MPE Report

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

FCC ID: **2AGM4-WUS13**

Refer Standard: KDB 447498 D01 General RF Exposure Guidance v06

FCC Part 2 §2.1091

KDB 865664 D02 RF Exposure Reporting v01r02

1. 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 modeled 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.

2. Limits for General Population/Uncontrolled Exposure

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

3. 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

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the maximum gain of the used antenna as following table, the RF power density can be obtained.

4. Conducted Power Results

4.1 Standalone Mode

Bluetooth

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
GFSK-LE	0	2402	7.34
	19	2440	7.42
	39	2480	7.66
GFSK	0	2402	8.04
	39	2441	7.72
	78	2480	7.54
π/4DQPSK	0	2402	9.51
	39	2441	9.22
	78	2480	9.17
8DPSK	0	2402	9.79
	39	2441	9.51
	78	2480	9.49

2.4GHzWLAN

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)	
			Antenna 0	Antenna 1
IEEE 802.11 b	1	2412	15.55	16.02
	6	2437	16.67	15.78
	11	2462	16.36	15.76
IEEE 802.11 g	1	2412	14.94	15.35
	6	2437	14.57	15.21
	11	2462	15.08	15.58
IEEE 802.11 n HT20	1	2412	14.87	14.81
	6	2437	14.37	15.33
	11	2462	14.87	15.36
IEEE 802.11 n HT40	3	2422	14.27	14.71
	6	2437	14.15	14.75
	9	2452	14.07	15.35

5.8GHzWLAN – Band 1

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)	
			Antenna 0	Antenna 1
IEEE 802.11 a	36	5180	13.08	13.34
	44	5220	12.44	12.44
	48	5240	12.47	12.47
IEEE 802.11 n HT20	36	5180	13.60	14.01
	44	5220	13.75	14.01
	48	5240	13.78	14.31
IEEE 802.11 ac HT20	36	5180	13.25	13.26
	44	5220	13.29	13.03
	48	5240	13.37	13.35
IEEE 802.11 n HT40	38	5190	15.83	15.86
	46	5230	15.66	15.44
IEEE 802.11 ac HT40	38	5190	15.22	15.12
	46	5230	15.59	15.65
IEEE 802.11 ac HT80	42	5210	14.61	14.78

5.8GHzWLAN – Band 2A

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)	
			Antenna 0	Antenna 1
IEEE 802.11 a	52	5260	14.04	13.67
	60	5280	14.44	13.85
	64	5320	14.13	14.37
IEEE 802.11 n HT20	52	5260	14.97	13.71
	60	5280	14.87	14.23
	64	5320	15.20	13.86
IEEE 802.11 ac HT20	52	5260	13.15	13.20
	60	5280	15.16	13.78
	64	5320	13.41	13.04
IEEE 802.11 n HT40	54	5270	15.72	15.71
	62	5310	15.64	15.64
IEEE 802.11 ac HT40	54	5270	15.52	15.55
	62	5310	15.73	15.75
IEEE 802.11 ac HT80	58	5290	14.34	14.39

5.8GHzWLAN – Band 2C

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)	
			Antenna 0	Antenna 1
IEEE 802.11 a	100	5500	12.92	12.49
	116	5580	12.30	12.76
	140	5700	12.26	12.55
IEEE 802.11 n HT20	100	5500	13.61	13.60
	116	5580	12.84	13.49
	140	5700	12.62	13.53
IEEE 802.11 ac HT20	100	5500	13.26	13.40
	116	5580	13.77	13.53
	140	5700	12.96	13.07
IEEE 802.11 n HT40	102	5510	13.38	13.46
	134	5670	13.55	13.57
IEEE 802.11 ac HT40	102	5510	15.37	15.85
	134	5670	15.29	15.13
IEEE 802.11 ac HT80	106	5530	11.70	11.95

5.8GHzWLAN – Band 3

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)	
			Antenna 0	Antenna 1
IEEE 802.11 a	149	5745	11.82	13.25
	157	5785	12.18	12.08
	165	5825	11.92	11.99
IEEE 802.11 n HT20	149	5745	12.12	13.18
	157	5785	12.31	13.12
	165	5825	12.71	12.44
IEEE 802.11 ac HT20	149	5745	12.63	12.21
	157	5785	11.99	12.18
	165	5825	12.06	11.83
IEEE 802.11 n HT40	151	5755	13.97	13.83
	159	5795	12.28	13.55
IEEE 802.11 ac HT40	151	5755	14.79	15.04
	159	5795	14.43	14.57
IEEE 802.11 ac HT80	155	5775	12.57	12.57

