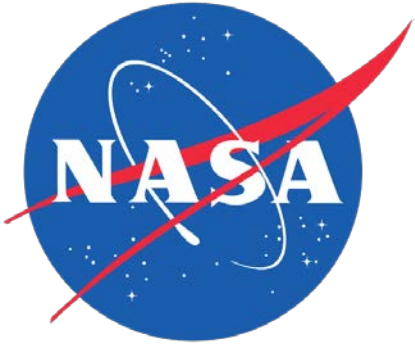
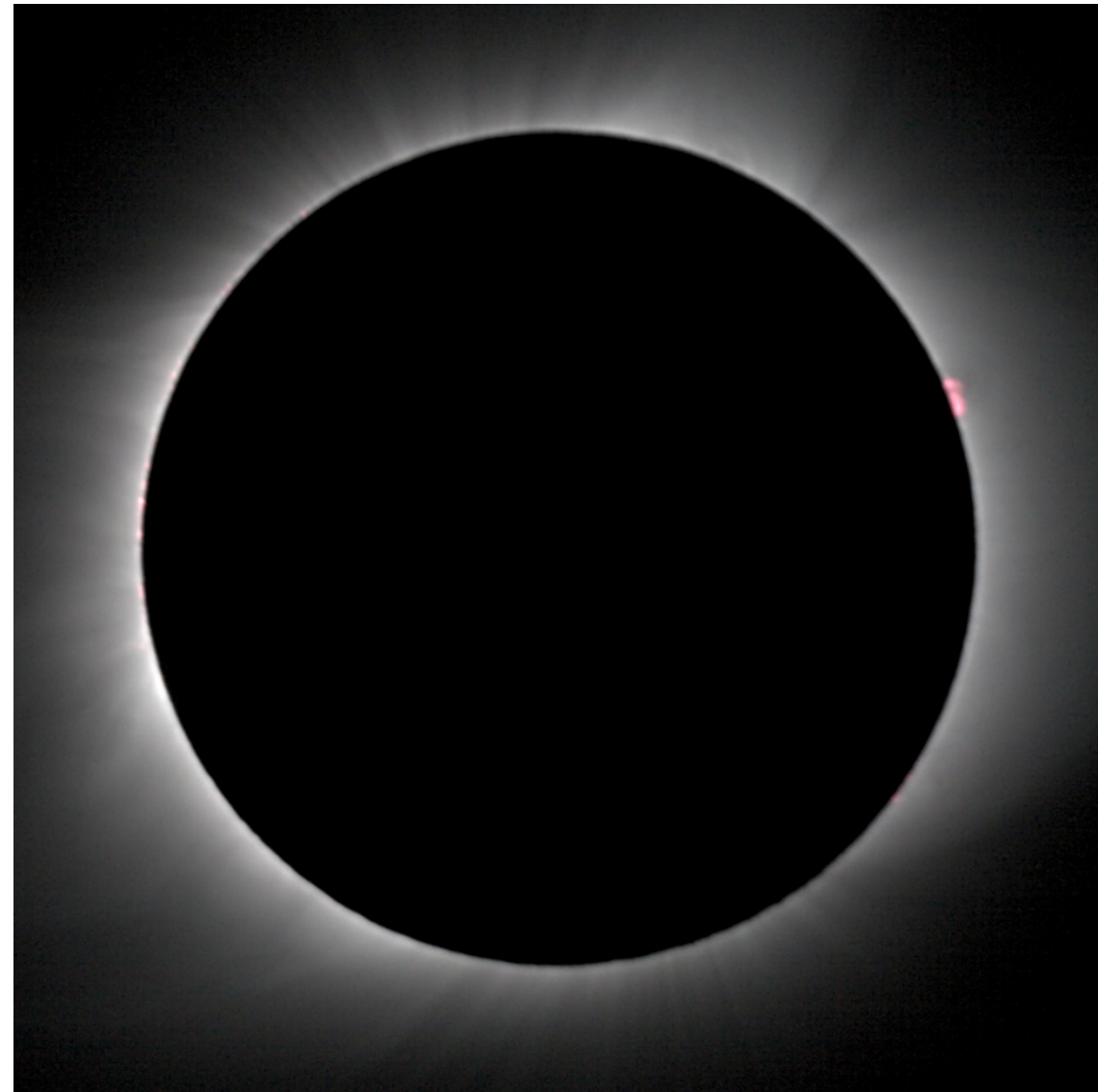


Ham Radio Activities at Marshall Space Flight Center during the 2017 Total Solar Eclipse: Transmitting Node

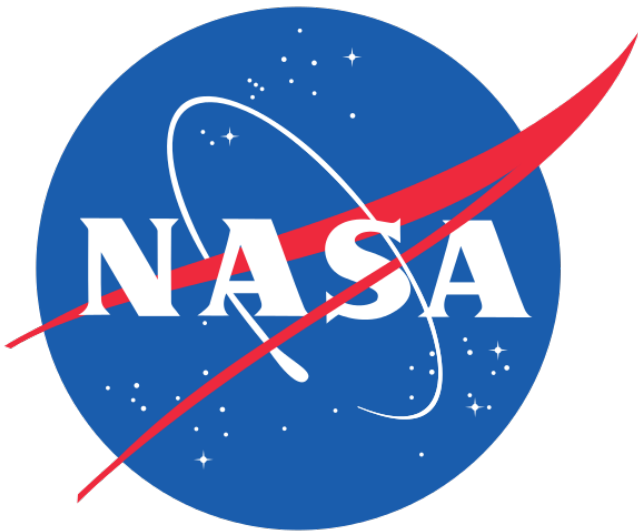


HamSCI Workshop, 2018

- Jesse McTernan (KN4EZR)
- Linda Krause (KODRK)
- Ghee Fry (WL7C)



Ham Radio Activities at Marshall Space Flight Center: Part 2



Just heard Ghee talk about the RBN

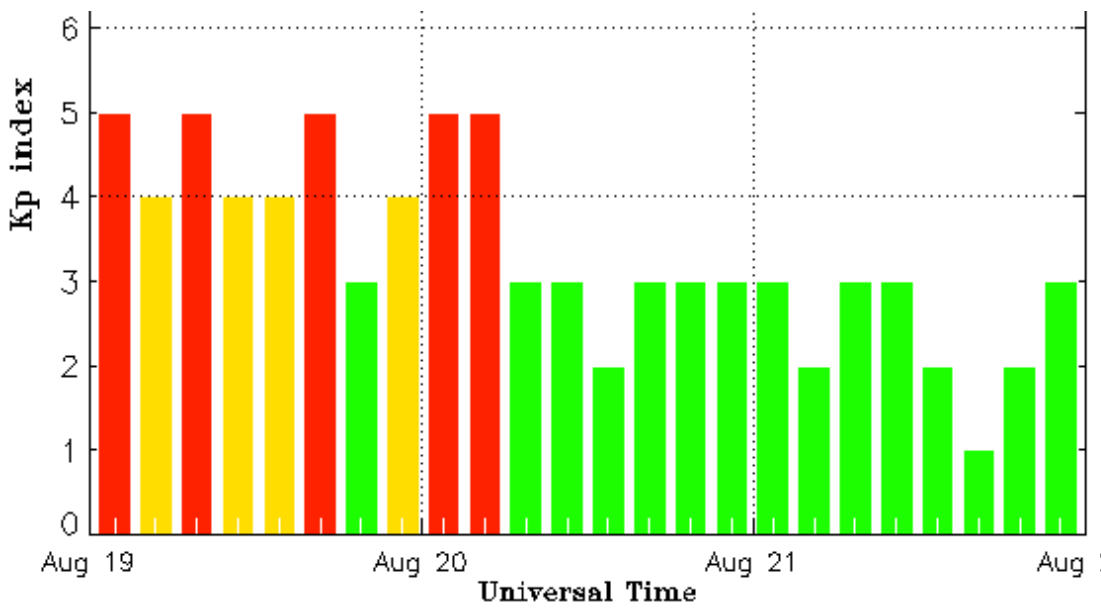
Now we talk about setting up a transmit
(DX) node

