

IC RF Test Report

(Bluetooth)

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-HHRK4-915, NEBHNT-HHRK4-915-2, NEBHNT-HHRK4-915-3

Canada IC: 27187-HHRK4

Applicable standards: RSS-Gen Issue 5, RSS-247 Issue 2

Date of sample receipt: 05 Jan., 2022

Date of Test: 06 Jan., to 08 May, 2022

Date of report issued: 18 May, 2022

Test Result: PASS

Tested by:

Date:

18 May, 2022

Reviewed by:

Date:

18 May, 2022

Approved by:

Date:

18 May, 2022

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in above the application standard version. Test results reported herein relate only to the item(s) tested.

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2 Version

Version No.	Date	Description
00	09 May, 2022	Original
01	18 May, 2022	Updated page1, 4, 10

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4 General Information

4.1 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

4.2 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-HHRK4-915, NEBHNT-HHRK4-915-2, NEBHNT-HHRK4-915-3
Operation frequency:	2402 MHz - 2480 MHz
Transfer rate:	1/2/3 Mbps/s
Number of channel:	79
Modulation type:	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation technology:	FHSS
Antenna Type:	External Antenna
Antenna gain:	1 dBi (declare by applicant)
AC adapter:	Model No.:R241-1202500I Input: AC100-240V, 50/60Hz 1.5 A Output: DC 12.0V, 2.5A
Remark:	Model No.: NEBHNT-HHRK4-915, NEBHNT-HHRK4-915-2, NEBHNT-HHRK4-915-3 were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being model name.
Test model, sample#	NEBHNT-HHRK4-915, WSZR122200088
Test sample condition:	The test samples were provided in good working order with no visible defects.

4.3 Test Mode and Test Environment

Test Modes:	
Non-hopping mode:	Keep the EUT in continuous transmitting mode.
Hopping mode:	Keep the EUT in hopping mode.
Remark: For AC power line conducted emission and radiated spurious emission, pre-scan GFSK, $\pi/4$ -DQPSK, 8DPSK modulation mode, found GFSK modulation was worse case mode. The report only reflects the test data of worst mode.	
Operating Environment:	
Temperature:	15°C ~ 35°C
Humidity:	20 % ~ 75 % RH
Atmospheric Pressure:	1010 mbar

4.4 Description of Support Units

The EUT has been tested as an independent unit.

4.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Conducted Emission for LISN (9kHz ~ 150kHz)	±3.11 dB
Conducted Emission for LISN (150kHz ~ 30MHz)	±2.62 dB
Radiated Emission (30MHz ~ 1GHz) (3m SAC)	±4.45 dB
Radiated Emission (1GHz ~ 18GHz) (3m SAC)	±5.34 dB
Radiated Emission (18GHz ~ 40GHz) (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.	

4.6 Additions to, Deviations, or Exclusions From the Method

No

4.7 Laboratory Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> ● 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
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4.8 Laboratory Location

<p>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</p>

4.9 Test Instruments list

Radiated Emission(3m SAC):					
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	03-07-2021	03-06-2022
				02-17-2022	02-16-2023
Biconical Antenna	Schwarzbeck	VUBA9117	WXJ002-1	06-20-2021	06-19-2022
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	03-07-2021	03-06-2022
				02-17-2022	02-16-2023
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-3	06-18-2021	06-17-2022
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXG001-7	03-07-2021	03-06-2022
				02-17-2022	02-16-2023
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXG001-3	03-07-2021	03-06-2022
				02-17-2022	02-16-2023
Pre-amplifier (18GHz ~ 40GHz)	RF System	TRLA- 180400G45B	WXG001-9	03-07-2021	03-06-2022
				02-17-2022	02-16-2023
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	03-03-2021	03-02-2022
				02-17-2022	02-16-2023
Spectrum Analyzer	KEYSIGHT	N9010B	WXJ004-2	11-27-2021	11-26-2022
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	03-07-2021	03-06-2022
				02-17-2022	02-16-2023
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN- 8M	WXG001-5	03-07-2021	03-06-2022
				02-17-2022	02-16-2023
Coaxial Cable (18GHz ~ 40GHz)	JYTSZ	JYT3M-40G-SS- 8M	WXG001-7	03-07-2021	03-06-2022
				02-17-2022	02-16-2023
Test Software	Tonscend	TS+	Version: 3.0.0.1		

Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Manage No.	Cal.Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESCI 3	WXJ003	03-03-2021	03-02-2022
				02-17-2022	02-16-2023
RF Switch	TOP PRECISION	RSU0301	WXG003	03-03-2021	03-02-2022
				02-17-2022	02-16-2023
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	03-18-2021	03-17-2022
				02-17-2022	02-16-2023
LISN	Rohde & Schwarz	ESH3-Z5	WXJ005-1	06-18-2021	06-17-2022
LISN Coaxial Cable (9kHz ~ 30MHz)	JYTSZ	JYTCE-1G-NN-2M	WXG003-1	03-03-2021	03-02-2022
				02-17-2022	02-16-2023
Test Software	AUDIX	E3	Version: 6.110919b		

5 Measurement setup and procedure

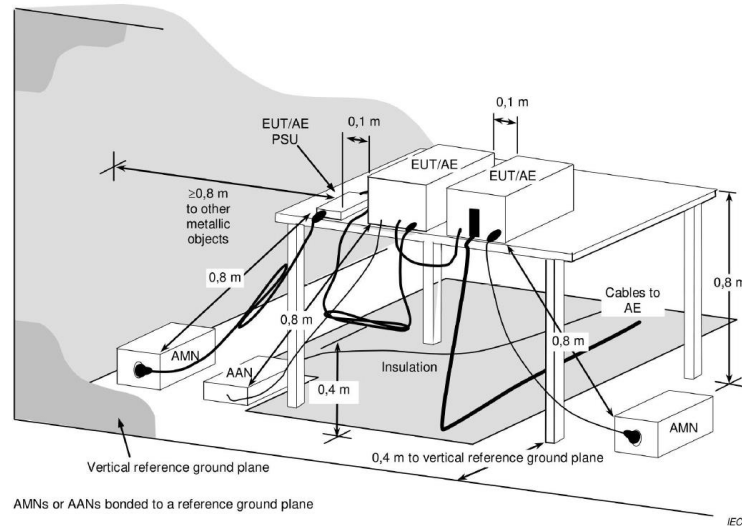
5.1 Test channel

According to ANSI C63.10-2013 chapter 5.6.1 Table 4 requirement, select lowest channel, middle channel, and highest channel in the frequency range in which device operates for testing. The detailed frequency points are as follows:

Lowest channel		Middle channel		Highest channel	
Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	39	2441	78	2480

5.2 Test setup

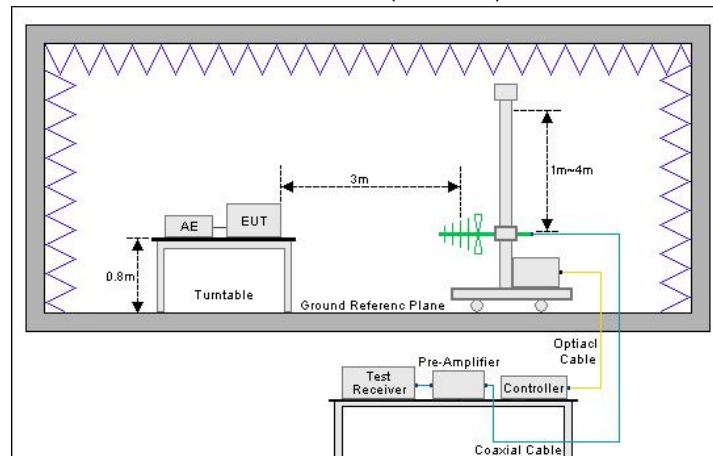
1) Conducted emission measurement:



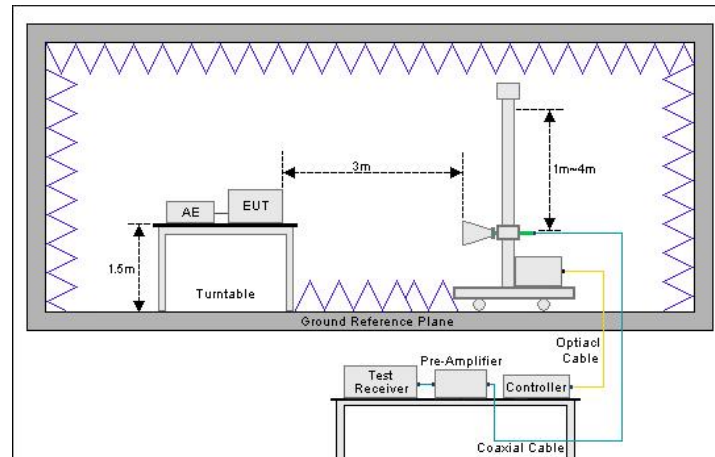
Note: The 0.8 m distance specified between EUT/AE/PSU and AMN/AAN, is applicable only to the EUT being measured. If the device is AE then it shall be >0.8 m.

2) Radiated emission measurement:

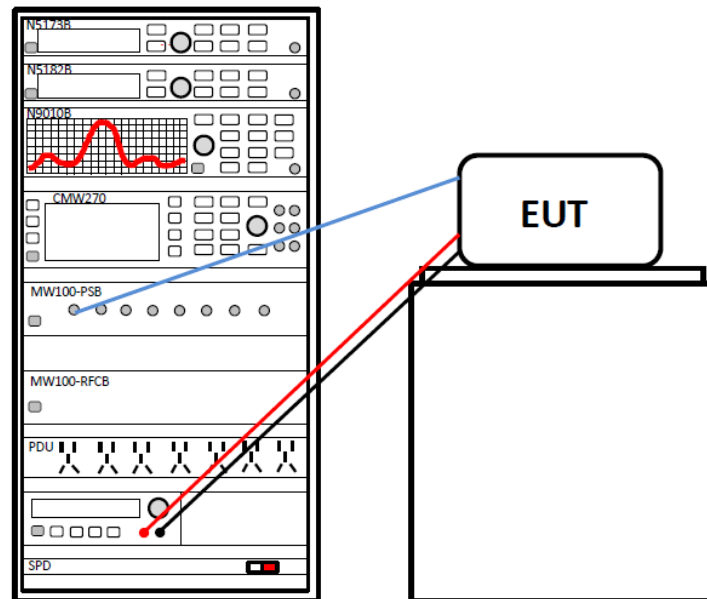
Below 1GHz (3m SAC)



Above 1GHz (3m SAC)



3) Conducted test method



5.3 Test procedure

Test method	Test step
Conducted emission	<ol style="list-style-type: none"> 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. 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 C63.10 on conducted measurement.
Radiated emission	<p>For below 1GHz:</p> <ol style="list-style-type: none"> 1. The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested, and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data. <p>For above 1GHz:</p> <ol style="list-style-type: none"> 1. The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m. 2. EUT works in each mode of operation that needs to be tested, and having the EUT continuously working, respectively on 3 axis (X, Y & Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations. 3. Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.
Conducted test method	<ol style="list-style-type: none"> 1. The Bluetooth antenna port of EUT was connected to the test port of the test system through an RF cable. 2. The EUT is keeping in continuous transmission mode and tested in all modulation modes. 3. Open the test software, prepare a test plan, and control the system through the software. After the test is completed, the test report is exported through the test software.

6 Test Results

6.1 Summary

6.1.1 Clause and data summary

Test Items	Standard Clause	Test Data	Result
Antenna Requirement	RSS-Gen Section 6.8 RSS-247 Section 5.4(f)	See Section 6.2	Pass
AC Power Line Conducted Emission	RSS-Gen Section 8.8	See Section 6.3	Pass
Conducted Peak Output Power	RSS-247 Section 5.4(b)	Appendix A - BT	Pass
20dB Occupied Bandwidth	RSS-247 Section 5.1(a)	Appendix A - BT	Pass
Carrier Frequencies Separation	RSS-247 Section 5.1(b)	Appendix A - BT	Pass
Hopping Channel Number	RSS-247 Section 5.1(d)	Appendix A - BT	Pass
Dwell Time	RSS-247 Section 5.1(d)	Appendix A - BT	Pass
Band-edge Emission Conduction Spurious	RSS-247 Section 5.5	Appendix A - BT	Pass
Emissions in Restricted Frequency Bands	RSS-Gen Section 8.10 RSS-247 Section 5.5	See Section 6.4	Pass
Emissions in Non-restricted Frequency Bands	RSS-Gen Section 6.13 RSS-247 Section 5.5	See Section 6.5	Pass
Remark: 1. Pass: The EUT complies with the essential requirements in the standard. 2. N/A: Not Applicable. 3. The cable insertion loss used by "RF Output Power" and other conduction measurement items is 0.5dB (provided by the customer).			
Test Method:	ANSI C63.10-2013 KDB 558074 D01 15.247 Meas Guidance v05r02		

