NCDXF Beacon Antenna Replacement Project

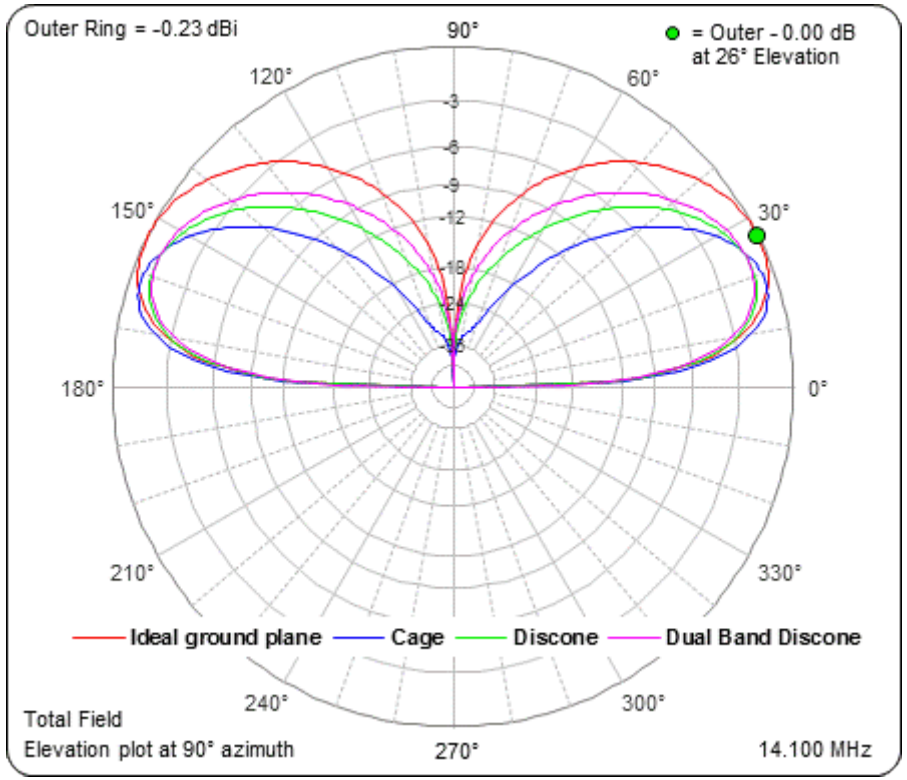
Initial Requirements List*

- Mandatory:
  - Survivability – 100 mph survivability
  - No traps (unlike existing antenna)
  - Easily shipped worldwide (max container dimension 6’)
  - SWR < 2:1 on all NCDXF Beacon frequencies
  - Reliable construction
  - Require little to no maintenance
- Desirable:
  - Max height 16’ (existing MFJ antenna height)
  - Maximum diameter footprint 6’ (existing MFJ antenna)
- Stretch:
  - Gain within 3 dB of λ/4 vertical at low elevation angles
  - SWR < 1.5:1 on all NCDXF Beacon frequencies

