FCC EMC Test Report

Applicant:	Nebra Ltd
Address of Applicant:	Unit 4 Bells Yew Green Business Court, Bells Yew Green, Tunbridge Wells, East Sussex, TN3 9BJ
Equipment Under Test (EUT)	
Product Name:	Nebra HNT 5G Gateway
Model No.:	NEBHNT-5G-915-1, NEBHNT-5G-915-2
FCC ID:	2AZDM-HNT5G
Applicable Standards:	FCC CFR Title 47 Part 15B
Date of Sample Receipt:	07 Feb., 2023
Date of Test:	08 Feb., to 23 Feb., 2023
Date of report Issued:	24 Feb., 2023
Test Result:	PASS

Tested by:	Mike ou ***Test Engineer***	***Date:***	*24 Feb., 2023*
Reviewed by:	Winner Zhang ***Project Engineer***	***Date:***	*24 Feb., 2023*
Approved by:	Hans Zheng ***Manager***	***Date:***	*24 Feb., 2023*

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.

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.

1 Version

Version No.	Date	Description
00	*24 Feb., 2023*	*Original*

2 Contents

Page

Cover Page **1**
1 Version **2**
2 Contents **3**
3 General Information **4**
3.1 Client Information 4
3.2 General Description of E.U.T. 4
3.3 Test Mode 4
3.4 Description of Test Auxiliary Equipment 5
3.5 Description of Cable Used 5
3.6 Measurement Uncertainty 5
3.7 Additions to, Deviations, or Exclusions from the Method 5
3.8 Laboratory Facility 5
3.9 Laboratory Location 5
3.10 Test Instruments List 6
4 Measurement Setup and Procedure **7**
4.1 Test Setup 7
4.2 Test Procedure 9
5 Test Results **10**
5.1 Summary 10
5.1.1 Clause and data summary 10
5.1.2 Test Limit 10
5.2 Conducted Emission 11
5.3 Radiated Emission 13

3 General Information

3.1 Client Information

Applicant:	Nebra Ltd
Address:	Unit 4 Bells Yew Green Business Court, Bells Yew Green, Tunbridge Wells, East Sussex, TN3 9BJ
Manufacturer:	SUNSOAR TECH CO., LIMITED
Address:	4/F, Block E, Fengze Building, Huafeng No.2 Industrial Park, Hangkong Road, XiXiang Town, BaoAn District, Shenzhen, China
Factory:	EvrTech
Address:	No.44, Ying Tai Industry Area, Dalang South RD, Shenzen, China

3.2 General Description of E.U.T.

Product Name:	Nebra HNT 5G Gateway
Model No.:	NEBHNT-5G-915-1, NEBHNT-5G-915-2
AC Adapter:	Model: RC0653-1205000CI Input: AC100-240V, 50/60Hz, 1.5A Output: DC 12.0V, 5.0A 60.0W
Remark:	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 flag 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.

3.3 Test Mode

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

3.4 Description of Test Auxiliary Equipment

Manufacturer	Description	Model	S/N	FCC ID/DoC
Lenovo	Laptop	ThinkPad T14 Gen 1	SL10Z47277	DoC
Router	Honor	X1	/	DoC

3.5 Description of Cable Used

Cable Type	Description	Length	From	To
Parvicostellae	Shielding	3.0m	/	/

3.6 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%(U = 2Uc(y)))
Conducted Emission for LISN (9kHz ~ 10MHz)	1.9 dB
Conducted Emission for LISN (10MHz ~ 30MHz)	2.6 dB
Radiated Emission (30MHz ~ 1GHz) (3m SAC)	3.8 dB
Radiated Emission (1GHz ~ 18GHz) (3m SAC)	3.6 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.*

