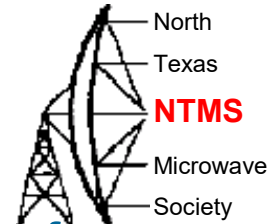


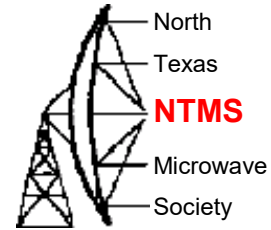
# Analysis & Forecasting mm-Wave propagation Part 4

**KM5PO & W5ISP – May 9, 2026**  
**North Texas Microwave Society**

# Significant discoveries



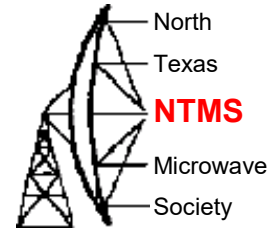
- What started off with simple questions has evolved into a set of useful and enlightening findings and tools.
- In this presentation we will recap the beginnings and the changes that have led to a more complex project.
- The single big boost to the project is the collaboration of multiple team members
  - W5ISP, Graham McIntire
    - An engineer with in-depth experience of back-end server functionality. Owns a WISP with multiple microwave back haul systems.
  - N5PYK, Joe Jureka
    - Senior Meteorologist, National Weather Service, Lubbock, Texas
  - K6ML, Mike Lavelle
    - Retired engineer (Sun Microsystems)
    - 122 GHz dx world record holder



# Recap of Part 1

- What mechanism in the atmosphere enables long over-the-horizon contacts at 47 Ghz. These are not LOS paths.
- First, ask for an analysis of one confirmed two-way contact (successful link closure).
- Evaluate the answer (duct based on various factors / Skew-T)
- Additional confirmed contacts (100+ km) added at 24 and 47 GHz
- Build a predictive tool using everything we know, up until now, and use real time inputs.
- The result: a surface based (ASOS) model with 7 scoring elements with calibration from actual contacts (4).

# Automated Surface Observation Station

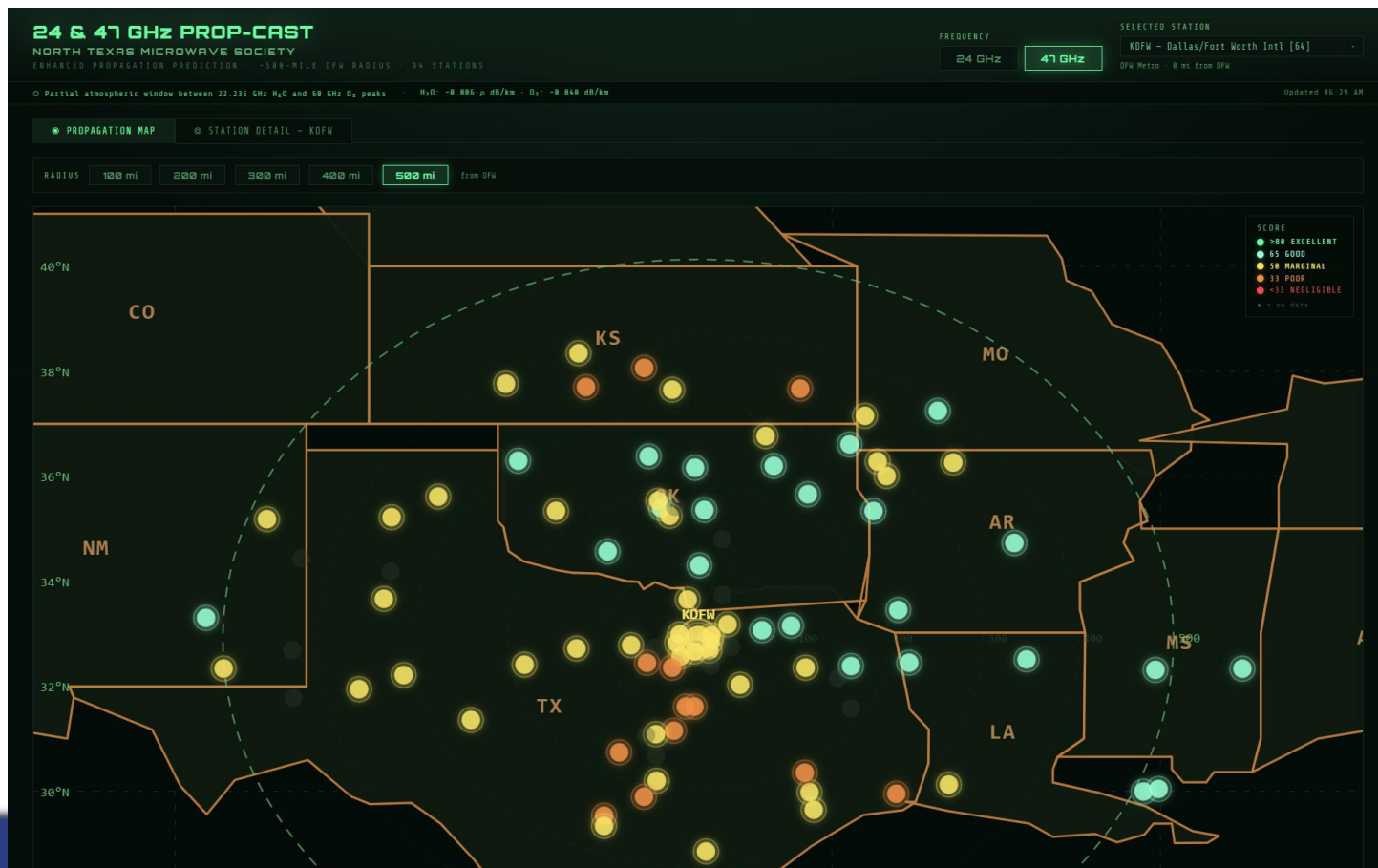


# 7 scoring factors

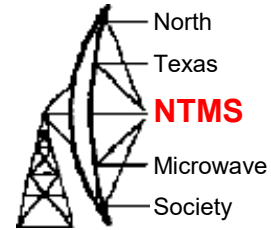
Factor	Weight (%)	Description	Algo Unified (Graham)
Absolute Humidity	26%	Grams of water vapor per cubic meter of air ( $\text{g}/\text{m}^3$ ). More moisture = better refractivity for ducting at 24/47 GHz; scored against rho thresholds by frequency.	Flips at 10 GHz
Wind - Calm	18%	Surface wind speed in mph. Calm winds allow nocturnal inversions to build undisturbed. Strong winds create turbulent mixing that destroys duct layers.	Overweighted, drop to 8%
Sky - Radiative Cooling	15%	Cloud cover condition (Clear/Few/Scattered/Broken/Overcast). Clear skies allow the ground to radiate heat at night, building the surface inversion that drives ducting.	
Time of Day	14%	Position relative to local sunrise. Pre-dawn through ~90 min post-sunrise is the peak inversion window. Afternoon convective mixing scores lowest.	
T/Td Depression	11%	Temperature minus dewpoint (F). Larger spread = drier air aloft = more stable layering. Scored differently by frequency - higher bands need drier air.	
Season	9%	Calendar month proxy for long-term moisture regime. Nov-Feb scores highest (cold, dry, strong inversions). July-Aug scores lowest (Gulf moisture, weak inversions).	
Pressure - Subsidence	7%	Barometric pressure trend (rising/falling/steady). Rising pressure indicates post-frontal subsidence and stable air. Falling pressure signals approaching instability.	

# First map of results

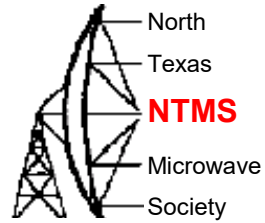
- Selectable ASOS station
- Composite score of 7 factors



# Skew-T plots added



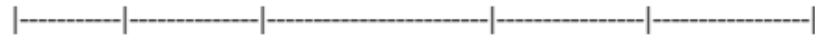
- **Min  $dN/dH$  gradient** — requires knowing temperature and dewpoint at every pressure level from surface to 200 hPa, not just at ground level. 200 hPa=top of troposphere
- **Inversion layers** — require seeing where temperature *increases* with altitude, invisible from surface obs alone
- **Duct layers (M-profile)** — require computing modified refractivity at each level and finding where it decreases with height
- **BL Depth** — requires seeing where the potential temperature profile departs from the surface value
- **Lifted Index and K-Index** — require 850/700/500 hPa temperature and dewpoint simultaneously



# Min $dN/dH$ gradient

## Atmosphere Layers (Approximate Heights)

| Layer | Pressure | Height Above Ground | Color Code | Description |



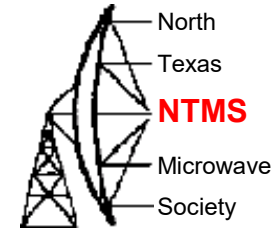
| **Surface** | 1000 hPa | 0 km (0 miles) | ■ Green | Where we live, breathe, and walk. |

| **Lower Atmosphere** | 850–500 hPa | 1–5 km (0.6–3 miles) | ■ Blue | Where most clouds and weather happen. |

| **Mid Atmosphere** | 500–300 hPa | 5–9 km (3–5.5 miles) | ■ Yellow | Around airplane cruising altitude. |

| **Upper Atmosphere** | 200 hPa | ~12 km (7 miles) | ■ Red | Very thin air, near the top of the troposphere. |

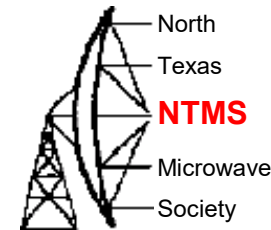
- Looking up from bottom of swimming pool – light is refracted.
- RF in atmosphere does same thing = refractivity index.
- Refractive index of air isn't the same at every altitude.
- When  $dN/dH$  exceeds -157 per km, we have ducting (at some altitude)
- The more negative this number, the stronger the duct.



# Additional apps created

- Mm-Wave Link Budget Analyzer
- Input two grids, nominal station data

- Predicts closure %
- Skew-T plots now on panel



# Additional apps created

- Prop-Analyzer
- Input historical information

**PROP-ANALYZER**  
NORTH TEXAS MICROWAVE SOCIETY  
HISTORICAL CONTACT ATMOSPHERIC ANALYZER

335.5 km - 71.8° ENE  
87.58 dBi - 132.24  
1921 - 88-17

**CONTACT PARAMETERS**

GRID A (UP TO 10 CHAR) GRID B (UP TO 10 CHAR) DATE TIME UTC - 24 HOUR (ZULU)

EM02HQ49DL EM23A073EV 08/17/2025 12:56

FREQUENCY 10 GHz 24 GHz 47 GHz

EM02HQ → EM23A0 335.46 km 71.8° ENE 10 GHz 12:56Z 07:56 CDT

**PATH MAP - 5 WEATHER STATIONS**

**SURFACE OBS - HISTORICAL AVERAGE**

TEMPERATURE	79.7°F	DEWPOINT	72.9°F
FDI DAP	6.8°F	REL HUMIDITY	88%
ABS HUMIDITY	20.02 g/m <sup>3</sup>	WIND SPEED	8.5 mph
PRESSURE	1015.5 mb	SKY COVER	BKN

**Surface Duct / Inversion** 95%

PRE-DAWN INVERSION - inversion layer traps 10 GHz energy near surface, dramatically extending range. Duct enhancement can add 20-40 dB beyond free-space loss.

**Tropospheric Scatter** 85%

Standard tropo scatter at 10 GHz. Path length 335 km is well within scatter range (~500 km limit). Scatter volume near path midpoint.

**Moist Layer Scattering** 55%

High absolute humidity (20.02 g/m<sup>3</sup>) creates elevated moist layer scatter. Humidity gradients in top of BL scatter signal forward.

**HISTORICAL SOUNDING - SKEW-T LOG-P**

Fort Worth TX (FWO) - Valid: 2025-08-07T0200Z - matched to contact time

FWD - Fort Worth TX  
Valid: 2025-08-17T12:00Z

**DERIVED PROPAGATION PARAMETERS**

MIN DM/DH GRADIENT	-220 /km
SUPER-REFRACTIVE @ 403m AGL	
LIFTED INDEX	23.2
Very Stable / Dry - excellent ducting conditions	
K-INDEX	40
High convective potential	
PRECIPITABLE WATER	52.0 mm
BL DEPTH	538 @ AGL
Moderate	
INVERSION LAYERS	2
302-619m, 4036-4039m	
DUCT LAYERS (M-PROFILE)	1
302-619m (ADM-g)	

**SOUNDING INTERPRETATION - 10 GHz**

- 1 duct layer identified in M-profile - 393-619m AGL. Elevated duct - signal may couple into layer for extended range. Temperature inversion at 393m AGL (+0.8°C). Elevated inversion - potential for wave duct above. Super-refractive layer at 4043m AGL (dn/dh=-220/km). Ducting highly

**ATMOSPHERIC REFRACTIVITY STATE**

1.55 (INDEX) 378 (UNITS) ENHANCED REFRACTION (CONDITION) PRE-DAWN INVERSION (TIME OF DAY)

TOD PROPAGATION SCORE 95.0 SEASON SCORE 75.0 SUMMER - HIGH HUMIDITY

ABS HUMIDITY 20.0 g/m<sup>3</sup> WIND SPEED 8.5 mph

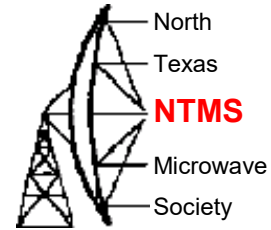
**PATH LOSS BUDGET - 10 GHz**

FSPL	162.56 dB
GAS ABSORPTION	4.364 dB
FSPL + GAS	167.33 dB
FREDEL R. (MID)	58.2 m
EARTH BULGE (MID)	1.7 m
λ (WAVELENGTH)	3.00 cm

**STATION OBSERVATIONS DETAIL**

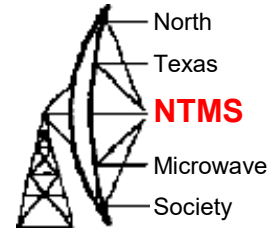
NTMX	1:79°F Td:75°F p:21.5 kV 8mph P:1016mb CLR
HPFW	1:02°F Td:73°F p:20.8 kV 10mph P:1014mb BKN
HCVI	1:79°F Td:73°F p:20.4 kV 9mph P:1017mb CLR
HEKCD	1:01°F Td:72°F p:19.4 kV 6mph P:1016mb SCT

# Apps are complementary

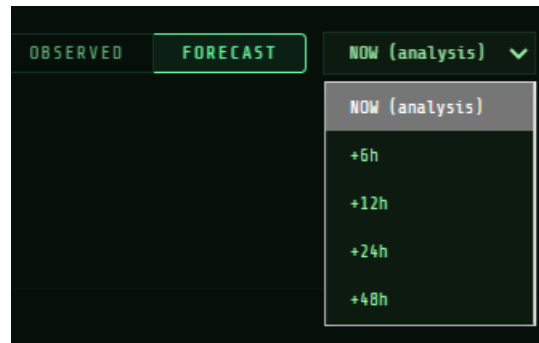


- **The original seven scoring factors** are a *surface weather* model. They answer the question: *"Based on what's happening at the surface right now, how favorable do conditions look?"*
- **The derived propagation parameters** from the addition of Skew-T sounding — either an actual radiosonde balloon launch (Observed mode) or the GFS model forecast (Forecast mode). answer a different question: *"What is the actual vertical structure of the atmosphere doing right now, and is a duct physically present?"*

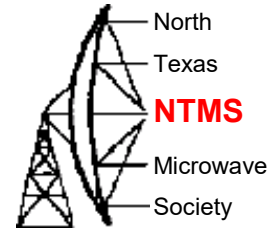
# Skew-T to GFS (all apps)



- Skew-T from IEM RAOB (observed soundings).
  - Temperature and dewpoint profiles from real radiosonde balloon launches at 00Z and 12Z.
  - only showed current or recent conditions, only at the nearest radiosonde station and only twice a day.
- GFS forecast soundings from open-meteo.com.
  - Gave us the OBSERVED/FORECAST toggle you see in the panel header, with forecast hours of +0, +6, +12, +24, and +48 hours.



