Handbook
Service Instructions
RADIO SETS
AN/ARC-94,
AN/ARC-119,
AND
AN/ARC-120

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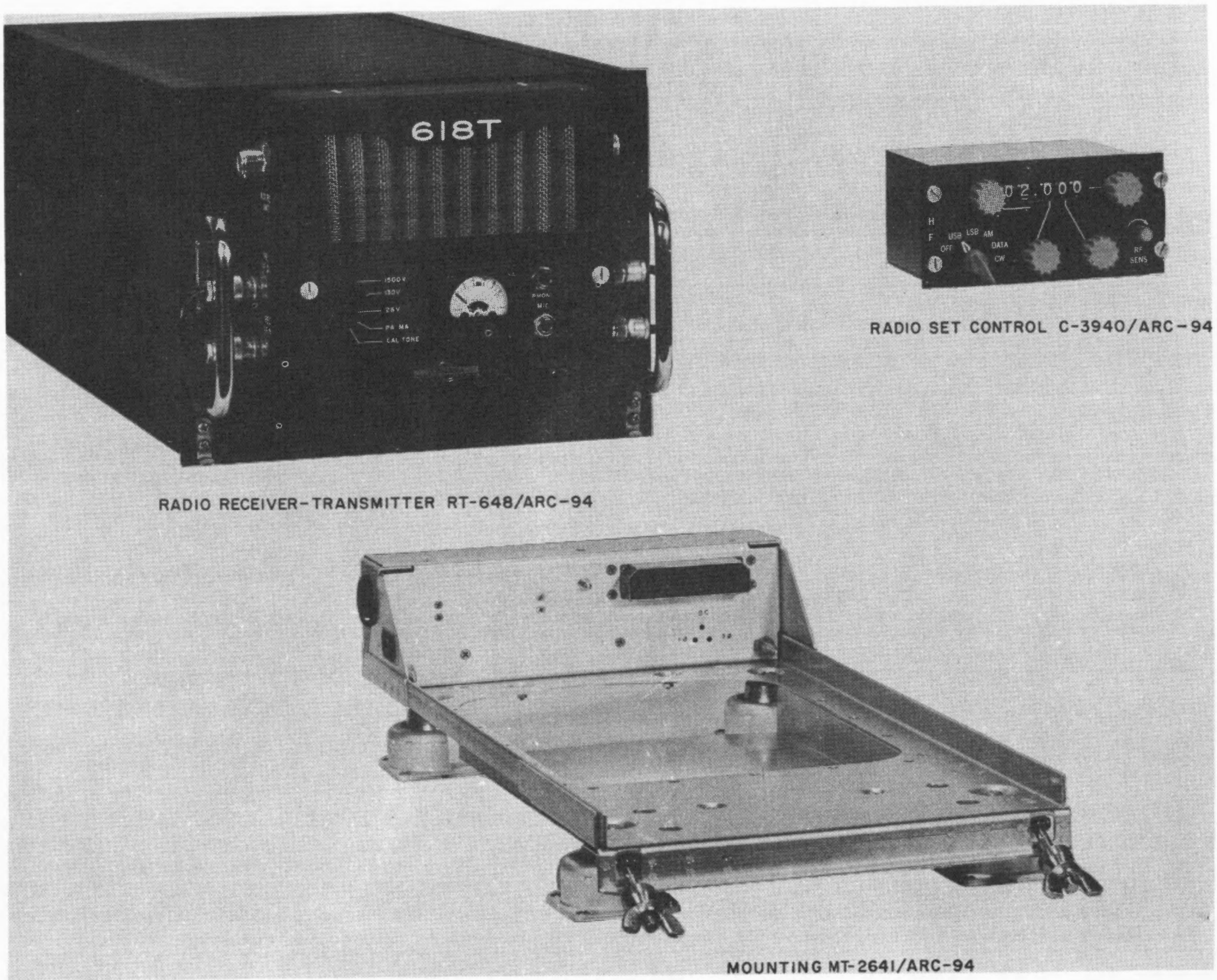


Figure 1-1. Radio Set AN/ARC-94

INTRODUCTION

This technical manual provides service instructions covering Radio Set AN/ARC-94. The equipment covered includes Radio Receiver-Transmitter RT-648/ARC-94, Radio Set Control C-3940/ARC-94, and Mounting MT-2641/ARC-94.

The manual has been prepared in accordance with the general style and format requirements specified in MIL-H-5474A. The technical content of this manual has been organized in accordance with MIL-H-6757A(ASG). The scope of coverage includes all maintenance procedures within the capabilities of the tools, test equipment, and spare parts normally available at organizational and field maintenance facilities. Technical Manual, Illustrated Parts Breakdown, Radio Set AN/ARC-94, NavWeps 16-30ARC94-4 is a supporting publication of interest to users of this manual.

Radio Receiver-Transmitter RT-648/ARC-94 is of modular construction. The modules are designated A1 through A12. (Module A8 is not supplied as part of Radio Set AN/ARC-94.) Where detail parts located in different modules are considered in the same discussion, the module designation and part designation are combined into a compound reference designation, such as A1R2, A2R2, etc, to indicate this specific part and location. Parts located on submodules are designated by a triple compound designation such as A12A2C3, where A12 is the module, A2 is the submodule, and C3 is the detail part of interest.

SECTION I
DESCRIPTION AND LEADING PARTICULARS

1-1. SCOPE.

1-2. This publication comprises service instructions for Radio Set AN/ARC-94 (figure 1-1) manufactured by Collins Radio Company, Cedar Rapids, Iowa, under contract NOw(A)62-0321-f. Sections I through VII of this handbook apply to AN/ARC-94, contract NOw(A)62-0321-f. Additional models will be covered in section VIII by the use of difference data sheets. Service instructions for models included in section VIII are the same as the procedures given in sections I through VII, except for the specific differences noted in the applicable difference data sheets.

1-3. PURPOSE OF EQUIPMENT.

1-4. Radio Set AN/ARC-94 provides facilities for communication between aircraft, and between aircraft and fixed or mobile ground communications stations. The AN/ARC-94 transmits and receives communications in the high-frequency (h-f) band and can operate over the 28-megacycle band between 2.000 and 29.999 megacycles.

1-5. EQUIPMENT SUPPLIED.

1-6. The equipments comprising the AN/ARC-94 are shown in figure 1-1 and listed in table I. In addition,

TABLE I. EQUIPMENT SUPPLIED

QTY	NOMENCLATURE	OVER-ALL DIMENSIONS (in.)			WEIGHT (lb)
		HEIGHT	WIDTH	DEPTH	
1	Radio Receiver-Transmittter RT-648/ARC-94	7-5/8	10-1/8	22-3/16	52
1	Radio Set Control C-3940/ARC-94	2-5/8	5-3/4	4-7/8	2
1	Mounting MT-2641/ARC-94	4-63/64	11-9/64	21-7/8	5

table I shows the quantity, size, and weight of each of the components.

1-7. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1-8. The AN/ARC-94 requires a headset, microphone, key, antenna coupler, and antenna to complete an airborne h-f communications system. These additional equipments are referred to as accessory equipment.

1-9. FUNCTION OF COMPONENTS.

1-10. RADIO RECEIVER-TRANSMITTER RT-648/ARC-94. Radio Receiver-Transmitter RT-648/ARC-94 provides either single-sideband, data, compatible AM, or cw reception and transmission as part of an over-all h-f communications system. Frequency selection in 1-kc increments over the entire band provides a total of 28,000 operating frequencies. Figure 1-2 shows the RT-648/ARC-94 with modules removed and identified.

1-11. RADIO SET CONTROL C-3940/ARC-94. Radio Set Control C-3940/ARC-94 provides remote control for selecting the desired operating frequency and for selecting either USB, LSB, AM, data, or cw mode of operation.

1-12. MOUNTING MT-2641/ARC-94. Mounting MT-2641/ARC-94 supports Radio Receiver-Transmitter RT-648/ARC-94 in the aircraft and provides mechanical isolation from airframe vibrations and shocks.

1-13. LEADING PARTICULARS.

1-14. GENERAL. The leading particulars for the AN/ARC-94 are listed in table II. The characteristics are grouped in three categories; over-all characteristics, characteristics which apply to transmit operation, and characteristics which apply to receive operation.

TABLE II. LEADING PARTICULARS

OVER-ALL CHARACTERISTICS	
Ambient temperature range	-40°C (-40°F) to +55°C (+131°F) with 30-minute operation at +70°C (+158°F).
Ambient humidity range	Up to 95 percent relative humidity at 50°C (122°F) for 48 hours.
Altitude range	Pressure equivalent of 40,000 feet with externally supplied cooling air.
Power source	115 ±5 volts, 400 ±10 cps, 3-phase, 27.5 ±0.5 volts dc.
Frequency range	2.000 to 29.999 megacycles.
Number of frequency channels	28,000.
Frequency stability	±0.8 part per million per month from -40°C (-40°F) to +75°C (+167°F).
Time required to change	8 seconds maximum, independent of external antenna tuner.
TRANSMIT CHARACTERISTICS	
R-f power output	SSB: 400 watts PEP ±1 db. AM: 100 watts carrier. Cw: 100 watts, locked key.
R-f output impedance	51.5 ohms.
Audio input impedance	100 ohms unbalanced, 600 ohms balanced.
Audio frequency response	5-db peak-to-valley ratio from 300 to 3000 cps.
Distortion	SSB: Third-order distortion products down at least 30 db. AM: Less than 20 percent at 85 percent modulation.

TABLE II. LEADING PARTICULARS (Cont)

RECEIVE CHARACTERISTICS	
Sensitivity	SSB: 1 microvolt for 10-db S+N/N ratio. AM: 3 microvolts modulated 30 percent, 1000 cps for 6-db S+N/N ratio.
Selectivity	SSB: 2.7 kc minimum, 5 db down; 6.0 kc, 60 db down. AM: 6.0 kc minimum, 5 db down; 14.0 kc, 60 db down.
Agc characteristic	Maximum variation of audio output is 6 db for input signals from 10 to 10,000 microvolts. No overload below 1-volt signal input.
I-f rejection	80 db minimum.
Audio output power	200 milliwatts into 300-ohm load.
Audio distortion	Less than 10 percent.
Audio frequency response	5-db peak-to-valley ratio from 300 to 3000 cps.
Image rejection	60 db minimum to 25 mc, 50 db minimum above 25 mc.

1-15. MODULE COMPLEMENT. Table III lists the module complement of the RT-648/ARC-94. Modules are found only within the RT-648/ARC-94.

1-16. VACUUM-TUBE COMPLEMENT. Table IV lists the vacuum-tube complement of the AN/ARC-94.

1-17. TRANSISTOR COMPLEMENT. Table V lists the transistor complement of the AN/ARC-94.

1-18. DIODE COMPLEMENT. Table VI lists the diode complement of the AN/ARC-94.

1-19. RELAY AND MOTOR COMPLEMENTS. Table VII lists the relay and motor complements of the AN/ARC-94.

1-20. CRYSTAL COMPLEMENT. One crystal, Y1, is located in r-f oscillator module A2, and operates on the fundamental frequency of 3.000 mc.

1-21. POWER CONSUMPTION. A detailed breakdown of the power consumption of Radio Set AN/ARC-94 is shown in table VIII. Figures 1-3 through 1-6 show typical turn-on and switching surge current characteristics.

1-22. CONTROLS. The operating control of Radio Set AN/ARC-94 and their locations and functions are given in table IX.

TABLE III. MODULE COMPLEMENT

MODULE	FUNCTIONAL NAME	COLLINS PART NUMBER
A	Chassis	544-9293-00
A1	Frequency divider	546-2142-005
A2	R-f oscillator	528-0251-005

TABLE III. MODULE COMPLEMENT (Cont)

MODULE	FUNCTIONAL NAME	COLLINS PART NUMBER
A3	I-f translator	544-9286-00
A4	Kilocycle-frequency stabilizer	528-0112-005
A5	Low-voltage power supply	544-9292-00
A6	Electronic control amplifier	544-9290-005
A7	Three-phase high-voltage power supply	544-9291-00
A9	AM/audio amplifier	546-6053-00
A10	Megacycle-frequency stabilizer	544-9289-005 (effective through MCN 3274) 528-0329-00
A11	Power amplifier	544-9283-00
A12	R-f translator	528-0113-00
A12A1	Autopositioner submodule	546-6873-005
A12A2	Variable frequency oscillator (vfo) submodule	522-2424-004

TABLE IV. VACUUM-TUBE COMPLEMENT

LOCATION	SYMBOL	QTY	TYPE	FUNCTION
Power amplifier module A11	V1, V2	2	Eimac 8621/4CX250FG	Power amplifiers
R-f translator module A12	V1	1	12AT7WA	Transmit 1-f mixer
	V2	1	12AT7WA	Transmit 17.5-mc mixer
	V3	1	12AT7WA	Transmit h-f mixer
	V4, V5	2	6DC6	R-f amplifiers
	V6, V7	2	6CL6	Drivers
	V8	1	6AH6WA	Receive 1-f mixer
	V9	1	6AH6WA	Receive 17.5-mc mixer
	V10	1	6AH6WA	17.5-mc oscillator
	V11	1	6AH6WA	H-f oscillator
	V12	1	12AT7WA	Receive h-f mixer

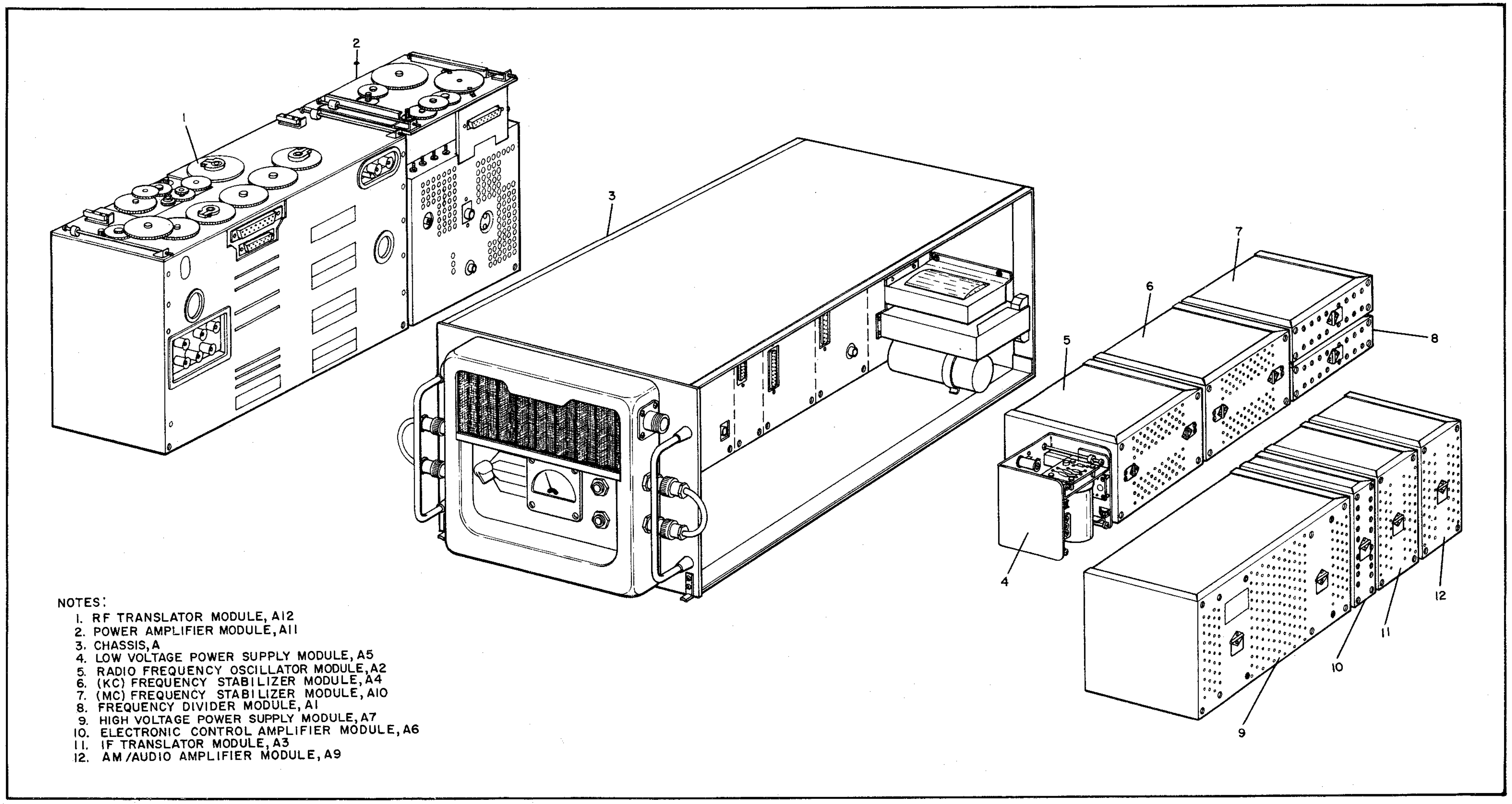


Figure 1-2. Radio Receiver-Transmitter RT-648/ARC-94

TABLE V. TRANSISTOR COMPLEMENT

LOCATION	SYMBOL	QTY	TYPE	FUNCTION
Frequency divider module A1	Q1	1	2N2188	Emitter follower
	Q2	1	2N2188	Locked oscillator
	Q3	1	2N2188	Emitter follower
	Q4	1	2N697	Locked oscillator
	Q5	1	2N2188	Pulse inverter
	Q6	1	2N697	Blocking oscillator
	Q7	1	2N2188	Isolation amplifier
	Q8	1	2N2188	Locked oscillator
	Q9	1	2N2188	Switch
	Q10	1	2N1671B	Unijunction divider
	Q11	1	2N2188	Pulse amplifier
	Q12, Q13	2	2N404	1-kc keyer
	Q14	1	2N2188	Keyed oscillator
R-f oscillator module A2	Q1	1	2N703	Crystal oscillator
	Q2	1	2N703	Isolation amplifier
	Q3	1	2N703	Emitter follower
	Q4	1	2N703	Locked oscillator
	Q5	1	2N703	500-kc amplifier
	Q6	1	2N703	500-kc amplifier
	Q7	1	2N703	Emitter follower
	Q8	1	2N703	Locked oscillator
	Q9	1	2N703	100-kc output amplifier
I-f translator module A3	Q1	1	2N78	Alc amplifier
	Q2 thru Q5	4	2N2188	I-f amplifier
	Q6	1	2N542	Tgc-adc amplifier
Kilocycle-frequency stabilizer module A4	Q1	1	2N2188	Vfo isolation amplifier
	Q2	1	2N2188	First mixer

TABLE V. TRANSISTOR COMPLEMENT (Cont)

LOCATION	SYMBOL	QTY	TYPE	FUNCTION
Kilocycle-frequency stabilizer module A4 (Cont)	Q3	1	2N2188	Second mixer
	Q4	1	2N2188	Isolation amplifier
	Q5 thru Q8	4	2N2188	Signal i-f amplifier
	Q9	1	2N706	10-kc keyer
	Q10	1	2N706	10-kc keyer
	Q11	1	2N706	Keyed oscillator
	Q12	1	2N2188	Digit oscillator
	Q14	1	2N2188	Isolation amplifier
	Q15	1	2N2188	Reference mixer
	Q16 thru Q19	4	2N2188	Reference i-f amplifier
Low-voltage power supply module A5	Q1	1	2N670	Transient blanker switch
	Q2	1	2N458	Transient blanker switch
	Q3	1	2N1131	Regulator amplifier
	Q4	1	2N332	Regulator amplifier
	Q5	1	2N550	Regulator controller
Electronic control amplifier module A6	Q1 thru Q4	4	2N651	Amplifier
	Q5	1	2N457	Phase inverter
	Q6, Q7	2	2N457	Push-pull output amplifier
AM/audio amplifier module A9	Q1, Q2	2	2N158	Audio amplifier
	Q3 thru Q6	4	2N2188	I-f amplifier
	Q7	1	2N2188	Agc amplifier
	Q8	1	2N651	Audio amplifier
	Q9	1	2N651	Audio amplifier
Megacycle-frequency stabilizer module A10 (Effective through MCN 3274)	Q1	1	2N1285	Squaring amplifier
	Q2	1	2N697	Pulse amplifier

TABLE V. TRANSISTOR COMPLEMENT (Cont)

LOCATION	SYMBOL	QTY	TYPE	FUNCTION
Megacycle-frequency stabilizer module A10 (Effective through MCN 3274) (Cont)	Q3	1	2N697	Spectrum generator
	Q4, Q5	2	2N489	Automatic level detector
	A1Q1, A2Q1	2	2N1285	Limiting amplifier
	A1Q2, A2Q2	2	2N706	Isolation amplifier
	A1Q3, A2Q3	2	2N697	Mixer
	A1Q4, A2Q4	2	2N1285	1-mc i-f amplifier
Megacycle-frequency stabilizer module A10 (Effective MCN 3275)	Q1	1	2N706	Squaring amplifier
	Q2	1	2N2218	Pulse generator
	Q3	1	2N489	17.5 recycle
	Q4	1	2N489	8.5 - 16 recycle
	A1Q1, A2Q1	2	2N2188	R-f amplifier
	A1Q2, A2Q2	2	2N706	R-f amplifier
	A1Q3, A2Q3	2	2N706	Mixer
	A1Q4, A2Q4	2	2N3135	I-f amplifier
Vfo submodule A12A2	Q1	1	2N1196	Oscillator
	Q2	1	2N2189	Amplifier
	Q3	1	2N2189	Amplifier
	Q4	1	2N2189	Amplifier
Chassis (Effective MCN 3293)	Q1	1	2N491	Time delay switch

TABLE VI. DIODE COMPLEMENT

LOCATION	SYMBOL	QTY	TYPE	FUNCTION
Frequency divider module A1	CR1	1	1N270	Blocking oscillator circuit (protects transistor Q6)
	CR2	1	1N198	Switch circuit
	CR3, CR4	2	1N627	Unijunction divider circuit
	CR5	1	1N270	Pulse amplifier circuit
I-f translator module A3	CR1	1	MQ4532	Diode quad balanced modulator
	CR3	1	HD2120	Protects transistor Q2
	CR4	1	HD2120	Protects transistor Q3
	CR5A, CR5B	2	1N67	Product detector
	CR6	1	HD2160	Transmit-receive switch
	CR7	1	1N645	Tgc gate

TABLE V. TRANSISTOR COMPLEMENT (Cont)

LOCATION	SYMBOL	QTY	TYPE	FUNCTION
Kilocycle-frequency stabilizer module A4	CR1, CR11	2	1N3064	Frequency discriminator
	CR3	1	1N457	Blocking diode
	CR4, CR5	2	1N457	Protects transistor Q10
	CR6 thru CR8	3	1N2167A	Vfo bias (reference breakdown)
	CR9, CR10	2	1N3064	Phase discriminator
	CR12	1	1N645	Digit oscillator circuit
	CR13	1	1N270	Keyed oscillator circuit
	CR14, CR15	2	1N457	Keyed oscillator circuit
(Effective through MCN 3999)	CR16	1	1N198	Keyed oscillator circuit
(Effective MCN 6000)	CR17	1	1N645	Protects transistor Q19
Low-voltage power supply module A5	CR1	1	1N3018A	Transient blanker circuit (breakdown)
	CR2	1	1N2621A	Regulator circuit (reference breakdown)
	CR3	1	1N1492	Half-wave rectifier
Electronic control amplifier module A6	CR1	1	PS6903	Interstage isolation (breakdown)
	CR2	1	PS6903	Interstage isolation (breakdown)
Three-phase high-voltage power supply module A7	CR1 thru CR36	36	1N1492	Full-wave rectifier
	CR37	1	1N645	Protects relay K1
	CR38	1	1N645	Protects relay K2
AM/audio amplifier module A9	CR1	1	1N645	SSB agc detector
	CR2	1	HD2120	SSB agc detector
	CR4	1	HD2120	AM audio detector
	CR5, CR6	2	HD2120	AM agc detector
	CR7	1	HD2120	SSB agc detector
	CR8 thru CR10	3	1N645	Cw keying circuit
	CR11	1	HD2120	Agc gate
	CR12	1	1N645	Key line isolation
	CR13	1	SZ885	Agc delay Zener
	CR14	1	1N645	1-kc tuned circuit switch
Megacycle-frequency stabilizer module A10 (Effective through MCN 3274)	CR1	1	1N198	Spectrum pulse
	CR2, CR3	2	1N645	Spectrum pulse
	A1CR1, A2CR1	2	1N198	R-f limiter

TABLE V. TRANSISTOR COMPLEMENT (Cont)

LOCATION	SYMBOL	QTY	TYPE	FUNCTION
Megacycle-frequency stabilizer module A10 (Effective MCN 3275)	A1CR1 A2CR1	2	1N198	R-f limiter
	A1CR2	1	1N198	Rectifier for 17.5-mc oscillator control voltage
	A2CR2	1	1N198	Rectifier for 8.5- to 16-mc oscillator control voltage
Power amplifier module A11	CR1	1	1N1491	Half-wave bias rectifier
	CR2A, CR2B	2	MP3040	Phase discriminator
	CR3	1	1N198	Adc rectifier
	CR4	1	1N457	Adc gate
	CR5	1	1N3004B	Bias stabilization (breakdown)
	CR6	1	1N3020B	Tgc reference stabilization (breakdown)
(Effective through MCN 7389)	CR7A, CR7B	2	10M200Z2	400-volt screen voltage stabilization (breakdown)
(Effective MCN 7390)	CR10A, CR10B	2	50M195ZB2	400-volt screen voltage stabilization (breakdown)
(Effective through MCN 7389)	CR8A, CR8B	2	FD1009	PEP limiter
R-f translator module A12	CR1	1	1N645	Capacity switch
	CR5	1	1N645	Protects relay K3
	CR6	1	1N645	Agc rectifier
	CR9	1	1N645	17.5-mc oscillator bias switch
Autopositioner submodule A12A1	CR1, CR2	2	1N645	Protects relays
	CR3, CR4	2	1N645	Protects relays
Chassis	CR1, CR2	2	1N34	Sidetone relay rectifier
	CR3	1	1N645	Isolation diode
	CR4	1	1N647	400-cycle interlock relay rectifier
	CR5	1	1N645	Transient suppression
	CR6	1	1N645	Transient suppression
(Effective MCN 6500)	CR7	1	1N198	Sidetone rectifier
(Effective MCN 6500)	CR8	1	1N645	Gating
(Effective MCN 6500)	CR9	1	1N645	Gating
(Effective MCN 6500)	CR10	1	1N645	Protects relay K3
(Effective MCN 6967)	CR11	1	1N645	Protects relay K6

TABLE VII. RELAY AND MOTOR COMPLEMENT

LOCATION	SYMBOL	QUANTITY	FUNCTION
RELAYS			
I-f translator module A3	K1	1	TR relay
	K2	1	Sideband selector
	K3	1	AM/SB relay
	K4	1	SB/AM relay
	K5	1	TR relay
Three-phase high-voltage power supply module A7	K1	1	Plate contactor relay
	K2	1	Step-start relay
	K3	1	Overload relay
AM/audio amplifier module A9	K1	1	Cw keying relay
	K2	1	Cw TR delay relay
Power amplifier module A11	K1	1	PA band-switch interlock relay
	K3	1	Tune power relay
R-f translator module A12	K1	1	TR relay
	K2	1	TR relay
	K3	1	Motor relay
	K4	1	TR relay
Autopositioner submodule A12A1	K1	1	1-kc motor relay
	K2	1	10-kc and 100-kc motor relay
Chassis	K1	1	On-off relay
	K2	1	Delayed keying relay
	K3	1	Keying relay
	K4	1	Recycle relay
	K5	1	Antenna transfer relay
	K6	1	Sidetone relay
	K7	1	Time delay relay
	K8	1	Delay interlock relay
	K9	1	400-cycle interlock relay
	K10	1	18-volt delay relay

TABLE VII. RELAY AND MOTOR COMPLEMENT (Cont)

LOCATION	SYMBOL	QUANTITY	FUNCTION
MOTORS			
Power amplifier module A11	B1 B2	1 1	Band-switch motor Servo tuning motor
R-f translator module A12	B1	1	Band-switch motor
Autopositioner submodule A12A1	B1 B2	1 1	1-kc motor 10-kc and 100-kc motor
Chassis	B1	1	Blower motor

TABLE VIII. DETAILED POWER CONSUMPTION

VOLTAGE	RECEIVE (STANDBY)		TRANSMIT (STEADY-STATE)		MAXIMUM (SURGE CURRENT) AT TURN ON		MAXIMUM (SURGE CURRENT) WHEN KEYED	
	amp	watt	amp	watt	amp	va	amp	va
115 volts, 3 phase, 400 cps, phase 1 (pin 1 of rear connector, RT-648/ARC-94)			2.01	216	0	0	2.6	300
115 volts, 3 phase, 400 cps, phase 2 (pin 2 of rear connector)			2.12	223	0	0	2.6	300
115 volts, 3 phase, 400 cps, phase 3 (pins 3 and 12 of rear connector)	1.21	131	3.35	361	4.8	550	3.5	402
27.5 volts dc	1.09	30.7	1.67	46.6	10.7	300	2.55	71.5

TABLE IX. OPERATING CONTROLS

LOCATION	CONTROL	FUNCTION
Radio Set Control C-3940/ARC-94	Mode selector	Selection of operating mode and on-off function.
	RF SENS	R-f gain control.
	Four frequency selector knobs	Selection of proper operating frequency.
Radio Receiver-Transmitter RT-648/ARC-94	Meter selector switch	Monitor supply voltages and check frequency accuracy.

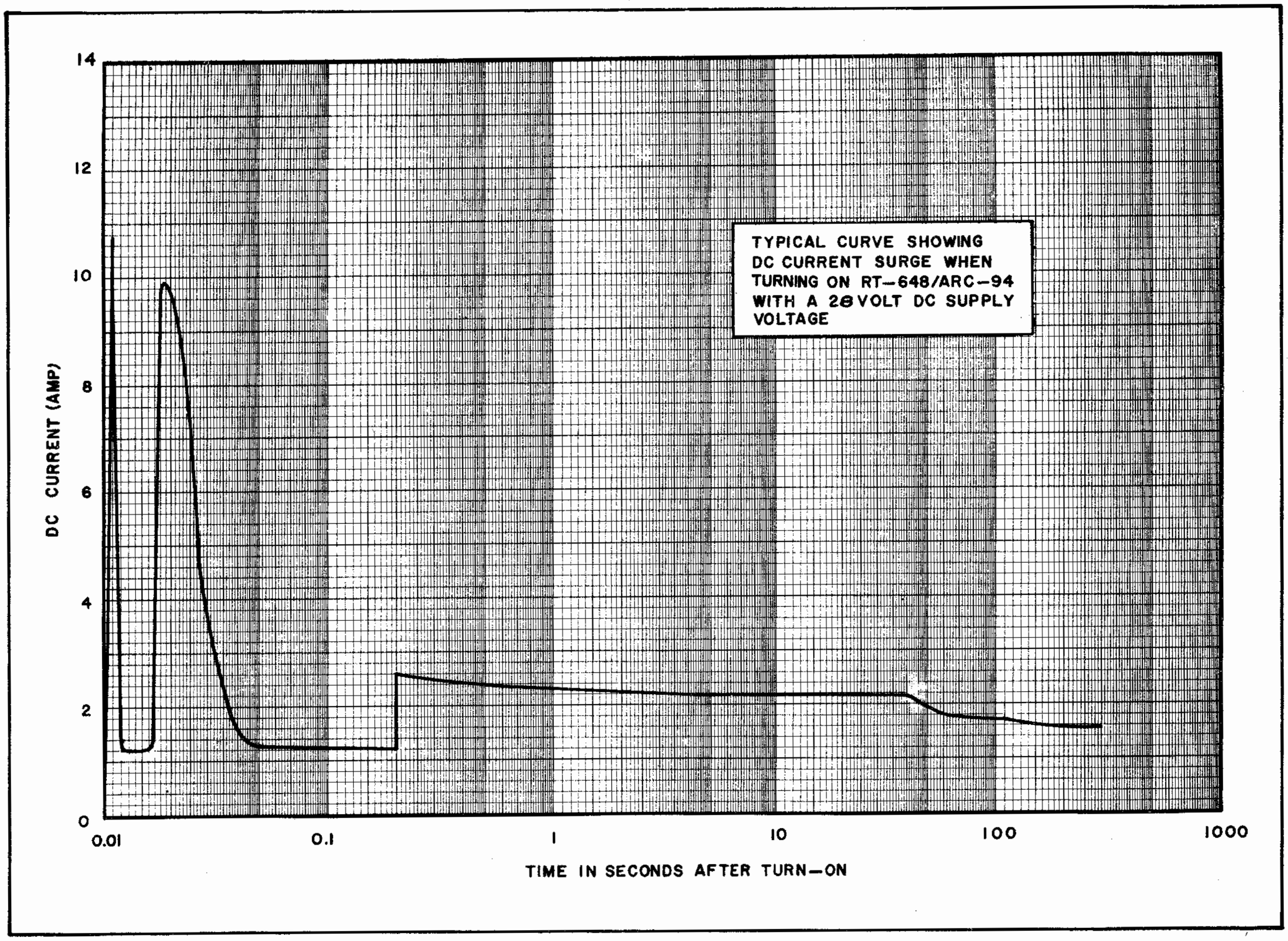


Figure 1-3. Typical D-C Turn-On Surge Current

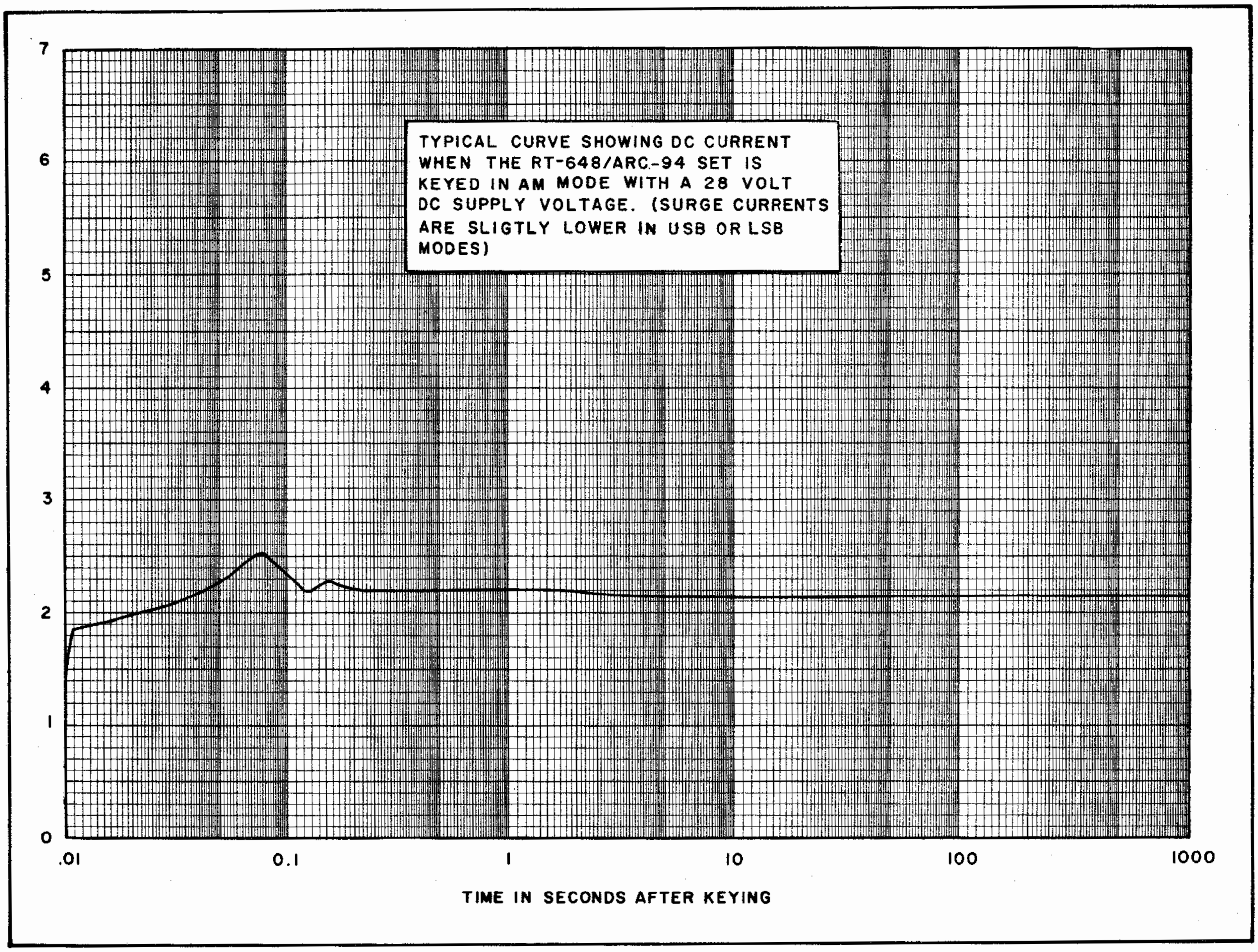


Figure 1-4. Typical D-C Transmitter Keying Surge Current

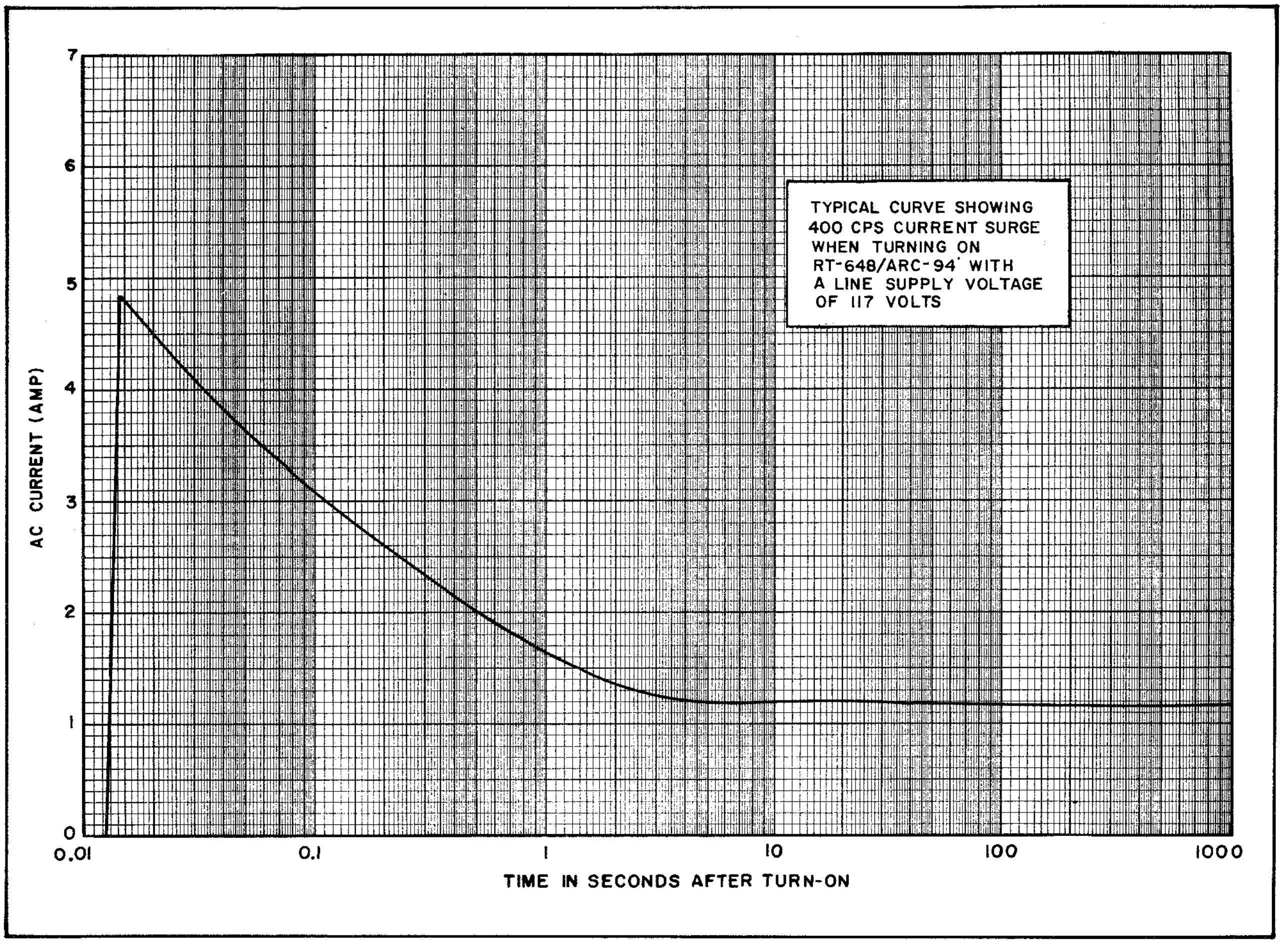


Figure 1-5. Typical A-C Turn-On Surge Current

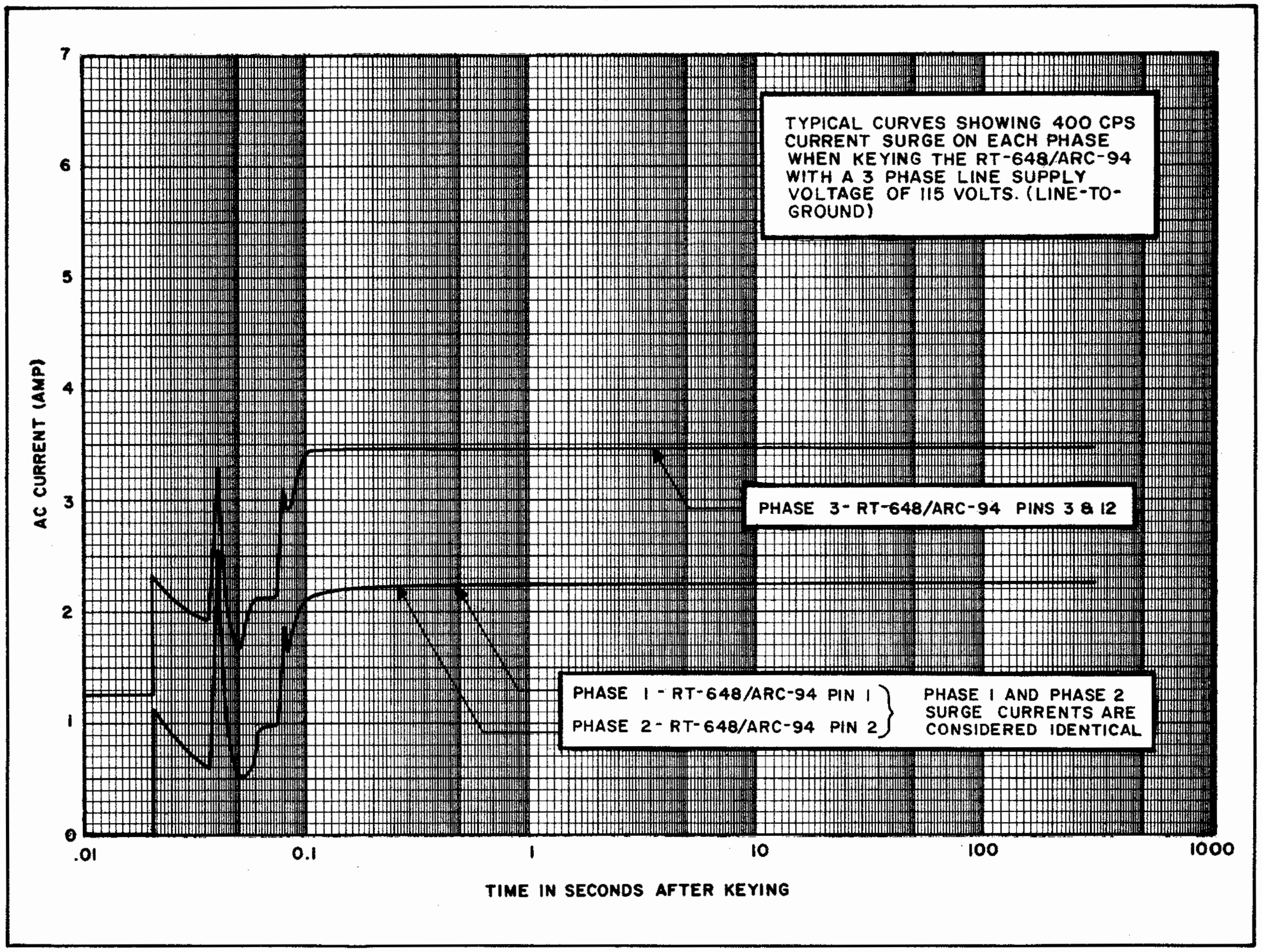


Figure 1-6. Typical A-C, Three-Phase, Transmitter Keying Surge Current

SECTION II
TEST EQUIPMENT AND SPECIAL TOOLS

2-1. GENERAL.

2-2. This section lists all test equipment and special tools required for organizational and field level maintenance of Radio Set AN/ARC-94.

2-3. TEST EQUIPMENT.

2-4. The test equipment required for organizational and field level maintenance of Radio Set AN/ARC-94 is listed in table X. Figure numbers for special items of test equipment are given in the first column of table X. References to the specific use and application of test equipments are given in the last column of table X. Some of the test equipment required is contained in a maintenance kit, Collins part number 547-3915-00. Paragraphs 2-7 and 2-11 provide additional information on Radio Set Test Harness 678P-1 and Radio Test Set 678Z-1.

TABLE X. TEST EQUIPMENT

FIGURE NO.	INDEX NO.	NAME	AN TYPE OR MANUFACTURER'S DESIGNATION	ALTERNATE	USE
		A-c vtvm	TS-505A/U	Ballantine 310A	Measures a-c voltages.
		Audio oscillator	AN/USM-30	Hewlett-Packard 200CD	Generates audio signals.
		Vtvm	TS-520/U	Hewlett-Packard 410B	Measures a-c and d-c voltages.
		6-db pad		Measurements Corp. model 80-Z H3	Used as pad for HP-606A.
		Dummy load	Bird 82C, 51.5 ohms		Used as RT-648/ ARC-94 load.
		Frequency converter	Hewlett-Packard 525A		Used with frequency counter.
		Frequency counter	AN/USM-26A	Hewlett-Packard 525B	Tests signal frequency control.
2-5		Radio Test Set	678Z-1, Collins part No. 548-8001-005		Voltage comparator, tgc override and vfo capture range function, and dummy microphone.
2-6	3	Test lead No. 1	549-1006-003 p/o 678Z-1		Test connection.
2-6	4	Test lead No. 2	549-1007-003 p/o 678Z-1		Test connection.
2-6	5	Test lead No. 3	549-1008-003 p/o 678Z-1		Test connection.
2-6	7	Test lead No. 4	549-1009-003 p/o 678Z-1		Test connection.

TABLE X. TEST EQUIPMENT (Cont)

FIGURE NO.	INDEX NO.	NAME	AN TYPE OR MANUFACTURER'S DESIGNATION	ALTERNATE	USE
2-6	8	Test lead No. 5	549-1010-003 p/o 678Z-1		Test connection.
2-6	2	Test lead (ground)	549-1005-003 p/o 678Z-1		Test connection.
2-6	1	Test lead bag	024-0252-00 p/o 678Z-1		Holds test lead.
2-6	6	Power cable	548-3539-002 p/o 678Z-1		Provides power to 678Z-1.
		Signal generator	AN/URM-25	Hewlett-Packard 606A*	Generates special test signal.
		High-impedance headphones			Monitors audio signals.
		Microphone	Electro-Voice 205		Supplies audio signal input.
		Oscilloscope	Tektronix 541		Visual signal observation.
		Oscilloscope amplifier	Tektronix 53/54B		Used with oscilloscope.
		Oscilloscope amplifier	Tektronix 53/54K		Used with oscilloscope.
		Power supply, 28 volts dc			Supplies d-c power.
		Power supply, 115 volts, 400 cps, 3 phase			Supplies a-c power.
2-1 2-2 2-3		Radio Set Test Harness	678P-1, Collins part No. 547-3914-00		Furnishes a means of connecting and controlling RT-648/ARC-94 during test adjustment.
2-1 2-2		Test harness subassembly	548-8292-005 (p/o 678P-1)		Provides controls for operating RT-648/ARC-94 during test and adjustment.
2-3	1	Cable, RT-648/ARC-94	548-8002-004 (p/o 678P-1)		Connects RT-648/ARC-94 to 678P-1.
2-3	10	Cable assembly, 27.5 volts dc	548-8023-003 (p/o 678P-1)		Connects 27.5-volt d-c power supply to 678P-1.
2-3	4	Cable assembly, 115 volts, 400 cps, 3 phase	548-8025-003 (p/o 678P-1)		Connects 115-volt a-c power supply to 678P-1.

TABLE X. TEST EQUIPMENT (Cont)

FIGURE NO.	INDEX NO.	NAME	AN TYPE OR MANUFACTURER'S DESIGNATION	ALTERNATE	USE
2-3	7	Cable assembly, C-3940/ARC-94	548-8284-004 (p/o 678P-1)		Connects C-3940/ ARC-94 to 678P-1.
2-3	6	Cable r-f	549-4334-002 (p/o 678P-1)		Connects signal generator to 678P-1.
		R-f adapter connectors (2)	357-9291-00		Signal connections.
		T-connector	Hewlett-Packard 455A		Signal connections.
		Multimeter	Triplett 630A		General purpose.
		Calibrated receiver	Collins 51J		Oscillator frequency check.

*If the signal generator used has an output impedance of 52 ohms (Hewlett-Packard 606A has an output impedance of 52 ohms), a 6-db pad must be inserted between the signal generator and the RT-648/ARC-94. Set the output voltage of the signal generator, as indicated on the signal generator meter, to exactly the setting given in the test procedure. This will give "hard" microvolt sensitivities. Refer to IRE standards on measurement of receiver sensitivity. To check the HP-606A, connect the vtvm, using the 455A probe T-connector, to the output of the 6-db pad. Adjust the output of the generator to read 2 volts on the signal generator meter; note reading on the vtvm. This reading should be the same as the generator meter reading. Remove the probe T-connector from the 6-db pad, and connect a 3- or 4-foot length of coaxial cable to the 6-db pad. Connect the probe T-connector to the end of this coaxial cable. The vtvm should now read the same voltage that was read at the output of the 6-db pad. If the signal generator does not meet the above check, it should not be used to perform any test on the RT-648/ARC-94.

2-5. SPECIAL TOOLS.

2-6. The special tools required for organizational and field level maintenance of Radio Set AN/ARC-94 are listed in table XI. Figure numbers for special tools are given in the first column of table XI. References to the specific use and application of special tools are given in the last column of table XI. Most of the special tools required are contained in Maintenance Kit 678Y-1 shown in figure 2-9.

TABLE XI. SPECIAL TOOLS

INDEX NO. IN FIGURE 2-9	COLLINS PART NUMBER	NOMENCLATURE	USE AND APPLICATION
	547-3915-00	678Y-1 Maintenance Kit	
1	554-4851-005	Cabinet	Storage space for maintenance kit
2	549-0990-004	Radio set test fixture	Holds transceiver during test
3	548-3452-00	Test set, r-f translator module A12	Facilitates test and adjustments
4	549-0637-002	Printed circuit repair kit	Repairs printed circuits

TABLE XI. SPECIAL TOOLS (Cont)

INDEX NO. IN FIGURE 2-9	COLLINS PART NUMBER	NOMENCLATURE	USE AND APPLICATION
5	548-3455-004	Test set, low-voltage power supply module A5	Facilitates tests and adjustments
6	548-3501-004	Test set, megacycle-frequency stabilizer module A10	Facilitates tests and adjustments
7	548-3453-004	Test set, electronic control amplifier module A6	Facilitates test and adjustments
8	548-3502-004	Test set, frequency divider module A1	Facilitates tests and adjustments
9	548-3463-004	Test set, r-f oscillator module A2	Facilitates tests and adjustments
10	548-3461-004	Test set, AM/audio amplifier module A9	Facilitates tests and adjustments
11	548-3505-004	Test set, i-f translator module A3	Facilitates tests and adjustments
12	548-3459-004	Test set, kilocycle-frequency stabilizer module A4	Facilitates tests and adjustments
13	548-8014-003	Autopositioner frame	Facilitates test and adjustments of Autopositioner*
14	548-3489-003	Phone cable	Connects test equipment to HEADSET jack on 678P-1
15	548-3490-002	Mike cable	Connects test, equipment to MIKE jack on 678P-1
16	549-4334-002	R-f cable	Facilitates test equipment connections
17	548-3522-002	50-ohm signal generator load	Impedance matching for h-f signal generator
18	548-3528-002	Capacitor divider, 8 to 30 mc	Voltage divider
19	548-3525-002	Capacitor divider, 2 to 8 mc	Voltage divider
20	548-3533-003	Neutralizing detector	Driver and feedback neutralization adjustments
21	104N4X6	Bag, cotton duck	Container for small tools
22	220-1463-00	Tube extender, 9-pin	Extends vacuum tubes for test purposes
23	220-1461-00	Tube extender, 7-pin	Extends vacuum tubes for test purposes

TABLE XI. SPECIAL TOOLS (Cont)

INDEX NO. IN FIGURE 2-9	COLLINS PART NUMBER	NOMENCLATURE	USE AND APPLICATION
24	549-0989-003	R-F translator electrical load	Driver plate load
25	546-7321-002	Coaxial jumper cables (6)	Signal connection for test purposes
26	549-0974-002	Pointer	Alignment and check of Autopositioner
27	343-0133-00	Machine screws 4-40 x 1/4 (3)	Attaches Autopositioner frame to r-f translator module extender
28	024-2700-00	Bristo wrench no. 8 (with handle)	Assembly and disassembly procedures
29	024-0309-00	Alignment tool no. 2	Facilitates adjustment of electrical components
30	024-0310-00	No. 2 Phillips screwdriver	General purpose hand tool
31	328-0048-00	Setscrew 4-40 (2)	Connects dial to Autopositioner output shaft
32	024-2900-00	Bristo wrench no. 4	Assembly and disassembly procedure
33	024-0019-00	Bristo wrench no. 8	Assembly and diasassembly procedure
34	024-0295-00	Alignment tool no. 1	Facilitates adjustments of electrical components
35	547-2796-002	Tuning tool	Tuning electrical components
36	357-9337-00	BNC straight adapter (UG-491/U)	Electrical connections
37	357-9314-00	BNC T-adapter (UG-274A/U)	Electrical connections
38	357-9329-00	BNC straight adapter (UG-914/U)	Electrical connections
39	024-0345-00 or 024-0307-00	PA tube extractor	Removes power amplifier tubes from transceiver chassis
40	361-0154-00	Shielded-cap double banana plug (2)	Electrical connections
41	548-3530-002	Dial	Aligns and checks Autopositioner
42	548-3486-002	Test probe no. 1	Connects coaxial cables to transceiver signal test points
43	548-3499-002	Test probe no. 2	Connects coaxial cables to transceiver signal test points
44	548-3499-002	Test probe no. 3	Connects coaxial cables to transceiver signal test points
45	756-4330-003	Detector, 2 to 30 mc	Transmit noise measurements

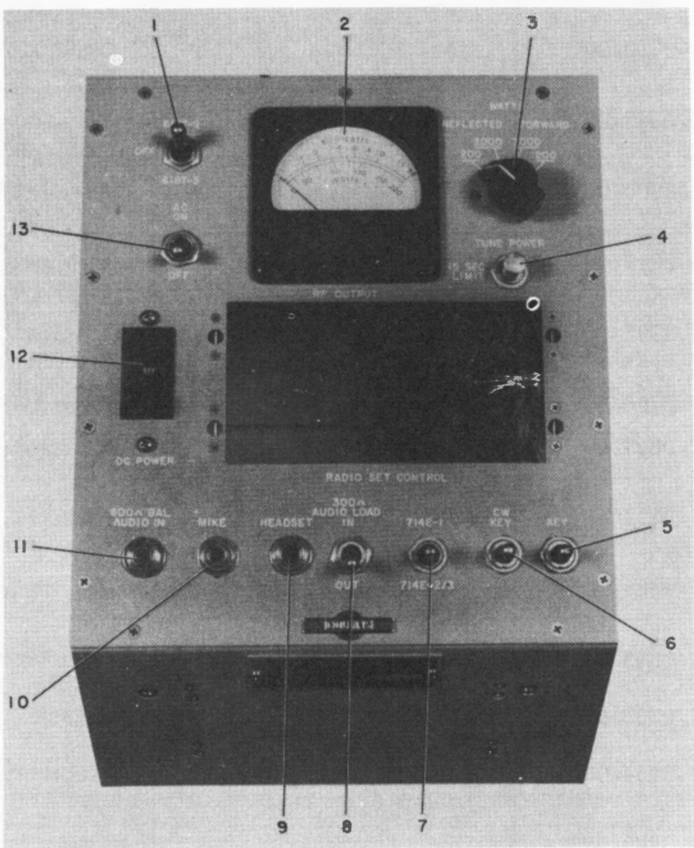
2-7. RADIO SET TEST HARNESS 678P-1. Radio Set Test Harness 678P-1 furnishes a means of connecting and controlling Radio Receiver-Transmitter RT-648/ARC-94 while it is being tested and adjusted. Radio Set Control C-3940/ARC-94 may be plugged into Radio Set Test Harness 678P-1 to control the RT-648/ARC-94.

2-8. Radio Set Test Harness 678P-1 is 8-1/2 inches wide, 9-9/16 inches high, and 16 inches deep. It weighs 30 pounds maximum, including cables which are furnished as part of Radio Set Test Harness 678P-1. Operating controls are located on a sloping front panel for convenient operation. All power connectors and protective components are located on a horizontal rear deck.

2-9. Figures 2-1, 2-2, and 2-3 identify all controls, connectors, and associated cables of Radio Set Test Harness 678P-1. Figure 2-4 is an over-all schematic diagram of Radio Set Test Harness 678P-1.

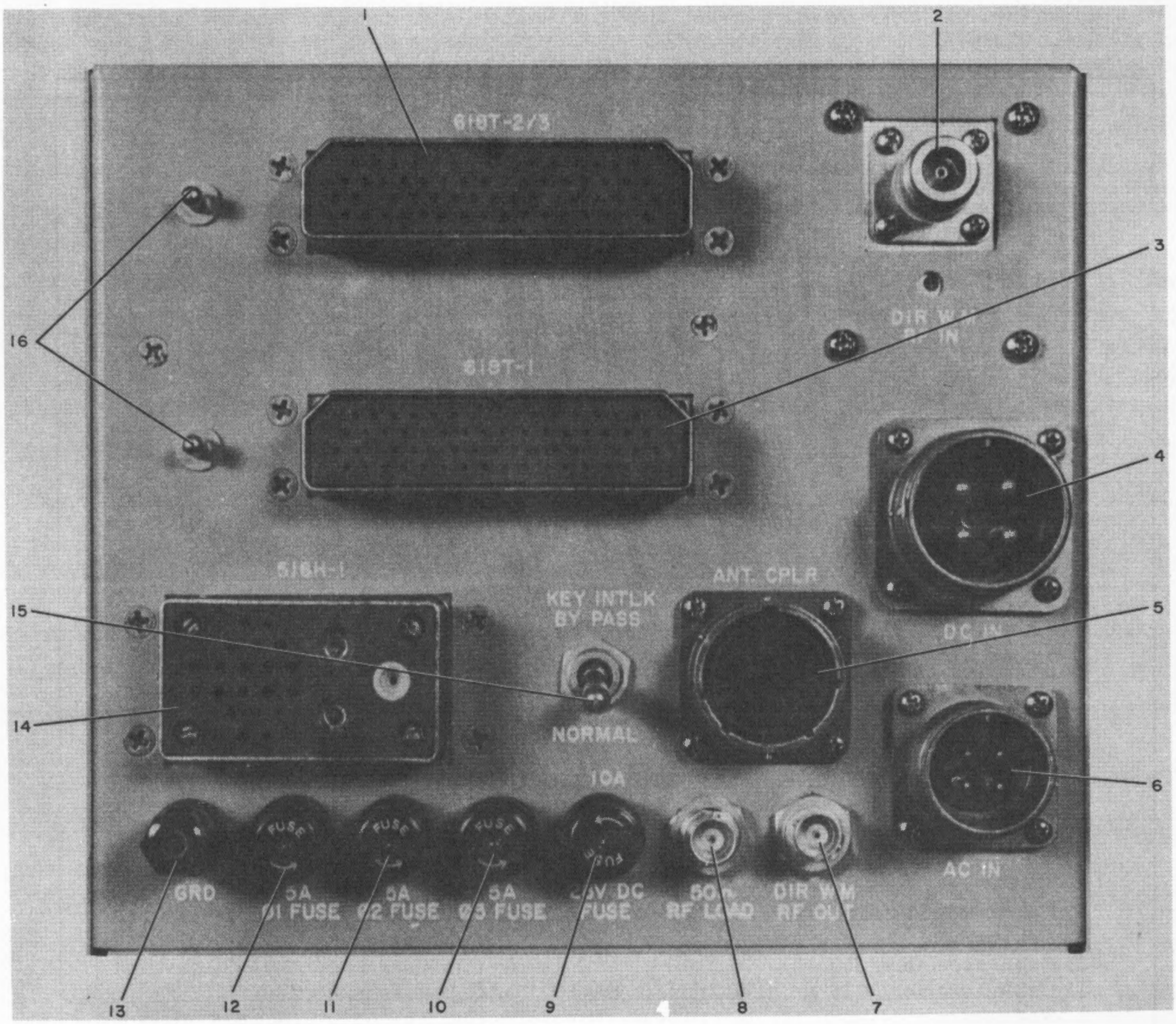
NOTE

When using Radio Set Test Harness 678P-1 with Radio Set AN/ARC-94, the transceiver selector switch, located in the upper left-hand corner of the sloping front panel of the 678P-1, must be set to 618T-2. The remote control panel selector switch, located third from the lower right-hand corner of the 678P-1, must be set to 714E-2/3. The RT-648/ARC-94 cable must be plugged into the connector marked 618T-2/3. The performance of these steps sets up the 678P-1 for use with the AN/ARC-94.



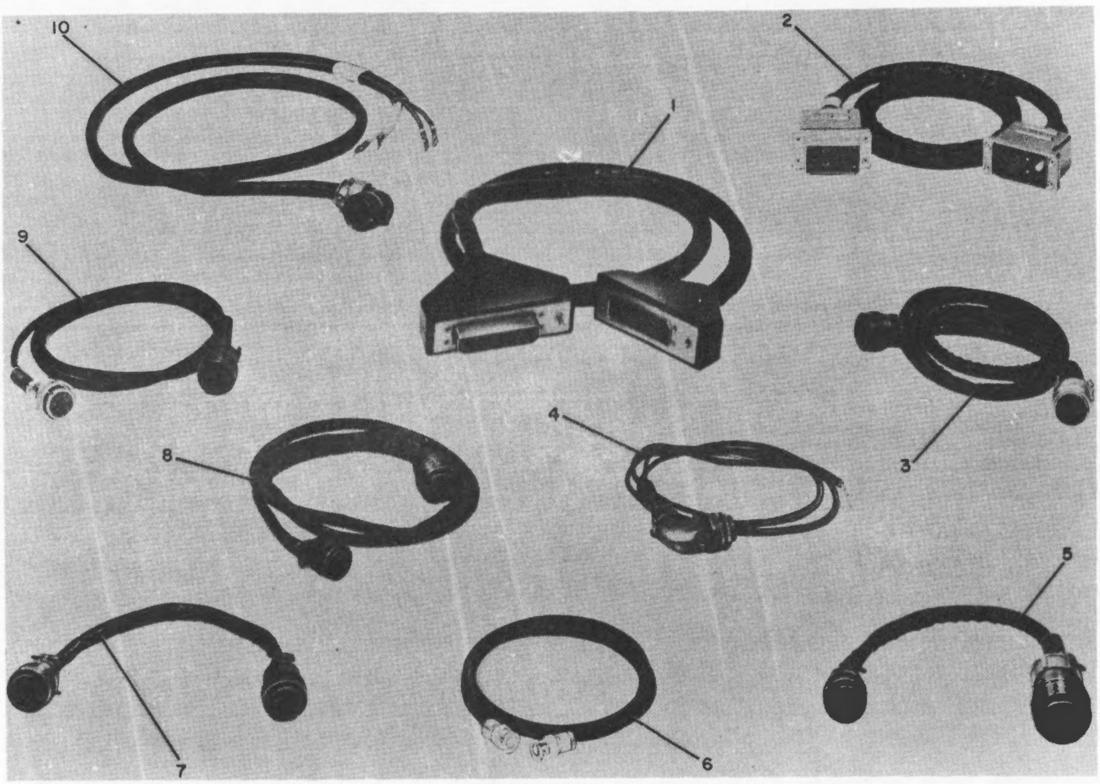
1. Transceiver selector switch
2. RF OUTPUT meter
3. WATTS REFLECTED-FORWARD meter switch
4. TUNE POWER button
5. KEY switch
6. CW KEY switch
7. Remote control panel selector switch
8. 300Ω AUDIO LOAD switch
9. HEADSET jack
10. MIKE jack
11. 600Ω BAL AUDIO IN jack
12. DC POWER switch
13. AC ON-OFF switch

Figure 2-1. Radio Set Test Harness 678P-1, Front Panel



1. RT-648/ARC-94 connector
2. DIR WM RF IN connector
3. Not used
4. DC IN connector
5. ANT. CPLR connector
6. AC IN connector
7. DIR WM RF OUT connector
8. 50Ω RF LOAD connector
9. 28V DC FUSE
10. 5A Ø3 FUSE
11. 5A Ø2 FUSE
12. 5A Ø1 FUSE
13. GRD connector
14. Not used
15. KEY INTLK BY PASS-NORMAL switch
16. Ground pins

Figure 2-2. Radio Set Test Harness 678P-1, Top Panel



1. Cable, RT-648/ARC-94
2. Not used
3. Cable assembly, 309A-1
4. Cable assembly, 115 volts, 400 cps, 3 phase
5. Not used
6. Cable, r-f
7. Cable assembly, C-3940/ARC-94
8. Cable assembly, 309A-2D
9. Cable assembly, 180L
10. Cable assembly, 27.5 volts dc

Figure 2-3. Radio Set Test Harness 678P-1, Associated Cables

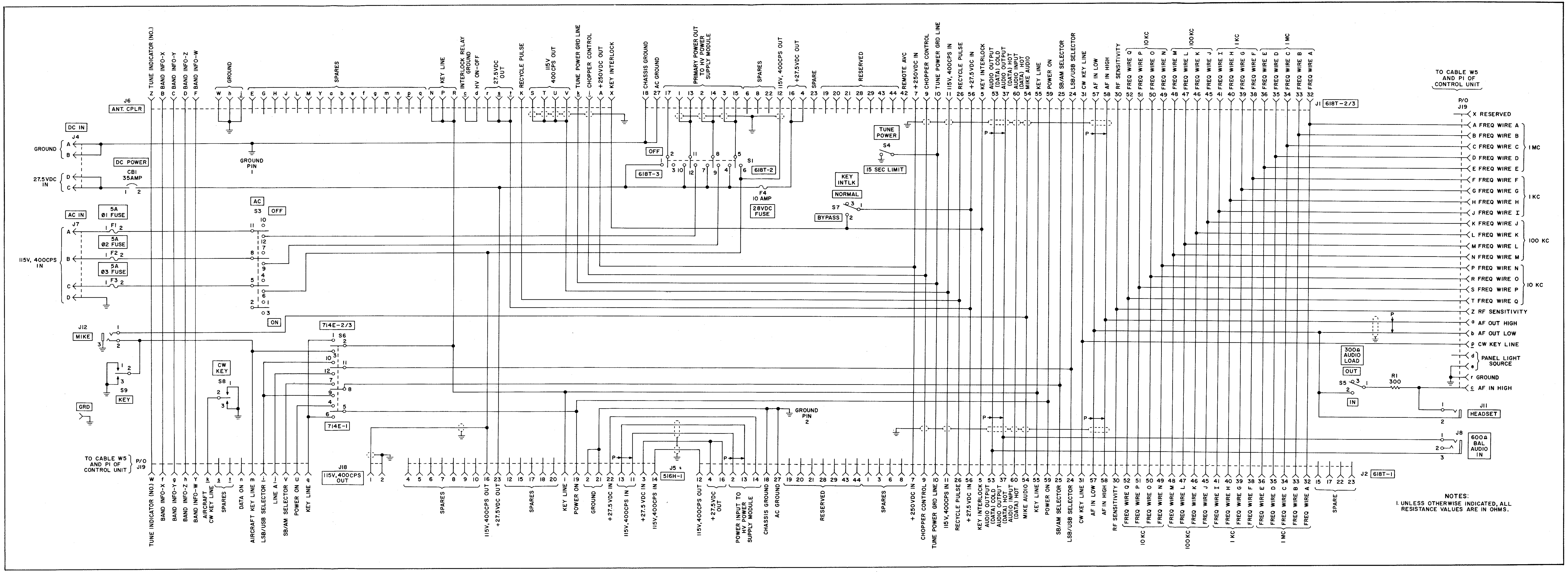
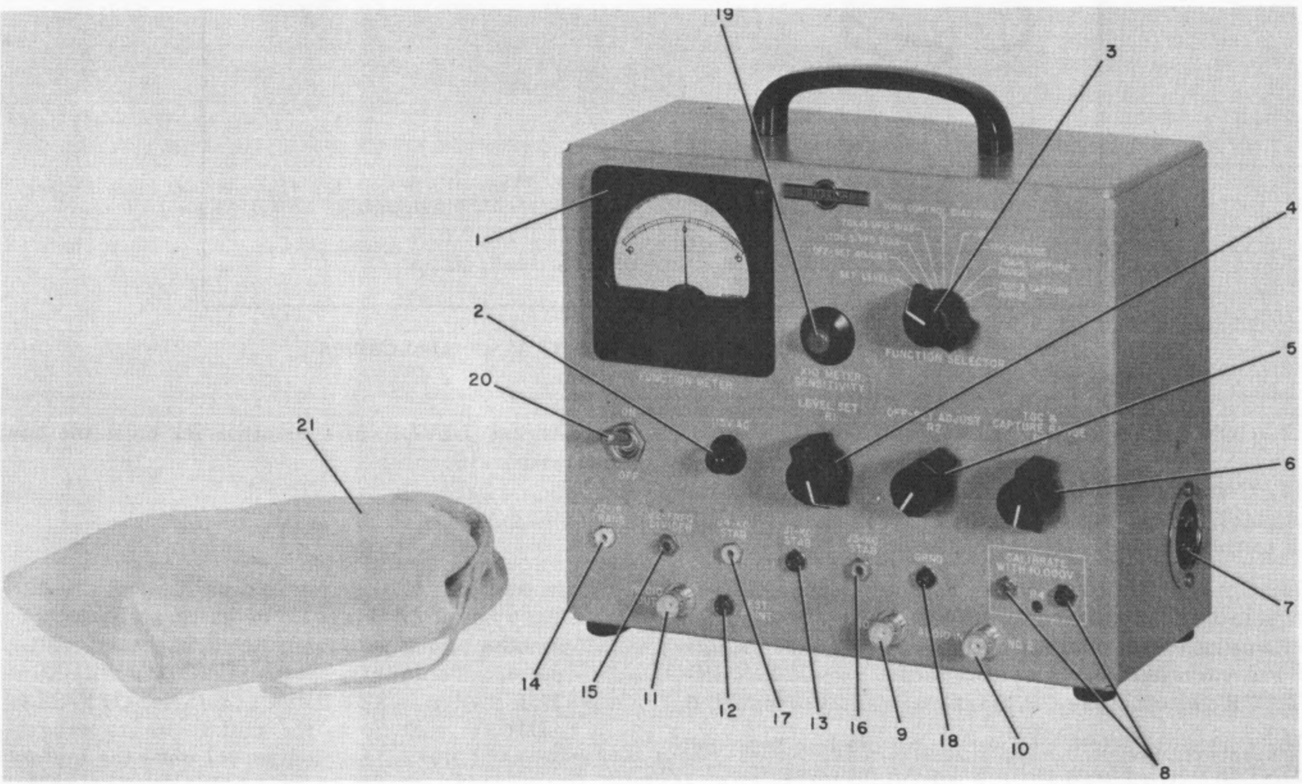


Figure 2-4. Radio Set Test Harness 678P-1, Schematic Diagram

2-10. FUNCTIONS. Radio Set Test Harness 678P-1 has switches that control the power, both ac and dc, which is supplied to the RT-648/ARC-94 being tested. All power inputs are fused. There are switches for keying the RT-648/ARC-94. A directional wattmeter is provided for measuring both forward and reflected power. Jacks are provided for use of Radio Set Test Harness 678P-1 either with or without an antenna coupler. The TUNE POWER button is used to check the circuit in the PA that places the 25-ohm resistance in series with the r-f output for tune-up operation with an antenna tuner.

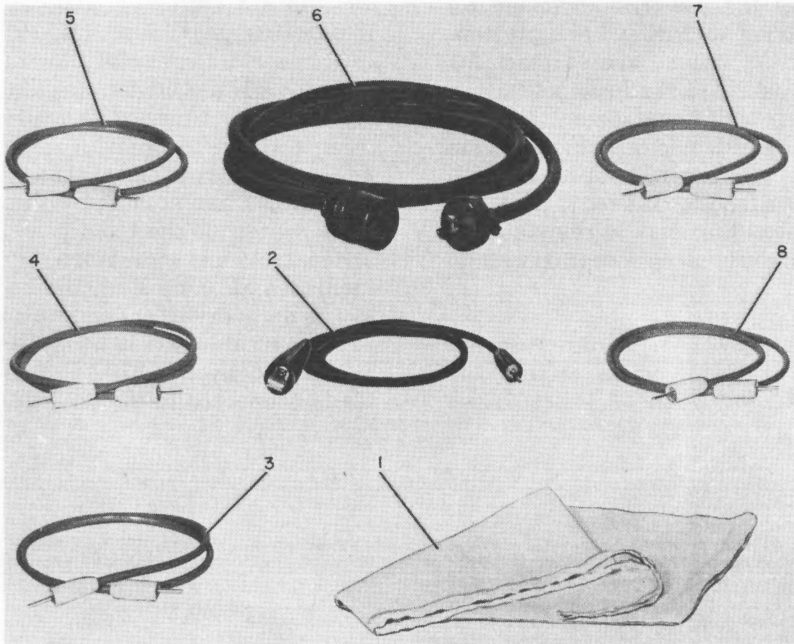
2-11. RADIO TEST SET 678Z-1. Radio Test Set 678Z-1 performs several functions in testing and adjusting the RT-648/ARC-94. Radio Test Set 678Z-1 contains an accurate voltage comparator which may be used to set critical voltages in the RT-648/ARC-94. It contains provisions for overriding the transmitter gain control for performing measurements. In addition, the 678Z-1 contains a dummy microphone which is used to connect audio tone inputs to the RT-648/ARC-94.

2-12. The operations that are performed by Radio Test Set 678Z-1 are selected with the FUNCTION SELECTOR switch on the front panel. Figure 2-5 identifies all controls and indicators on the 678Z-1. Figure 2-6 identifies all cables supplied with the 678Z-1. Figure 2-7 is an over-all schematic diagram of Radio Test Set 678Z-1. Table XII is a list of operations that may be performed by the 678Z-1 together with the indicated leads connected to the RT-648/ARC-94.



1. FUNCTION METER
2. 115V. AC pilot light
3. FUNCTION SELECTOR switch
4. LEVEL SET R1 control
5. OFF-SET ADJUST R2 control
6. TGC & CAPTURE RANGE R3 control
7. Line power connector
8. CALIBRATE WITH 10.000V test points
9. AUDIO IN NO 1 connector
10. AUDIO IN NO 2 connector
11. AUDIO OUT connector
12. TEST POINT jack
13. J1-KC STAB jack
14. J2-IF TRANS jack
15. J2-FREQ DIVIDER jack
16. J3-KC STAB jack
17. J4-KC STAB jack
18. GRND jack
19. X10 METER SENSITIVITY button
20. ON-OFF switch
21. Associated cables (see figure 2-6)

Figure 2-5. Radio Test Set 678Z-1, Front Panel



1. Bag
2. Test lead, ground
3. Test lead, No. 1
4. Test lead, No. 2
5. Test lead, No. 3
6. Power cable assembly
7. Test lead, No. 4
8. Test lead, No. 5

Figure 2-6. Radio Test Set 678Z-1, Associated Cables

2-13. CONNECTIONS.

2-14. Connect the 115-volt, 400-cps power cord to the receptacle on the rear of the 678P-1. Connect the GRD jack to the RT-648/ARC-94 chassis.

2-15. Connect the test leads to the RT-648/ARC-94 test points indicated near the 678Z-1 test jacks. When performing tests, connect only the leads listed in table XII for each particular setting of the FUNCTION SELECTOR switch. The GRD jack may remain connected.

2-16. CALIBRATION. Each time Radio Test Set 678Z-1 is used, check calibration as follows:

a. Lay Radio Test Set 678Z-1 on its back so that the front panel is horizontal; keep it in this position while performing tests.

b. Before applying power, adjust the FUNCTION METER needle to exactly 0 by adjusting the meter zeroing screw.

c. Set the ON-OFF switch to ON. Allow Radio Test Set 678Z-1 to warm up for 15 minutes.

d. Set the FUNCTION SELECTOR switch to SET LEVEL.

CAUTION

Do not press the X10 METER SENSITIVITY button or damage to the meter may result.

e. Adjust LEVEL SET control R1 until the meter indicates +10.

NOTE

In addition to this regular calibration, Radio Test Set 678Z-1 should be calibrated every 6 months using an accurate differential voltmeter. To do this, set the FUNCTION SELECTOR switch to SET LEVEL, and set OFF-SET ADJUST control to the middle of its range. Adjust LEVEL SET control R1 until the meter indicates +10. Connect a differential voltmeter, AN/USM-98( ), between the two CALIBRATE WITH 10.000V test points. Adjust R4 until the voltmeter indicates 10.000 $\pm$0.001 volts dc. Do not ground either test point during this procedure. Remove the 678Z-1 back cover. Apply 19.930 volts as measured by the AN/USM-98( ), between J4-KC STAB jack and ground. Turn the FUNCTION SELECTOR switch to 10KC CONTROL BIAS (+20V) position. Adjust R25 for a null on the 678Z-1 FUNCTION METER. Replace the back cover.

2-17. MAINTENANCE KIT 678Y-1. Maintenance Kit 678Y-1 is composed of 47 items which aid in aligning,

TABLE XII. RADIO TEST SET 678Z-1, OPERATING PROCEDURES

FUNCTION	OPERATION
NOTE When adjusting for a meter null while the FUNCTION SELECTOR switch is in the following positions, adjust carefully until no meter movement can be detected when the X10 METER SENSITIVITY button is depressed and released several times. The 678Z-1 GRD jack should be connected to the RT-648/ARC-94 chassis whenever the 678Z-1 is used.	
SET LEVEL	No leads connected. Adjust LEVEL SET control R1 until meter indicates +10. DO NOT USE X10 METER SENSITIVITY BUTTON.
OFF-SET ADJUST	Connect J1 in kilocycle-frequency stabilizer module A4 to corresponding jack on 678Z-1. Ground TP5 in kilocycle-frequency stabilizer module A4 and adjust OFF-SET ADJUST control R2 for an exact meter null with X10 METER SENSITIVITY button depressed.
70K-5 VFO BIAS	Connect J1 and J3 in kilocycle-frequency stabilizer module A4 to corresponding jack on 678Z-1. With TP5 grounded, adjust VFO BIAS ADJ control R62 in kilocycle-frequency stabilizer module A4 for an exact meter null with X10 METER SENSITIVITY button depressed. (To be used only with module A4 part number 528-0112-005.)
NOTE Do not attempt to check vfo frequency until the leads have been disconnected from J1 and J3 in kilocycle-frequency stabilizer module A4.	
10KC CONTROL BIAS (+20V)	Set C-3940/ARC-94 to 9.000 mc. Connect J4 in kilocycle-frequency module A4 to corresponding jack in 678Z-1. Adjust 10KC CONT BIAS ADJ control R63 in kilocycle-frequency stabilizer module A4 for an exact meter null with X10 METER SENSITIVITY button depressed.
+18V	Connect J2 in frequency divider module A1 to corresponding 678Z-1 jack. Adjust R15 in low-voltage power supply module A5 for an exact meter null with X10 METER SENSITIVITY button depressed.
TGC OVERRIDE	Connect J2 in frequency divider module A1 and J2 in i-f translator module A3 to corresponding 678Z-1 jack. This function is to be used in making distortion and carrier attenuation measurements. Set TGC & CAPTURE RANGE control R3 fully counterclockwise. Then key RT-648/ARC-94 and adjust R3 until RT-648/ARC-94 r-f output is 154 volts for two-tone input and 72 volts for AM mode. NOTE Care must be taken not to overdrive the RT-648/ARC-94 when the tgc is overridden. Observe output and never exceed 100 watts for AM or 400 watts PEP for two-tone SSB modulation.
70K-5 CAPTURE RANGE	Connect J2 in frequency divider module A1 and J3 in kilocycle-frequency stabilizer module A4 to corresponding 678Z-1 jack. See instructions for kilocycle-frequency stabilizer capture range check, paragraph 5-45.

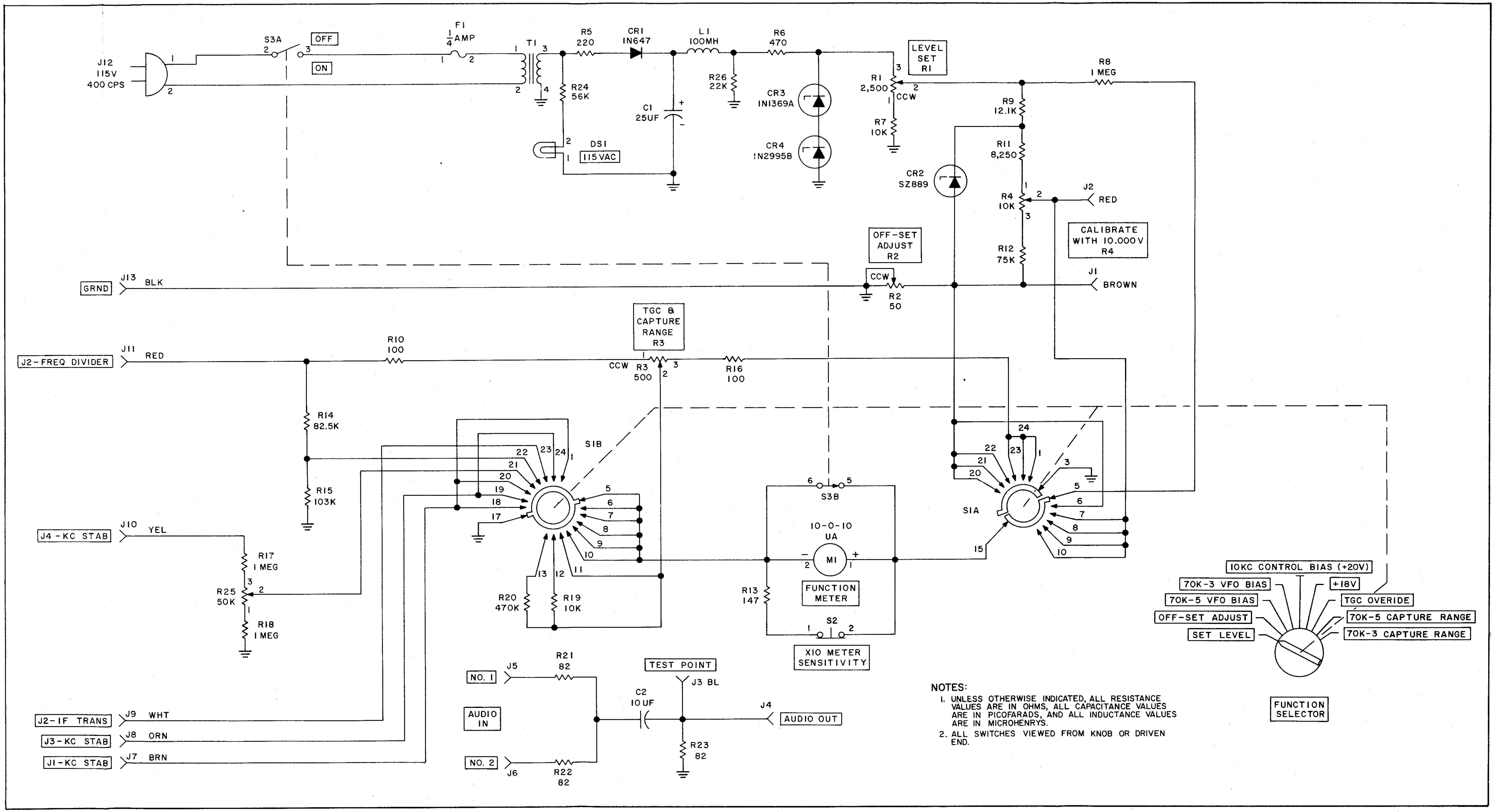


Figure 2-7. Radio Test Set 678Z-1, Schematic Diagram

testing, and trouble-shooting the AN/ARC-94. These items are contained in a cabinet that is supplied as part of the 678Y-1.

2-18. Maintenance Kit 678Y-1 includes module extenders for the modules in the RT-648/ARC-94. These extenders permit modules to be extended outside the RT-648/ARC-94 chassis while they are operating. This makes the modules more accessible for testing or trouble-shooting. Test points on the extenders bring some of the pins on the module plugs out to test jacks so that the voltages at these points may be measured easily.

2-19. Maintenance Kit 678Y-1 also includes a number of special test probes, test cables, and tuning or alignment tools which facilitate RT-648/ARC-94 maintenance procedures.

2-20. Figure 2-9 shows Maintenance Kit 678Y-1 cabinet and components.

Figure 2-8. (Deleted.)

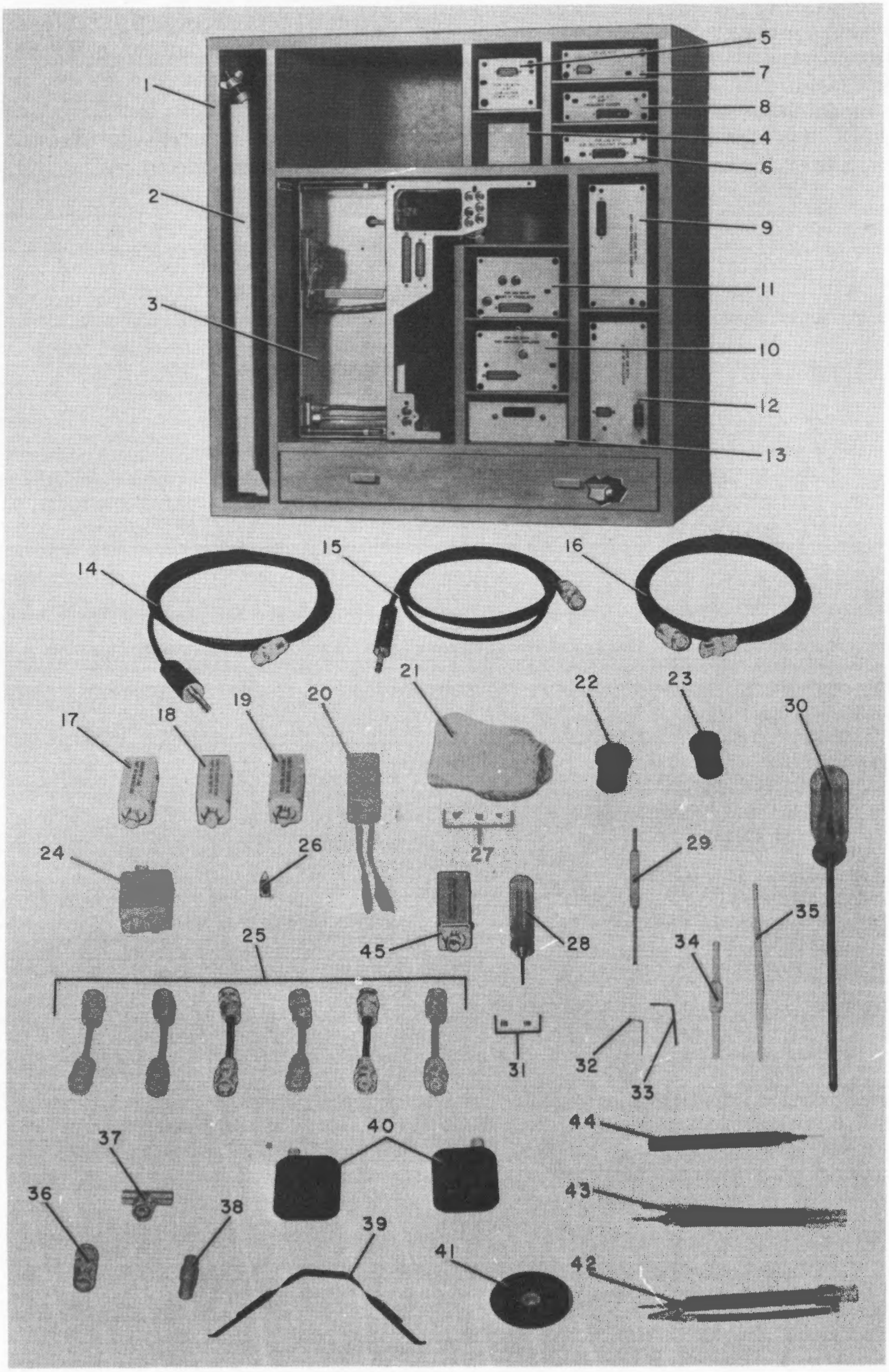


Figure 2-9. Maintenance Kit 678Y-1

SECTION III
PREPARATION FOR USE AND RESHIPMENT

3-1. GENERAL.

3-2. This section contains procedures for unpacking, preparing for use, and repacking the components and intercomponent cabling of Radio Set AN/ARC-94. Before unpacking the equipment, check the shipping containers for signs of external damage. If the shipping containers are undamaged, retain them for use when the equipment is repackaged for storage or shipment.

3-3. DAMAGE CLAIM.

3-4. If Radio Set AN/ARC-94 is damaged in transit, retain all shipping containers and packaging material, and contact the transport agency immediately. Damage claims against civilian transportation companies will not be honored unless packaging material is retained for their examination.

3-5. UNPACKING.

3-6. To unpack the components of the AN/ARC-94, proceed as follows:

a. Refer to figure 3-1, 3-2, and 3-3. Remove each of the containers from the components as shown. Remove packaging material with care. Plan to reuse it for storage and/or future shipment.

b. Check the packing slip to verify that all items listed have been included in the shipping container.

c. Check each component of the shipment for signs of damage in transit. Examine the cases, listen for loose internal parts, and check controls for proper operation.

3-7. PREPARATION FOR USE.

3-8. GENERAL PROCEDURE. To prepare Radio Receiver-Transmitter RT-648/ARC-94 for use, it must be mounted in Mounting MT-2641/ARC-94, supplied with cooling air if required, wired to the aircraft electrical system, and tested. Radio Set Control C-3940/ARC-94 is usually installed on the aircraft instrument panel, and Radio Receiver-Transmitter RT-648/ARC-94 is usually installed in the electronics compartment.

CAUTION

Radio Receiver-Transmitter RT-648/ARC-94 must be supplied with cooling air at the specified pressure and volume to prevent overheating and premature failure.

3-9. MOUNTING. To install the equipment in the aircraft, proceed as follows:

a. Select an accessible location for MT-2641/ARC-94 and RT-648/ARC-94. Refer to figure 3-4. Be sure to allow adequate sway space for RT-648/ARC-94. When selecting the location, take into consideration the cooling requirements specified in paragraph 3-12.

b. After selecting the location, drill holes as shown in figure 3-4.

c. Install Mounting MT-2641/ARC-94 with 16 machine screws, nuts, and lock washers.

NOTE

Be sure to connect ground straps to clean, bare metal when installing MT-2641/ARC-94. Remove all paint, dirt, and other foreign matter from 2-inch square where the vibration isolators contact the aircraft.

d. Slide RT-648/ARC-94 onto the MT-2641/ARC-94 and push to the rear as far as possible. Do not force.

e. Secure RT-648/ARC-94 to the MT-2641/ARC-94 using the two wing nuts. Do not overtighten. Safety wire the wing nuts.

f. Install Radio Set Control C-3940/ARC-94 in the aircraft instrument panel in the desired position. Refer to figure 3-5 for outline and mounting dimensions for C-3940/ARC-94.