**Compiled by K6TU & AA7A*

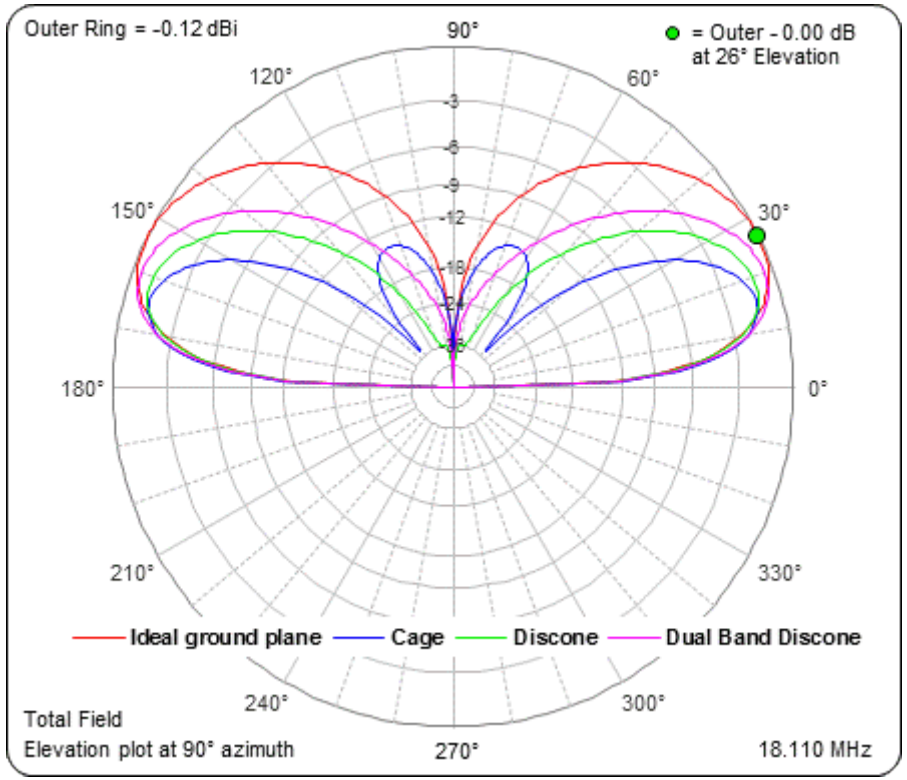
Modeling Results

Elevation Pattern Comparisons – 20 m



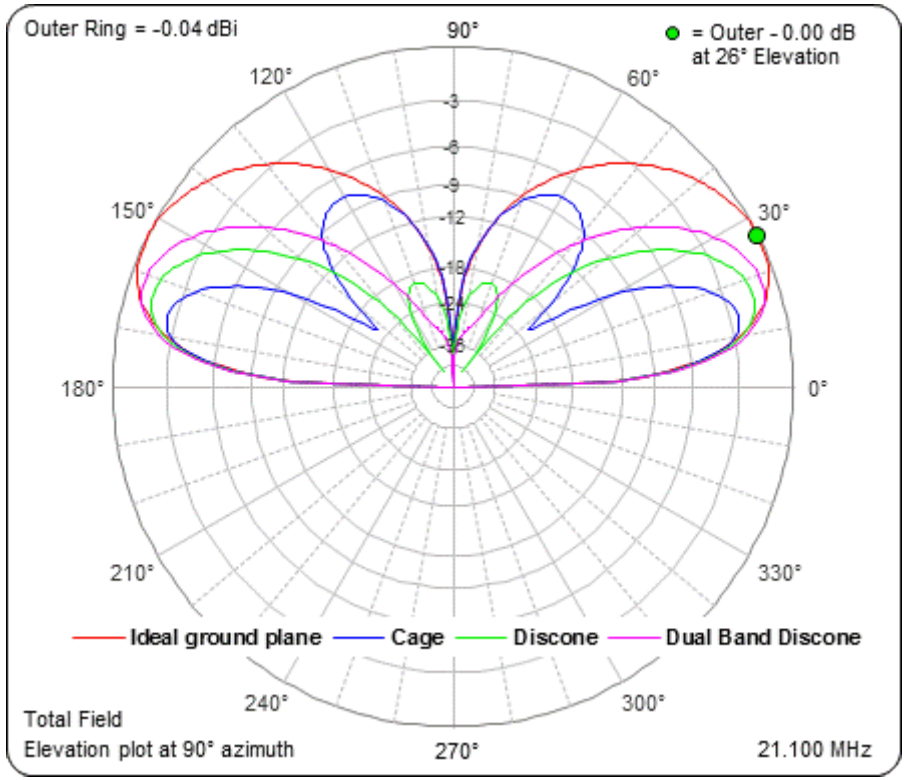
Modeled using NEC4D over High Accuracy “Average Soil” ground

Elevation Pattern Comparisons – 17 m



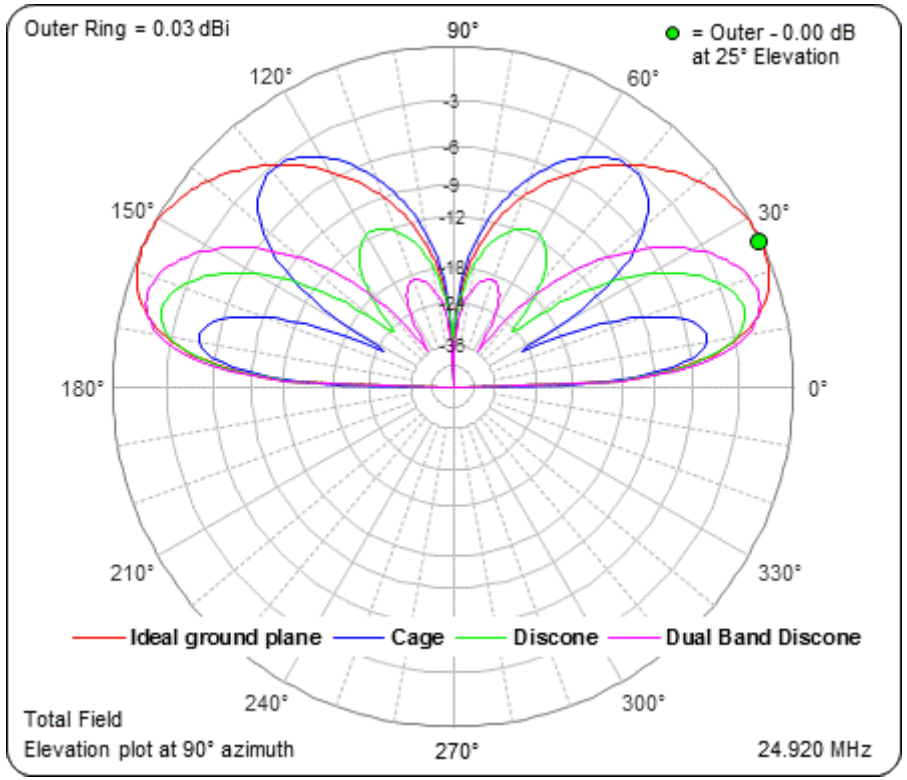
Modeled using NEC4D over High Accuracy “Average Soil” ground