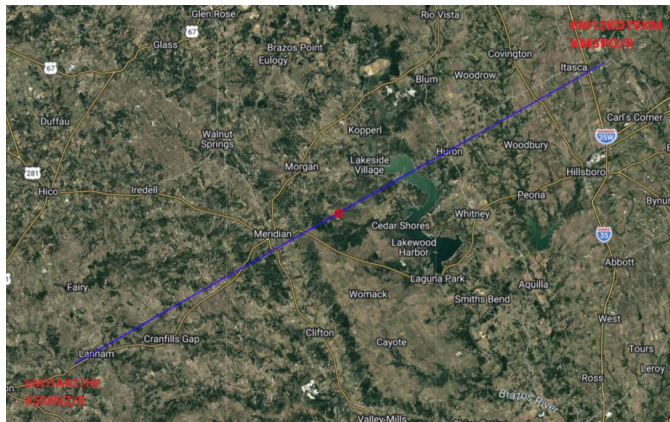
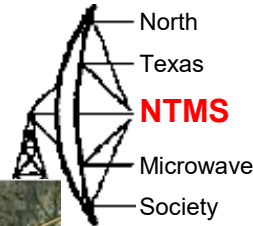
- Moving to prediction (K6ML method with Windy.com)



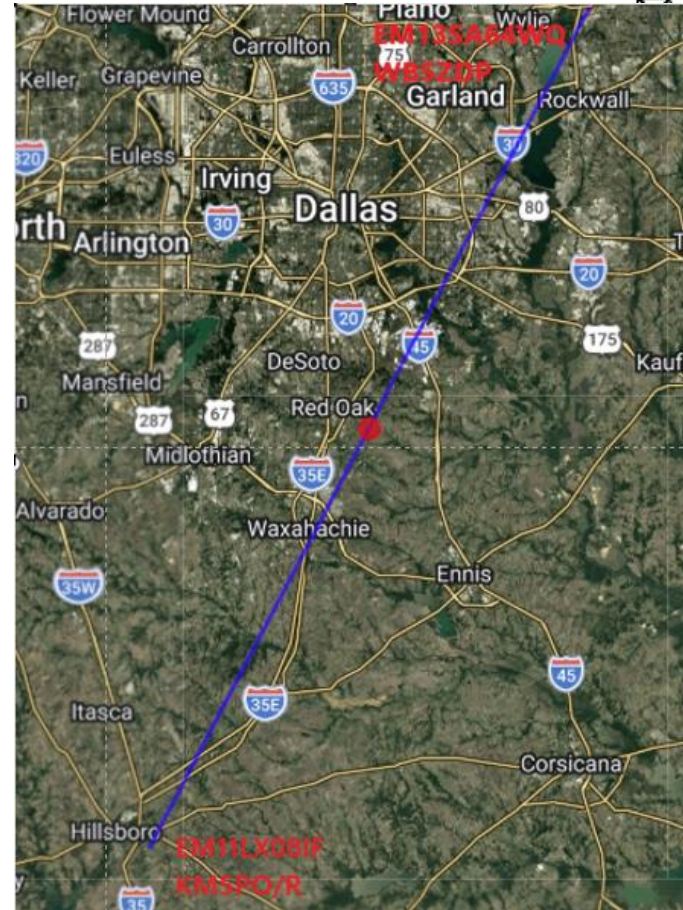
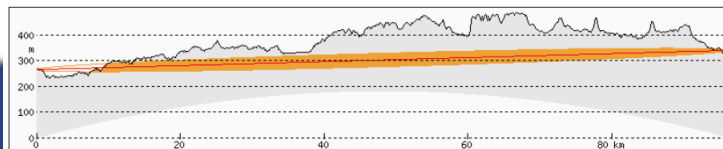
# Put it to use

- We need to observe app predictions and real time data versus actual conditions experienced through contact attempts.
  - Are beacon reports from microwave ops aligned with propagation tools?
  - A report from Keith WB5ZDP: 4-6-26 “10 & 24 GHz beacons are +20 dB versus nominal”.
- Anticipate a “truck roll”. What triggers to watch for.
  - GFS predictions
  - Stable weather patterns that lead to 24 & 48 hour repeating propagation factors
- MAD was rained out 4-4-26 but tool predictions for 4-6-26 and 4-7-26 looked favorable. Time to coordinate with partners.

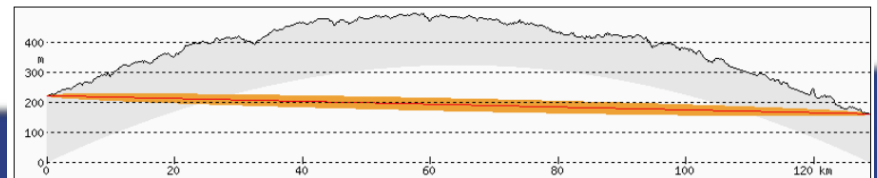
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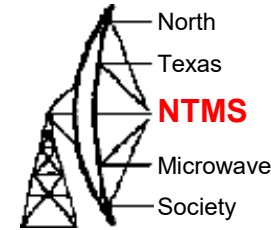


- 10 GHz – 599 signals 100 km



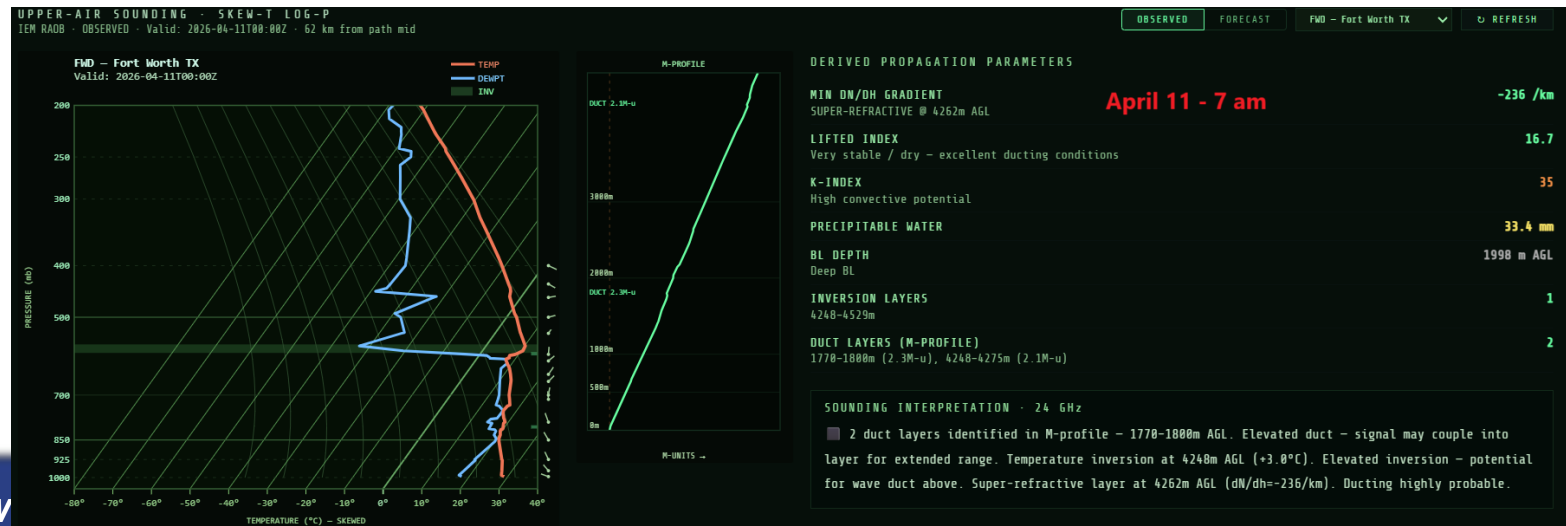
- 24 GHz – strong signals 129 km





# Comparisons

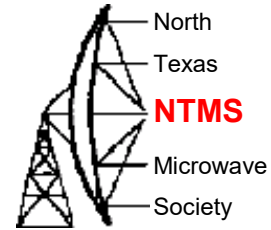
- April 7<sup>th</sup> 8 am – a 129 km contact at 24 GHz occurred with strong signals



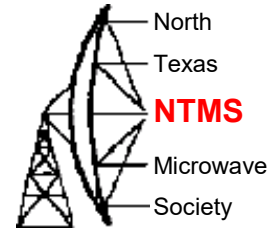
# Project acceleration

- March 1, 2026 – Algo 1 and 3 apps created.
- March 14 – NTMS in-person meeting presentation (Part 1)
- March 28 – W5ISP, Graham joins.
- **April 7** – First successful contacts based on Algo 1 model predictions.
- April 11 – NTMS Zoom meeting presentation (Part 2)
  - Following the meeting, Graham added:
    - User submitted contact data, one-at-a-time or csv/ADIF file import.
    - Upper Air Soundings (RAOB)
    - HRRR Model Data
    - IEMRE Gridded Hourly Weather
    - SRTM Terrain Elevation Data
    - Commercial Link Validation Data
    - Solar Indices
- **May 2** – confirmed prop predictions, nominal +24 Ghz, better later

# First transformation in calibration



- **Algo2 — 58,282 ARRL Contest QSOs (2019–2024)** Six years of microwave contest contacts cross-referenced with actual weather conditions at time of contact. Largest empirical mm-wave propagation dataset assembled for amateur radio.
- **Algo3 — 18,540 Commercial Link Measurements** Graham's own WISP backhaul links at 11, 24, and 68 GHz — continuous 24/7 signal monitoring. Fixed paths, known geometry, real-time calibration data.

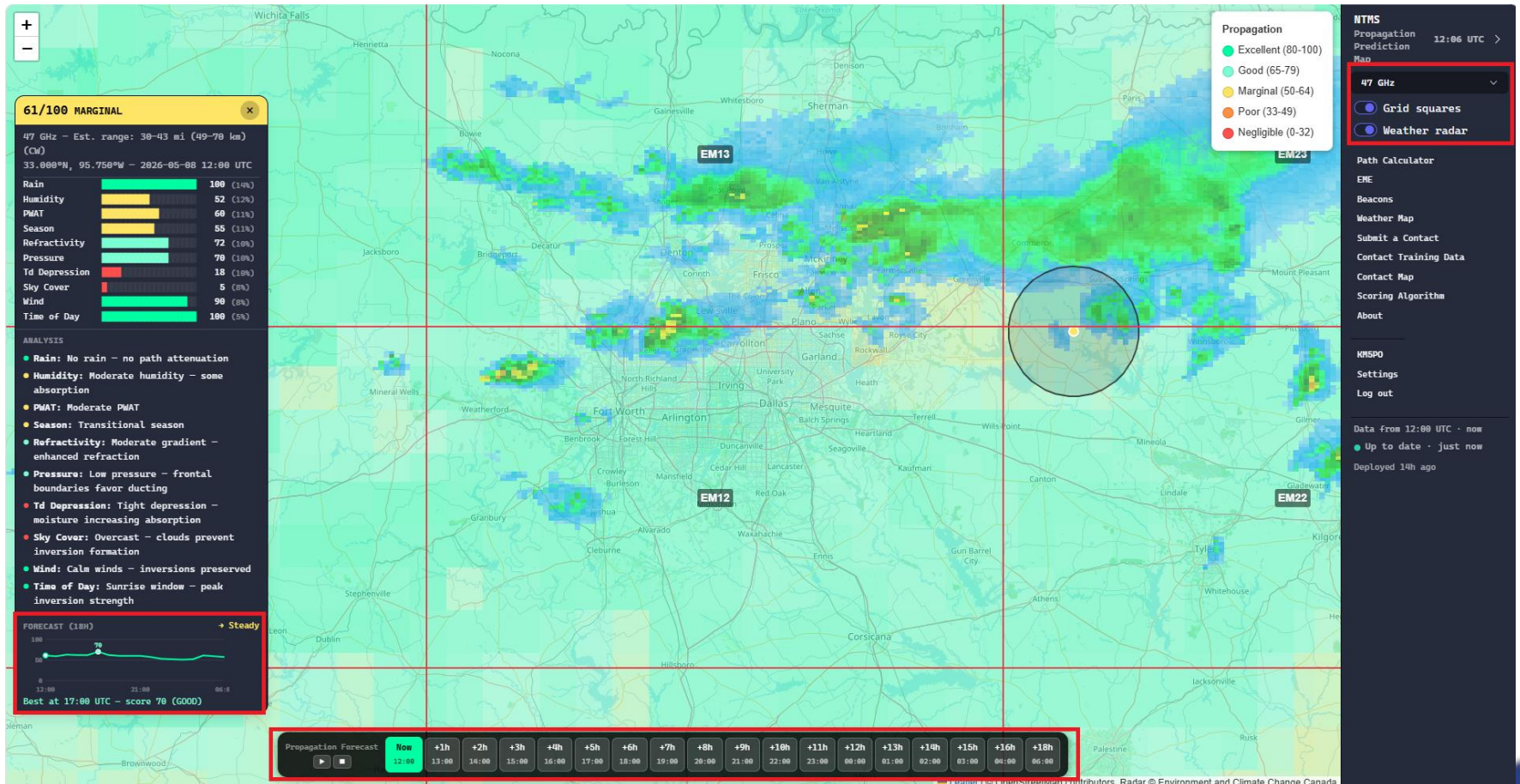
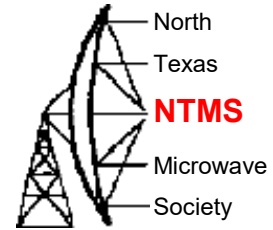


