

## Maximum Permissible Exposure (MPE)

### Related Submittal(s) / Grant (s)

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

This is a Mobile device, the MPE is required.

According to §1.1310 and §2.1093 RF exposure is calculated.

This submittal(s) (test report) is intended to comply with Section Part 22, subpart H and Part 24, subpart E and Part 27 subpart C & subpart L of the FCC CFR 47 Rules. And RSS-102 issue 4 For 47 CFR 1.1310 Radio frequency Radiation Exposure requirement.

### Special Accessories

Not available for this EUT intended for grant.

### Equipment Modifications

Not available for this EUT intended for grant.

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**Limitation**

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (minute)
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 <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

\* = Plane-wave equipment power density

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m <sup>2</sup> )	Averaging Time (minutes)
0.003-1	280	2.19	-	6
1-10	280/f	2.19/f	-	6
10-30	28	2.19/f	-	6
30-300	28	0.073	2*	6
300-1500	1.585 f <sup>0.5</sup>	0.0042 f <sup>0.5</sup>	f/150	6
1500-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/f <sup>1.2</sup>
150000-300000	0.158 f <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> f <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> f	616000/f <sup>1.2</sup>

Note: f is frequency in MHz.

\* Power density limit is applicable at frequencies greater than 100 MHz.

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### Maximum Permissible Exposure (MPE) Evaluation

In this application we seek approval to the CB001 LTE Based on the FCC OET Bulletin 65 Supplement C and 47 CFR §2.1091, we have concluded that the CB001 LTE will comply with the FCC rules on RF exposure for mobile devices in cellular band and PCS band. The following analysis will demonstrate such compliance. The analysis will be done in two US bands.

#### Operation in cellular band (824.20– 848.80 MHz)

The Pout of CB001 LTE in cellular band is 31.90dBm max at **GPRS 850** mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	CH	Avg. Power (1DN 1UP) (dBm)
GPRS 850 (Class 8)	824.2	128	31.70
	836.6	190	31.70
	848.8	251	<b>31.90</b>

$$P_{out} = 31.90\text{dBm} = 1549.00 \text{ mW}$$

$$\text{Power Density} = (P_{out} \cdot G) / (4 \pi R^2)$$

$$= 1549 \cdot 2.5 / (4 \cdot \pi \cdot 20^2) = 0.1733606 \text{ mW/cm}^2$$

Where GPRS 850 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

$$\text{MPE limit} = 824.20 / 1500 = 0.549 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore CB001 LTE in cellular band is compliant with the FCC rules on RF exposure.

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Operation in PCS band (1850.2– 1909.8 MHz)

The Pout of CB001 LTE in PCS band is 29.0dBm max at **GPRS 1900** mode. The resulted power density at a distance of 20 cm can be deducted as follows:

EUT Mode	Frequency (MHz)	CH	Avg. Power (1DN 1UP) (dBm)
GPRS 1900 (Class 8)	1850.2	512	<b>29.00</b>
	1880.0	661	29.00
	1909.8	810	28.80

$$P_{out} = 29.0\text{dBm} = 794.00 \text{ mW}$$

$$\begin{aligned} \text{Power Density} &= (P_{out} \cdot G) / (4 \pi R^2) \\ &= 794 \cdot 0.6 / (4 \cdot \pi \cdot 20^2) = 0.1815308 \text{ mW/cm}^2 \end{aligned}$$

Where GPRS 1900 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

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

As we can see the resulted power density is below the MPE limit, therefore CB001 LTE in cellular band is compliant with the FCC rules on RF exposure.

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Operation in LTE band (779.5 – 784.5 MHz)

The Pout of CB001 LTE in **LTE band 13 5MHz /QPSK/RB 1** is 23.88dBm max at LTE mode. The resulted power density at a distance of 20 cm can be deducted as follows:

Smaller channel bandwidth of LTE band 13_5 MHz							
channel	Frequency (MHz)	Uplink Channel Number	Bandwidth (MHz)	RB Number	RB Offset	Modulation	Max. Average Power (dBm)
Low	779.5	23205	5	12	6	QPSK	22.83
	779.5	23205	5	25	0	QPSK	22.93
	779.5	23205	5	1	24	QPSK	23.87
	779.5	23205	5	1	0	QPSK	23.63
	779.5	23205	5	12	6	16 QAM	21.89
	779.5	23205	5	25	0	16 QAM	22.24
	779.5	23205	5	1	24	16 QAM	22.95
	779.5	23205	5	1	0	16 QAM	22.81
Middle	782	23230	5	12	6	QPSK	22.85
	782	23230	5	25	0	QPSK	22.81
	782	23230	5	1	24	QPSK	<b>23.88</b>
	782	23230	5	1	0	QPSK	23.96
	782	23230	5	12	6	16 QAM	21.78
	782	23230	5	25	0	16 QAM	22.16
	782	23230	5	1	24	16 QAM	22.85
	782	23230	5	1	0	16 QAM	22.93

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High	784.5	23255	5	12	6	QPSK	22.74
	784.5	23255	5	25	0	QPSK	22.85
	784.5	23255	5	1	24	QPSK	23.71
	784.5	23255	5	1	0	QPSK	23.75
	784.5	23255	5	12	6	16 QAM	21.83
	784.5	23255	5	25	0	16 QAM	22.08
	784.5	23255	5	1	24	16 QAM	22.81
	784.5	23255	5	1	0	16 QAM	22.94

$$P_{out} = 23.88\text{dBm} = 244.0\text{mW}$$

$$\begin{aligned} \text{Power Density} &= (P_{out} \cdot G) / (4 \pi R^2) \\ &= 244 \cdot 0.8 / (4 \cdot \pi \cdot 20^2) = 0.112447 \text{ mW/cm}^2 \end{aligned}$$

where LTE band 13 5MHz /QPSK/RB 1 operation and R is 20 cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the FCC OET Bulletin 65 Supplement C and can be calculated as follows:

$$\text{MPE limit} = 779.5 / 1500 = 0.520 \text{ mW/cm}^2$$

As we can see the resulted power density is below the MPE limit, therefore CB001 LTE in LTE band is compliant with the FCC rules on RF exposure.

\*The worst-case is selected to compute for MPE compliance with respect to corresponding frequency Band.

**- End of Report -**

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