

INTRODUCTION

Congratulations on purchasing the MFJ-856 AC Line Noise Meter. Like professional RFI trackers used by utility companies, your MFJ-856 leads you to trouble spots fast. Here are some important features:

VHF Design: The MFJ-856 operates at 135 MHz where antenna length is short, on-air interference is minimal, and RFI is localized easily for accurate tracking.

Wideband IF: 100 kHz IF bandwidth provides optimized noise sampling.

1 uV Sensitivity: Picks up all noise signatures, weak or strong.

Semi-Log Metering: Semi-log metering system covers a wide signal range without the need for add-on step attenuators.

Balanced Antenna: The 3 element beam is decoupled from case electronics and head phone leads to deliver a clearly-defined null. Locates RFI sources easily.

Audio Jack: Plug in stereo or mono type headphones for audible monitoring, or connect a portable cassette recorder to make sound recordings for later analysis. Many powerline faults have identifiable noise signatures that experienced powerline technicians can identify easily--even over the phone!

Battery Indicator: LED power indicator also monitors battery status--let's you know when it's time to replace the battery *before* the meter stops working properly.

Tracks Many Types of RFI: In addition to transmission line noises, the MFJ-856 also ferrets out residential and industrial noise sources such as electric fence arcs, sparking power equipment, poorly suppressed specialty lighting, and much more. Give your claims added credibility by showing the owners of defective equipment where the problem is being generated--and letting them hear what it actually sounds like!

Fully Portable: Compact hand-held size and built-in battery power let you to explore freely in search of trouble spots.

Always Available: Many power-related noise problems are intermittent and rarely occur when power company engineers are in the neighborhood with the RFI truck. With the MFJ-856, you can capture the data you need instantly--when its happening!

Be a detective and put the fun back into Ham Radio! In addition to solving problems in your own neighborhood, this is a great way to lend assistance to

friends or fellow club members who are having problems of their own. When power companies get a concise description of the noise and a specific pole number, you get much faster service!

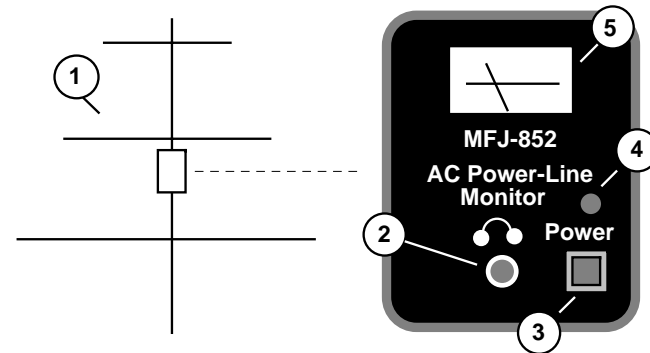
SPECIFICATIONS

Operating Frequency:	135 MHz (internally tunable)
Receiver Sensitivity:	.3 uV for audible detection
Meter Sensitivity:	<2 uV for usable deflection
Meter Range:	50 dB, semi-log response
Receiver IF Bandpass:	100 kHz
Audio Output:	Fixed, headphone level (line level for record)
Power Source:	Self-contained, 9 volt flatpack battery
Current Drain:	30 mA
Antenna:	3 element beam

BATTERY INSTALLATION

To install a 9-volt battery, you must first remove the four small Philips head screws located in the outer corners. Once you have removed the four screws, you may need to apply a small amount of force to remove the faceplate. After installing the battery, reposition the faceplate and replace the screws.

