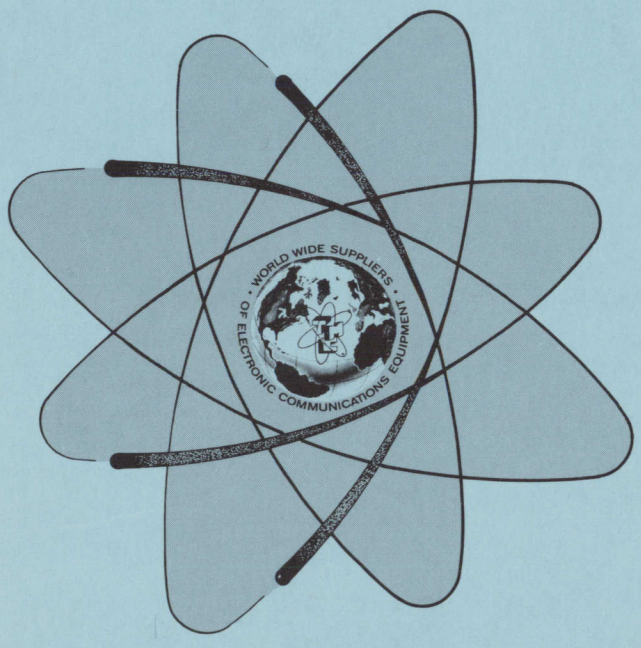
TECHNICAL MANUAL

for

GENERAL PURPOSE HIGH FREQUENCY TRANSMITTER

MODEL GPTA-1KJ



THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

Printed in U.S.A.

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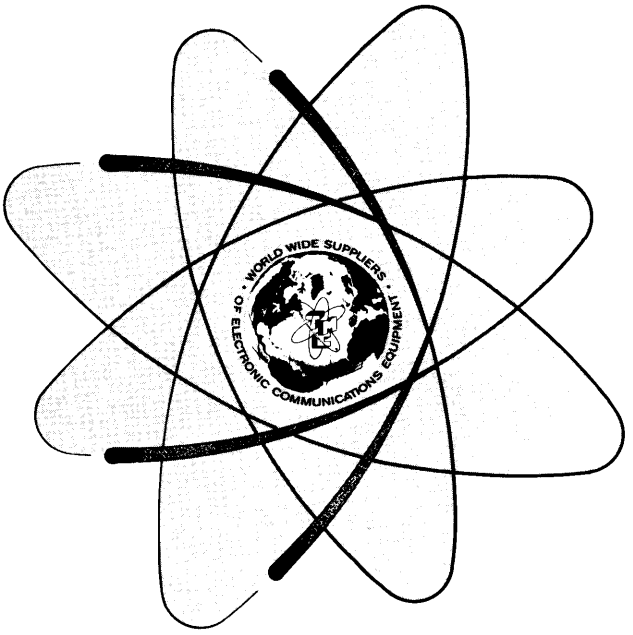

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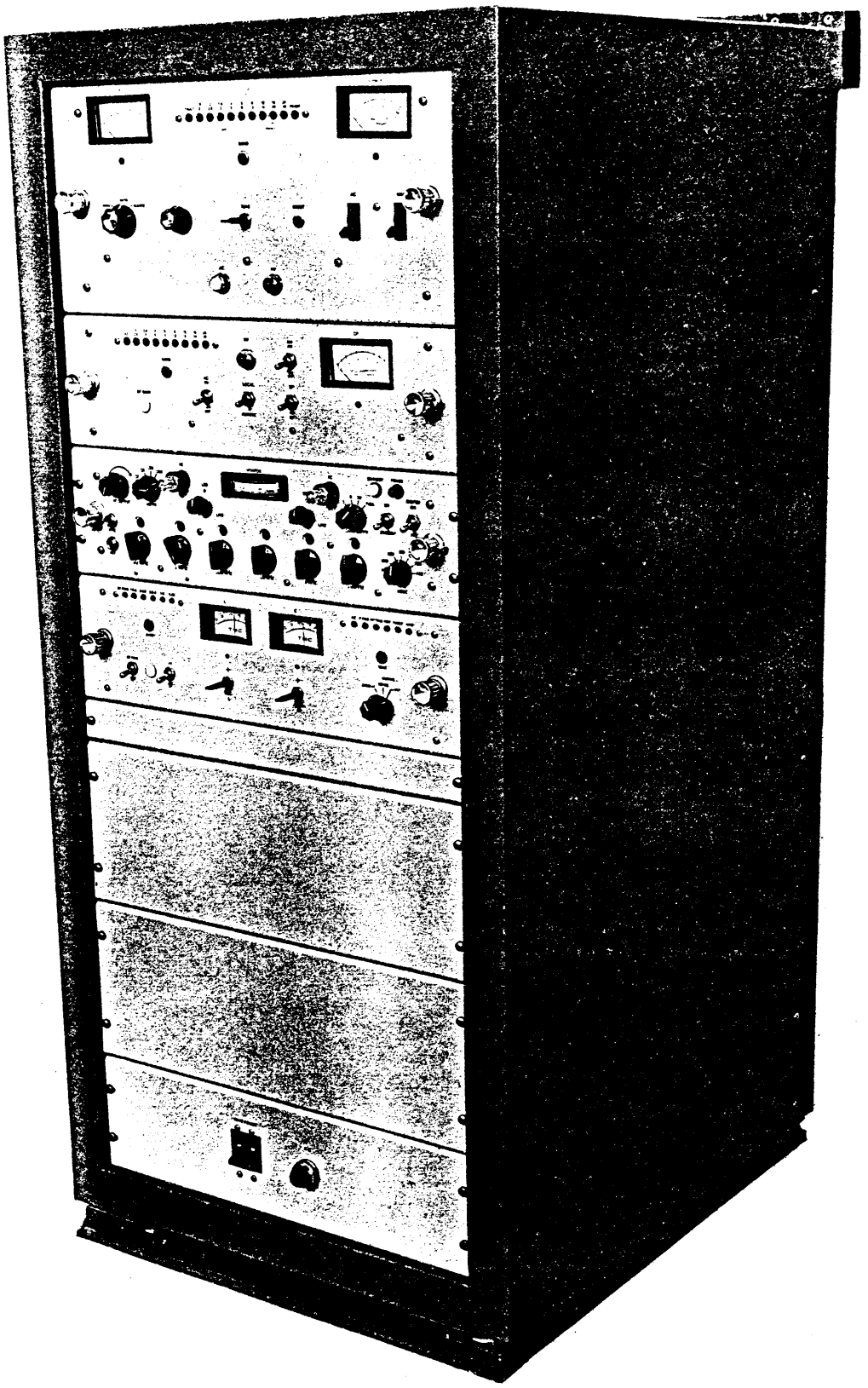

Figure 1-1. General Purpose High Frequency Transmitter, Model GPTA-1KJ

SECTION 1
GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION

The Technical Materiel Corporation (TMC) of Mamaroneck, New York designed and manufactures the high frequency transmitter Model GPTA-1KJ shown in figure 1-1. This equipment, as the model number indicates, is a general purpose transmitter which will deliver one kilowatt of output power (1 kw peak envelope power or 500 watts average). The transmitter consists of three basic units: a solid-state multi-mode exciter, model MMX(A)-2, and two linear power amplifiers, the model HFL-100 and the model TMA-1K.