3-10. INTERCONNECTING WIRING. Figure 3-6 is an interconnecting wiring diagram which shows the interconnections between RT-648/ARC-94, C-3940/ARC-94, and an antenna tuning unit or antenna coupler. Interconnections between antenna couplers or tuning units can be made by referring to the chart given in figure 3-6 for the antenna coupler used.

3-11. Provisions for test connections during maintenance are afforded by the MIC and PHONE jacks located on the front panel of the RT-648/ARC-94. Antenna connections are also made to front panel connectors. All other connections to the RT-648/ARC-94 are made through a 60-pin connector mounted at the rear of the case. A separate grounding pin is located beside the 60-pin connector.

NOTE

If an auxiliary antenna is connected to the AUX REC. ANT. connector on the front of the RT-648/ARC-94, the jumper connecting the auxiliary antenna with the main antenna should be removed. This jumper is located in the relay component under the front panel. The

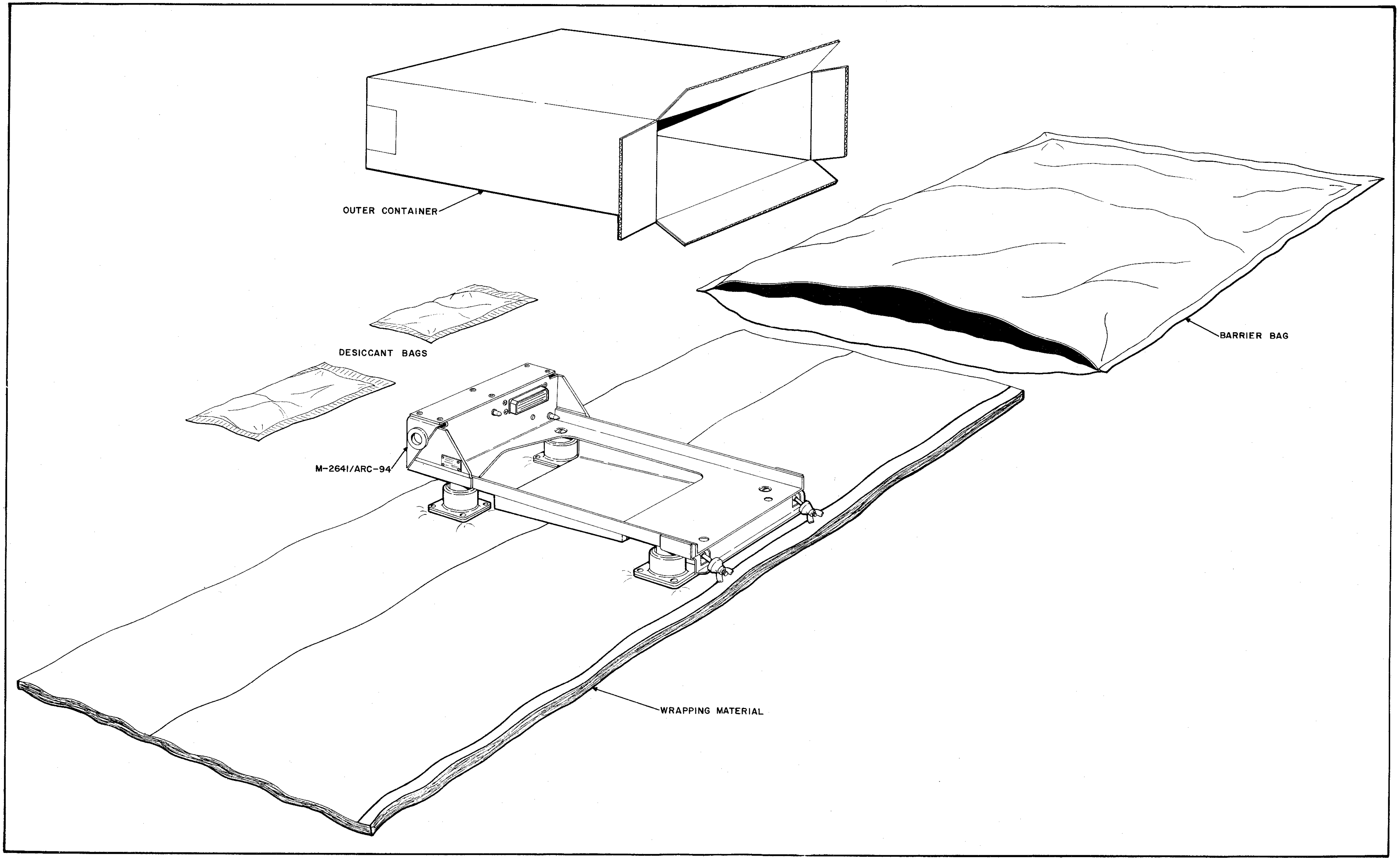


Figure 3-2. Packaging Details, Mounting MT-2641/ARC-94

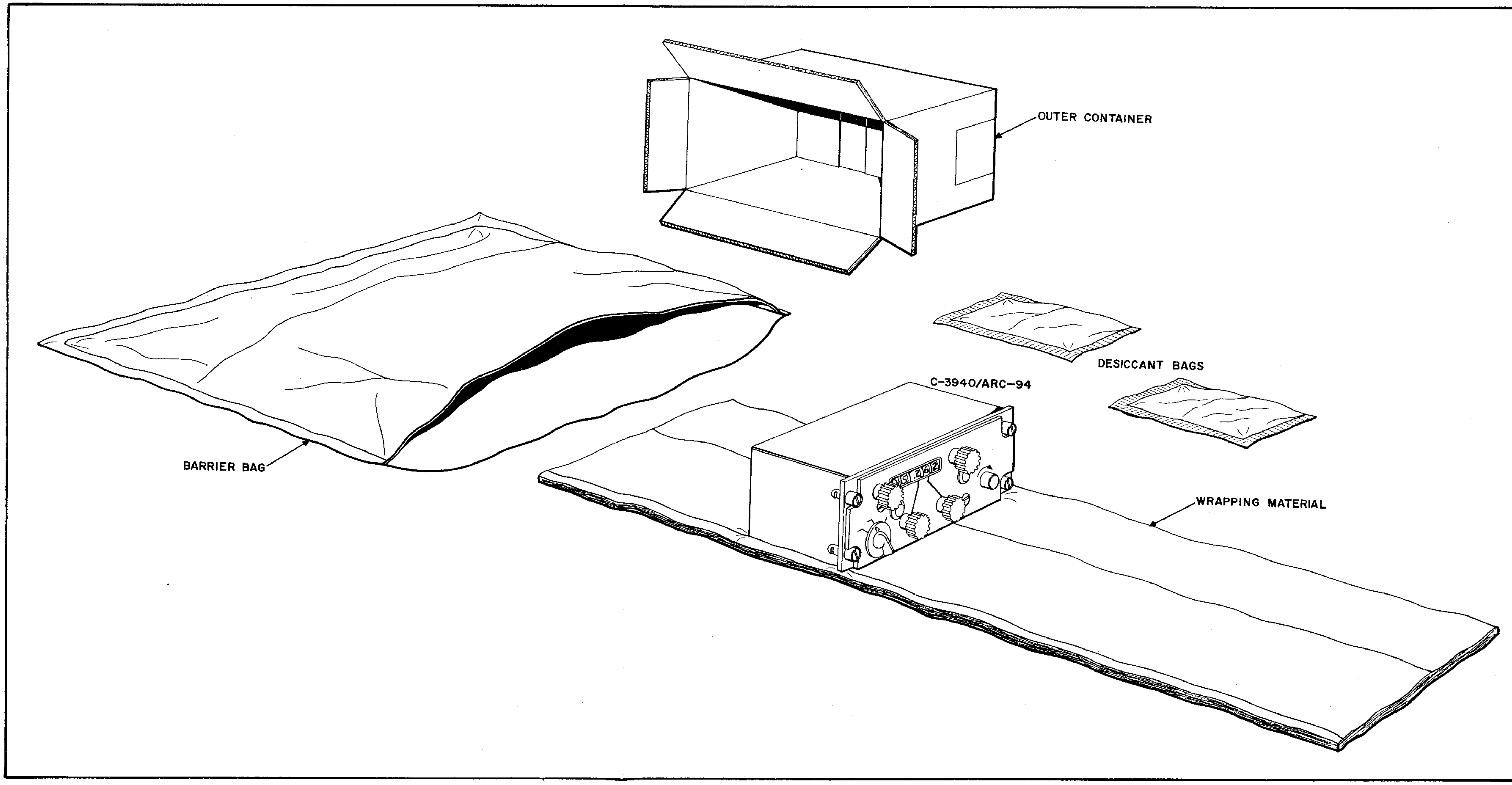


Figure 3-1. Packaging Details, Radio Set Control C-3940/ARC-94

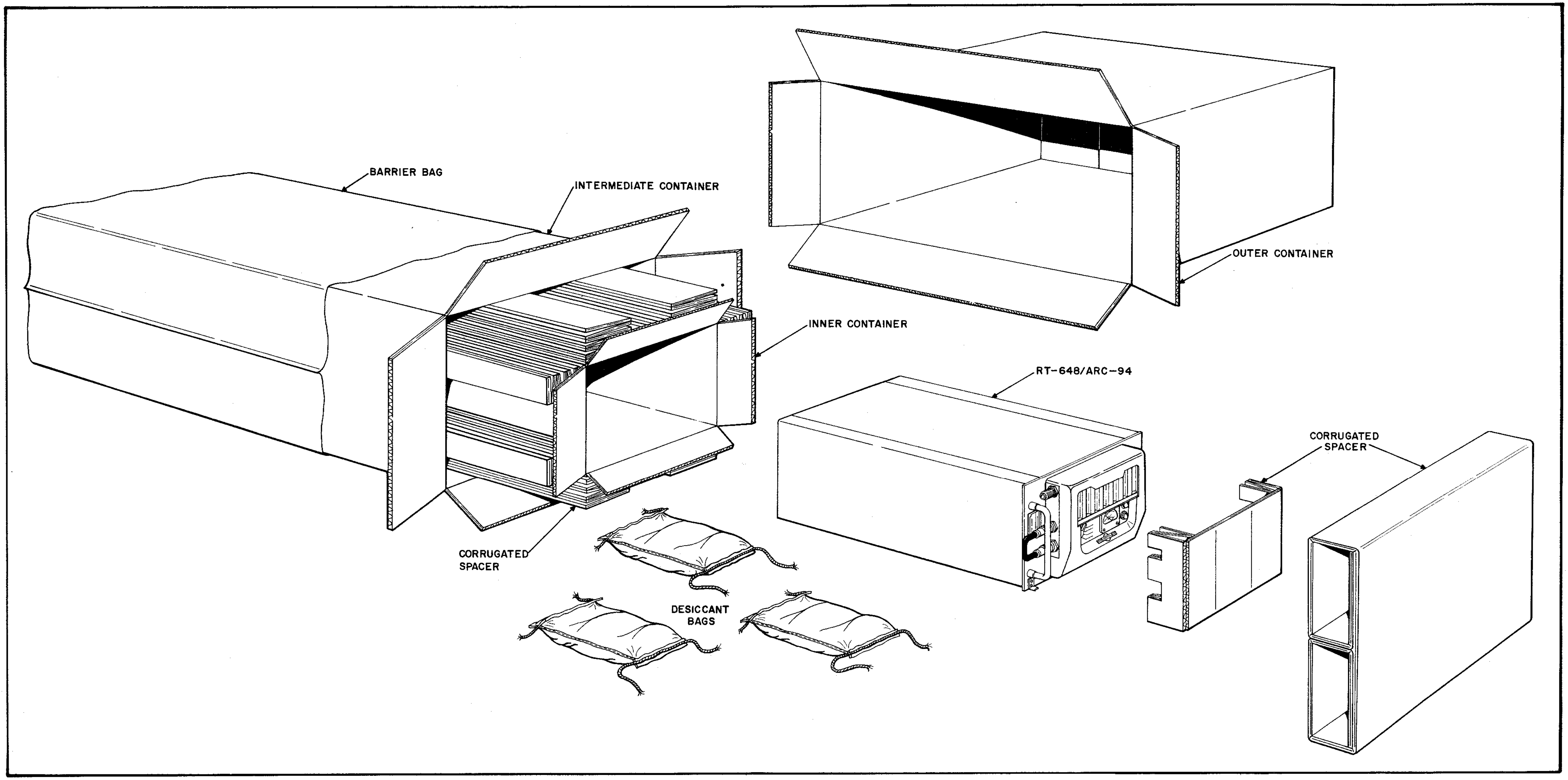


Figure 3-3. Packaging Details, Radio Receiver-Transmitter RT-648/ARC-94

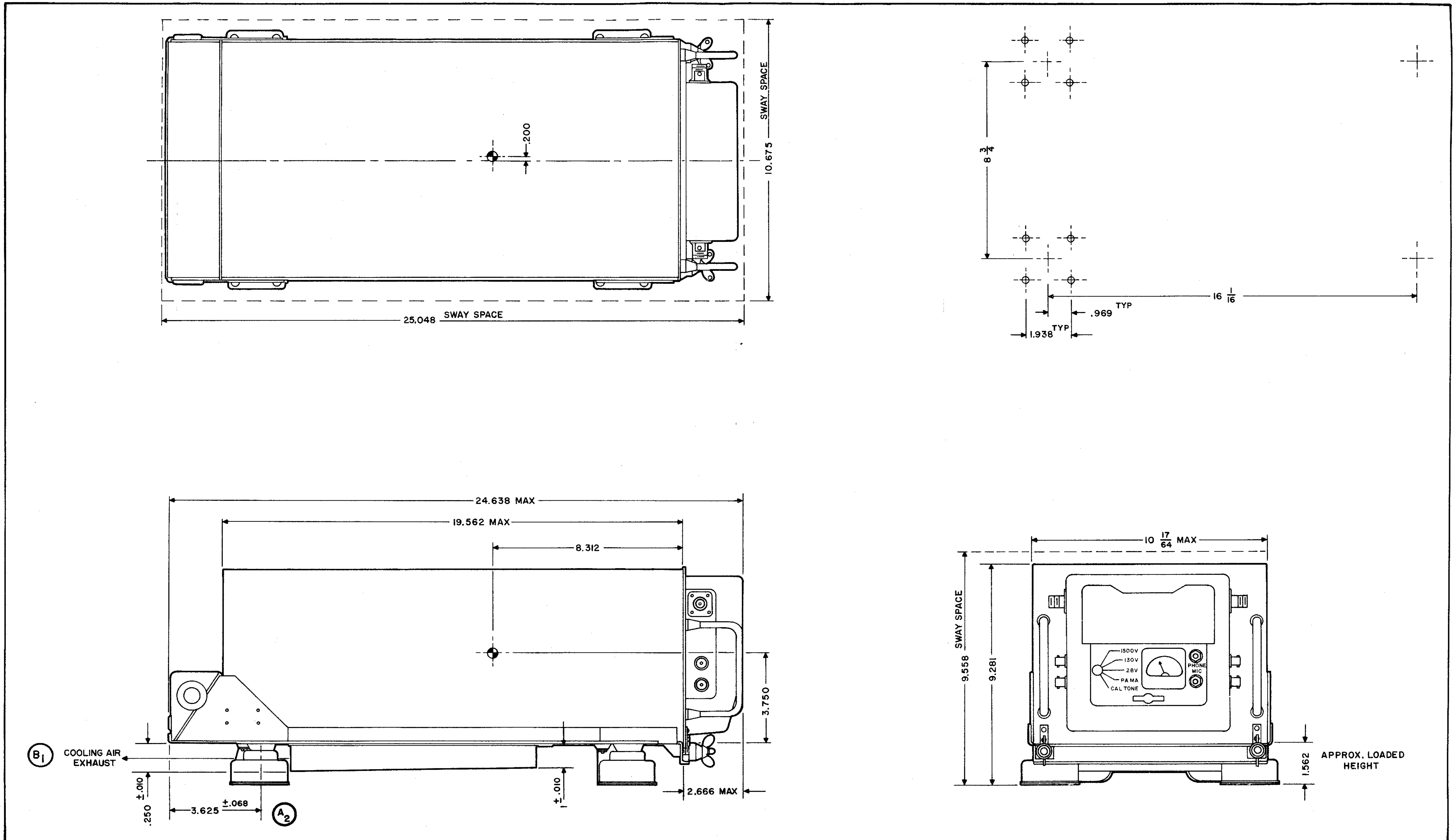


Figure 3-4. Outline and Mounting Dimensions for Radio Receiver-Transmitter RT-648/ARC-94 on Mounting MT-2641/ARC-94

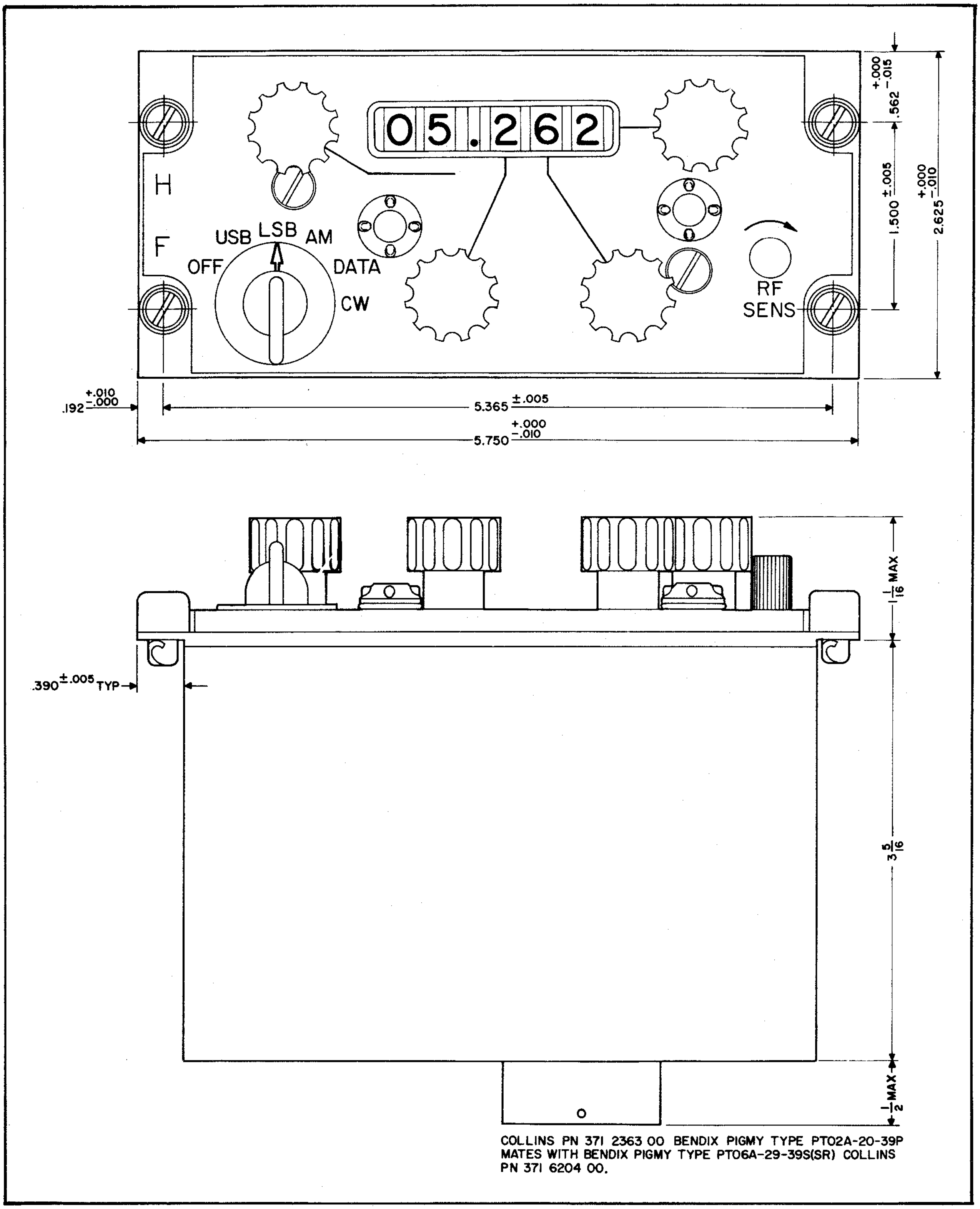
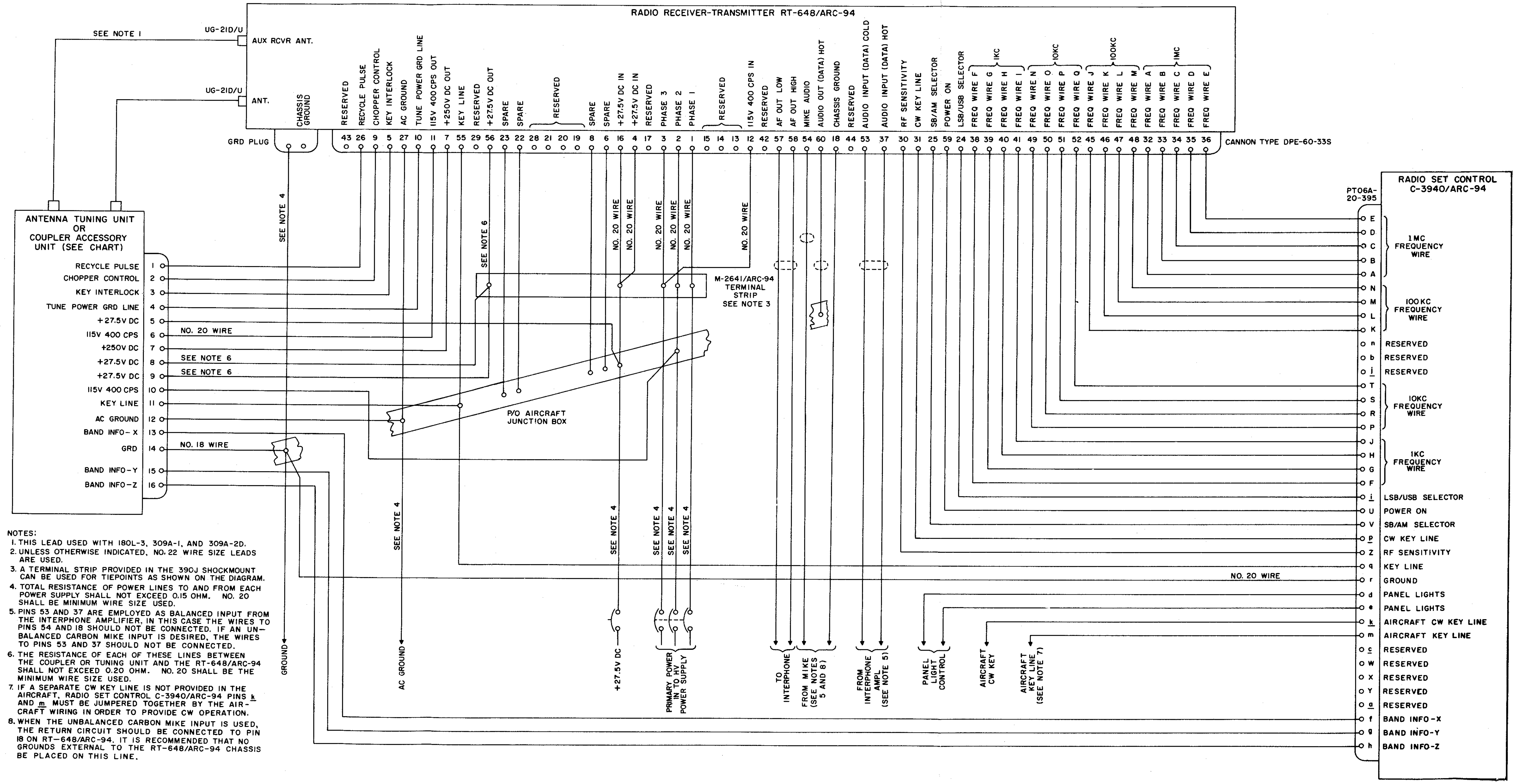


Figure 3-5. Outline and Mounting Dimensions for Radio Set Control C-3940/ARC-94

CHART FOR CONNECTIONS TO ANTENNA TUNING UNITS OR COUPLER ACCESSORY

WIRE NO.	RT-6481 ARC-94 CONNECTOR PIN NUMBER	WIRE FUNCTION	TO ANTENNA TUNING UNIT OR COUPLER ACCESSORY (PIN NUMBER)			
			ANTENNA TUNING WITH 180L-2 OR 180L-3	COUPLER ACCESSORY UNIT 309A-1	COUPLER ACCESSORY UNIT 309A-2D	REMINGTON RAND CONTROL TYPE 3206A1
1	--26--	Recycle Pulse	---10---	---10---	---T---	--- 3---
2	-- 9--	Chopper Control	--- 7---	No Connection	No Connection	No Connection
3	-- 5--	Key Interlock	---12---	---27---	---E---	--- 4---
4	--10--	Tune Power Grd Line	--- 4---	--- 7---	---W---	---26---
5	Aircraft Junction Box	+27.5 V DC In	No Connection	No Connection	No Connection	---27---
6	--11--	115V, 400CPS In	--- 8---	--1, 3--	--a, c--	No Connection
7	-- 7--	+250 V DC In	---14---	No Connection	No Connection	No Connection
8	--56--	+27.5 V DC In	---13---	---28---	---2---	---25---
9	--56--	+27.5 V DC In	---11---	---29---	No Connection	No Connection
10	Aircraft Junction Box	115 V, 400 CPS	No Connection	No Connection	No Connection	---28---
11	Aircraft Junction Box	Key Line	--- 9---	-2, 8, 12-	--R, V--	---19---
12	Aircraft Junction Box	AC Ground	---12---	---20---	---G---	---20---
13	C-3940/ ARC-94 Pin f	Band Info-X	No Connection	---23---	---D---	No Connection
14	Aircraft Junction Box	Ground	---15---	---20, 26, 11---	---G, A, S---	--2, 23--
15	C-3940/ ARC-94 Pin g	Band Info-Y	No Connection	---24---	---C---	No Connection
16	C-3940/ ARC-94 Pin h	Band Info-Z	No Connection	---25---	---B---	No Connection
	ANT. Connector	Antenna	To Navy 49195 Connector	To Antenna Coupler 180R-4	To Antenna Coupler 180R-6	J7
	AUX RCVR ANT.	Auxiliary Receiver Antenna	To UG-88/U Connector (18L-3 Only)	P3	J2	No Connection



NOTES:
1. THIS LEAD USED WITH 180L-3, 309A-1, AND 309A-2D.
2. UNLESS OTHERWISE INDICATED, NO. 22 WIRE SIZE LEADS ARE USED.
3. A TERMINAL STRIP PROVIDED IN THE 390J SHOCKMOUNT CAN BE USED FOR TIEPOINTS AS SHOWN ON THE DIAGRAM.
4. TOTAL RESISTANCE OF POWER LINES TO AND FROM EACH POWER SUPPLY SHALL NOT EXCEED 0.15 OHM. NO. 20 SHALL BE MINIMUM WIRE SIZE USED.
5. PINS 53 AND 37 ARE EMPLOYED AS BALANCED INPUT FROM THE INTERPHONE AMPLIFIER, IN THIS CASE THE WIRES TO PINS 54 AND 18 SHOULD NOT BE CONNECTED. IF AN UNBALANCED CARBON MIKE INPUT IS DESIRED, THE WIRES TO PINS 53 AND 37 SHOULD NOT BE CONNECTED.
6. THE RESISTANCE OF EACH OF THESE LINES BETWEEN THE COUPLER OR TUNING UNIT AND THE RT-648/ARC-94 SHALL NOT EXCEED 0.20 OHM. NO. 20 SHALL BE THE MINIMUM WIRE SIZE USED.
7. IF A SEPARATE CW KEY LINE IS NOT PROVIDED IN THE AIRCRAFT, RADIO SET CONTROL C-3940/ARC-94 PINS k AND m MUST BE JUMPERED TOGETHER BY THE AIRCRAFT WIRING IN ORDER TO PROVIDE CW OPERATION.
8. WHEN THE UNBALANCED CARBON MIKE INPUT IS USED, THE RETURN CIRCUIT SHOULD BE CONNECTED TO PIN 18 ON RT-648/ARC-94. IT IS RECOMMENDED THAT NO GROUNDS EXTERNAL TO THE RT-648/ARC-94 CHASSIS BE PLACED ON THIS LINE.

Figure 3-6. Interconnection Wiring Diagram for Radio Set AN/ARC-94 jumper between K5-8 and K5-5 should be removed. On later units this jumper is added by operation of a toggle switch accessible under the front cover near the antenna connector.

3-12. COOLING REQUIREMENTS.

3-13. GENERAL. The reliability of Radio Receiver-Transmitter RT-648/ARC-94 is determined to a great extent by the operating temperatures of components. Proper cooling will ensure maximum reliability of the RT-648/ARC-94. The RT-648/ARC-94 has been thermally balanced to ensure effective cooling of all components. These paragraphs describe the cooling requirements for the RT-648/ARC-94.

3-14. MOUNTING. The RT-648/ARC-94 should be mounted directly on Mounting MT-2641/ARC-94. If the equipment is mounted directly to the frame of the aircraft, ensure that air circulation is provided around all sides of the component. If the RT-648/ARC-94 is mounted on an exhaust plenum, the component should be provided with a negative pressure source which removes air from the exhaust air opening at the bottom of the component. Figure 3-7 shows the maximum altitude and temperature limits at which the RT-648/ARC-94 may be operated without auxiliary cooling. The graph is based on a maximum transmit duty cycle of 5 minutes transmit followed by a minimum of 5 minutes receive. This duty cycle applies when RT-648/ARC-94 is operating on 10 percent high-line voltage with full rated output of 400 watts PEP in SSB or 100 watts carrier in AM or cw. The RT-648/ARC-94 may be operated continuously in the receive mode.

CAUTION

The gaskets and seals must be in place and in good condition to preserve the internal airflow balance. The air filter at the input of the RT-648/ARC-94 must be clean when making air-pressure measurements. The exhaust openings in the bottom of the RT-648/ARC-94 must be free of obstructions.

Figures 3-8, 3-9, and 3-10 describe and illustrate three procedures which may be used to check the RT-648/ARC-94 installation for proper airflow. These procedures apply only when auxiliary cooling is used.

3-15. AUXILIARY COOLING.

3-16. The RT-648/ARC-94 may be cooled by withdrawing air through the exhaust opening in combination with air supplied by its own blower. To determine the amount of negative pressure necessary in the exhaust plenum to cool the RT-648/ARC-94 adequately, perform the instructions of paragraphs 3-17 through 3-22. Paragraph 3-23 gives an example of a typical cooling problem.

3-17. Refer to figure 3-11. This figure illustrates the relationship between the amount of cooling air W_{in} that must enter the blower opening at the front of the RT-648/ARC-94 and the cooling air temperature. Determine the ambient temperature of the inlet air in degrees centigrade. Enter the graph along the vertical axis representing this temperature, and intersect the cooling curve. Read the required inlet airflow (W_{in}) in pounds per hour along the horizontal axis. The value obtained is the mass airflow input (W_{in}) required to cool the RT-648/ARC-94 properly when it is operating under maximum duty cycle conditions for the determined ambient temperature.

3-18. Refer to figure 3-12. This graph illustrates the relationship between the exhaust airflow (W_{out}) and the inlet cooling air (W_{in}). Enter the graph at the mass airflow input (W_{in}) found in step 3-17. Intersect the desired mode flow line.

CAUTION

If the intersection falls within the shaded area, follow the desired mode flow line to the right to a point approximately 20 percent beyond the right-hand edge of the shaded area. Consider this the intersection.

3-19. From the intersection in step 3-18, follow a vertical line down, and read the value of air exhaust flow (W_{out}). This is the air exhaust flow needed to maintain the required value of W_{in}.

3-20. Refer to figure 3-13. This graph illustrates the relationship between the exhaust airflow (W_{in}) and the negative pressure in the exhaust plenum required to maintain W_{out} at sea level. Enter the graph along the horizontal axis at the value of (W_{out}) obtained in paragraph 3-19. Follow a vertical line to the intersection of the desired mode flow line (transmit, receive, or blower off but freewheeling).

CAUTION

If the intersection falls within the shaded area, follow the desired mode flow line up to a point approximately 20 percent beyond the top of the shaded area. Consider this the point of intersection.

3-21. From the point of intersection, read the value of ΔP_2 on the vertical scale. Record the figure of ΔP_2. Do not use this figure for ΔP.

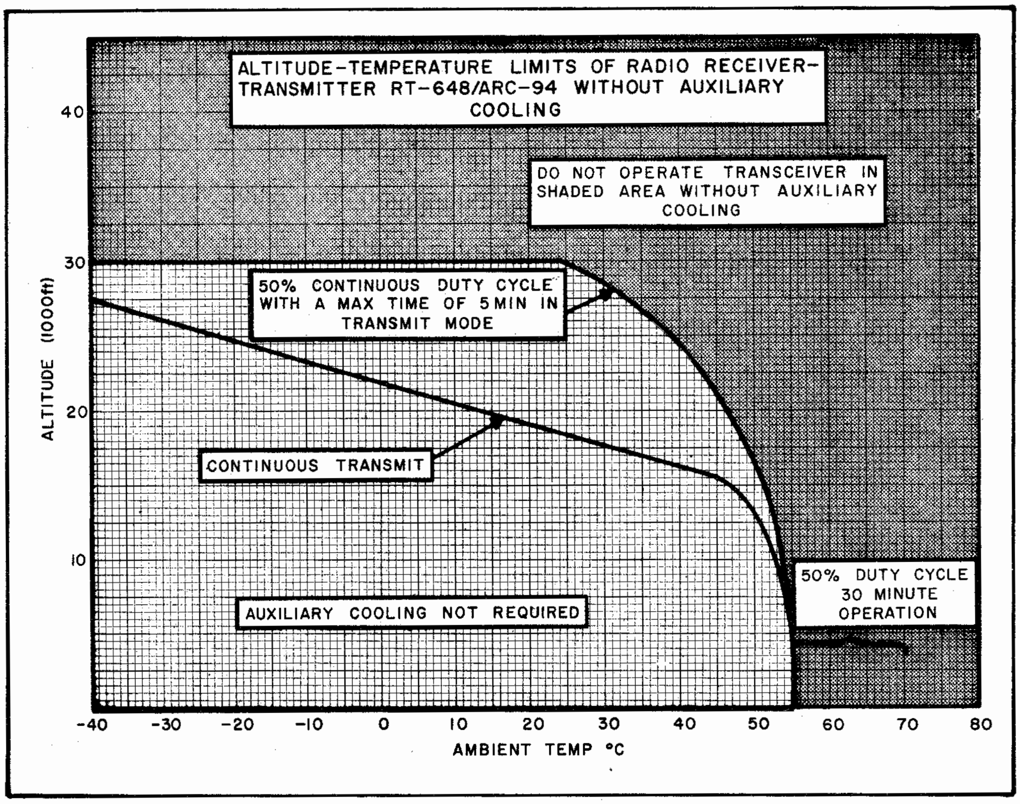


Figure 3-7. Altitude-Temperature Limits

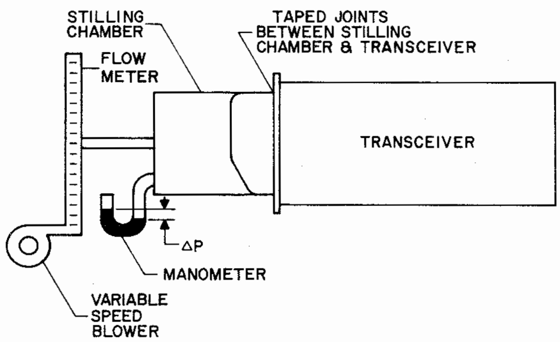
MEASUREMENT OF AIR MASS FLOW
ENTERING THE TRANSCEIVER

WHEN USED:

May be used in any installation and is the most accurate method of determining air mass flow into the transceiver to determine cooling adequacy. This method, however, requires equipment sometimes not available at the installing agency.

PROCEDURE:

Fabricate a stilling chamber as shown below. Joint between stilling chamber and transceiver must be airtight. Connect a flow meter and manometer as shown. Level and calibrate the manometer. Operate the transceiver in the transmit mode and adjust variable speed blower for zero ΔP. Read mass flow rate into the transceiver.



RESULTS:

The measured flow rate must be at least (2483.8 lb/hr) x (D).

D = air density in lb/ft^3 at the altitude of test (available from meteorological station or weather station.)

EXAMPLE:

If test is conducted at 10,000 feet altitude at a temperature of +25°C, a typical air density would be 0.0508 lb/ft^3. Measured mass air flow must be at least:

= (2483.8) x (0.0508) = 126 pounds/hour

Figure 3-8. Measurement of Air Mass Flow Entering Radio Receiver-Transmitter RT-648/ARC-94

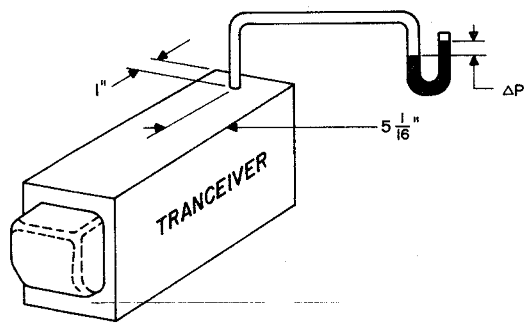
MEASUREMENT OF STATIC PRESSURE IN TRANSCEIVER CASE

WHEN USED:

Used when the transceiver is installed on Mount 390J-1 or on any system allowing free discharge of cooling air. This is the quickest and simplest check.

PROCEDURE:

Level and calibrate a manometer. With the transceiver operating in transmit, hold the rubber hose of the manometer tightly over the 0.015-inch diameter hole located as shown below. Do not pinch tube. Read ΔP in a decimal fraction of an inch of water. This is a measure of pressure differential between the transceiver case and the atmosphere.



RESULTS:

The measured pressure differential must be at least (7.20) x (D).

D = air density in lb/ft^3 at the altitude of test (available from meteorological station or weather service).

EXAMPLE:

If test is conducted at 10,000 feet altitude at a temperature of +25°C, a typical air density would be 0.0508 lb/ft^3. Measured ΔP must be at least:

$$\Delta P = (7.20) \times (0.0508) = 0.365 \text{ inches } H_2O$$

Figure 3-9. Measurement of Static Pressure in Radio Receiver-Transmitter RT-648/ARC-94 Case

MEASUREMENT OF STATIC PRESSURE
IN EXHAUST PLENUM UNDER THE TRANSCEIVER

WHEN USED:

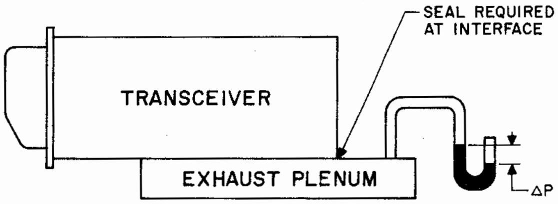
Used when transceiver is installed on an exhaust plenum for auxiliary cooling.

PRECAUTIONS:

Make sure gaskets under the transceiver are in place correctly. Do not measure static pressure in areas of high cooling air velocity. Make sure this test includes the effects of any orfice plates used beneath the transceiver.

PROCEDURE:

Level and calibrate a manometer. With the transceiver operating in transmit, hold the rubber hose of the manometer tightly over a small hole in the exhaust plenum. Do not pinch the tube. Read ΔP in a decimal fraction of an inch of water. This is a measure of pressure differential between the exhaust plenum and the atmosphere.



RESULTS:

The pressure differential, ΔP, must be zero or negative (as shown) under all conditions of aircraft operation at all altitudes and temperatures when the transceiver is operating in the transmit mode. Refer to paragraph 3-15 for instructions on interpretation of ΔP_2 readings obtained from figure 3-11. Follow instructions carefully.

Figure 3-10. Measurement of Static Pressure in Exhaust Plenum Under Radio Receiver-Transmitter RT-648/ARC-94

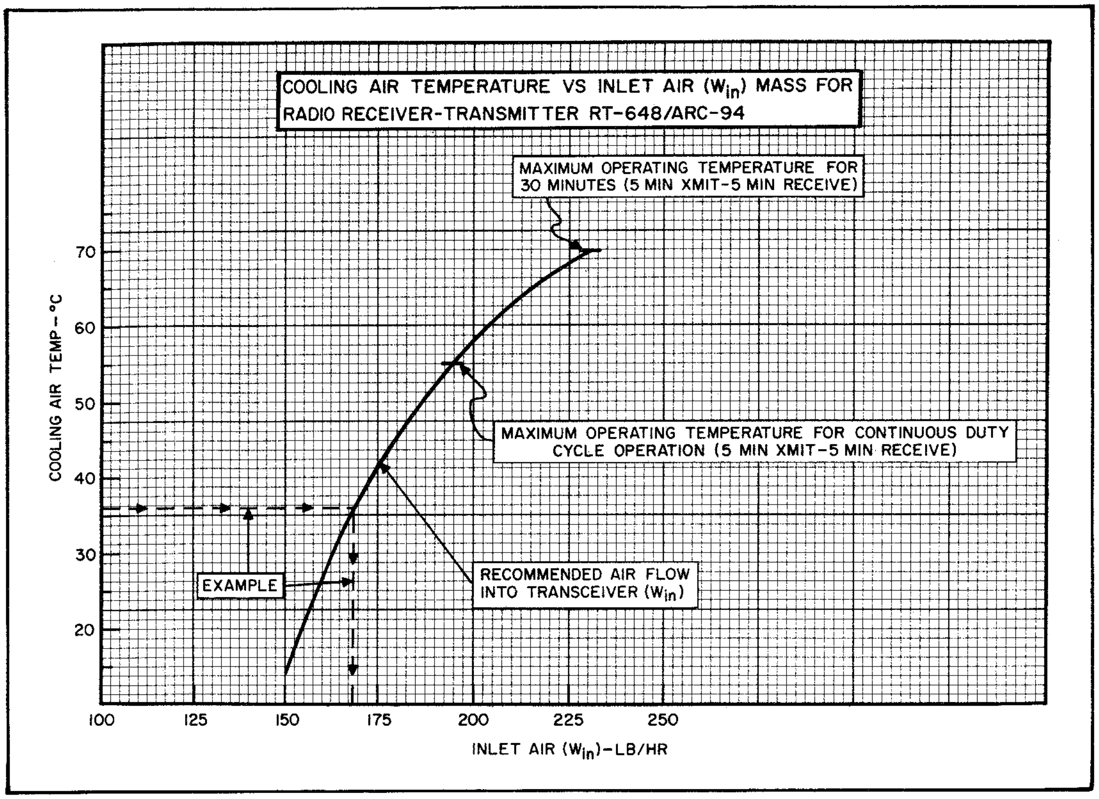


Figure 3-11. Air Temperature In Vs Inlet Air Mass

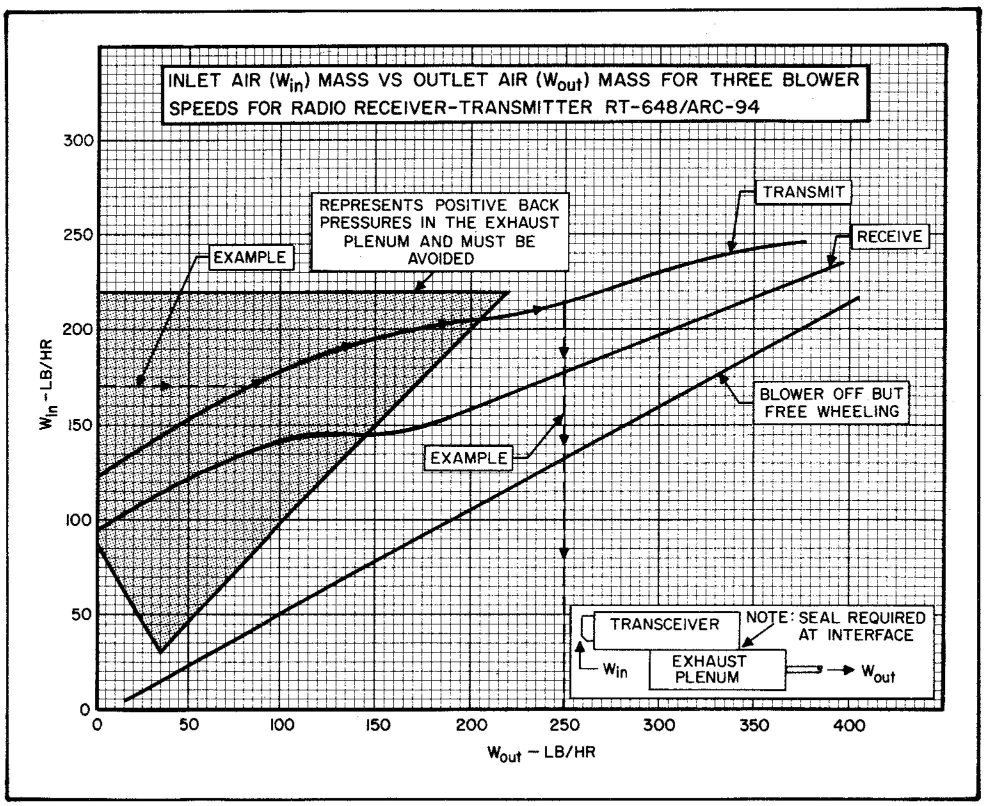


Figure 3-12. Inlet Air Mass Vs Outlet Air Mass

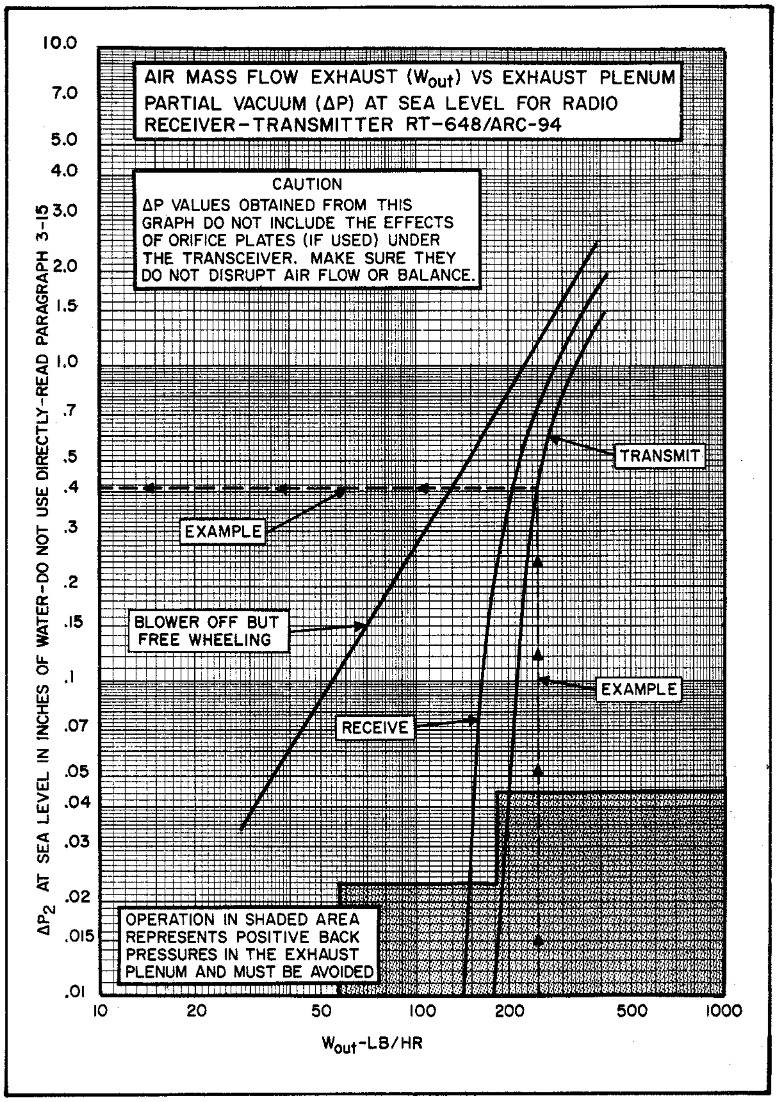


Figure 3-13. Air Flow Vs Exhaust Partial Vacuum

3-22. Call air weather service or the base meteorological station and obtain the air density (pounds per cubic foot) at the altitude and temperature of the test. Record this figure. Solve the following equation using the recorded data.

$$\Delta P = \Delta P_2 \times \frac{0.0765}{D}$$

Where ΔP_2 = reading taken from figure 3-13 in inches of water,

D = density of air reported by weather service in lb/ft^3,

and ΔP = required pressure differential in inches of water needed to ensure effective cooling of RT-648/ARC-94.

Record ΔP. This minimum value of partial vacuum must be obtained when the RT-648/ARC-94 is tested for cooling adequacy according to the instructions in figure 3-10.

3-23. EXAMPLE.

3-24. The following steps present a sample solution effected following the steps presented in paragraph 3-15. The graphs of figures 3-11, 3-12, and 3-13 are marked with dashed lines to indicate the path of the solution as work progresses.

3-25. Refer to figure 3-11. Assume a cooling air temperature of 36 degrees centigrade. Enter the graph from the left at 36 degrees. Follow a horizontal line to the intersection of the recommended air flow curve. Follow a vertical line down and read a value of 170 pounds per hour for W_{in}.

3-26. Refer to figure 3-12. Enter the graph at the left at a W_{in} value of 170 pounds per hour. Follow a horizontal line to the intersection of the transmit mode curve. Since the example intersection falls within the shaded area, proceed along the transmit mode curve to a point about 20 percent beyond the right-hand edge of the shaded area. Assume this to be the intersection, and follow a vertical line down to 250 pounds per hour for required W_{out}. Note that W_{out} is always greater than W_{in}.

3-27. Refer to figure 3-13. Enter the graph at the bottom at a W_{out} value of 250 pounds per hour. Follow a vertical line up to the intersection of the transmit mode curve. From this intersection, follow a horizontal line left and read a required value of ΔP_2 of 0.41 inch of water.

3-28. Call air weather service or the base meteorological station. Assume a reported air density of 0.0521 pound per cubic foot. Solve the equation in paragraph 3-22:

$$\Delta P = \Delta P_2 \text{ (from fig 3-13) } \times \frac{0.0765 \text{ (constant)}}{0.0521 \text{ (from weather service)}}$$

$$\Delta P = 0.41 \times \frac{0.0765}{0.0521} = 0.602 \text{ inch of water vacuum.}$$

3-29. ADDITIONAL INSTALLATION REQUIREMENTS.

3-30. MICROPHONE INPUT CIRCUITS. If the AN/ARC-94 is to be operated directly from a carbon microphone, connect the output of the carbon microphone directly to pin 54 on the rear connector of the RT-648/ARC-94. The audio level will be correct. If it is desired to connect the microphone audio to the RT-648/ARC-94 through an interphone amplifier, insert an audio pad between the interphone amplifier output and the input to the RT-648/ARC-94. This pad must reduce the output of the interphone amplifier to the levels specified in table XIII. Figure 3-14 shows two typical installations, one for an unbalanced input to the RT-648/ARC-94, and the other for a balanced input to the RT-648/ARC-94.

3-31. INSTALLATION TESTING. After the AN/ARC-94 is installed, it must be thoroughly tested and checked out. Installation testing enables maintenance personnel to establish the specific operating characteristics of each installation. Installation testing is identical to that given in paragraphs 5-15 through 5-26.

3-32. PREPARATION FOR RESHIPMENT.

3-33. To prepare Radio Set AN/ARC-94 for shipment, perform the following steps:

a. Remove input power to the equipment.
b. Disconnect all intercomponent cabling.
c. Remove RT-648/ARC-94 from MT-2641/ARC-94 by loosening two wing nuts.
d. Remove MT-2641/ARC-94 from aircraft.
e. Remove C-3940/ARC-94 from aircraft.
f. Remove intercomponent cabling and input power circuit breakers if equipment is not to be reinstalled at a later date.

3-34. PACKING FOR RESHIPMENT.

3-35. Refer to figures 3-1, 3-2, 3-3, and package equipment according to the illustrations. Use the specified packing materials or their approved substitutes. If Radio Set AN/ARC-94 is to be shipped under special circumstances, different packaging may be acceptable. The packaging specified in figures 3-1, 3-2, and 3-3 is not sufficient for overseas transportation. Get in touch with your supply officer for overseas packaging information.

TABLE XIII. STANDARD GAIN SETTINGS FOR RADIO RECEIVER-TRANSMITTER RT-648/ARC-94

Receiver audio output	300-mv output with an input signal of 1000 microvolts modulated 30 percent at 100 cps.
Sidetone output	100-mw output with 0.25 volt input on microphone line.
Microphone input, unbalanced	0.25-volt input at pin 54 gives proper modulation.
Microphone input, balanced	0.8-volt input across pins 53 and 37 gives proper modulation.

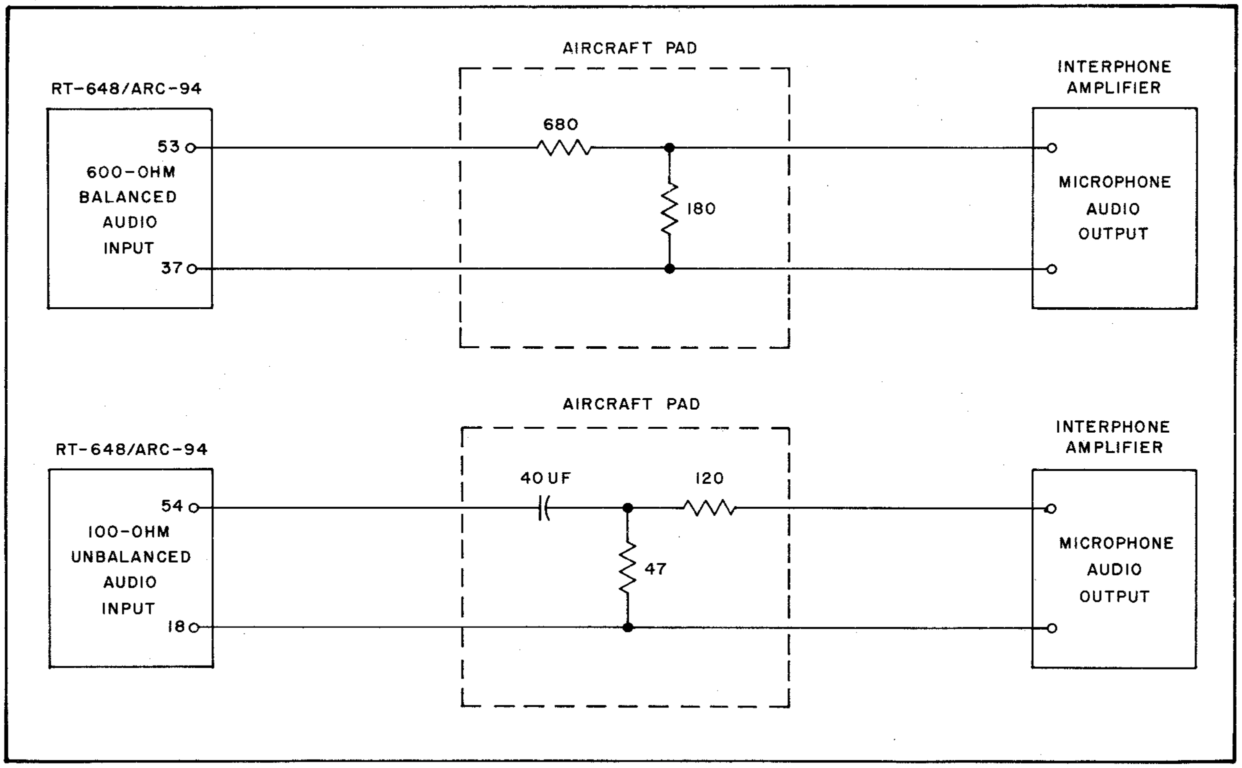


Figure 3-14. Typical Microphone Input Connections

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section provides a general block diagram explanation of the operation of Radio Set AN/ARC-94 and a separate block diagram explanation of Radio Receiver-Transmitter RT-648/ARC-94 and Radio Set Control C-3940/ARC-94. This theory of operation should be read and understood thoroughly as an aid in the maintenance and trouble-shooting of Radio Set AN/ARC-94.

4-3. For personnel who have no single-sideband (SSB) experience, a brief explanation of single-sideband theory precedes the discussion of the AN/ARC-94.

4-4. SINGLE SIDEBAND THEORY.

4-5. Single sideband (SSB) has proved to be a more efficient and reliable means of voice communications than has amplitude modulation (AM). Efficiency has been improved by the concentration of the entire transmitter r-f output into a single frequency spectrum rather than the division of power by the AM transmitter into a lower sideband, a carrier, and an upper sideband. This division of power in an AM transmitter results in less r-f energy available at the AM receiver for detection of the modulated audio than would be available at an SSB receiver if a single-sideband transmitter were being used.

4-6. To fully understand the development of the single-sideband signal, a review of amplitude modulation may be helpful. Figure 4-1 is a graphic illustration of AM signal development. When the modulating audio spectrum (from approximately 300 to 3000 cps) is mixed (modulated) with the carrier frequency, three frequencies result; the carrier frequency minus the audio frequency (lower sideband), the carrier frequency, and the carrier frequency plus the audio frequency (upper sideband). As each sideband contains identical information, the sidebands are redundant with only one sideband and the carrier being needed in AM detection.

4-7. In single sideband (see figure 4-2), the audio spectrum is mixed with a carrier frequency in a balanced mixer. The output of the balanced mixer contains the carrier frequency minus the audio signal (lower sideband, LSB) and the carrier frequency plus the audio frequency (upper sideband, USB). The design of the balanced mixer is such that the carrier frequency is suppressed. The output of the balanced mixer is applied to mechanical filters which pass only one sideband each. The outputs of the mechanical filters are essentially the audio frequency translated up to the carrier frequency, plus or minus the audio frequency.

4-8. The sideband, selected by the operator (example, USB), is heterodyned to the desired operating frequency, amplified in the transmitter power amplifier, and fed to an antenna. As stated previously, the sideband power applied to the antenna is greater with single sideband because all transmitted power is contained within one sideband.

4-9. In Radio Set AN/ARC-94 the operator may select either USB, LSB, AM, data, or cw operation with the mode selector located on Radio Set Control C-3940/ARC-94. In SSB operation, either the upper sideband (USB) or lower sideband (LSB) can be utilized to convey intelligence, as required.

4-10. GENERAL SYSTEM OPERATION.

4-11. Radio Set AN/ARC-94 consists of the C-3940/ARC-94 and the RT-648/ARC-94. These units are complemented in actual operation by accessory units which complete an AN/ARC-94 installation. The accessory units involved are a microphone, headset, antenna coupler, and an antenna. These items are identified in figure 4-3, which shows the components and accessory units in their proper positions. In addition to the accessory units mentioned above which represent a voice communications system, a key is necessary for cw operation and data equipment for data operation.

4-12. Radio Set Control C-3940/ARC-94 selects the mode of operation (USB, LSB, AM, data, or cw) in which the RT-648/ARC-94 can be operated. The C-3940/ARC-94 provides the means of controlling the receive r-f gain and thus the a-f output. In addition, the frequency selector circuits of the RT-648/ARC-94 are actuated by the four frequency selector knobs located on the C-3940/ARC-94. The C-3940/ARC-94 can select any of 28,000 frequencies in the 2.000- to 29.999-megacycle range in 1-kc increments.

4-13. In the transmit function, Radio Receiver-Transmitter RT-648/ARC-94 translates the audio input information into either an upper or lower sideband from 2.000 to 29.999 megacycles, if either the USB or LSB mode of operation is selected by Radio Set Control C-3940/ARC-94. If the AM mode is selected on the C-3940/ARC-94, the RT-648/ARC-94 selects the USB and reinserts the 500-kc carrier. This mixed signal in turn is heterodyned up to the desired operating frequency, amplified, and fed to an antenna. This type of transmission is called amplitude modulation equivalent (AME). For cw operation, a 1-kc signal is obtained from the stabilized master oscillator through a frequency divider and is fed into the RT-648/ARC-94 normal audio input whenever the

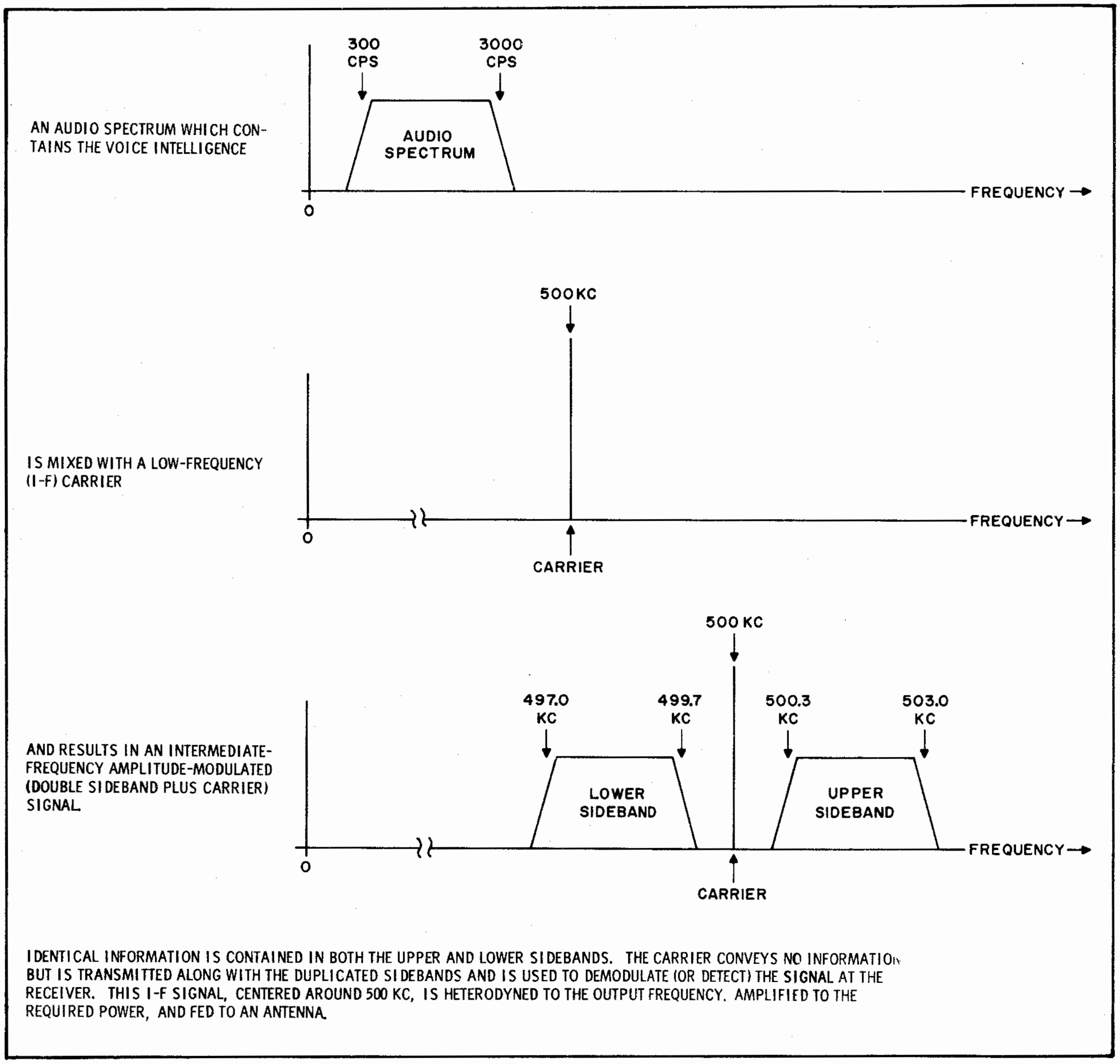


Figure 4-1. AM Signal Development

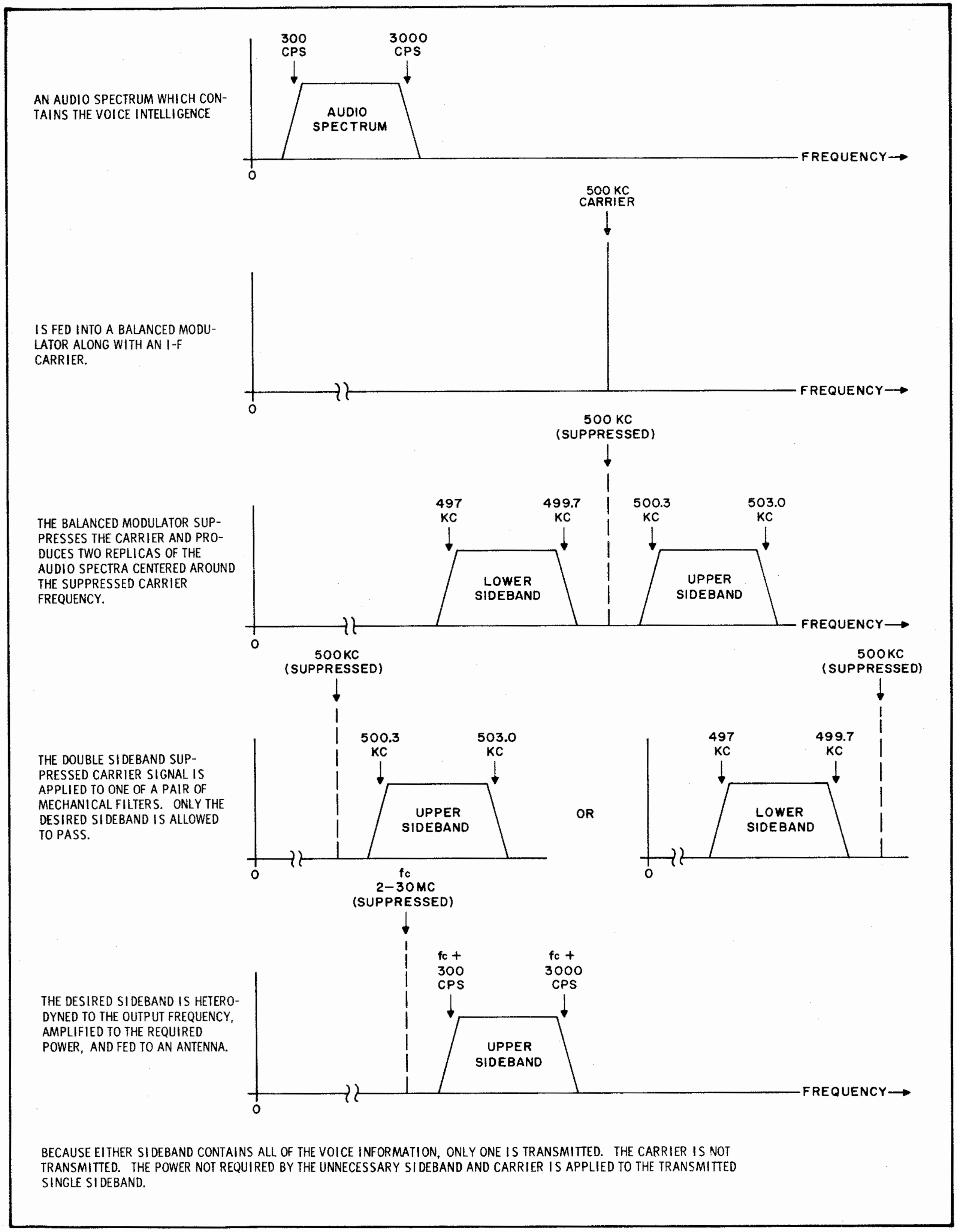


Figure 4-2. SSB Signal Development

cw key is closed. As the USB is actuated in cw, the frequency obtained at the RT-648/ARC-94 output is 1 kc above the frequency indicated on the C-3940/ARC-94 (selected frequency plus the 1-kc keying frequency). For data operation, the data equipment is connected to the RT-648/ARC-94 audio input terminals. The RT-648/ARC-94 is in the upper-sideband mode when the mode selector is positioned at DATA.

4-14. Much of the same circuitry used in the transmit mode is used in the receive mode. In USB, LSB, data, or cw modes, sideband signals are translated to audio frequencies in Radio Receiver-Transmitter RT-648/ARC-94 by identical methods. In the AM mode, the received signal is detected by a separate AM detector and is then fed to the RT-648/ARC-94 audio amplifiers. In all modes, a Selcal (selected calling) output is available from the AM detector.

4-15. The antenna coupler is necessary to match the antenna to the RT-648/ARC-94. The antenna coupler is not supplied as part of Radio Set AN/ARC-94.

4-16. GENERAL OPERATION OF RADIO SET AN/ARC-94.

4-17. Operation of Radio Set AN/ARC-94 includes a transmit function, a receive function, and a carrier generator function common to transmitting and receiving. These three functions will be discussed in block diagram form in the following paragraphs. Figure 4-4 is a block diagram of Radio Set AN/ARC-94. Principal intelligence signal flow is shown by heavy lines.

4-18. TRANSMIT FUNCTION.

4-19. GENERAL. The transmit function is detailed in figure 4-4. The transmit function includes an a-f input section, an i-f translator section, and an r-f translator section. The stages that comprise these sections are listed in table XIV.

4-20. The a-f input section provides coupling and amplification for the voice intelligence to be transmitted. The i-f translator section contains the circuitry for selecting the desired mode of operation (SSB, AM, data, or cw), and the stages that modulate and process the desired signal accordingly. The r-f translator section performs the final conversion step in translating the modulated signal information to the frequency band selected for transmission. The carrier generator function provides all the frequencies required for the double conversion transmit function. The carrier generator function also provides all the frequencies required for demodulating in the receive function. Tuning is carried out within the carrier generator function by means of an Autopositioner system.

4-21. A-F INPUT SECTION. An audio signal from the operator's microphone, fed into the 100-ohm unbalanced input, is amplified in audio amplifier stages A9Q1 and A9Q2 and applied to the balanced modulator in the i-f translator section. When a 600-ohm balanced audio input is used, the signal is preamplified by audio amplifier A9Q8 before being applied to A9Q1 and A9Q2.

4-22. When the transmitter is operating in the cw mode, a 1-kc audio signal is obtained from frequency divider module A1. This 1-kc signal is then fed from cw keying relay A9K1 to the audio input.

4-23. I-F TRANSLATOR SECTION. The audio signal from the a-f input section and a carrier signal from locked oscillators A2Q4 and A2Q8 in the carrier generator function are combined in the balanced modulator. The balanced modulator yields a suppressed carrier amplitude modulated output consisting of upper and lower sidebands. The balanced modulator output is fed to automatic load control A3Q1, which is controlled by a signal fed back from the power amplifier in the power amplifier section. The output level of the automatic load control stage is adjusted by the feedback voltage to maintain the

TABLE XIV. TRANSMIT FUNCTION SECTIONS AND STAGES

A-F INPUT SECTION	I-F TRANSLATOR SECTION (Cont)
Microphone (accessory)	I-f amplifier A3Q4
Audio amplifiers A9Q1, A9Q2	Transmitter gain control (tgc) amplifier A3Q6
Audio amplifier A9Q8	R-F TRANSLATOR SECTION
Cw keying relay A9K1	Transmit l-f mixer A12V1
I-F TRANSLATOR SECTION	Transmit 17.5-mc Mixer A12V2
	Transmit h-f mixer A12V3
	R-f amplifiers A12V4, A12V5
Balanced modulator (in module A3)	Drivers A12V6, A12V7
Automatic load control A3Q1	Power amplifier module A11
I-f amplifier A3Q2	Electronic control amplifier module A6
P/o mode selector (on C-3940/ARC-94)	Antenna coupler (accessory)
3-kc mechanical filters A3FL1, A3FL2	Transmitting antenna (accessory)

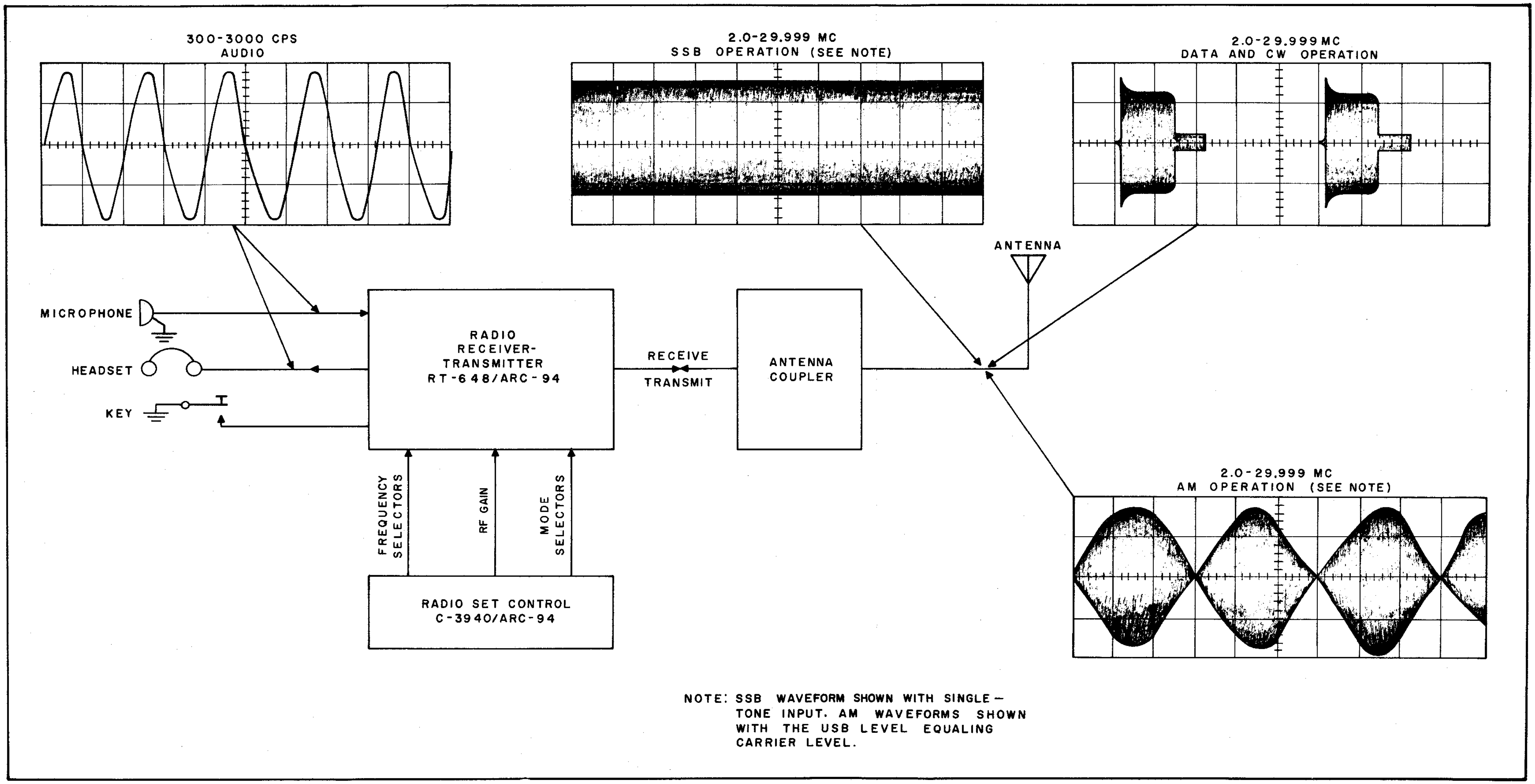


Figure 4-3. Radio Set AN/ARC-94, Block Diagram with Input and Output Waveforms

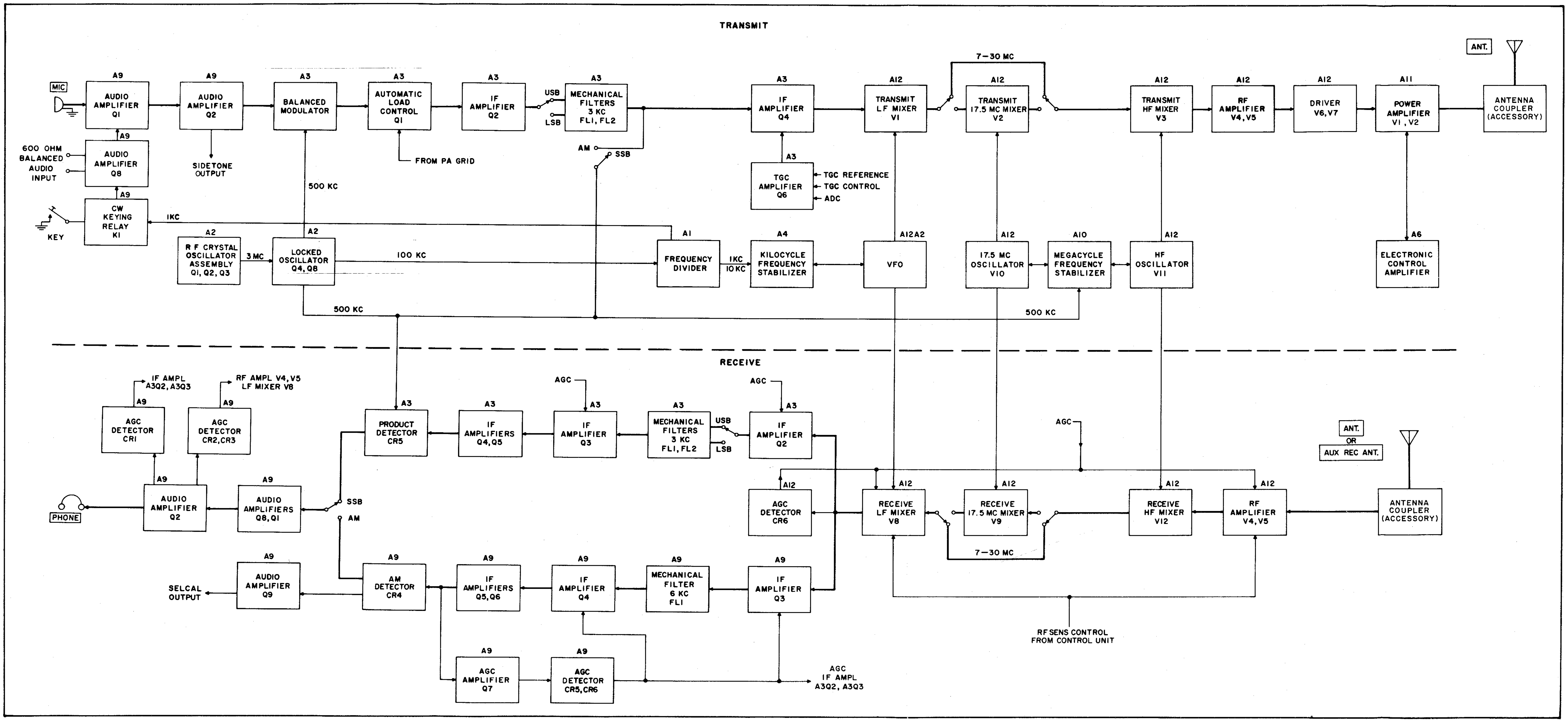


Figure 4-4. Radio Set AN/ARC-94, Functional Block Diagram

transmitter output at a predetermined level. From A3Q1, the signal is applied to A3Q2 through relay A3K5. The desired signal is then amplified by i-f amplifier A3Q2 and applied to the mode selector.

4-24. The mode selector provides the option of operating the AN/ARC-94 in either SSB, AM, data, or cw mode. In SSB mode, the further option of using USB or LSB is provided.

4-25. In AM mode, the double-sideband suppressed carrier signal is applied to 3-kc mechanical filter A3FL1, which passes only the upper sideband. A 500-kc carrier signal from the carrier generator function is reinserted into the upper sideband at the output of filter A3FL1.

4-26. In SSB mode, the carrier reinsertion capability is disabled. The double-sideband suppressed carrier output of A3Q2 is switched either to 3-kc mechanical filter A3FL1 or A3FL2, depending on the setting of the mode selector. Filter A3FL1 passes only the USB and A3FL2 passes only the LSB. The sideband not passed is suppressed. An intelligence consisting of a USB or LSB signal is then fed through relay A3K5 to i-f amplifier A3Q4.

4-27. The data and cw modes are similar in function to the SSB modes since USB is always used for data and cw operation.

4-28. The desired signal is amplified in A3Q4 and fed to transmit l-f mixer A12V1. Transmitter gain control amplifier A3Q6 controls the output transmission level by adjusting the gain of A3Q4 in accordance with control voltages provided in the form of a tgc control signal and an automatic drive control (adc) signal.

4-29. R-F TRANSLATOR SECTION. The desired signal is mixed in A12V1 with a preselected output from the variable frequency oscillator in the carrier generator function. The output circuit of A12V1 is tuned to the difference frequency of the two signal inputs to the mixer. The frequency range of the output signal from the transmit l-f mixer is 2.001 to 3.000 mc in 1-kc increments. If the selected output frequency of the AN/ARC-94 is to be in the range of 2.0 to 6.999 mc, the l-f mixer output signal is coupled to transmit 17.5-mc mixer A12V2. A signal is also applied to A12V2 from 17.5-mc oscillator A12V10. The output circuit of A12V2 is tuned to the difference frequency of the two signals to produce an output frequency in the range of 14.5 to 15.5 mc. If the selected output frequency of the AN/ARC-94 is to be in the 7.0- to 30.0-mc range, the output of A12V1 is coupled directly to A12V3. A signal is also applied to A12V3 from h-f oscillator A12V11. The difference frequency of the two input signals mixed in A12V3 is at the desired output frequency and is amplified by r-f amplifiers A12V4 and A12V5 and fed to drivers A12V6 and A12V7. The driver output is fed to power amplifiers A11V1 and A11V2.

4-30. POWER AMPLIFIER SECTION. The power amplifier is band-switched by the Autopositioner and tuned by a servo-driven inductance in electronic control amplifier module A6. The output of the power amplifier is designed for a 52-ohm unbalanced load and is applied to the transmitting antenna through an antenna coupler.

4-31. RECEIVE FUNCTION.

4-32. GENERAL. The receive function is detailed in the block diagram of figure 4-4. The receive function includes an r-f input section, a first and second conversion section, an SSB channel, an AM channel and an audio section. The stages that comprise these sections are detailed in table XV.

TABLE XV. RECEIVE FUNCTION SECTIONS AND STAGES

R-F INPUT SECTION	SSB CHANNEL (Cont)
Receiving antenna (accessory) Antenna coupler (accessory) R-f amplifier A12V4,* A12V5*	3-kc mechanical filters A3FL1,* A3FL2* I-f amplifiers A3Q3, A3Q4,* A3Q5 Product detector A3CR5
FIRST AND SECOND CONVERSION SECTION	AM CHANNEL
First Conversion Group Receive h-f mixer A12V12 Receive 17.5-mc mixer A12V9	I-f amplifier A9Q3 6-kc mechanical filter A8FL1 I-f amplifier A9Q4, A9Q5, A9Q6 Agc amplifier A9Q7 Agc detectors A9CR5, A9CR6 AM detector A9CR4
Second Conversion Group Receiver l-f mixer A12V8 Agc detector A12CR6	AUDIO SECTION
SSB CHANNEL	
I-f amplifier A3Q2* P/o mode selector switch (on C-3940/ARC-94)	Audio amplifiers A9Q8,* A9Q1,* A9Q2* Audio amplifier A9Q9 (for Selcal) Agc detectors A9CR2, A9CR3, A9CR1 Headset phone (accessory)
*Stages common to transmit function. Refer to paragraph 4-35.	

4-33. The r-f input section receives the desired signal broadcasted by the remote station. The signal is amplified and sent to the first and second conversion sections, where a double conversion is performed to bring the signal to the desired intermediate frequency. In SSB, data, and cw modes, the AM channel is disabled and the desired signal is brought to the SSB channel. After being amplified to a suitable level, the desired SSB signal is demodulated in a product detector. The resultant audio signal is amplified in the audio section and applied to headset phones.

4-34. In AM mode, the SSB channel is disabled and the desired signal is brought to the AM channel. In the AM channel, a standard AM detector is used to demodulate the signal. All other functions are similar to what occurs in the SSB channel.

4-35. STAGES COMMON TO TRANSMIT AND RECEIVE FUNCTIONS. The receive function of the AN/ARC-94 uses many stages in common with the transmit function. The common stages are noted with an asterisk in the stage breakdown of table XV. Function selection is controlled by the operator with a push-to-talk switch. When the switch is operated, the transmit function is actuated. At all other times the receive function is actuated. A relay operated switching system shifts the assignments of the common stages between transmit and receive functions as required.

4-36. R-F INPUT SECTION. The r-f input section receives the desired signal from a remote station. The impedance of the antenna is matched to that of r-f amplifiers A12V4 and A12V5 by a suitable coupler device to ensure maximum energy transfer. The r-f amplifiers step up the received signal and apply it to receive h-f mixer A12V12 in the first conversion group. R-f gain is manually adjustable from the C-3940/ARC-94. The r-f amplifiers are also under agc system control.

4-37. FIRST AND SECOND CONVERTER SECTION. The output of A12V4 and A12V5 is fed to receive A12V12 where it is mixed with the signal from h-f oscillator A12V11 in the carrier generator section. The output of A12V12 is coupled to receive 17.5-mc mixer A12V9 if the operating frequency is in the range of 2.0 to 6.999 mc. It is coupled to receive l-f mixer A12V8 if the operating frequency is in the range of 7.0 to 30.0 mc. The output from A12V8 is a 500-kc i-f signal. The 500-kc i-f signal is fed to either the SSB or AM channels.

4-38. SSB CHANNEL AND AM CHANNELS. In SSB mode, the 500-kc i-f signal is applied to one of two mechanical filters, A3FL1 or A3FL2. Each mechanical filter has a bandwidth of 2.7 kc. One filter passes the upper sideband, and the other passes the lower sideband. The appropriate filter is selected at the mode selector on the C-3940/ARC-94. The filter output is amplified in i-f amplifiers A3Q3, A3Q4, and A3Q5. The output of A3Q5 is applied to product detector A3CR5 which recovers the audio signal.

4-39. In AM mode, the output of A12V8 is fed to i-f amplifier A9Q3 for amplification and is coupled to 6-kc mechanical filter A9FL1. The signal is then fed to three more i-f amplifers, A9Q4, A9Q5, and A9Q6. The output of A9Q6 is fed to diode detector A9CR4 which recovers the audio signal and applies it to the audio section.

4-40. AUDIO SECTION. In either channel, the desired audio signal is amplified in audio amplifiers A9Q1, A9Q8, and A9Q2, and fed to the operator's headset. Selcal (selective calling) signals detected in AM detector A1CR4 are fed to audio amplifier A9Q9 and are coupled to the rear connector of the RT-648/ARC-94. Selcal signals are detected in all modes of operation.

4-41. CARRIER GENERATOR FUNCTION.

4-42. GENERAL. The carrier generator function is detailed in the block diagram of figure 4-4. The carrier generator function includes r-f oscillator A2, frequency divider A1, kilocycle-frequency stabilizer A4, variable frequency oscillator (vfo) A12A2, 17.5-mc oscillator A12V10, megacycle-frequency stabilizer A10, and h-f oscillator A12V11.

4-43. FREQUENCY GENERATION AND STABILIZATION. The AN/ARC-94 transmits and receives on every 1-kc increment from 2.000 to 29.999 mc. This provides 28,000 possible separate operating frequencies. The operating frequency is selected at the C-3940/ARC-94. The 100-kc, 10-kc, and 1-kc frequency selector knobs on the C-3940/ARC-94 actuate Autopositioner A12A1. The Autopositioner mechanically tunes variable frequency oscillator A12A2 over the range from 2.501 to 3.500 mc in 1000 1-kc increments. The megacycle frequency selector knob on the C-3940/ARC-94 controls a motor in r-f translator module A12. This motor switches tuning elements which tune h-f oscillator A12V11 to one of 28 different frequencies. The h-f oscillator, in conjunction with 17.5-mc oscillator A12V10, provides 28 1-mc bands for each of the 1000 1-kc increments from variable frequency oscillator A12A2.

4-44. Megacycle-frequency stabilizer module A10 stabilizes the frequency of A12V10 and A12V11 by comparing each oscillator frequency with the frequency of a spectrum point derived from the 500-kc output of r-f oscillator module A2. The coarse frequency of A12V11 is controlled by the motor in r-f translator module A12. The frequency range of A12V11 is 8.5 to 32.0 mc. The output of A12V11 is tuned to the second harmonic of the fundamental oscillator frequency when the selected operating frequency of the RT-648/ARC-94 is in the range of 14.0 to 29.999 mc. This signal is coupled to transmit h-f mixer A12V3, and to receive h-f mixer A12V12.

4-45. The extremely high stability of the AN/ARC-94 operating frequency is obtained by basing frequency control of the entire RT-648/ARC-94 on the frequency of a very stable crystal oscillator located in r-f oscillator module A2. Frequency stability of this crystal oscillator is assured by utilizing a temperature-compensating network.

4-46. The h-f and 17.5-mc oscillators are frequency locked, and the variable frequency oscillator is phase locked to the crystal generated reference frequency by circuits in the megacycle- and kilocycle-frequency stabilizer modules. The i-f injection frequency is derived from the crystal oscillator. The RT-648/ARC-94 operating frequency is thus held accurate within ±0.8 part per million per month from -40°C (-40°F) to +75°C (+167°F).

4-47. DETAILED OPERATION OF RADIO SET AN/ARC-94.

4-48. The following paragraphs describe the operation of Radio Set AN/ARC-94 on an assembly (module) basis. Operation of Radio Set Control C-3940/ARC-94 and the mechanical portion of module A12 is discussed in paragraph 4-169.

4-49. RADIO RECEIVER-TRANSMITTER RT-648/ARC-94 CHASSIS-MOUNTED CIRCUITS.

4-50. Radio Receiver-Transmitter RT-648/ARC-94 chassis-mounted circuits (figure 7-1) perform power distribution, keying, transmit/receive switching, sidetone, and recycle functions.

4-51. POWER DISTRIBUTION CIRCUITS. The power distribution circuits (figure 7-1) are activated when the mode selector on the C-3940/ARC-94 is switched from OFF to any other position. A 400-cycle interlock relay, K9, located in the power distribution circuit permits the RT-648/ARC-94 to operate only when 115 volts at 400 cycles and 27.5 volts dc are applied from the power supplies to the relay.

4-52. Relay K10 (figure 7-1) is an 18-volt delay relay that removes transistor supply voltages from kilocycle-frequency stabilizer module A4 to make it inoperative during the tuning cycle. This action allows the variable frequency oscillator to be mechanically tuned by the Autopositioner to approximately the correct frequency before the phase-locking action of module A4 is begun. Q1 and its associated circuitry in series with the coil of relay K10, delays the energizing of relay K10 for approximately 1/2 second after 130 volts dc is applied to prevent the kilocycle-frequency stabilizer from phase-locking the variable frequency oscillator with an incorrect spectrum point.

4-53. KEYING CIRCUITS. A simplified schematic diagram of the RT-648/ARC-94 keying circuits is shown in figure 4-5. When the RT-648/ARC-94 is keyed, the keying circuits actuate the stages that must operate if the RT-648/ARC-94 is to transmit, while disabling receiver circuits that would interfere with transmission. When the key is released the keying circuits operate to switch off the transmitter and switch common stages from the transmit to the receive function.

4-54. SIDETONE CIRCUITS. Figure 4-6 is a simplified schematic diagram of the RT-648/ARC-94 sidetone circuits. The sidetone signal is taken from audio amplifier stage A9Q2 to provide audio monitoring in the transmit mode. The audio signal from the audio amplifier is fed through keying relay K3 in the sidetone level adjust network and sidetone relay K6 to the audio output.

4-55. A combination of two voltages is used to energize the sidetone relay. One voltage is derived from the r-f output of power amplifier module A11. This r-f output is rectified by rectifiers CR1 and CR2, filtered by capacitor C12, and applied to the sidetone relay coil. The second voltage, from three-phase high-voltage power supply module A7, is proportional to the power amplifier plate current. This voltage is the same one used for tgc control in i-f translator module A3. To energize the sidetone relay, sufficient plate current and plate voltage swing must be present in the power amplifier. Capacitor C5 is placed across the coil of the sidetone relay to keep the relay energized in the sideband transmit mode when the plate current varies with the applied audio signal.

4-56. RECYCLE CIRCUITS. Figure 4-7 is a simplified schematic diagram of the recycle circuits activated when any of the frequency selector knobs on the C-3940/ARC-94 are turned. When any Autopositioner operates, recycle relay K4 is energized. This relay remains energized so long as any tuning motor in the RT-648/ARC-94 is operating. Recycle relay K4 has the following functions:

a. Disconnects transistor supply voltage to the audio amplifier in order to mute the audio during the tuning cycle.

b. Provides a ground to activate the antenna tuner.

c. Interrupts the operation of kilocycle-frequency stabilizer module A4 during the tuning cycle.

d. Disconnects the keying so that the transmitter cannot be keyed during the tuning cycle.

