TECHNICAL MANUAL

for

MODEL GPTM-10KAC

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, CANADA

IN-1028 Issue Date June, 1969

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

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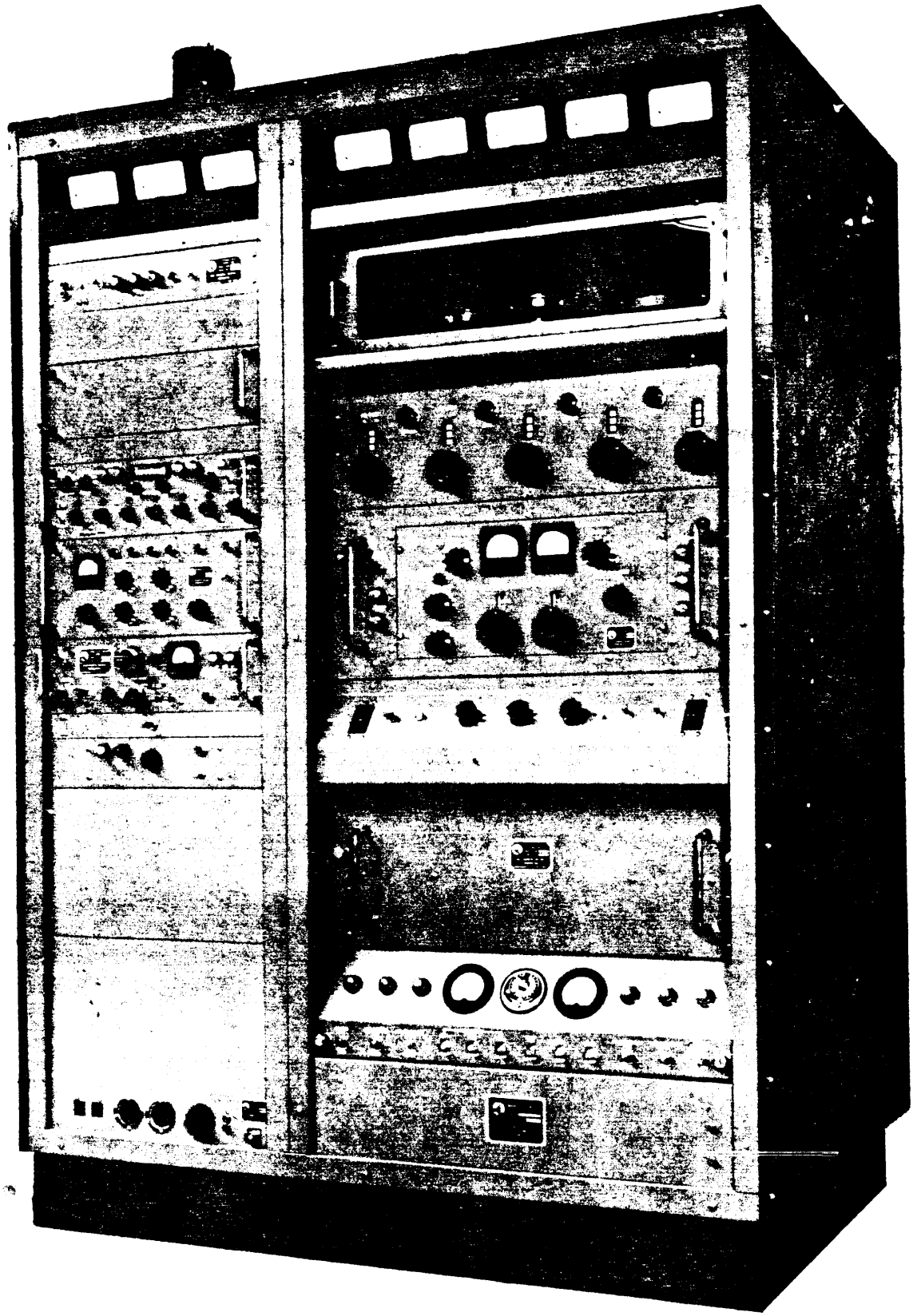

Figure 1-1. Front Angle View of General Purpose Transmitter, Model GPTM-10KAC

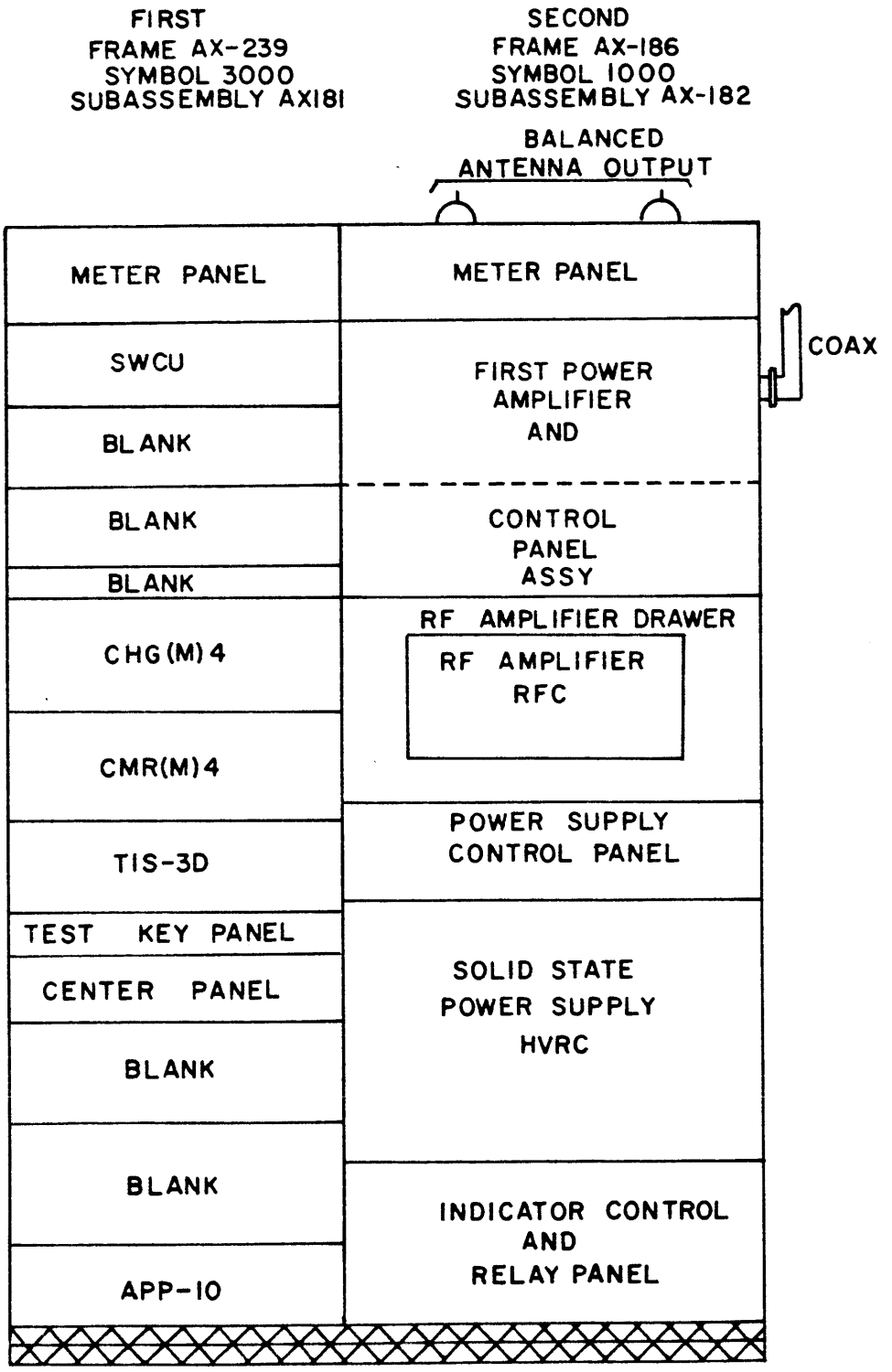

Figure 1-2 General Component Identification

SECTION 1

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION

General Purpose Transmitter Model GPTM-10KAC (hereafter called the Transmitter, the 10K, or the GPT) is a synthesized four-channel independent sideband transmitter capable of 10 kilowatts PEP output over the range 2- to 28 MHz, in the following emission modes: CW, SSB, 2-channel ISB, 4-channel ISB, Tone CW, Tone FSK, Tone FAX, AM, and AME. Full, reduced, or suppressed carrier may be employed, as applicable to the particular mode.

