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TECHNICAL MANUAL
for
GENERAL PURPOSE TRANSMITTER
MODEL SBT-1K(B)
(AN/URT-19(v))



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N.Y. **OTTAWA, ONTARIO**

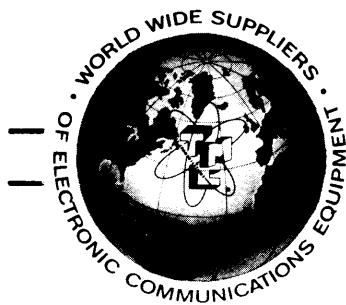
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NOTICE

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THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S E N G I N E E R S

700 FENIMORE ROAD

MAMARONECK, N. Y.

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1. Model Number of Equipment.
2. Serial Number of Equipment.
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4. Nature of defect or cause of failure.
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2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

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THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

CHANGE NO. 1

INSTRUCTION BOOK CHANGE NOTICE

Date October 29, 1972

Manual affected: General Purpose Transmitter IN
Model SBT-1K(B) (PAL-1K)

Page 4-8:

The second paragraph on page 4-8 should be changed to read as follows:

When TRANSMITTER VOLTAGES switch (S302) is closed, +500 vdc from Control Unit PS-4 is extended from terminal 9 of E302 through terminal F of J607, resistor R601, coil of relay K601, normally closed contacts of relay K602, terminal E of P607, to ground n terminal 4 of E302. Relay K601 is energized, closing a set of contacts to connect the output of RF Amplifier RFD to the antenna through J608 and E602 of RF Output Assembly AX-198.

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:

THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York

Attn: Director of Eng. Services.

FOREWORD

The SBT-1K(B) comprises 10 modular units; these modular units are used in various transmitter configurations as well as the SBT-1K(B). Individual manuals are written for each modular unit and then combined as required with a system manual to cover the overall transmitter.

With this package, an individual manual is provided for each modular unit in the SBT-1K(B) with the exception of Auxiliary Power Panel APP-4, Electrical Equipment Cabinet RAK-9B, and RF Output Assembly AX-198. Information concerning these units is grouped together in one manual the Appendix.

Commercial and military nomenclature for the SBT-1K(B), the cabinet, and the modular units that constitute the SBT-1K(B) are as follows:

General Purpose Transmitter

TMC: General Purpose Transmitter, Model SBT-1K(B)

MIL: Transmitting Set, Radio: AN/URT-19(V)

Monitor Control Unit

TMC: Monitor Control Unit, Model MCU-2-50/U

MIL: Control-Indicator: C-2995/URA-27

Antenna Tuner Unit

TMC: Antenna Tuner Unit, Model TU-2-50/U

MIL: Coupler, Antenna: CU-772/URA-27

Directional Coupler

TMC: Directional Coupler Unit, Model CU-2-50/U

MIL: Coupler, Directional CU-820/URA-34

Variable Frequency Oscillator

TMC: Variable Frequency Oscillator, Model VOX-5

MIL: Oscillator, Radio Frequency: 0-330()/FR

Exciter Unit

TMC: Exciter Unit, Model A-1516

MIL: Oscillator, Radio Frequency: 0-503A/URA-23

Power Supply

TMC: Power Supply, Model A-1397

MIL: Power Supply, PP-1769/URA-23

RF Amplifier

TMC: RF Amplifier, Model RFD-1A

MIL: Amplifier Radio Frequency: AM-2785A/URA-36

Low Voltage Power Supply

TMC: LV Power Supply, Model PS-4A

MIL: Power Supply: PP-2765A/URA-36

High Voltage Power Supply

TMC: HV Power Supply, Model PS-5

MIL: Power Supply: PP-2766/URA-36

Auxiliary Power Panel

TMC: Auxiliary Power Panel, Model APP-4

MIL:

Cabinet

TMC: Cabinet, Electrical Equipment, Model RAK-9B

MIL: Cabinet, Electrical Equipment: CY-3004/URT-19(V)

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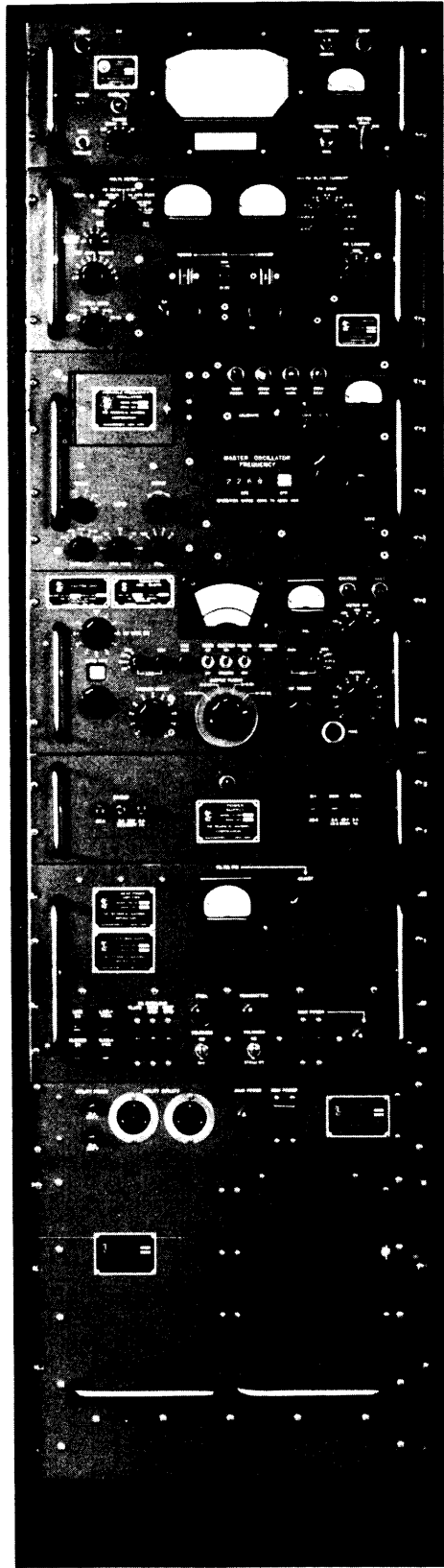


Figure 1-1. General Purpose Transmitter, Model SBT-1K(B)

SECTION 1

GENERAL INFORMATION

1-1. GENERAL DESCRIPTION

General Purpose Transmitter, Model SBT-1K(B), (figure 1-1), is a transmitting system with a conservatively rated output of 1000 watts PEP (Peak Envelope Power) and a frequency range of 2 to 32 mc, continuously variable. Front-panel controls permit the following modes of transmission:

CW Telegraphy (hand keying of carrier)

SSB (single sideband with voice or audio signal input and fully or partially suppressed carrier).

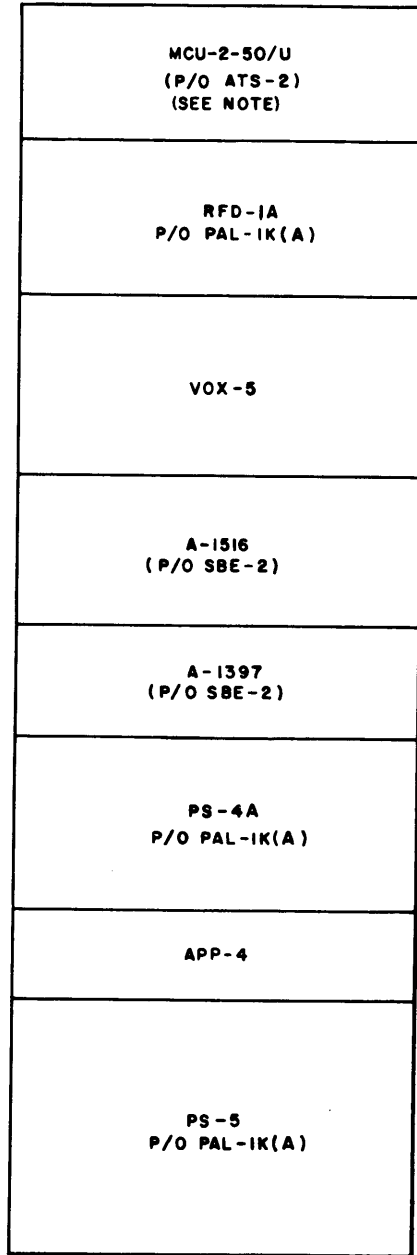
ISB (independent sideband with voice and/or audio signal input and fully or partially suppressed carrier)

AM (amplitude modulation with voice or audio signal input)

The SBT-1K(B) comprises various modular units (refer to paragraph 1-2) mounted in a single rack and is used in fixed-station or mobile communications systems. Figure 1-2 illustrates the chassis locations of the modular units. Two types of transmitters are available, varying only in rack-installation method and overall height as follows:

<u>Model</u>	<u>Installation</u>	<u>Overall Height</u>
SBT-1K(B) 2-B	Base Mounted (rigid)	74-3/4 inches
SBT-1K(B) 2-S	Shock Mounted	73-3/4 inches

The base-mounted model is provided with mounting holes in the base for bolting the rack directly to the floor; the shock-mounted model is equipped with a set of shock mounts for securing



RACK: RAK-9B EQUIPPED WITH AX-198 RELAY ASSEMBLY AND WIRING HARNESS

MOUNTS: BASE OR SHOCK

NOTE: MONITOR CONTROL UNIT MCU-2-50/U AND DIRECTIONAL COUPLER CU-2-50/U ARE MOUNTED IN RAK-9B; ANTENNA TUNER TU-2-50 IS MOUNTED EXTERNALLY.

FIGURE 1-2. MODULAR-UNIT CHASSIS LOCATIONS, SBT-1K(B)

the top and bottom of the rack to a mobile-unit structure.

All major components of the SBT-1K(B) are mounted on drawer slides. The transmitter contains its own internal forced-air cooling system consisting of an exhaust blower and air filter on the rear cabinet door, a blower and baffle for the power amplifier tube in Amplifier RFD-1A, and a filtered air intake at the top of the cabinet. The transmitter is manufactured in accordance with JAN/MIL specifications wherever practicable. All parts meet or exceed the highest quality standards.

1-2. DESCRIPTION OF UNITS

a. GENERAL - Paragraphs b through k below give a brief description of the modular units used in the SBT-1K(B). For more detailed information pertaining to these units, refer to the individual modular-unit manuals. It should be noted that the modular units contained in Antenna Tuning System ATS(50)-2 (MCU-2-50/U, TU-2-50/U, and CU-2-50/U) can be replaced by modular units MCU-2-70/U, and TU-2-70/U, and CU-2-70/U in order to provide an input impedance of 70 ohms (refer to ATS-2 modular-unit manual).

b. MONITOR CONTROL UNIT, MODEL MCU-2-50/U (C-2995/URA-27) - Monitor Control Unit, Model MCU-2-50/U is part of Antenna Tuning System ATS(50)-2. This unit contains two meters, controlling switches, and an overload protection circuit. A large dual-pointer meter indicates the forward and reflected transmitter power and the Voltage Standing Wave Ratio (VSWR). A small triple-scale meter indicates the position of the motor-driven short on the helical transmission line, the position of the

antenna resistance selector switch, or the humidity in the unit. The overload circuit will disable the transmitter to prevent damage to the equipment when the VSWR or transmitter power exceed preset levels.

c. ANTENNA TUNER UNIT, MODEL TU-2-50/U (CU-772/URA-27). -

Antenna Tuner Unit, Model TU-2-50/U, is part of Antenna Tuning System ATS(50)-2 and is used to match the transmitter to the antenna. The antenna tuner unit is installed at the antenna location; it is designed for outdoor installation and has waterproof stuffing tubes for cable connections.

d. DIRECTIONAL COUPLER UNIT, MODEL CU-2-50/U (CU-773/URA-27) -

Directional Coupler Unit, Model CU-2-50/U, is part of Antenna Tuning System ATS(50)-2. The directional coupler unit is a balanced radio-frequency bridge calibrated to operate with a 50-ohm coaxial line. Balancing and equalizing controls are provided.

e. VARIABLE FREQUENCY OSCILLATOR, MODEL VOX-5 (0-330()/FR) -

Variable Frequency Oscillator, Model VOX-5 is a highly stable 14-tube oscillator amplifier designed to provide high-frequency and medium-frequency oscillator injection voltage for the control of one or more receivers or transmitter exciters. The VOX-5 provides:

(1) High frequency r-f output voltage, continuously variable over the range of 2 to 64 mc (frequency dependent upon dial settings).

(2) Crystal-controlled high frequency output voltage over the range of 2 to 64 mc (frequency dependent upon crystals used).

f. EXCITER UNIT, MODEL A-1516 (0-503/URA-23) - Exciter Unit, Model A-1516, is part of Transmitting Mode Selector SBE-2 and is the exciter unit for the transmitter. From two audio input channels or mike input, Exciter Unit A-1516 translates intelligence into single or independent sideband with various degrees of carrier insertion as desired. Exciter Unit A-1516 also generates conventional AM signals and may be operated with a hand keyer for CW transmission.

g. POWER SUPPLY, MODEL A-1397 (PP-1766/URA-23) - Power Supply, Model A-1397 is part of Transmitting Mode Selector SBE-2 and supplies operating voltages for Exciter Unit, Model A-1516.

h. RF AMPLIFIER, MODEL RFD-1A (AM-2785A/URA-36) - RF Amplifier, Model RFD-1A, is part of Linear Power Amplifier PAL-1K(A) and consists of three cascade linear amplifier stages. RF Amplifier RFD-1A accepts input signals from Exciter Unit, Model A-1516. Together with Power Supplies PS-4A and PS-5, the amplifier is capable of providing 1000 watts peak envelope power (PEP) throughout the frequency range of 2 to 32 mc.

i. LV POWER SUPPLY, MODEL PS-4A (PP-2765A/URA-36) - LV Power Supply, Model PS-4A, is part of Linear Amplifier PAL-1K(A) and provides low B+ and bias voltages for RF Amplifier Model RFD-1A.

j. HV POWER SUPPLY, MODEL PS-5 (PP-2766/URA-36) - Power Supply, Model PS-5 is part of Linear Amplifier PAL-1K(A) and provides plate voltage for driver stage of RF Amplifier Model RFD-1A.

k. AUXILIARY POWER PANEL, MODEL APP-4 - Auxiliary Power Panel, Model APP-4, functions as a distributor for line voltage to the modular units contained in the SBT-1K(B). Wiring connections and terminal blocks are provided at the rear of the unit to

facilitate connection of a variety of equipment external to the SBT-1K(B). Included in this wiring arrangement are points for wiring the SBT-1K(B) into a larger transmitter system or into a transmitter/receiver system utilizing a common antenna. Associated with this function are sequential relays located in RF Output Assembly AX-198 mounted in back of Monitor Control Unit MCU-2-50/U.

1-3. REFERENCE DATA

Table 1-1 lists the reference data that is pertinent to the transmitter. For reference data concerning the modular units used in the SBT-1K(B), refer to the individual modular-unit manuals.

1-4. EQUIPMENT SUPPLIED

Table 1-2 lists the equipment supplied with the SBT-1K(B).

TABLE 1-1. ELECTRICAL CHARACTERISTICS, SBT-1K(B)

Output power	1000 watts PEP
Frequency range:	2 to 32 megacycles, continuously adjustable
Modes of Operation:	CW, SSB, ISB, and AM (sideband modes with suppressed carrier or any degree or carrier)
Output impedance:	Will match any unbalanced load from 70 to 150 ohms at +20 degrees in the range of 2 to 4 megacycles and any unbalanced load from 50 to 600 ohms +45 degrees in the range of 4 to 32 megacycles.
Harmonic suppression:	2nd harmonic at least 40 db below PEP 3rd harmonic at least 50 db below PEP

TABLE 1-1. ELECTRICAL CHARACTERISTICS, SBT-1K(B) (Cont)

Signal/distortion ratio:	2-30 mc: distortion at least 40 db below either tone of a standard two tone test 30-32 mc: distortion at least 35 db below either tone of a standard two tone test
Unwanted sideband rejection:	500 cps single tone, 60 db down from PEP output
Frequency stability:	1 part in 10^6 /day
Audio response:	Flat within + 1.5 db from 350 to 3300 cps range.
Audio input:	Two 600-ohm channels, balanced or unbalanced, -20 dbm to +20 dbm One 500,000-ohm input for crystal or dynamic mike, -50 dbm for full output
Tuning:	All tuning and bandswitching controls on front panels (no plug-in components)
Metering:	Front panel meters indicate operation of all critical circuits
ALDC:	An automatic load and drive control is furnished to limit distortion during high drive peaks or load changes
T/R function:	A coaxial antenna relay and receiver meeting circuit is provided to facilitate half-duplex operation
Cooling:	Pressurized cabinet, filtered forced-air for heat dissipation
Safety features:	1. Full interlock protection 2. Full overload and fuse protection
Environmental Conditions:	Designed to operate in any ambient temperature between 0° and 50°C, and any value of humidity up to 90%

TABLE 1-2. EQUIPMENT SUPPLIED

NOMENCLATURE		QTY PER EQUIP.	OVERALL DIMENSIONS (IN)			GROSS SHIPPING WEIGHT	WEIGHT (LBS)
NAME	MILITARY DESIGNATION		HEIGHT	WIDTH	DEPTH		
Monitor Control Unit, Model MCU-2-50/U	C-2995/URA-27	1	7	19	8	Refer to tables 2-1 and 2-2	15
Antenna Tuner Unit, Model TU-2-50/U	CU-772/URA-27	1	8-1/4	12	15-1/4		50
Directional Coupler, Model CU-2-50/U	CU-773/URA-27	1	3-1/2	9-1/2	3-1/2		2
Variable Frequency Oscillator Model VOX-5	0-330()/FR	1	10-1/2	19	19-1/4		68
Exciter Unit, Model A-1516	0-503/URA-23	1	8-3/4	19	7-1/4		40
Power Supply, Model A-1397	PP-1769/URA-23	1	5-1/4	19	10-1/4		36
RF Amplifier Model RFD-1A	AM-2785A/URA-36	1	8-3/4	19	19-3/4		46
LV Power Supply, Model PS-4A	PP-2765A/URA-36	1	10-1/2	19	15		64
HV Power Supply, Model PS-5	PP-2766/URA-36	1	15-3/4	19	18-1/4		194
Auxiliary Power Panel, Model APP-4		1	3-1/4	19			
Cabinet, Electrical Equipment, Model RAK-9B	CY-3044/URT-19(V)	1	75	20-3/4	23-1/2	330	

TABLE 1-2. EQUIPMENT SUPPLIED (Cont)

NOMENCLATURE		QTY PER EQUIP.	OVERALL DIMENSIONS (IN)			GROSS SHIPPING WEIGHT	WEIGHT (LBS)
NAME	MILITARY DESIGNATION		HEIGHT	WIDTH	DEPTH		
Cable Assembly, Interconnecting							
CA-346-3-9*		1					
CA-383-78C		1				Refer to Tables 2-1 and 2-2	
CA-435-3		1					
CA-468-7		1					
CA-480-3-80		1					
CA-480-6-49		1					
CA-490		1					
CA-491		1					
CA-493		1					
CA-506		1					
CA-507		1					
CA-509		1					
CA-586-1		1					
Cable Assembly, Control							
CA-541-XX			(supplied only upon request; customer must specify length in feet)				
Cable Assembly, Antenna							
CA-484*		1	30 inches long				
Cable Assembly, Service							
CA-108*		1					
CA-109*		1					
CA-502*		1					
Plugs and Connectors							
PI-100*		1					
PL-132-3*		1					
PL-150*		1					
PL-190NG*		1					
UG-260/U*		1					
UG-274/U*		1					
Equipment Mounting Kit		1					
Special Tools							
TP-110*		1					

* Supplied as loose item

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING

The SBT-1K(B) is shipped in 5 boxes as listed in table 2-1; box number and contents are stenciled on the outside of each box. Table 2-2 lists the gross weight and size of shipping boxes. Inspect all boxes for possible damage when they arrive at the operating site. With respect to equipment damage for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

Figures 2-1 and 2-2 are typical illustrations of the method used to pack RAK-9B and the SBT-1K(B) modular units for shipment. Using figures 2-1 and 2-2 as a guide, unpack RAK-9B and the modular units in the reverse order of the indicated packing procedures; refer to table 1-2 for information regarding size and weight of RAK-9B and modular units. Inspect the contents of each box for possible damage and inspect the packing material for parts that may have been shipped as loose items. Compare the material received against that listed in table 2-1 to ensure that all equipment is received. Most cable assemblies are mounted in RAK-9B and taped in place; however, some equipment interconnect cables are shipped as loose items.

TABLE 2-1. CONTAINER CONTENTS, SBT-1K(B)

BOX NO.	CONTENTS
1	Cabinet Electrical, TMC Model RAK-9; RF Output Assembly, TMC Model AX-198; Auxiliary Power Panel, TMC Model APP-4; and loose items (refer to table 1-2).

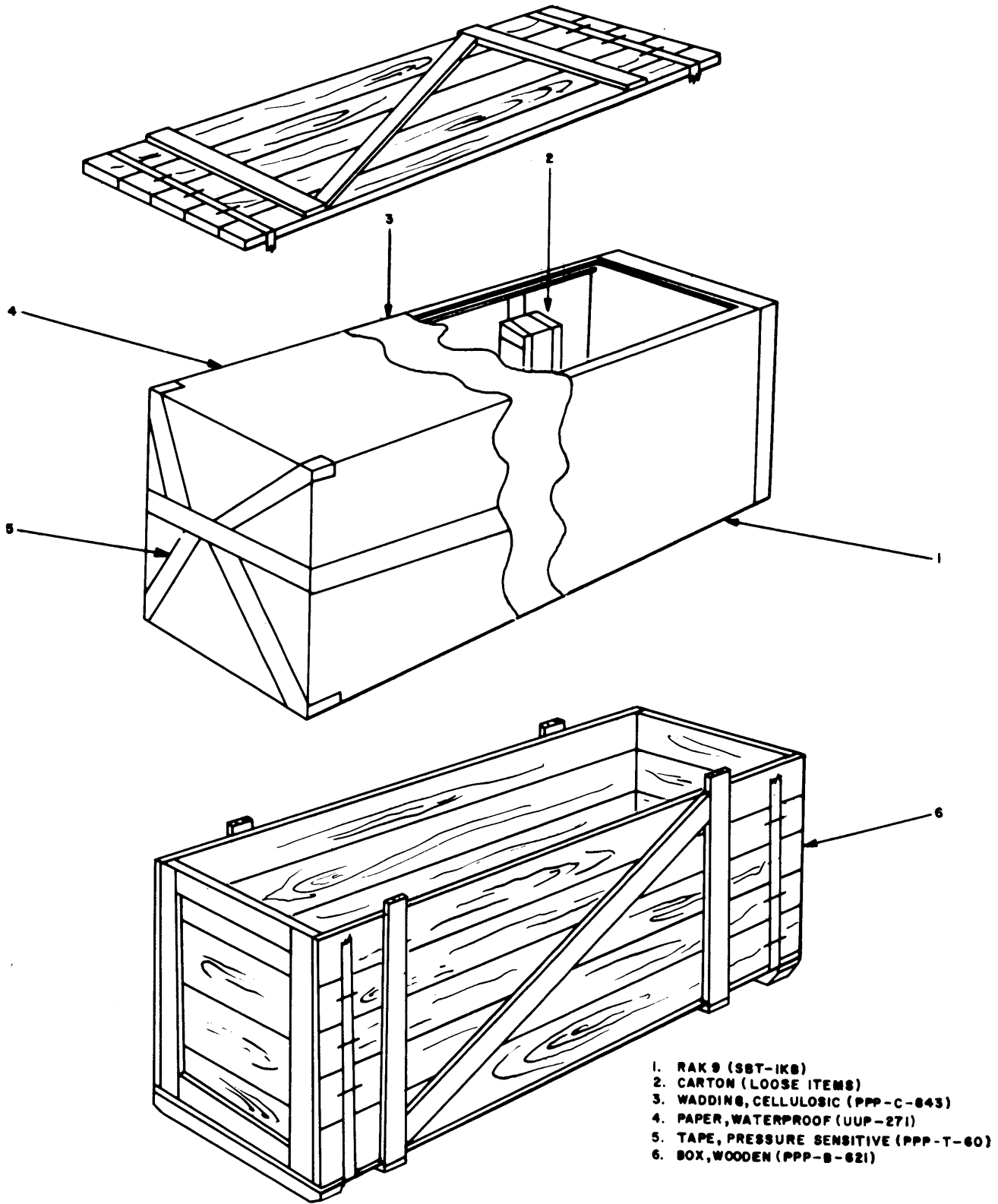
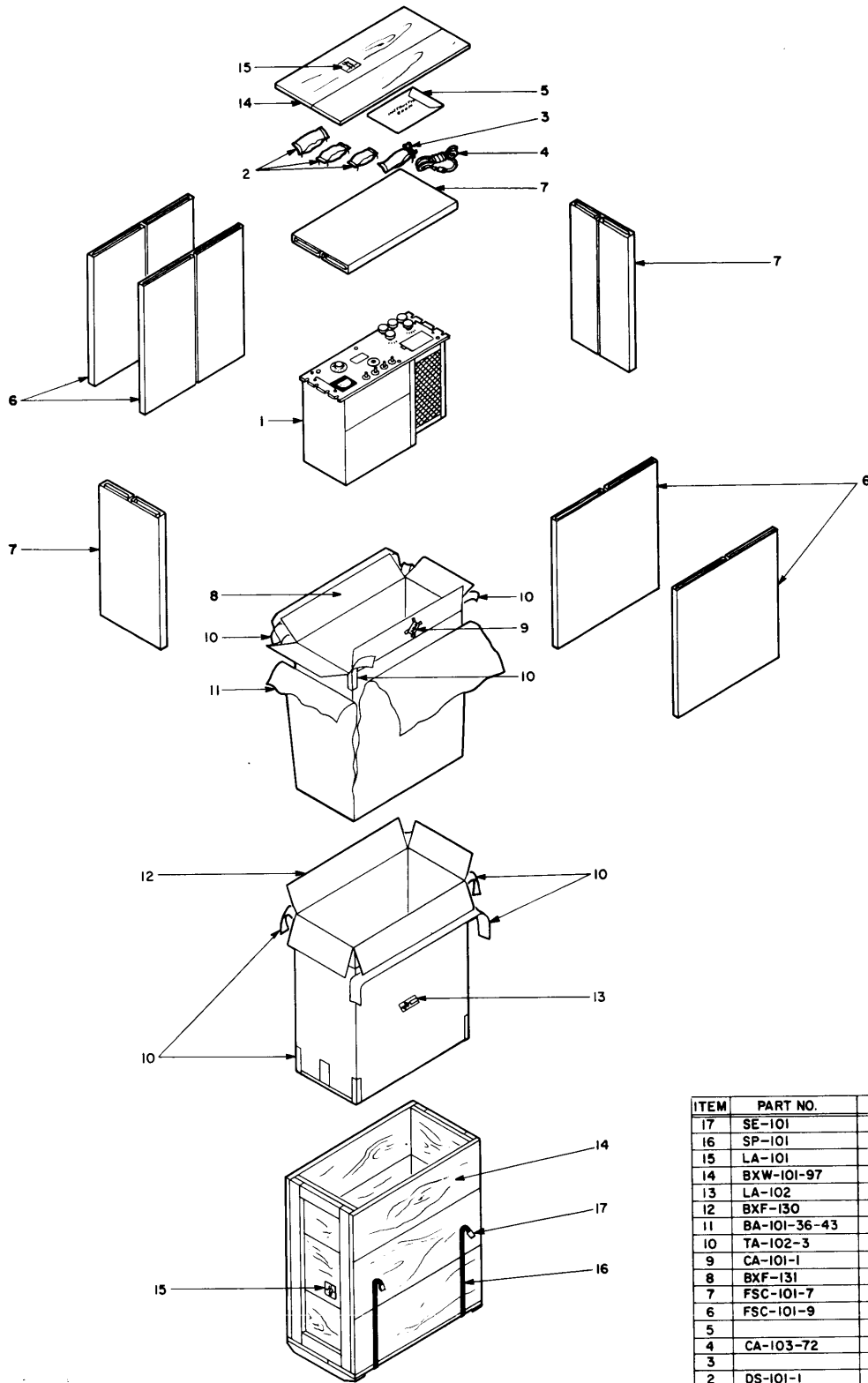


