

## FT-90R Alignment

The FT-90R 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. 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.

### Required Test Equipment

1. RF Signal Generator with calibrated output level at 500 MHz
2. Deviation Meter (linear detector)
3. AF Millivoltmeter
4. SINAD Meter
5. Inline Wattmeter with 5% accuracy at 500 MHz
6. Regulated DC Power Supply: adjustable from 10 to 17 VDC, 15A
7. 50-ohm Non-reactive Dummy Load: 100W at 500 MHz
8. Frequency Counter: >0.1 ppm accuracy at 500 MHz
9. AF Signal Generator
10. DC Voltmeter: high impedance
11. VHF/UHF Sampling Coupler
12. AF Dummy Load: 4 ohm, 5W
13. Oscilloscope
14. Spectrum Analyzer

## 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 be the same as that of the transceiver and test equipment, and that this temperature be held constant between 20 and 30 C (68 86F). 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.

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

## PLL & Transmitter

Set up the test equipment as shown for transmitter alignment.  
Maintain the supply voltage at 13.8V DC for all steps.

### PLL Reference Frequency

With the wattmeter, dummy load and frequency counter connected to the antenna jack, and while tuned to 435.000 MHz, key the transmitter and adjust TC1001 on the Main Unit, if necessary, so the counter frequency is within 100 Hz of 435.000 MHz.

### VHF Transmitter Output

- 1) While tuned to 146.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The [←] and [→] buttons on the panel to select the "HIPO", and rotate the Selector Knob so as to achieve 50 Watts on the wattmeter. Then press and hold the [DISP/SS] button.
- 3) The [←] and [→] buttons on the panel to select the "MID1", and rotate the Selector Knob so as to achieve 25 Watts on the wattmeter. Then press and hold the [DISP/SS] button.
- 4) The [←] and [→] button on the panel to select the "MID2", and rotate the Selector Knob so as to achieve 10 Watts on the wattmeter. Then press and hold the [DISP/SS] button.
- 5) The [←] and [→] button on the panel to select the "LOW", and rotate the Selector Knob so as to achieve 5 Watts on the wattmeter. Then press and hold the [DISP/SS] button.

### VHF Transmitter Deviation

- 1) While tuned to 146.000 MHz, adjust the AF generator level for 50 mV output at 1kHz to the MIC jack.
- 2) Key the transmitter and the [←] and [→] buttons on the panel to select the "MOD", and rotate the Selector Knob so as to achieve 4.5 kHz deviation on the deviation meter. Then press and hold the [DISP/SS] button.

### UHF Transmitter Output

- 1) While tuned to 440.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The [←] and [→] buttons on the panel to select the "HIPO", and rotate the Selector Knob so as to achieve 35 Watts on the wattmeter. Then press and hold the [DISP/SS] button.

- 3) The [←] and [→] buttons on the panel to select the "MID1", and rotate the Selector Knob so as to achieve 25 Watts on the wattmeter. Then press and hold the [DISP/SS] button.
- 4) The [←] and [→] button on the panel to select the "MID2", and rotate the Selector Knob so as to achieve 10 Watts on the wattmeter. Then press and hold the [DISP/SS] button.
- 5) The [←] and [→] button on the panel to select the "LOW", and rotate the Selector Knob so as to achieve 5 Watts on the wattmeter. Then press and hold the [DISP/SS] button.

#### UHF Transmitter Deviation

- 1) While tuned to 440.000 MHz, adjust the AF generator level for 50 mV output at 1kHz to the MIC jack.
- 2) Key the transmitter and the [←] and [→] buttons on the panel to select the "MOD", and rotate the Selector Knob so as to achieve 4.5 kHz deviation on the deviation meter. Then press and hold the [DISP/SS] button.

### Receiver

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

#### Interstage Transformers

##### VHF S-Meter(S-1 Level) Calibration

- 1) While tuned to 146.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The RF signal generator turned to the same frequency, set the generator for  $\pm 3.5$  kHz deviation with 1kHz tone modulation, and set the output level for  $-2\text{dB } \mu$  at the antenna jack.
- 3) The [←] and [→] buttons on the panel to select the "S-1", and rotate the Selector Knob so as to 1 digit appear on the S-meter on the display. Then press and hold the [DISP/SS] button.

##### VHF S-Meter(Full) Calibration

- 1) While tuned to 146.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The RF signal generator turned to the same frequency, set the generator for  $\pm 3.5$  kHz deviation with 1kHz tone modulation, and set the output level for  $25\text{dB } \mu$  at the antenna jack.
- 3) The [←] and [→] buttons on the panel to select the "S-F", and rotate the Selector Knob so as to full digit appear on the S-meter on the display. Then press and hold the [DISP/SS] button.

