

VOLUME 1 S

UNCLASSIFIED

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TECHNICAL MANUAL

for

SYNTHESIZED

GPT-40K TRANSMITTER

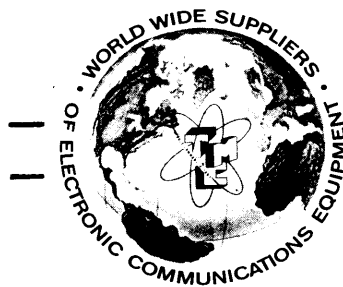


THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N. Y. OTTAWA, CANADA

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NOTICE

THE CONTENTS AND INFORMATION CONTAINED IN THIS INSTRUCTION MANUAL IS PROPRIETARY TO THE TECHNICAL MATERIEL CORPORATION TO BE USED AS A GUIDE TO THE OPERATION AND MAINTENANCE OF THE EQUIPMENT FOR WHICH THE MANUAL IS ISSUED AND MAY NOT BE DUPLICATED EITHER IN WHOLE OR IN PART BY ANY MEANS WHATSOEVER WITHOUT THE WRITTEN CONSENT OF THE TECHNICAL MATERIEL CORPORATION.



THE TECHNICAL MATERIEL CORPORATION

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W a r r a n t y

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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.

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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.

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*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

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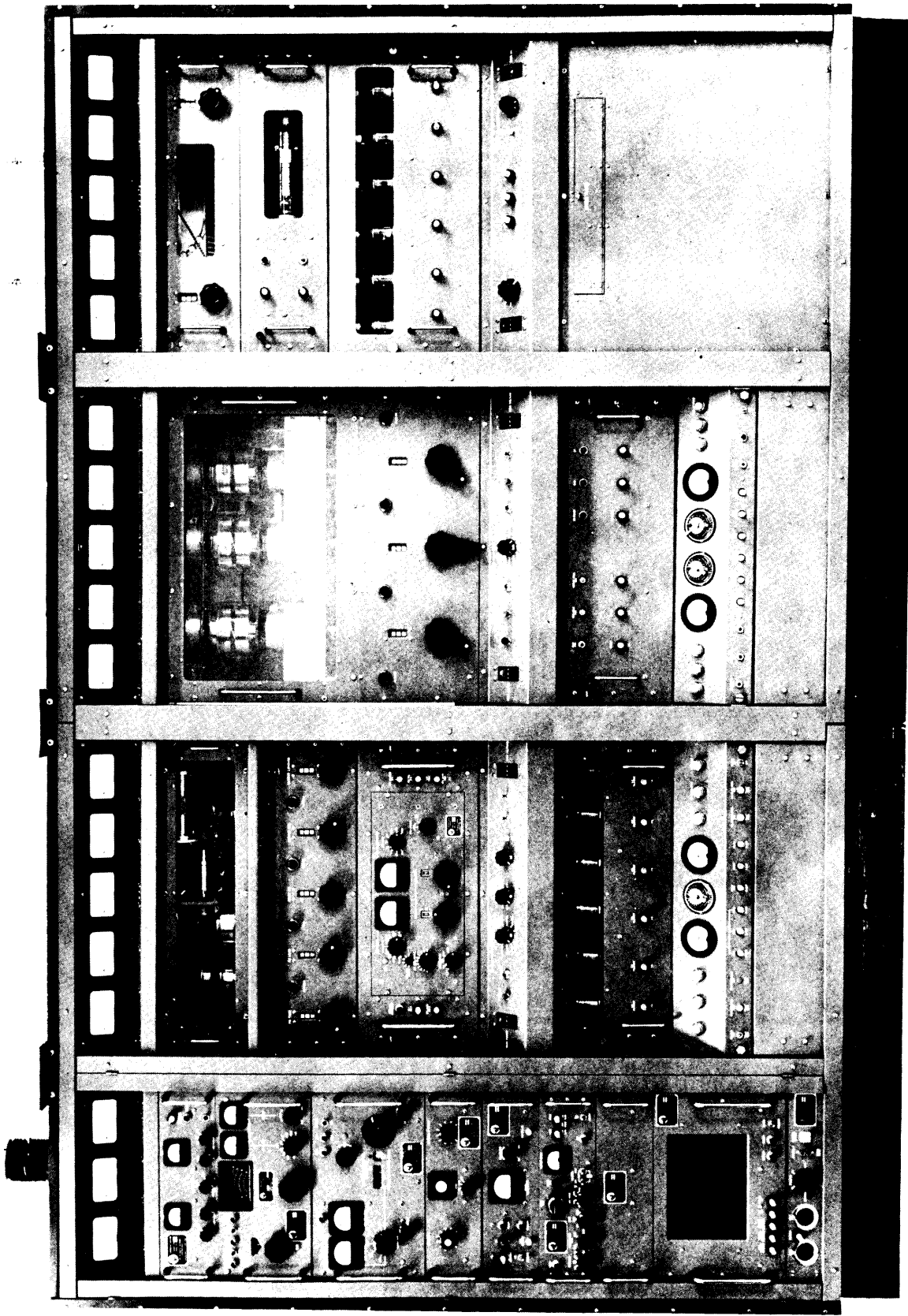


