

RF Exposure Assessment

Introduction

Any Radio Equipment is emitting Radio Frequency (RF) Radiation through its antenna which may be integrated to the equipment or not. It is important to follow any local, national or international regulation during installation and operation of the Radio Equipment to avoid radiation hazards.

Regulations

A lot of countries have issued and follow their own regulations but others adopted European or international regulations, standards or guidelines.

In Europe, some countries follow the recommendations included in 1999/519/EC directive which is based on the guidelines document published by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Other countries have issued their own regulations for this purpose.

The above mentioned European Directive provides the reference levels (limits) for assessment of the human exposure to electromagnetic fields based on health effects. European Union, FCC (US) and Industry Canada Reference Levels for microwave frequencies applied to INTRACOM Telecom equipment are given in the following table (Table 1).

Table 1: RF Exposure Reference Levels

Regulation	Frequency Range	Power Density	Notes
1999/519/EC	2-300 GHz	10 W/m ²	General Public
FCC 1.1310	1.5-100 GHz	1 mW/cm ² (10 W/m ²)	General Public
FCC 1.1310	1.5-100 GHz	5 mW/cm ² (50 W/m ²)	Occupational
IC RSS-102	6-150 GHz	1 mW/cm ² (10 W/m ²)	General Public
IC RSS-102	6-150 GHz	5 mW/cm ² (50 W/m ²)	Occupational

RF Exposure General Guidelines for equipment installation

As a general rule it is expected that the highest level of emission would be in line of sight and in close vicinity of the antenna. Additional requirements for the installation of equipment shall be as follows:

- The equipment should be located in such a way to prevent the public from accessing the area where the RF Radiation exceeds the regulation limits. For this, a compliance boundary is determined, based on its radio characteristics. Outside this area the RF radiation levels are below the reference levels (limits).
- Operation and maintenance personnel, which have to work within the RF radiation compliance boundary area, should be informed about the source of radiation and should have the capability to power off the radio equipment before entering the compliance boundary area.
- The compliance boundary area should be defined by a relevant warning sign or physical barrier.

Radiation Exposure Assessment – Compliance Boundary Calculation

In order to calculate the RF exposure compliance boundary around a Radio Equipment and its antenna, a theoretical approach is described below. As the installation environment could be complex, i.e obstacles causing reflections or scattering, soil conditions etc., this approach may be used to provide a rough estimation of the expected exposure in power flux density on a certain point. More precise estimations can be feasible if detailed knowledge of the installation environment is available. In some cases a safety factor can be used to increase the level of confidence.

The power flux density S can be calculated using the following formula:

$$S = P * G_{num} / (4 * r^2 * \pi)$$

where,

- P is the maximum power at the antenna port of the Radio Equipment,
- G_{num} is the numerical gain of the antenna,
- r is the distance between the antenna and the point of interest.

RF Radiation Safety Information

This equipment complies with
Cet équipement est conforme à

- ISED RSS-102
- FCC title 47 part 1.1310
- EMF Exposure Directive (1999/519/EC)

Radiation exposure limits set forth for an uncontrolled environment. This equipment (antenna) should be installed and operated with minimum distance between the radiator & the human body as depicted in the tables below. This distance provides additional safety margin for the product minimizing exposure to microwaves and is calculated as the worst case scenario (maximum transmitter power / antenna with maximum gain¹). These calculations were done in accordance with:

Limites d'exposition aux rayonnements établies pour un environnement non contrôlé. Cet équipement (antenne) doit être installé et utilisé avec une distance minimale entre le radiateur et le corps humain, comme indiqué dans les tableaux ci-dessous. Cette distance fournit une marge de sécurité supplémentaire pour le produit en minimisant l'exposition aux rayonnements et est calculée comme le pire des cas (puissance d'émission maximale / antenne avec gain maximal). Ces calculs ont été effectués conformément à :

- FCC Radio Frequency Exposure Methods & Limits 2.1091, 1.1310
- Health Canada Safety Code 6 / Industry Canada RSS 102
 - <https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/occupational-exposure-regulations/>
 - https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/h_sf06129.html
- EMF Exposure Directive (99/519/EC)

¹ In case different types of antennas are available to be used with the equipment

Product	WiBAS G5 evo-BS 24 GHz	WiBAS G5 evo-BS 24 GHz	WiBAS G5 evo-BS 24 GHz
Antenna Type	HG	SG	Omni
Antenna Diameter (m)	0.24	0.24	0.212
Antenna Gain (dBi)	19	14.8	10
Compliance Boundary (m) General Public	0.20	0.20	0.10
Compliance Boundary (m) Occupational	0.10	0.10	0.10

Product	WiBAS G5 evo-BS 26 GHz	WiBAS G5 evo-BS 26 GHz	WiBAS G5 evo-BS 26 GHz
Antenna Type		SG	Omni
Antenna Diameter (m)		0.24	0.212
Antenna Gain (dBi)		15.2	10
Compliance Boundary (m) General Public		0.20	0.10
Compliance Boundary (m) Occupational		0.10	0.10

Product	WiBAS G5 evo-BS 28 GHz	WiBAS G5 evo-BS 28 GHz	WiBAS G5 evo-BS 28 GHz	WiBAS G5 evo-BS 28 GHz
Antenna Type	HG	SG	Omni	Parabolic (PtP)
Antenna Diameter (m)	0.24	0.24	0.212	0,653
Antenna Gain (dBi)	19	15.5	10	42,8
Compliance Boundary (m) General Public	0.50	0.30	0.20	6,70
Compliance Boundary (m) Occupational	0.20	0.20	0.10	3,00

Product	WiBAS G5 Connect+ 24 GHz	WiBAS G5 Connect+ 24 GHz
Antenna Type	LP-0,3	LP-0,5
Antenna Diameter (m)	0.393	0.505
Antenna Gain (dBi)	36.3	39.5
Compliance Boundary (m)		
General Public	1.40	2.00
Occupational	0.70	0.90

Product	WiBAS G5 Connect+ 26 GHz	WiBAS G5 Connect+ 26 GHz
Antenna Type	LP-0,3	LP-0,5
Antenna Diameter (m)	0.393	0.505
Antenna Gain (dBi)	37	40
Compliance Boundary (m)		
General Public	1.60	2.30
Occupational	0.80	1.10

Product	WiBAS G5 Connect+ 28 GHz	WiBAS G5 Connect+ 28 GHz
Antenna Type	LP-0,3	LP-0,5
Antenna Diameter (m)	0.393	0.505
Antenna Gain (dBi)	37.5	40.5
Compliance Boundary (m)		
General Public	3.10	4.40
Occupational	1.40	2.00