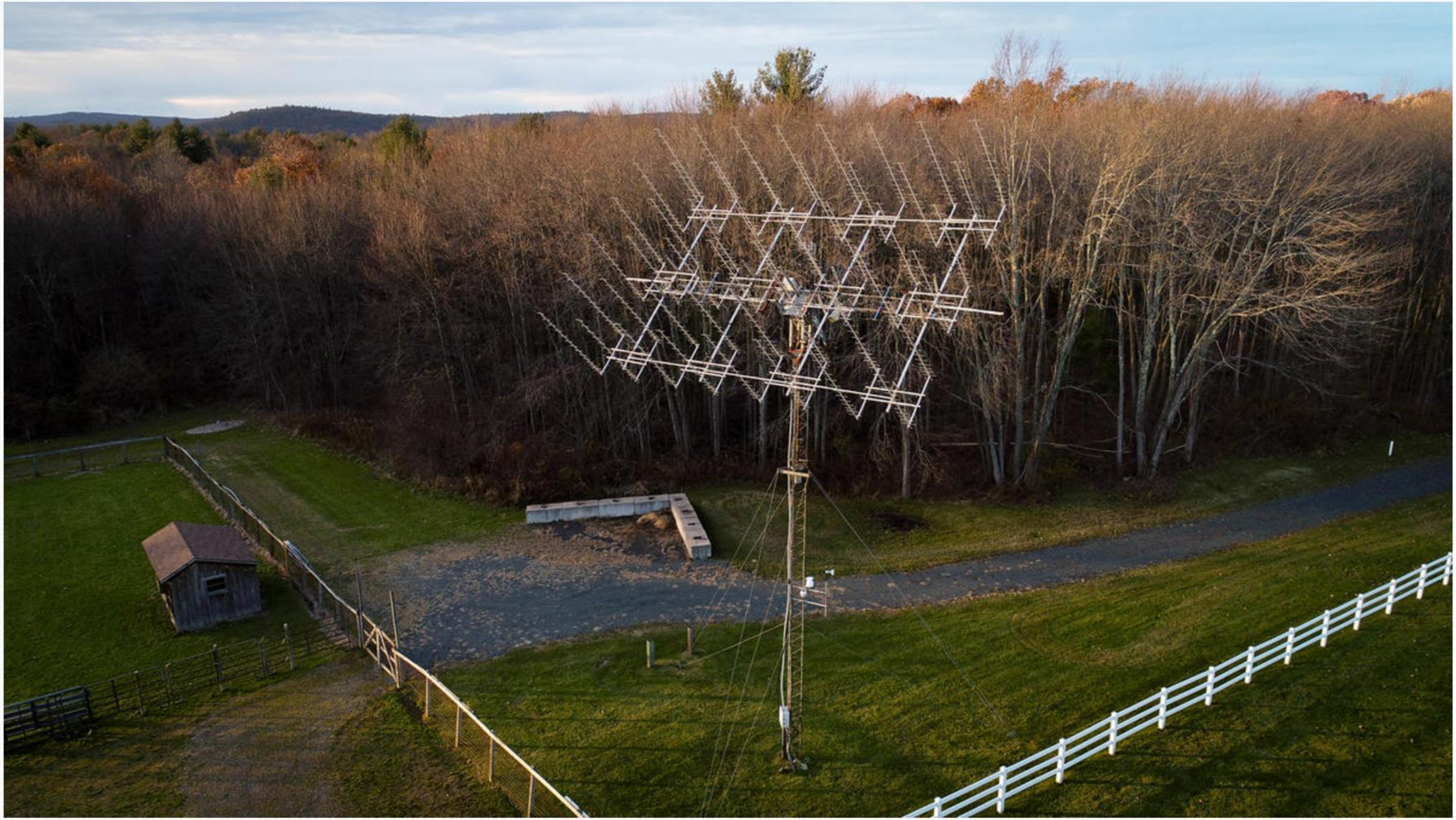


NC1I

The Anatomy of an EME QSO

- AVERAGE MOON DISTANCE: 384,000km
  - Average Round Trip: 770,000km!
  - Propagation Path Loss: 250+ dB!
  - Echo delay: ~ 2.4 Seconds
- 93% OF WAVE ABSORPTION BY MOON
  - Only 7% wave reflection
- ANGLES AND BEAMWIDTH
  - Moon is ~ 1 degree wide when seen from earth
  - Antenna is 0.00....1 degree wide when seen from the moon!