Figure 1. Synthesized GPT -40K Transmitter, Front View

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FOREWORD

This manual presents an overall description of the Synthesized GPT-40K Transmitter. For detailed maintenance and operating information, refer to the following TMC publications:

<u>ITEM</u>	<u>PUBLICATION</u>
Maintenance of Synthesized Exciter	Technical Manual for Synthesized Exciter
Maintenance of Auxiliary and Main Frames, less the Exciter	Maintenance Manual for GPT-10K Transmitter
Maintenance of PA and PA Frames	Maintenance Manual for GPT-10K Transmitter
Operating Procedures for Synthesized GPT-40K Transmitter	Operator's Manual for Synthesized GPT-40K Transmitter

1. PURPOSE OF EQUIPMENT.

The GPT-40K Transmitter (figure 1) is a conservatively rated general purpose transmitter that delivers 40,000 watts PEP (peak envelope power), or 20,000 watts average power, throughout the 2- to 28-mc range. The operating modes of the transmitter are:

1. SSB (single sideband) with suppressed or any degree of carrier.
2. DSB (double sideband) with suppressed or any degree of carrier. (This mode includes AM (amplitude modulation) operation and AME (AM equivalent)).
3. ISB (independent sideband) (separate intelligence on each sideband) with suppressed or any degree of carrier.
4. FSK (frequency-shift telegraphy).
5. FAX (facsimile).
6. CW (keyed carrier telegraphy).

2. TECHNICAL CHARACTERISTICS.

Frequency range:	2-28 mc (bandswitched).
Output Power:	40,000 watts, 2-tone PEP, 3rd order distortion products down at least 35 db below tone level.
Operating Modes:	SSB, ISB, DSB, FSK, FAX, CW, and AM.
Frequency Stability:	1 part in 10^8 (using CSS-1B) or 10^9 (using CSS-2), at any 100-cycle increment from 2 to 28-mc.
Carrier Insertion:	-55 db to full output.
Harmonic Suppression:	Second harmonic at least 50 db down from PEP; third harmonic at least 65 db down from PEP.

TECHNICAL CHARACTERISTICS (CONT)

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: Two independent 600-ohm channels, balanced or unbalanced; -20 dbm for full RF output.

Audio response per sideband: CBE-1: Within 3.0 db from 350 to 7500 cps.
CBE-2: Within 3.0 db from 250 to 3500 cps.

Power Consumption: 210-250/410-450 volts, 3-phase, 50-60 cps, 100/200 amps per leg.

3. EQUIPMENT SUPPLIED.

Table 1 lists the major components of the synthesized transmitter; corresponding common nomenclature is also indicated.

TABLE 1. EQUIPMENT SUPPLIED

TMC DESIGNATION	COMMON NAME
Auxiliary Frame Assembly AX-507	Auxiliary frame
Auxiliary Meter Panel AX-107	Auxiliary meter panel
Sideband Generator, Model SBG-1 or SBG-2	Sideband generator SBG
Sideband Exciter, Model CBE-1 or Sideband Exciter, Model CBE-2 (See note)	Sideband exciter CBE
<p>NOTE</p> <p>CBE-1 is Part of Sideband Generator SBG-1 CBE-2 is Part of Sideband Generator SBG-2</p>	

TABLE 1. EQUIPMENT SUPPLIED (CONT)

TMC DESIGNATION	COMMON NAME
Frequency Amplifier, Model CHG-2A	Frequency amplifier CHG
Controlled Master Oscillator, Model CMO-1	Controlled master oscillator CMO
Primary Standard, Model CSS-1, or CSS-2 or CSS-3	Primary standard CSS
Divider Chain, Model CHL-1	Divider chain CHL
Controlled Oscillator, Model CLL-1	Controlled oscillator CLL
Power Supply, Model CPP-5	Power supply CPP-5
Power Supply, Model CPP-2	Power supply CPP-2
Tone Intelligence Unit, Model TIS-3	Tone intelligence unit TIS
Auxiliary Power Panel, Model APP-8	Auxiliary power panel
Standing Wave Control Unit, Model SWCU-1	Standing wave control unit SWCU
Auxiliary Meter Panel AX-107	Auxiliary meter panel
Main Frame Assembly AX-505	Main frame
Main Meter Panel AM-122	Main meter panel
Power Amplifier Section AX-510	10-kw PA
Rf Amplifier Drawer AX-104	Rf amplifier drawer
Rf Amplifier RFC-1	1-kw IPA or RFC
Main Power Panel AX-504	Main power panel
High Voltage Rectifier AX-103 or Solid State Power Supply, Model HVRC-2	10-kw high voltage rectifier
Relay Panel AR-161	10-kw relay panel
Main Power Supply AX-138	10-kw main power supply

TABLE 1. EQUIPMENT SUPPLIED (CONT)

