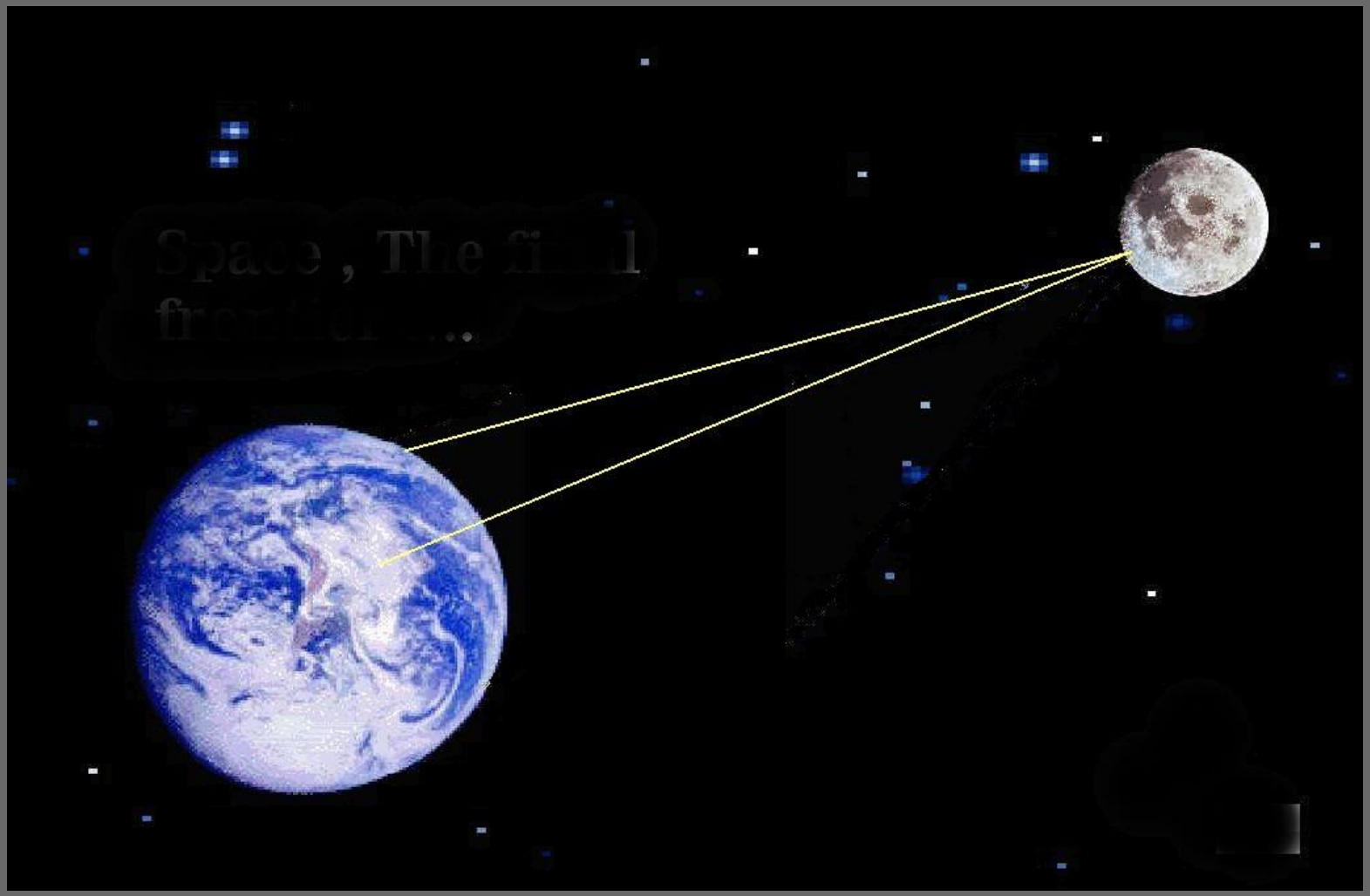


EME-102 Moon Bounce


(C) Event Horizons - Modem 503-777-1578 - For our customer's private use only!

