



RF Exposure Evaluation

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.



Test Result of RF Exposure Evaluation

EDR: (Antenna gain: 0.8dBi)

Mode	Output power to antenna (dBm)	Tune UP tolerance (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	3.167	2.5±1	3.5	2.24	0.00054	1.0	PASS
π/4-DQPSK	2.267	2±1	3	2.00	0.00048	1.0	PASS
8-DPSK	2.427	2±1	3	2.00	0.00048	1.0	PASS

WIFI2.4G: (Antenna gain: -1.78dBi)

Mode	Output power to antenna (dBm)	Tune UP tolerance (dBm)	Max Tune UP power (dBm)	Max Tune UP power (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
802.11b	15.122	15±1	16	39.81	0.00526	1.0	PASS
802.11g	17.634	17±1	18	63.10	0.00833	1.0	PASS
802.11n20	17.602	17±1	18	63.10	0.00833	1.0	PASS
802.11n40	17.980	17±1	18	63.10	0.00833	1.0	PASS

WIFI2.4G: (Antenna gain: -0.99dBi)

Mode	Output power to antenna (dBm)	Tune UP tolerance (dBm)	Max Tune UP power (dBm)	Max Tune UP power (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
802.11a	15.270	15±1	16	39.81	0.00631	1.0	PASS
802.11n20	15.144	15±1	16	39.81	0.00631	1.0	PASS
802.11n40	16.553	16±1	17	50.12	0.00794	1.0	PASS
802.11ac20	15.329	15±1	16	39.81	0.00631	1.0	PASS
802.11ac40	16.416	16±1	17	50.12	0.00794	1.0	PASS
802.11ac80	16.763	16±1	17	50.12	0.00794	1.0	PASS

Remark: The same antenna cannot transmit at the same time, ANT1 & ANT2 & ANT3 can transmit at the same time, So the worst simultaneous transmitting consideration:

The ratio = ANT1 MPE_(MAX) / limit + ANT2 MPE_(MAX) / limit + ANT3 MPE_(MAX) / limit = 0.00052 / 1.0 + 0.00833 / 1.0 + 0.00794 / 1.0 = 0.01679 < 1.0.