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

Document: Human Exposure to RF for FCC
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1. Overview

This document shows the calculation of the compliance boundary for the Metnet 1200 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 10GHz - 300GHz 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).

2. Device characteristics – Metnet1200 Node

The Metnet node emits RF energy through a common RF (waveguide) port connected directly either to an internal switched antenna array or directly to a third-party dish antenna.

The maximum RF power at the common RF port is 20.5dBm (with QPSK modulation).

In the case of the internal antenna configuration, 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 17.5 dBm.

The maximum gain of the internal antenna is 19.5dBi.

2.1 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

$S=(PG)/(4\pi r^2)$

PG=37dBm =5.0 Watts

Therefore:

$r^2 =(PG)/(S4\pi)$

$r^2 = 5.0 /(10 \times 4\pi)$

r = 19.95 cm

(For occupational exposure, according to OET65, r=8.92cm)

3. Device characteristics – Metnet1200 High Gain Node

The maximum RF power at the common RF port is 20.5 dBm (with QPSK modulation).

The maximum gain of the 20cm dish antenna is 34dBi.

The maximum gain of the 60cm dish antenna is 42.5dBi

3.1 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

$S=(PG)/(4\pi r^2)$

PG=54.5 dBm =281.83 Watts

Therefore for the 20cm dish:

$r^2 =(PG)/(S4\pi)$

$r^2 = 281.83/(10 \times 4\pi)$

r = 1.49m

(For occupational exposure, according to OET65, r=67cm)

And for the 60cm dish:

PG=63.0dBm=1995.26W

$r^2 =(PG)/(S4\pi)$

$r^2 = 1995.26/(10 \times 4\pi)$

r = 3.98m

(For occupational exposure, according to OET65, r=1.78m)

4. Installation guidance to ensure general public are outside compliance boundaries

The Metnet product is designed to be mounted on street furniture (e.g. lampposts) adjacent to small cellular base stations.

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.