

Maximum Permissible Exposure Report

1. Product Information

EUT	: Industrial 4G LTE Gateway
Test Model	: GL-X300BC4
Power Supply	: DC 12V, 1A from Adapter Adapter: Input: AC 100-240V, 50/60Hz, 0.3A Output: DC 12V, 1A, 12W
Hardware Version	: 1.1
Software Version	: 3.104

2.4G WLAN

Frequency Range	: 2412MHz-2462MHz
Channel Number	: 11 Channels for 20MHz bandwidth(2412~2462MHz) 7 Channels for 40MHz bandwidth(2422~2452MHz)
Channel Spacing	: 5MHz
Modulation Type	: IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	: External Antenna, 0.2dBi(Max.)

2G

Support Band	: <input type="checkbox"/> GSM 900 (EU-Band) <input type="checkbox"/> DCS 1800 (EU-Band) <input checked="" type="checkbox"/> GSM 850 (U.S.-Band) <input checked="" type="checkbox"/> PCS 1900 (U.S.-Band)
Release Version	: R99
GPRS Class	: Class 12
EGPRS Class	: Class 12
Type Of Modulation	: GMSK for GSM/GPRS; GMSK,8PSK for EGPRS
Antenna Description	: External Antenna; -2.00dBi (max.) For GSM 850; -1.70dBi (max.) For PCS 1900.

3G

Support Band	: <input checked="" type="checkbox"/> WCDMA Band II (U.S.-Band) <input checked="" type="checkbox"/> WCDMA Band V (U.S.-Band) <input checked="" type="checkbox"/> WCDMA Band IV (U.S.-Band) <input checked="" type="checkbox"/> WCDMA Band I (EU-Band) <input type="checkbox"/> WCDMA Band VIII (EU-Band)
Release Version	: R8
Type Of Modulation	: WCDMA: QPSK,16QAM; HSDPA/HSUPA: QPSK,16QAM
Antenna Description	: External Antenna; -1.70dBi (max.) For WCDMA Band II; -2.10dBi (max.) For WCDMA Band IV; -2.00dBi (max.) For WCDMA Band V.

LTE	:	
Support Band	:	<input checked="" type="checkbox"/> E-UTRA Band 2(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 4(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 5(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 7(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 12(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 13(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 25(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 26(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 38(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 41(U.S.-Band)
LTE Release Version	:	R13
Type Of Modulation	:	QPSK/16QAM
Antenna Description	:	External Antenna; -1.70dBi (max.) For E-UTRA Band 2; -2.10dBi (max.) For E-UTRA Band 4; -2.00dBi (max.) For E-UTRA Band 5; 1.90dBi (max.) For E-UTRA Band 7; 0.50dBi (max.) For E-UTRA Band 12; 0.70dBi (max.) For E-UTRA Band 13; -1.70dBi (max.) For E-UTRA Band 25; -1.60dBi (max.) For E-UTRA Band 26; 1.30dBi (max.) For E-UTRA Band 38; 1.90dBi (max.) For E-UTRA Band 41.
Power Class	:	Class 3
General population/uncontrolled environment	:	General population/uncontrolled environment
EUT Type	:	Production Unit
Device Type	:	Fixed Equipment

2. Evaluation Method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modelled or measured field strengths or power density, is ≤ 1.0 . The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the

MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

3. Limit

3. 1 Refer evaluation method

[ANSI C95.1-1999](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

[FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06](#): Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

[FCC CFR 47 part1 1.1310](#): Radiofrequency radiation exposure limits.

[FCC CFR 47 part2 2.1091](#): Radiofrequency radiation exposure evaluation: mobile devices

3.2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure				
Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	6
3.0 – 30	1842/f	4.89/f	(900/f ²)*	6
30 – 300	61.4	0.163	1.0	6
300 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6
Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure				
Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 30	824/f	2.19/f	(180/f ²)*	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

4. MPE Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S=power density

P=power input to antenna

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

R=distance to the center of radiation of the antenna

5. Antenna Information

VD-CB-01 can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna 0	External Antenna	2400 MHz – 2500 MHz	0.2Bi

6. Conducted Power

2.4G WLAN

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
IEEE 802.11b	1	2412	17.73
	6	2437	18.29
	11	2462	18.28
IEEE 802.11g	1	2412	22.04
	6	2437	22.19
	11	2462	22.32
IEEE 802.11n HT20	1	2412	21.23
	6	2437	21.60
	11	2462	21.64
IEEE 802.11n HT20	3	2422	22.10
	6	2437	21.44
	9	2452	22.12

7. Manufacturing Tolerance

2.4G WLAN			
IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	17.0	18.0	18.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	22.0	22.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	21.0	21.0	21.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	22.0	21.0	22.0
Tolerance ±(dB)	1.0	1.0	1.0

8. Measurement Results

8.1 Standalone MPE Evaluation

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, $r=20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW					
IEEE 802.11b	19.0	79.4328	0.20	1.0471	100%	0.0165	1.0000
IEEE 802.11g	23.0	199.5262	0.20	1.0471	100%	0.0416	1.0000
IEEE 802.11n HT20	22.0	158.4893	0.20	1.0471	100%	0.0330	1.0000
IEEE 802.11n HT40	23.0	199.5262	0.20	1.0471	100%	0.0416	1.0000

GSM&WCDMA<E(Max Average Power)

Band/Mode	Maximum Conducted Output Power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW			
GSM 850	25.81	381.07	-2.00	0.0478	0.5495
PCS 1900	22.81	190.99	-1.70	0.0257	1.0000
WCDMA II	25.00	316.23	-1.70	0.0425	1.0000
WCDMA IV	25.00	316.23	-2.10	0.0388	1.0000
WCDMA V	25.00	316.23	-2.00	0.0397	0.5509
LTE Band 2	25.00	316.23	-1.70	0.0425	1.0000
LTE Band 4	25.00	316.23	-2.10	0.0388	1.0000
LTE Band 5	25.00	316.23	-2.00	0.0397	0.5498
LTE Band 7	25.00	316.23	1.90	0.0974	1.0000
LTE Band 12	25.00	316.23	0.50	0.0706	0.4665
LTE Band 13	25.00	316.23	0.70	0.0739	0.5197
LTE Band 25	25.00	316.23	-1.70	0.0425	1.0000
LTE Band 26(814-824)	25.00	316.23	-1.60	0.0435	0.5431
LTE Band	25.00	316.23	-1.60	0.0435	0.5498

26(824-849)					
LTE Band 38	25.00	316.23	1.30	0.0849	1.0000
LTE Band 41	25.00	316.23	1.90	0.0974	1.0000

Remark:

1. *Output power including tune-up tolerance;*
2. *MPE evaluate distance is 20cm from user manual provide by manufacturer.*

8.2 Simultaneous Transmission MPE

The sample support 2.4GWLAN, another GSM/WCDMA/LTE antenna, so need consider simultaneous transmission;GSM/WCDMA/LTE exposure(refer FCC ID:XMR201903EG25G) Simultaneous transmission MPE According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
 \sum of MPE ratios ≤ 1.0

Mode	\sum MPE max ratios	Limit	Results
2.4GWIFI+GSM	0.1286	1.0	Pass
2.4GWIFI+WCDMA	0.1137	1.0	Pass
2.4GWIFI+LTE	0.1929	1.0	Pass

9. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

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