

Prüfbericht-Nr.: <i>Test report no.:</i>	CN231C12 003	Auftrags-Nr.: <i>Order no.:</i>	169785074	Seite 1 von 21 Page 1 of 21
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2023-02-07	
Auftraggeber: <i>Client:</i>	Shenzhen Chuangwei-RGB Electronics Co., Ltd. 13F-16F, Unit A, Skyworth Building, Shennan Road, Nanshan District, Shenzhen, Guangdong, P.R.China			
Prüfgegenstand: <i>Test item:</i>	WiFi+BT USB2.0 Module			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	NTUD-T12			
Auftrags-Inhalt: <i>Order content:</i>	Test Report			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 RSS-247 Issue 2 February 2017 CFR47 FCC Part 15: Subpart C Section 15.207 RSS-Gen Issue 5 February 2021 CFR47 FCC Part 15: Subpart C Section 15.209			
Wareneingangsdatum: <i>Date of sample receipt:</i>	2023-02-07	Refer to Photo Documentation		
Prüfmuster-Nr.: <i>Test sample no.:</i>	T230207021-Y01/01			
Prüfzeitraum: <i>Testing period:</i>	2023-02-07 to 2023-02-22			
Ort der Prüfung: <i>Place of testing:</i>	Shenzhen Central Standard International Center Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i> Lin Lin	X	genehmigt von: <i>authorized by:</i> Winnie Hou	X	
Datum: <i>Date:</i> 2023-02-28		Ausstellungsdatum: <i>Issue date:</i> 2023-02-28		
Stellung / Position:	Engineer	Stellung / Position:	Reviewer	
Sonstiges / Other: FCC ID: 2ANM3NTUDT12 IC: 23165-NTUDT12 HVIN: NTUD-T12				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet * Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specification(s) F(ail) = failed a.m. test specification(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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Test Summary

5.1.1 Antenna Requirement

RESULT: *Pass*

5.1.2 Maximum Conducted Output Power

RESULT: *Pass*

5.1.3 Conducted Power Spectral Density

RESULT: *Pass*

5.1.4 6dB Bandwidth

RESULT: *Pass*

5.1.5 99% Bandwidth

RESULT: *Pass*

5.1.6 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT: *Pass*

5.1.7 Radiated Spurious Emission

RESULT: *Pass*

5.1.8 Conducted Emission on AC Mains

RESULT: *Pass*

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up

Appendix B: Test Results of Wi-Fi 802.11 b/g/n

2 Test Sites

2.1 Test Facilities

Shenzhen Central Standard International Center Co., Ltd.
Room 201, Building 1, Mogen Fashion Industrial Park, No. 10, Shilongzai Road, Xinshi Community, Dalang Street, Longhua District, Shenzhen.
CNAS No.: L11671
A2LA No.: 6426.01
FCC Registration No.: 0031378433
IC CAB identifier No.: CN0051

The tests at the test sites have been conducted under the supervision of a TÜV engineer.

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Radio Spectrum Testing				
Equipment	Manufacturer	Model	Serial No.	Cal. until
Spectrum Analyzer	Agilent	N9020A	MY50200391	Jun. 13, 2023
Power sensor	KEYSIGHT	U2021XA	MY55080015	Jun. 13, 2023
Power sensor	KEYSIGHT	U2021XA	MY54250016	Jun. 13, 2023
Power sensor	KEYSIGHT	U2021XA	MY54250020	Jun. 13, 2023
Power sensor	KEYSIGHT	U2021XA	MY54210030	Jun. 13, 2023
Vector Signal Generator	Agilent	N5182A	MY50140130	Jun. 13, 2023
Signal generator	Agilent	SML03	100925	Jun. 13, 2023
Power sensor Box	MWRFtest	N/A	N/A	N/A
RF Switch Box	MWRFtest	MW100-RFCB	N/A	N/A
MTS 8310	MWRFtest	V 2.0.0.0		
Unwanted Emission Testing				
Equipment	Manufacturer	Model	Serial No.	Cal. until
Spectrum Analyzer	Agilent	N9020A	MY50200391	Jun. 13, 2023
Bilog Antenna	Schwarzbeck	VULB9168	VULB9168-250	Jul. 25, 2025
Horn Antenna	AARONIAAG	Powerlog 70180	3980	Jul. 04, 2025
Horn Antenna	A-INFOMW	LB-180400-KF	J211020657	Sep. 26, 2023
Loop Antenna	Schwarzbeck	FMZB1519B	00023	Nov. 15, 2023
Amplifier	HP	8447F	2634A02050	Jun. 13, 2023
Amplifier	Agilent	8449B	4035A00116	Jun. 13, 2023
3M Chamber	Maor	9*6*6	--	Jul. 26, 2023

