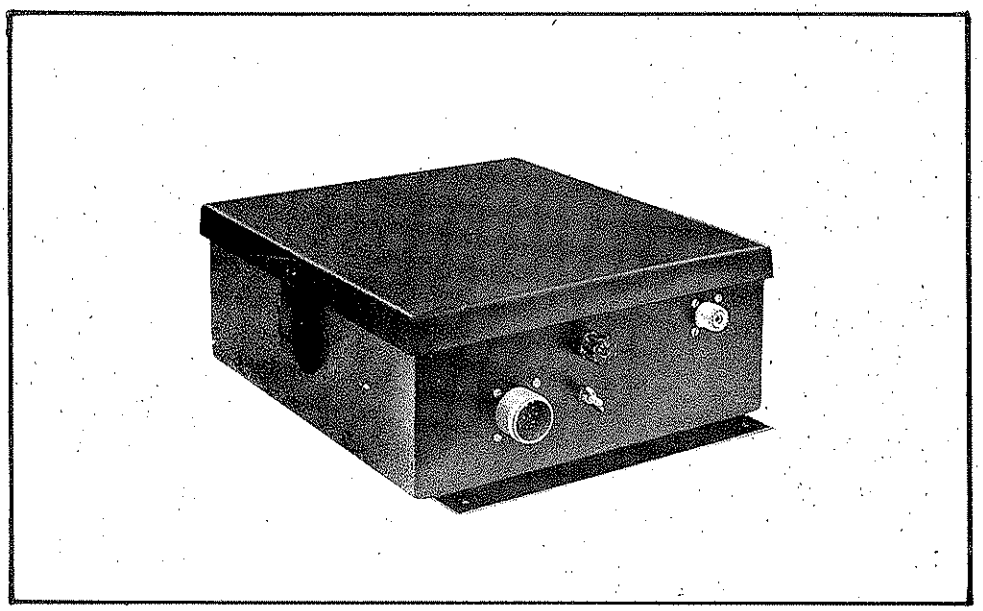
sunair electronics, inc.
3101 S. W. 3rd Avenue / Fort Lauderdale, Florida 33315, USA



INSTRUCTION MANUAL

ANTENNA COUPLER

GCU-310

1st Edition, 1 January 1973
Manual Part Number 97902

TABLE OF CONTENTS

This Policy effective 1 June 1980. Supercedes all others.

WARRANTY POLICY

GROUND AND MARINE PRODUCTS

Sunair Electronics warrants equipment manufactured by it to be free from defects in material or workmanship, under normal use for the lesser of one (1) year from the date of installation or 15 months from date of shipment by Sunair.

Sunair will repair or replace, at its option, any defective equipment or component of the equipment returned to it at its factory, transportation prepaid, within such warranty period. No reimbursement will be made for non-factory repair charges.

This warranty is void if equipment is modified or repaired without authorization, subjected to misuse, abuse, accident, water damage or other neglect, or has its serial number defaced or removed.

THIS WARRANTY IS ESPECIALLY IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. The obligation and responsibility of Sunair shall be limited to that expressly provided herein and Sunair shall not be liable for consequential or other damage or expense whatsoever therefore or by reason thereof.

Sunair reserves the right to make changes in design or additions to or improvements in its equipment without obligation to install such additions or improvements in equipment theretofore manufactured.

sunair electronics, inc.

Part #

0979020000 Maintenance Manual

SECTION I

GENERAL DESCRIPTION

1.0 SPECIFICATIONS

1.1 RF Power Input	:	100 watts PEP and Average (1)
1.2 Frequency Range	:	1.6 MHz to 30 MHz
1.3 Antenna Type	:	9', 16', 25', and 35' whip, 75' and 150' long wire
1.4 Channels	:	8
1.5 Channel Control	:	Remote, solenoid motor drive
1.6 Size	:	31.5cm x 25.4cm x 11cm LWH
1.7 Weight	:	3.2 kg
1.8 Environment	:	-30°C to +50°C, splash proof

(1) 100 watts PEP when used with 9' or 16' whip

1.1 DESCRIPTION

The GCU-310 antenna coupler will match the 50 ohm output impedance of a transceiver to the impedance of antennas from 9 feet to 150 feet in length. The required inductors and capacitors are installed in the coupler along with ceramic hi-voltage switches to allow selecting the components in various circuit configurations. After installation each coupler channel is tuned to the transmitter frequency and antenna impedance. Coupler channel selection is automatically performed by the solenoid motor which is controlled by the transceiver channel select switch via a coded 5 wire system. The solenoid motor is the only component in the coupler that makes it voltage dependent. One motor, PN 98629, is used with a 12VDC system. A different motor, PN 34271, is used with 24VDC and 115/230VAC systems.

1.2 ANTENNAS

The following types of antennas are recommended:

ANTENNA	ANTENNA PART NO.	MOUNT
9' Whip (FG)	71297	71573 Bumper Mount or 71574 Ball Mount
16' Whip (FG)	71295	
23' Whip(Self Supporting)	71576	
23' Whip (FG)	71298	71299 Lay Down
24' Whip (Aluminum)	71286	71287
75' Long Wire	99920	
150' Long Wire	99921	

1.3 EQUIPMENT SUPPLIED

The antenna coupler is supplied complete with all matching network components installed, two multi-pin channel connectors and instruction manual.

1.4 EQUIPMENT NOT SUPPLIED

The rf cable coax connectors, the channel control cable between the transmitter and antenna coupler and the antenna lead-in wire are not supplied. To order the rf coax cable and/or the channel control cable specify required length and part number.

