1500M SERVICE MENU ALIGNMENT INSTRUCTIONS

Introduction

The FT-1500M has been carefully aligned at the factory for the specified performance across the amateur band. Realignment should therefore not be necessary except in the event of a component failure. All component replacement and service should be performed only by an authorized Yaesu representative, or the warranty policy may be voided.

The following procedures cover the sometimes critical and tedious adjustments that are not normally required once the transceiver has left the factory. However, if damage occurs and some parts are replaced, realignment may be required. If a sudden problem occurs during normal operation, it is likely due to component failure; realignment should not be done until after the faulty component has been replaced.

We recommend that servicing be performed only by authorized Yaesu service technicians who are experienced with the circuitry and fully equipped for repair and alignment. Therefore, if a fault is suspected, contact the dealer from whom the transceiver was purchased for instructions regarding repair. Authorized Yaesu service technicians realign all circuits and make complete performance checks to ensure compliance with factory specifications after replacing any faulty components. Those who do undertake any of the following alignments are cautioned to proceed at their own risk. Problems caused by unauthorized attempts at realignment are not covered by the warranty policy. Also, Yaesu must reserve the right to change circuits and alignment procedures in the interest of improved performance, without notifying owners. Under no circumstances should any alignment be attempted unless the normal function and operation of the transceiver are clearly understood, the cause of the malfunction has been clearly pinpointed and any faulty components replaced, and the need for realignment determined to be absolutely necessary.

Required Test Equipment

The following test equipment (and thorough familiarity with its correct use) is necessary for complete realignment. Correction of problems caused by misalignment resulting from use of improper test equipment is not covered under the warranty policy. While most steps do not require all of the equipment listed, the interactions of some adjustments may require that more complex adjustments be performed afterwards. Do not attempt to perform only a single step unless it is clearly isolated electrically from all other steps. Have all test equipment ready before beginning, and follow all of the steps in a section in the order presented.

- ○ RF Signal Generator with calibrated output level at 200 MHz
- ○ Deviation Meter (linear detector)
- ○ AC Voltmeter
- ○ SINAD Meter
- ○ Inline Wattmeter with 5% accuracy at 200 MHz
- ○ Regulated DC Power Supply: adjustable from 9 to 16.5 VDC, 15A
- ○ 50-Ohm Non-reactive Dummy Load: 100 W at 200 MHz
- ○ Frequency Counter: ±0.1 ppm accuracy at 200 MHz
- ○ AF Signal Generator
- ○ DC Voltmeter: high impedance
- ○ VHF Sampling Coupler
- ○ AF Dummy Load: 4-Ohms, 5W

Alignment Preparation & Precautions

A dummy load and inline wattmeter must be connected to the main antenna jack in all procedures that call for transmission, except where specified otherwise. Correct alignment is not possible with an antenna. After completing one step, read the following step to determine whether the same test equipment will be required. If not, remove the test equipment (except dummy load and wattmeter, if connected) before proceeding.

Correct alignment requires that the ambient temperature in the repair shop be the same as that of the transceiver and test equipment, and that this temperature be held constant between 20° and 30°C (68° ~ 86°F). When the transceiver is brought into the shop from hot or cold air it should be allowed some time for thermal equalization with the environment before alignment. If possible, alignments should be made with oscillator shields and circuit boards firmly affixed in place. Also, the test equipment must be thoroughly warmed up before beginning.

Enabling the "Alignment Mode" of the FT-1500M

Complete alignment of the FT-1500M can be accomplished without opening the case of the transceiver, as all alignment steps may be performed, using the front panel controls and switches, via the FT-1500M's special "Alignment Mode." The "Alignment Mode involves the use of a special Alignment Menu, which allows adjustment of all internal adjustment parameters.

Before beginning alignment, turn the transceiver off. Press and hold in the **[LOW]**, and **[D/MR]** keys, and hold them in while you turn the radio on again. The transceiver now will be in the "Alignment Mode."

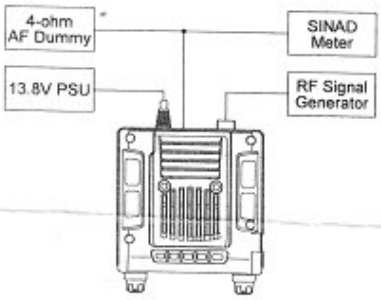
Note: Signal levels in dB referred to in this procedure are based on 0 dBμ = 0.5 μV (closed circuit).