FIGURE 2-1. RAK-9, PREPARATION FOR SHIPMENT



ITEM	PART NO.	DESCRIPTION
17	SE-101	SEALS, STRAPPING
16	SP-101	STRAPPING, STEEL
15	LA-101	LABEL, FRAGILE
14	BXW-101-97	CONTAINER, SHIPPING
13	LA-102	LA-, METHOD II
12	BXF-130	CONTAINER, OUTER
11	BA-101-36-43	BAG, BARRIER
10	TA-102-3	TAPE, PRESSURE SENSITIVE
9	CA-101-1	CARD, HUMIDITY INDICATOR
8	BXF-131	CONTAINER
7	FSC-101-7	FIBERBOARD SHEET, CREASED
6	FSC-101-9	FIBERBOARD SHEET, CREASED
5		MANUALS, INSTRUCTION
4	CA-103-72	CORD, LINE
3		LOOSE ITEMS
2	DS-101-1	DESICCANT, 16 UNIT
1		MODULAR UNIT

FIGURE 2-2. MODULAR UNITS, PREPARATION FOR SHIPMENT, TYPICAL

TABLE 2-1. CONTAINER CONTENTS, SBT-1K(B) (Cont)

BOX NO.	CONTENTS
2	Monitor Control Unit, TMC Model MCU-2-50/U; Antenna Tuner Unit, TMC Model TU-2-50/U; Directional Coupler Unit, TMC Model CU-2-50/U.
3	Exciter Unit, TMC Model A-1516; Power Supply, TMC Model A-1397; Variable Frequency Oscillator, TMC Model VOX-5.
4	RF Amplifier, TMC Model RFD-1A; LV Power Supply, TMC Model PS-4A.
5	High Voltage Power Supply, TMC Model PS-5.

TABLE 2-2. SHIPPING DATA (LEVEL A PACKAGING), SBT-1K(B)

BOX NO.	GROSS WEIGHT (LBS)	OUTSIDE DIMENSIONS (IN)			VOLUME (CU. FT.)
		LENGTH	WIDTH	HEIGHT	
1	485	78-1/2	23-1/8	31-1/2	35.6
2	175	28-1/4	24-1/2	32	12.0
3	305	47	23-1/4	28-3/4	17.0
4	220	32-1/2	23-1/8	27	11.8
5	285	28-1/4	24-1/4	30-1/4	12.0

2-2. POWER REQUIREMENTS

All units of the SBT-1K(B) leave the factory wired for 115-volt, 50/60 cycle, single phase line voltage. Change may be made to 230-volt, 50/60 cycle, single phase operation by making minor wiring changes in modular units as listed in Table 2-3. Consult the installation information and schematic diagrams provided in the individual modular-unit manuals for wiring-change information.

CAUTION

If 230 volt, 50/60 cycle operation is used, all line fuses except those in LV Power Supply PS-4A and Power Supply PS-5 must be reduced to one half their rated current values to assure adequate circuit protection. Regulated and high voltage fuses remain the same with either line voltage.

Power consumption of the SBT-1K(B) is approximately 3000 watts; power cabling of sufficient size to provide 30 amperes at 115 volts a-c, single phase, is adequate. For information concerning the connection of power cables, refer to paragraph 2-3e.

TABLE 2-3. WIRING CHANGES, 115-VS 230-VOLT LINE SUPPLY

MODULAR UNIT	WIRING CHANGE MADE AT:	MANUAL REFERENCE
LV Power Supply PS-4A*	Circuit Breaker CB301 Transformer T301	PAL-1K(A) PAL-1K(A)
HV Power Supply PS-5*	Transformer T401	PAL-1K(A)
Variable Frequency Oscillator VOX-5	Transformer T101 Crystal Oven Terminal Boards E301 and E302	VOX-5 VOX-5
Exciter Unit A1516	Crystal Oven Terminal Board TB101	SBE-2
Power Supply A-1397	Transformer T401	SBE-2
Auxiliary Power Panel APP-4	Circuit Breaker CB501	Appendix

* Do not replace fuses in these units.

2-3. INSTALLATION

a. LOCATION OF TRANSMITTER - Before attempting to install the SBT-1K(B) ensure that adequate power (paragraph 2-2) is available

at the selected site or location. Refer to dimensional outline drawing figure 2-3 when choosing the operating location. The room (or van) in which the SBT-1K(B) is located must have a ceiling height of at least 7 feet. Adequate ventilation must be provided; operation of the transmitter in a poorly ventilated room will cause the surrounding temperature to become too high. Also, a clearance of about two feet at the rear of the rack is needed for opening the door. Locate the cabinet as close to the antenna as possible so that transmission lines between the transmitter and antenna are short. For information pertaining to antenna connections, refer to paragraph 2-3d.

After unpacking and inspecting the cabinet (RAK-9B), place it in its operating location. It is advisable to do this while modular units are not installed because the added weight of the assembled transmitter will make movement more difficult. The four holes in the top of the rack and the four eyebolts included as loose parts in the shipment are for moving the rack with a crane hoist. Holes in the base are for rigid-mounting or shock mounting the rack to the floor. Holes along the top of the rear wall are for the top shock mounts. Use these holes as a template for drilling holes in the shelter or van.

NOTE

When equipment is to be shockmounted, a shock-mounting kit and separate installation instructions are supplied.

b. INSTALLATION OF MODULAR UNITS. - Refer to figure 1-2 for information regarding cabinet location of all modular units except Directional Coupler Unit CU-2-50/U and Antenna Tuner Unit TU-2-50/U; these units are mounted at the rear of the cabinet and at the antenna location respectively. Directional Coupler Unit CU-2-50/U is installed

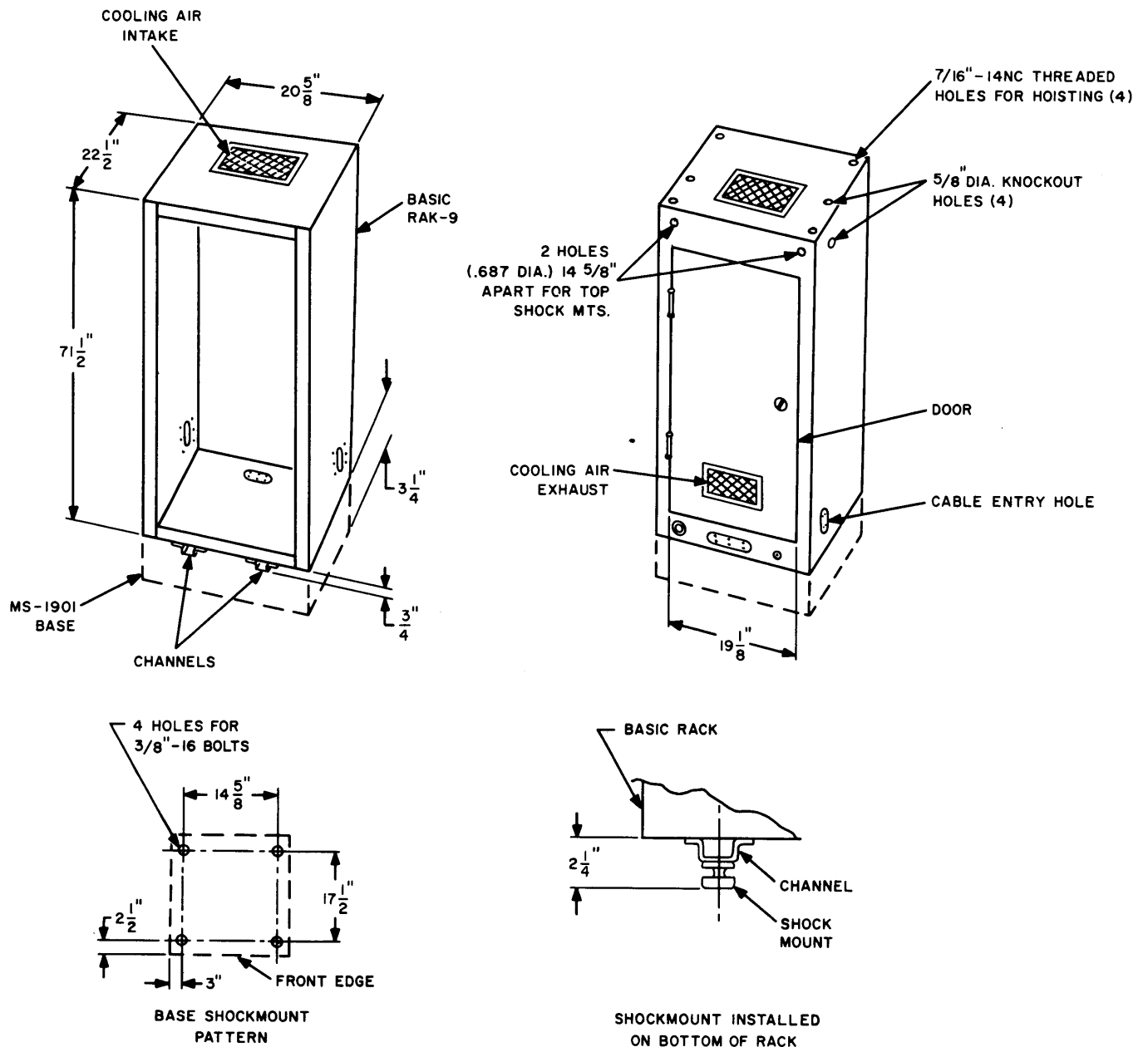


FIGURE 2-3. DIMENSIONAL OUTLINE AND INSTALLATION DRAWING, SBT-1K(B)

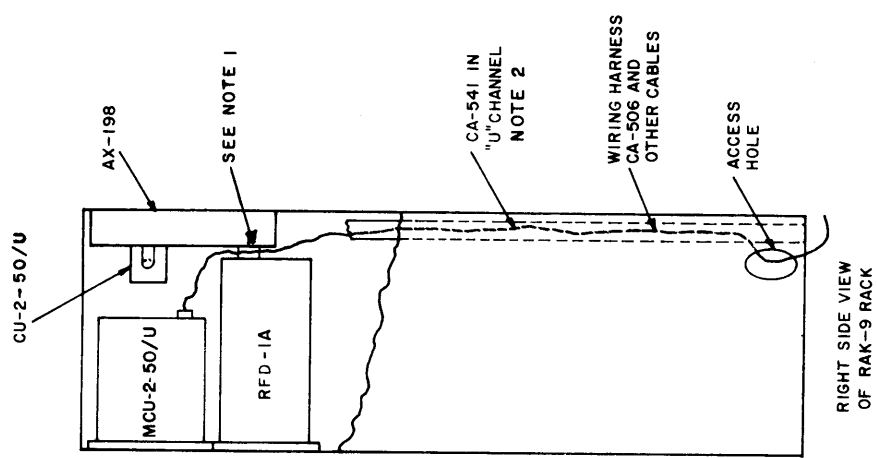
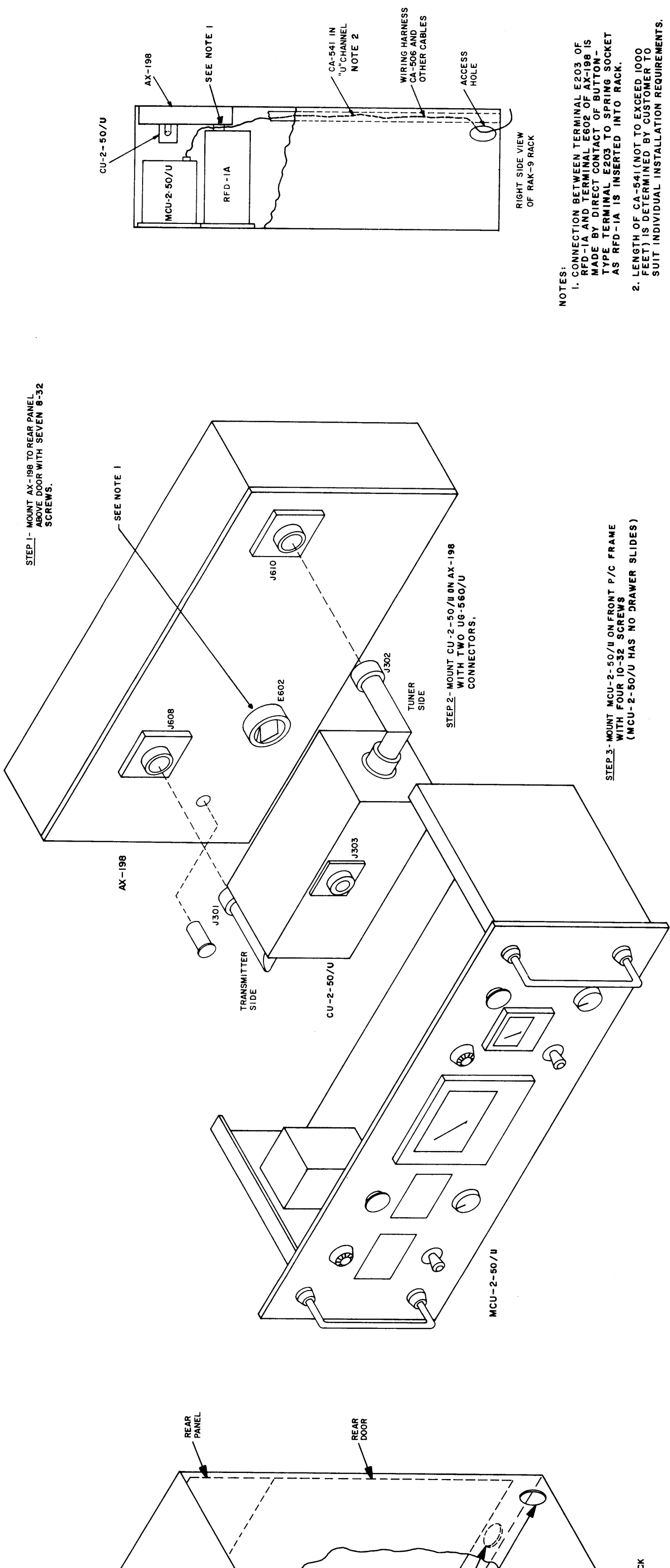
With RF Output Assembly AX-198 as illustrated in figure 2-4. Refer to paragraph 2-3c for cable and electrical connections for RF Output Assembly AX-198.

NOTE

If SBT-1K(B) is used without Variable Frequency Oscillator VOX-5, Exciter Unit A-1516 requires crystal installation and adjustment before operation (refer to SBE-2 manual).

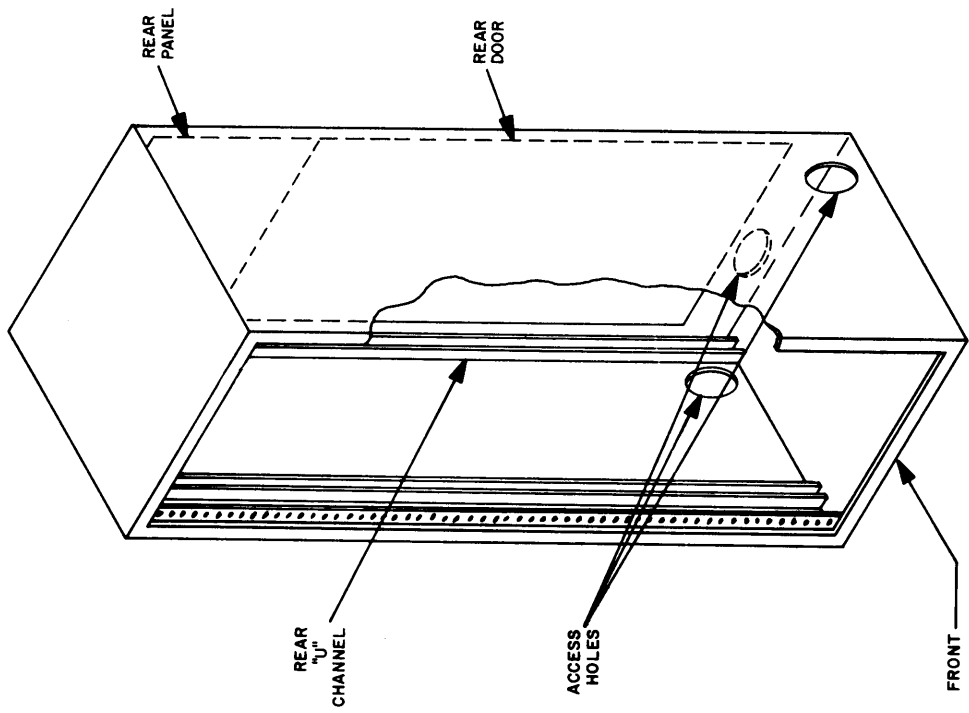
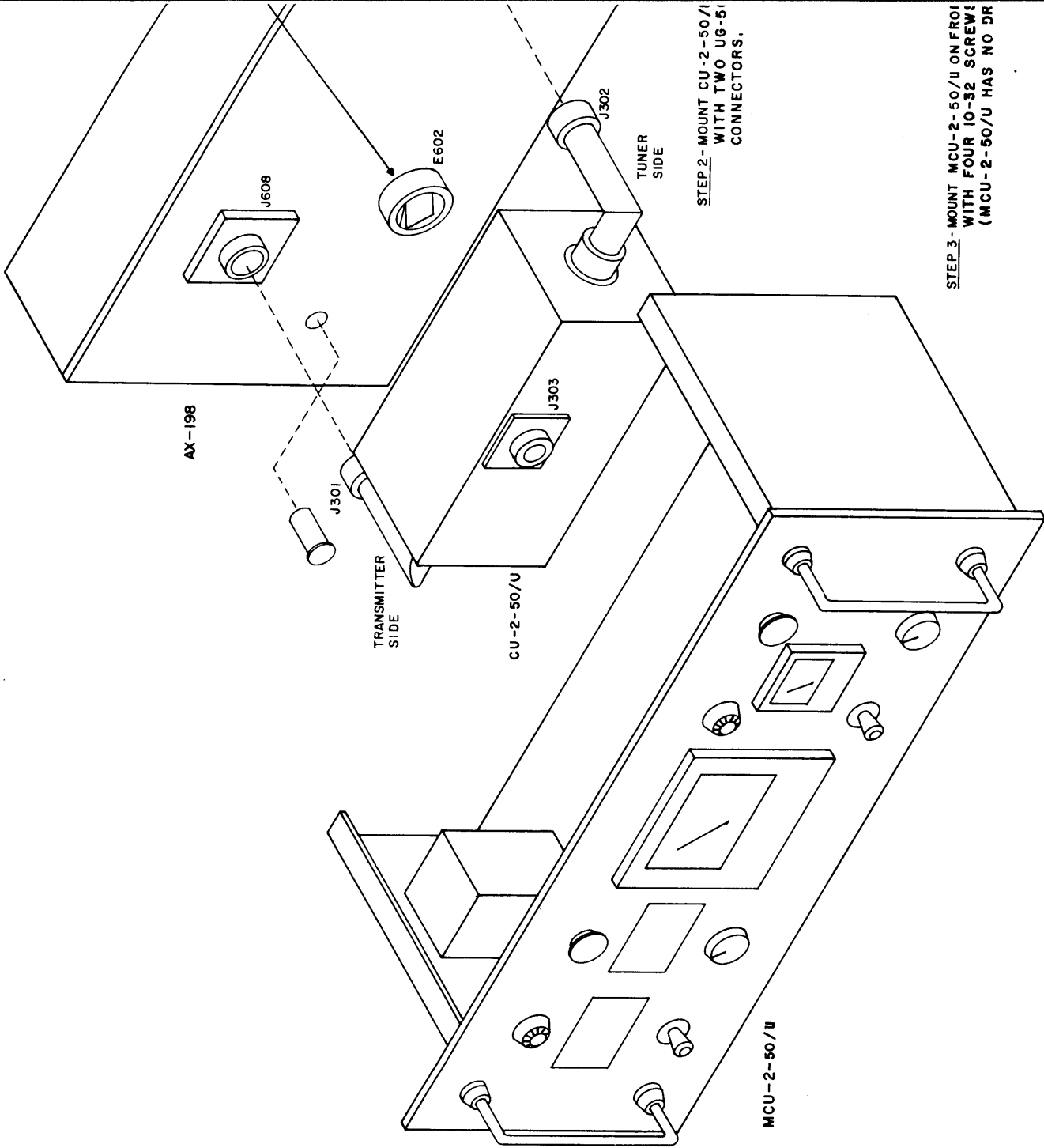
All modular units are slide mounted except Monitor Control Unit MCU-2-50/U, Power Supply A-1397, and Auxiliary Power Panel APP-4. Auxiliary Power Panel APP-4 is installed in RAK-9B prior to shipment. To install any slide-mounted unit in its compartment, refer to figure 2-5 and proceed as follows:

- (1) Untape or unstrap cable assemblies and all other components secured to the RAK-9B frame for shipment.
- (2) Pull center section of associated compartment track out until it locks in an extended position.
- (3) Position slide mechanisms of modular unit in tracks, and ease modular unit forward into rack until release buttons engage hole in track.
- (4) Make the necessary cable and electrical connections as described in paragraph 2-3d. To prevent the cables extending from Amplifier RFD-1A and LV Power Supply PS-4A from snagging, utilize the reel-mounted springs located inside RAK-9B.
- (5) Depress release buttons and slide modular unit completely into compartment.
- (6) Secure front panel of modular unit to RAK-9B with screws.



