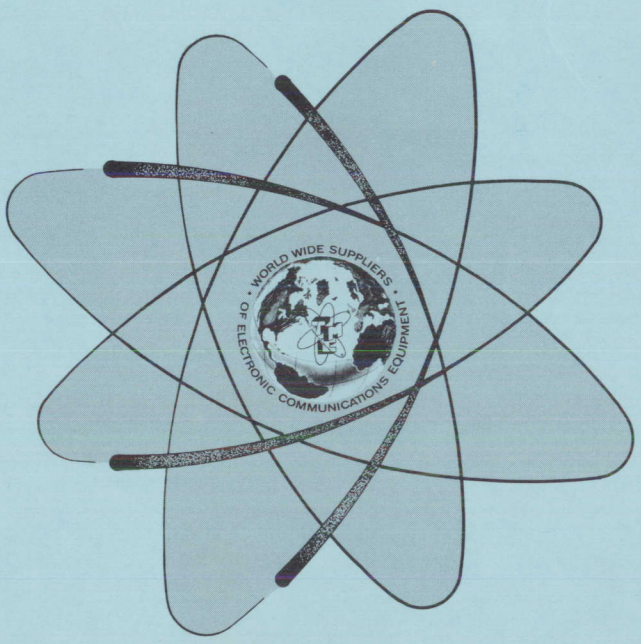
TECHNICAL MANUAL

for

GENERAL PURPOSE TRANSMITTER

MODEL SBT-1K(V)

SYSTEM



THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

Printed in U.S.A.

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IN-259V ISSUE DATE: 15 JUNE 1964

FOREWORD

TMC's General Purpose Receiver, Model SBT-1K(V), consists of 4 major components as follows:

Qty	Component
1	ATS-2 Antenna Tuning System
1	PAL-1K Linear Power Amplifier
1	SBE-6 Transmitting Mode Selector
1	VOX-5 Variable Frequency Oscillator

These 4 major components are also included in various TMC transmitter systems as well as in the SBT-1K(V). To satisfy this condition most practically, individual manuals on each unit are written, then combined, as required to cover any transmitter system. The SBT-1K(V) manual is made up of individual manuals as described in Table of Contents, Model SBT-1K(V).

TABLE OF CONTENTS

GENERAL PURPOSE TRANSMITTER

MODEL SBT-1K(V)

Part	Title
1	Technical Manual for General Purpose Transmitter, SBT-1K(V) -- System
2	Technical Manual for Antenna Tuning System, Model ATS-2 -- with Addendum #8/18/64, modification of Tuner
3	Technical Manual for Linear Power Amplifier, Model PAL-1K(A) -- with Addendum #8/18/64 describing PAL-1K(M)
4	Technical Manual for Transmitting Mode Selector, SBE-3 -- with Addendum #8/18/64 describing SBE-6
5	Technical Manual for Variable Frequency Oscillator, Model VOX-5
6	Technical Manual for General Purpose Transmitter, SBT-1K(V) -- Appendix

Addendum #1 to
SBE-8,-9,-10
Technical Manual
(IN-2008A)

Transmitting Mode Selector Model SBE-6 is superceded and directly replaced by Models SBE-8,-9,-10.

TABLE OF CONTENTS

SBT-1K(V) SYSTEM

Paragraph		Page
	SECTION 1 - GENERAL DESCRIPTION	
1-1	Function - - - - - - - - - - - - - - - - -	1-1
	a. General - - - - - - - - - - - - - - - - -	1-1
	b. Components - - - - - - - - - - - - - - -	1-1
1-2	Physical Description - - - - - - - - - - -	1-3
	SECTION 2 - INSTALLATION	
2-1	Introduction - - - - - - - - - - - - - - -	2-1
2-2	Initial Inspection - - - - - - - - - - - -	2-1
2-3	Rack Installation - - - - - - - - - - - -	2-1
	a. Location - - - - - - - - - - - - - - - -	2-1
	b. Installation - - - - - - - - - - - - - -	2-2
2-4	Modification for 230 VAC Line - - - - - -	2-2
	a. General - - - - - - - - - - - - - - - - -	2-2
	b. PAL-1K(M) - - - - - - - - - - - - - - -	2-3
	c. SBE-6 - - - - - - - - - - - - - - - - -	2-3
	d. VOX-5 - - - - - - - - - - - - - - - - -	2-3
	e. ATS-2 - - - - - - - - - - - - - - - - -	2-3
	f. APP-4 - - - - - - - - - - - - - - - - -	2-3
2-5	Assembly of Transmitter - - - - - - - - -	2-4
2-6	Initial Adjustments - - - - - - - - - -	2-5
2-7	Connection of External Equipment - - -	2-5
	a. Introduction - - - - - - - - - - - - -	2-5
	b. Remote Transmitter Plate Relay - -	2-6

TABLE OF CONTENTS

SBT-1K(V) SYSTEM (cont)

Paragraph		Page
	SECTION 2 - INSTALLATION (cont)	
2-7 (cont)	c. Regulated 115VAC - - - - - - - - - -	2-6
	d. External Interlocks - - - - - - - -	2-6
	e. Push-to-talk System - - - - - - - -	2-6
	f. Receiver Squelch - - - - - - - - -	2-7
	g. Audio Input-Channels 1 and 2 - - -	2-7
	h. Key Line - - - - - - - - - - - - - -	2-7
	i. Receiver Muting - - - - - - - - - -	2-7
	j. Reserved Terminals - - - - - - - -	2-8
	k. Antenna - - - - - - - - - - - - - -	2-8
	l. Transmitter/Receiver Antenna - - -	2-10
	m. Mike - - - - - - - - - - - - - - - -	2-11
	n. External ALDC - - - - - - - - - - - -	2-11
	SECTION 3 - OPERATOR'S SECTION	
3-1	Preliminary Considerations - - - - - - -	3-1
	a. General - - - - - - - - - - - - - - -	3-1
	b. Modes of Transmission - - - - - - - -	3-1
	c. Functions of Components - - - - - - -	3-2
	d. Functions of Controls - - - - - - - -	3-3
	e. Warm-up Time for Frequency Stability - - - - - - - - - - - - - -	3-3
	f. Power Amplifier Tube Protection - -	3-4
	g. Safety Interlock System - - - - - - -	3-4

TABLE OF CONTENTS

SBT-1K(V) SYSTEM (cont)

Paragraph		Page
	SECTION 3 - OPERATOR'S SECTION (cont)	
3-2	Tuning Procedure - - - - - - - - - -	3-5
	a. Tuning Tables - - - - - - - - - -	3-5
	b. General Notes on Tuning - - - - -	3-6
3-3	Operating Procedure - - - - - - - - -	3-21
	a. General - - - - - - - - - - - - -	3-21
	b. CW Mode - - - - - - - - - - - - -	3-22
	c. SSB Mode - - - - - - - - - - - -	3-22
	d. ISB Mode - - - - - - - - - - - -	3-23
	e. AM Mode - - - - - - - - - - - - -	3-23
3-4	Shut-down Procedure - - - - - - - -	3-28
	a. General - - - - - - - - - - - -	3-28
	b. Standby - - - - - - - - - - - -	3-28
	c. Normal Stopping - - - - - - - -	3-29
	d. Emergency Stopping - - - - -	3-29
	SECTION 4 - PRINCIPLES OF OPERATION	
4-1	Introduction - - - - - - - - - - - -	4-1
4-2	Operation - - - - - - - - - - - - - -	4-1
	a. Carrier Generation - - - - - - - -	4-1
	b. CW Transmission - - - - - - - - -	4-1
	c. SSB Transmission - - - - - - - - -	4-2
	d. ISB Transmission - - - - - - - -	4-2
	e. AM Transmission - - - - - - - - -	4-2

TABLE OF CONTENTS

SBT-1K(V) SYSTEM (cont)

Paragraph		Page
	SECTION 4 - PRINCIPLES OF OPERATION (cont)	
4-3	Frequency Translation - - - - - - - -	4-2
	a. Carrier Frequency - - - - - - - -	4-2
	b. Lower Sideband Frequencies - -	4-4
	c. Upper Sideband Frequencies - -	4-5
	d. Carrier Re-insertion - - - - -	4-6
4-4	Interlock System - - - - - - - - - - -	4-7
4-5	Antenna Disconnect - - - - - - - - - -	4-9
4-6	T/R Antenna System - - - - - - - - -	4-10
4-7	Receiver Muting - - - - - - - - - - -	4-11

LIST OF ILLUSTRATIONS

SBT-1K(V) SYSTEM

Figure		Page
	SECTION 1 - GENERAL DESCRIPTION	
1-1	General Purpose Transmitter, SBT-1K(V) - - - - - - - - - - - - - - -	vii
	SECTION 2 - INSTALLATION	
2-1	Wiring Modifications for 230VAC Line -	2-12
2-2	Slide Mounting Details - - - - - - - - -	2-13
2-3	Connection Diagram, External Equipment to SBT-1K(V) - - - - - - - - - - -	2-14
2-4	Antenna Installation Diagram - - - -	2-15
2-5	Installation of ATS-2 & RFD Units in Rack	2-16
	SECTION 4 - PRINCIPLES OF OPERATION	
4-1	Functional Block Diagram, SBT-1K(V) -	4-14
4-2	Frequency Translation Diagram, SBT-1K(V) - - - - - - - - - - - - - - - -	4-15
4-3	Interlock, Antenna Disconnect and T/R Antenna Circuit Schematic Diagram, SBT-1K(V) - - - - - - - - - - - - - - - -	4-16

LIST OF TABLES

SBT-1K(V) SYSTEM

Table		Page
	SECTION 1 - GENERAL DESCRIPTION	
1-1	Electrical Characteristics, SBT-1K(V)	1-4
	SECTION 3 - OPERATOR'S SECTION	
3-1	Tune-up for Carrier, SBT-1K(V)	3-8
3-2	Tuning Procedure for CW, SBT-1K(V)	3-15
3-3	Tuning Procedure for SSB, SBT-1K(V)	3-16
3-4	Tuning Procedure for ISB, SBT-1K(V)	3-18
3-5	Tuning Procedure for AM, SBT-1K(V)	3-20
3-6	On-off Operating Controls, SBT-1K(V)	3-24
3-7	Procedure for Placing SBT-1K(V) in Standby	3-28
	SECTION 4 - PRINCIPLES OF OPERATION	
4-1	Interlock Circuit Components, SBT-1K(V)	4-11

SECTION 1

GENERAL DESCRIPTION

1-1. FUNCTION

a. GENERAL - Model SBT-1K(V) General Purpose Transmitter sends CW, AM, SSB and ISB at a conservatively rated output of 1000 watts PEP (peak envelope power) over the range of 1.75 mc to 32 mc. Tuning is continuously variable and frequency stability is within 1 part in 1 x 10^6 per day. The transmitter has a self-contained exciter with sideband selector controls. Full carrier may be sent with both sidebands for AM transmission or, in sideband transmission, it can be adjusted to any percentage down to a fully suppressed carrier. Two 7.15-kc width audio input channels have the capacity for sending 4 discrete voice channels in ISB, with an external multiplexer, or 80 voice-frequency telegraph channels at 100 WPM (or 40 channels at 200 WPM), national standard spacing. Output tuning controls and a VSWR indicator enable highly accurate matching of the transmitter to a wide variety of antenna loads and environmental conditions. A safety interlock system provides protection for personnel and equipment. Sequential relays afford a transmitter/receiver antenna switching system which may be triggered by a single switch or by voice-control or audio input.

b. COMPONENTS - Referring to the components shown in figure 1-1 and in the order in which they appear from top to bottom, their functions are described in the following paragraphs.

(1) Model ATS-MCU-2 Monitor Control Unit is part of Model ATS-2 Antenna Tuning System. This unit matches the transmitter to the antenna through use of controls and indicators. Resistance and reactance settings are monitored on a multimeter which may be also switched to register ambient humidity. The large indicator in the middle is a VSWR (voltage standing wave ratio) indicator with two needles and scales to indicate forward and reflected power. A third reading of VSWR is had by the intersection of the two needles on the VSWR scale.

(2) Model RFD-2 is the amplifier component in the PAL-1K(M) Linear Power Amplifier system. This unit amplifies the 1.75- to 32-mc output from the SBE-6 exciter.

(3) Model VOX-5 Variable Frequency Oscillator is a precise, direct reading, variable frequency oscillator with high stability. It supplies a continuously adjustable 2-4 mc injection frequency to the SBE-6 exciter, thus providing a multitude of carrier frequencies through the 1.75- to 32-mc range.

(4) SBE-6 Transmitting Mode Selector is the exciter unit in the transmitter. From two audio input channels or mike input it translates intelligence into single or independent sidebands with suppressed carrier or any degree of carrier in the 1.75- to 32-mc range. It also generates the conventional AM signal and may be operated with a hand keyer for CW transmission.

(5) Directly below the SBE-6 exciter unit is the SBE-6 Power Supply, furnishing plate, filament and bias voltages to the exciter.

(6) Model PS-4A Low Voltage Power Supply is part of PAL-1K(M) Linear Power Amplifier and supplies the RFD-2 unit with bias and mid-voltages.

(7) Model APP-4 Auxiliary Power Panel, besides functioning as a distributor for line voltage to the drawer units, also contains wiring connections and terminal blocks on the rear of the unit for connection of a variety of equipment external to the SBT-1K(V). Audio inputs and external hand keyer connections are made here with additional connection points for wiring the SBT-1K(V) into a larger transmitter system and/or a transmitter/receiver system utilizing two antennas or a common antenna. Associated with this latter function are relays located in the AX-198 RF Output Chassis at the top of the rack mounted in back of the ATS-MCU-2 unit.

(8) Model PS-5 High Voltage Power Supply is part of PAL-1K(M) Linear Power Amplifier and supplies the RFD-2 unit with high plate voltages.

1-2. PHYSICAL DESCRIPTION

Model SBT-1K(V) General Purpose Transmitter is contained in a single rack. Two types are available, varying only in overall height and installation method as follows:

Model	Type	Overall Height
SBT-1K(V)-B	Base Mounted	74-3/4 inches
SBT-1K(V)-S	Shock Mounted	73-3/4 inches

The base mounted model (shown in figure 1-1) comes equipped with its own removable mounting base (3-1/4 inches high). The shock mounted model is the same as the base mounted model with a set of 4 shock mounts replacing the mounting base at the bottom and 2 shock mounts located at the top of the rear rack wall. Both models measure 20-5/8 inches wide x 24-1/2 inches deep. The major components are removable and mounted on tilt-type drawer slides. A full-length door on the rack provides access to interconnecting wiring. The SBT-1K(V) contains its own forced-air cooling system, consisting of an intake blower and air filter on the rear rack door, blowers for the power amplifier tube and high voltage components in the PAL-1K(M) and a filtered air exhaust at the top of the rack.

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

Output Power:	1000 watts PEP (peak envelope power) for all modes
Frequency Range:	1.75 to 32 megacycles
Modes of Operation:	CW, SSB, ISB and AM (side-band modes with suppressed carrier or any degree of carrier)
Output Impedance:	Will match any unbalanced load from 70 to 150 ohms at +20 degrees in the range of 1.75 to 4 megacycles and any unbalanced load from 50 to 600 ohms at +45 degrees in the range of 4 to 32 megacycles.

TABLE 1-1. ELECTRICAL CHARACTERISTICS, SBT-1K(V) (cont)

Frequency Stability:	Within 1 part in 1 x 10^6 per day.
Carrier Insertion:	-55 db to full output
Unwanted Sideband Rejection:	1000 cps tone at least 60 db below PEP
Audio Response:	Flat within 3 db from 350 to 7,500 cps range.
Audio Input:	a. Two 600-ohm channels balanced or unbalanced, -20 dbm to +20 dbm. b. 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)
Voice-controlled transmission:	For sideband signals containing carrier suppressed below 30%
ALDC:	An automatic load and drive control limits distortion during high drive peaks or load changes.
Harmonic Suppression:	2nd harmonic at least 40 db below PEP 3rd harmonic at least 50 db below PEP
Signal/distortion Ratio:	1.75-30 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

TABLE 1-1. ELECTRICAL CHARACTERISTICS, SBT-1K(V) (cont)

Safety Features:	a. Full interlock protection b. 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%
Power Consumption:	2,120 watts average

SECTION 2

INSTALLATION

2-1. INTRODUCTION.

Each SBT-1K(V) transmitter has been tested and calibrated as a complete system before shipment. Upon shipment it is disassembled and packed into crates. It is only necessary to unpack and reassemble the equipment as outlined in the following paragraphs. Recalibration of the individual rack mounted units is not necessary.

2-2. INITIAL INSPECTION.

The complete SBT-1K(V) will arrive in crates containing components as listed in table A in the Appendix section of this manual. Inspect each crate and its contents immediately for possible damage. Unpack the equipment carefully. Inspect all packing material for parts which may have been shipped as "loose items". With respect to damage to the equipment for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

2-3. RACK INSTALLATION.

a. LOCATION.- Adequate ventilation must be provided; operation of the transmitter in a poorly ventilated room will cause the surrounding temperature to become too high. The room (or van), in which the SBT-1K(V) is located, should have a ceiling height of at least 8 feet. A clearance of about two feet at the rear of the rack is needed for opening the service door. The distance between the transmitter and antenna is not critical,

due to the antenna tuning system feature in the SBT-1K(V). The ATS-TU-2 Tuner (part of ATS-2 Tuning System) is a weatherproof unit mounted adjacent to the antenna as described in paragraph 2-7k.

b. INSTALLATION.- Refer to figure A in Appendix. The four threaded holes on the top side of the rack and the four eyebolts included in the shipment are for lifting the rack with a crane hoist. The base-mounted rack is bolted to its own base. In the shock-mounted model, the four threaded holes in the two channels in the bottom of the rack are for the 4 shock mounts at the bottom. The two holes in the rear rack wall near the top edge are for the two top shock mounts. To install the shock-mounted model, rather than drill all 6 holes at once, first use the base shock-mount pattern in figure A (Appendix) for drilling in the floor or mounting base. Then hoist the rack onto the base mounts, assemble the transmitter and allow it to settle with its own weight before drilling for the two top shock-mounts. The two holes in the structure may then be matched to the transmitter in its static position thus ensuring a good shock-mount installation.

2-4. MODIFICATION FOR 230 VAC LINE.

a. GENERAL.- The SBT-1K(V) is factory-wired for 115 VAC 50/60 cycle, single phase line voltage unless specified as otherwise on order. If line voltage is 230 VAC 50/60 cycle, single phase, refer to paragraphs 2-4b through 2-4g for modi-

fication of SBT-1K(V) wired for 115 VAC.

b. PAL-1K(M). - Referring to figure 2-1a, relocate wiring connections at CB701 circuit breaker and T701 transformer in the PS-4A Low Voltage Power Supply. Relocate wiring connections at T401 transformer in the PS-5 High Voltage Supply as shown in figure 2-1b. Do not change any fuse values.

c. SBE-6. - Relocate jumpers at T401 and T402 transformers in the SBE Power Supply unit as shown in figure 2-1c. Replace 3-amp MAIN fuse (F402) cartridge with a 1-1/2 amp fuse cartridge (TMC part number FU-102-1.5). Replace 2-amp OVEN fuse (F401) cartridge with a 1-amp fuse cartridge (TMC part number FU-102-1). Relocate jumpers at TB101 oven heater terminal block in the SBE-6 exciter unit as shown in figure 2-1d.

d. VOX-5. - Relocate wiring jumpers at T101 transformer and oven heater circuitry as shown in figure 2-1e. Replace 3-amp OVENS fuse (F101) cartridge with a 1-1/2 amp fuse cartridge (TMC part number FU-100-1.5). Replace 2-amp POWER fuse (F102) cartridge with a 1-amp fuse cartridge (TMC part number FU-100-1).

e. ATS-2. - Relocate jumpers at E101 terminal block in ATS-MCU-2 Monitor Control Unit as shown in figure 2-1f. Replace 2-amp fuse (F101) cartridge with a 1-amp fuse cartridge (TMC part number FU-100-1).

f. APP-4. - Change bus straps at CB501 as shown in figure 2-1g.

