJUSTMENT OF COILS L49 THROUGH L52.

a. GENERAL. -Coils L49 through L52 should need adjustment only in case of damage. If the coil has not been broken replacement may not be necessary and reference should be made to paragraph 6-3d. If the coil has been broken, replacement and adjustment will be necessary. Location of the coils is shown on figure 5-1.

b. TEST EQUIPMENT AND SPECIAL TOOLS. -Test equipment required for a coil adjustment is the same as that given in paragraph 6-2b.

c. SPECIAL JIGS. -Two 20-ohm pads should be fabricated as described in paragraph 6-2c.

d. COIL REPLACEMENT.

Step 1. Remove damaged coil. It is possible that the coil does not contain any turns but may simply consist of a straight section of wire. Inspect the damaged coil to determine the number of turns needed in the replacement coil.

Step 2. Make a new coil using number 18 wire. Wind on a 3/16-inch diameter form. Coil will contain from zero to three turns depending upon the number of turns in the removed coil.

Step 3. Install new coil.

e. COIL ADJUSTMENT.

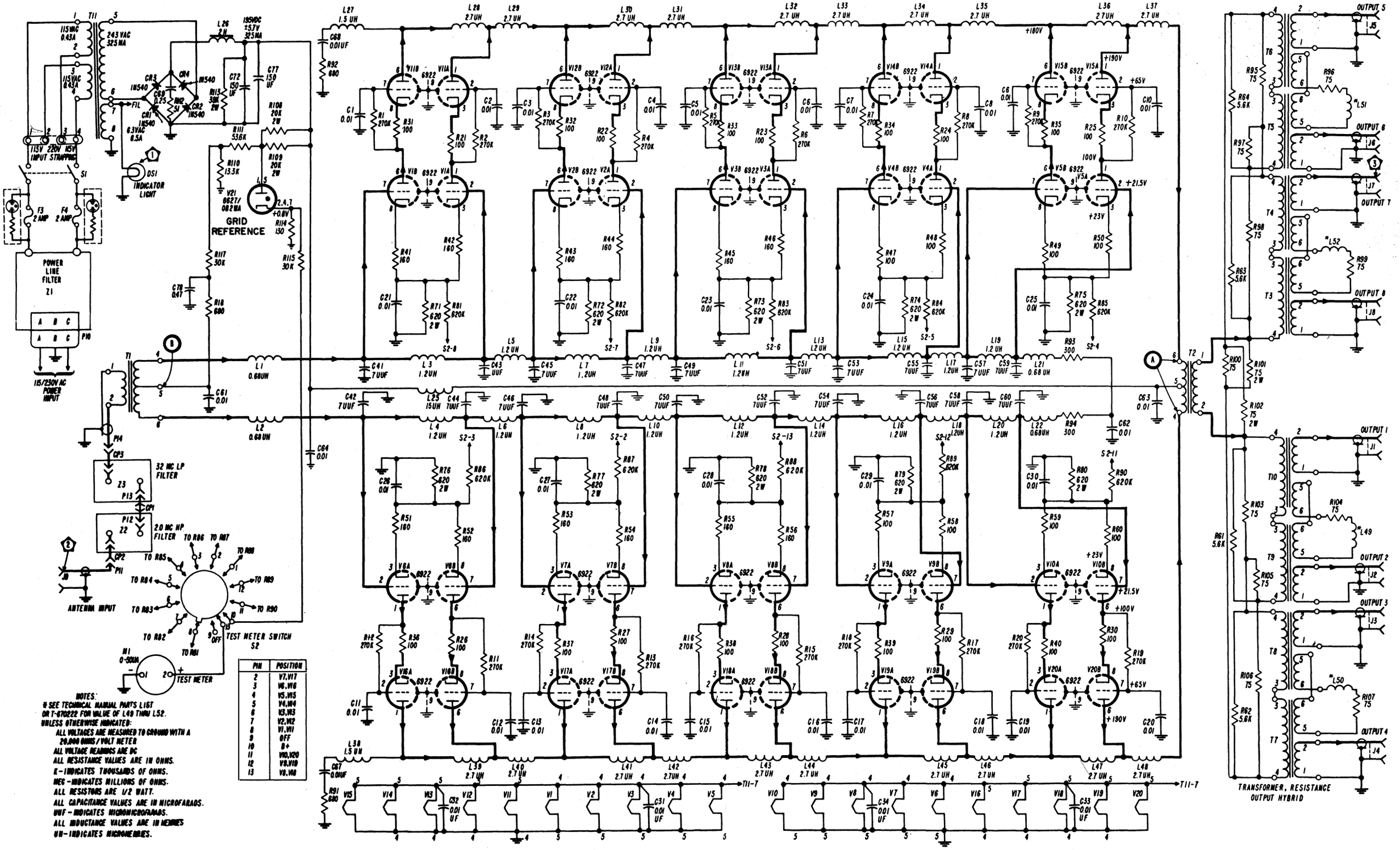
Step 1. Adjust RF Signal Generator Set AN/URM-25 series, or equivalent, to give a frequency of 32 megacycles.

