

RF Exposure Evaluation

According to KDB 447498 D01 General RF Exposure Guidance v06 and part 2.1091, Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied.

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

Where

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

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

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.

Test Result of RF Exposure Evaluation

FCC RF Exposure Evaluation

modulation	Channel Freq. (MHz)	Measured power (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm2)	Power density Limits (mW/cm)
802.11b	2412	15.75	±1	16.75	1.58	0.0149186364	1
	2437	16.42	±1	17.42	1.58	0.0174072084	1
	2462	17.15	±1	18.15	1.58	0.0205934509	1
802.11g	2412	15.21	±1	16.21	1.58	0.0131743479	1
	2437	15.99	±1	16.99	1.58	0.0157662762	1
	2462	16.65	±1	17.65	1.58	0.0183539325	1
802.11n20	2412	14.10	±1	15.10	1.58	0.0102030292	1
	2437	14.88	±1	15.88	1.58	0.0122103786	1
	2462	15.69	±1	16.69	1.58	0.0147139450	1
802.11n40	2422	14.51	±1	15.51	1.58	0.0112131887	1
	2437	14.82	±1	15.82	1.58	0.0120428459	1
	2452	15.24	±1	16.24	1.58	0.0132656682	1

modulation	Channel Freq. (MHz)	Field strength (dBuV/m)	EIRP (dBm)	Tune-up power (dBm)	Max tune-up power (dBm)	Antenna Gain Numeric	Evaluation result (mW/cm2)	Power density Limits (mW/cm)
LoRa(CSS)	913.2	52.65	-42.51	±1	-41.51	2.69	0.0000000378	0.6088
	915	60.05	-35.11	±1	-34.11	2.69	0.0000002078	0.6100
	917.4	53.67	-41.49	±1	-40.49	2.69	0.0000000478	0.6116

EIRP= Field strength+20log(dmeas)-104.7

EIRP is the equivalent isotropically radiated power, in dBm

Field strength is the field strength of the emission at the measurement distance, in dBuV/m

dmeas is the measurement distance, in m

Remark: Wifi 2.4G antenna gain=2dBi, LoRa antenna gain=4.3dBi

Simultaneous transmit evaluation worst result

WIFI 2.4G + LoRa(CSS)=0.0205934509/1+0.0000002078/0.61= 0.0205937916<1.

This confirmed that the device comply with FCC 1.1310 MPE limit.