4.2 MIMO Mode

2.4GHzWLAN

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
IEEE 802.11 b	1	2412	18.96
	6	2437	19.26
	11	2462	19.08
IEEE 802.11 g	1	2412	18.16
	6	2437	17.91
	11	2462	18.35
IEEE 802.11 n HT20	1	2412	17.85
	6	2437	17.89
	11	2462	18.13
IEEE 802.11 n HT40	3	2422	17.53
	6	2437	17.45
	9	2452	17.77

5.8GHzWLAN – Band 1

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
IEEE 802.11 a	36	5180	16.22
	44	5220	16.19
	48	5240	16.16
IEEE 802.11 n HT20	36	5180	16.82
	44	5220	16.89
	48	5240	17.06
IEEE 802.11 ac HT20	36	5180	16.27
	44	5220	16.17
	48	5240	16.37
IEEE 802.11 n HT40	38	5190	18.86
	46	5230	18.56
IEEE 802.11 ac HT40	38	5190	18.18
	46	5230	18.63
IEEE 802.11 ac HT80	42	5210	17.71

5.8GHzWLAN – Band 2A

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
IEEE 802.11 a	52	5260	16.87
	60	5280	17.17
	64	5320	17.26
IEEE 802.11 n HT20	52	5260	17.40
	60	5280	17.57
	64	5320	17.51
IEEE 802.11 ac HT20	52	5260	16.19
	60	5280	17.53
	64	5320	16.24
IEEE 802.11 n HT40	54	5270	18.73
	62	5310	18.65
IEEE 802.11 ac HT40	54	5270	18.55
	62	5310	18.75
IEEE 802.11 ac HT80	58	5290	17.38

5.8GHzWLAN – Band 2C

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
IEEE 802.11 a	100	5500	15.72
	116	5580	15.55
	140	5700	15.37
IEEE 802.11 n HT20	100	5500	16.62
	116	5580	16.19
	140	5700	16.11
IEEE 802.11 ac HT20	100	5500	16.34
	116	5580	16.66
	140	5700	16.03
IEEE 802.11 n HT40	102	5510	16.43
	134	5670	16.57
IEEE 802.11 ac HT40	102	5510	18.63
	134	5670	18.22
IEEE 802.11 ac HT80	106	5530	14.84

5.8GHzWLAN – Band 3

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
IEEE 802.11 a	149	5745	15.60
	157	5785	15.14
	165	5825	14.97
IEEE 802.11 n HT20	149	5745	15.69
	157	5785	15.74
	165	5825	15.59
IEEE 802.11 ac HT20	149	5745	15.44
	157	5785	15.10
	165	5825	14.96
IEEE 802.11 n HT40	151	5755	16.91
	159	5795	15.97
IEEE 802.11 ac HT40	151	5755	17.93
	159	5795	17.51
IEEE 802.11 ac HT80	155	5775	15.58

5. Manufacturing tolerance

5.1 Standalone Mode

Bluetooth

GFSK-LE (Peak Power)			
Frequency (MHz)	2402	2440	`2480
Target (dBm)	7.0	7.0	7.0
Tolerance ±(dB)	1.0	1.0	1.0
GFSK (Peak Power)			
Frequency (MHz)	2402	2441	`2480
Target (dBm)	8.0	8.0	8.0
Tolerance ±(dB)	1.0	1.0	1.0
π/4DQPSK (Peak Power)			
Frequency (MHz)	2402	2441	`2480
Target (dBm)	9.0	9.0	9.0
Tolerance ±(dB)	1.0	1.0	1.0
8DPSK (Peak Power)			
Frequency (MHz)	2402	2441	`2480
Target (dBm)	9.0	9.0	9.0
Tolerance ±(dB)	1.0	1.0	1.0

2.4GHzWLAN

IEEE 802.11 b (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Target (dBm)	15.0	16.0	16.0	16.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 g (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Target (dBm)	15.0	15.0	15.0	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Target (dBm)	14.0	14.0	14.0	14.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	2422	2437	2452	2422	2437	2452
Target (dBm)	14.0	14.0	14.0	14.0	14.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0

