

5 FCC § 2.1091, §15.247(i) and ISEDC RSS-102 – RF Exposure

5.1 Applicable Standards

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* (180/f ²)	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

Before equipment certification is granted, the procedure of ISEDC RSS-102 must be followed concerning the exposure of humans to RF field

According to RSS-102 section 4. Exposure Limits

Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/f	-	6**
1.1-10	87/f ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/f ^{0.25}	0.1540/f ^{0.25}	8.944/f ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/f ^{1.2}
150000-300000	0.158 f ^{0.5}	4.21 x 10 ⁻⁴ f ^{0.5}	6.67 x 10 ⁻⁵ f	616000/f ^{1.2}

Note: f is frequency in MHz.
***Based on nerve stimulation (NS).**
**** Based on specific absorption rate (SAR).**

5.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

5.3 Standalone RF Exposure Evaluation Results for FCC

906-924 MHz Radio

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>25</u>
<u>Maximum peak output power at antenna input terminal (mW):</u>	<u>316.23</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>914</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>1.2</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.318</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.083</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>0.609</u>

GSM850 /WCDMA Band 5

<u>Maximum source-based, time-averaged power at antenna input terminal (dBm):</u>	<u>24.80</u>
<u>Maximum source-based, time-averaged power at antenna input terminal (mW):</u>	<u>301.995</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>825</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>2.0</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.58</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.095</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>0.55</u>

PCS1900 /WCDMA Band 2

<u>Maximum source-based, time-averaged power at antenna input terminal (dBm):</u>	<u>23.60</u>
<u>Maximum source-based, time-averaged power at antenna input terminal (mW):</u>	<u>229.09</u>
<u>Prediction distance (cm):</u>	<u>20</u>
<u>Prediction frequency (MHz):</u>	<u>1850.2</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>2.0</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.58</u>
<u>Power density of prediction frequency at 20.0 cm (mW/cm²):</u>	<u>0.072</u>
<u>FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm²):</u>	<u>1</u>

5.4 Standalone RF Exposure Evaluation Results for ISED

906-924 MHz Radio

<u>Maximum peak output power at antenna input terminal (dBm):</u>	<u>25</u>
<u>Maximum peak output power at antenna input terminal (W):</u>	<u>0.31623</u>
<u>Prediction distance (m):</u>	<u>0.20</u>
<u>Prediction frequency (MHz):</u>	<u>914</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>1.2</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.318</u>
<u>Power density of prediction frequency at 0.2 m (W/m²):</u>	<u>0.83</u>
<u>ISED MPE limit for uncontrolled exposure at prediction frequency (W/m²):</u>	<u>2.764</u>

GSM850 /WCDMA Band 5

<u>Maximum source-based, time-averaged power at antenna input terminal (dBm):</u>	<u>24.80</u>
<u>Maximum source-based, time-averaged power at antenna input terminal (W):</u>	<u>0.301995</u>
<u>Prediction distance (m):</u>	<u>0.20</u>
<u>Prediction frequency (MHz):</u>	<u>825</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>2.0</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.58</u>
<u>Power density of prediction frequency at 0.2 m (W/m²):</u>	<u>0.95</u>
<u>ISED MPE limit for uncontrolled exposure at prediction frequency (W/m²):</u>	<u>2.578</u>

PCS1900 /WCDMA Band 2

<u>Maximum source-based, time-averaged power at antenna input terminal (dBm):</u>	<u>23.60</u>
<u>Maximum source-based, time-averaged power at antenna input terminal (W):</u>	<u>0.22909</u>
<u>Prediction distance (m):</u>	<u>0.20</u>
<u>Prediction frequency (MHz):</u>	<u>1850.2</u>
<u>Maximum Antenna Gain, typical (dBi):</u>	<u>2.0</u>
<u>Maximum Antenna Gain (numeric):</u>	<u>1.58</u>
<u>Power density of prediction frequency at 0.2 m (W/m²):</u>	<u>0.72</u>
<u>ISED MPE limit for uncontrolled exposure at prediction frequency (W/m²):</u>	<u>4.478</u>

5.5 Simultaneous Transmission RF Exposure Evaluation Results

FCC

906-924 MHz Radio + GSM850/WCDMA Band 5 = $0.083/0.609 + 0.095/0.55 = 0.31 < 1$

906-924 MHz Radio + PCS1900/WCDMA Band 2 = $0.083/0.609 + 0.072/1 = 0.21 < 1$

ISED

906-924 MHz Radio + GSM850/WCDMA Band 5 = $0.82/2.764 + 0.95/2.578 = 0.665 < 1$

906-924 MHz Radio + PCS1900/WCDMA Band 2 = $0.82/2.764 + 0.72/4.478 = 0.457 < 1$

5.6 Conclusion

The EUT is compliant with the FCC and ISED RF Exposure requirements for both standalone and simultaneous transmission configurations when a 20 cm separation distance from all persons is provided.