

Report No: JYTSZ-R12-2200082

<b>FCC REPOI</b>	RT
(Bluetooth)	

Applicant:	Nebra Ltd
Address of Applicant:	Unit 4 Bells Yew Green Business Court Bells Yew Green
Equipment Under Test (E	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
FCC ID:	2AZDM-HHRK4
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
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:



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.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.



### 2 Version

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

Tested by:

Date: 28 Jan., 2022

Mike.OU Test Engineer Winner Mang

Reviewed by:

**Project Engineer** 

Date: 28 Jan., 2022

Project No.: JYTSZR2201011



# **3** Contents

	Page
1 COVER PAGE	1
2 VERSION	2
3 CONTENTS	3
4 TEST SUMMARY	
5 GENERAL INFORMATION	
5.1 CLIENT INFORMATION	
5.2 GENERAL DESCRIPTION OF E.U.T.	
5.3 TEST ENVIRONMENT AND MODE	6
5.4 DESCRIPTION OF SUPPORT UNITS	
5.5 MEASUREMENT UNCERTAINTY	
5.6 ADDITIONS TO, DEVIATIONS, OR EXCLUSIONS FROM THE METHOD	
5.7 LABORATORY FACILITY	
5.8 LABORATORY LOCATION	
5.9 TEST INSTRUMENTS LIST	8
6 TEST RESULTS AND MEASUREMENT DATA	9
6.1 ANTENNA REQUIREMENT	9
6.2 CONDUCTED EMISSIONS	10
6.3 BAND EDGE	
6.3.1 Radiated Emission Method	13
6.4 Spurious Emission	26
6.4.1 Radiated Emission Method	
7 TEST SETUP PHOTO	31
8 EUT CONSTRUCTIONAL DETAILS	



## **4** Test Summary

Test Items	Section in CFR 47	Test Data	Result	
Antenna Requirement	15.203 & 15.247 (b)	See Section 6.1	Pass	
AC Power Line Conducted Emission	15.207	See Section 6.2	Pass	
Conducted Peak Output Power	15.247 (b)(1)	Please refer to FCC ID: 2AI4I-AP6212 Report No.: DRTFCC1610-0133	Pass*	
20dB Occupied Bandwidth	15.247 (a)(1)	Please refer to FCC ID: 2AI4I-AP6212 Report No.: DRTFCC1610-0133	Pass*	
Carrier Frequencies Separation	15.247 (a)(1)	Please refer to FCC ID: 2AI4I-AP6212 Report No.: DRTFCC1610-0133	Pass*	
Hopping Channel Number	15.247 (a)(1)	Please refer to FCC ID: 2AI4I-AP6212 Report No.: DRTFCC1610-0133	Pass*	
Dwell Time	15.247 (a)(1)	Please refer to FCC ID: 2AI4I-AP6212 Report No.: DRTFCC1610-0133	Pass*	
Conducted Band Edge	15.205 & 15.209&15.247(d)	Please refer to FCC ID: 2AI4I-AP6212 Report No.: DRTFCC1610-0133	Pass*	
Radiated Band Edge		See Section 6.9.2	Pass	
Conducted Spurious Emission	15.205 & 15.209&15.247(d)	Please refer to FCC ID: 2AI4I-AP6212 Report No.: DRTFCC1610-0133	Pass*	
Radiated Spurious Emission	1	See Section 6.10.2	Pass	
Remark:         1.       Pass: The EUT complies with the essential         2.       Pass*: Please refer to FCC ID: 2AI4I-AP62         ANSI C63.10-2013         KDB 558074 D01 15.247 Mea	12, and the report No.: DRTFC	C1610-0133 issue by DT&C	C Co., Ltd	



# **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-HHRK4-470-3, NEBHNT-HHRK4-868-3, NEBHNT-HHRK4-915-3		
Operation Frequency:	2402MHz~2480MHz		
Transfer rate:	1/2/3 Mbits/s		
Number of channel:	79		
Modulation type:	GFSK, π/4-DQPSK, 8DPSK		
Modulation technology:	FHSS		
Antenna Type:	External Antenna		
Antenna gain:	1 dBi		
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-HHRK4-470-3, 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.		
Test Sample Condition:	The test samples were provided in good working order with no visible defects.		



Operation	Operation Frequency each of channel for GFSK, $\pi$ /4-DQPSK, 8DPSK							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency	
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz	
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz	
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz	
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz	
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz	
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz	
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz	
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz	
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz	
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz	
19	2421MHz	39	2441MHz	59	2461MHz			
Remark: Channel 0, 39 &78 selected for GFSK, π/4-DQPSK and 8DPSK.								

## 5.3 Test environment and mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	54 % RH
Atmospheric Pressure:	1010 mbar
Test Modes:	
Non-hopping mode:	Keep the EUT in continuous transmitting mode with worst case data rate.
Hopping mode:	Keep the EUT in hopping mode.
Remark	GFSK (1 Mbps) is the worst case mode.
of 3m chamber*. Measurements emission was maximized by: ha about all 3 axis (X, Y & Z) and c interconnecting cables, rotating	was placed 0.8m (below 1GHz)/1.5m (above 1GHz) above the ground plane is in both horizontal and vertical polarities were performed. During the test, each ving the EUT continuously working, investigated all operating modes, rotated onsidered typical configuration to obtain worst position, manipulating 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.

## 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%)
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

## 5.6 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: <u>https://portal.a2la.org/scopepdf/4346-01.pdf</u>

### 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

<b>Radiated Emission:</b>					
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	Version: 6.110919b				



# 6 Test results and measurement data

### 6.1 Antenna Requirement

Standard requirement:	FCC Part 15 C Section 15.203 & 247(b)
responsible party shall be us antenna that uses a unique so that a broken antenna ca electrical connector is prohil 15.247(b) (4) requirement: (4) The conducted output po antennas with directional ga section, if transmitting anten power from the intentional ra	be designed to ensure that no antenna other than that furnished by the sed with the device. The use of a permanently attached antenna or of an coupling to the intentional radiator, the manufacturer may design the unit n be replaced by the user, but the use of a standard antenna jack or bited. wer limit specified in paragraph (b) of this section is based on the use of ins that do not exceed 6 dBi. Except as shown in paragraph (c) of this inas of directional gain greater than 6 dBi are used, the conducted output adiator shall be reduced below the stated values in paragraphs (b)(1), tion, as appropriate, by the amount in dB that the directional gain of the
E.U.T Antenna:	
The Bluetooth antenna is an the antenna is 1 dBi.	External antenna which permanently attached, and the best case gain of



