

Report No: JYTSZ-R12-2200086

FCC	REPORT
	(RFID)

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.: FCC ID:	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 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:



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.

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:

Mike.ou

Date: 28 Jan., 2022

28 Jan., 2022

Date:

Test Engineer

Winner Thang

Reviewed by:

Project Engineer



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4 Test Summary

Section in CFR 47	Test Data	Result
15.203 & 15.247 (b)	See Section 6.1	Pass
15.207	See Section 6.2	Pass
15.247 (b)(3)	Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01	Pass*
15.247 (a)(2)	Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01	Pass*
15.247 (e)	Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01	Pass*
15.247 (d)	Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01	Pass*
	See Section 6.3.1	Pass
15.205 & 15.209	Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01	Pass*
1	See Section 6.4.1	Pass
	15.247 (b)(3) 15.247 (a)(2) 15.247 (e) 15.247 (d)	15.207 See Section 6.2 15.247 (b)(3) Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01 15.247 (a)(2) Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01 15.247 (e) Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01 15.247 (d) Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01 15.247 (d) Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01 15.247 (d) Please refer to FCC ID: 2ARPP-GL5712UX Report No.: SZAWW180830006-01 15.205 & 15.209 Report No.: SZAWW180830006-01

Test Method:

ANSI C63.10-2013 KDB 558074 D01 15.247 Meas Guidance v05r02





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:	923.3-927.5 MHz
Channel numbers:	25
Channel separation:	1 MHz
Modulation technology:	Lora
Antenna Type:	External Antenna
Antenna gain:	3 dBi
Power supply:	DC 5V
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 Frequency each of channel					
Frequency	Channel	Frequency	Channel	Frequency	
923.3MHz	4	925.1MHz	7	926.9MHz	
923.9MHz	5	925.7MHz	8	927.5MHz	
924.5MHz	6	926.3MHz			
	Frequency 923.3MHz 923.9MHz	Frequency Channel 923.3MHz 4 923.9MHz 5	FrequencyChannelFrequency923.3MHz4925.1MHz923.9MHz5925.7MHz	FrequencyChannelFrequencyChannel923.3MHz4925.1MHz7923.9MHz5925.7MHz8	

Note:

In section 15.31(*m*), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test. Channel No. 1, 5 & 8 were selected as Lowest, Middle and Highest channel.



5.3 Test environment and mode

Operating Environment:		
Temperature:	24.0 °C	
Humidity:	54 % RH	
Atmospheric Pressure:	1010 mbar	
Test mode:		
Transmitting mode	Keep the EUT in continuous transmitting with modulation	

The sample was placed 0.8m (below 1GHz)/1.5m (above 1GHz) 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. Duty cycle setting during the transmission is 100% with maximum power setting for all modulations.

5.4 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
LENOVO	Laptop	SL510	2847A65	DoC

5.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
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

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
ISN	Schwarzbeck	CAT3 8158	#96	03-03-2021	03-02-2022
ISN	Schwarzbeck	CAT5 8158	#166	03-03-2021	03-02-2022
ISN	Schwarzbeck	NTFM 8158	#126	03-03-2021	03-02-2022
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



6 Test results and Measurement Data

6.1 Antenna requirement:

Standard requirement:	FCC Part 15 C Section 15.203 /247(c)
responsible party shall be us antenna that uses a unique so that a broken antenna ca electrical connector is prohil 15.247(c) (1)(i) requirement (i) Systems operating in the operations may employ tran	: 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point smitting antennas with directional gain greater than 6dBi provided the power of the intentional radiator is reduced by 1 dB for every 3 dB that the
E.U.T Antenna:	
The Lora antenna is an Exter antenna is 3 dBi.	nal antenna which cannot replace by end-user, the best-case gain of the