*This will be expanded on
It's the introduction*

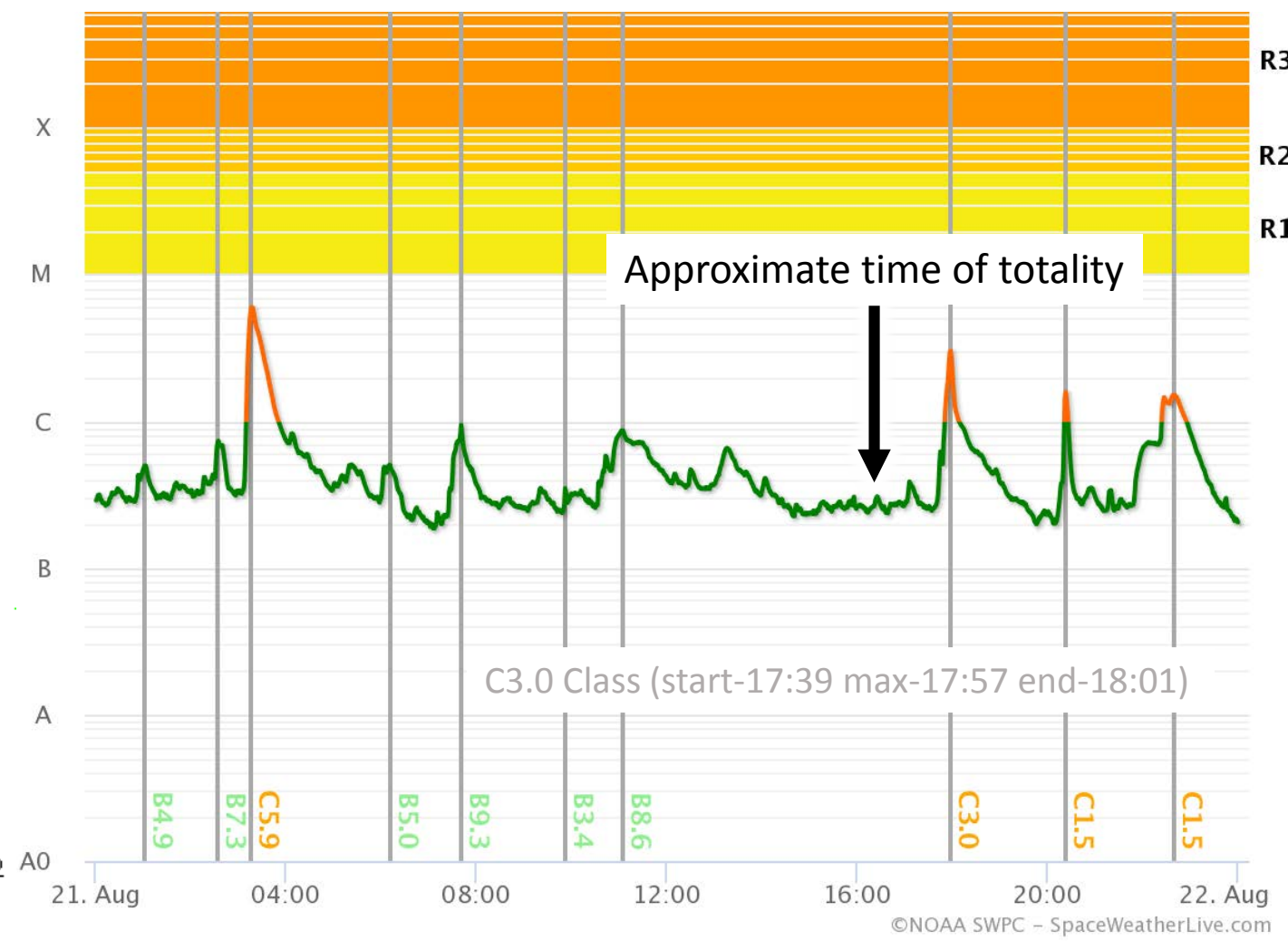


Solar activity on Monday, 21 August 2017 was relatively quiet

Parameter	Symbol	Value	Unit
Radio Flux	F	87.1	sfu
Sun spots	R	43	
X-ray background flux	A,B,C,M,X	B2.6	(W/m ²)
K-index	Kp	1	



Space weather data from NOAA SWPC archives



X-ray activity plot from spaceweatherlive.com

Physical location and setup

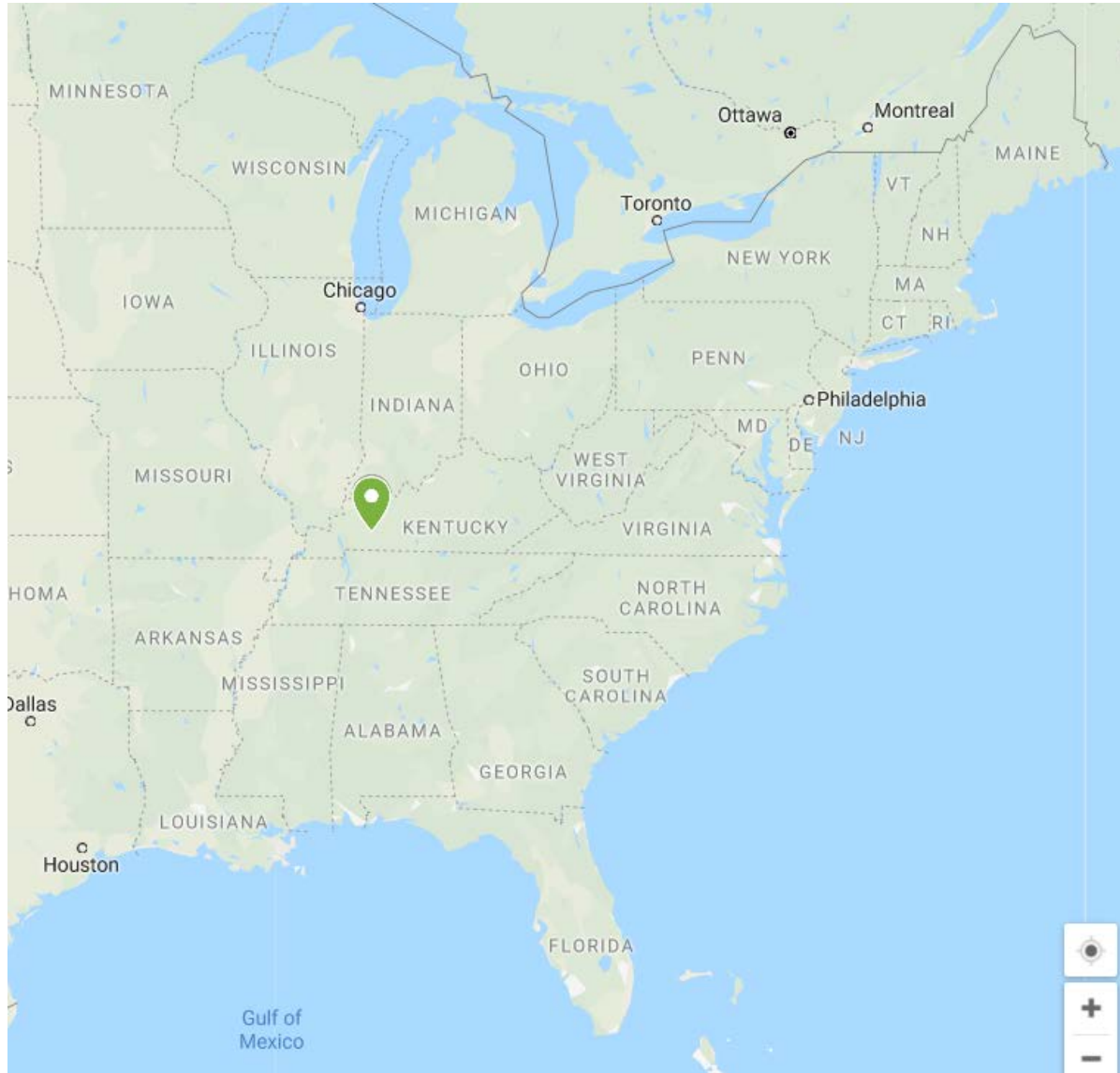


Image from Google Maps

Local eclipse contact times (CDT = UTC – 5)

C1 (Begin Partial)	C2 (begin total)	C3 (end totality)	C4 (End Partial)	
11:56:48	13:24:57	13:27:24	14:51:43	CDT
16:56:48	18:24:57	18:27:24	19:51:43	UTC

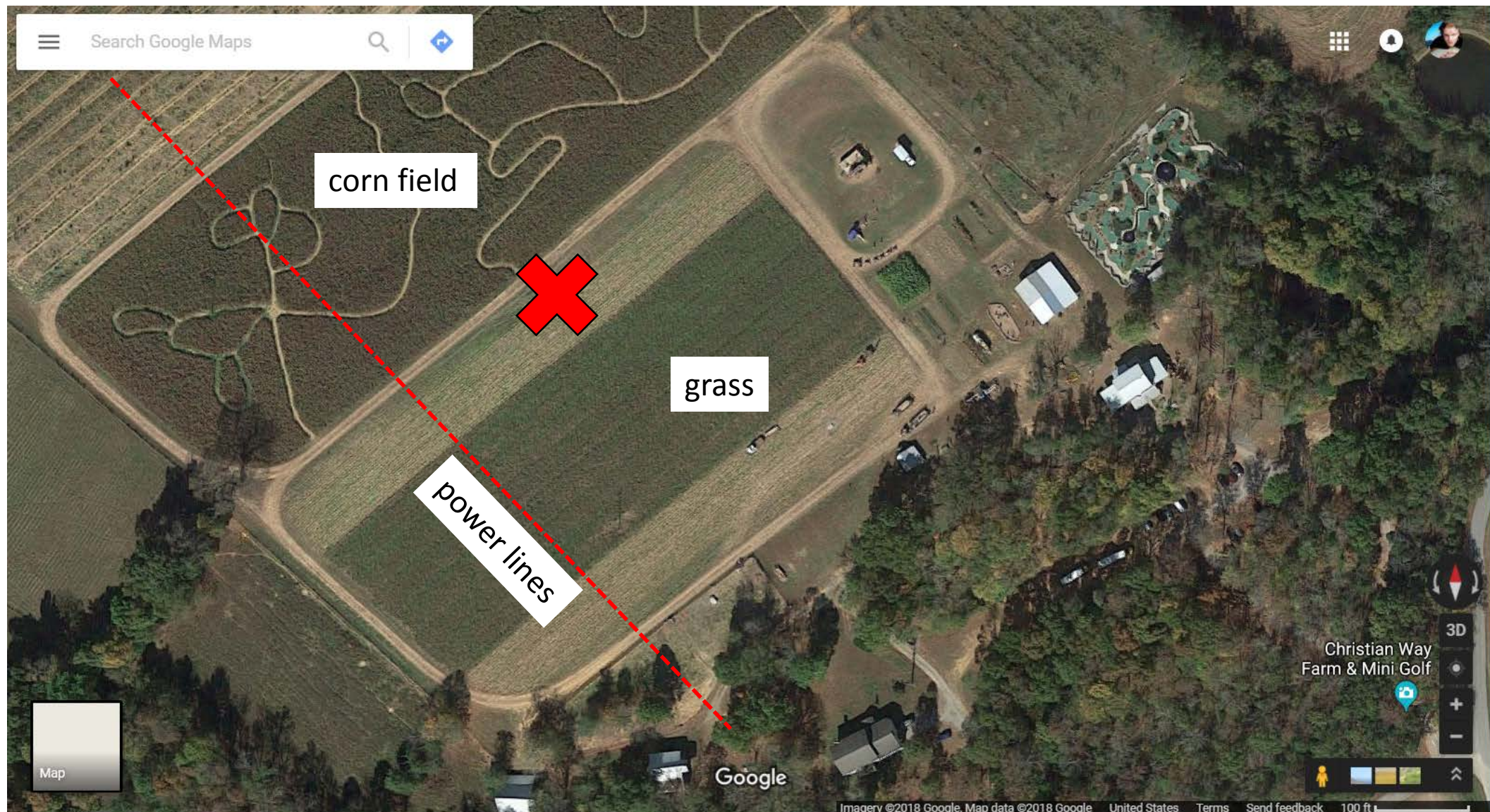
Location

lat	lon	Maidenhead
37.035796	-87.304767	EM67ia

Very limited internet!

