78 GHz DXing in the Desert Southwest

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MICROWAVE UPDATE CONFERENCE

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78 GHz DXing in the Desert Southwest

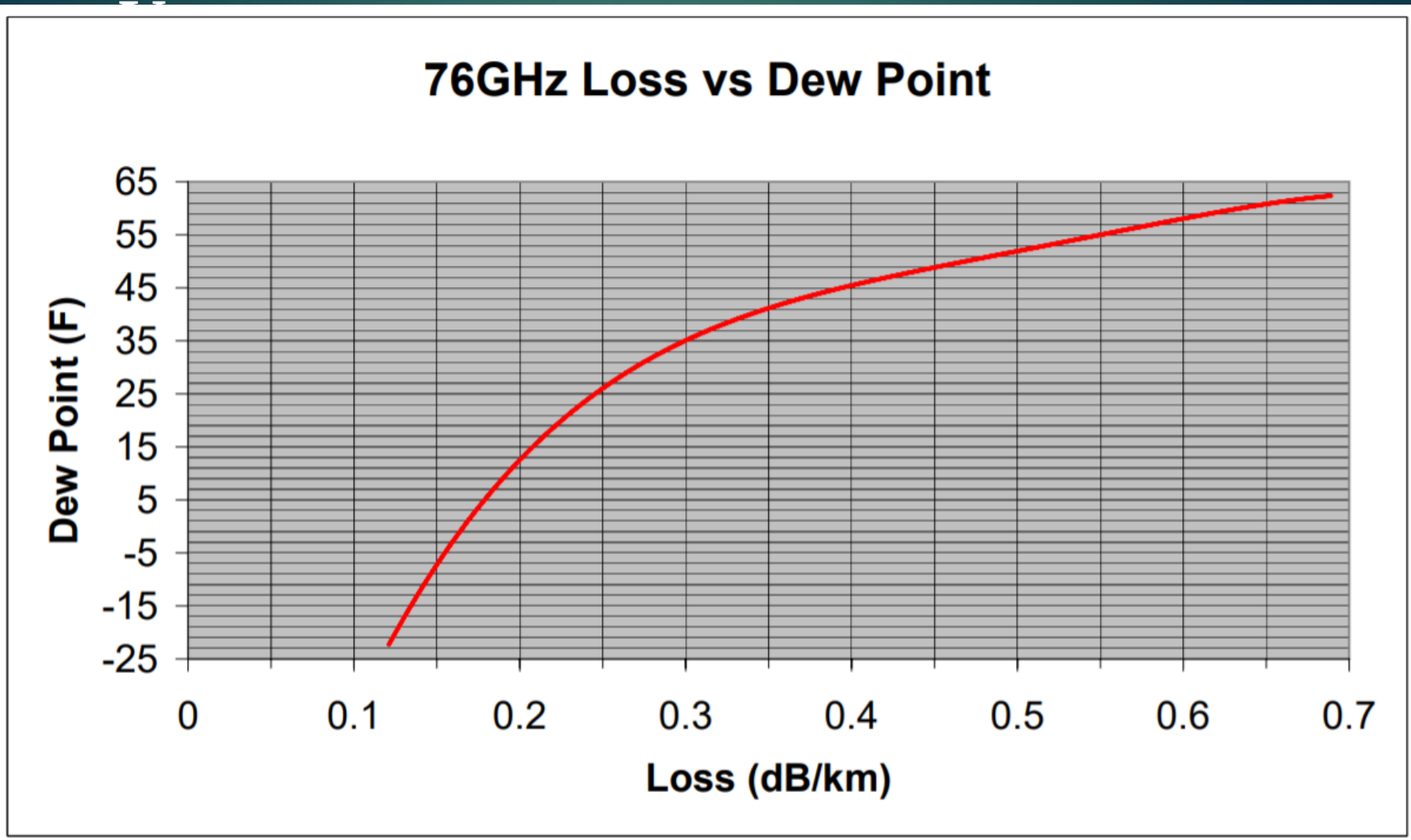
- Motivation for Arizona 78 GHz Effort
- 78 GHz Propagation
- Setting up a High Performance Station
- Analysis of Possible Paths
- Weather Forecasts & Choice of Dates
- Operating Results
- Further Work to be Done