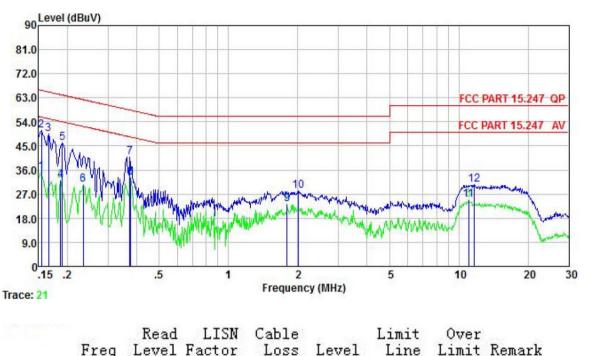
6.2 Conducted Emission

Test Requirement:	FCC Part 15 C Section 15.20	07	
Test Frequency Range:	150 kHz to 30 MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30 * Decreases with the logarith	60	50
Test procedure	 The E.U.T and simulato line impedance stabiliza 50ohm/50uH coupling ir The peripheral devices LISN that provides a 50 termination. (Please refore photographs). Both sides of A.C. line a interference. In order to positions of equipment a 	rs are connected to the r tition network (L.I.S.N.), w mpedance for the measu are also connected to the ohm/50uH coupling impe er to the block diagram o are checked for maximum find the maximum emiss and all of the interface ca 4(latest version) on cond	which provides a ring equipment. e main power through a edance with 50ohm f the test setup and n conducted sion, the relative ubles must be changed
Test setup:	Reference LISN 40cm 40cm Equipment E.U. Test table/Insulation plane Remarkc E.U.T: Equipment Under Test LISN: Line Impedence Stabilization N Test table height=0.8m	80cm Filter T EMI Receiver	— AC power
Test Instruments:	Refer to section 5.9 for detai	ls	
Test mode:	Refer to section 5.3 for detai	ls	
Test results:	Passed		



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:	Tx mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 22.5℃ Huni: 55%



-	MHz	dBuV		dB	dBuV	dBuV		
	1012	mas	ш	ш	max	mαv	ш	
1	0.154	35.10	0.04	0.01	35.15	55.78	-20.63	Average
1 2 3 4 5 6 7 8 9	0.154	50.77	0.04	0.01	50.82	65.78	-14.96	QP
3	0.166	49.43	0.04	0.01	49.48	65.16	-15.68	QP
4	0.186	32.21	0.04	0.02	32.27	54.20	-21.93	Average
5	0.190	46.12	0.04	0.03	46.19	64.02	-17.83	QP
6	0.234	30.54	0.04	0.02	30.60	52.30	-21.70	Average
7	0.373	40.78	0.04	0.03	40.85	58.43	-17.58	QP
8	0.377	33.18	0.04	0.03	33.25	48.34	-15.09	Average
9	1.800	23.07	0.07	0.19	23.33	46.00	-22.67	Average
0	2.012	27.87	0.07	0.21	28.15	56.00	-27.85	QP
.1	11.021	24.62	0.22	0.11	24.95	50.00	-25.05	Average
.2	11.621	30.14	0.23	0.11	30.48	60.00	-29.52	QP

Notes:

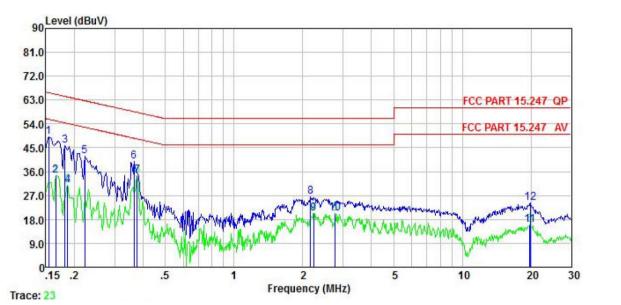
1. An initial pre-scan was performed on the line and neutral lines with peak detector.

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

3. Final Level =Receiver Read level + LISN Factor + 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:	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	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	<u>d</u> B	ā	dBu∛	dBuV	āB	
1	0.154	49.11	0.05	0.01	49.17	65.78	-16.61	QP
2	0.166	34.52	0.05	0.01	34.58	55.16	-20.58	Average
3	0.182	45.62	0.04	0.01	45.67	64.42	-18.75	QP
4	0.186	30.90	0.04	0.02	30.96	54.20	-23.24	Average
1 2 3 4 5 6 7 8 9	0.222	41.88	0.04	0.03	41.95	62.74	-20.79	QP
6	0.365	39.80	0.04	0.03	39.87	58.61	-18.74	QP
7	0.377	34.48	0.04	0.03	34.55	48.34	-13.79	Average
8	2.167	26.24	0.06	0.18	26.48	56.00	-29.52	QP
9	2.237	20.02	0.07	0.17	20.26	46.00	-25.74	Average
10	2.779	19.96	0.08	0.10	20.14	46.00	-25.86	Average
11	19.740	15.61	0.30	0.15	16.06	50.00	-33.94	Average
12	19.845	23.64	0.30	0.15	24.09	60.00	-35.91	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 + Cable Loss.



