UNCLASSIFIED

MASTER COPY
DO NOT DESTROY

TECHNICAL MANUAL

for

GENERAL PURPOSE TRANSMITTER

MODEL SBT-1K(F)

(AN/URT-19(v))

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

UNCLASSIFIED

TECHNICAL MANUAL

for

GENERAL PURPOSE TRANSMITTER

MODEL SBT-1K(F)

(AN/URT-19(v))

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

IN-273/F

Issue Date: 30 July, 1964

NOTICE

THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes* furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

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

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

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

CHANGE NO. 1 SBT-1K(F) (Sheet 1 of 2)

WORLD WIDE SUPPLIERS OF ELECTRONIC COMMUNICATIONS EQUIPMENT

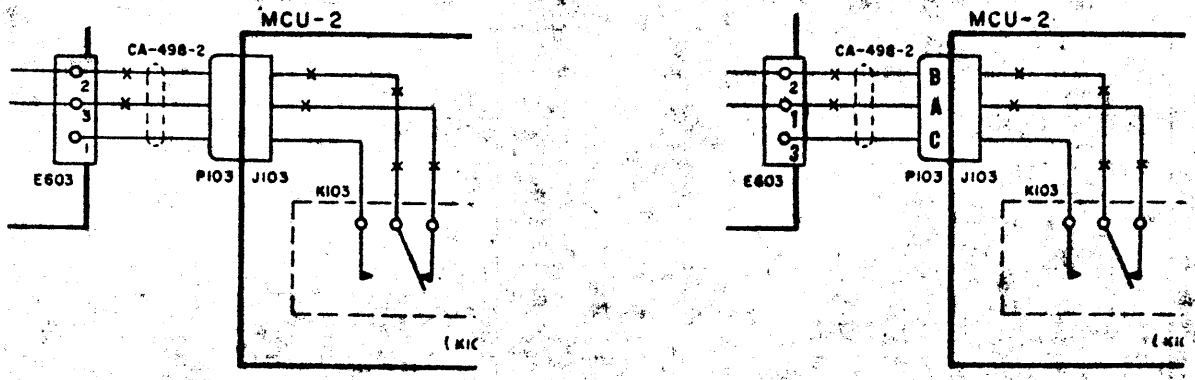
INSTRUCTION BOOK CHANGE NOTICE

Date Sept 3, 1964

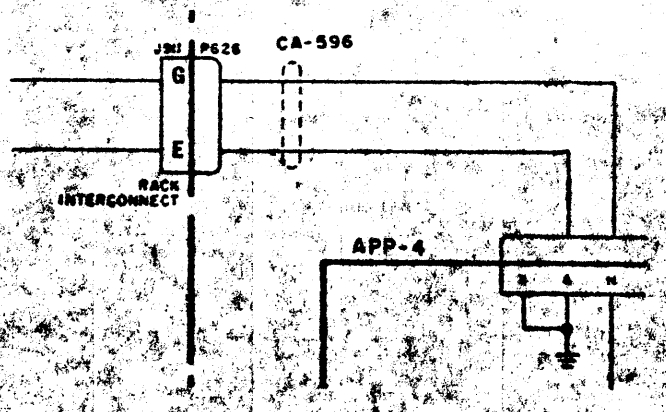
Manual affected: General Purpose Transmitter Model SBT-1K(F) IN -273/F

Page 4-13/4-14. Figure 4-2.

1. Change terminal block E603 of AX-198 and plug P103 of cable CA-498-2 as indicated below.



2. Add letter designations to jack J911 of rack interconnect as indicated below.



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

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

Attn.: Director of Eng. Services

INSTRUCTION BOOK CHANGE NOTICE

Date Sept 3, 1964

Manual affected: General Purpose Transmitter Model SBT-1K(F) IN -273/F

Page 4-13/4-14. Figure 4-2. (cont)

3. In Antenna Tuning System ATS-2 block, change MC4-2 to MCU-2 and C4-2 to CU-2.

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

FOREWORD

The SBT-1K(F) comprises 15 modular units mounted in 2 equipment racks and 1 unit (P/O ATS-2) that is installed at the antenna location; these modular units are used in various transmitter configurations as well as the SBT-1K(F). Individual manuals are written for each modular unit and then combined as required with a system manual to cover the overall transmitter.

The SBT-1K(F) system manual given herein discusses each modular unit only to the extent that it effects the system. Detailed information concerning any modular unit is available in the individual manual.

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

General Purpose Transmitter

TMC: General Purpose Transmitter, Model SBT-1K(F)
MIL: Transmitting Set, Radio: AN/URT-19V

Sideband Generator

TMC: Sideband Generator, Model SBG-1
MIL: Sideband Generator: AN/URA-30

Sideband Exciter (P/O SBG-1)

TMC: Sideband Exciter, Model CBE-1
MIL: Radio Frequency Oscillator: O-714/UR

Frequency Amplifier (P/O SBG-1)

TMC: Frequency Amplifier, Model CHG-2A
MIL: Radio Frequency Amplifier: AM-2505/URA-31

Controlled Master Oscillator (P/O SBG-1)

TMC: Controlled Master Oscillator, Model CMO-1
MIL: Radio Frequency Oscillator: 0-716/URA-31

Controlled Oscillator (P/O SBG-1)

TMC: Controlled Oscillator, Model CLL-1
MIL: Audio Frequency Oscillator: 0-717/URA-31

Frequency Divider (P/O SBG-1)

TMC: Divider Chain, Model CHL-1
MIL: Frequency Divider: CU-928/URA-31

Frequency Standard (P/O SBG-1)

TMC: Frequency Standard, Model CSS-1B
MIL: Radio Frequency Oscillator: 0-715/URA-31

Power Supply for CHG-1 (P/O SBG-1)

TMC: Power Supply, Model CPP-5
MIL: Power Supply: PP-2561A/URA-31

Power Supply for CMO-1 (P/O SBG-1)

TMC: Power Supply, Model CPP-2
MIL: Power Supply: PP-2562/URA-31

Linear Power Amplifier

TMC: Linear Power Amplifier, Model PAL-1K(A)
MIL: Power Amplifier: AN/URA-36

RF Amplifier (P/O PAL-1KA)

TMC: Amplifier, Model RFD-1A
MIL: Radio Frequency Amplifier: AM-2785/URA-36

Low Voltage Power Supply (P/O PAL-1KA)

TMC: LV Power Supply, Model PS-4A
MIL: Power Supply: PP-2765A/URA-36

High Voltage Power Supply (P/O PAL-1KA)

TMC: HV Power Supply, Model PS-5
MIL: Power Supply: PP-2766/URA-36

Tone Intelligence Unit

TMC: Tone Intelligence Unit, Model TIS-3
MIL: Terminal, Telegraph: TH-39A/UGT

Antenna Tuning System

TMC: Antenna Tuning System, Model ATS( )-2
MIL: AN/URA-27 or AN/URA-34

Antenna Tuner Unit (P/O ATS( )-2)

TMC: Antenna Tuner Unit, Model TU-2-( )/U
MIL: Coupler, Antenna: CU-772/URA-27 or CU-651/UR

Monitor Control Unit (P/O ATS( )-2)

TMC: Monitor Control Unit, MCU-2-( )/U
MIL: Control-Indicator: C-2995/URA-27

Directional Coupler (P/O ATS( )-2)

TMC: Directional Coupler, Model CU-2( )/U
MIL: Coupler, Directional: CU-773/URA-27 or CU-820/URA-34

Power Distribution Panel

TMC: Auxiliary Power Panel, Model APP-4
MIL: Power Distribution Panel: SB-1577

TABLE OF CONTENTS

SECTION 1 - GENERAL INFORMATION

SECTION 2 - INSTALLATION

TABLE OF CONTENTS (Cont'd)

SECTION 2 - INSTALLATION (Cont'd)

SECTION 3 - OPERATOR'S SECTION (Cont)

SECTION 4 - TROUBLESHOOTING

SECTION 5 - MAINTENANCE

LIST OF ILLUSTRATIONS

SECTION 1 - GENERAL INFORMATION

SECTION 2 - INSTALLATION

SECTION 3 - OPERATOR'S SECTION

SECTION 4 - TROUBLESHOOTING

LIST OF TABLES

SECTION 1 - GENERAL INFORMATION

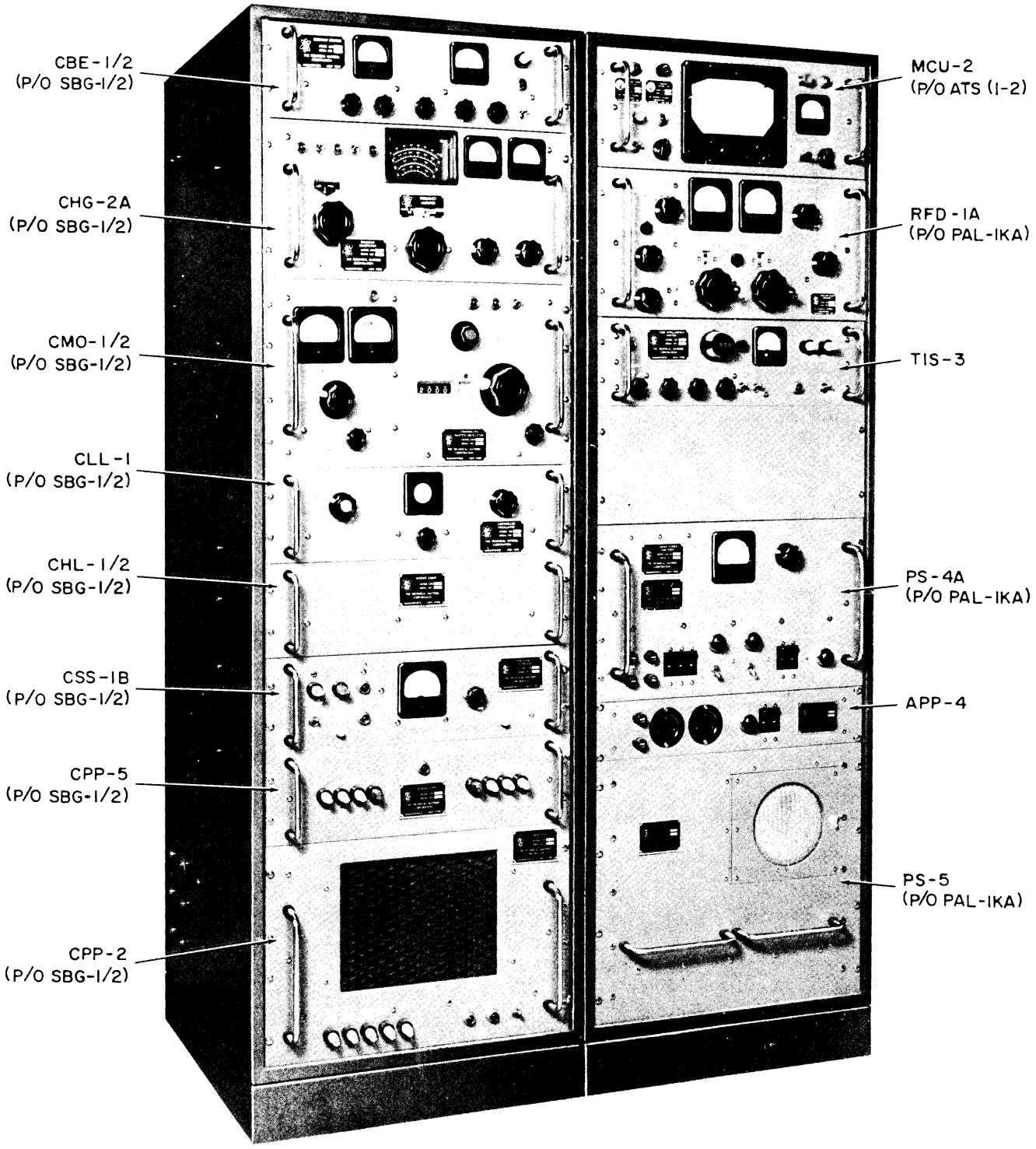


Figure 1-1. General Purpose Transmitter, Model SBT-1K(F)

SECTION 1

GENERAL INFORMATION

1-1. GENERAL DESCRIPTION

General Purpose Transmitter, Model SBT-1K(F), (Figure 1-1) is a transmitting system with a conservatively rated output of 1000 watts PEP (Peak Envelope Power) and a frequency range of 2 to 32 mc, continuously variable. Front-panel controls permit AM, Compatible AM, CW, SSB, ISB, FAX, and FSK modes of operation.

The SBT-1K(F) comprises three sub-systems (SBG-1, PAL-1K(A), and ATS-2) containing 15 modular units and a tone intelligence unit (TIS-3) mounted in two equipment racks and is used in fixed-station or mobile communications systems. Two types of transmitters are available, varying only in rack-installation method and overall height as follows:

Model	Installation	Overall Height
SBT-1K(F) 2-B	Base Mounted (rigid)	62-17/32 inches
SBT-1K(F) 2-S	Shock Mounted	61-17/32 inches

The base-mounted model is provided with mounting holes in the base for bolting the rack directly to the floor; the shock-mounted model is equipped with a set of shock mounts for securing the top and bottom of the rack to a mobile-unit structure. When the units are base-mounted, they are placed as shown in figure 1-1 but when they are shock-mounted, at least 3 inch separation of the two cabinets is recommended in order to allow lateral motion of the units.

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

1-2. DESCRIPTION OF UNITS

a. GENERAL - Paragraphs b through i below give a brief description of all modular units used in the SBT-1K(F) with the exception of those units that constitute Sideband Generator SBG-1; a brief description of SBG-1 modular units can be found in Section 4 of the SBG-1/2 manual. For detailed information pertaining to any modular unit, refer to the individual modular-unit manual.

It should be noted that the modular units contained in Antenna Tuning System ATS( )-2 can be obtained with a 50- or 70-ohm input impedance. Accordingly, the official nomenclature and equipment namesplates contain a "50" or "70" to designate the applicable input impedance (refer to the FOREWORD). For brevity in this manual, the modular units of antenna tuning system are designated MCU-2, TU-2, and CU-2 (refer to paragraphs b, c, and d below). Further, the antenna tuning system itself is designated ATS-2.

b. MONITOR CONTROL UNIT, MODEL MCU-2 - Monitor Control Unit, Model MCU-2 is part of Antenna Tuning System ATS-2. This unit contains two meters and their controlling switches, and an overload protection circuit. A large dual-pointer meter indicates the forward and reflected transmitter power and the Voltage Standing Wave Ratio (VSWR). A small triple-scale meter indicates the position of the motor-driven short on the helical transmission line, the position of the antenna resistance selector switch, or the humidity in the unit. The overload circuit will disable the transmitter to prevent damage to the equipment when the VSWR or transmitter power exceed preset levels.

c. ANTENNA TUNER UNIT, MODEL TU-2 - Antenna Tuner Unit, Model TU-2, is part of Antenna Tuning System ATS-2 and is used to match the transmitter to the antenna. The Antenna Tuner Unit is installed at the antenna location; it is designed for outdoor installation and has waterproof stuffing tubes for cable connections.

d. DIRECTIONAL COUPLER UNIT, MODEL CU-2 - Directional Coupler Unit, Model CU-2, is part of Antenna Tuning System ATS-2. The Directional Coupler Unit is a balanced radio-frequency bridge calibrated to operate with a 50- or 70-ohm coaxial line. Balancing and equalizing controls are provided.

e. RF AMPLIFIER, MODEL RFD-1A - RF Amplifier, Model RFD-1A is part of Linear Power Amplifier PAL-1K(A) and consists of three cascade linear amplifier stages. RF Amplifier RFD-1A

accepts input RF signals from Frequency Amplifier, Model CHG-2A. Together with Power Supplies PS-4A and PS-5, the amplifier is capable of providing 1000 watts peak envelope power (PEP) throughout the frequency range of 2 to 32 mc.

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

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

h. TONE INTELLIGENCE UNIT, MODEL TIS-3 - Tone Intelligence Unit, Model TIS-3 is a multi-purpose audio-tone keyer. The TIS-3 accepts three types of d-c signals (FSK, CW, and FAX) and converts them into audio-frequency output signals for sideband transmission via an associated sideband generator, which in turn provides the transmitter with the required r-f intelligence.

Front-panel controls permit selection of various discreet center frequencies. An audio CW channel fixed at 1000 cycles is also provided. A precisely calibrated, direct reading counter type dial presents fast, simple and accurate adjustment of the desired frequency shift from 12 to 1000 cycles. When used in the FAX mode, linear shift of up to 1200 cps is available for photographic transmission.

i. AUXILIARY POWER PANEL, MODEL APP-4 - Auxiliary Power Panel, Model APP-4, functions as a distributor for line voltage to the modular units contained in the SBT-1K(F). Wiring connections and terminal blocks are provided on the rear of the unit to facilitate connection of a variety of equipment external to the SBT-1K(F).

Included in this wiring arrangement are points for wiring the SBT-1K(F) into a larger transmitter system or into a transmitter/receiver system utilizing a common antenna. Associated with this function are sequential relays located in the AX-198 RF Output Chassis mounted on back of Monitor Control Unit MCU-2.

1-3. REFERENCE DATA

Table 1-1 lists the technical specifications pertinent to the SBT-1K(F) transmitter. For technical specifications concerning the modular units used in the SBT-1K(F), refer to the individual modular-unit manuals.

1-4. EQUIPMENT SUPPLIED

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

Table 1-1. ELECTRICAL CHARACTERISTICS, SBT-1K(F)

Output power	1000 watts PEP
Frequency range:	2 to 32 megacycles, continuously adjustable
Modes of Operation:	CW, SSB, ISB, AM, AM equivalent (AME), FSK and FAX
Carrier Insertion:	-55 db to full PEP output
Output impedance:	50 or 70 ohms unbalanced (dependent upon ATS-2 ordered)
Harmonic suppression:	2nd harmonic at least 40 db below PEP 3rd harmonic at least 50 db below PEP
Signal/distortion ratio:	2-30 mc: distortion at least 40 db below either tone of a standard two tone test
	30-32 mc: distortion at least 35 db below either tone of a standard two tone test

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

Unwanted sideband rejection:	1000 cps tone at least 60 db down
Frequency stability:	1 part in 1 x 10^8/day
Audio response:	Flat within +1.5 db 250 to 7500 cps (+1.5 db 250 to 6000 cps optional)
Audio input:	Two 600-ohm channels, balanced or unbalanced, -20 dbm to +20 dbm (-20 dbm input will produce full RF output)
Tuning:	All tuning and bandswitching controls on front panels (no plug-in components)
Metering:	Front panel meters indicate operation of all critical circuits.
ALDC:	An automatic load and drive control is furnished to limit distortion during high drive peaks or load changes.
T/R function:	A coaxial antenna relay and receiver muting circuit is provided to facilitate half-duplex operation.
Cooling:	Pressurized cabinet, filtered forced-air for heat maximum dissipation
Safety features:	1. Full interlock protection 2. Full overload and fuse protection
Environmental conditions:	Designed to operate in any ambient temperature between 0° and 50°C, and any value of humidity up to 90%.
Power Requirements:	115/230 volt, +10%. 50-60 cps, single phase power. Power consumption approximately 2060 watts. 3700

TABLE 1-2. EQUIPMENT SUPPLIED, SBT-1K(F)

NOMENCLATURE		QTY PER EQUIP.	OVERALL DIMENSIONS (IN)			GROSS SHIPPING WEIGHT	WEIGHT (LBS)
TMC DESIGNATION	MILITARY DESIGNATION		HEIGHT	WIDTH	DEPTH		
Sideband Exciter, Model CBE-1	O-714/UR	1	5-1/8	19	10-3/4	Refer to tables 2-1 and 2-2	16-1/4
Frequency Amplifier, Model CHG-2A	AM-2505/URA -31	1	10-1/2	19	19-1/4		85
Controlled Master Oscillator, Model CMO-1	O-716/URA-31	1	10-1/2	19	16		40
Controlled Oscillator, Model CLL-1	O-717/URA-31	1	5-1/4	19	19	Refer to tables 2-1 and 2-2	25
Divider Chain, Model CHL-1	CU-928/URA -31	1	5-1/4	19	15		20
Frequency Standard, Model CSS-1B	O-715B/URA -31	1	5-1/4	19	14-3/4		30
Power Supply, Model CPP-5	PP-2561A/ URA-31	1	5-1/4	19	16-1/2		16
Power Supply Model CPP-2	PP-2562/ URA-31	1	12-1/4	19	16		67
Tone Intelligence Unit, Model TIS-3		1	5-1/4	19	14-1/8		38
Monitor Control Unit, Model MCU-2	C2995/URA -27	1	7	19	8	Refer to tables 2-1 and 2-2	15
Antenna Tuner Unit, Model TU-2	CU-772/URA-27 or CU-651/UR	1	8-1/4	12	15-1/4		50
Directional Coupler, Model CU-2	CU-773/URA-27 or CU-820/URA-34	1	3-1/2	9-1/2	3-1/2		2
RF Amplifier Model RFD-1A	AM-2785A/ URA-36	1	8-3/4	19	19-3/4		46

TABLE 1-2. EQUIPMENT SUPPLIED, SBT-1K(F) (cont)

NOMENCLATURE		QTY PER EQUIP.	OVERALL DIMENSIONS (IN)			GROSS SHIPPING WEIGHT	WEIGHT (LBS)
TMC DESIGNATION	MILITARY DESIGNATION		HEIGHT	WIDTH	DEPTH		
LV Power Supply, Model PS-4A	PP-2765A/ URA-36	1	10-1/2	19	15		64
HV Power Supply, Model PS-5	PP-2766/URA -36	1	15-3/4	19	18-1/4	Refer to tables 2-1 and 2-2	194
Auxiliary Power Panel, Model APP-4		1	3-1/4	19			
Cabinet, Electrical Equipment, Model RAK-11	CY-2416/URT-19(V)	1	59-9/32	20-5/8	22-1/2		280
Cabinet, Electrical, Model RAK-17B			59-9/32	20-5/8	22-1/2		280
Cable Assemblies Supplied With RAK-11						Refer to tables 2-1 and 2-2	
CA-550		1					
CA-551-1		1					
CA-551-2		1					
CA-551-3		1					
CA-575-2		1					
CA-576-8-5		1					
CA-590		1					
CA-409-32-2.00		2					
Cable Assemblies Supplied With RAK-17B							
CA-480-3-80		1					
CA-383-10F		1					
CA-493		1					
CA-509		1					
CA-512-2-23		2					
CA-588-1		1					
CA-593		1					
CA-594		1					
CA-595		1					
CA-596		1					

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING

The SBT-1K(F) is shipped in 9 boxes as listed in table 2-1; box number and contents are stenciled on the outside of each box. Table 2-2 lists the gross weight and size of shipping boxes. Inspect all boxes for possible damage when they arrive at the operating site. With respect to equipment damage for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

Figures 2-1 and 2-2 are typical illustrations of the method used to pack RAK-11, RAK-17B and the SBT-1K(F) modular units for shipment. Using figures 2-1 and 2-2 as a guide, unpack RAK-11, RAK-17B and the modular units in the reverse order of the indicated packing proccdure; refer to table 1-2 for information regarding size and weight of RAK-11, RAK-17B and modular units. Inspect the contents of each box for possible damage and inspect the packing material for parts that may have been shipped as loose items. Most cable assemblies are mounted in RAK-9B and taped in place; however, some equipment interconnect cables as shipped as loose items.