4-57. FREQUENCY DIVIDER MODULE A1.

4-58. The theory of operation for frequency divider module A1 includes a block diagram analysis, a discussion of the generation and untilization of frequency spectra, and a detailed circuit analysis.

4-59. Frequency divider module A1 transforms a 100-kc sine-wave input from r-f oscillator module A2 to a 10-kc pulse and a 1-kc spectrum centered a 550 kc. These outputs are used for frequency stabilization in kilocycle-frequency stabilizer module A4. It also provides a 1-kc signal for cal tone and sidetone.

4-60. THEORY OF OPERATION.

4-61. BLOCK DIAGRAM ANALYSIS. A block diagram of frequency divider module A1 is shown in figure 4-8. A 100-kc input from r-f oscillator module A2 is applied through emitter-follower amplifier Q1 to locked oscillator Q2. The locked oscillator divides the signal by two to produce a 50-kc output. This output is fed through emitter-follower Q3 to locked oscillator Q4, where the signal is divided by five to produce a 10-kc output. The 10-kc signal is differentiated to produce a pulse which is inverted by pulse inverter Q5 and triggers blocking oscillator Q6. The 10-kc pulse output of the blocking oscillator is applied through a transformer to the connector plug.

4-62. Part of the 10-kc output of locked oscillator Q4 is applied through isolation amplifier Q7 to locked oscillator Q8. Oscillator Q8 divides the frequency by two, and the 5-kc output is used to switch saturated amplifier Q9, which produces a positive square wave. The square waves are applied to unijunction divider Q10, which divides the frequency by five to produce a 1-kc pulse output. The pulse is amplified in pulse amplifier Q11 and triggers a monostable multivibrator composed of transistors Q12 and Q13. The multivibrator output turns keyed oscillator Q14 on and off at a 1-kc rate. Since the free-running frequency of the oscillator is 550 kc, the oscillator output is a 1-kc spectrum centered around 550 kc. The 10-kc pulse and 1-kc spectrum outputs of frequency divider module A1 are applied to kilocycle-frequency stabilizer module A4.

4-63. FREQUENCY SPECTRA. The spectra used in the RT-648/ARC-94 frequency stabilization circuits are a series of discrete frequencies or spectrum points, spaced at equal intervals over a frequency range. These spectra are produced by creating pulses of a certain frequency. A pulse with a repetition rate of exactly 1 kc, for example, is composed of a series of sine waves in which each frequency is spaced exactly 1 kc from the others. The amplitudes of these spectrum points decrease as separation from the fundamental frequency increases.

4-64. Each spectrum point frequency has exactly the same frequency stability and phase relation as the fundamental. The spectrum points can be used as injection frequencies or reference frequencies in the frequency stabilization circuits, since they are generated by pulses derived from the crystal oscillator in r-f oscillator module A2.

4-65. In some instances, spectrum points far away from the fundamental frequency must be used. The amplitude of these points is too small to be used directly. When the 1-kc spectrum points around 550 kc are needed, for example, the amplitude of these points can be increased in the following way. The fundamental 1-kc pulse is used to sychronize a monostable multivibrator with a 1-kc rectangular pulse output. This pulse keys a free-running oscillator on and off at a 1-kc rate. The keyed oscillator is tuned to the frequency about which the spectrum points are to be used, in this case 550 kc. The oscillator output is a series of spectrum points at 1-kc intervals, with the maximum amplitude spectrum point appearing at 550 kc. This action takes place in stages Q12 through Q14 of the frequency divider module.

4-66. It is not necessary for the free-running frequency of the keyed oscillator to be exactly 550 kc. The oscillator frequency merely determines the frequency where the amplitude of the spectrum frequencies is greatest.

4-67. DETAILED CIRCUIT ANALYSIS. A schematic diagram of the frequency divider module is shown in figure 7-2. The 100-kc input is capacity coupled to emmitter-follower Q1 from resistor R1 which provides a load to the r-f oscillator (figure 7-2). Transistor Q1 provides a low-impedance source to locked oscillator Q2. The frequency of the locked oscillator is controlled by a tuned circuit consisting of capacitors C3, C4, and C5, and variable inductor L1. The output tank circuit is tuned to one-half the input frequency, and results in the 50-kc output frequency.

4-68. The 50-kc output of locked oscillator Q2 is capacity coupled to emitter-follower Q3. The emitter-follower output is now applied to locked oscillator Q4, where the signal frequency is divided by five. The 10-kc output is determined by the tuned circuit consisting of capacitors C7, C8, and C9, and variable inductor L2. One 10-kc output of locked oscillator Q4 is differentiated by capacitor C10 and resistor R14 to produce a 10-kc pulse. The pulse is inverted as it passes through pulse inverter Q5, and triggers blocking oscillator Q6. The output of the blocking oscillator is coupled through transformer T1 to pin A1 on output plug P1.

4-69. The 1-kc spectrum is produced by applying the second 10-kc output of locked oscillator Q4 to isolation amplifier Q7. The signal is amplified and capacity coupled to locked oscillator Q8. The frequency of the oscillator is controlled by the tuned network composed of capacitors C14, C15, C16, and C17, and variable inductor L4. Locked oscillator Q8 divides the signal frequency by two. The 5-kc output of the locked oscillator is applied to switch Q9, which is a saturated amplifier. The input signal switches transistor Q9 on, and capacitors C22 and C45, in parallel, and C23 charge through resistor R28. When transistor Q9 is switched off, capacitors C22 and C45 discharge through diode CR3 and resistor R27. Capacitor C23 cannot discharge because of diode CR4. As a result, each square wave pulse charges capacitor C23 to a higher voltage.

4-70. The parallel combination of capacitors C22 and C45 determine how much voltage is added to capacitor C23 during each cycle. Capacitor C23 is connected to the input of divider Q10, a unijunction transistor. A unijunction transistor shorts its input to ground when the applied voltage exceeds a certain value. Thus when the voltage across capacitor C23 becomes high enough, the capacitor discharges through transistor Q10, producing a positive pulse at the output of that transistor. The value of capacitor C45 is such that C23 reaches its discharge value at every fifth cycle of the input signal.

4-71. The 5-kc square-wave input to transistor Q10 produces a 1-kc pulse output. The pulse is amplified by pulse amplifier Q11, and triggers monostable multivibrators Q12 and Q13. The multivibrator output turns keyed oscillator Q14 on and off at a 1-kc frequency and also provides a 1-kc signal for cal tone and sidetone. The free-running 550-kc frequency of the keyed oscillator is determined by the tuned circuit composed of capacitors C30 and C31 in parallel, C32, and variable inductor L7. The output of keyed oscillator Q14 is a 1-kc spectrum centered around 550 kc. The spectrum is supplied to pin A1 of the module connector.

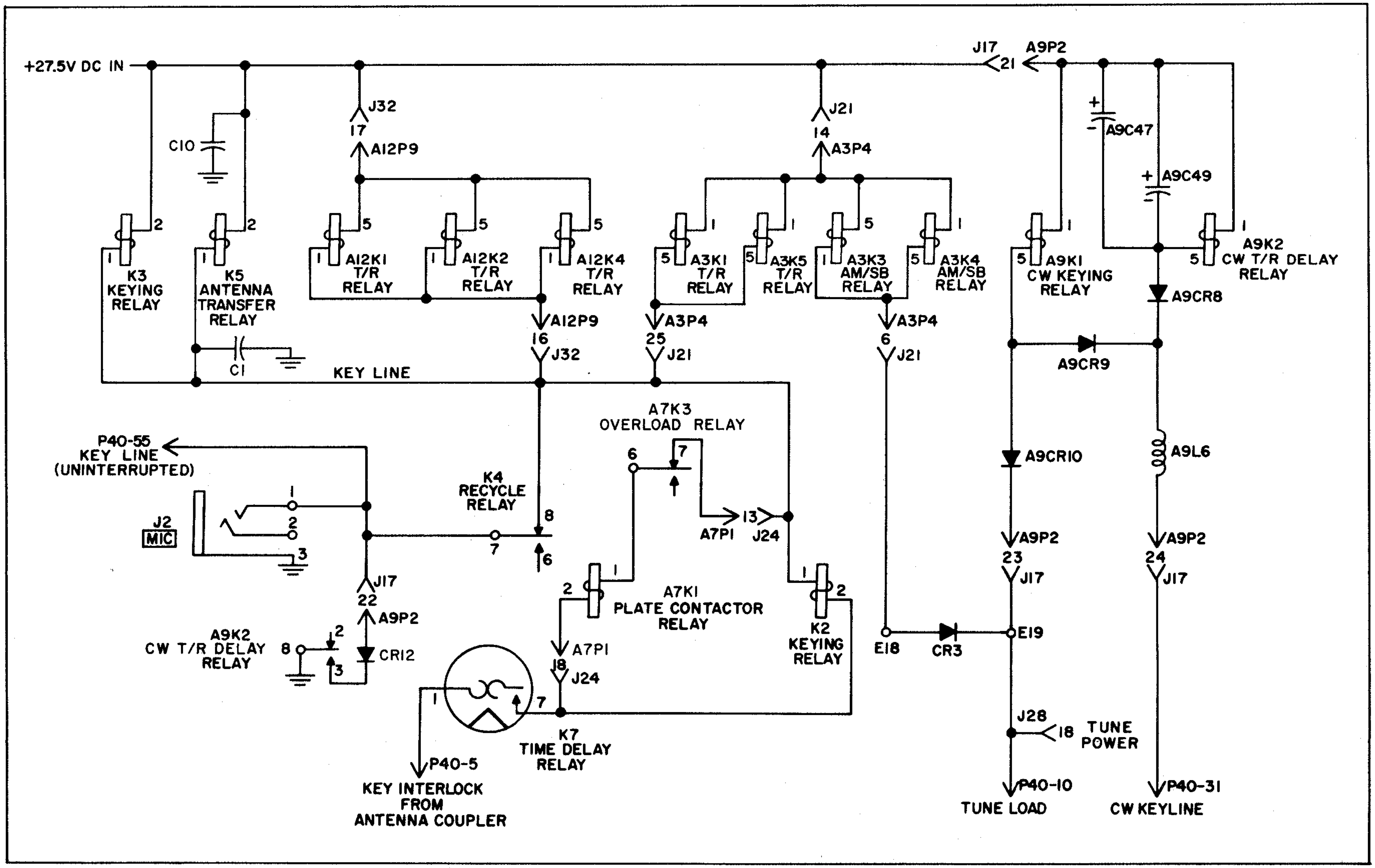


Figure 4-5. Keying Circuits, Simplified Schematic Diagram

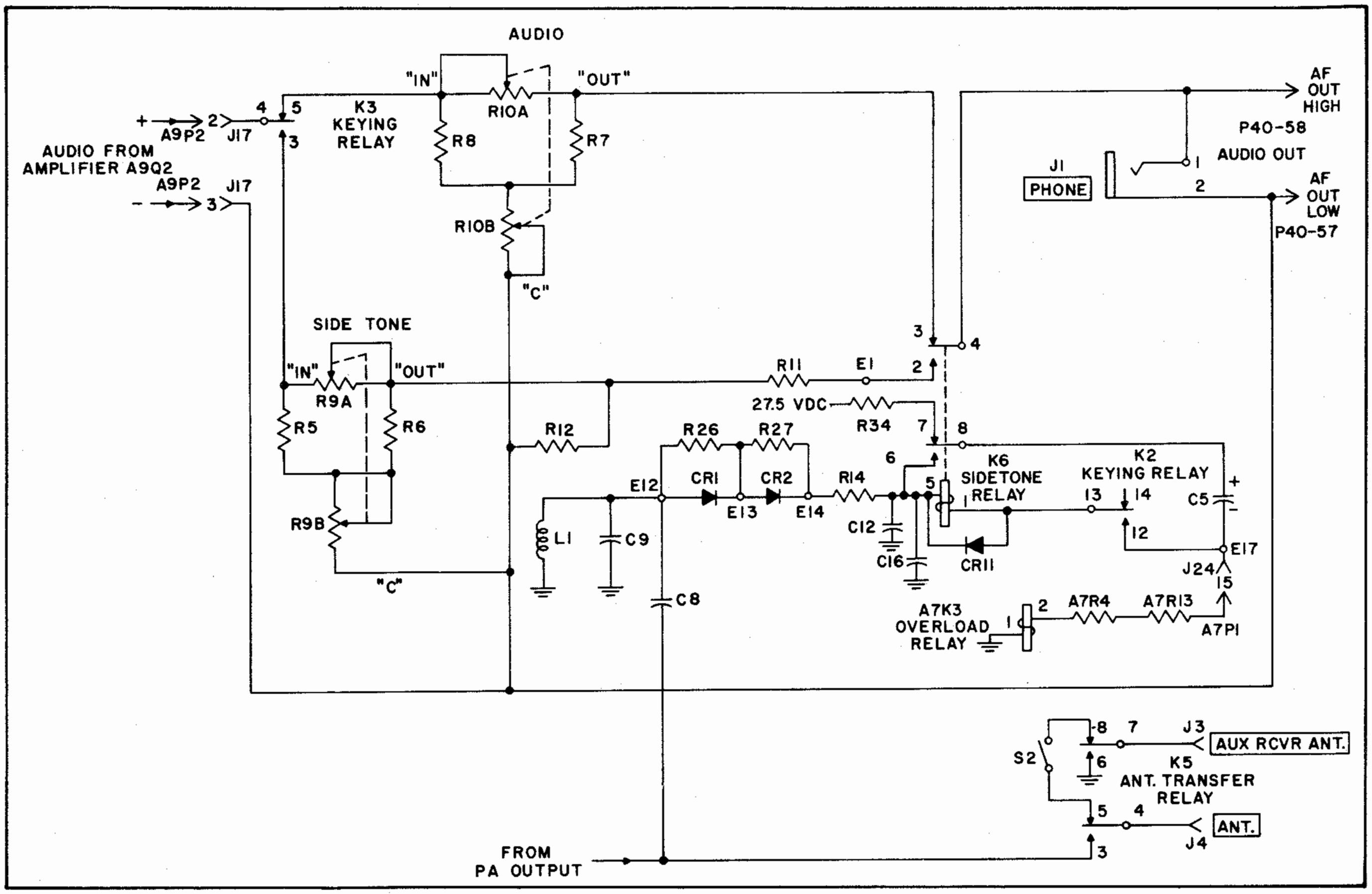


Figure 4-6. Sidetone Circuits, Simplified Schematic Diagram

4-72. R-F OSCILLATOR MODULE A2.

4-73. R-f oscillator module A2 generates stable 500-kc signals for use as an intermediate frequency and as a reference frequency by megacycle-frequency stabilizer module A10. The r-f oscillator module also supplies a 100-kc signal to frequency divider module A1.

4-74. A theory of operation is provided for r-f oscillator module A2. The theory of operation includes a block diagram and a detailed circuit analysis.

4-75. THEORY OF OPERATION.

4-76. BLOCK DIAGRAM ANALYSIS. A block diagram of r-f oscillator module A2 is shown in figure 4-9. The 3-mc signal generated by the temperature-compensated oscillator assembly is applied to locked oscillator Q4. The locked oscillator divides the 3-mc frequency by six to produce a 500-kc output. This 500-kc output is applied to 500-kc amplifier Q5 and to emitter-follower Q7. The output of amplifier Q5 is applied to megacycle-frequency stabilizer module A10 and to 500-kc amplifier Q6. The output of amplifier Q6 is applied to i-f translator module A3.

4-77. Emitter-follower Q7 isolates locked oscillator Q8 from preceding circuit stages. The 500-kc signal from emitter-follower Q7 is applied to locked oscillator Q8. The oscillator divides the 500-kc signal by five and produces a 100-kc output signal. The output is amplified by 100-kc amplifier stage Q9 and applied to frequency divider module A1.

4-78. DETAILED CIRCUIT ANALYSIS. A schematic diagram of r-f oscillator module A2 is shown in figure 7-3. The temperature-compensated crystal oscillator assembly corrects for the variations in frequency due to temperature changes of a quartz crystal. The output of the oscillator is applied to locked oscillator Q4 through a length of coaxial cable. Transistor Q4 is located on the opposite side of the module from the oscillator assembly and in the right-hand compartment. The frequency of the locked oscillator is controlled by a tuned circuit consisting of capacitors C13 through C16 and inductor L3. The circuit is tuned to one-sixth the crystal oscillator frequency, or 500 kc. The 500-kc output of locked oscillator Q4 is tapped from a voltage divider consisting of capacitors C15 and C16, and applied to the base of 500-kc amplifier Q5. Capacitors C15 and C16 also function as an impedance matching network. The output of locked oscillator Q4 is also applied to the base of emitter-follower Q7 through a length of coaxial cable. Transistor Q7 is located in the left-hand compartment on the opposite side of the module from the oscillator assembly.

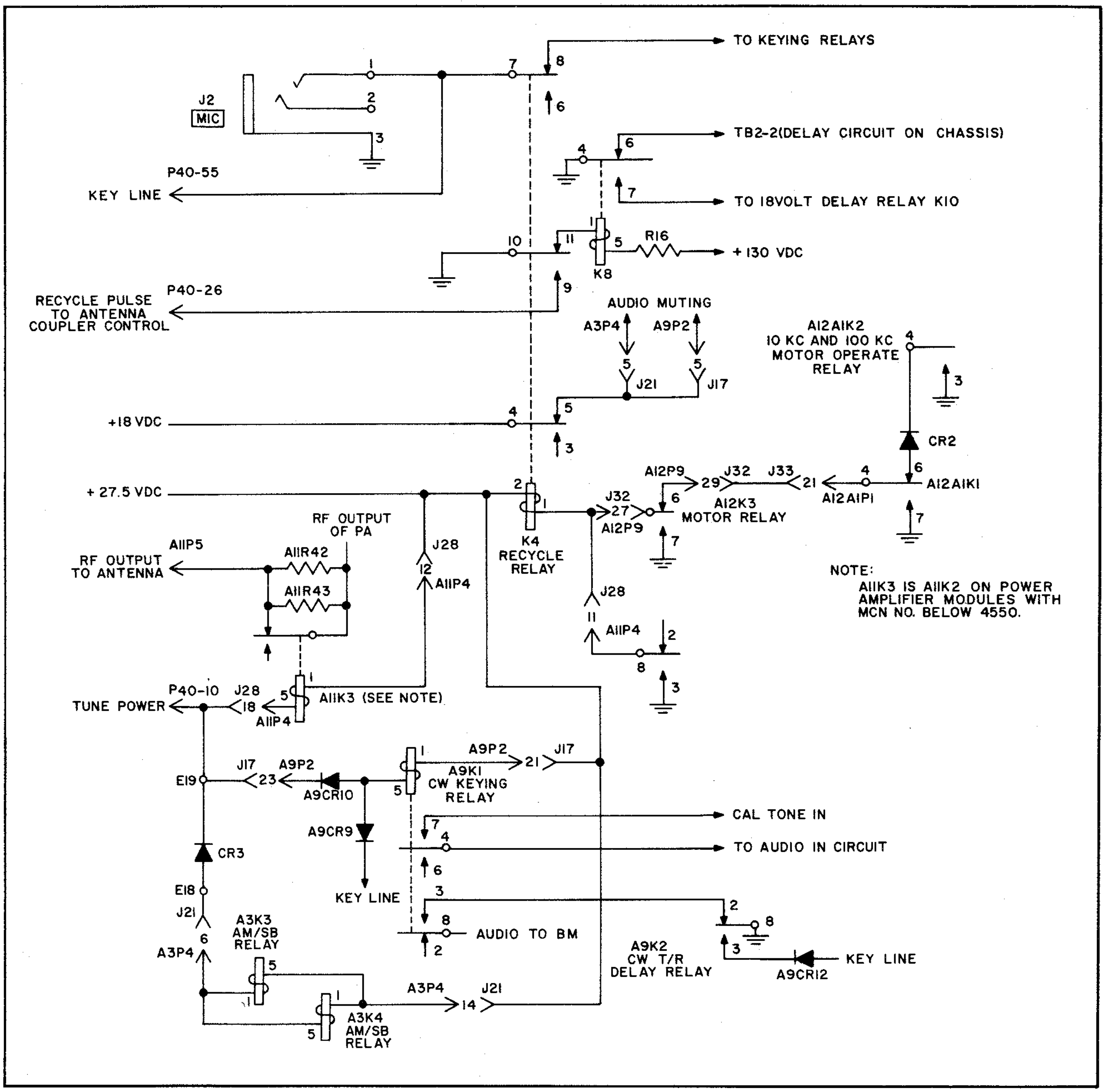


Figure 4-7. Recycle Circuits, Simplified Schematic Diagram

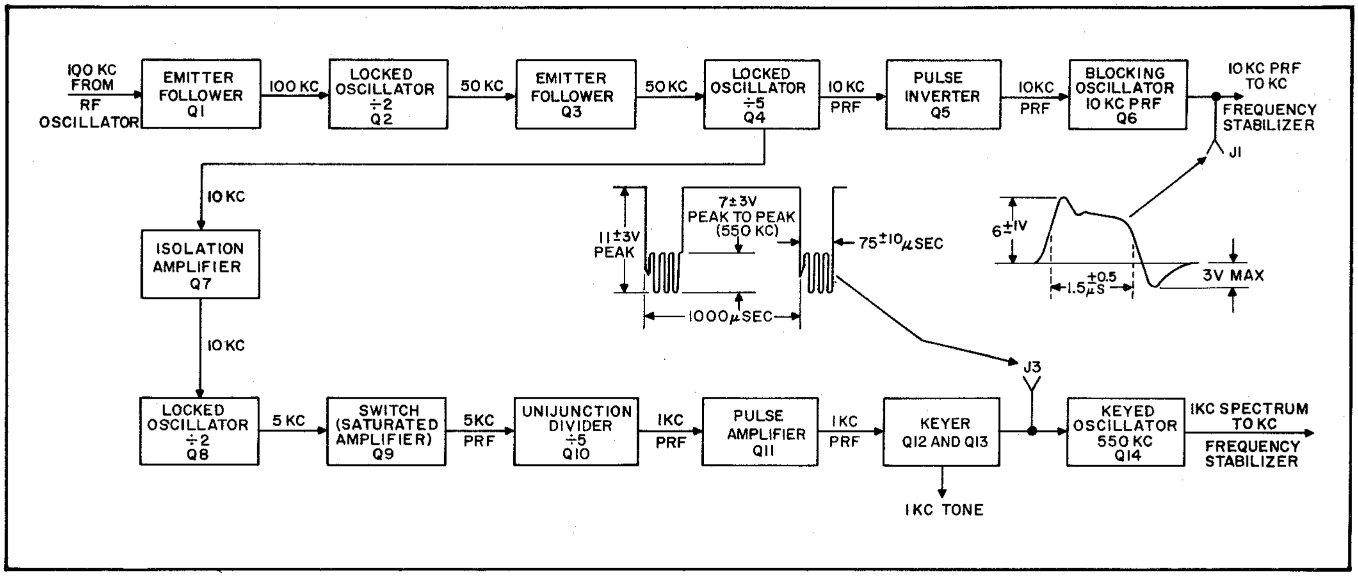


Figure 4-8. Frequency Divider Module A1, Block Diagram

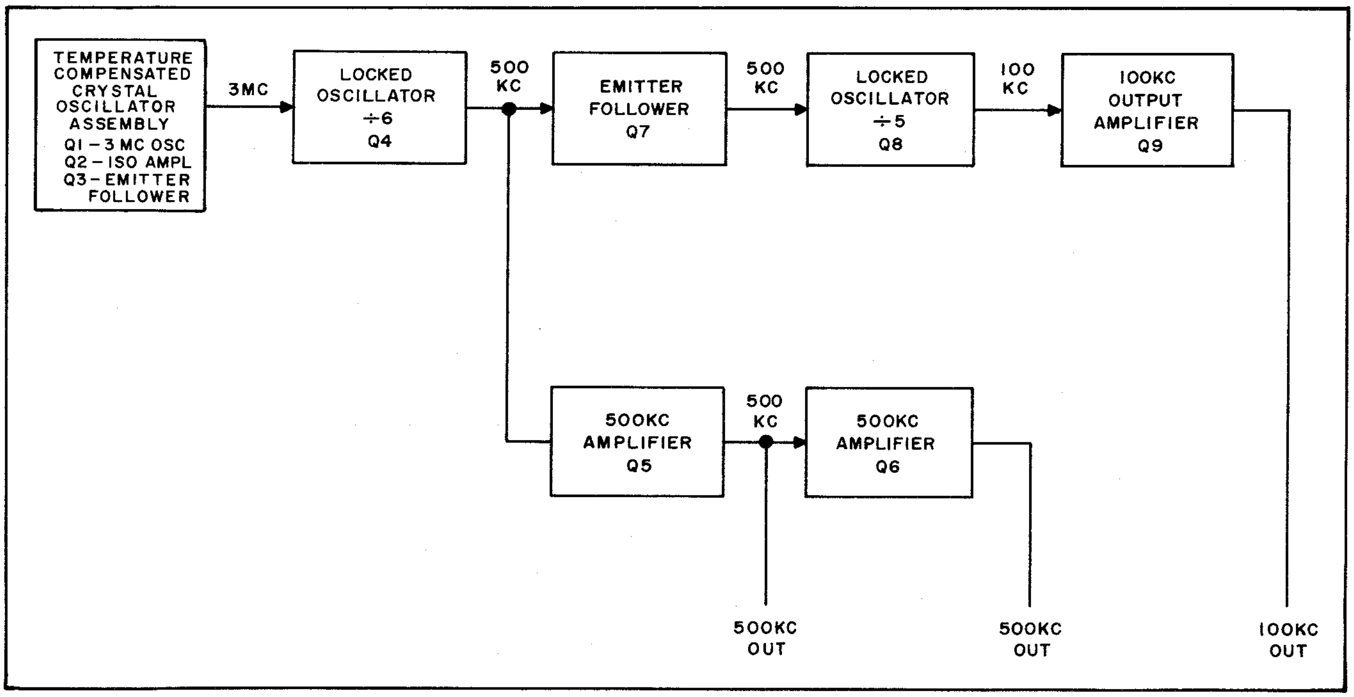


Figure 4-9. R-F Oscillator Module A2, Block Diagram

4-79. The 500-kc signal from locked oscillator Q4 is amplified by 500-kc amplifier Q5 and applied to jack J14A3 in megacycle-frequency stabilizer module A10. The output of 500-kc amplifier Q5 is also applied to 500-kc amplifier Q6 where it is further amplified and applied to jack J20 in i-f translator module A3.

4-80. The output of emitter-follower Q7 is applied to the base of locked oscillator Q8. Locked oscillator Q8 functions in the same manner as locked oscillator Q4. Oscillator Q8, however, is tuned to one-fifth the input frequency (500 kc) so that its output is 100 kc. The 100-kc signal is tapped from a voltage divider consisting of capacitors C30 and C31 and applied to the base of 100-kc amplifier Q9. The 100-kc signal is amplified and applied to jack J15A2 in frequency divider module A1.

4-81. I-F TRANSLATOR MODULE A3.

4-82. GENERAL.

4-83. I-f translator module A3 (figure 4-10) functions in both transmit and receive modes. In the transmit mode, i-f translator module A3 generates a 500-kc SSB, AM, data or cw signal. The i-f translator contains SSB i-f amplifiers and a product detector which functions when in the receive mode.

4-84. A theory of operation is provided for i-f translator module A3. The theory of operation includes a block diagram and a detailed circuit analysis.

4-85. THEORY OF OPERATION.

4-86. BLOCK DIAGRAM ANALYSIS. Figure 4-10 is a block diagram of i-f translator module A3. When the RT-648/ARC-94 is in the transmit mode, the amplified audio signal from AM/audio amplifier module A9 is combined with a 500-kc signal from r-f oscillator module A2 in balanced modulator A9CR1. The balanced modulator output signal is fed through transformer T1 to automatic load control amplifier Q1. The Q1 output is fed through relay K5 and is further amplified by i-f amplifier Q2, and fed to sideband relay K2. This relay, controlled by the mode selector at the C-3940/ARC-94, switches the double sideband so that it passes either through upper-sideband filter FL1 or lower-sideband filter FL2. When the mode selector is set to AM, the upper-sideband filter is used and a 500-kc carrier frequency is reinserted at the filter output. The filter output passes through relay K5 and is amplified by i-f amplifier Q4. During transmit, i-f amplifier Q3 is not required and is bypassed by relay K5. Stage Q4 is the transmitter gain control and automatic drive control stage. The gain of transmitter gain control stage Q4 is controlled by the output of d-c amplifier Q6.

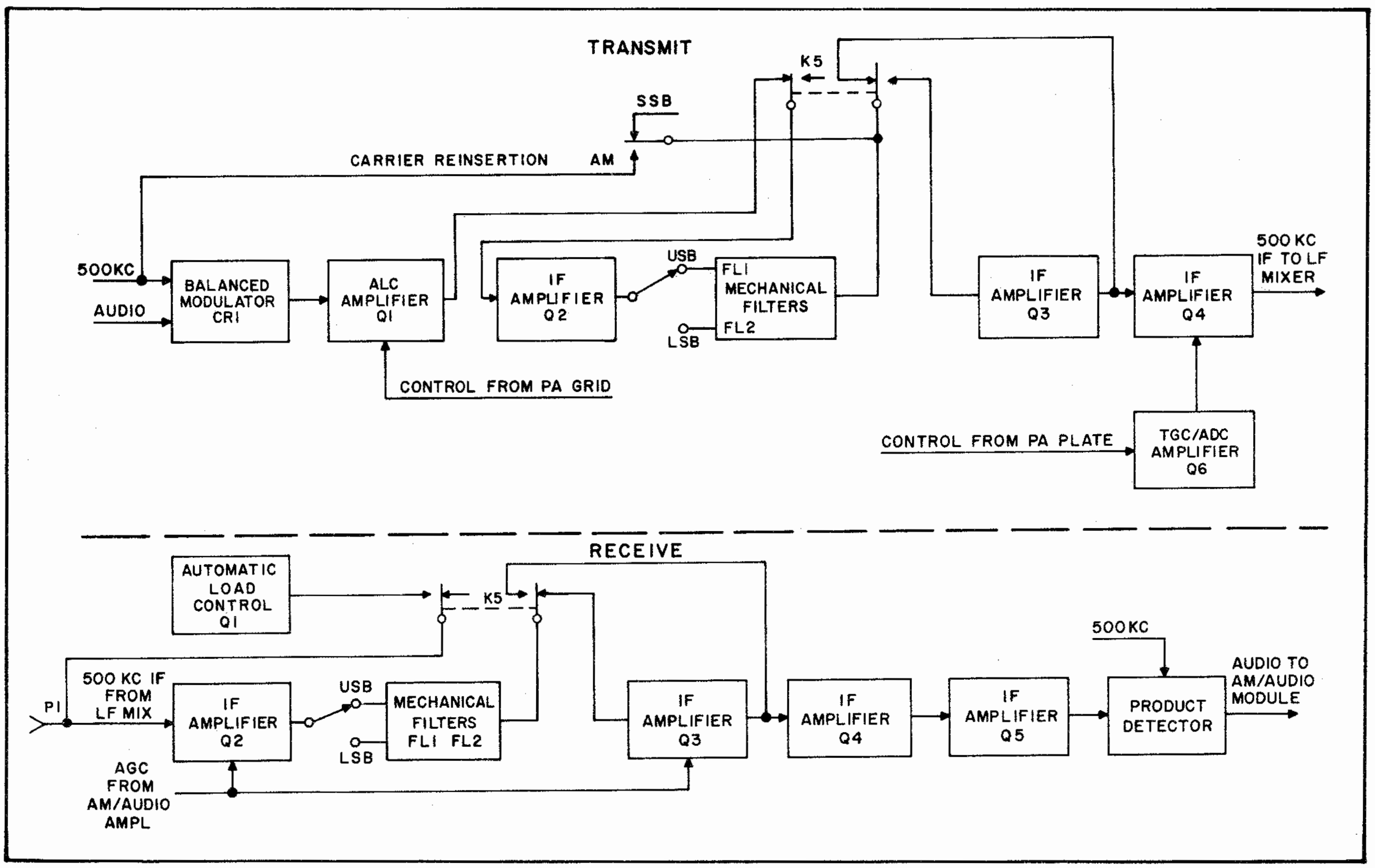


Figure 4-10. I-F Translator Module A3, Block Diagram

4-87. When the RT-648/ARC-94 is in the receive mode, the 500-kc i-f SSB signal from r-f translator module A12 is fed through i-f amplifier Q2 to the sideband mechanical filters. The filter that passes the sideband being received is switched into the circuit by the C-3940/ARC-94. The filter output is further amplified by i-f amplifiers Q3 through Q5, and then fed to the product detector.

4-88. DETAILED CIRCUIT ANALYSIS. Figure 7-4 is a schematic diagram of i-f translator module A3.

4-89. Balanced modulator A9CR1 (figure 4-11) is a diode chopper that reverses polarity of the audio input signal at a 500-kc rate. The 500-kc voltage switches the diodes on and off so that the audio input follows circuits as shown in (A) and (B), figure 4-11, on successive half cycles. The 500-kc switching voltage is approximately 10 times larger than the audio, so that audio voltage peaks do not switch the diodes.

4-90. The switching action of the diodes causes equal 500-kc currents to flow in opposite directions through primary winding transformer T1. The sum of the equal, opposite currents in the winding is zero. The 500-kc carrier component is balanced out of the modulator output. The diodes in the modulator circuit are matched. The forward resistances of the diodes in the two biased-on conditions, (A) and (B), figure 4-11, are equal. Resistor R9 and capacitor C9 are adjustable so that the currents can be balanced even more closely. Thus, the currents flowing through the diodes on successive half cycles are equal. Capacitors C6 and C9 overcome the effects of distributed capacitance in the modulator circuit. The balanced modulator output with a single-tone audio input signal is shown in (D), figure 4-11.

4-91. Automatic load control amplifier Q1 (figure 4-12) is biased by voltages taken from the power amplifier bias supply in power amplifier module A11. Resistor A11R1 in power amplifier module A11 is common to the grid circuit of the power amplifiers and the emitter-base circuit of the automatic load control amplifier. When the grids of the power amplifier are overdriven, grid current flows through resistor A11R1. The voltage drop across resistor A11R1 reduces the emitter current in the automatic load control amplifier.

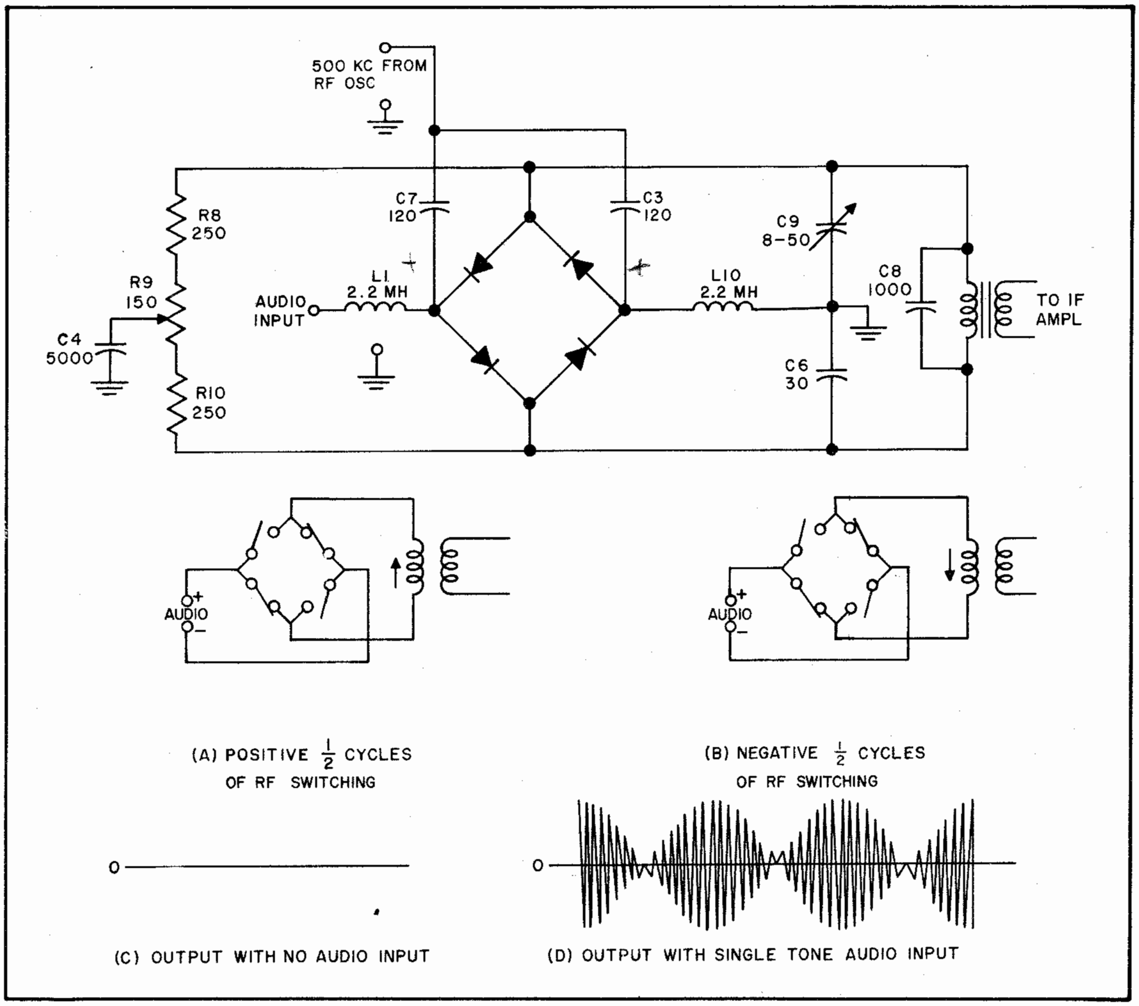


Figure 4-11. Balanced Modulator, Simplified Schematic Diagram

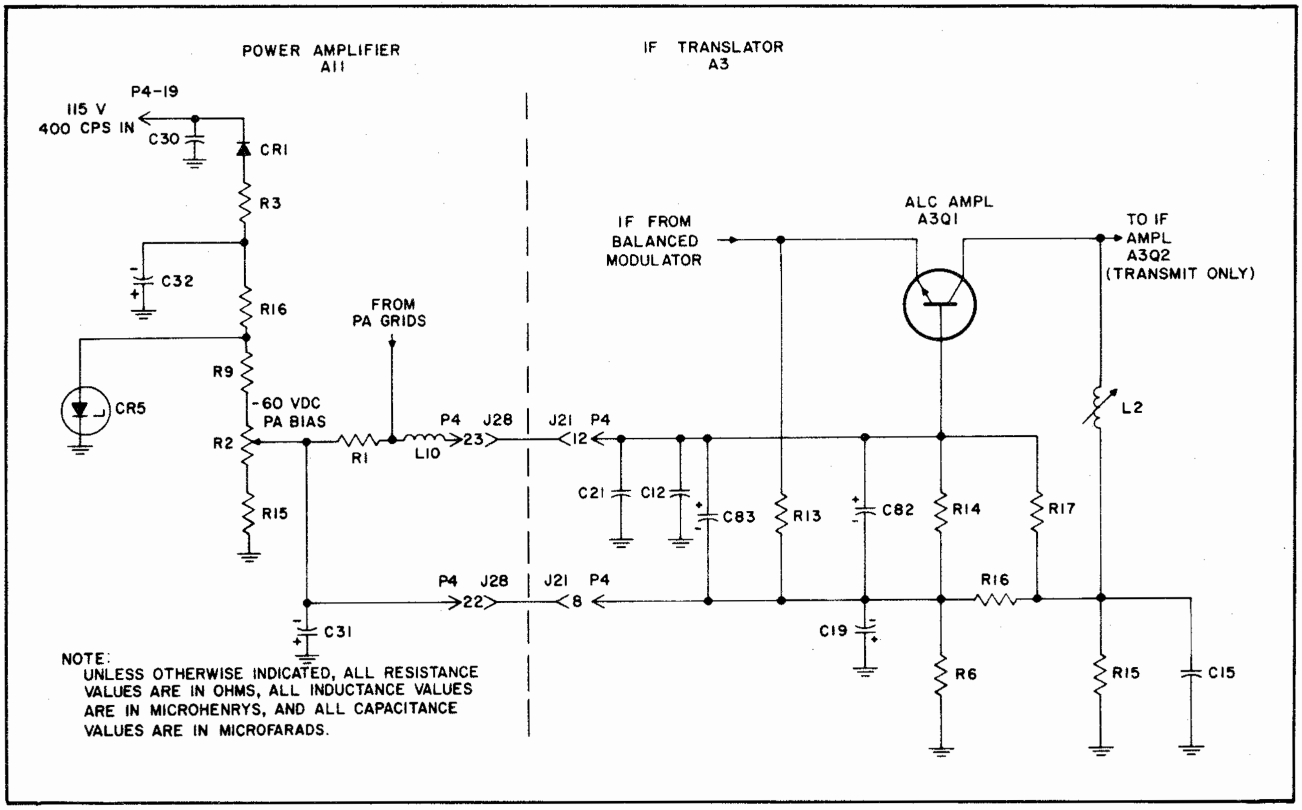


Figure 4-12. Automatic Load Control, Simplified Schematic Diagram

This condition decreases the amplifier gain, and reduces the drive to the power amplifier. The power amplifier grid drive is kept at its maximum possible level without grid current flowing. Q1 and its associated circuitry provide fast-attack, slow-release action for the automatic load control circuit.

4-92. The gain of transmitter gain control stage Q4 (figure 4-13) is controlled by the output of d-c amplifier Q6. Amplifier Q6 has two inputs. One of the inputs is from three-phase high-voltage power supply module A7. This negative voltage is proportional to the power amplifier plate current, drawn from the high-voltage power supply. The second input to d-c amplifier Q6 from power amplifier module A11 is proportional to the power amplifier r-f plate voltage swing. The level of this signal is adjusted so that there is an input signal only if the r-f plate voltage swing is excessive because the transmitter output is open-circuited. If the power amplifier plate current tends to increase, or the r-f plate voltage swing exceeds a preset value, the forward emitter-base voltage of transmitter gain control-automatic drive control amplifier Q6 is decreased, causing the collector current to decrease. This collector current flows through resistors which are common to the collector circuit of transmitter gain control amplifier Q6 and the emitter-base circuit of i-f amplifier Q4. When collector current decreases in amplifier Q6, the base voltage of Q4 becomes more positive, thus decreasing the forward emitter-base voltage of Q4. This reduces the emitter current in i-f amplifier Q4, and its gain. This feedback action keeps the power amplifier plate current and r-f plate voltage swing from exceeding certain preset values. Transmitter gain control reference adjust R5 in power amplifier module A11 controls the transmitter power output. This output is adjusted for approximately 100 watts into a 52-ohm load in the AM mode.

4-93. A protective circuit in i-f translator module A3 is used to prevent overdriving the transmitter before its gain control circuits are stabilized. An RC circuit consisting of capacitor C54 and resistor R39 gradually increases the transmitter gain from a low value to its normal value when the transmitter is keyed (figure 4-13). Capacitor C54, connected to the base of transistor Q6, is charged through resistor R39 to 18 volts when the RT-648/ARC-94 is in the receive mode. When the transmitter is keyed, capacitor C54 discharges through resistor R39. As a result, a negative voltage is placed on the base of transistor Q6, cutting off the transistor at the instant the transmitter is keyed. As capacitor C54 discharges, the base of transistor Q6 becomes less and less negative, until the input is biased forward and the amplifier is operating normally. The discharge time of the circuit is approximately 100 milliseconds.

4-94. The product detector used in the receive mode is a diode mixer that mixes the 500-kc i-f sideband signal from transistor Q5 with a 500-kc signal from

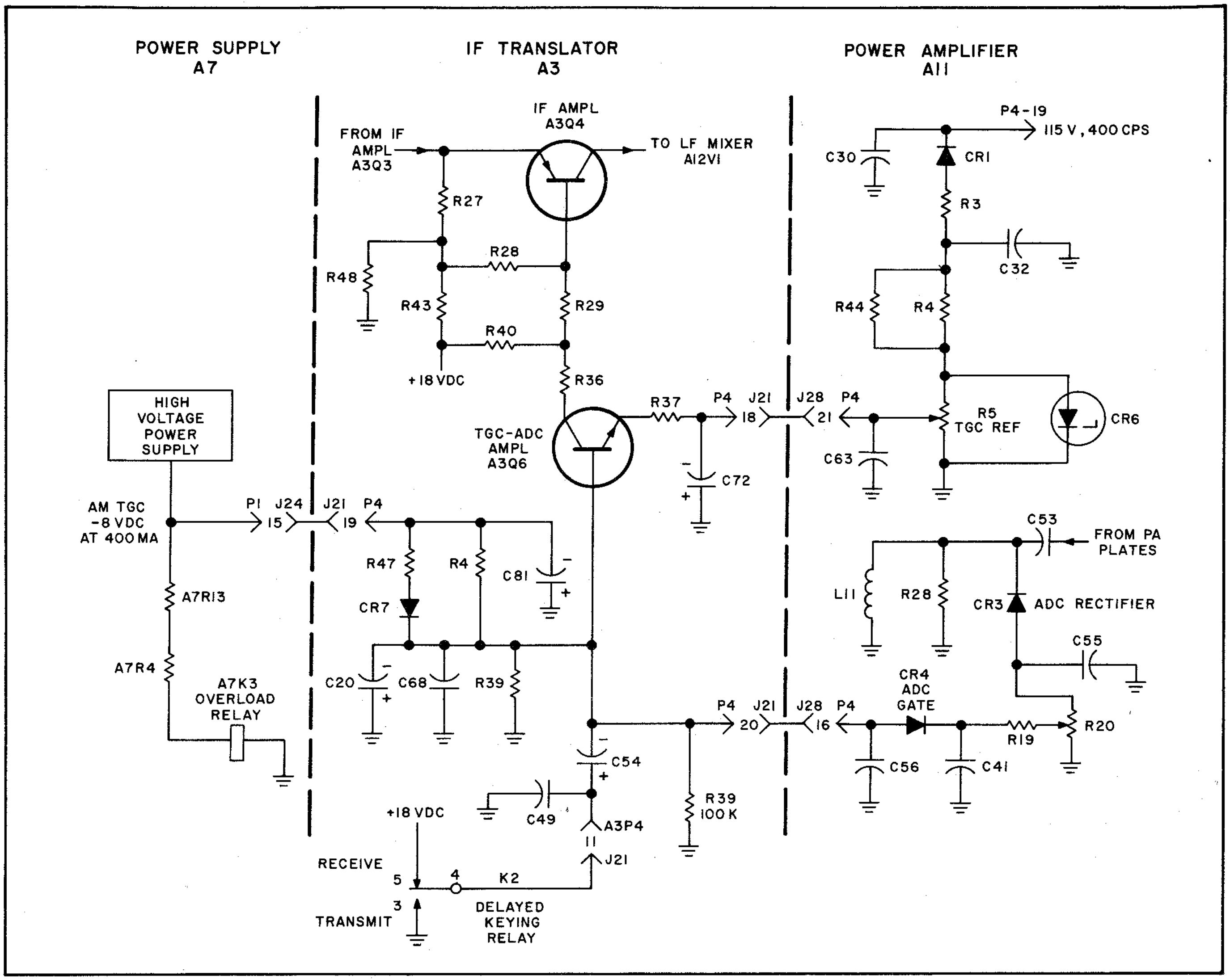


Figure 4-13. Transmitter Gain Control and Automatic Drive Control Circuits, Simplified Schematic Diagram

r-f oscillator module A2. The difference frequency output of this mixer is the audio signal. A low-pass filter at the product detector output filters out the higher order mixer products. The product detector output is fed through AM/SB switching relay K3 to the audio amplifier in AM/audio amplifier module A9.

4-95. The gain of i-f amplifiers Q2 and Q3 is controlled by an automatic gain control voltage that is a combination of voltages from two sources. Part of this automatic gain control voltage comes from the i-f automatic gain control detector in AM/audio amplifier module A9. The other part comes from the audio automatic gain control detector of module A9. The i-f amplifiers in i-f translator module A3 receive both i-f and audio automatic gain control from AM/audio amplifier module A9.

4-96. KILOCYCLE-FREQUENCY STABILIZER MODULE A4.

4-97. Kilocycle-frequency stabilizer module A4 supplies fixed bias and d-c control voltages to variable frequency oscillator submodule A12A2 to stabilize the frequency of the oscillator. The d-c control voltage is derived by locking the output of the variable frequency oscillator in 1-kc steps with reference frequencies derived from r-f oscillator module A2.

4-98. A theory of operation is provided for kilocycle-frequency stabilizer module A4. The theory of operation includes a block diagram analysis and a discussion of the voltage-stabilizing bridge circuit.

4-99. THEORY OF OPERATION.

4-100. Figure 4-14 is a block diagram of kilocycle-frequency stabilizer module A4; figure 7-5 is a schematic diagram. The variable frequency oscillator output is phase-locked in 1-kc steps with the reference frequency of r-f oscillator module A2 by the kilocycle-frequency stabilizer. A voltage-sensitive capacitor in the tuned circuit of the variable frequency oscillator tunes the variable frequency oscillator in response to a d-c tuning voltage from the kilocycle-frequency stabilizer. The tuning voltage for this voltage-sensitive

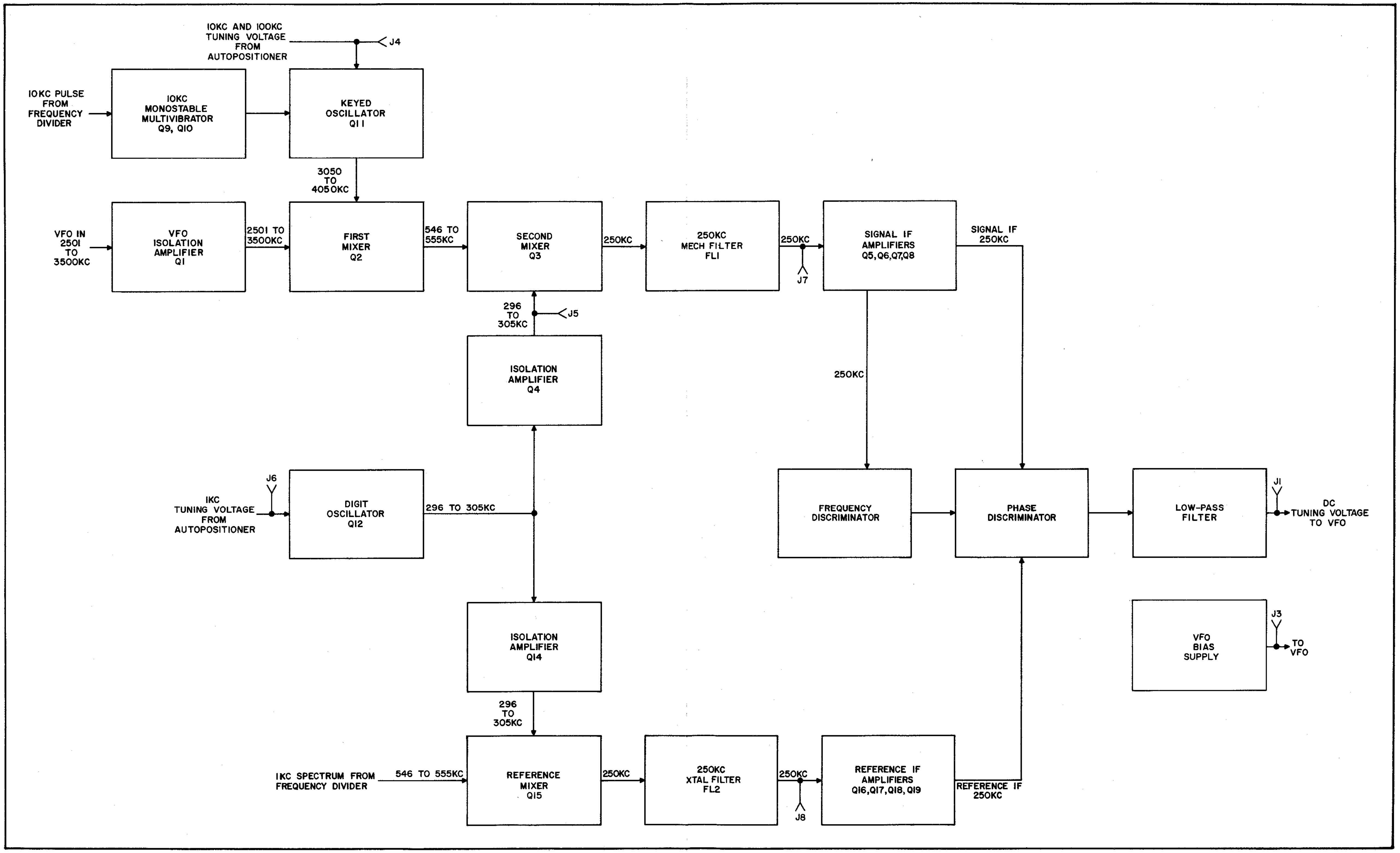


Figure 4-14. Kilocycle-Frequency Stabilizer Module A4, Block Diagram

capacitor is a combination of an adjustable bias voltage and frequency and phase-proportional control voltages from frequency and phase discriminators in the kilocycle-frequency stabilizer.

4-101. The inputs to the phase discriminator are two 250-kc signals. One is the variable frequency oscillator frequency that has been heterodyned to 250 kc. The other is the crystal r-f oscillator frequency that has been heterodyned to 250 kc. The phase discriminator output is a d-c error signal proportional to the phase difference between the two 250-kc signals. This error signal pulls the variable frequency oscillator frequency by tuning the voltage-sensitive capacitor in the variable frequency oscillator until the two signals are phase locked. By phase locking the variable frequency oscillator to the r-f oscillator, the variable frequency oscillator frequency is as accurate as that of the r-f oscillator reference frequency.

4-102. The heterodyning of the variable frequency oscillator signal is accomplished as follows: The variable frequency oscillator output, which varies from 2501 to 3500 kc in 1-kc steps, is amplified by transistor Q1, and mixed in transistor Q2 with a spectrum of frequencies, spaced 10 kc apart. The frequencies in the spectrum are centered 550 kc higher than the variable frequency oscillator frequency. As the variable frequency oscillator is tuned from 2501 to 3500 kc, the center of the 10-kc spectrum moves from 3050 to 4050 kc. This 10-kc spectrum is derived from the 10-kc pulse output of frequency divider module A1. The 10-kc pulse synchronizes monostable multivibrator Q9 and Q10, which in turn, keys keyed oscillator Q11 to produce the spectrum. The free-running frequency of this keyed oscillator, which is tuned to stay 550 kc higher than the variable frequency oscillator, determines the frequency about which the 10-kc spectrum points are located. The keyed oscillator is tuned by a d-c voltage applied to voltage-sensitive capacitor C52. The tuning voltage comes from a divider consisting of precision resistors located in Autopositioner submodule A12A1.

4-103. The output of mixer Q2 is the difference between the variable frequency oscillator frequency and the 10-kc spectrum frequencies. Therefore, the mixer output contains frequencies spaced 10 kc apart and centered around 550 kc. The exact frequencies present depend on the frequency of the variable frequency oscillator signal being injected into mixer Q2. The resultant band of frequencies is fed into a second mixer, Q3, where it is mixed with a signal from free-running digit oscillator Q12. The digit oscillator output signal is a single frequency that is varied by the 1-kc frequency selector knob on the control unit. The digit oscillator is tuned by voltage-sensitive capacitor C66 to ten frequencies from 296 to 305 kc, 1 kc apart. The tuning voltage for the digit oscillator is derived from a precision resistive divider in the Autopositioner submodule. When the free-running digit oscillator frequency is mixed in transistor Q3 with the series of frequencies spaced 10 kc apart and centered around 500 kc, another band of frequencies is produced spaced 10 kc apart, but centered around 250 kc. One of these frequencies will be 250 kc, plus or minus the variable frequency oscillator frequency error and the digit oscillator frequency error. The output of mixer Q3 is passed through mechanical filter FL1, which has a bandwidth of 8 kc centered at 250 kc. The mixer output frequency near 250 kc is passed, but all other frequencies are filtered, since the filter bandwidth extends only 4 kc on either side of 250 kc, and the nearest frequencies are 10 kc away. The signal i-f frequency (250 kc, plus or minus the variable frequency oscillator and digit oscillator errors) is then amplified by i-f amplifiers Q5 through Q8, and fed to the frequency discriminator. The frequency discriminator output is a d-c voltage that varies the capacitance of the voltage-sensitive capacitor to tune the variable frequency oscillator. The frequency discriminator output pulls the variable frequency oscillator signal closer to the desired frequency and within the locking range of the phase discriminator.

4-104. To provide a reference signal for the phase discriminator, the digit oscillator output is mixed in transistor Q15 with a series of frequencies spaced 1 kc apart and centered at 550 kc. This 1-kc spectrum comes from frequency divider module A1. When this 1-kc spectrum, centered around 550 kc, is mixed with the digit oscillator output, the mixer output is a series of frequencies spaced 1 kc apart, centered around 250 kc. One of these frequencies will be 250 kc, plus or minus the digit oscillator error. The output of mixer Q15 is passed through crystal filter FL2, which has a bandwidth of 0.8 kc centered at 250 kc. The mixer output frequency near 250 kc is passed, but all other frequencies are filtered. The reference i-f frequency (250 kc, plus or minus the digit oscillator error) is then amplified by i-f amplifiers Q16 through Q19 and fed into the phase discriminator.

4-105. In order for the reference i-f amplifiers to function properly, the digit oscillator must not vary more than 200 cps from its proper frequency for all conditions of environment. If the digit oscillator frequency is not within these limits, filter FL2 does not pass the desired frequency to the reference i-f amplifiers. The error in the digit oscillator injection frequency is cancelled in the phase discriminator because the oscillator output is mixed with both inputs to the discriminator. The phase discriminator control voltage overrides the frequency discriminator control voltage to lock the phase of the variable frequency oscillator frequency to the phase of the reference frequency, derived from the crystal r-f oscillator. Since all of the spectrum-point injection frequencies in the kilocycle-frequency stabilizer are derived from the crystal oscillator through frequency divider module A1, frequency stability depends on the performance of the crystal r-f oscillator. The variable frequency oscillator is therefore held as stable as the crystal r-f oscillator.

4-106. The a-c signal input to the kilocycle-frequency stabilizer from the variable frequency oscillator and the d-c control voltage input to the variable frequency oscillator from the kilocycle-frequency stabilizer are both carried by a common line. The a-c and d-c components are said to be diplexed. The diplexed components are separated in the modules at either side of the line and the respective desired signals are processed as required.

4-107. Because the frequency of the digit oscillator must be very accurate, the voltage that varies the capacitance of the voltage-sensitive capacitor in the tuned circuit of the oscillator must be very exact. This tuning voltage, as well as the tuning voltages for the voltage-sensitive capacitors that tune the variable frequency oscillator and the keyed oscillator in the kilocycle-frequency stabilizer, comes from a bridge circuit shown in figure 4-15. Part of the bridge is in the kilocycle-frequency stabilizer and part in Autopositioner submodule A12A1.

4-108. The bridge circuit input is 130 volts dc from low-voltage power supply module A5. The bridge output is kept constant by the action of three breakdown diodes, CR6 through CR8, connected in series. The precision resistive divider in the Autopositioner that tunes the digit oscillator to its 10 increments is placed across the bridge output. The digit oscillator frequency may be adjusted by varying resistor A4R59, which is in series with the resistive divider. The voltage tapped from the divider is fed to the voltage-sensitive capacitor in the digit oscillator tuned circuit.

4-109. Bias for the variable frequency oscillator and the voltage for tuning the keyed oscillator in the kilocycle-frequency stabilizer are taken from precision resistive dividers connected across the breakdown-diode leg of the bridge. Currents in both

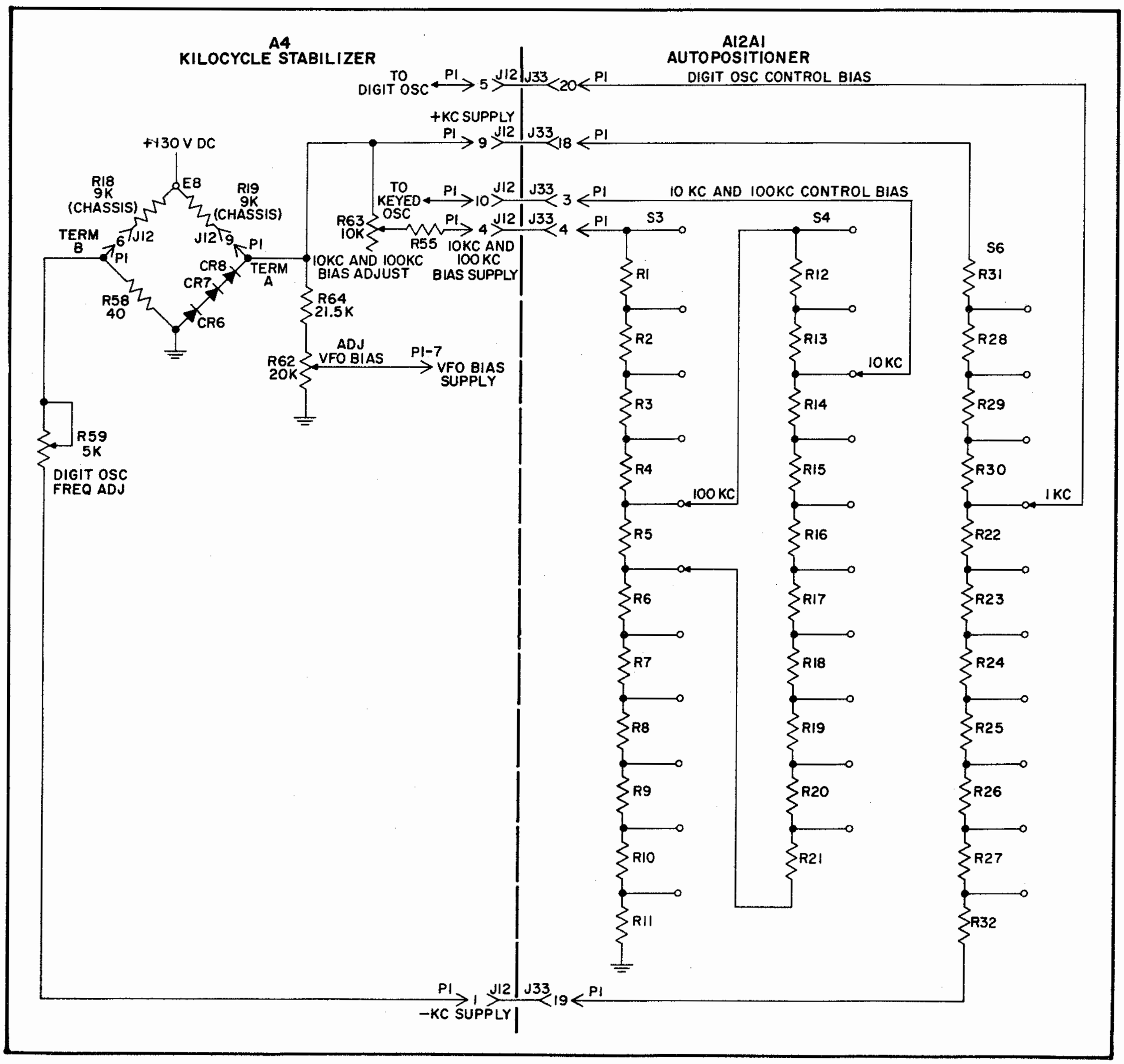


Figure 4-15. Voltage-Stabilizing Bridge Circuit, Simplified Schematic Diagram

dividers can be varied to produce the correct voltage for changing the capacitance of the voltage-sensitive capacitors. Resistor R58, 40 ohms, is in the bridge circuit opposite the diodes to balance voltage transients on the 130-volt d-c supply line. The 40-ohm resistance value of R58 equals the dynamic resistance of the breakdown diodes.

4-110. LOW-VOLTAGE POWER SUPPLY MODULE A5.

4-111. Low-voltage power supply module A5 includes a rectifier-filter power supply circuit which produces 130 volts dc from the 115-volt 400-cps line input, and an 18-volt d-c divider power supply that provides the highly regulated voltage required for stable transistor operation in the RT-648/ARC-94. Low-voltage power supply module A5 also contains a transient blanker circuit that protects transistors in the RT-648/ARC-94 from transient line-voltage surges. A theory of operation covering low-voltage power supply module A5 is given in the following paragraphs.

4-112. THEORY OF OPERATION.

4-113. 130-VOLT D-C SUPPLY. A schematic diagram of low-voltage power supply module A5 is shown in figure 7-6. The 130-volt d-c supply consists of silicon diode half-wave rectifier CR3 and a pi-type filter circuit composed of capacitors C1A and C1B1 and choke coil L1. Resistor R8 acts as a current limiter; resistor R11 is a bleeder across the power supply. Line voltage at 115 volts ac is applied to module A5 across pins 7 and 8 of plug P1. The output voltage of 130 volts appears at pin 14 of plug P1.

4-114. 18-VOLT D-C REGULATOR. The 18-volt d-c voltage regulator (figure 7-6) is composed of two d-c amplifiers, Q3 and Q4, and a control transistor, Q5. The d-c amplifiers closely regulate the control transistor voltage. The input to the d-c amplifiers is an error voltage fed back from the regulator output.

4-115. The emitter voltage of transistor Q4 is kept constant by breakdown diode CR2. The base voltage is derived from a resistive voltage divider that is connected across the regulator output. Thus, the emitter-base voltage of transistor Q4 is proportional to the error in the regulated output voltage.

4-116. If the output of the regulator is accidentally shorted, the regulator will cease operating, for the regulating action is initiated and controlled by the regulator output. When the short occurs, the base of Q4 is grounded and no base current flows. With no base current in Q4, it has no collector current, which is also the base current of Q3. With Q3 base current zero, the collector current of Q3 is zero. The collector current of Q3 is the base current of Q5. With zero base current in Q5, Q5 is cut off and the output voltage drops to zero. Once the short is removed, resistors R12 and R18 provide a path for current to flow to the base of Q4, which again starts the regulating action.

4-117. TRANSIENT BLANKER CIRCUIT. During operation, high transient voltage peaks may occur on the main electrical line of the aircraft in which the AN/ARC-94 is installed. These voltage peaks occur when electrical units, such as electric motors, are turned off. This causes voltage peaks on the 27.5-volt d-c line to the RT-648/ARC-94. These peaks are approximately 80 volts dc and return to normal line voltage in approximately 0.5 second. The transient blanker circuit (figure 7-6) protects the transistors in the RT-648/ARC-94 from these voltage surges by reducing the voltage on the 27.5-volt d-c line to approximately 0 volt for the duration of the surge. Figure 4-16 shows the waveform of the transient blanker in operation.

4-118. The switching action of switching transistor Q2 is accomplished with control transistor Q1, reference diode CR1, and biasing resistors R2 through R6. The bias network allows transistor Q2 to be biased to saturation when the line voltage is normal connecting the output load to the 27.5-volt d-c line. The bias network also provides variable bias for Q1 at the tap of resistor R5. This bias controls the point at which the transient blanker circuit operates. When the line voltage is less than +32 volts, bias current flows through the emitter-base junction of transistor Q2 and through resistors R2 through R6. Transistor Q2 saturates and places the collector at 27.5 volts dc. The bias voltage at the tap of resistor R5 is not sufficient to cause breakdown diode CR1 to conduct. Since diode CR1 does not conduct, transistor Q1 is cut off.

4-119. When a voltage transient occurs on the 27.5-volt line, the voltage at the emitter of transistor Q2 increases. The voltage applied across the voltage divider, consisting of resistors R2, R5, and R6, will increase a proportionate amount. Resistor R5 is adjusted so that when the input (line) voltage reaches 32 volts dc, the voltage drop between the base of transistor Q1 and the tap of resistor R5 is sufficient to cause diode CR1 to break down. This causes transistor Q1 to be biased to saturation. The resulting positive potential at the base of Q2 will cause it to cut off, removing the line voltage from the load. The

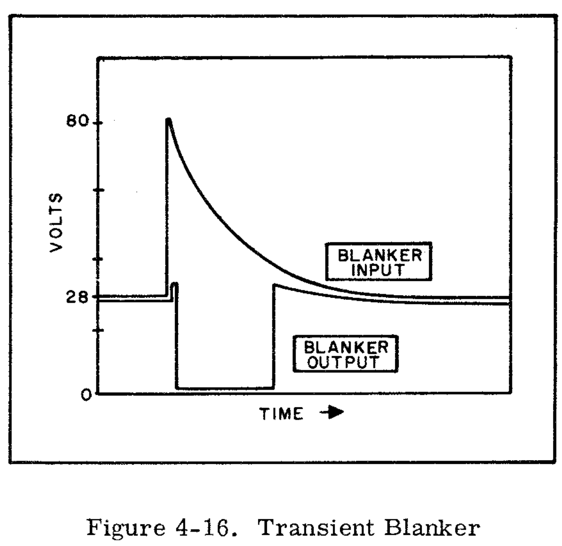


Figure 4-16. Transient Blanker Circuit, Waveforms

blanking action will continue as long as the transient voltage is about 32 volts. When the transient voltage drops below 32 volts, diode CR1 will stop conducting and transistor Q1 will be cut off. This in turn will cause transistor Q2 to again conduct and normal operation will be restored.

4-120. ELECTRONIC CONTROL AMPLIFIER MODULE A6.

4-121. Electronic control amplifier module A6 converts a d-c error signal from power amplifier module A11 to a corresponding 400-cps a-c error signal. The a-c error signal is amplified and fed back to the servo motor that tunes the output network of the transmit function power amplifier. The theory of operation covering the electronic control amplifier module A6 is given in the following paragraph.

4-122. THEORY OF OPERATION.

4-123. A schematic diagram of the electronic control amplifier module A6 is shown in figure 7-7. The circuit includes a 400-cps chopper, cascaded transistor amplifiers Q1 through Q5, and push-pull power output amplifiers Q6 and Q7. The input d-c error signal is changed to 400 cps ac by electromechanical chopper G1. The a-c error signal is amplified by the five PNP transistor amplifiers, Q1 through Q5, in cascade. A paraphase output is taken from the emitter and collector of amplifier Q5 and applied to the corresponding bases of transistors Q6 and Q7, connected in push-pull. Collector current regulation for push-pull operation is provided by thermistor RT1 in the common base return circuit of transistors Q6 and Q7. The amplified error signal is taken across pins 2 and 6 of the connector and fed to power amplifier module A11.

4-124. THREE-PHASE HIGH-VOLTAGE POWER SUPPLY MODULE A7.

4-125. Three-phase high-voltage power supply module A7 converts the 115-volt, 400-cps, three-phase power input into d-c voltages for use by various circuits in the RT-648/ARC-94. In addition, the module supplies filament voltages for the power amplifier and r-f translator.

4-126. The theory of operation for the three-phase high-voltage power supply module A7 is covered in the following paragraphs.

4-127. THEORY OF OPERATION.

4-128. A schematic diagram of three-phase high-voltage power supply module A7 is shown in figure 7-8. Plate contactor relay K1 may be energized 30 seconds after the RT-648/ARC-94 is turned on at the C-3940/ARC-94. The time delay is accomplished by time delay relay K7 located in the chassis (see figure 7-1). Resistors R1, R2, and R3 are in series with the input transformer primary winding to limit the transient current developed when relay K1 is energized. After the initial transient surge, step-start relay K2 is energized by the closing of relay contacts K1-3 and 4. The energizing of relay K2 shorts out series resistors R1, R2, and R3. The power supply is a conventional three-phase power supply. Capacitors C7 through C24 are placed across the diodes to equalize transient supply surge voltages across the diodes.

4-129. The 1500-volt d-c power supply consists of two separate conventional three-phase power supplies placed in series. A tap at the junction of the two supplies furnishes +260 volts to the r-f translator and to the antenna coupler accessory. Overload relay K3 operates when the PA plate and screen current exceeds a predetermined value. This action opens the three-phase input line removing plate voltages. The relay is held in the energized position through contacts 5 and 7 of K3 and the microphone keyline. The power amplifier will not receive high voltage until the keyline is opened, releasing overload relay K3, and again closed.

4-130. AM/AUDIO AMPLIFIER MODULE A9.

4-131. GENERAL.

4-132. AM/audio amplifier module A9 functions during both transmit and receive operations of the AN/ARC-94. The module provides audio amplification and agc during both transmit and receive operations. In addition, the module provides i-f amplification for received signals when the AN/ARC-94 operates in the AM mode.

4-133. The theory of operation for AM/audio amplifier module A9 is covered in the following paragraphs.

4-134. THEORY OF OPERATION.

4-135. TRANSMIT FUNCTION. A block diagram of the audio and cw stages contained in AM/audio amplifier module A9 is shown in figure 4-17. The transmit function stages shown at the left side include audio amplifiers Q1 and Q2. A schematic diagram of AM/audio amplifier module A9 is shown in figure 7-9. In transmit operation, AM/audio amplifier module A9 receives a microphone input signal on the unbalanced line. The input signal is amplified in audio amplifiers Q1 and Q2 and coupled to the balanced modulator stage in i-f translator module A3. Relay K2 is the key-line relay that switches the RT-648/ARC-94 from receive to transmit when the cw key is depressed. This relay is used in the cw mode only. Relay K1 inserts the 1-kc CAL TONE into audio amplifier Q8 whenever the cw key is depressed or when the antenna coupler is tuning. Capacitors C47 and C49, across relay K2, hold relay K2 in the transmit position for 550 ±200 milliseconds after the key is released. Receive operation is restored at the end of that time.

4-136. RECEIVE FUNCTION. A block diagram of the AM i-f stages contained in AM/audio amplifier module A9 is shown in figure 4-18. The audio amplifier and agc stages that function in receive operation are shown at the right side of the block diagram of figure 4-17. The detailed circuit construction of these stages and

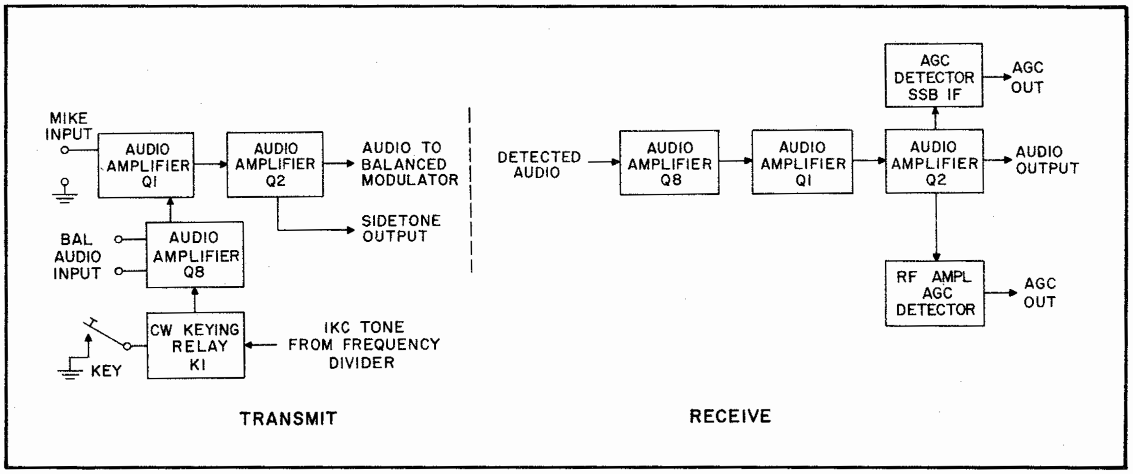


Figure 4-17. Audio Amplifier Stages in AM/Audio Amplifier Module A9, Block Diagram

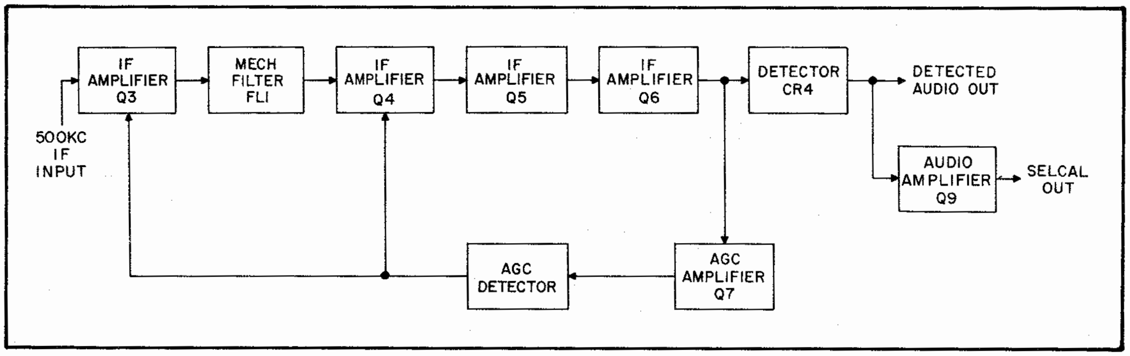


Figure 4-18. AM/Audio Amplifier Module A9, Block Diagram

their relationship to the transmit function of AM/audio amplifier module A9 are shown in the schematic diagram of figure 7-9. In receive operation, i-f amplifiers operate continuously. A 500-kc i-f input signal from r-f translator module A12 is applied through i-f amplifier Q3 to a 6-kc bandwidth mechanical filter, FL1, capable of passing both sidebands. Output of 6-kc filter FL1 is applied through i-f amplifiers Q4, Q5, and Q6 to AM detector CR4. Audio output of AM detector CR4 is applied to audio amplifier Q8 through the action of AM/SB switching relay K3 in i-f translator module A3. Output of audio amplifier Q8 is further amplified by stages Q1 and Q2 and fed to a headset. A portion of the unswitched audio output is coupled through audio amplifier Q9 to the output jack at the rear of the RT-648/ARC-94 as a Selcal output. Part of the output of i-f amplifier Q6 is coupled back to agc amplifier Q7, is rectified, filtered, and fed back to i-f amplifiers Q3 and Q4 for automatic gain control. The 1-kc tone is inserted in audio amplifier Q8 when the front panel meter selector switch is placed in the CAL TONE position. This function is used for a rapid frequency check with WWV.

4-137. MEGACYCLE-FREQUENCY STABILIZER MODULE A10.

NOTE

Radio Receiver-Transmitter RT-648/ARC-94 contains one of two possible different megacycle-frequency stabilizer modules. One is Collins part number 544-9289-005 (effective through MCN 3274) described in paragraphs 4-140 through 4-148. The other is Collins part number 528-0329-005 (effective MCN 3275) described in paragraphs 4-148A through 4-148L. The purpose of both modules is the same and is described in paragraph 4-138.

4-138. The megacycle-frequency stabilizer is an automatic frequency control device which serves to maintain the 17.5-mc and the 8.5- to 16-mc h-f oscillators, located in module A12, within a close tolerance of their operating frequencies. The module generates error-control voltages proportional to sensed frequency error of the oscillators, and applies these voltages to circuit elements within the oscillator circuits which act to correct frequency error. The megacycle-frequency stabilizer comprises two duplicate amplifier subassemblies, A1 and A2, and a spectrum-generating chain.

4-139. The theory of operation is provided for frequency-stabilizer module A10. The theory of operation includes a block diagram analysis and a detailed circuit analysis.

4-140. THEORY OF OPERATION. (Collins part number 544-9289-005.)

4-141. BLOCK DIAGRAM ANALYSIS. A block diagram of megacycle-frequency stabilizer module A10 is

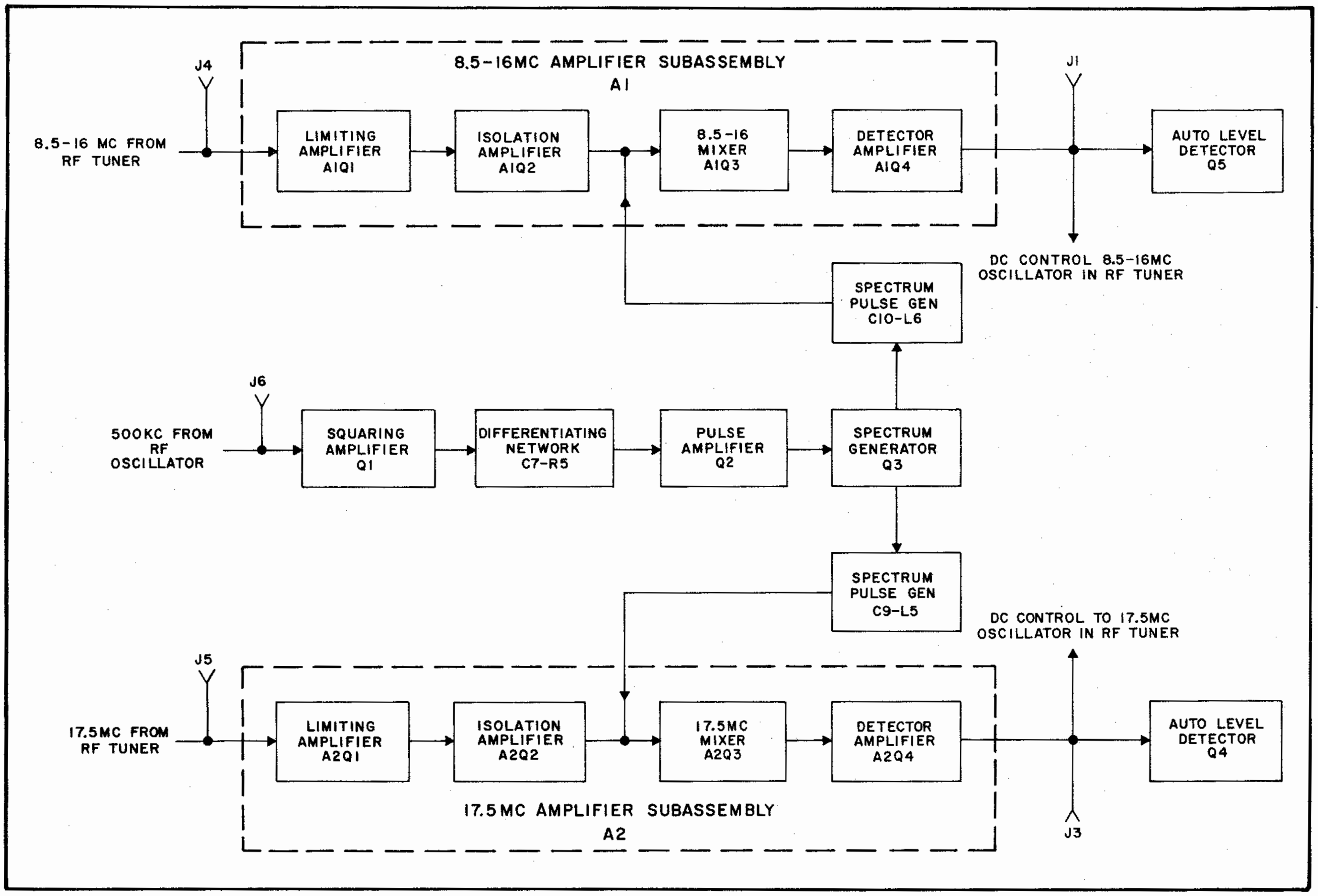


Figure 4-19. Megacycle-Frequency Stabilizer Module A10
(Collins Part Number 544-9289-005) Block Diagram

shown in figure 4-19. Amplifier A1 receives the 8.5- to 16-mc input from r-f translator module A12 while amplifier A2 receives the 17.5-mc input from the 17.5-mc oscillator of A12. These amplifier chains function in exactly the same manner; therefore, only 17.5-mc amplifier assembly A2 will be discussed.

4-142. The spectrum generating chain consists of stages Q1, Q2, and Q3. This circuit receives a 500-kc sine-wave signal from r-f oscillator module A2. The signal is clipped to a 500-kc square wave by squaring amplifier Q1. This squared output is differentiated by network C7-R5, producing a pulse having a prf of 500 kc. This pulse is amplified through pulse amplifier Q2 and is applied to spectrum generator Q3. Spectrum generator Q3 generates a spectrum of frequencies lying between 500 kc and 25 mc, centered at 7 mc, and at 500-kc intervals. This spectrum output is detected across a semiconductor diode and differentiated by network C9-L5 to produce the spectrum pulse.

4-143. An incoming nominal 17.5-mc signal is applied to limiting amplifier A2Q1 which limits the signal amplitude. The limited output is applied to 17.5-mc mixer A2Q3 through isolation amplifier A2Q2. The pulse spectrum output of network C9-L5 is also applied to 17.5-mc mixer A2Q3. In 17.5-mc mixer A2Q3, the nominal 17.5-mc input is mixed with the spectrum to produce two output error signals. These signals are amplified and detected by detector A2Q4. The d-c output voltage thus obtained is proportional to the frequency error of the incoming 17.5-mc oscillator signal. The d-c voltage obtained is fed back to voltage-variable capacitors located in the frequency-determining circuit of the 17.5-mc oscillator, which changes the capacitance, and therefore alters the frequency of the oscillator. Automatic level detector Q5 limits the excursion of the error voltage output to a preset level. This allows the oscillator frequency to sweep in a fashion to ensure lock.

4-144. DETAILED CIRCUIT ANALYSIS. A schematic diagram of megacycle-frequency stabilizer module A10 is shown in figure 7-10. The 500-kc sine-wave signal from r-f oscillator module A2 is applied through limiting amplifier Q1, where it is clipped to produce a 500-kc square wave. The output of transistor Q1 is differentiated by a differentiating network composed of C7 and R5 to produce 500-kc pulses. The pulses are amplified by pulse amplifier Q2, and applied to spectrum generator Q3. A ringing circuit composed of L4 and its distributed capacitance rings the pulse output of Q3 at approximately 7 mc. The output of Q3 is a spectrum of frequencies extending from 500 kc to

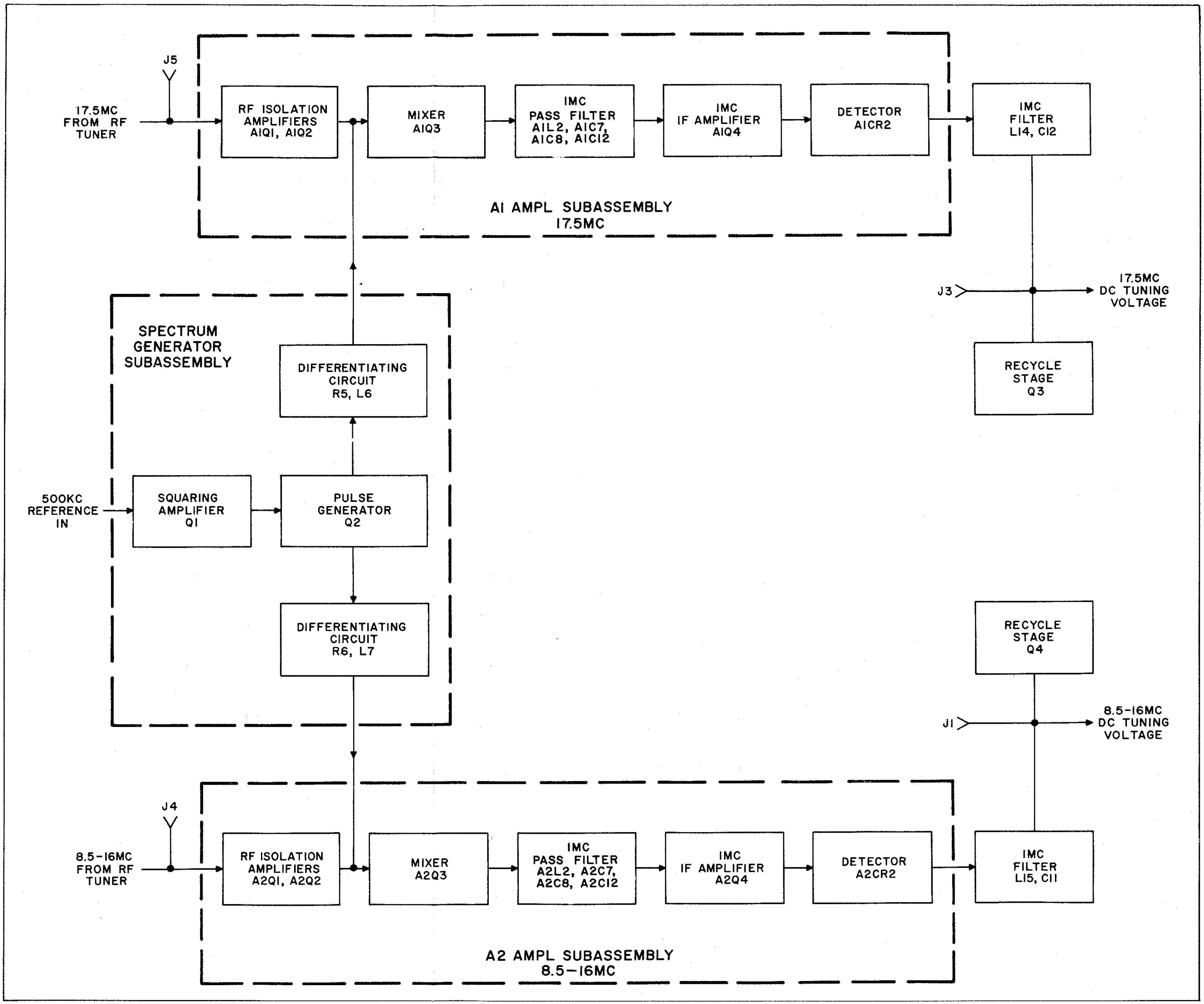


Figure 4-19A. Megacycle-Frequency Stabilizer Module A10 (Collins Part Number 528-0329-005), Block Diagram approximately 25 mc and centered at about 7 mc. The output of Q3 is rectified by CR1. Networks C9-L5 and C10-L6 differentiate the pulses. The frequency spectrum is applied to the input of 17.5-mc mixer A2Q3 and 8.5- to 16-mc mixer A1Q3.

4-145. The 17.5-mc and 8.5- to 16-mc r-f signals are fed into separate amplified channels (subassemblies A2 and A1) on the module. These channels are identical in circuitry, with minor variations in the values of components. The following discussion of the processing of these signals has been combined to describe the simultaneous operation of the two channels.

4-146. The 17.5-mc and 8.5-mc signals from the oscillators located on r-f translator module A12 are fed through separate limiting amplifiers (A2Q1 and A1Q1) and isolation amplifiers (A2Q2 and A1Q2). These circuits hold the r-f input signals from the oscillator at a nearly constant amplitude, and prevent source loading by succeeding circuits. The outputs of isolation amplifiers A2Q2 and A1Q2 are applied to 17.5-mc mixer A2Q3 and 8.5-mc mixer A1Q3. In 17.5-mc mixer A2Q3, the 17.5-mc signal is mixed with the 500-kc to 25-mc spectrum, generated as described in paragraph 4-144. In a like manner, the 8.5- to 16-mc signal is mixed with the 500-kc to 25-mc spectrum in 8.5- to 16-mc mixer A1Q3. The products of this mixing contain the full 500-kc to 25-mc spectrum consisting of frequencies spaced 500-kc apart, plus the sum and difference frequencies resulting from mixing the desired signal with each component in the spectrum. The outputs of mixers A1Q3 and A2Q3 are tuned to 1 mc.

4-147. If the frequency of the 17.5-mc oscillator was 300 cycles from 17.5 mc, the output of the mixer would be a 1-mc signal, the 1-mc component of the unmixed frequency spectrum, plus two frequencies of 1.0003 and 0.9997 mc resulting from mixing the oscillator error frequency with the 16.5- and 18.5-mc components of the frequency spectrum. When the 17.5-mc oscillator is not phase-locked, the vector sum of the 1-mc frequency spectrum component plus the two frequencies resulting from mixing the error frequency with the 16.5- and 18.5-mc components of the frequency spectrum varies at a frequency equal to the error in oscillator frequency. The 8.5- to 16-mc mixer, A1Q3, functions in a similar manner. The error signals obtained in each mixer are detected and amplified by A2Q4 and A1Q4. The d-c signals resulting from detection are filtered by networks A2C9-A2R12 and A1C9-A1R12, in each channel. The filtering process results in a positive d-c control voltage, which in each case is proportional to the frequency error of the oscillator in question. The control voltages generated as previously described are applied to voltage-sensitive capacitors located in the tuned circuits of the oscillators on r-f translator module A12. The control voltage affects the capacitance in the tuned circuit and therefore locks the frequency of the oscillator. When no frequency error is present in the output of each oscillator (that is, when the oscillator is phase-locked with the spectrum), the vector sum of the three 1-mc frequencies will be constant, and the constant detector output will keep the 17.5-mc oscillator frequency-locked with the reference.