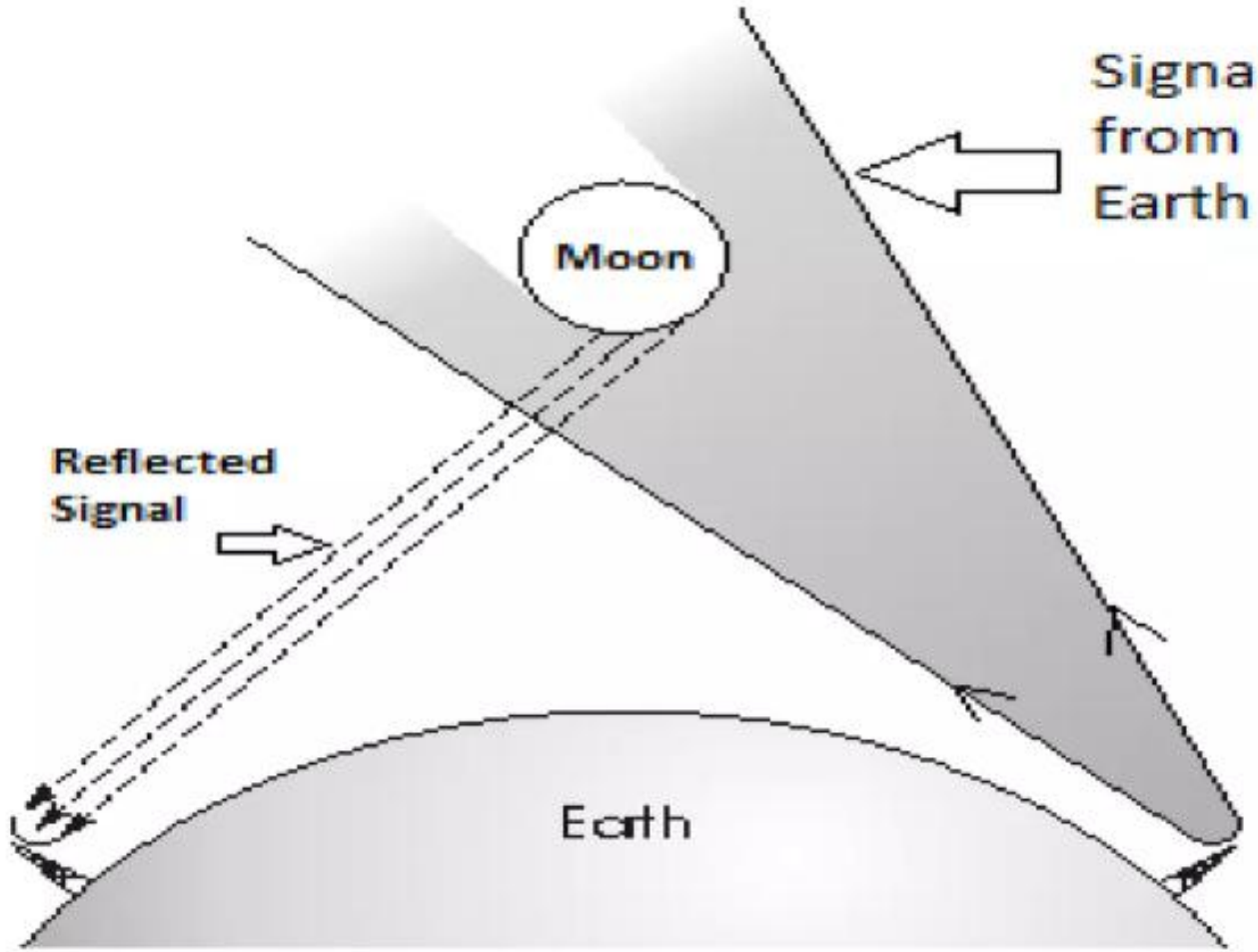
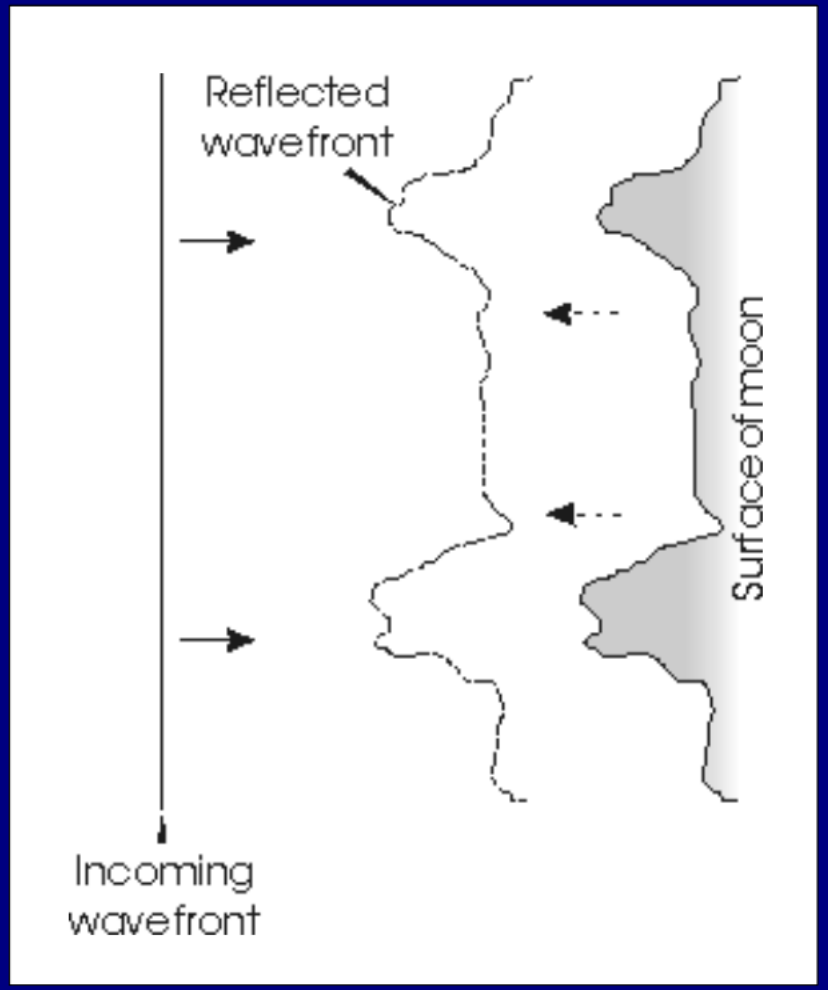


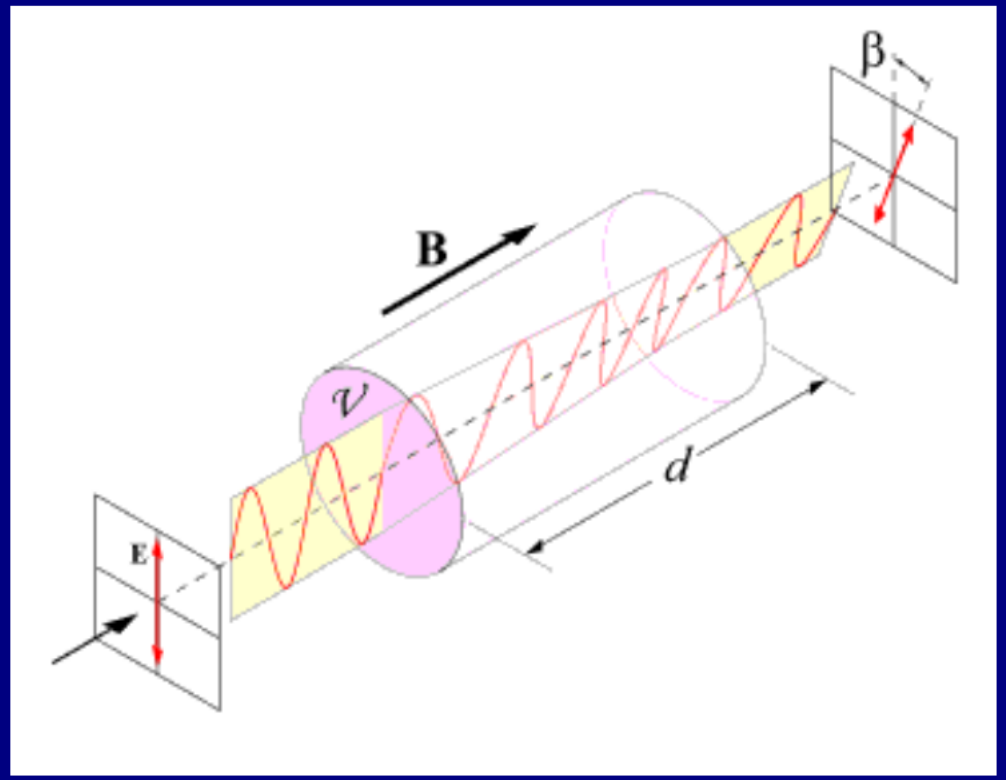
Fig 1. Conceptual model of EME

Impairments in an EME QSO

- POLARIZATON OFFSET
  - 90-degree polarization offset between stations, forget it!
    - FARADAY ROTATION: Polarization rotation due to Ionosphere and earth's magnetic field. At 432MHz, up to 1.5 complete rotation, at 1296MHz 0.25 rotation. Negligible at higher F.
    - SPATIAL OFFSET: Geometry of the path between two stations.
- LIBRATION FADING
  - Signal fading caused by the movement of the moon and surface imperfections.
  - The higher the frequency, the faster the fading
- COSMIC NOISE, SUN NOISE
  - When Moon has noisy sky in background, forget it!
  - When Sun and Moon line up, forget it!
- QRM, QRN...