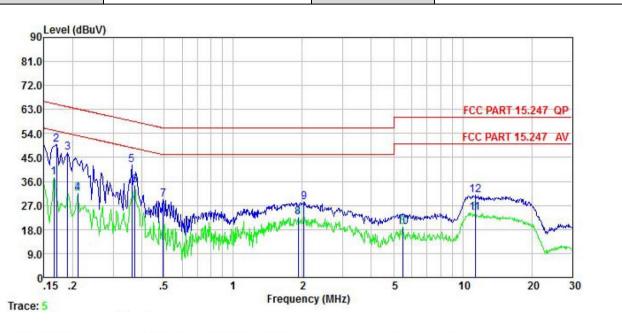
### **6.2 Conducted Emissions**

Test Requirement:	FCC Part 15 C Section 15.	207	
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9 kHz, VBW=30 kHz	z, Sweep time=auto	
Limit:	Frequency range (MHz)	Limit (c	dBuV)
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30 * Decreases with the logari	60 thm of the frequency	50
Test setup:	Reference Pl		
	AUX Equipment E.U.T Test table/Insulation plane Remark: E.U.T. Equipment Under Test LISN: Line Impedence Stabilization Networ Test table height=0.8m		
Test procedure:	<ol> <li>50ohm/50uH coupling in</li> <li>The peripheral devices a LISN that provides a 500 termination. (Please reference)</li> <li>Both sides of A.C. line interference. In order to positions of equipment</li> </ol>	tion network (L.I.S.N.). Th npedance for the measuri	is provides a ng equipment. main power through a ance with 500hm the test setup and n conducted sion, the relative ables must be changed
Test Instruments:	Refer to section 5.9 for det	ails	
Test mode:	Hopping mode		
Test results:	Pass		



#### 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:	BT Tx 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	dBuV	dB	dB	dBu∛	 dBu∛	āB	and part and part of the part
1	0.166	37.40	0.04	0.01	37.45	55.16	-17.71	Average
2	0.170	49.85	0.04	0.01	49.90	64.94	-15.04	QP
3	0.190	46.69	0.04	0.03	46.76	64.02	-17.26	QP
123456789	0.211	31.37	0.04	0.03	31.44	53.18	-21.74	Average
5	0.361	42.17	0.04	0.02	42.23	58.69	-16.46	QP
6	0.373	34.48	0.04	0.03	34.55	48.43	-13.88	Average
7	0.497	29.01	0.04	0.03	29.08	56.05	-26.97	QP
8	1.918	22.30	0.07	0.20	22.57	46.00	-23.43	Average
	2.033	27.94	0.07	0.20	28.21	56.00	-27.79	QP
10	5.505	18.86	0.13	0.09	19.08	50.00	-30.92	Average
11	11.317	23.83	0.23	0.11	24.17	50.00	-25.83	Average
12	11.377	30.47	0.23	0.11	30.81	60.00	-29.19	QP

Notes:

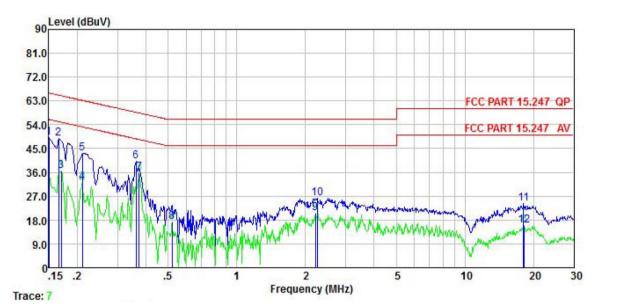
1. An initial pre-scan was performed on the line and neutral lines with peak detector.

2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.

3. Final Level = Receiver Read level + LISN Factor + Aux Factor + Cable Loss.



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:	BT Tx 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		Level	Limit Line	Over Limit	Remark
	MHz	dBuV		dB	dBu∛	 dBu⊽	āB	
1	0.150	48.93	0.05	0.01	48.99	66.00	-17.01	QP
2	0.166	48.63	0.05	0.01	48.69	65.16	-16.47	QP
1 2 3 4 5 6 7 8 9	0.170	36.37	0.05	0.01	36.43	54.94	-18.51	Average
4	0.211	32.27	0.04	0.03	32.34	53.18	-20.84	Average
5	0.211	43.25	0.04	0.03	43.32	63.18	-19.86	QP
6	0.361	40.20	0.04	0.02	40.26	58.69	-18.43	QP
7	0.373	35.67	0.04	0.03	35.74	48.43	-12.69	Average
8	0.521	17.20	0.04	0.03	17.27	46.00	-28.73	Average
9	2.213	20.48	0.07	0.17	20.72	46.00	-25.28	Average
10	2.249	26.13	0.07	0.17	26.37	56.00	-29.63	QP
11	18.039	23.69	0.28	0.15	24.12	60.00	-35.88	QP
12	18.232	15.56	0.28	0.15	15.99	50.00	-34.01	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 + Aux Factor + Cable Loss.



### 6.3 Band Edge

### 6.3.1 Radiated Emission Method

Test Requirement:	FCC Part 15 C	Section 15.20	)9 an	d 15.205				
Test Frequency Range:	2310 MHz to 23	90 MHz and	2483	5.5 MHz to 2	500 N	lHz		
Test Distance:	3m							
Receiver setup:	Frequency	Detector		RBW	V	BW	Remark	
		Peak		1MHz	31	MHz	Peak Value	
	Above 1GHz	RMS		1MHz	3MHz		Average Value	
Limit:	Frequence	cy L	.imit (	(dBuV/m @3	3m)		Remark	
	Above 1G	Above 1GHz 54.00 Average Value						
Test setup:		112		74.00			Peak Value	
		EUT Itable) Ground Test Receiver	3m Alference Pl		tenna Towe			
Test Procedure:	<ul> <li>determine the</li> <li>2. The EUT was antenna, whi tower.</li> <li>3. The antenna ground to de horizontal an measurement</li> <li>4. For each sus and then the the rota table maximum reations</li> <li>5. The test-rece Bandwidth withing</li> <li>6. If the emission limit specified EUT would b margin would</li> </ul>	B meter camb e position of t s set 3 meters ch was moun height is vari termine the m d vertical pola t. spected emiss antenna was e was turned f ading. eiver system v ith Maximum on level of the d, then testing	er. The high s awa ted o ed from arizat sion, t tune from ( was s Hold EUT g coul therv one	he table was ighest radiation ay from the in on the top of om one meter tions of the a the EUT was do to heights 0 degrees to set to Peak E Mode. in peak mo Id be stoppe wise the emis- by one using	s rotat ion. nterfe a vari er to f the fi antenr s arra from 0 360 Detect ed and ssions g pea	ed 360 rence-r able-he our met eld stre ha are s nged to 1 meter degrees Function as 10dB I the pe s that di k, quas	degrees to eceiving eight antenna ers above the ngth. Both set to make the its worst case to 4 meters and s to find the on and Specified b lower than the ak values of the d not have 10dB i-peak or	
Test Instruments:	Refer to section	5.9 for detail	s					
Test mode:	Non-hopping m	ode						
Test results:	Passed							