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

BOX NO.	CONTENTS
1	Cabinet Electrical Equipment, TMC Model RAK-11; Instruction Manuals; Loose Items.
2	Power Supply, TMC Model CPP-5; Divider chain, TMC Model CHL-1; Frequency Standard, TMC Model CSS-1B.

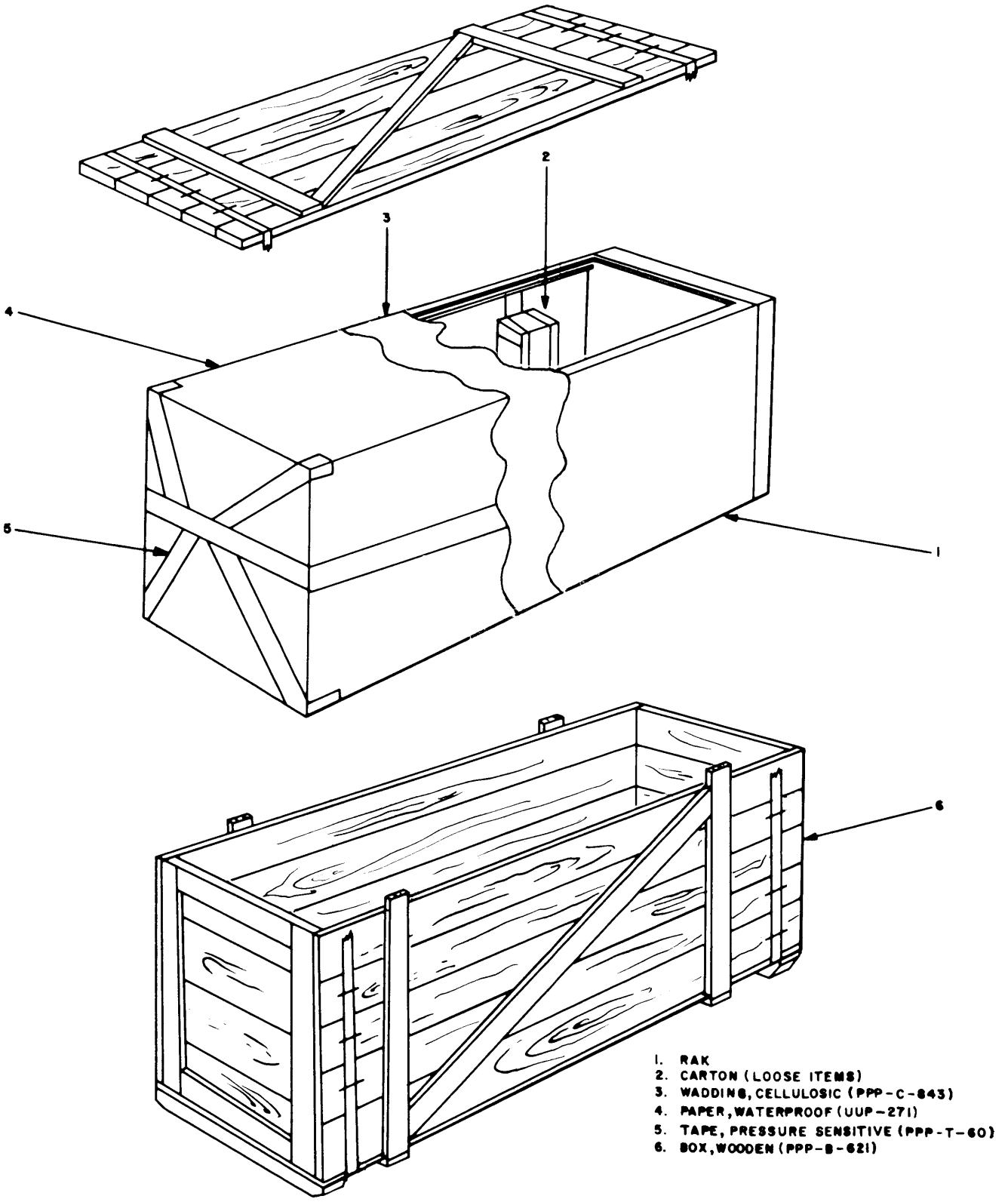
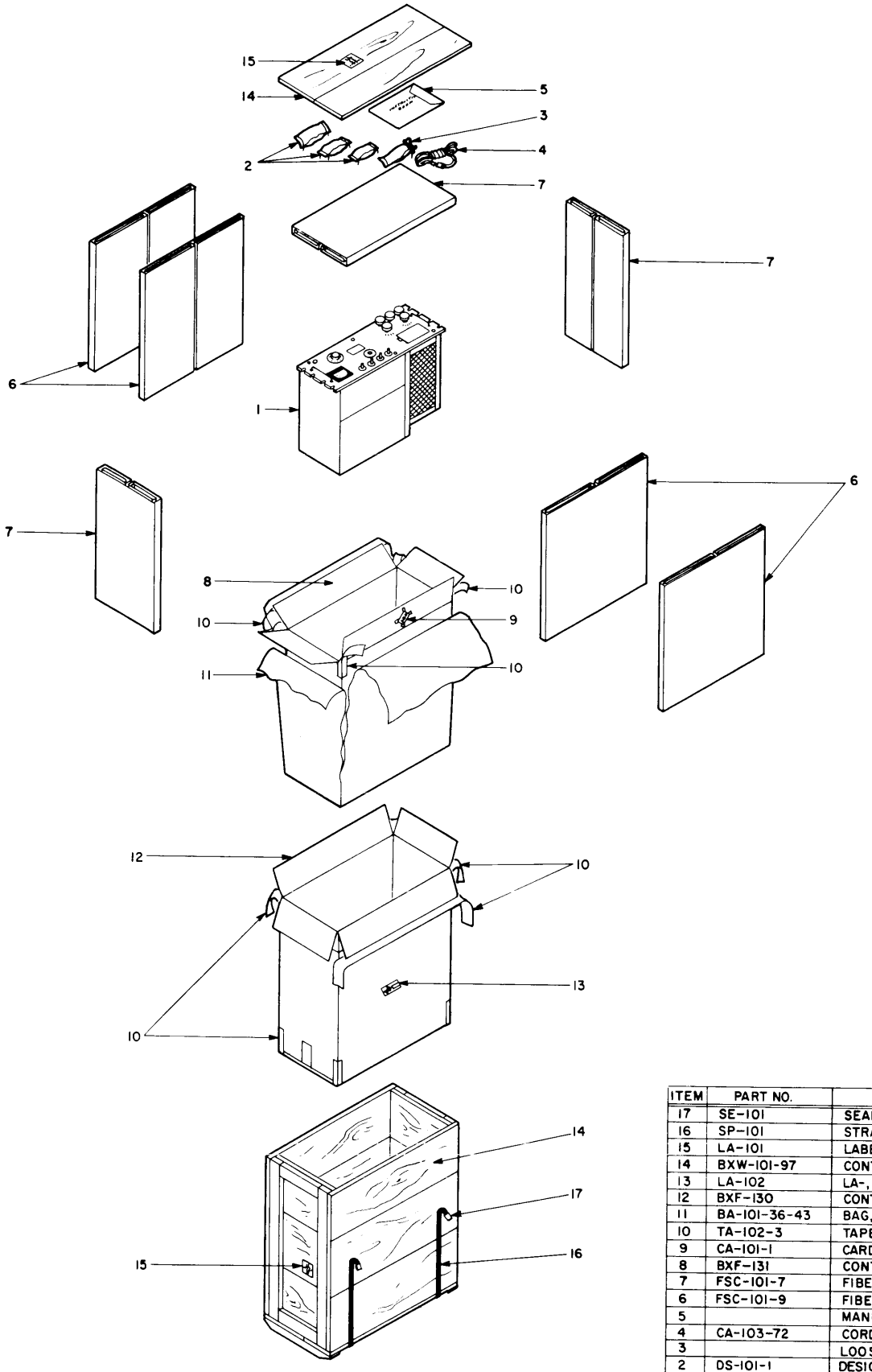


FIGURE 2-1. RAK-9, PREPARATION FOR SHIPMENT

FIGURE 2-1. RAK-11 AND 17B, PREPARATION FOR SHIPMENT



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

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

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

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

BOX NO.	CONTENTS
3	Controlled Oscillator, TMC Model CLL-1; Sideband Exciter, TMC Model CBE-1; Tone Intelligence Unit, TMC Model TIS-3
4	Controlled Master Oscillator, TMC Model CMO-1; Frequency Amplifier, TMC Model CHG-2A.
5	Power Supply, TMC Model CPP-2
6	Cabinet Electrical Equipment, TMC Model RAK-17B; Auxiliary Power Panel, TMC Model APP-4.
7	RF Amplifier, TMC Model RFD-1A; LV Power Supply, TMC Model PS-4A.
8	HV Power Supply, TMC Model PS-5
9	Monitor Control Unit, TMC Model MCU-2 Antenna Tuner Unit, TMC Model TU-2 Directional Coupler Unit, TMC Model CU-2

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

BOX NO.	DIMENSIONS IN INCHES			GROSS WEIGHT IN LBS.
	LENGTH	WIDTH	HEIGHT	
1	66-1/2	24-1/4	31-1/8	400
2	31-1/2	23-7/8	31-3/4	172
3	31-1/2	23-7/8	31-3/4	174
4	31-1/2	23-7/8	31-3/4	191
5	27-1/4	21-1/2	17-1/4	125
6	66-1/2	24-1/2	31-1/8	400
7	32	23-7/8	30-3/4	243
8	28-1/4	24	31-3/4	323
9	28-1/4	24	31-3/4	197

2-2. POWER REQUIREMENTS

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

CAUTION

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

Power Consumption of the SBT-1K(F) is approximately 2050 watts; power cabling of sufficient size to provide 30 amperes at 115 volts a-c, single phase, is adequate. For information concerning the connection of power cables, refer to paragraph 2-3e.

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

MODULAR UNIT	WIRING CHANGE MADE AT:	MANUAL REFERENCE
Sideband Exciter CBE-1	Transformer T201	CBE-1
Frequency Amplifier CHG-2A	Terminal Block E2301	CHG-2A
Controlled Master Oscillator CMO-1/2	Terminal Board E301	CMO-1/2
Controlled Oscillator CLL-1	Terminal Board E701	CLL-1

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

MODULAR UNIT	WIRING CHANGE MADE AT:	MANUAL REFERENCE
Primary Standard CSS-1B	Transformer T601	CSS-1B
Power Supply CPP-5	Transformer T401	CHG-2A
Power Supply CPP-2	Transformers T501 and T502	CPP-2
Monitor Control Unit MCU-2	Terminal Strip E101	ATS-2
Tone Intelligence Unit TIS-3	Transformer T1	TIS-3
LV Power Supply PS-4A*	Circuit Breaker CB301 Transformer T301	PAL-1K(A) PAL-1K(A)
HV Power Supply PS-5*	Transformer T401	PAL-1K(A)
* Do not replace fuses in these units		

2-3. INSTALLATION

a. LOCATION OF TRANSMITTER - Before attempting to install the SBT-1K(F) ensure that adequate power (paragraph 2-2) is available at the selected site or location. Refer to dimensional outline and installation drawing figure 2-3 when choosing the operating location. The room (or van) in which the SBT-1K(F) is located must have a ceiling height of at least 7 feet. Adequate ventilation must be provided; operation of the transmitter in a poorly ventilated room will cause the surrounding temperature to become too high. A clearance of approximately two feet at the rear of the rack is needed for opening the door.

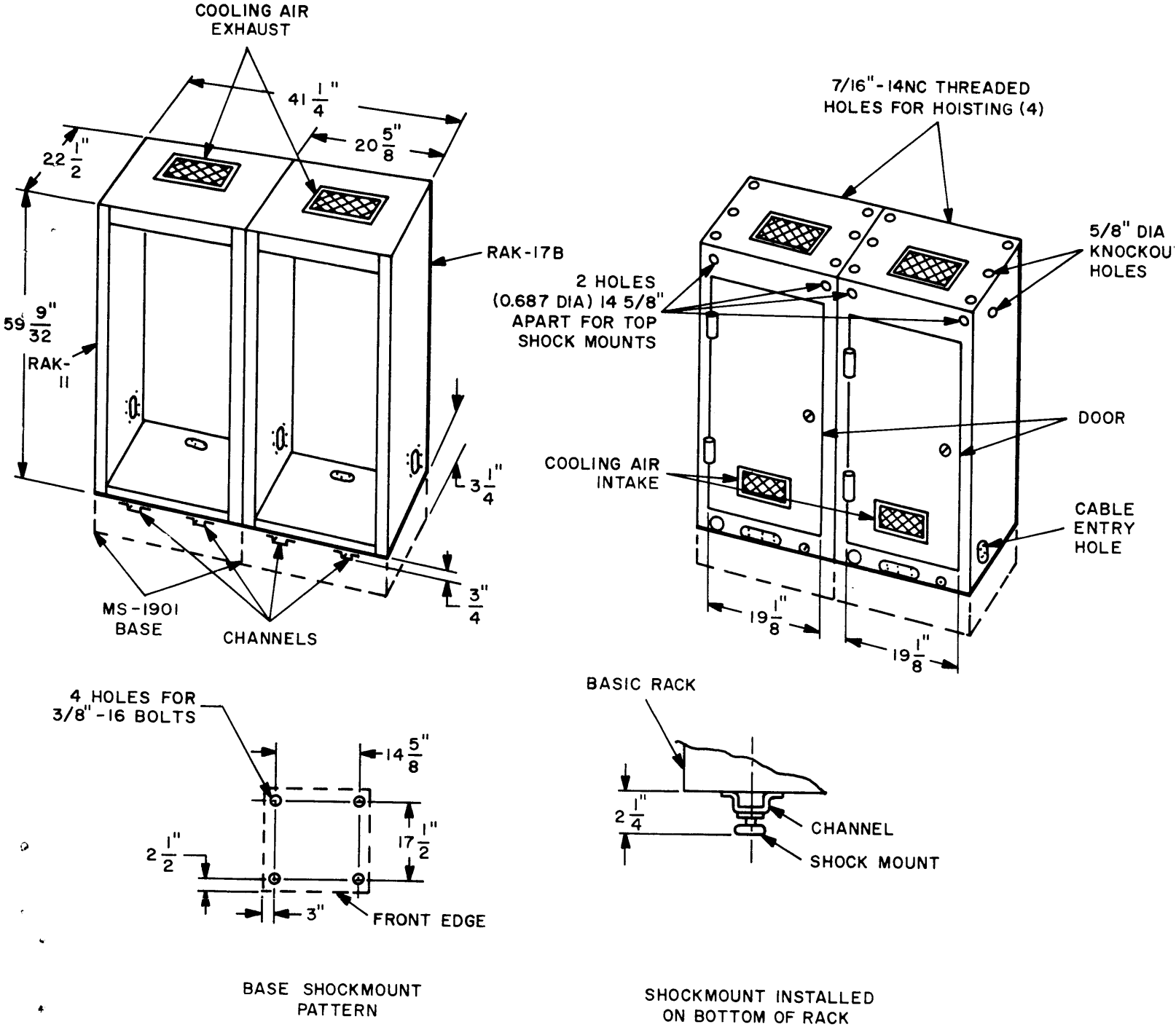


Figure 2-3. Dimensional Outline And Installation Drawing, SBT-1K(F)

For information pertaining to antenna connections, refer to paragraph 2-3d.

After unpacking and inspecting the cabinet (RAK-11 or RAK-17B), place it in its operating location. It is advisable to do this while modular units are not installed because the added weight of the assembled receiver will make movement more difficult. The four holes in the top of the rack and the four eyebolts included as loose parts in the shipment are for moving the rack with a crane hoist. Holes in the base are for rigid-mounting the rack to the floor. Holes in the four bottom channels and along the top of the rear wall are for the shock mounts. Use these holes as a template for drilling holes in the shelter or van.

NOTE

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

b. INSTALLATION OF MODULAR UNITS - Refer to figure 1-1 for information regarding cabinet location of all modular units except Directional Coupler Unit CU-2 and Antenna Tuner Unit TU-2; these units are mounted at the rear of the cabinet (RAK-17B) and at the antenna location respectively. Directional Coupler Unit CU-2 is installed with RF Output Assembly AX-198 as illustrated in figure 2-6 given at the end of this section. Refer to paragraph 2-3c for cable and electrical connections for RF output Assembly AX-198.

All modular units are slide mounted except Monitor Control Unit MCU-2, Auxiliary Power Panel APP-4 and Power Supply PS-5.

Auxiliary Power Panel APP-4 is installed in RAK-17B prior to shipment. To install any slide-mounted unit in its compartment, refer to figure 2-4 and proceed as follows:

(1) Untape or unstrap cable assemblies and all other components secured to the rack frame for shipment.

(2) Pull center section of associated compartment track out until it locks in an extended position.

(3) Position slide mechanisms of modular unit in tracks, and ease modular unit forward into rack until release buttons engage hole in track.

(4) Make the necessary cable and electrical connections as described in paragraph 2-3d. To prevent the cables extending from modular units from snagging, utilize the reel-mounted springs located inside the rack.

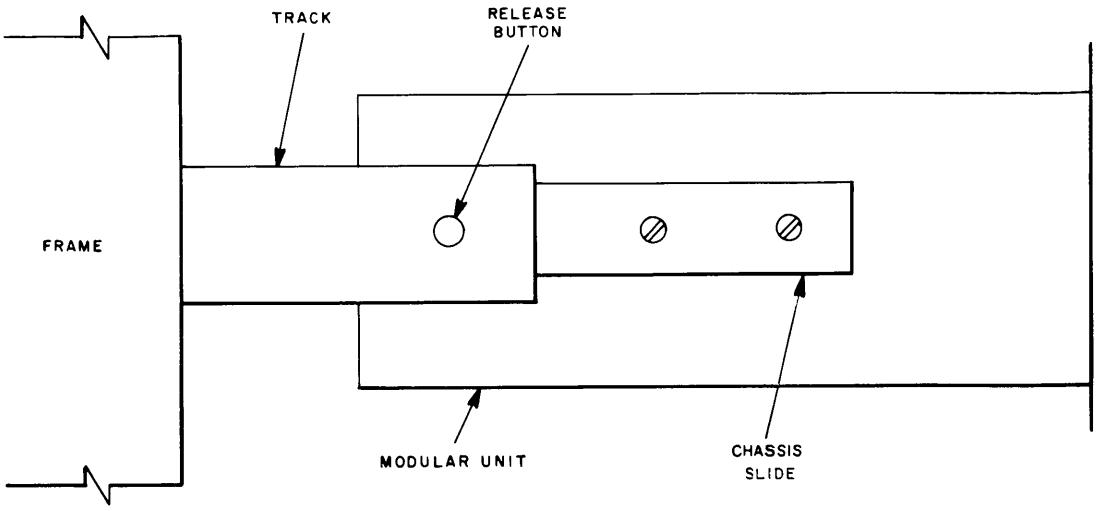
(5) Depress release buttons and slide modular unit completely into compartment.

(6) Secure front panel of modular unit to rack with screws.

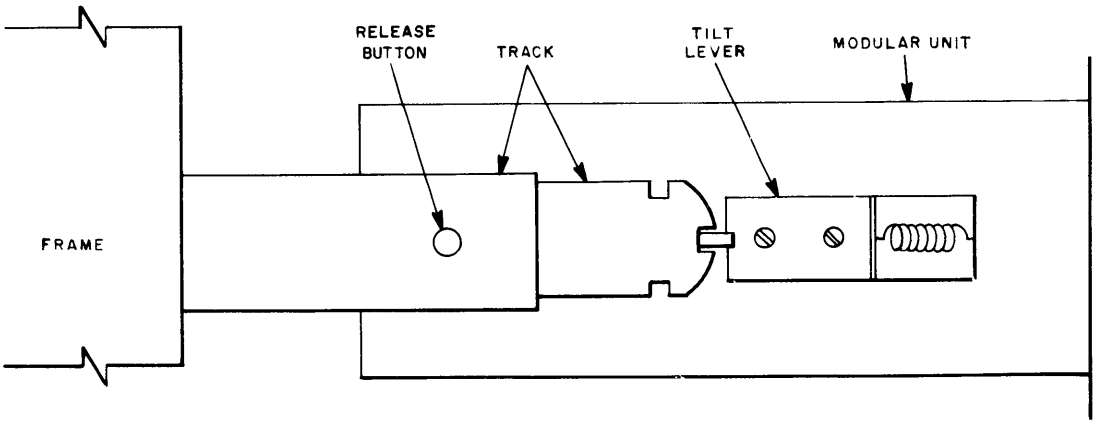
c. INTERCONNECTION OF MODULAR UNITS AND CABINETS - Figure 2-7 and 2-8 given at the end of this section illustrate the cabling and wiring interconnections between the various modular units contained in the transmitter. Figures 2-9 and 2-10 illustrate the cabling interconnection between cabinets (RAK-11 and RAK-17B). Refer to figures 2-7, through 2-10 and connect modular units and cabinets as indicated.

d. CONNECTION OF EXTERNAL EQUIPMENT

(1) GENERAL - Auxiliary Power Panel APP-4 is a standard modular unit present in all SBT-1K series of transmitters.



