Maximum Permissible Exposure Report

1. Product Information

Applicant	:	GDU-Tech Co., Ltd.
Address	:	Building 2, No.5, Huanglongshan South Road, Donghu New Technology Development ZoneWuhan 430074.China
EUT	:	Light Quadcopter UAV
Test Model	:	S220 Pro
Ratings	:	DC 14.4V by Battery, 8000mAh
Hardware Version	:	/
Software Version	:	/
2.4G SRD		
Frequency Range	:	2412MHz~2472.5MHz
Channel Number	:	12 Channel for 10MHz bandwidth(2412MHz~2472.5MHz) 12 channels for 20MHz bandwidth(2412MHz~2472.5MHz
Channel Spacing	:	5.5MHz
Modulation Type	:	OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	Antenna1: External Antenna, 1.42dBi(Max.) Antenna2: External Antenna, 0.7dBi(Max.)
5G SRD		
Frequency Range	:	5174MHz~5240MHz
Channel Number	:	7 channels for 10MHz bandwidth(5174MHz~5240MHz) 7 channels for 20MHz bandwidth(5174MHz~5240MHz)
Channel Spacing	:	11MHz
Modulation Type	:	OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	Antenna1: External Antenna, 0.21dBi(Max.) Antenna2: External Antenna, 0.62dBi(Max.)
5G SRD		
Frequency Range	:	5744MHz~5832MHz
Channel Number	:	9 channels for 10MHz bandwidth(5744MHz~5832MHz) 9 channels for 20MHz bandwidth(5744MHz~5832MHz)
Channel Spacing	:	11MHz
Modulation Type	:	OFDM (64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	Antenna1: External Antenna, 1.36dBi(Max.) Antenna2: External Antenna, 3.35dBi(Max.)
5.8GWIFI		
Frequency Range	:	5745MHz
Channel Number	:	1 channels for 20MHz bandwidth(5745MHz)

Modulation Type	:	802.11a/n: OFDM (64QAM, 16QAM, QPSK, BPSK) 802.11ac: OFDM (256QAM, 64QAM, 16QAM, QPSK, BPSK) 802.11ax: OFDMA (1024QAM, 256QAM, 64QAM, 16QAM, QPSK, BPSK)
Antenna Description	:	Antenna1: External Antenna, 3.96dBi(Max.) Antenna2: External Antenna, 4.06dBi(Max.)
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 C95.1–2019: 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.

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

5. Conducted Power

[2.4G SRD Ant1]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
10MHz Bandwidth	01	2412	12.68
	7	2445	12.71
	12	2472.5	12.69
20MHz Bandwidth	01	2412	11.14
	7	2445	11.52
	12	2472.5	11.09

[2.4G SRD Ant2]

Mode	Channel	Frequency (MHz)	Peak Conducted Output Power (dBm)
10MHz Bandwidth	01	2412	12.92
	7	2445	12.27
	12	2472.5	12.26
20MHz Bandwidth	01	2412	10.91
	7	2445	11.89
	12	2472.5	11.37

[5.2G SRD Ant1]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
10MHz Bandwidth	00	5174	12.82
	03	5207	11.49
	06	5240	10.79
20MHz Bandwidth	00	5174	13.15
	03	5207	11.97
	06	5240	14.35

[5.2G SRD Ant2]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
10MHz Bandwidth	00	5174	13.8
	03	5207	12.06
	06	5240	11.46
20MHz Bandwidth	00	5174	13.53
	03	5207	12.59
	06	5240	13.93

[5.8G SRD Ant1]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
10MHz Bandwidth	01	5744	13.62
	05	5788	13.6
	09	5832	13.09
20MHz Bandwidth	01	5744	15.18
	05	5788	17.02
	09	5832	16.17

[5.8G SRD Ant2]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
10MHz Bandwidth	01	5744	14.57
	05	5788	14.68
	09	5832	13.52
20MHz Bandwidth	01	5744	15.46
	05	5788	17.61
	09	5832	16.57

[5.8G WIFI Ant1]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
a	1	5745	13.12
n20	1	5745	11.47
ac20	1	5745	11.54
ax20	1	5745	11.61

[5.8G WIFI Ant2]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)
a	1	5745	12.54
n20	1	5745	12
ac20	1	5745	11.93
ax20	1	5745	11.97

6. Manufacturing Tolerance

[2.4G SRD Ant1]

10MHz Bandwidth (Peak)			
Channel	Channel 01	Channel 7	Channel 12
Target (dBm)	12.0	12.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
20MHz Bandwidth (Peak)			
Channel	Channel 01	Channel 7	Channel 12
Target (dBm)	11.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0

[2.4G SRD Ant2]

10MHz Bandwidth (Peak)			
Channel	Channel 01	Channel 7	Channel 12
Target (dBm)	12.0	12.0	12.0
Tolerance ±(dB)	1.0	1.0	1.0
20MHz Bandwidth (Peak)			
Channel	Channel 01	Channel 7	Channel 12
Target (dBm)	10.0	11.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0

[5.2G SRD Ant1]

10MHz Bandwidth (Average)			
Channel	Channel 00	Channel 03	Channel 06
Target (dBm)	12.0	11.0	10.0
Tolerance ±(dB)	1.0	1.0	1.0
20MHz Bandwidth (Average)			
Channel	Channel 00	Channel 03	Channel 06
Target (dBm)	13.0	11.0	14.0
Tolerance ±(dB)	1.0	1.0	1.0

[5.2G SRD Ant2]