Control Cable	PN 58869
Coax Cable RG58	PN 58813
or	
Coax Cable RG8	PN 58864

SECTION II
INSTALLATION

2.0 UNPACKING AND INSPECTION

Remove the antenna coupler from its shipping container and carefully inspect the enclosure and connectors for damage. Remove the top cover and check the ceramic switches and air dux. If damage is found save the carton and packing material to substantiate a claim to the carrier.

2.1 INSTALLATION

The antenna coupler enclosure is designed for either outside or inside mounting. If possible mount the coupler in the horizontal plane as this affords the best protection against water entry. If the coupler must be mounted in the vertical plane, orient the unit with the antenna post pointing upward or horizontally. Channeling cables must be oriented so water does not enter the rear of the connector as the cable/connector combination is not water tight unless sealing compound is used when wiring the connector.

2.1.1 WIRING

Either RG58 or RG8 coaxial cable may be used. If the cable length between the transceiver is greater than 25 feet RG8 should be used. AWG #18 size wire should be used for the channeling cable, A+, common and transmitter key line. A ground strap or number 12 AWG wire should be used as a ground for the coupler. The ground should be connected to a ground radial system, metal water pipe that returns to earth or a large metal mass such as an automobile or metal parts of a building. See wiring diagram page 4.

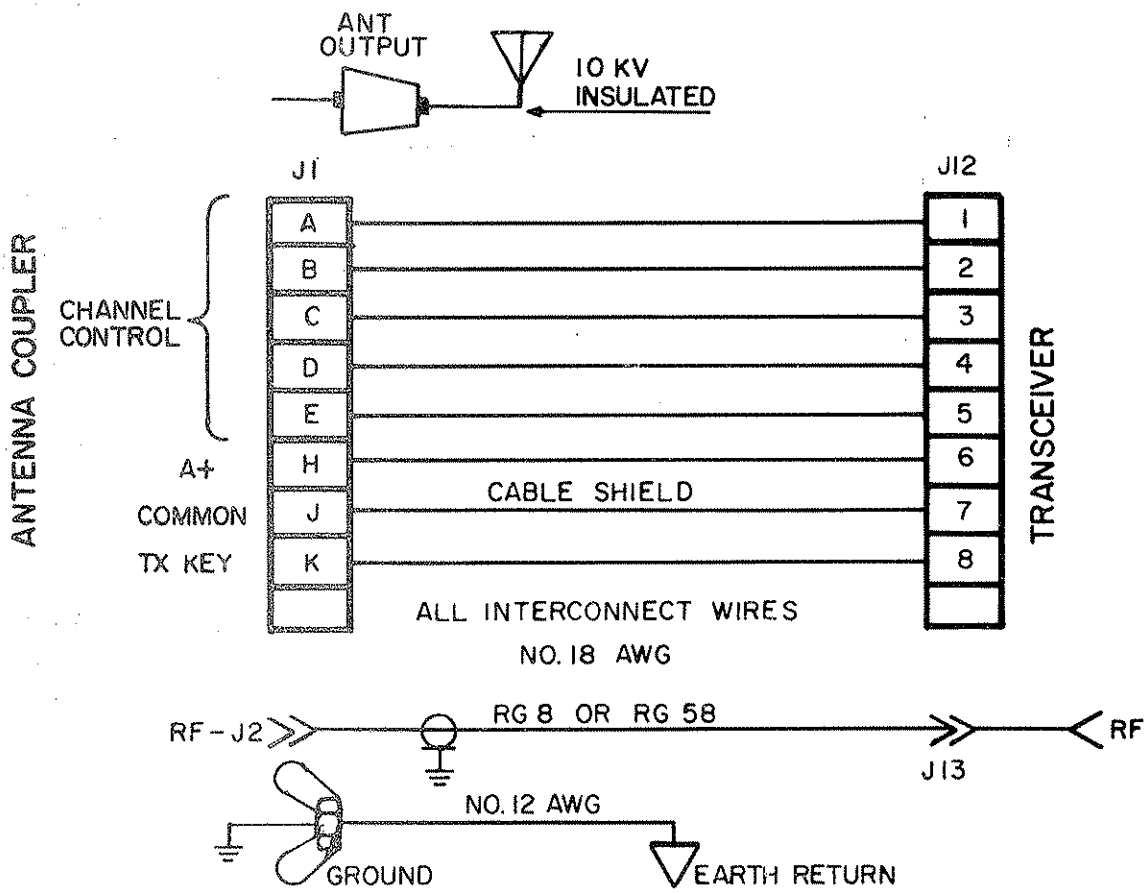


FIGURE II-1

INTERCONNECT WIRING

SECTION III

TUNING PROCEDURE

3.0 GENERAL

The antenna coupler contains all components to tune the antennas listed in Section I. Since each antenna installation is different it is not possible to tune the antenna coupler at the factory. It is therefore necessary for a qualified radio technician to properly tune the coupler after installation. The charts contained in Section V indicate the approximate component values required based upon an average antenna installation. Carefully read section III and IV before making circuit connections.

3.1 INITIAL CIRCUIT CONNECTION

From the appropriate antenna chart read the correct component values for the channel frequency and connect each channel as indicated.

3.1.1 CONNECTING Cin (C1-C18)

Cin is the total value of input capacity required. The input padder is always connected in the circuit and has a value of 170 pf to 750 pf. If Cin requirement is greater than 750 pf connect the correct channel wire from switch S2A to the correct terminal on TS-1. Store unused wires on storage terminal on TS-1.

3.1.2 CONNECTING L9

There are approximately 45 turns on the L9 air dux. Every other turn is bent down on two rows and the air dux mounted to allow access to both rows and therefore every turn. Turns are counted from the left side (cold end) as viewed from the front, motor end, of the enclosure. Even numbered turns are to the rear and odd numbered turns are to the front of the air dux. It is recommended that the taps not be tightened as it will probably be necessary to move them during final tune-up. Also less detuning will occur between channels if the high frequency channels are final tuned first.

