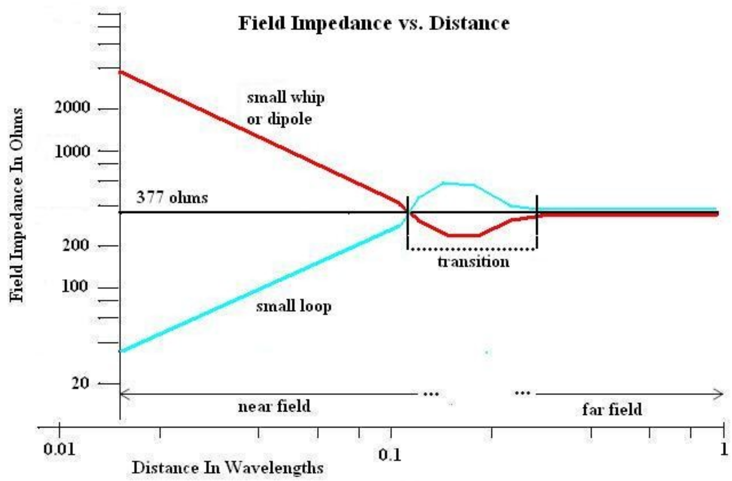
Measurements Of Some Antennas Signal To Man Made Noise Ratios
In The Daytime MW And LW Bands

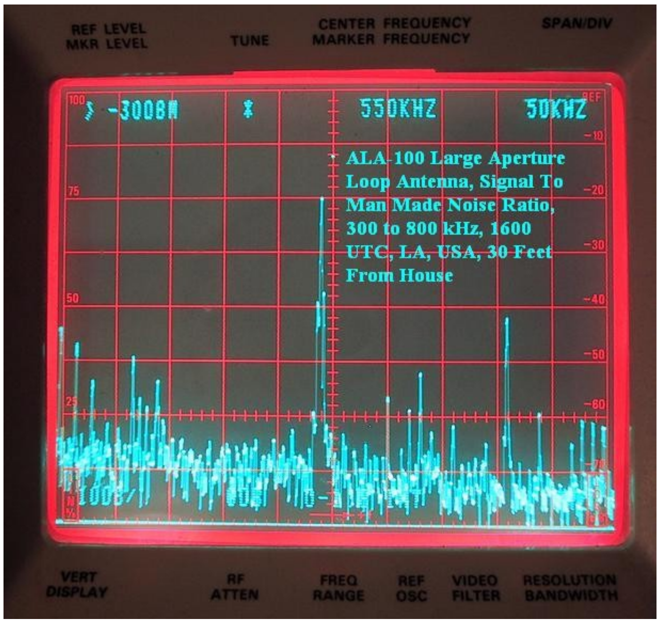
Dallas Lankford, 9/20/06, rev. 2/18/07

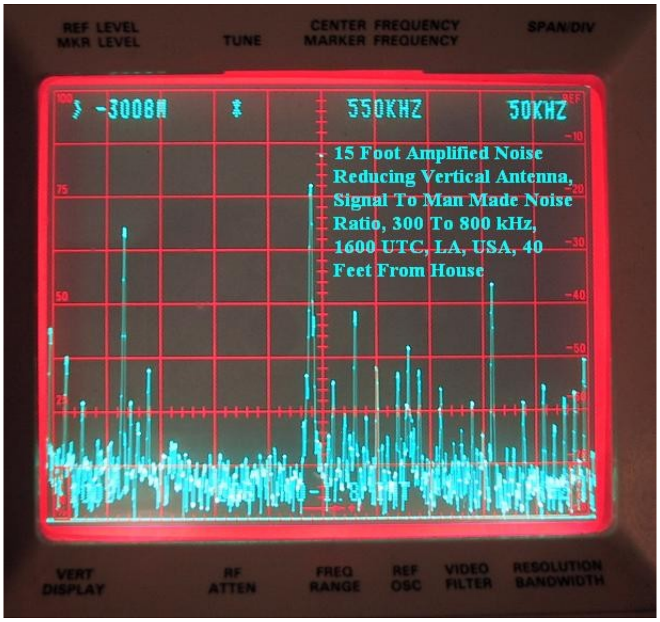
Over the years I have read repeated claims that loop antennas are more immune to man made noise than other kinds of antennas. And over the years I have used many kinds of loop antennas myself; yet I have never been able to discern that loop antennas are more immune to man made noise than other antennas except when a loop antenna is used to null man made noise, which, of course, isn't the same thing as immunity to man made noise. In and around the MW band man made noise frequently has a stronger highly directional component and a weaker more or less omni-directional component. Perhaps it is this aspect of man made noise and a loop's nulling ability which has caused some to claim that loops are more immune to man made noise than other kinds of antennas.

