

RADIO FREQUENCY EXPOSURE

Limit

According to section 4.3.1 of KDB 447498 D01 General RF Exposure Guidance v06, SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Appendix A.

Appendix A

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

MHz	30	35	40	45	50	mm
150	232	271	310	349	387	SAR Test Exclusion Threshold (mW)
300	164	192	219	246	274	
450	134	157	179	201	224	
835	98	115	131	148	164	
900	95	111	126	142	158	
1500	73	86	98	110	122	
1900	65	76	87	98	109	
2450	57	67	77	86	96	
3600	47	55	63	71	79	
5200	39	46	53	59	66	
5400	39	45	52	58	65	
5800	37	44	50	56	62	

Note: Manufacturer declared that the maximum antenna gain is 0.0dBi (Max.).

Conducted Power

Bluetooth(BDR+EDR)

Mode	Channel.	Maximum Peak Output Power [dBm]	Limit [dBm]	Verdict
GFSK	2402	3.00	21	PASS
GFSK	2441	3.77	21	PASS
GFSK	2480	3.91	21	PASS
$\pi/4$ DQPSK	2402	2.64	21	PASS
$\pi/4$ DQPSK	2441	3.47	21	PASS
$\pi/4$ DQPSK	2480	3.64	21	PASS
8DPSK	2402	2.76	21	PASS
8DPSK	2441	3.56	21	PASS
8DPSK	2480	3.70	21	PASS

Bluetooth(BLE)

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Ant1	2402	2.58	<=30	PASS
		2440	3.36	<=30	PASS
		2480	3.54	<=30	PASS

WiFi 2.4GHz Band

TestMode	Antenna	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	Ant1	2412	9.07	<=30	PASS
		2437	9.28	<=30	PASS
		2462	9.25	<=30	PASS
11G	Ant1	2412	8.24	<=30	PASS
		2437	8.53	<=30	PASS
		2462	8.80	<=30	PASS
11N20SISO	Ant1	2412	9.26	<=30	PASS
		2437	8.64	<=30	PASS
		2462	8.90	<=30	PASS
11N40SISO	Ant1	2422	8.56	<=30	PASS
		2437	8.59	<=30	PASS
		2452	8.83	<=30	PASS

Manufacturing Tolerance

Bluetooth(BDR+EDR)

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	2.5	3.5	3.5
Tolerance ±(dB)	1.0	1.0	1.0
π/4-DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	2.5	3.0	3.5
Tolerance ±(dB)	1.0	1.0	1.0
8-DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	2.5	3.5	3.5
Tolerance ±(dB)	1.0	1.0	1.0

Bluetooth(BLE)

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	2.0	3.0	3.0
Tolerance ±(dB)	1.0	1.0	1.0

WiFi 2.4GHz Band

IEEE 802.11b (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	8.5	8.5	8.5
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11g (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	8.5	8.5	8.5
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT20 (Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	8.5	8.5	8.5
Tolerance ±(dB)	1.0	1.0	1.0
IEEE 802.11n HT40 (Average)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	8.5	8.5	8.5
Tolerance ±(dB)	1.0	1.0	1.0

Results

Bluetooth(BDR+EDR)

Modulation Type	Max. Tune Up Power (dBm, Peak)	Antenna Gain (dBi)	Max. Eirp including Tune Up (dBm, Peak)	Max. Eirp including Tune Up (mW, Peak)	Exemption Limit (mW)
GFSK	4.50	0.00	-1.50	2.8184	10
π/4-DQPSK	4.50	0.00	-1.50	2.8184	10
8-DPSK	4.50	0.00	-1.50	2.8184	10

Bluetooth(BLE)

Modulation Type	Max. Tune Up Power (dBm, Peak)	Antenna Gain (dBi)	Max. Eirp including Tune Up (dBm, Peak)	Max. Eirp including Tune Up (mW, Peak)	Exemption Limit (mW)
GFSK	4.00	0.00	-1.50	2.5119	10

WiFi 2.4GHz Band – Ant 1

Modulation Type	Max. Tune Up Power (dBm, Average)	Antenna Gain (dBi)	Max. Eirp including Tune Up (dBm, Average)	Max. Eirp including Tune Up (mW, Average)	Exemption Limit (mW)
IEEE 802.11b	9.50	0.00	9.50	8.9125	10
IEEE 802.11g	9.50	0.00	9.50	8.9125	10
IEEE 802.11n HT20	9.50	0.00	9.50	8.9125	10
IEEE 802.11n HT40	9.50	0.00	9.50	8.9125	10

the Maximum Eirp is used for Routine Evaluation Exemption according to section 4.3.1 of KDB 447498 D01.

So, the SAR evaluation is not required.

Simultaneous Transmission for SAR Exclusion

The sample support one BT modular and one WLAN modular, they supports difference antenna, need consider simultaneous transmission;

$$\sum \text{of (the highest estimated SAR}_{BT} + \text{SAR}_{WLAN}) / 1.6 = (0.12 + 0.37) / 1.6 = 0.3 < 1.0;$$

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 v06.

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