

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 KDB 447498 D01 V06 and 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.

$$EIRP = E_{Meas} + 20 \log(d_{Meas}) - 104.7$$

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dB μ V/m

d_{Meas} is the measurement distance, in m

Test Result of RF Exposure Evaluation

wifi 2.4G mode

Channel	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
802.11b	22.67	184.9269	0.0548	1.0	PASS
802.11g	21.89	154.5254	0.0458	1.0	PASS
802.11n HT20	22.54	179.4734	0.0532	1.0	PASS
802.11n HT40	21.33	135.8313	0.0402	1.0	PASS

Remark: antenna gain=1.73dBi

wifi 5G mode:

Band	Channel	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
Band 1	802.11a	15.771	37.7659	0.0155	1.0	PASS
	802.11n HT20	15.762	37.6877	0.0155	1.0	PASS
	802.11n HT40	14.872	30.7044	0.0126	1.0	PASS
	802.11ac HT20	15.584	36.1743	0.0149	1.0	PASS
	802.11ac HT40	14.987	31.5283	0.0130	1.0	PASS
	802.11ac HT80	14.795	30.1648	0.0124	1.0	PASS

Remark: antenna gain=3.15dBi

Band	Channel	Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
Band 4	802.11a	13.903	24.5641	0.0153	1.0	PASS
	802.11n HT20	13.785	23.9056	0.0149	1.0	PASS
	802.11n HT40	14.309	26.9712	0.0168	1.0	PASS
	802.11ac HT20	13.972	24.9574	0.0155	1.0	PASS
	802.11ac HT40	14.421	27.6758	0.0172	1.0	PASS
	802.11ac HT80	14.214	26.3876	0.0164	1.0	PASS

Remark: antenna gain=4.95dBi

For BT

Output power to antenna (dBm)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm ²)	Limit (mW/cm ²)	Result
2.02	1.5922	0.0005	1.0	PASS

Remark: antenna gain=1.73dBi

For Simultaneous transmitting, 1): The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = $0.0548/1 + 0.0155/1 + 0.0172/1 + 0.0005/1 = 0.088 < 1$ Since the sum of the MPE ratios for all simultaneously transmitting antennas incorporated in the device is ≤ 1.0 , the EUT is considered to satisfy MPE compliance for simultaneous transmission operations.