

FCC RF Exposure Evaluation

1. Product Information

FCC ID:	2AVTH-10M4
Product name	I1012
Model number	10WWA464B
Power supply	DC 7.6V by Rechargeable Li-ion Battery(3000mAh) Recharged by 12V 2000mA Adapter
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V4.2 (DSS) GFSK for Bluetooth V4.2 (DTS) IEEE 802.11b: DSSS (CCK,DQPSK,DBPSK); IEEE 802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11a/n/ac: OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	PIFA Antenna(ANT 0), used for Bluetooth & WIFI 1.61dBi(Max.) for Bluetooth, 1.69dBi(Max.) for 2.4GWIFI 0.74dBi(Max.) for 5.2GWIFI, 0.93dBi(Max.) for 5.8GWIFI PIFA Antenna(ANT 1), used for WIFI 1.69dBi(Max.) for 2.4GWIFI 0.74dBi(Max.) for 5.2GWIFI, 0.93dBi(Max.) for 5.8GWIFI
Hardware version	EM_G8811_366B_V6.1
Software version	OS build:19041.508 /BIOS Version/Date: American Megatrends inc. V1.1.2. P1S0E1F0L28BOT4P0G2U0D502 3668 timing, 2020-09 -18
Bluetooth Operation frequency	2402MHz-2480MHz
Operation frequency	79 channels for Bluetooth V4.2 (DSS) 40 hannels for Bluetooth V4.2 (DTS) 11 channels for 20MHz bandwidth (2412~2462MHz) 7 Channels for 40MHz bandwidth(2422~2452MHz) 4 Channels for 20MHz bandwidth(5180-5240MHz) 5 channels for 20MHz bandwidth(5745-5825MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 Channels for 80MHz bandwidth(5210MHz) 1 channels for 80MHz bandwidth(5775MHz)
Exposure category	General population/uncontrolled environment
EUT Type	Production Unit
Device Type	Portable Device

2. Evaluation method and Limit

According to KDB447498 D01 General RF Exposure Guidance v06 Section 4.3.1 Standalone SAR test exclusion considerations: "Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.22 The minimum test separation distance is determined by the smallest distance from the antenna and radiating

structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc.²³ “

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [v_f (\text{GHz})]$
 ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where:

- f (GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. 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. 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 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 2.1093](#): Radiofrequency radiation exposure evaluation: portable devices

4. Conducted Power Results

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK	0	2402	4.748
	39	2441	4.798
	78	2480	3.991
$\pi/4$ DQPSK	0	2402	1.350
	39	2441	1.254
	78	2480	0.507
8-DPSK	0	2402	1.565
	39	2441	1.494
	78	2480	0.732
BT LE	0	2402	3.215
	19	2440	3.106
	39	2480	2.388

[2.4GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11b	1	2412	5.48
	6	2437	5.49
	11	2462	5.53
IEEE 802.11g	1	2412	6.40

	6	2437	6.16
	11	2462	6.33
	1	2412	6.37
IEEE 802.11n HT20	6	2437	6.42
	11	2462	6.19
IEEE 802.11n HT40	3	2422	6.25
	6	2437	6.46
	9	2452	6.27

[2.4GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11b	1	2412	5.43
	6	2437	5.77
	11	2462	5.27
IEEE 802.11g	1	2412	6.14
	6	2437	6.21
	11	2462	6.22
IEEE 802.11n HT20	1	2412	6.18
	6	2437	6.49
	11	2462	6.27
IEEE 802.11n HT40	3	2422	6.39
	6	2437	6.25
	9	2452	6.48

[5.2GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	36	5180	4.73
	40	5200	4.76
	48	5240	4.85
IEEE 802.11N20	36	5180	4.55
	40	5200	4.56
	48	5240	4.66
IEEE 802.11N40	38	5190	4.75
	46	5230	4.61
IEEE 802.11N20	36	5180	4.72
	40	5200	4.84
	48	5240	4.91
IEEE 802.11AC40	38	5190	4.74
	46	5230	4.65
IEEE 802.11AC80	42	5210	4.83

