North Texas NTMS Microwave Society

March 2019 Arizona Expedition

W5LUA

April 13, 2019

47 & 75 GHz DX Records

www.arrl.org

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47 GHz			
Tropo (C)	344.8	AD6FP /6 (DM07as) - W6QIW/6 (DM04ms)	19-Sep-15
Tropo (C)	343	W6QI/6 (DM04ms) - AD6FP/6 (DM07bs)	30-Oct-05
Tropo (C)	246	W0EOM/6 (CM97ei) - KF6KVG/6 (DM06ms)	9-Feb-03
Tropo (C)	232	KB8VAO/6 (CM96qi) - AD6FP/6 (DM04ms)	18-Sep-04
Tropo (C)	215	KT1J/N1JEZ (FN34bi) - VE2UG/VE3FN (FN26rf)	30-Jun-16
Tropo (C)	205	N1JEZ/1 (FN44ig) - WA1MBA/1 (FN42bl)	3-Jul-05
Tropo (C)	174	W3IY/4 (FN10ff) - W4SW/4 (FM08us)	14-Nov-01
Tropo (C)	120	NU7Z (CN87ms) - KD7TS (CN96aw)	4-Oct-03
75 GHz			
LOS	289	AD6IW (CN90fl) - KF6KVG (CM97av)	23-Jun-14
LOS	289	AD6IW (CN90fl) - K6GZA (CM97av)	23-Jun-14
LOS	205	N1JEZ/1 (FN44ig) - WA1MBA/1 (FN42bl)	19-Sep-14
LOS	177	AD6FP/6 (CM88qp) - KF6KVG/6 (CM97ad)	1-Mar-02
LOS	177	W0EOM/6 (CM88qp) - KF6KVG/6 (CM97ad)	1-Mar-02
LOS	110	K2AD (EM96ur) - W2SZ (FM07fm)	20-May-99

LOS	60	W2SZ (FM07fm) - WA4RTS (FM08ia)	1-May-99

The Plan & Results

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Date			
3/5/19	Tony leaves Ohio		
3/6/19	Tony arrives in Allen, Tx		
3/6/19	We drive to Pecos, Tx		
3/7/19	We arrive in Apache Junction, AZ		
3/8/19 AM	We make 1km QSOs in trailer park (My first ever 78 GHz QSO!)		
3/8/19 PM	Worked 63km on 10, 47, 78 GHz		
3/9/19	Drove to Mt. Lemmon, AZ – worked 207 km on 10, 47, 78 GHz		
3/10/19 AM	Drove back to Mt. Lemmon to attempt a 285 km path – only worked on 10 GHz		
3/10/19 PM 3/11/19 3/12/19	Drove to Van Horn, TX I arrived home Tony arrives home in Ohio		

Western Operation

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- The Western group's operation was organized by Kevin Jacobson AD7OI and his wife Tammy, KI7GVT. Kevin has access to many sites in the Phoenix area. Mark Lewis N0IO came down from Grand Junction, CO with 10, 24, 48, 78 GHz equipment and Bill Schwantes W7QQ drove over from Santa Fe, NM to assist.

Eastern Operation

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- Mt.Lemmon was organized by Barry Malowanchuk VE4MA, Steve Bell KJ7OG and his wife Clare White. Steve is a Univ of Az alumni and was able to gain us entry into the Mt.Lemmon Observatory. Ron Jones K7RJ also assisted. This is where Barry, Tony K8ZR and I operated from.

Day 1 Morning was spent in Apache Junction, AZ

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Day 1 Afternoon

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- Tony, Barry and I went to DM43ee15hr and Mark and Bill went to DM33wo
- QSOs completed at 66 km on 10, 47 and 78 GHz
- We were pumped for Day 2…

At the corner of Skyline Dr and Wagon Wheel Rd, some town, AZ DM43ee15hr
W5LUA & K8ZR setup

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W5LUA Setup for 47 & 78 GHz

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At the corner of Skyline Dr and Wagon Wheel Rd, some town, AZ DM43ee15hr
K8ZR & VE4MA

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View from DM43ee15hr

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A closer look at the sign reveals….!

