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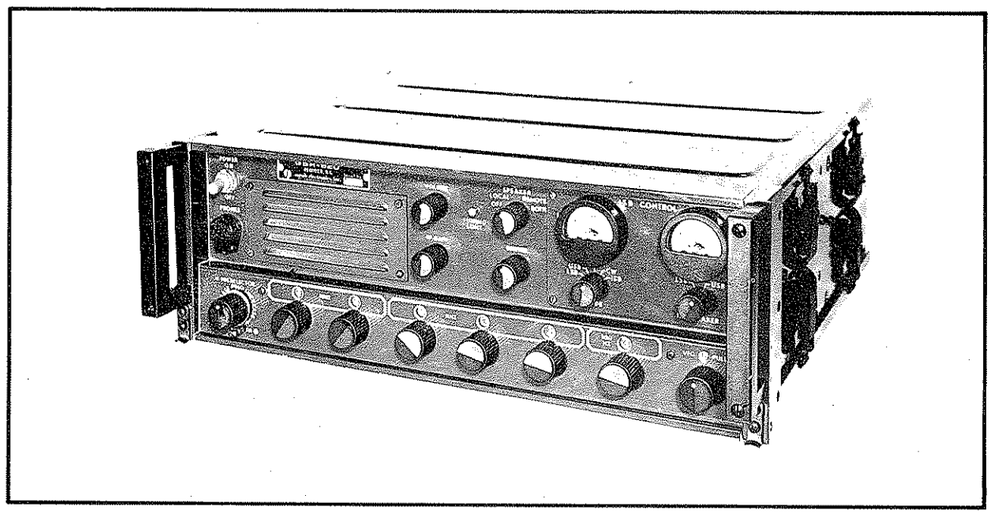

OPERATION AND MAINTENANCE MANUAL

GSR-920

RECEIVER HF/SSB SYNTHESIZED

SECOND EDITION SEPTEMBER 1979
MANUAL PART TM6028000604

This Policy effective 1 June 1980. Supercedes all others.

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Part #

6028000604 Maintenance Manual
6028000612 Installation Manual

TABLE OF CONTENTS

Section		Page
I	GENERAL INFORMATION	
	1.1 Scope	1-1
	1.2 Receiver Description	1-1
	1.3 Technical Specifications	1-4
	1.4 Equipment Supplied	1-5
	1.5 Optional Equipment	1-5
II	INSTALLATION	
	2.1 General	2-1
	2.2 Unpacking and Inspection	2-1
	2.3 Reshipping	2-1
	2.4 Installation and Mounting	2-2
	2.5 Antennas	2-4
	2.6 Power Requirements	2-6
	2.7 Installation Checkout	2-10
III	OPERATION	
	3.1 General	3-1
	3.2 Front Panel Operating Controls	3-1
	3.3 Rear Apron Components	3-5
	3.4 Operating the GSR-920 Receiver	3-5
IV	THEORY OF OPERATION	
	4.1 General	4-1
	4.2 Synthesizer–1A4	4-1
	4.2.1 General	4-1
	4.2.2 Spectrum Generator	4-2
	4.2.3 Low Digit Generator	4-5
	4.2.4 Translator	4-6
	4.2.5 V.H.F. Divider	4-10
	4.2.6 V.C.O.	4-12
	4.2.7 Synthesizer Mother Board	4-13
	4.2.8 Temperature Compensated Crystal Oscillator (TCXO)	4-14
	4.3 Receiver	4-15
	4.3.1 General	4-15
	4.3.2 VHF Mixer Board	4-16
	4.3.3 IF/Filter Board	4-19
	4.3.4 Audio Board	4-20
	4.3.5 Speaker Driver	4-21
	4.3.6 Receiver/Exciter Mother Board	4-21
	4.4 Power Supply	4-21
	4.4.1 General	4-21
	4.4.2 12 VDC Regulator and 21 VDC Output	4-21
	4.4.3 5 VDC Regulator	4-22
	4.4.4 D-C Relay Turn on	4-22
	4.4.5 D.C. Inverter	4-22
	4.5 Filter Module	4-23
	4.5.1 Odd and Even Channel Filter Boards	4-23
	4.5.2 Motor Control Board	4-23
	4.6 Preselector Module 1A5 (Optional)	4-23
	4.6.1 General	4-23
	4.6.2 Circuit Description	4-23
	4.6.3 Receiver Protector (Optional)	4-24
	4.7 Front Panel	4-24
	4.7.1 General	4-24
	4.7.2 Frequency Digit Switches	4-24
	4.7.3 VFO Control	4-24
	4.7.4 Volume and RF Gain Controls	4-24
	4.7.5 Dimmer	4-25
	4.7.6 Speaker Switch	4-25
	4.7.7 Speaker Driver	4-25
	4.7.8 Audio System	4-25
	4.7.9 Control Head, SSB	4-26
	4.7.10 Control Head, ISB	4-26
	4.8 Rear Apron	4-26
	4.8.1 General	4-26
	4.8.2 Distribution Amplifier	4-26
	4.9 Remote Speaker	4-27

TABLE OF CONTENTS (Cont.)

Section		Page
V	MAINTENANCE AND REPAIR	
	5.1 General	5-1
	5-2 Preventive Maintenance	5-1
	5.3 Cover Removal	5-1
	5.4 Performance Test	5-1
	5.4.1 Test Equipment	5-1
	5.4.2 Preliminary	5-1
	5.4.3 Power Supply	5-3
	5.4.4 Front Panel and Mainframe	5-3
	5.4.5 Receiver Test	5-4
	5.5 Synthesizer	5-5
	5.5.1 Fault Analysis	5-5
	5.5.2 Synthesizer Subassembly Testing and Alignment	5-11
	5.6 Receiver Board Alignment	5-28
	5.6.1 V.H.F. Mixer Board	5-28
	5.6.2 IF/Filter Board	5-28
	5.7 Fault Analysis Table	5-29
	5.7.1 If ISB Installed	5-30
	5.7.2 If Preselector Installed	5-30

LIST OF ILLUSTRATIONS

Figure		Page
1.1	GSR-920 Major Assembly Locations	1-3
2.1	Outline Configurations	2-2
2.2	Typical Vehicular Installation	2-2
2.3	Rack Mounted Installations	2-3
2.4	Shock Mount Assembly and Details	2-4
2.5	Base Station Installation	2-5
2.6	Whip Antenna	2-5
2.7	Doublet Antenna	2-6
2.8	Inverted "V" Antenna	2-6
2.9	Long Wire Antenna	2-7
2.10	Antenna Mounting	2-7
2.11	A.C. Line Voltage Range Table	2-8
2.12	115 VAC Power Cord Schematic	2-9
2.13	230 VAC Power Cord Schematic	2-9
2.14	GSR-920 Fuse Table	2-10
2.15	Power Supply Wiring - 115 V or 230 VAC Inputs	2-11
2.16	Power Supply Wiring - 132V or 265 VAC Inputs	2-11
2.17	D. C. Inverter Connections to Power Supply Terminal Strip 1A6TB2	2-12
2.18	D.C. Power Connector Schematic.	2-13
2.19	GRS-902 Remote Speaker Interconnect Diagram	2-13
2.20	GRS-902 Remote Speaker Outline Configuration	2-14
3.1	GSR-920 Receiver Front Panel, Standard	3-1
3.2	GSR-920 Receiver Front Panel, ISB Optional	3-2
3.3	GSR-920 Rear Panel	3-4
4.1	Overall Block Diagram	4-3
4.2	Synthesizer Block Diagram and Details	4-7
4.3	Receiver Section Block Diagram	4-17
4.4	CA3053 Schematic	4-19
5.1	GSR-920 Cover Disassembly	5-1
5.2	Synthesizer Mechanical Assembly	5-31
5.3	GSR-920 Top View and Table of Assemblies	5-33
5.4	Main Frame Wiring	5-35
5.5	Spectrum Generator (1A4A1) Schematic	5-37
5.6	Low Digit Generator (1A4A2) Schematic	5-39
5.7	Translator (1A4A3) Schematic	5-43
5.8	V.H.F. Divider (1A4A4) Schematic	5-45
5.9	VCO (1A4A5) Schematic	5-47
5.10	Synthesizer Mother Board (1A4A6) Schematic	5-49
5.11	V.H.F. Mixer (1A3A1) Schematic.	5-51
5.12	IF/Filter (1A3A2) Schematic.	5-53
5.13	Audio Board (1A3A4) Schematic	5-55
5.14	Speaker Driver (1A1A1) Schematic	5-57
5.15	Receiver Mother Board (1A3A7) Schematic	5-59
5.16	Power Supply (1A6) Schematic	5-61
5.17	D.C. Inverter (1A6A2) Schematic	5-63
5.18	Filter Module Assembly (1A5)	5-62
5.19	Receiver Filter Schematic	5-65
5.20	Preselector Schematic	5-67
5.21	Preselector Mechanical	5-68
5.22	Front Panel Wiring Diagram	5-69
5.23	Audio System Wiring Diagram	5-70
5.24	Control Head SSB Schematic.	5-71
5.25	Control Head, ISB, Schematic	5-72
5.26	Distribution Amplifier Schematic	5-73
5.27	Remote Speaker Schematic GRS-902	5-74

LIST OF TABLES

Section		Page	Section		Page
2.1	Panel and Mating Connectors	2-15	5.4	100 KHz Switch	5-8
4.1	Frequency Digit Switches	4-25	5.5	10 KHz Switch	5-8
5.1	Front Panel Control Test Positions	5-2	5.6	1 KHz Switch	5-9
5.2	10 MHz Switch	5-7	5.7	100 Hz Switch	5-9
5.3	1 MHz Switch	5-7	5.8	Coarse Steering Voltage Readings	5-10

SECTION 1
GENERAL INFORMATION

1.1 SCOPE

This instruction manual contains the necessary information to install, operate and service the GSR-920 Receiver.

1.2 RECEIVER DESCRIPTION

1.2.1 GENERAL

The GSR-920 is a high quality single sideband receiver covering the frequency range of 1.6000 to 29.9999 MHz. Modes of operation include Lower Sideband (LSB), Upper Sideband (USB), Amplitude Modulation (AM), Continuous Wave (CW), and Independent Sideband (ISB) optional. Operation in the Frequency Shift Keying (FSK) and Facsimile (FAX) Modes are also possible with the addition of suitable modems. The receiver is mechanically and electrically designed to meet stringent military specifications for shock, vibration and protection from outside environments. The unit is completely sealed (dust free) utilizing neither blowers nor ventilating louvers, making it ideal for mobile as well as base station use. It can operate over wide temperature extremes (-30° to + 65°C) and up to 100% relative humidity.

The GSR-920 is composed of six major subassemblies, (1) front panel 1A1, (2) mode control panel 1A2, (3) receiver 1A3, (4) synthesizer 1A4, (5) filter module 1A5 or preselector (optional), (6) power supply 1A6. See Figure 1.1 for major assembly location.

1.2.2 FRONT PANEL – 1A1

The front panel contains all controls necessary to operate the receiver. All wiring from the panel terminates in two plug-in connectors (meter panel lamp terminates in a quick disconnect connector).

This allows the front panel to be easily removed for servicing or remotely located and connected to the receiver by a control cable. This method of construction thus allows the front panel to be used as a remote control unit over a multi-conductor cable. A cut out in the front panel accepts the SSB control panel (standard) or the ISB control panel (optional).

1.2.3 CONTROL PANEL – (1A2)

This unit plugs into the front panel and may be of two different configurations. The SSB panel as supplied with the standard GSR-920 (no ISB option) contains 1 meter and mode switch for LSB, USB, AM and CW operation. When the ISB option is included in the receiver, the panel contains two meters for monitoring LSB and USB signals and an additional position, "ISB", on the mode switch for simultaneous reception of LSB and USB signals, and an ISB SPEAKER switch used to connect the output of either channel to the speaker.

1.2.4 RECEIVER – 1A3

The receiver module contains all of the basic circuitry of the receiver. The 1st I.F. frequency is well above the 30 MHz upper limit of the receiver - providing the unusually high spurious signal rejection found only in this modern frequency scheme. The extensive use of integrated circuits provides an unusually high level of uniformity and reliability. High quality crystal filters are employed both in the "front end" of the radio and in the I.F. section for sideband selection. The Receiver is fully contained on three plug-in printed circuit boards plus a mother board and employs fully modularized construction. If the ISB option is installed 2 additional plug-in boards are included; a separate filter board for LSB operation and a second audio board.

1.2.5 SYNTHESIZER – 1A4

Frequency control is by means of a digital frequency synthesizer providing 100 Hz frequency steps. In addition, the operator can select a high stability VFO mode of operation, which provides

continuous tuning between the 100 Hz synthesized increments. All frequencies in the receiver are derived from a Temperature Compensated Crystal Oscillator (TCXO) which provides instant on-frequency operation with no warmup. The frequency stability is better than ± 1 X 10^{-6} Hz over the full specified ambient temperature range of the radio. The long term stability is ± 5 x 10^{-7} Hz per year; permitting long intervals between calibration.

For the most exacting applications, Sunair offers a proportional control oven frequency standard (part no. 5024-0137) which is a direct plug-in replacement for the TCXO. With the oven standard, frequency stability is better than ± 1 x 10^{-8} Hz over the full specified ambient temperature range of the radio.

The Synthesizer is fully modularized for ease of maintenance. High reliability is assured through the extensive use of both digital and linear integrated circuits. The Synthesizer is fully contained on five plug-in printed circuit boards plus a mother board.

1.2.6 FILTER MODULE – (1A5)

The filter module is supplied in each GSR-920 unless replaced by the optional preselector. The filter module is composed of three p-c boards housed in a removable module. The filter selectivity is divided into 8 bands from 1.6 to 29.999 MHz and each filter section is composed of a high pass and a low section combined to form a band pass. These filters are mounted on 2 of the p-c boards. The third p-c board contains the motor and its control circuitry which are required to select the correct filter. Filter selection is automatically accomplished by the two MHz frequency selector switches mounted on the front panel.

1.2.7 POWER SUPPLY – 1A6

The GSR-920 will operate from power sources of 115 or 230 volt 50-60 Hz A.C. and in addition from 13 or 26 volt D.C. sources (either positive or negative ground) with the optional, self contained, D.C. module. The same receiver can operate from both A.C. and D.C. power sources, with the D.C. Module installed, by changing the external power input cable. The selection of 13 or 26 volt D.C. operation is easily accomplished by changing connections in the power supply. The power supply employs fully modularized construction for ease of maintenance.

1.2.8 PRESELECTOR MOUDLE

For those applications that require a higher order of front end selectivity (such as full duplex operation) an optional preselector may be installed in place of the standard filter module.

The preselector is automatically band switched by the MHz front panel switches and fine tuned by the operator while monitoring the "S" meter or speaker volume level.

Use of the preselector in place of the standard band-pass filter module provides additional protection against blocking and cross modulation resulting from strong interfering signals.

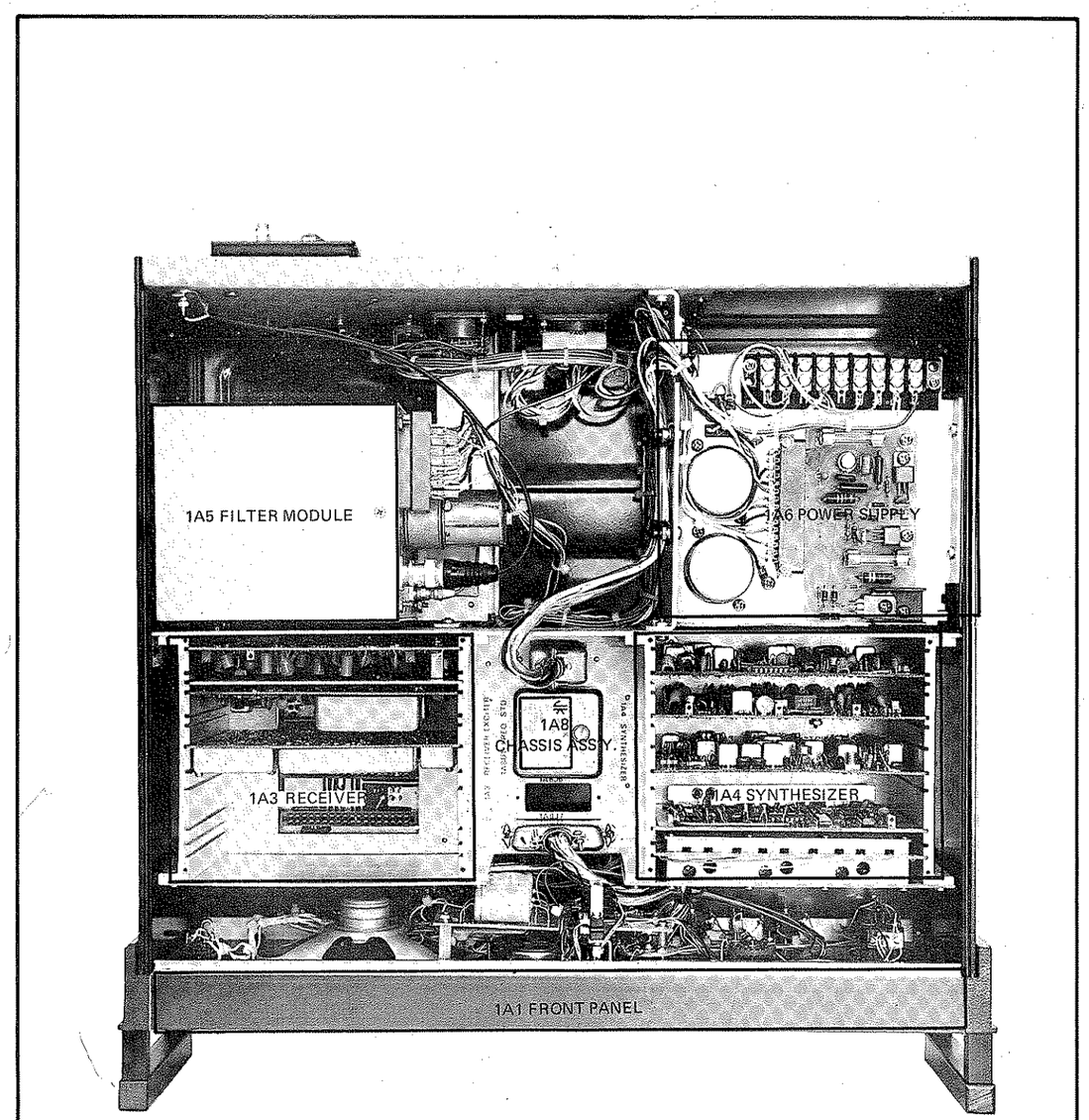


Figure 1.1 GSR-920, Major Assembly Locations

1.3 TECHNICAL SPECIFICATIONS

FREQUENCY RANGE: 1.6 to 29.999 MHz, 100 Hz steps plus VFO

CHANNELS: 284,000, synthesized

FREQUENCY STABILITY: ± 1 x 10^{-6} over temperature range (TCXO) ± 1 x 10^{-8} proportional oven (optional)

OPERATING MODES: USB, LSB, AME, CW (FSK and FAX with optional external modems) ISB (optional)

RF INPUT IMPEDANCE: Designed for nominal 50 ohms, unbalanced

METERS AND INDICATORS: Meter(s) monitor received signal strength. Lamps indicate VFO in use, low frequency limit and tuning limit for optional preselector

FRONT PANEL CONTROLS: Digital frequency select (6), VFO, Volume, RF gain, Speaker select, Power on/off, lamp dimmer, Mode, ISB speaker (optional), preselector (optional)

POWER INPUT: AC: 115/230 VAC, ± 15%, 48-65 Hz, 50 watts
DC: 13/26 VDC, ± 10%, 55 watts

DIMENSIONS: 6 x 18.25 x 18 inches HWD (15.2 x 46.6 x 45.7 CM HWD)

WEIGHT: 41 pounds, (18.6 kgs)

TEMPERATURE: Per MIL-STD-810B, method 501, procedure II, (-30°C to +68°C)

HUMIDITY: Per MIL-STD-810B, method 507, procedure I (+70°C, 95%)

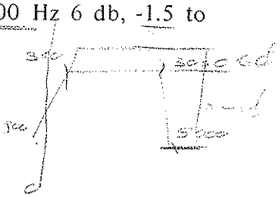
SHOCK: Per MIL-STD-810B, method 516.1, procedure I, (15G, 18 shocks)

VIBRATION: Per MIL-STD-810B, method 514.1 procedure VIII, curve V. (5 to 500 Hz, 1.3g.)

ENCLOSURE: Per MIL-STD-810B, splash proof

SENSITIVITY: SSB: 0.5 uv into 50 ohms for 10 db S+N/N. 1 uv below 2 MHz.
AM: 3.0 uv into 50 ohms for 10 db S+N/N. 5 uv below 2 MHz

SELECTIVITY: 300 to 3000 Hz 6 db, -1.5 to 5.0 kHz 50 db



IF REJECTION: 70 db

IMAGE REJECTION: 80 db

AUDIO OUTPUTS: (a) 2 watts to either internal or external 8 ohm speaker at less than 10% distortion
(b) Balanced 600 ohm, adjustable to +10dbm at less than 10% distortion
(c) 600 ohm phone unbalanced

AUTOMATIC GAIN CONTROL: Fast Attack, slow release, threshold 5 uv nominal, 15 db audio change for 100 db rf input change

INTERNAL SPURIOUS RESPONSE: 99.5% of channels below equivalent 0.2 uv noise input at antenna terminals

EXTERNAL SPURIOUS RESPONSE: -65 db, non-harmonically related

BLOCKING (DESENSITIZATION): Reference 20 db S+N/N. For 3 db degradation in S+N/N.
Preselector Out: 20,000 uv emf removed ± 30 kHz
Preselector In: Typically 1V emf, removed ± 10% from Fo

CROSS MODULATION: 100 uv desired signal, output NLT 10 db below reference with:
Preselector Out: Typically 100,000 uv emf removed + 20 kHz
Preselector In: Typically 2V emf removed ± 10% from Fo

1.4 EQUIPMENT SUPPLIED

The following table is a list of equipment, with their appropriate Sunair part numbers, supplied with the GSR-920 Receiver.

		Sunair Part No.
1.4.1	Receiver, GSR-920 with 115/230 volt power supply.	6028-0000 6028000051 GREY 6028000094 GREEN
1.4.2	Operating and Maintenance Manual.	6028-0006 6028000604
1.4.3	Power Cord Assembly, 115 V A.C. OR Power Cord Assembly, 230V A.C.	6028-0017 6028001791 6028-0018 6028001899
1.4.4	Ancillary Kit, consisting of: Extender card (to service P.C. boards) Spare bulbs, Tuning tools Accessory and antenna connectors.	6028-0004 6028000451 115VAC 6028000493 230VAC

1.5 OPTIONAL EQUIPMENT—NOT SUPPLIED

The following table of accessories and spares are NOT supplied but are made available by Sunair Electronics, Inc. as compatable equipment for the GSR-920. Part numbers and descriptions are given to facilitate ordering.

1.5.1	Independent Sideband (ISB) Operation (Provides simultaneous reception of upper and lower sideband. Option includes additional IF filter and audio p-c boards and plug-in control panel for mode selection and meters for dual channel monitoring)	6028-0045 602800455 3 GREY 602800459 6 GREEN
1.5.2	D.C. Inverter Module with power cord and appropriate fuse. (Powers the GSR-920 from either 13V or 26V DC while still permitting operation from 115/230 AC mains. Module mounts inside GSR-920)	6028-0215 602802159 8

		Sunair Part No.	
1.5.4	Preselector Module. (Internally installed in place of standard filter module. Provides more front-end selectivity and greater protection from cross modulation)	6028-0500	6028060091
1.5.5	High Stability Proportional Oven Frequency Standard (replaces TCXO standard inside GSR-920 to provide better than 1 x 10^{-8} Hz frequency stability over full ambient temperature range)	5024-0137	5024013701
1.5.6	Rack Mount Kit (adapts GSR-920 to mount in a 19 inch wide rack at least 22 inches deep, includes rack slides)	5024-0040	5024004051 GREY 5024004094 GREEN
1.5.7	Shock Mount Kit (includes mounting plate and shock isolators, recommended for mobile applications)	5024-0025	5024002598
1.5.8	Headset (includes cable and connector, to plug in front panel audio jack)	84020	0840200005
1.5.9	Coaxial Cable type RG-58/U (recommended for connecting antenna to receiver)	58813	0588130001
1.5.10	Doublet Antenna Kit	99624	0996240004
1.5.11	75 foot Long Wire Antenna Kit	99920	0999200003
1.5.12	150 foot Long Wire Antenna Kit	99921	0999210009
1.5.13	16 foot Mobile Fiberglass Whip Antenna (use with 1.5.14 or 1.5.15)	71295	0712950001
1.5.14	Heavy Duty Strap Bumper Mount (for 16 foot antenna, item 1.5.13 above)	71573	0715730002
1.5.15	Heavy Duty 60° Ball Mount (for 16 foot antenna, item 1.5.13 above)	71574	0715740008
1.5.16	23 foot Fiberglass Whip Antenna with Flange Base, self supporting	71576	0715760009
1.5.17	23 foot Fiberglass Whip Antenna without base	71298	0712980008
1.5.18	Laydown Mount for 23 foot antenna item 1.5.17 above	71299	0712990003

		Sunair Part No.
1.5.19	Depot Spare Parts Kit for GSR-920 (to support 3 to 5 units for 2 to 4 years)	6028-9000 6028900095
1.5.20	Depot Spare Parts Kit for Preselector	6028-9010 6028901091
1.5.21	Depot Spare Parts Kit for D-C Invertor	6028-9020
1.5.22	Remote Speaker, GRS-902	6028-8500 6028850055 GREY 6028850098 GREEN
1.5.23	Cable for GRS-902	5024-9050 6028851001
1.5.24	Field Module Kit (PC Board)	6028-9005 6028900508

SECTION 2

INSTALLATION

2.1 GENERAL

Section two contains all necessary instructions for the unpacking, inspection, and if necessary, reshipping of damaged equipment or parts. In addition, further information regarding location and mounting considerations, power requirements, antenna and ground system hook-ups and final checkouts after installation are also provided.

2.2 UNPACKING AND INSPECTION

Unpack and inspect all parts and equipment as soon as received.

NOTE

Be sure to retain the carton and it's associated packing materials should it be necessary to reship damaged equipment.

Do not accept a shipment where there are visible signs of damage to the cartons until a complete inspection is made. If there is a shortage or any evidence of damage is noted, insist on a notation to that effect on the shipping papers before signing the receipt from the carrier.

If concealed damage is discovered after a shipment has been accepted, notify the carrier immediately in writing and await his inspection before making any disposition of the shipment. A full report of the damage should also be forwarded to Sunair. Include the following:

(a) Order number
(b) Model and serial number
(c) Name of transportation agency

When Sunair receives this information, arrangements will be made for repair or replacement.

2.3 RESHIPPING

The shipping carton for the GSR-920 has been carefully designed to protect the receiver and its accessories during shipment. This carton and its associated packing materials should be used to reship the radio.

If the original shipping carton is not available, be sure to carefully pack each unit separately, using suitable cushioning material where necessary. Very special attention should be given to providing enough packing material around controls, connectors, and other protrusions from the radio. Rigid cardboard should be placed at the corners of the equipment to protect against denting.

When returning one or more subassemblies for repair, you must ship AIR PARCEL POST consigned to:

SUNAIR ELECTRONICS, INC.
3101 SW 3rd Avenue
Ft. Lauderdale, Florida 33315
U.S.A.

Plainly mark with indelible ink all mailing documents as follows:

U.S. GOODS RETURNED FOR REPAIR
VALUE FOR CUSTOMS - $100.00

and be sure to mark on all sides of the package

"FRAGILE - ELECTRONIC EQUIPMENT"

NOTE

Before shipping, carefully inspect the package to be sure it is marked properly and is securely wrapped.

2.4 GENERAL INSTALLATION AND MOUNTING INFORMATION

General installation procedures and mounting requirements are given for the GSR-920 receiver. Satisfactory operation of this equipment will depend upon the care and throughness taken during installation.

2.4.1 GENERAL INSTALLATION

The GSR-920 can be installed in either a base station (table top or rack mount), mobile station or a marine station. Installation is not critical, however normal care and some planning is necessary in order to insure a neat and professional installation. Following the suggestions and drawings contained in this section will greatly aid in avoiding problems that may arise.

2.4.2 BASE STATION INSTALLATION

The GSR-920 may be installed simply by setting it on a table or desk top whose location is convenient for access to a-c power and the antenna lead. The outline dimensions of the receiver are shown in

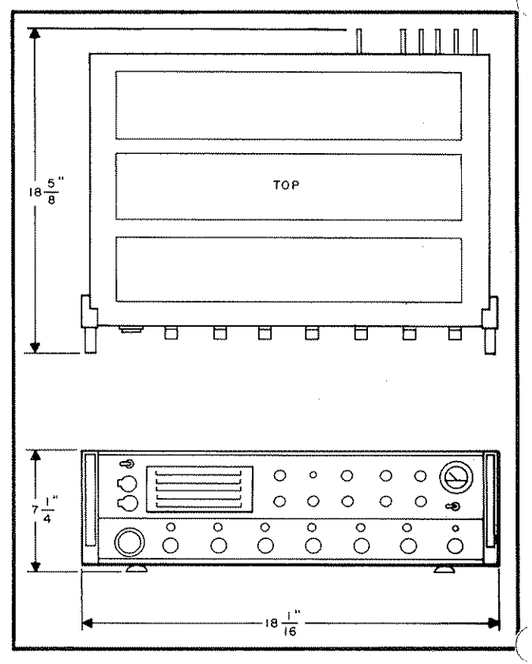


Figure 2.1 Outline Configuration

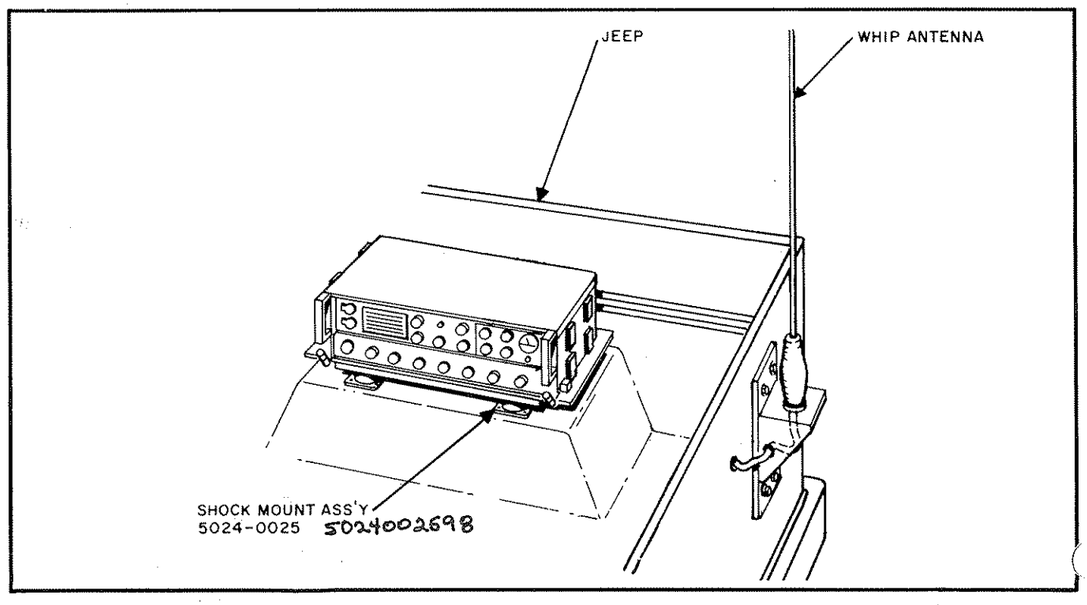


Figure 2.2 Typical Vehicular Installation

Figure 2.1. The unit is also designed for rack mounting with slides in a 19 inch rack with a minimum depth of at least 22 inches. This installation is shown in Figure 2.3 and the rack mount kit listed in paragraph 1.5 must be ordered for this installation.

2.4.3 MOBILE INSTALLATION

The receiver is designed for installation in a mobile vehicular or shelter station that utilizes either a-c or d-c power. A typical vehicular installation is shown in Figure 2.2. If the vehicular station will be traveling over rough terrain it is recommended that the receiver be mounted on the shock rack listed in paragraph 1.5. Shock mount details are shown in Figure 2.4. If the mobile installation power source is d-c, the d-c inverter module must be installed in the receiver. This option is listed in paragraph 1.5.

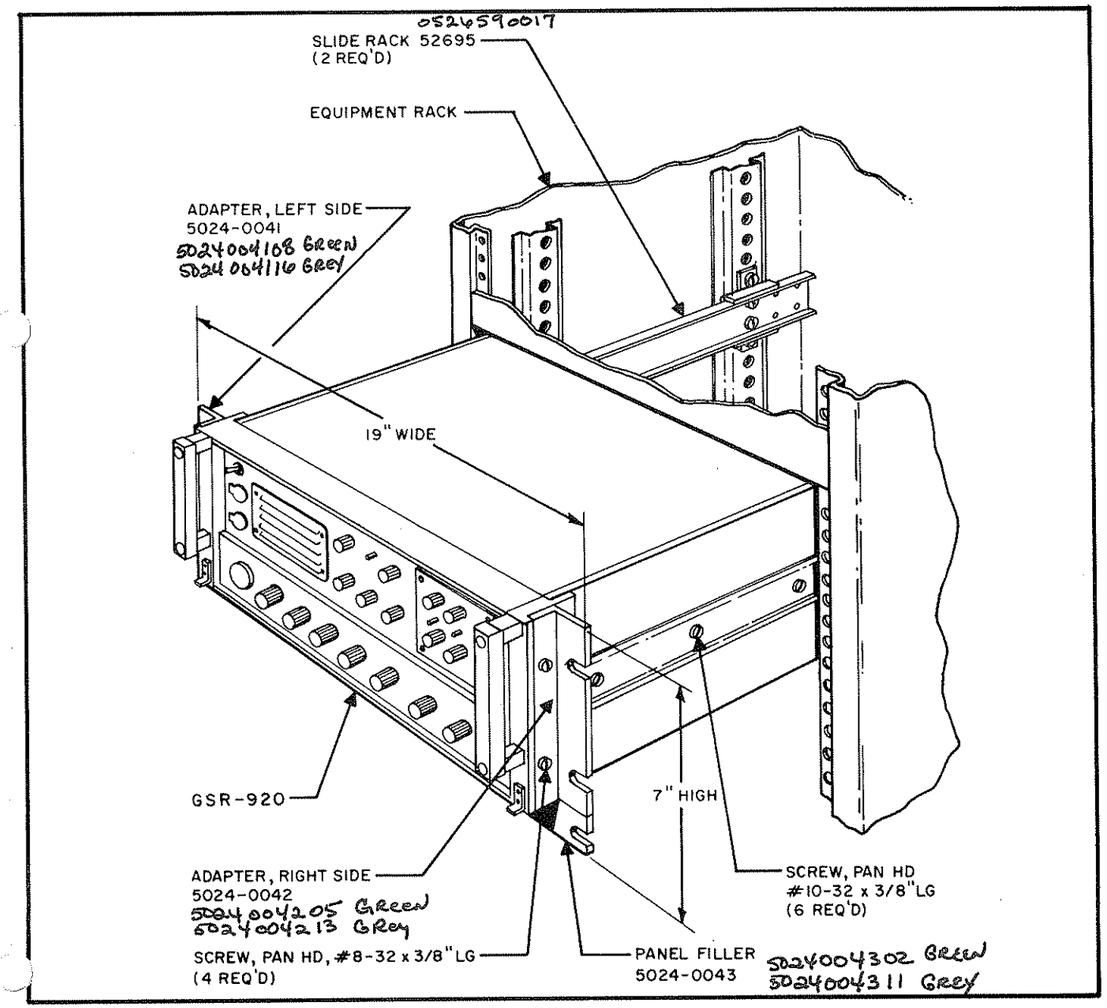


Figure 2.3 Rack Mounted Installation

2.4.4 REMOTE SPEAKER, GRS-902.

Refer to Figures 2.19 and 2.20.

If the GRS-902 remote speaker accessory is to be installed using the interconnect cable, refer to Figure 2.19. Figure 2.20 is an outline drawing of the unit also showing the bracket mounting dimensions.

2.5 ANTENNAS

An adequate antenna must be provided so as not to degrade the capability of the receiver. The choice of antenna is the most important consideration to be made about the type of installation. Included in this section are drawings representing various types of antennas for base and mobile applications. The antennas listed in the Optional Equipment Section, paragraph 1.5, plus any good log periodic designed to cover the necessary frequency range will be adequate.

2.5.1 BASE STATION ANTENNAS

The base station installation allows the greatest choice of antenna types that may be used. The

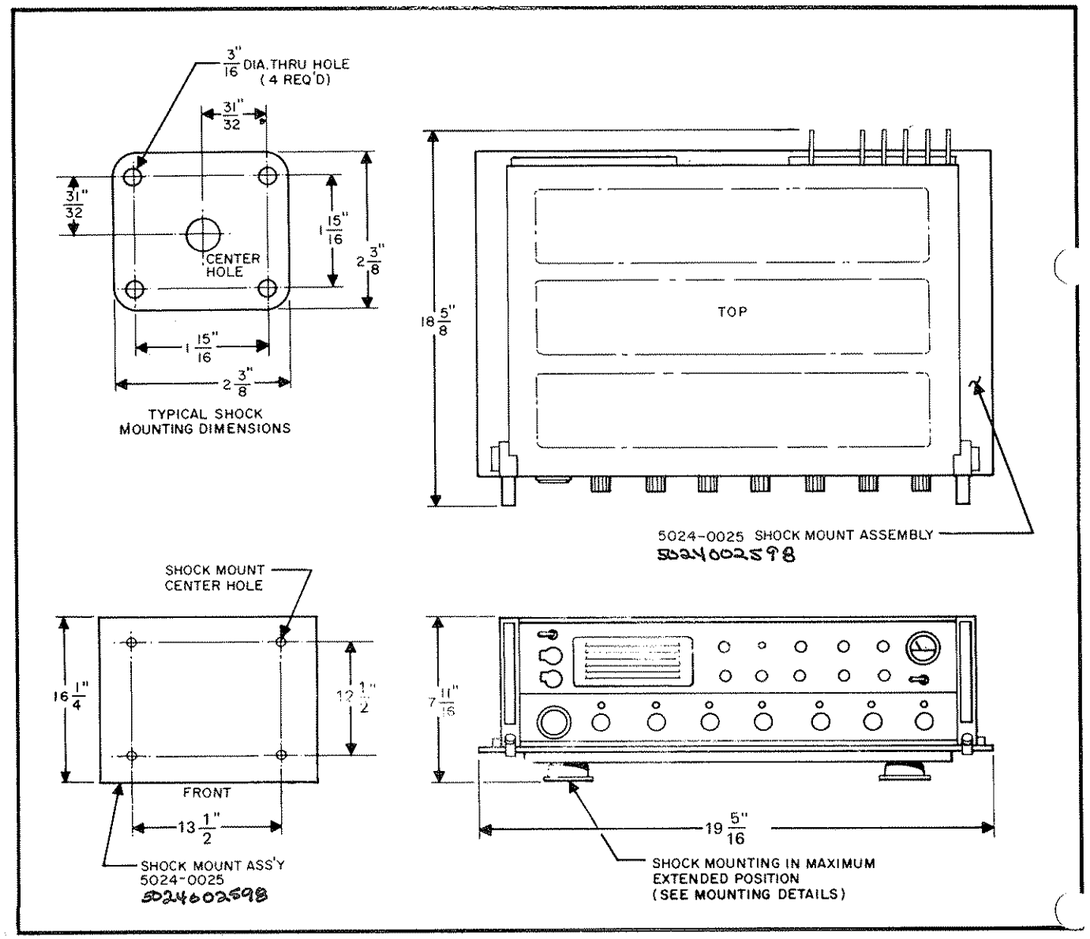


Figure 2.4 Shock Mount Assembly and Details

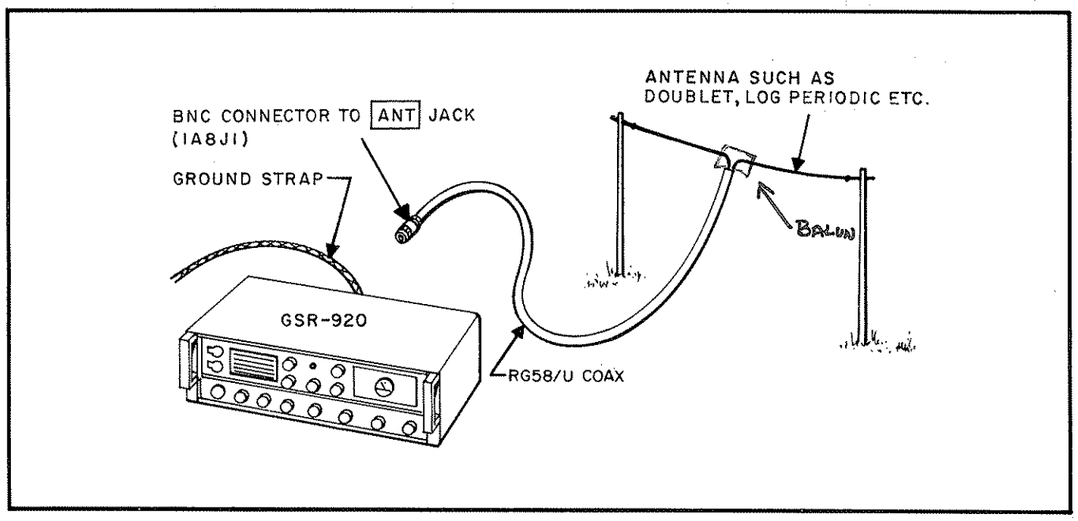


Figure 2.5 Base Station Installation

antenna that would yield optimum performance would be the stearable log periodic. However it is expensive and not easily errected and requires about a 75 to 100 foot radius of free area.

If omni directional coverage is required the 23 foot whip antenna will provide satisfactory performance. If some directivity is acceptable the doublet antenna or the inverted "V" antenna will provide good results. The simplest antenna to erect but the one with the least performance is the long wire antenna. This antenna exhibits a wide impedance variation and as in the doublet maximum sensitivity is at right angles to the antenna axis. However, if the requirements are not too stringent the long wire antenna may be entirely satisfoctory. Illustrations of typical base station antennas are shown in Figures 2.5 through 2.9.

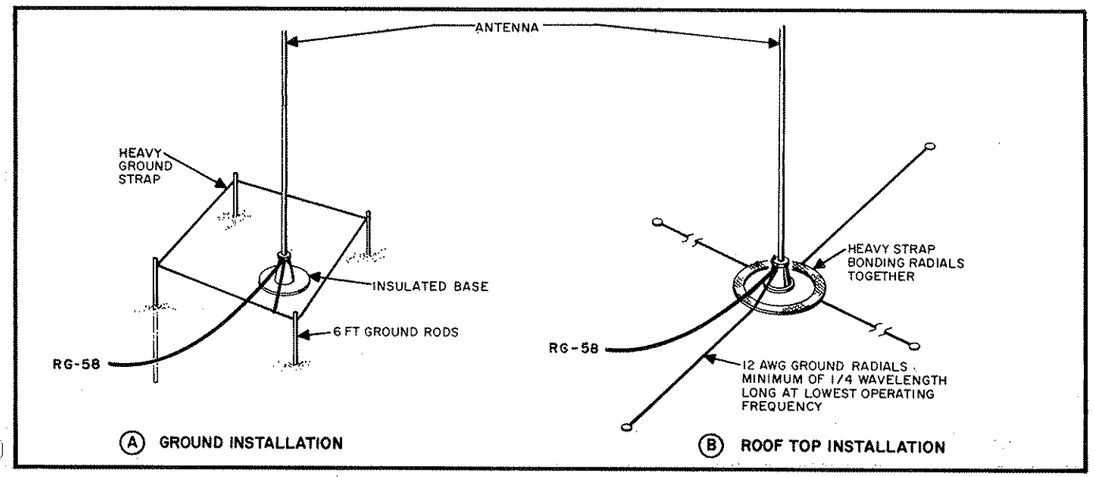


Figure 2.6 Whip Antenna

2.5.2 MOBILE STATION ANTENNA

There is little choice about the type of antenna to be used in a mobile station. The whip is the only practical antenna with the choice being restricted to the type of whip. The 16 foot antenna listed in section 1.5 is recommended. A typical installation is shown in Figure 2.10.

2.6 POWER REQUIREMENTS

2.6.1 OPERATION FROM ALL A.C. POWER SOURCES

As supplied from the factory, the GSR-920 is wired for continuous operation from 115 or 230 volt ±15%, 50-60 Hz, single phase A.C. power mains.

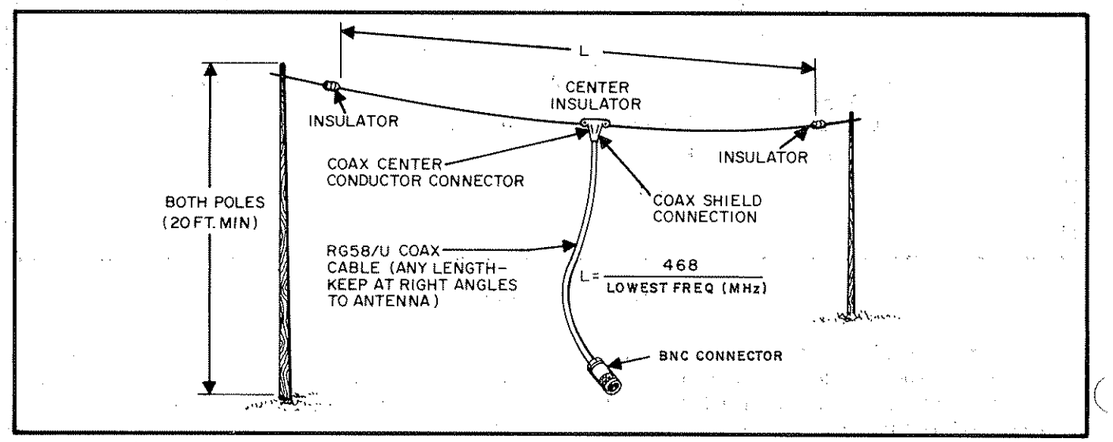


Figure 2.7 Doublet Antenna

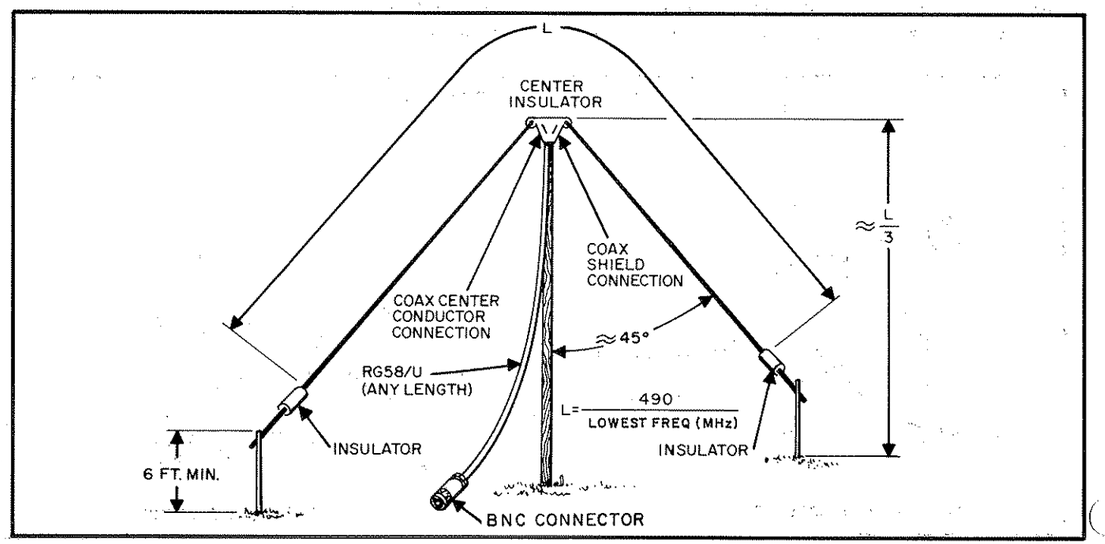


Figure 2.8 Inverted 'V' Antenna

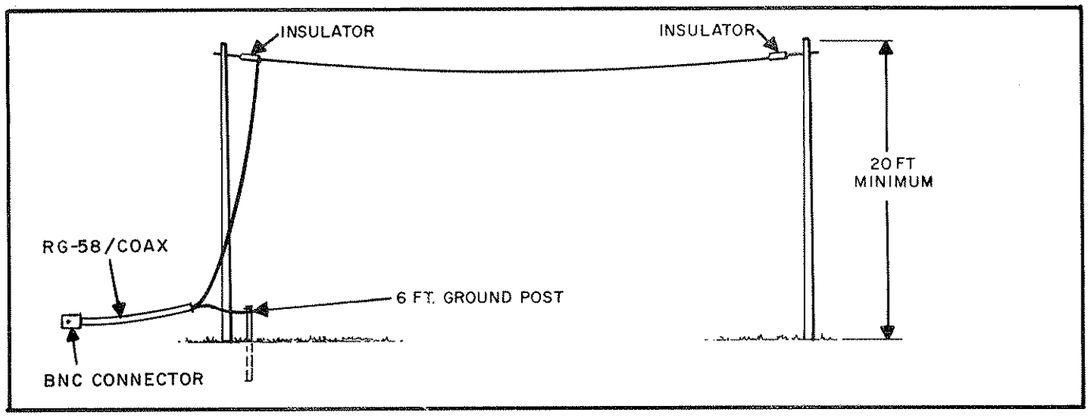


Figure 2.9 Long Wire Antenna

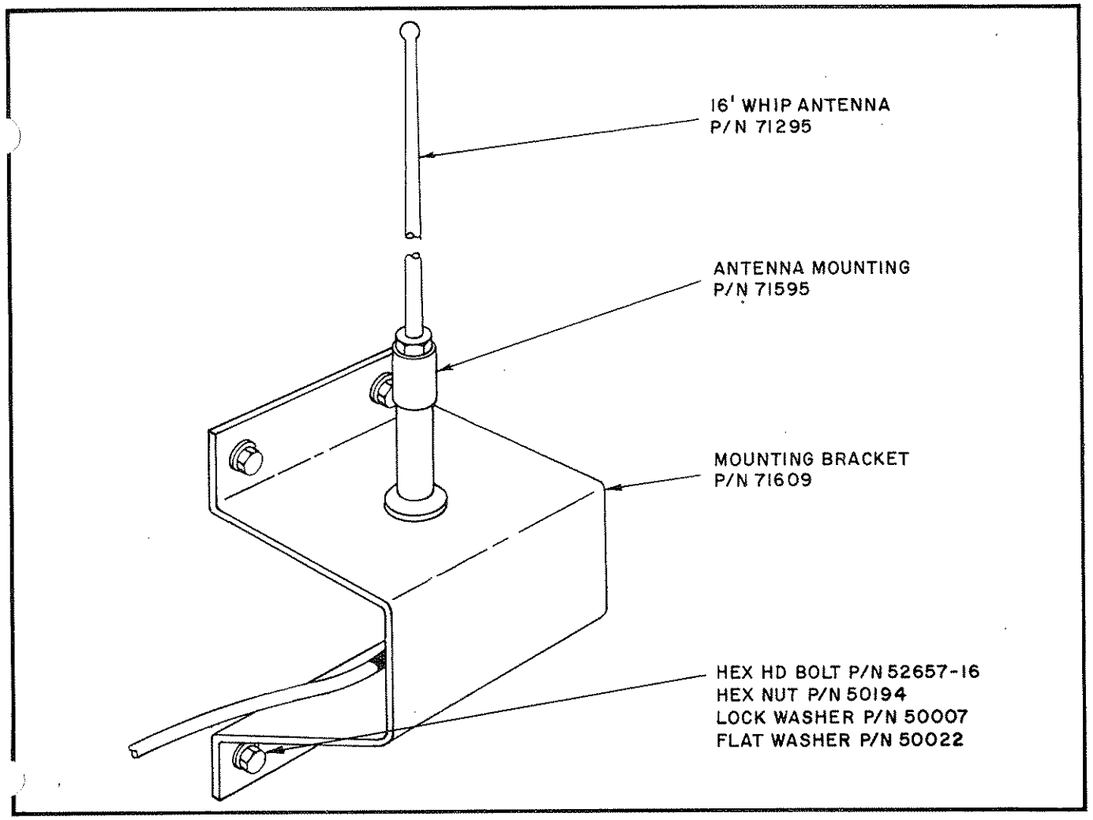


Figure 2-10. Mobile Antenna Mounting

The selection of 115 or 230 volt nominal line voltage is made by the appropriate wiring in the connector of the A.C. power cord assembly. The line voltage range may therefore be easily altered by changing the power cord, (See Figure 2.11). The nominal line voltage is normally specified by the customer at the time of ordering and the proper A.C. power cord is shipped with the radio. Figure 2.12 shows the line cord assembly wiring for 115 volt operation while Figure 2.13 shows the 230 volt wiring.

CAUTION

Check the tag on the line cord before connecting the radio to power mains to insure that the correct voltage has been selected. Permanent damage to the radio may occur if the incorrect power cord is used. Refer to Figure 2.14 and check fuses F1 and F2 on the rear apron to make sure the proper value has been inserted in the fuse holders.

2.6.2 A.C. OPERATION UNDER HIGH LINE VOLTAGE CONDITIONS

The GSR-920 power supply contains a special provision to allow continuous operation at line voltages of 115 or 230 volts +35% or −5%. This feature allows cooler (and therefore more reliable) operation under these high line voltage conditions. The radio may be wired for high line voltage operation by changing connections on terminal strip 1A6TB1 on the power supply (refer to Figures 2.15 and 2.16). The GSR-920 is normally wired at the factory for the nominal 115/230 volt connections.

NOTE

The high line voltage connections must either be requested at the time of ordering or the radio must be rewired in the field to provide for continuous high line voltage operation (see figure 2.16).

2.6.3 OPERATION FROM D.C. POWER SOURCE

If the GSR-920 is equipped with the optional D.C. Inverter Module (Sunair part no. 6028-0215) operation from D.C. power sources of 13 or 26 volts, ±10%, positive or negative ground, is possible. The GSR-920 is unique in that both D.C. and A.C. power supplies can be left in the radio at all times. Selection of D.C. or A.C. operation is accomplished by wiring in the connector of the Power Cord Assembly. The selection of operation from nominal 13 or 26 volt power sources is accomplished by changing connections on terminal strip 1A6TB2 (see Figure 2.17) on the power supply and on the D.C. Inverter assembly 1A6A2. (See paragraph 2.6.4.) The Power Cord wiring for D.C. operation is shown in Figure 2.18.

CAUTION

Before connecting the radio to the D.C. power source, check the marker tag on the regulator heat sink at the rear of the radio to make sure that the proper voltage range has been selected. Permanent damage to the radio can occur if the wrong range is selected.

NOMINAL LINE VOLTAGE	LINE VOLTAGE RANGE	POWER CORD IN USE	REFER TO FIGURES
115	98 to 132	115V	2.12, 2.15
132	112 to 152	115V	2.12, 2.16
230	186 to 264	230V	2.13, 2.15
265	224 to 304	230V	2.13, 2.16

Figure 2.11 A.C. Line Voltage Range Table

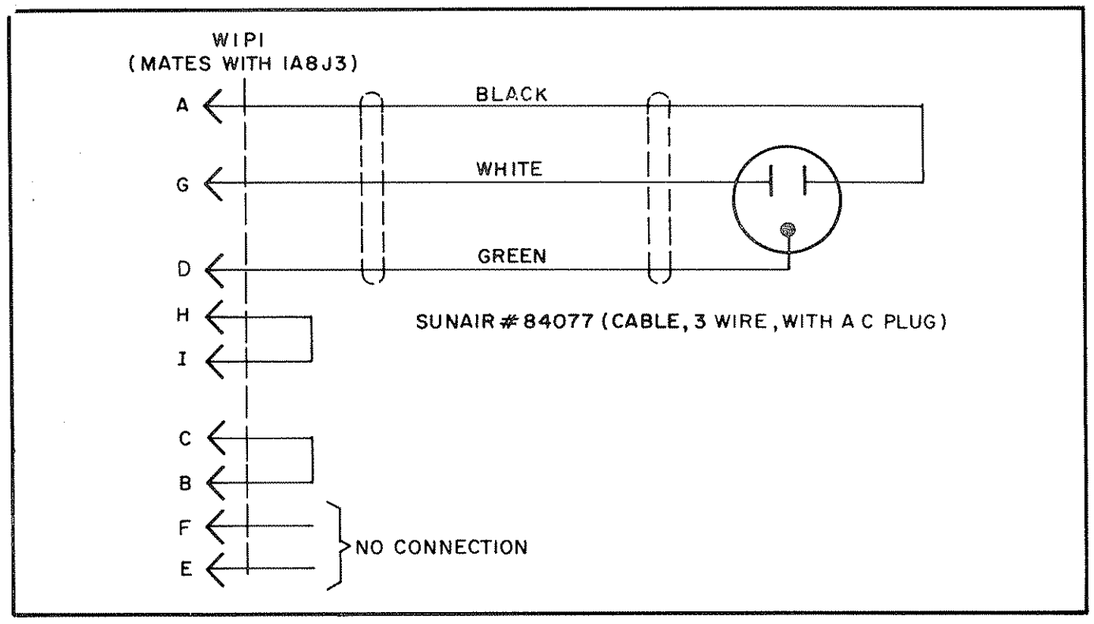


Figure 2.12 115 VAC Power Cord Schematic

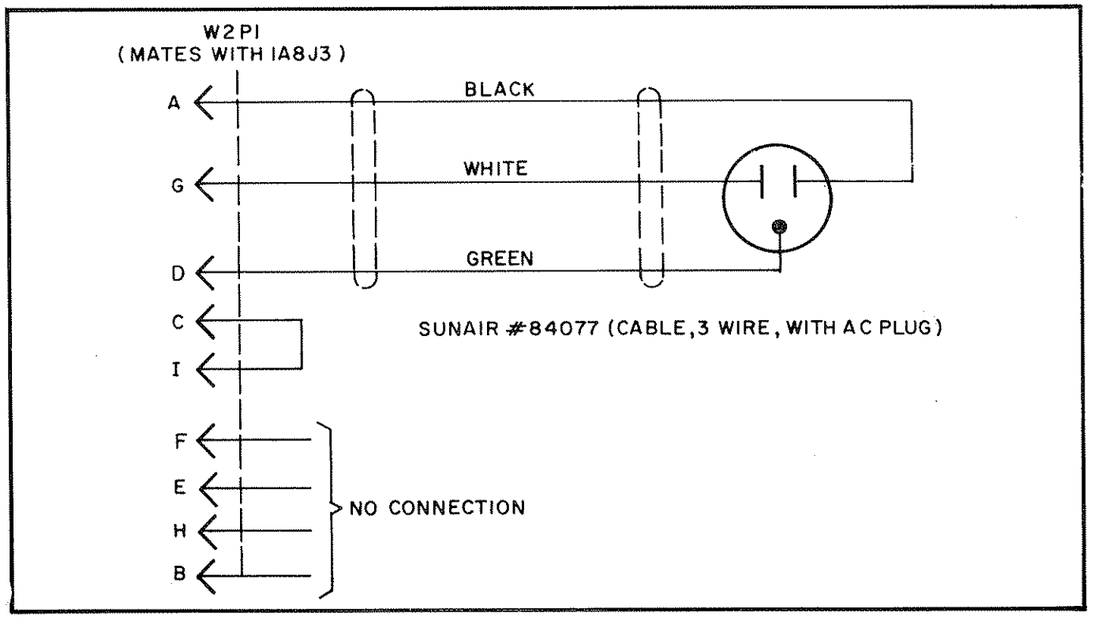


Figure 2.13 230 VAC Power Cord Schematic

The GSR-920 incorporates reverse polarity protection when fed from D.C. power sources. If the radio does not operate, check the polarity of the D.C. power connections. Refer to the chassis wiring diagram, Figure 5.15 and D.C. power cord connector wiring, Figure 2.18 for polarity details. The D.C. Power Cable Assembly is supplied from the factory with approximately 10 feet of connecting cable. However, if the installation permits, the cable should be then trimmed to minimum length consistent with a neat installation and minimum voltage drop.

NOTE

Before applying power to the radio, refer to Figure 2.14 and check that the correct value of fuse F3 (on the rear apron of the radio) has been inserted in its fuse holder.

2.6.4 D.C. VOLTAGE CHANGE

The D.C. operating voltage of the GSR-920 may be changed from 13 to 26 VDC or 26 to 13 VDC by changing the connections on TB2 located next to the regulator board, changing the link strap located on the inverter board 1A6A2 and changing the D.C. input fuse. Information to make this change is shown in Figure 2.14, Figure 2.17 and Figure 5.17. After the change is made the voltage tag attached to the heat sink must be turned over to show the correct voltage configuration.

