

# Technical Note

## Insulated Support Structures

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Wood or fiberglass support structures are not a good idea. They are an insulator. The cabinet earth ground, coaxial cables, and conduits attached to the support would be the only conductive path for lightning energy. If a wood or fiberglass pole must be used, the first step is to provide an alternate conductive path down the pole to earth. A lightning diverter (lightning rod) on top of the pole (above the antenna) with a separate 3 inch copper strap as an earth ground conductor, would provide a low inductance/large surface area conductive path to an earth ground system.

If an equipment box were mounted below the antenna on the insulated pole, coaxial cable shield grounding kits could be applied to the coax cable above and below the cabinet with 1½ inch straps around the pole to the downward 3 inch copper strap. The 3 inch copper strap earth ground conductor should be routed on the opposite side of the pole from the coax cable. (See “Coaxial Entry Panels” and “Grounding” topic)

When large currents flow through any conductor, a strong magnetic field is developed around the conductor and can couple energy to other nearby conductors. A circular conductor will usually be surrounded with a cylindrical magnetic field varying in intensity as the current flow propagates down the conductor. The circular conductor's cylindrical field “pattern” is also indicative of its magnetic field susceptibility boundaries.

A copper strap will also develop a magnetic field closely aligned with its physical shape. As current propagates down the strap, a magnetic field develops close in to the flat portion and extends out from the edges. The strap's field “pattern” is also indicative of its magnetic field susceptibility boundaries.

If downward circular conductors were arranged perpendicular to the flat side of the copper strap (opposite sides of wood pole), the magnetic field overlap would be reduced and mutual coupling would be minimized. The strap will conduct most of the current to earth ground with less reverse EMF developed on the coax cable.

- If the Cabinet is pad mounted, all the energy on the large surface area conduits and/or coaxial cables would be directed towards the cabinet (entering from the top or side) with resultant large currents through the cabinet to local earth ground. Below grade cabinet bottom entry with a low ground connection on the coax would reduce current flow through the cabinet (recommended). The conduits and/or coaxial cable shields should be grounded at the base of the support. The remaining energy would go to earth down the cabinet's internal earth ground conductor. The usual center pin/shield propagation differential voltage would occur and could be equalized by an appropriate dc blocked center pin protector.

- If the Cabinet is pole mounted, current flow from the antenna coaxial cables shields and coax / conduit (going downward from the cabinet) could pass through the cabinet, and connector panel ground plane. Duplexer internal ground connections could sustain cumulative damage and PCB ground plane traces could be destroyed. If coaxial cables were brought down the outside of the cabinet, looped up, and entering through a bottom connector (preferred), the lowest inductance path would be through the bottom panel of the cabinet to downward ground conductors. The additional coax and 180 degree turn would add series inductance. Current flow through equipment would be minimized and a bulkhead type center pin protector could be used as a bottom connector.

## **Concrete Poles**

Concrete when in moist soil is a fairly good conductor, but when dried out is not very good except for the embedded rebar. The concrete pole will not conduct the high lightning potential as well as the coax cable. Almost all the stroke energy will be split between the rebar and the coax. Even with an additional 2/0 down conductor, One hundred feet of 2/0 is very inductive and will create a voltage drop of several hundred thousand volts during an average strike (could be much more). With that much potential at the top, it could arc over to the antenna coax, down to the radio, and to whatever path to earth it can find. The solution is to provide a more suitable (to lightning) path to earth. Perhaps the pole manufacturer provides an external connection to the rebar?

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