

**IEEE C95.1
KDB 447498 D03
47 C.F.R. Part 1, Subpart I, Section 1.1310
47 C.F.R. Part 2, Subpart J, Section 2.1091**

RF EXPOSURE REPORT

For

MXConnect M2M Advanced In-Vehicle 4G/LTE Wireless Router

Model: BEC MX-1000

Data Applies To : BEC MX-500

Trade Name: BEC

Issued for

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Issued Date: October 15, 2015**



Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	09/23/2015	Initial Issue	ALL	Michelle Chiu
01	10/15/2015	Revised	ALL	Michelle Chiu

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1. 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.

2. EUT SPECIFICATION

EUT	MXConnect M2M Advanced In-Vehicle 4G/LTE Wireless Router	
Model	BEC MX-1000	
Data Applies To	BEC MX-500	
Frequency band (Operating)	<input checked="" type="checkbox"/> 802.11b/g/gn HT20: 2.412GHz ~ 2.462GHz 802.11gn HT40: 2.422GHz ~ 2.452GHz <input checked="" type="checkbox"/> GPRS / EDGE : 850: 824.2MHz ~ 848.8MHz <input checked="" type="checkbox"/> GPRS / EDGE : 1900: 1850.2MHz ~ 1909.8MHz <input checked="" type="checkbox"/> WCDMA / HSDPA / HSUPA Band II: 1852.4MHz ~ 1907.6MHz <input checked="" type="checkbox"/> WCDMA / HSDPA / HSUPA Band V: 826.4MHz ~ 846.6MHz <input checked="" type="checkbox"/> WCDMA / HSDPA / HSUPA Band IV: 1712.5MHz ~ 1752.6MHz <input checked="" type="checkbox"/> LTE Band XII: 701.5MHz ~ 713.5MHz <input checked="" type="checkbox"/> LTE Band XVII: 706.5MHz ~ 713.5MHz <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 (S=1mW/cm ²)	
Antenna Specification	2.4GHz: Antenna 1 / Chain 1 Gain 3.55 dBi (Numeric gain: 2.26) 2.4GHz: Antenna 2 / Chain 2 Gain 3.55 dBi (Numeric gain: 2.26) GPRS / EDGE 850 Gain: -1.01 dBi (Numeric gain: 0.79) GPRS / EDGE 1900 Gain: -0.47 dBi (Numeric gain: 0.90) WCDMA Band II Gain: -0.47 dBi (Numeric gain: 0.90) WCDMA Band V Gain: -1.01 dBi (Numeric gain: 0.79) WCDMA / HSDPA / HSUPA Band II Gain: -3.27 dBi (Numeric gain: 0.47) LTE Band XII Gain: -7.31 dBi (Numeric gain: 0.19) LTE Band XVII Gain: -7.31 dBi (Numeric gain: 0.19)	

<p>Maximum Average output power</p>	<p>IEEE 802.11b Mode: 20.95 dBm (124.451 mW)</p>
	<p>IEEE 802.11g Mode: 23.87 dBm (243.781 mW)</p>
	<p>IEEE 802.11gn HT 20 Mode: 23.90 dBm (245.471 mW)</p>
	<p>IEEE 802.11gn HT 40 Mode: 23.28 dBm (212.814 mW)</p>
	<p>For Module MC7354 :</p>
	<p>GPRS 850 Mode: 28.01 dBm (632.412 mW)</p>
	<p>GPRS 1900 Mode: 21.88 dBm (154.170 mW)</p>
	<p>EDGE 850 Mode: 21.31 dBm (135.207 mW)</p>
	<p>EDGE 1900 Mode: 18.36 dBm (68.549 mW)</p>
	<p>WCDMA Band II Mode: 21.78 dBm (150.661 mW)</p>
	<p>HSDPA Band II Mode: 21.92 dBm (155.597 mW)</p>
	<p>HSUPA Band II Mode: 21.81 dBm (151.705 mW)</p>
	<p>WCDMA Band V Mode: 20.70 dBm (117.490 mW)</p>
	<p>HSDPA Band V Mode: 14.41 dBm (27.606 mW)</p>
	<p>HSUPA Band V Mode: 14.47 dBm (27.990 mW)</p>
	<p>WCDMA Band IV Mode: 11.47 dBm (14.028 mW)</p>
	<p>HSDPA Band IV Mode: 10.68 dBm (11.695 mW)</p>
<p>HSUPA Band IV Mode: 10.64 dBm (11.588 mW)</p>	
<p>LTE Band XVII Mode: 20.88 dBm (122.462 mW)</p>	
<p>For Module WW-DL060 :</p>	
<p>LTE Band XII Mode: 18.56 dBm (71.779 mW)</p>	
<p>LTE Band XVII Mode: 20.30 dBm (107.152 mW)</p>	
<p>Evaluation applied</p>	<p><input checked="" type="checkbox"/> MPE Evaluation* <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A</p>