TMC DESIGNATION	COMMON NAME
PA Frame Assembly AP-116	PA frame
PA Frame Meter Panel AM-115	PA frame meter panel
Power Amplifier AX-511	40-kw PA
PA Control Panel AX- 210	PA frame control panel
Bias Supply Drawer AP-117	Bias supply drawer
PA Frame Relay Panel AR-116	PA frame relay panel
PS Frame Assembly AP-118	PS frame
Antenna Tuning Unit AT-106	Antenna tuning unit
Crowbar Drawer AX-212	Crowbar drawer
12-kv High Voltage Rectifier AP-105 or Solid State Power Supply, Model HVRB-2	40-kw high voltage rectifier
PS Control Panel AX-213	PS frame control panel

4. DESCRIPTION OF EQUIPMENT.

a. GENERAL. - The GPT-40K transmitter (figure 1) consists of an auxiliary frame, a main frame, a power amplifier (PA) frame, and a power supply (PS) frame. All four frames are bolted together and to two base assemblies. One base assembly is common to the auxiliary and main frames, and the other is common to the PA and PS frames. The four frames house all the components of the transmitter and are equipped with protective front and rear 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 PS frame. For unbalanced output operation, a coaxial connector is located on top of the PA frame.

The same auxiliary frame is used in the GPT-40K transmitter as in the GPT-10K. The main frame of the GPT-40K transmitter is a slightly modified version of that used in the GPT-10K. In the GPT-40K, the 10-kw PA stage is modified to operate as a single-ended 10-kw (PEP) driver for the 40-kw power amplifier that is located in the PA frame. An output switch is used in place of the GPT-10K OUTPUT LOADING coils. A dummy load is provided for tuning the 10-kw PA when this switch is set at TUNE. In the EMER position (and with some simple strapping) the GPT-40K can be operated at a reduced output PEP of 10 kw. In the OPER position of the output switch, the 10-kw PA output is applied to the final 40-kw PA.

Physically, the auxiliary and main frames are not altered from their GPT-10K counterparts. The meters in the meter panel at the top of the auxiliary frame are labeled PA SCREEN, PA BIAS, and PA PLATE in accordance with the GPT-10K configuration, but these meter readings now represent 10-kw PA voltages. Similarly, PA designations on the main frame (such as those included on the main meter panel, main frame "PA" section, main power panel, and relay panel) refer to the 10-kw PA stage of the GPT-40K transmitter.

b. AUXILIARY FRAME. - The auxiliary frame houses the GPT-40K exciter components; this frame is divided into a front and rear section by a partition that supports miscellaneous controls, connectors and terminal boards. Power supply CPP-5 and Standing Wave Control Unit SWCU are mounted at the upper rear of the auxiliary frame. All other major components are mounted on the front of the frame. Except for Sideband Exciter CBE, the major exciter units are slide-mounted and can be partially withdrawn from the cabinet and tilted to expose the top or bottom surface of each unit without removing any input and output connections. Thus, adjustments and maintenance procedures may be conveniently performed. 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, ac power is applied to an autotransformer bolted to the rear base of the auxiliary frame. The transformer delivers 115 volts ac to an ac power strip positioned vertically within the auxiliary frame. The ac power cords of the exciter units are plugged into the strip to receive primary power. 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 main frame of the transmitter.

(1) AUXILIARY METER PANEL AX-107. - The auxiliary meter panel, mounted at the top of the auxiliary frame, contains three meters. These meters monitor the 10-kw power amplifier screen grid voltage, control grid bias, and plate voltage.

(2) SIDEBAND EXCITER CBE-1 (OR CBE-2). - The Sideband Exciter, CBE, accepts two channels of intelligence from Tone Intelligence Unit TIS and frequency translates these audio inputs into lower and upper sidebands at a nominal frequency of 250 kc. The CBE-1 and CBE-2 are physically identical units that differ only in audio bandpass. The CBE-1 provides a wide bandpass of 7.5 kc per sideband; the CBE-2 narrow bandpass is 3.3 kc per sideband. To simplify presentation, all subsequent references in this manual made to the CBE are applicable to both, unless otherwise specified.

Controls on the front panel of the CBE permit independent level control of upper and lower sideband audio inputs. The relative power in each sideband is monitored by front panel meters. Either audio input may be switched to either sideband, and carrier level is adjustable from -55 db to 0 db.

(3) FREQUENCY AMPLIFIER CHG-2. - The CHG receives sideband signals and other precise frequencies generated in the sideband generator system, and provides the final 1-watt exciter output in the frequency range of 1.75 to 33.75 mc, precisely synchronized at any 100-cycle increment. Full frequency coverage is obtained through a front-panel bandswitch and tuning controls. Rf level is adjusted by a level control. Front panel meters facilitate tuning and indicate rf output level. Supplementary controls permit standby or full power application for continuous oven operation. A lamp indicates synchronization of the CHG frequency control circuits.