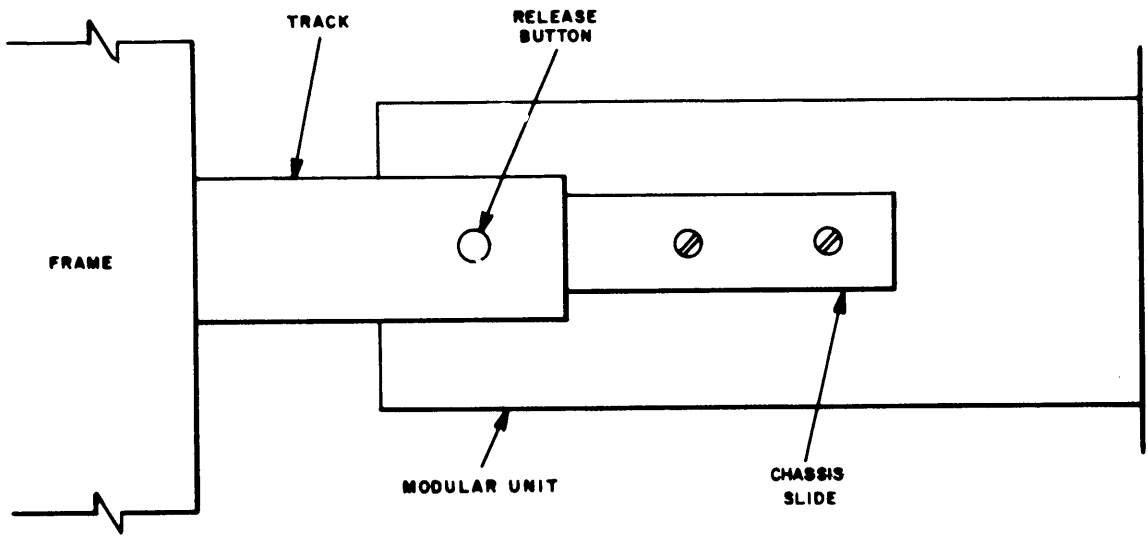
- NOTES:
1. CONNECTION BETWEEN TERMINAL E203 OF RFD-1A AND TERMINAL E602 OF AX-198 IS MADE BY DIRECT CONTACT OF BUTTON-TYPE TERMINAL E203 TO SPRING SOCKET AS RFD-1A IS INSERTED INTO RACK.
 2. LENGTH OF CA-541 (NOT TO EXCEED 1000 FEET) IS DETERMINED BY CUSTOMER TO SUIT INDIVIDUAL INSTALLATION REQUIREMENTS.

FIGURE 2-4. INSTALLATION OF AX-198, CU-2-50/U, MCU-2-50/U AND RFD-1A UNITS

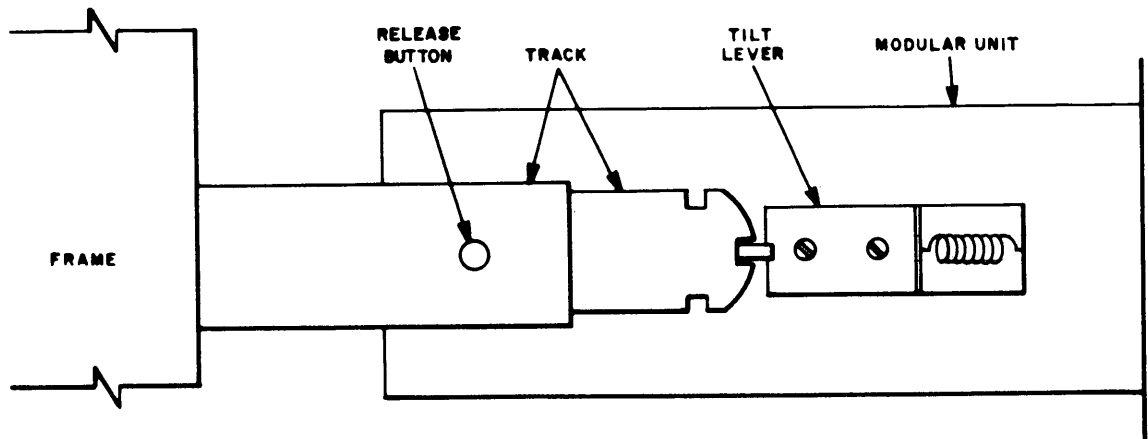


STANDARD RAK-9 RACK

321-5



A NON-TILTING SLIDE MECHANISM



B TILTING SLIDE MECHANISM

FIGURE 2-5. SLIDE-MOUNTING DETAILS

c. INTERCONNECTION OF MODULAR UNITS. - Figures 2-6 and 2-7 illustrate the cabling and wiring interconnections between the various modular units contained in the transmitter. Refer to figures 2-6 and 2-7 and connect modular units as indicated.

d. CONNECTION OF EXTERNAL EQUIPMENT

(1) GENERAL. - Auxiliary Power Panel APP-4 is a standard modular unit present in all SBT-1K(B) transmitters. Besides functioning as a distributor for line voltage, the APP-4 provides two terminal blocks to facilitate connection of external equipment to the transmitter. Except for antenna and receiver connections at jacks J609 and J606 on RF Output Assembly AX-198 and the MIKE connection on Exciter Unit A-1516, all external connections may be made at terminal blocks E501 and E502 located at the rear of Auxiliary Power Panel APP-4. Figure 2-8 and the following paragraphs illustrate the possible external connections to the SBT-1K(B). Schematic diagrams in the individual modular-unit manuals should be used as an aid for tracing wiring.

(2) REMOTE TRANSMITTER PLATE RELAY. - Terminals 1 and 2 of terminal block E501 are provided for attachment to the coil of a relay supplying plate voltage to an additional stage of r-f amplification external to the SBT-1K(B). This enables control of the entire transmitter at the exciter unit panel by means of the XMTR OFF/ON switch. Such a relay is sometimes employed in larger TMC transmitter systems of which SBT-1K(B) is a sub-assembly.

(3) REGULATED 115 VAC. - Terminals 3 and 4 of terminal block E501 are available for an extension source of the regulated 115 VAC used in Power Supply PS-4.

(4) EXTERNAL INTERLOCKS. - Terminals 5,6, 7 and 8 of terminal block E501 are provided for connection of additional safety interlock/s

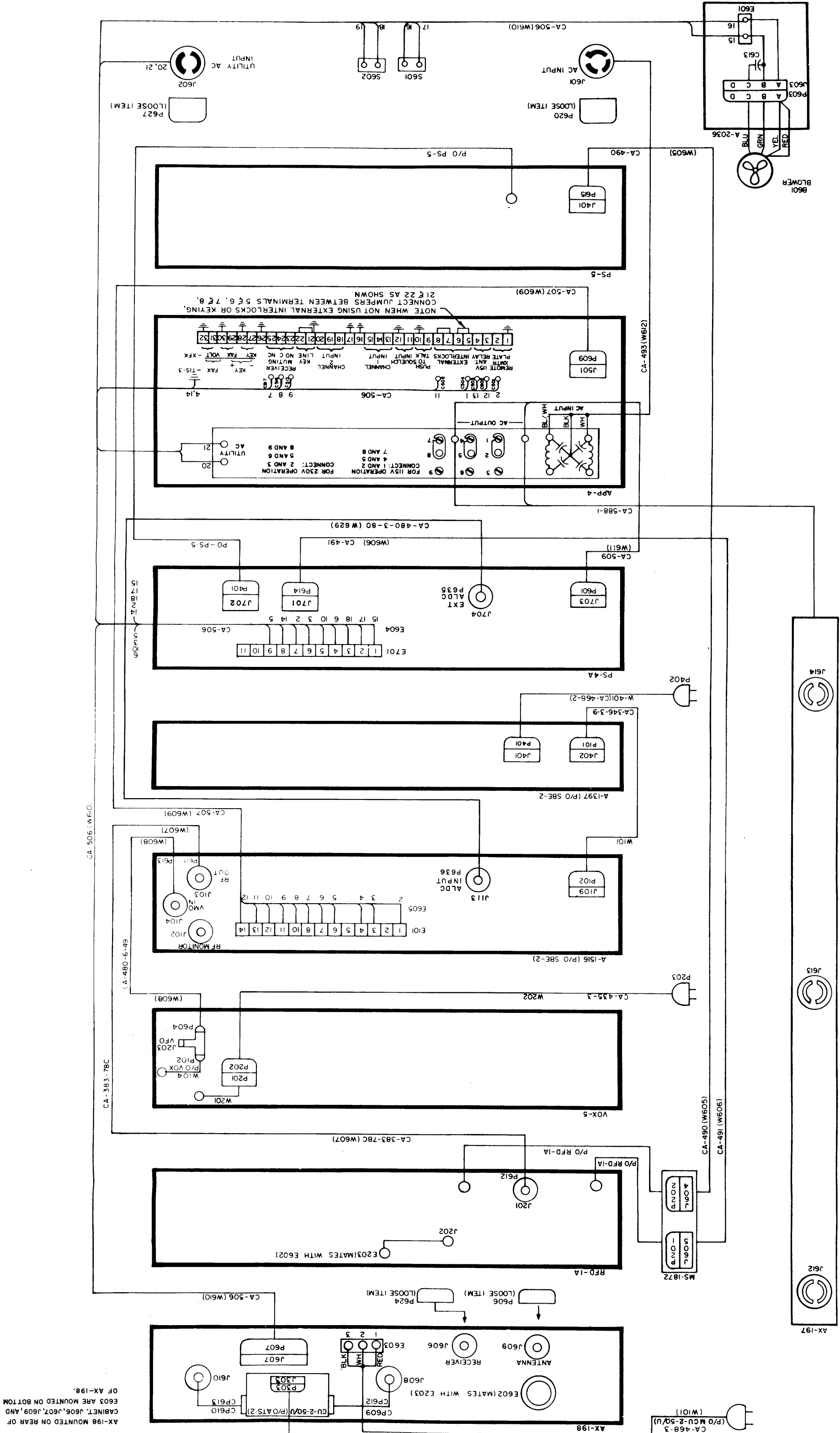
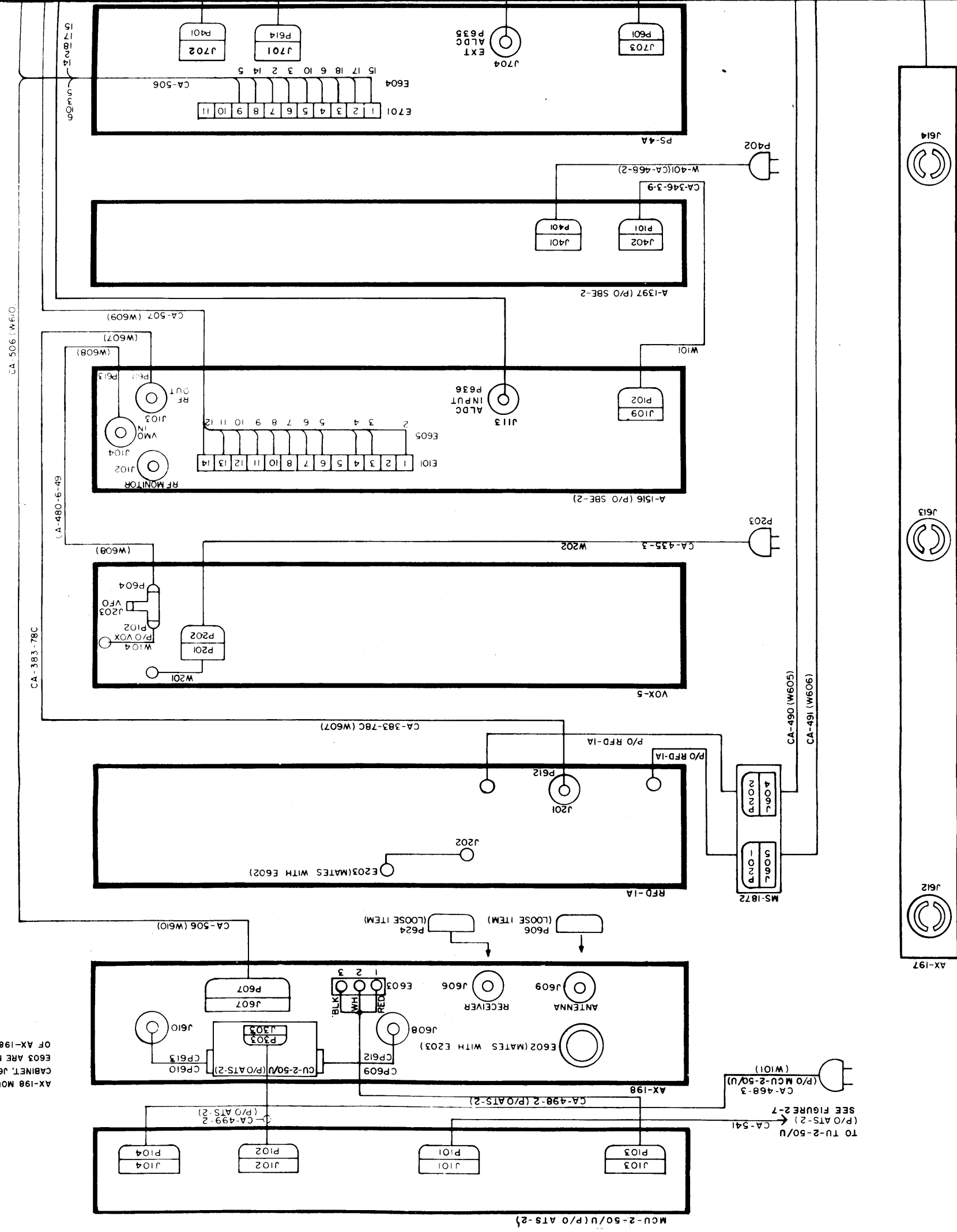


FIGURE 2-6. CABLING INTERCONNECTIONS, SBT-1K (B)



AX-198 MOUNTED ON REAR OF CABINET. J606, J607, J609, AND E603 ARE MOUNTED ON BOTTOM OF AX-198.

TO TU-2-50/U (P/O ATS-2) → CA-541
 SEE FIGURE 2-7
 CA-468-3 (P/O MCU-2-50/U) (W101)

CK-568B

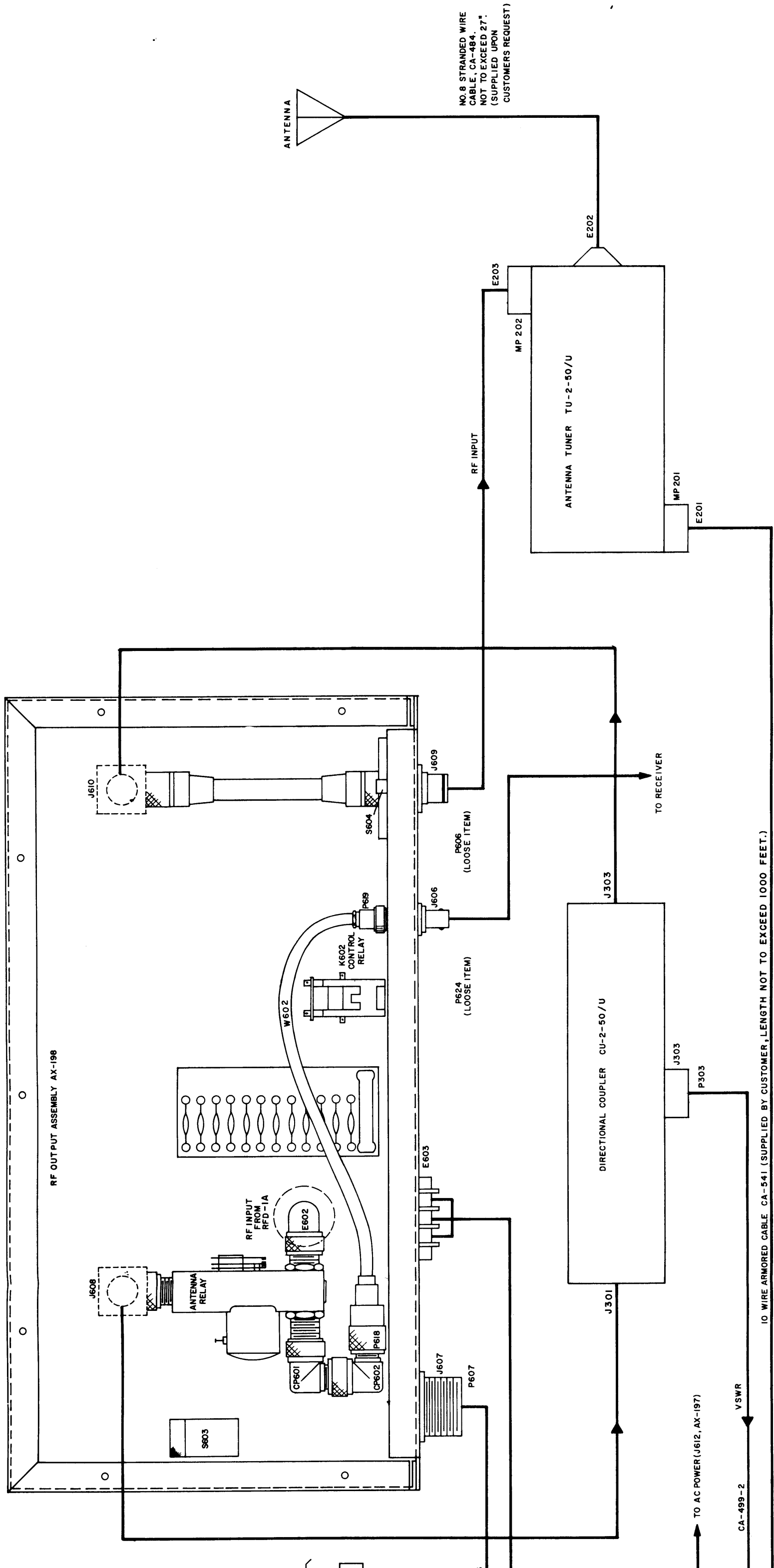
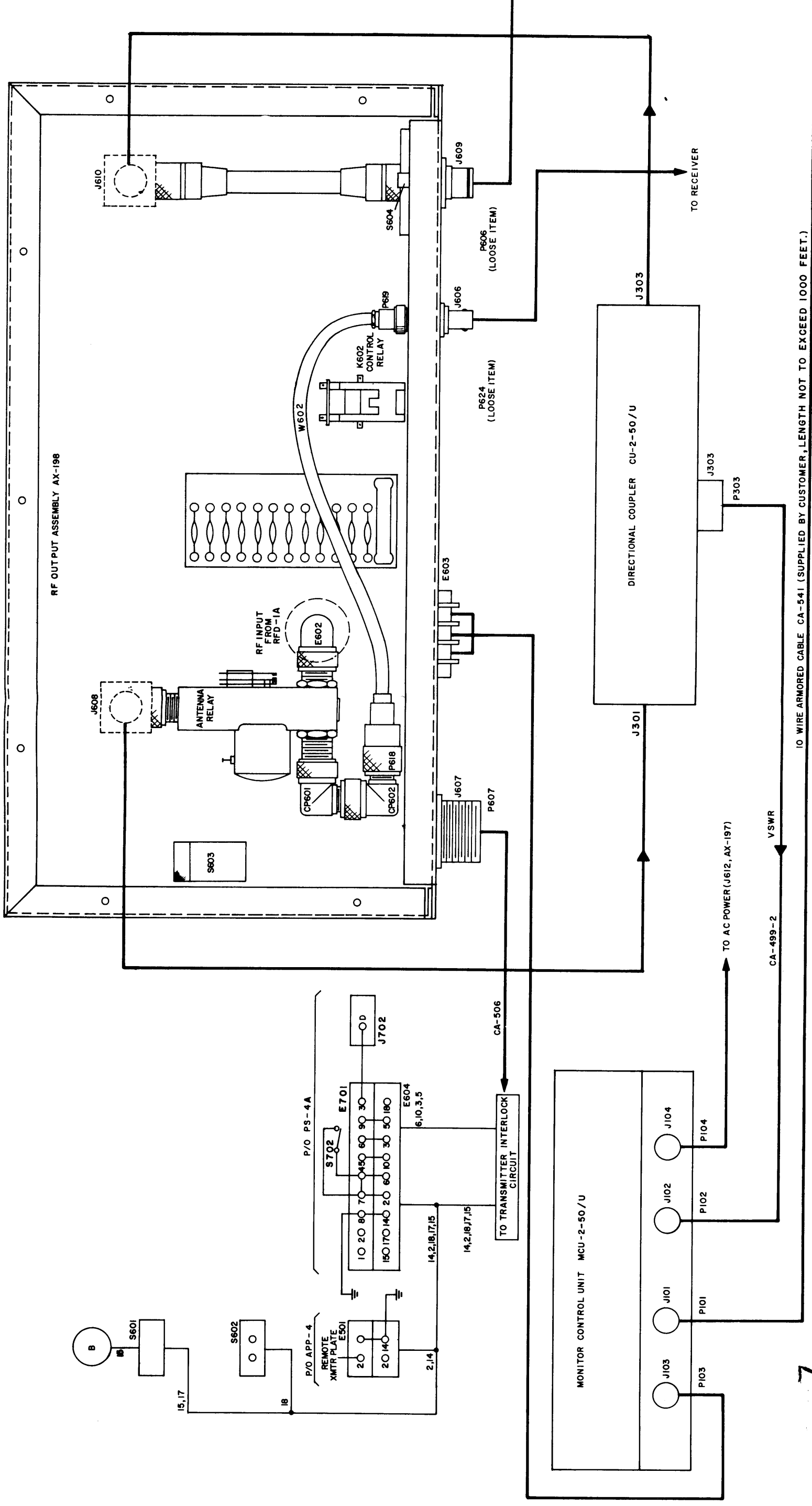


FIGURE 2-7. PARTIAL WIRING DIAGRAM SHOWING INTER-CONNECTIONS OF AX-198 ASSEMBLY AND CLOSELY ASSOCIATED UNITS



LEGEND:
 ——— EXISTING WIRING
 - - - WIRING TO BE ADDED
 - * - JUMPER TO BE REMOVED WHEN
 EXTERNAL WIRING IS ADDED.

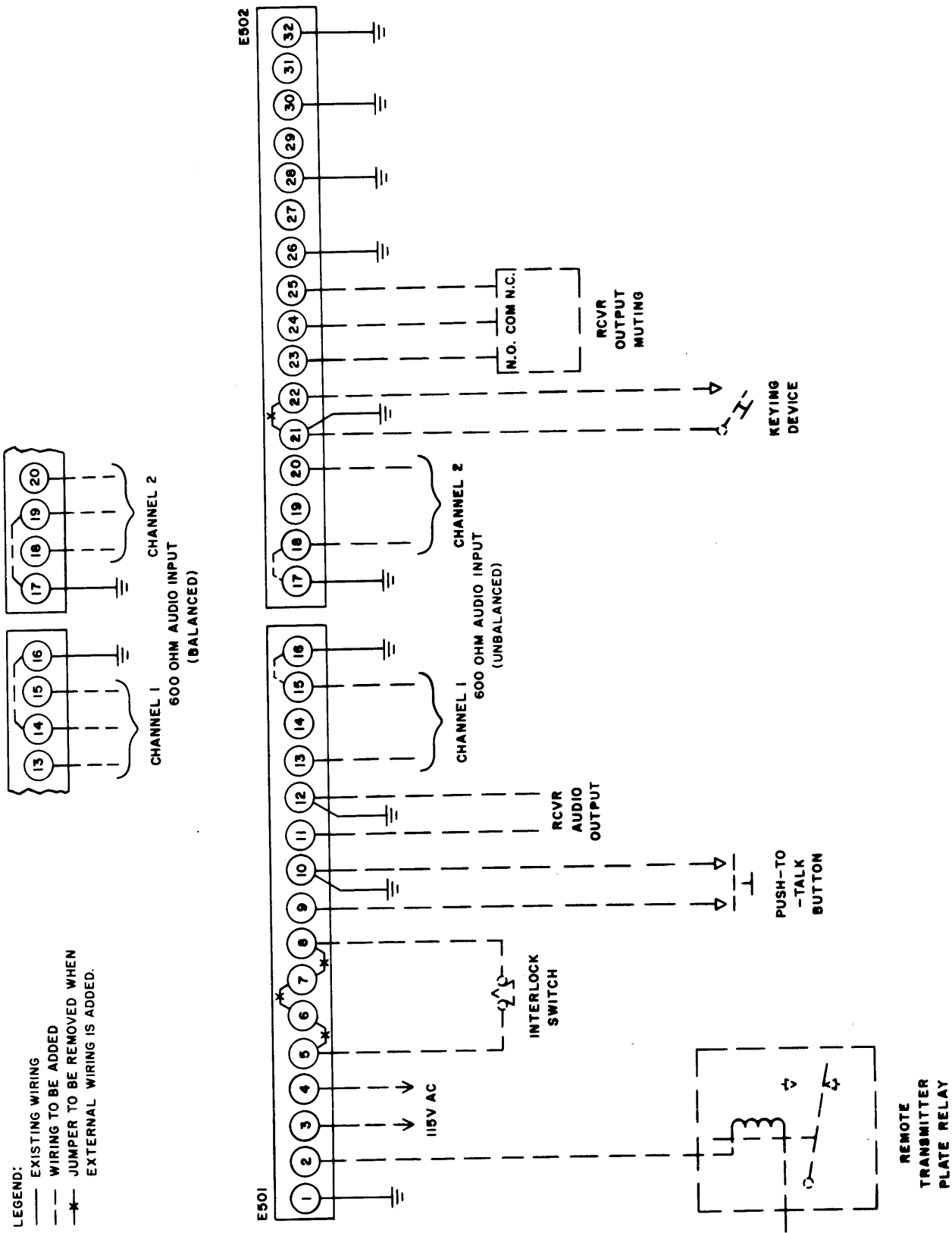


FIGURE 2-8. CONNECTION DIAGRAM, EXTERNAL EQUIPMENT TO SBT-1K(B)

external to the SBT-1K(B) transmitter. Such additional interlock/s will be in series with the SBT-1K(B) interlocks and form another link in the interlock circuit. When these terminals are not used in this way, the jumpers remain in place.

