

**Maximum Permissible Exposure Report****1. Product Information**

EUT	:	Gateway
Test Model	:	KG03
Additional Model No.	:	KG01, KG05, KG06
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power Supply	:	Input: DC 12V, 1A or POE
Hardware Version	:	V1.0
Software Version	:	V1.06
Bluetooth		
Frequency Range	:	2402MHz~2480MHz
Channel Number	:	40 channels for Bluetooth V5.0 (DTS)
Channel Spacing	:	2MHz for Bluetooth V5.0 (DTS)
Modulation Type	:	GFSK for Bluetooth V5.0 (DTS)
Bluetooth Version	:	V5.0
Antenna Description	:	Ant3: External Antenna, 0dBi(Max.)
WIFI(2.4G Band)		
Frequency Range	:	2412MHz~2462MHz
Channel Number	:	11 Channels for 20MHz bandwidth (2412~2462MHz)
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	:	Ant0: Internal Antenna, 0dBi(Max.) Ant1: Internal Antenna, 0dBi(Max.)
Exposure category	:	General population/uncontrolled environment
EUT Type	:	Production Unit
Device Type	:	Mobile Device



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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 C95.1–2019](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz 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/Uncontrolled 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

EUT can only use antennas certificated as follows provided by manufacturer;

Internal/ External Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
External	External Antenna	2400MHz-2500MHz	0dBi	Bluetooth Antenna3
Internal	Internal Antenna	2400MHz-2500MHz	0dBi	2.4GWIFI Antenna0
Internal	Internal Antenna	2400MHz-2500MHz	0dBi	2.4GWIFI Antenna1





6. Conducted Power

[BT LE]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	00	2402	-6.90
	19	2440	-6.78
	39	2480	-6.65

[2.4G WIFI]

Mode	Channel	Frequency (MHz)	Ant 0 Max Conducted Power(dBm)	Ant 1 Max Conducted Power(dBm)
11B	1	2412	15.69	15.92
	6	2437	15.62	15.09
	11	2462	16.04	15.24
11G	1	2412	15.89	16.01
	6	2437	15.33	15.11
	11	2462	15.81	15.35
11N20 SISO	1	2412	16.02	15.66
	6	2437	15.5	15.41
	11	2462	16.65	16.22

[2.4G WIFI]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
11N20 MIMO	1	2412	18.85
	6	2437	18.47
	11	2462	19.45

7. Manufacturing Tolerance

[BT LE]

GFSK(Peak)			
Channel	Channel 00	Channel 19	Channel 39
Target (dBm)	-6.0	-6.0	-6.0
Tolerance ± (dB)	1.0	1.0	1.0

[2.4G WIFI Ant0]

11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20(Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	16.0	15.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0





[2.4G WIFI Ant1]

11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	16.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
11N20(Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	16.0
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.

[BT LE Ant3]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE ratios
	dBm	mW					
BT LE	-5.0	0.3162	0	1.0000	0.0001	1.0000	0.0001

[2.4G WIFI Ant0]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE ratios
	dBm	mW					
IEEE 802.11b	17.0	50.1187	0	1.0000	0.0100	1.0000	0.0100
IEEE 802.11g	16.0	39.8107	0	1.0000	0.0079	1.0000	0.0079
IEEE 802.11n HT20	17.0	50.1187	0	1.0000	0.0100	1.0000	0.0100

[2.4G WIFI Ant1]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE ratios
	dBm	mW					
IEEE 802.11b	16.0	39.8107	0	1.0000	0.0079	1.0000	0.0079
IEEE 802.11g	17.0	50.1187	0	1.0000	0.0100	1.0000	0.0100
IEEE 802.11n HT20	17.0	50.1187	0	1.0000	0.0100	1.0000	0.0100

Remark:

1. Output power including tune-up tolerance;
2. Output power was adjusted to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.



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8.2 Simultaneous Transmission MPE Evaluation

The EUT equipped with one BT LE antenna and two 2.4GWIFI antenna. So, need consider simultaneous transmission;
 According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
 $\Sigma\Sigma$ of MPE ratios ≤ 1.0

Simultaneous Transmission					
BT LE Max MPE ratios	2.4GWIFI MAX MPE ratios		Σ MPE ratios	Limit	Results
Ant3	Ant0	Ant1			
0.0001	0.0100	0.0100	0.0201	1.0	Pass

Remark:

1. Output power including turn-up tolerance;
2. BT/BLE/2.4G WIFI output power is burst peak power;
3. 5G WIFI output power is burst average power;
4. MPE evaluate distance is 20cm from user manual provide by manufacturer;
5. MPE values = $PG/4\pi R^2$
6. Bluetooth Antenna is Antenna1.

9. Conclusion

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

-----THE END OF REPORT-----