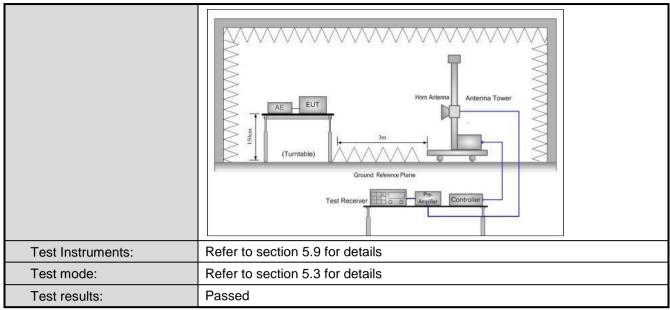
6.3 Band Edge

Test Frequency Range: 96 Test site: Me Receiver setup: 9						
Test site: Me Receiver setup: 9 Limit: 9 Test Procedure: 1. 2.	CC Part15 C Sect	ion 15.20	9 and	15.205		
Receiver setup: 9 Limit: 9 Test Procedure: 1. 2.	60MHz to 1.240GI	Hz				
Limit: Test Procedure: 1. 2.	easurement Dista	nce: 3m				
Limit: Test Procedure: 1. 2.	Frequency	Detec	tor	RBW	VBW	Remark
Limit: Test Procedure: 1. 2.	960MHz-1GHz	Quasi-p	eak	120kHz	300kHz	Quasi-peak Value
Limit: Test Procedure: 1. 2.	Above 1GHz	Peal		1MHz	3MHz	Peak Value
Test Procedure: 1. 2.		RMS		1MHz	3MHz	Average Value
2.	Frequency		Lin	<u>nit (dBuV/m</u>	@3m)	Remark
2.	960MHz-1GH	IZ		54.00		Quasi-peak Value
2.	Above 1GHz	<u>z</u>		54.00 74.00		Average Value Peak Value
4. 5. 6.	 /1.5m(above 1) was rotated 36 radiation. The EUT was s antenna, which tower. The antenna h ground to dete horizontal and measurement. For each suspe and thenthe an the rotatablewa maximum read The test-receiv SpecifiedBand If the emission limitspecified, t 	GHz) abc of degree set 3 met was mou- eight is va rmine the vertical p ected emi- tenna wa as turned ling. ver system width with level of t chen testin reported. pere-teste	ers av inted aried ission ission ission from n was n Max he EL ng con Other	op of a rota e groundat ; etermine the way from the on the top o from one m mum value ations of the , the EUT w ed to height 0 degrees t set to Peal imum Hold JT in peak n uld be stopp wise the en e by one usi	a 3 meter e position e interfere of a variab eter to fou of the field e antenna vas arrang cs from 1 r o 360 deg c Detect F Mode. node was bed and th nissions th ng peak, o	0.8m(below 1GHz) chamber.The table of the highest nce-receiving le-height antenna ir meters above the d strength. Both are set to make the ged to its worst case neter to 4 meters and prees to find the unction and 10dB lower than the e peak values of the nat did not have 10dB quasi-peak or
Test setup: Be	elow 1GHz	v 0.8m	m Im			Antenna Tower Search Antenna F Test

6.3.1 Radiated Emission Method

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. Telephone: +86 (0) 755 23118282 Fax: +86 (0) 755 23116366 Project No.: JYTSZR2201011







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:	Tx mode
Test Channel:	Highest channel	Polarization:	Vertical
Test Voltage:	AC 120/60Hz	Environment:	Temp: 24℃ Huni: 57%



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	42.1250	30.80	16.10	-14.70	40.00	23.90	PK	Vertical
2	63.8288	31.46	15.97	-15.49	40.00	24.03	PK	Vertical
3	113.662	31.62	16.05	-15.57	43.50	27.45	PK	Vertical
4	307.298	31.14	18.63	-12.51	46.00	27.37	PK	Vertical
5	550.041	31.87	24.98	-6.89	46.00	21.02	PK	Vertical
6	915.610	31.93	30.72	-1.21	46.00	15.28	PK	Vertical

Remark:

