

Ham 126 – Lightning in your yard?

Dr. Marc & Rosemary © 230907

1. Lightning. Would you rather have it in your backyard or your ham shack? Fair question.
 - a. If you have an outdoor antenna, you will have opportunity to say, I wish I had.
2. Lightning is electromagnetic energy, discharged from a cloud on its way to earth. It is just an electrical circuit. If we can direct electrical energy, we can direct lightning. Really.
 - a. If it is properly directed, catastrophe seldom occurs.
 - b. Former Ch. 8 1040' tower is across the valley from our ranch. Intriguingly, each thunderstorm, I can look out the large double windows in my office - ham shack and see 6 to 10 direct strikes.
 - c. The tower and control building lights never waver. The radios do not falter. How can that be?
3. *"Each lightning signal has a rise time $\sim 10\mu\text{s}$, with a duration of 20 - 350 μs . The time generates noise in megahertz. Follow-on current lasts several seconds. Lightning current is 10kA - 200kA. Voltages are 100kV - 1 MV. The cloud charge is 10 - 40 Coulomb (C). Due to extremely short duration, the total energy is relatively low, 10s of Joules. The power is tremendous, at several hundred megawatts to gigawatts of power. The high power is what causes physical damage."* Lightning Protection at Petrochemical Facilities – Part 3 Alternative Protection Systems, Dr. R.A. Durham, Dr. M.O. Durham, Tommy Gillaspie, IEEE PCIC.
4. We strongly recommend not putting up outside antennas in our part of the world.
 - a. When you stick a nice shiny piece of metal higher than your house, that becomes an open invitation to Nature to send lightning your way. You have heard the old saying, 'Do not mess with Mother Nature.' Don't.
 - b. In some circumstances, like a repeater, it becomes necessary to go outside to get high enough. Heed instructions. NFPA 780 provides risk guidance.
 - c. *Masts and metal structures supporting antennas shall be grounded in accordance: with 810.21, unless the antenna and its related supporting mast or structure are within a zone of protection defined by a 46 M (150ft) radius rolling sphere.* National Electrical Code, NFPA 78
5. NFPA 780, NEC, and other lightning standards have rigorous specifications. First a 18" lightning rod is attached to the top of the tower. This is the 'point of attachment'. Its purpose is to attract lightning attachment. Yes attract.
6. Three paths go all the way to the earth. One path is the tower. Ever joint, pin, and connection must be rigorously connected. Then an electrical bond must connect across any joint that is not welded.
7. The second path is a very large woven (#1/0) electrical conductor running from the attachment point to earth. The conductor bonds to the tower at the top, bottom, and if >60' near middle. Coax is the other.
8. The real work happens near the bottom. Three ground rods at least 8' long are driven into the earth.
 - a. In poor soil, drill a hole, place the rod, and fill with concrete.
 - b. Connect each ground rod to the adjacent two with #4 bare copper wire.
 - c. Separate the ground rods about 17' apart.
 - d. Run the #1/0 downcomer conductor to one of the ground rods. Attach another #1/0 conductor to the base of the tower and connect to a different ground rod. Connect the third rod with #4 AWG to the electrical ground.
9. Regardless of outside antenna or not, create a common ground point (plate) where the coax enters the building or room.
 - a. Run a separate #10 AWG conductor to the closest ground rod. The distance should be less than 20'
 - b. At the single point install the lightning protector and ferrite beads to block entry along the coax.
 - c. I prefer two arrestors, but that makes an additional weather entry on the coas.
 - d. From bus bar, run a separate wire to each grounded component like duplexer, radio, and supply.
 - e. Avoid daisy chaining one device to another. Keep metal components at the same potential.
10. Avoid disconnecting the antenna in lightning. Lightning is seeking a path to ground. If you have provided a good one, the energy will happily go to earth.
 - a. If you disconnect coax during lightning, and the unthinkable happens, lightning has no easy path to earth. It will make a path, arcing across the disconnected coax, creating sparks and fire. This is not a good thing.
 - b. Only two choices exist: proper grounding or risk damage.
11. Dissimilar metals corrode, making poor connections. An aluminum tower creates unique problems.
12. Life is good. Enjoy!



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