

Maximum Permissible Exposure Report

1 PRODUCT INFORMATION

EUT	: DRONE
Model Number	: F11PRO 2, F11PRO 2-3B, F11PRO 2 Fly More, F11PRO 5, F11PRO 5-3B, F11PRO 5 Fly More, F11MINI, F11MINI-3B, F11MINI Fly More, F11MINI SE, F11MINI SE-3B, F11MINI SE Fly More, F11MINI 4K, F11MINI 4K-3B, F11MINI 4K Fly More, F11PRO 4K, F11PRO 4K-3B, F11PRO Fly More, F11Air, F11Air-3B, F11Air-Fly More
Model Declaration	: All the same except for the model name
Test Model	: F11PRO 2
Power Supply	: DC 7.7V by battery
Hardware version	: SM-A18-W4-V1.2
Software version	: V1.0

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

Antenna Gain and type refer to Antenna specification

6 CONDUCTED POWER

5G Band

UNII Band 1

Test Mode	Antenna	Frequency[MHz]	Result [dBm]
11A	Ant1	5180	8.66
11A	Ant2	5180	8.85
11A	Ant1	5200	8.92
11A	Ant2	5200	9.26
11A	Ant1	5240	9.82
11A	Ant2	5240	10.15
11N20MIMO	Ant1	5180	5.68
11N20MIMO	Ant2	5180	5.92
11N20MIMO	total	5180	8.81
11N20MIMO	Ant1	5200	5.58
11N20MIMO	Ant2	5200	6.26
11N20MIMO	total	5200	8.94
11N20MIMO	Ant1	5240	6.77
11N20MIMO	Ant2	5240	7.27
11N20MIMO	total	5240	10.04
11AC20MIMO	Ant1	5180	6.32
11AC20MIMO	Ant2	5180	5.48
11AC20MIMO	total	5180	8.93
11AC20MIMO	Ant1	5200	6.37
11AC20MIMO	Ant2	5200	5.72
11AC20MIMO	total	5200	9.07
11AC20MIMO	Ant1	5240	7.44
11AC20MIMO	Ant2	5240	6.69
11AC20MIMO	total	5240	10.09

UNII Band 3

Test Mode	Antenna	Frequency[MHz]	Result [dBm]
11A	Ant1	5745	9.80
11A	Ant2	5745	11.05
11A	Ant1	5785	6.93
11A	Ant2	5785	8.16
11A	Ant1	5825	5.88
11A	Ant2	5825	7.11
11N20MIMO	Ant1	5745	8.24
11N20MIMO	Ant2	5745	9.70
11N20MIMO	total	5745	12.04
11N20MIMO	Ant1	5785	7.20
11N20MIMO	Ant2	5785	8.71
11N20MIMO	total	5785	11.03
11N20MIMO	Ant1	5825	6.45
11N20MIMO	Ant2	5825	7.61
11N20MIMO	total	5825	10.08
11AC20MIMO	Ant1	5745	6.90
11AC20MIMO	Ant2	5745	7.70
11AC20MIMO	total	5745	10.33
11AC20MIMO	Ant1	5785	6.01
11AC20MIMO	Ant2	5785	7.78
11AC20MIMO	total	5785	9.99
11AC20MIMO	Ant1	5825	4.64
11AC20MIMO	Ant2	5825	5.98
11AC20MIMO	total	5825	8.37

7 MANUFACTURING TOLERANCE

UNII Band 1
– Antenna 1

IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	8	8.5	9.5
Tolerance $\pm$ (dB)	1	1	1
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	5	5	6.5
Tolerance $\pm$ (dB)	1	1	1
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	6	6	7
Tolerance $\pm$ (dB)	1	1	1

UNII Band 1
– Antenna 2

IEEE 802.11a (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	8.5	9	9.5
Tolerance $\pm$ (dB)	1	1	1
IEEE 802.11n HT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	5.5	6	7
Tolerance $\pm$ (dB)	1	1	1
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 36	Channel 40	Channel 48
Target (dBm)	5	5	6
Tolerance $\pm$ (dB)	1	1	1

UNII Band 3
– Antenna 1

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9.5	6.5	5.5
Tolerance $\pm$ (dB)	1	1	1
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	7.5	6.5	6
Tolerance $\pm$ (dB)	1	1	1
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	6.5	5.5	4
Tolerance $\pm$ (dB)	1	1	1

UNII Band 3
– Antenna 2

IEEE 802.11a (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	10.5	7.5	6.5
Tolerance $\pm$ (dB)	1	1	1
IEEE 802.11n HT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	9	8	7
Tolerance $\pm$ (dB)	1	1	1
IEEE 802.11ac VHT20 (Average)			
Channel	Channel 149	Channel 157	Channel 165
Target (dBm)	7	7.5	5.5
Tolerance $\pm$ (dB)	1	1	1

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.

UNII Band 1
– Ant 1

Modulation Type	Output power		Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	10.5	11.2202	1.0000	100%	0.0022	1.0000
IEEE 802.11n HT20	7.5	5.6234	1.0000	100%	0.0011	1.0000
IEEE 802.11ac VHT20	8.0	6.3096	1.0000	100%	0.0013	1.0000

UNII Band 1
– Ant 2

Modulation Type	Output power		Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	10.5	11.2202	1.0000	100%	0.0022	1.0000
IEEE 802.11n HT20	8.0	6.3096	1.0000	100%	0.0013	1.0000
IEEE 802.11ac VHT20	7.0	5.0119	1.0000	100%	0.0010	1.0000

UNII Band 3

– Ant 1

Modulation Type	Output power		Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	10.5	11.2202	1.0000	100%	0.0022	1.0000
IEEE 802.11n HT20	8.5	7.0795	1.0000	100%	0.0014	1.0000
IEEE 802.11ac VHT20	7.5	5.6234	1.0000	100%	0.0011	1.0000

UNII Band 3

– Ant 2

Modulation Type	Output power		Antenna Gain (linear)	Duty Cycle	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11a	11.5	14.1254	1.0000	100%	0.0028	1.0000
IEEE 802.11n HT20	10.0	10.0000	1.0000	100%	0.0020	1.0000
IEEE 802.11ac VHT20	8.5	7.0795	1.0000	100%	0.0014	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

UNII Band 1(Worst Case: IEEE 802.11n HT20):

$$0.0013 \text{ mW/cm}^2 + 0.0010 \text{ mW/cm}^2 = 0.0023 \text{ mW/cm}^2 < 1 \text{ mW/cm}^2$$

UNII Band 3(Worst Case: IEEE 802.11n HT20):

$$0.0014 \text{ mW/cm}^2 + 0.0020 \text{ mW/cm}^2 = 0.0034 \text{ mW/cm}^2 < 1 \text{ mW/cm}^2$$

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-----