A NON-TILTING SLIDE MECHANISM



B TILTING SLIDE MECHANISM

FIGURE 2-5. SLIDE-MOUNTING DETAILS

FIGURE 2-4. SLIDE-MOUNTING DETAILS

Besides functioning as a distributor for line voltage, the APP-4 provides two terminal blocks to facilitate connection of external equipment to the transmitter. Except for antenna and receiver connections at J609 and J606 on RF Output Assembly AX-198, all external connections may be made at terminal blocks E501 and E502 located at the rear of Auxiliary Power Panel APP-4. Figure 2-5 and the following paragraphs illustrate the possible external connections to the SBT-1K(F). Schematic diagrams in the individual modular-unit manuals should be used as an aid for tracing wiring.

(2) REMOTE TRANSMITTER PLATE RELAY - Terminals 1 and 2 of E501 are provided for attachment to the coil of a relay supplying plate voltage to an additional stage of r-f amplication external to the SBT-1K(F). This enables control of the entire transmitter at the PS-4A Power Supply Panel by means of the TRANSMITTER VOLTAGES switch.

(3) REGULATED 115 VAC - At terminals 3 and 4 of E501, 115 VAC is available.

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

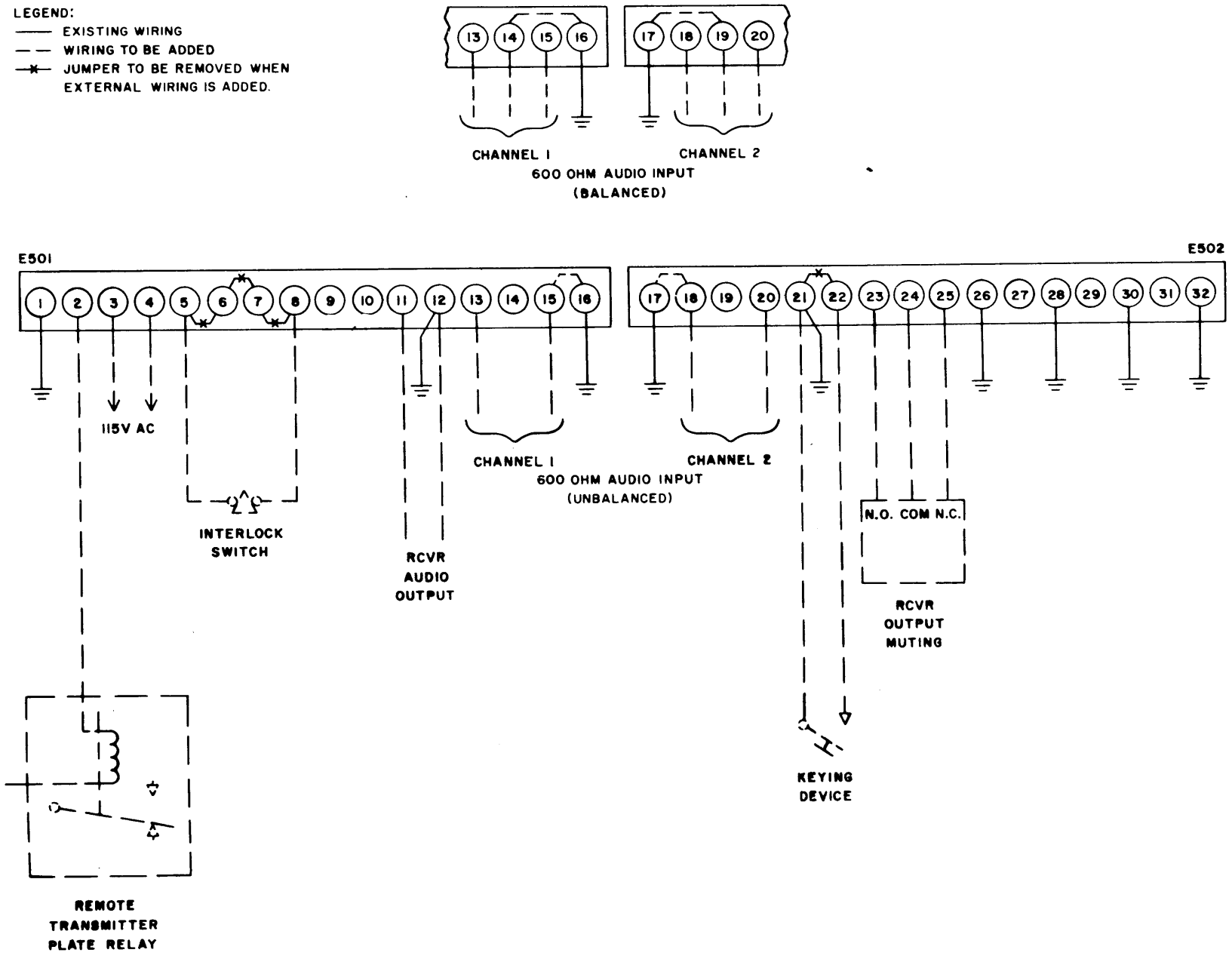


FIGURE 2-5. CONNECTION DIAGRAM, EXTERNAL EQUIPMENT TO SBT-1K(F)

(5) PUSH-TO-TALK SYSTEM - Terminals 9 and 10 are provided for a push-to-talk button attachment. Since the SBT-1K(F) does not supply push-to-talk, terminals 9 and 10 are not connected.

(6) RECEIVER SQUELCH - Terminals 11 and 12 are provided for the attachment to receiver audio output, if receiver "squelch" is desired when using VOX (voice-operated) features in some exciter units. Since the SBT-1K(F) does not employ VOX, terminals 11 and 12 are not connected.

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

(8) KEY LINE - Terminals 21 and 22 are provided for the attachment of a keying device in CW mode of transmission. Pushing down on the key grounds the cathode circuit of amplifier V305 in Controlled Master Oscillator CMO-1 enabling it to operate.

(9) 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 in OFF or STAND-BY condition. Terminals 23 and 24 make contact with each other through relay K601 to enable the receiver when the transmitter is off (terminals 25 and 24 are disconnected). When transmitter is on, relay K601 connects terminals 25 and 24 to disable the

receiver (terminals 23 and 24 are disconnected).

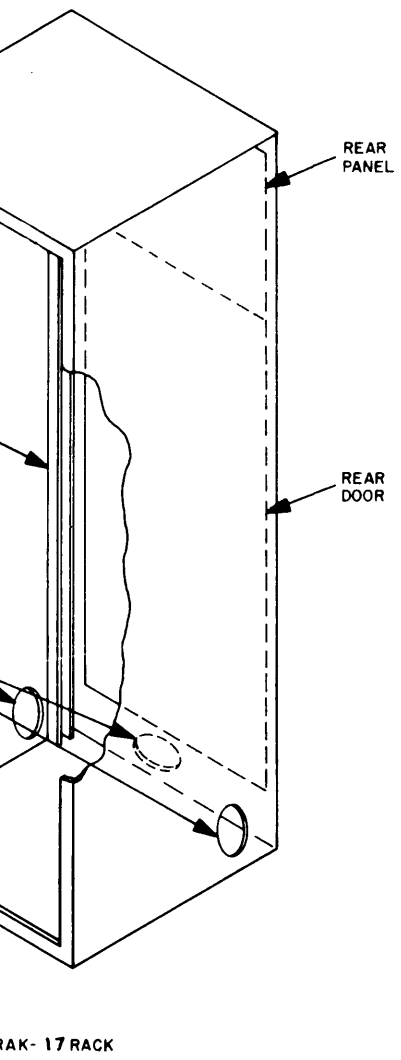
(10) KEY AND FAX - TIS-3/XFK. - Terminals 27 through 32 of E502 are provided for the interconnection of equipment necessary for FSK (Frequency Shift Keying) and FAX (Facsimile) modes of transmission. Mark and space pulses are extended to the first keyer circuit of Tone Intelligence Unit TIS-3.

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

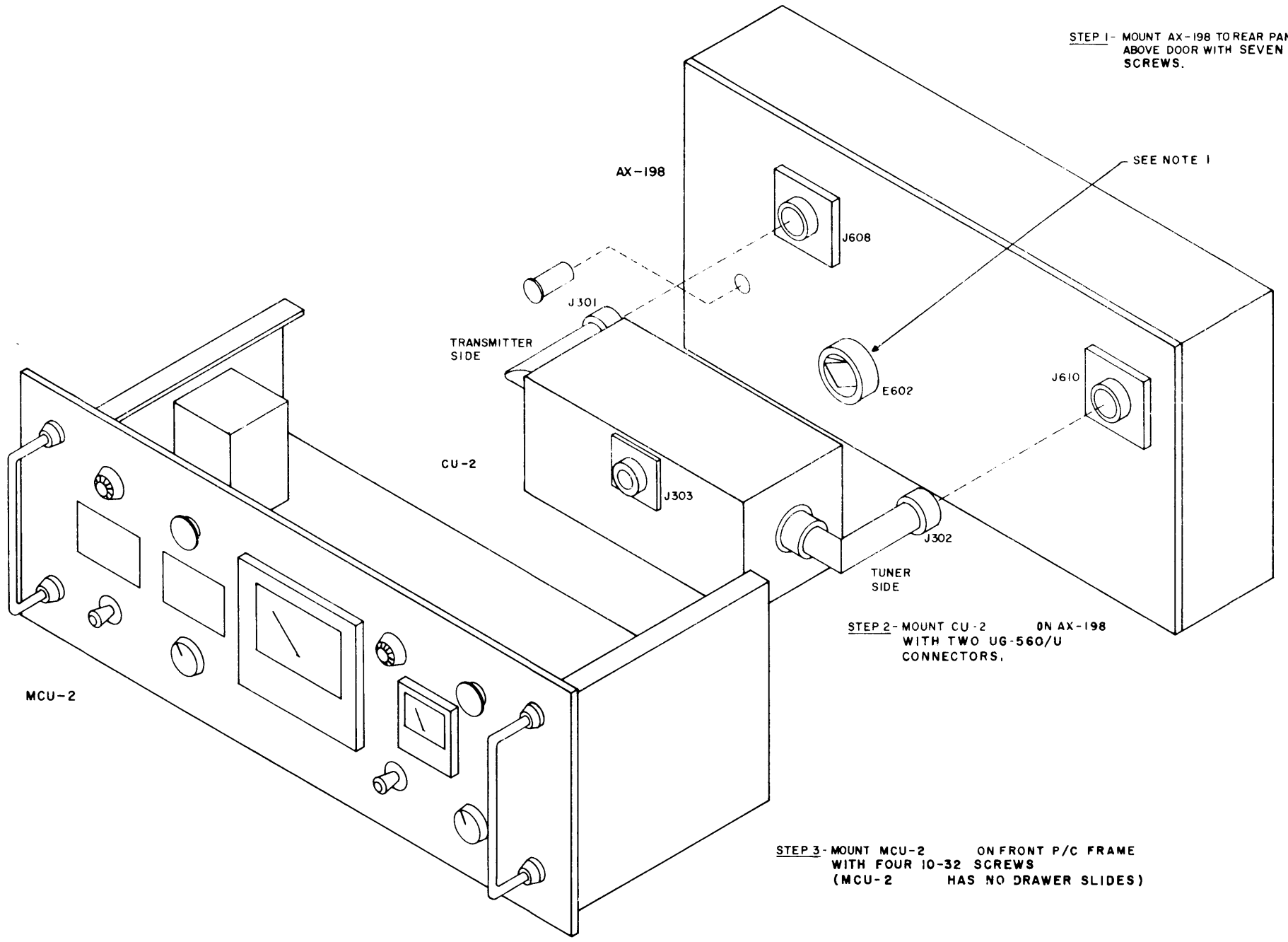
(12) TRANSMITTER/RECEIVER ANTENNA.- Receptacle J606 on RF Output Assembly AX-198 and mating plug P624 are provided for connecting the transmitting antenna to a receiver input (see figure 2-8), thus making the transmitter antenna double for a receiving antenna. Antenna relay K601 switches the antenna 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.

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

2-4. INITIAL ADJUSTMENTS.- The SBT-1K(F) has been factory tested and adjusted before shipment. No initial adjustments of chassis mounted variable components are necessary before operation, unless the unit has been subjected to damage or extreme transportation shakeup.



RAK-17 RACK

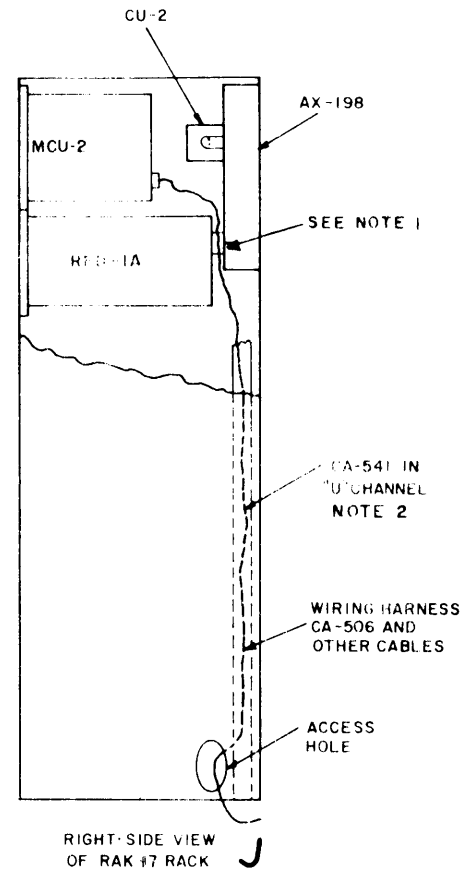


STEP 1- MOUNT AX-198 TO REAR PANEL ABOVE DOOR WITH SEVEN 8-32 SCREWS.

SEE NOTE 1

STEP 2- MOUNT CU-2 ON AX-198 WITH TWO UG-560/U CONNECTORS.

STEP 3- MOUNT MCU-2 ON FRONT P/C FRAME WITH FOUR 10-32 SCREWS (MCU-2 HAS NO DRAWER SLIDES)

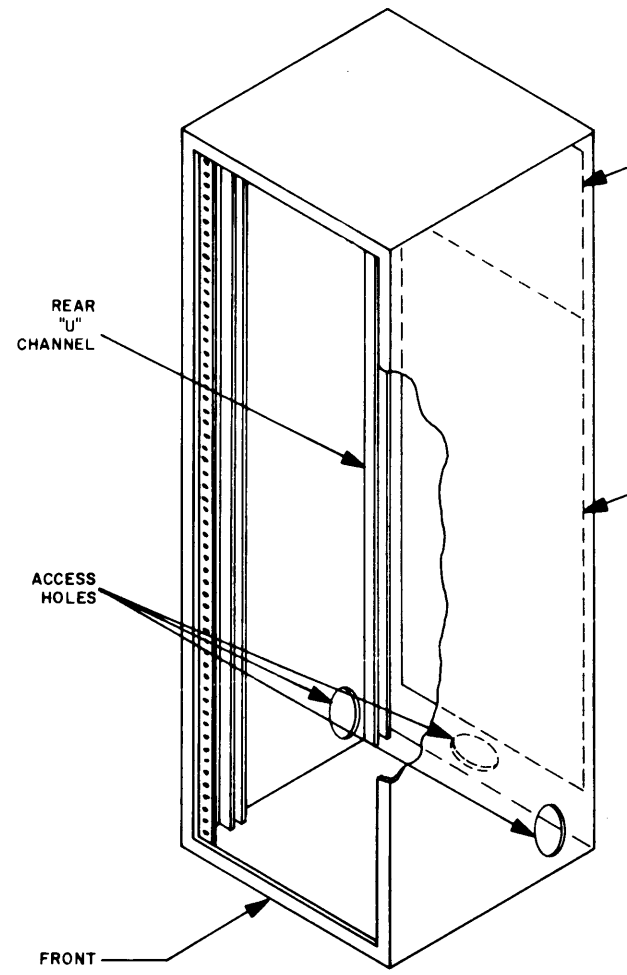


RIGHT SIDE VIEW OF RAK #7 RACK

NOTES:

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

Figure 2-6. Isometric Diagram Illustrating Installation of AX-198 Assembly, ATS-2 (CU), ATS-2 (MCU), and RFD-1A in RAK-17B Rack.



STANDARD RAK- 17 RACK

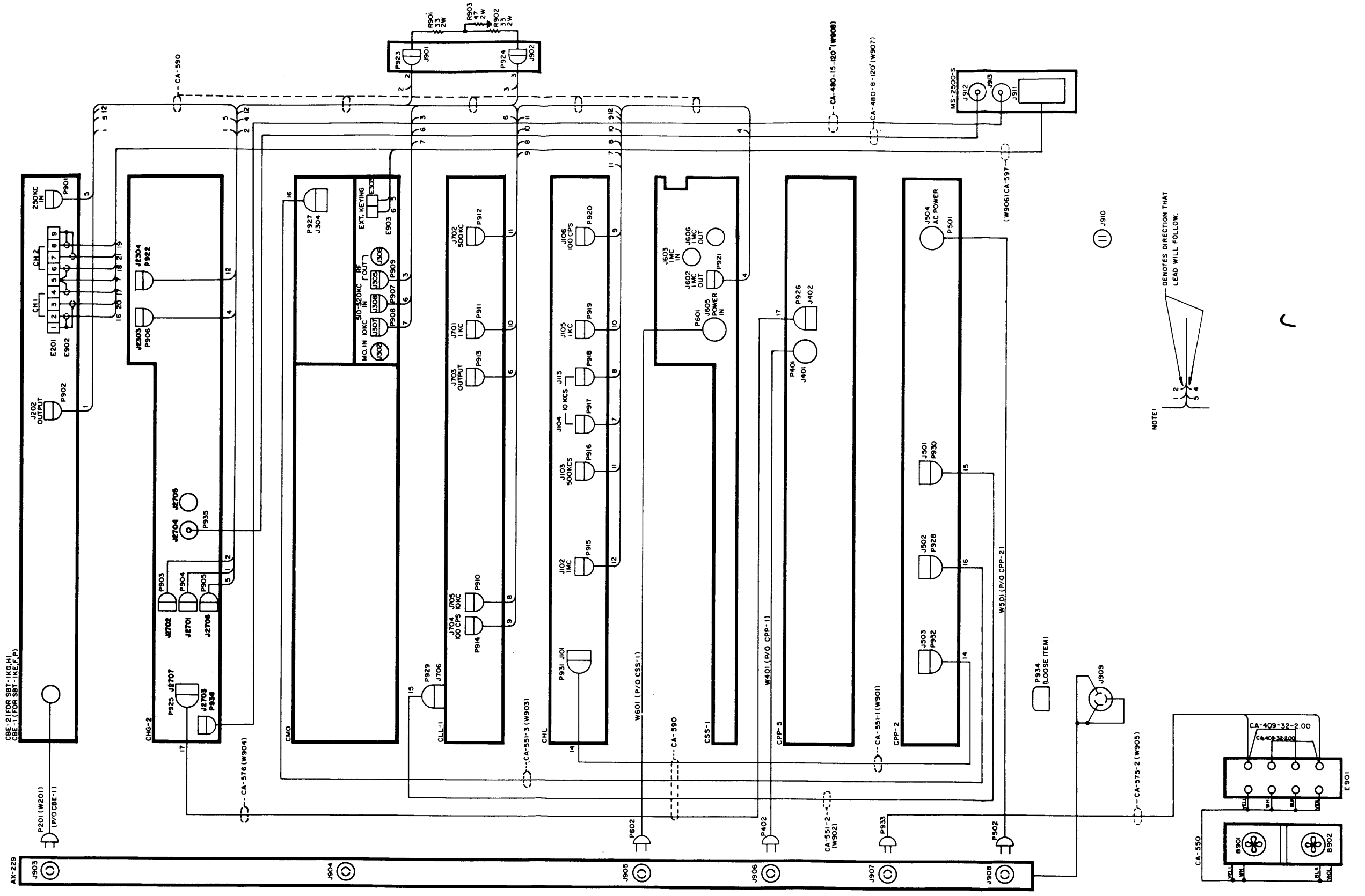


Figure 2-7. Cabling Diagram of SBT-1K(F), (Sheet 1 of 2)