3.7 Additions to, Deviations, or Exclusions from the Method

No

3.8 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L15527**

JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

3.9 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

3.10 Test Instruments List

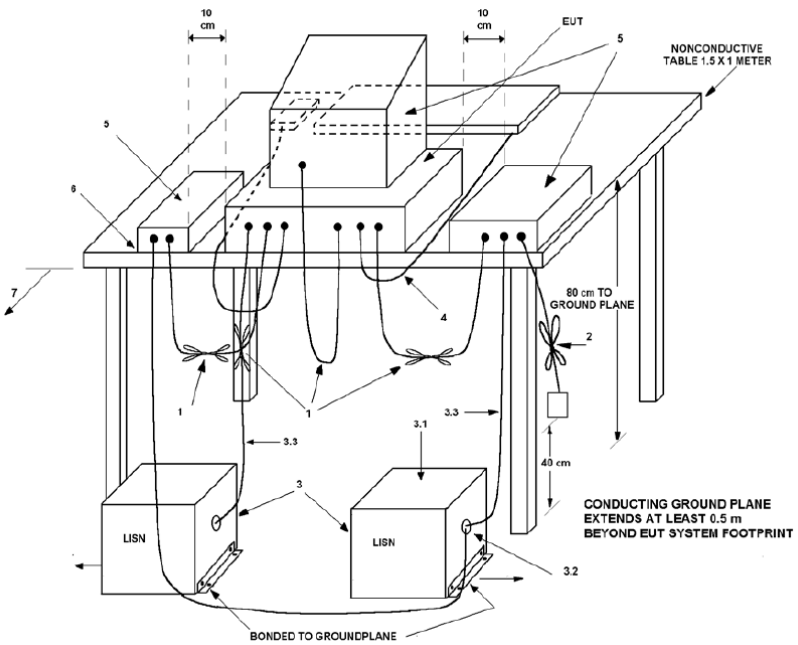
Radiated Emission(3m SAC):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	03-08-2022	03-07-2023
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	03-08-2022	03-07-2023
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	01-10-2023	01-09-2024
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXJ001-3	01-10-2023	01-09-2024
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	03-05-2022	03-04-2023
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	01-10-2023	01-09-2024
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	01-10-2023	01-09-2024
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	01-10-2023	01-09-2024
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
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	ESR3	WXJ003-2	07-12-2022	07-11-2023
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	02-24-2022 02-24-2023	02-23-2023 02-23-2024
LISN	Rohde & Schwarz	ESH3-Z5	WXJ005-1	03-30-2022	03-29-2023
LISN Coaxial Cable (9kHz ~ 30MHz)	JYTSZ	JYTCE-1G-NN-2M	WXG003-1	02-24-2022 02-24-2023	02-23-2023 02-23-2024
RF Switch	TOP PRECISION	RSU0301	WXG003	N/A	
Test Software	AUDIX	E3	Version: 6.110919b		

4 Measurement Setup and Procedure

4.1 Test Setup

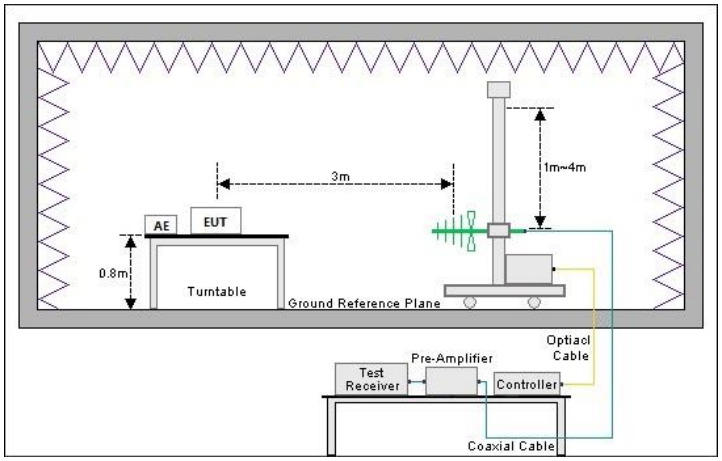
1) Conducted emission measurement:



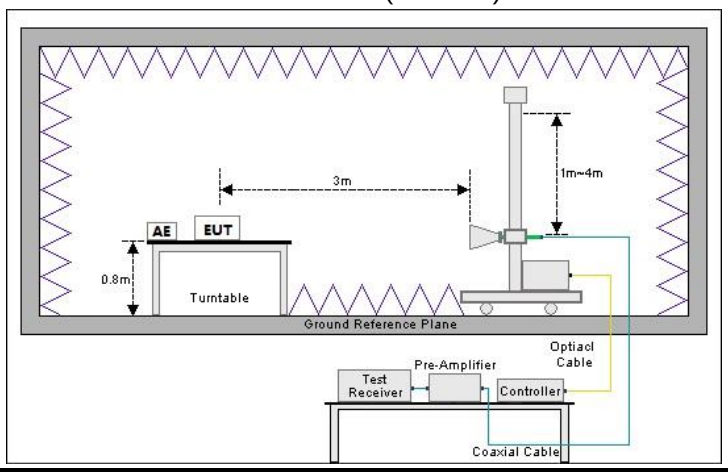
Note: The detailed descriptions please refer to Figure 8 of ANSI C63.4:2014.

2) Radiated emission measurement:

Below 1GHz (3m SAC)



Above 1GHz (3m SAC)



4.2 Test Procedure

Test method	Test step
Conducted emission	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 C63.4 on conducted measurement.
Radiated emission	**For below 1GHz:** 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. **For above 1GHz:** 1. The EUT was placed on the tabletop of a rotating table 0.8 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.

5 Test Results

5.1 Summary

5.1.1 Clause and data summary

Test items	Standard clause	Test data	Result
Conducted Emission	Part 15.107	See Section 5.2	Pass
Radiated Emission	Part 15.109	See Section 5.3	Pass

Remark:

1. *The EUT is a **Class B** digital device.*
2. *Pass: The EUT complies with the essential requirements in the standard.*
3. *N/A: Not Applicable.*

Test Method:	*ANSI C63.4:2014*

5.1.2 Test Limit

Test items	Limit
Conducted Emission	
Radiated Emission	

Frequency (MHz)	Class A Limit (dBμV)		Class B Limit (dBμV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15 – 0.5	79	66	66 to 56 Note 1	56 to 46 Note 1
0.5 – 5	73	60	56	46
5 – 30	73	60	60	50

Note 1: The limit level in dBμV decreases linearly with the logarithm of frequency.
Note 2: The more stringent limit applies at transition frequencies.

Frequency (MHz)	Class A Limit (dBμV/m)		Class B Limit (dBμV/m)	
	Quasi-Peak @ 3m	Quasi-Peak @ 10m	Quasi-Peak @ 3m	Quasi-Peak @ 10m
30 – 88	49.0	39.0	40.0	30.0
88 – 216	53.5	43.5	43.5	33.5
216 – 960	56.0	46.0	46.0	36.0
960 – 1000	60.0	50.0	54.0	44.0

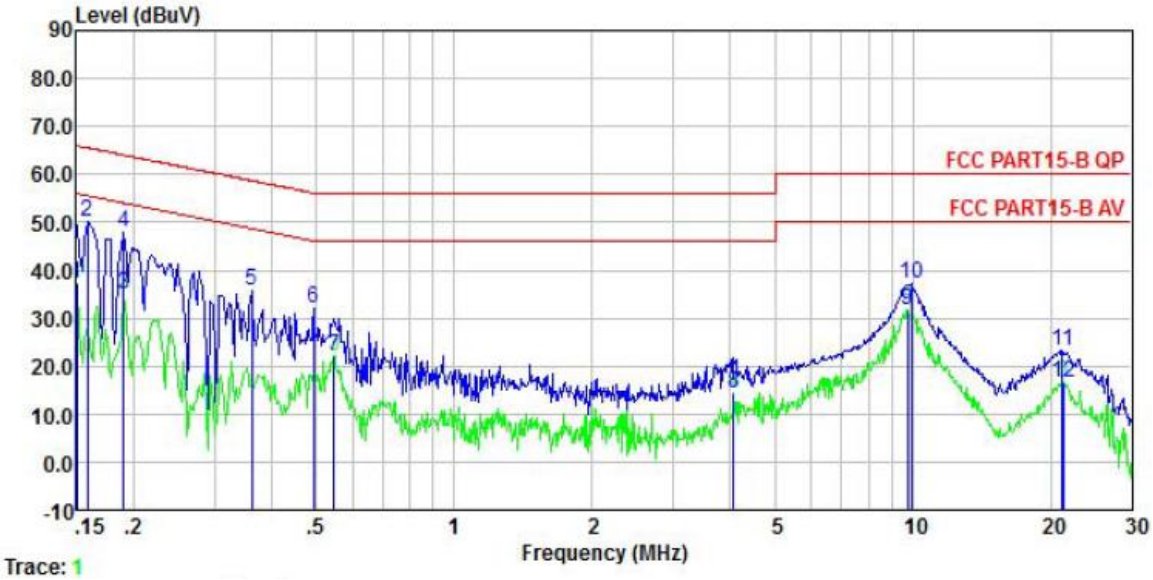
Note: The more stringent limit applies at transition frequencies.

