

Maximum Permissible Exposure Report

1. Product Information

FCC ID:	2APN5RFBRIDGE
Product name	433MHz RF Bridge
Test Model	RF Bridge
Power supply	Input: 5V $\pm$ 1A
Operation frequency	2.412-2.462GHz for 2.4G WIFI 433MHz for SRD
Antenna Gain	PCB Antenna, 1.0dBi for 2.4G WIFI Internal Antenna, 2.0dBi(Max.) for SRD
Hardware version	433RFBRIGE R2 V1.0
Software version	FWRF-BG85-BRIDGE-8285-V2.7.0
Channel Number	11 channels for 20MHz bandwidth (2412~2462MHz) 1 channel for SRD
Channel Spacing	5MHz for 2.4G WIFI
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 ≤ 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

ES-D4 can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
PCB Antenna	2000 MHz – 2500 MHz	1.0 dBi	WiFi Antenna

6. Conducted Power

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
IEEE 802.11b	1	2412	10.98
	6	2437	11.12
	11	2462	11.15
IEEE 802.11g	1	2412	11.01
	6	2437	11.24
	11	2462	11.23
IEEE 802.11n HT20	1	2412	10.88
	6	2437	10.79
	11	2462	11.06

7. Measurement Results

2.4GWIFI

IEEE 802.11b (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	10.0	11.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11g (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	11.0	11.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
IEEE 802.11n20 (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	10.0	10.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0

8. Evaluation Results

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

Band/Mode	f (GHz)	RF output power		Antenna Gain (dBi)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
		dBm	mW				
IEEE 802.11b	2.462	12	15.8489	1.0	100%	0.0040	1.0000
IEEE 802.11g	2.437	12	15.8489	1.0	100%	0.0040	1.0000
IEEE 802.11n HT20	2.462	12	15.8489	1.0	100%	0.0040	1.0000

Remark:

1. Output power including turn-up tolerance;
2. Output power is burst average power;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer;
4. MPE values = $PG/4\pi R^2$

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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