Libration And Faraday Rotation





1946, U. S. Army Project Diana



Bounced a RADAR signal (111.2 MHz) off of the Moon!

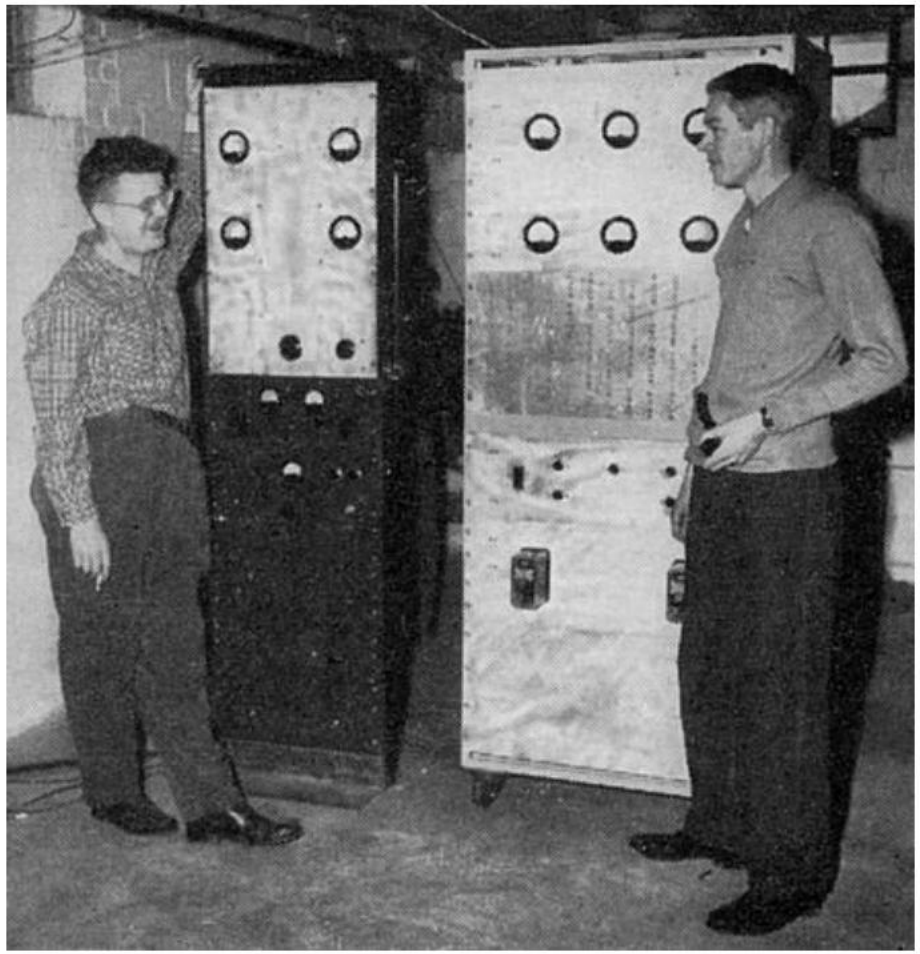
It consists of 64 half-wave dipoles in an 8x8 array in front of a flat reflective screen, and had a gain of 24 dB and a main lobe beamwidth of about 15°.
It was driven by a 50 kW modified SCR-271 radar set that produced quarter-second pulses.

1960, U. S. Navy Communications Moon Relay (CMR)



The USS Hancock (CVA-19) was the subject for the first official photograph to be transmitted by radio facsimile via moon-bounce.

Amateur Radio Moonbounce



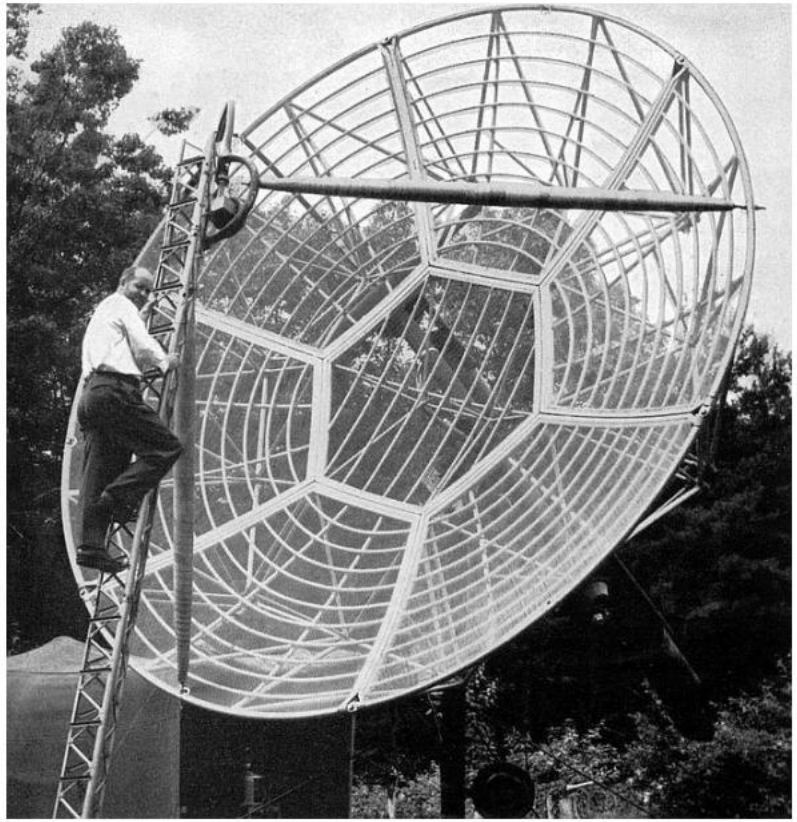
1953: Ross Bateman, W4AO, and Bill Smith, W3GKP, recorded first amateur radio signals bounced off of the Moon.