The HFL-100 increases the rf input from the exciter to 50 watts average power (100 watts PEP) and the TMA-1K amplifier completes the amplification raising the signal to the 1000 watt PEP output level (500 watts average). Two optional subsystems are available for use with the basic system. When used they become integral parts of a total system. Either or both options may be included. The first, a model ATSA-3 antenna tuning system is the most common, and the system interconnect wiring makes provision for the inclusion of it. The second, recommended when special harmonic problems exist, is a switchable harmonic filter model TFP-1K. An adapter wiring harness will make it possible to integrate this unit with the system.

The MMX(A)-2 exciter generates a 250 mw, rf output signal at any selected frequency in the range of 2.0 to 30.0 MHz. With the MMX(A)-2, the operating frequency is selectable in discrete 100 Hz increments over the entire frequency range. It also provides bandswitching signals to the other tunable components of the system. The output signal of the exciter is sent to the amplifying units of the system in one of six operating modes; CW (carrier wave), AM (amplitude modulation), SSB (single sideband), including AME (amplitude modulation equivalent), ISB (independent side band-USB and LSB), FSK (frequency shift keying), and FAX (facsimile).

The rf output of the final amplifier (TMA-1K) may be routed directly to the antenna or, if optional equipment has been added, through this equipment. The ATSA-3 antenna tuning system, if included, operates automatically to match the impedance of a 35-foot whip antenna to the impedance of a 50 ohm transmission line at any selected transmission frequency. A harmonically supressed signal for transmission is provided when the TFP-1K harmonic filter has been made part of the system. Both the tuning system and the filter are electrically tied to the frequency selection circuitry of the transmitter to syncronize their operation to the correct transmission band for the frequency at which the transmitter is operating.

Table 1-1 shows the nomenclature and interrelationship (by indention) of the various system components.

TABLE 1-1. TRANSMITTER COMPONENTS

NOMENCLATURE	NAME
GPTA-1KJ	General Purpose H.F. Transmitter
MMX(A)-2	Multi-mode Exciter
HFL-100	Linear Power Amplifier-100 watt PEP
TMA-1K	Linear Power Amplifier-1000 watt PEP
*ATSA-3	Antenna Tuning System
AX5175	Tuning Control Unit
AX5176	Antenna Tuning Unit
*TFP-1K	Harmonic Filter

*Optional Equipment

1-2. PHYSICAL DESCRIPTION

All of the components of the GPTA-1KJ transmitter are designed to be slide-rack mounted in a standard 10-inch equipment cabinet, with the exception of the AX5176 tuning unit. This unit must be mounted within 27 inches of the antenna base.

Jacks for microphone or key inputs are provided on the front panel of the exciter but the other external connections to the transmitter are made at the rear of the unit. A connector for primary power is also located at the rear of the transmitter. Connecting plugs and terminals which mate with the jacks and terminal boards on the interface panel where the external connections are made are furnished as "loose items."

1-3. REFERENCE DATA

Table 1-2 lists the technical characteristics of the GPTA-1KJ transmitter. The power tube compliment of the system is shown in Table 1-3.

TABLE 1-2. TECHNICAL SPECIFICATIONS

Frequency Range:	2.0 to 30.0 MHz, standard
Stability and Frequency Control:	Within 1 part in 10^8 /day; higher stability is possible with the use of a more stable external standard
Operating Modes:	CW, AM, SSB, AME, ISB, FAX and FSK
Power Output:	1000 watts PEP or 500 watts average
Output Impedance:	50 ohms, unbalanced
VSWR:	Maximum of 2:1 without degrading performance
ALDC:	Automatic Load and Drive Control to improve linearity, limit distortion and maintain relatively constant output level during high modulation peaks and load changes. Front panel control allows adjustment of level at which ALDC takes effect.
Tuning:	Automatic or manual; automatic has manual override.

TABLE 1-2. TECHNICAL SPECIFICATIONS (cont)

Carrier Suppression:	Selectable at four levels in relation to PEP (1) 0: full carrier, no suppression (2) -6: 6 db down (3) -16: 16 db down (4) full: at least 40 db down
Features:	Forced air cooling, overload protection, safety interlocks on high voltage unit, fused power inputs
Environmental:	Designed to operate in an ambient temperature of 0 to 50°C with a maximum humidity of 90 per cent
Primary Power:	Single phase, 115/230 vac, 50/60 Hz
Power Requirements:	1.8 Kw maximum depending on options exercised
Size:	23 inches wide X less than 4 1/2 ft. high X 2 1/2 ft. deep (max). Mounted in customer selected standard cabinet
Weight:	Less than 200 pounds. Actual weight depends on optional equipment incorporated

TABLE 1-3. TUBE COMPLEMENT

Unit	Reference Designation	Part Number or Type	Function
HFL-100	V101	12HG7*	1st Amplifier
	V102	12HG7*	2nd RF Amplifier
	V103	4CX350	3rd RF Amplifier
TMA-1K	V101	8163*	Power Amplifier
	V102	8163*	Power Amplifier

SECTION 2
INSTALLATION

2-1. INITIAL UNPACKING AND INSPECTION

The GPTA-1KJ transmitter was assembled, calibrated and tested at the factory prior to shipment. Following successful completion of all operational tests, the transmitter was partially disassembled and the several individual units packed and crated separately. This shipping technique reduces the possibility of equipment damage in transit and provides for more efficient material handling.

When received at the installation site, each of the crates and cartons should be carefully examined to be sure that no damage to the contents occured during shipment. If damage is discovered, a claim should be filed with the carrier at once. The Technical Materiel Corporation will assist in rectifying such damage by recommending replacement parts and by describing repair methods.

Refer to the packing list provided with each shipment and make certain that all material has been received. Carefully inspect all packing material to be sure that no material or parts shipped as "loose items" (cabinet hardware, connectors, cables, technical manuals and the like) has been overlooked.