6.1.2 Test Limit

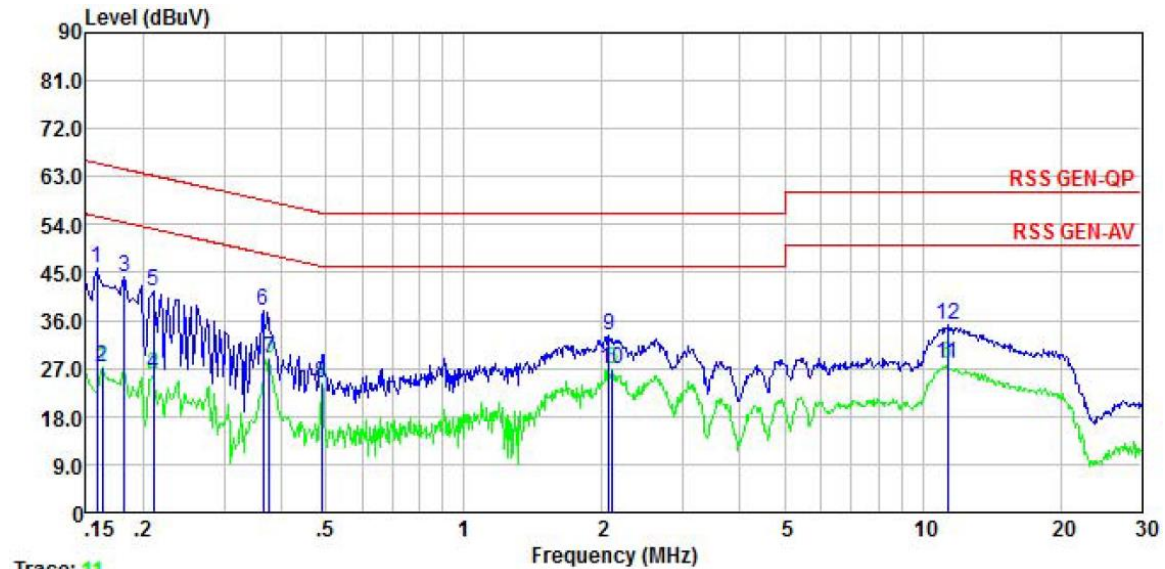
Items	Limit																																								
AC Power Line Conducted Emission	<table><tr><th rowspan="2">Frequency (MHz)</th><th colspan="2">Limit (dBµV)</th></tr><tr><th>Quasi-Peak</th><th>Average</th></tr><tr><td>0.15 – 0.5</td><td>66 to 56 <small>Note</small></td><td>56 to 46 <small>Note</small></td></tr><tr><td>0.5 – 5</td><td>56</td><td>46</td></tr><tr><td>5 – 30</td><td>60</td><td>50</td></tr><tr><td colspan="3">Note: The level decreases linearly with the logarithm of the frequency.</td></tr></table>	Frequency (MHz)	Limit (dBµV)		Quasi-Peak	Average	0.15 – 0.5	66 to 56 <small>Note</small>	56 to 46 <small>Note</small>	0.5 – 5	56	46	5 – 30	60	50	Note: The level decreases linearly with the logarithm of the frequency.																									
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0.5 – 5	56	46																																							
5 – 30	60	50																																							
Note: The level decreases linearly with the logarithm of the frequency.																																									
Conducted Peak Output Power	For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).																																								
20dB Occupied Bandwidth	The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system's radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.																																								
Carrier Frequencies Separation	FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.																																								
Hopping Channel Number Dwell Time	FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.																																								
Band-edge Emission	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required:																																								
Conduction Spurious	<table><tr><th rowspan="2">Frequency (MHz)</th><th colspan="2">Limit (dBµV/m)</th><th rowspan="2">Detector</th></tr><tr><th>@ 3m</th><th>@ 10m</th></tr><tr><td>30 – 88</td><td>40.0</td><td>30.0</td><td>Quasi-peak</td></tr><tr><td>88 – 216</td><td>43.5</td><td>33.5</td><td>Quasi-peak</td></tr><tr><td>216 – 960</td><td>46.0</td><td>36.0</td><td>Quasi-peak</td></tr><tr><td>960 – 1000</td><td>54.0</td><td>44.0</td><td>Quasi-peak</td></tr><tr><td colspan="4">Note: The more stringent limit applies at transition frequencies.</td></tr><tr><th rowspan="2">Frequency</th><th colspan="2">Limit (dBµV/m) @ 3m</th><th rowspan="2"></th></tr><tr><th>Average</th><th>Peake</th></tr><tr><td>Above 1 GHz</td><td>54.0</td><td>74.0</td><td></td></tr><tr><td colspan="4">Note: The measurement bandwidth shall be 1 MHz or greater.</td></tr></table>	Frequency (MHz)	Limit (dBµV/m)		Detector	@ 3m	@ 10m	30 – 88	40.0	30.0	Quasi-peak	88 – 216	43.5	33.5	Quasi-peak	216 – 960	46.0	36.0	Quasi-peak	960 – 1000	54.0	44.0	Quasi-peak	Note: The more stringent limit applies at transition frequencies.				Frequency	Limit (dBµV/m) @ 3m			Average	Peake	Above 1 GHz	54.0	74.0		Note: The measurement bandwidth shall be 1 MHz or greater.			
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6.2 Antenna Requirement

Standard requirement:	RSS-Gen Section 6.8 and RSS-247 Section 5.4(f)
<p>RSS-Gen Section 6.8 requirement: The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.</p> <p>RSS-247 Section 5.4(f) requirement: Transmitters operating in the band 2400-2483.5 MHz, may employ antenna systems that emit multiple directional beams simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers, provided that the emissions comply with the following:</p> <ol style="list-style-type: none"> Different information must be transmitted to each receiver. If the transmitter employs an antenna system that emits multiple directional beams, but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device (i.e. the sum of the power supplied to all antennas, antenna elements, staves, etc., and summed across all carriers or frequency channels) shall not exceed the applicable output power limit specified in sections 5.4(b) and 5.4(d). However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain. If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the applicable power limit specified in sections 5.4(b) and 5.4(d). If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the applicable limit specified in sections 5.4(b) and 5.4(d). In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the applicable limit specified in sections 5.4(b) and 5.4(d) by more than 8 dB. Transmitters that transmit a single directional beam shall operate under the provisions of sections 5.4(b), 5.4(d) and 5.4(e). 	
E.U.T Antenna:	
<p>The Bluetooth antenna is an External antenna which cannot replace by end-user, the best case gain of the antenna is 1 dBi. See product internal photos for details.</p>	

6.3 Conducted Emissions

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		

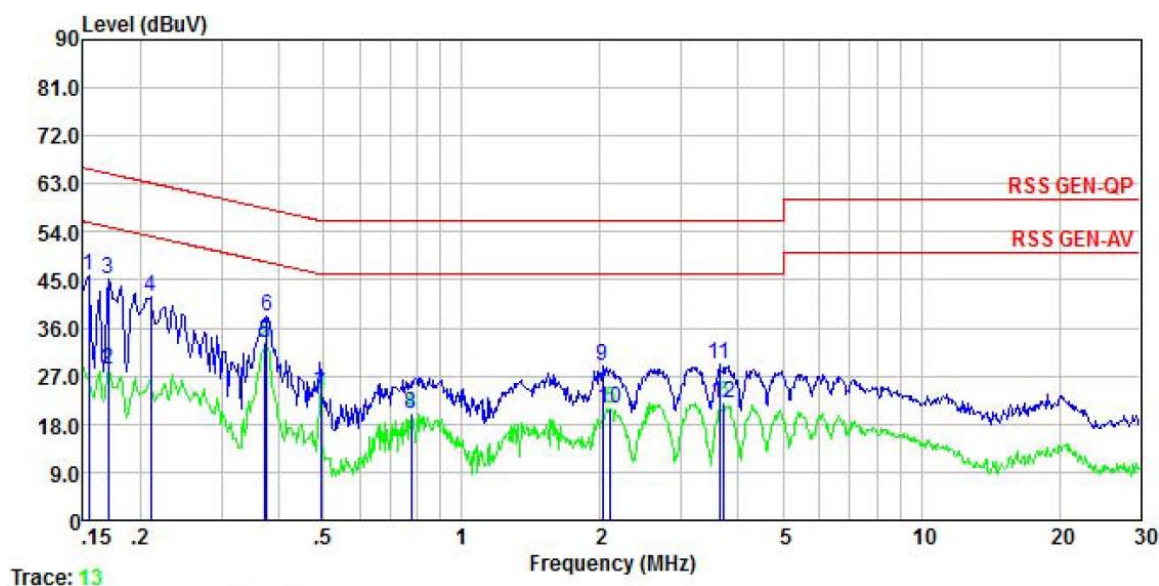


	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.158	45.95	0.00	0.01	45.96	65.56	-19.60	QP
2	0.162	27.16	0.00	0.01	27.17	55.34	-28.17	Average
3	0.182	44.05	0.00	0.01	44.06	64.42	-20.36	QP
4	0.211	25.88	0.00	0.03	25.91	53.18	-27.27	Average
5	0.211	41.54	0.00	0.03	41.57	63.18	-21.61	QP
6	0.365	37.86	0.00	0.03	37.89	58.61	-20.72	QP
7	0.377	28.93	0.00	0.03	28.96	48.34	-19.38	Average
8	0.489	24.38	0.00	0.03	24.41	46.19	-21.78	Average
9	2.066	32.92	0.00	0.20	33.12	56.00	-22.88	QP
10	2.110	26.55	0.00	0.19	26.74	46.00	-19.26	Average
11	11.317	27.95	0.00	0.11	28.06	50.00	-21.94	Average
12	11.377	35.00	0.00	0.11	35.11	60.00	-24.89	QP

Remark:

1. Level = Read level + LISN 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		



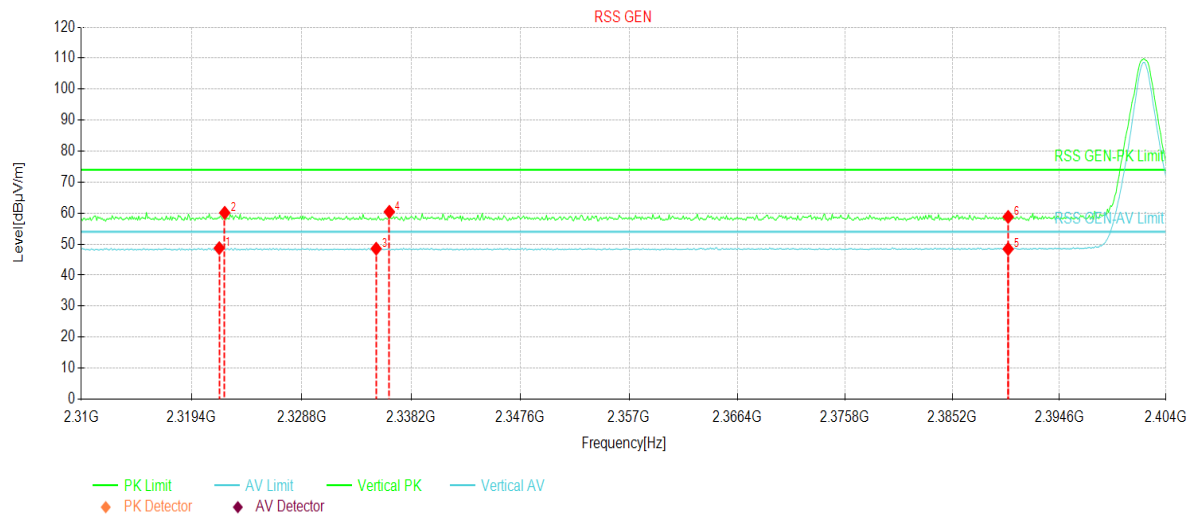
	Freq	Read	LISN	Cable	Level	Limit	Over	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.154	45.71	0.00	0.01	45.72	65.78	-20.06	QP
2	0.170	28.31	0.00	0.01	28.32	54.94	-26.62	Average
3	0.170	45.31	0.00	0.01	45.32	64.94	-19.62	QP
4	0.211	41.68	0.00	0.03	41.71	63.18	-21.47	QP
5	0.373	33.07	0.00	0.03	33.10	48.43	-15.33	Average
6	0.377	38.18	0.00	0.03	38.21	58.34	-20.13	QP
7	0.494	23.58	0.00	0.03	23.61	46.10	-22.49	Average
8	0.775	19.96	0.00	0.03	19.99	46.00	-26.01	Average
9	2.023	28.56	0.00	0.20	28.76	56.00	-27.24	QP
10	2.110	20.86	0.00	0.19	21.05	46.00	-24.95	Average
11	3.642	29.22	0.00	0.08	29.30	56.00	-26.70	QP
12	3.720	21.92	0.00	0.08	22.00	46.00	-24.00	Average

Remark:

1. Level = Read level + LISN Factor + Cable Loss.

6.4 Emissions in Restricted Frequency Bands

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:	DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	AC 120/60Hz		

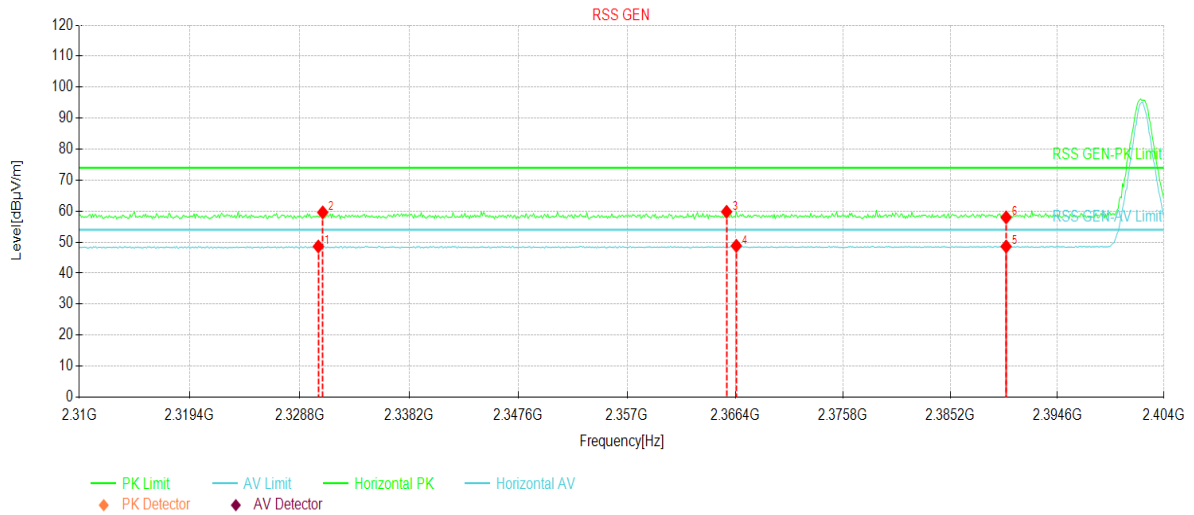


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2321.750	13.36	48.71	35.35	54.00	5.29	AV	Vertical
2	2322.220	24.75	60.11	35.36	74.00	13.89	PK	Vertical
3	2335.192	13.08	48.53	35.45	54.00	5.47	AV	Vertical
4	2336.320	24.97	60.43	35.46	74.00	13.57	PK	Vertical
5	2390.088	12.60	48.44	35.84	54.00	5.56	AV	Vertical
6	2390.088	22.96	58.80	35.84	74.00	15.20	PK	Vertical

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	AC 120/60Hz		

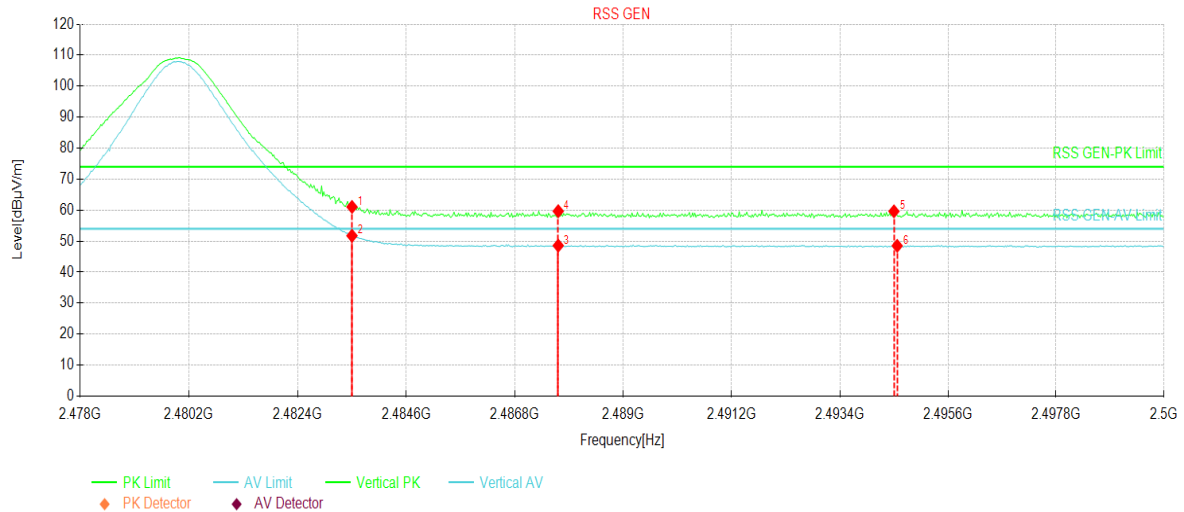


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2330.398	13.18	48.60	35.42	54.00	5.40	AV	Horizontal
2	2330.774	24.17	59.59	35.42	74.00	14.41	PK	Horizontal
3	2365.648	24.13	59.80	35.67	74.00	14.20	PK	Horizontal
4	2366.494	13.14	48.81	35.67	54.00	5.19	AV	Horizontal
5	2390.088	12.77	48.61	35.84	54.00	5.39	AV	Horizontal
6	2390.088	22.14	57.98	35.84	74.00	16.02	PK	Horizontal