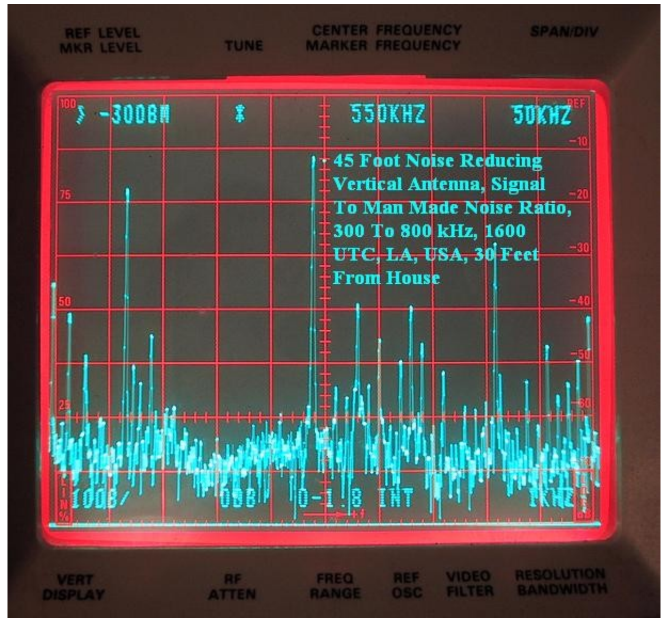


Sometimes a field impedance argument similar to the following has been given to support claims that loop antennas are more immune to man made noise than other kinds of antennas. ***If you consider that most sources of electrical noise, such as the dreaded PC, radiate their noise from the mains wiring, and that the near field E dominates, it is indisputably true that an antenna which responds to the E field and which is in a cloud of radiated noise will transfer the noise to your receiver and effectively blanket any wanted signals which are arriving from the far field, in other words, just those signals you want to hear and can't because of the electrical din created by your house wiring and all the devices connected to it.*** Sketches of the graphs of the field impedance of a small loop antenna and small whip antenna or dipole are given above. If the field impedance argument were true, then within about 0.08 wavelength of my house a loop antenna would have a better signal to man made noise ratio than a whip or dipole antenna.

For the MW band 0.08 wavelength is about 180 feet at 500 kHz and about 50 feet at 1700 kHz. I have a 45 foot noise reducing vertical about 30 feet from my computer, a 15 foot amplified noise reducing vertical about 40 feet from my computer, and a 60 foot circumference ALA 100 loop about 30 feet from my computer. As a long time MW DXer I was naturally interested to see if I could observe any signal to man made noise ratio (abbreviated S/MMN) differences among those antennas in and around the MW band. Measurements were made at midmorning to eliminate atmospheric noise. A frequency range of 300 to 800 kHz was used so that all antennas were well within the near field of my house, and so that MW and NDB signals as well as man made noise could be seen clearly on a Tektronix 495P using a 1 kHz resolution bandwidth. My computer was running during all of the measurements.