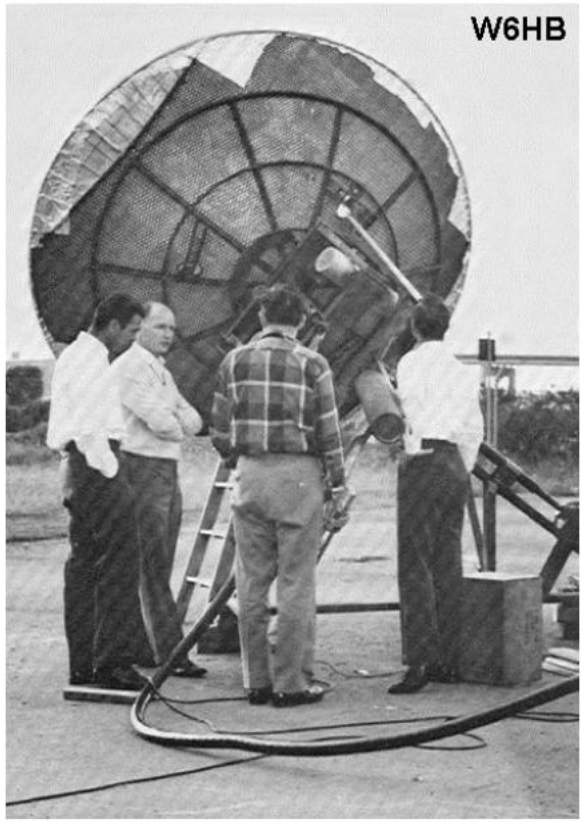
- 144 MHz
- 1 kw
- <4 dB NF
- stacked rhombics