Motivation for Arizona 78 GHz Effort

- New High Performance Radio Hardware Available Now
- More Capability to Explore Difficult Paths
- More Stations Becoming Active
- Able to be Active in Colder Months
- Mountainous Terrain with Dry Air
- Disappointment with Lake Superior

78 GHz Propagation

- **Heavily Affected by Atmospheric Water**



78 GHz Propagation

- **Heavily Affected by Atmospheric Water Vapor**
- **Radio Technology Historically Poor**
  - **-High Noise Figures from DSB Mixers**
  - **-No Preamps**
  - **-Low Transmit Powers from Multipliers/ Mixers**
  - **-Poor Local Oscillator Stability**
- **So Paths Limited to Line of Sight on a Dry Day!**

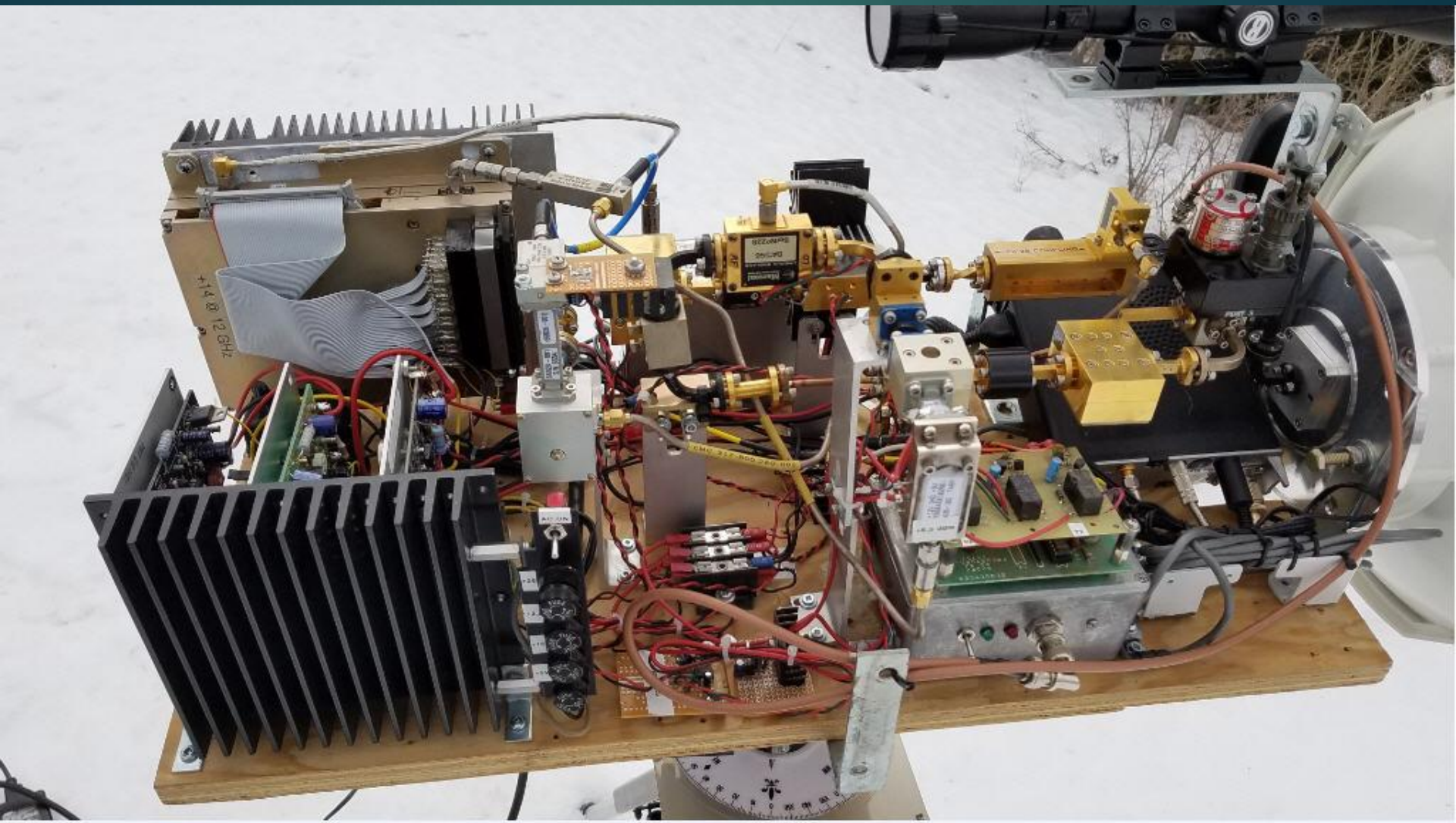
High Performance HDW Available Now

- Kuhne Transverter