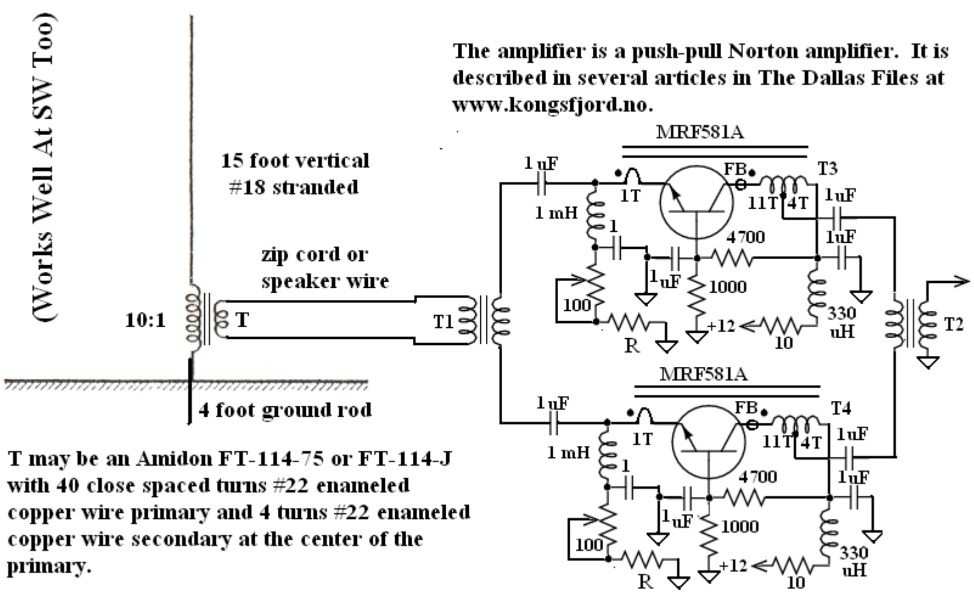






First we view the spectrum of the ALA 100 oriented for maximum signal pickup E-W. The ALA 100 was located 30 feet East of my house. The strongest signal visible is KNOE 540 kHz in Monroe, LA, almost due East of my house. Several other MW signals are visible, as well as several NDB's. Second, we view the spectrum of an amplified 15 foot noise noise reducing vertical antenna located 40 feet to the Southeast of my house; see the schematic below. Examination shows that the 15 foot vertical has about a 5 dB better overall S/MMN than the ALA 100 loop. A schematic of the amplified 15 foot vertical noise reducing antenna is given below. Third, we view the spectrum of a 45 foot noise reducing vertical antenna (described in "MW and LW Noise Reducing Antennas," in The Dallas Files here) located about 30 feet South of my house. Overall it has about a 5 dB better S/MMN than the 15 foot vertical, and about 10 dB better than the ALA 100 for the 300 to 800 kHz frequency spectrums above (and also throughout the MW and LW bands based on other observations not shown).

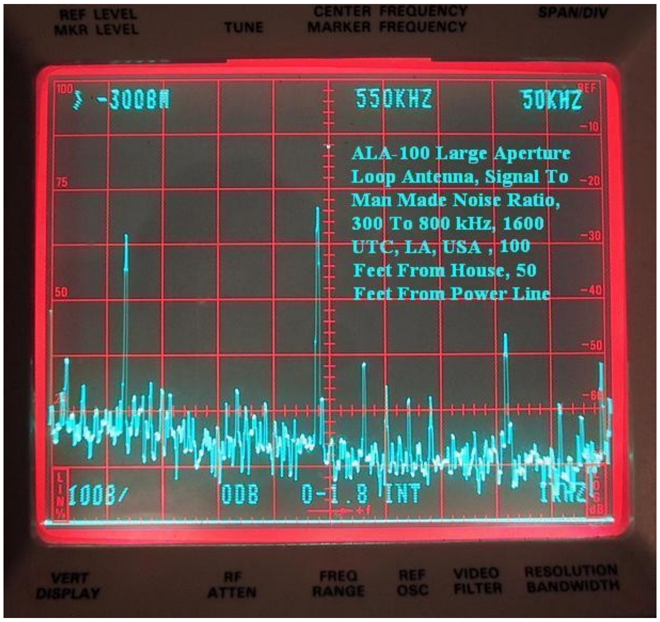
Short Amplified High Performance MW And LW Vertical Antenna