[5.2GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	36	5180	4.58
	40	5200	4.92
	48	5240	4.88
IEEE 802.11N20	36	5180	4.87
	40	5200	4.90
	48	5240	4.64
IEEE 802.11N40	38	5190	4.55
	46	5230	4.69
IEEE 802.11N20	36	5180	4.98
	40	5200	4.79
	48	5240	4.77

IEEE 802.11AC40	38	5190	4.86
	46	5230	4.75
IEEE 802.11AC80	42	5210	4.62

[5.8GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	149	5745	4.23
	157	5785	4.19
	165	5825	4.24
IEEE 802.11N20	149	5745	4.33
	157	5785	4.10
	165	5825	4.09
IEEE 802.11N40	151	5755	4.46
	159	5795	4.20
IEEE 802.11N20	149	5745	4.21
	157	5785	4.30
	165	5825	4.14
IEEE 802.11AC40	151	5755	4.11
	159	5795	4.12
IEEE 802.11AC80	155	5775	4.23

[5.8GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	149	5745	4.32
	157	5785	4.15
	165	5825	4.22
IEEE 802.11N20	149	5745	4.29
	157	5785	4.18
	165	5825	4.47
IEEE 802.11N40	151	5755	4.26
	159	5795	4.27
IEEE 802.11N20	149	5745	4.20
	157	5785	4.19
	165	5825	4.35
IEEE 802.11AC40	151	5755	4.28
	159	5795	4.32
IEEE 802.11AC80	155	5775	4.26

5. Manufacturing tolerance

BT			
GFSK			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	4.0	4.0	3.0
Tolerance ±(dB)	1	1	1
π/4DQPSK			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.0	1.0	0.0
Tolerance ±(dB)	1	1	1
8DPSK			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.0	1.0	0.0
Tolerance ±(dB)	1	1	1
BT LE			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	3.0	3.0	2.0
Tolerance ±(dB)	1	1	1

[2.4GWLAN Max Peak Conducted Power ANT0]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11b	1	2412	5.0	1.0
	6	2437	5.0	1.0
	11	2462	5.0	1.0
IEEE 802.11g	1	2412	5.5	1.0
	6	2437	5.5	1.0
	11	2462	5.5	1.0
IEEE 802.11n HT20	1	2412	5.5	1.0
	6	2437	5.5	1.0
	11	2462	5.5	1.0
IEEE 802.11n HT40	3	2422	5.5	1.0
	6	2437	5.5	1.0
	9	2452	5.5	1.0

[2.4GWLAN Max Peak Conducted Power ANT1]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11b	1	2412	5.0	1.0
	6	2437	5.0	1.0
	11	2462	5.0	1.0
IEEE 802.11g	1	2412	5.5	1.0
	6	2437	5.5	1.0
	11	2462	5.5	1.0
IEEE 802.11n HT20	1	2412	5.5	1.0
	6	2437	5.5	1.0
	11	2462	5.5	1.0
IEEE 802.11n HT40	3	2422	5.5	1.0
	6	2437	5.5	1.0
	9	2452	5.5	1.0

[5.2GWLAN Max Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	36	5180	4.0	1.0
	40	5200	4.0	1.0
	48	5240	4.0	1.0
IEEE 802.11N20	36	5180	4.0	1.0
	40	5200	4.0	1.0
	48	5240	4.0	1.0
IEEE 802.11N40	38	5190	4.0	1.0
	46	5230	4.0	1.0
IEEE 802.11N20	36	5180	4.0	1.0
	40	5200	4.0	1.0
	48	5240	4.0	1.0
IEEE 802.11AC40	38	5190	4.0	1.0
	46	5230	4.0	1.0
IEEE 802.11AC80	42	5210	4.0	1.0

