

AFTER ACTION REPORT
MARCH 23 2019
INVESTIGATIONS OF EOC HF COMMUNICATIONS

Background Papers

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|--|---|
| EOC Consensus Antenna Proposal - 5/19/2018 | https://qsl.net/nf4ac/2018/AntennaConsensusDocumentation.pdf |
| New EOC Antennas Initial Evaluation – Oct 1 2018 | https://qsl.net/nf4ac/2019/InitialAntennaEvaluationDocument.pdf |
| HF Bands interference Report – Feb 22 2019 | https://qsl.net/nf4rc/2019/EOCInterferenceFeb222019Report.pdf |

Brief Summary of Background:

The EOC high frequency amateur radio / SHARES communications systems are still struggling with two problems. (1) A much improved antenna, a sloping off-center fed commercial Buckmaster antenna offers improved performance over the previous much lower vertical end fed antenna, but has continued mechanical tangling problems due to improper installation and SWR issues which are still being investigated. (2) A severe wide band man-made noise problem below 10 MHz of 12-20 dB above background makes crucial frequencies basically unusable for communications to emergency counter parties in the 100-600 mile range.

Over the past 2 years significant improvements in the amateur radio/SHARES backup communications possibilities have also be realized, including:

- a) three excellent VHF/UHF antennas now available at the 60-foot level on the tower offer direct simplex communications roughly to the west all the way to the I-75 corridor. Geography and curvature of the earth prevent direct simplex communications beyond that range and require the utilization of digital or analog repeaters.
- b) New coax for all antennas was installed to replace aging long lengths of coax.
- c) A new feed for the HF Antenna reduced the length of coax to that antenna.
- d) Multiple large capacity 12V batteries were made available
- e) 2 new VHF/UHF transceivers were added at the EOC and four go-box systems were created for deployment
- f) An additional computer was obtained to allow improved operations at the EOC

INVESTIGATIONS ON SATURDAY 3/23/2019

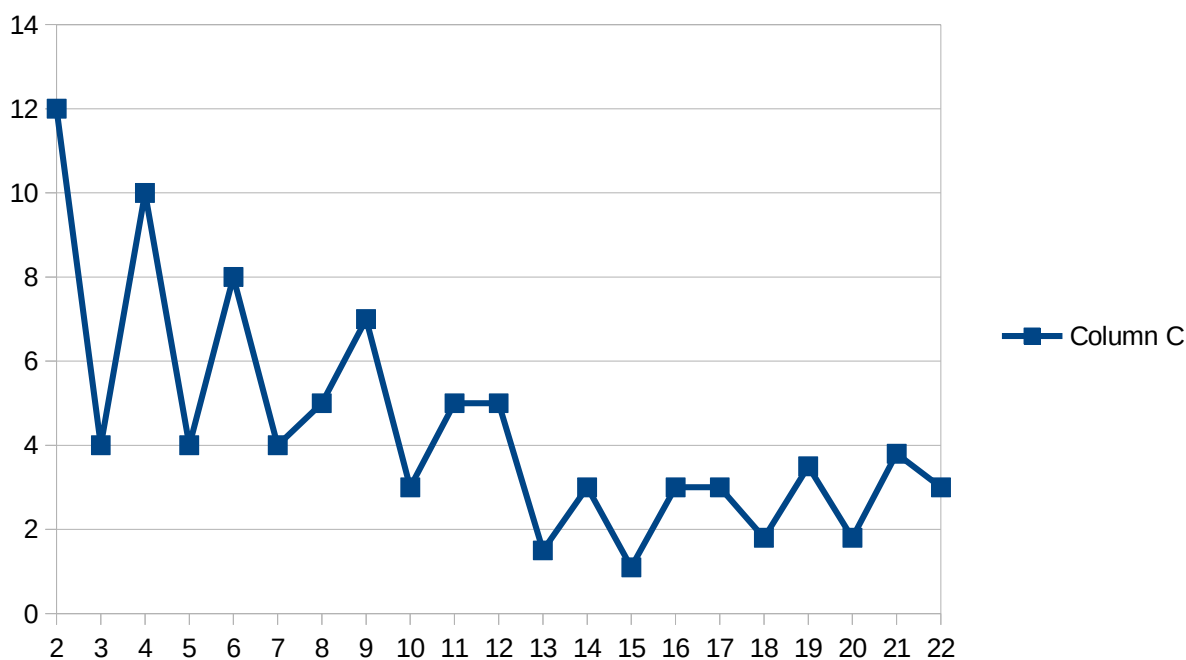
SWR MEASUREMENTS ON EOC ANTENNA –

Leland Gallup, AA-30 antenna analyzer.