Alignment

PLL & Transmitter

Set up the test equipment as shown for transmitter alignment.

Maintain the supply voltage at 13.8V DC for all steps.



TX Alignment Setup

TX Frequency Setting

During alignment, four different alignment frequencies will be utilized. So as to allow the transceiver to be peaked for maximum performance in the most-often-used frequency segments preferred by the operator, use this step to set up these alignment points. The examples below assume that the transceiver is to be used in a 4-MHz-wide band (144-148 MHz).

Note: It is not possible to guarantee 50 Watts of power output outside the frequency range 144-148 MHz.

- ❒ Rotate the Main Dial knob to change the display to "TX DEF."
- ❒ Press the **[MHz]** key, then rotate the Main Dial knob to change the "**T1**" frequency to the desired lower limit. (for example, set to 144.000 MHz).
- ❒ Press ***and hold*** the **[LOW]** key, then rotate the Main Dial knob to change the "**T2**" frequency which is at least 100 kHz higher than the lower limit. (for example, set to 145.500 MHz).
- ❒ Press ***and hold*** the **[LOW]** key, then rotate the Main Dial knob to change the "**T3**" frequency which is at least 100 kHz below the upper limit. (for example, set to 146.500 MHz).
- ❒ Press ***and hold*** the **[LOW]** key, then rotate the Main Dial knob to change the "**T4**" frequency to the desired upper limit. (for example, set to 148.000 MHz).
- ❒ Press the **[MHz]** key to exit to the "Alignment Mode" (selection screen).

PLL Reference Frequency

- ❒ Connect the wattmeter, dummy load and frequency counter to the antenna jack.
- ❒ Rotate the Main Dial knob to change the display to "TX FRQ."
- ❒ Press the **[MHz]** key.
- ❒ Key the transmitter, and adjust Main Dial knob, if necessary, so the counter frequency is within 100 Hz of the "**T2**" frequency.
- ❒ Press the **[MHz]** key to exit to the "Alignment Mode."

Transmitter Output

(T1 Frequency)

- ❒ Rotate the Main Dial knob to change the display to "TX PWR."
- ❒ Press the **[MHz]** key. You will now align the "L1" (Low Power 1) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 5 W (±0.5 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "L2" (Low Power 2) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 10 W (±1.0 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "L3" (Low Power 3) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 25 W (±2.0 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "Hl" (High Power) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 50 W (±3.0 W) on the wattmeter.

(T2 Frequency)

- ❒ Press ***and hold*** the **[LOW]** key. You will now align the "L1" (Low Power 1) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob sc as to achieve 5 W (±0.5 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "L2" (Low Power 2) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob s as to achieve 10 W (±1.0 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "L3" (Lov Power 3) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob s as to achieve 25 W (±2.0 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "Hl" (Hig Power) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob s as to achieve 50 W (±3.0 W) on the wattmeter.

(T3 FREQUENCY)

- ❒ Press ***and hold*** the **[LOW]** key. You will now align the "L1" (Low Power 1) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 5 W (±0.5 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "L2" (Low Power 2) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 10 W (±1.0 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "L3" (Low Power 3) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 25 W (±2.0 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "HI" (High Power) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 50 W (±3.0 W) on the wattmeter.

(T4 FREQUENCY)

- ❒ Press ***and hold*** the **[LOW]** key. You will now align the "L1" (Low Power 1) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 5 W (±0.5 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "L2" (Low Power 2) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 10 W (±1.0 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "L3" (Low Power 3) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 15 (25?) W (±2.0 W) on the wattmeter.
- ❒ Press the **[LOW]** key. You will now align the "HI" (High Power) setting.
- ❒ Key the transmitter, and rotate the Main Dial knob so as to achieve 20 (50) W (±3.0 W) on the wattmeter.
- ❒ Press the **[MHz]** key to exit to the "Alignment Mode."

Transmitter Deviation

The alignment procedures for Voice Deviation and CTCSS Deviation are performed individually, for best precision in alignment.