2-2. POWER REQUIREMENTS

The GPTA-1KJ transmitter requires a single phase source of 115 or 230 volt, 50 or 60 cycle ac power at approximately 1.8 kilowatts maximum. The equipment has been factory wired for use with the ultimate power supply indicated by the customer. If a decision is made to use an alternate power source, wiring changes must be made to accomodate a change in voltage. The technical manuals for each individual unit should be consulted and the necessary changes made before installation.

2-3. INITIAL INSTALLATION

a. GENERAL. The equipment rack or cabinet should be coveniently located in relation to any associated equipment, taking into consideration that from time to time access to the rear of the equipment will be required, and that adequate ventilation is necessary.

Disconnected cabling and wiring has been tagged for proper connection and secured to the interior of the cabinet. Free this cabling and be certain that all packing material has been removed prior to component installation.

b. UNIT INSTALLATION. Each of the units which comprise the GPTA-1KJ transmitter is designed to be slide mounted in the rack or cabinet. After completing the unpacking and initial inspection of equipments, carefully slide each unit into position as shown in figure 2-1. Begin the installation with the unit nearest to the cabinet base. The circuit breaker panel, if supplied, is usually not disassembled from the cabinet. No special tools or skill are required to properly position the units but care must be exercised when sliding them into place to avoid any entanglement with installed wiring.

NOTE

Blank panels (usually already installed) are supplied to fill the rack space for unincorporated optional equipment.

The AX5176 tuning unit of the optional ATSA-3 antenna tuning system is mounted at the base of the associated antenna. For installation details refer to the ATSA-3 technical manual.

c. ELECTRICAL CONNECTIONS. The electrical connections required to make the GPTA-1KJ transmitter operative may vary slightly from system to system depending on what, if any, available optional equipment has been added to the basic transmitter. The wiring necessary to add the ATSA-3 automated antenna tuning system has been included in the standard internal wiring harness since this option is most often exercised. The harness is delinated in figure 2-2. If other optional equipment is added, the necessary cabling and instructions are furnished separately.

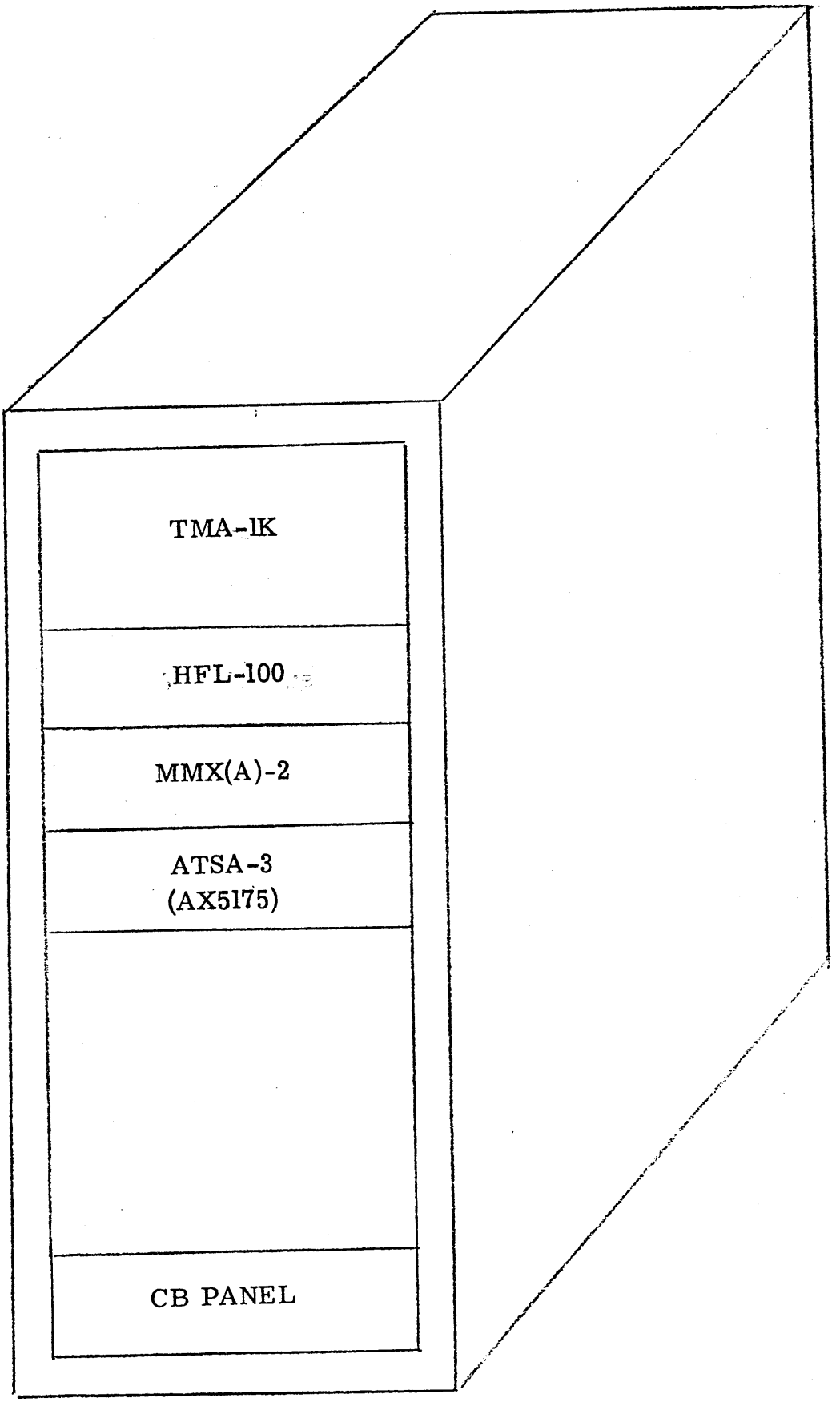

Figure 2-1. Modular Component Location - GPTA-1KJ Transmitter

(1) INTERNAL CONNECTIONS - Each of the jacks and terminal boards at the rear of the modular units has been marked with the appropriate "J" or "TB" number to facilitate interconnecting the units with the internal cabling. The connectors on the wiring harness have also been similarly identified. Reference to the internal interconnection diagram figure 2-2 will assist the installer in making these connections.

The completion of one internal circuit, namely the rf output line, varies depending on the optional equipment included. The rf output of the TMA-1K power amplifier may terminate at J402 (RF IN) of the harmonic filter; at the internal side of J202 on the interface panel where the external connections are made, or at the transmit/receive relay RL139 if this unit is included in the transmitter. When adding optional equipment subsequent to the initial installation the wiring changes necessary are described, and connecting plugs furnished with the added unit.

(2) EXTERNAL CONNECTIONS - Primary power must be supplied to the transmitter through a customer supplied connection to J203. Plug P203 (PL190-NG) is furnished as a "loose item" to facilitate the fabrication of this connection. This connection is located at the lower left rear of the equipment cabinet.

