KENDECOM MT450-B TRANSMITTER

OPERATING MANUAL

134 - 174 MHz

Kendecom Incorporated
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CONTENTS

DESCRIPTION

The MT450-B is a solid-state FM transmitter capable of operating on any crystal controlled single frequency in the 134 - 174 MHz range. The MT450-B is engineered for high reliability to provide maintenance free coperation in continuous duty repeater and base station applications. The transmitter may be arranged to operate at output power levels of 2 watts or 25 watts.

Transmitter circuitry is contained on two printed wiring boards mounted in a 17.8 mm (7 inch) by 18.4 mm (7 1/4 inch) by 5 mm (2 inch) aluminum enclosure. One circuit board contains audio, modulator, oscillator, multiplier, and driver circuitry plus the low power (2 watt) amplifier. The second board contains the high power (25 watt) TMOS power FET amplifier. All input leads and non-RF output leads entering the transmitter enclosure are bypass filtered with individual feedthrough capacitors. The RF output signal is delivered via an enclosure mounted coaxial connector.

Notices

Versions of the MT450-B transmitter are type accepted under FCC regulations parts 90 and 95. An authorized station licensed is required for operation in services governed by those regulations. FCC regulations should be consulted to determine whether installation and adjustment of the transmitter must be done by a licensed radio technician.

Kendecom Incorporated limits its liability with respect to the ownership and operation of this equipment as described in the warranty section of this manual. By installing and/or operating this equipment the owner signifies acceptance of these limitations.

1. SPECIFICATIONS

Frequency range:	134 - 174 MHz
Power Output:	2 watts in low power mode 30 watts in high power mode
Output amplifier:	TMOS FET in high power mode capable of withstanding infinite VSWR
Frequency control:	Parallel resonant crystal (32 pf load capacitance, HC-25/U holder). Proportional oven used in FCC type accepted versions.
Multiplication ratio:	12
Frequency stability:	+/- 0.0005 % (-30°C to + 60°C)
Harmonic output:	Greater than 65 dB below rated output
Spurious output:	Greater than 70 dB below rated output
Noise output:	More than 90 dB below rated output in high power mode at 600 KHz from output frequency
Modulation:	Direct frequency modulation. Deviation adjustable 0 - 7 kHz
Audio response:	Within +2 / -3 dB of EIS standard 6dB/octave pre-emphasis from 300 Hz to 2700 Hz Less than 2% distortion
Power requirements	+12 VDC, 0.3 A, +28 VDC, 1.3A
Duty cycle:	Continuous
Emission designator:	5F3

2. INSTALLATION

2.1 Operating Location

Reliability of the MT450-B will be enhanced by selecting a location which will not subject the unit to extreme environmental conditions. The location should be chosen such that the unit will not be exposed to moisture or corrosive atomospheres.

2.2 Mounting

The MT450-B may be mounted in any position. The mounting arrangement should allow sufficient clearance so that internal adjustments can be accessed by removing the unit top cover. In most applications the transmitter enclosure provides sufficient heat sinking. In those cases where ventilation is inadequate, the transmitter enclosure should be mounted firmly to an equipment rach panel or other supplemental heat sink to insure that the transmitter internal ambient temperature does not exceed 60^{o} C.

Four mouniting studs are provided on the bottom of the transmitter enclosure for holding the unit in place. The mounting studs accept standard 8-32 machine screws.

2.3 Connections - General

Non-RF connections should be made to the feedthrough capacitor terminals and ground terminal on the side of the transmitter enclosure. Connections may be made by soldering directly to the terminals. RF output is taken from a coaxial connector also located on the side of the transmitter enclosure. Locations of the terminals and coaxial connector are shown in figure 1.

Connections to the MT450-B should be done in accordance with applicable electrical safety codes and ordinances. In particular, electrical safety codes should be consulted to determine appropriate means for grounding, fusing, and lightning protection.

2.4 Power Connection

Power for the MT450-B should be supplied from well-filtered DC power sources with maximum noise and ripple voltages not exceeding 1% of the specified DC voltage. The power source should be arranged for negative ground operation. Connections should be made to the power input terminals as shown in table 2.1. If the power supply has a maximum current limiting feature, the current limits should be set to the values given in the table; otherwise, the power connections should be fused to limit the mximum current to the values given in the table.

[Note: The power supply input should be disconnected so that power is not applied to the transmitter at this time.]

Connect the power supply positive voltage outputs to the transmitter terminals as shown in the table and connect the power supply negative output terminal to the transmitter ground terminal. Connections must be made with the correct polarity otherwise the transmitter and/or power supply may be damaged.

Table 2.1

Terminal	Input voltage	Input current
TB4	+ 12 V	500 mA
TB2	+ 24 V	1.5 A
TB1 (lug)	Ground	

[Units arranged for use in Kendecom Mark 4 repeaters have switched +12 volts applied to terminal TB5. This voltage input is described in section 2.7]

2.5 RF Output

RF output from the transmitter is taken from coaxial connector **J1**. Connection should be made from connector **J1** to a 50 Ohm coaxial cable terminated in a male UHF-type connector. For proper operation the load impedance should have a VSWR less than 1.5:1.