- ❒ Connect the AF generator to the MIC jack, and inject a 50 mV signal at 1 kHz frequency to pin 5 (Mic input) and pin 4 (Ground) of the MIC jack.
- ❒ Rotate the Main Dial knob to change the display to "MAXDEV."
- ❒ Press the **[MHz]** key. You will now set the Deviation at the "**T1**" frequency.
- ❒ Key the transmitter, and rotate the Main Dial knob to achieve ±4.2 kHz deviation on the deviation meter (within 0.1 kHz).
- ❒ Press ***and hold*** the **[LOW]** key. You will now set the Deviation at the "**T2**" frequency.
- ❒ Key the transmitter, and rotate the Main Dial knob to achieve ±4.2 kHz deviation on the deviation meter (within 0.1 kHz).
- ❒ Press ***and hold*** the **[LOW]** key. You will now set the Deviation at the "**T3**" frequency.
- ❒ Key the transmitter, and rotate the Main Dial knob to achieve ±4.2 kHz deviation on the deviation meter (within 0.1 kHz).
- ❒ Press ***and hold*** the **[LOW]** key. You will now set the Deviation at the "**T4**" frequency.
- ❒ Key the transmitter, and rotate the Main Dial knob to achieve ±4.2 kHz deviation on the deviation meter (within 0.1 kHz).
- ❒ Press the **[MHz]** key to exit to the "Alignment Mode."

For alignment of the CTCSS Deviation, four different CTCSS Tone frequencies are use on each transmitter test frequency. This ensures highly-consistent Tone Deviation settings.

(67 Hz TONE ALIGNMENT, "T1" FREQUENCY)

- ❒ Rotate the Main Dial knob to change the display to "TONDEV."
- ❒ Press the **[MHz]** key, and reduce the AF generator injection to zero. Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(100 Hz TONE ALIGNMENT, "T1" FREQUENCY)

- ❒ Press the **[LOW]** key.
- ❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(151.4 Hz TONE ALIGNMENT, "T1" FREQUENCY)

- ❒ Press the **[LOW]** key.
- ❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(250.3 Hz TONE ALIGNMENT, "T1" FREQUENCY)

- ❒ Press the **[LOW]** key.
- ❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(67 Hz TONE ALIGNMENT, "T2" FREQUENCY)

Alignment

❒ Press ***and hold*** the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(100 Hz TONE ALIGNMENT, "T2" FREQUENCY)
❒ Press the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(151.4 Hz TONE ALIGNMENT, "T2" FREQUENCY)
❒ Press the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(250.3 Hz TONE ALIGNMENT, "T2" FREQUENCY)
❒ Press the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(67 Hz TONE ALIGNMENT, "T3" FREQUENCY)
❒ Press ***and hold*** the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(100 Hz TONE ALIGNMENT, "T3" FREQUENCY)
❒ Press the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(151.4 Hz TONE ALIGNMENT, "T3" FREQUENCY)
❒ Press the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

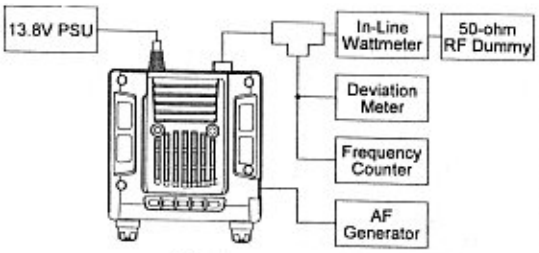
(250.3 Hz TONE ALIGNMENT, "T3" FREQUENCY)
❒ Press the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(67 Hz TONE ALIGNMENT, "T4" FREQUENCY)
❒ Press ***and hold*** the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(100 Hz TONE ALIGNMENT, "T4" FREQUENCY)
❒ Press the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(151.4 Hz TONE ALIGNMENT, "T4" FREQUENCY)
❒ Press the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter (within 0.1 kHz).

(250.3 Hz TONE ALIGNMENT, "T4" FREQUENCY)
❒ Press the **[LOW]** key.
❒ Key the transmitter, and rotate Main Dial knob to achieve ±0.6 kHz deviation on the deviation meter



RX Alignment Setup

(within 0.1 kHz).
❒ Press the **[MHz]** key to exit to the "Alignment Mode."

Receiver

Set up the test equipment as shown below for receive alignment.

RX Frequency Setting

The alignment frequency points for the receiver may b set to different frequencies from those utilized for trans mitter alignment. This allows the FT-1500M to be aligne optimally for a 144-148 MHz transmit range, with a re ceive range of 140-165 MHz, if desired. If the full 137-17 MHz capability of the FT-1500M is desired, just used th default values ion the procedure below.