Physical location and setup

Christian Way Farm Near Hopkinsville, KY

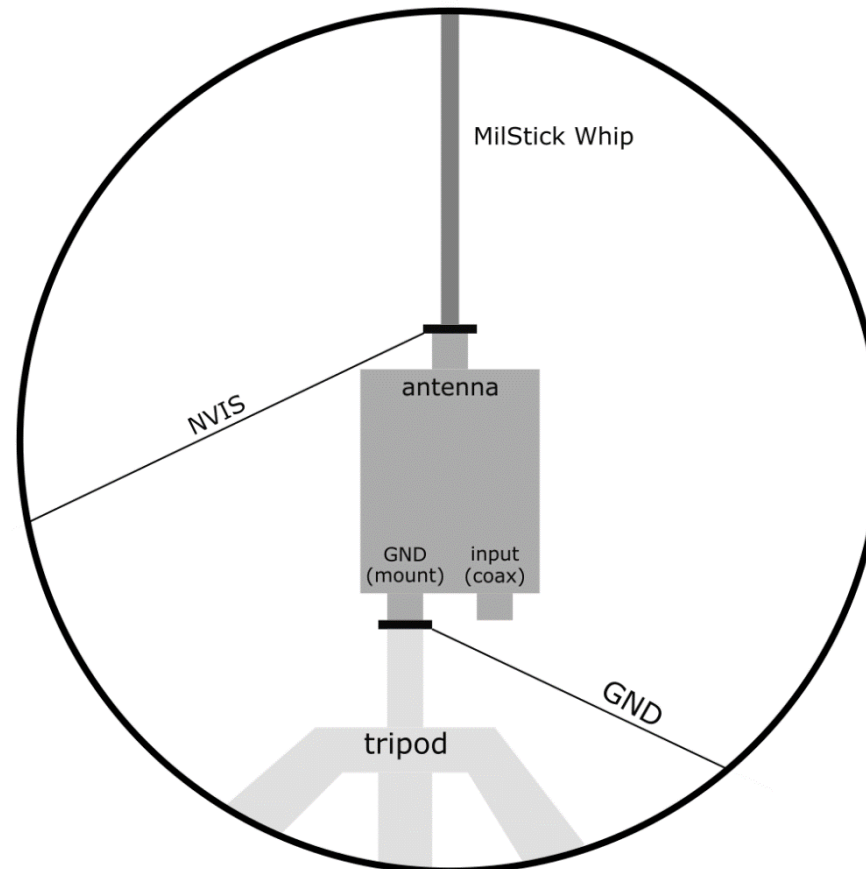


Physical location and setup: Antenna and Radio

Alpha Antenna



6-80M Complete Multiband
500W portable antenna



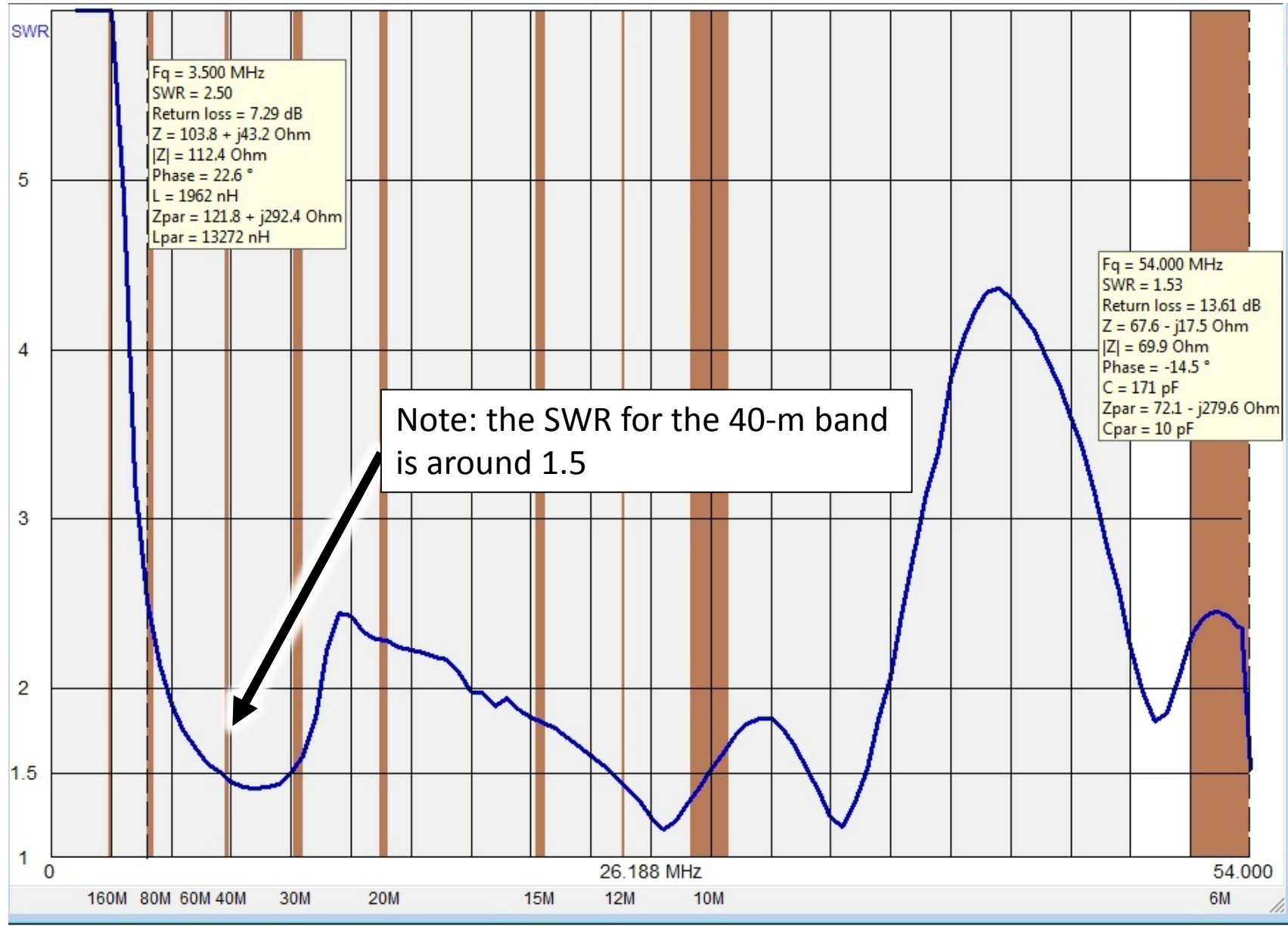
Two mistakes: didn't elevate antenna (5 feet)
Installed matching network backwards



Icom 7300
(image from www.icomamerica.com)