Elevation Pattern Comparisons – 15 m



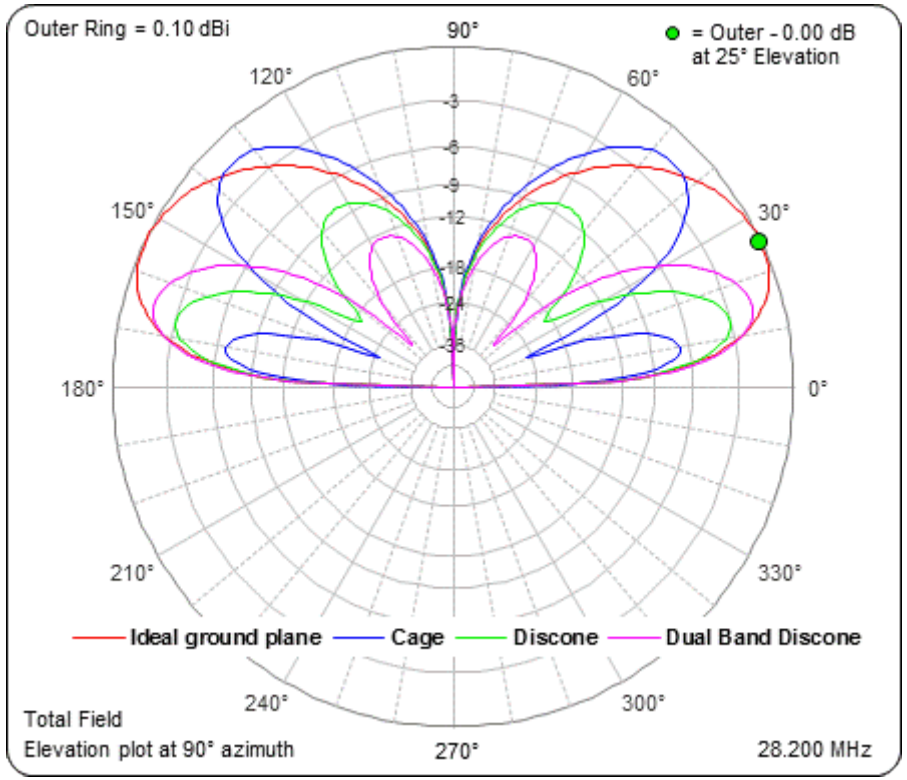
Modeled using NEC4D over High Accuracy “Average Soil” ground

Elevation Pattern Comparisons – 12 m



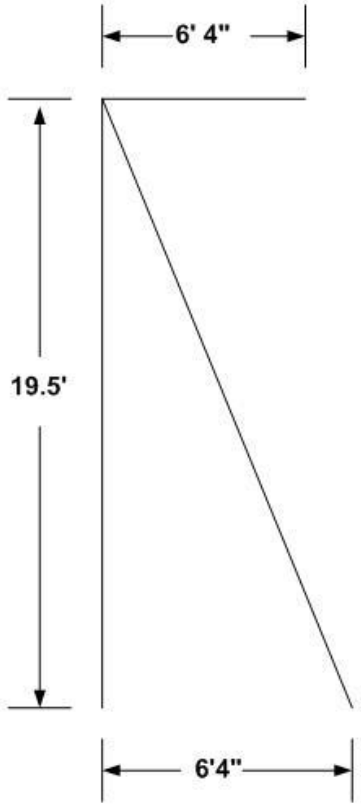
Modeled using NEC4D over High Accuracy “Average Soil” ground