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	AC 120/60Hz		

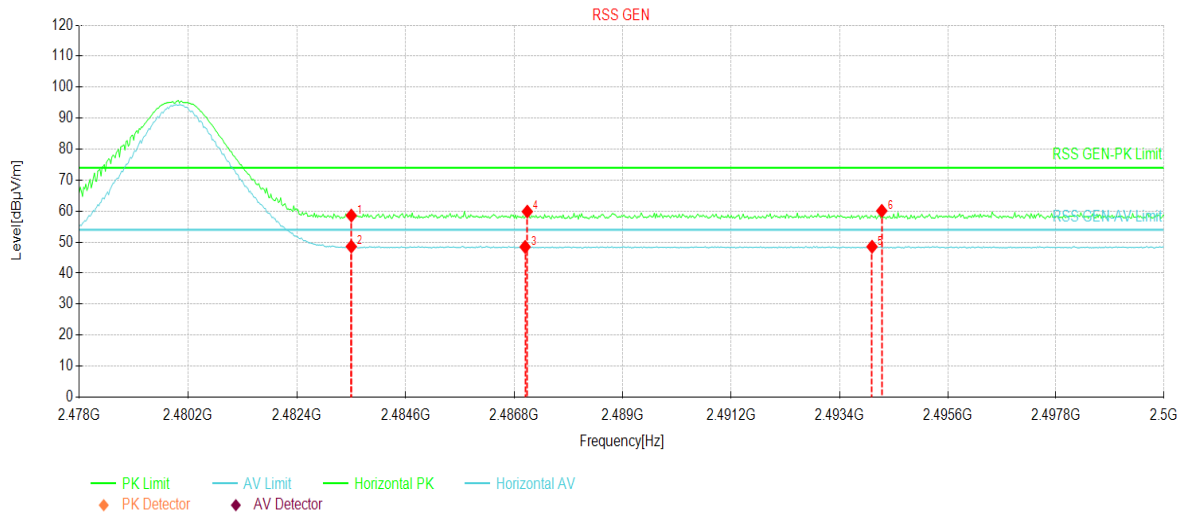


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2483.500	25.33	61.05	35.72	74.00	12.95	PK	Vertical
2	2483.500	16.02	51.74	35.72	54.00	2.26	AV	Vertical
3	2487.680	12.85	48.56	35.71	54.00	5.44	AV	Vertical
4	2487.680	23.95	59.66	35.71	74.00	14.34	PK	Vertical
5	2494.500	23.93	59.62	35.69	74.00	14.38	PK	Vertical
6	2494.566	12.80	48.49	35.69	54.00	5.51	AV	Vertical

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	AC 120/60Hz		



Suspected Data List

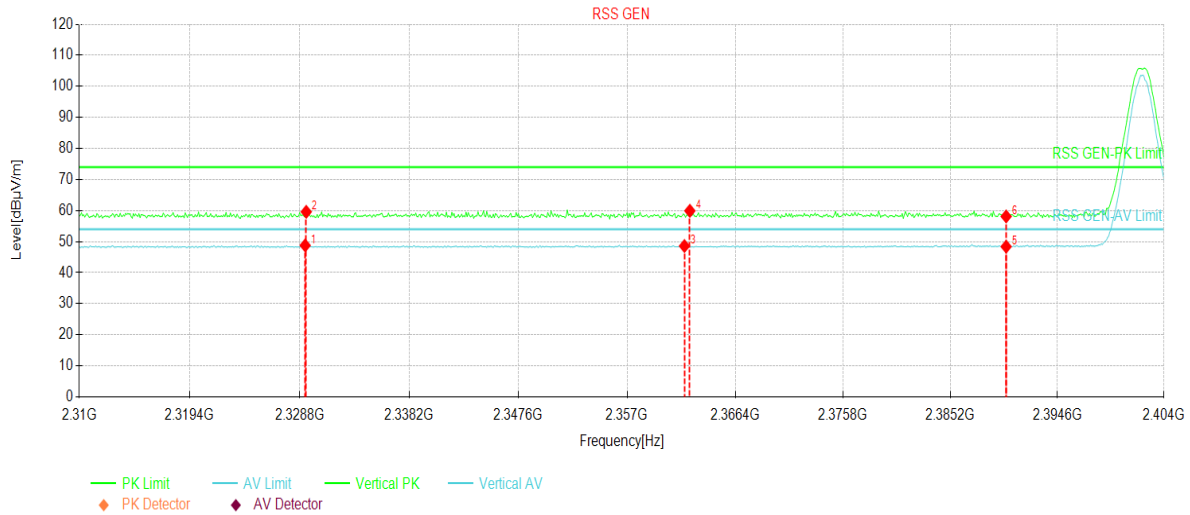
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2483.500	22.86	58.58	35.72	74.00	15.42	PK	Horizontal
2	2483.500	12.86	48.58	35.72	54.00	5.42	AV	Horizontal
3	2487.020	12.76	48.47	35.71	54.00	5.53	AV	Horizontal
4	2487.064	24.16	59.87	35.71	74.00	14.13	PK	Horizontal
5	2494.060	12.84	48.53	35.69	54.00	5.47	AV	Horizontal
6	2494.258	24.41	60.10	35.69	74.00	13.90	PK	Horizontal

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

π/4-DQPSK mode

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:	2DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	AC 120/60Hz		



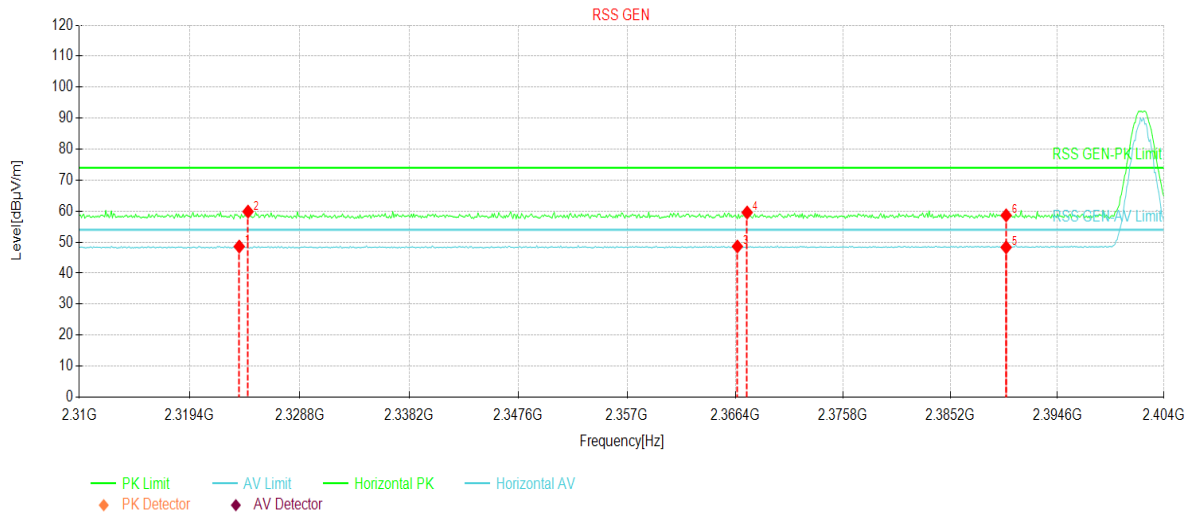
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2329.270	13.36	48.77	35.41	54.00	5.23	AV	Vertical
2	2329.364	24.19	59.60	35.41	74.00	14.40	PK	Vertical
3	2361.982	12.95	48.59	35.64	54.00	5.41	AV	Vertical
4	2362.452	24.27	59.91	35.64	74.00	14.09	PK	Vertical
5	2390.088	12.55	48.39	35.84	54.00	5.61	AV	Vertical
6	2390.088	22.28	58.12	35.84	74.00	15.88	PK	Vertical