2-5. ASSEMBLY OF TRANSMITTER.

Install components as shown in figure 1-1 and make cable connections as shown in figure B in Appendix. In some cases, some of the smaller parts may be assembled in shipment. The AX-198 RF Output Chassis arrives installed in the rack. ATS-CU-2 Directional Coupler mounts on the AX-198 RF Output Assembly cover by its own connectors and E203 output terminal on RFD-2 Amplifier automatically couples with E602 connector on AX-198 when the RFD-2 unit is pushed all the way into the rack (see figure 2-5). The RFD-2, PS-4A, SBE-6 and VOX-5 units are slide-mounted. The SBE-6 Power Supply, ATS-MCU-2 Monitor Control Unit and APP-4 Auxiliary Power Panel are mounted by their front panels. Follow this general procedure for installing the slide-mounted units (see figure 2-2):

(1) Set the component in position on the tracks.

(2) Slide the component on the tracks until the release button catches.

(3) Press the release buttons and push the component into the rack until the release buttons engage the holes in the equipment.

(4) When all the components have been installed and cabled, press the release buttons and push the component into the rack. To prevent the cables extending from the RFD-2 Amplifier and PS-4A Low Voltage Power Supply from snagging, utilize the take-up reels mounted at the top of the AX-198 RF Output Chassis above the service door and

in the right frame of the service door, respectively. The PS-5 High Voltage Power Supply mounts at the bottom of the rack. The two channels on the bottom of the PS-5 mate with the two channels on the rack floor to provide tracks. Slide the unit into the rack on the tracks and secure by panel mounting screws. The PS-5 channels have slots in the rear which engage with two threaded studs in the rack channels. Secure these two points by tightening the nuts on the studs.

2-6. INITIAL ADJUSTMENTS.

The SBT-1K(V) has been factory tested and adjusted before disassembly for crating. No initial adjustments of chassis-mounted variable components are necessary before operation.

2-7. CONNECTION OF EXTERNAL EQUIPMENT.

a. INTRODUCTION.- The APP-4 Auxiliary Power Panel is a standard modular unit present in all of the SBT-1K series of transmitters. Besides functioning as a distributor for line voltage, it contains wiring enabling connections for many variations of equipment external to the SBT-1K and remote control features. Except for antenna and receiver connections at J609 and J606 on the AX-198 RF Output Chassis and MIKE connection on the SBE-6 panel, all external connections may be made at two terminal blocks, E501 and E502, located at the rear of APP-4. Figure 2-3 and the following paragraphs illustrate the possible external connections to SBT-1K(V).

b. REMOTE TRANSMITTER PLATE RELAY.- Terminals 1 and 2 of E501 are provided for attachment to the coil of a relay supplying plate voltage to an additional stage of RF amplification external to the SBT-1K(V), if required. Such a relay might be employed in larger transmitter systems of which the SBT-1K(V) would be a sub-assembly. The connection enables control of the entire transmitter system either by means of the XMTR OFF/ON switch at the SBE-6 control panel or by the voice-operated control (VOX) feature (see paragraphs 3-3 and 4-4).

c. REGULATED 115 VAC.- Terminals 3 and 4 are available for an extension source of the regulated 115 VAC generated in the PS-4A Low Voltage Power Supply, if required.

d. EXTERNAL INTERLOCKS.- Terminals 5, 6, 7 and 8 are provided for connection of additional safety interlock/s external to the SBT-1K(V) transmitter (see paragraph 4-4), if required. Such additional interlock/s will be in series with the SBT-1K(V) interlocks and form another link in the interlock circuit. When these terminals are not used in this way, the jumpers across all 4 terminals remain in place.

e. PUSH-TO-TALK SYSTEM.- Terminals 9 and 10 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 SBE-6 unit (see paragraph 3-3).

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

g. AUDIO INPUT - CHANNELS 1 AND 2. - Terminals 13 through 20 are provided for the attachment of two separate sources (or channels) of intelligence. Each channel connection represents 600-ohms impedance. Figure 2-3 illustrates connections for either balanced or unbalanced inputs.

h. KEY LINE. - Terminals 21 and 22 are provided for the attachment of a keying device in CW mode of transmission. Pushing down on key grounds the cathode circuit of V118 1st RF Amplifier in the SBE-6 exciter unit, enabling it to operate.

i. RECEIVER MUTING. - Terminals 23, 24 and 25 are provided for a receiver muting feature. The purpose of this feature is to automatically disable the receiver when the transmitter is sending and enable it when the transmitter is set to STANDBY condition by means of the PS-4A TRANSMITTER VOLTAGES switch. Terminals 23 and 24 make contact with each other through a relay (K601) in AX-198 RF Output Chassis to enable the receiver when the transmitter is off (terminals 24 and 25 are disconnected). When transmitter is on (with TRANSMITTER VOLTAGES switch at ON), K601 relay connects terminals 24 and 25 to disable the receiver (terminals 23 and 24 are disconnected).

j. RESERVED TERMINALS.- Terminals 26 through 32 of E502 are present in all standard APP-4 Auxiliary Power Panels for the interconnection (within certain models of the SBT-1K series) of necessary equipment for FSK (Frequency Shift Keying) and FAX (Facsimile) modes of transmission. Since the SBT-1K(V) transmitter does not transmit FSK and FAX, these terminals are not used for external connections.

k. ANTENNA.- The ATS-2 Antenna Tuning System consists of Model ATS-MCU-2 Monitor Control Unit, Model ATS-CU-2 Directional Coupler and Model ATS-TU-2 Tuner. Refer to figure 2-5. The major unit, ATS-MCU-2, is mounted at the top of the rack. The AX-198 RF Output Chassis is mounted directly behind ATS-MCU-2 on the inside rack wall above the rear door. The ATS-CU-2 Directional Coupler is mounted on the AX-198 box, attached by its electrical connectors (see paragraph 2-5). The AX-198 will arrive in shipment installed in the rack. The ATS-TU-2 Tuner, however, is installed adjacent to the antenna and the following directions for connecting the antenna also include installation of the Tuner.

Refer to figure 2-4, Antenna Installation Diagram. AX-198, ATS-CU-2 and ATS-MCU-2 are shown already installed in the rack. To connect SBT-1K(V) to the antenna, it is necessary to install (1) the ATS-TU-2 Tuner, (2) a cable from AX-198 to the Tuner, (3) a cable from ATS-MCU-2 to the Tuner and (4) a cable from the Tuner to the antenna.

Install ATS-TU-2 Tuner in such a position that the cable running between E202 bowl connector on the Tuner and the antenna will not exceed 27 inches in length. The Tuner (see figure C in Appendix for mounting dimensions) is designed for outdoor installation and has two watertight terminal tubes for cable entry from the transmitter.

Cable assembly CA-484 is supplied for connection of the ATS-TU-2 output to the antenna. The terminal on one end fits the E202 bowl connector on ATS-TU-2. Cut the free end of the cable to fit the installation; do not allow length to exceed 27 inches.

Manufacture and install cable to run from J609 receptacle on AX-198 to E203 terminal in ATS-TU-2. Use RG-8/U coaxial cable (not supplied) and TMC #PL-150 plug (supplied).

NOTE

Do not substitute another plug for PL-150. This plug has a special flange that pushes in a plunger, when coupled to J609 on AX-198, thereby closing one of the interlock microswitches necessary for operation of the transmitter.

Pass the cable out of the transmitter rack through any of the four knockout holes in the top of the rack. Use TMC #PO-182 watertight tube (supplied) to bring the cable into the Tuner. Detailed directions for installing the watertight tubes are included in the ATS-2 manual, in Section 2.

If either CA-541 (plain) or CA-729 (armored) cable assembly has been supplied (on special order) install this cable between J101 receptacle at ATS-MCU-2 and E201 terminal block in ATS-TU-2. If this cable has not been supplied, the SBT-1K(V) shipment will include the following parts for making one:

Qty	TMC Part No.	Name
1	MS3106A20-27P	Plug (P101)
1	MS3057-12A	Cable Clamp
10	TE-120-2	Terminal Lug

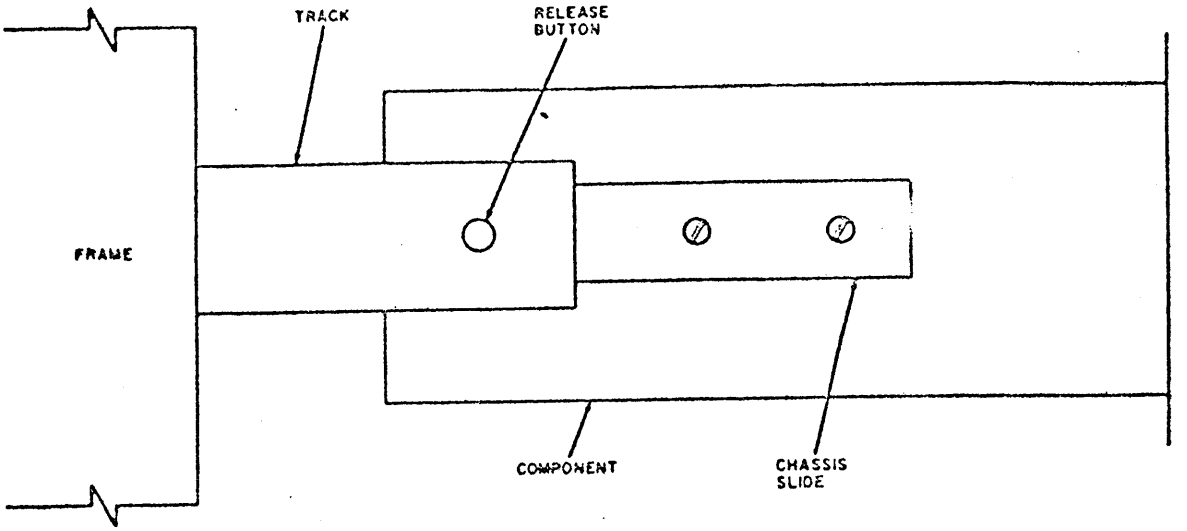
Wire cable in accordance with figure D (in Appendix). Connect cable as shown in figure 2-4, passing it through a knockout hole in the top of the rack and using #PO-181 watertight tube for entry into the ATS-TU-2 tuner. Referring to wire numbers shown in figure D, wire #1 is connected to terminal #1 of E201, wire #2 is connected to terminal #2, etc.

1. TRANSMITTER/RECEIVER ANTENNA.- RF receptacle J606 on the AX-198 RF Output Chassis and mating plug TMC #UG-260/U are provided for connecting the transmitting antenna to a receiver input, thus making the transmitting antenna double for a receiving antenna. With this connection, K601 antenna relay in AX-198, actuated by the PS-4A Low Voltage Power Supply TRANSMITTER VOLTAGES STANDBY/ON switch, switches the antenna from transmitter to receiver system 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

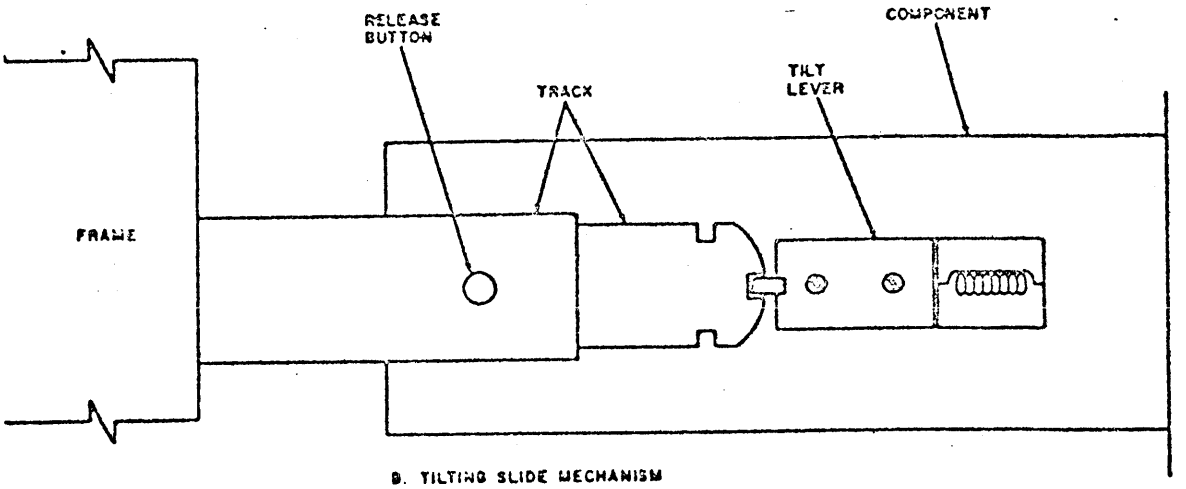
the transmitter and connected to the receiver.

m. MIKE. - The MIKE jack on the SBE-6 control panel is for the connection of a 50,000-ohm high impedance crystal or dynamic microphone. If microphone has a push-to-talk button on it, see paragraph 2-7e for wiring in this feature.

n. EXTERNAL ALDC. - When the ALDC switch located at the rear of RFD-2 Amplifier is placed in INT position, the output of the amplifier acts on its own input stage to effect ALDC (automatic load and drive control). When the ALDC switch is placed in EXT position, the ALDC signal is, instead, routed to the SBE-6 exciter to control its output level. The latter position (EXT) is preferable when the RFD-2 is used in the SBT-1K(V), since it is more effective in preventing overdrive conditions in the RFD-2.



A NON-TILTING SLIDE MECHANISM



B. TILTING SLIDE MECHANISM

Figure 2-2. Slide-mounting Details

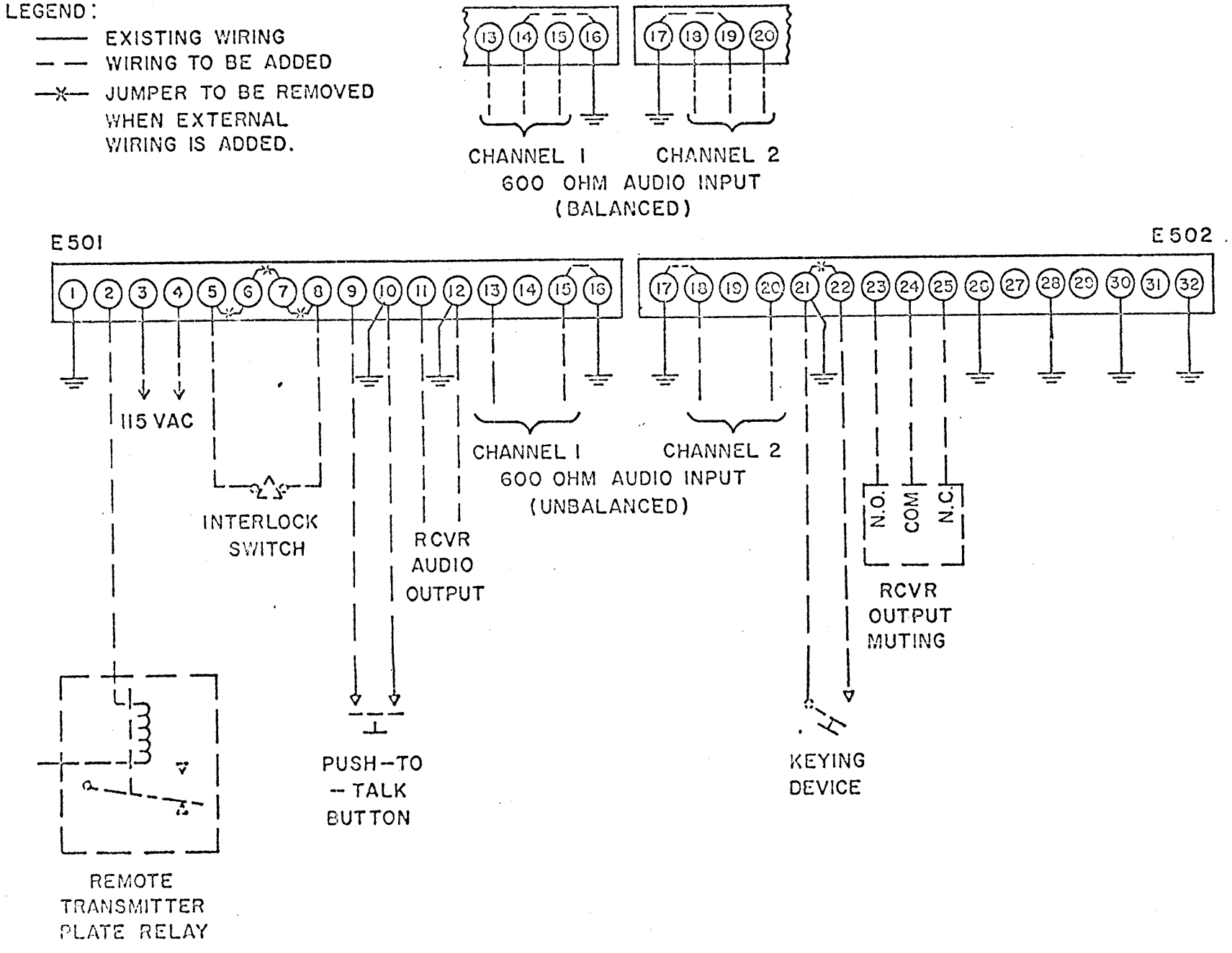


Figure 2-3. Connection Diagram, External Equipment to SBT-1K(V)