Step 2. Connect Radio Interference Measuring Set AN/URM-47 Series, or equivalent, to the output of the r-f signal generator through two Series connected 20-ohm pads. Adjust the r-f signal generator level to give approximately a mid-scale deflection on the radio interference measuring set. Record the indication of the radio interference measuring set for use as a 0-db reference. Do not change the output level of the r-f signal generator during the remainder of the adjustment.

Step 3. Locate the coil to be adjusted in the following table. The r-f signal generator and radio interference measuring set are to be connected through a 20-ohm pad to the terminals indicated for the specific coil.

COIL	CONNECT SIGNAL GENERATOR TO OUTPUT	CONNECT RADIO TEST SET TO OUTPUT
L49	1	2
L50	3	4
L51	5	6
L52	7	8

Step 4. Close or open the coil turns as required to obtain minimum indication on the radio interference measuring set. When the coil is properly adjusted the radio interference measuring set should indicate a signal level 45 db below that obtained in step 2. No noticeable increase in performance will be obtained at an isolation level greater than 50 db. If it is impossible to obtain an isolation of 45 db by opening or closing the coil turns, increase or decrease the number of turns and repeat this step. If closing the coil does not have sufficient effect, it may be necessary to connect the balance resistor (R96, R99, R104, R107) directly between transformers, thereby bypassing the coil.



PIN	POSITION
2	V7,V17
3	V6,V16
4	V5,V15
5	V4,V14
6	V3,V13
7	V2,V12
8	V1,V11
9	OFF
10	B+
11	V10,V20
12	V9,V19
13	V8,V18

Figure 6-1. Antenna Coupler CU-656/U, Schematic Diagram

SECTION 7

PARTS LIST

7-1 INTRODUCTION.

Reference designations have been assigned to identify all maintenance parts of the equipment. They are used for marking the equipment and are included on drawings, diagrams and the parts list. The letters of the designation indicate the kind of part (generic group) such as resistor, capacitor, electron tube, etc. The number differentiates between parts of the same generic group. Sockets associated with a particular plug-in device, such as an electron tube, are identified by a reference designation, which includes the reference designation of the plug-in device. For example, the socket for tube VI is designated XVI.

7-2 MAINTENANCE PARTS LIST.

Table 7-1 lists all component parts. Column 1 lists the reference series of the various parts in alphabetical and numerical order. Column 2 gives the names and describes the various parts. Complete information is given for all key parts (parts differing from any part previously listed in this table). Column 3 indicates how the part is used and gives its functional location in the unit.

7-3 STOCK NUMBER IDENTIFICATION.

New Stock Number Identification Tables (SNIT's) issued by the Electronics Supply Office include Federal Stock Numbers and Source Maintenance and Recoverability Codes. Therefore, reference shall be made to the SNIT for this information.

7-4 LIST OF MANUFACTURERS.

Table 7-2 lists the manufacturers of parts used in this equipment.

7-5 NOTES.

In table 7-1, the maintenance parts list, a blank notes column designates components which are common to Antenna Coupler CU-656/U, Antenna Coupler CU-873/U, Antenna Coupler CU-874/U and Antenna Coupler CU-656A/U. The numeral 1 in the notes column designates components which are peculiar to Antenna Coupler CU-656/U. The numeral 2 in the notes column designates components which are peculiar to Antenna Coupler CU-873/U. The numeral 3 in the notes column designates components which are peculiar to Antenna Coupler CU-874/U. The numeral 4 in the notes column designates components which are peculiar to Antenna Coupler CU-656A/U. Both numerals 2 and 3 in the notes column designate components which are peculiar to both Antenna Coupler CU-873/U and Antenna Coupler CU-874/U. Both numerals 1 and 4 in the notes column designate components which are peculiar to both Antenna Coupler CU-656/U and Antenna Coupler CU-656A/U.

