Copper Development Association Inc.
Copper Alliance

Finding the Path of Least Resistance

FIGURE 1. WRZN-AM in Hernando, Florida

What makes a good ground? Ideally, it's a connection to earth that can absorb an unlimited amount of current without changing its potential. Basically, that means a path for lightning and other power surges to take before they can course through any other part of and electrical/electronic system and damage or destroy equipment. A zero-resistance ground is ideal but impractical. The goal for broadcast facilities should be 5 ohms or less.

What systems should be grounded at a broadcast facility? Power distribution, telecommunications and transmission. All outside services that enter the facility on conductive wires should have lightning arrestors and/or surge protection devices. Those devices should have a home run ground bonding path to the primary ground bonding point. They should not be "mixed" on a common ground bar at the point the equipment enters the facility. Their bonding must be to the main ground bonding bar.

Those were the basic areas to be addressed when Power & Systems Innovations (PSI) of Tampa visited WRZN-AM in Hernando, Florida, at the request of the MARC Radio Group of Gainesville **(Figure 1)**. The rural station site includes a trailer housing the equipment for a studio, control room and programming. A thousand feet away is a transmitter building. Beyond that are three antenna towers.

FIGURE 2.

FIGURE 3.

Arriving at the WRZN, PSI's John West Sr. found a single existing ground rod with clamped connections and measuring nearly 300 ohms.

FIGURE 4.

West drove a deep earth ground proximate to the drip line of the air conditioner. The water dripping from the A/C keeps the soil moist, lowering the resistance to earth and enhancing the grounding.

FIGURE 5.

West exothermically bonded a new ground rod to the main bonding bar inside the trailer. A new 4/0 stranded copper communications ground and the trailer, itself, were also tied to the main bonding bar. "Now, all the critical systems found here share the path of least resistance to a robust common ground," he says. The typical resistance is now less than 5 ohms.

The trailer

When he arrived at the station, PSI's John West Sr. found a single existing ground rod with clamped connections **(Figure 2)** and measuring nearly 300 ohms **(Figure 3)**. West took advantage of the site to remedy the situation. He drove a deep earth ground proximate to the drip line of the air conditioner. The water dripping from the A/C **(Figure 4)** keeps the soil moist, lowering the resistance to earth and enhancing the grounding. West points out that this is a sustainable solution because most of the time when there's lightning in Florida the A/C is running.

West exothermically bonded a new ground rod **(Figure 5)** to the main bonding bar inside the trailer. The original #6 AWG solid copper communications ground **(Figure 2)** was replaced with 4/0 stranded copper and rerouted to the main bonding bar, too. Finally, the metal trailer, itself, was also connected to the main bonding bar. "Now, all the critical systems found here share the path of least resistance to a robust common ground," he says. Robust, indeed! The typical resistance is now less than 5 ohms **(Figure 5)**.

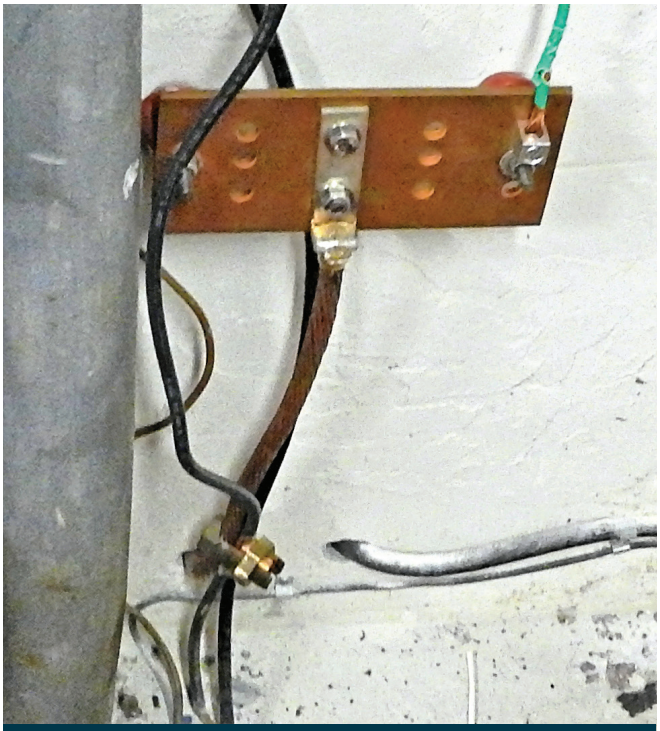


FIGURE 6.

A panel ground is currently connected with a split bolt to a strip of copper, which is basically a static shield. The bolt connection will be removed. According to West, "A split bolt is nothing more than a mechanical connection that's not sustainable over the long haul. It has a tendency to cause contamination. It'll take lightning off of one device and put it on all the rest of them."

FIGURE 7.

Gas tube arrestors are intended to divert lightning energy or anything that gets on the phone line that might cause injury or death. "The error here is that some of their connections were looping up. Lightning doesn't like to travel up. It likes to take the most direct path and go down towards the earth," states West.