(5) PUSH-TO-TALK SYSTEM - Terminals 9 and 10 of terminal block E501 are provided for a push-to-talk button attachment. A push-to-talk system may be used in lieu of or along with the voice-operated (VOX) circuit available in the exciter unit.

(6) RECEIVER SQUELCH - Terminals 11 and 12 of terminal block E501 are provided for the attachment to a receiver audio output, if receiver "squelch" is desired when using the VOX (voice-operated) feature in the exciter unit. Receiver squelch is used in order to prevent sound from a nearby receiver or other source from automatically actuating the VOX circuit.

(7) AUDIO INPUT - CHANNELS 1 AND 2 - Terminals 13 through 20 of terminal block E502 are provided for the attachment of two separate sources (or channels) of intelligence in the form of 600-ohm audio. Figure 2-8 illustrates connections for either balanced or unbalanced inputs.

(8) KEY LINE - Terminals 21 and 22 of terminal block E502 are provided for the attachment of a keying device in CW mode of transmission. Pushing down on key grounds the cathode circuit of first r-f amplifier V118 in Exciter Unit A-1516 enabling it to operate.

(9) RECEIVER MUTING - Terminals 23, 24 and 25 of terminal block E502 are provided for receiver muting. The purpose of this feature is to automatically disable the receiver when the transmitter is sending and enable it when the transmitter is in OFF or STANDBY condition. Terminals 23 and 24 make contact with each other through

relay K601 to enable the receiver when the transmitter is off (terminals 25 and 24 are disconnected). When the transmitter is on, relay K601 connects terminals 25 and 24 to disable the receiver (terminals 23 and 24 are disconnected).

(10) RESERVED TERMINALS - Terminals 26 through 32 of terminal block E502 are present in each standard APP-4 for the interconnection of necessary equipment for FSK (Frequency Shift Keying) and FAX (Facsimile) modes of transmission. The SBT-1K(B) does not transmit FSK and FAX and these terminals should not be used for connection of external equipment.

(11) ANTENNA - R-f receptacle J609 on RF Output Assembly AX-198 and mating plug P606 are provided for the antenna connection (see figure 2-7). Connector J609 (TMC Part No. JJ-147) is an adapter with a nominal impedance of 50-ohms, adapting a UHF type of connection on the inside of the chassis to a QDS type on the outside. P606 (TMC Part No. PL-150) is a QDS type plug with a nominal impedance of 50-ohms and is used with a RG-8/U or RG-10/U cable to connect the antenna to the SBT-1K(B).

(12) TRANSMITTER/RECEIVER ANTENNA - R-f receptacle J606 on RF Output Assembly AX-198 and mating plug P624 are provided for connecting the transmitting antenna to a receiver input (see figure 2-7), thus making the transmitting antenna double for a receiving antenna. Antenna relay K601 switches the antenna from the transmitter to the receiver and back. When the transmitter is sending, the antenna is connected to the transmitter and disconnected from the receiver. When the transmitter is not sending, the antenna is disconnected from the transmitter and connected to the receiver.

(13) MIKE. - The MIKE jack on the control panel of Exciter Unit A-1516 is for the connection of a 50,000-ohm high impedance crystal or dynamic microphone.

(14) EXTERNAL ALDC. - When the ALDC switch located at the rear of Amplifier RFD-1A is set at INT, the output of the amplifier acts on its own input stage to effect ALDC (automatic load and drive control). When ALDC switch is set at EXT, the ALDC signal is, instead, routed to the exciter unit to control its output level. The latter position (EXT) is preferable when the RFD-1A is used in the SBT-1K(B), since it is more effective in preventing overdrive conditions in the RFD-1A.

(15) LINE VOLTAGE. - Connect the 115- or 230-vac, 50/60 cycle, single phase line voltage source at receptacle J601 located at the bottom of the rack on the rear wall. Refer to table 1-2 for mating plug supplied in shipment.

2-4. INITIAL ADJUSTMENTS. - The SBT-1K(B) has been factory tested and adjusted before shipping; therefore, no initial adjustments of chassis mounted variable components are necessary before operation.

SECTION 3

OPERATOR'S SECTION

3-1. GENERAL

Paragraphs 3-3a through 3-3i below provide operating instructions for the SBT-1K(B). Before proceeding with any of the operating procedures provided in this section, the operator should familiarize himself with all operating controls and indicators (paragraph 3-2).

3-2. CONTROLS AND INDICATORS

Figure 3-1 located at the end of this section illustrates all SBT-1K(B) front-panel controls and indicators used during normal operation. Table 3-1 lists the controls and indicators and the function of each.

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Monitor Control Unit, MCU-2-50/U	1	OVERLOAD (lamp)	Lights when main transmitter power is interrupted.
	2	Power Meter (no front-panel designation)	Dual-pointer meter with scales calibrated for FORWARD-WATTS, REFLECTED-WATTS, and vswr (voltage standing wave ratio). Scales are calibrated 0 to 100. Vswr on transmission line is indicated by point of intersection of meter pointers.

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Monitor Control Unit, MCU-2-50/U (Cont)	3	RESISTANCE-OPERATE (push-button switch)	Controls unidirectional motor that drives selector switch in antenna tuner for selection of auto-transformer taps to match antenna resistance. Selector switch contacts resistance positions 1 to 6 in a clockwise direction and repeats the cycle.
	4	STOP (lamp)	Indicates when maximum or minimum inductances of variable inductor in antenna tuner have been reached. Microswitches are incorporated in antenna tuner to prevent reactance-changing motor from overdriving at either end of moving contact travel. These switches interrupt motor power and energize STOP indicator.
	5	Meter (no front-panel designation)	Three-scale meter indicates percent of total reactance of variable coil, position of variable resistor switch, and presence of humidity in antenna tuner unit. Scale reading is indicated by position of METER switch.
	6	METER (switch)	Three position switch that returns to REACT position when released. When set at RES., meter indicates resistance. When set at HUM, meter indicates humidity.

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Monitor Control Unit, MCU-2-50/U (Cont)	7	REACTANCE (switch)	Three-position lever action switch that controls direction of reversible motor that drives contact on variable inductance in antenna tuner. When switch is held at INCR., motor shaft rotates in direction to increase inductance of variable inductor. When switch is held at DECR, motor shaft rotates in direction to decrease inductance of variable inductor.
	8	POWER (switch)	Four-position rotary switch that turns on monitor control, selects watts scales factors, and shorts power meter.
	9	TUNE-OPERATE (switch)	Limits transmitter output to 100 watts when set at TUNE.
	10	RESET (push-button switch)	Allows transmitter to operate again after overload condition.
	11	POWER (lamp)	Lights when monitor control unit is on.
RF Amplifier RFD-1A	12	NEUT (adjustable capacitor)	Modifies spurious feedback from power amplifier stage.
	13	MULTIMETER (switch)	Selects circuit for measurement by MULTIMETER (14).
	14	MULTIMETER (meter)	Measures circuit selected by MULTIMETER switch (13).

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
RF Amplifier RFD-1A	15	PA PLATE CURRENT (meter)	Monitors plate current of power amplifier tube.
	16	PA BAND (nine-position selector switch)	Selects appropriate band for coarse-tuning power amplifier output.
	17	PA LOADING (three-position switch)	Selects appropriate circuit for coarse-adjust for antenna impedance matching.
	18	PA LOADING (dial)	Provides calibrated position readings for PA LOADING knob (19) movement.
	19	PA LOADING (knob)	Adjustable capacitor. Fine-adjustment for antenna impedance matching.
	20	ALDC (knob)	Adjusts ALDC operating level.
		ALDC INT/EXT (switch-located on RFD-1A rear chassis)	When set at INT, ALDC d-c bias is applied only to control grid of V201 in RFD-1A. When set at EXT, ALDC d-c bias is extended to Exciter Unit A-1516.
	21	PA TUNING (knob)	Adjustable capacitor. Fine-tunes power amplifier output to match antenna.
	22	PA TUNING (dial)	Provides calibrated position readings for PA TUNING knob (21) movement.

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
RF Amplifier RFD-1A	23	DRIVER BAND (Five-position selector switch)	Selects appropriate band for coarse-tuning r-f driver input and output
	24	1ST AMPL TUNING (knob)	Ganged adjustable capacitors. Fine-tunes first r-f amplifier output.
	25	PA GRID TUNING (knob)	Adjustable capacitor. Fine-tunes power amplifier input.
Variable Frequency Oscillator VOX-5	26	BEAT (switch-located in compartment behind door)	Supplies B+ to VOX-5 100-kc oscillator so that mixer V103 in calibrating chain receives 100-kc and VMO oscillator voltages for production of beat tones.
	27	METER (switch-located in compartment behind door)	Enables meter to measure output of HFO, IFO, BFO, and VMO.
	28	PHONES (jack-located in compartment behind door)	Enables plugged-in receiver to receive beat tones.
	29	BFO (switch-located in compartment behind door)	Applies d-c screen voltage to BFO tube.
	30	MAIN POWER (lamp)	Lights when VOX-5 is receiving 60-cycle power.

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Variable Frequency Oscillator VOX-5	31	INNER OVEN (lamp)	Lights when inner oven is receiving heat.
	32	OUTER OVEN (lamp)	Lights when outer oven is receiving heat.
	33	ZERO BEAT (lamp)	Indicates beat tones when calibrating VMO with 100-kc oscillator at check points.
	34	Output Meter (no designation)	Registers level of VOX's r-f outputs in line with position of METER selector switch located in compartment behind door.
	35	CALIBRATE (knob)	Calibrates VMO with 100-kc oscillator at check points.
	36	MASTER OSCILLATOR FREQUENCY (knob)	Controls output frequency of VMO
		BFO ADJ (potentiometer-mounted on top of chassis)	Controls BFO output level
		BFO XTAL (switch-mounted at rear of chassis)	Determines which of two crystals is used for BFO beats.
	37	LOCK (knob)	Locks MASTER OSCILLATOR FREQUENCY control in position.

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Variable Frequency Oscillator VOX-5 (Cont)	38	MASTER OSCILLATOR FREQUENCY (dial)	Registers output frequency of VOX-5 and tunes main oscillator.
	39	OUTPUT (knob)	Controls output level of HFO circuit
	40	XTAL (four-position selector switch)	Determines whether VOX-5 output is produced by crystals in positions 1, 2, 3, or by its VMO.
	41	XTAL FREQ (four-position selector switch)	Enables small changes in crystal frequency. Used only when VOX-5 uses a crystal for r-f output.
	42	BAND MCS (five-position selector switch)	Controls tuning elements in HFO circuit.
	43	TUNING (knob)	Tunes HFO output circuit. Used to maximize meter reading with METER selector switch in HFO position.
	44	IFO (switch - located in compartment behind door)	Applies d-c plate voltage to IFO tube.
	45	HFO (switch - located in compartment behind door)	Applies d-c plate voltage to HFO tubes.

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Variable Frequency Oscillator VOX-5 (Cont)	46	POWER (switch - located in compartment behind door)	Applies line voltage to or disconnects line voltage from power supply circuit.
Exciter Unit A-1516	47	MF XTAL SW (eleven-position selector switch)	Selects either VMO input from VOX-5 or proper crystal for mid-frequency oscillator in Exciter Unit A-1516.
	48	LSB/OFF/CH 1/CH 2/MIKE (four position selector switch)	Selects audio input for lower sideband.
	49	LSB/GAIN (knob)	Potentiometer. Adjusts level of lower sideband audio input.
	50	Dial (no front-panel designation)	Upper movable dial coordinated with OUTPUT TUNING disc (65). Lower movable dial coordinated with MF TUNING knob (62).
	51	XMTR/ON/OFF (switch)	ON position turns on amplifier stage external to transmitter. Not used in SBT-1K(B).
	52	EXCITER/ON/STANDBY (switch)	ON position activates r-f output stage of SBE-2. Used when VOX (voice-operated circuit) is not employed. STANDBY position allows VOX or push-to-talk circuit to activate SBE-2 and SBT-1K(B).

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Exciter Unit A-1516 (Cont)	53	POWER/ON/OFF (switch)	ON position supplies SBE-2 with power.
	54	Meter (no front-panel designation)	Indicates output levels of sideband, medium frequency, and r-f sections in SBE-2, selectable by METER SW (57)
	55	EXCITER (lamp)	Indicates r-f output stage of SBE-2 is transmitting to PAL-1K(A).
	56	OVEN (lamp)	Indicates high frequency crystal oven-heating element is on.
	57	METER SW (switch)	Selects section of SBE-2 system to be measured by built-in VTVM circuit.
	58	CAL (screwdriver adjustment)	Potentiometer. Zero adjust for output meter (54).
	59	OUTPUT (knob)	Potentiometer. Adjusts SBE-2 output level into PAL-1K(A).
	60	MIKE (jack)	Jack for audio pre-amp input for all high-impedance (500K) dynamic microphones.
	61	USB/OFF/CH 1/ CH 2/MIKE (four-position selector switch)	Selects audio input for upper sideband.

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Exciter Unit A-1516 (Cont)	62	MF TUNING (knob)	Ganged tuning capacitors. Selects mid-frequency setting as indicated in lower section of main tuning dial (50)
	63	USB/GAIN (knob)	Potentiometer. Adjusts level of upper sideband audio input.
	64	SQUELCH GAIN (knob)	Potentiometer. Adjusts level of receiver squelch if appropriate connection is made (see paragraph 2-3d).
	65	OUTPUT TUNING (outer disc)	Ganged tuning capacitors. Selects specific frequency within band selected by OUTPUT TUNING knob (66) for SBE-2 r-f output. Frequency is indicated on upper section of main tuning dial (50).
	66	OUTPUT TUNING (center knob)	Four-position selector switch. Selects band for SBE-2 r-f output stage.
	67	VOX GAIN (knob)	Potentiometer adjusts operating level of VOX (voice operated circuit) feature.
	68	CARRIER INSERT (knob)	Potentiometer. Adjusts level of carrier insertion.
	69	BAND MCS (ten-position selector switch)	Selects frequency range of high-frequency modulator in 2-mc increments. Ganged to BAND MCS knob (69)

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Exciter Unit A-1516 (Cont)	70	BAND MCS (dial)	Indicates injection frequency range of high-frequency modulator in 2-mc increments. Ganged to BAND MCS knob (69)
Power Supply A-1397	71	Main power indicator lamp (no front-panel designation)	Lights to indicate that that power is applied to Exciter Unit A-1516.
LV Power Supply PS-4A	72	PA FIL PRI (meter)	Indicates voltage applied to primary of transformer supplying filament voltages to amplifier tubes in PAL-1K(A)
	73	PA FIL PRI ADJUST (seven-position selector switch)	Selects tap on auto-transformer to produce proper regulated voltage to PAL-1K(A) filament transformer. Voltage selected registers on PA FIL PRI meter (72)
	74	MAIN POWER (lamp)	Indicates PAL-1K(A) system is receiving main line power supply
	75	MAIN POWER (circuit breaker)	Dual circuit breaker, companion trip type. ON position supplies line voltage power to PAL-1K(A) system. Protects main a-c power supply line to PAL-1K(A) from current overload.
	76	TRANSMITTER VOLTAGES (lamp)	Indicates RFD-1A tubes are receiving mid-voltage plate supply.

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
LV Power Supply PS-4A (Cont)	77	TRANSMITTER VOLTAGES ON/STANDBY (switch)	ON position feeds mid-voltage plate supply to RFD-1A tubes; STANDBY position cuts off supply.
	78	FINAL VOLTAGES ON/OFF (switch)	ON position supplies power-amplifier tube V203 with high screen-grid and plate voltages.
	79	FINAL VOLTAGES (lamp)	Indicates power amplifier tube V203 is receiveing high screen grid and plate voltages.
	80	PA OVERLOAD CONT GRID (circuit breaker)	Protects power amplifier tube control-grid circuit from current overload. (Circuit breaker in ON position forms a link in SBT-1K(B) interlock system).
	81	PA OVERLOAD SCRN GRID (circuit breaker)	Protects power-amplifier tube screen-grid circuit from current overload. (Circuit breaker in ON position forms a link in SBT-1K(B) interlock system).
	82	PA OVERLOAD PLATE (circuit breaker)	Protects power-amplifier tube plate circuit from current overload. (Circuit breaker in ON position forms a link in SBT-1K(B) interlock system).

TABLE 3-1. CONTROLS AND INDICATORS, SBT-1K(B) (Cont)

MODULAR UNIT	PANEL CALLOUT	PANEL DESIGNATION	FUNCTION
Auxiliary Power Panel APP-4	83	MAIN POWER (circuit breaker)	ON position supplies line voltage power to SBT-1K(B). Protects main line for a-c power supply to SBT-1K(B) from current overload.
	84	MAIN POWER (lamp)	Indicates SBT-1K(B) is supplied with line voltage.
	85	UTILITY OUTLETS	Receptacles. Available for additional supply of line voltage to external equipment, when line voltage is connected to J602 AC UTILITY INPUT at rear of rack.

3-3. OPERATING PROCEDURES

WARNING

Voltages employed in the SBT-1K(B) are high enough to be fatal. Every precaution should be taken by operating personnel to minimize the danger of shock.

a. GENERAL - Before attempting to turn-on, or operate the transmitter, the operator should first familiarize himself with all controls and indicators on the SBT-1K(B); refer to figure 3-1 and table 3-1 for the location and functions of SBT-1K(B) controls and indicators. When performing the procedures outlined in paragraphs b through i below, special consideration should be given to the following:

(1) PROTECTION OF POWER-AMPLIFIER TUBE - Rapid or inadvertent application and removal of plate voltage to power-amplifier V203

of Amplifier RFD-1A should be avoided. Rapid heat changes may shorten the life of the tube. Systematic starting, tuning, and stopping procedures should be adhered to in that sequence.

(2) WARM-UP TIME FOR CRYSTAL OVENS - Frequency-determining crystals for the SBT-1K(B) are located in ovens in Exciter Unit A-1516 and Variable Frequency Oscillator VOX-5. After tune-up, the transmitted frequency will remain within rated stability only if the crystal oven temperatures have become stabilized. Necessary warm-up time for the A-1516 and VOX-5 crystal ovens is 48 hours. If, after operating the transmitter, it is intended to use it again soon, repetition of the warm-up procedure may be eliminated by leaving the POWER switch of A-1516 and VOX-5, and the MAIN POWER circuit breaker of Auxiliary Power Panel APP-4 at ON (refer to paragraph 3-3i).

(3) MODE OF TRANSMISSION - There are six modes of transmission available. These are:

- (a) CW (keyed carrier)
- (b) SSB (single sideband) with suppressed carrier
- (c) SSB with adjustable carrier
- (d) ISB (independent sideband) with suppressed carrier
- (e) ISB with adjustable carrier
- (f) AM (both sidebands with full carrier)

The operator should inspect the connection points outlined in paragraph 2-3d to establish that the appropriate external equipment is attached to the SBT-1K(B). For the CW mode, a key line connection is required. For AM and Sideband modes, either a microphone connection or audio input (Channels 1 and 2) connection is required. In addition, other connections (ie: receiver squelch, receiver

muting, transmitter/receiver antenna, push-to-talk, etc.) result in auxiliary or optional features that may be had in transmission. These connections should be noted by the operator for their possible effect on tuning procedures as outlined in tables 3-3 through 3-7.

(4) GENERAL NOTES ON TUNING - Variable Frequency Oscillator VOX-5, although capable of generating 2 to 64 megacycles, is used in the SBT-1K(B) only to inject 2 to 4 megacycles into one of the modulation stages of Exciter Unit A-1516. As a result, bandswitching and high-frequency controls on the VOX-5 are not used. When tuning the VOX-5, care must be taken to rotate the MASTER OSCILLATOR FREQUENCY dial in one direction (preferably from a lower reading to a higher reading) in order to prevent any error due to backlash.

CAUTION

Avoid exceeding the 2000 to 4000 KCS range printed on the counters; doing so may cause a misalignment in the mechanical calibrations of the master oscillator. For the same reason, do not spin the MASTER OSCILLATOR FREQUENCY control too rapidly from one end of the range to the other.

Mode of transmission is selected by means of front-panel controls of Exciter Unit A-1516. For all modes of transmission, Exciter Unit A-1516 and Amplifier RFD-1A are tuned for carrier frequency, whether or not the carrier is to be transmitted. The various modes of transmission are accomplished as indicated below:

NOTE

When making sideband and carrier proportional adjustments with the USB GAIN, LSB GAIN, and CARRIER INSERT controls care should be taken not to exceed the 100 per cent marking on the exciter unit meter, when sending one sideband, both sidebands, or sideband and carrier. Considerable distortion from intermodulation may result otherwise.

(a) In SSB mode, Exciter Unit A-1516 and Amplifier RFD-1A are tuned to the carrier frequency. Next an audio signal from Channel 1, Channel 2, or MIKE input is injected into either the upper or lower sideband. Then the carrier is either suppressed or adjusted to some percentage.

(b) In DSB mode, Exciter Unit A-1516 and Amplifier RFD-1A are tuned to the carrier frequency. Next an audio signal from Channel 1, Channel 2, or MIKE input is injected into both upper and lower sidebands. Then the carrier is either suppressed or adjusted to some percentage.

(c) In ISB mode, Exciter Unit A-1516 and Amplifier RFD-1A are tuned to the carrier frequency. Next, two separate audio signals from Channels 1 and 2, or one channel and MIKE input is injected into both upper and lower sidebands. Then the carrier is either suppressed or adjusted to some percentage.

(d) In AM mode, Exciter Unit A-1516 and Amplifier RFD-1A are tuned to the carrier frequency. Next, an audio signal from Channel 1, Channel 2, or MIKE input is injected into both upper and lower sidebands.

(e) In CW mode, Exciter Unit A-1516 and Amplifier RFD-1A are tuned to the carrier frequency (f_0). Manipulation of a keyer enables and disables the first amplifier stage of Amplifier RFD-1A thereby producing CW signals.

b. VOX-5 FREQUENCY SELECTION - When the SBT-1K(B) output carrier frequency has been determined, the following method is used to calculate the 2-4 mc output frequency of Variable Frequency Oscillator VOX-5.

NOTE

The following formulas (included in this manual for convenience) are also used to determine crystal frequencies for the exciter unit (refer to Section 3 of the SBE manual).

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

Where f_o = SBT-1K(B) output carrier frequency
 N = BAND MCS dial (70) setting
(bottom figure under range in which f_o falls)
 f_{vox} = VOX-5 output frequency, ie: setting as appears on counters (38) of VOX-5 (in megacycles)

When f_o falls within 2- to 3.73 mc range:

$$f_{\text{vox}} = f_o + 0.27$$

When f_o falls within 3.73- to 4.27 mc range:

$$f_{\text{vox}} = f_o - 0.27$$

When f_o falls within 4.27- to 32.27 mc range:

$$f_{\text{vox}} = 2N - f_o + 0.270 \text{ mc}$$

The above formulas are calculated to prevent rotating MASTER OSCILLATOR FREQUENCY control (36) beyond the 2000-4000 kc range.

Example: The carrier frequency (f_o) = 10 megacycles. When BAND MCS dial (70) is rotated to the 8.27-10.27 range. 6 appears as bottom figure. VOX-5 output frequency (f_{vox}) is calculated as follows:

$$f_{\text{vox}} = 2N - f_o + 0.27 \text{ mc}$$

$$f_{\text{vox}} = 12 - 10 + 0.27 \text{ mc}$$

$$f_{\text{vox}} = 2.27 \text{ megacycles (2,270 kilocycles)}$$

Example: The carrier frequency (f_o) = 3 megacycles. In the 2- to 3.73 mc range, the formula is:

$$f_{\text{VOX}} = f_o + 0.27$$

$$f_{\text{VOX}} = 3 + 0.27 = 3.27 \text{ megacycles (3,270 kilocycles)}$$

c. STARTING PROCEDURE - Proceed as follows:

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

- (1) Ensure that interlock system is functioning correctly.
- (2) Turn ovens on by setting controls as listed below.

