Field Day Interference Topics and Field Day 2025 Operations

KA2C

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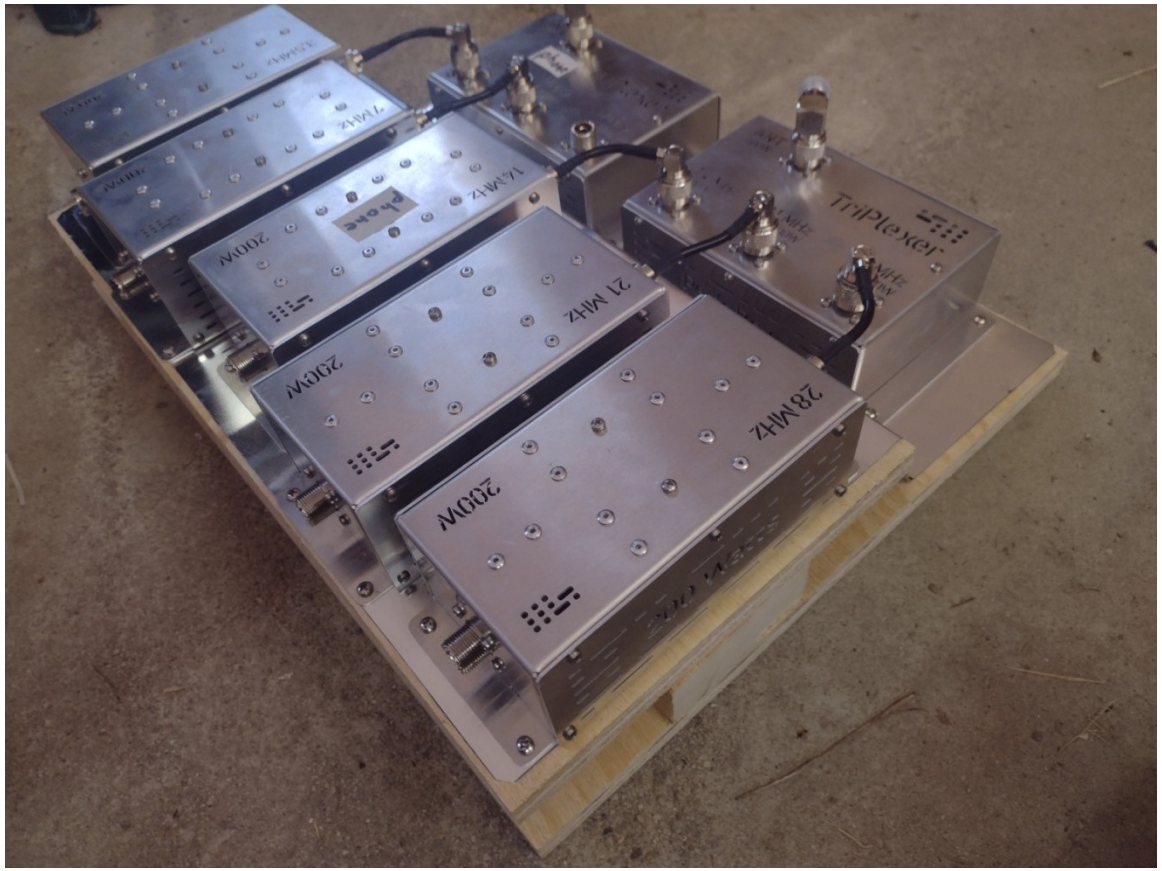
Review of Field Day Interference Basics

- Rigs with good RX and TX performance
  - High dynamic range and good RMDR RX
  - Low phase & composite TX noise for TX
  - Use TX settings for low spectral spread – CW keying envelope,…
  - Set RX RF gain to minimum to mid (not highest – especially on 80/40)
- Antennas with good isolation
  - Maximize separation
  - Cross-pol antennas or end-to-end/side-to-side
  - Balanced antennas with BALUN's and/or RF chokes at the feed-point
  - Target 70 dB isolation and measure in the field and/or model with EZNEC
- Same-band setup isolation/separation
  - Place rig/operating setups near antenna clusters
  - Avoid any shared power or other connections
  - If same-band rigs are closely placed, plan on testing and focus on bonding and other factors to control interference
- Use bandpass filters with non-shared antennas and triplexers/filters to share antennas on several bands and rigs
- Same-band RX and/or TX filters are possible and designs are available and proven but using them can usually be avoided with adequate performance and attention to the basic issues
- Test Interference at the Field Day site prior to the start of the contest on Friday afternoon or Saturday AM – CW into phone on each band – between rigs using the shared antennas on different bands, especially on harmonically related bands

