CE RF Test Report

(5GHz RLAN)

Applicant:	Nebra Ltd
Address of Applicant:	Unit 4 Bells Yew Green Business Court, Bells Yew Green, Tunbridge Wells, East Sussex, TN3 9BJ

Equipment Under Test (EUT)

Product Name:	Nebra Indoor LoRa Gateway ROCK Pi 4 Version / Nebra Indoor Helium Hotspot ROCK Pi 4 Version
Model No.:	NEBHNT-HHRK4-433, NEBHNT-HHRK4-470, NEBHNT-HHRK4-868, NEBHNT-HHRK4-915, NEBHNT-HHRK4-433-2, NEBHNT-HHRK4-470-2, NEBHNT-HHRK4-868-2, NEBHNT-HHRK4-915-2, NEBHNT-HHRK4-433-3, NEBHNT-HHRK4-470-3, NEBHNT-HHRK4-868-3, NEBHNT-HHRK4-915-3, NEBHNT-HHRK4-433-3, NEBHNT-HHRK4-470-3, NEBHNT-HHRK4-868-3, NEBHNT-HHRK4-915-3
Standards:	ETSI EN 301 893 V2.1.1 (2017-05)
Date of Receipt:	05 Jan., 2022
Date of Test:	06 Jan., to 24 Jan., 2022
Date of Issue:	25 Jan., 2022
Test Result:	PASS

Tested by:	***Test Engineer***	***Date:***	*25 Jan., 2022*
Reviewed by:	***Project Engineer***	***Date:***	*25 Jan., 2022*
Approved by:	***Manager***	***Date:***	*25 Jan., 2022*

2 Version

Version No.	Date	Description
00	*25 Jan., 2022*	*Original*

3 Contents

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4 Test Summary

Test Items	Test Requirement	Test Method	Limit / Severity	Result
Radio Spectrum Matter (RSM) Part of Tx				
Centre frequencies	Clause 4.2.1	Clause 5.4.2	±20 ppm	PASS*
Nominal Channel Bandwidth and Occupied Channel Bandwidth	Clause 4.2.2	Clause 5.4.3	>5MHz and 80%~100% Nominal Bandwidth	PASS*
RF Output Power,EIRP	clause 4.2.3	Clause 5.4.4	Table 2	PASS*
Power Spectrum Density	clause 4.2.3	Clause 5.4.4	Table 2	PASS*
Transmitter unwanted emissions outside the 5 GHz RLAN bands	clause 4.2.4.1	clause 5.4.5	Table 4	PASS
Transmitter unwanted emissions within the 5 GHz RLAN bands	clause 4.2.4.2	clause 5.4.6	Figure 1	PASS*
Dynamic Frequency Selection (DFS)	clause 4.2.6	clause 5.4.8.2.1.6	clause 4.2.6.2.5.2	N/A
Adaptivity (Channel AccessMechanism)	clause 4.2.7	clause 5.4.9	clause 4.2.7.3.3.3	PASS*
User Access Restrictions	clause 4.2.9	clause 4.2.9	clause 4.2.9.2	PASS*
Radio Spectrum Matter (RSM) Part of Rx				
Receiver spurious emissions	clause 4.2.5	clause 5.4.7	Table 5	PASS
Receiver Blocking	clause 4.2.8	clause 5.4.10	clause 4.2.8.4	PASS*

Remark:

1. *Tx: In this whole report Tx (or tx) means Transmitter.*
2. *Rx: In this whole report Rx (or rx) means Receiver.*
3. *PASS: Meet the requirement.*
4. *Pass*: Please refer to the report No.: BCTC2109795863-6E by Shenzhen BCTC Testing Co., Ltd, The module used by EUT in this report is that of Report BCTC2109795863-6E.*

5 General Information

5.1 Client Information

Applicant:	Nebra Ltd
Address:	Unit 4 Bells Yew Green Business Court, Bells Yew Green, Tunbridge Wells, East Sussex, TN3 9BJ
Manufacturer:	Nebra Ltd
Address:	Unit 4 Bells Yew Green Business Court, Bells Yew Green, Tunbridge Wells, East Sussex, TN3 9BJ