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
1-99 SERIES	1	Antenna Coupler provides coupling between a single antenna and eight receivers, AM type reception, utilizes balanced input circuit, push-pull amplification and band pass-band suppression filters. 115/230 VAC, 50/60 CPS, 125 W Approx., gray enamel case, 19 in. lg. 16-11/16 in. wide 7 in. high over-all, standard rack mounting, MFR. 89661, Dwg. 476D353G01. Navy type CU656	
	2	Antenna Coupler provides coupling between a single antenna and eight receivers, 2-32 MC, 115/230 VAC, 48 to 62 CPS, single phase, gray enamel case, 19 in. lg., 16-1/2 in. wide, 7 in. high, standard rack mounting, MFR. 89661, "DWG" 378A347G01. Navy type CU873/U.	
	3	Antenna Coupler provides coupling between a single antenna and eight receivers. 2-32 MC, 115/230 VAC, 48 to 62 CPS, single phase, 150 ohm impedance, gray enamel case, 19 in. lg., 16-1/2 in. wide, 7 in. high, standard rack mounting, MFR 89661, DWG. 346C145G01. Navy type CU874/U.	
	4	Coupler, Antenna provides coupling between a single antenna and eight receivers, AM type reception, utilizes balanced input circuit, push-pull amplification and band pass-band suppression filters. 115/230 VAC, 50/60 CPS, 125 W approx., gray enamel case, 19 in. lg., 16-11/16 in. wide, 7 in. high over-all, standard rack mounting, MFR 94518 Part No. VC656, Navy type CU656A/U	
C 1		Capacitor, Fixed. Ceramic dielectric 10,000 UUF plus 100% - 20%, 500 VDC working, MFR 14655, Part No. CK63Y103Z	V11A RF By-pass
C 2		Same as C1	V11B RF By-pass
C 3		Same as C1	V12A RF By-pass
C 4		Same as C1	V12B RF By-pass
C 5		Same as C1	V13A RF By-pass
C 6		Same as C1	V13B RF By-pass
C 7		Same as C1	V14A RF By-pass
C 8		Same as C1	V14B RF By-pass
C 9		Same as C1	V15A RF By-pass
C 10		Same as C1	V15B RF By-pass
C 11		Same as C1	V16A RF By-pass
C 12		Same as C1	V16B RF By-pass
C 13		Same as C1	V17A RF By-pass
C 14		Same as C1	V17B RF By-pass
C 15		Same as C1	V18A RF By-pass
C 16		Same as C1	V18B RF By-pass
C 17		Same as C1	V19A RF By-pass
C 18		Same as C1	V19B RF By-pass
C 19		Same as C1	V20A RF By-pass
C 20		Same as C1	V20B RF By-pass
C 21		Same as C1	V1 Cathode By-pass
C 22		Same as C1	V2 Cathode By-pass
C 23		Same as C1	V3 Cathode By-pass
C 24		Same as C1	V4 Cathode By-pass
C 25		Same as C1	V5 Cathode By-pass

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
C 26		Same as C1	V6 Cathode By-pass
C 27		Same as C1	V7 Cathode By-pass
C 28		Same as C1	V8 Cathode By-pass
C 29		Same as C1	V9 Cathode By-pass
C 30		Same as C1	V10 Cathode By-pass
C 31		Same as C1	V3 Filament By-pass
C 32		Same as C1	V13 Filament By-pass
C 33		Same as C1	V18 Filament By-pass
C 34		Same as C1	V8 Filament By-pass
C 35 THRU C 40		Not used	
C 41		Capacitor, Fixed, Ceramic dielectric 7UUF ± 0.25 UUF, 500 V DC working, CC20CH0 70C, Spec MIL-C-20	Grid Line Capacitance
C 42		Same as C41	Grid Line Capacitance
C 43		Same as C41	Grid Line Capacitance
C 44		Same as C41	Grid Line Capacitance
C 45		Same as C41	Grid Line Capacitance
C 46		Same as C41	Grid Line Capacitance
C 47		Same as C41	Grid Line Capacitance
C 48		Same as C41	Grid Line Capacitance
C 49		Same as C41	Grid Line Capacitance
C 50		Same as C41	Grid Line Capacitance
C 51		Same as C41	Grid Line Capacitance
C 52		Same as C41	Grid Line Capacitance
C 53		Same as C41	Grid Line Capacitance
C 54		Same as C41	Grid Line Capacitance
C 55		Same as C41	Grid Line Capacitance
C 56		Same as C41	Grid Line Capacitance
C 57		Same as C41	Grid Line Capacitance
C 58		Same as C41	Grid Line Capacitance
C 59		Same as C41	Grid Line Capacitance
C 60		Same as C41	Grid Line Capacitance

