



PATOKA VALLEY

MATEUR RADIO CLUB



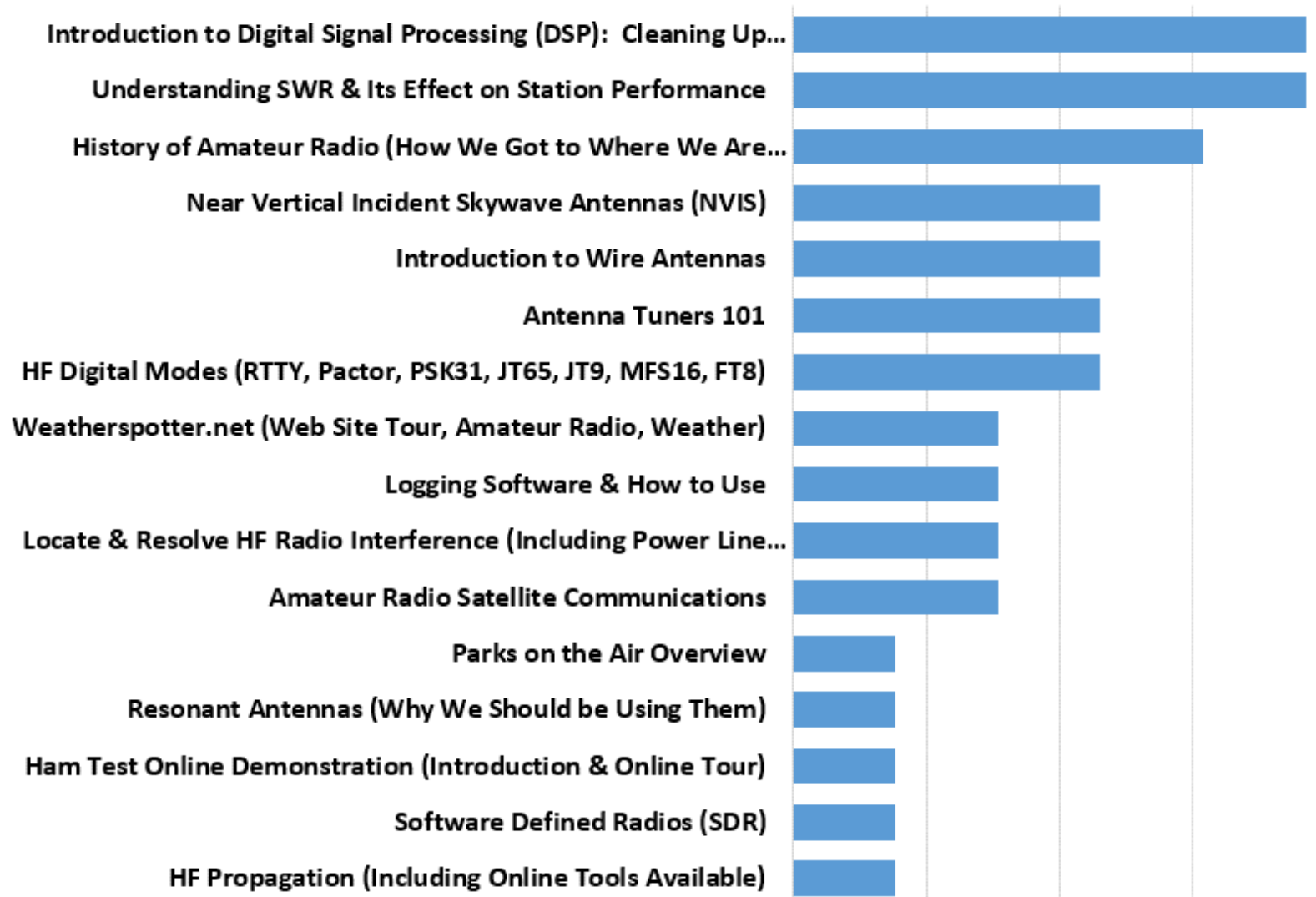
Presentation Series

Developing our communications skills and enhancing our enjoyment and understanding of amateur radio technology.

PVARC Presentation Series

- | | |
|----------------|---|
| Aug. 10, 2021 | Grounding & Bonding |
| Sept. 14, 2021 | New FCC RF Emission Rules |
| Oct. 12, 2021 | Introducing the New 440 Fusion Repeater |

PVARC PRESENTATION TOPICS SURVEY



For Our September 14, 2021 Meeting: New FCC RF Exposure Rules



- New FCC RF exposure standards went into effect on May 3, 2021.
- For stations already in place, an evaluation must be completed by May 3, 2023
- After May 3 of this year, any new station or modified existing station will need to conduct an evaluation

**Station Evaluation Services will be offered during the
September 14, 2021 PVARC Meeting following the
NEW FCC RF EXPOSURE LIMITS
presentation**

FCC EXPOSURE LIMITS (REQUIRED PARAMETERS)

Name: _____ Call Sign: _____			Transmit Duty Cycle (Transmit/Receive/Repeat)		
Band	Power	Mode Duty Cycle	Transmit Minutes (1 - 30)	Receive Minutes (0 - 30)	Antenna Gain (dBi)
		<input type="checkbox"/> Conversational SSB, no speech processing (mode duty cycle=20%) <input type="checkbox"/> Conversational SSB, heavy speech processing (duty cycle=50%) <input type="checkbox"/> Conversational CW (duty cycle=40%) <input type="checkbox"/> FM (duty cycle=100%) <input type="checkbox"/> AM (duty cycle=100%) <input type="checkbox"/> FSK/RTTY (duty cycle=100%) <input type="checkbox"/> AFSK SSB (duty cycle=100%) <input type="checkbox"/> Carrier Always On, i.e., for Tuning Up (duty cycle=100%)			
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ANTENNA INFORMATION