Full Moon

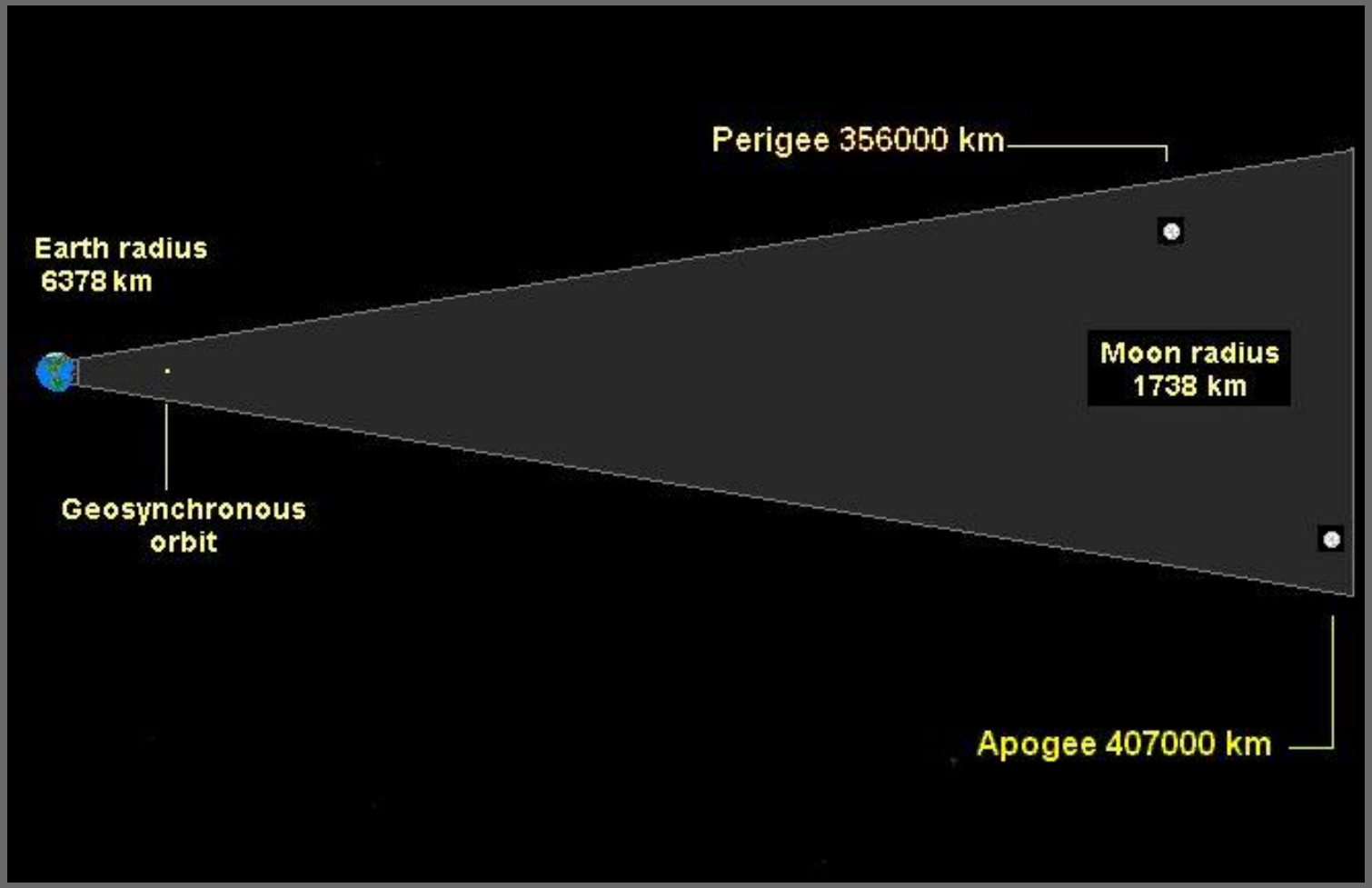
1296 EME

1296 EME operation can be an adventure, from building the station to operating “off the moon.”

Play EME recording and copy the signals ----------→>>>>>

EME BASICS

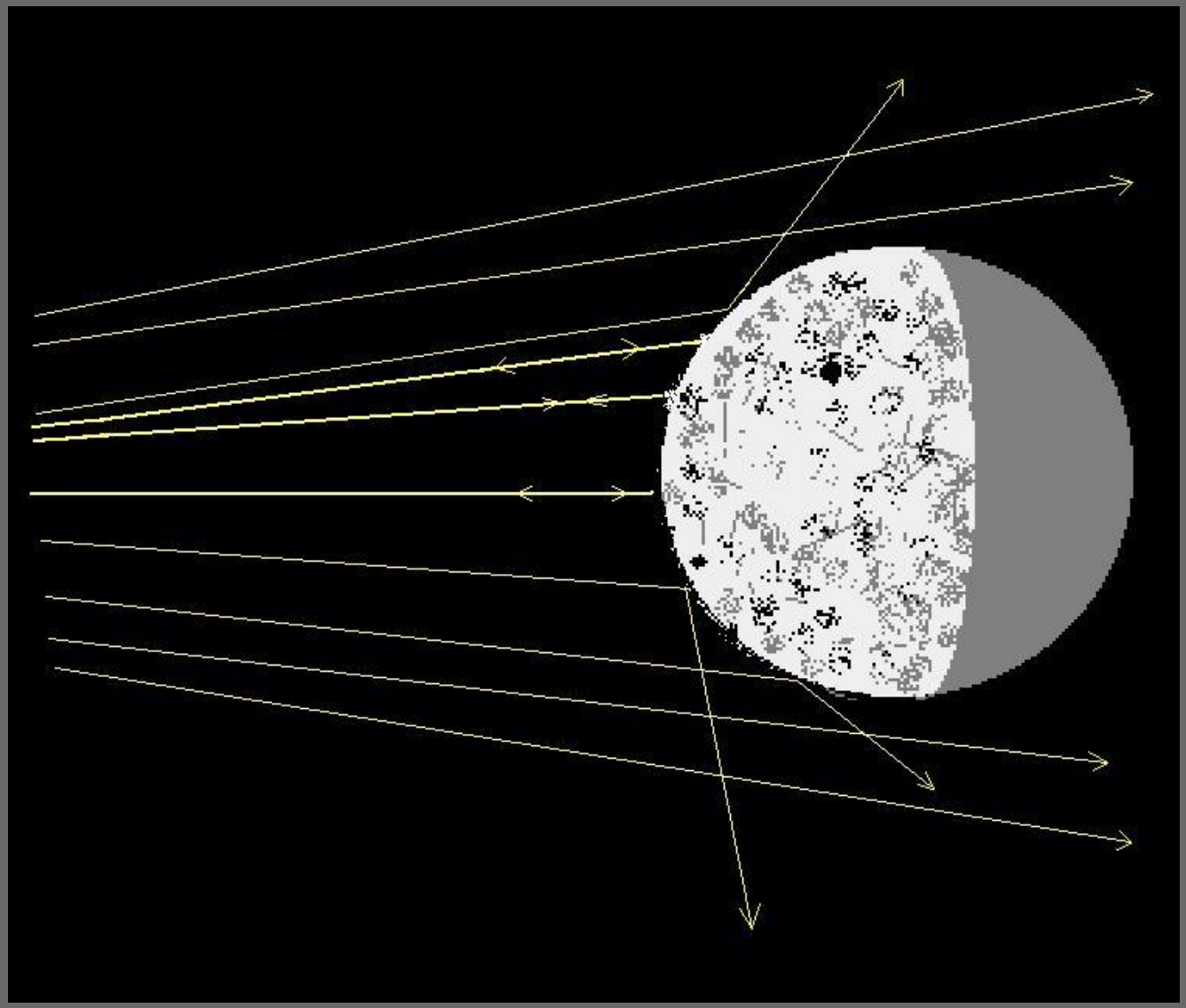
- Declination
- Polar Mount
- Az/El Mount
- Spatial Polarity Loss
- Apogee
- Perigee
- Circular Polarization
- Cavity Amp
- LNA
- Transverter
- Feed Horn
- Path Loss
- Noise Figure
- Sun Noise



The Moon subtends an angle of 0.49 degrees at apogee, 0.55 degree at perigee.

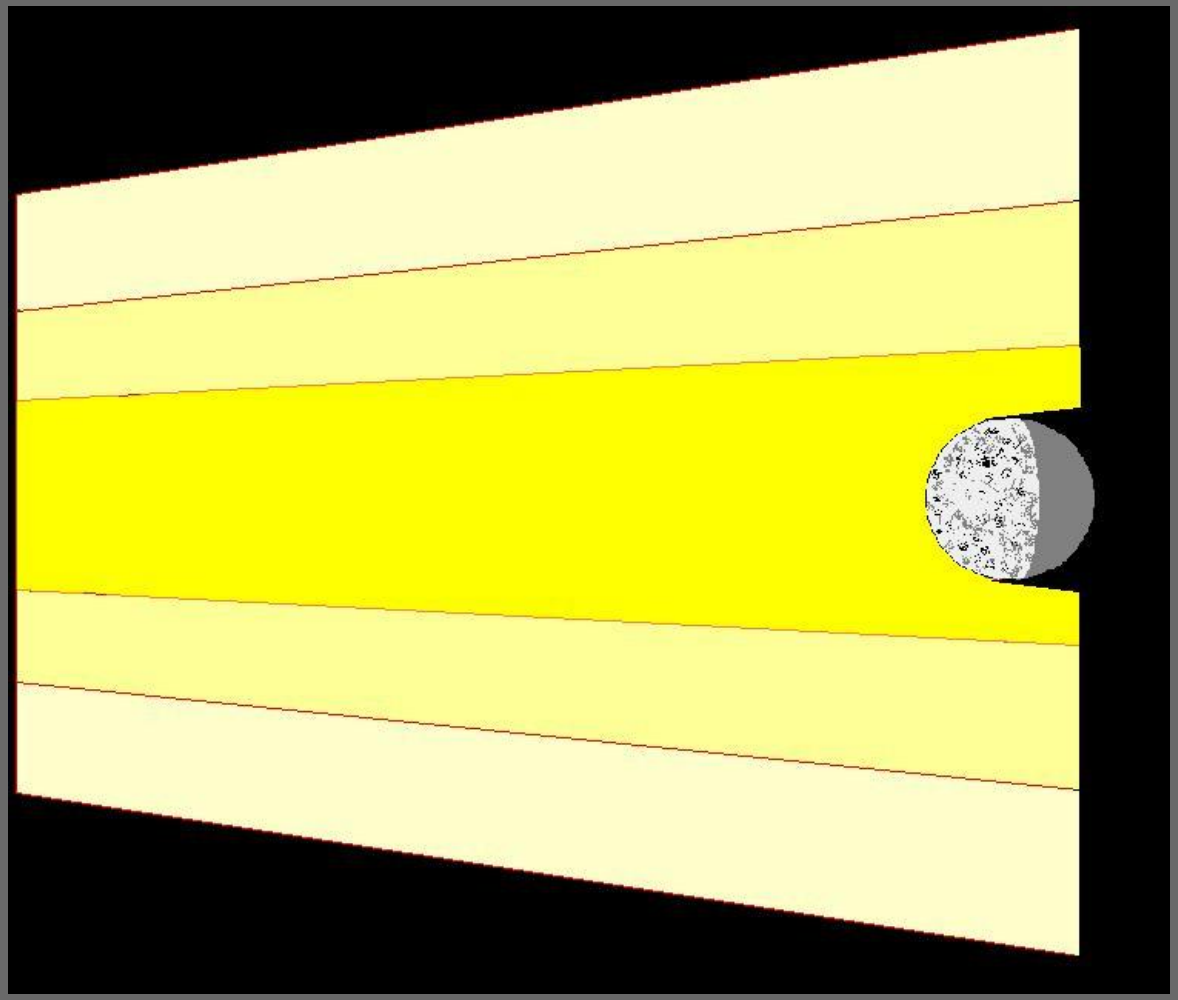
Earth – Moon Relationships

Rough Moon Surface



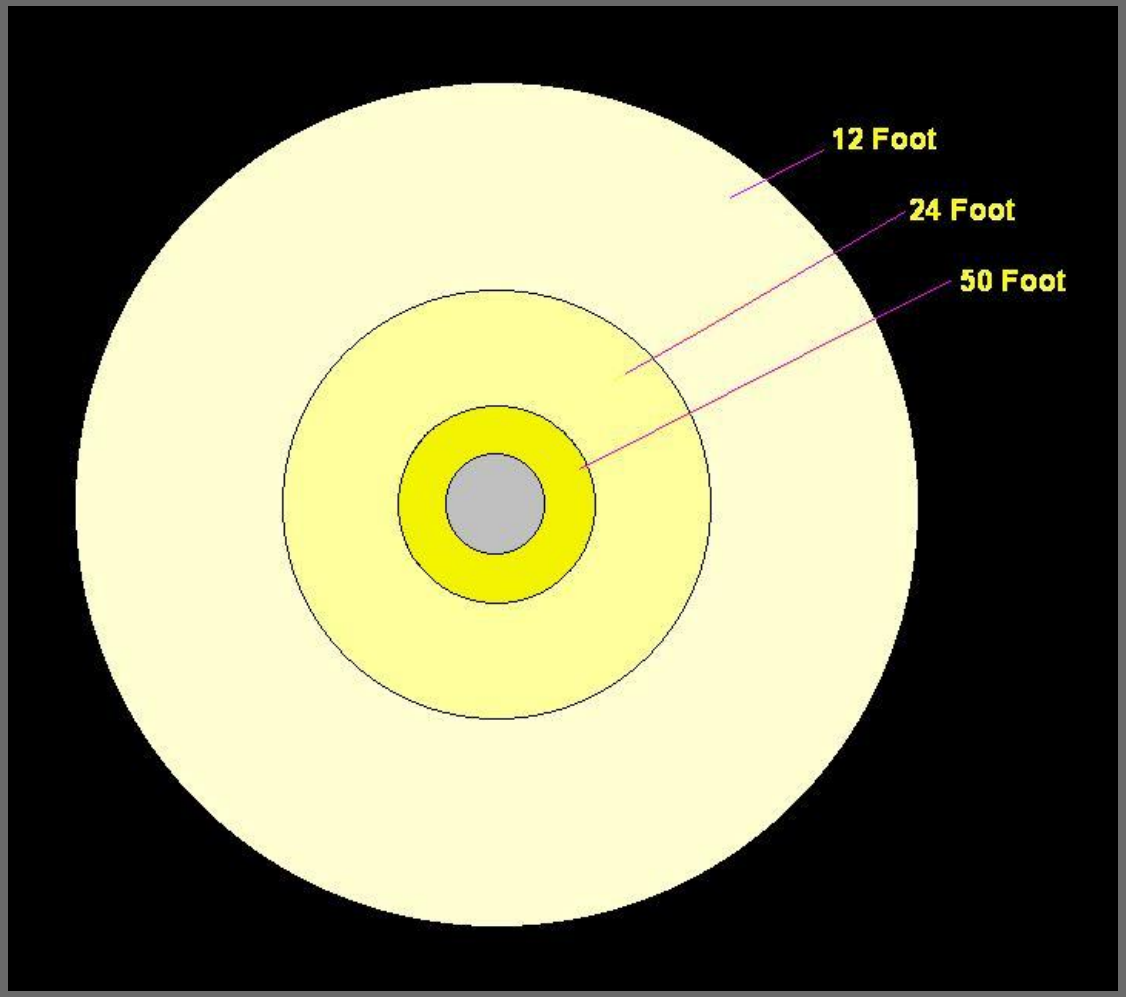
The Moon is a poor reflector. Being a rough convex surface, only about 7 per cent of the signal striking its surface is reflected back to the earths' surface. Only a very small percentage of that reflected signal actually reaches a receiving dish antenna. The path loss at 1296 Mhz is 271 db.

