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sunair electronics, inc.

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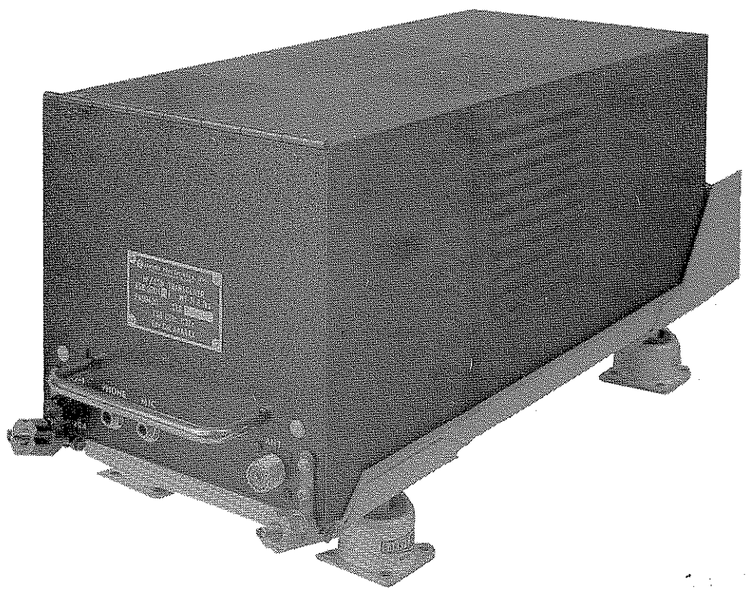

Maintenance Manual

SSB COMMUNICATIONS EQUIPMENT

ASB-320

1st Edition, 15 October 1971
Serial No. 150 and Subsequent
Manual Part Number 99422

WARRANTY POLICY

AVIONICS DIVISION

Sunair Electronics warrants each equipment manufactured by it to be free from defects in material or workmanship, under normal use for which intended, for one (1) year from date of installation. Sunair will hereunder replace or repair (at Sunair's discretion) any defective components (EXCLUDING TUBES AND SEMI-CONDUCTORS).

Any such defective equipment (or component) shall be returned, transportation charges prepaid, to Sunair or to a Sunair authorized warranty station. Provided that the failure is within the terms of this warranty and is not due to damage, misuse, improper installation or unauthorized modification or repair, Sunair will, in addition to replacing component parts within specified periods, also assume warranty labor costs for ninety (90) days from date of original installation. Any such charges must be reasonable and for actual bench repair only and limited to a maximum of four (4) hours. Labor not directly related to correcting the defective condition cannot be honored.

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

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

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SECTION I

GENERAL INFORMATION

A. INTRODUCTION

The Sunair ASB-320 HF transceiver is a light-weight airborne, 20 channel, single sideband (SSB) and compatible amplitude modulated (AM), transmitting-receiving system for long range voice communications in the 2 to 18 MHz frequency range. The system consists of a remote mounted receiver/exciter and power amplifier/power supply and a panel mounted control head.

B. SPECIFICATIONS FOR ASB-320 HF TRANSCEIVER:

Type Accepted under FCC Rules and Regulations, Parts 83 and 87.

TSO'd under FAA Rules and Regulations Part 37, C31c & C32c; Environmental Category AAAAAX.

Frequency Range	2 to 18 MHz (No channel frequency restrictions).
Number of Channels	20 channels single frequency simplex with up to 10 channels double frequency simplex.
Channeling Time	Two seconds maximum.
Modes of Operation	Compatible AM USB LSB TEL (Public Correspondence)
Input Power - Receive	3.0 amps at 28 volts (ovens on)
Transmit	15 amps at 28 volts (Peak-Full Modulation)
TRANSMITTER:	
Output Power	130 watts PEP nominal
Frequency Stability	± 20 Hz

Sidetone	Adjustable to 100mw into 500 ohms
Duty Cycle	50%
Output Impedance	50 ohms
RECEIVER:	
Input Impedance	50 ohms
Frequency Stability	Single Frequency Simplex ±20 Hz Dual Frequency Simplex ±.0025%
Clarifier	Adjusts carrier oscillator for voice clarity ±100 Hz range.
Selectivity	AM: 5.5 kHz NMT 6 db 20.0 kHz NLT 60 db SSB: fc +350 Hz and fc +2500 Hz NMT 6 db fc -2150 Hz and fc +5000 Hz NLT 60 db
Sensitivity	AM: NMT 2.0 uv for 6 db (S+N)/N SSB: NMT 0.7 uv for 10 db (S+N)/N
AGC	NMT 10 db change for 10 uv to 500,000 uv input (open circuit)
Audio Output	100mw into 500 ohms 100mw into 125 ohms
Audio Response	NMT 6 db from 350 Hz to 2500 Hz
Audio Distortion	AM: NMT 20% at rated output SSB: Third order 25 db below output
Spurious Response	NLT 60 db from .190 MHz to 150 MHz

C. EQUIPMENT SUPPLIED

		Sunair Part No.	Weight
Transceiver	ASB-320	99420	19.0 Lb.

		Sunair Part No.	Weight
Control Head	MCU-20 For use with CU-2200 Coupler	99695	0.7 Lb.
	MCU-20 For use with SAC-69 Coupler	99696	0.7 Lb.
Shock Rack For	ASB-320	99421	2.8 Lb.
Connector Kit For	MCU-20	99828	- - -
Connector RF		90273	- - -
Manual		99422	- - -

D. EQUIPMENT REQUIRED BUT NOT SUPPLIED:

			Sunair Part No.	Weight
*Antenna Coupler w/Connectors	CU-2200 (20 channel)		95249	8.75 Lb.
	Or SAC-69 (Automatic)		99474	17.0 Lb.
**Fixed Wire Antenna Kit	Bare Wire Antenna		95146	
	Or Anti-Precipitation Antenna		95158	
Electrical Reel Trailing Wire Antenna	ER-28	28V	96932	14.0 Lb.
Microphone, Shure Model	488T		87151	0.75 Lb.

Installation Cables - Custom Made

* Requires Fixed Wire Antenna.

** Requires Antenna Coupler.

E. OPTIONAL EQUIPMENT (Not Supplied)

	Sunair Part No.	Weight
1 Coax. Relay Kit, 28V	98693	0.4 Lb.
1 Switch, DPDT to operate Coax. Relay	32118	- - -
1 Test Set, Less Cable	97818	- - -
1 Test Set Cable	99522	- - -

F. SYSTEM DESCRIPTION

1. ASB-320 Transceiver

The receiver/exciter is a compact solid-state campatible AM and single sideband receiver and exciter unit. This unit has an operating frequency range between 2 and 18 MHz.

The power amplifier/power supply section contains the RF driver amplifier, the RF power amplifier and the power supply. The power amplifier amplifies the RF signals from the exciter and delivers the RF power to the antenna system from a 50 ohm output.

The ASB-320 is remote operated and may be mounted in any convenient space. Channeling is accomplished by means of a rotary solenoid. Vibration and shock isolation are provided by the shockmount.

2. MCU-20 Control Head

The miniature control head MCU-20 is the standard control head.

Control Head Functions:

a) ON/OFF VOLUME. This control activates the power relay in the power amplifier/power supply and controls the audio gain of the receiver.

b) CHANNEL SELECTOR. Selects the proper transmitter and receiver circuitry in the receiver/exciter, power amplifier/power supply and the antenna load unit.

c) MODE. This control selects the desired mode of operation. Modes available are USB, AM, TEL and LSB (optional).

d) CLARIFIER. The clarifier adjusts the pitch of the receiver single sideband signal for optimum clarity by varying the carrier oscillator frequency.

e) SQUELCH. The squelch control disables the receiver audio and sets the threshold of signal required for reception.

3. Accessories

The ASB-320 HF transceiver can be used with either a fixed antenna system or a trailing wire antenna. A fixed antenna system includes a fixed antenna, either bare or antiprecipitation type, with an antenna coupler either automatic tuned or pretuned to the antenna. A trailing wire antenna, either manual or electrical, may be installed in place of the coupler and fixed antenna, or may be included as a back-up antenna with a coax change-over relay.

SECTION II

INSTALLATION

A. UNPACKING

Adherence to the suggestions and instructions contained in this section will assure an easier and more satisfactory installation of the ASB-320 transceiver.

Unpack and inspect all parts and equipment as soon as received. 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 if 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, arrangement will be made for repair or replacement.

B. INSTALLATION CONSIDERATIONS AND MOUNTING INFORMATION

The location and installation of the ASB-320 transceiver will depend on the type of aircraft in which the equipment is to be installed. However, the following general requirements, applicable to all types of aircraft, should be considered when planning the installation.

1. Type and Location of Antenna to be Installed

It is recommended that a fixed grounded antenna with a SAC-69 automatic antenna coupler be installed as the primary antenna system. If this is not desirable, or a secondary, or back-up system is required, than a CU-2200 antenna coupler with an ungrounded antenna or a trailing wire antenna may be installed. If a CU-2200 antenna coupler is installed it is recommended that it be placed where it is accessible while in flight, if possible, to allow repeaking if the antenna system detunes while in flight. Refer to the proper coupler manual for mounting information.

2. Factors to consider before selecting and installing an antenna.

a) Recommended type and length

Refer to proper antenna coupler manual (SAC-69 or CU-2200) for recommended antenna configuration and installation.

b) Location of the antenna coupler

The antenna coupler should be located within 12 inches of the feed-through insulator.

c) Antenna Wire

Antenna wire should be one of the following two types:

1) Copperweld (#18 bare) with a tensile strength of 150 pounds.

2) Anti-precipitation static wire with a tensile strength of 250 pounds.

3. Installation Considerations of the Control Head

The Control Head should be installed on the instrument panel in a location that permits the controls to be easily read and comfortably reached. Consult the mounting outline dimensions, shown in Figure II-1, for the space required.

4. Installation Consideration for the ASB-320 Transceiver

The ASB-320 transceiver should be located so that it is accessible for inspection and maintenance, and in an area that is free from excessive vibration and heat. Installation dimensions are shown in Figure II-2.

5. Static Dischargers

It is recommended that static dischargers be installed on the aircraft. Consult the aircraft manufacturer for type and location.

6. Microphone

A noise cancelling, transistorized microphone, Shure Model No. 488T, or equivalent, is recommended for use with the ASB-320.

C. INSTALLATION INSTRUCTIONS

1. Installation of the Control Head

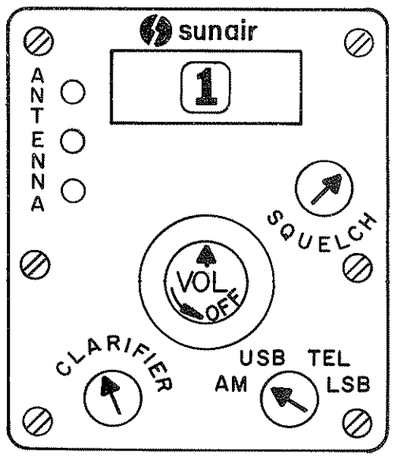
The control head should be mounted within convenient view and reach of the operator.

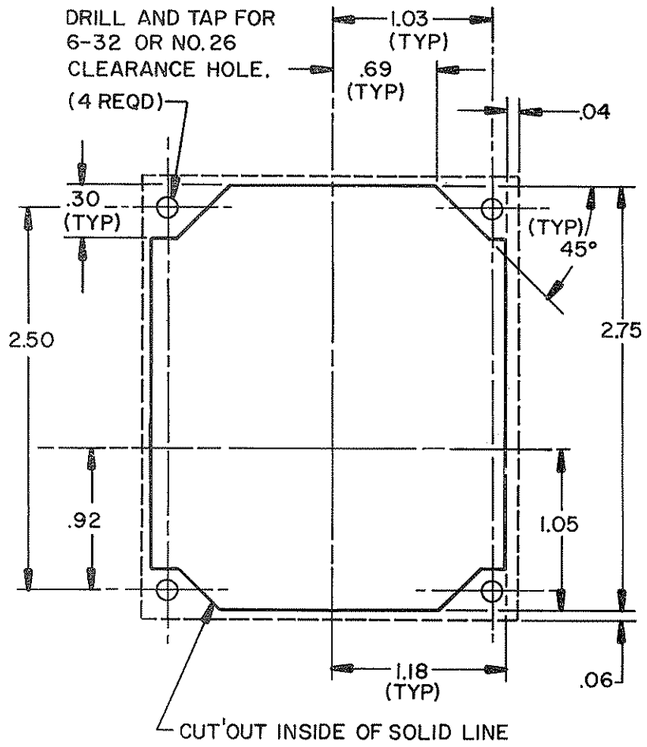
a) MCU-20

Installation dimensions for the MCU-20 control head are shown in Figure II-1. The MCU-20 is designed for use in a cockpit where space is a critical factor and/or to match the other heads of the same type.

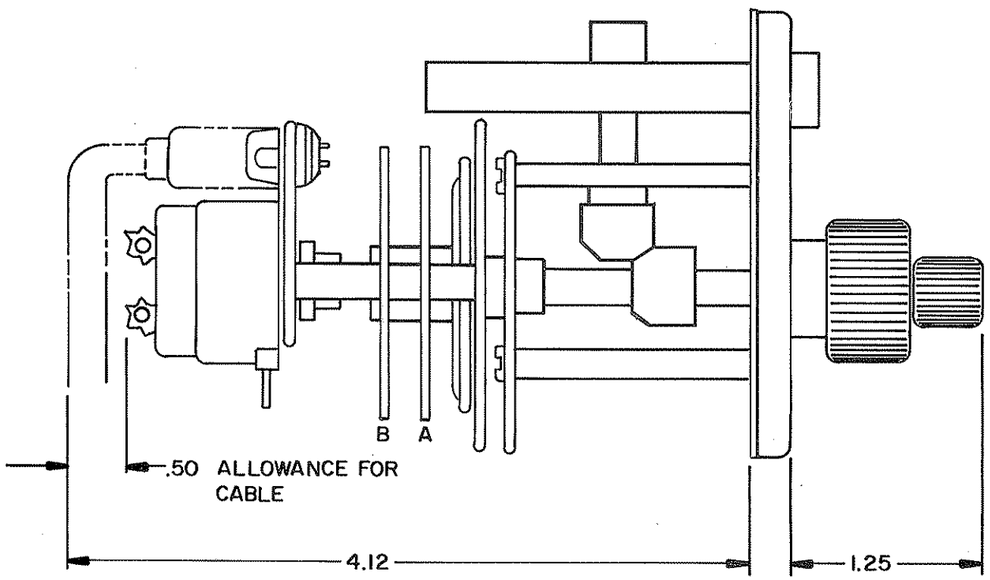
2. Installation of the ASB-320

Installation dimensions for the ASB-320 transceiver are shown in Figure II-2.





PANEL CUT'OUT



DEPTH OF CONTROL HEAD

FIGURE II-1
INSTALLATION DIMENSIONS, MCU-20 CONTROL HEAD

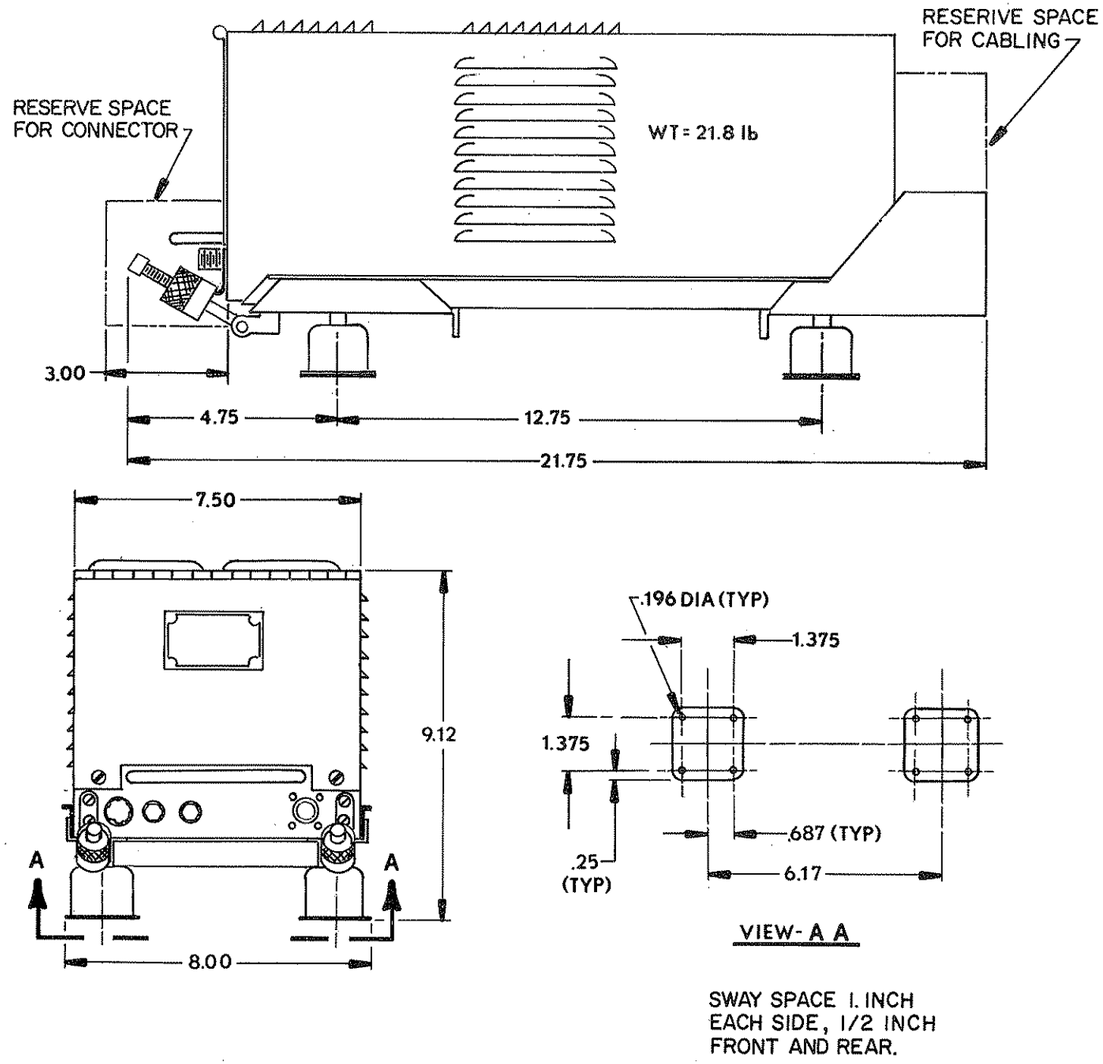


FIGURE II–2

INSTALLATION DIMENSIONS, ASB-320 TRANSCEIVER

3. Installation of Antenna Coupler

Refer to proper Antenna Coupler Manual for installation and tuning procedures.

D. INTERCONNECTING WIRING

The installation cables should be fabricated according to the interconnecting wiring diagram, Figure II-3 or II-4. The connectors required for the cables are supplied, but individual wires are not. The length of the installation cable will depend on the location of the equipment in the aircraft. Cables should be arranged so that shockmount travel is not restricted. Sharp bends should be avoided in all of the cables.

Factory fabricated installation cables are available. If these are desired, the following information must be furnished when ordering:

1. Cable length from the control head (MCU-20) to the transceiver (ASB-320).

2. If the antenna installation is to be:

   a) Fixed antenna ONLY - cable length from ASB-320 to antenna coupler and from control head to antenna coupler.

   b) Trailing wire antenna ONLY - cable length from ASB-320 to trailing wire antenna and cable length from electric reel control box to electric reel assembly.

   c) BOTH fixed antenna and trailing wire antenna - cable length from ASB-320 to coax relay and cable length from coax relay to antenna coupler and to trailing wire antenna. Also, cable length from the electric reel control box to electric reel assembly and from the control head to the antenna coupler.

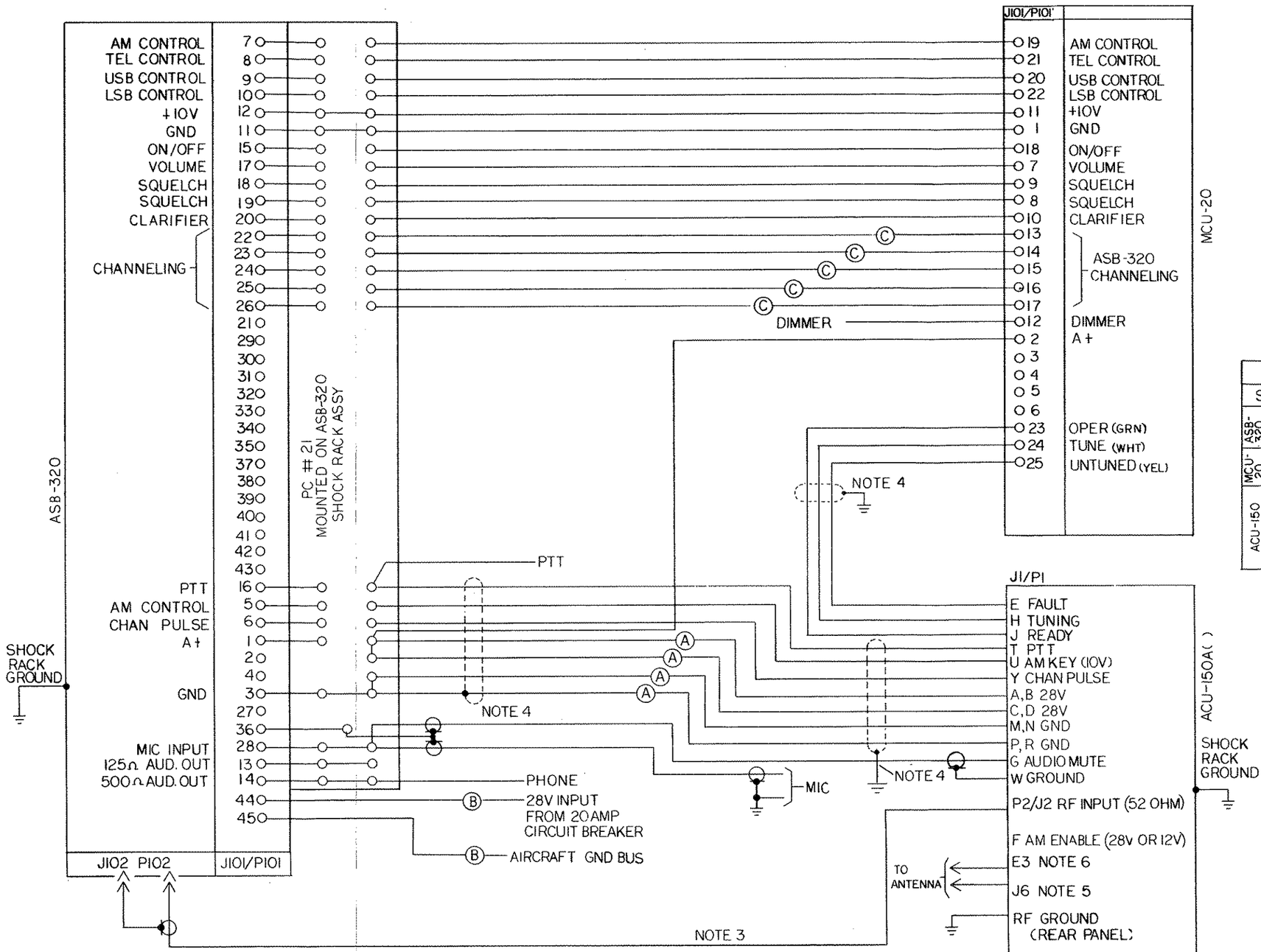
E. CHECKS AND ADJUSTMENTS AFTER INSTALLATION

1. Apply ground power to the aircraft and check for proper voltage 27.5 volts DC.

2. Turn the HF transceiver system on.

3. Channeling

Check the channeling of the ASB-320 and antenna coupler by listening to the channeling of the units while the channel selector is slowly turned down 1 to 20 and then from 20 to 1, or by visual inspection of the ASB-320 and antenna coupler wafer switches as the channel selector is turned.



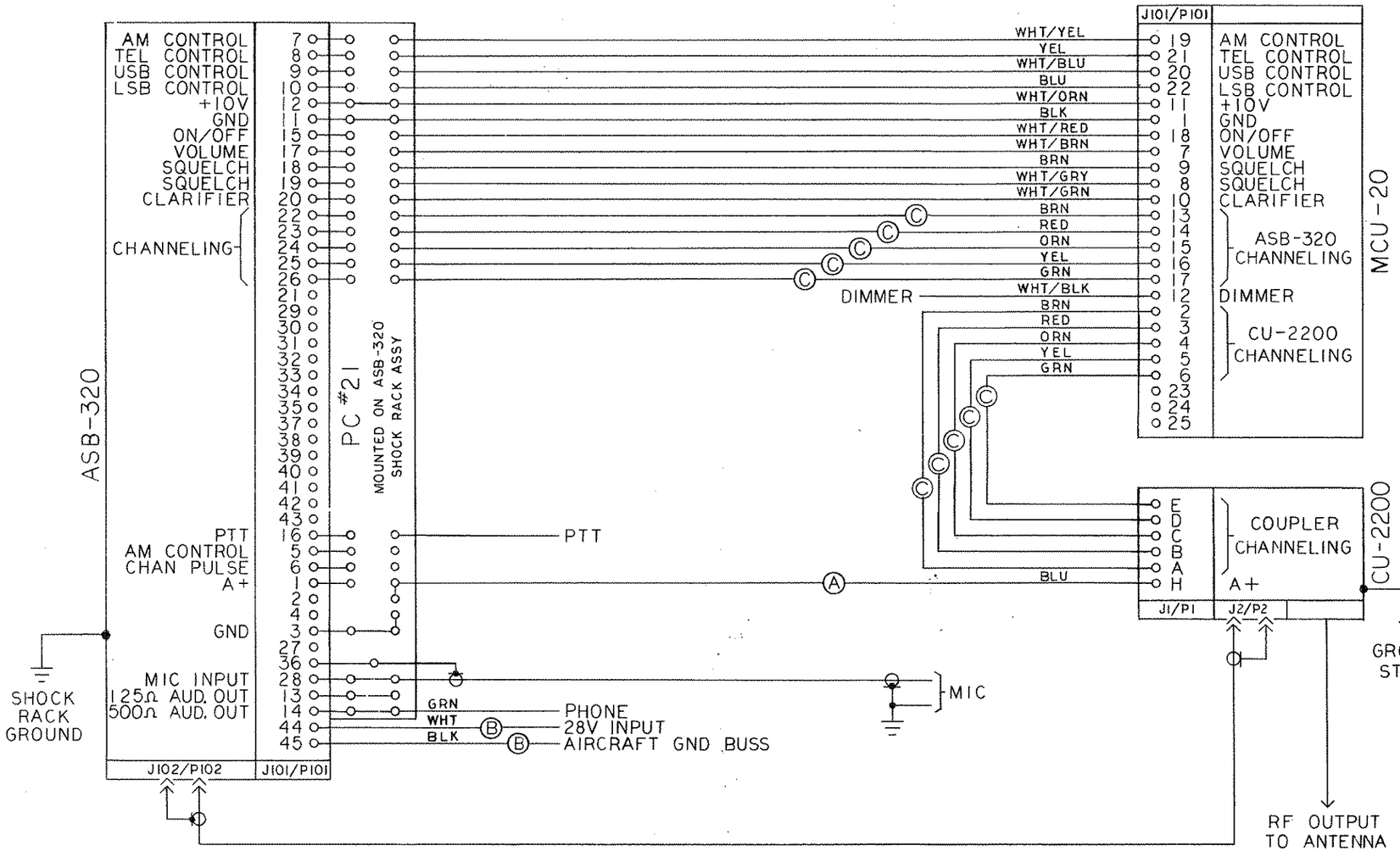
SIZE	LENGTH	SIZE AWG
A	UP TO 12FT	2#20
	12FT TO 20FT	2#20
	20FT TO 31FT	4#20
	MORE THAN 31FT	4#20
B	UP TO 10FT	#16
	10FT TO 18FT	#14
	18FT TO 35FT	#12
C	ALL LENGTHS	#20

ACU-150 ACCEPTS #20 MAX
A B C &D +28V
M,N,P& R GROUND

CONNECTORS			REDUCING ADAPTER	CABLE CLAMP	TYPE
SYM		PART NO.	PART NO.	PART NO.	
ASB-320	P101	0740130005			45 PIN VHF PL-259
	P102	0742190005	0742070000		
MCU-20	P101	0998280003			25 PIN
ACU-150	J1	0754470008	1001250001	0740250001	26 PIN UHF PL-259 HN UG59A/U (MALE)
	P2	0742190005	0742070000		
	P6	0753160005			

NOTES:
1. UNLESS OTHERWISE INDICATED WIRES (INCLUDING SHIELDED) SHOULD BE AWG #24 OR LARGER.
2. ALL SHIELDED WIRE INSULATED TYPE.
3. COAX CABLE RG-58A/U.
4. ALL WIRES COMING FROM ACU-150 ( ) P1 MUST BE SHIELDED AND THE SHIELD GROUNDED TO AIRCRAFT GROUND ON BOTH ENDS.
5. THE LENGTH OF COAX FROM J6 TO THE ANTENNA FEED-THRU GENERALLY SHOULD BE AS SHORT AS POSSIBLE FOR BEST EFFICIENCY AND THE LEAST RADIATION INSIDE THE AIRCARFT. COAX SHOULD BE RG8/U, RG213/U, OR RG214/U.
6. FEED WIRE TO ANTENNA FEEDTHRU SHOULD BE AS SHORT AS POSSIBLE FOR BEST EFFICIENCY AND THE LEAST RADIATION INSIDE THE AIRCRAFT.