If you have no idea what your antenna's gain is use the information below as an approximation

Antenna Type	Approx. Gain (dBi) *
Half wave dipole	2.15 dBi
0.3m dish	22.0 dBi
0.6m dish	24.0 dBi
1.0m dish	34.0 dBi
1.5m dish	38.0 dBi
10 element Yagi	15.1 dBi
2 element Yagi	5.9 dBi
3 element Yagi	8.1 dBi
4 element Yagi	9.1 dBi
5 element Yagi	10.1 dBi
6 element Yagi	11.1 dBi
8 element Yagi	13.1 dBi
Alford Slot	9.0 dBi
Big Colinear	8.2 dBi
Colinear	5.2 dBi
Delta	5.2 dBi
Flat Panel (typical)	24.0 dBi
Flat Quad	5.2 dBi
G5RV	1.0 dBi
Helix	14.1 dBi
Hex Beam	5.0 dBi
Horn (typical)	22.0 dBi
Log Periodic	6.0 dBi
Longer Yagi	19 dBi
Longwire	2.0 dBi
Moxon	6.0 dBi
Quad	9.1 dBi
Quarter Wave Vertical	1.5 dBi
Slotted Waveguide	12.0 dBi
SteppIR	7.1 dBi
Vertical Dipole	4.2 dBi
Windom (OCD)	2.0 dBi
ZS6BKW (GSRV type)	5.0 dBi

Fill Out & Bring This Form
To The September 14, 2021 Meeting

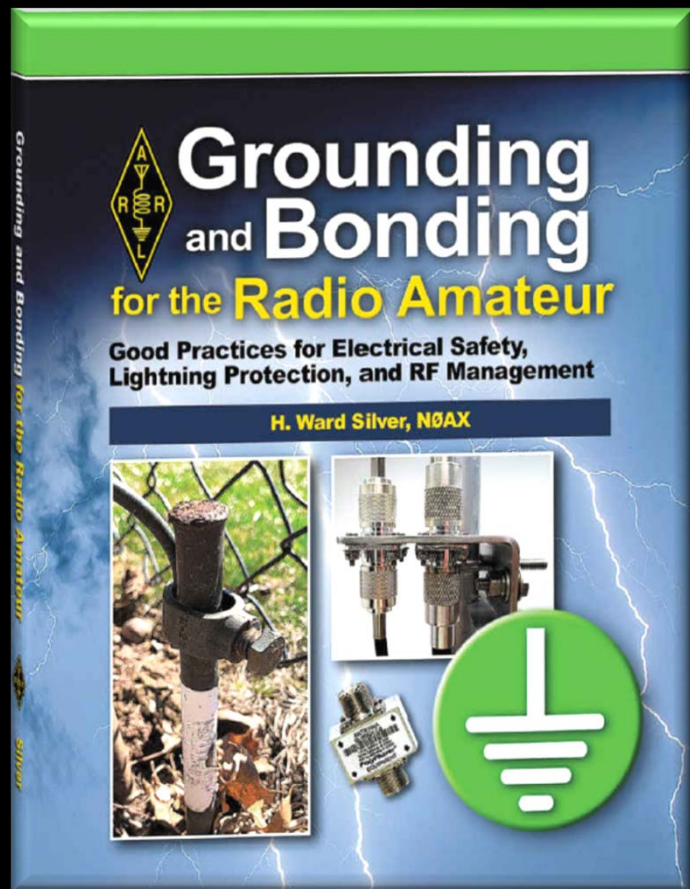
Notes: _____



Amateur Radio Grounding & Bonding 101

**How To Protect You & Your
Equipment from Lightning Strikes &
Electrical Faults**

After antennas, station grounding is probably the most discussed subject in amateur radio



AC Safety: Protect against shock hazards from ac-powered equipment when a wiring fault occurs **[Electrical Code]**

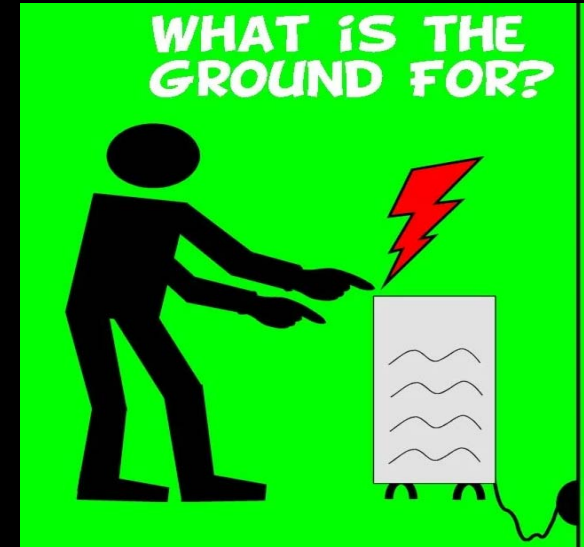
Lightning Protection: protect against lightning strikes through appropriate grounding, bonding, and surge protection.

RF Management: prevents unwanted RF currents and voltages from disrupting the normal functions of equipment (RFI).

