
INTRODUCTION & FEATURES

MFJ-9232 *MINI LOOP TUNER*™ INTRODUCTION

The MFJ-9232 *Mini Loop Tuner*™ is a small, versatile, high-efficiency device that turns any wire loop into a high-efficiency multi-band transmitting antenna system. It is designed for 50-ohm use at QRP-power input on all modes. Two items are required:

- MFJ-9232 *Mini Loop Tuner*™ (Shown in Figure 1)
- Wire Loop(s) (55ft)



Figure 1: MFJ-9232 Mini Loop Tuner

INTRODUCTION & FEATURES

The MFJ-9232 *Mini Loop Tuner*™ resonates various lengths of wire to create a Hi-Q tuned-circuit that functions as a transmitting loop. It uses special low-loss capacitors for high efficiency and interfaces the Hi-Q transmitting loop circuit with any length of 50-Ohm coaxial cable.

No ground, radials, or counterpoise system are needed. The MFJ-9232 *Mini Loop Tuner*™ functions with wire loops of any shape -- circle, square, rectangle etc. For highest efficiency, use wires approaching one quarter wavelength erected in the shape of a circle.

The MFJ-9232 *Mini Loop Tuner*™ uses fixed wire lengths to cover roughly a 1.5:1 frequency ratio (28-18 MHz, 10-7 MHz, etc.). Exact frequency coverage depends on each individual installation and involves your choice of wire length, loop diameter, loop shape, height above ground level, plus other stray factors in the immediate operating environment.

MFJ-9232 MINI LOOP TUNER™ FEATURES:

- **Passive Network:** No power supply required.
- **Maximum Input Power:** 25 Watts, all modes
- **Small Physical Profile:** 1.5" D, 2.75" W, 4.0" H
- **Low Radiation Angle:** Radiation pattern rivals full size dipoles.
- **Quiet Reception:** Loops make extremely quiet receiving antennas. Hi-Q rejects overload from out-of-band interference, rejects transmit harmonics.
- **Indoor Use:** Perfect for portable operation or antenna-restricted locations. Sets up quickly in apartments and motel/hotel rooms.

RF HAZARD PRECAUTIONS

RF HAZARD BACKGROUND INFORMATION

The following WARNINGS should be observed when using your MFJ-9232 *MINI LOOP TUNER*™:

ACUTE INJURY WARNING

DO NOT touch or make skin contact with the *Loop Connectors* or *Loop Antenna Wire* while transmitting

YOU Could BE SERIOUSLY INJURED !!!

The Hi-Q MFJ-9232 *Mini Loop Tuner*™ can yield *DANGEROUS* RF-voltage potentials during normal operation. Even at low QRP power levels, the resonant loop circuit can produce RF voltages capable of causing extremely painful RF-burns on unprotected skin! When tuning or transmitting, *always avoid skin contact* with the loop connectors and unjacketed loop wire. Also, avoid exceeding the recommended power limitation (25W). RF burns can be exceptionally painful and slow to heal!

EXCESSIVE RF-EXPOSURE NOTICE

You must follow all **PRECAUTIONS, WARNINGS, and FCC Guidelines for Human Exposure to Radio frequency (RF) Electromagnetic Fields**

What Is Radio Frequency (RF) Radiation?

Radio frequency (RF) energy is one form of electromagnetic energy. Electromagnetic waves and associated phenomena can be discussed in terms of energy, radiation or fields. Electromagnetic "radiation" is defined as waves of electric and magnetic energy moving together (i.e., radiating) through space. The movement of electrical charges generates these waves. For example, the movement of charge in a radio station antenna (the alternating current) creates electromagnetic waves radiating away from the antenna and intercepted by receiving antennas. Electromagnetic "field" refers to the electric and magnetic environment existing at some location due to a radiating source such as an antenna.

RF HAZARD PRECAUTIONS

An electromagnetic wave is characterized by its wavelength and frequency. The wavelength is the distance covered by one complete wave cycle. The frequency is the number of waves passing a point in a second. For example, a typical radio wave transmitted by a 2-meter VHF station has a wavelength of about 2 meters and a frequency of about 145 million cycles per second (145 million Hertz): one cycle/second = one Hertz, abbreviated Hz.