Set of Triplexers and Filters – 80/40 and 20/15/10 Meters



- Works well with 20/15/10 tri-band Yagi's, beams and dipoles and with 80/40 fan dipoles and inverted vees
-Mounting the 2 triplexers and 5 filters on a wooden base with a large aluminum bonding sheet makes for fast setup/teardown with good performance
- Allow for some interference directly on or very near to TX harmonics

Eclectic Interference Topics

- Generator noise – especially generator/inverters
- Electrical power cable
- Ethernet, WiFi & PC/laptop issues
- Grounding and bonding – when/where not to connect and where to connect

Generator Electrical Noise

- Ignition noise is generally fairly weak
  - Conventional generators create little electrical noise but are less efficient than generator-inverters, especially for 1 to 2 kW power levels
  - Keep generators some distance from antennas
  - We have operated light tower generators (standard with NO inverters) at 30 feet directly below antennas (but centered) without problems
- Generator-Inverter noise can be a major problem
  - Inverters contain high frequency/power switches which generate broadband noise
  - Generator dependent but even the best Honda units may be noisy on 160 meters
  - Place a good EMI/RFI filter like a CW4L2-20A-S in a water proof box with short (1 foot or so) connections to the generator output to filter hot and neutral to the generator ground with good bonding followed by 8 or 9 turns on 2 stacked FT240-31 toroid cores for common mode choking - this can fix even a very noisy generator-inverter

Electric Power Cables

- Electric power cables can act as antennas for noise, even if laying on the ground
- Electric power cables can conduct RF noise
- Keep power cables away from antennas – especially from running parallel on the ground underneath antennas – run perpendicular to antennas as much as possible to minimize and cancel coupling
- Modern rigs with modern 12V power supplies generally have excellent isolation with the 120VAC power lines and RF choking at the 12VDC power supply probably is not needed – especially using separate power sources for same-band rigs
- If same band operating rigs share a power source, consider adding EMI/RFI filters and RF chokes to the power cables if interference is a problem

Ethernet Cables and WiFi

- Ethernet cables used to network PC's/laptops can create major interference problems for multi-rig operations
- Strong TX RF coupling into nearby Ethernet cables can cause mixing of digital signaling with RF signals and harmonics creating strong wideband noise
- Keep Ethernet cables away from antennas as much as possible and especially avoid cables running parallel to antennas underneath them
- Use shielded Ethernet cables, even inside trailers and buildings used for operating positions
- WiFi devices generally will not create interference problems except for the Ethernet cable issues to connect them

Bonding and Grounding Issues

- Earth grounding of towers is recommended for lightning protection and disconnection and possible grounding of antennas during storms
- Earth grounding of each rig's chassis is good practice but may provide limited effectiveness for RF if the connections are long
- Earth grounding of generators depends on the situation
  - See:https://www.arrl.org/files/file/Technology/pdf/Portable%20Generators%20and%20OSHA%20Construction%20Standards%203-05%20(1).pdf and https://www.osha.gov/sites/default/files/publications/grounding_port_generator.pdf
  - OSHA allows for portable generators without an earth ground as long as the metal chassis/frame is bonded to the generator's neutral, the ground pin of electrical outlets are directly bonded to the generators chassis/frame, there are no subpanels in the system and only power cords going to appliances. If these requirements are strictly met, OSHA advises NOT to ground portable generators which in this case can increase electrical hazard
  - If a generator is possibly exposed to lightning hazard such as connected to a mast (example a light tower) and has outriggers that provide a poor ground, then installing a good earth ground at the generator is advisable or if there is a ground somewhere in the distribution system, then a good earth ground at the generator is advisable
  - The use of GFI's and/or other means including insulated devices for safety may be desirable at FD
  - Earth grounding at each rig is desirable but the length of ground wire may make earth grounding poor to ineffective for RF - since this may also connect the ground wire of the power cable to earth ground, this probably should be combined with an earth ground at generators
- Earth grounding is not a major issue for RF interference (not the case for RF bonding) and can in some cases actually increase interference by improving the radiation effectiveness of power cables and other cables
- Good and proper bonding is critical for EMI/RF filters, bandpass filters, triplexers,…..
  - Short and direct ground bonds for EMI/RF filters to sources/generators/devices are critical for interference suppression
  - Short coaxial connections provide good ground bonds for triplexers and filters, but ground sheets can improve effectiveness
- Avoiding any ground or other electrical cable connections between setups for same-band operations is recommended as well as large physical separation
  - Avoids any conducted interference between setups
  - Reduces possibilities of radiated interference coupling between setup