Figure 2.11 Interconnect Diagram, ASB-320/ACU-150A ( ) System



SIZE	LENGTH	SIZE AWG
A	LESS THAN 12FT	#20
	MORE THAN 12FT LESS THAN 20FT	#18
	MORE THAN 20FT LESS THAN 31FT	#16
	MORE THAN 31FT	#14
B	LESS THAN 10FT	#16
	MORE THAN 10FT LESS THAN 18FT	#14
	MORE THAN 18FT LESS THAN 35FT	#12
C	ALL LENGTHS	#20

SYM		TYPE	PART NO.
ASB-320	P101	45 PIN CONNECTOR	74013
	P102	"UHF", TYPE PL-259	90873
MCU-20	P101	25 PIN CONNECTOR	99828
CU-2200	P1	AMPHENOL No. 165-10	74362
	P2	COAXIAL PLUG, TYPE "UHF"	90873

INTERCONNECT DIAGRAM

ASB-320/CU-2200 SYSTEM

NOTES:

1. UNLESS OTHERWISE INDICATED WIRES (INCLUDING SHIELDED) SHOULD BE AWG #24 OR LARGER.
2. ALL SHIELDED WIRE INSULATED TYPE.
3. COAX CABLE RG-58A/U

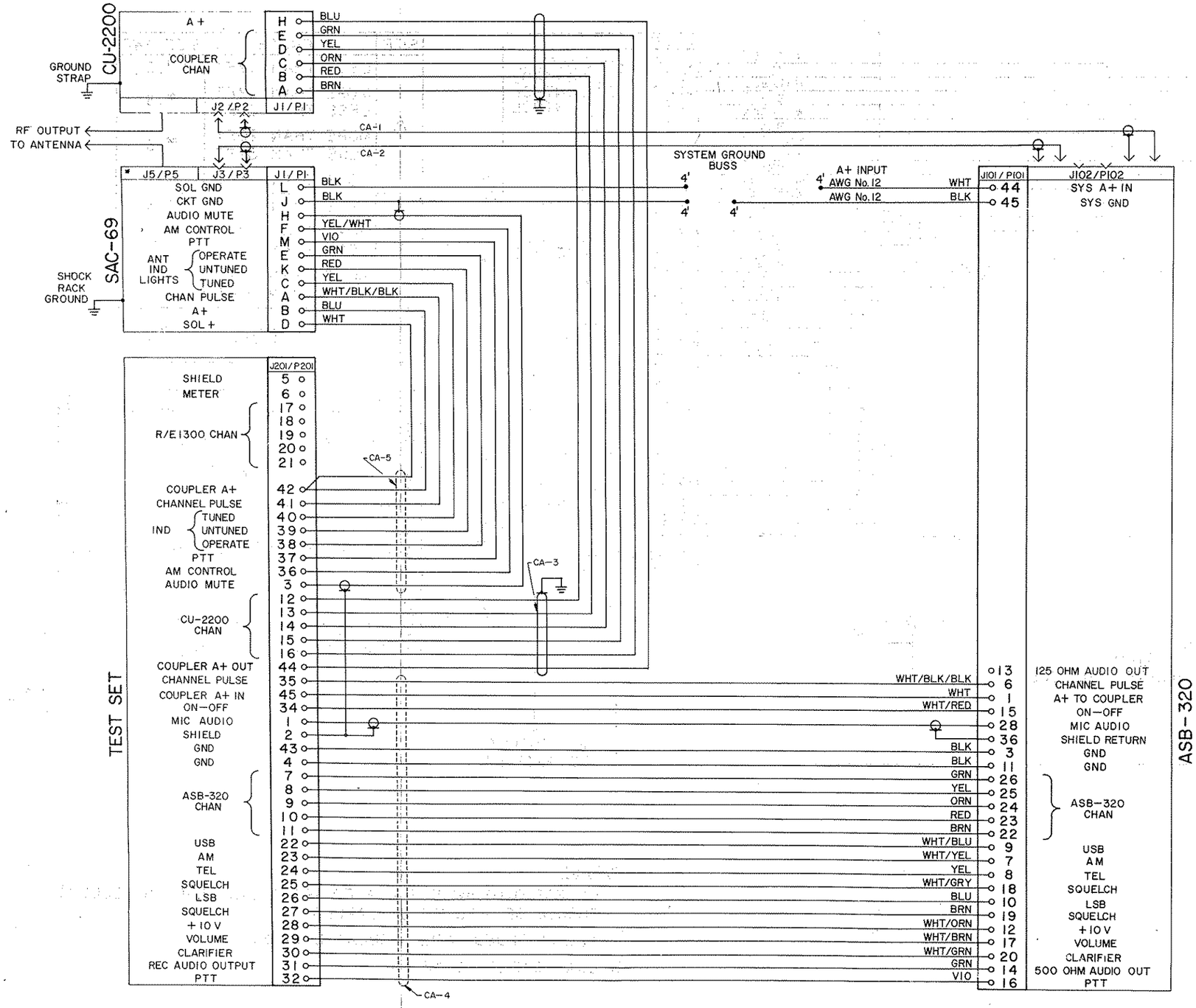


FIGURE II-5
INTERCONNECT, DIAGRAM TEST SET

	SYM	TYPE	PART NO.
TEST SET	P201	45 PIN RECTANGULAR CLAMP	74013 74336
ASB-320	P101	45 PIN RECTANGULAR CLAMP	74013 74336
CU-2200	P1	AMPHENOL No. 165-10	74362
	P2	COAXIAL PLUG, TYPE "UHF"	90873
SAC-69	P1	AMPHENOL No. 165-10	74362
	P3	TYPE "N" UG-536B/U	74702
	P5	(OPTIONAL) TYPE "HN" UG-59A/U	75316

NOTES:
1. UNLESS OTHERWISE INDICATED, WIRES (INCLUDING SHIELDED) SHOULD BE AWG No. 20.
2. CA-1, AND CA-2 MADE FROM RG-58 A/U, CA-3 IS 7 CONDUCTOR SHIELDED TYPE.
3. CABLES CA-3 THRU CA-5 ARE 4 FEET LONG, CA-1 AND CA-2 ARE 8 FEET LONG.

4. Transmitter Output - AM

Connect a Thruline Wattmeter (2-30 MHz, 100W) and a 50 ohm coaxial load to J102 of the ASB-320. Check the transmitter output on all active channels with the mode selector in the AM position. A Wattmeter reading of 25 to 35 watts is normal with standard input voltage.

5. Transmitter Output - SSB

The microphone that is to be installed in the aircraft should be used for this check. Set the mode selector to USB position. Press the microphone button and speak into the microphone. Notice there is power output only when speaking into the microphone. The Wattmeter should show peak readings of 20 to 25 watts when speaking in a normal tone of voice. The microphone level has been adjusted at the factory for a Shure Model 488T microphone. If a different type microphone is used, it may be necessary to adjust R505, microphone level control.

To adjust microphone level:

(a) Remove the transceiver from the dust cover.

(b) Key the microphone and while speaking in a normal tone of voice, adjust R505 for peak readings of 20 to 25 watts on the Wattmeter. R505 is located on PC5.

6. Sidetone

Talk into the microphone while listening to the sidetone on a headset and adjust R423 for desired level. R423 is located on PC4, front portion of the board.

7. Antenna Coupler

Disconnect the Wattmeter and connect the antenna coax to J102. Set the mode selector to the AM position. If there is an antenna coupler installed, tune the coupler using instructions outlined in the Antenna Coupler Manual. If there is a trailing wire antenna installed, check for correct motor action.

IMPORTANT: It is absolutely necessary to tune the antenna coupler correctly to achieve the performance the system is capable of providing.

8. Squelch

   Set squelch knob to CCW position. Turn volume up; there should be audio or noise in the audio system. Then rotate squelch knob clockwise. Audio should be silenced if signal is not greater than approximately 15 microvolts.

9. Volume

   With receiver unsquelched, rotate volume control clockwise and check for increase in audio output.

10. Clarifier

    Select a channel that has SSB traffic and vary clarifier knob and note change in voice pitch.

11. After the system has been checked using ground power, start the aircraft engine(s) and turn all equipment on. Check all channels for any interference or noise from any of the other equipment. Sources of noise and interference would be generators, alternators, power supplies, and motors. Filters may have to be installed to eliminate any noise and interference present.

12. It is recommended that a test flight be made to check the performance of the system in flight. Antenna tuning should be monitored and if detuning occurs in flight, the coupler should be repeaked, if CU2200 coupler is used. If Automatic antenna coupler (SAC-69) is installed check that coupler tunes while in flight. Refer to SAC-69 handbook for complete procedures.

SECTION III

OPERATION

A. GENERAL

The ASB-320 HF transceiver is simple to operate, requiring only a knowledge of the type of emission required for the channel; either sideband, AM or telephone for public correspondence. All controls are located on the control head mounted in the aircraft panel.

B. OPERATING CONTROLS

CONTROL	FUNCTION
OFF-GAIN	Applies power to system and controls receiver audio gain.
MODE	USB - For upper sideband operation AM - For compatible AM operation and full AM reception. TEL - For upper sideband with reduced carrier (Used for public correspondence telephone, ship-to-shore). LSB - (Option) For Lower sideband operation (Not legal in U.S., Canada and most other countries).
CLARIFIER	Used to "clarify" single sideband speech during RECEIVE.
CHANNEL SELECTOR	Selects desired channel. Also selects AM Mode if channel frequency is 2003 kHz, 2182 kHz, or 2638 kHz. (Automatic AM Required).

C. OPERATING PROCEDURE

Step 1: Turn the aircraft master power switch to ON.

Step 2: Turn the OFF-GAIN control clockwise and allow 15 minutes warm-up.

Step 3: Select the desired channel with the CHANNEL SELECTOR.

Step 4: Select the proper modulation with the MODE switch.

Step 5: Turn the SQUELCH counterclockwise and adjust the audio GAIN for normal noise output, then slowly adjust the SQUELCH clockwise until the receiver is silent.

Step 6: When an RF signal is received, adjust the CLARIFIER for maximum signal clarity.

Step 7: To transmit, select HF COMM with the microphone selector on the aircraft instrument panel and then depress the microphone button and talk.

D. LEGAL REQUIREMENTS FOR USE

Legal use of this equipment requires that it be included on the Aircraft Station License in the United States and most foreign countries and that the operator have at least a Restricted Radiotelephone Operator's Permit. These documents may be obtained from the Federal Communications Commission.

For sideband operation in the United States, Canada and various other countries, ONLY UPPER SIDEBAND MAY BE USED. Use of lower sideband is prohibited.

ONLY AM TRANSMISSIONS ARE PERMITTED ON THE FREQUENCIES 2003 kHz, 2182 kHz, and 2638 kHz. The switching for these frequencies is performed automatically upon channel selection.

SECTION IV

PRINCIPLES OF OPERATION

A. GENERAL

This section contains the principles of operation for the ASB-320 HF transceiver.

In single sideband (SSB) transmission, only one sideband is used to carry the intelligence. The carrier is suppressed and the unwanted sideband is filtered out, leaving the desired sideband. Thus the entire power capability of the transmitter is utilized to transmit only the necessary portion of the signal. There is no output from the transmitter except when speech modulation is present. For this reason, SSB transmitters are rated in peak envelope power (PEP).

In compatible AM transmission, again only the upper sideband is transmitted. However, the carrier is not suppressed and, therefore, is also transmitted. Since only one sideband is transmitted, this form of emission is essentially still single sideband but with a full carrier, which the receiver uses as the reference for detection.

The ASB-320 operates in two modes - single sideband and compatible AM. In the compatible AM mode,the carrier is reinserted so that the signal can be received by a standard AM receiver for those stations which do not have SSB capability. In the United States, the Federal Communications Commission requires that only this mode be used on certain frequencies (2003, 2182 and 2638 kHz). The capability to automatically switch to the AM mode when using these frequencies is provided in the exciter in order to comply with this requirement.

The receiver/exciter unit is completely transistorized and, therefore, requires very little power for operation. The power amplifier uses pentodes for final power amplification to 130 watts peak envelope power (PEP). Frequency stability is maintained by crystal-controlled oscillators housed in ovens at a constant +75^{o}C to insure precise frequency stability. A regulated voltage supply for the oscillators further insures frequency stability. A warm-up time of 15 minutes is required to allow the crystals to reach their operating temperature and the frequency to stabilize.

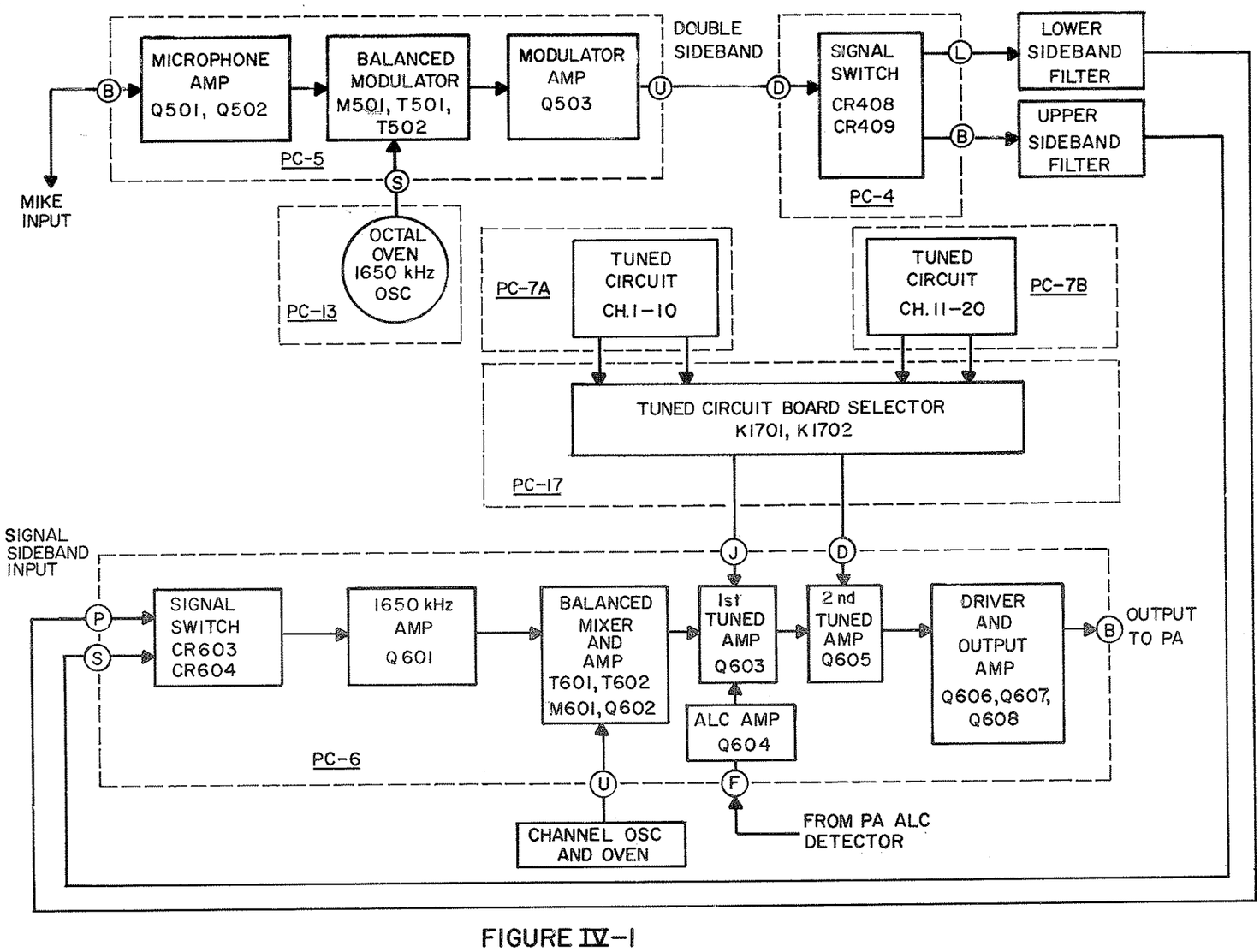


FIGURE IV-1
BLOCK DIAGRAM, EXCITER

The unit operates on 28 VDC nominal voltage, negative ground.

Nominal voltage to most circuits in the receiver/exciter is +10VDC regulated by a Zener Diode.

Final power amplification requires +420 VDC, +840 VDC and -32 to -62 VDC furnished by the power supply converter.

B. EXCITER

The receiver/exciter section contains all transmitter circuitry except for the final power amplifiers, which are contained in the power amplifier section. Figure IV-1 is a block diagram of the basic elements of the exciter. The component numbers in the blocks refer to the symbols on the P.C. Board schematic diagrams.

1. Microphone Amplifier, PC-5

The microphone amplifier provides current to the microphone and amplifies the voice signal in Q501 and Q502. R505 is used to adjust the audio input from the Microphone to compensate for various microphone output. Either a carbon or transistorized microphone may be used. Diode CR501 and resistor R504 are automatically switched in when AM is selected in order to reduce the gain of the amplifier for correct AM modulation percentage.

2. Balanced Modulator, PC-5

The output of Q502 is connected to the balanced modulator via R511, the audio balance control for the diode quad, M501. Two diodes of the ring modulator are switched on with one-half cycle of the 1650 kHz carrier oscillator and the other two diodes are turned on with the other half cycle. When no audio is present, there is no signal to unbalance the modulator and the output from the modulator amplifier, Q503, is reduced approximately 35 to 40 db below that present when audio is present. The output of Q503 with audio is a double sideband suppressed carrier signal that has been transformed up to 1650 kHz.

3. Carrier Reinsertion, PC-5

For AM operation, it is necessary to reinsert the carrier since it has been suppressed in the balanced modulator. This is accomplished by the mode switch applying +10V to Pin "J" which turns on diodes CR505 and CR507 and allows the 1650 kHz carrier to be routed to PC-6, Pin "P". The 1650 kHz reinserted level is controlled by C519. Since the United States Federal Communications Commission requires AM operation only on 2003, 2182 and 2638 kHz, it is necessary to automatically switch to AM if any of these frequencies are installed and selected by the operator. This is accomplished by connecting the appropriate channel switch position to either Pin "E", "F" or "H" on PC-5. Upon selection of one of the restricted frequencies, the 1650 kHz carrier is automatically reinserted as described above.

Another mode of emission used in the public correspondence AT&T System in the United States is the TEL mode. When selected, this allows a small amount of carrier to be transmitted which is used by the ground station to activate the ringer and lock the receiver to the transmit frequency. For this mode of operation, the carrier is transmitted 16 $\pm$2 db below peak envelope power. The mode switch when in the TEL position applies +10V to Pin "M", turning on diode switches CR504 and CR506 and allows the carrier to be routed to PC-6, Pin "P". Carrier level is controlled by R517.

4. Balanced Mixer, PC-6

The outputs from the two sideband filters are connected to PC-6, Pin "P" for USB operation and Pin "S" for LSB operation. As above, the mode switch applies +10V to diode switches to select the correct filter, CR604 for USB and CR603 for lower sideband. The selected sideband signal is routed to amplifier Q601 whose collector drives transformer T601, whose tuned secondary (1650 kHz) couples out-of-phase (Push-Pull) signals to the diode ring M601. The channel oscillator is connected to the center tap of the secondary of T601.

The balanced output transformer, T602, will cancel the channel oscillator frequency since equal current flows in both halves of T602 primary. Circuit balance is achieved by the transformer being wound balanced, and the setting of

R-609. The output of the mixer is the sum and difference of the channel oscillator and the 1650 kHz signal component and is applied to the wide band amplifier Q602. The tuned amplifiers, Q603 and Q605, whose tuned circuits are on PC-7, are tuned to the difference component of the two frequencies. The source follower, Q606, emitter follower, Q607 and amplifier Q608 are used as power amplifiers to transform the impedance and drive the remote power amplifier from a 50 ohm source.

5. ALC Amplifier, PC-6

The ALC amplifier is a PNP device which receives its drive from the ALC detector located in the power amplifier. As the power output of the final amplifier increases, the drive signal on Pin "F" decreases, which increases the conduction of Q604 and drives the collector more positive. This applies degenerative bias to the source of Q603 and reduces the gain of the amplifier and subsequent power output of the system. The opposite events occur when the final amplifier power decreases.

C.POWER AMPLIFIER/POWER SUPPLY, Figure IV-2

The purpose of the PA/PS section is to amplify the low level signal from the exciter to a power level of 130 watts PEP for sideband operation and 30 watts average for AM emission.

1. Driver, V3

The exciter signal from the wide-band amplifier in the receiver/exciter unit drives the control grid of the tuned amplifier, V3. The signal, which has been at a relatively low level throughout the previous portions of the exciter is now amplified approximately 30 db to drive the final amplifier.

2. Power Amplifier, V1, V2

The final amplifier stage is a linear amplifier operated class AB1 and consists of two tubes, V1 and V2. For linear operation, zero signal tube current is set to 30 ma per tube by adjusting R6 . This corresponds to approximately -60 VDC bias level and 0.3 VDC on each of the two cathodes. If V1 or V2 is replaced, they should be checked for approximately equal zero signal current. For 130 watts PEP output with a standard two-tone test signal input, the power

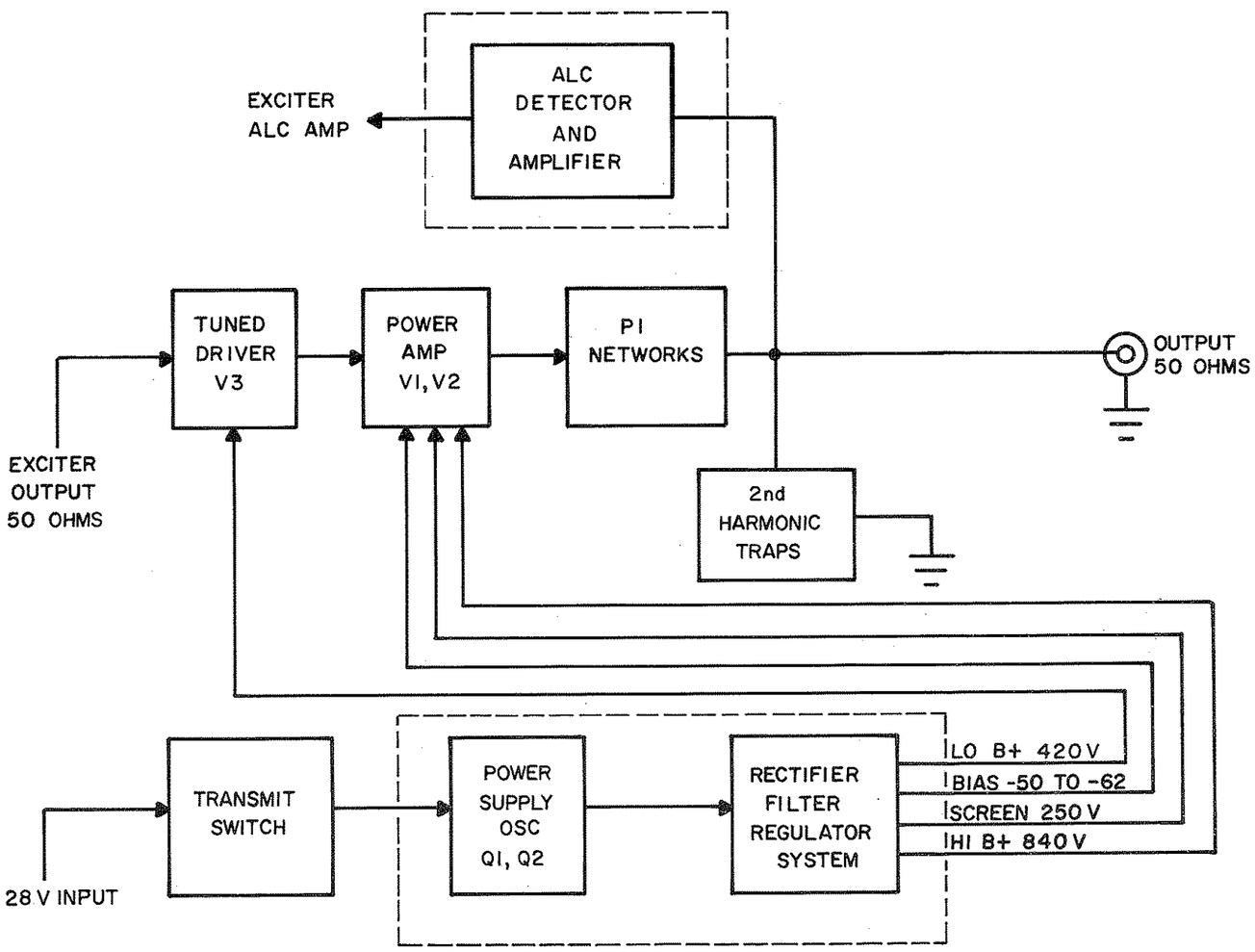


FIGURE IV-2
BLOCK DIAGRAM, POWER AMPLIFIER/POWER SUPPLY

input to each tube is approximately 84 watts average; 100 ma with plate voltage at 840 VDC.

3. ALC Detector and Amplifier

The ALC detector receives an input from the 50 ohm output of the power amplifier. The peak DC voltage produced by the diodes CR-1405 and CR-1406 is proportional to the power output and frequency compensated by C-1405 and C-1408 for SSB and AM respectively.