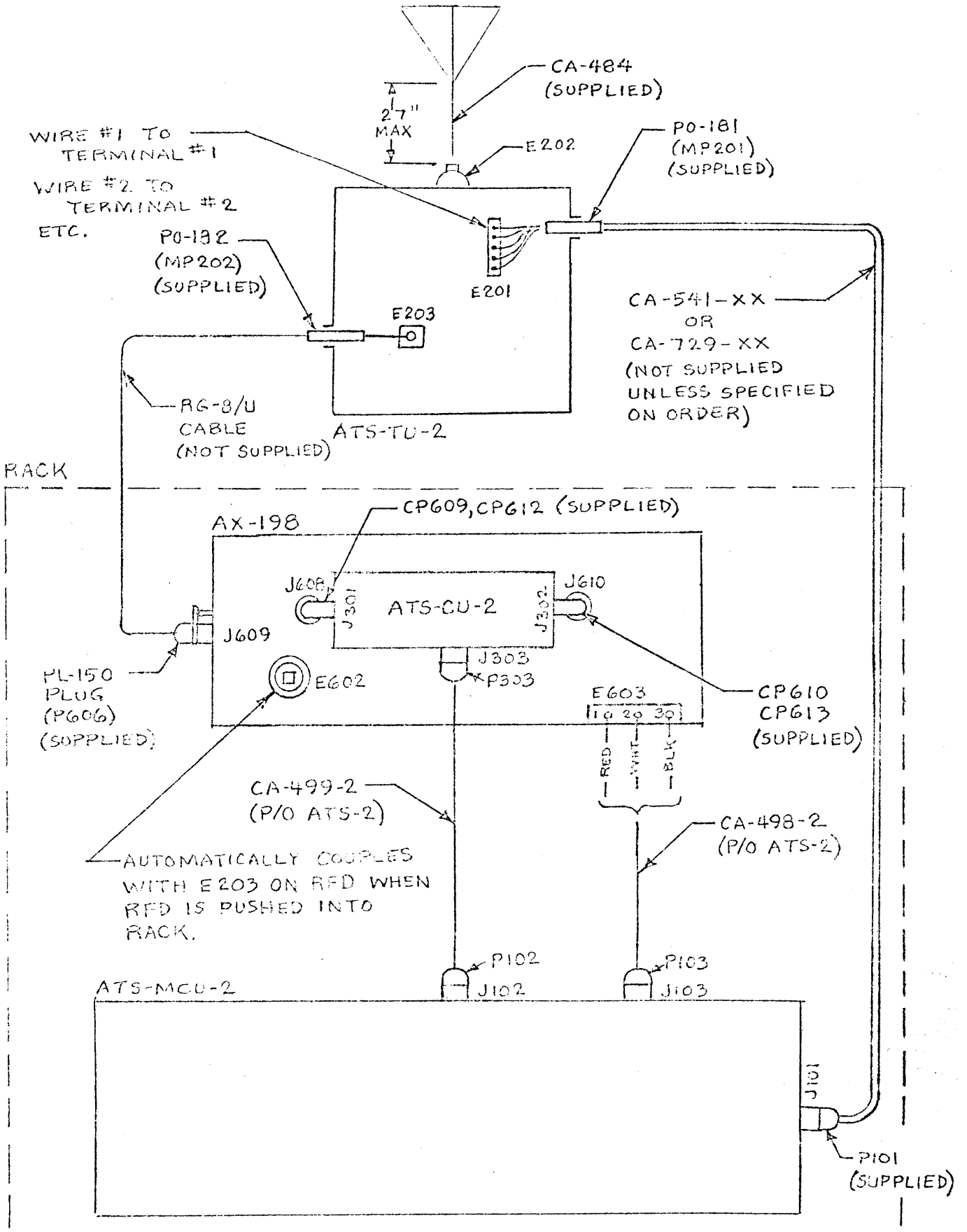


FIGURE 2-4. ANTENNA INSTALLATION DIAGRAM

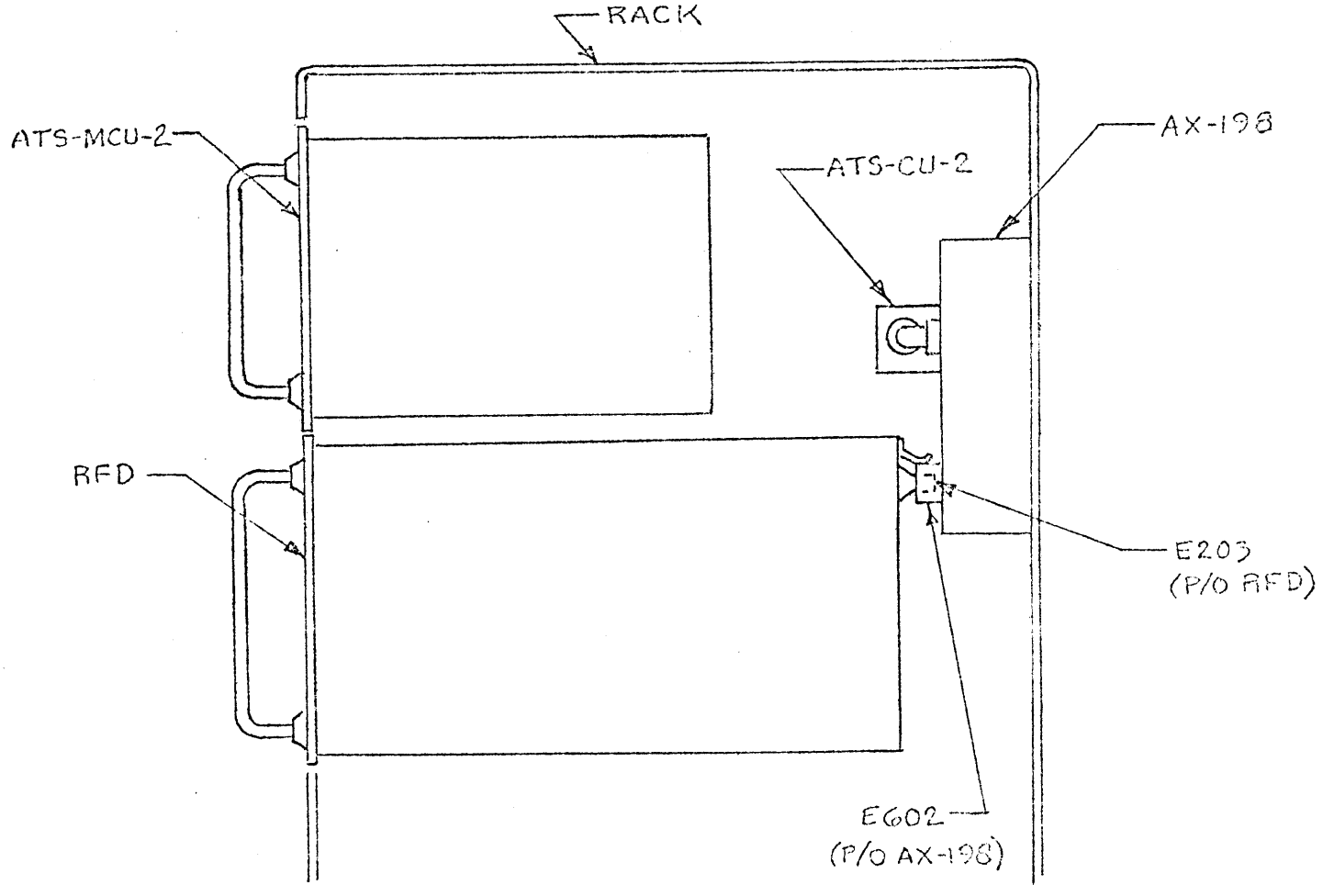


FIGURE 2-5. INSTALLATION OF ATS-2 & RFD UNITS IN RACK, SIDE VIEW

SECTION 3

OPERATOR'S SECTION

3-1. PRELIMINARY CONSIDERATIONS.

a. GENERAL. - Before proceeding to "turn on", tune or operate the SBT-1K(V) transmitter, certain preliminary considerations should be taken in order to protect equipment and personnel and to save time in tuning. The considerations are:

(1) Modes of Transmission

(2) Functions of Components

(3) Functions of Controls

(4) Warm-up Time for Frequency Stability

(5) Power Amplifier Tube Protection

(6) Safety Interlock System

b. MODES OF TRANSMISSION. - There are six modes of transmission available. These are:

(1) CW (Keyed Carrier)

(2) SSB (Single Sideband) with fully suppressed carrier

(3) SSB (Single Sideband) with partial carrier

(4) ISB (Independent Sidebands) with fully suppressed carrier

(5) ISB (Independent Sidebands) with partial carrier

(6) AM (Both sidebands with full carrier)

The operator should inspect the connection points outlined in paragraphs 2-7b through 2-7n to establish that the

appropriate external equipment is attached to the SBT-1K(V). For the CW mode, the key line connection is required. For AM and sideband modes, either the mike connection or audio input (channels 1 and/or 2) connection is required. In addition, other connections (ie: receiver squelch, receiver muting, transmitter/receiver antenna, push-to-talk, etc.) result in variations of operation, as described in paragraph 3-3.

c. FUNCTIONS OF COMPONENTS. -

(1) All Modes: Refer to figure 4-1, Functional Block Diagram. In all modes of transmission, the carrier is tuned up first, even though it may be suppressed in transmission, as in some sideband modes. The carrier is generated by the SBE-6 and VOX-5 and amplified by the PAL-1K(M). The ATS-2 matches the impedance of the transmitter output to the antenna to a highly accurate degree and contains an indicator which shows forward and reflected power and VSWR, simultaneously, for this purpose.

(2) CW Mode. - A head keyer enables and disables the SBE-6.

(3) SSB Mode. - An audio signal from CHANNEL 1, CHANNEL 2 or MIKE input is injected into either the upper or lower sideband at SBE-6. The carrier is either suppressed or adjusted to some percentage and the signal is stepped up into the 1.75 to 32 megacycle range and amplified by the PAL-1K(M).

(4) ISB Mode. - Two separate audio intelligence sources from CHANNELS 1, 2 or MIKE input at SBE-6 are injected into

upper and lower sidebands. The carrier is either suppressed or adjusted to some percentage and the signals take the same course as in SSB.

(5) AM Mode. - An audio signal from CHANNEL 1, CHANNEL 2 or MIKE input at the SBE-6 modulates the carrier. The signal is stepped up into the 1.75 to 32 megacycle range and amplified by PAL-1K(M).

d. FUNCTIONS OF CONTROLS. - Refer briefly to the Operator's Section of the PAL-1K(M), SBE-6, VOX-5 and ATS-2 manuals for control functions. Since only the variable 2-4 mc master oscillator portion of the VOX-5 is used, the following VOX-5 controls are ineffective on the SBT-1K(V):

HFO/ON switch	HFO/BAND MCS switch
IFO/ON switch	HFO/XTAL FREQ knob
BFO/ON switch	HFO/XTAL/VMO/1/2/3 switch
HFO/TUNING knob	HFO/OUTPUT knob

e. WARM-UP TIME FOR FREQUENCY STABILITY. - Temperature sensitive frequency determining components for the SBT-1K(V) are located in ovens in the VOX-5 and SBE-6 units. After the frequencies are set, the transmitted frequency will remain within the rated stability only if the oven temperatures have become stabilized. The procedure, therefore, is to turn on the ovens and allow a 48-hour period of warm-up for temperature stabilization before tuning the transmitter. If, after operating the transmitter, it is intended to use it again soon, a consequent repetition of the warm-up period may be eliminated by placing the transmitter in "standby"

condition as described in paragraph 3-4b. This turns off all power except to the oven elements and thermostats.

To turn the SBE-6 and VOX-5 ovens on for the initial warm-up period, set switches in positions as follows:

Module	Switch	Position
VOX-5	POWER/ON	ON
SBE-6	POWER ON/OFF	ON
APP-4	MAIN POWER ON/OFF	ON

VOX-5 MAIN POWER lamp, INNER OVEN lamp, OUTER OVEN lamp, SBE-6 Power Supply lamp, SBE-6 exciter OUTPUT TUNING dial and OVEN lamp, and APP-4 MAIN POWER lamp will light. The VOX-5 INNER OVEN and OUTER OVEN lamps and the SBE-6 OVEN lamp will remain lighted for several hours and then commence to cycle (on and off). Leave controls in this position for 48 hours before tuning the transmitter.

f. POWER AMPLIFIER TUBE PROTECTION. - The PA tube located in the RFD-2 Amplifier should not be powered up and down rapidly or inadvertently; this may result in too-rapid heat changes in the tube and shorten the life of the tube. A systematic procedure of tuning, operating and "shut-down" procedure should be adhered to as described in this section.

g. SAFETY INTERLOCK SYSTEM. - A series of mechanical and electrical interlock points run through the SBT-1K(V) system. If all the interlocks are closed, the transmitter can operate. If any one of the interlocks open, the high voltages are shut off and the transmitter cannot operate. The purpose of this system is to protect personnel from

shock and protect the equipment from overload conditions, rack blower failure, arcing at PA BAND switch and no load conditions (see table 4-1).

Before tuning the transmitter, check to ensure that the following conditions exist: -

(1) RFD-2 Amplifier is secured in rack.

(2) PS-5 High Voltage Power Supply is secured in rack.

(3) Top and bottom covers of RFD-2 are secured in position.

(4) Top cover of PS-5 is secured in position.

(5) PS-5 blower door is closed on front panel.

(6) Cable to ATS-TU-2 Tuner is connected at J609 receptacle on AX-198 RF Output Chassis in rack (above rear door).

(7) Either antenna or dummy load is connected to E202 bowl connector on ATS-TU-2 Tuner.

(8) Rear door on rack is securely closed.

WARNING

Do not attempt to override any part of the interlock system, in order to inspect the interior of the transmitter, once it has been turned on. Extremely dangerous voltages are present.

3-2. TUNING PROCEDURE.

a. TUNING TABLES. - Table 3-1 outlines the procedure for tuning the transmitter for the carrier frequency. In all modes of transmission the carrier is tuned first, even though it may be suppressed in transmission as in some of the sideband modes. Tables 3-2 through 3-5

include additional steps for tuning CW, SSB, ISB and AM modes.

b. GENERAL NOTES ON TUNING.

(1) Setting VOX-5 Frequency. - When the SBT-1K(V) output carrier frequency has been determined, the following method is used to calculate the VOX-5 2-4 mc output frequency:

Where F_c = SBT-1K(V) output carrier frequency (in mc)

Where N* = SBE-6 BAND MCS dial setting (bottom figure under range in which F_c falls)

Where F_{vox} = VOX-5 output frequency, ie: setting as it appears on MASTER OSCILLATOR FREQUENCY counters (in mc)

When F_c falls within 1.75- to 4.25-mc range:

$$F_{vox} = F_c + .250$$

When F_c falls within 4.25- to 32.25-mc range:

$$F_{vox} = 2N + .250 - Fc$$

Example: - The carrier frequency F_c = 10 megacycles. When SBE-6 BAND MCS dial is rotated to the 8.25-10.25 range, "6" appears as bottom figure. VOX-5 setting is then calculated as follows:

$$F_{vox} = 2N + .250 - F_c$$

$$F_{vox} = 12 + .250 - 10 = 2.250 \text{ megacycles}$$

Example: - The carrier frequency F_c = 3 megacycles. In the 1.75- to 4.25-mc range, the "2N" term is not used and the

---

*Obtain "N" by rotating SBE-6 BAND MCS dial setting to obtain frequency range reading in which F_c falls. "N" figure is printed directly below range.

VOX-5 setting is calculated as follows:

$$F_{vox} = F_c + .250$$

$$F_{vox} = 3 + .250 = 3.25 \text{ megacycles}$$

(2) SBE-6 Output Level Settings. - When tuning the SBE-6, avoid exceeding the "100%" marking on the SBE-6 output meter, whether sending one sideband, both sideband and carrier. Considerable distortion from intermodulation may result otherwise.

(3) Voice Operated Transmission. - The SBE-6 VOX GAIN knob (not to be confused with the VOX-5) is for setting up the transmitter for voice-operated on-off control after the transmitter has been tuned. It may be used in SSB transmission in which the carrier component does not exceed 30% of PEP (peak envelope power). Procedure for setting the VOX GAIN knob is described in table 3-3.

(4) Tuning Charts. - The "tuning chart", mentioned in step 20 in table 3-1, is a separate sheet included in the SBT-1K(V) shipment. The purpose of the tuning chart is to give starting points for the RFD-2 PA TUNING and PA LOADING knobs and PA LOADING switch in order to save time. These starting points depend upon the frequency being transmitted. They also vary from unit to unit and therefore the individual tuning chart for each transmitter is packed separately. The chart is made up for purposes of factory-testing the RFD-2 amplifier operating into a certain load with various associated TMC equipment. Therefore, in the tuning operation, only four columns are used, interpreted as follows:

Tuning Chart Column	Reference in Table 3-1
SBE FREQ MCS	F_c
TWO TONE TEST IPA TUNING	PA TUNING knob (RFD-2)
TWO TONE TEST IPA LOADING	PA LOADING knob (RFD-2)
TWO TONE TEST IPA LOAD POS	PA LOAD switch (RFD-2)

TABLE 3-1. TUNE-UP FOR CARRIER, SBT-1K(V)

STEP	MODULE	OPERATION
1	----	Install jumper across terminals 21 and 22 on terminal block E502 on the rear of APP-4. Perform check on safety interlock system per paragraph 3-1f. If transmitter has been shut off completely, perform 48-hour warm-up of ovens per paragraph 3-1d.
2	ATS-MCU-2	POWER switch to OFF.
3	RFD-2	ALDC knob fully ccw.
4	VOX-5	ON/BEAT switch down (off).
5	SBE-6	VOX GAIN and SQUELCH GAIN knobs fully ccw. XMTR/ON/OFF switch to OFF. LSB/OFF/CH 1/CH 2/MIKE and USB/OFF/CH 1/CH 2/MIKE switches to OFF. CARRIER INSERT and OUTPUT knobs fully ccw.
6	PS-4A	PA OVERLOAD/PLATE, PA OVERLOAD/SCRN GRID and PA OVERLOAD/CONT GRID circuit breakers to ON. FINAL VOLTAGES switch to OFF. TRANSMITTER VOLTAGES switch to STANDBY. MAIN POWER switch to ON.

TABLE 3-1. TUNE-UP FOR CARRIER, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
7	PS-4A	Check PA FIL PRI meter for a reading within the red mark on the dial. If necessary, make adjustment with PA FIL PRI ADJUST switch to bring reading within red mark.
8	RFD-2	Set MULTIMETER switch to PA DC BIAS V x 10 and observe MULTIMETER. Indication should be around 100 on red scale.
9	PS-4A	Set TRANSMITTER VOLTAGES switch to ON. TRANSMITTER VOLTAGES lamp should light, if 3 minutes have elapsed since MAIN POWER circuit breaker was switched to ON (step 6). Set FINAL VOLTAGES switch to ON. FINAL VOLTAGES lamp should light.
10	RFD-2	Set MULTIMETER switch to PA DC SCREEN V x 10 and observe MULTIMETER. Indication should be 500 on green scale. Set MULTIMETER switch to PA DC PLATE V x 100 and observe MULTIMETER. Indication should be about 3000 on black scale. Observe PA PLATE CURRENT meter. Indication should be around 220 milliamperes.
11	PS-4A	Set FINAL VOLTAGES switch to OFF. FINAL VOLTAGES lamp will go out. Set TRANSMITTER VOLTAGES switch to STANDBY. TRANSMITTER VOLTAGES lamp will go out.
12	SBE-6	BAND MCS switch to bring carrier frequency (F_c) range on BAND MCS dial.

TABLE 3-1. TUNE-UP FOR CARRIER, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
13	VOX-5	Compute VOX-5 frequency setting (F_{VOX}) based on F_c (carrier frequency) as described in paragraph 3-2b (1). BEAT switch to ON. ZERO BEAT lamp will light. Turn MASTER OSCILLATOR FREQUENCY knob to bring counter reading up to nearest 50-kc increment below F_{VOX}. Then adjust CALIBRATE knob to point that causes ZERO BEAT lamp to blink as slowly as possible.* Lock CALIBRATE knob with LOCK disc. Turn MASTER OSCILLATOR FREQUENCY knob to bring counter readings up to F_{VOX}. Lock with LOCK knob. Set BEAT switch to OFF. ZERO BEAT lamp will go out.
14	RFD-2	DRIVER BAND and PA BAND knobs for F_c range.
15	SBE-6	MF XTAL switch to VMO. LSB and USB GAIN knobs fully ccw. OUTPUT knob to 0. EXCITER switch to ON. EXCITER lamp will light. CARRIER INSERT knob fully cw. METER SW switch to MF. Set MF TUNING knob to bring reading on lower half of main tuning dial to equal VOX-5 MASTER OSCILLATOR FREQUENCY setting. Set center part of OUTPUT TUNING knob to appropriate range reading for F_c. Set outer disc of OUTPUT TUNING knob to bring reading on upper half of main tuning dial to equal a point slightly lower than F_c. Then readjust MF TUNING knob to obtain peak on output meter. If necessary, decrease CARRIER INSERT knob setting to avoid an off-scale reading. Lock MF TUNING knob with LOCK

*If preferred, headset at PHONES jack may be used to detect "zero beat" point.

