

PLEASE READ BEFORE USING THIS EQUIPMENT

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# *Eagle* Tomahawk

OWNER'S MANUAL

10 Meter AM/FM/SSB BASE/MOBILE RADIO

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# SPECIFICATIONS

## GENERAL

Frequency Range.....28.315 to 28.755 MHz  
Frequency Control.....Phase Lock Loop (PLL) synthesizer  
Frequency Stability.....±300 Hz  
Frequency Tolerance.....0.003%  
Emission Mode.....A3E(AM), F3E(FM), J3E(SSB)  
Microphone.....Plug in electret ; with push-to-talk  
Switch and coiled cord.  
Input Voltage.....13.8V DC nominal, 15.9V max., 12.0V min.  
110V AC  
Size (WDH).....300 x 240 x 85mm  
Weight.....3.4Kg  
Antenna Connector.....SO-239 50 Ohm unbalanced  
Speaker.....8 Ohm, 3 watts

## TRANSMITTER

Power Output.....FM/AM 4 watts, SSB 12 watts PEP  
Spurious Emission.....65 dB or better  
Current Drain No Modulation.....FM/AM less than 2.5A  
SSB less than 1.0A  
Current Drain at Max Power.....FM/AM less than 2.5A  
SSB less than 3.0A

## Modulation Frequency Response

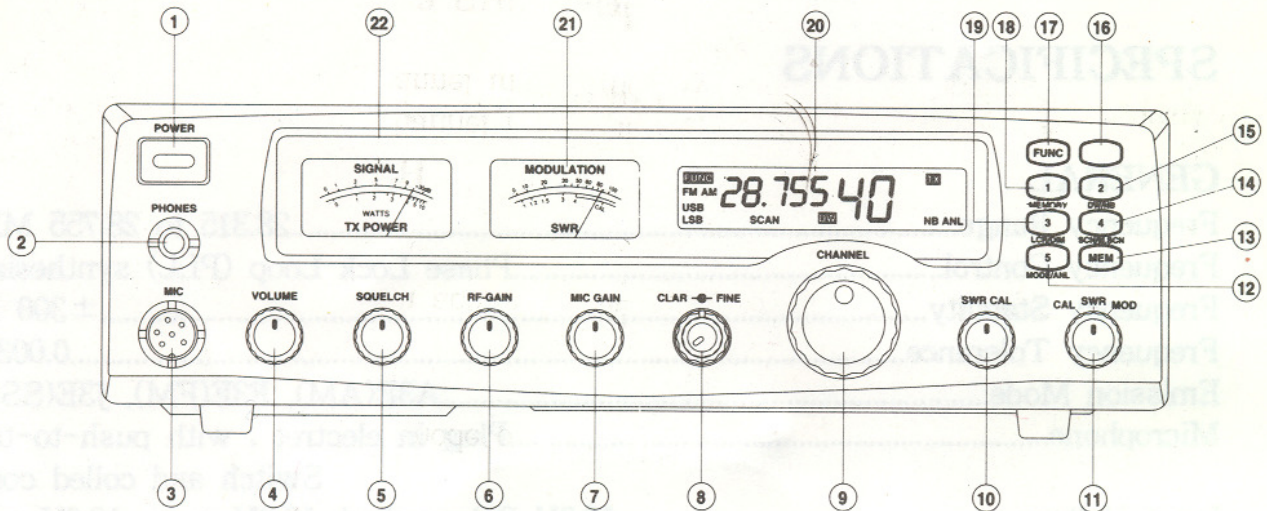
(1 KHz, 0 dB Reference).....Lower, at 450 Hz, AM -6 dB, SSB -6dB  
Upper, at 2.5 KHz, AM -6dB, SSB -6dB

Microphone Sensitivity.....AM 1.5 mV for 50% mod  
FM 1.5 mV for 1 KHz DEV  
SSB 1.5 mV for 4 watts PEP