3.1.3 CONNECTING Ca (Antenna Shunt C21-C24)

Values of Ca are selected by connecting the channel wires from S4B to the appropriate Ca tabs. Ca is composed of the high voltage transmitting capacitors and the two 450pf mica capacitors mounted on the terminal strip. Always use the lowest value of C2 possible. Store unused wires on the storage

post provided. Do not use the 450pf capacitors except as indicated in the antenna charts.

3.1.4 CONNECTING Cs (Series Capacitor C19, C20, C20s)

Cs is necessary where there is too much inductance in the coupler circuit at minimum setting of L9 and L variable. Always use the highest value of Cs possible and do not use it unless absolutely necessary. Carefully follow the instructions below when using the modified L or Pi network.

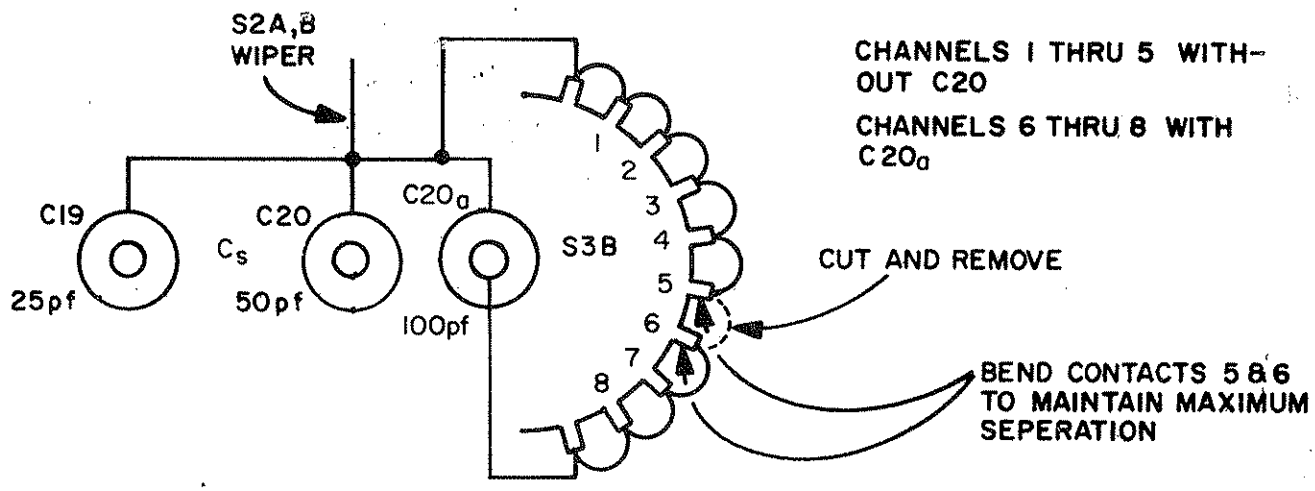
S3B contacts are jumpered together as shown below. If Cs is not required no change is necessary to S3B. Assuming the highest frequency is on the highest numbered channel and starting with that channel check the appropriate antenna chart in Section V to see if Cs is required. For example, if 25pf is specified for channel 8 frequency only, connect the open end of C19 to pin 8 or 9 of S3B and cleanly cut the jumper wire between pin 8 and 7 from both contacts 7 and 8 and slightly bend the contacts to maintain maximum seperation as high voltage may appear between the pins. If channels 7 and 6 requires 50pf connect the open end of C20 to channel 7 and remove the jumper wire from between pins 6 and 5. If 100pf is required for channel 5 frequency, connect the open end of C20a to pin 5 and remove the jumper between 5 and 4. This leaves the first four channels with no Cs, channel 5 with 100pf series capacity, channels 6 and 7 with 50pf and channel 8 with 25pf. Any arrangement of Cs is possible by proper connection to S3B and removing of the correct jumper wires.

To connect the open end of Cs to S3B use the wire provided in the coupler.

CAUTION

Care must be taken to ensure that the jumper wire is completely removed from between the pins of S3B in order to maintain maximum seperation and prevent arc-over of the voltage developed across Cs.

Figure III-1 illustrates how Cs is connected to S3B.



If it is necessary to use C19 and C20 also on a high frequency channel, wire SB3 as shown below.

