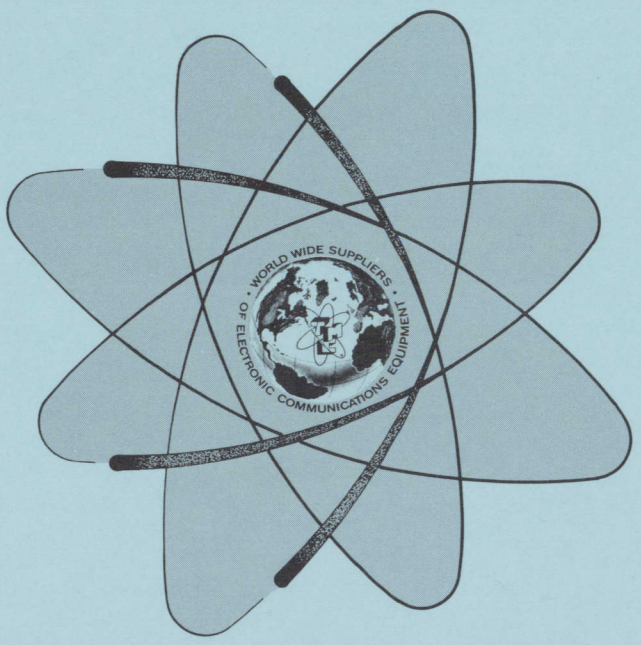
SERVICE MANUAL

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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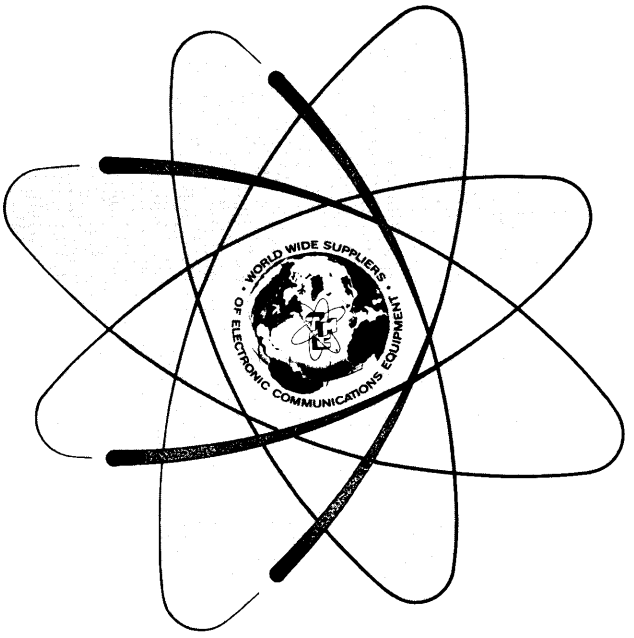

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THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

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

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

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

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

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

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

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

*Electron tubes also include semi-conductor devices.

RECORD OF CORRECTIONS MADE

Change No.	Date of Change	Date Entered	Entered By

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PRINCIPLES OF OPERATION

4-1. GENERAL INFORMATION

The Technical Materiel Corporation Model GPTA-1KJ transmitter is composed of three basic units; a Model MMX(A)-2 exciter, a Model HFL-100 linear amplifier, and a Model TMA-1K power amplifier. Either one or both of the available optional accessory equipments, a Model ATSA-3 antenna tuning system or a Model TFP-1K harmonic filter, may be added to enhance the performance of the basic transmitter. The antenna tuning system is the most common addition, and will therefore be included in this discussion of transmitter operation. All of the modular units except the tuning unit of the antenna tuning system are mounted in a single equipment cabinet. They are electrically interconnected to provide a stable output signal of 500 watts average power at any frequency between 2.0 and 29.9999 MHz.

Specific circuit data for each of the units which comprise the transmitter will be found in the individual technical manuals. This section refers to the subsystems only insofar as they effect the overall system operation.

4-2. SYSTEM OPERATION

The functional interconnections of the GPTA-1KJ are illustrated in the block diagram, figure 4-1. the frequency at which the transmitter will operate, and the mode of operation are manually selected at the multi-mode exciter. Normally the other units of the system are automatically tuned to match the selected carrier frequency but each may be manually tuned if required.

a. Frequency Bandswitching. A 24 vdc signal voltage developed in the power supply circuit of the TMA-1K amplifier is reduced to about 20 vdc and routed from pin 7 of TB101 to pin M of jack J119 of the MMX(A)-2 exciter. After passing through the frequency selector switches the signal is rerouted to the TMA-1K via J119 pins C through K. Each of these pins corresponds to a specific frequency band. They are connected to TB101 of the amplifier terminals 8 through 15.

