

## RECOMMENDATION ITU-R P.1409

**PROPAGATION DATA AND PREDICTION METHODS REQUIRED FOR  
THE DESIGN OF SYSTEMS USING HIGH ALTITUDE  
PLATFORM STATIONS AT ABOUT 47 GHz**

(1999)

The ITU Radiocommunication Assembly,

*considering*

- a) that the Radio Regulations include provisions for the use of systems in the fixed service employing high altitude platform stations at about 47 GHz;
- b) that the frequency bands identified are also allocated for use by the fixed service and by the fixed-satellite service (Earth-to-space),

*recommends*

**1** that the propagation mechanisms and effects set out in Annex 1 should be taken into account in the design of systems using high altitude platform stations at about 47 GHz, and in studies of sharing and compatibility.

## ANNEX 1

**1 Introduction**

The following mechanisms and effects should be considered when undertaking system design or sharing studies for systems employing high altitude platform stations at about 47 GHz:

- free-space path loss;
- atmospheric attenuation due to gaseous absorption in the troposphere; (it is sufficient to assume that all this attenuation occurs at heights below that of a platform);
- rain attenuation;
- cloud attenuation; (for time percentages smaller than about 1% the effects of cloud attenuation are included within the rain attenuation prediction method);
- back scatter from the Earth's surface; (back scatter from the top of rain cells or from the melting layer is expected to be less important);
- rain scatter;
- tropospheric scintillation.

The effects of ducting within the troposphere are not expected to be important as an interference mode for the slant paths (elevation angles well above 1°) from platform stations.

**2 Prediction methods**

For most cases other information contained in ITU-R Recommendations should be used as follows:

**2.1 Frequency sharing between ground-based stations of high altitude platform networks and other terrestrial stations**

The method of Recommendation ITU-R P.620 should be used for the evaluation of coordination distance, and Recommendation ITU-R P.452 should be used for detailed evaluation.

## **2.2 Frequency sharing between space stations and ground-based stations of high altitude platform networks**

The method described in Recommendation ITU-R P.619 provides relevant information.

## **2.3 Frequency sharing between platform stations and other terrestrial stations**

The method described in Recommendation ITU-R P.619 provides relevant information for this case also, since all losses except those due to free-space spreading occur below the height of the platform.

## **2.4 Frequency sharing between platform stations and space stations**

For the direct path between a platform station and a space station it is only necessary to consider free-space path loss.

In addition, paths should be considered which involve ground scatter or ground reflection. Until further information becomes available the following guidance can be given.

In some cases, smooth surfaces with areas of more than about  $100/\sin^2 \theta \text{ m}^2$  (where  $\theta$  is the elevation angle) may cause glints of good reflection with specular geometry. The signal in such cases may be determined from the e.i.r.p. in the appropriate direction, including the atmospheric attenuation loss due to two traverses of the troposphere for the slant angle involved, and assuming a reflection coefficient of  $-10 \text{ dB}$  (some particular cases may have higher reflection coefficients).

More generally the Earth's surface may be considered as rough. In this case it may be appropriate to assume radiation from the area wholly illuminated by the beam from the platform station into the half-space above the Earth's surface, again with a typical scatter coefficient of  $-10 \text{ dB}$ , i.e. assume a source on the Earth's surface radiating isotropically with a power given by: the actual transmitter power, reduced by the atmospheric attenuation loss due to the two traverses of the troposphere for the slant angles involved, further reduced by  $10 \text{ dB}$  for the reflection coefficient, and then increased by  $3 \text{ dB}$  since the radiation is only into a half space.

## **3 The prediction of system performance for systems using high altitude platform stations**

The method of Recommendation ITU-R P.618 should be used, noting that the use of diversity as described in § 2.2.4 may not be appropriate, and that Faraday rotation due to the ionosphere will not apply.

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