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



Product	name	: V		oRa Gateway ra Indoor Hel sion			model:	NEBHN	NT-HHRK			
Test By	:	М	like			Test mod	le:	Tx mod	le			
Test Ch	annel:	н	ighest channe)		Polarizat	ion:	Horizon	ntal			
Fest Vo	Itage:	A	C 120/60Hz			Environn	nent:	Temp: 2	emp: 24°C Huni: 57%			
					FCC PART 15.2	247						
	110				10017441102							
	90											
	80											
Ē	70											
Level[dBµV/m]	60							FC	CC PART 15.247	7-QP Limit		
evel[d	50											
Ľ.	40									. 6		
	30							5	a legislation of the later of the			
	20	m marine and the second	har man and har	Amound and the second states	Were and a fair and a start of the start of	and an and a second second second second						
	0											
	30M			40014								
	30101			100M	Frequency[H:	<u>z]</u>				1G		
	30101	— QP Limit → QP Detector	— Horizontal PK	TUUM	Frequency[H2	2]				1G		
ľ	3011	QP Detector					Marain			1G		
	NO.	QP Detector	Reading	Level	Factor	Limit	Margin [dB]	Trace	Pola			
	NO.	P Detector Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	[dB]			rity		
	NO.	P Detector Freq. [MHz] 37.5175	Reading	Level [dΒμV/m] 16.78	Factor [dB] -14.73	Limit [dBµV/m] 40.00	[dB] 23.22	PK	Horizo	rity		
	NO.	Freq. [MHz] 37.5175 54.7350	Reading [dBµV/m] 31.51	Level [dBµV/m]	Factor [dB] -14.73 -14.62	Limit [dBµV/m]	[dB] 23.22 23.73	PK PK	Horizo Horizo	rity ontal ontal		
	NO.	P Detector Freq. [MHz] 37.5175	Reading [dBµV/m] 31.51 30.89	Level [dBµV/m] 16.78 16.27	Factor [dB] -14.73	Limit [dBµV/m] 40.00 40.00	[dB] 23.22	PK	Horizo	rity ontal ontal		
	NO. 1 2 3	P Detector Freq. [MHz] 37.5175 54.7350 115.117	Reading [dBµV/m] 31.51 30.89 30.59	Level [dBµV/m] 16.78 16.27 15.10	Factor [dB] -14.73 -14.62 -15.49	Limit [dBµV/m] 40.00 40.00 43.50	[dB] 23.22 23.73 28.40	PK PK PK	Horizo Horizo Horizo	rity ontal ontal ontal ontal		



Above 1GHz:

Produc	t name	: Ver		oRa Gateway ndoor Helium H			t model:	NEBH	NT-HHR	K4-915
Fest By	<i>'</i> :	Mike	Э			Test mo	ode:	Tx mo	de	
Fest Ch	nannel:	: Higl	nest channel			Polariza	ation:	Vertica	al	
Fest Vo	ltage:	AC	120/60Hz			Enviror	nment:	Temp:	24 ℃	Huni: 57%
Level[dBµV/m]	110 100 90 80 70 60 50 40 30					5 C			FCC PART 15 (
	20 10 1G	PK Limit AV Detector	— AV Limit — Ve	2G ertical PK — Vertical	Frequency[3G Hz]	46	56		76
	10 0 1G		AV Limit – Va Reading [dBµV/m]				4G Margin [dB]	5G Trace	Pola	_
	10 0 16 NO.	 AV Detector Freq. [MHz] 1830.00 	Reading [dBµV/m] 56.54	Level [dBµV/m] 35.68	AV Factor [dB] -20.86	Limit [dBµV/m] 74.00	Margin [dB] 38.32	Trace	Verti	rity cal
	10 0 16 NO. 1 2	 AV Detector Freq. [MHz] 1830.00 1830.00 	Reading [dBµV/m] 56.54 48.87	Level [dBµV/m] 35.68 28.01	Factor [dB] -20.86 -20.86	Limit [dBµV/m] 74.00 54.00	Margin [dB] 38.32 25.99	Trace PK AV	Verti Verti	rity cal cal
	10 0 1G NO. 1 2 3	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 	Reading [dBµV/m] 56.54 48.87 57.14	Level [dBµV/m] 35.68 28.01 40.06	Factor [dB] -20.86 -20.86 -17.08	Limit [dBµV/m] 74.00 54.00 74.00	Margin [dB] 38.32 25.99 33.94	Trace PK AV PK	Verti Verti Verti	rity <u>cal</u> cal
	10 0 1G NO. 1 2 3 4	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 	Reading [dBµV/m] 56.54 48.87 57.14 49.78	Level [dBµV/m] 35.68 28.01 40.06 32.70	AV Factor [dB] -20.86 -17.08 -17.08	Limit [dBµV/m] 74.00 54.00 74.00 54.00	Margin [dB] 38.32 25.99 33.94 21.30	Trace PK AV PK AV	Vertio Vertio Vertio Vertio	rity cal cal cal cal
	10 0 16 NO. 1 2 3 4 5	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 	Reading [dBµV/m] 56.54 48.87 57.14 49.78 50.04	Level [dBµV/m] 35.68 28.01 40.06 32.70 35.59	AV Factor [dB] -20.86 -20.86 -17.08 -17.08 -14.45	Limit [dBµV/m] 74.00 54.00 74.00 54.00 54.00	Margin [dB] 38.32 25.99 33.94 21.30 18.41	Trace PK AV PK AV AV	Verti Verti Verti Verti Verti	rity cal cal cal cal cal
	10 0 1G NO. 1 2 3 4 5 6	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 3660.00 	Reading [dBµV/m] 56.54 48.87 57.14 49.78 50.04 56.98	Level [dBµV/m] 35.68 28.01 40.06 32.70 35.59 42.53	Factor [dB] -20.86 -20.86 -17.08 -17.08 -14.45 -14.45	Limit [dBµV/m] 74.00 54.00 74.00 54.00 54.00 74.00	Margin [dB] 38.32 25.99 33.94 21.30 18.41 31.47	Trace PK AV PK AV AV AV	Vertio Vertio Vertio Vertio Vertio Vertio	rity cal cal cal cal cal cal
	NO. 1 2 3 4 5 6 7	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 3660.00 4575.00 	Reading [dBµV/m] 56.54 48.87 57.14 49.78 50.04 56.98 55.28	Level [dBµV/m] 35.68 28.01 40.06 32.70 35.59 42.53 44.75	AV Factor [dB] -20.86 -20.86 -17.08 -17.08 -17.08 -14.45 -14.45 -10.53	Limit [dBµV/m] 74.00 54.00 74.00 54.00 54.00 54.00 74.00 74.00	Margin [dB] 38.32 25.99 33.94 21.30 18.41 31.47 29.25	Trace PK AV PK AV AV PK PK	Vertio Vertio Vertio Vertio Vertio Vertio	rity cal cal cal cal cal cal cal
	NO. 1 2 3 4 5 6 7 8	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 3660.00 4575.00 4575.00 	Reading [dBµV/m] 56.54 48.87 57.14 49.78 50.04 56.98 55.28 47.89	Level [dBµV/m] 35.68 28.01 40.06 32.70 35.59 42.53 44.75 37.36	AV Factor [dB] -20.86 -20.86 -17.08 -17.08 -17.08 -14.45 -14.45 -10.53 -10.53	Limit [dBµV/m] 74.00 54.00 74.00 54.00 54.00 74.00 74.00 74.00 54.00	Margin [dB] 38.32 25.99 33.94 21.30 18.41 31.47 29.25 16.64	Trace PK AV PK AV AV PK PK AV	Vertio Vertio Vertio Vertio Vertio Vertio Vertio	rity cal cal cal cal cal cal cal cal
	10 0 1G NO. 1 2 3 4 5 6 7 8 9	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 3660.00 4575.00 4575.00 5490.00 	Reading [dBµV/m] 56.54 48.87 57.14 49.78 50.04 56.98 55.28 47.89 56.70	Level [dBµV/m] 35.68 28.01 40.06 32.70 35.59 42.53 44.75 37.36 50.54	AV Factor [dB] -20.86 -20.86 -17.08 -17.08 -17.08 -14.45 -14.45 -10.53 -10.53 -10.53 -6.16	Limit [dBµV/m] 74.00 54.00 74.00 54.00 54.00 74.00 74.00 54.00 74.00 74.00	Margin [dB] 38.32 25.99 33.94 21.30 18.41 31.47 29.25 16.64 23.46	Trace PK AV PK AV AV PK AV PK AV	Verti Verti Verti Verti Verti Verti Verti Verti	rity cal cal cal cal cal cal cal cal cal
	NO. 1 2 3 4 5 6 7 8	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 3660.00 4575.00 4575.00 	Reading [dBµV/m] 56.54 48.87 57.14 49.78 50.04 56.98 55.28 47.89	Level [dBµV/m] 35.68 28.01 40.06 32.70 35.59 42.53 44.75 37.36	AV Factor [dB] -20.86 -20.86 -17.08 -17.08 -17.08 -14.45 -14.45 -10.53 -10.53	Limit [dBµV/m] 74.00 54.00 74.00 54.00 54.00 74.00 74.00 74.00 54.00	Margin [dB] 38.32 25.99 33.94 21.30 18.41 31.47 29.25 16.64	Trace PK AV PK AV AV PK PK AV	Vertio Vertio Vertio Vertio Vertio Vertio Vertio	rity cal cal cal cal cal cal cal cal cal cal

