

FCC ID: 2A729-DPNC

KDB447498 D01 General RF Exposure Guidance v06

Maximum Permissible Exposure (MPE)

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, as well as the gain of the used antenna, the RF power density can be obtained.

BLE:

Measurement Result

Operation Frequency: 2402MHz~2480MHz

Power density limited: 1mW/ cm²

Antenna Type: Antenna 1:PCB Antenna, Antenna 2 PCB Antenna

Antenna gain: Antenna 1Gain: 0.80 dBi and Antenna 2 Gain: 1.61dBi

R=5cm

$mW=10^{(dBm/10)}$

Antenna 1 gain Numeric= $10^{(dBi/10)}=10^{(1.611/10)}=1.45$

Antenna 2 gain Numeric= $10^{(dBi/10)}=10^{(1.61/10)}=1.45$

Antenna 1

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		
2402	GFSK(1M)	-9.19	-9±1	-8	0.158	0.80	1.20	0.00004	1
2440		-9.9	-9±1	-8	0.158	0.80	1.20	0.00004	1
2480		-9.93	-9±1	-8	0.158	0.80	1.20	0.00004	1
2402	GFSK(2M)	-13.61	-13±1	-12	0.063	0.80	1.20	0.00002	1
2440		-9.91	-9±1	-8	0.158	0.80	1.20	0.00004	1
2480		-12.71	-13±1	-12	0.063	0.80	1.20	0.00002	1

Antenna 2

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		
2402	GFSK(1M)	-9.19	-9±1	-8	0.158	1.61	1.45	0.00005	1
2440		-9.9	-9±1	-8	0.158	1.61	1.45	0.00005	1
2480		-9.93	-9±1	-8	0.158	1.61	1.45	0.00005	1
2402	GFSK(2M)	-13.61	-13±1	-12	0.063	1.61	1.45	0.00002	1
2440		-9.91	-9±1	-8	0.158	1.61	1.45	0.00005	1
2480		-12.71	-13±1	-12	0.063	1.61	1.45	0.00002	1

GSM:

Antenna Type: Antenna 1:PCB Antenna, Antenna 2 PCB Antenna

ANT Gain (G)

Antenna 1 gain: GSM 850: 0.95dBi (gain of antenna in linear scale=1.24)

PCS 1900:2.96dBi (gain of antenna in linear scale=1.98)

Antenna 2 gain: GSM 850: 0.37dBi (gain of antenna in linear scale=1.00)

PCS 1900:1.67dBi (gain of antenna in linear scale=1.47)

Antenna 1

Band	maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
GSM 850	30.00	0.95	30.95	1244.51	20.00	0.2476	0.57	Pass
GSM 1900	30.00	2.96	32.96	1976.97	20.00	0.3933	1.00	

Antenna 2

Band	maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
GSM 850	30.00	0.37	30.37	1088.93	20.00	0.2166	0.57	Pass
GSM 1900	30.00	1.67	31.67	1468.93	20.00	0.2922	1.00	

LTE(CAT-M)

Antenna Type: Antenna 1: PCB Antenna, Antenna 2: PCB Antenna

ANT Gain (G)

Antenna1 gain : B2 / B4 / B25 : 2.96 dBi (gain of antenna in linear scale=1.98)

B12 / B13 / B26 : 0.95dBi (gain of antenna in linear scale=1.24)

Antenna2 gain : B2 / B4 / B25 : 1.67 dBi (gain of antenna in linear scale=1.47)

B12 / B13 / B26 : 0.37dBi (gain of antenna in linear scale=1.00)

Antenna 1

Band	maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
Band2	24	2.96	26.96	496.59	20.00	0.0988	1.00	Pass
Band4	23	2.96	25.96	394.46	20.00	0.0785	1.00	
Band12	24	0.95	24.95	312.61	20.00	0.0622	0.48	
Band13	23	0.95	23.95	248.31	20.00	0.0494	0.52	
Band25	24	2.96	26.96	496.59	20.00	0.0988	1.00	
Band26	25	0.95	25.95	393.55	20.00	0.0783	0.57	
Band26(Part90)	24	0.95	24.95	312.61	20.00	0.0622	0.57	