(4) CONTROLLED MASTER OSCILLATOR CMO-1. - The CMO receives frequency-locked signals from Controlled Oscillator CLL and generates controlled frequencies in the range of 2 to 4 mc, precisely synchronized at any 100-cycle increment finely calibrated frequency counter and control sets the master oscillator output frequency. A tuning control and meter facilitates frequency tuning. Output level is adjusted by a front panel control. Supplementary front panel controls

permit crystal calibration of the master oscillator frequency prior to frequency synchronization. A SYNC IND lamp and ADJ FOR ZERO meter indicate CMO frequency synchronization. The frequency tuning control is equipped with a knob-controlled lock to prevent accidental movement of controls.

(5) CONTROLLED OSCILLATOR CLL-1. - The CLL receives precise frequency inputs from the sideband generator system Divider Chain CHL and generates frequencies in the range of 510.0 kc to 519.9 kc precisely synchronized at any 100-cycle increment. Two 10-position rotary switches on the front panel permit the selection of any 100-cycle step in this range. A front panel SYNC oscilloscope and 3-position switch permit monitoring of the three synthesizer loops in the CLL, thus facilitating trouble localization.

(6) PRIMARY STANDARD CSS. - The CSS provides the 1-mc reference signal that synchronizes the exciter circuits. The CSS-1B provides the signal at a frequency stability of 1 part in 10^8 per day; the CSS-2 provides increased stability of 1 part in 10^9 per day; the CSS-3 provides circuitry that automatically selects an externally supplied 1-mc signal in the event of failure of the internal standard.

A front-panel control on the CSS permits standby operation of the unit. With the control set at STANDBY, power is supplied to the self-contained oven only. The CSS-1B has a front-panel meter, sensitivity control, and coaxial input that permits check and calibration of any external 1-mc signal against that of the internal standard.

(7) TONE INTELLIGENCE UNIT TIS-3A. - The TIS is an audio-shift keyer that is used with a synthesized exciter. It generates 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, a high degree of carrier frequency stability is maintained. Key line, FAX, and two audio-line input terminals on the rear of the TIS receive audio and keying signals from two terminal boards at the rear of the auxiliary frame. The TIS audio outputs are applied to sideband exciter CBE.

Either or both TIS audio outputs can be applied to either or both audio channel inputs of sideband exciter CBE for ultimate insertion into the sidebands. During FAX operation, the TIS receives facsimile (FAX) signals via an auxiliary frame terminal board and converts them into an audio signal linearly shifted about one of four selected center frequencies; this signal is then applied to sideband exciter CBE. When operating FSK or CW, 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 a 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 displayed on a front panel meter and controlled

by an associated potentiometer. The TIS provides a 1000-cycle tone for CW keying. Oven-controlled crystal oscillators in the unit may be energized separately during standby operation to insure frequency stability.

(8) DIVIDER CHAIN CHL-1. - The CHL divides the 1-mc standard signal from primary standard CSS into lower frequencies for use in the sideband generator system low-frequency loops. This unit has no operating controls.

(9) POWER SUPPLY CPP-2. - The CPP-2 is the main power supply for the sideband generator low-frequency loop components. It supplies ac and dc power for divider chain CHL, controlled oscillator CLL, and controlled master oscillator CMO. A front-panel switch permits standby operation, with ac power applied to the ovens of the CMO and the CLL.

(10) AUXILIARY POWER PANEL APP-8. - The auxiliary power panel rack-mounted at the bottom of the auxiliary frame, contains two ac receptacles, a coaxial MONITOR switch, and a coaxial OUTPUT jack, and an AUDIO INPUT jack. The rf outputs of the exciter circuits, the 10-kw driver, and the 40-kw PA are wired to the switch. The selected rf output may be conveniently monitored by means of a spectrum analyzer at the OUTPUT jack on the Auxiliary Power Panel. The AUDIO INPUT jack applies audio to the TIS channel circuits.

(11) POWER SUPPLY CPP-5. - The CPP-5 provides ac and dc power for Frequency Amplifier CHG. The CPP-5 is controlled by the POWER ON/OFF switch on the CHG.

(12) STANDING WAVE CONTROL UNIT SWCU-1. - The SWCU, rack-mounted at the rear of the auxiliary frame, contains an SWR overload relay, a dc amplifier, and a power supply. This unit monitors voltage standing waves on the transmission line between the 10-kw PA and the 40-kw PA. When excessive VSWR is detected, the overload relay automatically removes the high voltage from the transmitter.

c. MAIN FRAME. - The main frame comprises a two-stage rf voltage amplifier, the 1-kw IPA and 10-kw PA, a relay panel, and associated power supply and power control circuits. The rf components are distributed through the upper portion of the frame; heavy power supply components are bolted to the base channels of the frame.

(1) MAIN METER PANEL AM-122. - The main meter panel, mounted at the top of the main frame, contains five meters. These meters monitor the 10-kw power amplifier tube filament voltage, screen grid current, plate current, rf plate voltage, and rf power output, and VSWR on the transmission line between the 10-kw PA and the 40-kw PA.

(2) 10 KW POWER AMPLIFIER SECTION AX-510. - The 10-kw PA is mounted below the main meter panel. It contains the 10-kw power amplifier tube and its associated tuned circuits. A blower motor that provides forced air cooling of the 10-kw power amplifier tube is mounted directly under the tube. The front panel of the 10-kw PA contains a plexiglass window, the 10-kw PA tuning and loading controls, and their associated counter-type dials, and indicator lamps.