The transmitter consists of the following sub-sections and/or modular units:

MODEL	NAME
AX557	Main Frame Assembly (contains 10 KW PA and 1 KW Driver sections, and associated power supplies)
AX5075	Auxiliary Frame Assembly; contains the following:
SBG	Sideband Generator
Consists of:	Consists of:
CMR	Sideband Exciter
CHG	Frequency Translator
TIS	Tone Intelligence System
AX5040	Test Key Panel
AX5031	KIT-321 (residual noise suppression)
SWCU	Standing Wave Control Unit
APP	Auxiliary Power Panel
A4117	Center Panel

1-2. DESCRIPTION OF EQUIPMENT

The following paragraphs briefly describe each sub-section or modular unit of the 10K. For more detailed information about a particular unit, refer to the modular manual for that unit.

a. GENERAL. As shown in figure 1-1, the transmitter consists of an auxiliary frame and a main frame that are bolted together and to a common base assembly. The two frames house all the components of the transmitter and are equipped with protective doors. Primary power connections are made through the base assembly. Two antenna bowl assemblies, used for balanced output operation, are provided at the top of the main frame. For unbalanced output operation, a connector must be mated to the directional coupler output flange located in the side of the main frame.

b. AUXILIARY FRAME. The auxiliary frame houses the exciter components of the transmitter. The frame is divided into a front and rear section by a partition which supports miscellaneous controls, connectors, and terminal boards. All major exciter units are mounted at the front of the auxiliary frame. The exciter units are slide-mounted and can be partially withdrawn from the cabinet and tilted to expose the top or bottom surface of each chassis. Thus, adjustments and maintenance procedures may be conveniently performed with full power applied. An AUXILIARY FRAME MAIN POWER circuit breaker, located on the rear of the inner partition, controls the application of primary power to the auxiliary frame. When it is turned on, a-c power is applied to an autotransformer bolted to the rear base of the auxiliary frame. The transformer delivers 115 volts ac to a strip positioned vertically within the auxiliary frame; the a-c power cords of the exciter units are plugged into this strip. A fan at the upper front portion of the auxiliary frame provides forced-air cooling of the exciter components. A red lamp on the roof of the auxiliary frame lights when high voltage is applied to the transmitter.

c. AUXILIARY METER PANEL.- The auxiliary meter panel, mounted at the top of the auxiliary frame, contains three meters. These monitor the power-amplifier screen grid voltage, grid bias voltage, and plate voltage.

d. SIDEBAND GENERATOR SBG. The SBG is a solid-state exciter system capable of producing a four-channel independent sideband signal over the entire frequency range of the GPT, tuning this range in 100-Hz increments. The SBG includes two modular

exciter units: Model CMR Sideband Exciter, and Model CHG Frequency Translator. The CMR uses frequency-division multiplexing to generate the basic four-channel ISB signal, centered about 1.75 mHz; the CHG mixes this with an internally-generated variable-frequency injection signal of high stability, to produce a 1.6 to 29.99999 mHz exciter output range. However, design parameters of the 10K are such that output of the entire transmitter falls between 2- and 28 mHz, only. The CHG also provides the CMR with a 1-mHz standard reference input, which the CMR uses to obtain its various internal signals.

The CMR portion of the SBG contains circuitry to permit a choice of transmitter keying sources, selected by a front-panel switch. Keying sources include hand key (CW), Push-to talk (PTT), voice-operated crossover (VOX), and direct manual keying (NORM). Of particular interest is the CMR's VOX circuitry, which automatically disables a channel in the absence of an audio input to that channel, thus preventing transmission of background noise, during inactive periods. Also controllable from the front panel are channel power level, carrier insertion, and metering functions.

e. TONE INTELLIGENCE UNIT TIS. The TIS is a multi-purpose audio-shift keyer that is specifically designed to be used in conjunction with a synthesized exciter. Its purpose is to generate a keyed or frequency-shifted audio tone output, so that the carrier frequency generated by the exciter will not have to be keyed or shifted directly. In this way, the high degree of carrier-frequency stability is maintained. Key line, FAX, and two audio-line inputs to the transmitter are connected to two Center Panel terminal boards at the rear of the auxiliary frame. These are wired to the input of the TIS through the internal cabling of the frame; the TIS audio outputs are cabled to Sideband Exciter CMR.

The TIS circuits contribute much flexibility in choice of sideband selection and control. When desired, either or both audio-line inputs to the transmitter may be applied directly to either or both inboard audio-channel inputs of the CMR for ultimate insertion into the sidebands. For FAX operation, FAX d-c voltage is converted

into a linear-shifted audio signal about one of four selected center frequencies, and applied to the CMR. For FSK or CW operation, voltage or current keying at different levels may be selected by a front panel KEY MODE switch. Total frequency shift for FSK operation is controlled by calibrated direct-reading counter-type control. A front panel TEST switch permits the keying circuits to simulate a mark or space condition for monitoring and test purposes. Audio output level of the TIS is display on a front-panel meter and controlled by an associated potentiometer. The TIS provides a precise 1000-cycle tone for CW keying. Oven-controlled crystal oscillators in the unit may be left energized during standby operation to insure frequency stability.

f. TEST KEY PANEL AX5040. The Test Key Panel provides a convenient point from which the GPT may be keyed for test purposes. The panel contains a single control: the Test Key itself. This is a three-position switch, providing the functions of Momentary Key (spring return), Key and Hold (non-return), and a center OFF (unkeyed; detent).

g. RESIDUAL NOISE SUPPRESSION KIT AX5031. This unit, hereafter called KIT-321, suppresses residual white noise under key-up conditions (so-called "diode hash"), by means of H.V. and bias switching of the transmitter's PA and IPA sections, under control of the keying source. KIT-321 is keyed directly by relay K101 in the CHG portion of the SBG. K101, in turn, is activated by the transmitter keying source.

h. STANDING WAVE CONTROL UNIT SWCU. The SWCU, mounted topmost in the auxiliary frame, contains an SWR overload relay, a d-c amplifier, and a power supply. During unbalanced output operation, this unit monitors SWR on the transmission line. When excessive SWR is detected, the overload relay automatically removes high voltage from the transmitter.

i. AUXILIARY POWER PANEL APP. The APP, mounted at the bottom of the auxiliary frame, contains two a-c receptacles, a coaxial MONITOR switch, and a coaxial OUTPUT jack. RF output samples of the exciter circuits, the 1-kw IPA, and the 10-kw PA are wired to the switch. The selected RF sample may be conveniently monitored by means of a spectrum analyzer at the OUTPUT jack on the APP front panel.

j. CENTER PANEL A4117. The Center Panel is located at the rear center of the auxiliary frame; it is a convenient central tie-point for all input and keying lines to the GPT.

k. MAIN FRAME. The main frame houses a two-stage r-f voltage amplifier, a 1-kw IPA (Intermediate Power Amplifier), the 10-kw PA, a relay panel, and associated power supply and power circuits. The r-f components are distributed through the upper portion of the frame; heavy power supply components are bolted to the base channels of the frame.

l. MAIN METER PANEL. The main meter panel, mounted at the top of the main frame, contains five meters. These monitor the 10-kw PA filament voltage, screen grid current, plate current, r-f plate voltage and r-f power output or unbalanced transmission line SWR.

m. POWER AMPLIFIER SECTION. The 10-kw PA is mounted below the main meter panel: it contains the power-amplifier tube and its associated tuned circuits. A blower motor, which provides forced-air cooling of the power-amplifier tube, is mounted directly under the power-amplifier tube. The front panel of the power amplifier contains a plexiglass window, the power amplifier tuning and loading controls and their associated counter-type dials, and indicator lamps.

n. RF AMPLIFIER RFC. AND POWER SUPPLY. The r-f amplifier and power supply is mounted below the 10-kw PA. This unit serves as the r-f voltage amplifier and 1-kw IPA between the exciter and the 10-kw PA. The inner section of the unit contains all r-f amplifier parts; the outer section houses the power supply components. The 1-kw IPA tube is air-cooled by a blower contained in the r-f section. The front panel of the inner r-f section contains tuning and loading controls for the 1-kw IPA, bandswitches to cover the 2- to 28-mc r-f range, and a monitoring meter and associated meter switch. All major d-c and r-f voltages in the r-f amplifier may be conveniently monitored with this arrangement.

o. MAIN POWER PANEL. The main power panel controls the application of plate, screen grid, and filament voltages to the 10-kw PA and monitors all interlock cir-

cuits contained in the main frame. Other front-panel controls include a reset push-button associated with the protective relays in the main frame, and an automatic load and drive control switch and level adjustment.

p. 10-KW HIGH-VOLTAGE RECTIFIER HVRC. The 10-kw high-voltage rectifier, mounted below the power panel, contains the solid-state high-voltage rectifiers. Operating as the high-voltage rectifier deck associated with the main power supply, this unit produces 7500 volts d-c for the plate of the 10-kw PA tube. Heavy insulated button connectors at the rear of the unit provide connection for the 3-phase input voltage and the d-c output voltage.

q. 10-KW RELAY PANEL. The 10-kw relay panel, mounted at the bottom of the main frame, contains nine relays that protect the transmitter circuits against overloads. The relays and their associated terminal boards are mounted under a front panel cover plate for quick accessibility. The upper portion of the relay panel contains filament and plate time meters, an automatic reset timer, and overload indicator lamps. All IPA and PA overload adjustments are also brought out on the relay panel for ease of adjustment.

1-3. TECHNICAL SPECIFICATIONS

Frequency Range:	2-28 mc (bandswitched).
Output Power:	10,000 watts PEP, 5,000 watts average. 3rd order distortion products down at least 35 db from either tone of a standard 2-tone test at full PEP.
Operating Modes:	SSB, 2- or 4-channel ISB, tone FSK, tone FAX, CW, tone CW, AM, and AME.
Frequency Stability:	1 part in 10^8 per day at any 100-cycle increment from 2- to 28-mc.
R-F Bandpass:	20 kc throughout the tuning range, between 3-db voltage points.
Carrier Insertion:	-55 db, -30db, -20db, -6db, -3db, full; switch selectable from exciter front panel.
Harmonic Suppression:	Second harmonic at least 50 db down from PEP; third harmonic at least 65 db down from PEP.
Environment:	Between 0°C (32°F) and 50°C (122°F) for humidity as high as 90%.

Output Impedance:	50 or 70 ohms unbalanced; 600 ohms balanced. Pi-L network will match load with VSWR of 2:1 maximum.
Audio Inputs to SBG:	Four independent 600-ohm channels, balanced or unbalanced.
Input Dynamic Range:	-25dbm to +5dbm.
Audio Response per channel:	350- to 3040-Hz each.
FSK Keying Inputs to TIS:	Two independent channels; 50V, 100V, 20ma, 60ma, (all neutral, floating, or either side grounded) per channel.
FAX Input:	0 to +20 volts for a linear shift of 1200 Hz.
CW Tone Frequency:	1000 Hz.
Power Consumption:	220 volts 3-phase, 60 cps, 50 amps per leg.

SECTION 2

INSTALLATION

2-1. GENERAL

This section shall deal mainly with choice of operating site and general installation of modular units. For detailed installation instructions, refer to the Installation Manual for General Purpose Transmitter Model GPT-10K (TMC issue number IN294). Note that installation details for shock-mount situations appear at the front of the Installation Manual, in the form of reproduced installation drawings.

