



January 25, 2024

TUV SUD America CB  
10 Centennial Drive FL2  
Peabody, MA 01960

Attention: Director of Certification

**RE: Analysis of RF Exposure per KDB 447498 D01 RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices v06 and RSS-102 Issue 5 March 2015.**

**1. General Information:**

Applicant: Gems Sensors & Controls  
Environment: General Population/Uncontrolled Exposure  
Exposure Conditions: Mobile  
FCC ID: 2A6KIRLI80  
IC: 28453-RLI80

**2. Technical Information:**

EUT Description: Level Probing Radar  
Frequency Range: 77 – 81GHz  
Antenna Type: Wave Guide Antenna  
Antenna Gain: 0.14 dBi  
PRF: 50Hz  
Frame Time: 500 ms  
Radar Type: FMCW

**3. Limits:**

Limits for General Population/Uncontrolled Exposure (Title 47 Subpart J §2.1091 and KDB 447498 D01 referring to limits under §1.1310)

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Electric Field Strength (H) (A/m)	Power Density (S) (mW/cm <sup>2</sup> )	Averaging Time (minutes)
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*

Limits for Devices Used by the General Public (Uncontrolled Environment (RSS-102 Issue 5 March 2015))

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

*f* is frequency in MHz

\*Based on nerve stimulation (NS)

\*\* Based on specific absorption rate (SAR)

4. Mobile MPE Calculation using a 20cm separation distance:

Mode	Output Power (dBm)	Power Density (mW/cm <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	ISED Limit (mW/cm <sup>2</sup> )
2.4 GHz BLE	5.117	0.00066	-	0.535
77GHz RADAR	21.01	0.02511	1	-

**Calculation Note:** More stringent ISED limit used for 2.4 GHz BLE calculation.

### 5. Mobile MPE Calculation using a 20cm separation distance

Using Power Density formula:

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density

P = power input to the antenna

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

R = distance to the center of radiation of the antenna

#### 2.4GHz BLE: FCC ID: X8WBC805M (from original filing)

Maximum output power at antenna input terminal:	5.11	(dBm)
Maximum output power at antenna input terminal:	3.24	(mW)
Antenna gain(typical):	0.14	(dBi)
Maximum antenna gain:	1	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	2402	(MHz)
ISED MPE limit for uncontrolled exposure at prediction frequency:	0.535	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.00066	(mW/cm <sup>2</sup> )
ISED Margin of Compliance:	-29.05	(dB)

### 6. Mobile MPE Calculation using a 20cm separation distance

#### 77GHz RADAR:

Maximum peak output power at antenna input terminal:	21.01	(dBm)
Maximum peak output power at antenna input terminal:	126.21	(mW)
Antenna gain(typical):	0	(dBi)
Maximum antenna gain:	1	(numeric)
Prediction distance:	20	(cm)
Source Based Time Average Duty Cycle:	100	(%)
Prediction frequency:	77470	(MHz)
FCC MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm <sup>2</sup> )
Power density at prediction frequency:	0.02511	(mW/cm <sup>2</sup> )
FCC Margin of Compliance:	-16.00	(dB)



**7. Simultaneous Transmission MPE:**

Transmitter type	MPE (mw/cm <sup>2</sup> )	Limit (mW/cm <sup>2</sup> )	FCC MPE ratio (MPE/Limit)
2.4 GHz BLE	0.00066	.535	0.00123
77GHz RADAR	0.02511	1	0.02511
Sum of the ratios (should be <1.0)			0.02634

Sincerely,

A handwritten signature in black ink, appearing to read 'Joe Salvador'.

Joe Salvador

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Name

Authorized Signatory

Title: Wireless/RF Test Engineer