Microphone Amplifier.....AM 50dB (between 89% and 80% modulation)  
SSB 50 dB (between 12W PEP and 10W PEP)

## RECEIVER

Max Sensitivity for 6dB S/N.....AM 0.5uV, FM/SSB 0.25uV  
Sensitivity for 10dB S/N.....AM 0.5uV, FM/SSB 0.25uV  
Overload Audio Fidelity at 6dB Down.....450 Hz ~ 2000 Hz  
Adjacent Channel Selectivity.....FM/AM 60dB, SSB 70dB  
Image Rejection (5.6MHz).....Typically better than 90 dB  
IF Rejection.....70dB or better  
Max Audio Output Power.....AM/FM/SSB 2.5 watts  
Squelch Range.....Adjustable from 0.5uV to 1mV  
Receiver Clarifier Range.....±1.25 KHz Variable  
Dynamic Range.....65dB (SSB)



**1. POWER ON/OFF SWITCH**

This switch turns the transceiver power on and off.

**2. HEAD PHONE JACK**

Connect headphone plug.

**3. MICROPHONE INPUT**

6pin socket for push-to-talk microphone.

**4. VOLUME CONTROL**

Controls audio output level.

**5. SQUELCH CONTROL**

Used to quiet the receiver during absence of receive signals.  
Sensitivity to incoming signals is fully adjustable.

**6. RF-GAIN CONTROL**

Controls the receiver sensitivity to reduce interference. To decrease RF gain turn the knob counter-clockwise. For the maximum receiver sensitivity the RF-GAIN control must be rotated to extreme clockwise.

**7. MIC-GAIN CONTROL**

This control provides the proper or desired modulation.

**8. CLARIFIER CONTROL**

This control provides an adjustment at tuning in station which are slightly OFF frequency, to optimize the AM and SSB reception.

## 9. CHANNEL SELECTOR SWITCH

FUNCTION OFF : This Rotary switch selects one of 40 channel in RX mode, but channel is not changed in TX mode.

FUNCTION ON : This Rotary switch moves channel up or down by 10 channels step in RX mode, but channel is not changed in TX mode.

## 10. SWR CALIBRATION CONTROL

The calibration control provides (while keying transmitter) meter calibration adjustment enabling true standing wave ratio reference.

## 11. CAL/SWR/MOD SELECTION

This switch is used to select the scale to be read on the RF Power Meter the switch has three positions MOD (Modulation), CAL (Calibrate), SWR (Standing Wave Ratio).

## 12. MODE/ANL/MEMORY 5 SWITCH

FUNCTION OFF ;

MODE FUNCTION-Select one of the operation mode FM/AM/USB/LSB.

\* Load channel in the memory 5 with MEM switch.

FUNCTION ON ;

ANL FUNCTION-This switch activates automatic noise limit circuits.

\* Save channel in the memory 5 with MEM switch.

## 13. MEM SWITCH

FUNCTION OFF ;

MEMORY LOAD FUNCTION-Load one of the 5 memory channel with 5 numeric key.

FUNCTION ON ;

MEMORY SAVE FUNCTION-Load one of the 5 memory channel with 5 numeric key.

## 14. SCAN/M-SCAN/MEMORY 4 SWITCH

FUNCTION OFF ;

SCAN FUNCTION-Set the scan-mode on/off in RX.

\* Load channel in the memory 4 with MEM switch.

FUNCTION ON ;

MEMORY-SCAN FUNCTION-Set the memory-scan-mode on/off in RX.

\* Save channel in the memory 4 with MEM switch.

## **15. DW/NB/MEMORY 2 SWITCH**

FUNCTION OFF ;

DW FUNCTION-This switch is used for DUAL WATCH in receive mode. When DW switch is pressed, "DW" appear and DW channel must be selected by UP/DOWN channel switch. If DW switch is pressed once more, DW mode release and "DW" disappear.

\* Load channel in the memory 2 with MEM switch.