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Mark N0IO operating from Shaw Butte DM33wo on Day 1

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Day 2

- Tony, Barry and I went to Mt. Lemmon at over 9000 ft in DM42ok56ig and Mark and Bill went to DM33rn26sp on White Tanks
- QSOs completed at 207 km on 10, 47 and 78 GHz
- We were once again pumped for Day 3…

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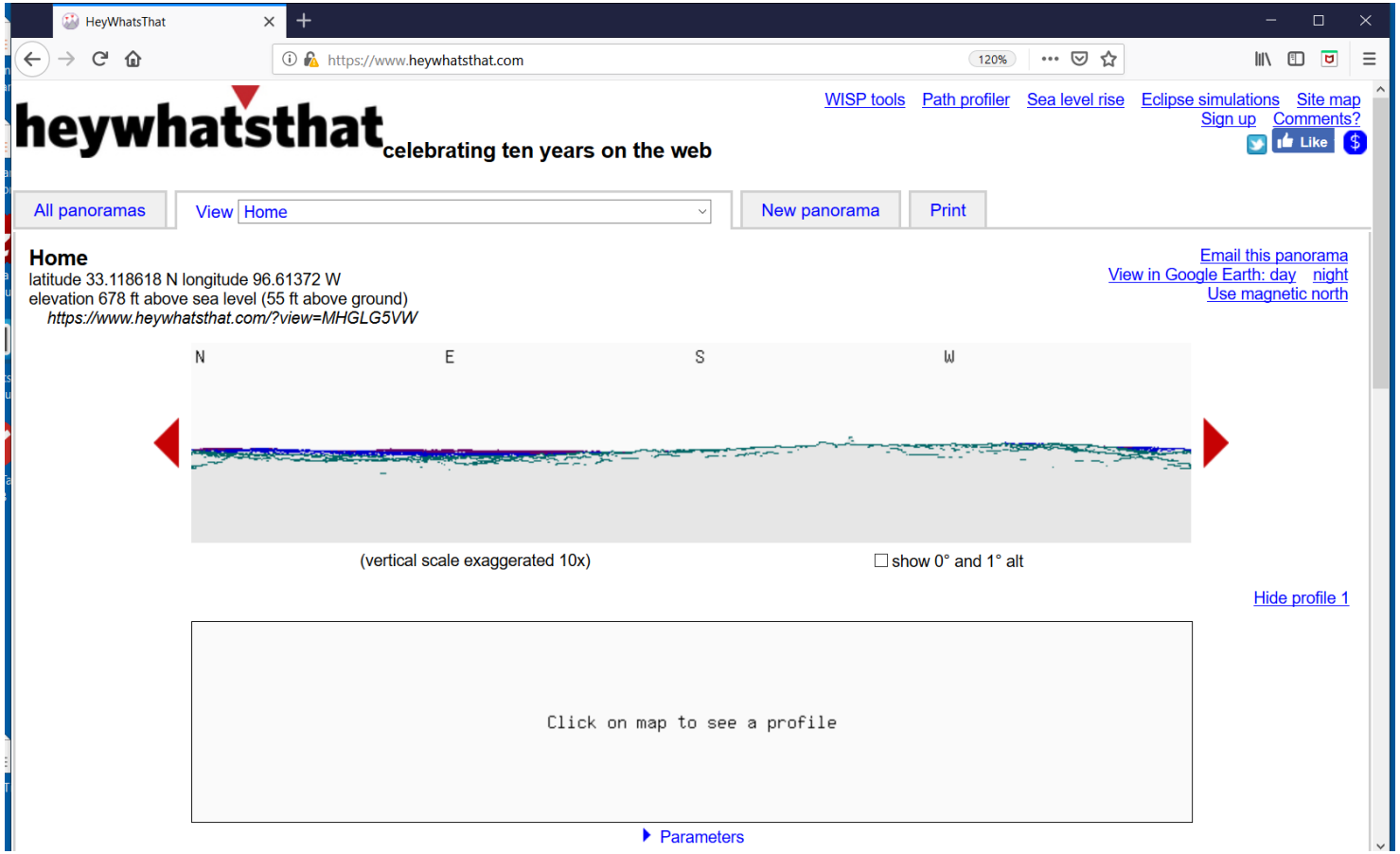
https://www.heywhatsthat.com