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



Product name:		e: Ve	ebra Indoor L ersion / Neb OCK Pi 4 Vers			Product model:		NEBHNT-HHRK4-915				
Test By:		М	Mike				Test mode:		Tx mode			
Test Ch	Test Channel:		ghest channe	1		Polariza	tion:	Horizon	tal			
Test Vo	oltage:	A	C 120/60Hz			Environ	ment:	Temp: 2	24℃ Huni: 5			
Level[dB, V/m]	10 10 10 10 10 10 10 PK Lim				FCC PART 1	5 C			FCC PART 15 C-PK Limit			
	10	PK Limit AV Detector	— AV Limit — He	2G orizontal PK — Hori	Frequency[3G iz]	46	5G	76			
	10 0 1G		– AV Limit – He				4G Margin					
	10	AV Detector		orizontal PK — Hon.	zontal AV	łz]		5G Trace	Polarity			
	10 0 1G	AV Detector Freq.	Reading	orizontal PK — Hori Level	zontal AV Factor	Limit	Margin					
	10 0 1G	AV Detector Freq. [MHz]	Reading [<u>dBµV</u> /m]	Level	Factor [dB]	Limit	Margin [dB]	Trace	Polarity			
	10 0 16 NO.	 AV Detector Freq. [MHz] 1830.00 	Reading [dBµV/m] 57.33	Level [dBµV/m] 36.47	Factor [dB] -20.86	Limit [dBµV/m] 74.00	Margin [dB] 37.53	Trace	Polarity Horizontal			
	10 0 16 NO. 1 2	 AV Detector Freq. [MHz] 1830.00 1830.00 	Reading [dBµV/m] 57.33 49.10	Level [dBµV/m] 36.47 28.24	Factor [dB] -20.86 -20.86	Limit [dBµV/m] 74.00 54.00 54.00 74.00	Margin [dB] 37.53 25.76 22.00 33.54	Trace PK AV	Polarity Horizontal Horizontal			
	10 0 16 NO. 1 2 3 4 5	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 	Reading [dBµV/m] 57.33 49.10 49.08	Level [dBµV/m] 36.47 28.24 32.00	Factor [dB] -20.86 -20.86 -17.08	Limit [dBµ\//m] 74.00 54.00 54.00	Margin [dB] 37.53 25.76 22.00 33.54 19.26	Trace PK AV AV	Polarity Horizontal Horizontal Horizontal			
	NO.	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 	Reading [dBµV/m] 57.33 49.10 49.08 57.54	Level [dBµV/m] 36.47 28.24 32.00 40.46	Factor [dB] -20.86 -20.86 -17.08 -17.08	Limit [dBµV/m] 74.00 54.00 54.00 74.00	Margin [dB] 37.53 25.76 22.00 33.54	Trace PK AV AV PK	Polarity Horizontal Horizontal Horizontal Horizontal			
	NO. 1 2 3 4 5 6 7	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 	Reading [dBµV/m] 57.33 49.10 49.08 57.54 49.19	Level [dBµV/m] 36.47 28.24 32.00 40.46 34.74	Factor [dB] -20.86 -20.86 -17.08 -17.08 -14.45	Limit [dBµV/m] 74.00 54.00 54.00 74.00 54.00 74.00 54.00 54.00	Margin [dB] 37.53 25.76 22.00 33.54 19.26	Trace PK AV AV PK AV PK AV	Polarity Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal			
	10 0 1G NO. 1 2 3 4 5 6	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 3660.00 	Reading [dBµV/m] 57.33 49.10 49.08 57.54 49.19 56.59	Level [dBµV/m] 36.47 28.24 32.00 40.46 34.74 42.14	Factor [dB] -20.86 -17.08 -17.08 -14.45 -14.45	Limit [dBµV/m] 74.00 54.00 54.00 74.00 54.00 74.00 74.00	Margin [dB] 37.53 25.76 22.00 33.54 19.26 31.86	Trace PK AV AV PK AV PK	Polarity Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal			
	NO. 1 2 3 4 5 6 7	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 3660.00 4575.00 5490.00 	Reading [dBµV/m] 57.33 49.10 49.08 57.54 49.19 56.59 47.62	Level [dBµV/m] 36.47 28.24 32.00 40.46 34.74 42.14 37.09	Factor [dB] -20.86 -20.86 -17.08 -17.08 -17.08 -14.45 -14.45 -10.53	Limit [dBµV/m] 74.00 54.00 54.00 74.00 54.00 74.00 54.00 54.00	Margin [dB] 37.53 25.76 22.00 33.54 19.26 31.86 16.91	Trace PK AV AV PK AV PK AV	Polarity Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal			
	NO. 1 3 4 5 6 7 8	 AV Detector Freq. [MHz] 1830.00 2745.00 2745.00 3660.00 3660.00 4575.00 4575.00 	Reading [dBµV/m] 57.33 49.10 49.08 57.54 49.19 56.59 47.62 55.44	Level [dBµV/m] 36.47 28.24 32.00 40.46 34.74 42.14 37.09 44.91	Factor [dB] -20.86 -20.86 -17.08 -17.08 -17.08 -14.45 -14.45 -14.45 -10.53 -10.53	Limit [dBµV/m] 74.00 54.00 54.00 74.00 54.00 74.00 54.00 74.00 54.00 74.00	Margin [dB] 37.53 25.76 22.00 33.54 19.26 31.86 16.91 29.09	Trace PK AV AV PK AV PK AV PK	Polarity Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal			
	NO. 1 2 3 4 5 6 7 8 9	 AV Detector Freq. [MHz] 1830.00 1830.00 2745.00 2745.00 3660.00 3660.00 4575.00 5490.00 	Reading [dBµV/m] 57.33 49.10 49.08 57.54 49.19 56.59 47.62 55.44 55.94	Level [dBµV/m] 36.47 28.24 32.00 40.46 34.74 42.14 37.09 44.91 49.78	Factor [dB] -20.86 -20.86 -17.08 -17.08 -14.45 -14.45 -10.53 -10.53 -6.16	Limit [dBµV/m] 74.00 54.00 54.00 74.00 54.00 74.00 54.00 74.00 74.00 74.00	Margin [dB] 37.53 25.76 22.00 33.54 19.26 31.86 16.91 29.09 24.22	Trace PK AV PK AV PK AV PK AV PK	Polarity Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal Horizontal			