TABLE 4-1. BAND SIGNALS FROM THE MMX(A)-2

MMX(A)-2 J119	Frequency Band	TMA-1K TB101
C	2.0 - 2.5999	15
D	2.6 - 2.9999	14
E	3.0 - 4.9999	13
F	5.0 - 7.9999	12
G	8.0 - 11.9999	11
H	12.0 - 15.9999	10
J	16.0 - 23.9999	9
K	24.0 - 29.9999	8

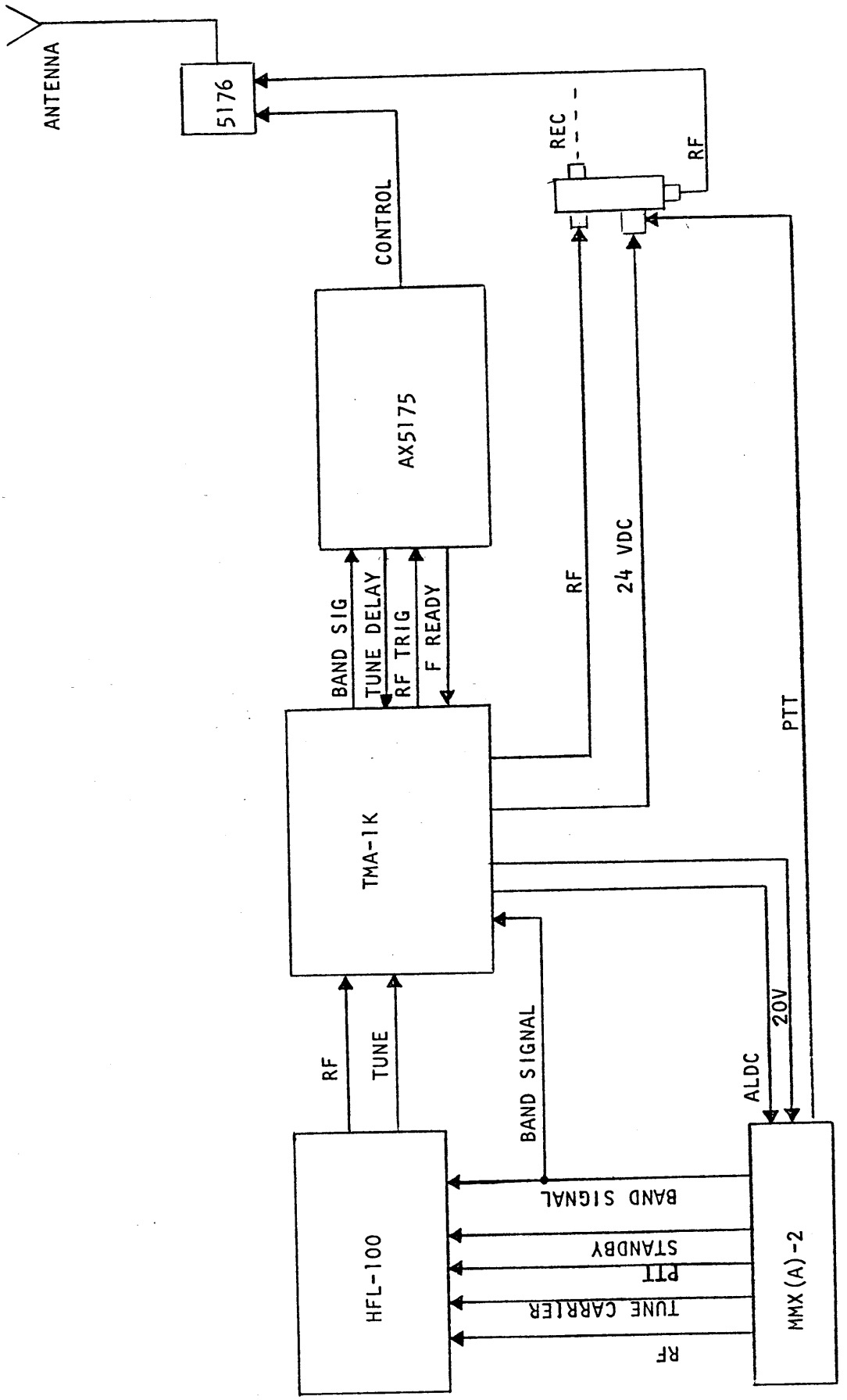

Figure 4-1. Block Diagram - GPTA-1KJ

in the control unit to pins A and B of J119 of the exciter. In the exciter selector switch circuit, various values of resistance are added as determined by position of the 100 KHz switch. The signal is then rerouted to the control unit via pins L and N of the exciter jack J119 and the control unit connector J104 pins T and U. This adjusted signal enables the control unit to properly position the tuning elements in the tuning unit while operating in the two lowest frequency bands (2.0 - 3.0 MHz).

b. Tuning Sequence. When the GPTA-1KJ transmitter is set for automatic operation, the tuning sequence is initiated by pressing the RESET pushbutton on the TMA-1K panel. The inductance and capacitance tuning components within the antenna tuning unit preposition for the selected frequency. During this prepositioning cycle the transmitter is held in a standby mode by removing the grid voltage from the tubes in the HFL-100 unit. Once the prepositioning is accomplished, the P POS indicator on the control unit (AX5175) lights and the grid voltage is re-applied. The servo system in the TMA-1K furnishes a path to ground for the coil of the tune relay, K104, in the MMX(A)-2 exciter and the tune carrier voltage is supplied to the system. With the grid voltage re-applied, there is an indication of plate current on the Ip meter of the HFL-100 amplifier.

