MPE Report

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

Refer Standard: KDB 447498 D01 General RF Exposure Guidance v06

   FCC Part 2 §2.1091

1. Evaluation method

Systems operating under the provisions of FCC 47 CFR section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as mobile device whereby a distance of 0.2m normally can be maintained between the user and the device, and below RF Permissible Exposure limit shall comply with.

In accordance with KDB447498D01 for Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on the calculated/estimated, numerically modeled or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum test separation distance required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency. Either the maximum peak or spatially averaged results from measurements or numerical simulations may be used to determine the MPE ratios. Spatial averaging does not apply when MPE is estimated using simple calculations based on far-field plane-wave equivalent conditions. The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.

2. Limits for General Population/Uncontrolled Exposure

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm²)	Averaging Time $|E|^2, |H|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

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

3. Calculation Method

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S=power density

P=power input to antenna

G=power gain of the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna

From the EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the maximum gain of the used 0dBi for BT , the RF power density can be obtained.

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
Antenna 0	Internal Antenna	2400 – 2500 MHz	0 dBi
Antenna 1	Internal Antenna	2400 – 2500 MHz	0 dBi

4. Estimation Result

4.1 Conducted Power Results

Bluetooth

Mode	Channel	Frequency(MHz)	Peak Conducted Output Power (dBm)
GFSK	00	2402	-1.10
	39	2441	-1.23
	78	2480	-1.56
π/4DQPSK	00	2402	-1.14
	39	2441	0.11
	78	2480	-0.18

Test Mode	Channel	Frequency (MHz)	Field Strength of Fundamental (dBuV/m)
2.4GHz	1	2420	88.43
	2	2443	88.37
	3	2465	87.78

4.2 Manufacturing tolerance

Bluetooth

GFSK			
Channel	2402	2441	2480
Maximum Output Power (dBm)	-1.00	-1.00	-1.00

π/4DQPSK			
Channel	2402	2441	2480
Maximum Output Power (dBm)	-1.00	0.00	0.00

4.3 Measurement Results

4.3.1 Standalone MPE
Antenna 0

Bluetooth

Mode	Output power		Antenna Gain	Antenna Gain	Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	(dBm)	(mW)	(dBi)	(linear)			
GFSK	0	1.0000	0	1.0000	100%	0.0002	1.0000
π/4DQPSK	1	1.2589	0	1.0000	100%	0.0003	1.0000

Remark:

  1. *Maximum power including tune-up tolerance;*

  2. *MPE use distance is 20cm from manufacturer declaration of user manual.*

Antenna 1

According to KDB 412172 D01 Determining ERP and EIRP format;

$eirp = p_t \times g_t = (E \times d)^2/30$

Where:

p_t = transmitter output power in watts,

g_t = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m,

d = measurement distance in meters (m).

EIRP = 88.43 dBuV/m = 0.2607 mW = -5.84 dBm

Modulation Type	EIRP Output power		Duty Cycle	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW			
GFSK	-5.84	0.2607	100%	0.0001	1.0000

4.3.2 Simultaneous Transmission MPE

The sample support one BT modular and 2.4GHz modular, they supports difference antenna, need consider simultaneous transmission;

Maximum Simultaneous transmission MPE Ratio for BT and 2.4GHz

Maximum MPE Ratio$_{BT}$	Maximum MPE Ratio$_{2.4G}$	$\sum$MPE $_{ratios}$	Limit	Results
0.0003	0.0001	<0.1	1.0	PASS

Remark:

1. Output power including tune-up tolerance;

2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

5. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

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