Frequency	Class A Limit (dBμV/m) @ 3m		Class B Limit (dBμV/m) @ 3m	
	Average	Peake	Average	Peake
Above 1 GHz	60.0	80.0	54.0	74.0

Note: The measurement bandwidth shall be 1 MHz or greater.

5.2 Conducted Emission

Product name:	Nebra HNT 5G Gateway	**Product model:**	NEBHNT-5G-915-1
Test by:	Mike	**Test mode:**	Working mode
Test frequency:	150 kHz ~ 30 MHz	**Phase:**	Line
Test voltage:	AC 120 V/60 Hz		

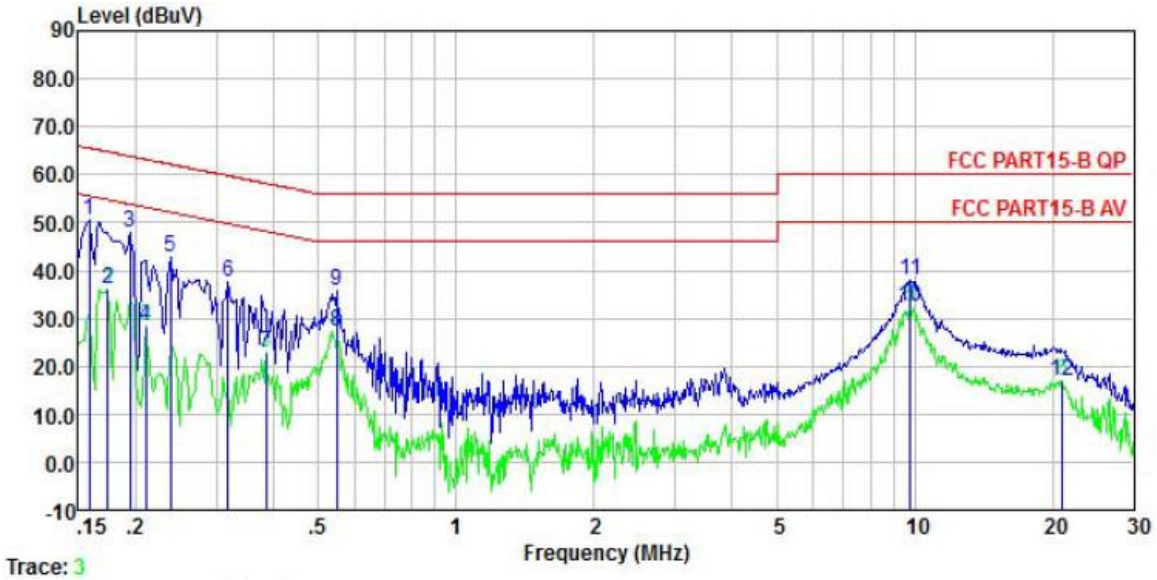


	Freq	Read Level	LISN Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.150	26.51	0.04	10.50	0.01	37.06	56.00	-18.94	Average
2	0.158	39.66	0.04	10.50	0.01	50.21	65.56	-15.35	QP
3	0.190	24.50	0.05	10.50	0.03	35.08	54.02	-18.94	Average
4	0.190	37.40	0.05	10.50	0.03	47.98	64.02	-16.04	QP
5	0.361	25.26	0.06	10.50	0.02	35.84	58.69	-22.85	QP
6	0.494	21.37	0.05	10.50	0.03	31.95	56.10	-24.15	QP
7	0.546	11.64	0.06	10.50	0.03	22.23	46.00	-23.77	Average
8	4.070	3.84	0.11	10.50	0.08	14.53	46.00	-31.47	Average
9	9.757	20.77	0.22	10.50	0.13	31.62	50.00	-18.38	Average
10	9.913	26.47	0.22	10.50	0.13	37.32	60.00	-22.68	QP
11	21.147	12.04	0.35	10.50	0.17	23.06	60.00	-36.94	QP
12	21.260	5.40	0.35	10.50	0.17	16.42	50.00	-33.58	Average