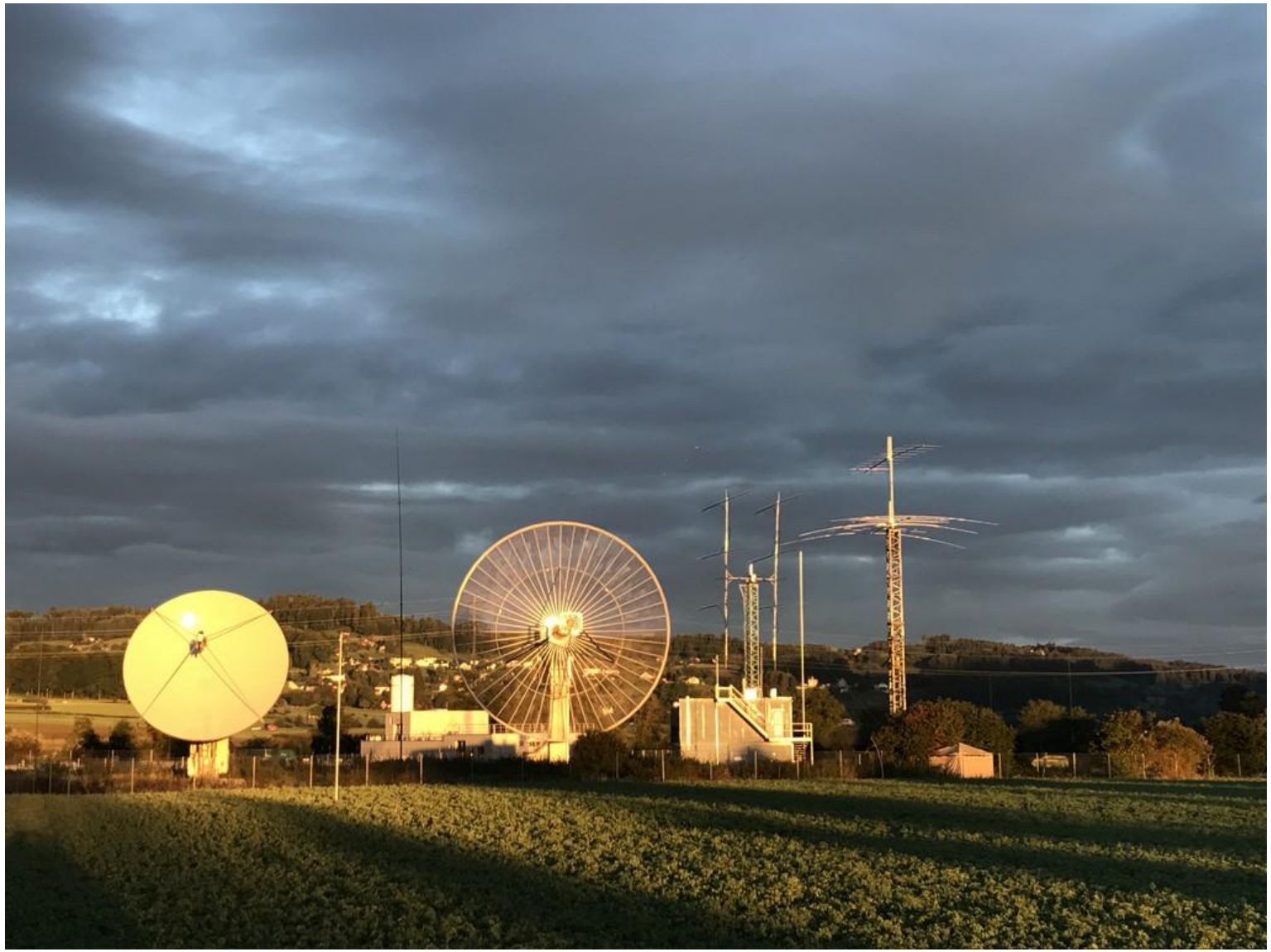
Amateur Radio Moonbounce

First Amateur Two-Way EME, 1960

Sam Harris, W1FZJ (operating W1BU)
Hank Brown, W6HB
1296 MHz







Big gun - HB9Q - https://hb9q.ch/


Regionaler Recyclinghof Reinach



20 ele Yagi

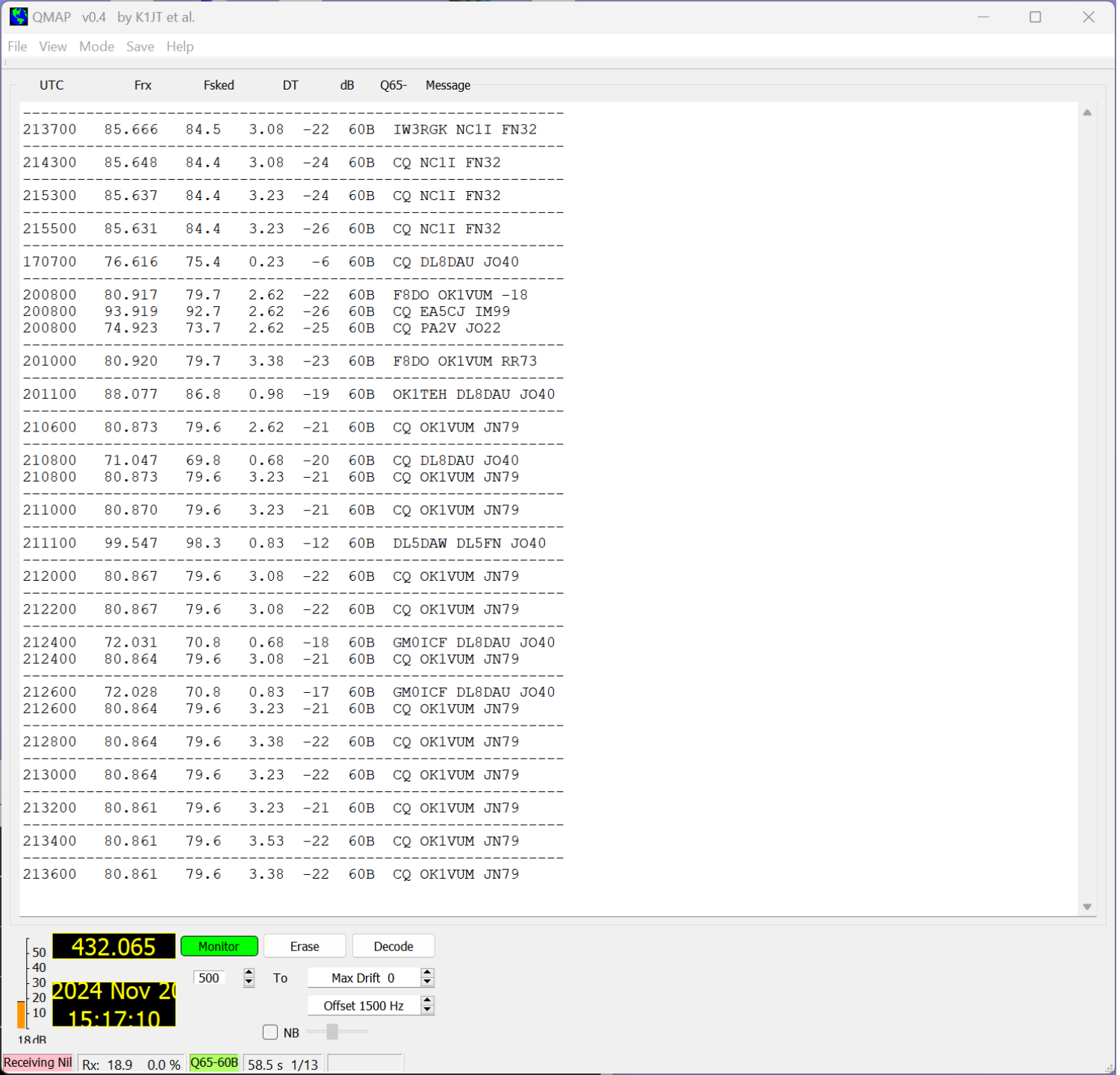


ICOM IC-7100 (35 W @ 432 MHz)

T/R Period (s)	Symbol Length (s)	"A" Tone Spacing (Hz)	"A" Occupied Bandwidth (Hz)	Transmission Duration (s)	SNR (dB)	Max AP SNR (dB)
15	0.150	6.667	433	12.8	-22.2	-23.7
30	0.300	3.333	217	25.5	-24.8	-26.6
60	0.600	1.667	108	51.0	-27.6	-30.2
120	1.333	0.750	49	113.3	-30.8	-32.5
300	3.456	0.289	19	293.8	-33.8	-37.4

T/R Period (s)	A		B		C		D		E	
	Spacing (Hz)	Width (Hz)	Spacing (Hz)	Width (Hz)	Spacing (Hz)	Width (Hz)	Spacing (Hz)	Width (Hz)	Spacing (Hz)	Width (Hz)
15	6.67	433	13.33	867	26.67	1733	N/A		N/A	
30	3,33	217	6.67	433	13.33	867	26.67	1733	N/A	
60	1.67	108	3.33	217	6.67	433	13.33	867	26.67	1733
120	0.75	49	1.50	98	3.00	195	6.00	390	12.00	780
300	0.29	19	0.58	38	1.16	75	2.31	150	4.63	301

- Ionospheric scatter on 50 MHz: **30A**
- QRP ionospheric scatter on 50 MHz: **120E**
- Ionospheric scatter on 144 MHz: **60C**
- Troposcatter and rainscatter at 10 GHz: **60D**
- Small-dish EME, 10 and 24 GHz: **120E**
- Other EME: 50, 144 MHz **60A;** 432 MHz **60B;** 1296 MHz: **60C;** 10 GHz: **60D**



SDRPlay 2 + SDR Console + QMAP

QMAP :

- Single channel
- Receive only capabilities
- Any of the 60- second submodes of Q65.
- 90 kHz subband
- Recording via SDR console

WSJT-X - 8 v2.7.0-rc7 by K1JT et al.

File Configurations View Mode Decode Save Tools Help

Single-Period Decodes

UTC	dB	DT	Freq	Message
				---------- 70cm
2049	-18	2.5	1766	CQ NC1I FN32 q3 U.S.A.
				---------- 70cm
2051	-18	2.5	1766	ON4PB NC1I -27 q3
				---------- 70cm
2053	-17	2.5	1776	ON4PB NC1I RR73 q3
				---------- 70cm
2055	-18	2.5	1773	CQ NC1I FN32 q3 U.S.A.

Average Decodes

UTC	dB	DT	Freq	Message
204800	Tx		1747	CQ ON4PB JO20
205000	Tx		1747	CQ ON4PB JO20
2049	-18	2.5	1766	CQ NC1I FN32 U.S.A.
205001	Tx		1747	NC1I ON4PB JO20
2051	-18	2.5	1766	ON4PB NC1I -27 q3
205200	Tx		1747	NC1I ON4PB R-18
2051	-19	2.5	1764	CQ NC1I FN32 q32 U.S.A.
2053	-17	2.5	1776	ON4PB NC1I RR73 q3
205400	Tx		1747	NC1I ON4PB 73
2053	-20	2.5	1764	CQ NC1I FN32 q33 U.S.A.

Log QSO | Stop | Monitor | Erase | Clear Avg | Decode | Enable Tx | Halt Tx | Tune | Menus

70cm | S | 432.083 937

Tx even/1st

Tx 1747 Hz

F Tol 400 | Submode B

Rx 1776 Hz | Max Drift 0

Report -18

T/R 60 s

Sh | Auto Seq | CQ: First | Tx6

H | FT8 | FT4 | MSK | Q65 | JT65

DX Call | DX Grid

NC1I | FN32

Az: 294 5791 km

Lookup | Add

2024 Nov 11
20:55:59

Generate Std Msgs | Next | Now | Pwr

NC1I ON4PB JO20		Tx 1
NC1I ON4PB -18		Tx 2
NC1I ON4PB R-18		Tx 3
NC1I ON4PB RR73		Tx 4
NC1I ON4PB 73		Tx 5
CQ ON4PB JO20	●	Tx 6

