

JianYan Testing Group Shenzhen Co., Ltd.

Report No: JYTSZ-R01-2200023

FCC REPORT

Applicant: Nebra Ltd

Address of Applicant: Unit 4 Bells Yew Green Business Court Bells Yew Green

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-HHRK4-868-

3, NEBHNT-HHRK4-915-3,

FCC ID: 2AZDM-HHRK4

Applicable standards: FCC CFR Title 47 Part 15 Subpart B

Date of sample receipt: 05 Jan., 2022

Date of Test: 06 Jan., to 27 Jan., 2022

Date of report issued: 28 Jan., 2022

Test Result: PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Bruce Zhang

Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

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Version

Version No.	Date	Description
00	28 Jan., 2022	Original

Tested by:	To at Empire and	Date:	28 Jan., 2022
	Te <mark>st</mark> Engineer		
Reviewed by:		Date:	28 Jan., 2022
	Project Engineer		· , -





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Test Summary

Test Item	Section in CFR 47	Result			
Conducted Emission	Part 15.107	Pass			
Radiated Emission	Part 15.109	Pass			
Remark: 1. Pass: The EUT complies with the essential requirements in the standard.					
Test Method: ANSI C63.4:2014	•				







5 General Information

5.1 Client Information

Applicant: Nebra Ltd	
Address: Unit 4 Bells Yew Green Business Court Bells Yew Green	
Manufacturer/Factory:	Nebra Ltd
Address:	Unit 4 Bells Yew Green Business Court Bells Yew Green

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-HHRK4-433-3, NEBHNT-HHRK4-915-3
AC adapter:	Model No.:R241-1202500I Input: AC100-240V, 50/60Hz 1.5 A
	Output: DC 12.0V, 2.5A
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-HHRK4-915-3, 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.
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

5.3 Test Mode and test samples plans

	Operating mode	De	etail	description
J	Working mode	Κe	ер	the EUT in Working + Lan link mode

The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

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5.4 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Conducted Emission (9kHz ~ 150KHz) for V-AMN	3.11 dB
Conducted Emission (150kHz ~ 30MHz) for V-AMN	2.62 dB
Conducted Emission (150kHz ~ 30MHz) for AAN	3.54 dB
Radiated Emission (9kHz ~ 30MHz electric field) for 3m SAC	3.13 dB
Radiated Emission (9kHz ~ 30MHz magnetic field) for 3m SAC	3.13 dB
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

5.5 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
Lenovo	Laptop	ThinkPad T14 Gen 1	SL10Z47277	DoC

5.6 Related Submittal(s) / Grant (s)

This is an original grant, no related submittals and grants.

5.7 Description of Cable Used

Cable Type	Description	Length	From	То
N/A	N/A	N/A	N/A	N/A

5.8 Additions to, deviations, or exclusions from the method

No

5.9 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

5.10 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.

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JianYan Testing Group Shenzhen Co., Ltd.

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5.11 Test Instruments list

Radiated Emission:	Radiated Emission:									
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)					
3m SAC	ETS	RFD-100	Q1984	04-14-2021	04-13-2024					
BiConiLog Antenna	SCHWARZBECK	VULB9163	9163-1246	03-07-2021	03-06-2022					
Biconical Antenna	SCHWARZBECK	VUBA 9117	9117#359	06-17-2021	06-17-2022					
Horn Antenna	SCHWARZBECK	BBHA9120D	912D-916	03-07-2021	03-06-2022					
Broad-Band Horn Antenna	SCHWARZBECK	BBHA9170	1067	04-02-2021	04-01-2022					
Broad-Band Horn Antenna	SCHWARZBECK	BBHA9170	1068	04-02-2021	04-01-2022					
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-03-2021	03-02-2022					
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-03-2021	03-02-2022					
Spectrum analyzer	Keysight	N9010B	MY60240202	10-27-2021	10-26-2022					
Low Pre-amplifier	SCHWARZBECK	BBV9743B	00305	03-07-2021	03-06-2022					
High Pre-amplifier	SKET	LNPA_0118G-50	MF280208233	03-07-2021	03-06-2022					
Cable	Qualwave	JYT3M-1G-NN-8M	JYT3M-1	03-07-2021	03-06-2022					
Cable	Qualwave	JYT3M-18G-NN-8M	JYT3M-2	03-07-2021	03-06-2022					
Cable	Qualwave	JYT3M-1G-BB-5M	JYT3M-3	03-07-2021	03-06-2022					
Cable	Bost	JYT3M-40G-SS-8M	JYT3M-4	04-02-2021	04-01-2022					
EMI Test Software	Tonscend	TS+		Version:3.0.0.1	·					