When the RF OUTPUT control on the MMX(A)-2 exciter is adjusted to increase the plate current of the PA tubes in the TMA-1K amplifier to a tune level of 300 ma, the "sense" circuit of the amplifier causes the servo system circuit to direct the rotation of the tuning motor, adjusting the variable tuning capacitor until resonance is achieved. At resonance an rf trigger signal is transmitted to the AX5175 tuning control of the antenna tuning system. This signal initiates the tuning cycle of the system. When this cycle is complete, and maximum rf output has been achieved by the automatic repositioning of the amplifier tuning capacitor, the RDY indicator on the AX5175 lights and a signal indicative of this condition is transmitted to the TMA-1K amplifier. Instantly the READY indicator on the panel lights and transmitter power may be increased to the proper level. The tune carrier circuit is deactivated, the ALDC is activated, and the system is prepared to receive intelligence. If the transmitter is in the PTT mode the PTT line is opened for external control.

c. ALDC Circuitry. The automatic load and drive control circuit of the TMA-1K amplifier develops a small negative voltage that is sent via output jack J104 to the MMX(A)-2 exciter input jack J125. In the exciter it is summ d with the internal ALDC voltage on the RF Output Assembly board Z115. The resulting signal is internally transmitted to the Translator Assembly board Z112 where it is used to control the gain of the 13.0 to 13.5 MHz and the 13.5 to 14.0 MHz amplifiers thus improving linearity and limiting distortion by eliminating peaks and surges in the rf signal. The rf output level at which the ALDC circuit will function is adjusted by means of a front panel control.

This 20 vdc signal coming into the TMA-1K triggers an SCR, Q101, which causes a ledex motor to rotate the bandswitch in the amplifier to position which corresponds to the selected frequency. The correct values of inductance and capacitance are inserted in the rf circuit by positioning the bandswitch.

The 20 vdc signal voltage is also routed to the HFL-100 amplifi r where it controls the positioning of the bandswitch of that unit in a similar manner. The signal voltage enters the HFL-100 via terminal board TB101 terminals 5 through 12. Table 4-2 describes this interconnection.

TABLE 4-2. BAND SIGNALS TO THE HFL-100

TMA-1K TB101	Frequency Band	HFL-100 TB101
8	24.0 - 29.9999	5
9	16.0 - 23.9999	6
10	12.0 - 15.9999	7
11	8.0 - 11.9999	8
12	5.0 - 7.9999	9
13	3.0 - 4.9999	10
14	2.6 - 2.9999	11
15	2.0 - 2.5999	12

Positioning the bandswitch of the TMA-1K amplifier provides a frequency band signal to the control unit (AX5175) of the ATSA-3 antenna tuning system. The 24 vdc signal voltage is routed through the bandswitch to connector J102 pins 1 through 9 and then to connector J104 of the AX5175. This connection is described in table 4-3.

TABLE 4-3. BAND SIGNALS FROM THE TMA-1K

TMA-1K J102	Frequency Band	AX5175 J104
2	2.0 - 2.5999	A
3	2.6 - 2.9999	B
4	3.0 - 4.9999	C
5	5.0 - 7.9999	D
6	8.0 - 11.9999	E
7	12.0 - 15.9999	F
8	16.0 - 23.9999	G
9	24.0 - 29.9999	H

In addition to providing bandswitching information to the AX5175, the 24 vdc signal voltage is used as an adjusted supplementary input signal to the AX5175 control unit. The signal is routed from pins A and B of J104

SECTION 5

MAINTENANCE

5-1. INTRODUCTION

The elimination of shutdowns caused by equipment failures was a prime consideration in the design of GPTA-1KJ transmitter by The Technical Materiel Corporation. Therefore, long-term, trouble-free operation may be expected when the recommended preventative maintenance schedule is followed. Should alignment or adjustment become necessary, it is recommended that only technicians familiar with the equipment perform the operations described in the technical manuals prepared for each of the modular components of the system. Reference to the block diagram (figure 4-1) and to the interconnecting wiring diagram (figure 5-1) will assist the technician in solving any system problem which might arise.

