

TEST REPORT

Applicant: Sichuan AI-Link Technology Co., Ltd
Address: Anzhou Industrial Park, Mianyang, Sichuan, P.R.C
Equipment Type: WIFI module
Model Name: WF-R12C-UWD2L (refer section 2.4)
Brand Name: AILINK
FCC ID: 2AOKI-WFR12CUWD2
Test Standard: 47 CFR Part 2.1091
KDB 447498 D01 v06
Test Date: Mar. 04, 2022 - Mar. 18, 2022
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ISSUED BY:

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Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions Content</u>
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1 GENERAL INFORMATION

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science & Technology Park, Shahe West Road, Nanshan District, Shenzhen, Guangdong Province, China
Phone Number	+86 755 6685 0100

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science & Technology Park, Shahe West Road, Nanshan District, Shenzhen, Guangdong Province, China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.
Description	All measurement facilities used to collect the measurement data are located at Block B, 1/F, Baisha Science & Technology Park, Shahe West Road, Nanshan District, Shenzhen, Guangdong Province, China

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Sichuan AI-Link Technology Co., Ltd
Address	Anzhou Industrial Park, Mianyang, Sichuan, P.R.C

2.2 Manufacturer Information

Manufacturer	Sichuan AI-Link Technology Co., Ltd
Address	Anzhou Industrial Park, Mianyang, Sichuan, P.R.C

2.3 Factory Information

Factory	Sichuan AI-Link Technology Co., Ltd
Address	Anzhou Industrial Park, Mianyang, Sichuan, P.R.C

2.4 General Description for Equipment under Test (EUT)

EUT Name	WIFI module
Model Name Under Test	WF-R12C-UWD2L
Series Model Name	WF-R12C-UWD3L
Description of Model name differentiation	All models are same with electrical parameters and internal circuit structure, but only differ in model name.
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Note: Not applicable.

2.6 Technical Information

Network and Wireless connectivity	2.4G WIFI 802.11b, 802.11g and 802.11n(HT20/40) 5G WIFI 802.11a, 802.11n(HT20/40) and 802.11ac(VHT20/40/80), U-NII-1/2A/2C/3
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	WLAN	
Frequency Range	802.11b/g/n(HT20)	2412 ~ 2462 MHz
	802.11n(HT40)	2422 ~ 2452 MHz
	802.11a	5150 ~ 5250 MHz
		5250 ~ 5350 MHz
		5470 ~ 5725 MHz
		5725 ~ 5850 MHz
	802.11n(HT20/HT40)	5150 ~ 5250 MHz
		5250 ~ 5350 MHz
		5470 ~ 5725 MHz
		5725 ~ 5850 MHz
	802.11 ac(VHT20/VHT40/ VHT80)	5150 ~ 5250 MHz
		5250 ~ 5350 MHz
		5470 ~ 5725 MHz
		5725 ~ 5850 MHz
Antenna Type	WLAN	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 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

2.4G WIFI												
Mode	ANT0				ANT1				MIMO			
	802.11 b	802.11 g	802.11 n20	802.11 n40	802.11 b	802.11 g	802.11 n20	802.11 n40	802.11 b	802.11 g	802.11 n20	802.11 n40
Output Power (dBm)	19.90	19.48	16.16	15.88	17.25	17.61	13.86	13.59	/	/	18.17	17.89
Note: The Output Power please refer to report 200801864SHA-001, which was issued by Intertek Testing Services Shanghai on Oct. 22, 2020, section 4.4 Test Results of Maximum conducted output power.												