2.7 INSTALLATION CHECKOUT

When the installation is complete, refer to section 3 (OPERATION) and fully check the operation of the system.

DESIGNATOR	FUNCTION	LOCATION	TYPE AND RATING
1A8F1, 1A8F2	A.C. Line	Rear Apron	For nominal 115V input, use type MDL (SLO-BLO), 1 amp. For nominal 230V input, use type MDL (SLO-BLO), 1/2 amp.
1A8F3	D.C. Line	Rear Apron	For nominal 13V input, use type MDL (SLO-BLO), 7 amp. For nominal 26V input, use type MDL (SLO-BLO), 3 amp.
1A6F1	+12V	Power Supply	Type 3AG, 2 amp.
1A6F2	+5V	Power Supply	Type 3AG, 2 amp.

Figure 2.14 GSR-920 Fuse Table

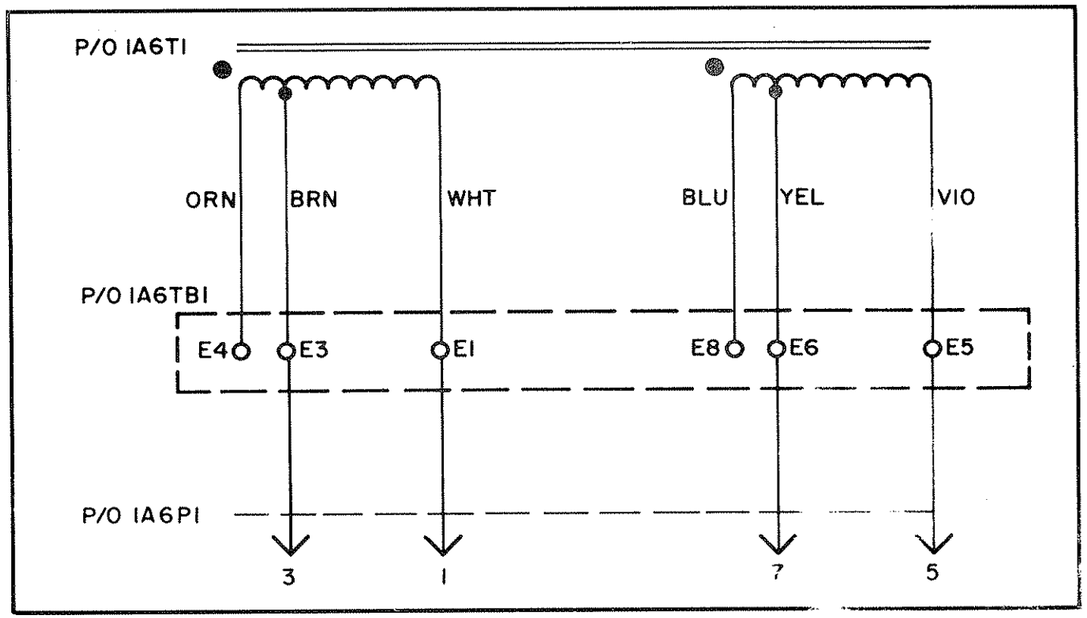


Figure 2.15 Power Supply Wiring – 115V or 230 VAC Inputs

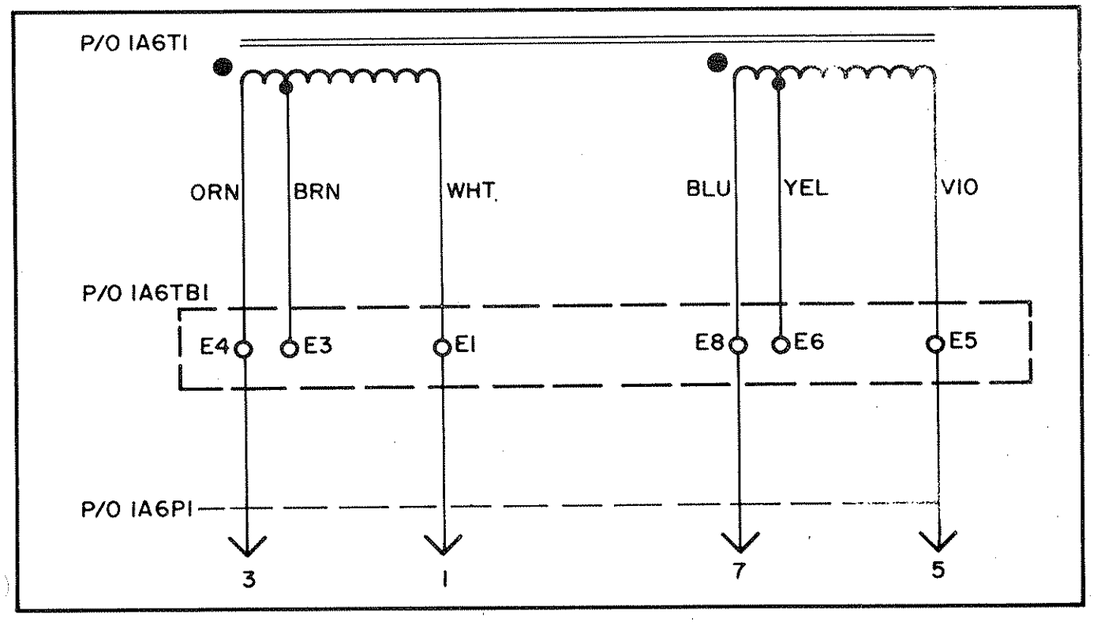
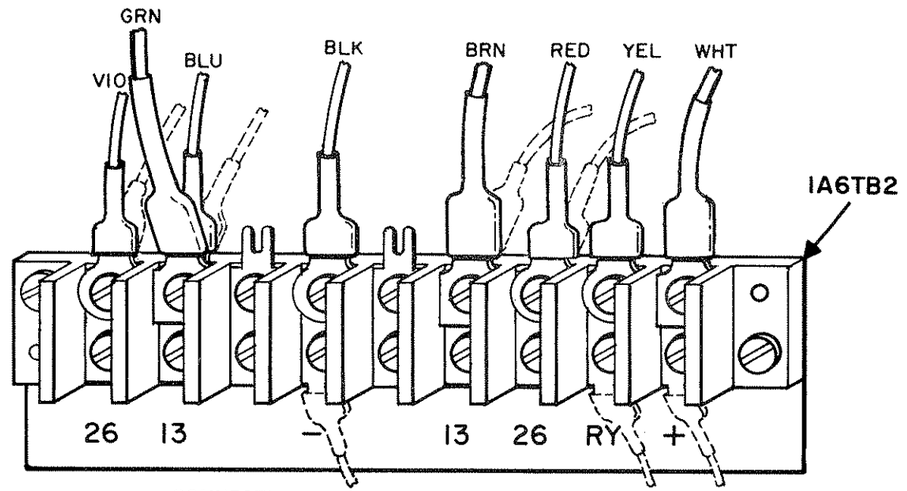
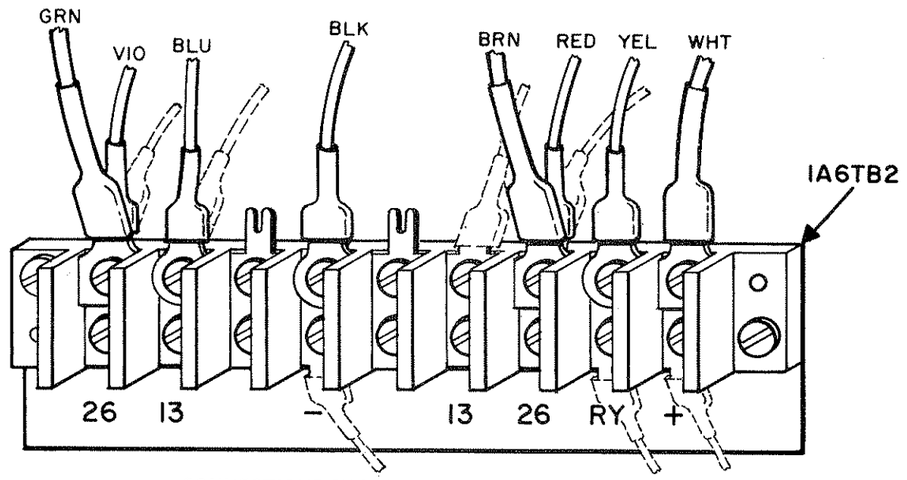


Figure 2.16 Power Supply Wiring – 132 V or 265 VAC Inputs



CONNECTIONS SHOWN ABOVE FOR 13 VDC OPERATION
NOTE: JUMPER MUST BE CONNECTED BETWEEN
E10 AND E11 ON D.C. INVERTER BOARD



CONNECTIONS SHOWN ABOVE FOR 26 VDC OPERATION
NOTE: JUMPER MUST BE CONNECTED BETWEEN
E9 AND E10 ON D.C. INVERTER BOARD

Figure 2.17 D.C. Inverter Connections to Power Supply Terminal Strip 1A6TB2

DESCRIPTION	DESIGNATOR	PART NUMBER	MATING PART		
			CONNECTOR	CABLE CLAMP	BOOTS PART NUMBER
PHONE	1A1J2	84085	75401		
ANTENNA	1A8J1	74374	74403		
ACCESSORY	1A8J2	0753990008	75400	74025	70055-4
POWER	1A8J3	0753440008	75358	75457	70055-3, -4, -5
AUDIO IN	1A8J11	75524			
5 MHz IN/OUT	1A8J4	74374	74403		
AUDIO	J1	75399	75400	75398	70055-4

TABLE 2.1 PANEL AND MATING CONNECTORS

0753580004

0754000001

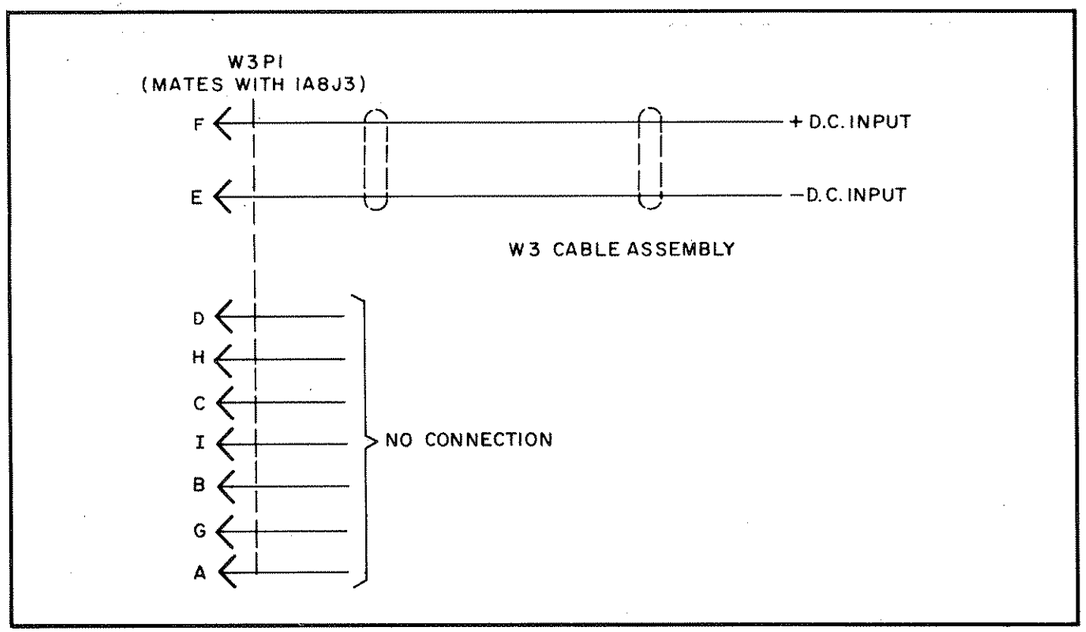


Figure 2.18 D.C. Power Connector Schematic

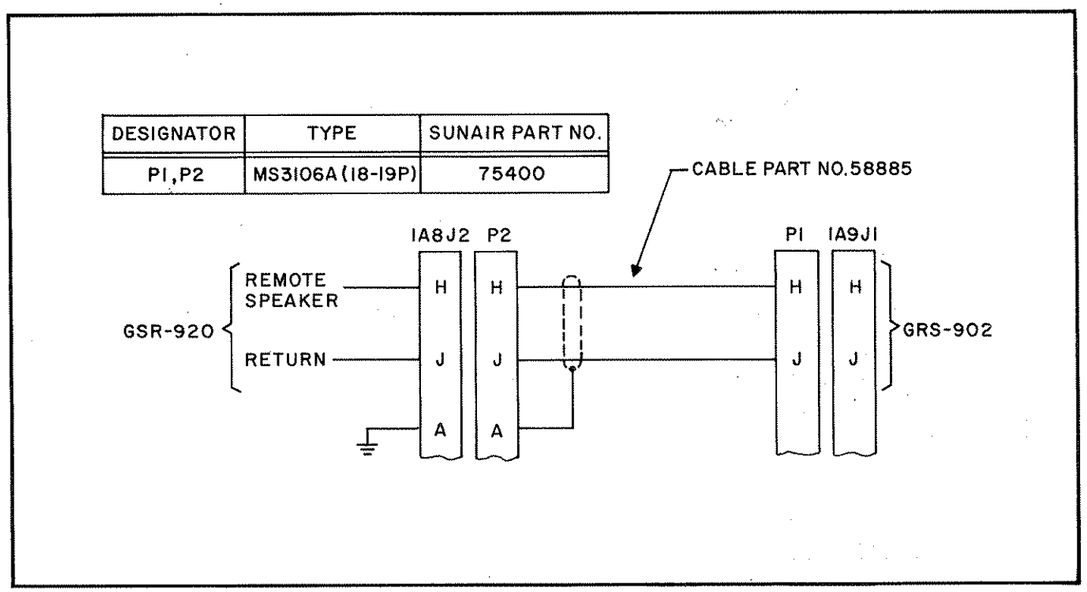


Figure 2.19 GRS-902 Remote Speaker Interconnect Diagram

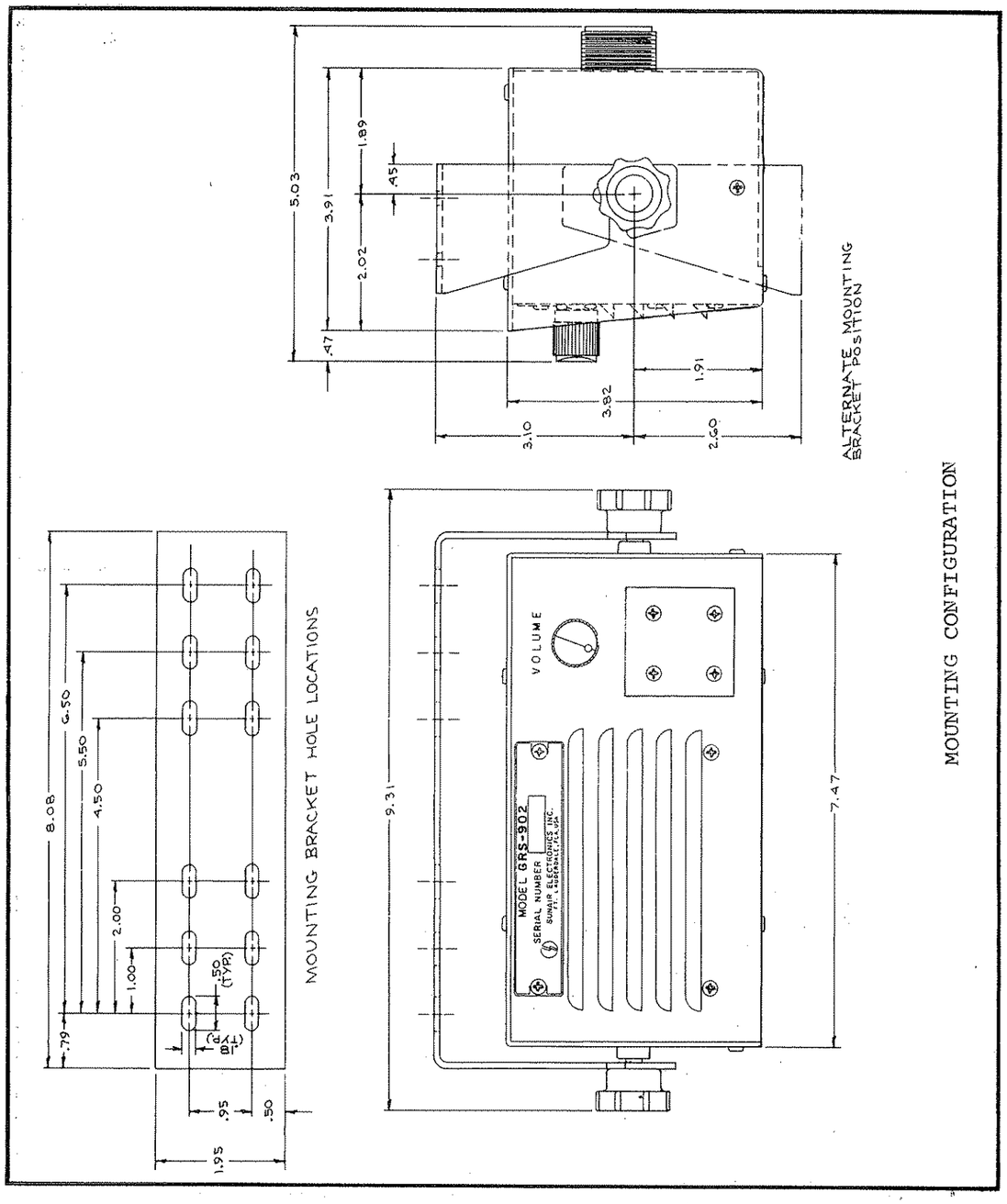


Figure 2.20 GRS-902 Remote Speaker Outline Configuration

SECTION 3
OPERATION

3.1 GENERAL

This section provides information and instructions required for proper operation of the GSR-920 Receiver.

3.2 FRONT PANEL OPERATING CONTROLS

3.2.1 Listed below are descriptions of all controls, indicators and connectors located on the front panel of the GSR-920 Receiver. Figure 3.1 shows the standard receiver with the SSB control head. Figure 3.2 shows the receiver with its optional ISB control head.

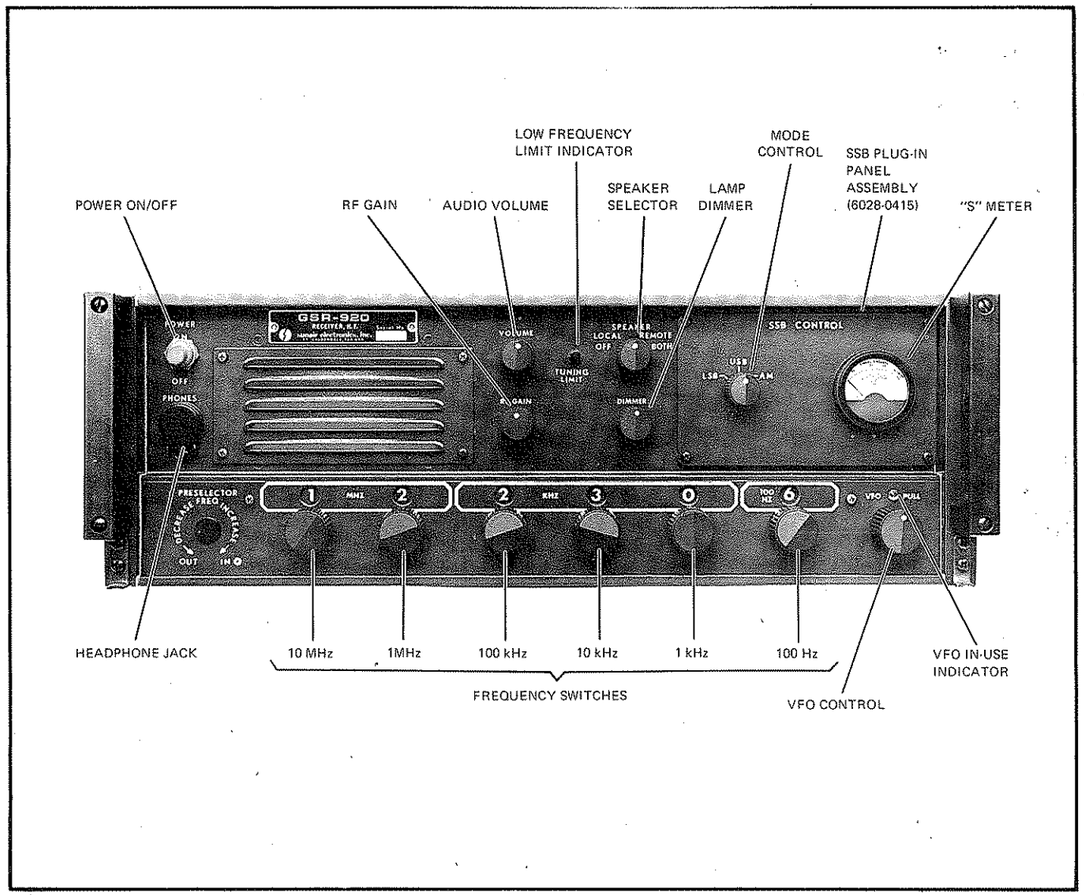


Figure 3.1 GSR-920 Receiver Front Panel, Standard

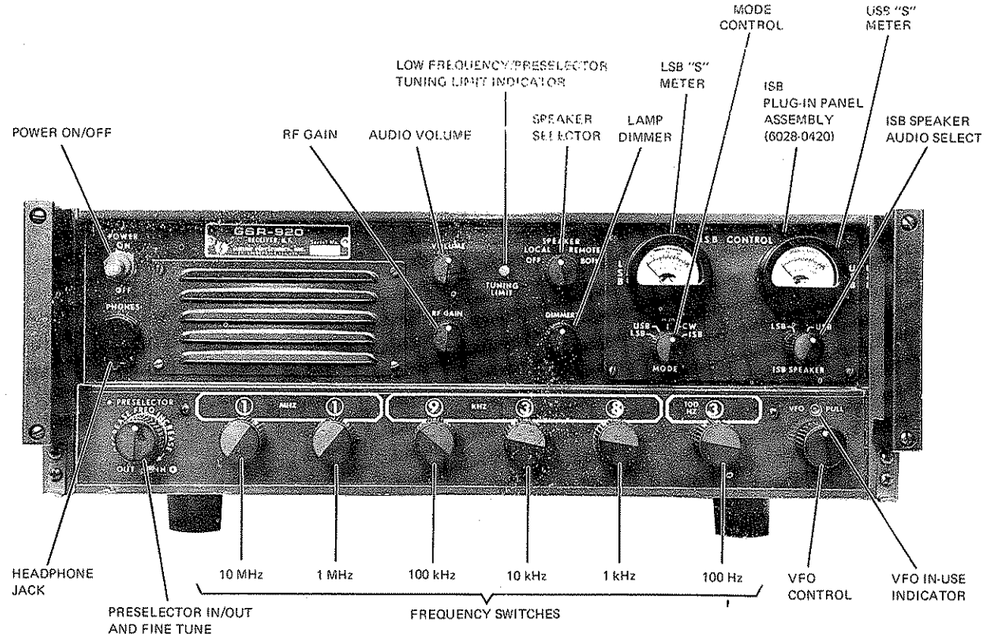


Figure 3.2 GSR-920 Receiver Front Panel, ISB Option

POWER ON/OFF SWITCH	Applies primary power to receiver
FREQUENCY SWITCHES (6)	Selects the operating frequency: 10 MHz switch, 1 MHz switch, 100 kHz switch, 10 kHz switch, 1 kHz switch, 100 Hz switch.

MODE SWITCH	
SWITCH POSITION	EQUIPMENT RESPONSE
LSB	Selects Lower Sideband mode
USB	Selects Upper Sideband mode
AM	Selects Amplitude Modulation mode
CW (ISB option)	Selects Continuous Wave mode special filter if option ordered. If no option, USB is selected.
ISB (optional)	Selects both Upper and Lower Sideband mode

VOLUME	Controls the gain of the rf and if amplifiers in the receive mode. Counter-clockwise rotation decreases the gain.
RF GAIN	Controls the gain of the RF and IF amplifiers in the RECEIVE mode. Counter-clockwise rotation decreases the gain.
PHONE jack	Accepts standard 1/4 inch 2 circuit plug from earphones.
DIMMER control	Controls intensity of frequency display and meter illumination.
METER	Indicates relative signal strength in "S" units.
VFO (potentiometer control with pull-on, push-off switch)	a) VFO OFF mode (control pushed in): frequency controlled solely by the 6 frequency knobs in 100 Hz steps. b) VFO ON mode (control pulled out): vernier ±5 kHz range is provided. VFO ON indicator light is lit in this mode.
VFO indicator light	Lights when in VFO mode.
TUNING LIMIT indicator light	Lights when a frequency below 1.60000 MHz has been selected. The Receiver is also disabled when this condition occurs. If option preselector module installed, lights when tuning end limit is reached.

	SWITCH POSITION	
SPEAKER SWITCH	OFF	Disconnects audio from speaker
	LOCAL	Connects audio to speaker mounted in front panel
	REMOTE	Disconnects audio from front panel speaker and connects audio to rear apron connector for remote speaker
	BOTH	Connects audio to front panel speaker and rear apron connector
ISB SPEAKER SWITCH (optional)	USB	When in ISB Mode, connects USB audio to SPEAKER switch
	LSB	When in ISB Mode, connects LSB audio to SPEAKER SWITCH
PRESELECTOR IN/OUT switch (optional)		Routes r-f from antenna to preselector when set to IN position
PRESELECTOR FREQ TUNE (optional)		Fine tunes preselector. This is a dual control, first detent is the slow rate of tune; further rotation will increase speed of tuning.

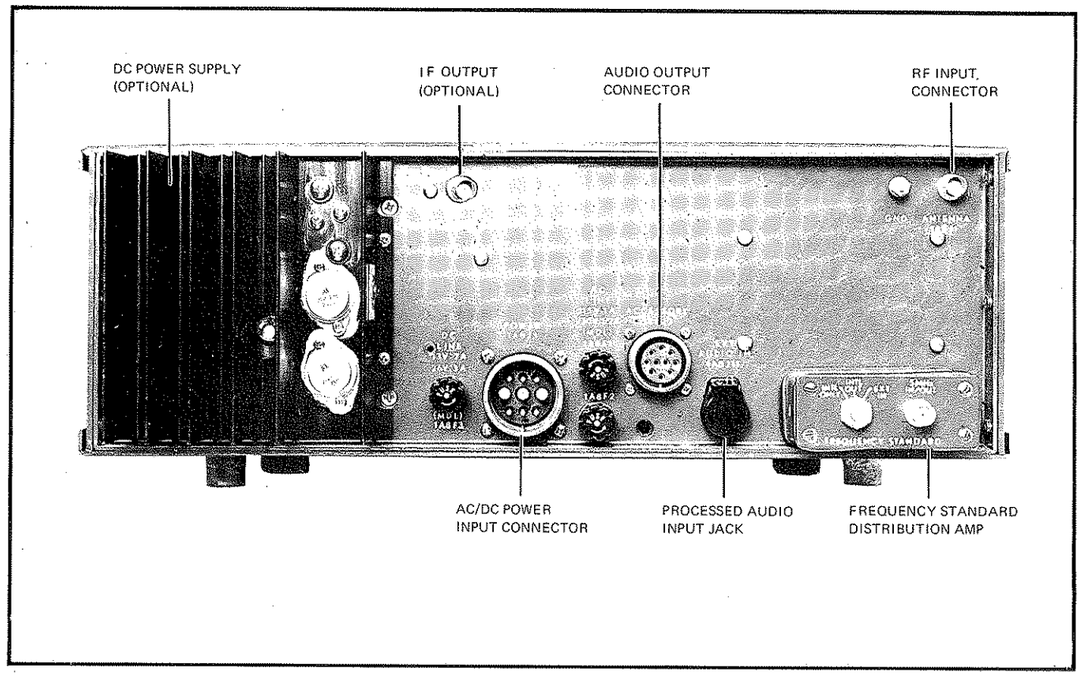


Figure 3.3 GSR-920 Rear Panel

3.3 REAR APRON COMPONENTS

3.3.1 Refer to Figure 3.3 for location.

ANT (1A8J1)	ANTENNA connector: R.F. input to unit. Mates with standard UG-88/U RF connector.
ACCESSORY (1A8J2)	Connector for access to USB and LSB 600 ohm audio outputs, 8 ohm speaker audio output and receiver muting control line. Mates with standard MS connector MS3106A(28-21P)
POWER (1A8J3)	Connector for connection of A.C. or D.C. power to the receiver. Mates with standard MS connector, MS3106A(24-11S)
AUDIO IN (1A8J11)	Phone jack: to return processed 600 ohm audio, taken from 1A8J2, to receiver. Mates with standard 1/4 inch 2 circuit phone plug.
FUSES (F1, F2, F3)	A.C. and D.C. input line fuses (see Figure 2.14)
GROUND POST	Stud for connection of ground wire
FREQ STD DISTRIBUTION AMP	Amplifier module to either accept frequency standard from other GSR-920 for internal distribution or to provide frequency standard for up to 5 other GSR-920 receivers. Switch on module selects operating mode.
FREQ STD IN/OUT	Connector on Freq Std Distribution Amp to pass 5 MHz frequency standard in or out of the receiver.

3.4 OPERATING THE GSR-920 RECEIVER

3.4.1 INITIAL CHECKS

a) Check that antenna is correctly installed, all antenna connections are made, and that the coax cable and connector from the antenna to the receiver does not have any open or shorted connections.

b) Check the fuses in the receiver rear apron fuse holders for the correct rating. (Refer to Figure 2.14).

c) Check that the A.C. power line cord supplied with the receiver has the correct tag attached: 115 or 230 V ac. Connecting the wrong cord to the power source may damage the radio. Reference Figures 2.12 and 2.13 for power cord connector wiring.

d) If optional d-c power module installed, check that voltage tag on power supply heat sink agrees with supply voltage, 13 or 26 VDC. The D-C operating voltage requirement in the radio can be changed from 13V or 26V or 26V to 13V by changing connections in the receiver. Reference paragraph 2.6.3.

e) Check that Frequency Standard Distribution switch on rear apron mounted module is in correct position.

1) INTL: if receiver contains 5 MHz standard and is not supplying the standard to other receivers.

2) INT OUT: if receiver is supplying 5 MHz standard to other receivers.

3) EXT IN: if receiver does not contain a 5 MHz standard and is being supplied from another receiver.

3.4.2 FUNCTIONAL OPERATING CHECKS

a) Connect the receiver to the power source.

b) Connect antenna or r-f signal generator to ANT connector on rear apron.

c) Set POWER switch on front panel to ON position.

d) Place MODE switch to AM, USB, or LSB position.

e) Set SPEAKER switch to LOCAL.

f) Adjust VOLUME and RF GAIN controls for a comfortable listening level.

NOTE

The RF GAIN control is normally set fully clockwise (max gain) to achieve maximum sensitivity. When receiving a strong signal, best results are usually obtained if the RF GAIN control is set so the signal when preset increases the meter reading 1 to 2 "S" units above the "no signal" reading.

g) Set frequency switches to receive a known transmitting station if the radio is connected to an antenna or set to any desired frequency (1.6 to 29.999 MHz) and tune the generator if using an rf signal generator.

h) When tuned to a signal pull out VFO control and rotate knob. The VFO control should vary the receiver frequency approx. ±5 kHz. Push knob in to deactivate VFO.

i) If the optional preselector is installed, switch preselector IN and tune for max signal or max speaker audio using preselector tune knob.

j) Use a signal generator set for a 5 microvolt output and check a frequency in each band of the filter or the preselector if installed.

BAND	FREQ MHz
1	1.6 – 1.99
2	2.0 – 2.99
3	3.0 – 3.99
4	4.0 – 5.99
5	6.0 – 8.99
6	9.0 – 12.99
7	13.0 – 19.99
8	20 – 29.99

k) If the optional remote speaker is to be used, connect it to the ACCESSORY plug, 1A8J2, on the rear apron and set SPEAKER switch to REMOTE. The radio speaker should be silenced and the remote speaker should be activated.

l) Adjust remote VOLUME control for comfortable listening level.

m) Set SPEAKER switch to BOTH. The radio speaker and the remote speaker should be activated. Note: The radio VOLUME control will control the audio level of both speakers.

SECTION 4

THEORY OF OPERATION

4.1 GENERAL

The discussion of the theory of operation of the GSR-920 will be presented in seven parts: overall block diagram, synthesizer, receiver, power supply, filter module, preselector module, and front panel. Each part will contain a general discussion followed by a detailed explanation of the circuit theory.

Figure 5.3 is a top view of the GSR-920, showing the location of all subassemblies, and their description and part numbers.

4.1.1 OVERALL BLOCK DIAGRAM

The GSR-920 is a totaly modularized receiver in that the five functional modules; synthesizer, receiver, power supply, filter module or preselector, and front panel are each designed to be removed intact or the p-c boards contained in each module may be removed. Figure 4.1 is an overall block diagram of the complete receiver, and Figure 5.4 is the overall main frame wiring diagram.

The r-f signal from the antenna is routed through the band pass filter module or the optional preselector module. The signal then passes to the VHF mixer p-c board where it is amplified, mixed with the 1st & 2nd oscillator frequencies from the synthesizer to derive the final IF of 10.5 MHz.

The signal is then connected to the IF/Filter board for sideband selection and amplification and then the Audio p-c board for detection. Two IF/Filter and Audio p-c boards may be installed if the Independent Sideband (ISB) option is included. Amplification of the audio signal is then performed in the Speaker Driver board which drives the panel mounted loud speaker.

The synthesizer provides the first L.O. frequency of 91.25 to 121.2499 MHz, corresponding to a received signal of 1.60 to 29.9999 MHz and the position of the front panel frequency dials. The 2nd and 3rd L.O. frequencies of 80.75 and 10.5 MHz are also derived in the synthesizer.

Inputs to the synthesizer are the TCXO frequency standard and the front panel controls for frequency selection.

The power supply provides +12V, +5V and +21 V DC to operate various portions of the receiver. Input is 115/230V ac 50 to 60 Hz. An optional d-c inverter may be installed to allow operation from 13 or 26 VDC power sources.

The front panel contains all operator controls necessary to operate the receiver. It may be removed for servicing by unplugging two connectors and removing the screws on the panel end plates where they attach to the receiver side panels.

4.2 SYNTHESIZER – 1A4

This unit consists of six printed circuit boards: Spectrum Generator (1A4A1), Low Digit Generator (1A4A2), Translator (1A4A3), VHF Divider (1A4A4), VCO (1A4A5) and the Synthesizer Mother board (1A4A6). Figure 4.2 shows an overall block diagram of the synthesizer. An isometric drawing of the physical components of the synthesizer unit is shown in Figure 5.2.

4.2.1 GENERAL

The synthesizer (1A4) generates the three local oscillator injection frequencies needed to determine the operating frequency of the radio. The synthesizer input is the 5 MHz reference signal from the frequency standard. The three local oscillator injection frequencies are obtained from the 5 MHz reference by a combination of direct synthesis and digital phase lock techniques. The frequency accuracy of the radio is therefore solely determined by the accuracy of the frequency standard.

The 3rd L.O. (10.5 MHz reference) is derived by direct synthesis techniques (i.e. by dividing and mixing). This local oscillator signal is used as a product detector injection frequency. This reference is derived in the Spectrum Generator assembly, 1A4A1.

The 2nd L.O. generator consists of a crystal oscillator at a nominal frequency of 80.7500 MHz located in the Translator assembly (1A4A3). This frequency is used in the VHF Mixer assembly (1A3A1), the receiver section, to convert the 1st I.F. frequency of 91.2500 MHz to the 2nd I.F. of 10.5 MHz. Since the 2nd L.O. oscillator is not referenced to the frequency standard, a small frequency error can exist on this L.O. However, because of the mixing scheme used in the Translator, this same error appears on the 1st L.O. frequency and is thrrefore cancelled at the output of the VHF Mixer.

The VCO (1st L.O.) generator is a phase locked oscillator covering the frequency range of 92.8500 to 121.2499 Hz in 100 Hz steps. The exact frequency of the oscillator is given by:

$$F_1 = 91.2500 + F_0 + e \text{ (MHz)}$$

Where: F_1=1st L.O. frequency

F_0=dialed frequency

e=2nd L.O. error

The 1st L.O. is used to convert the incoming signal up to the 1st I.F. frequency (91.25 MHz).

4.2.2 SPECTRUM GENERATOR – 1A4A1

Refer to Figure 5.5.

4.2.2.1 GENERAL

The Spectrum Generator (1A4A1) generates the fixed reference frequencies needed in the synthesizer. The input is the 5 MHz reference from the frequency standard and the outputs consist of references at the following frequencies: 10.5 MHz (Product Detector), 21 MHz (to Translator), 20 MHz (to Translator), 17 MHz (to Low Digit Generator), 100 kHz (to VHF Divider), and 1 kHz (to Low Digit Generator).

4.2.2.2 20 MHz REFERENCE GENERATOR

The 5 MHz reference from the frequency standard is amplified by U1 and formed into a short pulse by pulse generator U2. The fourth harmonic of this 5 MHz pulse (20 MHz) is filtered by the double-tuned circuit (C7, C8, C9, C10, L2 and L3) and is amplified by U3. The output is obtained from U3 through pi network (C14, C15, C16, C17, L4) which matches the high output impedance of U3 to 50 ohms. A portion of this signal is also applied to the 17 MHz mixer and to buffer amplifier U8.

4.2.2.3 1 MHz, 100 kHz and 1 kHz REFERENCE GENERATOR

The 5 MHz output pulse from U2A is fed to U4, a divide-by-5 counter. The resultant 1 MHz output is fed to three stages of divide-by-10 counters (U5, U6 and U7); thereby producing the desired 100 kHz and 1 kHz outputs.

4.2.2.4 17 MHz REFERENCE GENERATOR

The 1 MHz pulse from U4 is passed through a tuned circuit (L14, C53) which is tuned to 3 MHz (the 3rd harmonic of the 1 MHz). This 3 MHz signal is amplified by Q5, further filtered by another tuned circuit (L15, C55) and applied as one input to mixer Q6. A portion of the 20 MHz reference is also applied to Q6. The resultant 17 MHz signal is filtered by a double-tuned circuit (L16, C59, C62, L17, C65 and C66) and is applied to a complementary emitter follower (Q7, Q8). The emitter follower matches the high output impedance of mixer Q6 to 50 ohms.

4.2.2.5 21 MHz REFERENCE GENERATOR

The 1 MHz pulse from U4 is passed through a tuned circuit (L7, C30) which filters the pulse into a 1 MHz sine wave. Complementary emitter follower (Q1, Q2) transforms the impedance to 50 ohms to match the input impedance of the balanced mixer.

The 20 MHz reference from U3 is amplified by U8 and applied as the second input to the balanced mixer. The resultant 21 MHz signal is filtered by triple-tuned circuit (C32, C33, L8, C34, L9, C35, C36, L10, C37, and C38) and then amplified by U9. The output of U9 is matched to 50 ohms by emitter follower, Q9.

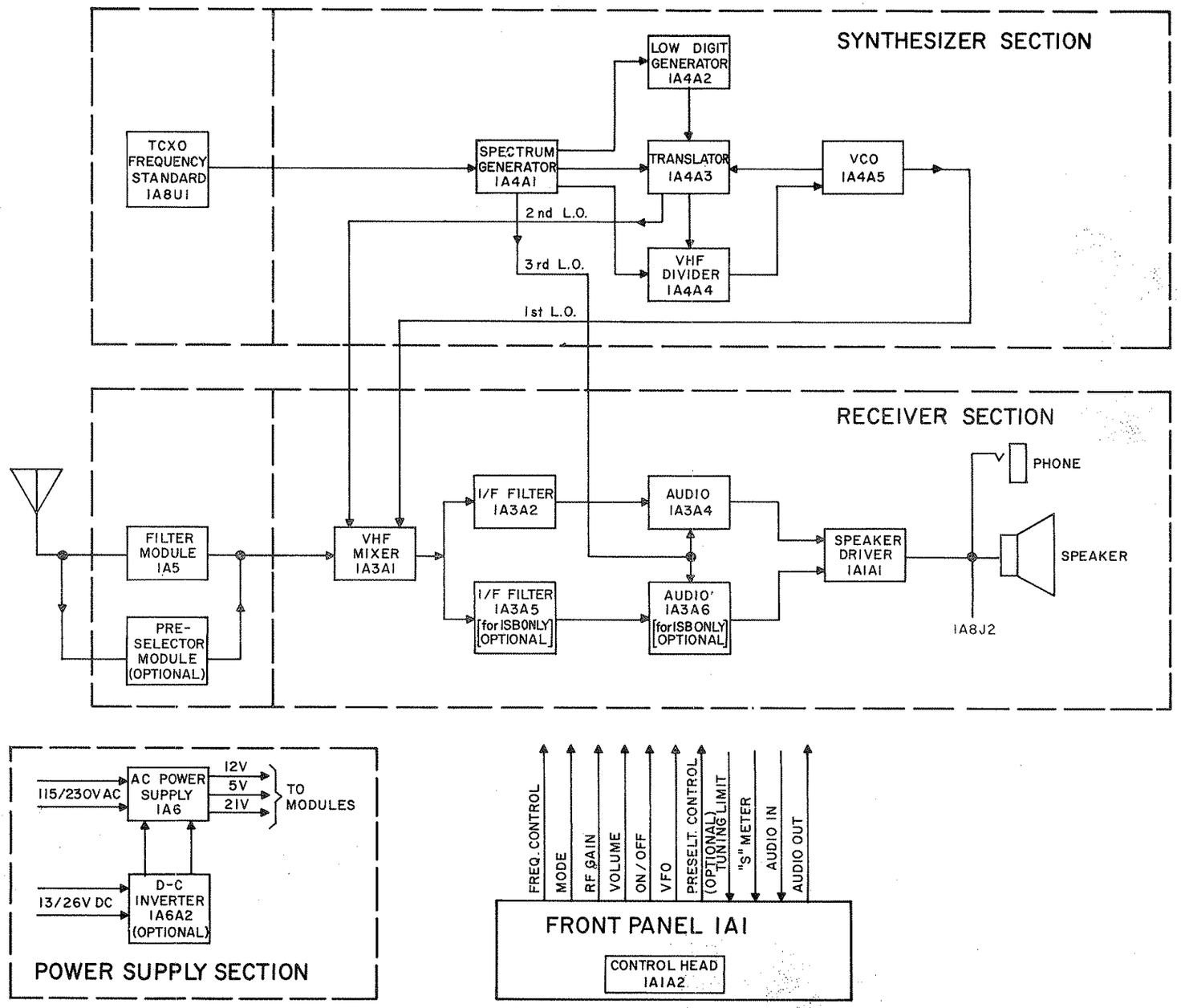


Figure 4.1 Overall Block Diagram

4.2.2.6 10.5 MHz REFERENCE GENERATOR

The 21 MHz output from U9 is also fed to flip-flop U10 which generates a 10.5 MHz square wave. The signal is filtered to a sine wave by a double-tuned circuit (L12, C46, C47, C48 and C49) and then matched to 50 ohms by emitter follower, Q4.

The flip-flop (U10) is disabled by switch (Q3) in the AM receive mode to prevent a "beat"note from appearing at the receiver output. +12 volts, applied to the "Blanking Pulse In" line in these modes, saturates Q3; thereby disabling the flip-flop and effectively removing the 10.5 MHz output. At all other times there is no voltage on the "Blanking Pulse In" line. Q3 is therefore cut off and the flip-flop (U10) operates in its normal divide-by-2 mode. A blanking pulse from the L.O. Blanker Assembly (1A8A1) also disables the flip-flop for approximately 100 milliseconds whenever setting of the 1 MHz frequency switch on the front panel is changed.

4.2.3 LOW DIGIT GENERATOR – 1A4A2

Refer to Figure 5.6.

4.2.3.1 GENERAL

The Low Digit Generator (1A4A2) generates the 100 Hz, 1 kHz and 10 kHz synthesized frequency steps. The inputs are the 17 MHz reference (from the Spectrum Generator), 1 kHz reference (from the Spectrum Generator), BCD frequency control lines (from the front panel frequency control switches) and the coarse steering voltage (from the 10 kHz frequency control switch on the front panel). The output is 1.5000 to 1.5999 MHz in 100 Hz steps and is fed to the Translator as a mixing reference.

4.2.3.2 VOLTAGE CONTROLLED OSCILLATOR

The Voltage Controlled Oscillator or VCO (Q1) is a Colpitts oscillator covering the range of 15.000 to 15.999 MHz. Coarse frequency tuning is provided by the action of the coarse steering voltage on varactor diodes CR1 and CR2. Fine frequency control is provided by the phase detector (U2) acting through the loop filter (R8, C7, R5 and C3) and 1 kHz notch filter (R4, C6, R6, C5, C4, C68 and R3) on varactor diodes CR3 and CR4. The oscillator output is loosely coupled through C15 to isolation amplifier U1.

The VCO is fed from a voltage regulator (R9, CR5, Q2 and R10) which provides a finely regulated 7.6 volts.

4.2.3.3 MIXER AND PULSE GENERATOR

The mixer (Q3) transforms the VCO frequency to 2.000-1.001 MHz to place the signal in the range of the Preset Counters. The inputs to the mixer consist of the VCO signal (fed from the output of U1) and the 17 MHz reference. The output of the mixer is filtered by a 2.5 MHz low pass filter (C23, C24, L7, C25, C26, L8 and C27) and is then amplified by U6. Quad NAND Gate, U7, connected as a monostable multivibrator, forms the signal into a short pulse to drive the preset counter.

4.2.3.4 PRESET COUNTER

The Preset Counter (U8, U9, U10, U11) is a counter whose division ratio is controlled by the 100 Hz, 1 kHz and 10 kHz Frequency control switches on the front panel. During the normal counting interval, the counter functions as a divide-by-2000 counter. During the Preset interval, the clock is disabled and the counter is loaded (or preset) to a count determined by the settings of the frequency control switches. The frequency control information is entered in binary-coded-decimal (BCD) format and the division ratio, D, is therefore determined by the formula:

$$D=2000-(100\,N_{10kHz} + 10\,N_{1kHz} + N_{100Hz})$$

where:

N_{10kHz} N_{1kHz} and N_{100Hz} are, respectively, the settings of the 10 kHz, 1 kHz and 100 Hz frequency dials.

Or, for example:

DIAL SETTINGS			PRESET	COUNT (D)
10 kHz	1 kHz	100 Hz		
0	0	0	000	2000
0	0	1	001	1999
0	0	2	002	1998
0	1	1	011	1989
1	9	9	199	1801
9	9	9	999	1001

4.2.3.5 PRESET GENERATOR

The preset generator applies a short pulse to the data strobe inputs of the preset counter when a full count is detected. A "look ahead" scheme is employed to eliminate miscounting due to the propagation delays in the counter. When the counter has reached a count of 1999, the inputs to pins 2, 3, 4, 5, 6, 11, and 12 of NAND gate U3 will be in a "one" state. As soon as the clock input to pin 1 of this gate returns to a "one" state, the output of U3 will change to a "zero" state, thereby triggering monostable multivibrator U4. Then U4 presets the counters by applying a "zero" to their data strobe inputs for approximately 100 nsec. The output of U4 will return to a "one" state before the beginning of the next clock pulse.

4.2.3.6 PHASE DETECTOR, LOOP FILTER and 1 kHz NOTCH FILTER

The phase detector compares the frequency of the output of the Preset Counter with that of the 1 kHz reference from the Spectrum Generator. Action of the phase detector is as follows: If the VCO frequency is high, the output frequency of mixer Q3 will be low. The output frequency of the Preset Counter will, therefore, also be low. The Phase Detector output voltage will decrease until the frequency error is corrected. Conversely, if the VCO frequency is low, the mixer output frequency will be high and the Phase Detector will increase until the error is corrected. If there is no frequency error, the output voltage of the Phase Detector will remain constant. The Loop Filter (R8, C7, R5, and C3) removes any 1 kHz components in the Phase Detector output and also determines the transient response of the loop. The 1 kHz frequency components are further attenuated by twin tee notch filter R3, R4, R6, C4, C5, C6, and C68. The action of this Phase Lock Loop is to make the VCO frequency follow the relationship: F_{VCO}=17.000-D (kHz); where D is the count ratio. The VCO will therefore vary from 15.000 to 15.999 MHz in 1 kHz steps.

4.2.3.7 OUTPUT DIVIDER CIRCUITRY

The output from Buffer U1 is further amplified by Q5 and fed to divide-by-10 counter U5. The output of U5 is filtered to a sine wave by a bandpass filter (L11, C39, C40, C41, and L13) and is fed to emitter follower, Q6 which matches the output to 50 ohms. The output from the Low Digit Generator is 1.5000 to 1.5999 MHz in 100 Hz steps and follows the relationship:

$$F_{OUT} = 1.5000(MHz) + N(kHz)$$

where N=knob settings of the 10 kHz, 1 kHz and 100 Hz (i.e. 0.1 kHz) dials.

4.2.4 TRANSLATOR–1A4A3

Refer to Figure 5.7.

4.2.4.1 GENERAL

The translator (1A4A3) combines the signals from the Low Digit Generator (1A4A2) and VCO (1A4A5) and generates a signal which, after subsequent frequency division in the VHF Divider (1A4A4), is used to phase lock the VCO to the proper frequency. The second L.O. and V.F.O. signals are also generated in this assembly. The inputs to this assembly are: 20 and 21 MHz references (from the Spectrum Generator); 1st L.O. (from the VCO); 1.5000-1.5999 MHz (from the Low Digit Generator); and the V.F.O. Control and V.F.O. ON/OFF signals from the front panel. The output is the 10.0-39.9 MHz reference signal which is fed to the VHF Divider. In the V.F.O. mode,

5024011627A

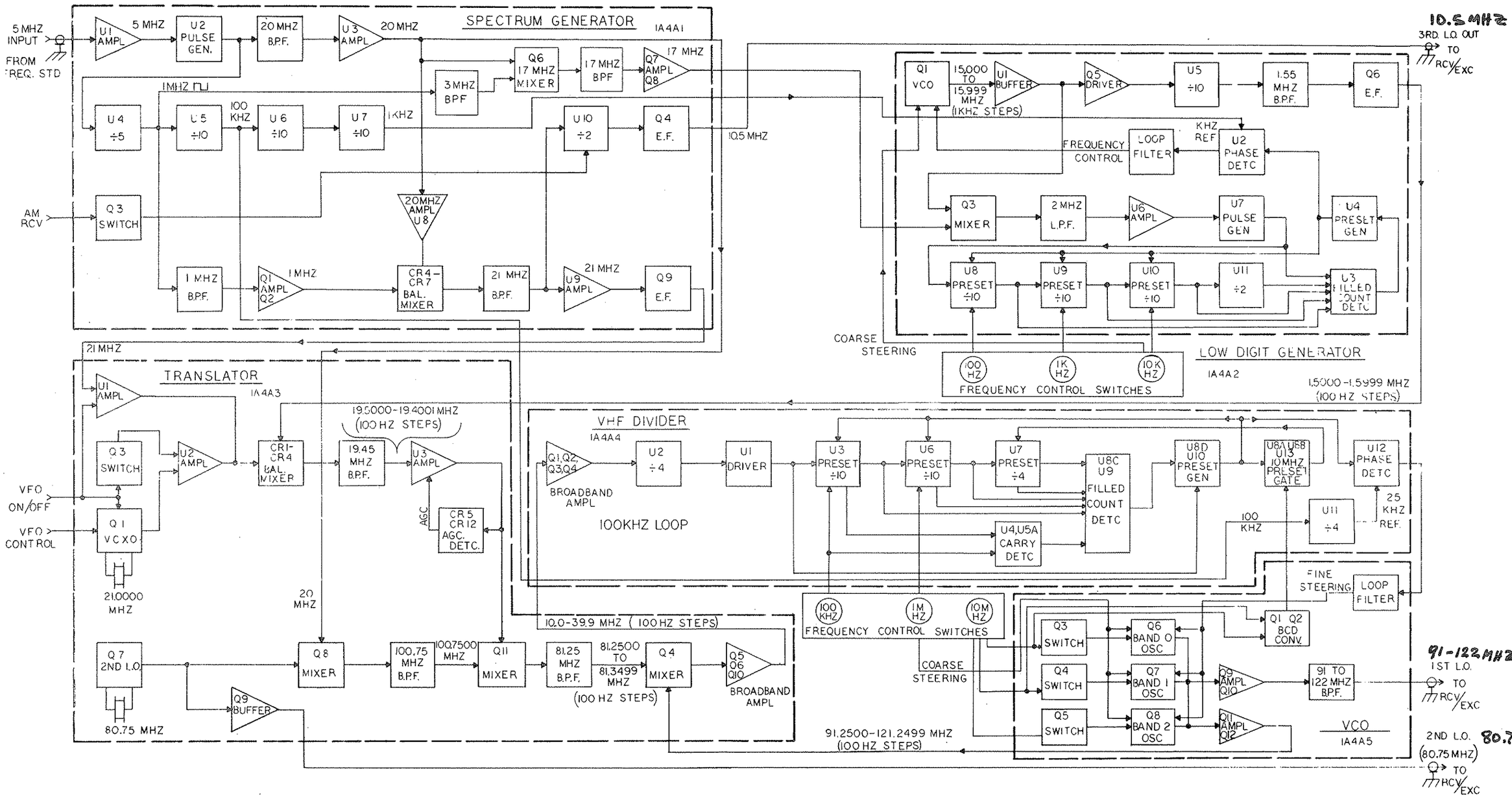


Figure 4.2 Synthesizer Block Diagram and Details

the internally generated 21 MHz V.F.O. is substituted for the 21 MHz reference from the Spectrum Generator.

4.2.4.2 ERROR CANCELLING

Since the 2nd L.O. is a free running crystal oscillator and is not referenced to the Frequency Standard, a small frequency error can exist. However, because of the mixing scheme employed in this assembly, both the 1st L.O. and 2nd L.O. will have the same frequency error. This error will therefore be cancelled in the VHF Mixer Assembly (1A3A1).

4.2.4.3 V.F.O. AND 21 MHz REFERENCE AMPLIFIERS

The V.F.O. (Q1) is a Colpitts Crystal Oscillator, covering the frequency range of 20.995 to 21.005 MHz and thereby providing approximately ±5 kHz tuning adjustment around the dialed frequency of the radio. The V.F.O. control voltage, acting on varactor diodes CR6 and CR7 in series with the crystal, "pulls" the crystal's oscillation frequency to provide this small frequency change. The tuned circuit in the collector of Q1 (L23,C101) adjusts the circuit to resonance at 21 MHz. Inductor L22, in series with crystal Y1, compensates for small variations in the oscillation frequency of the crystal thus adjusting the center frequency of the oscillator to 21.0000 MHz. The oscillator output is buffered and amplified by U2 when in the V.F.O. mode. The 21 MHz reference from the spectrum generator is amplified by U1 when the V.F.O. mode is not selected.

In the V.F.O. mode, +12V appears on the V.F.O. ON/OFF input line. This applies base bias to Oscillator Q1 and turns on amplifier U2 through transistor switch Q3. When the V.F.O. mode is not selected, the voltage on the V.F.O. ON/OFF line is removed, amplifier U1 is activated and the oscillator (Q1) and amplifier (U2) are turned off. The 21 MHz reference from the Spectrum Generator therefore controls the frequency of the radio.

Emitter Follower Q2 and the network consisting of R67, R68, R69, CR8, CR9, CR10, and CR13, CR14, CR15 compensate for the nonlinear frequency vs. voltage characteristic of the varactor diodes. The V.F.O. Control voltage from the front panel is applied to varactor diodes CR6 and CR7 through this network, thereby providing the desired small frequency swing around 21 MHz.

4.2.4.4 2nd L.O. CIRCUITRY

The 2nd L.O. (Q7) is a Colpitts crystal oscillator of similar design to the V.F.O. Tuned circuit L17, C46, C97 and C47 tunes the circuit to resonance at 80.75 MHz. A small sample of oscillator output is taken from the junction of C97, C47 and Y2 and is fed to Amplifier Q9. The 2nd L.O. output to the receiver/exciter module is taken from the drain of Q9 through pi network C67, L25 and C68 which matches the output to 50 ohms.

4.2.4.5 100.75 MHz MIXER

The 100.75 MHz mixer (Q8) heterodynes the 2nd L.O. output from Q7 and the 20 MHz reference from the Spectrum Generator. The triple tuned 100.75 MHz bandpass filter selects the desired sum frequency while rejecting the 80.75 MHz and 60.75 MHz components. Tuned circuit L28, C72 prevents loading of the 20 MHz signal by the oscillator. Tuned circuit L27, C71 prevents the loading of the oscillator by the pi network. Pi network C48, L18, C49 transforms the 50 ohm input impedance to 200 ohms thereby increasing the voltage level by approximately 2:1 to ensure adequate mixer drive. Test point TP3 provides a convenient 50 ohm test point for the connection of a spectrum analyzer or any other suitable measuring instrument to aid in bandpass filter alignment.

4.2.4.6. BALANCED MIXER

Depending on the mode selected, the balanced mixer heterodynes the 1.5000–1.5999 MHz output of the Low Digit Generator and either the 21 MHz reference or V.F.O. The mixer is a doubly-balanced mixer design using hot carrier diodes and balun transformers. The 19.45 MHz bandpass filter selects the desired difference frequency. The output is fed to U3 where the signal is amplified and further filtered by tuned circuit L5-C17. Automatic Gain Control (AGC) is provided by diodes CR5,

CR12 and their associated circuitry to ensure a constant and proper level to the 81.25 MHz mixer. Test point TP1 provides a well isolated point for observation of the signal without appreciable loading of the tuned circuit.

4.2.4.7 81.25 MHz MIXER

The 81.25 MHz Mixer combines the 19.5000-19.4001 MHz signal from amplifier U3 and the 100.7500 MHz signal from mixer Q8 to produce the difference frequency of 81.2500-81.3499 MHz. The 81.25 MHz bandpass filter (L7, C20, L38, C21, L8, C22, C23 and C24) selects the desired difference frequency. A well-isolated test point, TP2, is also provided here to permit observation of the signal with 50 ohm equipment.

4.2.4.8 OUTPUT MIXER AND BROADBAND AMPLIFIER

The output mixer, Q4, heterodynes the 81.25 MHz mixer output and the VCO sample from the VCO assembly (1A4A5). The VCO sample is fed to the mixer through balun transformer T3 which transforms the signal to a 200 ohm impedance level to ensure adequate voltage drive to the mixer. The mixer output is filtered by a 10-50 MHz bandpass filter (L9, C29, L10, C86 and L11) and then transformed to a low impedance by emitter follower Q10. Potentiometer R54 in the base circuit of Q10 permits output level adjustment. The output of Q10 passes through 50 MHz Low Pass Filter (C74, C75, L30, C76, C82, C31, L31) to the broadband amplifier (Q5, Q6). Negative feedback around the the amplifier (R17, R19, R6) provides flat gain to well beyond 50 MHz as well as a constant input impedance, stable D.C. operating point, and low output impedance.

4.2.5 V.H.F. DIVIDER–1A4A4

Refer to Figure 5.8.

4.2.5.1 GENERAL

The V.H.F. Divider (1A4A4) contains a divide-by-400 high speed preset counter which forms the 10 MHz, 1 MHz and 100 kHz frequency steps. A phase detector compares the frequency and phase of the output of this counter with that of the 100 kHz reference from the Spectrum Generator (1A4A1) and developes a fine steering correction voltage which is fed back to control the frequency of the VCO (1A4A5). This "phase lock loop", by controlling the VCO frequency, forces the input to the V.H.F. Divider to follow the relationship:

$$F_{in} = 10.0 + 10\,N_{10\ MHz} + N_{1\ MHz} + 0.1\,N_{100\ kHz}$$

where: $N_{10\ MHz}$ = the 10 MHz digit

$N_{1\ MHz}$ = the 1 MHz digit

$N_{100\ kHz}$ = 100 kHz (i.e. .1 MHz) digit

and F_{in} is given in MHz

The input frequency therefore varies from 10.0 to 39.9 MHz in 100 kHz steps. The 10 MHz input corresponds to dial settings of "000" whereas the 39.9 MHz input corresponds to dial settings of "299" on the 10 MHz, 1 MHz and 100 kHz dials respectively.

The inputs to the V.H.F. Divider are: the 100 kHz reference (from the Spectrum Generator): the output signal from the Translator; the frequency control lines from the 1 MHz and 100 kHz switches on the front panel (8 wires); and the 10 MHz preset lines (from the V.C.O.). The output is the fine steering voltage which is fed back to the V.C.O.

4.2.5.2 BROADBAND AMPLIFIER

The broadband amplifier consists of a two stage feedback amplifier (Q1,Q2) followed by a complementary emitter follower (Q3,Q4). The negative feedback network, (R6,R7,R4) around Q1 and Q2, provides flat gain to well beyond 50 MHz, a constant input impedance over the frequency range, and stable D.C. operating point. R1 establishes the the input impedance of this amplifier at 50 ohms. The output of the feedback amplifier is fed to the complementary emitter follower (Q3, Q4). This emitter follower provides a low driving impedance for the subsequent high speed prescaler, and also

establishes the proper logical zero and logical one levels to be compatible with the subsequent TTL logic integrated circuits.