Antenna 2

Band	maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
Band2	24	1.67	25.67	368.98	20.00	0.0734	1.00	Pass
Band4	23	1.67	24.67	293.09	20.00	0.0583	1.00	
Band12	24	0.37	24.37	273.53	20.00	0.0544	0.48	
Band13	23	0.37	23.37	217.27	20.00	0.0432	0.52	
Band25	24	1.67	25.67	368.98	20.00	0.0734	1.00	
Band26	25	0.37	25.37	344.35	20.00	0.0685	0.57	
Band26(Part90)	24	0.37	24.37	273.53	20.00	0.0544	0.57	

LTE(NB-IOT)

Antenna Type: Antenna 1:PCB Antenna, Antenna 2 PCB Antenna

ANT Gain (G)

Antenna1 gain : B2 / B4 : 2.96 dBi (gain of antenna in linear scale=1.98)

B5 / B12 / B13 / B71 : 0.95dBi (gain of antenna in linear scale=1.24)

Antenna2 gain : B2 / B4 : 1.67 dBi (gain of antenna in linear scale=1.47)

B5 / B12 / B13 / B71 : 0.37dBi (gain of antenna in linear scale=1.00)

Antenna 1

Band	maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
Band2	21	2.96	23.96	248.89	20.00	0.0495	1.00	Pass
Band4	21	2.96	23.96	248.89	20.00	0.0495	1.00	
Band5	21	0.95	21.95	156.68	20.00	0.0312	0.55	
Band12	21	0.95	21.95	156.68	20.00	0.0312	0.47	
Band13	21	0.95	21.95	156.68	20.00	0.0312	0.52	
Band71	22	0.95	22.95	197.24	20.00	0.0392	0.44	

Antenna 2

Band	maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Conclusion
Band2	21	1.67	22.67	184.93	20.00	0.0734	1.00	Pass
Band4	21	1.67	22.67	184.93	20.00	0.0583	1.00	
Band5	21	0.37	21.37	137.09	20.00	0.0544	0.55	
Band12	21	0.37	21.37	137.09	20.00	0.0432	0.47	
Band13	21	0.37	21.37	137.09	20.00	0.0544	0.52	
Band71	22	0.37	22.37	172.58	20.00	0.0685	0.44	

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

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

Antenna 1

Band	maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Calculation result	Conclusion
GSM 850	30	0.95	30.95	1244.51	20.00	0.2476	0.57	0.66090	Pass
LTE (CAT-M) Band 26	25	0.95	25.95	393.55	20.00	0.0783	0.57		
LTE (NB-IOT) Band 71	22	0.95	22.95	197.24	20.00	0.0392	0.44		
BLE1M	-9.19	0.80	-8.39	0.14	20.00	0.00003	1.00		

Antenna 2

Band	maximum output power (dBm)	Gain (dBi)	EIRP (dBm)	EIRP (mW)	R(cm)	S (mW/cm ²)	MPE Limit (mW/cm ²)	Calculation result	Conclusion
GSM 850	30.00	0.37	30.37	1088.93	20.00	0.2166	0.57	0.65591	Pass
LTE (CAT-M) Band 26	25	0.37	25.37	344.35	20.00	0.0685	0.57		
LTE (NB-IOT) Band 71	22	0.37	22.37	172.58	20.00	0.0685	0.44		
BLE1M	-9.19	1.61	-7.58	0.17	20.00	0.00005	1.00		

Note1: Max Calculation result=(0.2476/0.57)+(0.0783 /0.57)+(0.0392 /0.44)+(0.0003/1)= 0.6905

Note2: GSM / LTE(CAT-M) LTE(NB-IOT) Test data reference to FCC ID: 2AJYU-8VC0001.

Conclusion:

For the max result : 0.66090 ≤ 1.0 for Max Power Density, compliance RF exposure..

Signature: 

Date: 2025-08-21

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