#### GFSK Mode:

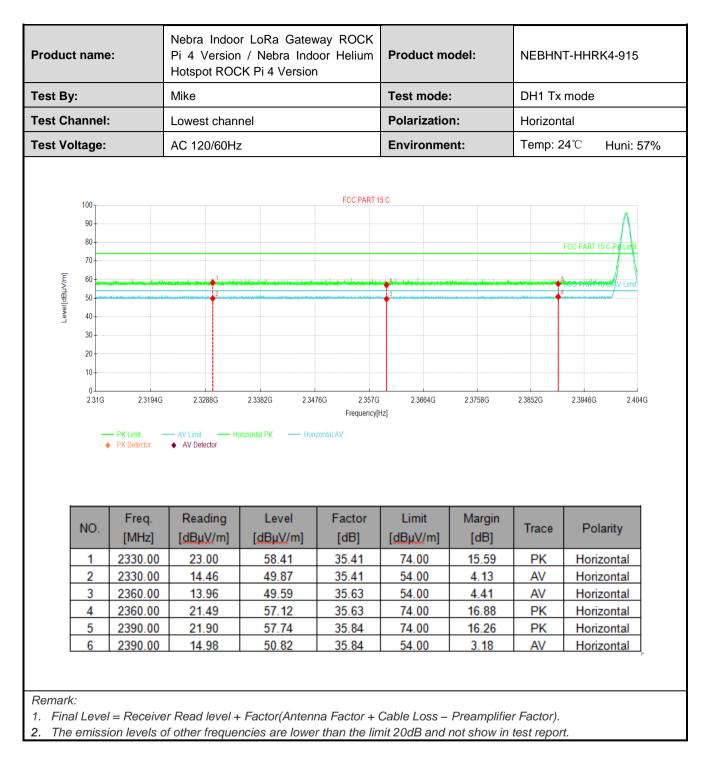
Product n	ame:		Nebra Indoor LoRa Gateway ROCK Pi 4 Version / Nebra Indoor Helium Hotspot ROCK Pi 4 Version			Product model:		NEBHI	NEBHNT-HHRK4-915			
Test By:			Mike				Test mode:		DH1 Tx mode			
Fest Channel:			Lowes	st chan	nel			Polariza	ation:	Vertica	1	
			AC 12	:0/60Hz	<u>z</u>			Environ	ment:	Temp:	<b>24</b> ℃	Huni: 57%
11 1( 	20 10 00 90 90 90 90 90 90 90 90 9	2.3194G		2288G	2.3382G ertical PK —	2.3476G — Vertical AV	2.357G Frequency[H	2.3664( z]	G 23758G	2.3852G	ECC PART	

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	2330.00	22.13	57.54	35.41	74.00	16.46	PK	Vertical
2	2330.00	14.65	50.06	35.41	54.00	3.94	AV	Vertical
3	2360.00	14.17	49.80	35.63	54.00	4.20	AV	Vertical
4	2360.00	22.26	57.89	35.63	74.00	16.11	PK	Vertical
5	2390.00	22.94	58.78	35.84	74.00	15.22	PK	Vertical
6	2390.00	14.42	50.26	35.84	54.00	3.74	AV	Vertical

Remark:

1. Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).







Product na	ame:	Pi 4 Versior	or LoRa Gatev n / Nebra Indo CK Pi 4 Versior	oor Helium	Product m	iodel:	NEBHN	T-HHRK4-9	15
Test By:		Mike			Test mode	):	DH1 Tx	mode	
Test Chan	nnel:	Highest char	nnel		Polarizatio	on:	Vertical		
Test Volta	ige:	AC 120/60H	z		Environme	ent:	Temp: 2	24℃ Hun	i: 57%
120 111 100	10-			FCC PART 1	15 C				
81 71 61 81 81 81 81 81 81 81 81 81 81 81 81 81	30		hadalan da an da ana an da ana	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			5	FCC PART 15 C-PK L	mit
0 0									
41 31 21 11	20 20 0 2.478G 2.4802G	2.4824G	2.4846G 2.486	38G 2.489G	2.4912G	2.4934G	2.4956G	2.4978G	2.5G
41 31 21 11	30 20 10 0		2.4846G 2.486 Yertical PK — Vertica	Frequency[		2.4934G	2.4956G	2.4978G	2.5G
41 31 21 11	30 20 0 2478G 2.4802G PK Limit • PK Detector	— AV Limit — V		Frequency[		24934G Margin [dB]	2.4956G	2.4978G Polarity	2.5G
44 31 20 11 0 2	0 0 0 0 0 0 0 0 0 0 0 0 0 0	AV Limit V AV Detector V	Vertical PK — Vertica	Frequency IAV	Hz] Limit	Margin			2.5G
44 31 20 11 0 2.	30 20 20 20 2478G 2.4802G PK Limit PK Detector O. [MHz]	AV Limit V AV Detector V Reading [dBµV/m]	<sup>l</sup> ertical PK — Vertica Level [dBµV/m]	Frequency IAV Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity	2.5G
44 30 10 2 10 2 10 2 10 2 11 2	30 20 20 20 2478G 2.4802G PK Limit PK Detector Freq. [MHz] 1 2483.50	AV Limit V AV Detector V Reading [dBµV/m] 25.73	Level [dBµV/m] 61.45	Frequency IAV Factor [dB] 35.72	Limit [dBµV/m] 74.00	Margin [dB] 12.55	Trace PK	Polarity Vertical	2.56
44 31 21 10 2. NG 11 2 3	0 0 0 0 0 0 0 0 0 0 0 0 0 0	AV Limit         V           AV Detector         V           Reading         [dBµV/m]           25.73         17.93	Level [dBµV/m] 61.45 53.65	Frequency Factor [dB] 35.72 35.72 35.71 35.71	Limit [dBµV/m] 74.00 54.00	Margin [dB] 12.55 0.35	Trace PK AV	Polarity Vertical Vertical	2.5G
44 33 20 10 2 2 11 2 2 11 2 2 11 2 2 11 2 11	30 20 20 21 2478G 2.4802G → PK Limit → PK Detector → PK Detector → Freq. [MHz] 1 2483.50 2 2483.50 3 2489.00	AV Limit V	Level [dBµV/m] 61.45 53.65 49.83	Frequency Factor [dB] 35.72 35.72 35.71	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 12.55 0.35 4.17	Trace PK AV AV	Polarity Vertical Vertical Vertical	2.56



