



RF EXPOSURE EVALUATION

According KDB 447498 D01 General RF Exposure Guidance v06.

7.1. Transmitters used in mobile device exposure conditions for standalone operations

Devices operating in standalone mobile device exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The distance must be at least 20 cm and fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2).

§ 2.1091(d)(2)

(i) For purposes of analyzing mobile transmitting devices under the occupational/controlled criteria specified in § 1.1310 of this chapter, time averaging provisions of the limits may be used in conjunction with the maximum duty factor to determine maximum time-averaged exposure levels under normal operating conditions.

(ii) Such time averaging provisions based on maximum duty factor may not be used in determining exposure levels for devices intended for use by consumers in general population/uncontrolled environments as defined in § 1.1310 of this chapter. However, “source-based” time averaging based on an inherent property of the RF source is allowed over a time period not to exceed 30 minutes.

Table 1 to § 1.1310(e)(1) - Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f ²)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f ²)	30
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30



f = frequency in MHz;

Friis transmission formula: $P_d = (P_{out} * G) / (4 * \pi * r^2)$;

Where

P_d = power density in mW/cm², **P_{out}** = output power to antenna in mW;

G = gain of antenna in linear scale, **P_i** = 3.1415926;

R = distance between observation point and center of the radiator in cm;

P_d is the limit of MPE, 1 mW/cm². If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

Test Procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

RF Exposure Evaluation For BLE								
Mode	Frequency (MHz)	Output power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Max tune-up power (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
GFSK	2402	4.909	4±1	5	3.16	0.001043	1.0	PASS
	2440	5.585	5±1	6	3.98	0.001314	1.0	PASS
	2480	6.621	6±1	7	5.01	0.001654	1.0	PASS
Note: Antenna Gain = 2.20dBi								