PolyPhaser

Technical Note

GPS Lightning Protection and Antenna Placement

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The first consideration for GPS antenna placement is a clear view of the sky, preferably 360 degrees. In the usual installation, the GPS antenna is located low and close to the equipment building roof. If an outdoor cabinet, the antenna is mounted on the cabinet or very low on the adjacent monopole/tower. A direct lightning hit to the above mounted antenna is unlikely. Mounting on an equipment building roof or cabinet is the safest place since the potential rise on the outside of either of these structures would be more or less equal with the potential on the inside. The PolyPhaser protector is there to equalize the differential in potential that occurs between center conductor and shield of the coax cable on its way from the antenna to the receiver.

The zone of protection from various lightning rod types is a well discussed topic. Many claims are made for different configurations. Let's consider a single point Franklin (lightning) rod. If below about 60 feet we can assume a 45 degree "cone of protection" to be a useful concept. If above 120 feet, we could apply the "rolling ball" theory. The space in between would have a varying probability of a strike depending on side arms and side mounted antennas.

If the GPS antenna is mounted on the monopole/tower (since this is the structure we expect to be hit), there will be an inductive voltage drop occurring during the event that will be distributed down the structure to earth ground. This voltage drop is the result of the fast rise time lightning current pulse traversing the inductance of the structure. (Ldi/dt). If the GPS antenna is mounted on this structure it will be elevated to a potential higher than the equipment building or cabinet. There will be current flow on the shield and center conductor of the coax cable towards the receiver. A coax cable grounding kit or PolyPhaser integrated ground entry panel will direct the shield currents toward earth. A PolyPhaser protector will "turn on" and direct any current on the center conductor towards earth. Proper shield grounding and center conductor protection are essential to receiver survival.

GPS tower mounted LNA protection.

The antenna element at GPS frequency is usually "grounded" and doesn't have enough capture area to couple much energy to the input. The problem is at the LNA output. In roof or cabinet mounting there isn't the potential that could occur with a monopole/tower mount. If the GPS antenna support structure is elevated in potential (due to its inductance), the GPS antenna / LNA will also be elevated to a potential determined by the voltage distribution across the structure, and the height of the GPS antenna mounting on the structure. Since the coax shield is usually common with the GPS antenna mounting bracket, current will flow down the shield. The voltage differential at the top of the coax between the shield and the not yet elevated center conductor will appear across the LNA output circuitry. The LNA output could be destroyed in the attempt to bring the center conductor up to shield potential. If another protector were installed at the output of the LNA, any voltage differential between center conductor and shield would "turn on" the protector. Current flow that would have gone through the LNA output now goes through the protector. The LNA would survive. The top protector could be combined with a voltage "pick-off" for power to the LNA. There have been few with LNA losses. The higher the GPS antenna is mounted on the support structure, the more probability of damage. See "Tower Top Electronics"

If there is no active electronics in the antenna, one protector at the equipment entrance is recommended.

If an LNA is in the antenna, a protector is recommended at both ends of the coax cable.

Please contact us for questions or further information on this topic.

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