

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

KDB 616217 D04 SAR for laptop and tablets

FCC Part 2 §2.1093

1. 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."

a) For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

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

- 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.

b) For 100 MHz to 6 GHz and test separation distances > 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following (also illustrated in Appendix B):

- 1) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot (f(\text{MHz})/150)]\}$ mW, for 100 MHz to 1500 MHz
- 2) $\{[\text{Power allowed at numeric threshold for 50 mm in step a)}] + [(\text{test separation distance} - 50 \text{ mm}) \cdot 10]\}$ mW, for > 1500 MHz and ≤ 6 GHz

Per KDB 616217 D04 SAR for laptop and tablets Section 4.2. Laptop host platform test requirements: "The

required minimum test separation distance for incorporating transmitters and antennas into laptop, notebook and netbook computer displays is determined with the display screen opened at an angle of 90degrees to the keyboard compartment.”

2. Conducted Power

Mode	Channel	Frequency (MHz)	Conducted Average Output Power (dBm)
GFSK-BLE	1	2402	-6.46
	20	2440	-6.51
	40	2480	-6.64
IEEE 802.11b	1	2412	15.26
	6	2437	15.13
	11	2462	15.27
IEEE 802.11g	1	2412	13.37
	6	2437	13.29
	11	2462	13.52
IEEE 802.11n HT20	1	2412	13.18
	6	2437	13.49
	11	2462	13.46
IEEE 802.11n HT40	3	2422	13.56
	6	2437	12.97
	9	2452	13.28

3. Manufacturing tolerance

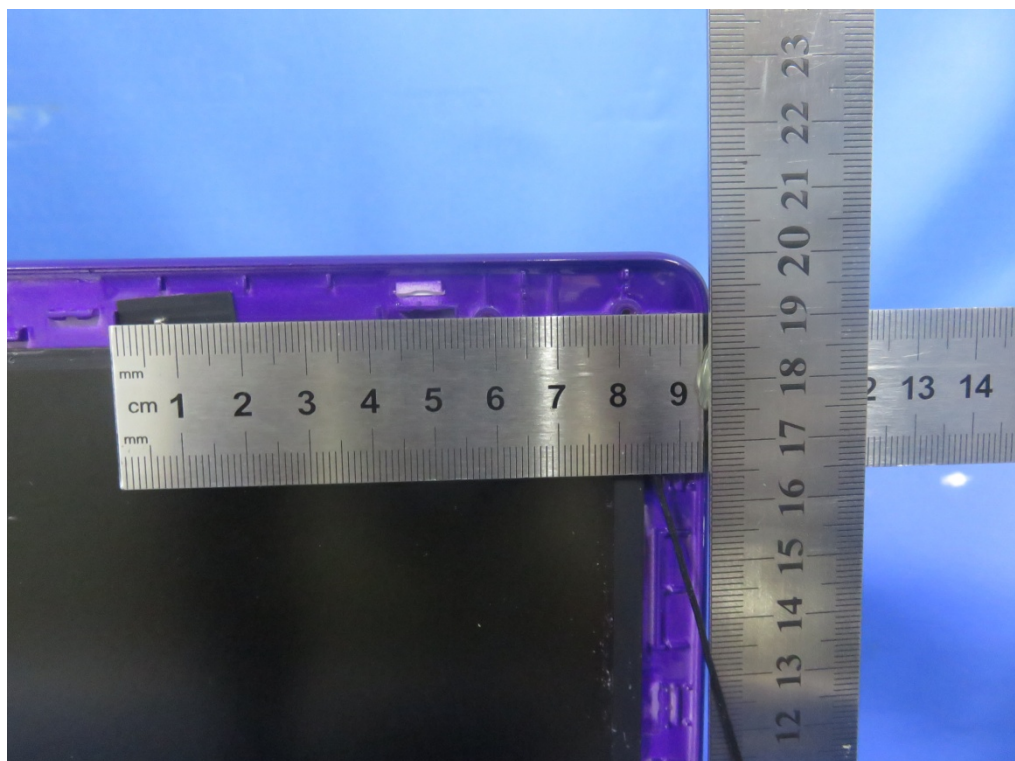
BLE-GFSK (Average)			
Frequency (MHz)	2402	2440	2480
Target (dBm)	-6.0	-6.0	-6.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11b (Average)			
Frequency (MHz)	2412	2437	2462
Target (dBm)	15.0	15.0	15.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11g (Average)			
Frequency (MHz)	2412	2437	2462
Target (dBm)	13.0	13.0	13.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Frequency (MHz)	2412	2437	2462
Target (dBm)	13.0	13.0	13.0
Tolerance \pm (dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Frequency (MHz)	2422	2437	2452
Target (dBm)	13.0	13.0	13.0
Tolerance \pm (dB)	1.0	1.0	1.0

4. Antenna Position

The overview of Antenna position



The Zoom picture of antenna distance



The distance is 190mm of antenna to keyboard

5. Evaluation Results

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
BT*	2.450	190	-5.0	0.32	1496.15 mW	Yes
IEEE 802.11b	2.450	190	16.0	39.81	1496.15 mW	Yes
IEEE 802.11g	2.450	190	14.0	25.12	1496.15 mW	Yes
IEEE 802.11n HT20	2.450	190	14.0	25.12	1496.15 mW	Yes
IEEE 802.11n HT40	2.450	190	14.0	25.12	1496.15 mW	Yes

Remark:

1. BT* - including Classics Bluetooth and Lower Energy Bluetooth
2. Maximum average power including tune-up tolerance
3. Per KDB 616217 D04 SAR for laptop and tablets Section 4.2. Laptop host platform test requirements:
"The required minimum test separation distance for incorporating transmitters and antennas into laptop, notebook and netbook computer displays is determined with the display screen opened at an angle of 90degrees to the keyboard compartment."

6. 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 D01.

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