TEST REPORT

Applicant:	Queclink Wireless Solutions Co., Ltd.
Address:	No.30, Lane 500, Xinlong Road, Minhang District, Shanghai, China 201101
Equipment Type:	GNSS Tracker
Model Name:	GL53MG(refer to section 2.4)
Brand Name:	Queclink
FCC ID:	YQD-GL53MG
Test Standard:	47 CFR Part 2.1091 KDB 447498 D01 v06
Sample Arrival Date:	Oct. 13, 2023
Test Date:	Oct. 17, 2023
Date of Issue:	Nov. 01, 2023

ISSUED BY:

Kunshan Balun Communications Technology Co., Ltd.

Tested by: Li Yupeng **Checked by:** Ye Feng **Approved by:** Luo Biao (General Manager)

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Nov. 01, 2023	Update Page 1 and Section 2.4, the original report is invalid.

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1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Kunshan Balun Communications Technology Co., Ltd.
Address	Room 101, Building 5, No. 1689, Zizhu Road, Yushan, Kunshan, Jiangsu, China

1.2 Test Location

Name	Kunshan Balun Communications Technology Co., Ltd.
Location	Room 101, Building 5, No. 1689, Zizhu Road, Yushan, Kunshan, Jiangsu, China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1352.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Queclink Wireless Solutions Co., Ltd.
Address	No.30, Lane 500, Xinlong Road, Minhang District, Shanghai, China 201101

2.2 Manufacturer Information

Manufacturer	Queclink Wireless Solutions Co., Ltd.
Address	No.30, Lane 500, Xinlong Road, Minhang District, Shanghai, China 201101

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	GNSS Tracker
Model Name Under Test	GL53MG
Series Model Name	GL53MG Plus
Description of Model name differentiation	1.Replaced 4400mAh battery for GL53MG Plus. GL53MG uses 2400mAh battery. 2.Change the same type antenna for GL53MG Plus. 3.Compared with GL53MG, GL53MG Plus has thicker backshell, longer antenna thimbles and one less thimble.
Sample No.	SC-EC23A0110-S05
Hardware Version	V2.02
Software Version	R00A01V23
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Ancillary Equipment	Battery	
	Brand Name	GREAT POWER
	Model No.	CP603742
	Serial No.	N/A
	Capacitance	4400 mAh
	Rated Voltage	3 V

	Limit Charge Voltage	N/A

2.6 Technical Information

Network and Wireless connectivity	2G Network GSM/GPRS/EDGE 850/900/1800/1900 MHz 4G Network FDD LTE–M1 Band 1/2/3/4/5/8/12/13/18/19/20/25/27/28/66/85 4G Network FDD NB-IoT Band 1/2/3/4/5/8/12/13/18/19/20/25/28/66 71/85 Bluetooth (BLE) GPS, GLONASS, BDS, Galileo

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	Bluetooth, GSM, LTE-M1, NB-IoT		
Frequency Range	Bluetooth	2400 ~ 2483.5 MHz	
	GSM 850	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	GSM1900	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE-M1 Band 2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE-M1 Band 4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	LTE-M1 Band 5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE-M1 Band 12	TX: 699 ~ 716 MHz	RX: 729 ~ 746 MHz
	LTE-M1 Band 13	TX: 777 ~ 787 MHz	RX: 746 ~ 756 MHz
	LTE-M1 Band 25	TX: 1850 ~ 1915 MHz	RX: 1930 ~ 1995 MHz
	LTE-M1 Band 66	TX: 1710 ~ 1780 MHz	RX: 2135 ~ 2155 MHz
	LTE-M1 Band 85	TX: 698 ~ 716 MHz	RX: 728 ~ 746 MHz
	NB-IoT Band 2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	NB-IoT Band 4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	NB-IoT Band 5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	NB-IoT Band 12	TX: 699 ~ 716 MHz	RX: 729 ~ 746 MHz
	NB-IoT Band 13	TX: 777 ~ 787 MHz	RX: 746 ~ 756 MHz
	NB-IoT Band 25	TX: 1850 ~ 1915 MHz	RX: 1930 ~ 1995 MHz
	NB-IoT Band 66	TX: 1710 ~ 1780 MHz	RX: 2135 ~ 2155 MHz
	NB-IoT Band 71	TX: 663 ~ 698 MHz	RX: 617 ~ 652 MHz
	NB-IoT Band 85	TX: 698 ~ 716 MHz	RX: 728 ~ 746 MHz
Antenna Type	Bluetooth	Ceramic	
	WWAN	PIFA	
Exposure Category	General Population/Uncontrolled Exposure		
EUT Stage	Mobile Device		