4-148. Two unijunction transistors, A10Q4 and A10Q5, are placed across the outputs of the two detectors. If the detector output voltage exceeds a certain value, the unijunction transistor across the output will conduct, shorting the output to 0 volt. The voltage then begins to charge capacitors C13 and C14 connected to the base of the unijunction transistors until it reaches the point where the oscillators lock. If the oscillators do not lock when the d-c control voltage reaches the locking point, the recycle stage operates again and the cycle is repeated until the oscillator locks. This action creates a recycle sawtooth voltage having an approximate repetition rate of 100 cps. The average locking time for the megacycle frequency stabilizer is 1/2 second. The recycle stages are provided so that each oscillator may be locked on its assigned frequency, independently of the other.

4-148A. THEORY OF OPERATION (Collins Part Number 528-0329-005)

4-148B. BLOCK DIAGRAM ANALYSIS. A block diagram of megacycle-frequency stabilizer module A10 (Collins P/N 528-0329-005) is shown in figure 4-19A. The megacycle-frequency stabilizer module stabilizes the frequencies of the 17.5-mc and h-f oscillators in the r-f translator module. The following discussion describes the action that stabilizes the 17.5-mc oscillator. Its theory applies equally, however, to each of the 16 h-f oscillator frequencies.

4-148C. The 17.5-mc oscillator output frequency is fed to the input of the megacycle-frequency stabilizer module. In this module it passes through two r-f isolation amplifier stages to the input of a mixer. The other mixer input is a 500-kc reference pulse. The spectrum of this pulse is a series of reference frequencies, equally spaced at 500-kc intervals from 500 kc to approximately 25 mc. Each of these spectrum frequencies is a harmonic of the 500-kc reference pulse, so each is as accurate and stable as the reference.

4-148D. The mixer output is fed through a 1-mc pass filter composed of L2, C7, C8, and C12. When the 17.5-mc oscillator is phase-locked with the reference spectrum frequencies, the 1-mc pass filter output will be a 1-mc signal that is a combination of three separate 1-mc components. These three 1-mc components are (1) the 1-mc component of the reference spectrum, (2) the mixer product that is the difference between the 17.5-mc oscillator frequency and the 18.5-mc reference spectrum component, and (3) the mixer product that is the difference between the 17.5-mc oscillator frequency and the 16.5-mc reference spectrum component. This 1-mc signal is then amplified and rectified. The rectified signal, proportional to the frequency error of the 17.5-mc oscillator, is applied to circuit elements within the oscillator circuits which act to correct the frequency error.

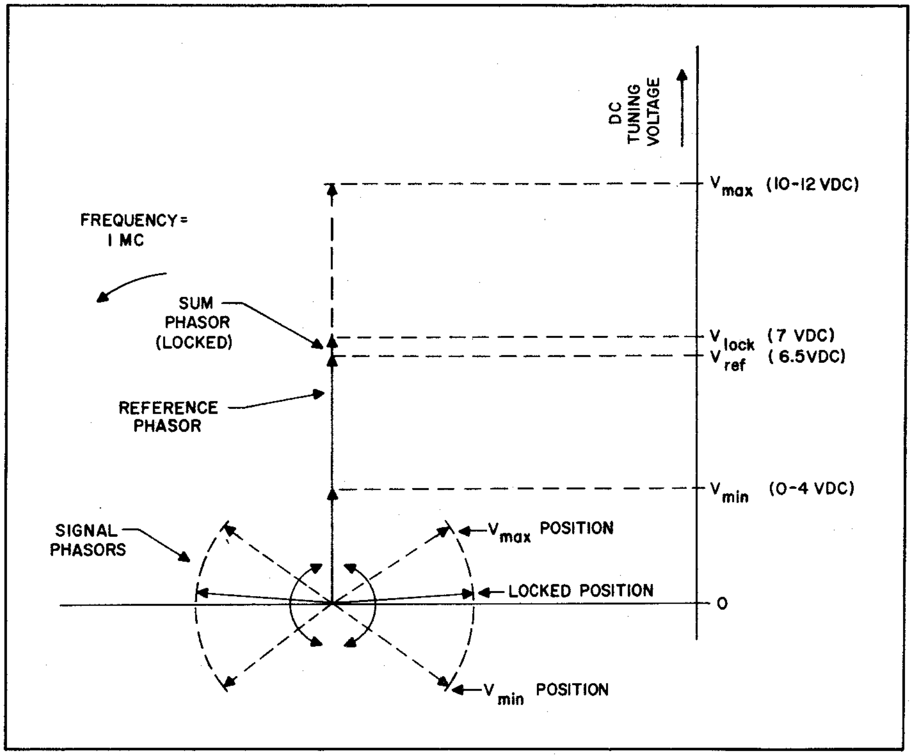


Figure 4-19B. Mixer Output Phasors

4-148E. DETAILED CIRCUIT ANALYSIS. A schematic diagram of the megacycle-frequency stabilizer module is shown in figure 7-10A. The 500-kc sinewave signal from r-f oscillator A2 is applied to squaring amplifier Q1, where the signal is shaped into a rectangular pulse. This pulse is applied to a pulse generator that sharpens the pulse leading edge. The output of the pulse generator is further differentiated by an RL network to produce the 500-kc pulse that is fed to the mixer input.

4-148F. The 17.5-mc and 8.5- to 16-mc oscillator signals are fed into separate amplified channels in the megacycle-frequency stabilizer module. These channels are identical in circuitry. Therefore, the following discussion is limited to the processing of the 17.5-mc signal that occurs in subassembly A1.

4-148G. The 17.5-mc signal from the oscillator located in the r-f translator module A12 is fed through to r-f amplifiers, A1Q1 and A1Q2. CR1 holds the output of A1Q2 to a nearly constant amplitude. The signal is then applied to mixer A1Q3 where it is mixed with the 500-kc to 25-mc spectrum, generated as described in paragraph 4-148C. The products of this mixing contain the full 500-kc to 25-mc spectrum consisting of frequencies spaced 500-kc apart, plus the sum and difference frequencies resulting from mixing the 17.5-mc signal with each component in the spectrum.

4-148H. The mixer output is tuned to 1 mc. When the 17.5-mc oscillator is phase locked with the reference spectrum frequencies, the mixer output will be a 1-mc signal that is a combination of three separate 1-mc components as described in paragraph 4-152. Refer to figure 4-19B. This figure is a phasor representation of the three 1-mc mixer-output components. The 1-mc reference frequency is represented by a vertical phasor that is rotating counterclockwise at a 1-mc rate. The two mixer products are represented by the two phasors approximately 90 degrees out of phase with the reference. These two signal phasors always lead and lag the reference by equal angles for the reason shown below. If the oscillator frequency, for example, leads the reference frequency by phase angle $\emptyset$; one mixer product will be

$$18.5 - (17.5 + \emptyset) = 1.\emptyset + \emptyset$$

and the other mixer product will be

$$(17.5 + \emptyset) - 16.5 = 1.\emptyset - \emptyset$$

Thus, the two phasors are at equal angles to the reference, one leading and one lagging.

4-148I. If the oscillator is phase locked with the reference, the three phasors are all rotating at exactly the same frequency, and the sum of these three 1-mc components will be a single 1-mc frequency represented by a vertical phasor that is in phase with the reference phasor. This 1-mc signal is amplified and detected by a 1-mc i-f amplifier. This detected output is a d-c voltage that is fed back to a voltage-variable capacitor in the oscillator tuned circuit to the oscillator frequency.

4-148J. If either the tuning voltage or oscillator frequency changes, the other will change to compensate for the original change, keeping the oscillator and reference frequencies phase locked at all times. If, for example, the oscillator frequency drifts with respect to the reference, the phase angle between the signal and reference frequencies will change. As this angle changes, the signal phasors will shift position and cause the length of the sum phasor to change. Since the d-c tuning voltage is obtained by rectifying the a-c voltage represented by the sum phasor, the tuning voltage is proportional to the length of the sum phasor and will also change. This change in tuning voltage will keep the oscillator and reference phase locked.

4-148K. The length of the sum phasor, however, is limited to a value determined by the lengths of the three component phasors. If the frequency drift is great enough to cause the signal phasors to drift into phase with the reference, this limiting value will be reached, the tuning voltage can no longer change, and the oscillator will drift out of lock with the reference. To eliminate this problem, the tuning-voltage output of the megacycle-frequency stabilizer is applied across a capacitor connected to the input of the unijunction transistor. When the oscillator frequency drifts so that the angle between the reference and signal phasors places the signal phasors at the V_{max} position, the sum vector will become long enough to produce a tuning voltage (V_{max}) that equals the unijunction conduction voltage. When this happens, the capacitor will be shorted, and the tuning voltage will be quickly reduced to a low value. This tuning-voltage change will abruptly retune the oscillator and cause the signal phasors to be repositioned to the V_{min} position. As the capacitors begin to recharge, the tuning voltage will increase, and the oscillator frequency will sweep across a frequency range limited by the tuning-voltage range allowed by the unijunction stage. As the oscillator frequency changes, it will eventually reach the equilibrium point at which the tuning voltage value will cause the reference and signal to be phase locked. When this point is reached, the sum phasor will again be the sum of the three 1-mc phasors and will cause a d-c tuning voltage that phase locks the oscillator.

4-148L. If the feedback loop is opened so that the d-c tuning voltage output of the megacycle-frequency stabilizer no longer controls the oscillator frequency, the oscillator frequency will continue to drift with respect to the reference, and the unijunction stage will recycle continuously. The movement of the signal phasors in this recycle condition will be up and down between the V_{max} and V_{min} positions. If the loop is closed, the signal phasors will stop when they reach the locked position because this is the equilibrium point of the feedback circuit. Note that when the oscillator is locked, the signal phasors should be slightly less than 90 degrees out of phase with the reference. This will cause the sum phasor to be slightly greater than the reference phasor. The position of the signal phasor in the locked position may be varied by adjusting the variable inductor in the oscillator tuned circuit. Doing this will cause the value of capacitance needed to lock the oscillator to change and, therefore, will require the d-c tuning voltage to change. When this inductance is changed, the signal phasors will reposition to produce the required tuning voltage. The oscillator will remain locked as long as the signal phasors are anywhere in the range between the V_{max} and V_{min} positions. The length of the reference phasor may be adjusted by disconnecting the oscillator input to the megacycle-frequency stabilizer. This will eliminate the signal phasors, leaving the sum phasor equal to the reference phasor. The amplitude of the 500-kc reference spectrum pulse then is adjusted to give a reference phasor length that will produce a tuning voltage of approximately 6.5 volts dc.

4-149. POWER AMPLIFIER MODULE A11.

4-150. Power amplifier module A11 amplifies the 2- to 30-mc input to 400-watt PEP in the SSB modes or 100-watt carrier power in the AM, data, and cw modes.

4-151. A theory of operation is provided for power amplifier module A11. The theory of operation includes a block diagram analysis and a detailed circuit analysis of the output network.

4-152. THEORY OF OPERATION.

4-153. BLOCK DIAGRAM ANALYSIS. A block diagram of power amplifier module A11 is shown in figure 4-20 and a schematic diagram in figure 7-11. The 2- to 30-mc output of r-f translator module A12 is applied to parallel linear power amplifiers V1 and V2. The output of the power amplifier is applied to a tuned output network. This output network is a pi-section that converts the 52-ohm antenna impedance to a 1000-ohm load for the power amplifier.

4-154. In the output network, the signal is tapped off, and applied to a phase discriminator network. The phase discriminator compares the phases of the input and output signals of the power amplifier. The phase discriminator produces a d-c output proportional in polarity and magnitude to the direction and magnitude of the phase error. The d-c error signal is applied through the connector plug to electronic control amplifier module A6. The electronic control amplifier produces a 400-cycle error signal which is applied to servo motor B2. The servo motor drives variable inductor L4, which tunes the output circuit until the input and output signals are exactly 180 degrees out of phase.

4-155. DETAILED CIRCUIT ANALYSIS. A schematic diagram of power amplifier module is shown in figure 7-11, and a simplified schematic diagram of the output network is shown in figure 4-22. The shunt capacitances and part of the series inductance of the output

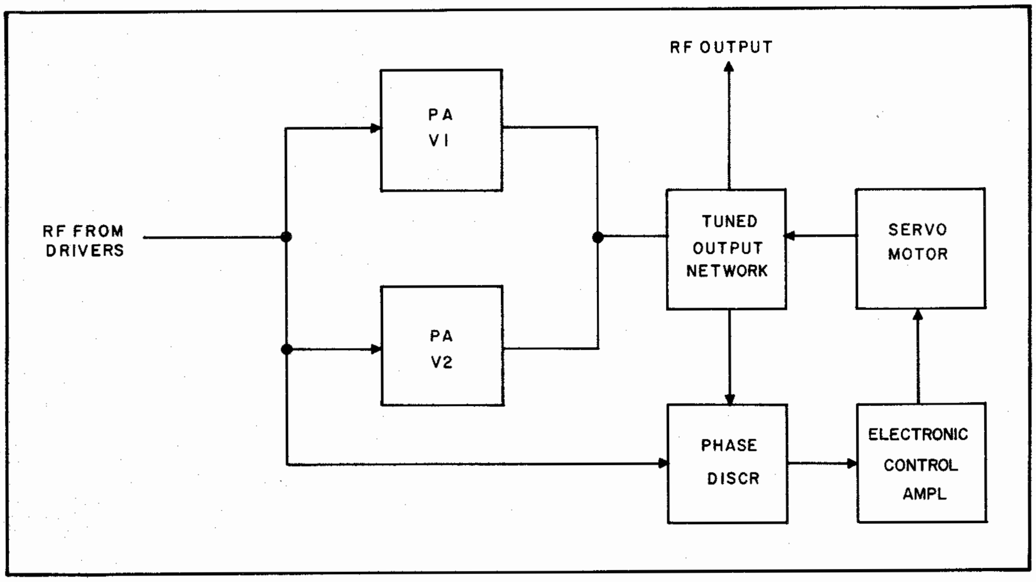


Figure 4-20. Power Amplifier Module A11, Block Diagram

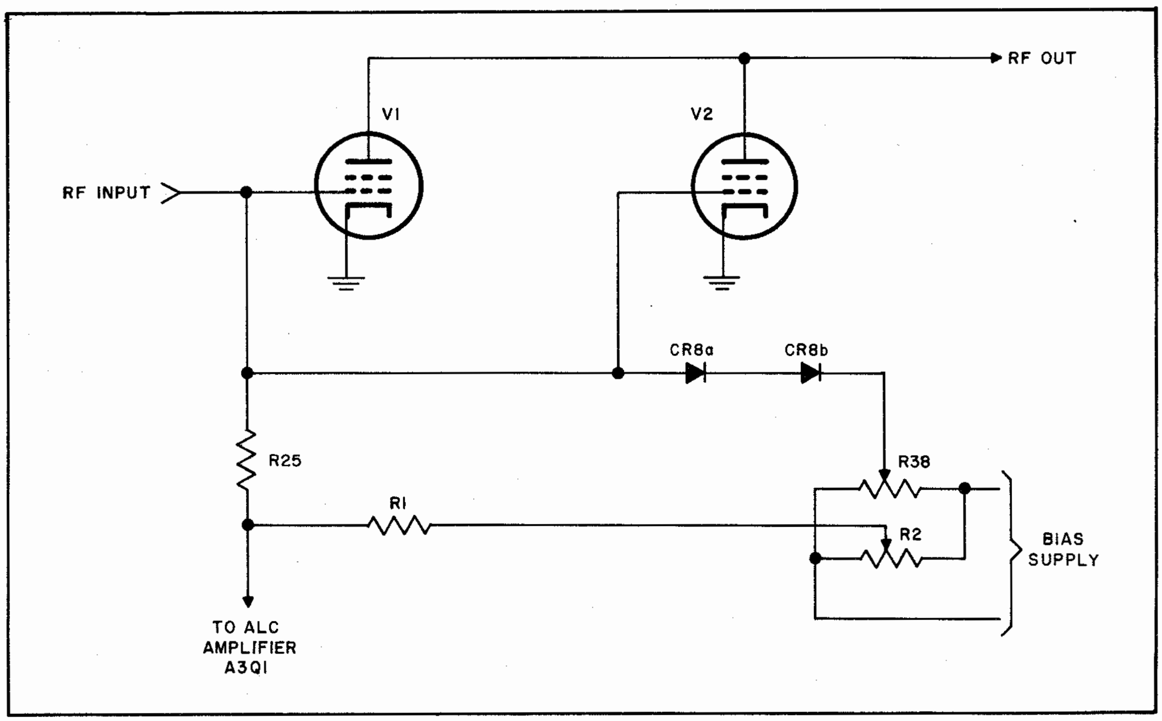
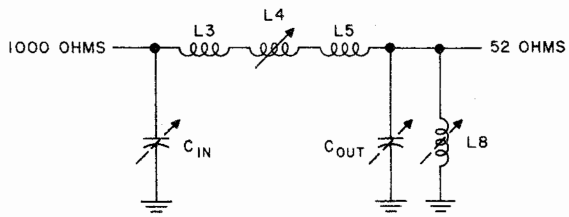
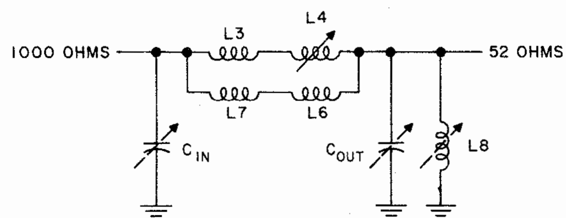


Figure 4-21. PEP Limiter, Simplified Schematic Diagram

network is switched by motor B1 to eight discrete steps on bands. Motor B1 is controlled by the megacycle frequency selector knob on the C-3940/ARC-94. On some of the eight bands, variable inductor L4 is in series with the other inductors (figure 4-22), while in other bands it is in a series-parallel arrangement. In both circuits, the values of inductances are selected so that the tuning range of the output circuit never exceeds 1.7 to 1 as the variable inductor is varied from one of its extremes to the other (table XVI). Band 1, for example, has a ratio of 3 mc to 2 mc, or 1.5 to 1. Inductor L8 is a compensating inductor that is tapped so that the parallel combination of L8 and C_{out} approaches resonance at the high end of the band in use. The high impedance of this parallel resonant circuit keeps the output impedance and the amplifier plate load nearly constant over the entire tuning range of the band in use.



(A) BANDS 1 THROUGH 3.



(B) BANDS 4 THROUGH 8.

BAND	RANGE (MC)	FREQUENCY RATIO
1	2-3	1.5 : 1
2	3-4	1.3 : 1
3	4-6	1.3 : 1
4	6-8	1.5 : 1
5	8-11	1.4 : 1
6	11-16	1.5 : 1
7	16-22	1.4 : 1
8	22-30	1.4 : 1

NOTE:
BROKEN ARROW INDICATES THAT VALUE IS VARIED IN 8 STEPS.

Figure 4-22. Power Amplifier Module A11, Simplified Schematic Diagram of Output Network

4-156. The 52-ohm output of the amplifier is coupled to the antenna tuning system. A signal from the antenna tuner during the tuning cycle energizes relay K2 and places a 25-ohm resistance (R42, R43 in parallel) in series with the power amplifier output during the tuning cycle. This reduces the power in the output circuit so that it will not be damaged when the antenna is being tuned. The resistor also provides isolation between the power amplifier and antenna tuner during the tuning cycle.

NOTE

The information given in paragraph 4-157 pertains only for modules with MCN 2250 through 7389.

4-157. Figure 4-21 is a simplified schematic diagram of the PEP limiting circuit of the power amplifier. This circuit limits the peak envelope power applied to the antenna coupler to a safe level. Resistor R38 is adjusted so that a sufficiently large positive r-f voltage swing will cause diodes CR8A and CR8B to conduct. This will cause current to flow through resistor R1 developing a voltage that is applied to the base of amplifier A3Q1. This action limits the r-f driving voltage that is applied to power amplifier tubes V1 and V2.

TABLE XVI
POWER AMPLIFIER MODULE A11, FREQUENCY RATIOS

BAND	RANGE (mc)	FREQUENCY RATIO
1	2-3	1.5:1
2	3-4	1.3:1
3	4-6	1.5:1
4	6-8	1.3:1
5	8-11	1.4:1
6	11-16	1.5:1
7	16-22	1.4:1
8	22-30	1.4:1

4-158. R-F TRANSLATOR MODULE A12.

4-159. R-f translator A12 transforms i-f signals to r-f signals for application to the power amplifier. This module also receives r-f signals from the antenna and transforms these signals to i-f signals for use in the receiving portion of the AN/ARC-94. The r-f translator module includes two submodules: an Autopositioner submodule that tunes the circuits to a particular operating frequency and a variable frequency oscillator that produces injection frequencies for the low frequency mixers in the receive and transmit functions.

4-160. A theory of operation is provided for r-f translator module A12. The theory of operation includes a block diagram analysis and a detailed circuit analysis of module functions and an analysis of the submodule A12A2. Autopositioner submodule A12A1 is discussed in paragraphs 4-169 through 4-180.

4-161. THEORY OF OPERATION.

4-162. TRANSMIT FUNCTION. A block diagram of r-f translator module A12 is shown in figure 4-23 and a schematic diagram is shown in figure 7-12. When the module is in the transmit function, a 500-kc i-f signal from i-f translator module A3 is combined with the variable frequency oscillator output at l-f mixer A12V1. When the AN/ARC-94 is operating in the frequency range of 2.000 to 6.999 mc, the output of the l-f mixer is applied to 17.5-mc mixer A12V2. A signal from 17.5-mc oscillator A12V10 is mixed

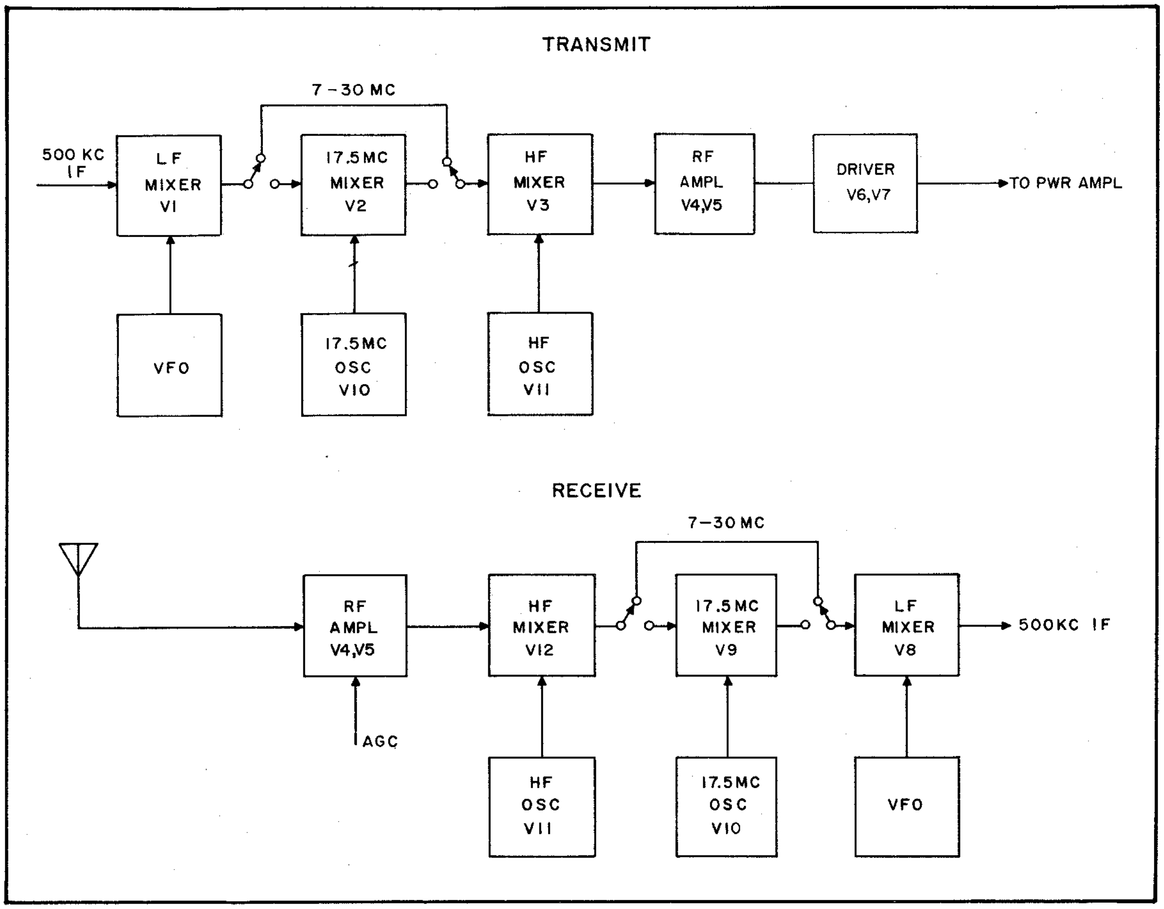


Figure 4-23. R-F Translator Module A12, Block Diagram

with the signal applied from the l-f mixer. A 14.5- to 15.5-mc signal is produced and applied to h-f mixer A12V3. However, if the AN/ARC-94 is operating in the range from 7.000 to 29.999 mc, the output of the l-f mixer is applied directly to h-f mixer A12V3. H-f oscillator A12V11 is capable of producing 28 frequencies, spaced 1 mc apart. The desired frequency is mixed with the input signal of the h-f mixer, and the output is applied to parallel-connected r-f amplifiers A12V4 and A12V5. The amplified output is then applied to parallel-connected drivers A12V6 and A12V7, which in turn apply an output to power amplifier module A11 for amplification to the output power level. The injection frequencies from the h-f oscillator for the 28 bands are tabulated in table XVII. These 28 frequencies provide 28 bands for the 1000 increments from the variable frequency oscillator, or 28,000 separate channels in all.

4-163. RECEIVE FUNCTION. When the AN/ARC-94 is set to receive function, the antenna signal is coupled to parallel-connected r-f amplifiers A12V4 and A12V5. The amplified signal is then applied to h-f mixer A12V12, where it is mixed with the desired signal from h-f oscillator A12V11, as in the transmit function. The mixed signal is then applied to l-f mixer A12V8, which in turn heterodynes this signal with the variable frequency oscillator signal to produce a 500-kc i-f signal. However, if the operating frequency range of the AN/ARC-94 is from 2.000 to 6.999 mc, the output of the h-f mixer is applied to the l-f mixer through 17.5-mc mixer A12V9, where it is mixed with a signal from 17.5-mc oscillator A12V10. The r-f amplifier and l-f mixer receive an automatic gain control voltage derived from the rectified, filtered audio output. In addition, the amplifier and mixer are supplied with carrier automatic gain control derived from the rectified, filtered r-f output of the l-f mixer. The 500-kc i-f output signal from the l-f mixer is applied to modules A3 and A9 for both SSB and AM i-f amplification and detection.

4-164. The frequencies of the 17.5-mc and high-frequency oscillators are frequency locked with the crystal-generated reference frequency from r-f oscillator module A2 by circuits in megacycle-frequency stabilizer module A10. These oscillators are tuned by voltage-sensitive capacitors, which are semiconductor devices whose capacitance varies as the d-c voltage across them varies. A typical relationship between capacitance and d-c voltages is shown in figure 4-24. A d-c bias voltage is applied to the voltage-sensitive capacitor so that the voltage variations change the capacity over the desired range.

TABLE XVII. R-F TRANSLATOR MODULE A12, H-F OSCILLATOR FREQUENCY FOR EACH OPERATING RANGE

OPERATING RANGE (mc)	H-F OSCILLATOR FREQUENCY (mc)	OPERATING RANGE (mc)	H-F OSCILLATOR FREQUENCY (mc)
2-3	12.5*	16-17	9.5**
3-4	11.5*	17-18	10.0**
4-5	10.5*	18-19	10.5**
5-6	9.5*	19-20	11.0**
6-7	8.5*	20-21	11.5**
7-8	10.0	21-22	12.0**
8-9	11.0	22-23	12.5**
9-10	12.0	23-24	13.0**
10-11	13.0	24-25	13.5**
11-12	14.0	25-26	14.0**
12-13	15.0	26-27	14.5**
13-14	16.0	27-28	15.0**
14-15	8.5**	28-29	15.5**
15-16	8.0**	29-30	16.0**

*These high-frequency oscillator frequencies are mixed with the 14.5- to 15.5-mc output from the 17.5-mc mixer.

**These high-frequency oscillator frequencies are doubled before injection into the high-frequency mixer.

4-165. DETAILED CIRCUIT ANALYSIS. A schematic diagram of r-f translator module A12 is shown in figure 7-12. When the AN/ARC-94 is in the transmit function, a 500-kc i-f signal is applied to connector P1 and transferred to the grid of l-f mixer V1. The variable frequency oscillator output is also applied to the cathode of the l-f mixer. The two signals are mixed and applied to switch S8, which in turn applies this signal to switch S9 or to the grid of 17.5-mc mixer V2, depending on the operating frequency of the AN/ARC-94. The 17.5-mc mixer receives a 17.5-mc signal on both cathode and grid from 17.5-mc oscillator V10. If a signal is applied from switch S8 to grid of the 17.5-mc mixer, this signal and the oscillator signal are mixed and transmitted to switch S9. Switch S9 transfers this signal to the grid of h-f mixer A12V3, where it is mixed with a signal from h-f oscillator A12V11. The output frequency of the h-f oscillator is selected by switch S10, which couples one of 28 tuned coils that determine the tuned circuit connected to the grid of the tube. In the transmit function, relay K2 is energized, and signals are applied through switches S4 through S7 to the grids of parallel-connected r-f amplifiers A12V4 and A12V5. Switches S4 through S7 make use of capacitors and inductors whose combinations are determined by the operating frequency. The signal is amplified by the r-f amplifiers and transmitted to the control grids of parallel-connected drivers A12V6 and A12V7, where the signal is further amplified and applied to connector P2.

4-166. In the receive function, operation of the AN/ARC-94 is the reverse of the transmit function. Since the circuits are similar, refer to the detailed circuit analysis of the transmit function and the block diagram analysis of the receive function for a detailed description of this function.

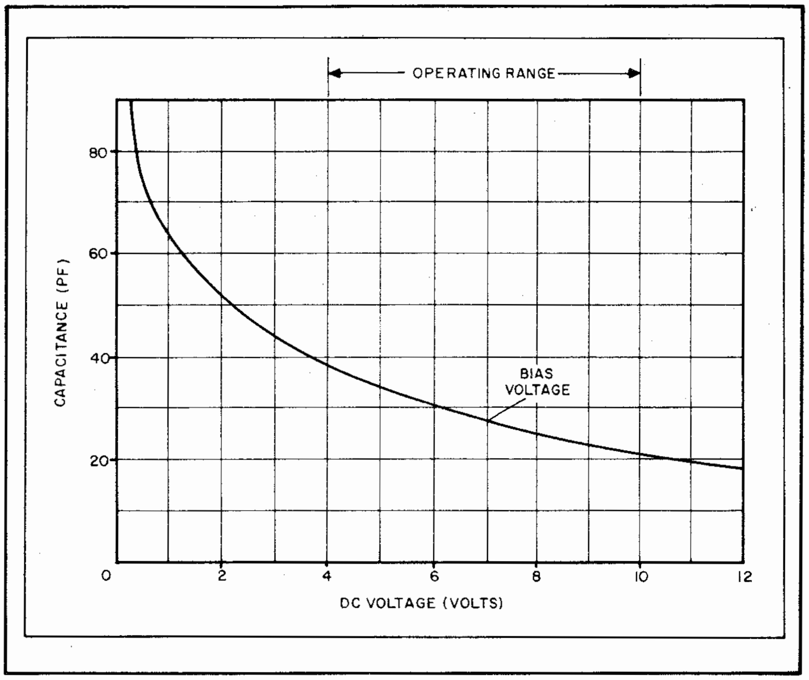


Figure 4-24. Typical Characteristics of Voltage-Sensitive Capacitor

4-167. VARIABLE FREQUENCY OSCILLATOR SUBMODULE A12A2. The frequency of variable frequency oscillator submodule A12A2 is controlled (through the Autopositioner) by the 100-, 10-, and 1-kc frequency selector knobs on the C-3940/ARC-94. It is turned in 1000 1-kc steps from 2.501 to 3.500 mc. Figure 7-14 is a schematic diagram of the variable frequency oscillator submodule.

4-168. Tuned-collector transistor oscillator A12A2Q1 is tuned by variable inductor A2L2, which is mechanically varied by the Autopositioner. The oscillator frequency is phase locked by voltage-sensitive capacitor A12A2VC1. The d-c voltage that tunes A2VC1 is a combination of a mechanically adjustable bias supply in kilocycle-frequency stabilizer module A4 and frequency- and phase-sensitive control voltages from frequency and phase discriminators in the kilocycle-frequency stabilizer. After the mechanical tuning is completed, the kilocycle-frequency stabilizer supplies a d-c control voltage from the frequency discriminator to bring the variable frequency within the capture range of the phase discriminator. The phase discriminator then superimposes a strong d-c correction voltage to override the frequency discriminator and to phase lock the variable frequency oscillator to the reference frequency from r-f oscillator module A2. After the variable frequency oscillator is phase locked, the phase discriminator constantly changes the control voltage to A12A2VC1, if necessary, to keep the variable frequency oscillator frequency phase locked with the reference. The variable frequency oscillator output goes through amplifiers A12A2Q2, A12A2Q3, and A12A2Q4, before it is coupled through A12A2T2 to the r-f translator 1-f mixers.

4-169. FUNCTIONAL MECHANICAL OPERATION.

4-170. The following paragraphs describe the mechanical operation of Autopositioner submodule A12A1 and of Radio Set Control C-3940/ARC-94.

4-171. AUTOPOSITIONER SUBMODULE A12A1.

4-172. MECHANICAL OPERATION. Autopositioner submodule A12A1 is a motor-driven, electrically-controlled tuning mechanism that automatically tunes the RT-648/ARC-94 to the frequency selected at the C-3940/ARC-94. The RT-648/ARC-94 may be located in the radio compartment of the aircraft, with the C-3940/ARC-94 near the pilot's instrument panel. The RT-648/ARC-94 can be completely controlled by the C-3940/ARC-94.

4-173. As shown in figure 4-25, the basic elements of the Autopositioner system are a motor and associated gear train, a slip clutch driving a rotary shaft fastened to a notched stop wheel, a pawl that engages the notches in the stop wheel, and a relay that controls the pawl and operates a set of electrical contacts to start and stop the motor. An electrical control system is part of each Autopositioner system. This control system consists of remotely located frequency selector knobs and related seeking switches driven by the Autopositioner shaft. The control system is the open-circuit seeking type. Whenever the frequency selector knobs and seeking switches are not in the same electrical position, the Autopositioner is energized and drives its shaft (and the tuning elements to which the shaft is coupled) to the proper position and stops.

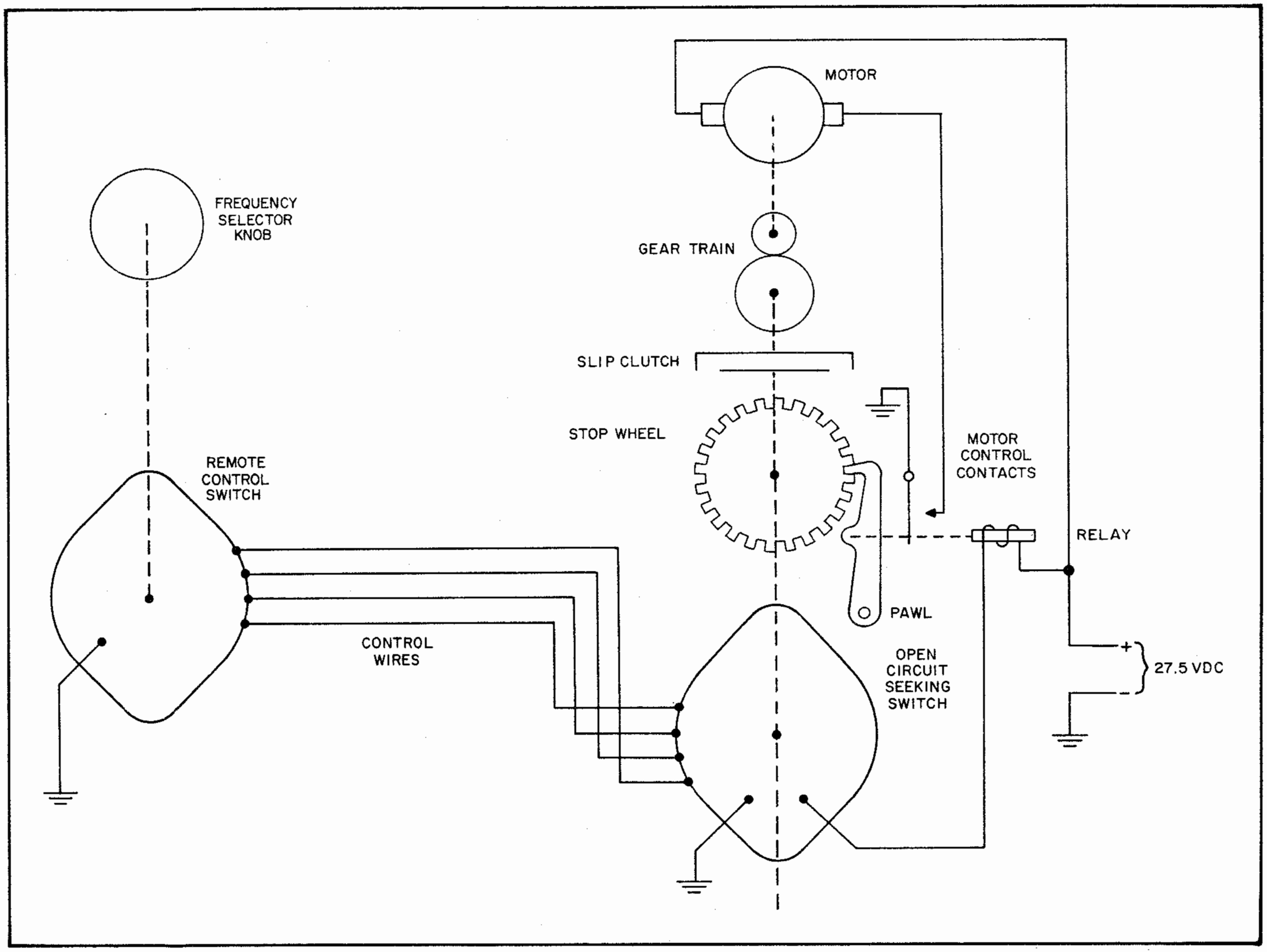


Figure 4-25. Autopositioner System, Basic Elements, Simplified Schematic Diagram

4-174. In a typical cycle of operation of the Autopositioner, the system is at rest with the control and seeking switches in corresponding positions (open circuit), relay in the de-energized position, pawl engaging a stop-wheel notch, and the motor off. When the operator changes the setting of the frequency selector knob on the C-3940/ARC-94, the control system energizes the relay lifting the pawl out of the stop-wheel notch and closing the motor control contacts. The motor starts and drives the Autopositioner shaft, the rotor of the seeking switches, and the tuning elements in tuned circuits. When the seeking switches reach the point corresponding to the new position of the frequency selector knobs, the relay circuit is opened, and the pawl is dropped into a stop-wheel notch. Shaft rotation stops, the motor control contacts open, and the motor coasts to a stop. The seeking switches of the control circuit are designed to open the relay circuit before the stop wheel reaches the point at which the pawl engages the proper notch. The relay contacts controlling the motor are adjusted so that they do not open until the pawl drops into the notch.

4-175. A binary control system external to the Autopositioner submodule is used with the Autopositioner. It provides a maximum number of tuning positions with a minimum number of control wires. This action is accomplished in the binary system by using the control wires in various combinations.

4-176. Operation of the binary system is similar to that of single-pole, double-throw switches, as shown in figure 4-26. When the frequency selector knobs and seeking switches are set as shown (switch S1 in the same position as switch S2, etc), there is no current path from the relay coil to ground, and the relay and motor are unenergized. If any of the frequency selector knobs are set to a position opposite that of corresponding seeking switches, a path to ground is closed, energizing the relay and motor. The motor turns the rotary seeking switches until they are again positioned in accordance with frequency selector knobs positions. When this happens, the relay circuit opens and the motor stops.

4-177. The total of combinations of switch positions in such a system is 2^n, where n is the number of

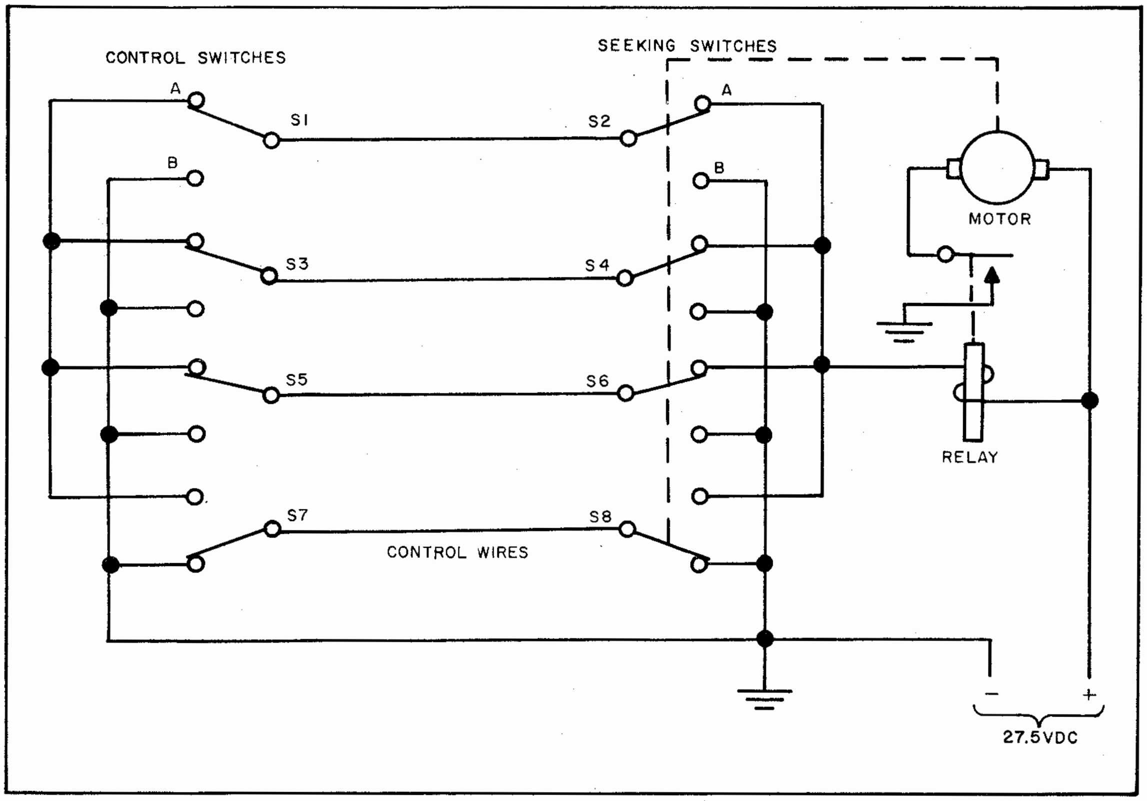


Figure 4-26. Frequency Control System, Simplified Schematic Diagram

control wires used. In the four-wire system shown, n=4 and 16 different combinations exist. One combination is not usable. If all the seeking switches in figure 4-26 are set to the B position, there can be no path from the relay coil to ground, no matter how the frequency selector knobs are set. The maximum number of usable combinations in such a system is 2^n-1. The four-wire system shown can control 15 positions. The frequency selector knobs for the Autopositioner system are contained in the C-3940/ARC-94.

4-178. The output shaft of the Autopositioner is mechanically coupled to a variable inductor in the tuned circuit of the variable frequency oscillator. Ten turns of the output shaft tune the variable frequency oscillator through a 1-mc frequency range. Figure 7-13 is a schematic diagram of Autopositioner submodule A12A1.

4-179. There are three seeking switches in the Autopositioner system: 100 kc, 10 kc, and 1 kc. For the selected variable frequency oscillator frequency to be set up, all three seeking switches must be satisfied. Since each of the three switches has 10 positions, there are 10^3, or 1000, possible switch combinations or shaft positions. The 100-kc seeking switch is geared to the output shaft by an intermittent movement so that it is moved one position for each rotation (100 kc) of the output shaft. The 10-kc seeking switch and stop wheel are coupled directly to the output shaft. The stop wheel has 10 notches, so that each notch position is separated from the next by 10 kc. The 100-kc and 10-kc seeking switches are both driven by motor A1B2. The 1-kc seeking switch is driven by a separate motor, A1B1, which also drives a gear and cam arrangement that turns the output shaft to 10 intermediate positions between each notch on the stop wheel. Each of the 10 positions is a 1-kc step. These 10 positions, together with the 100 notch positions furnished by the 10 rotations of stop wheel, give the required 1000 positions.

4-180. ELECTRICAL OPERATION. The Autopositioner mechanically tunes the variable frequency oscillator to within 2 kc of the selected operating frequency. The variable frequency oscillator is phase locked with the crystal-generated reference frequency from r-f oscillator module A2 by the action of circuits in kilocycle-frequency stabilizer module A4. Precision resistive dividers, which are ganged to the seeking switches in the Autopositioner, furnish voltage information to the stabilizing circuits so that they will phase lock the variable frequency oscillator at the correct 1-kc frequency. As in the case of the 17.5-mc and h-f oscillators in the r-f translator module, the variable frequency oscillator is tuned by a voltage-sensitive capacitor.

4-181. RADIO SET CONTROL C-3940/ARC-94.

4-182. Radio Set Control C-3940/ARC-94 functions as an external control for Radio Receiver-Transmitter

RT-648/ARC-94. The C-3940/ARC-94 provides means of selecting any of the 28,000 frequencies available for use by the RT-648/ARC-94. The C-3940/ARC-94 also provides a means of controlling the r-f gain of the RT-648/ARC-94 and provides a control for selecting the modes of operation. A schematic diagram of the C-3940/ARC-94 is shown in figure 7-15. The C-3940/ARC-94 consists of a number of switches which perform the functions described previously. Two panel lights, DS1 and DS2, light the frequency indicator dial. The dial shows the frequency at which the AN/ARC-94 is operating. As the frequency selector knobs operate directly with Autopositioner module A12A1, refer to paragraphs 4-169 through 4-180 and figure 4-26 for an explanation of the switching circuits. The mode selector consists of two wafers, S5A and S5B, which connect the necessary wires together for switching. The RF SENS control adjusts the gain of the r-f stages in the RT-648/ARC-94. This control is shorted to ground when the mode selector is switched to DATA.

SECTION V
ORGANIZATIONAL MAINTENANCE

5-1. INTRODUCTION.

5-2. GENERAL. This section contains instructions for the maintenance of Radio Set AN/ARC-94 by organizational maintenance personnel. Before attempting to service and test this equipment, maintenance personnel should be thoroughly familiar with the physical make-up of the equipment and its theory of operation. Throughout this section reference is made to meter indications of test equipment. When variations in measured values are normal, a tolerance figure is provided. It is essential that the test equipment be terminated properly, calibrated properly, and otherwise in excellent condition. Any attempted repairs or alignment of the components without the required test equipment or uncalibrated test equipment may result in misalignment of the equipment, and cause loss of accuracy and reduced reliability.

5-3. TEST POINTS. Test points are provided throughout the equipment to aid in trouble shooting and alignment of the equipment. Significant test points are identified by distinctive symbols placed throughout the technical manual. Separate symbols are used for major, secondary, and minor test points. The symbols are an aid to more quickly locating the test points on a schematic or servicing diagram. The type of symbol indicates the relative importance of the test point. Major test points are indicated by star-enclosed Arabic numerals. For example, 1 and 2 designate the test points for isolating the trouble to an over-all system function or power distribution system for the equipment. Major test points are referenced in text as test point 1, test point 2, etc. Secondary test points are indicated by encircled capital letters. For example, A and B designate test points for isolating the trouble to a subsystem or component. Secondary test points are referenced as test point A, test point B, etc. Minor test points are indicated by encircled capital letters followed by Arabic numerals. For example, A1 and B1 designate test points for isolating the trouble to one or more circuits of a component or assembly. Minor test points are referenced as test point A1, test point B1, etc.

5-4. Figure 5-1 lists the test points used for minimum performance standards tests and those test point locations within the RT-648/ARC-94. Module covers must be removed for access to certain test points.

5-5. INSPECTION SCHEDULE.

5-6. The parts of Radio Set AN/ARC-94 that require regular inspection are listed in table XVIII.

TABLE XVIII. INSPECTION SCHEDULE

COMPONENT	INSPECTION	TIME (hr)
Mounting MT-2641/ARC-94	Minimum performance standards (paragraph 5-12).	1000
Radio Set Control C-3940/ARC-94	Minimum performance standards (paragraph 5-15).	1000
Radio Receiver-Transmitter RT-648/ARC-94	Minimum performance standards (paragraph 5-15).	1000

5-7. MINIMUM PERFORMANCE STANDARDS.

5-8. PRIMARY POWER REQUIREMENTS FOR TEST.

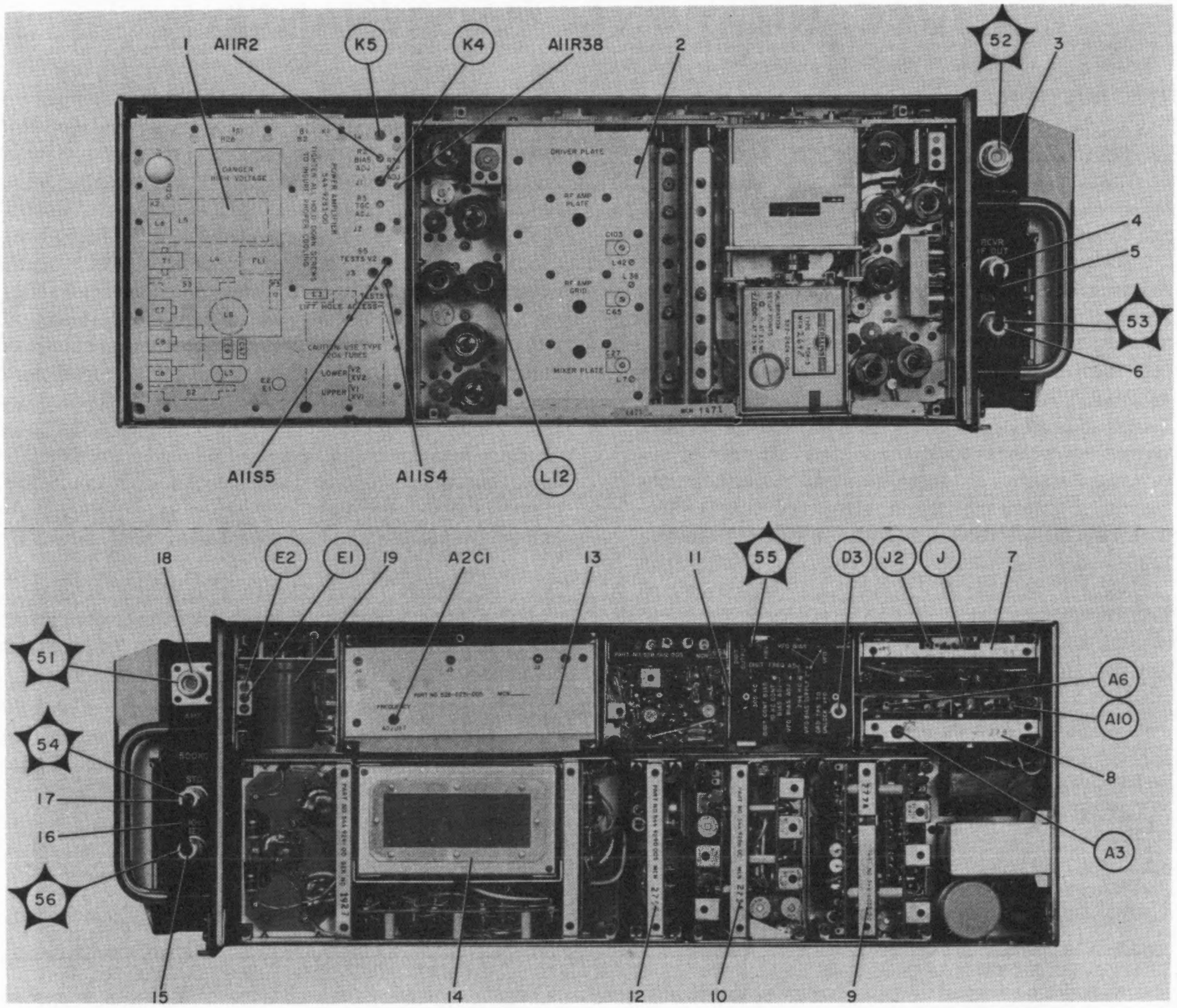
5-9. Unless otherwise specified, all maintenance tests will be conducted using the standard input voltages. Before performing the performance tests, adjust the voltages to the values given in table XIX.

5-10. VISUAL INSPECTIONS.

5-11. Before initiating the performance tests, perform the following visual inspections.

5-12. MOUNTING MT-2641/ARC-94. To check Mounting MT-2641/ARC-94, perform the following checks.

a. Visually check the MT-2641/ARC-94 in a normal, loaded position. Check for noticeable sagging in any of the resilient mounts.



1. Power amplifier module A11
2. R-f translator module A12
3. AUX REC. ANT. connector
4. REC. IF OUT connector
5. Coaxial jumper
6. REC. IF IN connector
7. Megacycle-frequency stabilizer module A10
8. Frequency divider module A1
9. AM/audio amplifier module A9
10. I-f translator module A3
11. Kilocycle-frequency stabilizer module A4
12. Electronic control amplifier module A6
13. R-f oscillator module A2
14. Three-phase high-voltage power supply module A7
15. 500 KC REF. connector
16. Coaxial jumper
17. 500 KC STD. connector
18. ANT. connector
19. Low-voltage power supply module A5

Figure 5-1. Minimum Performance Standards, Test Point and Adjustment Locations

TABLE XIX. STANDARD INPUT VOLTAGE LIMITS

NOMINAL VOLTAGE	MINIMUM	MAXIMUM
115 volts, 400 cps (3 phase, Y connected, line to grounded neutral)	110 volts, 390 cps	120 volts, 410 cps
27.5 volts	27.0 volts dc	28.0 volts dc

b. Depress one end of the MT-2641/ARC-94 from a normal, loaded position until the resilient mounts are in the bottom position. The resilient mounts should permit a minimum travel of 1/16 inch. Check the other end of the MT-2641/ARC-94 in the same manner.

c. Lift up one end of the MT-2641/ARC-94 until the resilient mounts are in an upward position. The resilient mounts should permit a minimum travel of 1/16 inch. Check the other end of the MT-2641/ARC-94 in the same manner.

5-13. RADIO SET CONTROL C-3940/ARC-94. To visually check Radio Set Control C-3940/ARC-94, perform the following checks.

a. Check that the rear cover fasteners are properly seated.

b. Check frequency selector knobs for looseness.

c. Check that the frequency selector knobs turn to all positions with no binding and with a positive action.

5-14. RADIO RECEIVER-TRANSMITTER RT-648/ARC-94. To visually check Radio Receiver-Transmitter RT-648/ARC-94, perform the following checks.

a. Remove four screws from rear of the RT-648/ARC-94 and remove side covers.

b. Check that all module dust covers are properly seated.

c. Check that module complement is complete (figure 1-2).

d. Check that captive screws on modules are properly fastened.

e. Remove r-f translator module A12 and power amplifier module A11, and inspect gears for signs of physical damage.

f. Reinstall r-f translator and power amplifier modules.

g. Loosen two front cover fasteners and remove front cover.

h. Inspect components behind front cover for signs of physical damage.

i. Inspect air filters for cleanliness.

5-15. PRELIMINARY AND PREINSTALLATION TESTS.

5-16. The purpose of the preliminary and preinstallation tests is to provide a general indication of the condition of the equipment as an aid in directing the maintenance approach of the technician and as a preinstallation test procedure. These tests may be performed without the removal of dust covers of Radio Receiver-Transmitter RT-648/ARC-94, and should be performed when the condition of the equipment is not known. No special test equipment is required for the performance of these tests. The tests may be performed while the equipment is installed.

5-17. Set the mode selector on Radio Set Control C-3940/ARC-94 to AM. Allow the RT-648/ARC-94 to warm up for at least 5 minutes. Check all connecting cables and antenna cable for proper seating to their respective connectors. Tune the AN/ARC-94 to several WWV frequencies. These frequencies are 2.5, 5.0, 10.0, 15.0, 20.0, and 25.0 megacycles. If the AN/ARC-94 is located beyond the range of WWV, attempt to tune in any of the stations listed in table XX. Perform an approximate frequency check on the AN/ARC-94 by listening to WWV (or alternate station) with the mode selector in the USB, LSB, and AM positions during an announcement interval. The voice quality should be good in all three modes with little or no change in voice pitch when switching through the three modes.

5-18. Set the meter selector switch on the front panel of the RT-648/ARC-94 to 130V. The meter should indicate in the red area.

5-19. Set the meter selector switch to the 28V position. The meter should indicate in the red area.

5-20. Set the meter selector switch to 1500V. The meter should indicate zero.

5-21. Set the meter selector switch to PA MA. Set the mode selector switch to AM. When the transmitter is not keyed, the meter should indicate zero. Disconnect the coax jumper from the 500KC STD jack on the right front panel of the RT-648/ARC-94. Key the transmitter. The meter should indicate approximately 300 ma. Unkey the transmitter and replace the coax jumper. Again key the transmitter. The meter should indicate in the red area. Speak into the microphone. The meter indication may vary slightly.

5-22. Set the mode selector on the C-3940/ARC-94 to LSB. When the meter selector switch is set to PA MA and the transmitter is keyed but not modulated, the meter indication should be approximately 300 ma. Speak into the microphone. The meter indication should follow the applied audio. The meter indication

TABLE XX. RADIO SET AN/ARC-94 RECEIVER CHECK STATIONS

CALL SIGN	STATION	TRANSMITTED FREQUENCIES (mc)	NOTES
CHU	Dominion Observatory, Canada	3.33, 7.335, 14.670	Voice announcements between 50 and 60 seconds of each minute.
WWVH	Hawaii, United States of America	5, 10, 15	Modulated alternately by 440 and 600 cps 3 minutes out of 5.
LOL	Buenos Aires, Argentina	5, 10, 15	Spanish voice announcements during the fourth minute of every 5.
ZUO	Olifatspontein, South Africa	5.0	Interruption from minute 15 to minute 25 of each hour and from 1030 to 0700 hours U. T.
MSF	Rugby, England	2.5, 5.0, 10.0	Code and voice announcements during the fourth and fifth minute of every 5 minutes.
JJY	Tokyo, Japan	2.5, 5.0, 10.0, 15.0	Voice announcements during the fourth and fifth minutes of every 5 minutes.
ZLFS	Lower Hutt, New Zealand	2.5	Broadcasts Tuesdays only from 0100 to 0400 hours U. T. Carrier only.

on audio peaks should be approximately 500 ma. Check that sidetone is present.

5-23. Set the mode selector on the C-3940/ARC-94 to USB. Repeat the procedure given in paragraph 5-22. The results should be the same.

5-24. Set the mode selector on the C-3940/ARC-94 to CW. When the meter selector switch is set to PA MA and the transmitter is not keyed, the meter indication should be 0 ma. Close the key. The meter indication should be approximately 500 ma. With the key closed, sidetone should be present.

5-25. If data equipment is available, set the mode selector on the C-3940/ARC-94 to DATA. Apply a data input to the AN/ARC-94 with the transmitter keyed. When the meter selector switch is set to PA MA, the meter indication should be approximately 500 ma.

5-26. If the above tests indicate that the AN/ARC-94 is not operating properly, remove the equipment from the installation and either replace it with equipment known to be in top operating condition or test the equipment further according to paragraphs 5-27 through 5-48.

5-27. MINIMUM PERFORMANCE STANDARD TESTS.

5-28. GENERAL. Minimum performance standard tests are used to perform three functions: to establish initial operating levels of performance, to provide periodic checks of equipment performance, and to provide a maintenance tool to give maintenance personnel aid in isolating trouble. Figure 5-1 shows the location of test points used in the minimum performance tests.

5-29. USE OF DATA SHEET. A data sheet is provided (table XXI) to aid maintenance personnel in locating trouble within the RT-648/ARC-94. The data sheet should be filled out initially by testing the RT-648/ARC-94 before installation and recording the results on it. During subsequent tests, the data sheet should be compared with actual equipment operational data and any deviation noted as a sign of trouble or the deterioration of the components. Deterioration of the components can then be corrected before actual equipment failure occurs or trouble can be isolated to a specific component or module.

5-30. TEST EQUIPMENT SETUP. The test setup for the minimum performance standard tests is illustrated in figure 5-2. All the test equipment shown in the test setup and utilized during the minimum performance tests is listed in table X.

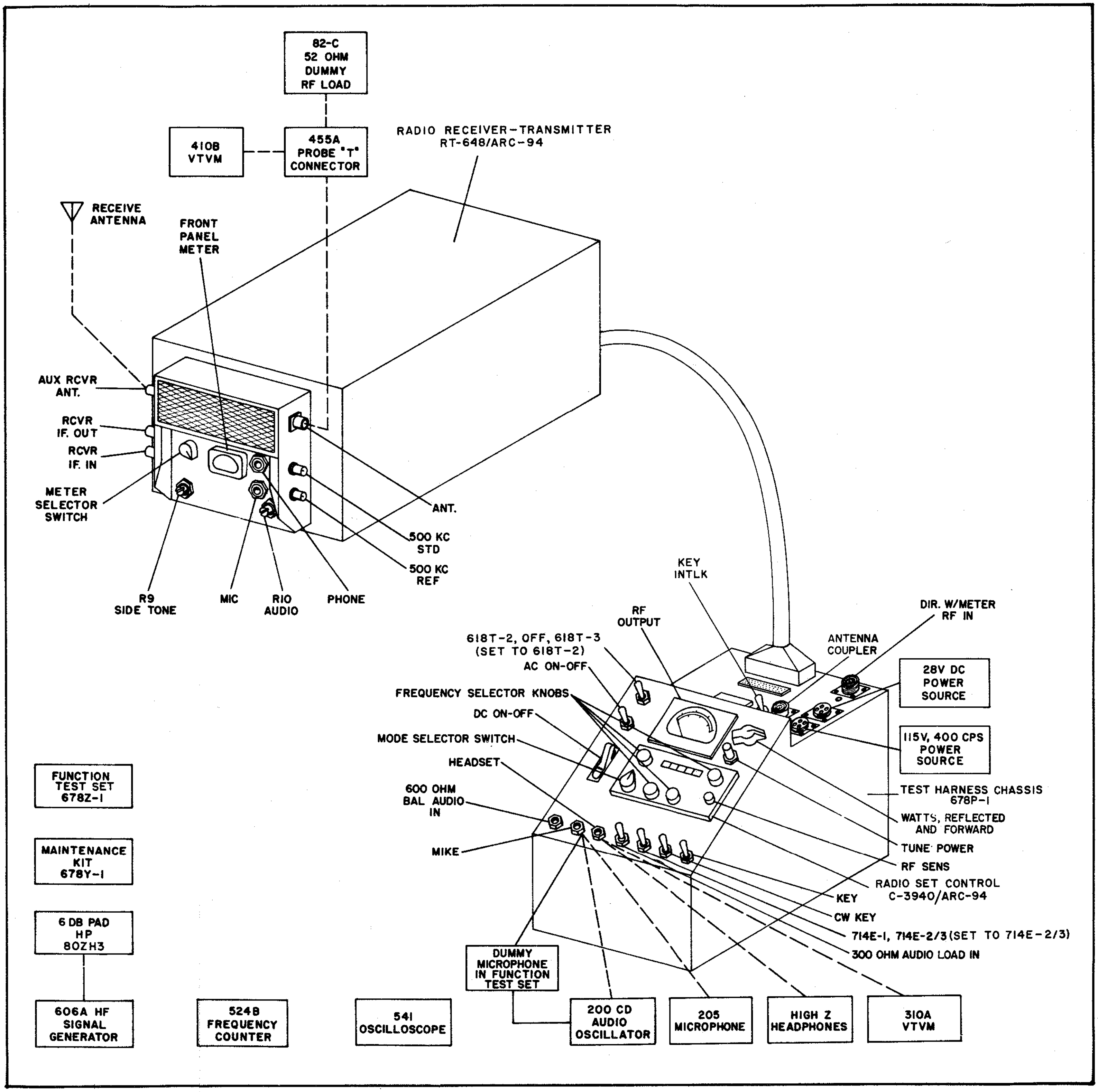


Figure 5-2. Test Setup for Minimum Performance Standard Tests

5-31. To set up the test equipment, proceed as follows:
a. Connect pendant cable between 678P-1 connector marked 618T-2/3 and the RT-648/ARC-94.
b. Install Radio Set Control C-3940/ARC-94 in the 678P-1 connecting the cable between the 678P-1 and C-3940/ARC-94.
c. Place the transceiver selector switch located on the 678P-1 to the 618T-2 position.
d. Place the remote control panel selector switch located on the 678P-1 to the 714E-2/3 position.
e. Connect the 3-phase a-c and the d-c sources to the equipment.

5-32. RECEIVER GAIN AND SENSITIVITY CHECK. To check the gain and sensitivity of the RT-648/ARC-94 during the receive operation, proceed as follows:
a. Disconnect cables from RT-648/ARC-94 test points 51 and 52 (figure 5-1).
b. Rotate both RT-648/ARC-94 AUDIO control R10 and C-3940/ARC-94 RF SENS control fully clockwise.
c. Connect signal generator through a 6-db pad to RT-648/ARC-94 test point 52, and connect a-c vtvm to the HEADSET jack on 678P-1. (Use phone jack adapter cables supplied with Maintenance Kit 678Y-1.)

NOTE

When using HP-606A, connect 6-db pad between AUX REC. ANT. connector and signal generator.

d. Place 678P-1 300Ω AUDIO LOAD switch (8, figure 2-1) to IN position.
e. Adjust signal generator for 2.1-mc, 3-microvolt output, 30 percent modulated with a 1000-cps signal.
f. Place C-3940/ARC-94 mode selector in AM position and slowly vary frequency of signal generator until maximum indication is observed on a-c vtvm; record this indication on the data sheet. The observed indication should be no less than 2.4 volts ac.
g. Remove modulation from signal generator observe and record a-c vtvm indication.
h. Determine and record on data sheet signal-plus-noise to noise ratio of the RT-648/ARC-94, subtracting a-c vtvm db indication obtained when using modulation from db indication obtained without modulation. This value should be no less than 6 db.
i. Place the C-3940/ARC-94 mode selector in LSB position.
j. Remove modulation from signal generator output and adjust amplitude of output to 1 microvolt. Readjust frequency of signal generator output until maximum indication is observed on a-c vtvm; record this indication on data sheet. The observed indication should be no less than 1.3 volts ac.
k. Detune signal generator and again observe indication on a-c vtvm. Record db indication on data sheet. Signal-plus-noise to noise ratio in db is the difference in db between this indication and the obtained in step j.
l. Place C-3940/ARC-94 mode selector in USB position.
m. Repeat steps j and k for all 28 frequencies shown on data sheet.

5-33. RECEIVER AGC CHARACTERISTICS CHECK. To check the receiver agc characteristic, proceed as follows:
a. Place the C-3940/ARC-94 mode selector to AM and adjust frequency selector knobs until frequency indicator dial indicates 7.300 mc.
b. Adjust signal generator for 7.3-mc, 10-microvolt output, 30 percent modulated with a 1000-cps signal.
c. Place 678P-1 300Ω Audio load switch to IN position.
d. Connect a-c vtvm to 678P-1 HEADSET jack (9, figure 2-1) using phone jack adapter.
e. Readjust signal generator output frequency until maximum indication is observed on a-c vtvm; record this indication on the data sheet for 10-microvolt input.
f. Increase amplitude of signal generator output to 0.1 volt and observe that a-c vtvm indication is not more than 6 db more than that observed in step e; record this indication on the data sheet.
g. Connect d-c vtvm to r-f translator module jack test point L12 and observe that the indication is between 8 and 10 volts dc with 0.1-volt input from signal generator. Use test probe No. 2 (44, figure 2-9) supplied in the 678Y-1 to make this measurement. Record the indication on the data sheet.

5-34. AUDIO GAIN CHECK. To perform the audio gain check, proceed as follows:

NOTE

The RT-648/ARC-94 AUDIO control R10 is factory-adjusted for a 100-milliwatt output across 300 ohms for an input of 1000 microvolts, 30 percent modulated with a 1000-cps signal. When the equipment is initially installed, the proper attenuators must be selected to existing system or AUDIO control R10 must be adjusted. To ensure interchangeability of the RT-648/ARC-94, it is advisable to use attenuators. The following procedure presents the method used at the factory for performing the audio gain adjustment.

a. Disconnect cables from test points 51 and 52 on RT-648/ARC-94.
b. Connect signal generator to RT-648/ARC-94 test point 52 (figure 5-1) and a-c vtvm to 678P-1 HEADSET jack using phone jack adapter.
c. Place 678P-1 300 Ω AUDIO LOAD switch in IN position.

NOTE

When using HP-606A signal generator, connect 6-db pad between test point 52 and signal generator output.

d. Adjust signal generator for 7.3-mc, 1000-microvolt output, 30 percent modulated with 1000-cps signal.
e. Place C-3940/ARC-94 mode selector to AM position, adjust frequency selector knobs until frequency indicator dial indicates 7.3 mc, and turn RF SENS control fully clockwise.
f. Readjust signal generator output frequency until maximum indication is observed on a-c vtvm.
g. Adjust RT-648/ARC-94 AUDIO control R10 until a-c vtvm indicates 5.5 volts and record this indication on the data sheet.
h. Turn C-3940/ARC-94 RF SENS control fully counterclockwise and observe that a-c vtvm indication decreases to 0.2 volt or below.
i. Turn RF SENS control fully clockwise.

5-35. POWER AMPLIFIER STATIC PLATE CURRENT CHECK. To check the power amplifier static plate current, proceed as follows:
a. Connect dummy load to RT-648/ARC-94 test point 51.
b. Set KEY INTLK switch on top of 678P-1 to BY PASS position.
c. Remove coaxial jumper (figure 5-1) between RT-648/ARC-94 test points 54 and 56.

NOTE

When coaxial jumper is removed, drive to power amplifier is disabled and static plate current can be measured.

d. Set RT-648/ARC-94 meter selector switch to 28V and 130V positions and observe that meter indicates in red area for each position; make entry in data sheet.
e. Set RT-648/ARC-94 meter selector switch to PA MA position.
f. Key RT-648/ARC-94 by operating 678P-1 KEY switch (5, figure 2-1), and observe that RT-648/ARC-94 blower speeds up.

CAUTION

If RT-648/ARC-94 blower does not speed up when RT-648/ARC-94 is keyed, unkey RT-648/ARC-94 immediately and check blower.

g. Check RT-648/ARC-94 meter indication for approximately 300 ma. If indication is not 300 ma, adjust potentiometer A11R2 to obtain this reading.

NOTE

If 300 ma cannot be obtained by adjusting A11R2, refer to maintenance procedures in paragraph 6-174.

h. Place RT-648/ARC-94 meter selector switch to 1500V position, and observe that meter indicates in red area when 678P-1 KEY switch operated. Make entry on data sheet.
i. Unkey RT-648/ARC-94.
j. Using eraser end of pencil, depress RT-648/ARC-94 switch A11S4 (figure 5-1), operate 678P-1 KEY switch, and observe that indication on RT-648/ARC-94 meter differs from that recorded in step g by 80 to 120 ma; record this indication on data sheet.
k. Unkey RT-648/ARC-94.
l. Depress RT-648/ARC-94 switch A11S5 using the eraser end of a pencil (figure 5-1), operate 678P-1 KEY switch, and observe that indication on RT-648/ARC-94 meter is less than that recorded in step g by 80 to 120 ma; record indication on data sheet.
m. Unkey RT-648/ARC-94.

NOTE

If normal indications specified in steps j and l are not obtained, refer to maintenance procedures outlined in paragraph 6-174.

n. Reconnect coaxial jumper between test points 54 and 56 on RT-648/ARC-94 front panel.

5-36. TRANSMITTER POWER OUTPUT CHECK. To perform a transmitter power output test, proceed as follows:
a. Connect dummy load to RT-648/ARC-94 test point 51.
b. Place C-3940/ARC-94 mode selector to AM position and adjust frequency selector knobs until frequency indicator dial indicates 2.1 mc. Operate KEY switch on 678P-1.
c. Observe that voltage across dummy load (using a-c vtvm and T-connector) is between 70 and 90 volts ac. Record this indication in data sheet.
d. Repeat the procedure in step c for all frequencies shown in data sheet.

5-37. TRANSMITTER MODULATION CHECK. To check the transmitter modulation, proceed as follows:
a. Connect oscilloscope to RT-648/ARC-94 r-f output connector (test point 51) using 11- to 14-picofarad probe.

CAUTION

Do not connect more than 15 picofarads to RT-648/ARC-94 r-f output connector. If equipment is checked in line, do not load antenna with more than 15 picofarads.

b. Place C-3940/ARC-94 mode selector to AM and adjust frequency selector knobs until frequency indicator dial indicates 7.3 mc.

c. Connect audio oscillator to 678P-1 MIKE input jack (10, figure 2-1) through 678Z-1 dummy microphone and adjust oscillator for 2000-cps signal.
d. Connect a-c vtvm to 678Z-1 TEST POINT jack (12, figure 2-5).
e. Operate 678P-1 KEY switch.
f. Increase audio oscillator output until 85 percent modulation is indicated on oscilloscope or observe that a-c vtvm indicates 0.25 volt rms, whichever occurs first.
g. Compute percent of modulation by dividing maximum peak-to-peak value of observed waveform by minimum peak-to-peak value; the quotient must be greater than 12.3 indicating more than 85 percent modulation. Record information on data sheet.

5-38. SIDETONE OUTPUT CHECK. To check the sidetone output, proceed as follows:
a. Set up test equipment by repeating the procedures outlined in paragraph 5-37.
b. Adjust audio oscillator output until a-c vtvm indicates 0.25 volt.
c. Adjust RT-648/ARC-94 SIDE TONE control R9 for 5.5-volt indication at HEADSET jack on 678P-1. Record information on data sheet.

5-39. RADIO TALK-OUT CHECK. To perform radio talk-out check, proceed as follows:
a. Place C-3940/ARC-94 mode selector to AM and adjust frequency selector knobs for 7.3 mc. Connect RT-648/ARC-94 test point 51 to the dummy load.
b. Operate 678P-1 KEY switch and measure voltage across dummy load with vtvm.
c. Adjust vertical sensitivity of oscilloscope for 35 volts rms centimeter. For example, if measured voltage in step b is 77 volts, adjust peak-to-peak oscilloscope indication for 2.2 centimeters.
d. Connect microphone to 678P-1 MIKE jack and speak into microphone.
e. Observe oscilloscope indication. Waveform should increase to approximately 4.0 centimeters in height on voice peaks. Record information on data sheet.
f. Repeat steps d and e with C-3940/ARC-94 mode selector set to USB and to LSB. Record information on data sheet.

5-40. CARRIER BALANCE AND RESIDUAL NOISE CHECK. To perform the carrier balance and residual noise check, proceed as follows:
a. Place C-3940/ARC-94 mode selector to AM and adjust frequency selector knobs for 2.1 mc. Connect RT-648/ARC-94 test point 51 to the dummy load. Remove microphone from MIKE jack.
b. Operate 678P-1 KEY switch and observe that a-c vtvm indicates between 70 and 90 volts. Record information on data sheet.
c. Unkey 678P-1 KEY switch and place C-3940/ARC-94 mode selector to USB.
d. Rekey 678P-1 KEY switch and observe a-c vtvm indication is less than 25 volts. Record information on data sheet.

5-41. POWER SUPPLY BLANKER CIRCUIT CHECK. To perform supply blanker circuit check, proceed as follows:
a. Place C-3940/ARC-94 mode selector to AM. (Frequency selector knobs can be set to any frequency.)
b. Connect d-c vtvm to test point E3 and observe that d-c vtvm indicates +18 volts dc. Record information on data sheet.
c. Connect test point E1 to ground and observe that d-c vtvm indicates 0 volt dc. Remove ground from test point E1 and observe that d-c vtvm indicates +18 volts dc. Record information on data sheet.

5-42. FREQUENCY ACCURACY MEASUREMENT CHECK. To perform frequency accuracy measurement test, proceed as follows:
a. Connect frequency counter to RT-648/ARC-94 r-f output jack (test point 51) through the 8- to 30-mc capacitive divider supplied in 678Y-1. Also connect dummy load to r-f output jack.
b. Place C-3940/ARC-94 mode selector to AM and adjust frequency selector knobs until frequency indicator dial indicates 9.999 mc.
c. Operate 678P-1 KEY switch and count operating frequency to nearest 0.1 cycle per second as indicated on the frequency counter. The error should be less than 8.0 cps. Record information on data sheet.

5-43. FREQUENCY ADJUSTMENT. To perform the frequency adjustment, proceed as follows:
a. Connect RT-648/ARC-94 to antenna located in low-noise area.
b. Place C-3940/ARC-94 mode selector to USB and adjust frequency controls to frequency 1 kc below that of WWV.

NOTE

WWV transmits on frequencies of 2.5, 5.0, 10.0, 15.0, 20.0, and 25.0 mc. Select frequency that provides best reception. This test requires good signal with little fading.

c. Connect oscilloscope across 300-ohm audio load and observe 1000-cps sine wave. This signal represents WWV carrier. Record information on data sheet. Connect frequency counter to the 300-ohm audio load. The indication should be 1000 cps. Any error will be the error of the RT-648/ARC-94 frequency standard.
d. Depress RT-648/ARC-94 meter selector switch to CAL TONE. This connects 1000-cps signal from frequency divider to audio output.
e. Turn C-3940/ARC-94 RF SENS control fully counterclockwise; then slowly increase gain until both signals are at same amplitude, as observed on oscilloscope.
f. Adjust frequency adjust trimmer capacitor A2C1 (on r-f oscillator module, figure 5-1) for zero drift rate between two 1000-cps signals.

5-44. KILOCYCLE-FREQUENCY STABILIZER DIGIT OSCILLATOR FREQUENCY CHECK. To perform the kilocycle-frequency stabilizer digit oscillator frequency check, proceed as follows:

a. Connect frequency counter using probe No. 1 (43, figure 2) supplied in 678Y-1, to digit oscillator output jack J5 (test point 55) on kilocycle-frequency stabilizer module A4 (figure 5-1).
b. Adjust frequency selector knobs until frequency indicator dial indicates 9.996 mc.
c. Count digit oscillator frequency as indicated on frequency counter. Record information on data sheet.

NOTE

If a stronger signal is required to drive the frequency counter, connect an auxiliary high-input impedance amplifier such as Tektronix Model 541 Oscilloscope to probe No. 1 and use vertical amplifier output to drive the counter.

d. Repeat steps b and c using frequency indicator dial settings of 9.999 mc and 9.9995 mc.

5-45. KILOCYCLE-FREQUENCY STABILIZER CAPTURE RANGE AND PHASE LOCKING CHECK. To perform kilocycle-frequency stabilizer capture range and phase locking check, proceed as follows:
a. Connect jacks A1J2 in frequency divider module A1 and A4J3 in kilocycle-stabilizer module A4 to the corresponding jacks on the 678Z-1. Connect GRND jack on the 678Z-1 to the transceiver chassis. Place the 678Z-1 FUNCTION SELECTOR switch to 70K-5 CAPTURE RANGE.
b. Set TGC & CAPTURE RANGE control R3 on the 678Z-1 fully counterclockwise.
c. Connect frequency counter to RT-648/ARC-94 r-f output using 8- to 30-mc capacitive divider (18, figure 2-9) supplied in 678Y-1.
d. Adjust frequency selector knobs until frequency indicator dial indicates 9.100 mc.
e. Key the RT-648/ARC-94 and count operating frequency as indicated on frequency counter. Record information on data sheet.
f. Connect kilocycle-frequency stabilizer test point D3 to ground, and adjust 678Z-1 TGC & CAPTURE RANGE control R3 until frequency counter indicates 3000 to 3500 cps higher than reading in step e. Record information on data sheet.
g. Disconnect kilocycle-frequency stabilizer test point D3 from ground.
h. Operate 678P-1 KEY switch and count operating frequency as indicated on the frequency counter. Record information on data sheet.
i. Repeat steps f and g for 3000 to 3500 cps lower than frequency in step d. Record the output frequency when kilocycle-frequency stabilizer test point D3 is ungrounded.

5-46. VFO TRACKING CHECK. To perform the vfo tracking check, proceed as follows:
a. Place C-3940/ARC-94 mode selector to AM and adjust frequency selector knobs to indicate 9.001 mc on frequency indicator dial.
b. Connect frequency counter to RT-648/ARC-94 r-f output using 8- to 30-mc capacitive divider supplied in 678Y-1.
c. Operate 678P-1 KEY switch. Check that counter indication is 9.001 mc ±8 cps. Record this indication on data sheet.
d. Adjust C-3940/ARC-94 frequency selector knobs for 9.553 mc.
e. Operate 678P-1 KEY switch and check that counter indicates 9.553 mc ±8 cps. Record this indication on data sheet.
f. Adjust C-3940/ARC-94 frequency selector knobs for 9.999 mc.
g. Operate 678P-1 KEY switch and check that counter indicates 9.999 mc ±8 cps. Record this indication on data sheet.
h. Connect test point D3 to ground and repeat steps a through g. Tolerance in steps c, e, and g is ±2 kc with test point D3 grounded. Record these indications on data sheet.

5-47. MEGACYCLE - FREQUENCY STABILIZER CHECK. To perform megacycle-frequency stabilizer check, proceed as follows:
a. Connect d-c vtvm to test point J and observe that indication is 7 ±1 volts dc for a 2.1-mc frequency; record this indication on data sheet. The a-c reading must be less than 0.1 volt.

NOTE

Use a 51J receiver loosely coupled to the h-f oscillator or 17.5-mc oscillator to determine that the oscillator frequency is locked to the correct point.

b. Repeat step a for all frequencies listed on chart of data sheet.
c. Connect d-c vtvm to test point J8 and observe that indication is 7 ±1 volts for 2.1-mc frequency. Record this indication on data sheet.

NOTE

The procedure given in paragraph 5-48 is used only for modules with MCN 2250 through 7389.

5-48. PEP LIMITER CHECK. To perform PEP limiter check, proceed as follows:
a. Place C-3940/ARC-94 mode selector to AM and adjust frequency selector knobs until frequency indicator dial indicates 11.000 mc.
b. Connect signal generator to test point L12 in r-f translator module A12. Use test probe No. 2 (44, figure 2-9) provided in 678Y-1 for this connection. Set signal generator to 11.000 mc modulated 100 percent with a 1000-cps tone.

CAUTION

Be sure 11.000-mc signal is modulated 100 percent before connecting signal generator to test point L12. Less modulation may overdrive the power amplifier tubes and cause them to burn out.

c. Connect dummy load to test point 51 on the front panel of the RT-648/ARC-94.
d. Connect a-c vtvm across dummy load using coaxial T-connector.

e. Connect d-c vtvm to test points K4 and K5 on power amplifier module A11.
f. Operate 678P-1 KEY switch. With no r-f signal applied, d-c vtvm should read 0.6 to 1.5 volts dc.
g. Increase r-f signal until voltage indicated in d-c vtvm reads one-half the value obtained in step f above. Observe reading in a-c vtvm across dummy load. Meter should read 161 ±2 volts.

NOTE

If this reading is 161 ±2 volts, the PEP limiter circuit is properly adjusted. If the vtvm reading is not 161 ±2 volts, perform the following step to properly adjust the PEP limiter circuit.

h. Adjust magnitude of the h-f signal as necessary to maintain reading in d-c vtvm one-half the value obtained in step f above, and adjust A11R38 until a-c vtvm across dummy load reads 161 ±2 volts.

NOTE

If A11R38 is tuned fully clockwise and 161 ±2 volts cannot be obtained across dummy load, PEP limiter circuit is properly adjusted.

5-49. REMOVAL AND REPLACEMENT.

5-50. The following paragraphs describe the procedures used in the removal and replacement of components of the AN/ARC-94.

5-51. REMOVAL OF RADIO RECEIVER-TRANSMITTER RT-648/ARC-94. To remove the RT-648/ARC-94 from the MT-2641/ARC-94, proceed as follows:
a. Disconnect and tag the cables attached to the front connectors of the RT-648/ARC-94.
b. Remove the safety wiring from the hold-down clamp thumb screws and loosen the hold-down clamp assembly.
c. Carefully remove the RT-648/ARC-94 from the MT-2641/ARC-94 by grasping the two handles located on the front of the RT-648/ARC-94.

5-52. REPLACEMENT OF RADIO RECEIVER-TRANSMITTER RT-648/ARC-94. To replace the RT-648/ARC-94 in MT-2641/ARC-94, proceed as follows:
a. Place the RT-648/ARC-94 on MT-2641/ARC-94 and push toward the rear. When the RT-648/ARC-94 makes contact with the MT-2641/ARC-94 connector, carefully slide the two connectors together making sure the two connectors seat properly.
b. Engage and tighten the hold-down clamp assembly to the RT-648/ARC-94 angle bracket.
c. Safety wire the hold-down clamp thumb screws and reconnect the cables to the front connectors.

5-53. REMOVAL OF MOUNTING MT-2641/ARC-94. To remove the MT-2641/ARC-94, proceed as follows:
a. Remove the grounding straps from the radio rack.
b. Remove the screws, lock washers, and nuts which hold the resilient mounts to the radio rack.
c. The MT-2641/ARC-94 may now be removed by disconnecting the connector and cabling from the rear.

5-54. REPLACEMENT OF MOUNTING MT-2641/ARC-94. To replace the MT-2641/ARC-94, proceed as follows:
a. Connect the connector and cabling to the rear of the MT-2641/ARC-94. The connector must be located in the MT-2641/ARC-94 so the two chamfered corners are at the top of the connector.
b. Fasten the resilient mounts to the radio rack with 10-32 screws, lock washers, and nuts.
c. Connect the grounding straps to the radio rack making sure the surface is clean.

5-55. REMOVAL OF RADIO SET CONTROL C-3940/ARC-94. To remove the C-3940/ARC-94, proceed as follows:
a. Loosen the four Dzus fasteners holding the C-3940/ARC-94 to the instrument or control panel.
b. Remove the C-3940/ARC-94 from the instrument or control panel and remove the cable and connector.

5-56. REPLACEMENT OF RADIO SET CONTROL C-3940/ARC-94. To replace the C-3940/ARC-94, proceed as follows:
a. Replace the connector and cabling to the rear of the C-3940/ARC-49 and replace the C-3940/ARC-94 into the instrument or control panel.
b. Tighten the C-3940/ARC-94 into place by turning the four Dzus fasteners clockwise until the fastener stops are reached.

5-57. REMOVAL OF SIDE COVERS, MODULE COVERS, AND MODULES OF RADIO SET AN/ARC-94. To remove the side covers, module covers, and modules of the AN/ARC-94, proceed as follows:
a. To remove the RT-648/ARC-94 side covers, remove the four screws located at the rear of the RT-648/ARC-94. Slide the covers to the rear slightly and remove the covers.
b. The module covers located on the left side of the RT-648/ARC-94 are removed by grasping the wire loops located on each cover and pulling straight out. The r-f translator cover may be removed by placing a finger in each of the two large holes located in the upper portion of the r-f translator module and pulling until the cover lip clears the module chassis gear plate. The cover should then be slid upward until the lower portion of the module cover clears the module chassis lower lip. The r-f translator cover may be removed by loosening 14 small screws located around the perimeter of the cover and 3 small screws located toward the center of the module. The cover may then be slid up until the screw heads clear the holes in the cover. The cover can then be removed.
c. To remove the modules, loosen the redheaded Phillips hold-down screws located in the corners of the modules. The modules may then be removed by pulling them straight out. Use module puller, Collins part number 546-6463-002, to assist in removing modules.

5-58. REPLACEMENT OF MODULES, MODULE COVERS, AND SIDE COVERS OF RADIO SET AN/ARC-94. To replace the modules, module covers, and side covers of the AN/ARC-94, proceed as follows:

a. To replace the modules, slide the modules into proper chassis location. Seat the module guide pins into the chassis guide pin holes and press the module connectors together. Tighten the module redheaded Phillips hold-down screws.

NOTE

Be certain that all connectors are seated properly before tightening hold-down screws. Connectors may be damaged if not mated properly. Be certain that gaskets on J25, J26, and J29 are in place before modules are fastened on chassis. Modules cannot be placed in the wrong chassis location due to the module locating pins.

b. The module covers may be replaced on the left side of the chassis by pressing the module cover over the module until the module cover is securely seated in its spring clip. The r-f translator module cover may be replaced by placing the lower portion of the cover between the module chassis and the spring clips and pressing down until the upper cover lip is aligned between the chassis gear plate and the attaching spring clips. The cover should then be seated between the spring clips and the chassis gear plate. The power amplifier module cover may be replaced by aligning the cover over the cover screws and sliding the cover down under the screw heads. The 2-56 screws should then be tightened securely.
c. The RT-648/ARC-94 covers may be replaced by aligning the front portion of the covers into the slots located in the RT-648/ARC-94 front panel. The cover may then be fastened by placing four screws into the rear of the covers.

5-59. LUBRICATION.

5-60. No periodic lubrication of the AN/ARC-94 is necessary between overhaul periods.

5-61. MINOR REPAIRS.

5-62. The minor repairs which may be performed on the AN/ARC-94 are limited to cleaning the air filter located on the RT-648/ARC-94. The air filter should be cleaned before the air-outlet side becomes dirty. The air filter should be cleaned as follows:
a. Remove the air filter from the chassis by loosening the two Dzus fasteners on the front cover and removing the cover. The filter may then be removed by sliding the filter up until the filter clears the chassis.
b. Slowly immerse the filter, dirty side up, in cool water to which a mild detergent has been added. This will float out dirt and lint. A slight up-and-down motion will remove any remaining particles. If it is impossible to immerse the filter, pass a fine spray of water through the filter in the direction opposite that of air flow.
c. Shake the filter to remove excess water. Allow the filter to drain dry.
d. Lightly coat all filter surfaces with filter oil. A filter oil such as Air-Maze Filterkote 'M' Water Soluble Oil, or equivalent, is recommended.

TABLE XXI. RADIO SET AN/ARC-94, SAMPLE DATA SHEET

PAR.	5-32m USB GAIN	5-32m S+N/N - SENS.	5-36d POWER OUTPUT	5-47b MC STABILIZER	PAR.	5-32n USB GAIN	5-32n S+N/N - SENS.	5-36d POWER OUTPUT	5-47b MC STABILIZER
FRE-QUENCY (mc)	Input, 1 uv. Not less than 1.3 V ac audio out.	Input, 1 uv. Not less than 10 db.	70 to 90 volts.	6 to 9 V dc.	FRE-QUENCY (mc)	Input, 1 uv. Not less than 1.3 V ac audio out.	Input, 1 uv. Not less than 10 db.	70 to 90 volts.	6 to 9 V dc.
2.100					16.900				
3.100					17.900				
4.100					18.900				
5.500					19.900				
6.900					20.900				
7.100					21.900				
8.100					22.900				
9.100					23.900				
10.100					24.900				
11.100					25.900				
12.100					26.900				
13.100					27.900				
14.100					28.900				
15.500					29.900				

PAR.	STEP	FUNCTION	TEST POINT	QUANTITY BEING MEASURED	C-3940/ ARC-94 SETTING (mc)	TRANS-MITTER KEYED (X)	DATA	LIMITS
5-32	f	Receiver gain/ sensitivity	HEADSET jack (678P-1)	AM audio output voltage (5-uv input)	AM, 2.100			Not less than 2.4 volts ac.
	h		Same	AM S+N/N ratio (3-uv input)	AM, 2.100			Not less than 6 db down.
	j		Same	LSB audio output voltage (3-uv input)	LSB, 2.100			Not less than 1.3 volts ac.
	k		Same	LSB S+N/N ratio (1-uv input)	LSB, 2.100			Not less than 10 db down.
	m		Same	USB audio output and USB S+N/N ratio (1-uv input)	USB (See chart)		See chart	Not less than 10 db down.
5-33	e	Receiver agc characteristics	Same	Audio output voltage (10-uv input)	AM, 7.300			Check.
	f		Same	Audio output voltage (100,000-uv input)	AM, 7.300			Not more than 6 db more than the value in step e.
	g		A12J3 (test point L12)	Agc voltage (100,000-uv input)	AM, 7.300			Not less than 8 volts dc.
5-34	g	Audio gain	HEADSET jack (678P-1)	Audio output voltage (1000-uv input)	AM, 7.300			5.5 volts ac. (Adjust R10.)
5-35	d	Power amplifier static plate current	Front panel meter	28-volt d-c and 130-volt d-c supply voltages	AM, any frequency			Meter should indicate in red area on scale.
	g		Same	Static plate current	Same	X		Approximately 300 ma.
	h		Same	1500-volt d-c plate voltage	Same	X		Meter should indicate in red area on scale.
	j		Same	Static plate current (S4 depressed)	Same	X		80 to 120 ma less than in step g.
	l		Same	Static plate current (S5 depressed)	Same	X		80 to 120 ma less than in step g.
5-36	d	Transmitter power output	ANT. connector (test point 51)	R-f output voltage	AM (See chart)	X	See chart	70 to 90 volts ac.