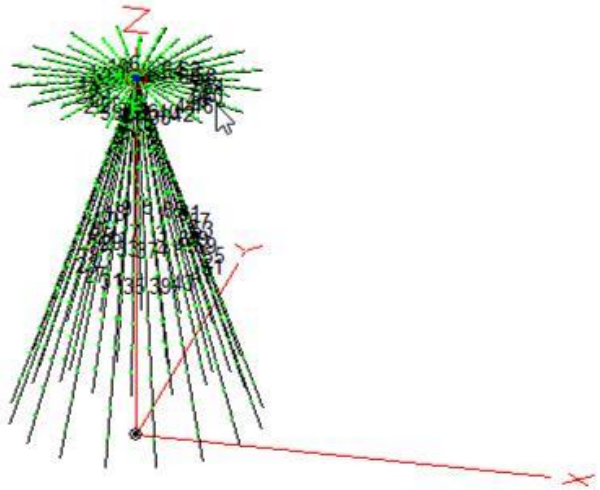
Elevation Pattern Comparisons – 10 m



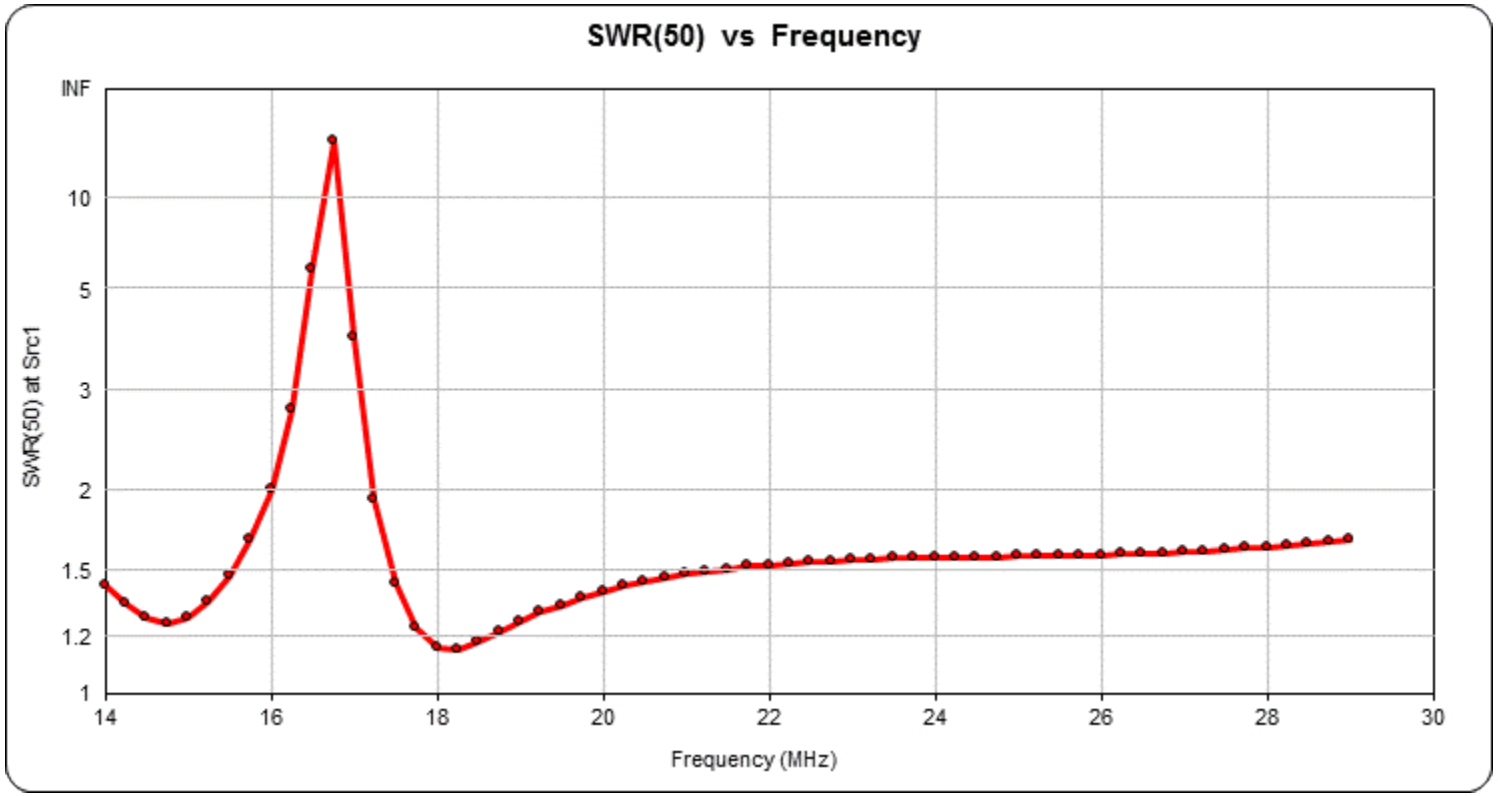
Modeled using NEC4D over High Accuracy “Average Soil” ground