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1091	Radiofrequency radiation exposure evaluation: mobile devices
2	KDB 447498 D01 v06	447498 D01 General RF Exposure Guidance D01 v06

4 DEVICE CATEGORY AND LEVELS LIMITS

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)

5 ASSESSMENT RESULT

5.1 Output Power

BLE			
Mode	GFSK		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	**6.05**	5.98	5.90
Antenna Gain (dBi)	2.10	2.10	2.10
EIRP (dBm)	8.15	8.08	8.00
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC23A0361-601 for more details.			

GPRS			
Mode	GPRS 850		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	32.95	**33.30**	33.14
Antenna Gain (dBi)	-0.02	-0.02	-0.02
EIRP/ ERP (dBm)	30.78	31.13	30.97
Mode	GPRS 1900		
	Low Channel	Low Channel	Low Channel
Conducted Power (dBm)	**30.89**	30.76	30.35
Antenna Gain (dBi)	2.20	2.20	2.20
EIRP/ ERP (dBm)	33.09	32.96	32.55
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC21C0723-701 for more details.			

EGPRS			
Mode	EGPRS 850		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	27.53	**27.57**	27.37
Antenna Gain (dBi)	-0.02	-0.02	-0.02
EIRP/ ERP (dBm)	25.36	25.40	25.20
Mode	EGPRS 1900		
	Low Channel	Low Channel	Low Channel
Conducted Power (dBm)	**25.82**	25.54	25.29
Antenna Gain (dBi)	2.20	2.20	2.20
EIRP/ ERP (dBm)	28.02	27.74	27.49
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC21C0723-701 for more details.			

LTE-M1					
Mode	Band 2	Band 4	Band 5	Band 12	Band 13
Conducted Power (dBm)	22.98	22.79	22.80	22.83	22.66
Antenna Gain (dBi)	2.20	2.28	-0.02	-1.22	-2.51
EIRP/ ERP (dBm)	25.18	25.07	20.63	19.46	18.00
Mode	Band 25	Band 66	Band 85	/	/
Conducted Power (dBm)	22.50	22.48	22.49	/	/
Antenna Gain (dBi)	2.20	2.20	-1.22	/	/
EIRP/ ERP (dBm)	24.70	24.68	19.12	/	/
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC21C0723-701 for more details.					

NB-IoT					
Mode	Band 2	Band 4	Band 5	Band 12	Band 13
Conducted Power (dBm)	22.40	22.39	22.40	22.34	22.37
Antenna Gain (dBi)	2.20	2.28	-0.02	-1.22	-2.51
EIRP/ ERP (dBm)	24.6	24.67	20.23	18.97	17.71
Mode	Band 25	Band 66	Band 71	Band 85	/
Conducted Power (dBm)	22.30	22.31	21.88	22.29	/
Antenna Gain (dBi)	2.20	2.20	-1.71	-1.22	/
EIRP/ ERP (dBm)	24.5	24.51	18.02	18.92	/
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC21C0723-701 for more details.					