FUNCTION ON ;

NB FUNCTION-If your reception is disturbed by interference from impulse type noise (Ignition noise and other electrical noise) press NB to reduce or eliminate the noise.

\* Save channel in the memory 2 with MEM switch.

## **16. CRSE SWITCH**

This switch sets the beep-mode on off.

## **17. FUNC SWITCH**

BRIEF PUSH : This switch activates the secondary function of double function switches.

## **18. MEMORY 1 SWITCH**

FUNCTION OFF : Load channel in the memory 1 with MEM switch.

FUNCTION ON : Save channel in the memory 1 with MEM switch.

## **19. LCR/DIM/MEMORY 3 SWITCH**

FUNCTION OFF ;

LCR FUNCTION-Press LCR to return to the last channel that was used for longer than 3 seconds or was transmitted on.

\* Load channel in the memory 3 with MEM switch.

FUNCTION ON ;

DIM FUNCTION-This switch is used to make the lighting dimmer.

\* Save channel in the memory 3 with MEM switch.

## **20. LCD DISPLAY**

LCD indicates the channel selected by 40 position, and function.

## **21. MOD/SWR ANALOG METER**

This meter relate indication of SWR calibration and modulation Meter indicator is only operated at TX mode.

## 22. S/RF ANALOG METER

At receive mode, this meter rate indication of signal strength. In the transmit mode this Meter relate indication of antenna RF power.

### - BEET TONE -

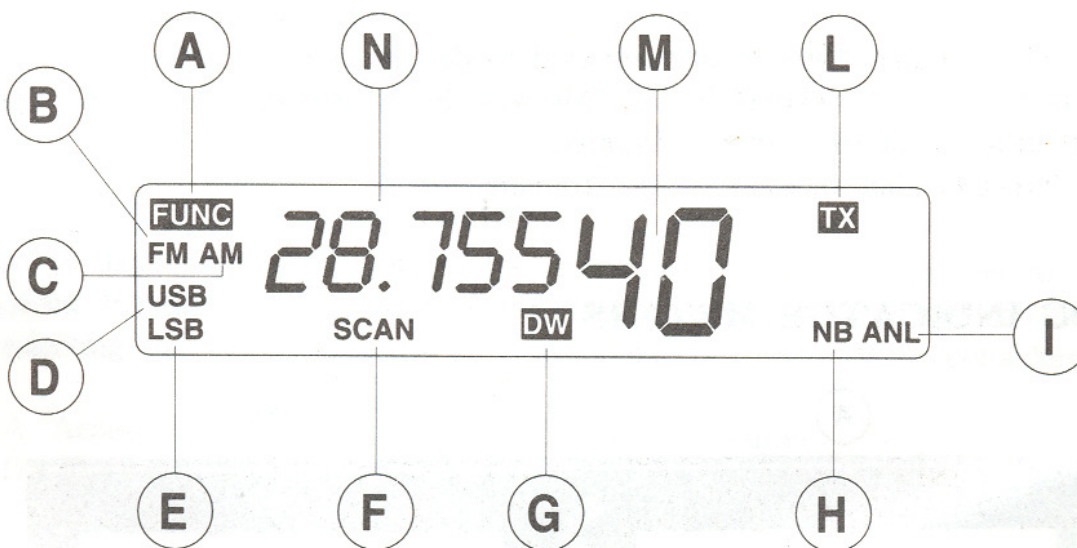
Turning on power switch with keeping PTT key pressed sets beep-mode on/off

@ FUNC SWITCH : HIGE TONE

@ Primary function SWITCH (with FUNC SWITCH OFF) : MID TONE

@ Second function SWITCH (with FUNC SWITCH ON) : LOW TONE

**Display Panel Features** : Illustrated below are all the VISUAL INDICATORS that appear on the display, and the corresponding feature function that they associate with.