Recommended Antenna- Dual Band Discone

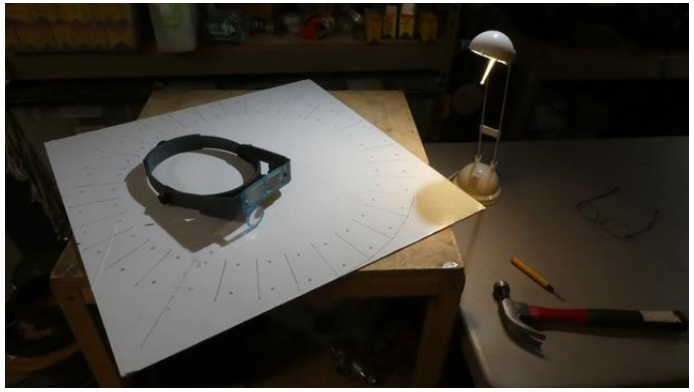


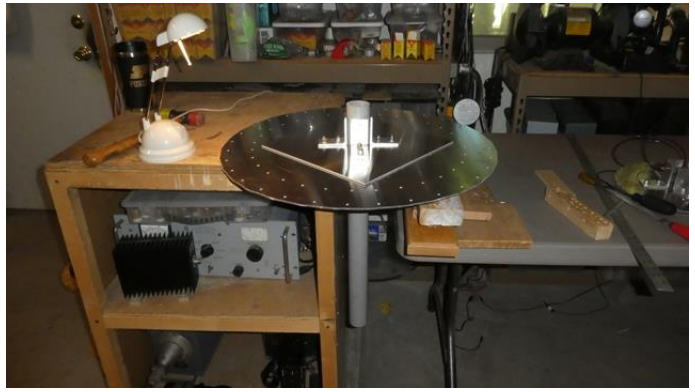


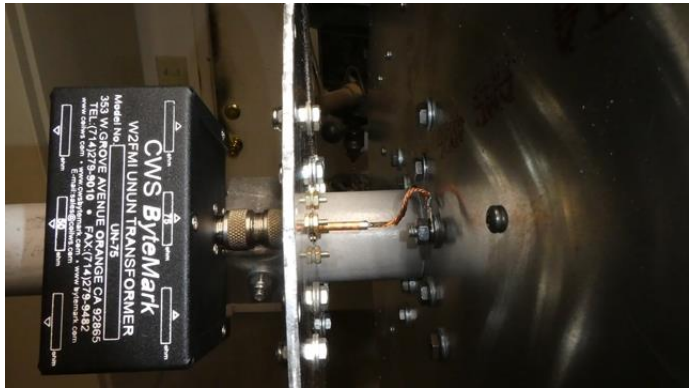
Dual Band Discone – SWR vs frequency

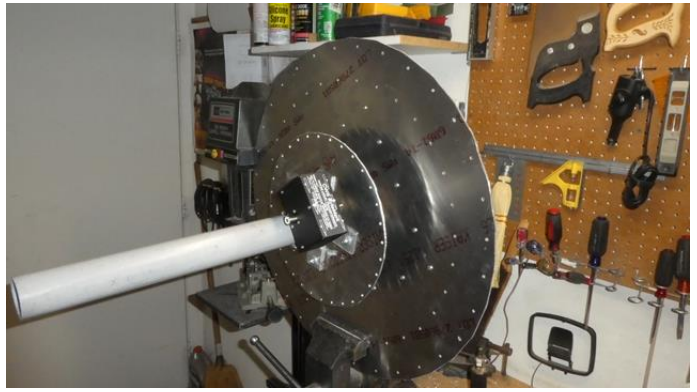


DBD Construction

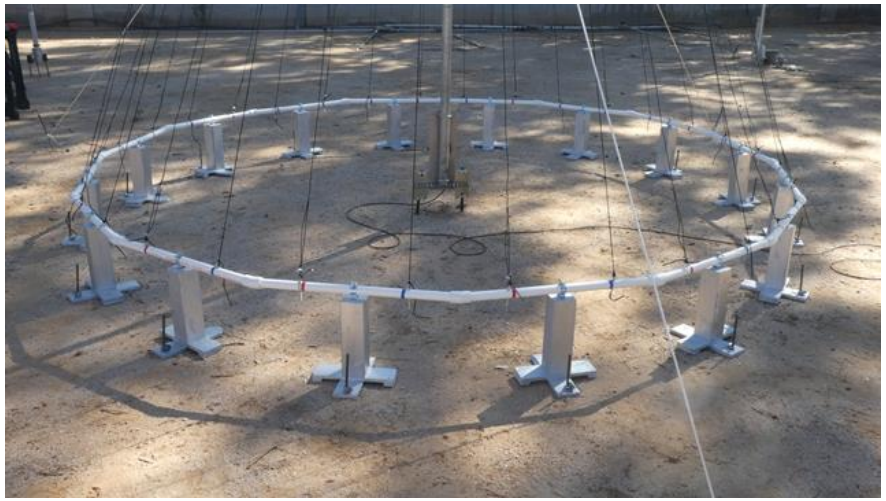








Final Assembly



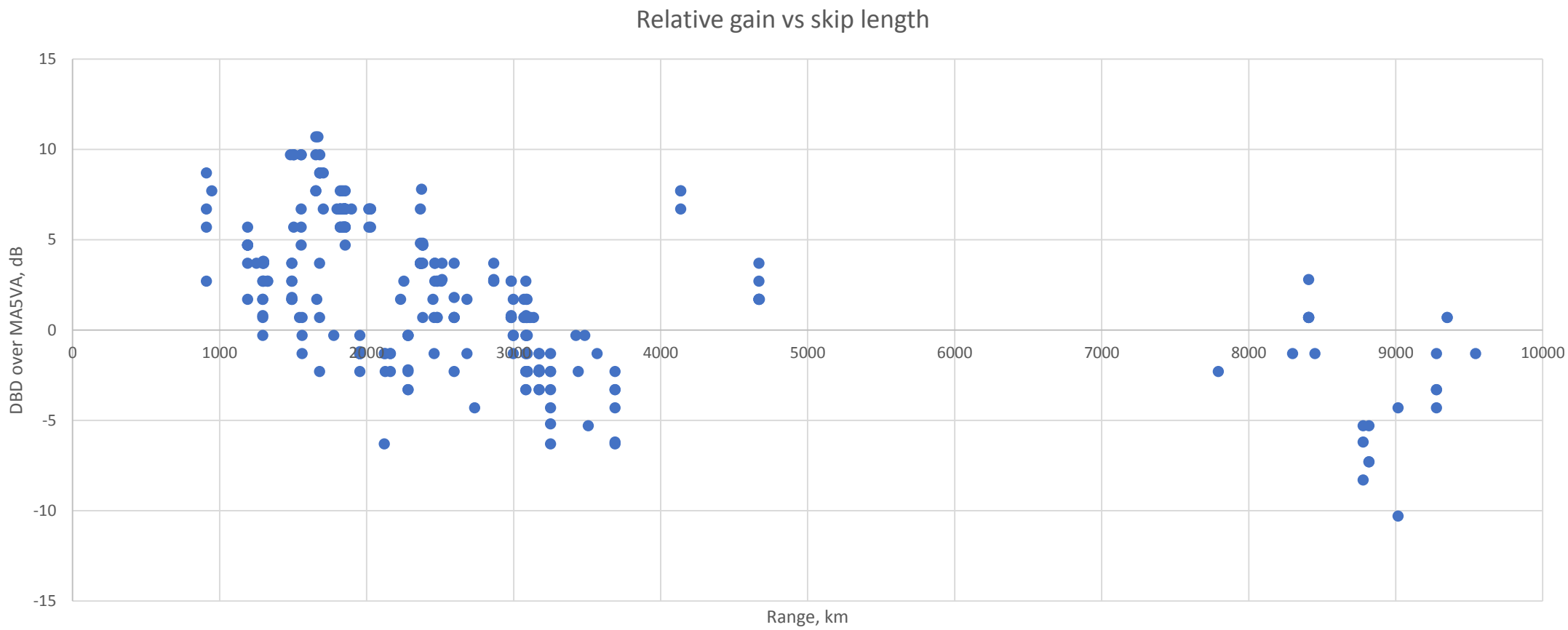
AA7A Antenna Test Range

- Antennas separated by 50 feet…> λ/2 on 20m
- No noted interactions to nearby conductors
  - Neither antenna's SWR changed when "adjusting" resonant frequency of nearby conductors…best known method to check for interaction
- Cable less differences measured on each WSPR frequency and used to adjust results in difference measurements
- Using 10 watts on 20/17m, 50 watts on 15 m
- No performance difference data available on 12 and 10 meters up to this point in time

Test data collection method

- Set both station's frequency and power level to be the same
  - Take data frequently while bands are open…once every ten minutes or so
  - Randomize the audio frequency in WSPR between tests to reduce effects of interference as much as possible
- Set WSPR software application to force transmissions to occur at the same time
- Assure that both stations are in TX mode and making the right power for the same 2-minute TX interval
- Wait until all relevant reporting station data is available in the WSPRnet database (at least one minute)
- Screen scrape the data in your browser following a database query for each station
  - http://wsprnet.org/drupal/wsprnet/spots
- Import data into Excel and filter the results to show only reporting results from stations that detected both stations
- Compute SNR differences and collect results into a spreadsheet for each band
- Inspect results and remove outliers
- Plot the data from reporting station
  - Look at results vs range to reporting stations (look for behavior for different skip zones)
  - Look at results vs bearing to reporting stations (look for bias from nearby conductors)
  - Make sense of the results (YMMV)

Results – 20 meters; 268 data points; sorted by Range



Relative signal level of DBD over MA5VA (dB) vs Range Bins (skip length?)

