Human Exposure to Radiofrequency RF fields – calculations as defined by EN50385:2002 and OET65

V03

Confidential

Overview

This document shows the calculation of the compliance boundary for the Umbra product to meet the basic restrictions as defined in EN50385:2002, and those defined in 0ET65 Edition 97-01.

The limit defined for a device operating at 28GHz according to Council Recommendation 1999/519/EC is $10W/m^2$.

The limit for occupational exposure according to OET65 is $5mW/cm^2$ ($50W/m^2$).

The limit for general population exposure according to OET65 is $1mW/cm^2$ ($10W/m^2$).

Device characteristics – Standard Umbra Node

The Umbra node emits RF energy on a single RF channel.

The maximum RF power at the filter output is 25.3dBm (with QPSK modulation). The RF energy then passes through an RF switch module before being fed to the selected antenna. The minimum loss of this switch module is 3dB.

Therefore the worst case output power at the antenna is 22.3dBm.

The maximum gain of the antenna is 19.5dBi.

Calculation of compliance boundary for general public exposure

The far field (spherical) calculation method defined in 8.3.2. of EN 50383 has been used to define the compliance boundary, using the maximum gain noted above.

As noted in 8.3.2., this gives a conservative result (it overestimates the field strength). Therefore the exposure at the distance calculated below will be well within safe limits.

S= Power Density – basic restriction is $10W/m^2$
P= Output Power
G= Gain (relative to isotropic)
r= compliance boundary radius

$S=(PG)/(4PIr^2)$

Therefore:

$r^2 =(PG)/(S4PI)$

$r^2 = 15.14/(10 \times 4PI)$

r = 35cm

(For occupational exposure, according to OET65, r=16cm)

Device characteristics – Umbra High Gain Node

The Umbra node emits RF energy on a single RF channel.

The maximum RF power at the filter output is 25.3dBm (with QPSK modulation).

The maximum gain of the antenna is 34dBi.

Calculation of compliance boundary for general public exposure

The far field (spherical) calculation method defined in 8.3.2. of EN 50383 has been used to define the compliance boundary, using the maximum gain noted above.

As noted in 8.3.2., this gives a conservative result (it overestimates the field strength). Therefore the exposure at the distance calculated below will be well within safe limits.

S= Power Density – basic restriction is $10W/m^2$
P= Output Power
G= Gain (relative to isotropic)
r= compliance boundary radius

$S=(PG)/(4PIr^2)$

Therefore:

$r^2 =(PG)/(S4PI)$

$r^2 = 851.14/(10 \times 4PI)$

r = 2.6m

(For occupational exposure, according to OET65, r=1.2m)

Installation guidance to ensure general public are outside compliance boundaries

The Umbra product is designed to be mounted on street furniture (e.g. lampposts) adjacent to small cellular basestations.

The equipment is necessarily mounted out of reach of the general public for the following reasons:

1. To avoid interference with the equipment by the general public
2. To avoid blocking of the radio signal by passing traffic e.g. double-decker buses – requires installation height greater than 5 metres

Therefore the equipment is only accessible to authorised personnel.