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
C 61		Same as C1	T1 Secondary RF By-pass
C 62		Same as C1	Grid Line DC Blocking
C 63		Same as C1	T2 Primary RF By-pass
C 64		Same as C1	B Plus By-pass
C 65		Not used	
C 66		Not used	
C 67		Same as C1	Plate Line DC Blocking
C 68		Same as C1	Plate Line DC Blocking
C 69		Capacitor, Fixed, Paper Dielectric 220,000 UUF ± 20%, 400 V DC Working, CH04A1ME224M, SPEC MIL-C-18312	B Plus Spike Suppressor
C 70		Not used	
C 71		Not used	
C 72		Capacitor, Fixed, Electrolytic 150 UF, 300 V DC Working, CE51F151N SPEC MIL-C-62	B Plus Filter
C 73 THRU C 76		Not used	
C 77		Same as C72	B Plus Filter
C 78		Capacitor, Fixed, Paper Dielectric 470,000 UUF ± 20%, 100 V DC Working, CP05A1EB474M, SPEC MIL-C-25	Bias Filtering
C 79 THRU C 99		Not used	
C P1		Adaptor, Connector Male to Male, 50 ohms, 500 V Peak, UG491A/U, MS35176.	Connector Adaptor
C P2 THRU C P99		Not used	
C R1		Semiconductor Device, Diode Silicon, Axial Wire Leads, 1N540, SPEC MIL-E-1C	B Plus Rectifier
C R2		Same as CR1	B Plus Rectifier
C R3		Same as CR1	B Plus Rectifier
C R4		Same as CR1	B Plus Rectifier
C R5 THRU C R99		Not used	
D S1		Lamp, Incandescent 0.15 AMP, 6-8 Volt, T-3 1/4 Bulb, MS15571-2	Pilot Light
D S2 THRU D S99		Not used	
E 1		Insulator, Standoff Melamine Insulation, 9/16 in. lg., 1/4 in. across flats, MFR 81312, Part No. 776	Tie Point
E 2		Same as E1	Tie Point
E 3		Same as E1	Tie Point
E 4		Same as E1	Tie Point
E 5		Same as E1	Tie Point
E 6		Same as E1	Tie Point
E 7		Same as E1	Tie Point
E 8		Same as E1	Tie Point
E 9		Same as E1	Tie Point
E 10		Same as E1	Tie Point
E 11		Same as E1	Tie Point
E 12		Shield, Electron Tube, Heat Dissipating w/Shield insert, blackfinish SO967, SPEC MIL-S-19786	Tube Shield
E 13		Same as E12	Tube Shield

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
E 14		Same as E12	Tube Shield
E 15		Same as E12	Tube Shield
E 16		Same as E12	Tube Shield
E 17		Same as E12	Tube Shield
E 18		Same as E12	Tube Shield
E 19		Same as E12	Tube Shield
E 20		Same as E12	Tube Shield
E 21		Same as E12	Tube Shield
E 22		Same as E12	Tube Shield
E 23		Same as E12	Tube Shield
E 24		Same as E12	Tube Shield
E 25		Same as E12	Tube Shield
E 26		Same as E12	Tube Shield
E 27		Same as E12	Tueb Shield
E 28		Same as E12	Tube Shield
E 29		Same as E12	Tube Shield
E 30		Same as E12	Tube Shield
E 31		Same as E12	Tube Shield
E 32		Shield, Electron Tube 2.125 in. h., 0.810 in. dia., Black finish SO765, SPEC MIL-S-19785	Tube Shield
E 33		Retainer, Electron Tube 1.375 dia. open 1.125 in. w., MFR 91506 Part No. S168F7-803M	Tube Clamp
E 34		Same as E17	Tube Clamp
E 35 THRU E 99		Not used	
F 1		Fuse, Cartridge 2 AMP, 125 V Max. Time Lag, F02D2R00B, MIL-F-15160C	Power Input
F 2		Same as F1	Power Input
F 3		Same as F1	Spare
F 4		Same as F1	Spare
F 5 THRU F 99		Not used	
H (*)		Knob Round w/Dial Skirt 1.822 max. dia. 1/4 in. dia. shaft. Matte finish MFR. 49956 Part No. 125-3-2G	Test Meter Switch
J 1	1,4	Connector, Receptacle, Electrical 1 contact coaxial type, UG568/U	RF Output
J 1	2,3	Connector, Receptacle, Electrical 1 contact coaxial type, UG58A/U	RF Output
J 2	1,4	Same as J1	RF Output
J 2	2,3	Same as J1	RF Output
J 3	1,4	Same as J1	RF Output
J 3	2,3	Same as J1	RF Output
J 4	1,4	Same as J1	RF Output
J 4	2,3	Same as J1	RF Output
J 5	1,4	Same as J1	RF Output
J 5	2,3	Same as J1	RF Output
J 6	1,4	Same as J1	RF Output
J 6	2,3	Same as J1	RF Output
J 7	1,4	Same as J1	RF Output
J 7	2,3	Same as J1	RF Output
J 8	1,4	Same as J1	RF Output
J 8	2,3	Same as J1	RF Output
J 9	1,4	Same as J1	RF Input
J 9	2,3	Same as J1	RF Input
J 10		Part of Z1 listed for reference only	
J 11 THRU J 14		Not used	

