

Maximum Permissible Exposure Report

1. Product Information

FCC ID	:	2A2OC-PEGV14
EUT	:	Fivestars-Pegasus
Test Model	:	SBC2.0a
Power Supply	:	Input: 12V---2A
Hardware Version	:	V14
Software Version	:	Android 9.0
Bluetooth	:	
Frequency Range	:	2402MHz ~ 2480MHz
Chanel Number	:	40 channels for Bluetooth V5.0 (DTS)
Chanel Spacing	:	2MHz for Bluetooth V5.0 (DTS)
Modulation Type	:	GFSK for Bluetooth V5.0 (DTS)
Bluetoth Version	:	V5.0
Antenna Description	:	ANT0: PCB Antenna, 2.65dBi (max.)
WIFI(2.4G Band)	:	
Frequency Range	:	2412MHz ~ 2462MHz
Channel Spacing	:	5MHz
Channel Number	:	11 Channels for 20MHz bandwidth (2412~2462MHz)
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)
Antenna Description	:	ANT0: PCB Antenna, 2.65dBi(Max.) ANT1: PCB Antenna, 2.65dBi(Max.)
5.2G WLAN	:	
Frequency Range	:	5180MHz-5240MHz
Channel Number	:	4 channels for 20MHz bandwidth(5180MHz-5240MHz) 2 channels for 40MHz bandwidth(5190MHz~5230MHz) 1 channels for 80MHz bandwidth(5210MHz)
Modulation Type	:	IEEE 802.11a/n/ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	ANT0: PCB Antenna, 1.83dBi(Max.) ANT1: PCB Antenna, 1.83dBi(Max.)
5.8G WLAN	:	
Frequency Range	:	5745MHz-5825MHz
Channel Number	:	5 channels for 20MHz bandwidth(5745MHz-5825MHz) 2 channels for 40MHz bandwidth(5755MHz~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Modulation Type	:	IEEE 802.11a/n/ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	ANT0: PCB Antenna, 3.0dBi(Max.) ANT1: PCB Antenna, 3.0dBi(Max.)
Exposure category	:	General population/uncontrolled environment
EUT Type	:	Production Unit
Device Type	:	Mobile Devices



2. Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	Certificate
---	ADAPTER	MAUS-120200	---	FCC SDOC

Note: The adapter is only used for test.

3. 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.



4. Limit

4. 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

4. 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

5. 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

6. Antenna Information

Fivestars-Pegasus can only use antennas certificated as follows provided by manufacturer;

Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
PCB Antenna 0	2400MHz-2500MHz 5150MHz-5850MHz	2.65 dBi @ 2.4G 1.83 dBi @ 5.2G 3.0 dBi @ 5.8G	BT/WiFi Antenna
PCB Antenna 1	2400MHz-2500MHz 5150MHz-5850MHz	2.65 dBi @ 2.4G 1.83 dBi @ 5.2G 3.0 dBi @ 5.8G	WiFi Antenna



7. Conducted Power

[2BLE Max Conducted Power]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
BT 2LE	0	2402	-3.29
	19	2440	-3.29
	39	2480	-4.41

[2.4GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	ANT 0 Max Conducted Power(dBm)	ANT 1 Max Conducted Power(dBm)
11B	1	2412	15.92	16.18
	6	2437	15.96	16.01
	11	2462	15.62	16.14
11G	1	2412	14.60	14.40
	6	2437	14.42	14.70
	11	2462	14.12	14.06
11N20SISO	1	2412	14.67	14.45
	6	2437	14.47	14.63
	11	2462	14.31	14.06

[5.2GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	ANT 0 Max Conducted Power(dBm)	ANT 1 Max Conducted Power(dBm)
11A	36	5180	10.18	12.53
	40	5200	10.73	13.19
	48	5240	10.22	12.17
11N20 SISO	36	5180	10.58	12.11
	40	5200	10.84	12.15
	48	5240	10.42	12.51
11N40 SISO	38	5190	10.91	12.21
	46	5230	8.09	11.74
11AC20 SISO	36	5180	10.50	11.84
	40	5200	10.49	12.25
	48	5240	10.87	12.01
11AC40 SISO	38	5190	10.88	12.37
	46	5230	11.00	12.44
11AC80 SISO	42	5210	10.00	10.34



[5.8GWIFI Max Conducted Power]

Mode	Channel	Frequency (MHz)	ANT 0 Max Conducted Power(dBm)	ANT 1 Max Conducted Power(dBm)
11A	149	5745	11.35	10.09
	157	5785	10.66	11.33
	165	5825	11.57	11.58
11N20 SISO	149	5745	11.27	11.04
	157	5785	10.49	11.29
	165	5825	10.14	11.25
11N40 SISO	151	5755	10.92	11.35
	159	5795	10.95	11.87
11AC20 SISO	149	5745	10.26	11.30
	157	5785	11.00	11.03
	165	5825	10.69	11.15
11AC40 SISO	151	5755	11.08	11.29
	159	5795	11.17	11.30
11AC80 SISO	155	5775	11.28	10.56



