RF Exposure evaluation

FCC ID: 2AYCQ-TE-304B-A12

Exposure category: General population/uncontrolled environment

EUT Type: Production Unit

Device Type: Mobile Device

1. Reference

According to §1.1307(b)(1), systems operating under the provisions of this 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.

According to §1.1310 and §2.1091 RF exposure is calculated.

KDB447498 D01: Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies

2. Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
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 – 1500	/	/	f/300	6
1500 – 100,000	/	/	5	6

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

Frequency Range(MHz)	Electric Field Strength(V/m)	Magnetic Field Strength(A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational/Controlled Exposure				
0.3 – 3.0	614	1.63	(100) *	30
3.0 – 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

*=Plane-wave equivalent power density

3. MPE 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

4. Antenna Information

TE-304B-A12 can only use antennas certificated as follows provided by manufacturer;

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
Bluetooth	/	FPC Antenna	0.0dBi for 2402-2480MHz;	
WCDMA&LTE	/	FPC Antenna	3.0dBi for WCDMA Band II;	
			2.0dBi for WCDMA Band IV;	
			1.0dBi for WCDMA Band V;	
			1.0 dBi for LTE Band 5/12/13/14/71;	
			2.0 dBi for LTE Band 4/66;	
			3.0 dBi for LTE Band 2;	

5. Manufacturing Tolerance

< WCDMA >

Band	Mode	The Tune-up Maximum Power (Customer Declared)(dBm)
W-B2	AMR 12.2kbps	23.0±1
	RMC 12.2Kbps	23.0±1
	HSDPA Subtest-1	22.0±1
	HSDPA Subtest-2	21.0±1
	HSDPA Subtest-3	21.0±1
	HSDPA Subtest-4	20.0±1
	HSUPA Subtest-1	22.0±1
	HSUPA Subtest-2	21.0±1
	HSUPA Subtest-3	21.0±1
	HSUPA Subtest-4	20.0±1
	HSUPA Subtest-5	20.0±1
	HSUPA+	21.0±1
	AMR 12.2kbps	23.0±1
	RMC 12.2Kbps	23.0±1

W-B4	HSDPA Subtest-1	22.0±1
	HSDPA Subtest-2	21.0±1
	HSDPA Subtest-3	21.0±1
	HSDPA Subtest-4	20.0±1
	HSUPA Subtest-1	22.0±1
	HSUPA Subtest-2	21.0±1
	HSUPA Subtest-3	21.0±1
	HSUPA Subtest-4	20.0±1
	HSUPA Subtest-5	20.0±1
	HSUPA+	21.0±1
W-B5	AMR 12.2kbps	23.0±1
	RMC 12.2Kbps	23.0±1
	HSDPA Subtest-1	22.0±1
	HSDPA Subtest-2	21.0±1
	HSDPA Subtest-3	21.0±1
	HSDPA Subtest-4	20.0±1
	HSUPA Subtest-1	22.0±1
	HSUPA Subtest-2	21.0±1
	HSUPA Subtest-3	21.0±1
	HSUPA Subtest-4	20.0±1
	HSUPA Subtest-5	20.0±1
	HSUPA+	21.0±1

< LTE >

Mode	Target Power		
QPSK	1RB	50%RB	100%RB
LTE BAND 2	22.0±2.0	22.0±2.0	22.0±2.0
LTE BAND 4	22.0±2.0	22.0±2.0	22.0±2.0
LTE BAND 5	22.0±2.0	22.0±2.0	22.0±2.0
LTE BAND 12	22.0±2.0	22.0±2.0	22.0±2.0
LTE BAND 13	22.0±2.0	22.0±2.0	22.0±2.0
LTE BAND 14	22.0±2.0	22.0±2.0	22.0±2.0
LTE BAND 66	22.0±2.0	22.0±2.0	22.0±2.0
LTE BAND 71	22.0±2.0	22.0±2.0	22.0±2.0

Mode	Target Power		
16QAM	1RB	50%RB	100%RB
LTE BAND 2	21.0±2.0	21.0±2.0	21.0±2.0
LTE BAND 4	21.0±2.0	21.0±2.0	21.0±2.0
LTE BAND 5	21.0±2.0	21.0±2.0	21.0±2.0
LTE BAND 12	21.0±2.0	21.0±2.0	21.0±2.0
LTE BAND 13	21.0±2.0	21.0±2.0	21.0±2.0
LTE BAND 14	21.0±2.0	21.0±2.0	21.0±2.0
LTE BAND 66	21.0±2.0	21.0±2.0	21.0±2.0
LTE BAND 71	21.0±2.0	21.0±2.0	21.0±2.0

<BT>

GFSK (Peak)1Mbps			
Channel	Channel 00	Channel 19	Channel 39
Target (dBm)	0.0	0.0	0.0
Tolerance ±(dB)	1.0	1.0	1.0
GFSK (Peak)2Mbps			
Channel	Channel 00	Channel 19	Channel 39
Target (dBm)	0.0	0.0	0.0
Tolerance ±(dB)	1.0	1.0	1.0

6. Standalone MPE Result

As declared by the Applicant, the EUT is a wireless device used in a fix application, at least 20 cm from any body part of the user or nearby persons; from the maximum EUT RF output power, the minimum separation distance, r =20cm, as well as the gain of WIFI antenna is 0dBi, the gain of BT antenna is 0dBi.the RF power density can be obtained.

[BT]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
BLE 1Mbps	1.0	1.2589	0.00	1.000	0.0003	1.0000
BLE 2Mbps	1.0	1.2589	0.00	1.000	0.0003	1.0000

[WCDMA&LTE]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
WCDMA B2	24.0	251.1886	3.00	1.9953	0.0998	1.0000
WCDMA B4	24.0	251.1886	2.00	1.5849	0.0792	1.0000
WCDMA B5	24.0	251.1886	1.00	1.2589	0.0629	0.5493
LTE B2	24.0	251.1886	3.00	1.9953	0.0998	1.0000
LTE B4	24.0	251.1886	2.00	1.5849	0.0792	1.0000
LTE B5	24.0	251.1886	1.00	1.2589	0.0629	0.5493
LTE B12	24.0	251.1886	1.00	1.2589	0.0629	0.4660
LTE B13	24.0	251.1886	1.00	1.2589	0.0629	0.5180
LTE B14	24.0	251.1886	1.00	1.2589	0.0629	0.5253
LTE B66	24.0	251.1886	2.00	1.5849	0.0792	1.0000
LTE B71	24.0	251.1886	1.00	1.2589	0.0629	0.4420

Remark:

1. Output power (Peak) including turn-up tolerance;

2. Output power was adjust to duty cycle at 100% if measured duty cycle less than 98%;

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

7. Summary simultaneous transmission results

The sample supports 2 antennas for BT and WCDMA&LTE. The antenna 0 and antenna 1 can transmit simultaneous.

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

∑ of MPE ratios ≤ 1.0

Antenna 0 for BT and Antenna 1 for WCDMA&LTE

Modulation Type	MPE_{ant0} (mW/cm^2)	MPE_{ant1} (mW/cm^2)	∑MPE ratios	Limit	Results
BT&WCDMA&LTE	0.0003	0.0998	0.1001	1.0	PASS

8. Conclusion

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

----------THE END OF REPORT----------