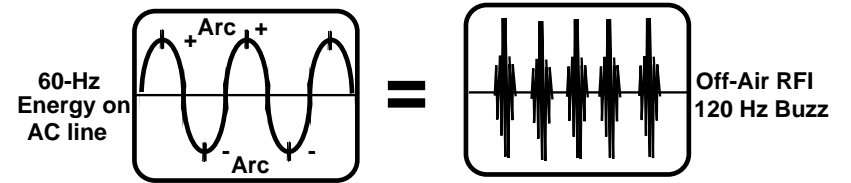
CONTROLS AND LOCATIONS



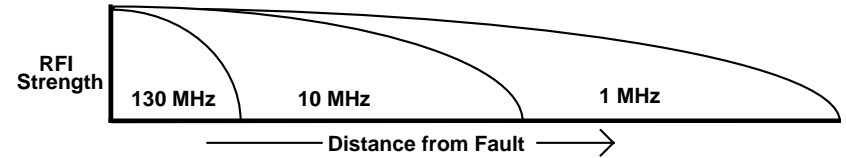
1. **Beam Antenna:** 3 elements for maximum sensitivity and best directivity. Best pick-up sensitivity is obtained when beam is pointed toward the source. A pronounced null is obtained when beam is 90-degrees to the source.
2. **Headphone Jack:** Connect standard stereo or monaural type headphones using a 3.5 mm plug. Also, the headphone jack may be used to feed a portable cassette recorder (line-level input)--or even a portable oscilloscope for complex waveform analysis.
3. **Power Switch:** Press in to apply power to unit.
4. **Power/Battery LED:** Illuminates when power is applied, extinguishes when battery voltage drops to a marginal level.
5. **Meter:** Semi-log metering system displays wide signal range with more resolution at the low end of the scale.

HUNTING DOWN NOISE ON THE POWER LINES

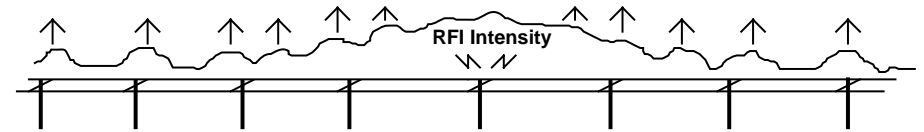
Most utility-line noises comes from arcing or corona. Arcing (or sparking) happens when 60 Hz AC swings to its extreme plus or minus value. This can induce voltage in associated wiring and hardware that arcs across an imperfect insulating medium. The resulting RFI often appears as a 120 Hz AM modulated buzz or hum. Corona happens when a discharge occurs in ionized air rather than through a discharge path to ground. Corona may produce a more constant noise, frying, or even a high-pitched whine.



The distance powerline RFI propagates usually drops rapidly as monitoring frequency increases. A noise that's received for a mile or more in the AM broadcast band may only be detectable for a hundred feet or so at 130 MHz. That's why utility companies use handheld VHF-AM receivers instead of HF radios to zero in on line noise problems.



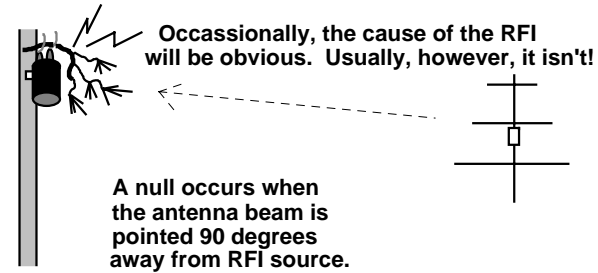
Due to standing waves, RFI varies in intensity along the powerline. This makes precise tracking at HF nearly impossible. However, near the fault, HF peaks occur progressively closer together and amplitude becomes more constant, signaling a "ballpark" location.



Use car's AM radio to find general area. Use MFJ-856 to find the exact source.

A good way to track residential RFI is to tune your car's AM radio to an open channel near the high end of the band. Drive around the affected area looking for a location where the RFI seems to peak up and hold relatively constant. When you find a "getting-warm" zone, get out of the car and use the MFJ-856 to look for a source (usually a specific pole). You should see (or hear) a null in the RFI noise when the beam antenna tip is pointed 90 degrees away from the source. If possible, get out from under overhead wires and well off to one side to pinpoint source. When you think you've isolated the source, write down the pole number.

Occasionally, the RFI source may be visible from the ground (a branch on wire, etc), or audible (a buzzing or frying sound). At night, corona or sparking may be visible, as well.



Power lines are made up from a large inventory of hardware and individual components, any one of which may eventually loosen or fail. Cracked insulators, loose bonding wires, corroded hardware, unbonded switches, open ground wires, damaged lightning arrestors, and defective line fuses are just a few causes! Also, weather (especially wind and humidity) may be an important contributing factor. For example, corona more likely occurs in damp weather, while arcing is more common in dry or windy conditions. Many utility-company RFI technicians are skilled at identifying specific problems by the noise signature they generate, which is why we recommend making a cassette recording of the noise. For a fast power company response, always report the following:

1. **Pole Number:** (123 over 13, etc.) and a general street location.
2. **Description of RFI noise:** (buzz, whine, frying, sporadic bursts, etc).
3. **Weather condition :** (dry/damp, windy/calm, hot/cold, etc).
4. **Special features on the pole:** (big transformer, branch lines, guy wires, etc.).

