

1. RF exposure evaluation

1.1 RF Exposure Compliance Requirement

1.1.1 Standard Requirement

According to KDB447498D01 General RF Exposure Guidance v06

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 Exclusion Threshold condition, listed below, is satisfied.

1.1.2 Limits

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:

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

Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

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 is applied to determine SAR test exclusion

When an antenna qualifies for the standalone SAR test exclusion of 4.3.1 and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:36

1)
$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})/x}] \text{ W/kg, for test separation distances } \leq 50 \text{ mm;}$$

where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

The SAR exclusion table from RSS-102 issue 5 is reproduced below:

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 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

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 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
<u>2450</u>	83 mW	123 mW	<u>173 mW</u>	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

EUT RF Exposure

Operation mode: BDR

The Max Conducted Output Power is 17.77dBm in Highest channel(2.441 GHz)

Target power & Tolerance

Target power: 16.80 dBm Tolerance: ± 1.00 dBm

17.80dBm logarithmic terms convert to numeric result is nearly 60.26 mW
According to the formula. calculate the Peak Output Power test result:

$$\text{General RF Exposure} = (60.26 \text{ mW} / 40 \text{ mm}) \times \sqrt{2.480 \text{ GHz}} = 2.37$$

So the SAR report is not required.

※ Remark

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}]$

Operation mode: EDR

The Max Conducted Output Power is 10.62dBm in Highest channel(2.441 GHz)

Target power & Tolerance

Target power: 10.00 dBm Tolerance: ± 1.00 dBm

11.00dBm logarithmic terms convert to numeric result is nearly 12.59 mW
According to the formula. calculate the Peak Output Power test result:

$$\text{General RF Exposure} = (12.59 \text{ mW} / 40 \text{ mm}) \times \sqrt{2.480 \text{ GHz}} = 0.50$$

So the SAR report is not required.

※ Remark

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}]$

Operation mode: BLE

The Max Conducted Output Power is 6.75dBm in Highest channel(2.440 GHz)

Target power & Tolerance

Target power:6.00 dBm Tolerance: ± 1.00 dBm

7.00dBm logarithmic terms convert to numeric result is nearly 5.01 mW
According to the formula. calculate the Peak Output Power test result:

$$\text{General RF Exposure} = (5.01 \text{ mW} / 40 \text{ mm}) \times \sqrt{2.480 \text{ GHz}} = 0.20$$

So the SAR report is not required.

※ Remark

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}]$

Operation mode: ZIGBEE

The Max Conducted Output Power is 17.11dBm in Highest channel(2.410 GHz)

Target power & Tolerance

Target power:16.50 dBm Tolerance: ± 1.00 dBm

17.50dBm logarithmic terms convert to numeric result is nearly 56.23 mW
According to the formula. calculate the Peak Output Power test result:

$$\text{General RF Exposure} = (56.23 \text{ mW} / 40 \text{ mm}) \times \sqrt{2.480 \text{ GHz}} = 2.21$$

So the SAR report is not required.

※ Remark

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}]$

Mode	dBm	mW	mm	Freq(GHz)	Result
BDR	17.80	60.26	40	2.48	2.37
EDR	11.00	12.59	40	2.48	0.50
BLE	7.00	5.01	40	2.48	0.20
ZIGBEE	17.50	56.23	40	2.48	2.21
Total	BDR+BLE+ZIGBEE (Worst Case)				4.79