

**Maximum Permissible Exposure Report****1. Product Information**

FCC ID	: 2BDDS-AGRONAVE7
EUT	: 7-inch Rugged Embedded Computer
Test Model	: agroNave7
Power Supply	: Input: 9-36VDC, 14W
Hardware Version	: PC7108LV00220221207
Software Version	: v3.5.4
Bluetooth	
Frequency Range	: 2402MHz~2480MHz
Channel Number	: 79 channels for Bluetooth V5.0(DSS) 40 channels for Bluetooth V5.0 (DTS)
Channel Spacing	: 1MHz for Bluetooth V5.0 (DSS) 2MHz for Bluetooth V5.0 (DTS)
Modulation Type	: GFSK, $\pi/4$ -DQPSK, 8-DPSK for Bluetooth V5.0(DSS) GFSK for Bluetooth V5.0 (DTS)
Bluetooth Version	: V5.0
Antenna Description	: FPC Antenna, 4.0037dBi(Max.)
WIFI(2.4G Band)	
Frequency Range	: 2412MHz~2462MHz
Channel Spacing	: 5MHz
Channel Number	: 11 Channels for 20MHz bandwidth (2412~2462MHz) 7 Channels for 40MHz bandwidth (2422~2452MHz)
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	: FPC Antenna, 4.0037dBi(Max.)
WIFI(5.2G Band)	
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: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	: FPC Antenna, 4.6828dBi(Max.)
WIFI(5.8G Band)	
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: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	: FPC Antenna, 1.3802dBi(Max.)
3G	
Support Band	: ☒ WCDMA Band II (U.S.-Band) ☒ WCDMA Band V (U.S.-Band) ☐ WCDMA Band IV (U.S.-Band) ☐ WCDMA Band I (EU-Band) ☐ WCDMA Band VIII (EU-Band)
Release Version	: R7
Type Of Modulation	: QPSK,16QAM
Antenna Description	: FPC Antenna 3.6579dBi (max.) For WCDMA Band II 2.5806dBi (max.) For WCDMA Band V
LTE	
Support Band	: ☒ E-UTRA Band 2(U.S.-Band) ☒ E-UTRA Band 4(U.S.-Band) ☒ E-UTRA Band 12(U.S.-Band)
LTE Release Version	: R8
Type Of Modulation	: QPSK/16QAM
Antenna Description	: FPC Antenna 3.6579dBi (max.) For E-UTRA Band 2 1.0051dBi (max.) For E-UTRA Band 4 1.8079dBi (max.) For E-UTRA Band 12
Power Class	: Class 3
Exposure category	: General population/uncontrolled environment
EUT Type	: Production Unit
Device Type	: Mobile Devices



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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 C95.1-2019](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz 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.



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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/Uncontrolled 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



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5. Antenna Information

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

Internal/External Identification	Antenna type and antenna number	Operate frequency band	Maximum antenna gain	Notes
Internal	FPC Antenna	824-849MHz 1850-1910MHz 1850-1910MHz 1710-1755MHz 699-716MHz	3.6579dBi (max.) For WCDMA Band II 2.5806dBi (max.) For WCDMA Band V 3.6579dBi (max.) For E-UTRA Band 2 1.0051dBi (max.) For E-UTRA Band 4 1.8079dBi (max.) For E-UTRA Band 12	3G/LTE Antenna
Internal	FPC Antenna	2400-2500MHz	4.0037dBi	BT/BLE
Internal	FPC Antenna	2400-2500MHz	4.0037dBi	2.4GWIFI
Internal	FPC Antenna	5150-5250MHz 5725-5850MHz	4.6828dBi For5.2GWIFI 1.3802dBi For5.2GWIFI	5.2GWIFI/5.8 GWIFI

6. Conducted Power

[BT]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	ANT Max. Tune Up Power (dBm)
GFSK	00	2402	-0.01	0±1.0
	39	2441	0.27	0±1.0
	79	2480	0.34	0±1.0
$\pi/4$ -DQPSK	00	2402	-0.06	0±1.0
	39	2441	0.02	0±1.0
	79	2480	0.13	0±1.0
8-DPSK	00	2402	0.02	0±1.0
	39	2441	0.39	0±1.0
	79	2480	0.10	0±1.0

[BLE]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	ANT Max. Tune Up Power (dBm)
GFSK	0	2402	-1.10	-1.0±1.0
	19	2440	-0.84	0±1.0
	39	2480	-0.81	0±1.0





[2.4G WIFI]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	ANT Max. Tune Up Power (dBm)
IEEE 802.11b	1	2412	15.39	15.0±1.0
	6	2437	15.10	15.0±1.0
	11	2462	14.67	14.0±1.0
IEEE 802.11g	1	2412	14.44	14.0±1.0
	6	2437	14.99	14.0±1.0
	11	2462	13.64	13.0±1.0
IEEE 802.11n HT20	1	2412	13.64	13.0±1.0
	6	2437	12.83	12.0±1.0
	11	2462	13.02	13.0±1.0
IEEE 802.11n HT40	3	2422	13.59	13.0±1.0
	6	2437	13.42	13.0±1.0
	9	2452	12.61	12.0±1.0

[5.2G WIFI]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	ANT Max. Tune Up Power (dBm)
IEEE 802.11a	36	5180	11.78	11.0±1.0
	40	5200	10.51	10.0±1.0
	48	5240	9.80	9.0±1.0
IEEE 802.11n HT20	36	5180	11.26	11.0±1.0
	40	5200	10.86	10.0±1.0
	48	5240	9.73	9.0±1.0
IEEE 802.11n HT40	38	5190	11.25	11.0±1.0
	46	5230	9.83	9.0±1.0
IEEE 802.11ac VHT20	36	5180	11.56	11.0±1.0
	40	5200	11.02	11.0±1.0
	48	5240	9.98	9.0±1.0
IEEE 802.11ac VHT40	38	5190	10.75	10.0±1.0
	46	5230	9.55	9.0±1.0
IEEE 802.11ac VHT80	42	5210	10.06	10.0±1.0