Electromagnetic waves travel through space at the speed of light. Wavelength and frequency are inversely related by a simple equation: (frequency) times (wavelength) = the speed of light. Since the speed of light is a constant quantity, High Frequency (HF) electromagnetic waves have short wavelengths, and Low-Frequency (LF) waves have long wavelengths. Frequency bands used for amateur radio transmissions are usually characterized by their approximate corresponding wavelengths, e.g., 12, 15, 17, 20 meters, etc.

The electromagnetic "spectrum" includes all of the various forms of electromagnetic energy ranging from extremely low frequency (ELF) energy (with very long wavelengths) to all the way up to X-rays and gamma rays, which have very high frequencies and correspondingly short wavelengths. In between these extremes lie radio waves, microwaves, infrared radiation, visible light and ultraviolet radiation, respectively. The RF part of the electromagnetic spectrum can generally be defined as that part of the spectrum where electromagnetic waves have frequencies that range from about 3 kilohertz (kHz) to 300 gigahertz (GHz). Figure 2 illustrates the electromagnetic spectrum.

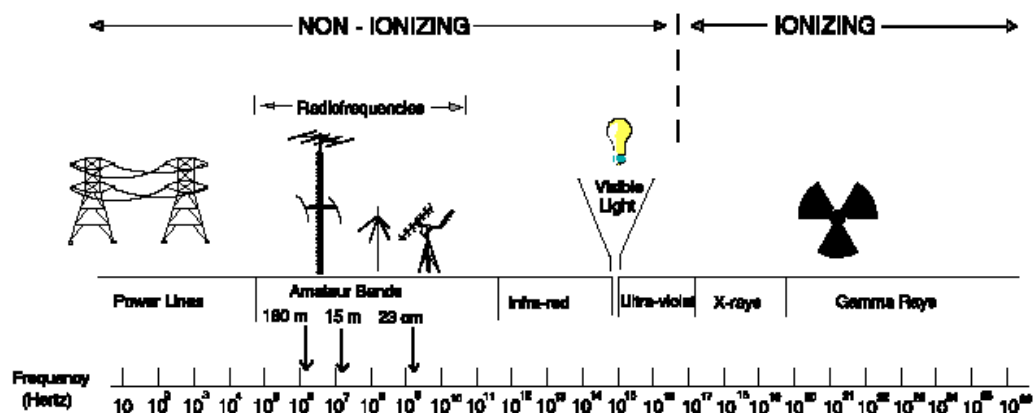


Figure 2: The Electromagnetic Spectrum

RF HAZARD PRECAUTIONS

FCC OET Bulletin 65, Supplement B, *Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields.*

The FCC Office of Engineering Technology (OET) Bulletin 65, Supplement B, *Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields* impacts directly the use and operation of the MFJ-9232 Mini Loop Tuner™. It establishes safe operating distances from the loop antenna and associated power levels in order to permit the operator and persons that may be impacted by operation to exist in a safe, RF radiation hazard-free environment. Guidelines for Maximum Permissible Exposure (MPE) are defined in Supplement B of the bulletin.

IMPORTANT NOTE

Use Supplement B in connection *with* FCC OET Bulletin 65, Version 97-01. The information in the supplement provides additional detailed information used for evaluating compliance of amateur radio stations with FCC guidelines for exposure to radio frequency electromagnetic fields. However, Supplement B users should also consult Bulletin 65 for complete information on FCC policies, guidelines and compliance-related issues. Definitions of terms used in this supplement appear in Bulletin 65. Bulletin 65 can be viewed and downloaded from the FCC's Office of Engineering and Technology's World Wide Web Internet Site:

<http://www.fcc.gov/oet/rfsafety>

OPERATING ENVIRONMENTS

Under some circumstances, such as an antenna located unusually near humans, an indoor antenna in a living space, or a balcony-mounted antenna a foot or so away from a neighbor's balcony, the FCC could require a station evaluation or take other action. *Computer models of small HF loops, for example, yield RF fields very near the antenna that are much higher than the standard amateur radio station outdoor antenna installation yields.* Therefore, when you use the MFJ-9232 Mini Loop Tuner™ in your Ham Shack, at a portable location (outdoors), or one such as a hotel/motel room, you must take care **not** to exceed established MPE for yourself and others who may encounter the RF field associated with your operation.

