

Exhibit D

Fixed Antenna Specifications

1 Parabolic Antenna Beamwidth

This application for an experimental license includes the use of a 0.019 meter (0.75 inch) conical horn antenna transmitting a CW signal at frequencies between 33 to 36 GHz. Antenna beamwidth is a function of wavelength or more practically the transmit frequency. Below is the formula used to determine the peak gain as a function of efficiency (η), diameter (D) and wavelength (λ).

$$G_{peak} = 10 \log \left[\eta \left(\frac{\pi D}{\lambda} \right)^2 \right] \quad (1)$$

The peak gain of a parabolic antenna can also be calculated as a function of efficiency (η) and the half power beamwidth (θ_{3dB})

$$G_{peak} = 10 \log \left[\eta \left(\frac{70\pi}{\theta_{3dB}} \right)^2 \right] \quad (2)$$

Equating 1 and 2:

$$10 \log \left[\eta \left(\frac{\pi D}{\lambda} \right)^2 \right] = 10 \log \left[\eta \left(\frac{70\pi}{\theta_{3dB}} \right)^2 \right] \quad (3)$$

$$\eta \left(\frac{\pi D}{\lambda} \right)^2 = \eta \left(\frac{70\pi}{\theta_{3dB}} \right)^2$$

$$\left(\frac{\pi D}{\lambda} \right)^2 = \left(\frac{70\pi}{\theta_{3dB}} \right)^2$$

$$\theta_{3dB} = \left(\frac{70c}{Df} \right)$$

$$\theta_{3dB} = \left(\frac{20985472060}{Df} \right) \quad (4)$$

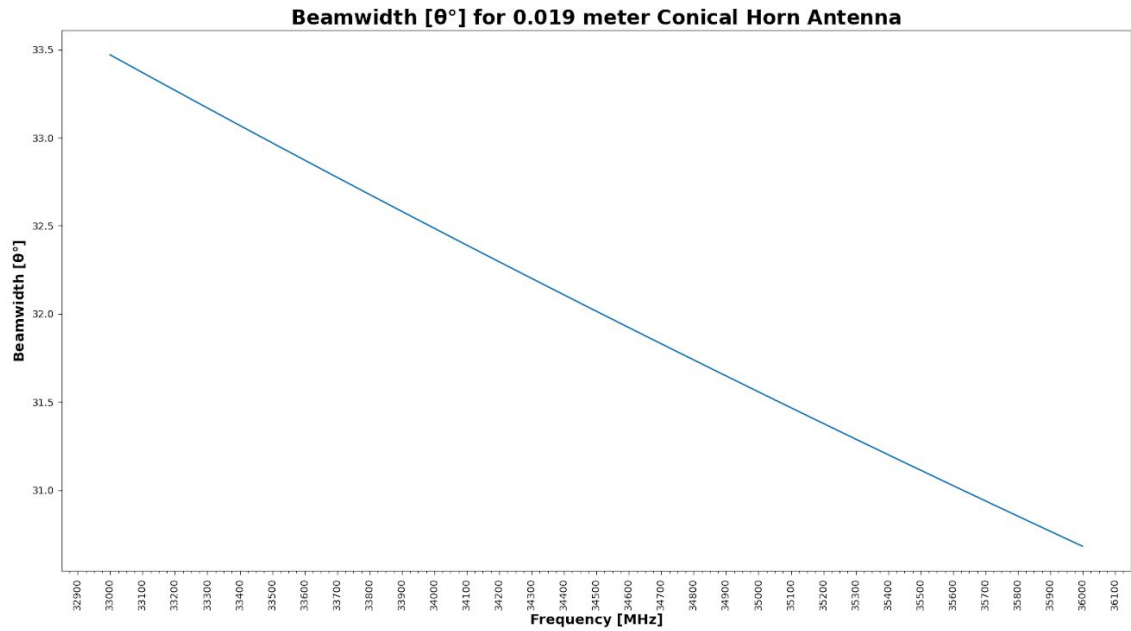


Figure 1: Beamwidth as a function of frequency [MHz]

At 36,000 MHz, the newly requested frequency, the beamwidth for the 0.019 meter conical antenna is 30.68°.

2 Orientation of Beam

The transmit antenna located at 33°57'48" N by 84°6'51" W is orientated in the horizontal plane 91.50° from true North and in the vertical plane—1.7° from the horizontal plane. Figure 2 shows the elevation profile of the path between the transmit and receive antennas.



Figure 2: Elevation profile between Reference Signal Antennas and Receive Test Antenna

Calculation of the vertical orientation of the beam is shown below:

$$\tan(\theta) = \frac{1084 \text{ ft} - 927 \text{ ft}}{5280 \text{ ft}} \quad (5)$$

$$= \frac{157}{5280}$$

$$\theta_{3dB} = \arctan\left(\frac{157}{5280}\right) \\ = 1.7^\circ \quad (6)$$