(3) RF AMPLIFIER RFC-1 and RF AMPLIFIER DRAWER AX-104. -

The rf amplifier drawer contains the RFC and is slide-mounted below the 10-kw PA. The RFC is the rf voltage amplifier and 1-kw IPA between the exciter and the 10-kw PA. The inner section of the rf amplifier drawer contains all rf voltage amplifier and 1-kw IPA parts; the outer section houses the power supply components. The 1-kw IPA tube is air-cooled by a blower in the RFC. The front panel of the RFC (1 KW IPA) contains tuning and loading controls for the 1-kw IPA, bandswitches to cover the 2- to 28-mc rf range, and a multimeter and associated meter switch. Bias voltage, dc screen grid voltage, dc plate voltage, screen grid current, first amplifier plate rf voltage, IPA grid rf voltage, IPA plate rf voltage, and 10 kw power amplifier rf input voltage can be observed on the multimeter.

(4) MAIN POWER PANEL AX-504. - The main power panel controls application of plate, screen grid, and filament voltages to the 10-kw PA, and monitors all the main frame interlock circuits. This panel also controls the primary ac power input to the main frame. Other front panel controls include a reset pushbutton associated with the protective relays in the main frame and an automatic load and drive control switch and level adjustment.

(5) HIGH VOLTAGE RECTIFIER AX-103. - The 10-kw high voltage rectifier, slide-mounted below the main power panel, provides +7500 vdc for the plate of the 10-kw PA tube. The unit also provides half-wave rectification for the 3200-volt section of the main power supply. Either a gaseous-tube unit (High Voltage Rectifier AX-103) or a solid-state unit (High Voltage Rectifier, Model HVRC-2) is supplied. Heavy insulated button connectors at the rear of the unit provide quick disconnection for drawer removal.

(6) RELAY PANEL AR-161. - The 10-KW relay panel, mounted at the bottom of the main frame, contains nine relays which protect the main frame circuits against overloads. The relays and their associated terminal boards are mounted under a front-panel cover plate. The upper portion of the relay panel contains filament and plate time meters, a time-delay relay, and overload indicator lamps. All 1-kw IPA and 10-kw driver overload adjustments are also mounted on the relay panel.

d. PA FRAME. - The PA frame contains the 40-kw PA stage of the transmitter. This frame is divided into upper and lower sections by a partition. The upper section contains the power amplifier and output tuning components. The lower section contains parts associated with the main power supply and a blower assembly for the power amplifier tube.

(1) PA FRAME METER PANEL AM-115. - The PA frame meter panel, mounted at the top of the PA frame, contains five meters associated with the 40-kw PA stage. These meters monitor the voltage to the primary of the filament transformer, the rf drive voltage, the plate current, the rf plate voltage, and during unbalanced output operation, the rf output power.

(2) POWER AMPLIFIER AX-511. - The 40 KW PA comprises the 40 kw power amplifier tube and its associated tuned circuits. A blower that provides forced air cooling of the 40-kw PA power amplifier tube is mounted on the PA frame directly below the tube. The front panel contains a plexiglass window, the PA tuning and loading controls and their associated counter-type dials, and indicator lamps.

(3) PA CONTROL PANEL AX-210. - The PA control panel is mounted at the front of the 40-kw PA frame. Switches on this panel control the application of main ac power and high voltage, and monitors the interlock circuits associated with the PA and PS frames. Other controls on this panel are associated with the operation of the 40-kw power amplifier and the PA frame relay panel.

(4) BIAS SUPPLY DRAWER AP-117. - The bias supply drawer, mounted below the PA control panel, contains two power supplies and SWR and retune protection circuits. The protection circuits automatically cause associated relays to trip when VSWR becomes excessive or the power amplifier is mistuned. The front panel contains three potentiometers, three lamps, and three fuses.

(5) PA FRAME RELAY PANEL AR-116. - The PA frame relay panel, mounted at the bottom of the PA frame, contains nine relays and associated parts. The relays protect various circuits in the PA and PS frames. The upper section of the relay panel contains controls and indicators associated with the relays. All relays and terminal boards are contained in the lower section and are easily accessible upon removal of a cover plate.

e. PS FRAME AP-118. - The PS frame contains the transmitter high voltage power supply, the PA output circuit used during balanced output operation, and a crowbar drawer. The front upper section of the PS frame contains the drawers which are removable. The main power supply components occupy the remainder of the frame.

(1) ANTENNA TUNING UNIT AT-106. - The antenna tuning unit contains a balancing circuit for balanced output operation. A BAND MCS switch and BALANCE control on the front panel are used during balanced operation. The front panel also contains five meters that monitor circuit parameters within the 40-kw PA, the crowbar filament voltage, and VSWR (during unbalanced output operation). A manually set pointer and adjustment knob on the SWR meter permits the operator to preset the level of VSWR at which the SWR protective circuits operate.