[5.8G WIFI]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	ANT Max. Tune Up Power (dBm)
IEEE 802.11a	149	5745	12.26	12.0±1.0
	157	5785	11.23	11.0±1.0
	165	5825	10.91	10.0±1.0
IEEE 802.11n HT20	149	5745	12.11	12.0±1.0
	157	5785	11.48	11.0±1.0
	165	5825	10.47	10.0±1.0
IEEE 802.11n HT40	151	5755	12.08	12.0±1.0
	159	5795	11.30	11.0±1.0
IEEE 802.11ac VHT20	149	5745	12.13	12.0±1.0
	157	5785	11.12	11.0±1.0
	165	5825	10.42	10.0±1.0
IEEE 802.11ac VHT40	151	5755	12.33	12.0±1.0
	159	5795	11.39	11.0±1.0
IEEE 802.11ac VHT80	155	5775	11.22	11.0±1.0



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[WCDMA Max Average Power]

Test Mode	Channel	Frequency (MHz)	Max Average Power (dBm)	ANT Max. Tune Up Power (dBm)
WCDMA Band II	Low	1852.4	23.46	23.0±1.0
	Middle	1880	23.57	23.0±1.0
	High	1907.6	23.30	23.0±1.0
WCDMA Band V	Low	1712.4	23.16	23.0±1.0
	Middle	1732.6	23.15	23.0±1.0
	High	1752.6	22.92	22.0±1.0

[LTE Max Average Power]

Test Mode		Channel	Max Average Power (dBm)	ANT Max. Tune Up Power (dBm)
LTE	Band 2	LCH	21.15	21.0±1.0
		MCH	21.60	21.0±1.0
		HCH	22.21	22.0±1.0
	Band 4	LCH	22.63	22.0±1.0
		MCH	22.20	22.0±1.0
		HCH	22.32	22.0±1.0
	Band 12	LCH	23.52	23.0±1.0
		MCH	23.13	23.0±1.0
		HCH	23.23	23.0±1.0

7. Measurement Results

7.1 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.

[BT]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
GFSK	1.0	1.2589	4.0037	2.5140	0.0006	1.0000
$\pi/4$ -DQPSK	1.0	1.2589	4.0037	2.5140	0.0006	1.0000
8-DPSK	1.0	1.2589	4.0037	2.5140	0.0006	1.0000

[BT LE]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
BT LE	1.0	1.2589	4.0037	2.5140	0.0006	1.0000





[2.4G WLAN]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11b	16.0	39.8107	4.0037	2.5140	0.0199	1.0000
IEEE 802.11g	15.0	31.6228	4.0037	2.5140	0.0158	1.0000
IEEE 802.11n HT20	14.0	25.1189	4.0037	2.5140	0.0126	1.0000
IEEE 802.11n HT40	14.0	25.1189	4.0037	2.5140	0.0126	1.0000

[5.2G WLAN]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	12.0	15.8489	4.6828	2.9395	0.0093	1.0000
IEEE 802.11n HT20	12.0	15.8489	4.6828	2.9395	0.0093	1.0000
IEEE 802.11n HT40	12.0	15.8489	4.6828	2.9395	0.0093	1.0000
IEEE 802.11ac VHT20	12.0	15.8489	4.6828	2.9395	0.0093	1.0000
IEEE 802.11ac VHT40	11.0	12.5893	4.6828	2.9395	0.0074	1.0000
IEEE 802.11ac VHT80	11.0	12.5893	4.6828	2.9395	0.0074	1.0000

[5.8G WLAN]

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	1.3802	1.3741	0.0055	1.0000
IEEE 802.11n HT20	13.0	19.9526	1.3802	1.3741	0.0055	1.0000
IEEE 802.11n HT40	13.0	19.9526	1.3802	1.3741	0.0055	1.0000
IEEE 802.11ac VHT20	13.0	19.9526	1.3802	1.3741	0.0055	1.0000
IEEE 802.11ac VHT40	13.0	19.9526	1.3802	1.3741	0.0055	1.0000
IEEE 802.11ac VHT80	12.0	15.8489	1.3802	1.3741	0.0055	1.0000





Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)	MPE2
	dBm	mW					
WCDMA Band II	24.00	251.1886	3.6579	2.3216	0.1160	0.5493	0.2112
WCDMA Band V	24.00	251.1886	2.5806	1.8116	0.0905	0.4660	0.1942
LTE Band 2	23.00	199.5262	3.6579	2.3216	0.0922	1.0000	0.0922
LTE Band 4	23.00	199.5262	1.0051	1.2604	0.0500	1.0000	0.0500
LTE Band 12	24.00	251.1886	1.8079	1.5163	0.0758	0.4660	0.1627

Remark:

1. Output power including turn-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.

8.2 Simultaneous Transmission MPE Evaluation

The sample support one BT&BLE&2.4GWLAN&5.2GWIFI, 5.8GWIFI another one LTE&WCDMA transmit antenna, so need consider simultaneous transmission;

PMR cannot work with LTE&WCDMA at the same time

Simultaneous transmission MPE

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

$\sum$ of MPE ratios ≤ 1.0

The Worst Mode	MPE1 Max.	MPE2 Max.	$\sum$ MPE ratios	Limit	Results
2.4GWIFI+WCDMA	0.0199	0.2112	0.2311	1.000	Pass

9. 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-----



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