10MHz Bandwidth (Average)			
Channel	Channel 00	Channel 03	Channel 06
Target (dBm)	13.0	12.0	11.0
Tolerance ±(dB)	1.0	1.0	1.0
20MHz Bandwidth (Average)			
Channel	Channel 00	Channel 03	Channel 06
Target (dBm)	13.0	12.0	13.0
Tolerance ±(dB)	1.0	1.0	1.0

[5.8G SRD Ant1]

10MHz Bandwidth (Average)			
Channel	Channel 01	Channel 05	Channel 09
Target (dBm)	13.0	13.0	13.0
Tolerance ± (dB)	1.0	1.0	1.0
20MHz Bandwidth (Average)			
Channel	Channel 01	Channel 05	Channel 09
Target (dBm)	15.0	17.0	16.0
Tolerance ± (dB)	1.0	1.0	1.0

[5.8G SRD Ant2]

10MHz Bandwidth (Average)			
Channel	Channel 01	Channel 05	Channel 09
Target (dBm)	14.0	14.0	13.0
Tolerance ± (dB)	1.0	1.0	1.0
20MHz Bandwidth (Average)			
Channel	Channel 01	Channel 05	Channel 09
Target (dBm)	15.0	17.0	16.0
Tolerance ± (dB)	1.0	1.0	1.0

[5.8G WIFI Ant1]

a (Average)	
Channel	Channel 1
Target (dBm)	13.0
Tolerance ±(dB)	1.0
n20 (Average)	
Channel	Channel 1
Target (dBm)	11.0
Tolerance ±(dB)	1.0
ac20 (Average)	
Channel	Channel 1
Target (dBm)	11.0
Tolerance ±(dB)	1.0
ax20 (Average)	
Channel	Channel 1
Target (dBm)	11.0
Tolerance ±(dB)	1.0

[5.8G WIFI Ant2]

a (Average)	
Channel	Channel 1
Target (dBm)	12.0
Tolerance ±(dB)	1.0
n20 (Average)	
Channel	Channel 1
Target (dBm)	12.0
Tolerance ±(dB)	1.0
ac20 (Average)	
Channel	Channel 1
Target (dBm)	11.0
Tolerance ±(dB)	1.0
ax20 (Average)	
Channel	Channel 1
Target (dBm)	11.0
Tolerance ±(dB)	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 =20cm, as well as the gain of the used antenna refer to antenna information, the RF power density can be obtained.

[2.4G SRD Ant1]

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
10MHz Bandwidth	13.0	19.9526	1.42	1.3868	0.0055	1.0000
20MHz Bandwidth	12.0	15.8489	1.42	1.3868	0.0044	1.0000

[2.4G SRD Ant2]

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
10MHz Bandwidth	13.0	19.9526	0.7	1.1749	0.0047	1.0000
20MHz Bandwidth	12.0	15.8489	0.7	1.1749	0.0037	1.0000

[5.2G SRD Ant1]

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
10MHz Bandwidth	13.0	19.9526	0.21	1.0495	0.0042	1.0000
20MHz Bandwidth	15.0	31.6228	0.21	1.0495	0.0066	1.0000

[5.2G SRD Ant2]

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
10MHz Bandwidth	14.0	25.1189	0.62	1.1535	0.0058	1.0000
20MHz Bandwidth	14.0	25.1189	0.62	1.1535	0.0058	1.0000

[5.8G SRD Ant1]

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
10MHz Bandwidth	14.0	25.1189	1.36	1.3677	0.0068	1.0000
20MHz Bandwidth	18.0	63.0957	1.36	1.3677	0.0172	1.0000

[5.8G SRD Ant2]

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
10MHz Bandwidth	15.0	31.6228	3.35	2.1627	0.0136	1.0000
20MHz Bandwidth	18.0	63.0957	3.35	2.1627	0.0271	1.0000

[5.8G WIFI Ant1]

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
a	14.0	25.1189	3.96	2.4889	0.0124	1.0000
n20	12.0	15.8489	3.96	2.4889	0.0078	1.0000
ac20	12.0	15.8489	3.96	2.4889	0.0078	1.0000
ax20	12.0	15.8489	3.96	2.4889	0.0078	1.0000

[5.8G WIFI Ant2]

Mode	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm2)	MPE Limits (mW/cm2)
	dBm	mW				
a	13.0	19.9526	4.06	2.5468	0.0101	1.0000
n20	13.0	19.9526	4.06	2.5468	0.0101	1.0000
ac20	12.0	15.8489	4.06	2.5468	0.0080	1.0000
ax20	12.0	15.8489	4.06	2.5468	0.0080	1.0000

Remark:
1. Output power including tune-up tolerance;
2. Output power was adjusted to duty cycle at 100% if measured duty cycle less than 98%;
3. MPE evaluate distance is 20cm from user manual provide by manufacturer.

7.2 Simultaneous Transmission MPE Evaluation

The EUT equiped with two 2.4G/5G SRD antenna(Not Support MIMO Function) and one 5.8GWIFI antenna so need consider simultaneous transmission;

According to KDB447498 for Transmitters used in mobile exposure conditions for simultaneous transmission operations;
∑∑of MPE ratios ≤ 1.0

Mode	MPE Antenna1_SRD (mW/cm2)	MPE Antenna1_5.8GW IFI (mW/cm2)	MPE Antenna2_5.8GW IFI (mW/cm2)	∑MPE ratios	Limit	Results
Antenna0+ Antenna1+ Antenna2	0.0055	0.0124	0.0101	0.028	1.0	PASS

8. Conclusion

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

10. Description of Test Facility

NVLAP Accreditation Code is 600167-0.
FCC Designation Number is CN5024.
CAB identifier is CN0071.
CNAS Registration Number is L4595.
Test Firm Registration Number: 254912.

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