The DC voltage from the detector is applied to the ALC amplifiers which operate in two distinct modes. In SSB operation Q-1401 becomes forward biased by the DC output of CR-1406 and keeps Q-1402 cutoff. However, the DC output from CR-1405 is applied to the differential input of IC-1401 thru threshold adjustment R-1403. If the voltage on Pin 7 of IC-1401 exceeds the voltage set by the divider R-1405 and R-1406 on Pin 1, IC-1401 conducts. The negative pulse developed across R-1412 is then coupled thru diode CR-1402 to the ALC amp. on PC-6 resulting in a reduction of output power. If the voltage on Pin 7 of IC-1401 is decreased by the adjustment of R-1403 or there is a decrease in output voltage the output power will increase. In AM operation Q-1401 is initially reverse biased by the voltage on the wiper of R-1402. The DC produced by CR-1406 and applied to the gate of Q-1402, if sufficient to overcome the reverse bias on the source, causes Q-1402 to conduct and a reduction in power results. If the voltage on the gate is decreased by the adjustment of R-1404 the power is increased. Q-1401 now acts as a limiter. As the carrier is modulated the reverse bias on Q-1401 is overcome and the DC level at the gate of Q-1402 is not allowed to increase any further. This causes the AM modulation peaks to double the carrier value or approach to PEP output on SSB. IC-1401 prevents the peaks from increasing beyond the present level of SSB PEP.

4. Pi Network

The output from amplifiers V1 and V2 is connected to a tuned, capacitive input pi network that transforms the plate impedance to a 50 ohm resistive output and attenuates harmonics of the fundamental frequency. Second harmonic traps are connected to the output to further attenuate the second harmonic to greater than 60 db below the fundamental frequency.

5. Power Supply

The Power Supply furnishes high voltages for the driver, V3, and the power amplifier, V1 and V2. A+ voltage is supplied to transistors, Q1 and Q2, which are connected to the square loop transformer, T2001. The transistors and transformer form an oscillator circuit that oscillates at approximately 1 kHz and couples a square wave output to the bridge rectifiers, CR-2001-CR-2004, and half wave rectifier, CR-2005. The output of the bridge circuit is approximately 840 VDC for the two final amplifiers. The 420 VDC centertap of the output winding supplies 300 VDC to the driver, V3, thru R15. High B+ is generated by the oscillator only when the microphone is keyed and relay K2 actuated. Rectifier CR-2005 output is -50 to -62 VDC and is the bias supply for V1 and V2. The 420 VDC output is also regulated by CR-1 and CR-2 at approximately 250 VDC and is the screen grid supply for V1 and V2. Regulating the grid supply results in improved power stability and linearity over input voltage variations.

D. RECEIVER, Figure IV-3

The receiver operates as a single sideband or an AM receiver. The principal difference between the two modes is that double conversion is used for AM, single conversion for SB, and signal demodulation for AM is an envelope detector and a product detector is used for SB.

The receiver oscillator frequency is crystal controlled and, depending upon the number of two frequency simplex channels installed in the radio, is derived from the transmit oscillator, receiver oscillator or a combination of both. The oscillator theory is contained in Section IV-E.

1. Preselector Tuned Circuits, PC-1

A three section tuned circuit selects the signal for each channel and is contained on PC-1. The input signal from the antenna relay is connected to PC-1 via the receiver input relay (PC-12). Relay K1201 selects the proper preselector tuned circuit board (PC-1A or 1B). The channel switch applies +10V to the selected channel which forward biases one diode and reverse biases all others and allows the signal to pass only through the selected three section filter which is tuned to the channel frequency. The output diodes are connected to Pins "B" and "C" and are selected and reverse biased the same as the input diodes.

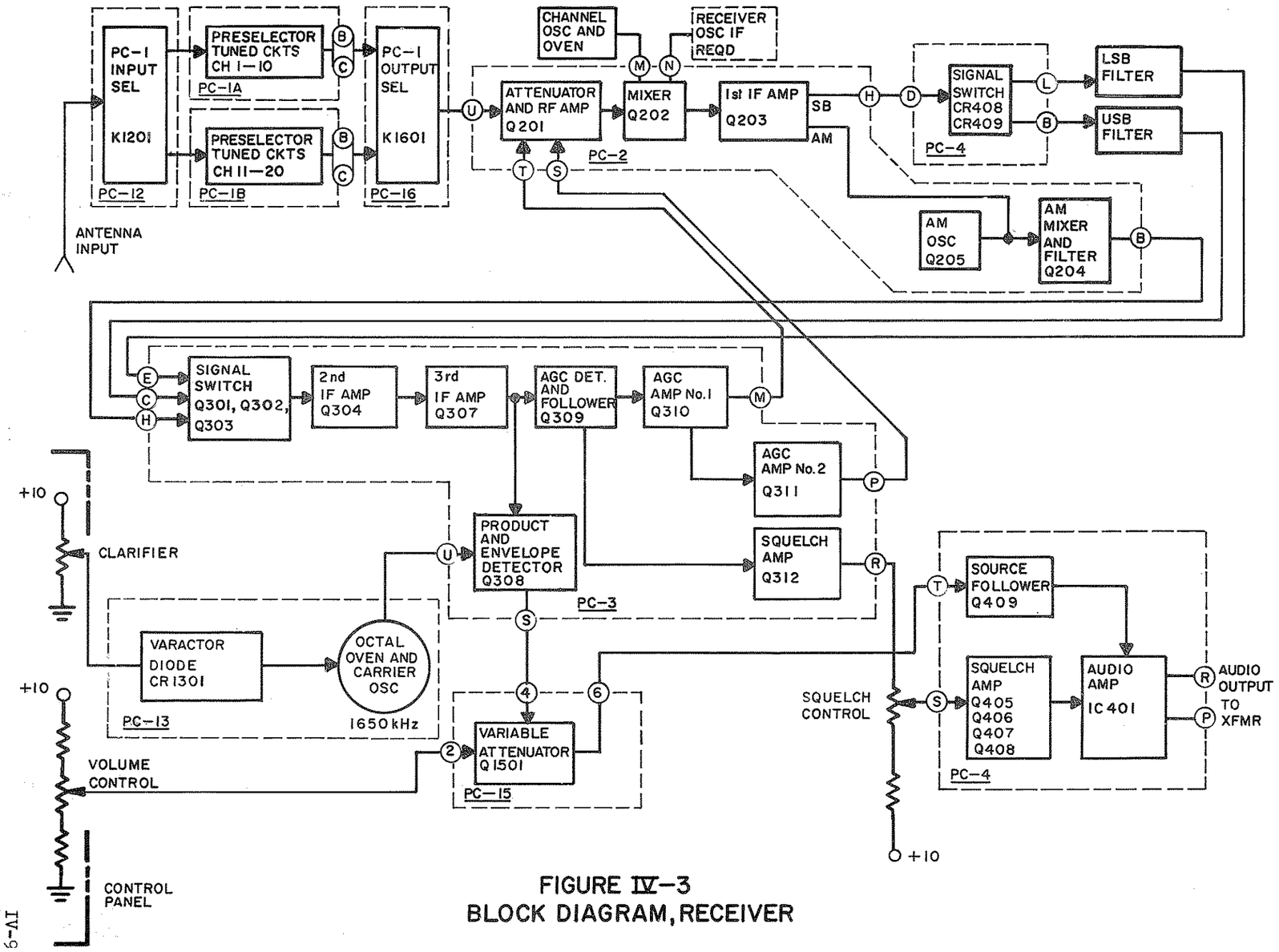


FIGURE IV-3
BLOCK DIAGRAM, RECEIVER

2. RF Amplifier Mixer, PC-2

The output from the preselector tuned circuits is connected to Pin "U" of PC-2 via relay K1601 through a variable attenuator which is controlled by AGC-2 amplifier. High level signals therefore are attenuated before they reach the base of the RF amplifier, Q201, which is an untuned broad band amplifier whose gain is controlled by AGC-1 amplifier. The output of the RF amplifier is connected to mixer Q202. The oscillator is injected at the base of Q201. (Two oscillators may be installed, dependent upon frequency requirements, see IV-E for description of oscillators). Mixing action takes place in the FET amplifier and the difference product, 1650 kHz, is selected by the drain tuned circuits.

3. First IF amplifier, AM Conversion, PC-2

The output of the mixer is connected to Q203, the first IF amplifier. Two outputs are taken from Q203, one from the drain is routed to PC-4 for USB or LSB selection and the output from the source is connected to Q204, the AM mixer. Q206 serves as the oscillator ON-OFF switch. When the mode switch is in the SB position, +.6 is applied to Pin "E", which turns on Q206, grounds the drain of Q205 and inhibits the AM oscillator. For AM operation, Q206 is off which allows Q205, the AM oscillator (1195 or 2105 kHz) to start. The receiver AM output from Q204 is connected to Q206 along with the oscillator signal. The difference frequency (1650-1195 = 455 kHz or 2105-1650 = 455 kHz) is selected in the collector load, which is a 455 kHz band-pass filter. In order to reduce the effects of oscillator harmonics, the AM oscillator frequency may be 1195 kHz or 2105 kHz, depending upon channel frequency.

4. IF Amplifiers, PC-3

The SB output from Q203 is switched by the circuitry on PC-4 and is routed through the selected SB filter to PC-3, Pin "E", for LSB operation and Pin "C" for USB operation. The output of the AM filter is connected directly to Pin "H". The mode selector switch applies +10V to one of the three transistor switches, Q301, Q302 or Q303. The selected transistor is forward biased allowing the signal to appear at the emitters along with the turn-on DC voltage which back biases the unselected transistor switches. Q304, the second IF

amplifier, and Q307, the third IF amplifier, increase the signal level sufficiently for the detector and AGC system. Q307 has two drain loads, one for SB tuned to 1650 kHz and the other for AM tuned to 455 kHz. The correct load is selected by diodes CR-301 and CR-302. For SB operation, the switching ckts. apply 10V to Pin "K" which forward biases CR-301 and connects the 1650 kHz load to Q307. The 10V on Pin "K" turns on Q305 which removes the base drive from Q306 which turns off the transistor and removes the forward bias from CR-302 and isolates the 455 kHz load from Q-307. The signal is then routed to the AGC detectors, CR-303 and CR-304, and audio detector, Q308.

5. AGC and Detector, PC-3

The AGC system controls the gain of the second IF amplifier, Q-304, the RF amplifier, Q201, and the input attenuator. The input attenuator AGC is voltage delayed and does not take effect until after AGC-1 has reduced the gain of Q304 and Q201. The two diodes CR-303 and CR-304 form a voltage doubler detector to rectify the IF output and is amplified by Q309, Q310 and Q311. R-330 controls the point that Q311 begins conducting by taking current through the attenuator diodes and increases the signal loss through the attenuator. The squelch amplifier, Q312, also receives its drive from Q309, the detector emitter follower. The emitter of Q312 is connected to the panel mounted squelch control potentiometer which sets the level of squelch operation.

The detector, Q308, receives its signal from the third IF amplifier, Q307. For SB operation, the input is 1650 kHz and the detector serves as a square law product detector which requires an input from the 1650 kHz carrier oscillator for detection. The resultant outputs are the audio signal and multiples of the 1650 kHz oscillator. The high frequencies are filtered out by the pi-filter C329, R326 and C330, leaving only the audio component. R336 in the source of Q308 is set for optimum dynamic range capability of Q308. For AM operation, the oscillator is turned off and Q308 serves as an envelope detector conducting only on positive half cycles. The pi-filter removes the 455 kHz component leaving the audio envelope which is taken from Pin "S" and connected to the drain of Q1501, the variable attenuator, used to adjust the audio input to PC-4. Bias is provided from the volume control located on the control head.

6. Squelch and Audio Amplifier, PC-4

The wiper arm of the squelch control potentiometer is connected to Q405 base and provides the DC control voltage for operation of the squelch system. An increase in signal level or a resetting of the potentiometer toward A+ will cause the base voltage of Q405 to increase which makes the emitter of Q406 increase until the diode CR411 starts to conduct and the collector of Q406 will decrease. Q407 starts to cut off which removes drive from Q408. This reduces the current through Q408 which reduces the voltage across CR411 and allows Q406 to conduct harder. This regenerative action continues until Q408 is turned off and the voltage on Pin 11 of the audio amplifier, integrated circuit IC401, increases enough to turn on the amplifier. When the signal decreases below the threshold the reverse action occurs but not in a regenerative fashion and therefore is slower.

The audio amplifier is an integrated circuit and supplies more than 100 milliwatts of audio power to the audio output transformer. Receiver audio is connected to Pin 10 from the drain of Q1501, variable attenuator via Q409. Input to the audio amplifier is approximately 30 to 50 millivolts and output approximately 7 to 10 volts.

The sidetone from the exciter is also amplified by the audio amplifier. The desired sidetone level is set by R423.

E. OSCILLATORS

The standard transceiver has two oscillators, a 1650 kHz carrier oscillator and a channel oscillator used for transmit and receive. The channel oscillator may contain up to twenty crystals which can be used in both the receive and transmit mode if the frequencies are the same, commonly termed "simplex." However, if one or more channels have different receive and transmit frequencies, commonly termed "two frequency simplex," the number of channels must be reduced accordingly to utilize a maximum of twenty crystals. This could be 10 transmit and 10 receive, each a two frequency simplex channel, or 12 and 8, 8 two frequency simplex requiring 16 crystals and four simplex channels requiring four crystals for a total of twenty.

However, there is an optional receive oscillator that can house ten crystals. This increases the transceiver capacity to 30 crystals, which could be 20 transmit channels of which 10 could be two frequency simplex and ten simplex or any combination that will not exceed a maximum of 30 crystals.

1. Carrier Oscillator 1650 kHz, PC-10

The carrier oscillator and crystal are housed in an octal plug-in oven located on PC-13. The oven temperature is maintained at +65°C. over an ambient range of -54°C. to +55°C. Since the oscillator is also in the oven, frequency stability is maintained within two cycles over the above temperature range. Warm-up time of the oven from -54°C. to oscillator stabilization time is about 6 minutes.

The carrier oscillator is activated during both receive and transmit, being used in the balanced modulator for transmit and the product detector for receive. In order to provide a tunable oscillator during the receive function for natural voice clarity on SB, provision is made to vary the oscillator by a control labeled "Clarifier". This varactor diode is activated only during receive and will not affect the oscillator frequency during transmit.

During the receive function, 10V is applied to pin 4 of the octal socket through CR1302 and R1302 which back biases CR1001 and shunts the 1650 kHz crystal to ground through L1301 and CR1301, the varactor diode. The remote clarifier control provides bias for CR1301, and can now vary the oscillator 100 Hz about the 1650 kHz center frequency. During transmit, 10V is removed from pin 4 and applied to pin 8 through CR1303 and R1301. This voltage turns on CR1001 and connects the 1650 kHz crystal to ground through C1001 which bypasses and inactivates the "Clarifier" control. The oscillator is set on frequency by C1003 (accessible through inner enclosure cover) while in the transmit mode. The oscillator supply voltage is also applied by the switching voltage through L1001.

2. Channel Oscillator, PC-8, PC-9

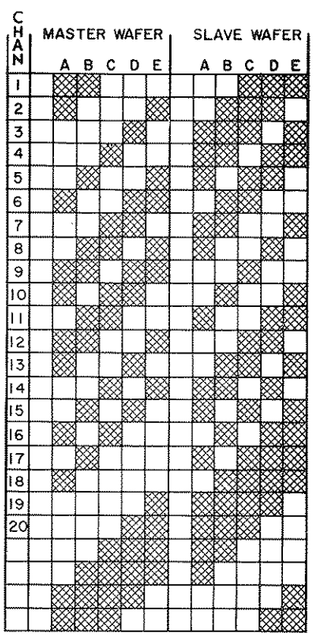
The channel oscillator and crystal are housed in the 20 crystal rectangular oven mounted to the chassis. The oven temperature is maintained at +75°C. over the ambient range of -54°C. to +55°C. Since the oscillator is also housed in the oven, stability is maintained to within ±20 Hz. The oscillator is an integrated circuit connected as a wideband amplifier with feedback. The feedback loop gain is controlled by the channel crystals which allow the oscillator gain to exceed unity only at the resonant frequency of the crystal. The crystal channel selection and crystal trimmer

circuitry are contained on PC-9, mounted on each side of the oven. The channel switch applies 10V from the program board to the selected channel. This turns on one of the diodes, CR901 A&B - CR910 A&B, back biasing the other diodes and connects the selected crystal into the circuit of the oscillator feedback loop. Correct crystal capacity and frequency trimming are provided by three capacitors for each channel mounted on PC-9. The 36pf capacitor is a temperature compensating type. The trimmer capacitor, 2-8pf, allows the channel crystal to be set to the exact frequency. The oscillator may be used for both receive and transmit, depending upon the number of crystals required. Programming the oscillator for transmit and/or receive is done on the program board, which will be discussed in the switching section.

3. Receive Oscillator Option, PC-11

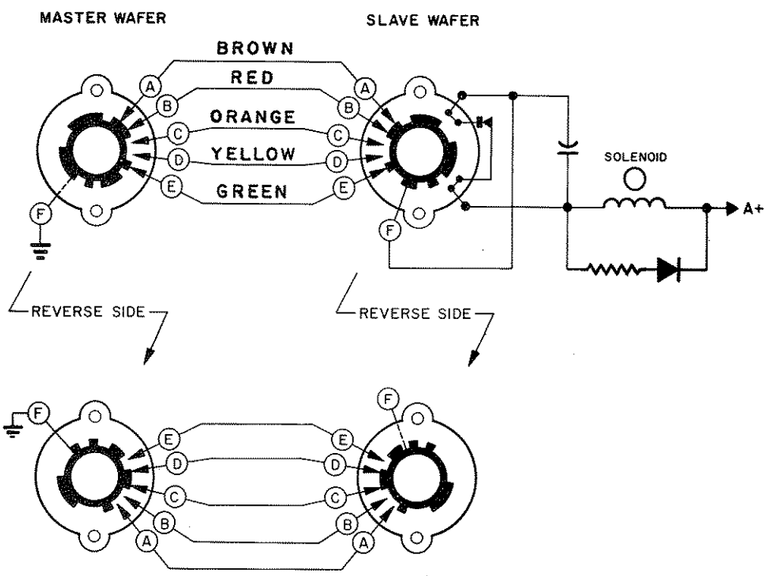
This oscillator is installed only as an optional accessory when two-frequency simplex operation requires more than 20 crystals in the radio. The electrical design of this oscillator is identical to the channel oscillator discussed in Paragraph 2 of this Section. Mechanically, the oscillator and trimmers are packaged on one PC board.

Only receive two-frequency simplex crystals are installed in the receiver oscillator. That is, all simplex channels (same transmit and receive frequency) utilize a single crystal housed in the oven. Additionally, if the total number of crystals does not exceed 20, with some channels being two-frequency simplex, the receive crystal will also be installed in the oven. However, if the total crystal requirements exceed twenty, which requires installation of the receiver oscillator function, then all two-frequency simplex receive crystals will be installed in the receiver oscillator module. This could take the form of sixteen channels, eight being two-frequency simplex, for a total of 24 crystals. Then sixteen crystals would be installed in the oven and eight crystals installed in the receiver oscillator module. Of the sixteen crystals in the oven, all sixteen would be used for transmit and eight of the sixteen would also serve as the receive crystal for the eight single frequency simplex channels. The eight two-frequency simplex channel receiver crystals would be installed in the receiver oscillator module.



INDICATE INTERCONNECTION OF WAFER PINS A,B,C,D OR E TO PIN F.

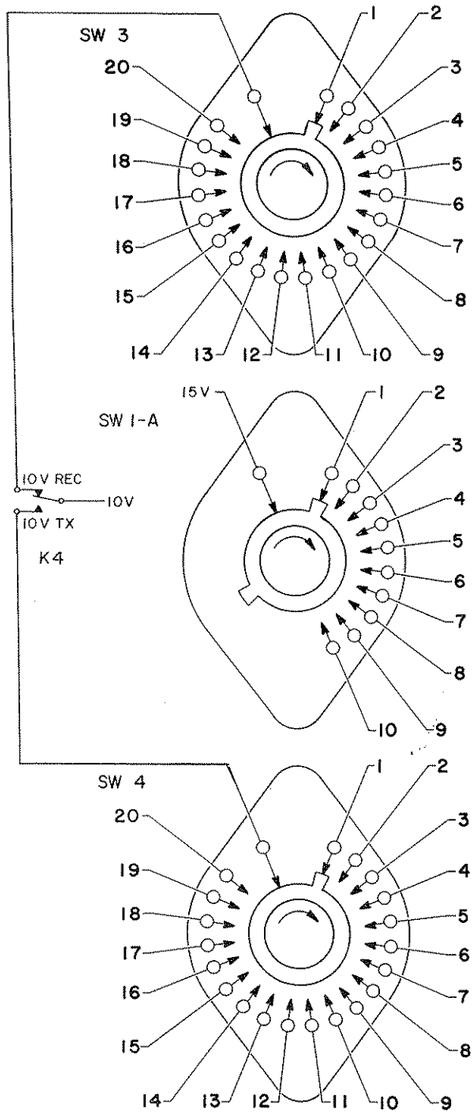
INDICATE NO INTERCONNECTION OF PINS A,B,C,D OR E TO PIN F.



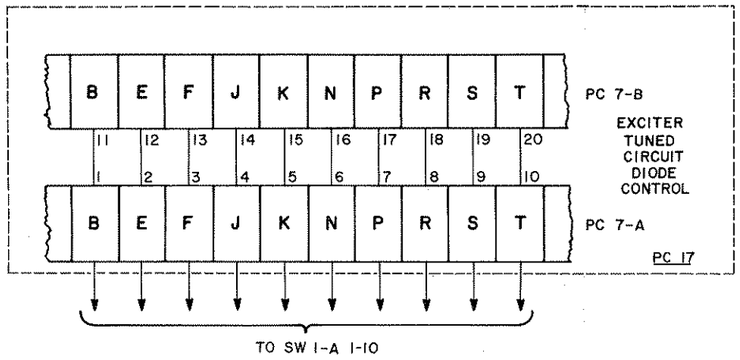
WAFERS SHOWN ON CHANNEL 7

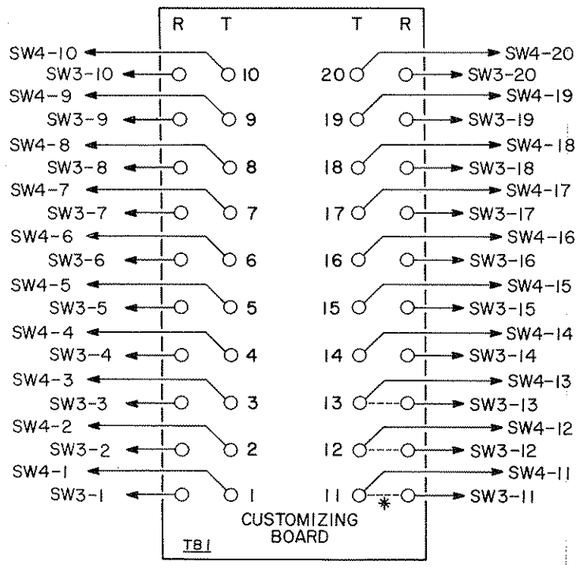
FIGURE IV-4

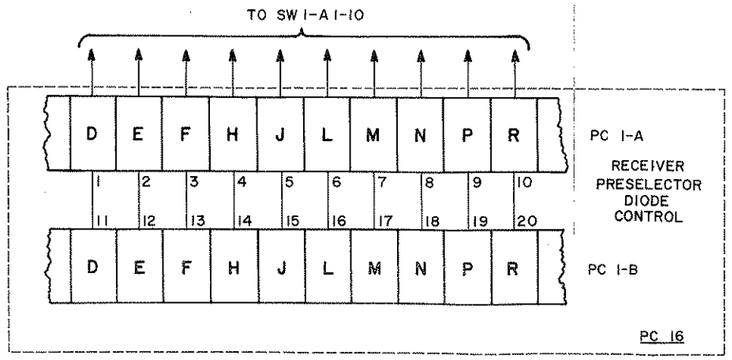
CHANNEL SWITCHING CODE DIAGRAM

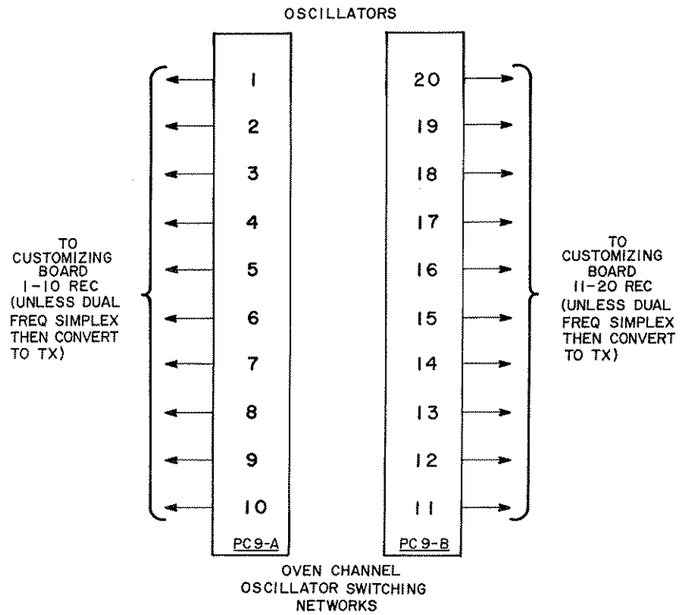


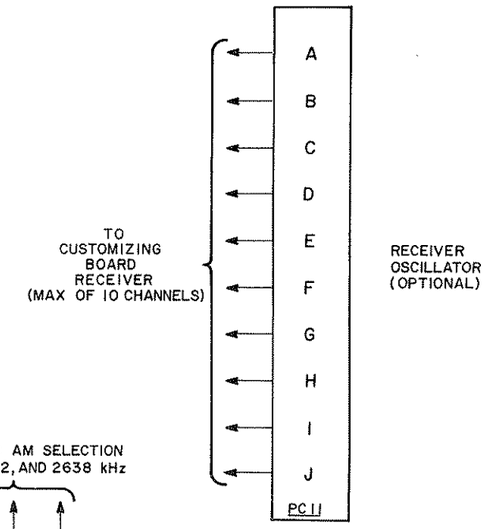
* JUMPERS INSTALLED BETWEEN TX & REC PINS OF SAME CHANNEL WHEN ONE OVEN CRYSTAL IS USED FOR TX AND REC. (SINGLE FREQUENCY SIMPLEX)











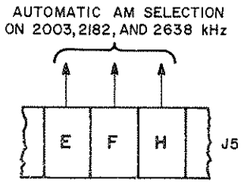


FIGURE IV-5

RECEIVER / EXCITER CHANNEL SWITCHING

This method would allow the addition of four channels at a later date with no change in the original crystals. This is necessary as the transmit and receive two-frequency simplex crystals cannot be interchanged because the transmit crystals are cut to operate at +75°C. and the receiver module crystals at +25°C.

The receiver oscillator channel line-up is programmed by the wiring on the program board. Channel A in the receiver oscillator is the lowest channel number two-frequency simplex channel; channel B the next, and so forth up to a maximum of ten receive only crystals.

F. CHANNEL SWITCHING CONTROL AND SYSTEM WIRING

1. Solenoid Channeling

The basic channel switching functions are controlled by two master switch wafers located in the control head. SW2 controls the antenna coupler solenoid. SW1 controls the transceiver solenoid.

The solenoid motors are controlled by a coded five wire system connected to the master wafers in the control head. The channeling diagram for the coupler and transceiver is shown in Figure IV-4. A+ voltage is wired to the rotary solenoids and if the corresponding master wafer is rotated to a new position, an A+ return or ground is provided for the solenoid and it rotates, moving its slave wafer, until all five wires are open circuited and current ceases to flow.

2. Receiver/Exciter Control Wiring, Figure IV-5

All receiver/exciter channel control wires from SW-1A are terminated on PC-16 and PC-17 (See receiver and exciter schematic diagrams for proper channel selection between PC-1A and PC-1B or PC-7A and PC-7B). SW-1A must provide 15V to the following receiver/exciter functions:

a) PC-1A and PC-1B, receiver preselector

b) PC-7A and PC-7B, exciter tuned circuit.

