

5 FCC §2.1093, §15.247(i) & ISEDC RSS-102 – RF Exposure

5.1 Applicable Standards

According to FCC KDB 447498 D01 General RF Exposure Guidance v05r02 Section 4.3.1, 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.

- 1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

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

- $f(\text{GHz})$ 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.

- 2) At 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B:

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

- 3) At frequencies below 100 MHz, the following may be considered for SAR test exclusion, and as illustrated in Appendix C:

- a) The power threshold at the corresponding test separation distance at 100 MHz in step 2) is multiplied by $[1 + \log(100/f(\text{MHz}))]$ for test separation distances > 50 mm and < 200 mm
- b) The power threshold determined by the equation in a) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$ for test separation distances ≤ 50 mm
- c) SAR measurement procedures are not established below 100 MHz. When SAR test exclusion cannot be applied, a KDB inquiry is required to determine SAR evaluation requirements for any test results to be acceptable.

According to IC RSS-102 Issue 5 §2.5.1,

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 Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤ 5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤ 300	71	101	132	162	193
450	52	70	88	106	123
835	17	30	42	55	67
1900	7	10	18	34	60
2450	4	7	15	30	52
3500	2	6	16	32	55
5800	1	6	15	27	41

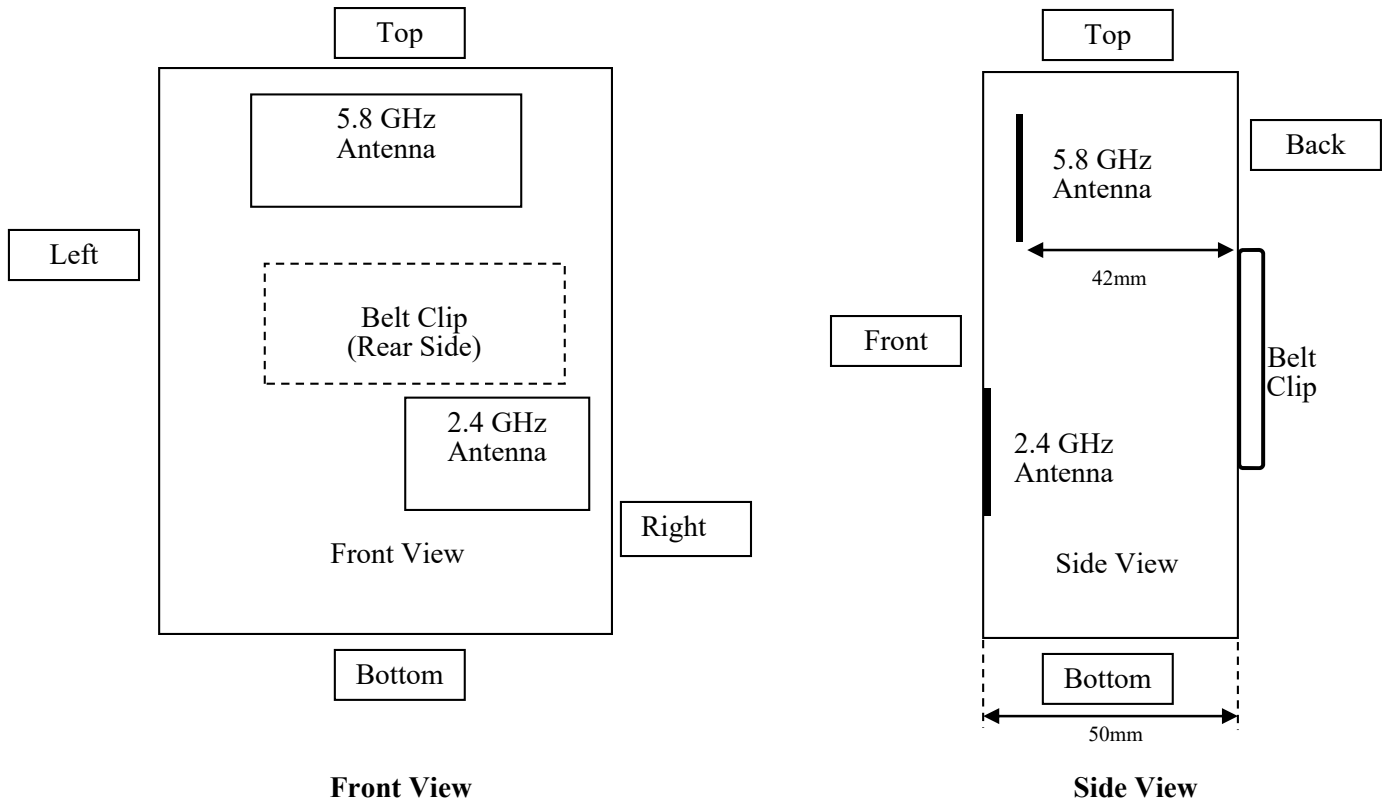
Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥ 50 mm
≤ 300	223	254	284	315	345
450	141	159	177	195	213
835	80	92	105	117	130
1900	99	153	225	316	431
2450	83	123	173	235	309
3500	86	124	170	225	290
5800	56	71	85	97	106

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required. For medical implants devices, the exemption limit for routine evaluation is set at 1 mW.