- Preamplifiers, Power Amps, WG Switches

High Performance HDW Available

- **Low Phase Noise Local Oscillators**
- **10 MHz Reference, Multi-Programability**

High Performance “the Old Way”



More Stations Becoming Active

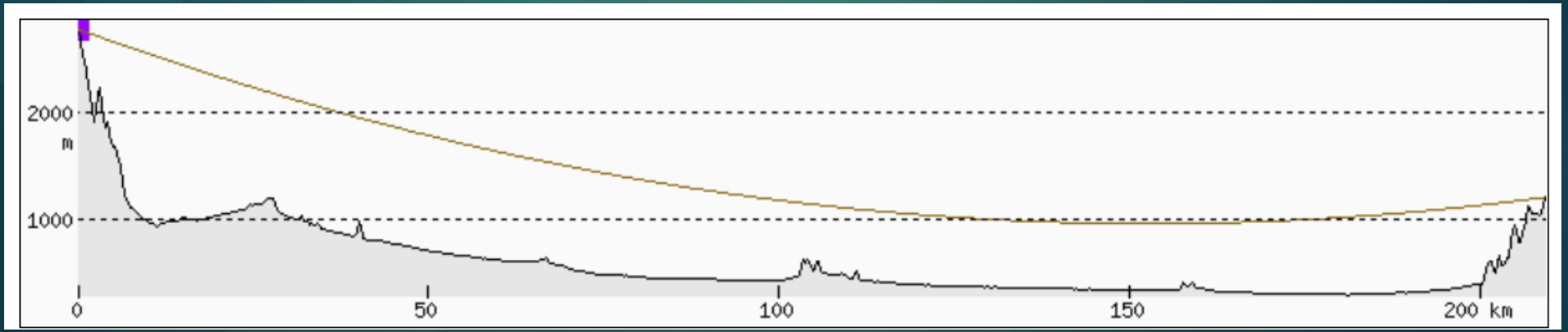
- **The Availability of the Kuhne Transverter has Resulted in Many New Stations QRV**
- **High Sticker Price (~$2000) but Extraordinary Capability in a Small Package**
  - **~1/3 W*, Good NF and Image Rejection, Frequency Agile**
- **NA Stations with Kuhne 76 include VE2UG, VE4MA, W5LUA, K8ZR, WB8TGY, WW8M**

*** FCC Decreed Power Limit is 316W ERP**

Analysis of Possible Paths

- "Many" LOS Paths in Phoenix ~60 km
- "Many" LOS Paths in AZ from 200 -270 km
- On a Dry Day ….. Signals Should be Huge!