5.2 Turn-up power

Mode		Range
BLE		5.0-7.0
GSM	GPRS 850	32.0-34.0
	GPRS 1900	29.5-31.5
	EGPRS 850	26.5-28.5
	EGPRS 1900	24.5-26.5
LTE-M1	Band 2	21.0-24.0
	Band 4	21.0-24.0
	Band 5	21.0-24.0
	Band 12	21.0-24.0
	Band 13	21.0-24.0
	Band 25	21.0-24.0
	Band 66	21.0-24.0
	Band 85	21.0-24.0
NB-IoT	Band 2	19.5-22.5
	Band 4	19.5-22.5

	Band 5	19.5-22.5
	Band 12	19.5-22.5
	Band 13	19.5-22.5
	Band 25	19.5-22.5
	Band 66	19.5-22.5
	Band 71	19.5-22.5
	Band 85	19.5-22.5

5.3 RF Exposure Evaluation Result

Evolution mode		Maximum conducted power tune up (dBm)	Antenna Gain (typical) (dBi):	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm²)	Power Density (mW/cm²)	Power Density / Limit	Verdict
BLE		7.0	2.10	8.13	20	1.000	0.002	0.0020	Pass
GSM	GPRS 850	34.0	-0.02	1524.05	20	0.549	0.303	0.5519	Pass
	GPRS 1900	31.5	2.20	2344.23	20	1.000	0.466	0.4660	Pass
	EGPRS 850	28.5	-0.02	429.54	20	0.549	0.085	0.1548	Pass
	EGPRS 1900	26.5	2.20	741.31	20	1.000	0.147	0.1470	Pass
LTE-M1	Band 2	24.0	2.20	416.87	20	1.000	0.083	0.0830	Pass
	Band 4	24.0	2.28	424.62	20	1.000	0.084	0.0840	Pass
	Band 5	24.0	-0.02	152.41	20	0.549	0.030	0.0546	Pass
	Band 12	24.0	-1.22	115.61	20	0.466	0.023	0.0494	Pass
	Band 13	24.0	-2.51	85.90	20	0.518	0.017	0.0328	Pass
	Band 25	24.0	2.20	416.87	20	1.000	0.083	0.0830	Pass
	Band 66	24.0	2.20	416.87	20	1.000	0.083	0.0830	Pass
	Band 85	24.0	-1.22	115.61	20	0.465	0.023	0.0495	Pass
NB-IoT	Band 2	22.5	2.20	295.12	20	1.000	0.059	0.0590	Pass
	Band 4	22.5	2.28	300.61	20	1.000	0.060	0.0600	Pass
	Band 5	22.5	-0.02	107.89	20	0.549	0.021	0.0383	Pass
	Band 12	22.5	-1.22	81.85	20	0.466	0.016	0.0343	Pass
	Band 13	22.5	-2.51	60.81	20	0.518	0.012	0.0232	Pass
	Band 25	22.5	2.20	295.12	20	1.000	0.059	0.0590	Pass
	Band 66	22.5	2.20	295.12	20	1.000	0.059	0.0590	Pass
	Band 71	22.5	-1.71	73.11	20	0.442	0.015	0.0339	Pass
	Band 85	22.5	-1.22	81.85	20	0.465	0.016	0.0344	Pass

5.4 Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + BLE	Verdict
GSM 850	824MHz ~ 849MHz	0.5519	**0.5539**	Pass
BLE	2400MHz ~ 2483.5MHz	0.0020		
Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + BLE	Verdict
LTE-M1 Band 4	1710MHz-1755MHz	0.0840	0.0860	Pass
BLE	2400MHz ~ 2483.5MHz	0.0020		
Evolution mode	Frequency(MHz)	Power Density/Limit	Σ(Power Density / Limit) of WWAN + BLE	Verdict
NB-IoT Band 4	1710MHz-1755MHz	0.0600	0.0620	Pass
BLE	2400MHz ~ 2483.5MHz	0.0020		

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 BLE + WWAN.
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 **0.5539**, which is less than “1”. This confirmed that the device comply with FCC 1.1310 MPE limit.
4. The DUT work frequency range used is 824MHz ~ 849MHz, 2400 MHz ~ 2483.5 MHz and 1710MHz-1755MHz 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.

5.5 Conclusion

This EUT is deemed to comply with the reference level limits , therefore the basic restrictions are compliant with human exposure limits.

Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
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--END OF REPORT--