

NAVSHIPS 93235(A)

(Non-Registered)

★

TECHNICAL MANUAL  
*for*  
ANTENNA COUPLER  
CU-691/U

COLLINS RADIO COMPANY

Cedar Rapids, Iowa

SHORE ELECTRONICS DEPARTMENT  
LIBRARY

DEPARTMENT OF THE NAVY MAR 16 1965  
BUREAU OF SHIPS

★

Contract: Nobsr 75183

Approved by BuShips: 24 April 1959

**LIST OF EFFECTIVE PAGES**

<b>PAGE NUMBERS</b>	<b>CHANGE IN EFFECT</b>	<b>PAGE NUMBERS</b>	<b>CHANGE IN EFFECT</b>
Title Page	Original	6-0 to 6-36	Original
ii to viii	Original	7-1 to 7-15	Original
ix Blank	Original	7-16 Blank	Original
1-0 to 1-2	Original		
2-1 to 2-5	Original		
3-0 to 3-6	Original		
4-1 to 4-10	Original		
5-1 to 5-3	Original		



DEPARTMENT OF THE NAVY  
BUREAU OF SHIPS  
WASHINGTON 25, D. C.

IN REPLY REFER TO  
Code 695E-100

From: Chief, Bureau of Ships  
To: All Activities concerned with the Installation, Operation,  
and Maintenance of the Subject Equipment

Subj: Technical Manual for Antenna Coupler CU-691/U, NAVSHIPS 93235(A).

1. This is the Technical Manual for the subject equipment and is in effect upon receipt. It supersedes NAVSHIPS 93235. Upon receipt hereof, NAVSHIPS 93235 shall be destroyed.
2. When superseded by a later edition, this publication shall be destroyed.
3. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.
4. Errors found in this publication (other than obvious typographical errors), which have not been corrected by means of Temporary Corrections or Permanent Changes should be reported. Such report should include the complete title of the publication and the publication number (short title); identify the page and line or figure and location of the error; and be forwarded to the Electronics Publications Section of the Bureau of Ships.
5. All Navy requests for NAVSHIPS electronics publications should be directed to the nearest Bureau of Supplies and Accounts Forms and Publications Supply Point. When changes or revised books are distributed, notice will be included in the Electronics Information Bulletin, NAVSHIPS 900,022A, and in the Forms and Publications Supply Office Index of Forms and Publications, Cognizance "I".

A. G. MUMMA  
Chief of Bureau



# TABLE OF CONTENTS

## SECTION 1 - GENERAL INFORMATION

Paragraph		Page
1-1.	Introduction . . . . .	1-1
1-2.	Functional Description . . . . .	1-1
1-3.	Factory or Field Changes . . . . .	1-1
1-4.	Quick Reference Data . . . . .	1-1
1-5.	Equipment Lists . . . . .	1-2
	a. Equipment Supplied . . . . .	1-2
	b. Equipment and Publications Required But Not Supplied . . . . .	1-2
	c. Shipping Data . . . . .	1-2
	d. Electron Tube Complement . . . . .	1-2

## SECTION 2 - INSTALLATION

2-1.	Unpacking and Handling . . . . .	2-1
2-2.	Installation Requirements . . . . .	2-1
	a. Installation Pointers . . . . .	2-1
	b. Cable Assembly . . . . .	2-1
2-3.	Inspection and Adjustments . . . . .	2-1
2-4.	Preparation for Reshipment . . . . .	2-1
	a. Equipment Preparation . . . . .	2-1
	b. Packing Instructions . . . . .	2-1

## SECTION 3 - OPERATOR'S SECTION

3-1.	Functional Operation . . . . .	3-1
3-2.	Preparation for Use . . . . .	3-1
3-3.	Operating Controls . . . . .	3-1
	a. Description of Controls . . . . .	3-1
	b. Sequence of Operation . . . . .	3-3
	(1) Operation with a Transmitter . . . . .	3-3
	(2) Operation with a Receiver, Method One . . . . .	3-3
	(3) Operation with a Receiver, Method Two . . . . .	3-3
	(4) Secure . . . . .	3-5
	c. Precautions . . . . .	3-5
3-4.	Summary of Operating Procedures . . . . .	3-5
	a. Operation with a Transmitter . . . . .	3-5
	b. Operation with a Receiver, Method One . . . . .	3-5
	c. Operation with a Receiver, Method Two . . . . .	3-6
3-5.	Operator's Maintenance . . . . .	3-6

## SECTION 4 - PRINCIPLES OF OPERATION

4-1.	Over-all Functional Description . . . . .	4-1
	a. Tandem Cavities . . . . .	4-2
	b. Combining Network . . . . .	4-2
	c. Monitor Circuits . . . . .	4-2
	d. Tuning System . . . . .	4-2
4-2.	Functional Sections . . . . .	4-2
	a. Tandem Cavities . . . . .	4-2
	(1) Cavity Design . . . . .	4-2
	(2) Coupling Elements . . . . .	4-3
	(a) Input and Output Coupling . . . . .	4-3
	(b) Intra-Cavity Coupling . . . . .	4-5

# TABLE OF CONTENTS (Cont)

Paragraph		Page
<u>b.</u>	Combining Network . . . . .	4-5
	(1) Function . . . . .	4-5
	(2) Design . . . . .	4-5
<u>c.</u>	Monitor Circuits . . . . .	4-6
	(1) General . . . . .	4-6
	(2) R-F Circuit . . . . .	4-6
	(3) D-C Circuit . . . . .	4-7
<u>d.</u>	Tuning System . . . . .	4-7
	(1) Cavity Tuning Mechanism . . . . .	4-7
	(2) Gear Drive and Tracking System . . . . .	4-7

## SECTION 5 - TROUBLE-SHOOTING

5-1.	General . . . . .	5-1
5-2.	Trouble-Shooting . . . . .	5-1
5-3.	Typical Troubles . . . . .	5-1
5-4.	Location of Parts . . . . .	5-2

## SECTION 6 - SERVICE AND REPAIR

6-1.	Failure Report . . . . .	6-0
6-2.	Preventive Maintenance . . . . .	6-0
	<u>a.</u> Introduction . . . . .	6-0
	<u>b.</u> Test Equipment . . . . .	6-0
	<u>c.</u> Preventive Maintenance Charts . . . . .	6-1
6-3.	Performance Standards . . . . .	6-17
	<u>a.</u> Introduction . . . . .	6-17
	<u>b.</u> Test Equipment . . . . .	6-17
	<u>c.</u> Performance Standard Charts . . . . .	6-17
6-4.	Repair . . . . .	6-28
	<u>a.</u> Disassembly and Removal Procedures . . . . .	6-28
	(1) Front Panel . . . . .	6-28
	(2) Wrap-Around Cover . . . . .	6-28
	(3) Rear Panel . . . . .	6-28
	(4) Gear Train Assemblies . . . . .	6-28
	(5) Movable Conductors . . . . .	6-31
	(6) Combining Network . . . . .	6-31
	(7) Monitor Coupler Assemblies . . . . .	6-31
	(8) Tandem Cavities . . . . .	6-31
	(9) Switch Panel . . . . .	6-31
	(10) Electrical Components . . . . .	6-31
	<u>b.</u> Replacement and Reassembly Procedures . . . . .	6-32
	(1) Switch Panel . . . . .	6-32
	(2) Tandem Cavities . . . . .	6-32
	(3) Monitor Coupler Assemblies . . . . .	6-32
	(4) Combining Network . . . . .	6-32
	(5) Movable Conductors . . . . .	6-32
	(6) Gear Train Assemblies . . . . .	6-32
	(7) Rear Panel . . . . .	6-32
	(8) Wrap-Around Cover . . . . .	6-32
	(9) Front Panel . . . . .	6-32
	<u>c.</u> Dial Calibration . . . . .	6-33
	<u>d.</u> Meter Calibration . . . . .	6-33
	<u>e.</u> Cavity Synchronization . . . . .	6-33
	<u>f.</u> Cavity Tracking . . . . .	6-34

# TABLE OF CONTENTS (Cont)

Paragraph		Page
<b>SECTION 7 - PARTS LIST</b>		
7-1.	Introduction . . . . .	7-1
7-2.	Maintenance Parts List . . . . .	7-1
7-3.	Stock Number Identification . . . . .	7-1
7-4.	List of Manufacturers . . . . .	7-1

## LIST OF ILLUSTRATIONS

Figure		Page
<b>SECTION 1 - GENERAL INFORMATION</b>		
1-1.	Antenna Coupler CU-691/U . . . . .	1-0
<b>SECTION 2 - INSTALLATION</b>		
2-1.	Antenna Coupler CU-691/U, Outline and Installation Dimensions . . . . .	2-2
2-2.	Antenna Coupler CU-691/U, Interconnecting Diagram of a Typical Installation. . . . .	2-3
2-3.	Installation of Type N Male Connectors on RG-8/U Transmission Line . . . . .	2-4
2-4.	Installation of Type HN Male Connectors on RG-8/U Transmission Line . . . . .	2-5
<b>SECTION 3 - OPERATOR'S SECTION</b>		
3-1.	Antenna Coupler CU-691/U, Front Panel Control Locations . . . . .	3-0
3-2.	Graph: Typical Channel-to-Channel Isolation Curves at Three Frequencies . . . . .	3-4
<b>SECTION 4 - PRINCIPLES OF OPERATION</b>		
4-1.	Antenna Coupler CU-691/U, Block Diagram . . . . .	4-1
4-2.	Cavity Design, Simplified Diagram . . . . .	4-2
4-3.	Graph: Typical Tandem Cavity Insertion Loss, 225 to 400 MC. . . . .	4-3
4-4.	Graph: Typical Tandem Cavity Selectivity Curves at Three Frequencies . . . . .	4-4
4-5.	Flux Density Distribution and Effective Coupling Area within a Cavity at Two Frequency . . . . .	4-5
4-6.	Monitor R-F Circuit, Simplified Schematic Diagram . . . . .	4-6
4-7.	Monitor D-C Circuit, Simplified Schematic Diagram . . . . .	4-8
4-8.	Cavity Tuning Mechanism, Cross Section Diagram . . . . .	4-9
4-9.	Tandem Cavity Gear Train Mechanism, Cross Section Diagram . . . . .	4-10
<b>SECTION 5 - TROUBLE-SHOOTING</b>		
5-1.	Antenna Coupler CU-691/U, Location of Parts, Front Panel Removed . . . . .	5-2
5-2.	Antenna Coupler CU-691/U, Location of Parts, Rear Panel Removed . . . . .	5-3
<b>SECTION 6 - SERVICE AND REPAIR</b>		
6-1.	Antenna Coupler CU-691/U, Partial Exploded View . . . . .	6-29/6-30
6-2.	Antenna Coupler CU-691/U, Schematic Diagram . . . . .	6-35/6-36

# LIST OF TABLES

## SECTION 1 - GENERAL INFORMATION

Table		Page
1-1.	Antenna Coupler CU-691/U, Equipment Supplied . . . . .	1-2
1-2.	Antenna Coupler CU-691/U, Shipping Data . . . . .	1-2

## SECTION 2 - INSTALLATION

2-1.	Antenna Coupler CU-691/U, Cable Requirements . . . . .	2-1
------	--	-----

## SECTION 3 - OPERATOR'S SECTION

3-1.	Controls/Indicators and Functions . . . . .	3-1
3-2.	Routine Check Chart . . . . .	3-6

## SECTION 5 - TROUBLE-SHOOTING

5-1.	Antenna Coupler CU-691/U, Typical Troubles . . . . .	5-1
------	--	-----

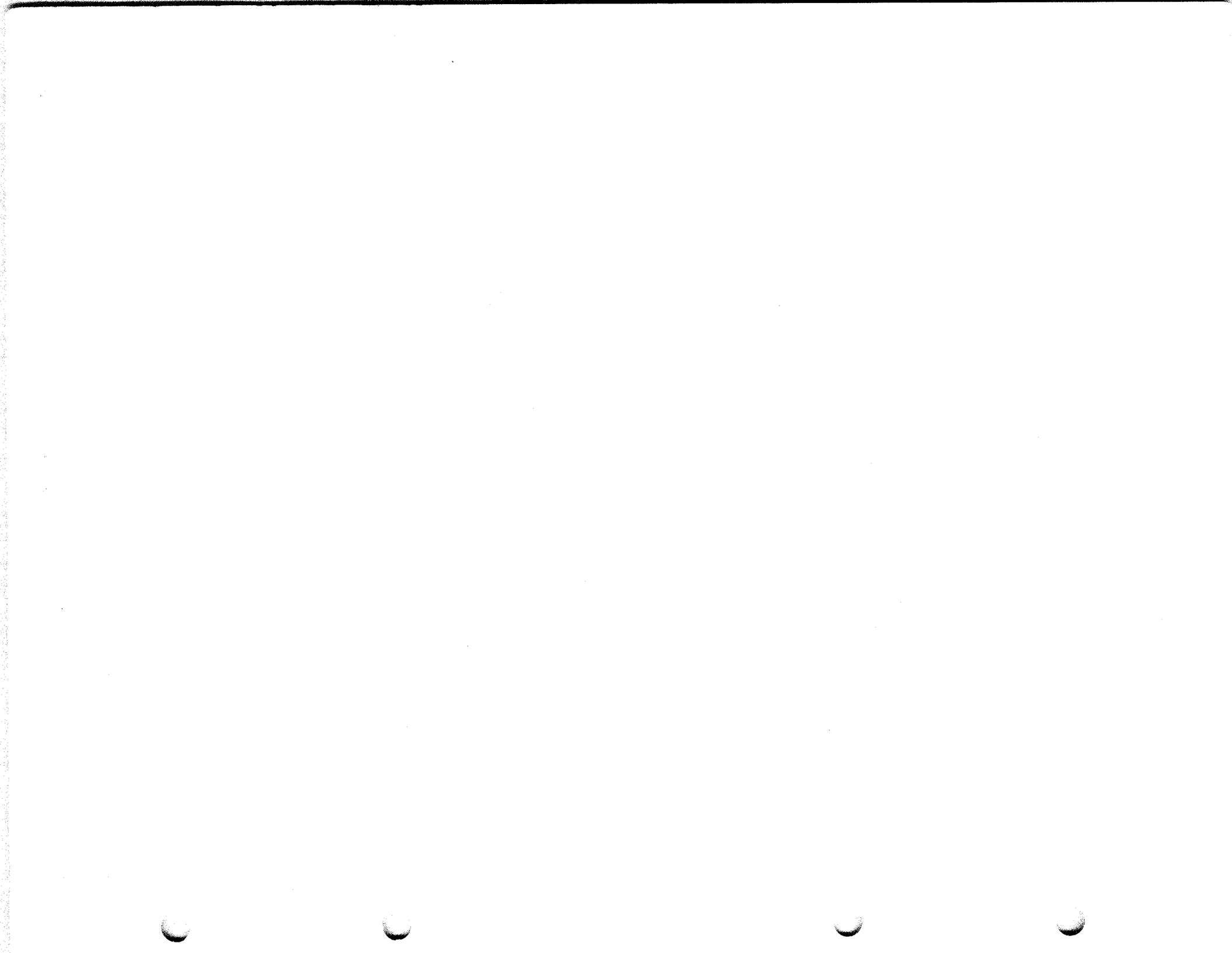
## SECTION 6 - SERVICE AND REPAIR

6-1.	Test Equipment (For Performing "Preventive Maintenance") . . . . .	6-0
6-2.	Test Equipment (For Performing "Performance Standards") . . . . .	6-17

## SECTION 7 - PARTS LIST

7-1.	Coupler, Antenna CU-691/U, Maintenance Parts List . . . . .	7-1
7-2.	Coupler, Antenna CU-691/U, List of Manufacturers . . . . .	7-13





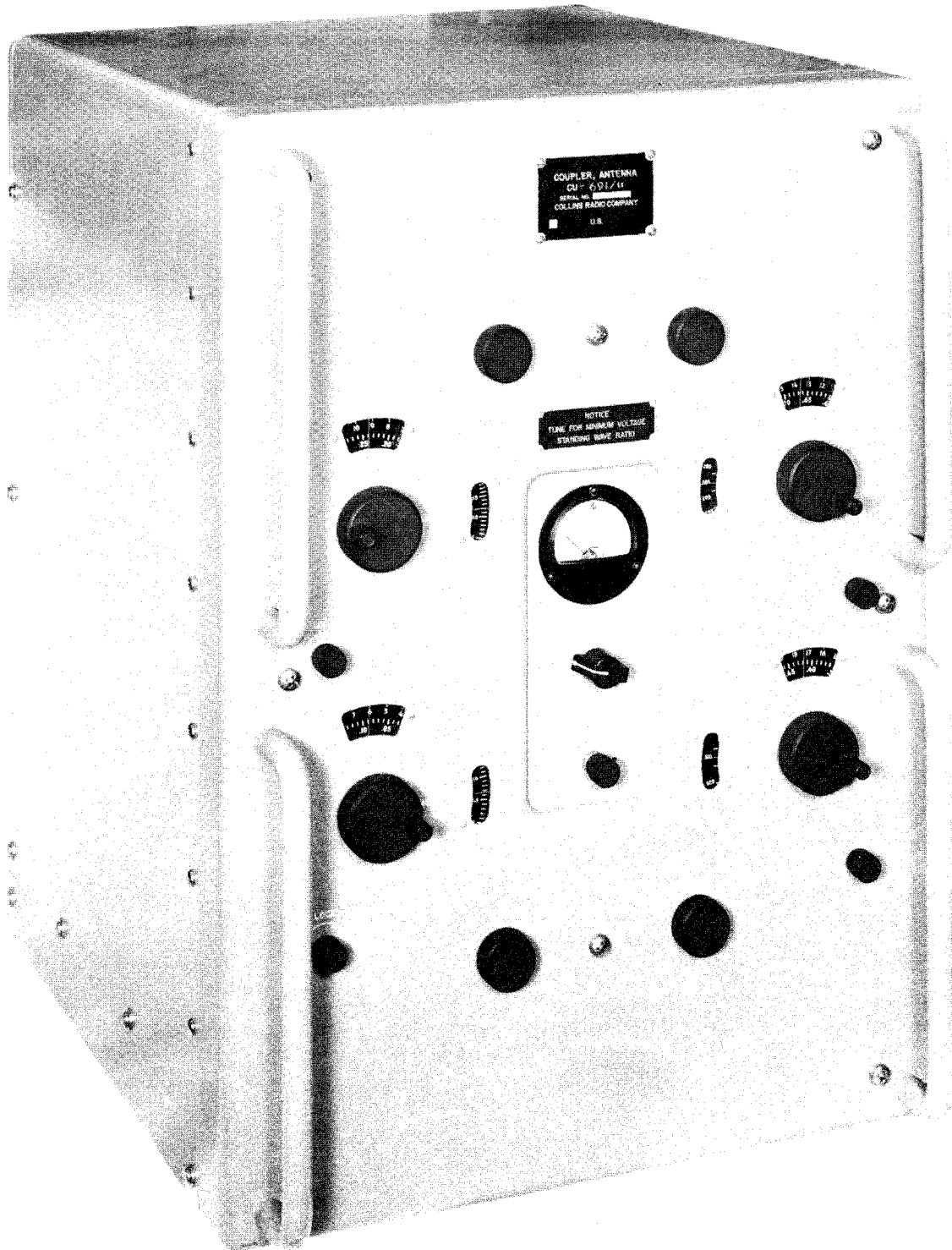


Figure 1-1. Antenna Coupler CU-691/U

## SECTION 1 GENERAL INFORMATION

### 1-1. INTRODUCTION.

This handbook contains installation and operation instructions, operating principles, and maintenance procedures for Antenna Coupler CU-691/U. The CU-691/U permits four separate transmitter and/or receiver combinations to operate simultaneously into a common antenna. The coupler operates in the frequency range of ~~225~~<sup>225</sup> to 400 megacycles (mc). Refer to figure 1-1.

### 1-2. FUNCTIONAL DESCRIPTION.

a. Antenna Coupler CU-691/U provides isolation between four transmitter and/or receiver combinations operating simultaneously into a common antenna. Isolation is achieved with four highly selective tandem filters and a combining network. The high selectivity reduces intermodulation interference, cross modulation interference, and spurious responses. Harmonic radiation from the transmitter(s) is also attenuated.

b. Inside the coupler are eight silver-plated aluminum tunable cavities. When properly tuned, each cavity is a 1/4-wavelength shorted coaxial element. The cavities are aperture coupled in groups of two, forming four dual-cavity tunable tandem filters. Adjustable tuning slugs in the cavity side walls permit compensation for minor irregularities in the cavity resonance curve. The outputs of the four filters are coupled to a common junction at the input of a combining network. The output of the combining network is the output connector for the antenna transmission line.

c. A monitor coupler assembly is inserted in each input transmission line between the input type N coaxial connector and the input to the tandem filter. The coupler assembly develops direct-current (d-c) voltages proportional to the forward and reflected wave components existing on each line. The d-c voltages are supplied to the meter circuit via the function selector switch. Calibrating resistors, selected by the switch, derive meter readings from the developed d-c voltages which show forward power and standing-wave ratio (swr). The meter readings are useful for tuning the filters and for monitoring line conditions during operation.

### 1-3. FACTORY OR FIELD CHANGES.

No field changes have been made on Antenna Coupler CU-691/U.

### 1-4. QUICK REFERENCE DATA.

Input impedance . . . . 50 ohms

Number of inputs . . . . 4 (type N connector)

Output impedance . . . . 50 ohms (nominal)

Number of outputs . . . . 1 (type HN connector)

Power level . . . . . 0-200 watts

Frequency range of tandem filters . . . . . 225-400 mc

Maximum swr . . . . . 2.0:1

Off-channel rejection . . . . 1 mc-20 db  
3 mc-40 db  
10 mc-60 db

Decoupling . . . . . 5 mc channel separation:  
50 db min.  
10 mc channel separation:  
60 db min.

Insertion loss . . . . . 2.0 db max.

Monitor meter scale . . Power (watts), 0-200  
SWR, unity-infinity

Monitor switch positions (one set for each input) . . . . POWER  
SWR CAL  
SWR

#### Monitor accuracy:

POWER: SWR:	±15% Actual	Indicated
	1.0:1	1.0:1 to 1.5:1
	2.0:1	1.5:1 to 2.6:1
	3.0:1	2.3:1 to 4.1:1
	4.0:1	2.9:1 to 6.0:1
	5.0:1	3.6:1 to 8.0:1

Type of tuning . . . . . Manual

Tuning scales . . . . . Megacycles

Calibration accuracy . . ±0.3 mc

Type of coupling . . . . Loop (input and output)  
Aperture (between tandem filter cavities)

Resettability . . . . . ±0.1 mc

**1-5. EQUIPMENT LISTS.**

a. EQUIPMENT SUPPLIED. - Equipment supplied is listed in table 1-1.

b. EQUIPMENT AND PUBLICATIONS, REQUIRED BUT NOT SUPPLIED. - No additional equipment is required for proper operation of Antenna Coupler CU-691/U. However, the coupler is used with an

antenna, four transmitter and/or receiver combinations, and the associated 52-ohm coaxial transmission line.

c. SHIPPING DATA. - Shipping data is listed in table 1-2.

d. ELECTRON TUBE COMPLEMENT. - Antenna Coupler CU-691/U contains no electron tubes but uses eight type 1N21C diodes.

TABLE 1-1. ANTENNA COUPLER CU-691/U, EQUIPMENT SUPPLIED

QUANTITY PER EQUIP.	NAME	DESIGNATION	OVERALL DIMENSIONS*			VOLUME*	WEIGHT*
			HEIGHT	WIDTH	DEPTH		
1	Antenna Coupler	CU-691/U	24-27/64	17-1/4	22-7/16	5.5**	90
6	Shockmounts	None	1-1/2	3	3	-----	--
4	Rack-Mounting Brackets	None	11-1/4	7/8	1	-----	--
1	Channel Mount	None	16-11/64	3-3/8	1-3/16	-----	--

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

\*\*Approximate value.

TABLE 1-2. ANTENNA COUPLER CU-691/U, SHIPPING DATA

BOX NO.	NOMENCLATURE		OVERALL DIMENSIONS			VOLUME*	WEIGHT*
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Antenna Coupler	CU-691/U	34	24-1/4	30-1/4	14.5	185

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

## SECTION 2 INSTALLATION

### 2-1. UNPACKING AND HANDLING.

Carefully unpack Antenna Coupler CU-691/U, and inspect it for evidence of shipping damage. If damage is evident, notify the transportation agency immediately. Packing material must be retained to substantiate damage claims.

### 2-2. INSTALLATION REQUIREMENTS.

a. **INSTALLATION POINTERS.** - Antenna Coupler CU-691/U may be either rack or bench mounted. For rack mounting, four rack-mounting brackets are provided. The brackets are stored within the wrap-around cover when the coupler is bench mounted. Six shockmounts and a channel mount are provided

for installations which require the coupler to be shockmounted. Refer to figure 2-1 for positions of brackets, shockmounts, and channel mount. Insure that there is at least a four-inch clearance behind the coupler to facilitate connecting the transmission line. An interconnecting diagram of a typical installation is shown in figure 2-2. Cable requirements are given in table 2-1.

#### NOTE

Refer to the applicable ship or station plans to determine cable lengths for any specific installation.

TABLE 2-1. ANTENNA COUPLER CU-691/U, CABLE REQUIREMENTS

NO. OF CABLES	TYPE OF CABLE	TERMINATION AT COUPLER
4	RG-8/U	Type N (male)
1	RG-8/U	Type HN (male)

b. **CABLE ASSEMBLY.** - Install type N male connectors on the input transmission lines as shown in figure 2-3. Install a type HN male connector on the antenna transmission line as shown in figure 2-4.

d. If the tuning systems are operating properly, replace the front panel. Refer to paragraph 6-4.b.(9).

e. For proper operating procedure, refer to paragraph 3-3.b.

### 2-3. INSPECTION AND ADJUSTMENTS.

a. Check the physical operation of the meter function switch. Switch action should be positive in all positions.

b. Expose the gear trains by removing the front panel. Refer to paragraph 6-4.a.(1).

c. While observing the REVOLUTIONS dials associated with each pair of cavities, manually turn each coarse tuning control knob throughout the entire tunable range (approximately 28.5 revolutions). If resistance is felt at any point, refer to section 5 for corrective action.

### 2-4. PREPARATION FOR RESHIPMENT.

a. **EQUIPMENT PREPARATION.** - Before the coupler is packed for reshipment, all channels should be tuned to 400 mc. The movable conductors will then be completely retracted and fully supported during shipment.

b. **PACKING INSTRUCTIONS.** - The following packing instructions are similar to those used to prepare the coupler for shipment from the factory. These instructions are suitable for overseas shipment and for long storage periods. If technical manuals are included in the shipping box, the box shall be marked, "TECHNICAL MANUALS INSIDE."

#### CAUTION

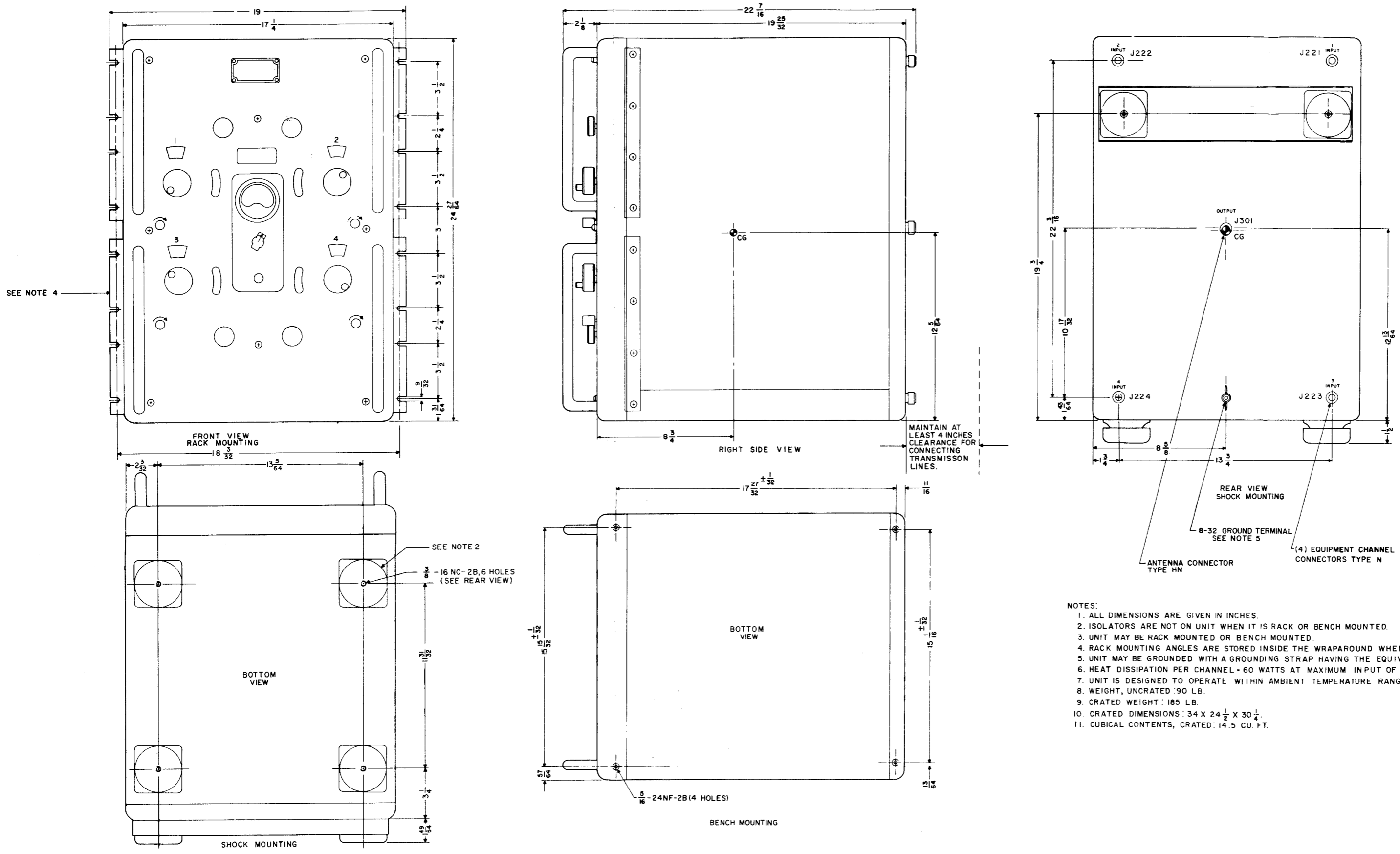
Avoid hitting end stops while tuning tandem cavities.