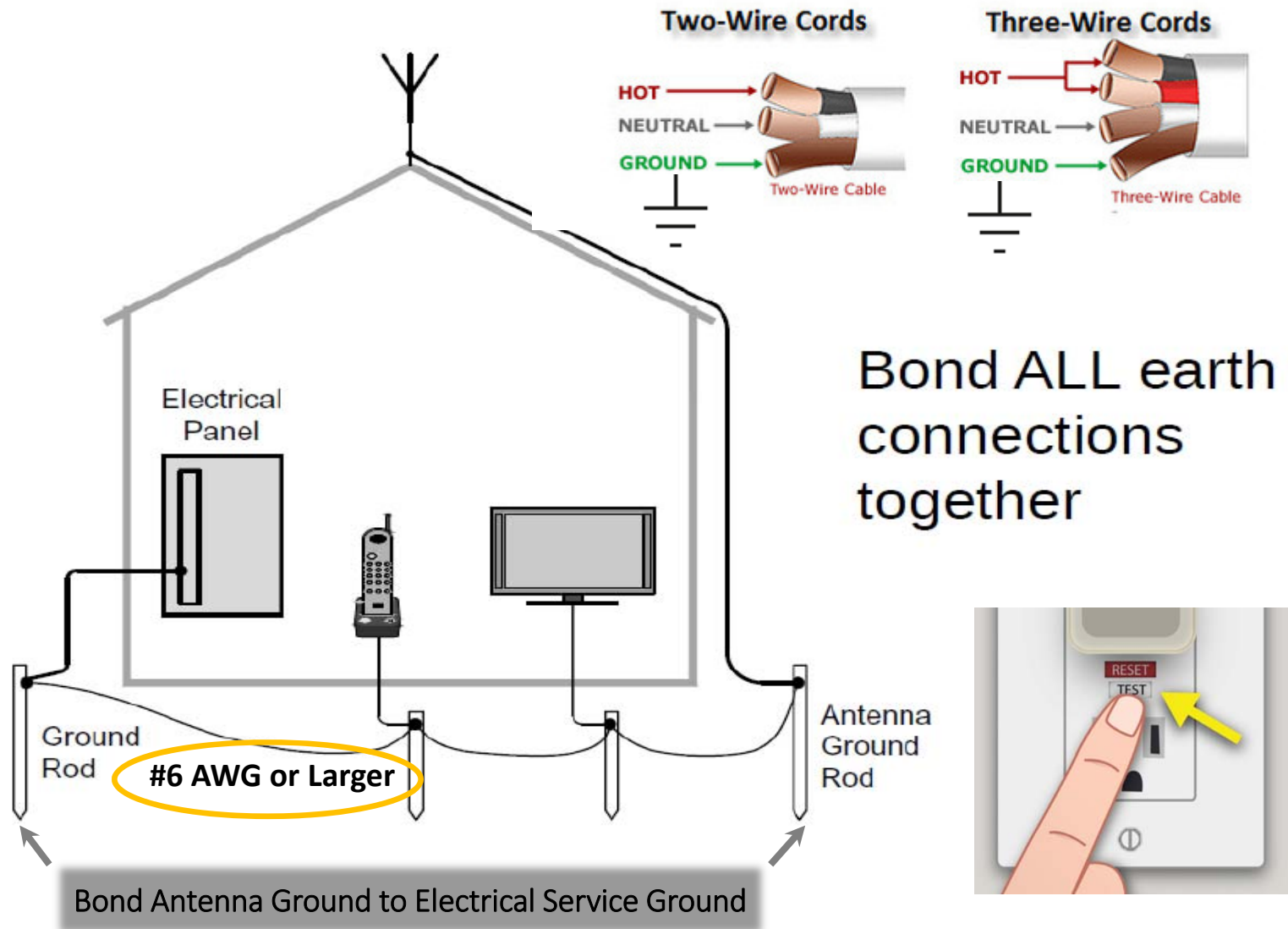
A properly installed
single point solid ground system
satisfies all requirements

AC Safety Grounding

- **Purpose is two-fold**
 - Provides a path to (earth) ground for fault current (shorts, insulation failures)
 - Stabilizes the ac power during faults or lightning
- **Electrical code is the law**
- If you don't know what you are doing, get a reference, or, hire a professional