TABLE 3-1. TUNE-UP FOR CARRIER, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
15 (cont)		disc. Set METER SW switch to RF. Turn up OUTPUT knob slightly to obtain indication on output meter. Adjust center part of OUTPUT TUNING knob to obtain peak on output meter. Return OUTPUT knob to 0.
16	PS-4A	TRANSMITTER VOLTAGES switch to ON. TRANSMITTER VOLTAGES lamp will light.
17	RFD-2 SBE-6	MULTIMETER switch to RF 1ST AMPL PLATE V x 1. Turn up SBE-6 OUTPUT knob slightly to obtain an indication on MULTIMETER black scale. Adjust 1ST AMPL TUNING knob for peak on MULTIMETER.
18	RFD-2 SBE-6	MULTIMETER switch to RF PA GRID V x 10. Adjust SBE-6 OUTPUT knob to obtain an indication on MULTIMETER red scale. Adjust PA GRID TUNING knob for peak on MULTIMETER.
19	SBE-6	Return OUTPUT knob to 0.
20	RFD-2	Refer to tuning chart shipped with SBT-1K(V) (see paragraph 3-2b (4). Set PA TUNING knob, PA LOADING knob and PA LOADING switch to positions indicated on chart for F_c.
21	ATS-MCU-2	Set POWER switch to SHORT. Set METER switch to HUM and note reading on meter. Refer to table 3-3 (35-Foot Whip Antenna Measurements) and note 1-6 figure as indicated in "Suggested Ant. Res. Position" column as applies to F_c as indicated in "MC" column,

TABLE 3-1. TUNE-UP FOR CARRIER, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
21 (cont)		for high or low humidity as noted on meter reading. Holding METER switch in RES position, depress RESISTANCE-OPERATE button for 2 seconds, release, and observe meter. Repeat until 1-6 figure (indicated in table 3-3) reading appears on meter. Release METER switch and allow it to return to REACT position. Then, observing meter, operate REACTANCE switch to INCR and DECR to insure that meter needle follows. Set POWER switch to X1. Set TUNE/OPERATE switch to TUNE.
22	PS-4A	FINAL VOLTAGES switch to ON. FINAL VOLTAGES lamp will light.
23	RFD-2	MULTIMETER switch to PA DC SCREEN MA x 1.
24	RFD-2 SBE-6	Observing RFD-2 PA PLATE CURRENT meter, turn SBE-6 OUTPUT knob slowly clockwise until slight increase occurs in meter reading.
25	RFD-2 ATS-MCU-2	Observing RFD-2 PA PLATE CURRENT meter, adjust PA TUNING knob until a pronounced dip occurs in meter reading. Indication should be obtained on ATS-MCU-2 power meter.
26	ATS-MCU-2 SBE-6	NOTE Do not allow indication on power meter to exceed 1/3 scale. Adjust SBE-6 OUTPUT knob as required to obtain 1/3 scale indication. If 100 watts is exceeded, ATS-MCU-2 overload relays will trip, shutting off transmitter. If this occurs,

TABLE 3-1. TUNE-UP FOR CARRIER, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
26 (cont)		NOTE (cont) turn SBE-6 OUTPUT knob clockwise, press RESET button and go back to step 24.
27	ATS-MCU-2	Observing power meter, operate REACTANCE switch towards INCR or DECR, as required, to obtain lowest REFLECTED-WATTS and VSWR indications.
28	ATS-MCU-2	Observing power meter and using RESISTANCE/OPERATE switch and REACTANCE switch as outlined in steps 21 and 27 respectively, tune ATS-MCU-2 for lowest VSWR in each resistance position (1, 2, 3, 4, 5 and 6). Retune ATS-MCU-2 to position that provides lowest VSWR: note resistance position for future reference.
29	SBE-6	Return OUTPUT knob to 0.
30	PS-4A	FINAL VOLTAGES switch to OFF.
31	ATS-MCU-2	TUNE/OPERATE switch to OPERATE. POWER switch to X10.
32	PS-4A	FINAL VOLTAGES switch to ON.
33	RFD-2 SBE-6	Observing RFD-2 PA PLATE CURRENT meter slowly turn SBE-6 OUTPUT knob clockwise to obtain approximately 300 ma on meter. Note PA DC SCREEN x 1 indication on RFD-2 MULTIMETER.
34	RFD-2	Observing PA PLATE CURRENT meter, adjust PA LOADING knob until meter reading begins to rise.

TABLE 3-1. TUNE-UP FOR CARRIER, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
35	RFD-2	Observing PA PLATE CURRENT meter, adjust PA TUNING knob for dip in reading.
		NOTE When performing step 36, adjustment of PA TUNING knob causes less dip in PA PLATE CURRENT meter (noted in step 35) as loading is increased.
		CAUTION At no time during final adjustment (step 36) should screen grid current (registering on RFD-2 MULTIMETER) be allowed to exceed full scale. If PAL-1K(M) turns off automatically as a result of PA overload (indicated by circuit breakers and TRANSMITTER VOLTAGES and FINAL VOLTAGES lamps), reduce SBE-6 OUTPUT knob setting before resetting associated circuit breakers.
36	SBE-6 RFD-2 ATS-MCU-2	Repeat steps 33, 34 and 35 until desired output power (indicated on FORWARD WATTS scale of ATS-MCU-2 power meter) is obtained with minimum drive (indicated on SBE-6 output meter). Note PA DC SCREEN MA x 1 reading on RFD-2 MULTIMETER. RFD-2 PLATE CURRENT readings will increase.
		NOTE Assuming a VSWR of 1.5 or less, proper tuning and loading for 1000 watts output power should show: -

TABLE 3-1. TUNE-UP FOR CARRIER, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
36 (cont)		NOTE (cont) FORWARD-WATTS - - - - - approximately 1000 REFLECTED-WATTS- - - - -approximately 50 PA DC SCREEN MA x 1 on MULTIMETER - - - - approximately 50 ma or less PLATE CURRENT - - - - - approximately 650 ma
37	SBE-6	Return OUTPUT knob to 0.
38	ATS-MCU-2	POWER switch to SHORT.

TABLE 3-2. TUNING PROCEDURE FOR CW, SBT-1K(V)

STEP	MODULE	OPERATION
1	-----	Perform 38 steps as described in table 3-1, Tune-up for Carrier, with a closed keyer in place of the jumper across terminals 21 and 22 on terminal block E502 on the rear of APP-4.
2	-----	Manipulation of key enables/disables SBE-6's first r-f amplifier, generating keying of carrier.

TABLE 3-3. TUNING PROCEDURE FOR SSB*, SBT-1K(V)

STEP	MODULE	OPERATION
1		Perform 38 steps as described in table 3-1, Tune-up for Carrier. Note FORWARD and REFLECTED WATTS and VSWR readings in step 36.
2	PS-4A	Check to ensure that FINAL VOLTAGES switch is OFF.
3	SBE-6	USB switch to OFF. LSB switch to CH 1. LSB GAIN knob to mid-position. CARRIER INSERT knob to "0". METER SW switch to RF. Turn up OUTPUT knob to obtain usable reading on SBE-6 output meter. Adjust LSB GAIN knob to obtain maximum of 100% on test audio peaks. Then adjust CARRIER INSERT and OUTPUT knobs as follows for desired degree of carrier insertion: - For fully suppressed carrier, leave CARRIER INSERT knob at "0". For any degree of carrier insertion, use OUTPUT knob to reduce audio peaks on meter by an amount on the "%" scale equal to the carrier insertion percentage desired; then return the reading up to "100%" with the CARRIER INSERT knob. Example: For 10% carrier injection (carrier down 20-db from full power), set OUTPUT knob to obtain "90%" on audio peaks with CARRIER INSERT knob set at "0"; then rotate CARRIER INSERT knob clockwise until audio peaks rise to "100%".

* For CHANNEL 1 information sent out on LSB; for CHANNEL 2 or MIKE on LSB or USB, use corresponding controls.

TABLE 3-3. TUNING PROCEDURE FOR SSB, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
4	SBE-6	If MIKE input is used and VOX (voice-operated transmission) control is desired*, set EXCITER switch to STANDBY. Then, speaking into mike and observing EXCITER lamp, adjust VOX GAIN knob so that reasonably strong speech lights EXCITER lamp. If, when using VOX control, it is also planned to use the receiver SQUELCH feature, adjust SQUELCH GAIN knob so that extraneous noises reaching the mike from the receiver do not light EXCITER lamp.
5	SBE-6	Return OUTPUT knob to "0".
6	PS-4A	FINAL VOLTAGES switch to ON. FINAL VOLTAGES lamp will light.
7	ATS-MCU-2	POWER switch to X10. TUNE/OPERATE switch to OPERATE.
8	ATS-MCU-2 SBE-6	Observe ATS-MCU-2 power output meter and SBE-6 output meter. Using test audio or voice input, slowly increase SBE-6 OUTPUT knob setting until ATS-MCU-2 power meter indicates desired output and a satisfactory VSWR as observed in step 1. Do not advance SBE-6 OUTPUT knob to point that brings SBE-6 output meter reading beyond "100%". Lock OUTPUT knob with LOCK disc.
9	ATS-MCU-2	Set POWER switch to SHORT.
10	RFD-2	If ALDC is desired, set MULTIMETER switch to RF OUT V x 10. Using test signal and observing MULTIMETER, turn ALDC knob slowly clockwise until meter reading just begins to drop.

* VOX control is effective when carrier is suppressed to below 30% of total power.

TABLE 3-4. TUNING PROCEDURE FOR ISB*, SBT-1K(V)

STEP	MODULE	OPERATION
1		Perform 38 steps as described in table 3-1, Tune-up for Carrier. Note FORWARD and REFLECTED WATTS and VSWR readings in step 36.
2	PS-4A	Check to ensure that FINAL VOLTAGES switch is OFF.
3	SBE-6	LSB switch to CH 1. USB switch to OFF. CARRIER INSERT knob to "0". Advance LSB GAIN knob 1/4 turn clockwise from full ccw position. METER SW switch to RF. Turn up OUTPUT knob to obtain usable reading on SBE-6 output meter. Then adjust LSB GAIN knob for degree of carrier insertion desired as follows: - For full suppressed carrier, adjust knob to bring "50%" on test audio peaks on output meter. For 10% carrier insertion, adjust knob for reading of "45%" on audio peaks. For 20% carrier insertion, adjust knob for reading of "40%" on audio peaks. For other values, decrease meter reading by "5%" for each 10% increase in carrier insertion.
4	SBE-6	LSB switch to OFF. USB switch to CH 2. Advance USB GAIN knob 1/4 turn clockwise from full ccw position.
5	SBE-6	Adjust USB GAIN knob for degree of carrier insertion desired in the same manner as that for LSB GAIN in step 3.

* For CHANNEL 1 information sent on LSB and CHANNEL 2 information on USB. For reverse arrangement or for MIKE input on one channel, use corresponding controls.

TABLE 3-4. TUNING PROCEDURE FOR ISB, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
6	SBE-6	Set LSB switch to CH 1 and observe output meter. If sideband levels were previously set for fully suppressed carrier, meter should now read "100%" on audio peaks. If set for 10% carrier insertion, meter should read "90%", etc.
7	SBE-6	For fully suppressed carrier, leave CARRIER INSERT knob at "0". For any degree of carrier insertion, advance CARRIER INSERT knob to bring meter reading to "100%" on test audio peaks.
8	SBE-6	Return OUTPUT knob to "0".
9	PS-4A	FINAL VOLTAGES switch to ON. FINAL VOLTAGES lamp will light.
10	ATS-MCU-2	POWER switch to X10. TUNE/OPERATE switch to OPERATE.
11	ATS-MCU-2 SBE-6	Observe ATS-MCU-2 power output meter and SBE-6 output meter. Using test audio for both channels, slowly increase SBE-6 OUTPUT knob setting until ATS-MCU-2 power meter indicates desired output and a satisfactory VSWR as observed in step 1. Do not advance SBE-6 OUTPUT knob to point that brings SBE-6 output meter reading beyond "100%". Lock OUTPUT knob with LOCK disc.
12	ATS-MCU-2	Set POWER switch to SHORT.

TABLE 3-5. TUNING PROCEDURE FOR AM*, SBT-1K(V)

STEP	MODULE	OPERATION
1		Perform 38 steps as described in table 3-1, Tune-up for Carrier. Note FORWARD and REFLECTED WATTS and VSWR readings in step 36.
2	PS-4A	Check to ensure that FINAL VOLTAGES switch is OFF.
3	SBE-6	LSB switch to CH 1. USB switch to OFF. CARRIER INSERT knob to "0". Advance LSB GAIN knob 1/4 turn clockwise from full ccw position. METER SW switch to RF. Turn up OUTPUT knob for usable reading on SBE-6 output meter. Then adjust LSB GAIN knob to bring "25%" on test audio peaks on meter. LSB switch to OFF. USB switch to CH 1. Adjust USB GAIN knob to bring "25%" on test audio peaks on meter. Set LSB switch to CH 1 and observe meter. Reading should now be "50%" on audio peaks. If necessary, adjust OUTPUT knob to obtain 50%. Advance CARRIER INSERT knob to bring reading of "100%" on audio peaks.
4	SBE-6	Return OUTPUT knob to "0".
5	PS-4A	FINAL VOLTAGES switch to ON. FINAL VOLTAGES lamp will light.
6	ATS-MCU-2	POWER switch to X10. TUNE/OPERATE switch to OPERATE.
7	ATS-MCU-2 SBE-6	Observe ATS-MCU-2 power output meter and SBE-6 output meter. Using test audio, slowly increase SBE-6 OUTPUT knob setting until ATS-MCU-2 power meter indicates desired output and a satisfactory

* For CHANNEL 1 information; for CHANNEL 2 or MIKE, use corresponding controls.

TABLE 3-5. TUNING PROCEDURE FOR AM, SBT-1K(V) (cont)

STEP	MODULE	OPERATION
7 (cont)		VSWR as observed in step 1. Do not advance SBE-6 OUTPUT knob to point that brings meter reading beyond "100%". Lock OUTPUT knob with LOCK disc.
8	ATS-MCU-2	Set POWER switch to SHORT.
9	RFD-2	If ALDC is desired, set MULTIMETER switch to RF OUT V x 10. Using test signal and observing MULTIMETER, turn ALDC knob slowly clockwise until meter reading just begins to drop.

3-3. OPERATING PROCEDURE.

a. GENERAL. - This section describes the effect of panel controls on the transmission after the transmitter has been tuned per tables 3-1 through 3-5. On/off control of the signal, and conversations over transmitter/receiver systems are discussed here. Table 3-6 shows the seven on-off controls that may be used, associated control stationary positions, and the effects of the on and off positions. To set up the transmitter for a specific on-off control as indicated in the "on-off control column", set controls in positions indicated in "stationary control positions" column. In general, the volume or power level of the transmitted signal should be

set in the tuning procedure and the control (SBE-6 OUTPUT knob) should be locked and left alone.

CAUTION

> While operating, do not turn transmitter on and off by means of the APP-4 panel MAIN POWER circuit breaker. PA tube damage will result from too-rapid heat changes. This control is used to shut down the transmitter in the prescribed order as outlined in paragraph 3-4c.

b. CW MODE. - Operate the SBT-1K(V) transmitter with keyer attached at APP-4 E502 terminal block as described in paragraph 2-7h. While SBE-6 EXCITER switch is in ON position, the transmitter sends the single r-f frequency when the keyer is held down. Frequency is interrupted when keyer button is released. When the EXCITER switch is in STANDBY position, no carrier can be transmitted and keyer is inoperative.

c. SSB MODE. - There are 6 on-off controls to choose from when sending single sideband signals. Referring to table 3-6, it can be seen that using the SBE-6 EXCITER switch turns the exciter output on and off. This sends and interrupts the signal, respectively; however the RFD-2 amplifier voltages remain on and, in a conversation, may cause noise from the antenna to circle back through the distant receiver, distant transmitter and local receiver to make listening difficult. In this case, any one of the 5 remaining on-off controls may be used as

indicated for SSB in table 3-6. These turn off the RFD-2 amplifier voltages and disconnect the antenna with the added feature of antenna switching and receiver muting (if these connections have been made). The SBE-6 voice-operated control and push-to-talk control, besides these, also have the added effect of controlling the exciter output as well.

d. ISB MODE. - For ISB, there are 4 on-off controls available. Similar to SSB, the SBE-6 EXCITER switch interrupts the signal but leaves the RFD-2 amplifier voltages on and the antenna connected. If it is required to shut off the latter items when listening, the SBE-6 XMTR switch, PS-4A TRANSMITTER VOLTAGES switch or PS-4A FINAL VOLTAGES switch may be used instead.

e. AM MODE. - There are 5 on-off controls available for AM transmission. As in SSB and ISB, the exciter output alone may be controlled by the SBE-6 EXCITER switch. As in SSB, a push-to-talk button may be more convenient and will have the added effect of shutting off the RFD-2 amplifier voltages, antenna switching and receiver muting. Instead of the push-to-talk button, the same effects (except for exciter control) are had by the SBE-6 XMTR switch, PS-4A TRANSMITTER VOLTAGES switch or PS-4A FINAL VOLTAGES switch.

TABLE 3-6. ON-OFF OPERATING CONTROLS, SBT-1K(V)

ON-OFF CONTROL	MODES	STATIONARY CONTROL POSITIONS						EFFECT ON EQUIPMENT		INDICATION OF TRANSMISSION
		PS-4A TRANSMITTER VOLTAGES sw.	PS-4A FINAL VOLTAGES sw.	SBE-6 EXCITER sw.	SBE-6 XMTR sw.	SBE-6 VOX GAIN knob	SBE-6 SQUELCH GAIN knob	ON position	OFF (or STANDBY) position	
SBE-6 EXCITER sw.	SSB ISB AM	ON*	ON*	---	OFF	ccw	ccw	Enables SBE-6 exciter output.	Disables SBE-6 exciter output.	SBE-6 EXCITER lamp
SBE-6 XMTR Switch	SSB ISB AM	STBY	ON	ON*	--	ccw	ccw	(1) Connects antenna or** Switches antenna from local receiver to transmitter. (2) Mutes local receiver*** (3) Turns on RFD-2 Amplifier voltages.	(1) Disconnects antenna or** switches antenna from transmitter to local receiver. (2) Turns on local receiver audio.*** (3) Turns off RFD-2 Amplifier voltages.	PS-4A TRANSMITTER VOLTAGES and FINAL VOLTAGES lamps
SBE-6 VOX (voice-operated transmission)	**** SSB	STBY	ON	STBY	OFF	Adjusted per step 4 in table 3-3.	Adjusted per step 4 in table 3-3.	Sound in mike or audio in SBE-6 CH 1 or CH 2:- (1) Connects antenna or** switches antenna from local receiver to transmitter.	Absence of sound in mike or audio in SBE-6 CH 1 or Ch 2:- (1) Disconnects antenna or** switches antenna from transmitter to local receiver.	SBE-6 EXCITER lamp and PS-4A TRANSMITTER VOLTAGES and FINAL VOLTAGES lamps

TABLE 3-6. ON-OFF OPERATING CONTROLS, SBT-1K(V) (cont)

ON-OFF CONTROL	MODES	STATIONARY CONTROL POSITIONS						EFFECT ON EQUIPMENT		INDICATION OF TRANSMISSION
		PS-4A TRANSMITTER VOLTAGES sw.	PS-4A FINAL VOLTAGES sw.	SBE-6 EXCITER sw.	SBE-6 XMTR sw.	SBE-6 VOX GAIN knob	SBE-6 SQUELCH GAIN knob	ON position	OFF (or STANDBY) position	
SBE-6 VOX (voice-operated) transmission) (cont)								(2) Mutes local receiver ***. (3) Enables SBE-6 exciter output. (4) Turns on RFD-2 Amplifier voltages.	(2) Turns on local receiver audio. *** (3) Disables SBE-6 exciter output. (4) Turns on RFD-2 Amplifier voltages.	
SBE-6 Push-to-talk Control *****	SSB AM	STBY	ON	STBY	OFF	ccw	ccw	Holding down push-button:- (1) Connects antenna or ** switches antenna from local receiver to transmitter. (2) Mutes local receiver ***. (3) Enables SBE-6 exciter output. (4) Turns on RFD-2 Amplifier voltages.	Release push-button:- (1) Disconnects antenna or** switches from transmitter to local receiver. (2) Turns on local receiver audio. *** (3) Disables SBE-6 exciter output. (4) Turns off RFD-2 Amplifier voltages.	SBE-6 EXCITER lamp and PS-4A TRANSMITTER VOLTAGES and FINAL VOLTAGES lamp

TABLE 3-6. ON-OFF OPERATING CONTROLS, SBT-1K(V) (cont)

ON-OFF CONTROLS	MODES	STATIONARY CONTROL POSITIONS						EFFECT ON EQUIPMENT		INDICATION OF TRANSMISSION
		PS-4A TRANSMITTER VOLTAGES sw.	PS-4A FINAL VOLTAGES sw.	SBE-6 EXCITER sw.	SBE-6 XMTR sw.	SBE-6 VOX GAIN knob	SBE-6 SQUELCH GAIN knob	ON position	OFF (or STANDBY) position	
PS-4A TRANSMITTER VOLTAGES switch	SSB ISB AM	--	ON	ON*	OFF	ccw	ccw	(1) Connects antenna or** switches antenna from local receiver to transmitter. (2) Mutes local receiver ***. (3) Turns on RFD-2 Amplifier voltages.	(1) Disconnects antenna or** switches antenna from transmitter to local receiver. (2) Turns on local receiver audio.*** (3) Turns off RFD-2 Amplifier voltages.	PS-4A TRANSMITTER VOLTAGES and FINAL VOLTAGES lamp
PS-4A FINAL VOLTAGES switch	SSB ISB AM	ON*	--	ON*	OFF	ccw	ccw	Turns on RFD-2 Amplifier high voltages.	Turns on RFD-2 Amplifier high voltages.	PS-4A FINAL VOLTAGES lamp.