Occasionally, identifying a specific pole may prove difficult for the layman RFI hunter due to multiple faults or other complicating factors. If you can't trace a RFI source to a specific pole, record a representative pole number in the zone-- and report the fault as "in the vicinity of" that pole number. Utility companies work by street name and pole number when trouble-shooting, and they'll need this information even if it isn't exact.

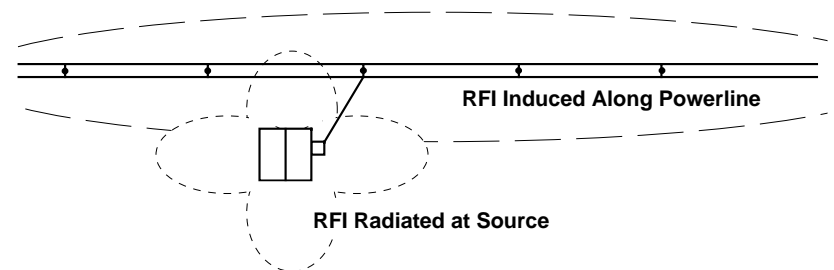
Important Note: It's both illegal and extremely dangerous to tamper with utility poles and powerline transmission equipment!

We've all heard grizzly tales of the old-timer who bashed a pole with a sledge hammer or shook guy wires violently to cure his noise problem. *Please don't attempt this--ever!* Power companies warn that pole-bashing may damage preservative coatings, fracture sensitive components, and loosen hardware--sometimes causing metal parts or energized lines to fall on the basher! Also, most power poles also support sensitive telephone and TV-cable transmission equipment that may be harmed. If you tamper with any of it, you may be subject to stiff criminal penalties--plus held libel for any resultant damage (which could be substantial). The best--and safest--rule of thumb is "look-but-don't-touch"!

NOISE FROM OTHER SOURCES

Not all RFI in your neighborhood may be caused by the utility company's transmission equipment. In many cases, electrical noise can be traced directly to a customer. Once electricity crosses the transom into a commercial business or private residence, responsibility for the problem is usually beyond the power company's control!

Tracking down the source of end-user RFI is much the same as searching the powerlines for faults. Induced RFI travels through the customer's entrance service and out onto the powerline at HF frequencies. When possible, use your car's AM radio to find the general area, then localize the source with your MFJ-856. For this type of noise, the source is usually located in a building rather than up a pole. RFI may be especially strong around the building's entrance cable and meter.



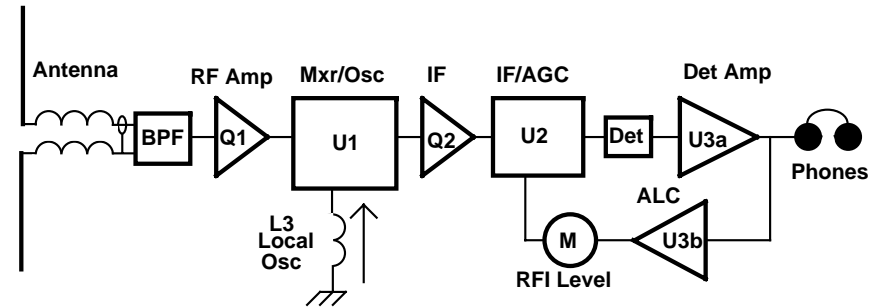
The noise signatures generated by customer-owned equipment may sound different than utility-generated sounds--mostly because the source is different. Popular culprits include heliarc welders, lighting using RF, mercury-vapor, or fluorescent fixtures, dimmers, industrial brush-type motors, switched power supplies and control systems, MRI or x-ray machines, poorly-shielded computer networks, electric fencing, and even defective heating pads or electric blankets. The trained ear of a utility company specialist may prove helpful in making a positive identification, even if it's not their equipment causing the problem.