- (1) Wrap the coupler in heavy wrapping paper.
- (2) Place the paper-wrapped coupler in a conforming cardboard carton with corner pads for support.

Figure 2-1

NAVSHIPS 93235(A)

CU-691/U  
INSTALLATION



- NOTES:
1. ALL DIMENSIONS ARE GIVEN IN INCHES.
  2. ISOLATORS ARE NOT ON UNIT WHEN IT IS RACK OR BENCH MOUNTED.
  3. UNIT MAY BE RACK MOUNTED OR BENCH MOUNTED.
  4. RACK MOUNTING ANGLES ARE STORED INSIDE THE WRAPAROUND WHEN THE UNIT IS BENCH OR SHOCK MOUNTED.
  5. UNIT MAY BE GROUNDING WITH A GROUNDING STRAP HAVING THE EQUIVALENT CROSS SECTIONAL AREA OF A NO.10 WIRE.
  6. HEAT DISSIPATION PER CHANNEL = 60 WATTS AT MAXIMUM INPUT OF 200 WATTS.
  7. UNIT IS DESIGNED TO OPERATE WITHIN AMBIENT TEMPERATURE RANGE OF -40° TO +50° CENTIGRADE.
  8. WEIGHT, UNCRATED : 90 LB.
  9. CRATED WEIGHT : 185 LB.
  10. CRATED DIMENSIONS : 34 X 24 1/2 X 30 1/4.
  11. CUBICAL CONTENTS, CRATED : 14.5 CU. FT.

Figure 2-1. Antenna Coupler CU-691/U, Outline and Installation Dimensions

- (3) Put approximately eight pounds of a desiccant (silica gel) in the carton around the coupler.
- (4) Wrap the cardboard carton in moisture-proof paper.

- (5) Next, place the unit in a heavy moisture-proof cardboard carton.
- (6) Finally, place the cardboard carton in a wooden box with corrugated pads for support.

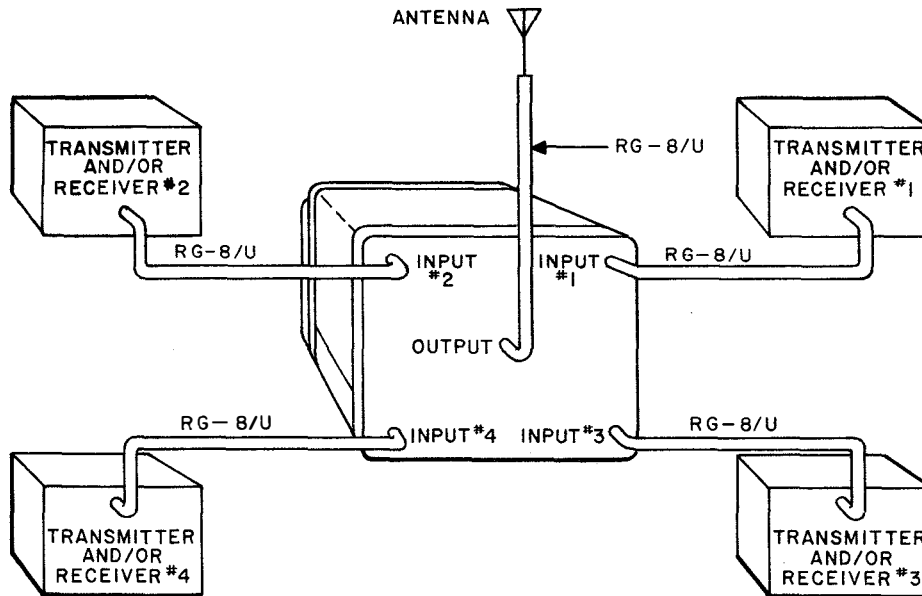


Figure 2-2. Antenna Coupler CU-691/U, Interconnecting Diagram of a Typical Installation

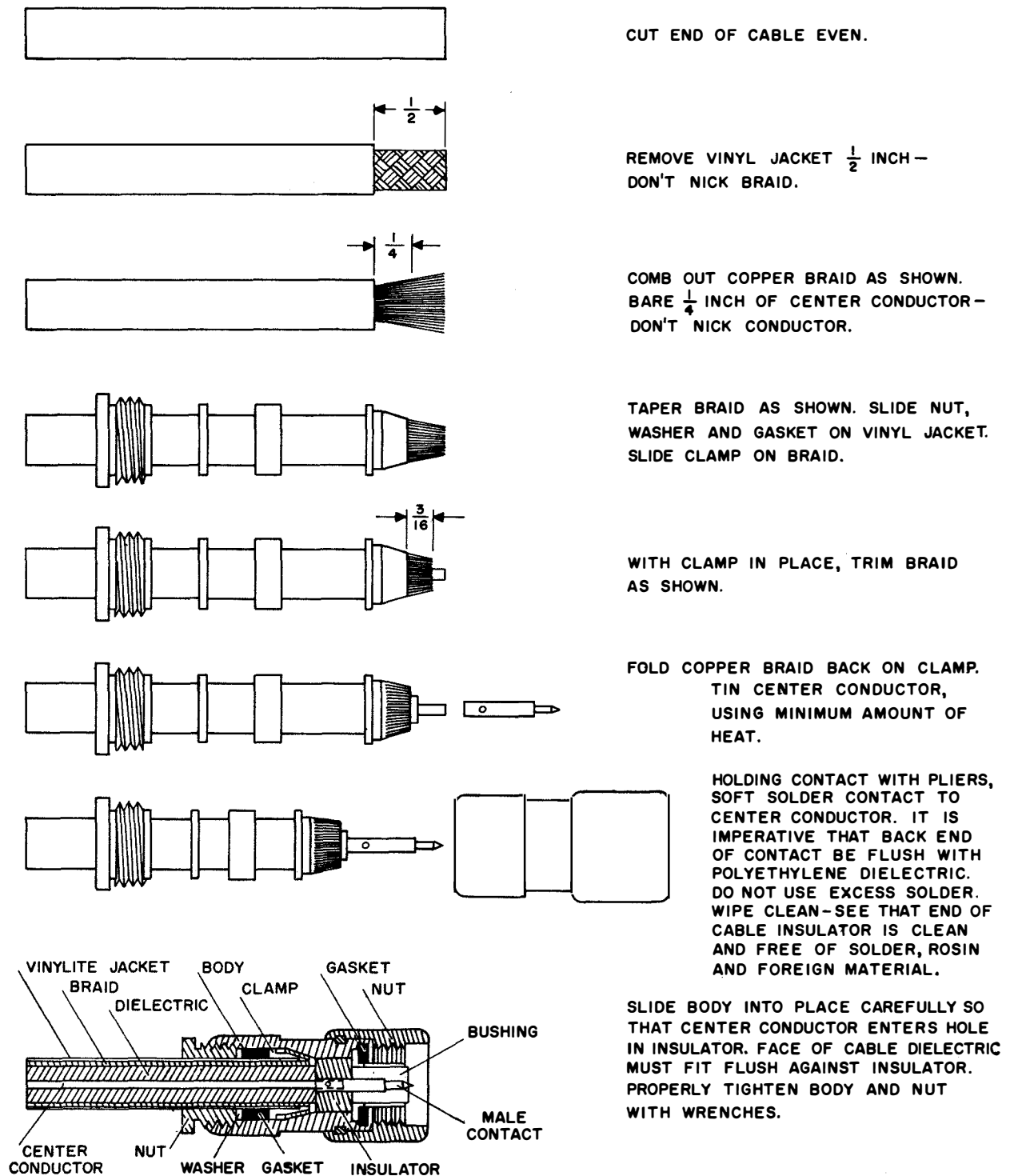
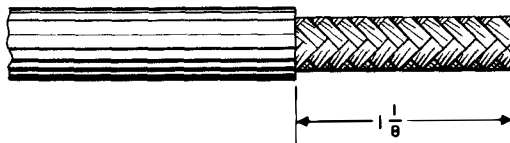
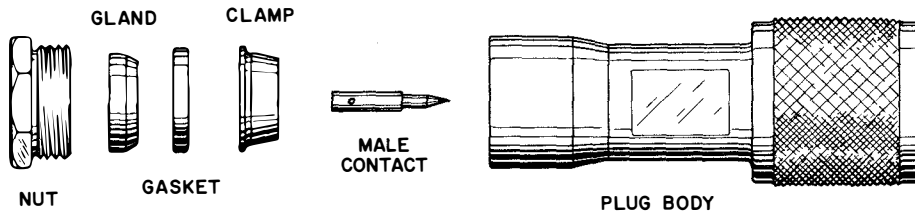
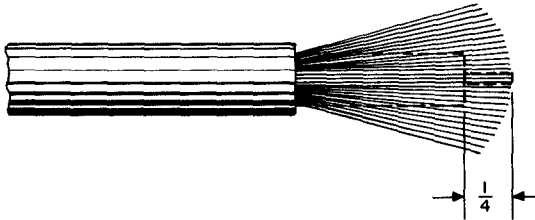


Figure 2-3. Installation of Type N Male Connectors on RG-8/U Transmission Line





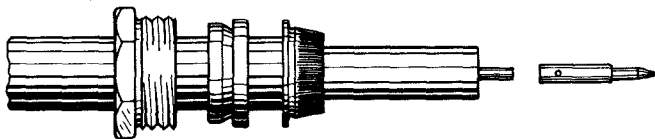
CUT END OF CABLE EVEN. STRIP OFF VINYL JACKET  $\frac{1}{8}$ " AS SHOWN. WHEN USING DOUBLE SHIELDED CABLE, THIS DIMENSION SHOULD BE  $\frac{3}{16}$ ".



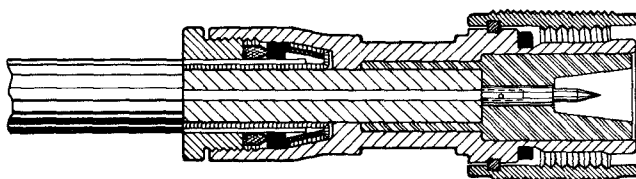
FRAY COPPER BRAID AS SHOWN. CUT OFF DIELECTRIC  $\frac{1}{4}$ " FROM END AND TIN CENTER CONDUCTOR.



TAPER BRAID AND SLIDE NUT AND GLAND ONTO JACKET. MAKE CERTAIN KNIFE EDGE OF GLAND IS TOWARD END OF CABLE. THEN SLIDE GASKET ONTO JACKET WITH "V" GROOVE TOWARD GLAND. CLAMP IS NOW PUSHED OVER BRAID SO THAT INTERNAL SHOULDER BUTTS FLUSH AGAINST VINYL JACKET.



FOLD BRAID BACK OVER CLAMP AND TRIM. SOFT SOLDER CONTACT TO CENTER CONDUCTOR. CONTACT MUST BUTT AGAINST CABLE DIELECTRIC. AVOID USE OF EXCESSIVE HEAT AS IT WILL SWELL DIELECTRIC. SEE THAT CONTACT AND END OF DIELECTRIC ARE FREE OF SOLDER, RESIN AND FOREIGN MATERIAL.



SLIDE BODY CAREFULLY INTO PLACE SO THAT CONTACT ENTERS HOLE IN INSULATOR. FACE OF DIELECTRIC MUST FIT FLUSH AGAINST INSULATOR. SLIDE GASKET, GLAND AND NUT INTO BODY BY PUSHING NUT. BE SURE KNIFE EDGE OF GLAND REMAINS IN GROOVE OF GASKET. TIGHTEN NUT WITH WRENCH. GASKET SHOULD BE CUT IN HALF DURING TIGHTENING.

Figure 2-4. Installation of Type HN Male Connectors on RG-8/U Transmission Line

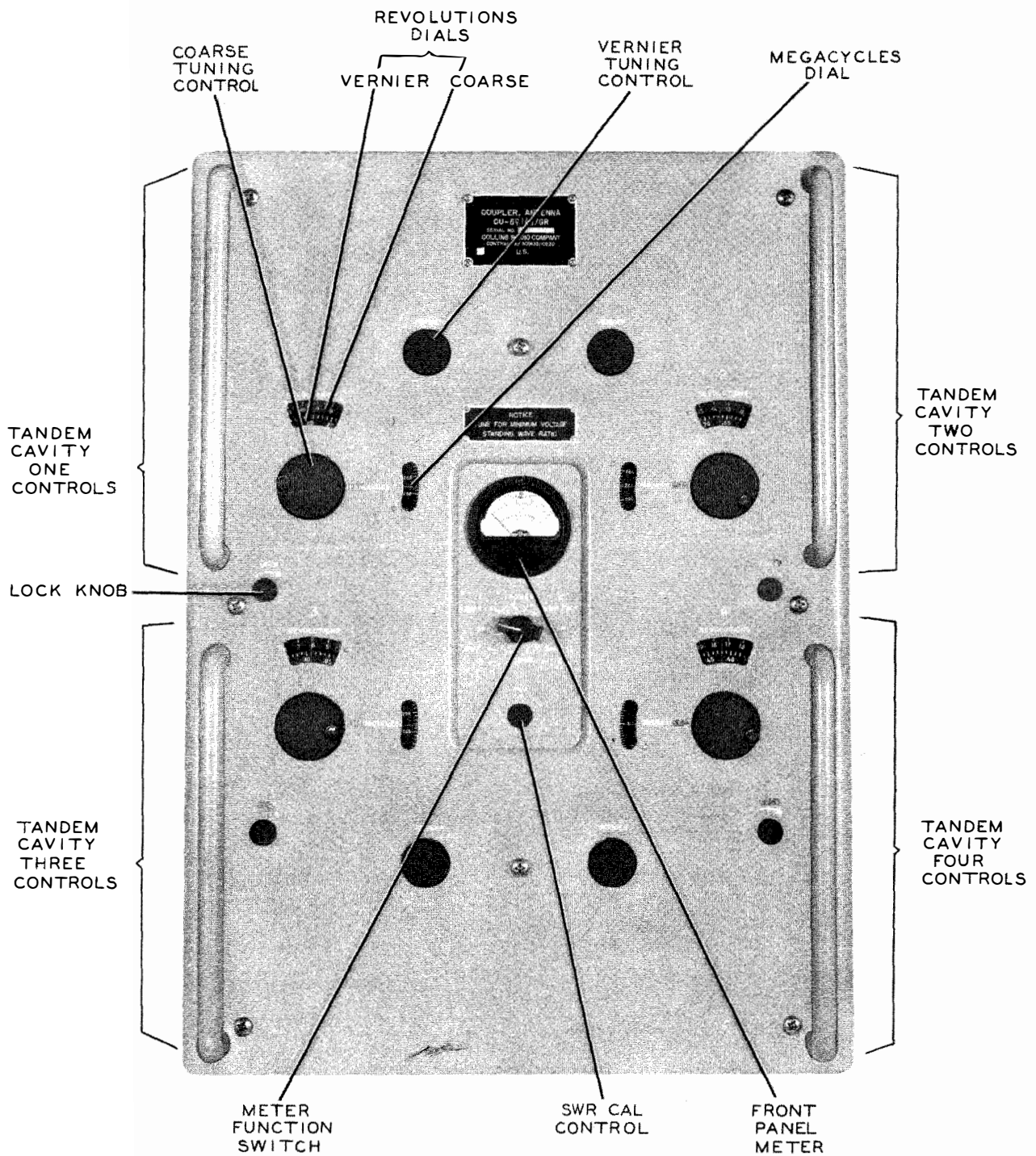


Figure 3-1. Antenna Coupler CU-691/U, Front Panel Control Locations

## SECTION 3 OPERATOR'S SECTION

### 3-1. FUNCTIONAL OPERATION.

a. Antenna Coupler CU-691/U provides isolation between four transmitter and/or receiver combinations operating simultaneously into a common antenna. Isolation is achieved with highly selective tandem filters and a combining network. Each filter consists of two cavities which are tuned simultaneously. When properly tuned, each cavity is a 1/4-wavelength shorted coaxial element. The cavities are tracked together across the entire tuning range (225 to 400 mc) with a spring-loaded gear train, which rotates precision lead screws connected to the cavity movable conductors. Small tracking slugs in the cavity side walls compensate for minor irregularities in the cavity resonance curve, permitting extremely accurate tracking throughout the tuning range. The output loop of each tandem filter is connected to the combining network input through a short section of transmission line.

b. The combining network consists of two short, equal lengths of transmission line in series. The two sections differ in characteristic impedance because of different size inner conductors. The combining network sections are selected so that the impedance looking into the output terminal is nominally the same as the impedance looking into the input terminal of a resonant tandem cavity. Both impedances have a nominal value of 50 ohms. The impedance looking into either the input or output coupling loop of any nonresonant cavity is essentially an open circuit.

c. Monitor circuits, located in the input transmission lines, derive d-c voltages proportional to the forward and reflected wave components existing on the input transmission lines. The derived d-c

voltages are used as the basis for POWER, SWR CAL, and SWR meter readings.

d. The movable conductors in each pair of cavities are mechanically positioned by two tuning control knobs. The position of the conductor is indicated on the index plates, which show the tuning range in megacycles and in revolutions. Mechanical loading eliminates backlash in the gear trains and in the precision lead screw assembly.

e. Antenna Coupler CU-691/U is capable of accepting r-f energy on all input channels simultaneously, each channel having a carrier power level of 200 watts. The coupler will operate at temperatures ranging from -40°C (-40°F) to +50°C (+12°F) and in relative humidities up to 95 percent.

f. The frequency separation between channels of the coupler determines the amount of isolation (attenuation) achieved between the channels. The greater the frequency separation becomes, the greater the isolation. Therefore, if the communication system employing the coupler requires a certain amount of attenuation between channels, the frequency separation between channels must be sufficient to give the desired attenuation. Typical channel-to-channel isolation curves for three frequencies are shown in figure 3-2.

### 3-2. PREPARATION FOR USE.

a. Connect the output transmission line (from the antenna) to the output jack (J301).

b. Connect the input transmission lines (from the transmitters and/or receivers) to the input jacks (J221, J222, J223, and J224).

### 3-3. OPERATING CONTROLS.

a. DESCRIPTION OF CONTROLS. - Table 3-1 describes the operating controls and indicators of Antenna Coupler CU-691/U. Refer to figure 3-1.

TABLE 3-1. CONTROLS/INDICATORS AND FUNCTIONS

CONTROL OR INDICATOR	FUNCTION
Tandem cavities 1, 2, 3, and 4 coarse tuning controls.	Drive gear trains coupled to the tandem cavity lead screws which coarse position the associated movable conductors.
Tandem cavities 1, 2, 3, and 4 VERNIER tuning controls.	Drive gear trains coupled to the tandem cavity lead screws which fine position the associated movable conductors. VERNIER to coarse tuning ratio is 4:1.
LOCK knobs 1, 2, 3, and 4.	Lock the tuning mechanism associated with a set of tuning controls in any desired position as set by the tuning controls.

TABLE 3-1. CONTROLS/INDICATORS AND FUNCTIONS (Cont)

CONTROL OR INDICATOR	FUNCTION		
MEGACYCLES dials 1, 2, 3, and 4.	Indicate the approximate frequency to which the associated tandem cavity is tuned.		
REVOLUTIONS dials 1, 2, 3, and 4.	Provide an accurate indication of the revolutions of the associated coarse tuning control, for resetting purposes. Each dial consists of two concentric index plates. The inner (lower) index plate makes one complete revolution with each revolution of the associated coarse tuning control. The outer (upper) index plate advances one division for each revolution of the associated coarse tuning control.		
Front panel meter.	Indicates POWER in watts or SWR as selected by the meter function switch.		
Meter function switch.	This switch has 12 positions as follows:		
	GROUP	POSITION	FUNCTION
	1	POWER	Connects the meter to indicate forward power on the input transmission line to tandem cavity 1.
		SWR CAL	Connects the meter so that by adjusting the SWR CAL control, the SWR reading is calibrated in accordance with the power level on the input transmission line to tandem cavity 1.
		SWR	Connects the meter to indicate SWR on the input transmission line to tandem cavity 1.
	2	POWER	Same as for group 1, except functions apply to tandem cavity 2.
		SWR CAL	
SWR			
3	POWER	Same as for group 1, except functions apply to tandem cavity 3.	
	SWR CAL		
	SWR		
4	POWER	Same as for group 1, except functions apply to tandem cavity 4.	
	SWR CAL		
	SWR		
SWR CAL control.	Adjusts the meter indication of forward power level for accurate SWR indications when the meter function switch is set at any of the four SWR CAL positions.		

b. SEQUENCE OF OPERATION.

**CAUTION**

WHENEVER TUNING TANDEM CAVITIES, AVOID HITTING END STOPS. MISALIGNMENT OF TUNING ASSEMBLIES MAY RESULT IF THE TUNING CONTROLS ARE ROTATED INTO THE STOPS.

(1) OPERATION WITH A TRANSMITTER.

**NOTE**

The following procedure assumes the transmitter transmission line is connected to the tandem cavity 1 input jack and the antenna transmission line is connected to the coupler output jack. (Antenna swr must be less than 2:1.)

(a) Rotate the tandem cavity 1 coarse tuning control until the corresponding MEGACYCLES dial indicates the transmitter operating frequency. Maintain adequate frequency separation between channels for proper system operation. See figure 3-2 for typical channel-to-channel isolation curves.

(b) Set the meter function switch to the group 1 SWR position.

(c) Energize the transmitter and rotate tandem cavity 1 VERNIER tuning control until the meter shows a decided dip or null, indicating the tandem cavity is resonated.

**CAUTION**

If no null can be found, de-energize the transmitter immediately. Lack of null indicates either an improper load, an erroneous transmitter frequency, or a defective coupler. Recheck the load and the transmitter frequency. If they are correct, refer to paragraph 5-3. for trouble-analysis of the CU-691/U.

(d) Set the meter function switch to the group 1 SWR CAL position. Rotate the SWR CAL control until the meter reads exactly full scale.

(e) Reset the meter function switch to the group 1 SWR position. The meter should read 2.0 or less.

**CAUTION**

A higher than 2.0 swr reading indicates either an improper load or a defective coupler. Recheck the load. If the load has an swr less than 2:1, refer to paragraph 5-3. for trouble analysis of the CU-691/U.

(f) Tandem cavity 1 is now tuned to the transmitter frequency. If at some later time the tandem cavity will be reset to this frequency, record the reading of the REVOLUTIONS index plates. The tandem cavity may then be retuned to this frequency by setting the recorded reading on the REVOLUTIONS index plates.

(g) Repeat this procedure for each transmitter and frequency. Refer the instructions to tandem cavity 2, 3, or 4 as appropriate.

(2) OPERATION WITH A RECEIVER, METHOD ONE. - The following procedure for operating a receiver with Antenna Coupler CU-691/U employs a transmitter to tune the coupler. If a transmitter is not available, refer to paragraph 3-3.b.(3).

**NOTE**

The following procedure assumes the tuning-transmitter transmission line is connected to the tandem cavity 1 input jack and the antenna transmission line is connected to the coupler output jack.

(a) Tune the transmitter to the receiver frequency. Maintain adequate frequency separation between channels for proper system operation. See figure 3-2 for typical channel-to-channel isolation curves.

(b) Tune the coupler as described in paragraphs 3-3.b.(1)(a) through 3-3.b.(1)(g) of this section.

(c) Remove the transmitter transmission line, and connect the receiver transmission line to the same input jack.

(d) The CU-691/U is now tuned to the receiver frequency. If at some later time the tandem cavity will be reset to this frequency, record the reading of the REVOLUTIONS index plates. The tandem cavity may then be retuned to this frequency by setting the recorded reading on the REVOLUTIONS index plates.

(e) Repeat this procedure for each receiver and frequency. Refer the instructions to tandem cavity 2, 3, or 4 as appropriate.

(3) OPERATION WITH A RECEIVER, METHOD TWO. - The following procedure for operating a receiver with Antenna Coupler CU-691/U is given if a transmitter is not available to tune the coupler:

**NOTE**

The following procedure assumes the receiver transmission line is connected to the tandem cavity 1 input jack and the antenna transmission line is connected to the coupler output jack.

(a) Rotate the tandem cavity 1 coarse tuning control until the corresponding MEGACYCLES dial indicates the receiver frequency. Maintain adequate frequency separation between channels for proper

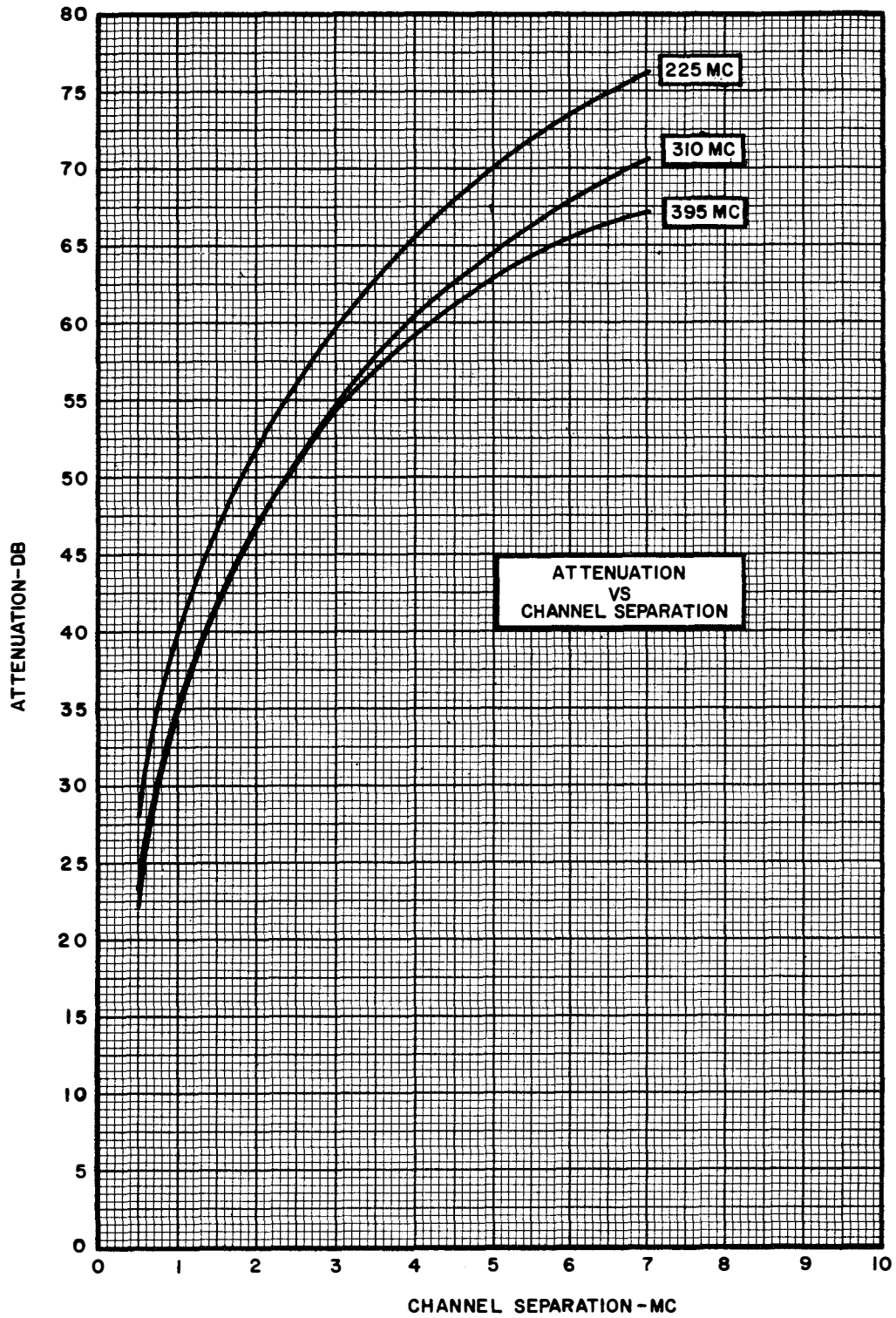


Figure 3-2. Graph: Typical Channel-to-Channel Isolation Curves at Three Frequencies

system operation. See figure 3-2 for typical channel-to-channel isolation curves.

(b) If a signal is present, observe the receiver signal-level meter and rotate the tandem cavity 1 VERNIER tuning control for maximum signal level. The CU-691/U is now tuned to the receiver frequency.

#### NOTE

If no signal is present, or if the signal is too weak for accurate tuning, proceed as follows:

(c) Disconnect the antenna transmission line from the output jack, and connect the line from a signal generator in its place.

(d) Energize the signal generator, and tune it to the receiver frequency.

(e) Observe the receiver signal-level meter, and rotate the tandem cavity 1 VERNIER tuning control for maximum signal level. Disconnect the signal generator and reconnect the antenna transmission line to the output jack.

(f) The CU-691/U is now tuned to the receiver frequency. If at some later time the tandem cavity will be reset to this frequency, record the reading of the REVOLUTIONS index plates. The tandem cavity may then be returned to this frequency by setting the recorded reading on the REVOLUTIONS index plates.