8. Measurement Results

2BLE

BT LE (Peak)			
Channel	Channel 0	Channel 19	Channel 39
Target (dBm)	-3.0	-3.0	-4.0
Tolerance \pm (dB)	1.0	1.0	1.0

2.4GWIFI (ANT0)

11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	15.0	15.0	15.0
Tolerance \pm (dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N20SISO (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0

2.4GWIFI (ANT1)

11B (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	16.0	16.0	16.0
Tolerance \pm (dB)	1.0	1.0	1.0
11G (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N20SISO (Peak)			
Channel	Channel 1	Channel 6	Channel 11
Target (dBm)	14.0	14.0	14.0
Tolerance \pm (dB)	1.0	1.0	1.0



5.2GWIFI (ANT0)

11A (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	10.0	10.0	10.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	10.0	10.0	10.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N40 SISO (Peak)			
Channel	Channel 38	Channel 46	
Target (dBm)	10.0		8.0
Tolerance \pm (dB)	1.0		1.0
11AC20 SISO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	10.0	10.0	10.0
Tolerance \pm (dB)	1.0	1.0	1.0
11AC40 SISO (Peak)			
Channel	Channe38	Channel 46	
Target (dBm)	10.0		11.0
Tolerance \pm (dB)	1.0		1.0
11AC80 SISO (Peak)			
Channel	Channel 42		
Target (dBm)	10.0		
Tolerance \pm (dB)	1.0		

5.2GWIFI (ANT1)

11A (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	12.0	13.0	12.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	12.0	12.0	12.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N40 SISO (Peak)			
Channel	Channel 38	Channel 46	
Target (dBm)	12.0		11.0
Tolerance \pm (dB)	1.0		1.0
11AC20 SISO (Peak)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	11.0	12.0	12.0
Tolerance \pm (dB)	1.0	1.0	1.0
11AC40 SISO (Peak)			
Channel	Channe38	Channel 46	
Target (dBm)	12.0		12.0
Tolerance \pm (dB)	1.0		1.0
11AC80 SISO (Peak)			
Channel	Channel 42		
Target (dBm)	10.0		
Tolerance \pm (dB)	1.0		



5.8GWIFI (ANT0)

11A (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	10.0	11.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	10.0	10.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N40 SISO (Peak)			
Channel	Channel 151		Channel 159
Target (dBm)	1.0		10.0
Tolerance \pm (dB)	1.0		1.0
11AC20 SISO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	10.0	11.0	10.0
Tolerance \pm (dB)	1.0	1.0	1.0
11AC40 SISO (Peak)			
Channel	Channe151		Channel 159
Target (dBm)	11.0		11.0
Tolerance \pm (dB)	1.0		1.0
11AC80 SISO (Peak)			
Channel	Channel 155		
Target (dBm)	11.0		
Tolerance \pm (dB)	1.0		

5.8GWIFI (ANT1)

11A (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	1.0	11.0	11.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N20 SISO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	11.0	11.0
Tolerance \pm (dB)	1.0	1.0	1.0
11N40 SISO (Peak)			
Channel	Channel 151		Channel 159
Target (dBm)	11.0		11.0
Tolerance \pm (dB)	1.0		1.0
11AC20 SISO (Peak)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	11.0	11.0	11.0
Tolerance \pm (dB)	1.0	1.0	1.0
11AC40 SISO (Peak)			



Channel	Channe151	Channel 159
Target (dBm)	11.0	11.0
Tolerance \pm (dB)	1.0	1.0
11AC80 SISO (Peak)		
Channel	Channel 155	
Target (dBm)	10.0	
Tolerance \pm (dB)	1.0	

9. Evaluation Results

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

Mode	RF output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
BLE	-2.0	0.6310	2.65	1.8408	0.0002	1.0
2.4G WIFI (ANT0)	16.0	39.8107	2.65	1.8408	0.0146	1.0
2.4G WIFI (ANT1)	17.0	50.1187	2.65	1.8408	0.0184	1.0
5.2G WIFI (ANT0)	12.0	15.8489	1.83	1.5241	0.0048	1.0
5.2G WIFI (ANT1)	14.0	25.1189	1.83	1.5241	0.0076	1.0
5.8G WIFI (ANT0)	12.0	15.8489	3.0	1.9953	0.0063	1.0
5.8G WIFI (ANT1)	12.0	15.8489	3.0	1.9953	0.0063	1.0

Remark:

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

9.2 Simultaneous Transmission MPE

The sample support two antennas, so need consider simultaneous transmission;

Simultaneous transmission MPE

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;

Σ of MPE ratios ≤ 1.0

Mode	MPE1 (mW/cm ²)	MPE2 (mW/cm ²)	Σ MPE ratios	Limit	Results
2.4G WIFI+2.4G WIFI	0.0146	0.0184	0.033	1.0000	PASS

Remark:

The worst case results (2.4G WIFI MIMO Mode) were recorded.

10. Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

-----THE END OF REPORT-----