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/cm^2, **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

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

EIRP is the equivalent isotropically radiated power, in dBm

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

d_{Meas} is the measurement distance, in m

Pd id the limit of MPE, 1 mW/cm^2. 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

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	16.797	47.8300	0.01307	1.0	PASS
802.11g	13.622	23.0250	0.00629	1.0	PASS
802.11n HT20	14.628	29.0269	0.00793	1.0	PASS
802.11n HT40	13.762	23.7794	0.00650	1.0	PASS

Remark: antenna gain=1.38dBi

LoRa 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
125KHz	16.731	47.1086	0.02964	1.0	PASS
500KHz	15.66	36.8129	0.02316	1.0	PASS

Remark: antenna gain=5 dBi

WCDMA/LTE mode:

Channel	Maximum Conducted Output Power (dBm)	Antenna gain(dBi)	Output power to antenna (mW)	Power Density at R=20cm (mW/cm^2)	Limit (mW/cm^2)	Result
WCDMA II	25	1.59	316.2278	0.09073	1.00	PASS
WCDMA IV	25	2.00	316.2278	0.09971	1.00	PASS
WCDMA V	25	2.13	316.2278	0.10274	0.55	PASS
LTE Band 2	25	1.59	316.2278	0.09073	1.00	PASS
LTE Band 4	25	2.00	316.2278	0.09971	1.00	PASS
LTE Band 5	25	2.13	316.2278	0.10274	0.55	PASS
LTE Band 12	25	3.26	316.2278	0.13327	0.47	PASS
LTE Band 13	25	4.45	316.2278	0.17528	0.52	PASS
LTE Band 14	25	3.63	316.2278	0.14512	0.53	PASS
LTE Band 66	25	2.00	316.2278	0.09971	1.00	PASS
LTE Band 71	25	3.98	316.2278	0.15730	0.45	PASS

Note: The wcdma /LTE output power data is sourced from the 4G module MPE report.
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For Simultaneous transmitting, 1): The sum of the ratios of the spatially averaged results to the applicable frequency dependent MPE limits = 0.01307/1 + 0.02964/1+ 0.17528/0.52 = 0.37978< 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.