roduct	t name	<b>e</b> :	Pi 4 Version	or LoRa Gatev n / Nebra Indo CK Pi 4 Version	or Helium	Product me	odel:	NEBHN	IT-HHRK4-	915
est By	:		Mike			Test mode	:	DH1 Tx	mode	
est Ch	annel	:	Highest chan	nnel		Polarizatio	n:	Horizon	Ital	
est Vo	Itage:		AC 120/60Hz			Environme	nt:	Temp: 2	24℃ Hu	uni: 57%
	100 <sub>1</sub>				FCC PART 1	5 C				
	90									
	80		<b>X</b>						FCC PART 15 C-P	K Limit
	70	/								
[m//	60	r	The law second second	un allen ander	alara ana biya akiya aka aka a	eleksida barin meninci kutan maning sebagai	unione dispension and and another second	H	-	and the state of the
Level[dBµV/m]	50		2.	an a	14,40	ing the second	al milinay days, philippe any activity and	a a Grubba and de antici	م م م م م م م م م م م م م م م م م م م	
Level	40									
	30-									
	20									
	20									
	10	2,40000	24/04/0	20000 200	200	210120	24/24/0	2.40500	2.4070.0	
	10	2.4802G	2.4824G	2.4846G 2.486	i8G 2.489G Frequency[	2.4912G 1z]	2.4934G	2.4956G	2.4978G	2.5G
	10	2.4802G PK Limit - PK Detector					2.4934G	2.4956G	2.4978G	2.5G
	10 0 2.478G	— PK Limit —	— AV Limit — He		Frequency[		2.4934G Margin	_		
ſ	10	─ PK Limit ─ ● PK Detector	AV Limit Here Here Here Here Here Here Here Her	orizontal PK — Hori	Frequency[	łz]		2.4956G Trace	2.4978G Polarit	
	10 0 2.478G	PK Limit - PK Detector -	AV Limit H AV Detector Reading	orizontal PK — Hori	Frequency[ zontal AV Factor	tz] Limit	Margin	_		y
	10 0 2.478G	PK Limit PK Detector Freq. [MHz]	AV Limit H AV Detector H Reading [dBµV/m]	orizontal PK — Hori Level [dBµV/m]	Frequency[ zontal AV Factor [dB]	Limit	Margin [dB]	Trace	Polarit	y tal
	10 0 2.478G	PK Limit PK Detector Freq. [MHz] 2483.50	AV Limit AV Detector Reading [dBµV/m] 21.88	Level [dBµV/m] 57.60	Frequency[ zontal AV Factor [dB] 35.72	Limit [dBµV/m] 74.00	Margin [dB] 16.40	Trace	Polarit	y tal
	10 0 2.478G NO. 1 2	PK Limit           PK Detector           Freq.           [MHz]           2483.50           2483.50	AV Limit AV Detector Reading [dBµV/m] 21.88 14.01	orizontal PK — Hori Level [dBµV/m] 57.60 49.73	Frequency[ zontal AV Factor [dB] 35.72 35.72	Limit [dBµV/m] 74.00 54.00	Margin [dB] 16.40 4.27	Trace PK AV	Polarity Horizont	y tal tal
	10 0 2.478G NO. 1 2 3	PK Limit PK Detector [MHz] 2483.50 2483.50 2489.00	AV Limit AV Detector Reading [dBµV/m] 21.88 14.01 14.68	Dizontal PK — Hon Level [dBµV/m] 57.60 49.73 50.39	Frequency[ zontal AV Factor [dB] 35.72 35.72 35.71	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 16.40 4.27 3.61	Trace PK AV AV	Polarity Horizont Horizont	y tal tal tal tal



#### $\pi/4$ -DQPSK mode

Product	t name	:	Pi 4 Version	or LoRa Gatev n / Nebra Indo CK Pi 4 Versior	or Helium	Product m	odel:	NEBHN	IT-HHRK4-915	
Test By	:		Mike			Test mode	:	2DH1 T	x mode	
Test Ch	annel:		Lowest chan	nel		Polarizatio	on:	Vertical		
Test Vo	Itage:		AC 120/60H			Environme	ent:	Temp: 2		57%
	<u>j</u>			_						
	120				FCC PART 1	5 C				
	110									
	100								Λ·	
	90								/ \	
Ē	80								FCC PART 15 C-FK Limit	
_evel[dBµV/m]	70 60		.1			4			-	
wel[d	50	di katala di katala na pina sa katala sa katala Misa na panakina na manja katala na mina na	internet and the second se	an an an Anna an Anna an Anna Anna Anna	ander an gestaar die stel die die stel die stel Naam die stel die ste	en an			STOCIANTINE AV Limit	
Ļ	40									
	30									
	20									
	10									
	0									
	2.31G	2.3194G	2.3288G	2.3382G 2.34			2.3758G	2.3852G	2.3946G 2.40	)4G
	_	PK Limit PK Detector Freq.	AV Limit V AV Detector V Reading	Vertical PK Vertica	Frequency[ AV Factor	tz] Limit	Margin	2.3852G	23946G 2.40 Polarity	)4G
	NO.	Freq. [MHz]	AV Limit ◆ AV Detector Reading [dBµV/m]	retical PK Vertica Level [dBµV/m]	Frequency[ AV Factor [dB]	Limit	Margin [dB]	Trace	Polarity	)4G
	NO.	PK Limit PK Detector Freq. [MHz] 2330.00	AV Limit AV Detector Reading [dBµV/m] 23.09	Level	Frequency[ AV Factor [dB] 35.41	Limit [dBµV/m] 74.00	Margin [dB] 15.50	Trace PK	Polarity Vertical	)4G
	NO.	PK Limit           PK Detector           Freq.           [MHz]           2330.00           2330.00	AV Limit	Level [dBµV/m] 58.50 50.20	Frequency[ AV Factor [dB] 35.41 35.41	Limit [dBµV/m] 74.00 54.00	Margin [dB] 15.50 3.80	Trace PK AV	Polarity Vertical Vertical	)4G
	NO.	PK Limit         PK Detector           Freq.         [MHz]           2330.00         2330.00           2360.00         2360.00	AV LimitV AV DetectorV Reading [dBµV/m] 23.09 14.79 14.87	Level [dBµV/m] 58.50 50.20 50.50	Frequency[ AV Factor [dB] 35.41 35.41 35.63	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 15.50 3.80 3.50	Trace PK AV AV	Polarity Vertical Vertical Vertical	)4G
	NO. 1 2 3 4	PK Limit PK Detector [MHz] 2330.00 2330.00 2360.00 2360.00	AV Limit AV Detector Reading [dBµV/m] 23.09 14.79 14.87 23.65	Level [dBµV/m] 58.50 50.20 50.50 59.28	Frequency[ AV Factor [dB] 35.41 35.63 35.63 35.63	Limit [dBµV/m] 74.00 54.00 54.00 74.00	Margin [dB] 15.50 3.80 3.50 14.72	Trace PK AV AV PK	Polarity Vertical Vertical Vertical Vertical	)4G
-	NO.	PK Limit         PK Detector           Freq.         [MHz]           2330.00         2330.00           2360.00         2360.00	AV LimitV AV DetectorV Reading [dBµV/m] 23.09 14.79 14.87	Level [dBµV/m] 58.50 50.20 50.50	Frequency[ AV Factor [dB] 35.41 35.41 35.63	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 15.50 3.80 3.50	Trace PK AV AV	Polarity Vertical Vertical Vertical	)4G