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
J 15	2, 3	Same as J1	Provides Connection for balanced Antenna Input
J 16 THRU J 99	Not used		
L 1		Coil, Radio Frequency 0.68 UH ± 5%, 0.10 ohms, at 1/2 w., Phenolic Core, MFR 78526, Part No. 96803M	Grid Line
L 2		Same as L1	Grid Line
L 3		Coil, Radio Frequency 1.2 UH ± 5%, MFR 78526, Part No. 91202M	Grid Line
L 4		Same as L3	Grid Line
L 5		Same as L3	Grid Line
L 6		Same as L3	Grid Line
L 7		Same as L3	Grid Line
L 8		Same as L3	Grid Line
L 9		Same as L3	Grid Line
L 10		Same as L3	Grid Line
L 11		Same as L3	Grid Line
L 12		Same as L3	Grid Line
L 13		Same as L3	Grid Line
L 14		Same as L3	Grid Line
L 15		Same as L3	Grid Line
L 16		Same as L3	Grid Line
L 17		Same as L3	Grid Line
L 18		Same as L3	Grid Line
L 19		Same as L3	Grid Line
L 20		Same as L3	Grid Line
L 21		Same as L1	Grid Line
L 22		Same as L1	Grid Line
L 23		Not used	
L 24		Not used	
L 25		Coil, Radio Frequency 15 UH ± 10% Q of 40 at 3 MC, LT8K007, MS 91189-7 SPEC MIL-C-15305A	B Plus RF Decoupling
L 26		Reactor 2 H at 325 MA DC, 50 ohms, MFR 73386, Part No. 31741	Smoothing Choke
L 27		Coil, Radio Frequency 1.5 UH ± 5%, 1300 MA max. DC current, 1/2 w., MFR 78526, Part No. 91502M	Plate Line
L 28		Coil, Radio Frequency 2.7 UH, ± 5%, 840 MA max. DC current, MFR 78526, Part No. 92702M	Plate Line
L 29		Same as L28	Plate Line
L 30		Same as L28	Plate Line
L 31		Same as L28	Plate Line
L 32		Same as L28	Plate Line
L 33		Same as L28	Plate Line
L 34		Same as L28	Plate Line
L 35		Same as L28	Plate Line
L 36		Same as L28	Plate Line
L 37		Same as L28	Plate Line
L 38		Same as L27	Plate Line
L 39		Same as L28	Plate Line
L 40		Same as L28	Plate Line
L 41		Same as L28	Plate Line
L 42		Same as L28	Plate Line
L 43		Same as L28	Plate Line
L 44		Same as L28	Plate Line
L 45		Same as L28	Plate Line
L 46		Same as L28	Plate Line
L 47		Same as L28	Plate Line
L 48		Same as L28	Plate Line

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
L 49 THRU L 52		Value depends on isolation requirement. See paragraph 6-3.	
M 1		Ammeter 0-50 MA DC full scale deflection, MR26W050DCUAR	Test Meter
M 2 THRU M 99		Not used	
P 1	1,4	Connector Plug, Coaxial type UG573 B/U	RF Output
P 2		Same as P1	RF Output
P 3		Same as P1	RF Output
P 4		Same as P1	RF Output
P 5		Same as P1	RF Output
P 6		Same as P1	RF Output
P 7		Same as P1	RF Output
P 8		Same as P1	RF Output
P 9		Same as P1	RF Output
P 10		Connector, Plug, Electrical Bayonette type, 500 volt peak, MFR 91146, MS3106A14S-7S	Power Input
P 11		Connector, Plug, Electrical Coaxial type, 500 volt peak, UG260B/U	Filter Connection
P 12		Adaptor, Connector Coaxial type, 500 volt peak, 2 contacts, UG306/U, MS35368	Filter Connection
P 13		Same as P11	Filter Connection
P 14		Same as P12	Filter Connection
P 15 THRU P 99		Not used	
R 1		Resistor, Fixed, Composition 270,000 ohms ± 10%, 1/2 w., RC20GF274K, SPEC MIL-R-11	V11 Grid
R 2		Same as R1	V11 Grid
R 3		Same as R1	V12 Grid
R 4		Same as R1	V12 Grid
R 5		Same as R1	V13 Grid
R 6		Same as R1	V13 Grid
R 7		Same as R1	V14 Grid
R 8		Same as R1	V14 Grid
R 9		Same as R1	V15 Grid
R 10		Same as R1	V15 Grid
R 11		Same as R1	V16 Grid
R 12		Same as R1	V16 Grid
R 13		Same as R1	V17 Grid
R 14		Same as R1	V17 Grid
R 15		Same as R1	V18 Grid
R 16		Same as R1	V18 Grid
R 17		Same as R1	V19 Grid
R 18		Same as R1	V19 Grid
R 19		Same as R1	V20 Grid
R 20		Same as R1	V20 Grid
R 21		Resistor, Fixed, Composition 100 ohms ± 5%, 1/2 w., RC20GF101J, MIL-R-11	V11 Cathode
R 22		Same as R21	V12 Cathode
R 23		Same as R21	V13 Cathode
R 24		Same as R21	V14 Cathode
R 25		Same as R21	V15 Cathode
R 26		Same as R21	V16 Cathode
R 27		Same as R21	V17 Cathode
R 28		Same as R21	V18 Cathode
R 29		Same as R21	V19 Cathode
R 30		Same as R21	V20 Cathode
R 31		Same as R21	V11 Cathode