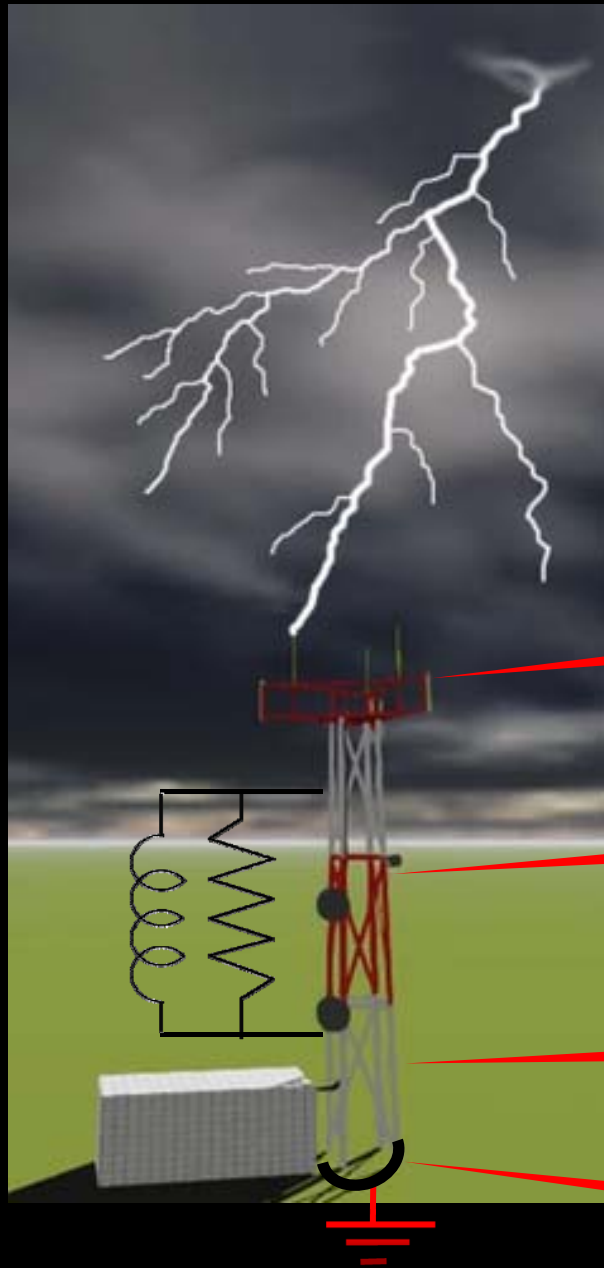


AC Safety Grounding



Lightning Protection

Voltage Distribution When Lightning Strikes



100,000 Volts

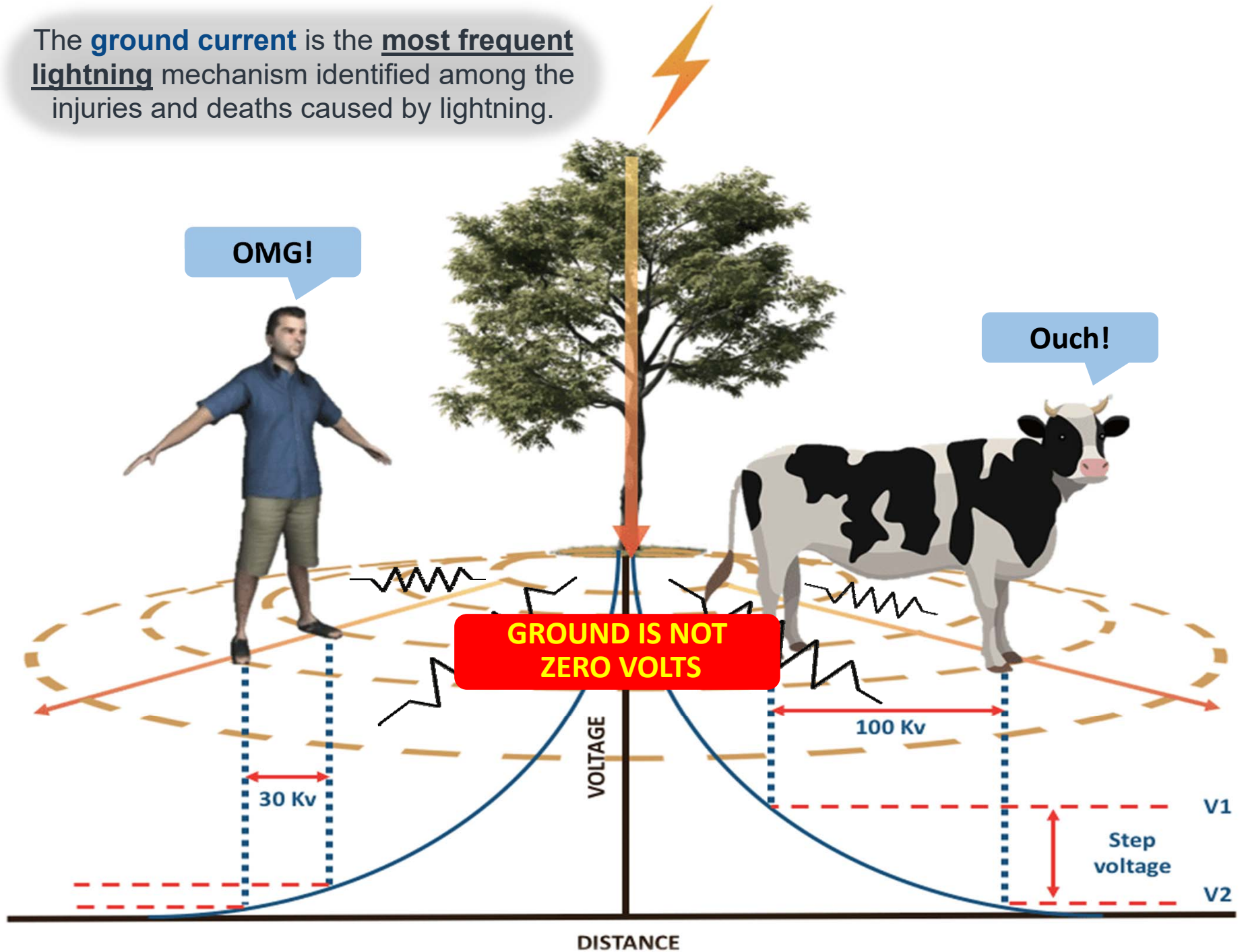
50,000 Volts

10,000 Volts

1,000 Volts

Ground is no longer 0 Volts!

The **ground current** is the **most frequent lightning** mechanism identified among the injuries and deaths caused by lightning.



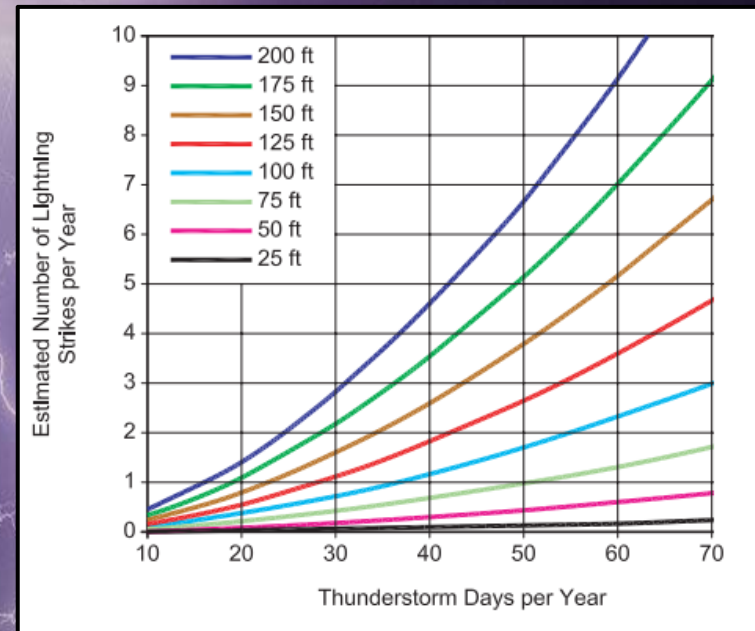
All Lines Leading Into and Out of Ham Shack Protected