Moon As a Microwave Reflector



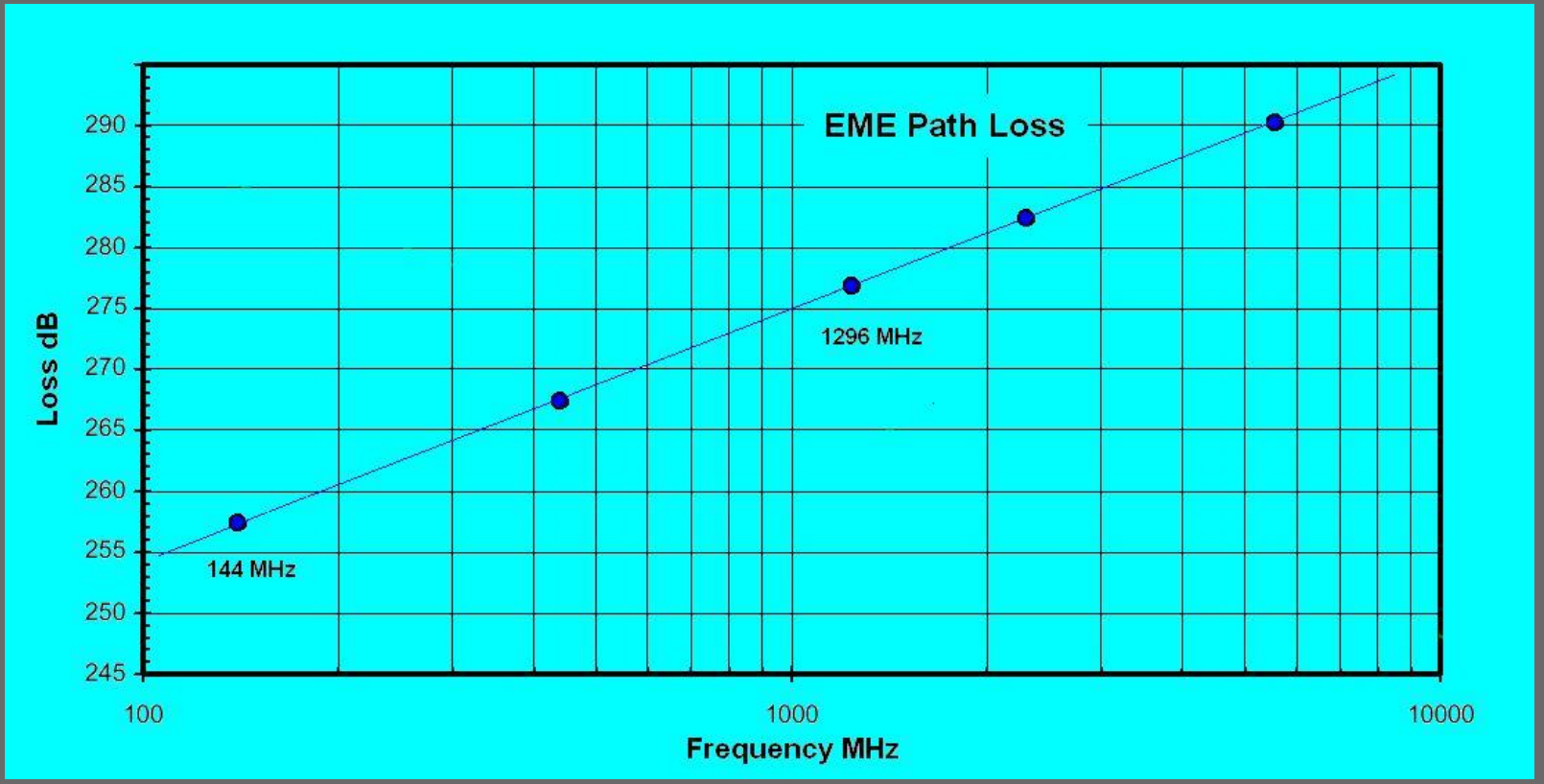
Relative 3db signal beam widths of 12, 24 and 50 foot diameter parabolic antennas at 1296 Mhz arriving at the Moon in perigee. The antenna 50 feet in diameter has a beam width of about 1.1 degrees, a 24 foot antenna 2.4 degrees, and 12 footer 4.5 degrees.

Relative Beam Widths

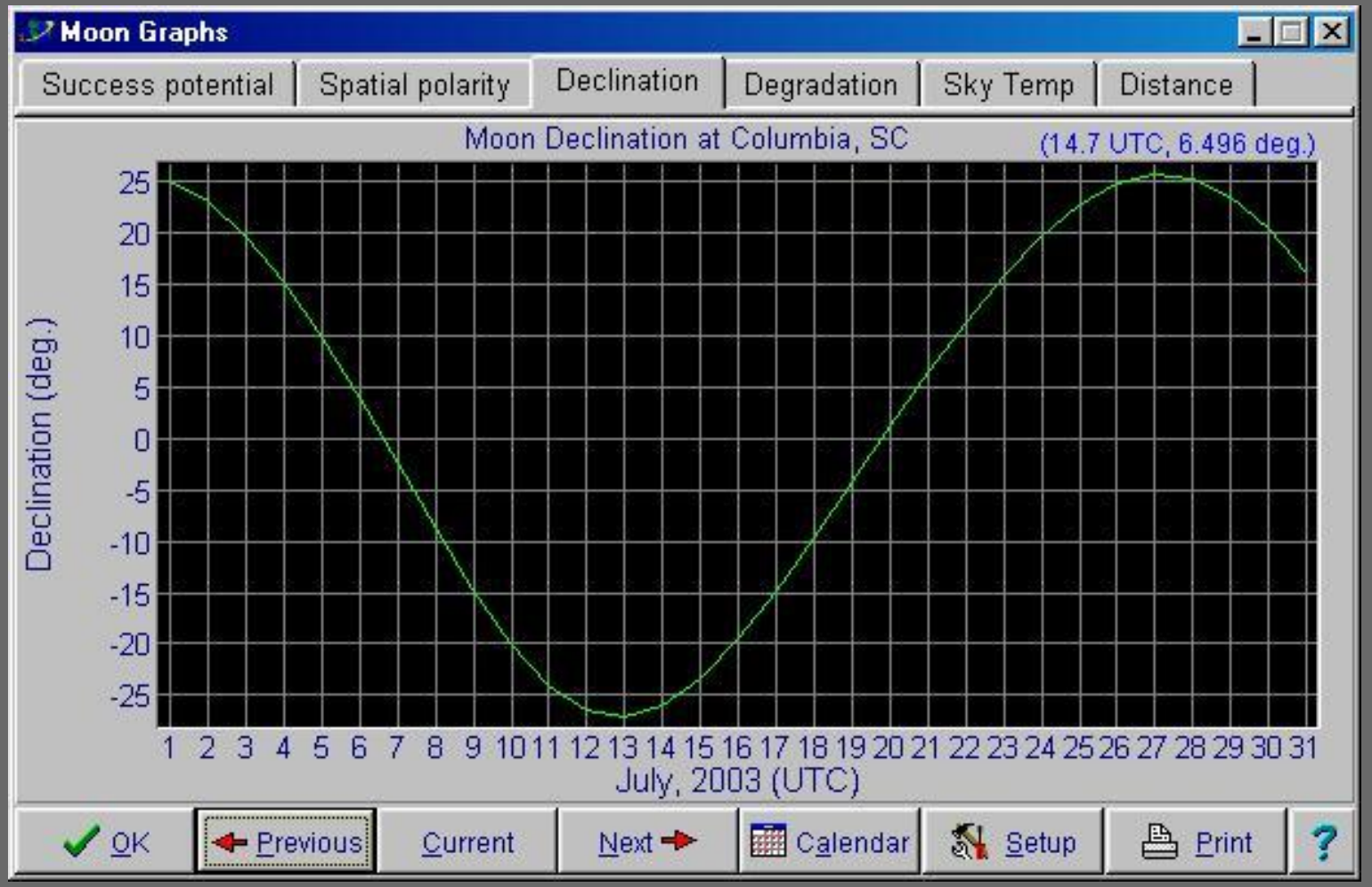


Relative percentage of 3db beam width power striking Moon surface. At perigee only 0.10 percent of the signal from a 12 foot antenna is reflected back to earth