Band	0 To 2km	2km to 4km	4km to 6km	6km to 8 km	> 8km
20	5.7	0.7	2.7	-2.3	-2.3
17	2.3	4.8	1.8	-	6.8
15	6.9	4.9	-1.1	-	3.9

Median value of signal difference (in dB) for 2km range bins

Deployment on Mt Umunhum

Analysis of data comparing DBD to MAV5 at W6WX

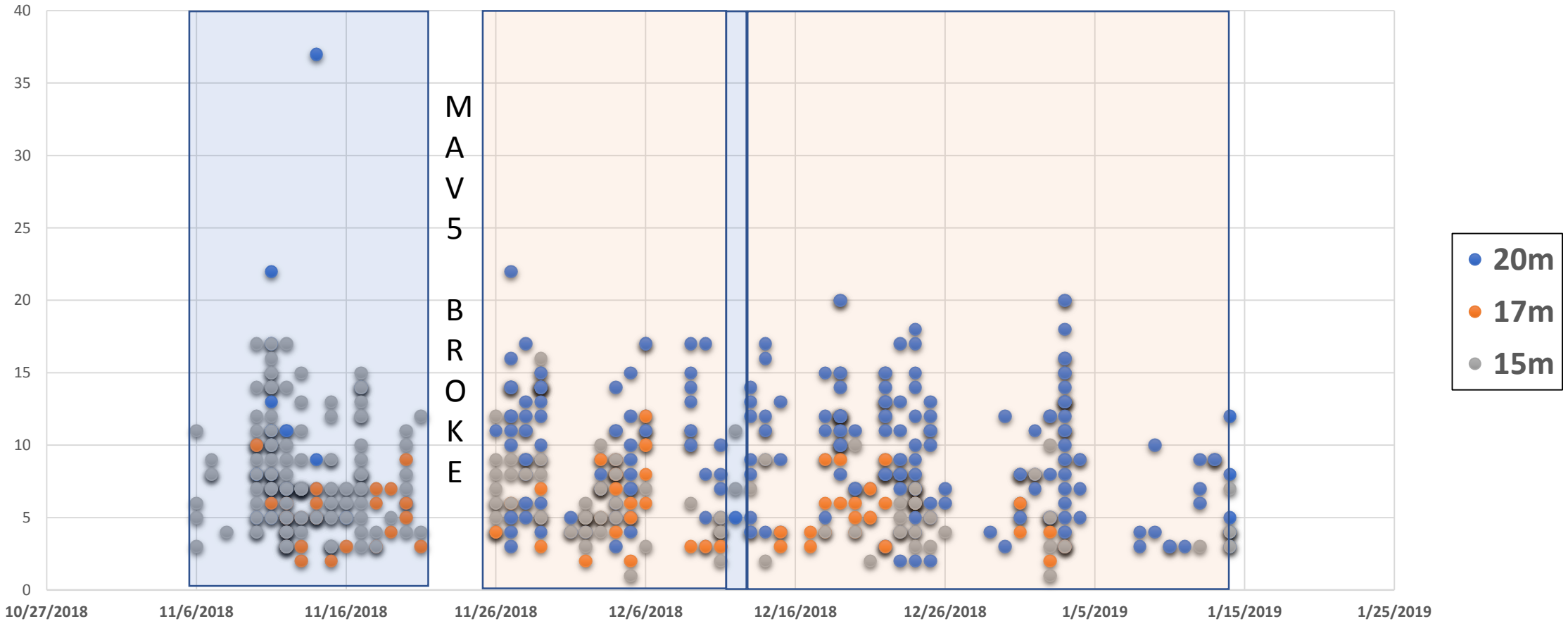
RX at ZL4YL

RX at OH6BG

RX at VE7CC

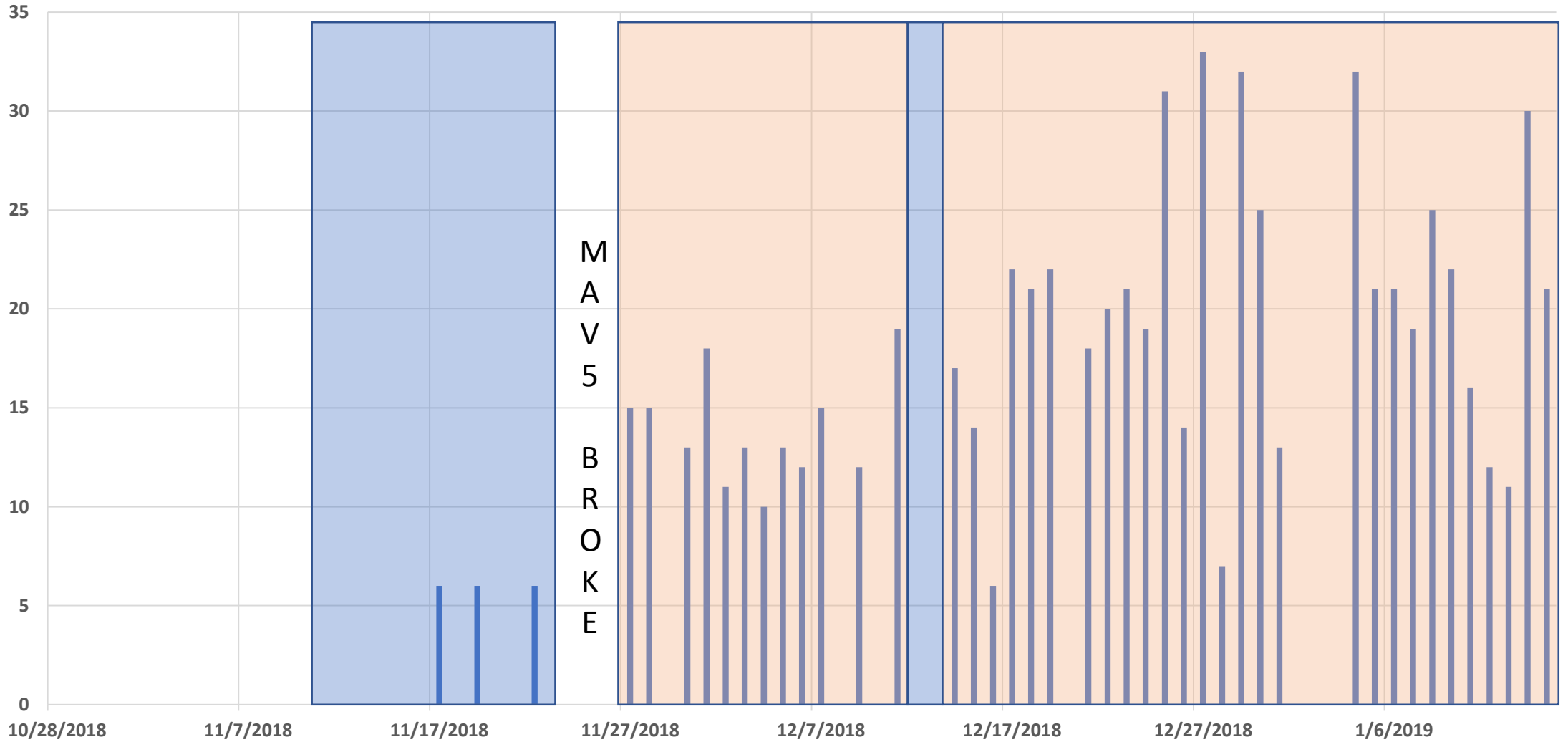
RX at KO7SS

ZL4YL SNR data during antenna changeovers at W6WX

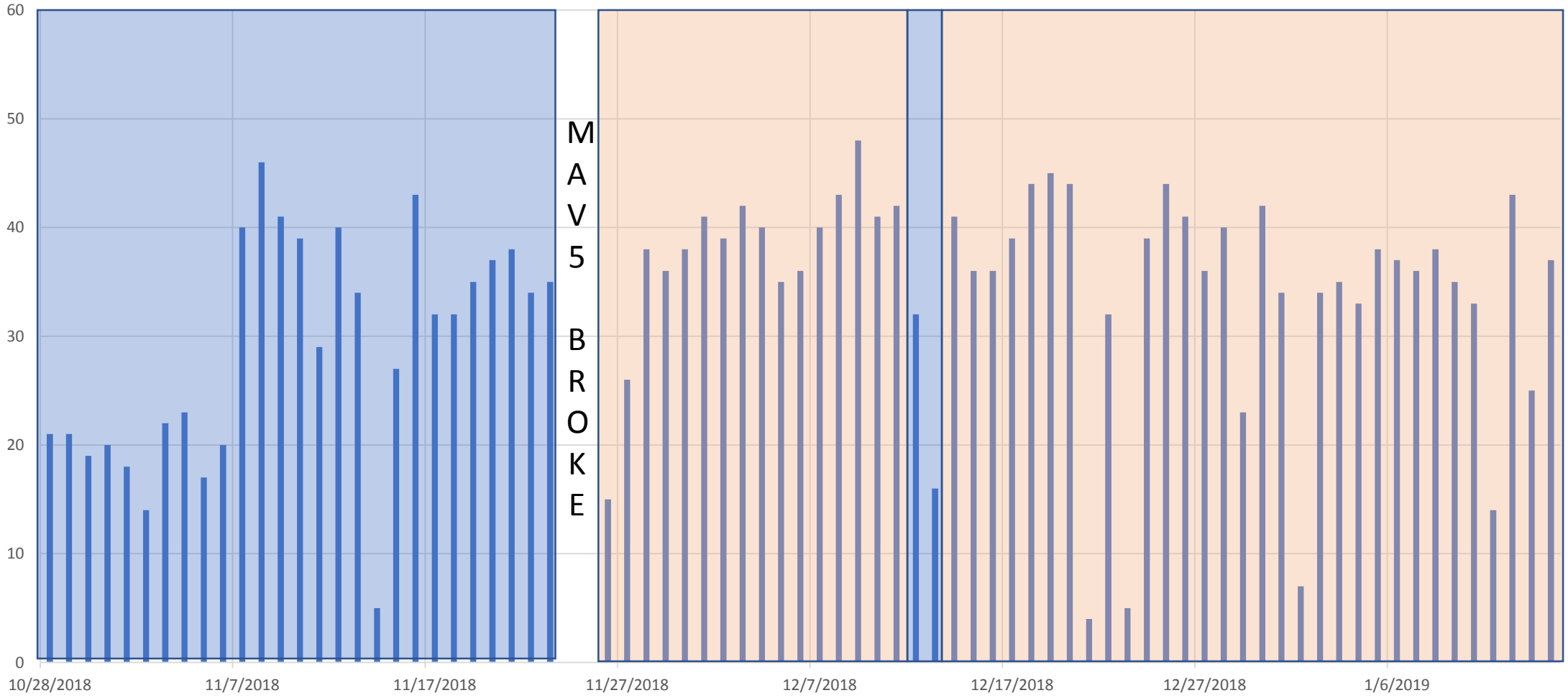