Conducted Emission:						
Test Equipment	Manufacturer		Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz		ESCI 3	101189	03-03-2021	03-02-2022
LISN	Schwarzbeck 🔺		NSLK 8127	QCJ001-13	03-18-2021	03-17-2022
LISN	Rohde & Schwarz	7	ESH3-Z5	843862/010	06-18-2020	06-17-2022
RF Switch	TOP PRECISION		RSU0301	N/A	03-03-2021	03-02-2022
Cable	Bost	,	JYTCE-1G-NN-2M	JYTCE-1	03-03-2021	03-02-2022
Cable	Bost	,	JYTCE-1G-BN-3M	JYTCE-2	03-03-2021	03-02-2022
EMI Test Software	AUDIX	E3 Version: 6.110919b		b		

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Test results and Measurement Data

6.1 Conducted Emission

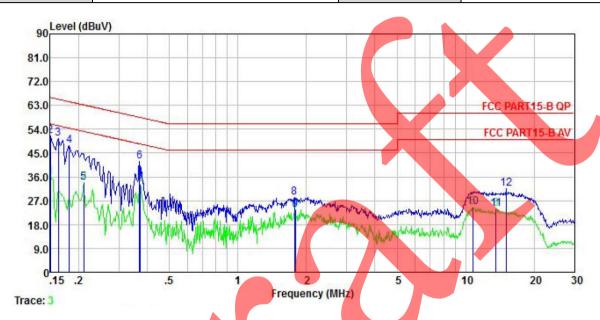
Test Requirement:	FCC Part 15 B Section 15.107				
Test Frequency Range:	150kHz to 30MHz				
Class / Severity:	Class B				
Receiver setup:	RBW=9kHz, VBW=30kHz				
Limit:	Frequency range (MHz)		(dBµV)		
	0.15-0.5	Quasi-peak 66 to 56*	Average 56 to 46*		
	0.5-5	56	46		
	0.5-30	60	50		
	* Decreases with the logarithm		33		
Test setup:	Reference Plane				
	Test table/Insulation plane Remark E.U.T. Equipment Under Test LISN: Line Impedence Stabilization Network Test table height=0.8m	Filter AC power			
Test procedure	 The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). The provide a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4(latest version) on conducted measurement. 				
Test Instruments:	Refe <mark>r to section 5.11 for details</mark>				
Test mode:	Refer to section 5.3 for details				
Test results:	Pass				
l est results:	Pass				

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Measurement data:

Product name:	Nebra Indoor LoRa Gateway ROCK Pi 4 Version / Nebra Indoor Helium Hotspot ROCK Pi 4 Version	Product model:	NEBHNT-HHRK4-915
Test by:	Mike	Test mode:	Working mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5°C Huni: 55%



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
_	MHz	dBu₹	dB	₫B	dBu₹	dBu∜		
1 2 3 4 5 6 7 8 9 10 11 12	0.150 0.150 0.162 0.182 0.211 0.369 0.373 1.772 1.790 10.733 13.623 15.066	35.83 51.55 50.56 47.72 33.76 41.88 33.23 27.84 23.43 24.28 23.63 31.20	0.04 0.04 0.04 0.04 0.04 0.04 0.07 0.07	0.01 0.01 0.01 0.03 0.03 0.03 0.18 0.19 0.12 0.12	35.88 51.60 50.61 47.77 33.83 41.95 33.30 28.09 23.69 24.62 24.01 31.61	66.00 65.34 64.42 53.18 58.52 48.43 56.00 46.00 50.00	-14.40 -14.73 -16.65 -19.35 -16.57 -15.13 -27.91 -22.31 -25.38	QP Average QP Average QP Average Average Average
Charles He		15-2 (16/4 mg/ 1/29/4/		10 May 10				00720

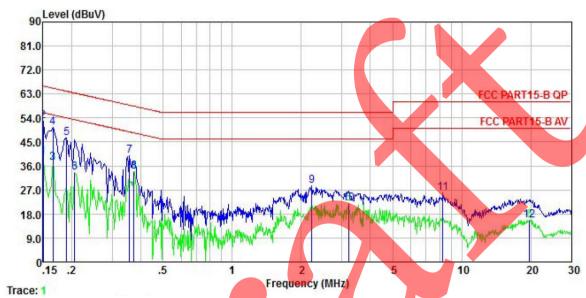
Notes

- 1. An initial pre-scan was performed on the line and neutral lines with peak detector.
- 2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
- 3. Final Level =Receiver Read level + LISN Factor + Cable Loss.

