RF Exposure Evaluation For FCC ID: YQD-GV57MG

Refer user manual this device is a GNSS Tracker, and this device was designed used in Mobile devices that the minimum distance between human's body is **20 cm.** 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)

Output Peak Power Test Data

BLE			
Mode	GFSK		
	Low Channel	Middle Channel	High Channel
Peak Power (dBm)	-0.53	-0.57	-0.68
Note: This report listed the worst case peak power value, please refer to RF test report No. BL-EC21C0778-601 for more details.			

GPRS			
Mode	GPRS 850		
	Low Channel	Middle Channel	High Channel
ERP (dBm)	30.04	**30.39**	30.23
Mode	GPRS 1900		
	Low Channel	Middle Channel	Low Channel
EIRP (dBm)	**29.69**	29.56	29.15
Note: This report listed the worst case ERP/EIRP value, please refer to RF test report No. BL-EC2140498-501 for more details.			

EGPRS			
Mode	EGPRS 850		
	Low Channel	Middle Channel	High Channel
ERP (dBm)	24.62	**24.66**	24.46
Mode	GPRS 1900		
	Low Channel	Middle Channel	Low Channel
EIRP (dBm)	**24.62**	24.34	24.09
Note: This report listed the worst case ERP/EIRP value, please refer to RF test report No. BL-EC2140498-501for more details.			

LTE-M1						
Mode	2	4	5	12	13	25
ERP/EIRP (dBm)	21.78	21.89	19.89	17.68	19.70	21.30
Mode	66	85				
ERP/EIRP (dBm)	21.58	17.94				
Note: This report listed the worst case ERP/EIRP value, please refer to RF test report No. BL-EC2140498-501 for more details.						

NB-IOT						
Mode	2	4	5	12	13	25
ERP/EIRP (dBm)	21.20	21.49	19.46	17.19	19.41	21.10
Mode	66	71	85			
ERP/EIRP (dBm)	21.41	15.63	17.74			
Note: This report listed the worst case ERP/EIRP value, please refer to RF test report No. BL-EC2140498-501 for more details.						

Turn-up power

Mode		Range (dBm)
GSM	GPRS 850	30.0-32.0
	GPRS 1900	29.0-30.0
	EGPRS 850	23.5-25.5
	EGPRS 1900	23.5-25.5
LTE-M1	Band 2	20.5-22.5
	Band 4	20.5-22.5
	Band 5	18.5-20.5
	Band 12	16.0-18.0
	Band 13	18.5-20.5
	Band 25	20.0-22.0
	Band 66	20.0-22.0
	Band 85	16.5-18.5
NB-IOT	Band 2	18.0-22.0
	Band 4	20.0-22.0
	Band 5	18.0-20.0
	Band 12	15.0-17.5
	Band 13	18.0-20.0
	Band 25	19.5-21.5
	Band 66	19.5-21.5
	Band 71	13.8-15.8
	Band 85	15.5-18.0
BLE		-1.0-0.0

Assessment result

Evolution mode		Maximum ERP/EIRP (dBm)	Antenna Gain (typical) (dBi&dBd):	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm²)	Power Density (mW/cm²)	Power Density / Limit	Verdict
GSM	GPRS 850	30.39	-0.76	1093.96	20	0.57	0.218	0.382	Pass
	GPRS 1900	29.69	-1.20	931.11	20	1	0.185	0.185	Pass
	EGPRS 850	24.66	-0.76	292.42	20	0.57	0.057	0.100	Pass
	EGPRS 1900	24.62	-1.20	289.73	20	1	0.057	0.057	Pass
LTE-M1	Band 2	21.78	-1.20	150.66	20	1	0.030	0.030	Pass
	Band 4	21.89	-0.90	154.53	20	1	0.031	0.031	Pass
	Band 5	19.89	-2.91	97.50	20	0.57	0.019	0.033	Pass
	Band 12	17.68	-5.15	58.61	20	0.48	0.012	0.025	Pass
	Band 13	19.70	-2.96	93.33	20	0.53	0.019	0.036	Pass
	Band 25	21.30	-1.20	134.90	20	1	0.027	0.027	Pass
	Band 66	21.58	-0.90	143.88	20	1	0.029	0.029	Pass
	Band 85	17.94	-4.55	62.23	20	0.48	0.012	0.025	Pass
NB-IOT	Band 2	21.20	-1.20	131.83	20	1	0.026	0.026	Pass
	Band 4	21.49	-0.90	140.93	20	1	0.028	0.028	Pass
	Band 5	19.46	-2.91	88.31	20	0.57	0.018	0.032	Pass
	Band 12	17.19	-5.15	52.36	20	0.48	0.01	0.021	Pass
	Band 13	19.41	-2.96	87.3	20	0.53	0.017	0.032	Pass
	Band 25	21.10	-1.20	128.82	20	1	0.026	0.026	Pass
	Band 66	21.41	-0.90	138.36	20	1	0.028	0.028	Pass
	Band 71	15.63	-6.25	36.56	20	0.47	0.007	0.015	Pass
	Band 85	17.74	-4.55	59.43	20	0.48	0.012	0.025	Pass
BLE		1.5	1.5	1.413	20	1	0.0003	0.0003	Pass

Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + BLE	Verdict
GSM 850	824MHz ~ 849MHz	0.382	0.3823	Pass
BLE	2400MHz ~ 2483.5MHz	0.0003		Pass
Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + BLE	Verdict
LTE-M1 Band 13	777MHz ~787MHz	0.036	0.0363	Pass
BLE	2400MHz ~ 2483.5MHz	0.0003		Pass
Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + BLE	Verdict
NB-IOT Band 13	777MHz ~787MHz	0.032	0.0323	Pass
BLE	2400MHz ~ 2483.5MHz	0.0003		Pass

Note:

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

2. Both of the BLE/WWAN can transmit simultaneously, the formula of calculated the MPE is

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

   CPD = Calculation power density

   LPD = Limit of power density

3. The worst-case situation is **0.3823**, which is less than "1". This confirmed that the device comply with FCC MPE limit.

4. The GNSS Tracker frequency range used is 824MHz ~ 849MHz, 2400MHz ~ 2483.5MHz and 777MHz ~787MHz the result close to the limit by the above formula so, we select worst case power to calculate the exclusion power threshold.

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

Conclusion:

RF exposure Evaluation Results: **Compliance**