SW-1B must provide 28 VDC to the change over relays K1201, K1601, K1701 and K1702. Channel control wires from SW-3 and SW-4 are terminated on the customizing Board TB-1, which is mounted directly under the wafer switches. Switch SW-3 controls the receiver crystal selection and it is connected to the bottom of the twenty pins of TB-1 on the receiver side. Switch SW-4 controls the transmitter crystals selection and it is connected to the transmit pins on TB-1. 10V receive and transmit is supplied to SW-3 and SW-4 through the change over relay K4. SW-3 and SW-4 must provide 10V to the following functions in the receiver/ exciter:

a) PC-9A and PC-9B, channel oscillator

b) PC-11 receive oscillator (if installed).

c) PC-5, Pins "E", "F", "H" for automatic AM selection if 2003, 2182 or 2638 kHz is installed in radio.

When a single frequency simplex channel is installed in the radio, the same crystal is used for both transmit and receive. This crystal is housed in the channel oscillator oven and the selection network is on PC-9A or PC-9B. PC-9A and PC-9B central wires are connected to the receive terminals of TB-1. When relay K4 is in the transmit position, 10V is supplied through switch SW4 to the selected TB-1 transmit terminal and then to PC-9A or PC-9B and PC-5, if applicable. When the microphone switch is released, relay K4 returns to the receive position and 10V is now applied to the receive side of TB-1. Since the channel is single frequency simplex, a jumper must be installed between the transmit and receive side on the selected channel.

If the channel is two-frequency simplex, the jumper is not required and a separate receive crystal is selected when the relay K4 is de-energized. However, the wire from PC-9A or PC-9B is now connected to the transmit side of TB-1, and the receive oscillator PC-11 is connected to the receive side of TB-1. Whether the receive crystal is in the channel oscillator oven or receiver oscillator module depends upon the number of channels and crystals installed.
See Section IV-E.

SECTION V

SPECIFICATION TEST PROCEDURE

A. GENERAL INFORMATION

1. The checks outlined in this Section should be performed after equipment maintenance or if a specification check is desired.

B. EQUIPMENT REQUIRED

1.	RF Voltmeter	H-P Model 410B, or equivalent
2.	RMS Voltmeter	H-P Model 400L, or equivalent
3.	Distortion Analyzer	H-P Model 330C, or equivalent
4.	RF Signal Generator	H-P Model 606B, or equivalent
5.	Frequency Counter	H-P Model 5245L, or equivalent
6.	Audio Oscillator	H-P Model 200CD, or equivalent (2)
7.	Attenuator	Kay Electric Model 30-0, or equivalent
8.	Wattmeter (100W Element)	Bird Model 43, or equivalent
9.	Dummy Load, 50 ohms	Bird Model 81B, or equivalent
10.	Oscilloscope	Tektronix Model 543B, or equivalent

C. OSCILLATORS

1. Channel Oscillator (20 Crystal Oven Unit)

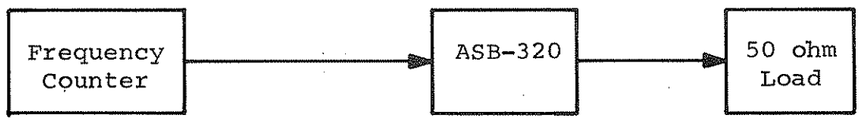


Figure V-1

(a) Off/On switch in "ON" position.

(b) Channel selector switch in Channel 1 position.

(c) Exciter Output disconnected from Driver Amp.

(d) Receiver/Exciter in transmit (Refer to Section IV-E for other than one frequency simplex channel frequency assignment).

(e) Allow equipment to warm up 15 minutes.

(f) Connect frequency counter to Pin "N" of PC-2 and record frequency.

(g) Turn channel selector switch to successive positions and record frequency.

(h) Frequency readings must be within ±20 Hz of assigned frequency plus 1650 kHz. NOTE: Oscillator should be set to exact channel frequency.

(i) If this requirement is not met, refer to Section VI-C for alignment or Section VII-C for repair.

2. Receive Oscillator (10 Crystal Positions)

(a) Refer to Figure V-1 for equipment hook-up.

(b) OFF/ON switch in "ON" position.

(c) Channel selector switch in position(s) outlined in Section IV-E.

(d) Receiver/Exciter in "receive".

(e) Connect frequency counter to Pin "M" of PC-2 and record frequency(ies).

(f) Frequency reading(s) must not vary more than ± 0.0025% from assigned frequency plus 1650 kHz.

(g) If this requirement is not met, refer to Section VI-C for alignment or Section VII-C for repair.

3. Carrier Oscillator (1650 kHz)

(a) Refer to Figure V-1 for equipment hook-up. (Exciter output disconnected from Driver Amp).

(b) OFF/ON switch in "ON" position.

(c) Receiver/Exciter in "receive" mode.

(d) Mode switch in USB, TEL or LSB position.

(e) Clarifier in CCW position.

(f) Connect frequency counter to Terminal "4" of PC-13 and record frequency.

(g) Turn clarifier to the extreme CW position and record frequency.

(h) Frequency difference between steps (f) and (g) must not be less than 200 Hz.

(i) Receiver/Exciter in "transmit".

(j) Frequency must not be more than ±2 Hz from 1650 kHz.

(k) If the requirements in steps (h) and (j) are not met, refer to Section VI-C for alignment or Section VII-C for repair.

D. RECEIVER

1. Sensitivity Measurements

a. SSB

(1) OFF/ON switch to "ON" position.

(2) Channel selector switch in desired frequency position.

(3) Squelch control full CCW.

(4) Receiver/Exciter in "receive".

(5) Connect test equipment as shown in Figure V-2.

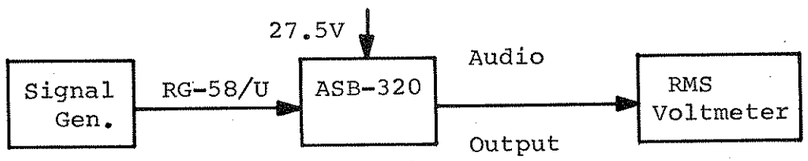


Figure V-2

(6) Set RMS voltmeter to 3 volt scale.

(7) Increase volume control on control panel until noise is observed on voltmeter.

(8) Turn mode switch to USB, TEL or LSB position.

(9) Set output of signal generator to luv (rms) and tune frequency dial for maximum indication on voltmeter, adjusting volume control to maintain 1V reading.

(10) Remove cable from J102 (antenna input); output on voltmeter must be no less than 10 db down from reading in step (9).

(11) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

b. AM

(1) Follow Steps (1) through (7) of Paragraph 1-a.

(2) Turn mode switch to AM position.

(3) Set output of signal generator to 2uv (rms), 30% modulation, 1000 Hz, and tune frequency dial for maximum indication on voltmeter, adjusting volume control to maintain 1V reading.

(4) Turn modulation on signal generator to "OFF" position; output on voltmeter must be no less than 6 db down from reading in step (3).

(5) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

2. Gain Measurements

a. SSB

(1) Follow steps (1) through (5) of Paragraph 1-a.

(2) Set RMS voltmeter to 10V scale.

(3) Turn volume control full CW.

(4) Turn mode switch to USB, TEL or LSB position.

(5) Set output of signal generator to luv (rms) and tune for maximum deflection on voltmeter; adjust output of generator for 7.1 volt indication on voltmeter. Re-peak voltmeter reading with frequency dial.

(6) Output of signal generator must be no more than 5uv (rms).

(7) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

b. AM

(1) Follow steps (1) through (5) of Paragraph 1-a and steps (2) and (3) of Paragraph 2-a.

(2) Turn mode switch to AM position.

(3) Set output of signal generator to 1 uv (rms); 30% modulation, 1000 Hz and tune for maximum deflection on voltmeter, adjust output of generator for 7.1 volt indication on voltmeter. Repeak meter reading with frequency dial.

(4) Output of signal generator must be no more than 10 uv (rms).

(5) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

3. Selectivity Measurement

a. SSB

(1) Follow steps (1) through (4) of Paragraph 1-a.

(2) Connect test equipment, as shown in Figure V-3.

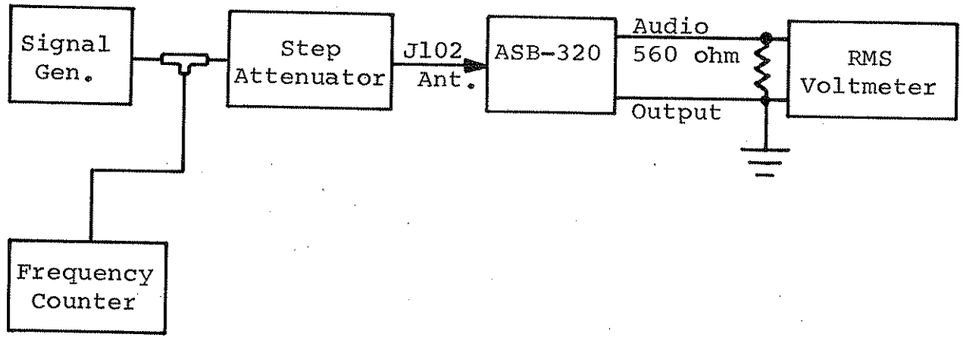


Figure V-3

(3) Set RMS voltmeter to 3 volt scale.

(4) Insert 100 db attenuation with step attenuator.

(5) Turn mode switch to USB, TEL or LSB position.

(6) Set signal generator to 100 MV (rms) and tune for maximum deflection on RMS voltmeter, adjust volume control for desired reading and record.

(7) Tune signal generator higher in frequency until meter reading is 6 db down from that in step (6). Record the frequency. Tune signal generator lower in frequency until meter reading is down 6 db from that in step (6). Record the frequency.

(8) The frequency difference between the readings in step (7) must be no less than 2.1 kHz.

(9) Retune signal generator for maximum indication on RMS meter and record reading.

(10) Increase signal input 60 db by switching attenuator.

(11) Tune signal generator higher in frequency until voltmeter reading is the same as recorded in step (9). Record the frequency. Tune signal generator lower in frequency until voltmeter reading is the same as recorded in step (9). Record the frequency.

(12) The frequency difference between the readings in step (11) must be no more than 6.5 kHz.

(13) If the requirements in step (8) and step (12) are not met, refer to Section VI-D for alignment or Section VII-D for repair.

b. AM

(1) Follow steps (1) through (4) of Paragraph 1-a and steps (2) through (4) of Paragraph 3-a.

(2) Turn mode switch to AM position.

(3) Set signal generator to 100 MV (rms); 30% modulation, 1000 Hz and tune for maximum deflection on RMS voltmeter, adjust volume control for desired reading and record.

(4) Tune signal generator higher in frequency until meter reading is 6 db down from that in step (3). Turn modulation "OFF" and record frequency. Turn modulation "ON" and tune signal generator lower in frequency until meter reading is 6 db down from that in step (3). Turn modulation "OFF" and record frequency.

(5) The frequency difference between the readings in step (4) must be no less than 5.5 kHz.

(6) Turn modulation "ON" and tune signal generator for maximum indication on voltmeter and record reading.

(7) Repeat steps (10) and (11) of Paragraph 3-a, but turn modulation off each time frequency is measured.

(8) The frequency difference between the readings in step (7) must be no more than 20 kHz.

(9) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

4. AGC Range Measurement

a. SSB

(1) Follow steps (1) through (5) of Paragraph 1-a.

(2) Set RMS voltmeter to 10 volt scale.

(3) Turn mode switch to USB, TEL, LSB position.

(4) Set signal generator to luv (rms) and tune for maximum deflection on voltmeter.

(5) Increase signal generator output to 250,000uv (500,000uv open circuit) and set volume control for 7.1 volt on the RMS voltmeter. Reduce generator output to 5uv (rms).

(6) Output measured on voltmeter must be no more than 10 db down from 7.1 volt.

(7) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

5. Audio Response Measurement

a. SSB

(1) Follow steps (1) through (4) of Paragraph 1-a.

(2) Connect test equipment, as shown in Figure V-4.

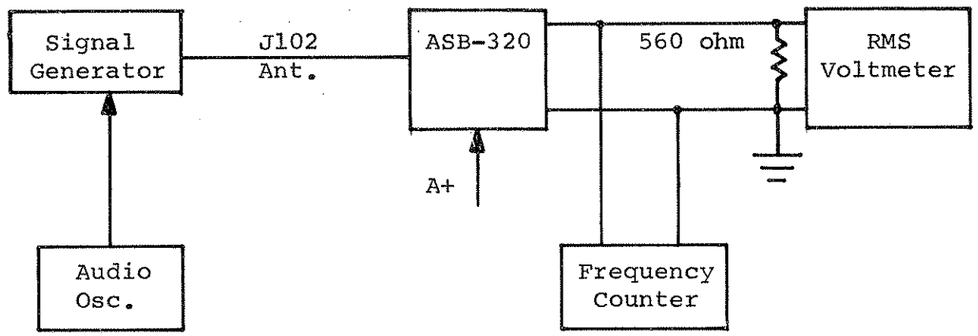


Figure V-4

(3) Set RMS voltmeter to 10 volt scale.

(4) Turn mode switch to USB, TEL or LSB position.

(5) Set signal generator to 1uv (rms) and tune until frequency counter indicates 1000 Hz. Increase generator output to 50uv (rms) and adjust volume control until voltmeter indicates 7.1 volts.

(6) Tune signal generator until frequency counter displays 350 Hz. Record voltmeter reading. Tune signal generator until frequency counter displays 2450 Hz. Record voltmeter reading.

(7) Meter readings obtained in step (6) must be no more than 6 db down from 7.1 volts.

(8) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

b. AM

(1) Follow steps (1) through (4) of Paragraph 1-a and steps (2) and (3) of Paragraph 5-a.

(2) Turn mode switch to AM position.

(3) Connect audio oscillator to external modulation on signal generator and set for 30% modulation, 1000 Hz.

(4) Set signal generator to luv (rms) and tune for maximum indication on RMS meter. Increase generator output to 50uv (rms) and set volume control until voltmeter indicates 7.1 volts.

(5) Turn audio oscillator to 350 Hz and record voltmeter reading. Turn audio oscillator to 3000 Hz and record voltmeter reading.

(6) Meter readings obtained in step (5) must be no more than 8 db down from 7.1 volts.

(7) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

6. Audio Distortion Measurements

a. SSB

(1) Follow steps (1) through (4) Paragraph 1-a.

(2) Connect test equipment, as shown in Figure V-5.

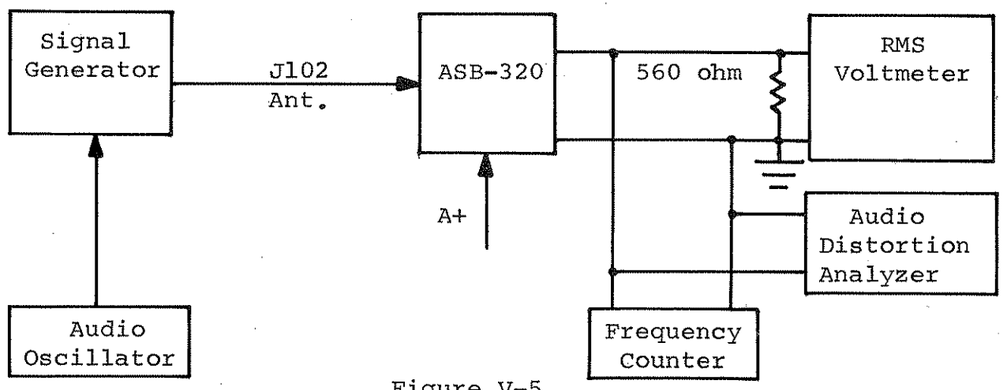


Figure V-5

(3) Set RMS voltmeter to 10 volt scale.

(4) Turn mode switch to USB, TEL or LSB position.

(5) Set signal generator to luv (rms) and tune until frequency counter displays 1000 Hz. Increase generator output to 100,000uv and set volume control until voltmeter indicates 7.1 volts.

(6) Set distortion analyzer for 100% reference indication.

(7) Turn analyzer function switch to distortion and tune analyzer for minimum deflection on analyzer meter. Record reading.

(8) Repeat steps (5) through (7) at 350 Hz and 2450 Hz.

(9) Readings obtained in steps (7) and (8) must be no more than 10%.

(10) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

b. AM

(1) Follow steps (1) through (4) of Paragraph 1-a and steps (2) and (3) of Paragraph 6-a.

(2) Turn mode switch to AM position.

(3) Connect audio oscillator to external modulation on signal generator and set for 85% modulation, 1000 Hz.

(4) Set signal generator to luv (rms) and tune for maximum indication on RMS meter. Increase generator output to 250,000uv (500,000uv open circuit) and set volume control until RMS voltmeter indicates 7.1 volts.

(5) Set distortion analyzer for 100% reference indication.

(6) Turn analyzer function switch to distortion and tune analyzer for minimum deflection on analyzer meter. Record reading.

(7) Repeat steps (3) through (6) for 350 Hz and 3000 Hz.

(8) Readings obtained in steps (6) and (7) must be no more than 20%.

(9) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

7. Intermediate Frequency Rejection Measurement (1650 kHz)

   a. SSB

      (1) Follow steps (1) through (9) of Paragraph 1-a.

      (2) Increase signal generator output 60 db and tune frequency to 1650 kHz.

      (3) Peak RMS voltmeter with frequency dial on generator.

      (4) Meter indication must be no more than reference indication (1 volt).

      (5) If this requirement is not met, refer to Section VI-D for alignment or Section VII-D for repair.

8. Image Frequency Rejection Measurement (fc + 3.3 MHz).

   a. SSB

      (1) Follow steps (1) through (9) of Paragraph 1-a.

      (2) Increase signal generator output 60 db and tune frequency 3300 kHz above channel frequency.

      (3) Peak RMS voltmeter with frequency dial on generator.

      (4) Meter indication must be no more than reference indication (1 volt).

      (5) If this requirement is not met, refer to Section VII-D for repair.

9. Squelch Sensitivity and Range Measurement

   a. SSB

      (1) Follow steps (1) through (9) of Paragraph 1-a.

      (2) Remove cable from J102 (antenna input). Receiver must not squelch.

      (3) Reconnect cable to J102.

      (4) Turn squelch control full CW.

      (5) Increase signal generator output until voltmeter deflects.

(6) Signal generator output should be 15 uv (nominal).

(7) If the requirements in steps (2) and (5) are not met, refer to Section VI-D for alignment or Section VII-D for repair.

E. TRANSMITTER

1. Power Output Measurement

(a) SSB

(1) Connect test equipment, as shown in Figure V-6.

(2) OFF/ON switch in "ON" position.

(3) Channel selector in desired frequency position.

(4) Allow 15 minutes for equipment warm-up.

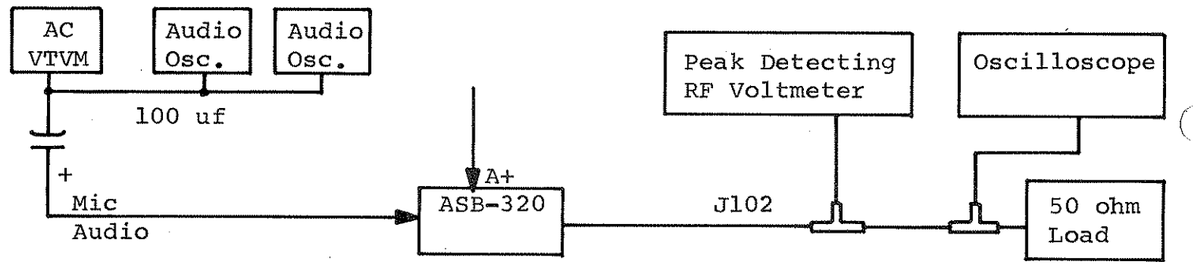


Figure V-6

(5) Turn mode switch to USB or LSB position.

(6) Set audio oscillators to 1800 Hz and 800 Hz respectively.

(7) Adjust combined audio oscillator output to 0.15 volt (rms) on AC VTVM.

(8) Key transmitter.

(9) Record output power (PEP) indicated on RF volt meter on all used channels.

NOTE: $PEP = \frac{(Vrms)}{50}^{2}$

(10) Output should be no less than 48W (120W PEP) on any channel.

(11) If this requirement is not met, refer to Section VI-E and F for alignment or Section VII-E and F for repair.

b. AM

(1) Repeat steps (1) through (4) of Paragraph 1-a.

(2) Turn mode switch to AM.

(3) Remove audio oscillator input from transceiver.

(4) Key transmitter.

(5) Record output power (average) indicated on wattmeter on all channels.

(6) Output should be no less than 30W average.

(7) If this requirement is not met, refer to Section VI-E and F for alignment or Section VII-E and F for repair.

2. Carrier Attenuation

a. SSB

(1) Repeat steps (1) through (8) of Paragraph 1-a.

(2) Record output voltage measured at 50 ohm load.

(3) Remove audio input to transceiver.

(4) The output measured at 50 ohm load must be no less than 40 db below the output measured in step (2).

(5) If this requirement is not met, refer to Section VI-E and F for alignment or Section VII-E and F for repair.

b. Telephone

(1) Repeat steps (1) through (8) of Paragraph 1-a.

(2) Turn mode switch to TEL.

(3) Record output volt measured at 50 ohm load.

(4) Remove audio input from transceiver.

(5) The resulting output measured at the 50 ohm load must be no less than 14 db and no more than 18 db below the output in step (3).

(6) If this requirement is not met, refer to Section VI-E and F for alignment or Section VII-E and F for repair.

SECTION VI

ADJUSTMENT AND ALIGNMENT PROCEDURES

A. GENERAL INFORMATION

1. The receiver/exciter and power amplifier/power supply are designed for minimum variations in specifications. After the initial factory alignment further alignment is not required unless circuit boards are replaced, channel frequencies are altered, or periodic inspections are scheduled to insure peak performance of the equipment.

2. The procedure outlined in this Section should be utilized whenever alignment or adjustment is required.

B. EQUIPMENT REQUIRED

1.	RF Voltmeter	H-P Model 410B, or equivalent
2.	RMS Voltmeter	H-P Model 400L, or equivalent
3.	Frequency Counter	H-P Model 330C, or equivalent
4.	RF Signal Generator	H-P Model 606B, or equivalent
5.	Audio Oscillator	H-P Model 200CD, or equivalent
6.	Wattmeter (100W Element)	Bird Model 43, or equivalent
7.	Dummy Load (50 ohms)	Bird Model, 81B, or equivalent
8.	Oscilloscope	Tektronix Model 543B, or equivalent
9.	DC VTVM	H-P Model 412A, or equivalent
10.	Tunable Receiver (4-36 MHz with S Meter) or Field Intensity Meter.	

C. OSCILLATORS

1. Channel Oscillator (20 Crystal Oven Unit)

   (a) For test setup, refer to Section V-C, Paragraph 1.

   (b) Adjust C901 through C-910 on both PC-9 until frequency is within ±5 Hz of assigned frequency plus 1650 kHz.

2. Receive Oscillator (10 Crystal Module Unit)

   (a) For test set up, refer to Section V-C, Paragraph 2.

   (b) Adjust C-1101 through C-1110 until frequency is within ±0.0010% of assigned frequency plus 1650 kHz.

3. Carrier Oscillator (1650 kHz)

(a) Refer to Section V-C, Paragraph 3.

(b) Adjust C-1003 until frequency is within ±2 Hz of 1650 kHz.

D. RECEIVER

1. Mixer and IF Alignment

(a) Refer to Section V-D, Paragraph 7-a for equipment hook-up.

(b) Remove PC-3 from receiver/exciter.

(c) Connect 2200 ohm resistor from Pin "T" of PC-2 to + 10 volts.

(d) Connect oscilloscope to Pin "H" of PC-2.

(e) Adjust L-211, L-212, L-213 (PC-2) for maximum output at Pin "H", reducing signal generator output to prevent saturation.

(f) Adjust L-207, L-210 for minimum output at Pin "H", increase signal generator to maintain readable presentation on oscilloscope.

(g) Repeat step (e) above.

(h) Remove 2200 ohm resistor from Pin "T" of PC-2.

(i) Reinstall PC-3.

2. Preselector Alignment

(a) Refer to Section V-D, Paragraph 1-a for equipment hook-up.

(b) Adjust coils corresponding to selected channel, L-101A through L-130A and L-101B through L-130B for maximum audio output on RMS meter.

3. Volume Control Threshold Adjustment

(a) Refer to Section V-D, Paragraph 2a for equipment hook-up.

(b) Adjust R-1501 until output does not increase any more.

(c) Turn volume control slightly CCW, output should decrease. If output does not decrease, adjust R1501 until output just starts to decrease.

3. AM and SSB Gain Equalizations

   (a) Refer to Section V-D, Paragraph 1-a, steps 1 through 8.

   (b) Connect DC VTVM to Pin "T" of PC-2.

   (c) Increase signal generator output to 10 uv and tune for minimum DC on VTVM. Record this voltage.

   (d) Switch to AM position and tune signal generator for minimum DC on VTVM. Record this voltage.

   (e) If the recorded voltages in steps (c) and (d) are unequal, adjust C-230 (AM oscillator injection) until voltages are as equal as possible.

4. AGC-2 Threshold and Distortion Adjustment

   (a) Refer to Section V-D, Paragraph 4-a.

   (b) Adjust R-330 so that a 10 db decrease in signal from 250,000 uv (500,000 uv open circuit) results in no change in output and minimum sine wave distortion is observed.

5. Detector Bias Adjustment

   (a) Refer to Section V-D, Paragraph 5-b.

   (b) Adjust R-336 for minimum sine wave distortion while maintaining output within $\pm$2 db of rated output.

6. Squelch Threshold Adjustment

   (a) Refer to Section V-D, Paragraph 9-a.

   (b) Turn squelch control CW.

   (c) Increase signal generator output until RMS meter indicates audio output.

   (d) Adjust R-415 so that squelch breaks with 15 uv nominal input signal.

E. EXCITER

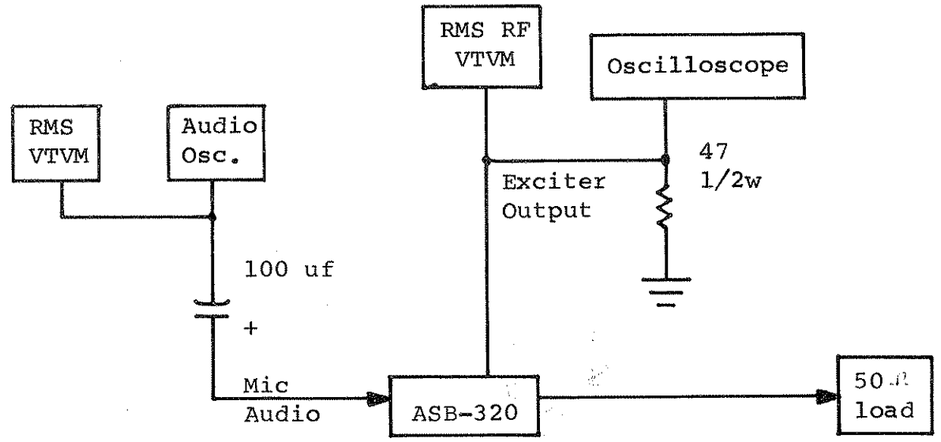


Figure VI-I

1. Modulation Adjustment

   (a) Set up equipment as shown in Figure VI-I.

   (b) Turn ON/OFF switch to "ON" position.

   (c) Allow 15 minutes for equipment warm-up.

   (d) Set audio oscillator output for 0.150V rms at 1000 Hz.

   (e) Turn mode switch to AM position.

   (f) Key transmitter.

   (g) Adjust R-505 until signal on oscilloscope is modulated 100%.