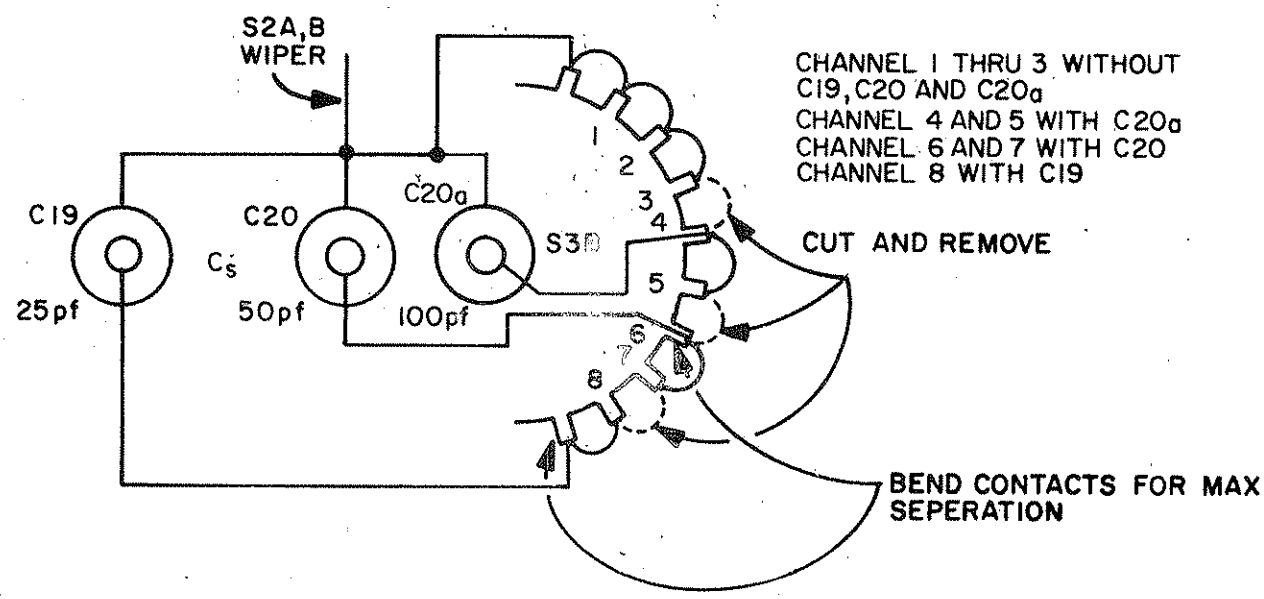


FIGURE III-I

3.2 FINAL TUNING PROCEDURE STEPS

(It is recommended that the Sunair SWR reflectometer Model R-20 PN 97847 and a signal generator be used for coupler tuning. Using the reflectometer or any equally sensitive tuning indicator allows tuning to be accomplished using a signal generator such as a Hewlett Packard 606 as the signal source. This has the advantage of allowing the frequency to be varied and determining at what frequency the antenna is tuned and then making the appropriate changes in the coupler. Additionally high r-f voltages are not present during tuning and the transmitter is not subjected to high VSWR conditions for prolonged periods. The reflectometer may also be used with the transmitter when the Sunair attenuator Model T-50 PN 97846 is inserted in the line between the transmitter and reflectometer.)

1- Install the antenna coupler and connect the antenna, channeling cable and ground strap.
2- Connect an SWR indicator between the signal source (transmitter or signal generator) and the coupler. Connect the r-f cable to the coupler.
3- Set transceiver to highest frequency channel and mode switch to AM if transmitter is being used as a signal source.
4- Key transmitter using S5 in the coupler and note reflected power.
5- Tune L variable for dip in reflected power (Minimum L is obtained when slug is at bottom of core)
6- Tune C1 padder for dip in reflected power.
7- If no dip is obtained when tuning L variable, set L variable to mid range and move the air dux tap with the transmitter keyed and note SWR indicator for dip.
8- Secure tap to selected air dux turn and tune L variable for minimum dip.
9- Tune C1 padder for minimum SWR
10- If C1 does not provide a dip in SWR,change the fixed value of capacity, C11-C18, across the padder.
11- Proceed to next channel and repeat the procedure.
12- After installing clips on the air dux check that they do not touch one another and that air dux turns are not shorted together.
13- If L9 is at 0 turns and coupler will not tune it may be necessary to use Cs or if Cs is being used to decrease the value.

SECTION IV
THEORY

4.0 CIRCUIT CONFIGURATIONS

The antenna coupler r-f tuning circuits can be configured in either an L network or a pi network as shown below.

4.1 L NETWORK

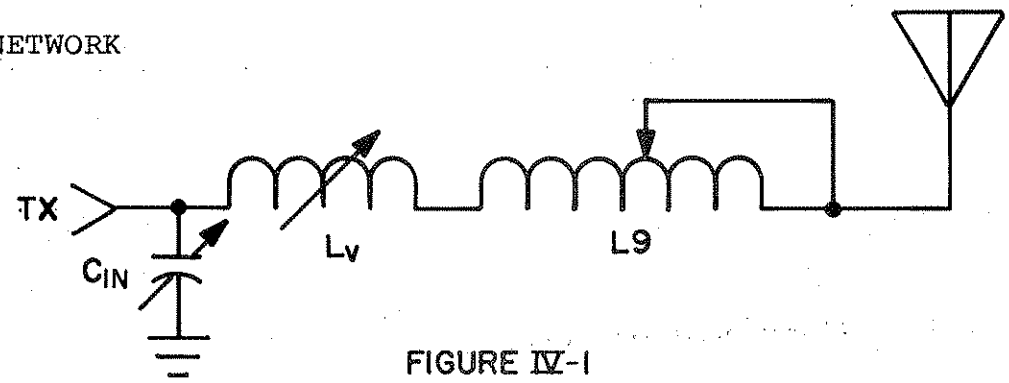


FIGURE IV-1

This circuit is used when the antenna resistance is less than 50 ohms (normally below a quarter wave length) and sufficient inductance is available in L.