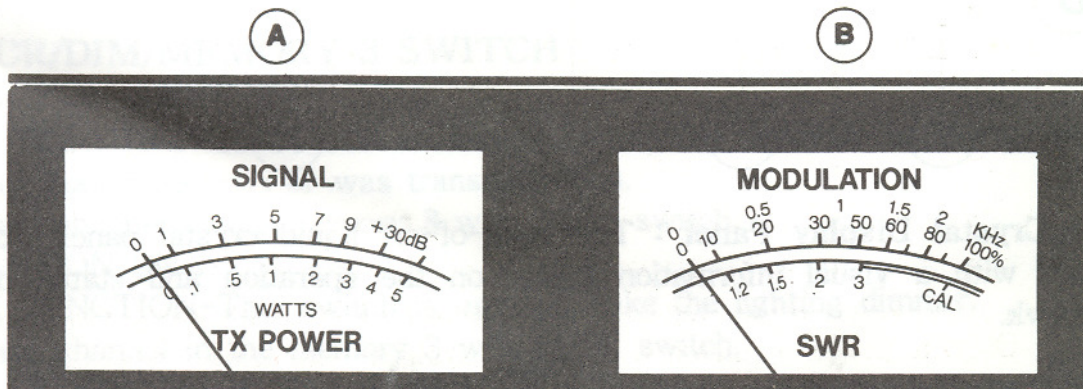
**Liquid Crystal Display Panel** : The state-of-art liquid crystal panel provides the user with a visual information center on the operation and status of the Tomahawk.

**CAUTION** : Due to the components inherent in them, liquid crystal displays should not be subjected to extremes of temperature or humidity. If the unit is exposed to temperatures below  $-20^{\circ}\text{C}$  ( $-5^{\circ}\text{F}$ ) or above  $+60^{\circ}\text{C}$  ( $+140^{\circ}\text{F}$ ), the display may temporarily cease to function properly, and in some cases, could result in permanent damage. Do not subject radio to extreme conditions, such as a closed automobile in direct sunlight or continuous sub-zero temperatures.

All liquid crystal displays have a preferred viewing angle when the display contrast is at a maximum. The best viewing point will vary by user, depending on such variables as temperature, humidity, battery condition, and the actual users eyesight.

- A) **Function Mode** : Indicated the "Func" button has been selected, which allows for operation of many of the various features.
- B) **AM** : Indicates AM mode operation.
- C) **FM** : Indicates FM mode operation.
- D) **USB** : Indicates upper side band mode operation.
- E) **LSB** : Indicates lower side band mode of operation.
- F) **SCAN** : Indicates that the radio is in the "scan" mode. which works in conjunction with all 40 channels and five memory locations.
- G) **Frequency Readout** : Displays the corresponding frequency associated with the channel you are communicating with.
- H) **DW** : Indicates that the Noise Blanker feature has been turned on.
- I) **Channel Indicator** : Displays the channel number in which the radio is operating on.
- J) **NB** : Indicates that the Noise Blanker features has been turned on.
- K) **ANL** : Indicates that the Automatic Noise Limiter feature has been turned on.
- L) **"L"** : Indicates that the memory retrieval mode has been activated.  
**"S"** : Indicates that radio is in the "Memory Store" mode, ready to receive a channel into one of the memory locations.
- M) **TX** : Indicates that radio is in the "transmit" mode.

**ANALOG INDICATOR METERS :**



- A) **S-TX METER** : Indicates relative incoming signal strength and out power.
- B) **Modulation Meter** : Measures the percent modulation of the AM signal. Note that the CAL/SWR/MOD switch must be in the "MOD" position for the meter to measure and read modulation.

**SWR Meter** : Measures the ratios of standing wave voltage of the antenna system, which is critical in properly adjusting the length of the antenna and all related electrical connections. This meter will indicate if there is any major changes in these critical areas caused by such things as humidity, vibration, or corrosion, which will cause the SWR Meter to rise. A rising SWR indicates that a problem exists.