Relative Power Densitys

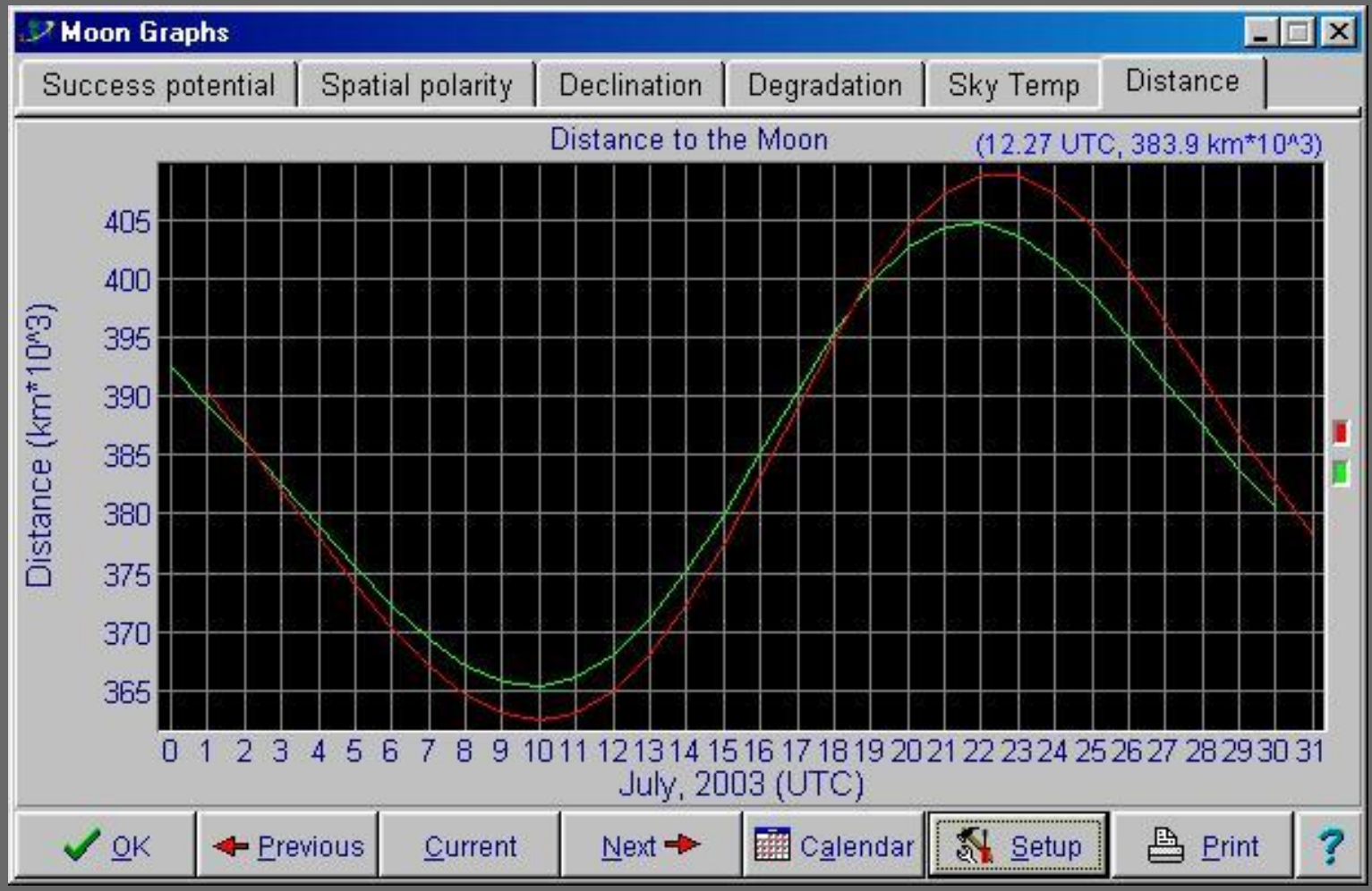


EME Path Loss vs Frequency



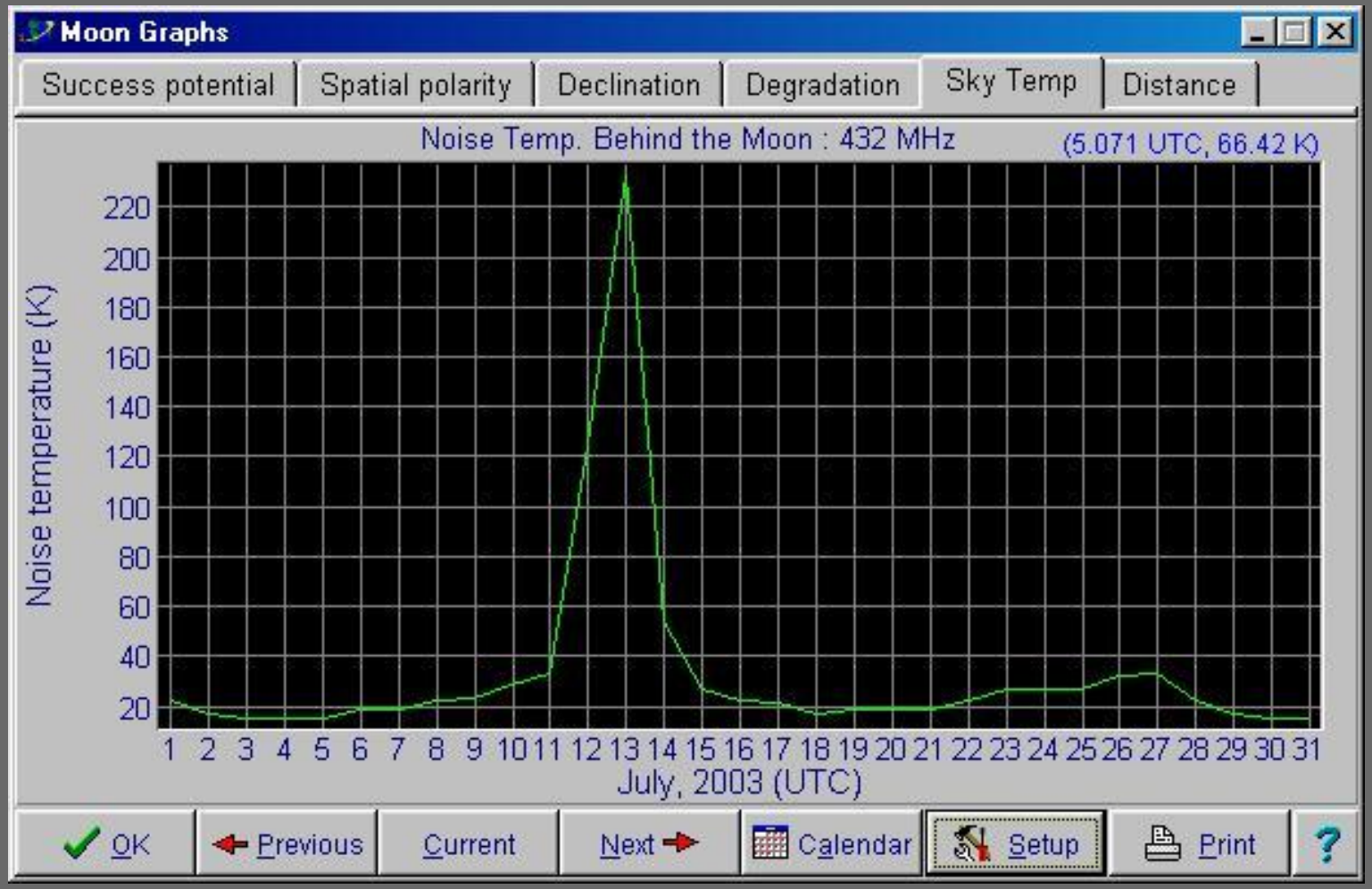
Declination of the Moon relative to the Equator. A complete cycle occurs every 27.2 days. EME operation in general is more desirable when the Moon is above the Equator, or in plus declination. This is due to the majority of EME stations being located in the Northern Hemisphere.