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Product name:	Nebra Indoor LoRa Gateway ROCK Pi 4 Version / Nebra Indoor Helium Hotspot ROCK Pi 4 Version	Product model:	NEBHNT-HHRK4-915
Test by:	Mike	Test mode:	Working mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5℃ Huni: 55%



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
_	MHz	dBu∀	₫B	₫B	dBu₹	dBu₹	dB	
1 2 3 4 5 6 7 8 9 10 11	0. 150 0. 150 0. 166 0. 166 0. 190 0. 206 0. 358 0. 373 2. 225 3. 224 8. 279	39.53 52.65 37.07 50.27 46.36 33.39 39.92 33.93 28.24 21.86 25.55	0.05 0.05 0.05 0.05 0.04 0.04 0.04 0.04	0.01 0.01 0.01 0.01 0.03 0.04 0.02 0.03 0.17 0.07	39.59 52.71 37.13 50.33 46.43 33.47 39.98 34.00 28.48 22.01 25.81	66.00 55.16 65.16 64.02 53.36 58.78 48.43 56.00 46.00	-13.29 -18.03 -14.83 -17.59 -19.89 -18.80 -14.43 -27.52	Average QP QP Average QP Average QP Average
12	19.740	15. 26	0.30	0.15	15.71	50.00	-34.29	Average

Notes:

- 1. An initial pre-scan was performed on the line and neutral lines with peak detector.
- 2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
- 3. Final Level =Receiver Read level + LISN Factor + Cable Loss.

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6.2 Radiated Emission

Test Requirement:	FCC Part 15 B Section 15.109							
Test Frequency Range:	30MHz to 6000M	30MHz to 6000MHz						
Test site:	Measurement Dis	Measurement Distance: 3m (Semi-Anechoic Chamber)						
Receiver setup:	Frequency	, , ,			Remark			
Neceiver setup.	30MHz-1GHz	Quasi-pe		120kHz	300kHz	Quasi-peak Value		
		Peak		1MHz	3MHz	Peak Value		
	Above 1GHz	RMS		1MHz	3MHz	Average Value		
Limit:	Frequenc	у	Lim	nit (dBuV/m	@3m)	Remark		
	30MHz-88N	ЛHz		40.0		Quasi-peak Value		
	88MHz-216			43.5		Quasi-peak Value		
	216MHz-960			46.0		Quasi-peak Value		
	960MHz-10	SHz		54.0		Quasi-peak Value		
	Above 1G	Hz		54.0		Average Value		
Test setup:	Below 1GHz			74.0		Peak Value		
	Tum John O.8m Table O.8m AAbove 1GHz	4m		RF	siver			
	AE (Turn		3m		Antenna Tower			
Test Procedure:	ground at a 3 r degrees to det 2. The EUT was which was mor 3. The antenna h ground to dete	meter semi- ermine the set 3 meters unted on the eight is vari rmine the m	anectoristics aware top ed from the top ed fro	hoic camber on of the hig ay from the i of a variable om one mete um value of	r. The table ghest radia nterference e-height ar er to four n	e-receiving antenna, ntenna tower. neters above the		





	4. For each suspected emission, the EUT was arranged to its worst case a then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.				
	5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.				
	6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.				
Test Instruments:	Refer to section 5.11 for details				
Test mode:	Refer to section 5.3 for details				
Test results:	Passed				
Remark:	All of the observed value above 6GHz ware the niose floor, which were no recorded				

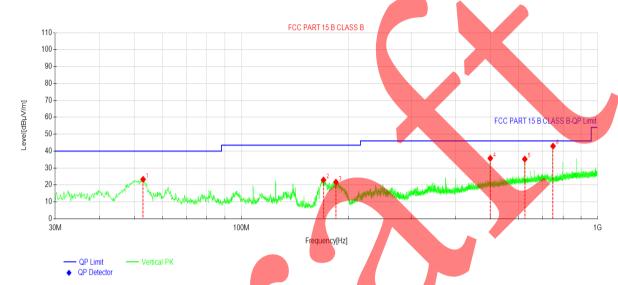
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Measurement Data:

Below 1GHz:

Product name:	Nebra Indoor LoRa Gateway ROCK Pi 4 Version / Nebra Indoor Helium Hotspot ROCK Pi 4 Version	Product model:	NEBHNT-HHRK4-915
Test By:	Mike	Test mode:	Working mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical
Test Voltage:	AC 120/60Hz	Environment:	Temp: 24℃ Huni: 57%



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	52.9913	37.96	23.31	-14.65	40.00	16.69	PK	Vertical
2	170.082	39.92	22.92	-17.00	43.50	20.58	PK	Vertical
3	184.342	38.08	21.65	-16.43	43.50	21.85	PK	Vertical
4	500.012	42.69	35.73	-6,96	46.00	10.27	PK	Vertical
5	625.057	40.58	35.27	-5.31	46.00	10.73	PK	Vertical
6	750.103	46.69	42.95	-3.74	46.00	3.05	PK	Vertical

Remark:

- 1. Final Level = Receiver Read level + Factor. (Antenna Factor + Cable Loss Preamplifier Factor).
- The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Product name:	Nebra Indoor LoRa Gateway ROCK Pi 4 Version / Nebra Indoor Helium Hotspot ROCK Pi 4 Version	Product model:	NEBHNT-HHRK4-915
Test By:	Mike	Test mode:	Working mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	AC 120/60Hz	Environment:	Temp: 24°C Huni: 57%



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	59.0059	28.72	13.78	-14.94	40.00	26.22	PK	Horizontal
2	169.888	34.78	17.78	-17.00	43.50	25.72	PK	Horizontal
3	250.018	34.05	20.26	-13.79	46.00	25.74	PK	Horizontal
4	375.063	44.49	33.61	-10.88	46.00	12.39	PK	Horizontal
5	500.012	40.68	33.72	-6.96	46.00	12.28	PK	Horizontal
6	750.103	43.38	39.64	-3.74	46.00	6.36	PK	Horizontal

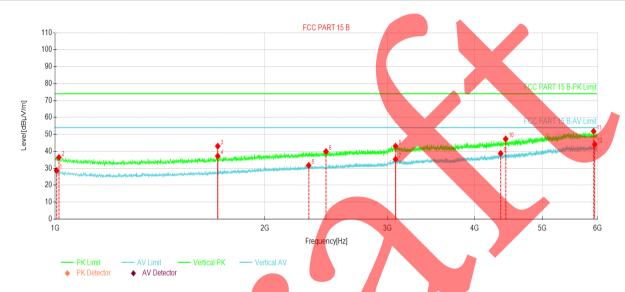
Remark:

- 1. Final Level = Receiver Read level + Factor. (Antenna Factor + Cable Loss Preamplifier Factor).
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.



Above 1GHz:

Product name:	Nebra Indoor LoRa Gateway ROCK Pi 4 Version / Nebra Indoor Helium Hotspot ROCK Pi 4 Version	Product model:	NEBHNT-HHRK4-915
Test By:	Mike	Test mode:	Working mode
Test Frequency:	1 GHz ~ 6 GHz	Polarization:	Vertical
Test Voltage:	AC 120/60Hz	Environment:	Temp: 24℃ Huni: 57%



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1005.00	50.31	28.70	-21.61	54.00	25.30	AV	Vertical
2	1012.50	58.09	36.36	-21.73	74.00	37.64	PK	Vertical
3	1711.25	64.83	43.07	-21,76	74.00	30.93	PK	Vertical
4	1711.25	58.96	37.20	-21.76	54.00	16.80	AV	Vertical
5	2311.25	50.74	31.70	-19.04	54.00	22.30	AV	Vertical
6	2446.87	58.58	39.87	-18.71	74.00	34.13	PK	Vertical
7	3078.75	51.47	35.32	-16.15	54.00	18.68	AV	Vertical
8	3078.75	59.22	43.07	-16.15	74.00	30.93	PK	Vertical
9	4357.50	50.15	38.77	-11.38	54.00	15.23	AV	Vertical
10	4430.62	58.40	47.33	-11.07	74.00	26.67	PK	Vertical
11	5923.75	56.69	51.84	-4.85	74.00	22.16	PK	Vertical
12	5945.62	49.01	44.11	-4.90	54.00	9.89	AV	Vertical