MAIN POWER lamp (30 and 84) and indicator lamp (71) on Power Supply A-1397 should light. INNER OVEN lamp (31), OUTER OVEN lamp (32), and OVEN lamp (56) should light, remain lit for a long period of time and then commence to cycle (on and off). Allow 48 hours for oven warm-up.

<u>MODULAR UNIT</u>	<u>CONTROL</u>	<u>POSITION</u>
Variable Frequency Oscillator VOX-5	POWER (46)	ON
Exciter Unit A-1516	POWER/ON/OFF (53)	ON
Auxiliary Power Panel APP-4	MAIN POWER (83)	ON

(3) After 48-hour warm-up period, set controls as listed below; then proceed with preliminary power-on check outlined in table 3-2.

<u>MODULAR UNIT</u>	<u>CONTROL</u>	<u>POSITION</u>
Exciter Unit A-1516	MF XTAL SW (47)	VMO
	LSB/OFF CH 1/ CH 2/MIKE (48)	OFF
	EXCITER/ON/ STANDBY (52)	ON
	USB/OFF/CH 1/ CH 2/MIKE (61)	OFF
	CARRIER INSERT (68)	0
	OUTPUT (59)	0
	LV Power Supply PS-4A	PA OVERLOAD PLATE (82)
PA OVERLOAD SCRN GRID (81)		ON
PA OVERLOAD CONT GRID (80)		ON
FINAL VOLTAGES ON/OFF (78)		OFF
TRANSMITTER VOLTAGES ON/ STAND BY (77)		STAND BY
MAIN POWER (75)		ON

TABLE 3-2. PRELIMINARY POWER-ON CHECK

STEP	OPERATION	PURPOSE
1	Check PA FIL PRI meter (72) for reading within red mark on dial. If necessary, change setting of PA FIL PRI ADJUST switch (73) to bring reading within red mark.	Compensates for variations in line voltage to produce a regulated voltage for driving PAL-1K(A) filament transformer.
2	Set ALDC control (20) at extreme counterclockwise position.	Sets level of ALDC (Automatic Load and Drive Control) at maximum voltage position.

TABLE 3-2. PRELIMINARY POWER-ON CHECK (Cont)

STEP	OPERATION	PURPOSE
3	Set MULTIMETER switch (13) at DC PA BIAS VX10 and observe MULTIMETER (14). Indication should be approximately 100 on red scale.	Checks bias supply to power-amplifier tube in Amplifier RFD-1A. Nominal value is -100 vdc.
4	Set TRANSMITTER VOLTAGES switch (77) at ON. TRANSMITTER VOLTAGES lamp (76) should light, if about 3 minutes have elapsed since MAIN POWER circuit breaker (75) was set at ON.	Furnishes Amplifier RFD-1A with low plate voltages.
5	Set FINAL VOLTAGES switch (78) at ON. FINAL VOLTAGES lamp (79) should light.	Furnishes power-amplifier tube in Amplifier RFD-1A with high plate and screen voltages.
6	Set MULTIMETER switch (13) at DC SCREEN VX10 and observe MULTIMETER (14). Indication should be 500 on green scale.	Checks Power-amplifier screen grid d-c supply. Nominal value is +500 vdc.
7	Set MULTIMETER switch (13) to DC PA PLATE VX100 and observe MULTIMETER (14). Indication should be about 3000 on black scale.	Checks Power-amplifier d-c plate supply. Nominal value is +3000 vdc.
8	Observe PA PLATE CURRENT meter (15). Indication should be approximately 220 milliamperes.	Checks idling value of power-amplifier plate current (with no signal). Nominal value is 220 milliamperes.
9	Set FINAL VOLTAGES switch (78) at OFF. FINAL VOLTAGES lamp (79) should go out.	Shuts off high plate and screen voltages to power-amplifier tube in preparation for first tuning phase.

d. TRANSMITTING CW SIGNALS - CW signals are transmitted by means of a keyer connected to terminal block E502 as described in paragraph 2-3d. With EXCITER switch of Exciter Unit A-1516 set at ON, the transmitter sends carrier when keyer is held down; with the EXCITER switch set at STANDBY, keyer is inoperative. Start the SBT-1K(B) as described in paragraph 3-3c. Install jumper wire across terminals 21 and 22 of terminal block E502 at rear of Auxiliary Power Panel APP-4; then proceed as outlined in table 3-3.

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

TABLE 3-3. TUNING PROCEDURE FOR CW MODE OF OPERATION

STEP	OPERATION	PURPOSE
A. TUNING EXCITER UNIT A-1516 AND VARIABLE FREQUENCY OSCILLATOR VOX-5		
1	Set MF XTAL SW switch (47) at VMO	Connects output of Variable Oscillator VOX-5 to VMO input of Exciter Unit A-1516.
2	Ensure that LSB/OFF/CH 1/ CH 2/ MIKE and USB/OFF/CH 1/CH 2/MIKE switches (48 and 61) are set at OFF. Turn LSB GAIN and USB GAIN controls (49 and 63) fully clockwise.	Disconnects audio input at Exciter Unit A-1516.

TABLE 3-3. TUNING PROCEDURE FOR CW MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
3	Set OUTPUT knob (59) at 5.	Sets output level of Exciter Unit A-1516 at mid-position.
4	Turn VOX GAIN knob (67) and SQUELCH GAIN knob (64) to extreme counterclockwise position.	Disables voice-operating (VOX) circuit control and receiver squelch control of Exciter Unit A-1516 output stage.
5	Ensure that EXCITER switch (52) is set at ON.	Enables output stage of Exciter Unit A-1516.
6	Establish carrier frequency (f_o) to be transmitted. Set BAND-MCS knob (69) to bring appropriate range reading for f_o on BAND MCS dial (70). Note bottom figure (N). Calculate VOX-5 output frequency (f_{vox}) as outlined in paragraph 3-3a(4).	Establishes f_o and f_{vox} figures. Selects proper insertion signal for high-frequency modulation stage in Exciter Unit A-1516.
7	Set CARRIER INSERT knob (68) at 10.	Applies 17-kc to first modulation stage in Exciter Unit A-1516.
8	Set MF TUNING knob (62) to bring f_{vox} on lower movable dial of main tuning dial (50).	Coarse-tunes mid-frequency stage of Exciter Unit A-1516.
9	Set OUTPUT TUNING center knob (66) to appropriate range reading for f_o .	Course tunes final output stage of Exciter Unit A-1516.
10	Set BEAT switch (26) at ON; ZERO BEAT lamp (33) should light.	Energizes 100-kc oscillator in Variable Frequency Oscillator VOX-5. Oscillator is used to calibrate VOX-5 output.

TABLE 3-3. TUNING PROCEDURE FOR CW MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
11	<p>Turn MASTER OSCILLATOR FREQUENCY knob (36) to bring MASTER OSCILLATOR FREQUENCY KCS and CPS dials (38) up to nearest 50kc increment below f_{vox}. Then adjust CALIBRATE knob (35) to point that causes ZERO BEAT lamp to zero beat. Tighten lock disc (outer ring of CALIBRATE control) to prevent inadvertent changing of frequency setting.</p> <p style="text-align: center;"><u>NOTE</u></p> <p>If preferred, headphones connected to PHONES jack (28) may be used to detect zero beat.</p>	<p>Calibrate VOX-5 frequency to 50-kc increment below f_{vox}.</p>
12	<p>Turn MASTER OSCILLATOR FREQUENCY knob to bring MASTER FREQUENCY OSCILLATOR KCS and CPS dial to f_{vox}. Tighten LOCK control (37) to prevent inadvertent changing of frequency setting.</p>	<p>Completes adjustment of VOX-5 output frequency f_{vox}.</p>
13	<p>Set BEAT switch (36) at off (down) position. ZERO BEAT lamp (33) should go out.</p>	<p>Turns off 100-kc oscillator in VOX-5.</p>
14	<p>Set METER SW knob (57) at MF.</p>	<p>Connects meter (54) to sample output level of mid-frequency stage of Exciter Unit A-1516.</p>

TABLE 3-3. TUNING PROCEDURE FOR CW MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
15	Adjust OUTPUT TUNING disc (65) to bring a reading which is slightly lower than f_o on upper section of dial (50). Then adjust MF TUNING knob (62) to obtain maximum indication on meter (54). If necessary, decrease setting of CARRIER INSERT knob (68) to avoid off-scale meter reading. Tighten outer lock disc of MF TUNING control; reading on lower section of dial (50) should now correspond with reading on MASTER OSCILLATOR FREQUENCY KCS and CPS dials (38).	Fine tunes mid-frequency range of Exciter Unit A-1516.
16	Set METER SW knob (57) at RF.	Connects meter (54) to sample output level of high-frequency stage of Exciter Unit A-1516.
17	Using OUTPUT TUNING control (65), increase frequency reading on upper section of dial (50) to first peak reading on meter (54).	Fine-tunes final stage of Exciter Unit A-1516.
18	Set OUTPUT knob (59) at 1. Tighten outer lock disc of OUTPUT control	Sets exciter unit output level to safe point to avoid over-driving PAL-1K(A) in subsequent tuning.
B. TUNING RF AMPLIFIER RFD-1A		
19	Set ALDC INT/EXT switch located at rear of RFD-1A at EXT. Ensure that ALDC control (20) is set at extreme counterclockwise position	Extends ALDC (automatic load and drive control) from PAL-1K(A) to Exciter Unit A-1516. Sets level of ALDC in PAL-1K(A) at maximum voltage position.

TABLE 3-3. TUNING PROCEDURE FOR CW MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
20	Set DRIVER BAND knob (23) to appropriate range for f_o .	Coarse-tunes first amplifier and driver stages of RF Amplifier RFD-1A.
21	Set PA BAND knob (17) to appropriate range for f_o .	Coarse-tunes power amplifier output stage of RF Amplifier RFD-1A.
22	Set MULTIMETER switch (13) at RF 1ST AMPL PLATE VX1. Increase setting of OUTPUT control (59) to obtain indication of 10 on black scale of MULTIMETER (14). Adjust 1ST AMPL TUNING control (24) for peak on MULTIMETER.	Fine-tunes first amplifier and driver stages of RF Amplifier RFD-1A.
23	Set MULTIMETER switch (13) at RF PA GRID VX10. Adjust OUTPUT control (59) to obtain indication of 7 on red scale of MULTIMETER (14). Adjust PA GRID TUNING control for peak on MULTIMETER.	Fine-tunes input to power-amplifier stage of RF Amplifier RFD-1A.
24	Set OUTPUT control (59) at 0.	Turns down Exciter Unit input to RF Amplifier RFD-1A in preparation for final output tuning and loading adjustments.
25	Adjust PA TUNING control (21) to bring reading on PA TUNING dial (22) as shown in tuning chart supplied with SBT-1K(B).	Coarse-tunes power-amplifier output and antenna.
26	Set PA LOADING control (19) at position shown in tuning chart supplied with SBT-1K(B)	Coarse-adjustment for antenna impedance match.

TABLE 3-3. TUNING PROCEDURE FOR CW MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
27	Adjust PA LOADING control to bring reading on PA LOADING dial (18) as shown in tuning chart supplied with SBT-1K(B)	Further adjustment for antenna impedance match.
28	Set FINAL VOLTAGES switch (78) at ON. FINAL VOLTAGES lamp (79) will light.	Furnishes RF Amplifier RFD-1A with high plate and screen voltages.
29	Set MULTIMETER switch (13) at RF OUT VX10.	Connects MULTIMETER (14) to indicate r-f output voltage from Amplifier RFD-1A for monitoring during final tuning.
30	Slowly increase setting of OUTPUT control (59) until PA PLATE CURRENT meter (15) indicates approximately 300 ma. Note indication on MULTIMETER (14).	Increases output of Exciter Unit A-1516 to suitable level for the beginning of final tuning.
31	Adjust PA TUNING control (22) until pronounced dip is produced on PA PLATE CURRENT meter (15).	First step in fine-tuning power-amplifier output circuit and antenna.
32	Adjust PA LOADING control (19) until indication on PA PLATE CURRENT meter begins to rise.	First fine adjustment for matching RF Amplifier RFD-1A output circuit with antenna load.
33	Readjust OUTPUT knob (59) until indication on PA PLATE CURRENT meter is 300 ma. Reading on MULTIMETER (14) should rise slightly from that noted in step 30.	Adjusts exciter unit input into RF Amplifier RFD-1A as finer tuning progresses in order to prevent overloading of power amplifier tube.

TABLE 3-3. TUNING PROCEDURE FOR CW MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
34	Repeat steps 31 through 33 until MULTIMETER indication in step 33 begins to fall. Readjust PA TUNING, PA LOADING, and OUTPUT controls to position immediately preceding position where MULTIMETER indication began to fall; this is point of ultimate tuning. * ***	Fine-tunes power-amplifier output circuit to match antenna in steps to prevent overloading of power-amplifier tube.
35	Set POWER switch (11) at X10 or X1, whichever is more appropriate range.	Connects SBT-1K(B) output to vswr meter.
36	Slowly adjust OUTPUT control (59) to obtain minimum vswr indication on meter (2) and desired power output. * ** ***	To obtain low vswr and desired power output.
37	Turn ALDC control (20) slowly clockwise until indication on MULTIMETER (13) begins to drop off.	Establishes proper bias for V113 in Exciter Unit A-1516 AGC action of ALDC network limits high drive peaks or load changes.
38	Remove jumper across terminals 21 and 22 on E502 terminal block. Replace with keying device.	
<p style="text-align: center;">* <u>NOTE</u></p> <p>In final adjustments, an occasional check should be made of power amplifier screen-grid current, by setting MULTIMETER switch (13) at PA DC SCREEN MA X 1 and observing black scale of MULTIMETER (14). With a resistive load, screen-grid current indication is usually under 15 ma; at no time should it exceed full-scale indication.</p>		

TABLE 3-3. TUNING PROCEDURE FOR CW MODE OF OPERATION (Cont)

**** NOTE**

Output power is increased as indication on MULTIMETER (MULTIMETER switch set at RF PA OUT VX10) is increased. PA PLATE CURRENT meter indication will also increase; it will indicate approximately 400 to 450 milliamperes when 1 kilowatt of output power is reached. However, actual output power at the antenna depends upon impedance matching between SBT-1K(B) and the antenna and is read at the indicator on the FORWARD-WATTS scale. To adjust the SBT-1K(B) to operate at its highest efficiency, controls should be adjusted to bring the vswr figure down as low as possible while maintaining the desired output power as indicated on the FORWARD-WATTS scale. This will also prevent overdriving the PAL-1K(A) and consequent damage to equipment due to overheating.

***** CAUTION**

If the SBT-1K(B) turns off automatically as a result of a power-amplifier overload (indicated by circuit breakers and TRANSMITTER VOLTAGES and FINAL VOLTAGES lamps on LV Power Supply PS-4A, reduce the OUTPUT knob (59) setting before re-setting associated circuit breakers.

e. TRANSMITTING SINGLE-SIDEBAND SIGNALS - Transmission of lower and upper-sideband signals is similar. This procedure assumes that the lower-sideband is transmitted, with a modulating signal applied at Channel 1 input terminals of E501 of Auxiliary Power Panel APP-4. To operate with a modulating signal from Channel 2 or from a microphone, use CH2 or MIKE settings, respectively, of the LSB/OFF/CH 1/CH/2MIKE switch instead of the CH 1 setting specified in this procedure. To transmit upper-sideband signals, use the USB/OFF/CH 1/CH 2/MIKE and USB GAIN controls instead of the corresponding LSB controls. Start the SBT-1K(B) as described in paragraph 3-3c, and proceed as outlined in table 3-4.

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

TABLE 3-4. TUNING PROCEDURE FOR SINGLE-SIDEBAND MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
1	Perform steps 1 through 18 in table 3-3	Tunes Exciter Unit A-1516 and Variable Frequency Oscillator VOX-5 for carrier frequency (f_0).
2	Set USB/OFF/CH 1/CH 2/MIKE switch (61) at OFF.	Disconnects CH 1 audio from upper sideband circuitry in Exciter Unit A-1516
3	Set LSB OFF/CH 1/CH 2/MIKE switch (48) at CH 1 and rotate LSB GAIN knob (49) to approximate mid-position.	Connects CH 1 audio input to lower-sideband circuitry in Exciter Unit A-1516. Adjusts lower-sideband level for meter reading.
4	Set CARRIER INSERT knob (68) at 0.	Turns down carrier level for subsequent adjustments.
5	Set METER SW knob (57) at LSB. Adjust LSB GAIN knob (49) until meter (54) indicates a maximum of 100 on audio peaks.	Connects meter (54) to sample level of lower-sideband signal. Adjusts lower-sideband signal level to indicate 100 on meter (54).
6	Set METER SW knob (57) at RF. Simultaneously, adjust OUTPUT knob (59) and CARRIER INSERT knob (68) for desired degree of carrier insertion. *	
7	Perform steps 19 through 36 in table 3-3. Indication on PA PLATE CURRENT meter should be approximately 220 ma in steps 30 and 33.	Tunes RF Amplifier RFD-1A to signal from Exciter Unit A-1516.

TABLE 3-4. TUNING PROCEDURE FOR SINGLE-SIDEBAND MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
8	<p>If transmitting voice, turn ALDC control (20) of RF Amplifier RFD-1A as far clockwise as possible without introducing obvious distortion. It is suggested that this adjustment be made with a remote station monitoring the quality of transmission. If transmitting other than voice, turn ALDC control slowly clockwise until indication on MULTIMETER (14) begins to drop off; MULTIMETER switch (13) should be set at PA E_{out} X10 for this reading.</p>	<p>Establishes proper bias for V113 in Exciter Unit A-1516. AGC action of ALDC network limits high drive peaks or load changes</p>
9	<p>If VOX control is to be used, set EXCITER switch (52) at STAND BY. Then, while speaking into microphone and observing EXCITER lamp (55), adjust VOX GAIN control (67) so that reasonable strong speech lights the EXCITER lamp.</p>	<p>Sets up voice-actuated (VOX) control of transmitter.</p>
10	<p>If VOX control is employed and the receiver squelch feature (refer to paragraph 2-3d) is to be used, adjust SQUELCH GAIN control (64) so that extraneous noises reaching the microphone from the receiver do not light EXCITER lamp (55).</p>	<p>Sets up receiver squelch feature to be used with VOX control.</p>

TABLE 3-4. TUNING PROCEDURE FOR SINGLE-SIDEBAND MODE OF OPERATION (Cont)

* NOTE

For suppressed carrier operation, leave CARRIER INSERT control at 0. For any degree of carrier insertion, reduce the level of the audio peaks on the meter, using OUTPUT control (59), by an amount equal to the carrier insertion desired; then return the level to 100 with the CARRIER INSERT control (68). Tighten lock disc of CARRIER INSERT control to prevent inadvertent changing of setting. Example: For 10-percent carrier injection (carrier down 20 db from full power), set OUTPUT control (59) so that meter (54) indicates 90 on audio peaks with the CARRIER INSERT control clockwise until indication on meter (54) rises from 90 to 100 on audio peaks.

f. TRANSMITTING DOUBLE-SIDEBAND SIGNALS - This procedure assumes the audio modulating signal is connected to Channel 1 input terminals E501 on Auxiliary Power Panel APP-4. If operation from Channel 2 or MIKE jack (60) is desired, use the corresponding CH 2 or MIKE settings of the LSB/OFF/CH 1/CH 2/MIKE and USB/OFF/CH 1/CH 2/MIKE switches (48 and 61) rather than the CH 1 settings. Start the SBT-1K(B) as described in paragraph 3-3c and proceed as outlined in table 3-5.

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

TABLE 3-5. TUNING PROCEDURE FOR DOUBLE-SIDEBAND MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
1	Perform steps 1 through 10 in table 3-3.	Tunes Exciter Unit A-1516 and Variable Frequency Oscillator VOX-5 for carrier frequency (fo).
2	Set LSB OFF/CH 1/CH 2/MIKE switch (48) at CH 1. Rotate LSB GAIN control (49) 1/4 turn to right from maximum counterclockwise position	Connects CH 1 audio input to lower-sideband circuitry in Exciter Unit A-1516. Adjusts lower-sideband level for meter reading.
3	Set USB OFF/CH 1/CH 2/MIKE switch (61) at OFF and CARRIER INSERT knob (68) at 0.	Disconnects CH 1 audio from upper sideband circuitry and turns down carrier level in preparation for lower sideband meter reading.
4	Set METER SW knob (57) at LSB.	Connects meter (54) to read level of lower-sideband signals only.
5	Observe meter (54) and adjust LSB GAIN control (49) for degree of carrier insertion required. For suppressed carrier, adjust control for meter indication of 50 on audio peaks. For 10 per cent carrier insertion, adjust control for meter indication of 45 on audio peaks. For 20 per cent carrier insertion, adjust control for meter indication of 40. For other values, decrease meter indication by 5 for each 10 per cent increase in carrier insertion.	Adjusts lower-sideband to appropriate level for desired degree of carrier transmission.

TABLE 3-5. TUNING PROCEDURE FOR DOUBLE-SIDEBAND MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
6	Set LSB/OFF/CH 1/CH 2/MIKE switch (47) at OFF and USB/OFF/CH 1/CH 2/MIKE switch (61) at CH 1. Advance USB GAIN control (63) 1/4 turn to right from maximum counterclockwise position.	Disconnects CH 1 audio input from lower-sideband circuitry and connects it to upper-sideband circuitry. Adjusts upper-sideband level for meter reading.
7	Set METER SW knob (57) at USB.	Connects meter (54) to read level of upper-sideband only.
8	Adjust USB GAIN control (63) for degree of carrier insertion required, in the same manner as in step 5.	Adjusts upper-sideband to appropriate level for desired degree of carrier transmission.
9	Set METER SW control (57) at RF.	Connects meter (54) to final output of Exciter Unit A-1516 to read upper-sideband level.
10	Advance OUTPUT knob (59) from 0 position to point that causes indication on meter (54) be the same as established in step 8.	Adjusts final output level of Exciter Unit A-1516 to obtain representative indication of upper-sideband on meter.
11	Set USB/OFF/CH 1/CH 2/MIKE at OFF and LSB/OFF/CH 1/CH 2/MIKE switch (48) at CH 1.	Disconnects meter (54) from upper sideband circuitry and connects it to lower sideband circuitry.

TABLE 3-5. TUNING PROCEDURE FOR DOUBLE-SIDEBAND MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
12	Adjust LSB GAIN control (49) to point that causes meter (53) indication to be same as established for upper sideband in step 10.	Adjusts lower sideband level to match upper sideband level.
13	Set USB/OFF/CH 1/CH 2/MIKE switch (61) at CH 1. If sideband levels were previously set for suppressed carrier operation, meter (54) should now read 100 on audio peaks. If set for 10 per cent carrier insertion, meter should read 90 on audio peaks etc.	Enables meter (54) to indicate proper level of sum of both sidebands.
14	For suppressed carrier operation, leave CARRIER INSERT knob (68) at 0. For any degree of carrier insertion, advance CARRIER INSERT knob to bring indication on meter (54) to 100. Tighten lock disc on CARRIER INSERT knob to prevent inadvertent changing of setting.	Adjusts carrier to proper level.
15	Perform steps 19 and 36 in table 3-3. Indication on PA PLATE CURRENT meter should be approximately 220 ma in steps 30 and 33.	Tunes RF Amplifier RFD-1A to signal from Exciter Unit A-1516.
16	Perform steps 8, 9 and 10 in table 3-4 as required.	Adjusts ALDC, VOX GAIN and SQUELCH GAIN as required.

g. TRANSMITTING INDEPENDENT-SIDEBAND SIGNALS - This procedure assumes that Channel 1 audio modulating signal is injected into the lower sideband, and the Channel 2 modulating signal is injected into the upper sideband. To switch the channel inputs, or to use the

microphone input as one of the modulating signals, use the corresponding CH 1, CH 2, or MIKE settings of the LSB/OFF/CH 1/CH 2/MIKE and USB/OFF/CH 1/CH 2/MIKE switches. Start the SBT-1K(B) as described in paragraph 3-3c, and proceed as outlined in table 3-6.

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1.