(2) CROWBAR DRAWER AX-212. - The crowbar drawer, mounted below the antenna tuning unit, provides protection against excessive grid current surges in the 40-kw PA. This unit contains a thyatron that is visible through a window on the front panel. A switch, lamp, and two fuses are also mounted on the front panel.

(3) 40-KW HIGH VOLTAGE RECTIFIER. - The 40-kw high voltage rectifier, slide mounted below the crowbar drawer, is the rectifier portion of the plate supply for the 40-kw PA tube. Either a solid-state unit (Solid State Power Supply, Model HVRB-2), or a gaseous-tube unit (12-kv High Voltage Rectifier AP-105) may be supplied. In either case input and output connections are made via button contacts on the rear of the drawer.

(4) PS CONTROL PANEL AX-213. - The PS control panel, mounted below the 40-kw high voltage rectifier, contains controls for adjusting filament voltages in several of the drawers and turning on filament and blower motor power. The front panel also contains an SWR meter calibration control and switch.

5. BLOCK DIAGRAM ANALYSIS. (See figure 2.)

The synthesized transmitter consists of a synthesized exciter, a 1-kw IPA (Intermediate Power Amplifier), a 10-kw PA, a 40-kw PA, and associated power supply and power control circuits. The transmitter delivers 40,000 watts PEP (20,000 watts average) throughout its 2- to 28-mc operating range. The exciter generates 1 watt (PEP) rf in the range of 1.75 to 33.75 mc, with the signal frequency-locked to an accuracy of 1 part in 10^8 when operating at any 100-cycle increment within this range. The 1-kw IPA, 10-kw PA, and 40-kw PA stages are tuned to the 2- to 28-mc range, fixing the transmitter output frequencies to this range.

The exciter circuits provide a large variety of operating modes and types of sideband intelligence. The circuits can be

set up for single sideband, double sideband, independent sideband, keyed carrier (CW), or AM equivalent (AME) transmission. Operating with proper terminal equipment, either or both sidebands may carry FSK, FAX, or audio line intelligence.

The heart of the exciter is the highly stable 1-mc signal generated in Primary Standard CSS. This signal is routed to Frequency Amplifier CHG where it is amplified and then routed to Divider Chain CHL.

Divider Chain CHL provides 500-kc, 10-kc, 1-kc, and 100-cps signals, stabilized to the 1-mc standard. Controlled Oscillator CLL accepts the four outputs of the CHL, and generates a signal in the 510-519.9-kc range. This signal is phase-locked to the four outputs of the CHL, and therefore has the same degree of stability as the standard 1-mc signal from Primary Standard CSS. The 510-519.9-kc signal from Controlled Oscillator CLL is used to stabilize a 2- to 4-mc VFO in Controlled Master Oscillator CMO.

Audio input signals are applied to Intelligence Unit TIS. For SSB, ISB, or AM operation, the audio signals are routed to Sideband Exciter CBE; for CW, FSK or FAX operation, an audio tone generated in the TIS is routed to the CBE.

The standard 1-mc signal from Primary Standard CSS is divided down to 250-kc in Frequency Amplifier CHG. This stable 250-kc signal is applied to Sideband Exciter CBE. The CBE, using the 250-kc sub-carrier and its audio inputs, generates an SSB, ISB or DSB signal. Carrier insertion is continuously adjustable for all of these modes. The 250-kc output of the CBE, which may be modulated or unmodulated, is routed to Frequency Amplifier CHG.

Frequency Amplifier CHG combines the 2- to 4-mc output of

Controlled Master Oscillator CMO and the 250-kc output of Sideband Exciter CBE, and heterodynes the resultant signal to any desired frequency in the 1.75- to 33.75-mc range. The high-frequency heterodyning signal used in the CHG is phase-locked to the standard 1-mc signal from Primary Standard CSS; the exciter output, therefore, has the same frequency stability as the standard 1-mc signal. The output of the CHG, up to 1-watt PEP, is routed to RF Amplifier RFC; a sample of this exciter output is also routed to Auxiliary Power Panel APP for monitoring purposes. The linear stages of the RFC raise the level of the input signals as high as 1-kw PEP; this signal is applied to the 10-kw PA.

The 10-kw PA, a grounded grid amplifier operating class AB1, raises the r-f level to 10-kw PEP. A dummy load is provided so that this stage may be tuned independently of the 40-kw PA. After 10-kw PA tuning is accomplished, the output of this stage is routed directly into the 40-kw PA.

The 40-kw PA, a grounded grid amplifier operating class AB2, raises the r-f level to 40-kw PEP. The output of the 40-kw PA may be routed to an unbalanced antenna via directional coupler DC7302, or to a balanced antenna via the antenna tuner unit.

Samples of the output signals from the 10-kw PA and 40-kw PA are routed to the auxiliary power panel where they may be conveniently monitored. A portion of the 10-kw PA output is applied to an ALDC (automatic load and drive control) circuit. When this circuit is properly adjusted, a control voltage is

applied to the exciter whenever a preset r-f level is exceeded. This control voltage decreases exciter output, thus limiting high drive peaks and suppressing unwanted transmission products.