Declination



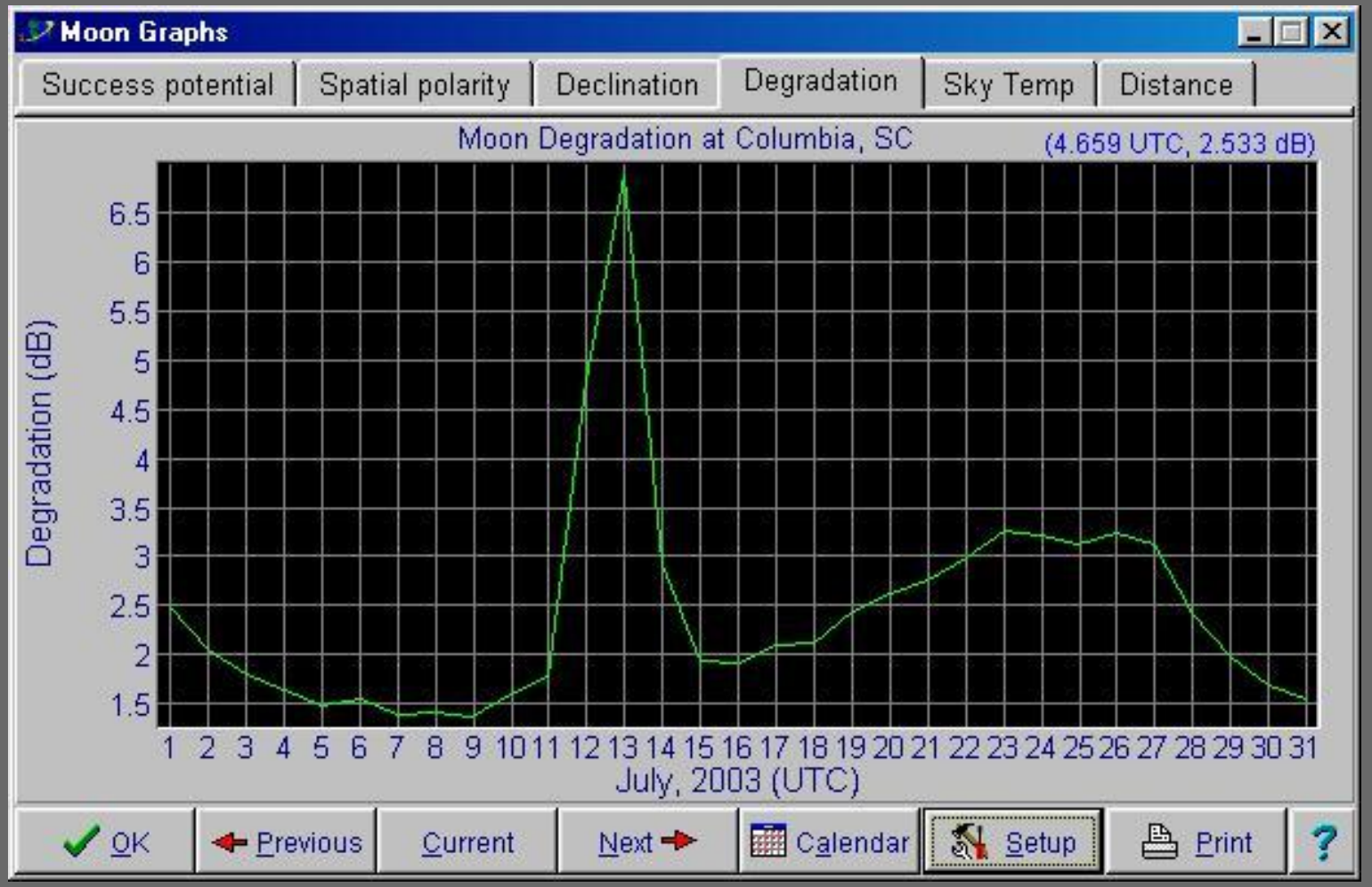
Graph of Moons distance from Earth. Path loss is about 2db greater at apogee (farthest) than at Perigee (closest). The green is geo-centric distance, the red is topo-centric.

Distance – Apogee - Perigee



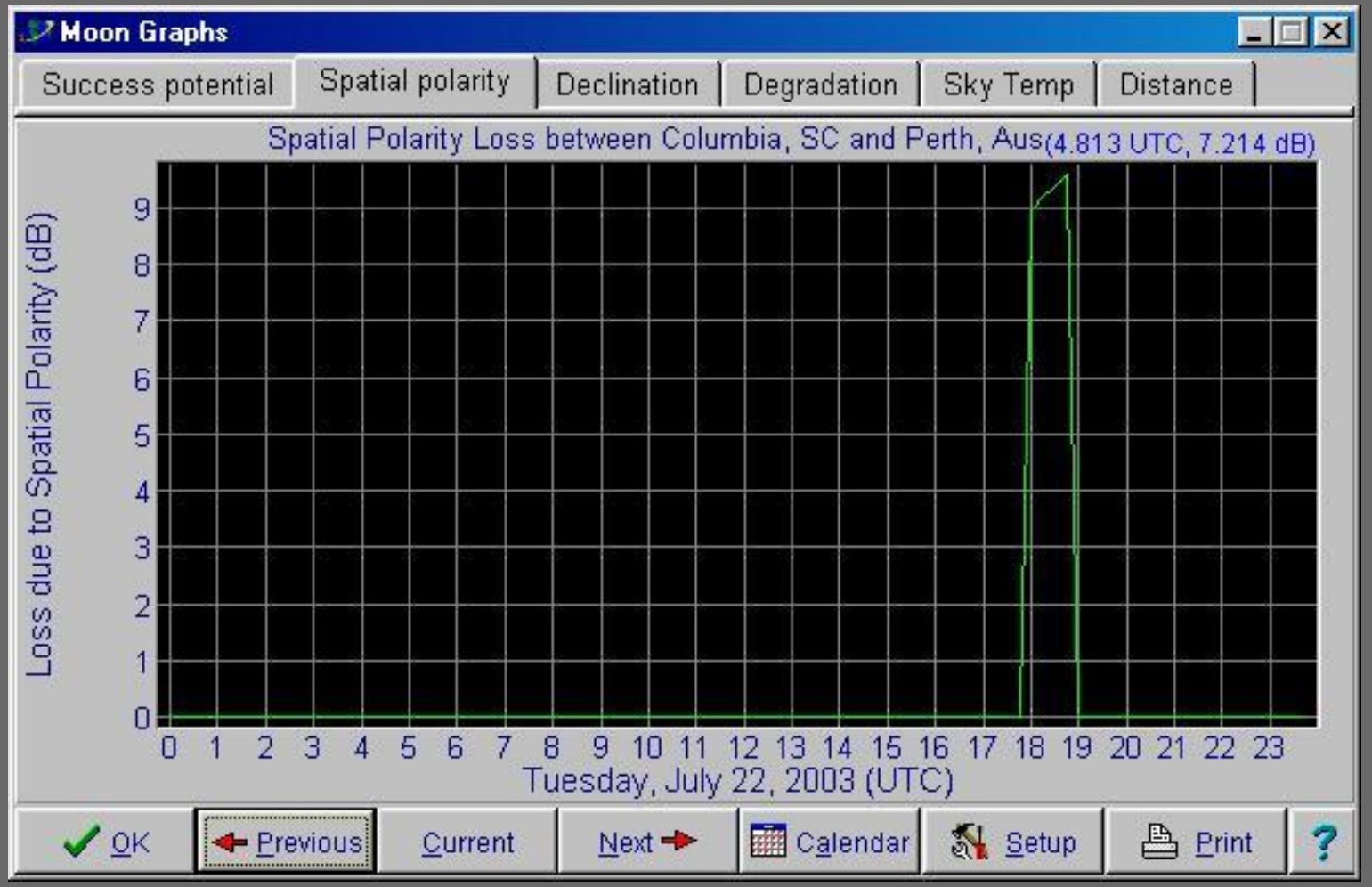
Graph of Noise Temperature from natural radio wave emitters that appear behind the Moon. The sources include the center of the Milky Way, and the Sun. EME operation is desirable when the Noise Temperature is low.