4.2 PI NETWORK

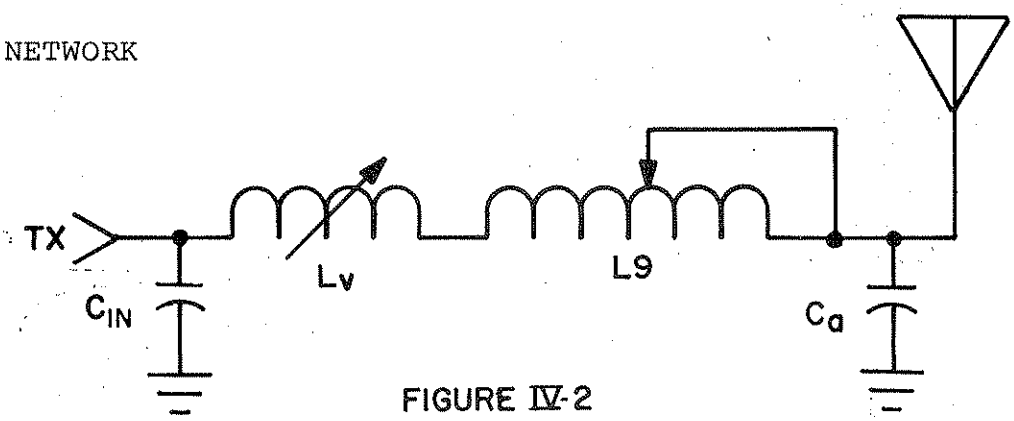


FIGURE IV-2

This circuit is used when the antenna resistance is greater than 50 ohms (normally above a quarter wave length) or there is insufficient inductance in L. Ca is composed of r-f transmitting capacitors grouped to yield 50pf, 150pf and 300pf. Additionally there are two 450pf 2500V mica capacitors mounted on a terminal strip to give 900pf capacitors. The 900pf capacitor value is only to be used on 75 and 150 foot antennas as indicated in the chart.
When Ca is used at any time, always use the lowest value possible as Ca increases the circulating current which creates high voltages and coupler inefficiency.

4.3 MODIFIED L OR PI NETWORK

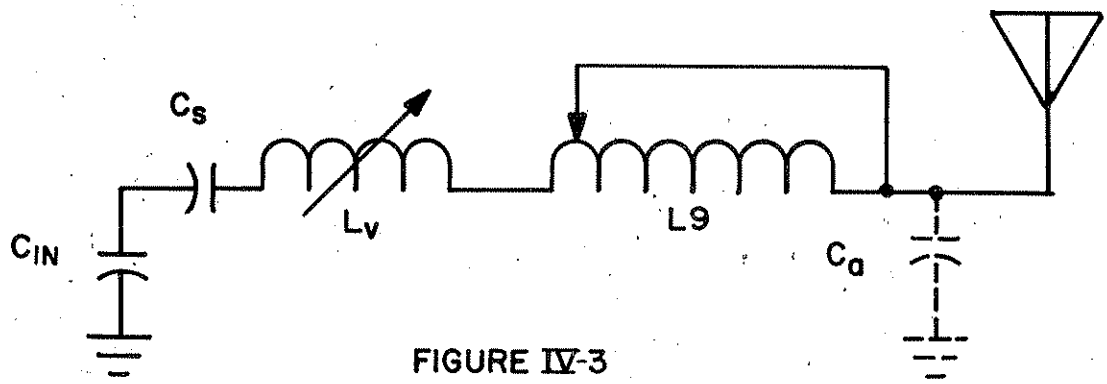


FIGURE IV-3

This network (addition of Cs) is used when there is too much inductance in Lv (0.9uh minimum) and it is necessary to subtract positive reactance by adding Cs, negative reactance. Do not use Cs except as indicated in the charts and always use the highest value possible. If the antenna chart indicates that C19 (25pf) is not required it will be possible to parallel C19 and C20 to make 75pf and use this value instead of 50pf if the highest frequency is sufficiently below the crossover to 25pf requirement. This is desirable as the voltage across Cs will be less.