The antenna was designed to operate on multiple ham bands

SWR

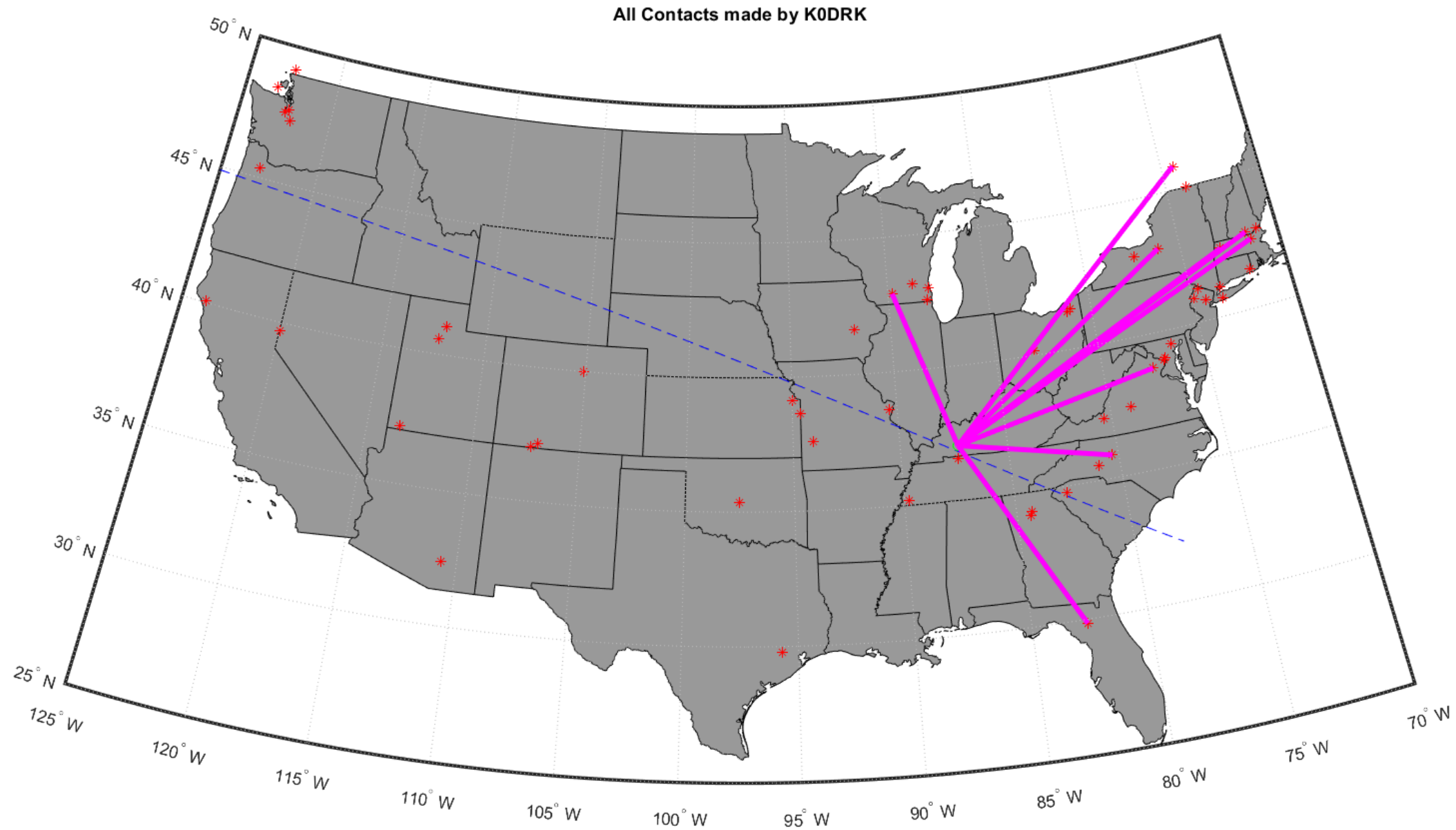


Frequency [MHz] and Band [m]

Relevant antenna characteristics

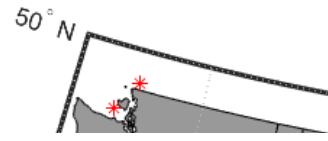
Electrical Characteristics	
Frequency range	3.5-29.7 MHz (54 MHz when mounted upon an optional tripod)
Polarization	Horizontal and Vertical polarization
RF power capacity (watts)	500 PEP SSB, 250 CW, or 100 digital
Input impedance	50 ohms
Radiation Pattern:	
Azimuth	Omnidirectional/Semi-Directional
Elevation	NVIS & DX
Physical Characteristics:	
Wind and ice	MilStick survives 70 MPH wind with no ice
Maximum Height erected	13 feet when mounted on the Jaw Mount and 19 feet when mounted upon an optional tripod
Minimum foot-print required	3 foot by 3 foot + 25 foot NVIS-2.1
Minimum Weight	2.00 pounds (MTCH-2.1 & MLSTK-2.1.XX)

Data analysis (all contacts)

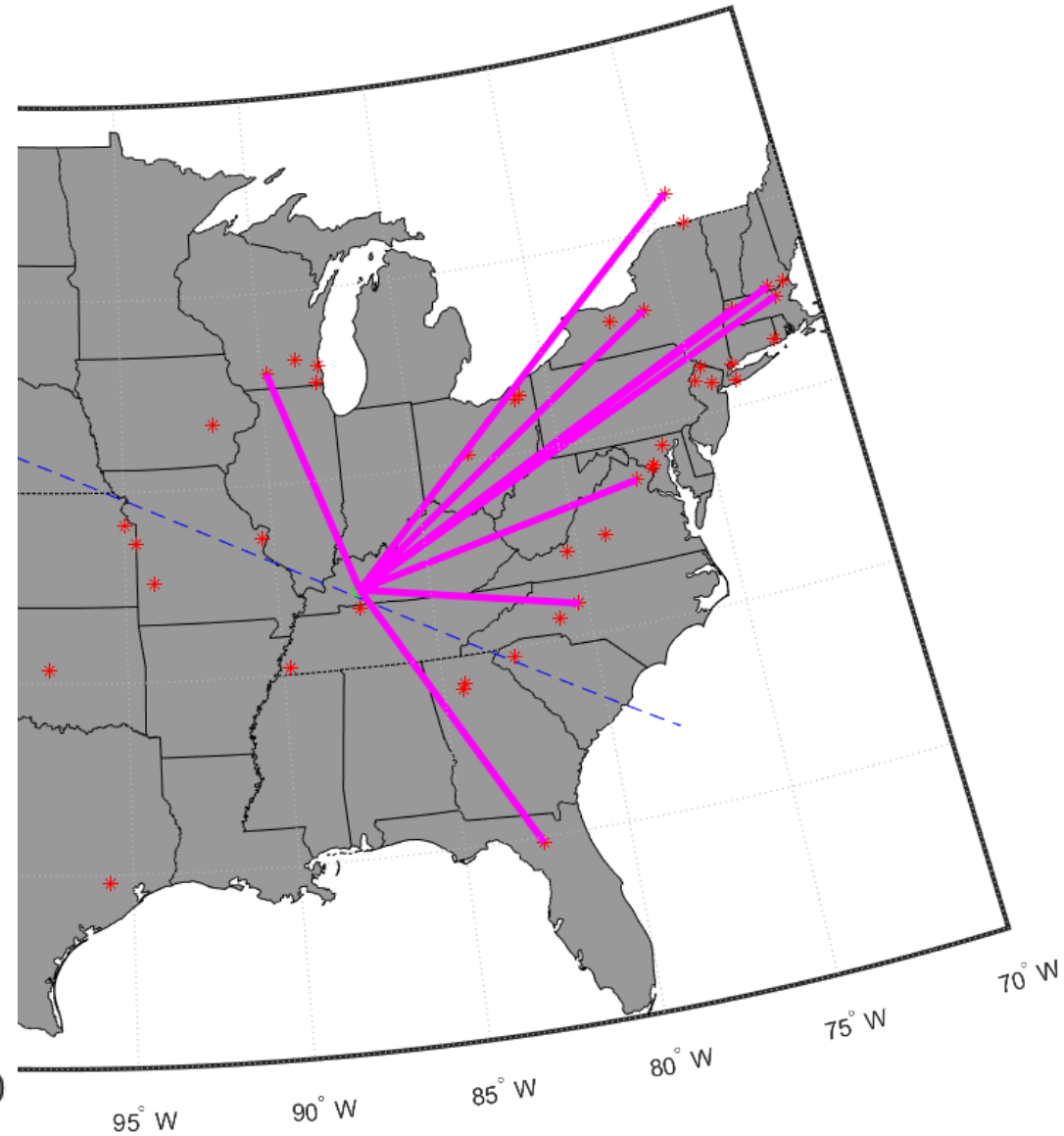
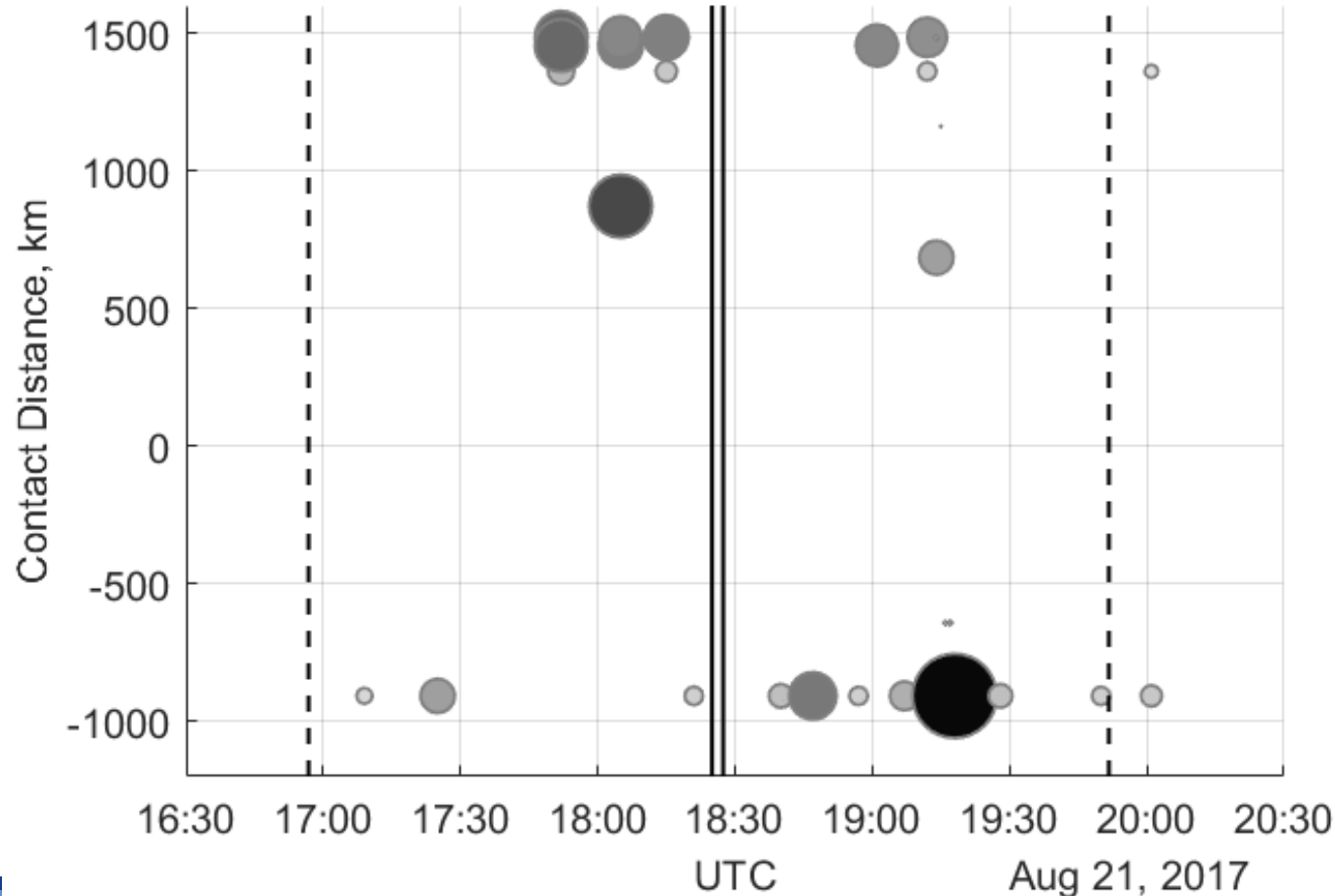