RF HAZARD PRECAUTIONS

RF-RADIATION EXPOSURE CONCERNS

Controlled population exposure limits apply to amateur licensees and members of their immediate household (but **not** their neighbors - see next paragraph). In general, a controlled environment is one for which access is controlled or restricted. In the case of a fixed or portable amateur station, the licensee or grantee is the person responsible for controlling access and providing the necessary information and training as described in FCC OET Bulletin 65, Supplement B.

General population/uncontrolled exposure limits apply to situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment, such as hotel/motel employees or overnight residents, may **not** be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the *general public* always fall under this category when exposure is **not** employment-related, as in the case of residents in an area near a broadcast tower. Neighbors of amateurs and other non-household members would normally be subject to the general population/uncontrolled exposure limits.

LOOP THEORY

LOOP-ANTENNA BACKGROUND INFORMATION

A *small loop* antenna is characterized by low-noise reception. It typically works well even when it is mounted at ground level and has a conductor length (or circumference) of less than 1/3 wavelength. An "ideal" small transmitting loop can theoretically performance as efficiently as a large antenna, and small loops often do approach that level of performance. However, bandwidth is always more narrow due to the very hi-Q of the tuned-circuit configuration.

Components in a resonated transmitting loop are subjected to high current and voltage because of the large circulating currents developed in the high-Q circuit formed by the antenna. It is important that capacitors used in this antenna have a high RF current rating because even a small 10-25 W transmitter may develop a peak current of several amperes. This consideration also applies to any conductors used to form the loop or connect to the capacitor (a short piece of #14 wire may have more resistance than the entire loop conductor). Soldered or welded electrical connections always yield the lowest resistance.

The heart of the MFJ-9232 *Mini Loop Tuner*™ is the loop-tuning capacitor. When coupled to a low-resistance loop conductor, it provides high efficiency.

As the loop antenna is elevated, its efficiency improves accordingly. When traveling, a room at some elevation above ground level makes for a better portable operation experience. At very low heights, close coupling to the ground causes detuning and losses due to current induced into a mirror image of the loop below the surface -- with resistance of the image loop proportional to soil resistance. Another loss component is caused by current flowing in the soil via capacitance between the loop and soil surface.

An operational height equal to 1/2 diameter of the loop antenna is recommended to prevent detuning and excess ground losses when using the MFJ-9232 *Mini Loop Tuner*™ loop antenna system. This means the tuner should be at that recommended height, since it is connected to the bottom (ends) of the loop, whatever the loop antenna configuration: circle, square, hexagonal, etc.

For operation on the 14 MHz band and higher, ground losses are a minimum near ground, so it is fine to operate on the ground floor. For the 7 MHz band and lower, ground losses become significant on the ground floor. To reduce ground losses, operate on a second or third floor.

LOOP THEORY

For minimum ground loss when operating near ground, the loop should be mounted vertically. For higher elevations (relative to the wavelength), horizontal mounting will also give low ground losses.

Using *freeware*-modeling programs, it is possible to improve the efficiency of the loop antenna system by varying the parameters until you optimize your particular operational configuration, even while portable. One source example for free programs is G4FPQ's Web site: <http://www.btinternet.com/~g4fgq.regp/>.