Conducted Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R&S	ESRP3	101936	Jun. 13, 2023
LISN	R&S	ENV216	100002	Jun. 13, 2023
Shelding Room	Maor	8*4*3	--	May. 03, 2023
EZ-EMC	Fara	V 3.1		

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Table 2: Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 2.7 \times 10^{-5}$
RF Power (conducted)	± 0.66 dB
Radiated Emission of Transmitter, valid up to 26.5 GHz	± 5.08 dB
Radiated Emission of Receiver, valid up to 26.5 GHz	± 5.08 dB
Conducted Emission, (150kHz to 30MHz)	± 3.26 dB
Radiated Emission (3m SAC), 30MHz to 1000MHz	± 4.58 dB
Radiated Emission (3m SAC), above 1000MHz	± 5.10 dB
Temperature	± 2 °C
Humidity	± 5 %
Voltage (DC)	± 5 %
Voltage (AC, <10kHz)	± 5 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

Shenzhen Central Standard International Center Co., Ltd.

Room 201, Building 1, Mogen Fashion Industrial Park, No. 10, Shilongzai Road, Xinshi Community, Dalang Street, Longhua District, Shenzhen

3 General Product Information

3.1 Product Function and Intended Use

The EUT is a RF Module which supports Bluetooth, 2.4G Wi-Fi 802.11 b/g/n, 5G Wi-Fi 802.11a/n/ac wireless technology.

For details refer to the User Manual, Technical Description and Circuit Diagram.

Note: This report is for 2.4GHz Wi-Fi 802.11 b/g/n mode only.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	WiFi+BT USB2.0 Module
Type Designation	NTUD-T12
Trade Mark	/
FCC ID	2ANM3NTUDT12
IC	23165-NTUDT12
HVIN	NTUD-T12
FVIN	T12_3ANT_Golden_WiFi_20221028
Operating Voltage:	DC 3.3V
Technical Specification of Wi-Fi 802.11 b/g/n	
Operating Frequency	2412 - 2462 MHz for 802.11b/g/n(HT20) 2422 - 2452 MHz for 802.11n(HT40)
Type of Modulation	DSSS(DBPSK/DQPSK/CCK) OFDM(BPSK/QPSK/16QAM/64QAM)
Data Rate	1/2/5.5/11 Mbps for 802.11b 6/9/12/18/24/36/48/54 Mbps for 802.11g MCS0 ~ MCS7 for 802.11n
Channel Number	11 channels for 802.11b/g/n(HT20) 7 channels for 802.11n(HT40)
Channel Separation	5 MHz
Antenna Type	PIFA antenna
Gain of 2.4G Wi-Fi	ANT1: 2.58 dBi ANT2: 2.72 dBi

Table 4: RF Channel and Frequency of Wi-Fi 802.11 b/g/n

RF Channel	802.11 b/g/n
	Frequency (MHz)
01	2412
02	2417
03	2422
04	2427
05	2432
06	2437
07	2442
08	2447
09	2452
10	2457
11	2462

Test frequencies are lowest channel: 2412 MHz, middle channel: 2437 MHz and highest channel: 2462 MHz for 802.11b/g/n(HT20);

lowest channel: 2422 MHz, middle channel: 2437 MHz and highest channel: 2452 MHz for 802.11n(HT40)

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Wi-Fi 802.11 b/g/n wireless transmitting mode
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
- B. On, Normal operation with Wi-Fi mode
- C. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013 and ANSI C63.4: 2014.