2-2. INSTALLATION

a. OPERATING SITE. Choice of operating site is of prime consequence in assuring reliable communications and transmitter operation.

Physically, the site must accomodate both volume and weight of the 10K. There should be adequate space provided around the transmitter to allow easy access to the GPT's interior by maintenance personnel. Remember to allow enough space to permit all doors to be opened easily. It is also particularly important that all air ducts, vents, filters, or grilles have adequate surrounding air space to permit unimpeded airflow. If operating and/or maintenance personnel are to be billeted at the transmitter site, or will be working there for extended periods, their quarters and/or working areas should not be located so near the GPT that a safety hazard could develop in course of time, or that personnel fatigue could result from the operating "rush" of the GPT's blowers: extended exposure to white noise could have deleterious psychological and physiological effects upon key personnel.

Electrically, the site must satisfy all primary power requirements of the GPT. Adequate 3-phase AC voltage and current regulation is essential for reliable, positive relay operation. The transmitter in general, and particularly high-impedance and/or unshielded lines, as well as all audio input lines, must be kept as far as possible from all potential sources of electrical noise, to avoid false keying of VOX circuitry, and worse, transmission of undesired noise. Especially to be avoided

are such sources as: Motors (particularly DC motors), high-voltage arcs (such as are found in neon signs, oil burners, or automotive ignition systems) make-and-break devices (thermostats, flashers, etc.), sources of RF, especially near the GPT's low-level circuits (diathermy equipment, TV receivers, etc.). The operating site should not be so far removed from the antenna site as to necessitate an extremely long antenna lead-in, particularly in those configurations using coaxial cable, with its relatively high inherent attenuation.

b. MODULAR UNIT INSTALLATION. Auxiliary frame units CHG, CMR, and TIS, and main frame units HVRC (High Voltage Rectifier) and AX104 (IPA Drawer) are slide-mounted for ease in installation/removal and servicing access. These units have the equipment portion of their slides already mounted on their sides. To install the slide-mounted units, proceed as follows:

(1) Mount cable retractors, if used, in rear of compartment (TMC recommends use of cable retractors to prevent cable snags and possible attendant damage to both cables and equipment).

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

(3) Position slide mechanism of unit in tracks, and ease forward into housing until lock buttons engage hole in track.

(4) After making necessary electrical and cable connections to unit, depress forward lock buttons and slide completely into compartment.

(5) Secure front panel of unit to housing with screws.

SECTION 3

SYSTEM OPERATING PROCEDURE

3-1. SCOPE

This section gives detailed operating instructions for the SBG exciter portion of the 10K, and for the transmitter as a system. For detailed tuning and operating procedures for the 10K amplifier sections, refer to Operating Instructions for Transmitting Set, Radio, Model GPT-10K Synthesized. Detailed operating instructions for the TIS may be found in the individual modular unit manual.

3-2. GENERAL

The operator should become thoroughly familiar with the location and function of each major control of the 10K. Bear in mind that, despite the extensive interlock system designed into the transmitter, a single incorrect control setting might still dangerously overload certain components, inviting early failure and consequent transmitter "down time", not to mention improper and illegal emission.

A definite operating sequence (as outlined by operating instructions) should be strictly followed; the operator should establish a procedural pattern, thus ensuring consistent operation.

Before applying power to the transmitter, check that the following inputs are connected: (as required for the modes of operation to be used). Refer to figure 3-1.

Also check that antenna connections are properly made for the particular antenna to be used. Connections for balanced and unbalanced operation are made on a terminal board located at the top of the power amplifier. For unbalanced operation, the rf output of the transmitter is routed to the external antenna through a coaxial connector which is customer-installed on the coaxial connector bracket at the upper right side of the transmitter. For operation with a balanced antenna, the antenna leads are connected to the bowl insulators, on the roof of the main frame, through individual rf ammeters (0 to 5 amperes). The ammeters are available from TMC as Model TMA-10K, or may be supplied by the customer.

"Carrier" frequency may be defined as that position in the rf spectrum reserved for the "carrier" whether the carrier is present or not. The "assigned" frequency is a reference frequency designed to identify or reserve a given portion of the rf spectrum. Most government agencies define the "assigned" frequency as the "center of a frequency band assigned to a station". The "assigned" frequency and the "carrier" frequency may or may not be the same. In practice, the assigned frequency is frequently suffixed by the carrier frequency in parenthesis for clarification.

Example 1 - For an upper sideband transmission, with carrier completely suppressed and with total audio bandpass extending to 3000 cycles, the assigned frequency is 1500 cycles above the non-existent carrier frequency.

Example 2 - For an independent sideband (ISB) transmission, with audio intelligence covering 350 to 7500 cycles per sideband, with or without carrier suppression, the assigned frequency and the carrier frequency are one and the same: both occupy the center of the transmitted spectrum.

c. DETERMINATION OF PROPER SYNTHESIZED FREQUENCY. -

(1) Dry Keying. When dry keying is used for nominal carrier on-off cw transmission, carrier frequency and assigned frequency are the same. Tune up on carrier as described in paragraphs 3-5 and 3-7.

(2) Double or Independent Sideband Operation. For either DSB or ISB, carrier and assigned frequncy are the same, regardless of the type of modulation. Tune up on carrier as described in paragraphs 3-5 and 3-7.

(3) CW Tone Keying. When the transmitter is keyed through the TIS-3, the TIS-3 delivers a keyed 1-kc tone to the selected input channel of the CMR. If the exciter is initially tuned to the desired output frequency in normal fashion, injection of the keyed tone will cause the output frequency to be in error by 1 kc; i.e., the assigned frequency and carrier frequency will be 1 kc apart. To compensate for this effect, the carrier frequency must be offset by 1 kc. This places the final keyed rf output signal on the desired frequency.

3-3. STARTING PROCEDURE

a. APPLYING POWER TO EXCITER. - The temperature-controlled oven circuits which contribute to the high degree of frequency stability in the synthesized exciter should be energized for at least thirty minutes before the exciter is operated. If the transmitter is to be operated on a fairly constant basis, its exciter should be left in standby during idle periods. Proceed as follows:

(1) Set the switches listed below to the positions shown:

Unit	Switch	Position
CHG-4	ON-STANDBY	ON
CMR-4	ON	ON
TIS-3D	B + ON-STANDBY	B+-ON
AX-5031	ON-OFF	ON

(2) Set the AUXILIARY FRAME MAIN POWER circuit breaker on the inner rear partition of the auxiliary frame to its ON position. The following actions should occur:

(a) Top fan in the auxiliary frame comes on.
(b) Power lamp on CHG-4 lights.
(c) Power lamp on CMR-4 lights.
(d) B+ lamp on TIS-3D lights.
(e) Power lamp on AX-5031 lights.

3-4. CONSIDERATIONS IN TUNING TRANSMITTER

a. GENERAL. - Before the transmitter is tuned for any specified mode of operation, it should be initially tuned and loaded on carrier. This procedure should be followed even if suppressed carrier operation is desired. After the transmitter is tuned to carrier, either or both sidebands are generated by applying the proper modulating signals (FAX, FSK, audio line, CW) required by the particular mode of operation. The carrier level may then be re-inserted or bypassed, as desired.

b. CARRIER FREQUENCY VS ASSIGNED FREQUENCY. - A brief description of "carrier" versus "assigned" frequency is presented at this point since these may be significantly different when operating in certain modes and will affect the choice of frequency to be synthesized in the exciter.

3-3. STARTING PROCEDURE

a. APPLYING POWER TO EXCITER. - The temperature-controlled oven circuits which contribute to the high degree of frequency stability in the synthesized exciter should be energized for at least thirty minutes before the exciter is operated. If the transmitter is to be operated on a fairly constant basis, its exciter should be left in standby during idle periods. Proceed as follows:

(1) Set the switches listed below to the positions shown:

Unit	Switch	Position
CHG-4	ON-STANDBY	ON
CMR-4	ON	ON
TIS-3D	B + ON-STANDBY	B+—ON
AX-5031	ON-OFF	ON

(2) Set the AUXILIARY FRAME MAIN POWER circuit breaker on the inner rear partition of the auxiliary frame to its ON position. The following actions should occur:

(a) Top fan in the auxiliary frame comes on.
(b) Power lamp on CHG-4 lights.
(c) Power lamp on CMR-4 lights.
(d) B+ lamp on TIS-3D lights.
(e) Power lamp on AX-5031 lights.

3-4. CONSIDERATIONS IN TUNING TRANSMITTER

a. GENERAL. - Before the transmitter is tuned for any specified mode of operation, it should be initially tuned and loaded on carrier. This procedure should be followed even if suppressed carrier operation is desired. After the transmitter is tuned to carrier, either or both sidebands are generated by applying the proper modulating signals (FAX, FSK, audio line, CW) required by the particular mode of operation. The carrier level may then be re-inserted or bypassed, as desired.

b. CARRIER FREQUENCY VS ASSIGNED FREQUENCY. - A brief description of "carrier" versus "assigned" frequency is presented at this point since these may be significantly different when operating in certain modes and will affect the choice of frequency to be synthesized in the exciter.