TABLE 3-6. ON-OFF OPERATING CONTROLS, SBT-1K(V) (cont)

ON-OFF CONTROLS	MODES	STATIONARY CONTROL POSITIONS						EFFECT ON EQUIPMENT		INDICATION OF TRANSMISSION
		PS-4A TRANSMITTER VOLTAGES sw.	PS-4A FINAL VOLTAGES sw.	SBE-6 EXCITER sw.	SBE-6 XMTR sw.	SBE-6 VOX GAIN knob	SBE-6 SQUELCH GAIN knob	ON position	OFF (or STANDBY) position	
Hand Keyer at SBE-6	CW	ON*	ON*	ON*	OFF	ccw	ccw	Enables SBE-6 exciter output	Disables SBE-6 exciter output.	SBE-6 output meter (with METER switch in RF position)

* Associated lamp remains on.
** With transmitter/receiver antenna connections per paragraph 2-7l.
*** With receiver muting connections per paragraph 2-7i.
**** For SSB signals containing maximum of 30% carrier.
***** With push-to-talk connections per paragraph 2-7e.

3-4. SHUT-DOWN PROCEDURE. -

a. GENERAL. - The SBT-1K(V) may be placed in "standby condition" or completely turned off. Standby is recommended when transmitting sideband modes and it is intended to transmit again in the near future. This eliminates repeating the 48-hour oven warm-up procedure as described in paragraph 3-1d.

b. STANDBY. - To place SBT-1K(V) in standby condition, set switches as shown in table 3-7.

TABLE 3-7. PROCEDURE FOR PLACING SBT-1K(V) IN STANDBY

STEP	MODULE	OPERATION
1	SBE-6	Set EXCITER switch to STANDBY. EXCITER lamp will go out. Set XMTR switch to OFF and VOX GAIN knob fully ccw.
2	PS-4A	Set FINAL VOLTAGES switch to OFF. FINAL VOLTAGES lamp will go out. Set TRANSMITTER VOLTAGES switch to STANDBY. TRANSMITTER VOLTAGES lamp will go out.
		CAUTION Wait at least 5 minutes before proceeding to step 3. This delay will gradually cool the PA tube in PAL-1K(M) and prolong its life.
3	PS-4A	Set MAIN POWER circuit breaker to OFF. MAIN POWER lamp will go out.
4	VOX-5	Leave POWER switch set to ON. MAIN POWER lamp will remain lighted and INNER and OUTER OVEN lamps will continue to cycle.

TABLE 3-7. PROCEDURE FOR PLACING SBT-1K(V) IN STANDBY (cont)

STEP	MODULE	OPERATION
5	SBE-6	Leave POWER switch set to ON. POWER lamp and main tuning dial will remain lighted. OVEN lamp will continue to cycle.
6	ATS-MCU-2	Set POWER switch to OFF. POWER lamp will go out.
7	APP-4	Leave MAIN POWER circuit breaker set to ON. MAIN POWER lamp will remain lighted.

c. NORMAL STOPPING. - To completely turn off the SBT-1K(V) transmitter, follow the procedure outlined in table 3-7, steps 1 through 3, then set the ATS-MCU-2, VOX-5, SBE-6 and APP-4 POWER switches to OFF.

d. EMERGENCY STOPPING. - To turn off the SBT-1K(V) in an emergency, set the APP-4 MAIN POWER circuit breaker to OFF.

SECTION 4

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

Figure 4-1 is a functional block diagram of the SBT-1K(V) transmitter, showing the main interrelationships of the ATS-2, PAL-1K(M), VOX-5 and SBE-6. For a complete functional block diagram and schematic diagram of each unit, refer to the individual manual for the unit. Schematic diagrams for AX-198 RF Output Chassis, APP-4 Auxiliary Power Panel and RAK-9B rack wiring are included in the Appendix.

4-2. OPERATION.

a. CARRIER GENERATION (Figure 4-1). - An r-f carrier, in the 1.75- to 32-mc range, is generated in the SBE-6 and VOX-5. The VOX-5 is used for the SBE-6's MF stage (2-4 mc) injection oscillator in place of its MF XTAL fixed frequency oscillators. Since the VOX-5 is continuously adjustable in the 2-4 mc range, this gives the continuously adjustable feature to the 2-32 mc carrier. The carrier is amplified up to the 1-kw level by PAL-1K(M). The ATS-2 contains tuning circuits to match the output of PAL-1K(M) to a wide variety of antennas. The Monitor Control Unit includes a VSWR indicator and tuning controls which enable a very fine degree of match.

b. CW TRANSMISSION (Figure 4-1). - In CW transmission, a hand keyer enables and disables the 1.75-32 mc amplifier stage in the SBE-6, thus controlling carrier output.

c. SSB TRANSMISSION (Figure 4-1). - In SSB mode, the audio from CH 1, CH 2 or mike modulates the 1.75-32 mc carrier in the SBE-6. Either the upper or lower sideband is sent out with fully or partially suppressed carrier.

d. ISB TRANSMISSION (Figure 4-1). - In ISB mode, two separate intelligence sources (two audio channels or one audio channel and mike) are introduced at the SBE-6 audio input. The two audio channels modulating the 1.75-32 mc carrier are routed to upper and lower sideband circuitry. Transmission consists of upper and lower sideband with either fully or partially suppressed carrier.

e. AM TRANSMISSION. - In AM mode, the audio input from CH 1, CH 2 or mike modulates the 1.75-32 mc carrier in the SBE-6. Both upper and lower sidebands plus full carrier are sent out.

4-3. FREQUENCY TRANSLATION.

a. CARRIER FREQUENCY. - Figure 4-2 shows the origin of the carrier (250 kc oscillator in the SBE-6) and the successive modulation stages which bring it to the 1.75-32 mc range. When the carrier is to be between 4.25 and 32 mc, two stages of modulation are used: MF and HF. The 250-kc is mixed with the VOX-5 2-4 mc output in the MF Modulator to raise the carrier into the 2-4 mc stage. The difference frequency output of the MF Modulator is then mixed with the HF Oscillator output in the HF Modulator to produce a dif-

ference frequency in the 4.25 to 32 mc range. When the carrier is to be between 1.75 and 4.25 mc, only the first (MF) stage of modulation is required to raise the 250-kc frequency into this range; the second (HF) stage of modulation is bypassed.

The MF modulation stage output tuning circuit is set by the MF TUNING knob and lower portion of the movable main tuning dial on the SBE-6; the HF modulation stage output tuning is set by the OUTPUT TUNING knob and upper portion of the main tuning dial. Although each output may be tuned to pass either the sum or difference frequency, the dials are calibrated in terms of tuning in the difference frequency. Only one calculation, VOX-5 output frequency (f_{VOX}) in terms of the carrier frequency (f_o), is made by the operator (see paragraph 3-2b1). This is $f_{vox} = f_o + .250$. The MF TUNING knob dial is calibrated to show the same frequency as that appearing on the VOX-5 MASTER OSCILLATOR FREQUENCY counters (f_{vox}) in order to save the operator another step of calculation. When the MF TUNING dial is set for this figure, the MF Modulator output circuit is actually tuned to the difference frequency resulting in combining f_{vox} with 250 kc. In the next modulation stage (HF), setting the OUTPUT TUNING dial for the carrier frequency (f_o), actually tunes the HF Modulator output circuit to pass the difference frequency.

The carrier frequency translation may then be described in terms as follows (see figure 4-2): -

Where f_o = output carrier frequency (in mc)

Where N = "dial numeric" figure appearing below output range on BAND MCS

Where 2N = HFO frequency (in mc)

Where f_m = difference frequency output of MF Modulator

Where f_{vox} = VOX-5 output frequency (in mc) or SBE-6 MF crystal frequency (in mc), if used

When f_o falls between 1.75 and 4.25 mc: -

$$f_o = f_m$$

$$f_m = f_{vox} - .250$$

$$\therefore f_o = f_{vox} - .250$$

When f_o falls between 4.25 and 32 mc: -

$$f_o = 2N - f_m$$

$$f_m = f_{vox} - .250$$

$$\therefore f_o = 2N-(f_{vox} - .250) = 2N-f_{vox} + .250$$

b. LOWER SIDEBAND FREQUENCIES. - As shown in figure 4-2, an audio tone, f_a, at SBE-6 audio input mixes with the 250-kc in the LSB IF Modulator to produce a lower sideband tone equal to 250-kc minus f_a. The LSB filter in the modulator output blocks out the 250-kc and passes only the lower sideband tone (f_{lsb}). The 250-kc component is further blocked off by turning the CARRIER INSERT knob to minimum and only f_{lsb} enters the MF Modulator, where it mixes with f_{vox} to produce f_{vox} -(.250 - f_a) or f_{vox} - .250 + f_a at the modulator output. The MF Modulator output then mixes with 2N

in HF Modulator to produce $2N-(f_{vox} - .250 + f_a)$ or $2N-f_{vox} + .250-f_a$ at the HF Modulator output. This is the output frequency (f_{lo}) of the lower sideband and may be simplified as follows:

$$f_{lo} = 2N - f_{vox} + .250 - f_a$$

From paragraph 4-3a, $f_o = 2N - f_{vox} + .250$

$$\therefore f_{lo} = f_o - f_a$$

The above f_{lo} is evolved in the manner described above when f_o falls between 4.25 and 32 mc and the HF modulation stage is used. In cases where f_o falls between 1.75 and 4.25, the HF modulation stage is bypassed and a resulting sideband reversal (i.e. — f_{uo} for f_{lo}) must be prevented. To do this, wiring is arranged between the SBE-6 LSB and USB selector and BAND-MCS switches to switch f_a to the USB IF Modulator and filter when the BAND-MCS switch is set to a 1.75 to 4.25 mc range. The lower sideband frequency (f_{lo}) is then evolved as follows: -

$$f_{lo} = f_{vox} - f_{usb}$$

$$f_{lo} = f_{vox} - (.250 + f_a)$$

$$f_{lo} = f_{vox} - .250 - f_a$$

From paragraph 4-3a, $f_o = f_{vox} - .250$

$$\therefore f_{lo} = f_o - f_a$$

c. UPPER SIDEBAND FREQUENCIES. - The upper sideband output frequency (f_{uo}) is evolved in the same general manner as is the lower sideband, and may be shown as follows: -

When f_o falls between 1.75 and 4.25 mc: -

$f_{uo} = f_{vox} - f_{lsb}$ (from sideband filter reversal)

$f_{uo} = f_{vox} - (.250 - f_a)$

$f_{uo} = f_{vox} - .250 + f_a$

From paragraph 4-3a, $f_o = f_{vox} - .250$

$\therefore f_{uo} = f_o + f_a$

When f_o falls between 4.25 and 32 mc: -

$f_{uo} = 2N - f_m$

$f_m = f_{vox} - f_{usb}$

$f_{uo} = 2N - (f_{vox} - f_{usb})$

$f_{usb} = .250 + f_a$

$f_{uo} = 2N - \left[f_{vox} - (.250 + f_a)\right]$

$f_{uo} = 2N - f_{vox} + .250 + f_a$

From paragraph 4-3a, $f_o = 2N - f_{vox} + .250$

$\therefore f_{uo} = f_o + f_a$

d. CARRIER RE-INSERTION (figure 4-2). - In sideband transmission, the 250-kc carrier originating frequency removed by the i-f modulators may be re-inserted by means of the SBE-6 CARRIER INSERT knob. The output carrier frequency (f_o) then evolves as described in paragraph 4-3a and is transmitted alongside the sideband in the frequency spectrum. The carrier remains a constant frequency and amplitude as set and the sideband frequency varies in frequency and amplitude as does the audio input frequency (f_a). The CARRIER INSERT control is turned up to full maximum in AM transmission.

4-4. INTERLOCK SYSTEM (Figure 4-3). - Figure 4-3 shows the complete safety interlock system through the transmitter, with its relationship to the PS-4A Power Supply TRANSMITTER VOLTAGES and FINAL VOLTAGES switches. The purpose of the interlock system is to prevent the transmitter from operating when any one of a series of undesirable conditions exist, in order to protect personnel and equipment. Essentially, a negative voltage (-150 VDC), originating in the PS-4A unit, completes a circuit to ground through a series of interlocks (see table 4-1) when the PS-4A TRANSMITTER VOLTAGES switch is closed. The same effect is had if, instead, the SBE-6 XMTR switch is closed or the VOX (voice-operated transmission) or push-to-talk controls are used; the current is then grounded through the SBE-6 K101 VOX relay. The two antenna switching relays (K601 and K602) in AX-198 R.F. Output Chassis are also involved as links in the interlock circuit and operate along with K703 relay in the PS-4A unit as follows.

When the PS-4A TRANSMITTER VOLTAGES switch is set to ON position (or when the SBE-6 control is operated to connect the interlock circuit to ground), the +500 VDC source at terminal 5 on PS-4A K703 relay finds ground through PS-4A E701 terminal 9, pin F of P607 and J607 on AX-198, the coil of AX-198 K601 relay, normally closed contacts of AX-198 K602 relay, pin E of J607 and P607 on AX-198, terminals 4 and 7 of PS-4A E701 and the TRANSMITTER VOLT-

AGES (or other) switch. The resulting current through AX-198 K601 relay coil energizes this relay and closes the set of contacts thereby closing the one remaining interlock link which had been open. The -150 VDC interlock circuit source at PS-4A K703 relay pin 12 now finds ground through the series of closed interlocks through the system as illustrated by the coded line in figure 4-3, up to AX-198 K602 normally closed contacts and through pin G of J607 and P607 connectors. The resulting current through PS-4A K703 relay coil energizes this relay and a set of K703 contacts close to complete the a-c line voltage circuit from PS-4A J703 receptacle through the closed FINAL VOLTAGES switch in PS-4A, through PS-5 T401 high voltage transformer primary and the coil of AX-198 K602 relay. The energized K602 relay contacts then close, causing the +500 VDC and -150 VDC sources at this point to switch paths to ground. In this "transmitting" condition, all three relays (K703, K601 and K602) remain energized. The effect of the energized K703 relay in PS-4A is to furnish +500 VDC to the RFD-2 driver plate and P.A. screen grid, +225 VDC for the RFD-2 1st amplifier and ALDC circuit and a-c line voltage to the PS-5 high voltage transformer primary. The purpose of relays K601 and K602 is to connect the antenna at an instant before the high voltages are sent to the RFD-2 amplifier and is described in paragraphs 4-5 and 4-6.

Setting the TRANSMITTER VOLTAGES switch to STANDBY position de-energizes all 3 relays. The -150 VDC current, cut off from ground, ceases to flow through K703 coil and this relay becomes de-energized, shutting off voltages to the power amplifier tubes and, at the same time, to the K602 relay coil in AX-198. K602 becomes de-energized and the contacts switch to deprive the +225 VDC current through K601 relay coil its connection with ground. K601 relay is then de-energized, breaking the interlock link at that point. The sequence of relay action now acts to shut off the high voltages at an instant before the antenna is disconnected by the de-energized K601 and K602 relays.

4-5. ANTENNA DISCONNECT (Figure 4-3).

The purpose of the antenna disconnect feature is to eliminate antenna radiation of noise from the PAL-1K(M) Amplifier when no signal is being transmitted. The two relays (K601 and K602 in AX-198) are tied into the interlock circuit in order to operate in a sequence that will also prevent the transmitter from operating for an instant without a load.

In order to have the antenna disconnect feature and also provide connections for a T/R (transmitter/receiver) antenna system (see paragraph 4-6), K601 is inserted in the circuitry. When the PS-4A TRANSMITTER VOLTAGES switch is closed, as described in paragraph 4-4, K601, K703 and K602 relays are energized in that order. The energized

K601 connects the RFD-2 output to the antenna through ATS-CU-2 Directional Coupler and also mutes a local receiver (see paragraph 4-7). K703 then works to connect high voltages to the RFD-2 and K602 switches ground paths in order to provide the proper sequence of relay de-energization when the TRANSMITTER VOLTAGES switch is set to STANDBY.

When the TRANSMITTER VOLTAGES switch is set to STANDBY, as described in paragraph 4-4, K703, K602 and K601 become de-energized in that order. The de-energized K703 disconnects the high voltages to the RFD-2, K602 switches back ground paths and K601 then acts to disconnect the antenna from the RFD-2 output and re-activate the local receiver.

4-6. T/R ANTENNA SYSTEM (Figure 4-3).

The T/R (transmitter/receiver) antenna system is tied in with the antenna disconnect system (paragraph 4-5) utilizing the same two relays, K601 and K602. Its purpose is to make the SBT-1K(V) adaptable to using a common antenna with the local receiver and to automatically switch the antenna from transmitter to receiver and back with the same control (PS-4A TRANSMITTER VOLTAGES switch or SBE-6 control) as for the interlock and antenna disconnect systems.

The K601 and K602 relay action accomplishes the same connections and sequence as in the antenna disconnect

system (paragraph 4-5) except that when the antenna is disconnected from the transmitter it has become connected to the receiver and vice versa.

4-7. RECEIVER MUTING (Figure 4-3).

The local receiver audio muting feature may be used along with the antenna disconnect or T/R antenna systems or without them. Its purpose is to disconnect the local receiver output to its speaker at the time of transmission and reconnect when transmission is over. The same relay (K601) used for antenna switching is utilized for this feature. The set of receiver muting contacts on K601 act to make and break the local receiver connection with its speaker.