Data analysis (all contacts)

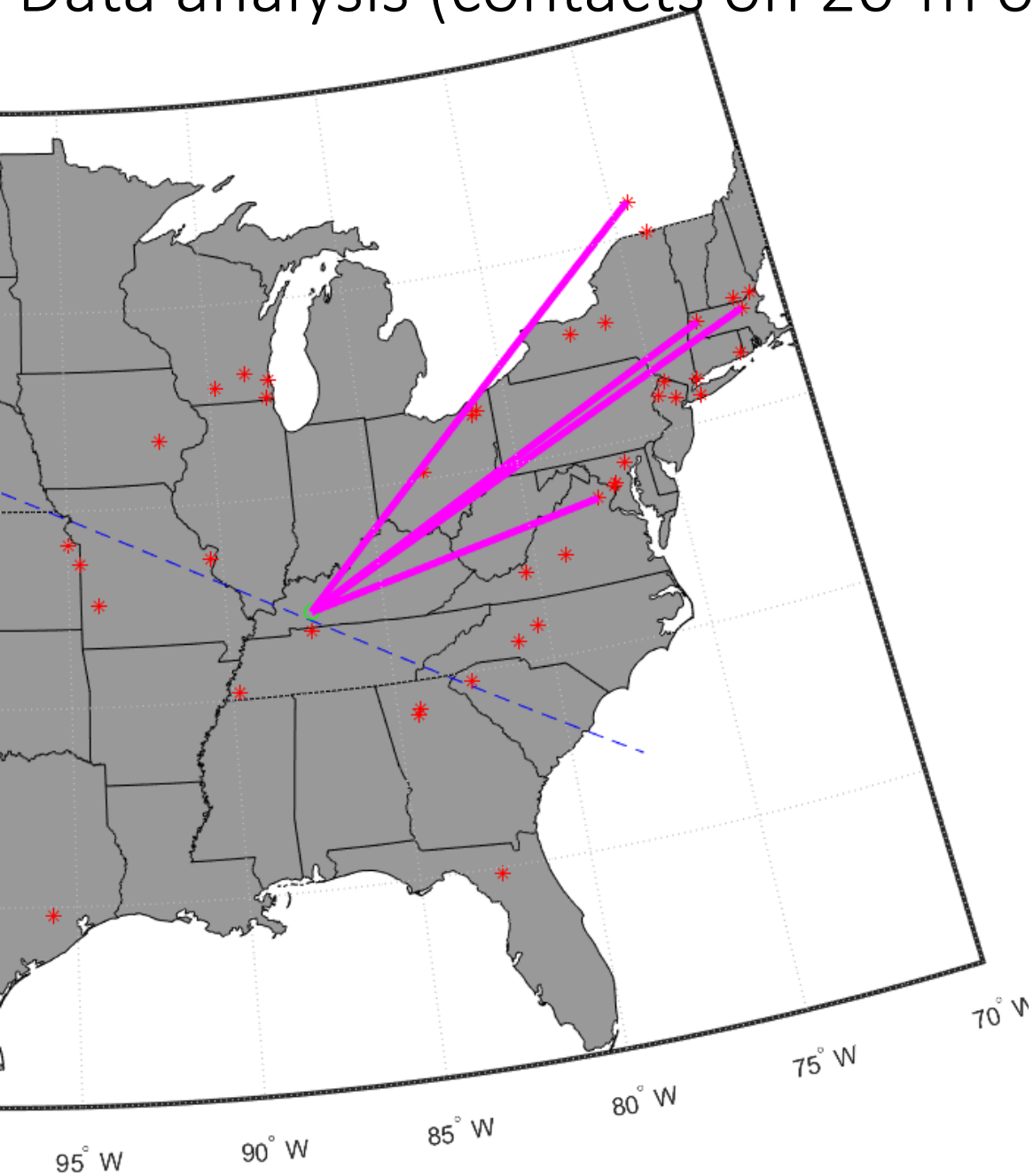
All Contacts made by K0DRK



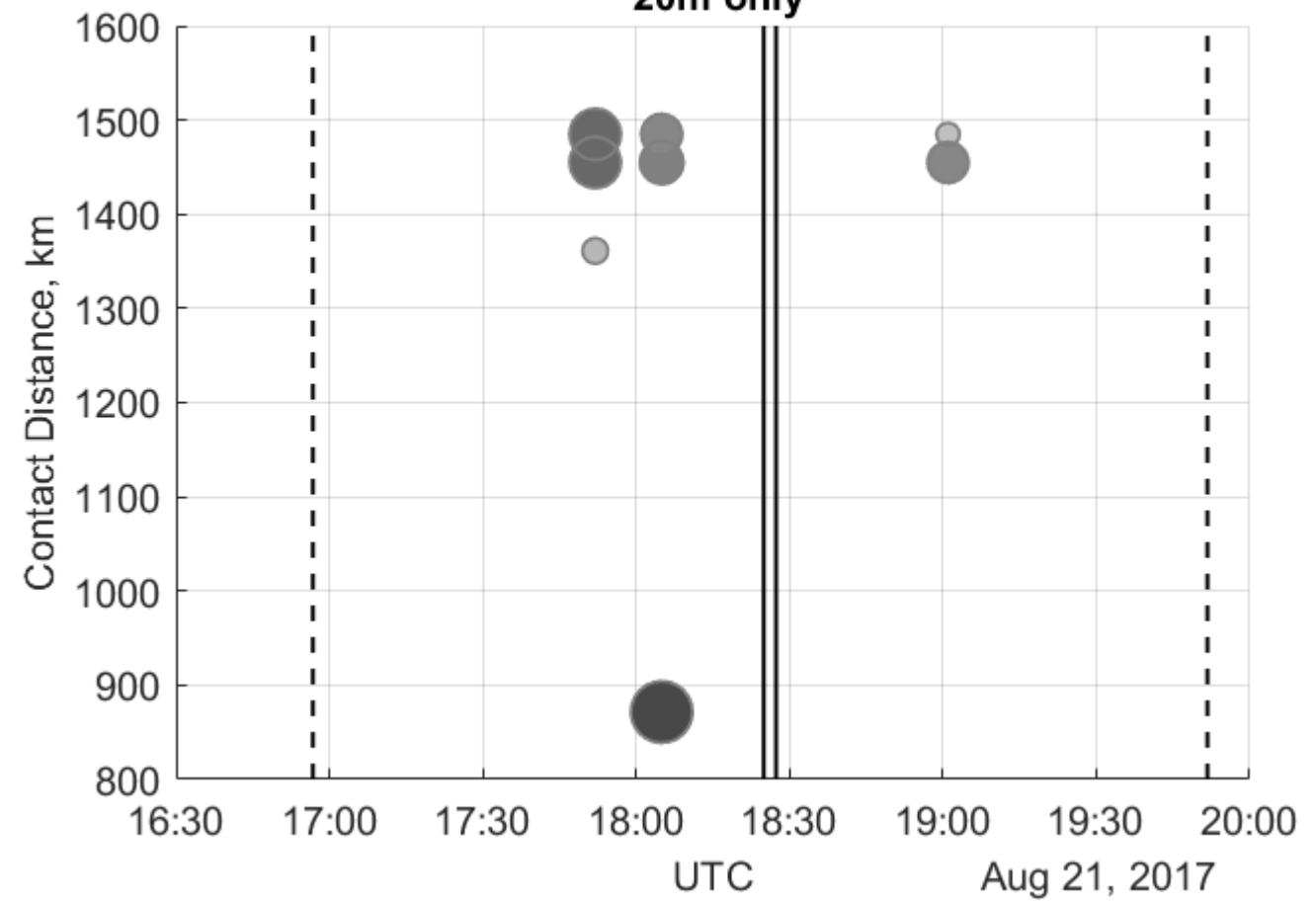
Distances between DX (K0DRK) and All Contacted DE Nodes
(Calculated Using WGS 84 Reference Ellipsoid)