WARNING

BEFORE MAKING ANY ELECTRICAL CONNECTIONS TO THE TRANSMITTER BE CERTAIN THAT NO CONNECTION HAS BEEN MADE TO ANY POWER SOURCE AND THAT THE POWER SUPPLY JACK IS TAGGED TO PREVENT ACCIDENTAL USE.

Most of the external connections to the transmitter are made at the interface panel at the rear of the unit. Mating connectors for the terminal boards and jacks mounted on the panel are, if required, furnished as "loose items". These items are used to terminate the control and signal cables which must be fabricated by the customer. The layout of the interface panel showing the location of these connections is presented in figure 2-3.

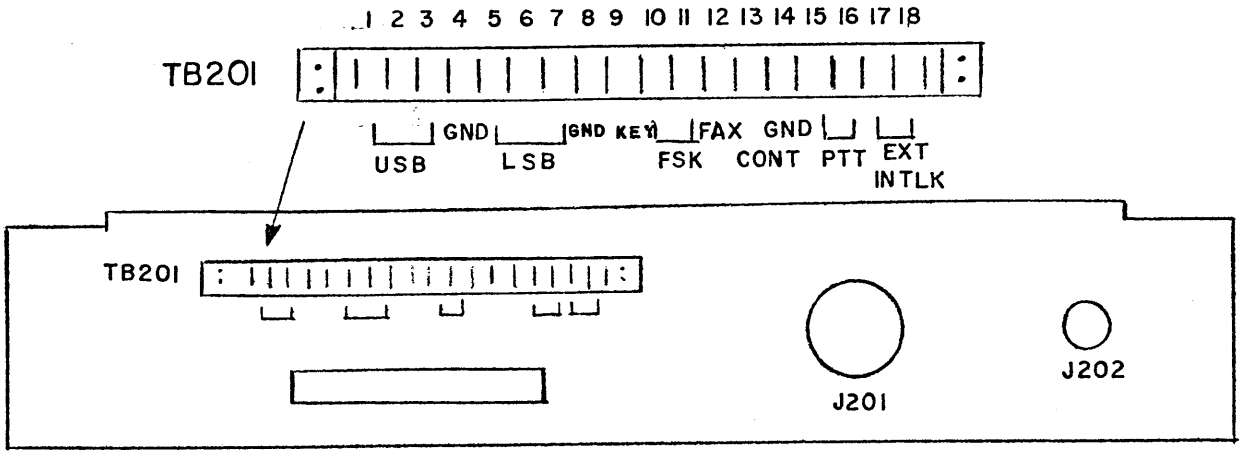

Figure 2-3. Interface Panel, Model GPTA-1KJ

Terminal board, TB201, on the interface panel provides access to the transmitter for the external operating signals. The cabling to this connector is provided by the customer. Shielded wire should be used and the connections made as shown in table 2-1 using the terminal strip provided.

TABLE 2-1. CONNECTIONS TO TERMINAL BOARD TB201

Terminal No.	Signal Input
1	Upper Sideband (600 ohm)
2	Upper Sideband (600 ohm)
3	Center Tap
4	Shield (ground)
5	Lower Sideband (600 ohm)
6	Center Tap
7	Lower Sideband (600 ohm)
8	Shield (ground)
9	CW Key Input (Shield to 8)
10	FSK (-) (Shield to 8)
11	FSK (+) (Shield to 14)

TABLE 2-1. CONNECTIONS TO TERMINAL BOARD TB201 (cont'd)

Terminal NO.	Signal Input
12	FAX (Shield to 14)
13	FSK Contact Key
14	FSK Shield (ground)
15	PTT (need to be shielded)
16	PTT ground (need to be shielded)
17	External Interlock (need to be shielded)
18	External ground

NOTE

If no external interlock is used, a jumper wire should be installed between terminals 17 and 18 of TB201.

If the antenna tuning system is incorporated, a control cable must also be fabricated to carry the control signals to the AX5176 tuner at the antenna base. Table 2-2 shows the pin to pin connections to be made between the mating plug for J201 and the interface panel and the mating plug for J202 on the tuning unit. The length of this cable should not exceed 100 feet. For specific installation details and a preoperational check of the ATSA-3 system refer to the antenna tuning system technical manual.

TABLE 2-2. CONNECTIONS ON PLUG P201

P201 Pin No.	To P202 Pin NO.	P201 Pin No.	To P202 Pin No.	P201 Pin No.	To P202 Pin No.
A	A	P	P	d	c
B	B	R	R	e	d
C	C	S	S	f	e
D	D	T	T	g	f
E	E	U	U	h	g
F	F	V	V	j	h
G	G	W	W	k	j
H	H	X	X	m	k
J	J	Z	Y	n	l
K	K	a	Z	p	m
L	L	b	a	r	n
M	M	c	b	s	6
N	N				

NOTE

Terminal boards and connectors installed but not used, or the mounting provisions for them, are provided to simplify future wiring changes when adding options or increasing transmitter capability.

Two jacks, MIKE (J118) and KEY (J117) on the front panel of the MMX(A)-2 exciter accept respectively the input from a 47,000 ohm impedance microphone and the input from a dry contact keyer for CW mode of operation. The mating connectors, P117 (PJ055B) and P118 (PJ068B) are furnished as "loose items" with the transmitter, but the cabling must be fabricated by the customer.

The rf output connection from the GPTA-1KJ transmitter is made at J202 on the interface panel or if a RL139 transmit/receive relay figure 2-4 is incorporated, at the output connector of that unit. In either case, the necessary connecting plug is furnished as a "loose item". The customer must fabricate the shielded cable to carry this signal to the antenna or to the AX5176 tuning unit portion of the ATSA-3 antenna tuning system, if this equipment is a part of the specific configuration of the GPTA-1KJ transmitter. This cabling should conform to specification RG215/U and should not exceed 100 feet in length.