NOTE

Before operating CMR, ensure that CHG has had adequate warm-up time: approximately 30 minutes should suffice, and that CHG POWER switch is set to ON position (up).

c. CHG. - Refer to figure 3-3. Controls and indicators for the CHG are as follows:

Table 3-1. Controls and Indicators, CHG

NAME	FIG. 3-2 REF.	FUNCTION
10MHz, 1MHz, 100KHz, 10KHz, 1KHz, 100HZ	1	Selects output frequency of CHG, and therefore, of entire 10K. Six switches: decade arrangement from 100Hz (minimum increment) to 10MHz (maximum increment).
RF OUTPUT	2	Varies maximum RF output of CHG from 0 to 250 mw; functions as drive control for 10K.
METER	3	Switches MONITOR meter (ref. 4 below) into collector circuits of RF amplifiers Q1, Q2, and Q3, and to RF output of CHG. Four positions: Q1, Q2, Q3, RF.
MONITOR	4	Indicates collector current of RF amplifiers Q1, Q2, Q3; also indicates relative RF output of CHG. Switched by METER (ref. 3 above).
LINE	5	Line fuses; protect both sides of primary power input line. 1.0 amp each.
STANDBY; POWER (2 separate indicators)	6	Indicate position of ON/STANDBY switch (ref. 7 below), and, therefore, condition of CHG.
ON/STANDBY (2 positions of same switch)	7	Applies or removes B+ from all circuits excepts Ovenized Oscillator Z301; Z301 receives power at all times, as long as primary AC is applied to unit.

d. SBG Operating Procedure. - This sub-section enables the operator to produce a useable signal of the desired frequency and emission mode from the SBG. For system instruction, refer to section 3-7, and to the GPT Operator's Manual.

(1) Full-carrier (tune-up). This provides a steady, unmodulated carrier of

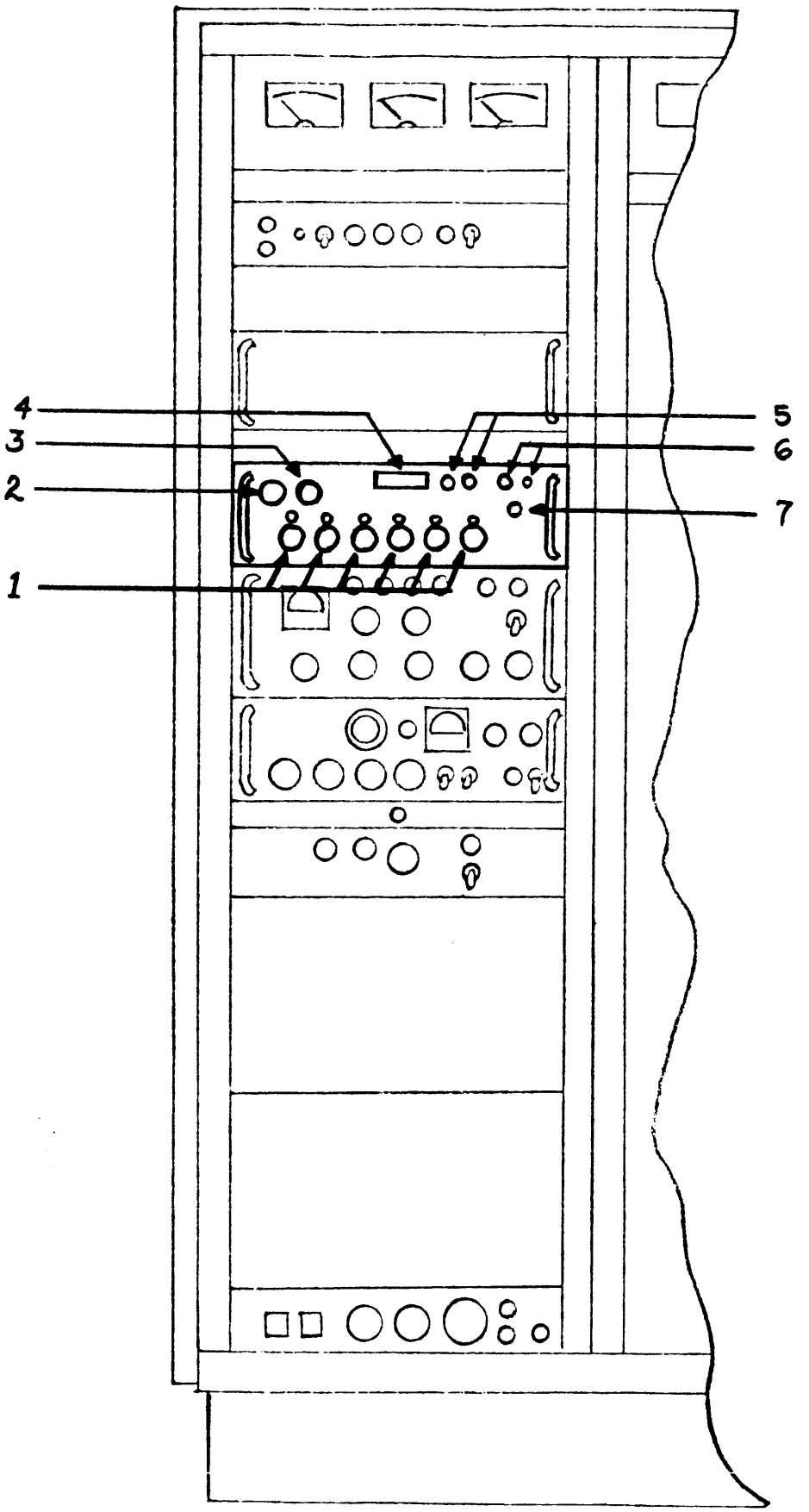

Figure 3-2. Controls and Indicators, CHG.

continuously-variable amplitude at the desired operating frequency for use during system tune-up. To produce this "key-down" condition, do the following:

CMR

Control	Position
power switch	ON
MODE	NORM
CARRIER SUPPRESSION (db)	0
CHANNEL PRIORITY (All four controls)	0

CHG

Control	Position
ON/STANDBY	ON
frequency selector switches	set to desired operating frequency.
METER	RF
RF OUTPUT	vary as necessary to obtain proper drive to 10K; see 10K Operator's Manual.

Those controls which are not listed are, in effect, electrically bypassed in the given mode.

NOTE

> Once having tuned the GPT on a carrier, reduce RF OUTPUT of the CHG to minimum (RF OUTPUT control full CCW). At this point, a fairly accurate estimate must be made of the total number of modulating tones to be contained in the entire transmitted spectrum. RF OUTPUT must then be increased no further than the point at which average power is such as to produce 10,000 watts PEP, when under modulation by the estimated total number of tones. See section 4 (Supplementary Data) of Operating Instructions for Transmitting Set, Radio, Model GPT-10K Synthesized, for information on PEP determination.

In view of the above note, the following operational procedures will omit direct mention of RF OUTPUT control settings. Bear in mind, however, that this control must be adjusted for each mode of operation, in accordance with the note.

(2) CW Operation. Simply set the SBG as previously described for Full Carrier tune-up, with the following exception: set CMR MODE switch to CW. SBG may now be keyed via the transmitter's Center Panel CW key connections.

Modify the tone CW operating procedure for the CHG in paragraph 3-5 as follows: Should a keyed output frequency of, say 15.5 mc be desired, tune the CHG to 15.4900 mc the resulatant would then be a keyed 15.5 mc signal.

(4) FAX Operation. The international standard "center" frequency for facsimile transmission is 1900 cps. When the transmitter is to be used only for FAX transmission on one sideband, the TIS-3 will deliver a 1900-cycle center frequency to the selected channel. The instantaneous output frequency will shift about this point, so that the assigned frequency will be 1900 cycles removed from the carrier. To compensate for this effect, the carrier frequency must be offset by 1900 cycles. For example, when operating upper sideband, for a nominal output frequency of 15.5 mc, the frequency control settings on the CHG should be set at 15.4981 mc.

(5) FSK Operation. The international standard "center" frequency for frequency shift teletype signals is 2550 cycles. The TIS-3 provides a choice of a 2000 or 2550 cycle center frequency for FSK. The mark and space frequencies will shift about the center frequency selected, so that the assigned frequency and carrier frequency will be separated by an amount equal to the selected center frequency. The 2000-cycle center frequency should be used with the synthesized exciter since the system is not capable of precision frequency control in less than 100-cycle increments. (The 2550-cycle center frequency may cause off-frequency violation if the circuit is not cleared for SSB.) Using the preceding example of upper sideband operation: for a nominal output frequency of 15.5 mc, set the CHG frequency controls for 15.4980 mc.

3-5. SBG OPERATION

a. The SBG consists of the CMR and CHG units. The actual signal to be eventually transmitted is generated in the CMR; it is in this unit that the degree of carrier suppression and mode of keying are selected. Channel power allocations (so-called "Channel Priorities") are also selected in the CMR. Output of a carrier frequency of 1.75 MHz is fed from the CMR to the CHG. The CHG mixes the 1.75 MHz intelligence

with variable-frequency RF supplied by its internal synthesizer, to produce intelligence at the desired output frequency. Output frequency is selected at the CHG, and is directly displayed in its six frequency-selection switch indicator windows. Drive to the IPA-PA sections is also set at the CHG.

The following paragraphs provide detailed operating procedures for the CMR-CHG combination. Before operating these units be sure that all primary power connections to the transmitter have been made, and that the auxiliary frame MAIN BREAKER located on the rear of the auxiliary frame's inner partition has been set to ON.

b. CMR. - Refer to figure 3-3. Controls and indicators for the CMR are as follows:

Table 3-2. Controls and Indicators, CMR

NAME	FIG. 3-3 REF.	FUNCTION
CHANNEL ACTIVITY (4 indicators; 1 per channel)	1	Illuminates to indicate activity within channel(s).
STANDBY	2	Illuminates to indicate no activity on any channel (all channels inactive).
POWER	3	Illuminates to indicate application of primary power to CMR.
Power Switch (marked ON)	4	Applies or removes CMR's primary power.
MODE	5	Selects one of four keying sources for CMR: CW, PTT, VOX, NORM.
CARRIER SUPPRESSION (db)	6	Selects one of six degrees of carrier suppression: 0db, -3db, -6db, -20db, -30db, FULL (-55db).
CHANNEL PRIORITY (4 controls; 1 per channel)	7	Apportions total transmitter power among the four channels as desired: calibrated in percent of total available power.
METER FUNCTION	8	Switches INPUT LEVEL (dbm) meter to one of four channels: A1, A2, B1, B2.
INPUT LEVEL (dbm)	9	Indicates input level (dbm) of particular channel selected by METER FUNCTION switch.

