

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 $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), 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 P_{th} (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). P_{th} is given by Formula (B.2).

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

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 $ERP_{20\text{cm}}$ is per Formula (B.1).

The example values shown in Table B.2 are for illustration only.

Frequency (MHz)	Distance (mm)										
	5	10	15	20	25	30	35	40	45	50	
300	39	65	88	110	129	148	166	184	201	217	
450	22	44	67	89	112	135	158	180	203	226	
835	9	25	44	66	90	116	145	175	207	240	
1900	3	12	26	44	66	92	122	157	195	236	
2450	3	10	22	38	59	83	111	143	179	219	
3600	2	8	18	32	49	71	96	125	158	195	
5800	1	6	14	25	40	58	80	106	136	169	

Conducted Power Results

BR/EDR

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
GFSK	00	2402	0.37
	39	2441	0.95
	78	2480	0.86
π/4-DQPSK	00	2402	0.67
	39	2441	1.22
	78	2480	1.12
8-DPSK	00	2402	1.19
	39	2441	1.71
	78	2480	1.67

BLE

Test Mode	Channel	Frequency (MHz)	Measured Peak Output Power (dBm)
GFSK(1Mbps)	00	2402	2.35
	19	2440	3.84
	39	2480	4.24

Manufacturing tolerance

BR/EDR

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0.0	0.5	0.5
Tolerance ±(dB)	1.0	1.0	1.0
π/4-DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	0.5	1.0	1.0
Tolerance ±(dB)	1.0	1.0	1.0
8-DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	1.0	1.5	1.5
Tolerance ±(dB)	1.0	1.0	1.0

BLE

GFSK (1Mbps Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	2.0	3.0	4.0
Tolerance ±(dB)	1.0	1.0	1.0

Results

BR/EDR(Antenna Gain: 2.3dBi)

Test Mode	Channel Frequency (MHz)	Max. Tune Up Power (dBm, Peak)	Max. Eirp including Tune Up (dBm, Peak)	Max. Eirp including Tune Up (mW, Peak)	Exemption Limit (mW)
GFSK	2402	1.0	3.3	2.14	3060
	2441	1.5	3.8	2.40	3060
	2480	1.5	3.8	2.40	3060
π/4-DQPSK	2402	1.5	3.8	2.40	3060
	2441	2.0	4.3	2.69	3060
	2480	2.0	4.3	2.69	3060
8-DPSK	2402	2.0	4.3	2.69	3060
	2441	2.5	4.8	3.02	3060
	2480	2.5	4.8	3.02	3060

BLE(Antenna Gain: 2.41dBi)

Test Mode	Channel Frequency (MHz)	Max. Tune Up Power (dBm, Peak)	Max. Eirp including Tune Up (dBm, Peak)	Max. Eirp including Tune Up (mW, Peak)	Exemption Limit (mW)
GFSK(1Mbps)	2402	3.0	5.41	3.48	3060
	2440	4.0	6.41	4.38	3060
	2480	5.0	7.41	5.51	3060

The Maximum Eirp 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.