Honey Works Better than Vinegar:

Most commercial or residential property owners don't want to hear about "harmful interference" problems that might cost money to repair. As the bearer of bad news, it's up to you to put a positive spin on the need for correction and remedy. This means *showing* them the source, letting them listen to what it sounds like, explaining FCC guidelines pertaining to harmful interference, and conveying your concern that severe RFI is often symptomatic of dangerous in-house electrical hazards. Courtesy and specific technical information are always the best tools for winning cooperation. If your initial approach doesn't work, more punitive options are available. One of your best resources may be the ARRL's Regulatory Information Branch at their headquarters in Newington, CT. Also, The ARRL RFI Book (ARRL), and the Interference Handbook (Radio Amateur Callbook), are instructive references that are on sale in most ham stores.

THEORY OF OPERATION

The MFJ-856 is a single-frequency broadband AM receiver operating in the 135 MHz region. RFI signals are picked up by a 3 element beam antenna that is decoupled from the receiver PC board by a choke-style balun. Image rejection is provided by bandpass filter L1/L2, and preamplifier Q1 boosts signals by approximately 20 dB prior to mixer stage U1. U1 also contains the receiver's local oscillator, which operates at approximately 124.3 MHz. The 10.7 MHz IF filter FL1 sets the message channel bandwidth at around 100 kHz, and IF pre-amplifier Q1 boosts signals prior to IF amplifier/AGC gate U2. U2 provides up to 50 dB gain on weak signals, and delivers a 70 dB measurement range for signal input levels exceeding 2 uV in strength. A diode AM detector simultaneously demodulates noise signals and generates a DC level for AGC control. This composite energy is amplified by op-amp U3a. The AF component is routed to the receiver's headphone monitoring circuit, and the DC component is routed to U3b where it is amplified and re-biased to drive the AGC input of U2. The AGC line also drives the receiver's semi-log signal-strength indicator meter.



IN CASE OF DIFFICULTY

Your meter has few internal adjustments and is a trouble-free design. However, it has a sensitive electro-mechanical meter that may sustain damage if dropped. Also, the MFJ-856 is not "weatherproof", and should not be exposed to heavy rain, snow, or other harsh environmental conditions. If you experience a problem, look through the checklist below to determine if it's something simple you can fix yourself.

Fails to Power Up: Check battery condition.

Erratic Operation: Check battery condition--is LED illuminating?

Chronic Interference from Aircraft or Wx-Satellite Signals: Retune L3 slightly.

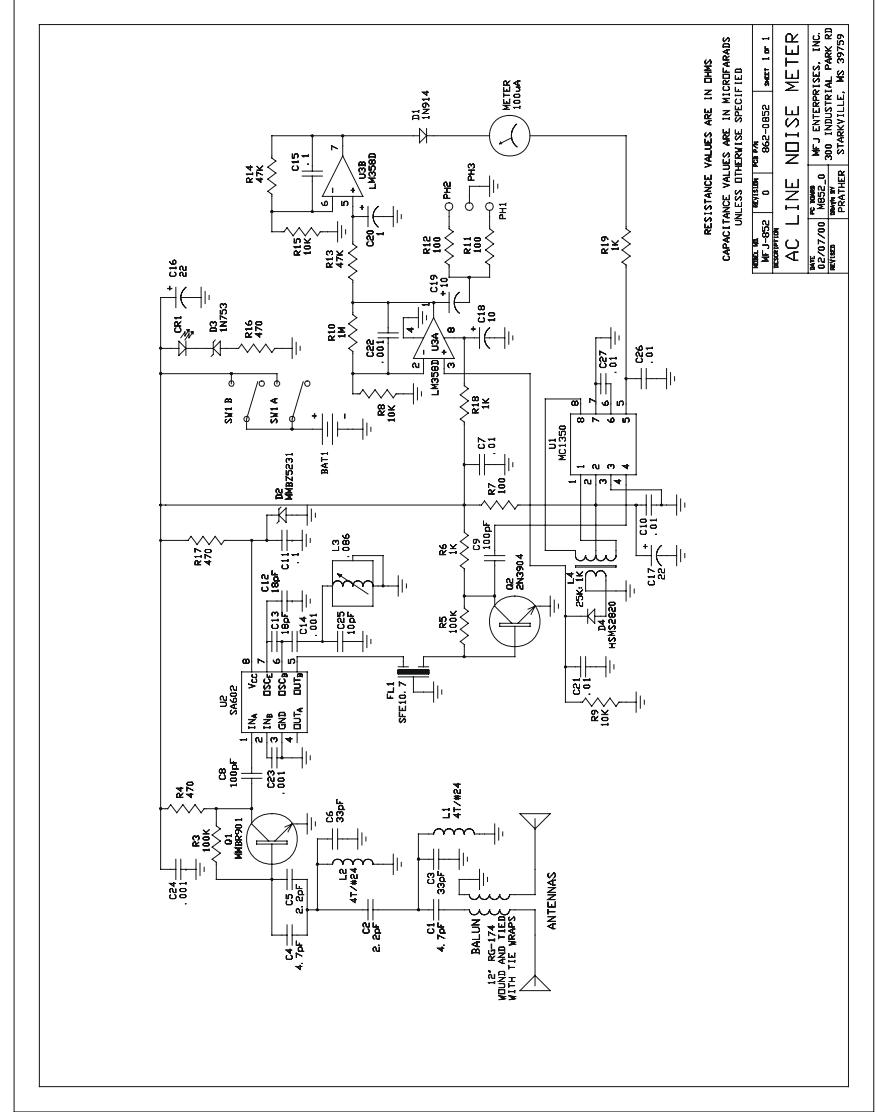
Noisy or Intermittent Audio: Check headphone wires, plug.