Product nam	e:	Pi 4 Versior	or LoRa Gatev n / Nebra Indo CK Pi 4 Versior	oor Helium	Product m	odel:	NEBHN	T-HHRK4-9	15
Test By:		Mike			Test mode	:	2DH1 T	x mode	
Test Channel	:	Highest char	nnel		Polarizatio	on:	Vertical		
Test Voltage:		AC 120/60H	z		Environme	ent:	Temp: 2	24℃ Hun	i: 57%
120			1	FCC PART 1	5 C			1	
110 100 90 80 70 100 100 90 80 70 100 100 90 90 90 90 90 90 90 90 90 90 90 90 9					de in white man de martin de series			FCC PART 15 C-PK L	
50 40 30 20 10									
40 30 20 10 0 2.478G	2.4802G PK Limit - PK Detector	2.4824G AV Limit V AV Detector	2.4846G 2.486 /ertical PK — Vertica	Frequency[	2.4912G Hz]	2.4934G	2.4956G	2.4978G	2.5G
40 30 20 10 2.478G	— PK Limit —	— AV Limit — V		Frequency[		2.4934G Margin [dB]	2 4956G	2.4978G Polarity	2.5G
	→ PK Limit → PK Detector →	AV Limit V AV Detector V Reading	Vertical PK — Vertica	Frequency[ IAV Factor	Hz] Limit	Margin			2.5G
40 30 20 10 0 2.478G	PK Limit → PK Detector → Freq. [MHz]	AV Limit V AV Detector V Reading [dBµV/m]	Vertical PK — Vertica Level [dBµV/m]	Frequency[ IAV Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity	2.5G
40 30 20 10 0 2.4780 NO. 1	Freq. [MHz] 2483.50 2489.00	AV Limit V ◆ AV Detector V Reading [dBµV/m] 23.14 15.97 14.50	Level [dBµV/m] 58.86 51.69 50.21	Frequency[ IAV Factor [dB] 35.72 35.72 35.71	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 15.14 2.31 3.79	Trace PK AV AV	Polarity Vertical	2.5G
40 30 20 10 0 2 4780 NO. 1 2 3 4	Freq. [MHz] 2483.50 2483.50	AV Limit → V AV Detector → V Reading [dBµV/m] 23.14 15.97	Level [dBµV/m] 58.86 51.69	Frequency[ IAV Factor [dB] 35.72 35.72	Limit [dBµV/m] 74.00 54.00	Margin [dB] 15.14 2.31	Trace PK AV	Polarity Vertical Vertical	2.5G
40 30 20 10 0 2.4783 2.47843 2.47833 2.4783 2.4783 2.47833 2.4783 2.4783 2.4783 2.4783	Freq. [MHz] 2483.50 2489.00	AV Limit V ◆ AV Detector V Reading [dBµV/m] 23.14 15.97 14.50	Level [dBµV/m] 58.86 51.69 50.21	Frequency[ IAV Factor [dB] 35.72 35.72 35.71	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 15.14 2.31 3.79	Trace PK AV AV	Polarity Vertical Vertical Vertical	2.5G



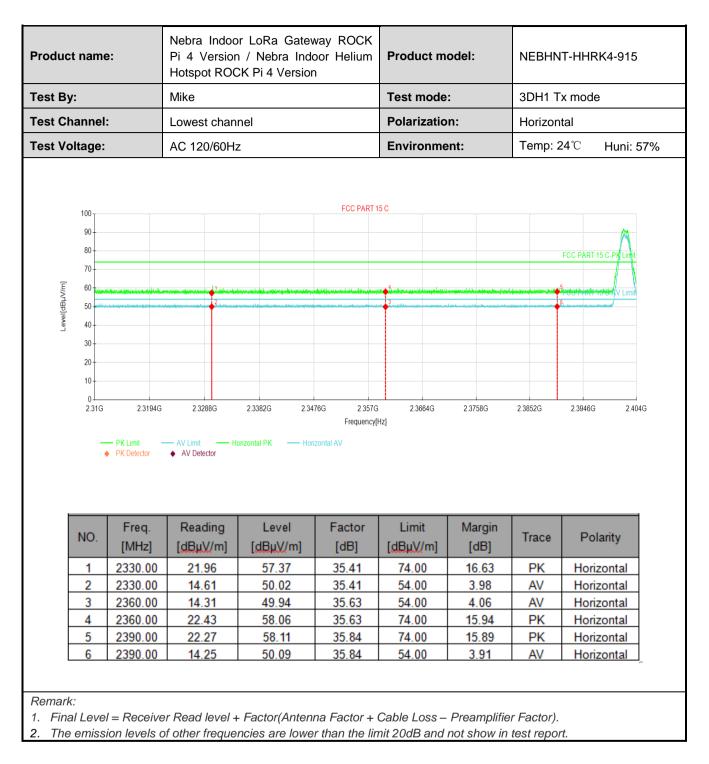
Product name	e:	Pi 4 Version	r LoRa Gatew / Nebra Indo X Pi 4 Version	or Helium	Product me	odel:	NEBHN	IT-HHRK4-915
Fest By:		Mike			Test mode	:	2DH1 T	x mode
Fest Channel	:	Highest chan	inel		Polarizatio	n:	Horizon	ital
Fest Voltage:		AC 120/60Hz	2		Environme	nt:	Temp: 2	24℃ Huni: 57%
100 90 80 70 60 90 50 40			David vie a bit agendiale a bit of the gib age	FCC PART 1	5C		ing Satura the feld and	FCC PART 15 C-PK Limit
30 20 10 0 2.478G	2 4802G PK Limit PK Detector	2 4824G — AV Limit — Ho ◆ AV Detector	2.4846G 2.4860 prizontal PK — Horiz	Frequency[ł	2.4912G 1z]	2.4934G	2.4956G	2.4978G 2.5G
30 20 10 0 2.478G	— PK Limit —	AV Limit Ho AV Detector Ho		Frequency[ł		2.4934G Margin		
30 20 10 2.478G	PK Limit → PK Detector	AV Limit → Ho ◆ AV Detector	orizontal PK – Horiz	Frequency[I	łz]		2.4956G Trace	2.4978G 2.5G
30 20 10 2.4786	PK Limit PK Detector Freq. [MHz] 2483.50	AV Limit Ho AV Detector Reading [dBµV/m] 22.16	Level [dBµV/m] 57.88	Frequency( zontal AV Factor [dB] 35.72	Limit [dBµV/m] 74.00	Margin [dB] 16.12	Trace	Polarity Horizontal
30 20 10 2.478G NO. 1 2	PK Limit PK Detector [MHz] 2483.50 2483.50	AV Limit Ho AV Detector Reading [dBµV/m] 22.16 14.55	Level [dBµV/m] 57.88 50.27	Frequency() zontal AV Factor [dB] 35.72 35.72	Limit [dBµV/m] 74.00 54.00	Margin [dB] 16.12 3.73	Trace PK AV	Polarity Horizontal Horizontal
30 20 10 2.4786	PK Limit PK Detector Freq. [MHz] 2483.50 2483.50 2489.00	AV Limit Ho AV Detector Ho AV Detector Reading [dBµV/m] 22.16 14.55 14.38	Level [dBµV/m] 57.88 50.27 50.09	Frequency[/ zontal AV Factor [dB] 35.72 35.72 35.71	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 16.12 3.73 3.91	Trace PK AV AV	Polarity Horizontal
30 20 10 2.478G NO. 1 2	PK Limit           PK Detector           Freq.           [MHz]           2483.50           2483.50           2489.00           2489.00	AV Limit Ho AV Detector Reading [dBµV/m] 22.16 14.55	Level [dBµV/m] 57.88 50.27	Frequency() zontal AV Factor [dB] 35.72 35.72	Limit [dBµV/m] 74.00 54.00 54.00 74.00	Margin [dB] 16.12 3.73	Trace PK AV	Polarity Horizontal Horizontal Horizontal Horizontal
30 20 10 2 478G 2 478G	PK Limit PK Detector Freq. [MHz] 2483.50 2483.50 2489.00	AV Limit Ho AV Detector Ho AV Detector Reading [dBµV/m] 22.16 14.55 14.38	Level [dBµV/m] 57.88 50.27 50.09	Frequency[/ zontal AV Factor [dB] 35.72 35.72 35.71	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 16.12 3.73 3.91	Trace PK AV AV	Polarity Horizontal Horizontal Horizontal