The 10-kw high voltage rectifier, operating with the main power supply, provide all high d-c potentials required by the 10-kw PA and the 1-kw IPA. Circuitry within the IPA drawer provide bias voltages for the 10-kw PA and 1-kw IPA tubes, and operating voltages for the low level amplifier stages in the RFC.

Plate potential for the 40-kw power amplifier is provided by the 40-kw high voltage rectifier. The crowbar drawer, a protective device, samples the 40-kw power amplifier tube grid current. If a sharp rise of grid current occurs (as a result of arcing), the + and - outputs of the 40-kw high voltage rectifier are shorted, causing the circuit breaker in the high voltage primary circuit to trip.

Bias for the 40-kw power amplifier tube is provided by the bias supply drawer.

During unbalanced output operation, directional coupler senses VSWR on the output transmission line. When VSWR becomes excessive, circuitry within the SWR meter, bias supply drawer, and PA frame relay panel disable the transmitter high voltage circuits.

An indication of SWR at the output of the 10-kw PA is applied to the Standing Wave Control Unit SWCU in the auxiliary frame. When a preset level of SWR is exceeded, an SWR overload signal from the SWCU automatically removes high voltage from the transmitter by opening the interlock circuit.

The 10-kw relay panel contains overload coils that open interlocks that disable the transmitter high voltage circuits. The protective circuits sample the IPA and 10-kw PA plate and screen currents, bias-supply voltages, and the current in a voltage-regulating diode assembly in the main power supply. When any of these currents is excessive, or if a voltage is deficient, the associated protective relay operates and removes high voltage.

The PA frame relay panel contains protective circuitry similar to that of the 10-kw relay panel. Relays in this panel sample 40-kw PA tube plate current, bias, filament voltage, transmission line VSWR, 40-kw PA r-f voltage, and tube compartment temperature. If any of these values are out of tolerance, the transmitter high voltage circuits are automatically disabled.

Interlock circuits are provided in the transmitter for personnel and equipment safety. When one of these interlocks opens, the high voltage power supplies are turned off automatically, and the high-voltage capacitors are shorted to ground. Interlock circuits are provided for drawers in which potentials greater than 500 volts are present. Important cooling air ducts are also interlocked for equipment safety.