TABLE XXI. RADIO SET AN/ARC-94, SAMPLE DATA SHEET (Cont)

PAR.	STEP	FUNCTION	TEST POINT	QUANTITY BEING MEASURED	C-3940/ ARC-94 SETTING (mc)	TRANS-MITTER KEYED (X)	DATA	LIMITS
5-37	g	Transmitter modulation	ANT. connector (test point 51)	R-f output waveform (0.25-volt input)	AM, 7.300	X		Not less than 85 percent.
5-38	c	Sidetone output	HEADSET jack (678P-1)	Audio output voltage (0.25-volt input)	AM, 7.300	X		5.5 volts ac, (Adjust R9.)
5-39	e	Radio talk-out	ANT. connector (test point 51)	R-f output waveform (35 volts/cm)	AM, 7.300	X		Approximately 4 cm.
	f		Same	Same	USB, LSB	X		Approximately 4 cm.
5-40	b	Carrier balance and residual noise	Same	R-f output voltage	AM, 2.100	X		70 to 90 volts ac.
	d		Same	Same	USB, 2.100	X		Not more than 25 volts.
5-41	b	Power supply blanker circuit	A5J3 (test point E2)	18-volt d-c supply voltage	AM, any frequency			18 volts dc.
	c		A5J3 (test point E2)(A5J1 shorted)	Same	Same			0 volt.
5-42	c	Frequency accuracy measurement	ANT. connector (test point 51)	Output frequency	AM, 9.999	X		9.999 mc ±8.0 cps.
5-43	c	Frequency adjustment	HEADSET jack (678P-1)	WWV carrier frequency	USB, 1 kc below WWV freq			Check.
5-44	c	Kilocycle-frequency stabilizer digit oscillator frequency	A4J5 (test point 55)	Digit oscillator frequency	9.996			296 kc ±20 cps.
	d		Same	Same	9.995			305 kc ±20 cps.
	d		Same	Same	9.999			299 kc ± 20 cps.
5-45	e	Kilocycle-frequency stabilizer capture range and phase-locking	ANT. connector (test point 51)	Output frequency (locked)	9.100	X		9.100 mc ±8.0 cps.
	f		Same (A4TP5 shorted)	Output frequency (unlocked and pulled)	9.100	X		9.100 mc +3.0 to 3.5 kc.
	h		Same	Output frequency (relocked)	9.100	X		±1 cps of reading in step e.
	i		Same (A4TP5 shorted)	Output frequency (unlocked and pulled)	9.100	X		9.100 mc -3.0 to 3.5 kc.
	i		Same	Output frequency (relocked)	9.100	X		±1 cps of reading in step e.
5-46	c	Vfo tracking	ANT. connector (test point 51)	Output frequency (locked)	9.001	X		9.001 mc ±8 cps.
	e		Same	Same	9.553	X		9.553 mc ±8 cps.
	g		Same	Same	9.999	X		9.999 mc ±8 cps.
	h		Same (A4TP5 shorted)	Output frequency (unlocked)	9.001	X		9.001 mc ±2 kc.
	h		Same (A4TP5 shorted)	Same	9.553	X		9.553 mc ±2 kc.
	h		Same (A4TP5 shorted)	Same	9.999	X		9.999 mc ±2 kc.
5-47	b	Megacycle-frequency stabilizer	A10J1 (test point J)	H-f oscillator d-c control voltage	See chart		See chart	7 ±1 volts dc.
	c		A10J3 (test point J8)	17.5-mc oscillator d-c control voltage	AM, 2.100			7 ±1 volts dc.
5-48		PEP limiter check	Dummy load	R-f output voltage	AM, 11.000	X		161 ±2 volts.

SECTION VI
FIELD MAINTENANCE

6-1. INTRODUCTION.

6-2. This section provides instructions essential for the maintenance of Radio Set AN/ARC-94 by field maintenance personnel. Before attempting to service and test this equipment, technicians should be thoroughly trained in maintenance practices and familiar with the theory of operation of this equipment. The theory of operation is given in section IV of this handbook. Maintenance procedures presented in this section are limited to those practices which are performed with test equipment and tools authorized for field maintenance personnel. Reference is made to Radio Set AN/ARC-94 Handbook of Overhaul Instructions, NavWeps 16-30ARC94-3, for maintenance procedures not covered in this handbook.

6-3. Maintenance information in this section is divided on a per-module, or a component basis. Each maintenance division contains minimum performance tests, trouble-shooting information, removal and replacement procedures, test point voltage and resistance charts, and lubrication information where applicable.

6-4. GENERAL.

6-5. Field maintenance of the equipment is based on a complete test procedure designed to check out the AN/ARC-94 system. This section provides maintenance information for each module of the RT-648/ARC-94 and for C-3940/ARC-94. Defects disclosed during performance tests must be corrected by use of trouble-isolation and adjustment procedures applicable to the specific unit under test. Alignment and adjustment procedures should not be attempted unless it has been definitely established that a malfunction exists because a circuit is misaligned. It is essential that the test equipment used be properly calibrated and otherwise in excellent condition.

6-6. GENERAL TROUBLE SHOOTING.

6-7. This section assumes that trouble has been isolated to a module within the equipment component by the organizational maintenance test procedures of section V. Make a visual check of the module to determine whether the cause of trouble is evident. Check tags which may accompany the module for indications of trouble symptoms. Prepare the defective module for field maintenance by removing a similar module from the test RT-648/ARC-94 and substituting the defective module. Refer to the appropriate module maintenance division of this section for service instructions of the defective module. A defective module is ready for use after it has been subjected to the trouble-isolation, repair, and final adjustment procedures of the particular module maintenance procedure. In some cases, it is necessary to make further adjustments of the module when it has been replaced in the component of the equipment. In all cases, placing a module known to be in good operating condition into a component requires that the component be subjected to the appropriate minimum performance standard tests of section V.

NOTE

When trouble-shooting a module and the accompanying test point voltage and resistance tables are used, the ohmmeter output voltage must be checked for polarity. This can be done by taking a second voltmeter and connecting the ohmmeter leads to it. The voltmeter indication will show which ohmmeter lead is positive and which is negative. Often the black ohmmeter lead will be positive. It is important that this procedure is followed to obtain accurate resistance measurement comparisons.

6-8. MODULE REPAIR.

6-9. The following procedures pertain to the repair of etched circuit boards of modules within the RT-648/ARC-94.

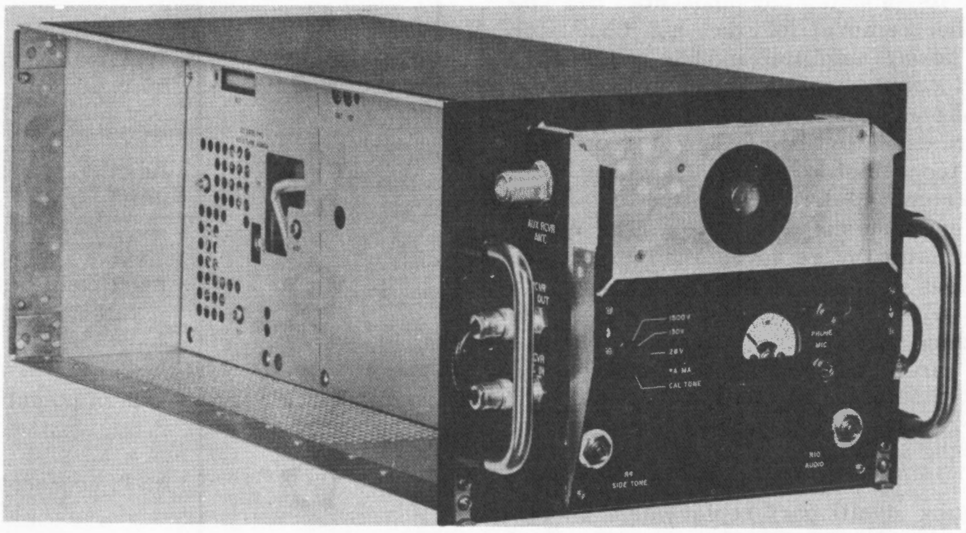
6-10. The etched boards used in the modules have been moisture sealed after all components were mounted in place. Replacement of component parts may be performed in a normal manner, as the heat from a soldering iron will disperse the moisture sealant from the area being heated. The moisture sealant should be replaced when servicing is completed to prevent accumulation of moisture that may cause faulty operation of the equipment. Moisture sealant replacement is accomplished by brushing the deficient area with a material known as Dennis 1169, or its equivalent. This material is available in the printed circuit repair kit (2, figure 2-8) a part of Maintenance Kit 678Y-1. After brushing on the moisture sealant, bake the module for one hour at +60°C (+140°F). If baking facilities are not available, the process may be completed by permitting the moisture sealant to cure at room temperature for seven days. (The moisture sealant will cure tack-free in two hours at room temperature after which the module may be reassembled and operated.)

6-11. The diodes and transistors have their connecting leads soldered directly to etched circuit terminals. Each lead must be disconnected before any of these parts can be removed.

CAUTION

Diodes and transistors can be damaged permanently by the application of excessive heat while removing or replacing them. When soldering diodes or transistors, the lead should be held with a pair of long-nosed pliers between the point to be soldered and the diode or transistor. The pliers will act as a heat sink to prevent excessive heating of the part. The use of high-wattage soldering irons may result in damage to the etched board if extreme care is not used. Therefore, for optimum servicing, soldering iron wattage should be restricted to approximately 30 watts or less. Even with soldering irons in this range, care must be exercised to prevent application of heat to printed boards for extended periods of time.

CHASSIS-MOUNTED CIRCUITS MAINTENANCE



CHASSIS-MOUNTED CIRCUITS

Figure 6-1. Chassis-Mounted Circuits Maintenance Marker

6-12. RT-648/ARC-94 CHASSIS-MOUNTED CIRCUITS.

6-13. GENERAL. The chassis-mounted circuits of Radio Receiver-Transmitter RT-648/ARC-94 are checked as part of the entire Radio Set AN/ARC-94 system performance check. Refer to paragraph 5-27 for the system performance check. Similarly, all adjustments are performed as part of the system performance check. Trouble shooting is performed using the point-to-point investigation trouble-isolation method. Table XXII lists the test points used for maintenance and the location of these test points on the chassis. Figure 7-1 is a schematic diagram of the chassis-mounted circuits.

6-14. REMOVAL.

6-15. Most chassis-mounted components can be reached with the removal of the r-f translator module and the power amplifier module and removing the shield located directly below the modules. Chassis-mounted components located behind the front panel may be reached by removing the front dust cover and the front meter panel. The front dust cover may be removed by turning the two Dzus fasteners and removing the dust cover. The meter panel may be removed by removing the four screws located in the four corners of the meter panel and swinging the panel to the left, taking care not to twist the attaching cable. The remaining chassis detail parts are then available for testing or replacement.

6-16. REPAIR.

6-17. After making detail part replacement as required, reassemble the module by reversing the removal procedure (paragraph 6-15).

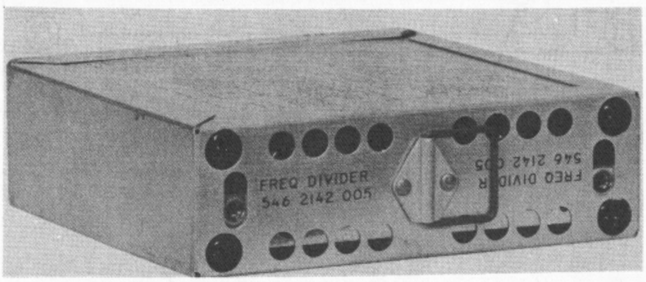
6-18. PREPARATION FOR USE.

6-19. Mount the modules in the repaired chassis-mounted circuits, and connect the RT-648/ARC-94 into the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench tests, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

TABLE XXII
RADIO RECEIVER-TRANSMITTER
RT-648/ARC-94 CHASSIS, LIST OF TEST POINTS

DESIGNATION	LOCATION
1	Junction of resistor R21 and capacitor C11
2	Junction of resistor R21 and diode CR4
3	Junction of transistor Q1 and resistor R25
4	Junction of resistors R6 and R9A
5	Junction of resistors R12 and R9B
6	Junction of resistors R10A and R8
7	Arm of potentiometer R10B
51	ANT. connector J4
52	AUX REC. ANT. connector J3

FREQUENCY DIVIDER MODULE MAINTENANCE



FREQUENCY DIVIDER MODULE

Figure 6-2. Frequency Divider Module A1, Maintenance Marker

6-20. FREQUENCY DIVIDER MODULE A1.

6-21. Testing and trouble-shooting procedures of this module are performed with the frequency divider module, A1, mounted on module extender 548-3505-004 (4, figure 2-8) which has been connected in place of the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect the RT-648/ARC-94 to the bench test setup as shown in figure 5-2.

6-22. Table XXIV lists the test points used for maintenance and the location of test points within module A1. The actual location of test points in the module is shown in figure 6-3. Waveforms

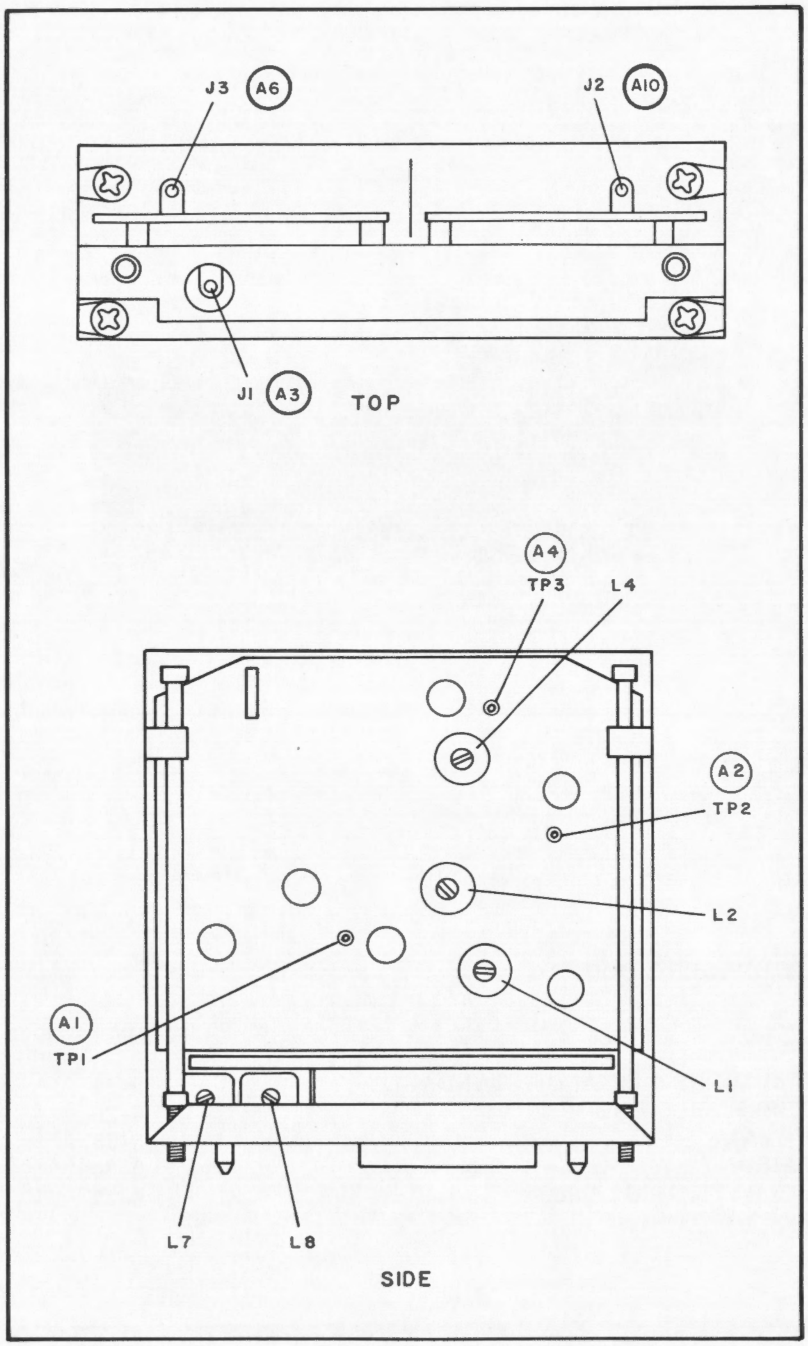


Figure 6-3. Frequency Divider Module A1, Location of Test Points

obtained at the various test points are shown in figure 6-4. Table XXVI shows typical test point voltage and resistance values.

6-23. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform the minimum performance tests. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures.

6-24. MINIMUM PERFORMANCE STANDARDS.

6-25. The minimum performance test of table XXIII provide indications by which maintenance personnel may determine that a repaired module meets the minimum standards of performance. If the module does not check out, perform the trouble-shooting procedures for this module as directed in paragraph 6-26.

TABLE XXIII. FREQUENCY DIVIDER MODULE A1, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
A3	Frequency divider Module	Frequency division	Connect the frequency divider module to the frequency divider module extender which is placed in an RT-648/ ARC-94 known to be in good operating condition. Connect signal generator to J3 in the module extender and adjust for 0.5 volt (rms), at 100 kc.* Connect oscilloscope to test point A3. The waveform pictured in G, figure 6-4 should be observed. Vary the signal generator frequency slightly, above and below 100 kc. The waveform pictured in G, figure 6-4 should shift back and forth. If waveform does not shift, divider is not functioning properly.
A6	Frequency divider module	Frequency division	Duplicate test conditions described above. Connect oscilloscope to test point A6. Waveform pictured in L or M, figure 6-4 should be observed. Vary the signal generator frequency slightly, above and below 100 kc. The waveform pictured in L or M should shift back and forth. If the waveform does not shift, divider is not functioning properly.
A1	Frequency divider module	Locking bandwidth	Duplicate test conditions described above. Connect 100-kc signal generator output to the oscilloscope horizontal input terminals and to J3 of the module extender. Connect oscilloscope vertical input terminals to test point A1 . Waveform pictured in B, figure 6-4 should be observed. Vary the signal generator output frequency until Lissajous indication on oscilloscope becomes unstable or fuzzy indicating edge of bandwidth has been reached. Bandwidth should be centered at 100 ±1 kc and extends more than 4 kc on each side of center point. If indication is abnormal, adjust L1 to center bandwidth midfrequency.

TABLE XXIII. FREQUENCY DIVIDER MODULE A1, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
A2	Frequency divider module	Locking bandwidth	Duplicate test and standard conditions described for test point A1 for test point A2 . If bandwidth conditions are abnormal, adjust L2 to center bandwidth midfrequency. (See waveform D)
A4	Frequency divider	Locking bandwidth	Duplicate test and standards described for test point A1 for test point A4 . If bandwidth conditions are abnormal adjust L4 to the center bandwidth midfrequency. (See waveform F)
*When using HP-606A, connect 6-db pad between J3 on module extender and signal generator.			

TABLE XXIV. FREQUENCY DIVIDER MODULE A1, LIST OF TEST POINTS

DESIGNATION	LOCATION	DESIGNATION	LOCATION
A	100-kc in pin A2 plug 1	A6	J3 collector Q13
A1	TP1 emitter Q2	A7	TP5 collector Q14
A2	TP2 emitter Q4	A8	TP6 junction of capacitors C33 and C34
A3	J1 output jack transformer T1	A9	+18-volt d-c pin 2 plug P1
A4	TP3 emitter Q8	A10	+18-volt d-c J2 junction coil L10 and capacitor C40
A5	TP4 emitter Q10		

6-26. TROUBLE SHOOTING.

6-27. If trouble has been isolated to the frequency divider module, remove the cover and inspect the module detail parts for evidence of burning or shorts. If visual checks fail to isolate the cause of trouble, perform trouble-shooting procedures given in table XXV. Figure 7-2 is a schematic diagram of the frequency divider module. Table XXVI shows typical voltage and resistance values at the various test points.

6-28. REMOVAL.

6-29. Access to detail parts is accomplished by removal of the module dust cover. The cover is

TABLE XXV. FREQUENCY DIVIDER MODULE A1, TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Waveform does not shift at test point A3 with shift in 100-kc input signal.	Defective detail part in transistor stage Q2 or Q4.	Isolate defective part through voltage and resistance measurements, and replace.
Waveform does not shift at test point A6 with shift in 100-kc input signal.	Defective detail part in transistor stage Q7 or Q8.	Locate and replace defective part through the use of voltage and resistance measurements.

TABLE XXVI. FREQUENCY DIVIDER MODULE A1,
TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
A1	TP1	4.4	0.62	15 k	2.5 k	For waveform see A and B, figure 6-4. Ohmmeter (-) reading taken on X1K meter scale.
A2	TP2	3.6	0.92	9.2 k	18.5 k	For waveform see C and D, figure 6-4. Ohmmeter (+) reading taken on X1K meter scale.
A3	J1	0	3.7	0		For waveform see G and H, figure 6-4.
A4	TP3	5.9	1.9	18 k	2.4 k	For waveform see E and F, figure 6-4. Ohmmeter (-) reading taken on X1K meter scale.
A5	TP4	8.0	2.1	36 k	9 k	For waveform see I and J, figure 6-4. Ohmmeter (+), (-) reading taken on X1K meter scale.
A6	J3	0	0.94			For waveform see L and M, figure 6-4. Resistance readings infinity.
A7	TP5	0	2.25	1.7		For waveform see N and O, figure 6-4.
A8	TP6	0	0	11		
A10	J2	17	0	100	125	

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with module mounted on module extender and with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

removed by pulling the cover from the module frame. The mounting boards may be removed by removing the four Phillips-head screws which secure the boards to the module frame. The boards then may be pulled carefully out to the limit of their connecting leads, and test or repair may be effected.

6-30. REPAIR.

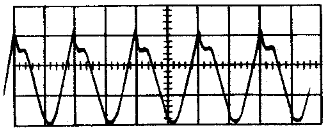
6-31. After making detail part replacement as required, reassemble the module by reversing the removal procedure.

6-32. PREPARATION FOR USE.

6-33. Install the repaired frequency divider module into Radio Receiver-Transmitter RT-648/ARC-94, and connect to the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

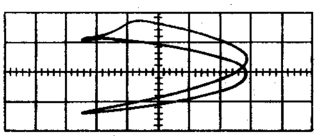
A1 50-kc locked oscillator output, TP1, 10 usec/cm, 1.5 ±0.3 volts peak to peak

A



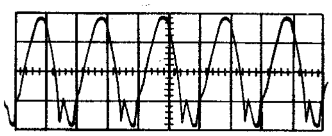
A1 2-to-1 Lissajous figure, TP1, versus 100-kc input signal

B



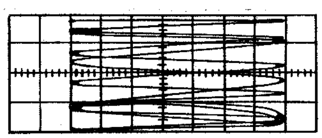
A2 10-kc locked oscillator output, TP2, 50 usec/cm, 2.3 ±0.5 volts peak to peak

C



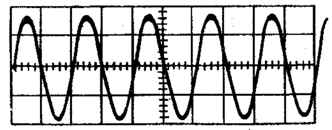
A2 10-to-1 Lissajous figure, TP2, versus 100-kc input signal

D



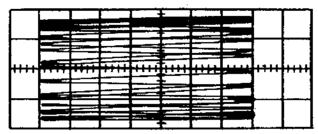
A4 5-kc locked oscillator output, TP3, 100 usec/cm, 4.5 ±1 volts peak to peak

E



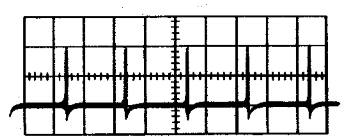
A4 20-to-1 Lissajous figure, TP3, versus 100-kc input signal

F



A3 10-kc pulse output, J1, 50 usec/cm, 6 ±1 volts peak into 50-ohm load

G



A3 10-kc pulse output, J1, 1 usec/cm

H

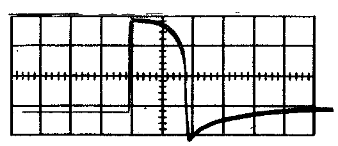


Figure 6-4. Frequency Divider Module A1, Waveforms (Sheet 1 of 2)

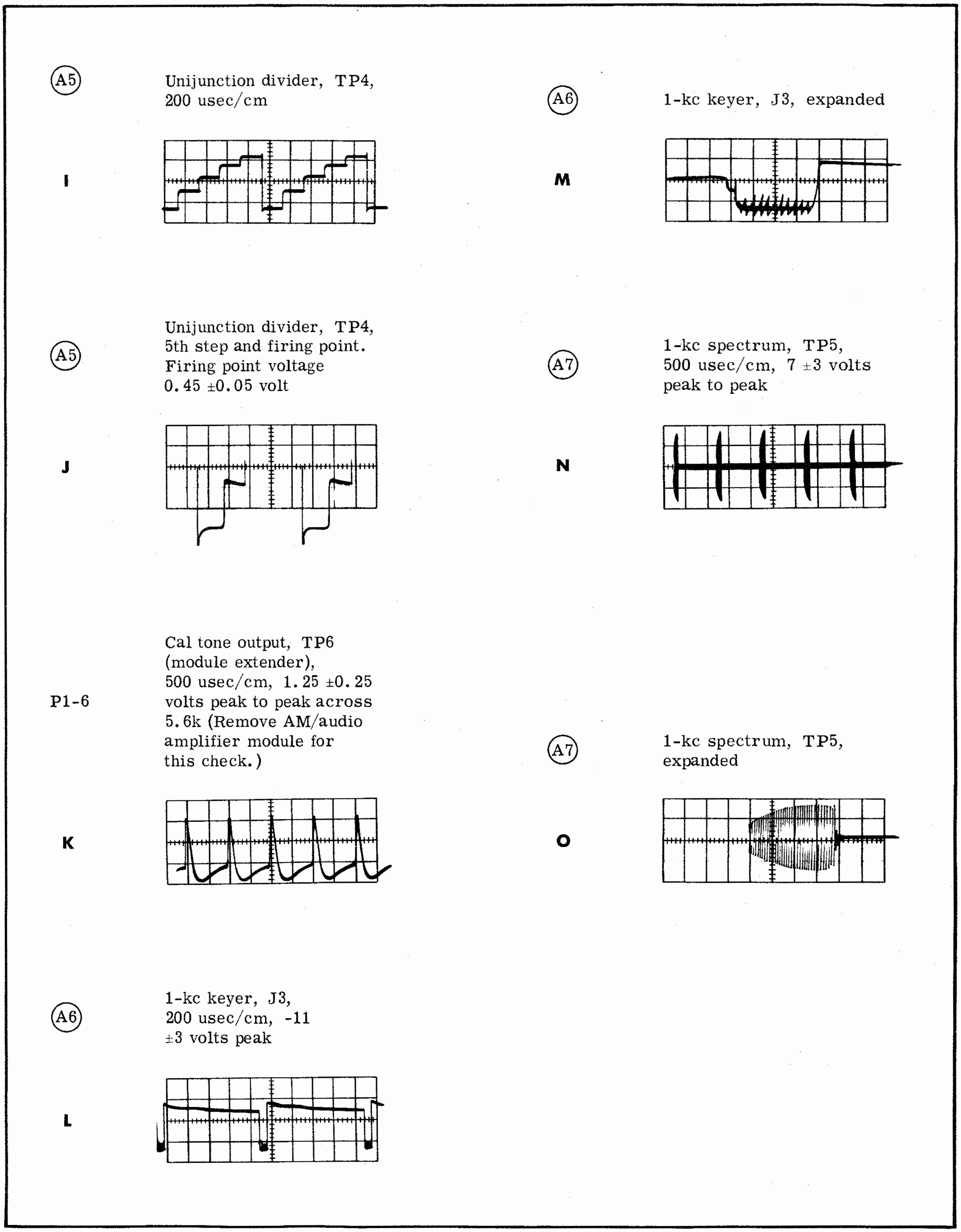
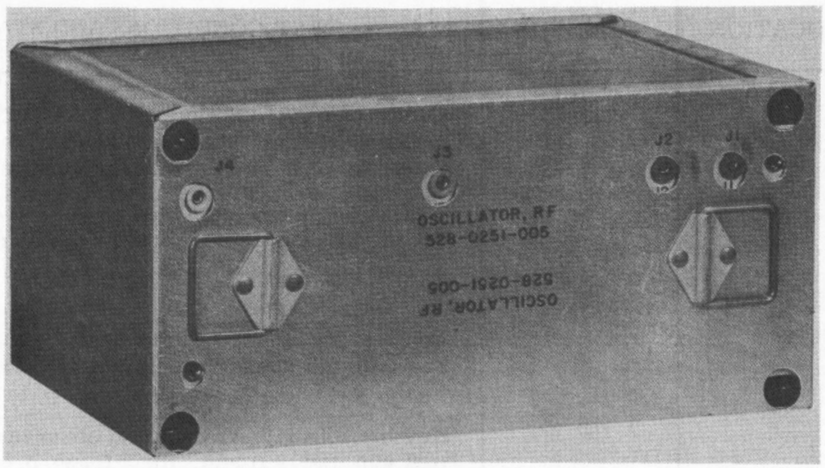


Figure 6-4. Frequency Divider Module A1, Waveforms (Sheet 2 of 2)

R-F OSCILLATOR MODULE MAINTENANCE



R-F OSCILLATOR MODULE

Figure 6-5. R-F Oscillator Module A2, Maintenance Marker

6-34. R-F OSCILLATOR MODULE A2.

6-35. Testing and trouble-shooting procedures of this module are performed with the r-f oscillator module, A2, mounted on module extender 548-3463-004 (8, figure 2-8) which has been connected in place in the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect the RT-648/ARC-94 to the bench test setup as shown in figure 5-2.

6-36. Table XXVIII lists the test points used for maintenance and the location of test points within module A2. The actual location of test points in the module is shown in figure 6-6. Table XXX shows typical test point voltage and resistance values.

6-37. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform the minimum performance tests. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures.

6-38. MINIMUM PERFORMANCE STANDARDS.

6-39. The minimum performance test of table XXVII provides indications by which maintenance personnel may determine that the repaired module meets the minimum standards of performance. If the module does not check out, perform the trouble-shooting procedures for this module as directed in paragraph 6-40.

TABLE XXVII. R-F OSCILLATOR MODULE A2, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
51	ANT. connector	Crystal oscillator frequency	Connect the r-f oscillator module to the r-f oscillator module extender which is placed in an RT-648/ARC-94 known to be in good operation condition. Set the mode selector on the C-3940/ARC-94 to AM and the frequency to 9.999 mc. Connect frequency counter to test point 51 through the 8- to 30-mc capacitive divider (18, figure 2-9.) Key the RT-648/ARC-94 and observe that the frequency is 9.999 mc ±8.0 cps. Read frequency to nearest 0.1 cps. Use a 10-second count.*
B1	R-f oscillator module	Locked oscillator output	Duplicate test conditions described above. Connect horizontal oscilloscope input to test point B1. Connect vertical input to the base of Q4. Oscilloscope pattern should be 6-to-1 Lissajous pattern. The pattern should be stable.** If the pattern is not stable, choose another value of capacity for C14 to correct locked oscillator frequency error.
B1 B	R-f oscillator module	100-kc output	Duplicate test conditions described above. Connect horizontal oscilloscope input to test point B1. Connect vertical oscilloscope input to test point B. Oscilloscope pattern should be 5-to-1 Lissajous figure. The pattern should be stable.** If the pattern is not stable, change the value of C29 to correct error in locked oscillator frequency.

TABLE XXVII. R-F OSCILLATOR MODULE A2, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
B	R-f oscillator module	R-f output	Duplicate test conditions described above. Connect oscilloscope vertical input to test point B. Waveform should be a sine wave with 1.1-volt peak-to-peak minimum amplitude.
B1	R-f oscillator module	R-f output	Duplicate test conditions described above. Connect oscilloscope vertical input to test point B1. Waveform should be a sine wave with 3.1 ±0.3-volt peak-to-peak minimum amplitude.
B3	R-f oscillator module	D-c voltage	Duplicate test conditions described above. Connect d-c vtvm to test point B3 ; reading should be +16 volts dc.
51	ANT. connector	Oscillator frequency	Duplicate test conditions described above. With frequency set at 9.999 mc and capacity divider connected to test point 51, key RT-648/ARC-94 and adjust C1 (figure 6-6) for 9.999 mc as measured on frequency counter. Oscillator must be adjusted to within ±8.0 cps of 9.999 mc.

*The frequency deviation of ±8.0 cps corresponds to an accuracy of ±0.8 part per million in crystal oscillator frequency. In order to reliably accomplish this measurement, it is necessary to use an external 100-kc standard with an accuracy of at least ±1 part in 10^7 in conjunction with the frequency counter.

**A stable oscilloscope pattern is one with no instantaneous phase changes (may have slow phase changes) and/or no fuzziness of the Lissajous display.

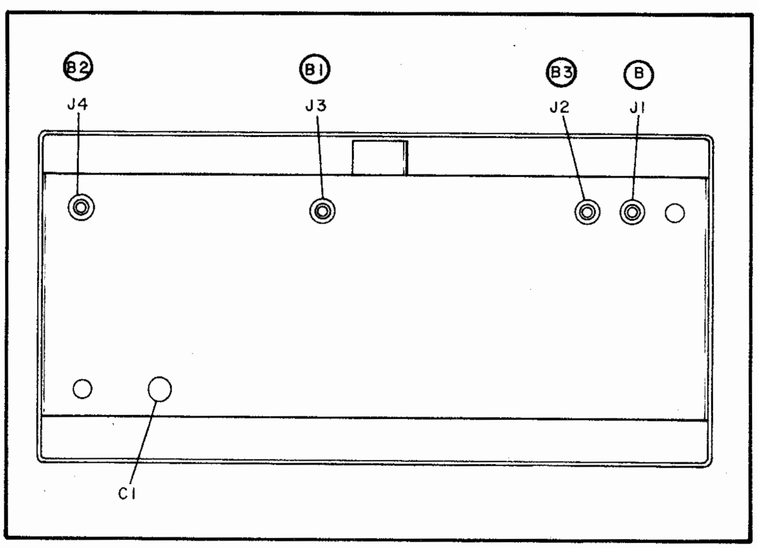


Figure 6-6. R-F Oscillator Module A2, Location of Test Points

TABLE XXVIII
R-F OSCILLATOR MODULE A2,
LIST OF TEST POINTS

DESIGNATION	LOCATION
B	J1
B1	J3
B2	J4
B3	J2

6-40. TROUBLE SHOOTING.

6-41. Remove the module cover and visually inspect the module terminal boards for evidence of burning or shorts. Check etched circuit boards for cracks or other imperfections which could result in a module malfunction. If visual checks fail to isolate the trouble, connect the r-f oscillator module to the module extender and connect to the RT-648/ARC-94. Perform the trouble-shooting procedures given in table XXIX. Figure 7-3 is a schematic diagram of the r-f oscillator module.

6-42. REMOVAL.

6-43. Access to detail parts is accomplished by removal of the module dust cover. The cover is removed by pulling the cover from the module frame. If the cause of trouble is isolated to the oscillator board, remove the entire board for replacement. Oscillator board replacement is accomplished as follows:

a. Remove the two 2-56 screws fastening the red-headed module hold-down screws to the module frame. The hold-down screws located on the oscillator board side should be removed only.

b. Carefully remove the upper foam material and the oscillator board from the module frame until the limit of the connecting wires is reached. Foam material is not mechanically connected to module frame.

c. Unsolder the two connecting wires and the shielded cable from the oscillator board. Tag the wires before removal.

d. Carefully remove the oscillator board from the foam material being careful not to tear the foam. The module is now ready for oscillator board replacement.

6-44. REPAIR.

6-45. After making detail part or oscillator board replacement as required, reassemble the module by reversing the module removal procedure.

CAUTION

Do not attempt to make repairs on the oscillator board as equipment is not available in the field to properly adjust any replaced components. Return the defective boards to the factory for repair.

6-46. PREPARATION FOR USE.

6-47. Install the repaired r-f oscillator module into Radio Receiver-Transmitter RT-648/ARC-94 and

TABLE XXIX. R-F OSCILLATOR MODULE A2, TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
500-kc signal not present at test point B1 .	Defective detail part in transistor stage Q4 or Q5.	Locate and replace defective part through the use of voltage and resistance measurements.
500-kc signal not present at test point B2 but is present at B1 .	Detail part in transistor stage Q6 defective.	Locate and replace defective part through the use of voltage and resistance measurements.
100-kc signal not present at test point B.	Detail part in transistor stage Q7, Q8, or Q9 defective.	With oscilloscope, check outputs of each of the three stages until malfunctioning stage isolated. Locate and replace defective part through the use of voltage and resistance measurements.

connect to the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

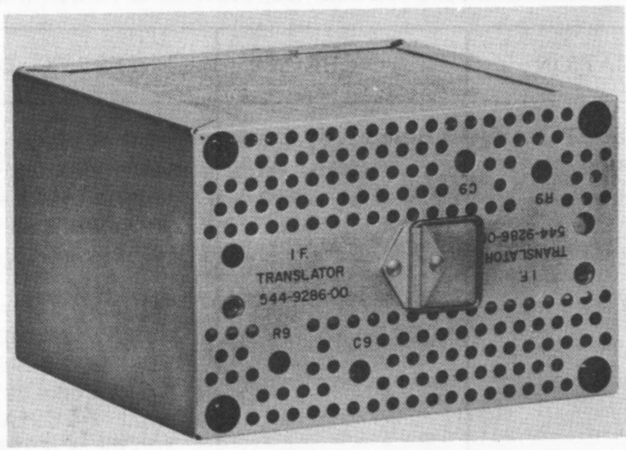
TABLE XXX. R-F OSCILLATOR MODULE A2, TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
B	J1	0	0.4 (min)	62		
B1	J3	0	1.1 ±0.2			Resistance is infinity.
B2	J4	0	1.7 ±0.2	200		
B3	J2	16	0	140	170	

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

I-F TRANSLATOR MODULE MAINTENANCE



I-F TRANSLATOR MODULE

	Paragraph Number
MINIMUM PERFORMANCE STANDARDS	6-52
TROUBLE SHOOTING	6-54
REMOVAL	6-56
REPAIR	6-58
ALIGNMENT	6-60
PREPARATION FOR USE	6-64

Figure 6-7. I-F Translator Module A3, Maintenance Marker

6-48. I-F TRANSLATOR MODULE A3.

6-49. Testing and trouble-shooting procedures of this module are performed with the i-f translator module, A3, mounted on module extender 548-3505-004 (9, figure 2-8) which has been connected in place in the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect the RT-648/ARC-94 to the bench test setup as shown in figure 5-2.

6-50. Figure 6-8 lists the test points used for maintenance and the location of test points within the module.

6-51. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform the minimum performance tests. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures. Table XXXIII shows typical voltage and resistance measurements at the various test points.

6-52. MINIMUM PERFORMANCE STANDARDS.

6-53. The minimum performance standards of table XXXI provide indications by which maintenance personnel may determine that a module meets the minimum performance standards. If the module proves to be defective, trouble-shoot the module according to the trouble-shooting procedures of paragraph 6-54. If the i-f translator module proves to be out of alignment, proceed with the alignment procedures given in paragraph 6-60. Table XXXIV is a sample data sheet used for recording data from the minimum performance standards.

TABLE XXXI. I-F TRANSLATOR MODULE A3, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
HEADSET jack	Radio Set Test Harness 678P-1	Selectivity	Connect the i-f translator module to the i-f translator module extender which is placed in an RT-648/ARC-94 known to be in good operating condition. Connect to bench test setup. Set mode selector of C-3940/ARC-94 to USB. Disconnect coaxial jumper from RT-648/ARC-94 test point 53 (figure 5-1). Connect signal generator to test point 53 . *Adjust signal generator to 100 uv at 501 kc, no modulation. Connect a-c vtvm to HEADSET jack on 678P-1, and adjust the signal generator output until a-c vtvm indicates 4 volts. Increase signal generator output level 1000 times (60 db up). Adjust signal generator frequency above 500 kc (avoid zero beat) until audio output level is again 4 volts as indicated on the vtvm. The signal generator output should be equal to or less than 504.6 kc. Repeat the above steps to determine the 60-db point below 500 kc. The signal generator frequency should be equal to or greater than 498.8 kc. Repeat all of the above steps with the C-3940/ARC-94 mode selector set to LSB and the signal generator adjusted to 100 uv at 499 kc, no modulation. The upper 60-db point should be equal to or less than 501.2 kc. The lower 60-db point should be equal to or more than 495.4 kc.

TABLE XXXI. I-F TRANSLATOR MODULE A3, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
TP9	Module extender	Agc characteristics	Duplicate the test conditions as described above. Set the mode selector of the C-3940/ARC-94 to USB. Connect a-c vtvm to HEADSET jack on 678P-1. Connect d-c vtvm to test point TP9 on module extender. Adjust signal generator connected to test point 53 * for 100 microvolts at approximately 501 kc. Adjust the signal generator frequency for maximum output at the HEADSET jack. Adjust the signal generator output for 5 volts at the HEADSET jack. A-c vtvm now reads 0 db; record this indication in table XXXIV. Increase signal generator output in 20-db steps to 60 db; record a-c voltage, db readings, and d-c voltage in table XXXIV. Repeat above tests with C-3940/ARC-94 mode selector set to LSB and the signal generator set to 499 kc.
HEADSET jack	Radio Set Test Harness 678P-1	Audio response	Duplicate the test as described above. Set C-3940/ARC-94 mode selector to USB. Connect a-c vtvm and frequency counter to HEADSET jack on 678P-1. With a signal generator connected to test point 53 *, tune the generator for maximum audio output (approximately 501 kc), then adjust for 4 volts on the a-c vtvm. Tune signal generator for an audio output in frequency range from 300 to 3000 cps. Record maximum in db of audio output across the range. Audio output level should not vary more than 5 db from 0 db level obtained above. Set the C-3940/ARC-94 mode selector to LSB and repeat the above tests with the signal generator set to 499 kc. The results should be the same as in USB.
HEADSET jack	Radio Set Test Harness 678P-1	Gain check	Duplicate the test as described above. Set the C-3940/ARC-94 mode selector to USB. Connect a-c vtvm to HEADSET jack on 678P-1.

TABLE XXXI. I-F TRANSLATOR MODULE A3, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
HEADSET jack (Cont)			With signal generator connected to test point 53 (figure 5-1), tune the generator around 500 kc for maximum indication on the vtvm. Adjust the signal generator level until the vtvm indicates 5 volts. Record microvolt output of signal generator in table XXXIV. The generator output should be 100 microvolts or less. Repeat the gain check with the C-3940/ARC-94 mode selector set to LSB. The signal generator output should be 100 microvolts or less.
RF OUT jack	I-f translator module extender	Transmit output power	Duplicate the test connections as described above. Set the C-3940/ARC-94 mode selector to USB. Connect audio oscillator through dummy microphone in the 678Z-1 to MIKE jack of the 678P-1.** Set the oscillator to 1000 cps at an output level of 0.25 volt. Disconnect coaxial connector in module extender and connect it to the load in the module extender. Connect a-c probe of vtvm to RF OUT jack on module extender. Key RT-648/ARC-94 by operating KEY switch on 678P-1. Adjust the trimmer capacitor located near the RF OUT jack on the extender for maximum r-f output as indicated on the vtvm. Set the C-3940/ARC-94 mode selector to AM. The vtvm should indicate 0.4 volt ±1 db. Set the C-3940/ARC-94 mode selector to LSB and again adjust the trimmer capacitor for maximum indication on the vtvm. Set the C-3940/ARC-94 mode selector to AM. The vtvm should indicate 0.4 volt ±1 db. Remove the audio input; the vtvm should indicate 0.30 volt ±1 db. Unkey the RT-648/ARC-94.
RF OUT jack	I-f translator module extender	Alc attenuation	Duplicate the test connections as described above. Set the C-3940/ARC-94 mode selector to USB. Connect the audio oscillator through dummy microphone in 678Z-1 to MIKE oscillator to 1000 cps at an output level of 0.25 volt.

TABLE XXXI. I-F TRANSLATOR MODULE A3, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
RF OUT jack (Cont)			Disconnect coaxial connector in module extender and connect it to the load in the module extender. Connect the a-c probe of vtvm to RF OUT jack on module extender. Connect coaxial jumper to RT-648/ARC-94 test point 53 Short test point TP8 to TP12 on module extender. Key the RT-648/ARC-94. Determine that vtvm indicates not more than 0.1 volt.
A3J2	I-f translator module	Tgc level	Duplicate the test connections as described above. Set the C-3940/ARC-94 mode selector to USB. Connect audio oscillator through dummy microphone in 678Z-1 to MIKE jack on 678P-1.** Set the audio oscillator to 1000 cps at an output level of 0.25 volt. Disconnect coaxial connector in module extender and connect it to the load in module extender. Connect d-c vtvm to jack A3J2 for positive voltage measurement. Record d-c vtvm indication in table XXXIV. Key the RT-648/ARC-94. Note the position of resistor R5 in power amplifier module A11. Turn the resistor A11R5 fully counterclockwise, the d-c vtvm indication should be between +10 and +14 volts dc. Unkey RT-648/ARC-94 and return resistor A11R5 to the original setting.

*When using HP-606A, connect 6-db pad between RT-648/ARC-94 test point 53 and signal generator output.

**To make use of the dummy microphone in 678Z-1, connect the audio oscillator to either AUDIO IN jack located on the front panel of the 678Z-1. The dummy microphone output is obtained from the AUDIO OUT connector on the 678Z-1.

6-54. TROUBLE SHOOTING.

6-55. Remove the module cover and visually inspect the disconnected module for evidence of malfunction. Look for shorts, discoloration due to burning, and pay particular attention to the etched boards where breaks or other imperfections may be present. If visual checks fail to isolate the cause of trouble, connect the i-f translator module to the module extender and connect both to the RT-648/ARC-94. Perform the trouble-shooting procedures given in table XXXII. Figure 7-4 is a schematic diagram of the i-f translator module.

6-56. REMOVAL.

6-57. Access to most detail parts is accomplished by removal of the module dust cover. The remaining detail parts, which consist mainly of relays, are accessible by the removal of etched circuit

DESIGNATION	LOCATION
C	P2
C1	J3
C2	P4-8
C3	P4-20
C4	P4-4
C5	P4-9
C6	J4
C7	P1

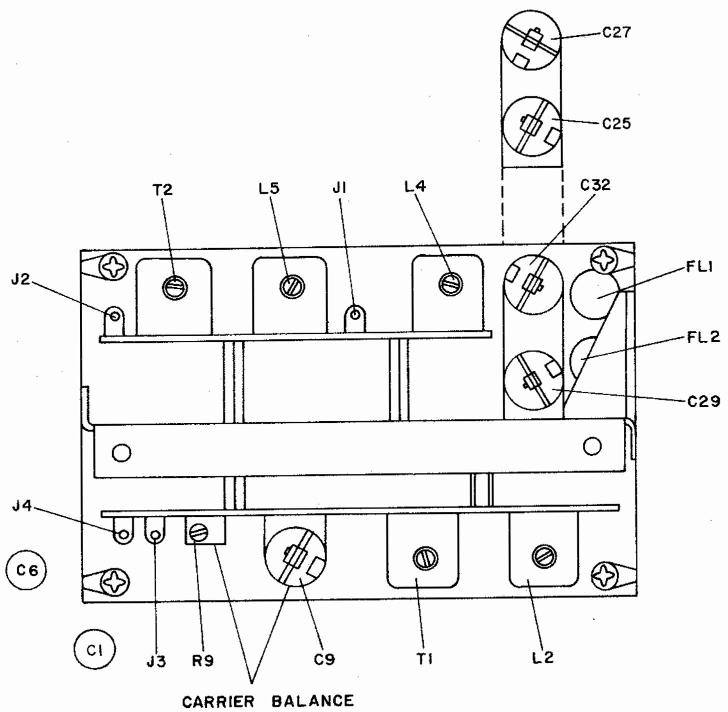


Figure 6-8. I-F Translator Module A3, List and Location of Test Points

TABLE XXXII. I-F TRANSLATOR MODULE A3, TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Selectivity does not meet specifications.	Bad mechanical filter.	Replace FL1 (USB) or FL2 (LSB).
Agc does not operate properly.	CR4, CR5A, CR5B may be defective. Check transistors and circuitry surrounding transistors Q2, Q3, and Q5.	Check stages with oscilloscope until malfunctioning stage is isolated. Locate and replace defective part through use of voltage and resistance measurements.
Improper audio responses.	Bad mechanical filter.	Replace FL1 (USB) or FL2 (LSB).
Low gain.	Transistor stage Q2, Q3, Q4 or Q5.	Isolate malfunctioning stage with oscilloscope, then locate defective part through the use of resistance and voltage measurements. If gain is low but is within a few db of the proper amount, correct in SSB mode by selecting value for A3R5. The level in the AM mode may be corrected by selecting value for A3R42. Select value for A3R45 to equalize gain in each sideband.
Improper alc attenuation.	Q1 or detail part associated with Q1. Check L2.	Isolate defective part through the use of voltage and resistance measurements. Replace L2.
Improper tgc level.	Transistor Q4 or Q6 or associated circuitry.	Isolate defective part through the use of voltage and resistance measurements.

boards. These boards are removed by removing four screws which hold each board in place. The boards then may be removed to the limit of the interconnecting cable.

6-58. REPAIR.

6-59. After making detail part replacement as required, reassemble the module by reversing the removal procedure.

6-60. ALIGNMENT.

6-61. To align the i-f translator module, proceed as shown in the following paragraphs. The alignment instructions pertain to gain and transmit power output adjustment.

6-62. To adjust gain (receive), proceed as follows:

a. Remove coaxial jumper from RT-648/ARC-94 test point 53.

b. Set C-3940/ARC-94 mode selector to USB.

c. Connect signal generator to RT-648/ARC-94 test point 53 through 6-db pad. Set signal generator to 500 kc, unmodulated.

d. Connect a-c vtvm to HEADSET jack on 678P-1. Set 300Ω AUDIO LOAD switch on 678P-1 to IN.

e. Tune signal generator for maximum output as indicated on a-c vtvm. Adjust signal generator for reading of 2 to 3 volts as indicated on a-c vtvm at 500.3 mc.

f. Adjust inductors L4 and L5 and transformer T2 for maximum output as indicated on a-c vtvm. Reduce signal generator output, if necessary, to keep audio output at not more than 5 volts.

g. Set signal generator to 501.0 kc. Adjust capacitors C25 and C29 for maximum output.

h. Set C-3940/ARC-94 mode selector to LSB. Set signal generator to 499 kc.

TABLE XXXIII. I-F TRANSLATOR MODULE A3, TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
C	P2	7.2	0	3.8 k	2.6 k	Transmit d-c voltage 4.6 volts.
C1	J3	0	0	650		
C6	J4	0	0	0		Transmit a-c voltage 1.3 volts.
C7	P1	0	0	5		
	J1	5.6	0	850	6 k	Ohmmeter (+) reading taken on X100 scale.
	J2	5.3	0	6 k	13.5 k	

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

i. Adjust capacitors C27 and C32 for maximum audio output as indicated on a-c vtvm.

6-63. To adjust transmit power output, proceed as follows:

a. Set C-3940/ARC-94 mode selector to USB.
b. Install module extender between chassis and i-f translator module A3.
c. Disconnect coaxial connector in module extender. Connect it to load in module extender.
d. Connect a-c vtvm to RF OUT jack on module extender.
e. Short capacitor C9 to ground. Key RT-648/ARC-94. Adjust transformer T1 and inductor L2 for maximum output as indicated on d-c vtvm.
f. Remove ground from capacitor C9, and adjust capacitor C9 and resistor R9 for minimum output on vtvm.
g. Set C-3940/ARC-94 mode selector to LSB. Adjust C9 and R9 for minimum output on d-c vtvm.
h. Repeat steps e through g until carrier is balanced nearly equally in both USB and LSB modes. The minimum reading should be 25 volts or less.

NOTE

This test is not recommended for very accurate carrier balance tests. For best results a distortion analyzer should be used and the tgc overriden as stated in table XII, TGC OVERRIDE. The tgc is adjusted for 72 volts out in AM mode and carrier balance then checked by switching to each sideband and adjusting R9 and C9 as in paragraph 6-63, steps f, g, and h.

6-64. PREPARATION FOR USE.

6-65. Install the repaired i-f translator module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

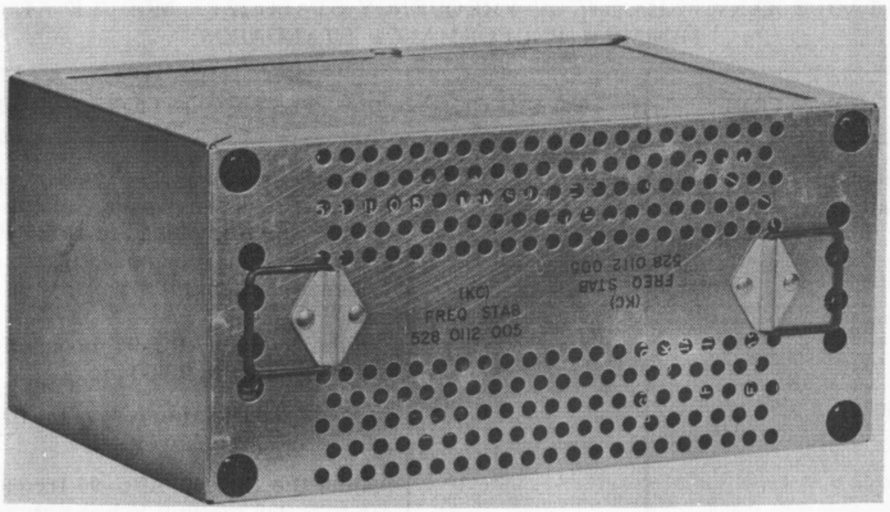
TABLE XXXIV. I-F TRANSLATOR MODULE A3, SAMPLE DATA SHEET

TEST FUNCTION	TEST POINT	QUANTITY BEING MEASURED	REMOTE CONTROL PANEL SETTING	TRANS-MITTER KEYED (X)	DATA	LIMITS
Selectivity	HEADSET jack (678P-1)	Upper 60-db frequency (USB)	USB, any frequency			Not more than 504.6 kc.
	Same	Lower 60-db frequency (USB)	Same			Not less than 498.8 kc.
	Same	Upper 60-db frequency (LSB)	LSB, any frequency			Not more than 501.2 kc.
	Same	Lower 60-db frequency (LSB)	Same			Not less than 495.4 kc.
Agc characteristics and audio output	Same	Audio output voltage (100-uv input)	USB, any frequency			Not less than 5-volt audio output.
	TP9	Agc voltage (100-uv input)	Same			
	HEADSET jack (678P-1)	Db level (5-volt audio)	Same			0 db (reference).
	Same	Audio output voltage (20-db increase)	Same			Not less than 5 volts.
	TP9	Agc voltage	Same			
	HEADSET jack (678P-1)	Db level	Same			Not more than 7-db change.
	Same	Audio output voltage (40-db increase)	Same			Not less than 5 volts.
	TP9	Agc voltage (40-db increase)	Same			
	HEADSET jack (678P-1)	Db level (40-db increase)	Same			Not more than 7-db change.
	Same	Audio output voltage (60-db increase)	Same			Not less than 5 volts.
	TP9	Agc voltage (60-db increase)	Same			
	HEADSET jack (678P-1)	Db level (60-db increase)	Same			Not more than 7-db change.
	Same	Audio output voltage (100-uv input)	LSB, any frequency			Not less than 5-volt audio output.
	TP9	Agc voltage (100-uv input)	Same			
	HEADSET jack (678P-1)	Db level (5-volt audio)	Same			0 db (reference).

TABLE XXXIV. I-F TRANSLATOR MODULE A3, SAMPLE DATA SHEET (Cont)

TEST FUNCTION	TEST POINT	QUANTITY BEING MEASURED	REMOTE CONTROL PANEL SETTING	TRANS-MITTER KEYED (X)	DATA	LIMITS
Agc charac-teristics and audio output (Cont)	Same	Audio output voltage (20-db increase)	Same			Not less than 5 volts.
	TP9	Agc voltage (20-db increase)	Same			
	HEADSET jack (678P-1)	Db level (20-db increase)	Same			Not more than 7-db change.
	Same	Audio output voltage (40-db increase)	Same			Not less than 5 volts.
	TP9	Agc voltage (40-db increase)	Same			
	HEADSET jack (678P-1)	Db level (40-db increase)	Same			Not more than 7-db change.
	Same	Audio output voltage (60-db increase)	Same			Not less than 5 volts.
	TP9	Agc voltage (60-db increase)	Same			
	HEADSET jack (678P-1)	Db level (60-db increase)	Same			Not more than 7-db change.
Audio response	Same		USB, any frequency			Vary no more than 5 db.
	Same	Audio response	LSB, any frequency			Vary no more than 5 db.
Gain	Same	Signal generator output (5-volt audio output)	USB, any frequency			Not more than 100 mv.
	Same	Same	LSB, any frequency			Same
Transmit power output						
	RF OUT jack module extender	I-f translator i-f input voltage	LSB, any frequency	X		0.40 volt ac ±1 db.
	Same	Same	USB, any frequency	X		0.40 volt ac ±1 db.
	Same	Same	AM, any frequency	X		0.30 volt ac ±1 db.
Alc attenuation	Same	Same (TP8 and TP12 connected)	Same	X		Not more than 0.1 volt ac.
Tgc level	A3J2	Tgc voltage	Same			Check.
	Same	Same (R5 full ccw)	Same	X		+10 to + 14 volts dc.

KILOCYCLE-FREQUENCY STABILIZER MODULE MAINTENANCE



KILOCYCLE-FREQUENCY STABILIZER MODULE

Figure 6-9. Kilocycle-Frequency Stabilizer Module A4, Maintenance Marker

6-66. KILOCYCLE-FREQUENCY STABILIZER MODULE A4.

6-67. Testing and trouble-shooting procedures of this module are performed with the r-f oscillator module, A4, mounted on module extender 548-3459-004 (7, figure 2-8) which has been connected in place in the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect the RT-648/ARC-94 to the bench test setup as shown in figure 5-2.

6-68. Table XXXVI lists the test points used for maintenance and the location of test points within module A4. The actual location of test points and adjustment points are shown in figure 6-10. Table XXXVIII shows typical test point voltage and resistance values.

6-69. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform the minimum performance test. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures.

6-70. MINIMUM PERFORMANCE STANDARDS.

6-71. The minimum performance test of table XXXV provides indications by which maintenance personnel may determine that a repaired module meets the minimum standards of performance. The procedure in table XXXV checks tracking voltage and digit oscillator control bias within the module. If the module does not check out, perform the trouble-shooting procedures for this module as directed in paragraph 6-72.

TABLE XXXV. KILOCYCLE-FREQUENCY STABILIZER MODULE A4, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
D1	Kilocycle-frequency stabilizer module	Tracking voltage	Connect the kilocycle-frequency stabilizer module to the kilocycle-frequency stabilizer module extender which is placed in an RT-648/ARC-94 known to be in good operating condition. Connect to bench test setup. Set the C-3940/ARC-94 mode selector to AM and the frequency to 9.000 mc. Connect d-c vtvm to test point D1 . The vtvm should indicate 20 volts dc. Adjust the C-3940/ARC-94 frequency from 9.111 mc to 9.999 mc in 0.111-mc steps. The voltage indicated on the d-c vtvm should continuously decrease from 20 volts dc at 9.000 mc to approximately 4 volts dc at 9.999 mc.
D2	Kilocycle-frequency stabilizer module	Digit oscillator control bias	Duplicate the test connections as described above. Set C-3940/ARC-94 mode selector to AM and the frequency to 9.995 mc. Connect d-c vtvm to test point D2 and observe that vtvm indication is approximately 23 volts dc. Readjust frequency at C-3940/ARC-94 from 9.994 mc to 9.986 mc in 0.001-mc steps. Observe that the voltage indicated by the vtvm continuously decreases in steps as the frequency is decreased. Normal indication at 9.986 mc is approximately 6 volts dc.
55	Kilocycle-frequency stabilizer module	Digit oscillator frequency	Duplicate the test connections as described above. Connect the frequency counter through probe No. 1 supplied in 678Y-1 to test point 55 .

TABLE XXXV. KILOCYCLE-FREQUENCY STABILIZER MODULE A4, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
55 (Cont)			Set the C-3940/ARC-94 to 9.996 mc. Count the digit oscillator frequency. The frequency indicated should be 296 ±20 cps. Repeat the above test with the C-3940/ARC-94 set to 9.995 mc. The frequency indicated should be 305 ±20 cps. Repeat the above test with the C-3940/ARC-94 set to 9.999 mc. The frequency indicated should be 299 ±20 cps. If the frequency counter cannot be driven directly from test point 55, connect an auxiliary high input impedance amplifier, such as Tektronix Model 541 Oscilloscope, to test probe No. 1 and use the vertical amplifier to drive the frequency counter.

TABLE XXXVI. KILOCYCLE-FREQUENCY STABILIZER MODULE A4, LIST OF TEST POINTS

DESIGNATION	LOCATION	DESIGNATION	LOCATION
D	TP18	D11	TP8
D1	J4	D12	TP10
D2	J6	D14	TP2
D3	TP5	D15	TP3
D4	J1	D16	TP4
D5	TP15	D17	TP7
D6	TP16	D18	TP9
D7	J8	D19	TP11
D8	TP12	D20	TP19
D9	J7	D21	TP13
D10	TP1	D22	TP14
		D23	TP17

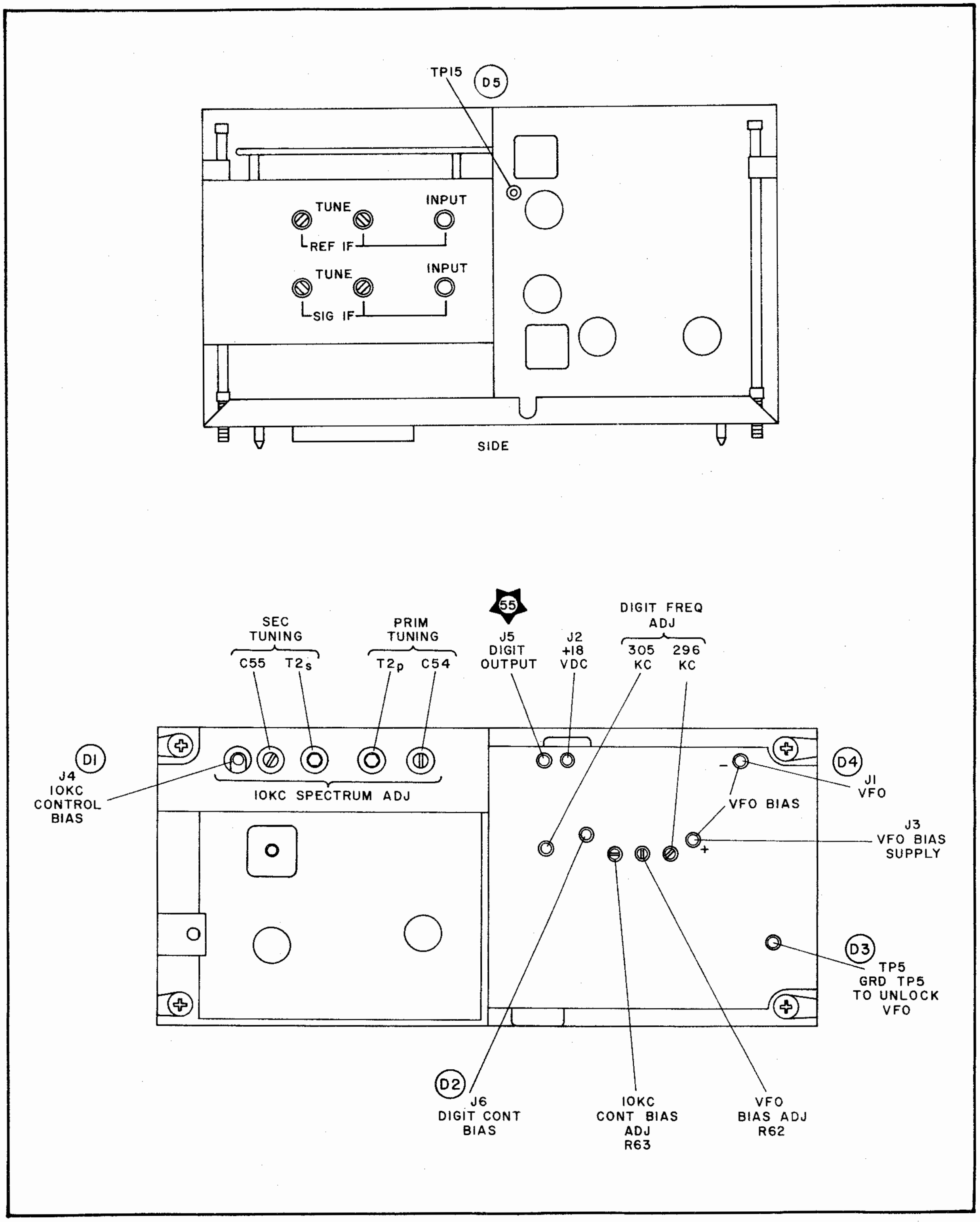


Figure 6-10. Kilocycle-Frequency Stabilizer Module A4, Location of Test Points

6-72. TROUBLE SHOOTING.

6-73. Remove the module cover and visually inspect the module etched circuit boards for evidence of burning or shorts. Check etched circuit boards for cracks or other imperfections which could result in a module malfunction. If visual checks fail to isolate the trouble, connect the kilocycle-frequency stabilizer module to the module extender and connect to the RT-648/ARC-94. Trouble may then be isolated to an individual circuit by comparing the waveform on the module test points with those shown in figure 6-11. If the trouble cannot be isolated in this manner, perform the trouble-shooting procedures given in table XXXVII. Figure 7-5 is a schematic diagram of the kilocycle-frequency stabilizer module.

NOTE

If the trouble in the kilocycle-frequency stabilizer module is traced to the 10-kc spectrum board E3, the digit oscillator board E4, the frequency discriminator on board E2, or the phase discriminator on board E6, the module must be returned to the manufacturer for repair and adjustment.

TABLE XXXVII. KILOCYCLE-FREQUENCY STABILIZER MODULE A4, TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Digit oscillator output not continuous.	Autopositioner submodule switch resistors.	Check resistors on switch A12A1S6 for opens or shorts. Replace defective detail part.
Phase locking or capture range difficulties.	Misalignment of module stages or detail part failure.	Perform the procedure given in paragraph 6-74 for isolation of malfunctioning stage or correction of alignment error. Isolate and replace defective detail parts.

6-74. PHASE LOCKING AND CAPTURE RANGE ALIGNMENT PROCEDURES. The following procedures are for correcting alignment errors or for isolation of malfunctioning stages. The malfunctioning stage can be assumed to be the stage which will not align properly.

a. Observe reference output waveform at test point D5. (Figure 6-11, letter D.)

b. Observe i-f signal waveform at test point D6. (Figure 6-11, letter K.)

NOTE

Both a-c and d-c voltages are present. Check for a-c voltage.

c. If any indication is not within tolerance, connect oscilloscope to test point D5, and observe that indication remains at same level for each digit point from 9.000 to 9.009 mc. If not, check capacitors C22 and C45 in unijunction divider stage Q10 in frequency divider module A1.

d. Connect oscilloscope to test point D7, and observe output of 30 millivolts peak to peak.

e. Connect oscilloscope to test point D8. If spectrum does not conform to that shown in L, figure 6-11, adjust frequency at the C-3940/ARC-94 to 9.005 mc, and adjust variable inductor L17 for maximum output at test point D7. Reset the C-3940/ARC-94 frequency to 9.006 mc, and adjust variable inductor L8 in frequency divider module for maximum output at test point D7. Reset frequency to 9.001 mc, and adjust variable inductor L7 in frequency divider module for maximum output at test point D7.

f. Rechannel frequency from 9.000 through 9.009 mc. Verify that output at test point D7 remains constant (±3 db) over digit range.

g. Connect oscilloscope to test point D9, and observe that output is not less than 80 microvolts peak to peak.

h. Connect oscillocsope to test point D9, and adjust variable inductors L2 and L3 to give maximum amplitude. Move oscilloscope to test point D16, and adjust capacitors C18 and C19 for maximum amplitude. Check for two tuning points on each capacitor to be sure that they are at resonance.

i. Ground test point D4 and connect signal generator to test point D9.

j. Tune generator to 250,020 ±20 cps. Check generator output frequency with counter.

k. Connect oscilloscope to test point D6. Set generator output level below that required to saturate signal i-f amplifiers. Adjust L7 and T1 for a peak voltage at test point D6. Unground test point D4.

l. For final tuning of signal channel, observe waveform at test point D9 (figure 6-11). Set frequency

TABLE XXXVIII. KILOCYCLE-FREQUENCY STABILIZER MODULE A4, TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
55	J5	0	1.4	8		See waveform G, figure 6-11.
D	TP18	0.18	0	170	50 k	
D1	J4	11.6	0	10.2 k		
D2	J6	10.3	0	12.5 k		
D3	TP5	0	4.4	10		See waveform J, figure 6-11.
D4	J1	-.2	0.6	170	70 k	See waveform A, figure 6-11. Ohmmeter (-) reading taken on X1K scale.
D5	TP15	0	8.9	9		See waveform O, figure 6-11.
D6	TP16	6.1	2.4	130 k	85 k	See waveform K, figure 6-11.
D7	J8	0		11		
D8	TP12	0		21		See waveform L, figure 6-11.
D9	J7	0		155		See waveform H, figure 6-11.
D10	TP1	0	0.12	0.4		See waveform E, figure 6-11.
D11	TP8	11.5	0	19 k	65 k	See waveform D, figure 6-11.
D12	TP10	0.49	1.4	12 k	2.8 k	See waveform C, figure 6-11. Ohmmeter (-) reading taken on X1K scale.
D14	TP2	15	0	2 k	10 k	See waveform F, figure 6-11. Ohmmeter (+) reading taken on X1K scale.
D15	TP3	9.2	0	660	4 k	Ohmmeter (+) reading taken on X100 scale.

TABLE XXXVIII. KILOCYCLE-FREQUENCY STABILIZER MODULE A4, TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS (Cont)

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
D16	TP4	0	0.75	5.5		See waveform I, figure 6-11.
D17	TP7	0.1	0	110	80 k	
D18	TP9	17	0	95	125	Ohmmeter (+) reading taken on X10 scale.
D19	TP11	0	3.6	1		
D20	TP19	1.05	5.5	4.4 k		See waveform B, figure 6-11. Ohmmeter (+) reading taken on X1K scale.
D21	TP13	9	0	2.8 k	3.3 k	Ohmmeter (+) reading taken on X1K scale.
D22	TP14	0	0	4		See waveform N, figure 6-11.
D23	TP17	0.06	0	105 k	60 k	

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

to 9.000 mc, and adjust variable inductors L2 and L3 and variable capacitors C18 and C19 for maximum output. Again check for two tuning points on each capacitor to be sure they are at resonance.

m. Connect oscilloscope to test point D9. Check that voltage at test point D9 does not vary more than ±6 db as frequency is varied from 9.000 mc to 9.999 mc in 100-kc steps. If adjustment is required to make the voltage at test point D9 more constant across this range, adjust C54 and C55 for correction around 9.000 mc and the primary and secondary of T2 for correction around 9.999 mc.

n. Ground test point D4 and test point D5. Connect signal generator to test point D9.

o. Set signal generator output to 250,020 ±5 cps, at 40 mv. Check generator output with frequency counter.

p. Connect vtvm between test point D17 (+) and ground. The voltage should be 0 ±5 mv dc. If not, adjust C128 for 0 volt between test point D17 and ground. Unground test points D4 and D5.

q. Set C-3940/ARC-94 to 9.005 mc. Connect oscilloscope to test point D22. Adjust L17 for a peak voltage at test point D22.
r. Tune filter FL2 by adjusting C85 and C86 for a peak voltage at test point D22. Check for two tuning points on each capacitor to be sure that they are at resonance.
s. Ground test point D8. Connect signal generator to test point D7.
t. Tune generator to 250,020 ±30 cps. Check signal generator to 250,020 ±30 cps. Check signal generator output with frequency counter.
u. Connect oscilloscope to test point D5. Set signal generator output level below that required to saturate reference i-f amplifiers. Adjust L19 and T3 for a peak voltage at test point D5. Remove ground from test point D8.

6-75. REMOVAL.

6-76. Removal of the module dust cover gives access to the test points and adjustments of the kilocycle-frequency stabilizer module. Access to the remaining detail parts is effected by removal of various shields and etched circuit boards.

6-77. To remove or have access to terminal boards E2 or E4 (part of the four parallel vertical boards), proceed as follows:
a. Remove the five screws holding the terminal boards to the center shield.
b. Lift the etched circuit boards from the module frame to the limit of their attaching cable.
c. Slide the shield, under the outer circuit board, upward until it is removed from the module frame. The inner etched circuit board (E2 or E4) is now available for test.

NOTE

When testing the kilocycle-frequency stabilizer module with the boards extended from the module frame, care should be exercised so none of the circuitry touches the module frame.

6-78. Access to capacitors C18, C19, C85, and C86 is obtained by removal of the shield covering these capacitors. Access is obtained as follows:
a. Remove the two screws located along the outer edge of etched circuit board E5 (the top horizontal board).
b. Remove the two screws located above and behind connector P1. The screws are accessible through holes in the bottom panel of the module frame.
c. Remove the two screws located directly below etched circuit board E5. The shield may now be removed.

6-79. To gain access to etched circuit board E3 and for removal of mechanical filters, observe the following procedures:
a. Remove the shield covering etched circuit board E3 by the removal of eight screws holding the shields to the module frame. Etched circuit board E3 is now exposed for testing or repair.
b. To gain access to the mechanical filters, remove the five screws holding etched circuit board E3 to the module frame and lift the board from the module to the limit of its connecting cable.
c. Remove the four screws holding the plate, which is directly under etched circuit board E3, to the module frame. Remove the plate. The mechanical filters may now be removed by removing the wiring connected to them from the opposite side, and by removal of the four self-locking nuts.

6-80. REPAIR.

6-81. After making detail part replacement as required, reassemble the module by reversing the removal procedures.

6-82. ALIGNMENT.

6-83. To align the kilocycle-frequency stabilizer module, proceed as shown in the following paragraphs. The alignment instructions adjust the 10-kc spectrum control bias, the digit oscillator control bias, and the vfo bias. Figure 6-10 shows the location of controls.

6-84. To adjust the 10-kc spectrum control bias, proceed as follows:
a. Calibrate Radio Test Set 678Z-1 (see paragraph 2-16).
b. Set the C-3940/ARC-94 to 9.000 mc.
c. Connect the GROUND jack on the 678Z-1 to the RT-648/ARC-94 chassis. Set FUNCTION SELECTOR switch on 678Z-1 to 10KC CONTROL BIAS (+20V) position.
d. Connect J4 in kilocycle-frequency stabilizer module A4 to the corresponding jack on the 678Z-1.
e. Adjust 10KC CONT BIAS ADJ control A4R63 for an exact null with X10 METER SENSITIVITY switch depressed.
f. Remove the lead from J4 in the kilocycle-frequency stabilizer module.

6-85. To adjust the digit oscillator control bias, proceed as follows:
a. Using test probe No. 1, connect frequency counter to digit oscillator output jack J5 (test point 55).
b. Adjust frequency controls of the C-3940/ARC-94 until dial indicates 9.995 mc.

NOTE

If higher voltage is required to drive the frequency counter, connect an auxiliary high impedance amplifier, such as Tektronix Model 541 Oscilloscope, to test probe No. 1 and use vertical amplifier output to drive counter.

c. Adjust 305-kc variable inductor L14 until frequency counter indicates 305 kc ±20 cps.
d. Readjust frequency selectors on C-3940/ARC-94 until dial indicates 9.996 mc.

e. Adjust 296-kc control A4R59 until frequency counter indicates 296 kc ±20 cps.

f. Repeat procedures outlined in steps b and c until 296 kc and 305 kc are correct within ±20 cps.

6-86. To adjust the vfo bias, proceed as follows:

a. Calibrate Radio Test Set 678Z-1 (see paragraph 2-16).

b. Set the FUNCTION SELECTOR switch on Radio Test Set 678Z-1 to OFF-SET ADJUST. Connect GRND jack on 678Z-1 to the RT-648/ARC-94 chassis. (Refer to paragraphs 2-11 through 2-16 and table XII.)

c. Short test point D3 to ground.

d. Connect J1 in kilocycle-frequency stabilizer module A4 to corresponding jack on 678Z-1. Adjust 678Z-1 OFF-SET ADJUST control R2 for an exact meter null with the X10 METER SENSITIVITY switch depressed.

e. Set the 678Z-1 FUNCTION SELECTOR switch to 70K-5 VFO BIAS. Connect J1 and J3 of kilocycle-frequency stabilizer module A4 to the corresponding 678Z-1 jack.

f. With test point D3 shorted to ground, adjust A4R62 for an exact meter null with the X10 METER SENSITIVITY switch depressed. Remove leads from A4J1 and A4J3.

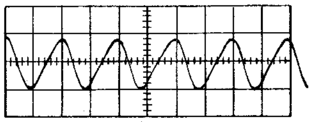
6-87. PREPARATION FOR USE.

6-88. Install the repaired kilocycle-frequency stabilizer module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

D4

Vfo input, J1, 0.5 volt/cm, 0.2 usec/cm

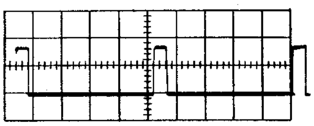
A



D20

10-kc keyer output, TP19, 5 volt/cm, 20 usec/cm

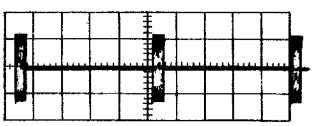
B



D12

10-kc keyed oscillator output, TP10, 2 volts/cm, 20 usec/cm

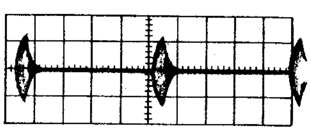
C



D11

10-kc spectrum generator output, TP8, 50 mv/cm, 20 usec/cm

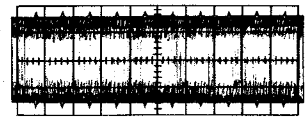
D



D10

Vfo and 10-kc spectrum input to first mixer, TP1, 50 mv/cm, 100 usec/cm

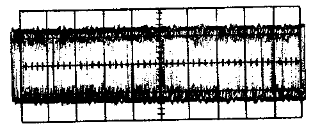
E



D14

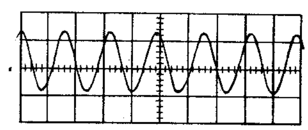
Digit oscillator and 10-kc spectrum input to second mixer, TP2, 100 mv/cm, 100 usec/cm

F



Digit oscillator isolation-amplifier output, J5, 2 volts/cm, 2 usec/cm

G



D9

Mechanical filter output-signal i-f input, J7, 50 mv/cm, 2 usec/cm

H

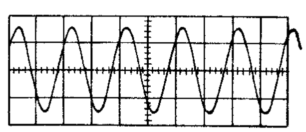
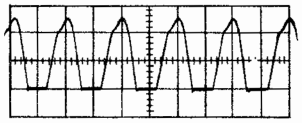


Figure 6-11. Kilocycle-Frequency Stabilizer Module A4, Waveforms (Sheet 1 of 2)

D16

Signal i-f amplifier interstage test point, TP4, 1 volt/cm, 2 usec/cm

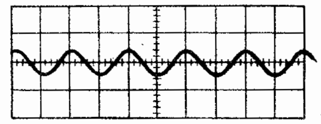
I



D7

Crystal filter output-reference i-f input, J8, 50 mv/cm, 2 usec/cm

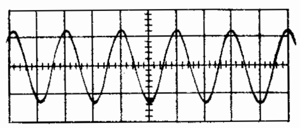
M



D3

Signal i-f amplifier output, TP5, 5 volts/cm, 2 usec/cm

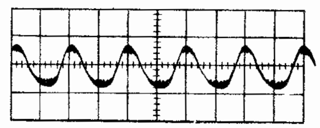
J



D22

Reference i-f amplifier interstage test point, TP14, 0.1 volt/cm, 0.2 usec/cm

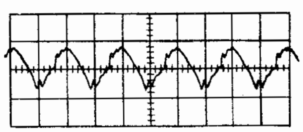
N



D6

Signal i-f input to phase discriminator, TP16, 5 volts/cm, 2 usec/cm

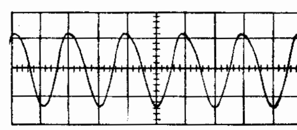
K



D5

Reference i-f amplifier output, TP15, 10 volt/cm, 2 usec/cm

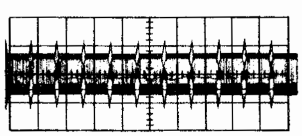
O



D8

Digit oscillator and 1-kc spectrum input to reference mixer, TP12, 100 mv/cm, 1 usec/cm

L



D19

10-kc pulse input, TP11, from frequency divider

P

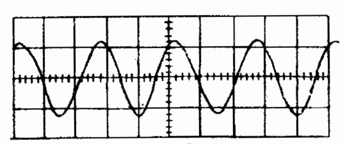
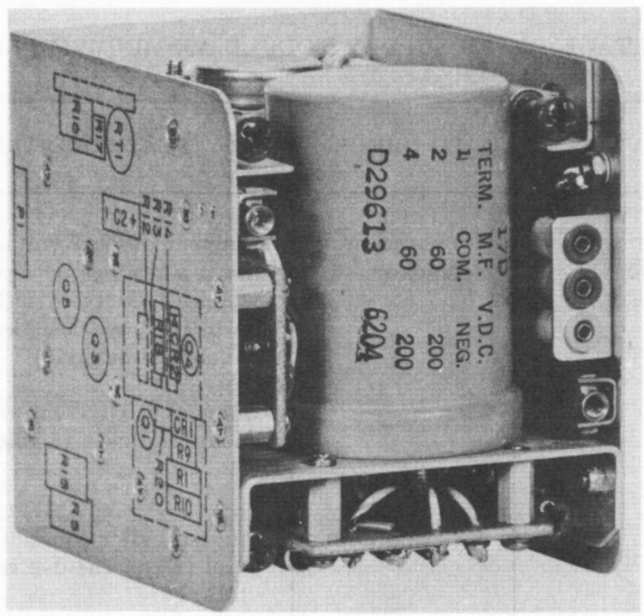


Figure 6-11. Kilocycle-Frequency Stabilizer Module A4, Waveforms (Sheet 2 of 2)

LOW-VOLTAGE POWER SUPPLY MODULE MAINTENANCE



LOW-VOLTAGE POWER SUPPLY MODULE

Figure 6-12. Low-Voltage Power Supply Module A5, Maintenance Marker

6-89. LOW-VOLTAGE POWER SUPPLY MODULE A5.

6-90. Testing and trouble-shooting procedures of this module are performed with the low-voltage power supply module, A5, mounted on module extender 548-3455-004 (3, figure 2-8) which has been connected in place in the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect the RT-648/ARC-94 to the bench test setup as shown in figure 5-2.

6-91. Table XLI lists the test points used for maintenance and the location of test points within module A5. The actual location of test points is shown in figure 6-13. Table XLII shows typical test point voltage and resistance values.

6-92. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform the minimum performance test. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures.

6-93. MINIMUM PERFORMANCE STANDARDS.

6-94. The minimum performance test of table XXXIX provides indications by which maintenance personnel may determine that a repaired module meets the minimum standards of performance. The minimum performance standards check the transient blanker, 18-volt regulator, and the 130-volt power supply. If the module does not check out, perform the trouble-shooting procedures for this module as directed in paragraph 6-95.

TABLE XXXIX. LOW-VOLTAGE POWER SUPPLY MODULE A5, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
E2	Low-voltage power supply module	Transient blanker	Connect the low-voltage power supply module to the low-voltage power supply module extender which is placed in an RT-648/ARC-94 known to be in good operating condition. Connect to the bench test setup. Connect a d-c vtvm to test point E2. The vtvm should indicate 18 volts. Short test point E1 to ground and observe that the d-c indication indicates zero. Unground test point E1. The d-c vtvm should indicate 18 volts.
A10	Frequency divider module	18-volt regulator	Duplicate the test connections as described above. Connect 678Z-1 GRND jack to RT-648/ARC-94 chassis. Connect 678Z-1 jack marked J2-FREQ DIVIDER to test point A10 in frequency divider module, and place 678Z-1 FUNCTION SELECTOR switch to +18V position. The meter on the 678Z-1 should indicate an exact null when the X10 METER SENSITIVITY switch is depressed and released several times.
Transceiver meter	RT-648/ARC-94	130-volt power supply	Place the meter selector switch on the RT-648/ARC-94 front panel to 130V position. The meter should indicate in the red area.

6-95. TROUBLE SHOOTING.

6-96. If trouble has been traced to the low-voltage power supply module, inspect the terminal boards for evidence of burning or shorts. Inspect other components for overheating or blistering. If visual checks fail to isolate the trouble, connect the low-voltage power supply module to the module extender and connect to the RT-648/ARC-94. Trouble may then be isolated to an individual circuit by determining which circuits are inoperative by performing the trouble-shooting procedures given in table XL. Figure 7-6 is a schematic diagram of the low-voltage power supply module.

6-97. REMOVAL.

6-98. Most module components are available for checking without the removal of any brackets or components. Those that are inaccessible may be made available by first removing the bracket holding C1; when necessary remove the subassembly which contains the component. This bracket is removed by removing the screws holding redheaded hold-down screws in place and the four screws fastening the C1 bracket in place.

6-99. REPAIR.

6-100. After making detail part replacement as required, reassemble the module by reversing the removal procedures.

6-101. ALIGNMENT.

6-102. To align the low-voltage power supply module, proceed as shown in the following paragraphs. The alignment instructions adjust the transient blanker and the 18-volt regulator. Figure 6-13 shows the location of the controls.

6-103. To adjust the transient blanker, proceed as follows:

NOTE

This adjustment is necessary only if CR1 in the blanker circuit has been replaced.

a. Remove the module and module extender from the chassis. Place module on extender, but do not connect extender to chassis.

b. Connect variable d-c voltage source to blanker input TP4 on module extender. Set variable d-c supply for 32 ±0.5 volts at TP4.

c. Connect d-c vtvm to 27-volt d-c blanker output pin 5.

d. Turn control R5 fully counterclockwise; then adjust control R5 until d-c vtvm indicates 0 volt.

e. Check setting of resistor R5 by reducing blanker input voltage to 25 volts dc, then increasing it slowly until the blanker output returns to 0 volt dc. Blanker input at this point should be 32 ±0.5 volts dc.

6-104. To adjust the 18-volt regulator, proceed as follows:

a. Connect ground lead of 678Z-1 to RT-648/ARC-94 chassis. Connect test point A10 of frequency divider module A1 to corresponding jack on 678Z-1, and place FUNCTION SELECTOR switch to +18V position.

b. Adjust control R15 until the meter on the 678Z-1 is nulled as closely as possible when the X10 METER SENSITIVITY switch on the box is pressed and released several times.

6-105. PREPARATION FOR USE.

6-106. Install the repaired low-voltage power supply module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance check given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

TABLE XL. LOW-VOLTAGE POWER SUPPLY MODULE A5, TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Transient blanker operating improperly.	Transistor Q1 or Q2 faulty.	If 27 volts is available at P1-9 and 18-volt output at test point E2 does not go to zero when test point E1 is grounded, replace Q2.
18-volt regulator inoperative.	Transistor Q3, Q4, or Q5 faulty.	If voltage at test point E2 is other than 18 volts, check Q3, Q4, or Q5.
	Short in 18-volt output.	If voltage at test point E2 is 0, remove module to determine if short is on 18-volt line. Check for short from J9-1 to ground. If zero resistance is noted, remove modules until shorted module is isolated. Repair shorted module.
No 130-volt output.	Diode CR3.	Replace diode CR3. Check other 130-volt rectifier components for shorted conditions.

TABLE XLI
LOW-VOLTAGE POWER SUPPLY MODULE A5,
LIST OF TEST POINTS

DESIGNATION	LOCATION
E	J2
E1	J1
E2	J3

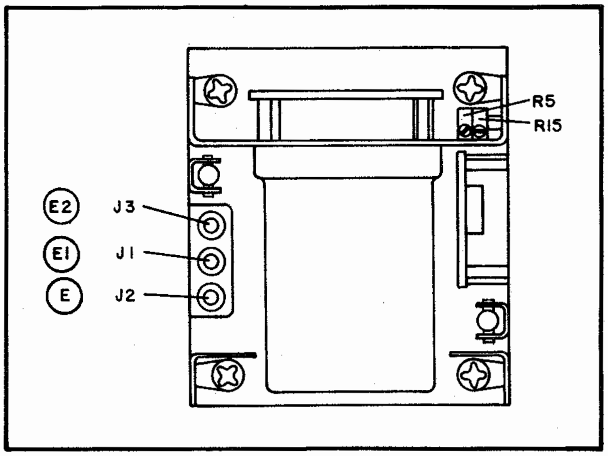


Figure 6-13. Low-Voltage Power Supply Module A5, Location of Test Points

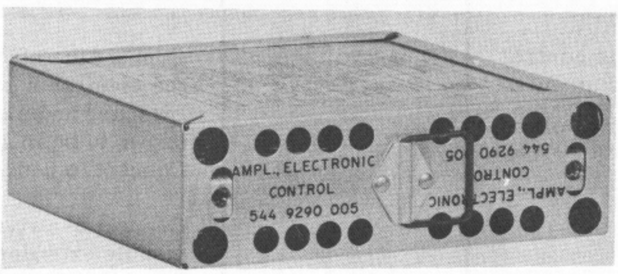
TABLE XLII. LOW-VOLTAGE POWER SUPPLY MODULE A5, TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
E	J2	28		10 k		
E1	J1	20.2		220		
E2	J3	18.0		10 k		

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

ELECTRONIC CONTROL AMPLIFIER MODULE MAINTENANCE



ELECTRONIC CONTROL AMPLIFIER MODULE

Figure 6-14. Electronic Control Amplifier Module A6, Maintenance Marker

6-107. ELECTRONIC CONTROL AMPLIFIER MODULE A6.

6-108. Testing and trouble-shooting procedures of this module are performed with the electronic control amplifier module, A6, mounted on module extender 548-3453-004 (5, figure 2-8) which has been connected in place in the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect the RT-648/ARC-94 to the bench test setup as shown in figure 5-2.

6-109. Table XLIV lists the test points used for maintenance and the location of test points within module A6. The actual location of test points is shown in figure 6-15.

6-110. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform the minimum performance test. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures. Figure 7-7 is a schematic diagram of electronic control amplifier A6. Table XLVI shows typical test point voltage and resistance values.

6-111. MINIMUM PERFORMANCE STANDARDS.

6-112. The minimum performance test of table XLIII provides indications by which maintenance personnel may determine that a repaired module meets the minimum standards of performance. The minimum performance standards check the gain of the amplifier. If the module does not check out, perform the trouble-shooting procedures for this module as directed in paragraph 6-113.