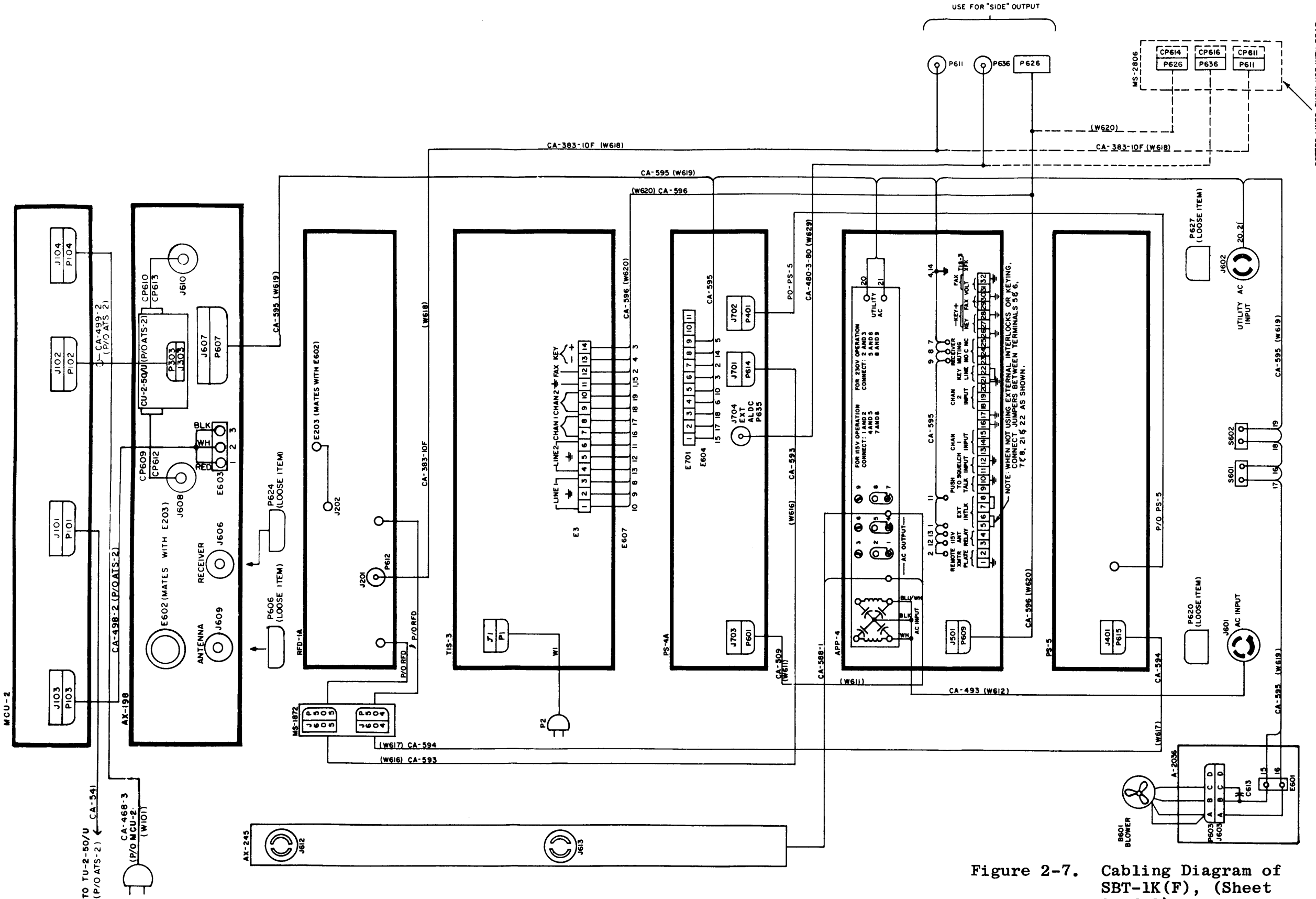


Figure 2-7. Cabling Diagram of SBT-1K(F), (Sheet 2 of 2)

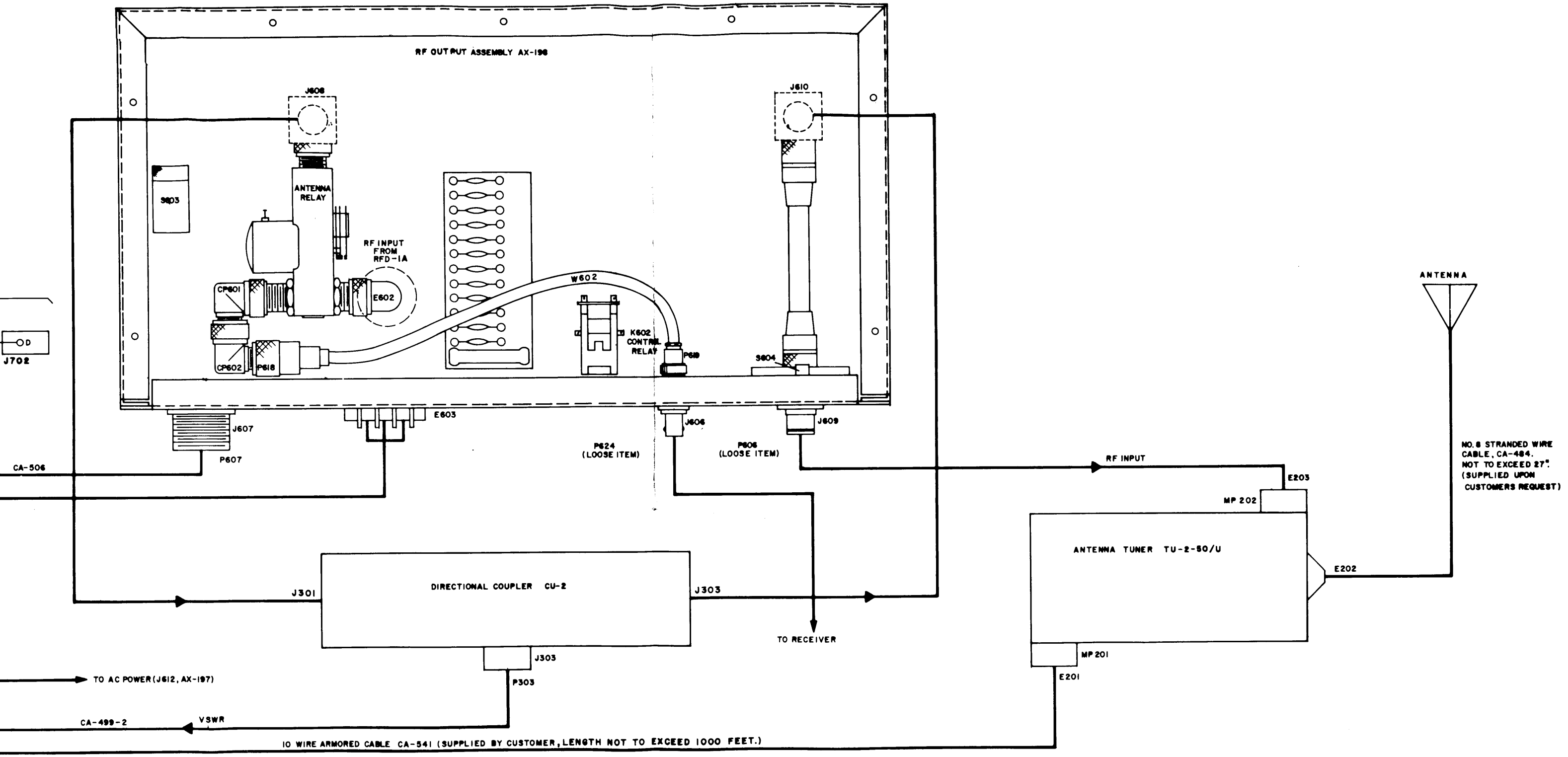
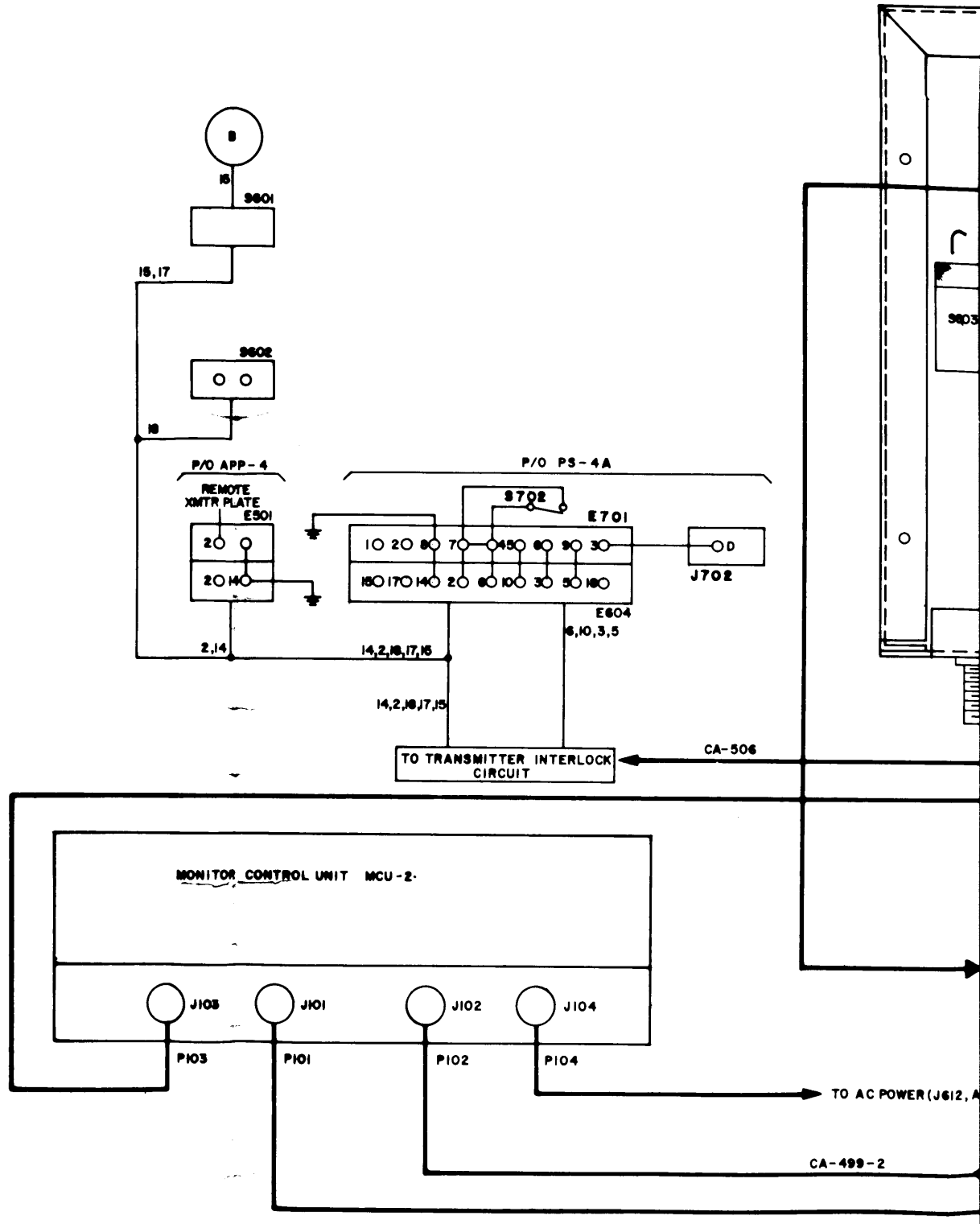
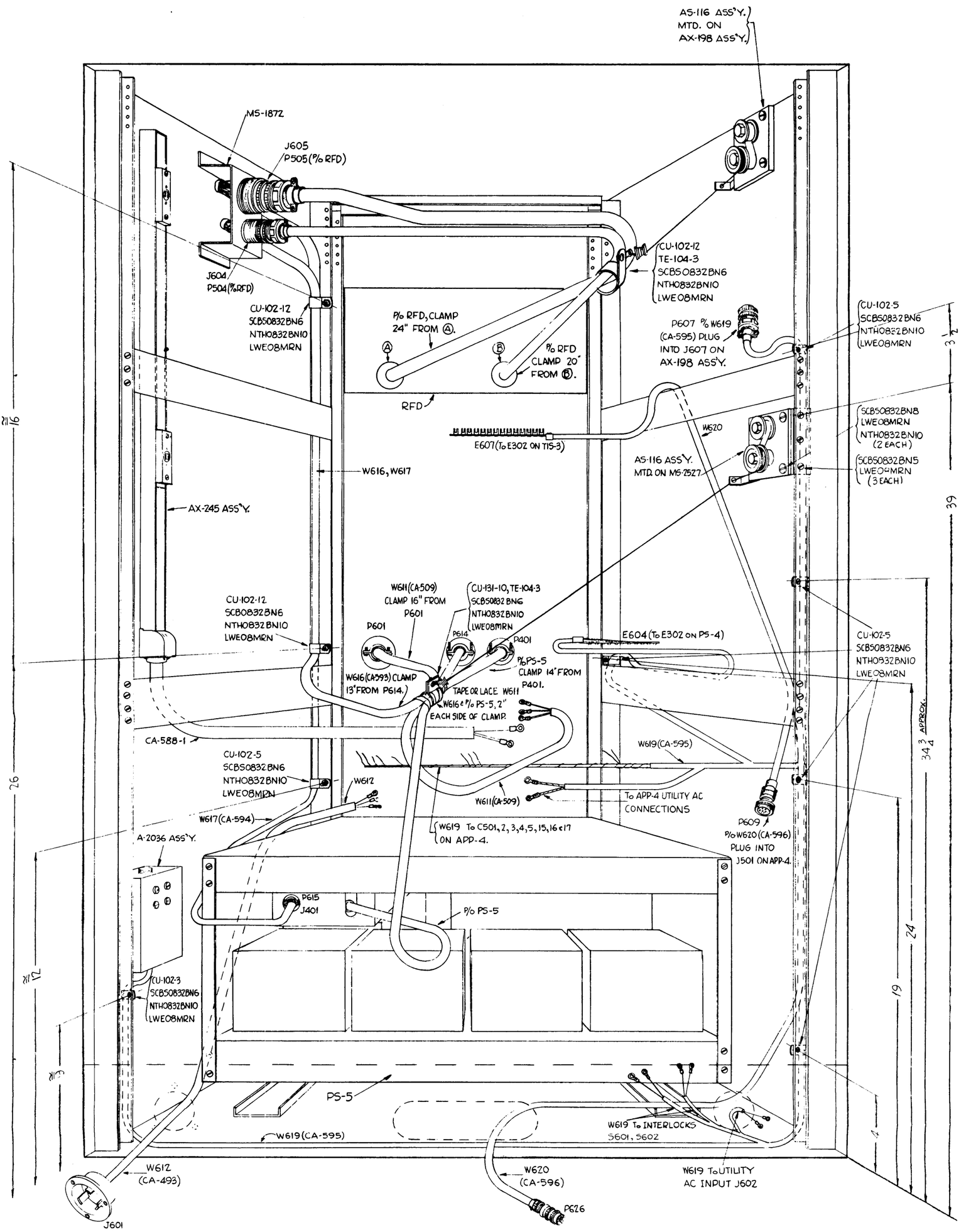


Figure 2-8. Partial Wiring Diagram Showing Interconnections of AX-198 Assembly and Closely Associated Units

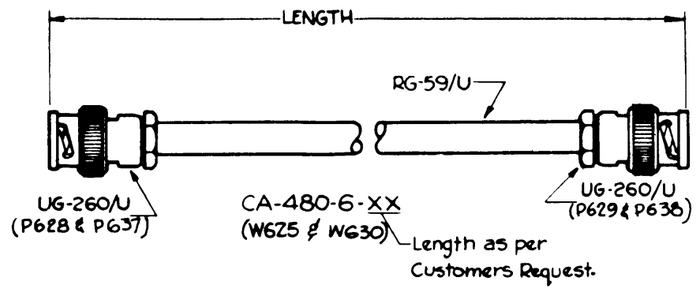

B
15
S601
15,17
S602
18
P/O APP-4
REMOTE XMTR PLATE
E501
P/O PS-4A
S702
E701
J702
E604
2,14
14,2,18,17,15
6,10,3,5
14,2,18,17,15
TO TRANSMITTER INTERLOCK CIRCUIT
CA-506
MONITOR CONTROL UNIT MCU-2
J103
J101
J102
J104
P103
P101
P102
P104
TO AC POWER (J612, A
CA-499-2



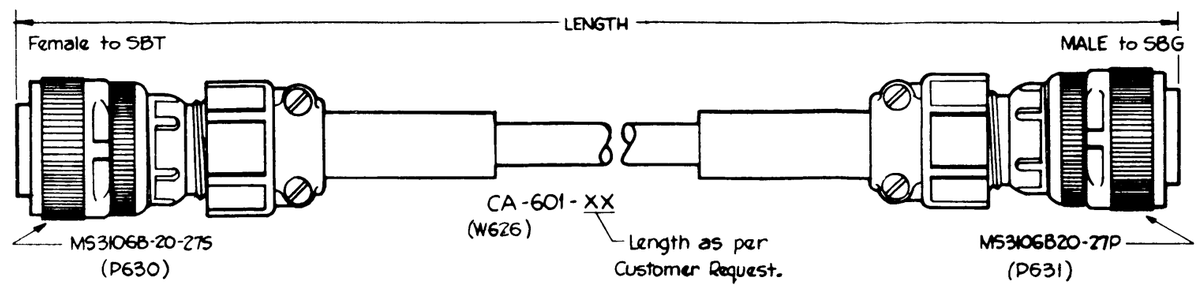
NOTES:
1. PS-5 SHOWN IN RACK IN NORMAL OPERATING POSITION.
2. RFD SHOWN IN FULLY EXTENDED SLIDE POSITION WITH SLIDES REMOVED FOR CLARITY.
3. ALL MEASUREMENTS TO CLAMPS ARE APPROX. WITH REFERENCE TO NEAREST MTG. HOLE.

Figure 2-9. Installation Diagram of RAK-17B E/W Cables and Slides

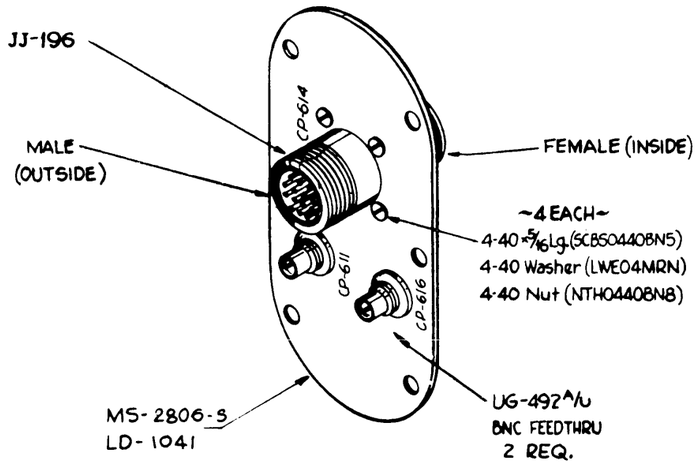
INTERCONNECT CABLE
(2 PER)



INTERCONNECT CABLE
(1 PER)



INTERCONNECT PLATE ASS'Y.
(1 PER)



(1KW TRANSMITTER RACK)
RAK-17A

TYPICAL REAR INTERCONNECT INSTALLATION USING MOD. KIT KIT-101 TO CONNECT SBG RACK TO 1KW TRANSMITTER RACK IN SBT-1K SYSTEM.

(SBG RACK)
RAK-11

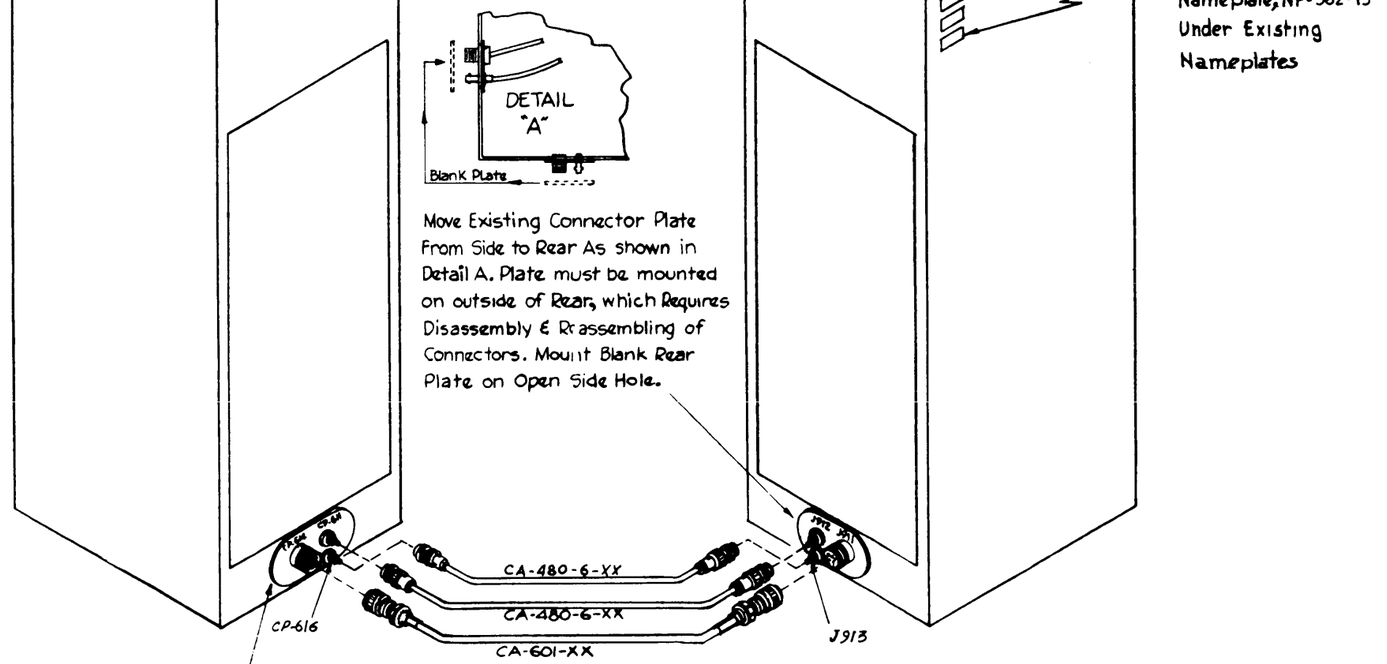


Figure 2-10. Installation Diagram Showing Interconnection of RAK-11 and RAK-17B by means of KIT-132

SECTION 3

OPERATOR'S SECTION

3-1. GENERAL

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

3-2. CONTROLS AND INDICATORS

Figure 3-1 illustrates all SBT-1K(F) front-panel controls and indicators used during normal operation. Table 3-1 lists the controls and indicators and the function of each; serial designations containing the letter "A" are associated with figure 3-1A, whereas serial designations containing the letter "B" are associated with figure 3-1B.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Sideband Exciter CBE-1	A1	LSB/OFF/CH 1/CH 2 (selector switch)	Selects audio input source for lower sideband channel.
	A2	LSB GAIN (potentiometer)	Adjusts level of LSB audio input.
	A3	LSB (meter)	Indicates relative power level of lower sideband.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Sideband Exciter CBE-1 (cont)	A4	CARRIER LEVEL (potentiometer)	Controls level of carrier insertion.
	A5	USB GAIN (potentiometer)	Adjusts level of USB audio input.
	A6	USB (meter)	Indicates relative power level of upper sideband.
	A7	USB/OFF/CH 1/CH 2 (selector switch)	Selects audio input source for upper sideband channel.
	A8	POWER (lamp)	Lights to indicate that power is applied to CBE-1.
	A9	ON/OFF (switch)	On position applies power to CBE-1; OFF position disconnects power from CBE-1.
Frequency Amplifier CHG-2A	A10	OUTPUT TUNING	Used to obtain peak tuning of output frequency.
	A11	BAND	Used to set band of output frequency.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Frequency Amplifier CHG-2A (cont)	A12	MCS (dial)	Indicates r-f band selected by operation of BAND switch (A11).
	A13	OVEN (lamp)	Lights to indicate that oven is receiving power.
	A14	POWER (switch)	ON position applies power to CHG-2A; STANDBY position applies power to oven only.
	A15	STANDBY (lamp)	Lights when POWER switch (A14) is set at STANDBY.
	A16	B+ (switch)	ON position applies +200V to r-f amplifier.
	A17	SYNC (lamp)	Lights when 2 mc output of mixer V2503 synchronizes with 2 mc output of doubler V2505.
	A18	MCS (dial)	Indicates output frequency selected by operation of OUTPUT TUNING control (A10).

