

§1.1310 & §2.1093 – RF EXPOSURE

Applicable Standard

According to §2.1093 and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

According to KDB447498 D01 General RF Exposure Guidance v06:

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:

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

· $f(\text{GHz})$ 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

· When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Standalone SAR test exclusion

Mode	Frequency Range (MHz)	Conducted Output Power			Minimum Distance (mm)	Calculated Value	Threshold (1-g)	SAR Test Exclusion
		ANT0 (dBm)	ANT1 (dBm)	ANT0+ANT1 (dBm)				
Bluetooth	2402-2480	-1.00	/	/	5.00	0.3	3.00	Yes
BLE	2402-2480	-1.00	/	/	5.00	0.3	3.00	Yes
802.11b	2412~2462	8.50	8.00	/	5.00	2.2	3.00	Yes
802.11g	2412~2462	8.00	7.50	/	5.00	2.0	3.00	Yes
802.11n20	2412~2462	6.00	5.00	8.00	5.00	2.0	3.00	Yes
802.11n40	2422~2452	5.00	4.50	8.00	5.00	2.0	3.00	Yes
802.11a	5180~5240	7.50	7.00	/	5.00	2.6	3.00	Yes
	5745~5825	7.50	7.00	/	5.00	2.7	3.00	Yes
802.11n20	5180~5240	5.00	4.00	7.50	5.00	2.6	3.00	Yes
	5745~5825	4.50	4.00	7.00	5.00	2.4	3.00	Yes
802.11n40	5190~5230	4.50	4.00	7.00	5.00	2.3	3.00	Yes
	5755~5795	5.00	4.00	7.50	5.00	2.7	3.00	Yes
802.11ac20	5180~5240	5.00	4.00	7.50	5.00	2.6	3.00	Yes
	5745~5825	5.00	4.00	7.50	5.00	2.7	3.00	Yes
802.11ac40	5180~5240	5.00	4.00	7.50	5.00	2.6	3.00	Yes
	5755~5795	5.00	4.00	7.50	5.00	2.7	3.00	Yes
802.11ac80	5210	4.50	3.50	7.00	5.00	2.3	3.00	Yes
	5775	5.00	4.00	7.50	5.00	2.7	3.00	Yes

Standalone SAR estimation:

Mode	Frequency Range (MHz)	Max tune-up power				Distance (mm)	Estimated _{1-g} (W/kg)	
		(dBm)		(mW)			ANT 0	ANT 1
		ANT 0	ANT 1	ANT 0	ANT 1			
Bluetooth	2402-2480	-1.00	/	0.79	/	5	0.03	/
BLE	2402-2480	-1.00	/	0.79	/	5	0.03	/
802.11b	2412~2462	8.50	8.00	7.08	6.31	5	0.30	0.26
802.11g	2412~2462	8.00	7.50	6.31	5.62	5	0.26	0.24
802.11n20	2412~2462	6.00	5.00	3.98	3.16	5	0.17	0.13
802.11n40	2422~2452	5.00	4.50	3.16	2.82	5	0.13	0.12
802.11a	5180~5240	7.50	7.00	5.62	5.01	5	0.34	0.31
	5745~5825	7.50	7.00	5.62	5.01	5	0.36	0.32
802.11n20	5180~5240	5.00	4.00	3.16	2.51	5	0.19	0.15
	5745~5825	4.50	4.00	2.82	2.51	5	0.18	0.16
802.11n40	5190~5230	4.50	4.00	2.82	2.51	5	0.17	0.15
	5755~5795	5.00	4.00	3.16	2.51	5	0.20	0.16
802.11ac20	5180~5240	5.00	4.00	3.16	2.51	5	0.19	0.15
	5745~5825	5.00	4.00	3.16	2.51	5	0.20	0.16
802.11ac40	5180~5240	5.00	4.00	3.16	2.51	5	0.19	0.15
	5755~5795	5.00	4.00	3.16	2.51	5	0.20	0.16
802.11ac80	5210	4.50	3.50	2.82	2.24	5	0.17	0.14
	5775	5.00	4.00	3.16	2.51	5	0.20	0.16

When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

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

where $x = 7.5$ for 1-g SAR.

When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

Simultaneous Transmission:

Description of Simultaneous Transmit Capabilities		
Transmitter Combination		Simultaneous?
ANT 0	ANT 1	
2.4G BT/BLE	2.4G Wi-Fi	×
2.4G BT/BLE	5G Wi-Fi	√
2.4G Wi-Fi	2.4G Wi-Fi	√
2.4G Wi-Fi	5G Wi-Fi	×
5G Wi-Fi	2.4G Wi-Fi	×
5G Wi-Fi	5G Wi-Fi	√

Simultaneous SAR test exclusion considerations:

Mode (ANT 0+ ANT 1)	Reported SAR (W/kg)		ΣSAR < 1.6W/kg
	ANT 0	ANT 1	
2.4G BT +5G Wi-Fi	0.03	0.32	0.35
2.4G Wi-Fi	0.30	0.26	0.56
5G Wi-Fi	0.36	0.32	0.68

Conclusion: ΣSAR < 1.6 W/kg therefore simultaneous transmission SAR is not required.