TABLE XLIII. ELECTRONIC CONTROL AMPLIFIER MODULE A6, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
TP9	Electronic control amplifier module extender	Input voltage	Connect the electronic control amplifier to the electronic control amplifier module extender and place in an RT-648/ARC-94 known to be in good operating condition. Connect to bench test setup. Connect d-c vtvm to test point TP9 on module extender and key the RT-648/ARC-94. Manually move the power amplifier module roller coil gear slightly in one direction, and observe that indication on d-c vtvm is between 0 and 0.5 volt for slight gear rotation. The d-c indication is proportional to the amount of gear rotation.*
F6, F7	Electronic control amplifier module	Output voltage	Duplicate the test connections as described above. Connect an a-c vtvm between test points F6 and F7. Key the RT-648/ARC-94. Rotate power amplifier roller coil gear slightly in either direction to obtain a d-c vtvm indication of 0.2 volt at TP9 on the module extender. The a-c voltage between test points F6 and F7 should be between 18 and 30 volts. Carefully release the power amplifier coil gear and unkey the RT-648/ARC-94.

*Move power amplifier roller coil gear slightly in the opposite direction from which it was moved originally, and observe that the indication on d-c vtvm is approximately the same magnitude as that observed originally but of opposite polarity.

6-113. TROUBLE SHOOTING.

6-114. If trouble has been traced to the electronic control amplifier module, inspect the terminal board for evidence of burning or shorts. Check etched circuit boards for cracks or other imperfections which could result in a module malfunction. If visual checks fail to isolate the trouble, connect the electronic control amplifier module to the module extender and connect to the RT-648/ARC-94. Trouble may then be isolated to an individual circuit by use of test points and by use of table XLV. Before starting to trouble-shoot, check that 25 volts dc is present at TP3 on module extender, check that 6.3 volts ac is present between test point TP7 and ground.

6-115. REMOVAL.

6-116. Access to detail parts is accomplished by removal of the module cover. The cover is removed by pulling the cover from the module frame. Access to the output transistor terminals is accomplished by removal of the etched circuit board from the module frame. To replace the output transistors, it is necessary to remove the transistor air duct and the etched circuit board.

6-117. REPAIR.

6-118. After making detail part replacement as required, reassemble the module by reversing the removal procedure. When replacing transistors within the module air duct, care should be shown to replace the insulator between the transistor body and the module frame.

6-119. PREPARATION FOR USE.

6-120. Install the repaired electronic control amplifier module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

TABLE XLIV
ELECTRONIC CONTROL AMPLIFIER MODULE A6, LIST OF TEST POINTS

DESIGNATION	LOCATION
F	Connector plug terminals 4 and 9
F1	Connector plug terminals 1 and 7
F2	Connector plug terminal 3
F3	Connector plug terminals 2 and 6
F4	J1
F5	J2
F6	J3
F7	J4

TABLE XLV. ELECTRONIC CONTROL AMPLIFIER MODULE A6, TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
No d-c input voltage	Phase discriminator in power amplifier module A11.	Check phase discriminator with voltage and resistance checks. Replace faulty detail parts.
No output measured at test point F4.	Chopper or transistor Q1.	Check for 400-cps voltage at the base of Q1. If voltage is present, replace Q1. If no voltage is present, replace chopper G1.
No output measured at test point F5.	Transistor stage Q2, Q3, or Q4.	Isolate faulty stage through the use of 400-cps voltage checks at the bases of Q2, Q3, or Q4. Replace defective detail part.

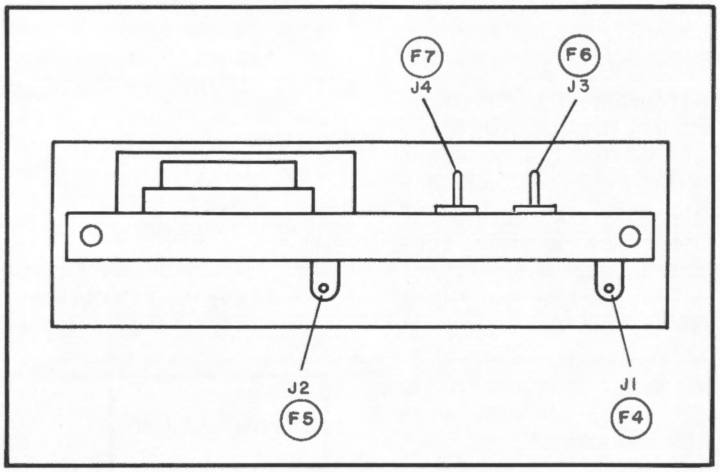


Figure 6-15. Electronic Control Amplifier Module A6, Location of Test Points

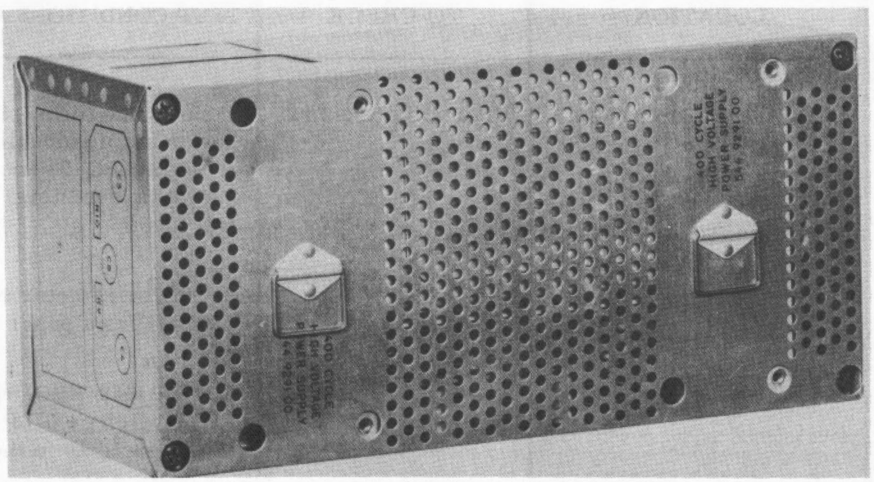
TABLE XLVI. ELECTRONIC CONTROL AMPLIFIER MODULE A6, TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
F4	J1	5.6		2500		
F5	J2	4.9		2300	1100	
F6	J3	0.14		8.7	8.0	
F7	J4	0.15		8.7	8.0	

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

THREE-PHASE HIGH-VOLTAGE POWER SUPPLY MODULE MAINTENANCE



THREE-PHASE HIGH-VOLTAGE POWER SUPPLY MODULE

Figure 6-16. Three-Phase High-Voltage Power Supply Module A7, Maintenance Marker

6-121. THREE-PHASE HIGH-VOLTAGE POWER SUPPLY MODULE A7.

6-122. Initial testing of the three-phase high-voltage power supply module, A7, is done with the module installed in an RT-648/ARC-94 known to be in good operating condition. The RT-648/ARC-94 is then connected to the bench test setup as shown in figure 5-2.

6-123. To determine if the module is defective before beginning trouble-isolation procedures, first perform the minimum performance test. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures.

6-124. MINIMUM PERFORMANCE STANDARDS.

6-125. The minimum performance test of table XLVII provides indications by which maintenance personnel may determine that a repaired module meets the minimum standards of performance. The minimum performance standards check the high-voltage output of the module. As the low-voltage and high-voltage outputs of the high-voltage power supply are in series, checking the high-voltage output is a check on both voltage outputs.

TABLE XLVII. THREE-PHASE HIGH-VOLTAGE POWER SUPPLY MODULE A7, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
Front panel meter	RT-648/ARC-94 chassis	High voltage output	Connect the three-phase high-voltage power supply module in place in an RT-648/ARC-94 known to be in good operating condition. Connect to bench test setup. Set meter selector switch on RT-648/ ARC-94 front panel to 1500V position. Key RT-648/ARC-94 by operating KEY switch on 678P-1. The meter should indicate in the red area.

6-126. TROUBLE SHOOTING.

6-127. If trouble has been traced to the three-phase high-voltage power supply module, inspect the terminal board components for evidence of burning or shorts. Inspect the transformer for evidence of overheating indicating overloading or shorted windings. Inspect the contactors for evidence of burned or pitted contacts which could result in contactor failure. If visual checks fail to isolate the trouble, proceed with the trouble-shooting checks of table XLVIII. Figure 7-8 is a schematic diagram of the three-phase high-voltage power supply module.

6-128. REMOVAL.

6-129. Access to detail parts is accomplished by removal of the module cover and removal of certain mounting brackets. The cover is removed by pulling the cover from the module frame. Access to the high-voltage rectifiers is accomplished by removing the six screws which hold the three boards to the module frame. The three boards may then be removed to the limit of the interconnecting cable by sliding the boards upward until clear of the module. Access to the plate contactor, step start relay, and the overload relay is accomplished by removal of the cover containing these detail parts. The remaining detail parts are accessible by removal of the eleven screws holding the relay bracket to the module frame and the consequent removal of the relay bracket.

6-130. REPAIR.

6-131. After making detail part replacement as required, reassemble the module by reversing the removal procedure.

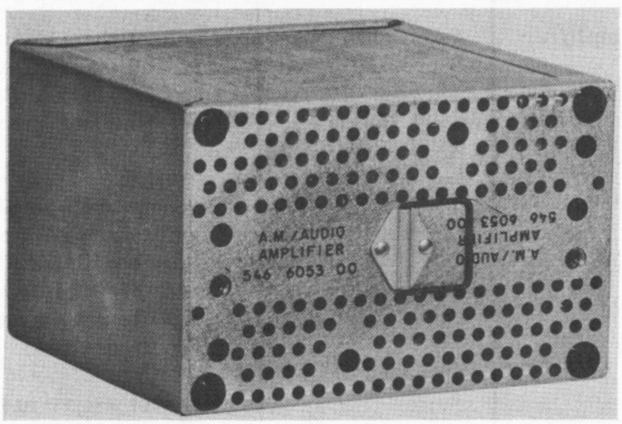
6-132. PREPARATION FOR USE.

6-133. Install the repaired three-phase high-voltage power supply module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance checks given in paragraph 5-27 for the AN/ARC-94. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ ARC-94 is ready for use.

TABLE XLVIII. THREE-PHASE HIGH-VOLTAGE POWER SUPPLY MODULE A7, TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
No +400-volt d-c output	Diodes CR9 through CR12, CR21 through CR24, and CR33 through CR36.	Measure forward and back resistance of diodes. The forward resistance should be much lower than the back resistance. Isolate and replace faulty detail part.
+400 volts d-c available, but no +260 volts d-c.	Resistors R11, R14, and R15.	Check for burned out resistors. Isolate and replace faulty detail part.
+400 and +260 volts available, but no +1500 volts d-c.	Plate contactor K1 or overload relay K3. Diodes CR1 through CR8, CR13 through CR20, and CR25 through CR32.	Check the relays and diodes for proper operation. Isolate and replace faulty detail part.
No 27 volts a-c.	Transformer T2.	Check T2 for proper operation. Replace if found defective.

AM/AUDIO AMPLIFIER MODULE MAINTENANCE



AM/AUDIO AMPLIFIER MODULE

Figure 6-17. AM/Audio Amplifier Module A9, Maintenance Marker

6-134. AM/AUDIO AMPLIFIER MODULE A9.

6-135. Testing and trouble-shooting procedures of this module are performed with the AM/audio amplifier module, A9, mounted on module extender 548-3461-004 (item 10, figure 2-8) which has been connected in place in the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect the RT-648/ARC-94 to the bench test setup as shown in figure 5-2.

6-136. Figure 6-18 lists the test points used for maintenance and shows the actual location of these test points within module A9.

6-137. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform the minimum performance test. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures. Figure 7-9 is a schematic diagram of AM/audio amplifier module A9. Table LI shows typical test point voltage and resistance values.

6-138. MINIMUM PERFORMANCE STANDARDS.

6-139. The minimum performance test of table XLIX provides indications by which maintenance personnel may determine that a repaired module meets the

TABLE XLIX. AM/AUDIO AMPLIFIER MODULE A9, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
I1	AM/audio amplifier module	Audio gain	Connect the AM/audio amplifier module to the AM/audio amplifier module extender and place in an RT-648/ARC-94 known to be in good operating condition. Connect to bench test setup. Connect audio oscillator through dummy microphone* in 678Z-1 to MIKE jack on 678P-1 and adjust oscillator for 1000-cps output. Place the C-3940/ARC-94 mode selector in AM position. Remove coaxial jumper from test point 53 (figure 5-1). Connect a-c vtvm to test point I1 on AM/audio amplifier module A9. Place 300 Ω AUDIO LOAD switch 678P-1 in IN position. Place AUDIO gain control R10 in front panel of the RT-648/ARC-94 fully clockwise. Connect probe of a second a-c vtvm to TEST POINT jack on 678Z-1. Key the RT-648/ARC-94 by operating KEY switch on 678P-1. Adjust audio oscillator output until the second a-c vtvm indicates 0.25 volt. Output indicated on the first a-c vtvm should exceed 4 volts ac. Record indication in table LII. Connect the audio oscillator to 600 Ω BAL AUDIO IN jack on 678P-1. Adjust audio oscillator for 1000 cps. The audio oscillator must be connected properly for a balanced 600-ohm output. Key the RT-648/ARC-94 by operating KEY switch on 678P-1. Adjust the audio oscillator output until the a-c vtvm on the 678Z-1 test point jack indicates 0.78 volt ac. The output indicated by the a-c vtvm on test point I1 should exceed 4 volts ac. Record in table LII.

TABLE XLIX. AM/AUDIO AMPLIFIER MODULE A9, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
HEADSET jack	Radio Set Test Harness 678P-1	I-f gain	Duplicate the test connections as described above. Remove coaxial jumper from RT-648/ARC-94 test point 53. Place mode selector of C-3940/ARC-94 in AM position. Connect signal generator to RT-648/ARC-94 test point 53 (figure 5-1) through 6-db pad. Adjust signal generator for 500 kc, 30 percent modulated with 1000 cps. Connect a-c vtvm to the HEADSET jack on 678P-1. Place the 300 Ω AUDIO LOAD switch on the 678P-1 to IN position. Adjust signal generator output for 5 volts as indicated on a-c vtvm. The signal generator output should not be less than 100 uv or more than 200 uv. Record indication in table LII.
12	AM/audio amplifier module	I-f selectivity	Duplicate the test connections as described above. Remove coaxial jumper from RT-648/ARC-94 test point 53. Place mode selector of C-3940/ARC-94 in AM position. Connect signal generator to RT-648/ARC-94 test point 53 (figure 5-1) through 6-db pad. Adjust signal generator for 200-uv output at 500 kc, unmodulated. Connect a-c vtvm to HEADSET jack of the 678P-1. Adjust signal generator output level until 5 volts audio output is observed at the HEADSET jack. Note signal generator output level. Increase signal generator output level 1000 times (60 db up) and vary signal generator frequency below 500 kc until the reading of d-c vtvm is equal to that recorded above. The signal generator frequency must be equal to or greater than 493.4 kc. Record in table LII. Repeat setup procedure for no d-c vtvm movement. Increase signal generator output level 1000 times (60 db up) and vary signal generator frequency above 500 kc until the reading of the d-c vtvm is equal to that obtained for no d-c vtvm meter movement. The signal generator frequency must be equal to or greater than 506.6 kc. Record in table LII.

TABLE XLIX. AM/AUDIO AMPLIFIER MODULE A9, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
TP8	AM/audio amplifier module extender	Negative agc output	Duplicate the test connections as described above. Remove coaxial jumper from RT-648/ARC-94 test point 53. Place mode selector of C-3940/ARC-94 in AM position. Connect d-c vtvm to test point TP8 on module extender. Connect signal generator to RT-648/ARC-94 test point 53 through 6-db pad. Adjust signal generator for 200-uv output at 500 kc, 30 percent modulated with 1000 cps. Agc output, indicated on d-c vtvm, should not be less than -8-volt d-c output. Record in table LII.
HEADSET jack	Radio Set Test Harness 678P-1	Audio response check	Duplicate the test connections as described above. Remove the coaxial jumper from RT-648/ARC-94 test point 53. Place mode selector of C-3940/ARC-94 in AM position. Connect signal generator to RT-648/ARC-94 test point 53 through 6-db pad. Connect audio oscillator to the external modulation jacks of signal generator. Adjust signal generator for 500 kc. Adjust oscillator for 1000 cps. Adjust oscillator output until signal generator indicates 30 percent modulation. Connect a-c vtvm to HEADSET jack on 678P-1. Place the 300 Ω AUDIO LOAD switch on the 678P-1 to the IN position. Adjust signal generator output level until a-c vtvm indicates 4 volts. This is the 0-db reference point. Adjust signal generator frequency from 300 to 3000 cps, the maximum variation from the 0-db level shall not be more than 5 db. Record in table LII.
TP12	AM/audio amplifier module extender	Selcal output	Duplicate the test connections as described above. Remove coaxial jumper from RT-648/ARC-94 test point 53. Place mode selector of C-3940/ARC-94 in AM position. Connect a-c vtvm to test point TP12 on the module extender.

TABLE XLIX. AM/AUDIO AMPLIFIER MODULE A9, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
TP12 (Cont)			Connect signal generator to RT-648/ARC-94 test point 53 through 6-db pad. Connect audio oscillator to external modulation jacks of signal generator. Adjust signal generator for 500-kc output. Adjust oscillator for 1000 cps and for 30-percent modulation of the signal generator. Set signal generator output for 500 uv. The a-c output indicated on the vtvm should be more than 0.1 volt. Record in table LII. Set audio oscillator frequency to 300 cps. The output at TP12 should be more than 0.1 volt. Record in table LII. Set audio oscillator frequency to 3000 cps. The output at TP12 should be more than 0.1 volt. Record in table LII.
HEADSET jack	Radio Set Test Harness 678P-1	Hum and noise	Duplicate the test connections as described above. Remove coaxial jumper from RT-648/ARC-94 test point 53 . Place mode selector of C-3940/ARC-94 in AM position. Connect signal generator to RT-648/ARC-94 test point 53 through 6-db pad. Set signal generator to 500 kc, 30 percent modulated with 1000 cps. Connect a-c vtvm to HEADSET jack on the 678P-1. Adjust signal generator output level until a-c vtvm reads 6 volts. This is the 0-db reference point. Remove modulation and determine that db difference as indicated on a-c vtvm is not less than 27 db down. Record in table LII.
I1	AM/audio amplifier module	Audio distortion	Duplicate the test connections as described above. Remove coaxial jumper from RT-648/ARC-94 test point 53 . Place mode selector of C-3940/ARC-94 in AM position. Connect audio oscillator through the dummy microphone* in the 678Z-1 to the MIKE jack on 678P-1. Set oscillator to 1000 cps. Connect oscilloscope to test point I1 on the AM/audio amplifier module. Monitor the audio at TEST POINT jack J3 of the 678Z-1 with a-c vtvm. Key the RT-648/ARC-94, and adjust the audio oscillator output for 0.25 volt at TEST POINT jack J3 of the 678Z-1.

TABLE XLIX. AM/AUDIO AMPLIFIER MODULE A9, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
I1 (Cont)			Observe the waveform on the oscilloscope. The waveform should resemble that of figure 6-19.
*To make use of the dummy microphone in 678Z-1, connect the audio oscillator to either AUDIO IN jack located on the front panel of the 678Z-1. The dummy microphone output is obtained from the AUDIO OUT connector on the 678Z-1.			

DESIGNATION	LOCATION
I	Jack J3, input to audio amplifier Q1
I1	Jack J4, audio output to balanced modulator of i-f translator module A3
I2	Jack J1, agc fed back to i-f amplifiers Q3 and Q4
I3	Jack J2, detector audio output
I4	Jack J6, unswitched audio output to RT-648/ARC-94

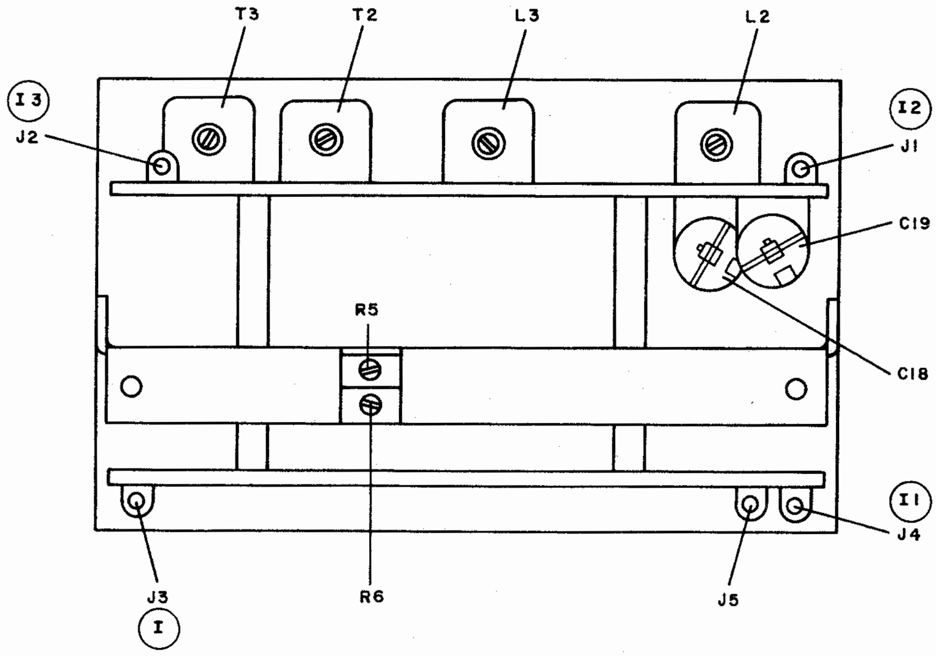


Figure 6-18. AM/Audio Amplifier Module A9, List and Location of Test Points

minimum standards of performance. The procedures in table XLIX check audio gain, i-f gain, i-f selectivity, negative agc output, audio response, Selcal output, hum and noise, and audio distortion. If the module does not check out, perform the trouble-shooting procedures for this module as directed in paragraph 6-140. Table LII is a sample test data sheet for recording indications from the minimum performance standards tests.

6-140. TROUBLE SHOOTING.

6-141. If trouble has been traced to the AM/audio amplifier module, inspect the terminal boards for evidence of burning or shorts. Check etched circuit boards for cracks or other imperfections which could result in a module malfunction. If visual checks fail to isolate the trouble, connect the AM/audio amplifier module to the module extender and connect to the RT-648/ARC-94. Trouble may then be isolated to an individual circuit by use of test points and by use of table L. Before starting to trouble-shoot, check for +18 volts dc at test point TP5 on module extender and for +26 volts dc at test point TP6 on the module extender.

6-142. REMOVAL.

6-143. Access to detail parts is accomplished by removal of the module cover and removal of the two outer etched circuit boards. These boards can be extended to the limit of their interconnecting cables by the removal of the two screws holding each circuit board in place and by removing the two upper screws and the self-locking nuts. When removing the small etched circuit board, care should be exercised not to bend the fixed transistor wires excessively.

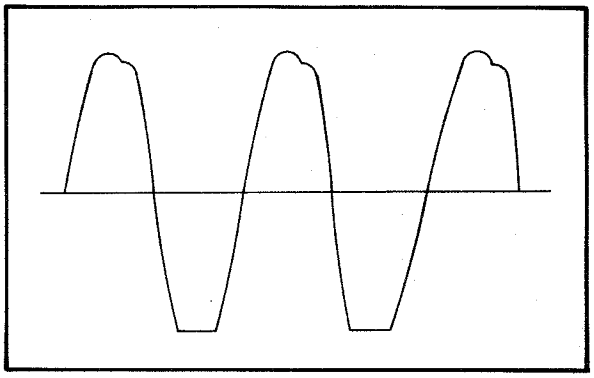


Figure 6-19. Audio Amplifier Distortion Measurement

6-144. REPAIR.

6-145. After making detail part replacement as required, reassemble the module by reversing the removal procedure.

TABLE L. AM/AUDIO AMPLIFIER MODULE A9, TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Improper audio gain.	Transistor Q1 or Q2, or associated detail part. If audio output is at test point I1, check transformer T1. If there is no audio output at test point I, check transistor Q8.	Isolate and replace defective detail part.
No i-f output.	Coils L2, L3 or transformer T2.	Isolate and replace defective detail part.
Low i-f output.	Transistors Q3, Q4, Q5, Q6, or associated detail part.	Isolate and replace defective detail part.
Poor selectivity.	Filter FL1.	Replace mechanical filter.
Improper agc output.	Transformer T3, diodes CR5, CR6; transistor Q7, or thermistor RT1.	Isolate and replace defective detail part.
Improper Selcal output.	Transistor Q9 or its associated circuitry.	Isolate and replace defective detail part.

TABLE LI. AM/AUDIO AMPLIFIER MODULE A9, TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
I	J3	13.0	0	650	60 k	Ohmmeter (-) reading taken with meter on X10K scale.
I1	J4	0.75	1.5	7.5		
I2	J1	4.4	0	1000	7 k	Ohmmeter (+) and (-) readings taken with meter on X100 scale.
I3	J2	0	0	9.5 k	530	Ohmmeter (-) reading taken with meter on X100 scale.
I4	J6	0	0		60 k	Ohmmeter (+) reading infinity. Ohmmeter (-) reading taken with meter on X10K scale.

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

6-146. ALIGNMENT.

6-147. To align the AM/audio amplifier module, proceed as shown in the following paragraphs. The alignment instructions adjust the audio gain, a tune-tone adjustment, and an i-f gain adjustment. Figure 6-18 shows the location of adjustment points.

6-148. To make the audio gain adjustment, proceed as follows:

a. Set the mode selector of the C-3940/ARC-94 in AM position.

b. Connect the audio oscillator through the dummy microphone in the 678Z-1 to the MIKE jack on the 678P-1. Set oscillator to 1000 cps.

c. Connect a-c vtvm to TEST POINT jack J3 on the 678Z-1.

d. Connect a second a-c vtvm to test point I1 on the AM/audio amplifier module. Key the RT-648/ARC-94. Adjust the audio oscillator output until a-c vtvm on TEST POINT jack indicates 0.25 volt. Turn SIDE TONE control R9 on the front panel of the RT-648/ARC-94 fully clockwise.

e. Adjust potentiometer R6 for 12-volt audio output as indicated on a-c vtvm on test point I1. Connect the audio oscillator to the 600Ω BAL AUDIO IN jack on 678P-1. Set the oscillator for 1000 cps, balanced output.

f. Key the RT-648/ARC-94 and adjust the audio oscillator for 0.78-volt output. Adjust potentiometer R5 for 12-volt audio output as indicated on the a-c vtvm on test point I1.

6-149. The tune-tone level is dependent upon the value of resistor R57. Resistor R57 has been selected at the factory for approximately 1-mw tune-tone output during tuning. The tune-tone level may be varied by changing the value of resistor R57.

6-150. To make the i-f gain adjustments, proceed as follows:

a. Remove the coaxial jumper from the RT-648/ARC-94 test point 53.

b. Set the mode selector of the C-3940/ARC-94 in AM position.

c. Connect signal generator to C-3940/ARC-94 test point 53 through the 6-db pad. Set generator to 500 kc, 30 percent modulated with 1000 cps.

d. Connect a-c vtvm to the HEADSET jack on 678P-1. Adjust signal generator output level until the a-c vtvm indicates 5 volts.

e. Adjust C18, C19, L2, L3, and T2 for maximum audio output as indicated on a-c vtvm.

f. Increase the signal generator output level to 300 uv.

g. Adjust transformer T3 for minimum audio output as indicated on a-c vtvm.

6-151. PREPARATION FOR USE.

6-152. Install the repaired AM/audio amplifier module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

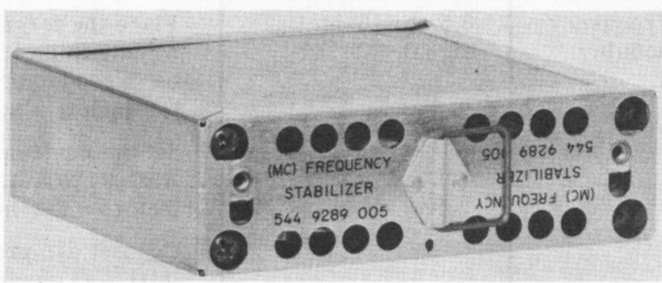
TABLE LII. AM/AUDIO AMPLIFIER MODULE A9, SAMPLE DATA SHEET

FUNCTION	TEST POINT	QUANTITY BEING MEASURED	REMOTE CONTROL UNIT SETTING	TRANSMITTER KEYED (X)	DATA	LIMITS
Audio gain	HEADSET jack (678P-1)	Audio output voltage (0.25 volt, unbalanced input)	AM, any frequency	X		Not less than 4 volts ac.
	Same	Audio output voltage (0.78 volt, balanced input)	Same	X		Not less than 4 volts ac.
I-f gain	Same	Signal generator output (5-volt audio output)	Same			Not less than 100 uv. Not more than 200 uv.
I-f selectivity	A9J1	Lower 60-db frequency (AM)	Same			Not less than 493.4 kc.
	A9J1	Upper 60-db frequency (AM)	Same			Not more than 506.6 kc.
Agc characteristic						Check.
Negative agc output	TP8 (module extender)	Agc output voltage (200-uv input)	AM, any frequency			Not less than -8 volts dc.
	Same	Agc output voltage (2000-uv input)	Same			Not less than -8 volts dc.
	Same	Agc output voltage (20,000-uv input)	Same			Not less than -8 volts dc.

TABLE LII. AM/AUDIO AMPLIFIER MODULE A9, SAMPLE DATA SHEET (Cont)

FUNCTION	TEST POINT	QUANTITY BEING MEASURED	REMOTE CONTROL UNIT SETTING	TRANSMITTER KEYED (X)	DATA	LIMITS
Negative agc output (Cont)	Same	Agc output voltage (200,000-uv input)	Same			Not less than -8 volts dc.
Audio response	HEADSET jack (678P-1)	Audio response between 300 and 3000 cps	Same			Not more than 5 db down.
Selcal output	TP12 (module extender)	Selcal output voltage (500-uv, 1000-cps input)	Same			Not less than 0.1 volt.
	Same	Selcal output voltage (500-uv, 300-cps input)	Same			Not less than 0.1 volt.
	Same	Selcal output voltage (50-uv, 3000-cps input)	Same			Not less than 0.1 volt.
Hum and noise	HEADSET jack (678P-1)	Db down from reference	Same			Not less than 27 db down.
Audio distortion	Same	Audio output waveform (0.25-volt input)	Same	X		Check.

MEGACYCLE-FREQUENCY STABILIZER MODULE MAINTENANCE



MEGACYCLE-FREQUENCY STABILIZER MODULE	Paragraph Number Collins Part Number 544-9289-005	 Collins Part Number 528-0329-005
MINIMUM PERFORMANCE STANDARDS	6-157	6-167E
TROUBLE SHOOTING	6-159	6-167G
REMOVAL	6-162	6-167J
REPAIR	6-164	6-167L
PREPARATION FOR USE	6-166	6-167N

Figure 6-20. Megacycle-Frequency Stabilizer Module A10, Maintenance Marker

6-153. MEGACYCLE-FREQUENCY STABILIZER MODULE A10. (Collins P/N: 544-9289-005).

6-154. Testing and trouble-shooting procedures of this module are performed with the megacycle-frequency stabilizer module, A10, mounted on module extender 548-3501-004 (item 6, figure 2-8) which has been connected in place in the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect the RT-648/ARC-94 to bench test setup as shown in figure 5-2.

6-155. Table LV lists the test points used for maintenance and the location of test points within the module. Figure 6-21 shows the actual location of the various test points within the module. Table LVI provides typical test point voltage and resistance measurements.

6-156. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform the minimum performance tests. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures. Figure 7-10 is a schematic diagram of megacycle-frequency stabilizer module A10.

6-157. MINIMUM PERFORMANCE STANDARDS.

6-158. The minimum performance test of table LIII provides indication by which maintenance personnel may determine that a repaired module meets the minimum standards of performance. If the module does not check out, perform the trouble-shooting procedures for this module as directed in paragraph 6-159.

TABLE LIII. MEGACYCLE-FREQUENCY STABILIZER MODULE A10, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
J1	Megacycle-frequency stabilizer module	8.5- to 16-mc signal	Place the megacycle-frequency stabilizer module in an RT-648/ARC-94 known to be in good operating condition. Connect to bench test setup. Set the mode selector of the C-3940/ARC-94 to AM. Set the frequency selectors until the dial indicates 2.1 mc. Connect a-c probe of vtvm to test point J1 and observe that a voltage indication of 0.1 to 0.5 volt is present.
J2	Megacycle-frequency stabilizer module	17.5-mc signal	Duplicate the test connections as described above. Set the mode selector of the C-3940/ARC-94 to AM. Set the frequency selectors until the dial indicates 2.1 mc. Connect a-c probe of vtvm to test point J2 and observe that a voltage indication of 0.1 to 0.5 volt is present.
	R-f translator module	H-f oscillator and 17.5-megacycle oscillator frequencies.	Duplicate the test connections as described above. Set the mode selector of the C-3940/ARC-94 to AM. Set the frequency selectors until the dial indicates 2.1 mc. Loosely couple a loop from calibrated test receiver antenna to A12V10. Monitor the frequency given in the chart of table LIV. The frequency shall remain at 17.5 mc. Loosely couple a loop from calibrated receiver antenna to A12V11. The frequencies shall be the same as those given in the chart of table LIV for each of the operating frequencies.

TABLE LIV. OPERATING FREQUENCIES VS OSCILLATOR FREQUENCIES FOR OSCILLATOR CHECK

OPERATING FREQUENCY (mc)	H-F OSCILLATOR FREQUENCY (mc)	17.5-MC OSCILLATOR FREQUENCY (mc)
2.000	12.5	17.5
3.000	11.5	17.5
4.000	10.5	17.5
5.000	9.5	17.5
6.000	8.5	17.5
7.000	10.0	
8.000	11.0	
9.000	12.0	
10.000	13.0	
11.000	14.0	
12.000	15.0	
13.000	16.0	
14.000	17.0	
15.000	18.0	
16.000	19.0	
17.000	20.0	
18.000	21.0	
19.000	22.0	
20.000	23.0	
21.000	24.0	
22.000	25.0	
23.000	26.0	
24.000	27.0	
25.000	28.0	
26.000	29.0	
27.000	30.0	
28.000	31.0	
29.000	32.0	

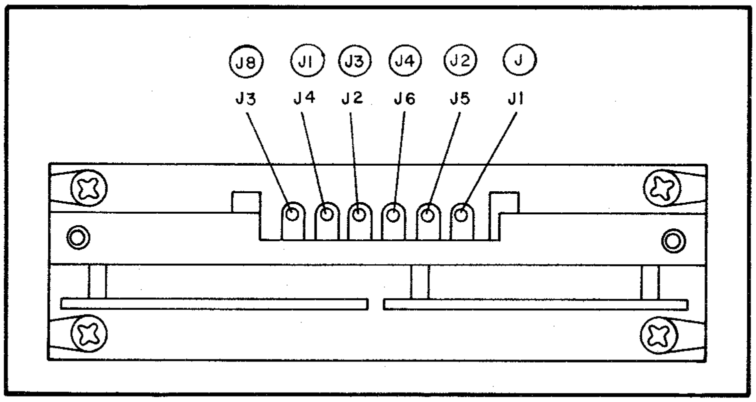


Figure 6-21. Megacycle-Frequency Stabilizer Module A10, Location of Test Points

6-159. TROUBLE SHOOTING.

6-160. Remove the module cover and visually inspect the disconnected module for evidence of malfunction. Look for shorts, discoloration due to burning, and pay particular attention to the etched boards where breaks or other imperfections may be present. If visual checks fail to isolate the cause of trouble, connect the megacycle-frequency stabilizer module to the module extender and connect both units to the RT-648/ARC-94. Perform the trouble-shooting procedures in paragraph 6-161 to isolate the defective stage.

TABLE LV
MEGACYCLE-FREQUENCY STABILIZER
MODULE A10, LIST OF TEST POINTS

DESIGNATION	LOCATION
J	J1
J1	J4
J2	J5
J3	J2
J4	J6
J6	P1-A2
J7	P1-A3
J8	J3

CAUTION

If transistors are found to be faulty (with the exception of Q4 and Q5), do not attempt to replace. Replacement will result in non-temperature compensated, inaccurate assemblies. Send faulty assemblies to overhaul stations for repair.

6-161. MODULE TROUBLE ISOLATION PROCEDURES.

a. Check voltage at test point J3 with d-c vtvm, and observe that the voltage is +18 volts dc.

b. Set frequency of C-3940/ARC-94 to any frequency between 2 and 6 mc. Connect oscilloscope to test point J and then to test point J8. The module should not be recycling. If the module is recycling, a saw-tooth voltage waveform shown in I, figure 6-22, will be observed in the oscilloscope, and the a-c voltage at test point J or J8 will be greater than 0.1 volt ac. If the module is not functioning properly, perform the following procedures.

c. Disconnect the coaxial jumpers from A1 and A2 on the module extender.

d. Check the a-c voltage at test point J4 with a-c vtvm. Voltage should be 1.1 ±0.1 volts. If this reading is not correct, see trouble-shooting procedures for r-f oscillator module A2.

e. Connect d-c vtvm to test point J, and observe that voltage indication is 5 to 10 volts dc. The voltage should preferably be 8-10 volts d-c with less than 0.1 volt ac.

f. Connect d-c vtvm to test point J8 and observe that voltage indication is 5 to 10 volts dc. The voltage should preferably be 7-9 volts dc with less than 0.1 volt ac.

NOTE

If more than 0.1 volt ac is measured at J or J8, the circuit is recycling due to a high spectrum generator setting. Refer to paragraph 6-161, steps q through u, for spectrum generator adjustment procedures.

g. If the voltage at test point J is low and the voltage at test point J8 is proper, check waveforms shown in F, G, and H, figure 6-22. Perform standard trouble-shooting procedures on transistor stages Q3 and Q4 if waveforms are not correct. If waveforms are correct, it will be necessary to perform procedure listed in steps g through u to correct low-voltage reading.

h. If d-c voltage at test point J8 is low and d-c voltage at test point J is proper, check waveforms shown in F, G, and H, figure 6-22. Perform standard trouble-shooting procedures on transistor stages Q3 and Q4. If waveforms are proper, perform procedure listed in steps q through u in order to correct the low-voltage reading.

i. If d-c voltages at both test points J and J8 are low or a-c voltages are high, adjust resistor R7 until voltages at both test points are proper.

NOTE

Resistor R7 may be adjusted by inserting a screwdriver through the slot in the spectrum generator shield.

j. Reconnect coaxial jumper to A1 and A2 on the module extender. Set C-3940/ARC-94 to 13.000 mc.

k. Short test point J4 to ground.

l. Connect oscilloscope to the base of transistor Q3 on amplifier subassembly A1, and observe that peak-to-peak r-f voltage is between 0.5 and 0.8 volt. If the voltage is not correct, select values of A1C3. Capacitor A1C3 may be any standard value from 47 pf to 220 pf.

m. Repeat step l for amplifier subassembly A2.

n. If either of these subassemblies are bad, and changing the value of A1C3 or A2C3 does not correct the condition, check transistors Q1 and Q2 and their circuit components.

o. Remove the short from test point J4.

p. Remove coaxial jumper from A1 and A2 on module extender. Observe waveform shown in F, figure 6-22. If waveform is not proper, check waveforms E, D, C, B, and A, figure 6-22, to isolate trouble.

q. To correct d-c control level voltages at either test point J or J8, set frequency of C-3940/ARC-94 to any frequency between 2 and 6 mc.

r. Remove coaxial jumpers from A1 and A2 on module extender.

s. Adjust oscilloscope for 5 volts dc per centimeter. Connect the oscilloscope to the test point (J or J8) which corresponds to the channel which has 261-ohm resistor for R7 (see figure 7-10, note 1).

NOTE

One resistor, either A1R7 or A2R7, will have a value of 261 ohms. The other resistor will have a value of less than 261 ohms.

t. Adjust resistor R7 in the spectrum generator (do not confuse it with fixed resistors A1R7 and A2R7) until the d-c control level measured at test point J (or J8) is the correct value (5 to 10 volts at J or J8).

NOTE

R7 may be adjusted by placing a screwdriver through the slot in the spectrum generator shield and engaging R7.

u. Select a resistor for the other channel to correct the d-c control level measured at J8 (or J), and solder in place of existing resistor.

NOTE

After adjusting resistor R7 (in the spectrum generator) to correct the d-c control level voltage of the channel containing 261 ohm resistor for R7, observe the test point (J

TABLE LVI. MEGACYCLE-FREQUENCY STABILIZER MODULE A10, TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS

TEST POINT	JACK	VOLTAGE		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
J	J1	6 to 9 volts	0	18 k	7.6 k	Ohmmeter (-) reading taken on X1K scale.
J1	J4	3 volts from 7 to 28 mc	0.1 to 0.5 volt	18 k	7.5 k	Ohmmeter (-) reading taken on X1K scale. D-c voltage on test point J1 will be 6 to 9 volts when RT-648/ARC-94 is tuned from 2 to 6 mc.
J2	J5	6 to 9 volts	0 from 7 mc to 28 mc	18 k	7.5 k	Ohmmeter (-) reading taken on X1K scale. A-c voltage on test point J2 will be 0.1 to 0.5 volt when RT-648/ARC-94 is tuned from 2 to 6 mc.
J3	J2	18 volts	0	10 k		
J4	J6	0	1.0 to 1.2 volts			Resistance readings infinity.
J8	J3	3 volts from 7 to 28 mc	0	18 k	7.5 k	Ohmmeter (-) readings taken on X1K scale. D-c voltage on test point J8 will be 6 to 9 volts when RT-648/ARC-94 is tuned from 2 to 6 mc.

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

or J8) of the opposite channel with an oscilloscope. If channel is recycling, a smaller value resistor will be required for R7. If channel is not recycling, a larger value resistor will be required to correct the d-c control level voltage to proper value.

6-162. REMOVAL.

6-163. Removal of the module cover gives access to the detail parts located on the etched circuit board subassemblies A1 and A2. The spectrum generator circuit board is located inside the shield on the opposite side of the module. The shield is removed after the removal of the four shield hold-down screws. Each of the two etched circuit board subassemblies can be removed after the removal of the four nuts and washers holding down each terminal board. The spectrum generator subassembly can be removed by loosening and removing the four posts located in each corner of the circuit board.

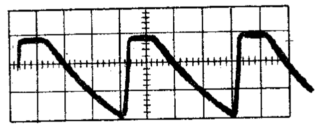
6-164. REPAIR.

6-165. After making detail part replacement as required, reassemble the module by reversing the removal process.

6-166. PREPARATION FOR USE.

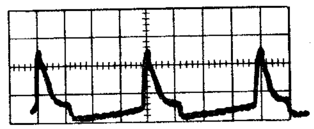
6-167. Install the repaired megacycle-frequency stabilizer module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

A



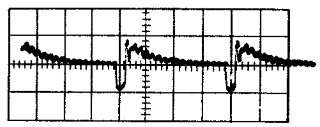
Squaring amplifier Q1 output, junction of R4 and C7, 0.5 usec/cm, 5.5 to 6.5 volts peak-to-peak ac

B



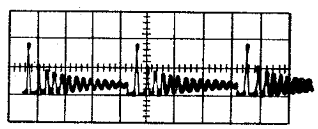
Pulse amplifier Q2 input, junction of C7 and R5, 0.5 usec/cm, 1 to 1.5 volts peak-to-peak ac

C



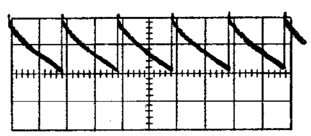
Spectrum generator Q3 input, junction of R6 and R7, 0.5 usec/cm, 7 to 10 volts peak-to-peak ac

D



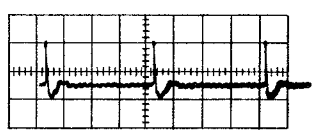
Spectrum generator Q3 output, junction of L4 and CR1, 0.5 usec/cm, 50 to 100 volts peak-to-peak ac

E



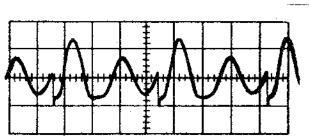
CR1-R8 output, 1 usec/cm, 60 to 90 volts peak to bottom of scale, 20 volts/cm dc

F



Spectrum pulse at junction of A1C5-A1R7 or A2C5-A2R7, no r-f input to megacycle-frequency stabilizer from tuner oscillators, 0.5 usec/cm, 0.5 to 1.2 volts peak-to-peak, 0.03- to 0.08-usec pulse width

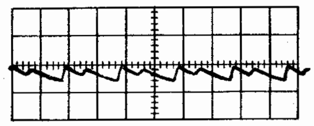
G



I-f amplifier input at junction of A1C7-A1L2 or A2C7-A2L2, 0.5 usec/cm, 0.5 volt/cm ac, no r-f input from tuner oscillators

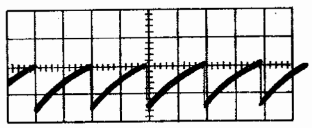
Figure 6-22. Megacycle-Frequency Stabilizer Module A10, Waveforms (Sheet 1 of 2)

H



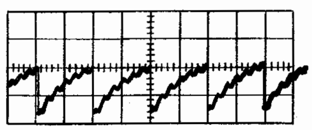
Detector output at junction of A1CR1-A1R11 or A2CR1-A2R11, 1 usec/cm, 5 volts/cm dc referenced to bottom of scale, no r-f input from tuner oscillators

I



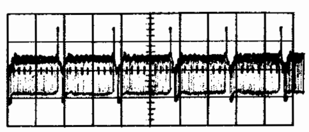
J1 or J3 recycle, 2 msec/cm, 5 volts/cm dc, 10 to 12 volts maximum, 0 to 4 volts minimum, 0.002- to 0.008-sec period

J



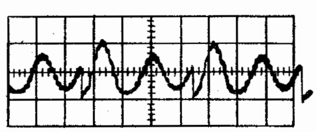
Recycle with tuner oscillator within 5 kc or desired frequency but with no dc fed from megacycle-frequency stabilizer to oscillator

K



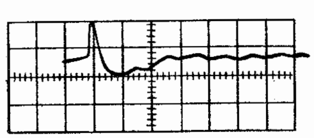
Input to A1Q3 or A2Q3, r-f input plus spectrum, junction of A1C5-A1R7 or A2C7-A2R5, 1 usec/cm, 0.5 volt/cm ac, r-f -0.6 to 0.8 volt peak-to-peak, spectrum pulse -0.8 to 1.2 volts peak to center line of rf

L



I-f amplifier input at junction of A1C7-A1L2 or A2C7-A2L2, 0.5 usec/cm, 0.5 volt/cm ac, oscillators locked with 7 volts dc from megacycle-frequency stabilizer

M



Spectrum pulse of picture F expanded, 0.1 usec/cm 0.5 volt/cm ac

Figure 6-22. Megacycle-Frequency Stabilizer Module A10, Waveforms (Sheet 2 of 2)

6-167A. MEGACYCLE-FREQUENCY STABILIZER MODULE A10 (Collins Part Number: 528-0329-005).

6-167B. Testing and trouble-shooting procedures of this module are performed with the megacycle-frequency stabilizer module, A10, mounted on its module extender which has been connected in place in the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect RT-648/ARC-94 to bench test setup as shown in figure 5-2.

6-167C. Table LVI-B lists test points used for maintenance and location of test points within the module. Figure 6-22A shows the actual location of various test points within the module.

6-167D. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform minimum performance tests. If the module does not meet minimum performance standards, proceed with trouble-shooting procedures. Figure 7-10A is a schematic diagram of the megacycle-frequency stabilizer module A10 (Collins P/N: 528-0329-005).

6-167E. MINIMUM PERFORMANCE STANDARDS.

6-167F. The minimum performance test of table LVI-C provides indication by which maintenance personnel may determine that a repaired module meets the minimum standards of performance. If the module does not check out, perform the trouble-shooting procedures for this module as directed in paragraph 6-167G.

TABLE LVI-A. MEGACYCLE-FREQUENCY STABILIZER MODULE A10, LIST OF TEST POINTS

DESIGNATION	LOCATION
J9	J1
J10	J2
J11	J3
J12	J4
J13	J5
J14	TP1
J15	TP2
J16	TP3
J17	TP4
J18	A1Q4, A2Q4 Output

TABLE LVI-B. MEGACYCLE-FREQUENCY STABILIZER MODULE A10 (Collins Part Number: 528-0329-005), MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
J9	Megacycle-frequency stabilizer module	*8.5-16 mc oscillator dc control voltage	Connect the megacycle-frequency stabilizer to its module extender and place in an RT-648/ARC-94 known to be in good operating condition. Disconnect the two coaxial jumpers on the module extender. Connect to bench test setup. Set the mode selector of the C-3940/ARC-94 to AM. Set the frequency controls until dial indicates 2.100 mc. Connect the d-c probe of vtvm to test point J9 and observe that a voltage indication of 7 ±1.0 volts dc is present. If the voltage is not as stated, adjust R6 for proper voltage at test point J9.
J11	Megacycle-frequency stabilizer module	*17.5 mc oscillator dc control voltage	Duplicate the test connections and adjustment to the equipment as described above.

TABLE LVI-B. MEGACYCLE-FREQUENCY STABILIZER MODULE A10 (Collins Part Number: 528-0329-005), MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
J11 (Cont)			Connect the d-c probe of vtvm to test point J11 and observe that a voltage indication of 7 ±1.0 volts dc is present. If the voltage is not as stated, adjust R5 for proper voltage at test point J11. If necessary, readjust R5 and R6 until voltages at both test points J9 and J11 are 7 ±1.0 volts dc.
J9 and J12	Megacycle-frequency stabilizer module	Recycle	Duplicate the test connections as described above. Connect the a-c probe of vtvm to test point J12. Connect the signal generator to A2 on the module extender. Tune signal generator to 8.003 mc and adjust its output for an indication of 0.08 volt on the vtvm. Connect oscilloscope to test point J9. The waveform at test point J9 should be a sawtooth with a peak voltage of 10 to 12 volts and a frequency of approximately 400 to 600 cps. The sawtooth minimum voltage should be 0 to 4 volts. See figure 6-22B.
J11	Megacycle-frequency stabilizer module	Recycle	Disconnect the oscilloscope from test point J9 and connect it to test point J11. Disconnect the a-c probe of vtvm from test point J12 and connect it to test point J13. Disconnect the signal generator from A2 on the module extender and connect it to A1 on module extender. Tune signal generator to 17.003 mc and adjust its output for an indication of 0.08 volts on vtvm. The waveform on oscilloscope should be the same as when the oscilloscope was connected to test point J9. See figure 6-22B.

*To make sure the 8.5-16 and 17.0 mc oscillators are locking, connect both coaxial jumpers on the module extender. Then refer to paragraphs 6-205, steps a through g and 6-206, steps a through e.

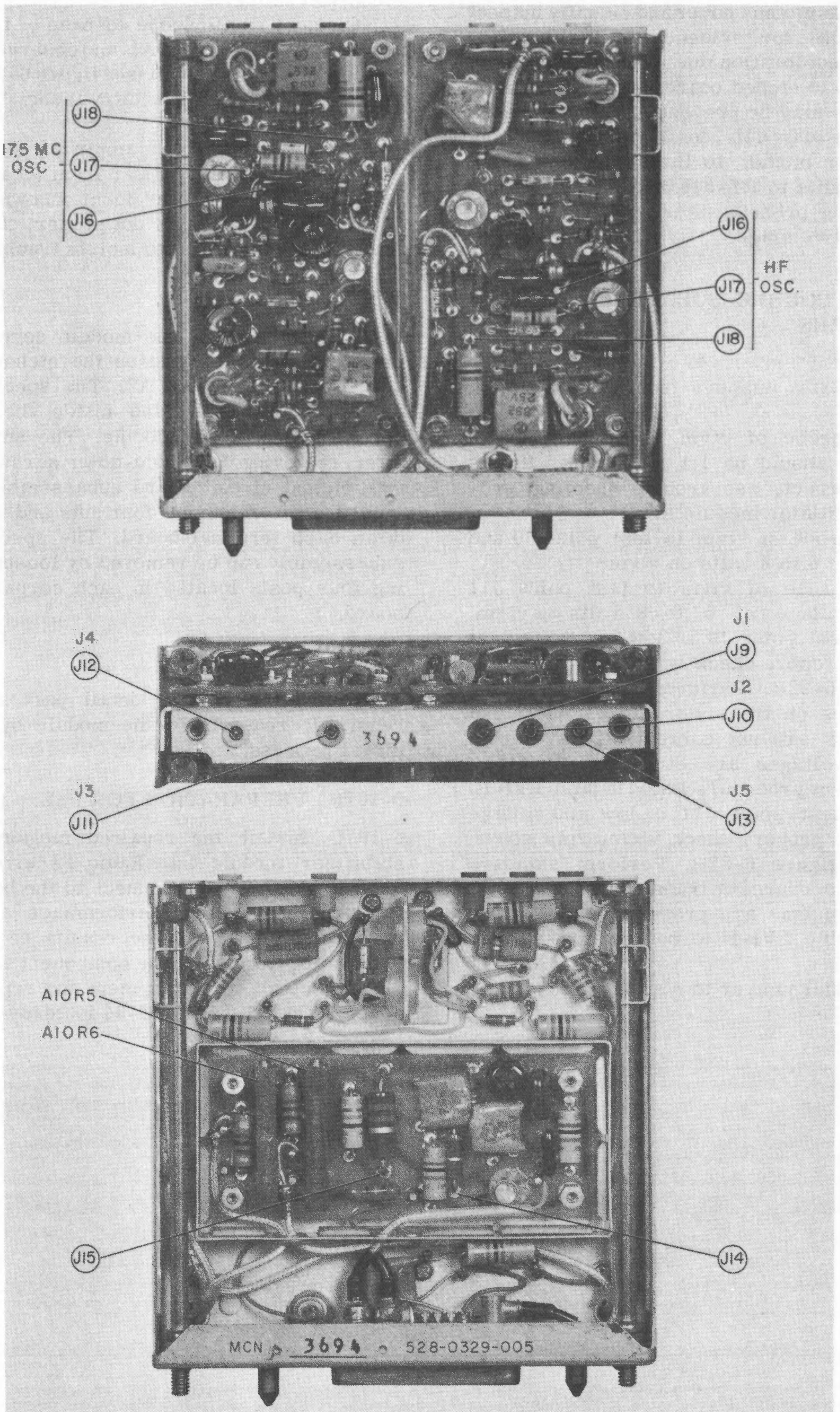


Figure 6-22A. Megacycle-Frequency Stabilizer Module A10 (Collins P/N: 528-0329-005)
Location of Test Points

6-167G. TROUBLE SHOOTING.

6-167H. Remove the module cover and visually inspect disconnected module for evidence of malfunction. Look for shorts, discoloration due to burning, and pay particular attention to etched boards where breaks or other imperfections may be present. If visual checks fail to isolate cause of trouble, connect the megacycle-frequency stabilizer module to the module extender and connect both units to RT-648/ARC-94. Perform the trouble isolating procedures in paragraph 6-167I to isolate the defective stage.

6-167I. MODULE TROUBLE ISOLATION PROCEDURES.

a. Disconnect coaxial jumpers from A1 and A2 on module extender.

b. Connect a-c probe of vtvm to module 500-kc input. The voltage should be 1.1 ±0.1 volts. If this reading is not correct, see trouble-shooting procedures for r-f oscillator module A2.

c. Connect d-c probe of vtvm to test point J9 and observe a voltage of 6 to 8 volts on vtvm.

d. Connect d-c probe of vtvm to test point J11 and observe a voltage of 6 to 8 volts on vtvm.

e. If voltage at test point J9 is low and voltage at test point J11 is proper, check waveforms shown in C, F, and G, figure 6-22B. Perform standard trouble-shooting procedures on transistor stages A1Q3 and A1Q4 if waveforms are not correct. If waveforms are correct and voltages are still low, it will be necessary to perform procedure listed in table LVI-B.

f. If voltage at test point J11 is low and voltage at test point J9 is proper, check waveforms shown in C, F, and G, figure 6-22B. Perform standard trouble-shooting procedures on transistor stages A2Q3 and A2Q4. If waveforms are proper, perform procedure listed in table LVI-B to correct low-voltage reading.

g. Reconnect coaxial jumper to A1 and A2 on module extender.

h. Connect a-c probe of vtvm first to test point J12 and then to test point J13. Both voltages should be 0.008 volt minimum.

i. Connect oscilloscope to base of transistor Q3 on amplifier subassembly A1, and observe a peak-to-peak voltage of 0.6 to 0.8 volt (see figure 6-22B). If voltage is not proper, check circuitry associated with transistor Q1 and Q2.

j. Repeat step i for amplifier subassembly A2.

k. Remove coaxial jumper from A1 and A2 on module extender. Observe waveform shown in C, figure 6-22B. If waveform is not proper, check waveforms A and B, figure 6-22B to isolate trouble.

6-167J. REMOVAL.

6-167K. Removal of the module cover gives access to detail parts located on the etched circuit board subassemblies A1 and A2. The spectrum generator circuit board is located inside the shield on the opposite side of the module. The shield is removed after removing four hold-down screws. Each of the two etched circuit board subassemblies can be removed after removing four nuts and washers holding down each terminal board. The spectrum generator subassembly can be removed by loosening and removing four posts located in each corner of the circuit board.

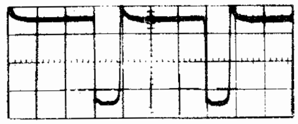
6-167L. REPAIR.

6-167M. After making detail part replacement as required, reassemble the module by reversing removal process.

6-167N. PREPARATION FOR USE.

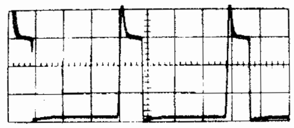
6-167O. Install the repaired megacycle-frequency stabilizer module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance checks given in paragraph 6-167E. If the results of these tests are satisfactory, remove the component from bench test, disconnect all test equipment and replace component cover. The RT-648/ARC-94 is ready for use.

A



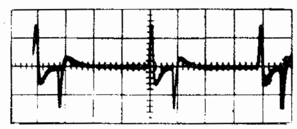
Squaring amplifier Q1 output, junction of R1 and R2, test point TP1, 0.5 volt/cm, 5 usec/cm.

B



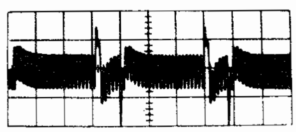
Pulse generator Q2 output, junction of R3 and R4, test point TP2, 5 volts/cm, 5 usec/cm.

C



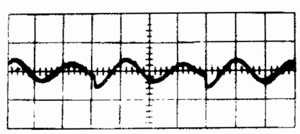
Mixer A1Q3, A2Q3 input, junction of A1R9, A2R9, and A1R10, A2R10, 0.5 volt/cm, 5 usec/cm. No oscillator r-f input to A1Q1, A2Q1.

D



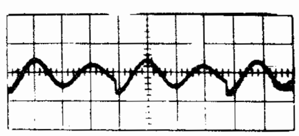
Mixer A1Q3, A2Q3 input, junction of A1R9, A2R9 and A1R10, A2R10, 0.5 volt/cm, 5 usec/cm. Oscillator r-f input to A1Q1, A2Q1.

E



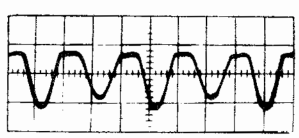
Mixer A1Q3, A2A3 output, junction of A1C7, A2C7 and A1L2, A2L2, test point TP4, 0.5 volt/cm, 0.5 usec/cm. No oscillator r-f input to A1Q1, A2Q1.

F



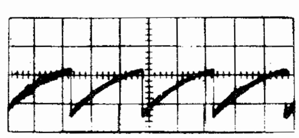
Mixer A1Q3, A2Q3 output, junction of A1C7, A2C7 and A1L2, A2L2, test point TP4, 0.5 volt/cm, 0.5 usec/cm. Oscillator r-f input to A1Q1, A2Q1.

G



I-f amplifier A1Q4, A2Q4 output, junction of A1L3, A2L3 and A1R15, A2R15, 10 volt/cm, 5 usec/cm. No oscillator r-f input to A1Q1, A2Q1.

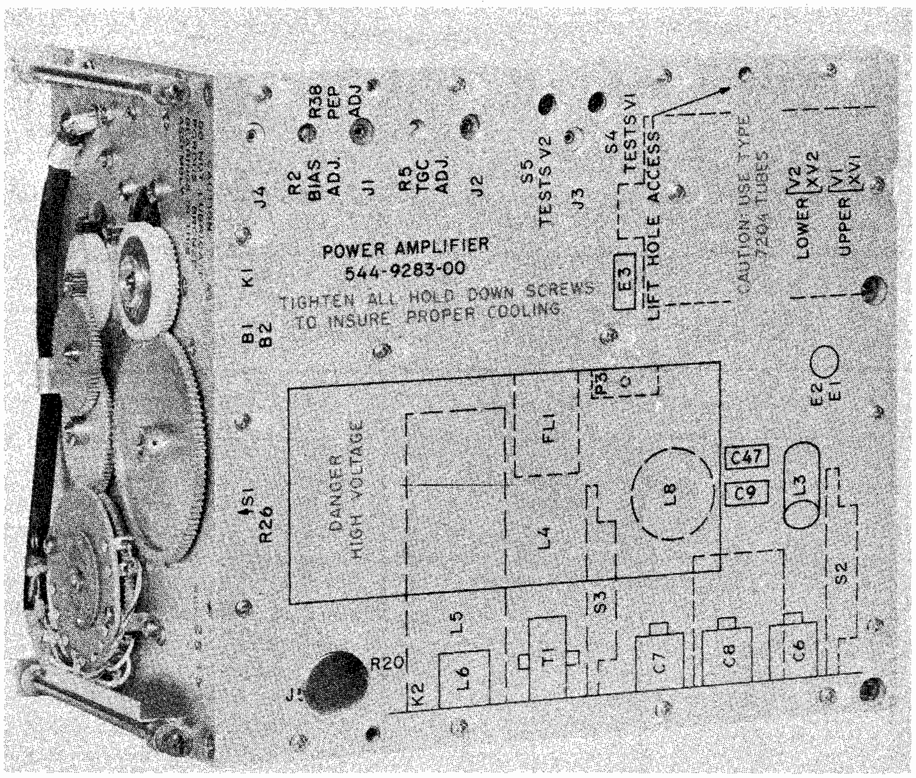
H



Recycle voltage at J1 or J3, 5 volts/cm, 1 ms/cm. Oscillator r-f input to A1Q1, A2Q1.

Figure 6-22B. Megacycle-Frequency Stabilizer Module A10 (Collins P/N: 528-0329-005), Waveforms

POWER AMPLIFIER MODULE MAINTENANCE



POWER AMPLIFIER MODULE

Figure 6-23. Power Amplifier Module A11, Maintenance Marker

6-168. POWER AMPLIFIER MODULE A11.

6-169. Testing and trouble-shooting procedures of this module are performed with the module mounted in place in the chassis of Radio Receiver-Transmitter RT-648/ARC-94. Connect the RT-648/ARC-94 to the bench test setup as shown in figure 5-2.

6-170. Figure 6-24 lists the test points used for maintenance and shows the actual location of these test points within module A11.

6-171. To determine which stage or stages are defective before beginning trouble-isolation procedures, first perform the minimum performance test. If the module does not meet the minimum performance standards, proceed with the trouble-shooting procedures. Figure 7-11 is a schematic diagram of power amplifier module A11. Table LIX shows typical test point voltage and resistance values.

6-172. MINIMUM PERFORMANCE STANDARDS.

6-173. The minimum performance test of table LVII provides indication by which maintenance personnel may determine that a repaired module meets the minimum standards of performance. If the module does not check out, perform the trouble-shooting procedures for this module as directed in paragraph 6-174. Checks conducted by these tests are roller coil travel checks, test point voltage checks, tuning timing check, and break-free torque check. A sample data sheet is provided in table LX for recording data taken from the minimum performance standards.

WARNING

Dangerous voltages are employed in power amplifier module A11. Short plates of tubes to ground before gaining access to the module.

CAUTION

Damage to the tubes of power amplifier module A11 will result from operation for more than a few seconds with the cover removed.

TABLE LVII. POWER AMPLIFIER MODULE A11, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITION AND STANDARDS
None		Roller coil travel	Connect the power amplifier module to an RT-648/ARC-94 known to be in good operating condition. Connect to bench test setup. Set mode selector of C-3940/ARC-94 to AM and adjust frequency selectors until dial indicates 2 mc. Key the RT-648/ARC-94 by operating KEY switch on the 678P-1 set, and observe that the power amplifier tunes and delivers 70 to 90 volts to the r-f load. Unkey the RT-648/ARC-94. Manually turn the large roller coil gear (figure 6-24) clockwise as viewed from gear plate side and observe that the coil turns more than one turn to the end stop. Record indication in table LX. Set frequency on C-3940/ARC-94 to 2.999 mc and repeat the above procedures of keying the RT-648/ARC-94. Unkey the RT-648/ARC-94. Manually turn the large roller coil gear counterclockwise as viewed from the gear plate side and observe. Determine that the coil turns more than one turn to the end stop. Record indication in table LX.

TABLE LVII. POWER AMPLIFIER MODULE A11, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITION AND STANDARDS
(Cont)			Repeat the above steps with the frequency set on the C-3940/ARC-94 to 3.000, 3.999, 4.000, 5.999, 6.000, 7.999, 8.000, 10.999, 11.000, 15.999, 16.000, 21.999, 22.000, and 29.999 mc and record indications of gear in table.
K, K3, K4, K5, K6	Power amplifier module	Test point voltages	Duplicate the test connections as described above. Set the mode selector of the C-3940/ ARC-94 to AM. Measure the power amplifier d-c grid voltage by connecting a d-c vtvm to test point K4. The meter should indicate between -55 and -75 volts dc. Record in table LX. Measure the power amplifier d-c tgc reference voltage by connecting d-c vtvm to test point K6. The meter should indicate between -5 and -8 volts dc. Record in table LX. Key the RT-648/ARC-94. Measure the power amplifier d-c screen voltage by connecting d-c vtvm to test point K3. The meter should indicate between 360 and 440 volts dc. Record in table LX. Measure the power amplifier d-c adc voltage by connecting d-c vtvm to test point K. The meter should indicate not more than -4.75 volts dc across the 2-mc band (2 to 3 mc). Record in table LX.
None		Tuning time	Duplicate the test connections as described above. Switch power amplifier to high-frequency end band No. 1 (2.999 mc). Manually turn large roller coil gear counterclockwise, as viewed from gear plate side, until roller coil reaches high-frequency end stop. Set mode selector on C-3940/ARC-94 to AM, and adjust frequency selectors until dial indicates 2 mc. Key RT-648/ARC-94 and observe that roller coil positions within 7 seconds. Record time in table LX.

TABLE LVII. POWER AMPLIFIER MODULE A11, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITION AND STANDARDS
TP9	Electronic control amplifier module extender	Break-free torque	Duplicate the test connections as described above. Install electronic control amplifier A6 on its module extender (item 5, figure 2-8). Set mode selector on C-3940/ARC-94 to AM. Key RT-648/ARC-94 and check for r-f output of 70 to 90 volts. Connect d-c vtvm to test point TP9 on electronic control amplifier module extender. Manually move the power amplifier roller coil gear until a ±1.0-volt error signal is indicated on d-c vtvm. Carefully release the gear and observe that coil turns to reduce the error to less than ±0.1 volt. Record d-c voltage in table LX.
K	Power amplifier module	Automatic drive control (adc)	Duplicate the test connections as described above. Set the mode selector of the C-3940/ ARC-94 to AM. Ground test point K and note if the power output increases. No increase should be observed.

6-174. TROUBLE SHOOTING.

6-175. Remove the module cover and visually inspect the disconnected module for evidence of malfunction. Look for evidence of shorts, discoloration due to burning, or other imperfections which may be present. If visual checks fail to isolate the cause of trouble, perform the trouble-shooting procedures given in table LVIII.

WARNING

Dangerous voltages are employed in power amplifier module A11. Short plates of tubes to ground before gaining access to the module.

CAUTION

Damage to tubes of power amplifier module A11 will result from operation for more than a few seconds with the cover removed.

6-176. REMOVAL.

6-177. To disassemble the power amplifier module, perform the following disassembly procedures:

a. Refer to figure 6-25. Remove top cover plate from the module by loosening 17 screws on cover, sliding it toward the gear plate, and lifting it off.

b. Remove square plate on end of module opposite gear plate by removing eight mounting screws.

c. Remove one screw and two washers holding end of the large silver-plated coil to bracket on roller coil assembly.

d. Loosen one screw holding lower strap on roller coil assembly.

e. Remove two nylon screws and washers holding roller coil assembly to bracket at end of roller coil nearest tubes. Push the screen bypass capacitor out of the way to get at these screws.

f. Unsolder two wires connected to tune power resistor assembly, R42 and R43. Remove nine screws (S) from gear plate.

g. Remove the gear plate assembly by gently, but firmly, pulling gear plate directly away from the module. Do not force the movement of any component. Do not move, bend, or rotate the switch shaft.

DESIGNATION	LOCATION	DESIGNATION	LOCATION
K	J5	K11	P4-24
K1	P2	K12	P3
K2	P1	K13	P4-19
K3	J3	K14	P4-14, P4-15
K4	J1	K15	P4-11
K5	J4	K16	P4-12
K6	J2	K17	P4-9
K7	P4-16	K18	P4-10
K8	P4-23	K19	P4-13, P4-25
K9	P4-22	K20	P4-18
K10	P4-21		

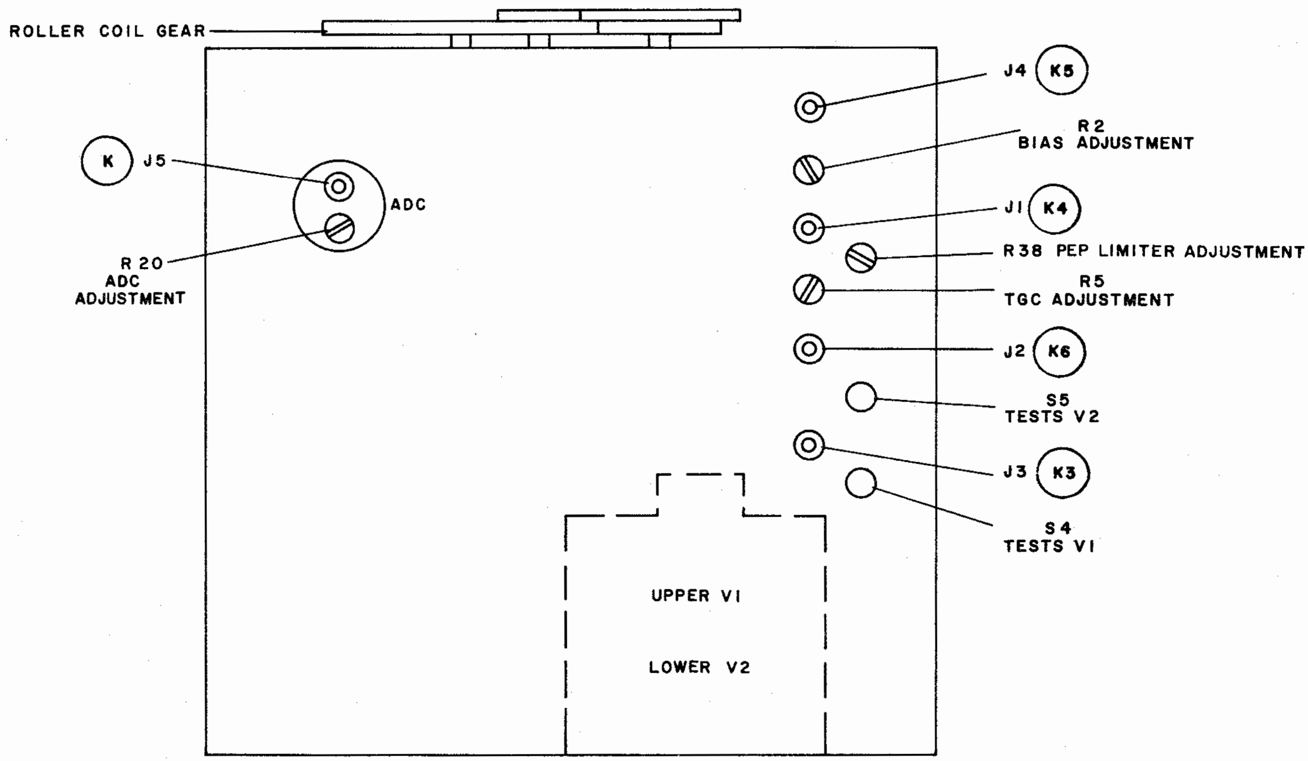


Figure 6-24. Power Amplifier Module A11, List and Location of Test Points

TABLE LVIII. POWER AMPLIFIER MODULE A11, TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Improper static plate current.	Power amplifier tubes V1 and V2.	Replace power amplifier tubes with a known good pair of tubes. Refer to paragraph 5-35 for proper matching of tubes.*
	Failure of high-voltage connector P3 or intermodule wiring.	Check plate current of power amplifier for d-c continuity. Power tubes are capable of delivering full cathode current to the screen grid in the absence of plate voltage. This will cause tube failure. Replace P3 or faulty detail part in high-voltage lead.
Certain bands do not tune up.	Switch S2 or S1 failure.	Isolate faulty frequency band and replace defective detail parts as indicated in schematic diagram, figure 7-11.
Improper tuning of all bands.	Stiff coil bearing or misaligned coil coupler. Stiff motor bearing. Faulty discriminator.	To isolate faulty discriminator, check for ±1-volt excursions at test point TP9 on electronic control amplifier module extender. Maximum levels will occur near resonance when tuning with AM carrier in a power amplifier module which is operating properly. If excursions are low, discriminator is faulty.
Improper break-free torque.	Faulty or sticking bearing.	Isolate and replace defective defective detail part.

*CAUTION: Insert new tubes carefully. Be certain the pins are properly aligned before forcing the tube into the socket. Check to make certain that the tube is fully engaged before tightening the plate strap.

h. To remove power amplifier tubes, remove tube cover plate from end of module opposite gear plate by removing six screws. Loosen straps around tubes. Remove tubes by rotating and pulling tubes with tube pullers supplied in maintenance kit.

CAUTION

Short plate straps to chassis with an insulated-handled screwdriver before removing tubes.

6-178. REPAIR.

6-179. After making detail part replacement as required, reassemble the module by reversing the removal procedure.

6-180. ALIGNMENT.

6-181. Alignment of the power amplifier consists of an adjustment of roller coil travel and an adc adjustment.

6-182. No roller coil travel adjustments are possible on bands 1 through 7. If the roller hits the coil end

TABLE LIX. POWER AMPLIFIER MODULE A11, TEST POINT VOLTAGE-RESISTANCE MEASUREMENTS

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
K	J5	0	0	10.5 k	9.5 k	Transmit d-c voltage 4.4 volts. Transmit a-c voltage 0.1 volt.
K3	J3	0	0.7	127 k	550 k	Transmit d-c voltage +375 volts.
K4	J1	-61	0	18.2 k	12.2 k	
K5	J4	-61	0	100 k		
K6	J2	-7	0	740		

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

stop when tuning these bands, some error exists in the tank circuit components or other detail parts are out of tolerance.

a. To adjust roller coil travel for band 8, adjust L6 for more or less spacing between turns. If less roller travel is required, push the turns of L6 closer together; for more roller travel spread, push the turns of L6 apart.

WARNING

Dangerous voltages are employed in power amplifier module A11. Short plates of tubes to ground before gaining access to the module.

CAUTION

Damage to the tubes of power amplifier module A11 will result from operation for

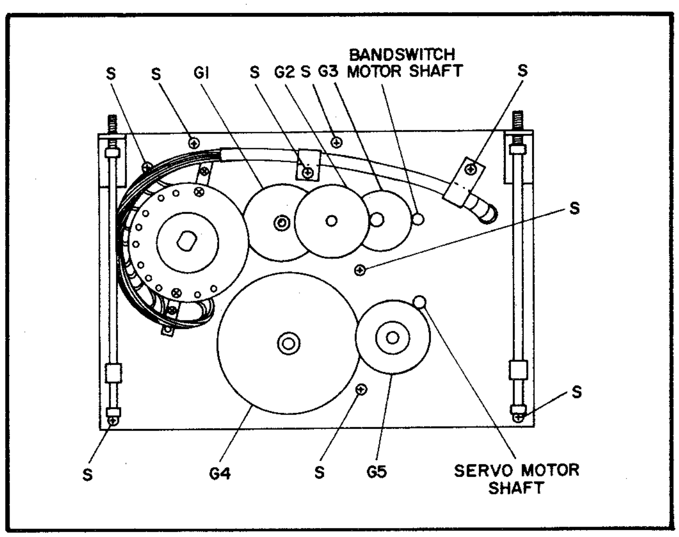


Figure 6-25. Power Amplifier Module A11, Gear Arrangement Diagram

more than a few seconds with the cover removed.

b. To adjust the automatic drive control, set the C-3940/ARC-94 to AM and the frequency to 3.000 mc.
c. Key the RT-648/ARC-94 and readjust tgc reference adjustment R5 in the power amplifier module for 72 volts of r-f output.
d. Remove the plug in the upper left-hand corner of the power amplifier module, and monitor the d-c voltage at test point K with the vtvm.
e. Unkey the RT-648/ARC-94 and key in CW to obtain a modulated output. Turn the adc potentiometer, R20, to increase the d-c voltage at test point K. Continue to increase the voltage until the r-f output is reduced.
f. If the adc is functioning properly, the reading at test point K should now be between 5 and 8 volts.
g. Reset R20 for 4.75 volts at test point K without modulation. Recheck to see that the r-f output is still 72 volts. If not, readjust R5 and then R20 for -4.75 volts at test point K.
h. Replace plug in the power amplifier to prevent damage to the module due to reduced cooling.
i. Rekey the RT-648/ARC-94 and check r-f output voltage. If necessary, reset R5 for correct r-f output.

6-183. PREPARATION FOR USE.

6-184. Install the repaired power amplifier module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component cover. The RT-648/ARC-94 is ready for use.

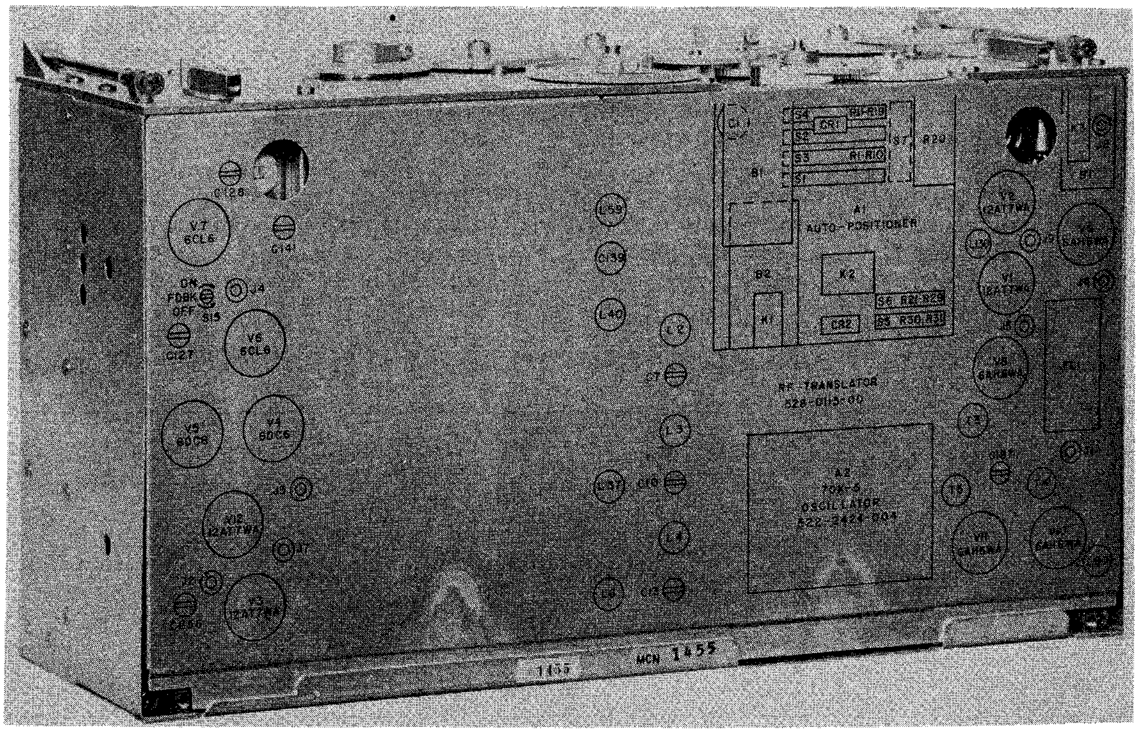
TABLE LX. POWER AMPLIFIER MODULE A11, SAMPLE DATA SHEET

FUNCTION	TEST POINT	QUANTITY BEING MEASURED	REMOTE CONTROL PANEL SETTING	TRANSMITTER KEYED (X)	DATA	LIMITS
Static plate current check						Check.
Roller coil travel	Roller coil gear	Coil turns to end stop (after power amplifier has tuned)	AM, 2.000			Not more than 1 turn (cw).
	Same	Same	AM, 2.999			Not more than 1 turn (ccw).
	Same	Same	AM, 3.000			Same (cw).
	Same	Same	AM, 3.999			Same (ccw).
	Same	Same	AM, 4.000			Same (cw).
	Same	Same	AM, 5.999			Same (ccw).
	Same	Same	AM, 6.000			Same (cw).
	Same	Same	AM, 7.999			Same (ccw).
	Same	Same	AM, 8.000			Same (cw).

TABLE LX. POWER AMPLIFIER MODULE A11, SAMPLE DATA SHEET (Cont)

FUNCTION	TEST POINT	QUANTITY BEING MEASURED	REMOTE CONTROL PANEL SETTING	TRANSMITTER KEYED (X)	DATA	LIMITS
Roller coil travel (Cont)	Same	Same	AM, 10.999			Same (ccw).
	Same	Same	AM, 11.000			Same (cw).
	Same	Same	AM, 15.999			Same (ccw).
	Same	Same	AM, 16.000			Same (cw).
	Same	Same	AM, 21.999			Same (ccw).
	Same	Same	AM, 22.000			Same (cw).
	Same	Same	AM, 29.999			Same (ccw).
Test point voltages	A11J1	Power amplifier grid voltage	AM, any frequency	X		-55 to -75 volts dc.
	A11J2	Tgc reference voltage	Same	X		-5 to -7 volts dc.
	A11J3	Power amplifier screen voltage	Same	X		360 to 440 volts dc.
	A11J4	Bias supply	Same	X		Approximately same as in A11J1.
	A11J5	Adc voltage	AM, random frequencies from 2 to 3 mc	X		Approximately -4.75 volts dc.
Tuning time		Tuning time	AM, 2.999	X		Not more than 7 seconds.
Break-free torque	TP9 (module extender)	Discriminator output voltage	AM, any frequency	X		Not more than 0.1 volt dc.

R-F TRANSLATOR MODULE MAINTENANCE



R-F TRANSLATOR MODULE

Figure 6-26. R-F Translator Module A12, Maintenance Marker

6-185. RF TRANSLATOR MODULE A12.

6-186. Testing and troubleshooting procedures for rf translator module A12 are interrelated with procedures for other modules. When the minimum performance standards tests are performed, it is imperative that all other modules are known to be functioning normally. In particular, it is very difficult to determine if the injection oscillators of rf translator module A12 are working normally if the condition of the frequency stabilizing modules is unknown. Perform the minimum performance standards procedures before proceeding with troubleshooting. Figure 7-12 is the schematic diagram of rf translator module A12. Tables LXIII and LXIV provide typical test-point voltage and resistance values.

6-187. MINIMUM PERFORMANCE STANDARDS.

6-188. To meet performance standards, normal indications are required in all procedures of table LXI. In addition, perform the carrier balance and residual noise check of paragraph 5-40, the transmitter power output check of paragraph 5-36, and the receive/transmit gain balance check of paragraph 6-190.

6-189. All but the last two steps of table LXI (bandpass and variable if. check) are performed with rf translator module A12 connected in the chassis with the top cover removed. For the last two steps of table LXI, remove rf translator module A12 from the chassis, and reconnect it through the module extender, as follows:

a. Secure the module extender to the chassis with the redheaded captive screws. Secure rf translator module A12 to the module extender with the redheaded captive screws.

b. Disconnect the coaxial jumper at J34 on the module extender.

c. Remove the small block that holds J31 and J30 on the module extender. These jacks mate with plugs A12P2 and A12P3 on rf translator module A12.

d. Connect the rf translator load, supplied in the 678Y-1 maintenance kit (item 24 in figure 2-9), to P2 and P3. Make this connection so that the blue test point on the rf translator load is on the same side as A12P2.

e. Connect the vtvm ac probe to the blue test point. Referenced test points for the minimum performance standards tests are illustrated in figures 5-1 and 6-27. The test points are also provided on the schematic diagram of rf translator module A12, figure 7-12.

TABLE LXI. RF TRANSLATOR MODULE A12, MINIMUM PERFORMANCE STANDARDS

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
L15 52	VFO A12A2 output circuit to lf mixers A12V1, A12V8	Minimum vfo A12A2 output level for 70K-5 or 70K-9	Power on, AM mode, any frequency. Vtvm (ac probe) connected to L15 through No. 1 probe from 678Y-1 maintenance kit. Remove all connections from AUX RCVR ANT. 52 Not necessary to key. Read 0.8 volt rms minimum at L15.
L16	17.5-mc oscillator A12V10 output circuit.	Injection voltage to 17.5-mc mixers A12V2, A12V9	Same test conditions except frequency must be below 7.000 mc and ac probe to L16 . Read 0.9 volt rms minimum at L16 .
L13	Pin 2 of transmit hf mixer A12V3	Signal level at low frequency from bandpass filter	Change frequency to 2.100 mc. Move ac probe to L13 . Key RT-648/ARC-94. Read 0.05 to 0.35 volt rms at L13 . Unkey the RT-648/ARC-94.
L17	Hf oscillator A12V11 output circuit	Injection voltage to hf mixers A12V3, A12V12	Above test conditions except move ac probe to L17 , and do not key. Read 0.8 volt rms minimum at L17 .
L12	Grids of rf amplifiers A12V4, A12V5	Rf amplifier grid drive	Above test conditions except move ac probe to L12 , and key the RT-648/ARC-94. Read 0.05 to 0.2 volt rms at L12 . Unkey.

TABLE LXI. RF TRANSLATOR MODULE A12, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
L	Grids of rf drivers A12V6, A12V7	Rf driver grid drive	Above test conditions except move ac probe to L. Read 2.0 to 4.5 volts rms at L. Unkey.
L15	VFO A12V2 output circuit to lf mixers A12V1, A12V8	Vfo A12V2 frequency while phase-locked	Connect frequency counter to L15. Set operating frequency as shown in chart below. Read phase-locked frequency as shown in chart below. Not necessary to key. OPERATING FREQUENCY / VFO FREQUENCY X.000 3.500 X.111 3.389 X.222 3.278 X.333 3.167 X.444 3.056 X.555 2.945 X.666 2.834 X.777 2.723 X.888 2.612 X.999 2.501
L15 L18	Vfo A12A2 output circuit to lf mixers A12V1, A12V8	Vfo A12A2 frequency while free running	Refer to the above chart. Repeat the test, but on each operating frequency, ground test point L18, and note frequency change. Unground test point L18, and note that frequency of vfo A12A2 returns to phase lock within several seconds. Disconnect frequency counter.
L12	17.5-mc oscillator A12V10 output circuit	17.5-mc oscillator A12V10 phase lock	Any operating frequency below 7.000 mc. Not necessary to key. Tune 51J-4 receiver to 17.5 mc, and place the receiver antenna wire near oscillator tube A12V10. Check for 17.5-mc oscillator A12V10 heterodyne in 51V-4 receiver. Ground test point L12, and note that frequency varies as phase lock is disabled. Unground test point L12, and frequency should return to phase lock.
L16	Hf oscillator A12V11 output circuit	Hf oscillator A12V11 phase lock	Place the 51J-4 antenna near hf oscillator tube A12V11. Set operating frequency according to the chart below. At each operating frequency, set 51J-4 receiver frequency as indicated in the chart. Note heterodyne. Then ground L16, and note that frequency changes. Unground L16, and note that frequency returns to phase lock.
52	Output of receiver lf mixer A12V8 to	Receive output level	Operating frequency 9.990 mc, AM mode. AUDIO control on receiver-transmitter front panel at maximum. RF SENS control on C-3940/ARC-94 at maximum. Connect signal generator through 6-db pad to AUX RCVR ANT.

TABLE LXI. RF TRANSLATOR MODULE A12, MINIMUM PERFORMANCE STANDARDS (Cont)

TEST POINT	LOCATION	TO CHECK	TEST CONDITIONS AND STANDARDS
52 (Cont)	transformer A12T3		terminal 52 . Set signal generator frequency to 9.999 mc. Modulate 30 percent at 1000 mc. Connect ac vtvm to 678P-1 HEADSET jack, and adjust signal generator frequency to peak the reading at HEADSET jack. After peaking, adjust signal generator input level for 3 volts rms at HEADSET jack. The following check applies to rf translator modules below MCN6392: Adjust A12T3 for peak reading at HEADSET jack. If peak is above 5 volts rms, reduce signal generator input level to prevent distortion and repeak. If rf translator A12 module is MCN6392 or above, perform the additional procedure below. After peaking A12T3, change operating frequency and signal generator frequency to 26.100 mc. Repeak signal generator frequency by observing voltage at HEADSET jack, and then adjust signal generator output level for 3 mv. Adjust A12R78 for 3.8 volts rms at HEADSET jack.
L13	Input to grid of transmit hf mixer A12V3	Bandpass if. alignment check	Set operating frequency to 6.000 mc and mode to AM on C-3940/ARC-94. Connect signal generator (through 6-db pad) to J34 on module extender. Set signal generator frequency to 500 kc. Connect vtvm ac probe through no. 2 test probe to test point L13 . Key the RT-648/ARC-94, and adjust the signal generator output level for 0.5 volt rms at test point L13 . Then change operating frequency and signal generator frequency in 100-kc increments from 6.000 mc to 6.999 mc without varying the signal generator level. Unkey. If the reading obtained at test point L13 varies more than 2-to-1 across this frequency range, refer to the next procedure.
L13	Same as above	Variable if. alignment check	Same as above, but vary operating frequency and signal generator frequency from 8.000 mc to 8.999 mc. If voltage reading varies more than 2:1, refer to paragraph 6-208, variable if. alignment. If variation is not more than 2:1 in this step but more than 2:1 in the previous step, refer to paragraph 6-209, bandpass if. alignment. Disconnect the signal generator and vtvm.