Mt Lemmon to White Tanks 207 km



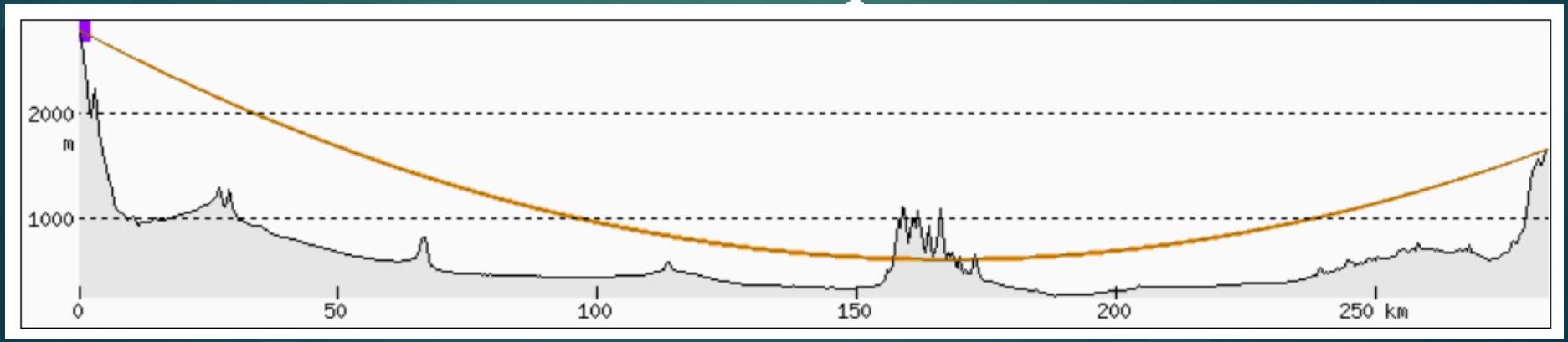
Analysis of Possible Paths

- **World Record is 289 km (AZ-CA)**

  -Hard to find LOS over 270 km…NON LOS?

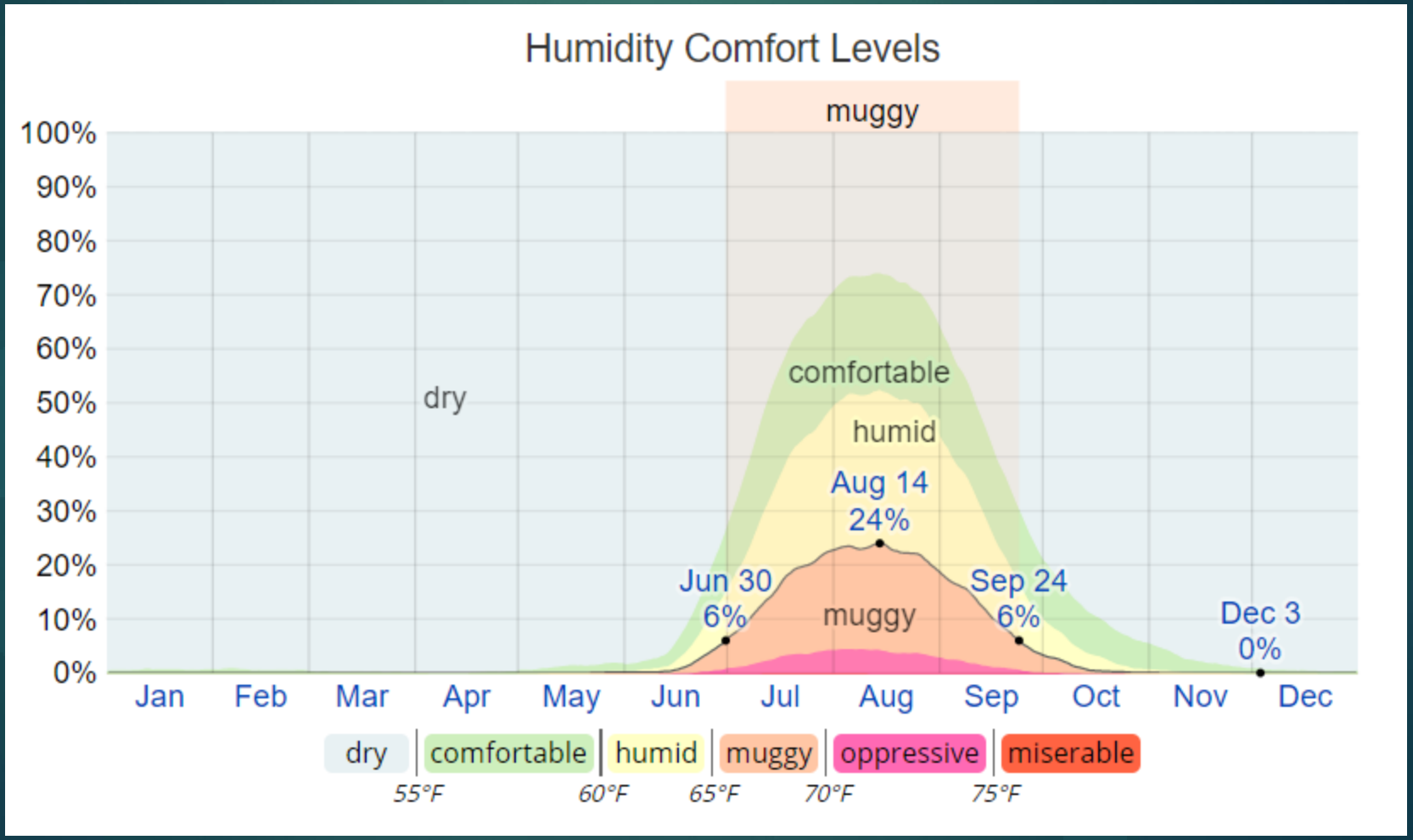
  -Path Programs Do Not Agree on Extent of Obstruction

