

## PROTECTING YOUR RADIO EQUIPMENT FROM EMP (ELECTRO MAGNETIC PULSE)

As amateur radio operators we try to be prepared to assist in all types of emergencies. However, there are two emergencies which are more difficult to be prepared for: they are high intensity Solar Storm or an Electromagnetic Pulse from a high-altitude nuclear explosion.

The last Solar Storm that creating significant damage occurred in 1859. It was so powerful that it destroyed major sections of electronic components taking out telegraph lines in the Northern Hemisphere. A storm of that magnitude today would have a much more significant impact.

A high-altitude (above 30 miles) nuclear explosion above the central US could completely wipe out electronic systems thousands of miles away without causing any human casualty. It is estimated that 6 or more states would be affected. A detonation at 300 miles would take out the entire US. A moderate strength (yield) detonation is capable of producing field amplitudes of up to 50,000 volts per meter at ground levels over a diameter of thousands of miles away from the explosion. A detonation can have various effects on radio communication including burn out of equipment components due to the intense transients that are generated. Operators many miles from a detonation could experience blackouts, signal absorption or abnormal reflections due to effect in the ionosphere, increased noise or phase distortion. The atmospheric effect will dissipate over time, but the damage to your equipment could be permanent.

Equipment can be "hardened" by protecting sensitive circuits against the high voltage or current spikes. However, RF shielding of all your equipment may not be practical. Vacuum tube systems or backup equipment that has been stored disconnected from: power and antennas may be useful. Knowledge is the first step towards solving this problem.

Simulated testing of various manufactures of amateur radio equipment in 1986 demonstrated that most amateur radio equipment should be protected from EMP as long as the following conditions exist:

- Long external wires are not attached. Short wires such as microphone and power cord did not cause a problem.
- If power lines or antennas are connected, then adequate transient-pulse protection must be placed in these lines.

Dennis Bodson, W4PWF gave the following suggestions in a series of 1986 QST articles:

1. "If you have spare equipment, keep it disconnected; use only the primary station gear. The spare equipment would then be available after an EMP event.
2. Keep equipment turned off and antenna and power lines disconnected when the equipment is not in use.
3. Connect only the external conductors necessary for the current mode of operation.
4. Tie all fixed equipment to a single point earth ground to prevent closed loops through the ground.
5. Obtain schematic diagrams of your equipment, tools, and components for repair of the equipment.
6. Have spare parts on hand for sensitive components of the radio equipment and antenna system.
7. Learn how to repair or replace the sensitive components of the radio equipment.
8. Use nonmetallic guy lines and antenna structural parts where possible.

9. Obtain an emergency power source and operate from it during period of increased world political tension. The power source should be completely isolated from the commercial power lines.
10. Equipment power cords should be disconnected when the gear is idle. Or, the circuit breaker for the line feeding the equipment should be kept in the off position when the station is off the air.
11. Disconnect the antenna lead-in when the station is off the air. Or, use a grounding antenna switch and keep it in the GROUND position when the equipment is not in use.
12. Have a spare antenna and transmission line on hand to replace a damaged antenna system.
13. Install EMP surge arrestors and filters on all primary conductors attached to equipment and antenna.
14. Retain tube type equipment and spare components; keep them in good working order.
15. Do not rely on a microprocessor to control the station after an EMP event. Be able to operate without microprocessor control." (QST\_Oct\_1986\_p38-41)

To update this information 20+ years we need to realize that more of our current day amateur radio equipment has the electronics mounted in remote/separable heads which are not protected by metal casings. The protection previously talked about relied on the casing of the radio equipment acting as a Faraday cage. Faraday learned that the intense electromagnetic pulse will remain on the outside skin of a metal cage. Depending on the type of equipment we own, we may need to do more to protect it by placing it in an efficient Faraday cage. There are inexpensive ways to accomplish this:

- One is simply to use an all metal garbage can with a tight fitting lid to store your spare equipment. Some recommend that equipment needs to be insulated from the inside of the Faraday cage. The cage does not need to be grounded.
- Another more compact method is to use EMP bags. There are several options on the market. These bags consist of Mylar that has two layers of metal alloy (aluminum) built into it and a plastic insulating covering to insulate your equipment. The Ziploc closure or closing clamp makes it easy to use and reuse the bags. These bags could be used to store your standby go kit equipment.

This is a list of other items you may also want to consider protecting:

- Laptop computer
- Cell phones
- GPS devices
- Calculators
- Electronic clocks
- Battery chargers
- Anything with an electronic ignition (some chain saws, generators use electronic ignition)
- Kitchen appliances
- Hard drives, thumb drive, electronic storage medium

There are several recent articles and videos on the internet about this subject which you can research. I have tried to boil the subject down to the minimum essential information for training and awareness.