5.8GHzWLAN – Band 1

IEEE 802.11 a (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5180	5220	5240	5180	5220	5240
Target (dBm)	13.0	12.0	12.0	13.0	12.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5180	5220	5240	5180	5220	5240
Target (dBm)	13.0	13.0	13.0	14.0	14.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5190	/	5230	5190	/	5230
Target (dBm)	15.0	/	15.0	15.0	/	15.0
Tolerance ±(dB)	1.0	/	1.0	1.0	/	1.0
IEEE 802.11 ac HT20 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5180	5220	5240	5180	5220	5240
Target (dBm)	13.0	13.0	13.0	13.0	13.0	13.0

Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 ac HT40 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5190	/	5230	5190	/	5230
Target (dBm)	15.0	/	15.0	15.0	/	15.0
Tolerance ±(dB)	1.0	/	1.0	1.0	/	1.0
IEEE 802.11 ac HT80 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	/	5210	/	/	5210	/
Target (dBm)	/	14.0	/	/	14.0	/
Tolerance ±(dB)	/	1.0	/	/	1.0	/

5.8GHzWLAN – Band 2A

IEEE 802.11 a (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5260	5280	5320	5260	5280	5320
Target (dBm)	14.0	14.0	14.0	13.0	13.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5260	5280	5320	5260	5280	5320
Target (dBm)	15.0	15.0	15.0	14.0	14.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5270	/	5310	5270	/	5310
Target (dBm)	15.0	/	15.0	15.0	/	15.0
Tolerance ±(dB)	1.0	/	1.0	1.0	/	1.0
IEEE 802.11 ac HT20 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5260	5280	5320	5260	5280	5320
Target (dBm)	13.0	15.0	13.0	13.0	13.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 ac HT40 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5270	/	5310	5270	/	5310
Target (dBm)	15.0	/	15.0	15.0	/	15.0
Tolerance ±(dB)	1.0	/	1.0	1.0	/	1.0
IEEE 802.11 ac HT80 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	/	5290	/	/	5290	/
Target (dBm)	/	14.0	/	/	14.0	/
Tolerance ±(dB)	/	1.0	/	/	1.0	/

5.8GHzWLAN – Band 2C

IEEE 802.11 a (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5500	5580	5700	5500	5580	5700
Target (dBm)	12.0	12.0	12.0	12.0	12.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5500	5580	5700	5500	5580	5700
Target (dBm)	13.0	13.0	13.0	13.0	13.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5510	/	5670	5510	/	5670
Target (dBm)	13.0	/	13.0	13.0	/	13.0
Tolerance ±(dB)	1.0	/	1.0	1.0	/	1.0
IEEE 802.11 ac HT20 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5500	5580	5700	5500	5580	5700
Target (dBm)	13.0	13.0	13.0	13.0	13.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 ac HT40 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5510	/	5670	5510	/	5670
Target (dBm)	15.0	/	15.0	15.0	/	15.0
Tolerance ±(dB)	1.0	/	1.0	1.0	/	1.0
IEEE 802.11 ac HT80 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	/	5530	/	/	5530	/
Target (dBm)	/	12.0	/	/	12.0	/
Tolerance ±(dB)	/	1.0	/	/	1.0	/

5.8GHzWLAN – Band 3

IEEE 802.11 a (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5745	5785	5825	5745	5785	5825
Target (dBm)	12.0	12.0	12.0	13.0	13.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5745	5785	5825	5745	5785	5825
Target (dBm)	12.0	12.0	12.0	13.0	13.0	13.0

Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5755	/	5795	5755	/	5795
Target (dBm)	13.0	/	13.0	13.0	/	13.0
Tolerance ±(dB)	1.0	/	1.0	1.0	/	1.0
IEEE 802.11 ac HT20 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5745	5785	5825	5745	5785	5825
Target (dBm)	12.0	12.0	12.0	12.0	12.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0	1.0	1.0	1.0
IEEE 802.11 ac HT40 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	5755	/	5795	5755	/	5795
Target (dBm)	15.0	/	15.0	15.0	/	15.0
Tolerance ±(dB)	1.0	/	1.0	1.0	/	1.0
IEEE 802.11 ac HT80 (Peak Power)						
Frequency (MHz)	Antenna 0			Antenna 1		
	/	5775	/	/	5775	/
Target (dBm)	/	12.0	/	/	12.0	/
Tolerance ±(dB)	/	1.0	/	/	1.0	/

