

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 *

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





Version

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

Tested by: Date: 28 Jan., 2022

Winner Thang
Project Engineer Reviewed by: Date: 28 Jan., 2022





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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-HHRK4-433-3, NEBHNT-HHRK4-433-3, NEBHNT-HHRK4-470-3, NEBHNT-HHRK4-868-3, 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-HHRK4-915-3, NEBHNT-HHRK4-433-3, NEBHNT-HHRK4-433-3, 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.	
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	Detail description
Working mode	Keep 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
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, Xingiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.

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JianYan Testing Group Shenzhen Co., Ltd.

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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5.11 Test Instruments list

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	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	V	ersion: 6.110919	b

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Test results and Measurement Data

6.1 Conducted Emission

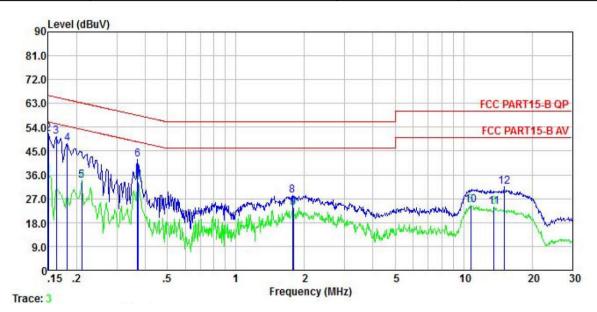
Test Requirement:	FCC Part 15 B Section 15.107			
Test Frequency Range:	150kHz to 30MHz			
Class / Severity:	Class B			
Receiver setup:	RBW=9kHz, VBW=30kHz			
Limit:	Frequency range (MHz)	Limit Quasi-peak	(dBµV)	
	, , ,	Average		
		0.15-0.5 66 to 56* 56 to 46*		
	0.5-5	56	46	
	0.5-30	60	50	
	* Decreases with the logarithm	of the frequency.		
Test setup:	Test table/Insulation plane Remark E.U.T. Equipment Under Test LISN: Line Impedence Stabilization Network Test table height=0.8m	LISN Filter — AC powe		
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:	Refer to section 5.11 for details			
Test mode:	Refer to section 5.3 for details			
Test 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℃ Huni: 55%



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBu∜	<u>dB</u>	dB	dBu₹	dBu₹	<u>dB</u>	
1	0.150	35.83	0.04	0.01	35.88			Average
2	0.150	51.55	0.04	0.01	51.60	66.00	-14.40	QP
3	0.162	50.56	0.04	0.01	50.61	65.34	-14.73	QP
4	0.182	47.72	0.04	0.01	47.77	64.42	-16.65	QP
1 2 3 4 5	0.211	33.76	0.04	0.03	33.83	53.18	-19.35	Average
6	0.369	41.88	0.04	0.03	41.95	58.52	-16.57	QP
7	0.373	33.23	0.04	0.03	33.30	48.43	-15.13	Average
8	1.772	27.84	0.07	0.18	28.09	56.00	-27.91	QP
8	1.790	23.43	0.07	0.19	23.69	46.00	-22.31	Average
10	10.733	24.28	0.22	0.12	24.62			Average
11	13.623	23.63	0.26	0.12	24.01			Average
12	15.066	31.20	0.27	0.14	31.61		-28.39	

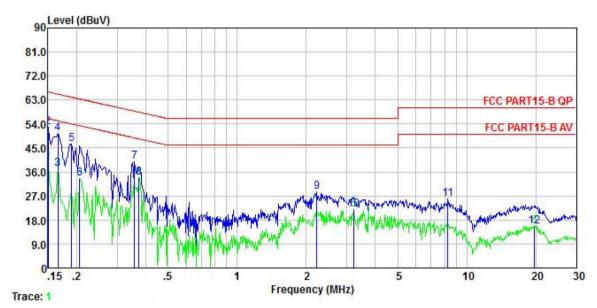
Notes:

- 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
118	MHz	dBu∜	<u>dB</u>	₫B	dBu₹	dBu∇	<u>dB</u>	
1 2	0.150 0.150	39.53 52.65	0.05 0.05	0.01 0.01	39.59 52.71		-16.41 -13.29	Average OP
3	0.166 0.166	37.07 50.27	0.05	0.01	37.13 50.33	55.16		Average
1 2 3 4 5	0.190 0.206	46.36	0. 04 0. 04	0.03	46.43	64.02	-17.59	9 IN 10 10 10 10 10 10 10 10 10 10 10 10 10
7 8 9	0.358 0.373	39.92 33.93	0.04	0.02	39.98 34.00	58.78	-18.80	
	2.225	28.24	0.07	0.17	28.48	56.00	-27.52	QP
10 11 12	3. 224 8. 279 19. 740	21.86 25.55 15.26	0.08 0.16 0.30	0.07 0.10 0.15	22.01 25.81 15.71	60.00	-34.19	Average QP 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.



