FCC RF Exposure Evaluation

1. Product Information

FCC ID	2ANTOEM-A839
Product name	All-in-One VR
Model number	EM_A839
Power supply	DC 3.8V by Li-ion Battery(2100mAh) Adapter Input: AC 100-240V, 50/60Hz, 0.5A Adapter Output: DC 5V/3A, 9V/2A, 12V/1.5A
Modulation Type	GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V4.0 (DSS) GFSK for Bluetooth V4.0 (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)
Channel Number	79 channels for Bluetooth V4.0 (DSS) 40 channels for Bluetooth V4.0 (DTS) 11 channels for 20MHz bandwidth (2412~2462MHz) 7 Channels for 40MHz bandwidth(2422~2452MHz) 4 Channels for 20MHz bandwidth(5180-5240MHz) 4 Channels for 20MHz bandwidth(5260-5320MHz) 11 Channels for 20MHz bandwidth(5500-5700MHz) 5 channels for 20MHz bandwidth(5745-5825MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 2 channels for 40MHz bandwidth(5270~5310MHz) 5 Channels for 40MHz bandwidth(5510-5670MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 Channels for 80MHz bandwidth(5210MHz) 1 channels for 80MHz bandwidth(5290MHz) 2 Channels for 80MHz bandwidth(5530-5610MHz) 1 channels for 80MHz bandwidth(5775MHz)
Antenna Description	Interal Antenna(ANT 0), used for WIFI TX/RX, 2.0dBi(Max.) for 2.4G Band, 1.9dBi(Max.) for 5G Band; Internal Antenna(ANT 1), used for WIFI/Bluetooth TX/RX, 2.0dBi(Max.) for 2.4G Band, 1.9dBi(Max.) for 5G Band
Hardware version	EM_A839_MB_V1.1
Software version	VR1103/20191025105352
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 v06Section 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. 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."
[(max. power of channel, including tune-up tolerance, mW)/ (min. test separation distance, mm)] · [√f (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.

When one of the following test exclusion conditions is satisfied for all combinations of simultaneous transmission configurations, further equipment approval is not required to incorporate transmitter modules in host devices that operate in the mixed mobile and portable host platform exposure conditions. The grantee is responsible for documenting this according to Class I permissive change requirements. Antennas that qualify for standalone SAR test exclusion must apply the estimated standalone SAR to determine simultaneous transmission test exclusion.

a) The [∑ of (the highest measured or estimated SAR for each standalone antenna configuration, adjusted for maximum tune-up tolerance) / 1.6 W/kg] + [∑ of MPE ratios] is ≤ 1.0.
b) The SAR to peak location separation ratios of all simultaneously transmitting antenna pairs operating in portable device exposure conditions are all ≤ 0.04, and the [∑ of MPE ratios] is ≤ 1.0.

3. 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 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	0.219
	39	2441	-1.934
	78	2480	-0.930
π/4DQPSK	0	2402	-0.831
	39	2441	-2.738
	78	2480	-1.672
8-DPSK	0	2402	-0.671
	39	2441	-2.320
	78	2480	-1.217

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
BT LE	0	2402	0.085
	19	2440	-2.064
	39	2480	-1.063

[2.4GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11b	1	2412	4.56
	6	2437	4.40
	11	2462	4.96
IEEE 802.11g	1	2412	5.74
	6	2437	5.86
	11	2462	5.67
IEEE 802.11n HT20	1	2412	5.79
	6	2437	5.73
	11	2462	5.76
IEEE 802.11n HT40	3	2422	6.01
	6	2437	5.96
	9	2452	6.06

[2.4GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11b	1	2412	4.82
	6	2437	4.46
	11	2462	4.92
IEEE 802.11g	1	2412	5.55
	6	2437	5.69
	11	2462	5.50
IEEE 802.11n HT20	1	2412	6.23
	6	2437	5.78
	11	2462	5.51
IEEE 802.11n HT40	3	2422	5.61
	6	2437	5.71
	9	2452	5.70

[5.2GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	36	5180	4.25
	40	5200	4.10
	48	5240	4.15
IEEE 802.11N20	36	5180	4.62
	40	5200	4.01
	48	5240	4.64
IEEE 802.11N40	38	5190	4.54
	46	5230	4.34
IEEE 802.11N20	36	5180	4.67
	40	5200	4.25
	48	5240	4.87
IEEE 802.11AC40	38	5190	4.48
	46	5230	4.43
IEEE 802.11AC80	42	5210	4.97

[5.2GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	36	5180	4.44
	40	5200	4.56
	48	5240	4.76
IEEE 802.11N20	36	5180	4.64
	40	5200	4.81
	48	5240	4.84
IEEE 802.11N40	38	5190	4.33
	46	5230	4.16
IEEE 802.11N20	36	5180	4.85
	40	5200	4.32
	48	5240	4.07
IEEE 802.11AC40	38	5190	4.03
	46	5230	4.5
IEEE 802.11AC80	42	5210	4.8

