TK-890 Tuning Procedures

Preparation for tuning the transceiver.

Before attempting to tune the transceiver, connect the unit to a suitable power supply. Whenever the transmitter is tuned, the unit must be connected to a suitable dummy load, unless the instruction specify otherwise. The speaker output connector must be terminated with a 4ohm dummy load at any time during the tuning and connected to an AC voltmeter and an audio distortion meter or a SINAD measurement meter at all the time during the tuning.

Transceiver tuning

NOTE: To avoid damaging components in the transceiver while tuning, transmitter on time should be kept minimum and if the chassis or heatsink temperature becomes excessively hot, give the transceiver enough time to cool down in the steps 10 through 14 below.

1. Connect a sweep signal generator to the antenna terminal.
2. Connect a display through an RF detector to CN101 in the TX-RX unit.
3. Tune L101 and L104 to obtain the maximum reading on the display while maintaining the required bandwidth.
4. Connect a sweep signal generator to CN102.
5. Connect a display through an RF detector to CN103 in the TX-RX unit.
6. Tune L112, L113, L115(Wide)/L111, L114, L116(Narrow) to obtain the maximum reading on the display while maintaining the required bandwidth.
7. Select the center frequency.
8. Modulate the receive signal with a 1000Hz tone at ±3.0kHz deviation.
9. Tune L120 for the minimum audio distortion.

   Reduce the volume control setting as tuning progress to avoid saturation in the audio amplifier stages.
   Select the channel to narrow-band.

Apply a standard signal at the level of 3dB less than the 12dB SINAD.
Tune the squelch threshold by the PC tuning.
Select the channel to wide-band.

Apply a standard signal at the level of 3dB less than the 12dB SINAD.
Tune the squelch threshold by the PC tuning.

10. Adjust VR1 in the transmitter final section for 40W±2W in the transmit mode.
11. Apply a 1000 Hz tone with a 50 mV (RMS) level to the MIC input.
12. Adjust the maximum deviation to ±5.0kHz or less in the frequency ranges of 480 to 512MHz by the UP/DOWN of PC tuning.
13. Reduce the 1000 Hz signal level to 5 mV (RMS).
14. Adjust VR501 in the Control section to obtain ±3.0kHz of deviation in the transmit mode.

FCC ID: ALH22943120
LIST OF ACTIVE DEVICES

***** SEMICONDUCTOR PARTS LIST *****

FOR MODEL : TK-890

(TX-RX UNIT , X57-5620)

SELECT:

CURCUIT SYMBOL	PARTS NUMBER	DESCRIPTION
D1	DSA3A1-FK	DIODE, PROTECTION
D2	22ZR-10D	SURGE ABSORBER, SURGE ABSORPTION
D3	MA4PH633	DIODE, ANT SWITCH
D4	MI809	DIODE, ANT SWITCH
D5	MI809	DIODE, ANT SWITCH
D6	HSM88AS	DIODE, FORWARD WAVE RECTIFICATION
D7	HSM88AS	DIODE, REFLECTED WAVE RECTIFICATION
D102	DAN235K	DIODE, IF SWITCH (WIDE/NARROW)
D103	DAN235K	DIODE, IF SWITCH (WIDE/NARROW)
D104	DAN235K	DIODE, IF SWITCH (WIDE/NARROW)
D105	DAN235K	DIODE, IF SWITCH (WIDE/NARROW)
D107	MA742	DIODE, NOISE DETCTOR
D108	1SS355	DIODE, DC SWITCH
D201	DA204K	DIODE, TX PRE-DRIVE BIAS
D301	1SV282	VARIABLE CAPACITANCE DIODE, FREQUENCY
D302	1SV282	VARIABLE CAPACITANCE DIODE, FREQUENCY
D303	1SV282	VARIABLE CAPACITANCE DIODE, FREQUENCY
D304	1SV282	VARIABLE CAPACITANCE DIODE, FREQUENCY