5.2 General Description of E.U.T.

Product Name:	Nebra Indoor LoRa Gateway ROCK Pi 4 Version / Nebra Indoor Helium Hotspot ROCK Pi 4 Version			
Model No.:	NEBHNT-HHRK4-433, NEBHNT-HHRK4-470, NEBHNT-HHRK4-868, NEBHNT-HHRK4-915, NEBHNT-HHRK4-433-2, NEBHNT-HHRK4-470-2, NEBHNT-HHRK4-868-2, NEBHNT-HHRK4-915-2, NEBHNT-HHRK4-433-3, NEBHNT-HHRK4-470-3, NEBHNT-HHRK4-868-3, NEBHNT-HHRK4-915-3, NEBHNT-HHRK4-433-3, NEBHNT-HHRK4-470-3, NEBHNT-HHRK4-868-3, NEBHNT-HHRK4-915-3			
Hardware version:	v1			
Software version:	781099d			
Operating Frequency:	Band 1: 5180MHz~5240MHz			
Nominal Bandwidth	20MHz:	802.11a	802.11n-HT20	802.11ac-VHT20
	40MHz:	802.11n-HT40	802.11ac-VHT40	
	80MHz:	802.11-VHT80		
Channel Spacing:	10MHz			
Modulation:	OFDM			
Antenna Type:	EXternal Antenna			
Antenna Gain	1 dBi			
TPC:	Not support			
Device Classification:	☐ Frame Based Equipment ☒ Load Based Equipment			
Remark:	Model no.: NEBHNT-HHRK4-433, NEBHNT-HHRK4-470, NEBHNT-HHRK4-868, NEBHNT-HHRK4-915, NEBHNT-HHRK4-433-2, NEBHNT-HHRK4-470-2, NEBHNT-HHRK4-868-2, NEBHNT-HHRK4-915-2, NEBHNT-HHRK4-433-3, NEBHNT-HHRK4-470-3, NEBHNT-HHRK4-868-3, NEBHNT-HHRK4-915-3, NEBHNT-HHRK4-433-3, NEBHNT-HHRK4-470-3, NEBHNT-HHRK4-868-3, NEBHNT-HHRK4-915-3, The difference between the models is that the LoRa Radio module used inside is different for each variant. Along with a respective antenna for each region / frequency. The -2 and -3 flags at the end of the model number relates to the specific chip part number for the main LoRa chip.			

5.3 Test environment and test mode

Operating Environment:	
Temperature:	Normal: 15℃ ~ 35℃, Extreme: -20℃ ~ +40℃
Humidity:	20 % ~ 75 % RH
Atmospheric Pressure:	1008 mbar
Voltage:	Nominal: 230Vac, Extreme: Low 207Vac, High 253Vac
Test mode:	
Transmitting mode:	Keep the EUT in continuously transmitting mode with modulation.
Receiving mode:	Keep the EUT in receiving mode.
We have verified the construction and function in typical operation. All the test items were carried out with the EUT in above test modes. And the test results are both the "worst case" and "worst setup" 6 Mbps for 802.11a, 6.5 Mbps for 802.11n(HT20), 13.5 Mbps for 802.11n(HT40), 29.3 Mbps for 802.11ac(HT80).	

5.4 Description of Support Units

The EUT has been tested as an independent unit.

5.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Radio Frequency	±10ppm
RF Power, Conducted	±1.5 dB
RF Power, Radiated	±4.44 dB
Spurious emission, Conducted	±3.0 dB
Temperature	±2°C
Humidity	±5 %
Time	±10%
Radiated Emission (30MHz ~ 1GHz) for 3m SAC	4.45 dB
Radiated Emission (1GHz ~ 18GHz) for 3m SAC	5.34 dB
Radiated Emission (18GHz ~ 40GHz) for 3m SAC	5.34 dB

Note: *All the measurement uncertainty value were shown with a coverage k=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.*

5.6 Additions to, deviations, or exclusions from the method

No

5.7 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L15527**

JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

5.8 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.
Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Tel: +86-755-23118282, Fax:+86-755-23116366
Email: info-JYTee@lets.com, Website: http://jyt.lets.com