4.2.5.3 PRESCALER

The prescaler (U2) is a high speed dual flip-flop connected in a conventional divide-by-four configuration. It's output is buffered by NAND gate AlC so as not to place excessive loading on U2.

4.2.5.4 PRESET COUNTERS

The preset counters (U3, U6, U7) consist of two stages of preset decade counters (U3, U6) followed by a preset divide-by-four dual flip-flop (U7). U7 is preset by quad two input NAND gate U13 and the A and B sections of quad two input NAND gate U8. During the normal counting mode (that is, when the counters are not being preset) the data strobe (D_S) lines on U3 and U6 are held in a "1" state by preset flip-flop U10. This permits these counters to function in their normal divide-by-ten mode. Similarly, the 10 MHz preset bus is held in a "0" state by U10. This forces the outputs of gates U8A and U8B and, therefore, the preset inputs to dual flip-flop U7, to be in a "1" state. Also the outputs of U13C and U13D, and therefore the clear inputs to U7 are forced to a "1" state. U7, therefore, counts in its normal divide-by-four mode. During the preset interval, the D_S lines to U3 are held in a "0" state by U10 and the inputs to U8A, U8B, U13C and U13D are held in a "1" state by U10. The clock pulse to the counters is inhibited and the preset information from the 10 frequency control lines is entered into counters U3, U6 and U7.

4.2.5.6 100 kHz CARRY GENERATOR

When all four 100 kHz preset lines are programmed to a "0" state by the front panel switches (corresponding to a dial setting of 0 on the 100 kHz frequency control), a special "carry" signal must be generated to program the counters to the correct division ratio.

Mathematically, this is necessary because a dial setting of zero requires the input counter, U3, to divide by zero--an impossible operation. The count is corrected by programming U3 to divide-by-ten in this state and then subtracting one count from the next decade counter. Note that this is the same mathematical operation of "borrowing" when, for example, one subtracts nine from ten.

Quad two input NAND gate U4 is connected as a quad inverter with a common output. One of the four 100 kHz input lines is connected to each section of the gate. This special gate is of the "open collector" type enabling all four outputs to be connected together. The output of U4 is inverted by U5A. If all four inputs to U4 are zero, (dial set to "0" on the 100 kHz switch), the output of U4 will be in a "one" state and the U5A output will be a "zero". If any of the 100 kHz inputs are in a "1" state, the U5A output will also be a "1".

4.2.5.7 PRESET GENERATOR

During the normal counting interval, the Q output of flip-flop U10 is in a "1" state, the preset bus is in a "1" state and the 10 MHz preset bus is in a "0" state. In order to count properly, the presetting must occur between input clock pulses. A "look ahead" scheme is therefore employed to eliminate the propagation delays through the various counters.

First assume that the 100 kHz dial is not in the "0" position (that is, that the output of U5A is in a "1" state). When the preset counter has reached a count of 399 (that is, one count from being filled); counter U3 will have a count of "9" (or binary 1001), U6 will have a count of "9" (or binary 1001) and U7 will have a count of "3" (or binary 11). The output of 8 input NAND gate U9 will sense this unique state and will go to a "0" state. U8C inverts this output to a "1" state, making the K1 input to master/slave flip-flop U10 a "1". On the next transition of the U3 input clock to a "0" state, the Q output of U10 will toggle to a "0" state and, therefore, the preset bus will be in a "0" state and the 10 MHz preset bus will be in a "1" state. Presetting will therefore occur. On the next transition of the U3 input clock back to a "1" state, the output of U8D will transition from a "1" to a "0" state, applying a "0" to the preset input (P) of U10 and forcing the Q

output of U10 back to a "1" state. This terminates the preset cycle, and the normal counting sequence is restored.

If the 100 kHz dial is set in the "0" position, the U5A output will be in a "0" state. The output of carry gate U5B will therefore always be in a "1" state and will not follow the Q_A output of U6. Flip-flop U10 will now be "armed" at the 389th counter state instead of at the 399th state. The desired "carry" of ten counts will therefore occur.

4.2.5.8 PHASE DETECTOR

The 100 kHz reference from the Spectrum Generator is divided in frequency by four to 25 kHz by dual flip-flop U11. In the phase detector (U12), the frequency and phase of the output of the preset counter is compared with that of the 25 kHz reference and a fine steering correction voltage is fed back to control the frequency of the V.C.O. (1A4A5). This feedback voltage changes in the correct direction to bring the V.C.O. into phase lock. The phase detector operates in the following manner: If the frequency of the preset counter output is greater than that of the 25 kHz reference, the phase detector output will decrease in voltage. If the frequency of the preset counter output is less than that of the 25 kHz reference, the phase detector output will increase in voltage. If the two frequencies are exactly the same, the phase detector output will remain constant.

4.2.6 V.C.O.–1A4A5

Refer to Figure 5.9.

4.2.6.1 GENERAL

The V.C.O. (1A4A5) generates the variable frequency 1st L.O. signal which controls the operating frequency, F_O, of the radio. This signal is generated in three voltage controlled oscillators, each covering a 10 MHz frequency range, and selected by the 10 MHz switch on the front panel of the radio. The frequency ranges of the oscillators are (assuming a 2nd L.O. frequency of nominal 80.7500 MHz):

The actual oscillator frequencies will deviate from the above by an amount equal to the difference between the actual 2nd L.O. frequency and its nominal 80.7500 MHz.

The exact operating frequency of the oscillators is controlled by two independent D.C. voltages, designated coarse and fine steering. Each steering voltage is applied to a voltage variable capacitance diode (varactor) connected across the oscillator tank circuit. The coarse steering voltage is derived from a precision voltage divider located on the 1 MHz frequency control switch on the front panel. This voltage sets the oscillator frequency within the acquiring range of the phase lock loop. The fine steering voltage is derived from the phase detector on the V.H.F. Divider (1A4A4) after subsequent filtering by the loop filter. This voltage is the D.C. feedback within the phase lock loop which forces the oscillator to the correct frequency.

The oscillator outputs are buffered by two independent amplifiers: one providing the output to the Receiver module (1A3) and the other providing the oscillator sample to the Translator (1A4A3).

OSCILLATOR	F_O RANGE (MHz)	VCO FREQUENCY RANGE (MHz)
Band 0	0.0000 to 9.9999	91.2500 to 101.2499
Band 1	10.0000 to 19.9999	101.2500 to 111.2499
Band 2	20.0000 to 29.9999	111.2500 to 121.2499

Two transistor switches develop the 10 MHz preset signals for the V.H.F. Divider (1A4A4).

4.2.6.2 OSCILLATORS

The three oscillators are of identical design and, therefore, only the "Band 0" Oscillator will be discussed. The "Band 0" Oscillator is a conventional Colpitts oscillator employing a low noise dual gate MOSFET(Q6). The resonant tank circuit consisting of C20, C21, L1, C16, CR3 and CR4 determines the oscillation frequency of the circuit. Feedback is provided by C20 and C21. Two point tracking of the oscillator frequency is provided by L1 at the low frequency end of the band and C16 at the high frequency end. The coarse steering voltage from a resistor string on the 1 MHz switch is applied to voltage variable capacitance diode (varactor) CR3 through the filter network (C10, R26, C11, and R27) and RF bypass network (R28, C12, R29 and C13). Fine steering voltage from the phase detector in the VHF Divider assembly, 1A4A4, is applied to varactor diode CR4 through the loop filter (R23, C7, R24, C8, R25, and C9) and the 25 kHz twin tee notch filter (R20, C5, R22, C3, C4, R21 and C6). The output is taken from the drain of Q6 through C22. Hot carrier diodes CR5 and CR6 prevent the RF signal from biasing the varactor diodes into their conducting region.

4.2.6.3 OUTPUT BUFFER AMPLIFIER

The output of each oscillator is fed to the output buffer amplifier (Q9, Q10). This amplifier is a conventional cascode configuration providing high input impedance, high isolation, and negligible feedback. The output of the amplifier is fed through bandpass filter (C46, L11, L12, C48, L13, and C50) and matching transformer (T1) to the Receiver module.

4.2.6.4 TRANSLATOR BUFFER AMPLIFIER

The translator buffer amplifier (Q11, Q12) is similar in operation to the output buffer. The output is taken from the collector of Q11 through C54 and matching transformer T2.

4.2.6.5 LOGIC SWITCHING

Transistors Q3, Q4 and Q5 apply +12 volts to the appropriate oscillator circuit when the respective band command line is connected to ground by the 10 MHz switch on the front panel. Transistors Q1 and Q2 generate the required 10 MHz preset code for the VHF Divider (1A4A4) in the following sequence:

10 MHz switch Position	2^1 Preset logic level	2^0 Preset logic level
0	1	0
1	0	1
2	0	0

NOTE

The TTL compatible logic levels are as follows:
Logical 0 = less than 0.8 volts
Logical 1 = greater than 2.0 volts but less than 5.0 volts

4.2.6.6 MECHANICAL

Refer to Figure 5.2.

The V.C.O. board is secured between two metal plates (front and rear) that serve as a support and an electrical shield. This unit is rigidly mounted to the end plate of the synthesizer card guides to ensure superior performance under extreme vibration and shock conditions. Ability to make alignment adjustments is provided by access holes where necessary.

4.2.7 SYNTHESIZER MOTHER BOARD-1A4A6

Refer to Figure 5.10.

The synthesizer mother board consists of five receptacles, and their related components and circuitry. It is mounted on four standoffs located on the chassis, under the synthesizer module, as shown

in figure 5.2. The five printed circuit cards (1A4A1, 1A4A2, 1A4A3, 1A4A4, and 1A4A5), described previously in this section, insert into this mother board thereby constituting the entire synthesizer module.

4.2.7.1 L.O. BLANKER CIRCUITRY (PART OF SYNTHESIZER MOTHER BOARD 1A4A6)

A local oscillator blanking circuit blanks the output of the 3rd L.O. (10.5 MHz) when the operator changes the 1 MHz frequency dial on the front panel. Blanking the L.O. is not absolutely necessary when the synthesizer is used only with a receiver. However this synthesizer is used with various other types of equipment which incorporate a transmit mode and to insure that spurious signals are not transmitted during the synthesizer settling time the output is blanked.

When the setting of the 1 MHz switch is changed, the "preset 2^0 1 MHz" frequency control line will change from either:

a) logical "0" (approximately 0.2 volts) to logical "1" (approximately 3 volts) state

or

b) logical "1" to logical "0" state

In case a) a positive-going differentiated pulse is formed by differentiating network C8, R3, CR2 and R10 and is applied to the base of switch Q2 through R4. Q2 will saturate driving switch Q1 into conduction and generate a 12 volt blanking pulse through isolation diode CR4. The blanking pulse is applied to the Spectrum Generator (1A4A1) to blank the 3rd L.O. (10.5 MHz) output. The blanking duration is approximately 100 to 200 msec and is controlled by the time constant of the differentiating network.

In case b) a negative-going pulse is formed by differentiating network C2, R2, CR1 and R5 and is applied to the base of Q1 through R8. Q1 will saturate, forming the blanking pulse. Blanking duration is 100 to 200 msec and is controlled by the time constant of the differentiating network.

in the AM RECEIVE mode, +12 volts is applied to the output through isolation diode CR3. This blanks the 3rd L.O. while in this mode and prevents a beat note between the 3rd L.O. and the carrier of the received signal.

4.2.7.2 VCO FILTER ASSEMBLY – 1A4A7

Because of the very high frequencies used in the synthesizer, it is possible for a small amount of the 2nd L.O. frequency (80.75 MHz) to appear on the 1st L.O. output feeding the receiver/exciter. If this signal were present, a large receiver input signal at the 2nd I.F. frequency (10.5 MHz) could produce a spurious receiver output and, therefore, degraded I.F. rejection in the radio

The VCO Filter assembly consists of a series tuned trap resonant at the 2nd L.O. frequency (80.75 MHz, placed in shunt with the 1st L.O. output coaxial cable feeding the receiver/exciter. This trap presents an extremely low impedance to any signal in the vicinity of 80.75 MHz while maintaining a high impedance at any 1st L.O. signal frequency. The VCO filter assembly is mounted to the front plate of the VCO assembly. The complete schematic is shown in figure 5.10.

4.2.8 TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR (TCXO) 1A8U1

The frequency accuracy of the synthesizer and subsequent tuning accuracy of the receiver is totally dependent upon the accuracy of the TCXO. The TCXO is a non-repairable assembly mounted in the chassis of the GSR-920 with a 7 pin tube socket, secured by four nuts on the chassis bottom and covered by a shield can to minimize r-f leakage. Pin designations are shown on the Main Frame Schematic Figure 5.4. The unit requires +12V dc on pin 2 supplied from the distribution amp switch on the rear panel and the 5.000,000 MHz output is taken from pin 6. If it is suspected that the frequency of the TCXO needs to be adjusted connect a counter with a time base accuracy of at leat 1 x 10^{-7} to 1A8A1J3 located on the distribution amplifier on the rear panel (J3 is labeled FREQ STD IN/OUT). Set the switch on the distribution amplifier to INT OUT. If adjustment is required remove

the screw on top of the TCXO can and adjust the trimmer capacitor with a small screwdriver. Frequency should be within ± 5 Hz of 5.0 MHz.

The TCXO output is connected to the distribution amplifier mounted on the rear apron. The amplifier output supplies the 5.0 MHz signal to the spectrum generator and it can also be used to drive other receivers that do not contain a TCXO.

4.3 RECEIVER

The receiver electronics are divided among four printed circuit boards: VHF MIXER (1A3A1), IF/FILTER (1A3A2), AUDIO (1A3A4), and SPEAKER DRIVER (1A1A1). The first three boards are interconnected by plugging into the RECEIVER MOTHER BOARD, (1A3A7). The SPEAKER DRIVER is located on the front panel. The block diagram is shown in figure 4.3.

4.3.1 GENERAL

Received signals are first passed through a band pass filter network in the filter module or an optional built-in preselector installed in place of the filter module. The output is fed into an 11 pole high pass filter on the VHF mixer board. The filter is a very sharp cut off broadcast band rejection network. The signal is then amplified and mixed in a balanced mixer with the first local oscillator, providing an output on 91.25 MHz.

In addition to 91.25 MHz, the mixer output contains several other significant mixing products, but because of the high frequencies involved they are separated in frequency from 91.25 MHz by a relatively large amount. The unwanted products are removed by passing the mixer output through a narrow band 91.25 MHz crystal filter. The resulting 91.25 MHz signal is then amplified and mixed again in another balanced mixer with the second local oscillator (80.75 MHz), which yields an output at 10.5 MHz. High frequency products from this mixing are removed by a low pass filter.

The 10.5 MHz I.F. signal is amplified, then fed to a diode gating network which selects the upper sideband filter (USB), lower sideband filter (LSB), or amplitude modulation filter (AM). These filters determine the receiver's bandwith and reduce the interference from adjacent channels. The filtered I.F. signal is passed through another diode gate, then is highly amplified in two integrated circuit I.F. amplifiers. The output of the second I.F. amplifier is coupled to a product detector when receiving sideband signals and to a fixed amplifier and an envelope detector for receiving amplitude modulated signals. The fixed amplifier also feeds into the AGC detector which develops a D.C. voltage proportional to the received signal amplitude. The AGC voltage is amplified and used to control the voltage gain of the RF amplifier and the two integrated circuit I.F. amplifiers.

The product detector combines the 2nd I.F. signal with the 3rd local oscillator (10.5 MHz), giving an audio signal which reproduces the original transmitted audio. The audio is fed to a 600 ohm line driver and to a fixed audio amplifier. The envelope detector detects the amplitude of the received signal reproducing the audio on a transmitted AM signal. The resultant audio is also fed to the 600 ohm line driver and to the fixed audio amplifier. If the standard SSB control head is installed in the front panel the audio from the fixed audio amplifier passes directly through the control head wiring to a "normal thru" jack labeled AUDIO IN on the rear panel. If an ISB control head is installed the audio signal is connected to the MODE and MONITOR switches prior to connection to the AUDIO IN jack. From the AUDIO IN jack the signal is then routed to the VOLUME control on the front panel and then to the speaker driver whose output drives the panel mounted speaker and headphone jack. A detailed wiring diagram of the audio routing is included in the discussion of the front panel.

The AGC voltage also is used to vary the current through the front panel meter to give a visual indication of relative signal strength received.

The front panel RF GAIN control acts to vary the gain of an amplifier which shuts back the AGC voltage, reducing the gain of the RF amplifier and the two integrated circuit I.F. amplifiers. This greatly reduces background noise when receiving strong signals.

The following subparagraphs describe circuit operation of the individual circuits by printed circuit board.

4.3.2 VHF MIXER BOARD -- 1A3A1

Refer to Figure 5.11.

Figure 5.11 consists of a front view (component) side) and rear view (foil side) plus a schematic of the VHF MIXER printed circuit board. In addition a complete parts list is provided on the reverse side of the fold out page.

4.3.2.1 BROADCAST FILTER

The R.F. input signal appears on pin 15 of 1A3A1-P1, and is passed through the broadcast band filter network, starting with C9 and ending at C13, to stepup transformer T1, which matches the R.F. amplifier (Q2) input impedance to the 50 ohm characteristic impedance of the broadcast band filter.

4.3.2.2. RF AMPLIFIER

The R.F. amplifier is a dual gate MOSFET with protection diodes built into the input gate to prevent burnout under overload. The input signal is applied to gate 1 and the amplified signal is taken from the drain through transformer T3. The source (gate 1 through R8) is biased positively by 3.6V to increase the dynamic gain range when Gate 2 voltage is varied. The MPF120 transistor can now be practically cut off when gate 2 voltage is taken to zero. Gate 2 derives its voltage from the automatic gain control (AGC) line, which varies between +8V at no signal to approximately +2V for an extremely strong signal.

The output of T3 passes through diode CR3 to the input of balanced mixer transformer T4. Diode CR3 is switched on (conducts) by the voltage on T3, through the winding on T4, and R14 to the +12T line (which is at ground potential). Likewise, diode CR1 is turned off during receive and has no effect on the operation.

4.3.2.3 1st LO AMPLIFIER AND BALANCED MIXER

Local oscillator number 1 is injected at pin 18 of 1A3A1-P1 into amplifier Q5. The amplified L.O. is applied to T5 to switch hot carrier diodes CR4-7 on and off at the L.O. frequency. The injected R.F. signal at T4 now mixes with the L.O. signal to provide several outputs, one of which is 91.25 MHz. The balanced mixer is used to minimize the number of mixing products because of its inherent ability to virtually eliminate the even harmonics of the mixing frequencies and their sums and differences, as well as the mixing frequencies themselves. Therefore, the primary mixer output is L.O. number 1 plus the R.F. signal and L.O. number 1 minus the RF signal. L.O. number 1 frequency is variable between 92.85 MHz and 121.25 MHz, corresponding to 1.6 to 29.999 MHz selected by the front panel frequency dials. In the GSR-920, the difference frequency is selected and a first I.F. of 91.25 MHz was picked to minimize spurious frequencies within the receiver. Note that at the lowest frequency of operation, 1.6 MHz, the sum and difference frequencies in the mixer output are 3.2 MHz apart making it a simple task to remove the sum frequency with a narrow band crystal filter.

For instance, if the received signal is on 10.000 MHz, the first L.O. frequency is 101.25 MHz,and the two mixer output frequencies are 91.25 and 111.25 MHz.

4.3.2.4 VHF FILTER AND BILATERAL AMPLIFIER

The mixer output is taken between the center taps of T4 and T5, fed through a matching network, L10 and C41, into filter FL1 at 91.25 MHz. The filter impedance is approximately 4000 ohms, hence the need for matching from the low impedance mixer output. Another matching network, C44 and L11, matches the filter into the 50 ohm input impedance of the bilateral amplifier, Q6 and Q7. The amplifier is bilateral in that it can amplify in both directions, however only Q6 is activated in this receive application.

Capacitors C46 and C47 form an impedance transformation network with T7 to match the gate 1 impedance of Q6. When Q6 is turned on by +12R on gate 2; Q7 is turned off by the +12T ground on its gate 2 (for explanation see paragraph 4.3.2.2). As with the R.F. amplifier, the source is biased positively by 3.6V to allow gate 2 to turn the device on or off. The output of amplifier Q6 is taken through impedance matching network T8, C55, and C56 to T9, the input to a second balanced mixer.

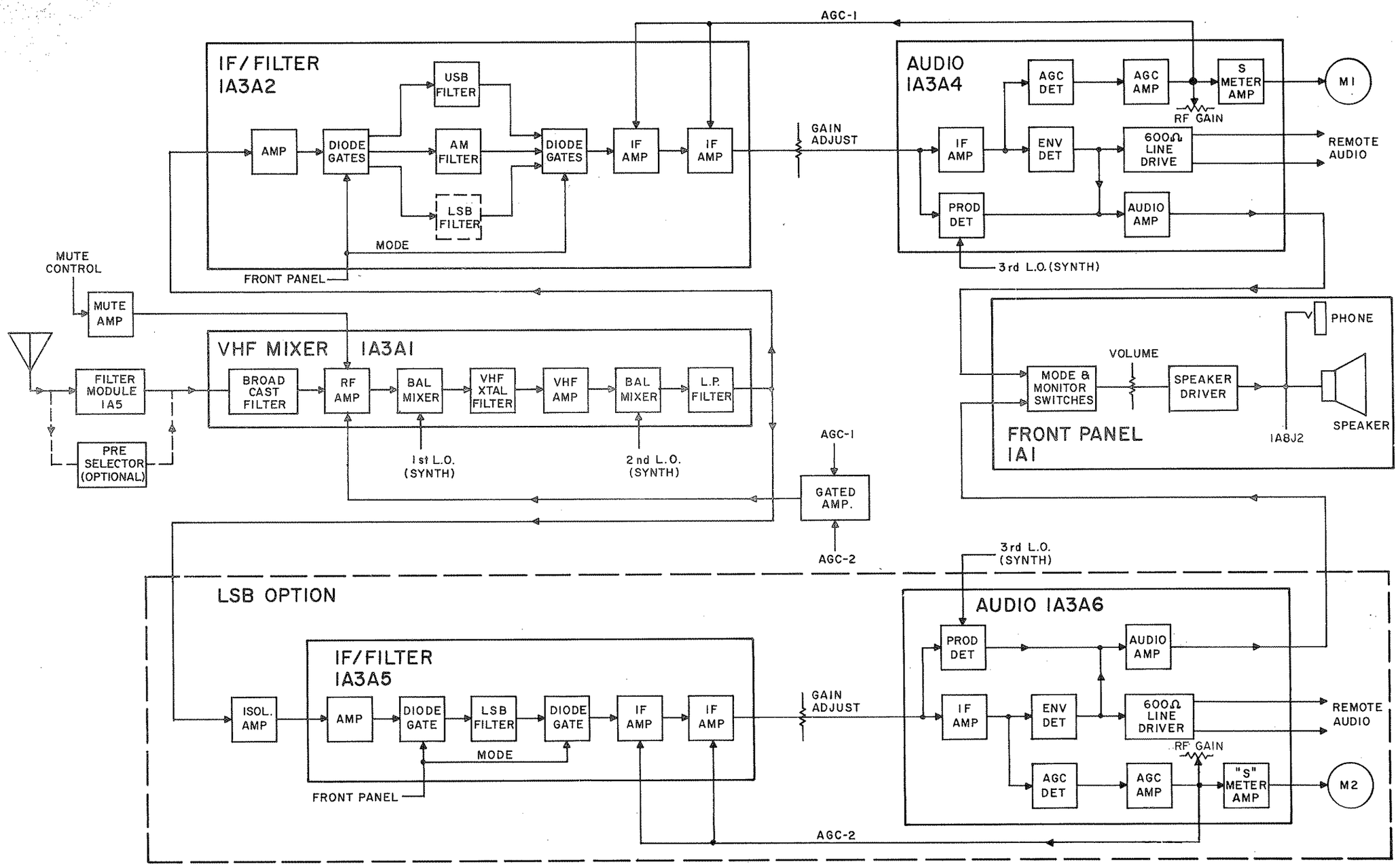


Figure 4.3 Receiver Section Block Diagram

4.3.2.5 2ND LO AMPLIFIER AND BALANCED MIXER

The second mixer operates in a manner similar to the first mixer. The main difference is that the first mixer is an "up converter", that is, its output frequency is higher than the input frequency. The second mixer is a "down converter" changing the 91.25 MHz signal to 10.5 MHz. Transistor Q8 amplifies the second local oscillator signal, 80.75 MHz, and feeds it to the mixer through transformer T11. The output of the second mixer is taken from T9 center tap and passes through a low pass filter to eliminate the high frequency mixing products. The output of the VHF mixer board is on pin number 5 of 1A3A1-P1.

4.3.3 IF/FILTER BOARD –1A3A2

Refer to Figure 5.12.

4.3.3.1 GENERAL

The IF/Filter board accepts the output of the VHF mixer, routes the signal through the selected bandpass IF filter and amplifies the resultant signal in the two IF amplifiers, U1 and U2.

4.3.3.2 DIODE GATES AND IF FILTERS

The signal from the VHF mixer board is fed to the IF/Filter board on pin 5 of 1A3A2-P1. This 10.5 MHz signal is amplified by Q3 and fed to the junction of diodes CR1, CR3, and CR5. Diodes CR1 and CR2 form a gate for the input of FL1, the LSB filter; CR3 and CR4 form a gate for the input of FL2, the AM filter; CR5 and CR6 form a gate for the input of FL3 the USB filter.

As the GSR-920 uses "high side" conversion, that is, the first local oscillator is always higher in frequency than the received signal, the sidebands are reversed. This means that a lower sideband signal received at the antenna is converted by the mixer to an upper sideband signal at the 10.5 MHz I.F. To pass the upper sideband IF signal on to the detector, an upper sideband filter must be used. Therefore, FL1 is the filter used for receiving the lower sideband, but is in reality an upper sideband filter. Similarly the upper sideband is received by lower sideband filter, FL3.

The diode gates, which are also repeated at the filter outputs, operate as follows: Assume the LSB mode is selected. A +12VDC voltage is applied to pin 9 of 1A3A2-P1. This turns on CR8, CR1 and CR12. Using the input gate as an example, current flows through R21, CR8, R27, CR1 and R19. A voltage of approximately +5VDC exists across R19 as a result, which turns off CR3 and CR5. CR2 is turned off because the cathode is more positive (+6V) than the anode (+4V). So the signal is allowed to pass into the filter. Additionally, the other filter input gates are turned off. Using CR3 and CR4 as an example, CR4 is conducting, (+4 VDC on its anode), with a path to ground for the cathode through R28 and R32. This shorts any signal leakage across CR3 to ground through C19; and CR3 is turned off with +5V on the cathode and +4V on the anode.

The input and output gates for the other filters operate in a similar manner. CR7, CR8, CR9 and CR10 prevent interaction with other control circuits.

4.3.3.3 INTEGRATED CIRCUIT IF AMPLIFIER

The filter output is fed through C37 and diode gate CR17 to pin 2 of U1, an integrated circuit amplifier. There it is amplified by approximately 30db and fed to pin 2 of U2, another integrated circuit amplifier. A schematic diagram of U1 and U2, CA-3053, is shown in Figure 4.4 below.

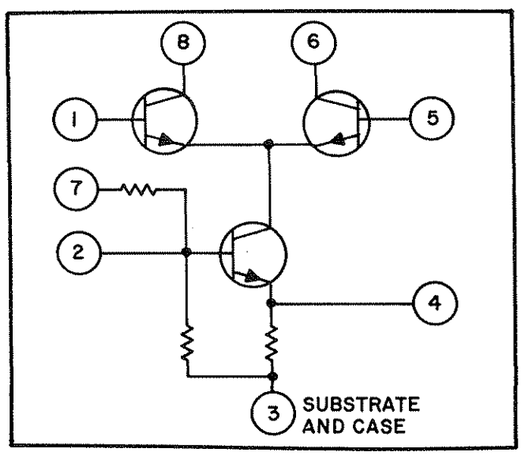


Figure 4.4 CA3053 Schematic of U1 and U2

The networks L3, C51, C52 and L4, C58, C59 are tuned to 10.5 MHz and are used for impedance transformation. The output of the I.F./Filter board is on pin 11 of 1A3A2-P1. AGC voltage for gain control of U1 and U2 is supplied through pin 13 of 1A3A2-P1.

4.3.4 AUDIO BOARD – 1A3A4

See Figure 5.13.

4.3.4.1 GENERAL

The 10.5 MHz I.F. output from the IF/Filter board is supplied to pin 11 of 1A3A4-P1, and then is routed to two circuits: the product detector, Q6, Q8, and Q9, and the fixed gain I.F. amplifier, Q1.

4.3.4.2 FIXED IF AMPLIFIER AND AGC DETECTOR

The output from Q1 is fed to an emitter follower, Q2, to drive the AGC detector amplifier, Q3. A threshold bias is established on Q3 by R14 and R15. Any received signal of sufficient amplitude to overcome this pre bias, that appears at the base of Q3 will cause Q3 to conduct thereby lowering the collector voltage. This allows diode CR4 to conduct, reducing the base voltage on AGC amplifier Q4. In turn this causes the emitter voltage on Q4, which is the AGC voltage, to drop proportional to received signal strength. The "no signal" value of AGC voltage is approximately +8.8 VDC which provides maximum R.F. and I.F. gains. A signal of 100,000 uv will cause the AGC voltage to drop to approximately +2.5 to +3.0 VDC. The "no signal" AGC voltage is established primarily by R16 and R17. The AGC attack time is determined by R13 and C11. CR3 is used to equalize the load on Q2.

4.3.4.3 "S" METER AMPLIFIER

Transistor Q5 is a D.C. amplifier which drives the "S" meter. Its threshold is set so that meter movement begins when a signal of approximately 2 or 3 uv is received, and provides full scale meter deflection for a 100,000 uv signal.

4.3.4.4 RF GAIN CONTROL AMPLIFIER

Amplifier Q12 is driven from the RF GAIN CONTROL to reduce the AGC voltage which in turn reduces the R.F. and I.F. amplifier gains. As the RF GAIN CONTROL is turned counter clockwise, the base voltage of Q12 is made more positive causing Q12 to conduct lightly at first, then more heavily to "pull down" the AGC voltage. With the RF GAIN CONTROL fully counter-clockwise, it should be possible to completely disable the receiver.

4.3.4.5 AM DETECTOR

In addition to the AGC circuitry, amplifier Q1 also drives the AM detector, Q7 and Q10. Transistor Q7 is a high gain amplifier used to drive amplitude detector Q10 with a large signal for best linearity. Q10 is biased almost to cutoff so that it will detect amplitude variations. The output is reduced by R43 to equal the product detector output voltage. The AM detector is turned on in the "AM" mode by the +12R AM voltage on pin 7 of 1A3A4-P1.

4.3.4.6 PRODUCT DETECTOR

The product detector Q6, Q8, and Q9 combines the 10.5 Mhz I.F. signal with that of the 3rd local oscillator, 10.5 MHz. Q9 amplifies the 3rd L.O. and injects it into the detector where the R.F. components are removed by C29 leaving only the audio. The product detector is turned on only in USB, LSB, or CW by voltages on either pin 8 or pin 9 of 1A3A4-P1. CR1 and CR2 are diode gates used to prevent interaction between the +12 USB and +12 LSB lines.

4.3.4.7 600 OHM LINE DRIVER

Both the product detector output and the envelope detector outputs are combined in R42 and feed integrated circuit 600 ohm line driver, U1, and fixed gain audio amplifier Q11. The CA3020 line driver is a conventional push-pull multistage amplifier feeding output transformer T1. The input to U1 is controlled by R48 and the balanced 600 ohm output appears on pins R and T of 1A3A4-P1. Pin S is the output transformer center tap and is not normally used.

4.3.5 SPEAKER DRIVER – 1A1A1

Refer to Figure 5.14.

The speaker driver is a hybrid integrated assembly capable of delivering three watts of audio to an eight ohm speaker. Output to the speaker is taken through a 500 uf capacitor, to provide good fidelity. Capacitor C4 reduces the high frequency response to eliminate high frequency hiss and noise.

4.3.6 RECEIVER/EXCITER MOTHER BOARD – 1A3A7

Refer to Figure 5.15.

This unit consists of five receptacles, a printed circuit board and related components. It is located under the chassis below the Receiver module to mount the printed circuit boards (1A3A1, 1A3A2, 1A3A4). If the ISB option is included 2 additional p-c boards are installed; another IF/Filter board 1A3A5, and Audio board 1A3A6. Refer to Figure 5.3 for proper orientation.

4.3.6.1 RECEIVER MUTING

As shown on the receiver mother board schematic drawing some circuitry is installed in addition to the p-c card connectors. The receiver contains a muting capability which allows the radio to be shut off by applying a ground (earth) at pin G of 1A8J2 located on the rear panel. This provision is provided if it is necessary to silence the receiver when a transmitter in the station is keyed on. When a ground is applied to pin G, Q2 is turned off which removes the drive from the PNP transistor Q3. This turns Q3 off and removes 12VR from the VHF Mixer and IF/FLT boards.

4.3.6.2 AGC ISOLATION AMPLIFIER

Transistor Q4 is required to isolate the two AGC lines when the ISB option is installed. The AGC amplifier is located on the Audio board, 1A3A, and controls the gain of the IF/FLT board and VHF mixer board. Since only 1 VHF mixer board is required even if the ISB option is installed and control will come from two amplifiers it is necessary to isolate the two lines and the channel with the larger signal will control the gain of the VHF mixer board.

4.3.6.3 IF GAIN ADJUST

Two potentiometers; R7, R8, are installed between the IF/FLT boards and the Audio boards for the purpose of equalizing the gain between USB and LSB when the ISB option is installed. See Section 5 for alignment procedure.

4.4 POWER SUPPLY – 1A6

Refer to Figure 5.16.

4.4.1 GENERAL

AC input is brought in through 1A6P1 Pins 1, 3, 5, and 7. The input windings are appropriately strapped by the power connector: i.e., for 115V operation, the primary windings are in parallel, and for 230V operation, the primary windings are in series. For continuous operation at line voltages 15% higher than 115V or 230V, taps are provided on terminal board TB1. DC output voltages of +21, +12 and +5 volts are provided for operation of the receiver.

4.4.2 12VDC REGULATOR AND 21VDC OUTPUT

A bridge rectifier, 1A6U1 supplies unregulated 21 volts d-c voltage to the regulator, A1U1. The 21 VDC rectifier output is also supplied directly to the speaker driver.

The regulated output of A1U1 drives the base of series regulator 1A6-Q1 which is required to supply the current to the receiver and synthesizer. The output voltage of A1U1 is normally 12.6 VDC and is set by the division ratio of R3 and R4. Overcurrent protection for both the 21V and 12V output is provided by fuse F1 located on the regulator board. Short circuit protection is provided in A1U1 by monitoring the voltage developed across R2 and removing the drive to 1A6-Q1. Overvoltage protection (1A6-Q1 shorted) is provided by the zener diode CR2 which conducts when the voltage exceeds 15V, sending a pulse to SCR CR1 and turning it on which blows fuse F1. 1A6-Q1 and 1A6-U1 are located on the side wall of the power supply module.

4.4.3 5VDC REGULATOR

A bridge rectifier, 1A6U2 supplies unregulated 12VDC to the 5V regulator 1A6U3. The regulator is a three terminal TO-3 package mounted on the power supply side wall. It is capable of delivering more than 1 amp and has internal overcurrent and thermal protection in that it will shut off if the parameters are exceeded. Should U3 fail in a shorted condition CR5 would conduct turning on SCR CR3 which blows fuse F2. Additionally CR4 conducts and fires SCR CR1 blowing the 12V fuse, F1. The reason for disabling the 12V line when an overvoltage occurs on the 5V line is that the overvoltage condition may be caused by a short circuit in the receiver between the 12V and 5V buss. If this would occur, disabling the 5V output would not remove the overvoltage condition and the digital IC's in the synthesizer would be damaged.

4.4.4 D-C RELAY TURN-ON

A constant current source, Q1, is contained on the regulator board assembly 1A6A1. This allows the radio to be operated from 13V or 26V DC (if the optional D-C module is installed) without changing relay K1 which has a 12V coil. D-C voltage is switched to pin 8 of 1A6P1 by SW9, the POWER switch on the front panel. CR8 prevents the circuit from being energized if the polarity is reversed so the D-C inverter will not be damaged. However either positive or negative ground D-C sources may be used since the D-C input circuit in the GSR-920 is floating with respect to ground. Diodes CR7 and CR8 provide the d-c bias for Q1. A constant voltage is developed across R9 and the current is therefore determined by the value of R9. CR9 is across the relay coil K1 to clip voltage transients that occur when the radio is turned off. Q1 output also provides current to activate the relay contained on the D-C Inverter assembly 1A6A2. Relay K1 is located on the power supply chassis next to the A-C power transformer.

4.4.5 D.C. INVERTER – 1A6A2

Refer to Figure 5.17.

Basically, the inverter is a transistor oscillator utilizing a saturable core. Upon application of D.C. voltage to the oscillator, Q1 and Q2, slight differences between the two transistors causes one to conduct more heavily than the other and it quickly reaches saturation. Once this occurs, no further change in current is noted and the field in transformer T1 collapses, driving the "on" transistor to an "off" state and the "off" transistor to an "on" state. When the second transistor reaches saturation, the cycle reverses. The result is a square wave oscillator capable of many amperes of current.

Transistors Q1 and Q2 supply the square wave current to the power transformer primary (1A6T1) for 13V or 26V operation. The saturable core transformer design used here allows only 1A6A2-T1 to saturate, and then at a relatively low current level (minimum power dissipation) and prevents the main power transformer from saturating. This eliminates voltage "spikes" in the output. Initial "turn on" bias is established by R1, R2, and R7. Diodes CR1, CR2 and associated components R5, R6 and C1, form an additional "despiking" network to insure that a clean wave form appears at the output.

NOTE

R1 on the DC inverter board (1A6A2) must be short circuited by the shorting bar provided when the transceiver is operated on 13V DC. Refer to paragraph 2.6 for instructions when changing DC operating voltage.

Relay K1 is used to keep the oscillator transistors within allowable ratings during AC operation of the power supply. This allows the DC modules to remain connected to the power supply without damage during AC operation. Note that for 13 VDC operation, the transistor collectors (Q1 and Q2) are connected to the 13V power transformer input windings 2 and 6 on TB2, and the board jumper is across E10 and E11, shorting out R1. For 26VDC operation, the transistor collectors (Q1 and Q2) are connected to the 26V power transformer input windings 1 and 7 on TB2 and the board jumper is between E9 and E10, inserting R1 into the bias circuit.

The oscillator transistors, Q1 and Q2, are physically located on the power supply heat sink at the rear of the transceiver.

4.5 FILTER MODULE – 1A5

Refer to Figure 5.19.

The filter module consists of three printed circuit boards: odd channel filter board, even channel filter board, and motor control board. (The r-f signal from the antenna is connected to the filter module where it is passed through the selected bandpass filter before it is further processed in the receiver.) Figure 5.18 shows the position of each board within the module enclosure.

4.5.1 ODD AND EVEN CHANNEL FILTER BOARDS

The operating range of the receiver is divided into eight frequency bands and filters for each band are contained on the two filter boards. The even channel filter board contains components for bands 2, 4, 6, and 8 corresponding to a frequency coverage of 2.0 to 3.0 MHz, 4.0 to 6.0 MHz, 9.0 to 13.0 MHz and 20 to 30 MHz respectively. The other four bands are contained on the odd channel filter board. Bands 1, 3, 5 and 7 corresponding to 1.6 to 2.0 MHz, 3.0 to 4.0 MHz, 6.0 to 9.0 MHz and 13.0 to 20 MHz.

The filters are 5 pole elliptical design low pass and high pass combined to form a bandpass network with attenuation characteristic of 40 db. Selection of the correct operating band is performed automatically by the front panel frequency select digit switches.

4.5.2 MOTOR CONTROL BOARD

The motor control board contains the d-c gearhead motor that responds to the band select information from the MHz and 10 MHz front panel digit dials and switches the correct band into the signal path. The motor control circuit is an open seeking type in that the required band select line is at 12V potential. The open seeking wafer switch is then driven by the motor until the open notch on the switch arrives at the selected line. Voltage is then removed from the motor, relay K1 is de-energized and applies a short circuit across motor armature, B1, causing it to rapidly stop. The network composed of C1, L1, C2 filters the d-c line and removes motor noise. Diode CR1 prevents the back EMF of the motor from holding in relay K1 when the voltage is removed.

The receiver front end protector, 5024-0024, is also mounted on the motor control board. The receiver front end is protected from burn out caused by high power transmitters located in close proximity.

4.6 PRESELECTOR MODULE 1A5 (OPTIONAL)

Refer to Figure 5.20 and Figure 5.21.

4.6.1 GENERAL

The preselector module is an optional unit that may be installed in the GSR-920 in place of the standard filter module. The preselector greatly increases the front end selectivity of the receiver over that obtained with the band pass filters used in the filter module. The use of the preselector is recommended when the receiver will be installed at a site with transmitters that are operating in the HF band. The preselector increases the receiver's ability to discriminate against strong interfering signals that would otherwise result in cross modulation or intermodulation products and desensitization of the receiver. See Paragraph 1.3, Technical Specifications.

4.6.2 CIRCUIT DESCRIPTION

The preselector is basically composed of three sets of parallel tuned circuits and a dual gate MOSFET r-f amplifier. The coils are wound on large forms for hi-Q and configured as transformers to maintain 50 ohm interface at the input, interstage, and output of the preselector.

The tuned circuits are divided into eight bands; 1.6 to 2, 2 to 3, 3 to 4, 4 to 6, 6 to 9, 9-13, 13-20, and 20 to 30 MHz. Selection of the correct band is automatically done by the MHz and 10 MHz frequency switches on the front panel. Since the selected band covers a range of frequencies, the tuned circuits must be "peaked" to the incoming signal. This is accomplished by the front panel mounted PRESELECTOR FREQ switch. A tuned or peaked condition is determined by monitoring the panel mounted "S" meter or listening to the

speaker output. The preselector may also be switched out and the signal routed directly to the VHF mixer p-c board by the lever switch located under the tuning knob. When the switch is at the preselector IN position+12V is applied to relay coil K1, band switch motor B2 and the r-f amplifier. With relay K1 energized the incoming signal is routed through the preselector. The relay poles that route the signal around the preselector when in the unenergized position, are shorted to ground to prevent a strong signal bypassing the preselector.

The motor driven air variable peaking capacitor, "C1", is a three gang six section capacitor. Each of the sets of tuned circuits is connected to one of the gangs. Each gang is divided into two sections. The small section varies from approximately 7 pf to 75 pf and remains connected to the tuned circuits via section F2 of each rotary switch throughout the frequency range. The larger section varies from approximately 8 pf to 250 pf and is connected to the tuned circuits via section R1 of each rotary switch for the first four bands only, 1.6 to 6.0 MHz. The rotary capacitor is automatically stopped at its minimum and maximum position by the cam mounted on its shaft which activates S5 and S6 and interrupts the drive voltage and lights the FREQ LIMIT lamp on the front panel.

The signal after passing through two tuned circuits is amplified by Q1, the dual gate MOSFET.

Gain control is provided on gate G2 by the AGC isolation amplifier located on the receiver mother board. The gain of the amplifier without AGC should be at least 6 db and is typically 10 to 15 db. A wire terminal, labeled E4 located on the p-c board may be monitored with an oscilloscope or r-f voltmeter to check for correct operation.

The output of the amplifier is routed to switch S3F2, which is driven by the band change motor, and selects the correct tuned circuit. S3F1 selects the correct tuned circuit output which is then routed to relay K1 and then to the VHF mixer p-c board.

4.6.3 RECEIVER PROTECTOR

A receiver front-end protection circuit is adjacent to the r-f input connector located on the preselector. This circuit is composed of pin diodes that conduct when high level signals are present and prevents damage to the r-f amplifier and other low level circuits in the preselector and receiver.

4.7 FRONT PANEL

4.7.1 GENERAL

Refer to Figures 5.22 and 3.1.

The function of each front panel control is explained in Section 3.2. All control functions from the front panel are electrical and routed through connectors, that is, there are no mechanical linkages or shafts from the front panel to the chassis. This allows the front panel to be removed for servicing or trouble shooting and also the panel may be remotely located. See Section 5 for removal instructions.

4.7.2 FREQUENCY DIGIT SWITCHES

There are six frequency select switches on the front panel; 10 MHz, 1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 Hz. Additionally the VFO control may be activated by pulling the knob out which allows the operator to tune a frequency range of approximately ± 5 kHz. The function of each digit switch is listed in Table 4.1.

4.7.3 VFO CONTROL

When the VFO control is activated by pulling the knob to the out position, the VFO lamp DS5 is lit and the variable frequency oscillator (VFO) on the translator board is activated. R27, the VFO frequency control, varies the d-c voltage applied to the varactor diodes which causes the 21 MHz oscillator frequency to change.

4.7.4 VOLUME AND RF GAIN CONTROLS

The volume control, R26, adjusts the level of audio from the receiver audio board which is delivered to transformer T1. A detailed discussion of the audio system is contained in paragraph 4.7. The RF gain control, R29, applies d-c voltage on the AGC line and is used to reduce the gain of the r-f amplifier on the VHF mixer board and the IF amplifiers U1, and U2 on the IF/FLT board.

DESIGNATION	DESCRIPTION	FUNCTION PERFORMED
S1	10 MHz	(1) Selects 1 of 3 VCO's on synthesizer VCO Board (2) Selects band 8 filter in receiver filter or pre-selector and provides input to 1 MHz switch to select remainder of bands (3) Provides input to tuning limit lamp and receiver disable function (AGC)
S2	1 MHz	(1) Selects bandpass filters 1 through 7 with input from 10 MHz switch (2) Provides course steering voltage to VCO on synthesizer VCO board (3) Provides input to tuning limit lamp and receiver disable function (AGC) (4) Provides preset input to programmable counter on VHF Divider (5) Provides input to L.O. Blanker amplifier on synthesizer mother board
S3	100 kHz	(1) Provides preset input to programmable counter on VHF Divider (2) Provides input to tuning limit lamp and receiver disable function (AGC)
S4	10 kHz	(1) Provides input to programmable counter on synthesizer Low Digit Gen board (2) Provides course stearing to VCO on synthesizer Low Digit Gen board
S5, S6	1 kHz, 100 Hz	(1) Provides input to programmable counter on synthesizer Low Digit Gen board

Table 4.1 Frequency Digit Switch Functions

4.7.5 DIMMER

The dimmer control varies the current through the lamps mounted behind the frequency display and the lamp mounted in the "S" meter(s).

4.7.6 SPEAKER SWITCH

The speaker switch receives the audio from the audio amplifier, 1A1A1, and is used to either switch the audio off, connect it to the panel mounted speaker, connect it to the remote speaker (accessory GSR-920) or to connect it to both speakers in parallel.

4.7.7 SPEAKER DRIVER, 1A1A1

Refer to Figure 5.14.

The speaker driver is mounted on a p-c board and attached to the rear of the front panel. It is a hybrid integrated circuit capabile of supplying approximately 3 watts output to an 8 ohm speaker with a B+ supply of 21 VDC. Its output is connected to the SPEAKER switch and the headphone jack mounted on the front panel. A 47 ohm resistor is in series with the headphone jack which prevents a short circuit in the headphone circuit from damaging the amplifier. Headphone impedance is not critical but normally 500 to 600 ohm sets are recommended.

4.7.8 AUDIO SYSTEM

Refer to Figure 5.23.

Figure 5.23 is a composite audio system diagram which shows the complete routing of the audio in

the GSR-920 receiver. Functions labeled ISB are included only if the radio is equipped with the optional ISB function. The audio is routed to and from the rear panel audio jack to allow processed audio to be returned to the receiver audio system. This makes it possible to route the 600 ohm audio output from 1A8J2 in the back panel to a de-scrambling unit or other audio processing device, then back to the receiver so it may be amplified and monitored in the speaker.

4.7.9 CONTROL HEAD, SSB, (1A1A2)

Refer to Figure 5.24.

The front panel is designed to accept several types of control heads. The SSB control head is standard and is supplied with every receiver if the optional ISB capability is not installed. The SSB control head contains the MODE switch and receive "S" meter.

All wiring to and from the control head passes through two connectors, 1A1A2P1 and 1A1A2P2, which allows the control head to be removed from the front panel.

The "Monitor Audio" line passes through the control head to the rear panel as it is switched only when an ISB control head is installed. The RF gain control also passes through the panel as that is the only route from the receiver mother board to the front panel RF GAIN control.

+12VDC is applied through pin 3 of 1A1A2P2 to the wiper of the mode switch which then switches 12V to the selected operating mode line, LSB, USB, or AM.

4.7.10 CONTROL HEAD, ISB, (1A1A2)

Refer to Figure 5.25.

The ISB control head is an option, replacing the SSB control head when the ISB capability is installed in the radio.

The control head contains, S1 the MODE switch, S2 the ISB SPEAKER switch and two "S" meters; one to monitor LSB/CW and the other for USB/AM. The appropriate meter is activated and lit by the MODE selector switch. Audio from each channel LSB/CW and USB/AM is connected to switch S1 (MODE). If the MODE switch is in the ISB position then the ISB MONITOR switch S2 determines if the upper or lower sideband band channel is routed to the audio system. If the MODE switch is in any position other than ISB, the ISB MONITOR switch is not in the circuit and the MODE switch determines the audio channel connected to the audio system.

4.8 REAR APRON

Refer to Figures 3.3 and 5.4.

4.8.1 GENERAL

The rear apron contains the power connector, accessory connector, audio jack, antenna connector, fuses and distribution amplifier. Connector descriptions and designations are contained in Table 2.1 and wiring information is contained in the Main Frame Wiring Diagram Figure 5.4.

4.8.2 DISTRIBUTION AMPLIFIER 1A8A1

Refer to Figure 5.26.

The purpose of the distribution amplifier is to provide a buffer for the TCXO so that TCXO can be used to drive additional receivers. The amplifier is a complementary emitter follower driver whose output is connected to the synthesizer and the distribution switch S1 and whose input can be switched between an internal TCXO or an external TCXO. Connector J3 on the amplifier serves as either an input or output of the frequency standard dependent upon the position of S1.

NOTE

Switch S1 must be in the INT ONLY or INT OUT position if the TCXO is internal. If the receiver is obtaining the standard frequency from an external source the switch must be in the EXT IN position.

4.9 REMOTE SPEAKER

Refer to Figure 5.27.

The remote speaker contains a volume control (L Pad) and 8 ohm speaker. It is designed to be driven from the speaker driver contained in the GSR-920 and switched on or off by the speaker switch on the receiver front panel.

Since the drive signal for the remote speaker is connected in parallel with the local speaker the local volume control varies the level of the remote speaker.

SECTION 5
MAINTENANCE AND REPAIR

5.1 GENERAL

This section provides test procedures for routine maintenance and evaluation of overall performance. A fault analysis table is included to aid the repairman in isolating a fault to the defective module or subassembly. Also included in this section are module removal procedures.

5.2 PREVENTIVE MAINTENANCE

The equipment should be periodically inspected internally for loose or damaged components, kinked, frayed, or broken wires and loose hardware. All cable connections should be checked for proper mating.

5.3 COVER REMOVAL

To remove the top and bottom covers from the equipment perform the following steps (See Figure 5.1).

a. Remove the Phillip's screw at the rear of each cover.

b. Unsnap the two fasteners on each side of the equipment for each cover and pull the cover up and back from the front panel.

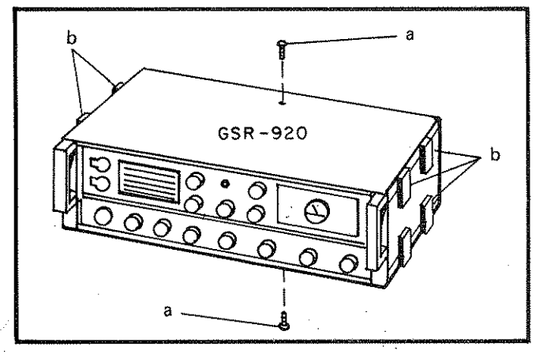


Figure 5.1 GSR-920 Cover Disassembly

5.4 PERFORMANCE TEST

The following tests will provide overall performance data on this equipment as well as aid in determining specific problems or a deterioration in performance.

5.4.1 TEST EQUIPMENT

The following test equipment or equivalent is required to perform the tests contained in this section.

a. RF Signal Generator–HP model 606 B

b. VTVM–HP model 410 B

c. Coax Tee connector–HP 11042A

d. Audio VTVM–HP model 400 D

e. Oscilloscope, 100 MHz Bandwidth–Tektronix 465

f. VOM–Simpson model 260 (20K ohms/volts)

g. VHF Signal Generator–HP model 608F

h. RF Voltmeter–Boonton model 92C with both open circuit probe tip and 50 ohm BNC adapter.

j. Frequency Counter–Systron Donner model 6050/option 12

k. DC Power Supply–O-28 VDC, 7 A

l. Spectrum Analyzer (optional)

HP 141T Display Section
HP 8554L RF Section
HP 8552A IF Section

5.4.2 PRELIMINARY

a. Connect AC power cable to rear panel connector J3 and to a 115 AC, 50 to 60 Hz, 1 phase power source (or 230 VAC, if a 230 VAC power cable is used).

b. Using the coaxial cable, connect the rf signal generator, paragraph 5.4.1 item A, to the rear panel antenna connector, J1.

c. Set front panel controls to the following positions listed in Table 5.1.

Refer to Figure 5.22 for Front Panel wiring and Figure 5.4 for Main Frame wiring diagrams with their appropriate parts lists

SWITCH or CONTROL	POSITION
FREQUENCY Switches	01.6000 MHz
MODE Switch	LSB
RF GAIN Control	Fully Clockwise
DIMMER Control	Fully Counter Clockwise
SPEAKER Switch	Off
VFO Control	In
VOLUME Control	Fully Counter Clockwise

Table 5.1 Front Panel Control Test Positions

5.4.3 POWER SUPPLY (1A6)

STEP No.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
1	Power Turn On		Perform Steps A thru C of paragraph 5.4.2	
2	+5 VDC	VOM on 10 VDC range, common lead on chassis ground, "+" lead on either pin 8 of X1A6A1 or cathode of zener diode CR5.	Read Voltage on VOM	VOM should read between +4.75 and +5.25 volts. If not, check line fuses 1A8F1 and 1A8F2, and fuse 1A6A1 F2 on regulator board, and 1A6U3 and associated circuitry.
3	+12 VDC	VOM on 50 VDC range, common lead on chassis ground, "+" lead on either lead of 0.22 ohm resistor, R2 on regulator board, 1A6A1.	Read voltage on VOM	VOM should read between +11.2 and +12.8 volts. First check fuse 1A6A1F1 on regulator board, and 1A6Q1 and associated circuitry.
4	+21 VDC	VOM on 50 VDC range, common lead on chassis ground "+" lead on fuse, F1.	Read voltage on VOM	VOM should read between +18 and +24 volts. If not, check fuse 1A6A1 F1, and bridge rectifier 1A6U1.

5.4.4 FRONT PANEL (1A1) AND MAIN FRAME (1A8)

1	DIMMER		Advance DIMMER control fully CW.	Meter and frequency dials should be lighted. If not, check cabling in front panel and main chassis for broken or shorted wires.
2a	LOW LIMIT FREQ. light		Turn frequency switches to 1.5000 MHz	LOW LIMIT FREQ lights should be lit and "S" meter should read full scale. If not, check cabling around front panel switches S1, S2, and S3.
2b	Same as 2a above		Turn frequency switches to 1.6000 MHz	LOW LIMIT FREQ. light should be out and "S" meter should read zero. If not, check transistor 1A3A4 Q4 on audio board.
3a	VFO Control		Pull out VFO control	Lamp above VFO control should be lighted.
3b	Same as 3a above		Push in VFO control	Lamp above VFO control should be out.
4	SPEAKER switch		With VOLUME control approximately 1/2 CW, turn SPEAKER switch to LOCAL	Noise should be heard in the background coming from the speaker. If not check S8 wiring, speaker or audio amp 1A1A1.
5	Same as 4 above		Turn SPEAKER switch to REMOTE	Local speaker should be silenced and remote speaker if connected should be powered.
6	Same as 4 above		Turn SPEAKER switch to BOTH	Both speakers should be powered.
7	L.O. Blanker (1A8A1)		Sequence 1 MHz Frequency control switch through each of its positions (both clockwise and counterclockwise) with MODE switch in USB.	Brief blanking of receiver noise whenever switch position is changed. If faulty, refer to schematic and check voltages and waveforms.

5.4.5 RECEIVER TEST

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
1			'Perform steps a thru c of par. 5.4.2 except set frequency to 16.0 MHz.	
2	Sensitivity	Audio VTVM on phone jack on front panel for steps 2 through 7.	Turn VOLUME control to 1/4 CW. Set RF signal generator to 50 microvolts at 16.0 MHz and adjust frequency for a peak audio signal on audio VTVM.	Peak indication. If none, consult sections 4.3.2, 4.3.3, and 4.3.4. Check for synthesizer outputs at LO 1, LO 2, and LO 3 on Receiver/Exciter Mother Board 1A3A7. See section 5.5.
3	Same		Remove coax cable from RF signal generator output. Adjust GSB-900 VOLUME control for audio VTVM reading of -10db on 30 MV scale.	-10db on 30 MV scale.
4	Same		Reconnect coax cable to RF generator and set generator to 0.5 microvolts (into 50 ohms).	Minimum 10db increase over level in step 3. If not, realign VHF mixer board (1A3A1) and IF/Filter Board (1A3A2).See par. 5.6.1 and 5.6.2.
5	Same		Set MODE switch to USB and repeat steps 3 and 4 above.	If no output, check MODE switch wiring for broken wire and check switching diodes on IF/Filter Board (1A3A2).
6	Same		Adjust RF signal generator frequency for "zero beat", and increase output to 3 microvolts (into 50 ohms). Set MODE switch to AM position and adjust VOLUME control for audio VTVM reading of -10db on 30 MV scale.	-10db on 30 MV scale. If no output, check MODE switch wiring for broken wire and check switching diodes on IF/Filter board (1A3A2).
7	AM Sensitivity		Turn on 30% modulation at 1 kHz on RF signal generator.	Minimum 10db increase over level in step 6.
8	AGC Control	Audio VTVM on PHONE jack on front panel and VOM set on 10 VDC range, between test point 1A3A4 TP1, on audio board and chassis ground for steps 8 thru 12.	Remove 1 kHz modulation and set signal generator output to zero, set MODE switch to USB.	VOM should read between +7.5 and +9.0 VDC, and "S" meter should read zero. If "S" meter reads full scale, check wiring around RF gain control and transistor Q4 on the audio board , (1A3A4).
9	Same		Set signal generator output to 5 microvolts and adjust frequency for peak audio VTVM reading.	VOM should read down scale and "S" meter should begin to read upscale.
10	AGC Control		Adjust VOLUME control for audio VTVM reading of -10db on the 1 volt scale.	-10db on 1 volt scale.
11	Same		Increase RF signal generator output to 500,000 microvolts.	VTVM should increase 10db or less from reading in step 10, and "S" meter should read full scale. If not, check 1A3A4 Q5 and associated circuitry.
12	RF GAIN control		Turn RF GAIN control fully counter clockwise.	Reading on VTVM should decrease at least 30db from reading in step 11. If not, check wiring on RF GAIN control and 1A3A4 Q12.
13	Same		Turn RF signal level to zero.	"S" meter should remain at full scale.
14			Turn RF GAIN control fully clockwise.	"S" meter reading should decayto zero.
15	SPEAKER		Turn RF signal generator level to 5 microvolts and turn SPEAKER switch to LOCAL	Audio present at speaker.
16	600 ohm AUDIO OUTPUT	Audio VTVM between pins E and F of rear panel AUDIO connector 1A8J2.	Set RF signal generator to 100 mocrovolts. Adjust potentiometer, R48, on the audio board (1A3A4), to provide a VTVM level of '0' dBM (800 MV RMS).	'0' dBM reading. If not, check integrated circuit, 1A3A4 U1, and associated circuitry.
17	600 ohm AUDIO OUTPUT	Audio VTVM between pins B and C of rear panel AUDIO connector 1A8J2	Set RF signal generator to 100 microvolts. Adjust potentiometer, R48, on the audio board (1A3A6), to provide a VTVM level of '0' dBM (800 MV RM.	'0' dBM reading. If not, check integrated circuit, 1A3A6U1, and associated circuitry.

5.5 SYNTHESIZER

The following paragraphs provide troubleshooting and fault isolation information for those problems peculiar to the synthesizer.

5.5.1 FAULT ANALYSIS

The Synthesizer Fault Analysis Table, contained in the following subparagraphs, is designed to isolate a faulty assembly first and then a faulty stage. If the defective assembly has been isolated by substitution, then the technician may proceed directly to the appropriate paragraph to isolate the faulty stage. Once a defective stage has been found, refer to the appropriate circuit diagram and make voltage checks to isolate the faulty component.