### To Calibrate SWR :

- a) Set the radio into the AM mode.
- b) Switch the CAL/SWR/MOD knob to the SWR position.
- c) Transmit by pressing the PTT button on the microphone, and adjust the SWR/CAL control until the needle reaches the CAL position on the meter.
- d) Put the CAL/SWR/MOD knob back to the SWR position, and read the SWR value.

## INSTALLATION

### 1. LOCATION OF THE RADIO

Prior to beginning operation of the transceiver, a basic installation must be prepared. Installation of the transceiver itself is a rather simple procedure.

In selecting the location for the unit, two basic factors must be considered:

- A. Access to 120V 60Hz or 13.8V DC power source.
- B. The location must be convenient for running the antenna lead-in cable if an outside antenna installation is proposed.

### 2. BASE STATION ANTENNA

Since the maximum allowable power output of the transmitter is limited by the Regulation, the antenna is the most important factor affecting transmission distance. Only a properly matched antenna system will allow maximum power transfer from the 50 ohm transmission line to the radiating element.

The recommended method of antenna tuning is to use the built-in SWR meter to adjust the antenna tuning for minimum reflected power on Frequency 28.535MHz.



The radio may be used with any type of 50-ohm base station antenna. A ground plane vertical antenna will provide the most uniform horizontal coverage. This type of antenna is best suited for communication with a mobile unit. For point-to-point operation where both stations are fixed, a directional beam will usually increase communicating range since this type of antenna concentrates transmitted energy in one direction. The beam antenna also allows the receiver to "listen" in only one direction, thus reducing interfering signals.

## **OPERATING PROCEDURE TO RECEIVE**

1. Turn the radio ON by pressing the POWER switch.
2. Press the "Mode" selection button (labeled "5" on the button) continuously until you find the mode of operation you desire to operate in (AM, FM, USB, LSB).
3. Adjust the VOLUME control until you reach your desired listening level.
4. Turn the CHANNEL selector knob to desired operating channel.
5. Tune the RF GAIN completely clockwise.
6. Adjust the "CLARIFIER" control to clarify the SSB signals.
7. Listen to the background noise coming from the radio. Turn the squelch control slowly until the noise just disappears. (No signal should now be present.) Leave the control at this setting. The SQUELCH is now properly adjusted. The receiver will remain quiet until a signal is actually received. Do not advance the knob too far, as some of the weaker signals will not be heard.

## **OPERATING PROCEDURE TO TRANSMIT**

1. Select the desired channel of transmission.
2. Set the MIC GAIN control fully clockwise.
3. Activate the press-to-talk switch. The receiver and transmitter are controlled by the press-to-talk switch on the microphone. Press the switch and the transmitter is activated. Release the switch to receive.
4. Hold the microphone two inches from your mouth, and speak in a clear normal voice.
5. The S-TX meter will indicate relative power output and the modulation meter will indicate percentage of modulation as you speak into the microphone.

**CAUTION :** Be sure the antenna is properly connected to the radio before transmitting. Prolonged transmitting without an antenna or a poorly matched antenna could cause damage to the transmitter.

## RECEIVING SSB SIGNALS

There are four types of signals presently used for communications in the Citizens Band : AM, FM, USB and LSB. When the MODE switch on your unit is placed in the AM, position, only standard double-sideband, full carrier signals will be detected. An SSB signal may be recognized while in the AM detector to produce an intelligible output. The USB and LSB modes will detect upper sideband and lower sideband respectively, and standard AM signals.

SSB reception differs from standard AM reception in that SSB receiver does not require a carrier or opposite sideband to produce an intelligible signal. A single sideband transmitted signal consists only of the upper or the lower sideband and no carrier is transmitted. The elimination of the carrier from the AM signal helps to eliminate the biggest cause of whistles and tones heard on channels which make even moderately strong AM signals unreadable. Also, SSB take only half of an AM channel, therefore two SSB conversations will fit into each channel, expanding the 40 AM channels to 80 SSB channels. The reduction in channel space required also helps in the receiver because only half of the noise and interference can be received with 100% of the SSB signal.