Mt Lemmon to Mt Harquahala 283 km



Weather Forecasts & Choice of Dates

- **Historical Phoenix Weather Pattern**



Weather Forecasts & Choice of Dates

- **This year WX Was Anything but Normal**
- **2x Normal Rainfall, Temps >10 deg F Lower**
- **Normally the Best Months are November to March…But Mountain Top Access Can be Difficult**
- **Decided to Try for Early March…then Over 3 ft of Snow in Mountains!**

Weather Forecasts & Choice of Dates

9 Day Phoenix Forecast for Early March 2019

Approx 20 Deg F Dew Pts!

Operating Results Day 1

- **Al W5LUA & Tony K8ZR Joined VE4MA**
- **Reprogramed Tony's LO from 76 to 78 GHz**
- **Had "One km" local QSOs with Al & Tony**
- **Moved to San Tan Mountain Site for successful 60 km QSOs on 10, 24, 47 & 78 GHz with Group on Shaw Butte (Mark N0IO, Bill W7QQ and supported by Kevin AD7OI and Tammy KI7GVT)**
- **K0KFC "10/24 Liason Rig" Tripod Toppled in Wind**

Operating Results Day 1

W7QQ 10 GHz on Shaw Butte

Operating Results Day 1

24/ 47/ 78 GHz on Shaw Butte

Operating Results Day 1

N0IO with 47 & 78 GHz on Shaw Butte

Operating Results Day 1

Edge of San Tan Mountain
Looking Towards Shaw Butte

Operating Results Day 2

- VE4MA, Al W5LUA, and Tony K8ZR Travel to 9000 ft Mt Lemmon near Tucson, AZ
- Supported by Steve KJ7OG and Ron K7RJ
- Second Group Travels to White Tanks Mtn on West side of Phoenix (207 km hop)
- Weather on Mt Lemmon, Snow Cover, Cloudy, 29 deg F, Dew Point 0 to -10 Deg F ! (Approx 35 dB of Water Vapor Loss)
- 78 GHz Signals Weak at White Tanks !?