Noise During Lunar Cycle



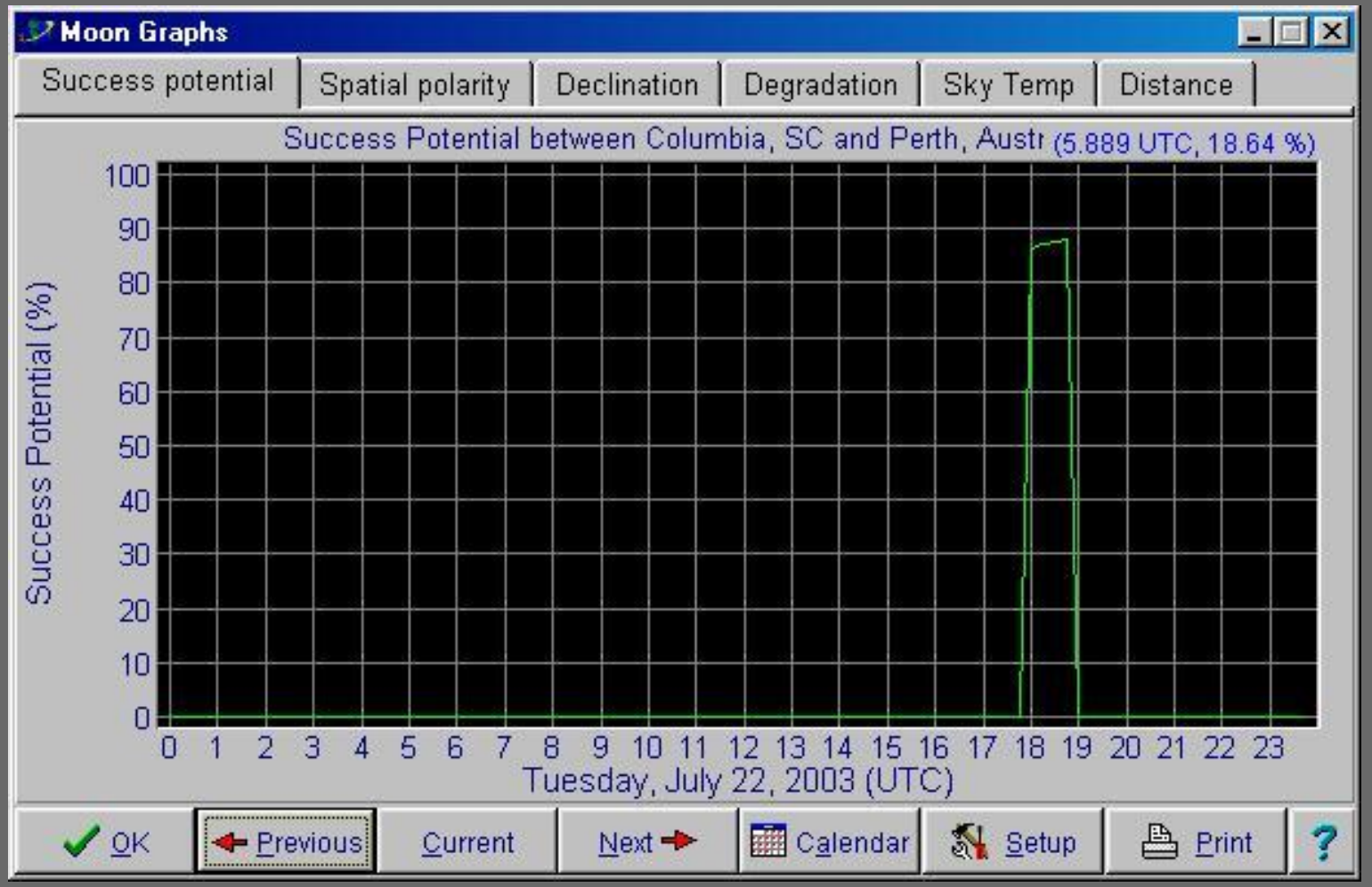
Graph of predicted path degradation as compared to an ideal situation. Calculated from formulas developed by Derwin King W5LUU. The calculation includes added path loss as compared to perigee, and the sky noise.

Path Degradation



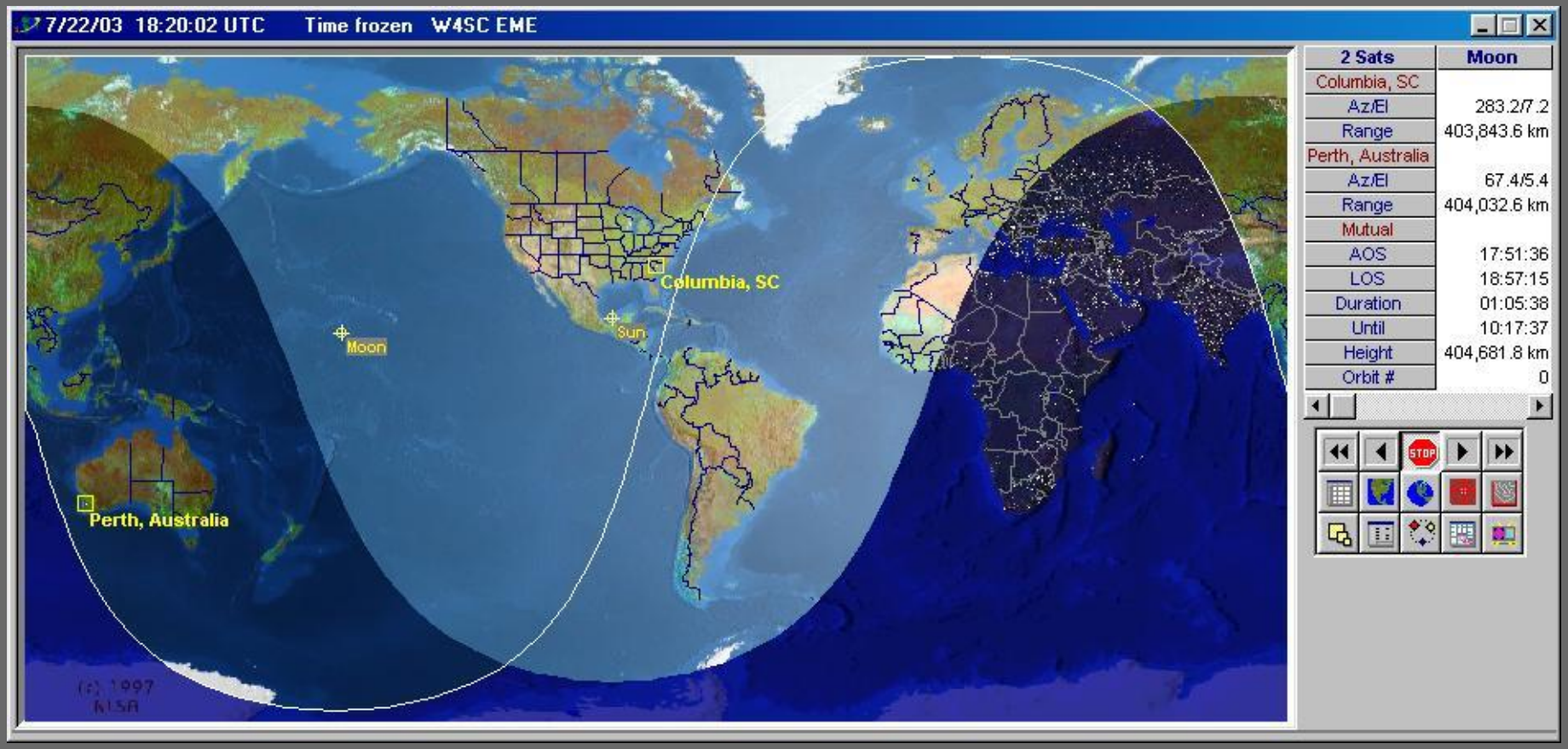
Graph of path loss in db due to the cross polarization that occurs when then the signals are reflected from the Moon. This occurs with linearly polarize antenna arrays (yagis), and depends on the angle of reflection. It is of little consequence at 1296 EME, as circular polarization is used.

Spatial Polarity Loss



Graph of predicted success of contact between two stations taking into account the spatial polarity loss and acute angles of reflection. This is for linearly polarized arrays, and is a low estimate for 1296 EME contacts using circular polarization