5.2G WIFI												
Mode	ANT0				ANT1				MIMO			
	802.11 a	802.11 n20	802.11 n40	802.11 ac80	802.11 a	802.11 n20	802.11 n40	802.11 ac80	802.11 a	802.11 n20	802.11 n40	802.11 ac80
Output Power (dBm)	18.19	14.92	13.90	13.79	17.88	14.74	13.99	12.51	/	17.84	16.96	16.21
5.3G WIFI												
Mode	ANT0				ANT1				MIMO			
	802.11 a	802.11 n20	802.11 n40	802.11 ac80	802.11 a	802.11 n20	802.11 n40	802.11 ac80	802.11 a	802.11 n20	802.11 n40	802.11 ac80
Output Power (dBm)	17.71	16.00	15.62	14.42	17.68	15.38	15.33	14.39	/	18.65	18.49	17.42
5.6G WIFI												
Mode	ANT0				ANT1				MIMO			
	802.11 a	802.11 n20	802.11 n40	802.11 ac80	802.11 a	802.11 n20	802.11 n40	802.11 ac80	802.11 a	802.11 n20	802.11 n40	802.11 ac80
Output Power (dBm)	16.38	14.71	14.36	12.92	15.98	15.06	14.16	13.67	/	17.90	17.27	16.32
5.8G WIFI												
Mode	ANT0				ANT1				MIMO			
	802.11 a	802.11 n20	802.11 n40	802.11 ac80	802.11 a	802.11 n20	802.11 n40	802.11 ac80	802.11 a	802.11 n20	802.11 n40	802.11 ac80
Output Power (dBm)	14.78	14.08	13.61	12.60	15.62	14.69	13.82	13.17	/	17.34	16.73	15.90
Note: The Output Power please refer to report 200801864SHA-002, which was issued by Intertek Testing Services Shanghai on Oct. 22, 2020, section 5.4 Test Results of Maximum conducted output power and e.i.r.p.												

5.2 Turn-up power

Mode		Range
2.4G WIFI	ANT0	13.00-20.00
	ANT1	11.00-18.00
	MIMO	13.00-20.00
5.2G WIFI	ANT0	12.00-19.00
	ANT1	11.00-18.00
	MIMO	12.00-19.00
5.3G WIFI	ANT0	11.00-18.00
	ANT1	11.00-18.00
	MIMO	12.00-19.00
5.6G WIFI	ANT0	10.00-17.00
	ANT1	10.00-17.00
	MIMO	11.00-18.00
5.8G WIFI	ANT0	8.00-15.00
	ANT1	9.00-16.00
	MIMO	11.00-18.00

5.3 RF Exposure Evaluation Result

Evolution mode	Maximum peak output power (dBm)	Antenna Gain (typical) (dBi):	Total Power (mw)	Distance (cm)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)	Power Density / Limit	Verdict
2.4G WIFI	20.00	2.58	181.1340	20	0.0360	1	0.0360	Pass
5.2G WIFI	19.00	5.52	283.1392	20	0.0563	1	0.0563	Pass
5.3G WIFI	19.00	5.52	283.1392	20	0.0563	1	0.0563	Pass
5.6G WIFI	18.00	5.52	224.9055	20	0.0447	1	0.0447	Pass
5.8G WIFI	18.00	5.52	224.9055	20	0.0447	1	0.0447	Pass

5.4 Collocated Power Density Calculation

Evolution mode	Frequency(MHz)	Power Density/Limit	$\Sigma(\text{Power Density / Limit})$ of 2.4G WIFI + 5.2G WIFI	Verdict
2.4G WIFI	2412MHz ~ 2462MHz	0.0360	0.0923	Pass
5.2G WIFI	5150MHz ~ 5250MHz	0.0563		
Evolution mode	Frequency(MHz)	Power Density/Limit	$\Sigma(\text{Power Density / Limit})$ of 2.4G WIFI + 5.2G WIFI	Verdict
2.4G WIFI	2412MHz ~ 2462MHz	0.0360	0.0923	Pass
5.3G WIFI	5250MHz ~ 5350MHz	0.0563		

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 2.4G WIFI + 5.2G WIFI/ 2.4G WIFI + 5.3G WIFI.
2. Both of the 2.4GHz/5GHz 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 0.0923, 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 2412MHz ~ 2462MHz and 5150MHz ~ 5250MHz or 2412MHz ~ 2462MHz and 5250MHz ~ 5350MHz 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

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--END OF REPORT--