

## **RF Exposure Evaluation For FCC ID: YQD-GL521MG**

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 **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  $\geq 20$  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 that 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 <sup>2</sup> )
0.3-1.34	614	1.63	(100)*
1.34-30	824/f	2.19/f	(180/f <sup>2</sup> )*
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 Power Test Data**

EIRP BLE			
Mode	GFSK		
	Low Channel	Middle Channel	High Channel
Peak Power (dBm)	0.63	0.81	0.75
Antenna Gain (dBi)	0.92		
EIRP (dBm)	1.55	<b>1.73</b>	1.67

Note: This report listed the worst case peak power value, please refer to RF test report No. BL-EC21C1103-601 for more details.

GPRS			
Mode	GPRS 850 <sup>Note2</sup>		
	Low Channel	Middle Channel	High Channel
ERP (dBm)	<b>32.78</b>	32.21	32.55
Mode	GPRS 1900 <sup>Note1</sup>		
	Low Channel	Middle Channel	High Channel
EIRP (dBm)	31.22	31.22	<b>31.40</b>

Note 1: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R2V1 which was issued by TA Technology (Shanghai) Co., Ltd. on July 23, 2020 for more details.

Note 2: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R1V1 which was issued by TA Technology (Shanghai) Co., Ltd. on July 23, 2020 for more details.

EGPRS			
Mode	EGPRS 850 <sup>Note 2</sup>		
	Low Channel	Middle Channel	Low Channel
ERP (dBm)	<b>26.79</b>	25.98	26.40
Mode	EGPRS 1900 <sup>Note1</sup>		
	Low Channel	Middle Channel	Low Channel
EIRP (dBm)	<b>27.23</b>	27.09	27.10
<p>Note 1: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R2V1 which was issued by TA Technology (Shanghai) Co., Ltd. on July 23, 2020 for more details.</p> <p>Note 2: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R1V1 which was issued by TA Technology (Shanghai) Co., Ltd. on July 23, 2020 for more details.</p>			

LTE-M1									
Mode	Band	Band	Band	Band	Band	Band	Band	Band	Band
	2 <sup>Note1</sup>	4 <sup>Note4</sup>	5 <sup>Note2</sup>	12 <sup>Note4</sup>	13 <sup>Note4</sup>	25 <sup>Note1</sup>	26 <sup>Note3</sup>	66 <sup>Note4</sup>	85 <sup>Note4</sup>
EIRP/ERP (dBm)	25.23	25.7	24.12	25.1	25.63	25.03	24.94	25.5	24.29
<p>Note 1: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R2V1 which was issued by TA Technology (Shanghai) Co., Ltd. on July 23, 2020 for more details.</p> <p>Note 2: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R1V1 which was issued by TA Technology (Shanghai) Co., Ltd. on July 23, 2020 for more details.</p> <p>Note 3: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R3V1 which was issued by TA Technology (Shanghai) Co., Ltd. on July 23, 2020 for more details.</p> <p>Note 4: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R4V1 which was issued by TA Technology (Shanghai) Co., Ltd. on August 5, 2020 for more details.</p>									

NB-IOT									
Mode	Band	Band	Band	Band	Band	Band	Band	Band	Band 85
	2 <sup>Note1</sup>	4 <sup>Note3</sup>	5 <sup>Note2</sup>	12 <sup>Note3</sup>	13 <sup>Note3</sup>	25 <sup>Note1</sup>	66 <sup>Note3</sup>	71 <sup>Note3</sup>	<sup>Note3</sup>
EIRP/ERP (dBm)	25.54	25.68	23.75	25.12	26.01	23.18	25.54	23.2	25.27
<p>Note 1: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R6 which was issued by TA Technology (Shanghai) Co., Ltd. on July 1, 2020 for more details.</p> <p>Note 2: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R5 which was issued by TA Technology (Shanghai) Co., Ltd. on July 1, 2020 for more details.</p> <p>Note 3: This report listed the worst case EIRP value, please refer to RF test report No. R2005A0283-R7 which was issued by TA Technology (Shanghai) Co., Ltd. on June 30, 2020 for more details.</p>									