Visual Horizon from Mt. Lemmon, AZ

https://www.heywhatsthat.com

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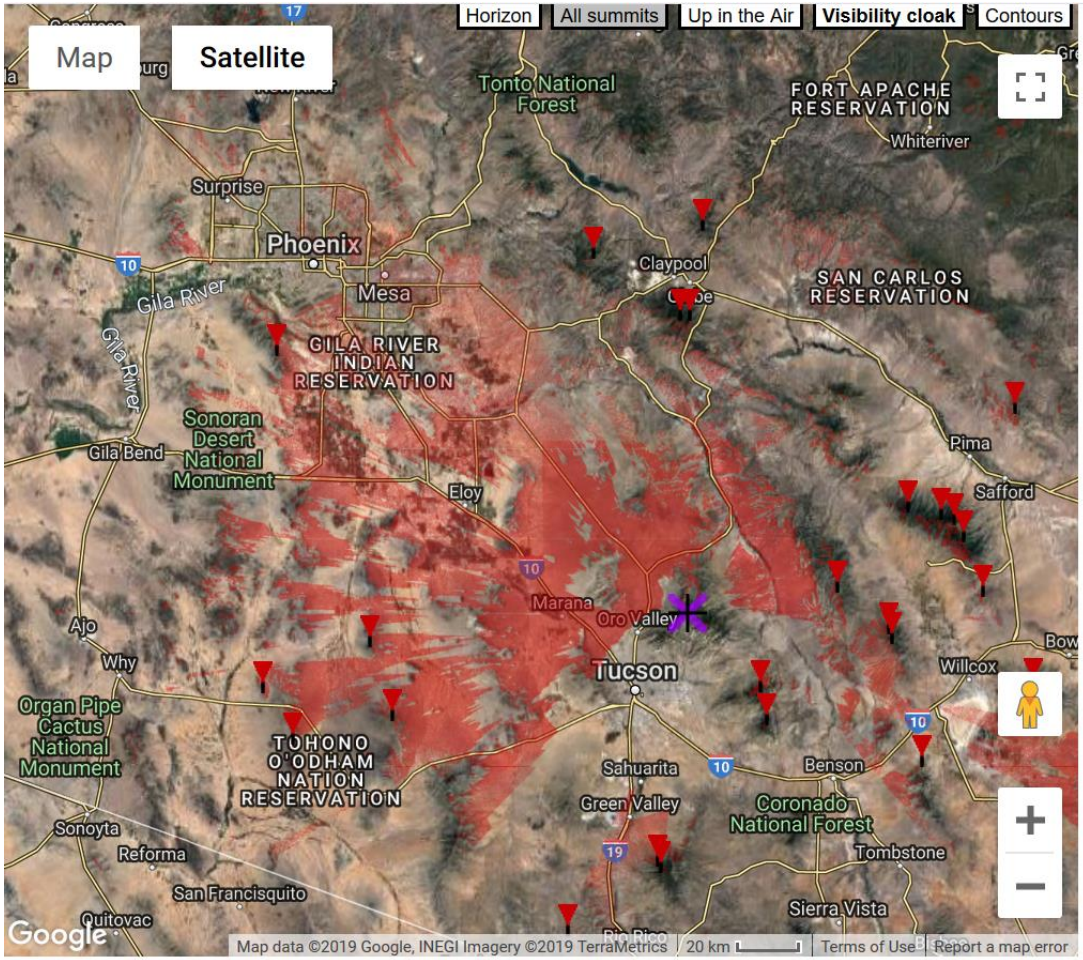

