RF Exposure Evaluation for FCC ID: 2AMLFJM-VL04

Refer user manual this device is a LTE GNSS TRACKER, and this device was designed used in Mobile devices that the minimum distance between human's body is 20cm. Based on the 47CFR 2.1091, this device belongs to Mobile device. The definition of the category as following:

Mobile Derives:
CFR Title 47 §2.1091(b)
(b) For purposes of this section, a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.
FCC KDB 447498 D01 General RF Exposure Guidance v06 Limit

Devices operating in standalone mobile exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits.   The distance must be fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2).   In cases where cable losses or other attenuations are applied to determine compliance, the most conservative operating configurations and exposure conditions must be evaluated.   The minimum test separation distance required for a device to comply with mobile exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements. For mobile devices that have the potential to operate in portable device exposure conditions, similar to the configurations described in § 2.1091(d)(4), a KDB inquiry is required to determine the SAR test requirements for demonstrating compliance.

When the categorical exclusion provision of § 2.1091(c) applies, the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance.   When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to FCC Part 1.1307, systems operating under the provisions of this section shall be operated in a manner the ensures that the public is not exposed to radio frequency energy level in excess of the commission's guidelines.

Limits for General Population/ Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength (H)(A/m)	Power Density (S)(mW/cm^2)
0.3-1.34	614	1.63	(100)*
1.34-30	824/f	2.19/f	(180/f2)*
30-300	27.5	0.073	0.2
300-1500			f/1500
1500-100,000			1.0

MPE calculation formula

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = power density

P = output power (mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Separation distance between radiator and human body (cm)

Test data

GSM		
Mode	GSM 850	GSM 1900
EIRP/ERP (dBm)	30.62	31.63
Note: This report listed the worst case EIRP/ERP power value, please refer to Report No. BL-SZ2150606-501 for more details.		

WCDMA		
Mode	Band 2	Band 5
EIRP/ERP (dBm)	24.50	20.22
Note: This report listed the worst case EIRP/ERP power value, please refer to Report No. BL-SZ2150606-501 for more details.		

LTE					
Mode	Band 2	Band 4	Band 5	Band 7	Band 66
EIRP/ERP (dBm)	24.22	23.98	20.51	23.89	24.19
Note: This report listed the worst case EIRP/ERP power value, please refer to Report No. BL-SZ2150606-501 for more details.					

Bluetooth			
Mode	GFSK(BLE)		
Channel	Low	Mid	High
Peak Power (dBm)	-12.81	-12.82	-13.30
Antenna Gain (dBi)	1.5		
EIRP (dBm)	**-11.31**	-11.32	-11.80
Note: This report listed the worst case EIRP power value, please refer to Report No. BL-SZ2150606-601 for more details.			

Tune-up power

Mode		Range
GSM	GSM 850	26.50-31.00
	GSM 1900	30.00-32.00
WCDMA	Band 2	23.00-25.00
	Band 5	19.00-21.00
LTE	Band 2	21.00-24.50
	Band 4	21.00-24.00
	Band 5	17.00-21.00
	Band 7	21.00-25.00
	Band 66	21.00-24.50
Bluetooth		(-12.00)-(-10.00)

Test result

Evolution mode		Maximum EIRP/ERP power (dBm)	Antenna Gain (dBi)	Total Power (mw)	Distance (cm)	Power Density (mW/cm²)	Limit of Power Density (mW/cm²)	Power Density / Limit	Verdict
GSM	GSM 850	31.00	-0.82	1258.93	20	0.25	0.55	0.45	Pass
	GSM 1900	32.00	1.20	1584.89	20	0.32	1.00	0.32	Pass
WCDMA	Band 2	25.00	1.20	316.23	20	0.06	1.00	0.06	Pass
	Band 5	21.00	-0.82	125.89	20	0.03	0.55	0.05	Pass
LTE	Band 2	24.50	1.20	281.84	20	0.06	1.00	0.06	Pass
	Band 4	24.00	1.20	251.19	20	0.05	1.00	0.05	Pass
	Band 5	21.00	1.20	125.89	20	0.03	0.55	0.05	Pass
	Band 7	25.00	1.20	316.23	20	0.06	1.00	0.06	Pass
	Band 66	24.50	1.20	281.84	20	0.06	1.00	0.06	Pass
Bluetooth		-10.00	1.50	0.10	20	0.01	1.00	0.01	Pass

Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + Bluetooth	Verdict
GSM 850	824MHz ~ 849MHz	0.45	**0.46**	Pass
Bluetooth	2400MHz ~ 2483.5MHz	0.01		Pass

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + Bluetooth	Verdict
WCDMA Band 2	1850MHz ~ 1910MHz	0.06	0.07	Pass
Bluetooth	2400MHz ~ 2483.5MHz	0.01		Pass

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + Bluetooth	Verdict
LTE Band 2	1850MHz ~ 1910MHz	0.06	0.07	Pass
Bluetooth	2400MHz ~ 2483.5MHz	0.01		Pass

Note:

1. Σ(Power Density / Limit): This is a summation of [(power density for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding Power Density limit)], for WWAN + Bluetooth.

2. Both of the WWAN/Bluetooth can transmit simultaneously, the formula of calculated the Power Density is

   CPD1 / LPD1 + CPD2 / LPD2 + ……etc. < 1

   CPD = Calculation power density

   LPD = Limit of power density

3. The worst-case situation is 0.46, which is less than "1". This confirmed that the device comply with Council Recommendation 199-519-EC Power Density limit.

4. More power list please refer to RF test report.

Conclusion:

RF exposure Evaluation Results: **Compliance**