6.4 Spurious Emission

6.4.1 Radiated Emission Method

Test Requirement:	FCC Part 15 C	Section 15	5.209	9 and 15.205				
Test Frequency Range:	9kHz to 25GHz							
Test Distance:	3m							
Receiver setup:	Frequency	Detector	r	RBW	VB	W	Remark	
	30MHz-1GHz	Quasi-peak		120KHz	300	KHz	Quasi-peak Value	
		Peak		1MHz	ЗM	3MHz Peak Val		
	Above 1GHz	RMS		1MHz	3M	Hz	Average Value	
Limit:	Frequenc	у	Lin	nit (dBuV/m @	23m)		Remark	
	30MHz-88M	lHz		40.0		C	luasi-peak Value	
	88MHz-216N	ЛНz		43.5		G	asi-peak Value	
	216MHz-960			46.0		G	aasi-peak Value	
	960MHz-1G	iHz		54.0			asi-peak Value	
	Above 1GH	-17		54.0			Average Value	
				74.0			Peak Value table 0.8m(below	
	 1GHz)/1.5m(above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 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. 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. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. If the emission level of the EUT in peak mode was 10 dB 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 10 dB margin would be re-tested one by one using peak, quasipeak or average method as specified and then reported in a data 							
Test setup:		3m			Sea Sea Ante RF Test Receiver			

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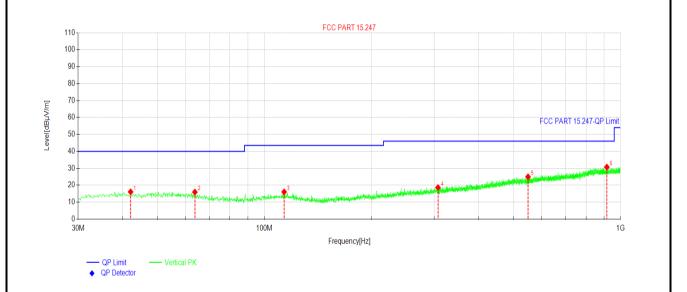
	Horn Antenna Tower Horn Antenna Tower Ground Reference Plane Test Receiver
Test Instruments:	Refer to section 5.9 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed
Remark:	 Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis is the worst case. 9 kHz to 30MHz is too low, so only shows the data of above 30MHz in this report.