TABLE 4-1. INTERLOCK CIRCUIT COMPONENTS, SBT-1K(V)

LOCATION	INTERLOCK	OPENED	CLOSED
PS-4A	PA OVERLOAD CONT GRID circuit breaker CB702	When overload condition exists in the RFD-2 PA grid circuit	When no overload condition exists in the RFD-2 PA grid circuit
PS-4A	PA OVERLOAD SCRN GRID circuit breaker CB703	When overload condition exists in the RFD-2 PA screen grid circuit	When no overload condition exists in the RFD-2 PA screen grid circuit
PS-4A	PA OVERLOAD PLATE circuit breaker CB704	When overload condition exists in the RFD-2 PA plate circuit	When no overload condition exists in the RFD-2 PA plate circuit

TABLE 4-1. INTERLOCK CIRCUIT COMPONENTS, SBT-1K(V) (cont)

LOCATION	INTERLOCK	OPENED	CLOSED
RFD-2	Air switch interlock S206	When RFD-2 blower B201 is not operating normally	When RFD-2 blower B201 is operating normally
RFD-2	PA BAND switch S205	When RFD-2 PA BAND switch contacts are not entirely mated in a switch position	When RFD-2 PA BAND switch contacts are completely mated in a switch position
RFD-2	Top cover interlock S207	When top chassis cover on RFD-2 is not secured in position	When top chassis cover on RFD-2 is secured in position
RFD-2	Bottom cover interlock S208	When bottom chassis cover on RFD-2 is not secured in position	When bottom chassis cover on RFD-2 is secured in position
PS-5	Blower door interlock S402*	When PS-5 blower door is opened	When PS-5 blower door is closed
PS-5	Top cover interlock S403	When top chassis cover on PS-5 is not secured in position	When top chassis cover on PS-5 is secured in position

* S401 blower door interlock is not part of the -150 VDC interlock circuit. It is a protective device that shuts off the blower when the door is opened by cutting off the a-c power to the blower.

TABLE 4-1. INTERLOCK CIRCUIT COMPONENTS, SBT-1K(V) (cont)

LOCATION	INTERLOCK	OPENED	CLOSED
Lower rack door frame	Door interlock S602	When rack door is opened	When rack door is closed
AX-198	Coupling interlock S603	When RFD-2 is not pushed all the way into the rack and secured. (E203 output terminal on RFD-2 has not coupled with E602 receptacle on AX-198).	When RFD-2 is pushed all the way into the rack and secured (E203 output terminal on RFD-2 has coupled with E602 receptacle on AX-198
ATS-MCU-2	Overload relay K103	When FOREWARD, REFLECTED power or VSWR at antenna has become excessive	When FOREWARD, REFLECTED power or VSWR at antenna is not excessive
AX-198	Coupling interlock S604	When output cable running from AX-198 to ATS-TU-2 Tuner is not connected at J609 receptacle on AX-198.	When output cable running from AX-198 to ATS-TU-2 Tuner is connected at J609 receptacle on AX-198
AX-198	Antenna switching relays K601 and K602	When PS-4A TRANSMITTER VOLTAGES switch or SBE-6 XMTR switch is in STANDBY. Or when push-to-talk button is released or no audio input into the SBE-6 in VOX operation.	When PS-4A FINAL VOLTAGES switch is ON and TRANSMITTER VOLTAGES switch or SBE-6 XMTR switch is ON. Or when PS-4A FINAL VOLTAGES switch is ON and push-to-talk button is pressed or there is audio input into SBE-6 in VOX operation.

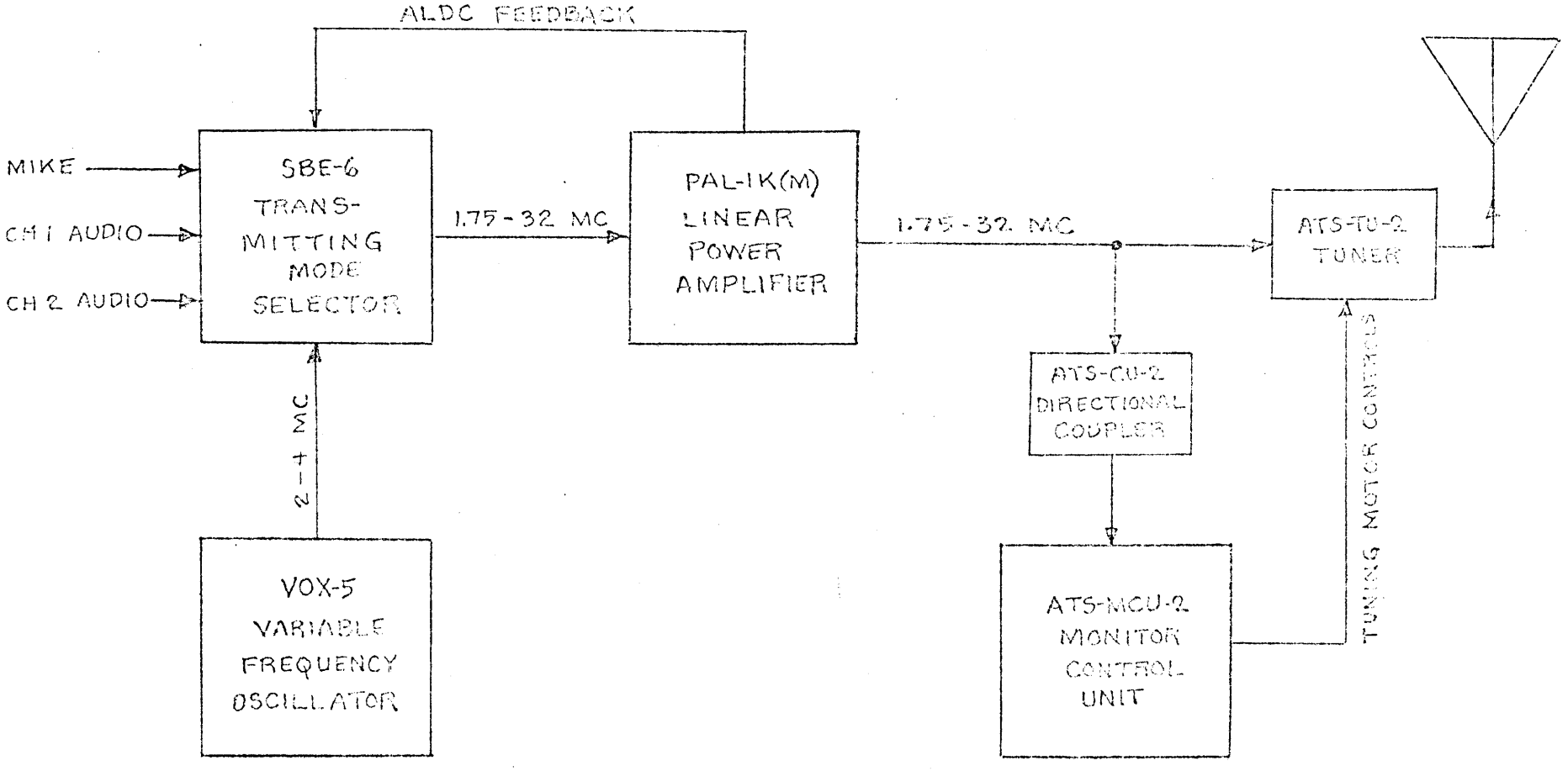


FIGURE 4-1. FUNCTIONAL BLOCK DIAGRAM, SBT-1K(V)

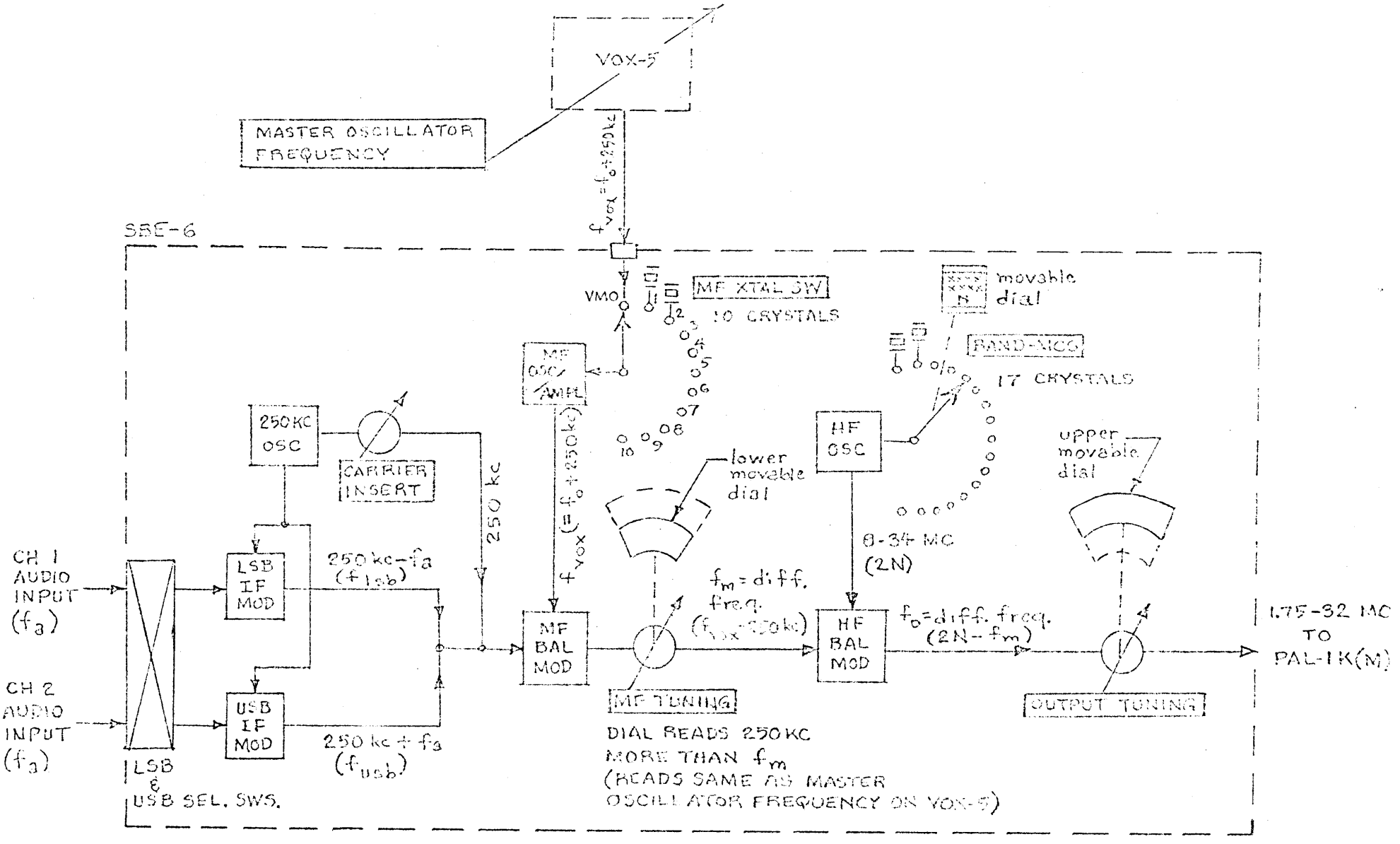


FIGURE 4-2. FREQUENCY TRANSLATION DIAGRAM, SBT-1K(V)

TECHNICAL MANUAL

for

GENERAL PURPOSE TRANSMITTER

MODEL SBT-1K(V)

APPENDIX

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N. Y. OTTAWA, ONTARIO
IN-259V-A ISSUE DATE: 15 JUNE 1964

TABLE OF CONTENTS

SBT-1K(V) APPENDIX

Paragraph		Page
1.	Introduction	1
2.	Parts Breakdown, SBT-1K(V)	1
3.	RAK-9B1 Rack	1
4.	AX-198 RF Output Chassis	3
5.	APP-4 Auxiliary Power Panel	3

List of Tables

Table		
A.	Shipping List, SBT-1K(V)	4
B.	Major Parts Breakdown, SBT-1K(V)	7
C.	RAK-9B1 Parts List	8
D.	APP-4 Parts List	18

List of Illustrations

Figure	Title	
A.	Model Rak-9 Rack Installation Dimensions	21
B.	Cable Installation Diagram, SBT-1K(V)	22
C.	ATS-TU-2 Tuner Mounting Dimensions	23
D.	CA-541 Cable Wiring Diagram	24
E.	APP-4 Schematic Wiring Diagram	25
F.	Auxiliary Power Panel, Model APP-4	26
G.	AX-198 Schematic Wiring Diagram	27
H.	CA-506 Cable Wiring Diagram	28
I.	CA-491 & CA-507 Cable Wiring Diagrams	29
J.	R.F. Output Chassis, Model AX-198, Front View	30
K.	R.F. Output Chassis, Model AX-198, Back View	31

APPENDIX

1. INTRODUCTION.

This part of the manual includes a complete parts list guide and describes Model RAK-9B1 Rack, AX-198 R.F. Output Chassis, APP-4 Auxiliary Power Panel and any modifications to the standard ATS-2, PAL-1K(M), SBE-6 and VOX-5 units peculiar to their use in the SBT-1K(V).

In addition, it is intended that this appendix and addendums thereto will reflect minor wiring and component rating variations occurring within successive production runs of the SBT-1K(V) transmitter. Changes will be entered on the addendums as they apply to specific production serial numbers of the SBT-1K(V).

Unless noted on attached addendums to this appendix, the following data applies to SBT-1K(V), serial #17529 and up.

2. PARTS BREAKDOWN, SBT-1K(V).

Table B, Major Parts Breakdown, SBT-1K(V), serves as the key to the complete electrical parts breakdown of the entire transmitter. The "Description" column refers to the part of the manual containing the detailed parts list for each major component. Included in the column entry is any parts variations peculiar to the SBT-1K(V) for that component.

When re-ordering a major component for replacement or as a spare, it is advisable to refer to table B to ensure that the special parts and/or adjustments are specified on the order.

3. RAK-9B1 RACK.

Model RAK-9B1 is a standard relay-type rack with a hinged rear door and comes equipped with 4 sets of tilt-lock drawer slides for mounting the RFD-2, VOX-5, SBE-6 and PS-4A units. Tracks are provided on the rack floor for

installation of the PS-5 unit.

The main rack structure is 13 gauge cold-rolled steel and is shown in figure A with pertinent installation dimensions. The basic RAK-9, as illustrated, is 20-5/8 inches wide x 24-1/2 inches deep x 71-1/2 inches high. The separate base, TMC P/N MS-1901, is 3 1/4 inches high and gives the base mounted transmitter a total height of 74-3/4, with the two channels on the bottom of the rack falling inside the base. In the shock-mounted transmitter, the 4 TMC P/N SH-104-4T6 shock-mounts on the bottom are installed on the two bottom channels, giving the transmitter a total height of 73-3/4 inches from the floor in its static condition. The 2 shock-mounts for the top are TMC P/N SH-104-4T6. Unless specified as otherwise on order, the standard finish is TMC RCAF Blue-grey smooth enamel.

Two reel-mounted springs are provided for retracting wiring cables to the RFD-2 and PS-4A units as they are pushed into the rack. The one for the RFD-2 is located at the top of the AX-198 RF Output Chassis; the PS-4A reel is located on the left inside wall of the rack.

Wiring entry and exit may be made through the 3 large access holes (with covers) near the bottom of the rack and 4 5/8-inch diameter knockout holes at the top of the rack.

The intake blower for the rack forced-air cooling system is installed on the lower part of the rear door. Removable air filter (TMC P/N AD-103-9) is inserted in the front of the blower. Air exhaust is in the rack ceiling through removable air filter TMC P/N AD-103-5.

TMC P/N AX-198 R.F. Output Chassis is part of the RAK-9B1 assembly and is described in the following section. All cabling and electrical parts that are part of RAK-9B1 assembly are listed in table C.

4. AX-198 RF OUTPUT CHASSIS.

The AX-198 assembly consists of two relays, two micro-switches, capacitor, connectors and adapters as listed in table C with notation "(P/O AX-198)". The assembly is wired as shown in figure G. All components are mounted in a box enclosure (see figure J) measuring 8-1/2 x 16-3/4 x 3-3/4 inches. One side of the box is open with a flange with 7 threaded holes running around the opening. The box is mounted with its open side to the inside of the upper rear rack wall and secured by machine screws through the seven threaded holes. Part of the AX-198 assembly is a take-up reel for RFD-2 cable retraction; the reel is mounted at the top of the box. The button-type terminal E203 output of the RFD-2 Amplifier becomes coupled to E602 spring-socket receptacle on AX-198 as the RFD-2 is pushed into the rack.

The primary function of AX-198 is to provide a switching relay connection of the SBT-1K(V) to the common antenna of a transmitter/receiver system. As a secondary function, the relays and micro-switches become additional links in the PAL-1K(M) safety interlock system. Theory of operation of the AX-198 is included in paragraphs 4-4 through 4-7, in the SBT-1K(V) Systems manual.

5. APP-4 AUXILIARY POWER PANEL.

Model APP-4 Auxiliary Power Panel contains the main circuit breaker and indicator light for the a-c power input to the SBR-1K(V) system. Movable straps on resistor shunts enable adaptation to a 115VAC or 230VAC line. In addition, the APP-4 contains internal wiring enabling a variety of connections between the SBT-1K(V) and external equipment.

TABLE A. SHIPPING LIST, SBT-1K(V) (cont'd)

CRATE NO.	QTY	CONTENTS ITEM
1 (cont'd)	1	CA-484 Cable. E202 on ATS-TU-2 to antenna. Consists of #8 stranded wire, 27 inches long with terminal lug to mate with E202.
	1	CA-468-3 Cable, a-c power. J612 on rack a-c power strip to J104 on ATS-MCU-2.
	1	TP-110 Tool, core aligner. For NULL and EQUALIZER adjustments on ATS-CU-2.
	1	PO-182 Watertight terminal tube, type "B" packing, gland ring and nut. For bringing RG-8/U cable from J609 on AX-198 into ATS-TU-2 enclosure.
	1	PO-181 Watertight terminal tube, type "D" packing, gland ring and nut. For bringing CA-541 or CA-729 cable from J101 on ATS-MCU-2 into ATS-TU-2 enclosure.
	1	GL-114 1-oz. tube of silicone compound lubricant for ATS-TU-2 all-weather motor lubrication.
	1	CA-383-78C Cable. J103 on SBE-6 to J201 on RFD-2.
	1	CA-480-6-49 Cable. UG-274/U tee on VOX-5 to J104 on SBE-6.
	1	CA-507 Cable. J501 on APP-4 to E101 on SBE-6.
	1	CA-480-3-80 Cable. J704 on PS-4A to J113 on SBE-6.
	1	UG-260/U Connector, plug. Mates with J606 on AX-198. For T/R antenna system.
	1	PL-190-NG Connector, plug, a-c power. Mates with rack AC INPUT receptacle.
	1	PL-100 Connector, plug, a-c power. Mates with rack UTILITY AC INPUT receptacle.
	1	UG-274/U Tee adapter. Mates with J203 on VOX-5.

