

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

FCC ID	: 2ALVGETCH
EUT	: Enterprise Catm1 tracker
Test Model	: ETCH1S
Additional Model No.	: ETCH1A, ETCH2A, ETCH2S, ETCH1A-GW, ETCH2A-GW, ETCH1S-GW, ETCH2S-GW
Model Declaration	: ETCH1A and ETCH1A-GW(without SI7055 temperature sensor),ETCH2A and ETCH2A-GW (with SI7055 temperature sensor), ETCH1S and ETch1S-GW (with SI7020 temperature and humidity sensor), ETCH2S and ETCH2S-GW (with BME680 temperature and humidity sensor), the appearance screen printing of all models is different. the others are the same, these models were tested for EMC differences and only the worst model(ETCH1S) data was recorded in the report
Power Supply	: Input: DC 3.6V, 2A Max
Hardware Version	: V5
Software Version	: V1.11.3.0
Bluetooth	
Frequency Range	: 2402MHz~2480MHz
Channel Number	: 40 channels for Bluetooth V5.0(DTS)
Channel Spacing	: 2MHz for Bluetooth V5.0(DTS)
Modulation Type	: GFSK for Bluetooth V5.0(DTS)
Bluetooth Version	: V5.0
Antenna Description	: PCB Antenna, 0.9dBi(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	: PCB Antenna, 0.75dBi(Max.)
LTE	
Support Band	: <input checked="" type="checkbox"/> E-UTRA Band 12(U.S.-Band) <input checked="" type="checkbox"/> E-UTRA Band 25(U.S.-Band)
LTE Release Version	: R8
Type Of Modulation	: QPSK/16QAM
Antenna Description	: Internal Antenna 0.95dBi (max.) For E-UTRA Band 12



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	2.9dBi (max.) For E-UTRA Band 25
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.

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

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	PCB Antenna	2400-2500MHz	0.9dBi	BT Antenna
Internal	PCB Antenna	2400-2500MHz	0.75dBi	WIFI Antenna
Internal	Internal Antenna	699-746MHz 1850-1995MHz	0.95dBi for 699-746MHz 2.9dBi for 1850-1995MHz	LTE Antenna



**6. Conducted Power****[BLE]**

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	ANT Max. Tune Up Power (dBm)
GFSK	0	2402	-0.99	0±1.0
	19	2440	-1.10	-1.0±1.0
	39	2480	-1.35	-1.0±1.0

[2.4G WIFI]

Mode	Channel	Frequency (MHz)	Max Conducted Power(dBm)	ANT Max. Tune Up Power (dBm)
IEEE 802.11b	1	2412	8.75	8.0±1.0
	6	2437	8.25	8.0±1.0
	11	2462	8.43	8.0±1.0
IEEE 802.11g	1	2412	10.15	10.0±1.0
	6	2437	9.78	9.0±1.0
	11	2462	9.87	9.0±1.0
IEEE 802.11n HT20	1	2412	9.97	9.0±1.0
	6	2437	9.72	9.0±1.0
	11	2462	11.53	11.0±1.0

[LTE Max Average Power]

Test Mode		Channel	Max Average Power (dBm)	ANT Max. Tune Up Power (dBm)
Band 12		LCH	20.85	20.0±1.0
		MCH	20.92	20.0±1.0
		HCH	20.81	20.0±1.0
Band 25		LCH	20.69	20.0±1.0
		MCH	20.70	20.0±1.0
		HCH	20.34	20.0±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 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	0.9	1.2303	0.0003	1.0000

[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	9.0	7.9433	0.75	1.1850	0.0019	1.0000
IEEE 802.11g	11.0	12.5893	0.75	1.1220	0.0030	1.0000
IEEE 802.11n HT20	12.0	15.8489	0.75	1.1220	0.0037	1.0000

[LTE]

Modulation Type	Output power		Antenna Gain (dBi)	Antenna Gain (linear)	MPE (mW/cm ²)	MPE Limits (mW/cm ²)
	dBm	mW				
LTE Band 12	21.00	125.8925	0.95	1.2445	0.0312	0.4660
LTE Band 25	21.00	125.8925	2.9	1.9498	0.0488	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 BT, another one 2.4GWLAN and another 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;

\sum of MPE ratios ≤ 1.0

Mode	MPE1 (mW/cm ²)	MPE2 (mW/cm ²)	MPE3 (mW/cm ²)	\sum MPE ratios	Limit	Results
BT+2.4G WIFI+ LTE	0.0003	0.0037	0.0670	0.0710	1.0	PASS



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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-----