(g) Repeat this procedure for each receiver and frequency. Refer the instructions to tandem cavity 2, 3, or 4 as appropriate.

(4) SECURE. - Antenna Coupler CU-691/U is a passive unit, therefore no securing instructions are necessary. Securing the transmitter(s) and/or receiver(s) secures the coupler.

#### c. PRECAUTIONS.

(1) Do not operate a transmitter into an untuned tandem cavity. The transmitter might be seriously damaged even if it were operated into an untuned cavity for a short period of time. Therefore, always tune the tandem cavity to the transmitter frequency (refer to paragraph 3-3.b.(1)(a)) before energizing the transmitter. Immediately after energizing the transmitter, fine tune the tandem cavity to the exact transmitter frequency (refer to paragraph 3-3.b.(1)(c)).

(2) Avoid hitting end stops while tuning tandem cavities. Misalignment of tuning assemblies may result if the tuning controls are rotated into the stops.

#### 3-4. SUMMARY OF OPERATING PROCEDURES.

a. OPERATION WITH A TRANSMITTER. - Repeat the following steps for each transmitter and frequency.

Step 1. - Connect the transmitter transmission line to one of the tandem cavity input jacks.

Step 2. - Connect the antenna transmission line to the coupler output jack. (Antenna swr must be less than 2:1.)

ORIGINAL

Step 3. - Rotate the corresponding tandem cavity coarse tuning control until the associated MEGACYCLES dial indicates the transmitter frequency. Maintain adequate frequency separation between channels for proper system operation. See figure 3-2 for typical channel-to-channel isolation curves.

#### CAUTION

Do not operate a transmitter into an untuned cavity. Always tune the tandem cavity to the transmitter frequency before energizing the transmitter. Avoid hitting end stops while tuning tandem cavities.

Step 4. - Set the meter function switch to the corresponding tandem cavity SWR position.

Step 5. - Energize the transmitter.

Step 6. - Rotate the corresponding tandem cavity VERNIER tuning control until the meter shows a decided dip or null.

#### CAUTION

If no null can be found, de-energize the transmitter immediately. Recheck the antenna swr and the transmitter frequency. If they are correct (swr less than 2:1, frequency as selected), the CU-691/U is defective and must be repaired before continuing.

Step 7. - Set the meter function switch to the corresponding tandem cavity SWR CAL position, and rotate the SWR CAL control until the meter reads exactly full scale.

Step 8. - Reset the meter function switch to the previous SWR position. If a minimum swr is obtained (2.0 or less), the coupler is tuned to the transmitter frequency.

#### CAUTION

If the meter reads higher than 2.0, recheck the antenna swr. If the antenna has an acceptable swr (less than 2:1) the coupler is defective and must be repaired before continuing.

Step 9. - Secure the transmitter to secure the coupler.

b. OPERATION WITH A RECEIVER, METHOD ONE. - Operating a receiver with the CU-691/U, method one, requires a transmitter to tune the coupler to the receiver frequency. If a transmitter is not available, refer to paragraph 3-4.c. Repeat the following steps for each receiver and frequency.

Step 1. - Connect the transmitter transmission line to one of the tandem cavity input jacks.

Step 2. - Connect the antenna transmission line to the coupler output jack. (Antenna swr must be less than 2:1.)

Step 3. - Tune the transmitter to the receiver frequency. Maintain adequate frequency separation between channels for proper system operation. See figure 3-2 for typical channel-to-channel isolation curves.

Step 4. - Tune the CU-691/U unit as described in paragraph 3-4.a., steps 3 through 8.

**CAUTION**

Avoid hitting end stops while tuning tandem cavities.

Step 5. - Remove the transmitter transmission line and connect the receiver transmission line to the same input jack. The coupler is now tuned to the receiver frequency.

Step 6. - Secure the receiver to secure the coupler.

c. OPERATION WITH A RECEIVER, METHOD TWO. - Repeat the following steps for each receiver and frequency.

Step 1. - Connect the receiver transmission line to one of the tandem cavity input jacks.

Step 2. - Connect the antenna transmission line to the coupler output jack. (Antenna swr must be less than 2:1.)

Step 3. - Energize the receiver, and tune it to the desired frequency.

Step 4. - Rotate the corresponding tandem cavity coarse tuning control until the associated MEGA-CYCLES dial indicates the receiver frequency. Maintain adequate frequency separation between channels

for proper system operation. See figure 3-2 for typical channel-to-channel isolation curves.

**CAUTION**

Avoid hitting end stops while tuning tandem cavities.

Step 5. - Observe the receiver signal-level meter, and rotate the corresponding tandem cavity VERNIER tuning control for maximum signal level. The coupler is now tuned to the receiver frequency.

Step 6. - Secure the receiver to secure the coupler.

**NOTE**

If no signal is present, or if the signal is too weak for accurate tuning, continue with step 7.

Step 7. - Disconnect the antenna transmission line, and connect the line from a signal generator in its place.

Step 8. - Energize the signal generator, and tune it to the receiver frequency.

Step 9. - Observe the receiver signal-level meter, and rotate the corresponding tandem cavity VERNIER tuning control for maximum signal level.

Step 10. - Remove the signal generator line, and reconnect the antenna transmission line to the output jack. The coupler is now tuned to the receiver frequency.

Step 11. - Secure the receiver to secure the coupler.

**3-5. OPERATOR'S MAINTENANCE.**

Table 3-2 contains routine checks to be made by the operator.

TABLE 3-2. ROUTINE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	CHECK RESULTS
Complete equipment.	Inspect visually.	Equipment should be mounted properly, and knobs and dials should be intact.
SWR CAL control, meter function switch, and LOCK knobs.	Operate controls.	Action of SWR CAL control should be smooth. Meter function switch should have positive action. LOCK mechanisms should lock and unlock properly.
Tuning controls and dials.	Individually tune cavities throughout frequency range. Be careful NOT to force knobs if operation is not free and smooth.	Tuning should be smooth. Gear trains should have no backlash.



## SECTION 4 PRINCIPLES OF OPERATION

### 4-1. OVERALL FUNCTIONAL DESCRIPTION.

Antenna Coupler CU-691/U is shown in block diagram form in figure 4-1. To clarify the operation,

the coupler is considered as being composed of four subdivisions; namely, the tandem cavities, the combining network, the monitor circuits, and the tuning system.

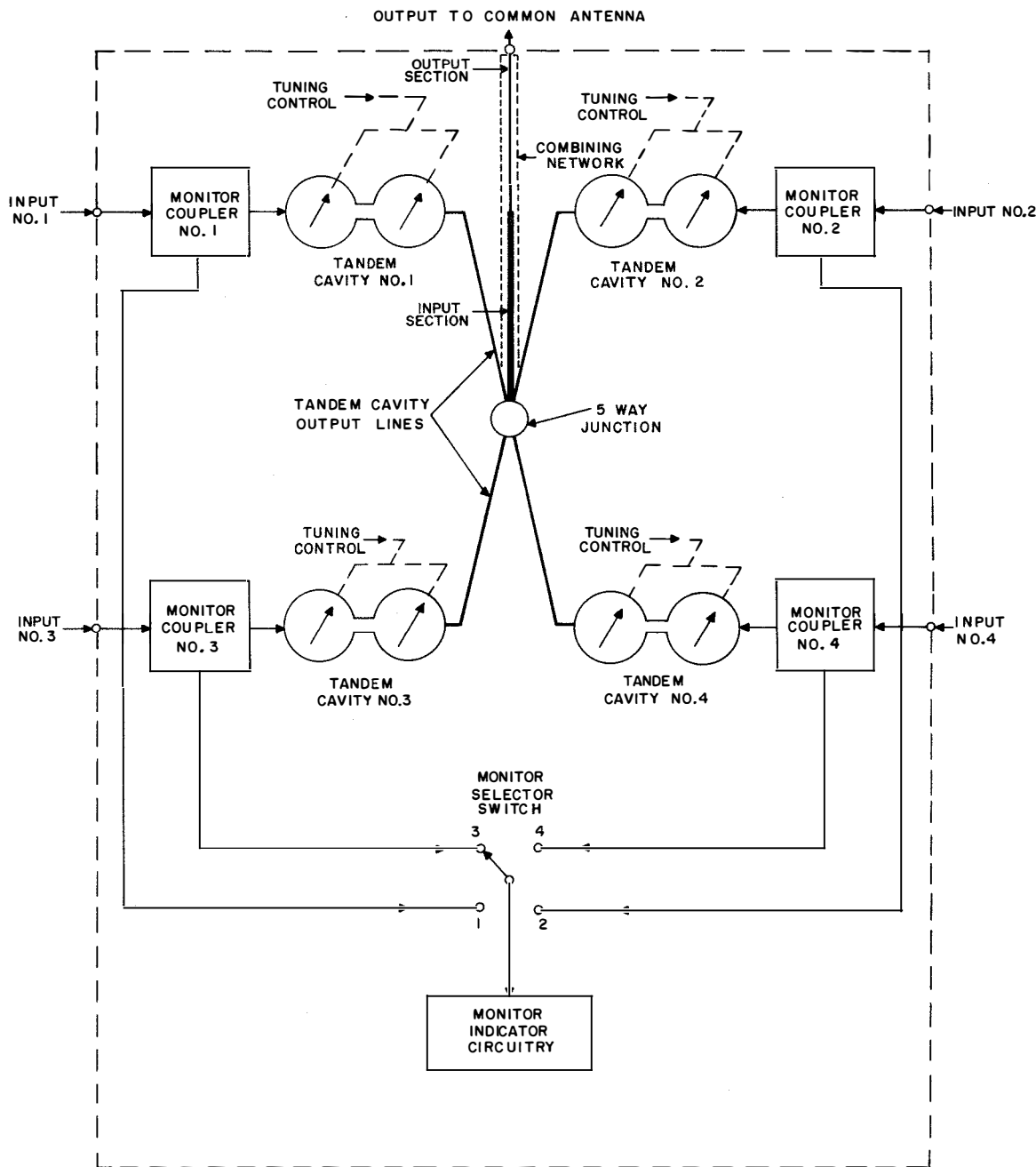


Figure 4-1. Antenna Coupler CU-691/U, Block Diagram

a. **TANDEM CAVITIES.** - Each tandem cavity is a two-section filter consisting of two cavities. Corresponding pairs of cavities are tracked together across the tuning range (225 to 400 mc) by a manually-positioned, spring-loaded gear train which rotates precision lead screws connected to the cavity movable conductors. Small tracking slugs in the cavity side walls (eight slugs in each cavity) compensate for minor irregularities in the cavity resonance curve, thus permitting extremely accurate tracking throughout the tuning range. The input and output transmission lines are loop coupled to the input and output cavities, respectively. Cavity pairs are coupled through an aperture in the cavity side walls.

b. **COMBINING NETWORK.** - The output loop of each of the four tandem cavities is connected to a short section of transmission line. The four lines join in a common junction at the input to the combining network. The output of the combining network is the output connector for the antenna transmission line. The combining network consists of two short, equal lengths of transmission line in series. The two sections differ in characteristic impedance because of a difference in the size of the inner conductors. The outer conductors of each section are identical. The impedance of the two sections of the combining network together with the impedance of the four sections of line from the tandem cavities, are such that the impedance looking into the output terminal is nominally the same as the impedance looking into the input terminal of a resonant tandem cavity. Both impedances have a nominal value of 50 ohms. The impedance looking into either the input or output coupling loop of any nonresonant cavity is essentially an open circuit.

c. **MONITOR CIRCUITS.** - The monitor circuits consist of four coupler units connected to a common indicator circuit through a function switch. Each coupler unit is inserted in the short section of transmission line between the input jack and the corresponding tandem cavity input. With this arrangement,

each input line is monitored separately before entering the associated tandem cavity. The coupler units derive d-c voltages proportional to the forward and reflected wave components existing on the input transmission lines. The derived d-c voltage proportional to the forward wave components (voltage and current) is used as the basis for the POWER meter reading and as the source of the full-scale level set by the SWR CAL control when the meter function switch is in the SWR CAL position. The derived d-c voltage proportional to the reflected wave components is used as the basis for the SWR meter reading.

d. **TUNING SYSTEM.** - The movable conductors in each pair of cavities are mechanically tracked through a gear train to a coarse tuning control, a fine tuning control, and a set of index plates. Mechanical loading eliminates backlash in the gear trains and in the precision lead screw assemblies.

## 4-2. FUNCTIONAL SECTIONS.

### a. TANDEM CAVITIES.

(1) **CAVITY DESIGN.** - The eight cavities are identically designed. Each cavity is composed of an outer conductor and an inner adjustable tuning conductor arranged to form an adjustable 1/4-wavelength coaxial element (figure 4-2). Each cavity acts as a shorted 1/4-wavelength stub. The cavities are tuned by positioning the movable inner cylinder of the tuning conductor. This varies the total length of the conductor to alter the resonant frequency of the cavity. The cavity elements are made of silver-plated aluminum. The outer conductor, which is 6 inches in diameter, is extruded from a single piece of material. The inner conductor, which is 1-3/4 inches in diameter, is composed of a fixed cylinder and a movable concentric extension or sleeve. When fully extended, the inner conductor length is such that the cavity resonates at 225 mc. The cavities have an unloaded Q of approximately 4000 and a loaded (operating) Q of approximately 700. The extremely high Q is due to the large size of the conductors and the small high-frequency losses inherent in the material and in the plating. Efficiency is related to Q by the formula:

$$\text{Efficiency} = \left(1 - \frac{Q_{\text{loaded}}}{Q_{\text{unloaded}}}\right) \times 100\%$$

The cavities thus have an efficiency of approximately 70 per cent over the tuning range. The absorbed power results in an insertion loss of less than 2.0 db at all frequencies. Figure 4-3 shows the distribution of insertion loss for a typical tandem cavity. The loss is about equally split between the two cavities. The power absorbed by a cavity is dissipated as heat. The heat rise is concentrated near the short-circuited end of the inner conductor, because the field distribution within the cavity gives rise to high circulating currents in the conductors in this area. The temperature rise in this area is the principal limiting factor in determining the power rating of the coupler.

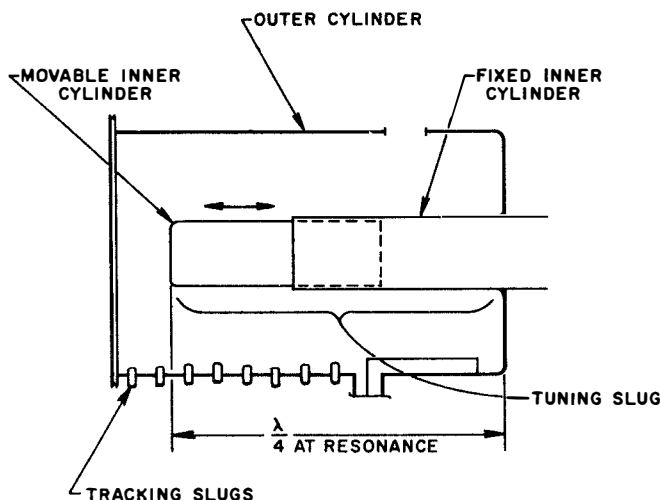


Figure 4-2. Cavity Design, Simplified Diagram

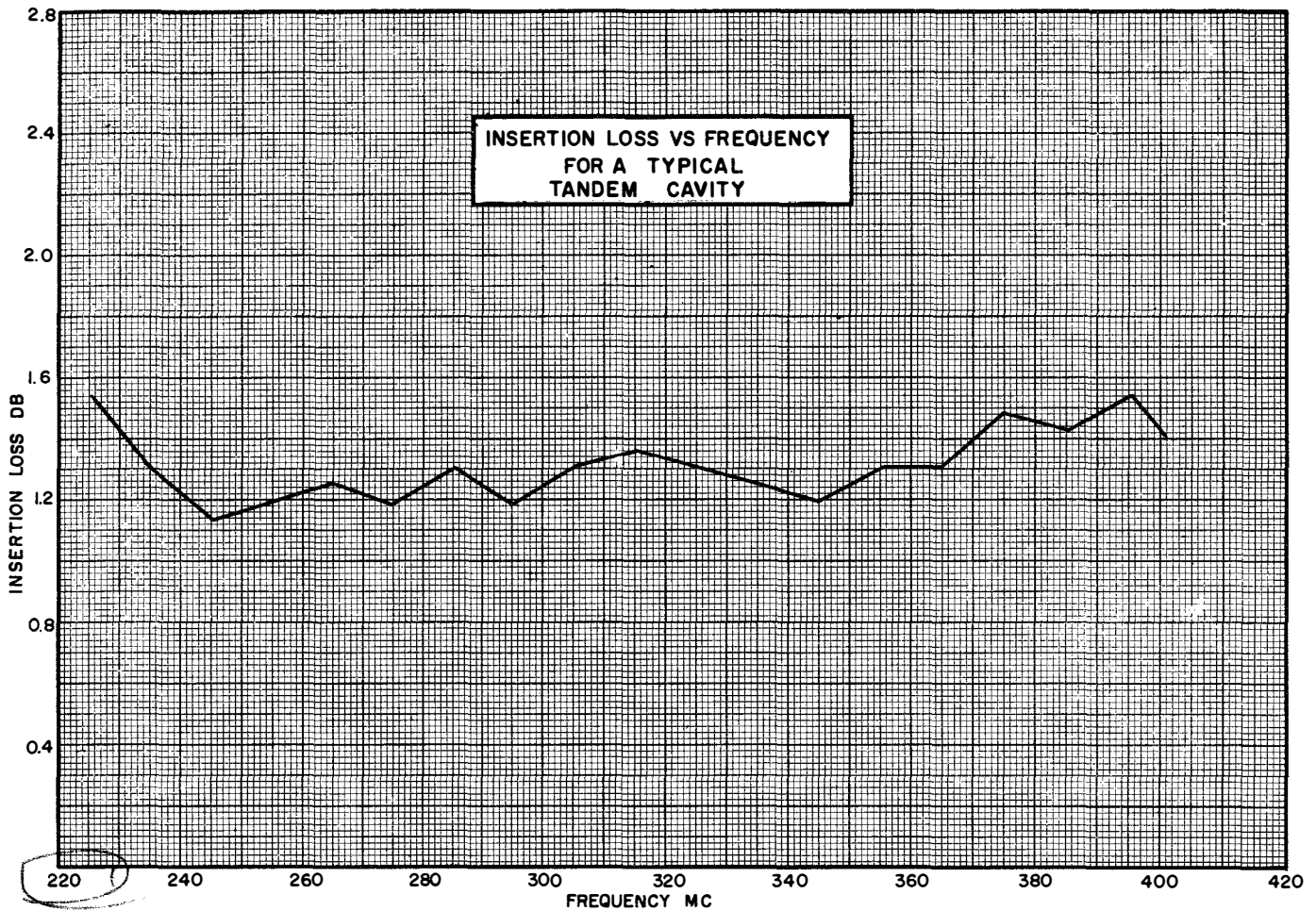


Figure 4-3. Graph: Typical Tandem Cavity Insertion Loss, 225 to 400 MC

Since the temperature rise is concentrated near the base of the center conductor, the precision lead screw and the cavity mounting posts are positioned in an area of heat dissipation. The temperature effects on these elements are minimized by making the lead screw of temperature-compensated Invar and the mounting posts of low-temperature-coefficient cold rolled steel. These materials compensate for temperature, permitting satisfactory frequency stability with temperature changes. Along the side of each cavity are eight fine-tracking slugs. The mechanical tuning system tracking accuracy is sufficient for coarse tracking, but cannot compensate for minor irregularities in the individual cavities. The fine-tracking slugs compensate for these irregularities, accurately tracking the resonant frequencies of the two cavities within the broad end of the selectivity curve (see figure 4-4). The slugs are factory adjusted for each matched pair of cavities.

(2) COUPLING ELEMENTS.

(a) INPUT AND OUTPUT COUPLING. - Inductive loop coupling is used to couple into and out

of the tandem cavity. There is one inductive loop in each of the eight cavities. One side of each loop is a flat strip of copper approximately 4 inches long and 5/8 inch wide. The strip is positioned 1/4 inch away from the inner wall of the outer conductor, parallel to the longitudinal axis of the cavity. One end of the strip is anchored to the wall with a solid copper block near the short-circuited (forward) end of the cavity. The other end of the strip is connected to the inner conductor of the transmission line at a feed-through terminal. The terminal is located approximately 5 inches from the shorted end of the cavity. The strip, the cavity wall area beneath the strip, and the copper block form the coupling loop. The loops are positioned to permit a reasonably constant degree of coupling throughout the tuning range. Refer to figure 4-5. The degree of coupling of an inductive loop is proportional to two factors; namely, the frequency and the effective cross-sectional loop area enclosing dense areas of magnetic lines of flux. In a resonant cavity, the magnetic lines of flux are distributed as a cosine function along the longitudinal axis of the cavity, with the maximum flux density occurring

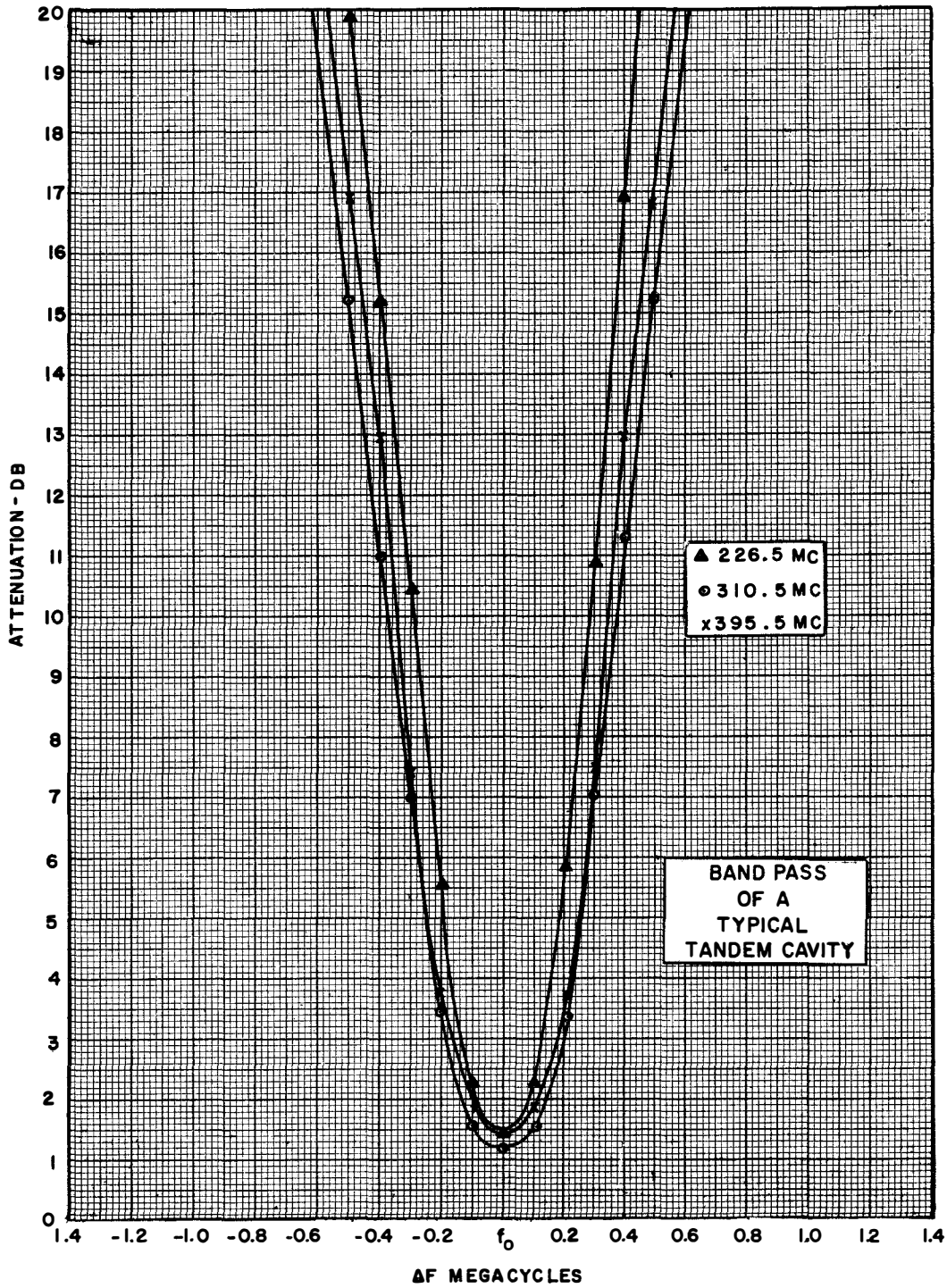


Figure 4-4. Graph: Typical Tandem Cavity Selectivity Curves at Three Frequencies

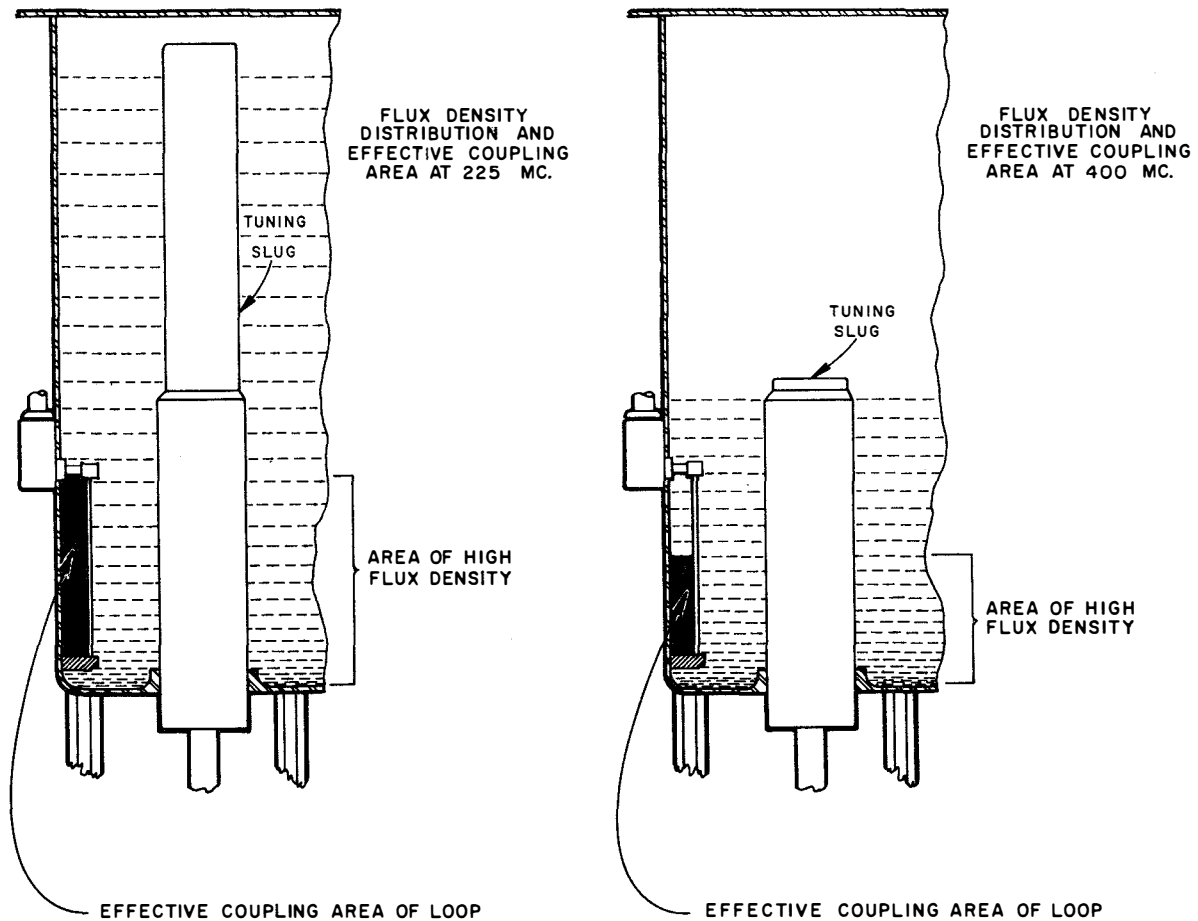


Figure 4-5. Flux Density Distribution and Effective Coupling Area Within a Cavity of Two Frequencies

near the shorted end. At the low-frequency end of the tuning range (225 mc), the tuning slug is well into the cavity. Therefore, the entire loop encloses an area of high flux density which compensates for the low degree of coupling due to the frequency. At the high-frequency end of the tuning range (400 mc), the tuning slug is well withdrawn from the cavity. Consequently, the magnetic lines of flux are highly compressed near the shorted end of the cavity, and only a small portion of the loop encloses an area of high flux density. However, the high degree of coupling due to the frequency compensates for the small effective loop-coupling area of high flux density. The effective loop-coupling area thus diminishes as the frequency is increased. By carefully selecting the position of the loop, the resultant degree of coupling is held reasonably constant throughout the tunable range of the cavity. Since operating  $Q$  and selectivity are related to the degree of coupling, the relatively constant degree of coupling maintains a reasonably constant  $Q$  and uniform selectivity across the entire tuning range.

(b) INTRA-CAVITY COUPLING. - Aperture coupling is used between the two cavities forming a tandem filter. The apertures consist of holes in

the cavity walls joined by a connecting collar attached to both cavities. The holes are positioned at a point where the degree of coupling remains relatively constant regardless of frequency. The area of the aperture is such that just enough energy is transferred from one cavity to the other to establish a state of critical coupling. This results in a broad-end selectivity curve with relatively steep sides, as is desirable for tracking purposes. The over-all selectivity curve at three representative resonant frequencies is shown in figure 4-4.

b. COMBINING NETWORK.