NOTE:No further gain adjustment should be required if a Shure Model 488T Noise Cancelling Microphone or a microphone with equivalent audio output is to be used. If the type microphone to be used is not known, refer to section II-E for readjustment of R505.

2. Balanced Modulator Adjustment

(a) Set up equipment, as shown in Figure VI-I.

(b) Turn ON/OFF switch to "ON" position.

(c) Allow 15 minutes for equipment warm-up.

(d) Turn mode switch to USB position.

(e) Key transmitter.

(f) Adjust R511 and R530 simultaneously for minimum output on RF VTVM or oscilloscope.

3. Balanced Mixer Adjustment

(a) Set up equipment, as shown in Figure VI-I.

(b) Turn channel selector switch to highest transmit frequency.

(c) Refer to Paragraphs 1-(b) through 1-(e).

(d) Turn mode select switch to "USB".

(e) Key transmitter.

(f) Remove audio oscillator input from transceiver.

(g) Adjust R-609 for minimum output on RF VTVM or oscilloscope.

4. Exciter Tuned Circuit Alignments

(a) Set up equipment, as shown in Figure VI-I.

(b) Set channel selector switch to desired frequency.

(c) Refer to Paragraphs 1-a through 1-f.

(d) Turn slugs of selected channel coils L701A&B - L710A&B and L711A&B - L720A&B all the way into the form.

(e) Slowly turn slugs CCW until signal appears on scope, alternately tune the coils until the oscilloscope shows a peak.

NOTE: Care must be taken not to tune the Exciter to the channel oscillator frequency (1650 kHz) above the transmit frequency.

5. Sidetone Adjustment

(a) For this adjustment, refer to Section II-E

F. POWER AMPLIFIER

CAUTION: VOLTAGES IN THIS SECTION ARE HAZARDOUS TO LIFE.

1. Bias Adjustment

(a) Connect equipment as shown in Figure VI-3.

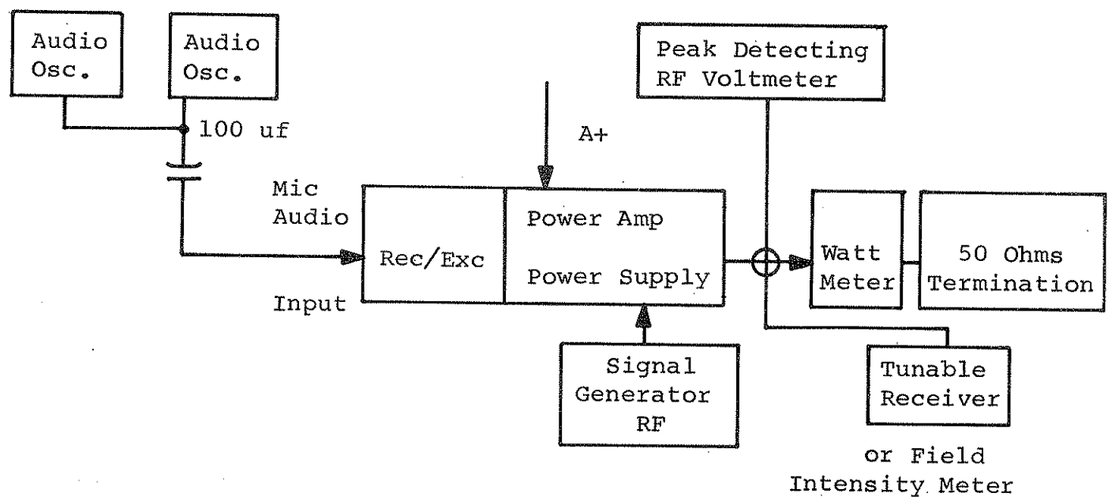


Figure VI-2

(b) Disconnect cable from exciter output

(c) Turn OFF/ON switch to ON.

(d) Allow 15 minutes for equipment warm-up.

(e) Connect DC voltmeter to Pin 1 of V-2 or test point 2 (TP-2).

(f) Turn voltmeter to "3 volt" scale.

(g) Key transmitter.

(h) Adjust R-6 until meter indicates 0.3 volts DC.

(i) Connect DC VTVM to Pin 1 of V1 or test point 1 (TP-1); voltage should be between .25-.35 volts.

2. Driver and Output Coil Tuning.

(a) Connect equipment as shown in Figure VI-3.

(b) Disconnect Receiver/Exciter and connect signal generator to the input of the driver amplifier.

(c) Turn channel selector to desired channel.

(d) Turn OFF/ON switch to "ON".

(e) Allow 15 minutes for equipment warm-up.

(f) Key transmitter.

(g) Tune signal generator for maximum output on wattmeter.

(h) Increase or reduce generator output until wattmeter indicates 50W.

(i) Alternately tune driver coil (L-5 through L-24) and output coil (L1901 through L1920) for peak indication on wattmeter. Reduce generator output to maintain 50W on wattmeter.

3. Neutralizing Capacitor Adjustment

(a) Refer to Figure VI-3 for test set-up.
(b) Connect oscilloscope to Pin 3 of the driver V-3.
(c) Select highest frequency channel.
(d) Disconnect exciter output from driver amplifier.
(e) Key transmitter.
(f) Inject channel frequency from signal generator into J102 (RF output). Caution: Use fused generator and connect to J102 after keying, if no power output is observed on the wattmeter.
(g) Adjust C61 neutralizing capacitor for minimum signal observed on the oscilloscope.
(h) Unkey transmitter and disconnect signal generator from J102.

4. ALC Adjustment

a. Refer to Figure VI-3 for test set-up.
b. Connect exciter output to the driver amplifier.
c. Turn R-1404, AM power adjustment, R-1403, SSB power adjustment and R-1402, AM peak modulation adjustment completely CCW.
d. Turn mode selector to USB or LSB.
e. Turn channel selector to lowest channel frequency used.
f. Key transmitter.
g. Adjust R-1403 (CW) until RF voltmeter indicates 79 volts.
h. Unkey transmitter and turn channel selector to highest frequency; key transmitter.
j. Adjust C-1405 until voltmeter indicates 79V.
k. Unkey transmitter and channel to lowest frequency.
l. Turn mode switch to AM and remove both audio oscillator inputs.
m. Key transmitter and adjust R-1404 (CW) until RF voltmeter indicates 39V.
n. Unkey transmitter and channel to highest frequency. Key the transmitter and adjust C-1408 until voltmeter indicates 39 volts.
o. Connect one audio oscillator to Mic. input and adjust R-1402 CW until the RF voltmeter indicates 79 volts. Then turn R-1402 back 1/2 turn.
p. Unkey transmitter and remove audio osc. input channel to all used frequencies and key transmitter. RF voltmeter should indicate 39V on all channels.

5. Telephone Adjustment

a. Refer to Figure VI-3 for test set-up.
b. Select telephone channel if installed.
c. Turn mode switch to TEL.
d. Connect audio oscillators to MIC input.
e. Key transmitter and record output.
f. Remove audio oscillator and record output.
g. Difference in output must be no less than 14 db and no more than 18 db.
h. Select resistor, R-517 on PC-5, for proper carrier attenuation. (Increase value if less than 14 db and decrease if greater than 18 db) Nominal value installed is 18k.

6. Second Harmonic Trap Adjustment

a. Refer to Figure VI-3 for test set-up.
b. Turn mode switch to AM.
c. Remove audio oscillator input.
d. Couple field intensity meter or receiver from 50 ohm output, and tune to twice the channel frequency.
e. Key transmitter and adjust L-1921 through L-1940, harmonic traps, for minimum signal.

NOTE: If a channel frequency falls close to the 2nd harmonic frequency of another channel the trap should not be adjusted to exact resonance.

SECTION VII

TROUBLE SHOOTING AND MAINTENANCE

A. GENERAL INFORMATION

1. When the transceiver is removed for maintenance, a visual inspection should be performed to check for broken wires, loose or shorted contacts or damaged components.

2. Malfunctions in the Receiver/Exciter may be isolated quite rapidly by the substitution of circuit boards. However, if no spare boards are available, a general signal tracing procedure in conjunction with the trouble analysis charts may be used. Once the faulty circuit board has been isolated it may be returned to Sunair Electronics, for repair or the signal and DC voltage tables provided in this section may be utilized to repair defective boards.

B. EQUIPMENT REQUIRED

1.	RF Voltmeter	H-P Model 410B, or equivalent
2.	RMS Voltmeter	H-P Model 400L, or equivalent
3.	RF Signal Generator	H-P Model 330C, or equivalent
4.	Audio Oscillator	H-P Model 200CD, or equivalent (2)
5.	Wattmeter (100W Element)	Bird Model 43, or equivalent
6.	Dummy Load, 50 ohms	Bird Model 81B, or equivalent
7.	Oscilloscope	Tektronix Model 543B, or equivalent
8.	Multimeter 20K ohms/volt	Simpson Model 260, or equivalent

C. OSCILLATORS

1. Channel Oscillator (20 Xtal Oven Unit or 10 Xtal Rec/Osc Unit)
(a) Trouble Analysis Chart

Symptom	Probable Cause	Remedy
No output on any channel	No +10 volts, or defective PC-8	Make voltage checks on +10 volt line. Refer to Table VII-1 and schematic diagram. Replace defective component or entire circuit board.

Symptom	Probable Cause	Remedy
No output on some channel(s).	Defective crystal(s), defective wafers SW3 or SW4, defective component(s) on PC-9A, PC-9B, PC-11.	Replace crystals check wafers SW3 or SW4 contacts for continuity, test PC-9A, PC-9B and PC-11 as shown in schematic diagram. Replace defective component.
Frequency does not meet requirements in Section V-C, Paragraphs 1 and 2.	Capacitor(s) C-901A&B thru C-910A&B or C-1101 thru C-1110 not adjusted properly, defective crystal or capacitor on PC-9 or PC-11.	See Section VI-C for alignment procedures test, as shown in schematic diagram. Replace defective component.

Test Point		DC Voltage	±10% Signal Voltage (RMS)
Integrated Circuit	Pin No.		
IC-801 or IC-1101	1,11	8.0V	-
	2	4.2V	-
	3,14	3.5V	-
	4	4.2V	-
	5, 9	5.8V	-
	6	3.1V	-
	7	2.4V	0.8V
	8	9.5V	-
	10	5.4V	-
	12	2.7V	-
	13	2.0V	-

Table VII-1 - Channel Oscillator Measurements

2. Carrier Oscillator (1650 kHz)

(a) Trouble Analysis Chart

Symptom	Probable Cause	Remedy
No output in receive or transmit.	Defective crystal or circuit board.	Replace crystal or test PC-10, as shown in Table VII-2 and schematic diagram.

2. Carrier Oscillator (1650 kHz) - Trouble analysis Chart - Continued.

Symptom	Probable Cause	Remedy
No output on receive; transmit normal.	Defective diode CR-1302, L-1301 or CR-1301	Check components and replace if defective.
	Defective switch Q-504 and Q-505 on PC-5.	Test as shown in Table VII-7. Replace defective component or entire circuit board.
No output on transmit.	No +10V transmit, diode CR-1303 or R1301 defective.	Check voltage on K-4 as shown in schematic diagram. Check diode and resistor. Replace if defective.
Frequency does not meet requirements in Section V-C, Paragraph 3, on transmit.	C-1003 not adjusted properly.	Refer to Section VI-C alignment procedures.

Test Point		DC Voltage ±10%		Signal	
Tube Socket	Pin No.	Rec (USB, TEL, LSB)	Transmit	Rec (USB, TEL, LSB)	Transmit
XV-13	2,3,5	Gnd	Gnd		
	4	3V	Gnd		
	6			0.1 V (RMS)	0.33V (RMS)
	7	28	28		
	8	Gnd	8.2		

Table VII-2 - Carrier Oscillator Measurements

D. RECEIVER

1. Trouble Analysis Chart

Symptom	Probable Cause	Remedy
No audio output on any channel, AM or SSB	Squelch control on control head or test set, set to quiet receiver.	Turn squelch control full CCW.
	Squelch threshold R-415 not adjusted properly.	Refer to Section VI-D for alignment and adjustment procedures.
	No +10 volts.	Check voltage on CR3 and CR4. Replace defective component.
	Channel oscillator defective.	Test as shown in Section VII-C, Paragraph 1 and Schematic Diagram. Replace defective circuit board or component.
	Diode CR-4 shorted.	Check diode, replace if defective.
	Defective relay K-4.	Check relay contacts for continuity, replace if defective.
	Defective volume control board. PC-15	Check adjustment of R1502, test ckt. board.
	Defective circuit boards, PC-2, 3, 4.	Substitute circuit boards or test as shown in Tables VII-3, 4, 5 and schematic Diagrams. Replace defective component or entire curcuit board.
No audio output on some channels, AM or SSB.	Defective crystal(s) in channel oscillator.	Repalce crystal(s).

D. Receiver - Trouble Analysis Chart - Continued

Symptom	Probable Cause	Remedy
No audio output on some channels, AM or SSB.	Preselector (PC-1) coils misaligned or defective component.	Refer to Section VI-D for alignment procedures or test as shown in Schematic Diagram. Replace defective component.
	Oscillator trimmer circuit (PC-9) defective.	Check components on inoperative channel(s) on PC-9. Replace defective component. Refer to Section VII-C, Paragraph 1.
No audio output on AM, SSB normal.	Defective mode switch in control head.	Check continuity, replace if defective.
	Defective PC-2, PC-3, or PC-4	Substitute circuit boards or test as shown in Tables VII-3, 4, 5 and Schematic Diagrams. Replace defective component or entire circuit board.
No audio output on SSB, AM normal.	Defective carrier oscillator (1650 kHz).	Test as shown in Table VII-2 and Schematic Diagram. Replace defective component or entire circuit board.
	Defective SSB Rec switch Q-504 and Q-505 on PC-5.	Test as shown in Table VII-7 and Schematic Diagram. Replace defective component or entire circuit board.
	Defective switching circuits on PC-4.	Test as shown in Table VII-5 and Schematic Diagram. Replace defective board.

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ADDENDUM 5
DATE: 8/23/71

REFERENCE: High Voltage Zener Diodes of PA-1010B

PURPOSE: Zener Diode Z4892 P/N 40282 is discontinued.

MANUAL REFERENCE: PA-1010B Schematic
Page 86,91

TEXT: CR 3 Changed from Z4892 P/N 40282 to 1N3008B, P/N 40506
CR 4 Changed from Z4892 P/N 40282 to 1N3009B, P/N 40507

SUNAIR ELECTRONICS, INC.
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ADDENDUM 6
DATE: 25 Aug. 71

REFERENCE: Microphone amplifier PC-5

REVISION: (1) Brown (PC-5)
(2) Brown (PC-5) with revision E printed circuit board

PURPOSE: (1) Reduce input sensitivity of audio amplifier
(2) Inprove linearity of amplifier below AGC threshold

MANUAL REFERENCE: PC-5 schematic; installation and checkout procedure (page 17)

TEXT: (1) R502 1.5k P/N 17247 changed to 680 ohm P/N 17663
(2) Add capacitor 6.8 uf P/N 28753 from emitter of Q507 to ground.

NOTE: The microphone amplifier is equipped with an AGC loop to maintain a constant amplitude audio input to the balanced modulator regardless of microphone gain variations. However, the loop gain of the system is high enough, that in extremely noisy environments and without the aid of a noise cancelling type microphone, output may appear on the relative power meter, in that case; a reduction of R502 reduces the input sensitivity and makes the system less susceptable to ambient noise.

Test Point		DC Voltage ±10%		Signal Volt. & Waveform	
Transistor or FET	Pin No.	SSB	AM	SSB	AM
Q-201 [1]	Emitter	1.75V	1.75V	-	-
	Base	2.55V	2.55V	-	-
	Collector	6.9 V	6.9 V	0.38V	0.38V
Q-202 [2]	Drain	10.0V	10.0V	0.28V	0.28V
	Source	2.25V	2.25V	-	-
	Gate	-	-	2.0V	2.0V
Q-203 [2]	Drain	8.9V	8.9V	0.5V	-
	Source	0.5V	0.5V	-	0.5V
	Gate	-	-	0.12V	0.12V
Q-204 [2]	Emitter	-	1.6V	-	-
	Base	-	2.3V	-	0.22V
	Collector	-	8.7V	-	2.4V
Q-205 [2]	Drain	-	2.9V	-	-
	Source	-	2.6V	-	0.6V
	Gate	-	-	-	-
Q-206 [2]	Emitter	0	0	-	-
	Base	0.7V	0	-	-
	Collector	0	2.9V	-	-

Note 1: DC measurements were taken with no signal input. Signal measurements were taken with 1 MV (rms) input (no modulation) on Pin "U", PC-2; channel oscillator off.

Note 2: DC measurements static. No signal conditions. Signal measurements were taken with 100 uv (rms) no modulation) input on Pin "U", PC-2; channel oscillator on.

Table VII-3 - PC-2 DC and Signal Measurements

Test Point Transistor or FET	Pin No.	DC Voltage ±10% USB	AM	TEL	LSB	Signal Voltage and Waveforms SSB	AM
Q-301	E	3.7 V	3.9 V	3.5 V	4.0 V		
	B	0	0	0	4.7 V		
	C	10.0 V	10.0 V	10.0 V	10.0 V		
Q-302	E	3.7 V	3.9 V	3.5 V	4.0 V		
	B	4.4 V	0	4.2 V	0		
	C	10.0 V	10.0 V	10.0 V	10.0 V		
Q-303	E	3.7 V	3.9 V	3.5 V	4.0 V		
	B	0	4.6 V	0	0		
	C	10.0 V	10.0 V	10.0 V	10.0 V		
Q-304	E	1.45V	1.45V	1.45V	1.45V		
	B	2.25V	2.25V	2.25V	2.25V		
	C	9.3 V	9.3 V	9.3 V	9.3 V	0.23V	0.34V
Q-305	E	0	0	0	0		
	B	0.7 V	0	0.7 V	0.7 V		
	C	0	10.0 V	0	0		
Q-306	E	0	9.5 V	0	0		
	B	0	10.0 V	0	0		
	C	10.0 V	10.0 V	10.0 V	10.0 V		
Q-307	D	8.5 V	8.8 V	8.5 V	8.5 V	1.4 V	1.6 V
	S	0.71V	0.71V	0.71V	0.71V		
	G	-	-	-	-	0.25V	0.25V
			SSB	AM			
Q-308	D		3.9 V	4.2 V		0.46V	0.6 V
	S		1.7 V	1.6 V		0.5 V	-
	G		-	-		0.06V	0.36V
Q-309	E		0.16V	0.16V		-	4.2VDC
	B		0.7 V	0.7 V		-	4.9VDC
	C		10.0 V	10.0 V		-	10.0VDC
Q-310	E		0	0		-	1.2VDC
	B		0	0		-	1.9VDC
	C		9.6 V	9.6 V		-	5.5VDC
*Q-311	E		0	0		-	-
	B		0	0		-	-
	C		0	0		-	-
Q-312	E		0.7 V	0.7 V		-	4.8VDC
	B		0	0		-	0
	C		0	0		-	4.1VDC

Note 1: DC measurements static. No signal conditions.
Note 2: Signal measurements taken with 1 MV (rms) input on Pin "C", PC-3, and Pin "H", PC-2, for SSB and AM respectively, 30% modulation, 1000 Hz on AM.
*Q-311 does not conduct until emitter of previous stage Q-311 reaches 1.4VDC.

Table VII-4 - PC-3 DC and Signal Measurements

Test Point Transistor or FET	Pin No.	DC Voltage ±10% USB	AM	TEL	LSB	Signal Voltage and Waveforms SSB	AM
Q-401	E	0	0	0	0	-	-
	B	0	0	0	0	-	-
	C	0	4.4 V	0	0.6V	-	-
Q-402	E	0	0	0	0	-	-
	B	0	0.7 V	0	0	-	-
	C	3.8 V	0	3.6	0.0V	-	-
Q-403	E	0	0	0	0	-	-
	B	0	0.7 V	0	0.7V	-	-
	C	4.5 V	0	4.5V	0	-	-
Q-404	E	0	0	0	0		
	B	0.7 V	0.7 V	0.7V	0	-	-
	C	0	0	0	4.5V	-	-
Q-405	E	2.2 V	-	-	-	-	-
	B	2.8 V	-	-	-	-	-
	C	9.5 V	-	-	-	-	-
Q-406	E	1.2 V	-	-	-	-	-
	B	2.20V	-	-	-	-	-
	C	1.30V	-	-	-	-	-
Q-407	E	0.8 V	-	-	-	-	-
	B	1.00V	-	-	-	-	-
	C	9.5 V	-	-	-	-	-
			SSB	AM			
Q-408	E		1.30V	-		-	-
	B		0.40V	-		-	-
	C		2.15V	-		-	-
Q-409	S		1.25V	-		0.06V~	-
	D		9.5 V	-		-	-
	G		-	-		0.06V~	-
IC-401	1		4.2 V	-		-	-
	2		1.0 V	-		-	-
	3		1.0 V	-		-	-
	4		9.1 V	-		9.0 V~	
	5,6		0.013V	-		-	-
	7		9.1 V	-		9.0 V~	-
	8,9		9.5 V	-			-
	10		4.9 V	-		0.06V~	-
	11		2.15V	-		-	-
	12		0	-		-	-

Note 1: DC measurements static. No signal conditions.
Note 2: Signal measurements were taken with 20 MV (rms), 1000 Hz injected on Pin "T", PC-4.
Note 3: Q-405 thru Q-408 measurements were taken with R-2 and R-415 full CCW.

Table VII-5 - PC-4 DC and Signal Measurements

E. Exciter

1. Trouble Analysis Chart

Symptom	Probable Cause	Remedy
No output on any channel, SSB or AM.	No +10 Volt.	Check voltage regulator CR-3. Replace defective part.
	Defective channel or carrier oscillator.	Test as shown in VII-C, Paragraphs 1 and 2 and Schematic Diagram. Replace defective component.
	Defective PC Boards 4, 5 or 6.	Test as shown in Tables VII-6, 8, 9 and Schematic Diagrams. Replace defective part(s) or entire PC Board(s).
	Defective relay K-4.	Test for continuity replace if defective.
No output on some channels, SSB or AM.	Defective crystals.	Test and replace if defective.
	Defective channel oscillator (PC-9) trimmer board.	Test as shown in Table VII-1 and Schematic Diagram. Replace defective component.
	Coils on PC-7A or B not adjusted properly. Defective components on PC-7.	Refer to alignment procedure, Section VI-E. Test and replace defective components.
No output on SSB. No modulation on AM. Carrier normal.	R-511 not adjusted properly.	Adjust R-511 as shown in Section VI-E, alignment procedures.
No output on SSB. No modulation on AM. Carrier Normal.	Defective PC-5 audio circuit and balanced modulator.	Test as shown in Table VII-8 and Schematic Diagrams. Replace defective component or entire circuit board.

E. Exciter - Trouble Analysis Chart - Continued

Symptom	Probable Cause	Remedy
No carrier on AM. SSB normal.	Defective mode switch.	Check continuity. Replace if defective.
	Open diodes CR-505 or CR-507. Defective switch Q-506.	Test as shown in Table VII-8 and Schematic Diagram. Replace defective component or entire circuit board.
Output on SSB without audio input.	Defective balanced modulator (M-501), defective AM, TEL carrier insertion circuit on PC-5.	Test as shown in Table VII-8 and Schematic Diagram. Replace defective component or entire circuit board.
	Balanced mixer potentiometer (R-609) not adjusted properly.	Refer to alignment procedures, Section VI-E.
	Defective mixer, PC-6.	Test as shown in Table VII-9 and Schematic Diagram.
No sidetone output.	R-423 not adjusted properly, defective coupling cap.	Refer to Section II-E for adjustment. Test as shown in Tables VII-6, 8 and Schematic Diagrams.

Test Point Transistor or FET	Pin No.	DC Voltage ±10% USB	AM	TEL	LSB	Signal Voltage and Waveforms SSB	AM
Q-401	Emitter	0	0	0	0	-	-
	Base	0.7V	0.7V	0.7V	0.7V	-	-
	Collector	0	0	0	0	-	-
Q-402	E	0	0	0	0	-	-
	B	0	0.7V	0	0	-	-
	C	3.8V	0	3.6V	0.0V	-	-
Q-403	E	0	0	0	0	-	-
	B	0	0	0	0.7V	-	-
	C	4.5V	4.5V	4.5V	0	2.0V	1.2V
Q-404	E	0	0	0	0	-	-
	B	0.7V	0.7V	0.7V	0	-	-
	C	0	0	0	4.5V	2.0V	-
IC-401	10	-	-	-	-	0.06V	-
	4	-	-	-	-	9.0V	-
	7	-	-	-	-	9.0V	-

Note 1: DC measurements static. No signal conditions.

Note 2: Signal measurements were taken with 0.1V (rms), 1000 Hz input at Pin "B", PC-5.

Table VII-6 - PC-4 DC Voltage and Signal Measurements

Test Point Transistor or FET	Pin No.	DC Voltage ±10% USB	AM	TEL	LSB	Signal Voltage and Waveforms SSB	AM
Q-504	E	0	0	0	0	-	-
	B	0	0.7V	0	0	-	-
	C	9.0V	0	9.0V	0	-	-
Q-505	E	8.5V	0	8.5V	8.5V	-	-
	B	9.0V	0	9.0V	9.0V	-	-
	C	10.0V	10.0V	10.0V	10.0V	-	-
Q-506	E	0	0	0	0	-	-
	B	0.7V	0.7V	0.7V	0.7V	-	-
	C	0	0	0	0	-	-

Note 1: DC measurements static. No signal condition in Receive mode only.

Table VII-7 - PC-5 DC and Signal Measurements

Test Point Transistor	Pin No.	DC Voltage ±10% USB	AM	TEL	LSB	Signal Voltage and Waveforms SSB	AM
Q-501	E	2.0 V	-	-	-	-	-
	B	2.7 V	-	-	-	0.1 V	0.1V
	C	3.5 V	6.3V	-	-	1.0 V	0.6V
Q-502	E	2.9 V	5.6V	-	-	1.0 V	0.6V
	B	3.5 V	6.3V	-	-	1.0 V	0.6V
	C	10	10	-	-	-	-
Q-503	E	.56V	-	-	-	-	-
	B	1.2 V	-	-	-	.55V	0.3V
	C	9.7 V	-	-	-	2.0 V	1.2V
Q-504	E	0	0	0	0	-	-
	B	0	0.7V	0	0	-	-
	C	0	0	0	0	-	-
Q-505	E	0	0	0	0	-	-
	B	0	0	0	0	-	-
	C	0	0	0	0	-	-
Q-506	E	0	0	0	0	-	-
	B	0	0	0	0	-	-
	C	2.5V	5.0V	3.5V	2.5V	-	-

Note 1: DC measurements static. No signal conditions.

Note 2: Signal measurements were taken with 0.1V (rms) 1000 Hz input at Pin "B", PC-5.