Remark:

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

Product name:	Nebra HNT 5G Gateway	**Product model:**	NEBHNT-5G-915-1
Test by:	Mike	**Test mode:**	Working mode
Test frequency:	150 kHz ~ 30 MHz	**Phase:**	Neutral
Test voltage:	AC 120 V/60 Hz		



	Freq	Read Level	LISN Factor	Aux2 Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.158	39.98	0.06	10.50	0.01	50.55	65.56	-15.01	QP
2	0.174	25.72	0.05	10.50	0.01	36.28	54.77	-18.49	Average
3	0.194	37.19	0.05	10.50	0.03	47.77	63.84	-16.07	QP
4	0.211	17.72	0.05	10.50	0.03	28.30	53.18	-24.88	Average
5	0.238	32.19	0.05	10.50	0.02	42.76	62.17	-19.41	QP
6	0.318	27.04	0.05	10.50	0.03	37.62	59.75	-22.13	QP
7	0.385	12.23	0.05	10.50	0.03	22.81	48.17	-25.36	Average
8	0.549	16.60	0.05	10.50	0.02	27.17	46.00	-18.83	Average
9	0.549	25.24	0.05	10.50	0.02	35.81	56.00	-20.19	QP
10	9.809	21.62	0.21	10.50	0.13	32.46	50.00	-17.54	Average
11	9.809	27.13	0.21	10.50	0.13	37.97	60.00	-22.03	QP
12	21.035	5.89	0.35	10.50	0.17	16.91	50.00	-33.09	Average

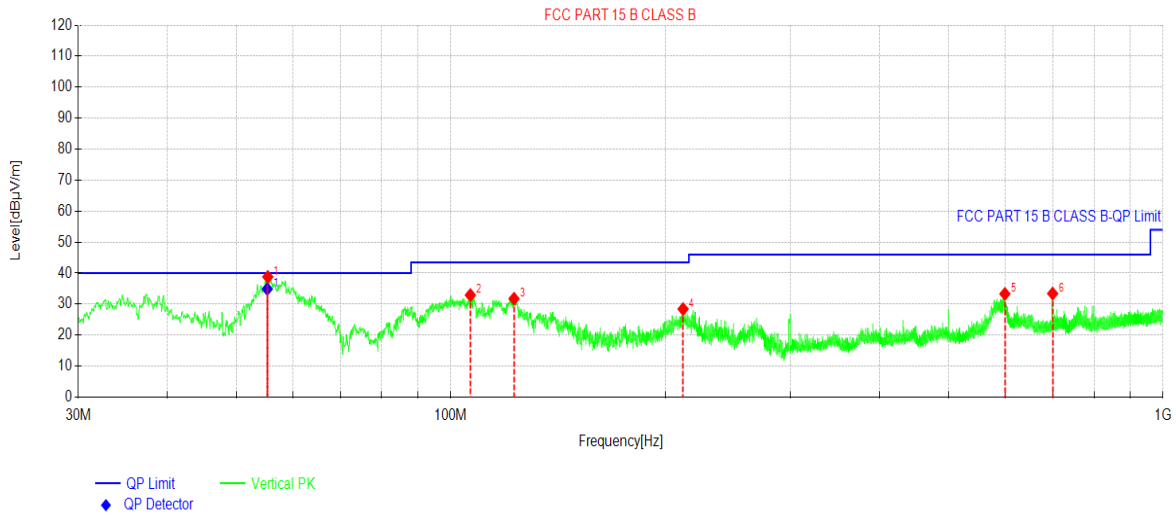
Remark:

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

5.3 Radiated Emission

Below 1GHz:

Product Name:	Nebra HNT 5G Gateway	**Product Model:**	NEBHNT-5G-915-1
Test By:	Mike	**Test mode:**	Working mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical
Test Voltage:	AC 120V/60Hz		



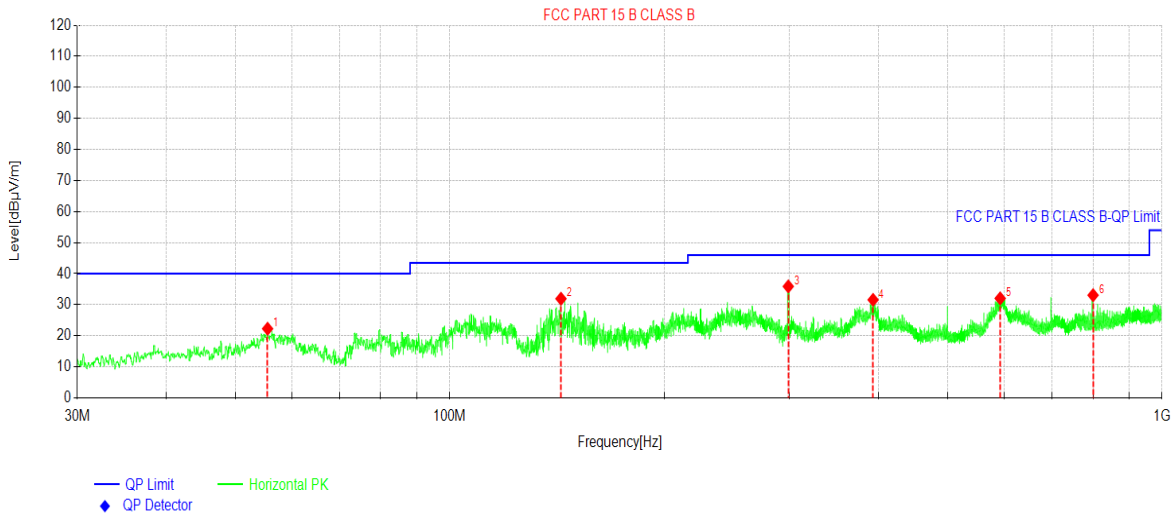
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	55.3655	52.08	38.80	-13.28	40.00	1.20	PK	Vertical
2	106.581	47.52	32.91	-14.61	43.50	10.59	PK	Vertical
3	122.732	48.81	31.74	-17.07	43.50	11.76	PK	Vertical
4	211.972	43.32	28.41	-14.91	43.50	15.09	PK	Vertical
5	599.875	39.95	33.31	-6.64	46.00	12.69	PK	Vertical
6	700.027	39.07	33.41	-5.66	46.00	12.59	PK	Vertical

Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	QP Reading [dBµV/m]	Angle [°]	Verdict
1	55.2758	-13.29	34.88	40.00	5.12	48.17	261.8	PASS

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Nebra HNT 5G Gateway	**Product Model:**	NEBHNT-5G-915-1
Test By:	Mike	**Test mode:**	Working mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Horizontal
Test Voltage:	AC 120V/60Hz		