5.2 MIMO Mode

2.4GHzWLAN

IEEE 802.11 b (Peak Power)			
Frequency (MHz)	2412	2437	2462
Target (dBm)	19.0	19.0	19.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 g (Peak Power)			
Frequency (MHz)	2412	2437	2462
Target (dBm)	18.0	18.0	18.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)			
Frequency (MHz)	2412	2437	2462
Target (dBm)	18.0	18.0	18.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)			
Frequency (MHz)	2422	2437	2452
Target (dBm)	17.0	17.0	17.0
Tolerance ±(dB)	1.0	1.0	1.0

5.8GHzWLAN – Band 1

IEEE 802.11 a (Peak Power)			
Frequency (MHz)	5180	5220	5240
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)			
Frequency (MHz)	5180	5220	5240
Target (dBm)	17.0	17.0	17.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)			
Frequency (MHz)	5190	/	5230
Target (dBm)	18.0	/	18.0
Tolerance ±(dB)	1.0	/	1.0
IEEE 802.11 ac HT20 (Peak Power)			
Frequency (MHz)	5180	5220	5240
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 ac HT40 (Peak Power)			
Frequency (MHz)	5190	/	5230
Target (dBm)	18.0	/	18.0
Tolerance ±(dB)	1.0	/	1.0
IEEE 802.11 ac HT80 (Peak Power)			
Frequency (MHz)	/	5210	/
Target (dBm)	/	17.0	/
Tolerance ±(dB)	/	1.0	/

5.8GHzWLAN – Band 2A

IEEE 802.11 a (Peak Power)			
Frequency (MHz)	5260	5280	5320
Target (dBm)	17.0	17.0	17.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)			
Frequency (MHz)	5260	5280	5320
Target (dBm)	17.0	17.0	17.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)			
Frequency (MHz)	5270	/	5310
Target (dBm)	18.0	/	18.0
Tolerance ±(dB)	1.0	/	1.0
IEEE 802.11 ac HT20 (Peak Power)			
Frequency (MHz)	5260	5280	5320
Target (dBm)	17.0	17.0	17.0

Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 ac HT40 (Peak Power)			
Frequency (MHz)	5270	/	5310
Target (dBm)	18.0	/	18.0
Tolerance ±(dB)	1.0	/	1.0
IEEE 802.11 ac HT80 (Peak Power)			
Frequency (MHz)	/	5290	/
Target (dBm)	/	17.0	/
Tolerance ±(dB)	/	1.0	/

5.8GHzWLAN – Band 2C

IEEE 802.11 a (Peak Power)			
Frequency (MHz)	5500	5580	5700
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)			
Frequency (MHz)	5500	5580	5700
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)			
Frequency (MHz)	5510	/	5670
Target (dBm)	16.0	/	16.0
Tolerance ±(dB)	1.0	/	1.0
IEEE 802.11 ac HT20 (Peak Power)			
Frequency (MHz)	5500	5580	5700
Target (dBm)	16.0	16.0	16.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 ac HT40 (Peak Power)			
Frequency (MHz)	5510	/	5670
Target (dBm)	18.0	/	18.0
Tolerance ±(dB)	1.0	/	1.0
IEEE 802.11 ac HT80 (Peak Power)			
Frequency (MHz)	/	5530	/
Target (dBm)	/	15.0	/
Tolerance ±(dB)	/	1.0	/

5.8GHzWLAN – Band 3

IEEE 802.11 a (Peak Power)			
Frequency (MHz)	5745	5785	5825
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT20 (Peak Power)			
Frequency (MHz)	5745	5785	5825

Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 n HT40 (Peak Power)			
Frequency (MHz)	5755	/	5795
Target (dBm)	16.0	/	16.0
Tolerance ±(dB)	1.0	/	1.0
IEEE 802.11 ac HT20 (Peak Power)			
Frequency (MHz)	5745	5785	5825
Target (dBm)	15.0	15.0	15.0
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11 ac HT40 (Peak Power)			
Frequency (MHz)	5755	/	5795
Target (dBm)	17.0	/	17.0
Tolerance ±(dB)	1.0	/	1.0
IEEE 802.11 ac HT80 (Peak Power)			
Frequency (MHz)	/	5775	/
Target (dBm)	/	15.0	/
Tolerance ±(dB)	/	1.0	/