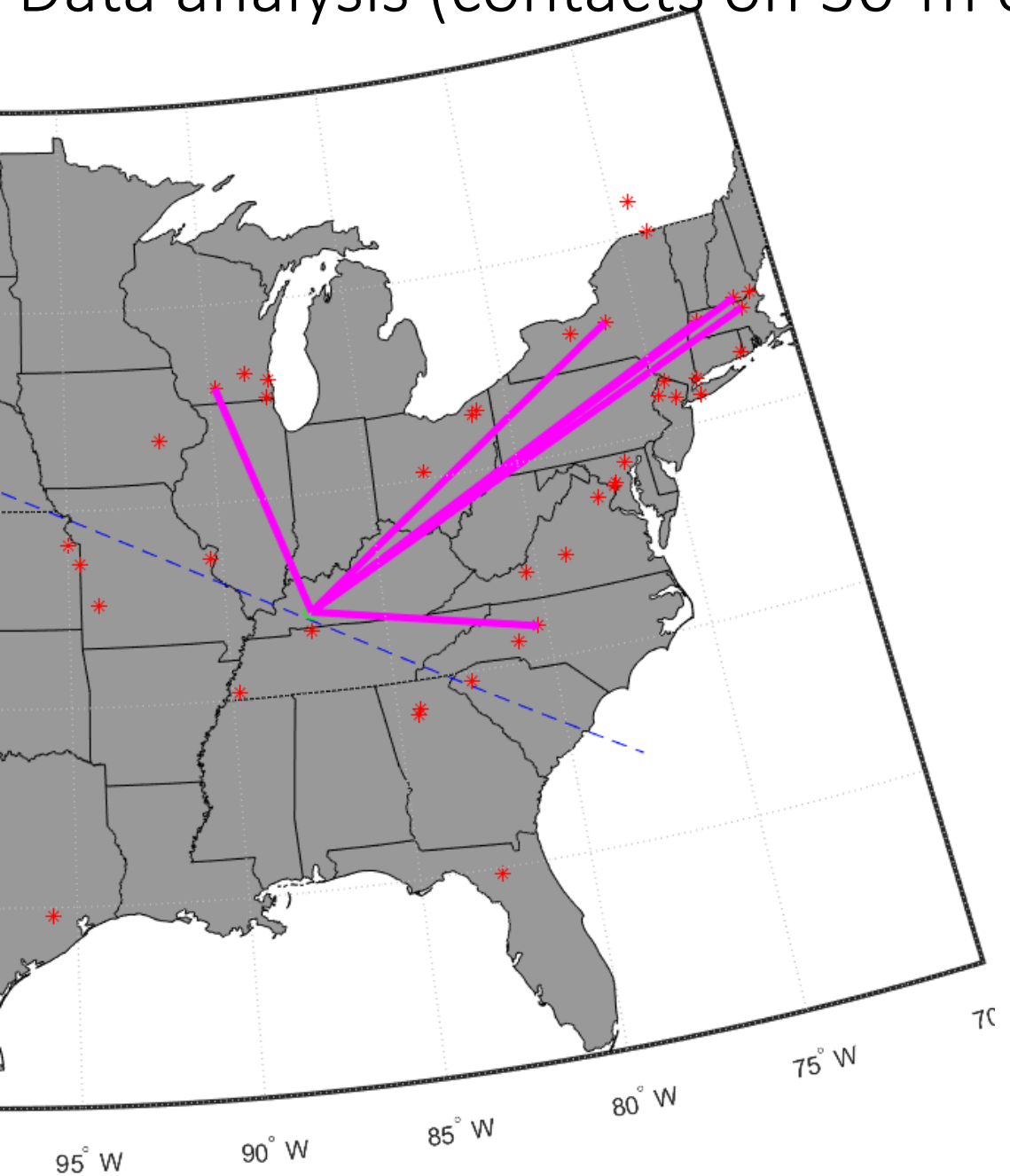
Data analysis (contacts on 20-m only)



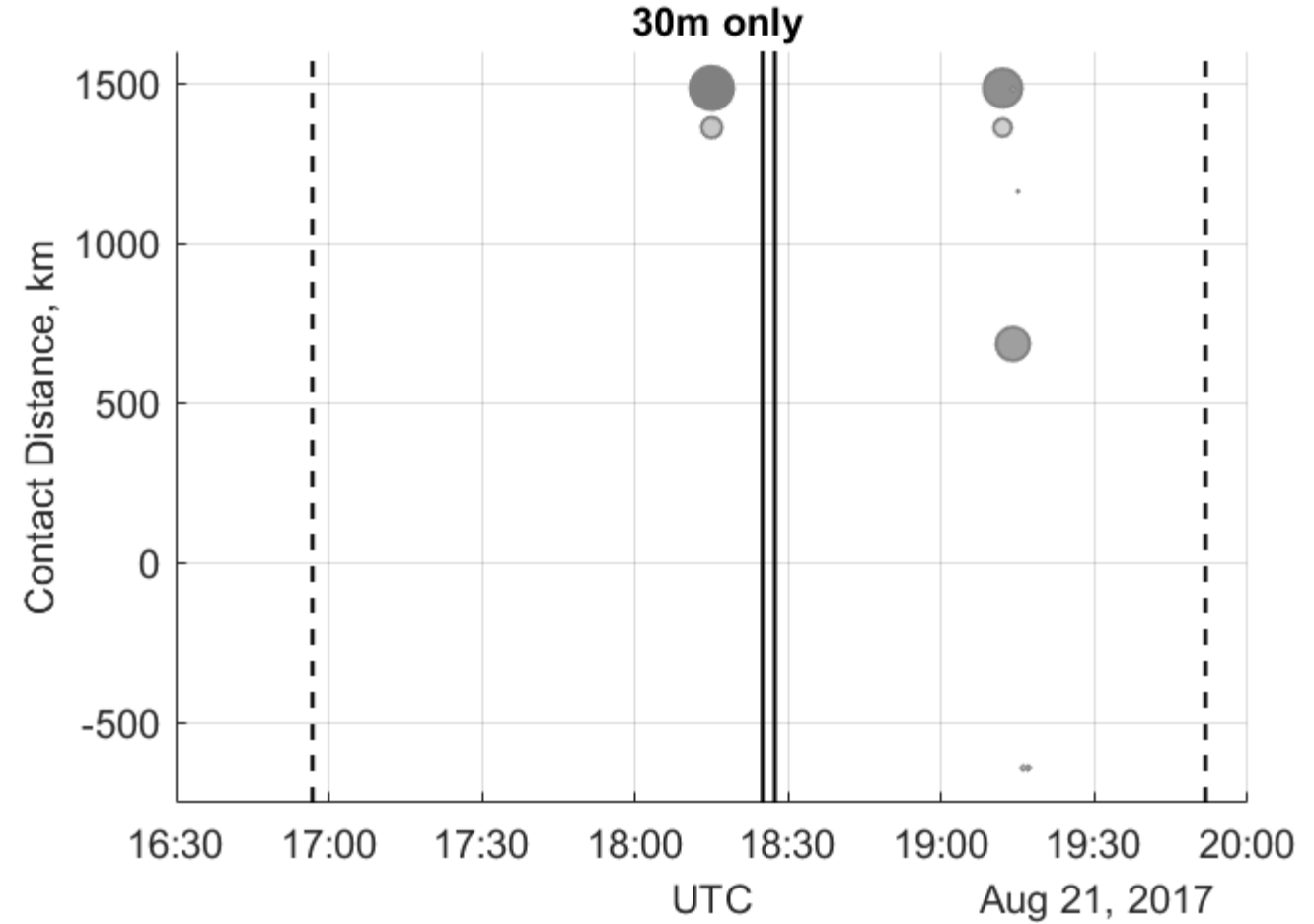
Distances between DX (K0DRK) and Contacted DE Nodes
(Calculated Using WGS 84 Reference Ellipsoid)
20m only



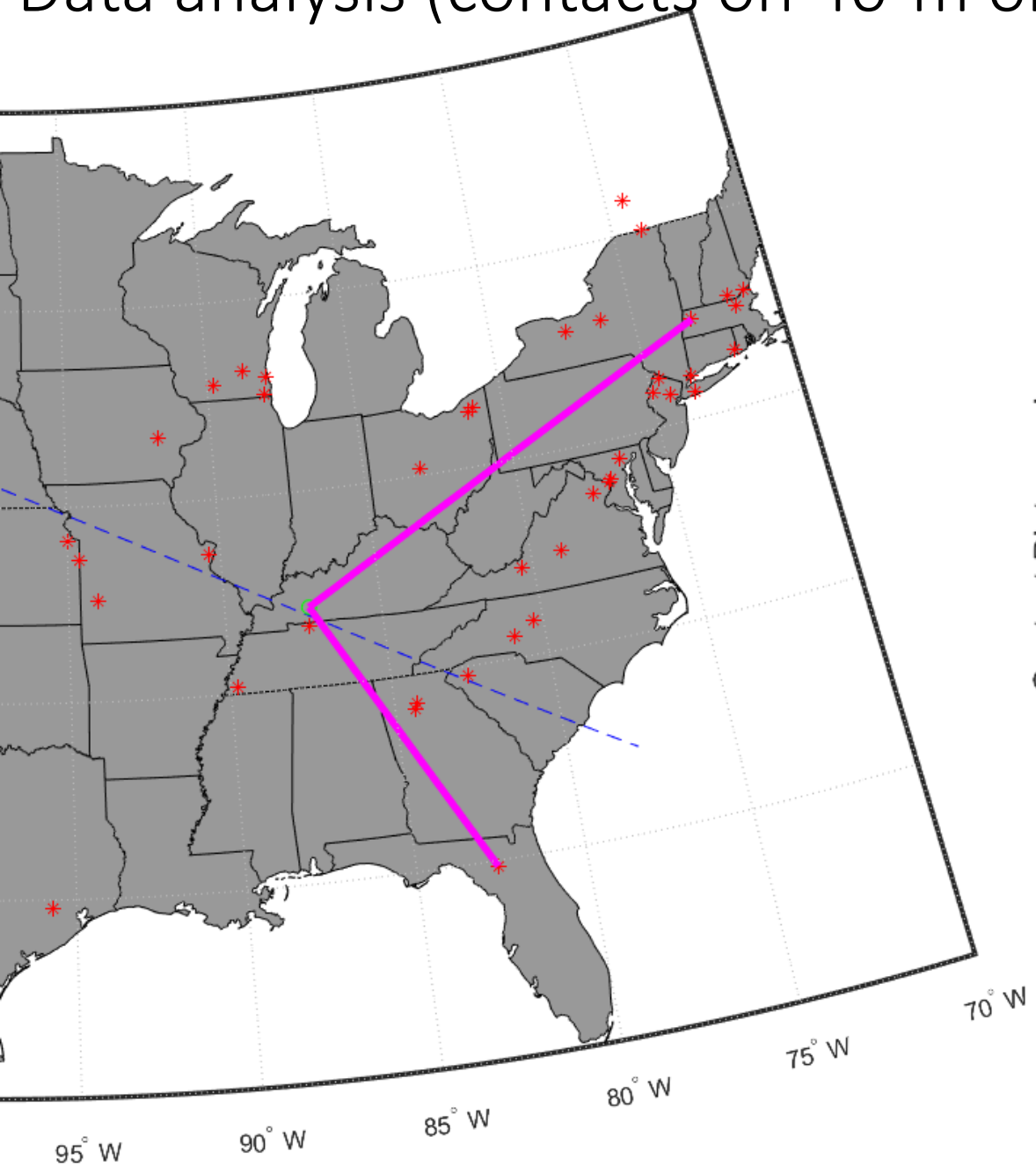
Data analysis (contacts on 30-m only)



