

RF Exposure evaluation

FCC ID: 2A29S-TCST-LVUS

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

TCST-LVUS can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna Identification in Internal photos	Antenna type and antenna number	Operate frequency band	Maximum antenna gain
ANT1	2.4G Wifi	PCB antenna	2.4GHz – 2.5 GHz	2.5 dBi

5. 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, $r=20\text{cm}$, as well as the gain of the used antenna is 2.5 dBi, the RF power density can be obtained.

Modulation Type	Max tune up power tolerance(dBm)	Max Output power to antenna (mW)	Antenna Gain (Numeric)	Power Density at R=20cm (mW/cm2)	Limit (mW/cm2)	Result
802.11b	19	79.4328	1.7783	0.0281	1.0000	Pass
802.11g	22	158.4893	1.7783	0.0561	1.0000	Pass
802.11n(HT20)	22	158.4893	1.7783	0.0561	1.0000	Pass
BLE	7.0	5.0119	1.7783	0.0018	1.0000	Pass

Manufacturing tolerance

<i>IEEE 802.11b</i>			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	18.0	18.0	18.0
Tolerance \pm (dB)	1.0	1.0	1.0
<i>IEEE 802.11g</i>			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	21.0	21.0	21.0
Tolerance \pm (dB)	1.0	1.0	1.0
<i>IEEE 802.11n(HT20)</i>			
Channel	Channel 01	Channel 06	Channel 11
Target (dBm)	21.0	21.0	21.0
Tolerance \pm (dB)	1.0	1.0	1.0

GFSK			
Channel	Channel 00	Channel 19	Channel 39
Target (dBm)	6.0	6.0	5.0
Tolerance \pm (dB)	1.0	1.0	1.0

6. Simultaneous transmission

Wifi and BLE share the same antenna and cannot transmitting at the same time, no Simultaneous transmission need considered.

7. 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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