6. Antenna Information

The EUT use antennas list as follow table

Mode	**Antenna Type**		**Maximum Antenna Gain**	
Bluetooth	PCB Antenna		5.1dBi	
2.4GWLAN	Antenna 0	Antenna 1	Antenna 0	Antenna 1
	PCB Antenna	PCB Antenna	3.5dBi	5.4dBi
5.8GWLAN Band 1	Antenna 0	Antenna 1	Antenna 0	Antenna 1
	PCB Antenna	PCB Antenna	6.3dBi	3.4dBi
5.8GWLAN Band 2A	Antenna 0	Antenna 1	Antenna 0	Antenna 1
	PCB Antenna	PCB Antenna	6.4dBi	3.2dBi
5.8GWLAN Band 2C	Antenna 0	Antenna 1	Antenna 0	Antenna 1
	PCB Antenna	PCB Antenna	5.3dBi	3.3dBi
5.8GWLAN Band 3	Antenna 0	Antenna 1	Antenna 0	Antenna 1
	PCB Antenna	PCB Antenna	3.7dBi	3.7dBi

7. Measurement Results

7.1 Standalone MPE

Bluetooth

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
Bluetooth*	10.0	10.0000	5.1	3.2359	0.0064	1.0000

Bluetooth* - Including Lower power Bluetooth (BLE) and Typical Bluetooth
Output Power* - Output power including turn power tolerance declared by manufacture.

2.4GHzWLAN

Antenna 0

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
WLAN*	17.0	50.1187	3.5	2.2387	0.0223	1.0000

Antenna 1

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
WLAN*	17.0	50.1187	5.4	3.4674	0.0346	1.0000

WLAN* - Including IEEE 802.11b, IEEE 802.11g, IEEE 802.11n HT20 and IEEE 802.11n HT40;
Output Power* - Output power including turn power tolerance declared by manufacture.

5.8GHzWLAN - Band 1

Antenna 0

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
WLAN*	16.0	39.8107	6.3	4.2658	0.0338	1.0000

Antenna 1

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
WLAN*	16.0	39.8107	3.4	2.1878	0.0173	1.0000

5.8GHzWLAN - Band 2A

Antenna 0

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
WLAN*	16.0	39.8107	6.4	4.3652	0.0346	1.0000

Antenna 1

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)

WLAN*	16.0	39.8107	3.2	2.0893	0.0166	1.0000

5.8GHzWLAN - Band 2C

Antenna 0

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
WLAN*	16.0	39.8107	5.3	3.3884	0.0269	1.0000

Antenna 1

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
WLAN*	16.0	39.8107	3.3	2.1380	0.0169	1.0000

5.8GHzWLAN - Band 3

Antenna 0

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
WLAN*	16.0	39.8107	3.7	2.3342	0.0186	1.0000

Antenna 1

Mode	Output Power* (dBm)	Output Power* (mW)	Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	Limit (mW/cm^2)
WLAN*	16.0	39.8107	3.7	2.3342	0.0186	1.0000

WLAN* - Including IEEE 802.11a, IEEE 802.11ac HT20, IEEE 802.11ac HT40, IEEE 802.11ac HT80, IEEE 802.11n HT20 and IEEE 802.11n HT40;
Output Power* - Output power including turn power tolerance declared by manufacture.

7.2 Simultaneous MPE

As the sample with more than one antenna, they can simultaneous transmitter; please refer to Operation Description for all antennas simultaneous transmit; we need consider simultaneous MPE according to KDB 447498;

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

$\sum$ of MPE ratios ≤ 1.0

Bluetooth and WLAN* Simultaneous MPE

Maximum Bluetooth* MPE Ratio	Maximum Sum WLAN* MPE Ratio at Antenna 0 and Antenna 1	Sum MPE Ratios	Limit	Results
0.0064	0.0569	0.0633	1.0	PASS

Bluetooth*MPE - Bluetooth including Lower Power Bluetooth (BLE) and Typical Bluetooth MPE

Sum WLAN*MPE – Including 2.4GHzWLAN, 5.8GHzWLAN summary MPE ratio;

8. Conclusion

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