# Several new applications

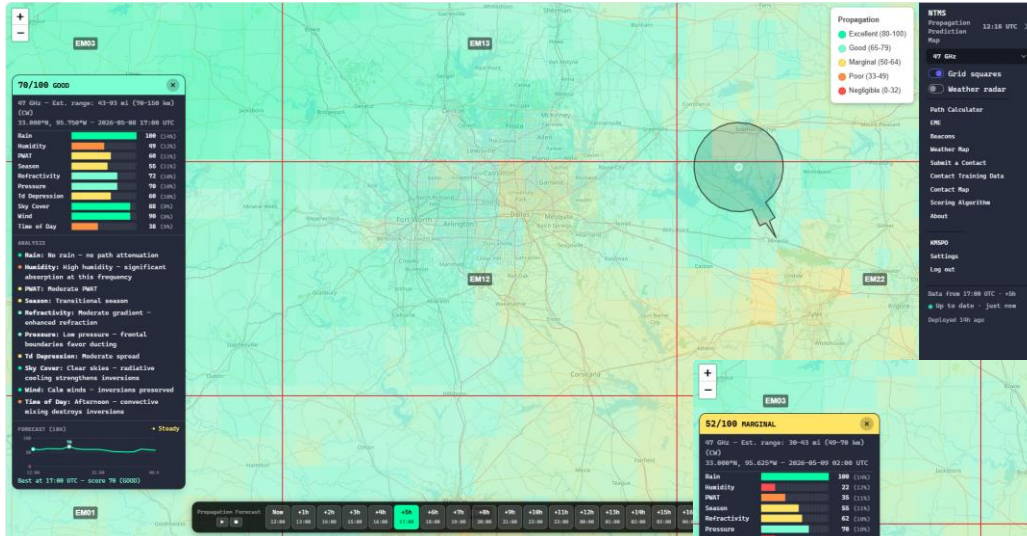
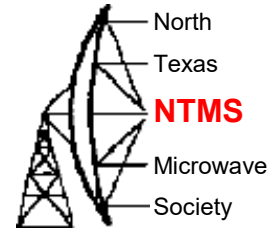
- **Live Scoring Data**
- Coverage: CONUS grid at 0.125° resolution
- Update cadence: hourly (HRRR-based via PropagationGridWorker) + 10-minute ASOS adjustments (AsosAdjustmentWorker)
- Per grid point: composite score (0-100), 9 individual factor scores, valid\_time
- Bands scored: all configured bands (902 MHz, 1296 MHz, 2304 MHz, 3456 MHz, 5760 MHz, 10, 24, 47, 68, 75, 122, 134, 241 GHz)
- Retention: 2 most recent valid\_times kept, older data pruned automatically

# Browse to prop.w5isp.com

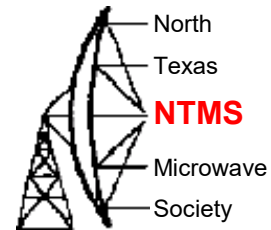
Land on the maps page



# Diff in forecasts

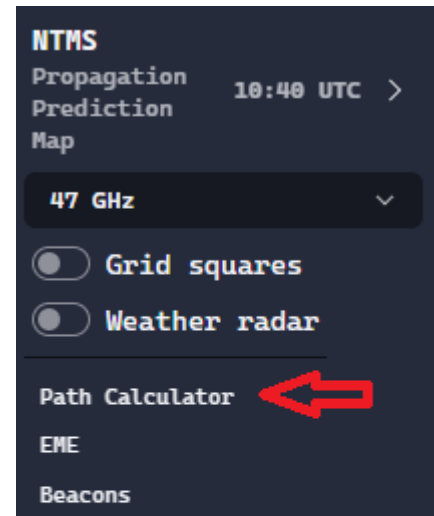


Video demo



# Path Calculator

- Enter the two grid locations, frequency and station parameters
- Click Calculate Path (can take full minute)

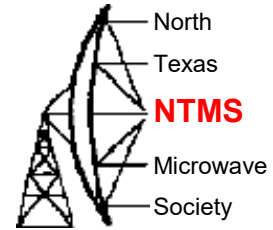


## Path Calculator

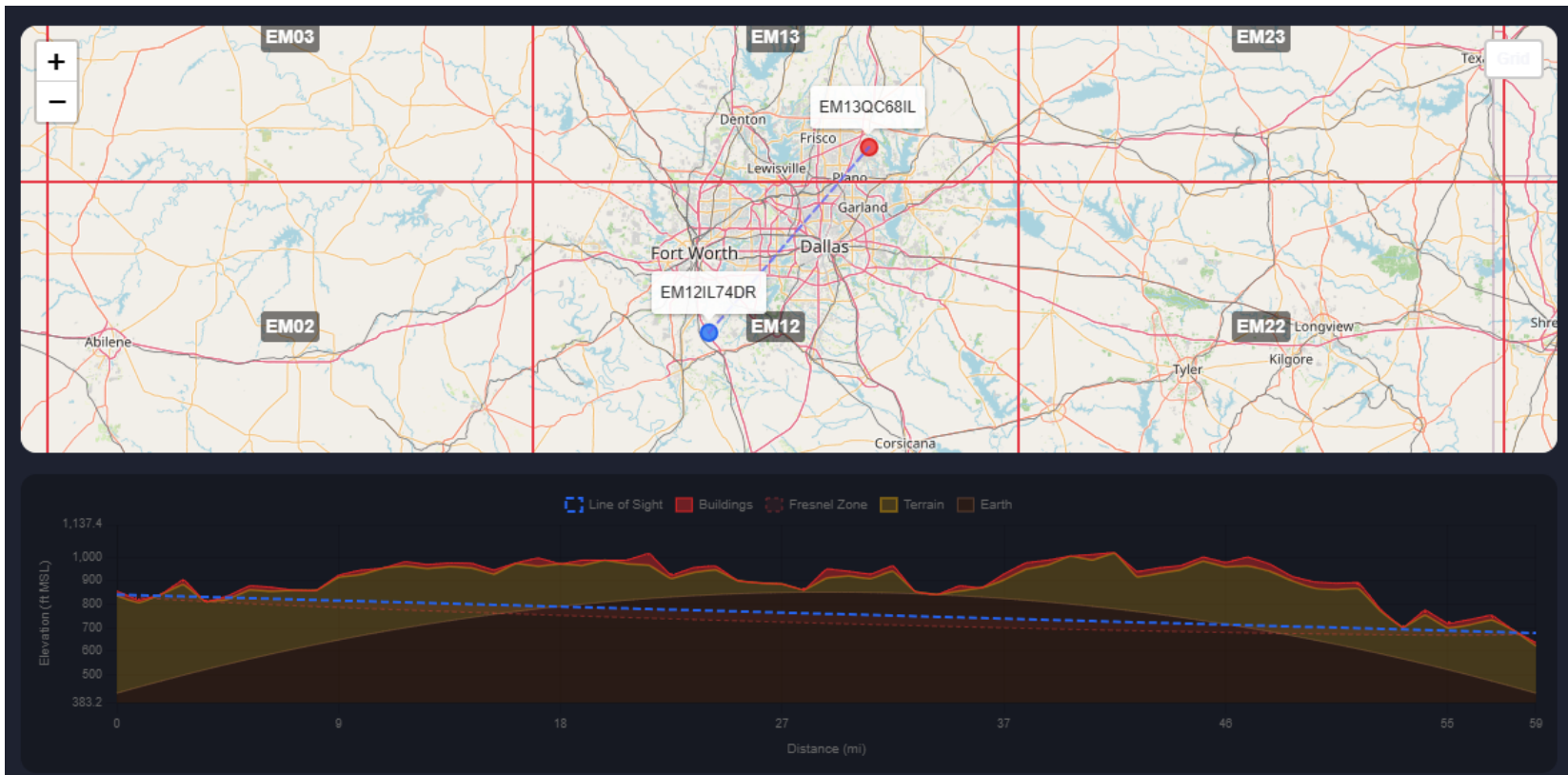
Analyze microwave propagation between two points

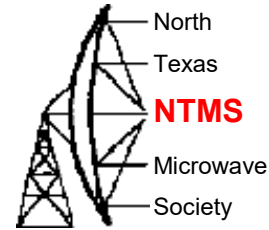
Source	Destination ( <u>callsign</u> or grid)	Band	TX Power (dBm)
EM12IL74FN <input type="button" value="My Location"/>	EM13QC68IL	24 GHz	33
TX Height (ft)	TX Gain (dBi)	RX Height (ft)	RX Gain (dBi)
6	40	55	40
<input type="button" value="Calculate Path"/>			

# Path Calculator



- A zoomable map is displayed
- Scroll down





# Path Calculator

Real time metrics are displayed

Link Summary · 24 GHz

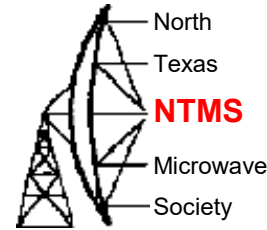
Distance	Bearing	Terrain	Propagation	HRRR Data
59 mi (94 km)	40.7°	BLOCKED	61/100 <small>MARGINAL</small>	9 / 9 points

<p>Loss Budget · 24 GHz</p> <table border="0" style="width: 100%;"> <tr> <td>FSPL (free-space)</td> <td style="text-align: right;">159.5 dB</td> </tr> <tr> <td>Gaseous (O<sub>2</sub>+H<sub>2</sub>O)</td> <td style="text-align: right;">5.0 dB</td> </tr> <tr> <td style="color: orange;">Diffraction loss</td> <td style="text-align: right; color: orange;">91.8 dB</td> </tr> <tr> <td><b>TOTAL PATH LOSS</b></td> <td style="text-align: right;"><b>256.3 dB</b></td> </tr> </table> <p><small>Gas rate: 0.1 dB/km H<sub>2</sub>O: 0.8 dB/km/g · O<sub>2</sub>: 0.8 dB/km Abs humidity avg: 16.3 g/m<sup>3</sup></small></p>	FSPL (free-space)	159.5 dB	Gaseous (O <sub>2</sub> +H <sub>2</sub> O)	5.0 dB	Diffraction loss	91.8 dB	<b>TOTAL PATH LOSS</b>	<b>256.3 dB</b>	<p>Power Budget</p> <table border="0" style="width: 100%;"> <tr> <td>TX Power</td> <td style="text-align: right;">33.0 dBm (2.0 W)</td> </tr> <tr> <td>TX Ant Gain</td> <td style="text-align: right;">40.0 dBi</td> </tr> <tr> <td>Feed Loss (x2)</td> <td style="text-align: right;">-2.0 dB</td> </tr> <tr> <td>EIRP</td> <td style="text-align: right;">71.0 dBm</td> </tr> <tr> <td style="color: orange;">Path Loss (w/FF)</td> <td style="text-align: right; color: orange;">-256.3 dB</td> </tr> <tr> <td>RX Ant Gain</td> <td style="text-align: right;">40.0 dBi</td> </tr> <tr> <td>RX Power</td> <td style="text-align: right;">-145.3 dBm</td> </tr> <tr> <td>Sensitivity (CW)</td> <td style="text-align: right;">-141.0 dBm</td> </tr> <tr> <td style="color: red;">MARGIN</td> <td style="text-align: right; color: red;">-5.3 dB</td> </tr> </table>	TX Power	33.0 dBm (2.0 W)	TX Ant Gain	40.0 dBi	Feed Loss (x2)	-2.0 dB	EIRP	71.0 dBm	Path Loss (w/FF)	-256.3 dB	RX Ant Gain	40.0 dBi	RX Power	-145.3 dBm	Sensitivity (CW)	-141.0 dBm	MARGIN	-5.3 dB
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Sensitivity (CW)	-141.0 dBm																										
MARGIN	-5.3 dB																										

<p>Path Weather Avg</p> <table border="0" style="width: 100%;"> <tr> <td>Temperature</td> <td style="text-align: right;">69.3°F</td> <td>Dewpoint</td> <td style="text-align: right;">66.4°F</td> </tr> <tr> <td></td> <td style="text-align: right;"><small>20.7°C</small></td> <td></td> <td style="text-align: right;"><small>19.1°C</small></td> </tr> <tr> <td>T/Td Gap</td> <td style="text-align: right;">2.9°F</td> <td>Abs Humidity</td> <td style="text-align: right;">16.3 g/m<sup>3</sup></td> </tr> <tr> <td>Pressure</td> <td style="text-align: right;">984.1 mb</td> <td>PWAT</td> <td style="text-align: right;">27.3 mm</td> </tr> <tr> <td>BL Depth</td> <td style="text-align: right;">196.9 m</td> <td>Refrac Gradient</td> <td style="text-align: right;">-97.1 N/km</td> </tr> </table>	Temperature	69.3°F	Dewpoint	66.4°F		<small>20.7°C</small>		<small>19.1°C</small>	T/Td Gap	2.9°F	Abs Humidity	16.3 g/m <sup>3</sup>	Pressure	984.1 mb	PWAT	27.3 mm	BL Depth	196.9 m	Refrac Gradient	-97.1 N/km	<p>Propagation Factors · 24 GHz</p> <table border="0" style="width: 100%;"> <tr> <td>Time of Day</td> <td style="text-align: right;">100</td> </tr> <tr> <td>Rain</td> <td style="text-align: right;">100</td> </tr> <tr> <td>Pressure</td> <td style="text-align: right;">82</td> </tr> <tr> <td>Refractivity</td> <td style="text-align: right;">62</td> </tr> <tr> <td>PWAT</td> <td style="text-align: right;">60</td> </tr> <tr> <td>Sky Cover</td> <td style="text-align: right;">50</td> </tr> <tr> <td>Wind</td> <td style="text-align: right;">50</td> </tr> <tr> <td>Season</td> <td style="text-align: right;">47</td> </tr> <tr> <td>T-Td Depression</td> <td style="text-align: right;">18</td> </tr> <tr> <td>Humidity</td> <td style="text-align: right;">0</td> </tr> </table>	Time of Day	100	Rain	100	Pressure	82	Refractivity	62	PWAT	60	Sky Cover	50	Wind	50	Season	47	T-Td Depression	18	Humidity	0
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T-Td Depression	18																																								
Humidity	0																																								



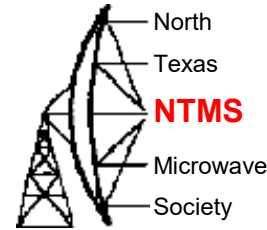
# Path Calculator

Real time metrics are displayed



[Copy Link](#)

# EME



Real time metrics are displayed

### EME Calculator

Earth-Moon-Earth path loss, link budget, and real-time Moon az / el for antenna aiming. Moon position updates every 10 seconds; refresh to force an immediate recompute.

Station (callsign, grid, or "lat,lon")

Band (MHz)  TX power (dBm)  Antenna gain (dBi)

Detection BW (Hz)  System noise Tsys (K)

Antenna aim		2026-05-04 11:40:30Z	
Station		KMSPQ	
Lat / lon		32.804, -97.196	
Azimuth		223.04°	
Elevation	<span style="background-color: #00FF00;">above horizon</span>	14.81°	
Slant range		405,566 km	

Link budget (Earth → Moon → Earth)	
TX power	50.0 dBm (100.0 W)
Antenna gain	+30.0 dBi
= EIRP	80.0 dBm (100.00 kW)
Free-space spreading (x2)	413.7 dB
Moon reflection ( $\rho = 0.065$ )	-141.6 dB
= Round-trip path loss	272.1 dB
Received power	-162.1 dBm
Noise floor	-156.9 dBm
Doppler (self-echo)	-59 Hz (+6.9 m/s)
SNR	<span style="background-color: #FF0000;">below noise</span> -5.3 dB

Round-trip path loss = 2 × free-space spreading minus the Moon's effective scattering gain  $10 \cdot \log(4\pi \sigma / \lambda^2)$ , with  $\sigma = \rho \cdot \pi \cdot R_{\text{moon}}^2$ . Albedo  $\rho$  varies by band ( $\approx 0.065$  at VHF,  $\approx 0.08$  at microwave, dropping above 40 GHz). Cable, feed, and polarisation losses are on you.

