FCC RF Exposure Analysis

Revision	Report Date	Reason for Revision
∅	August 15, 2021	Initial Issue.
1	August 18, 2021	TCB Review Updates

FCC RF Exposure Evaluation of Devices

RF Exposure Requirements: **§1.1307(b)(1) and §1.1307(b)(2):** Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

RF Radiation Exposure Limit: **§1.1310:** As specified in this section, the Maximum Permissible Exposure (MPE) Limit shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Sec. 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Sec. 2.1093 of this chapter.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
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
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) 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
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

RF Exposure Limits

$$S = PG / 4\pi R^2 \quad \text{or} \quad R = \sqrt{(PG / 4\pi S)}$$

where, S = Power Density (mW/cm^2)
P = Power Input to antenna (mW)
G = Antenna Gain (numeric value)
R = Distance (cm)

For Antenna Gain → **dBi = 10log(Numeric)**

Test Results:

Band	Frequency	Maximum Conducted Power	Conducted Power	Antenna Gain	Antenna Gain	Power Density	Limit	Margin	Distance	Result
	(MHz)	(dBm)	(mW)	(dBi)	(Numeric)	(mW/cm2)	(mW/cm2)		(cm)	
GSM 850	831.5	24	251.19	1.00	1.259	0.063	0.554	0.491	20	Pass
GSM 1900	1880.0	21	125.89	2.50	1.778	0.045	1	0.955	20	Pass
LTE B2	1880.00	24	251.19	2.50	1.778	0.089	1	0.911	20	Pass
LTE B4	1732.5	23	199.53	2.50	1.778	0.071	1	0.929	20	Pass
LTE B5	836.5	24	251.19	1.00	1.259	0.063	0.558	0.495	20	Pass
LTE B12	707.5	24	251.19	0.50	1.122	0.056	0.472	0.416	20	Pass
LTE B13	782.0	24	251.19	0.50	1.122	0.056	0.521	0.465	20	Pass
LTE B26	831.5	24	251.19	1.00	1.259	0.063	0.554	0.491	20	Pass
BLE	2402.0	0	1.00	0.50	1.122	0.0002	1	1.000	20	Pass
WLAN 2.4 GHz	2437.0	24	251.19	3.77	2.382	0.119	1	0.881	20	Pass

MPE Calculation for Bands

Simultaneous Transmission

Note: Results are based on KDB 447498 D01 (Section 7.2) Transmitters used in mobile devices exposure conditions for simultaneous transmission operations.

Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in a host device is ≤ 1.0, according to calculated/estimated, numerically modeled, or measured field strengths or power density. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to the MPE limit at the test frequency.

The formula for calculating the simultaneous MPE is

CPD1/LPD1 + CPD2/LPD2 + „„ CPDn/LPDn < 1

CPD: Calculated Power Density
LPD: Limit of Power Density

	Power Density	Limit	Ratio		
Cellular	0.056	0.472	0.119		
BLE	0.0002	1	0.0002		
WiFi 2.4G	0.119	1	0.119		
SUM	NA	NA	0.238	< 1	Pass