[5.3GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	52	5260	3.99
	56	5280	3.27
	64	5320	3.45
IEEE 802.11N20	52	5260	4.67
	56	5280	3.98
	64	5320	3.73
IEEE 802.11N40	54	5270	4.7
	62	5310	4.03
IEEE 802.11N20	52	5260	4.6
	56	5280	4.04
	64	5320	3.78
IEEE 802.11AC40	54	5270	4.43
	62	5310	3.57
IEEE 802.11AC80	58	5290	4.84

[5.3GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	52	5260	3.38
	56	5280	3.54
	64	5320	3.08
IEEE 802.11N20	52	5260	3.54
	56	5280	3.48
	64	5320	3.19
IEEE 802.11N40	54	5270	3.16
	62	5310	3.26
IEEE 802.11N20	52	5260	4.24
	56	5280	4.19
	64	5320	3.95
IEEE 802.11AC40	54	5270	4.41
	62	5310	4.28
IEEE 802.11AC80	58	5290	4.61

[5.5GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	100	5500	3.41
	120	5600	3.53
	140	5700	4.06
IEEE 802.11N20	100	5500	3.20
	120	5600	3.37
	140	5700	3.94
IEEE 802.11N40	149	5510	3.47
	157	5590	3.13
	165	5670	3.77
IEEE 802.11N20	100	5500	3.23
	120	5600	3.37
	140	5700	4.31
IEEE 802.11AC40	149	5510	2.45
	157	5590	2.89
	165	5670	2.64
IEEE 802.11AC80	106	5530	2.09
	122	5610	3.68

[5.5GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	100	5500	3.15
	120	5600	3.06
	140	5700	3.78
IEEE 802.11N20	100	5500	3.04
	120	5600	3.15
	140	5700	3.76
IEEE 802.11N40	149	5510	3.24
	157	5590	3.01
	165	5670	3.54
IEEE 802.11N20	100	5500	3.12
	120	5600	3.30
	140	5700	4.25
IEEE 802.11AC40	149	5510	2.41

	157	5590	2.74
	165	5670	2.52
IEEE 802.11AC80	106	5530	2.00
	122	5610	3.54

[5.8GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	149	5745	3.88
	157	5785	3.97
	165	5825	2.91
IEEE 802.11N20	149	5745	3.51
	157	5785	4.08
	165	5825	3.71
IEEE 802.11N40	151	5755	3.79
	159	5795	3.95
IEEE 802.11N20	149	5745	3.71
	157	5785	3.78
	165	5825	4.09
IEEE 802.11AC40	151	5755	3.62
	159	5795	4.23
IEEE 802.11AC80	155	5775	3.85

[5.8GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Max Conducted Power (dBm)
IEEE 802.11A	149	5745	3.95
	157	5785	4.24
	165	5825	3.13
IEEE 802.11N20	149	5745	4.07
	157	5785	4.40
	165	5825	3.29
IEEE 802.11N40	151	5755	4.30
	159	5795	4.36
IEEE 802.11N20	149	5745	4.35
	157	5785	4.07
	165	5825	3.41
IEEE 802.11AC40	151	5755	4.03
	159	5795	2.42
IEEE 802.11AC80	155	5775	4.26

5. Manufacturing Tolerance

Mode	Channel	Frequency (MHz)	Target (dBm)	Tolerance ±(dB)
BT	0	2402	0	1.0
	39	2441	-2.0	1.0
	78	2480	-1.0	1.0
BT LE	0	2402	0	1.0
	19	2441	-2.0	1.0
	39	2480	-1.0	1.0

[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 Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	36	5180	4	1.0
	40	5200	4	1.0
	48	5240	4	1.0
IEEE 802.11N20	36	5180	4	1.0
	40	5200	4	1.0
	48	5240	4	1.0
IEEE 802.11N40	38	5190	4	1.0
	46	5230	4	1.0
IEEE 802.11N20	36	5180	4	1.0
	40	5200	4	1.0
	48	5240	4	1.0
IEEE 802.11AC40	38	5190	4	1.0
	46	5230	4	1.0
IEEE 802.11AC80	42	5210	4	1.0

[5.2GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	36	5180	4	1.0
	40	5200	4	1.0
	48	5240	4	1.0
IEEE 802.11N20	36	5180	4	1.0
	40	5200	4	1.0
	48	5240	4	1.0
IEEE 802.11N40	38	5190	4	1.0
	46	5230	4	1.0
IEEE 802.11N20	36	5180	4	1.0
	40	5200	4	1.0
	48	5240	4	1.0
IEEE 802.11AC40	38	5190	4	1.0
	46	5230	4	1.0
IEEE 802.11AC80	42	5210	4	1.0