4.3 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

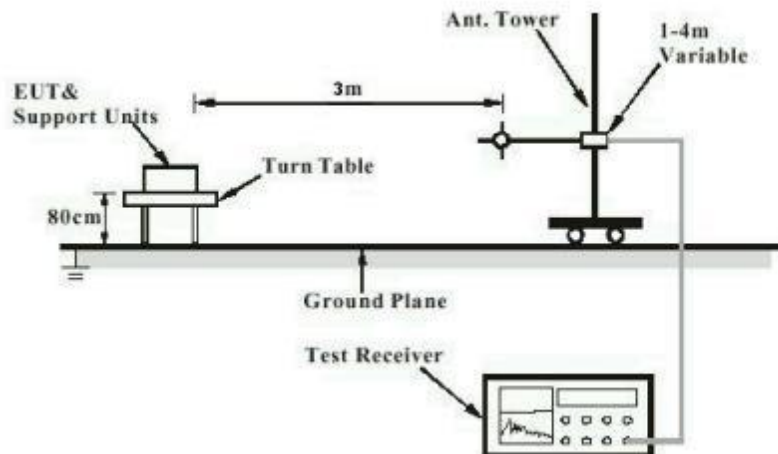


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

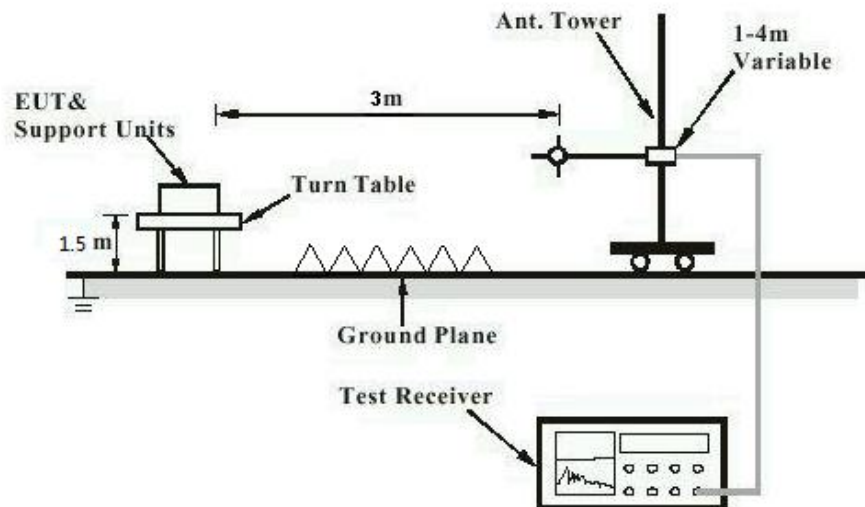


Diagram of Measurement Configuration for Mains Conduction Measurement

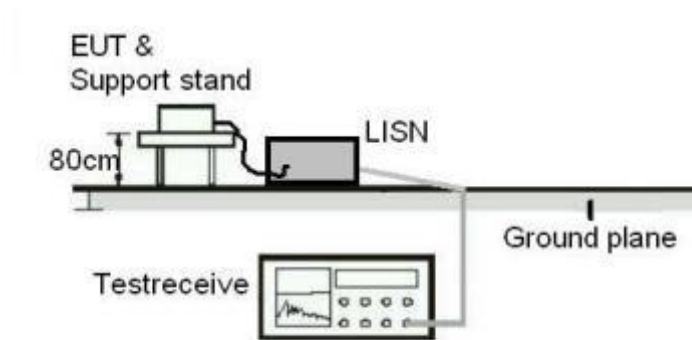
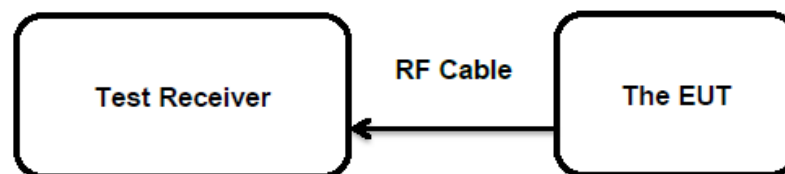


Diagram of Measurement Configuration for Conducted Transmitter Measurement



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5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Pass****Test Specification**

Test standard : FCC Part 15.247(b)(4) and Part 15.203

According to the manufacturer declared, the EUT has two PIFA antenna, the directional gain of antenna is 2.58 dBi(ANT1) and 2.72 dBi(ANT2), which that use of a non-standard antenna connector and no consideration of replacement. Therefore, the EUT is considered sufficient to comply with the provision.

Antennas 1 and 2 are uncorrelated, and MIMO antenna gain is the maximum of the two antennas.