The Odds of Getting Hit

Dubois County has about 50 thunderstorms per year so

Tower Height	Estimated Strikes per Year
75 Feet	1
100 Feet	2
150 Feet	4
200 Feet	7



The Best Protection

1. Disconnect your antennas when not in use
2. Unplug your equipment when not in use
3. **NEVER** use the equipment during a thunderstorm



Even with the Best Lightning Suppression
Some Energy May Pass Through

OUR PRIMARY OBJECTIVES

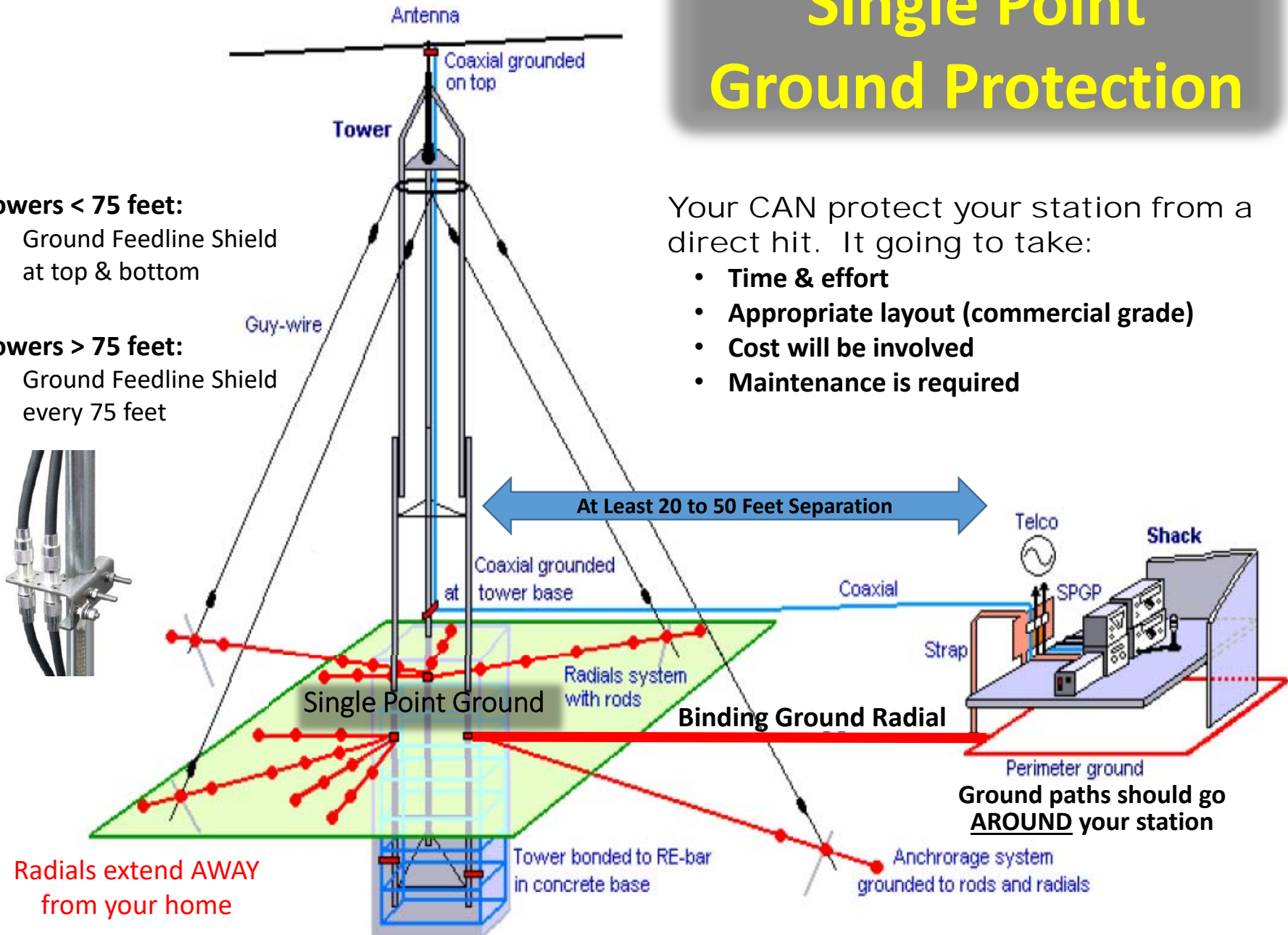
Single Point Ground Protection

Towers < 75 feet:

- Ground Feedline Shield at top & bottom

Towers > 75 feet:

- Ground Feedline Shield every 75 feet

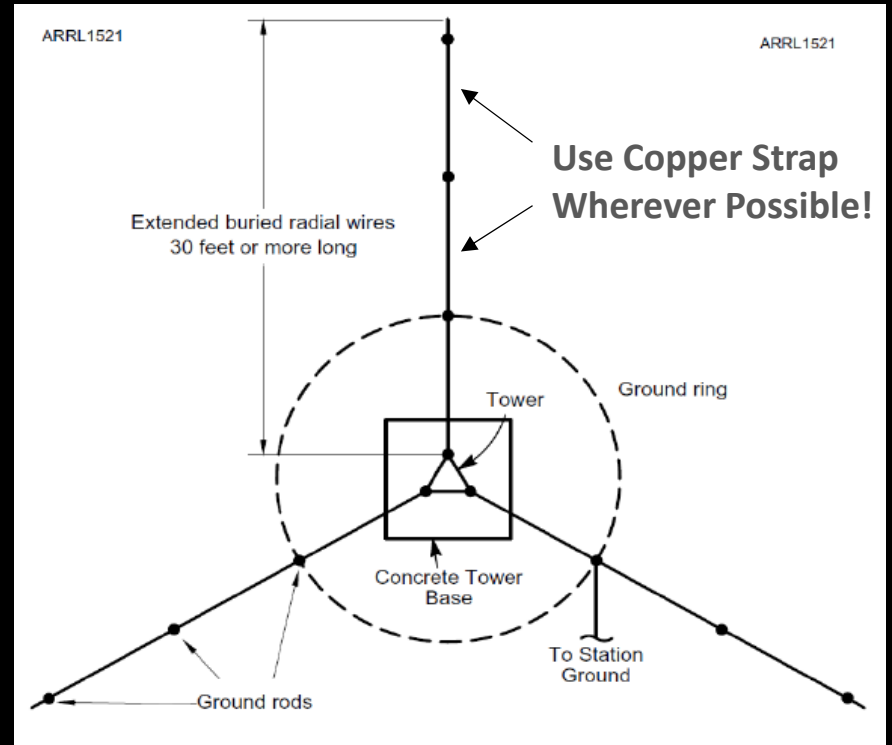


Your CAN protect your station from a direct hit. It going to take:

- Time & effort
- Appropriate layout (commercial grade)
- Cost will be involved
- Maintenance is required

If your Tower is more than 100 feet from your shack it is unlikely connecting it to shack ground would be of benefit

Tower Grounding



We want to dissipate as much as the energy from a tower strike as possible before it enters then house.

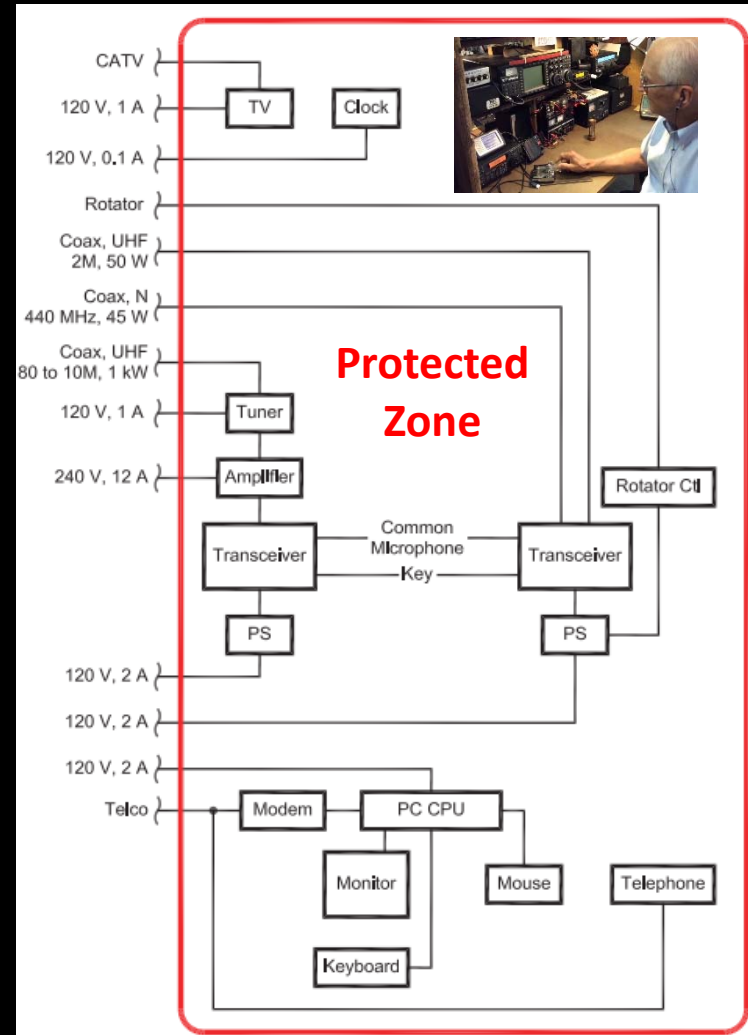
Shack Entrance – Single Point Ground



We want to dissipate as much as the energy from a tower strike as possible before it enters then house.

Inside the Shack

1. Identify ALL equipment to be protected
2. Protection ALL I/O lines:
 - ✓ Feedline
 - ✓ AC Power
 - ✓ Telco
 - ✓ Rotator
3. Bond all equipment to single point ground