[5.2GWLAN Max Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	36	5180	4.0	1.0
	40	5200	4.0	1.0
	48	5240	4.0	1.0
IEEE 802.11N20	36	5180	4.0	1.0
	40	5200	4.0	1.0
	48	5240	4.0	1.0
IEEE 802.11N40	38	5190	4.0	1.0
	46	5230	4.0	1.0
IEEE 802.11N20	36	5180	4.0	1.0
	40	5200	4.0	1.0
	48	5240	4.0	1.0
IEEE 802.11AC40	38	5190	4.0	1.0
	46	5230	4.0	1.0
IEEE 802.11AC80	42	5210	4.0	1.0

[5.8GWLAN Max Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	149	5745	3.5	1.0
	157	5785	3.5	1.0
	165	5825	3.5	1.0
IEEE 802.11N20	149	5745	3.5	1.0
	157	5785	3.5	1.0
	165	5825	3.5	1.0
IEEE 802.11N40	151	5755	3.5	1.0
	159	5795	3.5	1.0
IEEE 802.11N20	149	5745	3.5	1.0
	157	5785	3.5	1.0
	165	5825	3.5	1.0
IEEE 802.11AC40	151	5755	3.5	1.0
	159	5795	3.5	1.0
IEEE 802.11AC80	155	5775	3.5	1.0

[5.8GWLAN Max Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	149	5745	3.5	1.0
	157	5785	3.5	1.0
	165	5825	3.5	1.0
IEEE 802.11N20	149	5745	3.5	1.0
	157	5785	3.5	1.0
	165	5825	3.5	1.0
IEEE 802.11N40	151	5755	3.5	1.0
	159	5795	3.5	1.0
IEEE 802.11N20	149	5745	3.5	1.0
	157	5785	3.5	1.0
	165	5825	3.5	1.0
IEEE 802.11AC40	151	5755	3.5	1.0
	159	5795	3.5	1.0
IEEE 802.11AC80	155	5775	3.5	1.0

6. Evaluation Results

ANT 0

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
BT	2.450	5	5.0	3.1623	0.9899 < 3.0	Yes
BT LE	2.450	5	4.0	2.5119	0.7863 < 3.0	Yes
2.4G WIFI_SISO	2.450	5	6.5	4.4668	1.3983 < 3.0	Yes
5.2G WIFI_SISO	5.250	5	5.0	3.1623	1.4491 < 3.0	Yes
5.8G WIFI_SISO	5.850	5	4.5	2.8184	1.3634 < 3.0	Yes

ANT 1

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
2.4G WIFI_SISO	2.450	5	6.5	4.4668	1.3983 < 3.0	Yes
5.2G WIFI_SISO	5.250	5	5.0	3.1623	1.4491 < 3.0	Yes
5.8G WIFI_SISO	5.850	5	4.5	2.8184	1.3634 < 3.0	Yes

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 of KDB447498 is applied to determine SAR test exclusion.
3. WLAN and BT share same modular and same antenna, no need consider simultaneous transmit.

Simultaneous Transmission for SAR Exclusion

The sample support one modular and supports two antennas, need consider simultaneous transmission;

Mode	ANT0 Threshold	ANT1 Threshold	Simultaneous Transmission for SAR Exclusion	SAR Test Exclusion
2.4G WIFI_ANT1 & BT	1.3983	0.9899	2.3882 < 3.0	Yes
5.2G WIFI_ANT1 & BT	1.4491	0.9899	2.4390 < 3.0	Yes

5.8G WIFI_ANT1 & BT	1.3634	0.9899	2.3533<3.0	Yes
2.4G WIFI_MIMO	1.3983	1.3983	2.7966<3.0	Yes
5.2G WIFI_MIMO	1.4491	1.4491	2.8982<3.0	Yes
5.8G WIFI_MIMO	1.3634	1.3634	2.7268<3.0	Yes

7. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06.

.....THE END OF REPORT.....