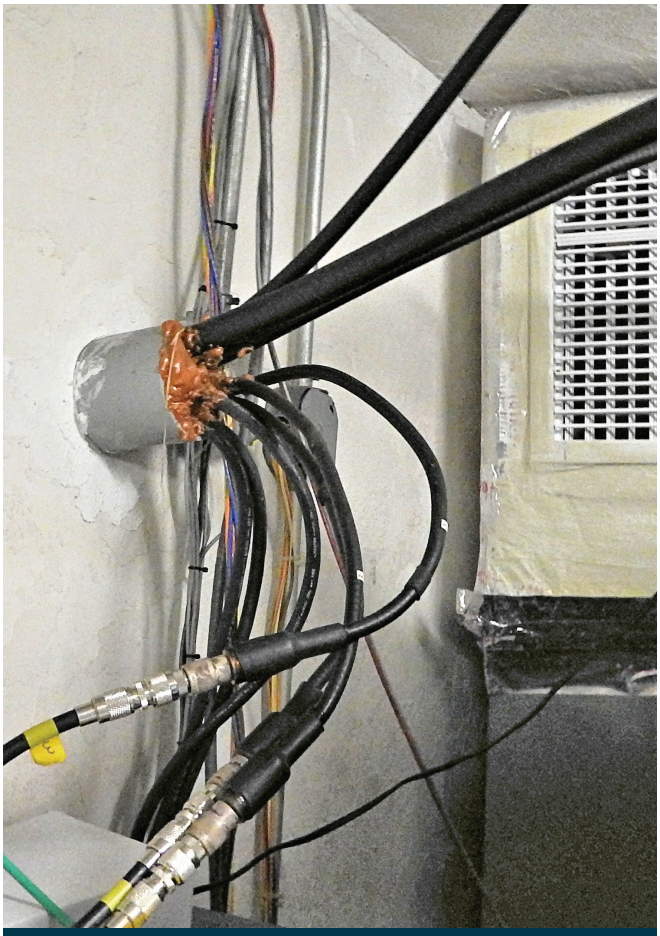


FIGURE 8.

The station's transmitter coaxes are fed out to the various antennas. However, there was no attempt to bond their shields to any kind of a ground. This will be done, but it has to be done by the RF engineers. PSI's job is to provide them with a ground bonding plate to accomplish that.

The transmitter building

Work is ongoing at the transmitter building. A panel ground is currently connected with a split bolt **(Figure 6)** to a strip of copper, which is basically a static shield. The bolt connection will be removed. According to West, "A split bolt is nothing more than a mechanical connection that's not sustainable over the long haul. It has a tendency to cause contamination. It'll take lightning off of one device and put it on all the rest of them."

Future connections will be made to a ground bar plate that will be connected exothermically to an earth ground using 4/0 stranded copper.

Gas tube arrestors were improperly installed on the primary phone lines coming into the facility. Gas tube arrestors are intended to divert lightning energy or anything that gets on the phone line that might cause injury or death. "The error here is that some of their ground connections were looping up **(Figure 7)**. Lightning doesn't like to travel up. It likes to take the most direct path and go down towards the earth," states West.

The ground connections from the arrestors and the devices they serve should all be home run downward to the ground bond bar, which is what will be done when it's re-bonded. That will ensure there is no cross-contamination between the devices and the telecom lines.

The station's transmitter coaxes are fed out to the various antennas **(Figure 8)**. However, there was no attempt to bond their shields to any kind of a ground. This will be done, but it has to be done by the RF engineers. PSI's job is to provide them with a ground bonding plate to accomplish that.

The towers

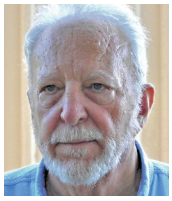
PSI did nothing with tower grounding **(Figure 9)**, because WRZN is an AM facility, which has its own radial ground system. West says, "Anything we might do would interfere with the signal. However, had this been an FM operation, we would have bonded the towers as well."

When all is said and done

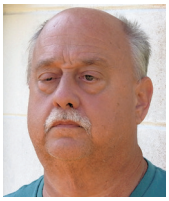
These simple, inexpensive repairs should keep the station alive and well during any lightning occurrence or power surge. That's the objective for this and the other six stations of the MARC Radio Group of Gainesville. The group's consulting broadcast engineer, Mark Schmucker, says, "I believe that for any facility, especially broadcasting or telecommunications, any investment made in proper grounding and bonding is well worth the money spent. And, it makes my job a whole lot easier."

FIGURE 9.

Nothing was done with tower grounding (Figure 9), because WRZN is an AM facility, which has its own radial ground system. West says, "Anything we might do would interfere with the signal. However, had this been an FM operation, we would have bonded the towers as well."



John N. West Sr. is president of Power & Systems Innovations of Tampa, Inc. (PSI), Hernando Beach, Florida. Its focus is sustainable electrical systems that will perform for years to come: grounding, bonding, surge protection, and lightning protection, including all aspects of power quality. PSI provides onsite consulting services. In addition, the company designs, installs and services a broad range of protection equipment and systems. For further information about PSI call 407-832-9018 or email JWest@PSITampa.com.



Mark Schmucker, Consulting Broadcast Engineer, MARC Radio Group, LLC, Gainesville, Florida. His responsibilities encompass maintenance of all the group's transmitter sites and broadcast facilities, including electrical, telephone, broadband, microwave, automation, computer and satellite downlink systems, along with IT services for office operations. Since 1972, Mark has provided similar services to other broadcast companies in North Florida markets. You can reach him at mschmucker@marcradio.com.

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