

FCC RF Exposure Evaluation

1.Product Information

FCC ID:	2AABM-GC3
Product name	Gatecrasher 3 Powerbar
Model number	Gatecrasher 3
Power supply	For adapter Input: AC 100-240V, 50/60Hz, 2A Max For adapter Output: DC 19V, 3.3A
Operation frequency	IEEE 802.11b:2412-2462MHz IEEE 802.11g:2412-2462MHz IEEE 802.11n HT20:2412-2462MHz Bluetooth: 2402MHz-2480MHz SKAA: 2403.5-2477MHz 5.2GHz Band:5180~5240MHz
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) GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V5.0 (DSS) GFSK for Bluetooth V4.2 (DTS) FSK For 2.4G IEEE 802.11a/n/ac: OFDM(64QAM, 16QAM, QPSK, BPSK)
Channel Number	11 Channels for 20MHz bandwidth(2412~2462MHz) 79 Channels for Bluetooth V4.0(BDR/EDR) 40 channels for Bluetooth V4.0(BT LE) 4 channels for 20MHz bandwidth(5180MHz-5240MHz) 2 channels for 40MHz bandwidth(5190MHz~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)
Antenna Type	PCB Antenna
Antenna Gain	4.0dBi(Max) for Bluetooth 3.3dBi(Max) for 2.4G 4.0dBi(Max) for 2.4G WIFI & 5.2G WIFI
Hardware version	20180629
Software version	4.0
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. Conducted Power Results

Mode	Channel	Frequency(MHz)	Average Conducted Output Power (dBm)
GFSK	0	2402	0.934
	39	2441	1.028
	78	2480	1.107
$\pi/4$ DQPSK	0	2402	0.832
	39	2441	0.897
	78	2480	0.941
8DPSK	0	2402	0.827
	39	2441	0.876
	78	2480	0.911
GFSK(BLE)	0	2402	1.772
	19	2440	1.766
	39	2480	1.766
IEEE 802.11b	1	2412	11.09
	6	2437	10.32
	11	2462	9.57
IEEE 802.11g	1	2412	9.26
	6	2437	10.08
	11	2462	9.74
IEEE 802.11n HT20	1	2412	9.92
	6	2437	9.88
	11	2462	9.52

IEEE 802.11a (5.2G)	36	5180	11.45
	40	5200	9.91
	48	5240	10.91
IEEE 802.11n20 (5.2G)	36	5180	10.64
	40	5200	9.18
	48	5240	9.75
IEEE 802.11n40 (5.2G)	38	5190	9.32
	46	5230	9.53
IEEE 802.11ac20 (5.2G)	36	5180	9.39
	40	5200	9.56
	48	5240	10.01
IEEE 802.11ac40 (5.2G)	38	5190	9.38
	46	5230	9.46
IEEE 802.11ac80 (5.2G)	42	5210	10.12

6. Manufacturing tolerance

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0.0	1.0	1.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
$\pi/4$ QPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0.0	0.0	0.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
8DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0.0	0.0	0.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
GFSK (BT LE) (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	1.0	1.0	1.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	11.0	10.0	9.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	9.0	10.0	9.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	10.0	9.0	9.0

Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11a(5.2G) (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	9.0	10.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11 N20 (5.2G) (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	10.0	9.0	9.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11 N40 (5.2G) (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	9.0	9.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11 ac20 (5.2G) (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	9.0	9.0	10.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11ac40 (5.2G) (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	9.0	9.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
IEEE 802.11ac80 (5.2G) (Average)			
Channel	Channel 42	/	/
Target (dBm)	10.0	/	/
Tolerance $\pm$ (dB)	1.0	/	/

7. Evaluation Results

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
GFSK	2.0	1.5849	4.00	2.5119	0.0008	1.0000
$\pi/4$ DQPSK	1.0	1.2589	4.00	2.5119	0.0006	1.0000
8DPSK	1.0	1.2589	4.00	2.5119	0.0006	1.0000
GFSK (BT LE)	2.0	1.5849	4.00	2.5119	0.0008	1.0000
IEEE 802.11b	12.0	15.8489	4.00	2.5119	0.0079	1.0000
IEEE 802.11g	11.0	12.5893	4.00	2.5119	0.0063	1.0000
IEEE 802.11n HT20	11.0	12.5893	4.00	2.5119	0.0063	1.0000
IEEE 802.11a (5.2G)	12.0	15.8489	4.00	2.5119	0.0079	1.0000
IEEE 802.11n20 (5.2G)	11.0	12.5893	4.00	2.5119	0.0063	1.0000
IEEE 802.11n40 (5.2G)	10.0	10.0000	4.00	2.5119	0.0050	1.0000
IEEE 802.11ac20 (5.2G)	11.0	12.5893	4.00	2.5119	0.0063	1.0000
IEEE 802.11ac40 (5.2G)	10.0	10.0000	4.00	2.5119	0.0050	1.0000
IEEE 802.11ac80 (5.2G)	11.0	12.5893	4.00	2.5119	0.0063	1.0000

Remark:

1. Output power including tune up tolerance;
2. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to f) in section 4.1 is applied to determine SAR test exclusion.
3. WLAN and BT are use difference module and antenna, but WLAN and BT cannot be used at the same time, so simultaneous transmit not need to consider.

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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