(1) FUNCTION. - The combining network, together with the short sections of transmission line between the cavities and the combining network input, re-establish a nominal 50-ohm impedance at the output terminal from the resonant cavity output impedance. Nonresonant cavities appear essentially as open circuits at both the input and output terminals of the cavity.

(2) DESIGN. - The combining network consists of two series sections of transmission line differing in characteristic impedance. Each section is  $1/4$ -wavelength long at 310 mc, or approximately  $9-1/2$

inches. The two sections have a common outer conductor. The inner conductor of the input section is larger than the inner conductor of the output section. The sizes of the inner conductors are such that the characteristic impedance of the input and output sections are approximately 41.5 ohms and 62.5 ohms, respectively. These values, together with the impedance of the four tandem cavity output coupling lines (52 ohms), give an output terminal impedance of 50 ohms (nominal) over the entire frequency range. These impedances provide the best band-pass characteristics consistent with good impedance match across the 225- to 400-mc range. The output section is terminated directly in the output connector on the rear panel. The sections of transmission line between the cavities and the input to the combining network are also 1/4-wavelength long at 310 mc (including the length of the output coupling loop). The lines are terminated in a five-way coaxial joint at the combining network input.

c. MONITOR CIRCUITS.

(1) GENERAL. - Each input transmission line is monitored separately by a coupler unit inserted in the input section of the line. The operating principles of each over-all monitor circuit are identical.

(2) R-F CIRCUIT.

(a) Refer to figure 4-6. The figure shows the coupler unit in input transmission line 1. Within the coupler unit, the center conductor of the transmission line is exposed, with the coupler unit case forming the outer conductor. Resistors R203 and R204 are positioned parallel to the exposed center conductor.

(b) Assume a mismatched line operating with standing waves. Transmission line current (I) induces a current (i) through each resistor, causing a voltage

drop across each resistor. Since the resistors are equal in value and have a grounded junction, the induced currents are equal in magnitude, but opposite in phase. The voltage drops across the resistors are similarly equal in magnitude and opposite in phase. These voltages are composed of two components, one proportional to forward wave current, and one proportional to reflected wave current. The voltage proportional to forward wave current is always larger than the voltage proportional to reflected wave current, and the voltages are related by some phase angle ( $\theta$ ). The phase angle is dependent on the degree of the line mismatch and the location of the coupler.

(c) Transmission line voltage (E) is capacitively coupled to resistors R203 and R204. This capacity coupling can be assumed as lumped between the transmission line and the ungrounded ends of the resistors, points A and B. The theoretical lumped capacitors are shown in figure 4-6 as C219 and C220. A voltage proportional to the line voltage appears across capacitors C205 and C207. Because the capacitors are equal in value, the capacity coupling to both resistors is equal, and the voltages across C205 and C207 are equal and in phase. Each of these voltages is composed of two components, one proportional to forward wave voltage, and one proportional to reflected wave voltage. Like the current components, the forward wave voltage component is always greater than the reflected wave voltage component, and the components are related by some phase angle ( $\phi$ ). The characteristics of the forward and reflected waves are such that the voltage angle ( $\phi$ ) is always the supplement of the current angle ( $\theta$ ); i.e.,  $\phi + \theta = 180$  degrees.

(d) The amount of inductive and capacitive coupling between the line and the resistors is adjusted by positioning R203 and R204 so that the component proportional to forward wave current is equal in magnitude to the component proportional

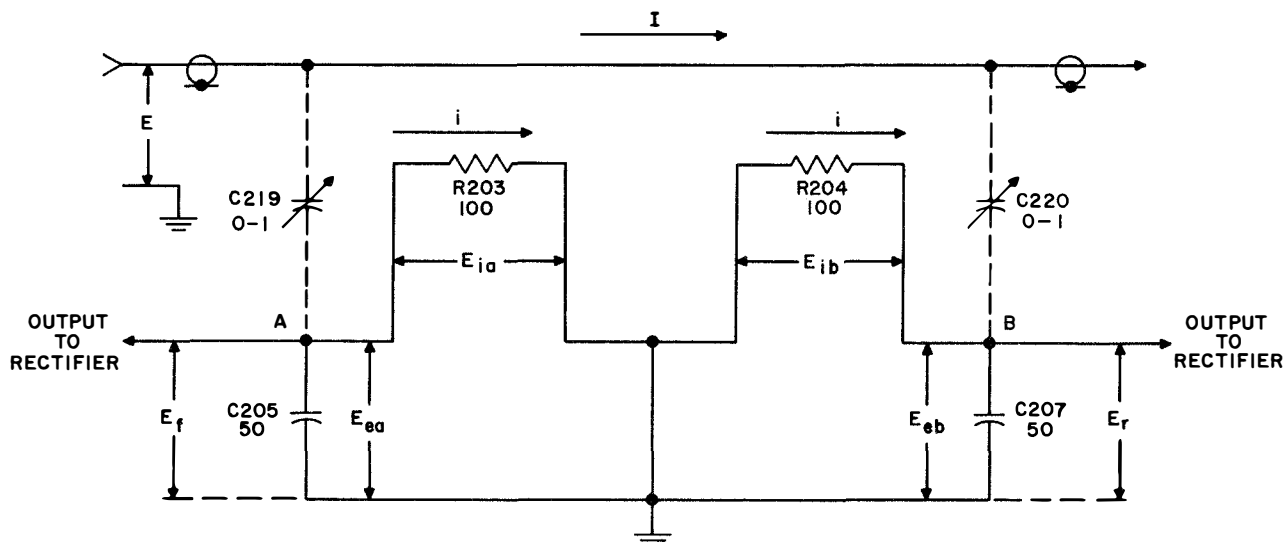


Figure 4-6. Monitor R-F Circuit, Simplified Schematic Diagram

to forward wave voltage. Then, the components proportional to the reflected wave current and voltage are also equal. The resultant r-f voltage outputs,  $E_f$  and  $E_r$ , are the vector sums of the voltage components between point A and ground, and point B and ground, respectively. Between point A and ground, since forward wave voltage is always in phase with forward wave current, and reflected wave voltage is always 180 degrees out of phase with reflected wave current, the equal forward wave components add and the equal reflected wave components cancel. The resultant r-f voltage output ( $E_f$ ) is thus the sum of the forward wave components, or directly proportional to the magnitude of the forward wave. Between point B and ground, due to the current phase reversal across R204, equal forward wave components cancel, while reflected wave components add. The resultant r-f voltage output ( $E_r$ ) is thus the sum of the reflected wave components, or directly proportional to the magnitude of the reflected wave.

(e) Since the magnitude of the voltage and the current (under given match conditions) is dependent on the characteristic impedance of the line, the proximity setting of R203 and R204 is correct for 52-ohm transmission line, regardless of the power level or the match conditions.

(f) The capacitively coupled r-f voltage components appearing between point A and ground, and point B and ground, have a magnitude determined by the ratio of C219 to C205 and C220 to C207, respectively. Although the reactance of these capacity dividers varies with frequency, the ratio of reactance remains constant, therefore the r-f voltage components are independent of frequency. Capacitors C205 and C207 have a value chosen to compensate for the residual inductance of R203 and R204 within the tunable range of the CU-691/U. The inductively coupled r-f current through the resistors is also relatively independent of frequency throughout the tuning range. Therefore, the resultant r-f voltages ( $E_f$  and  $E_r$ ) are proportional to the magnitude of the forward and the reflected waves, regardless of frequency.

### (3) D-C CIRCUIT.

(a) Refer to figure 4-7. Derived r-f voltages  $E_f$  and  $E_r$  are rectified and filtered, and then appear as d-c voltages across resistors R102 and R106, respectively. Meter function switch S101 is a two-section, twelve-position switch, with three positions for each tandem cavity. Only three of the positions, those relating to tandem cavity 1, are shown in figure 4-7. The corresponding positions for tandem cavities 2, 3, and 4 are identical. When S101 is in the POWER position, the forward wave voltage  $E_f$  (dc) causes a current to flow through the meter and the power calibrating variable resistor R110. The resistor is adjusted so that a full-scale deflection of the meter corresponds to 200 watts of forward power. The POWER WATTS meter scale is calibrated so that the current flow corresponding to other values of  $E_f$  is proportionately shown in watts. The meter reading is the power in the forward wave, rather than the transmitter power output. When the transmission line

swr is below 2:1, the power in the forward wave is within 5 percent of the transmitter power output.

(b) When S101 is in the SWR CAL position, the forward wave voltage  $E_f$  (dc) causes a current to flow through the meter and the swr calibrating variable resistor R109. The resistor is set to cause a full-scale meter deflection by adjusting the SWR CAL control. Then, when S101 is set to the SWR position, the reflected wave voltage  $E_r$  (dc) likewise causes a current to flow through the meter and the preset swr calibrating resistor, R109. Since the same setting of R109 is used in both switch positions, the ratio of current through the meter is directly proportional to the magnitude of the ratio of  $E_f$  to  $E_r$ . The SWR meter scale is calibrated to show this ratio as the swr.

(c) Resistors R102, R106, R109 and the corresponding resistors in the other monitor circuits, have values which compensate for component tolerances, thus providing uniform accuracy. Capacitor C101 protects the meter from stray r-f fields.

### d. TUNING SYSTEM.

(1) CAVITY TUNING MECHANISM. - Refer to figure 4-8. The adjustable mechanism in each cavity is composed of a fixed outer conductor and a movable center conductor. The internal end of the movable conductor is closed, with a precision lead screw rigidly connected to the closed end. The lead screw passes through a mating nut secured in the end of a rotatable screw tube. The tube is connected to the driving gear train. As the tube rotates, the lead screw emerges or retracts through the nut, inserting or withdrawing the movable conductor. This action varies the effective length of the tuning element, thus changing the resonant frequency of the cavity. The fixed center conductor is electrically joined to the movable center conductor by a spring-finger contact ring. The lead screw and mating nut have a precision ground, quadruple lead, Acme thread. The thread advances the movable conductor 2/9 inch for each rotation of the screw tube. Approximately 28.5 turns are required to traverse the tunable range of each cavity. The lead screw and the movable conductor are prevented from turning by two pins that slide in mating grooves. The grooves are milled on the exterior of the bearing cup and the pins are rigidly secured to the movable conductor. Backlash in the lead screw and nut assembly is prevented by dual spring loading. The resettability of the tuning mechanism is such that the dial can be returned to any previous dial setting while maintaining a frequency accuracy of  $\pm 0.1$  mc for that particular setting.

(2) GEAR DRIVE AND TRACKING SYSTEM. - Figure 4-9 shows a cross section of one of the gear train mechanisms. The four tuning systems are identical. The driving gear train consists of support bearing assemblies for the rotatable drive tubes, and six gears, labeled A through F on the figure. The shaft from the coarse tuning control is directly connected to transfer gear A and to the rotatable tube in the output cavity. The large diameter part of transfer gear A couples to idler gear B, which in

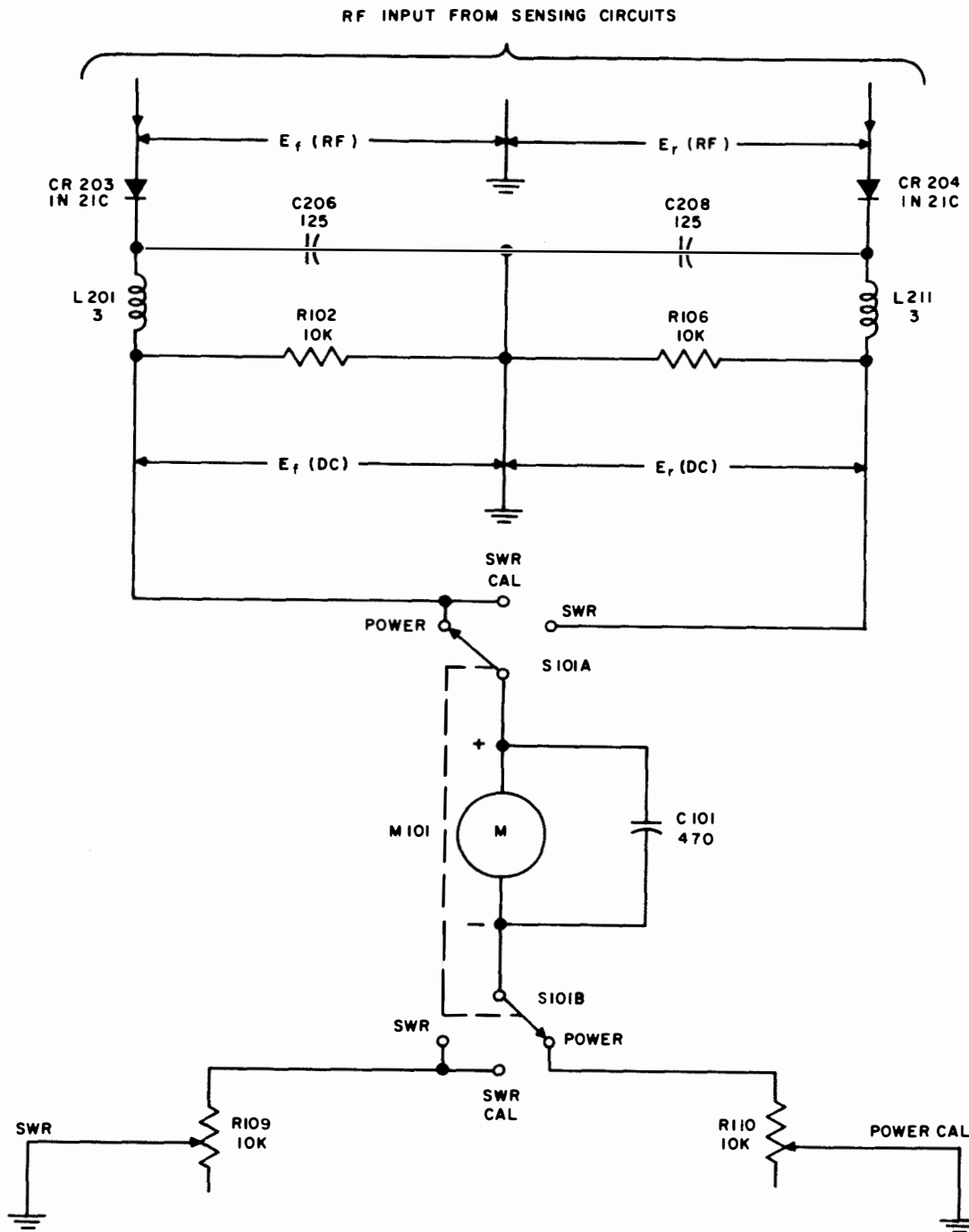


Figure 4-7. Monitor D-C Circuit, Simplified Schematic Diagram

turn couples to drive gear C. Drive gear C is directly connected to the rotatable tube in the input cavity. Since gear C has the same diameter as the large diameter part of gear A, and is driven through idler B, the motion of gear C exactly duplicates the motion of gear A, in both direction and phase. Therefore, the tuning slugs in both cavities move together, tracking the cavities throughout the tuning range.

Gear F, which is directly connected to the VERNIER tuning shaft, couples to idler gear B to provide fine tuning control. Gears A, B, C, and F form the primary gear train. The vernier dial plate, displaying the vernier REVOLUTIONS scale, is directly connected to the coarse tuning knob drive shaft. The dial plate makes one revolution with each rotation of the coarse tuning knob, and approximately



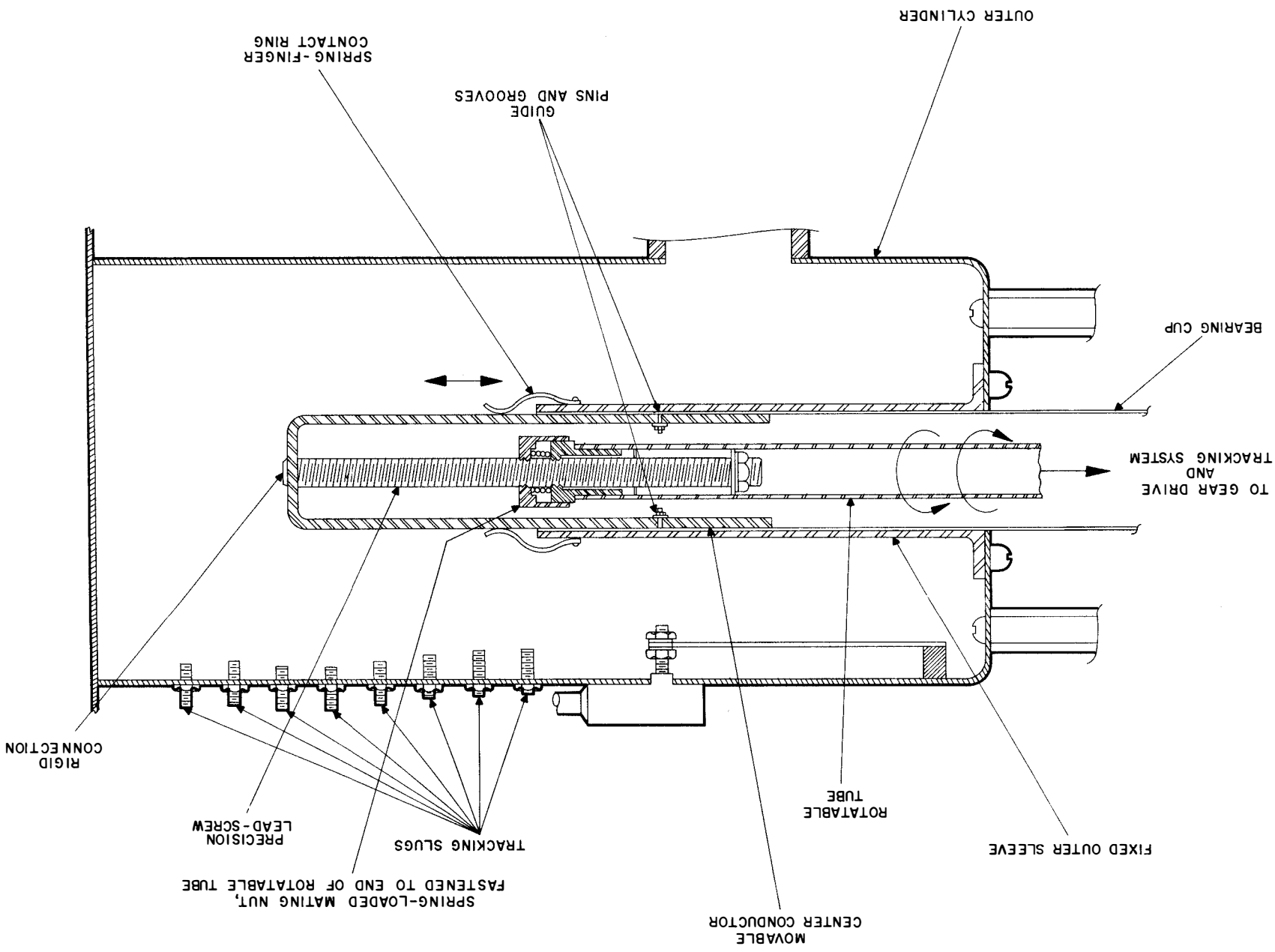


Figure 4-8. Cavity Tuning Mechanism, Cross Section Diagram

1/4 revolution with each rotation of the VERNIER tuning knob. The coarse tuning dial plate, displaying the coarse REVOLUTIONS and MEGACYCLES scales, is connected to drive gear E. The dial plate and gear E are secured to a sleeve bearing that is concentric with the main tuning drive shaft. Transfer gear D couples between the small diameter part of

gear A and gear E. The reduction through gears A, D, and E is 36:1. Gears A, D, and E form the secondary gear train. Gears C, E, and F and the large diameter parts of gears A and D are spring loaded to prevent backlash in the primary and the secondary gear trains.

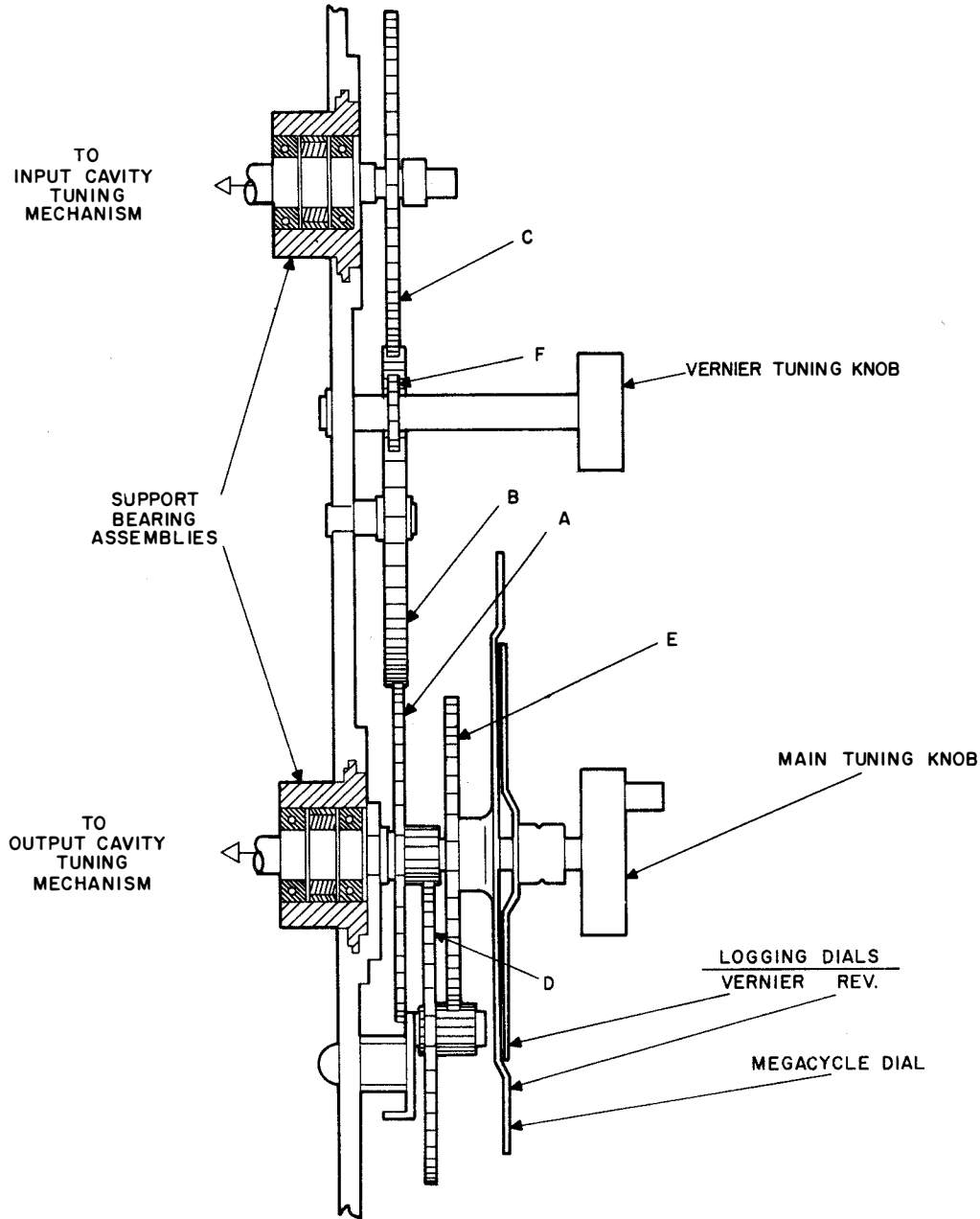


Figure 4-9. Tandem Cavity Gear Train Mechanism, Cross Section Diagram

## SECTION 5 TROUBLE-SHOOTING

### 5-1. GENERAL.

This section contains trouble-shooting information for Antenna Coupler CU-691/U unit, therefore, trouble analysis is based on the performance test results.

### 5-2. TROUBLE-SHOOTING.

A list of typical troubles with symptoms and nature of troubles is given in table 5-1. Reference to the results of electrical and mechanical performance tests (paragraph 6-2) and performance standards (paragraph 6-3) will aid in determining

the nature of the trouble and the remedial action required.

### 5-3. TYPICAL TROUBLES.

Table 5-1 contains possible troubles of Antenna Coupler CU-691/U. Correcting troubles consists of replacing defective components, realigning tandem cavities, and recalibrating adjustable components, as applicable. The NATURE OF TROUBLE column suggests the required corrective action. In some cases, disassembly and reassembly procedures are necessary to permit repair. These procedures are given in paragraphs 6-4.a. and 6-4.b.

TABLES 5-1. ANTENNA COUPLER CU-691/U, TYPICAL TROUBLES

TROUBLE	NATURE OF TROUBLE	SYMPTOMS
Irregular tuning control.	Tuning slug or gear train damaged or jammed with foreign material.	Tuning mechanism skips, jams, or turns with difficulty.
Backlash in gear train.	Excessive wear, loose gear coupling, failure of loading springs, damaged gear train or cavity components.	Poor resettability accuracy.
Faulty metering circuit.	Meter or meter circuit components defective.	Measured swr greater than 2:1 when all tandem cavities are resonated.
External impedance mismatch.	Antenna or antenna transmission line has improper swr.	Measured swr greater than 2:1 when all tandem cavities are resonated.
Faulty combining network.	Defective output jack or tandem cavity coupling lines.	Measured swr greater than 2:1 when all tandem cavities are resonated.
Faulty monitor coupler unit.	Defective monitor circuit components.	Measured swr greater than 2:1 for one tandem cavity when resonated.
Detuned tandem cavity.	Cavity pair not tracking properly.	Measured swr greater than 2:1 for one tandem cavity when resonated.
Faulty metering circuit.	Meter circuit components of corresponding tandem cavity defective.	One tandem cavity will not resonate at any or all frequencies.
Faulty monitor coupler unit.	Defective monitor circuit components.	Insertion loss and/or resettability outside specified limits, one tandem cavity.
Faulty metering circuit.	Meter or meter circuit components defective.	None of the tandem cavities will resonate. Insertion loss outside specified limits.
Faulty antenna transmission line or internal output lines.	Shorted or open antenna transmission line. Defective combining network, output jack, or five-way junction.	None of the tandem cavities will resonate. Insertion loss outside specified limit.

**5-4. LOCATION OF PARTS.**

Replaceable parts are shown on figures 5-1, 5-2, and 6-1.