2.6 Audio Input

Audio input should be applied at an amplitude of approximately 500 millivolts peak-to-peak from a nominal 600 Ohm source. Connect the audio input to transmitter terminal **TB6**. Shielded wire should be used for making this connection with the shield connected to ground lug **TB1**.

Grounding arrangements in some installations may create ground loops which can cause hum and noise pickup on the wiring between the audio source and the MT450-B. In these cases hum pickup can sometimes be eliminated by grounding the audio cable shield at the audio source only and not at the MT450-B. In cases where the audio source is separated from the transmitter by a long distance, noise pickup can often be eliminated by connecting the shield to transmitter ground terminal **TB1** through a small capacitor (of about .001 uF.)

2.7 Control

Transmitters, except for those used in Kendecom Mark 4 repeaters, are controlled by applying a ground to push-to-talk (PTT) input terminal **TB5**. Applying a ground to **TB5** causes the transmitter to operate, and applying +12 volts or an open circuit to **TB5** stops the transmitter from operating.

Transmitters arranged for use in Kendecom Mark 4 repeaters use a different means of control. For these units, the transmitter is activated by applying a switched +12 volt input to terminal **TB5**, and it is deactivated by removing the switched voltage.

2.8 CTCSS (optional)

In applications where Continuous Tone Coded Squelch (CTCSS) is used, audio from an external CTCSS encoder should be applied to transmitter terminal **TB7**. The signal applied to this input must be a single frequency tone with a sinusoidal wavefrom having less than 10% distortion. The signal applied to terminal **TB7** should have an amplitude of approximately 0.25 Volts rms.

3. ADJUSTMENTS

3.1 Initial Adjustments

The MT450-B transmitter is completely aligned and tested prior to shipment from the factory, so field adjustments are not normally needed before placing the transmitter into service. However, as a precaution the transmitter frequency and deviation should be checked to verify that these adjustments where not affected in shipment. Procedures for checking deviation and frequency are given in sections 3.2 and 3.4 respectively.

3.2 Deviation Adjustment

The modulation level was adjusted prior to shipment from the factory to provide 4.8 kHz deviation. The transmitter limter will allow this full deviation level to be reached on voice peaks over a wide range of audio input levels. Transmitter deviation may be adjusted as follows:

Test equipment required:

-> 600 Ohm sinewave audio oscillator
-> Communications test set or modulation meter
-> 50 Ohm RF dummy load

Procedure:

1. Remove the four screws holding the transmitter top cover and remove the cover to allow access to the DEVIATION ADJUST potentiometer (R20).

2. Connect the audio oscillator to transmitter terminals **TB6** (audio) and **TB1** (ground.) Adjust the audio oscillator to provide a 200 mV rms. 1000 Hz output signal.

3. Connect the dummy load to transmitter RF output jack **J1**.

4. Apply DC voltages and a push-to-talk control voltage to the transmitter.

5. Measure the transmitter deviation using the modulation meter. Switch the modulation meter to measure both positive and negative deviation values.

6. With the aid of figure 2, locate the DEVIATION ADJUST potentiometer (R20). Use a fine bladed screw driver to set the potentiometer to obtain 5 kHz deviation for the modulation polarity which gives the highest reading on the modulation meter.

7. This completes the adjustment. Remove voltages from the transmitter and replace the unit top cover. Reconnect the antenna and actual audio source. Adjust the audio source level as described below.

3.3 Audio Level Adjustment

Input audio level should be adjusted so that occassional voice peaks produce a full 5 kHz deviation. The transmitter limiter will prevent over modulation in the event that excessive audio levels are applied; however, improper audio level settings may degrade performance by increasing background noise levels and by increasing distortion. Input audio level may be set by adjusting the audio source while directly measuring transmitter deviation as follows:

Test equipment required:

-> 50 Ohm RF dummy load
-> Communications test set or modulation meter

Procedure:

1. Connect an amplified microphone or equivalent 600 Ohm audio source to transmitter terminals **TB6** (audio) and **TB1** (ground).
2. Connect the dummy load to transmitter RF output **J1**.
3. Apply DC voltages and a push-to-talk control voltage to the transmitter.
4. Speak into the microphone in a normal voice.
5. Measure the transmitter output using the modulation meter. Switch the modulation meter to measure both positive and negative deviation values.
6. Adjust the audio level so that occassional audio peaks indicate 5 kHz deviaton. Audio level must be adjusted by changing the amplitude of the audio source. Audio level CANNOT be adjusted using the transmitter deviation potentiometer.
7. This completes the audio level adjustment.

3.4 Frequency Adjustment

Transmitter frequency is adjusted at the factory before shipment, but it is prudent to check the frequency before placing the unit in service. Frequency should be checked whenever the crystal or any other oscillator circuit component is replaced.