5.5.1.1 PRELIMINARY CHECKS

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE	IF FAULTY, CHECK-
1	Freq. Std. output	Oscilloscope probe at X1A4A1 pin S.	Check for proper wave form.	300 to 900 mv p-p sine wave, 200 nsec. rep. rate	a) Freq. Std. (1A8U1) and associated wiring. b) Spectrum Gen. (1A4A1) for shorted input. c) Proper position of switch S1 on rear panel distribution amplifier
2	Freq. Std. Alignment	Same as step 1 above except connect Frequency Counter to Vertical Output of oscilloscope.	Measure frequency. If out of tolerance: remove access screw at top of Freq. Std., adjust Frequency Trim and replace access screw.	Frequency within ±5 Hz of 5.000000 MHz.	If proper alignment cannot be obtained, Frequency Standard must be replaced.
3	Low Digit Phase Lock	Oscilloscope probe at test point 1A4A2TP3.	Set all FREQUENCY knobs to "0". Refer to Low Digit Gen. schematic and check waveform.	D.C. level of 1.5V to 2.5V	a) H.F. VCO Coarse Steering Voltage (see table 5.9) If faulty, check R12 through R22 located on the back of the 10 kHz switch (1A1S4). Also check associated front panel wiring. b) 1 kHz and 17 MHz references (consult Spectrum Gen., 1A4A1 schematic). If faulty, check Spectrum Gen.

5.5.1.1 PRELIMINARY CHECKS (CONT'D)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE	IF FAULTY, CHECK-
					c) Frequency Control lines (consult tables 5.3 thru 5.8). If faulty, check Frequency control switches on front panel and associated main frame wiring. d) Low Digit Gen. voltage readings (consult schematic). e) Low Digit Gen. alignment (See section 5.5.2.2).
4	VHF Loop Phase Lock	Oscilloscope probe at test point 1A4A4TP1.	Set all FREQUENCY knobs to "0". Consult VHF Divider schematic and check waveform.	D.C. level of 1.5V to 2.5V	a) VHF VCO Coarse Steering Voltage (see table 5.8). If faulty, check R1 thru R11 located on the back of the 1 MHz switch (1A1S2). Also check associated front panel wiring. b) Translator output (consult Translator schematic and if faulty, repair translator section 5.5.2.3). c) Frequency Control lines (consult tables 5.3 thru 5.8) If faulty check Frequency Control switches on front panel and associated wiring. d) VHF Divider voltage readings (consult schematic). If faulty repair VHF Divider. e) VCO output (consult VCO schematic and section 5.5.2.5). If faulty repair VCO.
5	VFO operation	Oscilloscope probe at 1A4A3U2 pin 6. Connect Vertical Ampl. output of oscilloscope to Frequency Counter (place Translator on extender card)	Pull out front panel VFO control. Rotate control to both extreme positions and measure frequency.	Minimum adjustment range of 20.995 to 21.005 MHz	a) VFO control voltage range at 1A4A3 pin A. Normal range is 4.2V (control CW) to 12V (control CCW). If faulty, check VFO control (1A1R27) on front panel and associated wiring. b) VFO ON/OFF control line. Should be +12V with control pulled out and OV with control pushed in. If faulty, check VFO control (1A1R27) on front panel and associated wiring. c) Faulty component in Translator VFO circuit. Consult Translator schematic and perform voltage check. d) Misalignment of VFO circuit in Translator. Consult alignment procedure (section 5.5.2.3).

5.5.1.2 FREQUENCY CODING

The following tables (5.2 thru 5.8) are provided to assist in making the preliminary checks described in this section.

10 MHz DIAL	X1A4A5 Pin Numbers (Function)		
	18(Band"0"Command)	17(Band"1"Command)	16(Band"2"Command)
0	0	1	1
1	1	0	1
2	1	1	0

NOTE

1. *A "0" indicates short circuit to chassis ground*
2. *A "1" indicates open circuit to chassis ground*
3. *All readings taken with VCO (1A4A5) disconnected from X1A4A5*

Table 5.2 10 MHz Switch

1 MHz DIAL	X1A4A4 Pin Numbers (Function)			
	J (2^0 1 MHz)	H (2^1 1 MHz)	8 (2^2 1 MHz)	7 (2^3 1 MHz)
0	1	0	0	1
1	0	0	0	1
2	1	1	1	0
3	0	1	1	0
4	1	0	1	0
5	0	0	1	0
6	1	1	0	0
7	0	1	0	0
8	1	0	0	0
9	0	0	0	0

NOTE

1. *A "0" indicates short circuit to chassis ground*
2. *A "1" indicates open circuit to chassis ground*
3. *All readings taken with VHF Divider (1A4A4) disconnected from X1A4A4.*

Table 5.3 1 MHz Switch

100 kHz DIAL	X1A4A4 Pin Numbers (Function)			
	4 (2^3 100 kHz)	5 (2^2 100 kHz)	D (2^1 100 kHz)	E (2^0 100 kHz)
0	0	0	0	0
1	1	0	0	1
2	1	0	0	0
3	0	1	1	1
4	0	1	1	0
5	0	1	0	1
6	0	1	0	0
7	0	0	1	1
8	0	0	1	0
9	0	0	0	1

NOTE

1. *A "0" indicates short circuit to chassis ground*
2. *A "1" indicates open circuit to chassis ground*
3. *All readings taken with VHF Divider (1A4A4) disconnected from X1A4A4*

Table 5.4 100 kHz Switch

10 kHz DIAL	X1A4A2 Pin Numbers (Function)			
	R (2^3 10 kHz)	15 (2^2 10 kHz)	14 (2^1 10 kHz)	S (2^0 1 kHz)
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

NOTE

1. *A "0" indicates short circuit to chassis ground*
2. *A "1" indicates open circuit to chassis ground*
3. *All readings taken with Low Digit Generator (1A4A2) disconnected from X1A4A4*

Table 5.5 10 kHz Switch

1 kHz DIAL	X1A4A2 Pin Numbers (Function)			
	N (2^3 1 kHz)	13 (2^2 1 kHz)	12 (2^1 1 kHz)	P (2^0 1 kHz)
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

NOTE

1. *A "0" indicates short circuit to chassis ground*
2. *A "1" indicates open circuit to chassis ground*
3. *All readings taken with Low Digit Generator (1A4A2) disconnected from X1A4A2*

Table 5.6 1 kHz Switch

100 Hz DIAL	X1A4A2 Pin Numbers (Function)			
	L (2^3 100 Hz)	11 (2^2 100 Hz)	10 (2^1 100 Hz)	M (2^0 100 Hz)
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

NOTE

1. *A "0" indicates short circuit to chassis ground*
2. *A "1" indicates open circuit to chassis ground*
3. *All readings taken with Low Digit Generator (1A4A2) disconnected from X1A4A2*

Table 5.7 100 Hz Switch

I H.F. VCO (Low Digit Coarse Steering)

10 kHz DIAL	X1A4A2 pin U VOLTS
0	3.50
1	3.85
2	4.15
3	4.55
4	4.95
5	5.40
6	5.90
7	6.40
8	7.00
9	7.70

II VHF VCO (VCO Coarse Steering)

1 MHz DIAL	X1A4A5 pin 15 VOLTS
0	1.37
1	1.78
2	2.18
3	2.75
4	3.31
5	4.12
6	4.93
7	6.15
8	7.85
9	9.56

NOTE

All voltages above measured with 20,000 ohm/volt meter. Variations of ±5% are permissable

Table 5.8 Coarse Steering Voltage Readings

5.5.2 SYNTHESIZER SUBASSEMBLY TESTING AND ALIGNMENT PROCEDURES

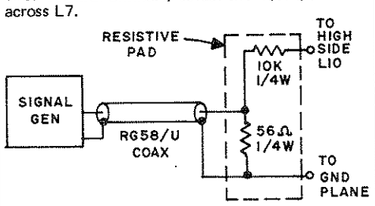
The following paragraphs give the testing and alignment procedures for the synthesizer printed circuit board subassemblies. It is assumed that the defective subassembly has first been isolated either by substitution or by following the preliminary checks of Section 5.5.1.1.During the following tests, the printed circuit board being tested should be extended from the card basket using the extender card (Sunair # 5024-0030) supplied in the ancillary kit.

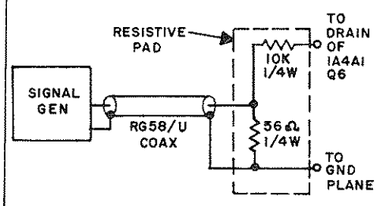
At any step in the procedure, if the required result cannot be obtained, refer to the schematic of the subassembly and make suitable voltage measurements to isolate the faulty component. When the faulty subassembly has been restored to operation the preliminary checks of Section 5.5.1.1 should be repeated to ensure full synthesizer operation.

5.5.2.1 SPECTRUM GENERATOR TESTING AND ALIGNMENT

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
1	20 MHz ref. alignment and test	Oscilloscope probe at 1A4A1 pin 1. Connect frequency counter to Vertical Ampl. output of oscilloscope.	Tune L2, L3 & L4 for maximum output. **NOTE** *Adjustments interact and must be repeated until no further increase in output can be obtained.*	Minimum output of 300 mv p-p (sine wave) on oscilloscope. Frequency of 20 MHz ±20 Hz on Frequency counter. **NOTE** *If proper output cannot be obtained, refer to the schematic and check U1, U2, U3 and their associated circuitry.*
2	1 kHz ref. output	Oscilloscope probe on 1A4A1 pin 18	Consult schematic and check waveform	Pulse with following parameters: Rep. rate= 1 millisecond Duty ratio=0.2 Logical "0" level: less than 0.6V Logical "1" level: greater than 2.2V
3	100 kHz Ref. output	Oscilloscope probe on 1A4A1 pin 17	Consult schematic and check waveform	Pulse with following parameters: Rep. rate=10 microseconds Duty ratio=0.2 Logical "0" level: less than 0.6V Logical "1" level: greater than 2.2V

5.5.2.1 SPECTRUM GENERATOR TESTING AND ALIGNMENT (CONT'D)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
4a	21 MHz Ref. alignment and test	RF voltmeter with unterminated tip on 1A4A1 pin 4. Connect signal generator as shown below. Set generator frequency to 21.00 MHz using Frequency Counter. Temporarily short jumper between U8 pin 2 and ground plane of printed circuit board. Similarly solder short jumper across L7.  	Set generator level to 250 mv RMS Tune L8, L9 & L10 for maximum output on RF voltmeter. **NOTE** *Adjustments interact and must be repeated until no further increase in output can be obtained.* Tune L10 for maximum output on RF voltmeter	
4b	21 MHz Ref. alignment and test	Same as 4a above except remove 10K resistor from L10 and connect to high side of L9	Tune L9 for maximum output. Repeak L10 for maximum output. Repeat tuning of L9 and L10 until no further output can be obtained	
4c	21 MHz Ref. alignment and test	Same as 4a above except remove 10K resistor from L10 and connect to high side of L8.	Tune L8, L9 and L10 for maximum output. Repeat tuning, in sequence, until no further output can be obtained.	
4d	21 MHz Ref. alignment and test	Leave RF voltmeter connected as in step 4a above. Disconnect the (2) jumpers and resistive pad network added in step 4a.	Carefully repeak L8, L9 and L10 for maximum output. Repeat tuning, in sequence, until no further output can be obtained	Meter indication of 85 mv RMS minimum, when tuning is complete. **NOTE** *If proper output cannot be obtained, refer to schematic and check Q1, Q2, and U8 and their associated circuitry. Also check CR4 thru CR7 and associated circuitry.*
5a	3rd L.O. (10.5 MHz Ref.) output	Connect RF voltmeter to 1A4A1 pin 13. Connect oscilloscope to U10 pin 8.	Place MODE switch on front panel in USB position. Refer to schematic and check waveform at U10 pin 8. Disconnect oscilloscope.	a) Proper oscilloscope waveform. b) RF voltmeter indication of 100 mv RMS minimum.
5b	3rd L.O. (10.5 MHz Ref.) output	Same as 5a above	Place MODE switch in AM position	RF voltmeter reading decreases at least 20 dB from that obtained in 5a above

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
6a	17 MHz Ref. alignment and test	RF voltmeter with unterminated tip on 1A4A1 pin 6. Temporarily solder a short jumper between gate # 1 of Q6 and the ground plane of the printed circuit board. **NOTE** *Gate #1 is the junction of C56, C61 and R50.* Connect the signal generator as shown below. Set generator frequency to 17.000 MHz (using the frequency counter) and set its level to 250 mv RMS. 	Tune L16 and L17 for maximum output on the RF voltmeter. **NOTE** *Adjustments interact and must be repeated until no further increase in output can be obtained.*	
6b	17 MHz Ref. alignment and test	Leave RF voltmeter connected as in 6a above. Disconnect resistive pad and jumper.	Tune L14 for maximum output on the RF voltmeter. Carefully repeak L16 and L17 for maximum output	Minimum output level of 90 mv RMS after tuning is completed **NOTE** *If proper output cannot be obtained, refer to the schematic and check Q5, Q6, Q7, Q8, and their associated circuitry.*

5.5.2.2 LOW DIGIT GENERATOR (1A4A2)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
1	17 MHz Ref.	Connect RF voltmeter to 1A4A2 pin C	Check RF voltmeter reading	Reading greater than 100 mv RMS. If out of specification, check C28, L9 and R21
2	1 kHz Ref.	Connect oscilloscope to 1A4A2 pin 18	Display waveform on scope	Pulse present with the following parameters: rep. rate=1 msec. Duty ratio=0.2 Logical "0" level: less than 0.6V Logical "1" level: greater than 2.2V If out of specification, check U2 and associated circuitry
3	Phase Lock	Connect oscilloscope to 1A4A2 pin 1. Connect vertical Ampl. output of oscilloscope to frequency counter. Connect V.O.M. to TP3.	Set 10 kHz, 1 kHz and 100 Hz frequency dials on front panel to "0"	V.O.M. should indicate approximately 1.5V. **NOTE** *If V.O.M. reads approximately 0.8V or 5V, this is an "out of phase lock" indication. Check:* *a) Voltage at TP1(see schematic) if incorrect, check CR5, Q2 and associated circuitry* *b) Refer to schematic and check waveform at TP2. If no signal is present, check Q1, U1 and associated circuitry* *c) Refer to schematic and check waveforms at U7, U8, U9, U10, U11, and U2.* *d) If the waveform at pin 1 of U7A deviates from the correct waveform on the schematic, check U6, Q3 and associated circuitry.* *If "out of Phase Lock" condition does not exist proceed to Step 4.*

5.5.2.2 LOW DIGIT GENERATOR (CONT'D)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
4a	Output frequency	Same as Step 3 above	Measure output frequency	Output frequency of 1.5000 MHz ±2 Hz. If out of tolerance: a) Refer to tables 5.9, 5.10, 5.11 and check 10 kHz, 1 kHz and 100 Hz preset lines. b) Refer to schematic and check waveforms at U3, U4, U7, U8, U9, U10 and U11
4b	Output frequency	Same as Step 3 above	Set 1 kHz and 100 Hz dials at "5	Output frequency of 1.5055 MHz ±2 Hz. V.O.M. indication of 1.95 ± 0.25V. **NOTE** *a) If V.O.M. indication is out of tolerance but frequency is correct, procede to step 5 and align VCO (Q1).* *b) If both frequency and V.O.M. readings are out of tolerance, refer to schematic and check U3, U4, U8, U9 and associated circuitry.*
4c	Output frequency	Same as Step 3 above	Leave 1 kHz and 100 Hz dials set at "0". Set 10 kHz dial at 9.	Output frequency of 1.5955 MHz ±2 Hz V.O.M. indication of 1.95 ± 0.25V. **NOTE** *a) If V.O.M. indication is out of tolerance but frequency is correct, procede to Step 6 and align VCO (Q1)* *b) If both frequency and V.O.M. readings are out of tolerance, refer to schematic and check U10 and associated circuitry.*

5.5.2.2 LOW DIGIT GENERATOR (CONT'D)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
4d	Output frequency	Same as Step 3 above	Follow the table below and check for required frequencies	

10 kHz DIAL	1 kHz DIAL	100 Hz DIAL	FREQUENCY (+2 Hz)
0	0	1	1.5001 MHz
0	0	2	1.5002 MHz
0	0	3	1.5003 MHz
0	0	4	1.5004 MHz
0	0	5	1.5005 MHz
0	0	6	1.5006 MHz
0	0	7	1.5007 MHz
0	0	8	1.5008 MHz
0	0	9	1.5009 MHz

If the required frequencies cannot be obtained, refer to schematic and check U8.

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
4e	Output frequency	Same as Step 3 above	Follow the table below:	

10 kHz DIAL	1 kHz DIAL	100 Hz DIAL	FREQUENCY (+2 Hz)
0	1	0	1.5010 MHz
0	2	0	1.5020 MHz
0	3	0	1.5030 MHz
0	4	0	1.5040 MHz
0	5	0	1.5050 MHz
0	6	0	1.5060 MHz
0	7	0	1.5070 MHz
0	8	0	1.5080 MHz
0	9	0	1.5090 MHz

If the required frequencies cannot be obtained, refer to schematic and check U9.

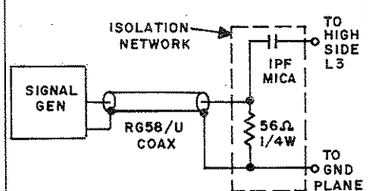
STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
4f	Output frequency	Same as Step 3 above	Follow the table below:	

10 kHz DIAL	1 kHz DIAL	100 Hz DIAL	FREQUENCY (+2 Hz)
1	0	0	1.5100 MHz
2	0	0	1.5200 MHz
3	0	0	1.5300 MHz
4	0	0	1.5400 MHz
5	0	0	1.5500 MHz
6	0	0	1.5600 MHz
7	0	0	1.5700 MHz
8	0	0	1.5800 MHz
9	0	0	1.5900 MHz

See Note on following page.

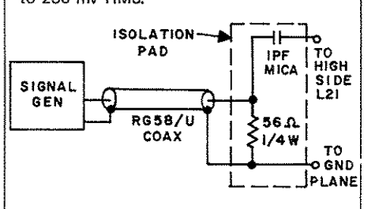
STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
				NOTE *If the required frequencies cannot be obtained, refer to schematic and check U10.*
5a	Output Level	Same as Step 3 above	Set 10 kHz, 1 kHz and 100 Hz dials to "0"	Output level of 200 mv p-p minimum.
5b	Output Level	Same as Step 3 above	Set 10 kHz, 1 kHz and 100 Hz dials to "9"	Output level of 200 mv p-p minimum.
				NOTE *If the required results cannot be obtained in Steps 5a and 5b above, refer to schematic and check Q5, Q6, U5 and associated circuitry.*
			NOTE *The alignment of the VCO, detailed in Step 6 below, should only be necessary if a component has been replaced in the voltage controlled oscillator (VCO) circuit (Q1). All other causes of improper operation should first be checked before proceeding with the alignment.*	
6a	VCO alignment	Same as Step 3 above	Set 1 kHz and 10 kHz dials to "5"; Set 10 kHz dial to "0". Tune L3 for a V.O.M. indication of 1.95 ±0.25 volts.	
6b	VCO alignment	Same as Step 3 above	Leave 1 kHz and 100 Hz dials set at "5". Tune C8 for a V.O.M. indication of 1.95 ±0.25 volts.	
6c	VCO alignment	Same as Step 3 above	Repeat 6a and 6b until required performance is obtained.	When tracking is complete, the V.O.M. should read 1.95 ±0.25 volts at both settings of the 10 kHz dial.

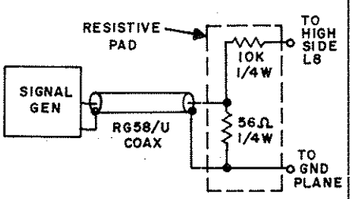
5.5.2.3 TRANSLATOR (1A4A3)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
1	21 MHz Ampl. alignment and test	Oscilloscope probe on TP4.	Place front panel VFO control in "IN" position. Tune L13 for maximum output.	Sine wave, 800 mv p-p min. rep. rate=47.6 nsec. **NOTE** *If required output cannot be obtained, refer to schematic and check U1 and associated circuitry.*
2a	VFO alignment and test	Same as step 1 above. Except also connect V.O.M. to 1A4A3 pin A. Connect Frequency Counter to Vertical Ampl. output of oscilloscope.	Pull OUT front panel VFO control. Rotate VFO until a reading of 7.6V is obtained on the V.O.M. Tune L23 until the VFO circuit begins to oscillate. Carefully rock the adjustment of L23 back and forth to center the tuning in the middle of the oscillation range.	
2b	VFO alignment (cont'd)	same as 2a above.	Adjust L22 for a frequency counter reading of 21.0000 MHz ±100 Hz. If this frequency cannot be obtained within the adjustment range of L22, slight adjustment of L23 is permissible to obtain the correct frequency.	Frequency counter reading of 21.0000 MHz ±100 Hz. Oscilloscope should indicate a sine wave, 700 mv p-p minimum amplitude.
2c	VFO alignment (con'd)	same as 2a above.  	Rotate VFO control over its complete range. When the test is complete, place the VFO control in the "IN" position.	Oscilloscope amplitude should remain greater than 700 mv p-p. The Frequency should varv. as a minimum between 20.995 and 21.005 MHz. **NOTE** *If the required results cannot be obtained, refer to the schematic and check Q1, Q3, U2 and their associated circuitry. If the VFO cannot be aligned on frequency, VFO crystal, Y1, should be replaced.*
3a	19.45 MHz Ampl.	Connect RF voltmeter to U3 pin 6. Temporarily unplug the Low Digit Generator, 1A4A2, from the mother board. Temporarily solder a short jumper from U1 pin 2 to the printed circuit board ground plane. Set the signal generator frequency to 19.45 MHz using the Frequency Counter. Set the generator level to 250 mv RMS and connect as shown above.	Tune L3 and L5 for max. RF voltmeter reading. As tuning progresses, reduce signal generator level to keep RF voltmeter reading below 100 mv RMS.	

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
3b	19.45 MHz alignment (cont'd)	Disconnect 1 pf capacitor from high side L3 and connect to the high side of L2. Set the generator level to 250 mv RMS.	Tune L2 and L3 for max. RF voltmeter reading (adjustments interact). As the tuning progresses, reduce the generator level to keep the RF voltmeter reading below 100 mv RMS.	
3c	19.45 MHz alignment (cont'd)	Disconnect 1 pf capaciter fron high side of L2 and connect to the high side of L1. Set the generator level to 250 mv RMS.	Tune L1, L2 and L3 for max. RF voltmeter reading (adjustments interact). As the tuning progresses, reduce the generator level to keep the RF voltmeter reading below 100 mv RMS.	
3d	19.45 MHz alignment (cont'd)	Disconnect the isolation network signal generator and jumper wire added in 3a above. Plug the Low Digit Generator back into the mother board. Place the V.O.M. on the 10V D.C. range and connect to U3 pin 1. Connect the RF voltmeter to TP1. Terminate TP1 in a 50 ohm lead. **NOTE** *If a spectrum analyzer is available, the following tuneup and test procedure may be used in lieu of steps 5a through 5d*	Carefully repeak the slugs on L1, L2, L3 and L4. A point will be found where the voltage on the V.O.M. begins to increase. Tune the four inductors for max. V.O.M. indication. **NOTE** *The V.O.M. is monitoring the Automatic Gain control (AGC) voltage on this amplifier.*	When tuning is complete, the RF voltmeter should read approximately 7 mv RMS. **NOTE** *If the required performance cannot be obtained, consult the schematic and check U3, CR1 through CR4 and associated circuitry. Also check the output of the Low Digit Generator (consult schematic).*
	19.45 MHz Ampl. Alternate Alignment and test (using Spectrum Analyzer)	Connect spectrum analyzer to TP1 using 50 ohm coaxial cable. Set C.F. to 19.45 MHz and Scan width to 1 MHz/div. Set B.W. at 30 kHz. Set control for a Log display.	Tune L1, L2, L3 and L5 for max. output at 19.45 MHz on the spectrum analyzer. A point will be found where the output appears to level off and becomes insensitive to tuning adjustments. This is the onset of Automatic Gain control (AGC) action. Carefully adjust the above inductors for lowest levels of spurious responses. **NOTE** *The adjustments of L1, L2 and L3 interact and must be repeaked, in sequence for best spurious rejection and maximum output.*	Approximate output level of -30 dBm at 19.45 MHz. All spurious outputs down at least 40 db from the 19.45 MHz output (typically will be 50 db down).

5.5.2.3 TRANSLATOR (1A4A3) (CONT'D)

STEP NO.	TEST	TES EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
4	2nd L.O. alignment and test	Oscilloscope probe at 1A4A3 pin 11. Connect ground lead of probe to printed circuit board ground plane. Connect Vertical Ampl. output of oscilloscope to frequency counter.	Tune L17 until the circuit breaks into oscillation (as evidenced by a sudden increase in meter reading). Tune L25 for maximum meter indication. Carefully rock L17 back and forth to adjust the circuit to the center of its oscillation range.	Minimum output level of 300 mv p-p. Output frequency of 80.7500 MHz ±4 kHz. **NOTE** *If required output cannot be obtained, refer to schematic and check Q7, Q9 and their associated circuitry. If the frequency is out of tolerance, replace crystal Y2.*
5a	100.75 MHz Bandpass Filter alignment and test	Temporarily solder a short jumper between Q8 gate #1 and the printed circuit board ground plane. Connect RF Voltmeter, terminated in a 50 ohm tip probe, to TP3. Set signal generator to 100.75 MHz using the frequency counter. Connect signal generator as shown below. Set generator level to 250 mv RMS.  	Tune L21 for maximum output on RF Voltmeter.	
5b	100.75 MHz Bandpass Filter alignment and test	Disconnect 1 pf capacitor from L21 and connect to the high side of L36	Tune L36 and L21 for maximum output on RF Voltmeter (adjustments interact and must be repeated until no further increase in output can be obtained).	
5c	100.75 MHz Bandpass Filter alignment and test	Disconnect 1 pf capacitor from L36 and connect to the high side of L20.	Tune L20, L36 and L21 for maximum output on RF Voltmeter (adjustments interact)	

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
5d	100.75 MHz Bandpass Filter alignment and test	Disconnect 1 pf capacitor, 56 ohm resistor and signal generator. Disconnect jumper added in Step 5a above.	Carefully repeak L20, L36 and L21 for maximum RF Voltmeter indication (adjustments interact). **NOTE** *If a spectrum analyzer is available, the following tuneup and test procedure may be used in lieu of steps 5a through 5d*	After tuning is complete, RF Voltmeter should read approximately 70 mv RMS.
	100.75 MHz Bandpass Filter alignment and test (alternate procedure for use with spectrum analyzer)	Connect spectrum analyzer to TP3. Set C.F. to 100.75 MHz, scan width to 5 MHz/div & bandwidth to 300 kHz. Set display mode to LOG.	Peak L20, L36 and L21 for maximum amplitude at 100.75 MHz (adjustments interact and must be repeated until no further output can be obtained).	After tuning is complete, output level on analyzer at 100.7500 MHz should be approximately -10 dBm. All spurious outputs should be at least 40 db below the 100.75 MHz output.
6a	81.25 MHz Bandpass Filter alignment and test	Temporarily solder a short jumper between Q11 gate 1 and the ground plane on the printed circuit board. Connect the RF voltmeter to TP2. Set the signal generator frequency to 81.25 MHz, using the frequency counter. Set the generator level at 250 mv RMS. Connect the signal generator as shown below. 	Tune L8 for maximum reading on RF voltmeter.	

5.5.2.3 TRANSLATOR (1A4A3) (CONT'D)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
6b	81.25 MHz B.P.F. alignment and test	Disconnect the 10K resistor from L8 and connect to the high side of L7.	Tune L7 and L8 for maximum RF voltmeter indication. **NOTE** *These adjustments interact and must be repeated until no further increase in output can be obtained.*	
6c	81.25 MHz B.P.F. alignment and test	Disconnect jumper, 10K resistor, 56 ohm resistor and signal generator added in step 6a.	Carefully repeak L7 and L8 for maximum indication on RF voltmeter (adjustments interact).	Indication of approximately 40 mv on RF voltmeter when tuning is complete. **NOTE** *If required output cannot be obtained, check Q11 and associated circuitry.*
7a	Output level adjustment	Connect oscilloscope probe to 1A4A3 pin 15 and connect ground lead of probe to the printed circuit board ground plane near pin 15.	Set front panel frequency dials (6) to 29.9999 MHz. Adjust R54 for a reading of 600 mv p-p on oscilloscope.	Oscilloscope display of 600 mv p-p, rep rate of 25 nsec (silghtly distorted sine wave)
7b	Output level adjustment	Same as 7a above.	Set front panel frequency dials to 00.0000 MHz	Oscilloscope display of 600 mv p-p minimum amplitude (distorted sine wave), rep rate of 100 nsec. **NOTE** *If required results cannot be obtained, refer to schematic and check: Q4, Q5, Q6, Q10 and associated circuitry. Also check the VCO (1A4A5) for proper output (refer to VCO schematic)*

5.5.2.4 VHF DIVIDER (1A4A4)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
1a	100 kHz Dial test	Connect Signal Generator to X1A4A4 pin B using 50 ohm coaxial cable. Set generator level to 100 mv RMS.	Connect VOM to TP1, Set signal generator frequency to 9.9 MHz using the frequency counter. Temporarily unplug the Translator (1A4A3) from the card basket. Set 10 MHz, 1 MHz, and 100 kHz dials on front panel to "0"	VOM indication of greater than 4.5 volts
1b	100 kHz Dial test	Same as 1a above	Slowly increase generator frequency	At 10.0 MHz ±1 kHz, VOM indication should abruptly change to an indication of less than 0.9 volts.
				NOTE *If the proper indication in Steps 1a and 1b above cannot be obtained, refer to schematic and check all D.C. voltages and waveforms.*
1c	100 kHz Dial test	Same as 1a above	Follow the table below. In each case, the V.O.M. should indicate greater than 4.5 volts with the generator below the transition frequency and less than 0.9 volts above the transition frequency	

10 MHz DIAL	1 MHz DIAL	100 kHz DIAL	Transition Frequency (±1 kHz)
0	0	1	10.1 MHz
0	0	2	10.2 MHz
0	0	3	10.3 MHz
0	0	4	10.4 MHz
0	0	5	10.5 MHz
0	0	6	10.6 MHz
0	0	7	10.7 MHz
0	0	8	10.8 MHz
0	0	9	10.9 MHz

NOTE

If the required results cannot be obtained, refer to schematic and check U3, U4, U5, U8, U9, U10, U13 and associated circuitry.

5.5.2.4 VHF DIVIDER (1A4A4) (CONT'D)

<table>
<tr><th>STEP NO.</th><th>TEST</th><th>TEST EQUIPMENT and TEST POINTS</th><th>PROCEDURE</th><th>REQUIRED PERFORMANCE</th></tr>
<tr><td>2</td><td>1MHz Dial test</td><td>Same as Step 1a above</td><td>Follow the table below. In each case the V.O.M. should indicate greater than 4.5V below the transition frequency and less than 0.9 volts above the transition frequency.

<table>
<tr><th>10 MHz DIAL</th><th>1 MHz DIAL</th><th>100 kHz DIAL</th></tr>
<tr><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>2</td><td>0</td></tr>
<tr><td>0</td><td>3</td><td>0</td></tr>
<tr><td>0</td><td>4</td><td>0</td></tr>
<tr><td>0</td><td>5</td><td>0</td></tr>
<tr><td>0</td><td>6</td><td>0</td></tr>
<tr><td>0</td><td>7</td><td>0</td></tr>
<tr><td>0</td><td>8</td><td>0</td></tr>
<tr><td>0</td><td>9</td><td>0</td></tr>
</table></td><td>Transition Frequency (±1 kHz)

11.0 MHz
12.0 MHz
13.0 MHz
14.0 MHz
15.0 MHz
16.0 MHz
17.0 MHz
18.0 MHz
19.0 MHz

NOTE

If required results cannot be obtained, refer to schematic and check U6, U5 and associated circuitry.</td></tr>
<tr><td>3</td><td>10 MHz Dial test</td><td>Same as Step 1a above</td><td>Follow the table below. In each case the V.O.M. should indicate greater than 4.5V below the transition frequency and less than 0.9V above the transition frequency

<table>
<tr><th>10 MHz DIAL</th><th>1 MHz DIAL</th><th>100 kHz DIAL</th></tr>
<tr><td>1</td><td>0</td><td>0</td></tr>
<tr><td>2</td><td>0</td><td>0</td></tr>
<tr><td>2</td><td>9</td><td>9</td></tr>
</table></td><td>Transition Frequency (±1 kHz)

20.0 MHz
30.0 MHz
39.9 MHz

NOTE

If required results cannot be obtained, refer to schematic and check U7, U8A, U8B, U13 and associated circuitry.</td></tr>
</table>

5.5.2.4 VHF DIVIDER (1A4A4) (CONT'D)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
4a	Max. toggle frequency	Same as Step 1a above	Set 10 MHz dial at "2". Set 1 MHz and 100 kHz dals at "9". Set the signal generator frequency at 45 MHz. Set the generator level at 100 mv RMS.	V.O.M. should indicate less than 0.9V
4b	Max. toggle frequency	Same as Step 1a above	Slowly increse the generator frequency until the V.O.M. indicates greater than 4.5 volts.	Generator frequency greater than 50.0 MHz. **NOTE** *If the required results cannot be obtained, refer to schematic and check:* *a) Q1 through Q4* *b) Waveform at U2 pin 3* *If a) and b) above check o.k. U2 should be replaced.*
5.5.2.5 V.C.O. (1A4A5)				
1a	BAND "0" alignment and test	Connect frequency counter to 1st L.O. out put (J1). Connect external +1.95 volts D.C. from power supply to X1A4A5 pin 4.	Set front panel 10 MHz frequency selector switch (1A1S1) to "0". Set 1 MHz frequency selector switch (1A1S2) to "0". Adjust L1 for for required performance.	Frequency indication of 91.75 ±-0.2 MHz. If no output present, proceed to steps 2 and 3. If steps 2 and 3 performance is acceptable, check Q3, Q6, and associated circuitry. If no output is obtained in all three steps, -1, 2, and 3- check buffer stage Q9, Q10.
1b	BAND "0" alignment and test	Same as 1a above.	Leave front panel 10 MHz frequency selector switch (1A1S1) set at "0". Set front panel 1 MHz frequency selector switch (1A1S2) to "9". Adjust C16 for required performance.	Frequency indication of 100.75 ± 0.75 MHz
1c	BAND "0" alignment and test	Same as 1a above.	Repeat steps 1a and 1b until both conditions are satisfied.	91.75 ±0.2 MHz 100.75 ± 0.75 MHz.
2a	BAND "1" alignment and test	Same as 1a above.	Set front panel 10 MHz frequency selector switch (1A1S1) to "1". Set front panel 1 MHz frequency selector switch (1A1S2) to "0". Adjust L4 for required performance.	Frequency indication of 101.75 ± 0.2 MHz. If no output present, but steps 1 and 3 are correct, check Q4, Q7, and associated circuitry.
2b	BAND "1" alignment and test	Same as 1a above.	Leave front panel 10 MHz frequency selector switch (1A1S1) set at "1". Set front panel 1 MHz frequency selector switch (1A1S2) to "9".	Frequency indication of 110.75 ± 0.75 MHz.
2c	BAND "1" alignment and test	Same as 1a above.	Repeat steps 2a and 2b until both conditions are satisfied.	101.75 ±0.2 MHz, 110.75 ±0.75 MHz.

5.5.2.5 VCO (1A4A5) (CONT'D)

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
3a	BAND "2" alignment and test	Same as 1a above.	Set front panel 10 MHz frequency selector switch (1A1S1) to "2". Set front panel 1 MHz frequency selector switch (1A1S2) to "0". Adjust L7 for required performance.	Frequency indication of 111.75 ± 0.2 MHz. If no output present, but steps 1 and 2 are correct, check Q5, Q8 and associated circuitry.
3b	BAND "2" alignment and test	Same as 1a above.	Leave front panel 10 MHz frequency selector switch (1A1S1) set at "2". Set front panel 1 MHz frequency selector switch (1A1S2) to "9". Adjust C38 for required performance.	Frequency indication of 120.75 ± 0.75 MHz.
3c	BAND "2" alignment and test	Same as 1a above.	Repeat steps 3a and 3b until both conditions are satisfied.	111.75 ± 0.2 MHz, 120.75 ±0.75 MHz.
4a	1st L.O. output level	Connect R.F. Voltmeter with 50 ohm BNC adapter to 1st L.O. output connector (J1). Connect external +1.95 volts D.C. from power supply to X1A4A5 pin 4. Tack solder 47 ohm 1/4 or 1/2 watt carbon resistor from X1A4A5 pin 2 to ground.	Set front panel 10 MHz frequency selector switch (1A1S1) to "1". Set front panel 1 MHz frequency selector switch (1A1S2) to "6". Adjust L12 (access hole near 1st L.O. output connector J1) for maximum level.	Reading greater than 100 mV rms (225 mV typical).
4b	1st L.O. output level	Same as 4a above.	Set front panel 10 MHz frequency selector switch (1A1S1) and 1 MHz frequency selector switch (1A1S2) to "0". Record this output level.	Reading greater than 100 mV RMS (225 mV typical).
4c	1st L.O. output level	Same as 4a above.	Set front panel 10 MHz frequency selector switch (1A1S1) to "2". Set front panel 1 MHz frequency selector switch (1A1S2) to "9". Record this output level.	Reading greater than 100 mV RMS (225 mV typical).
4d	1st L.O. output level	Same as 4a above.	If necessary, adjust L12 slightly so that the readings of steps 4a, b, and c are within 3 db of each other.	If any reading in steps 4a, b, or c is low, check buffer stage Q9, Q10 and associated circuitry.

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
5a	1st L.O. output level to translator	Tack solder 47 ohm 1/4 or 1/2 watt carbon resistor from X1A4A5 pin 2 to ground. Connect open circuit probe tip from R.F. Voltmeter to X1A4A5 pin 2. Place a 50 ohm load on 1st L.O. output connector J1. Connect +1.95 volts D.C. from external power supply to X1A4A5 pin 4.	Set front panel 10 MHz frequency selector switch (1A1S1) to "0". Sequence the front panel 1 MHz frequency selector switch (1A1S2) from "0" through "9".	Reading should remain greater than 100 mV RMS (225 mV typical) in each position of 1A1S2. If proper output cannot be obtained, refer to schematic and check buffer stage Q11 and Q12 and associated circuitry.
5b	1st L.O. output level to translator	Same as 5a above.	Set front panel 10 MHz frequency selector switch (1A1S1) to "1". Sequence the 1 MHz frequency selector switch (1A1S2) from "0" through "9".	Reading should remain greater than 100 mV RMS (225 mV typical) in each position of 1A1S2.
5c	1st L.O. output level to translator	Same as 5a above.	Set front panel 10 MHz frequency selector switch (1A1S1) to "2". Sequence the 1 MHz frequency selector switch (1A1S2) from "0" through "9".	Reading should remain greater than 100 mV RMS (225 mV typical) in each position of 1A1S2.
6a	Logic Outputs	V.O.M. on X1A4A5 pin 17.	Front panel 10 MHz frequency selector switch (1A1S1) position: "0" "1" "2"	 less than 0.5 V.D.C. greater than 2.2 V.D.C. less than 0.5 V.D.C.
6b	Logic Outputs	V.O.M. on X1A4A5 pin 18.	Front panel 10 MHz frequency selector switch (1A1S1) position: "0" "1" "2"	 greater than 2.2 V.D.C. less than 0.5 V.D.C. less than 0.5 V.D.C. If these readings cannot be obtained, consult the schematic and check logic switches Q1, Q2, and associated circuitry.

5.6 RECEIVER BOARD ALIGNMENT

The following paragraphs provide alignment instructions for the Receiver printed boards.

STEP NO.	TEST	TEST EQUIPMENT and TEST POINT	PROCEDURE	REQUIRED PERFORMANCE
5.6.1 V.H.F. MIXER BOARD (1A3A1)				
1	1st IF alignment	Connect RF Signal Generator to Antenna connector 1A8J1 and set frequency for 16.0 MHz.	Remove VHF Mixer Board from RCVR card basket by grasping corners of board and pulling upward. Install extender card in slot for connector 1A3J1 and plug VHF mixer into extender card. Set Frequency switches at 16,0000. Mode switch at USB, and adjust RF gain Control so that "S" meter reads "S 9". Set RF generator level to 10 MV and adjust frequency until a tone of approximately 1 kHz is heard in the speaker. Adjust capacitors C41 and C44 for peak on the "S" meter. Next adjust Transformer T7 and T8 for peak on the "S"' meter. Recheck C44 and T7 for meter peak. Remove extender card and replace VHF mixer board into its connector in the card basket.	If no peaking is observed ckeck E24 and E18 on the RCVR Mother board, using a high frequency oscilloscope to determine if 1st L.O. and 2nd L.O. are present (approximate OdBM). If not, check synthesizer sections 4.2 and 5.5. If 1st L.O. and 2nd L.O. are present, check outputs of Q5 and Q8 on VHF mixer board, then check Q2 and associated circuitry.
5.6.2 IF/FILTER BOARD (1A3A2)				
1	2nd IF alignment	Connect RF Signal Generator to Antenna connector 1A8J1, and set frequency for 16.0 MHz.	Remove IF/Filter board from RCVR card basket by grasping corners of board and pulling upward. Install extender card in slot for connector 1A3J2, and plug IF/Filter board into extender card. Set frequency switches at 16,0000 mode switch at USB and adjust RF GAIN control so that "S" meter reads "S 9". Set RF Generator level to 10 MV and adjust frequency until a tone of approximately 1 kHz is heard in the speaker. Adjust inductors L3 and L4 for peak on the "S" meter. Remove Extender card and replace IF/Filter board in its connector in the card basket.	If no peak is observed, check U1 and U2 plus associate circuitry on IF/Filter board. Also check Q3 and associated circuitry.

5.7 RECEIVER FAULT ANALYSIS TABLE

SYMPTOM	POSSIBLE TROUBLE	CHECKS AND CORRECTIVE ACTION
Receiver inoperative, meter not illuminated.	a. Primary power fuse F1, F2 or (for DC operation) F3 not installed or open.	a. Replace fuse.
	b. +12VDC fuse (1A6A1 F1) open in power supply.	b. Replace fuse.
	c. Power cord defective or not connected.	c. Make continuity check of cable, replace or repair cable.
	d. Power supply defective.	d. Refer to sections 4.4 and 5.4.3. Repair or replace regulator board or entire power supply module if required.
No audio or background noise at speaker or phones jack. Meter indicates RF signal present.	a. 21 VDC not connected to audio amplifier protective crowbar has operated.	a. Turn off main power. Wait 15 seconds and re-energize radio. If still no audio, check 28VDC power supply for short circuited ouput.
	b. Speaker switch position or wiring.	b. Check position of switch and make necessary continuity checks.
	c. Speaker driver board defective.	c. Refer to section 4.3.5. Repair or replace defective assembly.
	d. Amplifier 1A3A4 Q11 defective.	d. Replace defective transistor.
No audio or background noise at speaker in all modes. meter does not indicate, but is illuminated.	a. +5 VDC fuse open in power supply. (F2)	a. Replace fuse. If fuse blows again, check +5V line for short circuit.
	b. VHF mixer board defective.	b. Refer to section 4.3.2. Repair or replace defective assembly.
	c. IF/Filter board defective.	c. Refer to section 4.3.3. Repair or replace defective assembly.
	d. Audio board defective.	d. Refer to section 4.3.4. Repair or replace defective assembly.
	e. Synthesizer defective.	e. Refer to section 4.2. Repair or replace defective assembly.
AM mode normal, other modes inoperative.	a. 3rd L.O. injection absent at 1A3A4 audio board.	a. Make continuity test of cable. Repair or replace.
	b. Synthesizer defective.	b. Refer to section 4.2. Repair or replace defective assembly.
AM, or USB, or LSB, inoperative, other modes operative.	a. Mode switch defective.	a. Make continuity check. Repair or replace switch.
	b. IF/Filter board defective.	b. Check diode switches on IF/Filter board. Check filters. Repair or replace defective parts.
No audio at speaker. Meter at full scale.	a. RF GAIN control fully CCW or defective.	a. Adjust RF GAIN control CW. Replace defective component.
	b. Transistor 1A3A4 Q12 defective.	b. Replace defective component.
Distorted audio at speaker. Meter remains at full scale.	a. Transistor 1A3A4 Q4 defective.	a. Replace transistor.
Received signals weak in all modes "S" meter also low.	a. Filter module defective or does not channel.	a. Refer to section 4.7. Repair or replace defective component.
	b. VHF mixer board defective.	b. Refer to section 4.3.2. Repair or replace defective assembly.

5.7 FAULT ANALYSIS TABLE (CONT'D)

SYMPTOM	POSSIBLE TROUBLE	CHECKS AND CORRECTIVE ACTION
Received signals weak in all modes-Cont.	c. IF/Filter board defective.	c. Refer to section 4.3.3. Repair or replace defective assembly.
	d. Local oscillator injection levels low.	d. Refer to section 4.2. Repair or replace defective assembly.
	e. Coaxial cables defective.	e. Make continuity tests, repair or replace defective cable.
Unit inoperative with DC main power applied.	a. Main source polarity reversed.	a. Switch + and – leads to DC source.
	b. DC module not installed or installed improperly.	b. Refer to section 2.3.2.
	c. DC module defective.	c. Refer to section 4.6.2 and repair or replace defective module.
	d. Relay K1 defective.	d. Check relay operation.
	e. Relay turn-on circuit, 1A6A1 Q1, defective.	e. Check Circuit operation on power supply board.
5.7.1 IF ISB INSTALLED		
One channel operational, other channel weak or inoperative.	a. IF/FLT Board or Audio Board.	a. Refer to Sections 4.3.3 and 4.3.4.
	b. Defective switch, broken wire in ISB Control Head, open diode.	b. Check S1 and S2, diodes CR1 and CR2 in control head and wiring to connectors.
	c. Emitter follower on receiver mother board defective.	c. Check Q1.
	d. Potentiometer R7, R8 defective.	d. Check potentiometers on receiver or receiver mother board.
5.7.2 IF PRESELECTOR INSTALLED		
Preselector will not channel.	a. Selector switch on front panel in out position.	a. Set to Preselector In.
	b. Relay K2 inoperative.	b. Check coil terminal for +12V, replace defective relay.
	c. B2 motor inoperative.	c. Replace motor.
Preselector will not fine tune.	a. B1 motor inoperative.	a. Check and replace motor.
	b. Front panel control switch, S, inoperative.	b. Check and replace switch.
	c. Microswitches, S5, S6 inoperative.	c. Check and replace switches.
RF Circuit open or sensitivity greatly reduced.	a. Relay K1 defective.	a. Check relay and wiring.
	b. Open contact on S1, S2, or S3.	b. Trace r-f path, check switch and wire continuity.
RF circuit open.	c. RF amp Q1 defective.	c. Check for AGC voltage, check circuit operation.

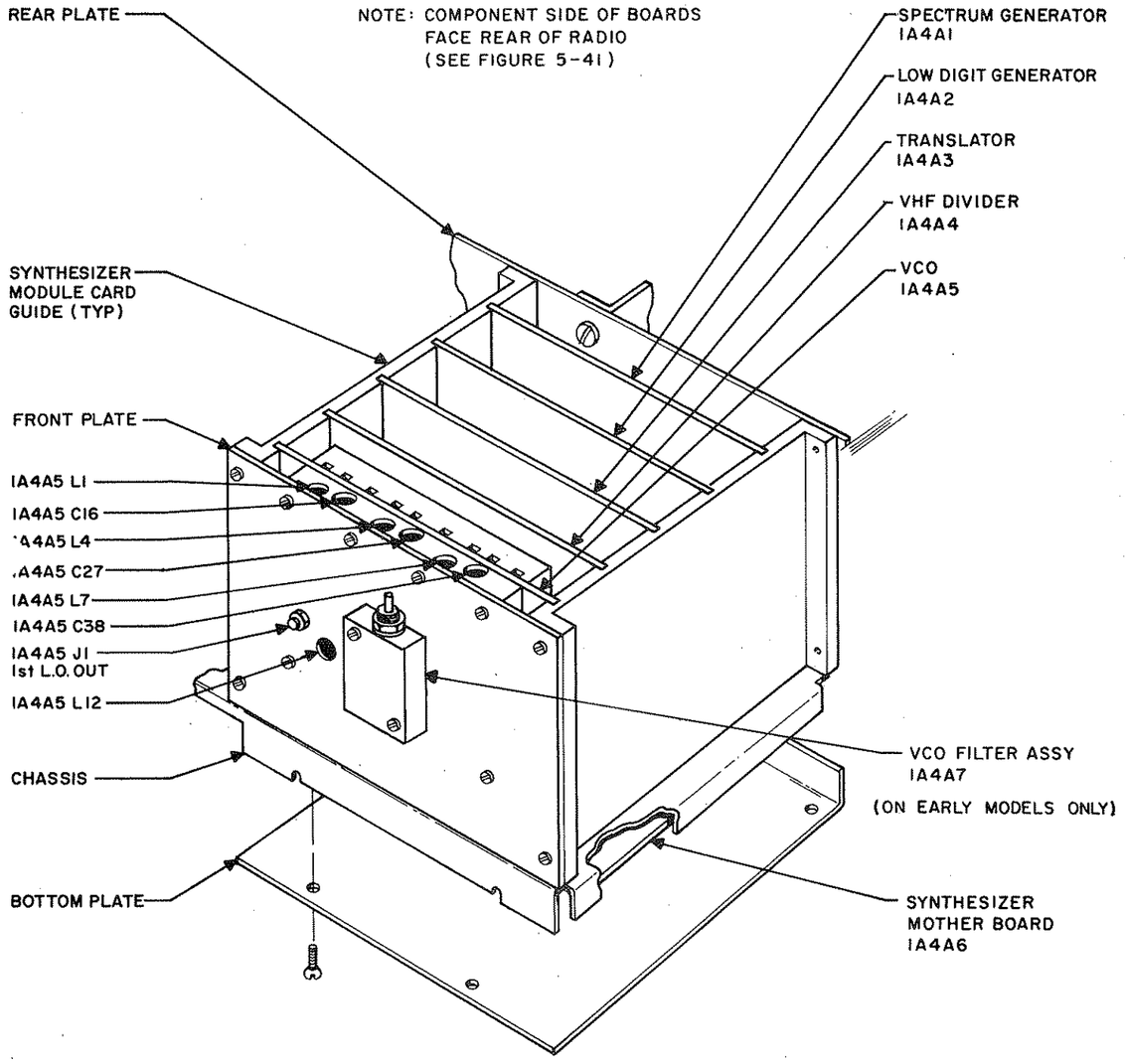


Figure 5.2 Synthesizer Mechanical Assembly

DESIGNATOR		DESCRIPTION	SUNAIR PART NUMBER
ASSEMBLY	SUBASSEMBLY		
1A1		FRONT PANEL ASSEMBLY GRY/GRN	6028040053/96 ~~5024041798~~ ~~6028041394~~
	1A1A1	SPEAKER DRIVER	
	1A1A2	SSB CONTROL PANEL GRY/GRN OR ISB CONTROL PANEL GRY/GRN	6028041556/99 6028042056/99
1A3		RECEIVER ASSEMBLY	---------
	1A3A1	VHF MIXER	5024110099
	1A3A2	IF/FILTER	5024120094 5024121091
		ISB OPTION	6028120090
	1A3A4	AUDIO BOARD	5024140095
	1A3A5	IF FILTER (ISB OPTION)	6028121096
	1A3A6	AUDIO BOARD (ISB OPTION)	5024140095
	1A3A7	RECEIVER MOTHER BOARD	6028011894
1A4		SYNTHESIZER ASSEMBLY	
	1A4A1	SPECTRUM GENERATOR	5024060091
	1A4A2	LOW DIGIT GENERATOR	5024070097
	1A4A3	TRANSLATOR	5024080092
	1A4A4	VHF DIVIDER	5024090098
	1A4A5	V.C.O.	5024100093
	1A4A6	SYNTHESIZER MOTHER BOARD	5024011597
1A5		FILTER MODULE	6028055093
	1A5A1	ODD CHANNEL FILTER	6028055697
	1A5A2	EVEN CHANNEL FILTER	6028056791
	1A5A4	MOTOR CONTROL BOARD OR	6028057592
1A5		PRESELECTOR MODULE (OPTIONAL)	6028050091
	1A5A1	TUNER, RF AMP	6028052094
	1A5A2	INPUT TUNER	6028053091
1A6		POWER SUPPLY	6028020095
	1A6A1	REGULATOR	6028020591
	1A6A2	D-C INVERTER (OPTIONAL)	6028021792
1A8		CHASSIS ASSEMBLY	
	1A8A1	DISTRIBUTION AMP, FREQ. STANDARD	6028012092

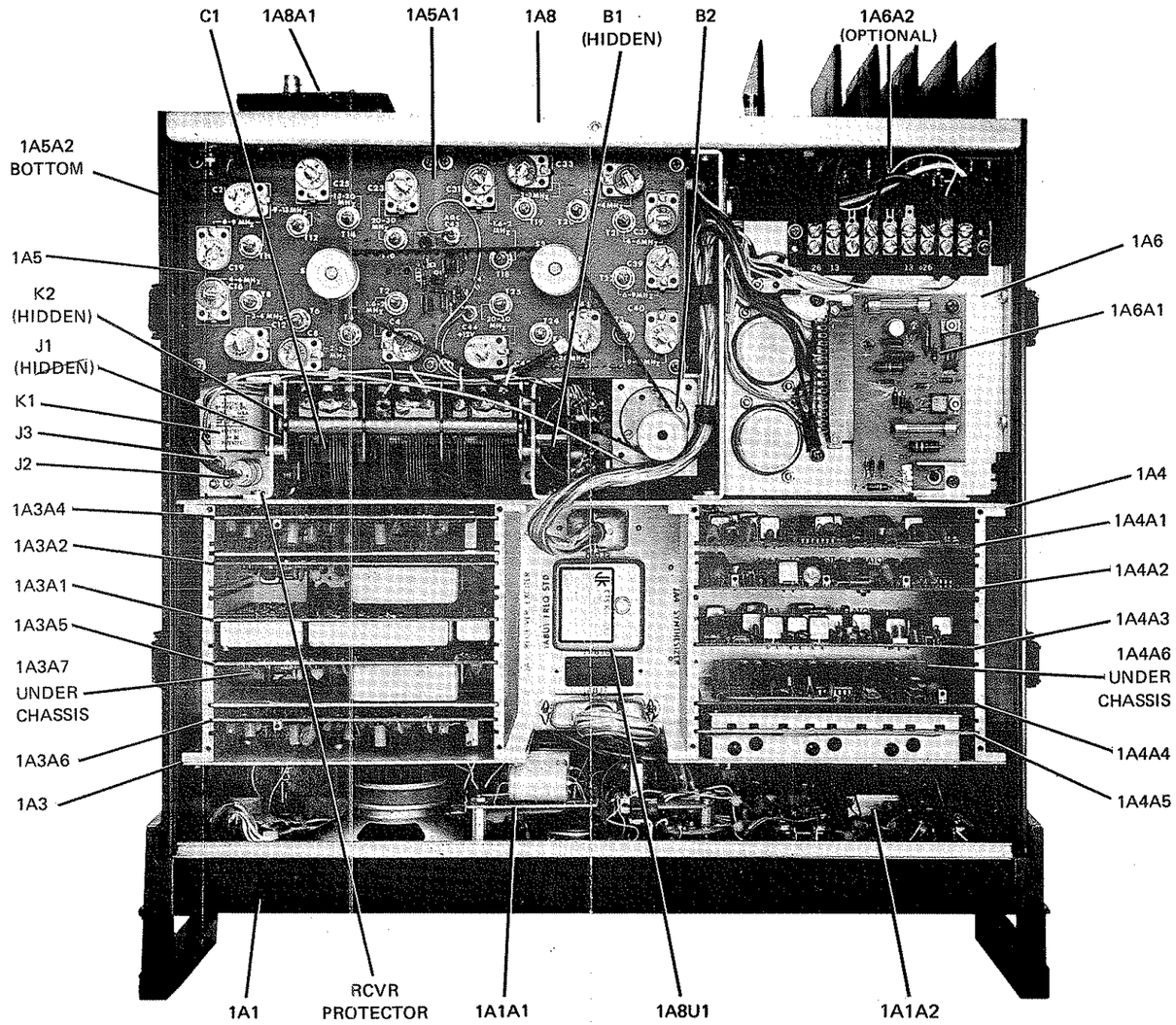
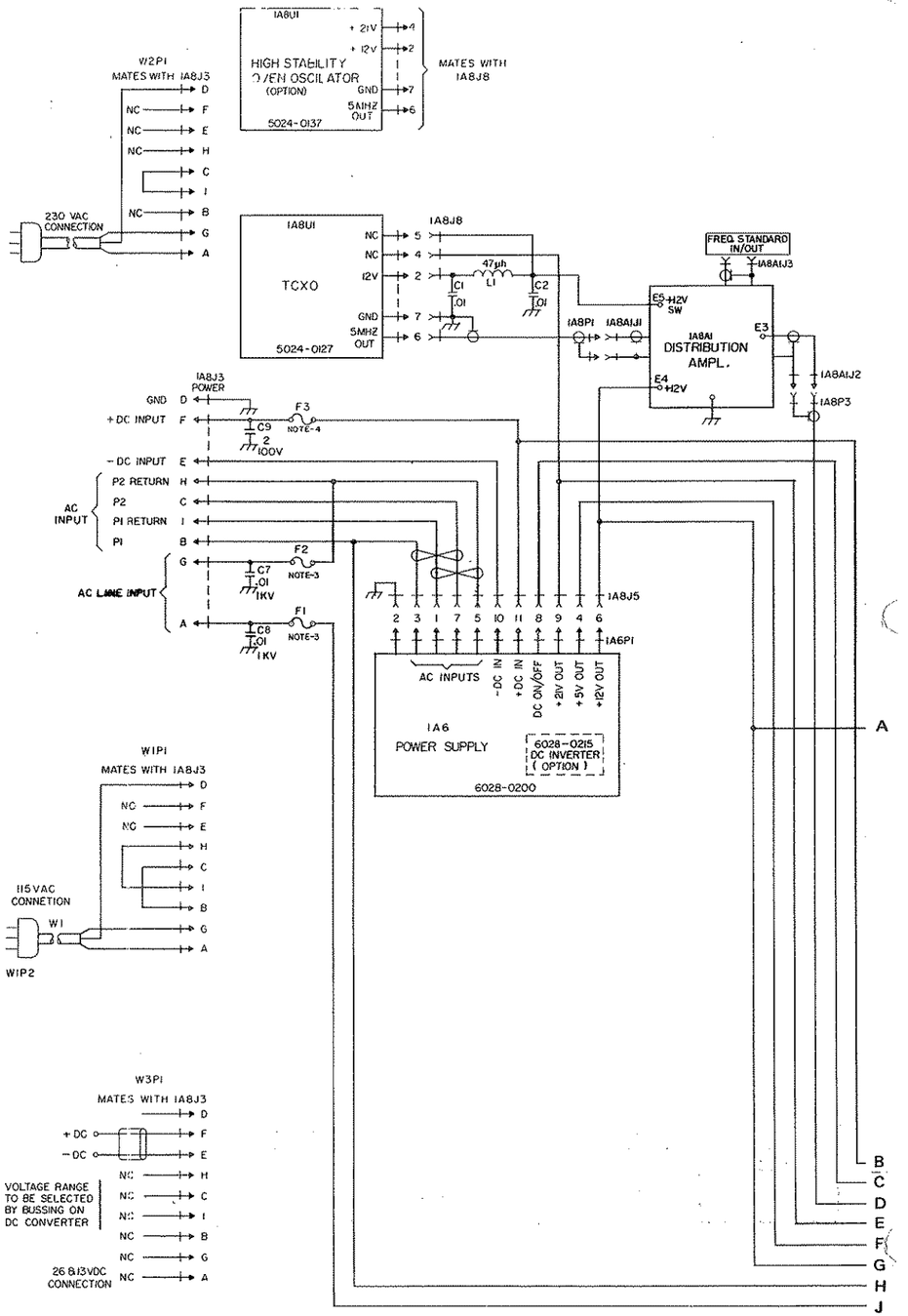