TABLE 3-6. TUNING PROCEDURE FOR INDEPENDENT-SIDEBAND MODE OF OPERATION

STEP	OPERATION	PURPOSE
1	Perform steps 1 through 18 in table 3-3.	Tunes Exciter Unit A-1516 and Variable Frequency Oscillator VOX-5 for carrier frequency (f_0).
2	Set LSB/OFF/CH 1/CH 2/MIKE switch (48) at CH 1. Advance LSB GAIN control (49) 1/4 turn to right from maximum counter-clockwise position.	Connects CH 1 audio input to lower sideband circuitry in SBE-2. Adjusts lower-sideband level for meter reading.
3	Set USB/OFF/CH 1/CH 2/MIKE switch (61) at OFF and CARRIER INSERT knob (68) at 0.	Disconnects CH 2 audio input from upper sideband and turns down carrier level in preparation for lower sideband meter reading.
4	Set METER SW knob (57) at LSB.	Connects meter (54) to read level of lower sideband only.

TABLE 3-6. TUNING PROCEDURE FOR INDEPENDENT-SIDEBAND MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
5	Observe meter (54) and adjust LSB GAIN control (49) for degree of carrier insertion required. For suppressed carrier adjust control for meter indication of 50 on audio peaks. For 10 per cent carrier insertion, adjust control for meter indication of 45 on audio peaks. For 20 per cent carrier insertion, adjust control for meter indication of 40. For other value, decrease meter indication by 5 for each 10 per cent increase in carrier insertion.	Adjusts lower sideband to appropriate level for desired degree of carrier transmission.
6	Set LSB/OFF/CH 1/CH 2/MIKE switch (48) at OFF and USB/CH 1/CH 2/MIKE switch (61) at CH 2. Advance USB GAIN control (63) 1/4 turn to right from maximum counter-clockwise position.	Disconnects CH 1 audio input from lower sideband circuitry and connects CH 2 to upper sideband circuitry. Adjusts upper sideband level for meter reading.
7	Set METER SW knob (57) at USB.	Connects meter (54) to read level of upper sideband only.
8	Adjust USB GAIN knob (63) for degree of carrier insertion required, in the same manner as for lower sideband in step 5.	Adjusts upper sideband appropriate level for desired degree of carrier transmission.
9	Set METER SW knob (57) at RF.	Connects meter (54) to final output of Exciter Unit A-1516 to read upper-sideband level.

TABLE 3-6. TUNING PROCEDURE FOR INDEPENDENT-SIDEBAND MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
10	Advance OUTPUT knob (59) from 0 position to point which causes meter (54) indication to be the same as noted in step 8.	Adjusts final output level of Exciter Unit A-1516 to obtain representative indication of upper-sideband on meter.
11	Set USB/OFF/CH 1/CH 2/MIKE switch (61) at OFF and LSB/OFF/CH 1/CH 2/MIKE switch (48) at CH 1.	Disconnects meter (54) from upper sideband circuitry and connects it to lower sideband circuitry.
12	Adjust LSB GAIN knob (48) to point that causes meter (54) indication to be the same as noted in step 5.	Adjusts lower-sideband level to match upper-sideband level.
13	Set USB/OFF/CH 1/CH 2/MIKE switch (61) at CH 2. Of sideband levels were previously set for suppressed carrier operation, meter (54) should now read 100 on audio peaks. If set for 10 per cent carrier insertion, the meter should read 90 on audio peaks, etc.	Causes meter (54) to indicate sum of upper-and-lower sidebands. Provides check for proper level of sum of both sidebands.
14	For suppressed carrier operation, leave CARRIER INSERT knob (68) at 0. For any degree of carrier insertion, advance CARRIER INSERT knob to bring indication on meter (54) to 100. Tighten lock disc of CARRIER INSERT knob to prevent inadvertent changing of setting.	Adjusts carrier to proper level.
15	Perform steps 19 through 36 in table 3-3. Indication on PA PLATE CURRENT meter should be approximately 220 ma in steps 30 and 33.	Tunes RF Amplifier RFD-1A to signal from Exciter Unit A-1516.

TABLE 3-6. TUNING PROCEDURE FOR INDEPENDENT-SIDEBAND MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
16	Perform step 8 in table 3-4.	Establishes proper bias for V113 in Exciter Unit A-1516. AGC action of ALDC network limits high drive peaks or load changes.

h. TRANSMITTING AM SIGNALS - This procedure assumes that the audio modulating signal is connected to Channel 1 input terminals of E501 on Auxiliary Power Panel APP-4. If operation from Channel 2 or the MIKE jack (60) is desired, use the corresponding CH 2 or MIKE settings of the LSB/OFF/CH 1/CH 2/MIKE and USB/OFF/CH 1/CH 2/MIKE switches (48 and 61) rather than the CH 1 settings. Start the SBT-1K(B) as described in paragraph 3-3_c, and proceed as outlined in table 3-7.

TABLE 3-7. TUNING PROCEDURE FOR AM MODE OF OPERATION

STEP	OPERATION	PURPOSE
1	Perform steps 1 through 18 in table 3-3.	Tunes Exciter Unit A-1516 and Variable Frequency Oscillator VOX-5 for carrier frequency (f_0).
2	Set LSB/OFF/CH 1/CH 2/MIKE switch (48) at CH 1. Advance LSB GAIN control (49) 1/4 turn to right from maximum counter-clockwise position.	Connects CH 1 audio input to lower-sideband circuitry of Exciter Unit A-1516. Adjusts lower-sideband level for meter indication.

TABLE 3-7. TUNING PROCEDURE FOR AM MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
3	Set USB/OFF/CH 1/CH 2/MIKE switch (61) at OFF and CARRIER INSERT knob (68) at 0.	Disconnects CH 1 audio input from upper sideband and turns down carrier level in preparation for lower-sideband indication.
4	Set METER SW knob (57) at LSB.	Connects meter (54) to read level of lower-sideband only.
5	Adjust LSB GAIN control (49) for reading of 25 on meter (54) on audio peaks.	Adjusts lower sideband to proper level for AM transmission.
6	Set LSB/OFF/CH 1/CH 2/ MIKE switch (47) at OFF and USB/OFF/CH 1/CH 2/MIKE switch (61) at CH 1. Advance USB GAIN control (63) 1/4 turn to right from maximum counterclockwise position.	Disconnects CH 1 audio input from lower-sideband circuitry and connects it to upper-sideband circuitry. Adjusts upper-sideband level for meter indication.
7	Set METER SW knob (57) at USB.	Connects meter (54) to read level of upper sideband only.
8	Adjust USB GAIN control (63) for reading of 25 on meter (54) on audio peaks.	Adjusts upper sideband to proper level for AM transmission.
9	Set METER SW knob (57) at RF.	Connects meter (54) to final output of Exciter Unit A-1516 to read upper-sideband level.

TABLE 3-7. TUNING PROCEDURE FOR AM MODE OF OPERATION (Cont)

STEP	OPERATION	PURPOSE
10	Advance OUTPUT knob (59) from 0 position to point which brings meter (54) readings up to 25 on audio peaks.	Adjusts final output level of Exciter Unit A-1516 to obtain representative indication of upper-sideband on meter.
11	Set USB/OFF/CH 1/CH 2/MIKE switch (40) at OFF and LSB/OFF/CH 1/CH 2/MIKE (48) at CH 1.	Disconnects meter (54) from upper sideband and connects it to lower sideband.
12	Note meter (54) reading. If necessary, adjust LSB GAIN knob (49) to bring reading to 25 on audio peaks.	Adjusts lower sideband level to match upper sideband level.
13	Set USB/OFF/CH 1/CH 2/MIKE switch (61) at CH 1 and observe meter (54) reading. Reading should now be 50 on audio peaks.	Adds USB to LSB at meter (54) reading. Provide check for proper level of sum of both sidebands.
14	Advance CARRIER INSERT knob (68) to bring meter (54) reading to 100 on audio peaks. Tighten lock disc on CARRIER INSERT knob to prevent inadvertent changing of setting.	Adjusts carrier to proper level for AM transmission. Carrier level is now 50 per cent and sidebands are 25 per cent each.
15	Perform steps 19 through 36 in table 3-3. Indication on PA PLATE CURRENT meter should be approximately 220 ma in steps 30 and 33.	Tunes RF Amplifier RFD-1A to signal from Exciter Unit A-1516.
16	Perform step 8 of table 3-4.	Establishes proper bias for V113 in Exciter Unit A-1516 AGC action of ALDC network limits high drive peaks or load changes.

i. STOPPING PROCEDURE

(1) GENERAL - The SBT-1K(B) may be placed in standby or completely turned off. Standby is recommended when it is intended to transmit again in the near future; this eliminates repeating the 48-hour crystal oven warm-up procedure (step 2 of paragraph 3-3c).

(2) STANDBY - To place the transmitter in standby, set controls in positions indicated in table 3-8.

TABLE 3-8. PROCEDURE FOR PLACING SBT-1K(B) in STANDBY

STEP	OPERATION	PURPOSE
1	Set FINAL VOLTAGES switch (78) at OFF. FINAL VOLTAGES lamp (79) will go off.	Cuts off screen grid and high plate voltages to power-amplifier tube in RF Amplifier RFD-1A.
2	Set TRANSMITTER VOLTAGES switch (77) at STAND BY. TRANSMITTER VOLTAGES lamp (75) will go off. <u>CAUTION</u> Wait at least 5 minutes before proceeding to step 3. This delay will gradually cool the power amplifier tube in Amplifier RFD-1A and prolong its life.	Cuts off mid-voltage plate supply in RF Amplifier RFD-1A.
3	Set MAIN POWER circuit breaker (75) at OFF. MAIN POWER lamp (74) will go off.	Cuts off line voltage supply to PAL-1K(A).

TABLE 3-8. PROCEDURE FOR PLACING SBT-1K(B) IN STANDBY (Cont)

STEP	OPERATION	PURPOSE
4	Leave POWER/ON switch (46) at ON; MAIN POWER lamp (30) will remain lit, and INNER and OUTER OVEN lamps (31 and 32) will continue to cycle.	Power remains connected to VMO crystal oven heating circuit in VOX-5 to keep temperature stable. VOX-5 plate and filament supply also remains connected.
5	Leave POWER/ON/OFF switch (53) in ON position. Dial light for dial (50) and lamp (71) will remain lit. OVEN lamp (56) will continue to cycle.	Power remains connected to crystal-oven heating circuit of Exciter Unit A-151C to keep temperature stable. Exciter unit plate and filament supply also remains connected.
6	Leave MAIN POWER circuit breaker (83) in ON position. MAIN POWER lamp (84) will remain lighted.	Line voltage remains connected to Variable Frequency Oscillator VOX-5 and Exciter Unit A-1516.

(3) NORMAL STOPPING - To completely turn off the SBT-1K(B) proceed as outlined in steps 1, 2, and 3 of table 3-8, set POWER/ON switch (46), POWER/ON/OFF switch (53), and MAIN POWER circuit breaker (83) at OFF.

(4) EMERGENCY STOPPING - To turn off the SBT-1K(B) in an emergency, set MAIN POWER circuit breaker (83) at OFF.

3-4. OPERATOR'S MAINTENANCE

a. GENERAL - The operator should observe that modular-unit controls, indicator lamps, and meters are in good condition and functioning properly (see figure 3-1 and table 3-1). Daily during operation, all electrical quantities measurable with built-in meters should be observed and compared with established standards for irregularity. Any noticeable irregularity is an indication of trouble.

b. REPLACEMENT OF FUSES - With the exception of the fuses for Variable Frequency Oscillator VOX-5, all fuses for the SBT-1K(B) are located on the front panel of Power Supply A-1397, LV Power Supply PS-4A, and Auxiliary Power Panel APP-4. Fuses for the VOX-5 are located on the rear chassis apron of the unit. The operator should replace fuses as required.

CAUTION

Do not replace a fuse with one of higher rating. If a fuse burns out immediately after replacement, do not replace it a second time until the trouble has been located and corrected.

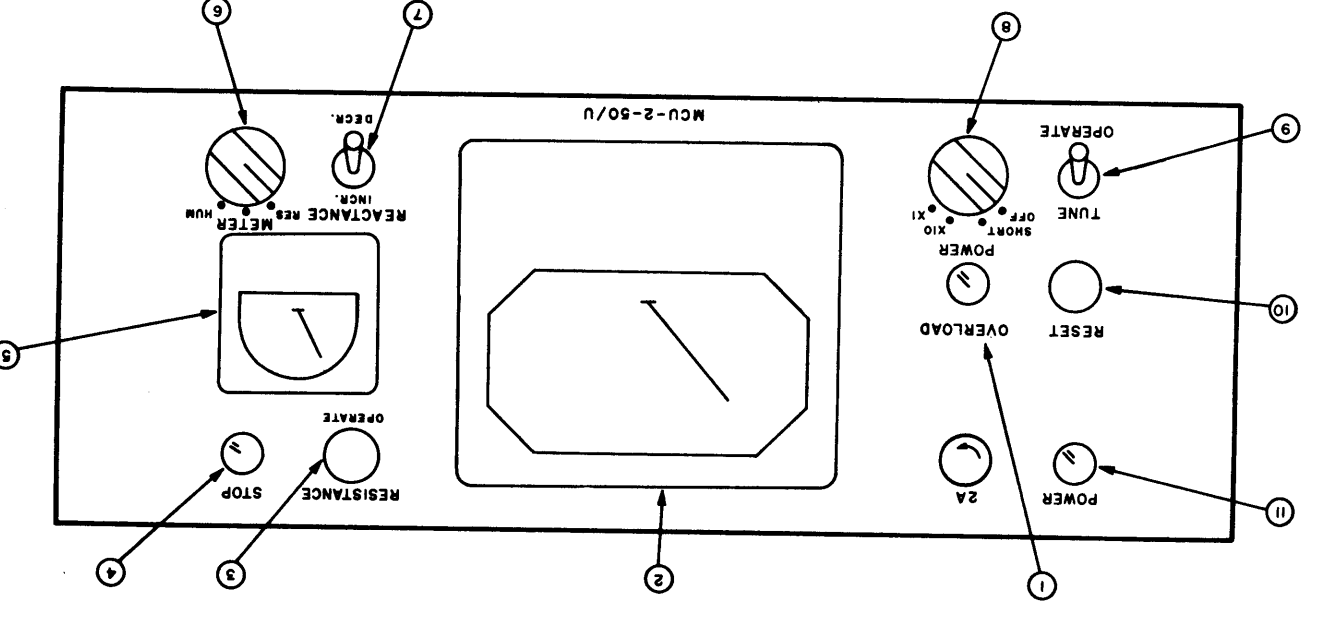
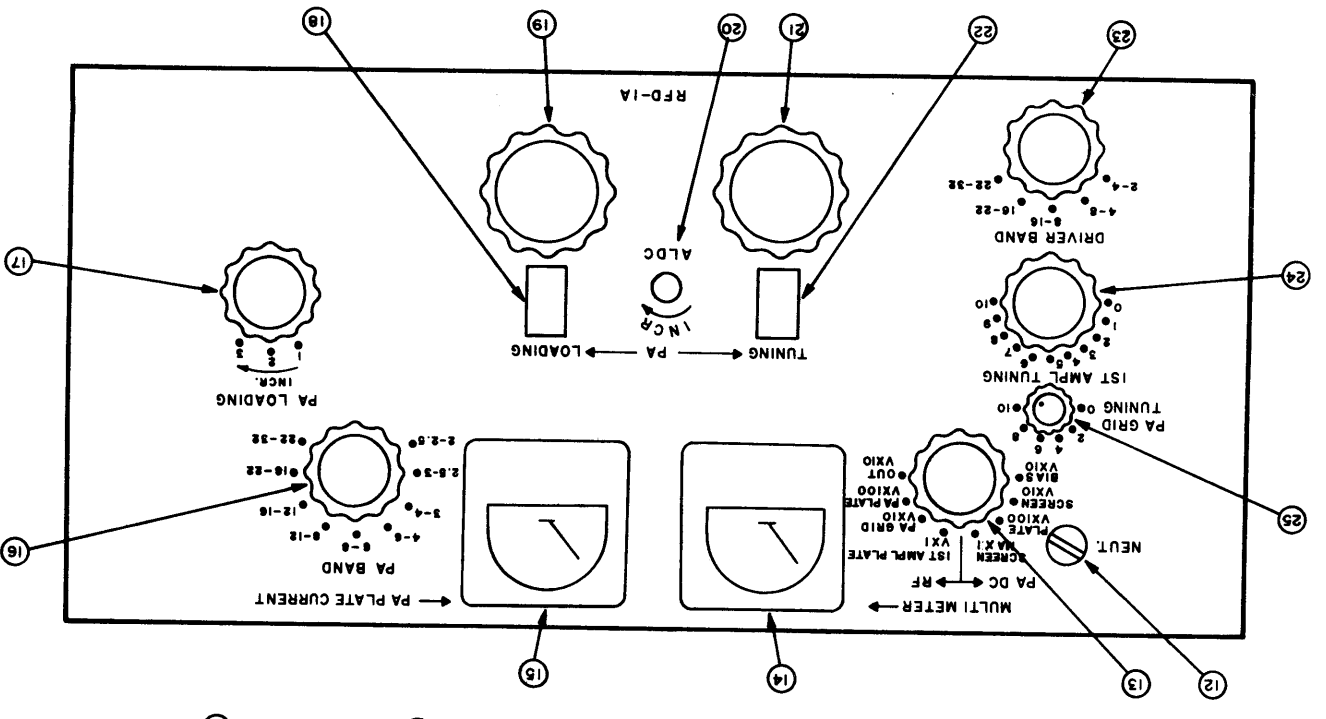
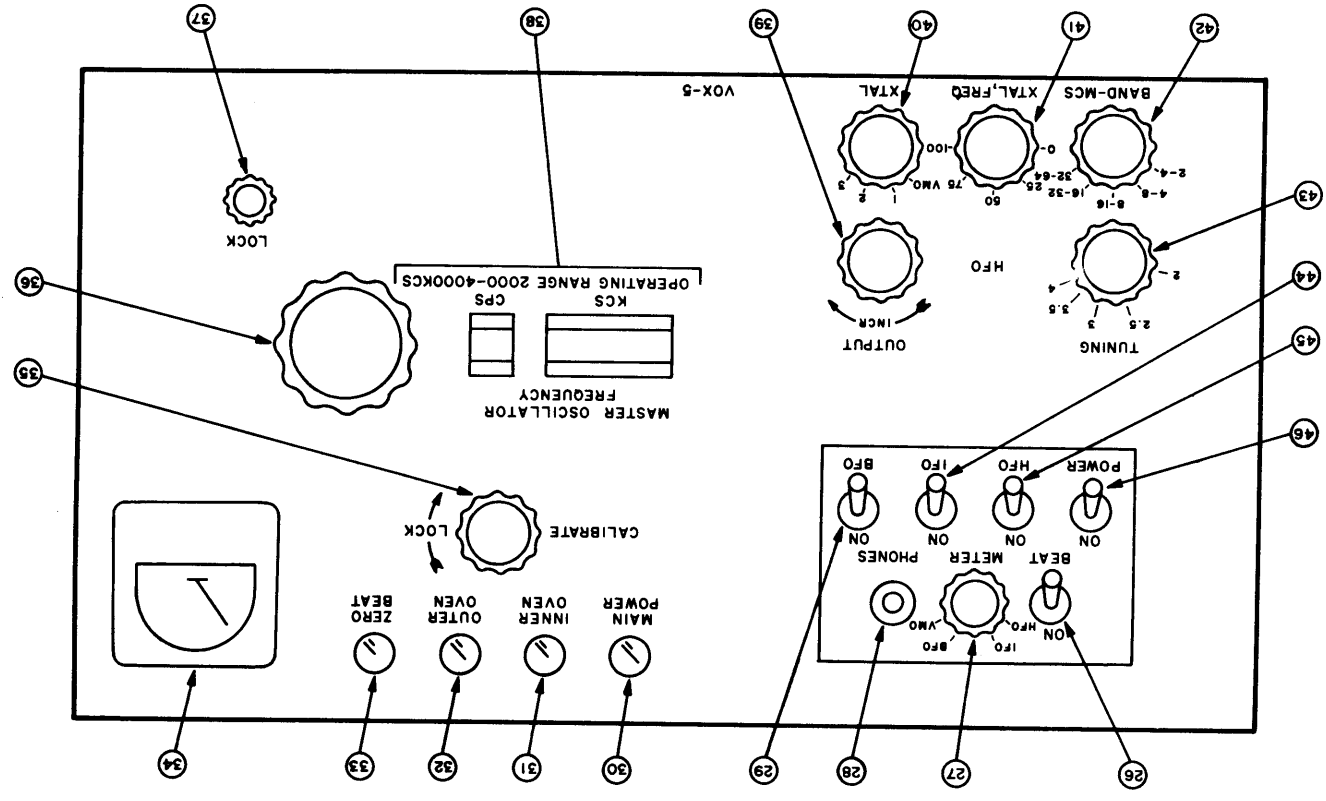
c. REPLACEMENT OF ELECTRON TUBES - The operator should check the general condition of electron tubes periodically; tubes that appear to be defective should be checked on a reliable tube tester and replaced as required. When testing or replacing tubes, particular attention should be paid to the following:

(1) When withdrawing miniature tubes from their sockets, pull them straight out; do not rock or turn them. If pins of miniature tubes are bent, straighten them with a proper pin straightener

before replacing the tube.

(2) Some circuits, for example oscillator circuits, may function better with one tube than with another even though both tubes are new or both tubes measure the same when checked on a tube tester.

(3) Tubes should not be replaced or discarded merely because they have been used for some time. Satisfactory operation in a circuit is the final proof of tube quality; the tube in use may work better than a new tube.



SECTION 4

TROUBLESHOOTING

4-1. INTRODUCTION

This section contains both troubleshooting information and functional analysis of the SBT-1K(B). The information given in this section, coupled with the information provided in the individual modular-unit manuals, will facilitate the location of equipment troubles.

4-2. FUNCTIONAL ANALYSIS

a. GENERAL - Refer to figure 4-1. Audio input signals applied to Exciter Unit A-1516 undergo four stages of modulation to produce sideband or AM output signals in the 2-32 mc frequency range. Variable Frequency Oscillator VOX-5 furnishes a continuously adjustable 2-4 mc injection frequency for the fourth modulation stage of Exciter Unit A-1516 thereby providing continuous adjustment for the SBT-1K(B)'s 2-32 mc output. In CW transmission, the 2-4 mc signal generated by the VOX-5 is used as the code signal source. Although the VOX-5 is capable of delivering 2-64 mc, only the output of its 2-4 mc master oscillator is used in the SBT-1K(B).

Output signals from the exciter unit are applied to RF Amplifier RFD-1A where they undergo three stages of amplification. Amplifier RFD-1A provides 1 kw peak envelope power (PEP) throughout the frequency range of 2-32 mc. Antenna Tuning System ATS-2 serves as a transmitter-to-antenna impedance matching device and has provisions to continuously monitor forward and reflected power and vswr on the transmission line.

When switch S209 is set at EXT (refer to paragraph 2-3d), ALDC d-c bias developed in the power-amplifier stage of RF Amplifier RFD-1A is extended to the MF modulator stage of Exciter Unit A-1516.

An increase in V203 output beyond a safe point causes an increase in the negative d-c signal applied to modulator V113; the output of V113 is consequently decreased.

b. INTERLOCK SYSTEM - The safety interlock system (figure 4-2) is designed to prevent the transmitter from operating when any of a series of undesirable conditions exist, in order to protect personnel and equipment. Essentially, a negative voltage (-150 vdc), originated in LV Power Supply PS-4A, is extended through a series of interlocks when TRANSMITTER VOLTAGES switch S702 is closed; the completion of this circuit energizes TRANSMITTER PLATES relay K703. Closed contacts of relay K303 apply both plate and screen grid voltage to amplifier V201 and driver V202 located in Amplifier RFD-1A. Subsequent closing of the FINAL VOLTAGES switch (S703) applies screen grid voltage to power amplifier V203 of Amplifier RFD-1A; closing of switch S703 also applies line voltage to HF Power Supply PS-5, which in turn supplies +3000 vdc to the plate of V203. The SBT-1K(B) interlock system is the same as the PAL-1K(A) interlock system with an additional link extending through Auxiliary Power Panel APP-4 and RF Output Assembly AX-198. The complete series of links capable of opening the interlock circuit are summarized in table 4-1.

TABLE 4-1. INTERLOCK CURCUIT COMPONENTS

MODULAR UNIT	INTERLOCK OR CIRCUIT BREAKER	WHEN CLOSED
LV Power Supply PS-4A	PA OVERLOAD SCRNR GRID circuit breaker CB703	When no overload condition exists in Amplifier RFD-1A screen grid circuit.

