Maximum Permissible Exposure Report

Product Information

EUT	:WIFI TOUCH SCREEN KARAOKE SYSTEM
Model Number	:ISM9011, ISM9022, ISM9023, ISM9027, ISM9022XX, ISM9023XX, ISM9027XX (XX means unit color, it can be A to Z or N/A), ISM9011XX
Model Declaration	:All the same except for the model name and color
Test Model	:ISM9011
Power Supply	:AC 100-240V 50/60Hz by adapter
Hardware version	:SMC9010_V21
Software version	:V1.0

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 ≤ 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.

3. Limit

3. 1 Refer evaluation method

ANSI C95.1–1999: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.
FCC KDB publication 447498 D01 General 1 RF Exposure Guidance v06: 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 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

4. MPE Calculation Method

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

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

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

5. Antenna Information

Antenna Gain and type refer to Antenna specification

6. Conducted Power

Bluetooth(BDR+EDR)

Test Mode	Antenna	Frequency[MHz]	Result[dBm]
DH5	Ant1	2402	-1.50
DH5	Ant1	2441	-0.94
DH5	Ant1	2480	-1.12
2DH5	Ant1	2402	-1.27
2DH5	Ant1	2441	-0.61
2DH5	Ant1	2480	-0.95
3DH5	Ant1	2402	-0.65
3DH5	Ant1	2441	-0.17
3DH5	Ant1	2480	-0.32

WiFi 2.4GHz Band

Test Mode	Antenna	Frequency[MHz]	Result [dBm]
11B	Ant1	2412	9.78
11B	Ant1	2437	8.44
11B	Ant1	2462	10.76
11G	Ant1	2412	12.37
11G	Ant1	2437	11.55
11G	Ant1	2462	11.92
11N20SISO	Ant1	2412	11.12
11N20SISO	Ant1	2437	10.35
11N20SISO	Ant1	2462	10.66

5G Band
UNII-1 Band

TestMode	Antenna	Frequency[MHz]	Conducted Power[dBm]
11A	Ant1	5180	9.02
11A	Ant1	5200	8.84
11A	Ant1	5240	10.16
11N20SISO	Ant1	5180	8.99
11N20SISO	Ant1	5200	8.78
11N20SISO	Ant1	5240	12.51
11AC20SISO	Ant1	5180	11.57
11AC20SISO	Ant1	5200	11.07
11AC20SISO	Ant1	5240	11.18

UNII-3 Band

TestMode	Antenna	Frequency[MHz]	Conducted Power[dBm]
11A	Ant1	5745	12.57
11A	Ant1	5785	11.30
11A	Ant1	5825	10.14
11N20SISO	Ant1	5745	9.78
11N20SISO	Ant1	5785	11.14
11N20SISO	Ant1	5825	9.90
11AC20SISO	Ant1	5745	10.24
11AC20SISO	Ant1	5785	9.30
11AC20SISO	Ant1	5825	8.64

7. Manufacturing Tolerance

Bluetooth(BDR+EDR)

GFSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	-2.0	-1.5	-1.5
Tolerance ±(dB)	1	1	1
π/4-DQPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	-2	-1	-1.5
Tolerance ±(dB)	1	1	1
8-DPSK (Peak)			
Channel	Channel 0	Channel 39	Channel 78
Target (dBm)	-1	-0.5	-1
Tolerance ±(dB)	1	1	1

WiFi 2.4GHz Band

IEEE 802.11b(Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	9.5	8	10.5
Tolerance ±(dB)	1	1	1
IEEE 802.11g(Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	12	11	11.5
Tolerance ±(dB)	1	1	1
IEEE 802.11n HT20(Average)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	10.5	10	10
Tolerance ±(dB)	1	1	1

UNII-1 Band

IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	8.5	8.5	9.5
Tolerance ±(dB)	1	1	1
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	8.5	8.5	12
Tolerance ±(dB)	1	1	1
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11	10.5	10.5
Tolerance ±(dB)	1	1	1

UNII-3 Band

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	12	11	9.5
Tolerance ±(dB)	1	1	1
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9.5	10.5	9.5
Tolerance ±(dB)	1	1	1
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9.5	9	8
Tolerance ±(dB)	1	1	1

8. Measurement Results

8.1 Standalone MPE

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.

Bluetooth(BDR+EDR)

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
GFSK	-0.5	0.8913	-0.58	0.8750	0.0002	1.0000
π/4-DQPSK	0.0	1.0000	-0.58	0.8750	0.0002	1.0000
8-DPSK	0.5	1.1220	-0.58	0.8750	0.0002	1.0000

WiFi 2.4GHz Band

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
IEEE 802.11b	11.5	14.1254	5.5	3.5481	0.0100	1.0000
IEEE 802.11g	13.0	19.9526	5.5	3.5481	0.0141	1.0000
IEEE 802.11n HT20	11.5	14.1254	5.5	3.5481	0.0100	1.0000

UNII-1 Band

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
IEEE 802.11a	10.5	11.2202	3.17	2.0749	0.0046	1.0000
IEEE 802.11n HT20	13.0	19.9526	3.17	2.0749	0.0082	1.0000
IEEE 802.11ac VHT20	12.0	15.8489	3.17	2.0749	0.0065	1.0000

UNII-3 Band – Ant 1

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm^2)	MPE Limits (mW/cm^2)
	dBm	mW				
IEEE 802.11a	13.0	19.9526	3.39	2.1827	0.0087	1.0000
IEEE 802.11n HT20	11.5	14.1254	3.39	2.1827	0.0061	1.0000
IEEE 802.11ac VHT20	10.5	11.2202	3.39	2.1827	0.0049	1.0000

Remark:
1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

8.2 Simultaneous Transmission MPE
Bluetooth + Wi-Fi

Maximum MPE Ratio	Maximum MPE Ratio	∑MPE Ratio	Limit	Results
0.0002	0.0141	0.0143	1	PASS

Remark:
1. Output power including tune-up tolerance;
2. MPE evaluate distance is 20cm from user manual provide by manufacturer;

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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