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Frequency Amplifier CHG-2A (cont)	A19	OUTPUT (meter)	Indicates output power level of CHG.
	A20	MF TUNING (meter)	Indicates peak tuning of mid-frequency stages.
	A21	MF TUNING (variable capacitor)	Tunes mid-frequency stages.
	A22	OUTPUT (potentiometer)	Adjusts output level of CHG.
Controlled Master Oscillator CMO-1	A23	OUTPUT (potentiometer)	Adjusts output power level.
	A24	TUNING KCS (ganged tuning capacitor)	Tunes power amplifier and 10-kc harmonic selector sections.
	A25	ADJ FOR ZERO (meter)	Indicates polarity of d-c voltage applied to V303 to correct master oscillator. Green-band reading indicates that master oscillator is putting out correct frequency.
	A26	TUNE FOR MAX (meter)	Indicates output power level.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Controlled Master Oscillator CMO-1 (cont)	A27	SYNC IND (lamp)	Lights to indicate synchronization of oscillator frequency with frequency standard.
	A28	CAL/BEAT (lamp)	Indicates calibration of master oscillator to 100-kc increments.
	A29	OPERATE/CAL (switch)	CAL position applies power to calibration section and cuts off synthesizer loop action. OPERATE position activates synthesizer loop and disconnects power from calibration section.
	A30	OVEN (lamp)	Lights to indicate oven cycling.
	A31	Calibrate control (no front-panel designation)	Slightly alter resonant frequency of internal oscillator (V301) so that V301 is precisely set against internal secondary standard 100 kc oscillator (V302B).
	A32	LOCK	Locks calibrate control (A33) against movement.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Controlled Master Oscillator CMO-1 (cont)	A33	MASTER OSCILLATOR FREQUENCY (ganged tuning capacitor)	Tunes oscillator section to desired output frequency. Output frequency is indicated on MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR FREQUENCY CPS counters (A34).
	A34	MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR FREQUENCY CPS (counters)	Indicates frequency selected by operation of MASTER OSCILLATOR FREQUENCY control (A33).
	A35	LOCK	Locks MASTER OSCILLATOR FREQUENCY control (A33) against movement.
Controlled Oscillator CLL-1	A36	KILOCYCLES (selector switch)	Permits adjustment of output frequency.
	A37	SYNC (oscilloscope)	Permits visual monitoring of products of phase detectors in loops 1, 2, and 3.
	A38	HUNDREDS OF CYCLES (selector switch)	Permits adjustment of output frequency.
	A39	SYNC (switch)	Selects loop (1, 2, or 3) to be visually monitored with SYNC oscilloscope (A37).

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Frequency Standard CSS-1B	A40	1 MC MONITOR (jack)	Permits sampling internal standard with external frequency counter.
	A41	ON/STANDBY (switch)	ON position applies B+ to CSS-1B circuitry. STANDBY position applies power to proportional oven only.
	A42	STANDBY (lamp)	Lights to indicate that power is applied to proportional oven only.
	A43	POWER (lamp)	Lights to indicate that B+ is applied to CSS-1B circuitry.
	A44	PHASE COMPARATOR (meter)	Indicates phase difference of internal and external frequency standards.
	A45	SENSITIVITY (potentiometer)	Sensitivity adjustment for PHASE COMPARATOR meter (A44).
	A46	PRI STD IN (jack)	Input jack for external 1-mc frequency standard.
Power Supply CPP-2	A47	STANDBY (lamp)	Lights when POWER/STANDBY switch (A49) is set at STANDBY.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Power Supply CPP-2 (cont)	A48	POWER (lamp)	Lights when POWER/ STANDBY switch (A49) is set at POWER.
	A49	POWER/STANDBY (switch)	POWER position applies power to CHL-1, CMO-1, CLL-1 units after 60-second delay. STANDBY position applies power to CLL-1 and CMO-1 ovens.
Monitor Control Unit MCU-2	B1	TUNE/OPERATE (switch)	TUNE position limits transmitter output to 100 watts.
	B2	POWER (four-position rotary switch)	Turns on monitor control, selects watts scales factors, and shorts power meter.
	B3	RESET (push-button switch)	Allows transmitter to operate again after overload condition.
	B4	OVERLOAD (lamp)	Lights when main transmitter power is interrupted.
	B5	POWER (lamp)	Lights when monitor control unit is on.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Monitor Control Unit MCU-2 (cont)	B6	Power Meter (no front panel designation)	Dual-pointer meter with scales calibrated for FORWARD-WATTS, REFLECTED-WATTS, and vswr (voltage standing wave ratio). Scales are calibrated 0 to 100. Vswr on transmission line is indicated by point of intersection of meter pointers.
	B7	RESISTANCE-OPERATE (push-button switch)	Controls unidirectional motor that drives selector switch in antenna tuner for selection of autotransformer taps to match antenna resistance. Selector switch contacts resistance position 1 to 6 in a clockwise direction and repeats the cycle.
	B8	STOP (lamp)	Indicates when maximum or minimum inductances of variable inductor in antenna tuner have been reached. Microswitches are incorporated in antenna tuner to prevent reactance-changing motor from overdriving at either end of moving contact travel. These switches interrupt motor power and energize STOP indicator.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Monitor Control Unit MCU-2 (cont)	B9	Meter (no front panel designation)	Three-scale meter indicates percent of total reactance of variable coil, position of variable resistor switch, and presence of humidity in antenna tuner unit. Scale reading is indicated by position of METER switch.
	B10	REACTANCE (three-position lever action switch)	Controls direction of reversible motor that drives contact on variable inductance in antenna tuner. When switch is held at INCR., motor shaft rotates in direction to increase inductance of variable inductor. When switch is held at DECR, motor shaft rotates in direction to decrease inductance of variable inductor.
	B11	METER (three-position switch)	When set at RES., meter indicates resistance. When set at REACT, meter indicates reactance. When set at HUM, meter indicates humidity. Returns to REACT position when released.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
RF Amplifier RFD-1A	B12	DRIVER BAND (Five-position selector switch)	Selects appropriate band for coarse-tuning r-f driver input and output
	B13	PA TUNING (variable capacitor)	Fine-tunes power amplifier output to match antenna.
	B14	1ST AMPL TUNING (ganged tuning capacitors)	Fine-tunes first r-f amplifier output.
	B15	PA TUNING (dial)	Provides calibrated position readings for PA TUNING knob (B13) movement.
	B16	PA GRID TUNING (variable capacitor)	Fine-tunes power amplifier input.
	B17	MULTIMETER (switch)	Selects circuit for measurement by MULTIMETER (B18).
	B18	MULTIMETER (meter)	Measures circuit selected by MULTIMETER switch (B17).
	B19	PA PLATE CURRENT (meter)	Monitors plate current of power amplifier tube.
	B20	PA BAND (nine-position selector switch)	Selects appropriate band for coarse-tuning power amplifier output.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
RF Amplifier RFD-1A (cont)	B21	ALDC (knob)	Adjusts ALDC operating level.
		ALDC INT/EXT (switch-located on RFD-1A rear chassis)	When set at INT, ALDC d-c bias is applied only to control grid of V201 in RFD-1A. When set at EXT, ALDC d-c bias is extended to Frequency Amplifier CHG-2A.
	B22	PA LOADING (dial)	Provides calibrated position readings for PA LOADING knob (19) movement.
	B23	PA LOADING (three-position switch)	Selects appropriate circuit for coarse-adjust for antenna impedance matching.
	B24	PA LOADING (variable capacitor)	Fine-adjustment for antenna impedance matching.
Tone Intelligence Unit TIS-3	B25	TEST (switch)	MARK position provides continuous mark pulse for test purposes. SPACE position provides continuous space pulse for test purposes. Switch is normally set at LINE.
	B26	CENTER FREQ CPS (switch)	Selects center frequency of audio tone output.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Tone Intelligence Unit TIS-3 (cont)	B27	FUNCTION (switch)	Selects mode of operation.
	B28	KEY MODE (switch)	Matches input level of signal applied by external source to output level of crystal oscillator.
	B29	OVEN (lamp)	Lights to indicate that oven containing frequency determining components of reactance controlled oscillator is operating.
	B30	SHIFT CPS (potentiometer and counter)	Shifts audio tone output by amount indicated on counter.
	B31	OUTPUT LEVEL (meter)	Indicates output level in db.
	B32	LEVEL ADJ (potentiometer)	Adjusts level of output (drive) applied to load.
	B33	B+ (lamp)	Lights to indicate that B+ is applied to all stages of TIS-3.
	B34	B+ (switch)	ON position applies B+ to all stages of TIS-3. STANDBY position disconnects B+ from all stages of TIS-3.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
Tone Intelligence Unit TIS-3 (cont)	B35	EXCITER CH 2 (switch	FSK/FAX/CW position applies audio output of TIS-3 to CBE-1. When set at LINE, audio input to TIS-3 bypasses TIS-3 circuitry and is applied directly to CBE-1.
	B36	EXCITER CH 1 (switch)	Same as B35.
LV Power Supply PS-4A	B37	FINAL VOLTAGES ON/OFF (switch)	ON position supplies power-amplifier tube V203 with high screen-grid and plate voltages.
	B38	PA OVERLOAD PLATE (circuit breaker)	Protects power-amplifier tube plate circuit from current overload. (Circuit breaker in ON position forms a link in SBT-1K(F) interlock system).
	B39	PA OVERLOAD SCRN GRID (circuit breaker)	Protects power-amplifier tube screen-grid circuit from current overload. (Circuit breaker in ON position forms a link in SBT-1K(F) interlock system).
	B40	PA OVERLOAD CONT GRID (circuit breaker)	Protects power amplifier tube control-grid circuit from current overload. (Circuit breaker in ON position forms a link in SBT-1K(F) interlock system).

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
LV Power Supply PS-4A (cont)	B41	FINAL VOLTAGES (lamp)	Indicates power amplifier tube V203 is receiving high screen grid and plate voltages.
	B42	PA FIL PRI (meter)	Indicates voltage applied to primary of transformer supplying filament voltages to amplifier tubes in PAL-1K(A).
	B43	PA FIL PRI ADJUST (seven-position selector switch)	Selects tap on autotransformer to produce proper regulated voltages to PAL-1K(A) filament transformer. Voltage selected registers on PA FIL PRI meter (B42).
	B44	TRANSMITTER VOLTAGES (lamp)	Indicates RFD-1A tubes are receiving mid-voltage plate supply.
	B45	MAIN POWER (circuit breaker)	Dual circuit breaker, companion trip type. ON position supplies line voltage power to PAL-1K(A) system. Protects main a-c power supply line to PAL-1K(A) from current overload.
	B46	MAIN POWER (lamp)	Indicates PAL-1K(A) system is receiving main line power supply.

TABLE 3-1. CONTROLS AND FUNCTIONS, SBT-1K(F) (cont)

MODULAR UNIT	SERIAL DESIGNATION (FIGURE 3-1)	PANEL DESIGNATION	FUNCTION
LV Power Supply PS-4A (cont)	B47	TRANSMITTER VOLTAGES ON/ STANDBY (switch)	ON position feeds mid-voltage plate supply to RFD-1A tubes; STANDBY position cuts off supply.
Auxiliary Power Panel APP-4	B48	MAIN POWER (circuit breaker)	ON position supplies line voltage power to PAL-1K(A), ATS-2, and TIS-3 component units. Protects main a-c power line from current overload.
	B49	MAIN POWER (lamp)	Indicates that MAIN POWER circuit breaker (B48) is set at ON position.
	B50	UTILITY OUTLETS	Receptacles. Available for additional supply of line voltage to external equipment, when line voltage is connected to J602 AC UTILITY INPUT at rear of rack.

3-3. OPERATING PROCEDURES

WARNING

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

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

(1) PROTECTION OF POWER-AMPLIFIER TUBE. - Rapid or inadvertent application and removal of plate voltage to power-amplifier RFD-1A should be avoided. Rapid heat changes may shorten the life of the tube. Systematic starting, tuning, and shut-down procedures should be adhered to in that sequence.

(2) WARM-UP TIME FOR CRYSTAL OVENS. - Frequency-determining crystals for the SBT-1K(F) are located in ovens contained in Primary Standard CSS-1B, Controlled Master Oscillator CMO-1, Frequency Amplifier CHG-2A, and Tone Intelligence Unit TIS-3. After tune-up, the transmitted frequency will remain within rated stability only if the crystal oven temperatures have become stabilized. Necessary initial warm-up time for the SBT-1K(F) crystal ovens is 48 hours. If, after operating the transmitter, it is intended to use it again soon, repetition of the warm-up procedure may be eliminated by leaving the POWER/STANDBY switch of Power Supply

CPP-2 and the MAIN POWER circuit breaker of Auxiliary Power Panel APP-4 at POWER and ON respectively (refer to paragraph 3-3i).

(3) TUNING

(a) OVERALL TUNING. - Regardless of the mode of operation, the SBT-1K(F) is initially tuned and loaded on carrier. Intelligence is then applied, and the initial adjustments and intelligence controls are modified, as required, to meet the desired output power and distortion characteristics.

(b) PROPER SETTING OF CMO-1 COUNTERS AND MF TUNING CONTROL OF CHG-2. - The r-f output of the transmitter is determined by the adjustment of controls located on Controlled Master Oscillator CMO-1 and Frequency Amplifier CHG-2A.

NOTE

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

The CHG-2A is tuned directly to the SBT-1K(F) output frequency by means of the BAND switch (A11) and the OUTPUT TUNING control (A10). However, mid-frequency amplifier stages contained in the CHG-2A must be tuned to a signal in the range of 1.75 - 3.75 mc by means of the MF TUNING control (A21). Further, Controlled Master Oscillator CMO-1 must be tuned to provide an output signal in the 2 - 4 mc range. To establish the proper setting of the CMO-1 counters and the MF TUNING control of the CHG-2A, refer to examples 1, 2, and 3 below and proceed as follows:

NOTE

It should be noted that the CMO-1 output is 250 kc higher than indicated on the MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR FREQUENCY CPS counters (A34).

1. Determine r-f output frequency of the transmitter.

2. Using BAND switch (A11) and OUTPUT TUNING control (A10), tune CHG-2A to frequency established in step (a) above. Note numeric on MCS dial (A12) of CHG-2A.

3. Determine proper setting of MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR FREQUENCY CPS counters (A34) and of MF TUNING controls (A21) of CHG-2A by subtracting the numeric noted on MCS dial in step (b) above from output frequency determined in step (a) above.

CAUTION

When performing step (d) below, do not exceed the 1750 to 3750 kc operating range of the CMO-1; doing so may cause a misalignment in the mechanical calibration of the master oscillator.

4. Set MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR FREQUENCY CPS counters (A34) of CMO-1 and MF TUNING control (A21) of CHG-2A at appropriate position for frequency determined in step (c) above.

Example 1: R-f output frequency desired is 2.45 mc.

When the CHG-2A is tuned to 2.45 mc, the MCS dial (A12) is rotated to the 1.75 - 3.75 mc range; a 0 appears

as the dial numeric. The setting of the MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR CPS counters on the CMO-1 is calculated as follows:

```
 2.45 mc = R-f output frequency
-0       = Dial numeric
 2.45 mc = Setting of MF TUNING control MASTER
           FREQUENCY KCS and MASTER OSCILLATOR
           FREQUENCY CPS counters.
```

Example 2: R-f output frequency desired is 5.63 mc.

When the CHG-2A is tuned to 5.63 mc, the MCS dial is rotated to the 3.75 to 5.75 mc range, and 2 appears as the dial numeric. The setting of the MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR FREQUENCY CPS counters on the CMO-1 is calculated as follows:

```
 5.63 mc = R-f output frequency
-2       = Dial numeric
 3.63 mc = Setting of MF TUNING control MASTER
           OSCILLATOR FREQUENCY KCS and MASTER
           OSCILLATOR FREQUENCY CPS counters.
```

Example 3: R-f output frequency desired is 12.0 mc.

When the CHG-2A is tuned to 12.0 mc, the MCS dial is rotated to the 11.75 - 13.75 mc range, and 10 appears as the dial numeric. The setting of the MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR FREQUENCY CPS counters on the CMO-1 is calculated as follows:

```
 12.0 mc = R-f output frequency
-10      = Dial numeric
  2.0 mc = Setting of MF TUNING control MASTER
           OSCILLATOR FREQUENCY KCS and MASTER
           OSCILLATOR FREQUENCY CPS counters.
```

b. STARTING PROCEDURE. - Before attempting to start the SBT-1K(F), refer to Section 2 and ensure that the necessary cabling connections have been made. Proceed as follows:

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1. Callouts A1, A2, A3, etc. are associated with figure 3-1A; callouts B1, B2, B3, etc. are associated with figure 3-1B.

(1). Ensure that interlock system is functioning properly.

(2). Ensure that modular-unit controls are set at positions indicated in table 3-2. Controls not mentioned in table 3-2 are of no significance at this time.

TABLE 3-2. PRELIMINARY CONTROL POSITIONS

MODULAR UNIT	CONTROL	POSITION
Sideband Exciter CBE-1	ON/OFF (A9)	OFF
Frequency Amplifier CHG-2A	POWER (A14) B+ (A16) OUTPUT (A22)	STANDBY OFF MIN
Controlled Master Oscillator CMO-1	OPERATE/CAL (A29)	CAL
Controlled Oscillator CLL-1	SYNC (A39) KILOCYCLES (A36) HUNDREDS OF CYCLES (A38)	OFF 0 0

TABLE 3-2. PRELIMINARY CONTROL POSITIONS (cont)

MODULAR UNIT	CONTROL	POSITION
Frequency Standard CSS-1B	ON/STANDBY (A41)	STANDBY
Power Supply CPP-2	POWER/STANDBY (A49)	STANDBY
Monitor Control Unit MCU-2	POWER (B2) TUNE/OPERATE (B1)	OFF TUNE
RF Amplifier RFD-1A	ALDC INT/EXT (located on rear chassis apron) ALDC (B21)	INT Fully clockwise
Tone Intelligence Unit TIS-3	B+ (B34) EXCITER CH 1 (B35) EXCITER CH 2 (B36)	STANDBY LINE LINE
Power Supply PS-4A	MAIN POWER (B45) TRANSMITTER VOLTAGES (B47) FINAL VOLTAGES (B37) PA OVERLOAD PLATE (B38) PA OVERLOAD SCRN GRID (B39) PA OVERLOAD CONT GRID (B40) PA FIL PRI ADJUST (B17)	OFF STAND BY OFF OFF OFF OFF Fully counter-clockwise

(3). Set MAIN POWER circuit breaker (B48) of Auxiliary Power Panel APP-4 at ON; MAIN POWER lamp (B49) should light. Allow 48-hour warm-up period.

NOTE

The SBT-1K(F) is operational immediately after initial starting; however, to insure the specified stability (refer to table 1-1), an initial warm-up period of 48 hours is required for oven-oscillator circuits contained in the SBG-1 sideband generator.

(4). Set ON/OFF switch (A9) of Sideband Exciter CBE-1 at ON.

(5). Set POWER switch (A14) of Frequency Amplifier CHG-2A at ON.

(6). Set ON/STANDBY switch (A41) of Frequency Standard CSS-1B at ON; POWER lamp (A43) should light.

(7) Set POWER/STANDBY switch (A49) of Power Supply CPP-2 at POWER; POWER lamp (A48) should light. After 60-second time delay, CPP-2 furnishes power to CHL-1, CMO-1, and CLL-1 units.

(8) On Power Supply PS-4A, proceed as follows:

(a) Ensure that TRANSMITTER VOLTAGES switch (B47) and FINAL VOLTAGES switch (B37) are set at STAND BY and OFF respectively.

(b) Set MAIN POWER circuit breaker (B45) at ON; MAIN POWER lamp (B46) should light.

(c) Adjust PA FIL PRI ADJUST control (B43) as required to obtain red-line indication on PA FIL PRI meter (B42).