### NTMS

Propagation Prediction 10:40 UTC >  
 Map

Grid squares  
 Weather radar

### Path Calculator

EME ←

Beacons  
 Weather Map  
 Submit a Contact  
 Contact Training Data  
 Contact Map  
 Scoring Algorithm  
 About

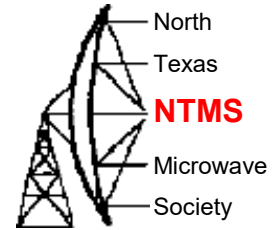
### Earth-Moon geometry (not to scale)

Drag to rotate. Shaded hemisphere is everyone who cannot currently see the Moon - outside your bounce footprint.

Earth texture: NASA Blue Marble 2015 (public domain). Moon texture: NASA CGI Moon Kit, LROC colour mosaic (public domain).

# Beacons

Locations are plotted on map



**Beacons**  
Microwave beacons tracked by NTMS. [+ Submit Beacon](#)

Search ... 10 [Export](#)

Frequency (MHz)	Call	Grid	EIRP (mW)	Height AGL (ft)	Keying	On air	Actions
432.38	W5HN/B	EM13kf45qb	800	280	On/Off	Yes	Details
903.05	W5HN/B	EM13kf45qb	9,000	280	On/Off	Yes	Details
1,296.375	W5HN/B	EM13kf45qb	3,000	280	On/Off	Yes	Details
24,192.3	AA5C/B	EM13sf89	500	75	On/Off	Yes	Details
5,760.364	W5HN/B	EM13kf45qb	158	280	On/Off	Yes	Details
10,368.368	W5HN/B	EM13kf45qb	2,500	280	FSK	Yes	Details

**NTMS**  
Propagation Prediction Map 10:40 UTC >

47 GHz

Grid squares  
 Weather radar

Path Calculator

EME

**Beacons** ←

Weather Map

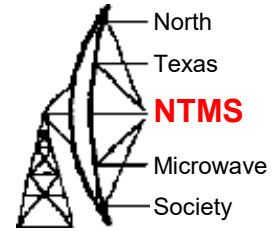
Submit a Contact

Contact Training Data

Contact Map

Scoring Algorithm

About



# Beacons

## Zoomable/Clickable

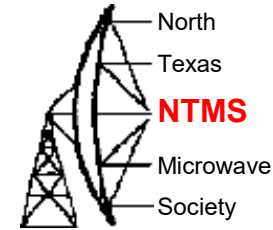
**Beacons**  
Microwave beacons tracked by NTMS.

[+ Submit Beacon](#)

AA5C/B  
24,192.3 MHz  
Grid EM13sf89  
Keying: On/Off  
[View details →](#)

Search ... 10 [Export](#)

Frequency (MHz)	Call	Grid	EIRP (mW)	Height AGL (ft)	Keying	On air	Actions
47,088.36	W5HN/B	EM12il56fi	1,000	55	Q65C-60	Yes	<a href="#">Details</a>
47,088.001	KF6KVG	CM97b159jt	500	35	FM Voice	Yes	<a href="#">Details</a>
24,192.3	AA5C/B	EM13sf89	500	75	On/Off	Yes	<a href="#">Details</a>
24,192	N6NU/B	CM97b159jt	1,000	35	On/Off	Yes	<a href="#">Details</a>
10,369.025	K6MG	CM97b159jt	8,000	35	On/Off	Yes	<a href="#">Details</a>



# Beacons

After clicking 'view detail'

**AA5C/B**  
24,192.3 MHz · EM13sF89

[Plot path to beacon](#) [Edit](#)

Show estimated current coverage

FREQUENCY	CALLSIGN	KEYING	ON THE AIR
24,192.3 MHz	AA5C/B	On/Off	Yes
GRID	LATITUDE	LONGITUDE	EIRP
EM13sF89	33.246179	-96.426505	500 mW
HEIGHT AGL	BEARING		
75 ft	Omni		

Submitted by **W5ISP**

**AA5C/B**  
24,192.3 MHz · EM13sF89

[Plot path to beacon](#) [Edit](#)

Show estimated current coverage

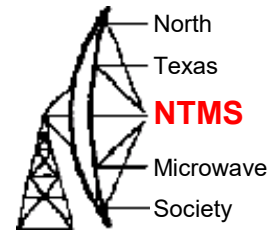
Band 24 GHz · EIRP 17.0 dBm · Atm Loss 0.04 dB/km

Beacon grid score 58 at 2026-05-16 00:00 UTC · 2375 cells rendered

- Excellent ( $\geq -100$  dBm)
- Good ( $\geq -115$  dBm)
- Marginal ( $\geq -125$  dBm)
- Weak CW ( $\geq -135$  dBm)
- Detection ( $\geq -145$  dBm)

FREQUENCY	CALLSIGN	KEYING	ON THE AIR
24,192.3 MHz	AA5C/B	On/Off	Yes
GRID	LATITUDE	LONGITUDE	EIRP
EM13sF89	33.246179	-96.426505	50 mW
HEIGHT AGL	BEARING		
75 ft	Omni		

Submitted by **W5ISP**



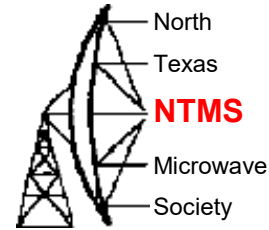
# Beacons

Clicking “Plot path to beacon”  
brings up the Path Calculator

## Path Calculator

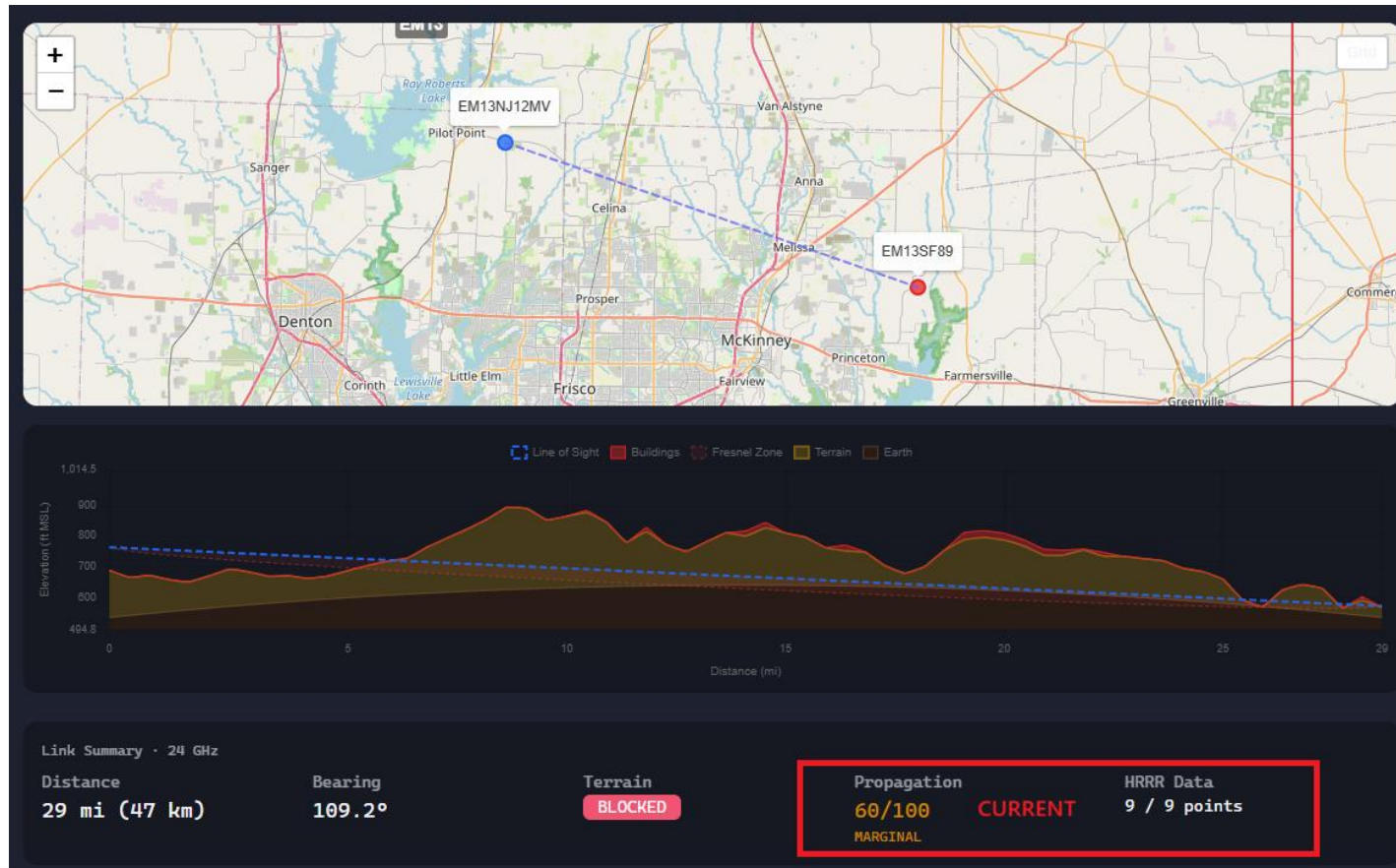
Analyze microwave propagation between two points

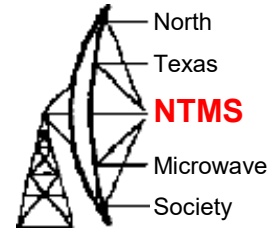
Source	Destination ( <u>callsign</u> or grid)	Band	TX Power (dBm)
em13nj12mv <input type="button" value="My Location"/>	EM13sf89	24 GHz ▾	20.0
TX Height (ft)	TX Gain (dBi)	RX Height (ft)	RX Gain (dBi)
75	17.0	5	40



# Beacons

The Path analysis window opens with all the detail

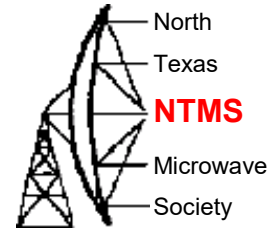




# Beacons

Scroll down for more detail



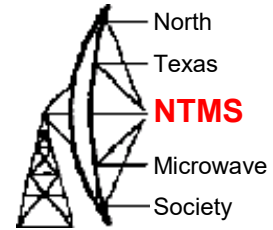


# Beacons

HRRR data and prediction graph at bottom of panel



# Beacons



To understand the historical reception of the beacon, I entered it as a contact!

## Contacts

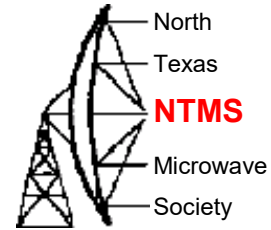
82,094 total - sort or search by callsign, grid, or mode. + Submit Contact

CONTACTS BY MONTH (ALL YEARS COMBINED)

Search:  10 Export

Station 1	Grid 1	Station 2	Grid 2	Band	Mode	Distance	Enriched	QSO (UTC)	Added (UTC)	Private
KM5PO	EM13NJ12MV	AA5C/B	EM13SF89TB	24000	CW	29 mi (47 km)	Partial	2026-02-08 20:28	2026-05-09 10:49	
KM5PO	EM13NJ12MV	AA5C	EM13SE	24000	CW	29 mi (47 km)	Partial	2026-02-08 20:28	2026-05-09 10:49	
KM5PO	EM13NJ12MV	W5LUA	EM13QC68IL	24000	CW	25 mi (40 km)	Partial	2026-02-08 20:28	2026-05-09 10:49	
KM5PO	EM13NJ12MV	W5LUA	EM13QC68IL	10000	CW	25 mi (40 km)	Partial	2026-02-08 20:25	2026-05-09 10:49	
KM5PO	EM13NJ12MV	AA5C	EM13SE	10000	CW	29 mi (47 km)	Partial	2026-02-08 20:25	2026-05-09 10:49	
KM5PO	EM13NJ12MV	WB5ZSP	EM13SA	10000	CW	36 mi (58 km)	Partial	2026-02-08 20:18	2026-05-09 10:49	
KM5PO	EM13NJ12MV	WB5ZSP	EM13SA	24000	CW	36 mi (58 km)	Partial	2026-02-08 20:18	2026-05-09 10:49	

# Beacons



Scored “GOOD” but not a great set of conditions

**Propagation Analysis**

Path is terrain-obstructed at 2.6 mi (4.2 km) from KM5PO. Path is obstructed with 94.7 dB diffraction loss. Contact may have been enabled by knife-edge diffraction or tropospheric scatter.

Refractivity gradient: -61 N-units/km (normal).  
Boundary layer depth: 481 m.

Factor	Score	Weight	Contribution	Notes
Rain	100/100	21%	21.5	None
Humidity	67/100	15%	9.9	6.3 g/m <sup>3</sup> (harmful at this band)
Pressure	70/100	12%	8.4	994.2 mb (low)
PMAT	60/100	13%	8.1	20.9 mm (absorption)
Refractivity	55/100	13%	6.9	dN/dh = -63 (normal)
Season	84/100	7%	6.1	Feb (winter peak band)
<b>T-Td Depression</b>	<b>96/100</b>	<b>4%</b>	<b>3.5</b>	<b>T-Td = 29.9°F (dry)</b>
Sky Cover	50/100	5%	2.4	-
Wind	50/100	5%	2.4	-
Time of Day	18/100	5%	1.0	Solar hour -14 (afternoon)
Composite	70/100			<b>GOOD</b>

**Propagation Mechanism**

**Troposcatter**

No duct, no meaningful rain inside the common volume - default tropospheric forward scatter.

