RADIO FREQUENCY EXPOSURE

Limit

According to section B.4 of 447498 D04 Interim General RF Exposure Guidance v01

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of λ/4.

As for devices with antennas of length greater than λ/4 where the gain is not well defined, but always less than that of a half-wave dipole (length λ/2), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold Pth (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by Formula (B.2).

$$P_{\text{th}}\ (\text{mW}) = \begin{cases} ERP_{20\ \text{cm}}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ \text{cm}} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases} \qquad (\text{B.2})$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ \text{cm}}\sqrt{f}}\right)$$

and f is in GHz, d is the separation distance (cm), and ERP_{20cm} is per Formula (B.1).

Results

RF Exposure at Separation distance (cm): 20									
Mode	Antenna	Frequency [MHz]	Conducted Power [dBm]	Manufacturing tolerance		Antenna Gain [dBi]	Max of ERP and Conducted Power including Tune Up		SAR-based exemption threshold Pth [mW]
				Target Power [dBm]	Tolerance ±[dB]		[dBm]	[mW]	
11A	Ant1	5180	10.06	9.5	1	3.51	11.86	15.35	3060.00
11A	Ant1	5200	10.97	10.5	1	3.51	12.86	19.32	3060.00
11A	Ant1	5240	11.52	11	1	3.51	13.36	21.68	3060.00
11A	Ant2	5180	9.38	9	1	3.94	11.79	15.10	3060.00
11A	Ant2	5200	10.64	10	1	3.94	12.79	19.01	3060.00
11A	Ant2	5240	11.15	10.5	1	3.94	13.29	21.33	3060.00
11N20SISO	Ant1	5180	9.76	9.5	1	3.51	11.86	15.35	3060.00
11N20SISO	Ant1	5200	10.79	10.5	1	3.51	12.86	19.32	3060.00
11N20SISO	Ant1	5240	11.46	11	1	3.51	13.36	21.68	3060.00
11N20SISO	Ant2	5180	9.37	9	1	3.94	11.79	15.10	3060.00
11N20SISO	Ant2	5200	10.45	10	1	3.94	12.79	19.01	3060.00
11N20SISO	Ant2	5240	10.94	10.5	1	3.94	13.29	21.33	3060.00
11AC20SISO	Ant1	5180	10.22	9.5	1	3.51	11.86	15.35	3060.00
11AC20SISO	Ant1	5200	11.17	10.5	1	3.51	12.86	19.32	3060.00
11AC20SISO	Ant1	5240	11.83	11.5	1	3.51	13.86	24.32	3060.00
11AC20SISO	Ant2	5180	9.77	9.5	1	3.94	12.29	16.94	3060.00
11AC20SISO	Ant2	5200	10.79	10.5	1	3.94	13.29	21.33	3060.00
11AC20SISO	Ant2	5240	11.07	10.5	1	3.94	13.29	21.33	3060.00

RF Exposure at Separation distance (cm): 20							
Mode	Antenna	Frequency [MHz]	Conducted Power [dBm]	Antenna Gain [dBi]	Max of ERP and Conducted Power including Tune Up		SAR-based exemption threshold Pth [mW]
					[dBm]	[mW]	
11N20MIMO	total	5180	12.58	3.94	14.37	27.35	3060.00
11N20MIMO	total	5200	13.63	3.94	15.42	34.83	3060.00
11N20MIMO	total	5240	14.22	3.94	16.01	39.90	3060.00
11AC20MIMO	total	5180	13.01	3.94	14.8	30.20	3060.00
11AC20MIMO	total	5200	13.99	3.94	15.78	37.84	3060.00
11AC20MIMO	total	5240	14.48	3.94	16.27	42.36	3060.00

RF Exposure at Separation distance (cm): 20									
Mode	Antenna	Frequency [MHz]	Conducted Power [dBm]	Manufacturing tolerance		Antenna Gain [dBi]	Max of ERP and Conducted Power including Tune Up		SAR-based exemption threshold Pth [mW]
				Target Power [dBm]	Tolerance ±[dB]		[dBm]	[mW]	
11A	Ant1	5745	13.08	12.5	1	3.17	14.52	28.31	3060.00
11A	Ant1	5785	12.77	12.5	1	3.17	14.52	28.31	3060.00
11A	Ant1	5825	11.75	11.5	1	3.17	13.52	22.49	3060.00
11A	Ant2	5745	10.89	10.5	1	3.6	12.95	19.72	3060.00
11A	Ant2	5785	10.39	10	1	3.6	12.45	17.58	3060.00
11A	Ant2	5825	9.78	9.5	1	3.6	11.95	15.67	3060.00
11N20SISO	Ant1	5745	10.88	10.5	1	3.17	12.52	17.86	3060.00
11N20SISO	Ant1	5785	10.4	10	1	3.17	12.02	15.92	3060.00
11N20SISO	Ant1	5825	9.38	9	1	3.17	11.02	12.65	3060.00
11N20SISO	Ant2	5745	8.71	8	1	3.6	10.45	11.09	3060.00
11N20SISO	Ant2	5785	8.06	7.5	1	3.6	9.95	9.89	3060.00
11N20SISO	Ant2	5825	7.4	7	1	3.6	9.45	8.81	3060.00
11AC20SISO	Ant1	5745	9.14	8.5	1	3.17	10.52	11.27	3060.00
11AC20SISO	Ant1	5785	9.4	9	1	3.17	11.02	12.65	3060.00
11AC20SISO	Ant1	5825	8.29	8	1	3.17	10.02	10.05	3060.00
11AC20SISO	Ant2	5745	7.48	7	1	3.6	9.45	8.81	3060.00
11AC20SISO	Ant2	5785	6.85	6.5	1	3.6	8.95	7.85	3060.00
11AC20SISO	Ant2	5825	6.5	6	1	3.6	8.45	7.00	3060.00

RF Exposure at Separation distance (cm): 20							
Mode	Antenna	Frequency [MHz]	Conducted Power [dBm]	Antenna Gain [dBi]	Max of ERP and Conducted Power including Tune Up		SAR-based exemption threshold Pth [mW]
					[dBm]	[mW]	
11N20MIMO	total	5745	12.94	3.6	14.39	27.48	3060.00
11N20MIMO	total	5785	12.4	3.6	13.85	24.27	3060.00
11N20MIMO	total	5825	11.51	3.6	12.96	19.77	3060.00
11AC20MIMO	total	5745	11.4	3.6	12.85	19.28	3060.00
11AC20MIMO	total	5785	11.32	3.6	12.77	18.92	3060.00
11AC20MIMO	total	5825	10.5	3.6	11.95	15.67	3060.00

Max of ERP and Conducted Power including Tune Up (dBm) = Max Conducted Tune Up Power(dBm) and Max Conducted Tune Up Power(dBm) + Antenna Gain(dBi)-2.15), whichever is greater.

The Maximum ERP is used for Routine Evaluation Exemption according to B.4 of 447498 D04 Interim General RF Exposure Guidance v01.

So, the SAR evaluation is not required.