32.442708 N 110.788889 W 9160 ft

Click here to re-center map on Mt.Lemmon

0°	**East Mountain**	58 miles	6893 ft
2°	**Apache Peaks**	76 miles	6939 ft
50°	**Rose Peak**	107 miles	8783 ft
56°	**Grey Peak**	97 miles	7470 ft
58°	**Bryce Mountain**	76 miles	7280 ft
65°	**West Peak**	48 miles	8658 ft
70°	**Webb Peak**	54 miles	10007 ft
71°	**Hawk Peak**	56 miles	10614 ft
75°	**Heliograph Peak**	57 miles	10007 ft
81°	**Bassett Peak**	30 miles	7628 ft
86°	**Greasewood Mountain**	59 miles	7090 ft
95°	**Reiley Peak**	40 miles	7608 ft
98°	**Muskhog Mountain**	41 miles	7415 ft
102°	**Dos Cabezas Peaks**	71 miles	8314 ft
104°	**Wood Mountain**	88 miles	7303 ft
109°	**Sugarloaf Mountain**	91 miles	7290 ft
123°	**Dragoon Peak**	56 miles	6440 ft
137°	**Mica Mountain**	21 miles	8619 ft
145°	**Rincon Peak**	27 miles	8264 ft
150°	**Cerro San José**	94 miles	8353 ft
186°	**Mount Hopkins**	52 miles	8451 ft
187°	**Pete Mountain**	51 miles	7569 ft
201°	**Bartolo Mountain**	69 miles	5335 ft
250°	**Mount Devine**	63 miles	4777 ft
252°	**Ben Nevis Mountain**	84 miles	3432 ft
260°	**Sierra Blanca**	87 miles	3563 ft
264°	**Gu Achi Peak**	64 miles	4521 ft
302°	**Montezuma Peak**	97 miles	4308 ft
345°	**Pinto Peak**	73 miles	5906 ft
358°	**Pinal Mountains**	58 miles	7838 ft

(Bearings are true; for magnetic bearings

DM42ok56ig at University of Arizona Observatory at Mt. Lemmon, AZ

http://k7fry.com/grid/?qth

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White Tank Mountain, AZ

http://k7fry.com/grid/?qth

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White Tank to Mt. Lemmon, AZ

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http://k7fry.com/grid/?qth

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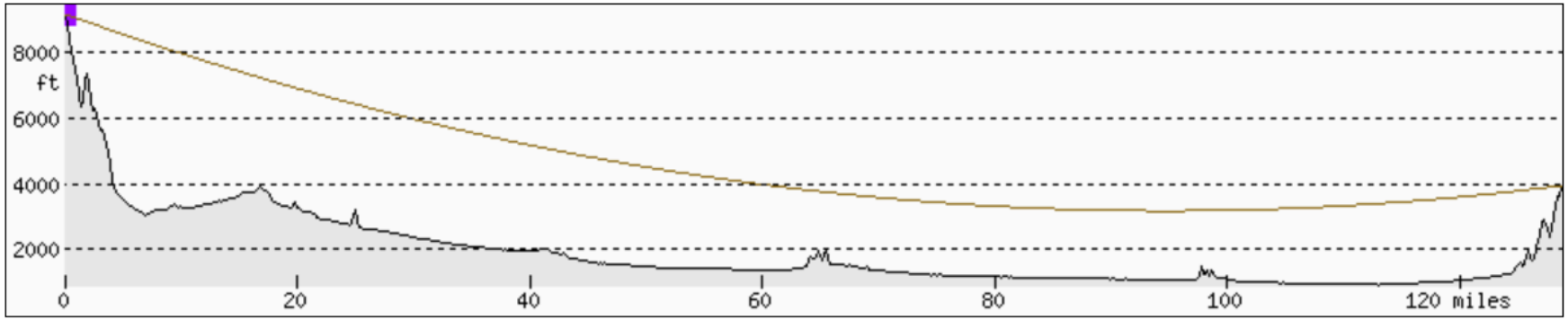
Mt. Lemmon to White Tank Mountain 207km (129 miles) Line of Sight Path