D305	1SV282	VARIABLE CAPACITANCE DIODE, FREQUENCY
D306	1SV282	VARIABLE CAPACITANCE DIODE, FREQUENCY
D307	1SV214	VARIABLE CAPACITANCE DIODE, MODULATOR
D308	DAN235K	DIODE, RF SWITCH
D501	02CZ18(X, Y)	ZENER DIODE, DC SWITCH
D502	1SS355	DIODE, REVERSE CURRENT PREVENTION
D503	1SS355	DIODE, SURGE ABSORPTION
D504	02CZ5.6(X, Y)	ZENER DIODE, VOLTAGE REFERENCE
D505	1SS355	DIODE, DC SWITCH
D506	1SS301	DIODE, DC SWITCH
D507	02CZ15(X, Y)	ZENER DIODE, VOLTAGE REFERENCE
D508	1SS355	DIODE, DC SWITCH
D511	1SS301	DIODE, DC SWITCH
D512	1SS355	DIODE, REVERSE CURRENT PREVENTION
D513	DA204U	DIODE, SURGE ABSORPTION
D514	DA204U	DIODE, SURGE ABSORPTION
D515	DA204U	DIODE, SURGE ABSORPTION
D516	DA204U	DIODE, SURGE ABSORPTION
D517	DA204U	DIODE, SURGE ABSORPTION
D518	DA204U	DIODE, SURGE ABSORPTION
D519	DA204U	DIODE, SURGE ABSORPTION
D520	DA204U	DIODE, SURGE ABSORPTION
D521	DA204U	DIODE, SURGE ABSORPTION
D522	DA204U	DIODE, SURGE ABSORPTION
D523	DA204U	DIODE, SURGE ABSORPTION
D524	DA204U	DIODE, SURGE ABSORPTION
D525	DA204U	DIODE, SURGE ABSORPTION
D526	DA204U	DIODE, SURGE ABSORPTION

D527	DA204U	DIODE, SURGE ABSORPTION
D528	1SS355	DIODE, REVERSE CURRENT PREVENTION
D529	1SS355	DIODE, REVERSE CURRENT PREVENTION
A101	W02-1939-05	IC, DBM
IC101	TA31136FN	IC, FM IC
IC201	BU4094BCF	IC, SHIFT REGISTER
IC202	NJM78L05UA	IC, 5V AVR
IC203	AN8009M	IC, 9V AVR
IC301	SA7025DK	IC, PLL IC
IC501	TC4013BF(N)	IC, D FF

***** SEMICONDUCTOR PARTS LIST *****

FOR MODEL : TK-890

(TX-RX UNIT , X57-5620)

- SELECT:

CURCUIT SYMBOL	PARTS NUMBER	DESCRIPTION
IC502	NJM4558M	IC, LPF
IC503	TA7808S	IC, 8V AVR
IC504	TC35453F	IC, COMPANDER
IC505	NJM4558M	IC, HPF/IDC
IC506	L78LR05B-FA	IC, 5V AVR
IC508	NJM4558M	IC, LIMIT/BUFFER AMP.
IC509	MC33172D	IC, BUFFER AMP.
IC510	NJM4558M	IC, SUMMING AMP./LPF

IC511	PCD3312CT	IC, DTMF ENCODER
IC512	M62364FP	IC, D/A CONVERTER
IC513	NJM4558M	IC, LPF/SUMMING AMP.
IC514	AT24C64N10SI27	IC, EEPROM
IC515	BU4066BCF	IC, ANALOG SWITCH
IC516	784214GC0228EU	IC, CPU
IC517	BU4094BCF	IC, SHIFT REGISTER
IC518	NJM4558M	IC, BUFFER AMP.
IC519	AT29C020-90TI	IC, FLASH
IC520	TC7S02F	IC, NOR GATE
IC521	NJM4558M	IC, BUFFER AMP. /AMP.
IC522	TDA8561Q	IC, AUDIO POWER AMP.
IC523	BU4094BCF	IC, SHIFT REGISTER
IC524	NJM4558M	IC, BUFFER AMP. /DE-EMPHASIS
IC525	LC73872M	IC, DTMF DECODER
Q1	2SA1162(Y)	TRANSISTOR, DC AMP.
Q2	2SD2399	TRANSISTOR, APC CONTROLLER
Q3	2SC2712(Y)	TRANSISTOR, DC SWITCH
Q4	DTC144EUA	TRANSISTOR, DC SWITCH
Q5	FMW1	TRANSISTOR, APC COMPARATOR
Q6	2SC2712(Y)	TRANSISTOR, DC SWITCH
Q101	2SC3357	TRANSISTOR, RF AMP.
Q102	2SC3357	TRANSISTOR, IF AMP.
Q103	2SC3356	TRANSISTOR, RF AMP.
Q104	2SC3357	TRANSISTOR, RF AMP.
Q105	DTA144EUA	TRANSISTOR, DC SWITCH
Q106	DTC144EUA	TRANSISTOR, DC SWITCH
Q107	2SC4215(Y)	TRANSISTOR, IF AMP.