Figure 5.3 GSR-920 Top View and Table of Assemblies

PARTS LIST, Main Frame Wiring 6028014095 B

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.	
		XSS	
C1	Capacitor, Ceramic, 0.01 UF 20%, 25 V	0281620008	
C2	Capacitor, Ceramic, 0.01 UF 20%, 25 V	0281620008	
C3	Capacitor, Ceramic, 0.01 UF 20%, 25 V	0281620008	
C4	Capacitor, Ceramic, 0.01 UF 20%, 25 V	0281620008	
C5	Capacitor, Ceramic, 0.01 UF 20%, 25 V	0281620008	
C6	Capacitor, Ceramic, 0.01 UF 20%, 25 V	0281620008	
C7	Capacitor, Ceramic, 0.01 UF, 1 KV	0296040002	.01, 1000V Z5U, 20% 0243550006
C8	Capacitor, Ceramic, 0.01 UF, 1 KV	0296040002	.01, 1000V, Z5U, 20% 0243550006
C9	Capacitor, Mylar, 2 UF, 100 V	0272420000	
L1	Inductor, 47 UH 10% 5%	0652680003	
1A8J1	Connector, BNC	0743740009	
1A8J2	Connector, 10 Pin	0753990008	
1A8J3	Connector, 9 Pin	0753440008	
1A8J5	Connector, 11 Pin	0754360009	
1A8J7	Connector, 36 Pin	0753520001	
1A8J8	Socket, 7 Pin Tube	0764370006	
1A8J11	Jack, Phone, Closed Circuit	0755240006	
1A8P1	Connector, RF Miniature SUB	0753360004	0755260001
1A8P2	Connector, 20 Pin	0753350008	
1A8P3	Connector, RF Subminiature	0753700000	
1A8P4	Connector, RF Miniature	0753720001	
1A8P5	Connector, BNC	0753710005	
1A4ES	Connector, RF, Coax Feedthru	0753690004	

1A3P1 Connector RF Subminiature 0753700000



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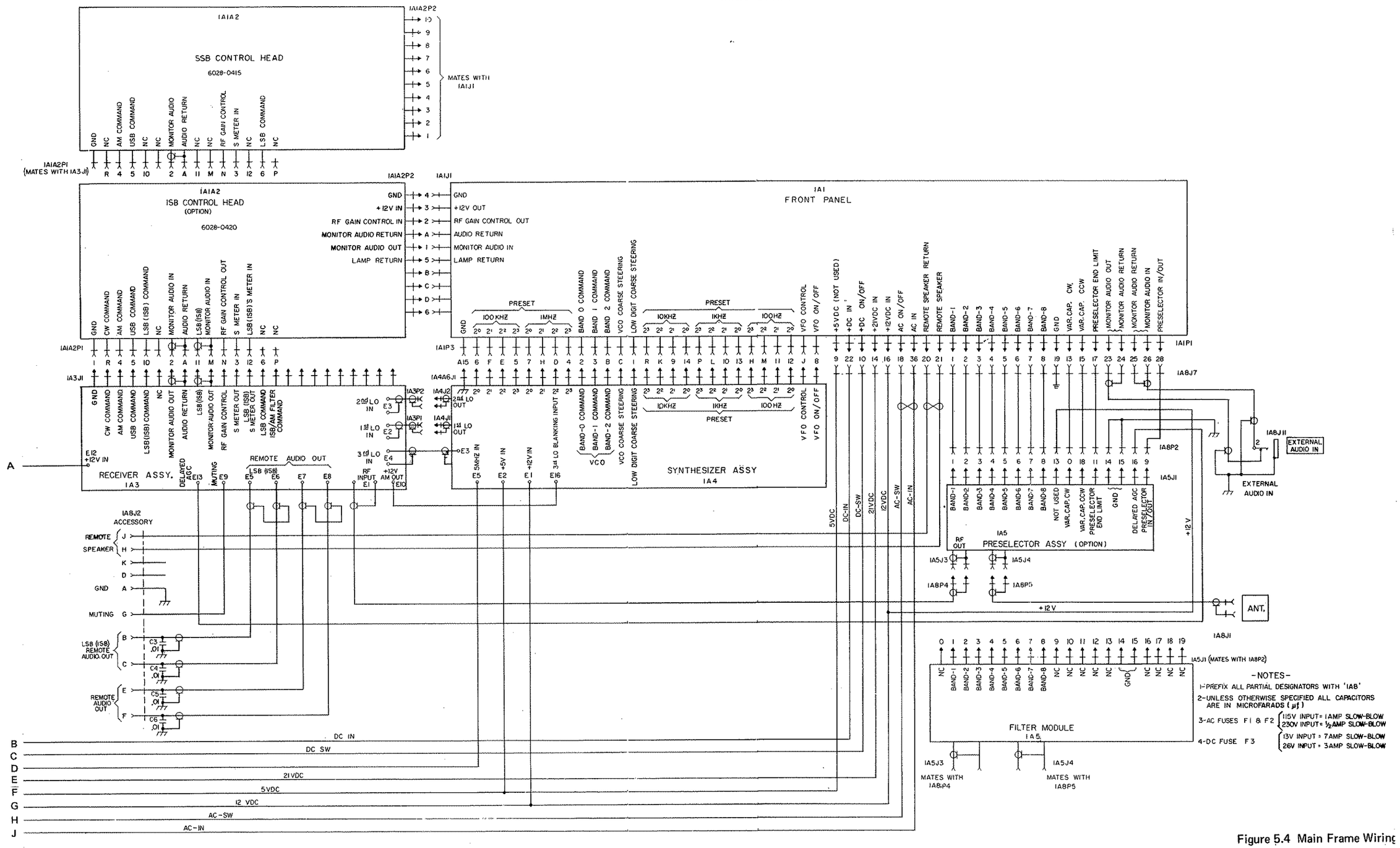
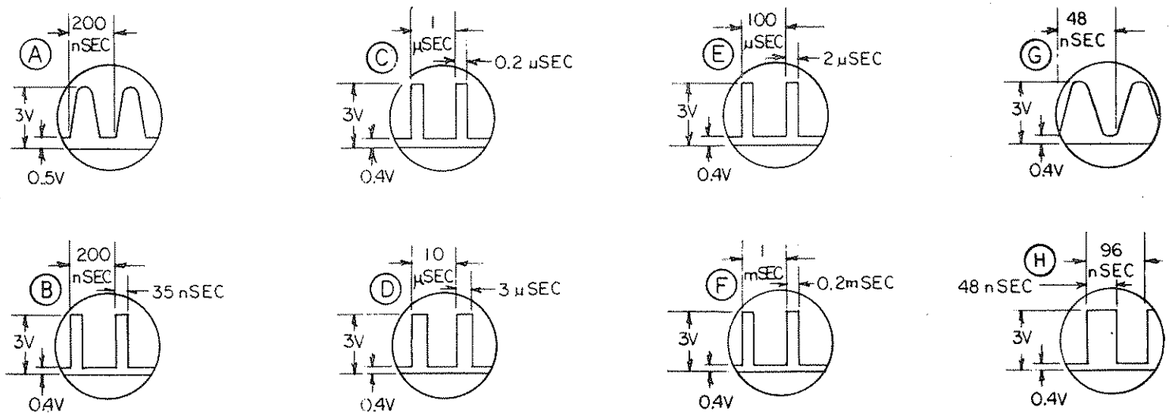


Figure 5.4 Main Frame Wiring

PARTS LIST 1A4A1

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Disc Ceramic, .01 UF, 25 V	0218620008
C2	Capacitor, Disc Ceramic, .01 UF, 25 V	0218620008
C3	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C4	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C5	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C6	Capacitor, Mica, 91 PF 5%, 500 V	0284420000
C7	Not used	
C8	Capacitor, Mica, 2 PF 5%, 500 V	0259710008
C9	Capacitor, Mica, 130 PF 5%, 500 V	0274860007
C10	Capacitor, Mica, 270 PF 5%, 500 V	0275030008
C11	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C12	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C13	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C14	Capacitor, Mica, 91 PF 5%, 500 V	0284420000
C15	Capacitor, Mica, 560 PF 5%,300 V	0283750006
C16	Capacitor, Mica, 10 PF 5%, 500 V	0259830003
C17	Capacitor, Mica, 47 PF 5%, 500 V	0259830003
C18	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C19	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C20	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C21	Not used	
C22	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C23	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C24	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C25	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C26	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C27	Capacitor, Mica, 330 PF 5%, 500 V	
C28	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C29	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C30	Capacitor, Mica, 2200 PF 2%, 500 V	0281360006
C31	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C32	Capacitor, Mica, 91 PF 5%, 500 V	0284420000
C33	Capacitor, Mica, 750 PF, 5%, 300 V	0275410005
C34	Capacitor, Mica, 2 PF 5%, 500 V	0259710008
C35	Capacitor, Mica, 91 PF 5%, 500 V	0284420000
C36	Capacitor, Mica, 2 PF 5%, 500 V	0259710008
C37	Capacitor, Mica, 120 PF 5%, 500 V	0189850002
C38	Capacitor, Mica, 180 PF 5%, 500 V	0258280000
C39	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C40	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C41	Not used	
C42	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C43	Capacitor, Mica, 68 PF 5%, 500 V	0261070002
C44	Capacitor, Mica, 270 PF 5%, 500 V	0275030008
C45	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C46	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C47	Capacitor, Mica, 15 PF 5%, 500 V	0259950009
C48	Capacitor, Mica, 150 PF 5%, 500 V	0274980002
C49	Capacitor, Mica, 360 PF 5%, 500 V	0275150003
C50	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C51	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C52	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C53	Capacitor, Mica, 180 PF 5%, 500 V	0258280000
C54	Capacitor, Disc Ceramic,.01 UF, 25 V	0281620008
C55	Capacitor, Mica, 150 PF 5%, 500 V	0281290008
C56	Capacitor, Mica, 10 PF 5%, 500 V	0259830003
C57	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C58	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C59	Capacitor, Mica, 2 PF 5%, 500 V	0259710008
C60	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C61	Capacitor, Mica, 10 PF 5%, 500 V	0259830003
C62	Capacitor, Mica, 2 PF .5 PF 500V	0159710008
C63	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C64	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C65	Capacitor, Mica, 130 PF 5%, 500 V	0274860007
C66	Capacitor, Mica, 270 PF 5%, 500 V	0275030008
C67	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C68	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C69	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C70	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
C71	Capacitor, 68 UF, 15 V	0296540005
C72	Capacitor, Disc Ceramic, .01 UF, 25 V	0281620008
CR1	Diode, 1N4454	0405270003
CR2	Diode, 1N4454	0405270003
CR3	Diode, 1N4454	0405270003
CR4	Diode, MBD-102	0405280009
CR5	Diode, MBD-102	0405280009
CR6	Diode, MBD-102	0405280009
CR7	Diode, MBD-102	0405280009
CR8	Diode, 1N4454	0405270003
CR9	Diode, 1N4454	0405270003
CR10	Diode, 1N4454	0405270003
CR11	Diode, 1N4454	0405270003
CR12	Diode, 1N4454	0405270003
CR13	Diode, 1N4454	0405270003
CR14	Diode, 1N4454	0405270003
L1	Inductor, 220 UH	0650500008
L2	Inductor, Variable, 0.68 UH	0647900009
L3	Inductor, Variable, 0.68 UH	0647900009
L4	Inductor, Variable, 0.68 UH	0647900009
L5	Inductor, 22 UH 5%	0650000005
L6	Inductor, Variable, 0.68 UH	0647900009
L7	Inductor, 12 UH 5%	0652700004
L8	Inductor, Variable, 0.68 UH	0647900009
L9	Inductor, Variable, 0.68 UH	0647900009
L10	Inductor, Variable, 0.68 UH	0647900009
L11	Inductor, 1 UH 5%	0649150007
L12	Inductor, 2.2 UH 5%	0649890001
L13	Inductor, 2.2 UH 5%	0649890001
L14	Inductor, Variable, 15 UH	0629790001
L15	Inductor, 47 UH 5%	0652680003
L16	Inductor, Variable, 1 UH	0647910004
L17	Inductor, Variable, 1 UH	0647910004
L18	Inductor, Molded, 33 UH 5%	0646300008
Q1	Transistor, 2N4124	0448010003
Q2	Transistor, 2N4124	0448010003
Q3	Transistor, 2N4124	0448010003
Q4	Transistor, 2N4124	0448010003
Q4	Transistor, 2N4124	0448010003
Q5	Transistor, MPF-122	0448030004
Q7	Transistor, 2N4124	0448010003
Q8	Transistor, 2N4126	0448020009
Q9	Transistor, 2N4124	0448010003
R1	Resistor, Carbon, 56 ohm 10%, 1/4 W	0174290004
R2	Resistor, Carbon, 3.9 K 10%, 1/4 W	0178830001
R3	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620006
R4	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R5	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R6	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R7	Not used	
R8	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R9	Resistor, Carbon, 390 ohm 10%, 1/4 W	0178330001
R10	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R11	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R12	Resistor, Carbon, 3.9 K 10%, 1/4 W	0178830001
R13	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620006
R14	Resistor, Carbon, 3.9 K 10%, 1/4 W	0178830001
R15	Resistor, 8.2 K 10% 1/4 W	0181620006
R16	Resistor, Carbon, 8.2 K 10%, 1/4 W	0171320000
R17	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620006
R18	Resistor, Carbon, 680 ohm 10%, 1/4	0176630007
R19	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R20	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R21	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R22	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R23	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R24	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R25	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R26	Resistor, Carbon, 3.9 K 10%, 1/4 W	0178830003
R27	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620006
R28	Not used	
R29	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R30	Not used	
R31	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R32	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R33	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R34	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R35	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R36	Resistor, Carbon, 12 K 10%, 1/4 W	0183180003
R37	Resistor, Carbon, 22 K 10%, 1/4 W	0172230004
R38	Resistor, Carbon, 820 ohm 10%, 1/4 W	0178210005
R39	Resistor, Carbon, 10 ohm 10%, 1/4 W	0177160004
R40	Resistor, Carbon, 2.20 ohm 10%, 1/4 W	0171320000
R41	Resistor, Carbon, 2.20 ohm 10%, 1/4 W	0171320000
R42	Resistor, Carbon, 68 K 10%, 1/4 W	0173520006
R43	Not used	
R44	Resistor, Carbon, 33 K 10%, 1/4 W	0177920009
R45	Resistor, Carbon, 1.5 K 10%, 1/4 W	0172470005
R46	Resistor, Carbon, 470 ohm 10%, 1/4 W	0172610001
R47	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R48	Not used	
R49	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004

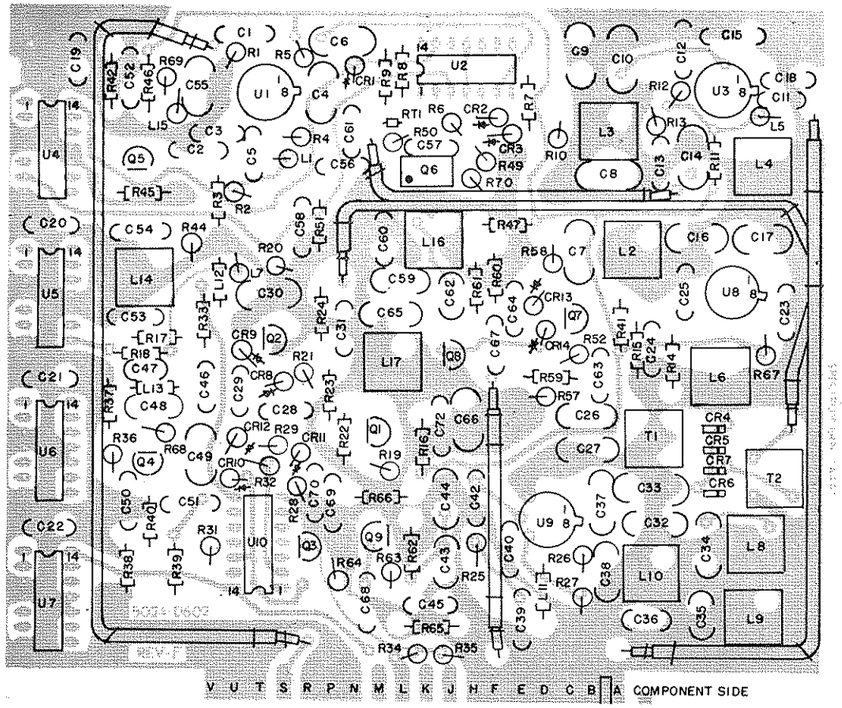
REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
R50	Resistor, Carbon 22 K 10%, 1/4 W	0172230004
R51	Resistor, Carbon, 47 ohm 10%, 1/4 W	0179360001
R52	Resistor, Carbon, 4.7 K 10%, 1/4	0170770001
R53	Not used	
R54	Not used	
R55	Not used	
R56	Not used	
R57	Resistor, Carbon, 47 K 10%, 1/4 W	0170770001
R58	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R59	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R60	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R61	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R62	Resistor, Carbon, 12 K 10%, 1/4 W	0183180003
R63	Resistor, Carbon, 22 K 10%, 1/4 W	0172230004
R64	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R65	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R66	Resistor, Carbon, 220 ohm, 10%, 1/4 W	0171320000
R67	Resistor, Carbon, 220 ohm, 10%, 1/4 W	0171320000
R68	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R69	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R70	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004
RT1	Thermister, 1 K at 25 C	0196110009
T1		
T2		
U1	Integrated Circuit, Linear, CA3053	0448060001
U2	Integrated Circuit, Digital, SN5400N	0448400006
U3	Integrated Circuit, Linear CA3053	0448060001
U4	Integrated Circuit, Digital N8280A	0448080001
U5	Integrated Circuit, Digital N8280A	0448080001
U6	Integrated Circuit, Digital N8280A	0448080001
U7	Integrated Circuit, Digital N8280A	0448080001
U8	Integrated Circuit, Linear, CA3053	0448060001
U9	Integrated Circuit, Linear CA3053	0448060001
U10	Integrated Circuit, Digital, SN541172H	0448410001

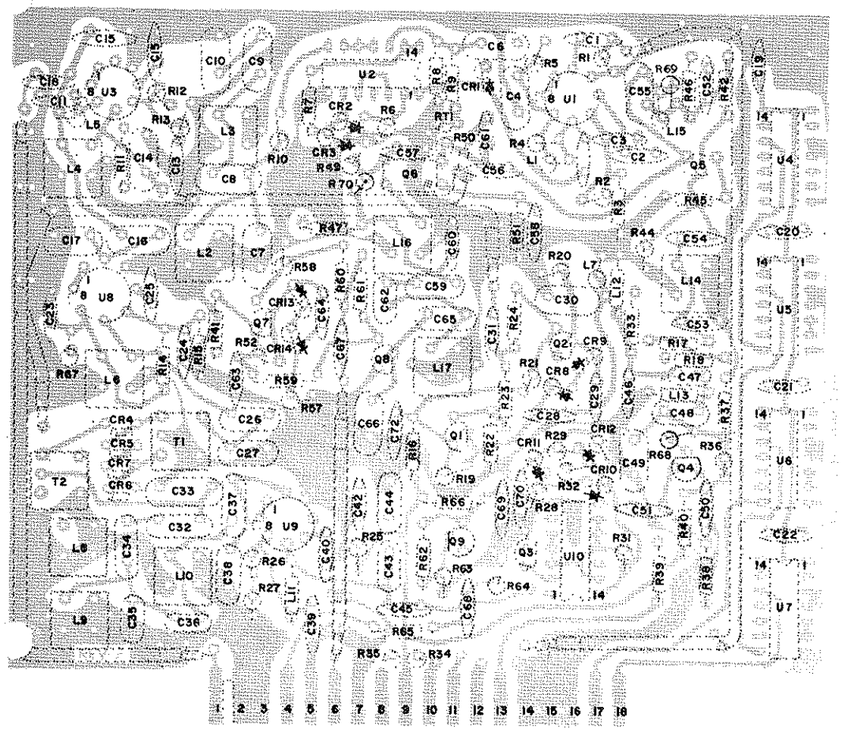


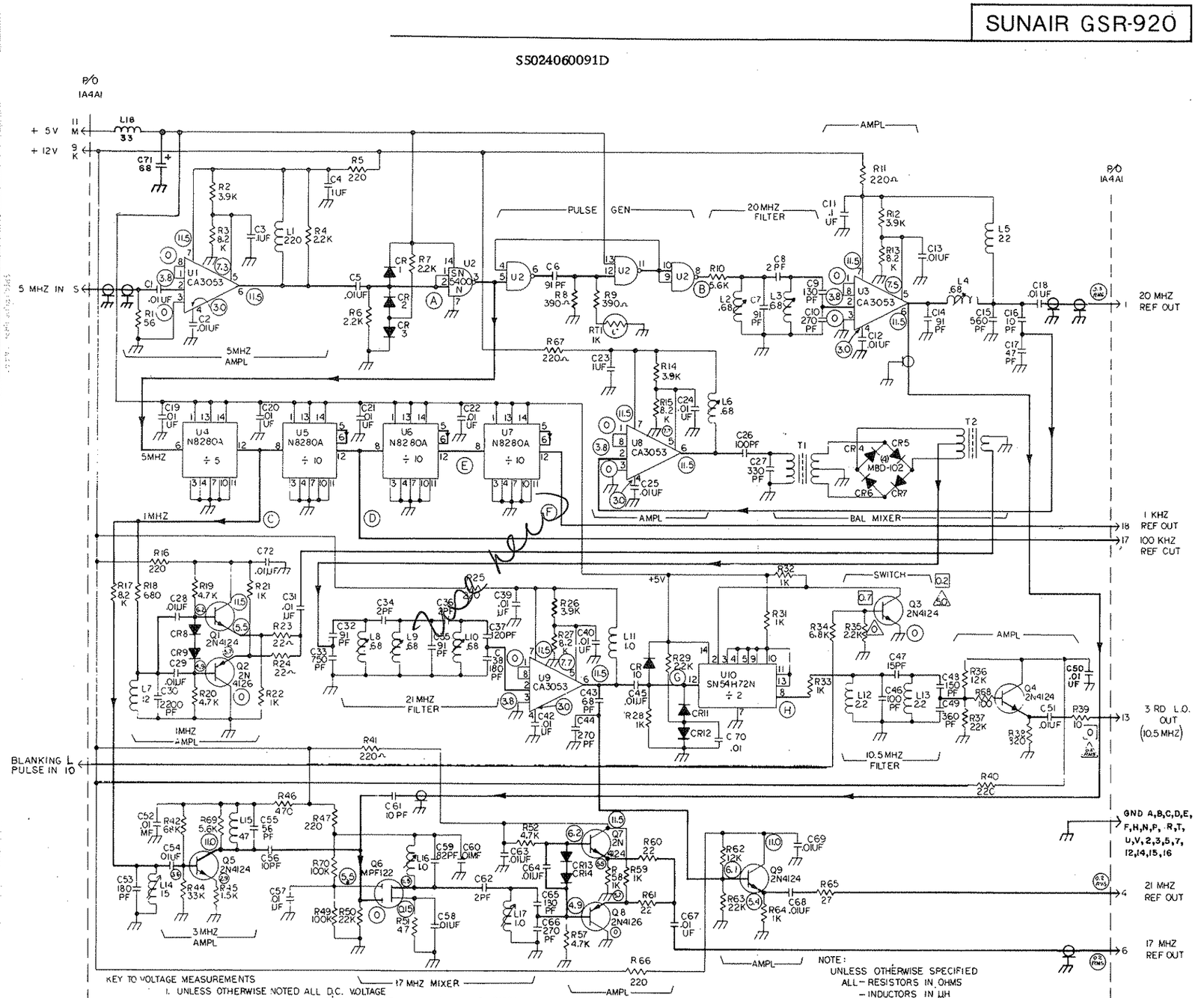
NOTE: H DOES NOT CLOCK IN AM. ECV. MODE

Spectrum Generator (1A4A1) Waveforms
(Frequency Dials at 00000.0 kHZ

S5024060091D





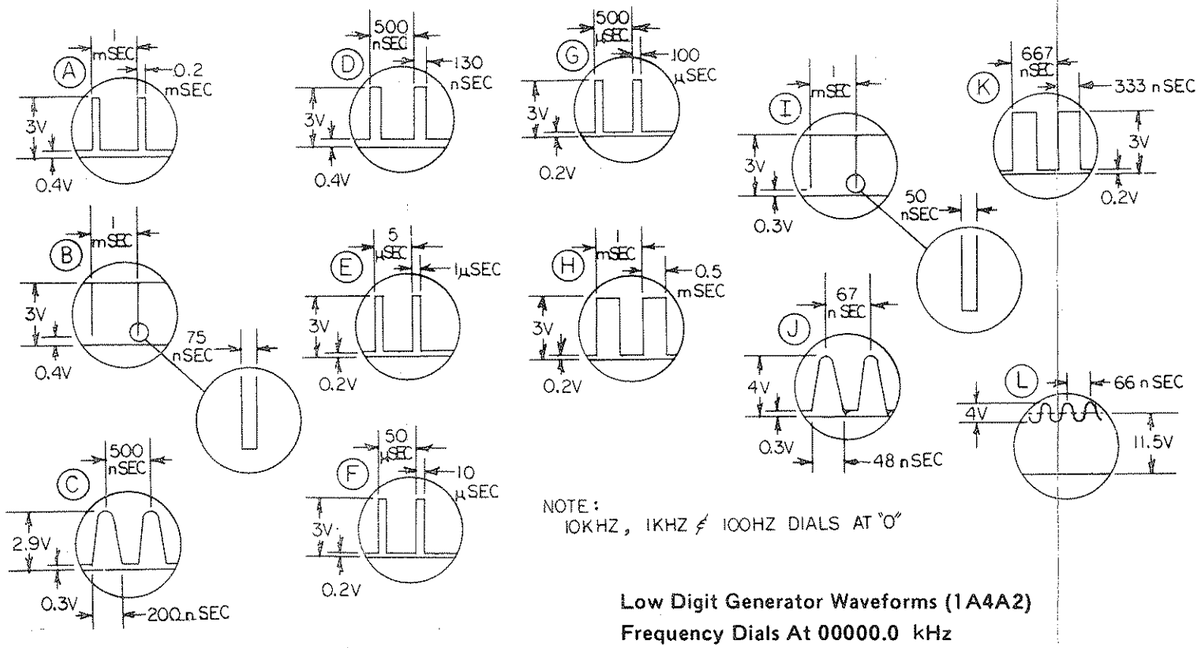


KEY TO VOLTAGE MEASUREMENTS

1. UNLESS OTHERWISE NOTED ALL D.C. VOLTAGE MEASUREMENTS MADE WITH 20,000 OHM/VOLT V.O.M. ≠ MAY VARY ±15%
2. (12) — DENOTES READINGS MADE WITH 11 MEGOHM V.T.V.M. ≠ MAY VARY ±15%
3. (12) — READINGS PRESENT IN ALL MODES
4. [12] — READINGS PRESENT IN AM RCV. MODE
5. △12 — READINGS PRESENT WHEN NOT IN AM RCV. MODE
6. ALL WAVEFORMS MEASURED WITH 100 MHZ OSCILLOSCOPE IN D.C. MODE
7. (A) — REFERENCE WAVEFORMS WITH ALL FREQUENCY DIALS SET AT 0

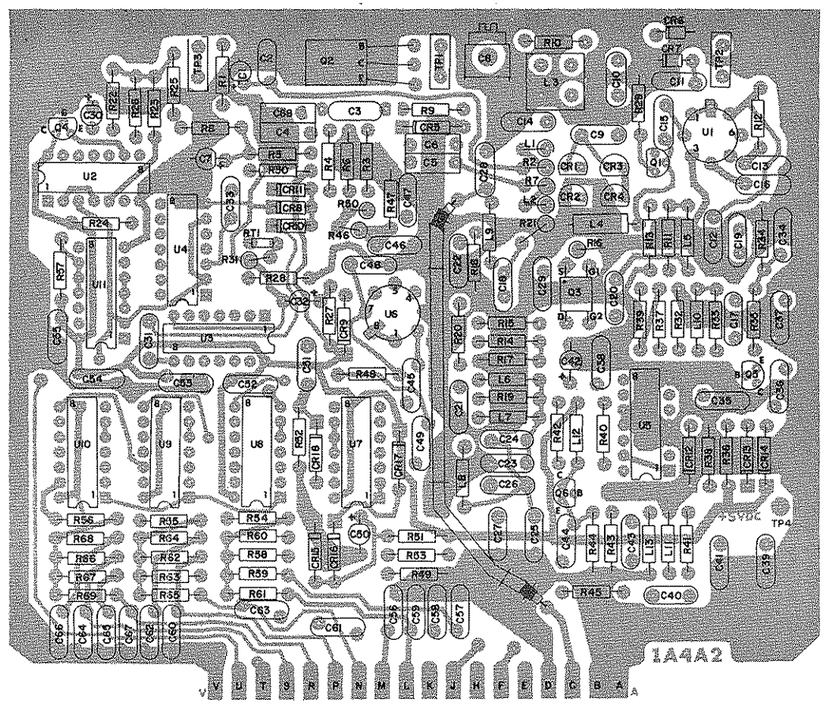
NOTE: UNLESS OTHERWISE SPECIFIED ALL — RESISTORS IN OHMS — INDUCTORS IN µH

Figure 5.5 Spectrum Generator (1A4A1) Schematic

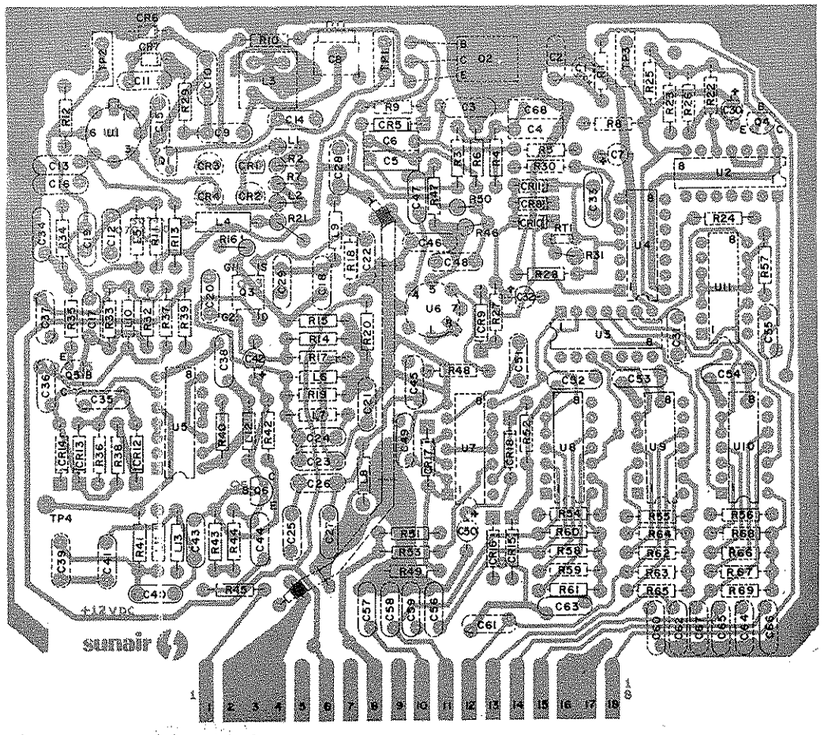


NOTE:
10KHZ, 1KHZ & 100HZ DIALS AT "0"

Low Digit Generator Waveforms (1A4A2)
Frequency Dials At 00000.0 kHz



LOW DIGIT GENERATOR



S5024070097A

S5024070097C

1A4A2

KEY TO VOLTAGE MEASUREMENTS

(12) D.C. VOLTAGE MEASURED WITH 20,000 OHM/VOLT V.O.M.

(12) D.C. VOLTAGE MEASURED WITH 11 MEGOHM V.T.V.M.

(A) REFERENCE WAVEFORM MEASURED WITH 100 MHZ D.C. COUPLED SCOPE AND 9pF/1 MEGOHM PROBE

(0.47 RMS) RMS VOLTAGE MEASURED WITH RF VOLTMETER

NOTE: ALL VOLTAGES MAY NORMALLY VARY ±15% FROM NOMINAL SHOWN

UNLESS OTHERWISE SPECIFIED:
ALL-DIODES ARE TYPE 1N4454
-DECIMAL CAPACITORS IN UF,
ALL OTHERS IN PF
-INDUCTORS IN UH
-RESISTORS IN OHMS

LAST DESIGNATORS
R69
C68
L13
CR18
PREFIX ALL DESIGNATORS WITH "1A4A2"

Figure 5.6 Low Digit Generator (1A4A2) Schematic

Low Digit Generator

PARTS LIST, 1A4A2 5024070097 N

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
1A4A2		
C1	Capacitor, Tantalum, 3.3 UF, 15 V	0281680001
C2	Monolithic, 0.1 UF, 50 V	0281610002
C3	Capacitor, Mylar, 0.068 UF	0281640009
C4	Capacitor, Mylar, 0.0047 UF, 50 V	0281540004
C5	Capacitor, Mylar, 0.0047 UF, 50 V	0281540004
C6	Capacitor, Mylar, 0.0047 UF, 50 V	0281540004
C7	Capacitor, Tantalum, 0.33 UF, 35 V	0281650004
C8	Capacitor, Variable, Ceramic, 3-15 PF	0285710001
C9	Capacitor, Mica, 120 PF 5%, 500 V	0289850002
C10	Capacitor, Mica, 82 PF 5%, 500 V	0266520006
C11	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C12	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C13	Capacitor, Disc, Cer., 0.01 UF, 25 V	0281620008
C14	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C15	Capacitor, Mica, 7 PF 5%, 500 V	0288580001
C16	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C17	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C18	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C19	Capacitor, Mica, 27 PF 5%, 300 V	0260660001
C20	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C21	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C22	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C23	Capacitor, Mica, 68 PF 5%, 500 V	0261070002
C24	Capacitor, Mica, 5 PF 1/2 PF, 500 V	0261190008
C25	Capacitor, Mica, 110 PF 5%, 500 V	0257750002
C26	Capacitor, Mica, 12 PF 5%, 500 V	0260280003
C27	Capacitor, Mica, 62 PF 5%, 500 V	0283010002
C28	Capacitor, Mica, 130 PF 5%, 500 V	0274860007
C29	Capacitor, Mica, 110 PF 5%, 500 V	0257750002
C30	Capacitor, Tantalum, 15 UF, 15 V	0281720002
C31	Capacitor, Disc. Cer., 1000 PF, 50 V	0281630003
C32	Capacitor, Tantalum, 1 UF, 35 V	0281660000
C33	Capacitor, Mica, 910 PF 5%, 100 V	0288660005
C34	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C35	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C36	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C37	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C38	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C39	Capacitor, Mica, 680 PF 5%, 500 V	0286240009
C40	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C41	Capacitor, Mica, 680 PF, 5%, 500 V	0286240009
C42	Capacitor, Tantalum, 1 UF, 35 V	0281660000
C43	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C44	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C45	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C46	Capacitor, Monolithic, 0.01 UF, 50 V	0281610002
C47	Capacitor, Monolithic, 0.01 UF, 50 V	0281610002
C48	Capacitor, Monolithic, 0.01 UF, 50 V	0281610002
C49	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C50	Capacitor, Tantalum, 1 UF, 35 V	0281660000
C51	Capacitor, Mica, 100 UF 5%, 500 V	0258280000
C52	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C53	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C54	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C55	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C56	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C57	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C58	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C59	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C60	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C61	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C62	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C63	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C64	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C65	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C66	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C67	Capacitor, Disc. Cer., 0.01 UF, 25 V	0281620008
C68	Capacitor, Mylar, 0.0047 UF, 50 V	0281540004
CR1	Diode, MV2115	0405030000
CR2	Diode, MV2115	0405303000
CR3	Diode, MV2110	0405290004
CR4	Diode, MV2110	0405290004
CR5	Diode, 1N5237B	0405240007
CR6	Diode, Signal, 1N4454	0405270003
CR7	Diode, Signal, 1N4454	0405270003
CR8	Diode, Signal, 1N4454	0405270003
CR9	Diode, Signal, 1N4454	0405270003
CR10	Diode, Signal, 1N4454	0405270003
CR11	Diode, Signal, 1N4454	0405270003
C69	Capacitor 68uF 15V T368	0296900005

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
CR12	Diode, Signal, 1N4454	0405270003
CR13	Diode, Signal, 1N4454	0405270003
CR14	Diode, Signal, 1N4454	0405270003
CR15	Diode, Signal, 1N4454	0405270003
CR16	Diode, Signal, 1N4454	0405270003
CR17	Diode, Signal, 1N4454	0405270003
CR18	Diode, Signal, 1N4454	0405270003
L1	Inductor, 33 UH 5%	0659690004
L2	Inductor, 33 UH 5%	0659690004
L3	Inductor, Variable, 1 UH	0647910004
L4	Inductor, 150 UH 5%	0646780000
L5	Inductor, 3.3 UH 5%	0658920006
L6	Inductor, 220 UH 5%	0650500008
L7	Inductor, 82 UH 5%	0659450003
L8	Inductor, 68 UH 5%	0651650003
L9	Inductor, 1 UH 5%	0649150007
L10	Inductor, 8.2 UH 5%	0652060005
L11	Inductor, 15 UH 5%	0659070006
L12	Inductor, 47 UH 5%	0652680003
L13	Inductor, 15 UH 5%	0659070006
Q1	Transistor, 2N5486	0448050005
Q2	Transistor, 2N4921	0448040000
Q3	Transistor, MPF-122	0448030004
Q4	Transistor, 2N4124	0448010003
Q5	Transistor, 2N4124	0448010003
Q6	Transistor, 2N4124	0448010003
R1	Resistor, Carbon 820 ohm 10%, 1/4 W	0178210005
R2	Resistor, Carbon 4.7 K 10%, 1/4 W	0170770001
R3	Resistor, Film 33.2 K 1%, 1/8 W	0196470005
R4	Resistor, Film 33.2 K 1%, 1/8 W	0196470005
R5	Resistor, Carbon 3.9 K 10%, 1/4 W	0178830003
R6	Resistor, Film, 16.5 K 1%, 1/8 W	0196590001
R7	Resistor, Carbon 4.7K 10%, 1/4 W	0170770001
R8	Resistor, Carbon, 820 ohm 10%, 1/4 W	0178210005
R9	Resistor, Carbon, 680 ohm 10%, 1/4 W	0176630007
R10	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R11	Resistor, Carbon, 120 ohm 10%, 1/4 W	0186550006
R12	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R13	Resistor, Carbon, 5.6 K 10% 1/4 W	0183060008
R14	Resistor, Carbon, 220 K 10%, 1/4 W	0177780002
R15	Resistor, Carbon, 220 K 10%, 1/4 W	0177780002
R16	Resistor, Carbon, 22 K 10%, 1/4 W	0177230004
R17	Resistor, Carbon, 47 K 10%, 1/4 W	0171060008
R18	Resistor, Carbon, 150 ohm 10%, 1/4 W	0172730007
R19	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R20	Resistor, Carbon, 120 ohm 10%, 1/4 W	0186550006
R21	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R22	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R23	REsistor, Carbon, 10 K 10%, 1/4 W	0170410005
R24	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R25	Resistor, Carbon, 2.2 Meg 10%, 1/4 W	0176870008
R26	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R27	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R28	Resistor, Carbon, 470 ohm 10%, 1/4 W	0172610001
R29	Resistor, Carbon, 47 K 10%, 1/4 W	0171060008
R30	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R31	Resistor, Carbon, 470 ohm 10%, 1/4 W	0172610001
R32	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R33	Resistor, Carbon, 15 K 10% 1/4 W	0172350000
R34	Resistor, Carbon, 470 ohm 10%, 1/4 W	0172610001
R35	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R36	Resistor, Carbon, 1 K 10% 1/4 W	0171560001
R37	Not used	
R38	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R39	Resistor, Carbon, 120 ohm 10%, 1/4 W	0186550005
R40	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R41	Resistor, Carbon 1 K 10%, 1/4 W	0171560001
R42	Resistor, Carbon, 3.3 K 10%, 1/4 W	0170890007
R43	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R44	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R45	Resistor, Carbon, 47 ohm 10%, 1/4 W	0179360001
R46	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R47	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R48	Resistor, Carbon, 560 ohm 10%, 1/4 W	0183200004
R49	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R50	Resistor, Carbon, 120 ohm 10%, 1/4 W	0186550006
R51	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R52	Resistor, Carbon, 470 ohm 10%, 1/4 W	0172610001
R53	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
L14	Inductor, 33UH, 5%	0646300008

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
R54	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R55	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R56	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R57	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R58	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R59	Resistor, Carbon, 5.6 K 10% 1/4 W	0183060008
R60	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R61	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R62	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R63	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R64	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R65	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R66	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R67	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R68	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R69	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
RT1	Thermistor, 1 K at 25 C	0196110009
U1	Integrated Circuit, Linear, CA3053	0448060001
U2	Integrated Circuit, Digital, MC4044P	0448100002
U3	Integrated Circuit, Digital, SN7430N	0448110008
U4	Integrated Circuit, Digital, SN7400N	0448070006
U5	Integrated Circuit, Digital, N8290A	0448250004
U6	Integrated Circuit, Linear, CA3053	0448060001
U7	Integrated Circuit, Digital, SN7400N	0448070006
U8	Integrated Circuit, Digital, N8280A	0448080001
U9	Integrated Circuit, Digital, N8280A	0448080001
U10	Integrated Circuit, Digital, N8208A	0448080001
U11	Integrated Circuit, Digital, SN7472N	0448120003
TP1	Test Point, White	0753640007
TP2	Test Point, White	0753640007
TP3	Test Point, White	0753640007

PARTS LIST, 1A4A3 Translator SD24080092 M

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Mica, 82 PF 5%, 500 V	0266520006
C2	Capacitor, Mica, 820 PF 5%, 500 V	0293390007
C3	Capacitor, Mica, 2 PF 0.5 PF, 500 V	0259710008
C4	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C5	Capacitor, Mica, 2 PF .05 PF, 500 V	0259710008
C6	Capacitor, Mica, 200 PF 5%, 300 V	0287150003
C7	Capacitor, Mica, 200 PF 5%, 300 V	0287150003
C8	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C9	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C10	Capacitor, Mica, 680 PF 5%, 100 V	0284280003
C11	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C12	Capacitor, Mica, 1 PF 0.5 PF, 500 V	0281730008
C13	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C14	Capacitor, Mica, 1 PF, 0.5 PF, 500 V	0260160008
C15	Capacitor, Mica, 20 PF 5%, 500 V	0286740001
C16	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C17	Capacitor, Mica, 47 PF 5%, 500 V	0294960007
C18	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C19	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C20	Capacitor, Mica, 27 PF 5%, 300 V	0260660001
C21	Capacitor, Mica, 1 PF 0.5 PF, 500 V	0260160008
C22	Capacitor, Mica, 33 PF 5%, 500 V	0286860007
C23	Capacitor, Mica, 39 PF 2%, 500 V	0281150001
C24	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C25	Not used	
C26	Not used	
C27	Not used	
C28	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C29	Capacitor, Mica, 24 PF 5% 500 V	0290060001
C30	Not used	
C31	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C32	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C33	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C34	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C35	Capacitor, Monolithic, 0.01 UF, 50 V	0286860007
C36	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C37	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C38	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C39	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C40	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C41	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C42	Capacitor, Mica, 62 PF, 5%, 500 V	0281500002
C43	Capacitor, Mica, 560 PF 5%, 100 V	0285690001
C44	Capacitor, Monolithic, 0.01 UF, 50 V	0281610002
C45	Capacitor, Mica, 680 PF 5%, 100 V	0284280003
C46	Capacitor, Mica, 24 PF 5%, 500 V	0290060001
C47	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C48	Capacitor, Mica, 200 PF 5%, 300 V	0287150008
C49	Capacitor, Mica, 120 PF 5%, 500 V	0280880006
C50	Capacitor, Mica, 470 PF 5%, 100 V	0285570005
C51	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C52	Capacitor, Disc. Cer., 0.5 PF, 500 V	0281740003
C53	Capacitor, Mica, 12 PF 5%, 500 V	0286480000
C54	Capacitor, Disc. Cer., 0.5 PF, 500 V	0281740000
C55	Capacitor, Mica, 5 PF 0.5 PF, 500 V	0288570006
C56	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C57	Capacitor, Mica, 56 PF 5%, 500 V	0281290008
C58	Capacitor, Mica, 180 PF 5%, 500 V	0281050007
C59	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C60	Capacitor, Monolithic, 0.01 UF, 50 V	0287130008
C61	Capacitor, Mica, 5 PF, 0.5 PF, 500 V	0285570006
C62	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C63	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C64	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C65	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C66	Capacitor, Mica, 270 PF 5%, 500 V	0288630009
C67	Capacitor, Mica, 33 PF 5%, 500 V	0282680007
C68	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C69	Capacitor, Mica, 680 PF 5%, 100 V	0284280003
C70	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C71	Capacitor, Mica, 20 PF 5%, 500 V	0280880001
C72	Capacitor, Mica, 20 PF 5%, 500 V	0286740001
C73	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C74	Capacitor, Mica, 15 PF 5%, 500 V	0286500001
C75	Capacitor, Mica, 1 PF 5%, 500 V	0260160008
C76	Capacitor, Mica, 24 PF 5%, 500 V	0290060001
C77	Capacitor, Mica, 120 PF 5%, 500 V	0286480000
C78	Capacitor, Tantalum, 15 UF, 15 V	0281720002
C79	Capacitor, Mica, 12 PF 5%, 500 V	0286480000
C80	Capacitor, Mica, 15 PF 5%, 500 V	0286500001
C81	Capacitor, Mica, 82 PF 5%, 500 V	0266520006
C82	Capacitor, Mica, 2 PF 0.5 PF, 500 V	0259710008

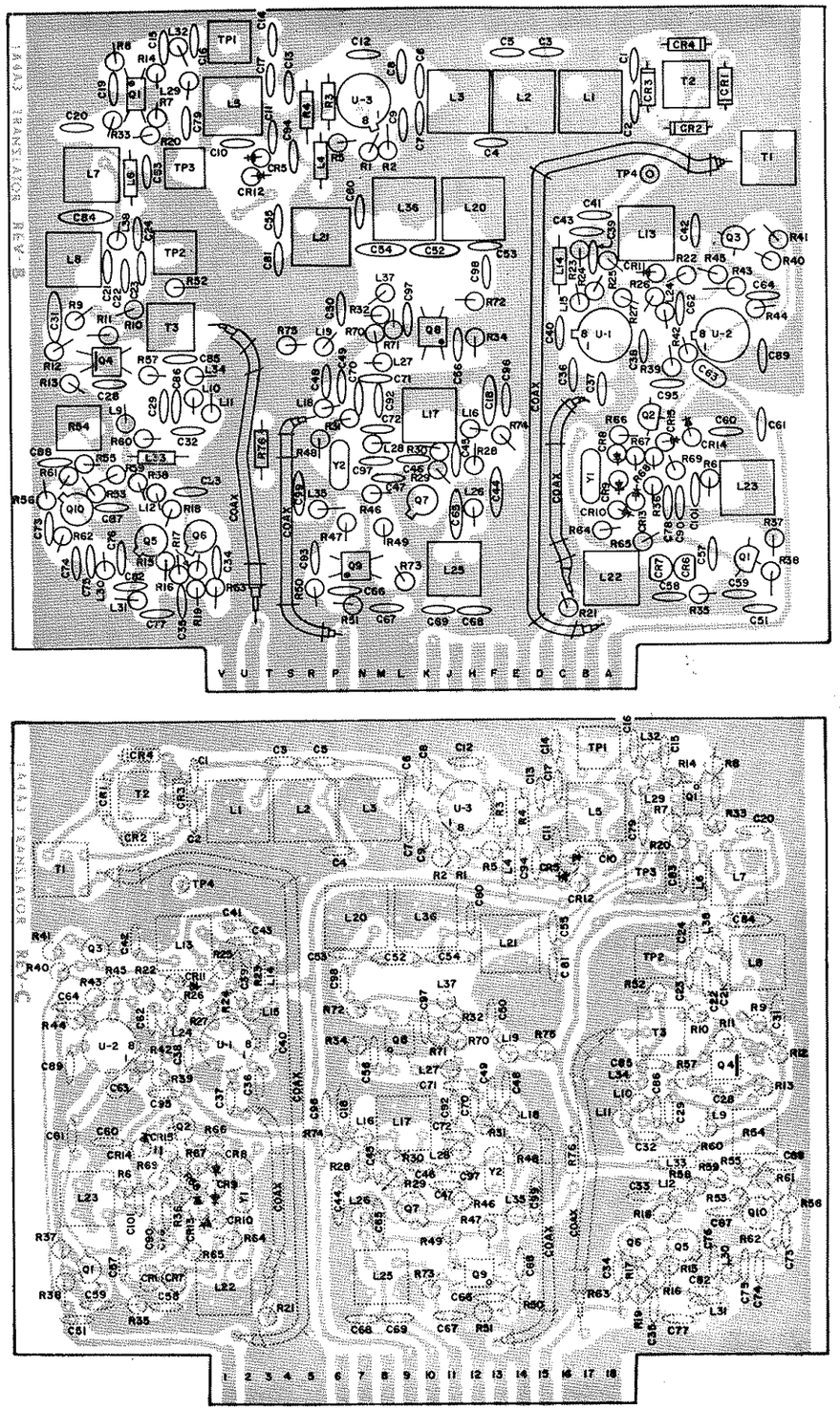
REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C83	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C84	Capacitor, Monolithic, 0.01 UF, 50 V	0281610002
C85	Capacitor, Mica, 100 PF, 5%, 500 V	0285450000
C86	Capacitor, Mica, 1 PF 0.5 PF, 500 V	0260160008
C87	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C88	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C89	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C90	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C91	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C92	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C93	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C94	Capacitor, Monolithic, 0.01 UF, 50 V	0281730008
C95	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C96	Capacitor, Mica, 120 PF 5%, 500 V	0280880001
C97	Not used	
C98	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C99	Capacitor, Mica, 200 PF 5%, 500 V	0287150003
C100	Not used	
C101	Capacitor, Mica, 18 PF 5%, 500 V	0282620003
CR1	Diode, MBD-102	0405280009
CR2	Diode, MBD-102	0405280009
CR3	Diode, MBD-102	0405280009
CR4	Diode, MBD-102	0405280009
CR5	Diode, 1N4454	0405270003
CR6	Diode, MV2106	0405310005
CR7	Diode, MV2106	0405310005
CR8	Diode, 1N4454	0405270003
CR9	Diode, 1N4454	0405270003
CR10	Diode, 1N4454	0405270003
CR11	Diode, 1N4454	0405270003
CR12	Diode, 1N4454	0405270003
CR13	Diode, 1N4454	0405270003
CR14	Diode, 1N4454	0405270003
CR15	Diode, 1N4454	0405270003
L1	Inductor, Variable, 0.68 UH	0647900009
L2	Inductor, Variable, 0.68 UH	0647900009
L3	Inductor, Variable, 0.68 UH	0647900009
L4	Inductor, Variable, 22 UH 10%	0650000005
L5	Inductor, Variable, 1 UH	0647910004
L6	Inductor, 4.7 UH 10%	0651910005
L7	Inductor, Variable, 0.18 UH	0647890003
L8	Inductor, Variable, 0.18 UH	0647890003
L9	Inductor, 6.8 UH 5%	0652910002
L10	Inductor, 2.2 UH 10%	0659710005
L11	Inductor, 8.2 UH 5%	0652060005
L12	Inductor, 22 UH 15%	0650000005
L13	Inductor, Variable, 1 UH	0647910004
L14	Inductor, 22 UH 5%	0650000005
L15	Inductor, 22 UH 5%	0650000005
L16	Inductor, 4.7 UH 5%	0651910005
L17	Inductor, Variable, 0.18 UH	0647890003
L18	Inductor, 0.68 UH 5%	0649030001
L19	Inductor, 4.7 UH 5%	0651910005
L20	Inductor, Variable, 0.18 UH	0647890003
L21	Inductor, Variable, 0.18 UH	0647890003
L22	Inductor, Variable, 5.6 UH	0647880008
L23	Inductor, Variable, 1 UH	0647910004
L24	Inductor, 22 UH 5%	0650000005
L25	Inductor, Variable, 0.18 UH	0647890003
L26	Inductor, 4.7 UH 5%	0651910004
L27	Inductor, 0.18 UH 10%	0651890004
L28	Inductor, 3.3 UH 5%	0658920006
L29	Inductor, 0.18 UH 10%	0651890004
L30	Inductor, 0.68 UH 5%	0649030001
L31	Inductor, 0.56 UH 5%	0649530004
L32	Inductor, 3.3 UH 5%	0658920006
L33	Inductor, 4.7 UH 5%	0651910005
L34	Inductor, 0.22 UH 5%	0650620003
L35	Inductor, 4.7 UH 5%	0651910004
L36	Inductor, Variable, 0.18 UH	0647890003
L37	Inductor, 2.7 UH 5%	0652180001
L38	Inductor, 4.7 UH 5%	0651910005
Q1	Transistor, 2 N4124	0448010002
Q2	Transistor, 2N4124	0448010002
Q3	Transistor, 2N4124	0448010002
Q4	Transistor, MPF-122	0448030004
Q5	Transistor, 2N5179	0445130008
Q6	Transistor, 2N5179	0445130008
Q7	Transistor, 2N5179	9445130008
Q8	Transistor, MPF-122	0448030003
Q9	Transistor, MPF-120	0448000008
Q10	Transistor, 2N5179	0445130008

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
Q11	Transistor, MPF-122	044800004
R1	Resistor, Carbon, 33 K 10%, 1/4 W	0177920009
R2	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R3	Resistor, Carbonn, 1 K 10%, 1/4 W	0171560001
R4	Resistor, Carbon, 150 ohm 10%, 1/4 W	0172730007
R5	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R6	Resistor, Carbon, 3.3 K 10%, 1/4 W	0178090007
R7	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004
R8	Resistor, Carbon, 150 ohm 10%, 1/4 W	0172730004
R9	Resistor, Carbon, 120 K 10%, 1/4 W	0175100004
R10	Resistor, Carbon, 47 K 10%, 1/4 W	0171060008
R11	Resistor, Carbon, 22 K 10%, 1/4 W	0172230004
R12	Resistor, Carbon, 220 K 10%, 1/4 W	0177780002
R13	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180002
R14	Resistor, Carbon, 22 K 10%, 1/4 W	0172230004
R15	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R16	Resistor, Carbon, 560 ohm 10%, 1/4 W	0181200004
R17	Resistor, Carbon, 470 ohm 10%, 1/4 W	0184110009
R18	Resistor, Carbon, 820 Ohm 10%, 1/4 W	0178210005
R19	Resistor, Carbon, 82 ohm 10%, 1/4 W	0184610001
R20	Resistor, Carbon, 220 K 10%, 1/4 W	0177780002
R21	Resistor, Carbon, 56 ohm 10%, 1/4 W	0174290004
R22	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R23	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620006
R24	Resistor, Carbon, 3.9 K 10%, 1/4 W	0178830003
R25	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R26	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R27	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R28	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R29	Resistor, Carbon, 1.2 K 10%, 1/4 W	0181860007
R30	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R31	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R32	Resistor, Carbon, 220 K 10%, 1/4 W	0177780002
R33	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R35	Resistor, Carbon, 12 K 10%, 1/4 W	0183180003
R36	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R37	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R38	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R39	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R40	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R41	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R42	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R43	Resistor, Carbon, 3.9 K 10%, 1/4 W	0178830003
R44	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620002
R45	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R46	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R47	Resistor, Carbon, 220 K 10%, 1/4 W	0177780002
R48	Resistor, Carbon, 22 K 10%, 1/4 W	0172230004
R49	Resistor, Carbon, 220 K 10%, 1/4 W	0177780002
R50	Resistor, Carbon, 47 K 10%, 1/4 W	0171060008
R51	Resistor, Carbon, 150 ohm 10% 1/4 W	0172730007
R52	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R53	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R54	Potentiometer, 1 Turn, 500 ohm, 1/2 W	0345980000
R55	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R56	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R57	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R58	Resistor, Carbon, 470 ohm 10%, 1/4 W	0184110009
R59	Resistor, Carbon, 220 ohm 10%. 1/4 W	0171320000
R60	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003
R61	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R62	Resistor, Carbon, 180 ohm 10% 1/4 W	0175220000
R63	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R64	Resistor, Carbon, 12 K 10%, 1/4 W	0183180003
R65	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R66	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R67	Resistor, Carbon, 3.3 K 10%, 1/4 W	0170890007
R68	Resistor, Carbon, 1.5 K 10%, 1/4 W	0127470005
R69	Resistor, Carbon, 1.8 K 10%. 1/4 W	0178190004
R70	Resistor, Carbon, 22 K 10%, 1/4 W	0172230004
R71	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004
R72	Resistor, Carbon, 22 ohm, 10%, 1/4 W	0192690001
R73	Resistor, Carbon, 22 ohm, 10%, 1/4 W	0192690001
R74	Resistor, Carbon, 100 ohm, 10%, 1/4 W	0171180003
R75	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R76	Resistor, Carbon, 100 ohm 10 %, 1/4 W	0171180003
T1	Transformer, Balun, 1:4	5024110300
T2	Transformer, Balun, 1:4	5024110300
T3	Transformer, Balun, 1:4	5024110300
U1	Integrated Circuit, Linear, CA5053	0448060001
U2	Integrated Circuit, Linear, CA3053	0448060001
U3	Integrated Circuit, Linear, CA3053	0448060001
Y1	Crystal, 21.0000, MHz	5024080300
Y2	Crystal, 80.7500 MHz	5024080400

TP1 Connector, RF, JCM 0753600005
TP2 Connector, RF, JCM 0753600005
TP3 Connector, RF, JCM 0753600005

R34 150, 10%, 1/4W 0172730007

Translator (1A4A3)



5024080076L

S5024-0800F

+12 V IN

J1 P1 1A4A3

1.5 - 1.5999 MHZ IN

BAL. MIXER

T1

(4) M8D102

19.45 MHZ B.P.F.

T2

VFO ON/OFF

21 MHZ REF IN

1ST L.O. IN

AMPL

V.F.O.

V.F.O. CONTROL IN

20 MHZ REF IN

V,T,S,R,M,N, L,E,C,18,17, 16,14,12,10, 2,3,4,5,13

AMPL

MIXER

81.25 MHZ B.P.F.

MIXER

BROADBAND AMPL

50 MHZ L.P.F.

OUTPUT LEVEL ADJ

P/O 1A4A3

10-39.9 MHZ OUT

600 mv

100 nsec

MEASUREMENTS TAKEN WITH ALL FREQUENCY DIALS SET AT "0"

LAST DESIGNATORS
R76
C101
L38
CR15

UNUSED DESIGNATORS
C25
C26
C27
C30
C100

100.75 MHZ B.P.F.

2ND L.O.

AMPL

MIXER

AMPL

80.7500 MHZ

2 ND L.O. OUT TO REC/EXC

800 mv

12.4 msec

1. UNLESS OTHERWISE SPECIFIED:
   ALL - DIODES ARE TYPE 1N4454
   -DECIMAL CAPACITORS IN µF. ALL OTHERS IN PF
   -INDUCTORS IN µH
   -RESISTORS IN OHMS
2. PREFIX ALL DESIGNATORS WITH "1A4A3"

KEY TO VOLTAGE MEASUREMENTS

1. Unless otherwise noted, all D.C. voltage measurements made with 20,000 ohm/volt V.O.M. and may vary ±15% from the indicated nominal readings.
2. Voltage readings followed by an asterisk (*) made with 11 megohm V.T.V.M.
3. ○ denotes readings present in all modes.
4. □ denotes readings present only in "VFO" mode.
5. ▽ denotes readings present when not in "VFO" mode.
6. ⌀ denotes readings which vary with setting of front panel VFO control. Readings shown are with control in the center of its range.