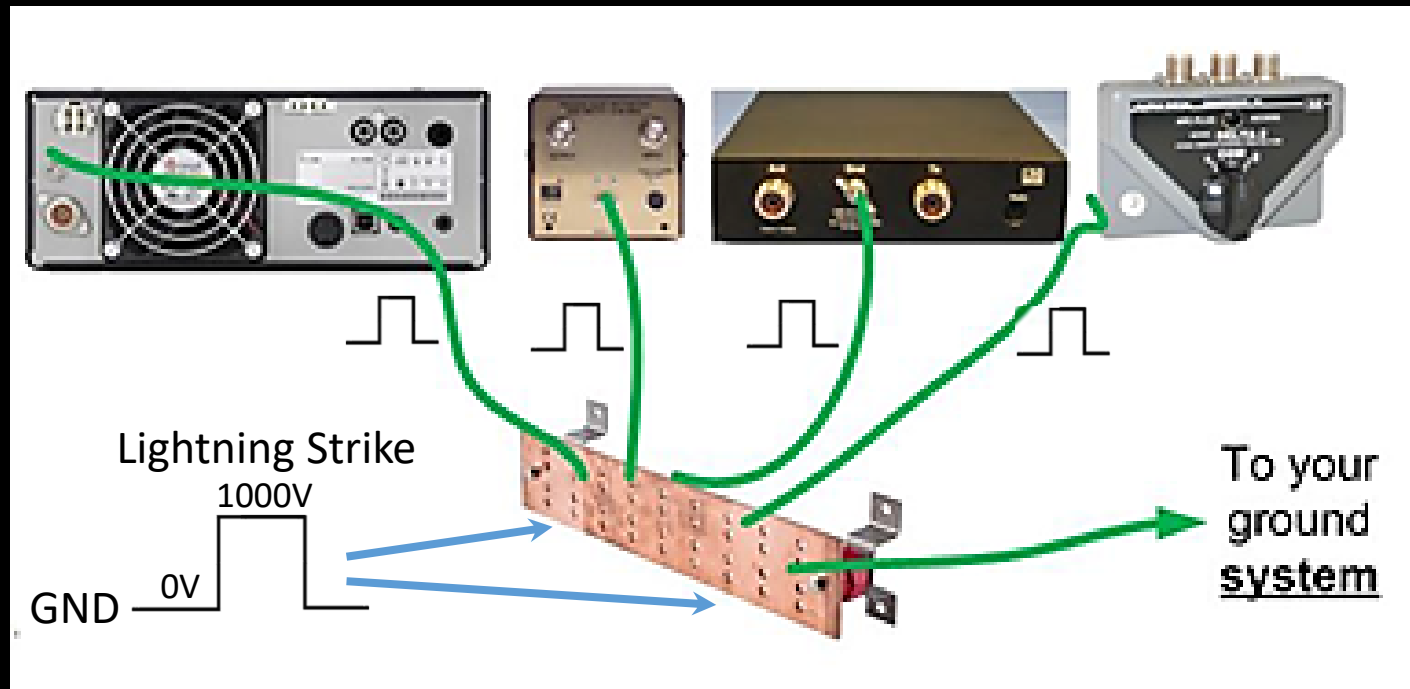




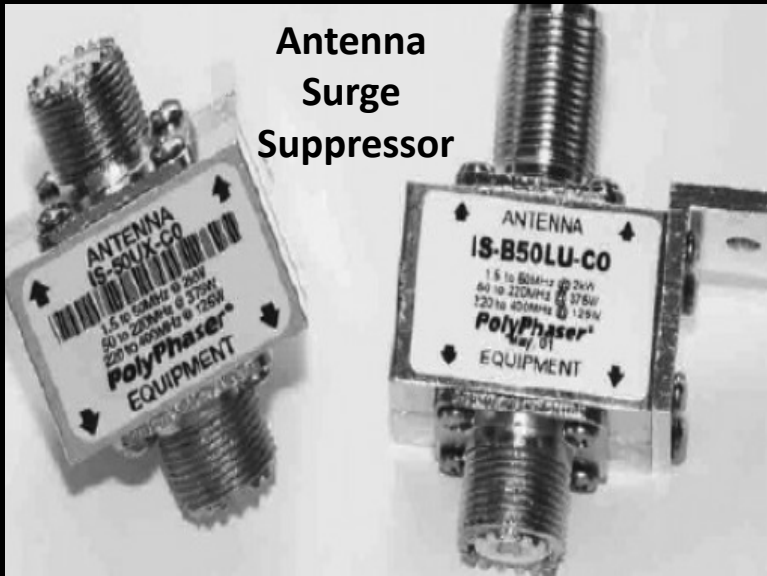
Protection is ALL or NONE



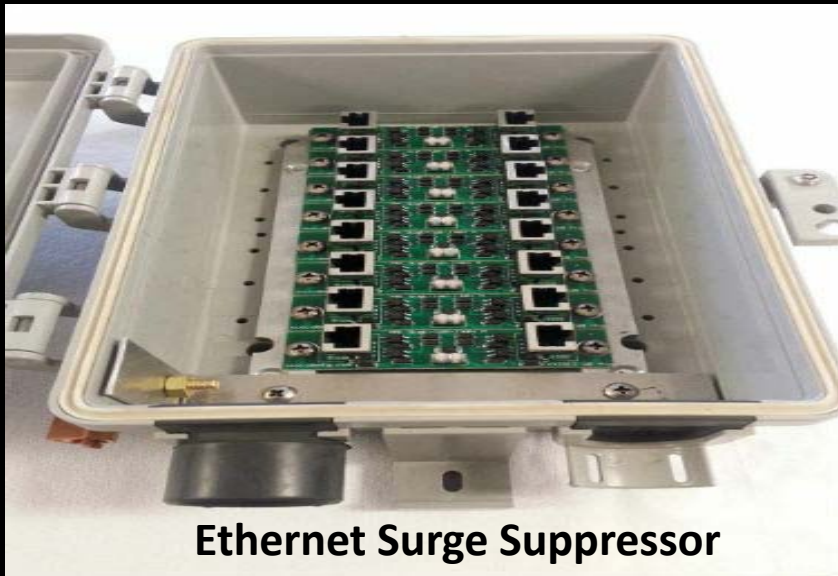
What is Bonding?



- **BONDING** – keeps all points at the same voltage
 - Must be Low-Z and “short” at the frequencies of interest
 - Heavy enough to carry the expected current
 - Sturdy enough to survive the environment



Antenna
Surge
Suppressor



Ethernet Surge Suppressor



Power Line Surge Suppressor



Whole
House
Suppressor

Things to Avoid

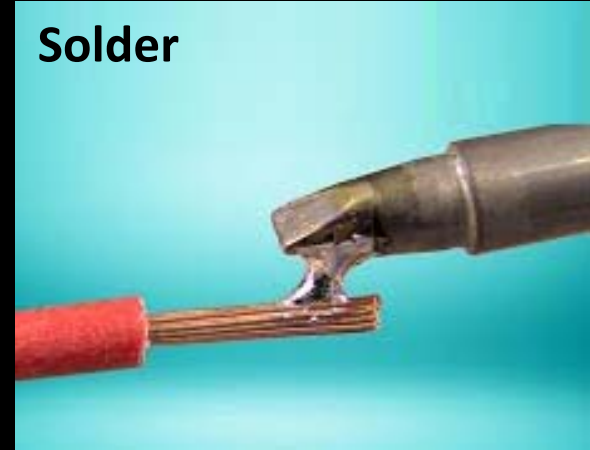


Do not solder ground connections unless they are high temperature silver-solder.

