



RF Exposure Evaluation

Standard(s): FCC Guidelines for Human Exposure IEEE C95.1 & FCC Title 47 Part 2.1091, KDB 447498 D01 General RF Exposure Guidance v06

Limits

The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

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: $Pd = (Pout * G) / (4 * \pi * r^2)$

Where

Pd = power density in mW/cm², **Pout** = output power to antenna in mW;

G = gain of antenna in linear scale, **Pi** = 3.1416;

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

Pd 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.



Table for Filed Antenna

For 900M transfer image

Antenna gain		Antenna Type
Ant1: 3.1dBi	Ant2: 3.1dBi	PCB antenna
Ant1: 5dBi	Ant2: 5dBi	External antenna

For 2.4G transfer image

Antenna gain		Antenna Type
Ant1: 3.3dBi	Ant2: 3.3dBi	PCB antenna
Ant1: 5dBi	Ant2: 5dBi	External antenna

For 5G transfer image

Antenna gain		Antenna Type
Ant1: 3dBi	Ant2: 3dBi	PCB antenna
Ant1: 5dBi	Ant2: 5dBi	External antenna

For 2.4GWiFi

Antenna gain		Antenna Type
6.7dBi		FPC antenna

For 5GWiFi

Antenna gain		Antenna Type
4dBi		FPC antenna



Test Result of RF Exposure Evaluation

Worst case as below

Operating Mode	Freq.	Maximum conducted output power	Directional Antenna Gain	Calculated maximum EIRP		MPE Limit	MPE Value
	(MHz)	(dBm)	(dBi)	(dBm)	(mW)	(mW/cm ²)	
900M transfer image PCB ant1	902-928	22.82	3.1	25.92	390.84	0.6	0.078
900M transfer image PCB ant2	902-928	21.01	3.1	24.11	257.63	0.6	0.051
900M transfer image External ant1	902-928	22.47	5	27.47	558.47	0.6	0.111
900M transfer image External ant2	902-928	21.16	5	26.16	413.05	0.6	0.082
2.4G transfer image PCB ant1	2400-2483.5	23.73	3.1	26.83	481.95	1	0.096
2.4G transfer image PCB ant2	2400-2483.5	25.22	3.1	28.32	679.20	1	0.135
2.4G transfer image External ant1	2400-2483.5	23.88	5	28.88	772.68	1	0.154
2.4G transfer image External ant2	2400-2483.5	25.37	5	30.37	1088.93	1	0.217
5G transfer image PCB ant1	5150-5250	12.31	3	15.31	33.96	1	0.007
	5725-5850	21.67	3	24.67	293.09	1	0.058
5G transfer image PCB ant2	5150-5250	13.21	3	16.21	41.78	1	0.008
	5725-5850	22.64	3	25.64	366.44	1	0.073
5G transfer image External ant1	5150-5250	12.42	5	17.42	55.21	1	0.011
	5725-5850	22.16	5	27.16	520.00	1	0.103
5G transfer image External ant2	5150-5250	13.32	5	18.82	76.21	1	0.015
	5725-5850	24.23	5	29.23	837.53	1	0.167
2.4G Wifi	2400-2483.5	21.71	6.7	28.41	693.43	1	0.138
5G Wifi	5150-5250	15.35	4	19.35	86.10	1	0.008
	5725-5850	15.14	4	19.14	82.04	1	0.016

Note: 1. The calculated distance is 20 cm.

2. The Wifi function can transmit at the same time with the transfer image function, transfer image function External antenna and PCB antenna can not transmit at the same time.

Simultaneous transmitting consideration(worst case)

$$\text{The ratio} = \text{MPE}_{2.4\text{G Wifi}}/\text{limit} + \text{MPE}_{2.4\text{G transfer image External ant1}}/\text{limit} + \text{MPE}_{2.4\text{G transfer image External ant2}}/\text{limit} \\ = 0.138/1 + 0.154/1 + 0.217/1 = 0.499 < 1.0$$

Result: Complies

(END OF REPORT)