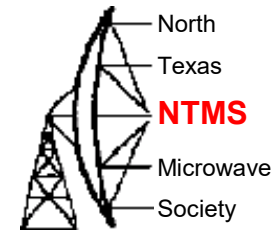
Common volume: 465036 km<sup>3</sup> Max reflectivity: 51.7 dBZ Heavy-rain pixels: 2

Radar coverage: 4% Frame: 2026-02-08 20:25 UTC

**Terrain Profile**

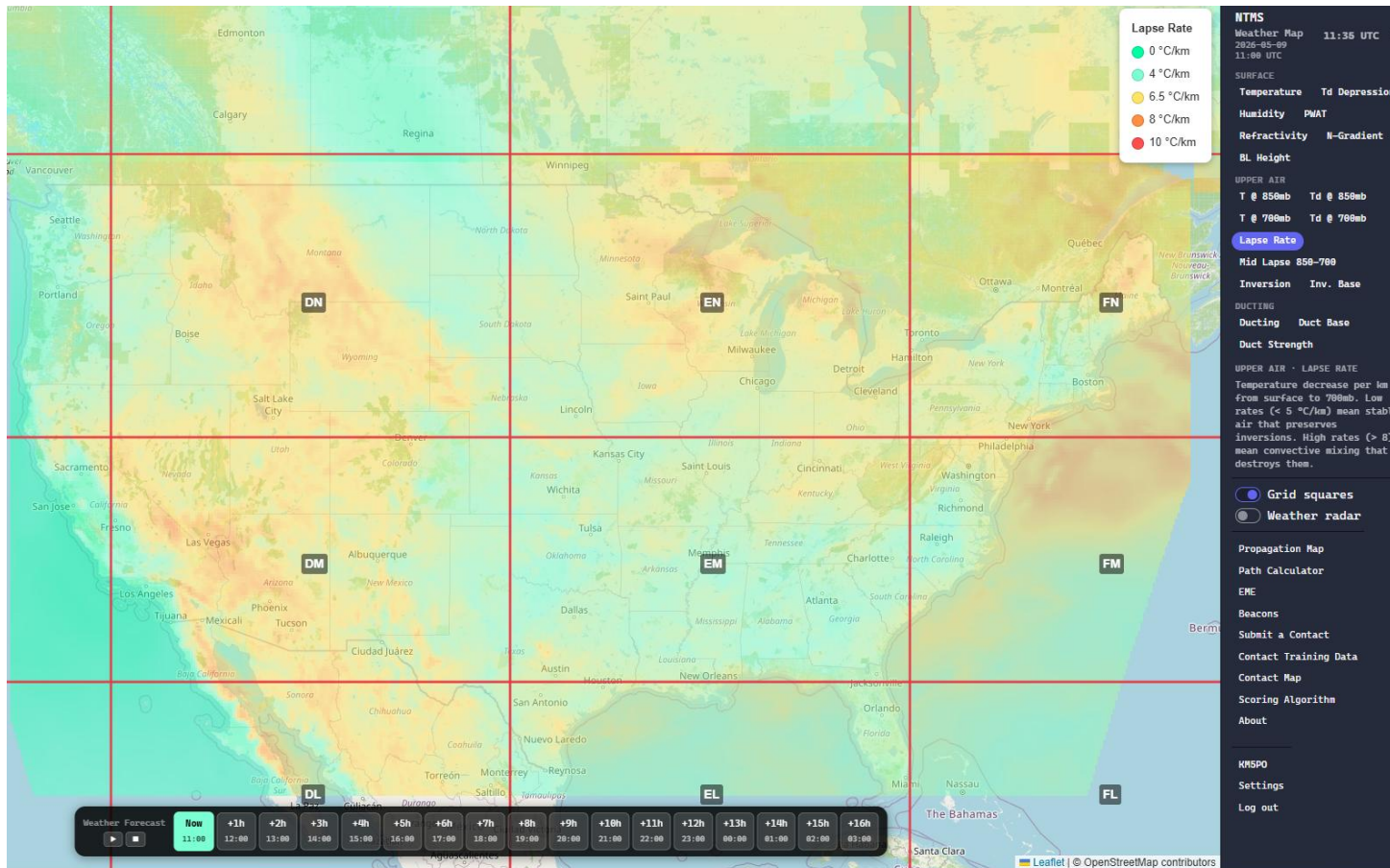
**BLOCKED** 65 samples Max elev: 250.0 m Min clearance: -77.0 m

Diffraction: 94.7 dB 51 obstructed 6 Fresnel hits



# Weather Map

Select metric on right-hand panel



**NTMS**  
 Propagation Prediction Map 10:40 UTC >

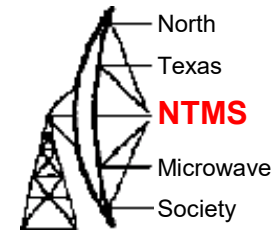
47 GHz

Grid squares  
 Weather radar

Path Calculator

EME  
 Beacons  
**Weather Map** ←  
 Submit a Contact  
 Contact Training Data  
 Contact Map  
 Scoring Algorithm  
 About

Video demo



# Weather Map

Click on the map to get location metrics on left panel

**Weather Details**

36.756°N, 95.375°W - 2026-05-09 11:00 UTC

- Temperature: 12.2 °C (54 °F)
- Td Depression: 0.1 °C
- Rel. Humidity: 100%
- Sfc Pressure: 981.5 mb
- Refractivity: 337.5 N
- N-Gradient: -183 N/km
- BL Height: 62 m
- PMAT: 11.4 mm
- T @ 850mb: 14.1 °C
- Td @ 850mb: -4.7 °C
- T @ 700mb: 1.4 °C
- Td @ 700mb: -19.3 °C
- Lapse Rate: 4.5 °C/km
- Lapse 850-700: 8.2 °C/km
- Inversion: +5.8 °C
- Inv. Base: 216 m AGL
- Ducting: Yes
- Duct Base: None
- Duct Strength: N/A

**NTMS** Weather Map 11:31 UTC  
2026-05-09 11:00 UTC

**SURFACE**

Temperature Td Depression  
Humidity PMAT  
Refractivity N-Gradient  
BL Height

**UPPER AIR**

T @ 850mb Td @ 850mb  
T @ 700mb Td @ 700mb  
Lapse Rate  
Mid Lapse 850-700  
Inversion Inv. Base

**DUCTING** Duct Base  
Duct Strength

DUCTING - DUCTING  
Whether a trapping layer (modified refractivity decreasing with height) was detected in the profile. Green = duct present, signals can travel far beyond line of sight.

Grid squares  
 Weather radar

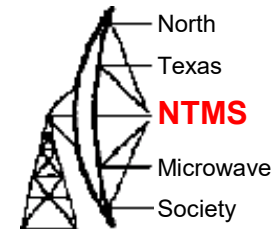
**Propagation Map**  
Path Calculator  
EME  
Beacons  
Submit a Contact  
Contact Training Data  
Contact Map  
Scoring Algorithm  
About

**KM5PO**  
Settings  
Log out

Weather Forecast: Now +1h +2h +3h +4h +5h +6h +7h +8h +9h +10h +11h +12h +13h +14h +15h +16h

11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 00:00 01:00 02:00 03:00





# Submit a Contact

### Submit Contact

Help us build a better propagation model

Every contact matters

Our propagation model improves with real-world data. Each verified contact you submit is matched against atmospheric conditions at the time of your contact, helping us calibrate predictions for all amateur bands from 50 MHz and up. The more contacts we have, the better our forecasts get for everyone.

Your contact will be available on the [contacts page](#) shortly after submission, with terrain analysis, atmospheric data, and propagation scoring added automatically.

**Single Contact** Upload CSV Upload ADIF

Station 1 \* Grid 1 \* Height 1 (ft AGL)  
W5XD EM12kp Optional

Station 2 \* Grid 2 \* Height 2 (ft AGL)  
K5TR EM00cd Optional

Be as specific as possible with grid squares (8 characters preferred, e.g. EM12kp37). Antenna heights are optional but improve terrain-clearance analysis.

Band \* Mode Timestamp (UTC, 24h) \*  
Select band Optional YYYY-MM-DD HH:MM

Notes (optional)  
Operator notes - propagation mode, weather, equipment, QSO commentary...

Private - only visible to me and administrators

[↑ Submit Contact](#)

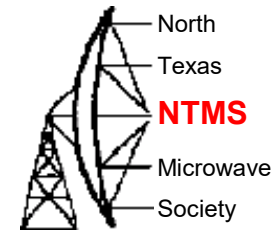
### NTMS

Propagation Prediction 10:40 UTC >  
Map

47 GHz ▾

Grid squares  
 Weather radar

Path Calculator  
EME  
Beacons  
Weather Map  
**Submit a Contact** ←  
Contact Training Data  
Contact Map  
Scoring Algorithm  
About



# Upload CSV - ADIF

Your contact will be available on the [contacts page](#) shortly after submission, with terrain analysis, atmospheric data, and propagation scoring added automatically.

Single Contact **Upload CSV** Upload ADIF

Upload a CSV file with multiple contacts. Columns:

station1, station2, grid1, grid2, band, mode, qso\_timestamp, notes

- Timestamps in most formats accepted (e.g. 2024-06-15T14:30:00Z, 6/15/2024 2:30 PM, 2024-06-15 14:30). All times assumed UTC.
- Grid squares should be as detailed as possible (8 characters preferred, e.g. EM12kp37)
- Band in MHz (e.g. 10000, 24000)
- Mode is optional – omit the mode column entirely (6 columns total) or leave its value blank.
- Notes is optional – free-form operator commentary up to 2000 characters. Leave the cell blank to store NULL.

[↓ Download sample CSV](#)

CSV File

Choose File No file chosen

Private – only visible to me and administrators

[↑ Upload Contacts](#)

Your contact will be available on the [contacts page](#) shortly after submission, with terrain analysis, atmospheric data, and propagation scoring added automatically.

Single Contact Upload CSV **Upload ADIF**

Upload an ADIF (.adi / .adif) file exported from your logging program.

- Required fields: CALL, STATION\_CALLSIGN (or OPERATOR), GRIDSQUARE, MY\_GRIDSQUARE, QSO\_DATE, TIME\_ON, and FREQ or BAND
- Contacts on amateur bands from 50 MHz and up will be imported
- HF contacts (below 50 MHz) are silently skipped
- Frequencies are fuzzy-matched to the nearest amateur band
- Operator commentary from NOTES is carried over (falling back to COMMENT)

## Mode handling

ADIF modes are normalized to the six modes we track. SUBMODE takes precedence when present (e.g. MODE=MFSK, SUBMODE=FT8 imports as FT8).

ADIF value	Stored as
CW / PCM	CW
SSB / USB / LSB / DSB	SSB
FM / NBFM / WFM	FM
FT8 (or MFSK+SUBMODE=FT8)	FT8
FT4 (or MFSK+SUBMODE=FT4)	FT4
Q65 (or MFSK+SUBMODE=Q65)	Q65
anything else	(blank – row still imports)

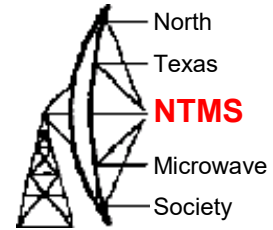
ADIF File

Choose File No file chosen

Private – only visible to me and administrators

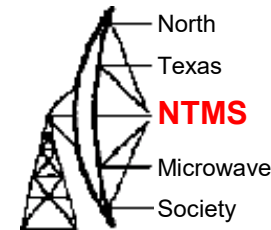
[↑ Upload Contacts](#)

# Typical CSV file to upload



	A	B	C	D	E	F	G	H	I	J	K
1	station1	station2	grid1	grid2	band	mode	qso_timestamp	notes			
2	KM5PO	WB5ZSP	EM13NJ12MV	EM13SA	10000	CW	2026-02-08T20:18:00Z				
3	KM5PO	WB5ZSP	EM13NJ12MV	EM13SA	24000	CW	2026-02-08T20:18:00Z				
4	KM5PO	AA5C	EM13NJ12MV	EM13SE	10000	CW	2026-02-08T20:25:00Z				
5	KM5PO	AA5C	EM13NJ12MV	EM13SE	24000	CW	2026-02-08T20:28:00Z				
6	KM5PO	W5LUA	EM13NJ12MV	EM13QC68IL	10000	CW	2026-02-08T20:25:00Z				
7	KM5PO	W5LUA	EM13NJ12MV	EM13QC68IL	24000	CW	2026-02-08T20:28:00Z				
8	KM5PO	AA5C/B	EM13NJ12MV	EM13SF89TB	24000	CW	2026-02-08T20:28:00Z	This is entered as a beacon reception			

# Contact Training Data



**Contacts**  
82,085 total - sort or search by callsign, grid, or mode.

Search ... 10

+ Submit Contact

Export

Station 1	Grid 1	Station 2	Grid 2	Band	Mode	Distance	Enriched	QSO (UTC)	Added (UTC)	Private
KM5PO	EM12IL74FN	W5LUA	EM13QC68IL	5760	CW	58 mi (94 km)	Complete	2026-05-02 20:06	2026-05-03 12:30	
KM5PO	EM12IL74FN	AA5C	EM13SE55VI	5760	CW	68 mi (110 km)	Complete	2026-05-02 20:09	2026-05-03 12:30	
KM5PO	EM12IL74FN	W5LUA	EM13QC68IL	24000	CW	58 mi (94 km)	Complete	2026-05-02 20:18	2026-05-03 12:30	
KM5PO	EM11CS05IK	AA5C	EM13SE55VI	10000	CW	127 mi (204 km)	Complete	2026-05-02 16:37	2026-05-03 12:30	
KM5PO	EM11CS05IK	AA5C	EM13SE55VI	5760	CW	127 mi (204 km)	Complete	2026-05-02 16:50	2026-05-03 12:30	
KM5PO	EM12IL74FN	AA5AM	EM13SG42SR	10000	CW	72 mi (116 km)	Complete	2026-05-02 20:02	2026-05-03 12:30	
KM5PO	EM12IL74FN	AA5C	EM13SE55VI	10000	CW	68 mi (110 km)	Complete	2026-05-02 19:58	2026-05-03 12:30	
KM5PO	EM11CS05IK	W5LUA	EM13QC68IL	5760	CW	117 mi (188 km)	Complete	2026-05-02 16:48	2026-05-03 12:30	
KM5PO	EM12IL74FN	WASWCP	EM12J088PN	10000	CW	11 mi (18 km)	Complete	2026-05-02 19:58	2026-05-03 12:30	
KM5PO	EM02WL37UE	W5LUA	EM13QC68IL	5760	CW	98 mi (158 km)	Complete	2026-05-02 12:55	2026-05-03 12:30	

Page 1

**NTMS**

Propagation Prediction Map 10:40 UTC >

47 GHz

Grid squares

Weather radar

---

Path Calculator

EME

Beacons

Weather Map

Submit a Contact

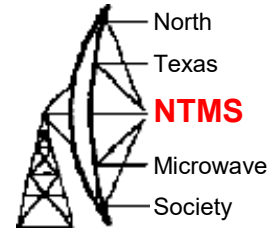
Contact Training Data ←

Contact Map

Scoring Algorithm

About

# Contact Training Data Detail



**KM5PO**  
/  
**W5LUA**

24 GHz · CW · 2026-05-02 20:18 UTC

Edit Flag as Invalid Open in Path Calculator Back to Contacts

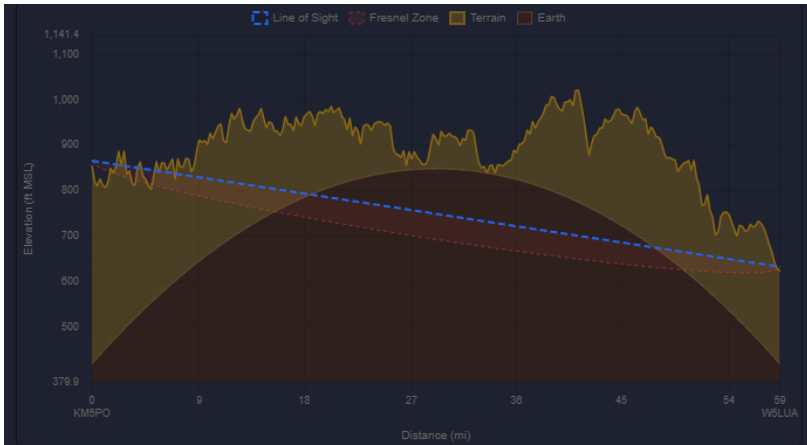
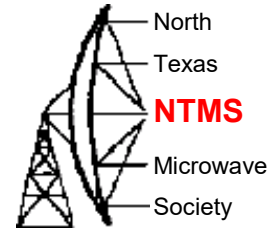
*Locations approximate, in the center of the grid squares. Have more detailed position information? Suggest an edit*

24 GHz · CW · 59 mi (94 km) · EM12IL74FN → EM13QC68IL

KM5PO → W5LUA	Az: 040.7°	EL: -0.36°
W5LUA → KM5PO	Az: 221.0°	EL: -0.27°

Obstructed at 2.3 mi (3.7 km)

# Contact Training Data Detail



## Propagation Analysis

Path is terrain-obstructed at 2.3 mi (3.7 km) from KM5PO. Path is obstructed with 95.9 dB diffraction loss. Contact may have been enabled by knife-edge diffraction or tropospheric scatter.