Table VII-8 - PC-5 DC Voltage and Signal Measurements

Test Point		DC Volts	Signal Voltage	
		USB, AM, TEL, LSB	USB	LSB
Q-601	E	0.6		
	B	1.2		
	C	9.0	0.3Vpp	0.3Vpp
Q-602	E	0.8		
	B	1.5		
	C	4.8	.05Vpp	.05Vpp
Q-603	S	1.6		
	D	6.6		
	G	0		
Q-604	E	9.5		
	B	11.0		
	C	1.4		
Q-605	S	1.7		
	D	7.7		
	G	0		
Q-606	S	1.0		
	D	9.0	0.2Vpp	0.2Vpp
	G	0		
Q-607	E	0.9		
	B	1.5		
	C	9.0		
Q-608	E	0.3		
	B	1.0		
	C	9.2	4.4Vpp	4.4Vpp

Table VII-9 - PC-6 Voltage and Signal Measurements

F. POWER AMPLIFIER,

1. Trouble Analysis Chart

Symptom	Probable Cause	Remedy
No output on any channel, tube filaments dark.	Fuse	Check and replace fuse.
	Defective power relay, K-1.	Burnish contacts or replace K-1.
	Defective tubes, V-1, V-2 or V-3.	Test and replace.
No output on any channel. No transformer switching noise. High A+ current.	Defective Q-1 or Q-2 switching transistors.	Test and replace if defective.
	Defective rectifier diodes CR-2001 thru CR-2004.	Test and replace if defective.
	Defective bias rectifier CR-2005.	Test and replace if defective.
	Defective relay K-2.	Test, burnish contacts, or replace.
No output on any channel, tubes lit, Switching noise present.	Defective antenna relay K-3.	Test, burnish contacts or replace.
	Defective Tubes V-1, V-2 or V-3.	Test and replace if defective.

F. Power Amplifier - Trouble Analysis Chart - Continued

Symptom	Probable Cause	Remedy
No output on any channel, Tubes lit, switching noise present.	Ledex motor not switching or switching to wrong channel.	Align to proper channel position and tighten coupling between motor and switch. Check A+ Ledex.
		Replace motor if defective. Check channel wire system.
No output on some channels.	Defective driver tuned circuits.	Test as shown in Schematic Diagram, replace defective components.
	Defective output tuned circuit.	Test as shown in Schematic Diagram, replace defective component.
	Defective contacts on wafers of SW-5,6,7,8,9,10.	Check continuity of SW-5,6,7,8,9,10 wafers, replace if defective.
Output low.	ALC potentiometers not set properly.	Adjust R-1403, R-1404, as shown in Section VI-F, alignment procedures.
	Bias adjustment V-1 and V-2 not correct.	Adjust R-6, as shown in Section VI-F alignment procedures.
	Tubes V-1, V-2, or V-3 defective.	Check tubes, replace if defective.
Output high.	ALC not adjusted properly or defective ALC circuits in PC-14 or exciter (PC-6).	Adjust ALC as shown in Section VI-F, alignment procedures, test ALC detector and amplifiers as shown in Schematic Diagram. Replace if defective.

Test Point Tube or Transistor	Pin No.	DC Voltage ±10%	Signal Voltage
V-3	1	1.50V	-
	2	-	-
	3	-	-
	4	FIL	-
	5	0	-
	6	-	-
	7	300.0V	-
	8	175.0V	-
	9	1.50V	-
V-1, V-2	1, 4, 6	.30V	-
	2	FIL	-
	3	+250.0V	-
	5	-60.0 OV	-
	7	FIL	
	Anode Cap *	+840.0V	-

* Measure on SB no signal only or measure on cold side of RF choke,L25, and check continuity of choke.

Note 1: DC Measurements static. No signal condition.

Table VII-10 - Driver and Power Amplifier DC and Signal Measurements.

SECTION VIII

INSTRUCTIONS FOR FREQUENCY CHANGE AND
ADDITION OF OPTIONS

A. FREQUENCY CHANGE

1. Receiver/Exciter

The receiver/exciter frequency range is divided into bands. Any frequency within a band may be tuned by retuning the channel coils located on PC-1A and PC-1B for the receiver and PC-7A and PC-7B for the exciter and changing the channel crystal. For changes outside of the installed band, Tables VIII-1 and VIII-2 list the required coil and capacitor combinations.

Crystals must be ordered from SunAir, specifying the part number and required channel frequency. Crystal part numbers are listed in the Parts List, Section IX. After installation of the tuned circuit components and crystals, refer to Section VI for the alignment procedure.

It is absolutely mandatory that only SunAir supplied crystals be used in the transmit oscillator and a frequency counter be used that will allow setting the channel frequency to within ± 2 Hz. Failure to install the correct crystal will result in off frequency operation and degraded performance, in addition to violation of the Commission Rules and Regulations, under which this unit is licensed.

2. Power Amplifier

The frequency dependent components are located in the driver plate circuit, the power amplifier pi-network and the second harmonic traps. Table VIII-3 shows the frequency range and part numbers of the required components. After installing the necessary components, refer to Section VI for the alignment procedure.

RECEIVER RF PRESELECTOR TUNED CIRCUITS PC-1

Frequency Range (MHz)	*L101-L130	*C101-C110	*C111-C120	*C121-C130	*C131-C140	*C141-C150	*C151-C160	*C161-C170
2.00-2.40	62981-1 Brn	.0033uf 28871	360pf 28727	20pf 28674	330pf 28865	20pf 28674	360pf 28727	.0018uf 28869
2.40-2.88	62981-2 Red	.0027uf 28870	300pf 28864	20pf 28674	270pf 28863	20pf 28674	300pf 28864	.0018uf 28869
2.88-3.46	62981-3 Orn	.0027uf 28870	270pf 28863	18pf 28862	220pf 28861	18pf 28862	270pf 28863	.0018uf 28869
3.46-4.15	62981-4 Yel	.0018uf 28869	220pf 28861	15pf 28650	180pf 28105	15pf 28650	220pf 28861	.0013uf 28868
4.15-5.00	62981-5 Grn	.0018uf 28869	200pf 28715	12pf 28648	150pf 28090	12pf 28648	200pf 28715	.0012uf 28867
5.00-6.00	62981-6 Blu	.0013uf 28868	150pf 28090	10pf 28859	130pf 28703	10pf 28859	150pf 28090	.0012uf 28867
6.00-7.20	62981-7 Vio	.0012uf 28867	130pf 28703	9pf 28636	110pf 28131	9pf 28636	130pf 28703	.0012uf 28867
7.20-8.65	62981-8 Gry	910pf 28866	110pf 28131	7pf 28858	91pf 28860	7pf 28858	110pf 28131	910pf 28866
8.65-10.40	62981-9 Wht	820pf 28399	91pf 28860	7pf 28858	82pf 26652	7pf 28858	91pf 28860	820pf 28399
10.40-12.45	62981-10 Blk	820pf 28399	82pf 26652	5pf 28857	75pf 28466	5pf 28857	82pf 26652	820pf 28399
12.45-15.00	62981-11 Brn Brn	680pf 28428	68pf 28076	5pf 28857	68pf 28076	5pf 28857	68pf 28076	680pf 28428
15.00-18.00	62981-12 Brn Red	430pf 28454	56pf 28129	2.2pf 25000	56pf 28129	2.2pf 25000	56pf 28129	430pf 28454

* Channel 1-10 Are Located on PC-1A
Channel 11-20 Are Located on PC-1B

Table VIII-1 - Receiver Customizing

ASB-320 FIRST AND SECOND TUNED AMPLIFIER, PC-7A AND PC-7B

Freq. MHz	P/N	Color	Capacitor P/N	Capacitor pf	Resistor P/N	Resistor Ohms
2.0- 2.3	62993-1	Brn	28399	820	17091	330
2.3- 2.6	62993-1	Brn	28624	680	17091	330
2.6- 2.9	62993-2	Red	28624	680	17091	330
2.9- 3.5	62993-2	Red	28612	500	17091	330
3.5- 4.0	62993-3	Orn	28612	500	17091	330
4.0- 4.5	62993-3	Orn	28600	390	17091	330
4.5- 5.2	62993-4	Yel	28600	390	17091	330
5.2- 6.0	62993-4	Yel	27632	300	17091	330
6.0- 6.9	62993-5	Grn	27632	300	17091	330
6.9- 7.9	62993-5	Grn	28595	220	17091	330
7.9- 9.0	62993-6	Blu	28595	220	17091	330
9.0-10.3	62993-6	Blu	28583	180	17091	330
10.3-12.1	62993-7	Vio	28583	180	17091	330
12.1-13.6	62993-7	Vio	27486	130	17091	330
13.6-15.0	62993-8	Gry	27486	130	18253	330
15.0-18.0	62993-8	Gry	27474	100	18253	330

Table VIII-2
Exciter Customizing

POWER AMPLIFIER

Frequency Range (MHz) From	To	Band	DRIVER TUNED CIRCUIT L5-24 P/N	ID	C21-40* P/N	ID	C41-60 P/N	ID	FINAL AMPLIFIER PI-NETWORK L1901-20 P/N	C71-90 P/N	ID	C1901-20 P/N	ID	TRAP C1921-40 P/N	ID
2.0	2.3	1	63375	A-4	28973 29070	560 pf 120, N2200	27527	620 pf	64719	27785	360 pf	24915	750 pf	28875	820 pf
2.3	2.6	2	66509	A-9	28612 29070	500 120, N2200	28973	560	64719	27759	300	24941	700	28624	680
2.6	3.0	3	66509	A-9	28600 29082	390 100, N2200	27591	470	64721	27747	270	24953	800	28961	510
3.0	3.4	4	66509	A-9	26951 29111	330 100, N1500	28600	390	64721	27723	240	25579	820	28600	390
3.4	3.9	5	66511	A-8	27503 29109	270 120, N1500	27515	360	64721	27709	200	24941	700	27632	300
3.9	4.5	6	63117	A2R	27632 29094	300 130, N1500	28600	390	64733	27682	170	25555	680	28595	220
4.5	5.2	7	63117	A2R	27620 29111	230 100, N1500	27632	300	64733	25892	150	24185	600	28583	180
5.2	5.9	8	63117	A2R	28874 29123	68 150, N750	28583	180	64745	25907	120	25529	530	27486	130
5.9	6.8	9	63143	D-6	28874 29123	68 150, N750	28583	180	64745	25919	100	25505	470	27474	100
6.8	7.9	10	63143	D-6	29123	150, N750	25775	110	64757	28789	82	25490	430	25232	75
7.9	9.0	11	63155	D-5	29123	150, N750	28985	120	64757	28806	62	25488	390	27462	56
9.0	10.3	12	63155	D-5	29135	130, N750	27474	100	64769	25933	50	25464	330	26080	43
10.3	11.8	13	63167	D-4	29147	100, N750	27462	56	64769	28820	39	25452	300	26078	33
11.8	13.6	14	63167	D-4	29159	82, N750	26080	43	64771	25945	30	25373	230	29006	24
13.6	15.5	15	63179	D-3	29161	68, N750	26042	20	64771	28947	27	25426	200	26030	18
15.5	18.0	16	63179	D-3	29173	36, N750	Note (1)		64771	Note (1)		25646	100	26028	12

Note (1): Use no capacitor; leave circuit open.

* Use two capacitors in parallel for bands 1-9 as noted above.

Table VIII-3 - Power Amplifier Customizing Components

B. LSB OPTION INSTALLATION

The filter for the lower sideband option is mounted on an identical bracket as the upper sideband operation filter.

Remove two screws holding Z shaped filter bracket and lift bracket until filter may be fitted in mounting holes. Mount filter and add 1K ohm resistor as on USB filter. Connect 50 ohm coax to input terminal and shield to ground side of filter. Connect other end of coax to J4-B and connect shield to ground bus. Connect 50 ohm coax to output terminal of filter and shield to ground lug. Connect other end of coax to J3-E and shield to ground bus. Reinstall Z bracket with two screws.

C. RECEIVE OSCILLATOR OPTION

An optional 10 X-TAL oscillator may be installed in the space provided on the hinged top. Two #4 screws are required to secure the oscillator to the bracket. The coaxial cable (oscillator output) is soldered to Pin "N" of PC-2. The orange wire is soldered to terminal #12 on PC-11. All other wires are channel wires and must be soldered to TB-1 (Rec) according to the desired two frequency simplex pairing.

EXAMPLE: If channel (1) is two frequency simplex, the wire, corresponding to crystal "A" on the optional oscillator has to be soldered to terminal (1) REC of TB-1. The jumper between terminal (1) REC and terminal (1) TX is removed and the wire from PC-9A channel 1 position is soldered to terminal (1) TX of TB-1.

PARTS LIST

CKT. SYM.	PART NO.	DESCRIPTION
C1	28923	Capacitor, Electrolytic 500uf 50V
C2	27929	" Disc Ceramic .05uf 100V
C3	28337	" " " 0.47uf 50V
C4	24587	" Tantalum 100uf 30V
C5	24587	" " " "
C6 thru C15	27357	" Disc Ceramic .05uf 25V
C16	28337	" " " 0.47uf 50V
C17	27412	" Tantalum 22uf 15V
C18	24587	" " 100uf 30V
C19	27929	" Disc Ceramic .05uf 100V
C20	28923	" Electrolytic 500uf 50V
C21 thru C60		" Frequency Dependent-See Customizing Chart (Section VIII)
C61	24850	" Variable Glass 1-30pf 1.5KV
C62	27345	" Disc Ceramic .02uf 100V
C63	27656	" " " .005uf 1KV
C64	27656	" " " " "
C65	27656	" " " " "
C66	27345	" " " .02uf 100V
C67	27656	" " " .005uf 1KV
C68	27656	" " " " "
C69	27345	" " " .02uf 100V
C70	28911	" " " .002uf 6KV
C71 thru C90		" Frequency Dependent-See Customizing Chart (Section VIII)
C91	24410	" Disc Ceramic .01uf 1.6KV
C92	25684	" " " .001uf 500V
C93	24458	" " " .02uf 150V
C94	27345	" " " .02uf 100V
C95	27345	" " " " "
C96	27345	" " " " "
C97	27345	" " " " "
C98	27230	" Mylar 1uf 100V
CR1	40506	Diode, Zener IN3008B
CR2	40507	" " IN3009B
CR3	40177	" " IN2974A
CR4	40511	" " IN5352B
CR5	40426	" " 9.1V 1W
CR6	44290	" Silicon IN914
CR7	44290	" " "
CR8	40165	" " 10D4
CR9	40165	" " "
E1	99362	Parasitic Suppressor
E2	99362	" "
F1	86030	Fuse, 3AG, 20Amp.
FL1	81731	Filter, USB Operation
FL2	81743	" LSB " (Optional)
H1	81858-1	Oven, Carrier Oscillator
H2	84042	" Channel " 20 Xtal

CKT. SYM.	PART NO.	DESCRIPTION
J1A	75328	Connector, Card
J1B	75328	" "
J2 thru J6	74972	" "
J7A	75328	" "
J7B	75328	" "
J101	74037	" Chassis
J102	74192	" UHF, SO-239
J103	84044	" Phone
J104	84056	" Microphone
K1	66004	Relay On/Off
K2	66016	" P.S.
K3	66286	" RF
K4	66377-2	" Rec/Exc
KR1	34271	Rotary Solenoid
L1	56372	Inductor 45uh
L2	93772	" 9mh
L3	64654	" 82uh
L4	56396	" Pi-wound 2.5mh
L5 thru L24		" Frequency Dependent-See Customizing Chart(Sec. VIII)
L25	56061	" Pi-wound 2.5mh
P101	74013	Connector, Mates with J101
P102	74219	" UHF PL-259
	74207	" Reducing Adapter for RG-58/U
R1	19001	Resistor 40 ohm 10W
R2	16011	" 150 " 3W
R3	18928	" 160 " 5W
R4	17156	" 1K " 1/4W
R5	17156	" " " "
R6	33590	Potentiometer 10K " 1/2W
R7	16724	Resistor 10K " "
R8	17936	" 47 " 1/4W
R9	18253	" 33 " "
R10	17936	" 47 " "
R11	17431	" 27K " 1W
R12	18875	" 1.5K " 10W
R13	19037	" 1K " 5W
R14	17742	" 18K " 1/2W
R15	18538	" 10 " "
R16	18538	" " " "
R17	18538	" " " "
R18	18538	" " " "
R19	18851	" 50 " 10W
R20	17027	" 1 " 1W
R21	19104	" 75 " 10W
R22	19099	" 2 " 10W
SW1	34574	Switch Wafer Rec/Exc Chan.
SW2	34572	" " Dummy
SW3	34573	" " Rec Channel Selector
SW4	34573	" " Exc " "
SW5	34573	" " Driver
SW6	34573	" " "
SW7	34572	" " Dummy
SW8	33162	" " PA Pi
SW9	33162	" " " "

PARTS LIST

CKT. SYM.	PART NO.	DESCRIPTION
PC4	10206	P.C. Board for 99794
	99794	P.C. Board Ass'y with all Components
C401	26913	Capacitor .02uf 25V
C402	26913	" .02uf 25V
C403	27400	" 15uf 35V
C404	28337	" .47uf 50V
C405	28337	" .47uf 50V
C406	26913	" .02uf 25V
C407	24472	" 2.2uf 15V
C408	26913	" .02uf 25V
C409	27357	" .05uf 25V
C410	24472	" 2.2uf 15V
C411	27357	" .05uf 25V
C412	27357	" " "
CR401 thru CR412	44290	Diode 1N914
IC401	44460	Integrated Circuit, Audio Amp.
Q401 thru Q404	44252	Transistor 2N3646
Q405 thru Q408	44434	" MPS2925
Q409	44393	" FET 2N4303
Q410	44434	" MPS2925
Q411	44434	" "
R401 thru R412	17120	Resistor 27K ohm 1/4W
R413	17156	" 1K " "
R414	17156	" 1K " "
R415	33849-4	Potentiometer 10K " 1/2W
R417	17807	Resistor 2.2K " 1/4W
R418	17039	" 100K " "
R419	17039	" 100K " "
R420	18306	" 5.6K " "
R421	18306	" 5.6K " "
R422	18306	" 5.6K " "
R423	33849-4	Potentiometer 10K " 1/2W
R424	18306	Resistor 5.6K " 1/4W
R425	18057	" 470K " "
R426	17077	" 4.7K " "
R427	18849	" 1.2K " 1/2W
R428	18411	" 470 " 1/4W
R429	17883	" 3.9K " "
R430	18411	" 470 " "
R431	17883	" 3.9K " "
R432	17039	" 100K " "

CKT. SYM.	PART NO.	DESCRIPTION
PC#5	10487	P C. Board for 99425
	99425	P.C. Board Ass'y with all components
C501	28038	Capacitor 68 uf 15V
C502	24472	" 2.2 uf 15V
C503	27357	" .05 uf 25V
C504	28404	" 10 uf 6V
C505	27357	" .05 uf 25V
C506	28753	" 6.8 uf 15V
C507	27357	" .05 uf 25V
C508	28337	" .47 uf 50V
C509	28416	" 25 uf 25V
C510	28208	" .001 uf 100V
C511	28865	" 330 pf
C512	28208	" .001 uf 100V
C513	28545	" 100 pf
C514	26834	" 10 pf
C515	28387	" 620 pf
C516	27357	" .05 uf 25V
C517	26913	" .02 uf 25V
C518	27357	" .05 uf 25V
C519	27333	" .005 uf 100V
C520	28519	" 27 pf
CR501 thru CR511	44290	Diode IN914
L501	65933	Choke 120 uh
L502	65907	" 15 uh
M501	40311	Module, Diode Ring
Q501	44434	Transistor MPS-2925
Q502	44434	" "
Q503	44434	" "
Q504	44252	" 2N3646
Q505	44379	" 40347
Q506	44252	" 2N3646
R501	17132	Resistor 220 Ohm 1/4W
R502	17481	" 6.8K " "
R503	18186	" 1.2K " "
R504	18186	" " " "
R505	33849-3	Pot. 200 " "
R506	17807	Resistor 2.2K " "
R507	18461	" 82 " "
R508	17091	" 330 " "
R509	17132	" 220 " "
R510	17663	" 680 " "
R511	34207	Pot. 1K " "
R512	17077	Resistor 4.7K " "
R513	17936	" 47 " "
R514	17792	" 33K " "
R515	17132	" 220 " "
R516	18162	" 8.2K " "
R517	17572	" 18K " "
R518	17792	" 33K " "
R519	17792	" " " "
R520	18318	" 12K " "
R521	17077	" 4.7K " "
R522	18162	" 8.2K " "
R523	17481	" 6.8K " "
R524	17089	" 3.3K " "
R525	17481	" 6.8K " "

PARTS LIST

CKT. SYM.	PART NO.	DESCRIPTION
R526	17089	Resistor 3.3K Ohm 1/4W
R527	17156	" 1K " "
R528	17041	" 10K " "
R529	18796	" 68 " "
R530	34439	Pot. 100 " "
R531	17156	Resistor 1K " "
T501	99693	Balanced Modulator Output Transformer
T502	99693	Balanced Modulator Input Transformer
PC#6	10204	P.C. Board for 99796
	99796	P.C. Board Ass'y with all components
C601	27333	CAPACITOR .005 uf 100V
C602	27333	" .005 uf 100V
C603	27333	" .005 uf 100V
C604	26913	" .02 uf 25V
C605	28533	" 43 pf
C606	26913	" .02 uf 25V
C607	28533	" 43 pf
C608	28545	" 100 pf
C609	28686	" 33 pf
C610	26913	" .02 uf 25V
C611	28686	" 33 pf
C612	28686	" 33 pf
C613	28337	" .47 uf 50V
C614	25098	" 500 pf
C615	28686	" 33 pf
C616	28686	" 33 pf
C617	26913	" .02 uf 25V
C618	26913	" .02 uf 25V
C619	28703	" 130 pf
C620	26913	" .02 uf 25V
C621	26913	" .02 uf 25V
C622	28337	" .47 uf 50V
C623	28337	" .47 uf 50V
C624	28208	" .001 uf 100V
C625	28868	" 1300 pf
CR601	44290	DIODE, SILICON 1N914
CR602	44290	" " 1N914
CR603	44290	" " 1N914
CR604	44290	" " 1N914
L601	66494	INDUCTOR, 1 mh
L602	66494	" 1 mh
M601	40323	MODULE, DIODE RING
Q601	44513	TRANSISTOR, SILICON 2N5180
Q602	44513	" " 2N5180
Q603	44484	" " 3N128
Q604	44587	" " 2N4288
Q605	44484	" " 3N128
Q606	44393	" " 2N4303

CKT. SYM.	PART NO.	DESCRIPTION
Q607	44513	TRANSISTOR, SILICON 2N5180
Q608	44331	" " 2N3643
R601	34441	POT 10K ohm .6 W
R602	18318	RESISTOR 12K " 1/4 W
R603	18318	" 12K " " "
R604	17819	" 1.8K " " "
R605	17118	" 100 " " "
R606	17936	" 47 " " "
R607	18318	" 12K " " "
R608	17663	" 680 " " "
R609	34439	POT 100 " .6 W
R610	17156	RESISTOR 1K " 1/4 W
R611	18174	" 15 " " "
R612	17077	" 4.7K " " "
R613	18318	" 12K " " "
R614	18667	" 2.7K " " "
R615	18320	" 560 " " "
R616	18320	" 560 " " "
R617	17675	" 150K " " "
R618	17845	" 270 " " "
R619	18186	" 1.2K " " "
R620	17106	" 47K " " "
R621	17118	" 100 " " "
R622	17675	" 150K " " "
R623	17845	" 270 " " "
R624	18186	" 1.2K " " "
R625	17675	" 150K " " "
R626	17118	" 100 " " "
R627	17118	" 100 " " "
R628	18318	" 12K " " "
R629	18667	" 2.7K " " "
R630	17118	" 100 " " "
R631	17118	" 100 " " "
R632	17247	" 1.5K " " "
R633	17273	" 150 " " "
R634	18174	" 15 " " "
R635	17716	" 10 " " "
T601	99693	TRANSFORMER, TOROID, TRIFILAR
T602	99693	" " "
T603	99692	" " BIFILAR

PARTS LIST

CKT. SYM.	PART NO.	DESCRIPTION
PC7	10203	P. C. Board for 99797
	99797	P. C. Board Ass'y. Without Customizing Components
C701 thru C720		Capacitor - Frequency Dependent - See Customizing Chart,
C721 thru C740	27357	Capacitor .05uf 25V
CR701 thru CR723	44290	Diode 1N914
L701 thru L720	62993	Coil, Variable - Frequency Dependent - See Customzing Chart,
R701 thru R710		Resistor - Frequency Dependent - See Customizing Chart,
PC8	10210	P. C. Board for 99798
	99798	P. C. Board Ass'y. With all Components
C801	26913	Capacitor .02uf 25V
C802	28090	" 150pf 500V
C803	25000	" 2.2pf 100V
C804	26913	" .02uf 25V
C805	26913	" " "
C806	25036	" 6pf 100V
C807	26834	" 10pf 500V
IC801	44551	Integrated Circuit CA3046
R801	17077	Resistor 4.7K ohm 1/4W
R802	17041	" 10K " "
R803	17156	" 1K " "
R804	17118	" 100 " "
R805	18667	" 2.7K " "
R806	18411	" 470 " "
R807	17041	" 10K " "
R808	17077	" 4.7K " "
R809	17845	" 270 " "
R810	18411	" 470 " "
R811	17118	" 100 " "

CKT. SYM.	PART NO.	DESCRIPTION
PC9	10211	P. C. Board for 99799
	99799	P. C. Board Ass'y. With All Components
C901 thru C910	26822	Capacitor, Variable 2-8pf
C911 thru C920	28478	" 36pf
C921 thru C930	28131	" 110pf
CR901 thru CR910	44290	Diode 1N914
R901 thru R910	18306	Resistor 5.6K ohm 1/4W
R911 thru R920	17089	" 3.3K " "
R921	18306	" 5.6K " "
PC#10	10212	P. C. Board for 99800
	99800	P. C. Board Ass'y with all components
C1001	26913	Capacitor .02uf 25V
C1002	28869	" .0018uf 100V
C1003	28741	" Variable 3-9pf
C1004	28648	" 12 pf
C1005	28862	" 240pf
C1006	28131	" 110pf
CR1001	44290	Diode IN914
L1001	65908	Choke 82uh
Q1001	44484	Transistor 3N128
Q1002	44331	" 2N3643
R1001	18148	Resistor 680K Ohm 1/4W
R1002	17247	" 1.5K " "
R1003	17089	" 3.3K " "
R1004	17089	" " " "
R1005	17118	" 100 " "
Y1001	81834	Crystal 1650 kHz +65°C

PARTS LIST

CKT. SYM.	PART NO.	DESCRIPTION
PC#11	10001	P.C. Board for 99760
	99760	P.C. Board Ass'y with all components
C1101 thru C1110	26822	Capacitor, Variable 2-8 pf
C1111 thru C1120	28478	" 36 pf
C1121 thru C1130	28131	" 110 pf
C1131	26913	" .02 uf 25V
C1132	28090	" 150 pf 500V
C1133	25000	" 2.2 pf 100V
C1134	26913	" .02 uf 25V
C1135	26913	" " "
C1136	25036	" 6 pf 100V
C1137	26834	" 10 pf 500V
CR1101 thru CR1110	44290	Diode 1N914
IC1101	44551	Integrated Circuit CA3046
R1101	18306	Resistor 5.6K ohm 1/4W
R1102	17089	" 3.3K " "
R1103	18306	" 5.6K " "
R1104	17089	" 3.3K " "
R1105	18306	" 5.6K " "
R1106	17089	" 3.3K " "
R1107	18306	" 5.6K " "
R1108	17089	" 3.3K " "
R1109	18306	" 5.6K " "
R1110	17089	" 3.3K " "
R1111	18306	" 5.6K " "
R1112	17089	" 3.3K " "
R1113	18306	" 5.6K " "
R1114	17089	" 3.3K " "
R1115	18306	" 5.6K " "
R1116	17089	" 3.3K " "
R1117	18306	" 5.6K " "
R1118	17089	" 3.3K " "
R1119	18306	" 5.6K " "
R1120	17089	" 3.3K " "
R1121	18306	" 5.6K " "
R1122	17077	" 4.7K " "
R1123	17041	" 10K " "
R1124	17156	" 1K " "
R1125	17118	" 100 " "
R1126	18667	" 2.7K " "
R1127	18411	" 470 " "
R1128	17041	" 10K " "
R1129	17077	" 4.7K " "
R1130	17845	" 270 " "
R1131	18411	" 470 " "
R1132	17118	" 100 " "
Y1101 thru Y1110	81860	Crystal, Channel, 27°C