Parameters

DM42ok56ig
VE4MA Barry
W5LUA Al
K8ZR Tony

https://www.heywhatsthat.com

DM33rn26sp
N0IO Mark
W7QQ Bill

Driving towards Mt. Lemmon Near Tucson, AZ

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University of Arizona Astronomy Observatory

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W5LUA, K8ZR, VE4MA on 78 GHz

View from Mt. Lemmon

White Tanks DM33rn26sp

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W7QQ 78GHz at DM33rn26sp

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Radio Ridge at Mt. Lemmon, AZ Elevation 9045 ft

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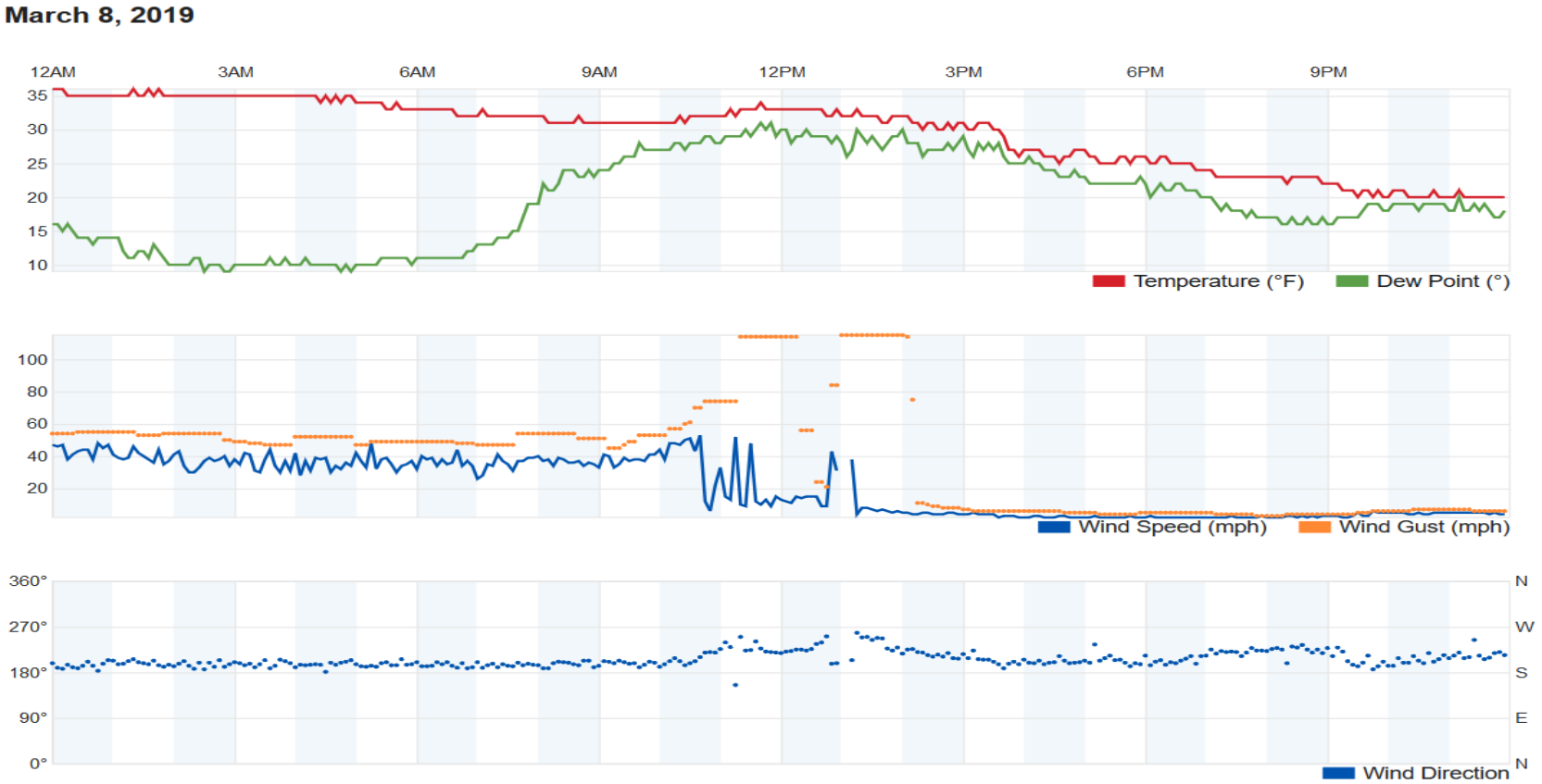

https://www.wunderground.com/dashboard/pws/KAZMOUNT7#history/s20190309/e20190309/mdaily