❒ Rotate the Main Dial knob to change the display to "F DEF."
❒ Press the **[MHz]** key, then rotate the Main Dial knob change the "**R1**" frequency. The default frequency 137.100 MHz.

- ❒ Press ***and hold*** the **[LOW]** key, then rotate the Main Dial knob to change the "**R2**" frequency. The default frequency is 146.100 MHz.
- ❒ Press ***and hold*** the **[LOW]** key, then rotate the Main Dial knob to change the "**R3**" frequency. The default frequency is 160.100 MHz.
- ❒ Press ***and hold*** the **[LOW]** key, then rotate the Main Dial knob to change the "**R4**" frequency. The default frequency is 173.900 MHz.
- ❒ Press the **[MHz]** key to exit to the "Alignment Mode."

Interstage Transformers

- ❒ Connect the RF signal generator to the antenna jack.

(R1 Frequency)

- ❒ Tune the RF signal generator to the "**R1**" frequency. Inject an RF signal with ±3.5 kHz deviation of a 1 kHz tone.
- ❒ Rotate the Main Dial knob to change the display to "RX TUN."
- ❒ Press the **[MHz]** key, then rotate the Main Dial knob for optimum SINAD, reducing the signal generator output level as necessary for proper meter deflection (ultimately, the input signal level should not exceed –7.5 dBµ for 12 dB SINAD).

(R2 Frequency)

- ❒ Tune the RF signal generator to the "**R2**" frequency. Inject an RF signal with ±3.5 kHz deviation of a 1 kHz tone.
- ❒ Press ***and hold*** the **[LOW]** key, then rotate the Main Dial knob for optimum SINAD, reducing the signal generator output level as necessary for proper meter deflection (ultimately, the input signal level should not exceed –7.5 dBµ for 12 dB SINAD).

(R3 Frequency)

- ❒ Tune the RF signal generator to the "**R3**" frequency. Inject an RF signal with ±3.5 kHz deviation of a 1 kHz tone.
- ❒ Press ***and hold*** the **[LOW]** key, then rotate the Main Dial knob for optimum SINAD, reducing the signal generator output level as necessary for proper meter deflection (ultimately, the input signal level should not exceed –7.5 dBµ for 12 dB SINAD).

(R4 Frequency)

- ❒ Tune the RF signal generator to the "**R4**" frequency. Inject an RF signal with ±3.5 kHz deviation of a 1 kHz tone.
- ❒ Press ***and hold*** the **[LOW]** key, then rotate the Main Dial knob for optimum SINAD, reducing the signal generator output level as necessary for proper meter deflection (ultimately, the input signal level should not exceed –7.5 dBµ for 12 dB SINAD).
- ❒ Press the **[MHz]** key to exit to the "Alignment Mode."

Squelch

- ❒ Tune the RF signal generator to the "**R2**" frequency, and inject a –13.0 dBµ RF signal (no modulation) to the antenna jack.
- ❒ Rotate the Main Dial knob to change the display to "SQL."
- ❒ Press the **[MHz]** key, then press the [LOW] key.
- ❒ Press ***and hold*** the **[LOW]** key, then press the **[LOW]** key.
- ❒ Leave the RF signal generator at the "**R2**" frequency, and inject a –4.0 dBµ RF signal (no modulation) to the antenna jack.
- ❒ Press the **[LOW]** key, then press ***and hold*** the **[LOW]** key.
- ❒ Press the **[LOW]** key.
- ❒ Press the **[MHz]** key to exit to the "Alignment Mode."

S-Meter Calibration

(S-1 Level Calibration)

- ❒ Tune the RF signal generator to the "**R2**" frequency, and inject a –7.0 dBµ RF signal (no modulation) to the antenna jack.
- ❒ Rotate the Main Dial knob to change the display to "S MTR."
- ❒ Press the **[MHz]** key, then press *and hold* [LOW] key.
- ❒ Press the **[LOW]** key.

(Full-Scale Calibration)

- ❒ Tune the RF signal generator to the "**R2**" frequency, and inject a +20 dBµ RF signal (no modulation) to the antenna jack.
- ❒ Press the **[LOW]** key, then press *and hold* the [LOW] key.
- ❒ Press the **[LOW]** key.
- ❒ Press the **[MHz]** key to exit to the "Alignment Mode."

Exiting the Alignment Mode

- ❒ Press the **[REV]** key to exit to normal operation.