

TEST REPORT

Applicant: Queclink Wireless Solutions Co., Ltd.
Address: No.30, Lane 500, Xinlong Road, Minhang District,
Shanghai, China
Equipment Type: INDUSTRIAL ROUTER
Model Name: WR201LG
Brand Name: QUECLINK
FCC ID: YQD-WR201LG
Test Standard: 47 CFR Part 2.1091
KDB 447498 D01 v06
Sample Arrival Date: Sep. 15, 2023
Test Date: Dec. 12, 2023
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ISSUED BY:

Kunshan Balun Communications Technology Co., Ltd.

Tested by: Li Yupeng **Checked by:** Huang Chengkun **Approved by:** Zhang Yanqing
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Li Yupeng

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Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions Content</u>
<u>Rev. 01</u>	<u>Dec. 12, 2023</u>	<u>Initial Issue</u>

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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

2.2 Manufacturer Information

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

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	INDUSTRIAL ROUTER
Model Name Under Test	WR201LG
Series Model Name	N/A
Description of Model name differentiation	N/A
Sample No.	SC-EC2381046-S07
Hardware Version	V1.02
Software Version	R00A03V04

2.5 Technical Information

Network and Wireless connectivity	2G Network GSM/GPRS/EDGE 850/900/1800/1900 MHz 3G Network WCDMA/HSDPA/HSUPA/DC-HSDPA/HSPA+ Band 1/2/4/5/6/8/19 4G Network LTE FDD Band 1/2/3/4/5/7/8/12/13/18/19/20/25/26/28 LTE TDD Band 38/39/41 2.4G WIFI 802.11b, 802.11g, 802.11n(HT20/40) 5G WIFI 802.11a, 802.11n(HT20/40), 802.11ac(VHT20/40/80) U-NII-1/2A/2C/3, 5.8G SRD, GPS, GLONASS BDS Galileo
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	2.4G WIFI, 5G WIFI, GSM, LTE		
Frequency Range	2.4G WIFI	2400 ~ 2483.5 MHz	
	5G WIFI	U-NII-1: 5150 ~ 5250 MHz,	
		U-NII-2A: 5250 ~ 5350 MHz,	
		U-NII-2C: 5470 ~ 5725 MHz,	
		U-NII-3: 5725 ~ 5850 MHz	
	GSM 850	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	GSM1900	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	WCDMA B2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	WCDMA B4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	WCDMA B5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE Band 2	TX: 1850 ~ 1910 MHz	RX: 1930 ~ 1990 MHz
	LTE Band 4	TX: 1710 ~ 1755 MHz	RX: 2110 ~ 2155 MHz
	LTE Band 5	TX: 824 ~ 849 MHz	RX: 869 ~ 894 MHz
	LTE Band 7	TX: 2500 ~ 2570 MHz	RX: 2620 ~ 2690 MHz
	LTE Band 12	TX: 699 ~ 716 MHz	RX: 729 ~ 746 MHz
	LTE Band 13	TX: 777 ~ 787 MHz	RX: 746 ~ 756 MHz
	LTE Band 25	TX: 1850 ~ 1915 MHz	RX: 1930 ~ 1995 MHz
	LTE Band 26	TX: 814 ~ 849 MHz	RX: 859 ~ 894 MHz
	LTE Band 38	TX: 2570 ~ 2620 MHz	RX: 2570 ~ 2620 MHz
	LTE Band 41	TX: 2496 ~ 2690 MHz	RX: 2496 ~ 2690 MHz
Antenna Type	2.4G WIFI	Rod Antenna	
	5G WIFI	Rod Antenna	
	WWAN	Rod Antenna	
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 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 ²)
0.3-1.34	614	1.63	(100)*
1.34-30	824/f	2.19/f	(180/f ²)*
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

2.4GWIFI				
Mode	802.11b	802.11g	802.11n-HT20	802.11n-HT40
Conducted Power (dBm)	15.04	15.29	12.47	12.95
Antenna Gain (dBi)	1.88	1.88	1.88	1.88
EIRP (dBm)	16.92	17.17	14.35	14.83
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC2390557-601 for more details.				