6.2 Padiated Emission

T (D)	on	45 46						
Test Requirement:	FCC Part 15 B Se)9					
Test Frequency Range:	30MHz to 6000M	Hz						
Test site:	Measurement Dis	Measurement Distance: 3m (Semi-Anechoic Chambe		Chamber)				
Receiver setup:	Frequency	Detecto	or	RBW	VBW	Remark		
·	30MHz-1GHz Quasi-pea		ak	120kHz	300kHz	Quasi-peak Value		
	Above 1GHz	Peak		1MHz	3MHz	Peak Value		
		RMS		1MHz	3MHz	Average Value		
Limit:		Frequency Limit (dBuV/m @3m) Remark 30MHz-88MHz 40.0 Quasi-peak Value						
	88MHz-216			40.0 43.5		Quasi-peak Value Quasi-peak Value		
	216MHz-960			46.0		Quasi-peak Value		
	960MHz-10			54.0		Quasi-peak Value		
				54.0		Average Value		
	Above 1G	Hz		74.0		Peak Value		
Test setup:	Below 1GHz Turn Table Ground Plane Above 1GHz	4m		RFT				
	AE	W V V	3m		Antenna Tower			
Test Procedure:	ground at a 3 r degrees to dete 2. The EUT was s which was mou 3. The antenna h ground to dete	meter semi- ermine the p set 3 meters unted on the eight is vari rmine the m	anecl positions awa top ed from axim	noic camber on of the hig ly from the i of a variable om one mete um value of	The table The table	e-receiving antenna, ntenna tower. neters above the		

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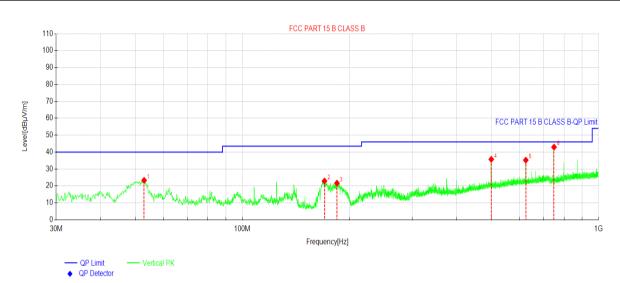
	 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified 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



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°C 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

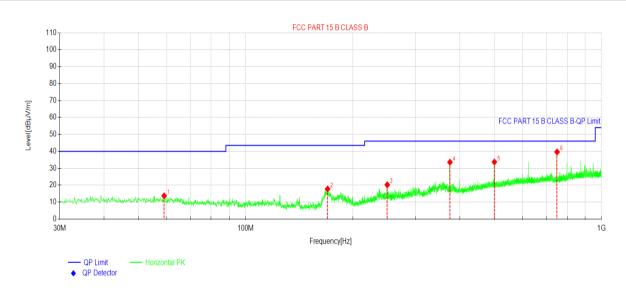
Remark:

- 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:

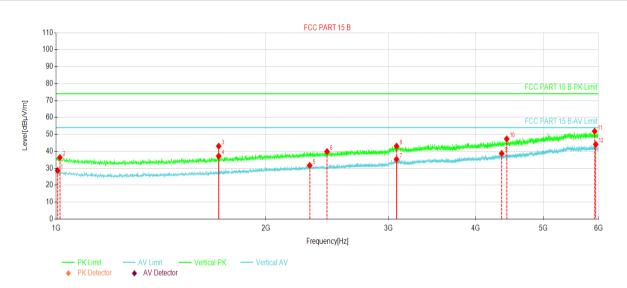
- 1. Final Level = Receiver Read level + Factor.(Antenna Factor + Cable Loss Preamplifier Factor).
- 2. The emission levels of other frequencies are lower than the limit 20dB and not show in test report.

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Above 1GHz:

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



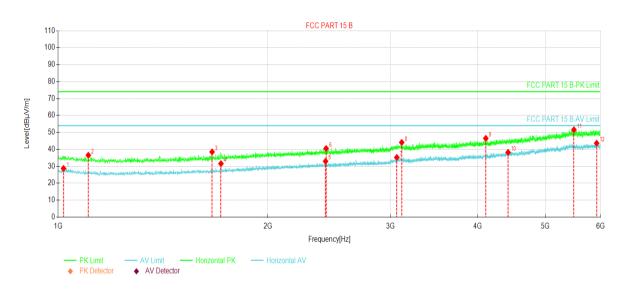
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1005.00	50.31	28.70	-21.61	54.00	25.30	AV	Vertical
2	1012.50	58.09	36.36	-21.73	74.00	37.64	PK	Vertical
3	1711.25	64.83	43.07	-21.76	74.00	30.93	PK	Vertical
4	1711.25	58.96	37.20	-21.76	54.00	16.80	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

- 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:	l: 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°C 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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