#### 8DPSK mode

oduct n	ame	:	Pi 4 Versior	or LoRa Gatev n / Nebra Indo CK Pi 4 Versior	oor Helium	Product m	odel:	NEBHN	IT-HHRK4-915	1	
est By:	Channel:		Mike			Test mode	:	3DH1 Tx mode			
est Chan	Channel: Voltage:		Lowest chan	nel		Polarization:		Vertical			
est Volta	ge:		AC 120/60H	z		Environme	ent:	Temp: 2	24℃ Huni:	57%	
					FCC PART 1	50					
12 11											
10									$\wedge$		
	90 - 30 -								FCC PART 15 C-FK Limit		
	70								FCC PART 15 C-PK LIMI		
-	30	and an and define and profession of the profession of the		in general sources in the last of the second se	الجالد ومردا والمتحد والمتاجو والمتحد والمتحد						
≥ 5	50 +	ninengi di septi di panagki adapen kelekum naga	ingan yan distangan di kalipi ng taka di jantara di kaliman dan jin	na dala mangantak jengan katalan katala	() ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( )		a llanna ha sunna dha ni sa dha an bhlion an shli suni				
	10										
4	40 30										
4 3 2	30 20										
4 3 2 1	30	2.3194G	2.3288G	2 3382G 2 34			2.3758G	2.3852G	2.3946G 2.40	)4G	
4 3 2 1	30 20 10 0 2.31G			2.3382G 2.34 lertical PK — Vertica	Frequency[		2.3758G	23852G	2.3946G 2.40	)4G	
4 3 2 1 .	30 20 10 2.31G	– PK Limit –	— AV Limit — V		Frequency[		2.3758G Margin			14G	
4 3 2 1	30 20 10 2.31G	<ul> <li>→ PK Limit →</li> <li>→ PK Detector</li> </ul>	AV Limit V AV Detector	ertical PK — Vertica	Frequency[	Hz]		23852G	23946G 240 Polarity	)4G	
4 3 2 1 :	30 20 10 2.31G	PK Limit - PK Detector -	AV Limit V AV Detector V Reading	rertical PK — Vertica	Frequency[ IAV Factor	Hz] Limit	Margin			)4G	
	0.	PK Limit PK Detector Freq. [MHz]	AV Limit V AV Detector V Reading [dBµV/m]	Level	Frequency[	Limit [dBµV/m]	Margin [dB]	Trace	Polarity	14G	
	0 0 0 0 2 3 0 0 0 0 0 0 2 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	PK Limit           PK Detector           Freq.           [MHz]           2330.00           2330.00           2360.00	AV Limit V • AV Detector V • AV Detect	Level [dBµV/m] 57.31 49.56 49.92	Frequency[ IAV Factor [dB] 35.41 35.41 35.63	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 16.69 4.44 4.08	Trace PK AV AV	Polarity Vertical Vertical Vertical	04G	
	00 00 00 02 231G 00 0 0 231G 0 0 1 2 3 4	PK Limit           PK Detector           Freq.           [MHz]           2330.00           2330.00           2360.00           2360.00	AV Limit V AV Detector V Reading [dBµV/m] 21.90 14.15 14.29 22.96	Level [dBµV/m] 57.31 49.56 49.92 58.59	Frequency[ AV Factor [dB] 35.41 35.63 35.63 35.63	Limit [dBµV/m] 74.00 54.00 54.00 74.00	Margin [dB] 16.69 4.44 4.08 15.41	Trace PK AV AV PK	Polarity Vertical Vertical Vertical Vertical	04G	
	0 0 0 0 2 3 0 0 0 0 0 0 2 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	PK Limit           PK Detector           Freq.           [MHz]           2330.00           2330.00           2360.00	AV Limit V • AV Detector V • AV Detect	Level [dBµV/m] 57.31 49.56 49.92	Frequency[ IAV Factor [dB] 35.41 35.41 35.63	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 16.69 4.44 4.08	Trace PK AV AV	Polarity Vertical Vertical Vertical	)4G	