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	2DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	AC 120/60Hz		

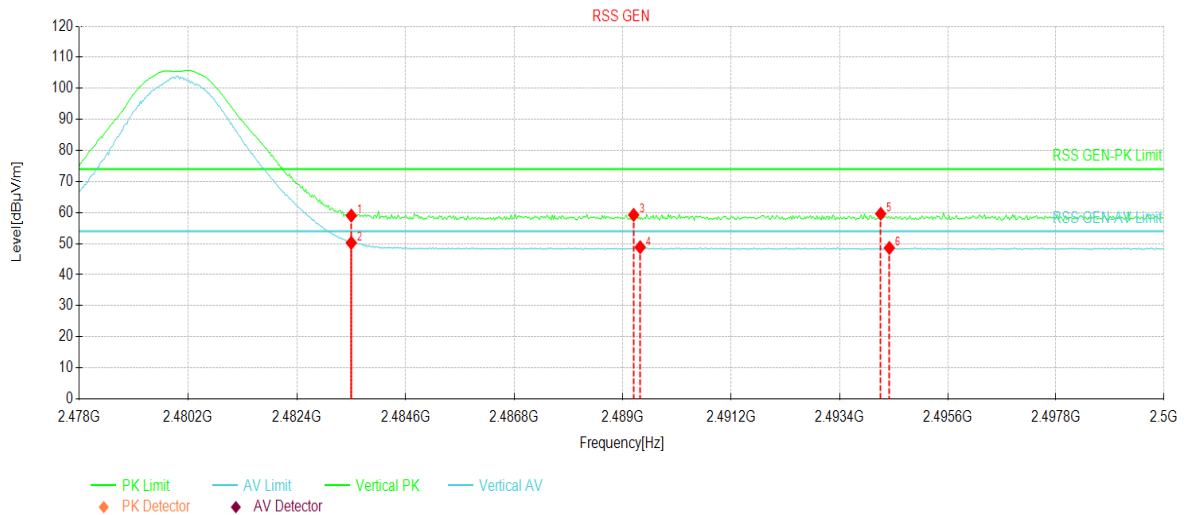


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2323.630	13.21	48.58	35.37	54.00	5.42	AV	Horizontal
2	2324.382	24.49	59.86	35.37	74.00	14.14	PK	Horizontal
3	2366.588	12.93	48.60	35.67	54.00	5.40	AV	Horizontal
4	2367.434	23.89	59.57	35.68	74.00	14.43	PK	Horizontal
5	2390.088	12.49	48.33	35.84	54.00	5.67	AV	Horizontal
6	2390.088	22.81	58.65	35.84	74.00	15.35	PK	Horizontal

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	2DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	AC 120/60Hz		



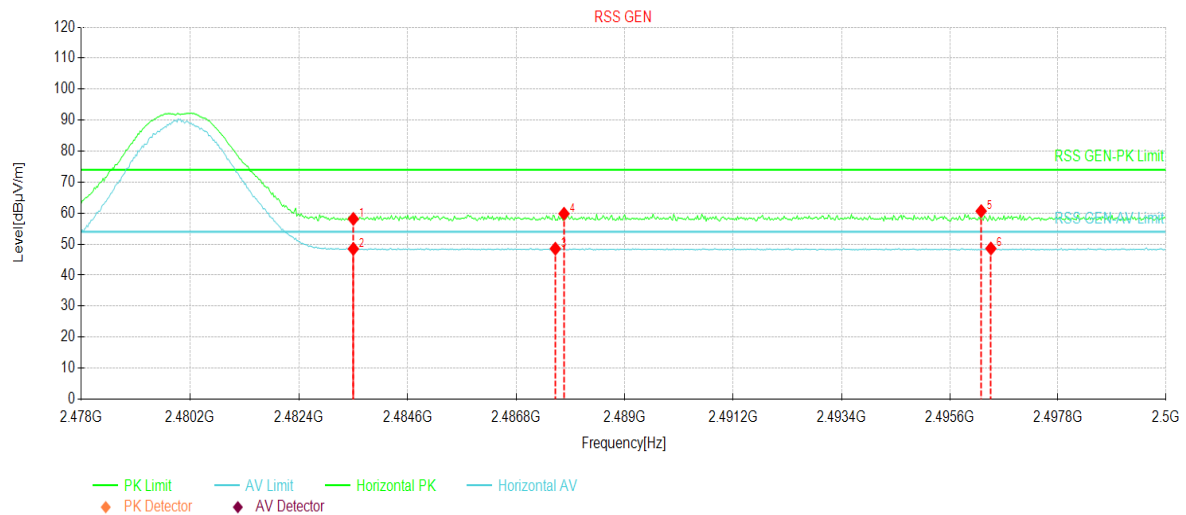
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2483.500	23.30	59.02	35.72	74.00	14.98	PK	Vertical
2	2483.500	14.53	50.25	35.72	54.00	3.75	AV	Vertical
3	2489.220	23.55	59.25	35.70	74.00	14.75	PK	Vertical
4	2489.352	13.14	48.84	35.70	54.00	5.16	AV	Vertical
5	2494.236	23.92	59.61	35.69	74.00	14.39	PK	Vertical
6	2494.412	12.91	48.60	35.69	54.00	5.40	AV	Vertical

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	2DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	AC 120/60Hz		



Suspected Data List

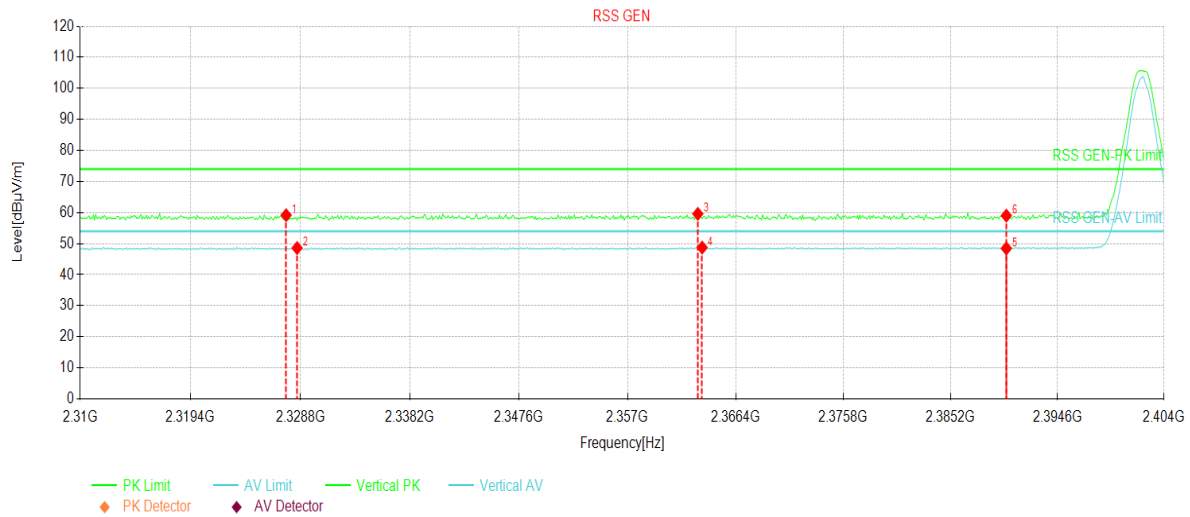
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2483.500	22.42	58.14	35.72	74.00	15.86	PK	Horizontal
2	2483.500	12.76	48.48	35.72	54.00	5.52	AV	Horizontal
3	2487.592	12.82	48.53	35.71	54.00	5.47	AV	Horizontal
4	2487.768	24.11	59.82	35.71	74.00	14.18	PK	Horizontal
5	2496.238	24.97	60.66	35.69	74.00	13.34	PK	Horizontal
6	2496.436	12.90	48.59	35.69	54.00	5.41	AV	Horizontal