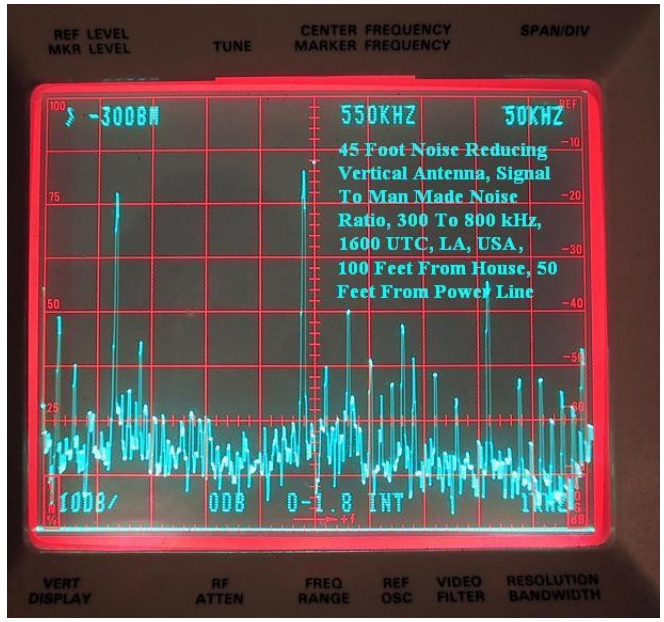


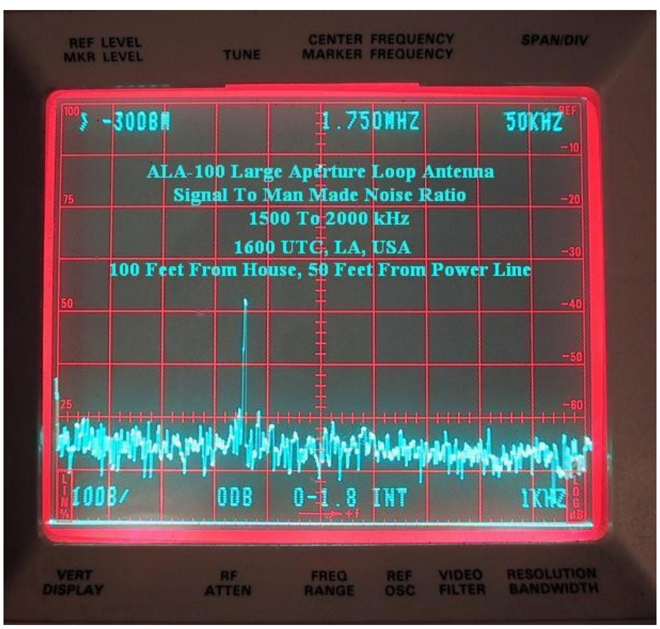
Based on these and other measurements made over many hours, the field impedance argument that loop antennas always have better S/MMN's than other receiving antennas in the near field of houses is clearly without basis in fact.

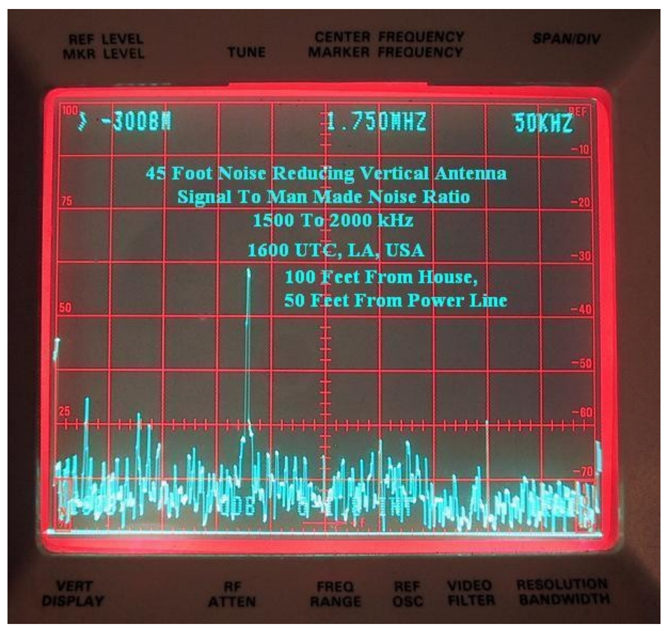
In fact, these measurements have shown that noise reducing vertical antennas generally have better S/MMN's than an ALA 100 for MW and LW reception when the antennas are located within the near field of my house.

Because of space constraints one of my 45 foot noise reducing vertical antennas for my MW phased array is in the near field of the elevated power lines on the poles along the road in front of my house. To determine if an ALA 100 would have a better S/MMN in this setting, I put one at the same distance from the power line as the vertical. Below are typical S/MMN's which I observed for these antennas and placements.