Q108	DTC144EUA	TRANSISTOR, DC SWITCH
Q109	2SC4617(S)	TRANSISTOR, SQL AMP.
Q201	2SC4226(R24)	TRANSISTOR, TX PRE-DRIVE AMP.
Q202	2SB1132(Q, R)	TRANSISTOR, DC SWITCH
Q203	DTC114EUA	TRANSISTOR, DC SWITCH
Q204	2SC3357	TRANSISTOR, TX PRE-DRIVE AMP.
Q205	2SC2954	TRANSISTOR, TX PRE-DRIVE AMP.
Q206	DTC114EUA	TRANSISTOR, DC SWITCH
Q207	2SB1132(Q, R)	TRANSISTOR, DC SWITCH
Q301	2SC4116(GR)	TRANSISTOR, RIPPLE FILTER
Q302	2SC4116(GR)	TRANSISTOR, RIPPLE FILTER
Q303	2SC3722K(S)	TRANSISTOR, LOOP FILTER
Q304	2SC3722K(S)	TRANSISTOR, LOOP FILTER
Q305	2SK508NV(K52)	FET, OSC
Q306	2SK508NV(K52)	FET, OSC
Q307	2SK508NV(K52)	FET, OSC
Q308	2SC4116(Y)	TRANSISTOR, DC SWITCH
Q309	2SC4116(Y)	TRANSISTOR, DC SWITCH
Q310	2SC4116(Y)	TRANSISTOR, DC SWITCH

***** SEMICONDUCTOR PARTS LIST *****

FOR MODEL : TK-890

(TX-RX UNIT , X57-5620)

- SELECT:

CURCUIT SYMBOL	PARTS NUMBER	DESCRIPTION

Q311	DTC114EUA	TRANSISTOR, DC SWITCH
Q312	DTC114EUA	TRANSISTOR, DC SWITCH
Q313	2SC4226(R24)	TRANSISTOR, BUFFER AMP.
Q314	2SC3356	TRANSISTOR, AMP.
Q315	2SC4226(R24)	TRANSISTOR, AMP.
Q501	DTA114EUA	TRANSISTOR, DC SWITCH
Q502	DTC114EUA	TRANSISTOR, DC SWITCH
Q503	DTC114EUA	TRANSISTOR, DC SWITCH
Q504	DTC363EK	TRANSISTOR, DC SWITCH
Q505	DTC144EUA	TRANSISTOR, DC SWITCH
Q506	DTA114YUA	TRANSISTOR, DC SWITCH
Q507	DTC114YUA	TRANSISTOR, DC SWITCH
Q509	DTC144EUA	TRANSISTOR, DC SWITCH
Q510	DTC144EUA	TRANSISTOR, DC SWITCH
Q511	DTC144EUA	TRANSISTOR, DC SWITCH
Q512	DTC144EUA	TRANSISTOR, DC SWITCH
Q513	DTC144EUA	TRANSISTOR, DC SWITCH
Q514	DTA144TKA	TRANSISTOR, DC SWITCH
Q515	DTC114EUA	TRANSISTOR, DC SWITCH
Q516	DTA114TUA	TRANSISTOR, DC SWITCH
Q517	DTC144EUA	TRANSISTOR, DC SWITCH
Q518	DTA114EUA	TRANSISTOR, DC SWITCH
Q519	2SJ506(S)	FET, DC SWITCH
Q520	DTD114EK	TRANSISTOR, DC SWITCH
Q522	2SC4215(Y)	TRANSISTOR, BEAT SHIFT SWITCH
Q523	DTC114TU	TRANSISTOR, DC SWITCH
Q524	DTC114TU	TRANSISTOR, DC SWITCH