Receiving | Q65-60B | Last Tx: NC1I ON4PB 73 | 0 3 | 59/60 | WD:9m

WSJT-X - 8 - Astronomical Data

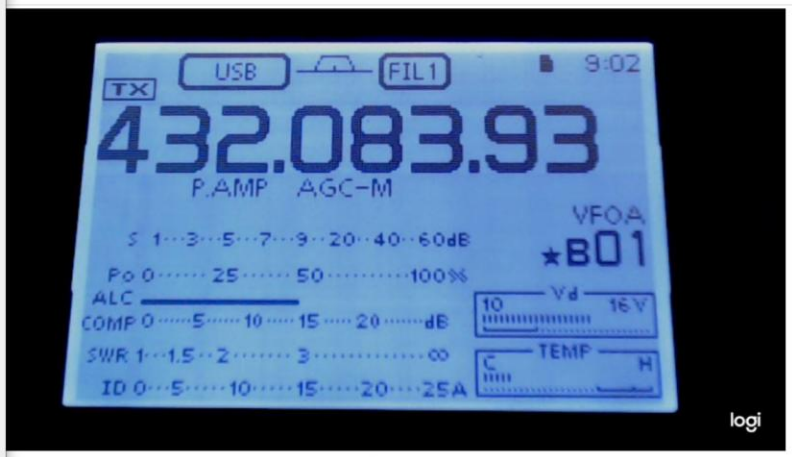
2024 Nov 11
UTC: 20:55:59
Az: 199.0
El: 34.0

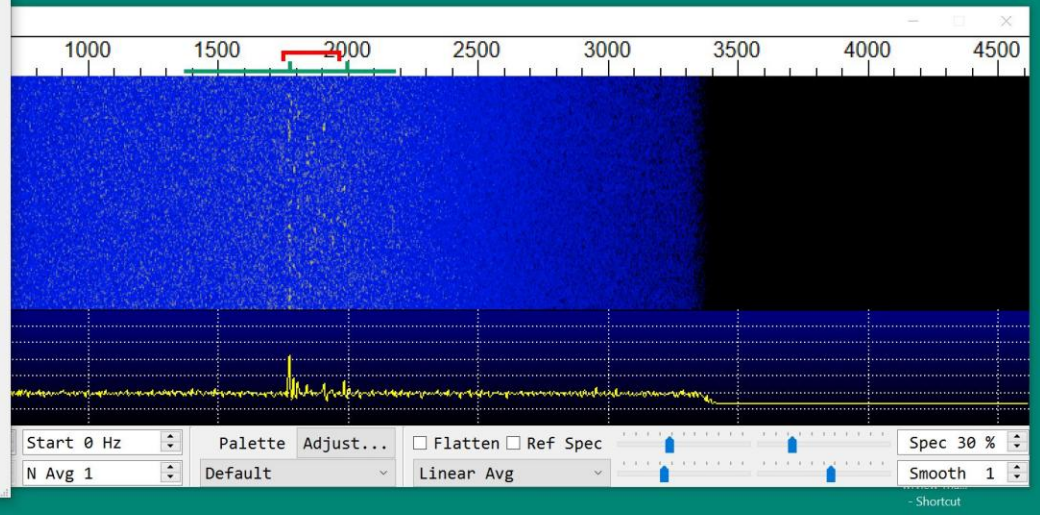
Doppler tracking
- Full Doppler to DX Grid
- Own Echo
- Constant frequency on Moon

HID Relay Control

Relay Boards Present: 0 - USBRelay2

Relay Channels: 1 ON 1 OFF | 2 ON 2 OFF | 3 ON 3 OFF | 4 ON 4 OFF | 5 ON 5 OFF | 6 ON 6 OFF | 7 ON 7 OFF | 8 ON 8 OFF