Product	name	:	Pi 4 Ve	ersion	r LoRa Gatev / Nebra Inde K Pi 4 Versior	oor Helium	Product m	odel:	NEBHN	JT-HHRK4	1-915
Test By:	:		Mike				Test mode	:	3DH1 T	Tx mode	
Test Ch	annel:		Highest	chan	nel		Polarizatio	n:	Vertical		
Test Vo	tage:		AC 120/	/60Hz	<u>.</u>		Environme	ent:	Temp: 2	24℃ F	luni: 57%
	100					FCC PART 1	15 C				
	120										
	100	$\bigcap$	N								
	90 80	/									
[m/	70									FCC PART 15 C	-PK Limit
Level[dBµV/m]	60		X		di tanih di dila mangkasa phina	andituran internetion of the	1749   gandlai   14. mar al an far fal 1870 (an an an far a far de			A DOC DINITIASIO	and the second
Level	50			2	Mandalan di seringan terse daran selatatan s		la katela kana na panakata pinin	alandari kaca da fasi ala attik kaca na	6	en, en met schrie gibte aktion aber er	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
	40 30										
	20 10										
	20	2.4802G	2.48240	G	2.4846G 2.486			2.4934G	2.4956G	2.4978G	2.5G
	20- 10- 0-		2.48240 — AV Limit AV Detecto	Ve	2.4846G 2.484 ertical PK — Vertica	Frequency[		2.4934G	2.4956G	2.4978G	2.56
	20- 10- 0-	PK Limit PK Detector Freq.	AV Limit ◆ AV Detecto Readi	ve tor	ertical PK — Vertica Level	Frequency( I AV	Hz]	Margin	2.4956G Trace	2.4978G	
	20 10 0 2.478G	PK Limit PK Detector Freq. [MHz]	AV Limit AV Detector Readi [dBµV	or Ve	ertical PK — Vertica Level [dBµV/m]	Frequency IAV Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polari	ty
	20 10 0 2.478G	Freq. [MHz] 2483.50	AV Limit AV Detector Readi [dBµV/ 24.01	• Ve tor ing [/m] 18	Level [dBµV/m] 59.80	Frequency Factor [dB] 35.72	Limit [dBµV/m] 74.00	Margin [dB] 14.20	Trace	Polari Vertic	ty al
	20- 10- 0 2.478G	Freq. [MHz] 2483.50 2483.50	AV Limit AV Detector Readi [dBµV/ 24.03 15.8		Level [dBµV/m] 59.80 51.57	Frequency IAV Factor [dB] 35.72 35.72	Limit [dBµV/m] 74.00 54.00	Margin [dB] 14.20 2.43	Trace PK AV	Polari Vertic Vertic	ty al al
	20 10 0 2.478G	PK Limit PK Detector [MHz] 2483.50 2483.50 2489.00	AV Limit AV Detector Readi [dBµV/ 24.00 15.83 14.75	ing [/m] 18 15 78	Level [dBµV/m] 59.80 51.57 50.49	Frequency IAV Factor [dB] 35.72 35.72 35.71	Limit [dBμV/m] 74.00 54.00 54.00	Margin [dB] 14.20 2.43 3.51	Trace PK AV AV	Polari Vertic Vertic Vertic	ty al al
	20- 10- 0 2.478G	Freq. [MHz] 2483.50 2483.50	AV Limit AV Detector Readi [dBµV/ 24.03 15.8	ing [/m] 88 55 78 7	Level [dBµV/m] 59.80 51.57	Frequency IAV Factor [dB] 35.72 35.72	Limit [dBµV/m] 74.00 54.00	Margin [dB] 14.20 2.43	Trace PK AV	Polari Vertic Vertic	ty al al al



roduct nam	e:	Pi 4 Version	or LoRa Gatev n / Nebra Indo CK Pi 4 Versior	oor Helium	Product m	odel:	NEBHN	IT-HHRK4-915
est By:		Mike			Test mode	:	3DH1 T	Tx mode
est Channe	l:	Highest char	nnel		Polarizatio	n:	Horizon	ntal
est Voltage:	:	AC 120/60Hz	z		Environme	ent:	Temp: 2	24℃ Huni: {
100 90 80 70 [W/\180] 50 40		1		FCC PART 1	15 C		5 5	FCC PART 15 C-PK Limit
30 20 10 2.4780	<ul> <li>≥ 2.4802G</li> <li>PK Limit</li> <li>PK Detector</li> </ul>	2.4824G AV Limit Hi AV Detector	2.4846G 2.486 orizontal PK — Hon	i8G 2.489G Frequency[ zontal AV		2.4934G	2.4956G	2.4978G 2.5
20 10 0 2.4780	PK Limit → PK Detector →	— AV Limit — He		Frequency[	Hz]	2.4934G Margin [dB]	2 4956G Trace	24978G 25 Polarity
20	PK Limit      PK Detector	AV Limit H AV Detector H	orizontal PK — Hori Level	Frequency[ zontal AV Factor	Hz]	Margin		
20 10 0 2 4780	PK Limit → PK Detector → Freq. [MHz]	AV Limit H AV Detector H	orizontal PK — Hori Level [dBµV/m]	Frequency zontal AV Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
20 10 2.4780 NO. 1	PK Limit → PK Detector Freq. [MHz] 2483.50	AV Limit AV Detector Reading [dBµV/m] 22.67 14.49	Level [dBµV/m] 58.39 50.21	Frequency zontal AV Factor [dB] 35.72 35.72	Limit [dBµV/m] 74.00 54.00	Margin [dB] 15.61 3.79	Trace PK AV	Polarity Horizontal Horizontal
20 10 2.4780 NO. 1 2	<ul> <li>PK Limit</li> <li>PK Detector</li> <li>PK Detector</li> <li>Freq.</li> <li>[MHz]</li> <li>2483.50</li> <li>2483.50</li> <li>2489.00</li> </ul>	AV Limit H AV Detector H Reading [dBµV/m] 22.67	Level [dBµV/m] 58.39	Frequency zontal AV Factor [dB] 35.72 35.72 35.71	Limit [dBµV/m] 74.00	Margin [dB] 15.61 3.79 3.53	Trace	Polarity Horizontal Horizontal Horizontal
20 10 0 2.4780 NO. 1 2 3	<ul> <li>PK Limit</li> <li>PK Detector</li> <li>Freq.</li> <li>[MHz]</li> <li>2483.50</li> <li>2483.50</li> </ul>	AV Limit H AV Detector H Reading [dBµV/m] 22.67 14.49 14.76	Level [dBµV/m] 58.39 50.21 50.47	Frequency zontal AV Factor [dB] 35.72 35.72	Limit [dBµV/m] 74.00 54.00 54.00	Margin [dB] 15.61 3.79	Trace PK AV AV	Polarity Horizontal Horizontal



### **6.4 Spurious Emission**

### 6.4.1 Radiated Emission Method

Test Deminentest		Deation 15	000				
Test Requirement:	FCC Part 15 C S		209				
Test Frequency Range:	9 kHz to 25 GHz						
Test Distance:	3m						
Receiver setup:	Frequency	Detecto		RBW	VBW		Remark
	30MHz-1GHz	Quasi-pe		120kHz	300k⊦		Quasi-peak Value
	Above 1GHz	Peak		1MHz	3MH:		Peak Value
		RMS		1MHz	3MH:	z	Average Value
Limit:	Frequenc	-	Lin	nit (dBuV/m	@3m)		Remark
	30MHz-88N			40.0			Quasi-peak Value
	88MHz-216I			43.5			Quasi-peak Value
	216MHz-960			46.0			Quasi-peak Value
	960MHz-10	GHz		54.0		(	Quasi-peak Value
	Above 1G	H7		54.0			Average Value
		12		74.0			Peak Value
		Jum 0.8m	4m			RF T Rece	
		11/1/11				777	,
	Groun	d Plane					
	Above 1GHz						
		AE EUT (Turntable)	k	3m Ground Reference Plane	korn Antenna 	Antenna	Tower
Test Procedure:	1. The EUT was /1.5m(above) was rotated 3 radiation.	1GHz) abo	ove th	ne ground at	a 3 met	er ch	namber. The table