Radio Ridge at Mt. Lemmon, AZ Elevation 9045 ft

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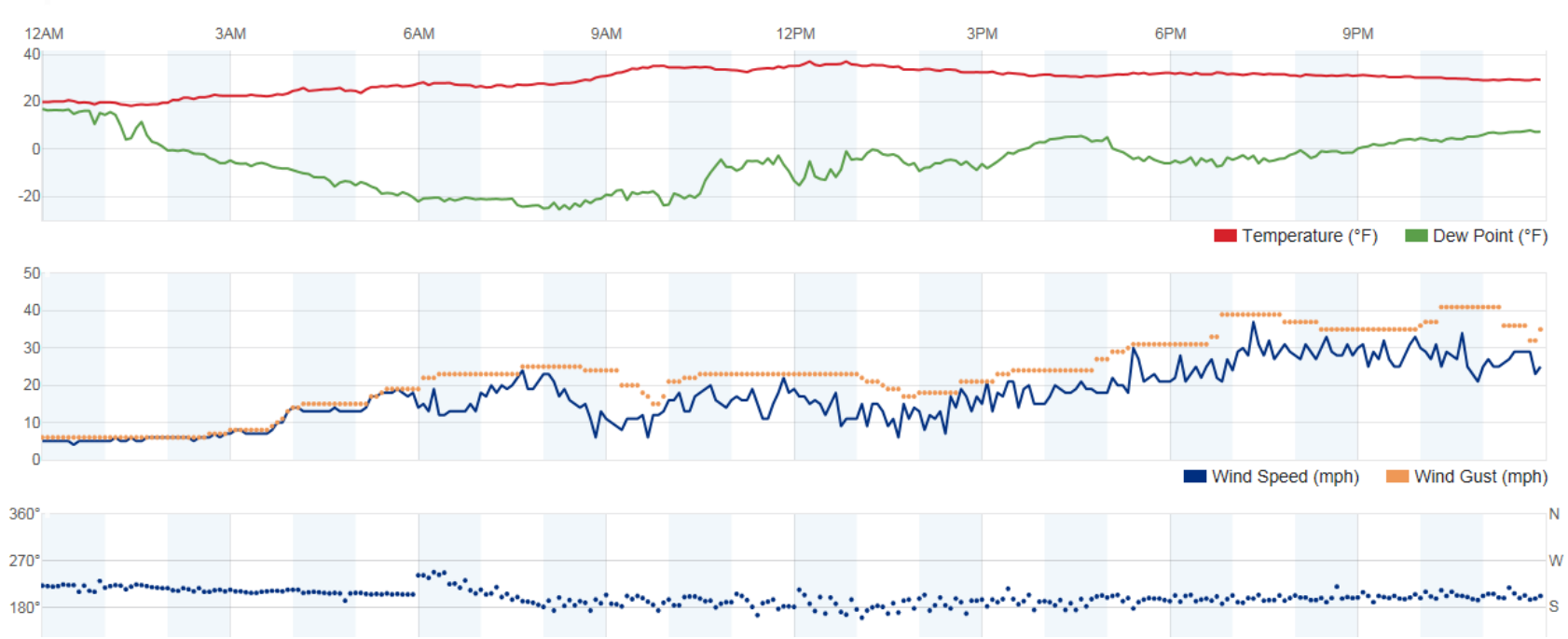
Weather History Graph
March 9, 2019



https://www.wunderground.com/dashboard/pws/KAZMOUNT7#history/s20190309/e20190309/mdaily