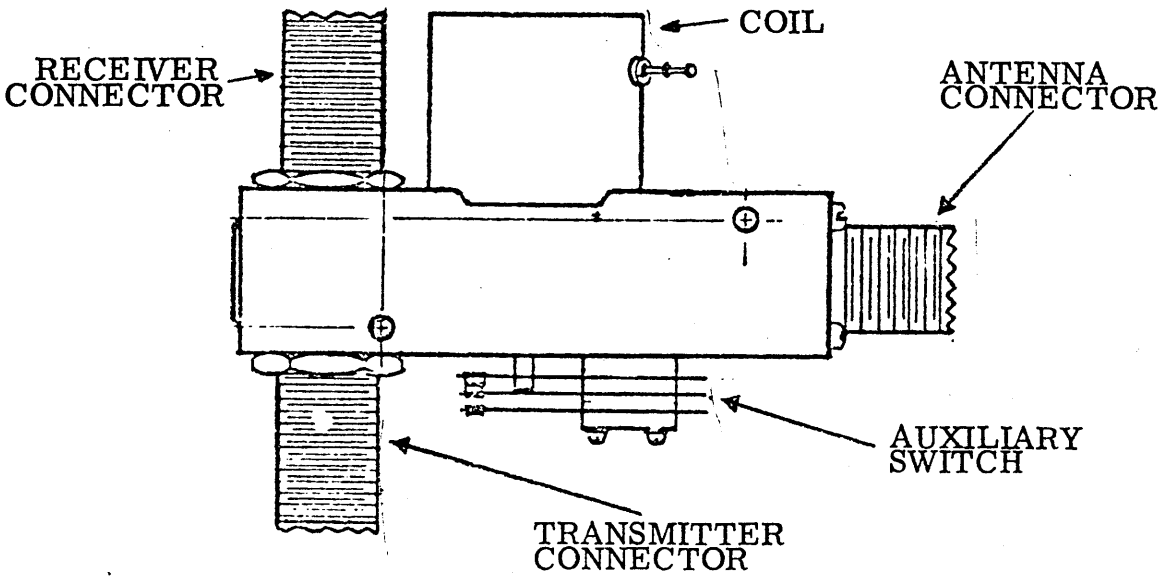

Figure 2-4. Transmit/Receive Relay Model RL139

2-4. FINAL INPSECTION

After all electrical connections have been completed the transmitter should be visually inspected to be sure of the following:

a. The interlocks are operable. The interlocks on the GPTA-1KJ transmitter are located on the TMA-1K linear power amplifier unit, and must close when the top and bottom protective covers are secured in place.

b. All electrical connections have been properly made and that the connectors are mechanically secure in the correct positions.

c. The protective top and bottom cover are securely affixed to each modular unit and that the units are secured in the cabinet with panel locks or mounting hardware.

d. The rear cabinet panel is in place and secured with the mounting hardware provided.

e. The antenna system or equivalent dummy load is properly connected to the rf output connector of the transmitter system.

SECTION 3
OPERATORS' SECTION

3-1. GENERAL

The GPTA-1KJ transmitter provides 1 kilowatt PEP (peak envelope power) or 500 watts average power in any of six operating modes. This section gives instructions for tuning, operating, and monitoring the transmitter. These instructions consider the most common configuration of the transmitter, that is, with the inclusion of the optional ATSA-3 antenna tuning system. The addition or inclusion of other optional equipment is covered by an appropriate addendum to this publication. The instructions are, however, in general applicable to any configuration of the transmitter.

3-2. OPERATING CONTROLS AND SEQUENCE

The operator should familiarize himself with the location of each control and indicator by refering to the technical manual for each modular component.

It is also important that the sequence of operation outlined in these instructions be habitually followed. Undue stress on system components may be the result of improper operation.

3-3. PRELIMINARY CONTROL SETTINGS

The operator must verify that the antenna or suitable dummy load is properly connected to the rf output connection of the specific transmitter (refer to paragraph 2-3 (2)) before applying any power to the transmitter. The operator should also be certain that the controls on each unit are positioned as outlined in table 3-1.

TABLE 3-1 PRELIMINARY CONTROLS SETTINGS

Modular Unit	Control	Setting
Circuit Breaker Panel	Main Circuit Breaker	OFF
ATSA-3 (AX5175)	ON/AC switch BYPASS/OFF switch	AC position (off) OFF

TABLE 3-1 PRELIMINARY CONTROL SETTINGS (cont)

Modular Unit	Control	Setting
MMX(A)-2	ON/STANDBY switch	STANDBY
	CARRIER switch	0
	MODE switch	USB
	MIKE/LINE controls	0
	RF OUTPUT control	Fully counterclockwise
HFL-100	AC ON/OFF switch	OFF
	LOCAL/REMOTE switch	REMOTE
	HV ON/OFF switch	OFF
	IP/RF switch	IP
TMA-1K	MANUAL/AUTO/REMOTE	REMOTE
	AC switch	Down position (off)
	HF switch	Down position (off)

3-4. OPERATING PROCEDURES

The GPTA-1KJ is primarily designed for operation as an automatically tuned transmitter. When the desired operating frequency is manually set on the MMX(A)-2 exciter, the tunable components of the transmitter are automatically adjusted to accommodate the selected frequency when the RESET pushbutton on the TMA-1K unit is pressed. Table 3-2 gives the procedureal steps to be taken to operate the transmitter in the normal manner. To change the operating frequency when the transmitter has already been adjusted for automatic operation the steps presented in table 3-3 should be followed.

Provision has also been made in the design of the transmitter to tune each of the units manually should such an operating technique be required. Naturally such a procedure is more complex and requires more skill and understanding on the part of the operator. The procedural steps and directions given in Table 3-4 should be followed to manually tune the transmitter.

a. OPERATING PROCEDURES FOR TRANSMITTER TUNING To initially tune or retune the transmitter, proceed as directed in Tables 3-2, 3-3 or 3-4.

NOTE

The controls should be positioned as outlined in table 3-1 before initiating any tuning sequence.

TABLE 3-2 PROCEDURE FOR NORMAL TUNING ON CARRIER

CAUTION

Before attempting any tuning procedures make certain that the RF OUTPUT control on the MMX(A)-2 is rotated fully counterclockwise.

Step No.	Modular Unit	Operation	Normal Indication
1	ATSA-3 (AX5175)	Set AUTO/MAN switch (on chassis) to AUTO position. (This is the normal operating position)	None
2	AX5175	Set AUTO/SENSE/P. POS switch to AUTO position.	None
3	MMX(A)-2	Set frequency selector switches to the desired frequency.	Selected frequency is displayed on the digital indicators asso- with each switch.
4	MMX(A)-2	Set EXCITER switch to ON position.	None
5	CB Panel	Set circuit breakers to ON position.	AC indicator lamp lights.
6	MMX(A)-2	Set ON/STANDBY switch to ON position.	STANDBY indicator lamp goes off and POWER indicator lights.

NOTE

STANDBY indicator lamp lights when external power is supplied to the transmitter.