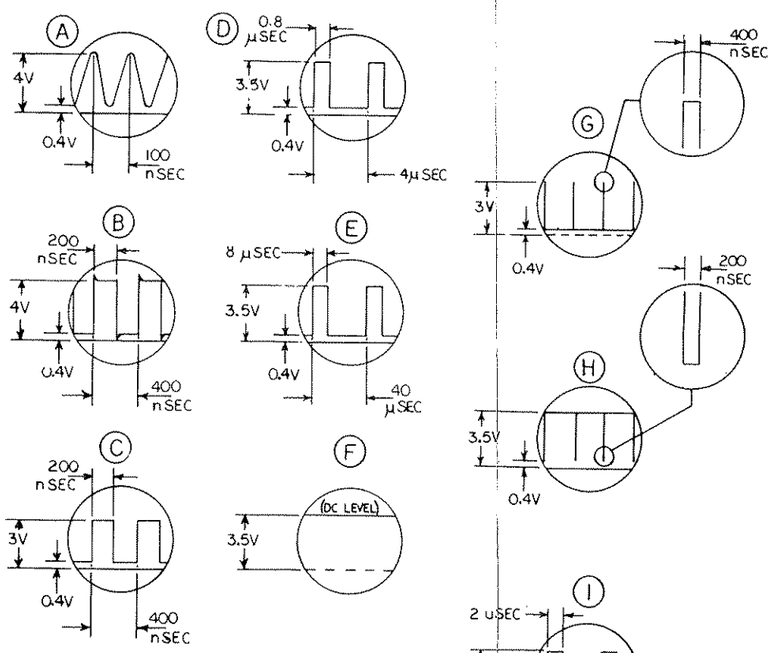
Figure 5.7 Translator (1A4A3) Schematic

PARTS LIST, 1A4A4 VHF DIVIDER 5024090098 G

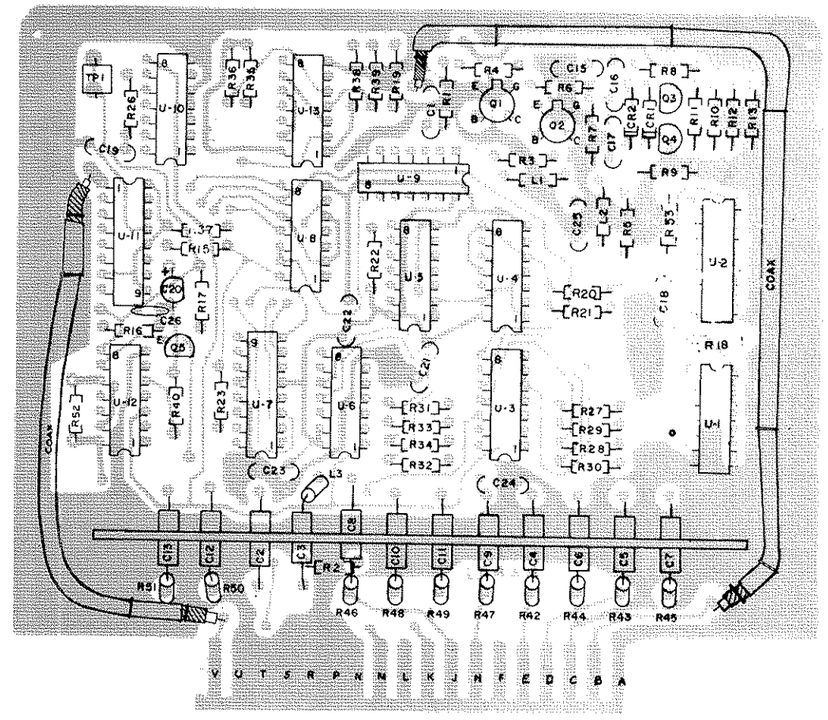
REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Disc Cer., .01 UF, 25 V	0286120008
C2	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C3	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C4	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C5	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C6	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C7	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C8	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C9	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C10	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C11	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C12	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C13	Capacitor, Feed Thru, 1500 PF, 500 V	0281760004
C14	Not used	
C15	Capacitor, Mica, 82 PF, 500 V	0262120003
C16	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C17	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C18	Capacitor, Disc Cer.,.0.01 UF, 25 V	0281620008
C19	Capacitor, Disc Cer.,0.01 UF, 25 V	0281620008
C20	Capacitor, Tantalum, 3.3 UF, 15 V	0281680001
C21	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C22	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C23	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C24	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C25	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C26	Capacitor, Mica, 100 PF, 500 V	0285450000
CR1	Diode, 1N4454	0405270003
CR2	Diode, 1N4454	0405270003
L1	Inductor, 22 UH 5%	0650000000
L2	Inductor, 22 UH 5%	0650000000
L3	Inductor, 15 UH 5%	0659070006
Q1	Transistor, 2N5179	0445130008
Q2	Transistor, 2N5179	0445130008
Q3	Transistor, 2N4124	0448010003
Q4	Transistor, 2N4126	0448020009
Q5	Transistor, 2N4124	0448010003
R1	Resistor, Carbon, 56 ohm 10%, 1/4 W	0174290004
R2	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R3	Resistor, Carbon, 820 ohm 10%, 1/4 W	0178210005
R4	Resistor, Carbon, 180 ohm 10%, 1/4 W	0175220000
R5	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R6	Resistor, Carbon, 320 ohm 10%, 1/4 W	0170910008
R7	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R8	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R9	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R10	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R11	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R12	Resistor, Carbon, 22 ohm 10%, 1/4 %	0192690001
R13	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R14	Not used	
R15	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R16	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R17	Resistor, Carbon, 4.7 K 5%, 1/4 W	0170770001
R18	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R19	Resistor, Carbon, 1K 10%, 1/4 W	0171560001
R20	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R21	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R22	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R23	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R24	Not used	
R25	Not used	
R26	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R27	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R28	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R29	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R30	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R31	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R32	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R33	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R34	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R35	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R36	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R37	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R38	Resistor, Carbon, 2.2 K 10 %, 1/4 W	0178070009
R39	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R40	Resistor, Carbon 1 K 10%, 1/4 W	0171560001
R42	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003
R43	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003
R44	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003
R45	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003
R46	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003
R47	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003
R48	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003
R49	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003

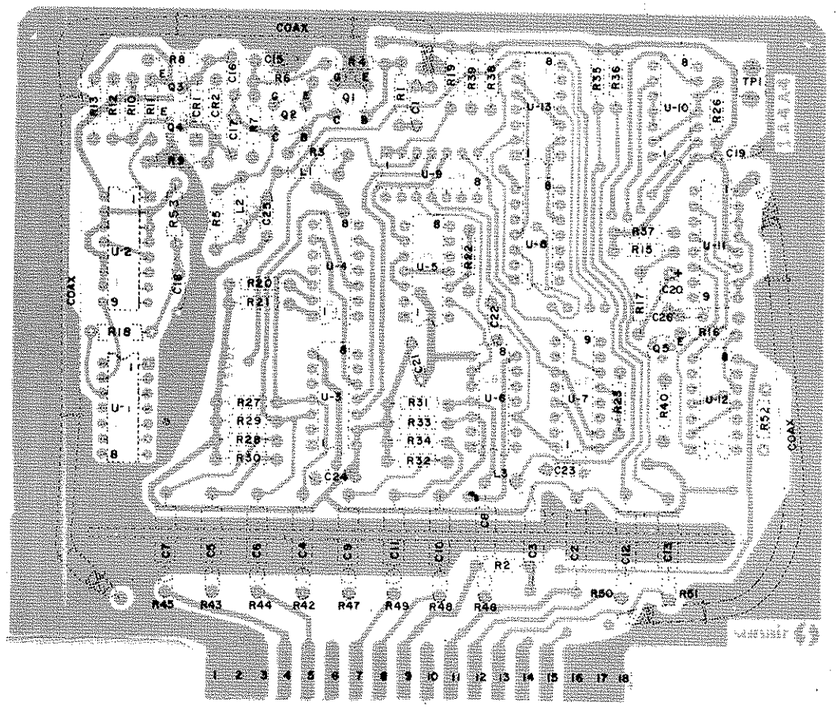
REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
R50	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960003
R51	Resistor, Carbon, 60 ohm 10%, 1/4 W	0187960003
R52	Resistor, Carbon, 22 M 10%, 1/4 W	0180590002
R53	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
U1	Integrated Circuit, Digital, SN7400N	0448070006
U2	Integrated Circuit, Digital, SN74S112N	0448450003
U3	Integrated Circuit, Digital, N8290A	0448250004
U4	Integrated Circuit, Digital, SN7401N	0448230003
U5	Integrated Circuit, Digital SN7400N	0448070006
U6	Integrated Circuit, Digital, N8290A	0448250004
U7	Integrated Circuit, Digital SN7476N	0448240009
U8	Integrated Circuit, Digital, 1SN7400N	0448070006
U9	Integrated Circuit, Digital, SN7430N	0448110008
U10	Integrated Circuit, Digital SN74H72N	0448090007
U11	Integrated Circuit, Digital, SN7476N	0448240009
U12	Integrated Circuit, Digital, MC4044P	0448100002
U13	Integrated Circuit, Digital, SN7400N	0448070006

IPI Testpoint, White 0753640007



V.H.F. Divider Waveforms (1A4A4)
Frequency Dials At 00000.0 kHz





~~5024-0900C~~ 5024090071E

+ 5V IN
+ 12V IN
10-39.9 MHZ IN
100 KHZ REF. IN
N,F,R,S,T,U,C,A 18,17,16,14,3,2,1
100 KHZ PRESET IN
1 MHZ PRESET IN
10 MHZ PRESET IN
P/O 5024-0903-01 ASSY
P/O 1A4A4
FINE STEERING OUT
P/O 1A4A4
100 KHZ REF.
25KHZ
BROADBAND AMPL
100KHZ CARRY GEN.
CARRY GATE
PRESET BUS
10 MHZ PRESET BUS
PRESET GEN
+ 5V

PREFIX ALL DESIGNATORS WITH "1A4A4" UNLESS OTHERWISE SPECIFIED
ALL - DIODES ARE TYPE 1N4454
- RESISTORS IN OHMS
- INDUCTORS IN μH
- DECIMAL CAPACITORS IN μF, ALL OTHERS IN pf

R27 THRU R36 ARE 2.2K
R42 THRU R51 ARE 68 Ω
C2 THRU C13 ARE 1500 pF

KEY TO VOLTAGE READINGS

(12) DESIGNATES - VOLTAGE PRESENT IN ALL MODES
(B) - REFERENCE WAVEFORM WITH ALL FREQUENCY DIALS SET AT "0"
[5] - VOLTAGE PRESENT WITH ALL 100 KHZ PRESET INPUTS IN "0" STATE (100 KHZ DIAL "0")
▽5 - VOLTAGE PRESENT IF ANY 100 KHZ PRESET INPUT IS IN A "1" STATE (100 KHZ DIAL ≠ 0)

ALL D.C. VOLTAGES MEASURED WITH 20,000 OHM/VOLT V.O.M. AND MAY VARY ±15%

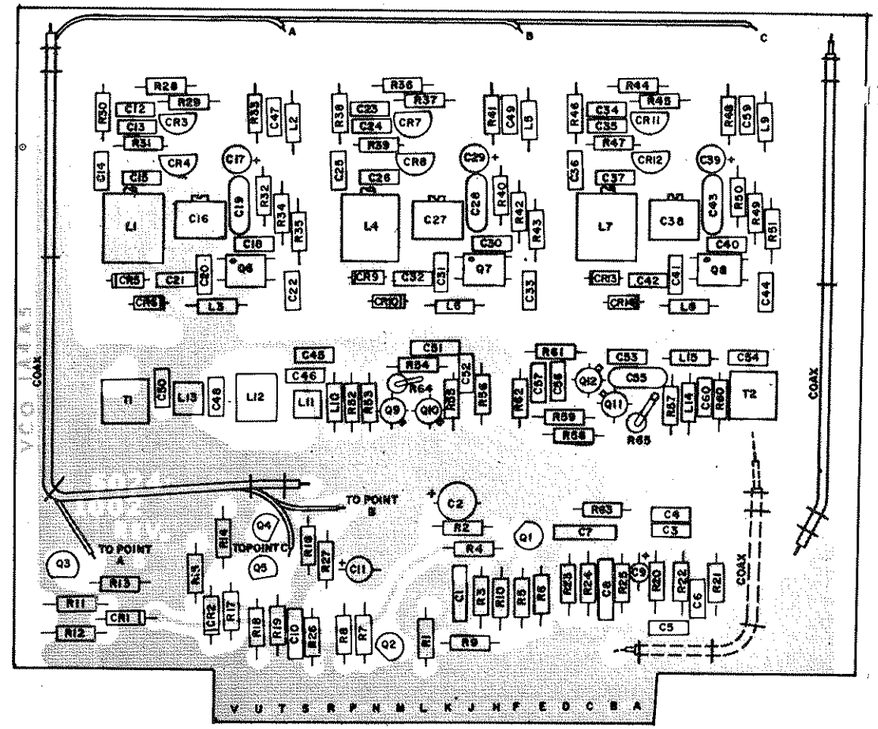
ALL WAVEFORMS MEASURED WITH 100MHZ OSCILLOSCOPE AND 9pF/1 MEGOHM PROBE

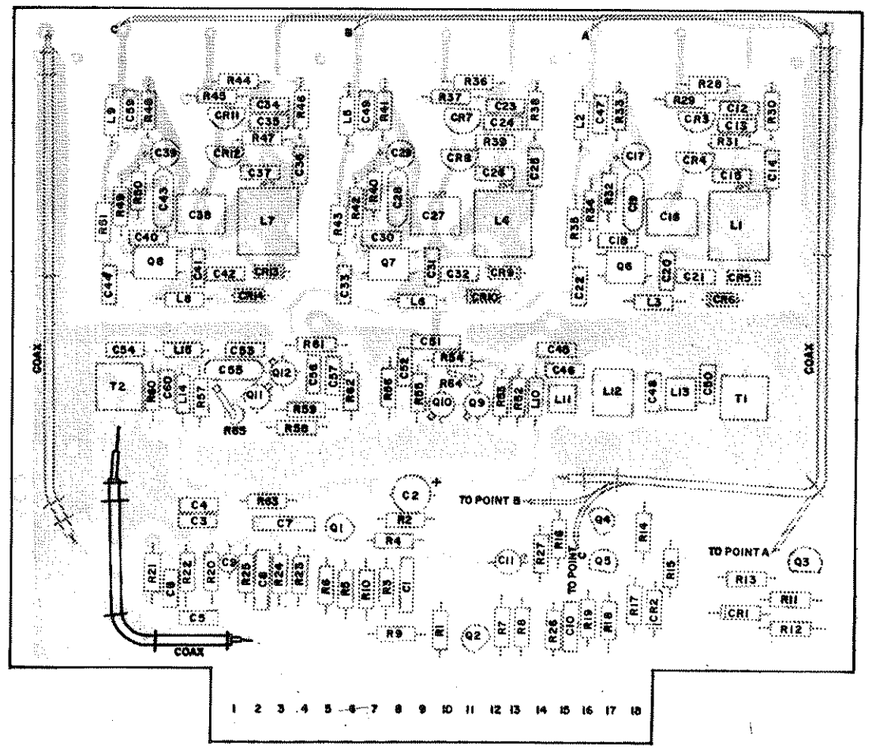
Figure 5.8 V.H.F. Divider (1A4A4) Schematic

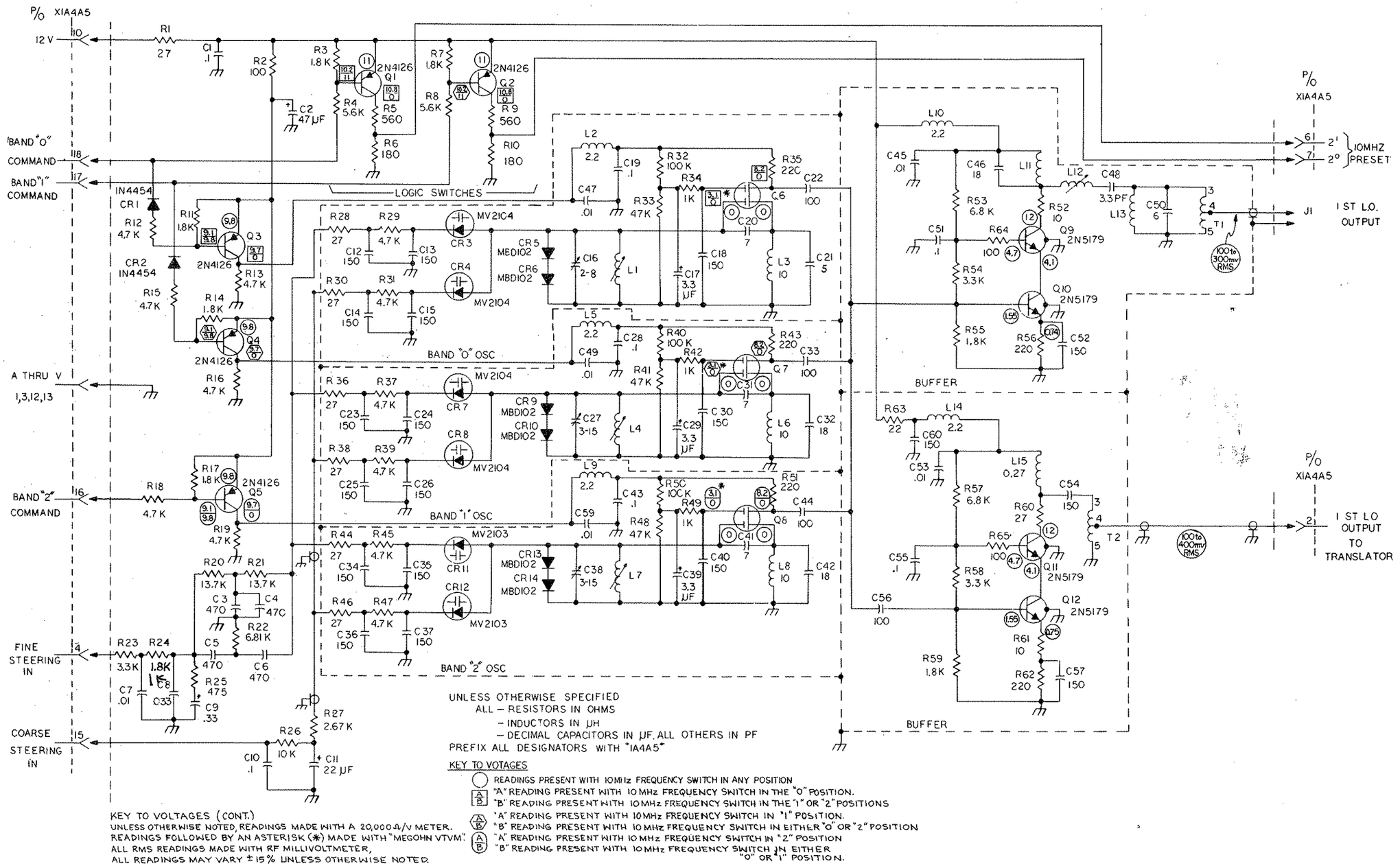
PARTS LIST, 1A4A5

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C2	Capacitor, Tantalum, 47 UF, 20 V	0281700001
C3	Capacitor, Mica, 470 PF, 5%, 100 V	0285570005
C4	Capacitor, Mica, 470 PF 5%, 100 V	0285570005
C5	Capacitor, Mica, 470 PF 5%, 100 V	0285570005
C6	Capacitor, Mica, 470 PF 5%, 100 V	0285570005
C7	Capacitor, Mylar, 0.01 UF, 5%, 50 V	0281560005
C8	Capacitor, Mylar, 0.033 UF, 50 V	0281770000
C9	Capacitor, Tantalum, 0.33 UF, 35 V	0281650004
C10	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C11	Capacitor, Tantalum, 22 UF, 15 V	0281690006
C12	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C13	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C14	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C15	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C16	Capacitor, Variable, 2-8 PF	0284300004
C17	Capacitor, Tantalum, 3.3 PF, 35 V	0281680001
C18	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C19	Capacitor, Monolithic, 0.1 PF, 50 V	0281610002
C20	Capacitor, Mica, 7 PF, .5 PF, 500 V	0288580001
C21	Capacitor, Mica, 5 PF 5%, 500 V	0261190008
C22	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C23	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C24	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C25	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C26	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C27	Capacitor, Variable, 3-15 PF	0285710001
C28	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C29	Capacitor, Tantalum, 3.3 UF, 35 V	0281680001
C30	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C31	Capacitor, Mica, 7 PF, .5 PF, 500 V	0288580001
C32	Capacitor, Mica, 18 PF 5%, 500 V	0286620006
C33	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C34	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C35	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C36	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C37	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C38	Capacitor, Variable, 3-15 PF	0285710001
C39	Capacitor, Tantalum, 3.3 UF, 35 V	0281680001
C40	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C41	Capacitor, Mica, 7 PF, 500 V	0288580001
C42	Capacitor, Mica, 18 PF 5%, 500 V	0286620006
C43	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C44	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C45	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C46	Capacitor, Mica, 18 PF 5%, 500 V	0286620006
C47	Capacitor, Disc Cer, 0.01 UF, 25 V	0281620008
C48	Capacitor, Disc Cer., 3.3 PF, 500 V	0262240009
C49	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C50	Capacitor, Disc Cer., 6 PF .5 PF	0250360004
C51	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C52	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C53	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C54	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C55	Capacitor, Monolithic, 0.1 PF, 50 V	0281610002
C56	Capacitor, Mica, 100 PF 5%, 500 V	0285450000
C57	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
C58	Not used	
C59	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C60	Capacitor, Mica, 150 PF 5%, 500 V	0280900007
CR1	Diode, 1N4454	0405270003
CR2	Diode, 1N4454	0405270003
CR3	Diode, MV2104	0405330006
CR4	Diode, MV2104	0405330006
CR5	Diode, MBD-102	0405280009
CR6	Diode, MBD-102	0405280009
CR7	Diode, MV2104	0405330006
CR8	Diode, MV2104	0405330006
CR9	Diode, MBD-102	0405280009
CR10	Diode, MBD-102	0405280009
CR11	Diode, MV2103	0505320004
CR12	Diode, MV2103	0505320004
CR13	Diode, MBD-102	0405280009
CR14	Diode, MBD-102	0405280009
L1	Inductor, Variable, Band "0"	5024100701
L2	Inductor, 2.2 UH 10%	0659710005
L3	Inductor, 10 UH 5%	0659570009
L4	Inductor, Variable, Band "1"	5024100808
L5	Inductor, 2.2 UH 10%	0657910005
L6	Inductor, 10 UH 5%	0659570009
L7	Inductor, Variable, Band "2"	5024100905
L8	Inductor, 10 UH 5%	0659570009
L9	Inductor, 2.2 UH 10%	0695710009
L10	Inductor, 2.2 UH 10%	0695710009
J1	Connector, RF, subminiature	0752670003

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
L11	Inductor, Air	5024101201
L12	Inductor, Variable	5024100603
L13	Inductor, Air	5024101308
L14	Inductor, 2.2 UH 10%	0659710005
L15	Inductor, 0.27 UH 5%	0649390008
Q1	Transistor, 2N4126	0448020009
Q2	Transistor, 2N4126	0448020009
Q3	Transistor, 2N4126	0448020009
Q4	Transistor, 2N4126	0448020009
Q5	Transistor, 2N4126	0448020009
Q6	Transistor, MPF-120	0448000008
Q7	Transistor, MPF-120	0448000008
Q8	Transistor, MPF-120	0448000008
Q9	Transistor, 2N5179	0445130008
Q10	Transistor, 2N5179	0445130008
Q11	Transistor, 2N5179	0445130008
Q12	Transistor, 2N5179	0445130008
R1	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R2	Resistor,Carbon, 100 ohm 10%, 1/4 W	0171180003
R3	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R4	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R5	Resistor, Carbon, 560 ohm 10%, 1/4 W	0181200004
R6	Resistor, Carbon, 180 ohm 10%, 1/4 W	0175220000
R7	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R8	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R9	Resistor, Carbon, 560 ohm, 1/4 W	0181200004
R10	Resistor, Carbon, 180 ohm 10%, 1/4 W	0175520000
R11	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R12	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R13	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R14	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R15	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R16	Resistor, Carbon, 4.7 K, 10%, 1/4 W	0170770001
R17	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R18	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R19	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R20	Resistor, Film, 13.7 K 1%, 1/8 W	0196230004
R21	Resistor, Film, 13.7 K 1%, 1/8 W	0196230004
R22	Resistor, Film, 6.81 K 1%, 1/8 W	0196350004
R23	Resistor, Carbon, 3.3 K 10%, 1/4 W	0170890007
R24	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R25	Resistor, Film, 475 ohm 1%, 1/8 W	0196610001
R26	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R27	Resistor, Film, 2670 ohm 1%, 1/8 W	0196730007
R28	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R29	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R30	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R31	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R32	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004
R33	Resistor, Carbon, 47 K 10%, 1/4 W	0171060008
R34	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R35	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R36	Resistor, Carbon, 27 ohm 10% 1/4 W	0172590001
R37	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R38	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R39	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R40	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004
R41	Resistor, Carbon, 47 K 10%, 1/4 W	0171060008
R42	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R43	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R44	Resistor, Carbon, 27 ohm, 10%, 1/4 W	0172590001
R45	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R46	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R47	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R48	Resistor, Carbon, 47 K 10%, 1/4 W	0171060008
R49	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R50	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004
R51	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R52	Resistor, Carbon, 10 ohm 10%, 1/4 W	0177160004
R53	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R54	Resistor, Carbon, 3.3 K 10%, 1/4 W	0170890007
R55	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R56	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R57	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R58	Resistor, Carbon, 3.3 K 10%, 1/4 W	0170890007
R59	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R60	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R61	Resistor, Carbon, 10 ohm 10%, 1/4 W	0177160004
R62	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R63	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R64	Resistor, Carbon, 100 ohm, 10%,1/4 W	0171180003
R65	Resistor, Carbon, 100 ohm, 10%,1/4 W	0171180003
T1	Transformer, Balum, 1:4	5024111401
T2	Transformer, Balum, 1:9	5024101103







UNLESS OTHERWISE SPECIFIED
ALL – RESISTORS IN OHMS
– INDUCTORS IN μH
– DECIMAL CAPACITORS IN μF. ALL OTHERS IN PF
PREFIX ALL DESIGNATORS WITH "1A4A5"

KEY TO VOTAGES

- READINGS PRESENT WITH 10MHz FREQUENCY SWITCH IN ANY POSITION
- A/B: "A" READING PRESENT WITH 10 MHz FREQUENCY SWITCH IN THE "0" POSITION. "B" READING PRESENT WITH 10MHz FREQUENCY SWITCH IN THE "1" OR "2" POSITIONS
- A/B: "A" READING PRESENT WITH 10MHz FREQUENCY SWITCH IN "1" POSITION. "B" READING PRESENT WITH 10 MHz FREQUENCY SWITCH IN EITHER "0" OR "2" POSITION
- A/B: "A" READING PRESENT WITH 10 MHz FREQUENCY SWITCH IN "2" POSITION "B" READING PRESENT WITH 10MHz FREQUENCY SWITCH IN EITHER "0" OR "1" POSITION.

KEY TO VOLTAGES (CONT.)
UNLESS OTHERWISE NOTED, READINGS MADE WITH A 20,000Ω/V METER.
READINGS FOLLOWED BY AN ASTERISK (*) MADE WITH "MEGOHN VTVM."
ALL RMS READINGS MADE WITH RF MILLIVOLTMETER,
ALL READINGS MAY VARY ±15% UNLESS OTHERWISE NOTED.

Figure 5.9 VCO (1A4A5) Schematic

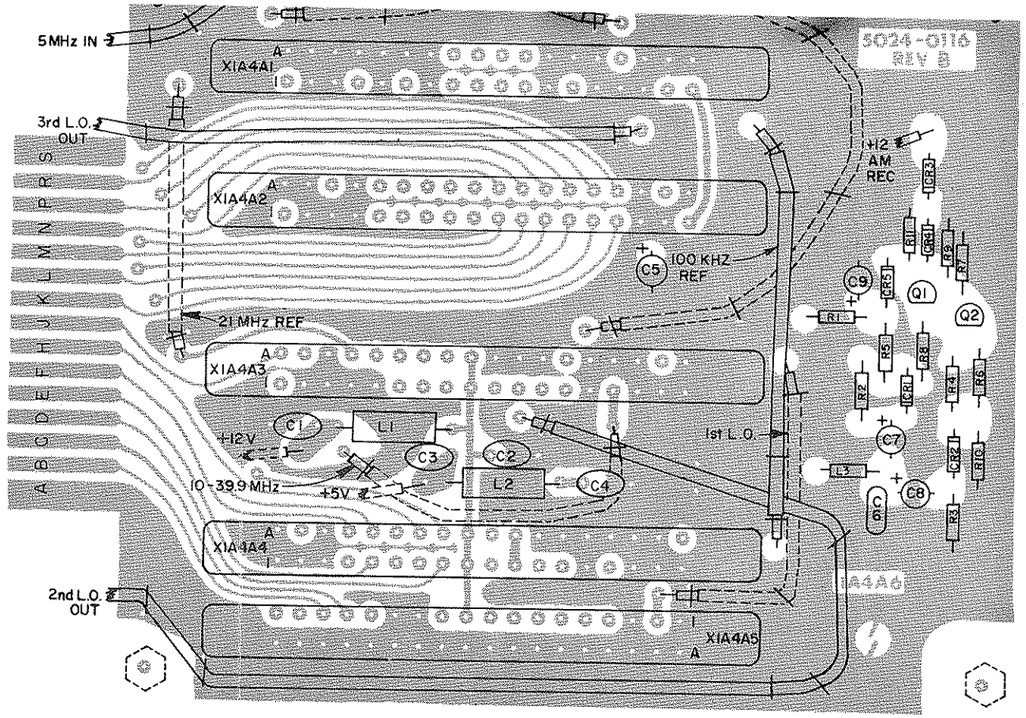
5024011597 B

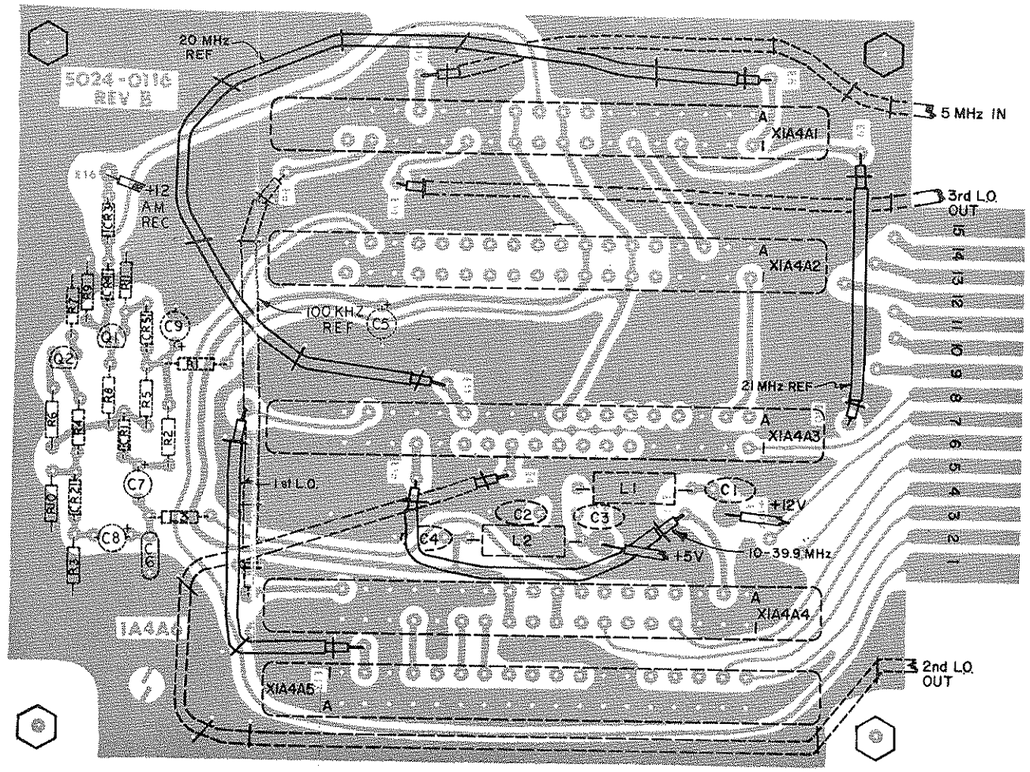
PARTS LIST, 1A4A6 Synthesizer Mother Board

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C2	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C3	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C4	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C5	Capacitor, Tantalum, 22 UF, 15 V	0281690006
C6	Capacitor, Disc Cer., 0.01 UF, 25 V	0281620008
C7	Capacitor, Tantalum, 22 UF, 15 V	0281690006
C8	Capacitor, Tantalum, 15 UF, 15 V	0281720002
C9	Capacitor, Tantalum, 47 UF, 20 V	0281700001
CR1	Diode, Signal, 1N4454	0405270003
CR2	Diode, Signal, 1N4454	0405270003
CR3	Diode, Signal, 1N4454	0405270003
CR4	Diode, Signal, 1N4454	0405270003
CR5	Diode, Signal, 1N4454	0405270003
L1	Inductor, 6.8 UH 10%	0652200001
L2	Inductor, 6.8 UH 10%	0652200001
L3	Inductor, 47 UH 5%	0652680003
Q1	Transistor, 2N4126	0448020009
Q2	Transistor, 2N4124	0448010003
R1	Resistor, Carbon, 180 ohm 10%, 1/4 W	0175220000
R2	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R3	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R4	Resistor, Carbon, 33 K 10%, 1/4 W	0177920009
R5	Resistor, Carbon, 22 K 10%, 1/4 W	0172230004
R6	Resistor, Carbon, 47 K 10%, 1/4 W	0171060008
R7	Resistor, Carbon, 330 ohm 10%, 1/4 W	0170910008
R8	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R9	Resistor, Carbon, 3.3 K 10%, 1/4 W	0170890007
R10	Resistor, Carbon, 22 K 10%, 1/4 W	0172230004
R11	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
X1 A4 A1	Connector, P.C. Edge, 18 pin	0753610001
X1 A4 A2	Connector, P.C. Edge, 18 pin	0753610001
X1 A4 A3	Connector, P.C. Edge, 18 pin	0753610001
X1 A4 A4	Connector, P. C. Edge, 18 pin	0753610001
X1 A4 A5	Connector, P.C. Edge, 18 pin	0753610001
LA4 J1	Connector, RF, Bulkhead, Male	0753630001
E1	Not used	
E2	Not used	
E3	Feed Thru, Coax	0753690004
E4	Not used	
E5	Feed Thru, Coax	0753690004

VCO FILTER ASSEMBLY, 1A47A

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Variable, Glass, 0.3 to 5 PF	0276390001
C2	Capacitor, Mica, 3 P F, 1/2 P F	0288560001
J1	Connector, R F, Bulkhead	0753670003
L1	Inductor, 0.68 UU, 5%	0651770009
P1	Connector, RF, Cable, Rt. Angle	0753700000
	Cable, Coax, RG178 B/U	0596090005





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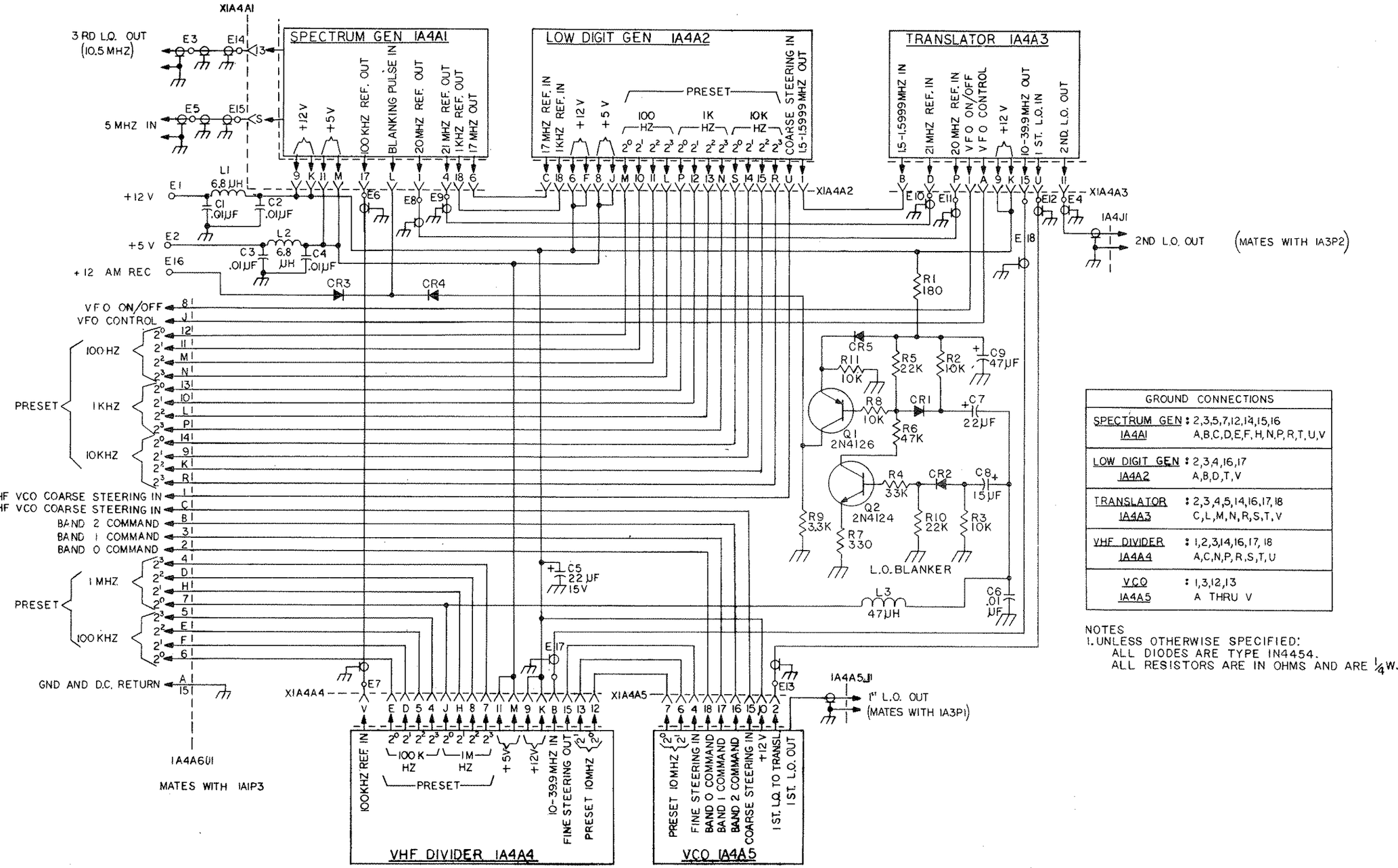


GROUND CONNECTIONS	
SPECTRUM GEN IA4AI	: 2,3,5,7,12,14,15,16 A,B,C,D,E,F,H,N,P,R,T,U,V
LOW DIGIT GEN IA4A2	: 2,3,4,16,17 A,B,D,T,V
TRANSLATOR IA4A3	: 2,3,4,5,14,16,17,18 C,L,M,N,R,S,T,V
VHF DIVIDER IA4A4	: 1,2,3,14,16,17,18 A,C,N,P,R,S,T,U
VCO IA4A5	: 1,3,12,13 A THRU V

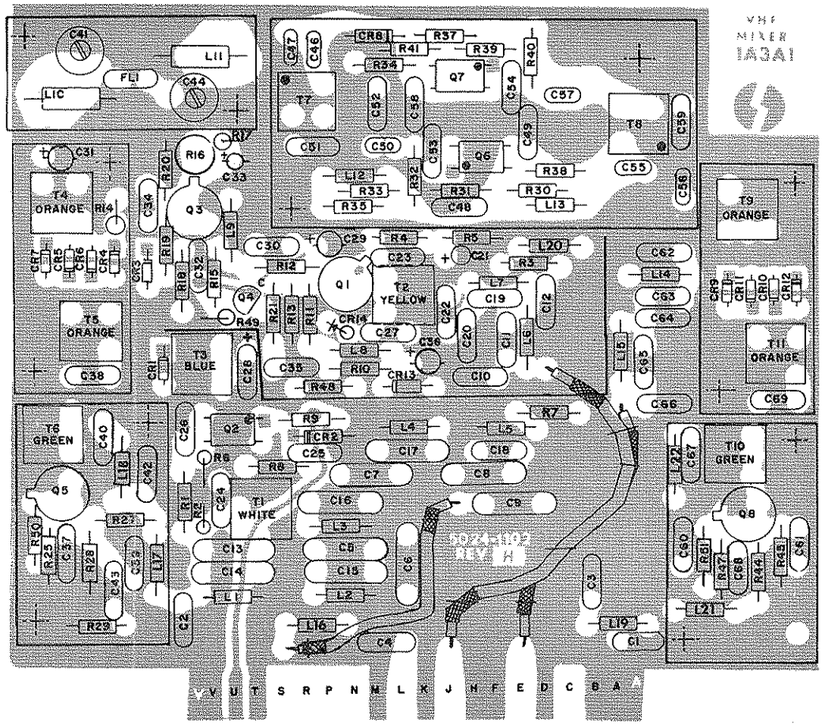
NOTES
1. UNLESS OTHERWISE SPECIFIED:
   ALL DIODES ARE TYPE IN4454.
   ALL RESISTORS ARE IN OHMS AND ARE ¼W.

Figure 5.10 Synthesizer Mother Board (1A4A6) Schematic

PARTS LIST, 1A3A1 VHF MIXER 5024110099M

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C2	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C3	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C4	Capacitor, Disc Cer., .91 UF, 25 V	0281620008
C5	Capacitor, Mica, 2000 PF, 2%, 400 V	0281410003
C6	Capacitor, Mica, 3300 PF 2%, 500 V	0281250006
C7	Capacitor, Mica, 2700 PF 2%, 500 V	0281240001
C8	Capacitor, Mica, 1500 PF 2%, 500 V	0281270007
C9	Capacitor, Mica, 1800 PF 2%, 500 V	0281300003
C10	Capacitor, Mica, 75 PF 2%, 500 V	0281110000
C11	Capacitor, Mica, 56 PF 5%, 500 V	0274620006
C12	Capacitor, Mica, 150 PF 5%, 500 V	0274980002
C13	Capacitor, Mica, 2400 PF 5%, 500 V	0280980001
C14	Capacitor, Mica, 3300 PF 2%, 500 V	0281250006
C15	Capacitor, Mica, 1200 PF 2%, 500 V	0281030006
C16	Capacitor, Mica, 910 PF 2%, 500 V	0281450005
C17	Capacitor, Mica, 2000 PF 2%, 500 V	0281410003
C18	Capacitor, Mylar, .12 UF 5%, 50 V	0181780005
C19	Capacitor, Mica, 20 PF 5%, 500 V	0260420000
C20	Capacitor, Mica, 100 PF 5%, 500 V	0274740001
C21	Capacitor, Tantalum, 1 UF, 50 V	0280910002
C22	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C23	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C24	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C25	Capacitor, Monolithic, 0.1 MF, 50 V	0281610002
C26	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C27	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C28	Capacitor, Tantalum, 47 UF, 20 V	0281700001
C29	Capacitor, Tantalum, 47 UF, 20 V	0281700001
C30	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C31	Capacitor, Tantalum, 0.33 UF, 35 V	0281650004
C32	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C33	Capacitor, Tantalum, 1 MF, 35 V	0281660000
C34	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C35	Capacitor, Monolithic, .001 UF, 50 V	0281630003
C36	Capacitor, Tantalum, 1 UF, 50 V	0280910002
C37	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C38	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C39	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C40	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C41	Capacitor, Variable Cer., 2-8 PF	0284300004
C42	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C43	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C44	Capacitor, Variable, Cer., 2-8 PF	0284300004
C45	Not used	
C46	Capacitor, Mica, 7 PF 5%, 300 V	0288580001
C47	Capacitor, Mica, 47 PF 5%, 300 V	0286980002
C48	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C49	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C50	Capacitor, Mica, 33 PF 5%, 500 V	0286860007
C51	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C52	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C53	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C54	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C55	Capacitor, Mica, 7 PF 5%, 300 V	0288580001
C56	Capacitor, Mica, 47 PF 5%, 300 V	0286980002
C57	Capacitor, Mica, 33 PF 5%, 500 V	0286860007
C58	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C59	Capacitor, Monolithic, 0.1 UF, 50 V	0281610002
C60	Capacitor, Mica, 220 PF, 5%, 500 V	0285950002
C61	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C62	Capacitor, Mica, 250 PF 2%, 500 V	0281100004
C63	Capacitor, Mica, 43 PF 5%, 500 V	0286800007
C64	Capacitor, Mica, 430 PF 5%, 500 V	0289590001
C65	Capacitor, Mica, 130 PF 2%, 500 V	0281010005
C66	Capacitor, Mica, 200 PF 5%, 500 V	0258040009
C67	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C68	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C69	Capacitor, Mica, 220 PF 5%, 500 V	0285850002
CR1	Diode, 1N4454	0405270003
CR2	Diode, 1N5229B, 3.6 V, 5%	0405250002
CR3	Diode, 1N4454	0405270003
CR4	Diode, MBD-102	0405280009
CR5	Diode, MBD-102	0405280009
CR6	Diode, MBD-102	0405280009
CR7	Diode, MBD-102	0405280009
CR8	Diode, 1N5227B, 3.6 V, 5%	0405250002
CR9	Diode, MBD-102	0405280009
CR10	Diode, MBD-102	0405280009
CR11	Diode, MBD-102	0405280009
CR12	Diode, MBD-102	0405280009
CR13	Diode, MBD-102	0405280009
CR14	Diode, 1N4454	0405270003
FL1	Filter, Crystal, 91, 35 MHz	5024110501
L1	Inductor, 6.8 UH, 5%	0659210002
L2	Inductor, 12 UH 5%	0652700004
L3	Inductor, 15 UH 5%	0659070006
L4	Inductor, 8.2 UH 5%	0652060005
L5	Inductor, 4.7 UH 5%	0651910005

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
L6	Inductor, 0.22 UH 5%	0650620003
L7	Inductor, 0.27 UH 5%	0649390008
L8	Inductor, 4.7 UH 5%	0651910005
L9	Inductor, 1.8 UH 5%	0652440002
L10	Inductor, 0.68 UH 5%	0651770009
L11	Inductor, 0.68 UH 5%	0651770009
L12	Inductor, 2.2 UH 5%	0649890001
L13	Inductor, 2.2 UH 5%	0649890001
L14	Inductor, 0.82 UH 5%	0652320007
L15	Inductor, 0.56 UH 5%	0649530004
L16	Inductor, 3.9 UH 5%	0650480007
L17	Inductor, 3.9 UH 5%	0650480007
L18	Inductor, 3.9 UH 5%	0650480007
L19	Inductor, 3.9 UH 5%	0650480007
L20	Inductor, 3.9 UH 5%	0650480007
L21	Inductor, 3.9 UH 5%	0650480007
L22	Inductor, 3.9 UH 5%	0650480007
L23	Inductor, 47 UH 10%	0652680003
Q1	Transistor, 2N3866	0448140004
Q2	Transistor, MPF120	0448000008
Q3	Transistor, 2N5179	0445130008
Q4	Transistor, 2N4124	0448010003
Q5	Transistor, 2N5179	0445130008
Q6	Transistor, MPF120	0448000008
Q7	Transistor, MpF120	0448000008
Q8	Transistor, 2N5179	0445130008
R1	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R2	Resistor, Carbon, 1.5 K 10%, 1/4 W	0172470005
R3	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R4	Resistor, Carbon, 10 ohm, 10%, 1/4 W	0177160004
R5	Resistor, Carbon, 120 ohm 10%, 1/4 W	0186550006
R6	Resistor, Carbon 10 K 10%, 1/4 W	0170410005
R7	Resistor, Carbon, 47 ohm 10%, 1/4 W	0179360001
R8	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004
R9	Resistor, Carbon, 820 ohm 10%, 1/4 W	0178210005
R10	Resistor, Carbon, 820 ohm 10%, 1/4 W	0278210005
R11	Resistor, Carbon, 1.5 K 10%, 1/4 W	0172470005
R12	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R13	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R14	Resistor, Carbon, 560 ohm 10%, 1/4 W	0183200004
R15	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R16	Potentiometer, 100 ohm	0346350000
R17	Resistor, Carbon, 560 ohm 10%, 1/4 W	0183200004
R18	Resistor, Carbon, 1.2 K 10%, 1/4 W	0181860007
R19	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R20	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R21	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R22	Not used	
R23	Not used	
R24	Not used	
R25	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R26	Not used	
R27	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R28	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R29	Resistor, Carbon, 56 ohm 10%, 1/4 W	0174290004
R30	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R31	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R32	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004
R33	Resistor, Carbon, 10 ohm 10%. 1/4 W	0177160004
R34	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R35	Resistor, Carbon, 820 ohm 10%, 1/4 W	0178210005
R36	Not used	
R37	Resistor, Carbon, 10 ohm, 10%, 1/4 W	0177160004
R38	Resistor, Carbon, 27 ohm 10%, 1/4 W	0175290001
R39	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R40	Resistor, Carbon, 100 K 10%, 1/4 W	0170390004
R41	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R42	Not used	
R43	Not used	
R43	Not used	
R44	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R45	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R46	Not used	
R47	Resistor, Carbon, 100 ohm, 10%, 1/4 W	0171180003
R48	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R49	Resistor, Carbon, 68 ohm 10%, 1/4 W	0187960005
R50	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R51	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
T1	Transformer, Input	5024110706
T2	Transformer, Balun 4:1	5024111401
T3	Transformer, RF Amp	5024110803
T4	Transformer, Mixer	5024110307
T5	Transformer, Mixer	5024110307
T6	Transformer, Balun 9:1	5024110901
T7	Transformer, Variable	5024110404
T8	Transformer, Variable	5024110404
T9	Transformer, Mixer	5024110307
T10	Transformer, Balun 9:1	5024110901
T11	Transformer, Mixer	5024110307



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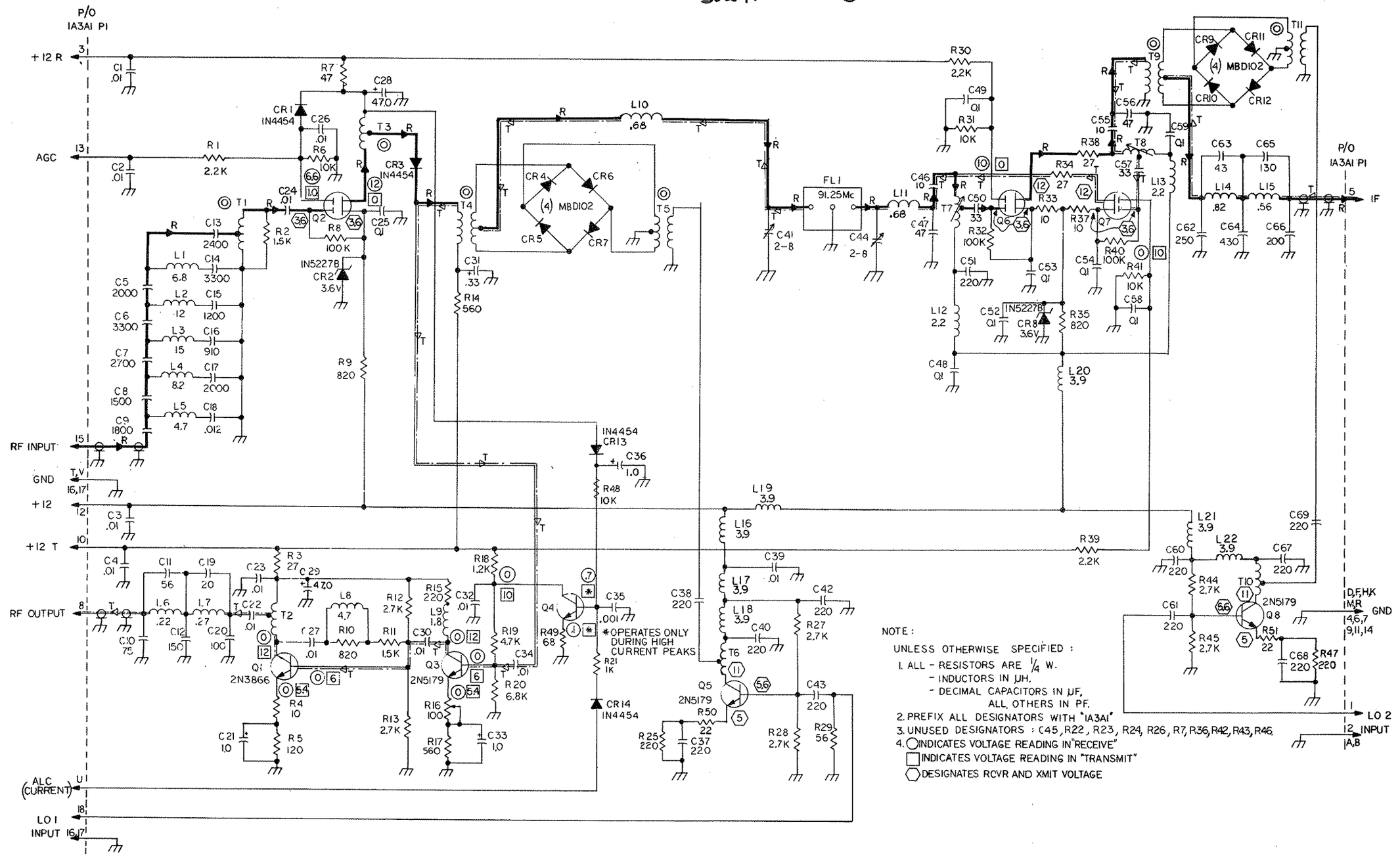
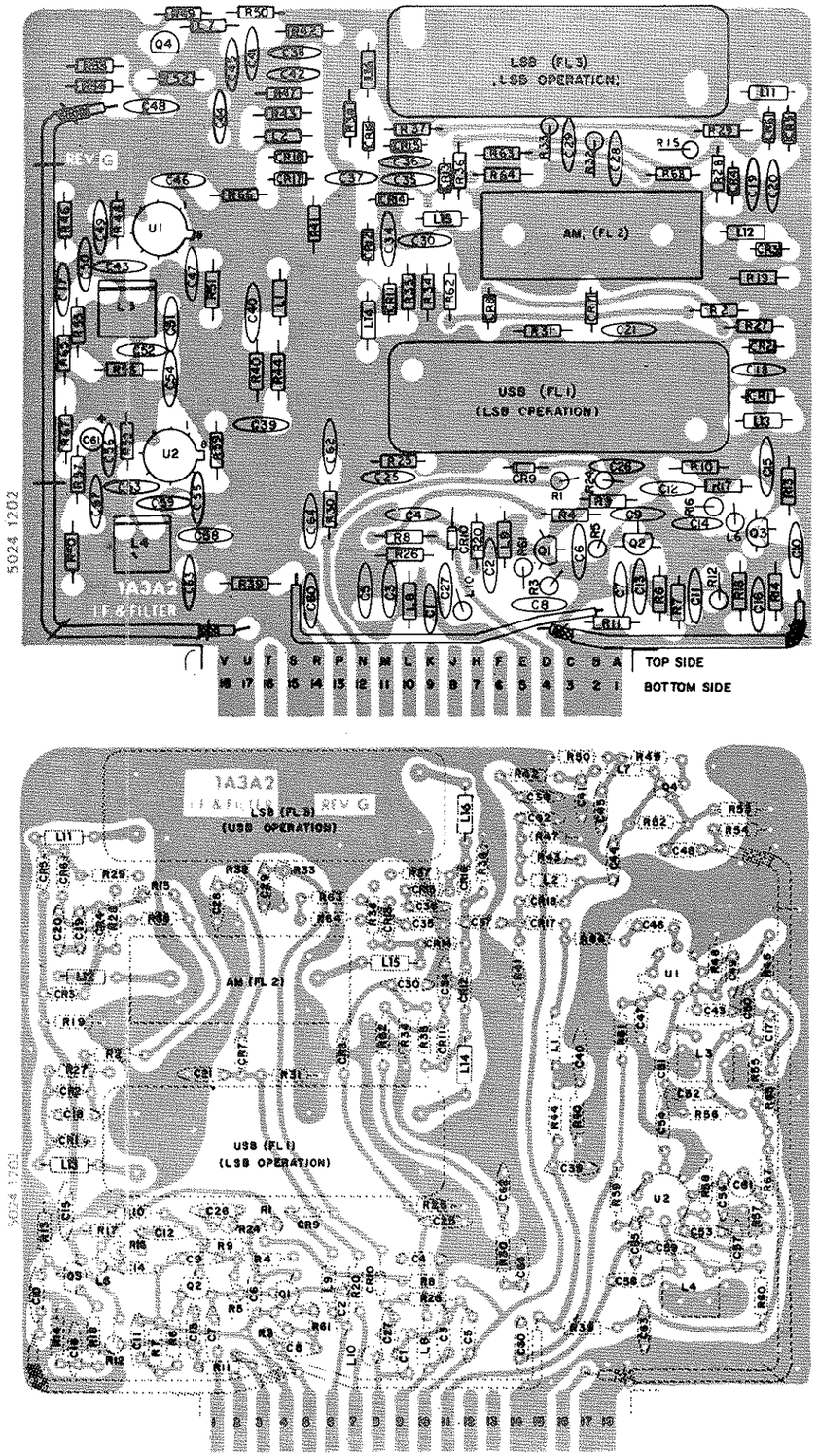


Figure 5.11 VHF Mixer (1A3A1) Schematic

PARTS LIST, 1A3A2

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C2	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C3	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C4	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C5	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C6	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C7	Capacitor, Mica, 10 PF 5%, 300 V	0259830003
C8	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C9	Capacitor, Tantalum, 68 UF, 15 V	0296540005
C10	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C11	Capacitor, Disc Cer., .01 UF, 25V	0281620008
C12	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C13	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C14	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C15	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C16	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C17	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C18	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C19	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C20	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C21	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C22	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C23	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C24	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C25	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C26	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C27	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C28	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C29	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C30	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C31	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C32	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C33	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C34	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C35	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C37	Capacitor, Disc Cer., 0.1 UF, 50 V	0281610002
C38	Capacitor, Disc Cer., 0.1 UF, 50 V	0281610002
C39	Capacitor, Disc Cer., 0.1 UF, 50 V	0281610002
C40	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C41	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C42	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C43	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C44	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C45	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C46	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C47	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C48	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C49	Capacitor, Disc Cer., 0.1 UF, 50 V	0281610002
C50	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C51	Capacitor, Mica, 82 PF 5%, 500 V	0262120003
C52	Capacitor, Mica, 360 PF 5%, 500 V	0275150003
C53	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C54	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C55	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C56	Capacitor, Disc Cer., 0.1 UF, 25 V	0281610002
C57	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C58	Capacitor, Mica, 82 PF 5%, 500 V	0262120003
C59	Capacitor, Mica, 360 PF 5%, 500 V	0275150003
C60	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C61	Capacitor, Tantalum, 68 UF, 15 V	
C62	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C63	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C64	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C65	Capacitor, Disc Cer., 68 UF, 15 V	0296540005
CR1	Diode, 1N4454	0405270003
CR2	Diode, 1N4454	0405270003
CR3	Diode, 1N4454	0405270003
CR4	Diode, 1N4454	0405270003
CR5	Diode, 1N4454	0405270003
CR6	Diode, 1N4454	0405270003
CR6	Diode, 1N4454	0405270003
CR7	Diode, 1N4454	0405270003
CR8	Diode, 1N4454	0405270003
CR9	Diode, 1N4454	0405270003
CR10	Diode, 1N4454	0405270003
CR11	Diode, 1N4454	0405270003
CR12	Diode, 1N4454	0405270003
CR13	Diode, 1N4454	0405270003
CR14	Diode, 1N4454	0405270003
CR15	Diode, 1N4454	0405270003
CR16	Diode, 1N4454	0405270003
CR17	Diode, 1N4454	0405270003
CR18	Diode, 1N4454	0405270003
FL1	Filter, LSB Operation	0818250003
FL2	Filter, AM	0818270004
FL3	Filter, USB Operation	0818260009
L1	Inductor, 150 UH, 10%	0659190001
L2	Inductor, 150 UH 10%	0659190001

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
L3	Inductor, Variable, 3.3 UH	0647930005
L4	Inductor, Variable, 3.3 UH	0647930005
L5	Not used	
L6	Inductor, 150 UH 10%	0659190001
L7	Inductor, 150 UH 10%	0659190001
L8	Inductor, 22 UH, 10%	0650000005
L9	Inductor, 22 UH, 10%	0650000005
L10	Inductor, 22 UH, 10%	0650000005
L11	Choke, 1.5 UH 5%	0649270002
L12	Choke, 1.5 UH 5%	0649270002
L13	Choke, 1.5 UH 5%	0649270002
L14	Choke, 1.5 UH 5%	0649270002
L15	Choke, 1.5 UH 5%	0649270002
L16	Choke, 1.5 UH 5%	0649270002
Q1	Transistor, 2N4124	0448010003
Q2	Transistor, 2N4124	0448010003
Q3	Transistor, 2N4124	0448010003
Q4	Transistor, 2N4124	0448010003
R1	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R2	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R3	Resistor, Carbon, 470 ohm 10%, 1/4 W	0184110009
R4	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R5	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R6	Resistor, Carbon, 18 ohm 10%, 1/4 W	0184590001
R7	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R8	Resistor, Carbon, 1.5 K 10%, 1/4 W	0174270005
R9	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620006
R10	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R11	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R12	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620006
R13	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R14	Resistor, Carbon, 820 ohm 10%, 1/4 W	0178210005
R15	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R16	Resistor, Carbon, 330 ohm, 10%, 1/4 W	0170910008
R17	Resistor, Carbon, 330 ohm 10%, 1/4 W	0170910008
R18	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R19	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R20	Resistor, Carbon, 56 ohm 10%, 1/4 W	0172490004
R21	Not used	
R22	Not used	
R23	Not used	
R24	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R25	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R26	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R27	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R28	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R29	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R30	Resistor, Carbon, 1.5 K 10%, 1/4 W	0172470005
R31	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R32	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R33	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R34	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R35	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R36	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R37	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R38	Resistor, Carbon, 1 K 10 ½, 1/4 W	0171560001
R39	Resistor, Carbon, 10 ohm 10%, 1/4 W	0177160004
R40	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R41	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R42	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R43	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R44	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R45	Not used	
R46	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R47	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R48	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R49	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R50	Resistor, Carbon, 560 ohm 10%, 1/4 W	0181200004
R51	Resistor, Carbon, 100 ohm 10 ½, 1/4 W	0171180003
R52	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R53	Resistor, Carbon, 3.9 K 10%, 1/4 W	0178830003
R54	Resistor, Carbon, 56 ohm 10%, 1/4 W	0174290004
R55	Resistor, Carbon, 100 ohm 10% 1/4 W	0171180003
R56	Resistor, Carbon, 56 ohm 10%, 1/4 W	0172490004
R57	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R58	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R59	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R60	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R61	Resistor, Carbon, 10 ohm 10%, 1/4 W	0177160004
R62	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R63	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R64	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R65	Resistor, Carbon, 150 ohm 10%, 1/4 W	0172730007
R66	Resistor, Carbon, 470 ohm 10%, 1/4 W	0184110009
R67	Resistor, Carbon, 150 ohm 10%, 1/4 W	0172730007
R68	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
U1	Integrated Circuit, Linear CA3053	0448060001
U2	Integrated Circuit, Linear CA3053	0448060001