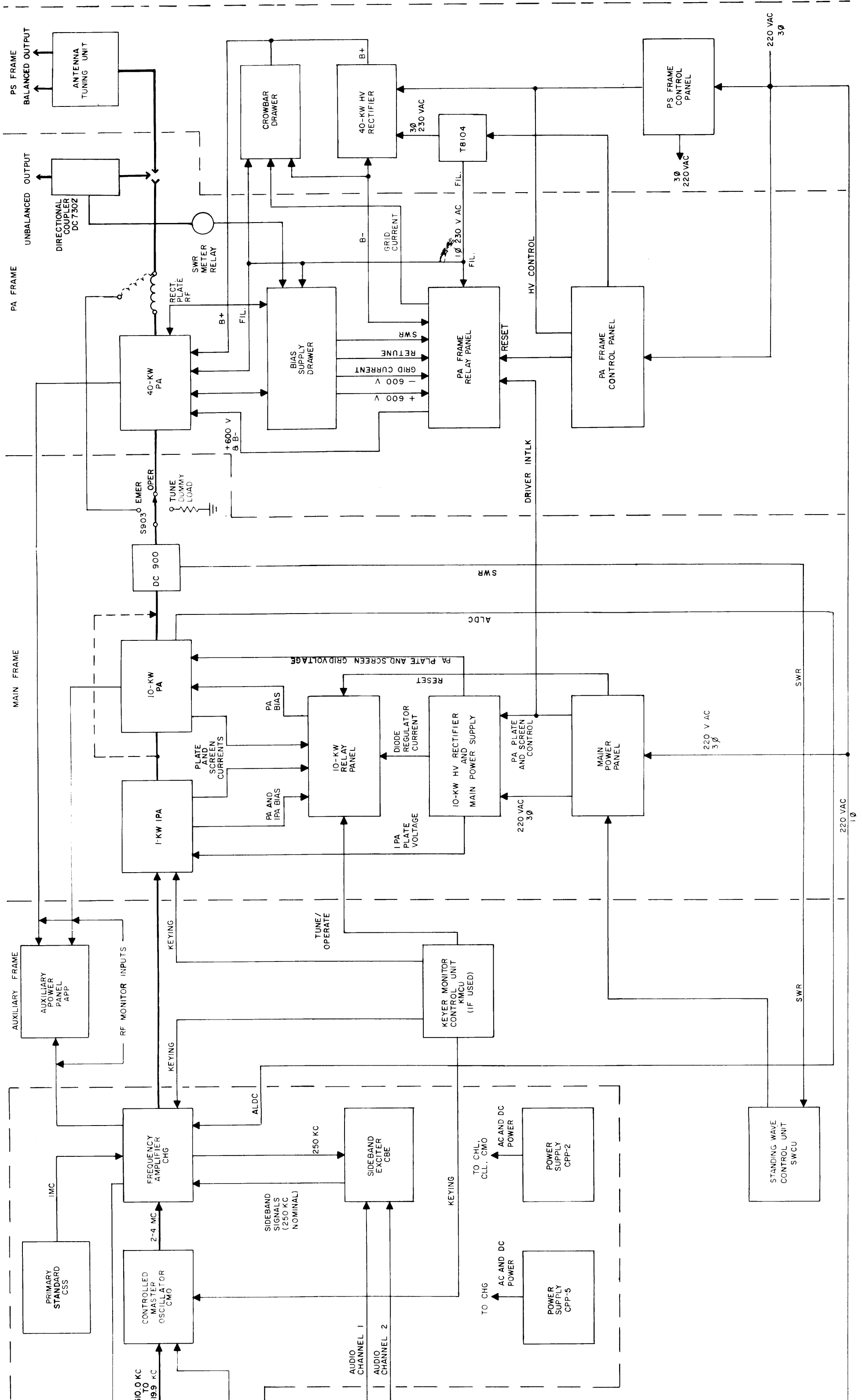
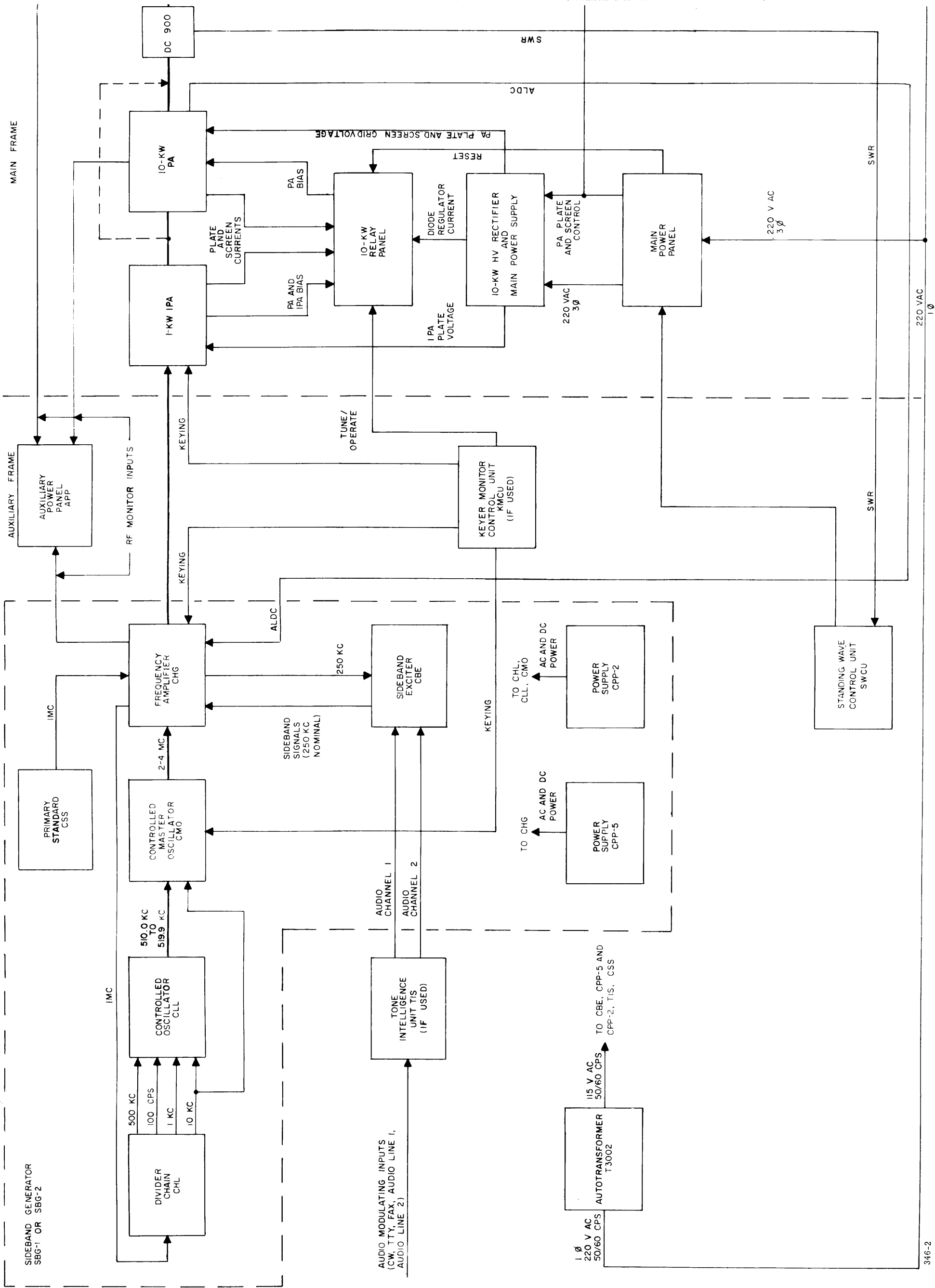


Figure 2. Synthesized GPT-40K Transmitter, Block Diagram



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