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
R 32		Same as R21	V12 Cathode
R 33		Same as R21	V13 Cathode
R 34		Same as R21	V14 Cathode
R 35		Same as R21	V15 Cathode
R 36		Same as R21	V16 Cathode
R 37		Same as R21	V17 Cathode
R 38		Same as R21	V18 Cathode
R 39		Same as R21	V19 Cathode
R 40		Same as R21	V20 Cathode
R 41		Resistor, Fixed, Composition 160 ohms ± 5%, 1/2 watt, RC20GF161J, MIL-R-11	V1 Cathode
R 42		Same as R41	V1 Cathode
R 43		Same as R41	V2 Cathode
R 44		Same as R41	V2 Cathode
R 45		Same as R41	V3 Cathode
R 46		Same as R41	V3 Cathode
R 47		Same as R21	V4 Cathode
R 48		Same as R21	V4 Cathode
R 49		Same as R21	V5 Cathode
R 50		Same as R21	V5 Cathode
R 51		Same as R41	V6 Cathode
R 52		Same as R41	V6 Cathode
R 53		Same as R41	V7 Cathode
R 54		Same as R41	V7 Cathode
R 55		Same as R41	V8 Cathode
R 56		Same as R41	V8 Cathode
R 57		Same as R21	V9 Cathode
R 58		Same as R21	V9 Cathode
R 59		Same as R21	V10 Cathode
R 60		Same as R21	V10 Cathode
R 61		Resistor, Fixed, Composition 5600 ohms ± 5%, 1/2 watt RC20GF562J, MIL-R-11	Hybrid Balance
R 62		Same as R61	Hybrid Balance
R 63		Same as R61	Hybrid Balance
R 64		Same as R61	Hybrid Balance
R 65 THRU R 70		Not used	
R 71		Resistor, Fixed, Composition 620 ohms ± 5%, 2 watt, RC42GF621J, MIL-R-11	V1 Cathode
R 72		Same as R71	V2 Cathode
R 73		Same as R71	V3 Cathode
R 74		Same as R71	V4 Cathode
R 75		Same as R71	V5 Cathode
R 76		Same as R71	V6 Cathode
R 77		Same as R71	V7 Cathode
R 78		Same as R71	V8 Cathode
R 79		Same as R71	V9 Cathode
R 80		Same as R71	V10 Cathode
R 81		Resistor, Fixed, Composition 620,000 ohms ± 5%, 1/2 w., RC20GF624J, SPEC MIL-R-11	V1 Cathode Metering
R 82		Same as R81	V2 Cathode Metering
R 83		Same as R81	V3 Cathode Metering
R 84		Same as R81	V4 Cathode Metering
R 85		Same as R81	V5 Cathode Metering
R 86		Same as R81	V6 Cathode Metering