##### VHF Squelch Threshold Calibration

- 1) While tuned to 146.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The RF signal generator turned to the same frequency, set the generator for  $\pm 3.5$  kHz deviation with 1kHz tone modulation, and set the output level for  $-12\text{dB } \mu$  at the antenna jack.
- 3) The [←] and [→] buttons on the panel to select the "SQ-S", and rotate the Selector Knob so as to adjust the Squelch Threshold. Then press and hold the [DISP/SS] button.

##### VHF Squelch Tight Calibration

- 1) While tuned to 146.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The RF signal generator turned to the same frequency, set the generator for  $\pm 3.5$  kHz deviation with 1kHz tone modulation, and set the output level for  $-2\text{dB } \mu$  at the antenna jack.
- 3) The [←] and [→] buttons on the panel to select the "SQ-T", and rotate the Selector Knob so as to adjust the Squelch Threshold. Then press and hold the [DISP/SS] button.

#### UHF S-Meter(S-1 Level) Calibration

- 1) While tuned to 440.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The RF signal generator turned to the same frequency, set the generator for  $\pm 3.5$  kHz deviation with 1kHz tone modulation, and set the output level for  $-2\text{dB } \mu$  at the antenna jack.
- 3) The [ $\leftarrow$ ] and [ $\rightarrow$ ] buttons on the panel to select the "S-1", and rotate the Selector Knob so as to 1 digit appear on the S-meter on the display. Then press and hold the [DISP/SS] button.

#### UHF S-Meter(Full) Calibration

- 1) While tuned to 440.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The RF signal generator turned to the same frequency, set the generator for  $\pm 3.5$  kHz deviation with 1kHz tone modulation, and set the output level for  $25\text{dB } \mu$  at the antenna jack.
- 3) The [ $\leftarrow$ ] and [ $\rightarrow$ ] buttons on the panel to select the "S-F", and rotate the Selector Knob so as to full digit appear on the S-meter on the display. Then press and hold the [DISP/SS] button.

#### UHF Squelch Threshold Calibration

- 1) While tuned to 440.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The RF signal generator turned to the same frequency, set the generator for  $\pm 3.5$  kHz deviation with 1kHz tone modulation, and set the output level for  $-12\text{dB } \mu$  at the antenna jack.
- 3) The [ $\leftarrow$ ] and [ $\rightarrow$ ] buttons on the panel to select the "SQ-S", and rotate the Selector Knob so as to adjust the Squelch Threshold. Then press and hold the [DISP/SS] button.

#### UHF Squelch Tight Calibration

- 1) While tuned to 440.000 MHz, and turn the radio off. Short the Pin #1 and #6 of Mic jack to the GND and hold while you turn the radio on. The radio now is in the Alignment Mode.
- 2) The RF signal generator turned to the same frequency, set the generator for  $\pm 3.5$  kHz deviation with 1kHz tone modulation, and set the output level for  $-2\text{dB } \mu$  at the antenna jack.
- 3) The [ $\leftarrow$ ] and [ $\rightarrow$ ] buttons on the panel to select the "SQ-T", and rotate the Selector Knob so as to adjust the Squelch Threshold. Then press and hold the [DISP/SS] button.