Q525	DTC144EUA	TRANSISTOR, DC SWITCH

***** SEMICONDUCTOR PARTS LIST *****

FOR MODEL : TK-890

(,Y51-4510)

- SELECT:

CURCUIT SYMBOL	PARTS NUMBER	DESCRIPTION
IC1	M68769SH	IC, POWER AMPLIFIER

TK-890 Circuit Descriptions

The Kenwood Model TK-890 is an all solid-state UHF FM transceiver designed to operate in the frequency range of from 480 to 512MHz.

The TK-890 consists of a display unit, a control section, a transmitter-receiver (TX-RX) section, and a transmitter power amplifier section.

1. Display Unit (Front Panel Section)

There are two types of displays, A and B, available as a dealer installable option. The display unit consists of a microprocessor (IC4), a liquid crystal display (LCD) assembly, a power supply control circuit, and associated circuits.

(1) A rotary encoder is used for selecting the operating channel. An up or down pulse, generated at the rotary encoder is converted to a serial data signal and it is sent to the control section by the microprocessor.

(2) On or Off signals from various function switches are converted to a corresponding serial data signal and sent to the control section by the microprocessor.

(3) Serial data, sent from the control section, is received by the microprocessor, and the corresponding LCD segments are turned on.
The A type display comprises an 8-digits 13-segments alphanumeric display, 3-digits 7-segments alphanumeric display and icon display for confirming operation.
TX and BUSY indicators are also provided.
The B type display comprises 14-digits(large) and 3-digits(small) dot-matrix, 14-digits alphanumeric display, 3-digits channel status display and icon display for confirming operation.
TX and BUSY indicators are also provided.

2. Control Section

The control section consists of a receive audio circuit, a transmitter microphone amplifier circuit, a microprocessor, and associated peripheral circuits.

The control section transfers data to or from the display unit in serial format.

- The control section microprocessor (IC516) is connected to an external EPROM (IC514) and an external FLASHROM (IC519), and controls the following functions:

(1) Programs or retrieves the channel frequency data to or from the EEPROM.
(2) Sends the channel frequency data to the frequency synthesizer section.
(3) Sends sub-audible signal encoder data to the microphone amplifier section.
(4) Processes (decodes) an incoming sub-audible signal, received at its analog-to-digital converter input port, and controls the audio mute circuit.
(5) Processes a squelch signal from the IF IC (IC101) and controls the noise squelch circuit.

(6) Controls the audio circuit and switches between transmit and receive according to the data sent from the display unit.

- Receive audio circuit and transmitter microphone amplifier (Mic amp.) circuit

A recovered audio signal from the received signal, obtained at the TX-RX unit, passes through band-pass filter circuit(IC518,524) and then it is applied to the D/A converter(IC512) for electronic volume control and the receive audio power amplifier(IC522) section. An audio signal, originating at the microphone, is applied to microphone amplifier section(IC505,510,513) after going through a mic gain adjustment (VR501).The signal is then pre-amplified, pre-emphasized. The processed audio signal is again amplified by a voltage saturation type limiting amplifier and it is routed to the TX-RX unit after going through a 24dB/oct low-pass filter and D/A converter (IC512) for maximum deviation control.

3. TX-RX Section

The TX-RX section contains a frequency synthesizer section, a receiver RF section, IF sections, and a transmitter exciter section.

3.1 Frequency Synthesizer Section

The frequency synthesizer section consists of a TCXO (X301), a PLL circuit, and associated circuits.

The TCXO operates at 16.8 MHz, its frequency being maintained within ±2.0ppm from -30°C to +60°C. The 16.8MHz signal from the TCXO is applied to the PLL IC (IC301), where the signal is divided by 40KHz or 50KHz reference signal.