Antietam Radio Association
Setup for FD 2025

Light tower

EmComm trailer

CW trailer

Phone/digital trap dipole on 20/15/10 and inverted vee on 80/40

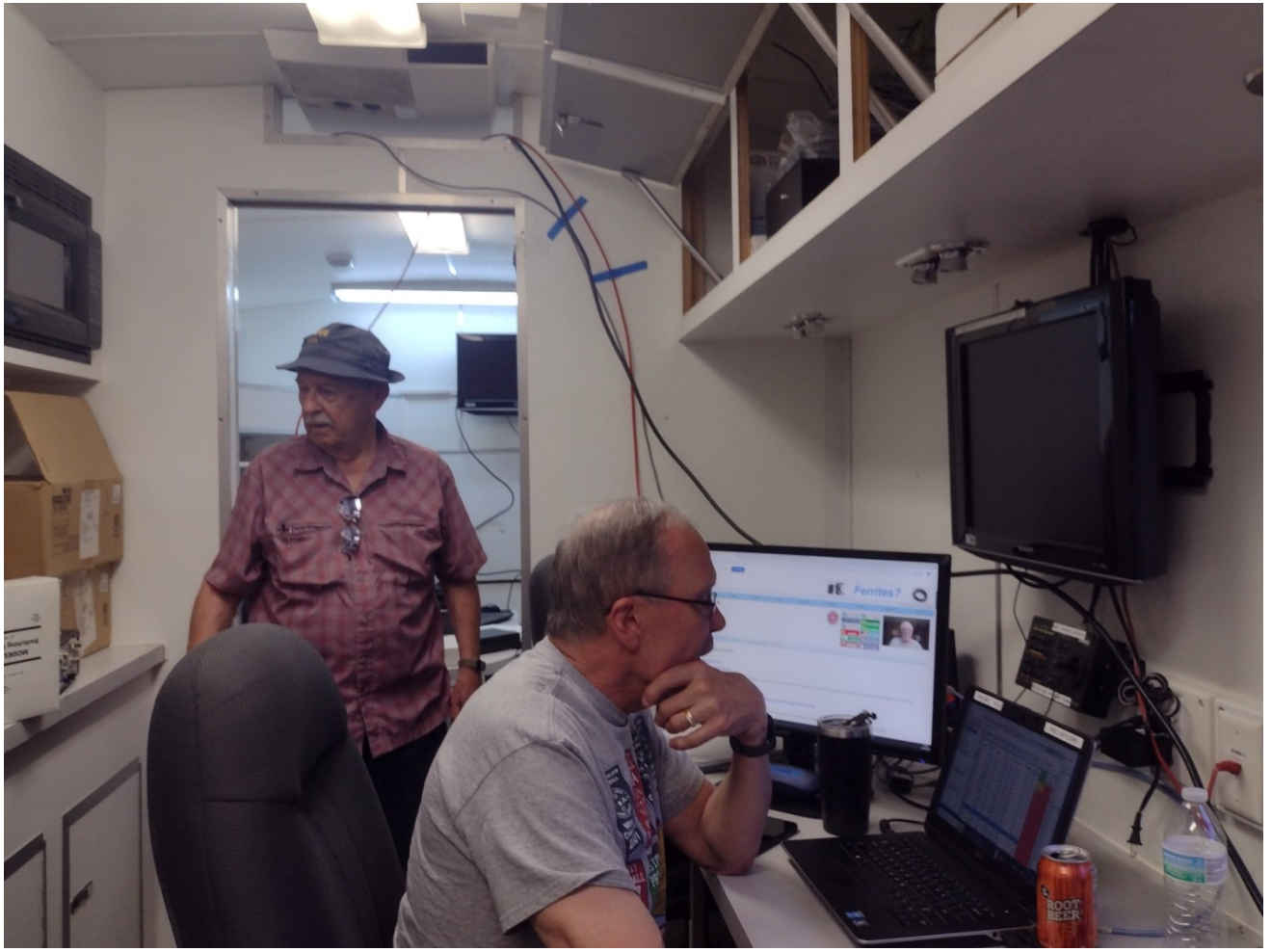
CW Verticals R5 on 20/15/10 And 33 feet Vertical on 80/40

The phone/digital dipole and inverted vee are placed to be perpendicular
To a line drawn to the CW verticals to achieve cross-pol isolation

Antietam FD 2025 Phone/Digital Setup

The light tower supported the 20/15/10 rotatable dipole for phone/digital and its generator provided power to an AC unit in the CW trailer 300 feet away over heavy cable – the AC unit was electrically isolated from all the equipment in the CW trailer and a separate small generator powered the CW equipment to prevent any conducted RFI

