1. MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 General Information

Client Information

Applicant:	Shenzhen Jimi IOT Co., Ltd
Address of applicant:	4/F, Building C, Gaoxinqi Industrial Park, Liuxian 1st Road, No.67 Xin'an Street, Bao'an District, Shenzhen, China
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General Description of EUT:

Product Name:	4G Vehicle GPS Tracker
Trade Name	JIMI
Model No.:	JM-VL01
Adding Model(s):	VL01, VL01A, JM-VL01A, VL01E, JM-VL01E, VL01LA, JM-VL01LA
Rated Voltage:	DC3.7V
Battery Capacity:	/
Adapter Model:	/
Software Version:	KU982026_VL01A
Hardware Version:	KU982026_MAIN_PCB
FCC ID:	2AMLF-JM-VL01-
Equipment Type:	Mobile

Technical Characteristics of EUT:	
2G	
Support Networks:	GSM, GPRS, EDGE
Support Band:	GSM850/PCS1900
Uplink Frequency:	GSM/GPRS/EDGE 850: 824~849MHz GSM/GPRS/EDGE 1900: 1850~1910MHz
Downlink Frequency:	GSM/GPRS/EDGE 850: 869~894MHz GSM/GPRS/EDGE 1900: 1930~1990MHz
Max RF Output Power:	GSM850: 32.90dBm, GSM1900: 30.06dBm EDGE850: 26.43dBm, EDGE1900: 26.21dBm
Type of Emission:	GSM850: 250KGXW, GSM1900: 255KGXW EDGE850: 248KG7W, EDGE1900: 248KG7W
Type of Modulation:	GMSK, 8PSK
Type of Antenna:	Integral Antenna
Antenna Gain:	GSM850: -2.5dBi; GSM1900: -2.0dBi
GPRS/EDGE Class:	Class 12

3G	
Support Networks:	WCDMA, HSDPA, HSUPA
Support Band:	WCDMA Band 2, WCDMA Band 5
Uplink Frequency:	WCDMA Band 2: 1850~1910MHz WCDMA Band 5: 824~849MHz
Downlink Frequency:	WCDMA Band 2: 1930~1990MHz WCDMA Band 5: 869~894MHz
RF Output Power:	WCDMA Band 2: 23.10dBm, WCDMA Band 5: 22.76dBm
Type of Emission:	WCDMA Band 2: 4M15F9W WCDMA Band 5: 4M17F9W
Type of Modulation:	BPSK
Antenna Type:	Integral Antenna
Antenna Gain:	WCDMA Band 2: -2.0dBi, WCDMA Band 5: -2.5dBi
4G	
Support Networks:	FDD-LTE
Support Band:	FDD-LTE Band 2, 4, 5, 7,12, 13, 17, 66
Uplink Frequency:	FDD-LTE Band 2: Tx: 1850-1910MHz, FDD-LTE Band 4: Tx: 1710-1755MHz, FDD-LTE Band 5: Tx: 824-849MHz, FDD-LTE Band 7: Tx: 2500-2570MHz, FDD-LTE Band 12: Tx: 699-716MHz, FDD-LTE Band 13: Tx: 777-787MHz, FDD-LTE Band 17: Tx: 704-716MHz FDD-LTE Band 66: Tx: 1710-1780MHz
Downlink Frequency:	FDD-LTE Band 2: Rx: 1930-1990MHz, FDD-LTE Band 4: Rx: 2110-2155MHz, FDD-LTE Band 5: Rx: 869-894MHz, FDD-LTE Band 7: Rx: 2620-2690MHz, FDD-LTE Band 12: Rx: 729-746MHz, FDD-LTE Band 13: Rx: 746-756MHz, FDD-LTE Band 17: Rx: 734-746MHz FDD-LTE Band 66: Rx: 2110-2200MHz
RF Output Power:	FDD-LTE Band 2: 24.18dBm, FDD-LTE Band 4: 24.17dBm, FDD-LTE Band 5: 23.61dBm, FDD-LTE Band 7: 23.62dBm, FDD-LTE Band 12: 23.76dBm, FDD-LTE Band 13: 23.82dBm, FDD-LTE Band 17: 23.85dBm FDD-LTE Band 66: 24.19dBm
Type of Emission:	FDD-LTE Band 2: 17M9G7D, 17M9W7D FDD-LTE Band 4: 17M9G7D, 17M9W7D