Three independent VCOs are provided for the transmitter and receiver to cover a wide frequency spread between the transmit and receive frequencies. The transmit signal is produced by Q305, and the receive LO signal is produced by Q305 and Q307. The RF signals, generated at the VCOs, are amplified by a common buffer amplifier (Q313). The output signal from the buffer amplifier is split into two and each signal is applied to buffer amplifiers Q314 and Q315. The Q315 output is routed to the PLL IC (IC301), and the Q314 output is used as the receiver LO signal or the transmit signal.
The PLL IC (IC301) consists of prescaler, fractional divider, reference divider, phase comparator, charge pump. The PLL IC is fractional-N type synthesizer and performs is the 40 or 50KHz reference signal which is eighth of the channel step (5, 6.25 KHz).
The input signal from the pin 5 of the PLL IC is divided down to the 40 or 50KHz and compared at phase comparator. The pulsed output signal of the phase comparator is applied to the charge pump and transformed into DC signal in the loop filter(Q303,304). The DC signal is applied to the VCO and locked to keep the VCO frequency constant.
The IC301 lock detector output signal causes the DC level to change and this is detected by the microprocessor in the control section. The microprocessor inhibits the transmitter to eliminate unlawful transmission if this condition occurs.
The output signal from the Mic amplifier in the control section is applied to the transmit VCO for frequency modulation (FM) of the transmit carrier signal.

3.2 Receiver RF and IF Stages

The receiver is a double conversion superheterodyne, designed to operate in the frequency range of from 480 to 512MHz. The RF and IF stages of the receiver section consists of an RF amplifier (Q101), a first mixer DBM(A101), a first IF amplifier (Q102,107) and a second IF system IC (IC101).

An incoming signal from the antenna is applied to a band-pass filter (L101) after going through a low-pass filter and an antenna switch. The signal is then amplified by the RF amplifier and again filtered by another band-pass filter (L104). The amplified and filtered signal is heterodyned at the first mixer with a first LO signal originated at the frequency synthesizer. The resulting 73.05MHz first IF signal is amplified by a first IF amplifier (Q102) and filtered by a 4-pole crystal filter (XF101;wide.XF102;narrow) and is further amplified by a first IF amplifier (Q107). The processed first IF signal is then applied to the second IF system IC, where the signal is heterodyned again down to 455kHz, amplified, filtered CF101,103(WIDE)/CF102,104(NARROW) and FM detected. The FM system IC also includes an oscillator circuit to generate a second LO signal of 73.505MHz. FM detection is performed by a quadrature type detector and the detected signal is routed to the control section.

3.3 Transmitter Exciter Section

The transmitter exciter section consists of three amplifiers(Q201,Q204,Q205) to amplify the modulated signal from the frequency synthesizer to between 200 and 300mW. The amplified signal is routed to the transmitter power amplifier section through a coaxial cable.

4. Transmitter Power Amplifier Section

The transmitter power amplifier section consists of an RF amplifier module an antenna switch, a low-pass filter and an automatic power control circuit (APC).
The exciter output signal from the TX-RX section is first amplified to 40W by the RF power amplifier module(IC1). The signal is routed to the antenna connector after going through the antenna switch and the low-pass(harmonics) filter. The low-pass filter of a chebychev type, which has an insertion loss of 0.5dB or less and a minimum attenuation of 40dB at the second harmonic frequency. The second harmonic attenuation at the output of IC1 is 30dB or more. Therefore, the total attenuation of any frequency above the second harmonic signal is guaranteed to be greater than 70dB. The antenna switch, which consists of D3,D4 and D5,is RF conductive to the receiver circuit when diodes are turned of. In the transmit mode, these diodes are turned on, causing the transmitter output signal to be conducted to the antenna while the receiver front-end is RF isolated by a quarter wave network.

The APC circuit comprises an RF level detector, and an exciter control section.
The RF level detector senses the forward and reflected power. The transmitter output power is kept constant by the exciter control circuit which monitors the forward power and regulates the supply voltage applied to the exciter section. If the antenna load becomes abnormal, the reflected power increases, causing the exciter control circuit to reduce the supply voltage to the exciter. This action reduces the transmitter output power to a safe operating level.