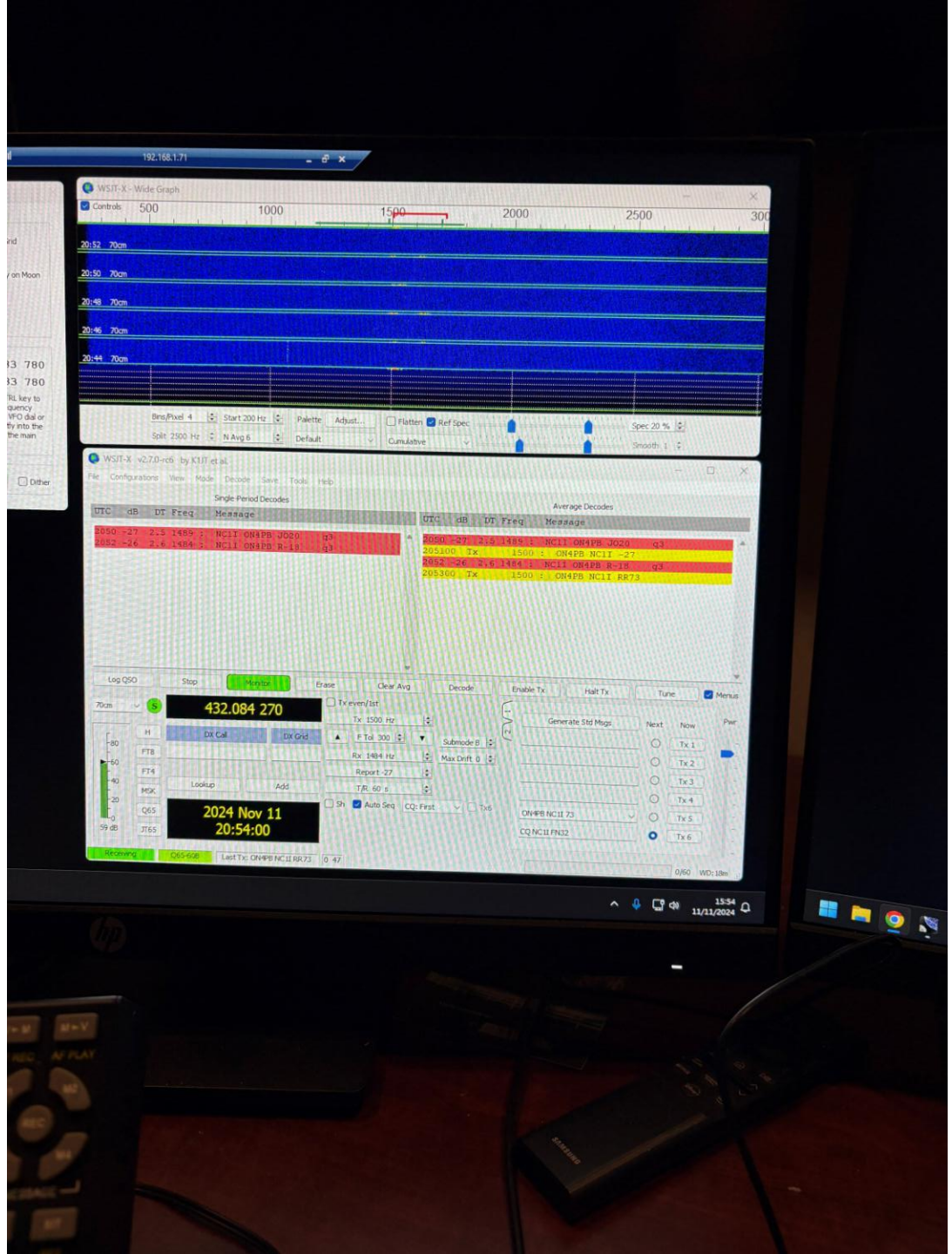


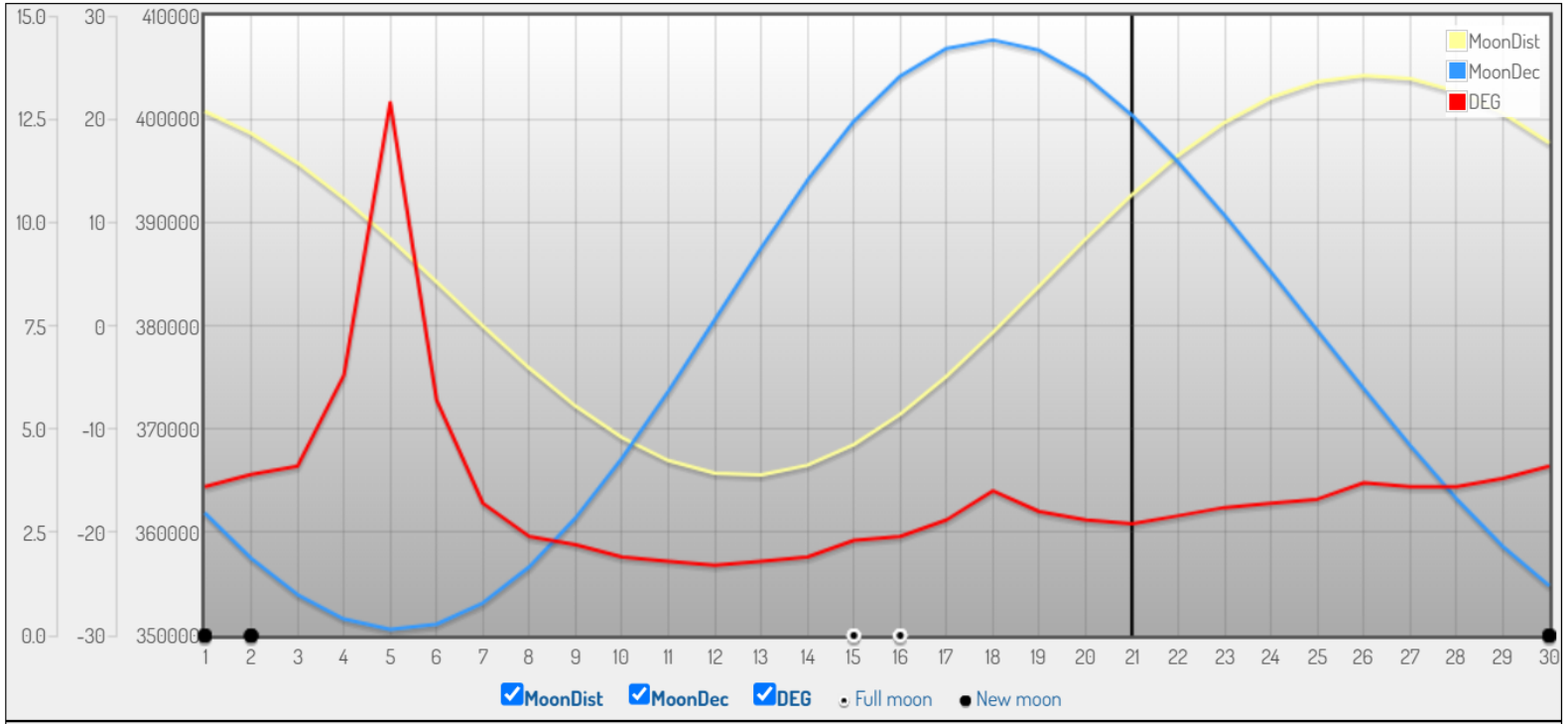


- Shortcut

Type here to search

ENG 9:55 PM 11/11/2024


192.168.1.71
WSJT-X - Wide Graph
WSJT-X v2.7.0-rc6 by K1JT et al.
Single Period Decodes
Average Decodes
UTC dB DT Freq Message
2050 -27 2.5 1489 : NC1I ON4PB JO20 q3
2052 -26 2.6 1484 : NC1I ON4PB R-18 q3
205100 Tx 1500 : ON4PB NC1I -27
205300 Tx 1500 : ON4PB NC1I RR73
Log QSO
Stop
Monitor
Erase
Clear Avg
Decode
Enable Tx
Halt Tx
Tune
Menus
432.084 270
DX Call
DX Grid
Generate Std Msgs
Next
Now
Tx 1
Tx 2
Tx 3
Tx 4
Tx 5
Tx 6
ON4PB NC1I 73
CQ NC1I FN32
2024 Nov 11
20:54:00
Receiving
Last Tx: ON4PB NC1I RR73
15:54
11/11/2024



November 2024 Go

Todays 144MHz EME conditions: Degradation = 2.7 dB => Fair

Background information:

Moon distance [km]: Earth-Moon distance. Mean distance is 384400 km. Minimim during perigee 356400 km. Maximum during apogee 406700 km. This translates to as much as 2.25dB difference in pathloss from apogee to perigee.

Moon declination [deg]: Moon declination in degrees north (+) and south (-) of the equator. Max declination up to 28.7 degrees.