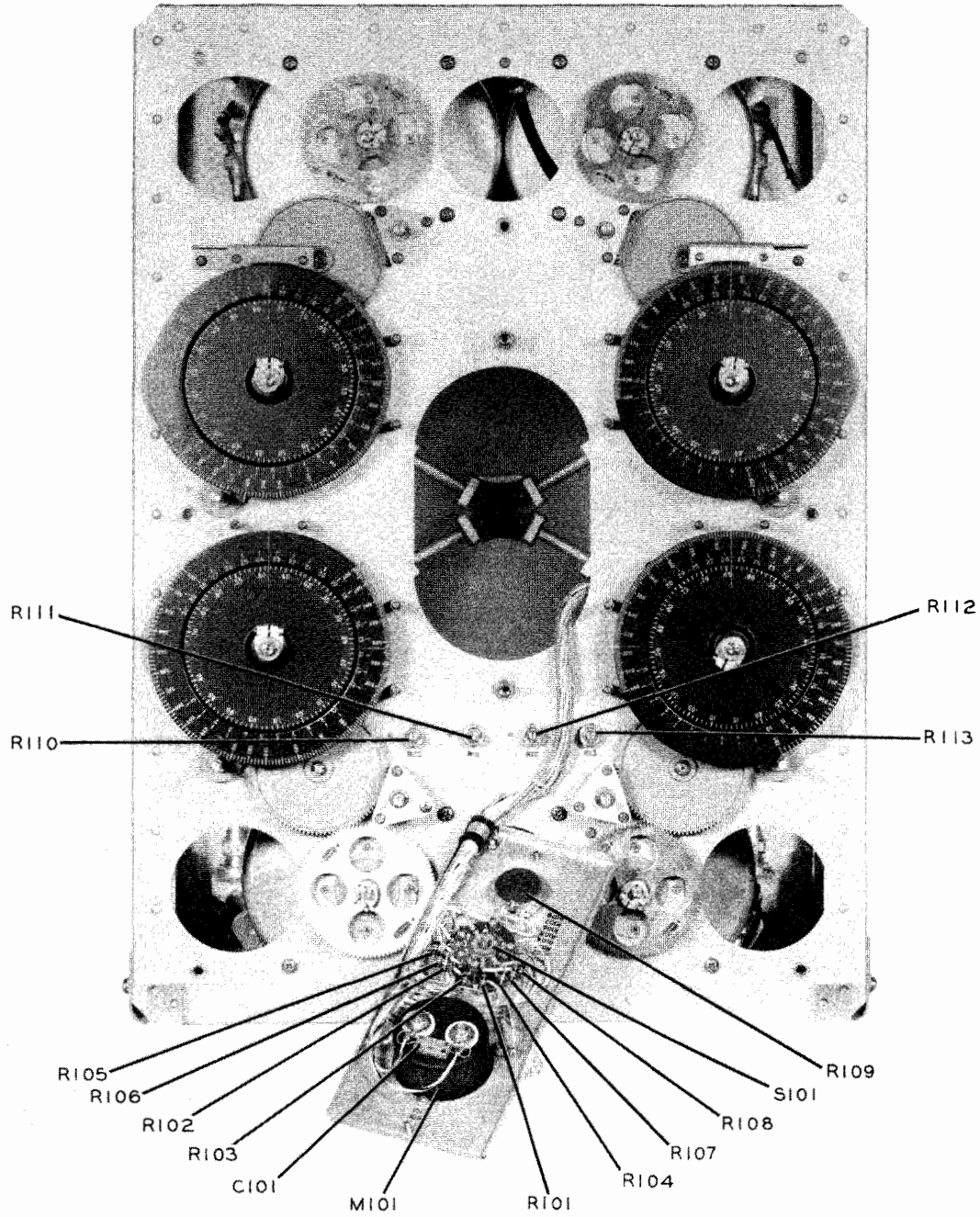


Figure 5-1. Antenna Coupler CU-691/U, Location of Parts, Front Panel Removed

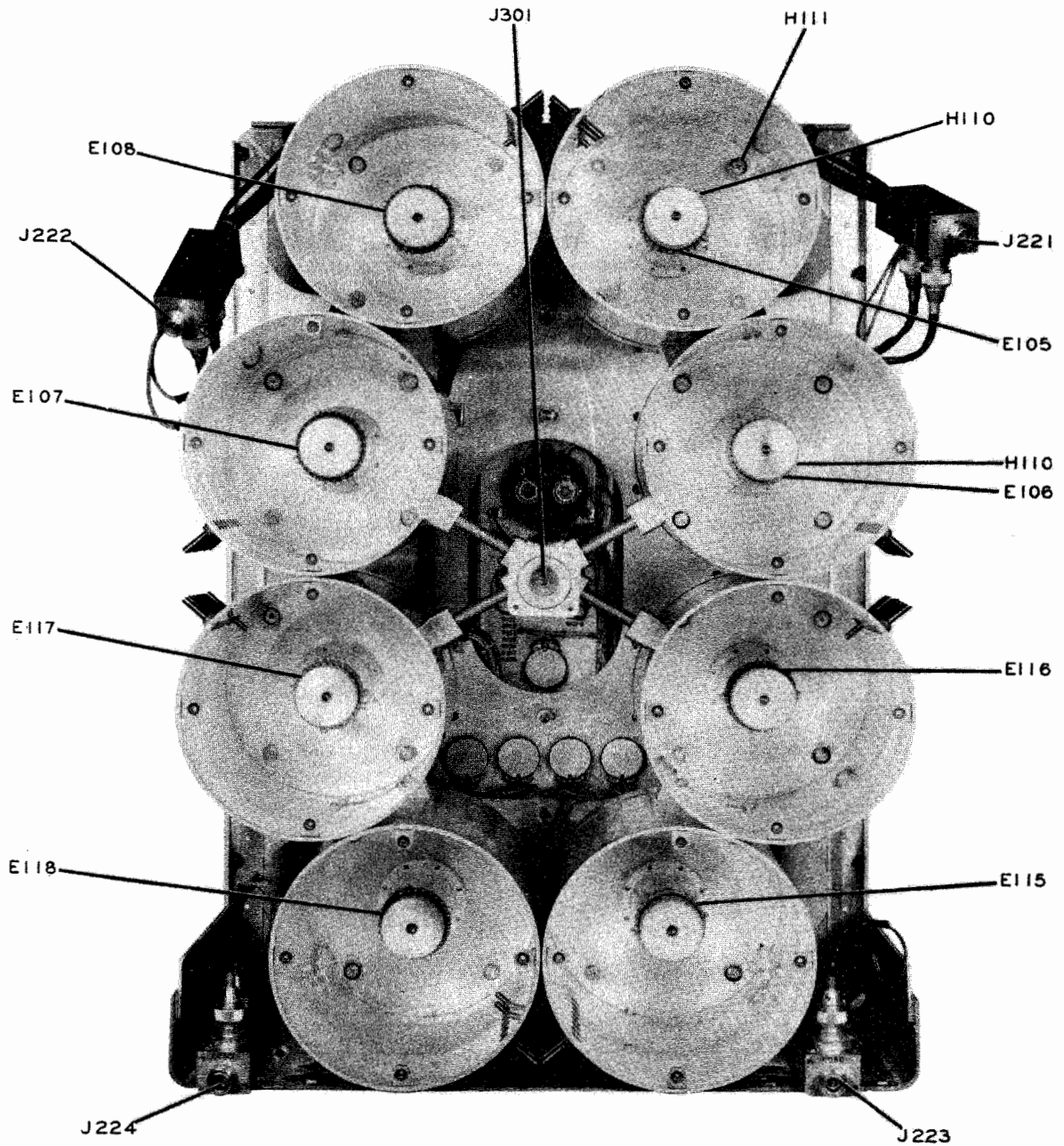


Figure 5-2. Antenna Coupler CU-691/U, Location of Parts, Rear Panel Removed

## SECTION 6 SERVICE AND REPAIR

### 6-1. FAILURE REPORT.

#### FAILURE REPORT

“Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRON 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), the type number and serial number of the major unit (from the major unit 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”

“Every FAILURE REPORT is a boost for you:

1. It shows that you are doing your job.
2. It helps make your job easier.
3. It insures available replacements.
4. It gives you a chance to pass your knowledge to every man on the team.

#### “BUREAU SIDE”

“The Bureau of Ships uses the information to:

1. Evaluate present equipment.
2. Improve future equipment.
3. Order replacements for stock.
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 Forms and Publications Supply Distribution Point.”

### 6-2. PREVENTIVE MAINTENANCE.

a. INTRODUCTION. - The preventive maintenance information consists of mechanical and electrical performance tests and lubrication procedures. The performance tests provide a means of evaluating the relative performance of the coupler by checking the performance of one channel against another. These

tests may be performed while the equipment is in use. When the results of these tests indicate the coupler is not functioning properly, refer to section 5 for trouble analysis.

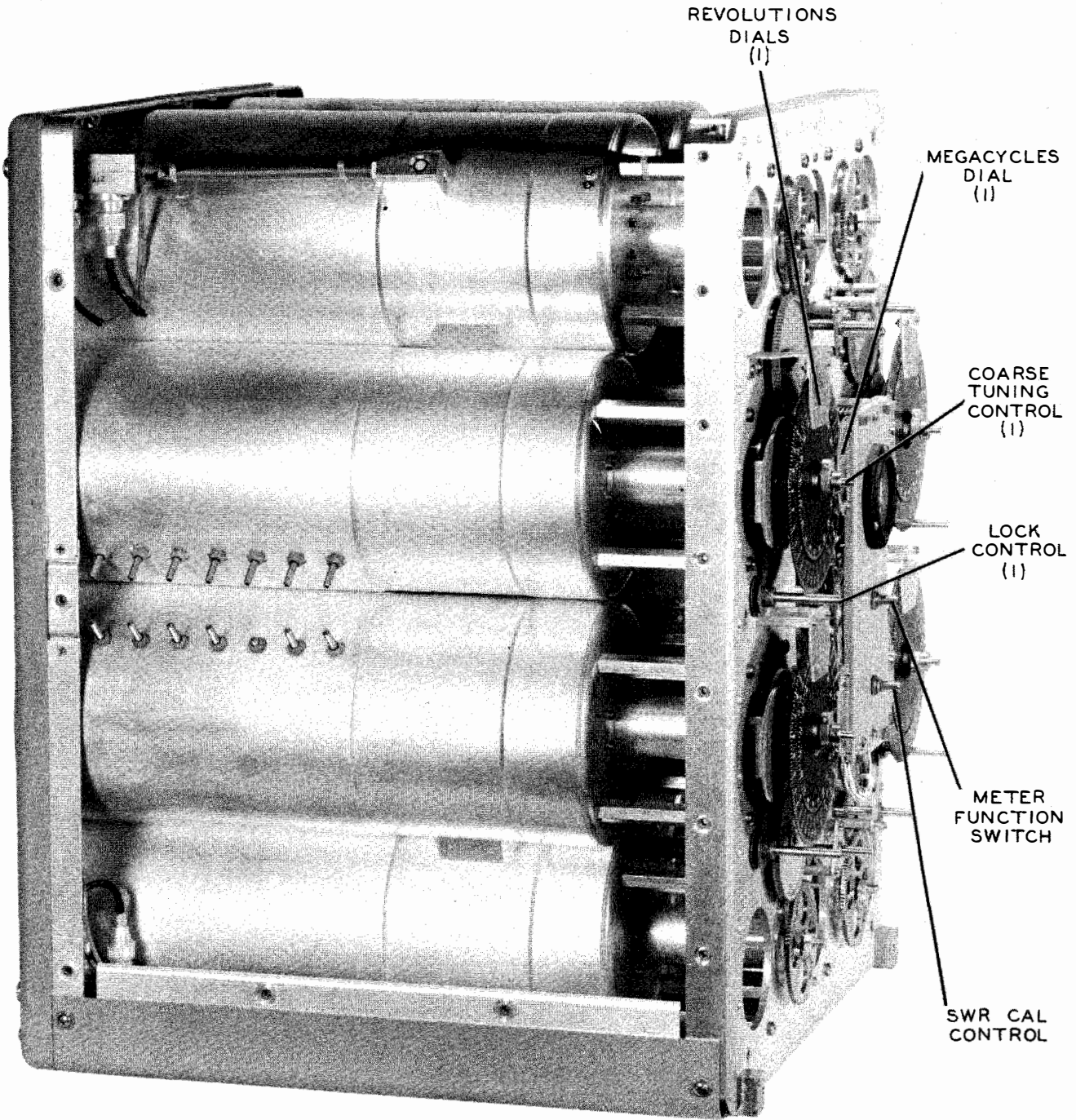
b. TEST EQUIPMENT. - Table 6-1 contains test equipment required to make the electrical performance tests. Also included are the corresponding test equipment characteristics to aid in selecting equivalent test equipment.

TABLE 6-1. TEST EQUIPMENT

DESCRIPTION	RECOMMENDED TYPE	CHARACTERISTICS
UHF transmitter		Frequency range: 225-400 mc Output impedance: 50 ohms Output level: less than 200 watts
UHF receiver		Frequency range: 225-400 mc Input impedance: 50 ohms
Signal generator	Hewlett-Packard 608D	Frequency range: 225-400 mc Output impedance: 50 ohms
Dummy load	Bird Model 82	Frequency range: 225-400 mc Absorption rating: 200 watts Input impedance: 50 ohms SWR: less than 2:1

c. PREVENTIVE MAINTENANCE CHARTS. - The preventive maintenance procedures are given in a series of chart pages. At the top right of each chart page is a list of test equipment, if any, required to perform the procedure on that page. At the top left of each chart page is a list of operating conditions and control settings. These apply to the entire page unless other conditions and settings are given for

some of the steps. The step numbers of the procedures are enclosed in circles for easy tie-in with corresponding step numbers shown on the accompanying illustration page facing the chart page. Arrows leading from a given step number on the illustration show the test equipment to be used, the indicator to be read, the test point to be used, or the surface to be lubricated for the associated step of the chart page.





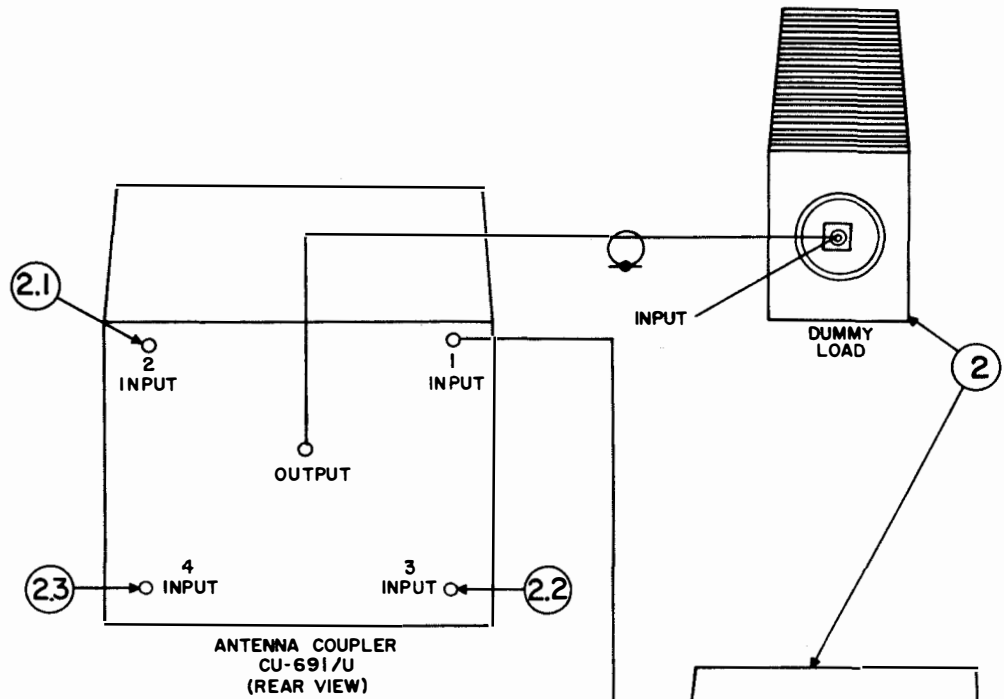
Operating Conditions and Control Settings:

Test Equipment Required:

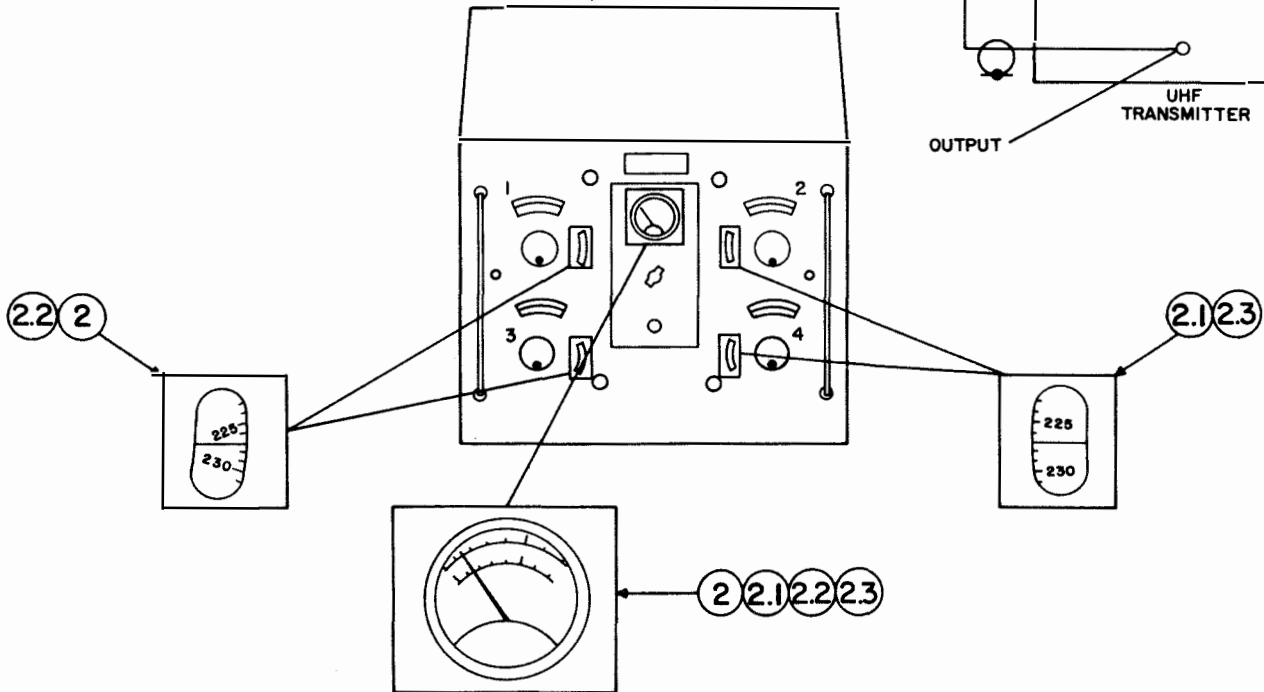
CU-691/U disconnected from antenna and transmitter(s) and/or receiver(s).

None

STEP		PROCEDURE
NO.	ACTION REQUIRED	
1	Test the mechanical performance of the CU-691/U.	<p>Remove the front panel (refer to paragraph 6-4. a. (1)). Rotate each coarse tuning knob through the entire tuning range while observing the associated REVOLUTIONS dials, MEGACYCLES dial, and gear train. Tuning should be smooth and regular.</p> <p style="text-align: center;"><b>CAUTION</b></p> <p style="text-align: center;">Do not force the tuning knobs to overcome abnormal resistance. Do not rotate tuning controls beyond megacycle scale end points.</p> <p>Remove the wrap-around cover ( refer to paragraph 6-4.a.(2)). Inspect the exposed interior for foreign particles and excessive wear. The interior should be clean and functioning properly. Rotate each coarse tuning knob back and forth through one or two revolutions while observing the gear trains. All gears of each train should move simultaneously, with no backlash in either direction. Replace the wrap-around cover and the front panel (refer to section 6, paragraphs 6-4.b.(8) and 6-4.b.(9)). Rotate the meter function switch through the 12 positions. Switch action should be positive. Rotate the SWR control through its entire range. Control should be smooth. Rotate the LOCK knobs to engage and disengage the locking mechanism. Locking mechanism should lock and unlock properly.</p>



ANTENNA COUPLER  
CU-691/U  
(FRONT VIEW)



USE 52 OHM COAXIAL CABLE FOR ALL CONNECTIONS

Operating Conditions and Control Settings:

UHF transmitter output connected to 1 INPUT jack.  
Dummy load input connected to OUTPUT jack.

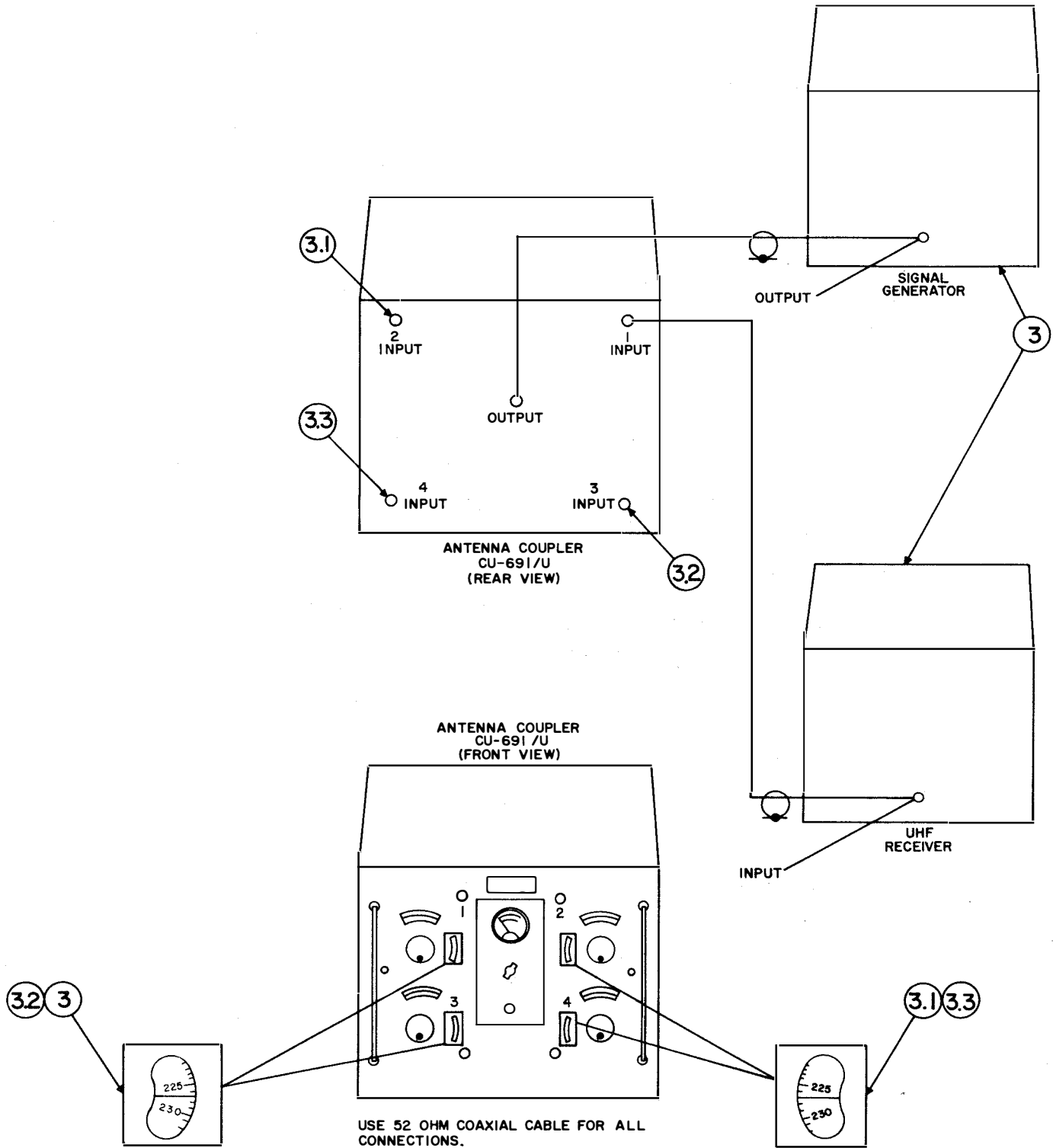
Test Equipment Required:

UHF transmitter\*  
Dummy load\*\*

STEP		PROCEDURE	RESULTS
NO.	ACTION REQUIRED		
2	Test the electrical performance of the CU-691/U with a transmitter, (channel 1).	Operate the CU-691/U with a transmitter (refer to section 3, paragraph 3-4. a.).  NOTE  Use any frequency within the tunable range of the coupler. Insure the other tandem cavities are not tuned to the vicinity of the transmitter frequency, at least a 5-mc spacing between channel frequencies, for test purposes only.  Record the SWR meter reading, the POWER WATTS meter reading, and the MEGACYCLES dial reading. De-energize the transmitter.	_____ SWR  _____ Power (watts)  _____ Freq (mc)
2.1	Test the electrical performance of the CU-691/U with a transmitter, (channel 2).	Repeat step 2, except connect the transmitter to 2 INPUT jack.  NOTE  Use same frequency as in step 2.	_____ SWR  _____ Power (watts)  _____ Freq (mc)
2.2	Test the electrical performance of the CU-691/U with a transmitter, channel 3).	Repeat step 2, except connect the transmitter to 3 INPUT jack.  NOTE  Use same frequency as in step 2.	_____ SWR _____ Power (watts) _____ Freq (mc)
2.3	Test the electrical performance of the CU-691/U with a transmitter, (channel 4).	Repeat step 2, except connect the transmitter to 4 INPUT jack.  NOTE  Use same frequency as in step 2.  Corresponding readings of each tandem cavity should be within the following limits:  SWR: ±20% Power: ±15% MEGACYCLES ±0.3	_____ SWR _____ Power (watts) _____ Freq (mc)

\*Frequency range of 225-400 mc and an output impedance of 50 ohms.

\*\*Use Bird model 82 or equivalent. Must have frequency range of 225 to 400 mc, absorption rating of 200 watts, an input impedance of approximately 50 ohms, and an SWR of less than 2:1.



Operating Conditions and Control Settings:

Test Equipment Required:

UHF receiver input connected to coupler 1 INPUT jack.

UHF receiver\*

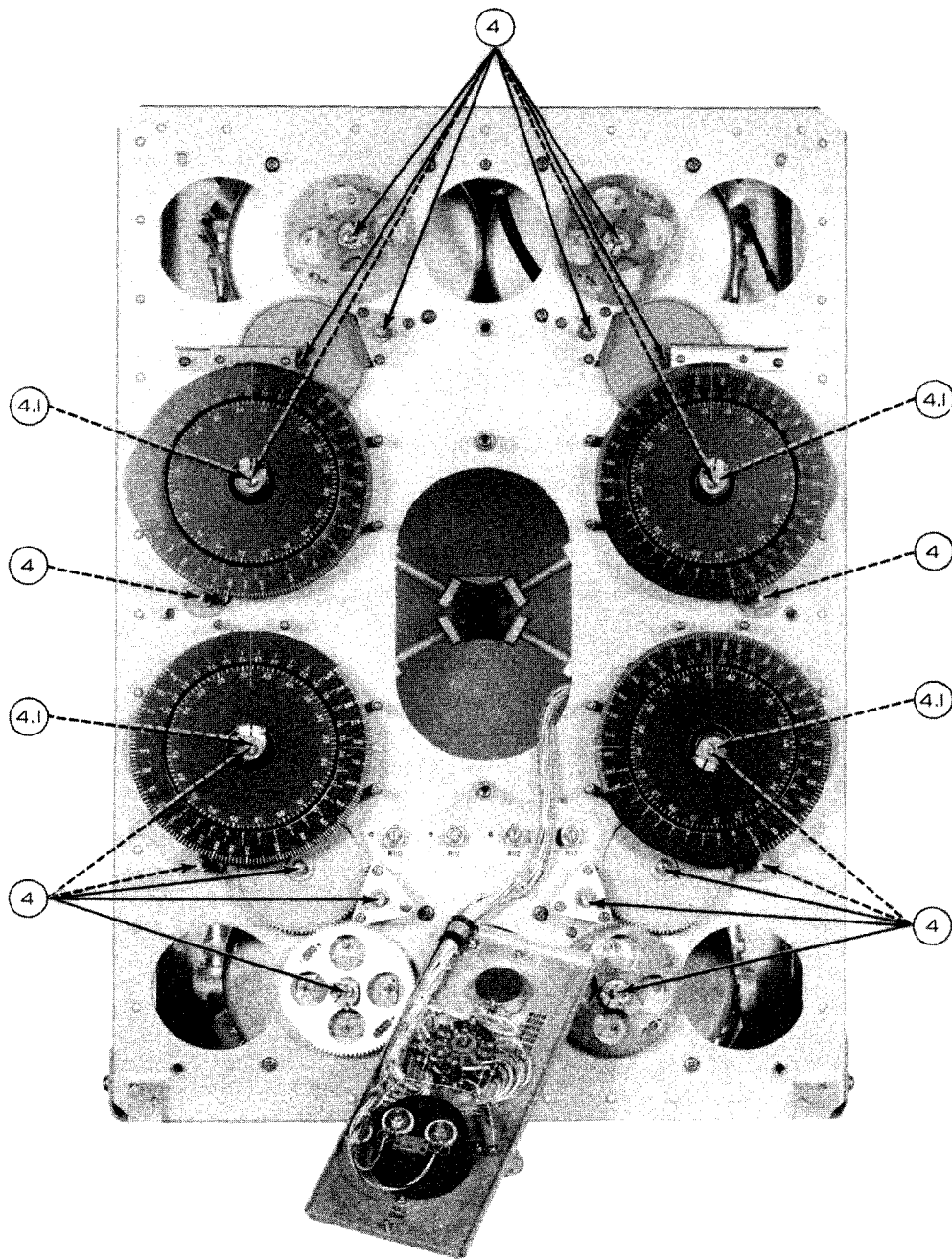
Signal generator output connected to coupler OUTPUT jack.

Single generator\*\*

STEP		PROCEDURE	RESULTS
NO.	ACTION REQUIRED		
3	Test the electrical performance of the CU-691/U with a receiver, (channel 1).	<p>Operate the CU-691/U with a receiver (refer to section 3, paragraph 3-4. c., steps 7 through 9).</p> <p>NOTE</p> <p>Use any frequency within the tunable range of the coupler. Insure the other tandem cavities are not tuned to the vicinity of the receiver frequency, maintain at least a .5-mc spacing between channel frequencies, for test purposes only.</p> <p>Record the coupler MEGACYCLES dial reading and the receiver signal-level meter reading.</p>	<p>_____</p> <p>Dial Reading (mc)</p> <p>_____</p> <p>Signal Level (db)</p>
3.1	Test the electrical performance of the CU-691/U with a receiver (channel 2).	<p>Repeat step 3, except connect the receiver to 2 INPUT jack.</p> <p>NOTE</p> <p>Use same frequency as in step 3.</p>	<p>_____</p> <p>Dial Reading (mc)</p> <p>_____</p> <p>Signal Level (db)</p>
3.2	Test the electrical performance of the CU-691/U with a receiver, (channel 3).	<p>Repeat step 3, except connect the receiver to 3 INPUT jack.</p> <p>NOTE</p> <p>Use same frequency as in step 3.</p>	<p>_____</p> <p>Dial Reading (mc)</p> <p>_____</p> <p>Signal Level (db)</p>
3.3	Test the electrical performance of the CU-691/U with a receiver, (channel 4).	<p>Repeat step 3, except connect the receiver to 4 INPUT jack.</p> <p>NOTE</p> <p>Use same frequency as in step 3.</p> <p>Corresponding readings of each tandem cavity should be within the following limits:</p> <p>MEGACYCLES: <math>\pm 0.3</math> Signal level: approx 1 db</p>	<p>_____</p> <p>Dial Reading (mc)</p> <p>_____</p> <p>Signal Level (db)</p>

\*Frequency range of 225 to 400 mc and input impedance of 50 ohms.

\*\*Use Hewlett-Packard 608D or equivalent. Must have frequency range of 225 to 400 mc and output impedance of approximately 50 ohms.