MAV5 antenna in use at W6WX

Dual Band Discone antenna in use at W6WX

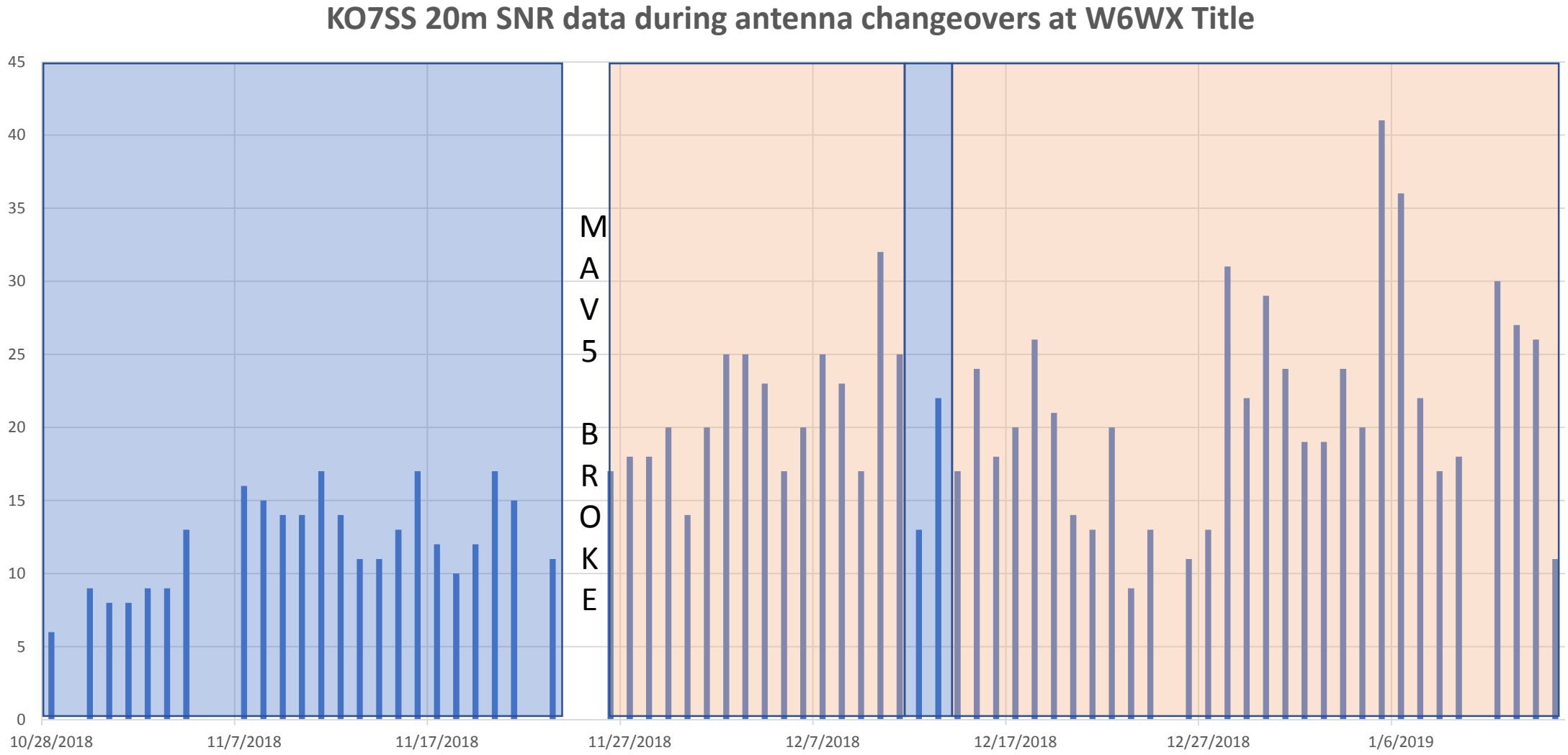

OH6BG 20 m SNR data during antenna changeovers at W6WX
35
30
25
20
15
10
5
0
10/28/2018
11/7/2018
11/17/2018
11/27/2018
12/7/2018
12/17/2018
12/27/2018
1/6/2019
MAV5 BROKE
MAV5 antenna in use at W6WX
Dual Band Discone antenna in use at W6WX

VE7CC 20m SNR data during antenna changeovers at W6WX



MAV5 antenna in use at W6WX

Dual Band Discone antenna in use at W6WX


KO7SS 20m SNR data during antenna changeovers at W6WX Title
45
40
35
30
25
20
15
10
5
0
10/28/2018
11/7/2018
11/17/2018
11/27/2018
12/7/2018
12/17/2018
12/27/2018
1/6/2019
MAV5 BROKE
MAV5 antenna in use at W6WX
Dual Band Discone antenna in use at W6WX

Current Summary

- DBD assembly and installation was moderately complex and took significant site preparation
- DBD meeting expectations on 20 thru 15. No 12/10 meter data yet
- Determine how do to go forward for this to be deployed for the start of the next solar cycle?