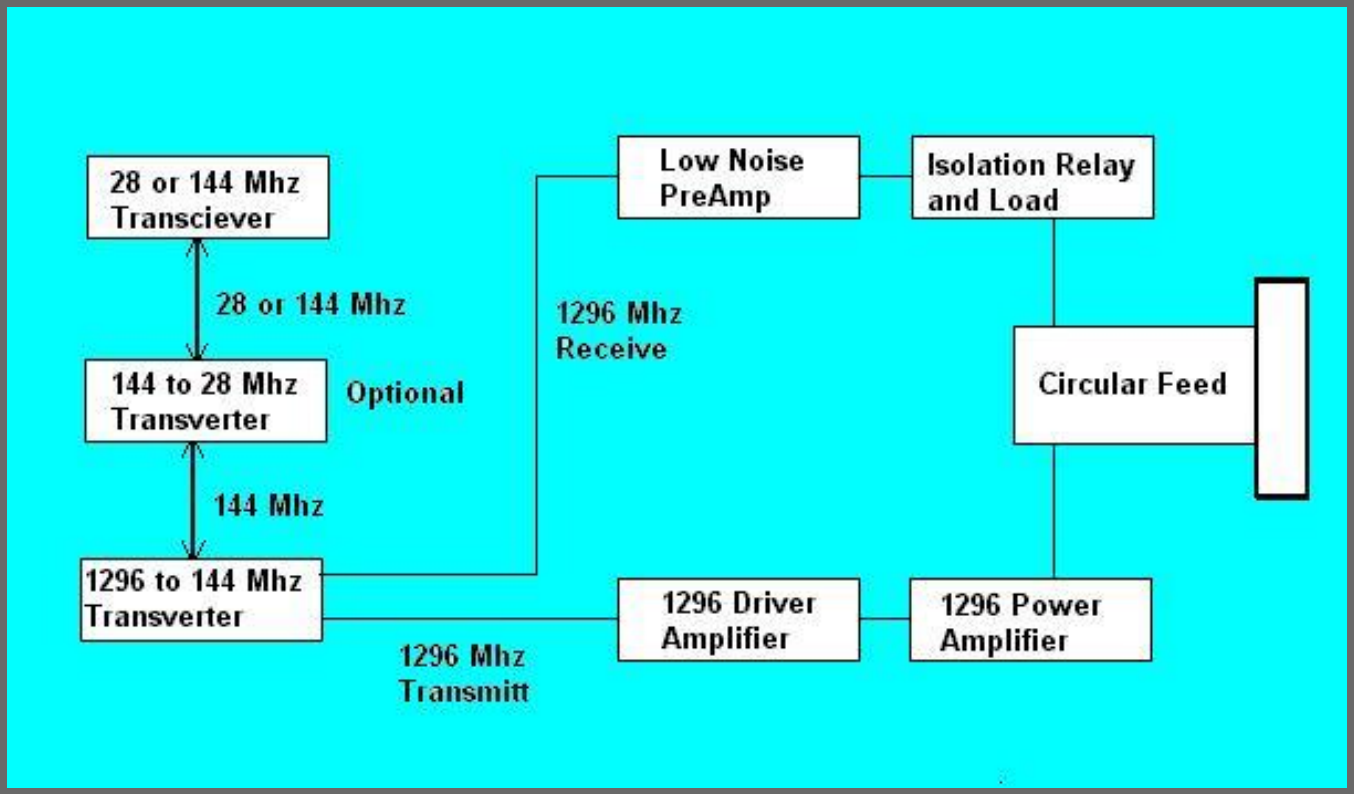
Predicted Success Potential



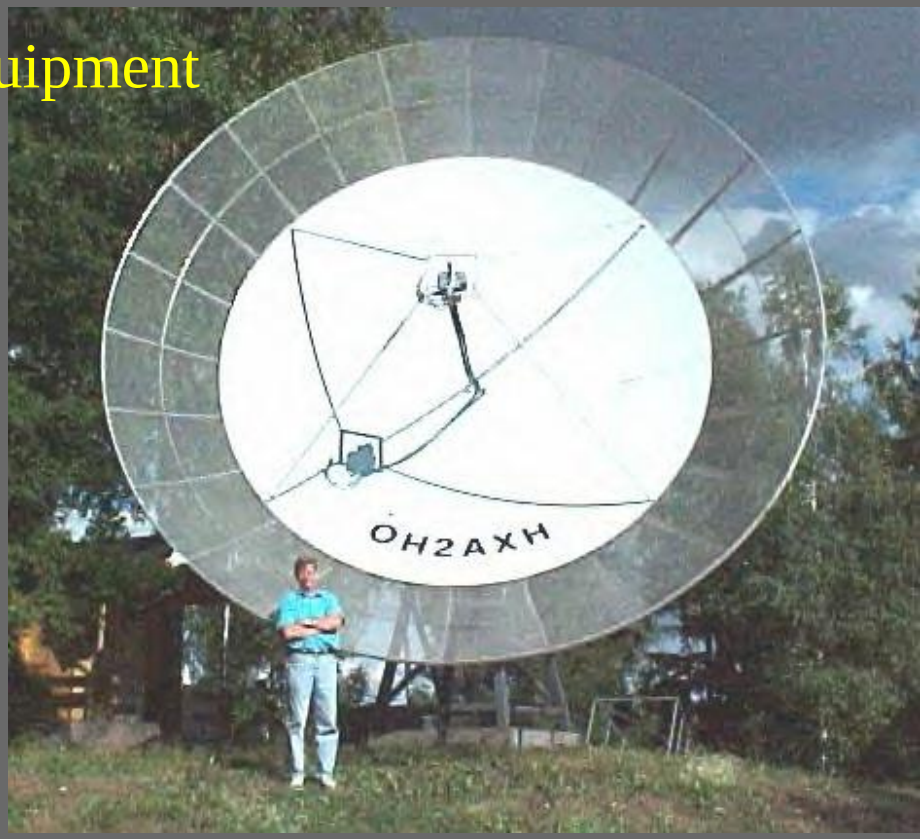
The calculated moon window between Perth WA and Columbia SC on this particular date has a duration of about 1 hour and 6 minutes if both horizons are visible. In reality, a more realistic estimate is 20 minutes for full visibility of the moon surface at both locations.

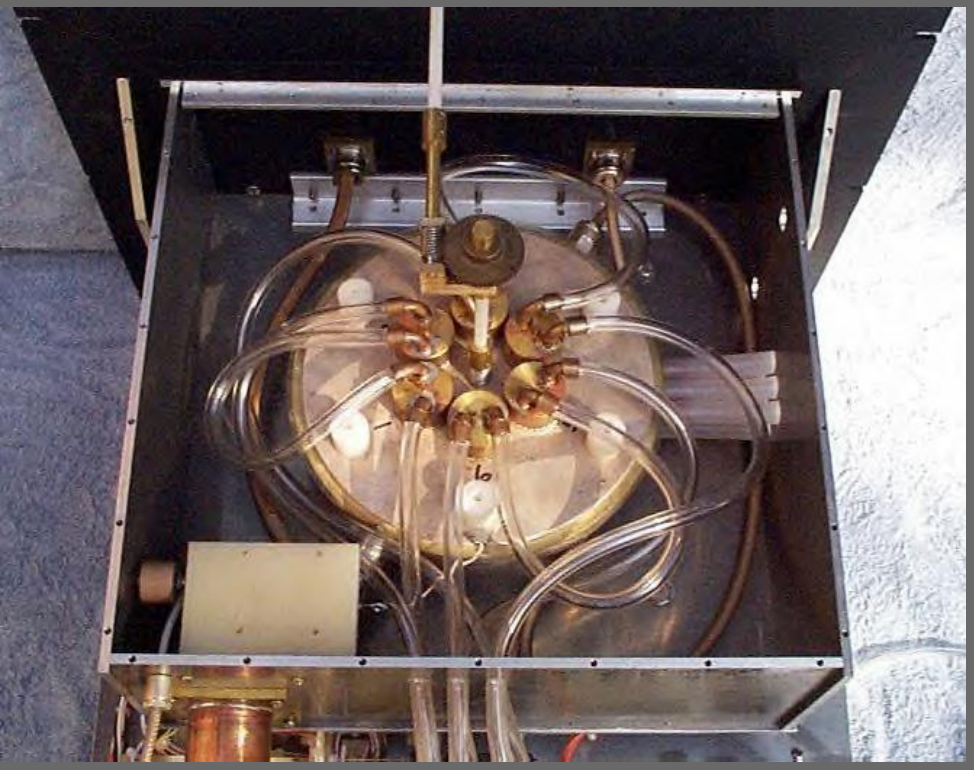
Moon Window – Columbia SC and Perth WA.