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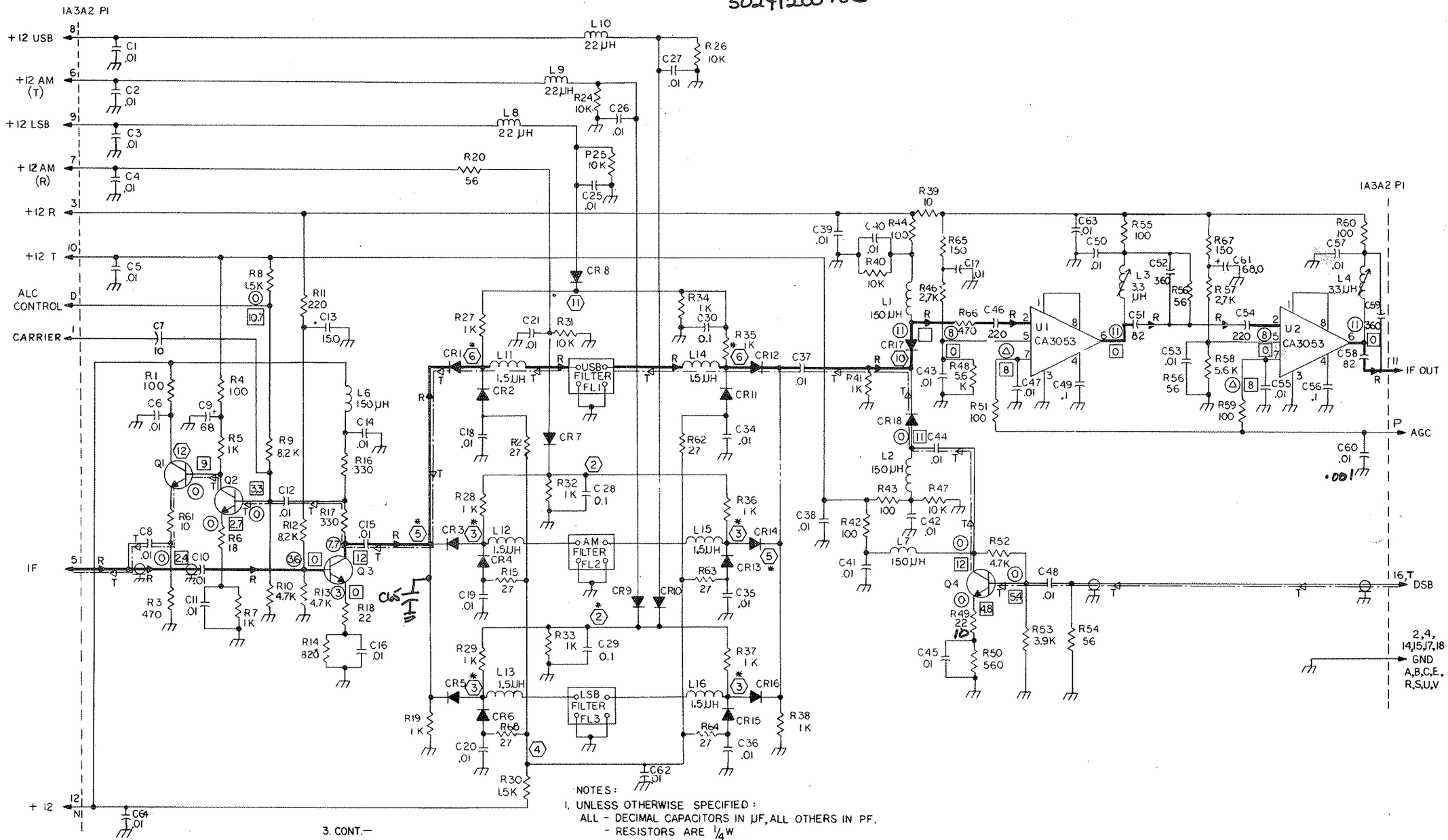


NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL - DECIMAL CAPACITORS IN µF, ALL OTHERS IN PF.
   - RESISTORS ARE 1/4 W
   - DIODES ARE IN4454
   - TRANSISTORS ARE 2N4124
2. PREFIX ALL DESIGNATORS WITH "1A3A2"
3. * VOLTAGES SHOWN WITH LSB MODE SELECTED
   ◯ DESIGNATES VOLTAGE READING IN "RECEIVE"

3. CONT.—
   □ DESIGNATES VOLTAGE READING IN "TRANSMIT"
   ⬡ DESIGNATES NON-SWITCHED VOLTAGE
   △ VOLTAGE DEPENDS ON RECEIVED SIGNAL LEVEL: 8V NO SIGNAL, 2V MAX SIGNAL

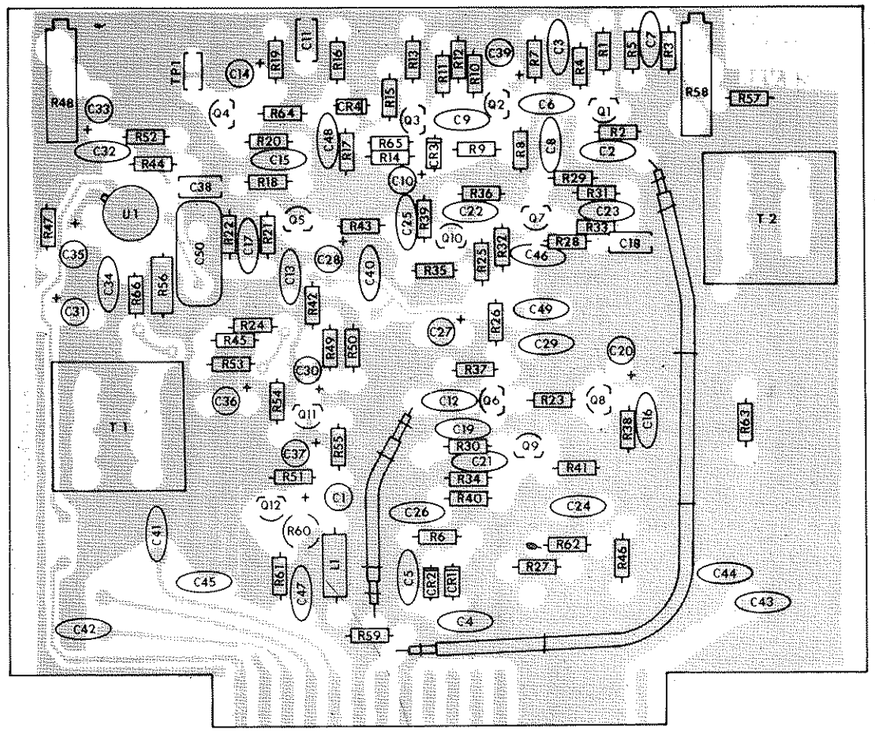
Figure 5-12 IF/Filter (1A3A2) Schematic

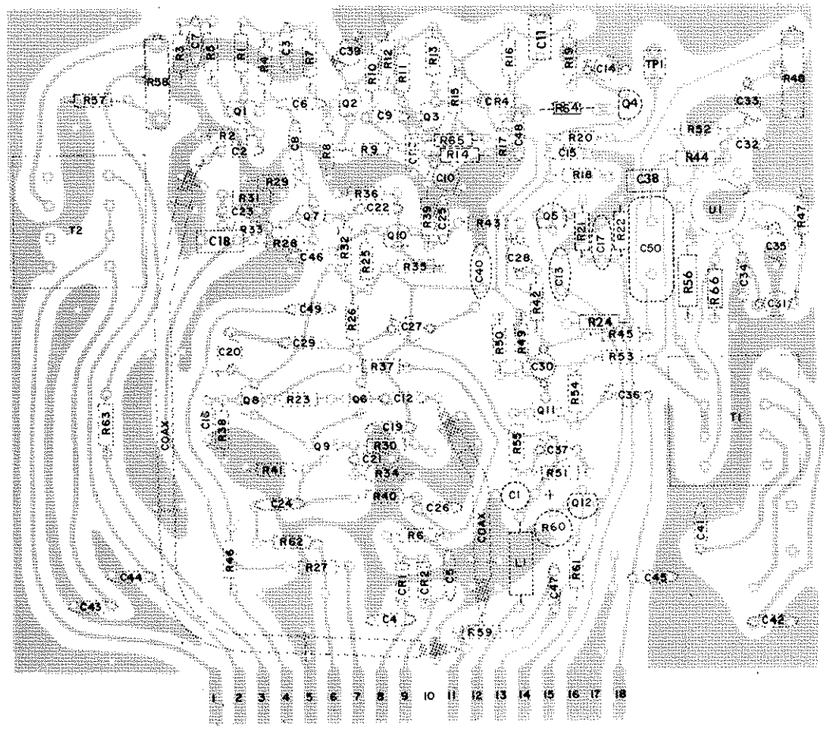
5024140095M

PARTS LIST 1A3A4 Audio Board

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Tantalum, 47 UF, 20 V	0281700001
C2	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C3	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C4	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C5	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C6	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C7	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C8	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C9	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C10	Capacitor, Tantalum, 15 V, 20 V	0280920008
C11	Capacitor, Tantalum, 68 UF, 28 V	0282150005
C12	Capacitor, Mica, 220 PF 5%, 500 V	0285950002
C13	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C14	Capacitor, Tantalum, 15 UF, 20 V	0280920008
C15	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C16	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C17	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C18	Capacitor, Tantalum, 68 UF, 28 V	0282150005
C19	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C20	Capacitor, Tantalum, 15 UF, 20 V	0280920008
C21	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C22	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C23	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C24	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C25	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C26	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C27	Capacitor, Tantalum, 1 UF, 50 V	0280910002
C28	Capacitor, Tantalum, 1 UF, 50 V	0280910002
C29	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C30	Capacitor, Tantalum, 1 UF, 50 V	0280910002
C31	Capacitor, Tantalum, 3.3 UF, 35 V	0281680001
C32	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C33	Capacitor, Tantalum, 1 UF, 50 V	0280910002
C34	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C35	Capacitor, Tantalum, 3.3 UF, 35 V	0281680001
C36	Capacitor, Tantalum, 1 UF, 50 V	0280910002
C37	Capacitor, Tantalum, 47 UF, 20 V	0281700001
C38	Capacitor, Tantalum, 68 UF, 28 V	0282150005
C39	Capacitor, Tantalum, 15 UF, 20 V	0280920008
C40	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C41	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C42	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C43	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C44	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C45	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C46	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C47	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C48	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
C49	Capacitor, Disc Cer., .01 UF, 25 V	0281620008
CR1	Diode, 1N4454	0405270003
CR2	Diode, 1N4454	0405270003
CR3	Diode, 1N4454	0405270003
CR4	Diode, 1N4454	0405270003
R1	Resistor, Carbon, 12 K 10%, 1/4 W	0181380003
R2	Resistor, Carbon, 3.3 K, 10%, 1/4 W	0170890007
R3	Resistor, Carbon, 220 ohm, 10%, 1/4 W	0171320000
R4	Resistor, Carbon, 560 ohm 10%, 1/4 W	0183200004
R5	Resistor, Carbon, 18 ohm 10%, 1/4 W	0184590001
R6	Resistor, Carbon, 56 ohm 10%, 1/4 W	0172490004
R7	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R8	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R9	Resistor, Carbon, 18 ohm 10%, 1/4 W	0184590001
R10	Resistor, Carbon, 680 ohm 10%, 1/4 W	0176630007
R11	Resistor, Carbon, 22 K 5%, 1/4 W	0192710001
R12	Resistor, Carbon, 3 K 5%, 1/4 W	0197180001
R13	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R14	Resistor, Carbon, 120 ohm 10%, 1/4 W	0186550006
R15	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R16	Resistor, Carbon, 3.3 K 10%, 1/4 W	0177920009
R17	Resistor, Carbon, 120 K 10%, 1/4 W	0175100004
R18	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620006
R19	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R20	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R21	Resistor, Carbon, 3.9 K 10%, 1/4 W	0178830003
R22	Resistor, Carbon, 1.2 K 10%, 1/4 W	0181860007
R23	Resistor, Carbon, 120 ohm 10%, 1/4 W	0186550006
R24	Resistor, Carbon, 560 ohm 10%, 1/4 W	0183200004
R25	Resistor, Carbon, 56 ohm 10%, 1/4 W	0174290004
R26	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R27	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R28	Resistor, Carbon, 18 K 10%, 1/4 W	0175720002

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
R29	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R30	Resistor, Carbon, 2.7 K 10%, 1/4 W	0186670001
R31	Resistor, Carbon, 270 ohm 10%, 1/4 %	0178450006
R32	Resistor, Carbon, 680 ohm 10%, 1/4 W	0176630007
R33	Resistor, Carbon, 82 ohm 10% 1/4 W	0184610001
R34	Resistor, Carbon, 680 ohm 10%, 1/4 W	0176630007
R35	Resistor, Carbon, 33 K 10%, 1/4 W	0177920009
R36	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R37	Resistor, Carbon, 3.3 K 10%, 1/4 W	0170890007
R38	Resistor, Carbon, 6.8 K 10%, 1/4 W	0174810008
R39	Resistor, Carbon, 1.2 K 10%, 1/4 W	0181860007
R40	Resistor, Carbon, 5.6 K 10%, 1/4 W	0183060008
R41	Resistor, Carbon, 3.3 K 10%, 1/4 W	0170890007
R42	Resistor, Carbon, 680 ohm 10%, 1/4 W	0176630007
R43	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R44	Not used 100K, 10%, 1/4W	0170390004
R45	Resistor, Carbon, 10 ohm 10%, 1/4 W	0177160004
R46	Resistor, Carbon, 8.2 K, 1/4 W	0181620006
R47	Resistor, Carbon, 4.7 K 10% 1/4 W	0170770001
R48	Potentiometer, 15 Turn, 2 K, 1/2 W	0000000000
R49	Resistor, Carbon, 18 K 10%, 1/4 W	0175720002
R50	Resistor, Carbon, 8.2 K 10%, 1/4 W	0181620006
R51	Resistor, Carbon, 560 ohm 10%, 1/4 W	0183200004
R52	Resistor, Carbon, 470 K 10%, 1/4 W	0180570005
R53	Resistor, Carbon 10 ohm 10%, 1/4 W	0177160004
R54	Resistor, Carbon 1 K 10%, 1/4 W	0171560001
R55	Resistor, Carbon, 56 ohm 10%, 1/4 W	0172490004
R56	Resistor, Carbon, 4.7 ohm 10%, 1/4 W	0195680006
R57	Resistor, Carbon 10 ohm 10%, 1/4 W	0177160004
R58	Potentiometer, 15 Turn, 500 ohm, 1/2 W	
R59	Resistor, Carbon, 120 ohm 10%, 1/4 W	0186550006
R60	Potentiometer, 1 Turn, 20, 10%, 1/2 W	1000080030
R61	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R62	Resistor, Carbon, 560 ohm 10%, 1/4 W	0183200004
R63	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R65	Resistor, 10, 10%, 1/4 W, m:600 ohm	0177160004
R66	Resistor, 330, 10%, 1/4 W, m:600 ohm	0170910008
T1	Transformer, Audio, 600 ohm:600 ohm	0491470002
T2	Transformer, Audio, 150 ohm:600 ohm	0491590008
Q1	Transistor, 2N4124	0448010003
Q2	Transistor, 2N4124	0448010003
Q3	Transistor, 2N4124	0448010003
Q4	Transistor, 2N4124	0448010003
Q5	Transistor, 2N4126	0448020009
Q6	Transistor, 2N4124	0448010003
Q7	Transistor, 2N4124	0448010003
Q8	Transistor, 2N4124	0448010003
Q9	Transistor, 2N4124	0448010003
Q10	Transistor, 2N4124	0448010003
Q11	Transistor, 2N4124	0448010003
L1	Inductor, Molded, 150 UH, 5%	0646780000
R64	100, 5% Y4W	0171180003
C50	910 PF 500V DM19, 5%	0297570005
U1	IC Linear CA3020	0444600001
Q12	TRANSISTOR, 2N4124	0448010003
	Testpoint, w/lit	0753640007





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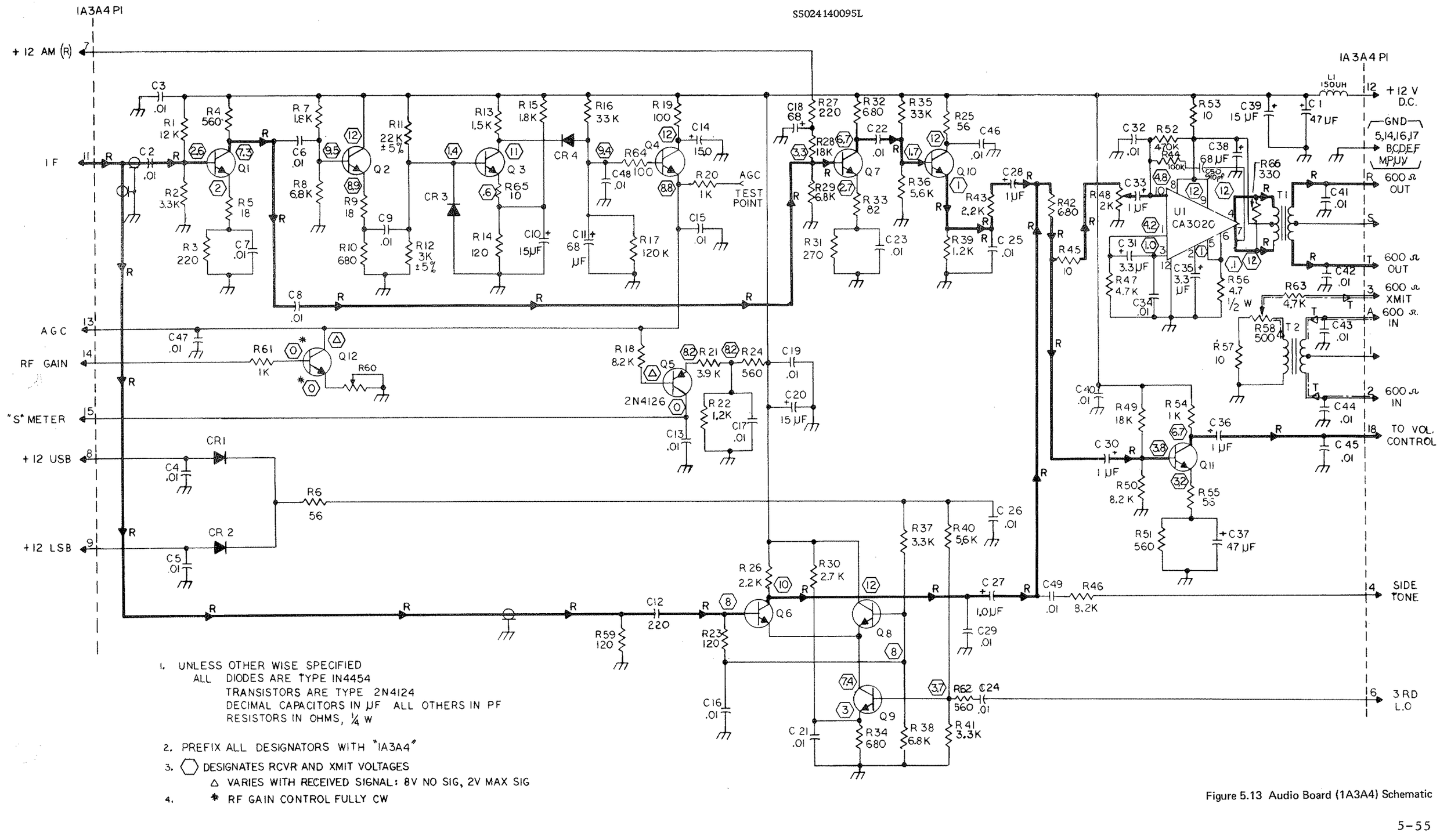


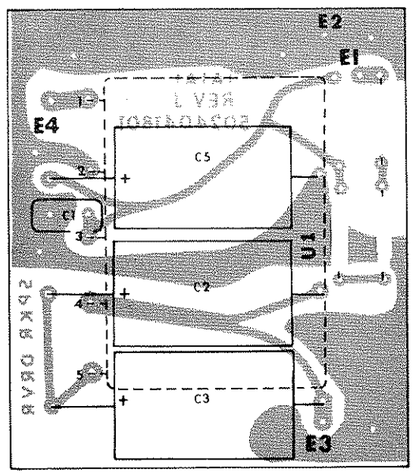
1. UNLESS OTHER WISE SPECIFIED
   ALL DIODES ARE TYPE IN4454
   TRANSISTORS ARE TYPE 2N4124
   DECIMAL CAPACITORS IN µF ALL OTHERS IN PF
   RESISTORS IN OHMS, ¼ W
2. PREFIX ALL DESIGNATORS WITH "1A3A4"
3. ⬡ DESIGNATES RCVR AND XMIT VOLTAGES
   △ VARIES WITH RECEIVED SIGNAL: 8V NO SIG, 2V MAX SIG
4. ✱ RF GAIN CONTROL FULLY CW

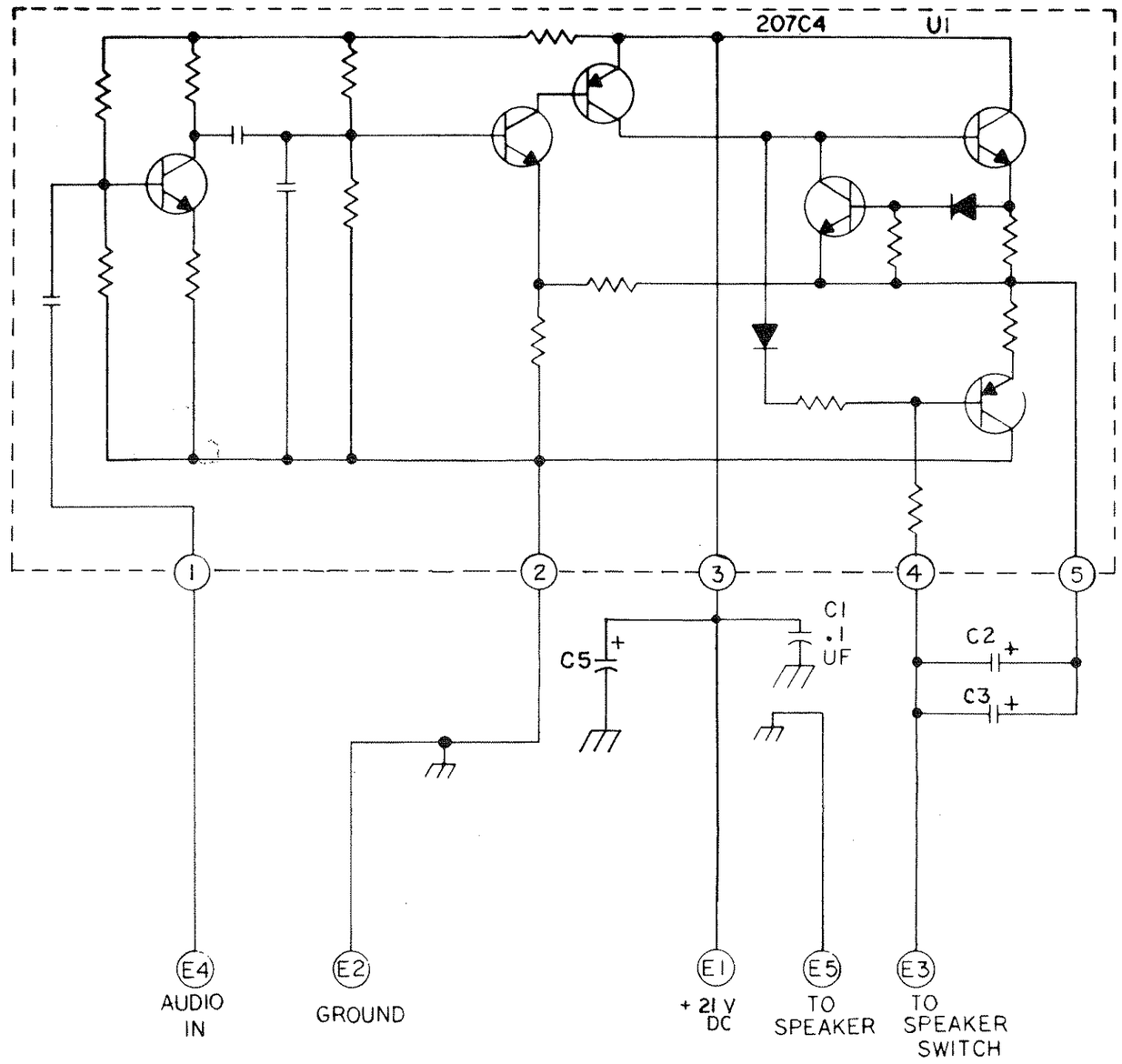
Figure 5.13 Audio Board (1A3A4) Schematic

5024041771E

SPEAKER DRIVER BOARD

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
	PCB. Speaker Driver	5024041801
C2,3,5	Capacitor, 470UF, 50V, TAL	0280890001
C1	Capacitor, 0.1UF, 50V, X7R, 20%	0281610002
U1	IC. Linear, 207C4SC	0448260000





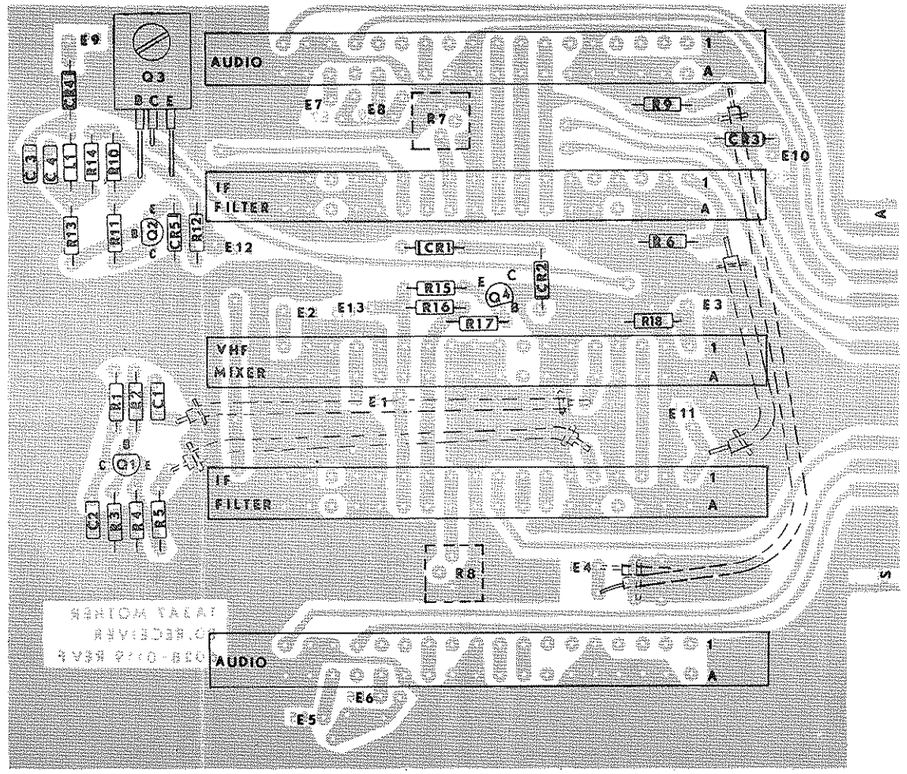
NOTES:
1. C1,C2,C3,C5 ARE 470 µF, 50V DCW
2. ALL DIODES ARE IN4004

Figure 5.14 Speaker Driver (1A1A1) Schematic

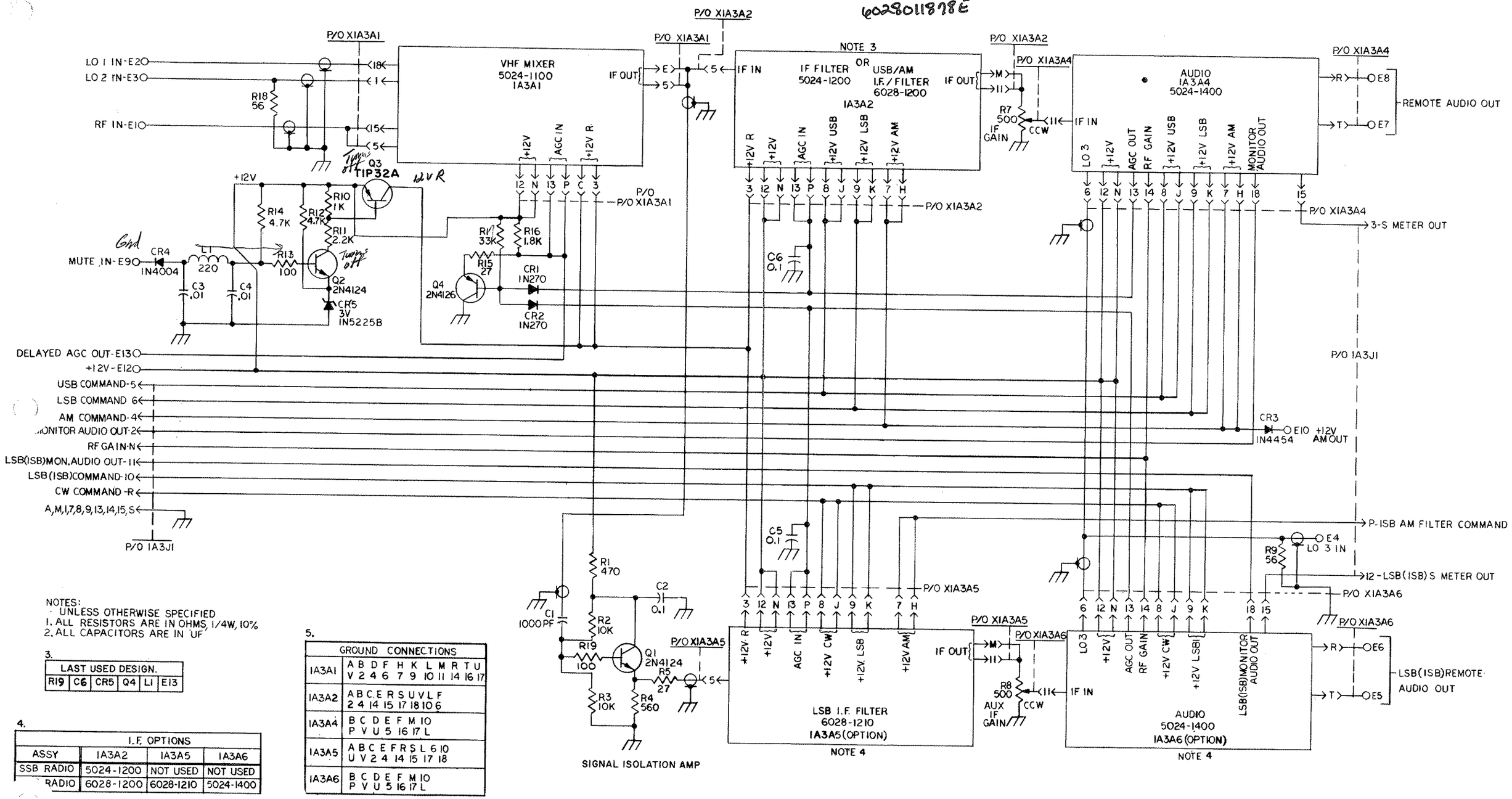
PARTS LIST, 1A3A7

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Ceramic, 100 PF 20%, 50 V	0281630003
C2	Capacitor, Ceramic, 0.1 UF 20%, 50 V	0281610002
C3	Capacitor, Ceramic, 0.01 UF 20%, 50 V	0281620008
C4	Capacitor, Ceramic, 0.01 UF 20%, 50 V	0281620008
CR1	Diode, Signal, 1N270	0405510004
CR2	Diode, Signal, 1N270	0405510004
CR3	Diode, Signal, 1N4454	0405270003
CR4	Diode, Si. pwr, 1A, 400 V, 1N4004	0405180004
CR5	Diode, Zener, 3.0V 5%, 0.5W, 1N5225B	0405520000
L1	Inductor, FXd, 220 UF 10%, 73 ma	0650500008
R1	Resistor, Carbon, 470 ohm 10%, 1/4 W	0184110009
R2	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R3	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R4	Resistor, Carbon, 560 ohm 10%, 1/4 W	0183200004
R5	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R6	Resistor, Carbon, 56 ohm 10%, 1/4 W	0174290004
R7	Resistor, Var., 500 ohm, 1/2 W	0345980000
R8	Resistor, Var., 500 ohm, 1/2 W	0345980000
R9	Resistor, Carbon, 56 ohm 10%, 1/2 W	0174290004
R10	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R11	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R12	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R13	Resistor, Carbon, 100 ohm 10%, 1/4 W	0171180003
R14	Resistor, Carbon, 4.7 K 10%, 1/4 W	0170770001
R15	Resistor, Carbon, 27 ohm 10%, 1/4 W	0172590001
R16	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R17	Resistor, Carbon, 33 K 10%, 1/4 W	0177920009
R18	Resistor, Carbon, 56 ohm 10%, 1/4 W	0174290004
Q1	Transistor, NPN, G.P., 2N4124	0448010003
Q2	Transistor, NPN, G.P., 2N4124	0448010003
Q3	Transistor, PNP, TIP32A	0448200007
Q4	Transistor, PNP, 2N4126	0448020009
X1 A3 A1	Connector, 18 Pin	0753610001
X1 A3 A2	Connector, 18 Pin	0753610001
X1 A3 A4	Connector, 18 Pin	0753610001
X1 A3 A5	Connector, 18 Pin	0753610001
X1 A3 A6	Connector, 18 Pin	0753610001

C5
C6
C7
C8
C9
C10
C11
C12
CR6
L2
L3
L4
R19
R21
R22
R23
Q5



S6028-0118D
6028011878E



NOTES:
UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE IN OHMS, 1/4W, 10%
2. ALL CAPACITORS ARE IN UF

3.

LAST USED DESIGN.					
R19	C6	CR5	Q4	L1	E13

4.

I.F. OPTIONS			
ASSY	1A3A2	1A3A5	1A3A6
SSB RADIO	5024-1200	NOT USED	NOT USED
RADIO	6028-1200	6028-1210	5024-1400

5.

GROUND CONNECTIONS	
1A3A1	A B D F H K L M R T U V 2 4 6 7 9 10 11 14 16 17
1A3A2	A B C E R S U V L F 2 4 14 15 17 18 10 6
1A3A4	B C D E F M 10 P V U 5 16 17 L
1A3A5	A B C E F R S L 6 10 U V 2 4 14 15 17 18
1A3A6	B C D E F M 10 P V U 5 16 17 L

Figure 5.15 Receiver Mother Board (1A3A7) Schematic

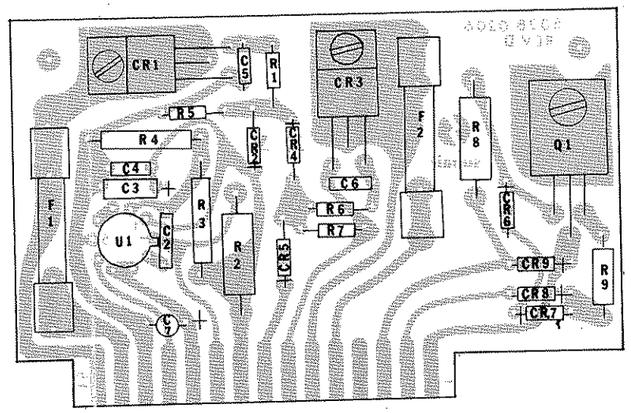
PARTS LIST, 1A6A1 Chassis Ass'y.

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Electrolytic,5500 UF, 40 V	0280930003
C5	Capacitor, Electrolytic,5500 UF, 40 V	0280930003
C7	Capacitor, Mylar, 0.22 UF 20%, 50 V	0286250004
C8	Capacitor, Mylar, 0.22 UF, 20%, 50 V	0286250004
Q1	Transistor	0448180006
T1	Transformer, Power (ECN 6028021300	6028020303
U1	Diode Array, Bridge Rect	0405260008
U2	Diode Array, Bridge Rect	0405260008
U3	Integrated Circuit, Regulator, 5 V, 1 A	0447190008
P1	Connector, 11 Pin Male	
	MISCELLANEOUS MECHANICAL PARTS	
TB1	Terminal, 9 Term., Barrier	0508030005
TB2	Terminal, 9 Term., Barrier	0508030005

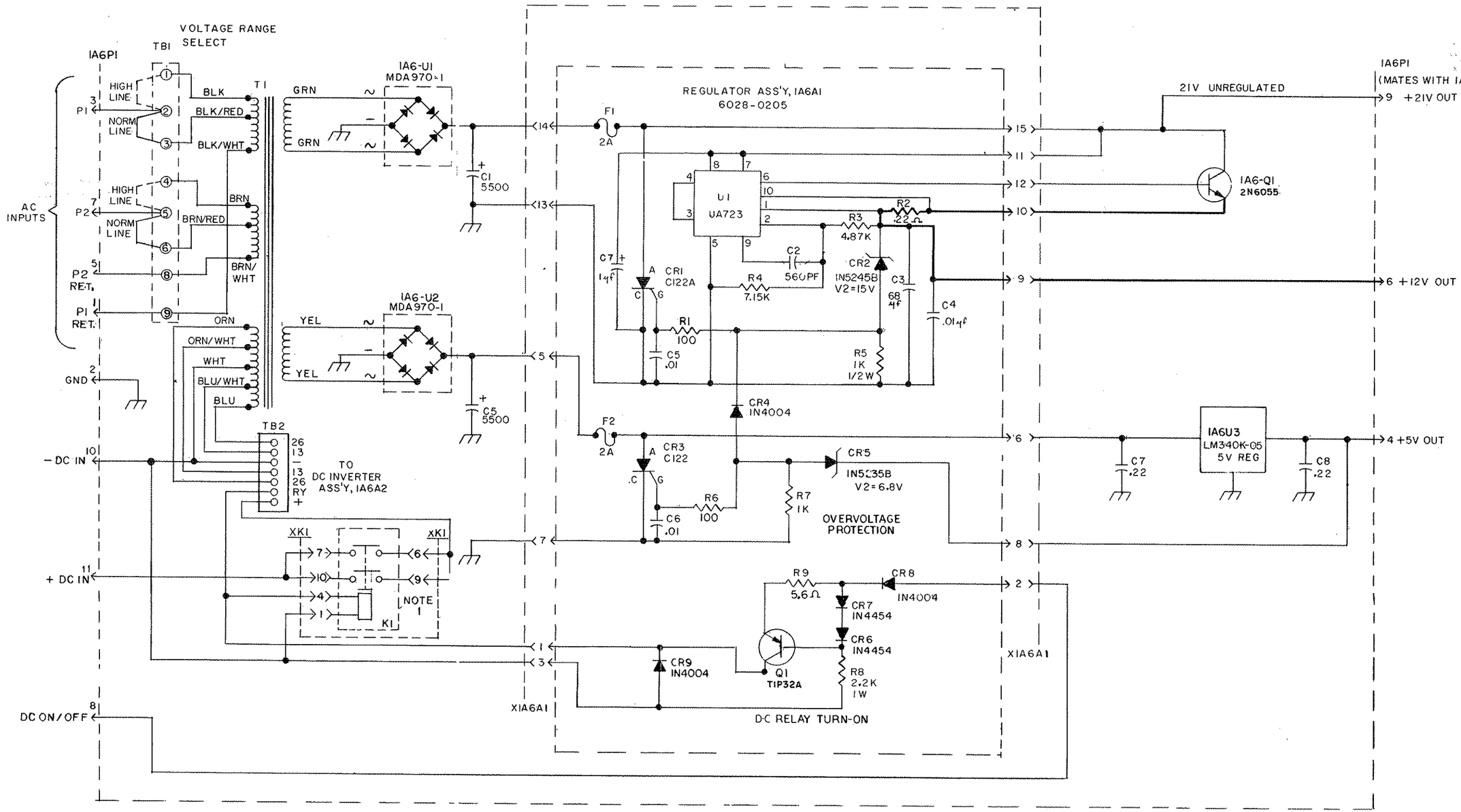
XK1
X1A6A1
Connector
(ECN 6028-128)
P1

PARTS LIST, 1A6A1 Regulator Board

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Not used	
C2	Capacitor, Mica, 560 PF 5%, 300 V	0282750002
C3	Capacitor, Tant., 68 UF 10%, 25 V	0282150005
C4	Capacitor, Ceramic, .01 UF, 25 V	0281620008
C5	Capacitor, Ceramic, .01 UF, 25 V	0281620008
C6	Capacitor, Ceramic, .01 UF, 25 V	0281620008
C7	Capacitor, Tant., 1 UF 20%, 35 V	0282150002
CR1	SCR, 100 V, 8 A	0446920002
CR2	Diode, Zener, 15 V 5%, 1/2 W,1N52548	0405210001
CR3	SCR, 100 V, 8 A	0446920002
CR4	Diode, 1 A, 400 V, 1N4004	0405180004
CR5	Diode, Zener, 6.8 V 5%, 1/2 W,1N52538	0405200005
CR6	Diode, Signal, 1N4452	0405270003
CR7	Diode, Signal, 1N4454	0405270003
CR8	Diode, 1 A, 400 V, 1N4004	0405180004
CR9	Diode, 1 A, 400 V, 1N4004	0405180004
F1	Fuse, 3 AG, 2 A	0878020004
F2	Fuse, 3 AG, 2 A	0878020004
Q1	Transistor, PNP, pwr. TIP32 A	0448200007
R1	Resistor, Carbon, 470 ohm 10%, 1/4 W	0184110009
R2	Resistor, Wirewound, 0.22 ohm 5%, 2 W	0196320006
R3	Resistor, Film, 4.87 K 1%, 1/2 W	0193740001
R4	Resistor, Film, 7.15 K 1%, 1/2 W	0193860007
R5	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R6	Resistor, Carbon, 470 Ohm 10%, 1/4 W	0184110009
R7	Resistor, Carbon, 1 K 10%, 1/4 W	0171560001
R8	Resistor, Carbon, 2.2 K 10%, 1 W	0164510001
R9	Resistor, Carbon, 5.6 ohm 10%, 1/2 W	0168030004
U1	Integrated Circuit, UA723	0448190001



S6028-0200D



NOTE
1. K1 SUPPLIED WITH DC INVERTER OPTION (6028-0215) ONLY

Figure 5.16 Power Supply (1A6) Schematic

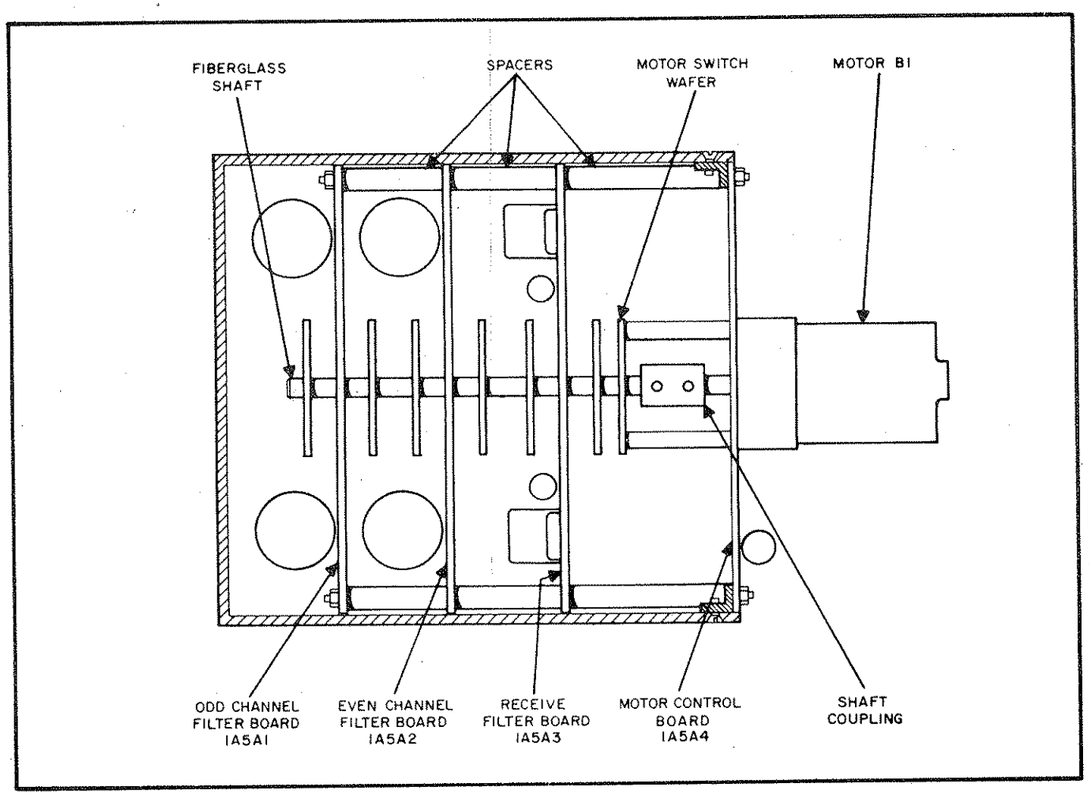
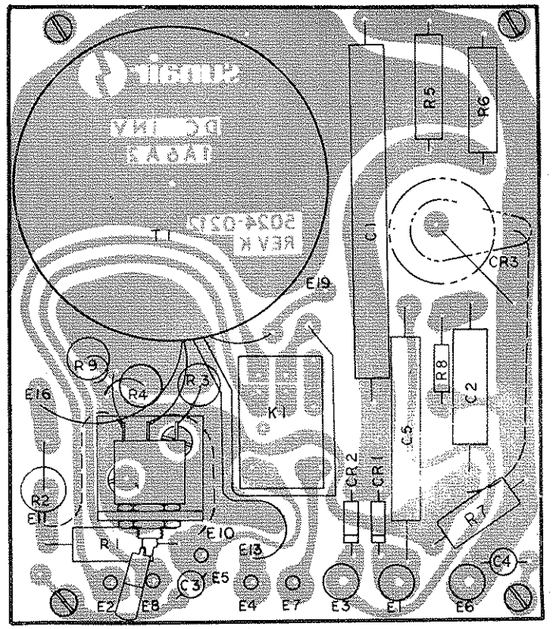


Figure 5.18 Filter Module Assembly (1A5)



PARTS LIST, 1A6A2 5024021495

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Mylar, 12 UF, 100 V	0282020004
C2	Capacitor, Mylar, 1 UF, 100 V	0272300004
C3	Capacitor, Ceramic, .1 UF, 50 V	0281610002
C4	Capacitor, Ceramic, .1 UF, 50 V	0281610002
C5	Capacitor, Mylar, 1 UF, 200 V	0245250000
CR1	Diode, 1N4004	0405180004
CR2	Diode, 1N4004	0405180004
CR3	Diode, 1N3209R	0405190000
K1	Relay, DPDT 5A, 12 V	0664680003
Q1	Transistor, 2N5439	0448320002
Q2	Transistor, 2N5439	0448320002
R1	Resistor, Carbon, 470 ohm 10%, 2 W	0163580006
R2	Resistor, Carbon, 470 ohm 10%, 2 W	0163580006
R3	Resistor, Wirewound, .47 ohm, 2 W	0197350003
R4	Resistor, Wirewound, .1 ohm, 10 %	0197490000
R5	Resistor, Carbon, 3.3 K 10%, 2 W	0197220002
R6	Resistor, Carbon, 3.3 K 10%, 2 W	0197220002
R7	Resistor, Carbon, 27 ohm 10%, 1 W	0197150004
R8	Resistor, Carbon, 1.2 ohm 10%, 1/2 W	0188490001
R9	Not used	
S1	Switch, Toggle, DPDT, Lever Lock	0346370001
T1	Transformer, Saturable	5024021509

S5024-0213F
5024021371 6

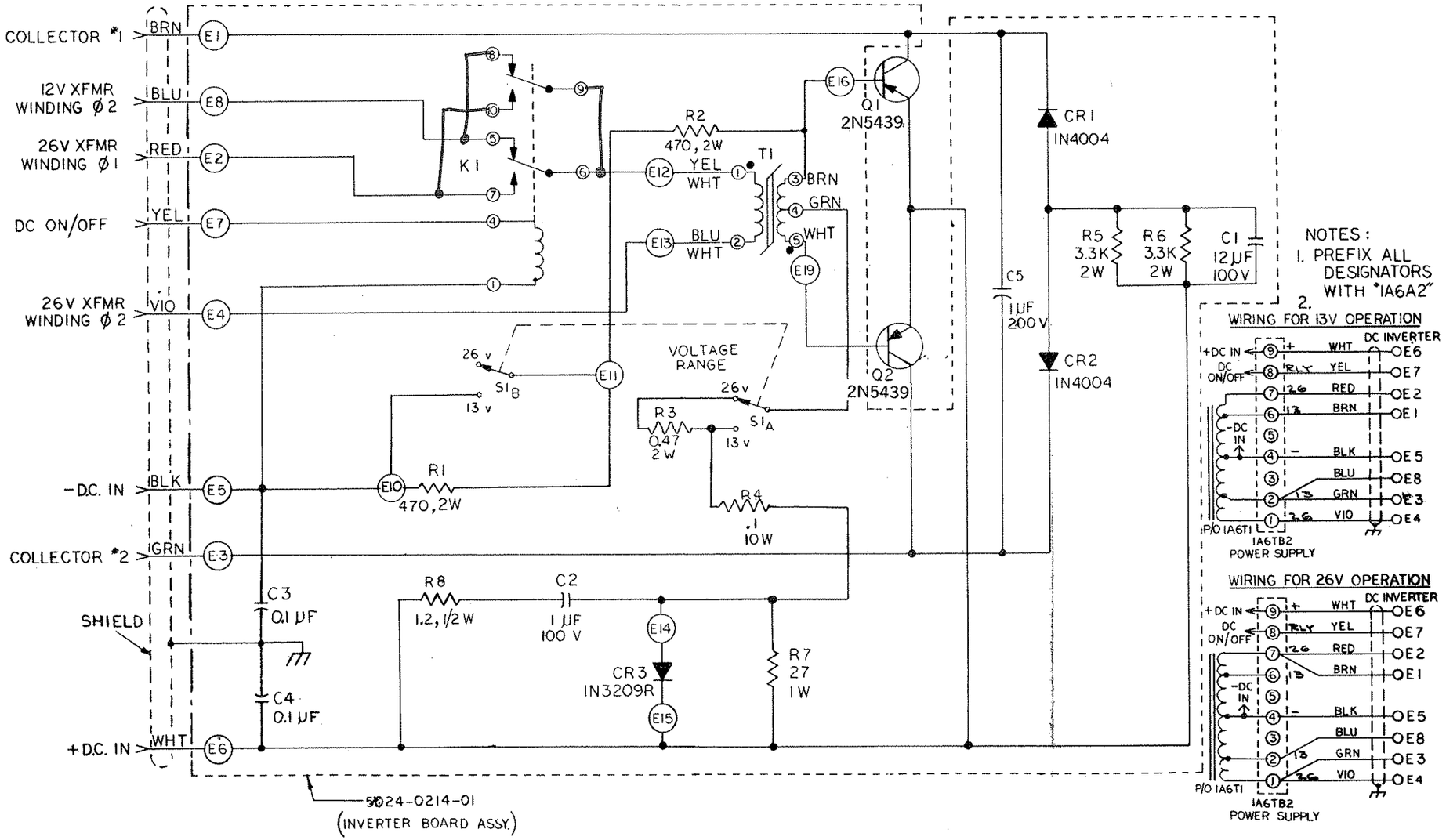
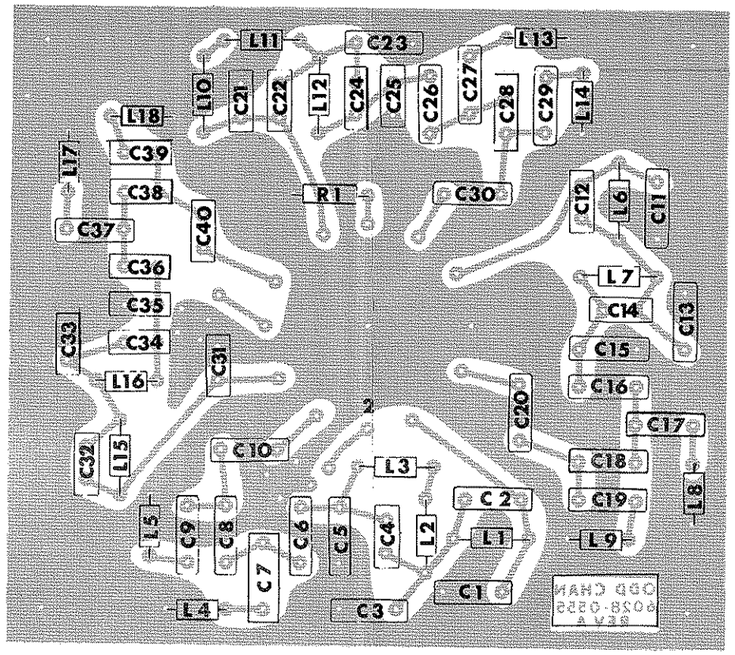
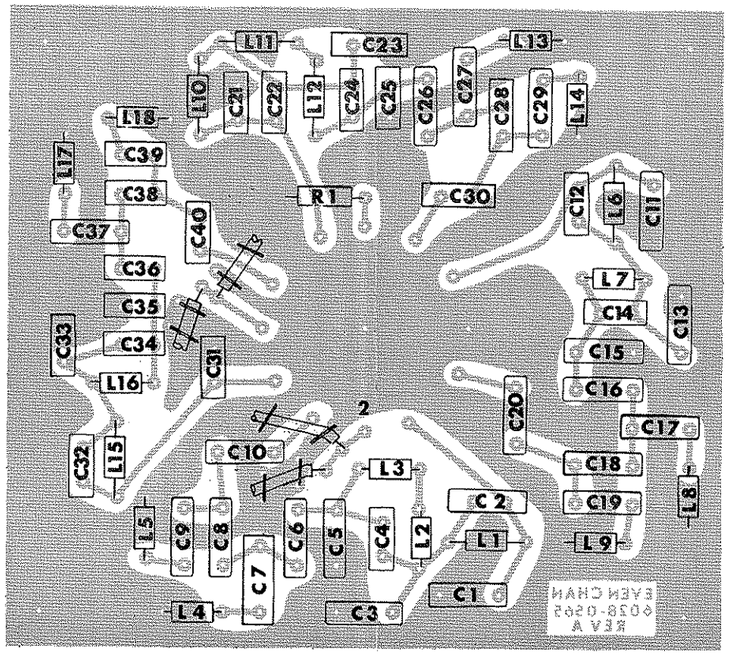
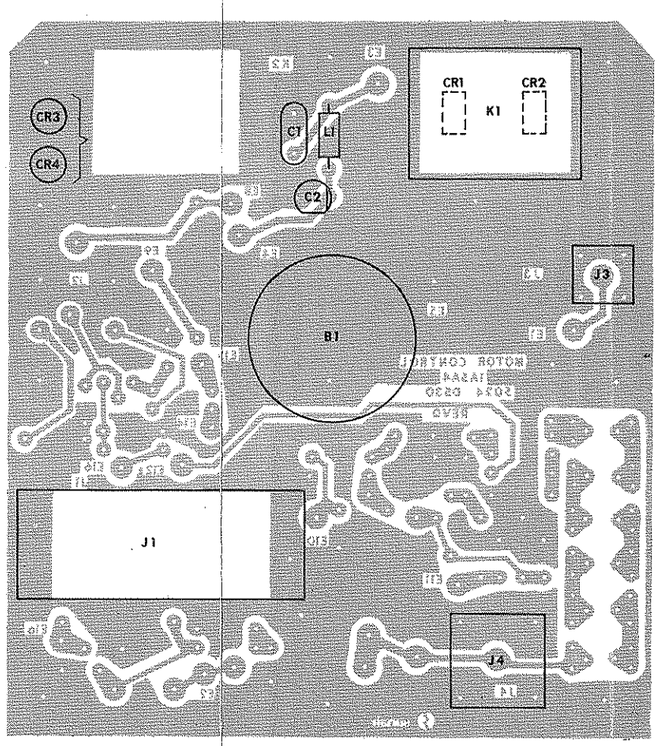


Figure 5.17 D.C. Inverter (1A6A2) Schematic







PARTS LIST, 1A5A2 Even Channel Filter Assy.

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Mica, 750 PF 2%, 500 V	0280990006
C2	Capacitor, Mica, 510 PF 2%, 500 V	0281230005
C3	Capacitor, Mica, 1600 PF 2%, 500 V	0281220000
C4	Capacitor, Mica, 180 PF 2%, 500 V	0281090009
C5	Capacitor, Mica, 1000 PF 2%, 500 V	0281210004
C6	Capacitor, Mica, 1600 PF 2%, 500 V	0281220000
C7	Capacitor, Mica, 9100 PF 2%, 500 V	0280960000
C8	Capacitor, Mica, 1100 PF 2% 500 V	0281000000
C9	Capacitor, Mica, 3300 PF 2%, 500 V	0281250006
C10	Capacitor, Mica, 2200 PF 2%, 500 V	0281360006
C11	Capacitor, Mica, 390 PF 2%, 500 V	0281040001
C12	Capacitor, Mica, 250 PF 2%, 500 V	0281100004
C13	Capacitor, Mica, 750 PF 2%, 500 V	0280990006
C14	Capacitor, Mica, 82 PF 2%, 500 V	0281120005
C15	Capacitor, Mica, 560 PF 2%, 500 V	0281060002
C16	Capacitor, Mica, 820 PF 2%, 500 V	0281280002
C17	Capacitor, Mica, 4700 PF 2%, 500 V	0281390002
C18	Capacitor, Mica, 560PF 2%, 500 V	0281060002
C19	Capacitor, Mica, 1800 PF 2%, 500 V	0281300003
C20	Capacitor, Mica, 1100 PF 2%, 500 V	0281000000
C21	Capacitor, Mica, 180 PF 2%, 500 V	0281090009
C22	Capacitor, Mica, 120 PF 2%, 500 V	0281180008
C23	Capacitor, Mica, 360 PF 2%, 500 V	0281160007
C24	Capacitor, Mica, 39 PF 2%, 500 V	0281150001
C25	Capacitor, Mica, 240 PF 2%, 500 V	0281140006
C26	Capacitor, Mica, 390 PF 2%, 500 V	0281040001
C27	Capacitor, Mica, 2000 PF 2%, 500 V	0281410003
C28	Capacitor, Mica, 220 PF 2%, 500 V	0281420009
C29	Capacitor, Mica, 750 PF 2%, 500 V	0280990006
C30	Capacitor, Mica, 510 PF 2%, 500 V	0281230005
C31	Capacitor, Mica, 75 PF, 500 V	0281110000
C32	Capacitor, Mica, 56 PF 2%, 500 V	0281350001
C33	Capacitor, Mica, 160 PF 2%, 500 V	0281340005
C34	Capacitor, Mica, 18 PF 2%, 500 V	0281330000
C35	Capacitor, Mica, 100 PF 2%, 500 V	0281190003
C36	Capacitor, Mica, 160 PF 2%, 500 V	0281340005
C37	Capacitor, Mica, 910 PF 2%, 500 V	0281450005
C38	Capacitor, Mica, 110 PF 2%, 500 V	0281460001
C39	Capacitor, Mica, 330 PF 2%, 500 V	0281070008
L1	Inductor, Fixed, 2.2 UH 5%	0649890001
L2	Inductor, Fixed, 1.5 UH 5%	0649270002
L3	Inductor, Fixed, 1.5 UH 5%	0649270002
L4	Inductor, Fixed, 3.9 UH 5%	0650480007
L5	Inductor, Fixed, 4.7 UH 5%	0651910005
L6	Inductor, Fixed, 1.2 UH 5%	0649910001
L7	Inductor, Fixed, 1.5 UH 5%	0649270002
L8	Inductor, Fixed, 1.8 UH, 5%	0652440002
L9	Inductor, Fixed, 2.2 UH 5%	0649890001
L10	Inductor, Fixed, 0.56 5%	0649530004
L11	Inductor, Fixed, 0.56 UH 5%	0649530004
L12	Inductor, Fixed, 0.1 UH 5%	0648620000
L13	Inductor, Fixed, 0.82 UH 5%	0652320007
L14	Inductor, Fixed, 1.0 UH 5%	0649150007
L15	Inductor, Fixed, 0.22 UH 5%	0650620003
L16	Inductor, Fixed, 0.27 UH 5%	0649390008
L17	Inductor, Fixed, 0.39 UH 5%	0649770005
L18	Inductor, Fixed, 0.47 UH 5%	0649410009
R1	Resistor, Carbon, 10 Ohms 10%, 1/2 W	0185380006
S1	Switch, Even Channel Top	5024051807
S2	Switch, Even Channel Bottom	5024053303

C40 0281420009

PARTS LIST, 1A5A4 Motor Control Board

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
B1	Motor, 12 VDC, Gearhead	5024053508
C1	Capacitor, Disc, 250 V	0281620008
C2	Capacitor, Tant., 1 UF 20%, 50 V	0280910002
CR3 2	Diode, 1N4004	0405180004
CR7	Diode, 1N5338B	0405660001
J1	Caonnector, 20 Pin	0753470004
J3	Connector, RF, JCM	0753600005
J4	Connector, RF, BNC	0753490005
K1	Relay, 12 VDC, 4 PDT	0666640009
L1	Inductor, 47 UF, 10%	0652680003
S1	Switch, Motor Control	5024053109

CR5 um4001C 0405430001
CR6 um4001CR 0405440006

6028055697B

PARTS LIST, 1A5A1 Odd Channel Filter Ass'y.