5.9 Test Instruments list

Radiated Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal.Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	ETS	9m*6m*6m	WXJ001-1	01-19-2021	01-18-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	03-03-2021	03-02-2022
Biconical Antenna	Schwarzbeck	VUBA9117	WXJ002-1	06-20-2021	06-19-2022
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	03-03-2021	03-02-2022
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-3	06-18-2021	06-17-2022
Loop Antenna	Schwarzbeck	FMZB 1519 B	WXJ002-4	03-07-2021	03-06-2022
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXG001-7	03-07-2021	03-06-2022
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXG001-3	03-07-2021	03-06-2022
Pre-amplifier (18GHz ~ 40GHz)	RF System	TRLA-180400G45B	WXG001-9	03-07-2021	03-06-2022
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	03-03-2021	03-02-2022
Spectrum Analyzer	KEYSIGHT	N9010B	WXJ004-2	10-27-2021	10-26-2022
Signal Generator	Agilent	N5173B	WXJ006-7	03-25-2021	03-24-2022
Coaxial Cable (30MHz ~ 1GHz)	JYT	JYT3M-1G-NN-8M	WXG001-4	03-07-2021	03-06-2022
Coaxial Cable (1GHz ~ 18GHz)	JYT	JYT3M-18G-NN-8M	WXG001-5	03-07-2021	03-06-2022
Coaxial Cable (9kHz ~ 30MHz)	JYT	JYT3M-1G-BB-5M	WXG001-6	03-07-2021	03-06-2022
Coaxial Cable (18GHz ~ 40GHz)	JYT	JYT3M-40G-SS-8M	WXG001-7	03-07-2021	03-06-2022
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	RE/RSE/RS Test System	Version: 3.0.0.1		

6 Technical requirements specification

6.1 Justification

The EUT and test equipment were configured for testing according to ETSI EN 301 893 V2.1.1 (2017-05).
The EUT was tested in the normal operating mode to represent worst-case results during the final qualification test.

6.2 Test Configuration of EUT

Channel List of 5150MHz ~ 5250MHz					
802.11a/n(HT20)/ac(HT20)		802.11n(HT40)/ac(HT40)		802.11ac(HT80)	
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
36	5180	38	5190	42	5210
40	5200	46	5230		
44	5220				
48	5240				

Note:
1. *Selected channel No.36 to perform the test of 802.11a/n(HT20)/ac(HT20).*
2. *Selected channel No.38 to perform the test of 802.11n(HT40)/ac(HT40).*
3. *Selected channel No.42 to perform the test of 802.11ac(HT80).*

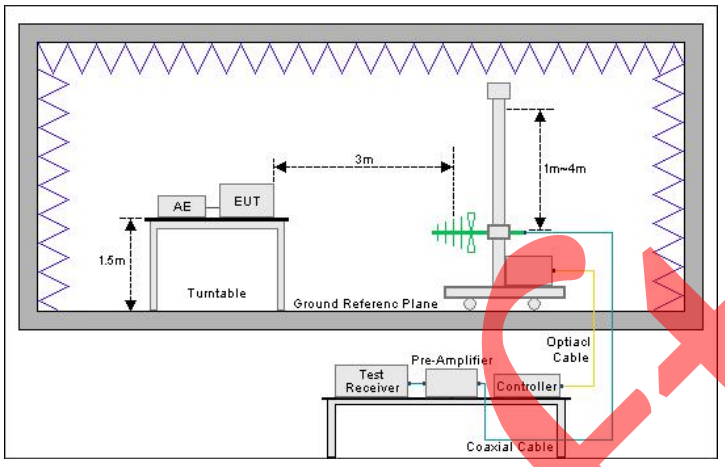
Test plan of 5150MHz ~ 5250MHz															
Clause No.	Test Conditions			Channel No.			Modulated Mode						Test mode		
	NVNT	NVLT	NVHV	36	38	42	802.11a	802.11n		802.11ac			Tx	Rx	Normal
								HT20	HT40	HT20	HT40	HT80			
4.2.4.1	√			√	√	√	√	√	√	√	√	√	√		
4.2.5	√			√	√	√	√	√	√	√	√	√		√	

Note:
1. *"√" means that this configuration is chosen for test.*
2. *"NVNT" means Normal Voltage Normal Temperature, "NVLT" means Normal Voltage Low Temperature, "NVHT" means Normal Voltage High Temperature.*
3. *Clause No.: "4.2.3^{PSD}" was Power Density test item.*