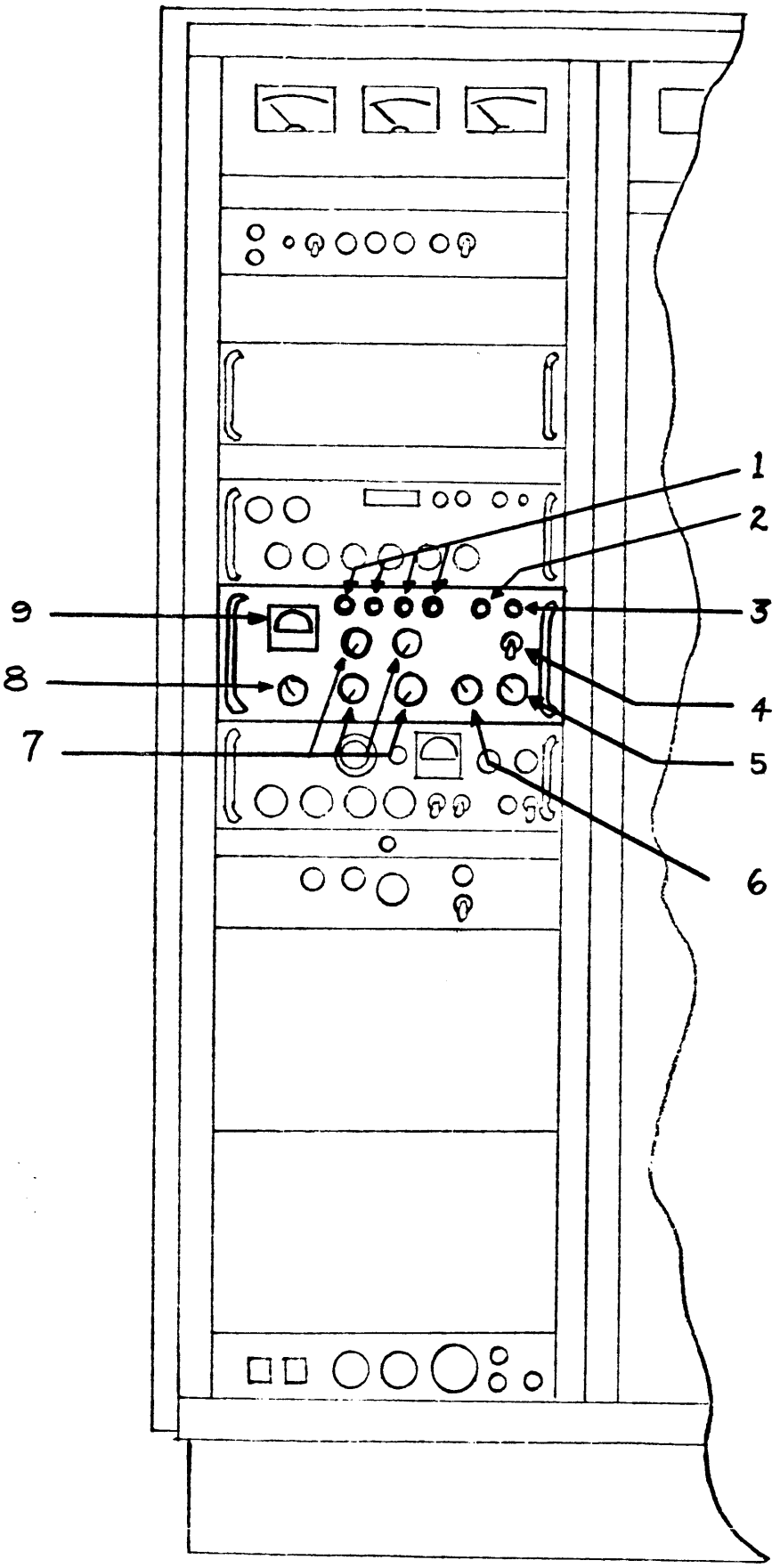

Figure 3-3. Controls and Indicators, CMR.

Audio and keying input connections to the SBG for the various modulated modes are made at the transmitter's Center Panel. See section 3-2.

Figure 3-4 shows a four-channel ISB spectrum:

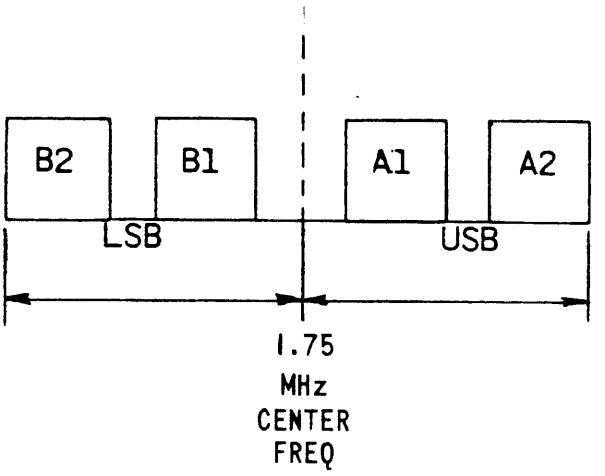

Figure 3-4. Four-channel ISB spectrum centered at 1.75 MHz.

Notice the channel labelling; this corresponds to the labelling on the CMR's CHANNEL PRIORITY controls. Each CHANNEL PRIORITY control adjusts power level of its associated channel, and is calibrated in percent of total available power. Therefore, the sum of the dial calibrations on all four controls should never exceed 100 (and should equal 100 only under full carrier suppression), representing total use of all available power. Thus, if it is desired to allocate, for example, 50 percent of total transmitter power to channel A1, and 25 percent to A2, then the total of channels B1 and B2 settings must not exceed 25 percent, or the remaining "unused" power (assuming full suppression).

Note that both inboard channels (A1 and B1) are the "normal" upper sideband and lower sideband, respectively, of the 1.75 MHz center frequency. Outboard channels A2 and B2 are the multiplexed channels.

The following paragraphs describe SBG operation for the various modulated modes: Full carrier suppression is assumed; partial carrier operation will be discussed subsequently.

(3) Upper Sideband (A1). Set SBG controls as follows:

CMR

Control	Position
Power Switch	ON
CARRIER SUPPRESSION	FULL
MODE	VOX or PTT, as desired
CHANNEL PRIORITY:	as follows:
A1	100
A2	0
B1	0
B2	0
METER FUNCTION	A1

CHG

Set CHG as described under Full Carrier tune-up operation.

Key SBG and apply audio input (if VOX is used, merely apply audio): A1 channel activity indicator should illuminate, and INPUT LEVEL (dbm) meter should indicate presence of audio.

(4) Lower Sideband (B1).

CMR

Set as for USB, with the following exceptions:

CHANNEL PRIORITY:

A1	0
A2	0
B1	100
B2	0
METER FUNCTION	B1

CHG

Set CHG as described under Full Carrier tune-up operation.

Key SBG and apply audio input (if VOX is used, merely apply audio): CHANNEL ACTIVITY indicator B1 should illuminate, and INPUT LEVEL (dbm) meter should indicate variations in average incoming audio level.

(5) Independent Sideband (A1 and B1). For two-channel ISB (inboard channels used, to conserve spectrum space), set the SBG as follows:

CMR

Control	Position
power switch	ON
MODE	VOX or PTT, as desired

CARRIER SUPPRESSION (db)	FULL
CHANNEL PRIORITY:	as follows:
A1	50
A2	0
B1	50
B2	0
METER FUNCTION	A1 or B1, as necessary or desired.

CHG

Set CHG as described under Full Carrier tune-up operation.

Key SBG and apply audio (if VOX is used, merely apply audio) to A1 and B1 inputs: CHANNEL ACTIVITY indicators A1 and B1 should illuminate, and INPUT LEVEL (dbm) meter should vary with average audio input level.

The above operating procedure assigned equal priorities (power allocations) to each channel. However, it is sometimes desirable to assign different power levels to each sideband channel, particularly when the most important (or highest-priority) channel carries complex modulation (eg. - 16-tone VFTG)), resulting in a low average power, compared to a lower-priority channel, carrying, say, relatively simple modulation, and enjoying a higher average power. The situation created, therefore, is precisely the opposite of that which is desired: the high priority channel carries less average power than the lower-priority channel.

To correct this situation, power may be reapportioned according to channel priority and/or complexity of modulation. CHANNEL PRIORITY controls are merely adjusted to establish proper priority and/or power allocations. Thus, instead of setting both A1 and B1 CHANNEL PRIORITY controls to 50, it may be necessary or desirable to use a ratio other than 50-50 (1:1). Simply set the CHANNEL PRIORITY controls to obtain desired priority or power-per-channel: this will necessitate a determination of relative peak-to-average rations between channels; if one channel, for example, has a peak-to-average ratio of 4 to 1 and the other channel has a peak-to-average ratio of 3 to 1, the relative ratio between channels is 4 to 3. CHANNEL PRIORITY controls are then set inversely to the between-channel ratio. Thus, in the case of a 4:3 between-channel ratio, the controls are adjusted to produce an inverse, or 3:4 power allocation ratio. This will restore power balance between channels. Once having achieved

a 1:1 power ratio between channels, the operator may then proceed to establish any desired ratio; a 1:1 ratio provides a convenient starting point, and allows the operator to visualize the power ratio between channels.

(6) Independent Sideband (A1, A2, B1, B2). For four-channel ISB, set the SBG as follows:

CMR

Control	Position
power switch	ON
MODE	VOX or PTT, as necessary or desired
CARRIER SUPPRESSION (db)	FULL
CHANNEL PRIORITY:	as follows:
A1	25
A2	25
B1	25
B2	25
METER FUNCTION	A1, A2, B1, B2 as necessary or desired

CHG

Set CHG as described under Full Carrier tune-up operation.

Key the SBG and apply audio (if VOX is used, merely apply audio) to A1, A2, B1, and B2 channel inputs. All CHANNEL ACTIVITY indicators should illuminate, if all channels are simultaneously active; only active channels will cause their respective CHANNEL ACTIVITY indicators to illuminate. INPUT LEVEL (dbm) meter will indicate variations in average level of the channel to which it is switched.