Radio Ridge at Mt. Lemmon, AZ Elevation 9045 ft

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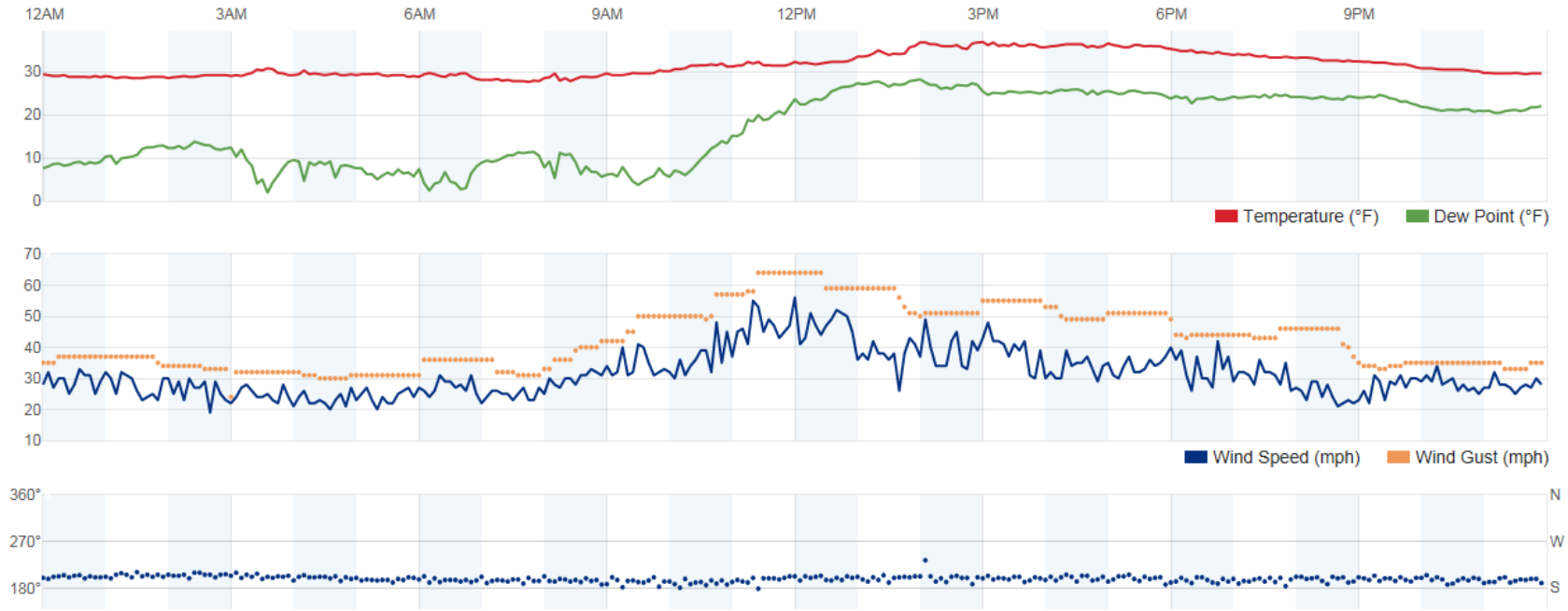
Weather History Graph
March 10, 2019



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Path Loss in the 4mm Band

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- Free Space Path Loss is defined as
  20 log (4πd/λ)
- 207km Path at 4mm = 176 dB loss
- Pout = +10 dBm into 1 ft dish at 45 dBi = +55 dBmi (Legal Limit)
- Power received = +55 - 176 dB path loss = -121dBm
- Adding in antenna gain of 45 dBi should result in a received signal level of -121 + 45dBi = -76dBm at receiver port
- Receiver noise floor in a 1 kHz BW = -144 dBm plus NF = -144 + 5dB NF = -139 dBm
- Therefore on a perfect day with no humidity and no oxygen, the received signal should have a signal to noise ratio of -76 dBm - -139dBm = 63dB S/N
- No problem, except we are not in outer space……..