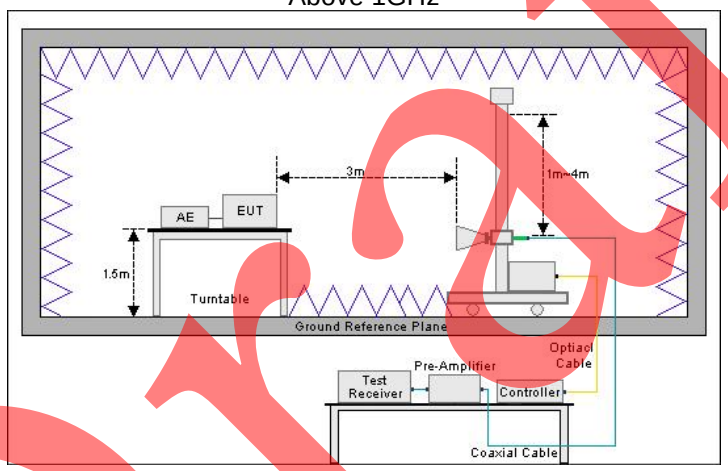
6.3 Test Setup Block

1) Radiated test method:

Below 1GHz

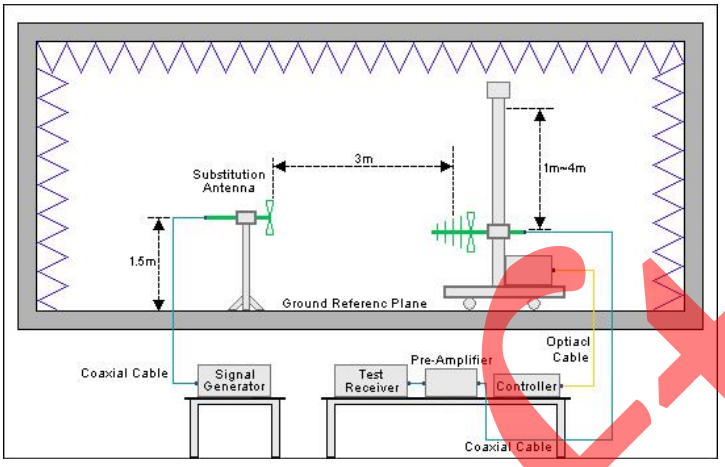


Above 1GHz

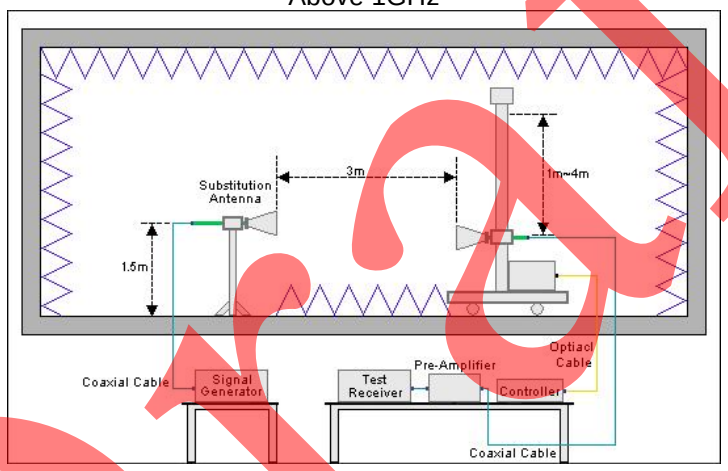


2) Substitution measurement

Below 1GHz



Above 1GHz



6.4 Test Results

6.4.1 Test Result Summary

Test Frequency Range: 5150MHz ~ 5250MHz				
Clause No.	**Mode**	**Test Condition**	**Test Data**	**Verdict**
4.2.1	UNMODULATION	NVNT	Refer to the report.: BCTC2109795863-6E	Pass
		LVLT		
		LVHT		
		HVLT		
		HVHT		
4.2.2	802.11 a & n(HT20) & n(HT40) & ac(HT20) & ac(HT40) & ac(HT80)	NVNT	Refer to the report.: BCTC2109795863-6E	Pass
4.2.3	802.11 a & n(HT20) & n(HT40) & ac(HT20) & ac(HT40) & ac(HT80)	NVNT	Refer to the report.: BCTC2109795863-6E	Pass
		NVLT		
		NVHT		
4.2.3^{PSD}	802.11 a & n(HT20) & n(HT40) & ac(HT20) & ac(HT40) & ac(HT80)	NVNT	Refer to the report.: BCTC2109795863-6E	Pass
4.2.4.1	802.11 a & n(HT20) & n(HT40) & ac(HT20) & ac(HT40) & ac(HT80)	NVNT	Refer to the report.: BCTC2109795863-6E	Pass
4.2.4.2	802.11 a & n(HT20) & n(HT40) & ac(HT20) & ac(HT40) & ac(HT80)	NVNT	Refer to the report.: BCTC2109795863-6E	Pass
4.2.5	802.11 a & n(HT20) & n(HT40) & ac(HT20) & ac(HT40) & ac(HT80)	NVNT	See Section 6.4.3	Pass
4.2.6	N/A	N/A	Refer to the report.: BCTC2109795863-6E	Pass
4.2.7	802.11 a & n(HT20) & n(HT40) & ac(HT20) & ac(HT40) & ac(HT80)	NVNT	Refer to the report.: BCTC2109795863-6E	Pass
4.2.8	802.11 a & n(HT20) & n(HT40) & ac(HT20) & ac(HT40) & ac(HT80)	NVNT	See Section 6.4.2	Pass
4.2.9	N/A	N/A	Refer to the report.: BCTC2109795863-6E	Pass

Note:

1. "NVNT" means Normal Voltage Normal Temperature, "LT" means Low Temperature, "HT" means High Temperature, "LV" means Low Voltage, "HV" means High Voltag.

6.4.2 Unwanted emissions in the spurious domain

802.11a mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
105.42	Vertical	-84.93	-54.00	PASS
201.81	V	-81.72		
381.38	V	-81.23	-36.00	
944.71	V	-72.14		