TABLE 4-1. INTERLOCK CIRCUIT COMPONENTS (Cont)

MODULAR UNIT	INTERLOCK OR CIRCUIT BREAKER	WHEN CLOSED
LV Power Supply PS-4A (Cont)	PA OVERLOAD PLATE circuit breaker CB704	When no overload condition exists in the plate circuit of power amplifier V203 located in RF Amplifier RFD-1A.
	PA OVERLOAD CONT GRID circuit breaker CB702	When no overload condition exists in the control-grid circuit of power-amplifier V203 located in RF Amplifier RFD-1A.
RF Amplifier RFD-1A	Top Cover Interlock S207	When the top cover of Amplifier RFD-1A is secured in position.
	Band switch S205	When PA BAND switch (S202) is properly set in detent.
	Air switch interlock S206	When blower motor B201 is operating normally.
	Bottom cover interlock S208	When the bottom cover of Amplifier RFD-1A is secured in position
HV Power Supply PS-5	Top cover interlock S403	When the top cover of HV Power Supply PS-5 is secured in position.
	Door interlock S402	When main blower fan door is closed.
Electrical Cabinet RAK-9B	Door interlock S602	When rear door of cabinet is closed.

TABLE 4-1. INTERLOCK CIRCUIT COMPONENTS (Cont)

MODULAR UNIT	INTERLOCK OR CIRCUIT BREAKER	WHEN CLOSED
RF Output Assembly AX-198	Push button interlock S603	When RFD-1A is secured in rack.
	Switch interlock S604	When antenna cable is connected to AX-198 at J609.
Monitor Control Unit MCU-2-50/U	Relay K103	When VSWR is normal.

c. TRANSMITTER/RECEIVER ANTENNA SYSTEM - Refer to figure 4-2.

If suitable connections are made to a receiver at terminals 23 through 25 of terminal block E502 in Auxiliary Power Panel APP-4 and at connector J606 on RF Output Assembly AX-198, a transmitter/receiver system may be obtained. In this system, the receiver and transmitter share the same antenna.

When TRANSMITTER VOLTAGES switch (S702) is closed, +500 vdc from LV Power Supply PS-4A is extended from terminal 9 of E302 through terminal F of J607, resistor R601, coil of relay K601, normally closed contacts of relay K602, terminal E of P607, to ground on terminal 4 of E302. Relay K601 is energized, closing a set of contacts to connect the output of RF Amplifier RFD-1A to the antenna through J608 and E602 of RF Output Assembly AX-198.

Closed contacts of relay K601 also complete part of the interlock circuit (paragraph 4-2b) thereby energizing relay K703 in LV Power Supply PS-4A. Operation of FINAL VOLTAGES switch S703 to ON supplies high voltage to RF Amplifier RFD-1A and a-c power to the coil of relay K602. Relay K602 is energized and causes the -150 vdc

used in the interlock circuit and the +500 vdc used in the antenna relay (K602) circuit to switch paths to ground.

As long as the FINAL VOLTAGES switch is set at ON, on-standby control of the transmitter can be obtained by manipulation of the TRANSMITTER VOLTAGES switch. When TRANSMITTER VOLTAGES switch is set at STAND BY, relays K703, K602 and K601 are de-energized in that sequence. When TRANSMITTER VOLTAGES switch is set at ON, relays K601, K703, and K602 are energized in that sequence. These sequences prevent the antenna from becoming disconnected at an instant when high plate voltages are still applied to RF Amplifier RFD-1A.

4-3. EQUIPMENT PERFORMANCE CHECK

Turn-on and tuning procedures given in Section 3, coupled with block diagram figure 4-1, can be used as equipment performance checks. In most cases, front-panel meters and indicators will provide sufficient information to localize common troubles to a particular modular unit. The initial point where SBT-1K(B) controls and indicators do not function correctly as described in the OPERATION column of tables 3-2 through 3-8 will serve to indicate the faulty unit. Once the trouble is localized to a modular unit, refer to the appropriate modular-unit manual for detailed information necessary to locate and repair or replace the faulty component.

If use of turn-on and tuning procedures (tables 3-2 through 3-8) as indicated above does not reveal the faulty unit, take voltage measurements of each unit as indicated in the appropriate modular-unit manual. Once the faulty unit is determined, refer to the appropriate modular-unit manual for further information necessary to locate and repair or replace the faulty component.

WARNING

Voltages employed in the SBT-1K(B) are high enough to be fatal. Every precaution should be taken by maintenance technicians to minimize the danger of shock.

When the SBT-1K(B) has been functioning satisfactorily and suddenly fails, the cause of failure may be apparent because of circumstances occurring at the time of failure or because of symptoms analogous to past failures. In these cases, it is not necessary to follow a lengthy and orderly course of troubleshooting in order to locate the faulty part. Also, the following generalizations may serve as aids in locating troubles.

<u>TROUBLE</u>	<u>CHECK</u>
SBT-1K(B) output is off frequency	Master oscillator of Variable Frequency Oscillator VOX-5
SBT-1K(B) output power cannot be brought up to desired level	Power Amplifier tube of RF Amplifier RFD-1A
SBT-1K(B) has distorted output	Amplifier tubes of RF Amplifier RFD-1A Output frequency of Variable Frequency Oscillator VOX-5. Output frequency of Exciter Unit A-1516
SBT-1K(B) output frequency is unstable	Output frequency stability of Variable Frequency Oscillator VOX-5
SBT-1K(B) is inoperative	Interlock system (refer to paragraph 4-2 <u>b</u> and table 4-1).*

*NOTE

Failure to check all the interlocks, particularly the one at antenna output connector J606, is the most common cause of trouble in this transmitter. Mating plug P606 (TMC part no. PL-149), shipped with the transmitter, must be used to make up the antenna cable. This plug has the necessary flange to close interlock switch S604 in the RF Output Assembly AX-198.

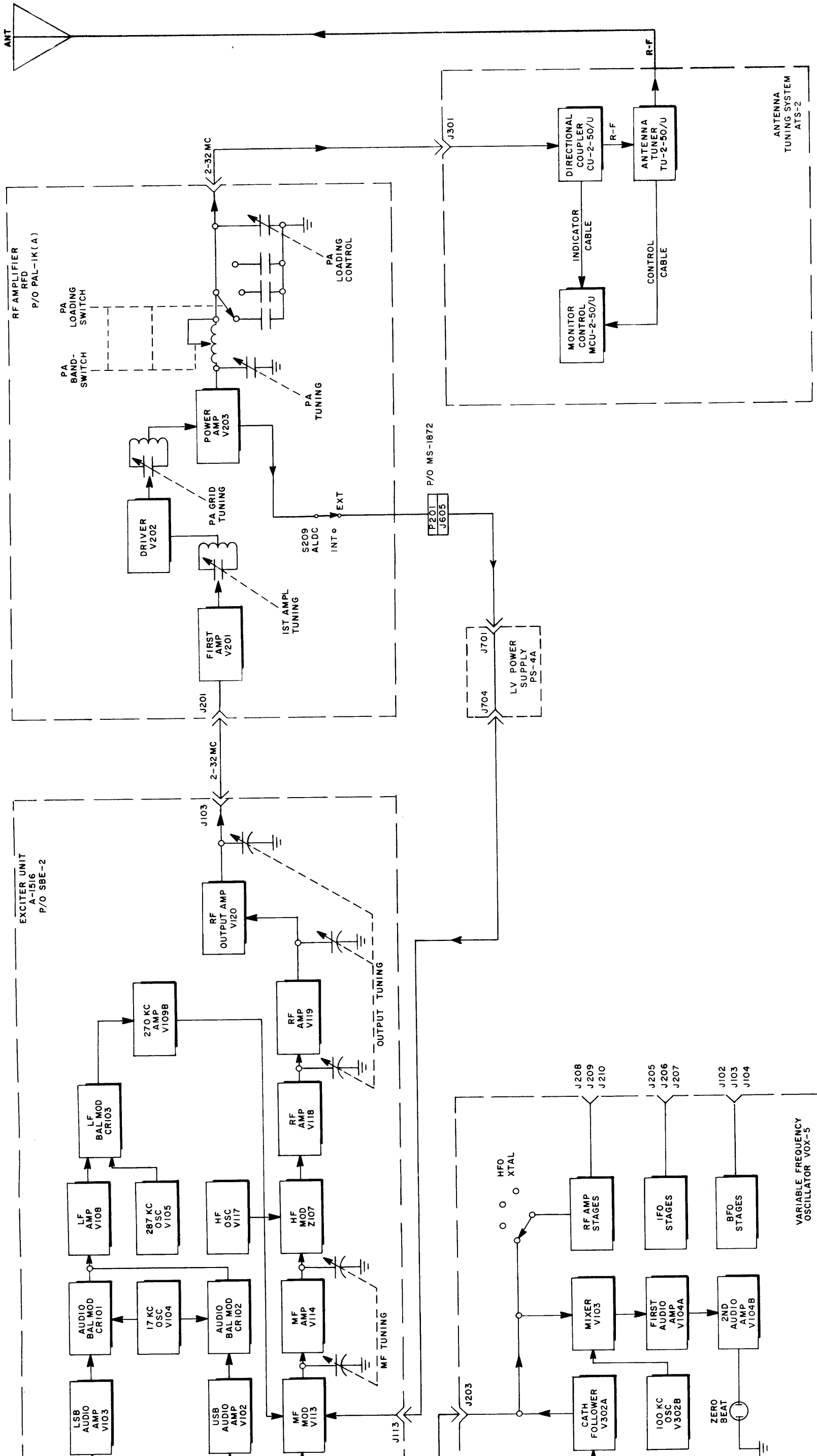


FIGURE 4-1. FUNCTIONAL BLOCK DIAGRAM, SBT-1K(B)

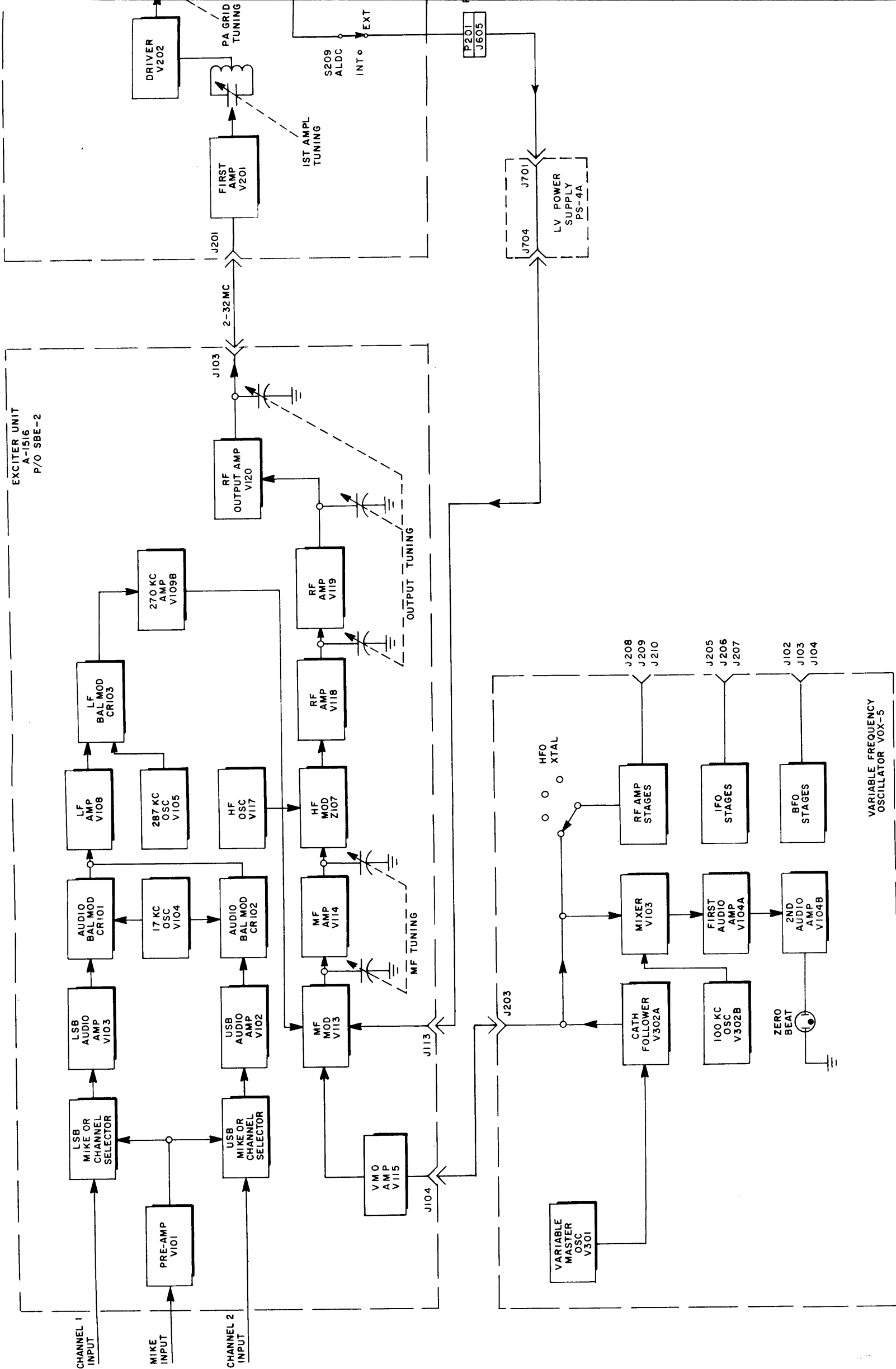


FIGURE 4-1

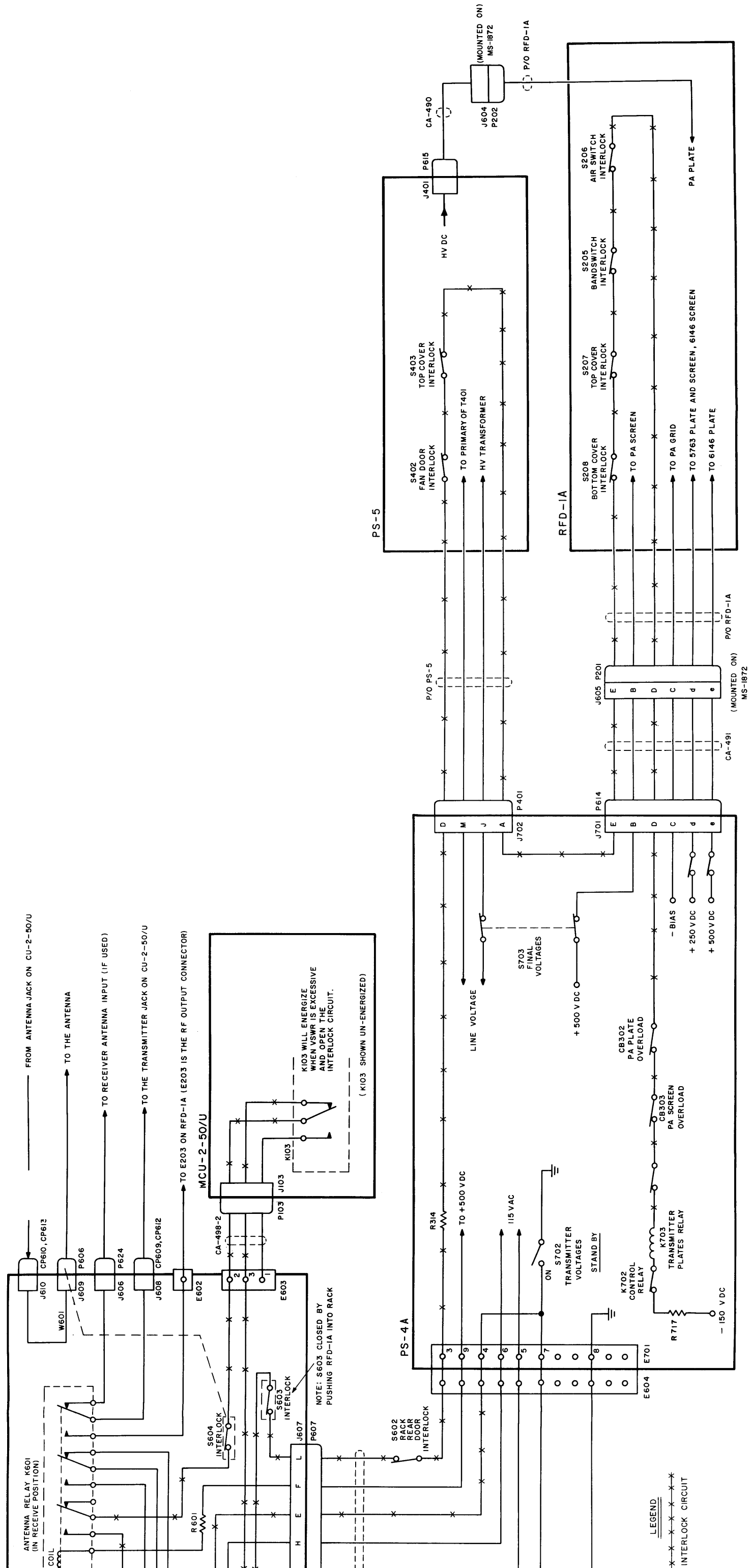
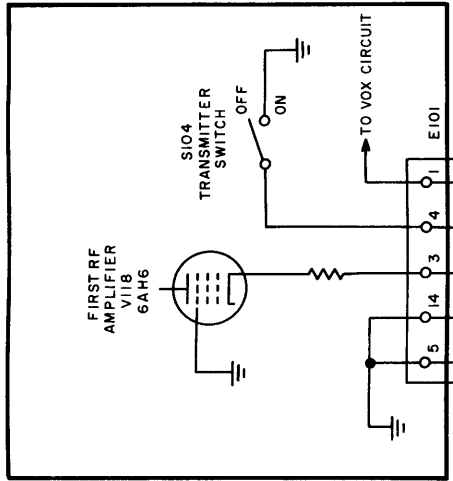
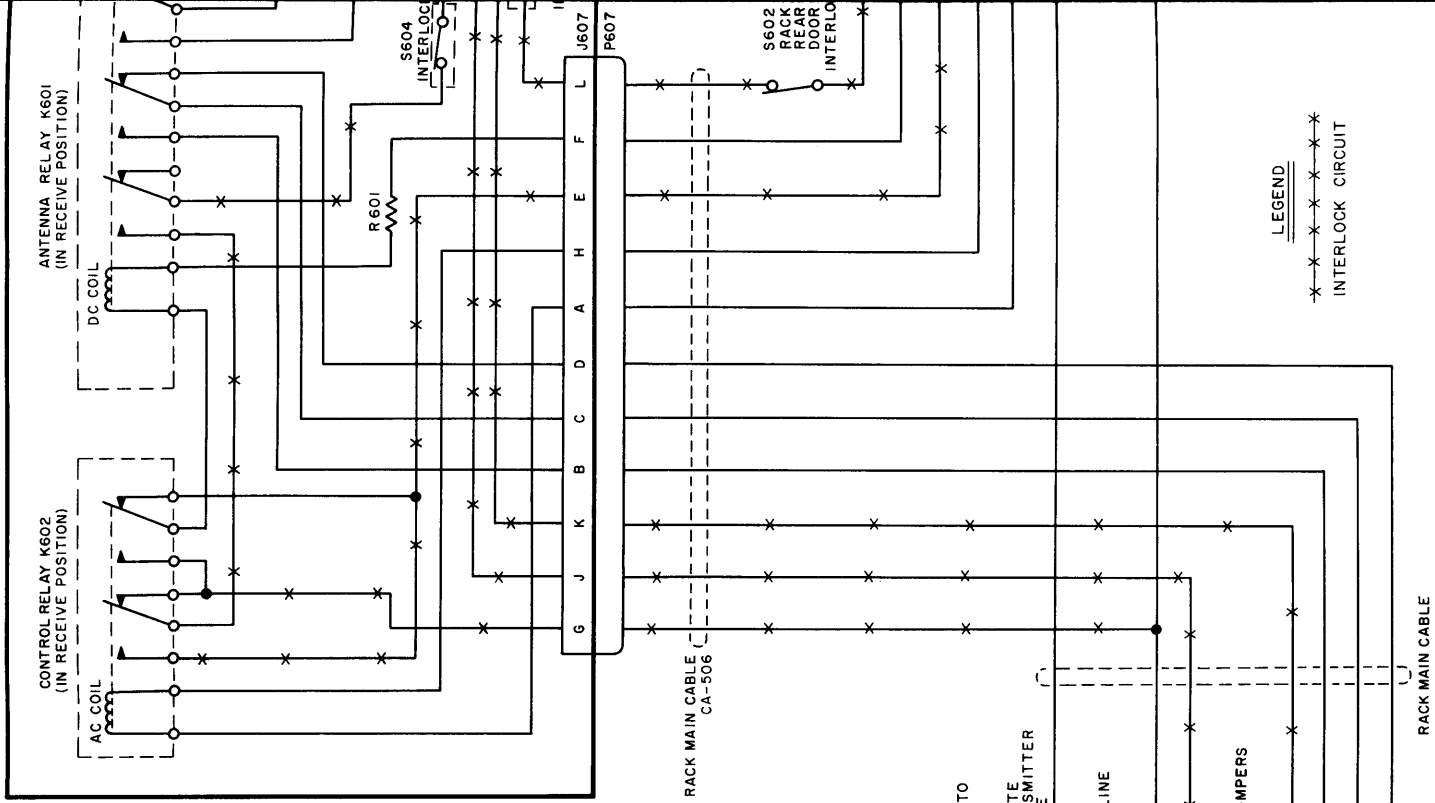


FIGURE 4-2. INTERLOCK SYSTEM, SBT-1K(B)

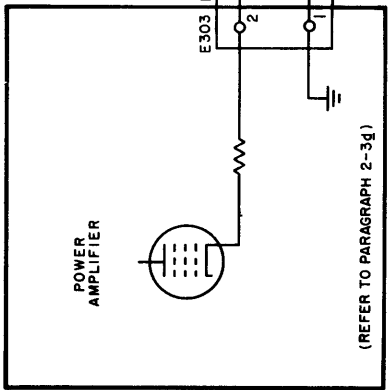
SBE-2



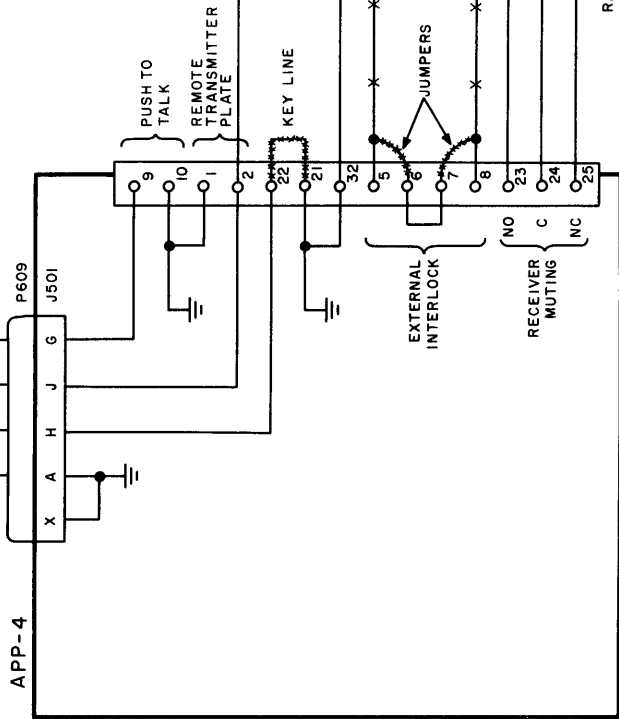
AX-198 ASSEMBLY



RACK INTERCONNECT



APP-4



SECTION 5
MAINTENANCE

5-1. GENERAL

Maintenance is divided into three categories: operator's maintenance, preventive maintenance, and repair. Repair procedures given in this section are confined to cable connectors, cable assemblies, and those items that are not part of any of the SBT-1K(B) modular units or of RAK-9B. Repair procedures for RAK-9B components or for any modular unit contained in the SBT-1K(B) are given in the appropriate modular-unit manual. Preventive maintenance includes information necessary to insure optimum performance of the SBT-1K(B). Alignment and adjustment is accomplished on an individual modular-unit basis and therefore is not included in the preventive maintenance information given in this section. Operator's maintenance for the SBT-1K(B) is described in Section 3.

5-2. SPECIAL TOOLS AND TEST EQUIPMENT

Special tools and test equipment required for the SBT-1K(B) maintenance are listed in table 5-1.