TABLE LXII. Deleted

DESIGNATION	LOCATION	DESIGNATION	LOCATION
L	J4	L9	P9-19
L1	P9-9	L10	P9-31
L2	P9-10	L11	J33-14 (extender)
L3	P9-11	L12	J3
L4	P9-12	L13	J2
L5	P9-13	L14	J6
L6	P9-15	L15	J5
L7	P9-17	L16	J1
L8	P9-18	L17	J7
		L18	J8

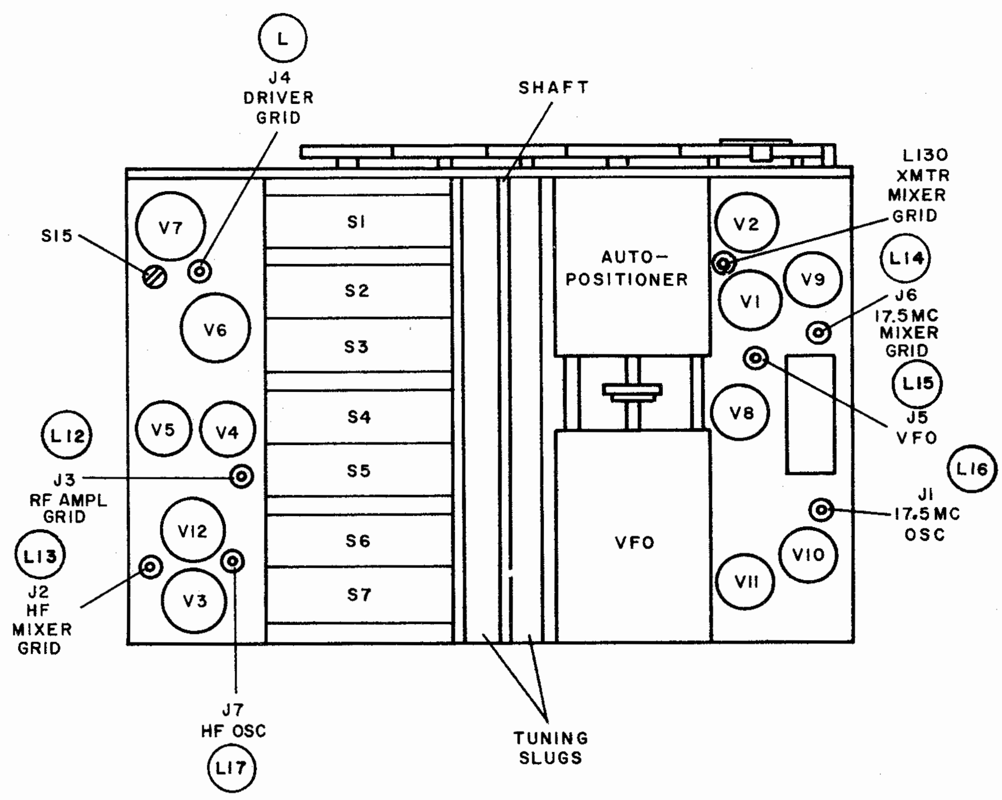


Figure 6-27. RF Translator Module A12, List and Location of Test Points

6-190. Perform the receive/transmit gain balance check. Remove rf translator module A12 from the module extender. Remove the module extender from the chassis. install rf translator module A12 in the chassis. Leave the module cover off. Refer to figure 6-27A, and proceed as follows:

a. Connect the vtvm ac probe to the T-connector at the ANT. terminal, test point 51. Set to 100-volt rms scale.

b. Connect the 678Z-1 jack labeled J2-1F TRANS to test point J2 on if. translator module A3. Connect the 678Z-1 jack labeled J2-FREQ DIV to test point A10 on frequency divider module A1. Connect the 678Z-1 jack labeled GRND to the chassis. Set the 678Z-1 FUNCTION SELECTOR switch to TGC OVERRIDE. Set the 678Z-1 TGC & CAPTURE RANGE control, R3, fully counterclockwise.

c. Set frequency selector on C-3940/ARC-94 to 29.000 mc and the mode selector on C-3940/ARC-94 to AM.

d. While keying RT-648/ARC-94, slowly adjust 678Z-1 TGC ± CAPTURE RANGE control for no more than 30-volt rms output at test point 51. Unkey.

e. Refer to figure 6-27A for location of RF AMP PLATE coil on rf translator module A12. Key again, and adjust this coil for maximum rms voltage at test-point 51. Unkey.

f. Adjust RF SENS control on C-3940/ARC-94 fully clockwise. Adjust AUDIO control on the RT-648/ARC-94 front panel fully clockwise.

g. Connect signal generator (through 6-db pad) to AUX RCVR ANT. connector, test point 53. Set signal generator output to 29.000 mc 30 percent modulated at 1000 cps.

h. Connect the ac vtvm to the 678P-1 HEADSET jack, and slowly adjust signal generator frequency for maximum reading at HEADSET jack. Then adjust signal generator output level to provide 3 volts rms at HEADSET jack.

i. Adjust the RF AMP PLATE coil again. Peak the voltage at the HEADSET jack with this adjustment. If the adjustment provides more than 3.8 volts rms at HEADSET jack, refer to paragraph 6-203.

6-191. If all the previous test steps result in normal indications, rf translator module A12 may be returned to service or prepared for reshipment. If it is necessary to replace either or both driver tubes (A12V6, A12V7), refer to paragraph 6-210, and perform neutralization adjustments before returning rf translator module A12 to service.

6-192. TROUBLESHOOTING.

6-193. No attempt should be made to isolate troubles to rf translator module A12 unless the chassis and all other modules of RT-648/ARC-94 are known to be functioning properly. Failing this, abnormal indications involve multiple unknowns and greatly increase troubleshooting time. Refer to the following analysis of the minimum performance tests for troubleshooting information:

a. The residual noise check of paragraph 5-40. If abnormal, proceed to paragraph 6-204. and perform mixer balance adjustment.

b. The transmitter power output of paragraph 5-36. If abnormal, refer to alignment procedures in paragraph 6-180.

c. Vfo A12A2 output check of table LXI. If no output, place the module on the module extender. Check for +18 volts dc at test point 28 of the module extender. It is assumed that low voltage power supply module A5 is properly adjusted to provide this voltage. If +18 volts dc is not present, remove the module from the extender, and recheck at test-point 28. If +18 volts dc is now present, trace the short circuit. If vfo A12A2 output signal is low, vfo A12A2 may be defective or overloaded in the If mixer circuits. Check capacitors A12C148, A12C252, A12C167, and A12C164. A substitute vfo A12A2 may be connected into the circuit for temporary check by disconnecting the leads of the suspected vfo A12A2 and temporarily attaching the leads of the substitute. Check thoroughly before removing vfo A12A2.

d. Injection voltage from 18.5-mc oscillator A12V10. If voltage is absent, check tube A12V10. Place the tube on the extender (item 22, figure 2-9), and check for proper voltage and resistance values.

CAUTION

Make sure the exposed pins of the tube extender do not touch ground before applying power.

If the output is low, perform alignment procedures of paragraph 6-206.

e. Signal level at low frequencies from bandpass filter. If abnormal, perform the last test of table LXI, the variable alignment check. If it also is abnormal, check A12V2. If A12V2 is normal, perform alignment of the variable if., paragraph 6-208. If it is abnormal, perform bandpass if. alignment, paragraph 6-209.

f. The injection voltage to the hf mixer A12V3 is generated by hf oscillator A12V11. It was tested on 2.100 mc. If abnormal, recheck voltage at operating frequencies 3 through 29 mc. If injection voltage is normal on one or more 1-mc increments, refer to hf oscillator alignment procedures of paragraph 6-205. If there is no output throughout the tuning range, check the tube (A12V11). Extend the tube, and check voltages and resistances before proceeding with paragraph 6-205.

CAUTION

Be certain exposed tube extender pins do not touch ground before applying power. The tube extender is item 23 of figure 2-9.

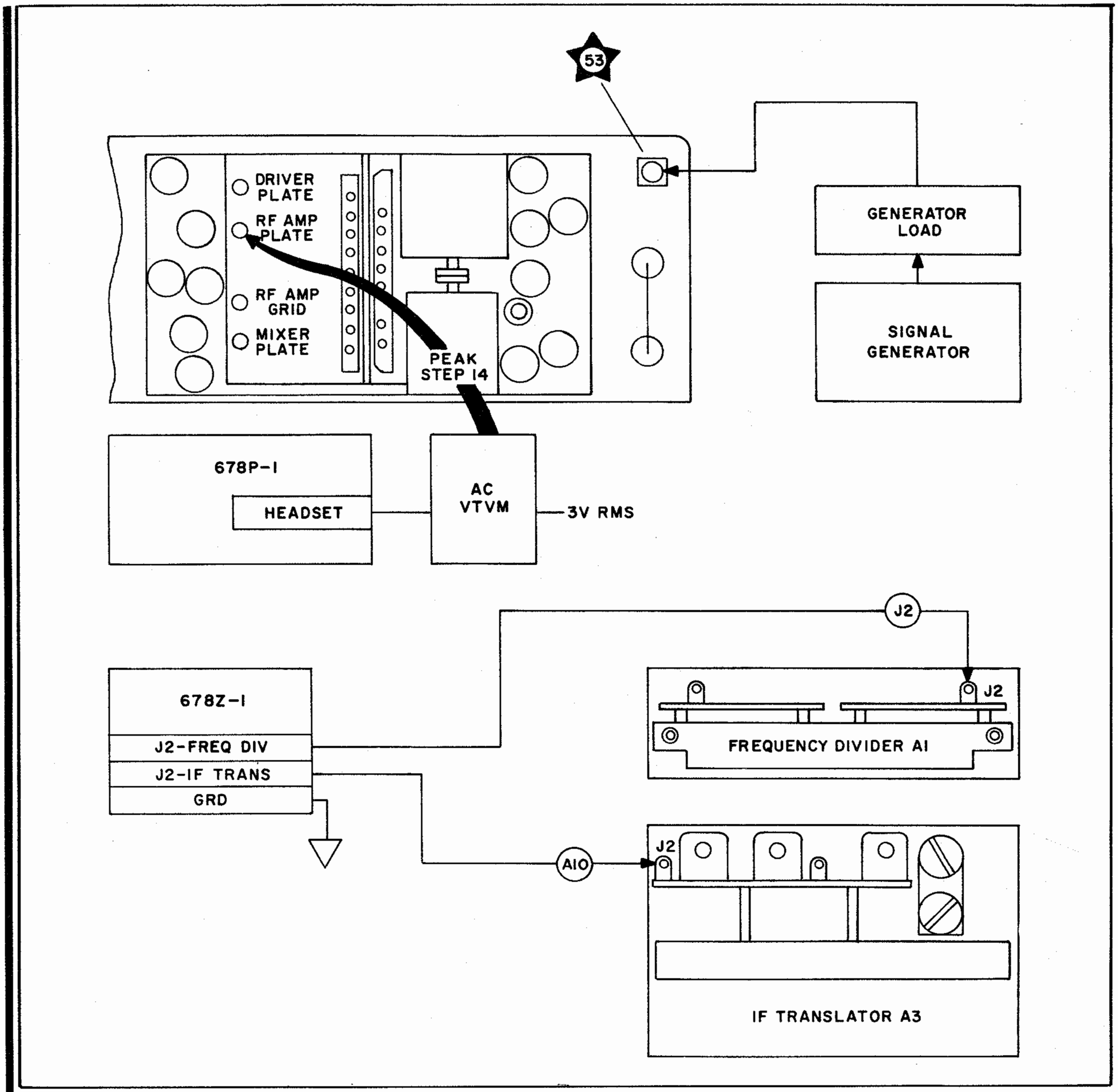


Figure 6-27A. Receive/Transmit Gain Balance Check

g. Rf amplifier grid drive. Check hf transmit mixer stage A12V3 if abnormal. Try other operating frequencies. If drive is normal at some frequencies, refer to rf turret alignment procedures, paragraph 6-207.

h. Rf driver grid drive. If abnormal, try other frequencies. If occasional frequencies are normal, refer to rf turret alignment procedures, paragraph 6-207. If abnormal throughout the frequency range, test A12V4, A12V5, and associated circuitry.

i. If vfo A12A2 will not phase-lock, refer to the digit oscillator bias check for paragraph 6-85. If digit oscillator bias check is normal, check digit oscillator frequency, paragraph 5-44. If also normal, refer to tracking adjustments of vfo A12A2, paragraph 6-213. Do not uncouple vfo A12A2 and disturb tracking adjustments (paragraph 6-213) until electronic checks have been made. The subsequent test of the vfo A12A2 while free running offers an important clue. If the frequency of the vfo changes more

TABLE LXIII. R-F TRANSLATOR MODULE A12, TEST POINT VOLTAGE-RESISTANCE MEASUREMENT

TEST POINT	JACK	VOLTAGE (volts)		RESISTANCE (ohms)		NOTES
		DC	AC	(+)	(-)	
L	J4	0	0	4.5 k		Transmit a-c voltage 2.3 volts.
L12	J3	0	0	380 k	210 k	Transmit a-c voltage 0.1 volt.
L13	J2	0	0.18	1.4		
L14	J6	-0.25	0	12 k		Transmit a-c voltage with RT-648/ARC-94 tuned between 2 and 6 megacycles 0.3 volt.
L15	J5	17	1.25	120	150	
L16	J1	0	0			Transmit a-c voltage with RT-648/ARC-94 tuned between 2 and 6 megacycles 1.25 volts.
L17	J7	0	1.8			

General Notes:

1. Resistance (+) indicates positive ohmmeter lead grounded.
2. Resistance (-) indicates negative ohmmeter lead grounded.
3. Resistance measurements made with Triplett Model 630A Multimeter.
4. Voltage measurements made with TS-520/U.
5. Measurements made with RT-648/ARC-94 tuned to 7.3 mc, in receive and AM modes. Gain control is fully clockwise with no r-f input.
6. Values given are approximate and may vary in some units.

TABLE LXIV. RF TRANSLATOR MODULE A12 EXTENDER, TEST POINT VOLTAGES

TEST POINT	FUNCTION	VOLTAGE
L1	Filament common	RT-648/ARC-94 only 6.3 volts ac between filament pins and filament return pins
L2	Filament	
L	Filament return	

TABLE LXIV. RF TRANSLATOR MODULE A12 EXTENDER, TEST POINT VOLTAGES (Cont)

TEST POINT	FUNCTION	VOLTAGE
L4	Filament	RT-648/ARC-94 only 6.3 volts ac between filament pins and filament return pins
L5	Filament return	
L1	Filament	RT-698/ARC-102 only 25.2 volts dc
L5	Filament return	
15	Avc	0 volt dc (no signal input, volume maximum)
17	B+	+28 volts dc
18	B+	+130 volts dc
19	B+	+260 volts dc, transmit; 0 volt dc, receive
28	B+	+18 volts dc
31	B+	+10.000 ±0.010 volts dc
(J33) 14	B+	+28 volts dc

than approximately 4-kc anywhere within its range, it is likely to require tracking. Refer to the capture range test, paragraph 5-45.

j. Th 17.5-mc oscillator A12V10 phase-lock check. If abnormal, but the injection voltage read in earlier test is normal, the oscillator is possibly outside capture range. Refer to alignment procedures of paragraph 6-206.

k. The hf oscillator A12V11 phase-lock check. If abnormal, refer to alignment procedures, paragraph 6-205.

l. If receive output level will not adjust to the required level, check receive mixer stages A12V8, A12V9, and A12V12. Check tubes and socket voltages and resistances. If transmit gain was normal, tuned circuits are not at fault since they are common to transmit and receive. Perform receive/transmit gain balance check, paragraph 6-190.

m. Instructions are given in table LXI regarding abnormal indications in the bandpass if. and variable if. alignment checks.

6-194. REMOVAL.

6-195. Access to certain detail parts, such as tubes, is accomplished by removal of the module front cover. See paragraph 5-58, step b, for rf translator module cover removal. See paragraph 6-196 for removal of vfo and Autopositioner submodules.

6-196. REMOVAL OF VFO AND AUTOPOSITIONER FROM RF TRANSLATOR MODULE.

a. With rf translator module in the chassis and power applied to the RT-648/ARC-94, position the vfo and Autopositioner to 500-kc position by setting frequency selector on C-3940/ARC-94 to x.500 mc, any megacycle band, and remove power.

b. Remove rf translator module from the chassis.

c. Remove top and bottom covers from rf translator module.

d. Refer to figure 6-28. Remove four screws (1) fastening vfo to Autopositioner.

e. Remove four screws (2) fastening vfo brackets to rf translator chassis and back plate.

f. Loosen two screws (3) holding back brackets on vfo. Rotate brackets approximately 90 degrees in order to have room to move vfo.

g. Loosen setscrews (4) on coupler between vfo and Autopositioner.

h. Remove four tubes (5) adjacent to vfo and Autopositioner.

i. To remove the vfo, tag and unsolder the vfo leads (6) from connectors P6 and P9-31 and the other internal connections in the module. Note placement of these leads on rf translator chassis. The vfo may then be lifted from rf translator.

j. Refer to figure 6-29. Remove 3/8-inch flatted shaft (7) directly above 25-pin connector (8) by loosening clamp (9) on gear that drives the shaft. Pull shaft out through gear.

k. Remove two screws (10) holding 25-pin connector to bottom of rf translator chassis.

l. Refer to figure 6-30. Remove idler gear (G9) which couples Autopositioner to slug rack gear.

m. Refer to figure 6-30. Remove four screws (11) holding Autopositioner to gear plate.

n. Carefully maneuver Autopositioner to free it from mounting plate. Remove Autopositioner by slowly lifting it from rf translator chassis. Be careful to not damage 28-position switch wafers when pulling 25-pin connector up through chassis.

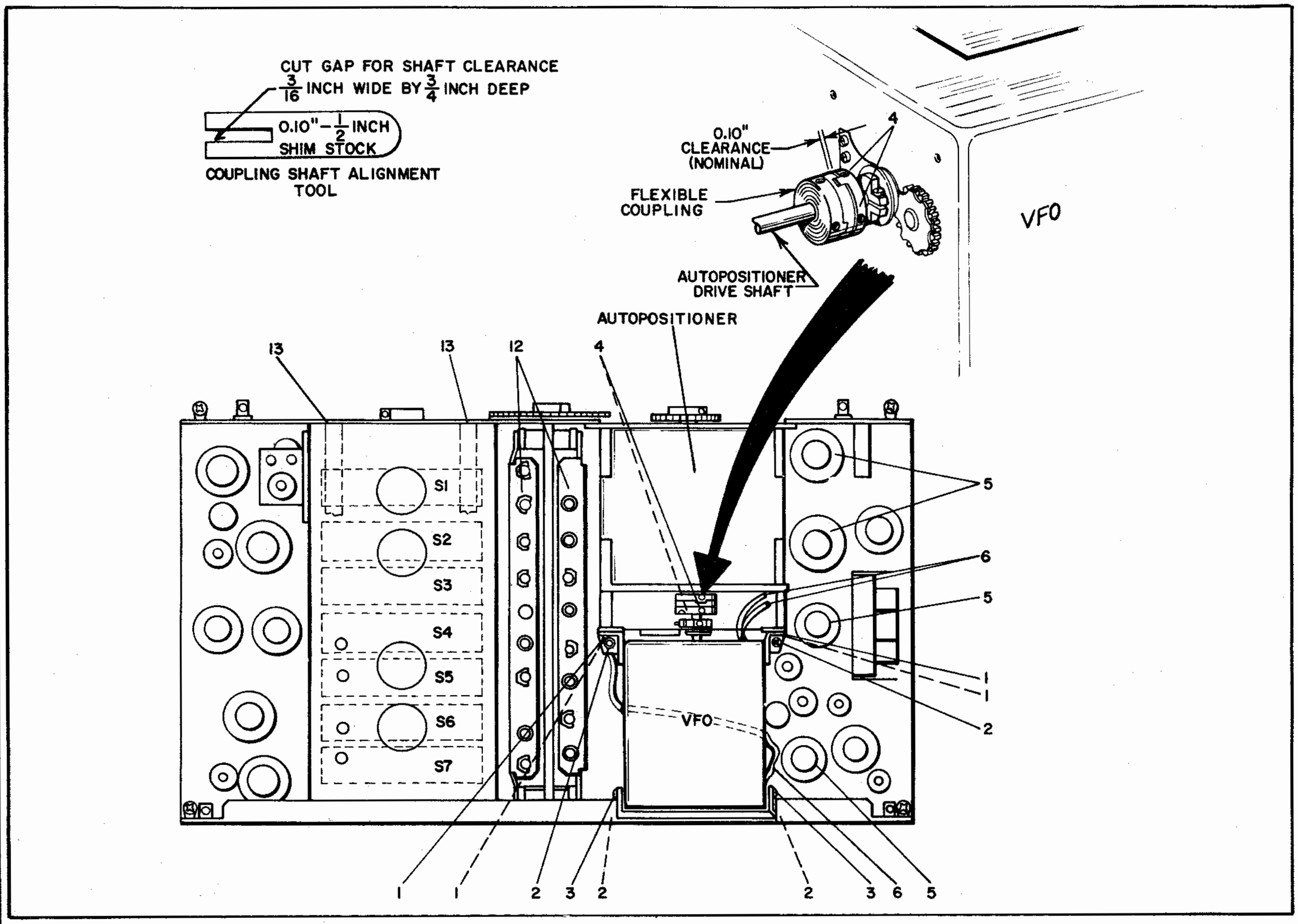


Figure 6-28. RF Translator Module A12, Top View

6-197. DISASSEMBLY OF VFO.

6-198. The vfo is a potted assembly and cannot be disassembled in the field. Any attempt to disassemble or adjust the vfo will result in misalignment and loss of accuracy. If the source of trouble has been definitely traced to the vfo, the vfo should be returned to the factory and replaced with a new unit.

6-198A. REPLACEMENT OF VFO AND AUTOPOSITIONER IN RF TRANSLATOR MODULE.

NOTE

Be sure Autopositioner is positioned to 500 kc before installing in rf translator.

a. Refer to figures 6-28, 6-29, and 6-30. Carefully maneuver Autopositioner into position under gear plate. Place 25-pin connector (8) through 28-position switch to its position at bottom of module. Be careful not to damage switch wafers when placing connector through switch.

b. Replace four screws (11) holding Autopositioner to gear plate. Leave screws one-half turn loose.

c. Position the two slug racks (12) at equal height above the chassis.

CAUTION

Make certain that the two slug racks are equal in height above the chassis. The slug rack has no stops. Therefore, if racks are not positioned correctly at 500 kc, Autopositioner could run rack beyond its design range, stretching and ruining the tapes.

With slug racks in this position, place clamp on slug rack gear so that it is facing top of module.

d. Replace idler gear (G9) that couples Autopositioner gears to slug rack gear.

e. Position Autopositioner in oversize mounting holes to remove as much backlash as possible in idler gear drive. Tighten four Autopositioner mounting screws (11).

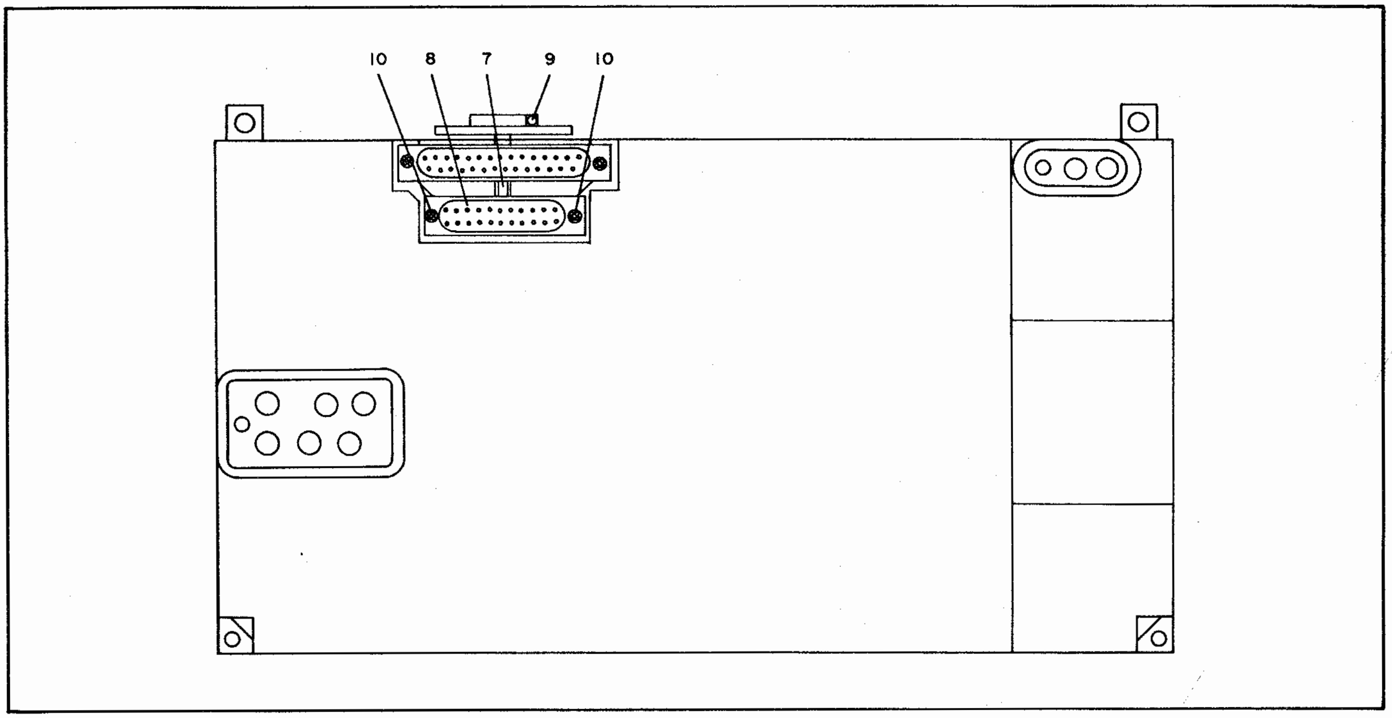


Figure 6-29. RF Translator Module A12, Bottom View

f. Fasten 25-pin connector (8) to bottom of rf translator chassis with two screws (10).

g. Replace 3/8-inch flatted shaft (7) above 25-pin connector by placing it through gear that turns shaft.

h. Tighten clamp (9) that holds shaft.

i. Position vfo shaft midway between end stops by positioning stop mechanism as shown in figure 6-30A.

j. Place vfo in its position under Autopositioner. Run three vfo leads (6) through holes in rf translator chassis, and solder to connector P6 and P9-31 and internal connections in module.

k. Replace four tubes (5) adjacent to vfo and Autopositioner.

l. Rotate rear brackets (3) on vfo so that they can be fastened to rear plate.

m. Replace four screws (2) fastening vfo brackets to rear plate and rf translator chassis.

n. Place the coupling shaft alignment tool (figure 6-28) between the coupling disc on vfo shaft and the brass, center disc. Press the coupling disc snugly against the alignment tool and tighten the two set screws of the coupling disc.

CAUTION

Refer to figure 6-28. Use of the 0.10-inch coupling shaft alignment tool is required for optimum mechanical adjustment. The allowable tolerance between the coupling faces is 0.005 in. to 0.015 in. An excessive gap (above 0.015 in.) will reduce tuning reset accuracy due to backlash; not enough gap (below 0.005 in.) will cause mechanical distortion transmitted to the vfo tuning element, resulting in poor (nonlinear) tracking.

o. Refer to paragraph 6-207, steps v through aa for slug rack alignment. Refer to paragraph 6-213, steps n and o for vfo alignment.

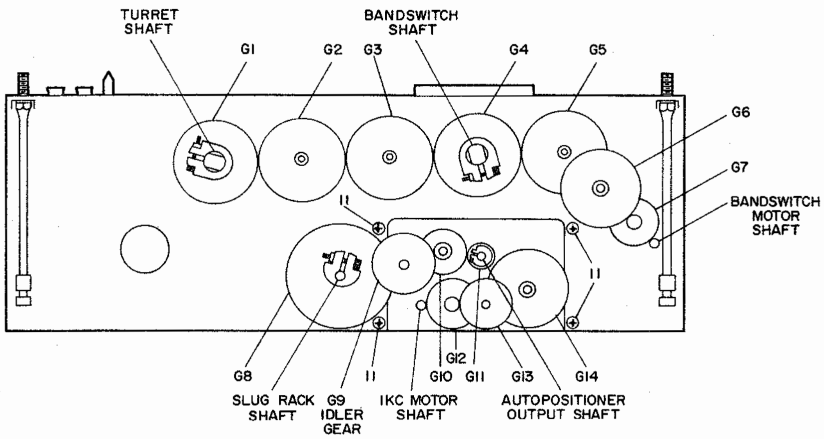


Figure 6-30. RF Translator Module A12, Gear Plate

6-199. REPAIR.

6-200. After making detail part replacement as required, reassemble the module by reversing the removal procedures.

6-201. ALIGNMENT AND ADJUSTMENT.

6-202. To align and adjust the rf translator module, proceed as shown in the following paragraphs.

6-203. Receive/transmit gain balance adjustment is as follows:

a. Remove rf translator module A12 from the chassis of RT-648/ARC-94. Remove the bottom cover plate of the module.

b. Refer to the schematic diagram, figure 7-12, and locate capacitor A12C61 in the driver compartment of rf translator module A12.

c. Select a new value for A12C61 from the complement of values (given in the illustrated parts list) that will hold the voltage at the HEADSET jack to the proper value.

d. Repeat the procedures of paragraph 6-188 to be certain the minimum standards have been met by A12C61 replacement.

e. Replace the bottom cover of rf translator module A12, and secure all screws.

6-204. Procedures in paragraphs 6-205 and 6-206 correct out-of-tolerance indications at test points J and J8 in megacycle-frequency stabilizer module A10.

6-205. Adjust hf oscillator as follows:

NOTE

Do not use module extender.

a. Set C-3940/ARC-94 mode selector to AM, and adjust frequency selectors until dial indicates one of the out-of-tolerance readings.

b. Connect the dc probe of the dc vtvm to megacycle-frequency stabilizer module A10, test point J.

c. Tune the 51J receiver to the hf oscillator frequency corresponding to the RT-648/ARC-94 (see table LIV), and loosely couple the 51J antenna to oscillator tube V11.

d. Key RT-648/ARC-94, and adjust appropriate coil (marked on the side cover) for megacycle band set on the C-3940/ARC-94 until dc vtvm indicates 7.0 ±0.5 volts dc.

e. Use the 51J receiver to determine that the hf oscillator is locked to the correct frequency. If frequency is incorrect, readjust coil until vtvm indicates +7 ±0.5 volts dc and the frequency is correct.

f. Repeat procedures outlined in d and e on all indicated out-of-tolerance frequencies, and adjust proper coil for each band. If insufficient inductance exists in any one band, readjustment of the common shunt core should bring the total inductance to the proper value. Changing the common core will require readjustment of all other coils. The common core is marked "C" on the side cover.

g. Connect ac probe of dc vtvm to test point L17 through test probe no. 2 supplied in the 678Y-1. Observe that indication is more than 0.8 volt ac.

NOTE

If indication observed in step g is less than 0.8 volt ac, perform procedures outlined in steps h through l.

h. Set frequency at C-3940/ARC-94 to 6.000 mc.

i. Adjust bottom slug of variable transformer T5 (location of transformer T5 shown on top cover) for maximum output at test point L17.
j. Set frequency at C-3940/ARC-94 to 14.000 mc, and adjust top slug of T5 for maximum output at test point L17.
k. Set frequency at C-3940/ARC-94 to 29.000 mc, and adjust trimmer C187 (location shown on top cover) for maximum output at test point L17.
l. Repeat procedures outlined in steps h through k for a final adjustment.

6-206. Adjust 17.5-mc oscillator as follows:

NOTE

Do not use module extender.

a. Set the C-4930/ARC-94 mode selector to AM, and set the frequency to 2.1000 mc.
b. Connect the dc vtvm to test point J8 on the megacycle-frequency stabilizer, Collins part number 544-9289-005, or to J2 on the megacycle-frequency stabilizer, Collins part number 528-0329-005. Tune the 51J to 17.5 mc, and loosely couple its antenna to 17.5-mc oscillator tube V10.
c. Adjust L90 in the lower right corner of the rf translator until the oscillator locks on 17.5 mc.
d. Adjust L90 for +7 ±0.5 volts dc on the vtvm.
e. Connect an ac vtvm to test point L16, and adjust T4 for a maximum reading.

6-207. Adjust rf turret coils as follows:
a. Install module extender between chassis and rf translator module A12.
b. Set the C-3940/ARC-94 mode selector to AM, and adjust frequency until dial indicates 2 mc.
c. Remove coaxial jumper from jack J34.
d. Connect signal generator through 6-db pad to jack J34, and adjust signal generator for 500-kc output.
e. Connect vtvm to driver plate load.
f. Key the RT-648/ARC-94, and adjust signal generator to give an rf output of 30 volts. Loosely couple the 51J receiver antenna to driver tubes, V6 and V7, to monitor the rf translator output. Use the 51J "S" meter indication to determine that rf coils are being peaked at the correct frequency in the following steps.

CAUTION

Do not allow rf output voltage to exceed 40 volts in the following steps. If necessary, decrease signal generator output level to keep rf output voltage below 40 volts.

g. Adjust all DRIVER PLATE turret coils for maximum rf output. Rotate coils one position at a time by changing C-3940/ARC-94 frequency in 1-mc steps.
h. Adjust RF AMP PLATE coils for maximum rf output.
i. Adjust RF AMP GRID coils for maximum rf output.
j. Adjust MIXER PLATE coils for maximum rf output.

NOTE

If the preceding steps failed to restore the module to normal operation, perform procedures outlined in steps k through u.

k. Remove the cover over the turrets.
l. Set the C-3940/ARC-94 mode selector to AM, 29.900 mc.
m. Key the RT-648/ARC-94, and adjust trimmers C103, C65, and C27 (location shown on turret cover) for maximum rf output.
n. Tune to 29.000 mc. Adjust turret coils L74B, L56B, L36B, and L22B for maximum output.
o. Repeat steps m and n as necessary.
p. Tune to 2.000 mc. Adjust turret coils L43A, L23A, and L9A for maximum output.
q. Set the C-3940/ARC-94 to AM, 2.900 mc.
r. Key the RT-468/ARC-94, and adjust trimmer coils L42, L38, and L7 for maximum output.
s. Repeat steps p through r.
t. Replace the turret cover.
u. Repeat steps f through j.

NOTE

If the preceding steps failed to restore the module to normal operation, perform procedures outlined in steps v through aa.

v. Remove bottom cover from module.
w. Position the module to 2.500 mc and determine that both racks are equal height above the chassis. If not, loosen clamp on slug rack gear, and carefully position racks to equal height above the chassis. Tighten clamp on slug rack gear.
x. Position the module to 2.000 mc.
y. Adjust the cores on the slug rack until insertion as measured from the bottom of the forms is as follows: C139, 1/8-inch insertion; L59, 11/32-inch insertion; and L40, L37, L6, 1/4-inch insertion.
z. Replace the bottom cover on the module.
aa. Repeat steps k through u.

6-208. Adjust variable frequency if. as follows:

NOTE

Perform this adjustment only if the previous adjustments failed to restore the module to proper operation.

a. Set C-3940/ARC-94 mode selector to AM, and adjust frequency selectors until dial indicates 8.999 mc.
b. Remove bottom cover from module, and install module extender between chassis and rf translator module A12.
c. Remove coaxial jumper from jack J34 on the module extender.
d. Remove coaxial block on module extender marked jacks J30 and J31, and insert driver load in place of block. Be sure that load is properly connected. Refer to table LXI, transmit gain check.
e. Connect signal generator to jack J34 on module extender. Ground pin 1 of rf amplifier V4 or V5.

NOTE

When using HP-606A, connect 6-db pad between jack J34 and signal generator output.

f. Connect vtvm to test point L13.
g. Set signal generator to 500-kc output. Disable the hf oscillator by pulling tube V11.
h. Key RT-648/ARC-94 by operating KEY switch on 678P-1. Increase signal generator output level until vtvm indicates 0.5 volt.

NOTE

A signal generator output level of from 10,000 uv to 30,000 uv should be required.

i. Adjust coils L2, L3, and L4 (location shown on top cover) for maximum output as indicated on ac vtvm. Vary signal generator output as each coil is adjusted to maintain a constant output. Adjust core of L130 (located near V2) for maximum output. Two peaks may be obtained; tune to peak with greatest output. On rf translators with MCN below 1508, capacitor C273, located on bottom in V1 compartment, replaces L130. On these units adjust C273 for maximum output.
j. Set frequency at C-3940/ARC-94 at 8.000 mc.
k. Adjust trimmer capacitors C7, C10, and C13 (shown on top cover) for maximum output
l. Repeat procedures outlined in steps g through k until coils track from 8.000 mc to 8.999 mc.
m. Set frequency at C-3940/ARC-94 to 8.000 mc and note indication on ac vtvm.
n. Change frequency in approximately 100-kc steps from 8.000 mc to 8.999 mc, and note the indication on the vtvm at each setting. The output shall not vary by more than 6 db, or a 2-to-1 change.
o. Replace tube V11.
p. Remove ground from pin 1 of rf amplifier V4 or V5.

6-209. Adjust 15-mc band-pass filter as follows:

NOTE

Perform this adjustment only if the previous adjustments fail to restore the module to proper operation between 2.000 and 6.999 mc.

a. Set C-3940/ARC-94 mode selector to AM and adjust frequency selectors until dial indicates 6.5 mc.
b. Install module extender between the chassis and rf translator module A12.
c. Connect signal generator to jack J34 on module extender and adjust output to 500 kc.

NOTE

When using HP-606A, connect 6-db pad between J34 and signal generator output.

d. Connect ac probe of vtvm to test point L13 through test probe No. 2. Key the RT-648/ARC-94 and increase signal generator output level until approximately 0.2 volt is indicated on vtvm.

NOTE

The 17.5-mc oscillator should be operating properly and locked at this point.

e. First adjust coil L123, then coil L128 (these are two bottom coils located on end of module) for maximum output as indicated on vtvm.
f. Set frequency at C-3940/ARC-94 to 6.000 mc, and observe indication on vtvm.
g. Set C-3940/ARC-94 frequency to 6.999 mc, and observe indication on vtvm. Output should not change more than 6 db, a 2-to-1 change from 6.000 to 6.999 mc.

NOTE

If procedures outlined in steps e, f, and g do not correct the difficulty, perform procedures outlined in steps h through t.

h. Remove bottom cover from module.
i. Set frequency at C-3940/ARC-94 to 6.500 mc. Set signal generator to 15.000 mc.
j. Short grid of 17.5-mc oscillator (pin 1 of V10) to ground.
k. Connect signal generator to grid of 17.5-mc mixer V2, pin 2.

NOTE

When using HP-606A, connect 6-db pad in series with signal generator output.

l. Connect vtvm to plate of V2, pin 1 or 6.

NOTE

Test points mentioned in following steps are located on plate holding bandpass filter. Refer to side cover for filter location.

m. Short test point no. 1 to ground, and adjust variable inductor L123 for maximum output as indicated on vtvm. Increase signal generator output level until vtvm indicates 0.5 volt ac.
n. Remove ground from test point no. 1, and ground test point no. 2.
o. Adjust coil L125 for a dip on vtvm.
p. Remove ground from test point no. 2, and ground test point no. 3.
q. Adjust variable inductor L126 for maximum output on vtvm.
r. Remove ground from test point no. 3, and ground test point no. 4.
s. Adjust variable inductor L127 for a dip on the vtvm.
t. Remove ground from test point no. 4, and adjust coil L128 for maximum output on vtvm.

6-210. If driver tubes A12V6 and A12V7 are replaced, driver and amplifier neutralization must be performed. Replace the tubes and tube shields.

NOTE

Rf circuits must be aligned before neutralizing. DRIVER PLATE, RF AMP PLATE, and RF AMP GRID must be tuned for maximum output before proceeding with neutralization.

a. Apply power, and select AM mode and 29.500 mc. Key the RT-648/ARC-94 to allow the power amplifier to tune. Unkey. Set mode switch on C-3940/ARC-94 to OFF.
b. Connect rf vtvm to test point L (driver grid).
c. Uncover the power amplifier module, and remove the small plate supporting the power amplifier screen grid test point. A11V1 tube socket and tube grid terminal (at 100-ohm resistor A11R18). Attach a 0.01-uf capacitor to this terminal, and attach the signal generator output to the other end of the capacitor.
d. Tune the signal generator to 29.500 mc, and adjust output level to obtain a reading on the rf vtvm at test point L with feedback switch A12S15 tuned off (counterclockwise).
e. Adjust A12C128 for minimum voltage at test point L.
f. Disconnect the signal generator, and remove the 0.01-uf capacitor from A11R18. Replace the small plate and the cover. Tighten the cover securely on power amplifier A11.
g. Connect the ac probe of the vtvm to the adapter at RT-648/ARC-94 ANT. test point 51.

NOTE

The basic test setup is still used, The 50-ohm dummy load in the 678P-1 is connected to the ANT. output circuit.

h. Override the tgc using the 678Z-1 as follows:
(1) Connect J2-FREQ DIVIDER on the 678Z-1 to frequency divider A1 test point A10 (see figure 6-27A).
(2) Connect J2-IF TRANS on the 678Z-1 to if. translator A3 test point J2 (figure 6-27A). Connect GRND jack on the 678Z-1 to chassis.
(3) Set TGC & CAPTURE RANGE control on 678Z-1 to maximum counterclockwise position. Set mode switch on C-3940/ARC-94 to AM.

CAUTION

Do not inject any signal into the RT-648/ARC-94 as it will be damaged if more than 100 watts AM or 400 watts PEP (SSB) are produced with tgc over-ridden.

(4) Key the RT-648/ARC-94, and adjust TGC & CAPTURE RANGE control for approximately 50 volts rms at ANT. test point 2. Do not exceed 90 volts rms.
i. After overriding tgc, continue to key and adjust A12C141 for power amplifier neutralization while moving roller coil gear A11G4 with the fingers. Capacitor A12C141 is correctly adjusted when equal rf output is obtained on both sides (symmetrical) of the tuned position of the roller coil.
j. Adjust feedback neutralization. Turn switch A12S15 back on. Readjust TGC & CAPTURE RANGE control on the 678Z-1, if necessary, to maintain approximately 50 volts rms at ANT. test point 51 while keying.
k. Adjust A12C127 for the same symmetrical indication obtained in step i above.
l. Disconnect 678Z-1 test leads for modules. The effectiveness of the above procedure depends upon how well A12C128 is adjusted for minimum voltage at rf driver grid test point L. Repeat the procedure if necessary to assure this.
m. Recheck for 72-volt rms (nominal) rf output according to paragraph 6-182c.

6-211. During this procedure, the DRIVER PLATE, RF AMP PLATE, RF AMP GRID, and MIXER PLATE turret coils must be kept adjusted for a maximum indication on the vtvm. These turret coils are found

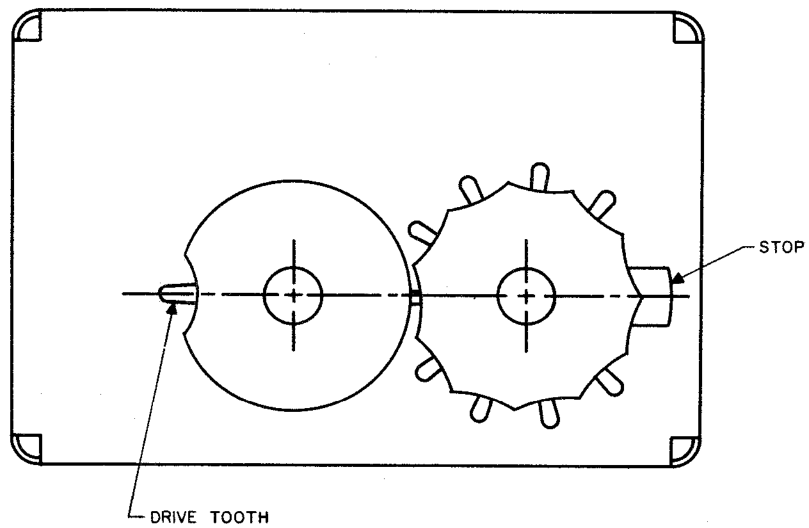


Figure 6-30A. VFO in 500-Kc Position

silkscreened on the turret cover after the top cover of the module is removed.

6-212. Deleted.

6-213. To adjust tracking of the variable frequency oscillator, proceed as follows:

a. Determine allowable tracking limits for variable frequency oscillator under test at various operating frequencies using procedure given in steps a through g.

b. Refer to graph, frequency data chart, and sample variable frequency oscillator offset markings shown in figure 6-31. Offset markings are stamped on the vfo case for frequency extremes (3.500 mc and 2.501 mc). Obtain these markings from the vfo case and plot them on a graph with coordinates similar to figure 6-31. Draw a straight line between two points just plotted.

c. At 3.500-mc end (left) of graph, plot two points 300 cps above and below end of line.

d. At 2.501-mc end (right) of graph, plot two points 300 cps above and below end of line.

e. At 2.400 mc, plot two points 1200 cps above and below line.

f. At 2.600 mc, plot two points 1200 cps above and below line.

g. Connect four points above and below line as shown in sample graph. Shaded area enclosed by connecting lines defines allowable tracking limits for variable frequency oscillator being adjusted (when it is unlocked from frequency-stabilizing circuits).

h. Calibrate 678Z-1 (see paragraph 2-16). Connect 678Z-1 to the RT-648/ARC-94 as stated in table XII for each position of the FUNCTION SELECTOR switch.

i. Apply power to RT-648/ARC-94. Set FUNCTION SELECTOR switch on 678Z-1 to OFF-SET ADJUST.

j. With test point D3 shorted to ground, adjust OFF-SET ADJUST control R2 on the 678Z-1 for a null with the X10 METER SENSITIVITY switch depressed.

k. Set FUNCTION SELECTOR switch in 678Z-1 to 70K-5 VFO BIAS position. With test point D3 shorted to ground, adjust R62 (VFO BIAS ADJUST) in kilocycle-frequency stabilizer module for an exact null with X10 METER SENSITIVITY switch depressed.

l. Set C-3940/ARC-95 mode selector to AM, and adjust frequency selectors until dial indicates 9.000 mc. Set FUNCTION SELECTOR switch on 678Z-1 to 10KC CONTROL BIAS (+20V). With test point D3 shorted to ground, adjust R63 (10KC CONT BIAS ADJUST) on kilocyle-frequency stabilizer module A4 for an exact null on the meter with the X10 METER SENSITIVITY switch depressed.

m. Connect frequency counter to test point L15 (variable frequency oscillator output) on r-f translator module A12, through probe No. 2 supplied in Maintenance Kit 678Y-1.

n. Set C-3940/ARC-94 mode selector to AM, 9.999 mc. With test point D3 grounded, counter should indicate frequency of 2,501,000 cps ±2.5-mc offset (cps) ±300 cps. If it does not, loosen coupler on vfo shaft by loosening two setscrews on coupler. Manually position this shaft until counter indicates 2,501,000 cps ±2.5-mc offset ±100 cps. Tighten shaft couplers on both Autopositioner and variable frequency oscillator.

o. Set the C-3940/ARC-94 to 9.000 mc. Counter should indicate 3,500,000 cps ±3.5-mc offset (cps) ±300 cps. If it does not, adjust L2 in variable frequency oscillator to a frequency of 3,500,000 cps ±3.5 mc offset (cps) ±100 cps.

p. Repeat steps n and o until proper indications are obtained.

q. Check variable frequency oscillator tracking by setting C-3940/ARC-94 to each of the frequencies given in frequency data chart of figure 6-31, and measuring the variable frequency oscillator frequency with test point D3 grounded. Recycle with the 100-kc control in each position to cause the Autopositioner to approach from the opposite direction and measure vfo frequency. Refer to graph which was plotted earlier to obtain tracking limits. Record frequency data in UNLOCKED column on frequency data chart, figure 6-31.

r. Remove short from test point D3 in kilocycle-frequency stabilizer module A4.

6-214. Mechanical adjustments for r-f translator module A12 include the Autopositioner alignment and check, the turret alignment, and the slug rack alignment procedures.

6-215. Align and check the mechanical component of the Autopositioner subassembly by performing the following procedure (see figure 6-32).

a. Set mode selector on C-3940/ARC-94 to OFF. Fasten Autopositioner submodule to r-f translator module A12 extender using special attachment supplied with Maintenance Kit 678Y-1 for the RT-648/ARC-94.

b. Check to see that actuating leaf or reversing switch is visible in both operating positions through hole in switch mounting bracket.

c. Check that gap between contacts 3 and 4 on solenoid relay (with pawl in notch) is at least 0.015 inch (figure 6-32 (B)).

d. Check that contacts 3 and 4 on solenoid relay are closed when pawl engages notched wheel by at least 0.005 inch.

e. Check that gap between contacts 5 and 6 on solenoid relay (with back of pawl against solenoid housing) is at least 0.015 inch.

f. Rotate 1-kc cam by hand until hole in cam is adjacent to cam follower. Set frequency to x.000 mc, any megacycle band. MOMENTARILY switch mode selector on C-3940/ARC-94 to USB, then back to OFF. While doing this, observe direction of rotation of camshaft from gear-plate side. When viewed from this side, shaft must rotate counterclockwise.

CAUTION

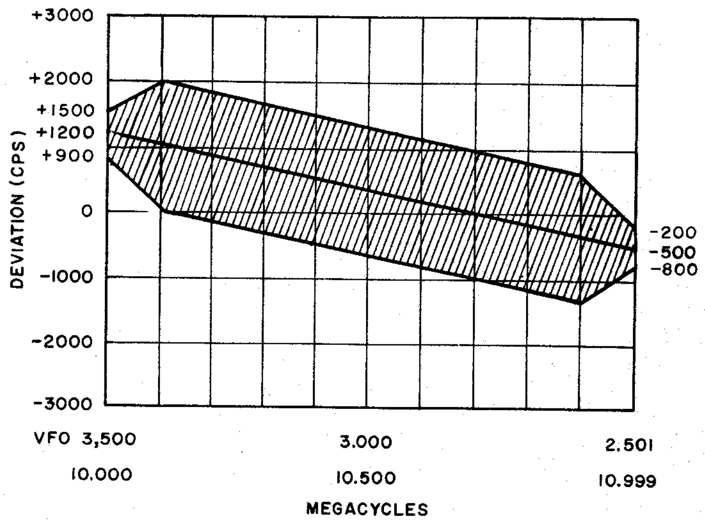
Cam will be damaged if it rotates clockwise.

g. Push actuating leaf of reversing switch toward cam. MOMENTARILY turn mode selector to USB and

(A) Sample VFO Offset Markings

CALIBRATION SETUP POINTS
-500 at 2.5 mc
+1200 at 3.5 mc

(B) Sample Graph



(C) Frequency Data Chart

OPERATING FREQUENCY (mc)	NOMINAL VFO FREQUENCY (mc)	UNLOCKED	
		VFO FREQUENCY	LIMIT (from graph)
10.000	3.500		
10.111	3.389		
10.222	3.278		
10.333	3.167		
10.444	3.056		
10.555	2.945		
10.666	2.834		
10.777	2.723		
10.888	2.612		
10.999	2.501		

Figure 6-31. Variable Frequency Oscillator, Sample Data for Tracking Adjustment

back to OFF. The clutch gear should then rotate clockwise as viewed from gear-plate side. With leaf in opposite position, clutch gear rotation should be in opposite direction. If directions of rotation are improper, rewire reversing switch as shown in figure 6-32(A).

h. Attach calibrated disc and pointer supplied in Maintenance Kit 678Y-1 to Autopositioner output shaft. Check that disc rotates one position for each 1-kc change in frequency, 10 positions for each 10-kc change, and one revolution for each 100-kc change.

6-216. Align r-f translator module A12 turret by performing the following procedure (see figure 6-33).

a. With frequency selector positioned to 2.000 mc, adjust turret drive shaft so that 2-mc turret contacts (identified by color coding) are centered on fixed contacts. Tighten clamp screw.

b. Adjust band-switch shaft until clip is positioned as shown in figure 6-33. Tighten clamp screw.

6-217. Align r-f translator module A12 slug rack by performing the following procedure:

a. Set C-3940/ARC-94 to 2.500 mc.

b. Observe whether both slug racks are at equal heights above the chassis. If they are not, follow procedure outlined in paragraph 6-207, steps v through aa.

6-218. PREPARATION FOR USE.

6-219. Install the repaired and aligned r-f translator module into Radio Receiver-Transmitter RT-648/ARC-94 and connect to the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test, disconnect all test equipment, and replace the component covers. The RT-648/ARC-94 is ready for use.

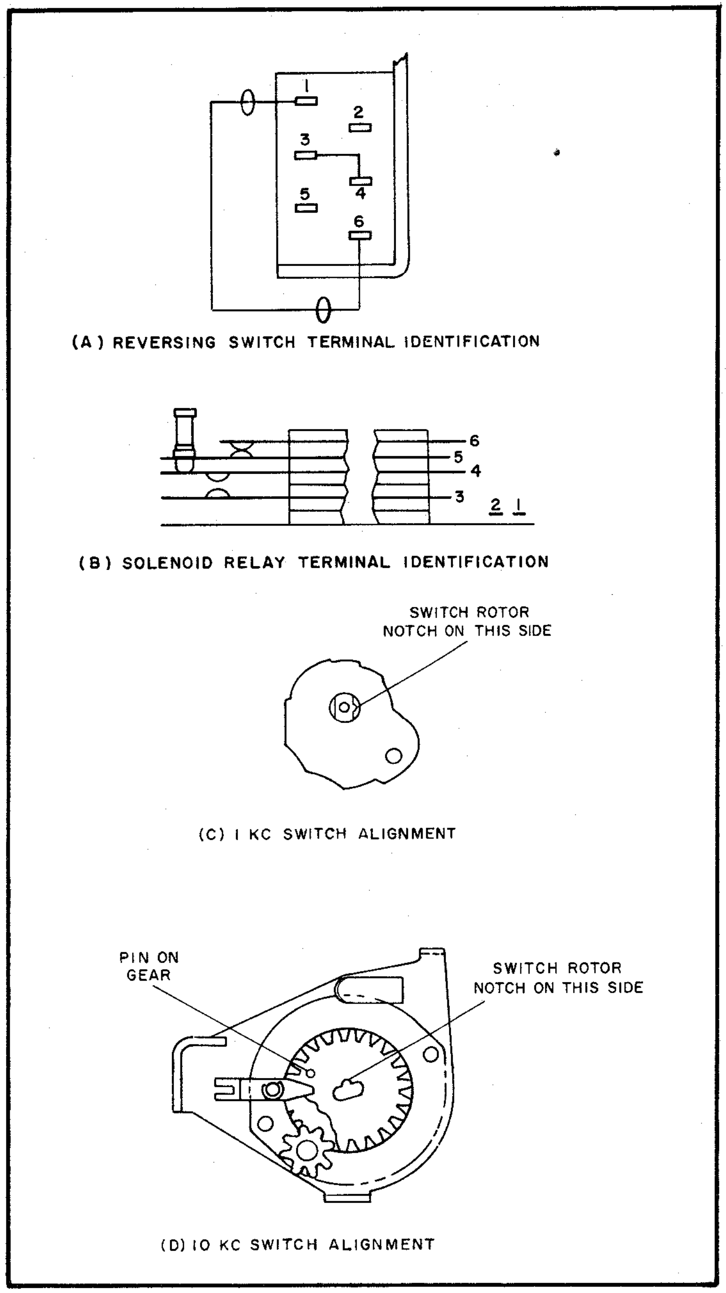


Figure 6-32. Autopositioner, Mechanical Adjustment, Alignment, and Checks

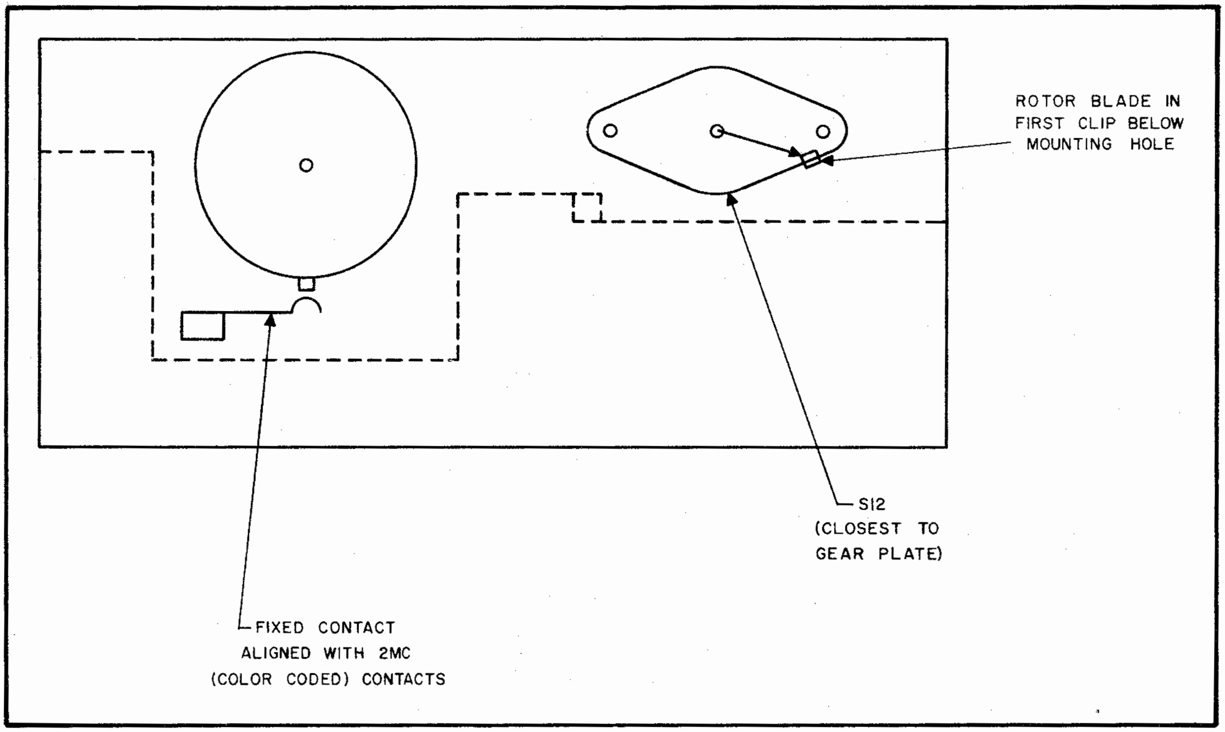


Figure 6-33. R-F Translator Module A12, Turret Alignment

TABLE LXV. R-F TRANSLATOR MODULE A12, SAMPLE DATA SHEET

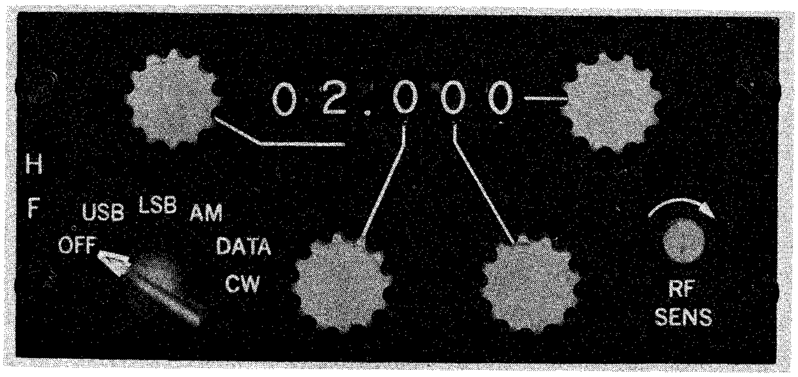
CHART
TRANSMIT GAIN CHECK

FREQUENCY (mc)	INPUT (uv)	FREQUENCY (mc)	INPUT (uv)
3.000		3.999	
4.000		4.999	
5.000		5.999	
6.000		6.999	
7.000		7.999	
8.000		8.999	
9.000		9.999	
10.000		10.999	
11.000		11.999	
12.000		12.999	
13.000		13.999	
14.000		14.999	
15.000		15.999	
16.000		16.999	
17.000		17.999	
18.000		18.999	
19.000		19.999	
20.000		20.999	
21.000		21.999	
22.000		22.999	
23.000		23.999	
24.000		24.999	
25.000		25.999	
26.000		26.999	
27.000		27.999	
28.000		28.999	
29.000		29.999	

TABLE LXV. R-F TRANSLATOR MODULE A12, SAMPLE DATA SHEET (Cont)

PAR.	STEP	FUNCTION	TEST POINT	QUANTITY BEING MEASURED	714E-( ) SETTING	TRANS-MITTER KEYED (X)	DATA	LIMITS
5-32		Receiver gain sensitivity						Check.
5-33		Agc characteristic						Check.
Part of Minimum Performance Standards		Test point check	J5	Vfo output voltage	Any			0.8 to 2.0 volts ac.
			J7	H-f oscillator output voltage	Any			0.8 to 2.0 volts ac.
			J1	17.5-mc oscillator output voltage	2.000-6.999 mc 7.000-29.999 mc			0.9 to 2.0 volts ac (2.000 to 6.999 mc). 0 volt (7.000 to 29.000 mc).
Part of Minimum Performance Standards		Transmit test point check	J5 J7 J1	Same as test point check.	Am, 2.100	X		Same as test point check.
			J2	H-f mixer grid voltage	Am, 2.100	X		0.05 to 0.35 volt ac.
			J3	R-f amplifier grid voltage	Am, 2.100	X		0.05 to 0.2 volt ac.
			J4	Driver grid voltage	AM, 2.100	X		2.0 to 4.5 volts ac.
Part of Minimum Performance Standards		Transmit gain check	Driver plate load	Signal generator output voltage (40-volt r-f driver output)	AM, 2.000	X		Not more than 5000 uv.
			Same	Same	AM, 2.999	X		Not more than 5000 uv. Not more than 4-to-1 variation from 2.000-mc setting.
			Same	Same	AM See chart.	X	See chart.	Not more than 5000 uv. Not more than 4-to-1 variation on any band.
Part of Minimum Performance Standards		Transmit spurious	Driver plate load	R-f driver output voltage	AM, 25.999	X		Not more than 1.0 volt ac.
			Same	Same	AM, 23.999	X		Not more than 1.0 volt ac.
			Same	Same	AM, 21.999	X		Not more than 1.0 volt ac.
6-211	i	Feedback neutralization						Check.
6-213	a	Vfo tracking						Check.
6-214		Band-switch alignment						Check.

RADIO SET CONTROL
C-3940/ARC-94
MAINTENANCE



RADIO SET CONTROL C-3940/ARC-94

	Paragraph Number
REMOVAL	6-222
PREPARATION FOR USE	6-224

Figure 6-34. Radio Set Control C-3940/ARC-94, Maintenance Marker

6-220. RADIO SET CONTROL C-3940/ARC-94.

6-221. Testing and trouble shooting of the C-3940/ARC-94 are performed with the C-3940/ARC-94 connected to the bench test setup (figure 5-2) to which an RT-648/ARC-94 is connected which is known to be in good operating condition. As the circuits of the C-3940/ARC-94 are relatively simple, no special performance tests are specified for testing the unit. Perform the system minimum performance tests to isolate troubles within the C-3940/ARC-94. When trouble is detected, utilize the schematic diagram (figure 7-15) and normal point-to-point trouble-shooting checks to find the trouble and repair the C-3940/ARC-94.

6-222. REMOVAL.

6-223. Access to the detail parts of the C-3940/ARC-94 is accomplished by turning the two Dzus fasteners, located on the rear of the C-3940/ARC-94, 1/4 turn counterclockwise. This loosens the cover for removal.

6-224. PREPARATION FOR USE.

6-225. Install the repaired Radio Set Control C-3940/ARC-94 into the bench test setup. Perform the system performance checks given in paragraph 5-27. If the results of these tests are satisfactory, remove the component from the bench test and disconnect all test equipment. The C-3940/ARC-94 is ready for use.

SECTION VII
DIAGRAMS

7-1. INTRODUCTION.

7-2. The following section includes schematic diagrams of the modules of RT-648/ARC-94 and a schematic diagram of Radio Set Control C-3940/ARC-94. Also included in this section is a wire code legend listing the wire code and type of wire used. The module schematic diagrams are arranged in module number order for ease of locating the desired schematic. The system interconnecting diagram is shown in figure 3-6.

7-3. INDEX OF DIAGRAMS.

7-4. WIRE CODE LEGEND.

EXAMPLES:

UNSHIELDED WIRE, MIL TYPE B #22 AWG, WHITE WITH RED AND GREEN TRACERS:

D	A	9	25	4-1/4
Type of Wire	Size of Wire	Color of Body	Color of Tracers	Length of Wire in Inches (Includes Stripping & Tinning)

SHIELDED WIRE (SINGLE), MIL TYPE C, #15 AWG, WHITE WITH RED AND GREEN TRACERS:

R	D	S	9	25	4-1/4
Type of Wire	Size of Wire	Shielded	Color of Body	Color of Tracers	Length of Wire in Inches (Includes Stripping & Tinning)

SHIELDED WIRE (MULTIPLE), MIL TYPE B, #22 AWG, WHITE, AND WHITE WITH RED TRACER:

D	A	S	(9)	(92)	4-1/4
Type of Wire	Size of Wire	Shielded	First Conductor	Second Conductor	Length of Wire in Inches (Includes Stripping & Tinning)

TYPE OF WIRE CODE	
LETTER	TYPE OF WIRE
A	Cotton braid over plastic (formerly AN-J-C-48)
B	Busbar, round tinned
C	MIL-W-16878 type B (#20 and larger, 600 volts)
D	Miniature wire, MIL-W-16878 type B (#22 and smaller)
E	
F	Extra flexible varnished cambric
G	
H	Kel-F (monochlorotrifluoroethylene)
J	
K	Neon sign cable (15,000 volts)
L	Silicone
M	
N	Single conductor stranded (not rubber covered)
P	Single conductor stranded (rubber covered)
Q	
R	MIL-W-16878 type C (1000 volts)
T	Teflon, MIL-W-16878 type E (600 volts)
V	MIL-W-16878 type D (3000 volts)
W	Teflon, MIL-W-16878 type EE (1000 volts)
X	
Y	
Z	Acetate yarn, telephone type

SIZE OF WIRE CODE	
LETTER	SIZE (AWG)
A	#22
B	#20
C	#18
D	#16
E	#14
F	#12
G	#10
H	#8
J	#6
K	#4
L	#2
M	#1
N	#0
P	#00
Q	#000
R	#0000
T	#28
V	#26
W	#24
X	#19
Y	#30
Z	

COLOR CODE	
NUMBER OR LETTER	COLOR
0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Gray (slate)
9	White
a	Clear
b	Tan
c	Pink
d	Maroon
d	Light green
e	Light blue

TABLE LXVI. FACTORY CHANGES TO TRANSCEIVER CHASSIS

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
2474	Deleted L4 (was from pin 1 of K5 to C1)
2474	Deleted L5 (was from pin 2 of K5 to C10)
2899	Deleted R17 (was from pin 7 of K8 to pin 1 of K8)
2899	Deleted parallel combination of C13, C14, and C15 (was from pin 4 of K8 to pin 1 of K8)
2899	Deleted CR6 (was from pin 5 of K10 to ground)
3025	Added S2
3514	Added C16, C17, C18, C19, C20, and C21
4613	Changed CR1 and CR2 from 1N39 to FD1009
5030	Added R26 and R27
6500	Added C25, C26, C27, and C28
6500	Added R30, R31, R32, R33, and R34
6500	Added CR7, CR8, CR9, and CR10
6500	Added L10
6500	Deleted R11 (was from R12 to E1)
6967	Added CR11
3293	Changed K8 from 18 volt delay relay to delay interlock relay
3293	Changed K10 from Delay interlock relay to 18 volt delay relay
3293	Added CR6
3293	Added R22, R23, R24, and R25
3293	Added C13
3293	Added Q1

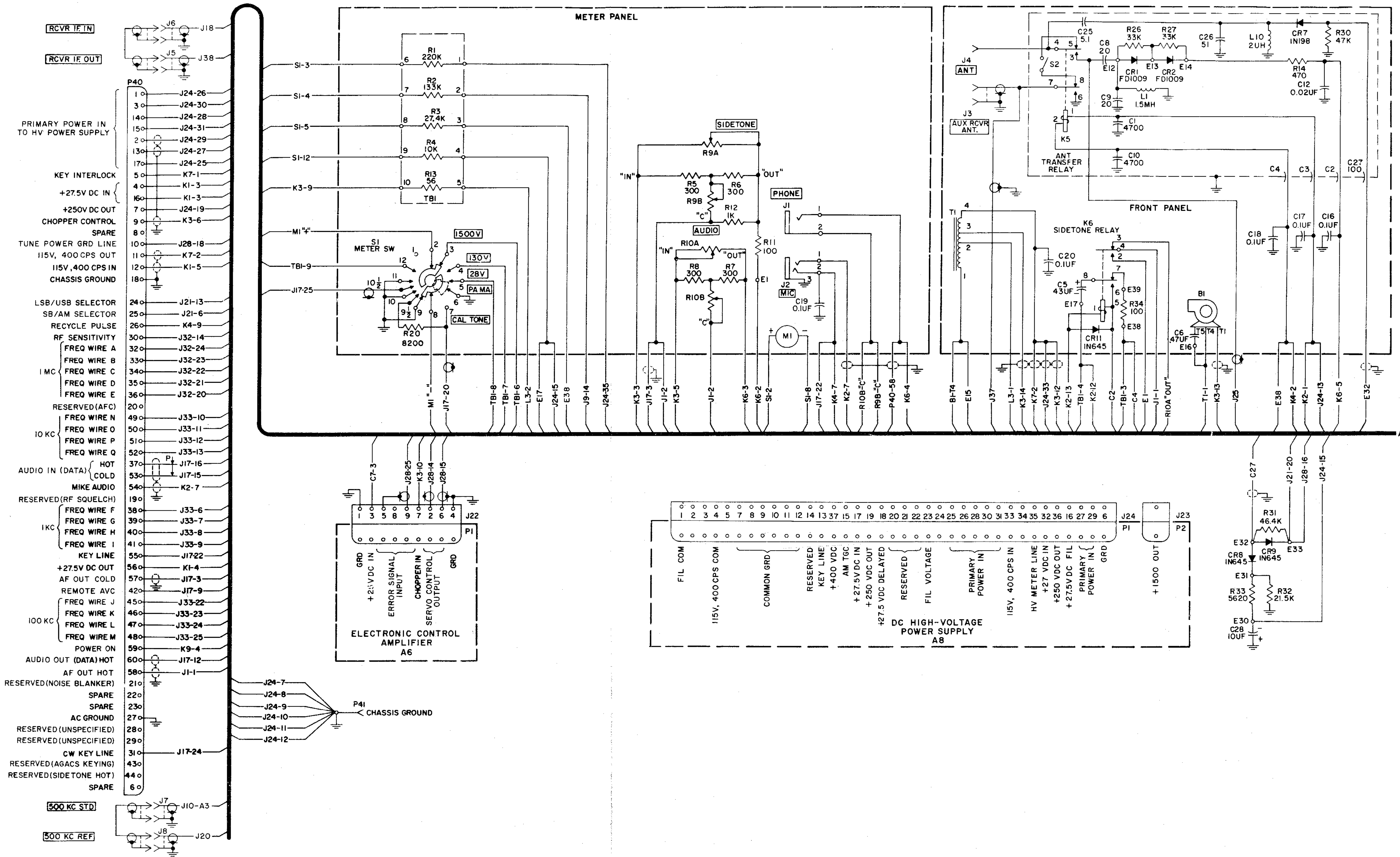


Figure 7-1. Radio Receiver-Transmitter RT-698/ARC-102 Chassis, Schematic Diagram (Sheet 1 of 3)

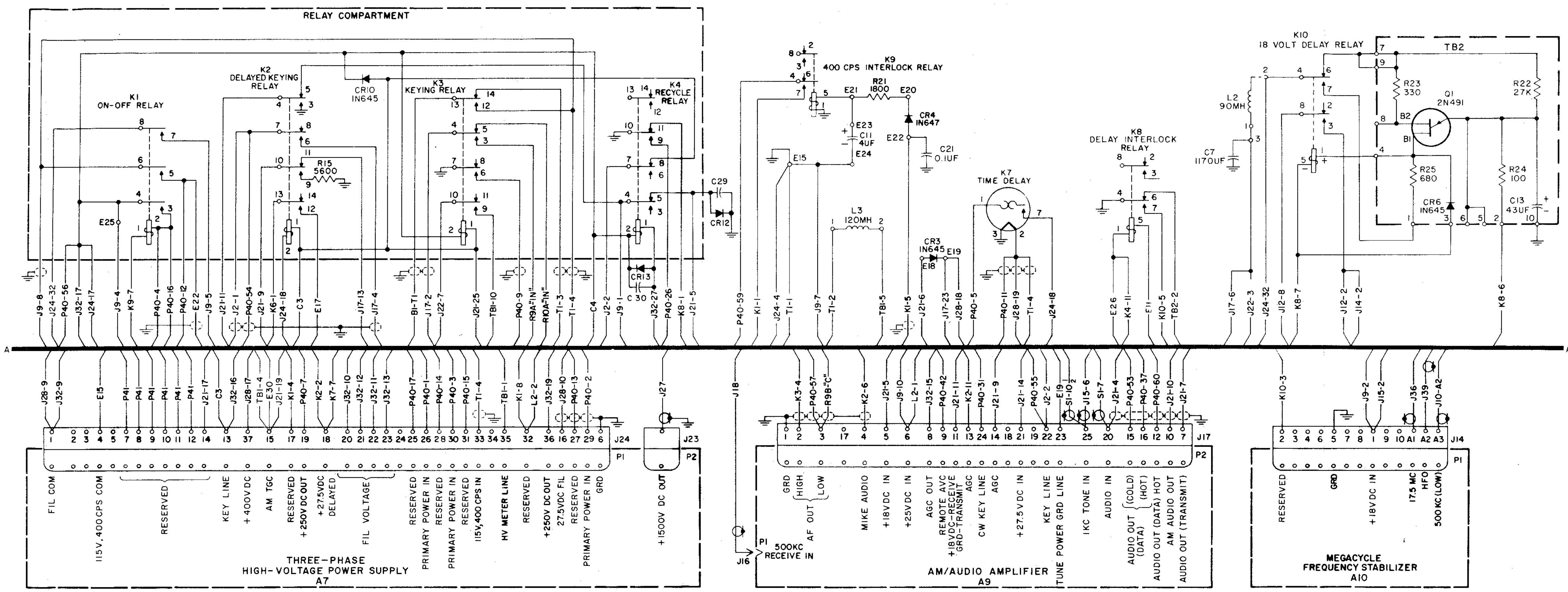


Figure 7-1. Radio Receiver-Transmitter RT-698/ARC-102 Chassis, Schematic Diagram (Sheet 2 of 3)

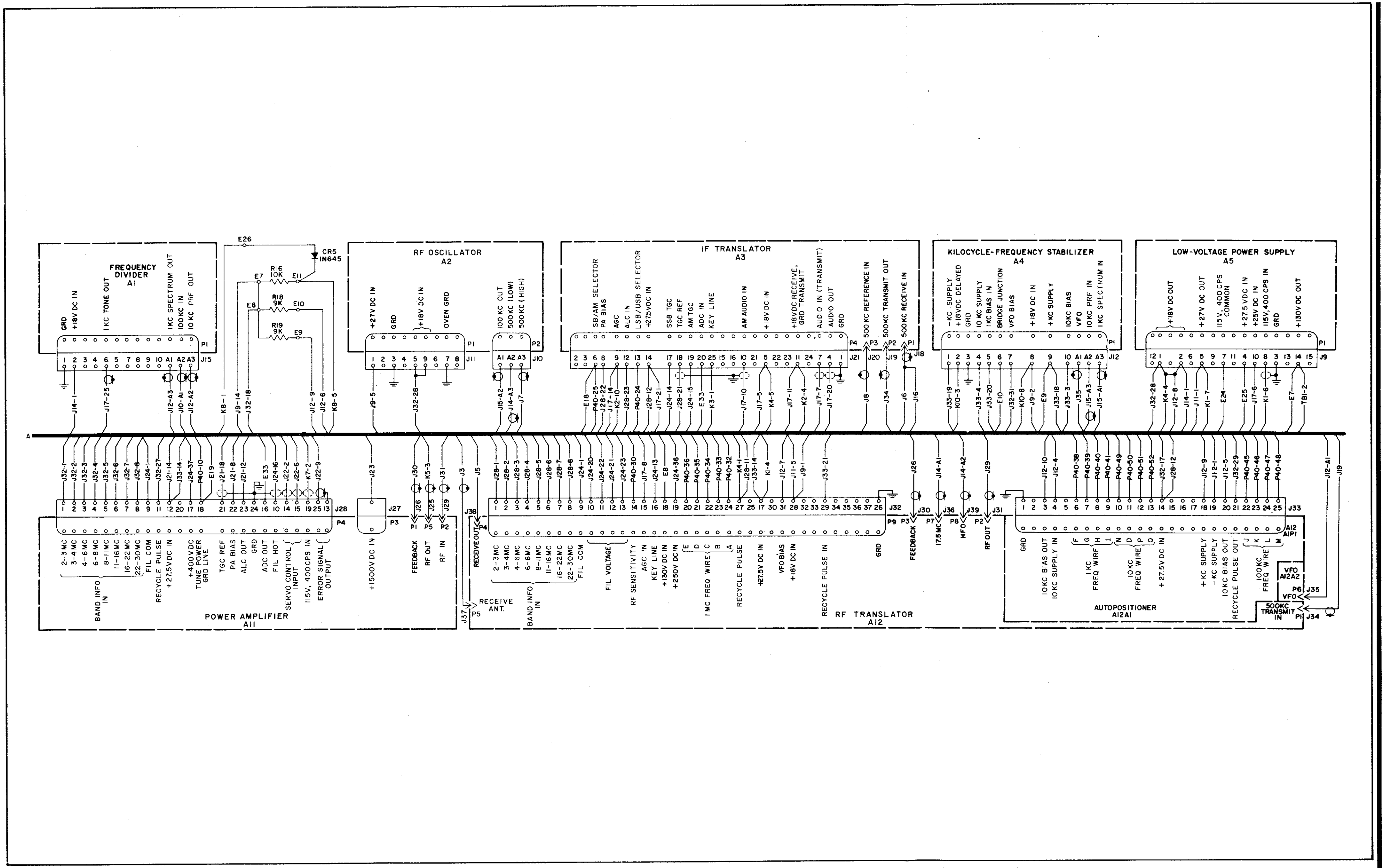


Figure 7-1. Radio Receiver-Transmitter RT-698/ARC-102 Chassis, Schematic Diagram (Sheet 3 of 3)

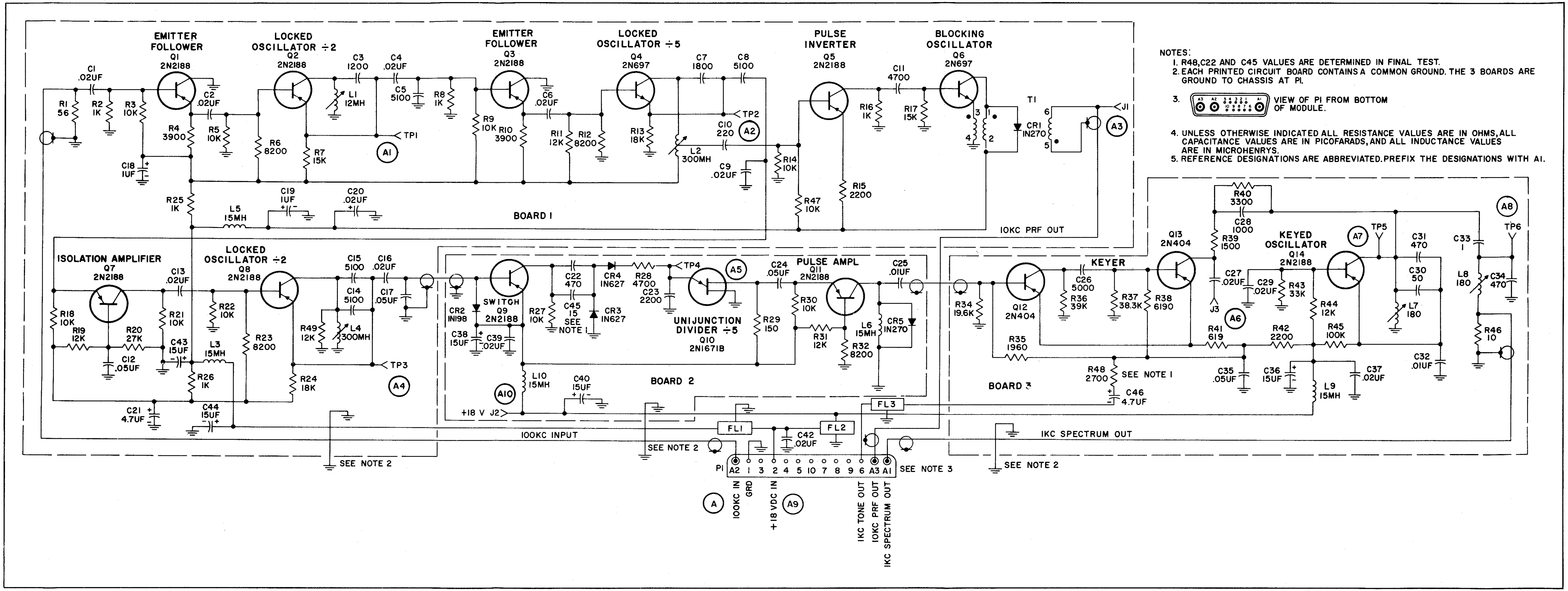


Figure 7-2. Frequency Divider Module A1, Schematic Diagram

TABLE LXVII. FACTORY CHANGES TO FREQUENCY DIVIDER MODULE A1

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
5000	Added R9
5000	Changed R34 from 17,600 ohms to 19,600 ohms
5775	Changed transistors Q1, Q2, Q3, Q5, Q7, Q8, Q9, Q11, and Q14 from 2N1285 to 2N2188
5775	Changed CR5 from 1N627 to 1N270
5775	Removed R33 and grounded CR5 and L6
9000	Changed Q10 from 2N491 to 2N1671B
-	Changed C7 from 2200 pf to 1800 pf

TABLE LXVIII. FACTORY CHANGES TO R-F OSCILLATOR MODULE A2

MANUFACTURING CONTROL (NUMBER (MCN)	CHANGE
101	Deleted C3 (was from Q9 to C35)
101	Changed capacitors C15, C16, and C26 from 5000 pf to 4700 pf
581	Changed L8 from 1 mh to 1.1 mh
650	Changed C33 from 2700 pf to 2500 pf
2775	Changed C26 from 4700 pf to 3300 pf
3050	Added C34
3050	Changed C32 from 0.02 uf to 0.01 uf
3050	Added C41
3050	Added R47
3050	Changed C21 from 0.01 uf to 4700 pf
3050	Changed C22 from 0.1 uf to 0.047 uf
3050	Changed R40 and R45 to selected values
3050	Changed C18 from 1000 pf to 2200 pf
3050	Changed R25 from 2700 ohms to 4700 ohms

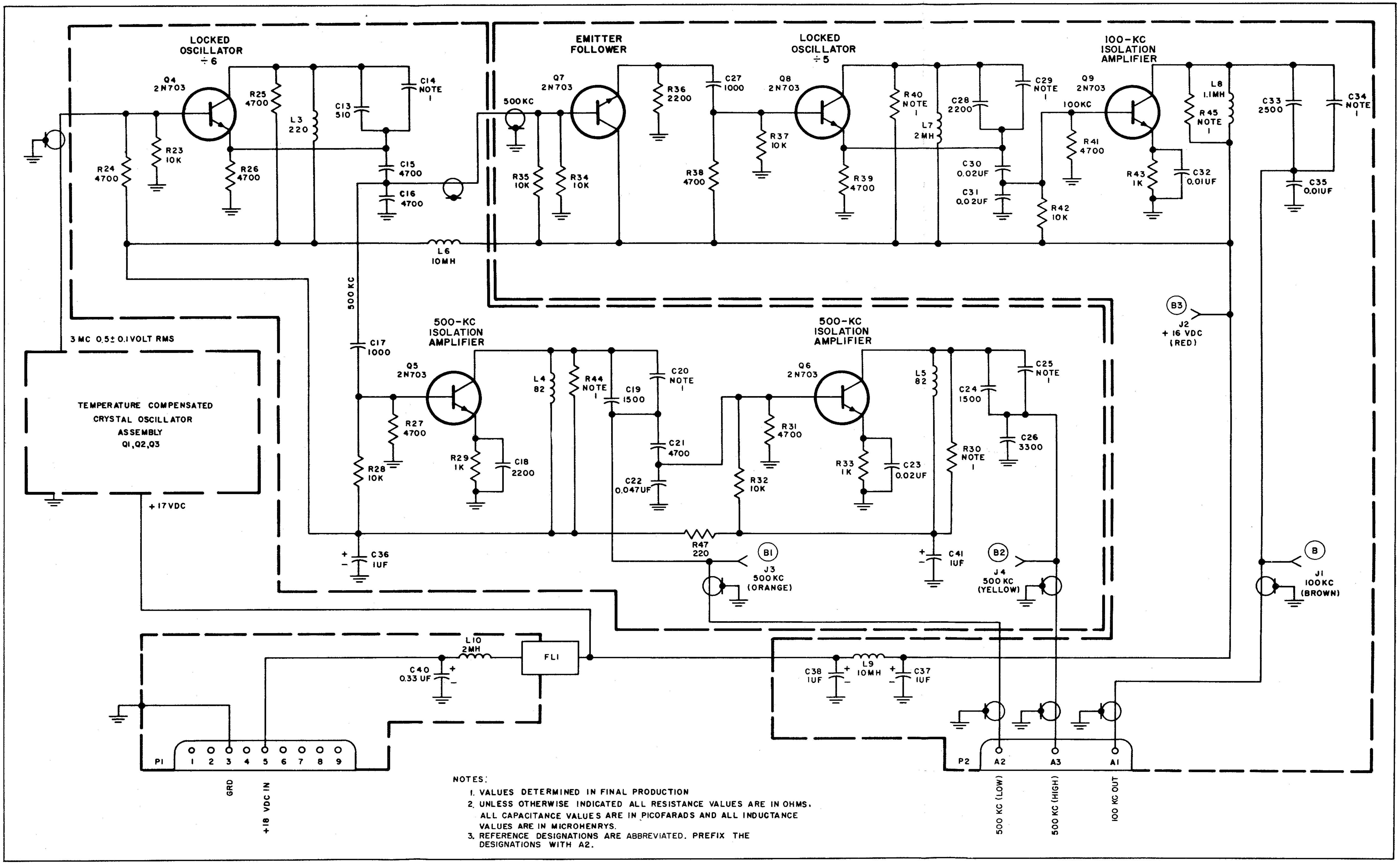


Figure 7-3. R-F Oscillator Module A2, Schematic Diagram

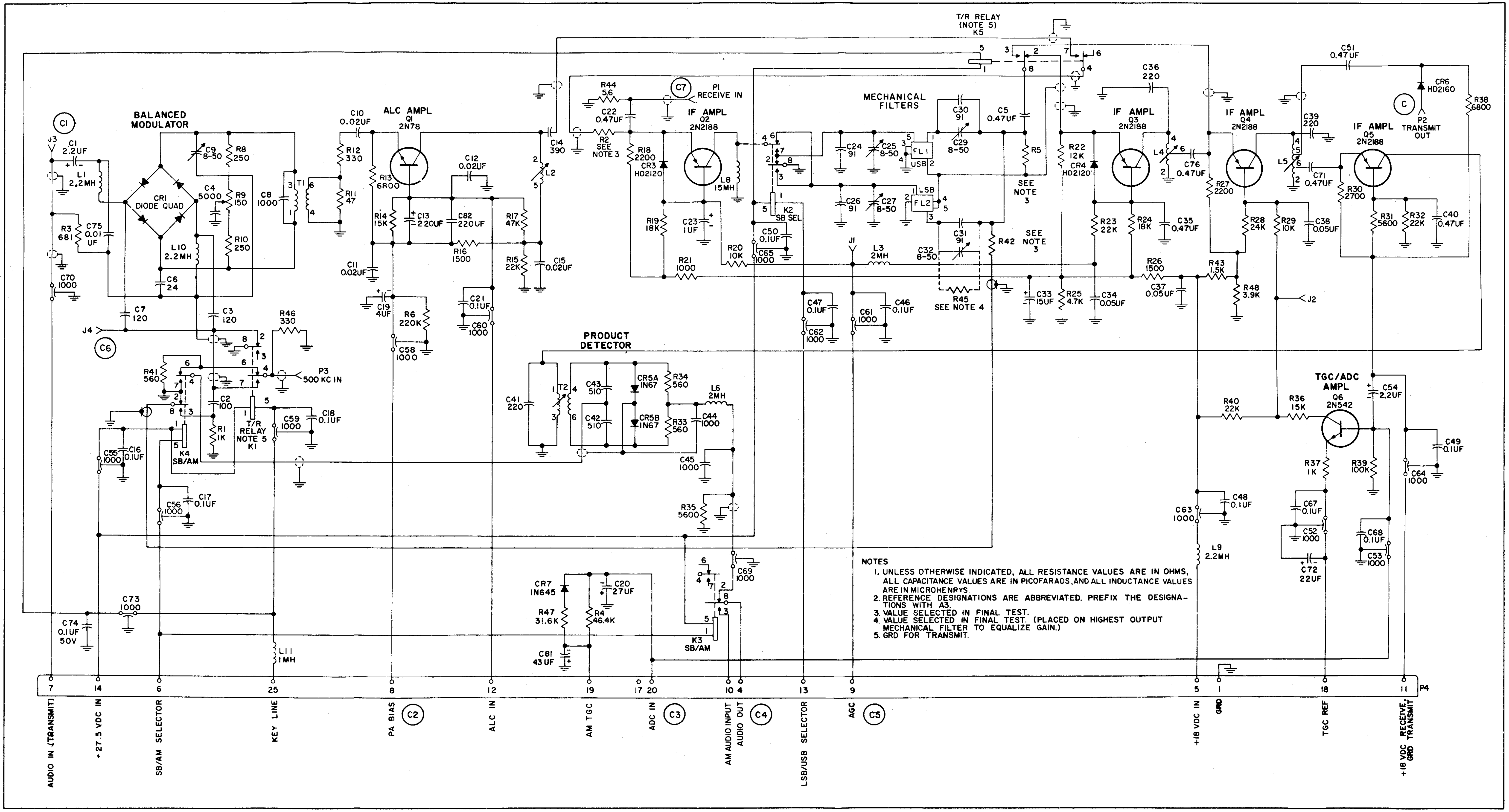


Figure 7-4. I-F Translator Module A3, Schematic Diagram

TABLE LXIX. FACTORY CHANGES TO I-F TRANSLATOR MODULE A3

MANUFACTURING CONTROL (NUMBER (MCN)	CHANGE
3084	Changed CR7 from HD2120 to 1N645
3300	Replaced C80 (1 uf) with C81 (43 uf)
3300	Deleted R48 (was from R4 to pin 19 of plug 4)
3350	Changed C20 from 6.8 uf to 15 uf
3750	Deleted parallel combination of C77, C78, C79, and R42 (was from C21 to ground)
3750	Added C77
3750	Replaced C77 (220 uf) with C82 (220 uf)
4200	Deleted L7 (was from C77 and C60)
4200	Changed C13 from 22 uf to 220 uf
5766	Changed L6 from 2 mh to 2.2 mh
6250	Changed Q2, Q3, Q4, and Q5 from 2N274 to 2N2188
6499	Changed C10, C11, C12, and C15 from 0.05 uf to 0.02 uf
7050	Changed R22 from 5600 ohms to 12,000 ohms
8835	Changed C20 from 15 uf to 27 uf

TABLE LXX. FACTORY CHANGES TO KILOCYCLE-FREQUENCY STABILIZER MODULE A4

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
1578	Changed Q10 from 2N1139 to 2N706
2000	Changed C49 from 1000 pf to 1500 pf
2000	Changed C17 from 510 pf to 270 pf
2000	Changed R13 from 12,000 ohms to 39,000 ohms
2000	Changed C15 from 200 pf to 180 pf
2000	Changed R9 from 33 ohms to 10 ohms
2000	Changed R8 from 47,000 ohms to 150,000 ohms
2000	Changed C1 from 18 pf to 10 pf
2000	Changed R41 from 47,000 ohms to 82,000 ohms
2000	Changed R44 from 1500 ohms to 820 ohms
2122	Changed R44 from 820 ohms to 1500 ohms
2122	Changed R41 from 82,000 ohms to 47,000 ohms
2122	Changed C49 from 1500 pf to 1000 pf
2122	Changed R8 from 150,000 ohms to 47,000 ohms
2122	Changed R9 from 10 ohms to 33 ohms
2122	Changed C1 from 10 pf to 18 pf
3100	Changed CR1 and CR11 from 1N926 to 1N3064
3100	Changed CR9 and CR10 from 1N926 to 1N3064
3650	Changed Q12 from 2N1285 to 2N1132
4000	Changed Q9 from 2N332 to 2N706
4000	Changed Q11 from 2N128 to 2N706
4000	Changed R44 from 1500 ohms to 2700 ohms
4000	Added C124 and C125
4000	Changed C43 from 270 pf to 56 pf
4000	Deleted CR16 (was from R43 to C30)
4000	Deleted RT1 (was in parallel with R43)
4000	Deleted R60 (was from R42 to ground)
4000	Changed R45 from 3900 ohms to 2700 ohms
4000	Changed R42 from 2700 ohms to 10,000 ohms
4000	Changed R41 from 47,000 ohms to 56,000 ohms
4000	Changed C45 from selected value to 5N1800
4000	Changed C53 from 1200 pf to 470 pf
5349	Changed C36 from 680 pf to 220 pf
6000	Changed Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q14, Q15, Q16, Q17, Q18, and Q19 from 2N1285 to 2N2188
6000	Changed C17 from 270 pf to 150 pf
6000	Changed R7 from 150,000 ohms to 180,000 ohms
6000	Changed R10 from 150,000 ohms to 180,000 ohms
6000	Changed R21 from 240 ohms to 2200 ohms
6000	Changed R22 from 4700 ohms to 2700 ohms
6000	Changed R72 from 150,000 ohms to 120,000 ohms
6000	Added CR17
6000	Changed C43 from 56 pf to 82 pf
6000	Changed R44 from 390 ohms to 560 ohms
6000	Changed C124 to C126 and C125 to C127

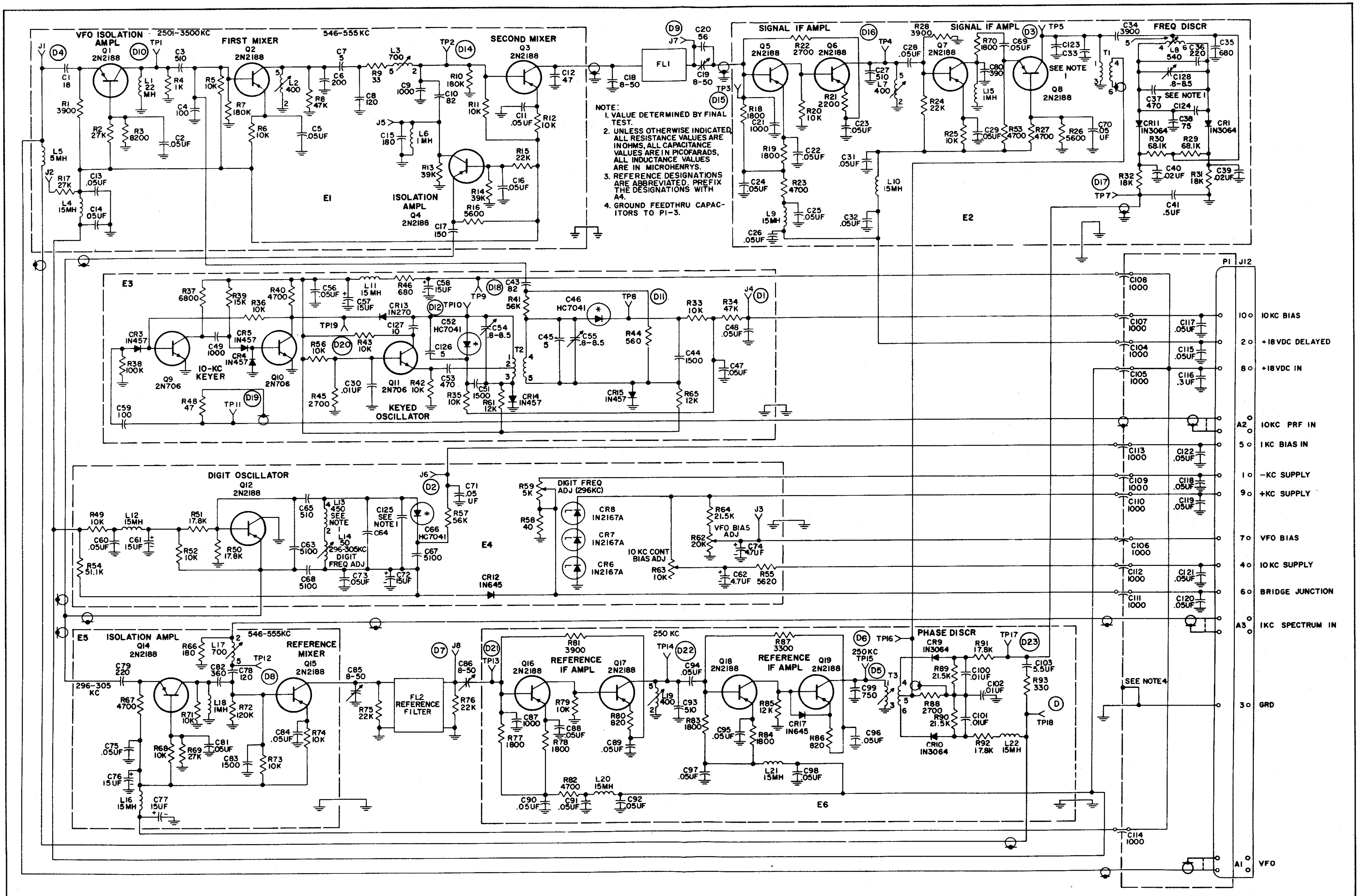
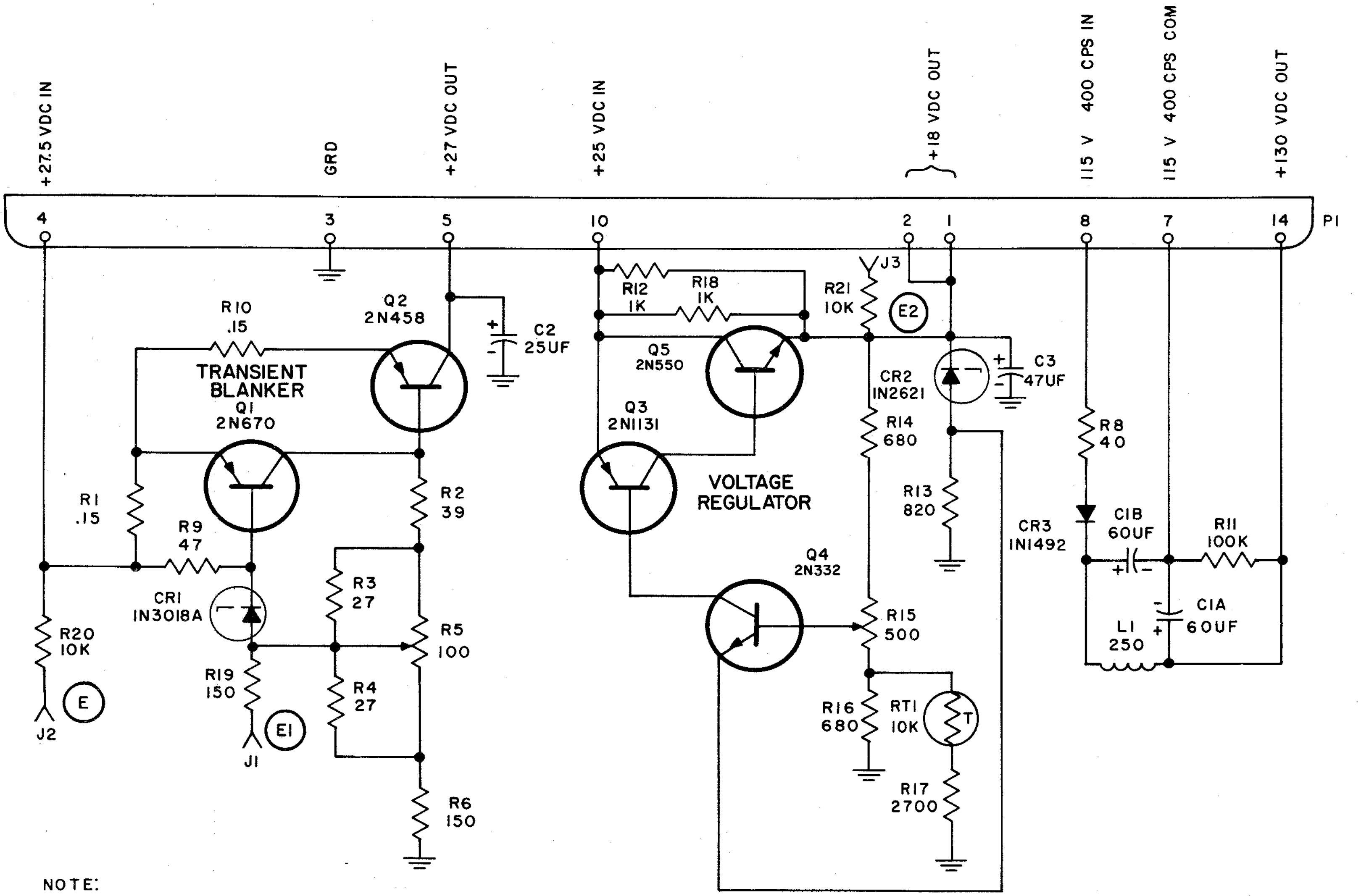


Figure 7-5. Kilocycle-Frequency Stabilizer Module A4, Schematic Diagram



NOTE:
1. UNLESS OTHERWISE INDICATED; ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS AND ALL INDUCTANCE VALUES ARE IN MILLIHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH A5.