Conventional solder connections will fail from the heat generated by lightning current.

CAD Weld (Exothermic) or sturdy clamp is acceptable.

Solder



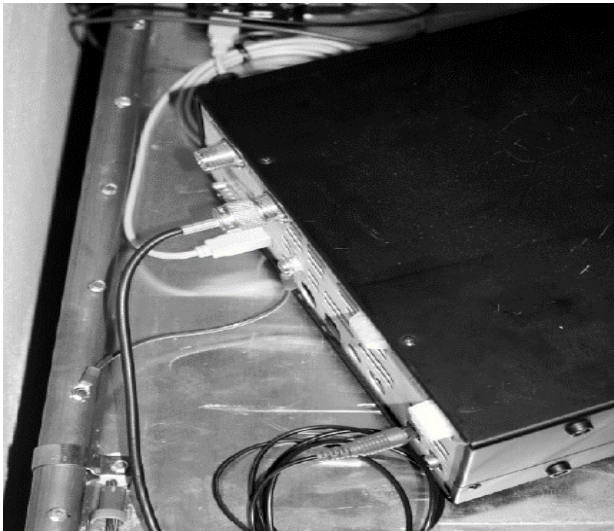
Exothermic
Weld



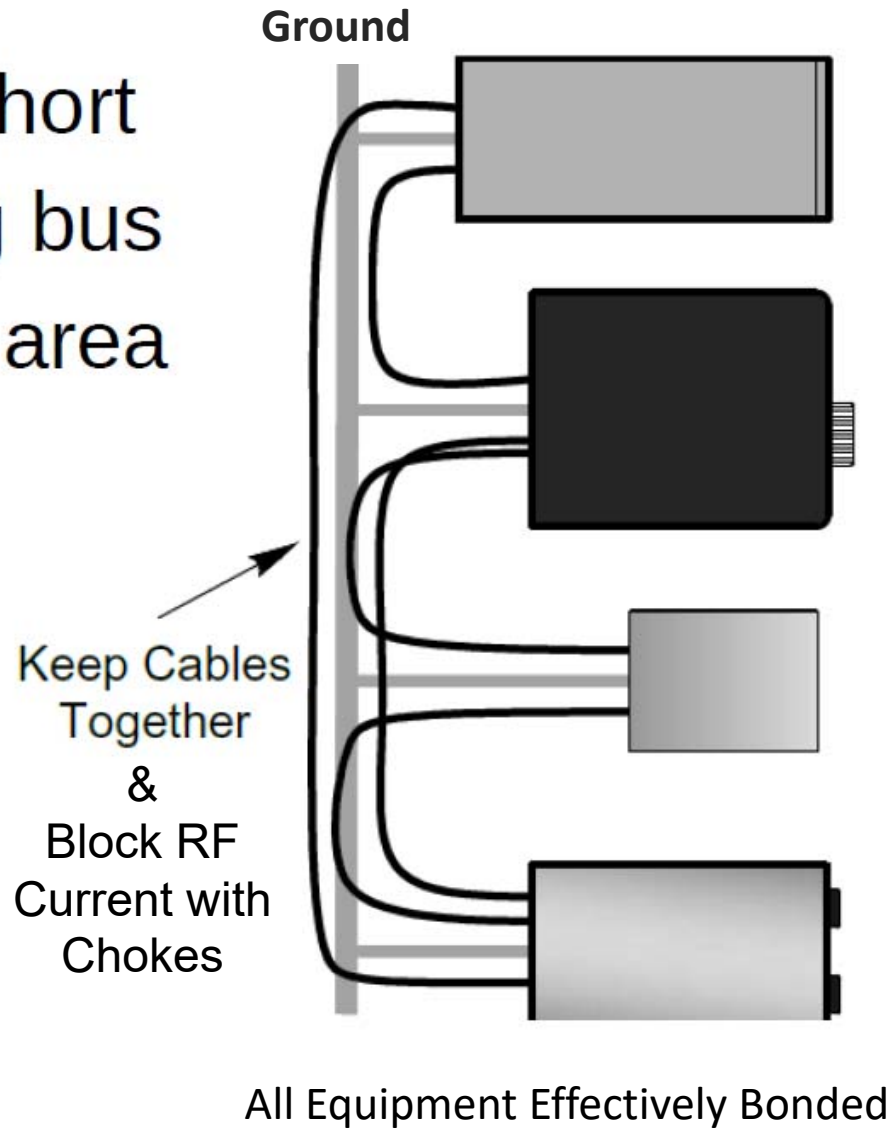
RF Grounding

RF Management

- Keep cables short
- Use a bonding bus
- Minimize loop area



Utilize an RF Ground Plane
If Possible



All Equipment Effectively Bonded

Operating Safety



NEVER operate your station during a thunderstorm

When  Thunder Roars, Go Indoors!

STOP all activities.

That includes operating amateur radio equipment which could be struck by lightning

No matter how good your lightning protection system is
You must NOT be in electrical contact with your equipment during a lightning strike

A dramatic sky with dark, stormy clouds and bright, jagged lightning bolts striking across the frame. The lightning bolts are bright white and yellow, contrasting sharply with the dark, moody blue and black clouds. The overall atmosphere is intense and powerful.

Thank You