TABLE 3-2. PROCEDURE FOR NORMAL TUNING ON CARRIER (cont)

Step No.	Modular Unit	Operation	Normal Indication
7	AX5175	Set ON/AC switch to ON position.	AC indicator lights. Band indicator for selected frequency band lights. When elements are pre-positioned P.POS indicator lights.
8	HFL-100	Set AC switch to ON position.	AC indicator lights.
9	TMA-1K	Set AC switch to on (up) position.	AC indicator lamp lights.
		CAUTION A time delay circuit in the TMA-1K prevents the application of high voltage to that unit for one minute after AC power is supplied. The HFL-100 has no time delay circuit. Allow at least that time for all tube filaments to heat.	
10	HFL-100	Set HV switch to ON position.	HV indicator lamp lights. IP meter reads 50-75 ma.
11	TMA-1K	Set HV switch to on (up) position.	HV indicator lamp lights. IP meter indicates approximately 200 ma.
12	TMA-1K	Press RESET pushbutton to test FAULT circuit.	After approximately 1 minute FAULT indicator lights.
13	MMX(A)-2	Slowly rotate the RF OUTPUT control clockwise until correct plate current is indicated.	IP meter on TMA-1K indicates 300 ma.

TABLE 3-2. PROCEDURE FOR NORMAL TUNING ON CARRIER (cont)

Step No.	Modular Unit	Operation	Normal Indication
14	TMA-1K	Press RESET button to initiate automatic tuning.	When the amplifiers are tuned a sharp increase will be observed on the OUTPUT meter. Simultaneously the RF TRIG on the AX5175 lights. At the completion of antenna tuning cycle the RDY indicator on the AX5175 lights followed instantaneously by the READY indicator on the TMA-1K.
15	MMX(A)-2	Rotate the RF OUTPUT clockwise to achieve the desired output. NOTE When the output reaches the desired level for which the automatic controls are preset, the tune carrier is removed and the ALDC circuit is activated.	RF output is indicated on the OUTPUT meter of the TMA-1K.

This completes the automatic tuning sequence and the system is prepared to receive intelligence.

TABLE 3-3. PROCEDURE FOR RETUNING TO A DIFFERENT FREQUENCY

Step No.	Modular Unit	Operation	Normal Indication
1	MMX(A)-2	IMPORTANT -- Rotate RF OUTPUT control fully counterclockwise.	OUTPUT meter on TMA-1K indicates minimum output.
2	MMX(A)-2	Set frequency selector switches to the desired frequency.	Selected frequency is displayed on the digital indicator associated with each switch.

TABLE 3-3. PROCEDURE FOR RETUNING TO A DIFFERENT FREQUENCY (cont)

Step No.	Modular Unit	Operation	Normal Indication
3	MMX(A)-2	Slowly rotate the RF OUTPUT control clockwise until correct plate current is indicated.	IP meter on TMA-1K indicates 300 ma. The appropriate band indicators on the TMA-1K, the HFL-100, and the AX5175 light.
4	TMA-1K	Press RESET pushbutton to initiate automatic tuning.	When system is tuned to the selected frequency the READY indicator on the TMA-1K lights.
5	MMX(A)-2	Rotate RF OUTPUT control clockwise to obtain desired output.	OUTPUT meter on TMA-1K indicates output level.

This completes the retuning sequence.

TABLE 3-4. PROCEDURE FOR MANUALLY TUNING THE TRANSMITTER

NOTE

Bandswitching for the ATSA-3 (AX5175) is accomplished automatically when the unit is interconnected in the transmitter system. The bandswitching, may be accomplished manually if required.

Step No.	Modular Unit	Operation	Normal Indication
1	ATSA-3 (AX5175)	Set BYPASS/OFF switch to OFF	None
2	AX5175	Set AUTO/SENSE/P.POS switch to AUTO	None
3	MMX(A)-2	IMPORTANT - - Turn RF OUTPUT control fully counterclockwise.	None
4	MMX(A)-2	Set frequency selector switches to the desired frequency.	Selected frequency is displayed on the digital indicator associated with each switch.
5	MMX(A)-2	Set EXCITER switch to ON position.	None
6	HFL-100	Set LOCAL/REMOTE switch to LOCAL.	None

TABLE 3-4. PROCEDURE FOR MANUALLY TUNING THE TRANSMITTER (cont)

Step No.	Modular Unit	Operation	Normal Indication
7	TMA-1K	Set MANUAL/AUTO/REMOTE switch to MANUAL.	None
8	CB Panel	Set circuit breakers to ON position.	AC indicator lamp lights.
9	MMX(A)-2	Set ON/STANDBY switch to ON position.	STANDBY indicator lamp goes off and POWER indicator lamp lights.
		NOTE STANDBY indicator lamp lights when external power is supplied to the transmitter.	
10	AX5175	Set ON/AC switch to ON position.	AC indicator lights.
11	HFL-100	Set AC switch to ON position.	AC indicator lights.
12	TMA-1K	Set AC switch to on (up) position.	AC indicator lamp lights.
13	TMA-1K	Rotate the ALDC control on the front panel fully counterclockwise.	None
14	MMX(A)-2	Set CARRIER control to 0 position.	None
15	HFL-100	Press and release BAND pushbutton sequentially until band switch is positioned properly for the selected frequency.	Band indicator lights to indicate band selected.
16	TMA-1K	Press and release BAND pushbutton sequentially until band switch is positioned properly for the selected frequency.	Band indicator lights to indicate band selected.

TABLE 3-4. PROCEDURE FOR MANUALLY TUNING THE TRANSMITTER (cont)

Step No.	Modular Unit	Operation	Normal Indication
17	AX5175	Observe that the bandswitch has been properly positioned for the selected frequency. (action controlled by the TMA-1K).	Lighted indicator shows band selected.
		NOTE If required, bandswitching of the ATSA-3 system may be accomplished manually by setting the AUTO/MAN switch (located within the AX5175 unit) to the MAN position and by depressing and releasing the BAND pushbutton sequentially until the appropriate BAND indicator illuminates.	
18	AX5175	Observe that the tuning elements have been properly prepositioned.	P.POS indicator lights.
		NOTE If required prepositioning of the tuning elements may be accomplished manually. Refer to the individual technical manual for the ATSA-3 antenna tuning system and perform steps 2 through 4 of Table 3-3.	
		CAUTION Be certain that the RF GAIN control is in the fully counterclockwise position before proceeding with the steps which follow.	

TABLE 3-4. PROCEDURE FOR MANUALLY TUNING THE TRANSMITTER (cont)

Step No.	Modular Unit	Operation	Normal Indication
		CAUTION A time delay circuit in the TMA-1K prevents the application of high voltage to that unit for one minute after AC power is supplied. The HFL-100 has no time delay circuit. Allow at least that time for all tube filaments to heat.	
19	TMA-1K	Set HV switch to ON position.	HV indicator lamp lights.
20	HFL-100	Set HV switch to ON position.	HV indicator lamp lights. IP meter indicates 50-75 ma. IP meter on TMA-1K indicates approximately 200 ma.
		CAUTION During initial transmitter tuning and prior to antenna tuning, the power output of the transmitter should be kept between 150 watts and 200 watts. Excessive output power may cause damage to the antenna tuner. During initial tuning, the OUTPUT meter should be monitored continually, and the output power controlled accordingly with the RF OUTPUT control on the MMX(A)-2 exciter.	
21	MMX(A)-2	Rotate RF OUTPUT control slowly in a clockwise direction until the required normal indication is obtained.	IP meter on the HFL-100 indicates approximately 70 ma. IP meter on TMA-1K indicates approximately 250 ma.