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Mica, 1100 PF 2%, 500 V	0281000000
C2	Capacitor, Mica, 750 PF 2%, 500 V	0280990006
C3	Capacitor, Mica, 2400 PF 2%, 500 V	0280980001
C4	Capacitor, Mica, 270 PF 2%, 500 V	0280970005
C5	Capacitor, Mica, 1500 PF 2%, 500 V	0281270007
C6	Capacitor, Mica, 2200 PF 2%, 500 V	0281360006
C7	Capacitor, Mica, 11000 PF 2%, 500 V	0281370001
C8	Capacitor, Mica, 1300 PF 2%, 500 V	0281380007
C9	Capacitor, Mica, 4700 PF 2%, 500 V	0281390002
C10	Capacitor, Mica, 2700 PF 2%, 500 V	0281240001
C11	Capacitor, Mica, 560 PF 2%, 500 V	0281060002
C12	Capacitor, Mica, 390 PF 2%, 500 V	0281040001
C13	Capacitor, Mica, 1200 PF 2%, 500 V	0281030006
C14	Capacitor, Mica, 1300 PF 2%, 500 V	0281010005
C15	Capacitor, Mica, 750 PF 2%, 500 V	0280990006
C16	Capacitor, Mica, 1100 PF 2%, 500 V	0281260001
C18	Capacitor, Mica, 750 PF 2%, 500 V	0280990006
C19	Capacitor, Mica, 2200 PF 2%, 500 V	0281360006
C20	Capacitor, Mica, 1500 PF 2%, 500 V	0281270007
C21	Capacitor, Mica, 250 PF 2%, 500 V	0281100004
C22	Capacitor, Mica, 180 PF 2%, 500 V	0281090004
C23	Capacitor, Mica, 560 PF 2%, 500 V	0281060002
C24	Capacitor, Mica, 62 PF 2%, 500 V	0282810005
C25	Capacitor, Mica, 330 PF 2%, 500 V	0281070008
C26	Capacitor, Mica, 560 PF 2%, 500 V	0281060002
C27	Capacitor, Mica, 3000 PF 2%, 500 V	0281320004
	Capacitor, Mica, 360 PF 2%, 500 V	0281160007
C29	Capacitor, Mica, 1200 PF 2%, 500 V	0281030006
C30	Capacitor, Mica, 750 PF 2%, 500 V	0280990006
C31	Capacitor, Mica, 150 PF 2%, 500 V	0281200009
C32	Capacitor, Mica, 100 PF 2%, 500 V	0281190003
C33	Capacitor, Mica, 250 PF 2%, 500 V	0281100004
C34	Capacitor, Mica, 33 PF 2%, 500 V	0281020001
C35	Capacitor, Mica, 180 PF 2%, 500 V	0281090009
C36	Capacitor, Mica, 270 PF 2%, 500 V	0280970005
C37	Capacitor, Mica, 1500 PF 2%, 500 V	0281270007
C38	Capacitor, Mica, 160 PF 2%, 500 V	0281340005
C39	Capacitor, Mica, 470 PF 2%, 500 V	0281440000
L1	Inductor, Fixed, 3.3 UH 5%	0651150001
L2	Inductor, Fixed, 2.2 UH 5%	0684980006
L3	Inductor, Fixed, 2.2 UH 5%	0648980006
L4	Inductor, Fixed, 4.7 UH 5%	0651910005
L5	Inductor, Fixed, 5.6 UH 5%	0650360001
L6	Inductor, Fixed, 1.5 UH 5%	0649270002
L7	Inductor, Fixed, 2.2 UH 5%	0648980006
L8	Inductor, Fixed, 2.2 UH 5%	0652180001
L9	Inductor, Fixed, 3.3 UH 5%	0658920006
L10	Inductor, Fixed, 0.56 UH 5%	0648480003
L11	Inductor, Fixed, 0.15 UH 5%	0648620000
L12	Inductor, Fixed, 110 UH 5%	0648360008
L13	Inductor, Fixed, 1.2 UH 5%	0649910001
L14	Inductor, Fixed, 1.5 UH 5%	0649270002
L15	Inductor, Fixed, 0.27 UH 5%	0649390008
L16	Inductor, Fixed, 0.39 UH 5%	0649770005
L17	Inductor, Fixed, 0.56 UH 5%	0649530004
L18	Inductor, Fixed, 0.82 UH 5%	0652320007
R1	Resistor, Carbon, 10 ohms 10%, 1/2 W	0185380000
S1	Switch, Odd Channel Top	5024050703
S2	Switch, Odd Channel Bottom	5024053206

C40
C17

6028055077B

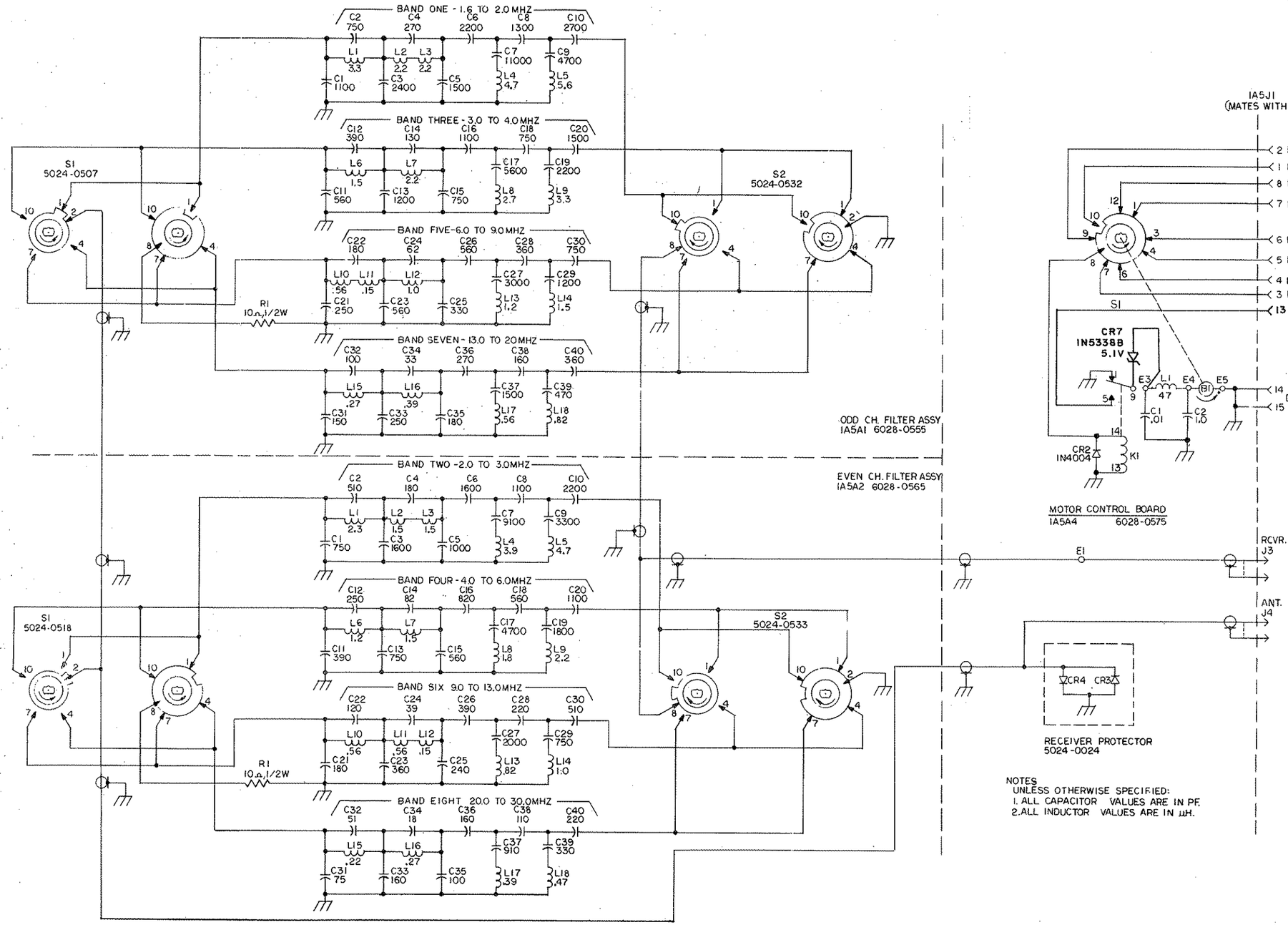
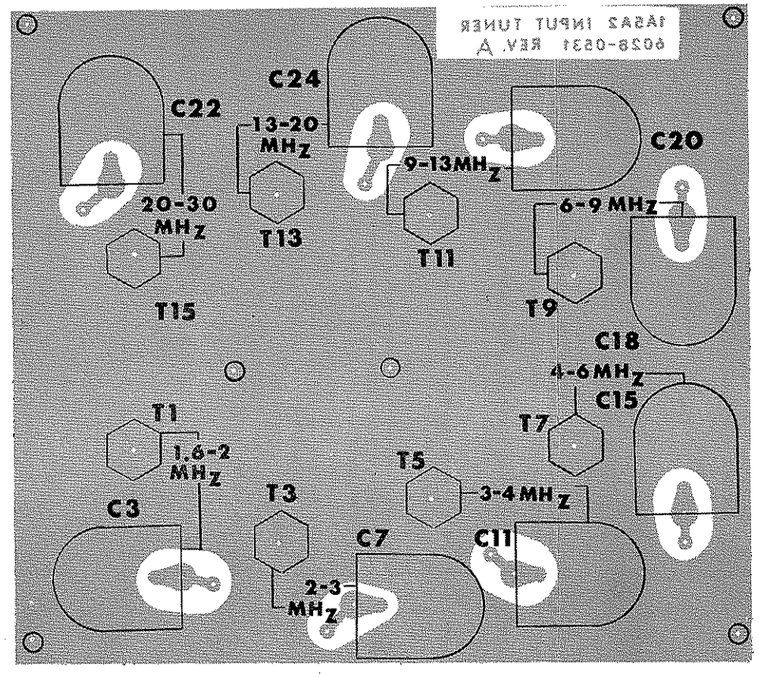


Figure 5.19 Receiver Filter Schematic



PARTS LIST, 1A5 Preselector Ass'y.

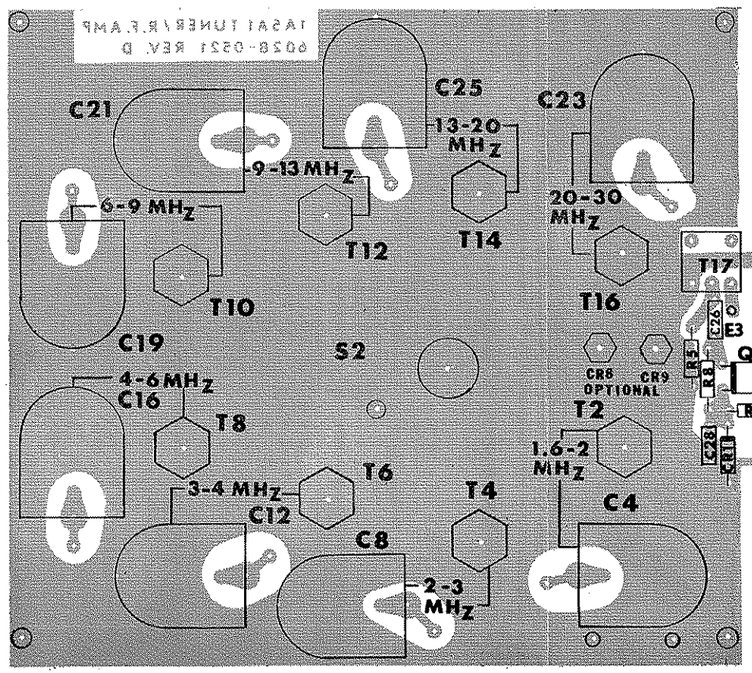
REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
B1	Motor, 12 VDC	6028053201
B2	Motor, 12 VDC	5024053508
C1	Capacitor, Tuning	6028050105
C45	Capacitor, Cer., 0.01 UF 20%, 50 V	0281620008
C46	Capacitor, Fixed, 1000 PF	0286270005
C47	Capacitor, Cer., 0.1 UF, 20%, 50 V	0281610002
C48	Capacitor, Cer., 0.1 UF 20%, 50 V	0281610002
C50	Capacitor, Electrolytic, 1 UF, 35 V	0181660000
CR2	Diode, 1N4004	0405180004
CR3	Diode, 1N4004	0405180004
CR4	Diode, 1N4004	0405180004
CR5	Diode, 1N4004	0405180004
CR6	Diode, 1N4004	0405180004
CR7	Diode, 1N4004	0405180004
J1	Connector, 20 Pin	0753470004
J2	Connector, RF BNC, UG1094/U	0743740009
J3	Connector, RF JMC	0753620006
K1	Relay, 4 PDT, 12 V	0666640009
K2	Relay, 4 PDT, 12 V	0666640009
L4	Inductor, Fixed, 47 UF, 10%	0652680003
L5	Inductor, Fixed, 47 UH 10%	0646420003
L6	Inductor, Fixed, 47 UH 10%	0646420003
R10	Resistor, Carbon, 100 ohms 10%, 1/4 W	0171180003
R11	Resistor, Carbon, 27 ohms 10%, 1/4 W	0172590001
R12	Resistor, Carbon, 390 ohms 10%, 1/4 W	0178330001
S4	Switch, Motor Control	6028052809
S5	Switch, Micro W/Roller SPDT, 5A	0345560001
S6	Switch, Micro W/Roller SPDT, 5A	0345560001

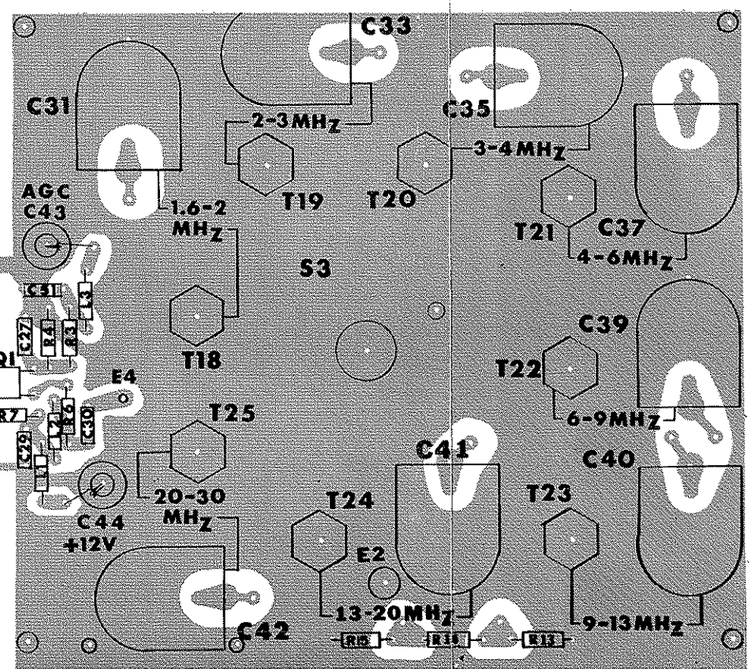
PARTS LIST, 1A5A2 Input Tuner Ass'y.

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C2	Capacitor, Mica, 250 PF, 500 V	0280900007
C3	Capacitor, Trimmer, 11-110 PF	0282880003
C6	Capacitor, Mica, 56 PF 2%, 500 V	0281290008
C7	Capacitor, Trimmer, 11-110 PF	0282880003
C10	Capacitor, Mica, 120 PF 2%, 500 V	0282880006
C11	Capacitor, Trimmer, 11-110 PF	0282880003
C14	Capacitor, Mica, 56 PF 2%, 500 V	0281290008
C15	Capacitor, Trimmer, 11-110 PF	0282880003
C18	Capacitor, Trimmer, 7-45 PF	0282890009
C20	Capacitor, Trimmer, 7-45 PF	0282890009
C22	Capacitor, Trimmer, 7-45 PF	0282890009
C24	Capacitor, Trimmer, 7-45 PF	0282890009
R2	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
S1	Switch, Wafer	6028052604
T1	Transformer, RF Band 1	6028051101
T3	Transformer, RF Band 2	6028051209
T5	Transformer, RF Band 3	6028051306
T7	Transformer, RF Band 4	6028051403
T8 ?	Transformer, RF Band 5	6028051501
T11	Transformer, RF Band 6	6028051608
T13	Transformer, RF Band 7	6028051705
T15	Transformer, RF Band 8	6028051802

PARTS LIST, 1A5A1 Amplifier Ass'y.

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C4	Capacitor, Trimmer, 11-110 PF	0282880003
C5	Capacitor, Mica, 150 PF 2% 500 V	0280900007
C8	Capacitor, Trimmer, 11-110 PF	0280880003
C9	Capacitor, Mica, 50 PF 2% 500 V	0281290008
C12	Capacitor, Trimmer, 11-1120 PF	0282880003
C13	Capacitor, Mica, 120 PF 2%, 500 V	0280880006
C16	Capacitor, Trimmer, 11-110 PF	0282880003
C17	Capacitor, Mica, 56 PF 2%, 500 V	0281290009
C19	Capacitor, Trimmer, 7-45 PF	0282890009
C21	Capacitor, Trimmer, 7-45 PF	0282890009
C23	Capacitor, Trimmer, 7-45 PF	0282890009
C25	Capacitor, Trimmer, 7-45 PF	0282890009
C26	Capacitor, Mica, 1000 PF 2%, 500 V	0281630003
C27	Capacitor, Ceramic, 0.91 UF, 35 V	0281620008
C28	Capacitor, Fixed Mono., 0.1 UF, 50 V	0281610002
C29	Capacitor, Fixed Mono., 0.1 UF, 50 V	0281610002
C30	Capacitor, Mica, 1000 PF 2%, 500 V	0281630003
C31	Capacitor, Trimmer, 11-110 PF	0282880003
C32	Capacitor, Mica, 150 PF 2%, 500 V	0280900007
C33	Capacitor, Trimmer, 11-110 PF	0282880003
C34	Capacitor, Mica, 5o PF 2%, 500 V	0281290008
C35	Capacitor, Trimmer, 11-110 PF	0282880003
C36	Capacitor, Mica, 120 PF 2%, 500 V	0280880003
C37	Capacitor, Trimmer, 11-110 PF	0280880003
C39	Capacitor, Mica, 56 PF 2%, 500 V	0281290008
C39	Capacitor, Trimmer, 7-45 PF	0282890009
C40	Capacitor, Trimmer, 7-45 PF	0282890009
C41	Capacitor, Trimmer, 7-45 PF	0282890009
C42	Capacitor, Trimmer, 7-45 PF	0282890009
C43	Capacitor, Feed-thru, 1000 PF	0286270005
C44	Capacitor, Feed-thru, 1000 PF	0286270005
C51	Capacitor, Ceramic, 0.01 UF, 35 V	0281620008
CR1	Diode, Zener, 3.6 V, 1N5227B	0405250[illegible]
E1	Connector, Feed-thru, Coax	0753690004
E2	Con., Feed-thru, Coax, Rt. Angle	0755120001
L1	Inductor, Fixed, 220 UH 10%	0650500008
L2	Inductor, Fixed, 220 UH 10%	0650500008
L3	Inductor, Fixed, 220 UH 10%	0650500008
R1	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R3	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R4	Resistor, Carbon, 10 K 10%, 1/4 W	0170410005
R6	Resistor, Carbon, 27 ohm, 10%, 1/4 W	0172590001
R7	Resistor, Carbon, 820 ohm 10%, 1/4 W	0178210005
R8	Resistor, Carbon 100 K, 10%, 1/4 W	0170390004
R9	Resistor, Carbon, 22 ohm, 10%, 1/4 W	0192690001
R13	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
R14	Resistpr. Carbpm. 22 ohm 10%, 1/4 W	0192690001
R15	Resistor, Carbon, 220 ohm 10%, 1/4 W	0171320000
S2	Switch, Wafer	6028052507
S3	Switch, Wafer	6028052701
T2	Transformer, RF Band 1	6028051101
T4	Transformer, RF Band 2	6028051209
T6	Transformer, RF Band 3	6028051306
T8	Transformer, RF Band 4	6028051403
T10	Transformer, RF Band 5	6028051501
T12	Transformer, RF Band 6	6028051608
T14	Transformer, RF Band 7	6028051705
T16	Transformer, RF Band 8	6028051802
T17	Transformer, RF Input	5024110706
T18	Transformer, RF Band 1	6028051101
T19	Transformer, RF Band 2	6028051209
T20	Transformer, RF Band 3	6028051306
T21	Transformer, RF Band 4	6028051403
T22	Transformer, RF Band 5	6028051501
T23	Transformer, RF Band 6	6028051608
T24	Transformer, RF Band 7	6028051705
T25	Transformer, RF Band 8	6028051802
Q1	Transistor, MPF-120	0497458000





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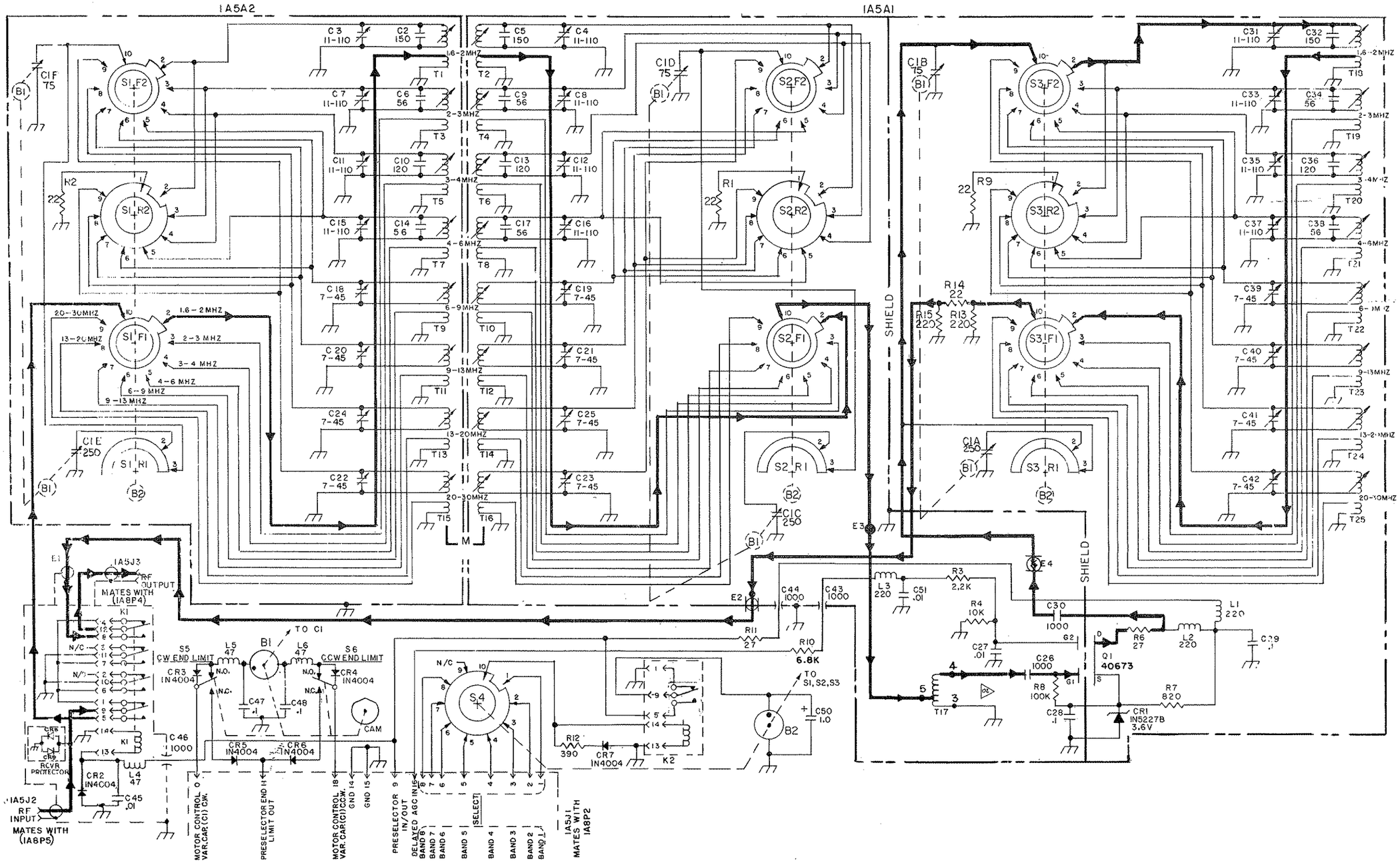
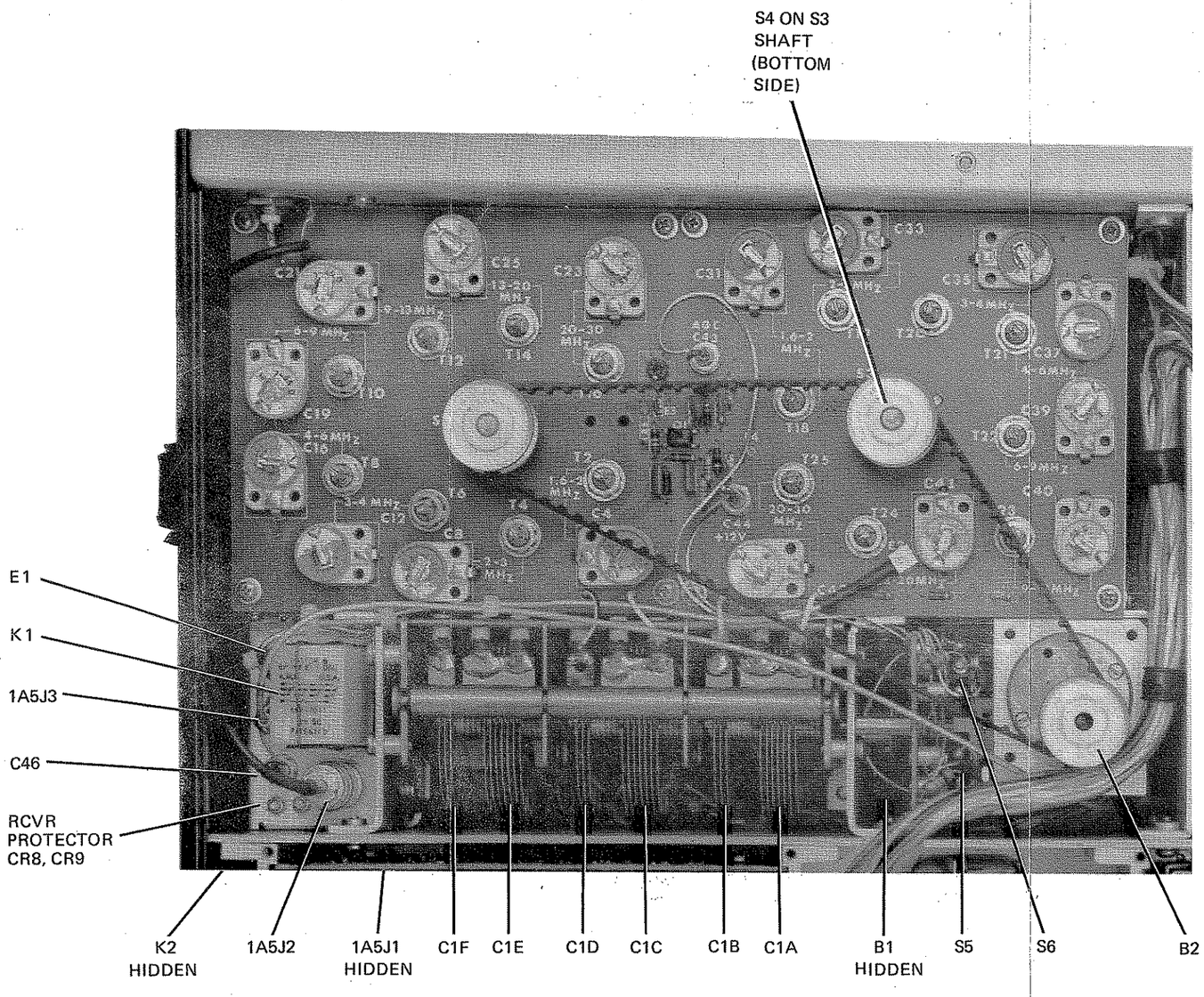


Figure 5.20 Preselector Schematic



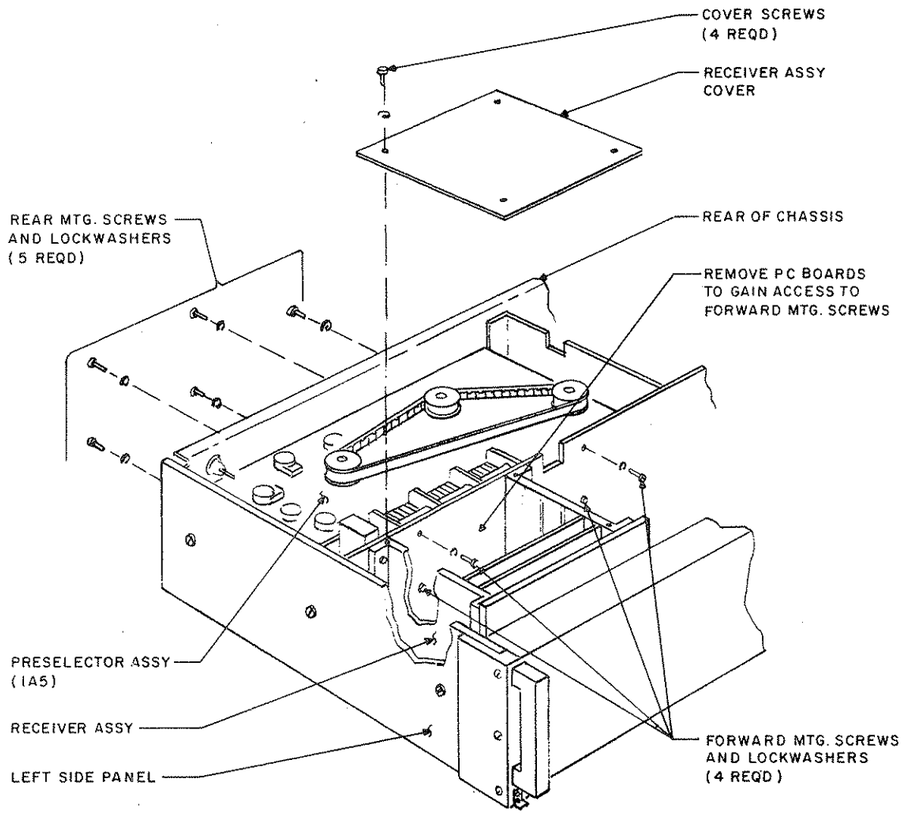


Figure 5.21 Preselector Mechanical

PARTS LIST, 1A1 Front Panel 6028040053W

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
CR1	Diode, Rectifier, G.P., 1N4004	0405180004
CR2	Diode, Signal, G.P., 1N4454	0405270003
CR5	Diode, Signal, G.P., 1N4454	0405270003
DS1	Lamp Ass'y, 14 V Red	0804740000
DS2	Lamp Ass'y, 14 V Clear	0804720009
DS3	Lamp Ass'y, 14 V Clear	0840720009
DS4	Lamp Ass'y, 14 V Clear	0804072009
DS5	Lamp Ass'y, 14 V Amber	0840870001
1A1J1	Lamp Ass'y, 6 Pin conn PC 12 pin	0755500008
J2	Jack, 2 Wire Phone	0840850000
	Cover, Waterproof Phone-jack	0840860005
P1	Connector, 36 Pin	0754070000
P3	Connector, 15 Pin	0753340003
R1	Resistor, Prec., 604 ohms 1%, 1/8 W	0193980002
R2	Resistor, Prec., 422 ohms 1%, 1/8 W	0194030008
R3	Resistor, Prec., 422 ohms, 1/8 W, 1%	0194030008
R4	Resistor, Prec., 301 ohms 1%, 1/8 W	0194150003
R5	Resistor, Prec., 340 ohms 1%, 1/8 W	0194910008
R6	Resistor, Prec., 100 ohms 1%, 1/8 W	0194890007
R7	Resistor, Prec., 200 ohms 1%, 1/8 W	0194270009
R8	Resistor, Prec., 100 ohms 1%, 1/8 W	0194890007
R9	Resistor, Prec., 200 ohms 1%, 1/8 W	0194270009
R10	Resistor, Prec., 140 ohms 1%, 1/8 W	0194390004
R11	Resistor, Prec., 140 ohms 1%, 1/8 W	0194390004
R12	Resistor, Prec., 866 ohms 1%, 1/8 W	0195440005
R13	Resistor, Prec., 140 ohms 1%, 1/8 W	0194390004
R14	Resistor, Prec., 121 ohms 1%, 1/8 W	0195320000
R15	Resistor, Prec., 100 ohms 1%, 1/8 W	0194890007
R16	Resistor, Prec., 715 ohms 1%, 1/8 W	0195060008
R17	Resistor, Prec., 60.4 ohms 1%, 1/8 W	0195180003
R18	Resistor, Prec., 100 ohms 1%, 1/8 W	0194890007
R19	Resistor, Prec., 60.4 ohms 1%, 1/8 W	0195180003
R20	Resistor, Prec., 80.6 ohms 1%, 1/8 W	0195200004
R21	Resistor, Prec., 80.6 ohms 1%, 1/8 W	0195200004
R22	Resistor, Prec., 80.6 ohms 1%, 1/8 W	0195200004
R23	Resistor, Prec., 10 ohms 1%, 1/8 W	0163220000
R24	Resistor, Prec., 10 ohms 1%, 1/8 W	0163220000
R25	Rheostat, 100 ohms, 12 1/2 W	0346090008
R26	Potentiometer, 5 K Log Tapes	0346020000
R27	Potentiometer, 5 K Linear W/P-P SW	5024043804
R28	Resistor, Carbon, 2.7 K 10% 1/4 W	0186670001
R29	Potentiometer, 5 K Log Tapes	0346020000
R30	Resistor, Carbon, 33 ohms 10%, 1/4 W	0186670001
R31	Resistor, Carbon, 3.9 K 10%, 1/4 W	0178830003
R32	Resistor, Carbon, 47 ohms 10%, 2W	0163720002
S1	Switch, 10 MHz	5024041101
S2	Switch, 1 MHz	5024041208
S3	Switch, 100 kHz	5024041305
S4	Switch, 10 kHz	5024041402
S5	Switch, 1 kHz & ~~100 Hz~~	5024041500
S6	Switch, ~~1 KHz~~ & 100 Hz	5024041500
S8	Switch, Speaker	6028040902
S9	Switch, Toggle, DPST, Power	0346430003
T1	Trans., Audio, 2500 ohms:2500 ohms	0491640005
	MISCELLANEOUS MECHANICAL PARTS	
	Knob, Frequency	0346040001
	Knob, VFO	0346050006
	Knob, Volume, RF Speaker	0346060001
	Knob, Dimmer	0346070007
	Boot, Toggle Switch	0346450004
	Speaker, Waterproof, 8 ohm	0877970009
TB1	Terminal	0536550008
TB2	Terminal	0996700102
TB3	Terminal	0996700081
TB4	Terminal	0996700048
1A1A1	Spkr Driver	5024041798

To be completed

S6028-0400B
6028040011C

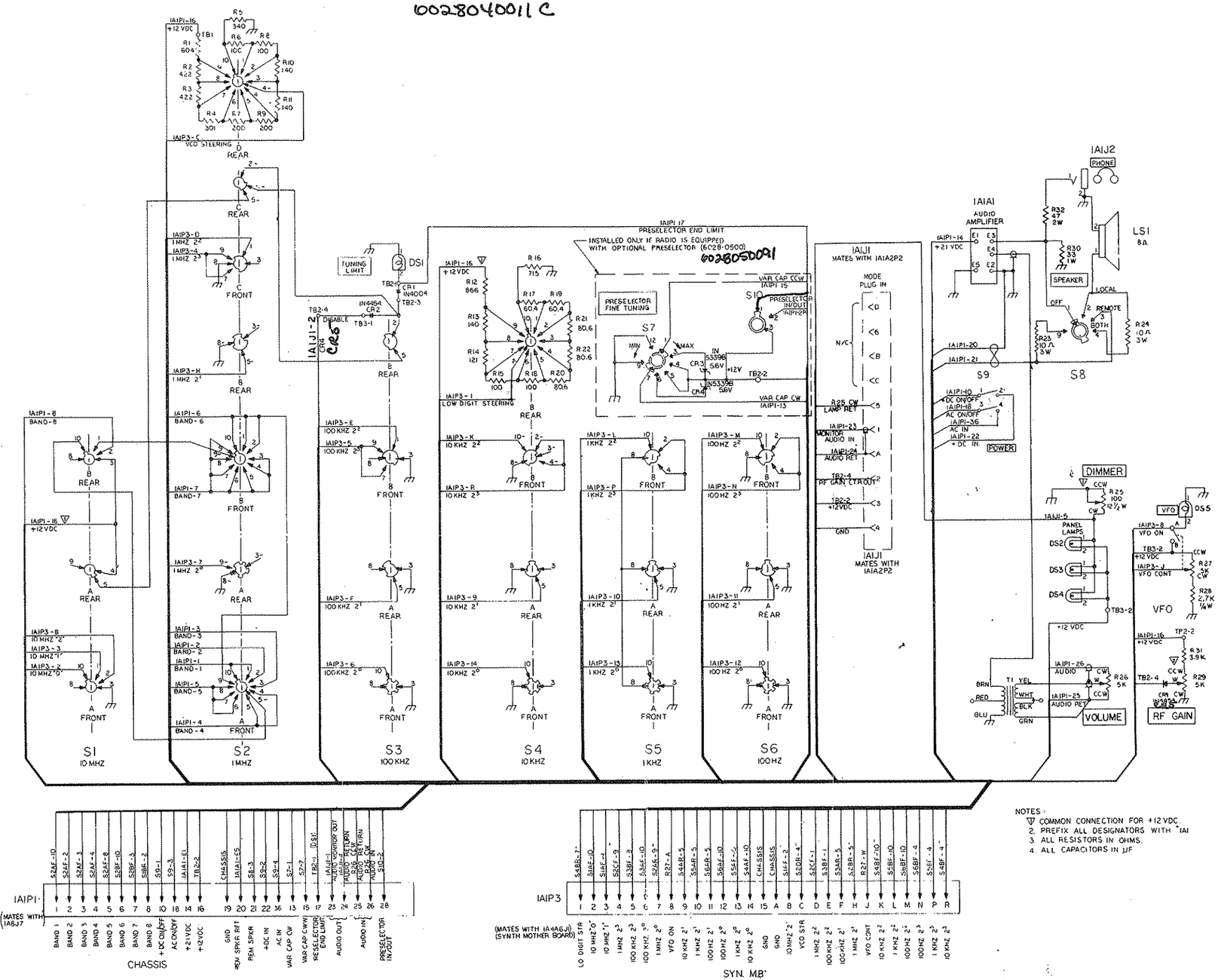


Figure 5.22 Front Panel Wiring Diagram

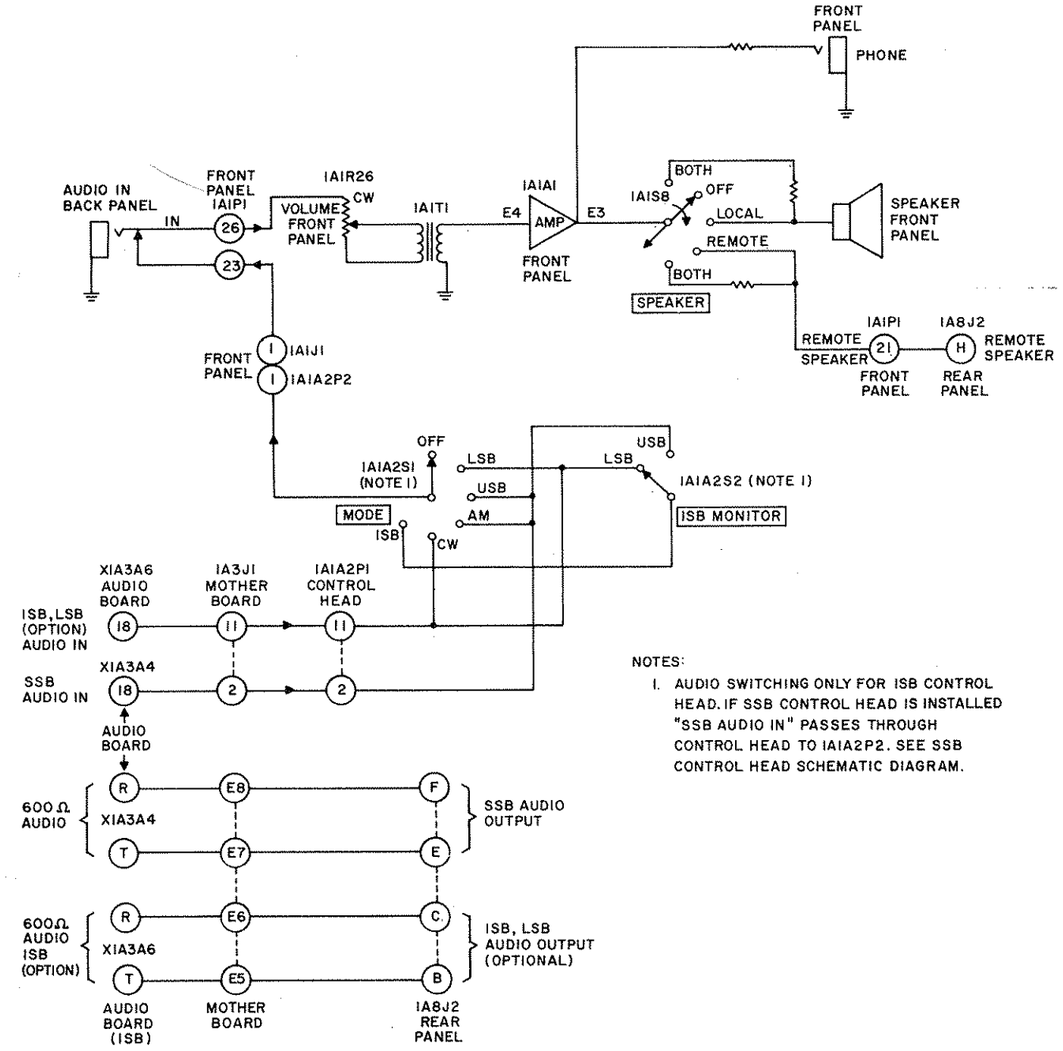


Figure 5.23 Audio System Wiring Diagram

S602804I5B

PARTS LIST, 1A1A2 SSB Control Head 602804155bG

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
M1	Meter, Waterproof	5024042204
P1	Connector, 15 Pin	0753340003
P2	Connector, 6 Pin, P. C. Card	6028041203
S1	Switch, Mode	6028041602
	Knob, Mode	0346060001

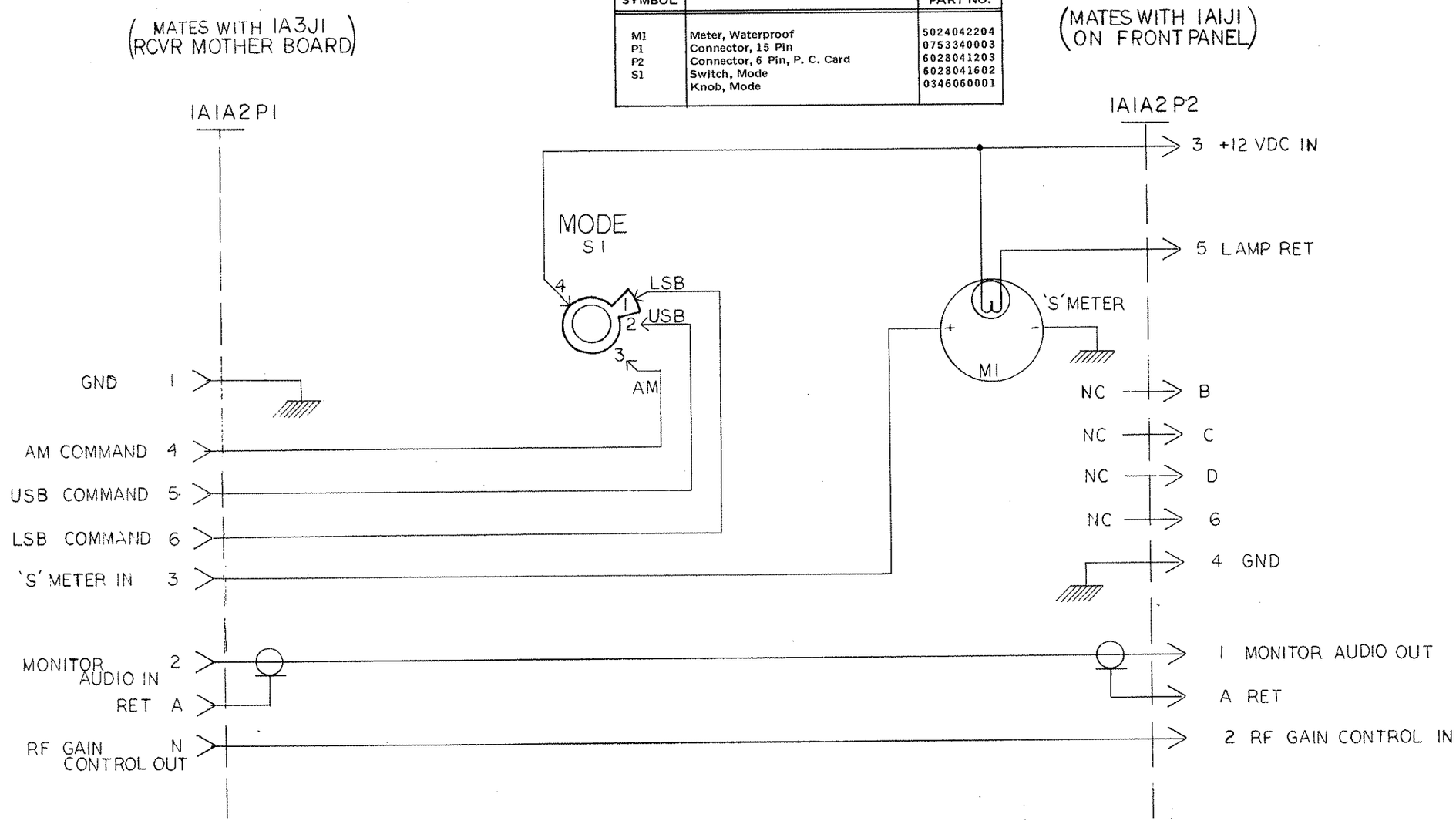
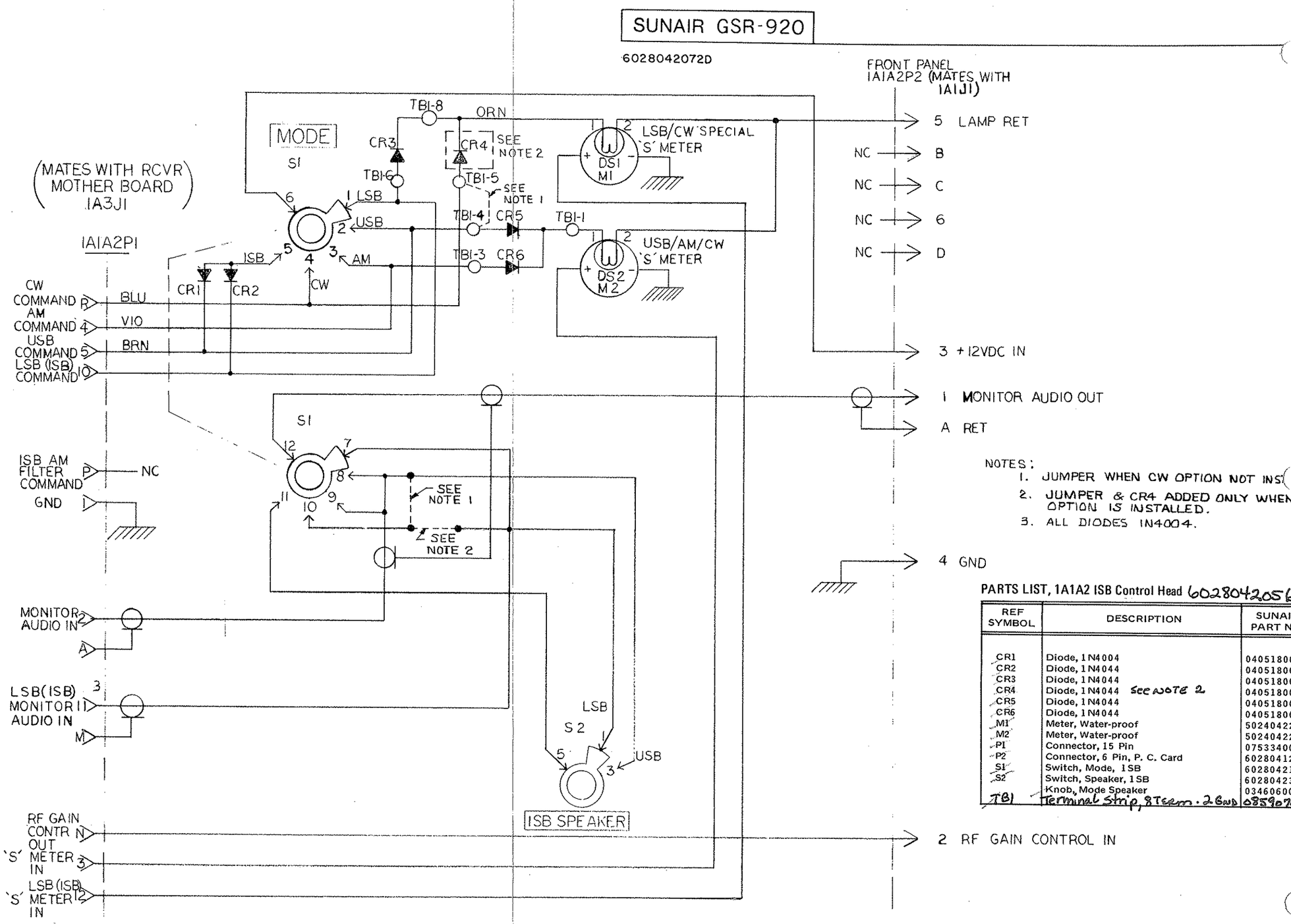


Figure 5.24 Control Head, SSB, Schematic

SUNAIR GSR-920

6028042072D



NOTES:

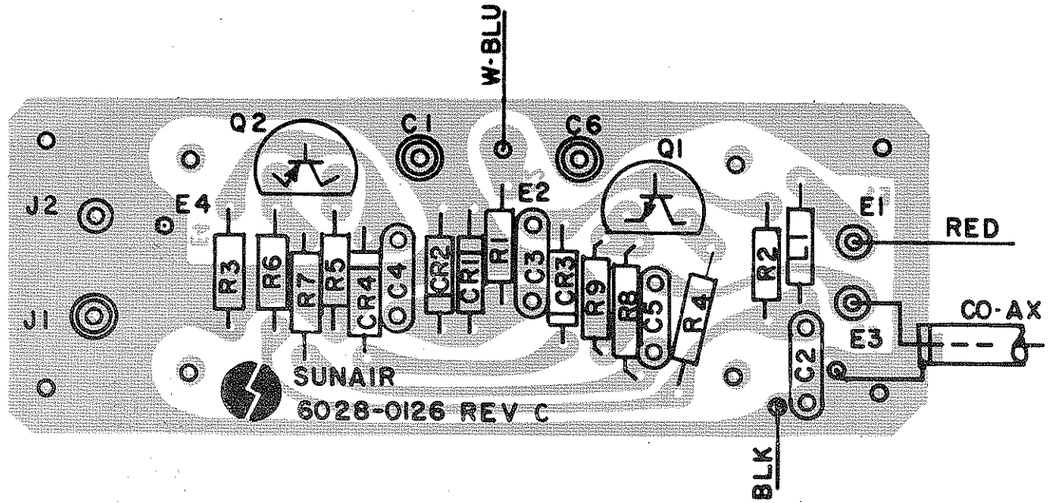
1. JUMPER WHEN CW OPTION NOT INSTALLED.
2. JUMPER & CR4 ADDED ONLY WHEN CW OPTION IS INSTALLED.
3. ALL DIODES IN4004.

PARTS LIST, 1A1A2 ISB Control Head 6028042056K

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
CR1	Diode, 1N4004	0405180004
CR2	Diode, 1N4044	0405180004
CR3	Diode, 1N4044	0405180004
CR4	Diode, 1N4044 see note 2	0405180004
CR5	Diode, 1N4044	0405180004
CR6	Diode, 1N4044	0405180004
M1	Meter, Water-proof	5024042204
M2	Meter, Water-proof	5024042204
P1	Connector, 15 Pin	0753340003
P2	Connector, 6 Pin, P. C. Card	6028041203
S1	Switch, Mode, 1SB	6028042102
S2	Switch, Speaker, 1SB	6028042307
	Knob, Mode Speaker	0346060001
TB1	Terminal Strip, 8Term. 2Gnd	0859070009

Figure 5.25 Control Head, ISB Schematic

S6028-0125A



PARTS LIST, 1A8A1 6028012092 F

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C1	Capacitor, Ceramic, 1500 PF, 500V X5U	0281760004
C2	Capacitor, Ceramic, 0.1 MF 20%, 50 V	0281610002
C3	Capacitor, Ceramic, 0.01 MF 20%, 50 V	0281620008
C4	Capacitor, Ceramic, 0.01 MF 20%, 50 V	0281620008
C5	Capacitor, Ceramic, 0.01 MF 20%, 50 V	0281620008
C6	Capacitor, Ceramic, 1500 PF, 500V X5U	0281760004
CR1	Diode, Signal, 1N4454	0405270003
CR2	Diode, Signal, 1N4454	0405270003
CR3	Diode, Signal, 1N4454	0405270003
CR4	Diode, Signal, 1N4454	0405270003
J1	Connector, RF Bulkhead, Female	0755480007 (0754780001)
J2	Connector, RF Bulkhead, Male	0753670003
L1	Inductor, Fixed, 47 UF 10%	0652680003
L2	Inductor, Fixed, 47 UF 5%	0652680003
L3	Inductor, Fixed, 47 UF 5%	0652680003
Q1	Transistor, 2N4124	0448010003
Q2	Transistor, 2N4126	0448020009
R1	Resistor, Carbon, 47 ohm 10%, 1/4 W	0173960001
R2	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R3	Resistor, Carbon, 1.8 K 10%, 1/4 W	0178190004
R4	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R5	Resistor, Carbon, 22 ohm 10%, 1/4 W	0192690001
R6	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R7	Resistor, Carbon, 10 ohm 10%, 1/4 W	0177160004
R8	Resistor, Carbon, 10 ohm 10%, 1/4 W	0177160004
R9	Resistor, Carbon, 2.2 K 10%, 1/4 W	0178070009
R10	Resistor, Carbon, 56 ohms 10%, 1/4 W	0174290004
S1	Switch, Freq., Standard Select	6028012301
	Connector, RF, BNC, UG-1094/U	0743740009

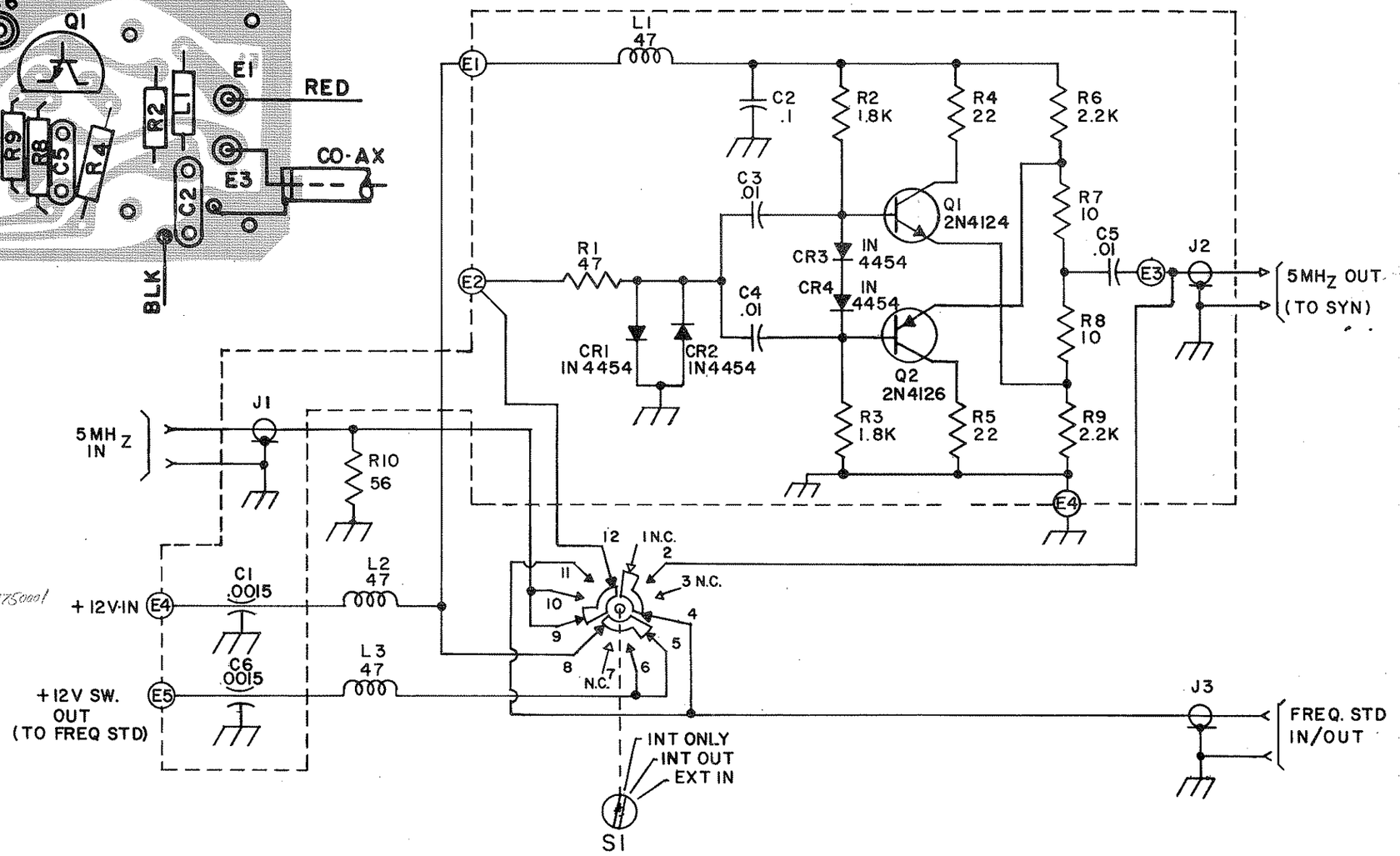


Figure 5.26 Distribution Amplifier Schematic

PARTS LIST, Remote Speaker

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
J1	Connector, 10 Pin, Female	0753990008
LS1	Speaker, 8 ohms, Waterproof	0877970009
R1	L-Pad, 8 ohms	6028851892

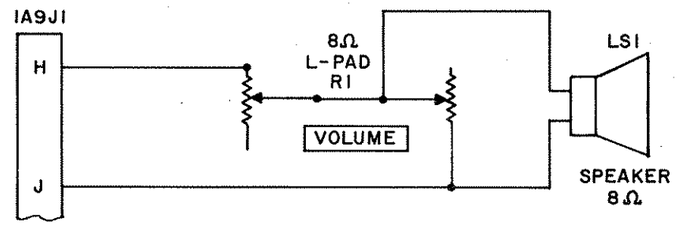


Figure 5.27 GRS-902 Remote Speaker Schematic