

Maximum Permissible Exposure Report

1. Product Information

FCC ID:	2AFIW-X750V2C4
Product name	4G LTE Wireless Gateway
Test Model	GL-X750V2C4
Power supply	Model 1:ICP30A-120-1500 Input: AC 100-240V, 50/60Hz, 0.8A Max Output: DC 12V, 1.5A, 18W Mode 2:MSA-C1500IC12.0-18P-zz Input: AC 100-240V, 50/60Hz, 0.7A Max Output: DC 12V, 1.5A, 18W
Operation frequency	2.412-2.462GHz for 2.4G WIFI 5180MHz-5240MHz for 5.2G WIFI 5745MHz-5825MHz for 5.8G WIFI 2402MHz-2480MHz for Bluetooth Band II/IV/V for WCDMA Band 2/4/5/12/13/66/77 for LTE
Hardware version	V2.0
Software version	3.104
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Mobile Device

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

GL-X750V2C4 can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
2.4GWIFI Ant 1	PCB Antenna	2400 MHz –2500 MHz	2.7 dBi
2.4GWIFI Ant 2	PCB Antenna	2400 MHz –2500 MHz	2.7 dBi
5GWIFI Antenna	PIFA Antenna	5000 MHz –6000 MHz	6.0 dBi
BT Antenna	PCB Antenna	2400 MHz –2500 MHz	-0.042 dBi
WWAN Main Antenna/ WWAN Aux Antenna	Dipole Antenna	WCDMA: -1.8dBi for WCDMA II -1.5dBi for WCDMA IV -0.7dBi for WCDMA V LTE: -1.8dBi(max.) For E-UTRA Band 2; -1.5dBi(max.) For E-UTRA Band 4; -0.7dBi(max.) For E-UTRA Band 5; -0.8dBi(max.) For E-UTRA Band 12; -0.5dBi(max.) For E-UTRA Band 13; -0.8dBi(max.) For E-UTRA Band 14; -1.5dBi(max.) For E-UTRA Band 66; -1.0dBi(max.) For E-UTRA Band 71;	

6. Conducted Power

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)		
			ANT 1	ANT 2	Sum
IEEE 802.11b	1	2412	18.13	18.00	/
	6	2437	18.71	18.54	/
	11	2462	18.95	18.58	/
IEEE 802.11g	1	2412	19.99	19.97	/
	6	2437	20.84	20.75	/
	11	2462	21.04	20.78	/
IEEE 802.11n HT20	1	2412	19.65	19.59	22.63
	6	2437	20.46	20.41	23.45
	11	2462	20.65	20.58	23.63
IEEE 802.11n HT40	3	2422	19.36	19.29	22.34
	6	2437	19.76	19.66	22.72
	9	2452	20.53	20.50	23.53

[5..2GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
11A	36	5180	18.58
	40	5200	18.85
	48	5240	19.80
11N20 SISO	36	5180	18.54
	40	5200	16.94
	48	5240	18.94
11N40 SISO	38	5190	18.18
	46	5230	18.83
11AC20 SISO	36	5180	18.10
	40	5200	18.59
	48	5240	19.08
11AC40 SISO	38	5190	18.15
	46	5230	18.69
11AC80 SISO	42	5210	20.29

[5.8GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
11A	149	5745	18.64
	157	5785	19.13
	165	5825	19.92
11N20 SISO	149	5745	18.49
	157	5785	19.27
	165	5825	19.86
11N40 SISO	151	5755	18.27
	159	5795	19.29
11AC20 SISO	149	5745	18.10
	157	5785	18.59
	165	5825	19.08
11AC40 SISO	151	5755	18.15
	159	5795	18.69
11AC80 SISO	155	5775	17.80

7. Manufacturing tolerance

2.4GWIFI

IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	18.0	18.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	20.0	20.0	21.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	22.0	23.0	23.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	22.0	23.0	23.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

5.2GWIFI

11A (5.2G) (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	18.0	18.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (5.2G) (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	18.0	17.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 SISO (5.2G) (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	18.0	19.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
11AC20 SISO (5.2G) (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	18.0	18.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 SISO (5.2G) (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	18.0	18.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
11AC80 SISO (5.2G) (Average)			
Channel	Channel 42	/	/
Target (dBm)	20.0	/	/
Tolerance $\pm$ (dB)	1.0	/	/

5.8GWIFI

11A (5.8G) (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	18.0	19.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (5.8G) (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	18.0	19.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 SISO (5.8G) (Average)			
Channel	Channel 151	Channel 59	/
Target (dBm)	18.0	19.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
11AC20 SISO (5.8G) (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	18.0	18.0	19.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 SISO (5.8G) (Average)			
Channel	Channel 151	Channel 59	/
Target (dBm)	18.0	18.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
11AC80 SISO (5.8G) (Average)			
Channel	Channel 155	/	/
Target (dBm)	17.0	/	/
Tolerance $\pm$ (dB)	1.0	/	/

8. Evaluation Results

As declared by the Applicant, the EUT is a wireless device used in a mobile 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.