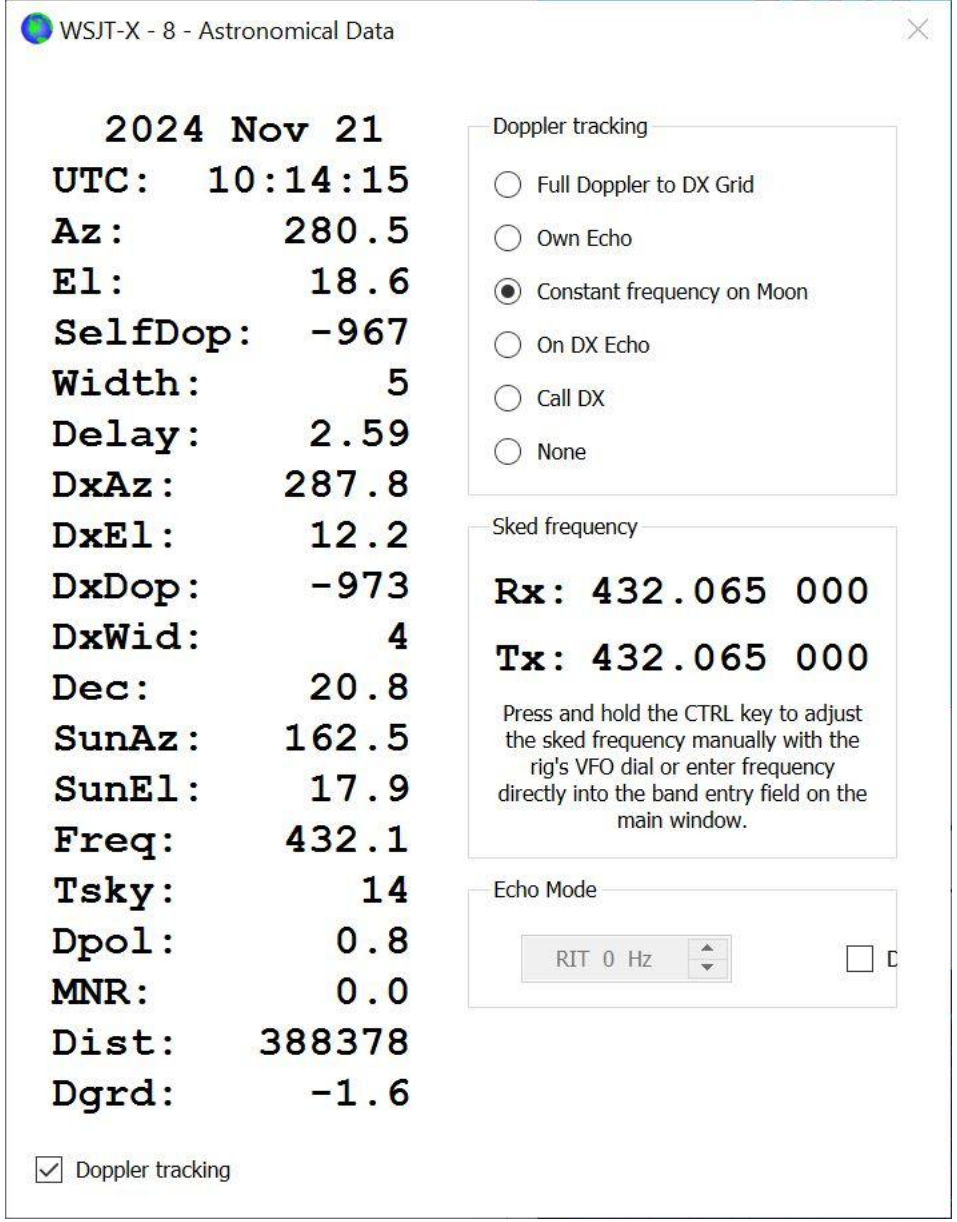
Degradation [dB]: Degradation in EME signal-to-noise, calculated as: Tsky [K] / (TskyMin [K] + Tsys [K]) + RangeFactor [dB]

Calculation assumptions for 144MHz: TskyMin = 200 K, Tsys = 80 K, Observer Position = Central Europe, Time = 12:00 UTC, Tsky data interpolated from EME Handbook 2010 / WSJT 7.03 source data by K1JT.

Conditions summary: Conditions are summarized on basis of the degradation. Be aware that this is only a theoretical approach and the real conditions may vary due to local or ionospheric changes. In general this info is only meant to show the current astronomical situation and to indicate a global trend. Within a day of New Moon (NM), high sun noise can make conditions 'Very Poor' regardless of the DEG. The conditions are classified i.a.w. following DEG [dB]:

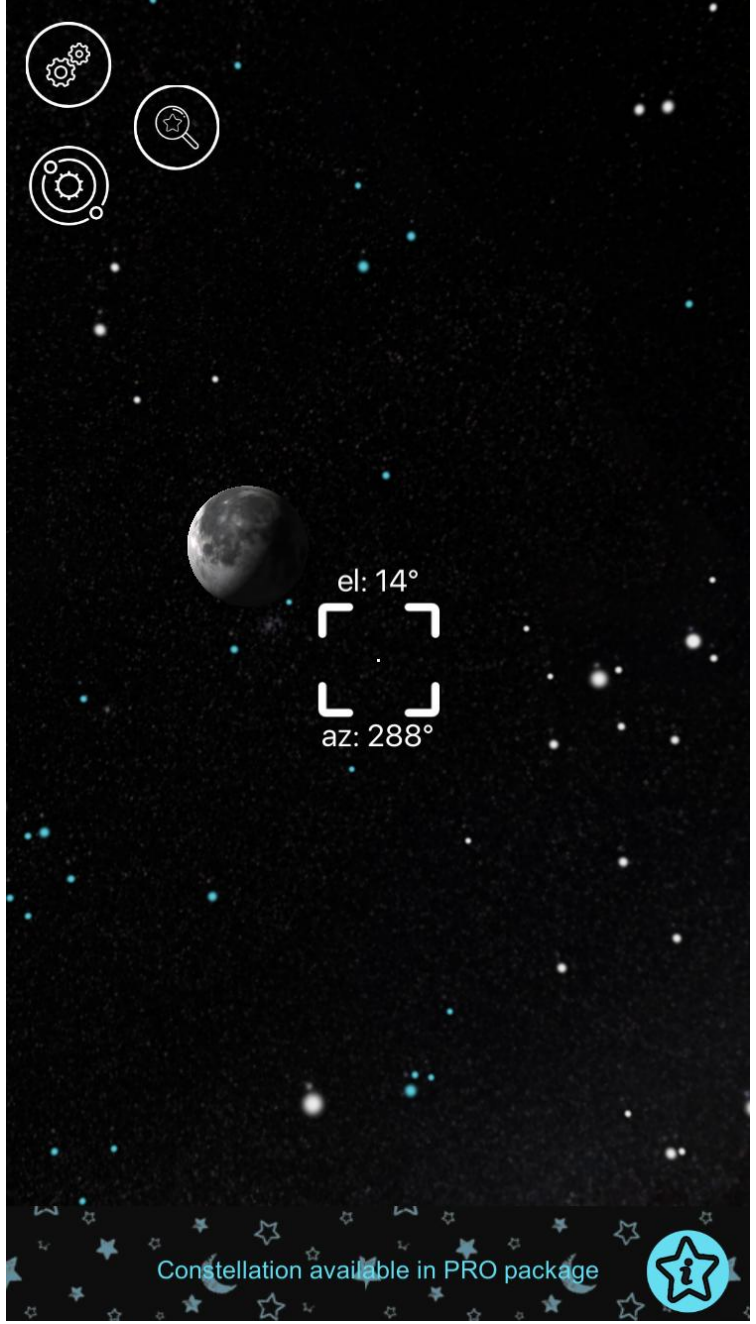
< 1.5 => Excellent
> 1.5 and <= 2.5 => Good
> 2.5 and <= 4.0 => Fair
> 4.0 and <= 5.5 => Poor
> 5.5 => Very Poor

Make more miles on VHF - https://www.mmmonvhf.de/eme.php



Doppler : moonrise -> moonset

- 300Hz @ 144 Mhz
- 1 kHz @ 432 MHz
- 3 kHz @ 1296 MHz



Star Map - app