CKT. SYM.	PART NO.	DESCRIPTION
PC12	10478	P.C. Board for 99424
	99424	P.C. Board Assy with all components.
C1201	26913	Capacitor .02uf 25V
C1202	26913	" " "
C1203	26913	" " "
K1201	66626	Relay DPDT
PC#13	10477	P.C. Board for 99426
	99426	P.C. Board Ass'y with all components
C1301	26913	Capacitor .02uf 25V
C1302	26913	" " "
C1303	26913	" " "
C1304	28337	" .47uf 50V
CR1301	40476	Diode Varactor MU2107
CR1302	44290	" IN914
CR1303	44290	" "
L1301	65910	Choke 430uh
R1301	18253	Resistor 33 Ohm 1/4W
R1302	17273	" 150 " "
R1303	17039	" 100K " "
XV1301	75287	Connector Octal

PARTS LIST

CKT. SYM.	PART NO.	DESCRIPTION.
PC#14	10327	P.C. Board for 97767
	97767	P.C. Board Ass'y with all components
	97769	ALC Detector Ass'y
C1401	28337	Capacitor .47 uf 50V
C1402	24472	" 2.2 uf 15V
C1403	28753	" 6.8 uf 15V
C1404	26913	" .02 uf 25V
C1405	27840	Capacitor, Variable, 2-8 pf
C1406	28246	" Disc. .0024 uf
C1407	27840	" Variable 2-8 pf
C1408	28866	" Dip Mica 910 pf
CR1401	40508	Diode, Zener MZ4625
CR1402	44290	" 1N914
CR1403	40464	" Zener 1N962B
CR1404	44290	" 1N914
CR1405	44290	Diode, 1N914
CR1406	44290	" "
IC1401	44446	Integrated Circuit CA3005
R1401	18306	Resistor 5.6K ohm 1/4W
R1402	34441	Potentiometer 10K "
R1403	33849-6	" 2K "
R1404	33849-4	" 10K "
R1405	17481	Resistor 6.8K " 1/4W ±5%
R1406	17807	" 2.2K " " ±5%
R1407	17807	" 2.2K " " ±5%
R1408	17041	" 10K " "
R1409	18306	" 5.6K " "
R1410	17041	" 10K " "
R1411	17077	" 4.7K " " ±5%
R1412	17352	" 68K " "
R1413	18992	" 390K " "
R1414	16920	Resistor, 4.7K, 1/2W ±5%
R1415	17596	" 1.2K, 1/2W ±5%
R1416	18320	" 560 , 1/2W ±5%
R1417	18954	" 8.2K, 1/2W ±5%
R1418	17596	" 1.2K, 1/2W ±5%
Q1401	44587	Transistor 2N4288
Q1402	44393	" 2N4303

CKT. SYM.	PART NO.	DESCRIPTION
PC#15	10311	P C Board for 99511
	99511	P C Board Assembly with Comp.
R1501	17089	Resistor, 3.3K ±10% 1/2W Carbon
R1502	33849-4	Potentiometer, 10K
C1501 thru C1503	27357	Capacitor, Ceramic .05uf 25V
C1504	28038	" 68uf Tant. 15V
Q1501	44393	Transistor 2N4303
PC#16	10479	P.C. Board for 99428
	99428	P.C. Board Assy with all components
C1601 thru C1610	27357	Capacitor .05uf 25V
C1611	28337	" 0.47uf 50V
C1612	27357	" .05uf 25V
K1601	66626	Relay DPDT
R1601 thru R1610	17077	Resistor 4.7K ohm 10% 1/4W
PC#17	10480	P.C. Board for 99429
	99429	P.C. Board Assy with all components
C1701	27321	Capacitor .01uf 100V
C1702	27321	" " "
K1701	66626	Relay DPDT
K1702	66626	" "
R1701 thru R1710	17091	Resistor 330 ohms 10% 1/4W
R1711	18320	" 560 " " "
R1712	18320	" " " " "

PARTS LIST

CKT. SYM.	PART NO.	DESCRIPTION
PC#19	10476	P.C. Board for 99430
	99430	P.C. Board Assy. without Customizing Components
C1901 thru C1940		Capacitor-Frequency Dependent-See Customizing Chart, Section VIII
L1901 thru L1920		Coil Variable-Frequency Dependent-See Customizing Chart, Section VIII
L1921 thru L1940	64575	Coil Variable-Second Harmonic Trap
PC#20	10475	P.C. Board for 99434
	99434	P.C. Board Assy with all components
C2001	28337	Capacitor 0.47 uf, 50V
C2002	24484	" 4 " 500V
C2003	24484	" " " "
C2004	29018	" 30 " "
C2005	29018	" " " "
C2006	27852	" 3 " 200V
C2007	27852	" " " "
CR2001 thru CR2005	40335	Diode SCEO
R2001	18538	Resistor 10 ohm 1/2W
R2002	18588	" 5.6K " "
R2003	17297	" 0.47 " 2W
R2004	17297	" " " "
R2005	16994	" 22 " "
R2006	18784	" 150 " 1W
R2007	18526	" 470K " 2W
T2001	49056	Transformer, Power

CKT. SYM.	PART NO.	DESCRIPTION
PC#21	10485	P.C. Board for 99432
	99432	P.C. Board Assy with all Components
C2101 thru C2113	27929	Capacitor .05uf 100V
L2101	56334	Choke 6 uh
L2102 thru L2105	64331	" 1 mh
L2106 thru L2109	63911	" 56uh
L2110	56334	" 6 uh
L2111	56334	" "
L2112	56334	" "
L2113	64331	" 1 mh
L2114	63911	" 56 uh
L2115	63911	" "
L2116	63911	" "
L2117	56334	" 6 uh
L2118	56334	" 6 uh

RECOMMENDED SPARE PARTS LIST

The recommended spare parts list contains printed circuit board assemblies which are working, fully fabricated plug-in circuit boards for the receiver/exciter. It is recommended that malfunctions be corrected in the receiver/exciter by board replacement and the malfunctioning board be returned to Sunair for repair. See NOTE below.

However, this handbook contains sufficient trouble shooting and repair information to allow a qualified radio shop to repair printed circuit boards by replacement of components. All parts for the boards are contained in the parts list. The spare parts list also contains parts for the power amplifier and power supply which are mounted on the chassis.

NOTE:

When returning one or more PC Boards, you must ship AIR PARCEL POST consigned to Sunair Electronics, 3101 S.W. 3rd Avenue, Fort Lauderdale, Florida, U.S.A., and plainly mark on all mailing documents:

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

sunair

RECOMMENDED SPARE PARTS LIST

Quantity Required for supporting indicated numbers of units per year				MODEL ASB-320	Voltage 28		
1	5	10	25	SunAir P/N	Description	Unit Price	Total Price
1	1	2	3	99792	PC#2 Assembly		
1	1	2	3	99793	PC#3 Assembly		
1	1	2	3	99794	PC#4 Assembly		
1	1	2	3	99425	PC#5 Assembly		
1	1	2	3	99796-1	PC#6 Assembly		
1	1	2	3	99798	PC#8 Assembly		
1	1	2	3	99799	PC#9 Assembly		
1	1	2	3	99800	PC#10 Assembly		
0	0	1	2	99447	PC#11 Assembly		
0	0	1	2	99424	PC#12 Assembly		
0	0	1	2	99426	PC#13 Assembly		
0	0	1	2	99767	PC#14 Assembly		
0	0	1	2	99511	PC#15 Assembly		
0	0	1	2	99428	PC#16 Assembly		
0	0	1	2	99429	PC#17 Assembly		
0	0	1	2	99431	PC#20 Assembly		
0	0	1	1	99432	PC#21 Assembly		
0	1	1	2	84042	Oven, Channel		
0	1	1	2	81858-1	Oven, Octal Plug-in		
0	0	1	1	81731	Filter, USB operation		
0	0	1	1	81743	Filter, LSB operation		
0	0	1	1	49018	Transformer, Audio		
0	0	1	1	49056	Transformer, Power		
2	4	6	10	44630	Transistor, Osc. Inv.		

sunair

RECOMMENDED SPARE PARTS LIST

Quantity Required for supporting indicated numbers of units per year				MODEL ASB-320	Voltage 28		
1	5	10	25	SunAir P/N	Description	Unit Price	Total Price
0	1	2	3	40177	Diode, Zener, 10V, 10W		
0	1	2	3	40511	Diode, Zener, 15V, 5W		
0	1	2	3	40426	Diode, Zener, 9.1V		
0	1	2	3	40506	Diode, Zener, 120V, 10W		
0	1	2	3	40507	Diode, Zener, 130V, 10W		
0	2	4	6	40510	Diode, 1N914		
4	6	8	10	40335	Diode, SCEO		
0	0	1	2	40165	Diode, 10D4		
1	1	2	3	66286	Relay, Antenna		
1	1	2	3	66016	Relay, Power		
1	1	2	3	66004	Relay, Power		
1	1	2	3	66377-2	Relay, Rec/Exc		
0	1	1	2	81834	Crystal, 1650KHz, +65°C		
0	1	1	2	34271	Solenoid, Rotary		
0	1	1	2	33590	Potentiometer, Bias		
1	1	2	4	76683	Vacuum Tube, Driver		
2	2	4	6	76669	Vacuum Tube, Output		
0	1	2	4	28911	Capacitor, .002uf, 6KV		
0	1	2	3	24850	Capacitor, Variable Glass		
0	0	1	2	97769	ALC Detector Assy		
5	10	15	20	86030	Fuse, 20 Amp		
0	0	1	2	84903	Fuse Holder		
1	1	2	2	99999	Service Kit (includes all required tuning tools and card extenders)		

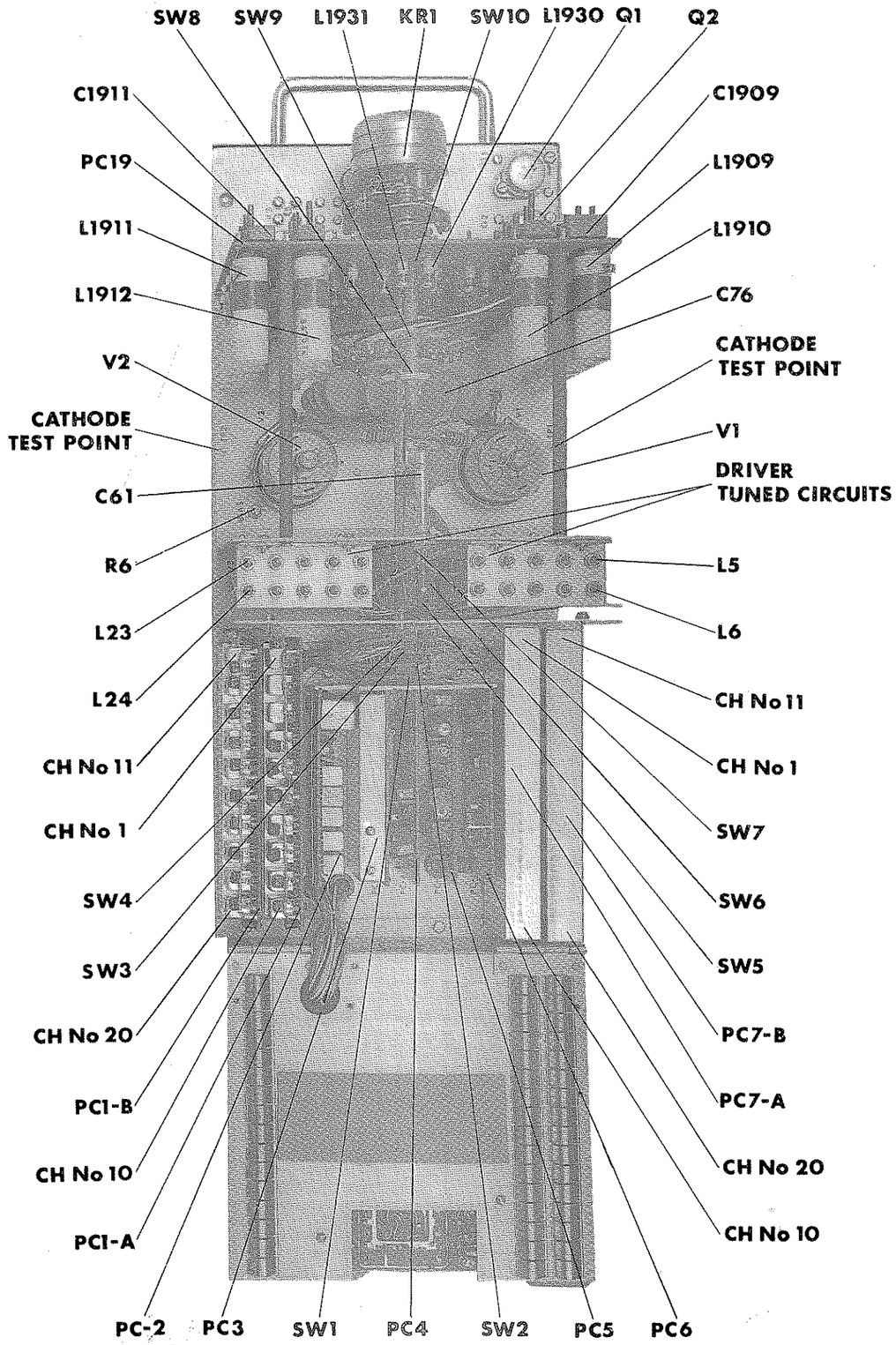


Figure X-1 ASB-320 TOP VIEW

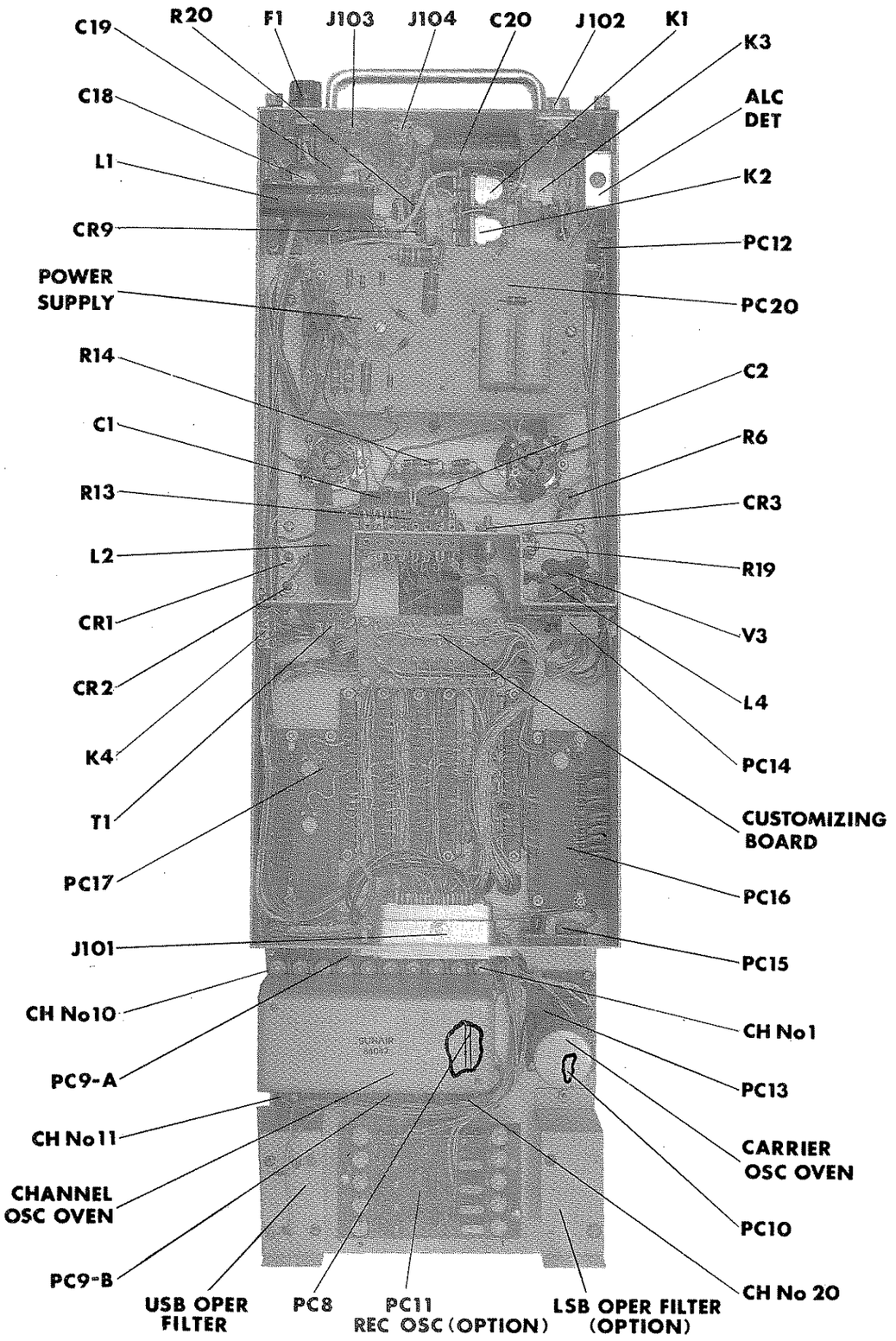
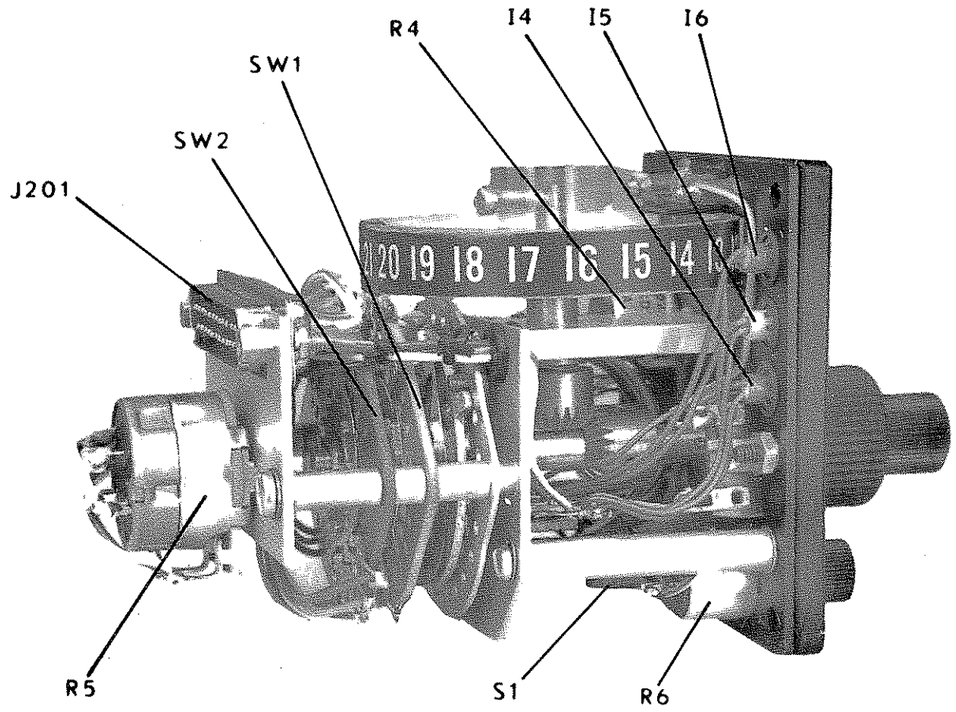


Figure X-2 ASB-320 BOTTOM VIEW & HINGED ASSY



MCU-20

Figure X-3 Control Unit, Side View

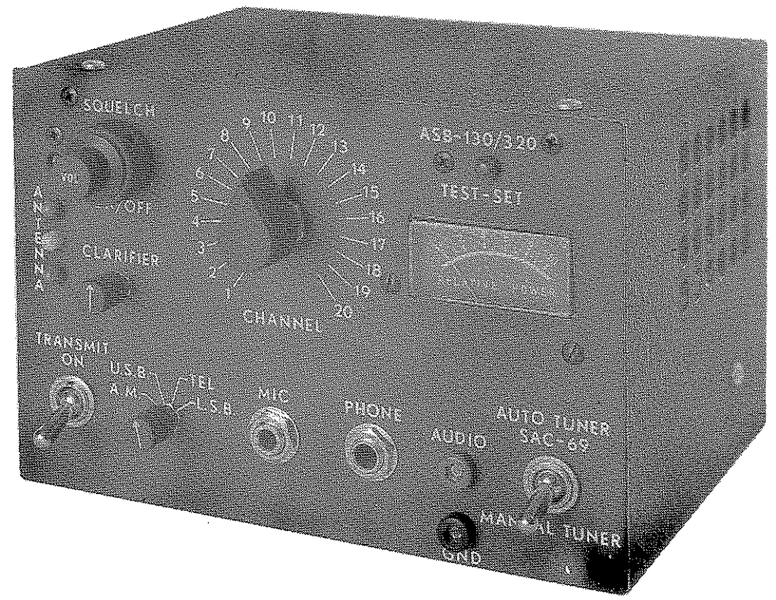
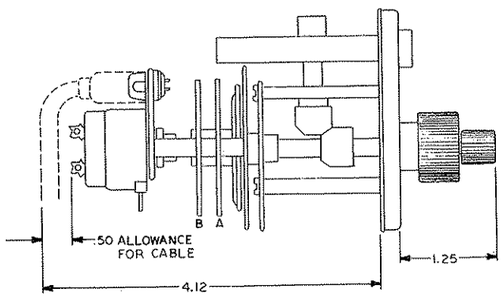
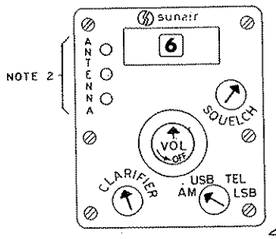


Figure X-4 ASB-130/320 Test Set

ASB-320 CONTROL HEAD

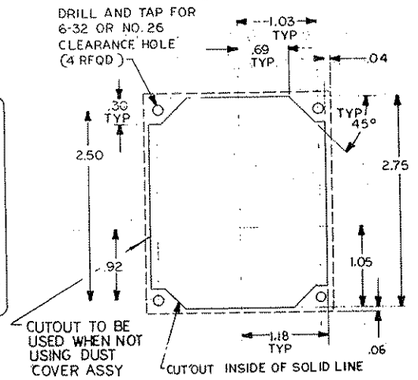


DEPTH OF CONTROL HEAD



NOTE 2

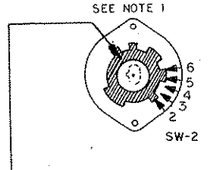
PANEL CUT'OUTS



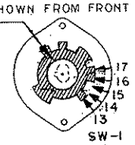
CONNECTOR PIN TABLE	CONN PIN NO.
A+ RETURN	1
ANTENNA COUPLER CHANNEL WIRE	2
" " " " SEE NOTE 1	3
" " " "	4
" " " "	5
" " " "	6
VOLUME	7
SQUELCH(WIPER)	8
SQUELCH(ARM)	9
CLARIFIER	10
PLUS 10V	11
DIMMER	12
REC/EXC CHANNEL WIRE	13
" " " "	14
" " " "	15
" " " "	16
" " " "	17
ON-OFF RELAY	18
AM CONTROL	19
USB CONTROL	20
TEL CONTROL	21
LSB CONTROL	22
SAC-69 INDICATOR, TUNED (GREEN)	23
" " CYCLING (AMBER)	24
" " UNTUNED (RED)	25

REFERENCE, INTERCONNECT DIAGRAM ASB 320 MANUAL

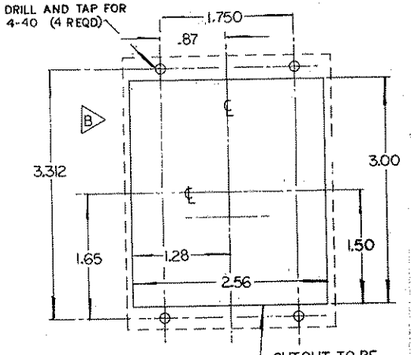
ANTENNA COUPLER CHANNELING WAFER (B) CHANNEL POS 6 SHOWN FROM FRONT SEE NOTE 1



TRANSCEIVER CHANNELING WAFER (A) CHANNEL POS 6 SHOWN FROM FRONT



DRILL AND TAP FOR 4-40 (4 REQD)



DIMMER VOLTAGE	5V	28V
R7	4.7K	27K
R8	27K	4.7K
R10	35 Ω 3W	JUMPER
CR3	10D4	JUMPER
C2	140uf 15V	DELETED
R11	180 ½W	DELETED

CH	2	3	4	5	6	13	14	15	16	17
1										
2	■									
3										
4										
5										
6										
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9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

ANTENNA COUPLER (B) — TRANSCEIVER (A)

CHANNELING TABLES
FILLED SQUARE INDICATES CONNECTION BETWEEN WIPER COMMON & CHANNEL WIRE

NOTES:
1. THIS SWITCH NOT USED WITH SAC-69 COUPLER
2. ANTENNA STATUS INDICATOR LIGHTS AND ELECTRONIC DIMMER CONTROL USED WITH SAC-69 ANTENNA COUPLER ONLY

TITLE: SCHEMATIC & MOUNTING DIAG MCU-20

SIZE	DRAWING NO.	REV.
C	10470	B

MCU-20 PARTS LIST

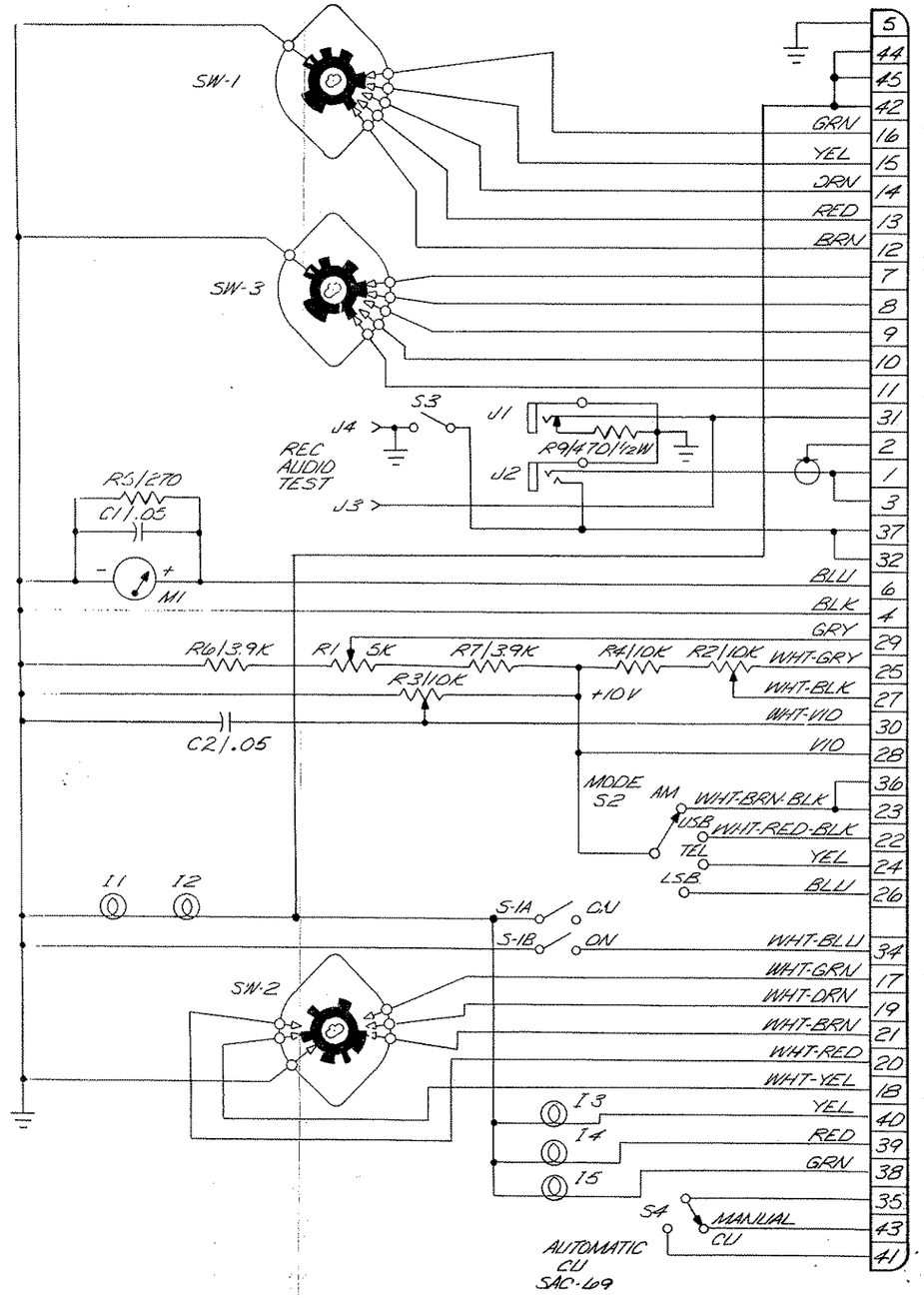
CKT. SYM.	PART NO.	DESCRIPTION
C1	27357	Capacitor .05uf 25V
I-1 thru I-3	87149	Lamp, 14V
I-1 thru I-3	84008	Lamp, 5V (Optional)
I-4	84038-7	Lamp, White, 28V
I-5	84038-2	Lamp, Amber, 28V
I-6	84038-3	Lamp, Green, 28V
I-4	84038-8	" White, 5V
I-5	84038-5	" Amber, 5V Optional
I-6	84038-6	" Green, 5V
J-201	74908	Connector, Male
P-201	99828	" Female, Cable
R-1	17883	Resistor, Comp. 3.9K 1/4W
R-2	17883	" " " "
R-3	17041	" " 10K "
R-4	33928	Potentiometer, "
R-5	34570	" 5K/S2
R-6	33928	" 10K
SW-1	33851	Wafer, ASB-320 Control
SW-2	33851	" Coupler Control
S-1	34130	Switch, Mode
	87137	Filter, Lamp, Blue
	87125	" " Red (Optional)
	32675	Knob, Channel
	33992	" Volume
	33954	" Mode Switch, Clar.
R-7	17077	Resistor Comp 4.7K 1/4W(5V)
R-7	17120	" " 27K " (28V)
R-8	17120	" " " " "
R-8	17077	" " 4.7K " (5V)
R-9	17120	" " 27K "
R-10	16293	" WW 350 3W (5V)
CR-1	40165	Diode 10D4
CR-2	40165	" "
Q-1	44252	Transistor 2N3646
Q-2	44331	" 2N3643
	10623	PC Board

Electronic dimmer Control used with SAC-69Coupler only.