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
R 87		Same as R81	V7 Cathode Metering
R 88		Same as R81	V8 Cathode Metering
R 89		Same as R81	V9 Cathode Metering
R 90		Same as R81	V10 Cathode Metering
R 91		Resistor, Fixed, Composition 680 ohms ± 5%, 1/2 w., RC20GF681J, SPEC MIL-R-11	Plate Line Termination
R 92		Same as R91	Plate Line Termination
R 93		Resistor, Fixed, Composition 300 ohms ± 5%, 1/2 w., RC20GF301J, SPEC MIL-R-11	Grid Line Termination
R 94		Same as R93	Grid Line Termination
R 95		Resistor, Fixed, Film 75 ohms ± 1%, 1/2 w., RN70B75ROF, SPEC MIL-R-10509	Hybrid Balance
R 96		Same as R95	Hybrid Balance
R 97		Same as R95	Hybrid Balance
R 98		Same as R95	Hybrid Balance
R 99		Same as R95	Hybrid Balance
R 100		Same as R95	Hybrid Balance
R 101		Resistor, Fixed, Film 75 ohms ± 1%, 2 w., RN30X75ROF, SPEC MIL-R-10509	Hybrid Balance
R 102		Same as R101	Hybrid Balance
R 103		Same as R95	Hybrid Balance
R 104		Same as R95	Hybrid Balance
R 105		Same as R95	Hybrid Balance
R 106		Same as R95	Hybrid Balance
R 107		Same as R95	Hybrid Balance
R 108		Resistor, Fixed, Composition 20,000 ohms ± 5%, 2 w., RC42GF203J, SPEC MIL-R-11	Bias Regulator
R 109		Same as R108	Bias Regulator
R 110		Resistor, Fixed, Film 13,300 ohms ± 1%, 1/2 w., RN70B1332F, SPEC MIL-R-10509	Grid Voltage Divider
R 111		Resistor, Fixed, Film 53,600 ohms ± 1%, 1/2 w., RN70B536F, SPEC MIL-R-10509	Grid Voltage Divider
R 112		Resistor, Fixed, Composition 51 ohms ± 5%, 1/2 w., RC20GF510J, SPEC MIL-R-11	B Plus Spike Suppressor
R 113		Resistor, Fixed, Composition 39,000 ohms ± 10%, 2 w., RC42GF393K, SPEC MIL-R-11	B Plus Bleeder
R 114		Resistor, Fixed, Composition 130 ohms ± 5%, 1/2 w., RC20GF131J, SPEC MIL-R-11	B Plus Metering
R 115		Resistor, Fixed, Composition 30,000 ohms ± 5%, 1/2 w., RC20GF303J, SPEC MIL-R-11	B Plus Metering
R 116		Not used	
R 117		Same as R115	Bias Filtering
R 118	2,3	Same as R91	Grid Bias Decoupling
R 119 THRU R 199		Not used	
S 1		Switch, Toggle, DPST; 25 amp, 125 V AC, 4 Screw type Terminals, MS35059-22, SPEC MIL-S-3750	Power On-Off
S 2		Switch, Rotary Single Section, Non shorting, 12 contacts, MFR 82044, Part No. 873691	Test Meter
S 3 THRU S 99		Not used	

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
T 1	1,4	Transformer, Radio Frequency two windings, one non-adjustable tap, cased, MFR 94518, Dwg. 8736932	Grid Input
T 1	2,3	Transformer, Radio Frequency 1 Primary 1 to 36 MC, 1 Secondary center tapped, 17 volt working, MFR 89661, Part No. 342C486H01	Grid Input
T 2	1,4	Transformer, Radio Frequency two windings, one non-adjustable tap, cased, MFR 94518, DWG 8736931	Plate Coupling
T 2	2,3	Transformer, Radio Frequency 1 Primary 1 to 36 MC, 1 Secondary center tapped, 184 volt working, MFR 89661, Part No. 342C490H01	Plate Coupling
T 3	1,4	Transformer, Radio Frequency three windings, untapped, cased, MFR 94518, Dwg. 8736933	Hybrid
T 3	2,3	Transformer, Radio Frequency 1 to 40 MC, 2 Secondary, 7.1 volt working, 0.4 w., MFR 89661, Part No. 342C989H01	Hybrid
T 4		Same as T3	Hybrid
T 5		Same as T3	Hybrid
T 6		Same as T3	Hybrid
T 7		Same as T3	Hybrid
T 8		Same as T3	Hybrid
T 9		Same as T3	Hybrid
T 10		Same as T3	Hybrid
T 11		Transformer Power, Step-up and Step-down 115/230 volt, 60 cycle, 236 V AC input, 6.3 V AC output, MFR 73386, Dwg. No. 8736929	Power
T 12	3	Transformer, Radio Frequency 1 Primary 1 to 40 MC, 2 Secondary 7.1 volt working, MFR 89661, Part No. 342C989H02	RF Input
T 13 THRU T 99		Not used	
TB 1		Terminal Board 6 Terminals, Phenolic, 3.5 in. lg., 2.875 in. w., 0.125 in. thk., MFR 94518, Dwg. No. 873699	B Plus Rectifier Mounting
TB 2		Terminal Board Phenolic, 5.25 in. lg., 1.75 in. w., 0.125 in. thk., MFR 94518, Dwg. No. 8736910	Component Mounting
TB 3		Terminal Board 31 Terminals, Phenolic, MFR 94518, Dwg. No. 8736911	Component Mounting
V 1		Electron Tube Dual Triode, 6922, SPEC MIL-E-1C	1st Distributed Amplifier
V 2		Same as V1	2nd Distributed Amplifier
V 3		Same as V1	3rd Distributed Amplifier
V 4		Same as V1	4th Distributed Amplifier
V 5		Same as V1	5th Distributed Amplifier
V 6		Same as V1	1st Distributed Amplifier
V 7		Same as V1	2nd Distributed Amplifier
V 8		Same as V1	3rd Distributed Amplifier
V 9		Same as V1	4th Distributed Amplifier
V 10		Same as V1	5th Distributed Amplifier
V 11		Same as V1	1st Distributed Amplifier
V 12		Same as V1	2nd Distributed Amplifier