TABLE 5-1. SPECIAL TOOLS AND TEST EQUIPMENT

ITEM	MANUFACTURER	WHERE USED
Tuning Tool	TMC Part No. TP-110	All units
Signal Generator	Measurements Model 82 or equivalent	SBE-2 and PAL-1K(A)

TABLE 5-1. SPECIAL TOOLS AND TEST EQUIPMENT (Cont)

ITEM	MANUFACTURER	WHERE USED
Two Tone Test Generator	TMC Model TTG-2 or equivalent	SBE-2
Multimeter	Simpson Model 260 or equivalent	PAL-1K(A)
R-f ammeter (thermocouple type, 0-8 amperes)	Simpson Model 39 or equivalent	PAL-1K(A)
Load Resistor, 51.5 ohms, 2500 watts	Thermaline Model 82C or equivalent	PAL-1K(A)
Vacuum Tube Voltmeter	Hewlett Packard Model 410B or equivalent	All units
R-f Voltmeter	Ballentine Laboratories Model 314 or equivalent	SBE-2
<p style="text-align: center;"><u>NOTE</u></p> <p style="text-align: center;">If an r-f voltmeter is not available, use the vacuum tube voltmeter listed above with an r-f probe.</p>		

5-3. PREVENTIVE MAINTENANCE.

a. GENERAL. - The SBT-1K(B) has been designed to provide long-term, trouble-free operation under continuous duty conditions. However, similar to any other piece of equipment that contains assemblies of many electrical and mechanical parts, optimum performance and service life of the SBT-1K(B) are dependent upon an adequate preventive maintenance schedule that is strictly adhered to. A suggested schedule is as follows:

<u>PREVENTIVE MAINTENANCE INTERVAL</u>	<u>ACTION</u>
Each shift during on-the-air period	Check operator's performance record for irregularities and possible sources of future trouble.
Daily during off-the-air period	Inspect SBT-1K(B) components for overheating and deterioration. Note deposits of dust and dirt. Check operation of all door interlocks.
Monthly during off-the-air period	Inspect, clean, and service all SBT-1K(B) components as described in paragraphs 5-3b, c, and d below.

b. CLEANING AND INSPECTION. - Monthly during off-the-air periods, each modular unit should be removed from the cabinet for cleaning and inspection. All accessible covers should be removed and the wiring and all components inspected for dirt, corrosion, charring, discoloring, or grease; in particular, the tube sockets should be carefully inspected for deterioration. Dust may be removed with a soft brush or a vacuum cleaner if one is available. Remove dirt or grease from electrical parts with trichloroethylene. Remove dirt or grease from other parts with any good dry cleaning fluid.

WARNING

When using trichloreethylene, make certain that adequate ventilation exists. Avoid prolonged contact with skin.

Trichloreethylene contains paint solvents; do not use on painted surfaces.

Carefully inspect equipment for loose solder connections or screws, especially those on solder lugs. Tighten and resolder connections as required. Check the condition of air filters; replace or clean air filters as required.

c. GEAR LUBRICATION - Examine all gears and gear assemblies contained in the modular units. If any of the gears show signs of becoming dry, lubricate them lightly with a drop or two of any high quality, light machine lubricant.

d. ALIGNMENT AND ADJUSTMENT - All alignment and adjustment is accomplished on an individual modular-unit basis. If conditions indicate a necessity for alignment or adjustment of any particular unit, refer to the appropriate modular-unit manual.

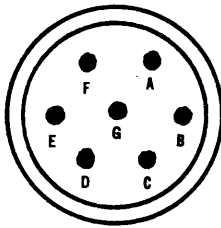
5-4. REPAIR

a. GENERAL - Repair encompasses those procedures necessary to fix and replace defective SBT-1K(B) components. As stated in paragraph 5-1, repair procedures given in this section are confined to cable connectors and cable assemblies. Repair procedures for RAK-9B components or any modular unit contained in the SBT-1K(B) can be found in the appropriate modular-unit manual.

NOTE

When a component part of oscillator assembly Z301 in the VOX-5 or crystal oven Z104 in the SBE-2 fail, it is recommended that the entire assembly (Z301 or Z104) be returned to the factory for repair and adjustment.

b. CABLE ASSEMBLIES CA-108, CA-109, AND CA-502 - Cable assemblies CA-108, CA-109, and CA-502 are auxiliary service cables used to interconnect the various sections of Variable Frequency Oscillator VOX-5 (refer to Section 2 of VOX-5 manual). No special information is required for the repair of cable assemblies CA-108 and CA-109; careful examination will reveal the nature of required repairs. Refer to figure 5-1 when repairing cable assembly CA-502; cable assembly CA-502 contains two cables (one-conductor cable, and six-conductor cable) wired to a male and female connector.



MALE AND FEMALE CONNECTOR

WIRING CHART

MALE CONNECTOR PIN NO.	COLOR	FEMALE CONNECTOR PIN NO.
A	BLUE (6-CONDUCTOR CABLE)	A
B	BLACK (6-CONDUCTOR CABLE)	B
C	ORANGE (6-CONDUCTOR CABLE)	C
D	RED (6-CONDUCTOR CABLE)	D
E	GREEN OF 6-CONDUCTOR CABLE AND SHIELD OF 1-CONDUCTOR CABLE	E
F	WHITE OF 1-CONDUCTOR CABLE	F

NOTE:

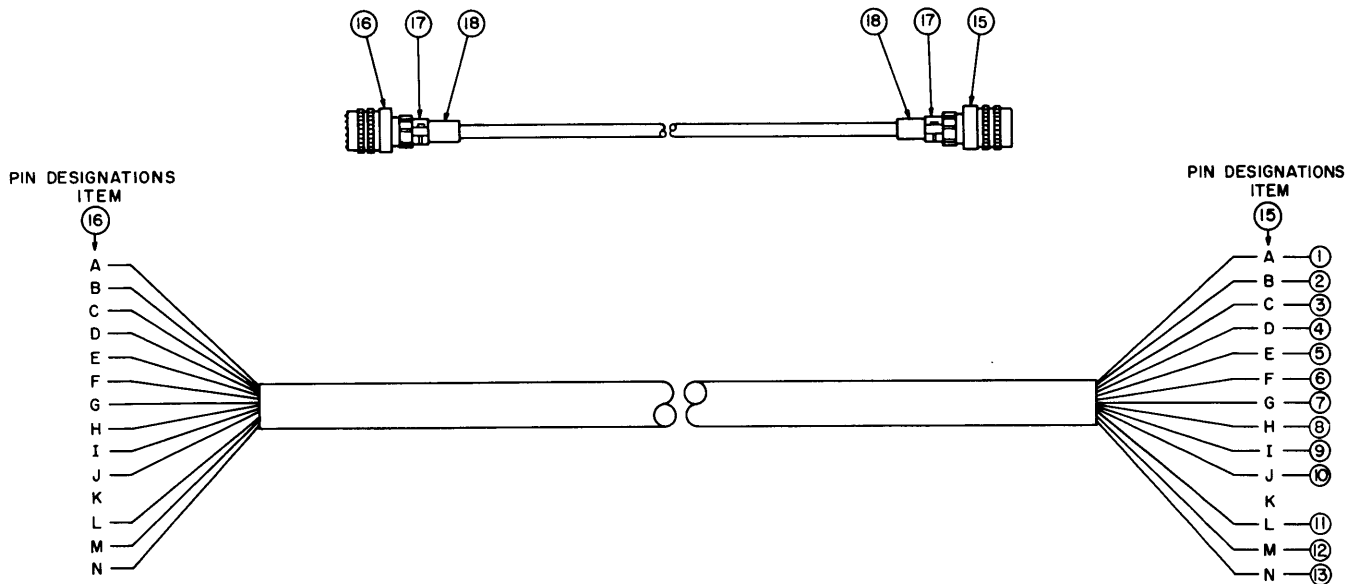
WHITE OF 6-CONDUCTOR CABLE NOT USED
(ENDS CUT OFF AT CABLE BREAKOUT)

Figure 5-1. Cable Assembly CA-502, Wiring Connection

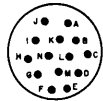
c. CABLE ASSEMBLIES CA-383-78C, CA-435-3, CA-468-2, CA-468-3, CA-480-3-80, CA-480-6-49, CA-490, CA-493, CA-509, CA-586-1 - Cable assemblies CA-383-78C, CA-435-3, CA-468-2, CA-468-3, CA-480-3-80, CA-480-6-49, CA-490, CA-493, CA-509, CA-586-1 are used to interconnect, or supply power to, the various SBT-1K(B) modular units as shown in figure 2-3. No special information is required for the repair of any of these cable assemblies; careful examination

will reveal the nature of required repairs.

d. CABLE ASSEMBLIES CA-346, CA-491, CA-506, AND CA-507 - Cable assemblies CA-346, CA-491, CA-506, and CA-507 (figures 5-2, 5-3, 5-4, and 5-5 respectively) are used to interconnect SBT-1K(B) modular units as shown in figure 2-3. Refer to the information provided in the appropriate illustration when repairing any of these cable assemblies.



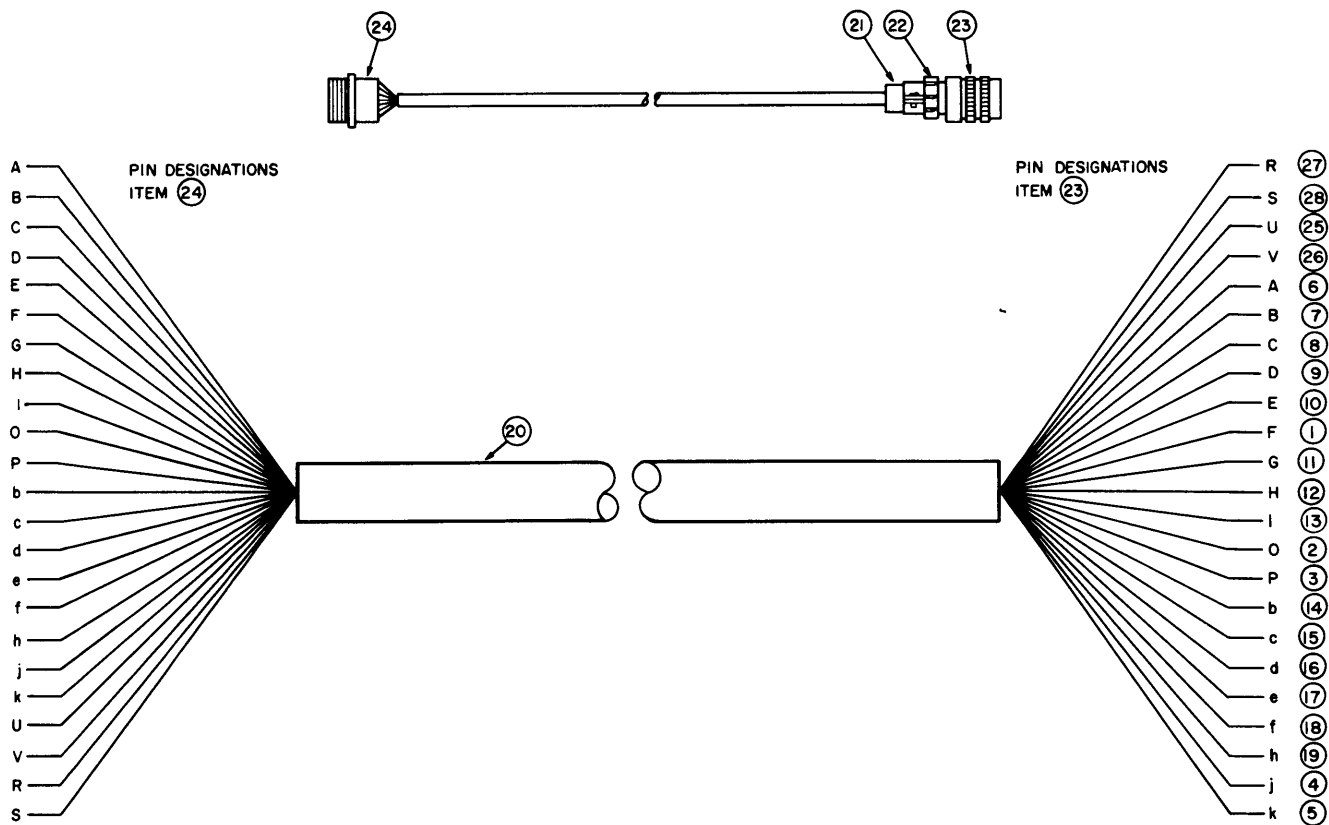
MALE AND FEMALE
CONNECTOR LAYOUT
(ITEMS 15 AND 16)



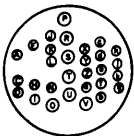
NOTES:
○ DENOTES ITEM NUMBER

ITEM	PART NO	DESCRIPTION	SYMBOL
19	BS-100	SOLDER, SOFT	
18	MS3420-10A	BUSHING, CABLE	
17	MS3057-12	CLAMP, CABLE	
16	MS3106B20-27P	CONNECTOR, PLUG, MALE	PIO1
15	MS3106B20-27S	CONNECTOR, PLUG, FEMALE	PIO2
14	PX-100-1-.375	INSULATION, SLEEVING	BLACK
13	MWC16(19)U-93	CABLE, INSULATED	WHITE/ORANGE
12	MWC18(16)U-94		WHITE/YELLOW
11	MWC18(16)U-0		BLACK
10	MWC16(19)U-6		BLUE
9	MWC18(16)U-96		WHITE/BLUE
8	MWC22(7)U-2		RED
7	MWC22(7)U-PINK		PINK
6	MWC16(19)U-9		WHITE
5	MWC18(16)U-8		GREY
4	MWC18(16)U-7		VIOLET
3	MWC16(19)U-90		WHITE/BLACK
2	MWC16(19)U-91		WHITE/BROWN
1	MWC16(19)U-1	CABLE, INSULATED	BROWN

FIGURE 5-2. CABLE ASSEMBLY CA-346



MALE AND FEMALE
CONNECTOR LAYOUT
(ITEMS 23 AND 24)

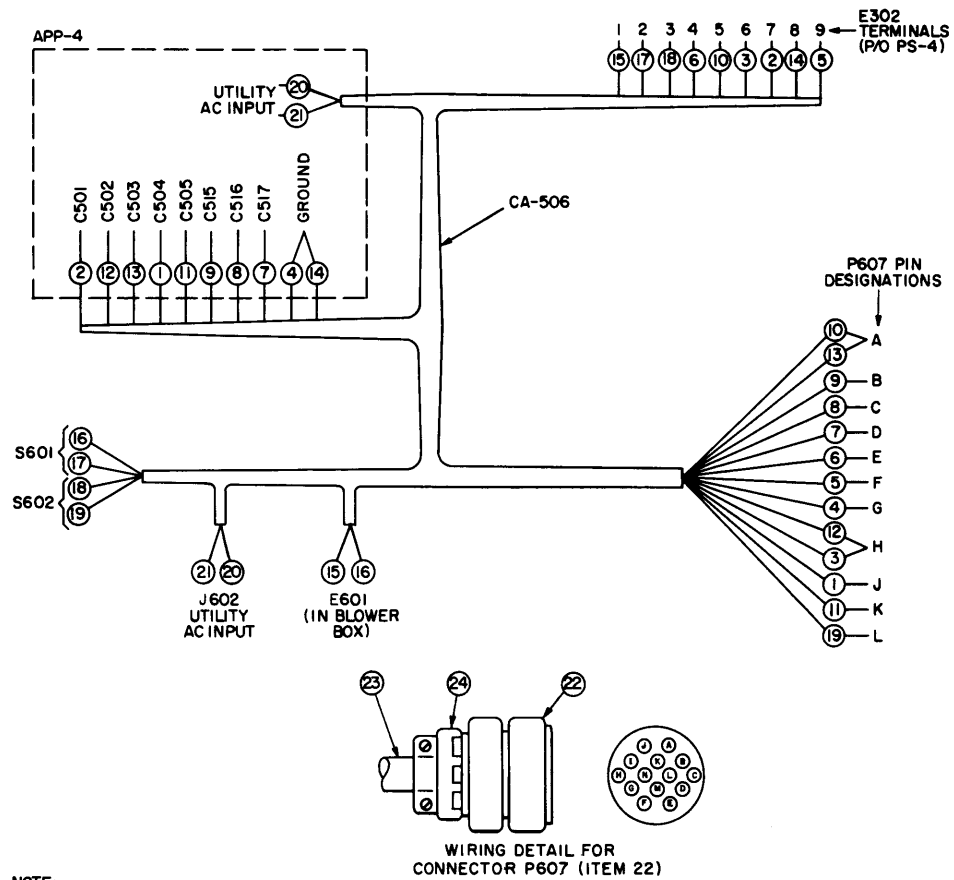


NOTES:

○ DENOTES ITEM NUMBER

28	MWC12(19)U9	CABLE, INSULATED	WHITE
27	MWC12(19)U9	↑ ↓	WHITE
26	MWC12(19)U0	↑ ↓	BLACK
25	MWC12(19)U0	CABLE, INSULATED	BLACK
24	MS3102A32-7S	CONNECTOR, RECEPTACLE (FEMALE)	J605
23	MS3106B-32-7P	CONNECTOR, PLUG (MALE)	P614
22	MS3057-20	CLAMP, CABLE	
21	MS3420-16A	BUSHING, CABLE	
20	PX100-1-.625	INSULATION, SLEEVING	BLACK
19	MWC22(7)U2	CABLE, INSULATED	RED
18	9	↑ ↓	WHITE
17	7	↑ ↓	VIOLET
16	6		BLUE
15	92		WHITE/RED
14	4		YELLOW
13	93		WHITE/ORANGE
12	5		GREEN
11	94		WHITE/YELLOW
10	91		WHITE/BROWN
9	1		BROWN
8	92		WHITE/RED
7	8		GRAY
6	MWC22(7)U0		BLACK
5	MWC16(19)U96		WHITE/BLUE
4	MWC16(19)U97		WHITE/VIOLET
3	MWC12(19)U9		WHITE
2	MWC12(19)U0	↑ ↓	BLACK
1	MWC16(19)U95	↑ ↓	WHITE/GREEN
ITEM	PART NO.	DESCRIPTION	SYMBOL

FIGURE 5-3. CABLE ASSEMBLY CA-491

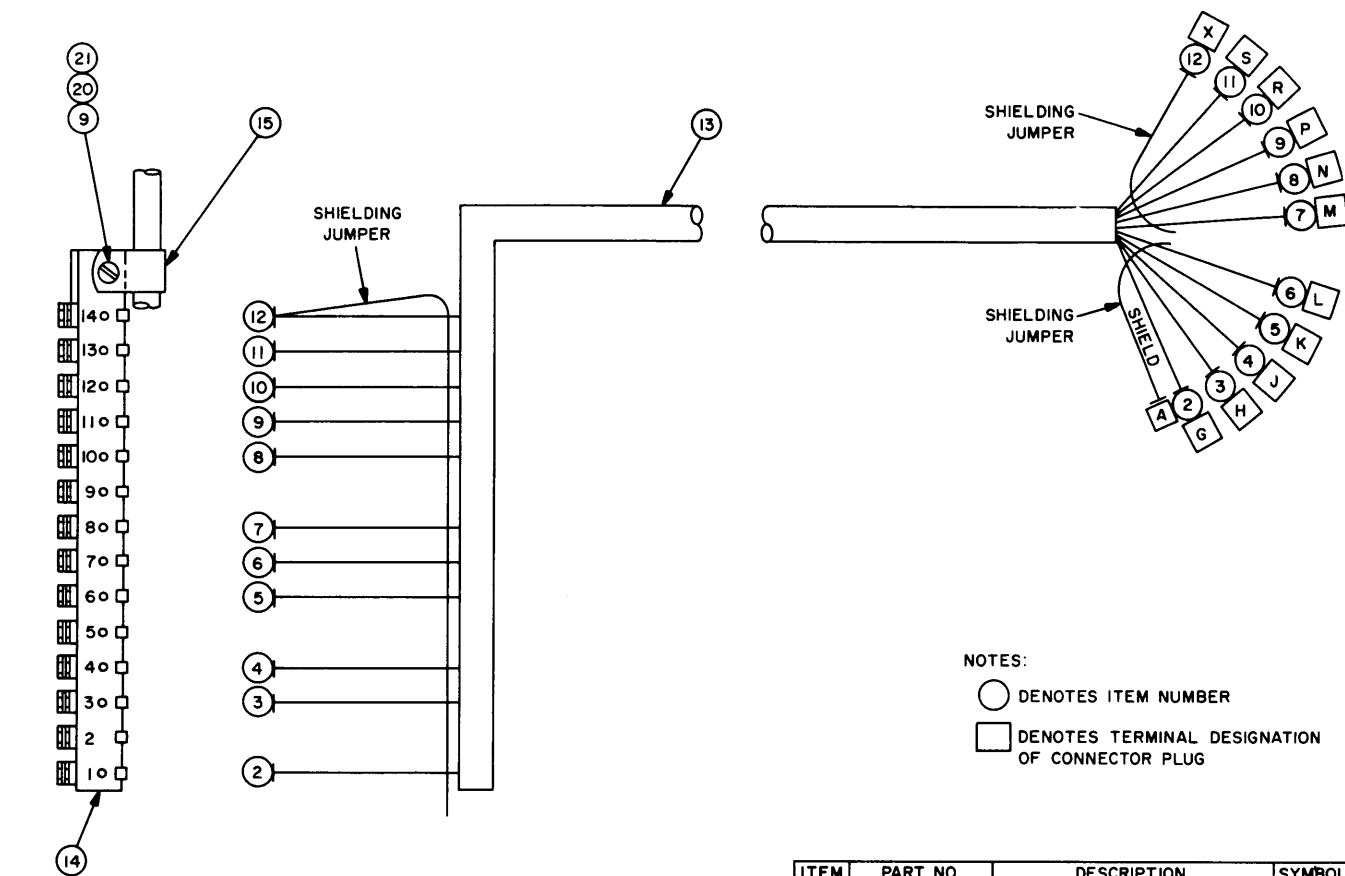


NOTE:

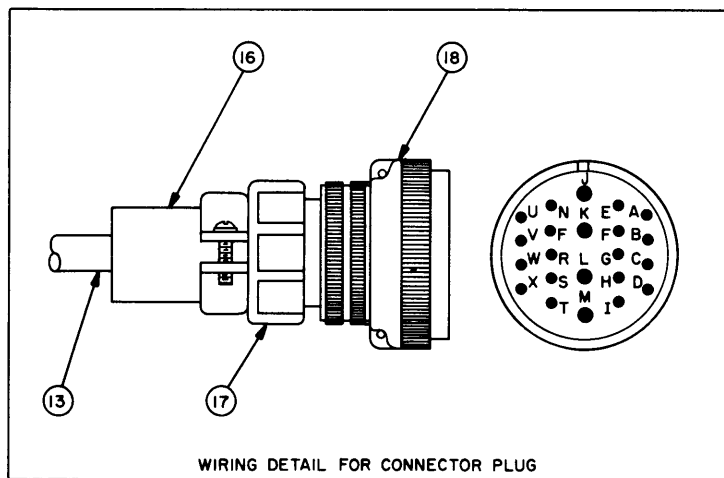
○ DENOTES ITEM NUMBER

ITEM	PART NO.	DESCRIPTION	SYMBOL
24	MS3057-12	CONNECTOR, SHELL	
23	MS3420-12A	BUSHING, RUBBER	
22	MS31062027S	CONNECTOR, FEMALE	
21	HWC14(7)U9	CABLE, INSULATED	WHITE
20	HWC14(7)U90		WHITE/BLACK
19	MWC24(7)U90		WHITE/BLACK
18	MWC24(7)U91		WHITE/BROWN
17	MWC24(7)U92		WHITE/RED
16	MWC24(7)U93		WHITE/ORANGE
15	MWC24(7)U94		WHITE/YELLOW
14	MWC24(7)U0		BLACK
13	MWC24(7)U1		BROWN
12	MWC24(7)U7		VIOLET
11	MWC24(7)U98		WHITE/GREY
10	MWC22(7)U1		BROWN
9	MWC22(7)U93		WHITE/ORANGE
8	MWC22(7)U4		YELLOW
7	MWC22(7)U3		ORANGE
6	MWC22(7)U5		GREEN
5	MWC22(7)U2		RED
4	MWC24(7)U0		BLACK
3	MWC24(7)U7		VIOLET
2	MWC24(7)U6		BLUE
1	MWC24(7)U8	CABLE, INSULATED	GREY

FIGURE 5-4. CABLE ASSEMBLY CA-506



NOTES:
 ○ DENOTES ITEM NUMBER
 □ DENOTES TERMINAL DESIGNATION OF CONNECTOR PLUG



ITEM	PART NO.	DESCRIPTION	SYMBOL
21	NTH0632BN8	NUT, HEX.	
20	LWEO6MRN	LOCKWASHER, EXT. TOOTH	
19	SCBS0632BN8	SCREW, MACHINE	
18	MS 3016B2811P	CONNECTER, PLUG	
17	MS 3057-16	CABLE, CLAMP	
16	MS 3420-16A	SLEEVING, RUBBER	
15	CU-102-5	CLAMP, "G" TYPE	
14	TM-105-14AR	FANNING STRIP, BARRIER TYPE	
13	PX-100-1-.375	INSULATION, SLEEVING	BLACK
12	MWC22(7)S 1	CABLE INSULATED, SHIELDED	BROWN
11		2	RED
10		3	ORANGE
9		4	YELLOW
8		6	BLUE
7		5	GREEN
6		8	GRAY
5		0	BLACK
4		6	BLUE
3		3	ORANGE
2	MWC22(7)S 8	CABLE INSULATED, SHIELDED	GRAY
1	DELETED		

FIGURE 5-5. CABLE ASSEMBLY CA-507