5-2. TEST EQUIPMENT

The test equipment listed in table 5-1 will be helpful in testing and maintaining the transmitter.

TABLE 5-1. TEST EQUIPMENT

Equipment	Type
Signal Generator:	Hewlett-Packard Model 606A, or 606B or equivalent.
VTVM:	Hewlett-Packard Model 410B, or equivalent.
Multimeter:	Simpson Model 260, or equivalent.
Oscilloscope:	Tektronix Model 541A, or equivalent.

Additonal test equipment which may be necessary is listed in the individual technical manuals for system components.

5-3. PREVENTIVE MAINTENANCE

The day-to-day external checks for dirt and deterioration, and recommended weekly internal inspection, fall well within the scope of operator responsibilities. A program set up to discover potential sources of trouble, keep the equipment free from the destructive effects of grit, grime or grease

and the immediate correction of minor flaws will ensure that maximum availability of the GPTA-1KJ transmitter. The individual technical manuals for each of the modular units which comprise the GPTA-1KJ describe the normal operation and give the normal indications which should be obtained on the monitoring instrumentation. Abnormal readings should not be overlooked, but the cause determined and the reason eliminated or corrected.

5-4. CORRECTIVE MAINTENANCE

Corrective maintenance is that which must be accomplished should a part or component need replacement or a failure occur. In most cases this work should be undertaken only by a trained technician familiar with the quipment.

Should a failure occur, isolate the fault to a specific modular component. Then troubleshoot that unit as described in the unit technical manual.

WARNING

High voltages will be encountered at several locations in the GPTA-1KJ transmitter. Extreme caution is mandatory when servicing the transmitter or its components.

The operator and technicians working with the transmitter must know the locations within the units where high potentials exist. Source power should be removed from the transmitter before any leads or cables are disconnected.

WARNING

When source power is removed, unplug the main input connector and tag to prevent any inadvertant reconnection.

To isolate the modular units from the transmitter proceed as described in the following paragraphs. Refer to figure 5-1 for reference designation of the connections.

a. The MMX(A)-2 Exciter

(1) Remove all power from the unit and set all switches to an off position.

(2) Disconnect P114 from J124 (RF OUT).

(3) Connect a 50 ohm, 1 watt non-inductive dummy load to J124.

(4) Disconnect P104 from J116 (Power).

(5) Provide power to J116 from an external source independent of the transmitter.

(6) Refer to the technical manual prepared for the MMX(A)-2 for maintenance procedures.

b. The HFL-100 Amplifier.

(1) Remove P101 from the AC terminal strip in the transmitter and set switches to the OFF position.

(2) Remove P203 from J103 (RF OUT).

(3) Remove P201 from J101 (RF IN).

(4) Connect a 50 ohm resistive dummy load or antenna system to J103.

(5) Connect an rf signal generator to J101.

(6) Provide primary power to P101 independently of the transmitter.

(7) Refer to the HFL-100 technical service manual for power distribution data and the operators manual for normal indications.

c. The TMA-1K Power Amplifier.

NOTE

The TMA-1K requires a 50 watt rf input. It is suggested that a properly adjusted HFL-100 amplifier be used as this source.

(1) Place all switches in an OFF position and remove P101 from J101 (PWR IN).

(2) Remove RF RELAY XMIT plug from J105 (RF OUT).

(3) Connect a 1 KW, 50 ohm non-inductive dummy load to J105.

(4) Remove P103 from J103 (RF IN).

(5) Connect a 50 watt rf source to J103 (RF IN) independent of the transmitter harness.

(6) Provide primary power to J101 (PWR IN) independent of the transmitter.

(7) Refer to the technical manual prepared for the TMA-1K for maintenance data.

d. The ATSA-3 Antenna Tuning System. Primary power for the ATSA-3 system is furnished through the transmitter system wiring harness at pins P, R and S (S is gnd) of J104 by plug P106. It is therefore, tested and aligned when part of the system. It should however, be isolated when troubleshooting the other system components in a system configuration.

To isolate the ATSA-3 system

(1) Set AUTO/SENSE/P. POS switch to P. POS.

(2) Set ON/AC switch to AC (off) position.

(3) Remove the XMIT connector from the Transmit/Receive relay Model RL139 and connect it to a 50 ohm 1 KW resistive dummy load.

For detailed alignment and maintenance procedures refer to the technical manual prepared for the ATSA-3 system.

SECTION 6

PARTS LIST

6-1. GENERAL

The GPTA-1KJ transmitter consists of the MMX(A)-2 exciter, the HFL-100 linear amplifier and the TMA-1K power amplifier. To these basic units may be added either the ATSA-3 antenna tuning system or the TFP-1K harmonic filter or both. A technical manual has been prepared for each of these equipments. Each contains a parts list for the specific unit to which reference should be made when ordering renewal parts.