(d) Set PA OVERLOAD PLATE, PA OVERLOAD SCRN GRID, and PA OVERLOAD CONT GRID circuit breakers (B38, B39, and B40) at ON.

c. TUNING SIDEBAND GENERATOR SBG-1. - As indicated in paragraph 3-3a, the SBT-1K(F) is tuned by functional sections. In the order given, Sideband Generator SBG-1 and Linear Power Amplifier PAL-1K(A) are tuned to carrier frequency. Next, Tone Intelligence Unit TIS-3 or Sideband

Exciter CBE-1 is tuned (refer to paragraph 3-3). Start the transmitter as described in paragraph 3-3b and tune Sideband Generator SBG-1 to carrier frequency as outlined in table 3-3.

NOTE

Before tuning the SBG-1, make certain that the OVEN indicator lamps on the CHG-2A, CMO-1, and TIS-3 are cycling at regular intervals.

Numbers enclosed in parenthesis are callouts referenced to figure 3-1. Callouts A1, A2, A3, etc. are associated with figure 3-1A; callouts B1, B2, B3, etc. are associated with figure 3-1B.

TABLE 3-3. TUNING PROCEDURE FOR SBG-1

MODULAR UNIT	STEP	CONTROL	ACTION
Sideband Exciter CBE-1	1	LSB/OFF/CH 1/CH 2 switch (A1) and USB/OFF/CH 1/ CH 2 switch (A7)	Set at OFF
	2	LSB GAIN control (A2) and USB GAIN control (A5)	Set fully counter-clockwise
	3	CARRIER LEVEL control (A4)	Set at 0 DB
Frequency Amplifier CHG-2A	4	BAND selector switch (A11)	Set at appropriate position for desired output frequency range. Note numeric on MCS dial (A12).

TABLE 3-3. TUNING PROCEDURE FOR SBG-1 (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Frequency Amplifier CHG-2A (cont)	5	OUTPUT TUNING control (A10)	Adjust as required for desired output frequency on MCS dial (A18).
	6	———	Subtract MCS dial numeric noted in step 4 from output frequency established in step 5 (refer to paragraph 3-3a). Note result carefully.
	7	MF TUNING control (A21)	Set fully counterclockwise
Controlled Oscillator CLL-1	8	KILOCYCLES control (A36)	Set at appropriate position to correspond with thousands digit of frequency established in step 6.
	9	HUNDREDS OF CYCLES control (A37)	Set at appropriate position to correspond with hundreds digit of frequency established in step 6.

TABLE 3-3. TUNING PROCEDURE FOR SBG-1 (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Controlled Oscillator CLL-1 (cont)	10	SYNC switch (A37)	Set at each consecutive position (L1, L2, and L3); stationary rectangular pattern should appear on SYNC scope (A37) for each position. Return L1/L2/L3/ OFF switch to OFF.
Controlled Master Oscillator CMO-1	11	TUNING KCS control (A24)	Set at appropriate position for frequency established in step 6.
	12	LOCK control (A35)	Turn counterclockwise to unlock MASTER OSCILLATOR FREQUENCY control (A33).
		CAUTION When performing step 13 below, do not exceed the 1750 to 3750 KC operating range of the CMO-1; doing so may cause a misalignment in the mechanical calibration of the master oscillator.	
	13	MASTER OSCILLATOR FREQUENCY control (A33)	Adjust as required to bring MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR FREQUENCY CPS counters (A34)

TABLE 3-3. TUNING PROCEDURE FOR SBG-1 (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Controlled Master Oscillator CMO-1 (cont)	13 (cont)		to nearest calibrating check point below frequency determined in step 6. Calibrating check points are 100 KC apart starting at 1750 KC (1750 KC, 1850 KC, 1950 KC, 2050 KC, etc.)
	14	LOCK control (A32) (black knob)	Turn counterclockwise to unlock calibrate control (A31).
	15	Red Calibrate control (A31) - no front-panel designation	Carefully adjust as required for zero-beat indication on CAL/BEAT indicator (A28). SYNC IND lamp (A27) may or may not beat in synchronization.
	16	MASTER OSCILLATOR FREQUENCY control (A33)	Carefully adjust for frequency determined in step 6. Approach this setting from lower frequency. Tighten LOCK control (A35).

TABLE 3-3. TUNING PROCEDURE FOR SBG-1 (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Controlled Master Oscillator CMO-1 (cont)	17	OPERATE/CAL switch (A29)	Set at OPERATE
	18	OUTPUT control (A23)	Adjust as required for significant indication on TUNE FOR MAX meter (A26). 1/4 scale indication is sufficient.
	19	TUNING KCS control (A24)	Carefully adjust as required for peak indication on TUNE FOR MAX meter (A26); SYNC IND lamp (A27) should light. peak should occur at position that correspond to setting of CMO-1 counters.
	20	Red calibrate control (A31)	Rotate slowly in both direction; pointer of ADJ FOR ZERO meter (A25) should follow in opposite direction. When this condition is obtained, adjust calibrate control as required for zero center-

TABLE 3-3. TUNING PROCEDURE FOR SBG-1 (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Controlled Master Oscillator CMO-1 (cont)	20 (cont)		scale indication on ADJ FOR ZERO meter. Tighten LOCK control (A32).
Frequency Amplifier CHG-2A	21	B+ switch (A16)	Set at ON.
		CAUTION When performing step 22, do not permit pointer of MF TUNING meter (A20) to fall in red portion of scale. Reduce CMO-1 output as required to prevent this condition.	
	22	MF TUNING control (A21)	Rotate in clockwise direction until maximum (peak) indication is obtained on MF TUNING meter (A20); Correct setting for MF TUNING control is position where first peak is obtained when control is rotated from full counter-clockwise position.
	23	OUTPUT control (A22)	Rotate clockwise until significant indication is obtained on OUTPUT meter (A19).

TABLE 3-3. TUNING PROCEDURE FOR SBG-1 (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Frequency Amplifier CHG-2A (cont)	23 (cont)		1/4 scale indication is sufficient.
	24	OUTPUT TUNING control (A10)	Adjust as required for maximum indication on OUTPUT meter (A19). MCS dial (A18) should indicate desired operating frequency. NOTE At full scale, meter A20 indicates 1 watt, PEP.
	25	OUTPUT control (A23)	Rotate clockwise to insure that 3/4 scale indication is obtainable on OUTPUT meter (A19). Return control fully counterclockwise; indication on OUTPUT meter should fall to zero. The SBT-1K(F) is now ready for loading. Proceed to paragraph 3-3d.

d. LOADING PROCEDURE FOR SBT-1K(F). - Loading procedure for the the SBT-1K(F) consists primarily of tuning Linear Power Amplifier PAL-1K(A) and Antenna Tuning System ATS-2. Make certain that Sideband Generator SBG-1 is tuned to carrier frequency (refer to paragraph 3-3c) and proceed as outlined in table 3-4.

NOTE

Numbers enclosed in parenthesis are callouts referenced to figure 3-1. Callouts A1, A2, A3, etc. are associated with figure 3-1A; callouts B1, B2, B3, etc. are associated with figure 3-1B.

TABLE 3-4. LOADING PROCEDURE FOR SBT-1K(F)

MODULAR UNIT	STEP	CONTROL	ACTION
RF Amplifier RFD-1A	1	PA BAND selector switch (B20) and DRIVER BAND selector switch (B12).	Set at appropriate position for desired output frequency.
	2	ALDC control (B21)	Set fully clockwise
	3	MULTIMETER switch (B17)	Set at PA DC BIAS V x 10; indication on MULTIMETER (B18) should be approximately 100 on red scale.
Power Supply PS-4A	4	TRANSMITTER VOLTAGES switch (B47)	Set at ON. TRANSMITTER VOLTAGES indication lamp (B44) should light if approximately 3 minutes have elapsed since MAIN POWER circuit breaker (B45) was set at ON.

TABLE 3-4. LOADING PROCEDURE FOR SBT-1K(F) (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Power Supply PS-4A	5	FINAL VOLTAGES switch (B37)	Set at ON. FINAL VOLTAGES indicator lamp (B41) should light.
RF Amplifier RFD-1A	6	MULTIMETER switch (B17)	Set at PA DC SCREEN V x 10; indication on MULTIMETER should be 500 on green scale.
	7	MULTIMETER switch	Set at PA DC PLATE V x 100; MULTIMETER should indicate approximately 3000 on black scale. Indication on PA PLATE CURRENT meter (B19) should be approximately 220 ma.
Power Supply PS-4A	8	FINAL VOLTAGES switch (B37)	Set at OFF; FINAL VOLTAGES lamp (B41) should go off.
RF Amplifier RFD-1A	9	MULTIMETER switch	Set at RF 1ST AMPL PLATE V x 1.
Frequency Amplifier CHG-2A	10	OUTPUT control (A23)	Rotate clockwise as required to obtain indication on black scale of MULTIMETER (B18).

TABLE 3-4. LOADING PROCEDURE FOR SBT-1K(F) (cont)

MODULAR UNIT	STEP	CONTOL	ACTION
RF Amplifier RFD-1A	11	1ST AMPL TUNING control (B14)	Adjust as required for peak on MULTIMETER.
	12	MULTIMETER switch (B17)	Set at RF PA GRID V x 10.
Frequency Amplifier CHG-2A	13	OUTPUT control (A23)	Adjust as required to obtain indication on red scale of MULTIMETER (B18).
RF Amplifier RFD-1A	14	PA GRID TUNING control (B16)	Adjust as required for peak on MULTIMETER (B18).
Frequency Amplifier CHG-2A	15	OUTPUT control (A23)	Set at MIN.
RF Amplifier RFD-1A	16	PA TUNING control (B13)	Tune for indication on PA TUNING dial (B15) that corresponds to indication given on tuning chart supplied with PAL-1K(A).
	17	PA LOADING switch (B23)	Set at position indicated in tuning chart supplied with PAL-1K(A).

TABLE 3-4. LOADING PROCEDURE FOR SBT-1K(F) (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
RF Amplifier RFD-1A (cont)	18	PA LOADING control (B24)	Tune for indication on PA TUNING dial (B15) that corresponds to indication given on tuning chart supplied with PAL-1K(A).
Monitor Control Unit MCU-2	19	POWER switch (B2)	Set at X1.
	20		Refer to tables 3-3 and 3-4 of ATS-2 manual. Determine appropriate resistance position.
	21	METER switch (B11)	Hold at RES. position.
		CAUTION Do not operate RESISTANCE/OPERATE switch (B7) as indicated in step 22 unless transmitter output is 100 watts or less. Serious equipment damage will result otherwise.	
	22	RESISTANCE/OPERATE switch (B7)	Depress for 2 seconds and release. Repeat until resistance position determined in step 20 is indicated on meter (B9). Release METER switch.

TABLE 3-4. LOADING PROCEDURE FOR SBT-1K(F) (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Monitor Control Unit MCU-2 (cont)	23	REACTANCE switch (B10)	Operate to INCR. and DECR. Observe that pointer of meter (B9) follows.
Power Supply PS-4A	24	FINAL VOLTAGES switch (B37)	Set at ON; FINAL VOLTAGES lamp (B41) should light.
RF Amplifier RFD-1A	25	MULTIMETER switch (B17)	Set at PA DC SCREEN MAX I.
Frequency Amplifier CHG-2A	26	OUTPUT control (A22)	Rotate slowly clockwise until slight increase occurs in indication on PA PLATE CURRENT meter (B19).
RF Amplifier RFD-1A	27	PA TUNING control (B13)	Adjust as required until pronounced dip is produced on PA PLATE CURRENT meter (B19). Indication should be obtained on meter B6.
Monitor Control Unit MCU-2	NOTE Do not allow indication on meter B6 to exceed 1/3 scale. Adjust OUTPUT control ( ) of CHG-2 as required to obtain 1/3 scale indication.		

TABLE 3-4. LOADING PROCEDURE FOR SBT-1K(F) (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Monitor Control Unit MCU-2 (cont)		NOTE (cont) If output of amplifier exceeds 100 watts, overload relays will trip. If this occurs, reduce output level of CHG-2 and press RESET button (B3).	
	28	REACTANCE switch (B10)	Operate to INCR. or DECR. as required to obtain lowest RE-FLECTED-WATTS and VSWR indications on meter (B6).
	29		Using RESIS-TANCE/OPERATE switch and RE-ACTANCE switch as outlined in steps 22 and 28 respectively, tune MCU-2 for lowest VSWR in each resistance position (1,2, 3,4,5 and 6). Retune MCU-2 to position that provides lowest VSWR; note re-sistance posi-tion for future reference.
Frequency Amplifier CHG-2A	30	OUTPUT control (A22)	Set at MIN.
Power Supply PS-4A	31	FINAL VOLTAGES switch (B37)	Set at OFF.

TABLE 3-4. LOADING PROCEDURE FOR SBT-1K(F) (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Monitor Control Unit MCU-2	32	TUNE/OPERATE switch (B1)	Set at OPERATE
	33	POWER switch (B2)	Set at X10.
Power Supply PS-4A	34	FINAL VOLTAGES switch (B37)	Set at ON.
Frequency Amplifier CHG-2A	35	OUTPUT control (A22)	Rotate clockwise as required for approximate 300 ma indication on PA PLATE CURRENT meter (B19). Note indication on MULTIMETER (B18).
RF Amplifier RFD-1A	36	PA LOADING control (B24)	Adjust until indication on PA PLATE CURRENT meter (B19) begins to rise.
	37	PA TUNING control (B13)	Adjust until a dip is obtained in indication PA PLATE CURRENT meter.
		NOTE When performing step 38, adjustment of the PA TUNING control causes less dip in PA PLATE CURRENT meter indication (noted in step 37) as loading is increased. CAUTION At no time during final adjustment (step 38) should screen grid current (indicated on black scale of MULTIMETER B18)	

TABLE 3-4. LOADING PROCEDURE FOR SBT-1K(F) (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
RF Amplifier RFD-1A (cont)		CAUTION (cont) be allowed to exceed full scale. If PAL-1K(A) turns off automatically as a result of PA overload (indicated by circuit breakers and TRANSMITTER VOLTAGES and FINAL VOLTAGES lamps), reduce CHG output level before resetting the associated circuit breakers.	
	38	NOTE Assuming a VSWR of 1.5 or less, proper tuning and loading for 1000 watts output power should show: Forward watts-----approximately 1000 Reflected watts ---approximately 50 Screen grid current -----approximately 50 ma or less Plate current -----approximately 650 ma	Repeat steps 35, 36, and 37 until desired output power (indicated on FORWARD WATTS scale of MCU-2) is obtained with minimum drive (indicated on OUTPUT meter A19) from CHG. Note indication on MULTIMETER (B18).

TABLE 3-4. LOADING PROCEDURE FOR SBT-1K(F) (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Frequency Amplifier CHG-2A	39	OUTPUT control (A22)	Set at MIN to prepare transmitter for application of intelligence (refer to paragraph 3-3e).

e. APPLYING INTELLIGENCE TO SBT-1K(F). - Applying intelligence to the transmitter entails the calculation of CBE intelligence levels (paragraph 1 below), the modification of CMO and CHG control settings for CW, FSK, and FAX modes of transmission (paragraph 2 below), and the preparation and final application of intelligence to the transmitter as described in paragraph 3 below.

(1) CALCULATING CBE INTELLIGENCE LEVELS. - Before calculating CBE intelligence levels, ensure that the following conditions exist.

(a) Indication on TUNE FOR MAX meter (A26) of Controlled Master Oscillator CMO-1 is approximately "3." This indicates that the CMO is providing an injection frequency to Frequency Amplifier CHG-2A at approximately 1 volt.

(b) Indication on MF TUNING meter (A20) of CHG-2A should be just to left of red portion of scale. This indicates that the CBE is providing an injection frequency to the CHG at approximately 120 millivolts.

Under all conditions, the voltage output of the CBE should be 120 millivolts. This means that the aggregate voltage out of the CBE as a result of the carrier, LSB intelligence, and

USB intelligence should not exceed 120 millivolts. Table 3-5 illustrates the relationship between CBE output voltage, percentage of CBE output voltage, and intelligence level (-db). Use table 3-5 as a reference, and calculate CBE intelligence levels in accordance with examples 1, 2, and 3 given below.

NOTE

In examples 1, 2, and 3, calculations are rounded off to the closest points given in table 3-5.

Example 1: Required = SSB (USB) with carrier at 0 db.

$E_{USB} + E_{CARR} = 120mv \qquad (E_{CARR} = E_{USB})$

$2\ E_{USB} = 120mv \quad \therefore\ E_{USB} = \frac{120mv}{2} = 60mv$

$E_{USB} = 60mv = 50\% = -6db \quad$ (USB level)

$E_{CARR} = 60mv = 50\% = -6db \quad$ (carrier level)

Example 2: Required = AM (DSB with carrier at plus 3 db).

$E_{USB} + E_{LSB} + E_{CARR} = 120mv \qquad (E_{USB} = E_{LSB})$

$E_{CARR} = 1.4E_{USB} \quad$ (carrier at + 3db)

$2\ E_{SB} + 1.4\ E_{SB} = 120mv \quad \therefore\ 3.4\ E_{SB} = 120mv$

$E_{SB} = \frac{120mv}{3.4} = 35mv$

$E_{USB} = 35mv = 28\% = -11db$

$E_{LSB} = 35mv = 28\% = -11db$

$E_{CARR} \frac{=50mv}{120mv} = \frac{42\%}{98\%} = -7.5db$

Example 3: Required = Independent Sideband (LSB 3 db below USB; carrier at -10 db with respect to USB).

$E_{USB} = E_{LSB} = E_{CARR} = 120ma$

$.7E_{USB} = E_{USB} = .32\ E_{USB} = 120ma$

$E_{USB} \cong 60mv$

$E_{USB} = 60mv = 50\% = -6db$

$E_{LSB} = 42mv = 35\% = -9db$

$E_{CARR} = \frac{19mv}{121mv} = \frac{16\%}{101\%} = -16db$

TABLE 3-5. CBE OUTPUT VOLTAGE VS INTELLIGENCE LEVEL

CBE OUTPUT VOLTAGE	PERCENTAGE OF CBE OUTPUT VOLTAGE	INTELLIGENCE LEVEL (-db)
120 mv	100	0
107	89	- 1
95	79	- 2
84	70	- 3
75	63	- 4
67	56	- 5
60	50	- 6
54	45	- 7
48	40	- 8
42	35	- 9
38	32	-10
34	28	-11
30	25	-12
27	22	-13
24	20	-14
21	18	-15
19	16	-16
17	14	-17
15	13	-18
13	11	-19
12	10	-20
4	3	-30
1	1	-40

NOTE

Percentages are rounded off to nearest whole number.

(2) MODIFICATION OF CBE, CMO, CHG, AND TIS-3 CONTROL SETTINGS FOR CW, FSK, AND FAX MODES OF TRANSMISSION. - When transmitting CW, FSK, or FAX signals, CBE, CHG, CMO and TIS-3 control adjustments should be made as described in paragraphs (a) through (d) below.

(a) CW OPERATION, KEYING VIA CMO KEYLINE. - In this type of operation, "dry keying" is used to enable or disable the power amplifier (V305) of Controlled Master Oscillator CMO-1. CBE controls should be set as indicated below.

CONTROL	POSITION
CARRIER LEVEL (A4)	0 DB
LSB/OFF/CH 1/CH 2	OFF
USB/OFF/CH 1/CH 2	OFF

(b) CW OPERATION, KEYING VIA TIS-3. - In this type of operation, the TIS-3 delivers a keyed 1 kc tone to either Channel 1 or Channel 2 input of the CBE. With CARRIER LEVEL control (A4) of the CBE set at MIN as outlined in table 3-6, carrier level of the CBE output is reduced to zero. Therefore, the CHG injection frequency provided be CBE is a 1 kc tone, one kilocycle removed from a non-existent 250 kc carrier.

To compensate for the change in injection frequency provided by the CBE, calculations for the setting of CMO counters (A34) and MF TUNING control (A20) as described in paragraph 3-3a must be modified. Refer to the example given below, and adjust controls as indicated.

Example: R-f output frequency desired is 15.5 mc. When the CHG-2A is tuned to 15.5 mc, the MCS dial is rotated to the 13.75 - 15.75 mc range, and 12 appears as the dial numeric. The setting of the MASTER OSCILLATOR FREQUENCY KCS and MASTER OSCILLATOR FREQUENCY CPS counters on the CMO-1 is calculated as follows:

```
 15.5 mc = R-f output frequency
-12.0 mc = Dial numeric
  3.5 mc = Setting of MF TUNING control, MASTER
           OSCILLATOR FREQUENCY KCS and MASTER
           OSCILLATOR FREQUENCY CPS counters as
           established by procedure outlined in
           paragraph 3-3a.

 3.5 mc
-1 kc    = Change in CBE output frequency
 3.499 mc = Corrected setting of MF TUNING control,
            MASTER OSCILLATOR FREQUENCY KCS and
            MASTER OSCILLATOR FREQUENCY CPS counters
            when using TIS-3 in CW operation.
```

(c) FSK OPERATION USING TIS-3. - When transmitting FSK signals only, particular attention should be paid to the following:

1. Depending upon the setting of TIS-3 controls, a 2000 cps or 2550 cps center frequency is applied to the CBE. FSK signals are normally transmitted in upper sideband, therefore the USB/OFF/CH 1/CH 2 switch (A7) of the CBE should be set at the appropriate position (CH 1 or CH 2) to select FSK signals from the TIS-3.

2. When using F_1 emission, the center frequency generated by Tone Intelligence Unit TIS-3 becomes the assigned operating frequency. The SBT-1K(F) transmitter is synthesized in 1 kc steps; for precise frequency control in F_1 emission, the 2000 cps center frequency should be used. Also, transmitting (in F_1 emission) to receivers that are tuned in 1 kc steps

dictates the use of 2000 cps as a center frequency.