Antenna raised off roof with three people pulling the top rope (Winch is not yet installed)

Some tangling of SE end (long) of the antenna observed. Most of this, but not all, was disentangled.

Plotting SWR at every MHz shows the following Result:



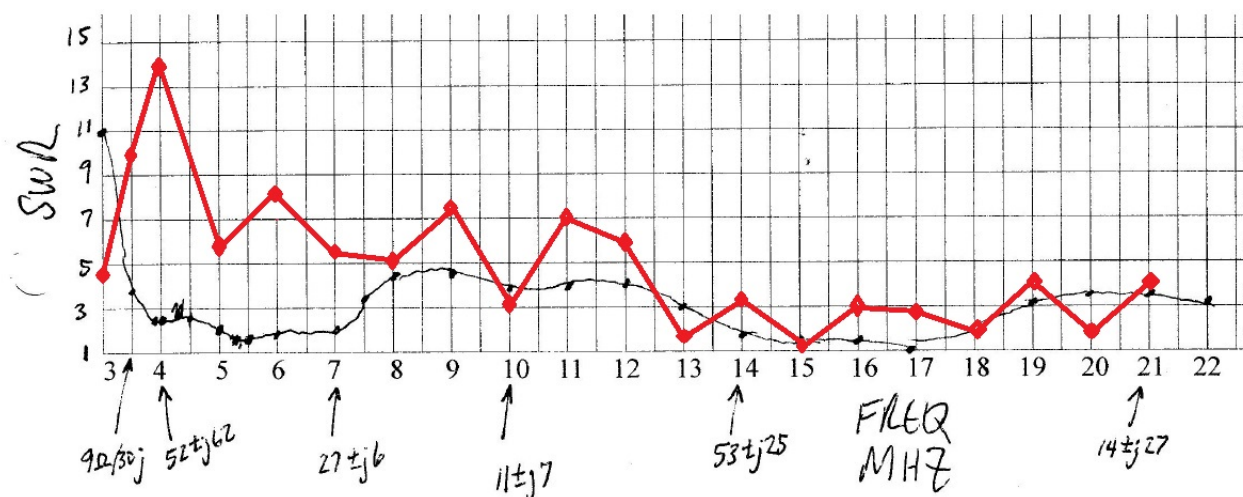
Points of lower SWRs were centered on these frequencies:

| Frequency | SWR | Comment |
|-----------|-----|--|
| 3.075 MHz | 2.6 | Fundamental ? |
| 6.25 MHz | 1.3 | Approximtely 2 nd harmonic of fundament |
| 8.3 Mhz | 1.1 | |
| 9.75 MHz | 1.6 | |
| 11.4 MHz | 1.5 | |
| | | |

There is no obvious explanation for these points of lower SWR based on the actual antenna length. To achieve a resonance at 3.075 the antenna would need to be approximately 25 feet longer than it actually is. I suspect an interaction with metal in or near the roof, possibly support structures, lightning grounding structures, etc.

Thankfully the matching system is able to match most of these frequencies, and the losses on the coax at the lower frequencies (e.g., 4 Mhz, 200 feet, SWR 12:1) are in the range of 2.5-3 dB.

