SITE INSPECTION

Date: April 30, 2021
Location: NOARC Clubhouse
Address: 4565 Live Oak Church Rd,
Crestview, FL 32539
Customer: North Okaloosa Amateur Radio Club
Contact: Dustin Stewart

Scope:

On this date the NOARC Clubhouse electrical, antenna tower, and associated equipment was inspected for connection and compliance with standard practices and codes. I present for your consideration and discussion the following information and observations of that inspection with the notable issues and a brief description of why each is important follows.

Findings:

1.) At the power panel there is a bonding strap in place between the ground bar and the neutral bar.
-This is a NEC code violation. Grounding of the electrical distribution system should only occur at the service entrance point only. The system ground conductors and power neutral conductors are to be kept separate.

2.) The tower grounding conductors and earth grounding electrodes are not bonded to the system ground at the club house power distribution panel or at the incoming utility grounding conductor.
-This is a NEC code violation. Without all three being properly connected, a condition is created where a potential difference is likely to exist under a variety of environmental conditions either from an event on the incoming utility such as phase to phase short, voltage regulator equipment failure on the primary utility feeder, lightning discharge into the tower, or just static electricity generated from other sources. Any of these conditions could lead to equipment damage or in some cases fire.

3.) The coax cable shields and the ladder line from the antennas are not bonded or referenced to the grounding system before entering the building.
-This is an NEC code violation. The shield of the coax cables to the Grounding System before entering the building. Failure to bond these results in induced currents from nearby lightning, static discharges and common mode electrical currents entering the building and damaging connected equipment.

4.) The communications and accessory equipment inside the building are not effectively bonded to the grounding system.
-This is an NEC code violation. This needs to be done to keep the potential difference between each piece of connected equipment at the same electrical potential and provide a path for ground currents

5.) There are no surge arrestors on any of the incoming transmission lines or antenna rotor control cable.
-While according to code this is optional, it is good practice to install these devices to mitigate the rise of voltage potential on the inner conductor of the coax. The antenna rotator cable presents another path of surge energy into the building as well.

6.) The ladder line disconnect switch is located inside the building.
-This is not good practice. If a lightning discharge strikes the tower or nearby structure a portion of the energy will be conducted into the building which can cause fire and/or equipment damage.

7.) There are two double pole 30 amp 240 volt breakers feeding two 120 volt loads by using only one pole per breaker.
-This is an NEC code violation. The double pole breaker is not listed for this use.

8.) No drawings of the current grounding system, or the antenna farm were found on site and available at the time of inspection.
-This is not good practice. If maintenance, corrective action, or instruction to new hams is needed this would be valuable information to have available.

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Corrective Actions:

Item 1 Any additional connection between neutral and ground conductors will create dangerous multiple undesirable paths for neutral current through other grounded surfaces to include any panel box, raceway, metal pipe, connected equipment enclosure, or any human body touching a connected surface. Also this will effectively bypass any neutral mode surge protection in any applied Surge Protective Devices (SPD) on the AC line. This can be quickly corrected by removing the bonding jumper located in the club house power distribution panel.

Item 2 This will require a copper conductor buried and connected between all three, the Station tower, the the power distribution panel in the club house, and the service entrance grounding conductor with at least 4 gauge bare copper wire (2 gauge wire or 3 inch strap preferred) and an 8 foot or longer copper clad ground rod close as practical at the club house panel end. The number and location of any additional ground rods will depend on the placement and condition of any existing ground rods at the tower.

Item 3 A grounding plate needs to be installed and all coax cables attached by arrestors or other shield grounding means at the base of the antenna and bonded to the system ground. The ladder line needs to have a protective device connected on the antenna side of the disconnect switch (at roughly the same point as the coax grounding plate) and bonded to the system ground.

Item 4 To correct this requires the installation of a grounding buss inside the station connected directly to the system ground. Every transceiver, antenna control, tuner, computer, digital mode interface, ethernet switch, modem, power supply, or other connected equipment needs a direct connection to this buss using copper ribbon, braid, or wire of 14 gauge (or larger) to the station grounding buss. This buss could be constructed using ½ inch OD copper pipe hard brazed with as few bends as possible, which is then connected directly to the system ground by at least 4 gauge bare copper wire.

Item 5 The antenna rotator cable needs to have an appropriate signal level protective device installed before it enters the building and grounded to the system ground. This should be located at the same point where the coax shield grounding takes place.

Item 6 This will require the relocation and upgrade of the disconnecting means to a double pole, double throw knife switch rated for at least 600 volts and located exterior to the building. The purpose of this is to open the line before it enters the building and connect the antenna side conductors to the system ground when not in use.

Item 7 The two pole 30 amp 240 volt breakers are not designed and listed for this type of connected load and should be replaced with two single pole 120 volt type HACR breakers with an amp rating chosen for the protection of the connected equipment (per nameplate data). The number 10 wire between the outlet and the breaker panel is acceptable for up to 30 amp loads.

Item 8 A complete documentation including the location, routing, and type of existing station grounding, wire, rods, and protective devices should be recorded including any modifications, maintenance, and testing results placed on display in the club house in a conspicuous location and also archived wherever important club documents are kept.

A possible plan of action detailing steps to implement the needed corrective actions, approximate cost, possible sources for donated materials, and timetable to complete will be presented for your consideration by the next business or committee meeting.

At Your Service,
C. Joseph Hughes KO4FNK

References:

(1)IEEE Guide for Surge Protection of Equipment Connected to AC Power and Communication Circuits
(2) NFPA 70, The National Electrical Code (NEC 2020)