3. As in CW operation (paragraph b above), carrier level of the CBE output is reduced to zero. In FSK operation, therefore, the CHG injection frequency provided by the CBE is a center frequency that is 2000 cps or 2550 cps (depending upon setting of TIS-3 controls) removed from a non-existent 250 kc carrier. Calculations for the setting of CMO counters (A34) and MF TUNING control (A20) as described in paragraph 3-3a must be modified by subtracting 2000 cps or 2550 cps.

4. Common practice is to use 850 cps shift between mark and space signals. Accordingly, the SHIFT CPS control (B30) of the TIS-3 should be adjusted as required to provide 850 cps shift.

(d) FAX OPERATION USING TIS-3. - When transmitting FAX signals, particular attention should be paid to the following:

1. Depending upon the setting of TIS-3 controls, a 1900 cps center frequency is applied to channel 1 or channel 2 of the CBE. FAX signals are usually transmitted in upper sideband, therefore the USB/OFF/CH 1/CH 2 switch (A7) of the CBE should be set at the appropriate position (CH 1 or CH 2 to select FAX signals from the TIS-3.

2. As in CW Operation (paragraph (b) above), carrier level of the CBE output is reduced to zero. In FAX operation, therefore, the CHG injection frequency provided by the CBE is 1900 cps removed from a non-existent 250 kc carrier. Calculations

for the setting of CMO counters (A34) and MF TUNING control (A20) as described in paragraph 3-3a must be modified by substracting 1900 cps.

3. PREPARING SYSTEM FOR APPLICATION OF INTELLIGENCE. - Before intelligence can be applied, the transmitter must first be tuned and loaded on carrier (refer to paragraph 3-3c and 3-3d). Ensure that the OUTPUT control (A22) of Frequency Converter CHG-2A is set at MIN as outlined in the last step of table 3-4, and proceed as outlined in table 3-6.

TABLE 3-6. PREPARATION OF SBT-1K(F) FOR APPLICATION OF INTELLIGENCE

MODULAR UNIT	STEP	CONTROL	ACTION
Sideband Exciter CBE-1	1	LSB/OFF/CH 1/CH 2 switch (A1) and USB/OFF/CH 1/CH 2 switch (A7)	Set at CH 1
	2	CARRIER LEVEL control (A4)	Set at MIN
	3	LSB GAIN control (A2) and USB GAIN control (A5)	Set fully counter-clockwise
Tone Intelligence Unit TIS-3	4	FUNCTION switch (B27)	Set at CW
	5	TEST switch (B25)	Set at MARK
	6	EXCITER CH 1 switch (B36)	Set at CW/FAX/FSK
	7	LEVEL ADJ control (B32)	Adjust as required for -20 db indication on OUTPUT LEVEL meter (B31). TIS-3 is now delivering 1 KC tone to channel 1 of CBE-1
Sideband Exciter CBE-1	8	LSB GAIN and USB GAIN controls (A2 and A5)	Rotate clockwise for an indication of 50% (-6 db) on associated LSB or USB meter (A3 and A6).
Frequency Amplifier CHG-2A	9	OUTPUT control (A22)	Adjust as required until desired output power (indicated on FORWARD WATTS scale of MCU-2) is obtained. Note indication on MULTIMETER (B19) of Amplifier RFD-1A (MULTIMETER switch set at RF PA PLATE VX100)

TABLE 3-6. PREPARATION OF SBT-1K(F) FOR APPLICATION OF INTELLIGENCE

MODULAR UNIT	STEP	CONTROL	ACTION
RF Amplifier RFD-1A	10	ALDC INT/EXT switch located on RFD-1A rear chassis	Set at EXT
	11	ALDC control (B21)	Rotate counterclockwise until indication on PA PLATE CURRENT meter begins to drop. Return ALDC control to position immediately preceeding point where indication on PA PLATE CURRENT meter begins to drop.
		NOTE ALDC is now set to operate when PEP output of the transmitter tends to exceed output power established in step 10.	
Frequency Amplifier CHG-2A	12	OUTPUT control (A22)	Set at MIN
Monitor Control Unit MCU-2	13	POWER switch (B)	Set at SHORT to prevent meter (B) damage due to surges in transmitter power output.
	14		Refer to section 3 of TIS-3 and CBE instruction manuals, and apply intelligence as described.

TABLE 3-6. PREPARATION OF SBT-1K(F) FOR APPLICATION OF INTELLIGENCE (cont)

MODULAR UNIT	STEP	CONTROL	ACTION
Monitor Control Unit MCU-2 (cont)	14 (cont)		Refer to parts 1 and 2 of this paragraph (paragraph 3-3e) for CBE intelligence levels, and modification of CBE, CMO, and CHG control settings.
Frequency Amplifier CHG-2A	15	OUTPUT control (A22)	Carefully rotate in clockwise direction until MULTIMETER (B19) indication is same as noted in step 10.
		NOTE A final check of output power can be made at this time by setting POWER switch (B2) of MCU-2 at X10 and MULTIMETER switch (B17) of RFD-1A at PA DC SCREEN MAX 1 and comparing indication on meters B6 and B18 with indications noted in step 38 of table 3-4.	

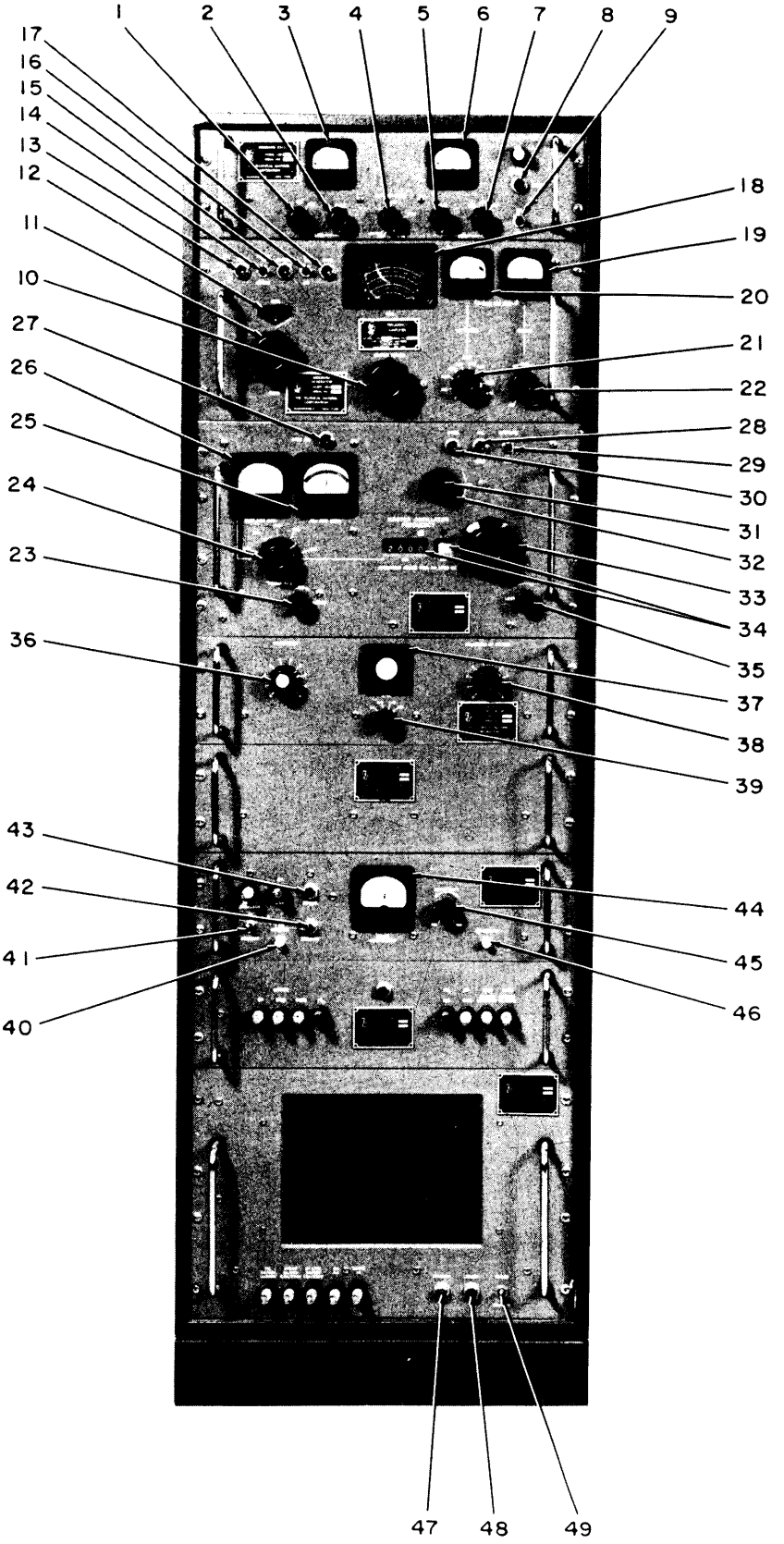
3-4. OPERATOR'S MAINTENANCE

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

b. REPLACEMENT OF FUSES - Information relating to function, location, and proper rating of fuses contained in the SBT-1K(F) is contained in the individual modular-unit manuals. The operator should refer to the appropriate modular-unit manual and replace fuses as required.

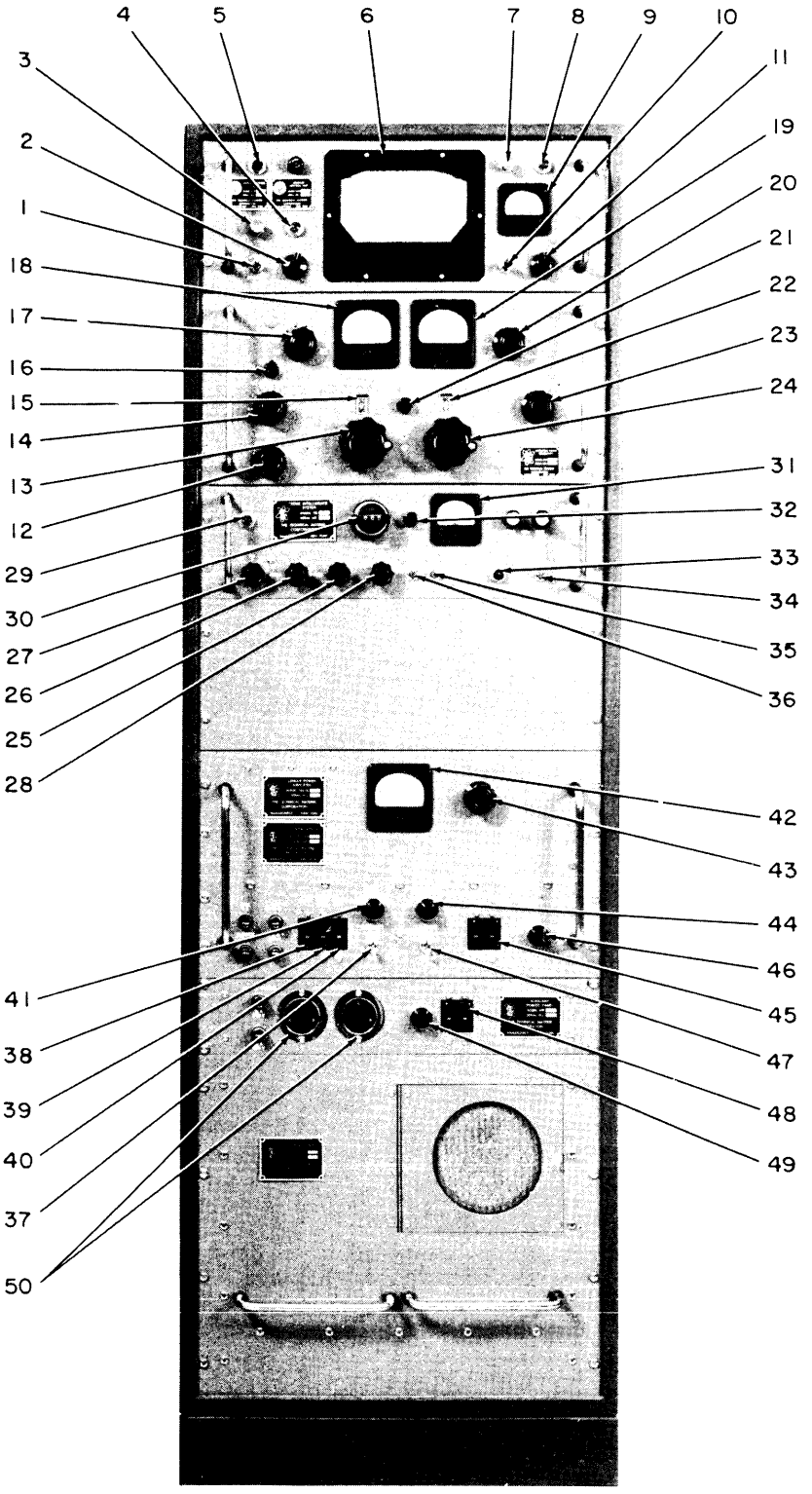
CAUTION

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



A. Sideband Generator SBG-1

Figure 3-1. Controls And Indicators, SBT-1k(F)



B. Amplifier, Antenna Tuning System, and Tone Intelligence Unit TIS-3

Figure 3-1. Controls and Indicators, SBT-1K(F)

SECTION 4

TROUBLESHOOTING

4-1. INTRODUCTION

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

4-2. FUNCTIONAL ANALYSIS, OVERALL SYSTEM

Refer to figure 4-1 given at the end of this section. All input signals (AM, FSK, FAX, and CW) to Sideband Transmitter SBT-1K(F) are applied to Tone Intelligence Unit TIS-3. Depending upon the position of FUNCTION switch S1, the TIS-3 converts FSK, CW, or FAX signals into a frequency-shifted audio output which is applied to EXCITER switch S4 and S5. AM signals are extended through the TIS-3 and applied directly to EXCITER switch S4 or S5. Audio output signals (Channel 1 and Channel 2) from the TIS-3, selected by means of the EXCITER switch, are applied to selector switches S202 and S203 of Sideband Exciter CBE-1.

Depending upon the position of switches S202 and S203, audio signals (Channel 1 and Channel 2) from the TIS-3 are applied to audio amplifier stages V203 or V207 of Sideband Exciter CBE-1. The amplified output of V203 or V207 is coupled to balanced modulators CR202 and CR203 where a stable, amplitude-regulated 250-kc $\pm$ audio signal is applied to filters Z201, Z203, and Z202; the filtering action of Z201, Z203, and Z202 is such that only the upper or lower sideband (in the 250 kc region) is applied to power amplifier V206.

Amplified upper or lower sideband signals from the CBE-1 are extend to Frequency Amplifier CHG-2A.

Balanced modulator V2701 of Frequency Amplifier CHG-2A mixes the 250 kc input from Sideband Exciter CBE-1 with a 2 to 4 mc signal from Master Oscillator CMO-1 to produce a 1.75 to 3.75 mc signal. This 1.75 to 3.75 mc signal is applied directly to amplifier stages V2706, V2707, and V2708 for band 0A (on MCS dial), to the balanced modulator (CR2201 and CR2202) in the IF chassis for bands 2B, 3B, 6C, and 8C, and to the balanced modulator (V2704 and V2705) in the RF section for all other bands. Signals extended to the IF chassis are modulated with 18 mc to produce a 14.25 to 16.25 mc signal which is amplified and then applied to V2704 and V2705 in the RF section. All signals that are applied to V2704 and V2705 in the RF section are modulated with a 10 to 30 mc signal; the resultant, a 1.75 to 33.75 mc signal, is then amplified and extended to RF Amplifier RFD-1A.

Signals applied to RF Amplifier RFD-1A undergo 3 stages of amplification and are then extended to Antenna Tuning System ATS-2. The ATS-2 serves as a transmitter-to-antenna impedance matching device and has provisions to continuously monitor forward and reflected power.

Primary Standard CSS-1A contains a crystal oscillator with a long term stability of better than one part in 10^8 per day and is used to provide a 1 mc injection frequency for the oven and oscillator stages of Frequency Amplifier CHG-2A. Depending upon the position of switch S2301 in the oven and oscillator section of the CHG-2A, the 1 mc signal generated by Primary Standard CSS-1A or by oscillator V2302A is applied to amplifier V2302B. The amplified 1 mc output of V2302B is then applied to harmonic generator V2502 and

doubler V2505 contained in the synthesizer section of the CHG and to mixer V2601 in the regenerative divider. The regenerative divider beats the 1 mc input with a 750 kc signal to produce a 250 kc injection frequency for the balanced modulator stages of Sideband Exciter CBE-1. The 1 mc input to V2502 in the synthesizer section is used to develop a 6 to 13 mc signal; this signal is applied to V2503 where it is beat with an 8 to 15 mc sample from high-frequency stages V2401 and V2402. The resultant, a nominal 2 mc signal that contains the error (if any) of the high-frequency oscillator, is applied to phase detector T5401 where it is compared with the 2 mc output of V2505. A d-c correction voltage developed by phase detector T2501 is used to correct high-frequency oscillator V2401 thereby maintaining high stability.

Divider Chain CHL-1, Controlled Oscillator CLL-1, and Master Oscillator CMO-1 are employed for the purpose of generating a highly-stable 2 to 4 mc injection frequency for the high-frequency balanced modulator stages of Frequency Amplifier CHG-2A. Divider Chain CHL-1 receives a 1 mc input signal from Frequency Amplifier CHG-2A. Multivibrator and amplifier circuits contained in the CHL-1 break down a 1 mc input signal to provide outputs at 100 cps, 1 kc, 10 kc, and 500 kc which are applied to Controlled Oscillator CLL-1. The CLL-1 consists of three synthesizer loops designed to convert the four input frequencies (100 cps, 1 kc, 10 kc, and 500 kc) to one output signal in the range of 510 to 519.9 kc. The 100 cps and 10 kc input signals are extended through loop 1 comprising V705, V706A, V706B, V707, and V711 to produce a 1 to 1.9 kc signal that is applied to the detector assembly (CR707 and CR708) contained in loop 3.

The 1 kc input signal is extended through loop 2 comprising V701A, V701B, V702B, V703A, and a detector assembly (CR703 and CR704) to produce a 9 to 18 kc signal that is applied to converter V704 of loop 3. The 500 kc input signal from Divider Chain CHL-1 and the output signals of loops 1 and 2 of the CLL-1 are extended through loop 3 comprising V703, V704, V708A, V708B, V709, V710, low-pass filter Z701 and a detector assembly (CR707 and CR708) to produce a 510 to 519.9 kc reference frequency that is applied to Master Oscillator CMO-1. Mixer V309 in the CMO-1 beats a sample of the 2 to 4 mc signal generated by master oscillator V301 with an harmonic of a 10 kc signal from Divider Chain CHL-1 to produce a nominal 510 to 519.9 kc signal. This signal, containing the error (if any) of master oscillator V301 is applied to phase detector V310 where it is compared with the 510 to 519.9 kc reference frequency from Controlled Oscillator CLL-1. A d-c correction voltage developed by the phase detector is used to correct master oscillator V301 thereby maintaining a highly stable 2 to 4 mc output signal.

Power Supplies PS-4A and PS-5 provide all the power requirements for RF Amplifier RFD-1A. Power Supply CPP-5 provides all power requirements for Frequency Amplifier CHG-2A. Power Supply CPP-2 provides the power requirements for the CLL-1, the power requirements for the CLL-1, CMO-1, and CHL-1 as listed below.

Modular Unit	Voltage
Controlled Oscillator CLL-1	+380 v unregulated -400 v unregulated -75 v regulated -6 v regulated 6.3 vac regulated
Controlled Master Oscillator, CMO-1	+380 v unregulated +160 v unregulated -6 v regulated 6.3 vac regulated

Modular Unit	Voltage
Divider Chain, CHL-1	+160 v regulated

4-3. FUNCTIONAL ANALYSIS OF INTERLOCK SYSTEM

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

TABLE 4-1. INTERLOCK CIRCUIT COMPONENTS

MODULAR UNIT	INTERLOCK OR CIRCUIT BREAKER	WHEN CLOSED
LV Power Supply PS-4A	PA OVERLOAD SCRN GRID circuit breaker CB703	When no overload condition exists in Amplifier RFD-1A screen grid circuit.
	PA OVERLOAD PLATE circuit breaker CB704	When no overload condition exists in the plate circuit of power amplifier V203 located in RF Amplifier RFD-1A.
	PA OVERLOAD CONT GRID circuit breaker CB702	When no overload condition exists in the control-grid circuit of power-amplifier V203 located in RF Amplifier RFD-1A
RF Amplifier RFD-1A	Top Cover Interlock S207	When the top cover of Amplifier RFD-1A is secured in position.
	Band switch S205	When PA BAND switch (S202) is properly set in detent.
	Air switch interlock S206	When blower motor B201 is operating normally.
	Bottom cover interlock S208	When the bottom cover of Amplifier RFD-1A is secured in position.
HV Power Supply PS-5	Top cover interlock S403	When the top cover of HV Power Supply PS-5 is secured in position
	Door interlock S402	When main blower fan door is closed
Electrical Cabinet RAK-9B	Door interlock S602	When rear door of cabinet is closed

TABLE 4-1. INTERLOCK CIRCUIT COMPONENTS (Cont)

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

4-4. FUNCTIONAL ANALYSIS OF TRANSMITTER/RECEIVER ANTENNA SYSTEM - Refer to figure 4-2. If suitable connections are made to a receiver at terminals 23 through 25 of terminal block E502 in Auxiliary Power Panel APP-4 and at connector J606 on RF Output Assembly AX-198, a transmitter/receiver system may be obtained. In this system, the receiver and transmitter share the same antenna.

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

Closed contacts of relay K601 also complete part of the interlock circuit (paragraph 4-3) thereby energizing relay K703 in LV Power Supply PS-4A. Operating FINAL VOLTAGES switch S703 to ON supplies high voltage to RF Amplifier RFD-1A and a-c power to the

coil of relay K602. Relay K602 is energized and causes the -150 vdc used in the interlock circuit and the +500 vdc used in the antenna relay (K602) circuit to switch paths to ground.