TABLE A. SHIPPING LIST, SBT-1K(V)

CRATE NO.	CONTENTS	
	QTY	ITEM
1	1	RAK-9B1 Rack with cables CA-506, CA-490, CA-491, CA-493, CA-509, CA-588-1 and APP-4 Auxiliary Power Panel installed.
	2	Instruction Manual, SBT-1K(V)
	1	Tuning Chart, SBT-1K(V)
	1	TM-105-16AL Fanning Strip, right angle, left end feed. For attachment of wires to E501 on APP-4.
	1	TM-105-16AR Fanning Strip, right angle, left end feed. For attachment of wires to E502 on APP-4.
	1	CA-346-3-9 Cable, SBE Power Supply to SBE-6 Exciter.
	1	PL-132-3 Connector, plug, male. For mike cable. Mates with MIKE jack on SBE-6 Exciter.
	1	CA-468-2 Cable, a-c power. J614 on rack a-c power strip to J401 on SBE Power Supply.
	1	CA-499-2 Cable. J102 on ATS-MCU-2 to J303 on ATS-CU-2.
	1	CA-498-2 Cable. J103 on ATS-MCU-2 to E603 on AX-198.
	1	PL-150 Plug. Mates with J609 on AX-198. For cable from J609 on AX-198 to E-203 in ATS-TU-2.
	1	CA-541-XX* rubber covered cable or CA-729-XX* armored cable (if specified on order). From J101 on ATS-MCU-2 to E201 in ATS-TU-2. If cable is not specified on order, the following items for the manufacture of this cable are included in shipment:

Qty	TMC P/N	Name
1	MS3106A20-27P	Plug
1	MS3057-12A	Cable Adapter
10	TE-120-2	Spade Lug Terminal

* XX - length as specified in inches

TABLE A. SHIPPING LIST, SBT-1K(V) (cont'd)

CRATE NO.	CONTENTS	
	QTY	ITEM
1 (cont'd)	4	SC-142-C Eyebolts. Fit in top of rack; for moving rack by means of crane hoist.
	44	SCBS1032BN8 Machine screws. For securing front panels of units in rack.
	44	WA-101-11 Washers, flat fiber. For use with SCBS1032BN8 screws.
2	1	ATS-MCU-2 Monitor Control Unit.
	1	ATS-CU-2 Directional Coupler
	1	ATS-TU-2 Tuner
3	1	SBE-6 Transmitting Mode Selector
	1	A-1397 SBE Power Supply
	1	VOX-5 Variable Frequency Oscillator
4	1	RFD-2 RF Amplifier
	1	PS-4A Low Voltage Power Supply
5	1	PS-5 High Voltage Power Supply

TABLE B. MAJOR PARTS BREAKDOWN, SBT-1K(V) GENERAL PURPOSE TRANSMITTER

QTY/ UNIT	TMC P/N	TITLE	DESCRIPTION
1	RAK-9B1	Rack	Consists of rack structure as shown in figure A and cables and components listed in RAK-9B1 Parts List (Table C).
1	ATS-MCU-2 (P/O ATS-2)	Monitor Control Unit	Consists of unit and parts as described in ATS-2 manual.
1	ATS-CU-2 (P/O ATS-2)	Directional Coupler	Consists of unit and parts as described in ATS-2 manual, with C302 and C305 capacitors trimmed for 50-ohm output
1	ATS-TU-2 (P/O ATS-2)	Tuner	Consists of unit and parts as described in ATS-2 manual.
1	RFD-2 (P/O PAL-1KM)	RF Amplifier	Consists of unit and parts as described for RFD-1A in PAL-1K(A) manual with modifications for RFD-2 as described in manual addendum # .
1	PS-4A (P/O PAL-1KM)	Medium Voltage Power Supply	Consists of unit and parts as described in PAL-1K(A) manual.
2	PS-5 (P/O PAL-1KM)	High Voltage Power Supply	Consists of unit and parts as described in PAL-1K(A) manual.
1	VOX-5	Variable Frequency Oscillator	Consists of unit and parts as described in VOX-5 manual, w/ special length attached a-c power cable CA-569-2(W201) and special separate cable CA-435-3 (W202) for SBT-1K use.
1	SBE-6	Exciter	Consists of unit and parts as described in SBE-3 manual with modifications for SBE-6 as described in manual addendum #
1	A-1397	SBE Power Supply	Consists of unit and parts as described in SBE-3 manual.
1	APP-4	Auxiliary Power Panel	Consists of unit as shown in figure F, wired per figure E, and parts as listed in table D.

TABLE C. RAK-9B1 PARTS LIST

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
B601	BLOWER, axial: 1650 RPM, 450 CFM, 115VAC, 60 cycle, single phase, running capacitor 2 uf.	Rack cooling	BL-101
C601	CAPACITOR, fixed: 10,000 uuf min., 500 WVDC (P/O AX-198)	RF bypass	CC-100-16
C602	Same as C601	RF bypass	
C603	Same as C601	RF bypass	
C604	Same as C601	RF bypass	
C605	Same as C601	RF bypass	
C606	Same as C601	RF bypass	
C607	Same as C601	RF bypass	
C608	Same as C601	RF bypass	
C609	Same as C601	RF bypass	
C610	Same as C601	RF bypass	
C611	Same as C601	RF bypass	
C612	Same as C601	RF bypass	
C613	CAPACITOR, fixed: paper dielectric, bathtub type, 2 uf $\pm$ 10%, 600 WVDC.	B601 running capacitor	CP53B1FF205K

TABLE C. RAK-9B1 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
CP601	ADAPTER, connector: RF, series UHF, right angle (P/O AX-198).	J606 to K601	UG-646/U
CP602	Same as CP601	J606 to K601	
CP603	Same as CP601	J608 to K602	
CP604	Same as CP601	E602 to K601	
CP605	Same as CP601	J610 to J609	
CP606	ADAPTER, connector: RF, series UHF, straight (P/O AX-198)	E602 to K601	SA-104
CP607	Same as CP606	J608 to K601	
CP608	NOT USED		
CP609	ADAPTER, connector: RF, right angle	ATS-CU-2 mounting to AX-198	UG-212C/U
CP610	Same as CP609	"	
CP611	NOT USED		
CP612	ADAPTER, connector: RF, HN to UHF	ATS-CU-2 mounting to AX-198	SA-103
CP613	Same as CP612	"	
CP614	NOT USED		

TABLE C. RAK-9B1 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
CP615	ADAPTER, connector: RF, tee, series BNC	Mates with J203, P102 and P604 on VOX-5	UG-274/U
E601	TERMINAL BLOCK: Barrier type, 2-terminal, 4 #6-32 binder head screws, bakelite body.	B601 Blower Connection	TM-102-2
E602	CONTACT ASSEMBLY: RF connector (P/O AX-198).	RFD-2 output to AX-198, closes S603	AX-154
E603	TERMINAL BLOCK: Barrier lug type, 3 terminals, 3 #6-32 binder head screws (P/O AX-198).	Interlock link	TM-100-3
E604	FANNING STRIP: 11-terminal, right angle, left end feed. (P/O W610).	For E604 in PS-4A	TM-105-11AR
E605	FANNING STRIP: 14-terminal, right angle, right end feed. (P/O W-609).	For E605 in SBE-6	TM-105-14AR
J601	CONNECTOR, receptacle: AC, 3-prong, male, polarized, locking type, non-grounded. (P/O W612).	SBT-1K(V) line voltage input	JJ-194-NG
J602	CONNECTOR, receptacle: AC, 2-prong, male, twist lock. (P/O W610).	SBT-1K(V) utility input	JJ-100
J603	CONNECTOR, receptacle: MIL type MS3102A14S-2S, female.	B601 Blower connection. Mates with P603.	MS3102A14S-2S

TABLE C. RAK-9B1 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
J604	CONNECTOR, receptacle: MIL type MS3102A18-16S, female (P/O W605).	PS-4A to RFD-2. Mates with P202.	MS3102A18-16S
J605	CONNECTOR, receptacle: MIL type MS3102A32-7S, female. (P/O W606).	PS-5 to RFD-2. Mates with P201.	MS3102A32-7S
J606	CONNECTOR, receptacle: RF, series BNC, straight feed-thru. (P/O AX-198).	Antenna to receiver. Mates with P624.	UG-492A/U
J607	CONNECTOR, receptacle: MIL type MS3102A-20-27P, male. (P/O AX-198).	AX-198 main connector. Mates with P607.	MS3102A-20-27P
J608	CONNECTOR, receptacle: RF, series UHF. (P/O AX-198).	Output to ATS-CU-2. Mates with CP609.	UG-307/U
J609	ADAPTER, connector: RF, series UHF to series QDS, female. (P/O AX-198).	Output to ATS-TU-2. Mates with P606.	JJ-147
J610	Same as J608	Input from ATS-CU-2. Mates with CP610.	
J611	CONNECTOR, receptacle: RF, series UHF, female. (P/O AX-198)	Input from RFD-2. Mates with CP606 and E602.	JJ-195
J612	CONNECTOR, receptacle: AC, 2-prong, female, w/bracket.	Extra line voltage outlet	JJ-170
J613	Same as J612	Line voltage to VOX-5. Mates with P203.	

TABLE C. RAK-9B1 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
J614	Same as J612	Line voltage to SBE-6. Mates with P402.	
K601	RELAY, coaxial: 220-VDC coil, RF switch SPDT, aux. switch DPDT, 1 kw power, with 3 series UHF connectors. (P/O AX-198).	Antenna relay	RL-139-4-220DC
K602	RELAY, AC coil: 115 VAC coil, 5-amp non-inductive contacts. (P/O AX-198).	Antenna sequence relay.	RL-116-AC-2C-115
MP601	FILTER, air: forced-air cooling system.	Rack intake air filter	AD-103-9
MP602	FILTER, air: forced-air cooling system.	Rack exhaust air filter	AD-103-5
P601	CONNECTOR, plug: AC, 3-prong, locking type, polarized, non-grounded. (P/O W611).	Mates with J703 on PS-4A.	PL-134-NG
P602	NOT USED		
P603	CONNECTOR, plug: elbow, MIL type MS3108A14S-2P, male.	Mates with J603 on Blower Box	MS3108A14S-2P
P604	CONNECTOR, plug: RF, series BNC. (P/O W608).	Mates with CP615 on VOX-5	UG-260/U
P605	NOT USED.		

TABLE C. RAK-9B1 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
P606	CONNECTOR, plug: RF, series QDS, male, universal, with plates	Antenna cable plug. Mates with J609 on AX-198.	PL-150
P607	CONNECTOR, plug: MIL type MS3106B20-27S, female. (P/O W610).	Mates with J607 on AX-198.	MS3106B20-27S
P608	NOT USED.		
P609	CONNECTOR, plug: MIL type MS3106B28-11P, male. (P/O W609).	Mates with J501 on APP-4.	MS3106B28-11P
P610	NOT USED.		
P611	Same as P604 (P/O W607)	Mates with J103 on SBE-6.	
P612	CONNECTOR, plug: RF, series UHF. (P/O W607).	Mates with J201 on RFD-2	PL-259A/TEF
P613	Same as P604 (P/O W608)	Mates with J104 on SBE-6.	
P614	CONNECTOR, plug: MIL type MS3106B32-7P, male. (P/O W606)	Mates with J701 on PS-4A.	MS3106B32-7P
P615	CONNECTOR, plug: MIL type MS3106B18-16P, male. (P/O W605)	Mates with J401 on PS-5	MS3106B18-16P
P616	Same as P612 (P/O W601)	Mates with J609 inside AX-198	

TABLE C. RAK-9B1 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
P616	Same as P612 (P/O W601)	Mates with J609 inside AX-198	
P617	Same as P604 (P/O W602)	Mates with J606 inside AX-198	
P618	Same as P612 (P/O W602)	Mates with CP602 inside AX-198	
P619	Same as P612 (P/O W601)	Mates with CP605 inside AX-198	
P620	CONNECTOR, plug: AC, 3-prong, locking type, polarized, non-grounded.	For main line voltage cables. Mates with J601 on rack.	PL-190-NG
P621	NOT USED		
P622	NOT USED		
P623	NOT USED		
P624	Same as P604	For receiver cable. Mates with J606 on AX-198.	
P625	NOT USED		
P626	NOT USED		
P627	CONNECTOR, plug: AC, 2-prong, twist lock, female.	For utility line voltage cable. Mates with J602 on rack.	PL-100

TABLE C. RAK-9B1 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
P628 THRU P634	NOT USED		
P635	CONNECTOR, plug: RF, series BNC. (P/O W629)	Mates with J704 on PS-4A	PL-169
P636	Same as P635 (P/O W629)	Mates with J113 on SBE-6	
R601	RESISTOR, fixed: wire-wound, 35K, 10 watts. (P/O AX-198)	Voltage drop	RW-109-40
S601	SWITCH, micro: push-pull type.	Safety switch for B601 Blower line supply. Works from rack door.	SW-230
S602	Same as S601	Link in main interlock circuit. Works from rack door.	
S603	Same as S601 (P/O AX-198)	Link in main interlock circuit. Closes upon in-sertion of RFD-2 into rack.	
S604	SWITCH, micro: push-button type (P/O AX-198)	Link in main interlock circuit. Closes when P606 mates with J609.	SW-189
W601	CABLE, RF: consists of RG-8/U coaxial cable, P616 and P619, 5-1/4 in. long. (P/O AX-198)	Internal cable in AX-198. J609 to CP605.	CA-512-1-5.25

TABLE C. RAK-9B1 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
W602	CABLE, RF: consists of RG-59/U coaxial cable, P617 and P618, 11-1/4 in. long. (P/O AX-198)	Internal cable in AX-198. J606 to CP602.	CA-383-11.25C
W603	NOT USED		
W604	NOT USED		
W605	CABLE, single conductor: consists of TMC #WI-131 hi-voltage wire, J604 and P615, 96 in. long.	J401 (PS-5) to P202 (RFD-2). High voltage.	CA-490
W606	CABLE, multiple conductor: consists of wiring as shown in figure VI-7, J605 and P614.	J701 (PS-4A) to P201 (RFD-2). Low voltage.	CA-491
W607	CABLE, RF: consists of RG-59/U coaxial cable, P611 and P612, 78 in. long.	J103 (SBE-6) to J201 (RFD-2)	CA-383-78C
W608	CABLE, RF: consists of RG-59/U coaxial cable, P604 and P613, 49 in. long.	CP615 (VOX-5) to J104 (SBE-6)	CA-480-6-49
W609	CABLE, multiple conductor: consists of wiring as shown in figure VI-7, E605 and P609.	J501 (APP-4) to E101 (SBE-6)	CA-507-1
W610	CABLE, harness: consists of wiring as shown in figure VI-7, P607 and E604.	Main rack cable harness.	CA-506

TABLE C. RAK-9B1 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
W611	CABLE, multiple conductor: consists of 2-conductor a-c power wire and P601.	APP-4 to J703 (PS-4A)	CA-509
W612	CABLE, multiple conductor: consists of 2-conductor a-c power wire and J601.	Line voltage to APP-4	CA-493
W613 THRU W628	NOT USED		
W629	CABLE, RF: consists of RG-174/U coaxial cable, P635 and P636.	ALDC feedback. J704 (PS-4A) to J113 (SBE-6)	CA-480-3-80

TABLE D. APP-4 PARTS LIST

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
C501	CAPACITOR, fixed: ceramic dielectric, 1000 uuf ±20% Char. A	RF bypass	CK70A102M
C502 THRU C520	Same as C501	RF bypass	
C521	CAPACITOR, fixed: mica dielectric, .01 uf ±10%, Char. B.	RF bypass	CM-35B103K
C522	Same as C501	RF bypass	
C523	Same as C501	RF bypass	
C524	Same as C501	RF bypass	
CB501	CIRCUIT BREAKER, dual type: calibrating tap, 15 amps, 60 cycle, 230 VAC.	SBT-1K(V) MAIN POWER switch	SW-261
E501	TERMINAL BLOCK: Barrier lug type, 16 terminals, 16 #6-32 binder head screws.	SBT-1K(V) external connections	TM-100-16
E502	Same as E501	SBT-1K(V) external connections	
F501	FUSE, cartridge: hi-rating, 15 amps, 250 max voltage, medium blow-time.	Utility AC circuit protection	FU-103-15

TABLE D. APP-4 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
F502	Same as F501	Utility AC circuit protection	
I501	LAMP, incandescent: 120 volts, 3 watts, S-6 clear bulb, bayonet base.	MAIN POWER indicator	BI-102-3
J501	CONNECTOR, receptacle: MIL type MS3102A28-11S, female.	Main APP-4 connector	MS3102A28-11S
J502	CONNECTOR, receptacle: AC power, grounding type.	Utility outlet	JJ-173
J503	Same as J502	Utility outlet	
L501	COIL, RF, fixed: 150 uh ±10%, 100 ma.	Choke, RF	CL-140-2
L502 THRU L520	Same as L501	Choke, RF	
L521	COIL, RF, fixed: 2 uh ±0.1 uhy, Q = 200 or more at 7.9 mc.	Choke, RF	CL-269
L522	Same as L521	Choke, RF	
R501	SHUNT, power: .0042-ohm +5% -1%, 20 ma at 115 VAC.	115- to 230-V conversion	AR-132
R502	Same as R501	115- to 230-V conversion	

TABLE D. APP-4 PARTS LIST (cont'd)

SYM	DESCRIPTION	FUNCTION	TMC PART NO.
R503	SHUNT, power: .075-ohm ±10%, 5 amps at 115 VAC.	115- to 230-V conversion	AR-133
R504	Same as R503	115- to 230-V conversion	
R505	RESISTOR, fixed: wire-wound 5K, 10 watts.	Voltage dropping	RW-109-32
XF501	HOLDER, fuse: extractor post, for 1/4 in. x 1-1/4 in. cartridge fuse.	F501 socket	FH-100-1
XF502	Same as XF501	F502 socket	
X1501	SOCKET, lamp: for S-6 bayonet bulb, with red lens.	1501 socket	TS-124-1