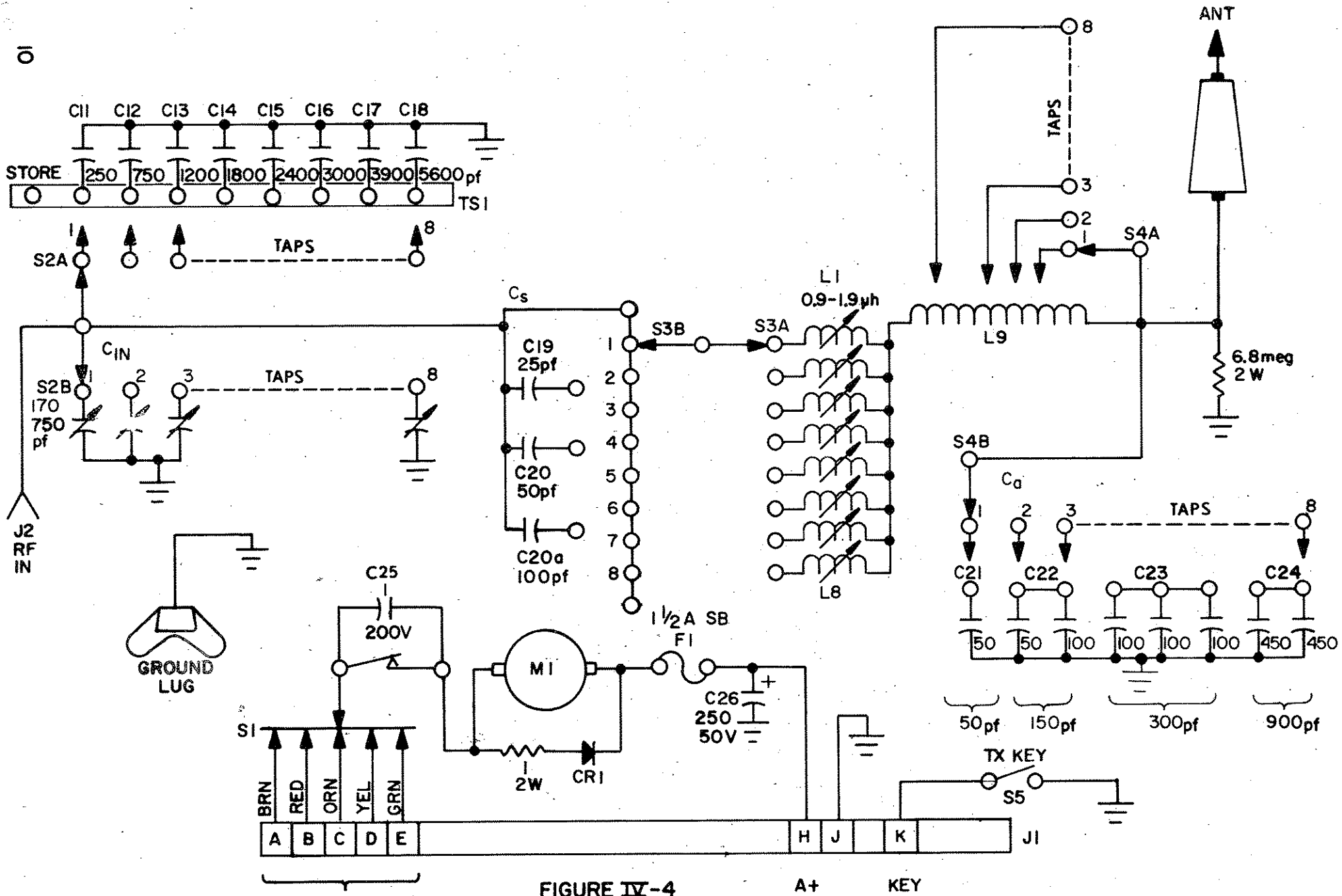


FIGURE IV-4
SCHEMATIC DIAGRAM
ANTENNA COUPLER
GCU-310

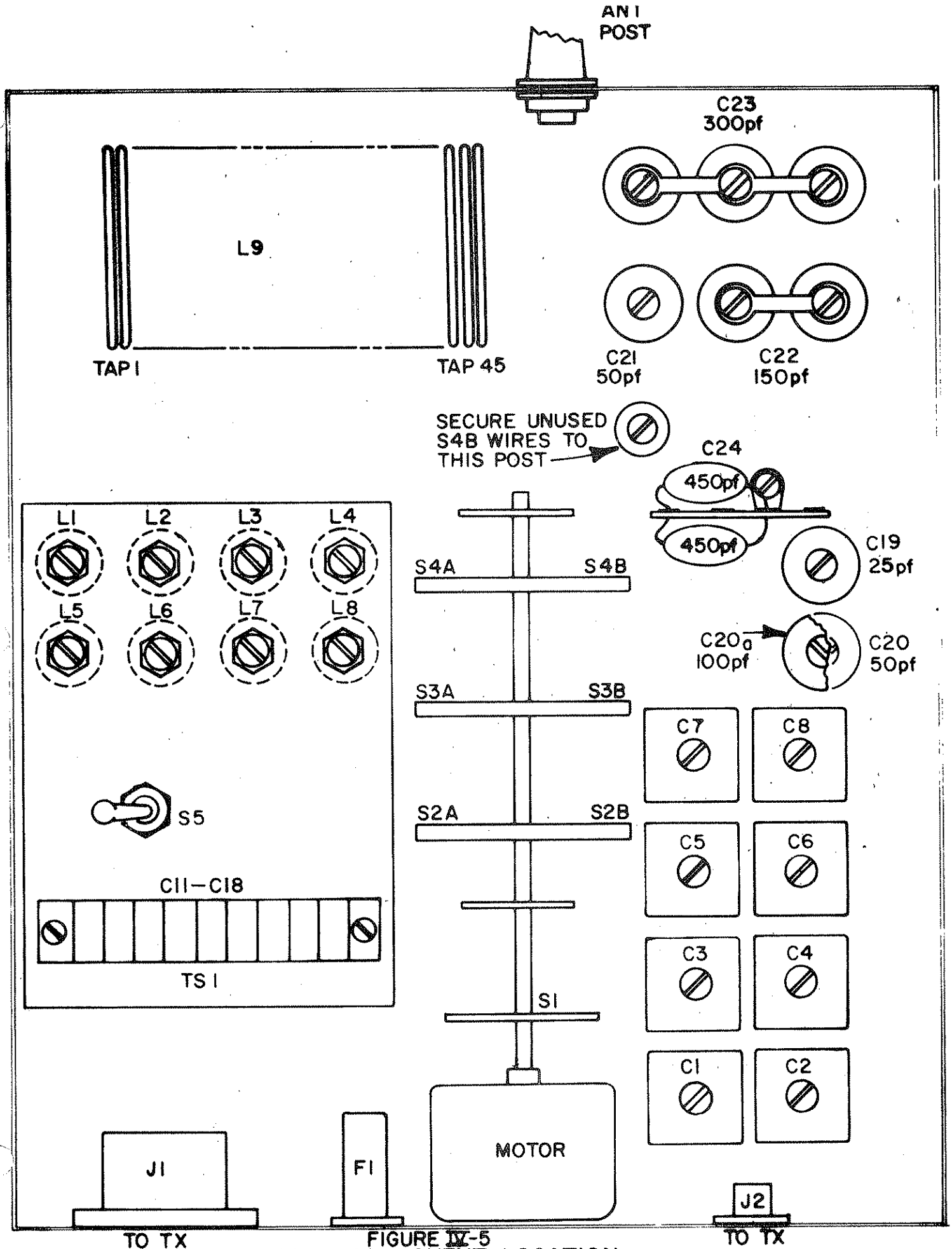


FIGURE IV-5
COUPLER COMPONENT LOCATION
GCU-310

SECTION V

TUNING CHARTS

The values shown on the tuning charts have been derived from measuring representative antennas in an average installation. These values will not be exact for all installations as many factors effect antenna characteristics and the information should be used as a guide for initial tuning and adjustments made during final tune-up.
The circuit components are identified by Cin, L9, Ca, Cs corresponding to the circuit configuration shown below.

