

**5.7. RF EXPOSURE REQUIRMENTS [§§ 15.247(i), 1.1310 & 2.1091]**

**5.7.1. Limits**

§ 1.1310: The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

**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: 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: 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.

**5.7.2. Method of Measurements**

**Calculation Method of Power Density/RF Safety Distance:**

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

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

$$r = \sqrt{\frac{PG}{4\pi \cdot S}} = \sqrt{\frac{EIRP}{4\pi \cdot S}}$$

**5.7.3. RF Evaluation**

**5.7.3.1. Standalone**

Maximum EIRP, <b>P<sub>EIRP</sub>[dBm]</b> :	36.00
MPE Limit for General Population/Uncontrolled Exposure, <b>S<sub>uncontrolled</sub>[mW/cm<sup>2</sup>]</b>	1.0
Calculated RF Safety Distance for General Population/Uncontrolled Exposure, <b>r<sub>safety uncontrolled</sub>[cm]</b>	17.8

**5.7.3.2. Co-location**

Pursuant to KDB 447498 D01 General RF Exposure Guidance v05r02, Section 7.2:

*Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is  $\leq 1.0$ .*

Co-location will only applies to EUT with 2 dBi dipole antenna, worst case EIRP of 32 dBm will be used in co-location at the minimum 23 cm evaluation separation distance required by the operating configurations and exposure conditions of the host device.

**The maximum calculated MPE ratio of the EUT with 2 dBi dipole antenna**

Frequency (MHz)	EUT EIRP (dBm)	EUT EIRP (mW)	Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	FCC/IC MPE Limit (mW/cm <sup>2</sup> )	MPE Ratio
2412	32	1584.893	23	0.238	1.0	0.238

The maximum calculated MPE ratio for the EUT with 2 dBi dipole antenna is 0.238, this configuration can be co-located with other antennas provided the sum of the MPE ratios for all the other simultaneous transmitting antennas incorporated in a host device is  $\leq 1.0$  -  $0.238 \leq 0.762$ . The following table addresses the co-location of the EUT with 2 dBi antenna with the specified radio modules.

**EUT with 2 dBi dipole antenna co-location with radio module identified in this table**

*Radio Module	Frequency (MHz)	EIRP (mW)	Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	FCC/IC MPE Limit (mW/cm <sup>2</sup> )	MPE Ratio	MPE Ratio of EUT with 2 dBi antenna	Sum of MPE Ratio	Verdict
Data Card Module (FCC ID: RI7LN930, IC: 5131A-LN930)	824.2	2511.89	23	0.378	0.549	0.689	0.238	0.927	Compliant
LTE Data Transmitter Module (FCC ID: R5Q-TOBYL100, IC: 8595B-TOBYL100)	782	2564.484	23	0.386	0.521	0.741	0.238	0.979	Compliant
GSM/UMTS/LTE Data Module (FCC ID: XPYTOBYL200, IC: 8595A-TOBYL200)	1909.8	2944.219	23	0.443	1.0	0.443	0.238	0.681	Compliant

\* The test data of the radio modules represented in this table is the worst-case configuration (maximum MPE ratio) derived from the original radio modules MPE reports. Refer to these reports for details.