TEST SET

CKT. SYM.	PART NO	DESCRIPTION
C1	27357	Capacitor .05uf 25V
C2	27357	" " "
I-1	87149	Lamp, 14V
I-2	87149	" "
I-3	84038-2	Lamp, Yellow 28V
I-4	84038-7	" White 28V
I-5	84038-3	" Green 28V
J201	74037	Connector, Male
P201	74013	" Female (Cable)
	74025	Clamp, Cable
M-1	87010	Meter
R1/R2	34415	Potentiometer, 5K/10K/Switch
S1		
R-3	33667	" 10K
R-4	17041	Resistor Comp. 10K 1/4W
R-5	17845	" " 270 "
R-6	17883	" " 3.9K "
R-7	17883	" " " "
R-8	17390	Resistor Comp. 470 ohm 1/2W
SW-1	33851	Switch, Wafer, Coupler
SW-2	34001	" " Rec/Exc RE1300
SW-3	33851	Switch, Wafer, ASB-320
S-2	34130	Switch, Mode
S-3	32118	Switch, TX
S-4	32118	Switch, SAC-69/CU-110 (ASB-130)
	33368	Knob, Clarifier, Mode Switch
	32106	" Channel
	32675	" Squelch
	32613	" Volume
	87137	Filter, Lamp (blue)
J-1	86535	Jack, Phone
J-2	84056	Jack, Mic
J-3	85153	Jack, Tip (Red)
J-4	85165	Jack, " (Black)

WAFERS SHOWN IN NO. 1 POSITION FOR ASB-130
OR NO. 6 POSITION FOR ASB-320



A+ TO CU-110 OR CU-2200
A+ FROM PA1010B OR ASB-320
A+ TO SAC-69

ANTENNA COUPLER CHANNELING

ASB-320 CHANNELING

500 OHM REC AUDIO
SHIELD
MIC AUDIO
MIC AUDIO
PTT
PTT
RF INVERTER
GROUND
VOLUME
SQUELCH VOLTAGE
SQUELCH CONTROL
CLARIFIER
+10V
AM
AM
USB
TEL
LSB

ON-OFF RELAY

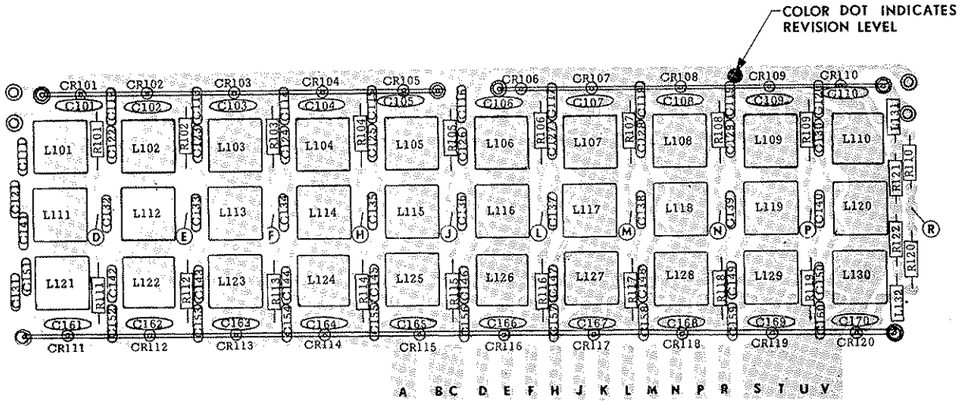
RECEIVER/EXCITER RE-1300 CHANNELING

TUNE
UNTUNED
OPERATE
} ANTENNA TUNER SAC-69

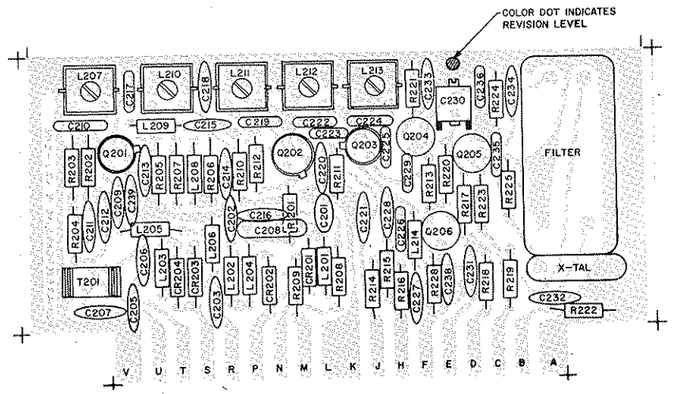
GND OR CHAN PULSE
GND
CHAN PULSE

SWITCH ASS'Y COMPLETE

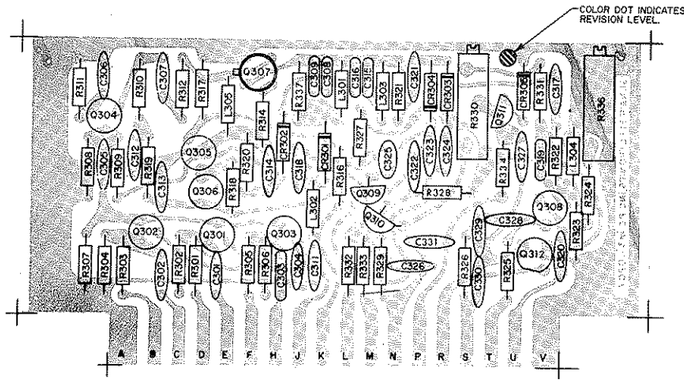
ASB-320 Test Set



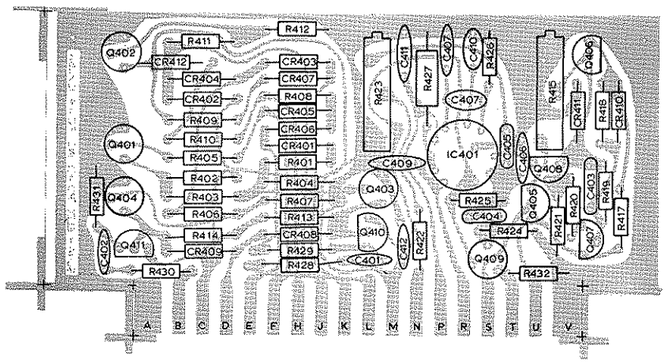
P.C. #1 Receiver Preselector



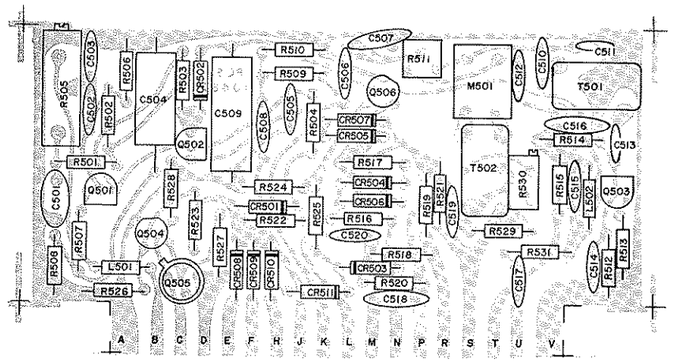
P.C. #2 RF Amplifier and Mixer



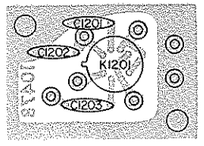
P.C. #3 IF Amplifier and Detector



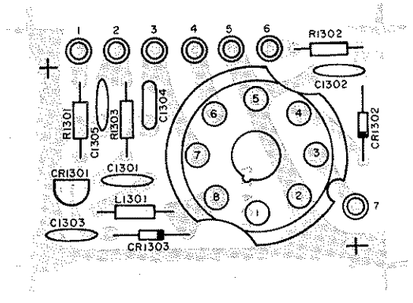
P.C. #4 Mode and Audio



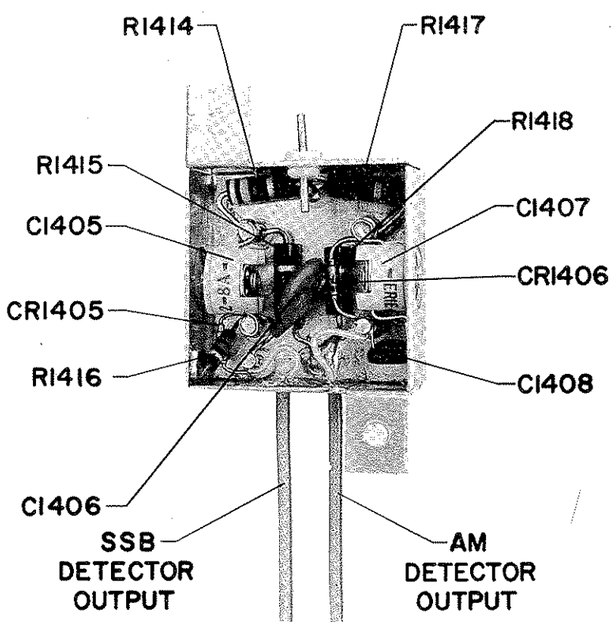
P.C. #5 Mike Amplifier and Balanced Modulator

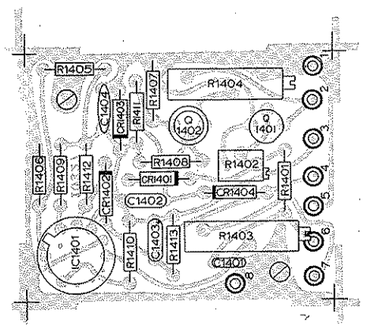


P.C. #12 Receiver Preselector Input Switch



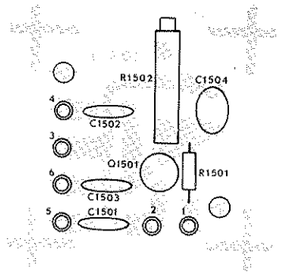
P.C. #13 Carrier Oscillator Oven Assy and Clarifier



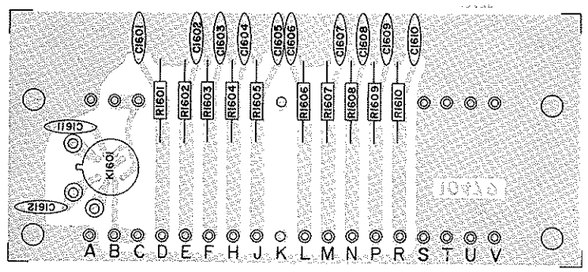


P.C. #14 ALC Detector and Amplifier

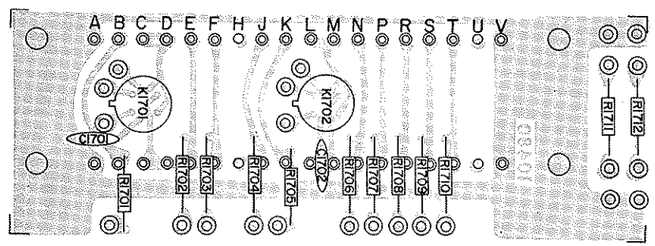
ALC DETECTOR



P.C. #15 Volume Control

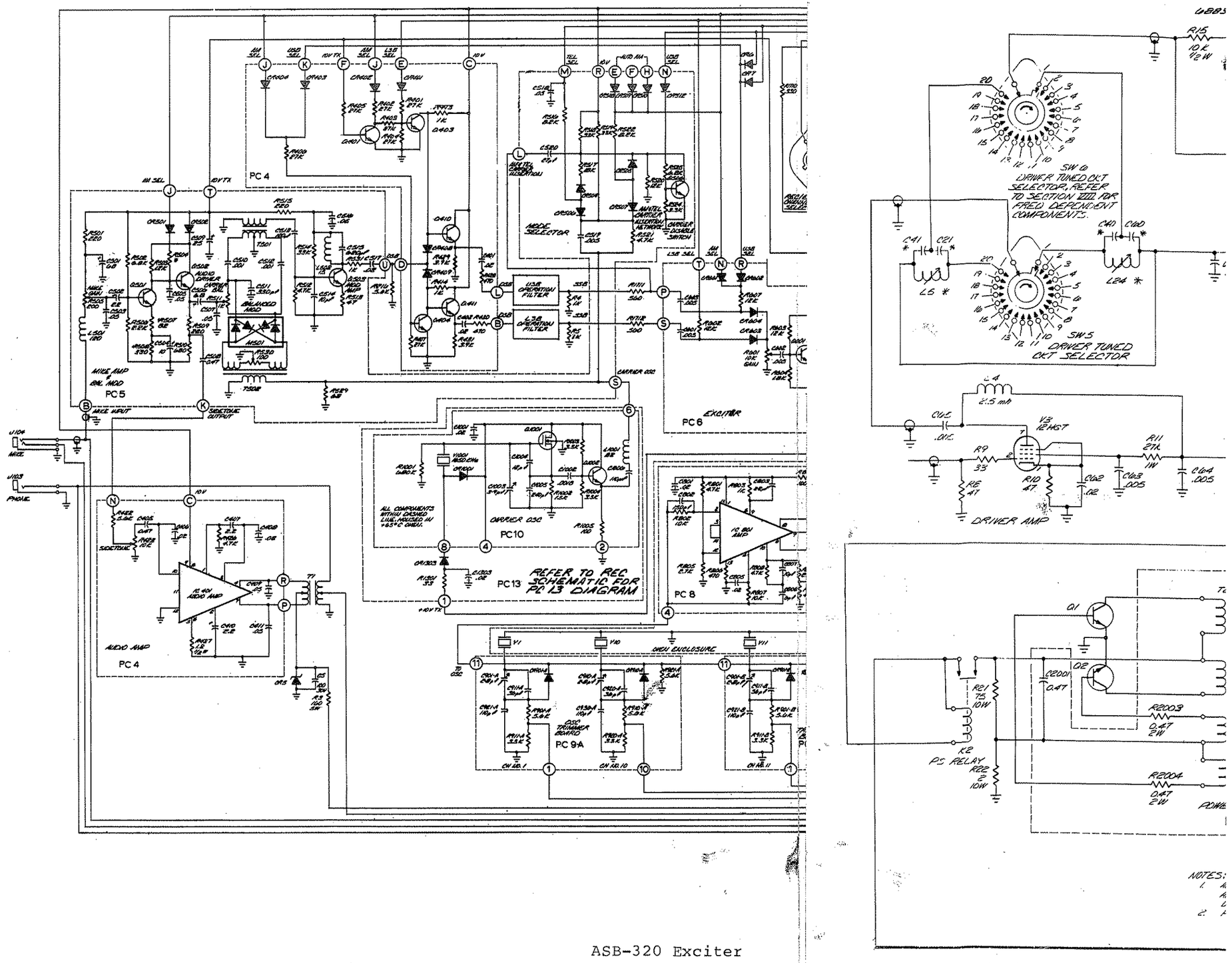


P.C. #16 Receiver Preselector Output Switch



P.C. #17 Exciter Tuned Ckt Board Selector

ASB-320 Power Amplifier/Power Suppl



ASB-320 Exciter

L25 2.5mh
C91 .01
C70 .002
E1
E2
V2 6883B
R18 10 1/2W
C67 .005
R16 10 1/2W
C68 .005
R17 10 1/2W
C69 .02
POWER AMPLIFIER
C61 1-30pf
C90
C71
SW8
L1901 *
C1921 *
C1901 *
L1921
SW9
PA OUTPUT
P1 NETWORK SELECTOR, REFER TO SECTION VIII FOR FREQUENCY DEPENDENT COMPONENTS.
SW10-A
RF TO ALC DETECTOR
RF INPUT TO RECEIVER
J102 ANT OUTPUT
K3 ANT RELAY
J101
16 PTT
L1920 *
C1940 *
2nd HARM. TRAP
L1940 *
C1920 *
SW10-B
R14 18K 1/2W
C93 .02
250V
R13 1K 5W
CR1 IN4008B
CR2 IN4009B
ON/OFF
L1145
F1 20 AMPS
C120 500
CR8
C19 .05
C18 100 30V
K1
44 A+ INPUT
15 ON/OFF
CR2001-2004
RED
GRN
RED
R2005 22 2W
R2006 150 1W
C2002 4
C2004 30
C2003 4
C2005 30
R2007 470K 2W
HI B+ 340V
LO B+ 420V
R12 1.5K 10W
BLK
BLK
R2001 10 1/2W
CR2005
R2002 5.6K 1/2W
C2006 3
C2007 3
R6 10K
-60V
R7 10K 1/2W
SUPPLY
C20
V1
V2
V3
C94 .02
C95 .02
C96 .02
R19 30 10W
C97 .02
SW11 SLAVE WAFER
C98 1
R20 1 1W
CR9
K1
26
25
24
23
22
CHANNELING
6 CHANNEL PULSE
1 A+ TO CONTROLLER
45 GND
3 GND
A+ TO I.F. & REC/EXC SECTION

RESISTORS IN OHMS 1/4W ±10%,
CAPACITORS IN μf. ALL INDUCTORS IN μh,
UNLESS OTHERWISE SPECIFIED.
FREQUENCY DEPENDENT COMPONENT *.

ADDENDUMS

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

SUNAIR ELECTRONICS,INC.

ADDENDUM # 1
DATE: 2/17/72

MANUAL: ASB-320

REFERENCE: MCU-20 Control Head

PURPOSE: Update MCU-20 Light color information.

MANUAL REFERENCE: Interconnect Diagram ASB-320/SAC-69, Page II-7, MCU-20 parts list.

TEXT: Replace Lamp I-4, White 28V, Sunair P/N 84038-7, and White 5V, Sunair P/N 84038-8, with Red 28V, Sunair P/N 84038-1, and Red 5V, Sunair P/N 84038-4. Replace Light color information on the interconnect Diagram of

SUNAIR ELECTRONICS, INC.
MANUAL: ASB-320

ADDENDUM 4
DATE: Sept. 5, 1972

REFERENCE: ASB-320 Power Supply (PC-20)
ECN 067-002

PURPOSE: Reduce turn-on time of power supply and improve reliability

MANUAL REFERENCE:

Section X Schematic drawing, power supply
Section X PC #20 overlay view
Section IX-9 Parts list PC #20

TEXT: Remove capacitor C2004 and C2005, 30 uf, 450V
P/N 29018

SUNAIR ELECTRONICS, INC.
MANUAL: ASB-320

ADDENDUM #5
DATE: 12/1/72

REFERENCE: Balance Modulator, Diode Ring, M501

ECN: 054-038

PURPOSE: Module M501, PN 40311, Package Change

MANUAL REFERENCE: PC-5 Schematic Diagram

TEXT: The modulator diode ring package has been changed to a TO-5 package. Schematic diagram and modulator connections are as shown below.

R1401 changed from 5.6K/10%/¼W P/N 18306 to 1.5K/10%/¼W P/N 17247.
CR1401 changed from MZ4625 to 1N751A.

SUNAIR ELECTRONICS, INC.
MANUAL: ASB-320

ADDENDUM 11
DATE: 11-28-73

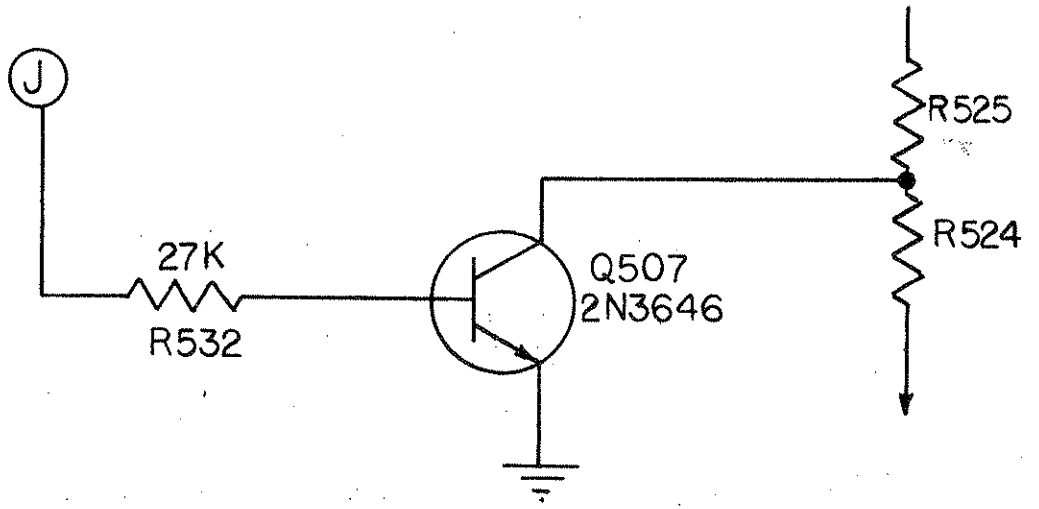
REFERENCE: Balance Modulator Board (PC-5)

ECN: 1841, 1842

PURPOSE: Module M501, P/N 40311 discontinued by manufacurer. Provide automatic AM operation when ASB-320 is used with SAC-69 antenna coupler, or an "AM ONLY" channel is installed.

MANUAL REFERENCE: Schematic diagram, Rec/Exc, Parts List, page IX-4.

TEXT: Change diode ring module M501 to 4 individual diodes CR512 thru CR515, MBD-102, P/N 40528.
Add transistor Q507, 2N3646, P/N 44252.
Add resistor R532, 27K, 1/4W, P/N 17120.



SUNAIR ELECTRONICS, INC.
MANUAL: ASB-320

ADDENDUM 12
DATE: 9-29-76

REFERENCE: Main Chassis Wiring

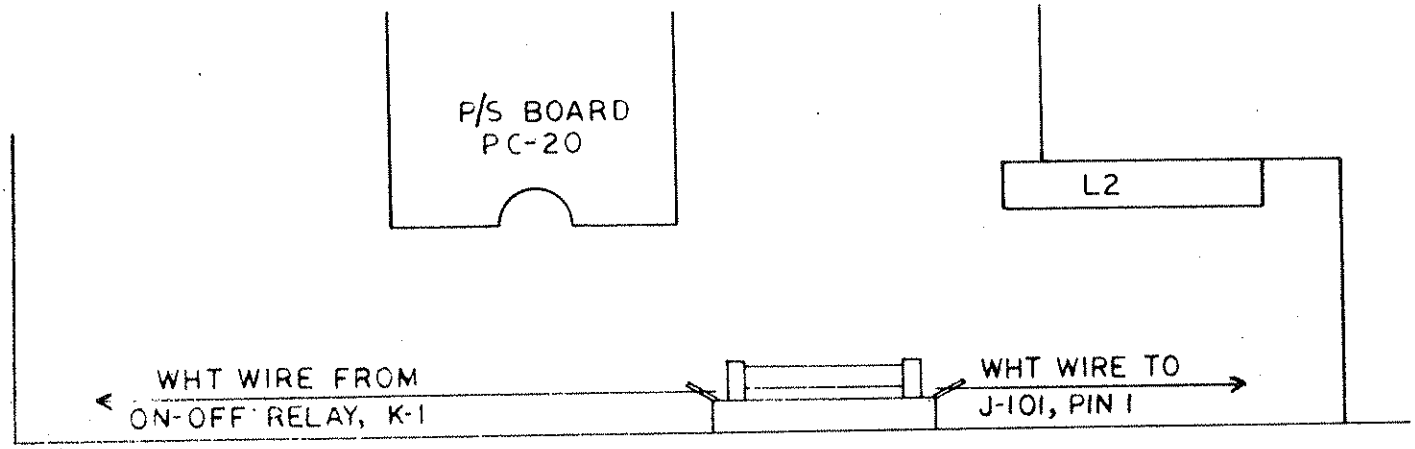
ECN: 067-036

EFFECTIVITY: Serial Number 586

PURPOSE: Add 5 amp fuse to coupler A+ wire.

MANUAL REFERENCE: Power Amplifier/Power Supply Schematic

TEXT: Add 5 amp fuse P/N 85866 and fuseholder P/N 84249 in line with coupler A+ wire as shown below.



BOTTOM VIEW ASB-320

SUNAIR ELECTRONICS, INC.
MANUAL: ASB-320

ADDENDUM 13
DATE: 3-10-77

REFERENCE:	Exciter Board, PC-6
ECN:	067-040
PURPOSE:	Change assembly part number.
MANUAL REFERENCE:	Parts list, page 14-5.
TEXT:	Change Exciter PC board assy part number from 99796 to 99796-1.

SUNAIR ELECTRONICS, INC.
MANUAL: ASB-320

ADDENDUM 14
DATE: 12/14/78

REFERENCE:	ALC Detector Assy
ECN:	067-058
PURPOSE:	Improve ALC tracking at high frequencies
MANUAL REFERENCE:	Exciter schematic diagram, parts list, page 1X-8
TEXT:	Add capacitor C1409, 1pf, PN 0269250000, across R1404(4.7K, ½W).