An SSB signal may be received only when the listening receiver is functioning in the same mode. In other words, an upper sideband signal (USB) may be made intelligible only if the receiver is functioning in the USB position.

If a lower sideband (LSB) signal is heard when the receiver is in the USB mode, no amount of turning will make the signal intelligible. The reason for this may be understood if you consider that when the modulation is applied to the transmitter's microphone in the USB mode, the transmitter's output frequency is increased whereas in the LSB mode the transmitter's output frequency is decreased. The result in listening to the receiver is that when the MODE switch is in the proper position (either USB or LSB), a true reproduction of single tone of modulation will result, and if the tone is increased in frequency (such as a low-pitched whistle or a high-pitched whistle) you will hear the increase in the output tone of the receiver. If the incorrect mode is selected, an increase in tone of a whistle applied to the transmitter will cause a decrease in the resultant tone from the receiver.

Thus when a voice is used in place of a whistle or tone, in the proper listening mode the voice will be translated backwards and cannot be made intelligible by the voice lock control. When listening to an AM transmission, a correct side band is heard in either mode since both upper and lower sideband are received.

Once the desired SSB mode has been selected, frequency adjustment may be necessary in order to make the incoming signal intelligible. The CLARIFIER controls allow the operator to vary the frequency above and below the exact-center frequency of the received signal. If the sound of the incoming signal is too high or too low pitched, adjust the CLARIFIER control. Consider it as performing the same function as a Dictaphone speed control. When the speed is set too high, voices will be high-pitched, and if set too low, voices will be low-pitched. Also, there is only one correct speed that will make a particular tape produce the same sound that was recorded. If the tape is played on a player that rotates in the wrong direction (opposite sideband), no amount of speed control (Clarifier) will produce an intelligible sound.

An AM signal received while listening in one of the SSB modes will produce a steady tone (carrier) in addition to the intelligence, unless the SSB receiver is tuned to exactly the same frequency by the Clarifier control. For simplicity it is recommended the AM modes be used to listen to AM signals.

## IF YOU NEED SERVICE

Send your unit to the Copper Electronics factory and furnish the following, in order to have the product serviced and returned:

1. For Warranty Repair include copy of the sales receipt. If you send the original receipt it can not be returned.
2. Send the entire product. For example-a mobile radio must include the DC power cord and any other parts (brackets, etc.) that were furnished with the product.
3. Enclose a description of what is happening with the unit. Include a typed or clearly printed name and address of where the unit is to be returned.
4. Pack unit securely to prevent damage in transit. If possible, use the original foam material box. Copper Electronics is not responsible for any damages in shipping.
5. Ship prepaid by way of a traceable carrier (USPS or UPS), to avoid loss in transit, to: Copper Electronics 3315 Gilmore Industrial Blvd., Louisville, KY40213.
6. Upon receipt of unit at Copper Electronics, and "acknowledgment card" will be sent to you. Keep this card and if you need information about your unit refer to the "Receiving Number" model number, your (or other) name exactly as it appears on return address (3 above) and date unit was shipped. Contact Service by mail only.

If you received the Copper Electronics product, as a gift and you do not have proof of purchase information necessary for service, mail the following information to the Copper Electronics, 3315 Gilmore Industrial Blvd., Louisville, KY 40213. An authorization letter will be sent to you, that must accompany your unit when the unit goes to an authorized Copper Electronics warranty service center.

Type or print clearly: Your name and address. Date, month and year you received the gift. Model and serial number of unit. Where purchase (if possible)-store name and location.

*All units sold to distributors or dealers, will carry a warranty not to exceed 1-year from the distributor or dealer purchase date.*

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**Copper Electronics**  
**3315 GILMORE INDUSTRIAL BLVD**  
**LOUISVILLE KY 40213**