FCC RF Exposure

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Portable Device

Refer Standard: KDB 447498 D01 General RF Exposure Guidance v06

FCC Part 2 §2.1093

Evaluation method

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 "
[(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 5) in section 4.1 is applied to determine SAR test exclusion.

Conducted Power Results:

2.4GHz WLAN IEEE 802.11b						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Peak Conducted Power (dBm)	8.48	8.10	8.24	8.31	8.06	8.12
2.4GHz WLAN IEEE 802.11g						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Peak Conducted Power (dBm)	7.56	7.42	7.81	7.58	7.39	7.19
2.4GHz WLAN IEEE 802.11n20						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Peak Conducted Power (dBm)	5.42	5.39	5.31	5.38	5.41	5.29
2.4GHz WLAN IEEE 802.11n40						
Frequency (MHz)	Antenna 0			Antenna 1		
	2422	2437	2452	2422	2437	2452
Peak Conducted Power (dBm)	5.37	5.34	5.36	5.33	5.24	5.40

5GHz WLAN IEEE 802.11a						
Frequency (MHz)	Antenna 0			Antenna 1		
	5745	5785	5825	5745	5785	5825
Peak Conducted Power (dBm)	3.46	3.39	3.41	3.42	3.40	3.38
5GHz WLAN IEEE 802.11n HT20						
Frequency (MHz)	Antenna 0			Antenna 1		
	5745	5785	5825	5745	5785	5825
Peak Conducted Power (dBm)	3.02	3.05	3.12	3.11	3.02	3.06
5GHz WLAN IEEE 802.11n HT40						
Frequency (MHz)	Antenna 0			Antenna 1		
	5755	/	5795	5755	/	5795
Peak Conducted Power (dBm)	3.07	/	3.01	3.02	/	3.04

Manufacturing tolerance:

2.4GHz WLAN IEEE 802.11b						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Target (dBm)	8.0	8.0	8.0	8.0	8.0	8.0
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
2.4GHz WLAN IEEE 802.11g						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Target (dBm)	7.0	7.0	7.0	7.0	7.0	7.0
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
2.4GHz WLAN IEEE 802.11n20						
Frequency (MHz)	Antenna 0			Antenna 1		
	2412	2437	2462	2412	2437	2462
Target (dBm)	5.5	5.5	5.5	5.5	5.5	5.5
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
2.4GHz WLAN IEEE 802.11n40						
Frequency (MHz)	Antenna 0			Antenna 1		
	2422	2437	2452	2422	2437	2452
Target (dBm)	5.5	5.5	5.5	5.5	5.5	5.5
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0

5GHz WLAN IEEE 802.11a						
Frequency (MHz)	Antenna 0			Antenna 1		
	5745	5785	5825	5745	5785	5825
Target (dBm)	3.5	3.5	3.5	3.5	3.5	3.5
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
5GHz WLAN IEEE 802.11n HT20						
Frequency (MHz)	Antenna 0			Antenna 1		
	5745	5785	5825	5745	5785	5825
Target (dBm)	3.0	3.0	3.0	3.0	3.0	3.0
Tolerance ± (dB)	1.0	1.0	1.0	1.0	1.0	1.0
5GHz WLAN IEEE 802.11n HT40						
Frequency (MHz)	Antenna 0			Antenna 1		
	5755	/	5795	5755	/	5795
Target (dBm)	3.0	/	3.0	3.0	/	3.0
Tolerance ± (dB)	1.0	/	1.0	1.0	/	1.0

Evaluation Results

Standalone MPE：

2.4GHz WLAN

Antenna 0

Band/Mode	f (MHz)	Antenna Distance (mm)	RF output power (including tune-up tolerance)		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
802.11b	2412	5	9	7.9433	2.4673<3.0	Yes
	2437	5	9	7.9433	2.4800<3.0	Yes
	2462	5	9	7.9433	2.4927<3.0	Yes
802.11g	2412	5	8	6.3096	1.9599<3.0	Yes
	2437	5	8	6.3096	1.9700 <3.0	Yes
	2462	5	8	6.3096	1.9800 <3.0	Yes
802.11n(HT20)	2412	5	6.5	5.0119	1.5568 <3.0	Yes
	2437	5	6.5	5.0119	1.5648 <3.0	Yes
	2462	5	6.5	5.0119	1.5728 <3.0	Yes
802.11n(HT40)	2422	5	6.5	5.0119	1.5600 <3.0	Yes
	2437	5	6.5	5.0119	1.5648 <3.0	Yes
	2452	5	6.5	5.0119	1.5696 <3.0	Yes

Antenna 1

Band/Mode	f (MHz)	Antenna Distance (mm)	RF output power (including tune-up tolerance)		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
802.11b	2412	5	9	7.9433	2.4673<3.0	Yes
	2437	5	9	7.9433	2.4800<3.0	Yes
	2462	5	9	7.9433	2.4927<3.0	Yes
802.11g	2412	5	8	6.3096	1.9599<3.0	Yes
	2437	5	8	6.3096	1.9700 <3.0	Yes
	2462	5	8	6.3096	1.9800 <3.0	Yes
802.11n(HT20)	2412	5	6.5	5.0119	1.5568 <3.0	Yes
	2437	5	6.5	5.0119	1.5648 <3.0	Yes
	2462	5	6.5	5.0119	1.5728 <3.0	Yes
802.11n(HT40)	2422	5	6.5	5.0119	1.5600 <3.0	Yes
	2437	5	6.5	5.0119	1.5648 <3.0	Yes
	2452	5	6.5	5.0119	1.5696 <3.0	Yes