Project No.: JYTSZR2201011



	<ol> <li>The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li> <li>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 rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</li> <li>The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>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.</li> </ol>
Test Instruments:	Refer to section 5.9 for details
Test mode:	Non-hopping mode
Test results:	Pass
Remark:	<ol> <li>Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case.</li> <li>9 kHz to 30 MHz is noise floor and lower than the limit 20dB, so only shows the data of above 30MHz in this report.</li> </ol>



#### Measurement Data (worst case):

#### Below 1GHz:

Product	aname:		/ersio	on / N	Vebra	Gateway ROCK a Indoor Helium 'ersion	Product mo	del:	NEBH	INT-HH	RK4-91	5
Test By	:	Mike					Test mode:		BT Tx mode			
Test Fre	equency:	30 MH	z ~ 1	GHz	:		Polarization	:	Vertical			
Test Vo	Itage:	AC 120	0/60⊦	Ηz			Environmen	it:	Temp	: <b>24</b> ℃	Hu	ni: 57%
	90								FCC PART 15 247-QP Limit			
Level[dBµV/m]	80 70 60 50 40 30 20 10 0 30M		even and	-4. Week	100			4	5		15.247-QP Lir	nit f 1G

NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	41.5188	31.07	16.44	-14.63	40.00	23.56	PK	Vertical
2	58.0088	30.62	15.76	-14.86	40.00	24.24	PK	Vertical
3	107.357	31.28	15.31	-15.97	43.50	28.19	PK	Vertical
4	296.992	31.15	18.39	-12.76	46.00	27.61	PK	Vertical
5	538.037	31.63	24.82	-6.81	46.00	21.18	PK	Vertical
6	983.873	31.86	31.03	-0.83	54.00	22.97	PK	Vertical

Remark:

1. Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).



roduc	t name	e:	Pi 4 Version	LoRa Gatew / Nebra Indo K Pi 4 Version	or Helium	Product mo	del:	NEBHN	T-HHRK4-915	
est By	/:		Mike			Test mode:		BT Tx mode		
est Fre	equen	cy:	30 MHz ~ 1 G	GHz	Polarization	<b>):</b>	Horizont	al		
est Vo	ltage:		AC 120/60Hz			Environmer	nt:	Temp: 2	4℃ Huni: 5	
	110				FCC PART 1	5.247	T			
	100									
	90									
_	80 70									
Level[dBµV/m]	60								C PART 15.247-QP Limit	
rel[dB	50							FC		
Lev	40									
	30							5	6	
	20		proposed and the state of the s	3		and an	And in the state of the birth of the state of the			
	10		Bryndy Whe	Virturally Will Be provided and the second states	Children and a start his start and a start	LINE AND DESCRIPTION OF THE OWNER				
	0 30M			100M	Frequency	[Hz]			16	
1	0	QP Limit QP Detector	- Horizontal PK						16	
[	0	QP Limit QP Detector Freq.	Reading	Level	Factor	Limit	Margin [dB]	Trace	IG	
	0 30M	QP Limit QP Detector	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	[dB]		Polarity	
	0 30M	QP Limit ↓ QP Detector Freq. [MHz] 44.3075	Reading [dBµV/m] 31.79	Level [dBµV/m] 16.83	Factor [dB] -14.96	Limit [dBµV/m] 40.00	[dB] 23.17	PK	Polarity Horizontal	
	0 30M	<ul> <li>QP Limit</li> <li>QP Detector</li> <li>Freq.</li> <li>[MHz]</li> <li>44.3075</li> <li>56.3113</li> </ul>	Reading [dBµV/m] 31.79 30.76	Level [dBµV/m] 16.83 16.04	Factor [dB] -14.96 -14.72	Limit [dBµV/m] 40.00 40.00	[dB] 23.17 23.96	PK PK	Polarity Horizontal Horizontal	
	NO.	QP Limit QP Detector Freq. [MHz] 44.3075 56.3113 106.630	Reading [dBµV/m] 31.79 30.76 32.64	Level [dBµV/m] 16.83 16.04 16.63	Factor [dB] -14.96 -14.72 -16.01	Limit [dBµV/m] 40.00 40.00 43.50	[dB] 23.17 23.96 26.87	PK PK PK	Polarity Horizontal Horizontal Horizontal	
	0 30M	<ul> <li>QP Limit</li> <li>QP Detector</li> <li>Freq.</li> <li>[MHz]</li> <li>44.3075</li> <li>56.3113</li> </ul>	Reading [dBµV/m] 31.79 30.76	Level [dBµV/m] 16.83 16.04	Factor [dB] -14.96 -14.72	Limit [dBµV/m] 40.00 40.00	[dB] 23.17 23.96	PK PK	Polarity Horizontal Horizontal	

Remark:

1. Final Level = Receiver Read level + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).



#### Above 1GHz:

		Test ch	annel: Lowest ch	nannel		
		De	tector: Peak Valu	Ie	-	_
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
4804.00	54.40	-9.60	44.80	74.00	29.20	Vertical
4804.00	55.14	-9.60	45.54	74.00	28.46	Horizonta
		Dete	ctor: Average Va	lue		
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
4804.00	47.44	-9.60	37.84	54.00	16.16	Vertical
4804.00	48.18	-9.60	38.58	54.00	15.42	Horizonta
		Test ch	annel: Middle ch	annel		
			tector: Peak Valu			
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
4882.00	53.97	-9.05	44.92	74.00	29.08	Vertical
4882.00	54.79	-9.05	45.74	74.00	28.26	Horizonta
		Dete	ctor: Average Va	lue		1
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
4882.00	47.03	-9.05	37.98	54.00	16.02	Vertical
4882.00	48.11	-9.05	39.06	54.00	14.94	Horizonta
			annel: Highest cl tector: Peak Valu	ie		
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
4960.00	54.16	-8.45	45.71	74.00	28.29	Vertical
4960.00	54.73	-8.45	46.28	74.00	27.72	Horizonta
		Dete	ctor: Average Va	alue		
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarizatio
(1011 12)		-8.45	39.38	54.00	14.62	Vertical
4960.00	47.83	-0.45	00.00			