Test equipment required:

-> Frequency counter with 2ppm, or better, accuracy
-> 50 Ohm RF dummy load

Procedure:

1. Remove the four screws holding the transmitter top cover and remove the cover.
2. Connect the transmitter RF output (**J1**) to a dummy load.
3. Apply +12 volts to transmitter termina TB4. Wait at least 2 minutes for transmitter component temperatures to stabilize.
4. Loosely couple an insulated wire loop from the frequency counter to the transmitter harmonic filter.
5. Apply ground to terminal **TB5** (On transmitters arranged for use in Kendecom Mark 4 repeaters apply + 12 volts to terminal **TB5**.)
6. Rotate capacitor C27 using an insulated tuning tool to set the transmitter to the correct frequency as indicated on the frequency counter.
7. This completes the transmitter frequency adjustment. Remove the wire loop and replace the transmitter top cover.

3.5 CTCSS Level Adjustment (optional)

In applications where Continuous Tone Coded Squelch (CTCSS) is used, tone encoder amplitude should be adjusted to properly modulate the transmitter. Typically, CTCSS deviation is adjusted to approxilately 0.5 kHz. Transmitter deviation must be adjusted (per section 5.1) before setting the CTCSS level.

Test equipment required:

-> 50 Ohm RF dummy load
-> Communications test set or modulation meter

Procedure:

1. Connect the CTCSS encoder to transmitter terminals **TB7** (tone) and **TB1** (ground).

2. Connect the dummy load to transmitter RF output **J1**.

3. Apply operating DC voltages to the transmitter.

4. Insure that no audio is being applied to transmitter audio input terminal **TB6**.

5. Measure the transmitter deviation using the modulation meter and adjust the CTCSS encoder level to obtain a transmitter deviation of 0.5 kHz.
   DO NOT adjust the transmitter deviation control to set the CTCSS deviation.

3.6 Alignment

The MT450-B transmitter is completely aligned prior to shipment from the factory. Re-alignment should not be necessary unless a component is replaced. Transmitter frequency (see section 3.3) and modulation level (see section 3.1) should be checked following alignment.

Test equipment required:

-> High impedance meter having a 0 - 10 volt scale.
-> 0-2 A current meter
-> RF dummy load
-> RF power meter

Procedure:

1. Remove the four screws holding the transmitter top cover and remove the cover.

2. Connect the transmitter RF output (**J1**) through the RF power meter to the dummy load.

3. Apply + 12 volts to transmitter terminals **TB4**.

4. Apply ground to terminal B (except for units arranged for operation in Kendecom Mark 4 repeaters. For these units apply +12 volts to terminal **TB5**)

5. Connect the voltmeter negative terminal to ground and the positive terminal, in turn, to each test point shown in table 3.4. Adjust the components shown in the table to obtain a maximum reading on the meter. Some interaction may occur so repeat the adjustments as necessary until no further increase can be obtained in the meter reading.

If the transmitter is wired for high power operation (30 watt output), follow steps 5 through 9. If the transmitter is wired for low power operation (2 watt output), skip to step 10.

The following step (step 5) sets the bias voltage of the final amplifier transistor Q101. This adjustment should be needed only if the transistor is replaced.

5. Remove the ground from terminal **TB5**, then apply +18 to +28 volts through the current meter to terminal **TB2**. Connect the voltmeter to bias resistor **R101** and and adjust potentiometer **R103** to obtain a voltage of 3.0 volts.

   [Resistor R101 is mounted on the power amplifier board and may be located with the aid of assembly drawing MCS-PA30. Connect the voltmeter to the end of R101 which is adjacent to potentiometer R103.]

Steps 6 through 8 tune the power amplifier. These steps should be performed when any change is made to the antenna system.

6. Activate the transmitter by connecting +18 to +28 volts through the current meter to terminal **TB2,** and by grounding terminal **TB5** (for units arranged for operation in Kendecom Mark 4 repeaters, apply +12 volts to terminal **TB5**.)

7. Connect the voltmeter to Relative RF Power indication, **TB3**. Adjust capacitors **C101, C102, C104,** and **C105** to obtain maximum reading on the voltmeter. Some interaction may occur, so repeat the adjustments as necessary until no further increase can be obtained in the meter reading.

8. Rotate the Power Amplifier Adjust potentiometer, **R58**, to obtain the desired power output as indicated on the RF power meter. Observe the current meter to insure that the amplifier current does not exceed 1.3 A. Adjust **R58** to decrease the output power, if necessary, to keep the current from exceeding 1.3 A.

9. Replace the transmitter cover. This completes alignment of the transmitter for high power operation.

The following steps should be done to complete the alignment when the transmitter is wired for low power operation.