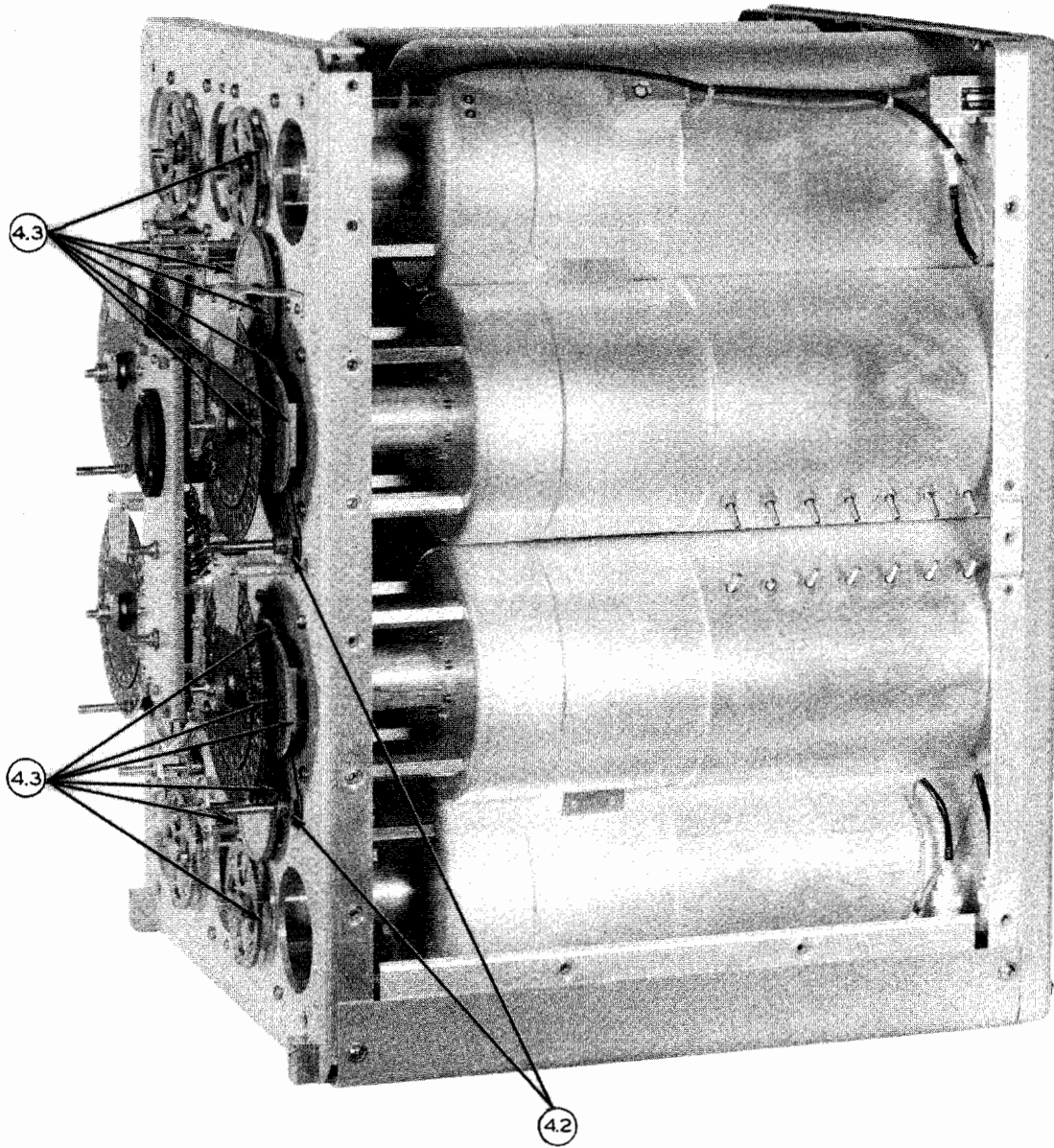
Operating Conditions and Control Settings:

Test Equipment Required:

CU-691/U disconnected from antenna and transmitters(s) and/or receiver(s).

None

STEP		PROCEDURE
NO.	ACTION REQUIRED	
④	Lubricate all bearings of the CU-691/U.	<p style="text-align: center;">NOTE</p> <p style="text-align: center;">Antenna Coupler CU-691/U should be lubricated semiannually.</p> <p>Remove wrap-around cover, front panel, and rear panel. (Refer to paragraphs 6-4. a. (1) through 6-4. a. (3)). Apply one drop of light oil MIL-L-7870 or equivalent, to all bearings as shown on opposite page.</p>
④.1	Lubricate all dial shafts of the CU-691/U.	Apply one drop of light oil, MIL-L-7870 or equivalent, to all MEGACYCLES/coarse REVOLUTIONS dial shafts (under concentric sleeves) as shown on opposite page.





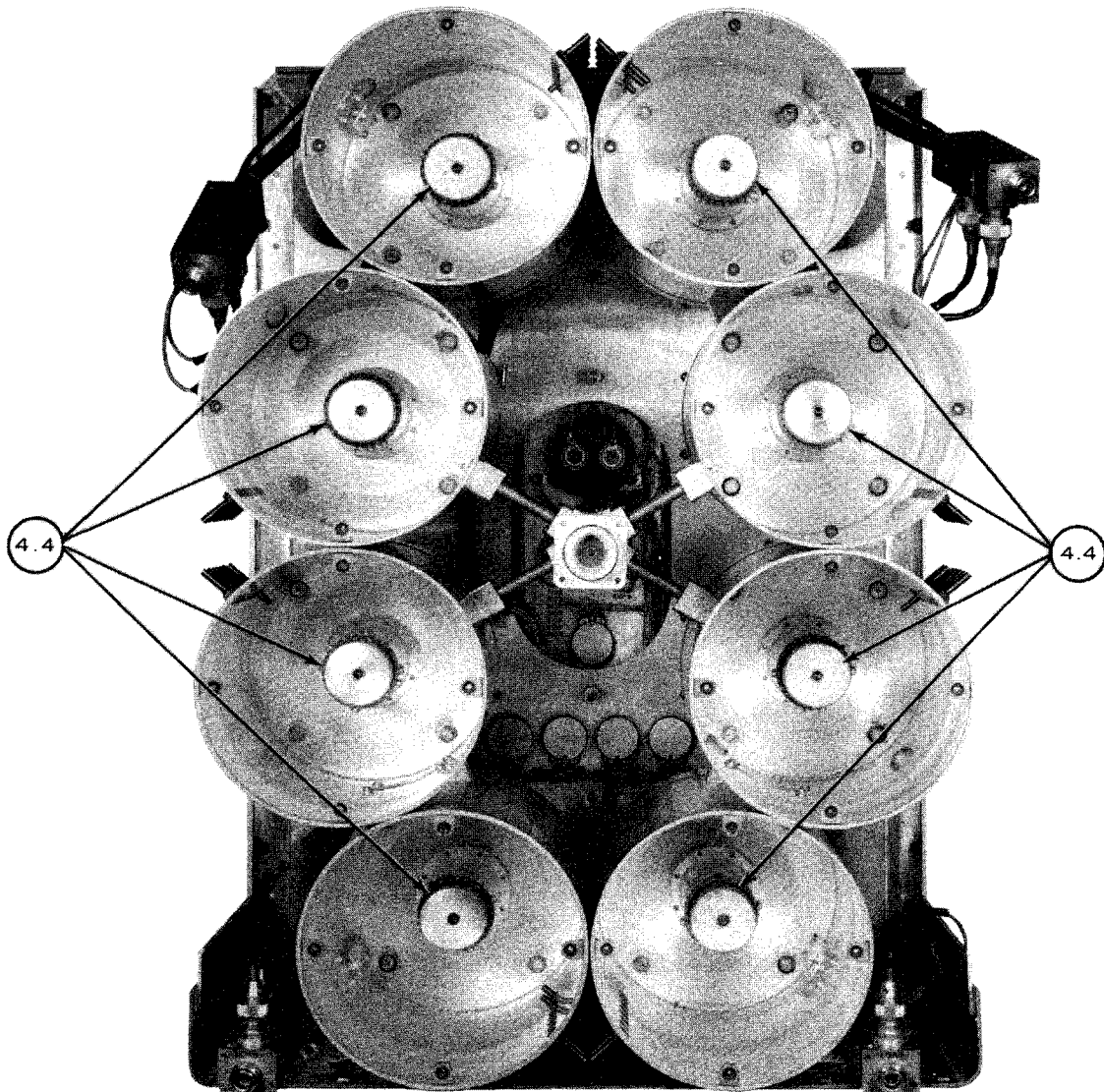
Operating Conditions and Control Settings:

Test Equipment Required:

CU-691/U disconnected from antenna and transmitter(s) and/or receiver(s).

None

STEP		PROCEDURE
NO.	ACTION REQUIRED	
4.2	Lubricate all dial lock cams of the CU-691/U.	Apply a thin coat of light grease, MIL-G-3278 or equivalent, to dial-lock cams as shown on opposite page. Wipe off excess.
4.3	Lubricate all gear tooth faces of the CU-691/U.	Apply a thin coat of light grease, MIL-G-3278 or equivalent, to all gear tooth faces (6 gears per each tandem cavity) as shown on opposite page. Wipe off excess.



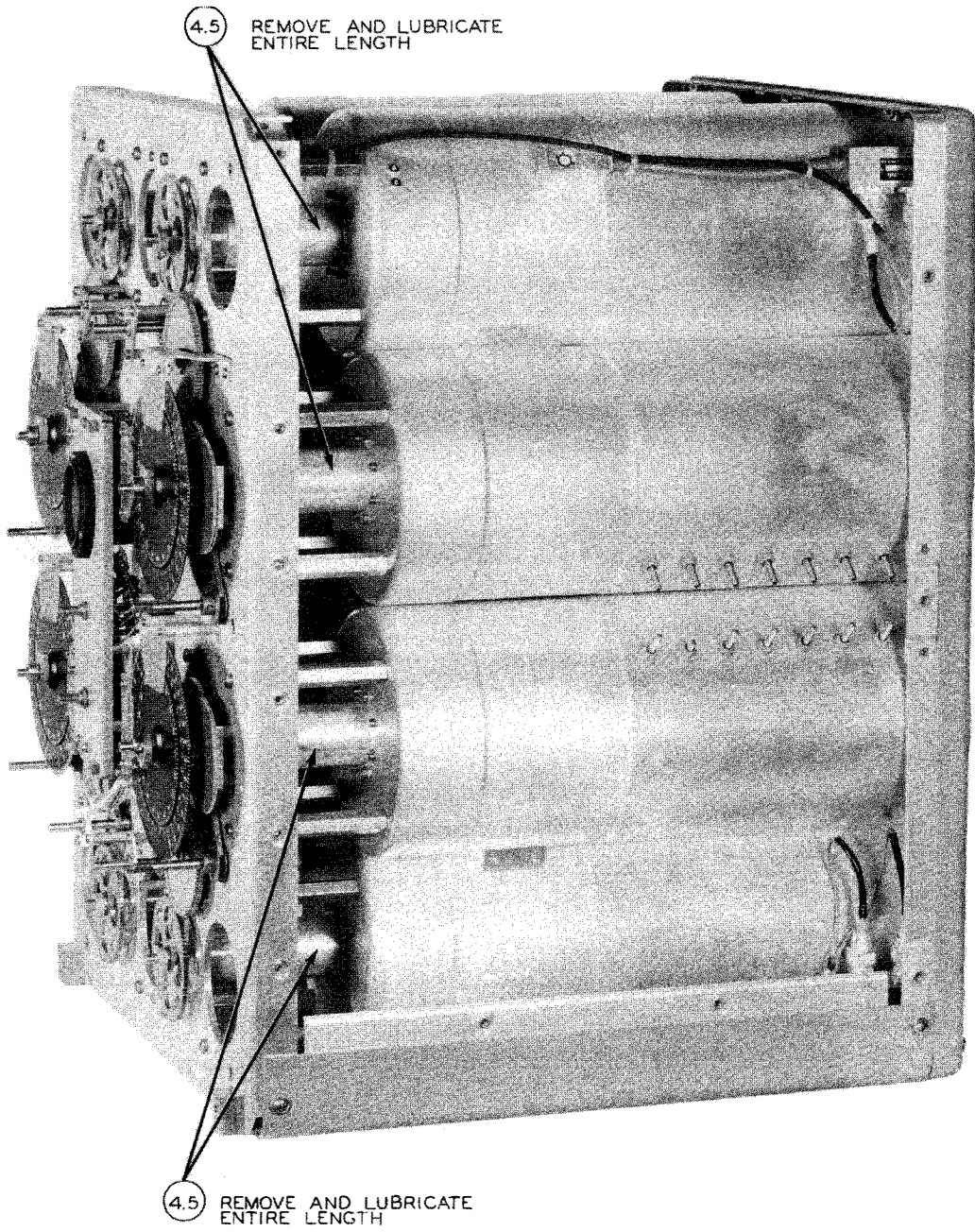
Operating Conditions and Control Settings:

Test Equipment Required:

CU-691/U disconnected from antenna and transmitter(s) and/or receiver(s).

None

STEP		PROCEDURE
NO.	ACTION REQUIRED	
4.4	Lubricate all the inner movable conductors of the CU-691/U.	Tune all cavities to the low end of the tuning range (225 mc). Apply a thin coat of noncorrosive electrical grease, Lubriplate 105 or equivalent, to the entire length of the movable conductor of each cavity as shown on opposite page. Wipe off excess.



Operating Conditions and Control Settings:

Test Equipment Required:

CU-691/U disconnected from antenna and transmitter(s) and/or receiver(s).

None

STEP		PROCEDURE
NO.	ACTION REQUIRED	
4.5	Lubricate all bearing cups of the CU-691/U.	Remove the bearing cup assembly from each cavity (refer to paragraph 6-4. a. (5)). Apply a thin coat of noncorrosive electrical grease, Lubriplate 105 or equivalent, to the entire length of the bearing cup of each cavity. Be sure to place grease in the grooves as well as on the cylinder. Replace the bearing cup assembly, the rear panel, the front panel, and the wrap-around cover (refer to paragraphs 6-4. b. (5) through 6-4. b. (9)).



**6-3. PERFORMANCE STANDARDS.**

a. **INTRODUCTION.** - The performance standards provide a means of testing the performance of the coupler against design standards. The results of these tests will show the maximum performance capabilities of the coupler. If the results of these

tests indicate the coupler is not functioning properly, refer to section 5 for trouble analysis.

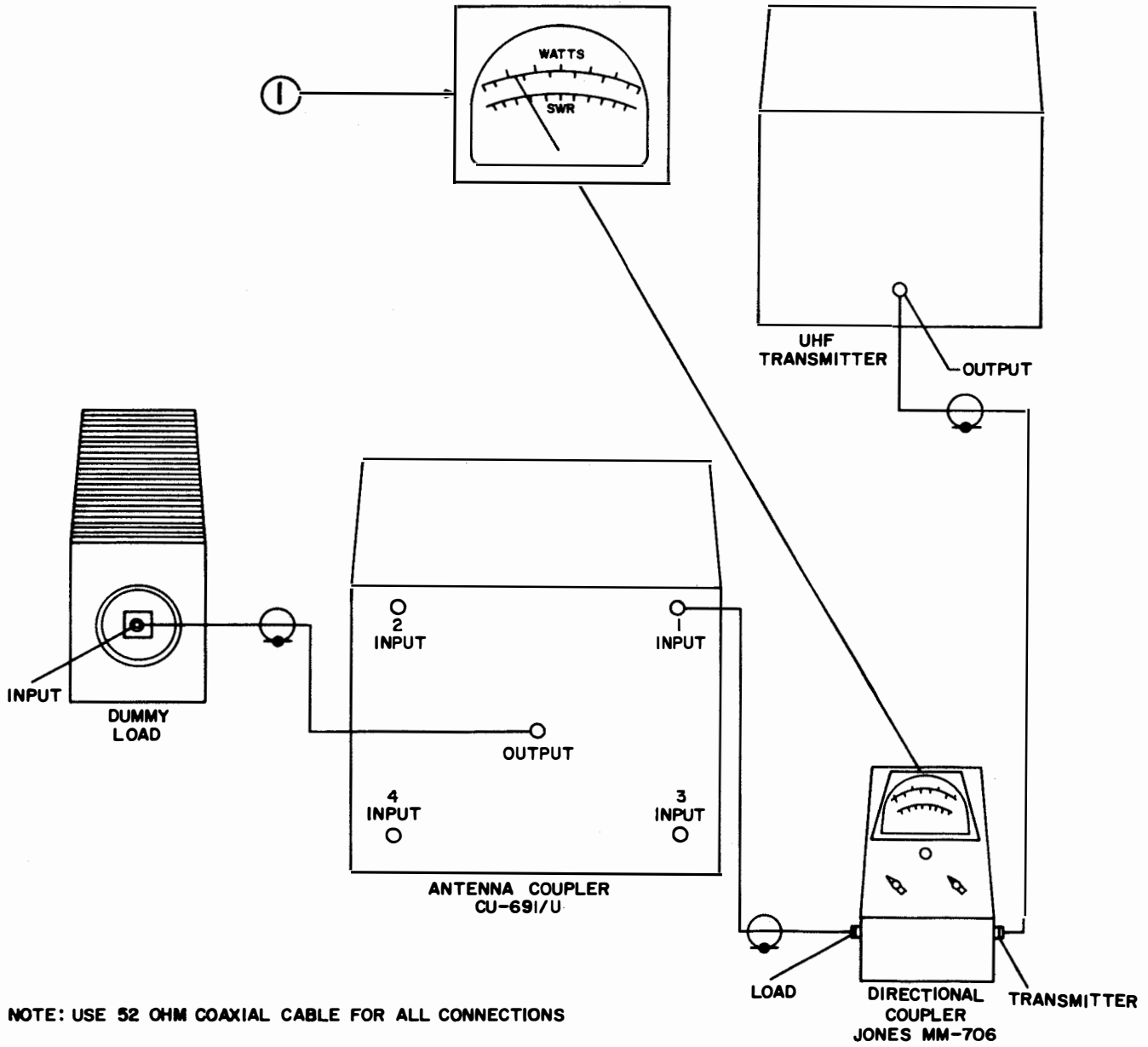
b. **TEST EQUIPMENT.** - Table 6-2 contains test equipment required to make the performance standard tests. Also included are the corresponding test equipment characteristics to aid in selecting equivalent test equipment.

TABLE 6-2. TEST EQUIPMENT

DESCRIPTION	RECOMMENDED TYPE	CHARACTERISTICS
UHF transmitter		Frequency range: 225-400 mc Output impedance: 50 ohms Output level: less than 200 watts
Directional coupler	Jones MM-706	Frequency range: 225-400 mc Power range: 0-200 watts Meter accuracy: $\pm 2\%$ Impedance: 50 ohms
Dummy load	Bird Model 82	Frequency range: 225-400 mc Absorption rating: 200 watts Input impedance: 50 ohms SWR: less than 2:1

c. **PERFORMANCE STANDARD CHARTS.** - The procedures for obtaining the performance standard test indications are given in a series of chart pages. At the top right of each chart page is a list of test equipment, if any, required to perform the procedure on that page. At the top left of each chart page is a list of operating conditions and control settings. These apply to the entire page unless other conditions and settings are given for some of the steps. The step numbers of the procedures are enclosed in

circles for easy tie-in with corresponding step numbers shown on the accompanying illustration page facing the chart page. Arrows leading from a given step number on the illustration show the point where the test equipment is to be connected and/or the indicator to be read for the associated step of the chart page. The tolerances shown in the REF. STD. column are not absolute limits; they are intended only as a general guide.





Operating Conditions and Control Settings:

CU-691/U detuned  
UHF transmitter: OFF  
MM-706 function selector switch: FOR

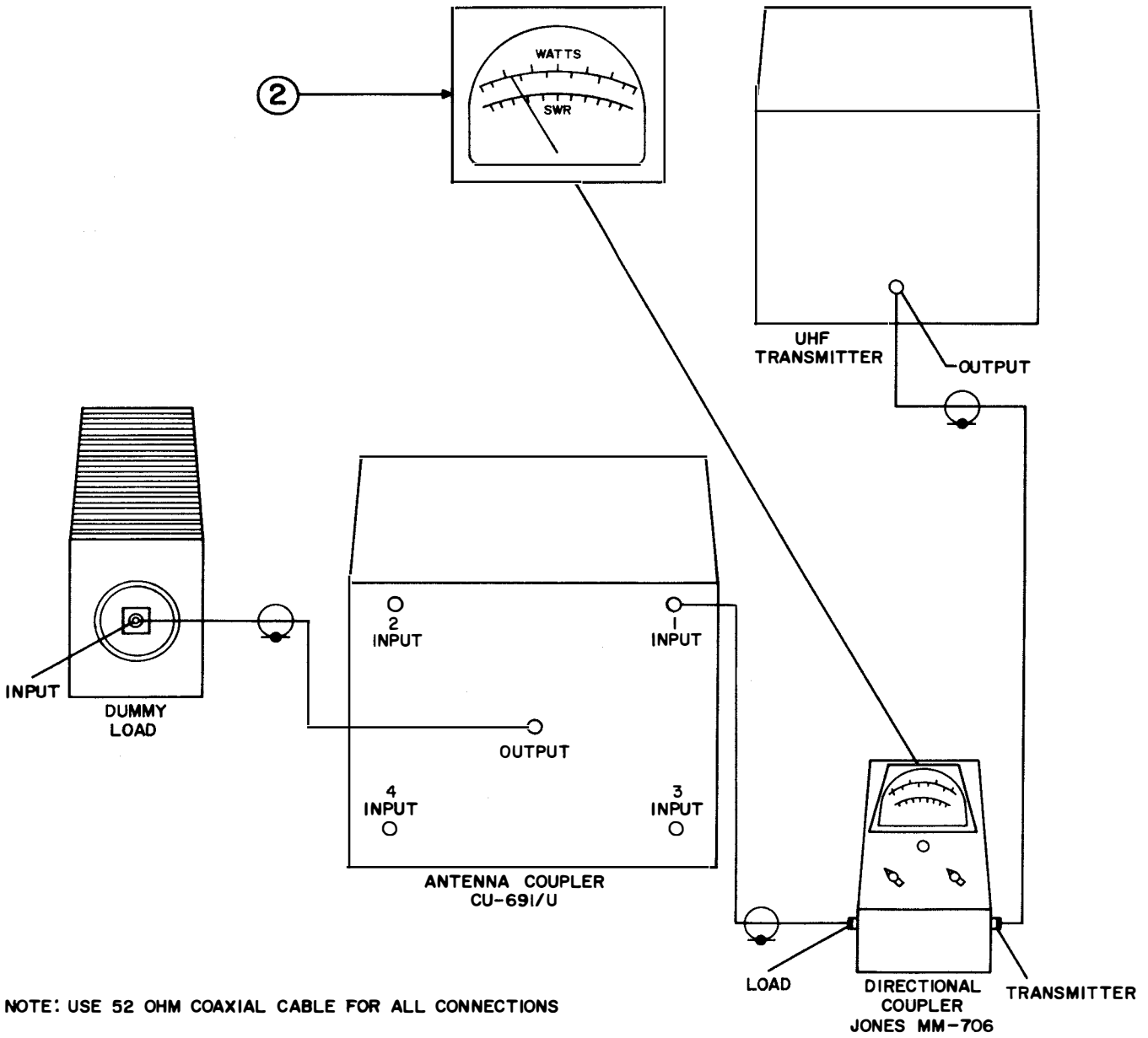
Test Equipment Required:

UHF transmitter\*  
Directional coupler,  
Jones MM-706  
Dummy load\*\*

INSERTION LOSS AND SWR

STEP		PRELIMINARY ACTION	READ INDICATION ON	REF. STD.
NO.	ACTION REQUIRED			
1	Measure power into the CU-691/U, (channel 1).	<p>Connect the UHF transmitter output to the TRANSMITTER side of the MM-706. Connect the LOAD side of the MM-706 to the 1 INPUT jack of the CU-691/U. Connect the OUTPUT jack of the CU-691/U to the input jack of the dummy load. Select 225 mc as the transmitter frequency. Tune tandem cavity 1 as given in section 3, paragraph 3-4.a. Energize the transmitter. Record the MM-706 power reading.</p> <p>NOTE</p> <p>Maintain at least a 5-mc spacing between channel frequencies, for test purposes only.</p>	MM-706	See step 4 for reference standard.

\*Frequency range of 225 to 400 mc and output impedance of 50 ohms.  
\*\*Use Bird model 82 or equivalent. Must have frequency range of 225 to 400 mc, absorption rating of 200 watts, an input impedance of approximately 50 ohms, and an SWR of less than 2:1.



NOTE: USE 52 OHM COAXIAL CABLE FOR ALL CONNECTIONS

Operating Conditions and Control Settings:

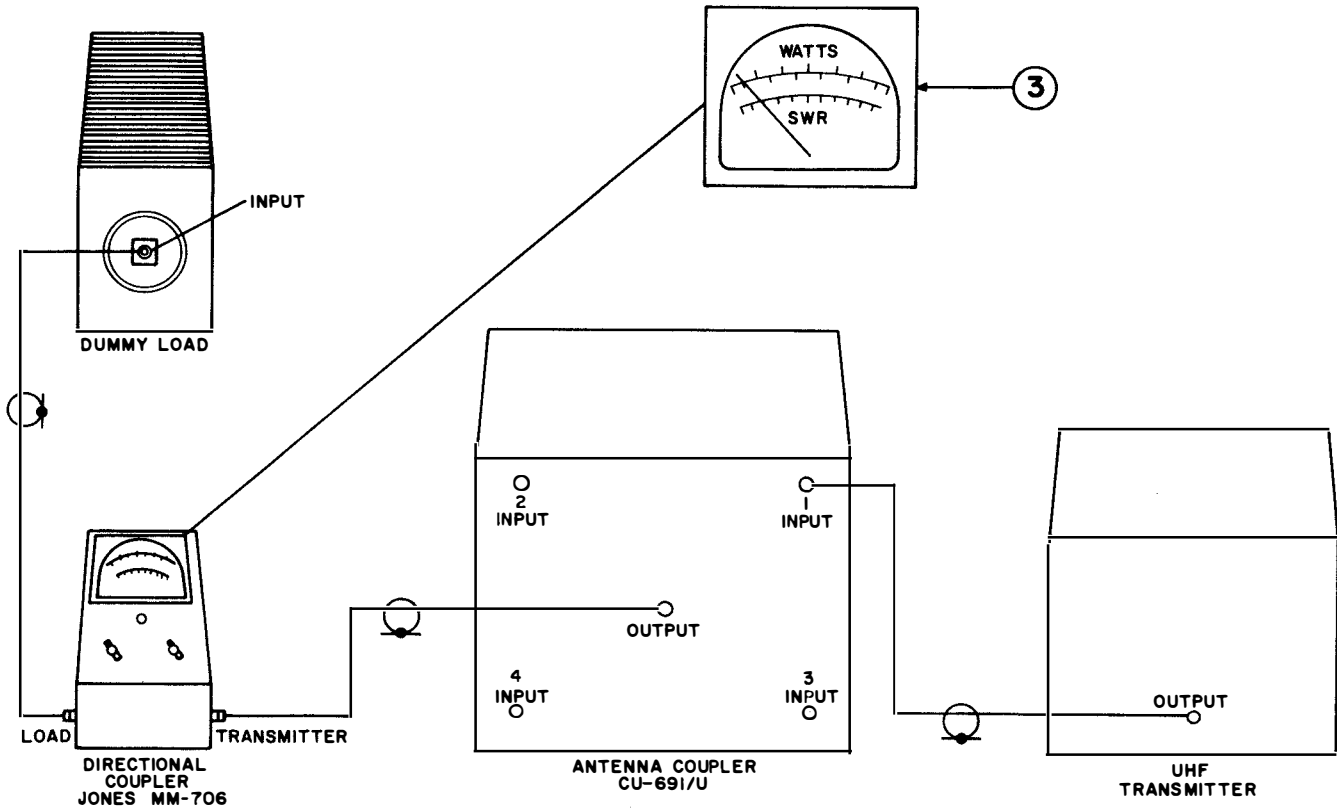
CU-691/U tuned  
UHF transmitter: ON  
MM-706 function selector switch: CAL

Test Equipment Required:

UHF transmitter  
Directional coupler,  
Jones MM-706  
Dummy load

INSERTION LOSS AND SWR

STEP		PRELIMINARY ACTION	READ INDICATION ON	REF. STD.
NO.	ACTION REQUIRED			
2	Measure the SWR of the CU-691/U, (channel 1).	<p>Maintain the same test setup as in step 1. Calibrate the MM-706 by placing the function selector switch in the CAL position and rotating the CALIBRATE knob until a full-scale meter reading is obtained. Then place the MM-706 function selector switch in the VSWR position. Observe and record the SWR. De-energize the transmitter.</p> <p>NOTE</p> <p>Do not change the output level or the frequency of the transmitter. Do not alter the tuned condition of the CU-691/U.</p>	MM-706	2.0 (2:1) max.



NOTE: USE 52 OHM COAXIAL CABLE FOR ALL CONNECTIONS.

