Useful RF calculation

Free space attenuation or path loss between two points:

The calculation is made assuming ideal conditions, ie:

No reflection from terrain,etc

No atmosferic (climatic) attenuation

No obstruction within the first Fresnel ellipsoid

Use of isotropic antennas at either end of the path

[A]: Frequency - Frequency for calculation expressed in MHz

[B]: Distance - Distance between transmitting and receiving antennas, in Km

Free Space Attenuation (path loss) [dB]= 20 x LOG (A) + 20 x LOG (B) + 32.5

Signal ⇒ Field Strength

Signal field strength at the location of the receiving antenna, given the received signal level measured at the output connector of this antenna, across 50 Ohms.

[A]: Frequency- the frequency of the calculation, expressed in MHz

[B]: Rx antenna gain- the gain of the complete receiving antenna, expressed in dBd (which is the gain in dB referred to a half wavelength dipole) in the actual direction (horizontally and vertically) in which the transmitting antenna is situated.

[C]: Received signal(dBuV)- the received signal voltage expressed in dB relative to 1uV (microvolt) measured at the output connector of the receiving antenna across a resistive impedance of 50 Ohms

$$\text{Field strength [dBuV / m]} = 20 \times Log\left[10^{\left(\frac{C-B}{20}\right)} \times \left(\frac{2 \times \pi \times A}{300}\right)\right]$$

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Parabolic Antenna Gain

Calculation of parabolic antenna gain, with the prime focus feed, with respect to an isotropic radiator (dBi).

[A]: Diameter - the diameter of the antenna, measured rim-to-rim directly across the parabolic reflector, expressed in metres

[B]: Frequency - the frequency for the calculation, expressed in GHz

[C]: Efficiency factor - efficiency factor for the illumination of the antenna. This takes into account the fact that the radiation from the feed does not illuminate the reflector uniformly. If the efficiency is not known, 0.55 may be assumed

$$\text{Parabolic antenna gain [dBi]} = 10 \times Log\left\{ C \times 4 \times \pi^2 \times \left[\frac{\left(\frac{A}{2}\right)^2}{\left(\frac{0.3}{B}\right)^2} \right] \right\}$$

Fresnel Zone Radius

Calculates the radius (minus axis/2 in metres) of the First Fresnel Ellipsoid at any point on the path. This is the zone which must be free from any obstruction in order to prevent attenuation, in excess of the free space value, caused by reflection from obstructions.

[A]: Path length - the direct distance between the transmitting and receiving antennas, measured in a straight line, expressed in Km

[B]: Distance from calculation point to path end - it is the distance from calculation point to the path end, measured horizontally in a straight line, expressed in Km.

[C]: Frequency - the frequency for the calculation, expressed in GHz

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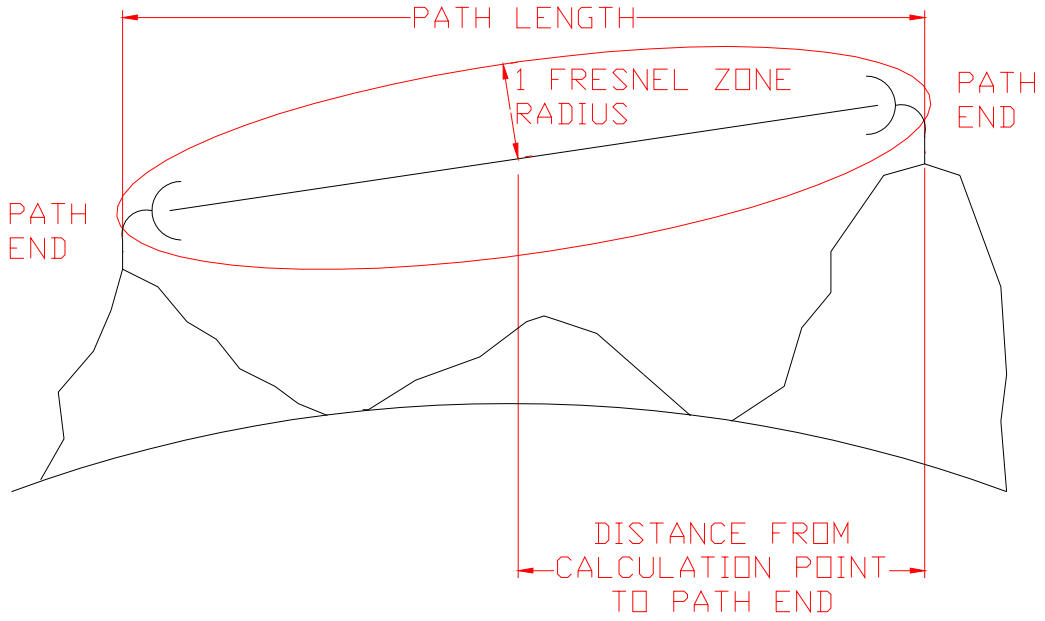
1st Fresnel zone radius over obstacle:

$$[\text{m}] = \frac{\sqrt{\left(\frac{0.3}{C}\right) \times B \times 1000 \times (A - B) \times 1000 \times \left(\frac{1}{A \times 1000}\right)}}{2}$$



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