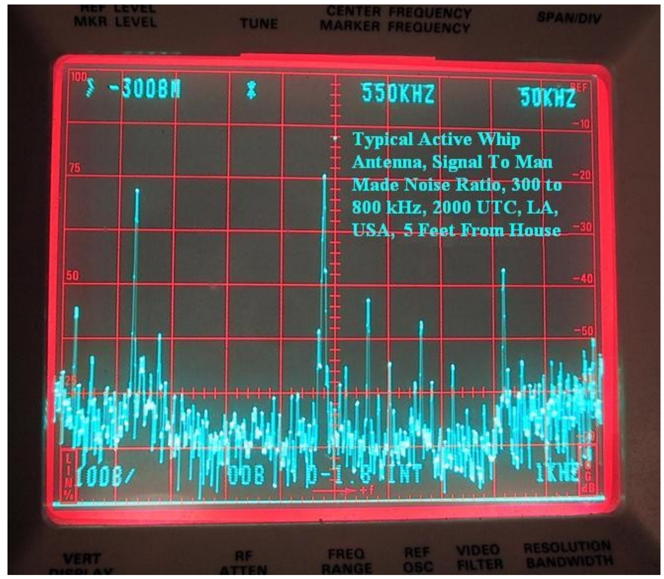




As can be seen, the 45 foot noise reducing vertical has about a 10 dB better S/MMN than the ALA 100 for the MW and LW bands when the antennas are in the near field of the power lines in front of my house. Similar measurements were made during many hours of observation.

Again, the field impedance argument that loop antennas always have better S/MMN's than other antennas located in the near field of man made noise sources is clearly without basis in fact.

The following quote is due to. http://www.aa5tb.com/loop.html ***It is often believed that magnetic antennas will not respond to local noise because local noise is mostly composed of electric fields. This is ONLY true if the offending source is in the extreme near field (reactive field) of the loop antenna AND if the source is truly of electric field origin. An example of this might be a high impedance power transmission line that had an arcing insulator and was right next to the antenna. In this case a small loop may not respond to the interference as much as say a dipole would.***



I have been asked how an active whip, as opposed to the amplified whip and noise reducing vertical antenna above, compares to the ALA 100 with 60 foot circumference. So here is a signal to man made noise spectrum for one of the typical active whip antennas I have used, cf. the article "Some of my favorite small antennas for MW and LW," in [The Dallas Files](). Unless an active whip uses isolated DC power and signal lead in, and is grounded with an outdoor ground rod, man made noise may couple into the signal path. Consequently, the power leads were isolated from the signal path and from the AC power supply with 1 mH chokes, and the signal was brought to the receiver with twin lead. Without these measures, man made noise was sometimes 15 dB or more higher than shown on the spectrum snapshot, i.e., the S/MMN was sometimes 15 dB or more worse. Careless installation of an active whip antenna might cause one to conclude that a loop antenna has a much better S/MMN than an active whip antenna. The whip I used for this measurement had short signal and power leads, and so it was located only 5 feet from my house. My computer was turned on and located about 25 feet away from the active whip antenna. The whip element was 5 feet long, and the output was amplified with a 10.8 dB gain push-pull Norton transformer feedback amplifier so that man made noise could be seen clearly on the Tektronix 495P. The active whip signal to man made noise ratio was essentially the same as an ALA 100 located about 30 feet from my computer.

Again, measurements show that there is no basis in fact for claims that loop antennas are always more immune to man made noise than other antennas when the antennas are in the near field of man made noise sources.

Recently I had opportunities to observe other occurrences of man made noise in the vicinity of my house. Strictly speaking these are not measurements of S/MMN, but rather comparative observations, and some were made at night. While testing a low noise 12 VDC active antenna power supply I had clear receptions of 183 kHz Felsberg, Germany and 162 kHz Allouis, France shortly after sunset on an active whip antenna about 30 feet from my house, while at the same times the receptions were poor or nonexistent using a 60 foot circumference ALA 100 and a 45' noise reducing vertical antenna at about the same distance from my house. Fortuitous placement of the active whip turned out to be the reason it produced clear audio while the ALA 100 and 45' vertical did not. I am not the first or only one to have observed that placement of a short active whip antenna can have a beneficial effect on the S/MMN. For example, John Plimmer has an interesting review of the [DX-1 Pro]() that includes a discussion of antenna placement during installation which minimized the S/MMN at his location. Also, while testing a Sony 2010 whip antenna modification of mine which consisted of an inductor in the whip base tuned by varactor diodes that made a very sensitive antenna, I noticed again what I have observed before with other sensitive portable receivers, namely that the "man made noise halo" of my house did not extend very far from the walls of my house, often hardly 10 feet. If I walked a few paces away from my house, daytime MW reception was usually about as good with my 2010 with modified whip antenna as with an R-390A and a 45' noise reducing vertical antenna. Of course, with my modified 2010 inside my house, weak daytime MW signals were covered with man made noise. It follows that for a good S/MMN an active or noise reducing MW antenna often does not need to be located at a great distance from your house, and that additional improvements in S/MMN can frequently be obtained by careful placement(s) of the antenna(s).