Operating Conditions and Control Settings:

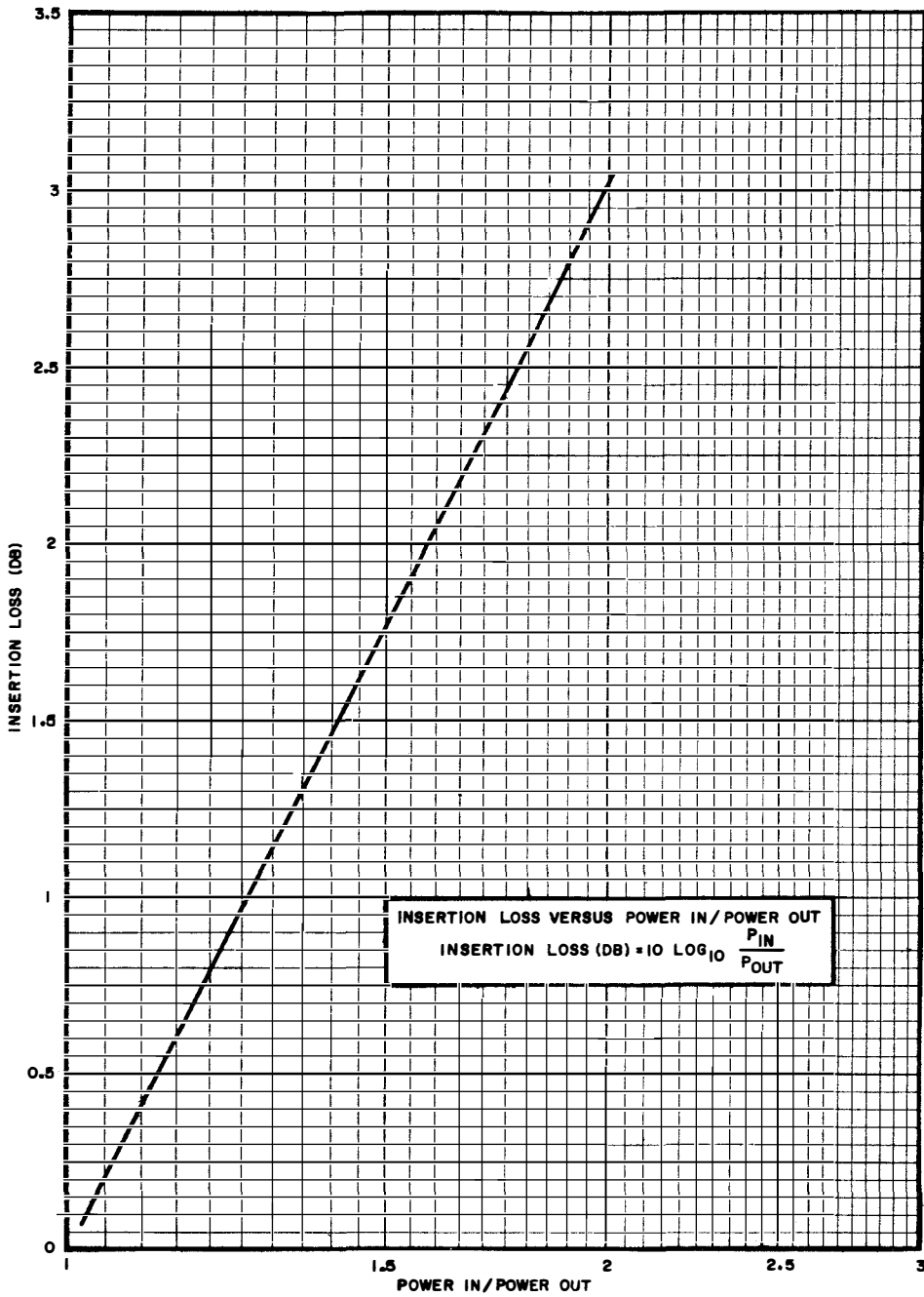
CU-691/U tuned  
UHF transmitter: OFF  
MM-706 function selector switch: FOR

Test Equipment Required:

UHF transmitter  
Directional coupler,  
Jones MM-706  
Dummy load

INSERTION LOSS AND SWR

STEP		PRELIMINARY ACTION	READ INDICATION ON	REF. STD.
NO.	ACTION REQUIRED			
3	Measure power out of the CU-691/U (channel 1).	Disconnect the MM-706 from the transmitter and the CU-691/U. Connect the transmitter output to the 1 INPUT jack of the CU-691/U. Connect the TRANSMITTER side of the MM-706 to the OUTPUT jack of the CU-691/U. Connect the LOAD side of the MM-706 to the input jack of the dummy load. Energize the transmitter and record the MM-706 power reading. De-energize the transmitter.	MM-706	See step 4 for reference standard.



Operating Conditions and Control Settings:

Test Equipment Required:

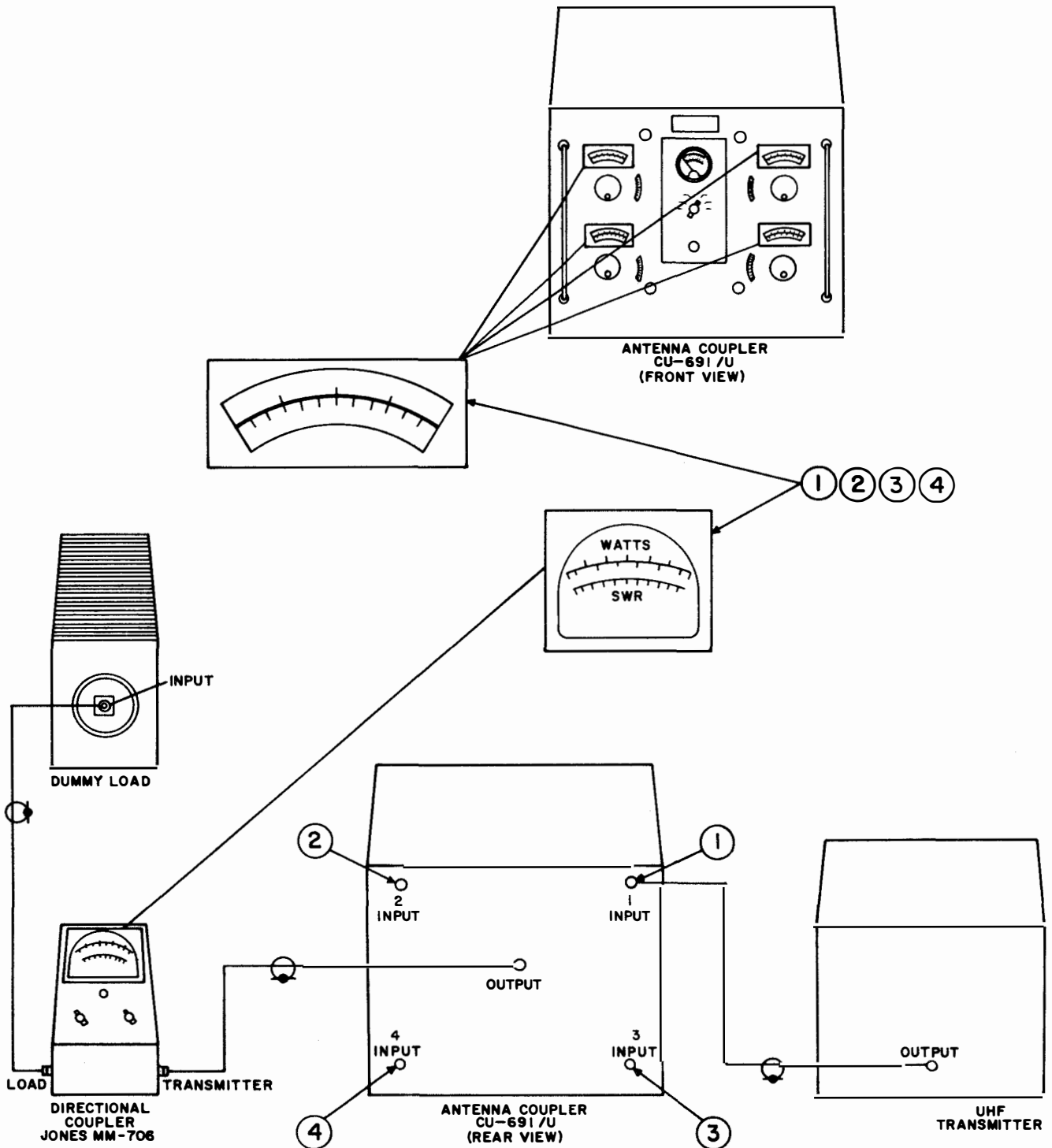
CU-691/U detuned

None

INSERTION LOSS AND SWR

STEP		PRELIMINARY ACTION	READ INDICATION ON	REF. STD.
NO.	ACTION REQUIRED			
④	Determine insertion loss of the CU-691/U, (channel 1).	Compute the ratio of power in to power out as determined in steps 1 and 3, respectively. Refer to the graph of insertion loss versus power in/power out on the opposite page and determine insertion loss.	Compute.	2.0 db max.
⑤	Determine SWR and insertion loss of the CU-691/U, (channel 2).	Repeat steps 1 through 4, except use 2 INPUT and associated controls of the CU-691/U.	MM-706 and compute.	SWR: 2.0 (2:1) max. Insertion loss: 2 db max.
⑤.1	Determine SWR and insertion loss of the CU-691/U, (channel 3).	Repeat steps 1 through 4, except use 3 INPUT and associated controls of the CU-691/U.	MM-706 and compute.	SWR: 2.0 (2:1) max. Insertion loss: 2 db max.
⑤.2	Determine SWR and insertion loss of the CU-691/U, (channel 4).	Repeat steps 1 through 4, except use 4 INPUT and associated controls of the CU-691/U.	MM-706 and compute.	SWR: 2.0 (2:1) max. Insertion loss: 2 db max.
⑥	Determine SWR and insertion loss of the CU-691/U, (channels 1, 2, 3, and 4).	Repeat steps 1 through 5.2, except use a frequency of 310 mc.	MM-706 and compute.	SWR: 2.0 (2:1) max. Insertion loss: 2 db max.
⑦	Determine SWR and insertion loss of the CU-691/U, (channels 1, 2, 3, and 4).	Repeat steps 1 through 5.2, except use a frequency of 399.9 mc.	MM-706 and compute.	SWR: 2.0 (2:1) max. Insertion loss: 2 db max.

- ①, ②, ③ and ④



NOTE: USE 52 OHM COAXIAL CABLE FOR ALL CONNECTIONS.



Operating Conditions and Control Settings:

CU-691/U detuned  
UHF transmitter: OFF  
MM-706 function selector switch: FOR

Test Equipment Required:

UHF transmitter\*  
Directional coupler,  
Jones MM-706  
Dummy load\*\*

RESETTABILITY

STEP		PRELIMINARY ACTION	READ INDICATION ON	REF. STD.
NO.	ACTION REQUIRED			
①	Determine the re-settability of the CU-691/U, (channel 1).	<p>Connect the UHF transmitter output to the 1 INPUT jack of the CU-691/U. Connect the CU-691/U OUTPUT jack to the TRANSMITTER side of the MM-706. Connect the LOAD side of the MM-706 to the dummy load input. Select 380 mc as the transmitter frequency. Tune tandem cavity 1 as given in section 3, paragraph 3-4.a. Energize the transmitter. Record the MM-706 power reading. Observe and record the setting of channel 1 REVOLUTIONS dials on the coupler to the nearest hundredth. De-energize the transmitter and rotate the channel 1 coarse tuning control several revolutions.</p> <p style="text-align: center;">NOTE</p> <p>Do not change the output level or frequency of the transmitter. Maintain at least a 5-mc spacing between channel frequencies, for test purposes only.</p> <p>Reset channel 1 REVOLUTIONS dials to the exact previous setting. Energize the transmitter: observe and record the MM-706 power reading.</p>	MM-706 and channel 1 REVOLUTIONS dials of the CU-691/U.	Final power reading: within 10% of initial power reading.
②	Determine the re-settability of the CU-691/U, (channel 2).	Repeat step 1, except use 2 INPUT jack and associated controls of the CU-691/U.	MM-706 and channel 2 REVOLUTIONS dials of the CU-691/U.	Final power reading: within 10% of initial power reading.
③	Determine the re-settability of the CU-691/U, (channel 3).	Repeat step 1, except use 3 INPUT jack and associated controls of the CU-691/U.	MM-706 and channel 3 REVOLUTIONS dials of the CU-691/U.	Final power reading: within 10% of initial power reading.
④	Determine the re-settability of the CU-691/U, (channel 4).	Repeat step 1, except use 4 INPUT jack and associated controls of the CU-691/U.	MM-706 and channel 4 REVOLUTIONS dials of the CU-691/U.	Final power reading: within 10% of initial power reading.

\*Frequency range of 225 to 400 mc and output impedance of 50 ohms.

\*\*Use Bird model 82 or equivalent. Must have frequency range of 225 to 400 mc, absorption rating of 200 watts, an input impedance of approximately 50 ohms, and an SWR of less than 2:1.

#### 6-4. REPAIR.

##### a. DISASSEMBLY AND REMOVAL PROCEDURES. - (Refer to figure 6-1.)

###### (1) FRONT PANEL.

(a) Loosen the setscrews retaining the four coarse tuning knobs O105, O106, O107, and O108 with a number 8 Bristo wrench; remove knobs.

(b) Loosen the setscrews retaining the four VERNIER tuning knobs O111, O112, O113, and O114 with a number 8 Bristo wrench; remove knobs.

(c) Loosen the setscrews retaining the four dial lock knobs O101, O102, O103, and O104 with a number 6 Bristo wrench; remove knobs.

(d) Loosen the eight captive screws holding front panel in position; remove front panel.

###### (2) WRAP-AROUND COVER.

(a) Loosen and remove the six 10-32 flat-head screws securing front and rear edges of the top of the wrap-around cover.

(b) Loosen and remove the twenty-four truss-head screws securing the sides of the wrap-around cover.

(c) Grasp both sides of the cover and lift straight up to clear the coupler.

###### (3) REAR PANEL.

(a) Position coupler so the rear panel does not support the weight of the coupler.

(b) Loosen and remove the four 4-40 round-head screws and the four lock washers holding the output jack in position.

(c) Loosen and remove the eight 6-32 round-head screws and the sixteen washers holding the input jacks J221, J222, J223 and J224 in position.

(d) Loosen and remove the thirty-two 6-32 roundhead screws and the thirty-two washers holding the rear panel in position.

(e) Loosen and remove the five 10-32 flathead screws fastening the bottom of the rear panel to the bottom cover.

(f) Loosen and remove the two 10-32 round-head screws and the two washers fastening the sides of the rear panel to the bottom cover.

(g) Pull panel away from the coupler. Be careful not to damage the threads on the input and the output jacks.

#### CAUTION

When rear panel is removed, cavity interiors are exposed. Do not touch interior surfaces with bare hands since this may tarnish or corrode plating. Use a soft rag or wear clean cotton gloves when working inside cavities.

###### (4) GEAR TRAIN ASSEMBLIES. - (Channel 4)

(a) Remove the frontpanel. Refer to paragraph 6-4.a.(1).

(b) Loosen and remove the four 4-40 round-head screws retaining large and small dial windows DS109 and DS113; remove dial windows DS109 and DS113.

(c) Loosen the two setscrews retaining locking collar MP153 with a number 8 Bristo wrench; remove locking collar MP153.

(d) Loosen the 4-40 socket head screw retaining coupler clamp MP111 with a number 8 Bristo wrench; remove coupler clamp MP111 and vernier revolution dial DS105.

(e) Loosen the two setscrews retaining frequency dial DS102 (behind the frequency dial); remove frequency dial DS102.

(f) Remove retaining ring H102.

(g) Grasp dial drive gear assembly MP141-MP161 by the gear teeth and pull assembly off the shaft.

#### CAUTION

This is a spring loaded gear, therefore, release the tension slowly to avoid losing the springs.

(h) Remove flat washer H112.

(i) Remove retaining ring H103.

(j) Grasp dial drive gear assembly MP137-MP177 by the gear teeth and pull assembly off the gear bracket pinion post.

#### CAUTION

This is a spring loaded gear, therefore, release the tension slowly to avoid losing the springs.

(k) Loosen and remove the two 6-32 flathead screws holding gear bracket to gear bracket posts H118.

(l) Grasp drive gear assembly MP145-MP165 by the gear teeth and pull assembly off the shaft.

(m) Remove flat washer located behind the drive gear assembly MP145-MP165.

(n) Remove retaining ring H103 and remove idler gear MP169.

(o) Loosen socket head screw retaining coupler clamp MP109 and drive gear assembly MP147-MP173; remove coupler clamp MP109.

(p) Grasp drive gear assembly MP147-MP173 by the gear teeth and pull assembly off the shaft.

(q) Loosen and remove the 6-32 roundhead screw and the lock washer retaining dial lock arm; remove dial lock arm and spacer H123.

(r) Loosen and remove the three 6-32 round-head screws and the three lock washers holding bearing plate assembly to bearing plate spacers H124 and spacing post H120; remove bearing plate assembly.

(s) Remove retaining ring H101 and washer H122 (behind the front plate).

(t) Pull VERNIER shaft assembly MP199.6 out of the front plate.

(u) Loosen the two setscrews retaining dial lock cam MP131 with a number 8 Bristo wrench; remove dial lock cam MP131.

(v) Remove retaining ring H101; pull dial lock shaft assembly MP157 out from the rear of the front plate.

(w) Repeat this procedure to disassemble channel 1, 2, and 3 gear trains.

(5) MOVABLE CONDUCTORS. (Channel 4)

(a) Remove the front panel. Refer to paragraph 6-4.a.(1).

(b) Remove the associated gear train assembly. Refer to paragraph 6-4.a.(4).

(c) Loosen and remove the eight 4-40 flathead screws retaining tuning slug cup plates; remove cup plates.

(d) Pull long and short movable conductor assemblies MP181 and MP185 out of output and input cavities, respectively.

**NOTE**

Special procedures and tools are required to disassemble and reassemble the long and short movable conductor assemblies. Therefore, replace the complete assemblies if they are damaged.

(e) Repeat this procedure to remove the movable conductors of channels 1, 2, and 3.

(6) COMBINING NETWORK.

(a) Remove the wrap-around cover. Refer to paragraph 6-4.a.(2).

(b) Remove the rear panel. Refer to paragraph 6-4.a.(3).

(c) Loosen and remove the four 4-40 hex nuts and the four lock washers connecting the combining network inner conductor to the coupling loops of the output cavities.

(d) Loosen and remove the eight 4-40 round-head screws connecting the coupling loops to the output cavities.

(e) Loosen and remove the eight 6-32 flat-head screws and the eight 6-32 roundhead screws connecting the matching network cable assemblies W101, W102, W103, and W104 to the output cavities; remove the combining network Z301.

**CAUTION**

Do not scratch or mar the plated interior surface of the cavities.

(7) MONITOR COUPLER ASSEMBLIES. (Channel 1)

(a) Remove the wrap-around cover. Refer to paragraph 6-4.a.(2).

(b) Remove the rear panel. Refer to paragraph 6-4.a.(3).

(c) Loosen and remove the 6-32 hex nut and the lock washer connecting the input inner conductor to the input coupling loop.

(d) Loosen and remove the two 4-40 round-head screws connecting the coupling loop to the input cavity.

(e) Loosen and remove the two 6-32 flathead screws and the two 6-32 roundhead screws connecting the input connector to the input cavity; carefully remove the input connector Z201 from the input cavity.

**CAUTION**

Do not scratch or mar the plated interior surface of the cavity.

(f) Loosen and remove the two d-c coupling connectors P201 and P211 from monitor coupler unit.

**CAUTION**

Diodes are loose inside coupling connectors. Remove diodes to avoid losing them.

(g) Cut cable ties holding the monitor coupler unit cables to the r-f input cable and the cavity support posts; remove the monitor coupler assembly Z201.

(h) Repeat this procedure to disassemble the monitor coupler assembly of channels 2, 3, and 4.

(8) TANDEM CAVITIES. (Channel 1)

(a) Remove the wrap-around cover. Refer to paragraph 6-4.a.(2).

(b) Remove the rear panel. Refer to paragraph 6-4.a.(3).

(c) Remove the combining network Z301 from the output cavity. Refer to paragraph 6-4.a.(6).

(d) Remove the monitor coupler assembly Z201 from the input cavity. Refer to paragraph 6-4.a.(7).

(e) Loosen and remove the eight 10-32 round-head screws and the eight lock washers holding the tandem cavity to the cavity support posts; remove the tandem cavity.

(f) Repeat this procedure to disassemble the tandem cavity of channels 2, 3, and 4.

(9) SWITCH PANEL.

(a) Remove the front panel. Refer to paragraph 6-4.a.(1).

(b) Loosen the two 4-40 roundhead screws (behind the front plate) holding the switch panel to the front plate; remove the switch panel.

(10) ELECTRICAL COMPONENTS. - Removal and replacement of electrical components, other than

those referenced in the proceeding paragraphs, require no special procedures.

**b. REPLACEMENT AND REASSEMBLY PROCEDURES.** - (Refer to figure 6-1.)

(1) SWITCH PANEL. - To replace switch panel, reverse procedure given in paragraph 6-4.a.(9).

(2) TANDEM CAVITIES. - To replace tandem cavities, reverse procedure given in paragraph 6-4.a.(8).

(3) MONITOR COUPLER ASSEMBLIES. - To replace monitor coupler assemblies, reverse procedure given in paragraph 6-4.a.(7).

**NOTE**

The distance between the coupling loop and the cavity side wall at the input connector must be within 0.010 inch of the distance between the coupling loop and the cavity side wall at the fixed end.

(4) COMBINING NETWORK. - To replace combining network, reverse procedure given in paragraph 6-4.a.(6).

**NOTE**

The distance between the coupling loops and cavity side walls at the output connectors must be within 0.010 inch of the distance between the coupling loops and the cavity side walls at the fixed ends.

(5) MOVABLE CONDUCTORS. - To replace movable conductors, reverse procedure given in paragraph 6-4.a.(5).

(6) GEAR TRAIN ASSEMBLIES. (Channel 4)

(a) Insert dial lock shaft assembly MP157 from the rear of the front plate, and replace retainer ring H101.

(b) Replace dial lock cam MP131 on dial lock shaft assembly MP157 and tighten setscrews with a number 8 Bristo wrench.

(c) Replace spacer H123 and dial lock arm on dial lock shaft assembly MP157.

**NOTE**

Insure that the dial lock arm does not bind the long movable conductor shaft when the locking mechanism is unlocked.

(d) Replace idler gear MP169 and retaining ring H103.

(e) Rotate both movable conductor shafts until the movable conductors are completely retracted.

(f) Replace drive gear assembly MP147-MP173 and coupler clamp MP109 on the short movable conductor shaft. Load the gear through two teeth and position it so that it meshes on the center line of the idler gear.

(g) Replace VERNIER gear and shaft assembly MP199.6. Load the gear through two teeth.

(h) Replace washer H122 and retaining ring H101 on the VERNIER gear shaft behind the front plate.

(i) Replace bearing plate assembly by inserting the three 6-32 roundhead screws through the mating lock washers and the bearing plate assembly, and securing them to the bearing plate spacers H124 and spacing post H120.

(j) Replace washer and drive gear assembly MP145-MP165 on the long movable conductor shaft. Load the gear through two teeth.

(k) Replace gear bracket by inserting the two 6-32 flathead screws through the gear bracket and securing them to the gear bracket posts H118.

(l) Replace dial drive gear assembly MP137-MP177 on the gear bracket pinion post. Load the gear through two teeth.

(m) Replace retaining ring H103 on the gear bracket pinion post.

(n) Replace flat washer H112 and dial drive gear assembly MP141-MP161 on drive gear assembly MP145-MP165 shaft.

(o) Replace retaining ring H102 on drive gear assembly MP145-MP165 shaft.

(p) Replace frequency dial DS102 and tighten the two retaining setscrews.

(q) Replace vernier revolution dial DS105 and coupler clamp MP111; tighten socket head screw retaining coupler clamp MP111.

(r) Replace locking collar MP153 and tighten the two retaining setscrews.

(s) Replace large dial window DS109 by inserting the two 4-40 roundhead screws through the window and securing them to the supporting posts H113.

(t) Replace small dial window DS113 by inserting the two 4-40 roundhead screws through the window and securing them to the supporting posts H113.

**CAUTION**

The cavities must be resynchronized and the dials must be recalibrated before the channel is ready for operation.

(u) Repeat this procedure to reassembly channel 1, 2, and 3 gear trains.

(7) REAR PANEL. - To replace rear panel, reverse procedure given in paragraph 6-4.a.(3).

(8) WRAP-AROUND COVER. - To replace wrap-around cover, reverse procedure given in paragraph 6-4.a.(2).

(9) FRONT PANEL. - To replace front panel, reverse procedure given in paragraph 6-4.a.(1).

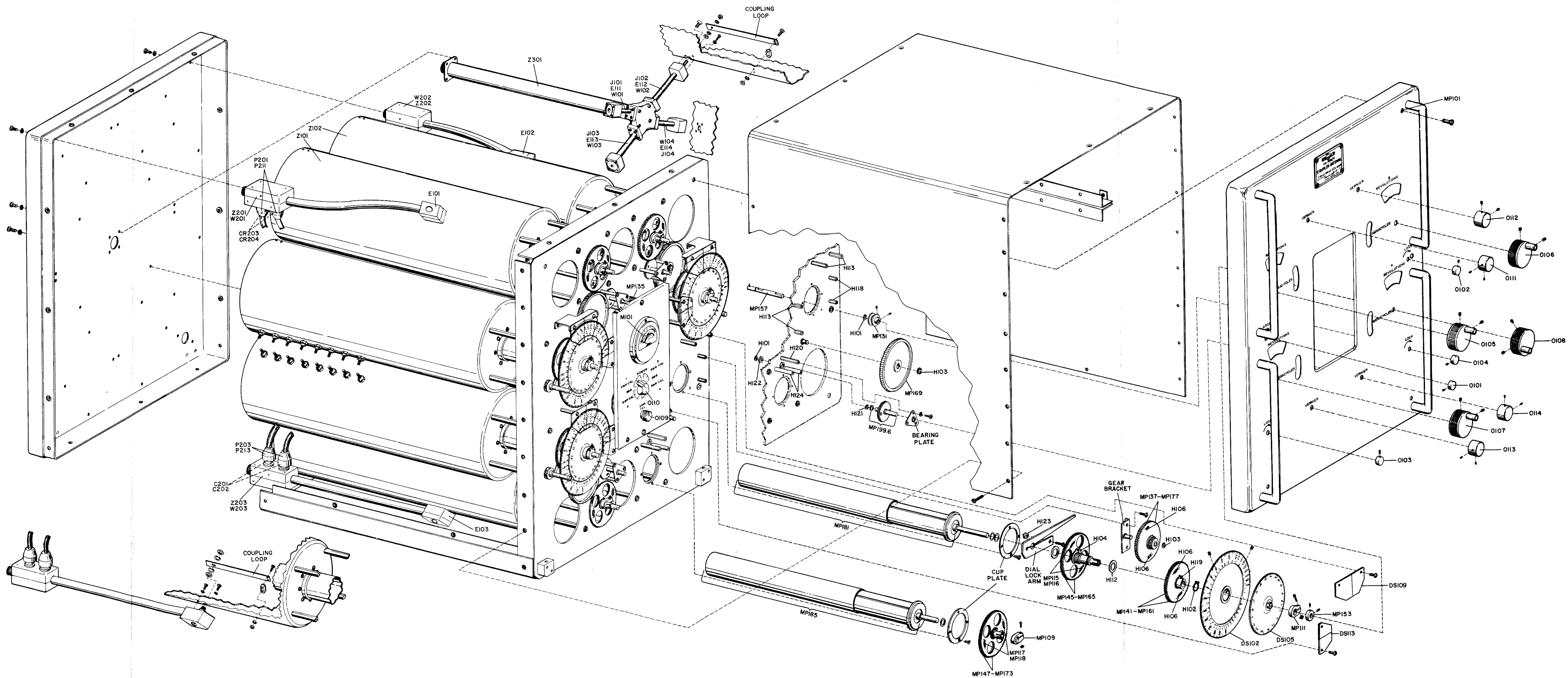


Figure 6-1. Antenna Coupler CU-691/U, Partial Exploded View

c. DIAL CALIBRATION. - (Channel 4)

(1) To calibrate frequency and revolutions dials, proceed as follows.

(2) Remove the front panel. Refer to paragraph 6-4.a.(1) of this section.

(3) Set up test equipment as in paragraph 6-2.c., step 2.3, of this section. Select 395.0 mc as the transmitter frequency, tune tandem cavity 4 as paragraph 3-4.a., for minimum swr, and energize the transmitter.

(4) Loosen vernier dial clamp MP111 and revolutions and megacycles dial clamp (hub behind dial).

(5) Adjust frequency dial to read 395.0 mc and tighten dial clamp (hub behind dial).

(6) Turn coarse tuning knob to the nearest integral number on the coarse revolutions dial and adjust vernier dial to the zero position (1.0); tighten vernier dial clamp MP111.

(7) Repeat this procedure for channels 1, 2, and 3.

(8) Replace the front panel. Refer to paragraph 6-4.b.(9) of this section.

d. METER CALIBRATION. - (Channel 1)

(1) To calibrate the front panel meter, proceed as follows.

(2) Remove the front panel. Refer to paragraph 6-4.d.(1).

(3) Set up test equipment as in paragraph 6-3.c., step 1 (INSERTION LOSS AND SWR). Select some frequency at which the transmitter is capable of a convenient reference output.

(4) Tune tandem cavity 1 to the approximate transmitter frequency.

**NOTE**

Maintain at least a 5-mc spacing between channel frequencies, for adjustment purposes only.

(5) Rotate the CU-691/U meter function switch to the channel 1 POWER position.

(6) Energize the transmitter.

(7) Rotate the Jones MM-706 function selector switch to the BACK position and fine tune tandem cavity 1 for minimum reflected power.

(8) Rotate the Jones MM-706 function selector switch to the FOR position.

(9) Adjust channel 1 power calibration potentiometer R110 so the CU-691/U meter reading corresponds to the reference power level as indicated by the Jones MM-706.

(10) Repeat this procedure for channels 2, 3, and 4, except adjust power calibration potentiometers R111, R112, and R113, respectively.

(11) Replace the front panel. Refer to paragraph 6-4.b.(9).

ORIGINAL

e. CAVITY SYNCHRONIZATION. - (Channel 1)

(1) To synchronize cavities, proceed as follows.

**NOTE**

Cavities must be synchronized after replacing and reassembling tuning assemblies.

(2) Remove the front panel. Refer to paragraph 6-4.a.(1) of this section.

(3) Decouple the input and output cavities by loosening coupler clamp MP109.

(4) Connect the output of a signal generator (such as Hewlett-Packard 608D) to the OUTPUT jack of the coupler.

(5) Connect the input of a UHF receiver to the 1 INPUT jack of the coupler.

(6) Temporarily install coarse tuning knobs on the coarse tuning shaft and the input cavity shaft extension of tandem cavity 1.

(7) Select 395 mc as the signal generator frequency and resonate tandem cavity 1 by rotating both tuning shafts independently and locating a peak in the receiver response.