10. Rotate the power adjust potentiometer, R58, to obtain a power output of 2 watts as indicated on the RF power meter.

11. Replace the transmitter top cover. This completes the alignment.

TABLE 3.4

Test Point	Nominal Voltage	Adjust Components
TP3	4 VDC	L2, C43, L3, C46
TP4	5.6	L4, C52, L5, C54
TP5	3.2	L6, C58, L8, C61
TP6	2.2	L10, C67, L11, C69

4. CRYSTAL

4.1 Crystal Specifications

The transmitter is shipped from the factory with the frequency controlling crystal installed and with the transmitter tuned to frequency. If the transmitter frequency is to be changed, the replacement crystal unit should conform to the following specification:

Crystal frequency = (Transmitter operating frequency) / 12

Operating mode: Parallel resonant, 32 pf load capacitance

Type: High- accuracy, 60°C turnover, HC-25/U holder

4.2 Crystal Replacement

The following describes the procedure to be used for removing and replacing a crystal unit. This procedure involves soldering and desolding components from the transmitter circuit board. Soldering should be done using a fine tipped, temperature controlled soldering iron. Use the minimum heat possible to avoid damaging sensitive components or the transmitter circuit board. A desoldering tool or wick may be helpful to remove excess solder.

1. Remove all power from the transmitter.
2. Remove the four screws holding the transmitter top cover and remove the cover.
3. Remove the four screws holding the exciter circuit board and cartefully lift the board to gain access to the foil side of the board.
4. In FCC type accepted transmitters, locate the crystal proportional oven, **HR1**. (Ovens are not used in non-type accepted units.) Observe the orientation of the oven, then unsolder the two wires holding the oven unit to the circuit board and remove the oven unit.
5. Unsolder the two wire leads holding the crystal unit, **Y1**, and remove the crystal.
6. Solder the new crystal unit in place. Dress the crystal unit leads so they will not be pinched by the oven unit; then replace the oven unit and solder it in place. Position the oven unit in its original orientation.
7. Replace the exciter circuit board and secure it in place with the mounting screws.

This completes the crystal replacement procedure. Refer to section 3.3 to set the transmitter frequency.

5 Low Power Operation

The MT-450B transmitter can be arranged to operate in a low power mode for use in applications where the maximum permitted output power is 2 watts. The wiring changes needed to operate in the low power mode are given below. These wiring changes are made at the factory when the low power option is ordered. The power amplifier board is not used in the low power mode; therefore, the board is not furnished in units which are factory wired for low power operation.

The following procedure converts the transmitter from high power to low power operation. Remove all power from the transmitter before making wiring changes. Cable removal and connection is done by soldering and unsoldering cable from circuit board terminals. Soldering should be done using a fine tipped, temperature controlled soldering iron. Use the minimum heat possible to avoid damaging cables or the transmitter circuit board. A desoldering tool or wick may be helpful to remove excess solder.

1. Remove the coaxial cable connecting from trhe power amplifier board to RF output coaxial connector **J1**.

2. Locate the coaxial cable connecting from terminal **E6** on the exciter board to terminal **E101** on the power amplifier board. Disconnect the end of this cable which is connected to terminal **E101**.

3. Connect the free end of the coaxial cable to RF output connector **J1**.

Power amplifier stage **Q101** is not used in the low power mode; therefore, no power connection should be made to terminal **TB2**. After the above wiring changes are made, the transmitter should be aligned in accordance with the procedure given in section 3.5 for low power operation. As described in that section, Power Adjust potentiometer **R58** should be used to set the transmitter output power to 2 watts.

6. CIRCUIT DESCRIPTION

6.1 Audio Amplifiers

Input audio is applied to the transmitter through feedthru capacitor **TB6** which removes and RF energy present on the input audio wiring. Additional RF bypassing is provided by capacitor **C1**. Audio input impedance is established by 1 kOhm resistor **R1**. Audio signals are amplified in operational amplifier **U1A** which provides a gain of 20 dB. Bias is set by resistive divider **R2** and **R3** to maintain the DC output voltage at a level of 6 volts. Feedback is provided by capacitors C3 to control the amplifier frequency response. Supply voltage decoupling is used to prevent noise pickup with ferrite beads **FB1** and **FB2** providing high frequency decoupling and capacitors **C4** and **C7** providing low frequency decoupling. Audio output from the second stage amplifier is applied to the limiter stage through resistor R9.

6.2 Limiter, and post limiter audio filter

Integrated circuit **U2A** contains an audion amplifier and a variable gain cell which cerves as both a compresser and peak limiter. Input audio is applied to pin 5 of **U2A** and output audio is taken from pin 7. DC feedback is provided by **R11** and AC feedback is provided by **C10** in combination with the internal circuitry of **U2A**.

The gain of **U2A** is determined by the voltage across capacitor C13. At low audio levels, the voltage present on **C13** is small so **U2A** operates as a linear amplifier. The output of **U2A** is sampled and amplified further by dual section amplifier **U3**. The output of **U3** is fed to **Q1**. At high audio levels, **Q1** causes the voltage across capacitor **C1** to increase which, in turn, reduces the gain of **U2A**. The adjustable gain cell in **U2A** operates in a logarithmic manner to accommodate a wide dynamic range of input signals with very low distortion. In typical operation where the transmitter deviation is set to a maximum of 5 kHz, **U2A** will function as a linear amplifier for deviation levels below 4.8 kHz. Compression will begin at the 4.8 kHz level and hard limiting will occur at a level of 5 kHz. In the hard limiting region the output is held constant for input overdrive levels greater than 30 dB.

