RF Exposure Evaluation for FCC ID: YQD-GL502MG

Refer user manual this device is a GPS 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

BLE			
Mode	GFSK (BLE 1M)		
	Low Channel	Middle Channel	High Channel
Peak Power (dBm)	-1.43	-2.45	-2.06
Mode	GFSK (BLE 2M)		
	Low Channel	Middle Channel	High Channel
Peak Power (dBm)	-2.21	-2.49	-2.04
Note: This report listed the worst case peak power value, please refer to RF test report for more details.			

WIFI												
Mode	802.11b			802.11g			802.11n20			802.11n40		
Channel	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
Average Power (dBm)	17.21	17.46	17.34	12.90	13.20	13.24	11.91	12.03	12.52	9.77	9.79	9.93
Antenna Gain (dBi)	0											
EIRP (dBm)	17.21	**17.46**	17.34	12.90	13.20	13.24	11.91	12.03	12.52	9.77	9.79	9.93
Note: This report listed the worst case EIRP value, please refer to RF test report for more details.												

GSM-GPRS		
Mode	GSM850	GSM1900
ERP/EIRP (dBm)	**32.81**	31.42
Note: This report listed the worst case EIRP value, please refer to RF test report for more details.		

LTE Cat M1									
Mode	Band 2	Band 4	Band 5	Band 12	Band 13	Band 25	Band 26	Band 66	Band 85
ERP/EIRP (dBm)	25.23	**25.70**	24.12	25.10	25.63	25.03	24.04	25.50	24.29
Note: This report listed the worst case EIRP value, please refer to RF test report for more details.									

NB-IOT									
Mode	Band 2	Band 4	Band 5	Band 12	Band 13	Band 25	Band 66	Band 71	Band 85
ERP/EIRP (dBm)	25.54	25.68	23.75	25.12	**26.01**	23.18	25.54	23.20	25.27
Note: This report listed the worst case EIRP value, please refer to RF test report for more details.									

Tune-up power

Mode		Range(dBm)
GSM	GSM850	31.00-33.00
	GSM1900	31.00-33.00
LTE Cat M1	Band 2	22.00-26.00
	Band 4	22.00-26.00
	Band 5	20.00-25.00
	Band 12	20.00-25.50
	Band 13	23.00-26.00
	Band 25	22.00-26.00
	Band 26	21.00-25.00
	Band 66	22.00-26.00
	Band 85	20.00-25.00
NB-IOT	Band 2	22.00-26.00
	Band 4	22.50-26.00
	Band 5	20.00-24.00
	Band 12	20.00-25.50
	Band 13	22.50-26.50
	Band 25	20.00-24.00
	Band 66	22.00-26.00
	Band 71	20.00-24.00
	Band 85	20.00-26.00
WIFI	802.11b	16.50-19.50
	802.11g	11.50-14.50
	802.11n20	10.50-13.50
	802.11n40	8.50-11.50
BLE		-3.00 - -1.00

Test result

For worst case

Evolution mode		Maximum ERP/ EIRP power (dBm)	Antenna Gain (typical) (dBi)	Total Power (mW)	Distance (cm)	Power Density (W/m²)	Limit of Power Density (W/m²)	Power Density / Limit	Verdict
GSM	GPRS850	34.00	-1.22	2511.89	20	0.500	0.55	0.909	Pass
	GPRS1900	32.00	0.21	1584.89	20	0.315	1	0.315	Pass
LTE Cat M1	Band 2	26.00	0.21	398.11	20	0.079	1	0.079	Pass
	Band 4	26.00	0.21	398.11	20	0.079	1	0.079	Pass
	Band 5	25.00	-1.22	316.23	20	0.063	0.56	0.113	Pass
	Band 12	25.50	-4.95	354.81	20	0.071	0.48	0.148	Pass
	Band 13	26.00	-1.66	398.11	20	0.079	0.52	0.152	Pass
	Band 25	26.00	0.21	398.11	20	0.079	1	0.079	Pass
	Band 26	25.00	-1.22	316.23	20	0.063	0.57	0.111	Pass
	Band 66	26.00	0.60	398.11	20	0.079	1	0.079	Pass
	Band 85	25.00	-5.35	316.23	20	0.063	0.47	0.134	Pass
NB-IOT	Band 2	26.00	0.21	398.11	20	0.079	1	0.079	Pass
	Band 4	26.00	0.21	398.11	20	0.079	1	0.079	Pass
	Band 5	24.00	-1.22	251.19	20	0.05	0.57	0.088	Pass
	Band 12	25.50	-4.95	354.81	20	0.071	0.48	0.148	Pass
	Band 13	26.50	-1.66	446.68	20	0.089	0.52	0.171	Pass
	Band 25	24.00	0.21	251.19	20	0.05	1	0.05	Pass
	Band 66	26.00	-1.22	398.11	20	0.079	1	0.079	Pass
	Band 71	24.00	-5.35	251.19	20	0.05	0.44	0.114	Pass
	Band 85	26.00	-5.35	398.11	20	0.079	0.48	0.165	Pass
WIFI		19.50	0.0	89.13	20	0.018	1	0.018	Pass
BLE		-1.00	2.10	2.04	20	0.0004	1	0.0004	Pass

Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + WLAN + BLE	Verdict
GSM 850	824MHz ~ 849MHz	0.909	**0.9274**	Pass
WIFI	2400MHz ~ 2483.5MHz	0.018		Pass
BLE	2400MHz ~ 2483.5MHz	0.0004		Pass
Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + WLAN + BLE	Verdict
LTE Band 4	1710MHz ~1755MHz	0.079	**0.0974**	Pass
WIFI	2400MHz ~ 2483.5MHz	0.018		Pass
BLE	2400MHz ~ 2483.5MHz	0.0004		Pass
Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + WLAN + BLE	Verdict
NB-IOT Band 13	777MHz ~787MHz	0.171	**0.1894**	Pass
WIFI	2400MHz ~ 2483.5MHz	0.018		Pass
BLE	2400MHz ~ 2483.5MHz	0.0004		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 + WLAN + BLE.
2. The worst-case situation is 0.9274, which is less than “1”. This confirmed that the device comply with FCC MPE limit.
3. The GPS Tracker frequency range used is 824MHz ~ 849MHz, 2400MHz ~ 2483.5MHz and 923.3MHz ~ 927.5MHz the result close to the limit by the above formula so, we select worst case power to calculate the exclusion power threshold.
4. More power list please refer to RF test report.

Conclusion:

RF exposure Evaluation Results: **Compliance**