(8) Disconnect the receiver and the signal generator.

(9) Connect a dummy load (such as Bird model 82) to the OUTPUT jack of the coupler.

(10) Connect a UHF transmitter to the 1 INPUT jack of the coupler. Tune the transmitter to 395 mc.

**NOTE**

Maintain at least a 5-mc spacing between channel frequencies.

(11) Rotate the coupler meter function switch to the channel 1 SWR position.

(12) Energize the transmitter.

**CAUTION**

Do not energize the transmitter unless it is known that both cavities of tandem cavity 1 are tuned to approximately 395 mc.

(13) Rotate the main tuning control for a dip (or null) in the SWR meter reading.

(14) Rotate the temporary tuning knob on the input cavity tuning shaft for a further dip (or null) in the SWR meter reading.

(15) Repeat procedure in (13) and (14) until no further reduction in the SWR meter reading can be obtained. Final SWR meter reading must be less than 2.0 (2:1).

(16) Couple the input and output cavities by tightening coupler clamp MP109.

(17) Adjust frequency and revolutions dials to correspond to 395 mc as explained in paragraph 6-4.c. of this section.

(18) Refer to paragraph 6-3.c. of this section and perform the resettability performance standard test.

(19) If SWR and resettability are satisfactory, remove the temporary installed control knobs and replace the front panel. Refer to paragraph 6-4.b.(9).

(20) Repeat this procedure for channels 2, 3, and 4 cavities.

f. CAVITY TRACKING. - (Channel 1)

**NOTE**

Cavity tracking is a factory adjustment and should not be attempted unless movable conductors or cavities have been replaced.

(1) To track cavities, proceed as follows.

**NOTE**

Cavity synchronization must be performed before attempting to track cavities.

(2) Remove the front panel. Refer to paragraph 6-4.a.(1) of this section.

(3) Set up test equipment as in paragraph 6-3.c., step 3 (INSERTION LOSS AND SWR), of this section. Select 399.9 mc as the transmitter frequency, tune tandem cavity 1 as in paragraph 3-4.a., for minimum swr, and energize the transmitter.

(4) Apply slight pressure to each movable conductor shaft in turn, and observe the MM-706 for a drop in load power. If applying slight pressure to a

movable conductor shaft causes a drop in load power, the cavity is tracking properly. However, if the load power rises, the cavity is misaligned at this frequency.

(5) To realign the cavity, turn the 399.9 mc tuning screw (tuning screw nearest the front panel) inward until maximum load power and minimum swr are obtained.

(6) There is some interaction between tuning screw adjustment and channel tuning, therefore, retune the channel being aligned as the tuning screw is adjusted.

(7) Tune channel 1 of the CU-691/U for minimum insertion loss by approaching resonance from a clockwise direction and note the load power. Repeat, except tune from a counterclockwise direction and note the load power.

(8) If any difference in load power is noted, tune to resonance from the direction giving lowest load power and repeat procedure in (4), (5), and (6) until the procedure of (7) results in no load power difference.

(9) Repeat procedure in (2) through (7) at the following tracking points: 370.0 mc, 330.0 mc, 300.0 mc, 275.0 mc, 250.0 mc, 230.0 mc, and 225.0 mc. The tuning screws are numbered consecutively starting with the one nearest the front panel being 399.9 mc.

**NOTE**

Tuning screws must be adjusted in sequence beginning at the high-frequency end since any adjustment affects all frequencies below the initially adjusted frequency.

(10) Repeat this procedure for optimum cavity alignment.

(11) Repeat this procedure for channel 2, 3, and 4 cavities.

(12) Replace the front panel. Refer to paragraph 6-4.b.(9) of this section.

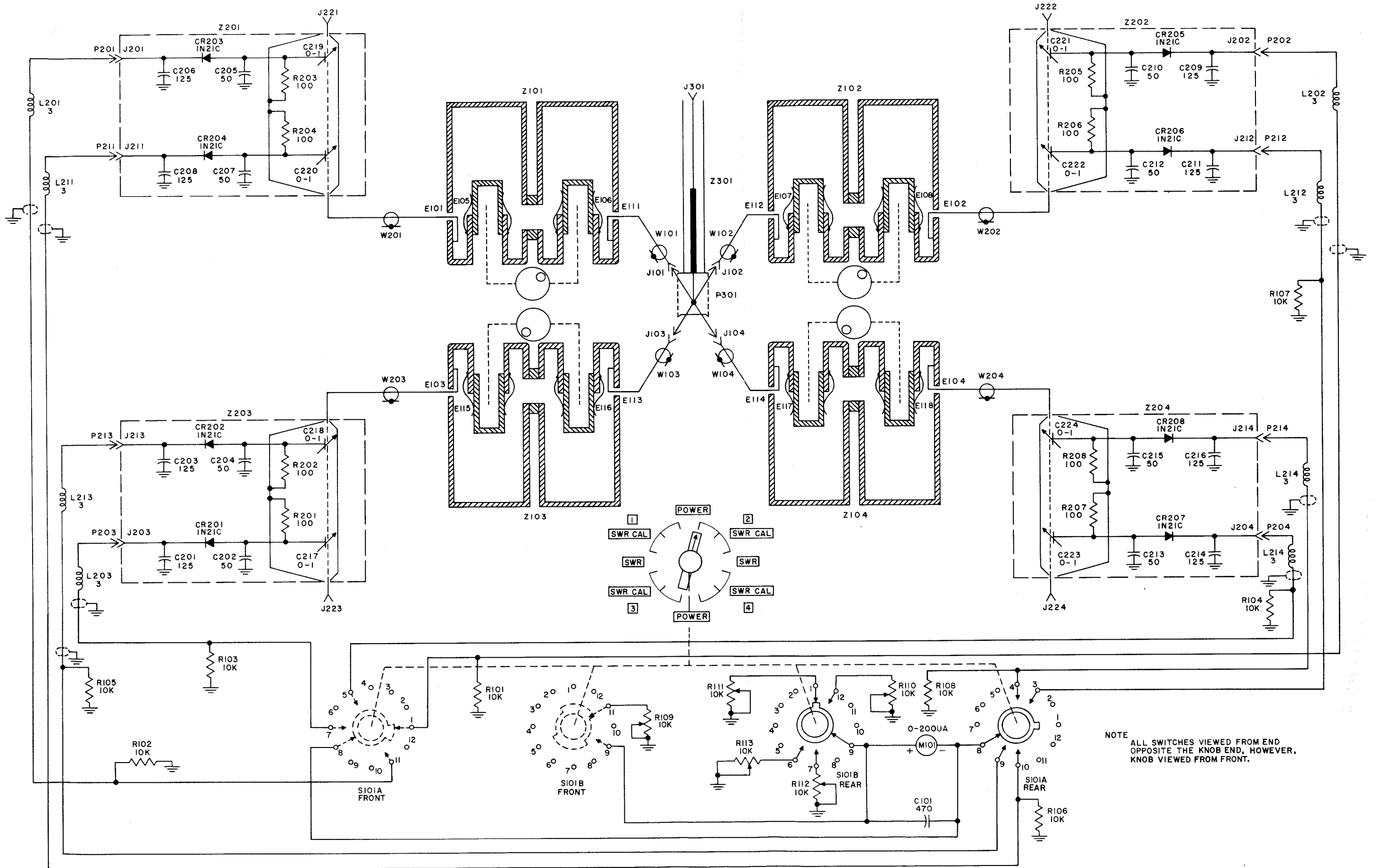


Figure 6-2. Antenna Coupler CU-691/U,  
Schematic Diagram



## SECTION 7 PARTS LIST

### 7-1. INTRODUCTION.

Reference designations (such as circuit symbols, reference symbols, etc.) have been assigned to identify all maintenance parts of the equipment. They are included on drawings, diagrams and the parts list. The letters of a reference designation indicate the kind of part (generic group), such as resistor, amplifier, electron tubes, etc. The number differentiates between parts of the same generic group. Parts of the same major unit are prefixed with the same unit number (see Table 7-1).

Sockets associated with a particular plug-in device, such as an electron tube or a fuse are identified by a reference designation which includes the reference designation of the plug-in device. For example the X prefix identifies the socket for fuse F7 and is designated XF7.

### 7-2. MAINTENANCE PARTS LIST.

Table 7-1 lists all of the major units and their replaceable maintenance parts. The parts of each major unit are grouped together. Column 1 lists the reference series of each major unit, followed by

the reference designations of the parts in alphabetical and numerical order. Column 2 refers to the explanatory notes. Column 3 gives the name and describes the various parts. Complete information is given for all key parts (parts differing from any part previously listed in this table) and sub-key parts (parts identical with a key part but appearing for the first time for a major unit). The description is omitted for succeeding duplicate parts; however, reference is made to the key part or sub-key part for the data. Column 4 gives the functional location of the part in the equipment.

### 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 manufacturers of parts used in the equipment. The first column includes the abbreviations used in Table 7-1 to identify manufacturers.

TABLE 7-1. ANTENNA COUPLER CU-691/U, MAINTENANCE PARTS LIST

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
100 thru 199 series			
C101		CAPACITOR, FIXED, MICA: 500 vdc, 470 uuf, $\pm 20\%$ plastic case, hermetically sealed, 51/64 in. by 15/32 in. by 7/32 in.; MIL-C-5A CM20B471M	Meter bypass
DS101		DIAL, CONTROL INDICATOR LEFT: movable scale type frequency; Collins Radio P/N 542 1437 002	Revolutions and frequency dial
DS102		DIAL, CONTROL INDICATOR, RIGHT: movable scale type revolutions; Collins Radio P/N 542 1438 002	Revolutions and frequency dial
DS103		Same as DS101	
DS104		Same as DS102	
DS105		DIAL: movable scale type revolutions; Collins Radio P/N 542 1443 002	Revolutions dial, vernier

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
DS106		Same as DS105	
DS107		Same as DS105	
DS108		Same as DS105	
DS109		WINDOW, DIAL: plastic, 0.062 in. by 1-11/16 in. by 1-15/16 in.; Collins Radio P/N 542 1467 002	Revolutions and vernier dial windows
DS110		Same as DS109	
DS111		Same as DS109	
DS112		Same as DS109	
DS113		WINDOW, DIAL: plastic, 0.062 in. by 31/32 in. by 2-7/16 in.; Collins Radio P/N 542 1468 002	Frequency dial window
DS114		Same as DS113	
DS115		Same as DS113	
DS116		Same as DS113	
E101		TERMINAL: p/o W201; built in	Cavity input
E102		Same as E101 p/o W202	
E103		Same as E101 p/o W203	
E104		Same as E101 p/o W204	
E105		CONTACT, ELECTRICAL: beryllium copper silver plated; Collins Radio P/N 542 1380 002	Inner cavity contact
E106		Same as E105	
E107		Same as E105	
E108		Same as E105	
E109		Not used	
E110		Not used	
E111		CONTACT, ELECTRICAL: beryllium copper, silver plated; automatic metal p/o W101; MIL-C-71, MS90163	Cavity output
E112		Same as E111 p/o W102	
E113		Same as E111 p/o W103	
E114		Same as E111 p/o W104	
E115		Same as E105	
E116		Same as E105	

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
E117		Same as E105	
E118		Same as E105	
H101		RING, RETAINING: beryllium copper; Waldes Koh-I-Noor, Inc. P/N 5100-25C	Vernier shaft
H102		RING, RETAINING: beryllium copper; Waldes Koh-I-Noor, Inc. P/N 5100-37C	Frequency and revolutions dial hub
H103		RING, RETAINING: beryllium copper; Waldes Koh-I-Noor, Inc. P/N 5133-18C	Idler and transfer gear
H104		RING, RETAINING: beryllium copper; Waldes Koh-I-Noor, Inc. P/N 5108-50-C	Output and input gear
H105		WASHER, FLAT: stainless steel; Collins Radio P/N 500 1098 003	Meter panel
H106		SPRING, HELICAL, COMPRESSION: steel music wire; Collins Radio P/N 340 0127 00	Revolutions dial drive gear, loading spring
H107		POST, SPACING: stainless steel; 0.250 in. dia by 2-5/32 in. lg; Collins Radio P/N 542 1393 002	Meter switch
H108		WASHER, LOCK: No. 4 silicon bronze silver plated; Collins Radio P/N 544 5359 001	Output cable pin
H109		WASHER, LOCK: No. 6; silicon bronze silver plated u/w Z101 thru Z104; Collins Radio P/N 544 5350 001	Cavity coupler blocks Input and output connector blocks
H110		WASHER, LOCK: internal tooth No. 4; phosphor bronze silver plated u/w Z101 thru Z104; Collins Radio P/N 544 5349 001	Inner cavity contacts
H111		WASHER, LOCK: No. 10 silicon bronze silver plated u/w Z101 thru Z104; Collins Radio P/N 544 5351 001	Inner cavity contacts
H112		WASHER, FLAT: stainless steel; Collins Radio P/N 504 0719 003	Cavity drive gear spacer
H113		POST, SPACING: aluminum; 1/4 in. hex by 1.312 in. lg tapped 6-32NC thd; 5/16 in. d one end, 4-40NC thd, 5/16 in. d other end; Collins Radio P/N 542 1425 002	Frequency and revolu- tions dial window
H114		Not used	
H115		SPRING, HELICAL COMPRESSION: stain- less steel; Collins Radio P/N 542 1385 002	Lead screw nut loading spring
H116		WASHER, FLAT: stainless steel; Collins Radio P/N 542 1567 003	Tuning slug bearing spring

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
H117		SCREW, MACHINE: stainless steel; Collins Radio P/N 1383 002	Lead screw loading nut
H118		POST, SPACING: chromate dipped aluminum; Collins Radio P/N 542 1476 002	Gear bracket
H119		RING, RETAINING: beryllium copper; Waldes Koh-I-Noor, Inc. P/N 5100-56C	Revolutions dial drive gear
H120		POST, SPACING: aluminum; 1/4 in. hex by 1-1/8 in. lg, 3/8 in. d tapped 6-32 thd each end; Collins Radio P/N 540 9223 003	Vernier shaft bearing plate bracket
H121		WASHER, FLAT: shim brass; Collins Radio P/N 504 0715 003	Vernier shaft shim
H122		WASHER, FLAT: stainless steel; Collins Radio P/N 540 3007 003	Vernier shaft
H123		SPACER, ARM: aluminum chromate dip; Collins Radio P/N 542 1464 002	Dial lock arm
H124		SPACER, BEARING PLATE: aluminum chromate dip; Collins Radio P/N 544 5372 002	Vernier bearing plate
J101		PIN, CONNECTOR: brass silver plated; 0.28 in. dia by 0.40 in. lg p/o W101; Collins Radio P/N 542 1454 002	Combining network input
J102		Same as J101, p/o W102	
J103		Same as J101, p/o W103	
J104		Same as J101, p/o W104	
MP101		SPRING, SLEEVE: copper; 13/64 in. id, 0.282 in. od, 0.187 in. lg; Collins Radio P/N 542 1402 002	Front panel mtg screw bushing
MP102		Same as MP101	
MP103		Same as MP101	
MP104		Same as MP101	
MP105		Same as MP101	
MP106		Same as MP101	
MP107		Same as MP101	
MP108		Same as MP101	
MP109		CLAMP: aluminum; 0.200 in. thk by 0.312 in. dia shaft; Collins Radio P/N 504 7537 002	Input cavity drive gear

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
MP110		Same as MP109	
MP111		CLAMP: aluminum 0.200 in. by 0.593 in. by 0.765 in. overall; accommodates a 0.375 in. dia shaft; Collins Radio P/N 504 7577 002	Coarse revolutions dial shaft clamp
MP112		Same as MP111	
MP113		Same as MP111	
MP114		Same as MP111	
MP115		SPRING, HELICAL, EXTENSION: 0.016 in. dia music wire; Collins Radio P/N 506 1937 002	Cavity drive gear loading
MP116		Same as MP115	
MP117		Same as MP115	
MP118		Same as MP115	
MP119		Same as MP115	
MP120		Same as MP115	
MP121		Same as MP115	
MP122		Same as MP115	
MP123		Same as MP115	
MP124		Same as MP115	
MP125		Same as MP115	
MP126		Same as MP115	
MP127		Same as MP115	
MP128		Same as MP115	
MP129		Same as MP115	
MP130		Same as MP115	
MP131		CAM, CONTROL: stainless steel; 0.251 in. id, 1 in. od; Collins Radio P/N 542 1466 002	Cavity gear train dial lock cam assy
MP132		Same as MP131	
MP133		Same as MP131	
MP134		Same as MP131	

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
MP135		SPRING, HELICAL COMPRESSION: corrosion resistant steel; 1-5/8 in. lg; Collins Radio P/N 542 1394 002	Switch and meter panel mtg spring
MP136		Same as MP135	
MP137		GEAR, SPUR: 2024-T3 aluminum; Collins Radio P/N 542 1415 002	Idler and transfer loading gear
MP138		Same as MP137	
MP139		Same as MP137	
MP140		Same as MP137	
MP141		GEAR, SPUR: 2024-T3 aluminum; Collins Radio P/N 542 1416 002	Frequency dial drive loading gear
MP142		Same as MP141	
MP143		Same as MP141	
MP144		Same as MP141	
MP145		GEAR, SPUR: drive No. 2, stainless steel, 18GA; Collins Radio P/N 542 1418 002	Output and input cavity drive
MP146		Same as MP145	
MP147		Same as MP145	
MP148		Same as MP145	
MP149		Same as MP145	
MP150		Same as MP145	
MP151		Same as MP145	
MP152		Same as MP145	
MP153		COLLAR, CLAMP: corrosion resistant steel; 0.312 in. id, 9/16 in. od, 0.218 in. lg; Collins Radio P/N 542 1423 002	Output cavity gear assy retaining
MP154		Same as MP153	
MP155		Same as MP153	
MP156		Same as MP153	
MP157		SHAFT, LOCK: stainless steel; 0.218 in. dia by 2-15/16 in. lg; Collins Radio P/N 542 1436 002	Cavity gear train dial lock shaft
MP158		Same as MP157	
MP159		Same as MP157	

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
MP160		Same as MP157	
MP161		GEAR, SPUR: aluminum, incl hub; Collins Radio P/N 542 1439 002	Frequency, frequency dial drive
MP162		Same as MP161	
MP163		Same as MP161	
MP164		Same as MP161	
MP165		GEAR ASSEMBLY: c/o one stainless steel spur gear shaft and 1 spur gear; Collins Radio P/N 542 1440 002	Cavity drive
MP166		Same as MP165	
MP167		Same as MP165	
MP168		Same as MP165	
MP169		GEAR, SPUR: aluminum gear, incl hub and bearing; Collins Radio P/N 542 1441 002	Cavity drive idler
MP170		Same as MP169	
MP171		Same as MP169	
MP172		Same as MP169	
MP173		GEAR, SPUR: steel gear, incl hub; Collins Radio P/N 542 1442 002	Cavity drive
MP174		Same as MP173	
MP175		Same as MP173	
MP176		Same as MP173	
MP177		GEAR ASSY: incl steel gear and aluminum spur gear; Collins Radio P/N 542 1444 002	Idler and transfer
MP178		Same as MP177	
MP179		Same as MP177	
MP180		Same as MP177	
MP181		CONDUCTOR SECTION, TUNED CAVITY: 10 in. lg by 1.547 in. dia; incl bearing cup, 2 bearings, 2 springs, lead screw, retaining ring, loading nut spring, washer and screw pin; 11.686 in. shaft; Collins Radio P/N 544 5390 003	Cavity tuning

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
MP182		Same as MP181	
MP183		Same as MP181	
MP184		Same as MP181	
MP185		CONDUCTOR SECTION, TUNED CAVITY: 10 in. lg by 1.547 in. dia, incl bearing cup, 2 bearings, 2 springs, lead screw, retaining ring, loading nut spring, washer and screw pin; 10.530 in. shaft; Collins Radio P/N 544 5391 003	Cavity tuning
MP186		Same as MP185	
MP187		Same as MP185	
MP188		Same as MP185	
MP189		BEARING, BALL, ANNULAR: New Departure type 77-R-6	Tuning slug bearing
MP190		Same as MP189	
MP191		Same as MP189	
MP192		Same as MP189	
MP193		Same as MP189	
MP194		Same as MP189	
MP195		Same as MP189	
MP196		Same as MP189	
MP197		SPRING, HELICAL, EXTENSION: 0.080 in. dia; stainless steel; Collins Radio P/N 542 1387 002	Bearing loading
MP198		Same as MP197	
MP199		Same as MP197	
MP199.1		Same as MP197	
MP199.2		Same as MP197	
MP199.3		Same as MP197	
MP199.4		Same as MP197	
MP199.5		Same as MP197	
MP199.6		SHAFT ASSY, VERNIER: 2-1/2 in. lg, 1/4 in. dia; incl retaining ring, 2 gears (1 riveted) and 1 spring; Collins Radio P/N 544 5381 002	Vernier gear



TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
MP199.7		Same as MP199.6	
MP199.8		Same as MP199.6	
MP199.9		Same as MP199.6	
MP199.10		Same as MP189	
MP199.11		Same as MP189	
MP199.12		Same as MP189	
MP199.13		Same as MP189	
MP199.14		Same as MP189	
MP199.15		Same as MP189	
MP199.16		Same as MP189	
MP199.17		Same as MP189	
MP199.18		MOUNT, RESILIENT: cup shape; rubber and metal; Barry Corp. P/N C-2060-T6	Shockmount
MP199.19		Same as MP199.18	
MP199.20		Same as MP199.18	
MP199.21		Same as MP199.18	
MP199.22		MOUNT, RESILIENT: cup shape; rubber and metal; Barry Corp. P/N C-2090-T6	Shockmount
MP199.23		Same as MP199.22	
M101		AMMETER: DC microampere; Simpson, Collins Radio P/N 476 0207 00	SWR and power
O101		KNOB: set screw type; aluminum body; Collins Radio P/N 503 8688 002	Dial lock and power cal
O102		Same as O101	
O103		Same as O101	
O104		Same as O101	
O105		KNOB: set screw type w/spinner; aluminum body, steel shaft, aluminum spinner; Collins Radio P/N 542 1465 002	Coarse tuning
O106		Same as O105	
O107		Same as O105	
O108		Same as O105	
O109		Same as O101	

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
O110		KNOB: set screw type w/ brass insert; bakelite body; Collins Radio P/N 508 1103 20	Meter switch
O111		KNOB: set screw type w/ brass insert; aluminum body; Collins Radio P/N 544 5371 002	Fine tuning
O112		Same as O111	
O113		Same as O111	
O114		Same as O111	
R101		RESISTOR, FIXED COMPOSITION: 10,000 ohms, $\pm 10\%$ ; 1/2 w; MIL-R-11, RC20GF103K	Monitor load
R102		Same as R101	
R103		Same as R101	
R104		Same as R101	
R105		Same as R101	
R106		Same as R101	
R107		Same as R101	
R108		Same as R101	
R109		RESISTOR, VARIABLE COMPOSITION: 10,000 ohms $\pm 20\%$ ; 2 w, linear taper, 3/4 in. lg; rd shaft; Chicago Tel type 95	SWR cal
R110		RESISTOR, VARIABLE COMPOSITION: 10,000 ohms, $\pm 20\%$ ; 1 w; linear taper; 5/8 in. lg, slotted shaft; Chicago Tel type 90	Power cal
R111		Same as R110	
R112		Same as R110	
R113		Same as R110	
S101 A, B, C, D		SWITCH, ROTARY: 2 sections, 12 position; Oak Mfg type F	Monitor selector
W101		CABLE, MATCHING NETWORK: c/o cylinder connector pin, coax cable, female terminal; Collins Radio P/N 544 5013 002	Cavity output
W102		Same as W101	
W103		Same as W101	
W104		Same as W101	

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
Z101		TUNED CAVITY SUBASSEMBLY: Collins Radio P/N 544 5395 005	Tandem cavity assy, 2 right cylinders per assy
Z102		TUNED CAVITY SUBASSEMBLY: Collins Radio P/N 544 5396 005	Tandem cavity assy, 2 left cylinders per assy
Z103		Same as Z102	
Z104		Same as Z101	
200 series			
CR201		SEMICONDUCTOR DEVICE DIODE: 1N21C p/o Z203; built in	Monitor rectifier
CR202		Same as CR201 p/o Z203	
CR203		Same as CR201 p/o Z201	
CR204		Same as CR201 p/o Z201	
CR205		Same as CR201 p/o Z202	
CR206		Same as CR201 p/o Z202	
CR207		Same as CR201 p/o Z204	
CR208		Same as CR201 p/o Z204	
C201		CAPACITOR, FIXED: 125 uuf, p/o Z203; built in	Filter
C202		CAPACITOR, FIXED: 50 uuf p/o Z203; built in	Divider
C203		Same as C201 p/o Z203	
C204		Same as C202 p/o Z203	
C205		Same as C202 p/o Z201	
C206		Same as C201 p/o Z201	
C207		Same as C202 p/o Z201	
C208		Same as C201 p/o Z201	
C209		Same as C201 p/o Z202	
C210		Same as C202 p/o Z202	
C211		Same as C201 p/o Z202	
C212		Same as C202 p/o Z202	
C213		Same as C202 p/o Z204	

TABLE 7-1. COUPLER, ANTENNA CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION	
C214		Same as C201 p/o Z204	Voltage sampling	
C215		Same as C202 p/o Z204		
C216		Same as C201 p/o Z204		
C217		CAPACITOR, VARIABLE: 0-1, p/o Z203; built in		
C218		Same as C217 p/o Z203		
C219		Same as C217 p/o Z201		
C220		Same as C217 p/o Z201		
C221		Same as C217 p/o Z202		
C222		Same as C217 p/o Z202		
C223		Same as C217 p/o Z204		
C224		Same as C217 p/o Z204		
J201		CONNECTOR: p/o Z201; built in		D-c output
J202		Same as J201 p/o Z202		
J203		Same as J201 p/o Z203		
J204		Same as J201 p/o Z204		
J205		Not used		
J206		Not used		
J207		Not used		
J208		Not used		
J209		Not used		
J210		Not used		
J211		Same as J201 p/o Z201		
J212		Same as J201 p/o Z212		
J213		Same as J201 p/o Z213		
J214		Same as J201 p/o Z214		
J215		Not used		
J216		Not used		
J217		Not used		
J218		Not used		

TABLE 7-1. ANTENNA COUPLER CU-691/U, MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
J219		Not used	
J220		Not used	
J221		R-F INPUT CONNECTOR: p/o Z201; built in	Equipment channel connector
J222		Same as J221 p/o Z202	
J223		Same as J221 p/o Z203	
J224		Same as J221 p/o Z204	
L201		CHOKES: R. F. ; 3 uh, $\pm 20\%$ , 130 mc, 1.2 ohms, 500 ma p/o P201; Jeffers Electronics P/N 10100-72	Monitor output line filter
L202		Same as L201 p/o P202	
L203		Same as L201 p/o P203	
L204		Same as L201 p/o P204	
L205		Not used	
L206		Not used	
L207		Not used	
L208		Not used	
L209		Not used	
L210		Not used	
L211		Same as L201 p/o P211	
L212		Same as L201 p/o P212	
L213		Same as L201 p/o P213	
L214		Same as L201 p/o P214	
P201		CONNECTOR: m/w J201; built in	Monitor d-c output plug
P202		Same as P201 m/w J202	
P203		Same as P201 m/w J203	
P204		Same as P201 m/w J204	
P205		Not used	
P206		Not used	
P207		Not used	

TABLE 7-1. ANTENNA COUPLER CU-691/U; MAINTENANCE PARTS LIST (CONT)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	LOCATING FUNCTION
P208		Not used	
P209		Not used	
P210		Not used	
P211		Same as P201 m/w J211	
P212		Same as P201 m/w J212	
P213		Same as P201 m/w J213	
P214		Same as P201 m/w J214	
R201		RESISTOR: p/o Z203; built in	R-F current sampling
R202		Same as R201 p/o Z203	
R203		Same as R201 p/o Z201	
R204		Same as R201 p/o Z201	
R205		Same as R201 p/o Z202	
R206		Same as R201 p/o Z202	
R207		Same as R201 p/o Z204	
R208		Same as R201 p/o Z204	
W201		CONNECTOR: input right p/o Z201; built in	Monitor R-F output cable
W202		Same as W201 p/o Z202	
W203		Same as W201 p/o Z203	
W204		Same as W201 p/o Z204	
Z201		CONNECTOR, INPUT, LEFT: incl C205 thru C208, C219 and C220, CR203, CR204; J201, J211, J221; R203, R204; W201; Collins Radio P/N 542 1483 003	Monitor coupler
Z202		CONNECTOR, INPUT, RIGHT: incl C209 thru C212, C221, C222; CR205, CR206; J202, J212, J222; R205, R206; W202; Collins Radio P/N 542 1484 003	Monitor coupler
Z203		Same as Z202	
Z204		Same as Z201	
300 series			
Z301		NETWORK-IMPEDANCE MATCHING: Collins Radio P/N 542 1485 003	Combining network

TABLE 7-2. ANTENNA COUPLER CU-691/U, LIST OF MANUFACTURERS

ABBREVIATION	NAME	ADDRESS
CR WKI ND	Military Specifications Collins Radio Company Waldes Koh-I-Noor, Inc. New Departure Div of General Motors Corp.	No address Cedar Rapids, Iowa Long Island City, N. Y. Bristol, Conn.
BLC SIC	Barry Corp. , The Simpson Electric Co. Division of American Gage and Machine Co.	Cambridge, Mass. Chicago, Illinois
CPH OAK JFE	Chicago Telephone Supply Co. Oak Mfg Co. Jeffers Electronics	Elkhart, Ind. Chicago, Illinois St. Marys, Pa.