TABLE 3-4. PROCEDURE FOR MANUALLY TUNING THE TRANSMITTER (cont)

Step No.	Modular Unit	Operation	Normal Indication
		CAUTION Do not allow the plate current of the TMA-1K to exceed 300 ma until tuning is complete.	
22	TMA-1K	Operate TUNE lever switch to obtain required normal indication.	OUTPUT meter indicates highest obtainable output (peak) when resonance is achieved.
		NOTE A peak reading on the OUTPUT meter should be accompanied by a decrease (dip) in the magnitude of the plate current as indicated on the Ip meter.	
23	AX5175	Note the completion of the antenna tuning cycle.	RDY indicator lights.
24	TMA-1K	Readjust the TUNE control if necessary to achieve resonance.	At resonance, the OUTPUT meter on the TMA-1K indicates a maximum or peak value.
25	MMX(A)-2	Rotate RF OUTPUT control clockwise to increase output to 10% above desired level.	OUTPUT meter on TMA-1K indicates average power level. Ip meter on TMA-1K indicates plate current.
		CAUTION The 50 watt average output limit of the HFL-100 amplifier should not be exceeded. A 0.5 ma indication on the meter with the meter switch in the RF position is equivalent to 50 watts.	

TABLE 3-4. PROCEDURE FOR MANUALLY TUNING THE TRANSMITTER (cont)

Step No.	Modular Unit	Operation	Normal Indication
26	TMA-1K	Rotate the ALDC control slowly clockwise until the output is reduced to the desired level.	OUTPUT meter indicates desired output.
27	MMX(A)-2	Set the CARRIER switch to the position which is correct for the operating mode in which the transmitter will be working.	Table 3-5 gives examples of operating modes, switch settings and carrier levels.

NOTE

When the transmitter is tuned automatically, the READY indicator lights to indicate completion of tuning. The transmitter is then ready for transmission of intelligence. When the transmitter is tuned manually, the operator must determine, by the observation of normal indications, that the transmitter is properly tuned and ready to transmit intelligence. Refer to paragraph 3-4 b for intelligence operation.

This completes the manual tuning sequence.

TABLE 3-5. OPERATING MODES AND CARRIER LEVELS

Operating Mode	Classification	Switch Setting	Carrier Level (Watts)
CW	A1	0	500
AME	A3H	6	125
SSBRC	A3A	16	35
SSBSC	A3J	FULL	0