2.4GWIFI Ant 1

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE ratios
	dBm	mW				
IEEE 802.11b	20.0	100.0000	2.7	0.0370	1.0000	0.0370
IEEE 802.11g	22.0	158.4893	2.7	0.0587	1.0000	0.0587
IEEE 802.11n HT20	24.0	251.1886	2.7	0.0931	1.0000	0.0931
IEEE 802.11n HT40	24.0	251.1886	2.7	0.0931	1.0000	0.0931

2.4GWIFI Ant 2

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE ratios
	dBm	mW				
IEEE 802.11b	20.0	100.0000	2.7	0.0370	1.0000	0.0370
IEEE 802.11g	22.0	158.4893	2.7	0.0587	1.0000	0.0587
IEEE 802.11n HT20	24.0	251.1886	2.7	0.0931	1.0000	0.0931
IEEE 802.11n HT40	24.0	251.1886	2.7	0.0931	1.0000	0.0931

5.2GWIFI

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE ratios
	dBm	mW				
IEEE 802.11a	20.0	100.0000	6.0	0.0792	1.0000	0.0792
IEEE 802.11n20	20.0	100.0000	6.0	0.0792	1.0000	0.0792
IEEE 802.11n40	20.0	100.0000	6.0	0.0792	1.0000	0.0792
IEEE 802.11ac20	20.0	100.0000	6.0	0.0792	1.0000	0.0792
IEEE 802.11ac40	19.0	79.4328	6.0	0.0629	1.0000	0.0629
IEEE 802.11ac80	21.0	125.8925	6.0	0.0997	1.0000	0.0997

5.8GWIFI

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE ratios
	dBm	mW				
IEEE 802.11a	20.0	100.0000	6.0	0.0792	1.0000	0.0792
IEEE 802.11n20	20.0	100.0000	6.0	0.0792	1.0000	0.0792
IEEE 802.11n40	20.0	100.0000	6.0	0.0792	1.0000	0.0792
IEEE 802.11ac20	20.0	100.0000	6.0	0.0792	1.0000	0.0792
IEEE 802.11ac40	19.0	79.4328	6.0	0.0629	1.0000	0.0629
IEEE 802.11ac80	17.0	50.1187	6.0	0.0397	1.0000	0.0997

BT LE

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE ratios
	dBm	mW				
GFSK-BLE	19	79.4328	-0.0427	0.0157	1.0000	0.0157

WCDMA&LTE

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE ratios
	dBm	mW				
WCDMA II	25.0	316.23	-1.8	0.0416	1.0000	0.0416
WCDMA IV	25.0	316.23	-1.5	0.0445	1.0000	0.0445
WCDMA V	25.0	316.23	-0.7	0.0535	0.550	0.0974
LTE Band 2	25.0	316.23	-1.8	0.0416	1.0000	0.0416
LTE Band 4	25.0	316.23	-1.5	0.0445	1.0000	0.0445
LTE Band 5	25.0	316.23	-0.7	0.0535	0.550	0.0974
LTE Band 12	25.0	316.23	-0.8	0.0523	0.470	0.1114
LTE Band 13	25.0	316.23	-0.5	0.0561	0.520	0.1079
LTE Band 14	25.0	316.23	-0.8	0.0523	0.530	0.0988
LTE Band 66	25.0	316.23	-1.5	0.0445	1.000	0.0445
LTE Band 71	25.0	316.23	-1.0	0.0500	0.450	0.1111

Remark:

- 1)Maximum output power for BT from module report (refer FCC ID:2AFIW-SH32BZ);
- 2)Maximum output power for WWAN from module report (refer FCC ID: XMR201808EC25AF);
- 3)Output power including turn-up tolerance;
- 4)Output power is burst average power;
- 5)MPE evaluate distance is 20cm from user manual provide by manufacturer;
- 6)MPE values = $PG/4\pi R^2$

Simultaneous Transmission MPE

The sample support two 2.4GWLAN, one 5G WLAN transmit antennas, one BT antenna and another WCDMA/LTE antenna(Main), so need consider simultaneous transmission;BT exposure (refer FCC ID:2AFIW-SH32BZ),WCDMA/LTE exposure(refer FCC ID:XMR201808EC25AF) Simultaneous transmission MPE According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
 Σ of MPE ratios ≤ 1.0

Mode	Σ MPE max ratios	Limit	Results
2.4GWIFI Ant1+2.4GWIFI Ant2 + 5GWIFI+BLE+WWAN	0.3925	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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