The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

5.2 EUT Dimension and Antenna Location

EUT Mechanical Configuration



Note 1: the diagram above is only to show antenna location, and it doesn't represent the shape of the host device or the antenna. Please refer to the EUT photos exhibit for detailed information.

Body-Worn:

The device has a belt clip on the back of the enclosure, which enables body-worn operation. The belt clip is a permanent part of the enclosure. Therefore, only rear side of the EUT will be in close proximity with human body. Please refer to the EUT setup photographs for details.

5.3 FCC and IC SAR Exclusion Consideration

5.8 GHz DTS

Channel	Frequency (MHz)	Measured Conducted Output Power		Distance (mm)	Calculated Value	FCC 1-g SAR Threshold	SAR Exclusion (Yes/No)
		dBm	mW				
Low	5734.375	11.52	14.19	42	0.809	3	Yes
Middle	5780.077	11.08	12.82	42	0.734	3	Yes
High	5841.013	11.23	13.27	42	0.764	3	Yes

Channel	Frequency (MHz)	Measured Conducted Output Power		Max. Antenna Gain (dBi)	Max. e.i.r.p (mW)	Distance (mm)	IC 1-g SAR Limit * (mW)	SAR Exclusion (Yes/No)
		dBm	mW					
Low	5734.375	11.52	14.19	7.1	72.778	42	87.43	Yes
Middle	5780.077	11.08	12.82	7.1	65.766	42	85.74	Yes
High	5841.013	11.23	13.27	7.1	68.077	42	83.48	Yes

*40 mm distance and linear interpolation was applied for finding the exemption limit for the channel frequencies list above. The following equation was used to determine the exemption power level p_c at channel frequency f_c .

$$(f_1 - f_2) / (f_c - f_2) = (p_1 - p_2) / (p_c - p_2)$$

2.4 GHz Wi-Fi

Measured Average Power:

	Channel	Frequency (MHz)	Measured Average Power (dBm)	Antenna Gain (dBi)	EIRP (dBm)
802.11b	Low	2412	17.76	2.6	20.36
	Middle	2437	17.48	2.6	20.08
	High	2462	17.69	2.6	20.29
802.11g	Low	2412	16.40	2.6	19
	Middle	2437	16.75	2.6	19.35
	High	2462	16.39	2.6	18.99

SAR Exemption Evaluation:

Channel	Frequency (MHz)	Measured Average Conducted Output Power		Distance (mm)	Calculated Value	FCC 1-g SAR Threshold	SAR Exclusion (Yes/No)
		dBm	mW				
Low	2412	17.76	59.70	50	1.85	3	Yes
Middle	2437	17.48	55.98	50	1.75	3	Yes
High	2462	17.69	58.75	50	1.84	3	Yes

Channel	Frequency (MHz)	Max. e.i.r.p. (dBm)	Max. e.i.r.p (mW)	Distance (mm)	IC 1-g SAR Limit * (mW)	SAR Exclusion (Yes/No)
Low	2412	20.36	108.64	50	309	Yes
Middle	2437	20.08	101.86	50	309	Yes
High	2462	20.29	106.91	50	309	Yes

*Threshold level at 2450 MHz was used.

5.4 Simultaneous Transmission SAR Exclusion Consideration

	Channel Frequency (MHz)	Measured Average Power (dBm)	Separation Distance (mm)	Estimated 1-g SAR (W/kg)
5.8 GHz DTS	5734.375	11.52	42	0.11
2.4 GHz Wi-Fi	2412	17.76	50	0.25

Estimated 1-g SAR value was calculated based on the following equation from FCC KDB 447498 D01 v06.

$$[(\text{max. Power of channel, including tune-up tolerance, mW}) / (\text{min. Test separation distance, mm})] [\sqrt{f_{(\text{GHz})}} / x] \text{ W/kg, } x = 7.5$$

$\text{SAR}_{5.8 \text{ GHz DTS}} + \text{SAR}_{2.4 \text{ GHz Wi-Fi}} = 0.11 + 0.25 = 0.36 \text{ W/kg} < 1.6$. Therefore, simultaneous transmission SAR is exempt.