Measurement Data (worst case):



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:	Tx 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	42.1250	30.80	16.10	-14.70	40.00	23.90	PK	Vertical
2	63.8288	31.46	15.97	-15.49	40.00	24.03	PK	Vertical
3	113.662	31.62	16.05	-15.57	43.50	27.45	PK	Vertical
4	307.298	31.14	18.63	-12.51	46.00	27.37	PK	Vertical
5	550.041	31.87	24.98	-6.89	46.00	21.02	PK	Vertical
6	915.610	31.93	30.72	-1.21	46.00	15.28	PK	Vertical

Remark:

1. Final Level = Receiver Read level + Factor(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:		Tx mode		
Test Frequency:		cy:	30 MHz ~ 1 GHz AC 120/60Hz				zation:	Horiz	ontal		
Test Volt	est Voltage:						Environment:		o: 24℃ Huni: 57%		
	110				FCC PART 1	5.247					
	100 90										
	80										
Level[dBµV/m]	70 60								CC PART 15.247-QP Limit		
evel[df	50										
_	40								6		
	20		-			4					
	10	mminula	water and the water water water	well also and a particular and and	www.anderson.land.achandarahista	united and a contractivities and set and the second					
	0 30M			100M					I		
_	-	← QP Limit ◆ QP Detector	Horizontal PK		Frequency						
1	NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity		
	1	37.5175	31.51	16.78	-14.73	40.00	23.22	PK	Horizontal		
	2	54.7350	30.89	16.27	-14.62	40.00	23.73	PK	Horizontal		
	3	115.117	30.59	15.10	-15.49	43.50	28.40	PK	Horizontal		
	4	280.017		18.78	-13.26	46.00	27.22	PK	Horizontal		
	5	506.270		25.71	-6.90	46.00	20.29	PK	Horizontal		
	6	979.145	31.72	30.80	-0.92	54.00	23.20	PK	Horizontal		



Above 1GHz:

	Test channel: Lowest channel									
Detector: Peak Value										
Frequency (MHz)	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit	Polarization		
· · ·	(dBuV)	(dB/m)	(dB)	(dB)	· · · · ·	`````	(dB)			
1806.00	59.40	23.10	4.12	41.21	45.41	74.00	-28.59	Vertical		
1806.00	58.37	23.10	4.12	41.21	44.38	74.00	-29.62	Horizontal		
Detector: Average Value										
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
1806.00	54.84	23.10	4.12	41.21	40.85	54	-13.15	Vertical		
1806.00	55.62	23.10	4.12	41.21	41.63	54	-12.37	Horizontal		
			Test ch	nannel: Mido	lle channel					
			De	tector: Peak	k Value					
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
1830.00	(dbdV) 55.80	23.17	4.15	41.27	41.85	74.00	-32.15	Vertical		
1830.00	56.49	23.17	4.15	41.27	42.54	74.00	-31.46	Horizontal		
1030.00	50.49	23.17		ector: Avera	I	74.00	-31.40	Honzonia		
	Read	Antonno	Cable	· · · · · · · · · · · · · · · · · · ·	je value		Over			
Frequency	Level	Antenna Factor	Loss	Preamp Factor	Level	Limit Line	Limit	Polarization		
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	1 olanzation		
1830.00	52.05	23.17	4.15	41.27	38.10	54.00	-15.90	Vertical		
1830.00	53.42	23.17	4.15	41.27	39.47	54.00	-14.53	Horizontal		
			Test ch	annel: High	est channel					
				tector: Peak						
	Read	Antenna	Cable	Preamp			Over			
Frequency	Level	Factor	Loss	Factor	Level	Limit Line	Limit	Polarization		
(MHz)	(dBuV)	(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)			
1854.00	57.91	23.22	4.17	41.32	43.98	74.00	-30.02	Vertical		
1854.00	60.51	23.22	4.17	41.32	46.58	74.00	-27.42	Horizontal		
			Dete	ector: Avera	ge Value					
Frequency	Read	Antenna	Cable	Preamp	Level	Limit Line	Over			
(MHz)	Level	Factor	Loss	Factor	(dBuV/m)	(dBuV/m)	Limit	Polarization		
	(dBuV)	(dB/m)	(dB)	(dB)	````	· · ·	(dB)			
1854.00	55.85	23.22	4.17	41.32	41.92	54.00	-12.08	Vertical		
1854.00	57.83	23.22	4.17	41.32	43.90	54.00	-10.10	Horizontal		
Remark:										
			-			-	-			
 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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