Refractivity gradient: -41 N-units/km (normal).

Boundary layer depth: 2177 m.

Factor	Score	Weight	Contribution	Notes
Rain	100/100	21%	21.5	None
PWAT	80/100	13%	10.8	14.2 mm (absorption)
Humidity	65/100	15%	9.6	6.4 g/m³ (harmful at this band)
Pressure	70/100	12%	8.4	992.4 mb (low)
Refractivity	48/100	13%	6.0	dN/dh = -41 (normal)
T-Td Depression	96/100	4%	3.5	T-Td = 34.4°F (dry)
Season	47/100	7%	3.4	May (winter peak band)
Sky Cover	50/100	5%	2.4	-
Wind	50/100	5%	2.4	-
Time of Day	18/100	5%	1.0	Solar hour ~14 (afternoon)
Composite	69/100			<b>GOOD</b>

## Propagation Mechanism

### Troposcatter

No duct, no meaningful rain inside the common volume – default tropospheric forward scatter.

Common volume: 427427 km³ Max reflectivity: 33.0 dBZ Heavy-rain pixels: 0

Radar coverage: 0% Frame: 2026-05-02 20:15 UTC

## Terrain Profile

**BLOCKED** 65 samples Max elev: 261.0 m Min clearance: -99.5 m

Diffraction: 95.9 dB 59 obstructed 2 Fresnel hits

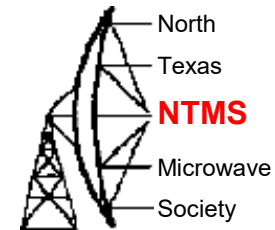
## Soundings

No soundings found within 1000 km.

## Solar Conditions

SFI: 158.7 Sunspot #: 142 Ap: 6 Kp: 2.3, 1.3, 0.7, 1.7, 1.3, 1.0, 1.3, 2.7

# Contact Training Data Detail



### Atmospheric Profile

HRRR (3 km) 32.5°, -97.3° 20:00 UTC HPBL: 2176.6 m PWAT: 14.7 mm
 ▼

N: 302.8 dN/dh: -40.7

---

### IEMRE Gridded Reanalysis

Grid point: 32.5°, -97.3° - 2026-05-02 hour - UTC

Temp: 53.2°F Dewpoint: 48.7°F Sky Cover: 34.0% Wind: 2.1 kts Precip: 0.0"  
Soil Temp: 61.4°F

---

### Surface Observations

Station	Time	Temp	Dewpt	RH%	Wind	Pres (mb)	Sky
DALLAS/LOVE FIELD	14:53	64.0	48.0	56.0	300° @ 4.0 kts	1021.7	CLR
DALLAS/LOVE FIELD	15:53	69.0	42.0	37.5	320° @ 4.0 kts	1021.8	CLR
DALLAS/LOVE FIELD	16:53	72.0	43.0	35.2	?° @ 6.0 kts	1021.9	FEW
DALLAS/LOVE FIELD	17:53	73.0	36.0	25.9	270° @ 4.0 kts	1021.3	FEW
DALLAS/LOVE FIELD	18:53	75.0	39.0	27.3	330° @ 7.0 kts	1020.4	FEW

---

### Data Sources

#### HRRR Model

3 path profiles  
13 pressure levels each  
Valid: 2026-05-02 20:00 UTC  
Grid: 32.48, -97.27

#### Elevation Profile

257 samples along path  
59 mi (94 km) path distance  
Source: SRTM 1-arcsecond  
0 duct layers detected

#### Terrain Analysis

65 profile samples  
Verdict: BLOCKED  
Max elevation: 261 m  
Diffraction: 95.9 dB

#### Surface Observations

5 stations  
14:53 - 18:53 UTC

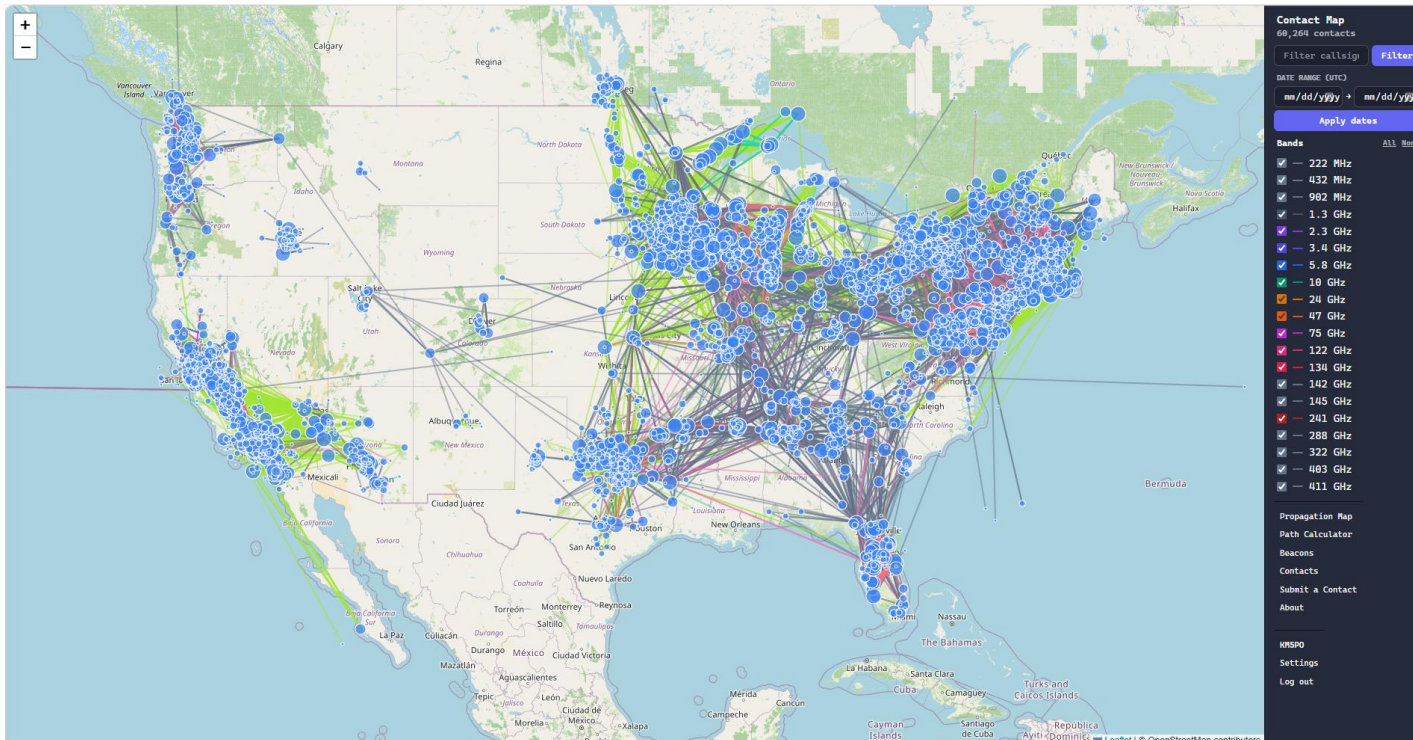
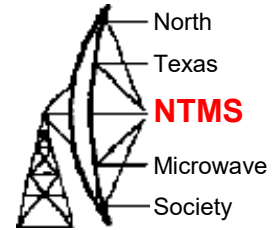
#### Soundings (RAOB)

0 profiles

#### Solar Indices

SFI: 158.7  
SSN: 142  
Ap: 6

# Contact Map

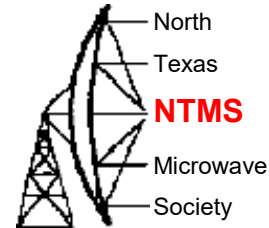


**NTMS**  
Propagation Prediction Map 10:40 UTC >

47 GHz

Grid squares  
 Weather radar

Path Calculator  
EME  
Beacons  
Weather Map  
Submit a Contact  
Contact Training Data  
**Contact Map** ←  
Scoring Algorithm  
About



# Contact Map

**Contact Map**  
60264 contacts

Filter callsign  **Filter**

DATE RANGE (UTC)

mm/dd/yyyy → mm/dd/yyyy

**Apply dates**

**Bands** All None

- 222 MHz
- 432 MHz
- 902 MHz
- 1.3 GHz
- 2.3 GHz
- 3.4 GHz
- 5.8 GHz
- 10 GHz
- 24 GHz
- 47 GHz

**Contact Map**  
60264 contacts

Filter callsign  **Filter**

DATE RANGE (UTC)

mm/dd/yyyy → mm/dd/yyyy

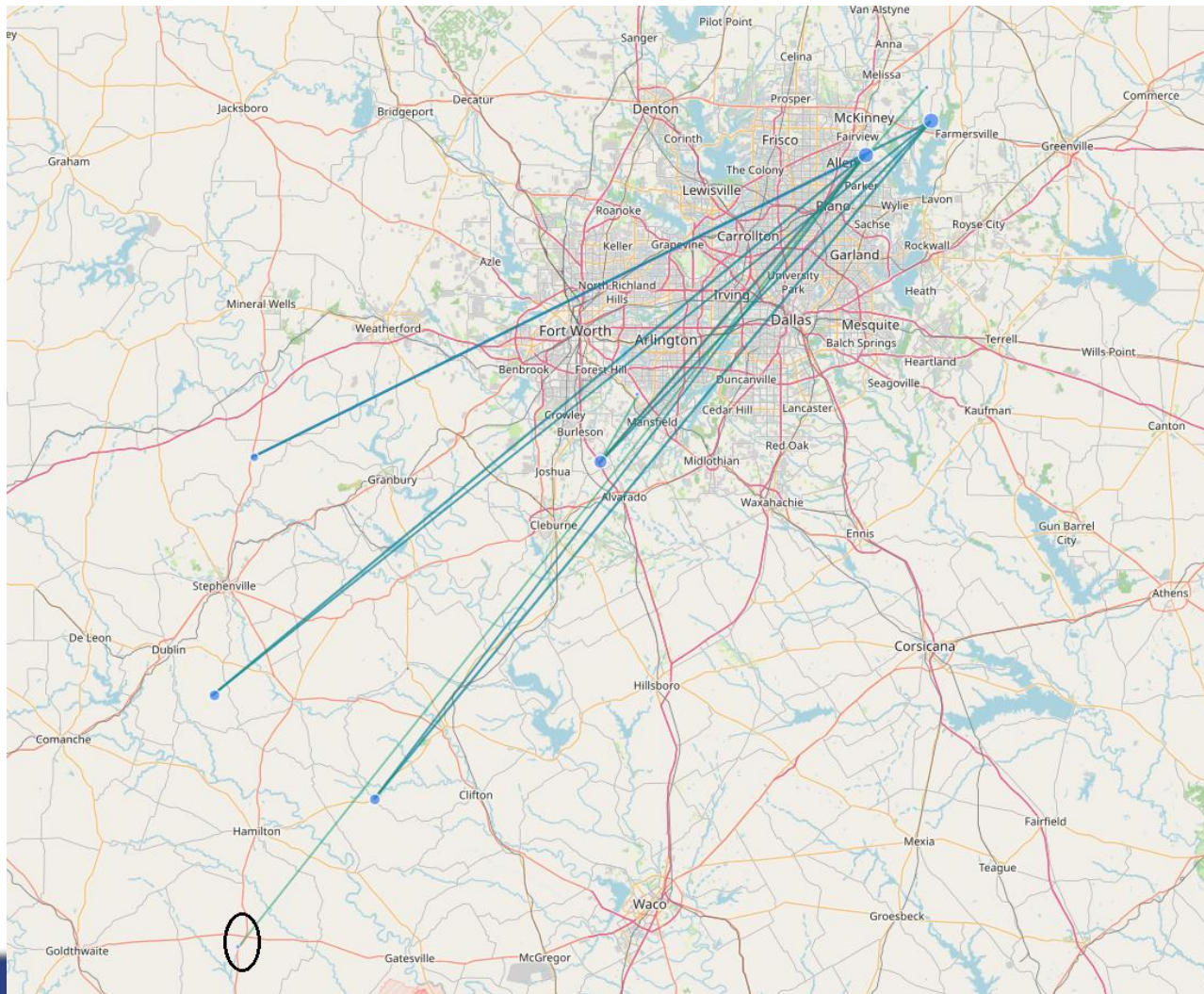
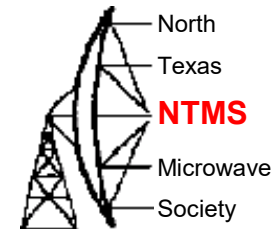
**Apply dates**

May 2026

Su	Mo	Tu	We	Th	Fr	Sa
26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

Clear Today

# Contact Map



**Contact Map**  
18 contacts

Filter callsign [Filter](#)

DATE RANGE (UTC)  
05/02/2026 → 05/02/2026

[Apply dates](#) [Clear](#)

