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Maximum Permissible Exposure Report

1. Product Information

FCC ID : 2A9MH-T77 EUT : FM Transmitter

Test Model : T77

Power Supply : Input Voltage : DC 12V-24V

PD Output: 5V/3A, 9V/3A, 12V/2.5A QC3.0 Output: 5V/3A, 9V/2A, 12V/1.5A

Hardware Version : V1.0.4 Software Version : V1.2

Bluetooth

Frequency Range : 2402MHz-2480MHz

Channel Number : 79 channels for Bluetooth V5.3(DSS)
Channel Spacing : 1MHz for Bluetooth V5.3 (DSS)

Modulation Type : GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V5.3(DSS)

Bluetooth Version : V5.3

Antenna Description : PCB Antenna, 2.3dBi(Max.)

Exposure category : General population/uncontrolled environment

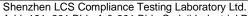
EUT Type : Production Unit Device Type : Mobile Device

2. 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 modelled or measured field strengths or power density, is \leq 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.







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3. Limit

3. 1 Refer Evaluation Method

ANSI C95.1–2019: IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz

<u>FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06:</u> Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies.

FCC CFR 47 part1 1.1310: Radiofrequency radiation exposure limits.

FCC CFR 47 part2 2.1091: Radiofrequency radiation exposure evaluation: mobile devices.

3. 2 Limit

Limits for Maximum Permissible Exposure (MPE)/Controlled Exposure

Frequency	Electric Field	Magnetic Field	Power Density	Averaging Time
Range(MHz)	Strength(V/m)	Strength(A/m)	(mW/cm²)	(minute)
Par I'ca	Limits for Oc	cupational/Controll		TCS.
0.3 – 3.0 614		1.63		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	500 – 100,000 /		5	6
	0.3 – 3.0 3.0 – 30 30 – 300 30 – 1500	Range(MHz) Strength(V/m) Limits for Oc. 0.3 – 3.0 614 3.0 – 30 1842/f 30 – 300 61.4 300 – 1500 /	Range(MHz) Strength(V/m) Strength(A/m) Limits for Occupational/Controll 0.3 - 3.0 614 1.63 3.0 - 30 1842/f 4.89/f 30 - 300 61.4 0.163 300 - 1500 / /	Range(MHz) Strength(V/m) Strength(A/m) (mW/cm²) Limits for Occupational/Controlled Exposure 0.3 - 3.0 614 1.63 (100) * 3.0 - 30 1842/f 4.89/f (900/f²)* 30 - 300 61.4 0.163 1.0 300 - 1500 / / f/300

Limits for Maximum Permissible Exposure (MPE)/Uncontrolled Exposure

- 1					
	Frequency	Electric Field	Magnetic Field	Power Density	Averaging Time
	Range(MHz)	Strength(V/m)	Strength(A/m)	(mW/cm²)	(minute)
		Limits for Occ	upational/Uncontro	lled Exposure	
	0.3 – 3.0 614		1.63	(100)_*	30
	3.0 - 30	824/f	2.19/f	(180/f ²)*	30
3	30 - 300	27.5	ab 0.073	0.2	30
6	300 – 1500	Westing Testing	/	f/1500	30
	1500 – 100,000	Y	1	1.0	30

F=frequency in MHz

4. MPE Calculation Method

Predication of MPE limit at a given distance Equation from page 18 of OET Bulletin 65, Edition 97-01

S=PG/4πR²

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

5. Antenna Information

EUT can only use antennas certificated as follows provided by manufacturer;

Internal/External	Antenna type and	Operate frequency	Maximum	Notes
Identification	antenna number	band	antenna gain	
Antenna	PCB Antenna	2400-2500 MHz	2.3dBi	BT Antenna
	- 1/2		11/2	



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^{*=}Plane-wave equivalent power density



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6. Conducted Power

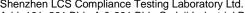
[BT]

		TARK AS	I A S
Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
	00	2402	0.04
GFSK	39	2441	0.27
	79	2480	0.36
π/4-DQPSK	00	2402	-0.31
	39	2441	-0.02
	79	2480	0
8-DPSK	00	2402	-0.13
	39	2441	0.09
	79	2480	0.14

7. Manufacturing Tolerance

GFSK(Peak)								
Channel	Channel 00	Channel 39	Channel 78					
Target (dBm)	0	0	0					
Tolerance ± (dB)	1.0	1.0	1.0					
	π/4-DQPSK(Peak)							
Channel	Channel 00	Channel 39	Channel 78					
Target (dBm)	0	0	0					
Tolerance ± (dB)	1.0	1.0	1.0					
	8-DPSK(Peak)							
Channel Channel 00		Channel 39	Channel 78					
Target (dBm)	0	0	0					
Tolerance ± (dB)	1.0	1.0	1.0					





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8. Measurement Results

8.1 Standalone MPE Evaluation

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 the used antenna refer to antenna information, the RF power density can be obtained.

[BT]

Modulation Type	Output power		Antenna	Antenna	MPE	MPE
	dBm mW	, M/ore	Gain	Gain		Limits
		IIIVV	(dBi)	(linear)	(mW/cm2)	(mW/cm2)
GFSK	1.0	1.2589	2.3	1.6982	0.000462	1.0000
π/4-DQPSK	1.0	1.2589	2.3	1.6982	0.000462	1.0000
8-DPSK	1.0	1.2589	2.3	1.6982	0.000462	1.0000

Remark:

- 1. Output power including tune-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.

For FM:

Max Field Strength:60.31dBuV/m@3m

EIRP=E-104.8+20Log3=-44.49+9.54=-34.95dBm

Maximum conducted power: -34.95dBm

Tune up<FM>

Frequency	Frequency 98.1MHz		
Target (dBm)	-34		
Tolerance ± (dB)	1.0		

Modulation	Out	put power	Antenna	Antenna	Distance	MPE	MPE
Type	dBm	mW	Gain	Gain	(m)	(mW/m2)	Limits
3 1			(dBi)	(linear)	, ,	,	(mW/cm2)
FM	-33	0.0005	0	1.0000	0.2	0.0000010	0.2

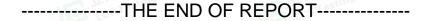
8.2 Simultaneous Transmission MPE Evaluation

The EUT equiped with one BT module and one FM module. So need consider simultaneous transmission.

0.00000010+0.000462=0.00046210<1 PASS

9. 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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