5GWIFI(U-NII-1: 5150-5250MHz)					
Mode	11a	11n (HT20)	11n (HT40)	11ac (VHT20)	11ac (VHT40)
Conducted Power (dBm)	15.73	15.71	14.51	15.93	14.85
Antenna Gain (dBi)	1.58	1.58	1.58	1.58	1.58
EIRP (dBm)	17.31	17.29	16.09	17.51	16.43
Mode	11ac (VHT80)	/	/	/	/
Conducted Power (dBm)	15.97	/	/	/	/
Antenna Gain (dBi)	1.58	/	/	/	/
EIRP (dBm)	17.55	/	/	/	/
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC2390557-602 for more details.					

5GWIFI(U-NII-2A: 5250 MHz to 5350 MHz)					
Mode	11a	11n (HT20)	11n (HT40)	11ac (VHT20)	11ac (VHT40)
Conducted Power (dBm)	16.69	16.64	14.49	15.62	14.66
Antenna Gain (dBi)	1.58	1.58	1.58	1.58	1.58
EIRP (dBm)	18.27	18.22	16.07	17.2	16.24
Mode	11ac (VHT80)	/	/	/	/
Conducted Power (dBm)	5.91	/	/	/	/
Antenna Gain (dBi)	1.58	/	/	/	/
EIRP (dBm)	7.49	/	/	/	/
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC2390557-602 for more details.					

5GWIFI(U-NII-2C: 5470 MHz to 5725 MHz)					
Mode	11a	11n (HT20)	11n (HT40)	11ac (VHT20)	11ac (VHT40)
Conducted Power (dBm)	17.62	17.52	16.54	17.59	16.38
Antenna Gain (dBi)	1.58	1.58	1.58	1.58	1.58
EIRP (dBm)	19.2	19.1	18.12	19.17	17.96
Mode	11ac (VHT80)	/	/	/	/
Conducted Power (dBm)	18.59	/	/	/	/
Antenna Gain (dBi)	1.58	/	/	/	/
EIRP (dBm)	20.17	/	/	/	/
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC2390557-602 for more details.					

5GWIFI(U-NII-3: 5725 MHz to 5850 MHz)					
Mode	11a	11n (HT20)	11n (HT40)	11ac (VHT20)	11ac (VHT40)
Conducted Power (dBm)	12.73	12.73	12.79	12.67	12.34
Antenna Gain (dBi)	1.58	1.58	1.58	1.58	1.58
EIRP (dBm)	14.31	14.31	14.37	14.25	13.92
Mode	11ac (VHT80)	/	/	/	/
Conducted Power (dBm)	12.83	/	/	/	/
Antenna Gain (dBi)	1.58	/	/	/	/
EIRP (dBm)	14.41	/	/	/	/
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC2390557-602 for more details.					

GPRS			
Mode	GPRS 850		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	32.69	32.36	31.88
Antenna Gain (dBi)	0.11	0.11	0.11
EIRP/ ERP (dBm)	30.65	30.32	29.84
Mode	GPRS 1900		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	31.49	31.34	30.66
Antenna Gain (dBi)	1.25	1.25	1.25
EIRP/ ERP (dBm)	30.59	30.44	29.76
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC2390557-501 for more details.			

EGPRS			
Mode	EGPRS 850		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	26.07	26.33	26.91
Antenna Gain (dBi)	0.11	0.11	0.11
EIRP/ ERP (dBm)	24.03	24.29	24.87
Mode	EGPRS 1900		
	Low Channel	Middle Channel	High Channel
Conducted Power (dBm)	27.94	27.22	26.63
Antenna Gain (dBi)	1.25	1.25	1.25
EIRP/ ERP (dBm)	27.04	26.32	25.73
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC2390557-501 for more details.			

WCDMA			
Mode	Band 2	Band 4	Band 5
Conducted Power (dBm)	24.26	23.63	22.17
Antenna Gain (dBi)	1.25	1.06	0.11
EIRP/ ERP (dBm)	25.51	24.69	20.13
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC2390557-501 for more details.			

