

# Measurements of High-Frequency Noise on Power Lines and Ground

OnFILTER's power line EMI Adapters MSN01 and MSN12 enable convenient and safe way to make accurate measurements of high-frequency signals and noise on power lines and ground without creating ground loops and without problems associated with high voltage on power lines.

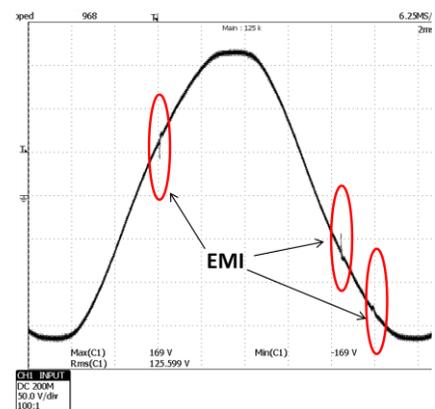
## Challenges in Measuring Signals on Power Lines

### High Voltage Problem

Connecting your oscilloscope or a spectrum analyzer to live power line is highly problematic. The peak voltage on a 250VAC line reached 353V in each polarity, meaning that a regular 10:1 probe is insufficient to fit a complete waveform on the screen of an oscilloscope. At a minimum, a 100:1 probe is required. Even with such probes strong power line surge can still damage your instrument.

### Measurement Problem

100:1 probe attenuates not only power line mains voltage but all signals on power lines. High-frequency signal will also be reduced by 100 times making it difficult to measure. If you are concerned with noise of 0.5V/0.3V as specified in IPC-A-610, now you would have to deal with looking for a 5mV signal with dubious certainty.



Noise on AC Line

### Triggering Problem

If the above is not enough, it is unlikely that you will be able to trigger your oscilloscope on the elusive high-frequency signal because your oscilloscope will be latching on an overpowering 50/60Hz signal. Even the scopes with high-pass filter on trigger are unlikely to succeed because the ratio between peak level of AC mains and high frequency noise is just too high.

### Ground Loop

With the exception of battery-powered instruments your oscilloscope or a spectrum analyzer would be AC-powered and grounded via its outlet. If during measurements ground lead of your scope probe touches live wire this would be catastrophic short via your instrument; if the scope probe's ground touches any other ground in wiring or equipment, this would create ground loop with serious measurement errors as the best outcome. Even with the battery-powered instrument there is still input imbalance vs. ground and a parasitic capacitive coupling between the oscilloscope's chassis and AC ground causing measurement issues at high frequencies.

### Impedance Matching

A 100:1 probe coupled with the scope would inevitably have high input impedance which is a poor match for the impedance of high-frequencies source on power and ground wires. This would cause ringing of high-frequency signals and amplitude errors which are just artifacts of measurements.

## Solving Above Problems with OnFILTER' Power Line EMI Adapters

Power Line EMI Adapters MSN01 and MSN12 resolve all the problems associated with measurements of high-frequency signals on power lines and ground.

### Blocked AC Mains Voltage

MSNxxx adapters completely block 50/60Hz signal while being transparent to higher-frequency signals present on power lines. This enables measurements of only high-frequency signals without triggering or measurements problems.

### Instrument Safety

Input of EMI Adapters is galvanically separated from its output, which in combination with rejection of 50/60Hz signal prevents high voltage from reaching sensitive electronics in your instrument.

### Balanced Input

MSNxxx adapters have completely balanced input which in combination with galvanic separation between input and output removes possibility of ground loop and allows use of AC-powered oscilloscopes or spectrum analyzers without a need for ground isolation

### Impedance Matching

While impedance of power lines and ground at high-frequency is seldom determined, it is certainly low. MSNxxx EMI Adapters provide low input impedance for such signals without loading AC mains resulting in more accurate measurements and reduced artifacts.

### Model Differentiation

MSN01 is a plug-in device equipped with the US-type NEMA5-15P plug. For use with any other outlet use common grounded outlet adapter. MSN01 provides selection between differential (live-to-neutral) and common mode (live+neutral-to-ground) measurements.

MSN12 is almost identical to MSN01 except instead of a plug it uses two test leads allowing EMI measurements in any outlet, electrical distribution box, different grounds in equipment and just about anywhere up to 380VAC.

Both adapters come with BNC cables and necessary RF adapters and terminators - see User's Guide for details.

While both models perform very similarly, if in doubt which one to use, keep in mind that MSN12 is more universal since it does not require an electrical outlet.

For more details please visit

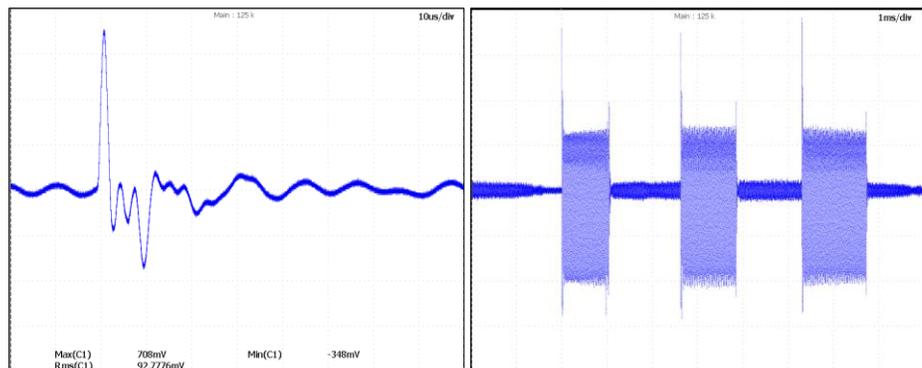
[www.onfilter.com](http://www.onfilter.com) for more detailed information. Contact us at [info@onfilter.com](mailto:info@onfilter.com).



Plug-In EMI Adapter MSN01



Hand-Held EMI Adapter MSN12



Spike from the Dimmer

Power Line Communication (PLC)