Operating Results Day 2

White Tanks Mountain

Operating Results Day 2

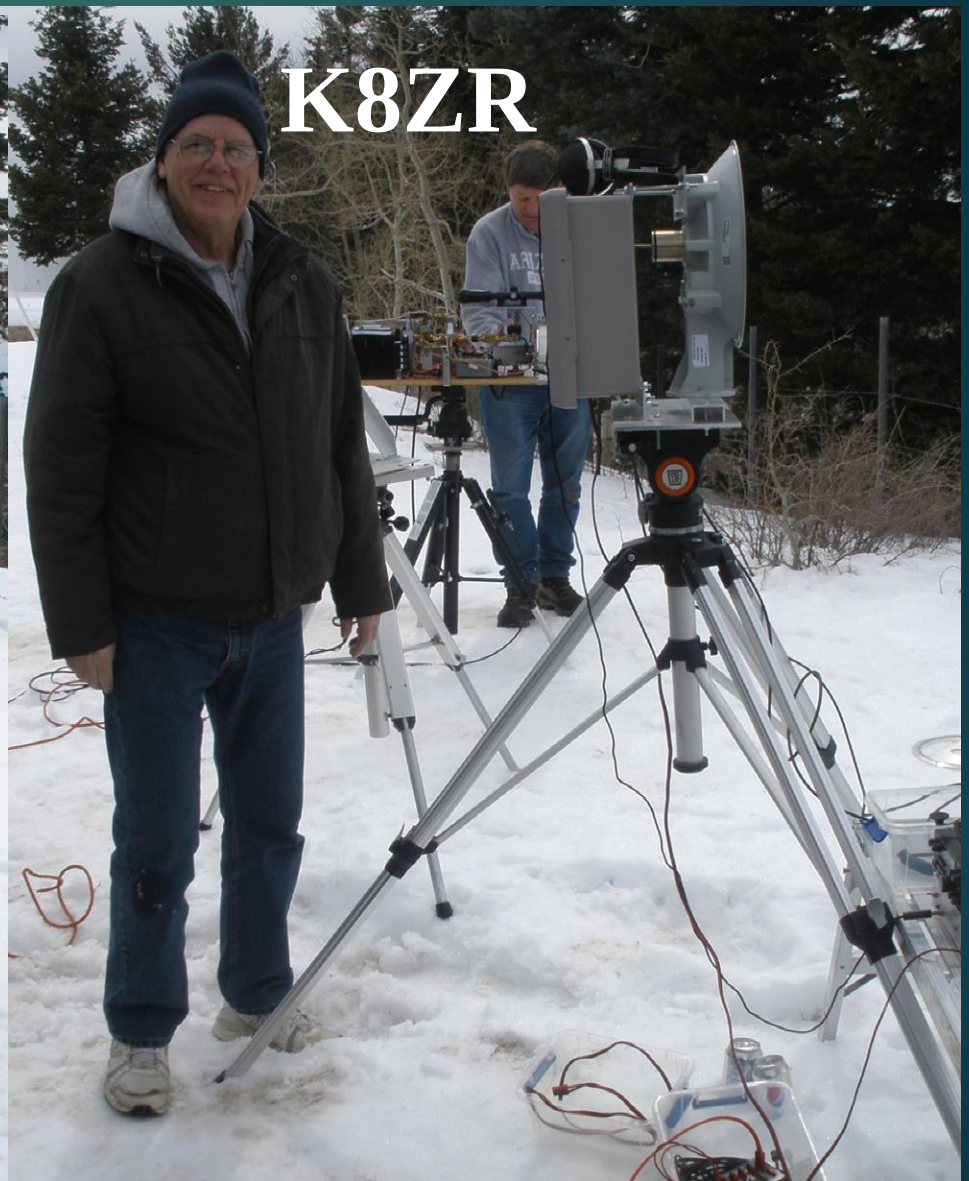
View From Mt Lemmon

Operating Results Day 2

Operating Results Day 2

- Signals Much Better at Mt Lemmon!