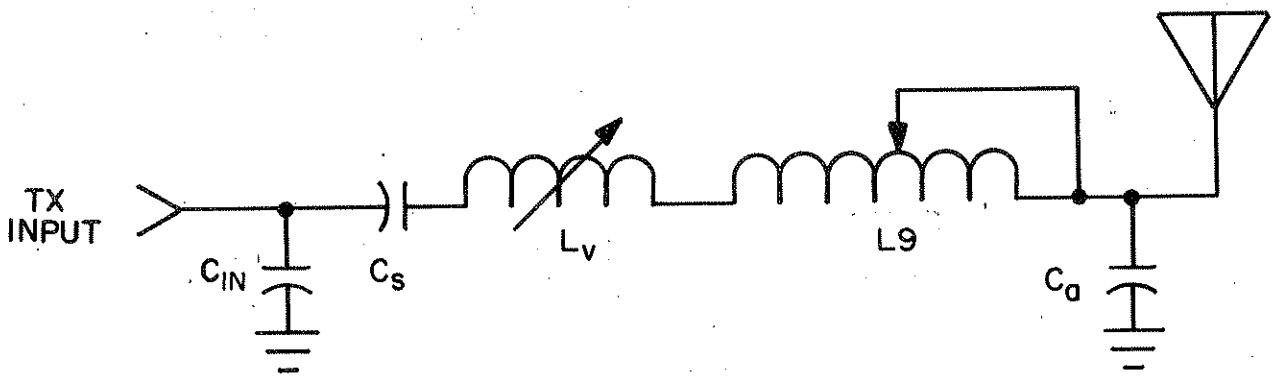


FIGURE V-1

L variable is always in the circuit and has an inductance of 0.9uh to 1.9uh. L9 Turns are counted from the Tx input end of the air dux.

9' WHIP ANTENNA

FREQ.MHz	Cinpf	L9(Turns)	Capf	Cspf
1.6	6000	41	300	-
2.0	5200	43	150	-
2.5	5000	30	150	-
3.0	2000	40	50	-
3.5	1900	30	50	-
4.0	600	44	-	-
4.5	600	36	-	-
5.0	480	29	-	-
5.5	800	27	-	-
6.0	560	22	-	-
6.5	600	19	-	-
7.0	600	16	-	-
8.0	600	13	-	-
9.0	550	10	-	-
10	500	7	-	-
11	470	5	-	-
12	420	4	-	-
13	390	2	-	-
14	350	1	-	-
15	320	1	-	-
16	300	2	-	50
18	230	1	-	50
20	200	0	-	50
22	400	0	50	25
24	340	0	50	25
26	280	0	50	25
28	180	0	150	25
30	420	0	300	25

16' WHIP ANTENNA

FREQ.MHz	Cinpf	L9(Turns)	Capf	Cspf
1.6				
2.0	7000	32	150	-
2.5				
3.0	4400	33	50	-
3.5				
4.0	1800	35	-	-
4.5				
5.0	1350	25	-	-
5.5				
6.0	1150	16	-	-
6.5				
7.0	900	10	-	-
8.0	600	7	-	-
9.0	500	4	-	-
10	400	2	-	-
11	300	1	-	-
12	300	3	50	50
13	200	2	300	50
14	360	1	300	50
15	600	0	300	50
16	300	0	150	50
18	400	0	150	50
20	650	0	150	25
22	230	0	50	25
24	260	0	50	25
26	320	0	50	25
28	320	0	50	25
30	320	0	50	25

24' WHIP ANTENNA

FREQ.MHz	Cinpf	L9 (Turns)	Capf	Cspf
1.6				
2.0	7000	26	150	
2.5				
3.0	2300	42		
3.5				
4.0	1300	25		
4.5				
5.0	1000	16		
5.5				
6.0	300	9		
6.5				
7.0	700	0	150	
8.0	300	7	150	100
9.0	400	6	300	100
10	250	3	150	100
11	350	1	300	100
12	450	2	300	50
13	400	1	300	50
14	300	1	150	50
15	450	0	150	50
16	500	0	150	50
18	600	0	150	50
20	200	0	50	50
22	230	0	50	25
24	200	0	50	25
26	350	0	150	25
28				
30				

35' WHIP ANTENNA

FREQ.MHz	Cinpf	L9(Turns)	Capf	Cspf
1.6	6500	44	150	
2.0	5800	37	50	
2.5				
3.0	2600	22		
3.5				
4.0	1500	10		
4.5				
5.0	800	2		
5.5				
6.0	400	13		100
6.5	250	10		100
7.0	200	7	**450	100
8.0	400	6	300	100
9.0	750	4	300	100
10	330	2	150	100
11	450	1	150	100
12	500	4	150	50
13	600	2	150	50
14	210	2	50	50
15	270	1	50	50
16	240	0	50	50
18	230	2	150	25
20				
22				
24				
26				
28				
30				

**Use 1 450pf cap in C24

50' LONG WIRE

FREQ.MHz	Cinpf	L9(Turns)	Capf	Cspf
1.6	3800	40	150	
2.0	3200	32	150	
2.5	1000	23	50	
3.0	670	20	50	
3.5	600	18	50	
4.0	700	6	150	
4.5				
5.0	250	0	*450	
5.5				
6.0	230	3	300	
6.5				
7.0	350	7	150	
8.0	450	2	150	
9.0	700	1	150	
10	320	3	50	
11	220	2	50	
12	620	3	150	100
13	370	1	150	100
14	250	2	150	50
15	400	1	300	50
16	300	1	150	50
18	400	0	50	50
20				
22				
24				
26				
28				
30				