[5.3GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	52	5260	4	1.0
	56	5280	4	1.0
	64	5320	4	1.0
IEEE 802.11N20	52	5260	4	1.0
	56	5280	4	1.0
	64	5320	4	1.0
IEEE 802.11N40	54	5270	4	1.0
	62	5310	4	1.0
IEEE 802.11N20	52	5260	4	1.0
	56	5280	4	1.0
	64	5320	4	1.0
IEEE 802.11AC40	54	5270	4	1.0
	62	5310	4	1.0
IEEE 802.11AC80	58	5290	4	1.0

[5.3GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	52	5260	4	1.0
	56	5280	4	1.0
	64	5320	4	1.0
IEEE 802.11N20	52	5260	4	1.0
	56	5280	4	1.0
	64	5320	4	1.0
IEEE 802.11N40	54	5270	4	1.0
	62	5310	4	1.0
IEEE 802.11N20	52	5260	4	1.0
	56	5280	4	1.0
	64	5320	4	1.0
IEEE 802.11AC40	54	5270	4	1.0
	62	5310	4	1.0
IEEE 802.11AC80	58	5290	4	1.0

[5.5GWLAN Max Peak Conducted Power_ANT0]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	100	5500	3.5	1.0
	120	5600	3.5	1.0
	140	5700	3.5	1.0
IEEE 802.11N20	100	5500	3.5	1.0
	120	5600	3.5	1.0
	140	5700	3.5	1.0
IEEE 802.11N40	149	5510	3.5	1.0
	157	5590	3.5	1.0
	165	5670	3.5	1.0
IEEE 802.11N20	100	5500	3.5	1.0
	120	5600	3.5	1.0
	140	5700	3.5	1.0
IEEE 802.11AC40	149	5510	3	1.0
	157	5590	3	1.0
	165	5670	3	1.0
IEEE 802.11AC80	106	5530	3	1.0
	122	5610	3	1.0

[5.5GWLAN Max Peak Conducted Power_ANT1]

Mode	Channel	Frequency(MHz)	Target (dBm)	Tolerance ±(dB)
IEEE 802.11A	100	5500	3.5	1.0
	120	5600	3.5	1.0
	140	5700	3.5	1.0
IEEE 802.11N20	100	5500	3.5	1.0
	120	5600	3.5	1.0
	140	5700	3.5	1.0
IEEE 802.11N40	149	5510	3.5	1.0
	157	5590	3.5	1.0
	165	5670	3.5	1.0
IEEE 802.11N20	100	5500	3.5	1.0
	120	5600	3.5	1.0
	140	5700	3.5	1.0
IEEE 802.11AC40	149	5510	3	1.0
	157	5590	3	1.0
	165	5670	3	1.0
IEEE 802.11AC80	106	5530	3	1.0

	122	5610	3	1.0

[5.8GWLAN Max Peak 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	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 Peak 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	1.0
IEEE 802.11AC80	155	5775	3.5	1.0

6. Evaluation Results

6.1 Standalone Evaluation

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
BT	2.48	5	1	1.26	0.40<3.0	Yes
BT LE	2.48	5	1	1.26	0.40<3.0	Yes
2.4G WIFI_SISO	2.462	5	6.5	4.47	1.40<3.0	Yes
5.2G WIFI_SISO	5.24	5	5	3.16	1.45<3.0	Yes
5.3G WIFI_SISO	5.32	5	5	3.16	1.46<3.0	Yes
5.5G WIFI_SISO	5.7	5	4.5	2.82	1.35<3.0	Yes
5.8G WIFI_SISO	5.825	5	4.5	2.82	1.36<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. We choose the highest frequency operate to calculate SAR Test Exclusion Threshold limit as higher frequency will have higher SAR Test Exclusion Threshold limits.

6.2 Simultaneous Transmission for SAR Exclusion

The sample supports two transmit antenna, the ANT 0 used for WIFI TX/RX and ANT 1 used for WIFI/Bluetooth TX/RX. So need consider simultaneous transmission;

Mode	ANT0 Threshold	ANT1 Threshold	Simultaneous Transmission for SAR Exclusion	SAR Test Exclusion
2.4G WIFI_ANT0 & BT	1.40	0.40	1.80<3.0	Yes
5.2G WIFI_ANT0 & BT	1.45	0.40	1.85<3.0	Yes
5.3G WIFI_ANT0 & BT	1.46	0.40	1.86<3.0	Yes
5.5G WIFI_ANT0 & BT	1.35	0.40	1.75<3.0	Yes
5.8G WIFI_ANT0 & BT	1.36	0.40	1.76<3.0	Yes
2.4G WIFI_MIMO	1.40	1.40	2.80<3.0	Yes
5.2G WIFI_ MIMO	1.45	1.45	2.80<3.0	Yes
5.3G WIFI_ MIMO	1.46	1.46	2.92<3.0	Yes
5.5G WIFI_ MIMO	1.35	1.35	2.70<3.0	Yes
5.8G WIFI_ MIMO	1.36	1.36	2.72<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.....