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

8DPSK mode

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:	3DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Vertical
Test Voltage:	AC 120/60Hz		



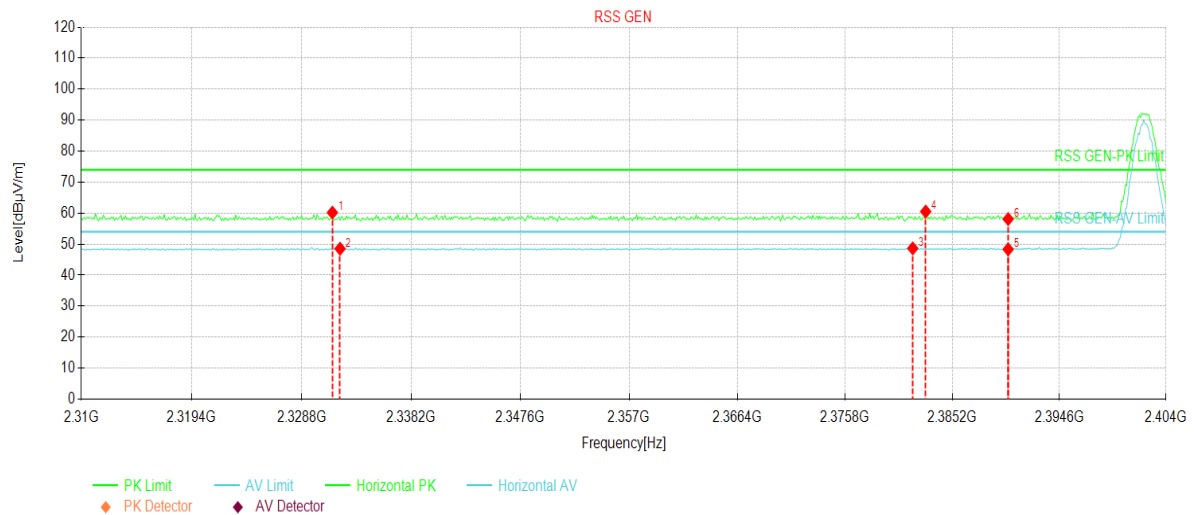
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2327.578	23.76	59.16	35.40	74.00	14.84	PK	Vertical
2	2328.518	13.18	48.58	35.40	54.00	5.42	AV	Vertical
3	2363.110	23.93	59.58	35.65	74.00	14.42	PK	Vertical
4	2363.486	13.09	48.74	35.65	54.00	5.26	AV	Vertical
5	2390.088	12.61	48.45	35.84	54.00	5.55	AV	Vertical
6	2390.088	23.18	59.02	35.84	74.00	14.98	PK	Vertical

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	3DH1 Tx mode
Test Channel:	Lowest channel	Polarization:	Horizontal
Test Voltage:	AC 120/60Hz		

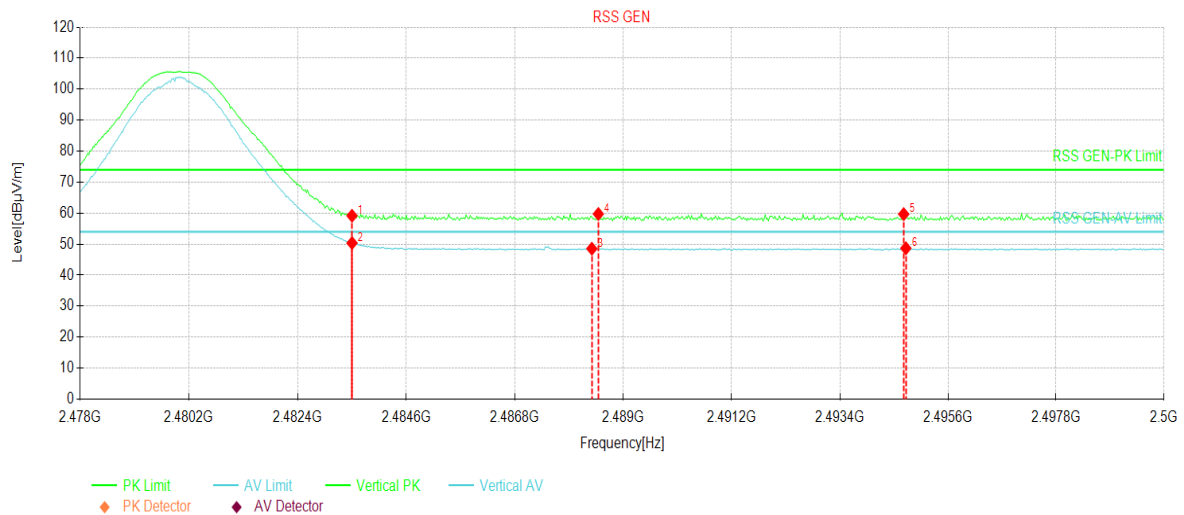


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2331.432	24.77	60.19	35.42	74.00	13.81	PK	Horizontal
2	2332.090	13.10	48.53	35.43	54.00	5.47	AV	Horizontal
3	2381.722	12.86	48.64	35.78	54.00	5.36	AV	Horizontal
4	2382.850	24.74	60.53	35.79	74.00	13.47	PK	Horizontal
5	2390.088	12.48	48.32	35.84	54.00	5.68	AV	Horizontal
6	2390.088	22.26	58.10	35.84	74.00	15.90	PK	Horizontal

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	3DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	AC 120/60Hz		

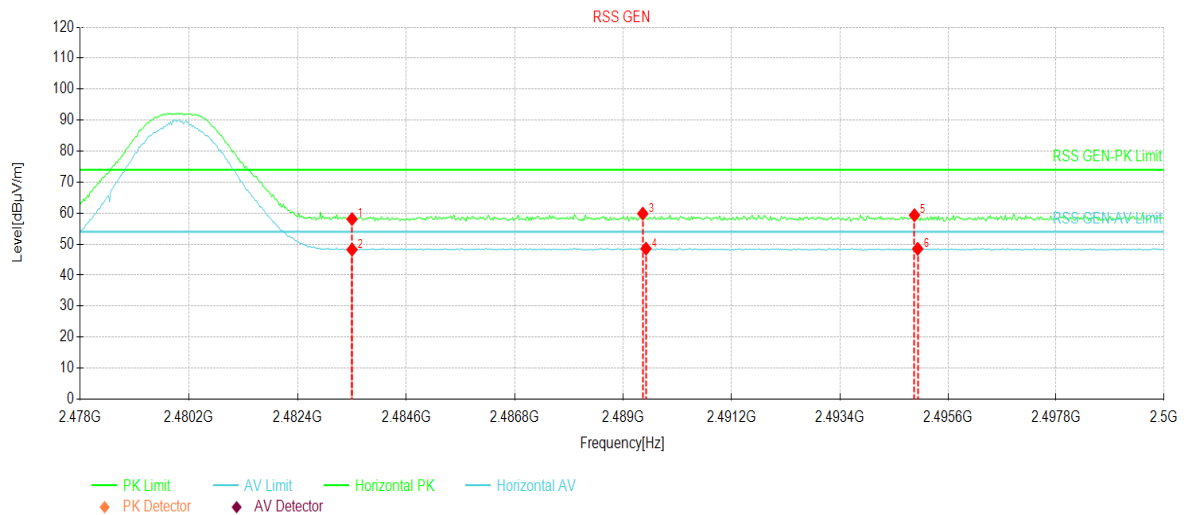


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2483.500	23.44	59.16	35.72	74.00	14.84	PK	Vertical
2	2483.500	14.64	50.36	35.72	54.00	3.64	AV	Vertical
3	2488.362	12.83	48.54	35.71	54.00	5.46	AV	Vertical
4	2488.494	24.04	59.75	35.71	74.00	14.25	PK	Vertical
5	2494.698	24.00	59.69	35.69	74.00	14.31	PK	Vertical
6	2494.742	12.99	48.68	35.69	54.00	5.32	AV	Vertical