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
V 13		Same as V1	3rd Dsitributed Amplifier
V 14		Same as V1	4th Distributed Amplifier
V 15		Same as V1	5th Distributed Amplifier
V 16		Same as V1	1st Distributed Amplifier
V 17		Same as V1	2nd Distributed Amplifier
V 18		Same as V1	3rd Distributed Amplifier
V 19		Same as V1	4th Distributed Amplifier
V 20		Same as V1	5th Distributed Amplifier
V 21		Electron Tube Miniature Diode, OB2WA, SPEC MIL-E-1C	Bias Reference
V 22 THRU V 99		Not used	
XC 1 THRU XC 71		Not used	
XC 72		Socket, Electron Tube 8 Contacts, bottom mounting, saddle type, TS101P01, SPEC MIL-S-12883	Socket for C72
XC 73 THRU XC 76		Not used	
XC 77		Same as XC72	Socket for C77
XC 78 THRU XC 99		Not used	
XDS 1		Lampholder Miniature, Red Lens, for T-3 1/4 bulb, LH62BR2. SPEC MIL-L-3661, MS90287-4	Holder for DS1
XDS 2 THRU XDS 99		Not used	
XF 1		Fuseholder indicating, 15 amps, 250 volt, FHL17G, MIL-F-19207	Socket for F1
XF 2		Same as XF1	Socket for F2
XF 3		Fuse Holder non-indicating, 15 amps, 250 volt, FHN20G, MIL-F-19207	Socket for F3
XF 4		Same as XF3	Socket for F4
XF 5 THRU XF 99		Not used	
XV 1		Socket, Electron Tube 9 Pin, molded plastic, TS 103P01, SPEC MIL-S-12883	Socket for V1
XV 2		Same as XV1	Socket for V2
XV 3		Same as XV1	Socket for V3
XV 4		Same as XV1	Socket for V4
XV 5		Same as XV1	Socket for V5
XV 6		Same as XV1	Socket for V6
XV 7		Same as XV1	Socket for V7
XV 8		Same as XV1	Socket for V8
XV 9		Same as XV1	Socket for V9
XV 10		Same as XV1	Socket for V10
XV 11		Same as XV1	Socket for V11
XV 12		Same as XV1	Socket for V12
XV 13		Same as XV1	Socket for V13

TABLE 7-1. ANTENNA COUPLER CU-656/U, MAINTENANCE PARTS LIST (Cont.)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FUNCTION
XV 14		Same as XV1	Socket for V14
XV 15		Same as XV1	Socket for V15
XV 16		Same as XV1	Socket for V16
XV 17		Same as XV1	Socket for V17
XV 18		Same as XV1	Socket for V18
XV 19		Same as XV1	Socket for V19
XV 20		Same as XV1	Socket for V20
XV 21		Socket, Electron Tube 7 Contacts, w/body shield base, TS102P01, SPEC MIL-S-12883	Socket for V21
XV 22 THRU XV 99		Not used	
Z 1		Filter, Radio Reference, 250 volt, 3 amp Power input, 600 volt, 60 cycle, 3 amp, MFR 81831, Part No. FA3692C.	Power Input
Z 2	1,2,3	Filter, High Pass 2 MC, 70 ohms impedance, MFR 89661, Part No. 468D425G01	RF Input
Z 3	1,2,3	Filter, Low Pass 32 MC, 70 ohms impedance, MFR 89661, Part No. 468D423G01	RF Input
Z 2	4	Filter, High Pass 2 MC, 70 ohms impedance, right angle Input Connector UG1174/U. MFR 94518, Part No. 87369-100	RF Input
Z 3	4	Filter, Low Pass 32 MC, 70 ohms impedance, right angle Output Connector UG 1174/U. MFR 94518, Part No. 87369-200	RF Input
Z 4 THRU Z 99		Not used	

TABLE 7-2. ANTENNA COUPLER CU-656/U, LIST OF MANUFACTURERS

MFR CODE	NAME	ADDRESS
14655	Cornell Dubilier Electric Corp.	South Plainfield, New Jersey
49956	Raytheon Mfg. Co.	Waltham, Massachusetts
73386	Freed Transformer Co., Inc.	Ridgewood, Brooklyn 60 New York
78526	Stanwyck Winding Co.	Newburgh, New York
81831	Filtron Co., Inc.	Flushing 55, Long Island, New York
82044	Central Radio Labs.	Milwaukee, Wisconsin
89661	Westinghouse Electric Co.	Baltimore, Maryland
91146	Cannon Electric Co.	Wakefield, Massachusetts
91506	Augat Bros., Inc.	Attleboro, Massachusetts
94518	Voron Electronics Corporation	Philadelphia 18, Pennsylvania