LTE					
Mode	Band 2	Band 4	Band 5	Band 7	Band 12
Conducted Power (dBm)	24.85	23.98	22.25	23.96	21.34
Antenna Gain (dBi)	1.25	1.06	0.11	4.16	-0.79
EIRP/ ERP (dBm)	26.10	25.04	20.21	28.12	18.40
Mode	Band 13	Band 25	Band 26	Band 38	Band 41
Conducted Power (dBm)	21.24	25.15	21.95	23.73	23.45
Antenna Gain (dBi)	1.09	1.25	0.11	3.37	4.16
EIRP/ ERP (dBm)	20.18	26.40	19.91	27.10	27.61
Note: This report listed the worst case conducted power value, please refer to RF test report No. BL-EC2390557-501 for more details.					

5.1.1 Turn-up power

Mode		Range
2.4GWIFI	802.11b/g	14.0-17.0
	802.11n	11.0-14.0
5GWIFI (U-NII-1: 5150-5250MHz)	802.11a/n	14.0-17.0
	802.11ac(VHT20/40)	14.0-17.0
	802.11ac(VHT80)	14.0-17.0
5GWIFI (U-NII-2A: 5250-5350 MHz)	802.11a/n	14.0-17.0
	802.11ac(VHT20/40)	14.0-17.0
	802.11ac(VHT80)	4.0-7.0
5GWIFI (U-NII-2C: 5470-5725 MHz)	802.11a/n	15.5-18.5
	802.11ac(VHT20/40)	14.0-17.0
	802.11ac(VHT80)	17.0-20.0
5GWIFI (U-NII-3: 5725-5850 MHz)	802.11a/n	11.0-14.0
	802.11ac(VHT20/40)	11.0-14.0
	802.11ac(VHT80)	11.0-14.0
GSM	GPRS 850	31.0-34.0
	GPRS 1900	30.0-33.0
	EGPRS 850	25.0-28.0
	EGPRS 1900	26.0-29.0
WCDMA	Band 2	21.5-24.5
	Band 4	21.0-24.0
	Band 5	19.5-22.5
LTE	Band 2	21.0-25.0
	Band 4	21.0-24.0
	Band 5	19.0-23.0
	Band 7	20.5-24.5
	Band 12	18.5-21.5
	Band 13	18.5-21.5
	Band 25	21.5-25.5
	Band 26	19.0-22.5
	Band 38	21.0-24.0
	Band 41	20.5-24.0

