

### 6.11. RF EXPOSURE REQUIRMENTS [§§ 15.247(e)(i), 1.1310 & 2.1091]

The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation.

#### FCC 47 CFR § 1.1310:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300 .....	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

#### 6.11.1. Method of Measurements

Refer to Sections 1.1310, 2.1091

In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

- (1) Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.
- (2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
- (3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
- (4) Any other RF exposure related issues that may affect MPE compliance

**Calculation Method of RF Safety Distance:**

$$S = PG/4\pi r^2 = EIRP/4\pi r^2$$

Where: P: power input to the antenna in mW  
 EIRP: Equivalent (effective) isotropic radiated power  
 S: power density mW/cm<sup>2</sup>  
 G: numeric gain of antenna relative to isotropic radiator  
 r: distance to centre of radiation in cm

$$r = \sqrt{EIRP/4\pi S}$$

**6.11.2. RF Evaluation**

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
Minimum calculated separation distance between antenna and persons required: <b>*18 cm</b>	Manufacturer' instruction for separation distance between antenna and persons required: <b>20 cm.</b>
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Antenna installation and device operating instructions shall be provided to installers to maintain and ensure compliance with RF exposure requirements.
Caution statements and/or warning labels that are necessary in order to comply with the exposure limits	Refer to User's Manual for RF Exposure Information.
Any other RF exposure related issues that may affect MPE compliance	None.

\*The minimum separation distance between the antenna and bodies of users are calculated using the following formula:

$$\text{RF EXPOSURE DISTANCE LIMITS: } r = (PG/4\pi S)^{1/2} = (EIRP/4\pi S)^{1/2}$$

$$S = 1.0 \text{ mW/cm}^2$$

$$EIRP = 36 \text{ dBm} = 10^{3.6} \text{ mW (assuming worst case)}$$

$$r = (EIRP/4\pi S)^{1/2} = (10^{3.6/10} / 4\pi(1.0))^{1/2} = 18 \text{ cm}$$

**YAGI CLASS ANTENNAS for Channels 11 to 24**

Part Number	Type (Description)	Gain	Application*	Min. Separation	Minimum Cable Loss/ Power Reduction/ Attenuation Required for 18dBm Output
A24-P15NF	Flat Panel	15.0 dBi	Fixed	2 m	1.8 dB
A24-P16NF	Flat Panel	16.0 dBi	Fixed	2 m	2.8 dB
A24-P19NF	Flat Panel	19.0 dBi	Fixed	2m	5.8 dB

\* **If using the RF module in a portable application** (for example - if the module is used in a handheld device and the antenna is less than 20cm from the human body when the device is in operation): The integrator is responsible for passing additional SAR (Specific Absorption Rate) testing based on FCC rules 2.1091 and FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, OET Bulletin and Supplement C. The testing results will be submitted to the FCC for approval prior to selling the integrated unit. The required SAR testing measures emissions from the module and how they affect the person.

**RF Exposure**



**WARNING:** To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance are not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

The preceding statement must be included as a CAUTION statement in OEM product manuals in order to alert users of FCC RF Exposure compliance.

**Europe (ETSI)**

The XBee RF Modules have been certified for use in several European countries. For a complete list, refer to [www.digi.com](http://www.digi.com)

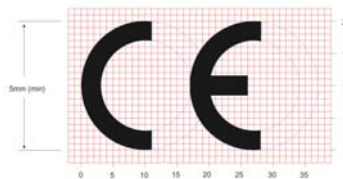
If the XBee RF Modules are incorporated into a product, the manufacturer must ensure compliance of the final product to the European harmonized EMC and low-voltage/safety standards. A Declaration of Conformity must be issued for each of these standards and kept on file as described in Annex II of the R&TTE Directive.

Furthermore, the manufacturer must maintain a copy of the XBee user manual documentation and ensure the final product does not exceed the specified power ratings, antenna specifications, and/or installation requirements as specified in the user manual. If any of these specifications are exceeded in the final product, a submission must be made to a notified body for compliance testing to all required standards.

**OEM Labeling Requirements**

The 'CE' marking must be affixed to a visible location on the OEM product.

**CE Labeling Requirements**



The CE mark shall consist of the initials "CE" taking the following form:

- If the CE marking is reduced or enlarged, the proportions given in the above graduated drawing must be respected.
- The CE marking must have a height of at least 5mm except where this is not possible on account of the nature of the apparatus.
- The CE marking must be affixed visibly, legibly, and indelibly.

**Restrictions**

**France:** Outdoor use limited to 10 mW EIRP within the band 2454-2483.5 MHz.

**Norway:** Norway prohibits operation near Ny-Alesund in Svalbard. More information can be found at the Norway Posts and Telecommunications site ([www.npt.no](http://www.npt.no)).