Address	Device name	Description	Application
<b>MAIN-UNIT</b>			
D 1001	DIODE	UM9957F/TR	ANT SW
D 1002	DIODE	UM9957F/TR	ANT SW
D 1004	DIODE	MA742-(TX)	APC DETECTOR
D 1005	DIODE	MA742-(TX)	APC DETECTOR
D 1007	DIODE	MA742-(TX)	APC DETECTOR
D 1008	DIODE	MA742-(TX)	APC DETECTOR
D 1014	DIODE	UM9957F/TR	ANT SW
D 1015	DIODE	UM9957F/TR	ANT SW
D 1016	DIODE	UM9957F/TR	ANT SW
D 1017	DIODE	UM9957F/TR	ANT SW
D 1034	DIODE	MA80WK-(TX)	TX/RX SW
D 1035	DIODE	MA80WK-(TX)	BAND SW
D 1039	DIODE	MA742-(TX)	NOISE DETECTOR
D 1040	DIODE	MA142WK-(TX)	UNLOCK SW
D 1041	DIODE	MA6S121-(TX)	SW
D 1042	DIODE	1SV214 TPH	DCS MOD
D 1043	SURGE ABSORBER	P6KA18	SURGE ABSORBER
D 1044	DIODE	RLS135 TE-11	TX SW
D 1045	DIODE	RLS135 TE-11	TX SW
D 1046	DIODE	1SS314 TPH3	TEMP. CONTROL
D 1047	DIODE	1SS314 TPH3	TEMP. CONTROL
D 1049	DIODE	1SS314 TPH3	TEMP. CONTROL
D 1053	DIODE	MA80WK-(TX)	RX SW
D 1054	DIODE	HSU277TRF	RX SW
D 1056	DIODE	MA142WK-(TX)	TX SW
D 1057	DIODE	HSU277TRF	RX SW
D 1059	DIODE	MA80WK-(TX)	RX SW
D 1060	DIODE	1SV286(TPL3)	BPF TUNE
D 1062	DIODE	1SV286(TPL3)	BPF TUNE
D 1063	DIODE	1SV286(TPL3)	BPF TUNE
D 1065	DIODE	1SV286(TPL3)	BPF TUNE
D 1066	DIODE	1SV217(TPH3)	BPF TUNE
D 1067	DIODE	1SV217(TPH3)	BPF TUNE
D 1068	DIODE	1SV217(TPH3)	BPF TUNE
D 1069	DIODE	1SV217(TPH3)	BPF TUNE
D 1073	DIODE	1SV276(TPH3)	BPF TUNE
D 1075	DIODE	HVU359TRF	BPF TUNE
D 1076	DIODE	HVU359TRF	BPF TUNE
D 1077	DIODE	HVU359TRF	BPF TUNE
D 1078	DIODE	HVU359TRF	BPF TUNE
D 1079	DIODE	MA142WK-(TX)	BAND SW
D 1080	DIODE	HSC277TRF	RX SW
Q 1001	TRANSISTOR	FMS1 T148	APC
Q 1005	TRANSISTOR	UMC5N TR	RX SW
Q 1006	TRANSISTOR	IMX1 T110	APC SW
Q 1007	IC	M67781L	TX PA
Q 1008	IC	M57788MR	TX PA
Q 1010	TRANSISTOR	UMC5N TR	RX SW
Q 1012	TRANSISTOR	2SA1244-Y(Te16L)	APC CONTROL
Q 1013	TRANSISTOR	UMC5N TR	RX SW
Q 1014	TRANSISTOR	2SC2954-T2	TX RF DRIVER
Q 1015	TRANSISTOR	UMC5N TR	RX SW
Q 1016	TRANSISTOR	2SC2954-T2	TX RF DRIVER
Q 1017	TRANSISTOR	2SB1301-T2 ZQ	POWER SW
Q 1019	TRANSISTOR	UN9212-(TX)	POWER SW
Q 1020	TRANSISTOR	2SC3357-T2 RF	TX PRE DRIVE
Q 1023	IC	BA09FP-E2	9V REG
Q 1025	TRANSISTOR	2SC5226-4/5-TL	BUFF
Q 1030	TRANSISTOR	UMG2N TR	RX SW
Q 1034	TRANSISTOR	2SC4215Y TE85R	AGC
Q 1035	TRANSISTOR	2SC4215Y TE85R	IF AMP
Q 1036	TRANSISTOR	2SC5226-4/5-TL	BUFF
Q 1037	TRANSISTOR	2SC5226-4/5-TL	BUFF
Q 1038	IC	TK10930VT1	FM SUBSYSTEM
Q 1039	IC	M64076AGP 600C	PLL SUBSYSTEM
Q 1041	TRANSISTOR	2SC4215Y TE85R	REF OSC
Q 1042	TRANSISTOR	DTC343TK T146	FAN CONTROL
Q 1043	IC	NJM2904V-TE1	BPF TUNE / BUFF
Q 1044	FET	SGM2016AM-T7	RX 1st MIXER
Q 1046	TRANSISTOR	IMD10A T108	TX SW
Q 1048	IC	TA4002F(Te85L)	BUFF
Q 1050	IC	NJM78L05UA TE1	5V REG
Q 1051	TRANSISTOR	IMD10A T108	TX SW
Q 1052	TRANSISTOR	UMD2N TR	TX SW
Q 1053	IC	TA4002F(Te85L)	RX RF AMP
Q 1054	FET	3SK131-T2B V12	RX RF AMP
Q 1055	FET	SGM2016AM-T7	RX RF AMP