5.2 RF Exposure Evaluation Result

Evolution mode		Maximum peak output power (dBm)	Antenna Gain (typical) (dBi):	Total Power (mw)	Distance (cm)	Limit of Power Density (mW/cm ²)	Power Density (mW/cm ²)	Power Density / Limit	Verdict
2.4GWIFI	802.11b/g	17.0	1.88	77.27	20	1.000	0.015	0.0150	Pass
	802.11n	14.0	1.88	38.73	20	1.000	0.008	0.0080	Pass
5GWIFI (U-NII-1: 5150-5250MHz)	802.11a/n	17.0	1.58	72.11	20	1.000	0.014	0.0140	Pass
	802.11ac(VHT 20/40)	17.0	1.58	72.11	20	1.000	0.014	0.0140	Pass
	802.11ac(VHT 80)	17.0	1.58	72.11	20	1.000	0.014	0.0140	Pass
5GWIFI (U-NII-2A: 5250-5350 MHz)	802.11a/n	17.0	1.58	72.11	20	1.000	0.014	0.0140	Pass
	802.11ac(VHT 20/40)	17.0	1.58	72.11	20	1.000	0.014	0.0140	Pass
	802.11ac(VHT 80)	7.0	1.58	7.21	20	1.000	0.001	0.0010	Pass
5GWIFI (U-NII-2C: 5470-5725 MHz)	802.11a/n	18.5	1.58	101.86	20	1.000	0.020	0.0200	Pass
	802.11ac(VHT 20/40)	17.0	1.58	72.11	20	1.000	0.014	0.0140	Pass
	802.11ac(VHT 80)	20.0	1.58	143.88	20	1.000	0.029	0.0290	Pass
5GWIFI (U-NII-3: 5725-5850 MHz)	802.11a/n	14.0	1.58	36.14	20	1.000	0.007	0.0070	Pass
	802.11ac(VHT 20/40)	14.0	1.58	36.14	20	1.000	0.007	0.0070	Pass
	802.11ac(VHT 80)	14.0	1.58	36.14	20	1.000	0.007	0.0070	Pass
GSM	GPRS 850	34.0	0.11	1570.36	20	0.549	0.312	0.5683	Pass
	GPRS 1900	33.0	1.25	2660.73	20	1.000	0.529	0.5290	Pass
	EGPRS 850	28.0	0.11	394.46	20	0.549	0.078	0.1421	Pass
	EGPRS 1900	29.0	1.25	1059.25	20	1.000	0.211	0.2110	Pass
WCDMA	Band 2	24.5	1.25	375.84	20	1.000	0.075	0.0750	Pass
	Band 4	24.0	1.06	320.63	20	1.000	0.064	0.0640	Pass
	Band 5	22.5	0.11	111.17	20	0.549	0.022	0.0401	Pass
LTE	Band 2	25.0	1.25	421.70	20	1.000	0.084	0.0840	Pass
	Band 4	24.0	1.06	320.63	20	1.000	0.064	0.0640	Pass
	Band 5	23.0	0.11	124.74	20	0.549	0.025	0.0455	Pass
	Band 7	24.5	4.16	734.51	20	1.000	0.146	0.1460	Pass
	Band 12	21.5	-0.79	71.78	20	0.466	0.014	0.0300	Pass
	Band 13	21.5	1.09	110.66	20	0.518	0.022	0.0425	Pass
	Band 25	25.5	1.25	473.15	20	1.000	0.094	0.0940	Pass

	Band 26	22.5	0.11	111.17	20	0.543	0.022	0.0405	Pass
	Band 38	24.0	3.37	545.76	20	1.000	0.109	0.1090	Pass
	Band 41	24.0	4.16	654.64	20	1.000	0.130	0.1300	Pass

5.3 Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	$\Sigma(\text{Power Density / Limit})$ of WWAN + WLAN	Verdict
GSM 850	824MHz ~ 849MHz	0.5683	0.6123	Pass
2.4GWIFI	2400MHz ~ 2483.5MHz	0.0150		
5GWIFI	5150MHz ~ 5850MHz	0.0290		
Evolution mode	Frequency(MHz)	Power Density/Limit	$\Sigma(\text{Power Density / Limit})$ of WWAN + WLAN	Verdict
WCDMA	824MHz ~ 849MHz	0.0750	0.119	Pass
2.4GWIFI	2400MHz ~ 2483.5MHz	0.0150		
5GWIFI	5150MHz ~ 5850MHz	0.0290		
Evolution mode	Frequency(MHz)	Power Density/Limit	$\Sigma(\text{Power Density / Limit})$ of WWAN + WLAN	Verdict
LTE	824MHz ~ 849MHz	0.1460	0.190	Pass
2.4GWIFI	2400MHz ~ 2483.5MHz	0.0150		
5GWIFI	5150MHz ~ 5850MHz	0.0290		

Note:

1. $\Sigma(\text{Power Density / Limit})$: This is a summation of [(power density for each transmitter/ antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN +WLAN.
2. Both of the WWAN/WLAN can transmit simultaneously, the formula of calculated the MPE is $\text{CPD1} / \text{LPD1} + \text{CPD2} / \text{LPD2} + \dots \text{etc.} < 1$
 CPD = Calculation power density
 LPD = Limit of power density
3. The worst-case situation is 0.6123, 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, 2400MHz ~ 2483.5MHz and 5150MHz ~ 5850MHz 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.

5.4 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.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
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--END OF REPORT--