3. 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 watts / meter

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:

$P (mW) = P (W) / 1000$ and

$d (cm) = d(m) / 100$

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

4. 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

IEEE 802.11b mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm2)
2437	124.451	2.26	20	0.0560	1

IEEE 802.11g mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm2)
2437	243.781	2.26	20	0.1096	1

IEEE 802.11gn HT20 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm2)
2462	245.471	2.26	20	0.1104	1

IEEE 802.11gn HT40 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm2)
2437	212.814	2.26	20	0.0957	1

For Module MC7354 :

GPRS 850 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
836.66	632.412	0.79	20	0.0994	0.558

GPRS 1900 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1909.68	154.170	0.90	20	0.0276	1.273

EDGE 850 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
824.120	135.207	0.79	20	0.0213	0.549

EDGE 1900 mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1909.920	68.549	0.90	20	0.0123	1.273

WCDMA Band II mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1908.600	150.661	0.90	20	0.0270	1.272

HSDPA Band II mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1908.360	155.597	0.90	20	0.0279	1.272

HSUPA Band II mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1908.120	151.705	0.90	20	0.0272	1.272

WCDMA Band V mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
864.980	117.490	0.79	20	0.0185	0.577

HSDPA Band V mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
825.020	27.606	0.79	20	0.0043	0.550

HSUPA Band V mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
825.080	27.990	0.79	20	0.0044	0.550

WCDMA Band IV mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1753.400	14.028	0.47	20	0.0013	1.169

HSDPA Band IV mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1753.800	11.695	0.47	20	0.0011	1.169

HSUPA Band IV mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
1753.000	11.588	0.47	20	0.0011	1.169

LTE Band XVII mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
711.9500	122.462	0.19	20	0.0046	0.475

For Module WW-DL060 :

LTE Band XII mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
706.7000	71.779	0.19	20	0.0027	0.471

LTE Band XVII mode:

Frq.(MHz)	P (mW)	Gain (num.)	D (cm)	Power density in mW / cm ²	Limit (mW/cm ²)
713.4500	107.152	0.19	20	0.0041	0.476

Simultaneously MPE

Simultaneously MPE = MPE 1 / Limit 1 + MPE 2 / Limit2 + MPE 3 / Limit 3

WiFi + 2G + 3G + LTE

$$\text{Simultaneously MPE} = (0.1104 \text{ mW/cm}^2 / 1) + (0.0994 \text{ mW/cm}^2 / 1) + (0.0279 \text{ mW/cm}^2 / 1) + (0.0046 \text{ mW/cm}^2 / 0.521) = 0.247$$

Simultaneously MPE = MPE 1 / Limit 1 + MPE 2 / Limit2 + MPE 3 / Limit 3 + MPE 4 / Limit 4

WiFi + 2G + 3G + LTE

$$\text{Simultaneously MPE} = (0.1104 \text{ mW/cm}^2 / 1) + (0.0994 \text{ mW/cm}^2 / 1) + (0.0279 \text{ mW/cm}^2 / 1) + (0.0041 \text{ mW/cm}^2 / 0.521) = 0.246$$