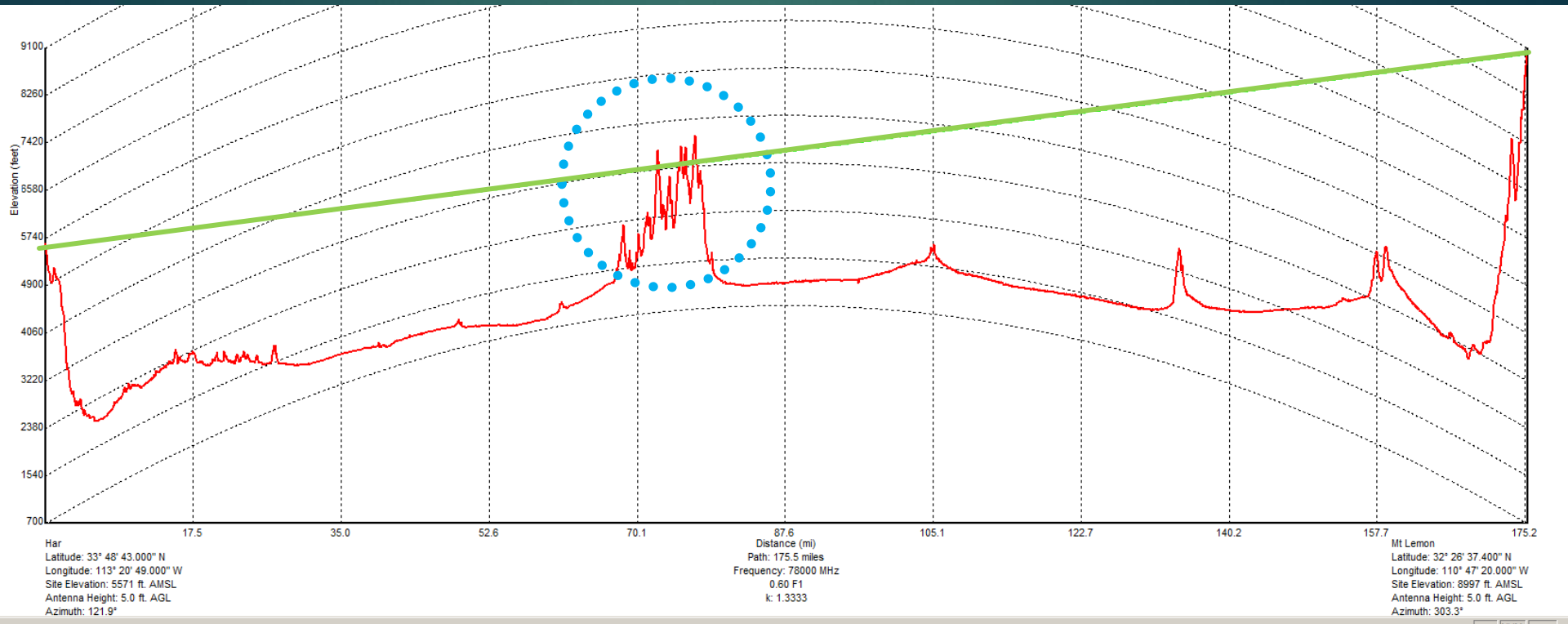
Operating Results Day 2



Operating Results Day 2

Operating Results Day 3

- **Mt Lemmon to Mt Harquahala 283 km**



- **How Much Obstruction Loss?**

Operating Results Day 3

- **Weather Changed Abruptly on Mt Lemmon**
- **50 MPH Wind Gusting to 64 MPH**
- **Dew Point Temperature ~ 25 Deg F**

  - Water Vapor Loss~52 dB..Increase of 17 dB !
- **Extreme Difficulty Setting Up 10 G Liason**
- **10 G Weak and No Signals on 47 or 78 GHz**

Operating Results Day 3

- View from Mt Harquahala

Operating Results Day 3

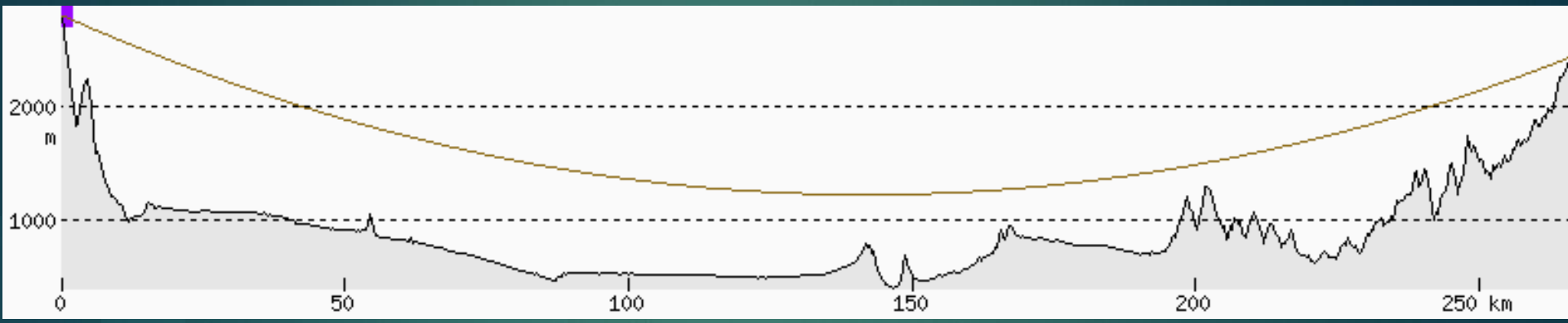
- **Group on Mt Harquahala**

Operating Results Day3

- Group on Mt Lemmon

Further Work for Fall 2019

- **Try Mt Lemmon to Mt Union 265 km LOS**



- **Try Some LOS & NON LOS Hops >290 km !**
- **Play with 122 & 241 GHz on Shorter Hops**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QUESTIONS?