	FDD-LTE Band 5: 8M99G7D, 8M97W7D FDD-LTE Band 7: 17M9G7D, 17M9W7D FDD-LTE Band 12: 8M99G7D, 8M99W7D FDD-LTE Band13: 8M99G7D, 8M99W7D FDD-LTE Band 17: 8M98G7D, 8M98W7D FDD-LTE Band 66: 17M9G7D, 17M9W7D
Type of Modulation:	QPSK, 16QAM
Antenna Type:	Integral Antenna
Antenna Gain:	FDD-LTE Band 2: -2.0dBi, FDD-LTE Band 4: -1.8dBi, FDD-LTE Band 5: -2.5dBi, FDD-LTE Band 7: -1.6dBi, FDD-LTE Band 12: -2.9dBi, FDD-LTE Band 13: -2.6dBi, FDD-LTE Band 17: -2.5Bi FDD-LTE Band 66: -2.4dBi
Wi-Fi	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz for 802.11b/g/n(HT20)
RF Output Power:	14.27dBm (Conducted)
Type of Modulation:	DBPSK,BPSK,DQPSK,QPSK,16QAM,64QAM
Quantity of Channels:	11 for 802.11b/g/n(HT20)
Channel Separation:	5MHz
Type of Antenna:	Integral Antenna
Antenna Gain:	1dBi
Bluetooth	
Bluetooth Version:	V4.0 (BR/EDR/LE mode)
Frequency Range:	2402-2480MHz
RF Output Power:	8.128dBm (Conducted)
Data Rate:	1Mbps, 2Mbps, 3Mbps
Modulation:	GFSK, π/4 DQPSK, 8DPSK
Quantity of Channels:	79/40
Channel Separation:	1MHz/2MHz
Type of Antenna:	Integral Antenna
Antenna Gain:	1dBi

1.2 Standard Applicable

According to §1.1307(b)(1) and KDB 447498 D01 General RF Exposure Guidance v06, 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.

(a) Limits for Occupational / Controlled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Times $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f)*	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	F/300	6
1500-100000	/	/	5	6

(b) Limits for General Population / Uncontrolled Exposure

Frequency range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Times $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-100000	/	/	1	30

Note: f = frequency in MHz: * = Plane-wave equivalents power density

1.3 MPE Calculation Method

$S = (30*P*G) / (377*R^2)$

S = power density (in appropriate units, e.g., mw/cm^2)

P = power input to the antenna (in appropriate units, e.g., mw)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor is normally numeric gain.

R = distance to the center of radiation of the antenna (in appropriate units, e.g., cm)

1.4 MPE Calculation Result

For GSM850

Maximum Tune-Up output power: 33(dBm)

Maximum peak output power at antenna input terminal: 1995.26 (mW)

Prediction distance: >20(cm)

Prediction frequency: 824.20 (MHz)

Antenna gain: -2.5 (dBi)

Directional gain (numeric gain): 0.56

The worst case is power density at prediction frequency at 20cm: 0.2232 (mw/cm^2)

MPE limit for general population exposure at prediction frequency: 0.5494 (mw/cm^2)

For PCS1900
Maximum Tune-Up output power: 30.5(dBm)
Maximum peak output power at antenna input terminal: 1122.02 (mW)
Prediction distance: >20(cm)
Prediction frequency: 1880 (MHz)
Antenna gain: -2.0 (dBi)
Directional gain (numeric gain): 0.63
The worst case is power density at prediction frequency at 20cm: 0.1408 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

For WCDMA Band 2
Maximum Tune-Up output power: 23.5(dBm)
Maximum peak output power at antenna input terminal: 223.87 (mW)
Prediction distance: >20(cm)
Prediction frequency: 1907.6 (MHz)
Antenna gain: -2.0(dBi)
Directional gain (numeric gain): 0.63
The worst case is power density at prediction frequency at 20cm: 0.0281 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

For WCDMA Band 5
Maximum Tune-Up output power: 23(dBm)
Maximum peak output power at antenna input terminal: 199.53 (mW)
Prediction distance: >20(cm)
Prediction frequency: 826.4 (MHz)
Antenna gain: -2.5(dBi)
Directional gain (numeric gain): 0.56
The worst case is power density at prediction frequency at 20cm: 0.0223 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 0.5509 (mw/cm^2)

For FDD-LTE Band 2
Maximum Tune-Up output power: 25(dBm)
Maximum peak output power at antenna input terminal: 316.23 (mW)
Prediction distance: >20(cm)
Prediction frequency: 1902.5 (MHz)
Antenna gain: -2.0(dBi)
Directional gain (numeric gain): 0.63
The worst case is power density at prediction frequency at 20cm: 0.0397 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

For FDD-LTE Band 4
Maximum Tune-Up output power: 25(dBm)
Maximum peak output power at antenna input terminal: 316.23 (mW)
Prediction distance: >20(cm)
Prediction frequency: 1745.0 (MHz)
Antenna gain: -1.8 (dBi)
Directional gain (numeric gain): 0.66
The worst case is power density at prediction frequency at 20cm: 0.0416 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

For FDD-LTE Band 5
Maximum Tune-Up output power: 24.5(dBm)
Maximum peak output power at antenna input terminal: 281.84 (mW)
Prediction distance: >20(cm)
Prediction frequency: 846.5 (MHz)
Antenna gain: -2.5 (dBi)
Directional gain (numeric gain): 0.56
The worst case is power density at prediction frequency at 20cm: 0.0315 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 0.5643 (mw/cm^2)