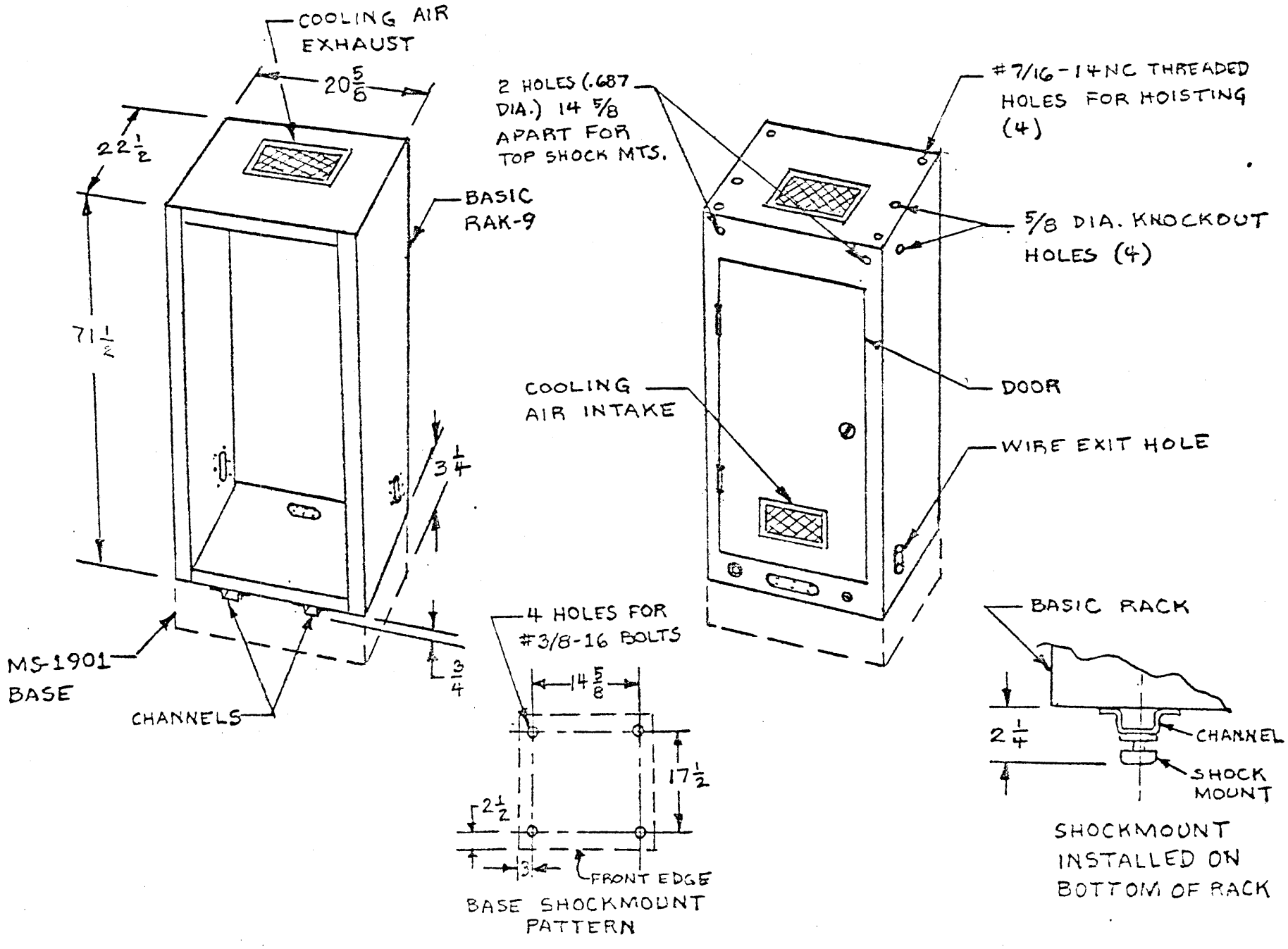


FIGURE A. MODEL RAK-9 RACK INSTALLATION DIMENSIONS

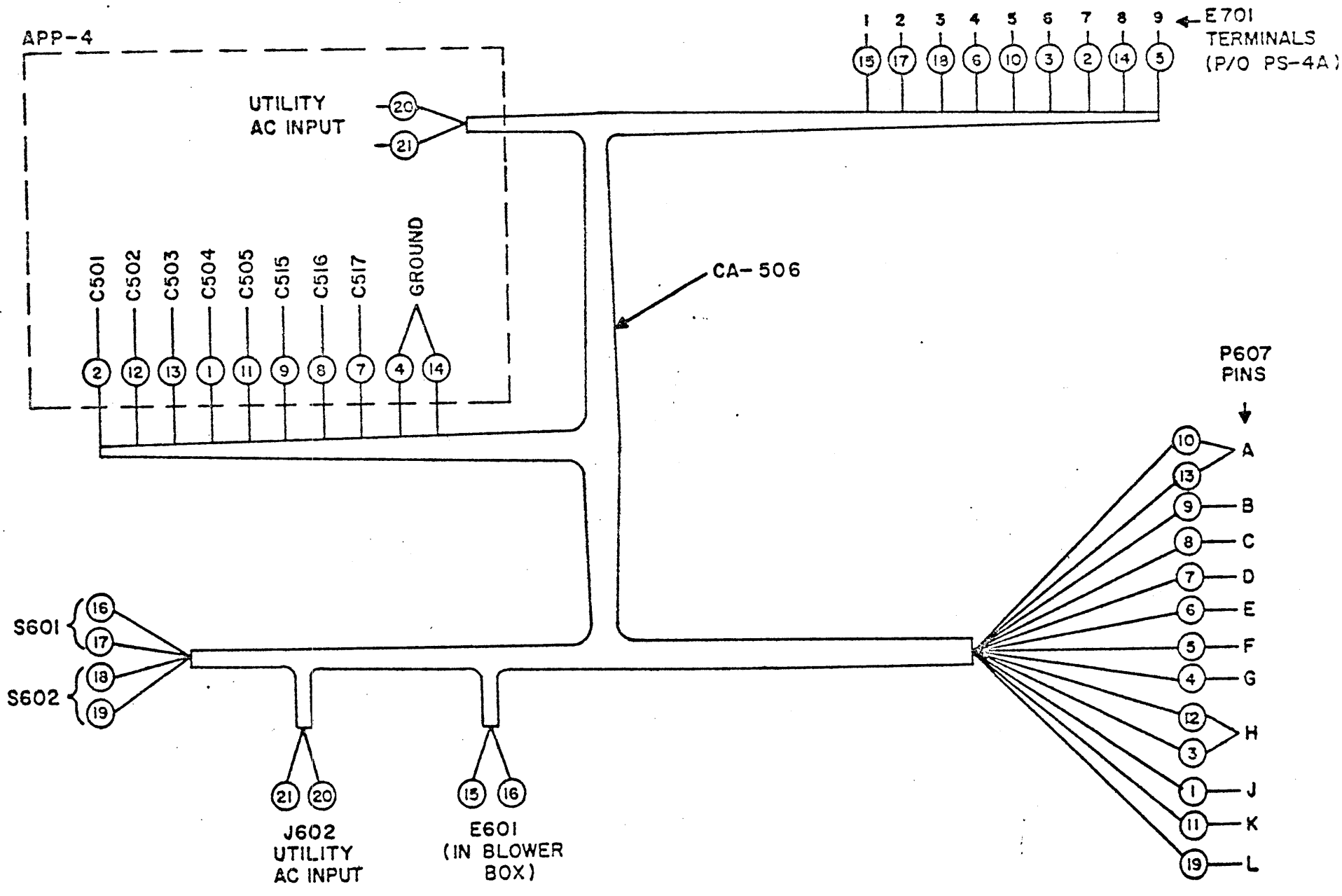
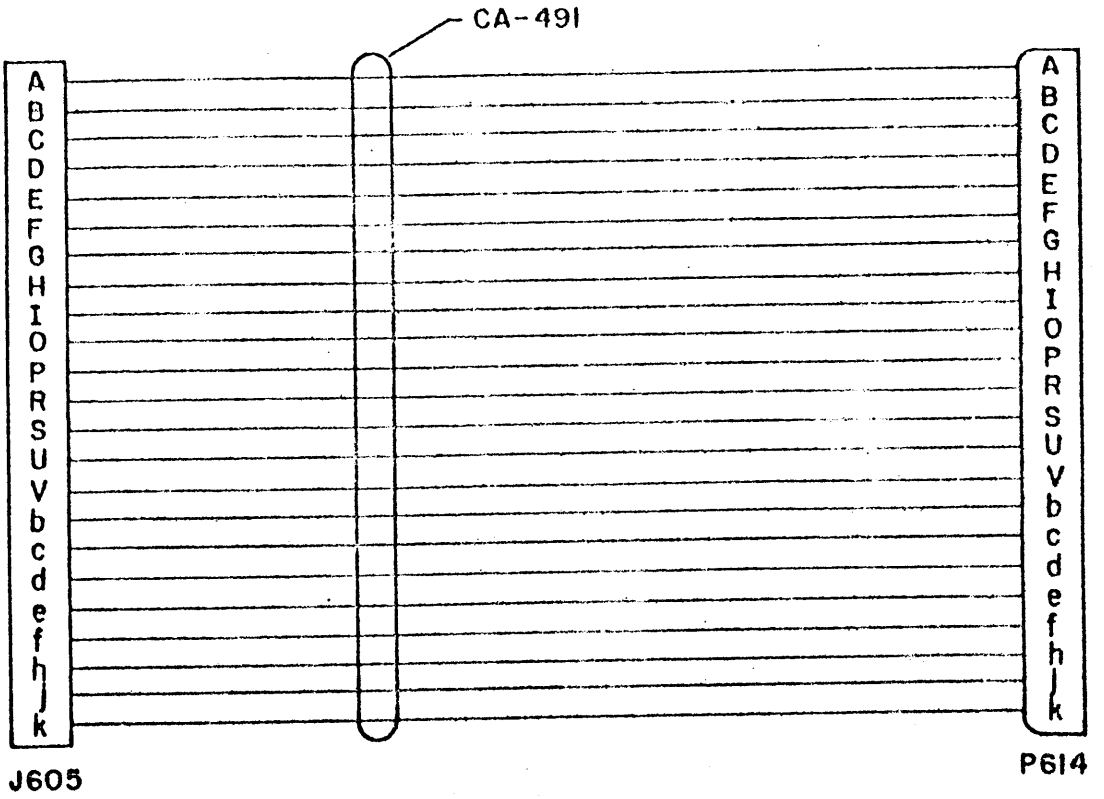


FIGURE H. CA-506 CABLE WIRING DIAGRAM



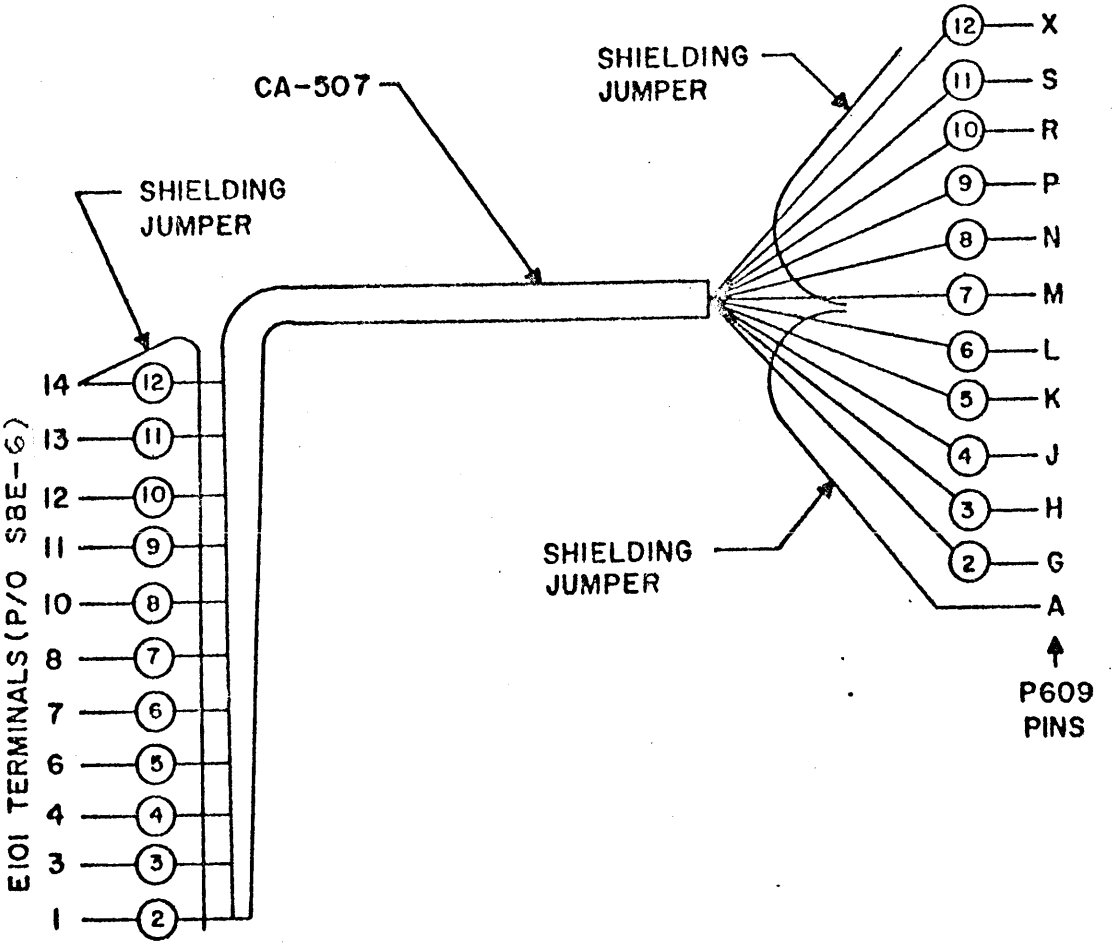


FIGURE I. CA-491 & CA-507 CABLE WIRING DIAGRAMS

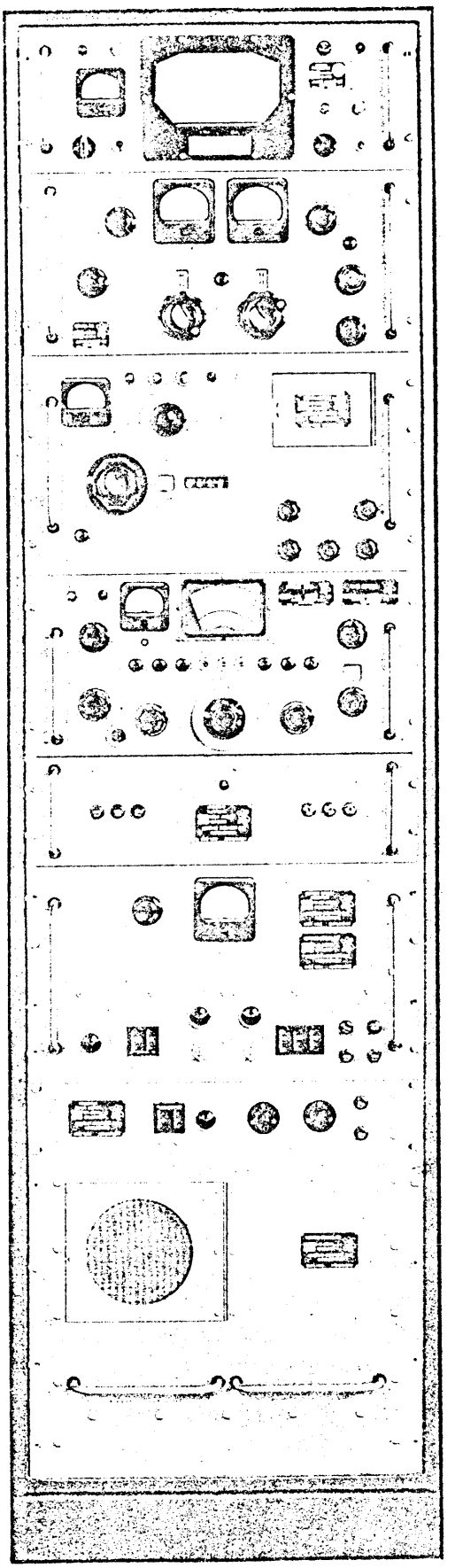


Figure 1-1. General Purpose Transmitter, Model SBT-1K(V)

Figure 5. R.F. Output Chassis, Model AX-198, Front View

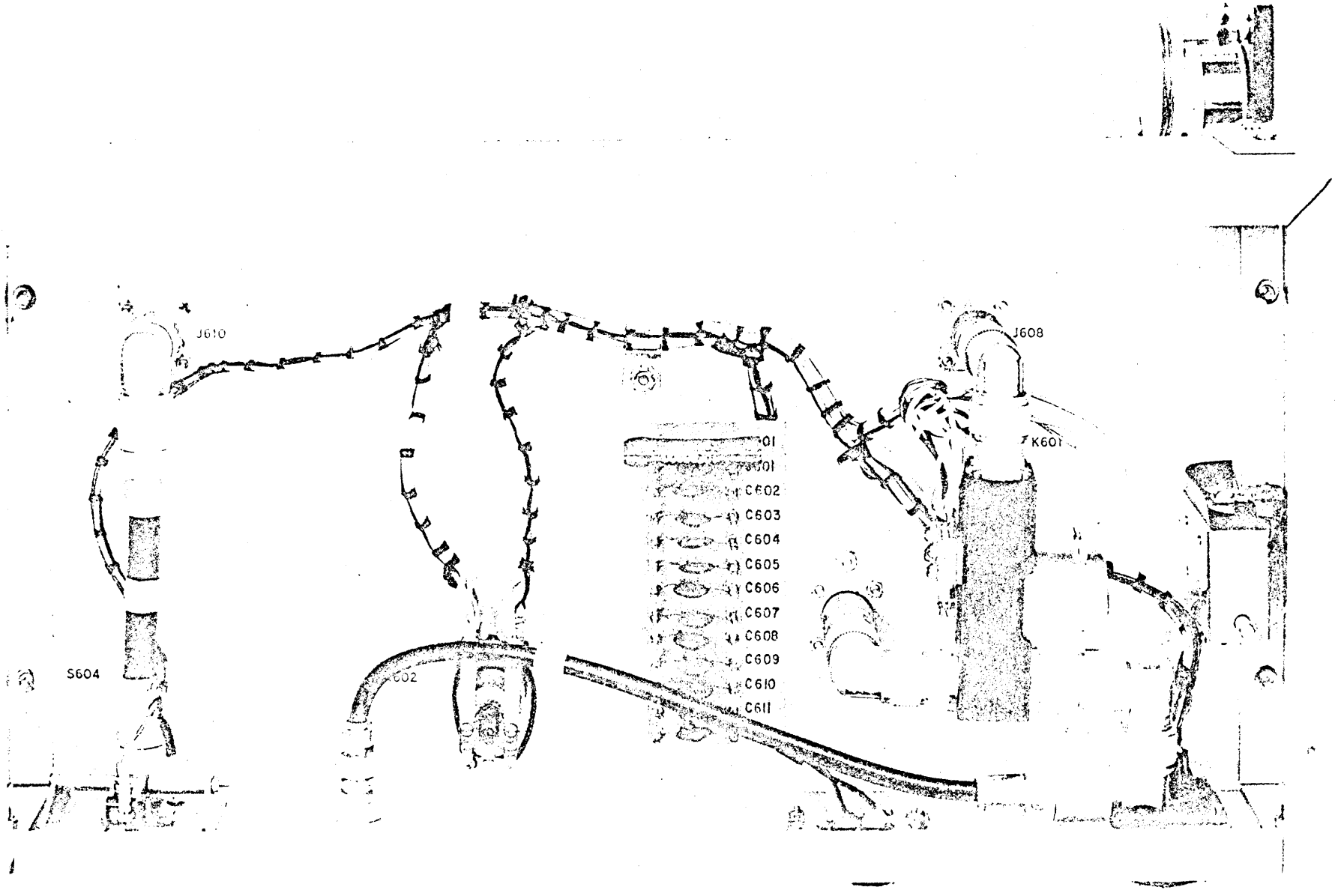


Figure 4. R.F. Output Chassis, Model AX-198, Back View

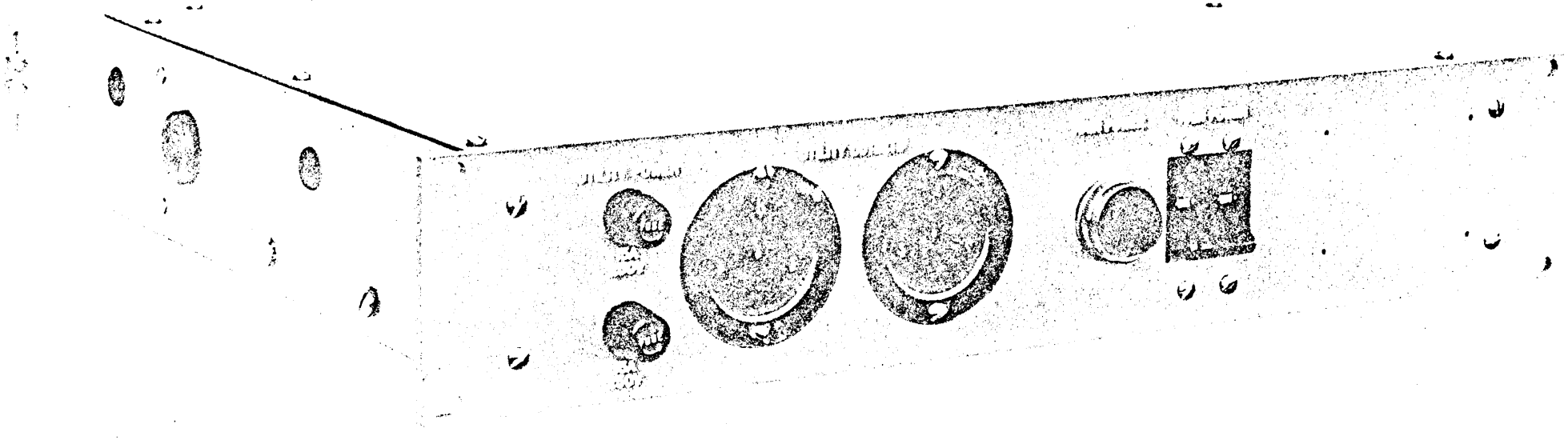


Figure F. Auxiliary Power Panel, Model APP-4

Figure B. Cable Installation Diagram, SBT-1K(V)

Figure C. ATS-TU-2 Tuner Mounting Dimensions

Figure D. CA-541 Cable Wiring Diagram

Figure E. APP-4 Schematic
Wiring Diagram

Figure G. AX-198 Schematic
Wiring Diagram