

Path Profile Analysis

An analysis of path profiles for proposed microwave links aids in location of an appropriate line-of-site path with the desired reliability characteristics.

Parameters can be adjusted during the modeling of the microwave link to provide an adequate line-of-sight path. For example, the diameter of a Fresnel zone varies inversely with frequency. A doubling of frequency decreases the diameter of the first Fresnel zone by a factor of 1/square root of two (0.707). Antenna height can also be varied to find a line-of-site path that meets the required terrain clearance level.

The effective earth curvature factor accounts for the effect of the atmosphere in bending the signal. The effective earth curvature factor is used to account for the curvature of the earth and for the interaction of the signal with the earth's surface. The effective earth curvature varies under different atmospheric conditions, so several levels are often modeled for best case, standard, and substandard conditions. In temperate zones the earth curvature factor (K) of 4/3 is often used to account for the interaction of the signal with the earth surface under normal conditions. A factor of $K = 2/3$ is often used to account for substandard conditions. And a factor of $K = \text{infinity}$, a flat earth with no curvature, provides the best case path profile model.

The amount of Fresnel zone clearance required will depend on the atmospheric conditions and the reliability requirements for the link. Under normal temperate zone conditions ($K=4/3$), clearance of the first Fresnel zone is generally required. Under substandard conditions or high reliability, $K = 2/3$, at least 30% clearance of the first Fresnel zone is generally required. When less reliability is required, an earth curvature of $K = 1$ with at least 60% clearance of the first Fresnel zone plus 10 feet of clearance is desired.

The GL Communications Path Profile Tool provides a terrain profile for the case of $K = \text{infinity}$, no earth curvature, by default. Additional conditions are selected by the user to provide profile plots with earth curvature effects and with commonly used Fresnel zone clearance levels. Additional path clearance should be allowed on a case by case basis to avoid interference from trees, buildings, and other structures that might project above the terrain. Site surveys are also advised to verify the line-of-site path.

Although software modeling is a valuable first step in the design process, computer models are not a substitute for the services of competent microwave engineering.