The output of **U2A** is fed to Deviation Adjust potentiometer R20 and them to the post limiter audio filter consisting of **R21, R22, R23, C15, C16, C17,** and **C19**. The post limiter filter provides a minimum of 18 dB per octave rejection of signals above 3 kHz. The output of the post limiter filter is fed to voltage amplifier **Q2** which drives varactor diode **CR1** to deviate the transmitter frequency.

6.3 Oscillator, buffer

Transistor Q3 and associated components form a Colpitts oscillator. Feedback to sustain oscillation is provided by capacitors **C33** and **C34**. Stable silver mica capacitors are used to maintain a precise feedback ratio. The bvoltage applied to **Q3** is maintained precisely by voltage regulator **VR1**. Oscillator frequencyt is nominally 12 MHz with the exact frequency being determined primarily by crystal **Y1**. Capacitors **C28A, C28B** and variable capacitor **C27** permit the transmitter frequency to be adjusted in a small range around the resonant frequency of the crystal.

Direct frequency modulation is obtained by applying an audio voltage to varactor diode **CR1** which is also placed in series with the crystal. Audio signals are applied to the varactor diode from buffer amplifier **U1B** through resistor **R30**. The applied audio voltage causes a corresponding change in diode capacitance which, in turn, causes deviation of the oscillator frequency.

In FCC type accepted units, crystal **Y1** and varactor diode **CR1** are mounted in a proportional oven which maintains both components at a constant temperature which minimizes the effect of ambient temperature on transmitter frequency.

Output from the oscillator is fed through capacitor **C35** to buffer amplifier **Q4**. The buffer amplifier acts as a constant load to isolate the oscillator from variations in loading as the mulitiplier stages are tuned. A test point, **TP1**, is provided at the emitter of buffer amplifier **Q4**. A nominal bvoltage of 2.2 VDC at this test pont signifies that the oscillator and buffer stages are operating properly.

6.4 Multipliers

Three stages are used to multiply the oscillator fundamental frequency to the final output frequency. The three stages compise a total multiplicaiton ratio of 12. Each stage consists of a transistor followed by a double tuned interstage filter. Double tuning provides high rejection of unwanted harmonics and low sensitivity to temperature variations and component ageing. The three multiplier stages are as follows.

Multiplication ratio	Transistor	Nominal output frequency in MHz	Interstage filter components
3	Q5	36	L2, C43, L3, C46
2	Q6	72	L4, C52, L5, C54
2	Q7	144	L6, C58, L8, C61

Test points are provided at the emitter of each multiplier stage to aid in alignment and troubleshooting. DC voltage measurements made at the test points are used to align the preceding multiplier stage as described in section 3.5

6.5 RF Amplifiers

Amplifiers **Q8** through **Q11** operate at the transmitter output frequency. **Q8** uses a double tuned output filter consisting of **L10, C67, L11,** and **C68** to provide high harmonic rejection. **Q9** is a pre-driver amplifier with a single tuned output network consisting of **L13** and **C74**. Series capacitor **C75** and shunt inductor **FB19** provide impedance matching from the output of **Q9** to the input of driver stage **Q10**. Test point **TP6** is provided at the emitter of **Q10** to aid in the alignment of preceding amplifier stage **Q9**. Transmitter power output level can be set by using **R58** to adjust the collector voltage of **Q9**.

Amplifier **Q10** provides drive to the final low power output stage. **Q10** is tuned by **L16** and **C78** to operate at the transmitter output frequency. Series capacitor **C79** and shunt inductor **FB20** provide impedance matching from the output of **Q10** to the input of amplifier **Q11**.

Amplifier transistor **Q11** increases power to the 2 to 3 watt range. When the transmitter is wired for low power operation, the output power may be set precisely to 2 watts by adjusting the drive level to **Q11**. When the transmitter is wired for high power operation, **Q11** operates at an output level of about 3 watts. The tuned output network of **Q11** consists of inductors **L20** and **L21**, and capacitors **C86, C87,** and **C88**. This output network provides both low pass filtering and impedance matching to a 50 Ohm load.

6.6 Power Amplifier

For high power operation, TMOS FET power amplifier transistor **Q101** raises the transmitter output power to 25 watts. **Q101** operates at a drain supply voltage of +28 volts and a gate bias of 3 volts. The drain supply voltage may be reduced to + 18 volts in applications where a corresponding reduction in power output is desired. To provide the gate bias, voltage regulator **CR102** develops a stabilized reference voltage and potentiometer **R103** compensates for variations in individual transistor characteristics. A stripline filter tuned by capacitors **C101** and **C102** is used at the input of **Q101**. The mechanical arrangement of the stripline causes it to function as a distributed tuned filter. The output of **Q101** is tuned by a similar stripline arrangement operating in conjunction with capacitors **C104** and **C105**. A two section pi filter is used at the output to provide excellent harmonic rejection. The filter consists of inductors **L104, L105** and associated capacitors. Output power is sampled by capacitor **C106** and rectified by diode **CR101** to provide an indication of relative output power level at terminal **TB6.**

6.7 Power Distribution

In non-repeater applications, MT-450B uses two separate power supply inputs: a continuous +12 volt input, and a continuous +28 volt input. The continuous +12 volt supply applied to terminal **TB4** powers buffer amplifier stage **Q4** directly, and is regulated down to +8 volts by **VR1** to power oscillator **Q3** and the proportional crystal oven **HR1** (in FCC type accepted units.).

