1. RF Exposure Requirements

1.1 General Information

Client Information

Applicant:	Shenzhen Jimi IOT Co., Ltd
Address of applicant:	3-4/F, Block A, Building #7, Shenzhen International Innovation Valley, Dashi 1st Road, Nanshan District, Shenzhen, Guangdong, China
Manufacturer:	Shenzhen Jimi IOT Co., Ltd
Address of manufacturer:	3-4/F, Block A, Building #7, Shenzhen International Innovation Valley, Dashi 1st Road, Nanshan District, Shenzhen, Guangdong, China

General Description of EUT:

Product Name:	GNSS Vehicle Terminal
Trade Name:	JIMI
Model No.:	JM-C21
Adding Model(s):	/
Rated Voltage:	Battery DC3.7V DC12V/24V
Battery:	/
Adapter Model:	/
FCC ID:	2AMLF-JM-C21
Equipment Type:	Mobile device

Technical Characteristics of EUT:

2G

Support Networks:	GPRS
Support Band:	GPRS850/GPRS1900
Uplink Frequency:	GPRS850: 824~849MHz GPRS1900: 1850~1910MHz
Downlink Frequency:	GPRS850: 869~894MHz GPRS1900: 1930~1990MHz
Max RF Output Power:	GPRS850: 32.22dBm, GPRS1900: 28.87dBm
Type of Emission:	GPRS850:245KGXW, GPRS1900: 246KGXW
Type of Modulation:	GMSK, 8PSK
Type of Antenna:	Integral Antenna
Antenna Gain:	GSM850: 3dBi; GSM1900: 3dBi
GPRS/EDGE Class:	Class 12

1.2 RF Exposure Exemption

According to §1.1307(b)(3) and KDB 447498 D04 Interim General RF Exposure Guidance v01, system operating under the provisions of this section shall be operating in a manner that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure.

Option A: FCC Rule Part 1.1307 (b)(3)(i)(A):The available maximum time-averaged power is no more than 1mW, regardless of separation distance.

Option B: FCC Rule Part 1.1307 (b)(3)(i)(B): The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. P_{th} is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

Option C: FCC Rule Part 1.1307 (b)(3)(i)(C): The minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. R must be at least λ/2π, where λ is the free-space operating wavelength in meters.

Single RF Sources Subject to Routine Environmental Evaluation	
RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2
1.34-30	3,450 R^2/f^2
30-300	3.83 R^2
300-1,500	0.0128 R^2f
1,500-100,000	19.2R^2

For Multiple RF sources: FCC Rule Part 1.1307(b)(3)(ii):

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required).

(B) In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a}\frac{P_i}{P_{th,i}}+\sum_{j=1}^{b}\frac{ERP_j}{ERP_{th,j}}+\sum_{k=1}^{c}\frac{Evaluated_k}{Exposure\ Limit_k}\leq 1$$

1.3 Calculated Result

Radio Access Technology	Prediction Frequency	Tune-up Power	Antenna Gain	Duty Cycle Factor	Tune-up Time-Averaged Power	ERP
	(MHz)	(dBm)	(dBi)	(dB)	(dBm)	(dBm)
GPRS850(1 slots)	824	32.5	3.0	9	23.50	24.35
GPRS850(2 slots)	824	32.0	3.0	6	26.00	26.85
GPRS850(3 slots)	824	30.5	3.0	4.25	26.25	27.10
GPRS850(4 slots)	824	29.5	3.0	3	26.50	27.35
GPRS1900(1 slots)	1850	29.0	3.0	9	20.00	20.85
GPRS1900(2 slots)	1850	28.5	3.0	6	22.50	23.35
GPRS1900(3 slots)	1850	27.5	3.0	4.25	23.25	24.10
GPRS1900(4 slots)	1850	26.0	3.0	3	23.00	23.85

Radio Access Technology	Option	Min. Distance	Max. Power		Exposure Limit	Ratio	Result
		(cm)	(dBm)	(mW)	(mW)		Pass/Fail
GPRS850(1 slots)	C	20.00	24.35	272.27	421.89	0.65	Pass
GPRS850(2 slots)	B	20.00	26.85	484.17	1680.96	0.29	Pass
GPRS850(3 slots)	B	20.00	27.10	512.86	1680.96	0.31	Pass
GPRS850(4 slots)	B	20.00	27.35	543.25	1680.96	0.32	Pass
GPRS1900(1 slots)	C	20.00	20.85	121.62	768.00	0.16	Pass
GPRS1900(2 slots)	C	20.00	23.35	216.27	768.00	0.28	Pass
GPRS1900(3 slots)	C	20.00	24.10	257.04	768.00	0.33	Pass
GPRS1900(4 slots)	C	20.00	23.85	242.66	768.00	0.32	Pass

Note: 1. For GSM, Duty cycle factor = 9 dB for 1 Tx slot, 6 dB for 2 Tx slots, 4.25 dB for 3 Tx slots, 3 dB for 4 Tx slots;

2. Tune-up time-average power = Tune-up Power - Duty cycle factor in dB

2. Output Power=EIRP- Antenna Gain; ERP=EIRP-2.15dB

3. Option A, B and C refers as clause 1.2.

4. For option B, Max (time-averaged power, effective radiated power (ERP)) converts to Max. Power. For option C, ERP converts to Max. Power;

5. For option B, P_{th} (mW) converts to Exposure Limit (mW); For option C, ERP (W) converts to Exposure Limit (mW).

6. Ratio= Tune-up ERP (mW)/ Exposure Limit (mW)

Mode for Simultaneous Multi-band Transmission:

Radio Access Technology	Ratio 1	Ratio 2	Simultaneous Ratio	Limit	Result
					Pass/Fail
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Note：GPRS850 and GPRS1900 can't transmit at the same time.

Result: Pass