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	3DH1 Tx mode
Test Channel:	Highest channel	Polarization:	Horizontal
Test Voltage:	AC 120/60Hz		



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	2483.500	22.36	58.08	35.72	74.00	15.92	PK	Horizontal
2	2483.500	12.51	48.23	35.72	54.00	5.77	AV	Horizontal
3	2489.396	24.15	59.85	35.70	74.00	14.15	PK	Horizontal
4	2489.462	12.86	48.56	35.70	54.00	5.44	AV	Horizontal
5	2494.918	23.66	59.35	35.69	74.00	14.65	PK	Horizontal
6	2494.984	12.81	48.50	35.69	54.00	5.50	AV	Horizontal

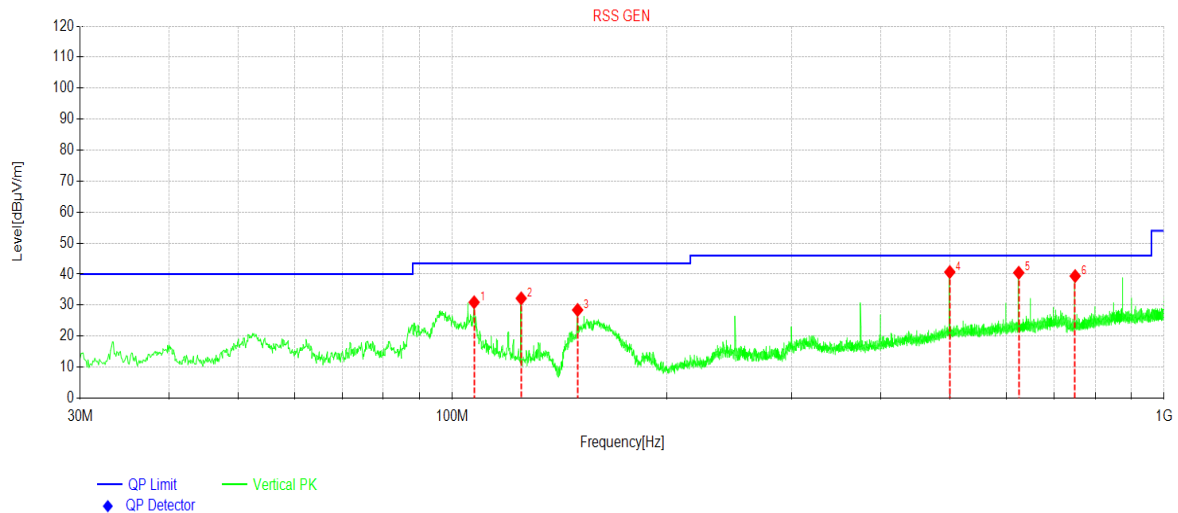
Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

6.5 Emissions in Non-restricted Frequency Bands

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:	BT Tx mode
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Vertical
Test Voltage:	AC 120/60Hz		



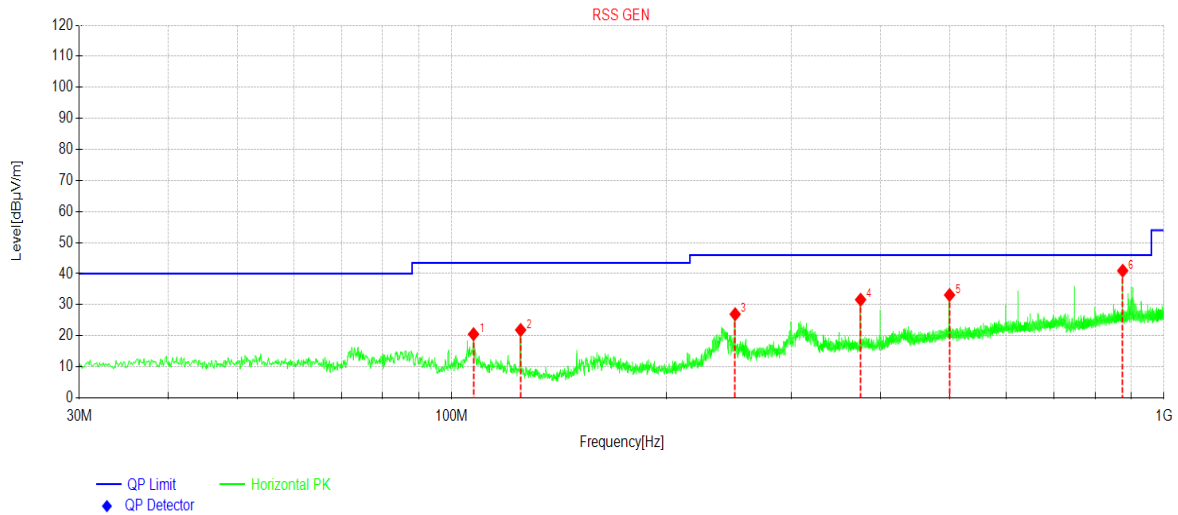
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	107.316	46.89	30.92	-15.97	43.50	12.58	PK	Vertical
2	124.972	48.95	32.19	-16.76	43.50	11.31	PK	Vertical
3	150.001	46.36	28.43	-17.93	43.50	15.07	PK	Vertical
4	500.012	47.63	40.67	-6.96	46.00	5.33	PK	Vertical
5	625.057	45.76	40.45	-5.31	46.00	5.55	PK	Vertical
6	750.103	43.13	39.39	-3.74	46.00	6.61	PK	Vertical

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

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:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	AC 120/60Hz		



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBμV/m]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin [dB]	Trace	Polarity
1	107.316	36.49	20.52	-15.97	43.50	22.98	PK	Horizontal
2	124.972	38.62	21.86	-16.76	43.50	21.64	PK	Horizontal
3	250.018	40.73	26.94	-13.79	46.00	19.06	PK	Horizontal
4	375.063	42.50	31.62	-10.88	46.00	14.38	PK	Horizontal
5	500.012	40.09	33.13	-6.96	46.00	12.87	PK	Horizontal
6	875.051	42.43	40.96	-1.47	46.00	5.04	PK	Horizontal

Remark:

1. Level = Read level + Antenna Factor + Cable Loss – Preamplifier Factor.

Above 1GHz:

Test channel: Lowest channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
4804.00	44.84	-9.60	35.24	74.00	38.76	Vertical
4804.00	44.69	-9.60	35.09	74.00	38.91	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
4804.00	37.58	-9.60	27.98	54.00	26.02	Vertical
4804.00	36.52	-9.60	26.92	54.00	27.08	Horizontal
Test channel: Middle channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
4882.00	44.61	-9.05	35.56	74.00	38.44	Vertical
4882.00	44.78	-9.05	35.73	74.00	38.27	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
4882.00	37.59	-9.05	28.54	54.00	25.46	Vertical
4882.00	36.66	-9.05	27.61	54.00	26.39	Horizontal
Test channel: Highest channel						
Detector: Peak Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
4960.00	44.16	-8.45	35.71	74.00	38.29	Vertical
4960.00	44.63	-8.45	36.18	74.00	37.82	Horizontal
Detector: Average Value						
Frequency (MHz)	Read Level (dBuV)	Factor(dB)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polarization
4960.00	37.57	-8.45	29.12	54.00	24.88	Vertical
4960.00	37.05	-8.45	28.60	54.00	25.40	Horizontal
Remark: 1. Level = Read level + Factor.						

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