

EMF Exposure Estimation for F203

1 About Electromagnetic Radiation Field Exposure

1.1 Introduction

CDMA fixed wireless terminal emits RF radiation (Radiation Hazard). Although there is no scientific evidence of possible health risks to persons living near to CDMA fixed terminal, some recommendations are giving below for the installation and operation of CDMA fixed terminal. Operators of CDMA fixed terminal are required to obey the local regulation for erecting CDMA fixed terminal.

1.2 Limits and Guidelines on Exposure to Electromagnetic Fields

There are a number of international and national regulations, standards and guidelines for exposure to electromagnetic fields. Several European countries have adapted the recommendation of the council of the European Union published on 12. July 1999 on the limitation of exposure of the general public to electromagnetic fields (1999/519/EC), the recommendation is based on the guideline published by the International Commission on Non-Ionizing Radiation protection (ICNIRP). Below table shows a comparison between different regulations and applied reference levels of some countries.

Country	Limit 824-849MHz E electric field strength	Limit 824-849MHz S power flux density
ICNIRP International	39.47 V/m(824MHz)	4.12 W/m ² (824MHz)
Europe (1999/519/EC)	39.47 V/m(824MHz)	4.12W/m ² (824MHz)

Note: the limit in 824MHz is most rigorous in the band 824MHz~849MHz.

Reference levels are provided for exposure assessment to determine whether the basic restrictions on exposure of humans to electromagnetic fields are exceeded. The basic restrictions on exposure to electromagnetic fields are based directly on established health effects and biological considerations.



1.3 Location of CDMA Fixed Wireless Terminal antennas

CDMA fixed wireless terminal antennas, the source of the radiation, are usually mounted on FWT with TNC converter, Generally the height of the antenna position does not fall below 20 cm. The Indoor omni antennas generally parameter is: omni-2.0dBi-vertical-50W-or-TNC/MALE; The direction of the antenna position is uprightness tabletop , you can adjust the direction of the antenna position basis view the signal strength on the display screen of the FWT; The power usually is focused into a horizontal main beam and slightly downward tilted. The remaining power goes into the weaker beams on both side of the main beam.

The highest level of emission would be expected in close vicinity of the antenna and in line of sight to the antenna.

1.4 Calculation of Compliance Boundary for CDMA fixed wireless terminal according to EN 50385

Below method describes a theoretical approach to calculate the compliance boundary according to EN 50383:2002 based on a typical configuration of the CDMA fixed wireless terminal. Compliance is declared with EN 50385:2002. Below method applies only to a site with the configurations described below, should the site include other transmitters namely from other CDMA network operators then those transmitters will affect the compliance boundaries for the antenna site. The method used for assessment is based on equations for far-field electromagnetic field calculation according to clause 8 of EN 50383. Those equations are accurate in the far-field of antennas but will over-predict in the near field, however it can be used for “worst case” or conservative prediction of electromagnetic fields or power densities radiated by antennas.

CDMA fixed wireless terminal use the omni indoor antenna, are usually mounted on FWT with TNC converter, so the estimation of compliance boundary is based on this omni antenna here.



1.4.1 Typical Configuration of the CDMA Fixed Wireless Terminal

The CDMA fixed wireless terminal is subscriber equipments in the CDMA system. The frequency band is Band Class 0. It implements such functions as RF signal receiving/sending, CDMA1x protocol processing, audio signal in/output, etc. Externally it RS232 interface (to computers), antenna interface, and power interface, in addition to the charging interface. Maximum output power is 250 mW.

1.4.2 Technical Description F203

Technical Specification:

Output power:	250mW (24 dBm) / TRX
Transmitter frequency band	824-894 MHz (CDMA Band Class 0)
Number of antenna ports:	1
Antenna system and type (typical)	TLB-800-2H indoor aerial Omnioriental
Frequency range:	824-894MHz
Gain:	2.0dBi
Mechanical specification (Height)	178mm

1.4.4 Estimation of compliance boundary for indoor antenna

The wavelength for 824 MHz to 849 MHz is 0.162m to 0.157m. Above calculations is accurate when the point of investigation is in the far-field region and over-estimates in the radiating near-field. The far-field region is determined by:

$$r = \frac{2D^2}{\lambda} = 0.437 \text{ m} (D=0.18525\text{m}, \lambda = 0.157)$$

Whereas:

r = distance from the antenna to the point of investigation

D = length of antenna

λ = wavelength of transmitting frequency

The radiating near-field region is determined by:

$$\frac{\lambda}{4} < r \leq \frac{2D^2}{\lambda} = 0.039 < r \leq 0.437 \text{ m}$$



For the final determination of the compliance boundary the model for far-field calculation is used since this overestimates the field strength in the near-field region. Thus the calculated compliance boundary should be rather more conservative and on the safe side.

For above CDMA fixed wireless terminal the following compliance boundary is calculated:

Power at antenna connector BTS: **24 dBm**

Antenna-cable attenuation: **0 dB**

Input power to antenna: **24 dBm (250mW)**

Antenna gain: **2.0 dBi (1.59)**

Reference level for 450 MHz based on recommendation 1999/519/EC: **39.47 V/m**

For any further assessment the value of 39.47 V/m is used.

Compliance boundary

For CDMA 824MHz band:

$$r^2 = \frac{30 * P * G_{(\theta,\phi)}}{E^2} = r^2 = \frac{30 * 0.25 * 1.59}{39.47^2}$$

r = 0.086 m for CDMA 824 MHz

The compliance boundary distance is close enough; the compliance boundary is much closer for indoor antenna. So the requirement is easily met for the user if only user is not close extremely to CDMA fixed wireless terminal.

1.4.5 Uncertainty of Calculation

Above calculations do not consider possible reflections from the ground, neighboring buildings or other obstacles. If the antenna is mounted on the rooftop of a building the field strength in D down direction is reduced by the building by around 10-20 dB.

Furthermore above calculations are assuming that the transceiver is operating at full power.

1.4.4 Compliance with EN 50385

Based on above assessment compliance with EN 50385:2002 can be shown for any point of investigation outside the compliance boundary. However it must be mentioned again that in case of co-locating other antennas the compliance boundary determined above is



not anymore applicable. Furthermore it is suggested to conduct measurements according EN 50383 after the installation of the CDMA fixed wireless terminal to confirm above calculated compliance boundaries.