10360.00	V	-41.27	-30.00	
50.13	Horizontal	-81.55	-54.00	
221.21	H	-82.52		
345.74	H	-82.43	-36.00	
807.46	H	-72.25		
10360.00	H	-42.49	-30.00	

802.11n20 mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
105.42	Vertical	-84.31	-54.00	PASS
201.81	V	-81.26		
381.38	V	-81.09	-36.00	
944.71	V	-72.24		
10360.00	V	-41.50	-30.00	
50.13	Horizontal	-81.33	-54.00	
221.21	H	-82.49		
345.74	H	-82.63	-36.00	
807.46	H	-72.22		
10360.00	H	-42.35	-30.00	

802.11n40 mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
105.42	Vertical	-84.76	-54.00	PASS
201.81	V	-81.49		
381.38	V	-80.91	-36.00	
944.71	V	-72.57		
10380.00	V	-41.57	-30.00	
50.13	Horizontal	-81.23	-54.00	
221.21	H	-82.06		
345.74	H	-82.46	-36.00	
807.46	H	-71.82		
10380.00	H	-42.75	-30.00	

802.11ac20 mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
105.42	Vertical	-84.77	-54.00	PASS
201.81	V	-81.55		
381.38	V	-80.75	-36.00	
944.71	V	-71.45		
10360.00	V	-41.10	-30.00	
50.13	Horizontal	-81.22	-54.00	
221.21	H	-83.35		
345.74	H	-83.42	-36.00	
807.46	H	-72.56		
10360.00	H	-41.98	-30.00	

802.11ac40 mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
105.42	Vertical	-84.35	-54.00	PASS
201.81	V	-81.07		
381.38	V	-81.05	-36.00	
944.71	V	-71.93		
10380.00	V	-41.51	-30.00	
50.13	Horizontal	-81.53	-54.00	
221.21	H	-82.97		
345.74	H	-83.10	-36.00	
807.46	H	-72.70		
10380.00	H	-41.99	-30.00	

802.11ac80 mode middle channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
105.42	Vertical	-85.05	-54.00	PASS
201.81	V	-81.58		
381.38	V	-81.14	-36.00	
944.71	V	-71.66		
10420.00	V	-40.65	-30.00	
50.13	Horizontal	-80.94	-54.00	
221.21	H	-83.79		
345.74	H	-83.80	-36.00	
807.46	H	-72.48		
10420.00	H	-41.80	-30.00	

6.4.3 Receiver spurious emissions

802.11a mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
344.64	Vertical	-80.85	-57.00	PASS
675.29	V	-75.51		
10360.00	V	-61.97	-47.00	
310.57	Horizontal	-83.73	-57.00	
656.14	H	-76.84		
10360.00	H	-64.08	-47.00	