Address	Device name	Description	Application
<b>[CNTL-UNIT]</b>			
D 2001	DIODE	1SS355 TE-17	UNLOCK SW
D 2003	DIODE	1SS355 TE-17	RESET CONTROL
D 2004	DIODE	HZM27WA-TR	SURGE ABSORBER
D 2005	DIODE	DAN222 TL	DET
D 2007	DIODE	HRF302ATR	SW
Q 2001	IC	M51132FP 600C	VOLUME
Q 2002	IC	NJM78L05UA TE1	5V REG
Q 2003	TRANSISTOR	2SC4617 TL R	SW
Q 2004	IC	LA4425A	AF PA
Q 2005	IC	TC4W53FU TE12L	SW
Q 2006	TRANSISTOR	2SA1774 TL R	LIMIT SW
Q 2007	IC	M51951AML-600C	RESET CONTROL
Q 2008	IC	AN8005M-(E1)	5V REG
Q 2010	IC	TC4W53FU TE12L	SW
Q 2011	TRANSISTOR	2SA1774 TL R	RESET CONTROL
Q 2012	TRANSISTOR	UN9212-(TX)	RESET CONTROL
Q 2013	IC	NJM2903M T2	RESET CONTROL
Q 2014	IC	NJM2902V-TE1	MIC AMP / LIMITER / LPF / BUFF
Q 2015	IC	NJM2902V-TE1	HPF / LPF / BUFF / PK AMP
Q 2016	IC	NJM2902V-TE1	PK AMP / LPF
Q 2017	TRANSISTOR	UMC5N TR	MUTE SW
Q 2018	IC	TC4W53FU TE12L	SW
Q 2019	IC	AT24C32N-10SC-1.8-TER	EEPROM
Q 2020	TRANSISTOR	2SC4617 TL R	HEAT SW
Q 2021	IC	HD6473337YTF16 R0259	MAIN CPU
Q 2022	TRANSISTOR	2SC4617 TL R	HEAT SW
Q 2023	IC	MX165CDW-TR	CTCSS SUBSYSTEM
Q 2024	TRANSISTOR	UN9212-(TX)	SW
Q 2025	TRANSISTOR	UN9212-(TX)	UHF TX SW
Q 2026	TRANSISTOR	2SC3356-T2B R24	CLOCK SHIFT
<b>[PANEL-UNIT]</b>			
D 3002	DIODE	HZM27WA-TR	SURGE ABSORBER
D 3003	DIODE	DAN222 TL	SW
D 3004	DIODE	DAN222 TL	SW
D 3005	LED	NSPW310AS	BACK LIGHT
D 3006	LED	NSPW310AS	BACK LIGHT
DS3001	LCD	A1281	LCD
Q 3001	IC	HD6433640RA56W	SUB CPU
Q 3003	IC	NJM78L05UA TE1	5V REG
Q 3004	TRANSISTOR	2SA1774 TL R	RESET CONTROL
Q 3005	TRANSISTOR	UN9212-(TX)	RESET CONTROL
Q 3006	IC	TC4W53FU TE12L	POWER SW
Q 3007	IC	NJU7662M(TE1)	LCD CONTROL
Q 3008	TRANSISTOR	2SA1774 TL R	LCD CONTROL
Q 3009	TRANSISTOR	2SA1774 TL R	LCD CONTROL
Q 3010	TRANSISTOR	2SA1774 TL R	LCD CONTROL
Q 3011	TRANSISTOR	2SB1132 T100 Q	DIMMER CONTROL
Q 3012	TRANSISTOR	UN9212-(TX)	DIMMER CONTROL
Q 3013	IC	LC7985ND-8733	LCD DRIVER
<b>[VCO-UNIT]</b>			
D 4001	DIODE	1SV280(TPH3)	UHF VCO
D 4002	DIODE	1SV286(TPL3)	VHF VCO
D 4003	DIODE	1SV281(TPH3)	VHF VCO
D 4004	DIODE	1SV286(TPL3)	VHF MOD
D 4005	DIODE	1SV281(TPH3)	UHF VCO
D 4006	DIODE	1SV286(TPL3)	UHF MOD
Q 4001	TRANSISTOR	2SC5006-T1	SHIFT SW
Q 4002	TRANSISTOR	2SC5006-T1	VHF VCO
Q 4003	TRANSISTOR	2SC5006-T1	UHF VCO
Q 4004	TRANSISTOR	UN9212-(TX)	VHF BAND SW
Q 4005	TRANSISTOR	UN9212-(TX)	UHF BAND SW
Q 4006	IC	TA4002F(TE85L)	BUFFER AMP