ANTENNAS

Home-made antennas can greatly improve the performance of AM and FM radios, short-wave receivers, and scanners. If you are a talk-radio fan then experiment with the AM band antennas and you will be able to hear shows from all over the country with surprising clarity. Short-wave receivers are always coping with weak signals and they must have a good antenna to perform adequately. Scanners can pick up local police and two-way radio with the little telescoping antenna provided but with good antennas a scanner becomes an amazing ear on the world nearby. No pre-amp, filter or other receiver refinement offers anywhere near the level of performance improvemen t that a well-designed antenna offers. The results can be quite satisfying, leaving no doubt that the project was well worth the effort.

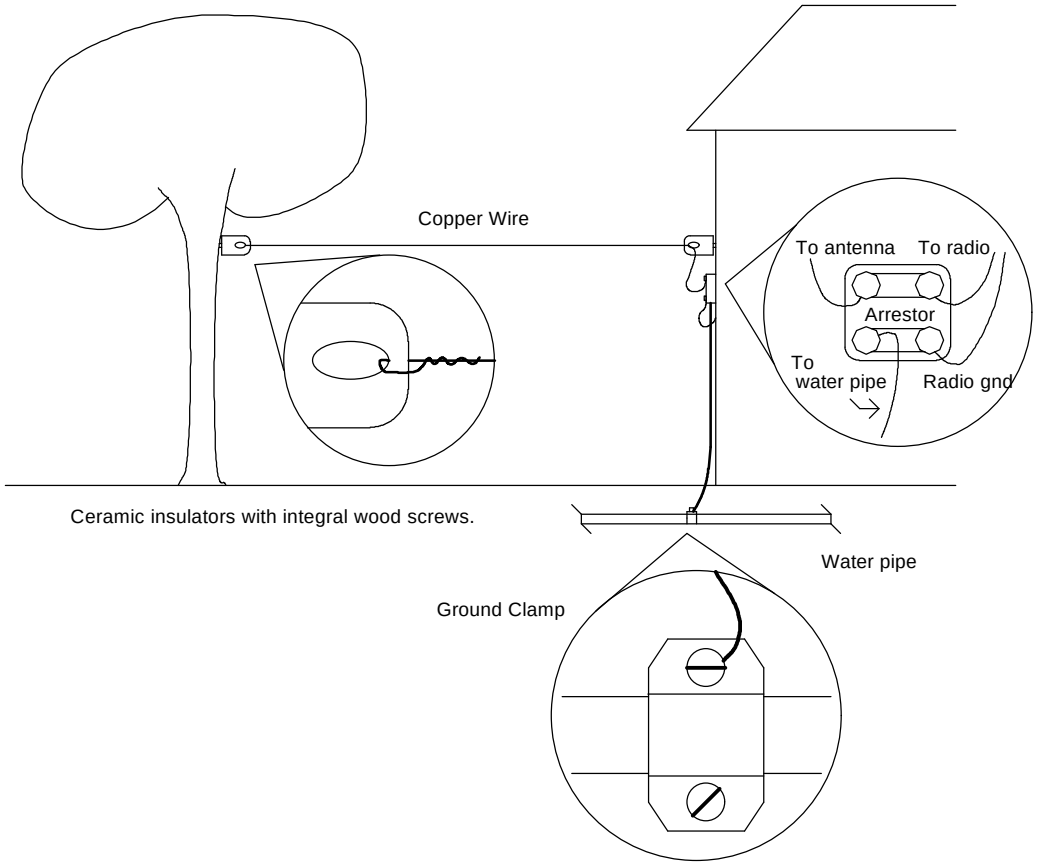

Figure 1: Long wire antenna for AM and shortwave radios.

