

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

SRD

Operation Frequency: GFSK: 905 MHz~926.5MHz

Antenna Type:

Antenna 1: Planar Inverted F- Antenna(ocw=120k)

Antenna 2: Planar Inverted F- Antenna(ocw=120k)

Antenna 3: Planar Inverted F- Antenna(ocw=140k)

Antenna 4: Planar Inverted F- Antenna(ocw=140k)

Antenna 5: External Antenna(ocw=120k)

Antenna 6: External Antenna(ocw=140k)

Antenna 1 : -1.22dBi

Antenna 2 : -0.55dBi

Antenna 3 : -1.54dBi

Antenna 4 : -0.64dBi

Antenna 5: -2dBi

Antenna 6: -2dBi

R=20cm

Module 1:ant1

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
905.00	GFSK-120K	15.8	16±1	17	50.119	-1.22	0.76	0.0075	0.60
915.85		15.66	16±1	17	50.119	-1.22	0.76	0.0075	0.61
926.50		15.52	16±1	17	50.119	-1.22	0.76	0.0075	0.62

ant2

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain		(mW/cm2)	(mW/cm2)
				(dBm)	(mW)	(dBi)	Numeric		
905.00	GFSK-120K	14.43	14±1	15	31.623	-0.55	0.88	0.0055	0.60
915.85		14.38	14±1	15	31.623	-0.55	0.88	0.0055	0.61
926.50		14.52	14±1	15	31.623	-0.55	0.88	0.0055	0.62

ant5

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
905.00	GFSK-120K	17.12	17±1	18	63.096	-2.00	0.63	0.0079	0.60
915.85		17.17	17±1	18	63.096	-2.00	0.63	0.0079	0.61
926.50		16.54	17±1	18	63.096	-2.00	0.63	0.0079	0.62

Module 2: ant3

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result	Power density Limits
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric	(mW/cm2)	(mW/cm2)
905.00	GFSK-140K	15.37	15±1	16	39.811	-1.54	0.70	0.0056	0.60
915.85		15.21	15±1	16	39.811	-1.54	0.70	0.0056	0.61
926.50		14.92	15±1	16	39.811	-1.54	0.70	0.0056	0.62

ant4

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density Limits (mW/cm2)
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
905.00	GFSK-140K	16.09	16±1	17	50.119	-0.64	0.86	0.0086	0.60
915.85		15.56	16±1	17	50.119	-0.64	0.86	0.0086	0.61
926.50		16.24	16±1	17	50.119	-0.64	0.86	0.0086	0.62

ant6

Channel Freq. (MHz)	modulation	conducted power	Tune-up power (dBm)	Max		Antenna		Evaluation result (mW/cm2)	Power density Limits (mW/cm2)
		(dBm)		tune-up power		Gain			
				(dBm)	(mW)	(dBi)	Numeric		
905.00	GFSK-140K	12.31	12±1	13	19.953	-2.00	0.63	0.0025	0.60
915.85		11.97	12±1	13	19.953	-2.00	0.63	0.0025	0.61
926.50		11.52	12±1	13	19.953	-2.00	0.63	0.0025	0.62

GSM/LTE

GSM/LTE Antenna Type: Antenna 1: Planar_Multiband Antenna
Antenna 2: External Antenna
Antenna Gain: GSM/WCDMA/LTE: Antenna 1 : -0.55dBi
Antenna 2 : 0dBi

modulation	Max		Antenna		Evaluation result	Power density Limits
	tune-up power		Gain		(mW/cm2)	(mW/cm2)
	(dBm)	(mW)	(dBi)	Numeric		
GPRS 850	32.88	1940.886	0	1.00	0.3861	0.55
GPRS 1900	30.22	1051.962	0	1.00	0.2093	1
WCDMA B2	23.91	246.037	0	1.00	0.0489	1
WCDMA B4	23.71	234.963	0	1.00	0.0467	1
WCDMA B5	23.23	210.378	0	1.00	0.0419	0.56
LTE Band 2	23.67	232.809	0	1.00	0.0463	1
LTE Band 4	22.78	189.671	0	1.00	0.0377	1
LTE Band 5	23.99	250.611	0	1.00	0.0499	0.55
LTE Band 7	23.87	243.781	0	1.00	0.0485	1
LTE Band 12	24.24	265.461	0	1.00	0.0528	0.47

SIMULTANEOUS TRANSMISSIONS

When a number of sources at different frequencies, and/or broadband sources, contribute to the total exposure, it becomes necessary to weigh each contribution relative to the MPE. To comply with the MPE, the fraction of the MPE in terms of E^2 , H^2 (or power density) incurred within each frequency interval should be determined and the sum of all such fractions should not exceed unity. In order to ensure compliance with the MPE for a controlled environment, the sum of the ratios of the power density to the corresponding MPE should not exceed unity. That is

$$\sum_{i=1}^n \frac{S_i}{MPE_i} \leq 1$$

Max. SIMULTANEOUS TRANSMISSIONS MODE

Band						MIMO		Verdict
	Max Conducted	Antenna	Separation distance (cm)	Evaluation result	Power density	Evaluation result	Power density Limits	
	(dBm)	Gain		(mW/cm2)	(mW/cm2)			
		(dBi)						
SRD 905 ANT1 +SRD 905 ANT2+GPRS 850	15.8	-1.22	20	0.007563	0.6	0.723833	1	PASS
	14.43	-0.55	20	0.005517	0.6			
	32.88	0	20	0.386118	0.55			
SRD 905 ANT3 +SRD 905 ANT4+GPRS 850	15.37	-1.54	20	0.00685	0.6	0.726926	1	PASS
	16.09	-0.64	20	0.008086	0.6			
	32.88	0	20	0.386118	0.55			

Note:

1. NO simultaneous transmissions are possible for this device of SRD ANT1+ANT2+ANT3+ANT4+ANT5+ANT6
2. NO simultaneous transmissions are possible for this device of External Antenna+ built-in Antenna.



Signature:

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