Remark

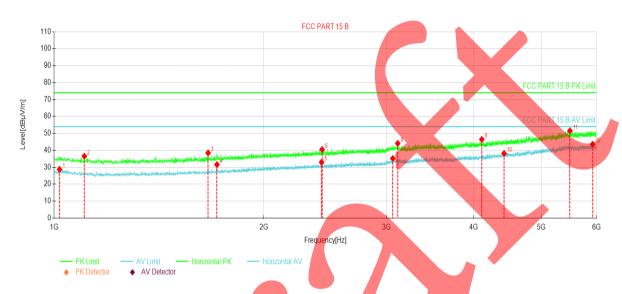
- 1. Final Level = Receiver Read level + Factor.(Antenna Factor + Cable Loss Preamplifier Factor).
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Project No.: JYTSZR2201011



Product name:	Nebra Indoor LoRa Gateway ROCK Pi 4 Version / Nebra Indoor Helium Hotspot ROCK Pi 4 Version	Product model:	NEBHNT-HHRK4-915	
Test By:	Mike	Test mode:	Working mode	
Test Frequency:	1 GHz ~ 6 GHz	Polarization:	Horizontal	
Test Voltage:	AC 120/60Hz	Environment:	Temp: 24℃ Huni: 57%	



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1018.12	50.55	28,73	-21.82	54.00	25.27	AV	Horizontal
2	1105.00	59.65	36.52	-23.13	74.00	37.48	PK	Horizontal
3	1663.12	60.45	38.48	-21.97	74.00	35.52	PK	Horizontal
4	1712.50	53.33	31.57	-21.76	54.00	22.43	AV	Horizontal
5	2419.37	51.72	32.96	-18.76	54.00	21.04	AV	Horizontal
6	2423.75	59.26	40.51	-18.75	74.00	33.49	PK	Horizontal
7	3061.25	51.53	35.22	-16.31	54.00	18.78	AV	Horizontal
8	3111.25	60.03	44.08	-15.95	74.00	29.92	PK	Horizontal
9	4107.50	58.98	46.49	-12.49	74.00	27.51	PK	Horizontal
10	4421.25	49.27	38.17	-11.10	54.00	15.83	AV	Horizontal
11	5495.62	57.61	51.54	-6.07	74.00	22.46	PK	Horizontal
12	5924.37	48.46	43.61	-4.85	54.00	10.39	AV	Horizontal

Remark:

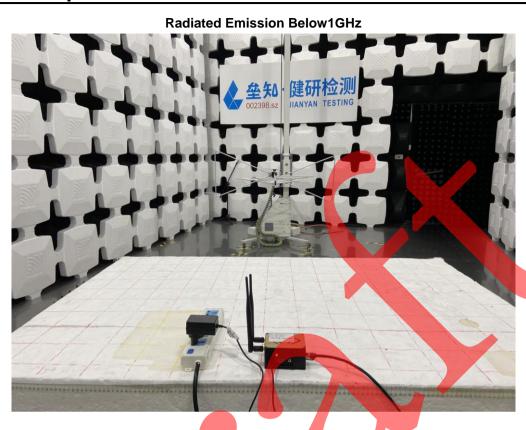
- 1. Final Level = Receiver Read level + Factor.(Antenna Factor + Cable Loss Preamplifier Factor).
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

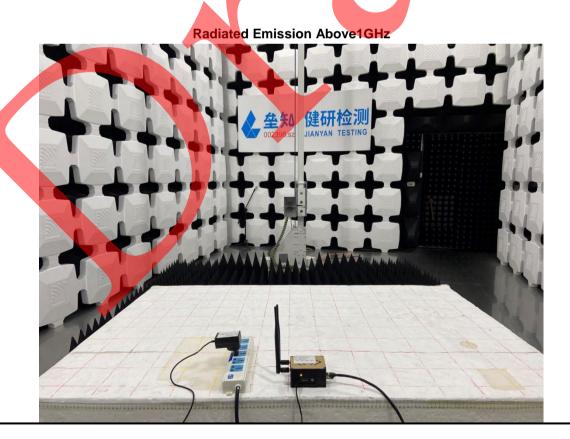
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Test Setup Photo





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8 EUT Constructional Details

Reference to the test report No.: JYTSZ-R12-2200086.

-----End of report-----