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

4-5. EQUIPMENT PERFORMANCE CHECK.

Turn-on and tuning procedures given in Section 3, coupled with block diagram figure 4-1, can be used as equipment performance checks. In most cases, front-panel meters and indicators will provide sufficient information to localize common troubles to a particular modular unit. The initial point where SBT-1K(F) controls and indicators do not function correctly as described in the ACTION column of tables 3-2 through 3-6 will serve to indicate the faulty unit. Once the trouble is localized to a modular unit, refer to the appropriate modular-unit manual for detailed information necessary to locate and repair or replace the faulty component. If use of turn-on and tuning procedures does not reveal the faulty unit, proceed as outlined in paragraph a and/or b below.

WARNING

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

a. If the synthesized exciter (Sideband Generator SBG-1) is suspected, follow the procedures outlined in Testing Procedure (Part III) For Synthesized Exciter SBG-1/2. Once the faulty unit is determined, refer to the appropriate modular-unit manual for further information necessary to locate and repair or replace the faulty component.

b. If Linear Power Amplifier PAL-1K(A), Antenna Tuning System ATS-2, or Tone Intelligence Unit TIS-3 is suspected, refer to the appropriate modular-unit manual for troubleshooting and corrective maintenance information.

If transmitter output-power measurements, other than those obtainable with Monitor Control Unit MCU-2, are required, they can be obtained as follows:

(1) Connect SBT-1K(F) to 52 ohm, 1 kw dummy load; connect Hewlett Packard Model 410 B VTVM or equivalent across dummy load.

(2) Using Test Generator TTG-2 connected as described in Testing Procedure (PART III) For Synthesized Exciter Model SBG-1/2; apply a two-tone test signal to Sideband Exciter CBE-1.

(3) Refer to operating procedures given in Section 3 of this manual and tune transmitter to any selected test frequency at full power output.

(4) Observe indication on VTVM: 1 kw PEP is 225 RMS across 52 ohm load.

NOTE

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

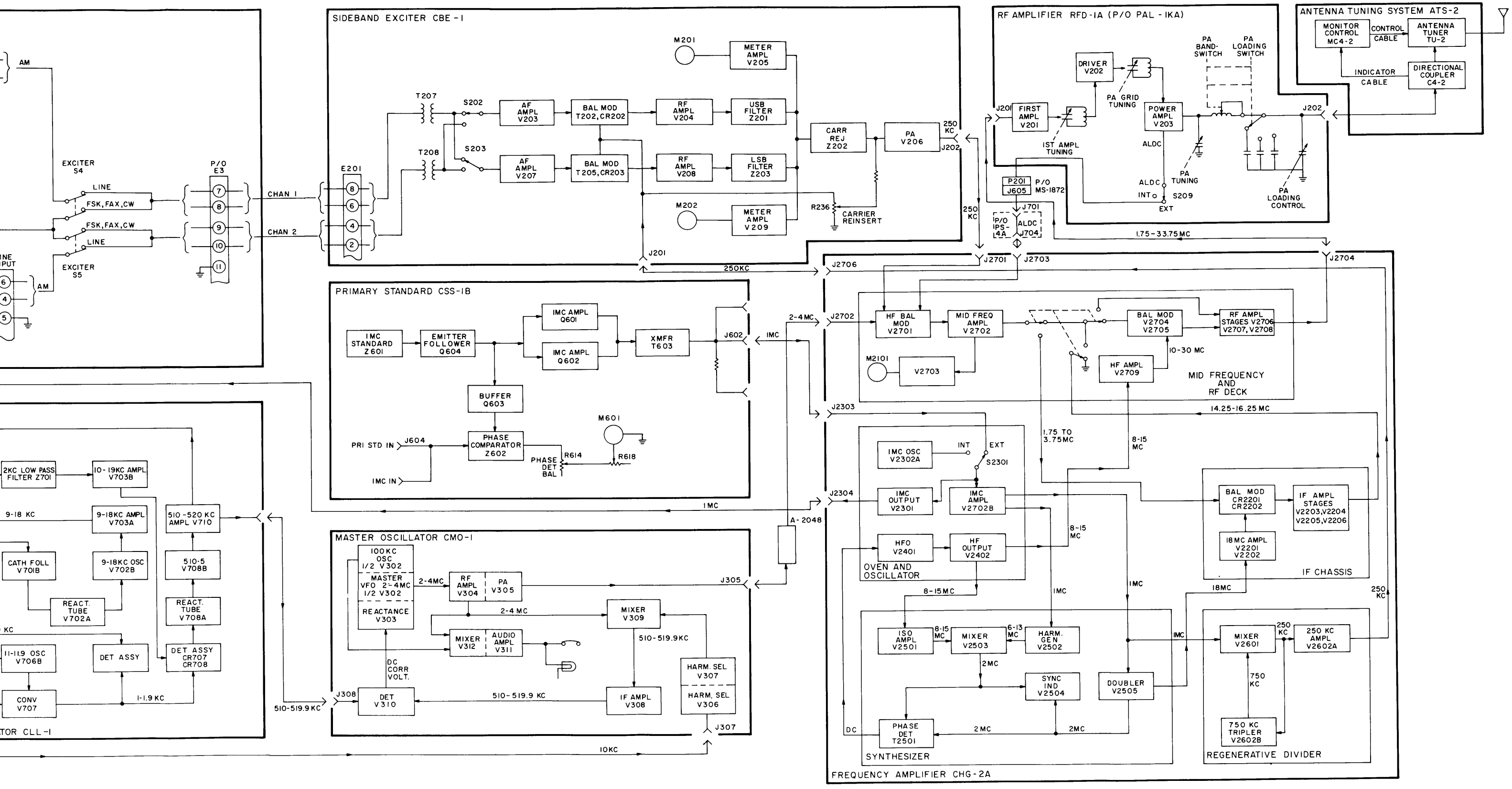
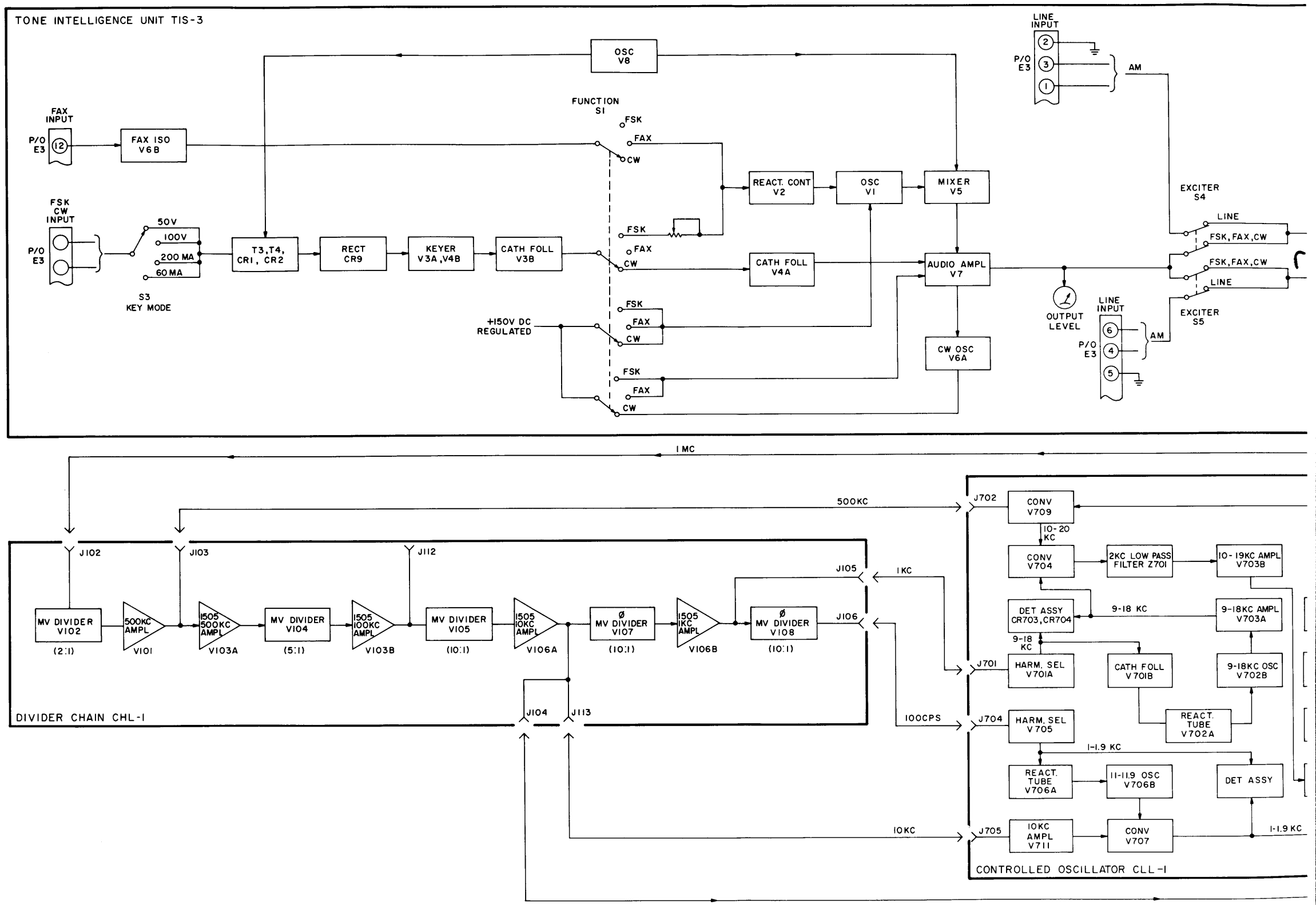


Figure 4-1. Functional Block Diagram, SBT-1K(F)


TONE INTELLIGENCE UNIT TIS-3
FAX INPUT
P/O E3
12
FAX ISO V6B
FSK CW INPUT
P/O E3
50V
100V
200 MA
60 MA
S3 KEY MODE
T3,T4, CR1, CR2
RECT CR9
KEYER V3A,V4B
CATH FOLL V3B
+150V DC REGULATED
FUNCTION S1
FSK
FAX
CW
OSC V8
REACT. CONT V2
OSC V1
MIXER V5
CATH FOLL V4A
AUDIO AMPL V7
CW OSC V6A
LINE INPUT
P/O E3
2
3
1
AM
EXCITER S4
LINE
FSK,FAX,CW
OUTPUT LEVEL
LINE INPUT
P/O E3
6
4
5
AM
EXCITER S5
1MC
500KC
J102
J103
J112
J105
J106
J104
J113
MV DIVIDER V102
(2:1)
500KC AMPL V101
1505 500KC AMPL V103A
MV DIVIDER V104
(5:1)
1505 100KC AMPL V103B
MV DIVIDER V105
(10:1)
1505 10KC AMPL V106A
Ø MV DIVIDER V107
(10:1)
1505 1KC AMPL V106B
Ø MV DIVIDER V108
(10:1)
DIVIDER CHAIN CHL-1
1KC
100CPS
10KC
J702
J701
J704
J705
CONV V709
10-20 KC
CONV V704
2KC LOW PASS FILTER Z701
10-19KC AMPL V703B
DET ASSY CR703,CR704
9-18 KC
9-18KC AMPL V703A
HARM. SEL V701A
CATH FOLL V701B
9-18KC OSC V702B
REACT. TUBE V702A
HARM. SEL V705
1-1.9 KC
REACT. TUBE V706A
11-11.9 OSC V706B
DET ASSY
10KC AMPL V711
CONV V707
CONTROLLED OSCILLATOR CLL-1

008640273/F

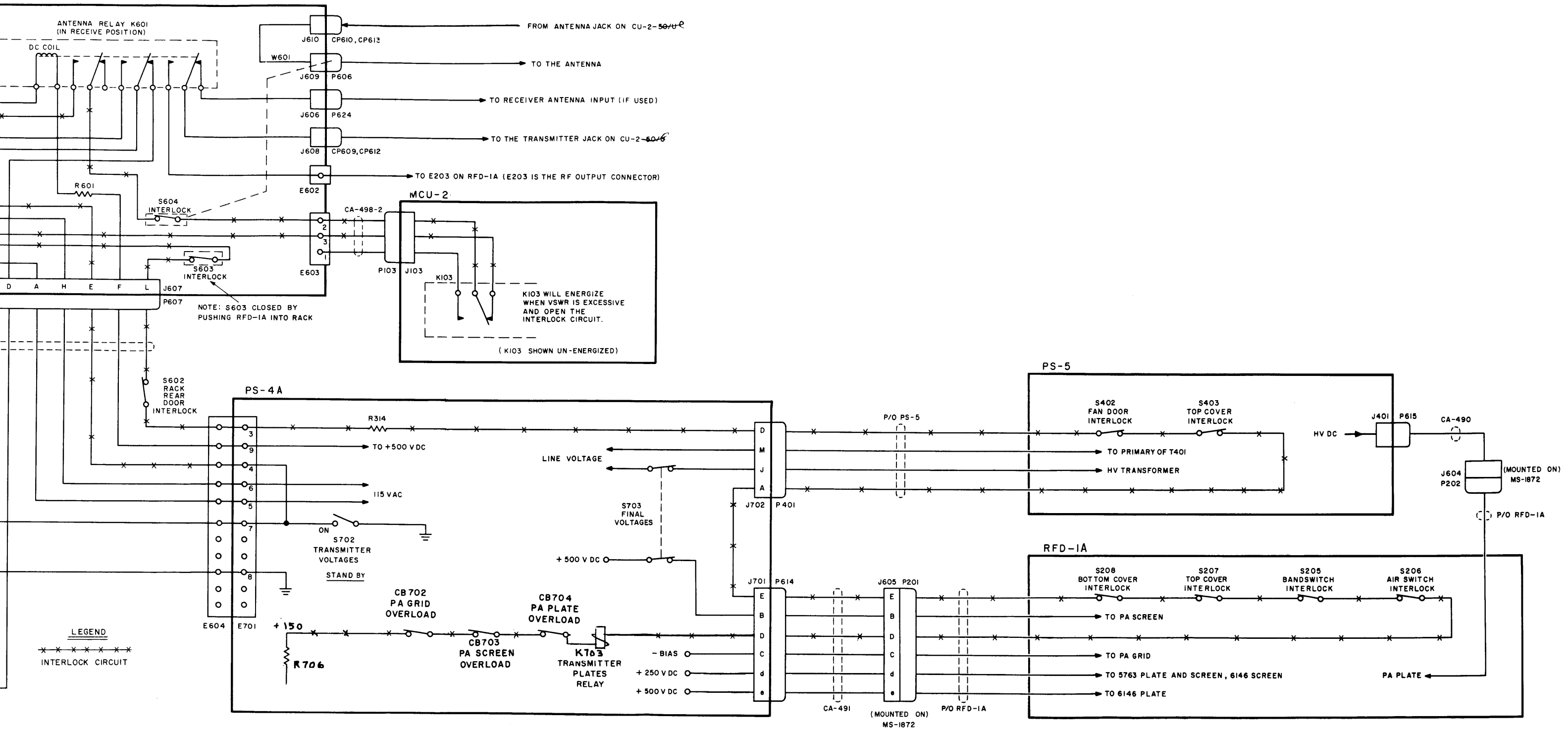
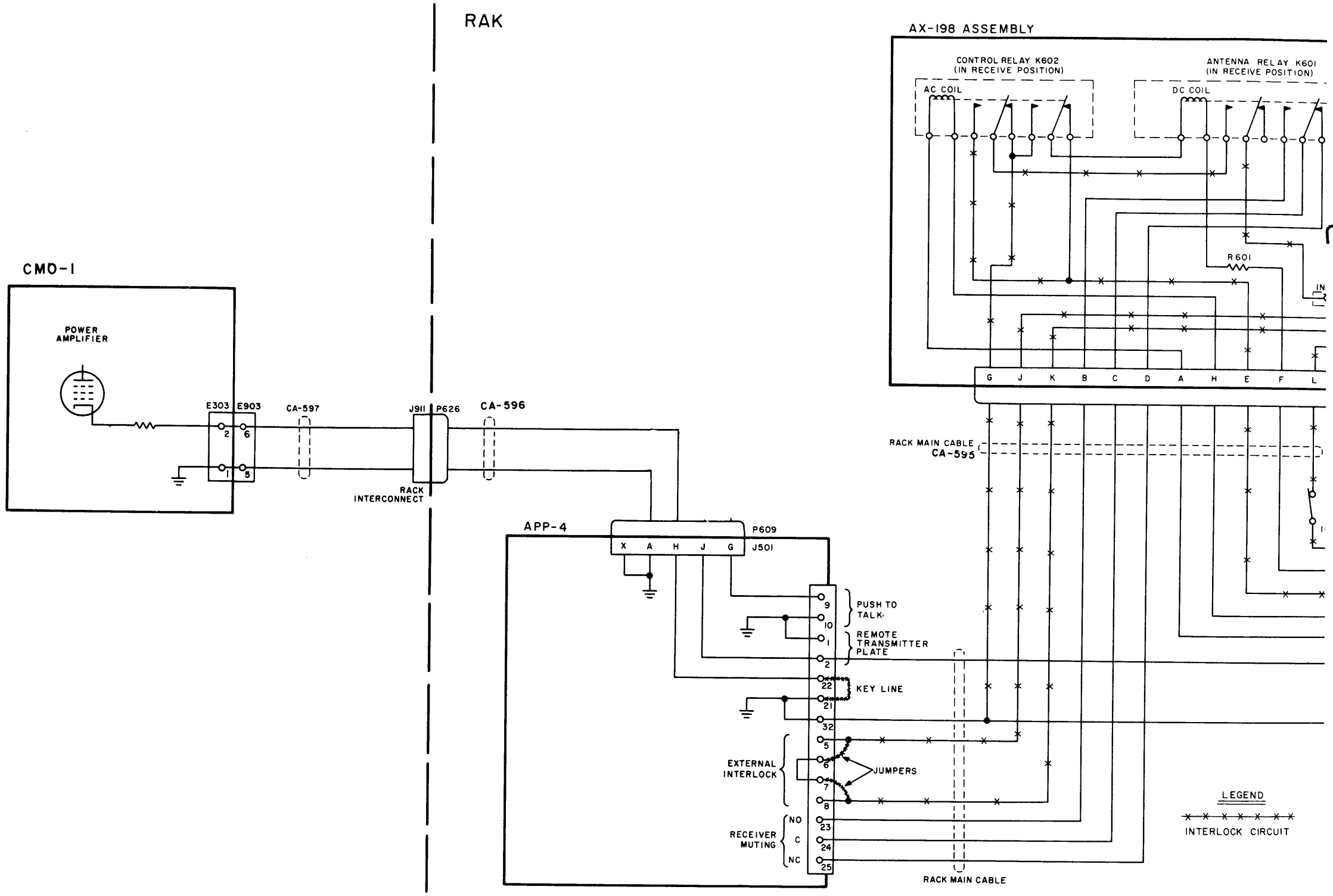


Figure 4-2.

Interlock System and Transmitter/ Receiver System SBT-1K(F)


RAK
CMD-1
POWER AMPLIFIER
E303
E903
2
6
1
5
CA-597
J911
P626
RACK INTERCONNECT
CA-596
APP-4
P609
X
A
H
J
G
J501
9
10
1
2
22
21
32
5
6
7
8
23
24
25
PUSH TO TALK
REMOTE TRANSMITTER PLATE
KEY LINE
EXTERNAL INTERLOCK
JUMPERS
RECEIVER MUTING
NO
C
NC
RACK MAIN CABLE
AX-198 ASSEMBLY
CONTROL RELAY K602
(IN RECEIVE POSITION)
AC COIL
ANTENNA RELAY K601
(IN RECEIVE POSITION)
DC COIL
R601
G
J
K
B
C
D
A
H
E
F
L
RACK MAIN CABLE
CA-595
LEGEND
INTERLOCK CIRCUIT

SECTION 5

MAINTENANCE

5-1. GENERAL.

Maintenance is divided into three categories: operator's maintenance, preventive maintenance, and repair. Repair procedures for RAK-31A components or for any modular unit contained in the DDR-8 are given in the appropriate modular-unit manual. Preventive maintenance includes information necessary to insure optimum performance of the DDR-8. For this reason, alignment and adjustment information is included under preventive maintenance. Operator's maintenance for the DDR-8 is described in Section 3.

5-2. SPECIAL TOOLS AND TEST EQUIPMENT.

Special tools and test equipment required for maintenance of the synthesized exciter (SBG-1) are listed in the testing procedures (Part III) for the synthesized exciter. Special test equipment required for maintenance of Linear Power Amplifier PAL-1K(A) and Antenna Tuning System ATS-2 consists of a Hewlett Packard Model 410B VTVM or equivalent.

5-3. PREVENTIVE MAINTENANCE.

a. GENERAL. - The SBT-1K(F) has been designed to provide long-term, trouble-free operation under continuous duty conditions. However, similar to any other piece of equipment that contains assemblies of many electrical and mechanical parts, optimum performance and service life of the SBT-1K(F)

are dependent upon an adequate preventive maintenance schedule that is strictly adhered to.

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

WARNING

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

Carefully inspect equipment for loose solder connections or screws, especially those on solder lugs. Tighten and resolder connections as required.

c. REPLACEMENT OF ELECTRON TUBES. - While the modular units are out of the cabinet for periodic inspection, all electron tubes should be checked and replaced as required. Particular attention should be paid to the following:

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

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

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

d. GEAR LUBRICATION. - Examine all gears and gear assemblies contained in the modular units. If any of the gears show signs of becoming dry, coat them heavily with a molybdenum disulphide compound such as Molykote Type G made by the Alpha Corporation of Greenwich, Conn.

e. ALIGNMENT AND ADJUSTMENT. - All SBT-1K(F) alignment and adjustment is accomplished on an individual modular-unit basis. Refer to the appropriate modular-unit manual for the necessary alignment or adjustment procedures.