

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

FCC ID	: 2AJTU-SF1650
EUT	: UAV (Unmanned Aerial Vehicle) for Photogrammetry & Mapping
Test Model	: SF1650
Additional Model No.	: Drone-eco, Drone-eco Pro, Bravo, Drone-eco Plus, Diverso, Rapido, SF600P-RTK, SF600, SF700A, SF600P, SF1000, SF2400, T600, T800A, T1650, T600P, T1000, T2400, H600, H700A, H1650, H600P, H1000, H2400, RF600, RF700A, RF1650, RF600P, RF1000, RF2400, FTF600, FTF700A, FTF1650, FTF600P, FTF1000, FTF2400
Model Declaration	: PCB board, structure and internal of these model(s) are the same, So no additional models were tested
Power Supply	: Input: 5V Battery: DC 22.8V, 13700mAh
Hardware Version	: SF60
Software Version	: 1.09.221216
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	: Internal Antenna, 3.0dBi(Max.)
2G	
Support Band	: <input checked="" type="checkbox"/> GSM 900 (EU-Band) <input checked="" type="checkbox"/> DCS 1800 (EU-Band) <input checked="" type="checkbox"/> GSM 850 (U.S.-Band) <input checked="" type="checkbox"/> PCS 1900 (U.S.-Band)
Release Version	: R99
GPRS Class	: Class 12
EGPRS Class	: Class 12
Type Of Modulation	: GMSK for GSM/GPRS; GMSK/8PSK for EGPRS
Antenna Description	: Internal Antenna 2.0dBi (max.) For GSM 850 2.0dBi (max.) For PCS 1900
3G	
Support Band	: <input checked="" type="checkbox"/> WCDMA Band II (U.S.-Band) <input checked="" type="checkbox"/> WCDMA Band V (U.S.-Band) <input checked="" type="checkbox"/> WCDMA Band IV (U.S.-Band)



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	<input checked="" type="checkbox"/> WCDMA Band I (EU-Band) <input checked="" type="checkbox"/> WCDMA Band VIII (EU-Band)
Release Version	: R7
Type Of Modulation	: QPSK,16QAM
Antenna Description	: Internal Antenna 2.0dBi (max.) For WCDMA Band II 2.0dBi (max.) For WCDMA Band IV 2.0dBi (max.) For WCDMA Band V
LTE	
Support Band	: <input checked="" type="checkbox"/> E-UTRA Band 2(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 4(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 5(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 7(U.S.-Band)
LTE Release Version	: R9
Type Of Modulation	: QPSK/16QAM
Antenna Description	: Internal Antenna 2.0dBi (max.) For E-UTRA Band 2 2.0dBi (max.) For E-UTRA Band 4 2.0dBi (max.) For E-UTRA Band 5 2.0dBi (max.) For E-UTRA Band 7
Power Class	: Class 3
Exposure category	: General population/uncontrolled environment
EUT Type	: Production Unit
Device Type	: Mobile Devices

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.



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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. 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
Antenna	Internal Antenna	2400-2500MHz	3.0dBi	WIFI Antenna
Antenna	Internal Antenna	800-2700MHz	2.0dBi	GSM/WCDMA/LTE Antenna

6. Conducted Power

[2.4G WIFI]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	ANT Max. Tune Up Power (dBm)
IEEE 802.11b	1	2412	13.42	13.0±1.0
	6	2437	13.75	13.0±1.0
	11	2462	14.25	14.0±1.0
IEEE 802.11g	1	2412	12.93	12.0±1.0
	6	2437	12.37	12.0±1.0
	11	2462	12.51	12.0±1.0
IEEE 802.11n HT20	1	2412	11.98	11.0±1.0
	6	2437	12.16	12.0±1.0
	11	2462	12.15	12.0±1.0
IEEE 802.11n HT40	3	2422	12.12	12.0±1.0
	6	2437	12.21	12.0±1.0
	9	2452	12.42	12.0±1.0

[GSM Max Average Power]

Test Mode	Channel	Frequency (MHz)	Max Average Power (dBm)	ANT Max. Tune Up Power (dBm)
PCS 1900	Low	1850.2	29.44	29.0±1.0
	Middle	1880.0	29.42	29.0±1.0
	High	1909.8	29.47	29.0±1.0
GSM 850	Low	824.2	32.39	32.0±1.0
	Middle	836.6	32.41	32.0±1.0
	High	848.8	32.39	32.0±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	23.30	23.0±1.0
	Middle	1880	23.51	23.0±1.0
	High	1907.6	23.24	23.0±1.0
WCDMA Band IV	Low	826.4	23.28	23.0±1.0
	Middle	836.4	23.16	23.0±1.0
	High	846.6	23.27	23.0±1.0
WCDMA Band V	Low	1712.4	22.81	22.0±1.0
	Middle	1732.6	22.90	22.0±1.0
	High	1752.6	22.79	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	21.56	21.0±1.0
		MCH	21.63	21.0±1.0
		HCH	22.32	22.0±1.0
	Band 4	LCH	22.62	22.0±1.0
		MCH	22.51	22.0±1.0
		HCH	22.43	22.0±1.0
	Band 5	LCH	20.78	20.0±1.0
		MCH	21.52	21.0±1.0
		HCH	20.92	20.0±1.0
	Band 7	LCH	20.78	20.0±1.0
		MCH	21.52	21.0±1.0
		HCH	20.92	20.0±1.0



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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.

[2.4GWLAN]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
IEEE 802.11b	15.0	31.6228	3.0	1.9953	0.0126	1.0000
IEEE 802.11g	13.0	19.9526	3.0	1.9953	0.0079	1.0000
IEEE 802.11n HT20	13.0	19.9526	3.0	1.9953	0.0079	1.0000
IEEE 802.11n HT40	13.0	19.9526	3.0	1.9953	0.0079	1.0000

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
GSM 850	33.0	1995.2623	2.0	1.5849	0.6294	0.5493
PCS1900	30.0	1000.0000	2.0	1.5849	0.3155	1.0000
WCDMA Band II	24.0	251.1886	2.0	1.5849	0.0792	1.0000
WCDMA Band IV	24.0	251.1886	2.0	1.5849	0.0792	1.0000
WCDMA Band V	23.0	199.5262	2.0	1.5849	0.0629	0.5493
LTE Band 2	23.0	199.5262	2.0	1.5849	0.0629	1.0000
LTE Band 4	23.0	199.5262	2.0	1.5849	0.0629	1.0000
LTE Band 5	22.0	158.4893	2.0	1.5849	0.0500	0.5493
LTE Band 7	22.0	158.4893	2.0	1.5849	0.0500	1.0000

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 WIFI Antenna and another one GSM & WCDMA & LTE transmit antenna, 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	Σ MPE max ratios	Limit	Results
WIFI + GSM	0.642	1.0	Pass
WIFI + WCDMA	0.0918	1.0	Pass
WIFI + LTE	0.0755	1.0	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-----

