VEHICLE LIGHTNING SAFETY

Sam Barricklow K5KJ writes :

I can tell you from experience that a nearby, or even more so, a direct lightning strike can damage or destroy your radios, and it can potentially damage you too even while you are inside your vehicle! But, you can take steps to reduce the probability that your equipment will be damaged.

First, I've been actively chasing for over 20 years and my radios have been damaged by lightning only once. The incident occurred near Happy, Texas during the late 1980s. My wife Patti and I were driving on the interstate north of Lubbock, punching a core just behind (west of) a tornadic HP supercell updraft. Lightning struck a sign located within 10 or so feet of the car at the side of the road. It instantly disabled my 2 meter XCVR's receiver front end and the TX RF output final and driver amplifier transistors. Fortunately, there was no damage to the human occupants, even though the microphone was in my lap. (We did experience temporary visual effects from the strike. A pinkish-red ghost image in the shape of the windshield (the direction we happened to be looking when the lightning occurred) was burnt into our retinas by the bright lightning flash. This image faded over a period of two or three minutes as our vision slowly returned to normal.)

However, from past experience, if you handle an "ungrounded" radio or the antenna feedline while lightning is striking close-by or when underneath a highly charged anvil, you can receive a strong shock. If lightning were to directly strike your vehicle under these circumstances, the results could be serious for you.

Precautions, starting with a little background information
Use a D.C. grounded antenna. Some 5/8ths wave 2 meter antennas use a tapped loading coil with one side of the coil connected to the shield and the other side connected to the antenna. The center conductor is connected to the coil somewhere in between, at the 50 ohm impedance point. Antennas constructed in this way usually say so on the packaging (e.g. D.C. grounded). Hy-Gain brand antennas were constructed this way in the past. Most of the Japanese antennas only use a series impedance matching inductor to make the antenna look like an electrical 3/4 wave, instead of the tapped coil that would provide a D.C. ground and a better 50 Ohm impedance match. The advantage with a grounded antenna is that since the antenna and the car chassis are electrically connected, they will share the same static charge, preventing (or at least minimizing) electrostatic discharge (ESD) through and damage to your radios, under most circumstances. A grounded antenna will also prevent electrical shocks to you via the coaxial feedline, since the car chassis and the antenna are already at the same voltage potential.

But, a *direct* strike to your D.C. grounded antenna would still likely destroy your radio and present a shock hazard to you. The extremely rapid increase in electrical charge from a lightning strike will flow from the strike point through *all* available conductors during its journey along "parallel paths" to ground (primarily on the "electrical surface" of the car chassis). Even though the direct connection to ground (in this case ground is considered to be the vehicle chassis) provided at the antenna may have a very low impedance (impedance = the complex reactance to charge flow due to changing voltage potentials that includes resistive, capacitive and inductive components) compared to the path through your radio, a small portion of the charge will flow through your radio, but it will be much much less than it would be if you were to use an ungrounded antenna. Your radio would provide only one of many paths to ground (in this case ground equals the Earth's surface underneath the vehicle) with the majority of the charge flowing through your vehicle's sheet metal, to the frame underneath the vehicle,

then arcing to ground either through or across the surface of your tires (assuming your tires are wet or have a film of mud or some other conductive medium on their surface). Or, it may arc from a piece of metal (especially one with a point or sharp edge where voltage potentials naturally reach a maximum) that is closer to the ground.

To effectively "drain" static electricity from your antenna to your vehicle chassis, your antenna must directly connect the braid (shield) of your coax (through the antenna mount) to the metal shell or chassis of your vehicle (as well as a D.C. connection to the antenna). (Mag mounts don't qualify!) As an added precaution, you should also ground the metal chassis of your radio directly to the vehicle frame through a short wire (18 ga. or larger copper wire or braid (braid is better) should suffice.

Gas Gap Lightning Protectors

For more protection, insert a gas gap type lightning discharge unit in series with your antenna feedline and ground it to your car chassis through a short wire. The gas gap type protectors can handle much more current than the solid state type, but they generally require a higher voltage threshold and more time (e.g. milliseconds) before they break down. (These devices discharge across an enclosed "air gap" between two conductors, but apparently use some type of gas to reduce the voltage required to initiate ionization.) You can buy gas gap lightning protectors from:

Texas Towers
A Division of Texas RF Distributors, Inc.
1108 Summit Avenue, Suite #4
Plano, TX 75074
Hours (CST): Weekdays: 9AM-5PM, Saturdays: 9AM-1PM
Sales: (800) 272-3467
Local: (972) 422-7306
Fax: (972) 881-0776
E.mail: sales@texastowers.com
Tech: (972)422-7306

Spline Balls

I have not done this yet, but you could also reduce the chances of being struck by installing one or two spline balls on your vehicle to dissipate static charge buildup through coronal discharge. The two-way radio and microwave industries have used this technique for years and they swear that the spline balls reduce or eliminate lightning strikes to their towers.

I recently found a metal chimney brush at the local hardware store (Lowe's) with what appeared to be stainless steel "bristles" mounted on a metallic handle (the ends of the bristles would each touch the surface of an imaginary cylinder about six or eight inches in diameter). You can fabricate a spline ball yourself using galvanized fence wire and galvanized electrical conduit. A spherical surface is the preferred shape defined by the ends of the wires. If you could find a way to strap and electrically connect one of these to your vehicle, you should be able to effectively dissipate static electricity, at least theoretically. But, expect strange looks from other motorists if you mount these on your vehicle. (The coronal discharge might be interesting to watch too!)

You could also install a ground strap, similar to those used to discharge aircraft, from your vehicle to ground. A piece of oil soaked leather should be sufficient. A ground strap should also reduce or eliminate the shocks that you sometimes get on dry days when exiting your vehicle.

The Crude Faraday Cage Theory
When spotting or chasing thunderstorms, I like to park underneath power lines. My idea is that the power lines act as a crude Faraday cage and should receive any direct strikes that occur, instead of the vehicle. Of course if the wind gets too strong, I move.

Some additional comments on lightning danger are located at:

http://www.k5kj.net

73,
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