Therefore, the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

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5.1.2 Maximum Conducted Output Power
RESULT:
Pass
Test Specification

Test standard : FCC Part 15.247(b)(3)
RSS-247 Clause 5.4(d)
Basic standard : ANSI C63.10: 2013
Limits : 1.0 Watts
Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-02-07 – 2023-02-21
Input voltage : DC 3.3V
Operation mode : A
Test channel : Low / Middle / High
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

Table 5: Test Result of Maximum Conducted Output Power, Wi-Fi 802.11 b/g/n

Test Mode	Data Rate	Test Channel (MHz)	Measured Average Power				Limit (W)
			(dBm)			(W)	
			Ant1	Ant2	Total		
802.11b	1 Mbps	2412	13.133	16.803	18.355	0.0685	< 1.0
		2437	12.725	16.254	17.849	0.0609	
		2462	12.562	17.933	19.040	0.0802	
802.11g	6 Mbps	2412	17.523	17.627	20.586	0.1144	
		2437	17.113	17.333	20.235	0.1056	
		2462	17.778	18.300	21.057	0.1276	
802.11n (HT20)	MCS0	2412	17.374	18.628	21.056	0.1275	
		2437	17.803	18.313	21.076	0.1281	
		2462	17.574	18.201	20.909	0.1233	
802.11n (HT40)	MCS0	2422	17.161	17.600	20.396	0.1095	
		2437	17.835	18.128	20.994	0.1257	
		2452	17.521	17.998	20.776	0.1196	
Maximum Measured Value			21.076			0.1281	

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G) of 802.11 b/g/n: 2.58 dBi(ANT1) and 2.72 dBi(ANT2), 2.72dBi(MIMO mode).
e.i.r.p.=P_(Peak power)+ G, which is far below the 4 W

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*Page 15 of 21***5.1.3 Conducted Power Spectral Density****RESULT:****Pass****Test Specification**

Test standard	:	FCC Part 15.247(e) RSS-247 Clause 5.2(b)
Basic standard	:	ANSI C63.10: 2013
Limits	:	< 8 dBm / 3kHz
Kind of test site	:	Shielded Room

Test Setup

Date of testing	:	2023-02-07 – 2023-02-21
Input voltage	:	DC 3.3V
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25 °C
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix B.

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*Page 16 of 21***5.1.4 6dB Bandwidth****RESULT:****Pass****Test Specification**

Test standard : FCC Part 15.247(a)(2)
RSS-247 Clause 5.2(a)
Basic standard : ANSI C63.10: 2013
Limits : > 500 KHz
Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-02-07 – 2023-02-21
Input voltage : DC 3.3V
Operation mode : A
Test channel : Low / Middle / High
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

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Test standard : FCC Part 15.247(a)
Basic standard : ANSI C63.10: 2013
Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-02-07 – 2023-02-21
Input voltage : DC 3.3V
Operation mode : A
Test channel : Low / Middle / High
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

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*Page 18 of 21***5.1.6 Conducted Spurious Emissions Measured in 100 kHz Bandwidth****RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.247(d) RSS-247 Clause 5.5
Basic standard	: ANSI C63.10: 2013
Limits	: 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2023-02-07 – 2023-02-21
Input voltage	: DC 3.3V
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix B.

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Test standard : FCC Part 15.247(d) & FCC Part 15.205
RSS-247 Clause 3.3

Basic standard : ANSI C63.10: 2013

Limits : Refer to 15.209(a) of FCC part 15.247(d)
RSS-Gen Table 5

Kind of test site : 3m Semi-anechoic Chamber

Test Setup

Date of testing : 2023-02-07 – 2023-02-21

Input voltage : DC 3.3V

Operation mode : A

Test channel : Low / Middle / High

Ambient temperature : 25.3 °C

Relative humidity : 52 %

Atmospheric pressure : 101 kPa

Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix B.

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Test standard : FCC Part 15.207(a)
RSS-Gen Clause 8.8

Basic standard : ANSI C63.10: 2013

Frequency range : 0.15 – 30MHz

Limits : FCC Part 15.207(a)
RSS-Gen Table 3

Kind of test site : Shielded Room

Test Setup

Date of testing : 2023-02-07 – 2023-02-21

Input voltage : AC 120V, 60Hz

Operation mode : B

Earthing : Not connected

Ambient temperature : 23.1 °C

Relative humidity : 60 %

Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

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