AM Band Antennas

A good AM Band antenna can be a simple long-wire strung between two trees or across the top of the roof. Even a modest length wire will give your receiver greatly improved reception

with less static because the signal pickup is occurring some distance from the interference generating appliances in the house. An insulator mounted high in a tree so that the wire has a large vertical rise will give great results. Mount the antenna as high and as far from the house as practical. Use a good quality ceramic insulator for holding the wire and add a commercial lightning arrestor where the antenna meets the house (Fig.1). Ceramic insulators are available with built-in wood screws and can be screwed into a tree or the wood parts of the house by hand. A good place for the arrestor is directly above the point where the water line enters the house. Run a heavy gauge ground wire straight down to the water pipe and attach it with a brass grounding clamp. This connection also makes an excellent ground for the receiver. A shielded cable lead-in wire can give improved results when the residence has unusually noisy appliances. If you do not have an AM radio with a coaxial antenna jack then consider using an auto radio. Auto radios are well shielded to prevent ignition noise from interfering with reception and all that is needed to make a superior receiver for the home is a 12 volt power supply and a speaker. Inexpensive AM car radios are quite common, being discarded for fancy stereo upgrades and even the cheapest car receiver will outperform most home radios.

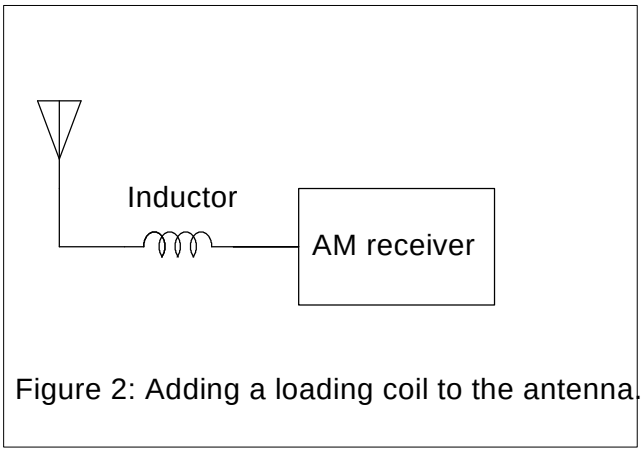

Figure 2: Adding a loading coil to the antenna.

In the event that a little more signal strength is desired, fig. 2 shows how to add a loading inductor to the antenna. Most long wire antennas will be considerably less than 1/4 wavelength at AM band frequencies and behave as though a small capacitor is connected in series. The inductor resonates with this capacity and will increase the signal strength significantly. Obviously, the required inductance varies with the received frequency. The values typically range from about 200 microhenry at the high end of the band to about 2 millihenry at the bottom end of the band for a 20 foot antenna.

Fig. 3 shows how to build a programmable loading coil using a 4.5 inch PVC coupling (found in the plumbing supply area of the local home improvement store) and 22 gauge insulated wire. The coil is wound with 100 turns with taps brought out every 10 turns by twisting a little loop in the wire.

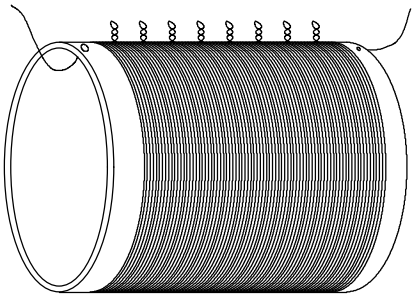

Figure 3: Multi-tapped loading coil wound on 4.5 inch PVC coupling.

The total inductance of this inductor is about 1 millihenry so short antennas may need more turns for the lower frequencies. Fixed inductors and a multi-position switch can be used to build a more compact and convenient unit shown schematically in fig.4.

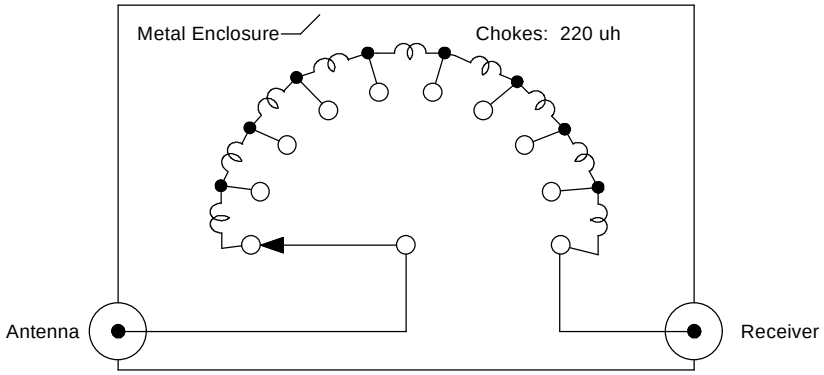

Figure 4: Adjustable loading coil built with a 10-position switch.