5GHz WLAN

Antenna 0

Band/Mode	f (MHz)	Antenna Distance (mm)	RF output power (including tune-up tolerance)		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
802.11a	5745	5	4.5	2.8184	1.3511<3.0	Yes
	5785	5	4.5	2.8184	1.3558<3.0	Yes
	5825	5	4.5	2.8184	1.3604<3.0	Yes
802.11n(HT20)	5745	5	4.0	2.5119	1.2041<3.0	Yes
	5785	5	4.0	2.5119	1.2083 <3.0	Yes
	5825	5	4.0	2.5119	1.2125 <3.0	Yes
802.11n(HT40)	5755	5	4.0	2.5119	1.2052 <3.0	Yes
	/	/	/	/	/	/
	5795	5	4.0	2.5119	1.2094 <3.0	Yes

Antenna 1

Band/Mode	f (MHz)	Antenna Distance (mm)	RF output power (including tune-up tolerance)		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
802.11a	5745	5	4.5	2.8184	1.3511<3.0	Yes
	5785	5	4.5	2.8184	1.3558<3.0	Yes
	5825	5	4.5	2.8184	1.3604<3.0	Yes
802.11n(HT20)	5745	5	4.0	2.5119	1.2041<3.0	Yes
	5785	5	4.0	2.5119	1.2083 <3.0	Yes
	5825	5	4.0	2.5119	1.2125 <3.0	Yes
802.11n(HT40)	5755	5	4.0	2.5119	1.2052 <3.0	Yes
	/	/	/	/	/	/
	5795	5	4.0	2.5119	1.2094 <3.0	Yes

Simultaneous Transmission MPE:

Summary simultaneous transmission information:

Modulation Type	Work Frequency Band	Transmit Antenna		Antenna 0 Antenna 1 Synchronization transmit	Antenna 0 Antenna 1 Synchronization transmit
		Antenna 0	Antenna 1		
IEEE 802.11a	5.8GHz	Yes	Yes	No	Yes
IEEE 802.11b	2.4GHz	Yes	Yes	No	
IEEE 802.11g	2.4GHz	Yes	Yes	No	
IEEE 802.11n HT20	2.4GHz	Yes	Yes	Yes	
IEEE 802.11n HT20	5.8GHz	Yes	Yes	Yes	
IEEE 802.11n HT40	2.4GHz	Yes	Yes	Yes	
IEEE 802.11n HT40	5.8GHz	Yes	Yes	Yes	

Summary simultaneous transmission results:

Antenna 0, Antenna 1 for 2.4GWLAN

Band/Mode	f (MHz)	Antenna Distance (mm)	RF output power (including tune-up tolerance)			SAR Test Exclusion Threshold	SAR Test Exclusion
			Antenna 0 (dBm)	Antenna 0 (dBm)	Sum (mW)		
802.11b	2412	5	9	9	/	/	/
	2437	5	9	9	/	/	/
	2462	5	9	9	/	/	/
802.11g	2412	5	8	8	/	/	/
	2437	5	8	8	/	/	/
	2462	5	8	8	/	/	/
802.11n(HT20)	2412	5	6.5	6.5	8.9337	2.7749 <3.0	Yes
	2437	5	6.5	6.5	8.9337	2.7893 <3.0	Yes
	2462	5	6.5	6.5	8.9337	2.8035 <3.0	Yes
802.11n(HT40)	2422	5	6.5	6.5	8.9337	2.7807 <3.0	Yes
	2437	5	6.5	6.5	8.9337	2.7893 <3.0	Yes
	2452	5	6.5	6.5	8.9337	2.7978 <3.0	Yes

Antenna 0 and Antenna 1 for 5GWLAN

Band/Mode	f (MHz)	Antenna Distance (mm)	RF output power (including tune-up tolerance)			SAR Test Exclusion Threshold	SAR Test Exclusion
			Antenna 0 (dBm)	Antenna 0 (dBm)	Sum (mW)		
802.11a	5745	5	4.5	4.5	/	/	/
	5785	5	4.5	4.5	/	/	/
	5825	5	4.5	4.5	/	/	/
802.11n(HT20)	5745	5	4.0	4.0	5.0238	2.4083<3.0	Yes
	5785	5	4.0	4.0	5.0238	2.4167 <3.0	Yes
	5825	5	4.0	4.0	5.0238	2.4250<3.0	Yes
802.11n(HT40)	5755	5	4.0	4.0	5.0238	2.4104 <3.0	Yes
	/	/	/	/	/	/	/
	5795	5	4.0	4.0	5.0238	2.4187 <3.0	Yes

Note: 2.4GHz WLAN and 5GHz WLAN can not transmit simultaneously they share the same aentennas.

Conclusion

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

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