

FCC RF Exposure Evaluation

1. Product Information

FCC ID	2AVNB-SCU41-BYOD
Product name	18G 4x1 Presentation Switcher with Soft Codec & Wireless BYOD
Model number	SCU41-BYOD, SCU41-BYOD-IP
Model Declaration	PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power supply	Input: 24V $\overline{\sim}$ 5A For AC Adapter Input :100-240V~, 50/60Hz , 2.0A Output: 24.0V $\overline{\sim}$ 5.0A
Modulation Type	IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM,QPSK,BPSK) IEEE 802.11a/n/ac: OFDM
Antenna Type	External Antenna
Antenna Gain	5dBi
Hardware version	AA2
Software version	V1.0.4
FCC Operation frequency	2412MHz-2462MHz 5180MHz ~ 5240MHz 5745-5825MHz
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

Artemis Antenna can only use antennas certificated as follows provided by manufacturer;

Internal Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Note
Antenna	External Antenna	2412MHz-2462MHz 5180MHz ~ 5240MHz 5745-5825MHz	5dBi	WIFI Antenna

6. Conducted Power

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
11B	1	2412	12.69
	6	2437	12.65
	11	2462	12.19
11G	1	2412	12.38
	6	2437	12.31
	11	2462	10.87
11N20SISO	1	2412	10.13
	6	2437	11.44
	11	2462	11.53
11N40SISO	3	2422	11.24
	6	2437	11.67
	9	2452	11.84
11A(5.2G)	36	5180	8.53
	40	5200	8.83
	48	5240	8.6
11N20 SISO(5.2G)	36	5180	8.26
	40	5200	6.67
	48	5240	7.02
11N40 SISO(5.2G)	38	5190	8.08
	46	5230	8.19
11AC20 SISO(5.2G)	36	5180	9.32
	40	5200	8.94
	48	5240	8.62
11AC40 SISO(5.2G)	38	5190	8.22
	46	5230	8.43
11AC80 SISO(5.2G)	42	5210	7.4
11A(5.8G)	149	5745	7.91
	157	5785	8.82
	165	5825	9.63
11N20 SISO(5.8G)	149	5745	7.7
	157	5785	9.1
	165	5825	8.89
11N40 SISO(5.8G)	151	5755	7.89
	159	5795	10.75
11AC20 SISO(5.8G)	149	5745	9.32
	157	5785	8.94
	165	5825	8.62
11AC40 SISO(5.8G)	151	5755	8.22
	159	5795	8.43
11AC80 SISO(5.8G)	155	5775	7.22

7. Manufacturing Tolerance

11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	12.0	12.0	12.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	12.0	12.0	10.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20SISO (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
11N40SISO (Peak)			
Channel	Channel 3	Channel 6	Channel 9
Target (dBm)	11.0	11.0	11.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11A (5.2G) (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	8.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (5.2G) (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	8.0	6.0	7.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 SISO (5.2G) (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	8.0	8.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
11AC20 SISO (5.2G) (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	9.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 SISO (5.2G) (Average)			
Channel	Channel 38	Channel 46	/
Target (dBm)	8.0	8.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/

11AC80 SISO (5.2G) (Average)			
Channel	Channel 42	/	/
Target (dBm)	7.0	/	/
Tolerance $\pm$ (dB)	1.0	/	/
11A (5.8G) (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	7.0	8.0	9.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N20 SISO (5.8G) (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	7.0	9.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11N40 SISO (5.8G) (Average)			
Channel	Channel 151	Channel 59	/
Target (dBm)	7.0	10.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
11AC20 SISO (5.8G) (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9.0	8.0	8.0
Tolerance $\pm$ (dB)	1.0	1.0	1.0
11AC40 SISO (5.8G) (Average)			
Channel	Channel 151	Channel 59	/
Target (dBm)	8.0	8.0	/
Tolerance $\pm$ (dB)	1.0	1.0	/
11AC80 SISO (5.8G) (Average)			
Channel	Channel 155	/	/
Target (dBm)	7.0	/	/
Tolerance $\pm$ (dB)	1.0	/	/

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, $r = 20\text{cm}$, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

[Antenna]

2.4GWIFI

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW			
IEEE 802.11b	13.0	19.9526	5	0.0126	1.0000
IEEE 802.11g	13.0	19.9526	5	0.0126	1.0000
IEEE 802.11n HT20	12.0	15.8489	5	0.0100	1.0000
IEEE 802.11n HT40	12.0	15.8489	5	0.0100	1.0000

5.2GWIFI

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW			
IEEE 802.11a	9.0	7.9433	5	0.0050	1.0000
IEEE 802.11n20	9.0	7.9433	5	0.0050	1.0000
IEEE 802.11n40	9.0	7.9433	5	0.0050	1.0000
IEEE 802.11ac20	10.0	10.0000	5	0.0063	1.0000
IEEE 802.11ac40	9.0	7.9433	5	0.0050	1.0000
IEEE 802.11ac80	8.0	6.3096	5	0.0040	1.0000

5.8GWIFI

Band/Mode	RF output power		Antenna Gain (dBi)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW			
IEEE 802.11a	10.0	12.5893	5	0.0063	1.0000
IEEE 802.11n20	10.0	10.0000	5	0.0063	1.0000
IEEE 802.11n40	11.0	12.5893	5	0.0079	1.0000
IEEE 802.11ac20	10.0	10.0000	5	0.0063	1.0000
IEEE 802.11ac40	9.0	7.9433	5	0.0050	1.0000
IEEE 802.11ac80	8.0	6.3096	5	0.0040	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

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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