220 microhenry chokes are shown to give enough inductance to handle shorter antennas but other values may be used depending on the application. Remember, a loading inductor is probably not needed unless the signal strength is too low or fading.

A directional antenna may be constructed with a ferrite rod and amplifier as shown in fig.5. A ferrite rod 5/16 inches in diameter and 7 inches long was wound with 90 turns which gave sufficient inductance (about 300 uh) to cover the AM band without tuning and gave good reception well into the short-wave band. Experiment with whatever loopstick is available but larger is better.

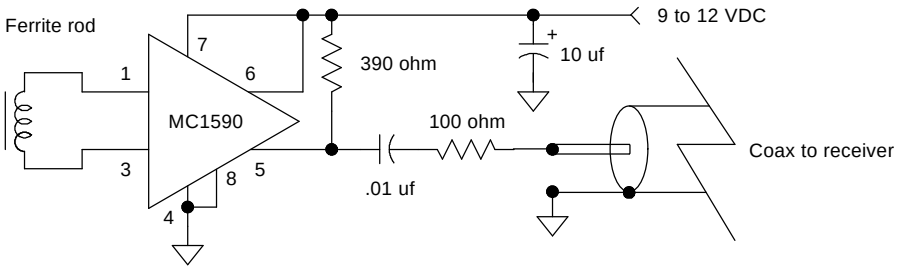

Figure 5: Ferrite antenna with built-in amplifier.

The MC1590 differential amplifier may be constructed on a small piece of copper-clad circuit board material using the copper board for ground connections. The amplifier should be mounted near the ferrite loopstick with the coax and power wire leading to the radio. No separate ground wire is shown since the coax shield will serve both purposes. The loopstick and amplifier may be slipped into a piece of 13/8 inch PVC with a cap on one end and a right angle coupling and pipe on the other (Fig. 6).

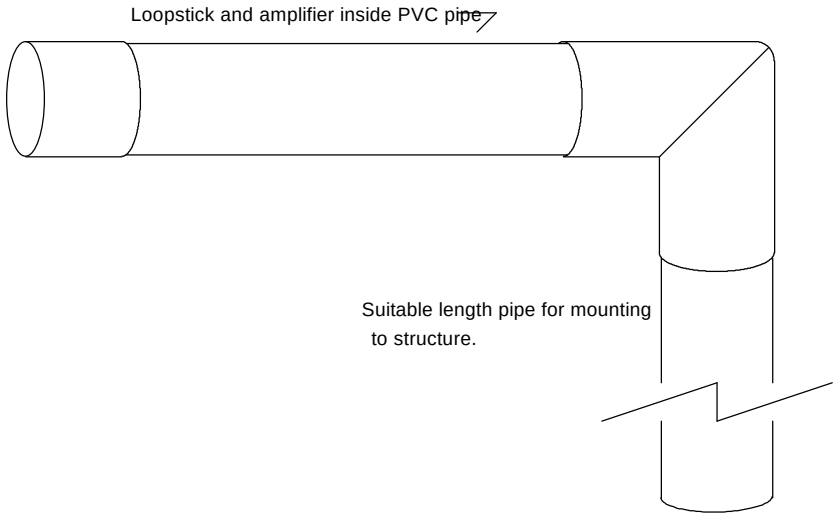

Figure 6: PVC enclosure for loopstick antenna.

The vertical pipe may be secured to the outside wall of the house with clamps loose enough to allow the antenna to be aimed. The wires can simply hang out of the bottom of the tube without any seal or a little squirt of foaming urethane caulking could be used to seal the pipe. Ground the coax to the cold water pipe for lightning protection if the loop is outside and high.