Multiplier, driver, amplifier, and audio stages are powered from switched +12 volt volts which is derived from the continuous +12 volt supply. Voltage switching is done by switching transistor **Q12** in response to the push-to-talk (PTT) control signal applied to terminal **TB5**. Ground applied to TB5 causes **Q12** to turn on thereby applying switched +12 volts and causing the transmitter to operate. Switching transistor **Q12** is not used in transmitters arranged for operation in Kendecom Mark 4 repeaters. In these units, switched +12 volts is applied directly to terminal **TB5** to activate the transmitter.

The +28 volt supply applied to terminal **TB2** powers output amplifier transistor **Q101**. Transistor **Q101**, and consequently the +28 volt supply, are used only when the transmitter is wired for high power operation. In applications where the transmitter is to be operated at less than full rated output, the voltage applied to terminal **TB2** may be correspondingly decreased to as low as +18 volts.

7. Maintenance

The MT450-B transmitter is designed and consturcted for reliable operation and long life. Periodic maintenance is not required.

If the transmitter fails to operate verify that the proper power supply voltages are being supplied to the unit. Also verify that the transmitter is properly grounded.

The transmitter can be damaged by lightning induced surges. Failure of the transmitter to draw current from the +28 volt supply is and indication that amplifier Q101 may have been damaged by a lightning surge.

Intermittent connections in the antenna system can give the appearance of intermittent transmitter operation. This condition can be evidenced by erratic readings of the final amplifier current as may be especially evident during windy conditions.

If no RF power is obtained from the transmitter, use a DC voltmeter to verify that proper voltages are present at the test points. An improper voltage indicates a fault in the stage being measured or in the preceding stage. Measurements should be made sequentially beginning with test point **TP1**.

Limited Warranty and Conditions

Kendecom Incorporated warrants to the original purchaser that this equipment shall be free of defects in material and workmanship for a period of one year from the original date of purchase.

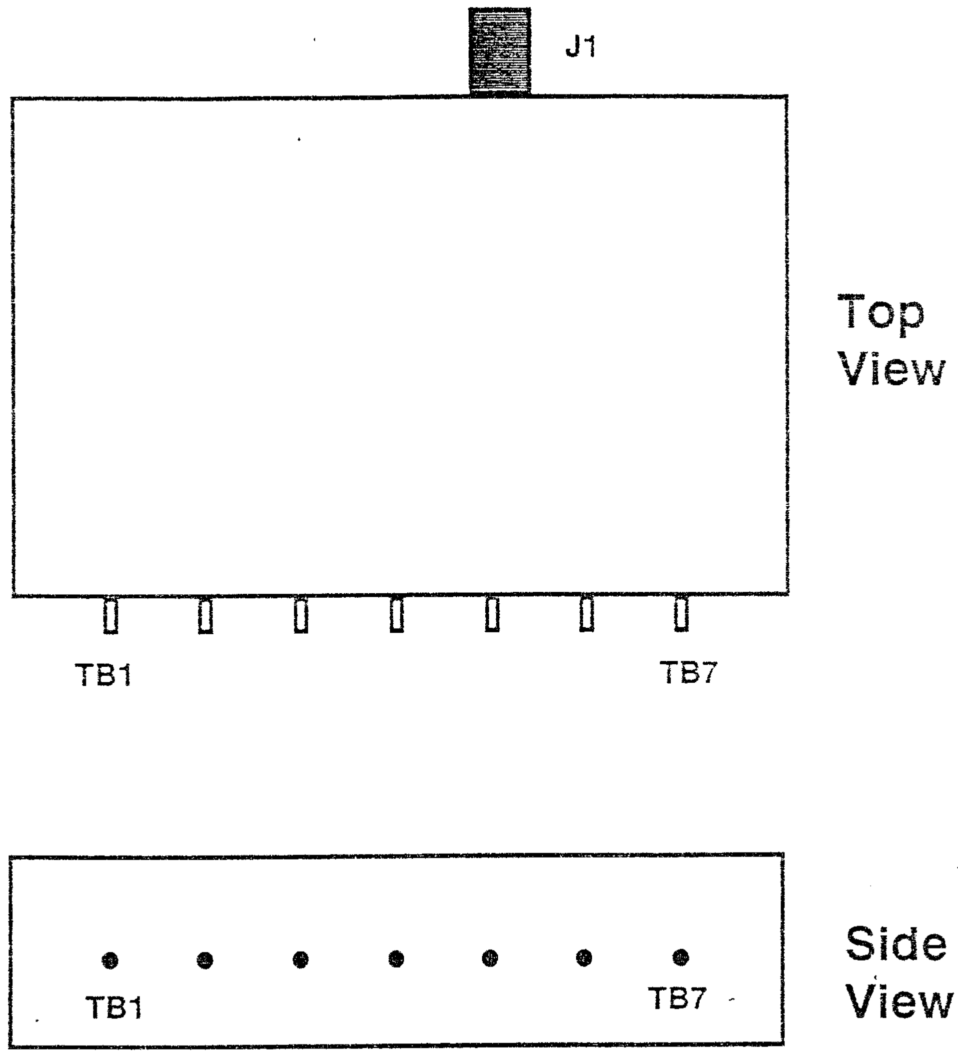
During the warranty period, Kendecom Incorporated will provide any parts neccessary to correct said defects provided that the unit is returned by the original owner intact to us for our examination and provided that our examination discloses that the unit is defective.