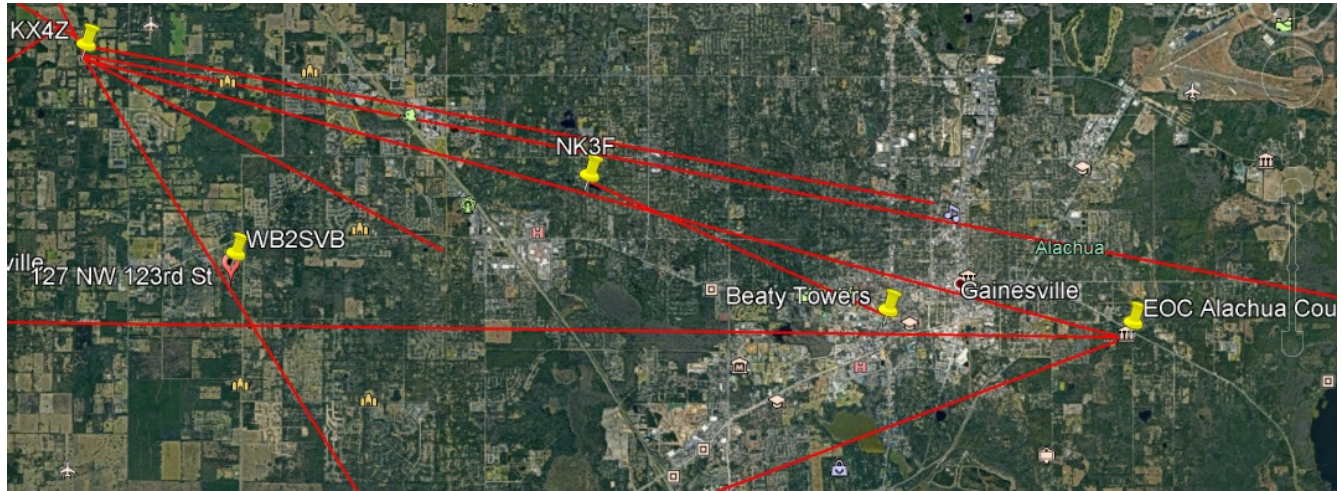
This current SWR chart is fairly similar to an earlier chart of the EOC antenna made by G. Gibby in Feb 2018 (RED) and measurement of a homemade similar antenna by Vann Chesney (black):



There is gross agreement between the measurements of Leland (March 2019) and Gordon (Feb 2018) on the EOC antenna – both are significantly worse than Vann’s data.

POINT TO POINT COMM LINK TESTS:

MAP of Stations Involved



| Path | Length | Comments |
|----------------|------------|--|
| EOC to WB2SVB | 11 miles | Ridge between (curvature = 84 feet |
| EOC to KX4Z | 13.5 miles | Ridge between (curvature = 125 feet |
| WB2SVB to KX4Z | 3.3 miles | Little geography between |

Note that the Fresnel space between these stations is quite large at HF frequencies and not inconsequential at 2 meters

TESTS & RESULTS

| No. / Time | Issue | Conclusion |
|----------------|--------------------------------------|---|
| 1 1300 (local) | Predicted geomagnetic storm level G2 | Unclear if this was an issue. SFI = 80 reported A index 1 K index 0 Eglin AFB reporting FoF2 = 4.975 MHz KX4Z was able to make connection to AJ4GU near Atlanta on 7.099 MHz, which would be difficult if there were a G2 geomagnetic storm. |
| 2 1347 (local) | Attempt for 80 meter communications | 1. WB2SVB able to hear the EOC station. (11.27 mi) 2. KX4Z unable to understand the words heard |

| | | |
|---|-------------------------------------|--|
| | | <p>(13.43 miles)</p> <p>3. EOC cannot hear either of our stations – as expected, with their noise problems.</p> <p>4. KX4Z and WB2SVB (3.3 miles) can hear each other >12 dB above background. Loud and clear.</p> <p><i>If the EOC had no noise problem, communications on 80 meters possible to W2SVB..</i></p> |
| 3 | Attempt for 20 meter communications | <p>1. WB2SVB and KX4Z again can hear each other very loudly. Approximately 15 dB above the noise level</p> <p>2. Communication with the EOC is not possible.</p> |
| 4 | Attempt for 10 meter communications | <p>1. WB2SVB and KX4Z hear each other as much as 20+ dB over background</p> <p>2. KX4Z and WB2SVB can make out the EOC and the EOC can hear us. Success.</p> <p>WINLINK peer to peer digital connections were also successful on both WINMOR and ARDOP between the EOC and KX4Z.</p> <p>This success is likely due to:</p> <p>a) reduced noise issues at 28 MHz at the EOC, making their receiver more effective</p> <p>b) significant Fresnel volume of 28 MHz signals allowing communications past significant geographic limitations</p> <p>c) 100 watts of power available at both stations</p> |
| 5 | 2 meter simplex communications | <p>Failure from KX4Z to the EOC. This is likely due to the significant ridges between the stations, the curvature of the earth (equal to > 100 feet) and the reduced Fresnel volume of 146 MHz transmissions.</p> <p>Communications out past roughly the I-75 limit will require repeaters, either digital or analog.</p> |

It likely that communications on 10 meters will be successful between the EOC and stations at the Senior Center and at Santa Fe during the upcoming Exercise on March 30 2019