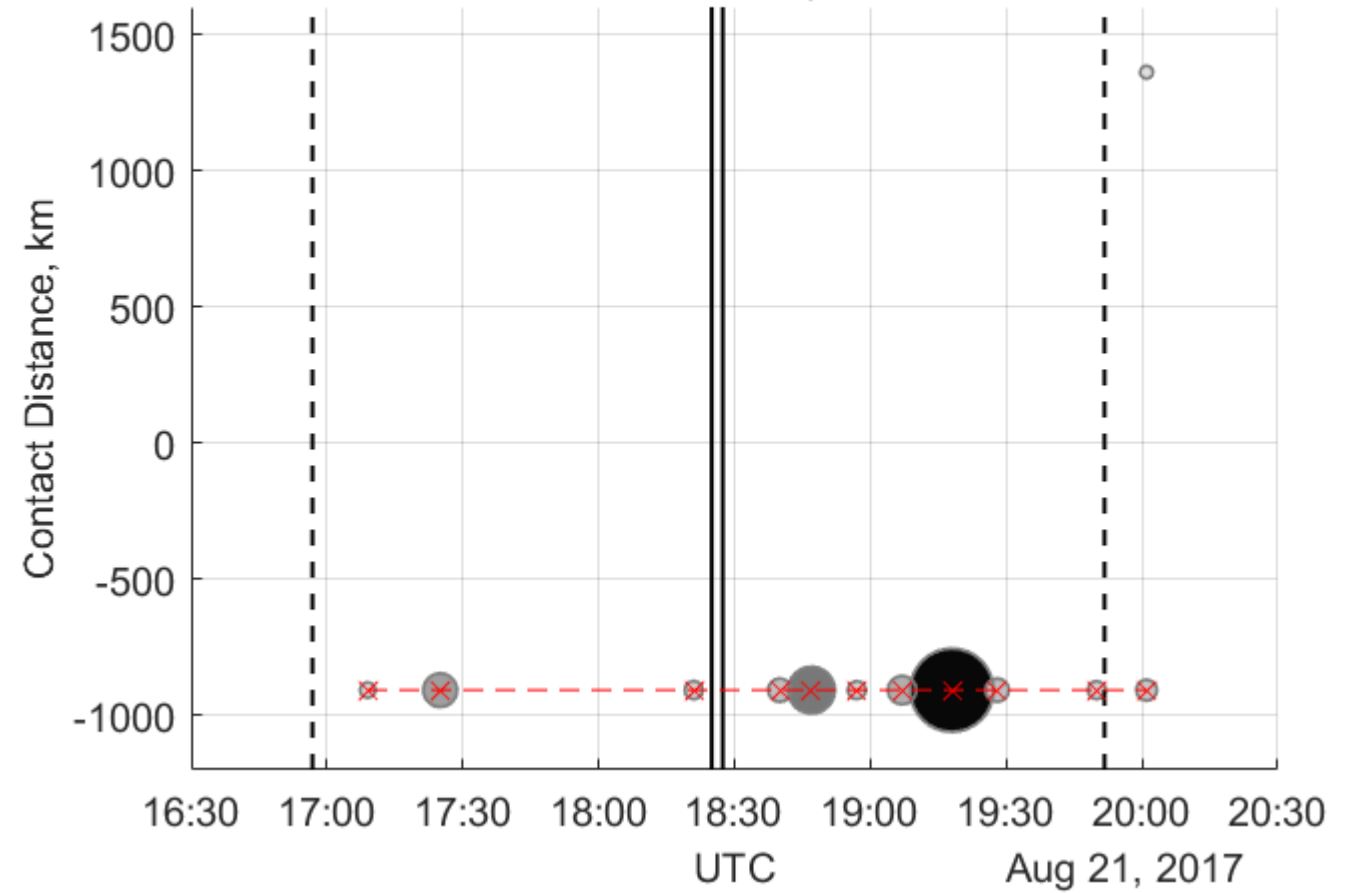
**Distances between DX (K0DRK) and Contacted DE Nodes
(Calculated Using WGS 84 Reference Ellipsoid)**



Data analysis (contacts on 40-m only)



Distances between DX (K0DRK) and Contacted DE Nodes
(Calculated Using WGS 84 Reference Ellipsoid)
40m only



2 unique DE stations

Discussion

Stats:

- 30 total contacts day of eclipse
- 12 contacts (40 meter)
- 10 contacts (30 meter)
- 8 contacts (20 meter)
- Y? unique DE stations
- Z? most contacts with one DE station

Look this up

Band (meters)	Frequency Range (MHz)	Range (kHz)
20	14.00 – 14.35	350
30	10.10 – 10.15	50
40	7.00 – 7.30	300

Ham radio band plan for reference

Observations

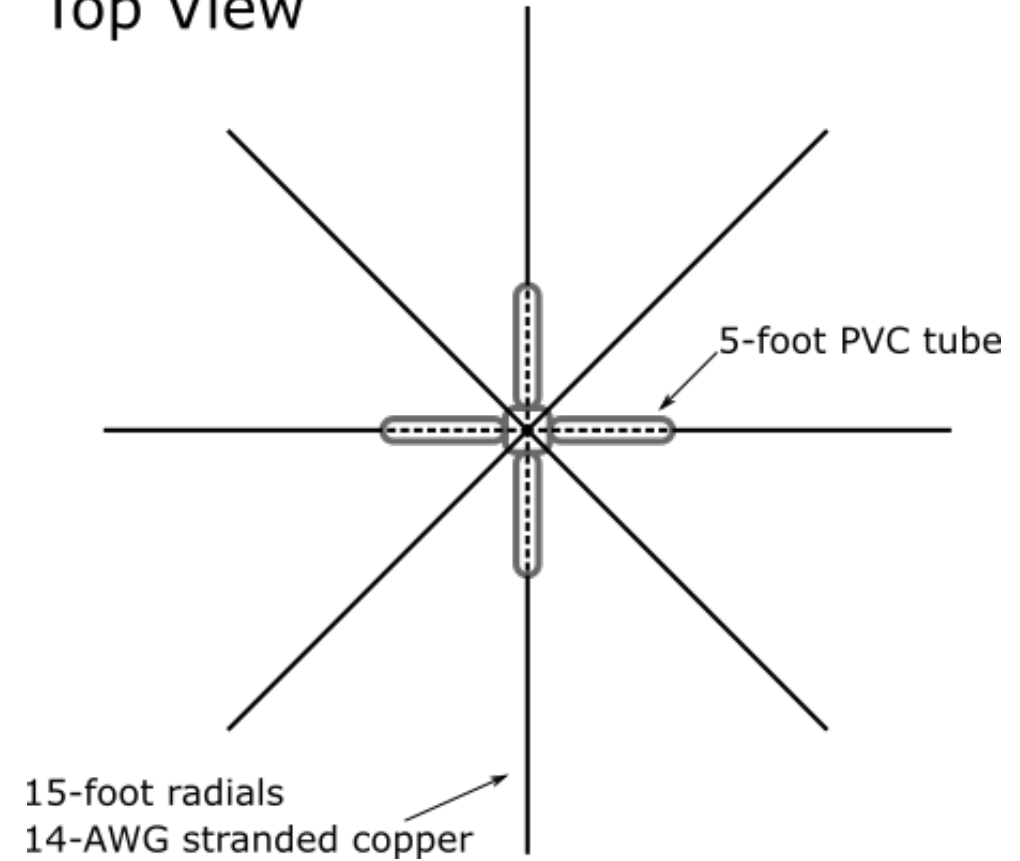
- Very limited internet!
- Apparent directionality of contacts (as expected with NVIS)
- Low number of data points
- Lack of confirmed DE/DX locations
- Did not contact MSFC's receiving node (WL7C)
- Equipment not installed properly