SYSTEM SETUP

SYSTEM SETUP CONFIGURATION

The MFJ-9232 *Mini Loop Tuner*™ setup configuration is simple and consists of the following components:

- RF Generator (Transmitter or transceiver, 5-Watts minimum)
- SWR/Wattmeter
- MFJ-9232 *Mini Loop Tuner*™
- Coaxial cable(s)
- Stranded wire cut to approximately 75% of a $\frac{1}{4}$ wavelength at the chosen resonant frequency

Figure 3 is a block diagram of the typical MFJ-9232 *Mini Loop Tuner*™ setup configuration.

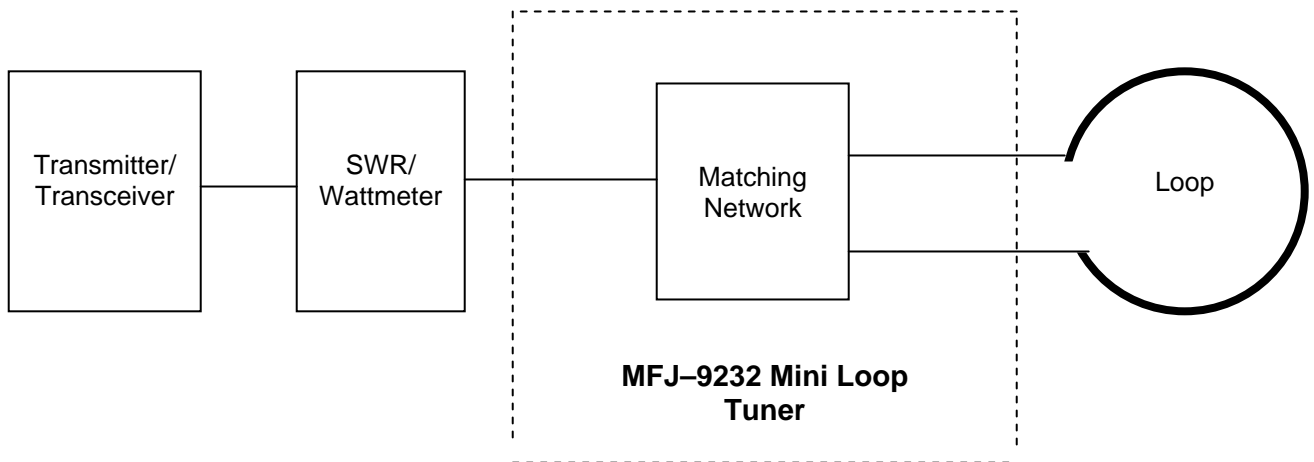


Figure 3: Typical MFJ-9232 *Mini Loop Tuner*™ Configuration

LOOP CONSTRUCTION

The loop can be constructed from wire, tubing, sheet, and an especially good material is 1" wide PC board. However, finding a piece of PC board long enough to form into a circular loop for 7.175 MHz may prove to be difficult! This leads us to the unique opportunity to **EXPERIMENT** while using the MFJ-9232 *Mini Loop Tuner*™ to resonate the loop antenna you design.

The applications and parameters can be adjusted easily with the help of the *Freeware* programs previously mentioned, and you may choose to design a totally new and unique loop antenna for on-air experimentation. Designing an outdoor loop for a band such as 7 MHz could be a challenge and result in a very good radiator and especially good receiving antenna for DX-ing and/or rag-chewing. We, at MFJ, think the experimental aspects of the *Mini Loop Tuner*™ are exciting, and can provide hours of quality operating, even at QRP levels.

SYSTEM OPERATION

MFJ-9232 MINI LOOP TUNER™ OPERATION

The most important aspect of using the MFJ-9232 *Mini Loop Tuner*™ is it opens-up opportunity for Hams to once again **experiment** while enjoying operating at the same time. Imagine how exciting it can be to establish contact with a distant station using an antenna that you designed for the first time. Even more so, what if you are just using a few watts, and the antenna is just a few feet away from your operating position *inside your home!*

Operation is simple, but must follow specific steps in a specific order. Moreover, you must have first consulted the RF Hazards section of this manual to ensure compliance with established standards for Minimum Permissible Exposure (MPE) to certain levels of RF radiation.