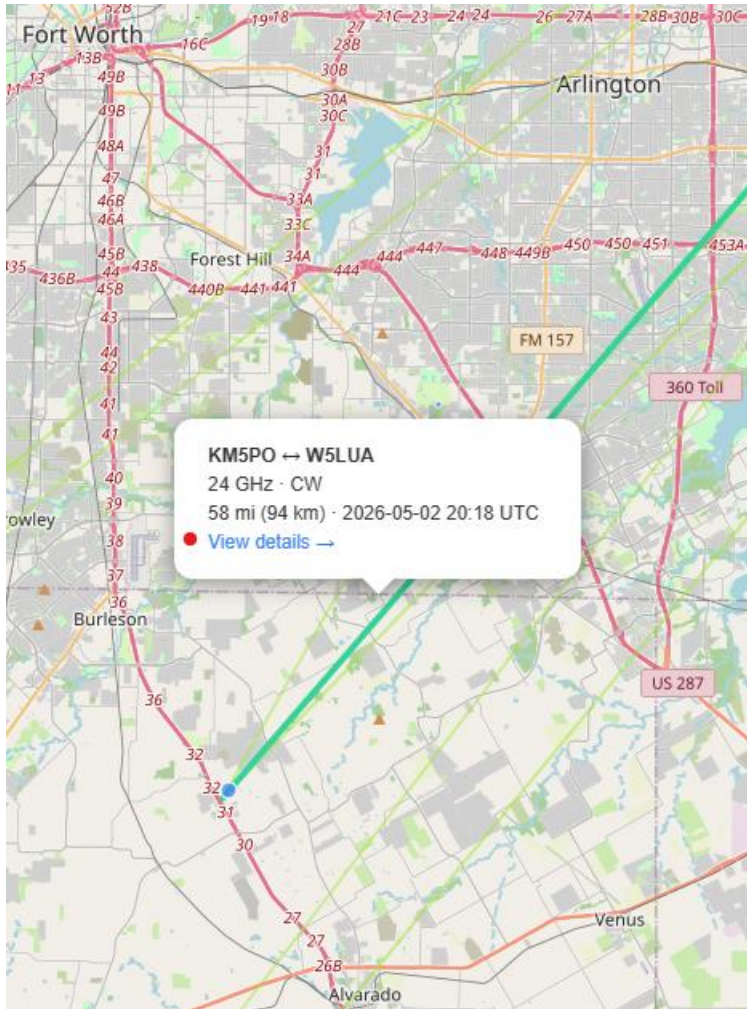
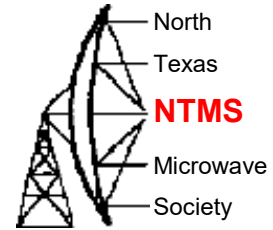
**Bands** [All](#) [None](#)

- 222 MHz
- 432 MHz
- 902 MHz
- 1.3 GHz
- 2.3 GHz
- 3.4 GHz
- 5.8 GHz
- 10 GHz
- 24 GHz
- 47 GHz
- 75 GHz
- 122 GHz
- 134 GHz
- 142 GHz
- 145 GHz
- 241 GHz
- 288 GHz
- 322 GHz
- 403 GHz
- 411 GHz

[Propagation Map](#)  
[Path Calculator](#)  
[Beacons](#)  
[Contacts](#)  
[Submit a Contact](#)  
[About](#)

[KMSPO](#)  
[Settings](#)  
[Log out](#)

# Contact Map



**KM5PO / W5LUA**

[Edit](#) [Flag as Invalid](#) [Delete](#) [Open in Path Calculator](#) [← Back to Contacts](#)

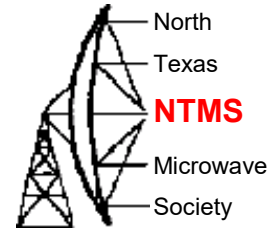
24 GHz · CW · 2026-05-02 20:18 UTC

*Locations approximate, in the center of the grid squares. Have more detailed position information? Suggest an edit*

24 GHz · CW · 59 mi (94 km) · EM12IL74FN → EM13QC68IL

KM5PO → W5LUA	Az: 040.7°	EL: -0.36°
W5LUA → KM5PO	Az: 221.0°	EL: -0.27°

# In development – Rover page



**Rover planning**  
10 GHz · Forecast +0h

Map showing a drive radius around a 'Home' location (Hamilton, TX) with various EM (Emergency Management) grid locations marked (EM01, EM02, EM11, EM12).

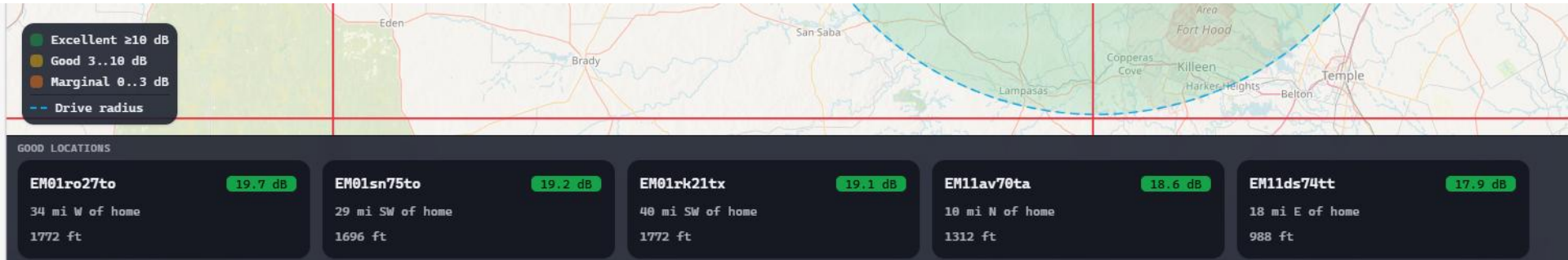
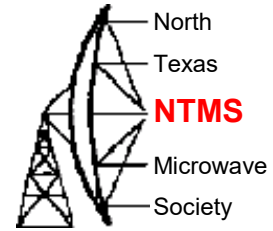
**Legend:**  
 - Excellent ≥10 dB (Green)  
 - Good 3..10 dB (Yellow)  
 - Marginal 0..3 dB (Red)  
 - Drive radius (Blue dashed line)

**Control Panel (Right):**

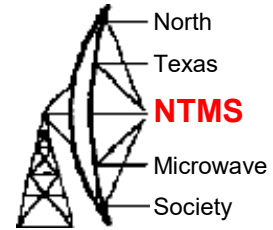
- HOME:** EM11AR6XE (Set)
- FIXED STATIONS:**
  - WSLUA EM13qc
  - W5HN EM13nf
  - NSXU EM10c1
  - AASC EM13se55
  - AASAC EM33jg83
- FORECAST HOUR:** +0h
- BAND:** 10G (Selected), 24G, 47G
- MAX DISTANCE:** 50 mi from EM11AR6XE
- CANDIDATES:**
  - Only use known good locations  
Restricts suggestions to spots tagged "good" in /rover-locations.

**Buttons:** Calculate, Call, Grid auto-look, Grid

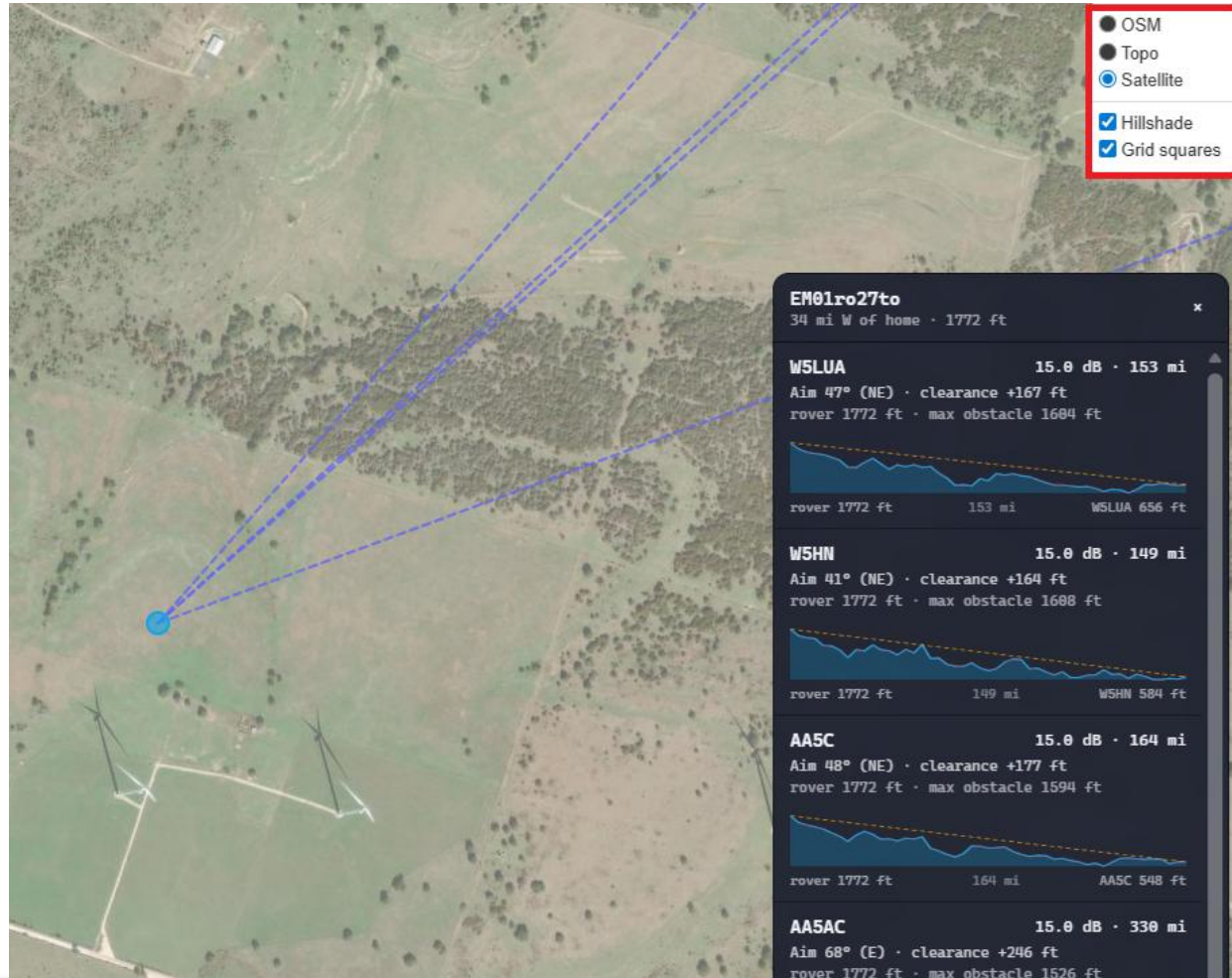
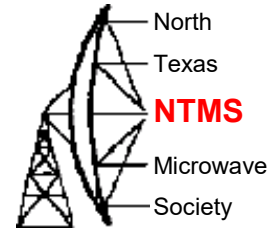
# In development – Rover page



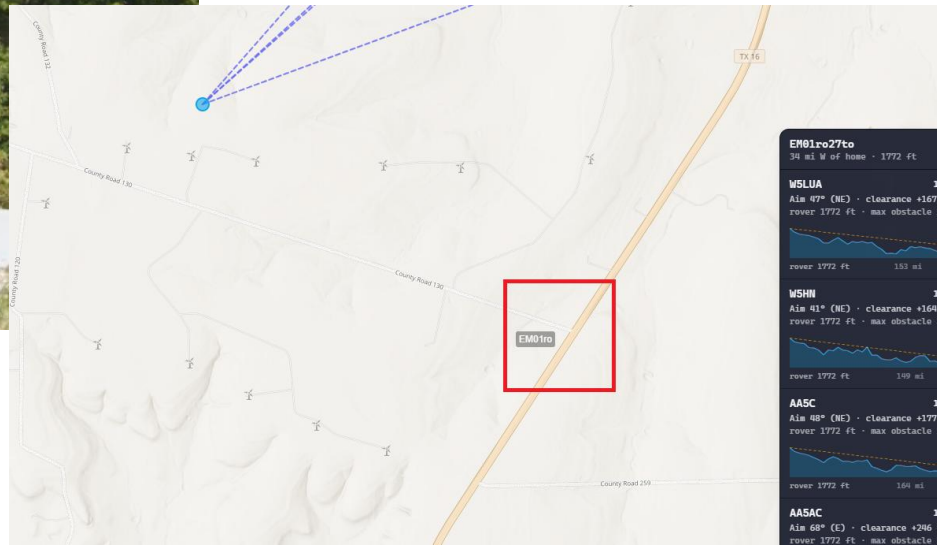
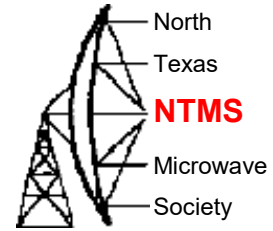
# In development – Rover page



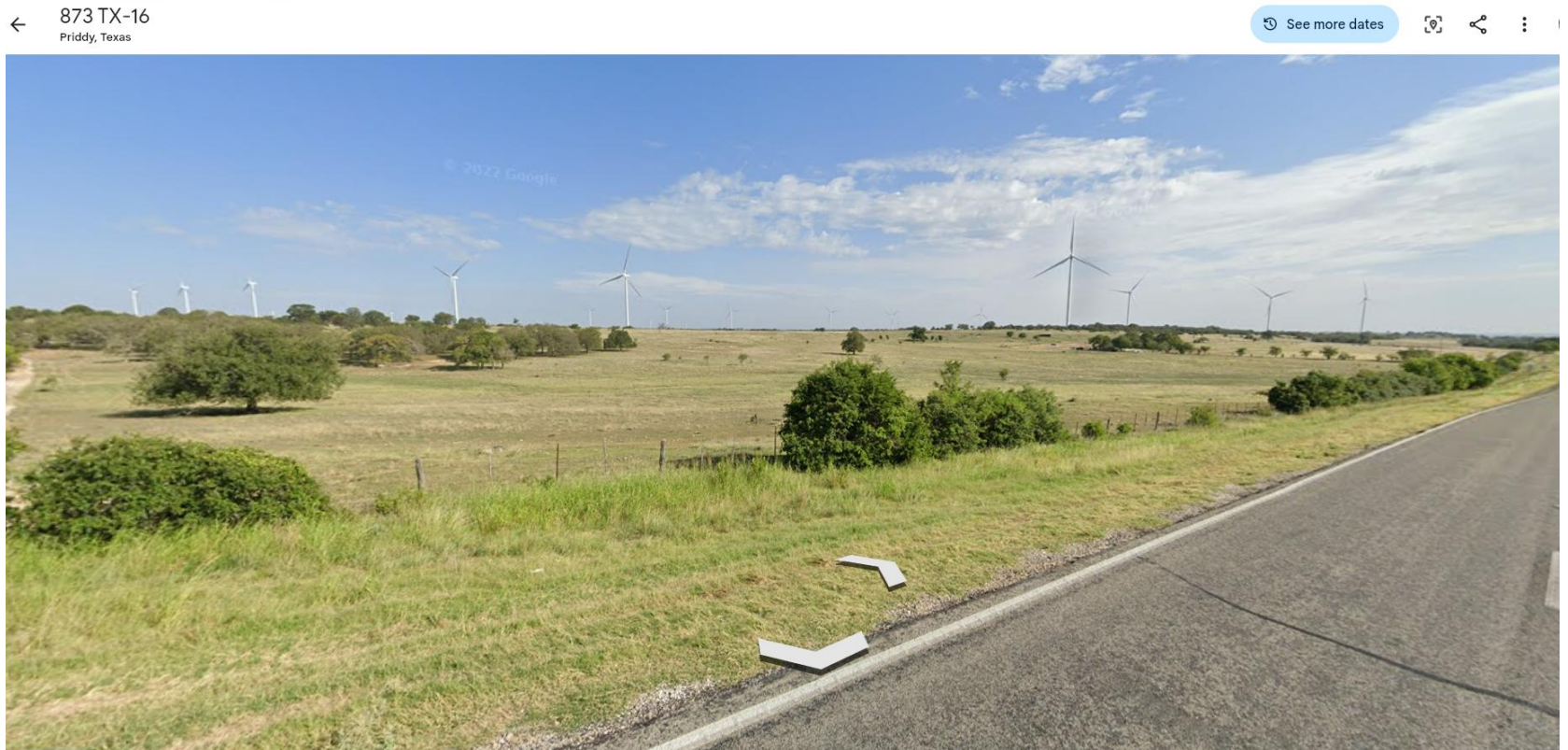
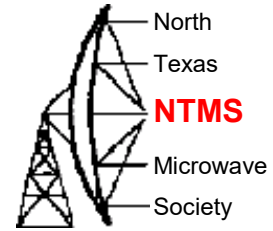
# In development – Rover page

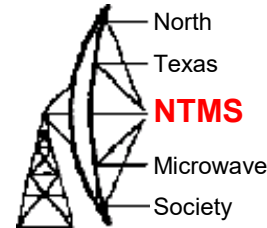


# In development – Rover page



# In development – Rover page





# In development – Rover page

**Rover Locations** Map + Add Location

Community-shared parking spots for portable rover ops.