Future Plans include a long-term receiving node at NSSTC



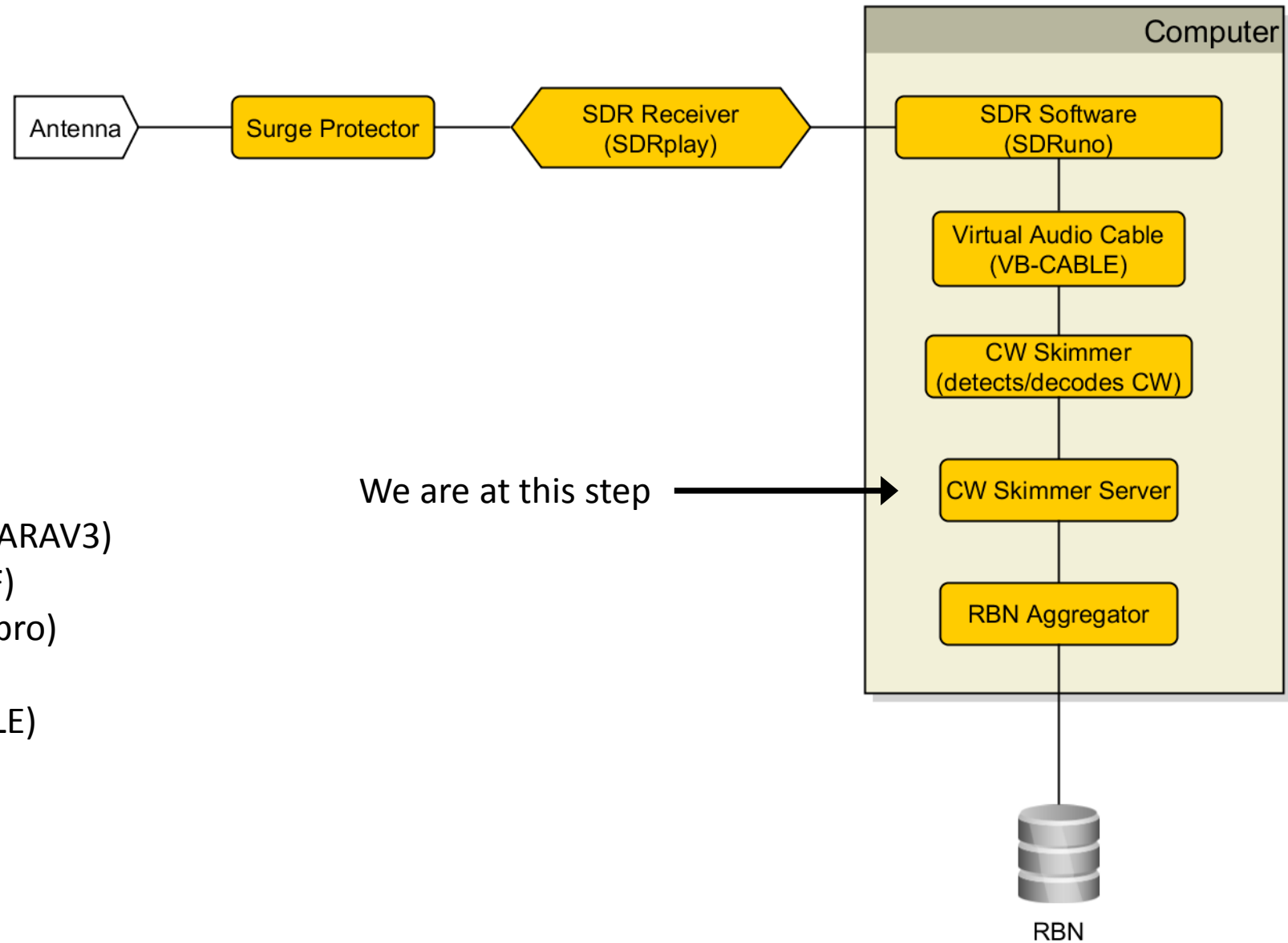
Concrete roof (don't think there is a metal layer)

Top View





The receiving node (RBN, WSPRnet, PSKReporter, etc.) is almost running in “phase 1”

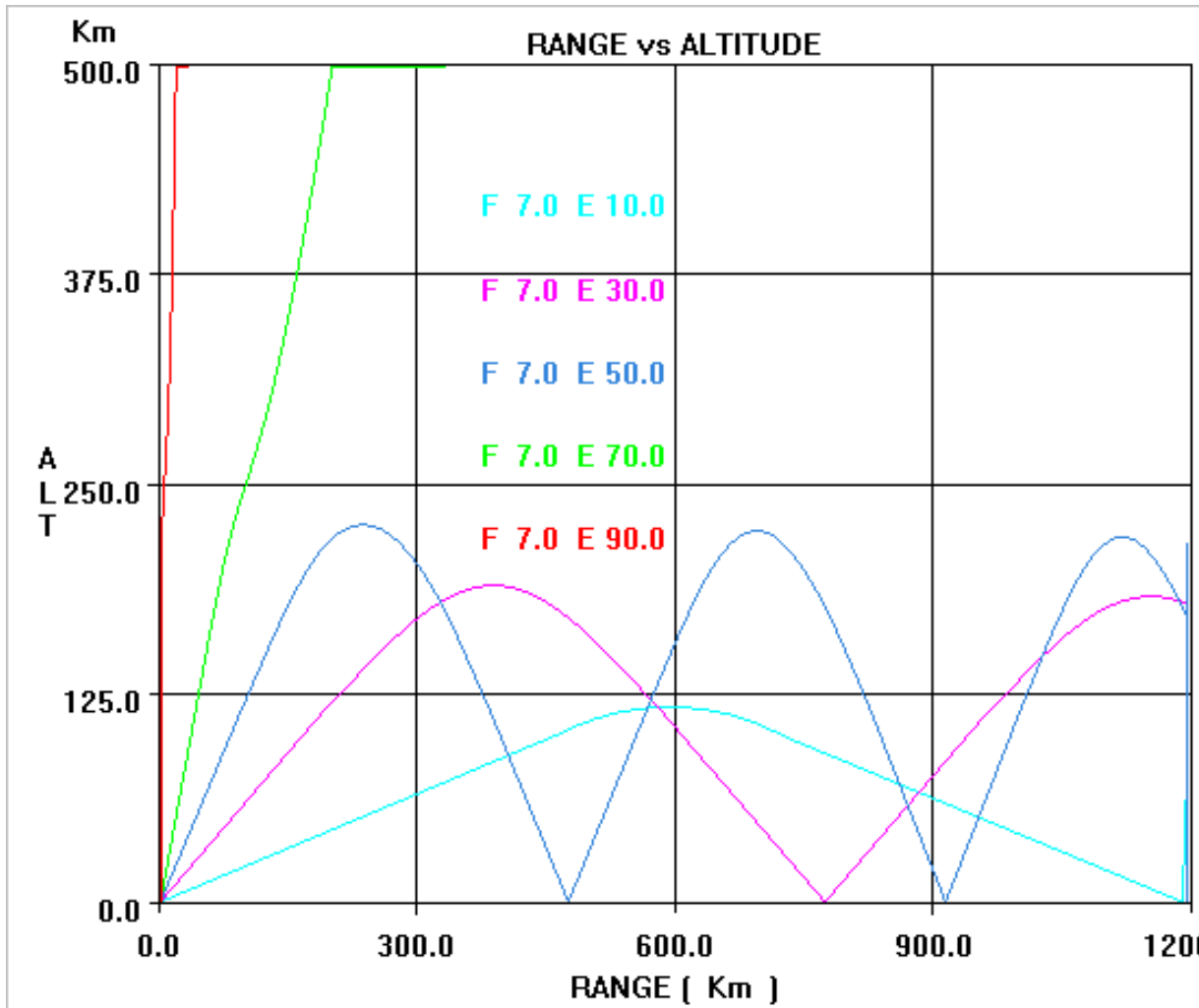


We are at this step →

Equipment List:

- Active Receive Antenna (DXE-ARAV3)
- Surge Protector (DXE-RLP75FF)
- SDR Hardware (SDRplay RSP2pro)
- SDR Software (SDRuno)
- Virtual Audio Cables (VB-CABLE)
- CW Decoder (CW Skimmer)

Future Plans: Ray tracing



Frequency = 7 MHz (40m)
Elevation span = 10 – 90 degrees
Relevant ionospheric parameters

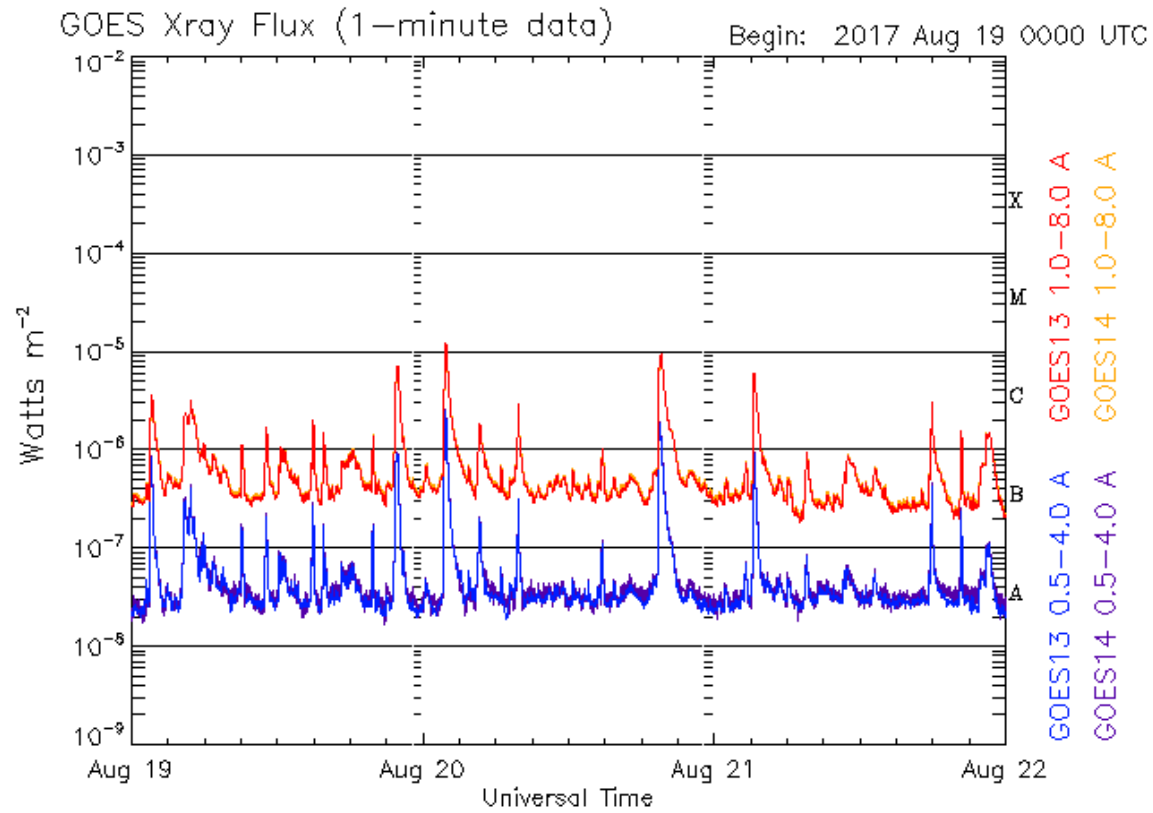
Frequency = 7 MHz (40m)
Elevation span = 10 – 90 degrees

Notice how NVIS signals penetrate the F layer.

AF-Geospace simulation using
Parameterized Ionospheric Model (PIM)



Thank you for your attention



Updated 2017 Aug 21 23:59:12 UTC

NOAA/SWPC Boulder, CO USA