A totally different approach to low frequency antennas is shown in fig.7. A very short antenna can give amazing results, often performing as well as a long wire antenna if the proper buffer amplifier is added between the radio and the antenna. The electrical model of a short antenna includes a very small series capacitor - so small that little signal gets through and the required resonating loading coil is impractically large. However, if the antenna is connected to a high impedance buffer with a very low input capacity, the antenna capacity will not attenuate the signal significantly. The amplifier must have good intermodulation characteristics so that phantom stations don't appear all over the dial and the antenna must be kept short to prevent amplifier overload. Don't connect this circuit to a long wire antenna unless you are curious to hear what radio chaos sounds like.

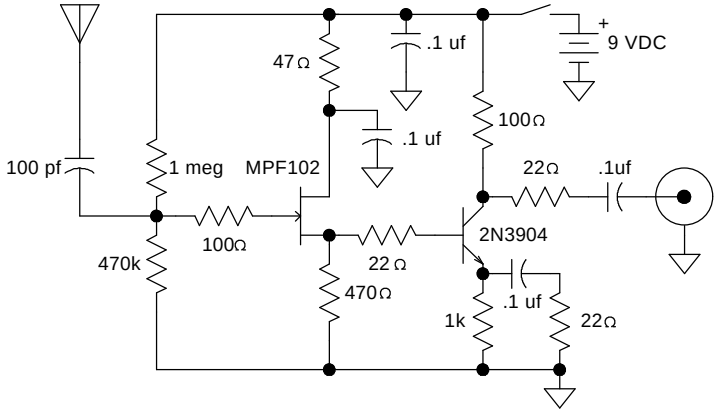

Figure 7: Short antenna buffer/amplifier.

The N-channel JFET shown is a MPF102 but other types may be substituted. The antenna may be a few inches to about 6 feet but avoid using longer antennas. With the values shown the buffer will work well from below 100 kHz to about 15 MHz which covers the frequency range where an antenna buffer is useful.

For higher frequencies, a resonant antenna becomes feasible. For example, Fig. 8 shows a simple vertical ground-plane antenna which connects directly to 50 ohm coaxial cable without a loading coil or matching network. Using the equations shown, a 49 MHz antenna would have a vertical element 57 inches long and ground elements 59 inches long. The vertical element simply connects to the center conductor of the coax and the ground elements connect to the coax braid. The elements may be mounted on a small square of phenolic, fiberglass, or other weatherproof board material. Try not to let dissimilar metals come in contact or, if they must, coat the contact area with silicone rubber. One simple approach is to make the whole affair from PVC pipe with copper wire or tubing on the inside.

It is often desirable to have a fixed-frequency antenna with directionality for monitoring a particular station or for installing on an antenna rotator. For example, if you live within a mile or two of a fast food restaurant you can probably pick up the little wireless microphones they use to take orders. You are probably wondering why anyone would want to pick up those signals (which are around 33 MHz). Hmmm. Well, it would be a challenge. Or, how about building a dedicated antenna to receive a distant weather transmitter instead. Or the police in a neighboring town, or a remote airport. Those sound a little better. The point is that a directional antenna will give greatly improved performance for any of the signals on your scanner.

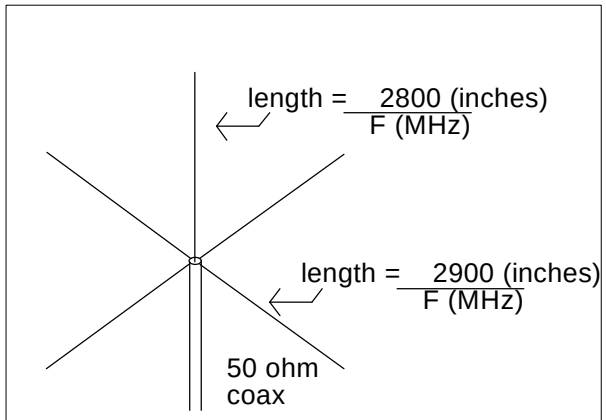

Figure 8: Vertical ground-plane schematic.

Multi-element yagi antennas are a good choice for single frequency reception and log-periodic antennas give excellent multi-band reception. The construction of these antennas can prove difficult and purchasing a factory assembled unit is usually a preferable approach.