Channel priorities for four-channel ISB operation may be assigned in similar manner to two-channel priority assignments. However, note that initial power balance becomes a two-step operation: 1. By the method previously described, balance A1 and A2; similarly, balance B1 and B2. 2. Then, balance both LSB channels ("B" channels) against both USB channels ("A" channels); when balancing, take care not to disturb the ratio already established between inboard and outboard channels of a given sideband (step 1 above).

(7) Tone FSK, Tone FAX, Tone CW. When used with Tone Intelligence System, Model TIS, the SBG is capable of generating RF tones keyed and/or varied in frequency in accordance with the particular desired tone emission mode. The TIS is capable of

driving two channels simultaneously, from the same TTY, FAX, or tone CW keying source.

To operate in any of the above tone modes, merely set the SBG controls for sideband emission of as many channels as total communications requirement dictates. Up to two of these channels may be driven by the TIS, as noted above. Refer to the TIS technical manual for detailed operating instructions pertinent to that unit.

The following paragraphs give operating instruction for full-and partial-carrier modes. These modes include AM, AME, and all previous sideband and tone modes, when operating procedure is properly modified as explained below.

(8) AM Operation. To place the SBG in AM operation, set controls as for two-channel ISB, with the following exceptions:

Unit	Control	Position
CMR	CARRIER SUPPRESSION (db)	3
CMR	CHANNEL PRIORITY:	as follows:
	A1	25
	A2	0
	B1	25
	B2	0

Other control settings and operating procedures remain unchanged,with the exception that identical audio is fed to both A1 and B1.

(9) AME Operation. AM Equivalent, or AME, consists of a single sideband plus a -6db carrier. It is indistinguishable to the ear from conventional AM, but uses only half the spectrum space, and enjoys a 6db sideband power advantage over AM (3db of this advantage results from elimination of one sideband, and 3db is the result of carrier reduction of 3db from the -3db conventional AM carrier); this results in a Total Intelligence Power (so-called "talk power") advantage of 3db, for the AME mode.

AME operation with the SBG is accomplished as follows: First, determine which sideband is to be transmitted; then, simply set the SBG as for SSB transmission of the desired sideband, with the following exceptions:

Unit	Control	Position
CMR	CARRIER SUPPRESSION (db)	6
CMR	CHANNEL PRIORITY	either A1 or B1, depending on desired sideband: 50.

Proceed as for single-sideband, suppressed-carrier operation: all further control settings and procedures are identical to those for SSB.

In those communications circuits that utilize Automatic Frequency Control (AFC) to maintain proper receiver tuning, it is usually necessary to insert a reduced or partially-suppressed pilot carrier at the transmitter, to provide a lock point for the receiver's AFC circuitry. Also, certain types of AGC circuits intended for use in multi-channel applications make use of a re-inserted pilot carrier, for proper operation.

The SBG may be operated in any of the single- or multi-channel modes previously described (for which full suppression was assumed), using reduced or only partially-suppressed carrier. Reduced carrier is defined as a carrier greater than 6db but less than 26db below full CW carrier; a carrier greater than 26db below a full CW carrier is defined as a Suppressed Carrier. The term "partially-suppressed carrier" is peculiar to this text, and is defined as a carrier greater than 26db below full CW carrier, but less than the greatest suppression of which the system is capable (in this case, 55db). Full carrier is defined as a carrier 6db or less below full CW carrier.

To operate the SBG with reduced- or partially-suppressed carrier, simply set the controls for the particular emission mode desired, as if the carrier were fully suppressed, with the following exception:

Unit	Control	Position
CMR	CARRIER SUPPRESSION (db)	either 20 or 30, as necessary or desired (20 position inserts a -20db carrier; 30 inserts a carrier -30db from full CW).

Theoretically, the partial reinsertion of a carrier would require a slight reduction in CHANNEL PRIORITY controls, since a certain amount of total available power is being used to generate the pilot carrier, and cannot, therefore, be called upon to produce sideband intelligence without overdriving the system. However, when calculated in terms of percentage of total available power, a -20db (worst-case) carrier amounts to only one percent of total power; this is negligible, for all practical purposes,

and is well beyond the readability and resettability limits of the CHANNEL PRIORITY controls and their respective calibrations.

3-6. RESIDUAL NOISE SUPPRESSION KIT AX5031

a. GENERAL. - Residual Noise Suppression Kit AX5031 (also known as KIT 321) suppresses residual transmitter noise generated in the IPA and PA sections during key-up conditions (so called "diode hash"), by means of screen and bias voltage switching.

Under key-up conditions, PA and IPA screen voltages are halved, and the voltage amplifier stage of the IPA is biased beyond cutoff.

b. OPERATION. - KIT 321 has only one operating control: a three-position MODE switch. The three positions of this switch correspond to three of the CMR MODE switch positions: CW, PTT, NORM. Setting of the KIT 321 MODE switch depends on the setting of the CMR MODE switch. KIT 321 should be set as follows:

CMR MODE Position	KIT 321 MODE Position
CW	CW
PTT	PTT
VOX	PTT
NORM	NORM

3-7. TUNE-UP OF 1-KW IPA AND 10-KW PA ON CARRIER

a. TUNING.

(1) Before applying power to the IPA and PA in the main frame, set up the tuning controls on these units for the selected carrier frequency in accordance with the appropriate factory tuning chart prepared for your transmitter. In the absence of such charts (one for unbalanced and another for balanced output operation), set up the controls in accordance with the sample tuning charts shown in tables 3-1 and 3-2. These charts were prepared from a typical transmitter at the factory, with the transmitter operating into a dummy load. If control settings are set up as shown, the charts should provide a good starting point for tuning the transmitter. When the transmitter is loaded into an antenna, the tuning will change somewhat. If necessary, modify the tuning charts so that they reflect actual field conditions. Preset the following controls on the transmitter:

UNIT	CONTROL
PA Section AX-236	PA TUNE (115) PA LOAD (116) BAND SW (117) OUTPUT BAL (118) OUTPUT LOADING (119)
RF Amplifier RFC-1	IPA GRID TUNING (123) 1ST AMPL TUNING (124) DRIVER BAND (125) IPA BAND (126) IPA LOADING (127) IPA TUNING (128) IPA LOADING (130)

(5) On the main power panel, set controls as follows:

CONTROL	POSITION
PA SCREEN (140)	OFF
TUNE-OPERATE (139)	TUNE
HIGH VOLTAGE (141)	OFF
ALDC (137)	OFF
INTERLOCK (135)	NORMAL

(6) Set TIME DELAY control (143) to 5 minutes.

(7) Set MAIN POWER circuit breaker (132) to ON:

(a) Main frame blowers should start up.
(b) TUNE lamp (107) should light.
(c) PA BIAS lamp (145) should light, then go off as rf amplifier power supply comes on.
(d) PA BIAS meter (2) should read 300 volts.

NOTE

If PA BIAS reading is incorrect, adjust PA BIAS ADJ control (151) on relay control panel.

(e) FILAMENT PRIMARY meter (101) should read 230 volts ac. If necessary, FIL ADJ switch (136) on main power panel for proper meter reading.
(f) At expiration of 5-minute preset delay period, INTERLOCK INDICATOR (134) lamp on main power panel should glow.

NOTE

If INTERLOCK INDICATOR lamp (134) does not come on, rotate INTERLOCK switch (135) clockwise from its NORMAL position. At first position that INTERLOCK INDICATOR (134) goes off, note switch designation and check interlock at that location. When open interlock has been closed return INTERLOCK switch to NORMAL position. When NORMAL position of switch turns on INTERLOCK INDICATOR, proceed to next step.

(8) Tune the IPA and PA circuits as follows:

CAUTION

When tuning and loading the IPA and PA, do not exceed the following meter indications:

PA PLATE CURRENT (103):	
At start of loading	0.5 to 1 amp
At end of loading	1.5 to 1.75 amp
PA SCREEN CURRENT (102):	25 to 50 ma
PA PLATE RF (104):	6 kv
IPA PLATE CURRENT (121):	400 ma
IPA screen current (as read on MULTIMETER (120) with MULTIMETER switch (122) set to DC IPA ISG):	25 ma

(a) Set MULTIMETER switch (122) to RF 1ST AMPL EP position.
(b) Apply rf drive from exciter by slowly advancing OUTPUT control (25) on CHG-4 until some indication is produced on MULTIMETER (120).
(c) Carefully adjust 1ST AMPL TUNING control (123) until peak is obtained on MULTIMETER (120). Adjust OUTPUT control as necessary to keep meter reading on scale.
(d) Set MULTIMETER switch (122) to RF IPA EG position.
(e) Adjust IPA GRID TUNING control (123) for maximum reading on MULTIMETER (120).
(f) Readjust 1ST AMPL TUNING control (123), if necessary, to peak reading on MULTIMETER (120).
(g) Reduce rf drive to minimum with OUTPUT control on CHG-4.

NOTE

If the transmitter has been idle for a long period of time, as after shipment, allow a half hour warm-up period.

(h) Depress OVERLOAD RESET pushbutton (133).
(i) Set HIGH VOLTAGE circuit breaker (141) to ON position. PLATE ON lamp (109) on power amplifier should light and red indicator on roof of auxiliary frame should glow dimly at first and should brighten after 20 seconds. PA PLATE meter (3) should indicate plate voltage.
(j) Carefully advance OUTPUT control on CHG-4 until some increase is noted on IPA PLATE CURRENT meter (121).
(k) Rotate IPA TUNING control (128) until a dip is obtained on IPA PLATE CURRENT meter (121).
(l) Carefully advance OUTPUT control (25) until some slight reading is obtained on PA PLATE CURRENT meter (103).