WARNING

DO NOT touch or come into contact with *Loop Connectors* or *Loop Antenna* while transmitting

YOU CAN BE SERIOUSLY INJURED !!!

Step 1

Place the MFJ-9232 *Mini Loop Tuner*™ at the chosen place of operation, and connect the loop antenna to the wing nut terminals on the rear panel.

Step 2

Using a pre-cut prepared wire and fasteners (non-conductive plastic clothespins for example) form a loop to enclose as much area as possible (for example, clothespin a wire loop to a curtain around a window frame). A circle encloses the maximum area. Otherwise, drape it across bookcases or similar objects to fashion a loop of sorts to use. If the loop antenna is rigid, then place the *Mini Loop Tuner*™ in a position to accommodate its particular shape and size.

Step 3

Complete the typical MFJ-9232 *Mini Loop Tuner*™ setup configuration as illustrated in Figure 3 of this manual.

Step 4

Make the following preliminary settings on the controls of the Mini Loop Tuner:

- TUNING control to position “Low Freq”.
- MATCHING control to position “Min C”.

Step 5

Tune the transceiver or receiver to the band and frequency of interest and “Ear-ball” tune the MFJ-9232 Mini Loop Tuner controls for maximum noise and S-Meter reading. “Ear-balling”, like “Ball-parking” is a term often used to describe the listening process as used to hear a “peak” in reception before actually applying a transmit signal to the tuner. The tuner will produce a peak when the proper positions for the controls are achieved. The normal process consists of the following suggested instructions:

- Slowly rotate TUNING control clockwise while listening for a peak until you reach position “High Freq.”
- If no peak is found, re-position TUNING control to “Low Freq.”
- Rotate MATCHING control counter-clockwise approximately 1/16 of a full turn.
- Slowly rotate TUNING control clockwise while listening for a peak until you reach position “High Freq.”
- If no peak is found, re-position TUNING control to “Low Freq.”
- Rotate MATCHING control counter-clockwise approximately 1/16 of a full turn.
- Slowly rotate TUNING control clockwise while listening for a peak until you reach position “High Freq.”
- Repeat this sequence until the MATCHING control reaches position “Max C”.
- If no peak is found, the loop length is incorrect for the frequency of interest.
- Once a peak is found, alternately adjust TUNING and MATCHING controls until the peak is maximized.

Step 6

Apply no more than 5-10 Watts of power to the MFJ-9232 Mini Loop Tuner and adjust the TUNING and MATCHING controls for minimum SWR on your external WR/Wattmeter. Readjust the controls until you see no further improvement in minimum SWR. Then, apply more power if required to maintain communication (do not exceed 25 Watts).

Step 7

Be sure that MPE distance standard as defined in Supplement B of the FCC OET Bulletin 65, version 97-01 is met. Should any arcing be detected, stop transmitting and check connections and proximity to objects that may be suspect. If arcing seems to be inside of the MFJ-9232 tuner, lower output power and re-check for arcing.

Step 8

You can now enjoy operating in your favorite mode. However, if you change frequency more than about 5 KHz, you may find you'll need to re-adjust the TUNING controls for minimum SWR. Rotate TUNING clockwise for higher frequencies and counter clockwise for lower frequencies. Even greater frequency excursions can cause the MATCHING control to also require adjustment.

This concludes the MFJ-9232 Mini Loop Tuner System Operation instructions.

TECHNICAL ASSISTANCE

TECHNICAL ASSISTANCE

If you have any problem with this unit first check the appropriate section of this manual. If the manual does not reference your problem or reading the manual does not solve your problem, you may call *MFJ Technical Service* at **662-323-0549** or the *MFJ Factory* at **662-323-5869**. You will be best helped if you have your unit, manual and all information on your station handy so you can answer any questions the technicians may ask.

You can also send questions by mail to MFJ Enterprises, Inc., 300 Industrial Park Road, Starkville, MS 39759; by Facsimile (FAX) to 662-323-6551; or by email to techinfo@mfjenterprises.com. Send a complete description of your problem, an explanation of exactly how you are using your unit, and a complete description of your station.

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