**Turn-up power**

Mode		Range (dBm)
GSM 850	GPRS 850	28.5-30.5
	EGPRS 850	23.5-25.5
GSM 1900	GPRS 1900	28.5-30.5
	EGPRS 1900	25.0-27.0
LTE-M1	Band 2	23.0-25.0
	Band 4	23.0-25.0
	Band 5	23.0-25.0
	Band 12	23.0-25.0
	Band 13	23.0-25.0
	Band 26	23.0-25.0
	Band 66	23.0-25.0
	Band 85	23.0-25.0
NB-IOT	Band 2	23.0-25.0
	Band 4	23.0-25.0
	Band 5	23.0-25.0
	Band 12	23.0-25.0
	Band 13	23.0-25.0
	Band 26	23.0-25.0
	Band 66	23.0-25.0
	Band 71	23.0-25.0
Band 85	23.0-25.0	
BLE		1.0-2.5

### Assessment result

Evolution mode		Maximum ERP/EIRP (dBm)	Antenna Gain(dBi)	Total Power(mw)	Distance (cm)	Limit of Power Density (mW/cm <sup>2</sup> )	Power Density (mW/cm <sup>2</sup> )	Power Density / Limit	Verdict
GSM	GPRS 850	30.5	2.53	2009.093	20	0.549	0.3997	0.7281	Pass
	GPRS 1900	30.5	1.59	1618.08	20	1	0.3219	0.3219	Pass
	EGPRS 850	25.5	2.53	635.331	20	0.549	0.1264	0.2302	Pass
	EGPRS 1900	27.0	1.59	722.77	20	1	0.1438	0.1438	Pass
LTE-M1	Band 2	25.0	1.59	456.037	20	1	0.0907	0.0907	Pass
	Band 4	25.0	1.94	494.311	20	1	0.0983	0.0983	Pass
	Band 5	25.0	2.53	566.239	20	0.563	0.1127	0.2002	Pass
	Band 12	25.0	3.26	669.885	20	0.474	0.1333	0.2812	Pass
	Band 13	25.0	4.45	881.049	20	0.52	0.1753	0.3371	Pass
	Band 25	25.0	1.38	434.51	20	1	0.0864	0.0864	Pass
	Band 26	25.0	2.29	535.797	20	0.546	0.1066	0.1952	Pass
	Band 66	25.0	2.0	501.187	20	1	0.0997	0.0997	Pass
NB-IOT	Band 85	25.0	3.26	669.885	20	0.474	0.1333	0.2812	Pass
	Band 2	25.0	1.59	456.037	20	1	0.0907	0.0907	Pass
	Band 4	25.0	1.94	494.311	20	1	0.0983	0.0983	Pass
	Band 5	25.0	2.53	566.239	20	0.566	0.1127	0.1991	Pass
	Band 12	25.0	3.26	669.885	20	0.477	0.1333	0.2795	Pass
	Band 13	25.0	4.45	881.049	20	0.521	0.1753	0.3365	Pass
	Band 25	25.0	1.38	434.51	20	1	0.0864	0.0864	Pass
	Band 66	25.0	2.0	501.187	20	1	0.0997	0.0997	Pass
BLE	Band 71	25.0	1.66	463.447	20	0.442	0.0922	0.2086	Pass
	Band 85	25.0	3.26	669.885	20	0.477	0.1333	0.2795	Pass
BLE		2.50	0.92	1.778	20	1.0	0.0004	0.0004	Pass

### Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	$\Sigma$ (Power Density / Limit) of WWAN + BLE	Verdict
GSM 850	824MHz ~ 849MHz	0.7281	0.7285	Pass
BLE	2400MHz ~ 2483.5MHz	0.0004		Pass
Evolution mode	Frequency(MHz)	Power Density/Limit	$\Sigma$ (Power Density / Limit) of WWAN + BLE	Verdict
LTE-M1 Band 13	777MHz ~787MHz	0.3371	0.3375	Pass
BLE	2400MHz ~ 2483.5MHz	0.0004		Pass
Evolution mode	Frequency(MHz)	Power Density/Limit	$\Sigma$ (Power Density / Limit) of WWAN + BLE	Verdict
NB-IOT Band 13	777MHz ~787MHz	0.3365	0.3369	Pass
BLE	2400MHz ~ 2483.5MHz	0.0004		Pass

**Note:**

1.  $\Sigma$  (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  $CPD1 / LPD1 + CPD2 / LPD2 + \dots$ .etc. < 1  
 CPD = Calculation power density  
 LPD = Limit of power density
3. The worst-case situation is **0.7285**, which is less than “1”. This confirmed that the device comply with FCC MPE limit.
4. The GPS 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**