(m) Adjust PA TUNE control (115) until a dip is obtained on PA PLATE CURRENT meter (102). The indication on the PA PLATE RF meter (104) should simultaneously maximize at this tuning point.
(n) Reduce rf drive to minimum with OUTPUT control.
(o) Set PA SCREEN switch (140) to ON.

NOTE

To prevent energizing PA screen overload circuit, be careful not to turn on PA SCREEN switch when TUNE-OPERATE switch is set to OPERATE. The proper sequence for applying full screen voltage is as follows:

TUNE-OPERATE switch (139) to TUNE
HIGH VOLTAGE circuit breaker (141) to ON

PA SCREEN SWITCH (140) to ON
TUNE-OPERATE switch (139) to OPERATE

NOTE

If any overload relay becomes energized, high voltage is automatically turned off and HIGH VOLTAGE circuit breaker (141) will automatically be set to OFF. If this occurs, reduce rf drive to minimum set TUNE-OPERATE switch (139) to TUNE and PA SCREEN switch (140) to OFF, then reapply high voltage and start retuning the high voltage circuits, starting with step (h) above.

(p) Set TUNE-OPERATE switch (139) to OPERATE position. The PA PLATE CURRENT meter (103) should read approximately 500 ma and the IPA CURRENT meter (121) should read approximately 200 ma. These are the static values of plate current.

NOTE

If necessary, adjust PA BIAS ADJ control (151) on relay panel and/or IPA BIAS ADJ screwdriver control on Power Supply AX-104 as required, to obtain proper readings.

(q) Retune rf amplifier and IPA circuits as described in steps (a) through (g) and (j) and (k) above. This completes tuning portion of operating procedure.

b. LOADING

(1) Alternately load the IPA with IPA LOADING controls (130 and 127) as indicated by increased reading on IPA PLATE CURRENT meter (121), and tune the IPA

with IPA TUNING control (128) as indicated by dip on IPA PLATE CURRENT meter. Continue to load and tune IPA, loading in small increments, until the IPA PLATE CURRENT meter reads approximately 300 ma. Set MULTIMETER switch (122) to IPA ISG position and check that IPA screen current does not exceed 25 ma as displayed on MULTIMETER (120). If IPA screen current is excessive, increase the IPA plate loading and retune until proper screen current is obtained.

CAUTION

During this IPA loading phase, be careful to limit drive to keep reading on PA PLATE CURRENT meter (103) at reasonable level (within previously specified limits).

(2) Alternately load the PA with PA with PA LOAD control (116) as indicated by increased reading on PA PLATE CURRENT meter (103), and tune the PA with PA TUNE control (115) as indicated by dip on PA PLATE CURRENT meter. Continue to load and tune the PA,, loading in small increments, until approximately 1.5 amperes is obtained on PA PLATE CURRENT meter (103) and 2 to 5 kv rf is obtained on PA PLATE CURRENT PLATE RF meter (104). Check that the reading on PA SCREEN CURRENT meter (102) is within 35-ma limit. If PA screen current is excessive, increase the PA plate loading and retune until proper screen current is obtained.

NOTE

The OUTPUT LOADING control (119) may genrally be left at its tuning chart position. Vary this control in conjunction with PA LOAD control (116) when necessary to obtain rated output.

c. UNBALANCED OUTPUT TERMINATION.

(1) If the GPT-10K is connected for unbalanced output (50 ohms), leave the OUTPUT BAL control (118) at the tuning chart position.

(2) Maximum permissible output, is 10 kilowatts PEP. (This corresponds to 5 kw as read on PA output meter (for two-tones only).

NOTE

When full rated output is obtained, note the corresponding reading on PA PLATE RF

meter (104). This reading will be used in setting up the transmitter for full PEP after modulation is applied.

(3) To measure SWR on the transmission line, set SWR switch (138) to SWR position and read SWR on the lower scale of PA OUTPUT meter (105).

d. BALANCED OUTPUT TERMINATION

(1) Adjust OUTPUT BAL control (118) either clockwise or counterclockwise until a point is reached where the two external antenna current meters move in opposite directions, then refine setting until both meter readings are exactly the same.

(2) For a balanced 600-ohm antenna, such as a rhombic, maximum permissible antenna current in each leg is 2.9 amps (5 kilowatts average).

NOTE

When full output is obtained, note the corresponding reading on PA PLATE RF meter (104). This reading will be used in setting up the transmitter for full PEP after modulation is applied.

e. FINAL CARRIER TUNE-UP CHECK

(1) Recheck setting of IPA TUNING control (120) to insure that output tuning has not affected IPA. If necessary, touch up settings of IPA controls.

(2) Recheck setting of PA TUNING control (115). If necessary, touch up settings of PA controls.

(3) This completes tune-up of transmitter on carrier. Reduce rf drive to minimum with OUTPUT control on CHG-4.

NOTE

Two-tone distortion testing is described in section 4.

3-8. SET-UP OF TONE INTELLIGENCE UNIT TIS-3.

NOTE

See paragraph 3-4c for discussion of offset carrier frequency operation when using the TIS-3 for keying or facimile transmitter operation only.

CH-A, and CH-B, modulating inputs to the GPT-10K are applied through the TIS-3D. The following paragraphs describe the procedures required to set up the TIS-3D after the transmitter is tuned to the carrier frequency.

a. AUDIO LINE MODULATION. - When audio line intelligence is connected to the audio line 1 CH-A1 and/or audio line 2 CH-B1 inputs of the transmitter, the TIS-3 audio tone circuits are not required. To modulate the transmitter directly from these lines, proceed as follows:

(1) For single or double sideband transmission, determine in which audio line channel the modulating intelligence is located. If it is contained in audio line A1, line 1, set EXCITER CH 1, switch (58) to LINE.

(2) For independent sideband transmission, when two audio line inputs are to be used for separate sideband transmissions, set both EXCITER switches to LINE. No other action is required.

b. FSK MODULATION. - For FSK operation from teletype signals delivered by associated teletype equipment, proceed as follows:

(1) Set FUNCTION switch to FSK.

(2) Set TEST switch to LINE.

(3) Set CENTER FREQ CPS switch to 2000 or 2550, depending on the center frequency desired.

(4) Adjust SHIFT CPS control until desired total frequency shift appears on counter.

(5) Set KEY MODE switch to position which matches the mode of TTY signal input (voltage or current, and level).

(6) Place the FSK audio output of the TIS-3 in the desired audio channel by positioning EXCITER CH 2 switch (as applicable) to FSK-FAX-CW.

(7) With teletype input signals applied to the GPT-10K, adjust LEVEL ADJ control for a mid-range reading on OUTPUT LEVEL meter.

c. FAX MODULATION. - For FAX operation from varying dc FAX signals delivered by associated facsimile equipment, proceed as follows:

(1) Set FUNCTION switch to FAX.

(2) Set CENTER FREQ CPS switch to 1900.

(3) Place the FAX audio output of the TIS-3 in the desired audio channel by positioning EXCITER CH 1 or EXCITER CH 2 switch (as applicable) to FSK-FAX-CW.

(4) With FAX input signals applied to the GPT-10K, adjust LEVEL ADJ control for a mid-range reading on OUTPUT LEVEL meter.

d. CW KEYING. (TELEGRAPHY). - For cw modulation from voltage or current keying CW signals delivered externally, proceed as follows:

(1) Set FUNCTION switch to CW position.

(2) Set TEST switch to LINE.

(3) Set KEY MODE switch to position which matches mode of CW input signal.

(4) Place the CW audio output signals of the TIS-3 in the desired audio channel by setting EXCITER CH 1 or EXCITER CH 2 switch to FSK-FAX-CW position.

(5) With CW input signals applied to the GPT-10K, adjust LEVEL ADJ control for mid-range reading on OUTPUT LEVEL meter.

e. CARRIER ON-OFF CW KEYING. - When "dry" CW keying is to be used, the TIS-3 is not utilized. To operate the transmitter in this mode, proceed as follows:

(1) Place MODE switch on CMR-4 to the CW position, activate test key provided on the auxiliary frame.

TABLE 3-3 MAIN FRAME OPERATING CONTROLS AND INDICATORS

NUMERICAL DESIGNATION	PANEL DESIGNATION	FUNCTION
101	FILAMENT PRIMARY meter	Indicates primary voltage applied to filament transformer of 10-kw amplifier.
102	PA SCREEN CURRENT meter	Indicates screen current of 10-kw amplifier.
103	PA PLATE CURRENT meter	Indicates plate current of 10-kw amplifier.
104	PA PLATE RF meter	Indicates rf output voltage of 10-kw amplifier.
105	PA OUTPUT meter	Normally indicates transmitter output power in kilowatts PEP (upper scale). When operating into unbalanced antenna, and with SWR switch (138) set to SWR, indicates SWR on lower scale.
106	AC POWER lamp	When lit, indicates that power is applied to main power supply.
107	TUNE lamp	When lit, indicates that TUNE-OPERATE switch (139) on main power panel is in TUNE position.
108	OPERATE lamp	When lit, indicates that TUNE-OPERATE switch (139) on main power panel is in OPERATE position.
109	PLATE ON lamp	When lit, indicates that ac voltage is applied to high voltage rectifier.