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 your problem is not solved by reading the manual 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 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.

SCHEMATIC



LIMITED 12 MONTH WARRANTY

MFJ Enterprises, Inc. warrants to the original owner of this product, if manufactured by MFJ Enterprises, Inc. and purchased from an authorized dealer or directly from MFJ Enterprises, Inc. to be free from defects in material and workmanship for a period of 12 months from date of purchase provided the following terms of this warranty are satisfied:

1. The purchaser must retain the dated proof-of-purchase (bill of sale, canceled check, credit card or money order receipt, etc.) describing the product to establish the validity of the warranty claim and submit the original or machine reproduction of such proof of purchase to MFJ Enterprises, Inc. at the time of warranty service. MFJ Enterprises, Inc. shall have the discretion to deny warranty without dated proof-of-purchase. Any evidence of alteration, erasure, or forgery shall be cause to void any and all warranty terms immediately.
2. MFJ Enterprises, Inc. agrees to repair or replace at MFJ's option without charge to the original owner any defective product under warranty provided the product is returned postage prepaid to MFJ Enterprises, Inc. with a personal check, cashiers check, or money order for \$10.00 covering postage and handling.
3. This warranty is NOT void for owners who attempt to repair defective units. Technical consultation is available by calling the Service Department at 662-323-0549 or the MFJ Factory at 662-323-5869.
4. This warranty does not apply to kits sold by or manufactured by MFJ Enterprises, Inc.
5. Wired and tested PC board products are covered by this warranty provided only the wired and tested PC board product is returned. Wired and tested PC boards installed in the owner's cabinet or connected to switches, jacks, or cables, etc. sent to MFJ Enterprises, Inc. will be returned at the owner's expense unrepaired.
6. Under no circumstances is MFJ Enterprises, Inc. liable for consequential damages to person or property by the use of any MFJ products.
7. Out-of-Warranty Service: MFJ Enterprises, Inc. will repair any out-of-warranty product provided the unit is shipped prepaid. All repaired units will be shipped COD to the owner. Repair charges will be added to the COD fee unless other arrangements are made.
8. This warranty is given in lieu of any other warranty expressed or implied.
9. MFJ Enterprises, Inc. reserves the right to make changes or improvements in design or manufacture without incurring any obligation to install such changes upon any of the products previously manufactured.
10. All MFJ products to be serviced in-warranty or out-of-warranty should be addressed to:
MFJ Enterprises, Inc.
300 Industrial Park Road
Starkville, Mississippi 39759 USA
and must be accompanied by a letter describing the problem in detail along with a copy of your dated proof-of-purchase and a daytime telephone number.
11. This warranty gives you specific rights, and you may also have other rights which vary from state to state.