For FDD-LTE Band 7
Maximum Tune-Up output power: 24.5(dBm)
Maximum peak output power at antenna input terminal: 281.84 (mW)
Prediction distance: >20(cm)
Prediction frequency: 2560.0(MHz)
Antenna gain: -1.6 (dBi)
Directional gain (numeric gain): 0.69
The worst case is power density at prediction frequency at 20cm: 0.0388 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

For FDD-LTE Band 12
Maximum Tune-Up output power: 24.5(dBm)
Maximum peak output power at antenna input terminal: 281.84 (mW)
Prediction distance: >20(cm)
Prediction frequency: 846.5 (MHz)
Antenna gain: -2.9 (dBi)
Directional gain (numeric gain): 0.51
The worst case is power density at prediction frequency at 20cm: 0.0288 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 0.4693 (mw/cm^2)

For FDD-LTE Band 13
Maximum Tune-Up output power: 24.5(dBm)
Maximum peak output power at antenna input terminal: 281.84 (mW)
Prediction distance: >20(cm)
Prediction frequency: 784.5 (MHz)
Antenna gain: -2.6 (dBi)
Directional gain (numeric gain): 0.55
The worst case is power density at prediction frequency at 20cm: 0.0308 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 0.5230 (mw/cm^2)

For FDD-LTE Band 17
Maximum Tune-Up output power: 24.5(dBm)
Maximum peak output power at antenna input terminal: 281.84 (mW)
Prediction distance: >20(cm)
Prediction frequency: 846.5 (MHz)
Antenna gain: -2.5 (dBi)
Directional gain (numeric gain): 0.56
The worst case is power density at prediction frequency at 20cm: 0.0315 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 0.4710 (mw/cm^2)

For FDD-LTE Band 66
Maximum Tune-Up output power: 25(dBm)
Maximum peak output power at antenna input terminal: 316.23 (mW)
Prediction distance: >20(cm)
Prediction frequency: 1745.0 (MHz)
Antenna gain: -2.4(dBi)
Directional gain (numeric gain): 0.58
The worst case is power density at prediction frequency at 20cm: 0.0362 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

Wi-Fi
Maximum Tune-Up output power: 14.5(dBm)
Maximum peak output power at antenna input terminal: 28.18 (mW)
Prediction distance: >20(cm)
Prediction frequency: 2412 (MHz)
Antenna gain:1.0(dBi)
Directional gain (numeric gain): 1.26
The worst case is power density at prediction frequency at 20cm: 0.0071 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

Bluetooth
Maximum Tune-Up output power: 8.5(dBm)
Maximum peak output power at antenna input terminal: 7.08 (mW)

Prediction distance: >20(cm)
Prediction frequency: 2441 (MHz)
Antenna gain: 1.0(dBi)
Directional gain (numeric gain): 1.26
The worst case is power density at prediction frequency at 20cm: 0.0018 (mw/cm^2)
MPE limit for general population exposure at prediction frequency: 1 (mw/cm^2)

Mode for Simultaneous Multi-band Transmission
GSM850+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.2232/0.5494+0.0071/1=0.4134 <1

PCS1900+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.1408/1+0.0071/1=0.1479 <1

WCDMA Band 2+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0281/1+0.0071/1=0.0352 <1

WCDMA Band 5+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0223/0.5509+0.0071/1=0.0476 <1

FDD-LTE Band 2+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0397/1+0.0071/1=0.0468 <1

FDD-LTE Band 4+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0416/1+0.0071/1=0.0487 <1

FDD-LTE Band 5+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0315/0.5643+0.0071/1=0.0629 <1

FDD-LTE Band 7+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0388/1+0.0071/1=0.0459 <1

FDD-LTE Band 12+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0288/0.4693+0.0071/1=0.0685 <1

FDD-LTE Band 13+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0308/0.523+0.0071/1=0.066 <1

FDD-LTE Band 17+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0315/0.471+0.0071/1=0.074 <1

FDD-LTE Band 66+Wi-Fi
The worst case is power density at prediction frequency at 20cm: 0.0362/1+0.0071/1=0.0433 <1

GSM850+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.2232/0.5494+0.0018/1 = 0.4081 <1

PCS1900+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.1408/1+0.0018/1 = 0.1426 <1

WCDMA Band 2+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0281/1+0.0018/1 = 0.0299<1

WCDMA Band 5+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0223/0.5509+0.0018/1 = 0.0423<1

FDD-LTE Band 2+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0397/1+0.0018/1 = 0.0415 <1

FDD-LTE Band 4+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0416/1+0.0018/1 = 0.0434 <1

FDD-LTE Band 5+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0315/0.5643+0.0018/1 = 0.0576<1

FDD-LTE Band 7+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0388/1+0.0018/1 = 0.0406<1

FDD-LTE Band 12+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0288/0.4693+0.0018/1 = 0.0632<1

FDD-LTE Band 13+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0308/0.523+0.0018/1 = 0.0607<1

FDD-LTE Band 17+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0315/0.471+0.0018/1 = 0.0687<1

FDD-LTE Band 66+Bluetooth
The worst case is power density at prediction frequency at 20cm: 0.0362/1+0.0018/1 = 0.038 <1

Result: Pass