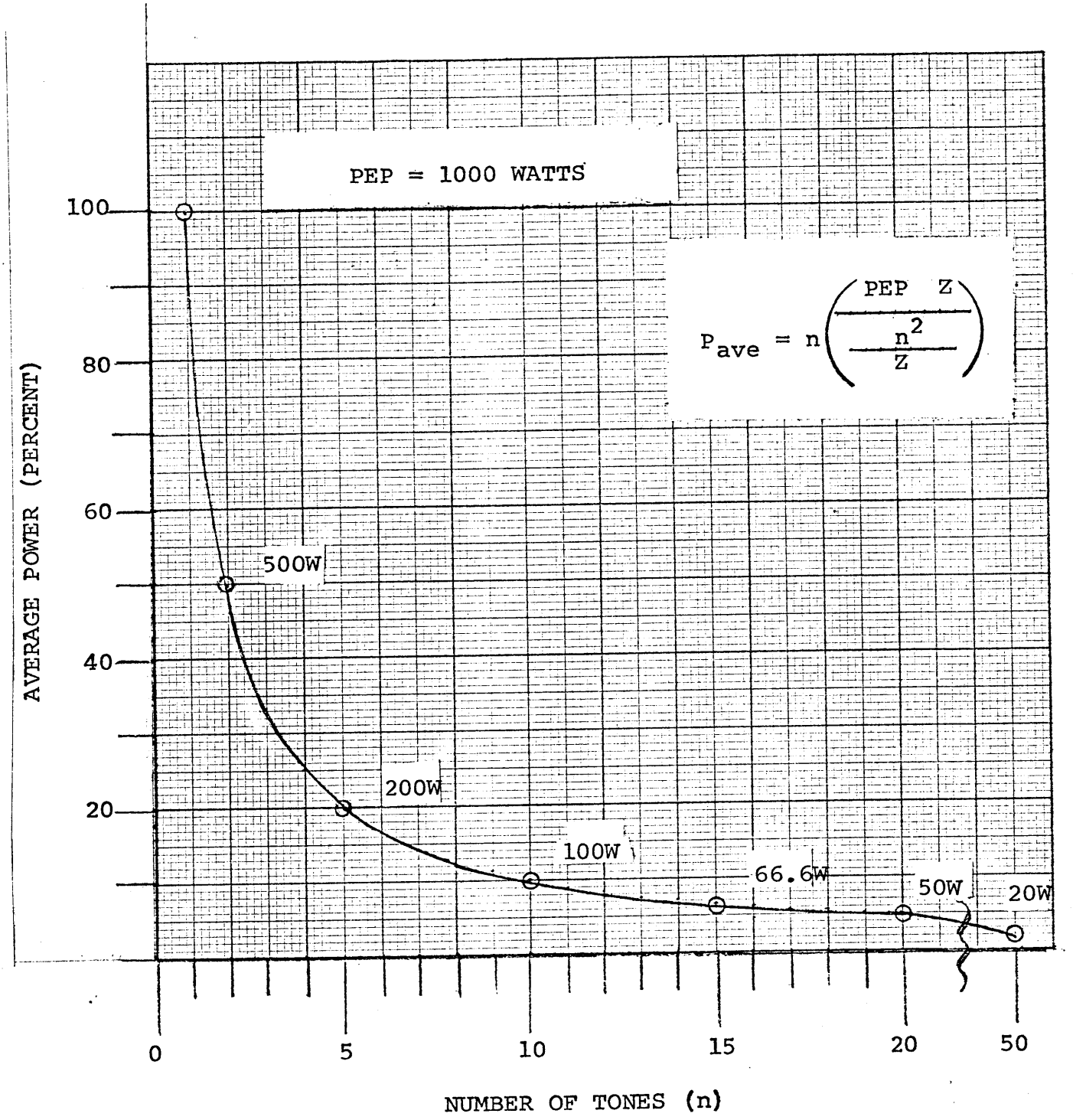

Figure 3-1. Ratio of Average Power to PEP as a function of tones

b. OPERATING PROCEDURES FOR INTELLIGENCE MODES. The intelligence mode in which the GPTA-1KJ transmitter is operated is determined by the type of intelligence to be transmitted and by local conditions. The operator should be familiar with the capabilities and limitations of the transmitter in each of the operating modes. The transmitter is capable of delivering 1 KW of peak envelope power (PEP) or 500 watts average power (P_{ave}). When the transmitter is initially tuned on carrier, PEP and P_{ave} are equal since all of the power is contained in a single tone, the carrier. This power level is indicated on the OUTPUT meter, an average power indicating device. In voice or other multitone transmissions however, PEP and P_{ave} are NOT equal. The PEP value is inherent in the design of the equipment. The average power is derived from the addition of the carrier power and the power of each individual modulating tone when the carrier and the tones are in phase or at the crest of the modulation wave. The transmitter is capable of providing 1 KW peak envelope power in all intelligence modes; however the average power, the power monitored on the OUTPUT meter, must be decreased in multitone transmission.

The more tones (teletype tones, carrier, voice, etc.) which are being transmitted, the less average power, as indicated on the OUTPUT meter. Figure 3-1 shows average power (measured in percent of peak envelope power) as a function of the number of tones being transmitted.

Two typical examples of proper operation, utilizing the relationship shown in figure 3-1, are given as follows:

(1) A single sideband transmission of two teletype tones with suppressed carrier at the full power level (1,000 watts PEP): The MMX(A)-2 MODE switch should be in the USB position and the CARRIER SUPPRESSION switch in the FULL position, providing full suppression of carrier. The transmission contains two tones, and by reference to figure 3-1 the maximum average power should be approximately 50 percent of the 1,000 watt PEP, or 500 watts average. The USB audio level control on the MMX(A)-2 should be adjusted so that the transmitter OUTPUT meter reads approximately 500 watts average.

(2) AME transmission of voice at the 800 watts PEP power level: The MMX(A)-2 MODE switch should be in the USB position and the CARRIER SUPPRESSION switch in the 6 db position, providing carrier suppression of 6 db from PEP, or approximately 200 watts (1/4 power). PEP is derived from the addition of carrier voltage and tone voltages. With carrier suppressed 6 db from PEP, the carrier voltage is already one half of the total voltage at PEP. The sum of the tone voltages must not exceed the remaining one half of the total voltage at PEP. Similarily, since the carrier voltage and the voltage available for tones are equal, so are the carrier power and the total tone power available. A maximum of approximately 200 watts PEP is available for tone transmission. A voice transmission contains an infinite number of tones, and by reference to figure 3-1, the average power for an infinite number of tones should be approximately 10% of 200 watts (20 watts). The CARRIER SUPPRESSION switch in the 6 db position will provide approximately 200 watts on the transmitter OUTPUT meter, and the USB audio level control on the MMX(A)-2 should be adjusted so that the transmitter OUTPUT meter reads approximately 220 watts average (the addition of carrier and intelligence power).

It is important that the exciter's intelligence levels be adjusted properly for the approximate average power on the OUTPUT meter, so that the transmitter's peak envelope power rating will not be exceeded. The transmitter also features automatic load and drive control (ALDC) circuits, which perform the function of limiting the exciter output during high modulation peaks, so that the transmitter's PEP will not be exceeded. The average power (P_{ave}) will also vary in different operating modes as does the carrier power (Pc).

In the conventional AM mode the carrier power (Pc) is limited to one fourth of the maximum avaiable power so that at the peak of the modulation cycle the design rating will not be exceeded resulting in distortion or exceeding component specifications. This is accomplished by suppressing the carrier 6 db. In the GPTA-1KJ transmitter this limits the carrier power to 250 watts.

For similiar reasons when transmitting a multitone signal (voice for instance) in a SSB mode the average power (P_{ave}) should not exceed 10 percent of the rated PEP.

Before operating the transmitter in the intelligence modes recheck the tuning as outlined in table 3-3. If the operating frequency is not to be changed, do not perform step 3 but check the frequency setting. Steps 1 thru 11 of table 3-2 outline the procedure for applying power to the transmitter. Connect the external signal source to the transmitter. If a microphone is used set the EXCITER switch on the MMX(A)-2 to the PTT position.

c. MONITORING THE TRANSMITTER. Perhaps the most practical method of ensuring that the design limits of the transmitter are not exceeded, while making the most efficient use of the power available to transmit intelligence, is to monitor the rf voltage output of the transmitter. Peak envelope power (PEP) is a direct function of that voltage as expressed in the following formula:

$$\text{Epev (or Emax)} = \sqrt{\text{PEP} \bullet Z}$$

where

Z=resistive impedance load of the antenna system.

This value (Z) remains constant, and is assumed to be 50 ohms.

The rf output voltage may be measured with an oscilloscope. To monitor the rf output voltage proceed as follows:

(1) Using the oscilloscope, monitor a sample of the transmitter's rf output.

(2) Set the MODE switch on the MMXA-2 exciter to the CW mode and close the keyline. (In this mode the average power and the PEP will be equal).

(3) Apply power to the transmitter (refer to table 3-2 steps 1 through 11).

(4) Adjust the RF OUTPUT control on the MMX(A)-2 unit so that the OUTPUT meter indicates the desired output power level but does not exceed the 1 KW rated power level.

(5) Adjust the oscilloscope controls so that the amplitude of the oscilloscope pattern is set at an easily measured or observable value, i.e. two vertical scale units.

NOTE

The oscilloscope display is indicative of Epev or Emax.

(6) Set the MODE switch to the desired operating mode.

(7) If carrier is to be transmitted, adjust it to its proper level.

(8) Continue to observe the oscilloscope display and adjust the audio gain (MIKE/LINE) control (s) as necessary so that the maximum value of Epev (established in step 3) is not exceeded.

NOTE

Do not readjust the oscilloscope controls unless the base measurement of Epev is maintained.

(9) The transmitter may be operated in any intelligence mode without exceeding the design limitations, providing that the maximum voltage output (Epev) is maintained within the established limit.

3-5. OPERATOR MAINTENANCE PROCEDURES

Day-to-day visual checks of the equipment will detect the most obvious defects; frayed cables, blown fuses, burned-out indicator lamps, cracked glass or broken knobs. A more thorough visual inspection including those components housed in the equipment cabinet should be made at regular intervals. Components showing signs of wear, aging or overheating should be noted and replaced if necessary. Accumulated dust or other foreign material should be removed. A regular program of operator care and the repair or replacement of defective minor parts may prevent serious failures and unnecessary "downtime".

CAUTION

Replacement parts should be identical to the part being replaced to ensure proper operation.