**New Location**

Grid (Maidenhead) Status

Latitude Longitude

Notes

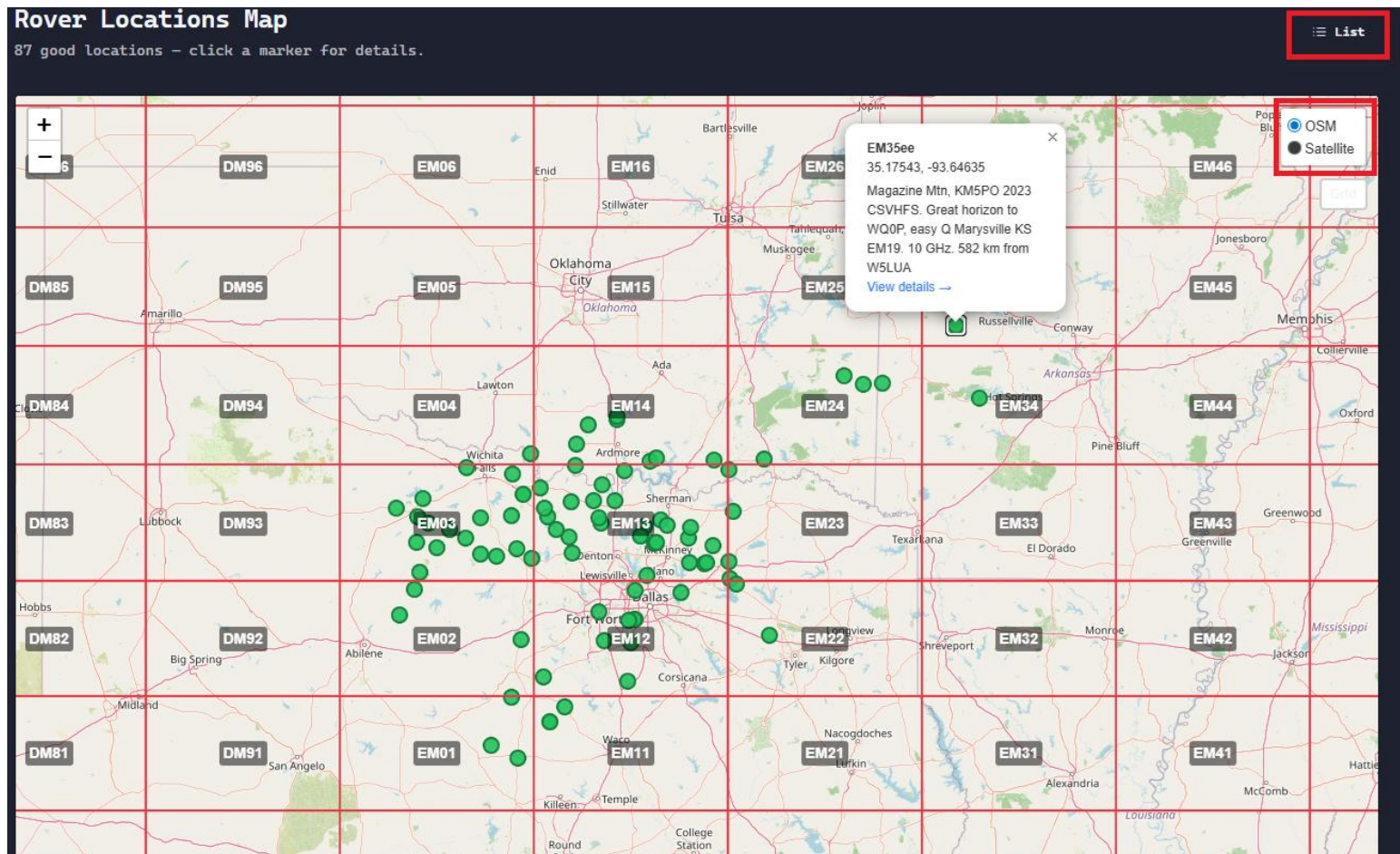
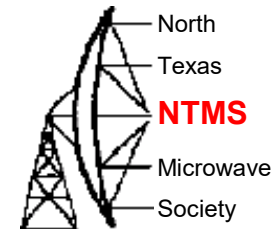
Add Cancel

Show: All

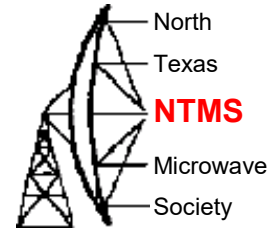
50 Export

Status	Location	Notes	Added (UTC)	Actions
<span>Bad</span>	<b>EM01wi57ao</b> 31.36493, -98.125	EM01WIS7AO Suggested by tool but on private property without road access.	2026-05-01	<span>Edit</span> <span>Delete</span>
<span>Good</span>	<b>EM01vk99tn</b> 31.45651, -98.16823	Event roadside park. 10 GHz. 236 km from WSLUA	2026-05-03	<span>Edit</span> <span>Delete</span>
<span>Good</span>	<b>EM01sn75to</b> 31.56493, -98.43507	EM01SN75TO Suggested by tool. Looks good as long as the road to the windmills is not gated.	2026-05-01	<span>Edit</span> <span>Delete</span>

# In development – Rover page



# In development – Rover page



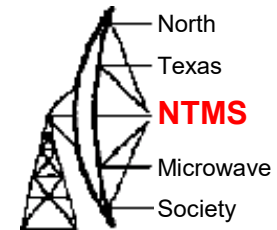
### Rover Location

Good EM35ee22kc ← Back Edit Delete

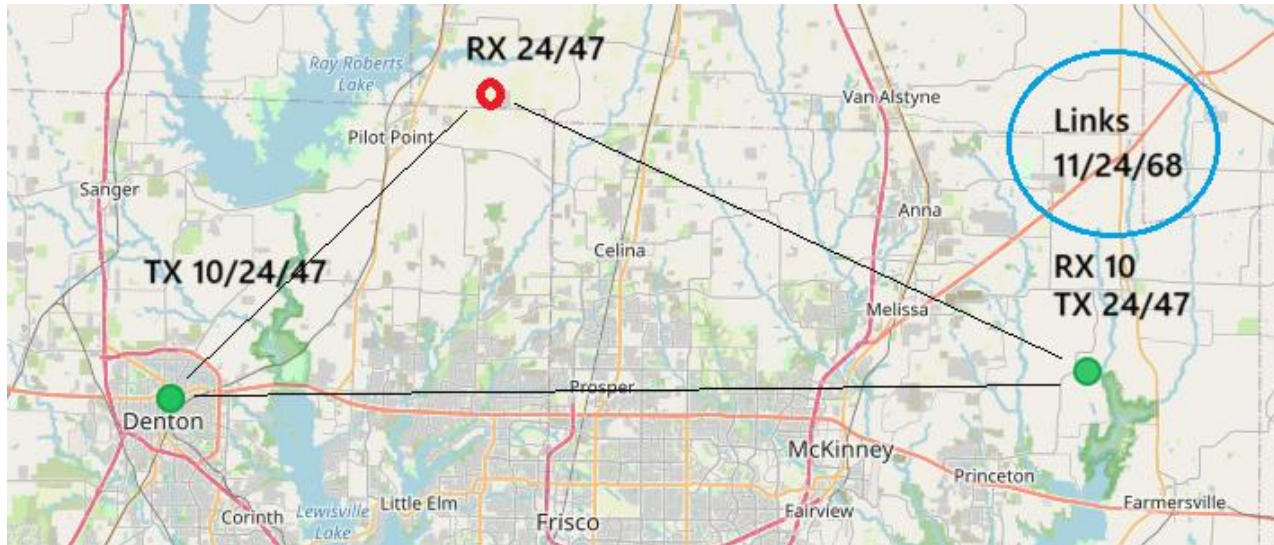
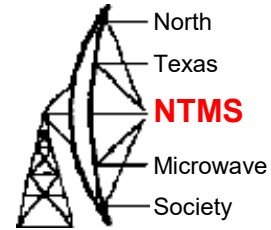
Grid	Coordinates
EM35ee22kc	35.175434, -93.646354
Status	Added
<span>Good</span>	2026-05-03 18:43 UTC
Submitted by	
<a href="#">WSISP</a>	
Notes	
Magazine Mtn, KM5PO 2023 CSVHFS. Great horizon to WQ8P, easy Q Marysville KS EM19 502 km. 10 GHz. 582 km from W5LUA	

Map controls: +, -, Satellite, OSM, Topo

# Vista looking toward OK & KS



# In Development – Beacon monitoring 24/7/365

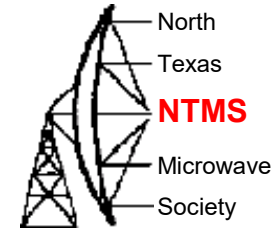


## 7 Commercial Links

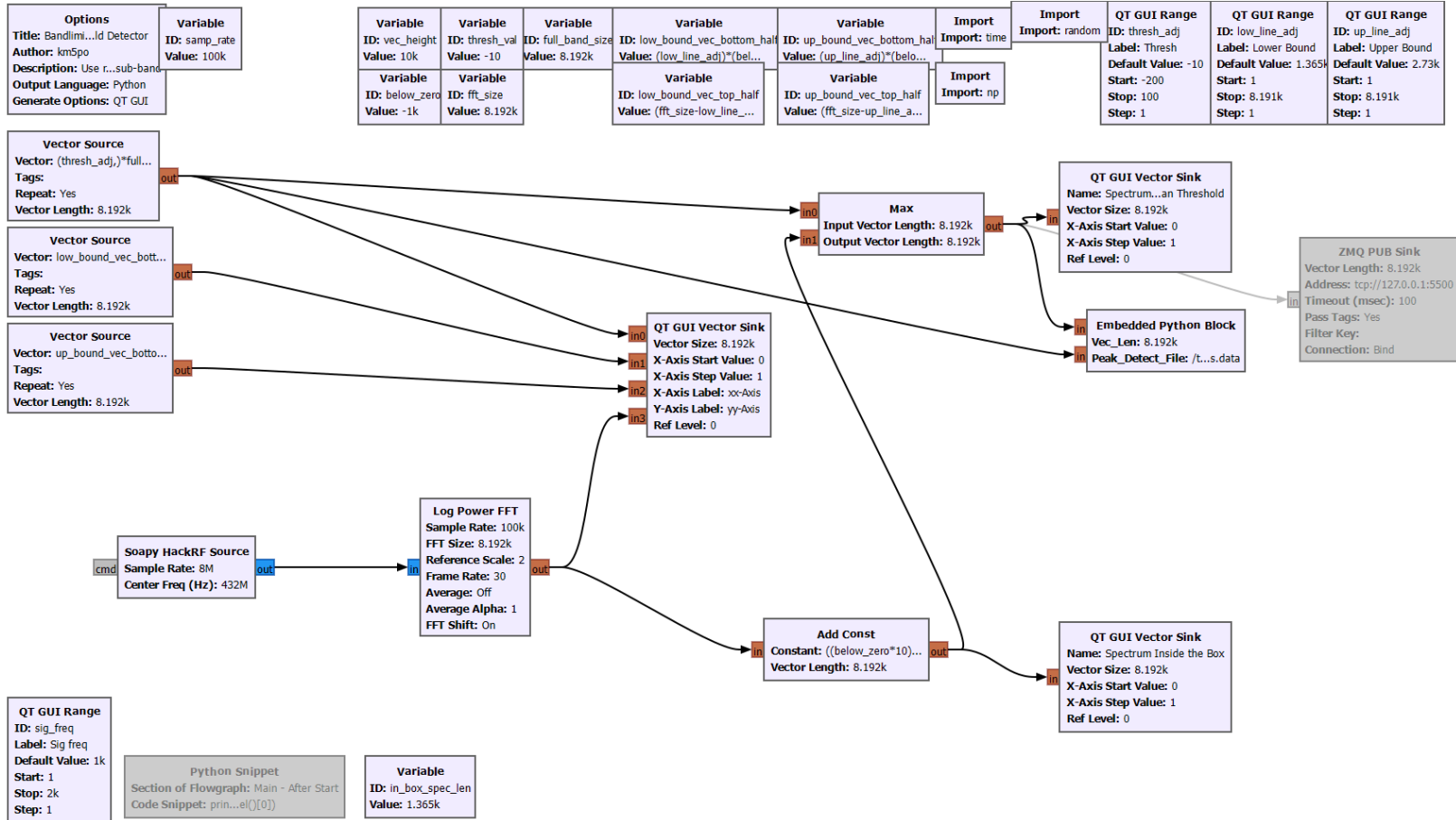
11 GHz dual chain  
24 GHz  
68 GHz

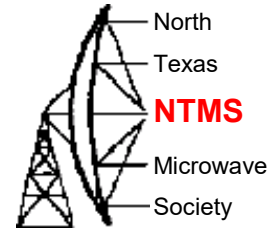
Live polling inserted to NTMS model  
Implemented  
3/14/26

TX 10/24/47	RX 24/47	RX10 TX 24/47
NTMS TX 10/24/47 beacons at TWU 285'	Remote Receive using 60 GHz Wireless data shuttle	W5ISP RX 10 AA5C/B TX 24 W5LUA/B TX 47



# Beacon monitor POC script





# Near/Long term goals

- **Obtain learnings of initial beacon monitoring systems.**
- We have the infrastructure, need the human power.
- Consider the value add and if improvements are needed.
- **Explore other commercial microwave links as partners.**
  - Jim Moss, N9JIM has access to commercial systems in the Bay Area.
- **From learnings, build a low-cost system for those who want to contribute. Need some volunteers.**
- This would consist of an SDR and SBC that would translate an IF radio output to a signal strength measurement and pass the data to the NTMS learning model via the ops internet connection.
- This system would bring value back to wherever it is installed while at the same time assist with calibrating the NTSM model. Think of an op in the Midwest monitoring a beacon and feeding that data back to NTMS and then gaining a benefit of prop prediction improvements in his operating theatre.

# Questions?

