

RECOMMENDATION ITU-R S.1844

Cross-polarization reference gain pattern for linearly polarized very small aperture terminals (VSAT) for frequencies in the range 2 to 31 GHz

(2009)

Scope

This Recommendation provides a cross-polarization reference gain pattern that, in the absence of particular information concerning the cross-polarization radiation pattern of a linearly polarized very small aperture terminal (VSAT) earth station antenna, should be used as a reference for interference calculations involving VSAT earth stations in the fixed-satellite service and stations of other services sharing the same frequency band, as well as coordination studies and interference assessment between systems in the fixed-satellite service.

The ITU Radiocommunication Assembly,

considering

- a) that, for studies of mutual interference between radiocommunication-satellite systems and between earth stations of such systems and stations of other services sharing the same frequency band, it may be necessary to use a single cross-polarization radiation pattern for the very small aperture terminal (VSAT) earth station antenna;
- b) that, for coordination studies and for the assessment of interference between VSAT earth stations and space stations, a cross-polarization radiation pattern for the angular region near the main beam based on the envelope of the peak power of the side lobes in this region may be appropriate;
- c) that the use of antennas with the best achievable cross-polarization radiation patterns will lead to the most efficient use of the radio-frequency spectrum and the geostationary-satellite orbit,

noting

- a) that increased utilization of the orbital arc has resulted in the widespread use of very small aperture antennas,

recommends

- 1** that, in the absence of particular information concerning the radiation pattern of the linearly polarized very small aperture terminal antenna for the earth station involved, a single reference radiation pattern should be used for coordination and interference studies involving linearly polarized VSAT earth stations in the fixed-satellite service and stations of other services sharing the same frequency band;

2 that the following cross-polarization reference gain pattern should be used for linearly polarized VSAT antennas with a diameter-to-wavelength (D/λ) less than 100, for different angles between the directions considered and the axis of the main beam (boresight direction), for frequencies in the range 2 to 31 GHz:

$$\begin{aligned}
 G_x(\varphi) &= G_{max} - 25 & \text{dBi} & \quad \text{for } 0^\circ \leq \varphi \leq \varphi_{0.3} \\
 G_x(\varphi) &= G_{max} - 20 & \text{dBi} & \quad \text{for } \varphi_{0.3} < \varphi \leq \varphi_{20} \\
 G_x(\varphi) &= G_{max} - 0.0025 \left\{ \left(\frac{D}{\lambda} \right) \varphi \right\}^2 & \text{dBi} & \quad \text{for } \varphi_{20} < \varphi < \varphi_{SXP} \\
 G_x(\varphi) &= 23 - 20 \log \varphi & \text{dBi} & \quad \text{for } \varphi_{SXP} \leq \varphi \leq 7^\circ \\
 G_x(\varphi) &= 20.2 - 16.7 \log \varphi & \text{dBi} & \quad \text{for } 7^\circ < \varphi \leq 26.3^\circ \\
 G_x(\varphi) &= 32 - 25 \log \varphi & \text{dBi} & \quad \text{for } 26.3^\circ < \varphi \leq 48^\circ \\
 G_x(\varphi) &= -10 & \text{dBi} & \quad \text{for } 48^\circ < \varphi \leq 180^\circ
 \end{aligned}$$

where:

$$G_{max}: \text{ antenna maximum gain (in the boresight direction)} = 10 \log \left\{ \eta \pi^2 \left(\frac{D}{\lambda} \right)^2 \right\}$$

D : antenna diameter (m)

λ : wavelength (m)

η : efficiency as a fraction

$\varphi_{0.3}$: angular limit of the -0.3 dB co-polar beamwidth = $10.95 \lambda/D$

φ_{20} : angular limit of the -20 dB co-polar beamwidth = $89.44 \lambda/D$

φ_{SXP} : angle of intersection between:

$$F1(\varphi) = G_{max} - 0.0025 \left\{ \left(\frac{D}{\lambda} \right) \varphi \right\}^2 \text{ and } F2(\varphi) = 23 - 20 \log \varphi$$

and can be approximated by the following expression:

$$\varphi_{SXP} = 101 \left(\frac{D}{\lambda} \right)^{-0.99}$$
