Actual propagation of electromagnetic waves

Component
École Nationale Supérieure d'Électrotechnique d'Électronique

In brief

- **Ametys Code:** N9EE15B
- **Open to exchange students:** Yes

Presentation

Objectives

Discover the influence of real terrain on the propagation of electromagnetic waves in wireless transmission of radio frequency and microwave signals; learn how to use and interpret Friis equations; learn how to evaluate the range of a microwave link in free space; learn how to estimate electric and magnetic fields in free propagation for a given transmitter

Know how to calculate the link budget in free propagation, as well as in the presence of a passive reflector

Understand the Huygens-Fresnel-Kirchoff formulation on the phenomenon of diffraction; know how to calculate Fresnel zones based on terrain problems; Know how to evaluate additional attenuation (AA) using the thin screen model (knife edge effect); know how to use different calculation models for multiple obstacles modeled as screens

Understand the electrical characteristics of different types of terrain and their role in evaluating link performance in multipath propagation; know how to calculate space waves and surface waves; understand their role in the design of transmission systems; Know how to calculate reflection parameters on curved surfaces; know how to evaluate the influence of the Earth's curvature on link balances; know how to perform the "line of sight" calculation.

Know the characteristics of tropospheric propagation; understand standard and non-standard refractions; know tropospheric diffusion models; understand the effects of gases and particles in the air on tropospheric propagation.

Description

• Causes of electromagnetic wave attenuation

• Diffracting screen model.

• Multi-path propagation in the presence of flat/curved surfaces

• Tropospheric propagation

Pre-requisites

Maxwell's equations; plane electromagnetic wave; representation in complex notation