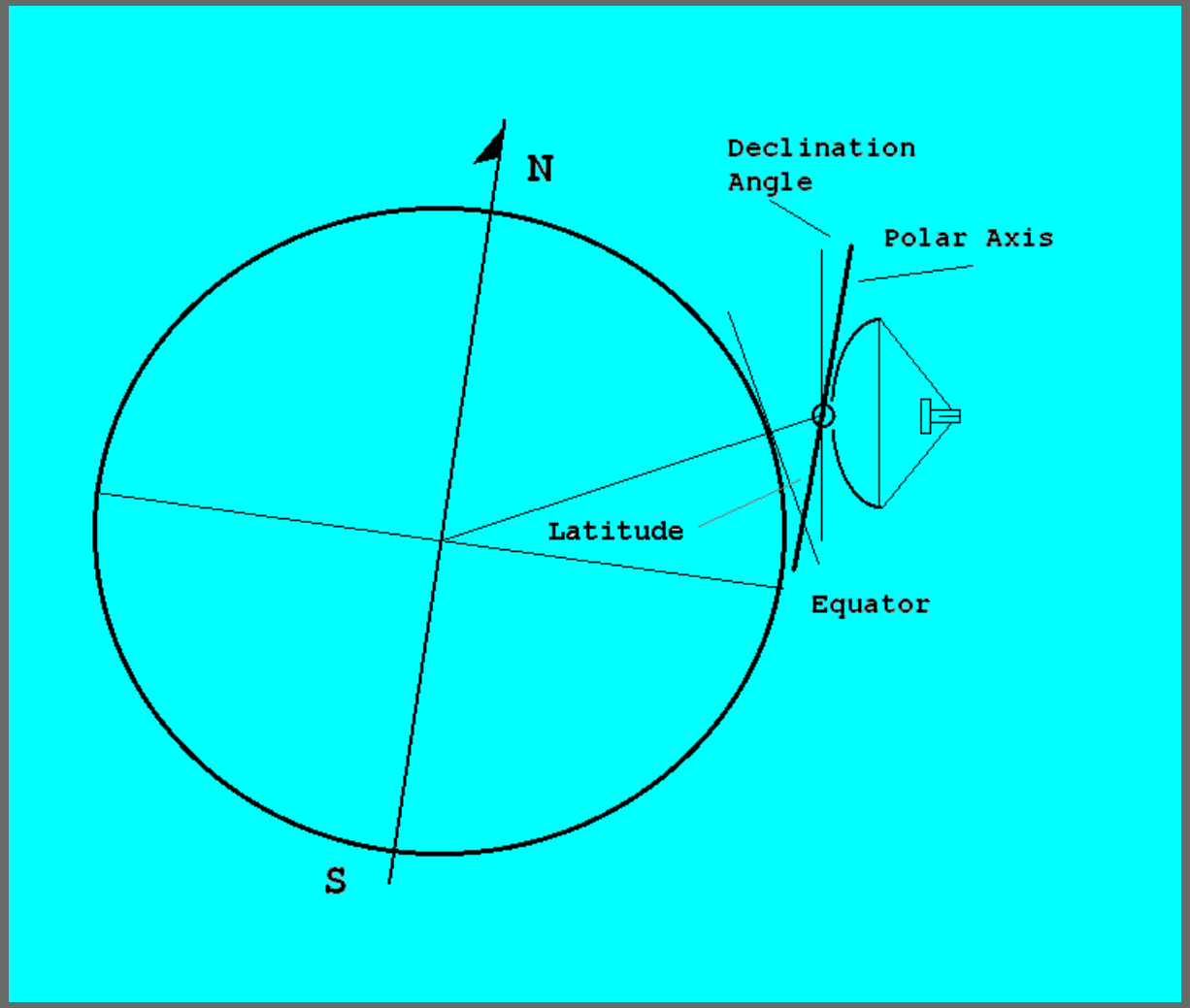
Typical EME Station Topology



EME Equipment

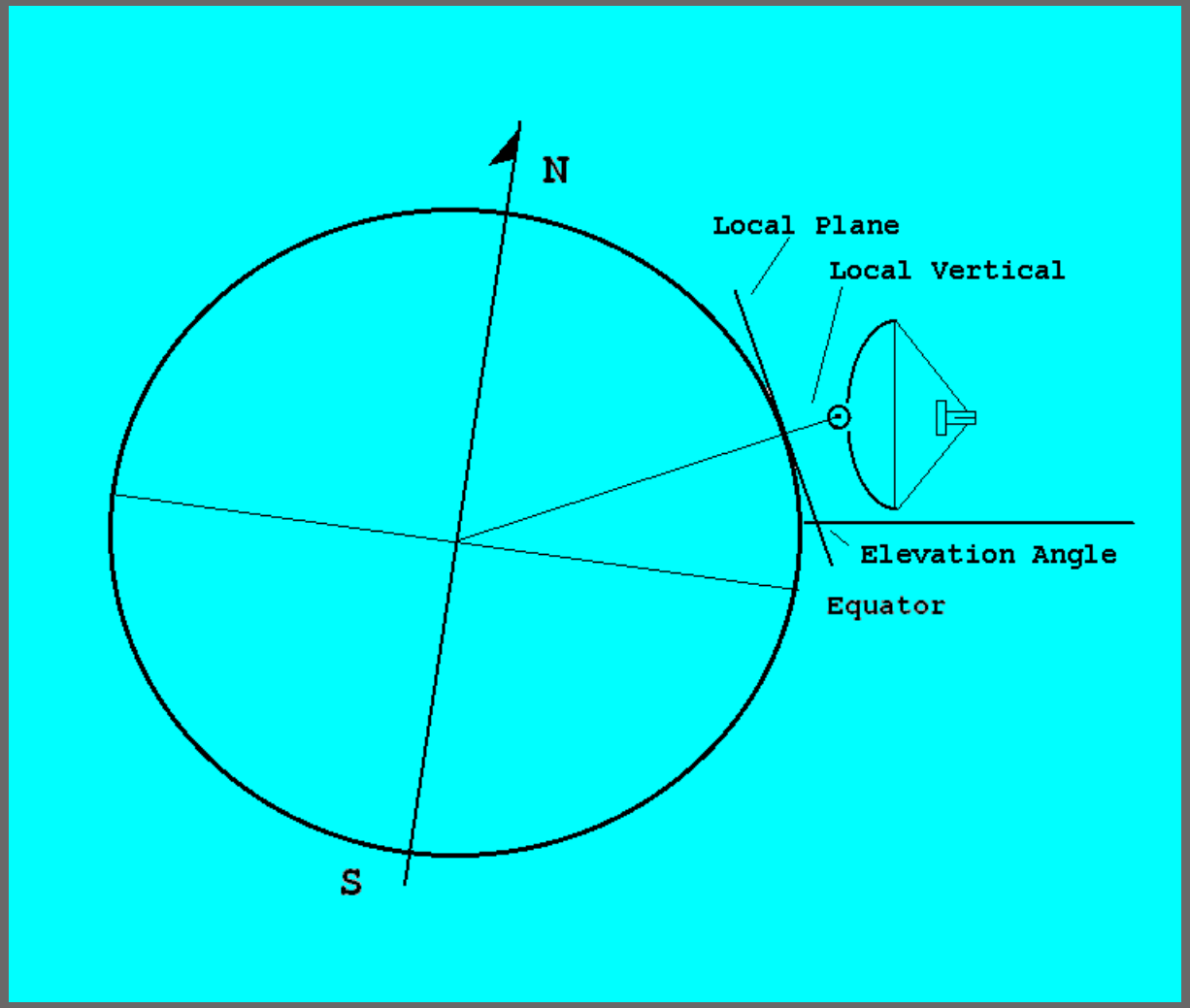






The dish is pointed using LHA and Declination of the Moon. The angle formed by the polar axis and local horizontal is equal to the latitude.

Polar Mount Basics



The dish is pointed using Azimuth and Elevation of the Moon on and relative to the local horizontal.

Az-El Mount Basics

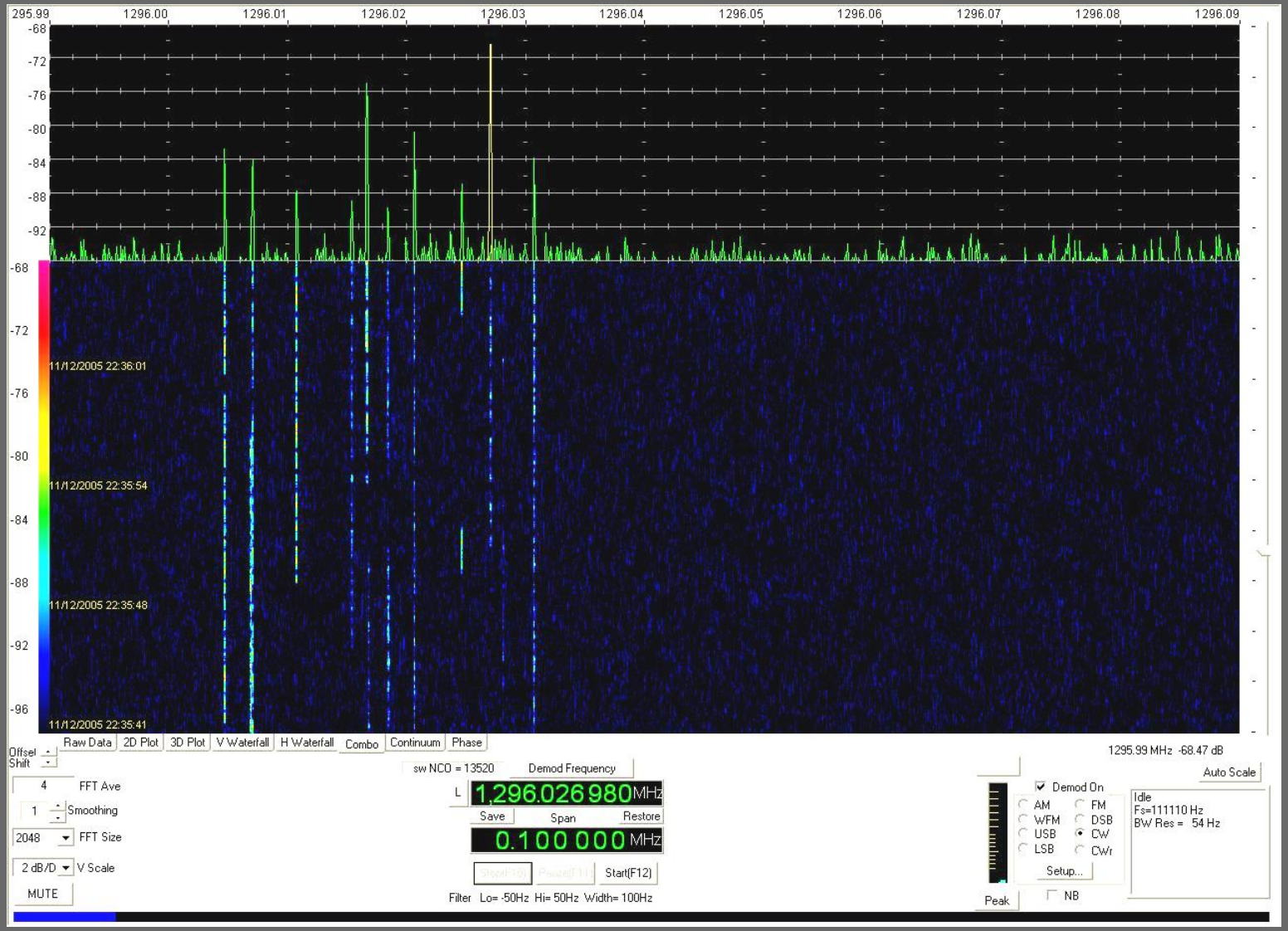
W4OP 12 Foot Dish

K0YW 30 Foot Dish

KA0Y 50 Foot Dish

LX1DB Dish

Is This 20 Meters?



1296 Mhz wide band recording during ARRL EME Contest using SDR-14 from RF Space

The Copy

The calls are W4OP, G4CCH and EA3UM.

During the ARRL 2001 EME contest, W4OP is working Howard G4CCH, giving him a report. EA3UM is calling W4OP trying to initiate a contact. The recording was made by Howard G4CCH.

The copy:

W4OP (chirpy signal): OM Howard la UR RST 569 569 FB. G4CCH DE W4OP K K

EA3UM: 4OP? W4OP?? DE EA3UM EA3UM K K KN