



APPENDIX I RADIO FREQUENCY EXPOSURE

LIMIT

According to §15.247(i), 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 levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

EUT Specification

EUT	4G LTE Embedded Mini-Card Module
Model	WW-DL060
Frequency band (Operating)	<input checked="" type="checkbox"/> LTE Band 12: 701.5MHz ~ 713.5MHz(Channel Bandwidth 5MHz) <input checked="" type="checkbox"/> LTE Band 12: 704.0MHz ~ 711.0MHz(Channel Bandwidth 10MHz) <input type="checkbox"/> Others
Device category	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others
Exposure classification	<input type="checkbox"/> Occupational / Controlled exposure (S = 5mW/cm ²) <input checked="" type="checkbox"/> General Population / Uncontrolled exposure
Antenna Specification	Dipole Antenna, Gain: 1.0 dBi ± 0.7 dBi @ low Band
Average output power	LTE Band 12 Channel Bandwidth 5MHz : QPSK : 24.26 dBm(266.686mW) 16QAM : 23.86 dBm(243.220mW) Channel Bandwidth 10MHz : QPSK : 23.10 dBm(204.174mW) 16QAM : 24.18 dBm(261.818mW)
Tune up limit	23 ± 2.7 dBm
Evaluation applied	<input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A
Remark: <i>The maximum output power is <u>24.26 dBm (266.686 mW) at 713.5 MHz (with 1.48 numeric antenna gain.)</u></i>	



TEST RESULTS

No non-compliance noted.

Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{377}$

Where $E =$ Field strength in Volts / meter

$P =$ Power in Watts

$G =$ Numeric antenna gain

$d =$ Distance in meters

$S =$ Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

$$S = \frac{30 \times P \times G}{377d^2}$$

Changing to units of mW and cm, using:

$$P \text{ (mW)} = P \text{ (W)} / 1000 \text{ and}$$

$$d \text{ (cm)} = d \text{ (m)} / 100$$

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2} \quad \text{Equation 1}$$

Where $d =$ Distance in cm

$P =$ Power in mW

$G =$ Numeric antenna gain

$S =$ Power density in mW / cm²



Maximum Permissible Exposure

Substituting the MPE safe distance using $d = 20$ cm into Equation 1:

$$S = 0.000199 \times P \times G$$

Where $P =$ Power in mW

$G =$ Numeric antenna gain

$S =$ Power density in mW / cm²

LTE Band 12 Channel Bandwidth 5MHz QPSK:

Ch.	Frequency (MHz)	P (mW)		Gain (num.)	D (cm)	Power density in mW / cm ²		Limit (mW/cm ²)
		Measured	Tune-up limit			Measured	Reported	
23155	713.5	286.418	371.535	1.48	20	0.0844	0.1094	0.5

LTE Band 12 Channel Bandwidth 5MHz 16QAM :

Ch.	Frequency (MHz)	P (mW)		Gain (num.)	D (cm)	Power density in mW / cm ²		Limit (mW/cm ²)
		Measured	Tune-up limit			Measured	Reported	
23155	713.5	243.220	371.535	1.48	20	0.0716	0.1094	0.5

LTE Band 12 Channel Bandwidth 10MHz QPSK:

Ch.	Frequency (MHz)	P (mW)		Gain (num.)	D (cm)	Power density in mW / cm ²		Limit (mW/cm ²)
		Measured	Tune-up limit			Measured	Reported	
23130	711.0	204.174	371.535	1.48	20	0.0601	0.1094	0.5

LTE Band 12 Channel Bandwidth 10MHz 16QAM :

Ch.	Frequency (MHz)	P (mW)		Gain (num.)	D (cm)	Power density in mW / cm ²		Limit (mW/cm ²)
		Measured	Tune-up limit			Measured	Reported	
23130	711.0	261.818	371.535	1.48	20	0.0771	0.1094	0.5