This warranty does not apply to any unit which has been subjected to misues, neglect, accident, improper installation, incorrect maintenance, or use in violation of written instructions furnished by us, nor to any unit which has been modified or used with accessories not recommended by us.

The foregoing constitutes the entire obligation of Kendecom Incorporated with respect to this product and no employee of Kendecom, its dealers, or distributors, has the authority to extend this warranty. By accepting this product the buyer agrees that no other remedy for incidental or consequential damages, injury to person or property, or other loss shall be available. Some states do not allow limitations on how long an implied warranty lasts or on consequential damages, so the above limitations may not apply to you.

The installation, operation, and maintenance of this unit may require licensing by the Federal Communications Commission or other regulatory agencies, and may require that adjustments by made by a licensed technician. The proper and legal operation of this unit in accordance with applicable regulations is the responsibility of the owner.

Kendecom Incorporated reserves the right to make changes and improvements to its products without notice and without obligation to install such changes into previously sold units.

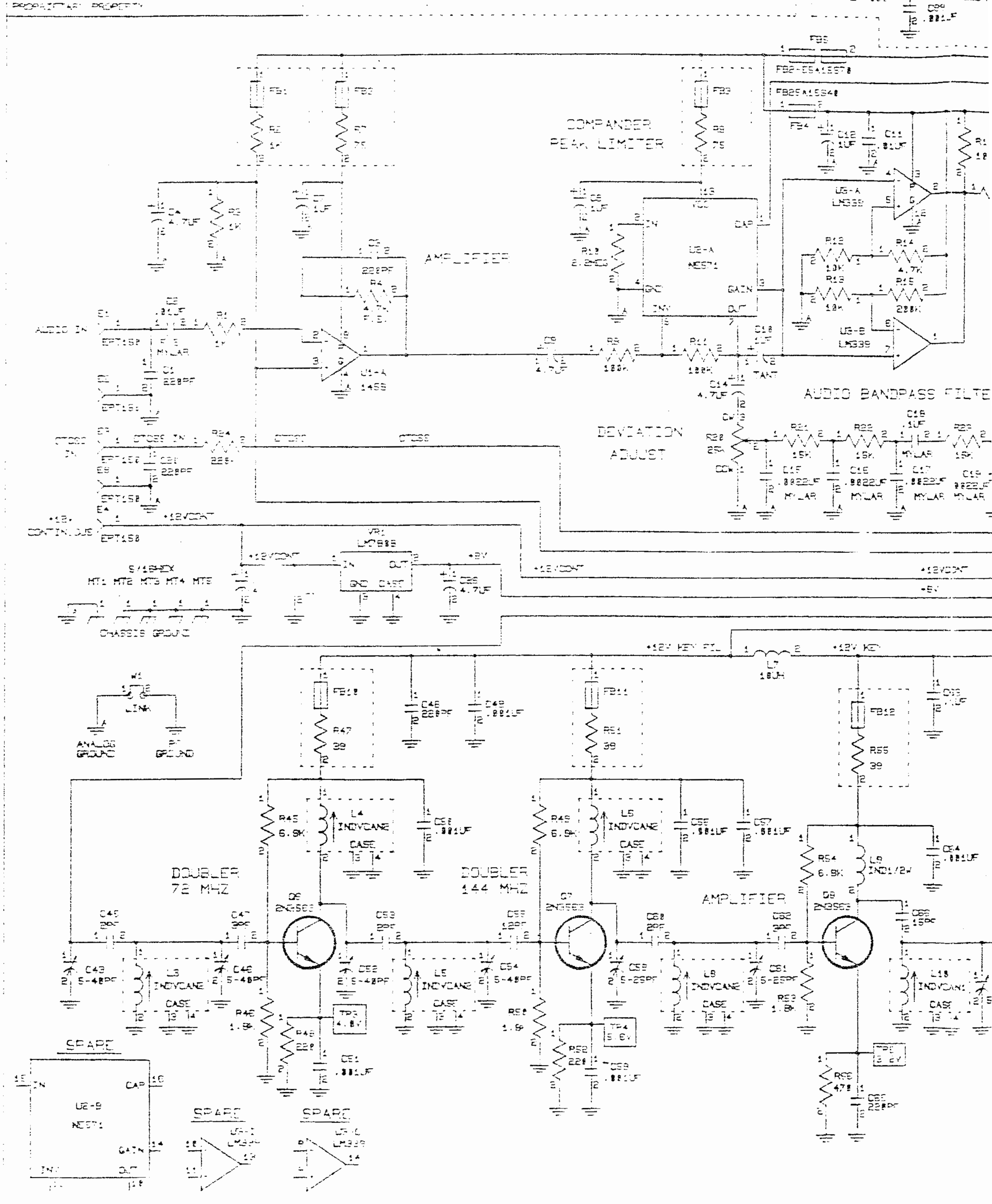


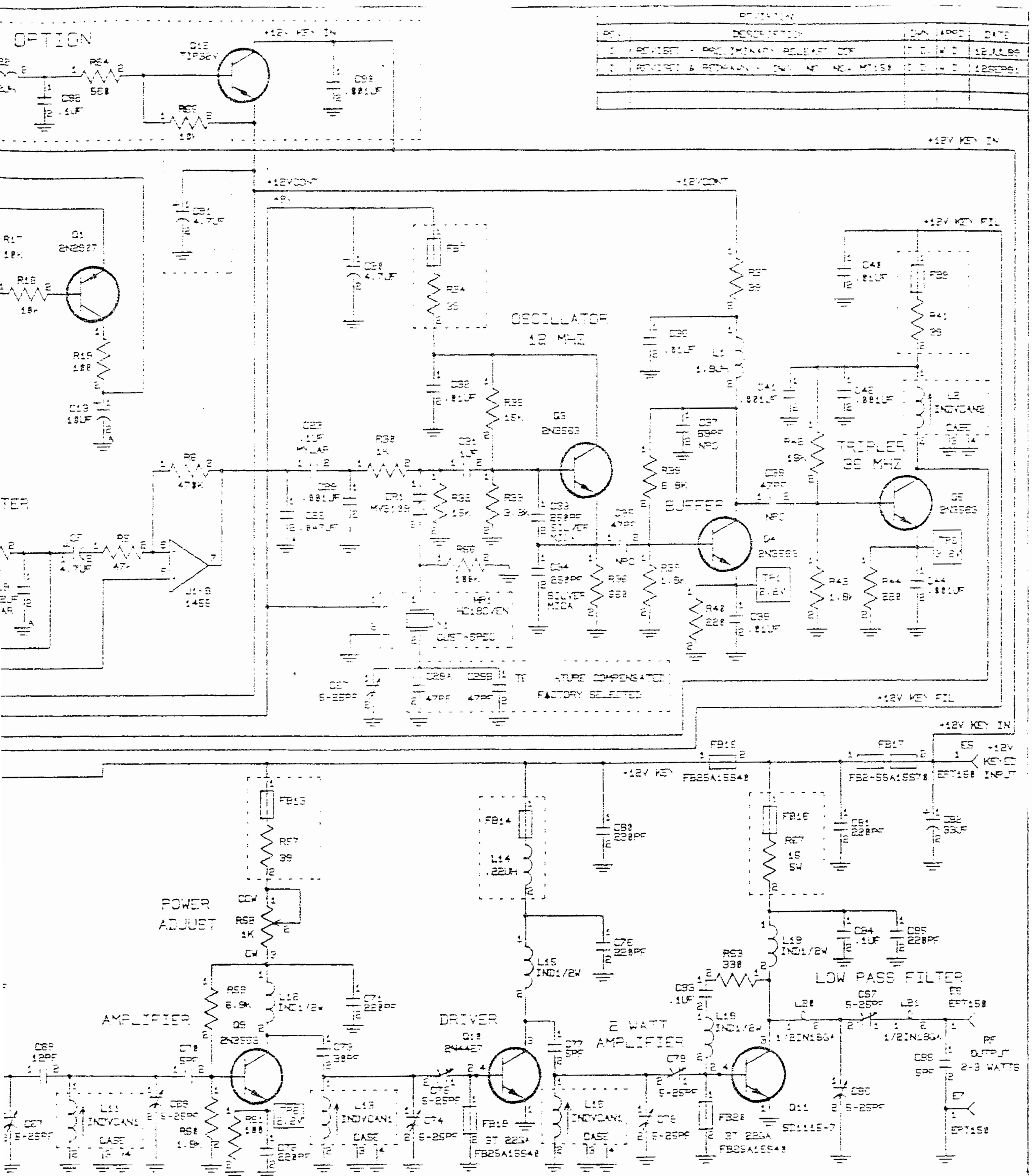
Enclosure assembly showing terminal locations

NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED
3. ASSEMBLY DRAWING NUMBER IS MT-412
4. FABRICATION DRAWING NUMBER IS MT-124
5. PRINTED CIRCUIT BOARD PART NUMBER IS MT-124

LOCAL KEY





KENDECOM INC.
23 ELM PARK
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DRAWN	DRAGONAYCH	DATE	19JUN89
CHECKED	W. DEWHIRST	DATE	19JUN89
ENGINEER	W. DEWHIRST	DATE	19JUN89
ENGR MGR	W. DEWHIRST	DATE	19JUN89

TITLE: SCHEMATIC MT-150 TRANSMITTER 134 - 174 MHZ

DWG NO: MT-150

SHEET 1 OF 1