TABLE 3-3 MAIN FRAME OPERATING CONTROLS AND INDICATORS (CONT)

NUMERICAL DESIGNATION	PANEL DESIGNATION	FUNCTION
110	PA TUNE dial	Indicates setting of PA TUNE control (115).
110	PA LOAD dial	Indicates setting of PA LOAD control (116).
112	BAND SW dial	Indicates setting of BAND SW switch (117).
113	OUTPUT BAL dial	Indicates setting of OUTPUT BAL control (118).
114	OUTPUT LOADING dial	Indicates setting of OUTPUT LOADING control (119).
115	PA TUNE control	Tunes output of 10-kw amplifier to desired frequency.
116	PA LOAD control	Varies power output of 10-kw amplifier.
117	BAND SW switch	Sets operating frequency range of 10-kw amplifier.
118	OUTPUT BAL control	Operates in conjunction with OUTPUT LOADING control (119) to match impedance of 10-kw amplifier to antenna impedance.
119	OUTPUT LOADING control	Operates in conjunction with OUTPUT BAL control (118) to match impedance of 10-kw amplifier to antenna impedance.
120	MULTIMETER	Indicates rf voltage, dc voltage or dc current as selected by MULTIMETER switch (122).
121	IPA PLATE CURRENT meter	Indicates plate current of 1-kw amplifier
122	MULTIMETER switch	8-position rotary switch: Position — Measures DC IPA BIAS — Bias on 1-kw amplifier DC IPA ESG — Screen voltage of 1-kw amplifier DC IPA EP — Plate voltage of 1-kw amplifier DC IPA ISG — Screen current of 1-kw amplifier RF 1ST AMPL EP — Rf voltage at plate of first rf amplifier RF IPA EG — Rf voltage at grid of 1-kw amplifier RF IPA EP — Rf voltage at plate of 1-kw amplifier RF PA EG — Rf voltage at input to 10-kw amplifier

TABLE 3-3 MAIN FRAME OPERATING CONTROLS AND INDICATORS (CONT)

NUMERICAL DESIGNATION	PANEL DESIGNATION	FUNCTION
123	IPA GRID TUNING control	Tunes rf input circuit of 1-kw amplifier.
124	1ST AMPL TUNEING control	Tunes rf output circuit of first rf amplifier.
125	DRIVER BAND switch	Sets operating frequency range of first two rf amplifiers.
126	IPA BAND switch	Sets operating frequency range of 1-kw amplifier.
127	IPA LOADING switch	Operates in conjunction with IPA LOADING control (130) to vary impedance at output of 1-kw amplifier.
128	IPA TUNING control	Tunes output circuit of 1-kw amplifier.
129	IPA TUNING dial	Indicates setting of IPA TUNING control (128).
130	IPA LOADING control	Operates in conjunction with IPA LOADING switch (127) to vary impedance at output of 1-kw amplifier.
131	IPA LOADING dial	Indicates setting of IPA LOADING control (130).
132	MAIN POWER circuit breaker	In ON position, applies primary power to main frame circuits.
133	OVERLOAD RESET pushbutton	When depressed, resets relays in relay panel after an overload occurs.
134	INTERLOCK INDICATOR lamp	When lit, indicates that interlock circuit selected by INTERLOCK switch (135) is closed.
135	INTERLOCK switch	Selects interlock switch circuit to be checked by INTERLOCK INDICATOR lamp (134) as follows: Position — Circuit or Condition Checked NORMAL — Closure of all main frame interlocks BAND SW — In-detent status of IPA BAND switch (126) IPA AIR SW — Normal operation of blower at 1-kw amplifier. EXTERNAL — Continuity at external interlock (terminals 8 and 10 of E3000 in auxiliary frame) REAR DOOR — Closure of rear door

TABLE 3-3 MAIN FRAME OPERATING CONTROLS AND INDICATORS (CONT)

NUMERICAL DESIGNATION	PANEL DESIGNATION	FUNCTION
135 (cont)		Position / Circuit or Condition Checked PA AIR SW — Normal operation of blower at 10-kw amplifier PA DECK — Closure of shield on power amplifier section PA BAND SW — In-detent status of BAND SW switch (117) RIGHT SIDE — Closure of right side panel HV DECK — Closure of high voltage rectifier in main frame RELAY DECK — Closure of relay panel in main frame TIMER — Activiatio of timer after time interval elapses
136	FIL ADJ switch	Sets ac input voltage at primary of 10-kw filament transformer.
137	ALDC switch and control	Switch connects ALDC circuit in system. Control sets rf level at which ALDC circuit becomes operative.
138	SWR switch	In SWR position, permits direct reading of SWR during unbalanced operation.
139	TUNE-OPERATE switch	In TUNE position, causes reduced dc voltage to be applied to screen grids of 1-kw and 10-kw amplifiers. In OPERATE position, it causes full screen voltage to be applied to amplifiers.
140	PA SCREEN switch	In ON position, applies screen voltage to 10-kw amplifier.
141	HIGH VOLTAGE circuit breaker	In ON position, turns on high voltage rectifier, applying high voltage dc to 10-kw amplifier plate circuit.
142	FILAMENT TIME meter	Indicates total operating time of filament circuit of 10-kw amplifier.
143	TIME DELAY timer	Delays application of high ac voltage to high voltage rectifier so that filaments may heat.

TABLE 3-3 MAIN FRAME OPERATING CONTROLS AND INDICATORS (CONT)

NUMERICAL DESIGNATION	PANEL DESIGNATION	FUNCTION
144	PLATE TIME meter	Indicates total operating time of high voltage rectifier.
145	PA BIAS lamp	When lit, indicates that no bias voltage is applied to 10-kw power amplifier.
146	PA PLATE OVLD lamp	When lit, indicates that overload occurred in plate circuit of 10-kw amplifier.
147	PA SCREEN OVLD lamp	When lit, indicates that overload has occurred in screen circuit of 10-kw amplifier.
148	IPA SCREEN OVLD lamp	When lit, indicates that overload has occurred in screen circuit of 1-kw amplifier.
149	IPA PLATE OVLD lamp	When lit, indicates that overload has occurred in plate circuit of 1-kw amplifier.
150	SWR OVLD lamp	When lit, indicates that overload has occurred as a result of excessive SWR.
151	PA BIAS ADJ control	Sets amplitude of bias voltage applied to 10-kw amplifier.
152	PA PLATE OVLD ADJ control	Controls dc level at which 10-kw amplifier plate overload relay is energized.
153	PA SCREEN OVLD ADJ control	Controls dc level at which 10-kw amplifier screen overload relay is energized.
154	IPA SCREEN OVLD ADJ control	Controls dc level at which 1-kw amplifier screen overload relay is energized.
155	IPA PLATE OVLD ADJ control	Controls dc level at which 1-kw amplifier plate overload relay is energized.
156	ALARM switch	When set to ON position, energizes an audible alarm until high voltage is applied to the 10-kw amplifier.
157	DRAWER INTERLOCK lamp	When lit, indicates that rf amplifier drawer interlock is open.

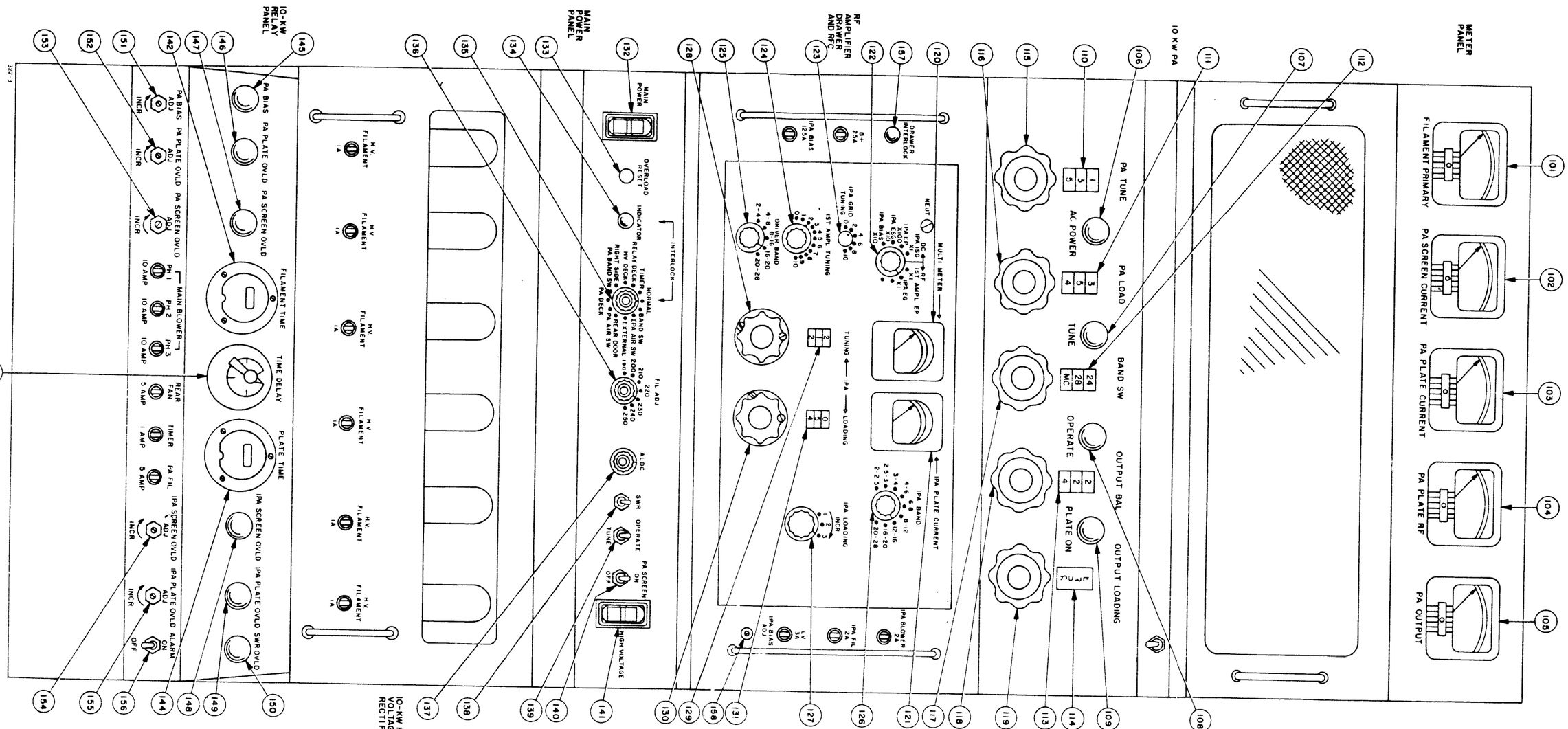

Figure 3-5 Main Frame, Operating Controls and Indicators