Inside the EmComm Trailer for Phone/Digital



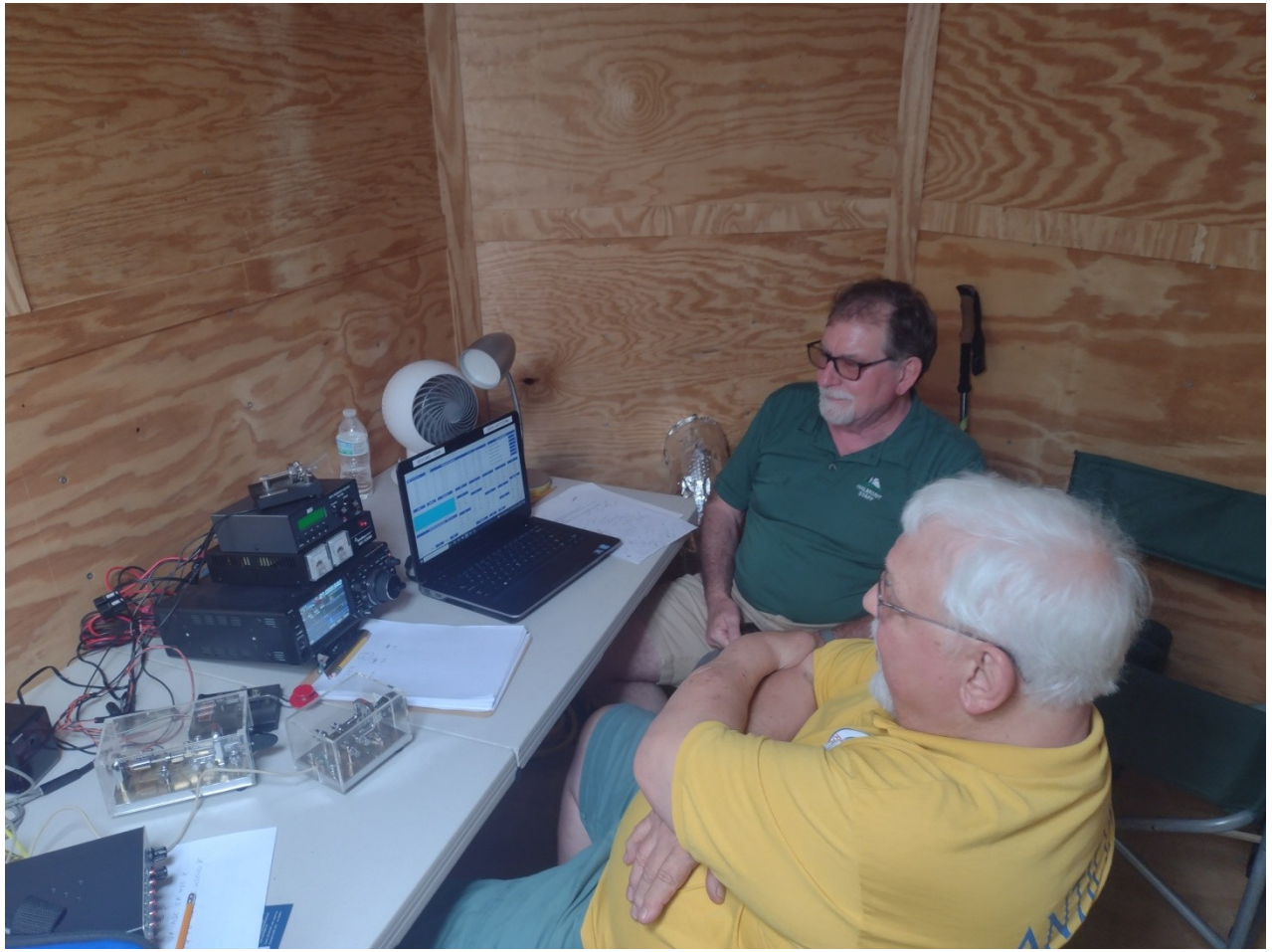
The EmComm Trailer for Phone/Digital

Thanks to Washington County for the use of the EmComm Traler

CW Setup

The CW or Morse Code trailer – The R5 for 20/15/10 is above the truck's windshield and The 80/40 33 feet vertical is above the small green tub

Inside the CW Trailer



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  - Rich Demoske – KC2EFA

ARA Field Day 2025 Results

- Operations experienced near ZERO interference between the 3 setups – the only known RFI issues were expected/planned including harmonic interference between rigs sharing antennas and CW interference if phone/digital operations were very close in frequency – some PC connectivity problems occurred prior to replacing an Ethernet cable internal to the EmComm trailer with a shielded cable
- 281 QSO's on CW
- 92 QSO's on phone
- 209 QSO's on digital using FT4, FT8 and PSK31
- WINlink messaging with long-distance 20 meters operation activated
- Starlink & an outdoor AP activated for Internet and WiFi service to the site