802.11n20 mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
344.64	Vertical	-81.26	-57.00	PASS
675.29	V	-75.63		
10360.00	V	-62.51	-47.00	
310.57	Horizontal	-83.09	-57.00	
656.14	H	-76.74		
10360.00	H	-63.83	-47.00	

802.11n40 mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
344.64	Vertical	-81.31	-57.00	PASS
675.29	V	-75.79		
10380.00	V	-62.14	-47.00	
310.57	Horizontal	-83.55	-57.00	
656.14	H	-76.71		
10380.00	H	-63.80	-47.00	

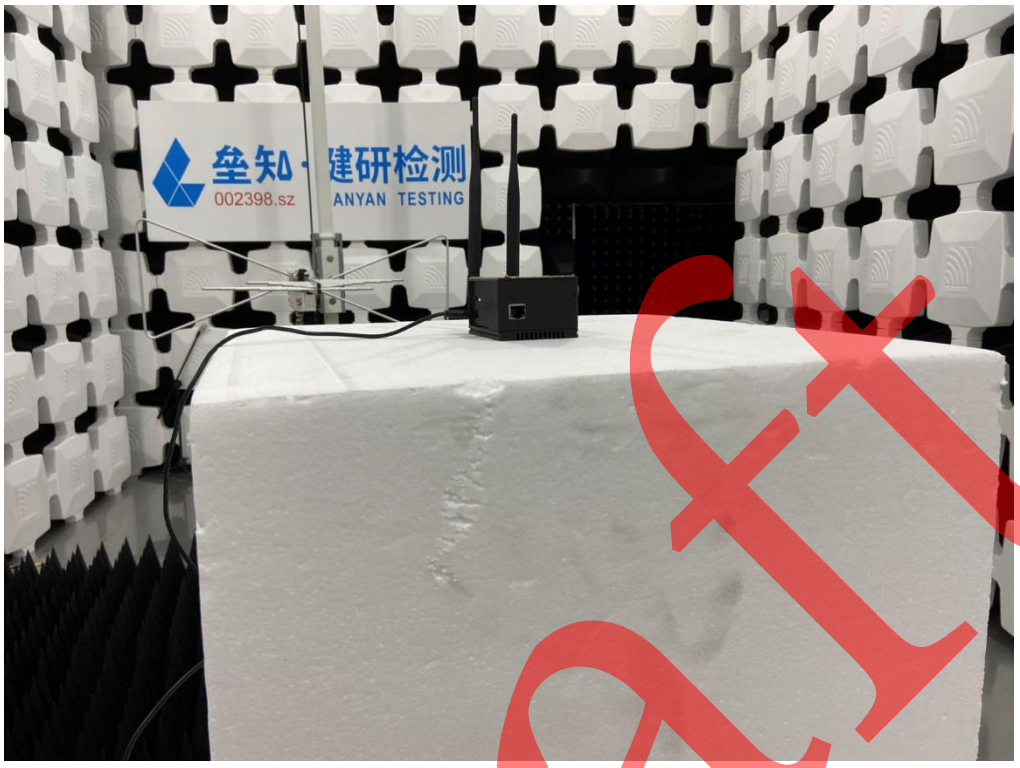
802.11ac20 mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
344.64	Vertical	-80.44	-57.00	PASS
675.29	V	-76.13		
10360.00	V	-62.65	-47.00	
310.57	Horizontal	-83.76	-57.00	
656.14	H	-76.66		
10360.00	H	-64.61	-47.00	

802.11ac40 mode Lowest channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
344.64	Vertical	-80.86	-57.00	PASS
675.29	V	-75.64		
10380.00	V	-62.78	-47.00	
310.57	Horizontal	-83.28	-57.00	
656.14	H	-76.71		
10380.00	H	-64.29	-47.00	

802.11ac80 mode middle channel				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	Polarization	Level(dBm)		
344.64	Vertical	-80.73	-57.00	PASS
675.29	V	-76.07		
10420.00	V	-62.44	-47.00	
310.57	Horizontal	-83.58	-57.00	
656.14	H	-76.19		
10420.00	H	-65.11	-47.00	

7 Test Setup Photos

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz

8 EUT Constructional Details

Refer to the report No.:

--- End of report---