

RF EXPOSURE EVALUATION

According to FCC 1.1310: 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 Exposure				
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
300-1,500			f/300	6
1,500-100,000			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
300-1,500			f/1500	30
1,500-100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 * P * G}}{d}$$

$$\text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Average RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 * P * G}{377 * D^2}$$

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

Measurement Result

Operation Frequency: 2402MHz-2480MHz; 5180MHz-5240MHz; 5745MHz-5825MHz;

Antenna Type: Ceramics Antenna

Antenna gain: 5dBi

R=20cm

SISO

Band	Max EIRP	Antenna	Separation distance (cm)	Evaluation result	Power density	Verdict
	(dBm)	Gain		(mW/cm2)	(mW/cm2)	
		(dBi)				
Wi-Fi 2.4G	16.55	5	20	0.008989	1	PASS
Wi-Fi 5.2G	16.34	5	20	0.008565	1	PASS
Wi-Fi 5.8G	16.55	5	20	0.008989	1	PASS

MIMO

Band	ANT	SISO					MIMO		Verdict
		Max EIRP	Antenna	Separation distance (cm)	Evaluation result	Power density	Evaluation result	Power density	
		(dBm)	Gain		(mW/cm2)	(mW/cm2)	(mW/cm2)	(mW/cm2)	
			(dBi)						
Wi-Fi 2.4G	Ant 1	16.01	5	20	0.007938	1	0.014086	1	PASS
	Ant 2	14.9	5	20	0.006148	1			
Wi-Fi 5.2G	Ant 1	16.34	5	20	0.008565	1	0.012038	1	PASS
	Ant 2	12.42	5	20	0.003473	1			
Wi-Fi 5.8G	Ant 1	15.84	5	20	0.007633	1	0.015058	1	PASS
	Ant 2	15.72	5	20	0.007425	1			

SIMULTANEOUS TRANSMISSIONS

Band	ANT	Standalone					Simultaneous		Verdict
		Max EIRP	Antenna	Separation distance (cm)	Evaluation result	Power density	Evaluation result	Power density	
		(dBm)	Gain (dBi)		(mW/cm ²)	(mW/cm ²)	(mW/cm ²)	(mW/cm ²)	
Wi-Fi 2.4G + LTE Band 26	Wi-Fi 2.4G Ant	16.55	5	20	0.008989	1	0.42006266	1	PASS
	LTE Band 26 Ant	30.5	5	20	0.223213	0.543			
Wi-Fi 5.2G + LTE Band 26	Wi-Fi 5.2G Ant	16.34	5	20	0.008565	1	0.41963866	1	PASS
	LTE Band 26 Ant	30.5	5	20	0.223213	0.543			
Wi-Fi 5.8G + LTE Band 26	Wi-Fi 5.8G Ant	16.55	5	20	0.008989	1	0.42006266	1	PASS
	LTE Band 26 Ant	30.5	5	20	0.223213	0.543			
Wi-Fi 2.4G + Wi-Fi 5.2G	Wi-Fi 2.4G Ant	16.55	5	20	0.008989	1	0.017554	1	PASS
	Wi-Fi 5.2G Ant	16.34	5	20	0.008565	1			
Wi-Fi 2.4G + Wi-Fi 5.8G	Wi-Fi 2.4G Ant	16.55	5	20	0.008989	1	0.017978	1	PASS
	Wi-Fi 5.8G Ant	16.55	5	20	0.008989	1			
Wi-Fi 2.4G + LTE Band 26	Wi-Fi 2.4G Ant 1	16.01	5	20	0.007938	1	0.42515966	1	PASS
	Wi-Fi 2.4G Ant 2	14.9	5	20	0.006148	1			
	LTE Band 26 Ant	30.5	5	20	0.223213	0.543			
Wi-Fi 5.2G + LTE Band 26	Wi-Fi 5.2G Ant 1	16.34	5	20	0.008565	1	0.42311166	1	PASS
	Wi-Fi 5.2G Ant 2	12.42	5	20	0.003473	1			
	LTE Band 26 Ant	30.5	5	20	0.223213	0.543			
Wi-Fi 5.8G + LTE Band 26	Wi-Fi 5.8G Ant 1	15.84	5	20	0.007633	1	0.42613166	1	PASS
	Wi-Fi 5.8G Ant 2	15.72	5	20	0.007425	1			
	LTE Band 26 Ant	30.5	5	20	0.223213	0.543			
Wi-Fi 2.4G + Wi-Fi 5.2G	Wi-Fi 2.4G Ant 1	16.01	5	20	0.007938	1	0.026124	1	PASS
	Wi-Fi 2.4G Ant 2	14.9	5	20	0.006148	1			
	Wi-Fi 5.2G Ant 1	16.34	5	20	0.008565	1			
	Wi-Fi 5.2G Ant 2	12.42	5	20	0.003473	1			
Wi-Fi 2.4G + Wi-Fi 5.8G	Wi-Fi 2.4G Ant 1	16.01	5	20	0.007938	1	0.029144	1	PASS
	Wi-Fi 2.4G Ant 2	14.9	5	20	0.006148	1			
	Wi-Fi 5.8G Ant 1	15.84	5	20	0.007633	1			
	Wi-Fi 5.8G Ant 2	15.72	5	20	0.007425	1			

Note: 1. LTE Band 26 Test data reference to FCC ID: XMR201901EM12G.

2. NO simultaneous transmissions are possible for this device of LTE Module 1 + LTE Module 2.

3. NO simultaneous transmissions are possible for this device of LTE Module + Wi-Fi 5G + Wi-Fi 2.4G.

Signature:

Date: 2020-09-16

Alex

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