*Use 1 450pf cap in C24

75' LONG WIRE

FREQ.MHz	Cinpf	L9(Turns)	Capf	Cspf
1.6	1300	40	150	
2.0	1000	26	150	
2.5	600	14	150	
3.0	1500	2	900	
3.5	1400	1	900	
4.0	400	0	900	
4.5				
5.0	460	11	150	
5.5				
6.0	1000	6	150	
6.5				
7.0	1100	1	150	
8.0	700	1	150	
9.0	320	0	150	
10	450	4	300	100
11	400	2	150	100
12	900	1	150	100
13	370	1	50	100
14	350	4	50	50
15	500	2	150	50
16	200	1	150	50
18	650	0	150	50
20	440	1	150	25
22	320	1	150	25
24	500	0	150	25
26	250	1	50	25
28	170	0	50	25
30	170	0	50	25

150' LONG WIRE

FREQ.MHz	Cinpf	L9(Turns)	Capf	Cspf
1.6	1500	10	900	
2.0	1300	13	900	
2.5	400	25	300	
3.0	800	26	150	
3.5	1250	15	150	
4.0	1000	10	150	
4.5				
5.0	200	1	300	
5.5				
6.0	420	7	150	
6.5	800	4	150	
7.0	220	8	50	
8.0	220	0	150	
9.0	350	0	150	
10	900	0	150	
11	400	3	150	100
12	200	2	150	100
13	730	4	150	50
14	600	2	150	50
15	200	1	150	50
16	700	0	150	50
18	250	0	150	50
20	700	0	150	50
22	400	1	150	25
24	400	1	150	25
26	600	0	150	25
28	170	0	50	25
30	170	0	50	25

PARTS LIST

CKT. SYM.	PART NO.	DESCRIPTION
C1-C8	27058	Capacitor,Variable Padder 170 to 750pf
C11	25438	Capacitor, 500V 250pf
C12	24915	" " 750pf
C13	24965	" " 1200pf
C14	26690	" " 1800pf
C15	26717	" " 2400pf
C16	24977	" " 3000pf
C17	26755	" " 3900pf
C18	26626	" " 5600pf
C19	29032	" 7.5KV 25pf
C20	29020	" 7.5KV 50pf
C21	29020	" 7.5KV 50pf
C22	---	" 150pf (29020&29044)
C23, 20a	29044	" 5KV 100pf (4)
C24	27838	" 2500V 450pf (2)
C25	27230	" 200V 1 uf
C26	27292	" 50V 250uf
	50665	Clips, Air Dux
CR1	40165	Diode 10D4
	84903	Fuseholder
F1	89654	Fuse, Slo-Blo 1½A
L1-L8	64787	Inductor, Variable, 0.9uh-1.9uh
L9	99643	Inductor, Air dux Assy
M-1	98629	Motor, Rotary, Solenoid (12V)
M-1	34271	Motor, Rotary, Solenoid (24V, 115/230VAC)
	71035	Post, Antenna
R1	18722	Resistor, 2W 6.8M ohm
R2	17027	Resistor, 2W 1 ohm
S2-S4	34386	Switch, Ceramic 2P11T
S5	32118	Switch, Key, DPDT
	50780	Terminal, Female for TS-1
	50781	Terminal, Female For Ca
C1-C8	27022	Capacitor,Variable, Padder 65 to 240pf for 22 MHz or higher

CKT. SYM.	PART NO.	DESCRIPTION
J1	75342	Connector,Chassis,Channel
J2	75192	Connector,Chassis RF Input
P1	75354	Connector,Cable,Channel Mates with J1
	99490	Cover, Plastic, Assy
P2	90873	Connector,Cable, RG58
P2	74219	Connector,Cable, RG8 P2 not supplied

sunair

RECOMMENDED SPARE PARTS LIST

Quantity Required for 2-4 years supporting 3 to 5 units				MODEL GCU-310		Voltage All	P/N 99529
				SunAir P/N	Description	Unit Price	Total Price
			2	27058	Capacitor,Variable,Padder		
			1	29032	" Transmit 25pf		
			1	29020	" " 50pf		
			1	29044	" " 100pf		
			2	64787	Inductor, Variable		
			1	99643	Inductor,Air Dux Assy		
			6	50665	Clips, Air Dux		
			10	50780	Terminals,Female For TS-1		
			10	50781	Terminals,Female For Ca		
			1	40165	Diode, 10D4		
			5	89654	Fuse 1½ A Slo Blo		
			1	71035	Post, Antenna		
			1	34386	Switch, Ceramic 2P11T		
			1	98629	Motor,Rotary Solenoid (12V)		
			1	34271	" " " 24V & ac		
			1	27022	Capacitor,Variable,Padder (22MHz up)		

ADDENDUMS

Information contained in this section supplements the information contained in the manual. References to this section may be indicated where necessary in the manual.

SUNAIR ELECTRONICS, INC.
MANUAL: GCU-310

ADDENDUM 73-01
DATE: Jan. 15, 1973

REFERENCE: Manual Text

PURPOSE: Correct Part Numbers

MANUAL REFERENCE: Page 1 and Parts List and Recommended Spare Parts List

TEXT:

Page 1: Change 23' whip (self supporting) part number to 71576
Parts List: Change L9, Air dux assembly part number to 99643
Spare Parts List: Add part number 64787 to Inductor, Variable

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SUNAIR ELECTRONICS, INC.
MANUAL: GCU-310

ADDENDUM 2
DATE: 3-10-77

REFERENCE: GCU-310 Channeling

ECN: 058-115

PURPOSE: Improve A+ filtering.

MANUAL REFERENCE: Schematic diagram, page 10, and Parts List.

TEXT: Add capacitor C27, 500uf, 50V, P/N 28923 across C26.

Change value of C26 from 250uf to 500uf, 50V, P/N 28923.