Figure 7-6. Low-Voltage Power Supply Module A5, Schematic Diagram

Revised 15 July 1964

TABLE LXXI. FACTORY CHANGES TO ELECTRONIC CONTROL AMPLIFIER MODULE A6

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
4000	Changed R6 from 100 ohms to 120 ohms
7000	Added R27
7000	Changed R6 from 120 ohms to 56 ohms
7000	Changed R14 from 220 ohms to 100 ohms

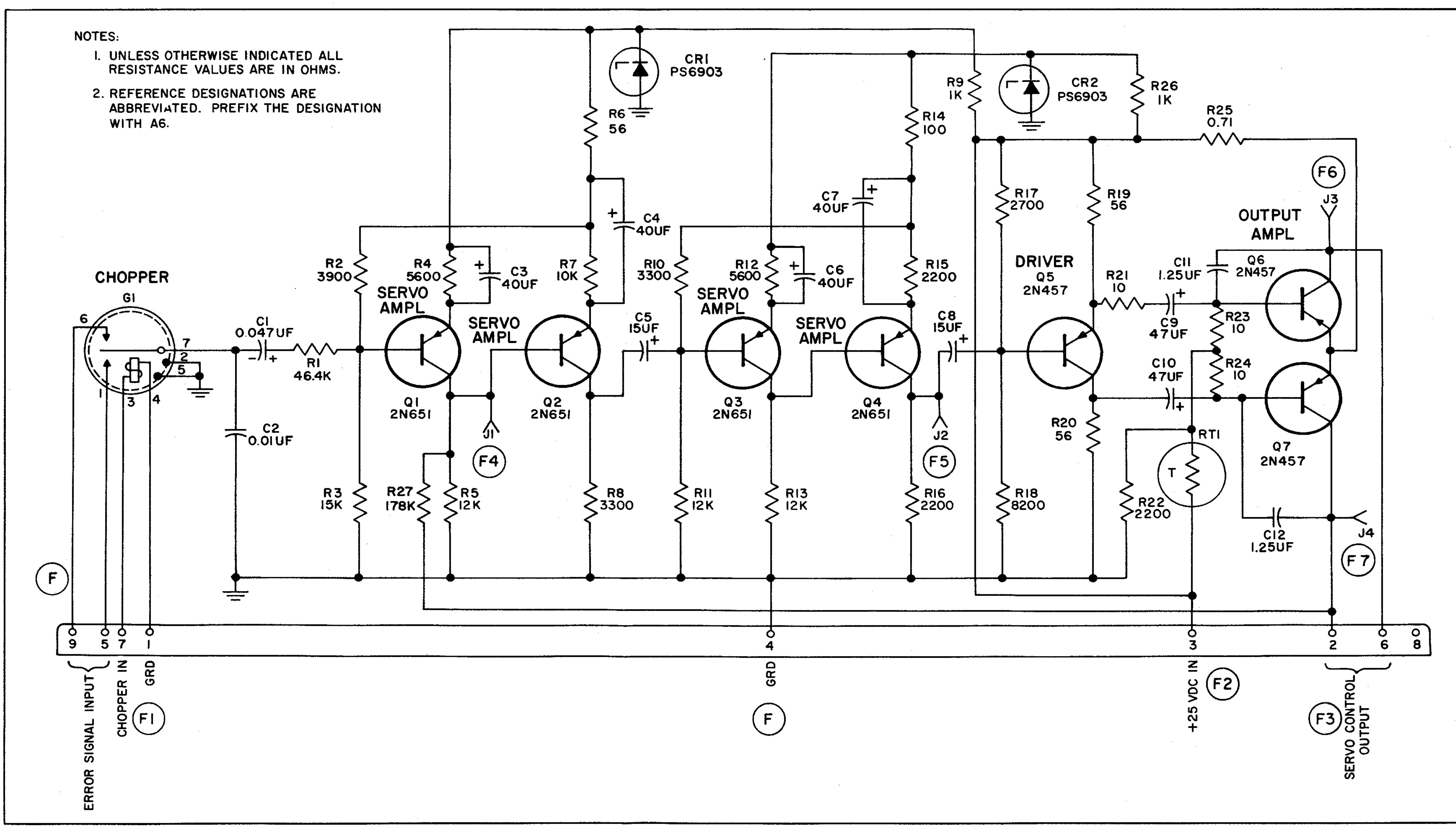
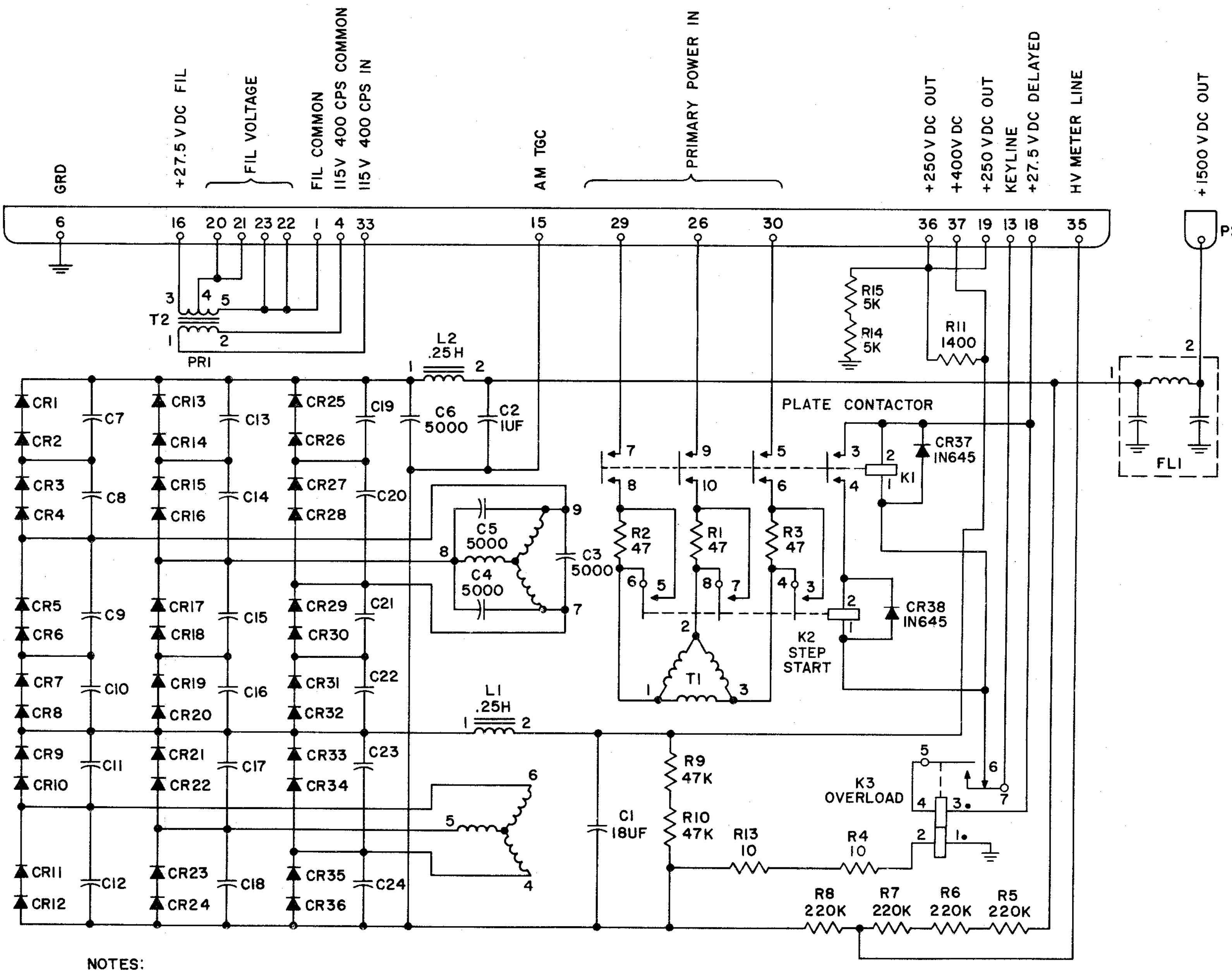


Figure 7-7. Electronic Control Amplifier Module A6, Schematic Diagram



NOTES:
1. CR1 THRU CR36 ARE IN1492 TYPE.
2. C7 THRU C24 ARE 1000 UUF.
3. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS AND ALL CAPACITANCE VALUES ARE IN PICOFARADS.
4. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH A7.

Figure 7-8. Three-Phase High-Voltage Power Supply Module A7, Schematic Diagram

TABLE LXXII. FACTORY CHANGES TO THREE-PHASE HIGH-VOLTAGE POWER SUPPLY MODULE A7

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
3788	Added CR37 and CR38

TABLE LXXIII. FACTORY CHANGES TO AM/AUDIO AMPLIFIER MODULE A9

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
2805	Deleted R42 (was from J2 to ground)
3508	Changed R49 from 47,000 ohms to 33,000 ohms
6486	Changed transistors Q3, Q4, Q5, Q6, and Q7 from 2N274 to 2N2188
7600	Added L9
7600	Added C53
7400	Changed C6 from 0.68 uf to 0.33 uf
7400	Changed R26 from 2200 ohms to 3900 ohms

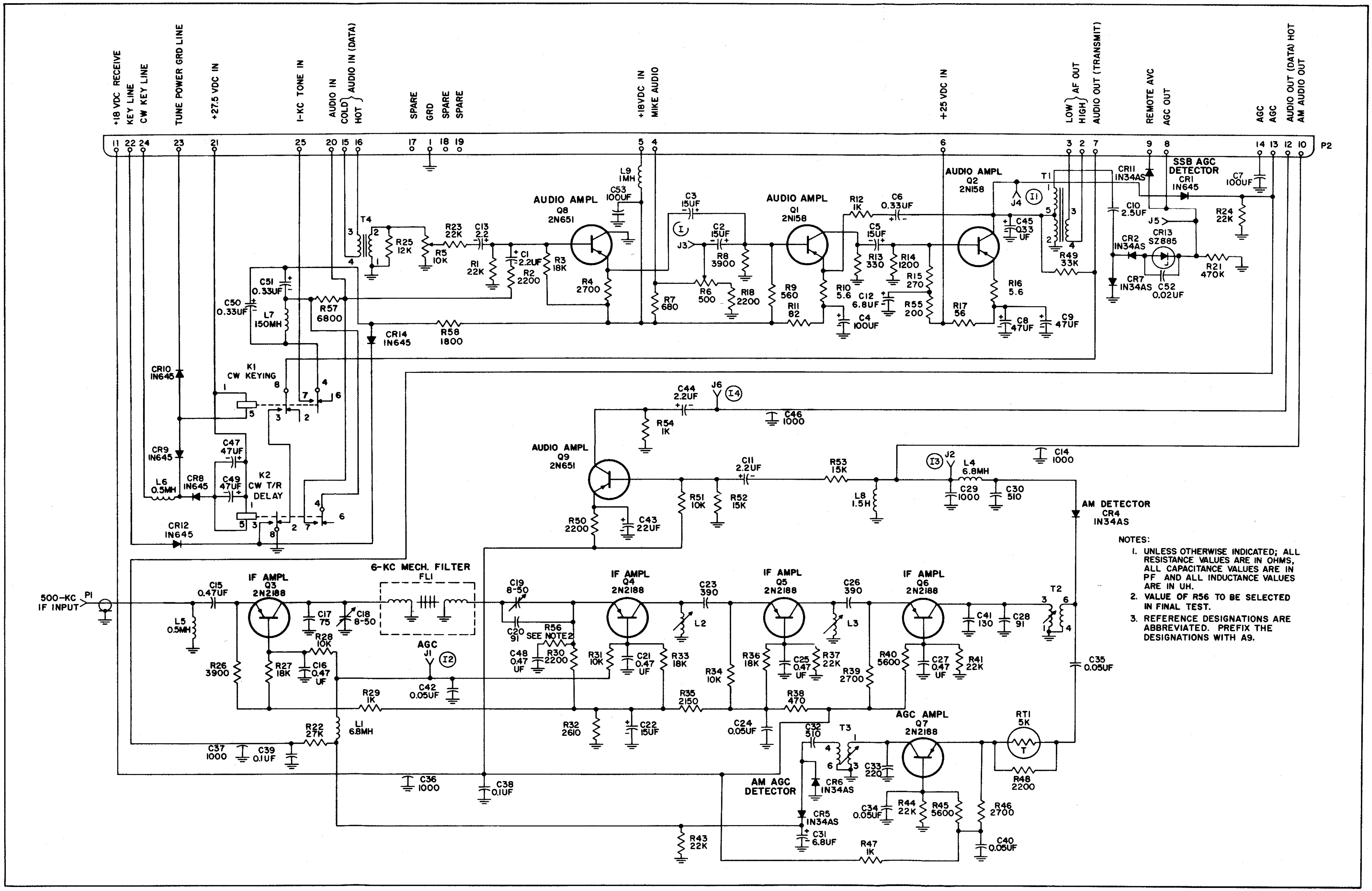
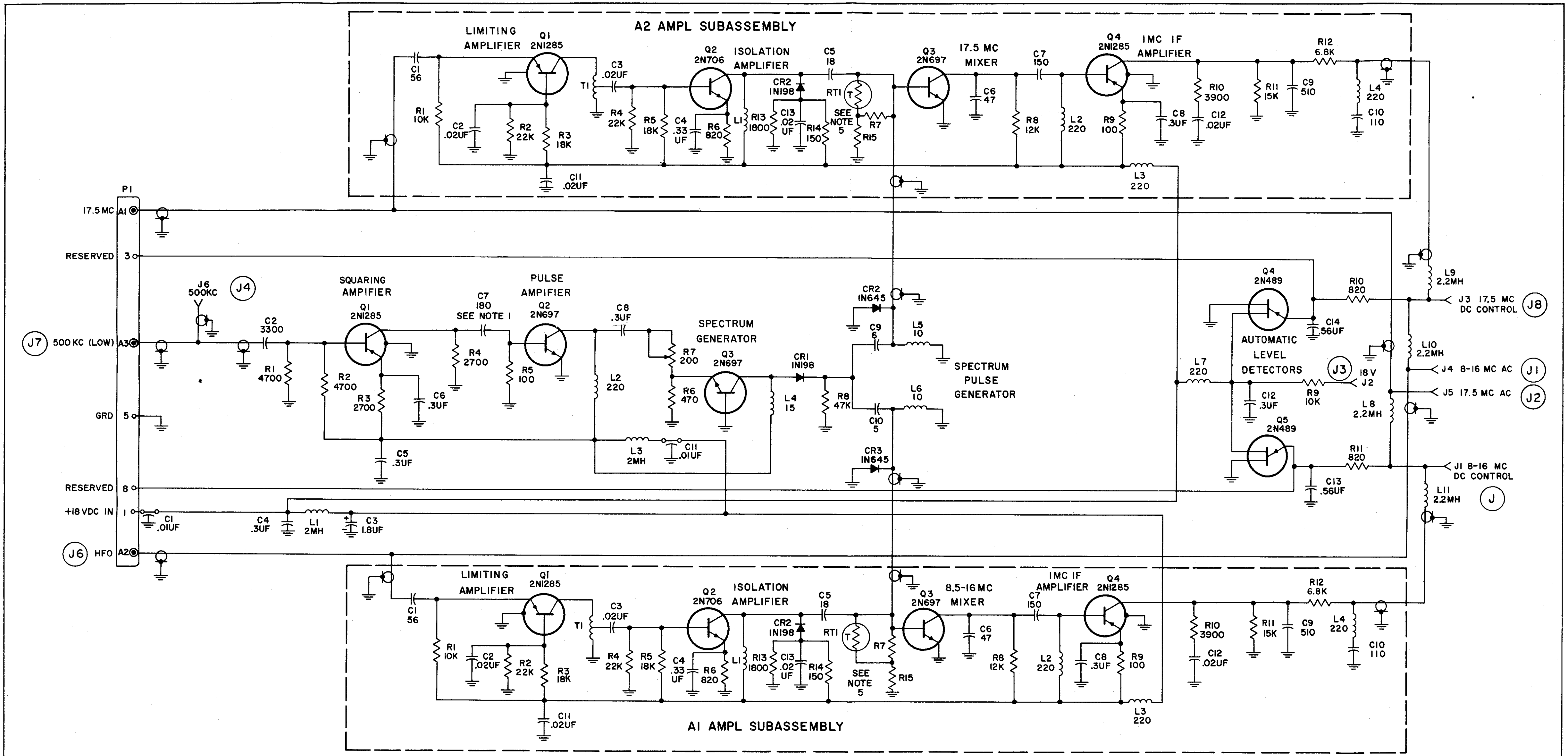


Figure 7-9. AM/Audio Amplifier Module A9, Schematic Diagram



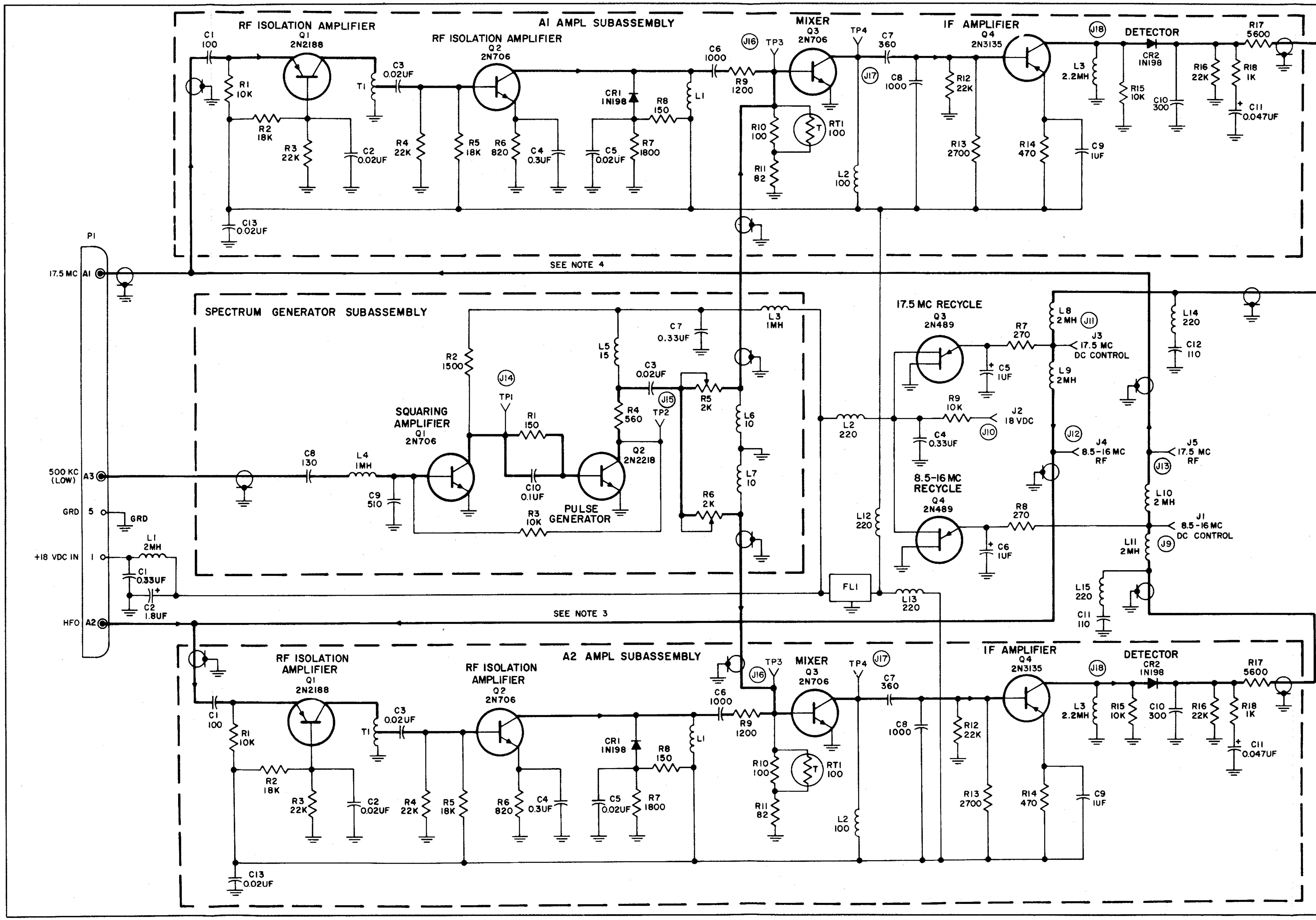
NOTES:

1. NOMINAL VALUE; PROPER VALUE SELECTED DURING TEST.
2. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
3. PREFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY/SUBASSEMBLY DESIGNATION A10, A10A1, OR A10A2.
4. EARLIER SERIAL NUMBERED MODULES USE 2N1224 TRANSISTORS IN PLACE OF 2N1285.
5. THE NOMINAL VALUE OF THE SERIES PARALLEL COMBINATION OF RT1, R7 AND R15 AT ROOM TEMPERATURE IS 250 OHMS. PROPER VALUES SELECTED DURING TEST.

Figure 7-10. Megacycle-Frequency Stabilizer Module A10 (Collins P/N: 544-9289-005), Schematic Diagram

TABLE LXXIV. FACTORY CHANGES TO MEGACYCLE-FREQUENCY STABILIZER MODULE A10
(Collins part number: 528-0329-005)

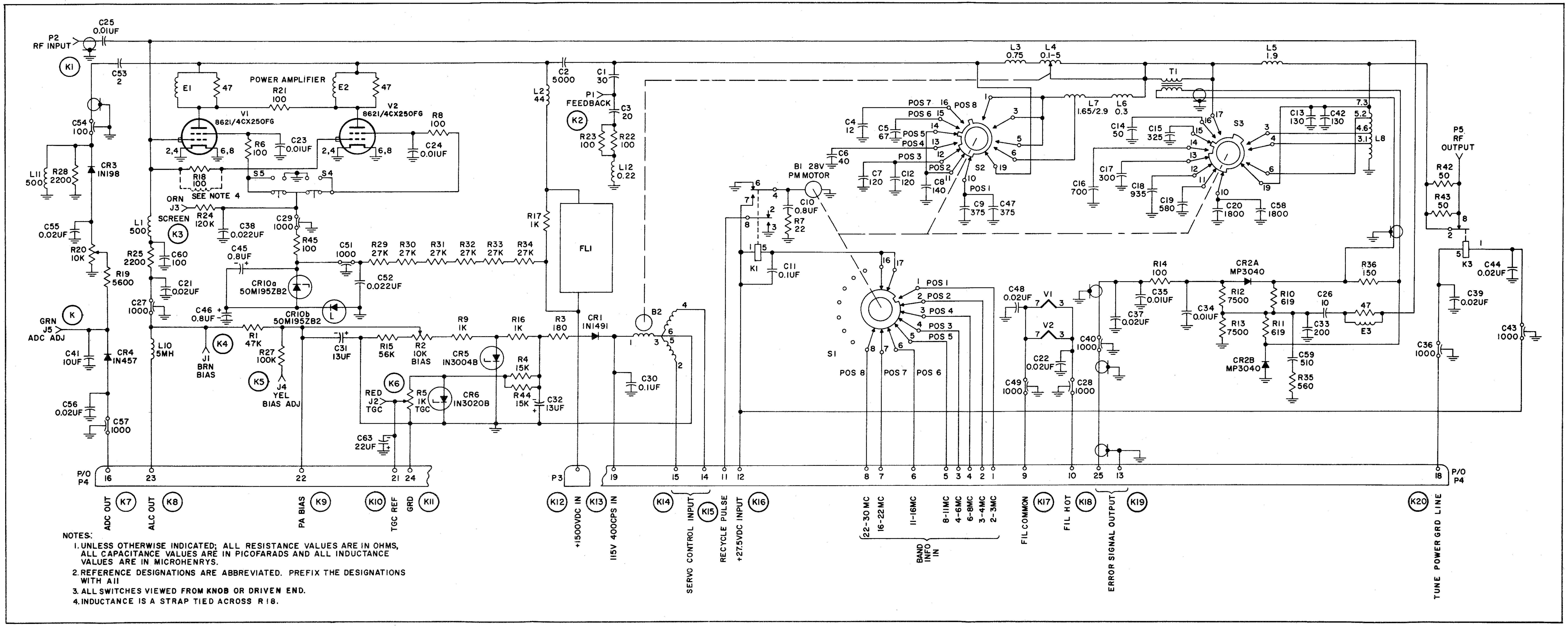
MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
2835	Changed transistors A1Q1, A1Q4, A2Q1, and A2Q4 from 2N1285 to 2N2188



NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY/SUBASSEMBLY DESIGNATION A10, A10A1, OR A10A2.
3. 17.5MC DC CONTROL IS RETURNED TO RF TRANSLATOR BY 8.5-16MC RF LINE.
4. 8.5-16MC DC CONTROL IS RETURNED TO RF TRANSLATOR BY 17.5MC RF LINE.

Figure 7-10A. Megacycle-Frequency Stabilizer Module A10 (Collins P/N: 528-0329-005), Schematic Diagram



NOTES:
1. UNLESS OTHERWISE INDICATED; ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH A11
3. ALL SWITCHES VIEWED FROM KNOB OR DRIVEN END.
4. INDUCTANCE IS A STRAP TIED ACROSS R18.

Figure 7-11. Power Amplifier Module A11, Schematic Diagram

TABLE LXXV. FACTORY CHANGES TO POWER AMPLIFIER MODULE A11

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
4800	Deleted R37 (was from R38 to CR5)
5000	Changed R26 (22 ohms) to R42 (50 ohms)
6261	Placed R23 and R22 in parallel and removed from ground
6261	Placed L12, 0.22 mh in series with R23 R22
6414	Changed C38 and C52 from 0.02 uf to 0.022 uf
6414	Changed C20 and C58 from 1700 pf to 1800 pf
-	Added R44
-	Changed R4 from 8200 ohms to 7500 ohms
-	Changed R16 from 1800 ohms to 1000 ohms
-	Added R43
4500	Changed K2 to K3
-	Changed CR2A and CR2B from 1N198 to MP3040
7390	Changed C45 and C46 from 1.2 uf to 0.8 uf
-	Changed R4 and R44 from 7500 ohms to 15,000 ohms
7390	Deleted R41 (was from R18 to R39)
7390	Deleted R39 (was from R41 to R40)
7390	Deleted R40 (was from R39 to C62)
7390	Deleted CR8A (was from R41 to CR8B)
7390	Deleted CR8B (was from CR8A to C62)
7390	Deleted C62 (was from CR8B to ground)
7390	Deleted C61 (was from CR8B to ground)
7390	Deleted R38 (was from C62 to R15)
7390	Added R45
7390	Changed CR7A (10M200Z2) to CR10A (50M195ZB2)
7390	Changed CR7B (10M200Z2) to CR10B (50M195ZB2)
-	Changed R45 from 470 ohms to 100 ohms

TABLE LXXVI. FACTORY CHANGES TO R-F TRANSLATOR MODULE A12

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
2224	Changed C161 from 0.01 uf to 0.1 uf
2224	Changed C248 from 0.01 uf to 0.1 uf
2224	Changed C163 from 0.01 uf to 0.1 uf
2224	Added C279
4098	Changed C166 from 4 uf to 1.5 uf
5100	Changed R92 from 10,000 ohms to 2200 ohms
5100	Changed CR6 from 1N67A to 1N645
6342	Changed C141 from 5-25 pf to 1.5-7.0 pf
6342	Changed C126 from 91 pf to 68 pf
6392	Changed R78 from 47 ohms to 500 ohms

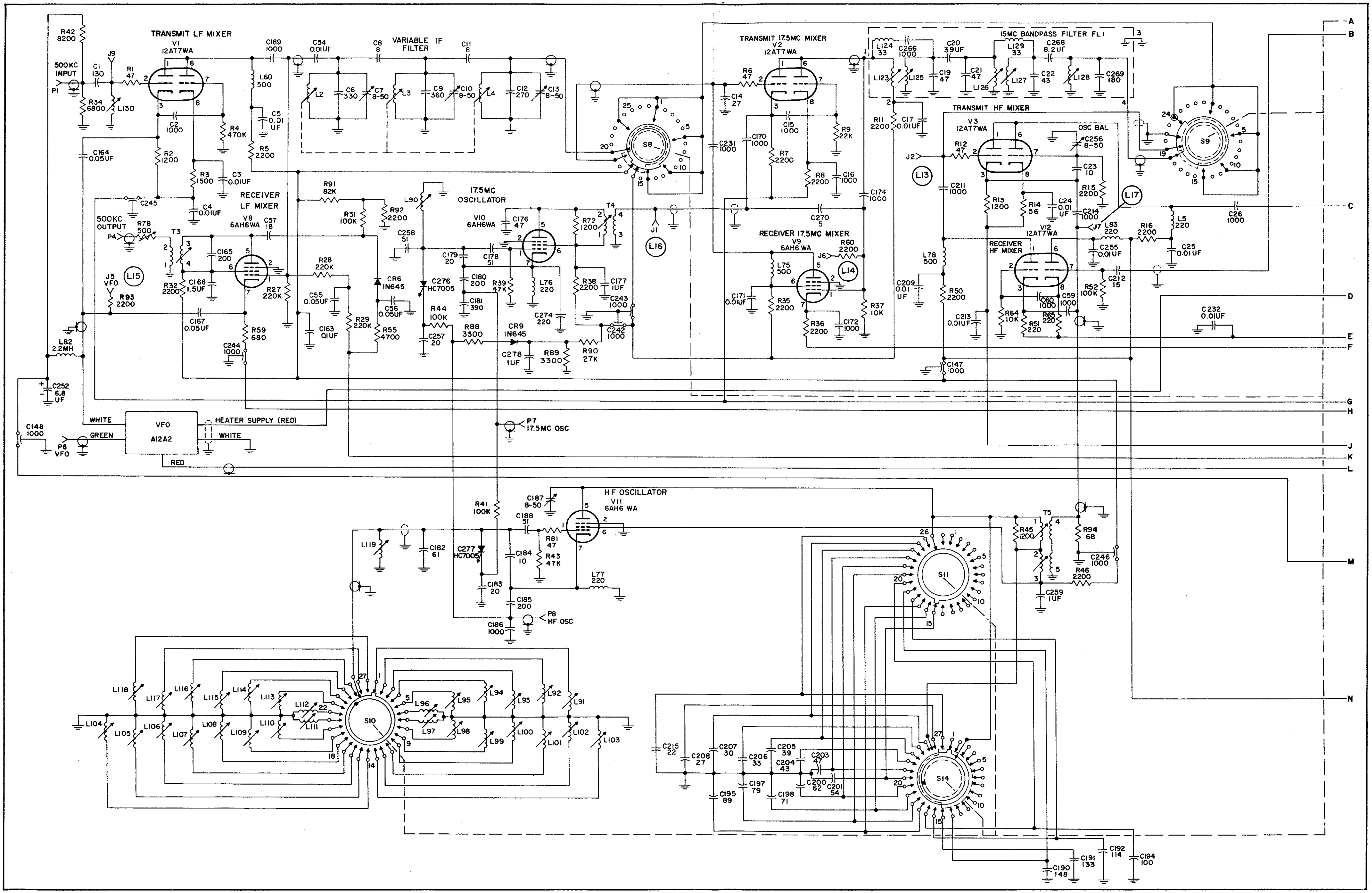


Figure 7-12. R-F Translator Module A12, Schematic Diagram (Sheet 1 of 3)

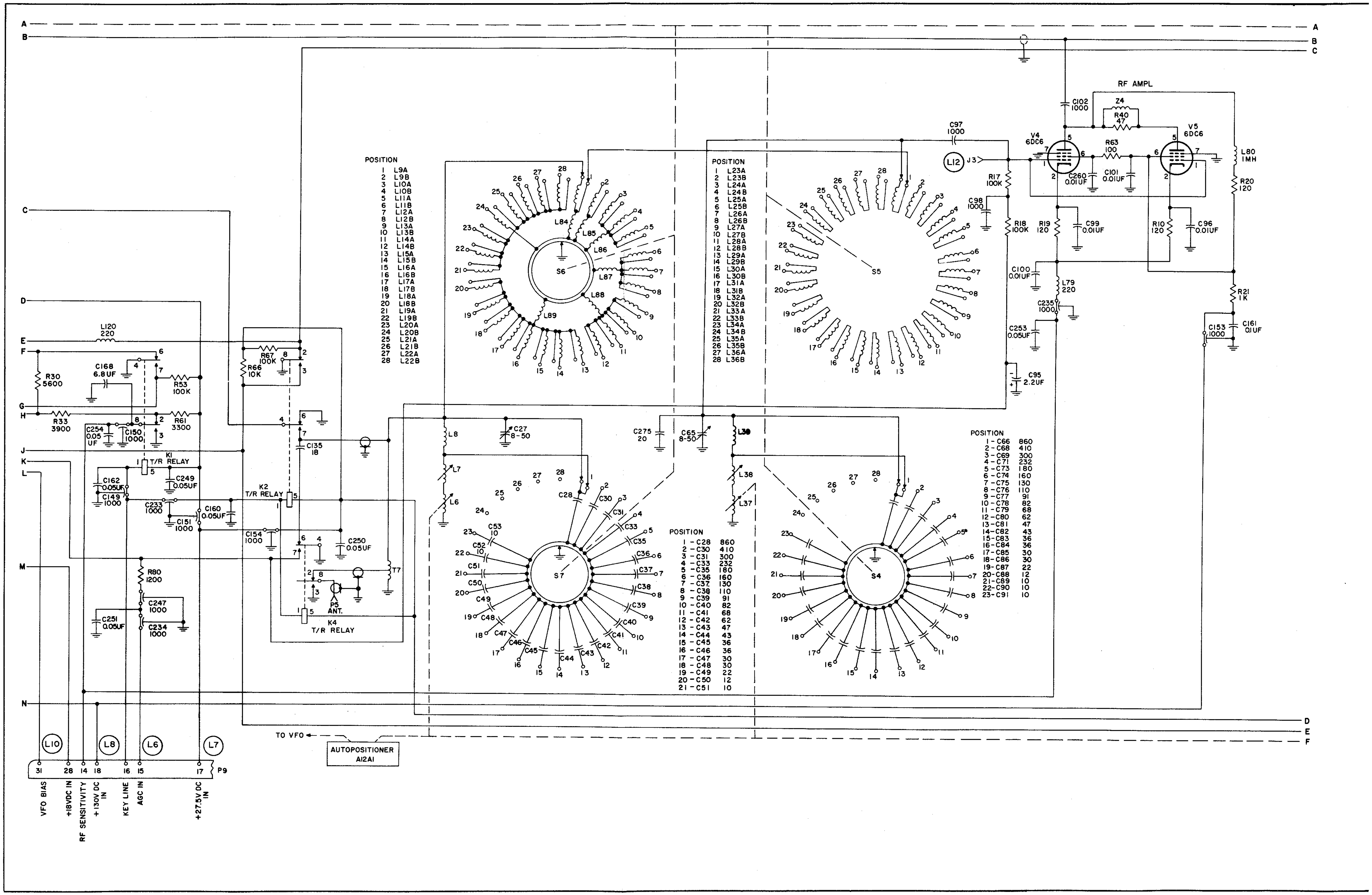


Figure 7-12. R-F Translator Module A12, Schematic Diagram (Sheet 2 of 3)

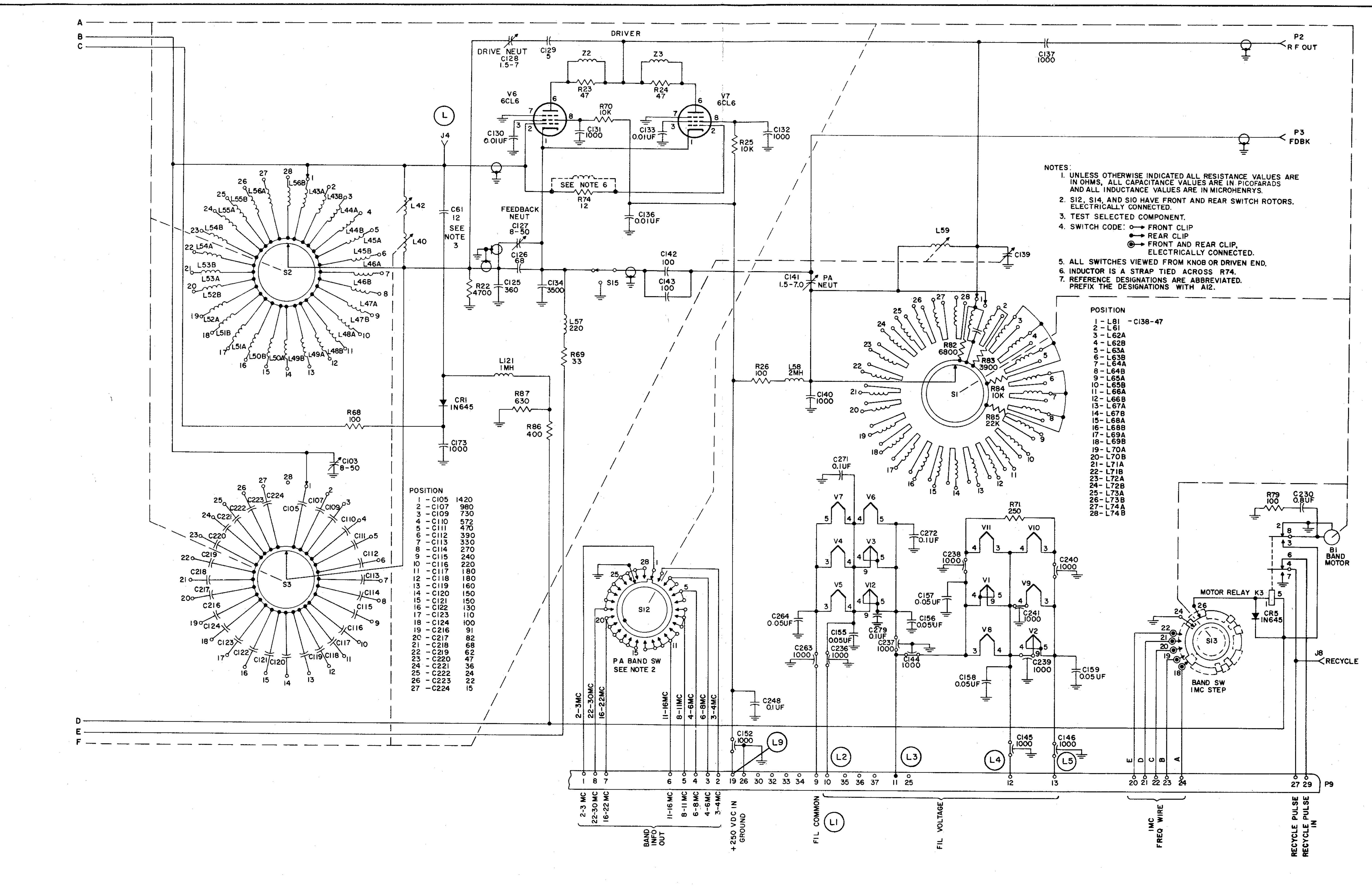


Figure 7-12. R-F Translator Module A12, Schematic Diagram (Sheet 3 of 3)

TABLE LXXVII. FACTORY CHANGES TO AUTOPOSITIONER SUBMODULE A12A1

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
3730	Added R34

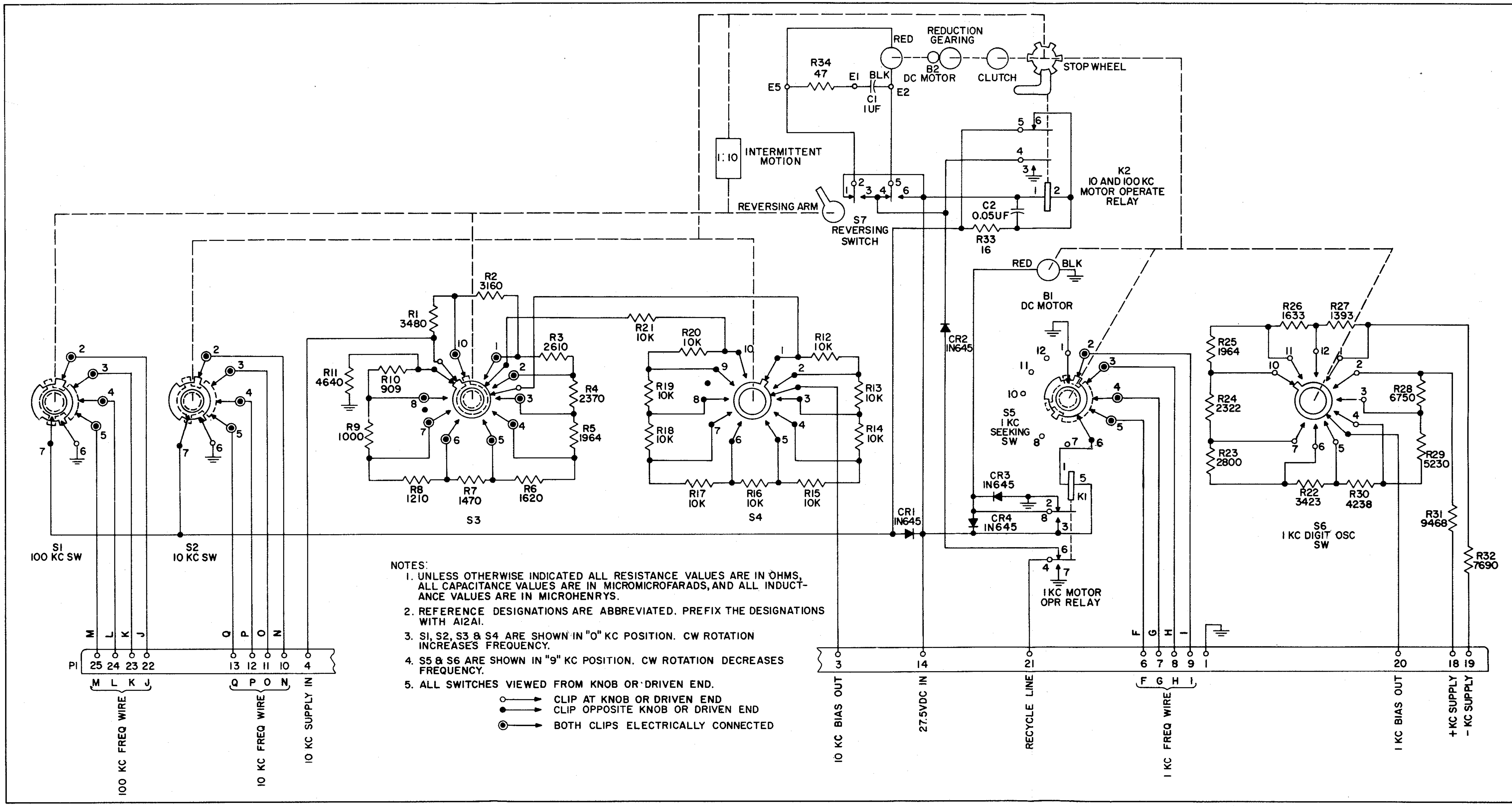


Figure 7-13. Autopositioner Submodule A12A1, Schematic Diagram

TABLE LXXVIII. FACTORY CHANGES TO VARIABLE FREQUENCY OSCILLATOR SUBMODULE A12A2

MANUFACTURING CONTROL NUMBER (MCN)	CHANGE
6491	Changed C9 from 510 pf to 620 pf Changed R21 from 470 ohms to 330 ohms

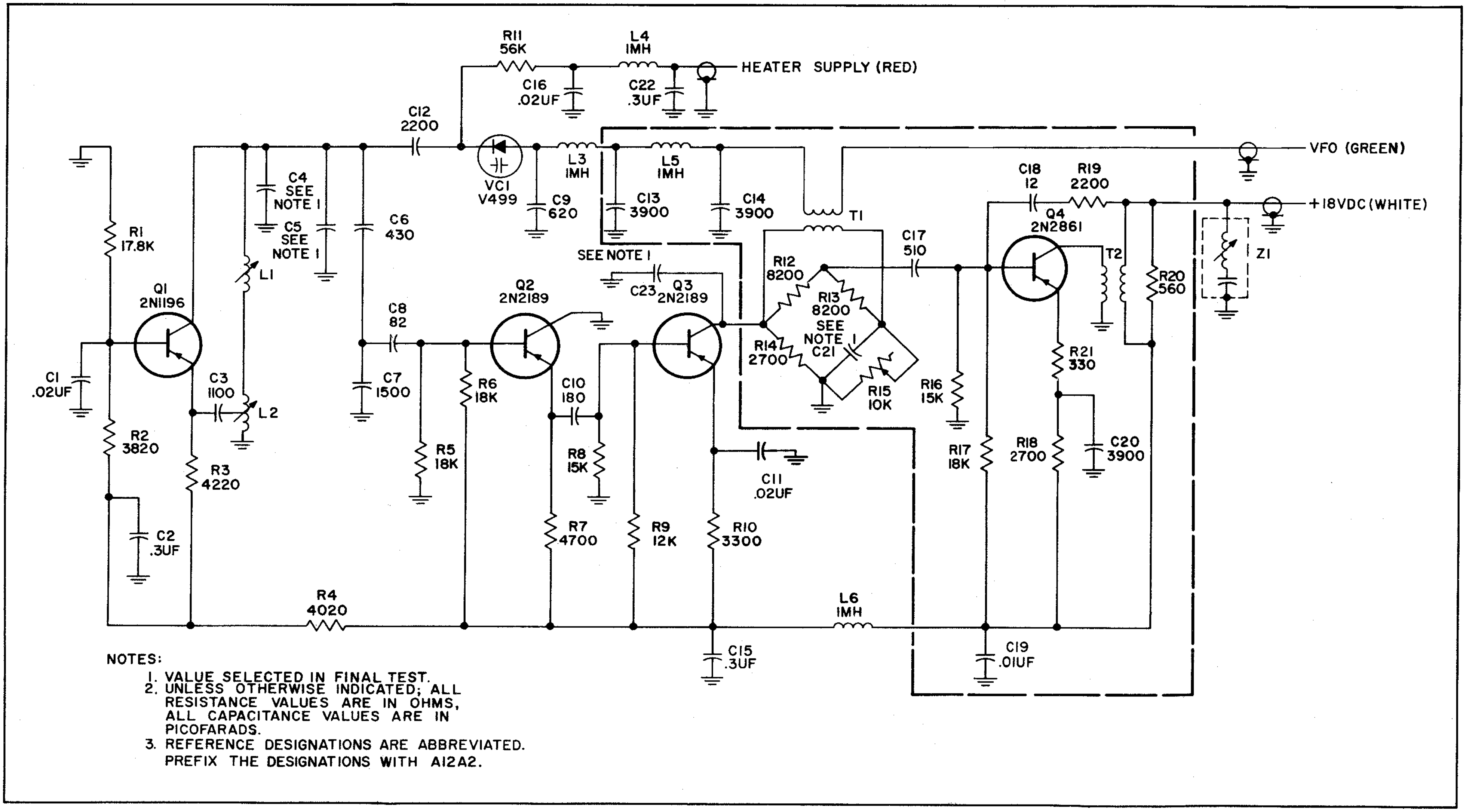


Figure 7-14. Variable Frequency Oscillator Submodule A12A2, Schematic Diagram

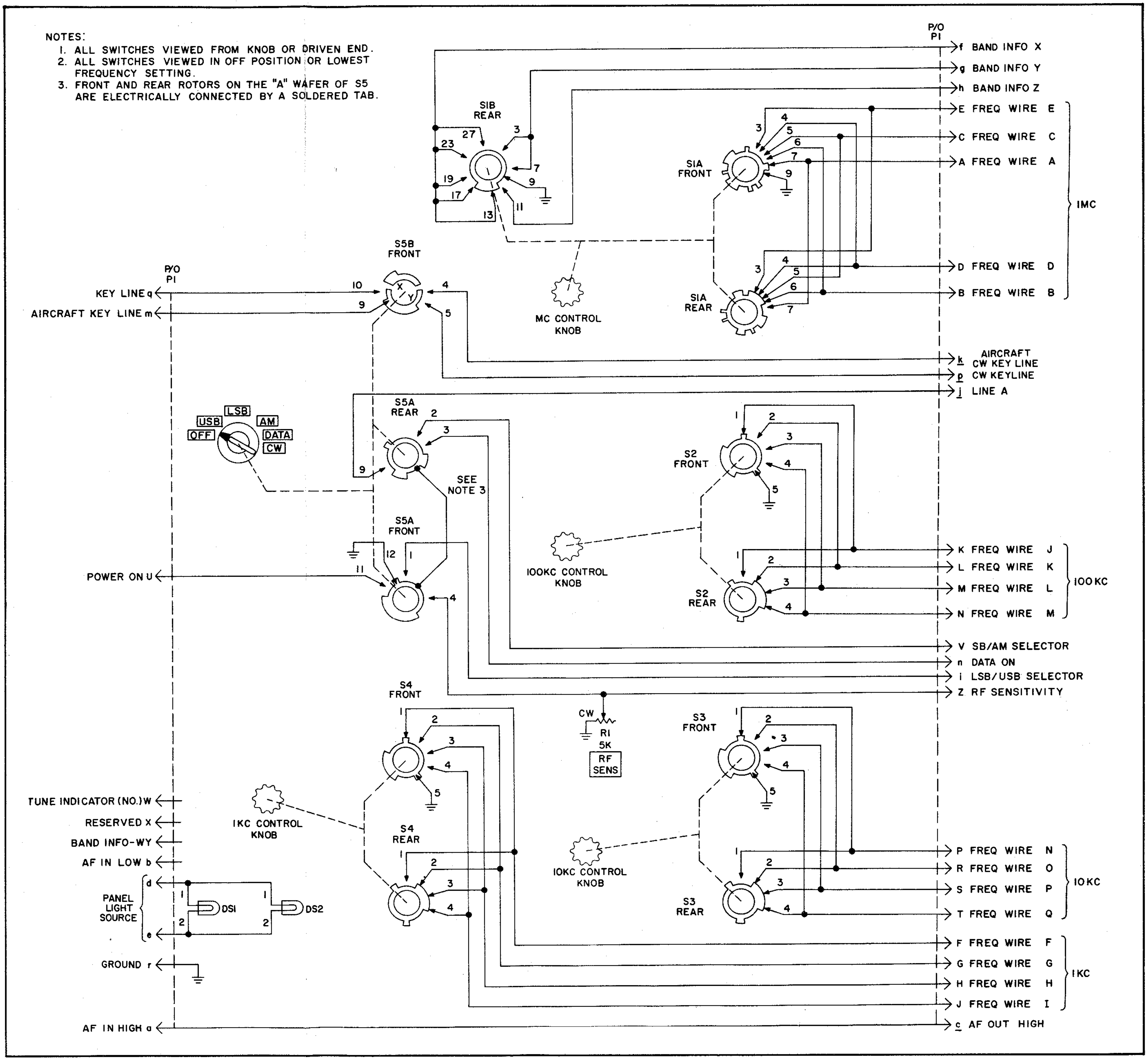


Figure 7-15. Radio Set Control C-3940/ARC-94, Schematic Diagram

SECTION VIII
DIFFERENCE DATA SHEETS

8-1. INTRODUCTION.

8-2. Service instructions for the models included in this section are the same as the procedures for Radio Set AN/ARC-94, except for the specific differences noted by the applicable difference data sheet. Sections I through VII contain complete service instruction information for Radio Set AN/ARC-94 manufactured and supplied under contract NOw(A)62-0321-f.

INDEX OF MODELS COVERED BY DIFFERENCE DATA SHEETS

RADIO SET AN/ARC-119. CONTRACT NOw 64-0342-f
RADIO SET AN/ARC-120 CONTRACT NOw 64-0342-f

THE INSTRUCTIONS CONTAINED IN PRECEDING SECTIONS OF THIS HANDBOOK APPLY EXCEPT FOR THE DIFFERENCES GIVEN IN THIS DATA SHEET.

RADIO SET AN/ARC-119.

Radio Set AN/ARC-119 differs from Radio Set AN/ARC-94 in the addition of three new components. (See table LXXIX and figure 8-1.) Radio Receiver-Transmitter RT-698/ARC-102 substitutes for RT-648/ARC-94. Radio Set Adapter MX-6990/ARC provides the means for adapting the RT-698/ARC-102 to Mounting MT-1414/ARC-38. Special Purpose Electrical Cable Assembly W1 of AN/ARC-119 is used in conjunction with MX-6990/ARC to provide interconnections with C-3940/ARC-94. The external wiring diagram of figure 8-2 illustrates the configuration.

RADIO SET AN/ARC-120.

Radio Set AN/ARC-120 differs from Radio Set AN/ARC-94 in the addition of one new component. (See table LXXIX and figure 8-1.) The Radio Receiver-Transmitter RT-698/ARC-102 substitutes for the RT-648/ARC-94. Refer to the external wiring diagram of figure 8-3.

RADIO RECEIVER-TRANSMITTER RT-698/ARC-102.

There is a slight difference in weight between RT-698/ARC-102 and RT-648/ARC-94. Other than

TABLE LXXIX. EQUIPMENT SUPPLIED

QTY	NOMENCLATURE	OVERALL DIMENSIONS (inches)			WEIGHT
		HEIGHT	WIDTH	DEPTH	
RADIO SET AN/ARC-119					
1	Radio Receiver-Transmitter RT-698/ARC-102	7-5/8	10-1/8	22-3/16	51
2	Radio Set Control C3940/ARC-94	2-5/8	5-3/4	4-7/8	2
4	Radio Set Adapter MX-6990/ARC	5-1/16	16-3/8	19-7/16	5
5	Special Purpose Electrical Cable Assembly W1 of AN/ARC-119	27 ±1 (length)			
RADIO SET AN/ARC-120					
1	Radio Receiver-Transmitter RT-698/ARC-102	7-5/8	10-1/8	22-3/16	51
2	Radio Set Control C3940/ARC-94	2-5/8	5-3/4	4-7/8	2
3	Mounting MT-2641/ARC-94	4-63/64	11-9/64	21-7/8	5

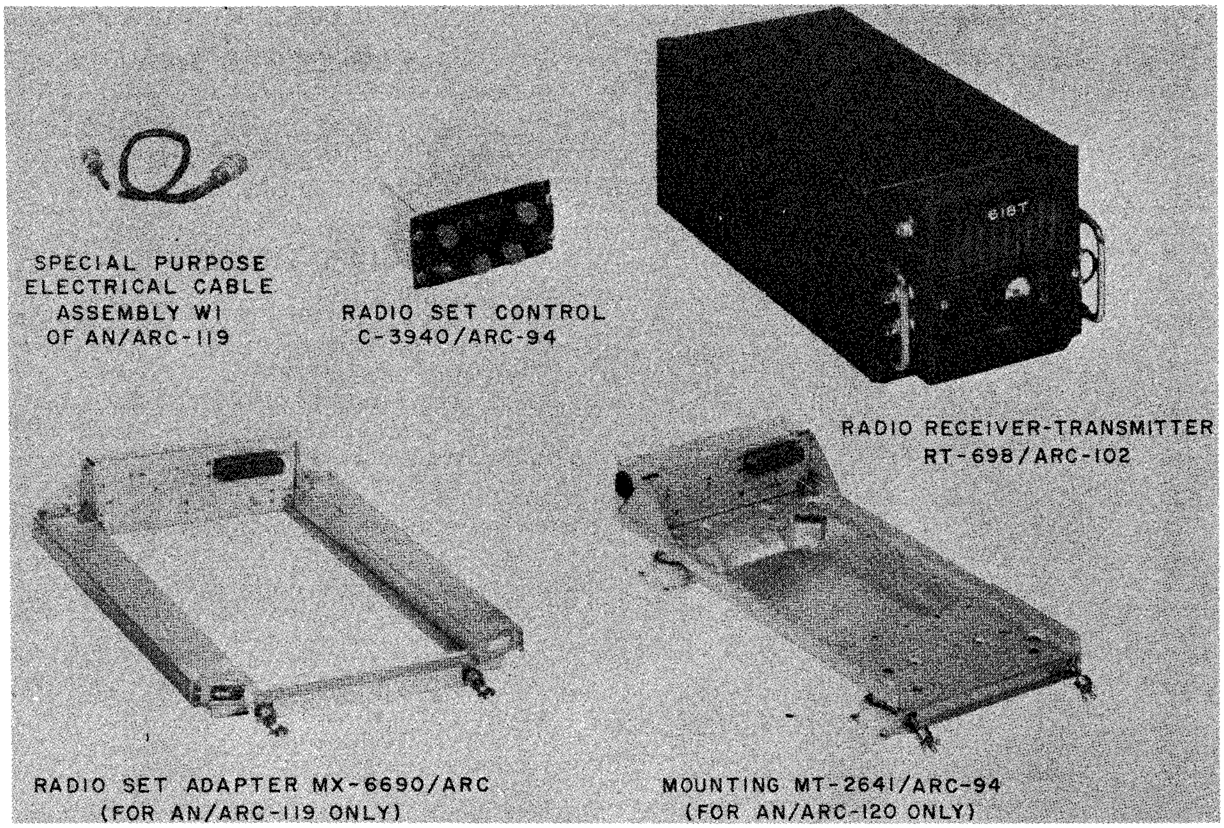


Figure 8-1. Radio Sets AN/ARC-119 and AN/ARC-120, Equipment Supplied

this exception, no difference can be detected externally. The RT-698/ARC-102 contains a different high-voltage module that functions with 27.5-volt dc voltage as its source of power, whereas the RT-648/ARC-94 high-voltage module operates principally with 115-volt (line-to-neutral) 3-phase, 400-cps power. The 27.5-volt dc high-voltage power supply A8 is covered in this difference data. The chassis and modules of the RT-648/ARC-94 are shown in figure 1-2; however, note no. 9 does not apply. Tables V, VI, and VII are not applicable to the RT-698/ARC-102 wherever the three-phase high-voltage power supply module A7 is referenced regarding transistors, diodes, and relays. Refer to the schematic diagram, figure 8-4, for this information.

The power consumption data of table VIII does not apply to the RT-698/ARC-102. Power requirements for the RT-698/ARC-102 are 27.5 volts dc, 1050 watts, and 115 volts, 400 cps, single phase, 100 watts. The surge current tables of section I are not applicable to the RT-698/ARC-102 except figure 1-4.

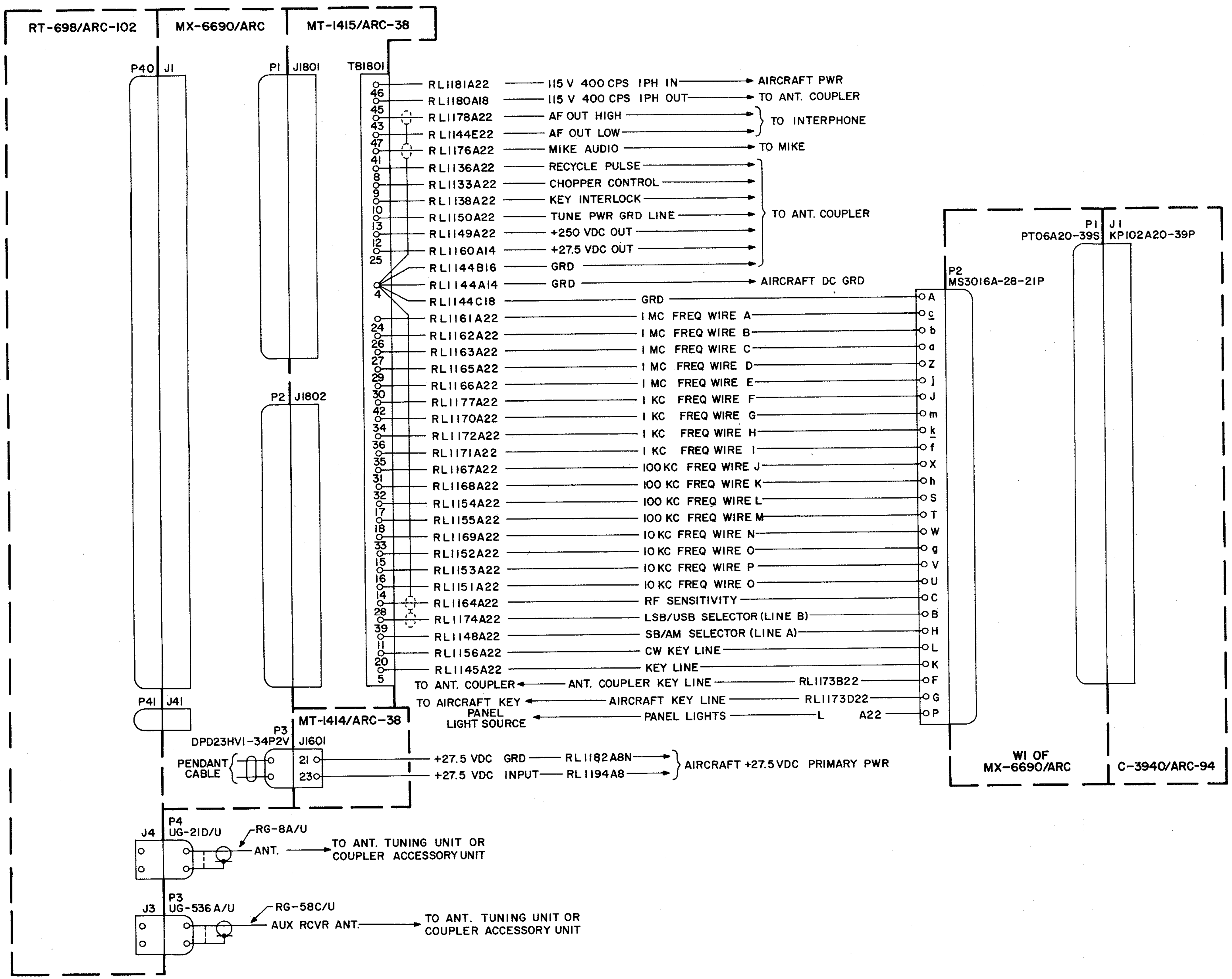
RADIO SET ADAPTER MX-6990/ARC.

Radio Set Adapter MX-6990/ARC contains two relays, and all other wiring is straightforward. It is advisable to perform the maintenance procedures for troubleshooting as well as for compliance with minimum performance standards. These maintenance procedures consist of visual inspection to determine the mechanical condition, cleaning, and the performance of a relay function continuity test.

Removal of the MX-6990/ARC is necessary to perform the maintenance procedures. To remove the MX-6990/ARC, loosen the two thumbscrews at the lower corners until they are free of the clamps on MT-1415/ARC-38. Then slide the MX-6990/ARC forward until it is free of the MT-1415/ARC-38 connectors. Disconnect the pendant cable from the MT-1414/ARC-38. Replacement of the MX-6990/ARC is substantially the reverse of this procedure.

Inspect the connectors. The MX-6990/ARC has a single-conductor ground connector and a 60-pin power and control connector. These engage with mating connectors on RT-698/ARC-102. The MX-6990/ARC also has two connectors that engage with mating connectors on the MT-1415/ARC-38 and a pendant cable which plugs into the MT-1414/ARC-38.

Test the relays of the MX-6990/ARC. To do this, the MX-6990/ARC is removed from MT-1415/ARC-38,



WIRE TABLE			
WIRE NUMBER	SYSTEM OPERATING VOLTAGE	CONDUCTED CURRENT AMPERES	MAXIMUM ALLOWABLE DROP
1138	+27.5	0.2	0.5
1145	+27.5	0.5	0.5
1151	+27.5	1	0.5
1152	+27.5	1	0.5
1153	+27.5	1	0.5
1154	+27.5	1	0.5
1155	+27.5	1	0.5
1160	+27.5	CPLR DRAIN	0.5
1167	+27.5	1	0.5
1168	+27.5	1	0.5
1169	+27.5	1	0.5
1180	115	CPLR DRAIN	1
1181	115	1+CPLR DRAIN	1
1194	+27.5	37	0.5

NOTES:

1. INSTALLATION OF WIRING SHALL CONFORM TO SPECIFICATION MIL-W-5088.
2. THE RADIO SET AN/ARC-119 IS USED AS AN AN/ARC-38 RETROFIT INSTALLATION, THEREFORE THE AN/ARC-38 BLOCK OF WIRE CODE NUMBERS WILL BE USED.
3. SEE EI- –2 AN/ARC-120 EXTERNAL WIRING DIAGRAM FOR THE ANTENNA COUPLER CONNECTION POSSIBILITIES.
4. SEGMENT LETTERS, IN ADDITION TO THOSE SHOWN, MAY BE USED AS NECESSARY TO FIT THE PARTICULAR INSTALLATION.
5. WIRE SIZES SHOWN ARE MINIMUM SIZES. LARGER SIZES SHALL BE USED WHERE REQUIRED.
6. WIRE CODING FOR PANEL LIGHTING WIRES SHALL BE ASSIGNED BY THE INSTALLING ACTIVITY. THIS WILL BE AS SEGMENTS OF THE PANEL LIGHTING CIRCUIT USING LETTER "L".
7. THE WIRE TABLE SHOWS THE NOMINAL OPERATING VOLTAGES, CONDUCTED CURRENT, AND MAXIMUM ALLOWABLE VOLTAGE DROP NECESSARY FOR INSTALLATION.
8. RIGHT ANGLE (MS3108) OR STRAIGHT (MS3106) CONNECTORS MAY BE USED INTERCHANGABLY IN LIEU OF THOSE SHOWN.
9. ALL CONNECTOR PINS ARE SHOWN WHETHER USED OR NOT AND THE REQUIRED SPARES WITH WIRE CODING AND WIRE SIZES.
10. PLUGS OTHER THAN THOSE SHOWN MAY BE USED WITH THE APPROVAL OF THE PROCURING ACTIVITY. SUCH PLUGS SHOULD BE COMPLETELY IDENTIFIED.

Figure 8-2. Radio Set AN/ARC-119, External Wiring Diagram

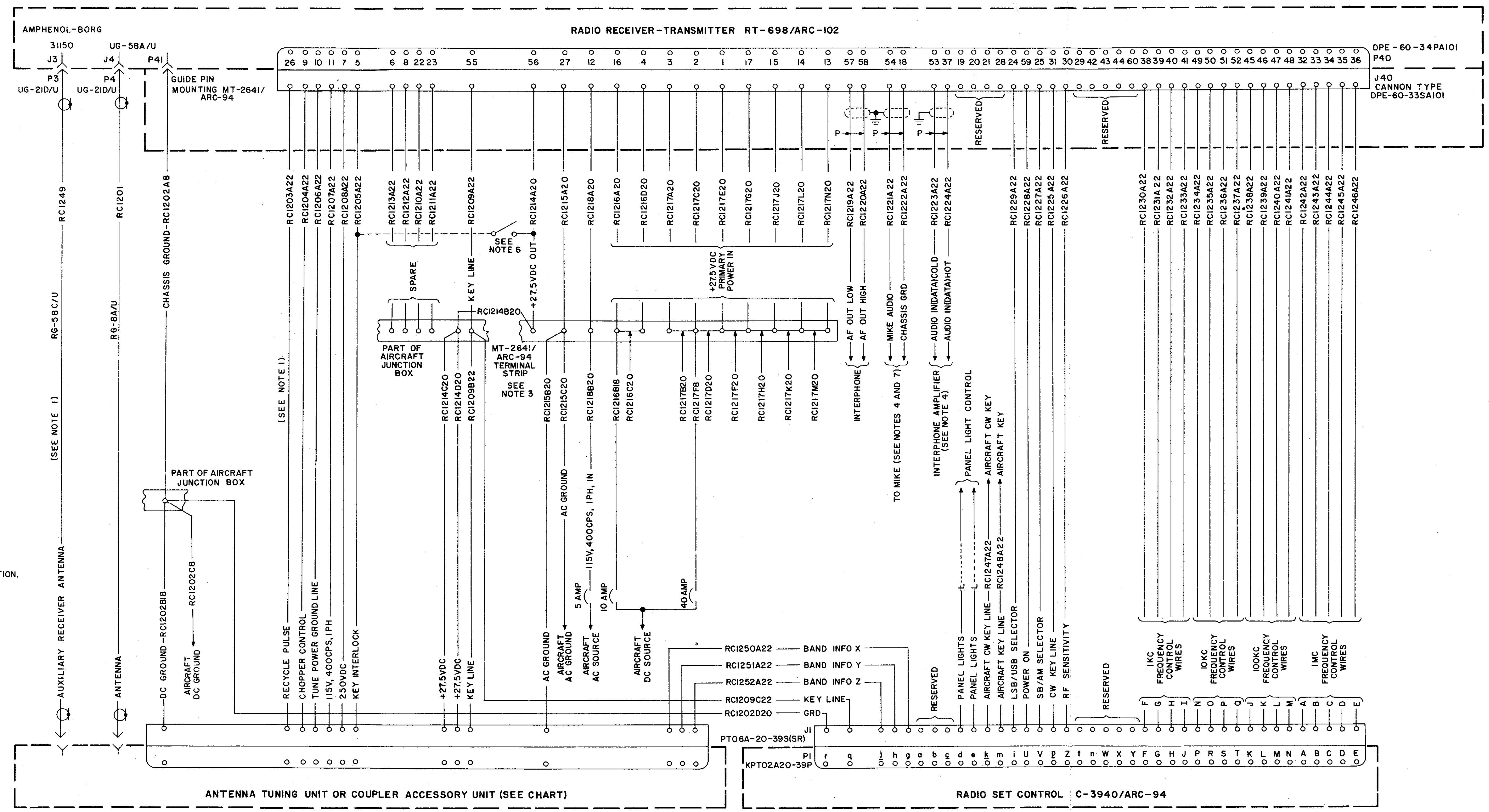
CHART FOR CONNECTIONS TO ANTENNA TUNING UNIT OR COUPLER ACCESSORY UNIT

WIRE NUMBER	RT-698/ARC-102 CONNECTOR PIN NUMBER	WIRE FUNCTION	TO ANTENNA TUNING UNIT OR COUPLER ACCESSORY (PIN NO.)			
			ANTENNA TUNING UNIT 180L-2 OR 180L-3	COUPLER ACCESSORY UNIT 309A-1	COUPLER ACCESSORY UNIT 309A-2D	REMINGTON RAND COUPLER ACCESSORY UNIT 3206A1
1203	26	RECYCLE PULSE	10	10	T	3
1204	9	CHOPPER CONTROL	7	NC*	NC	NC
1205	5	KEY INTERLOCK	12	27	E	4
1206	10	TUNE POWER GRD LINE	4	7	W	26
1207	11	115V,400CPS, 1PH	8	1,3	a,c	28
1208	7	+250 VDC	14	NC	NC	NC
1214C	AIRCRAFT J-BOX	+27.5VDC	13	28	L	25
1214D	AIRCRAFT J-BOX	+27.5VDC	11	29	NC	27
1209B	AIRCRAFT J-BOX	KEY LINE	9	2,8,12	R,V	19
1215B	27	AC GROUND	12	20	G	20
1202B	AIRCRAFT J-BOX	DC GROUND	15	20,26,11	G,A,S	2,23
1250	C-3940 PIN g	BAND INFO X	NC	23	D	NC
1251	C-3940 PIN h	BAND INFO Y	NC	24	C	NC
1252	C-3940 PIN j	BAND INFO Z	NC	25	B	NC
1201	J4	ANTENNA	TO NAVY 49195 CONNECTOR	TO ANTENNA COUPLER 180R-4	TO ANTENNA COUPLER 180R-6	J7
1249	J3	AUX. RCVR. ANTENNA	TO UG-88/U CONNECTOR (180L-3 ONLY)	P3	J2	NC

* NC MEANS NO CONNECTION

NOTES:

1. SEE CHART FOR ANTENNA CONNECTIONS.
2. SEE CHART FOR COUPLER INPUT CONNECTIONS.
3. TERMINAL STRIP PROVIDED IN THE MT-2641/ARC-94 MOUNTING CAN BE USED FOR A TIE POINT AS SHOWN.
4. PINS 53 AND 37 ARE EMPLOYED AS BALANCED INPUT FROM AN INTERPHONE. IN THIS CASE, WIRES TO PINS 54 AND 18 SHOULD NOT BE CONNECTED. IF AN UNBALANCED CARBON MIKE IS USED THE WIRES TO PINS 53 AND 37 SHOULD NOT BE CONNECTED.
5. IF A SEPARATE CW KEY LINE IS NOT PROVIDED IN THE AIRCRAFT, C-3940/ARC-94 CONTROL PINS k AND m MUST BE JUMPERED TOGETHER TO PROVIDE CW OPERATION.
6. IF BENCH OPERATION WITHOUT AN ANTENNA COUPLER IS DESIRED, PINS 5 AND 56 MUST BE CONNECTED AS SHOWN TO COMPLETE THE KEY INTERLOCK CIRCUIT. DO NOT CONNECT PINS 5 OR 56 TO AN EXTERNAL DC SOURCE.
7. WHEN UNBALANCED CARBON MIKE INPUT IS USED, THE MIKE RETURN CIRCUIT SHOULD BE CONNECTED TO PIN 18. IT IS RECOMMENDED THAT NO GROUNDS EXTERNAL TO THE RT-698/102 CHASSIS BE PLACED ON THIS LINE.
8. INSTALLATION OF WIRING SHALL CONFORM TO SPECIFICATION MIL-W-5088.
9. THE BLOCK OF WIRE CODE NUMBERS ASSIGNED FOR USE WITH THE RADIO SET AN/ARC-120 IS RC1201 THROUGH RC1300. THE HIGHEST NUMBER USED IS RC1252.
10. SEGMENT LETTERS IN ADDITION TO THOSE SHOWN MAY BE USED AS NECESSARY TO FIT THE PARTICULAR INSTALLATION.
11. WIRE CODING FOR PANEL LIGHTING WIRES SHALL BE ASSIGNED BY THE INSTALLING ACTIVITY. THIS WILL BE AS SEGMENTS OF THE PANEL LIGHTING CIRCUIT USING LETTER "L".
12. WIRE SIZES SHOWN ARE MINIMUM. LARGER SIZES MAY BE USED WHEN REQUIRED.
13. THE WIRE TABLE SHOWS THE NOMINAL OPERATING VOLTAGES, CONDUCTED CURRENT, AND MAXIMUM ALLOWABLE VOLTAGE DROP NECESSARY FOR INSTALLATION.
14. RIGHT ANGLE (MS3108) OR STRAIGHT (MS3106) CONNECTORS MAY BE USED INTERCHANGABLY IN LIEU OF THOSE SHOWN.
15. ALL CONNECTOR PINS ARE SHOWN WHETHER USED OR NOT AND THE REQUIRED SPARES WITH WIRE CODING AND WIRE SIZES.
16. PLUGS OTHER THAN THOSE SHOWN MAY BE USED WITH THE APPROVAL OF THE PROCURING ACTIVITY. SUCH PLUGS SHALL BE COMPLETELY IDENTIFIED.



WIRE TABLE

WIRE NUMBER	SYSTEM OPERATING VOLTAGE	CONDUCTED CURRENT AMPERES	MAXIMUM ALLOWABLE DROP
1205	+27.5	0.2	0.5
1207	115	CPLR PWR	1
1209	+27.5	0.5	0.5
1210			
1211			
1212			
1213			
1214A	+27.5	4 DEPENDS	0.5
1214C	+27.5	2 ON	
1214D	+27.5	2 CPLR	
1216B	+27.5	5+CPLR PWR	0.5
1217F	+27.5	32	0.5
1218	115	1+CPLR PWR	1
1234	+27.5	1	0.5
1235	+27.5	1	0.5
1236	+27.5	1	0.5
1237	+27.5	1	0.5
1238	+27.5	1	0.5
1239	+27.5	1	0.5
1240	+27.5	1	0.5
1241	+27.5	1	0.5

Figure 8-3. Radio Set AN/ARC-120, External Wiring Diagram

and the pendant cable is not connected to the MT-1414/ARC-38. Provide a 27.5-volt dc power supply capable of supplying one ampere of filtered voltage and proceed as follows:

a. Attach multimeter leads to chassis ground and to P3-24, P3-25, and P3-59 (in turn). Each connector test should read infinity ohms.

b. Energize relay K2 by connecting the positive terminal of the 27.5-volt dc supply to terminal 23 of the pendant cable and the negative terminal to P1-10. Connect the multimeter ground lead to chassis, and read resistance at P3-24, P3-25, and P3-59. The readings should be 0 ohm. This verifies proper switching for AM mode.

c. Move the negative terminal of the 27.5-volt dc supply from P1-10 to P1-14. K2 will deenergize and K1 energize. Check resistance from P3-59 to chassis. The reading should be 0 ohm. Check resistance from P3-24 to chassis and P3-25 to chassis. These two readings should be infinity. This verifies proper switching for LSB mode.

d. Do not change the location of the 27.5-volt dc connectors (K1 remains energized); however, add a jumper from P1-14 to P1-10 thus energizing relay K2 also. Check resistance from ground to P3-24 and P3-59 (in turn). Both readings should be 0 ohm. Check resistance from ground to P3-25. The reading should be infinity. This verifies proper switching for USB mode.

e. Disconnect the multimeter and power supply.

SPECIAL PURPOSE ELECTRICAL CABLE ASSEMBLY W1 OF AN/ARC-119.

W1 of AN/ARC-119 provides connections from the MX-6990/ARC to C-3940/ARC-94 in Radio Set AN/ARC-119. No scheduled procedure is provided for maintenance and inspection since such procedures are self-evident for this component.

27.5-VOLT DC HIGH-VOLTAGE POWER SUPPLY MODULE A8

THEORY OF OPERATION.

The 27.5-volt dc high-voltage power supply module A8 is contained in the RT-698/ARC-102. It occupies the same location as the three-phase high-voltage power supply module A7 in RT-648/ARC-94.

The 27.5-volt dc high-voltage power supply module A8 consists of an oscillatory circuit that inverts incoming dc to a square wave at 1500 cps. Refer to the schematic diagram in figure 8-4. A saturable core oscillator converts 27.5 volts dc to 1500 cps ac. Transistors A8Q1 and A8Q2 alternately are driven to saturation and then cut off by the action of saturable core transformer A8T2. These alternations produce a square-wave output in A8T2 secondary. The square-wave alternations switch transistor A8Q9 through A8Q12 in a push-pull power circuit delivering 400-volt, 1500-cps square-wave output to transformer A8T1 primary. The secondary of A8T1 increases this voltage to 1500 volts which is then rectified by diodes A8CR6 through A8CR17 and filtered. The following are noteworthy differences between 27.5-volt dc high-voltage power supply module A8 and three-phase high voltage power supply module A7.

a. The 27.5-volt dc power supply module A8 does not contain a filament transformer. Thus, RT-648/ARC-94 vacuum tubes are heated with alternating current, and RT-698/ARC-102 vacuum tubes are heated with direct current.

b. The 27.5-volt dc power supply contains both an inverter and a rectifier. The rectifier is a single-phase circuit.

c. In place of a step-start relay, the 27.5-volt dc power supply module A8 employs a delay of 30 seconds provided by thermal relay K7 in the chassis circuit. This delay withholds high voltage until the tube heaters have come to normal temperature.

Additional circuit details common to both high-voltage power supply modules are given with reference to figure 8-4, as follows:

a. The common return lead for high voltage is in series with 10-ohm resistors A8R12, A8R21, the overload winding of relay A8K2, and ground. The voltage drop across the A8K2 winding and A8R21, in series, is proportional to total current and is taken from A8P1-15 for metering of PA MA and for AM-tgc, the latter being the source for drive control to power amplifier module A11 should plate current become abnormal. If plate current increases to serious proportions (750 to 800 ma), the overload winding of A8K2 opens contacts 7 and 6, disrupting the high voltage. Contacts 4 and 5 close and latch relay A8K2 so that contacts 7 and 6 remain open as long as a ground is supplied at A8P1-13. This ground was originally established by keying.

b. Resistors A8R13 through A8R16 comprise a bleeder which samples a portion of the +1500-volt output for metering. The meter panel schematic (sheet 1 of figure 7-1) contains the balance of detail parts for this circuit that are required for PA MA monitoring.

c. Filter A8FL1 is a low pass filter which attenuates rf so that it does not enter the high voltage circuits.

d. Diodes perform various functions in the high voltage circuits. In figure 8-4, diodes A8CR2 through A8CR5 suppress the transients generated by the rapid collapse of the A8T2 magnetic field in the generation of square waves. These diodes then protect transistors A8Q1 and A8Q2. Diodes are used across relay contacts and windings to suppress transients which are the cause of radio frequency interference.

Figure 7-1 represents the chassis schematic diagram of RT-698/ARC-102 by difference data concerning the connections to the 27.5-volt dc high-voltage power supply module A8. The figure continues to represent the chassis schematic diagram for RT-648/ARC-94 which uses the three-phase high-voltage power supply A7.

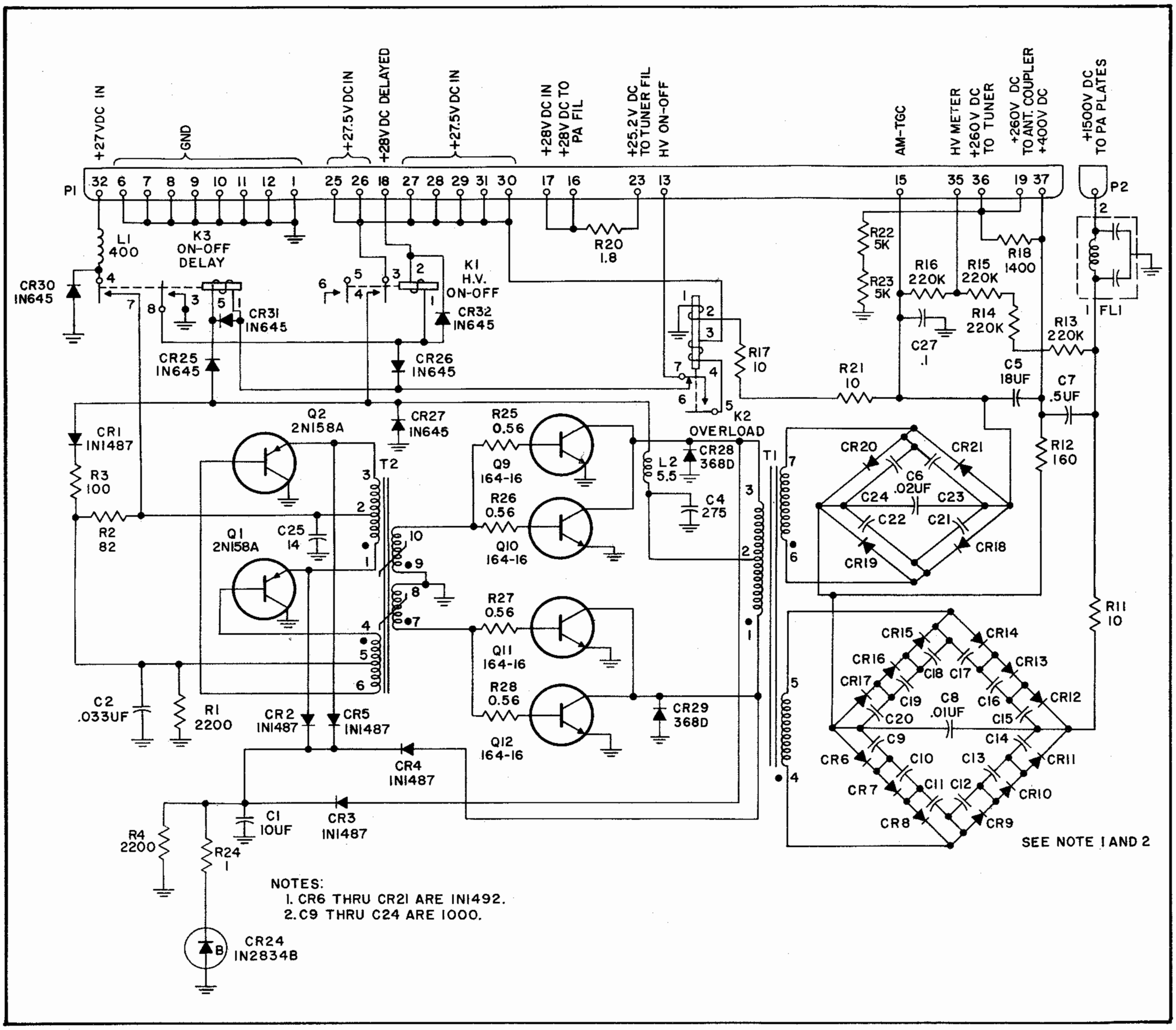


Figure 8-4. 27.5-Volt DC High-Voltage Power Supply Module A8, Schematic Diagram

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