

## Sun Interference Background

Satellite-based communication is affected by sun interference which is caused by the sun passing directly behind a geostationary satellite as seen from a receiving earth station, see Figure 1. Depending on the receive antenna size, its efficiency and the frequency band used, this interference can cause degradation in quality of service or a complete service outage.

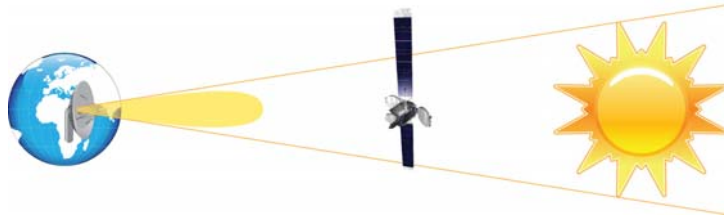


Figure 1: Sun's path during equinox season.

For several minutes each day for several days during the equinox season (February/March and September/October), the sun passes through the equatorial plane which is used by geostationary satellites. At these times, the apparent path of the sun across the sky takes it directly behind the satellite making it appear in the beam width of a receive earth station's line-of-sight.

The heat emitted by the sun is an intense source of thermal noise radiated at the same frequency range communication satellites use: radio frequencies (RF), and the receive antenna noise temperature rises significantly. A sun outage occurs because the earth station cannot distinguish between the energy from the sun and its intended communication signal. This can be expressed as a reduced Carrier-to-Interference (C/I) ratio, a degraded Carrier-to-Noise (C/N) ratio or as an increased antenna noise temperature (and thus reduced receive antenna G/T) as the Interference (Noise) increases during the sun transit.

For the receive earth station, this once-a-day natural phenomenon of additional solar thermal noise is noticed as a source of interference, which causes signal degradation (interference causing lower link availability) or even daily outages (total signal loss) for small periods of time. The timing and duration of the interference, as well as level of service degradation, varies based on the receive earth station location, its size and operational frequency. For earth stations located in the northern hemisphere, this interference occurs for several days just prior to the spring equinox and just after the autumnal equinox (exactly reversed for the southern hemisphere). In general, sun interference occurs during the morning hours for earth stations situated at longitudes west of the sub-satellite point, while they occur during the afternoon for those earth stations that are located east of the satellite's orbital location.

Since solar interference occurs when the sun appears within the receive earth station's line-of-sight, the Sun Interference Calculator computes the antenna beam width and determines the interference duration. This is achieved by determining the angle of visibility based on the receive earth station size, frequency band used and antenna location; from there, the software calculates the time at which the sun enters into the line-of-sight of the earth station, thus determining when interference starts based on proper antenna pointing, and accurately predicts the resulting daily interference duration. The calculator allows the user to determine outage times in advance allowing you to set expectations for your customers.