Attenuation due to Moisture

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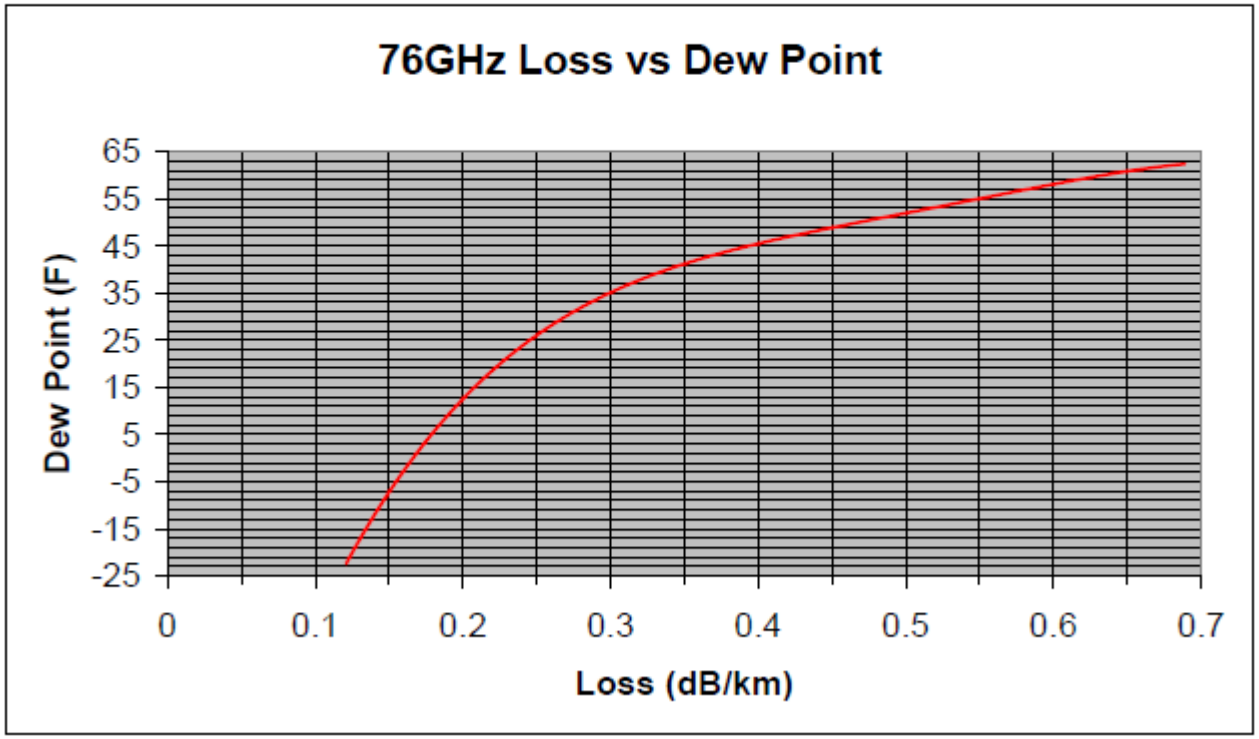
Path Loss Charts. This path loss is ONLY the part due to atmospheric attenuation/absorption. Based on Lieb formulations
Prepared by Brian Justin WA1ZMS. Calculated for Sea Level (standard pressure).



Attenuation vs Dew Point

Based on 207 km path

Date	Dew Point	Loss	S/N	
3/8/2019	30F	56 dB	7 dB	
3/9/2019	-8F	31 dB	32 dB	Success!
3/10/2019	25F	52 dB	11 dB	
Summer	65F	145 dB	-82 dB	

Day 3

- Day 3 was a 285 km path which is just short of the 289 km record held by AD6IW, KF6KVG & K6GZA
- Tony, Barry and I went back to Mt. Lemmon and Mark and Bill moved on to the Harquahala Mountains in southwestern Arizona
- We arrived on Mt. Lemmon with the winds howling at over 60mph and dew point of 28F
- We could only work on 10 GHz.
- We still went home happy with 207 km under our belts….there is always late fall of 2019