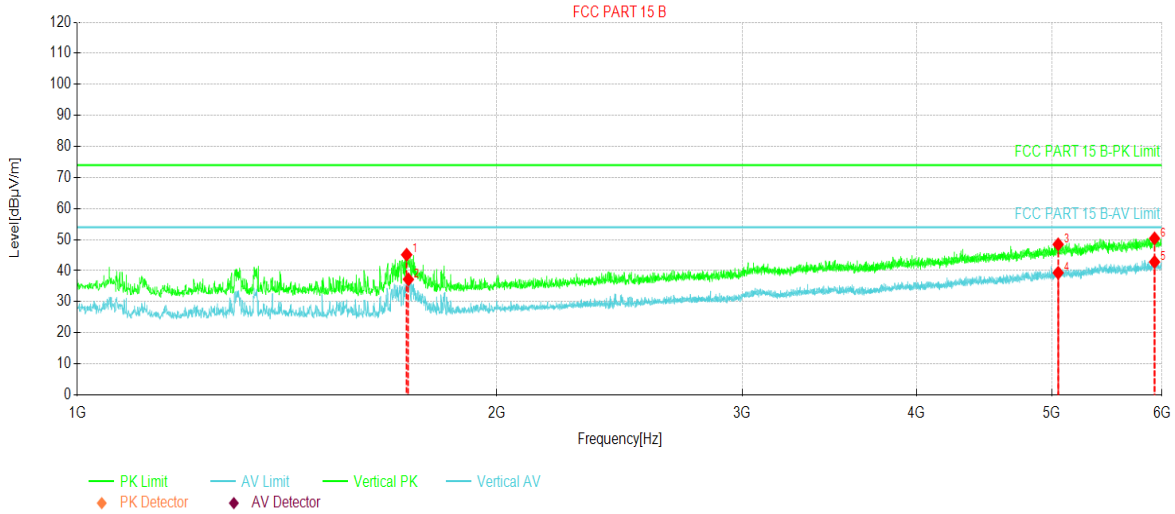
Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	55.5110	35.59	22.27	-13.32	40.00	17.73	PK	Horizontal
2	143.296	50.34	31.93	-18.41	43.50	11.57	PK	Horizontal
3	298.787	48.98	35.89	-13.09	46.00	10.11	PK	Horizontal
4	393.022	42.48	31.58	-10.90	46.00	14.42	PK	Horizontal
5	592.697	38.89	32.05	-6.84	46.00	13.95	PK	Horizontal
6	800.277	37.19	33.06	-4.13	46.00	12.94	PK	Horizontal

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Above 1GHz:

Product Name:	Nebra HNT 5G Gateway	**Product Model:**	NEBHNT-5G-915-1
Test By:	Mike	**Test mode:**	Working mode
Test Frequency:	1000 MHz ~ 6000 MHz	**Polarization:**	Vertical
Test Voltage:	AC 120V/60Hz		

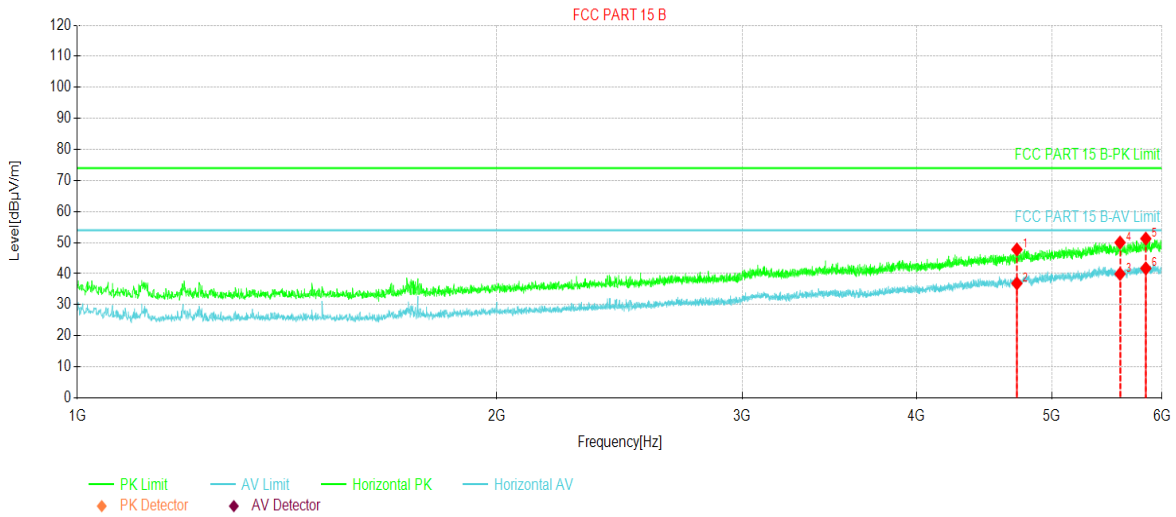


Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	1723.12	67.23	-22.10	45.13	74.00	28.87	PK	Vertical
2	1728.12	59.28	-22.09	37.19	54.00	16.81	AV	Vertical
3	5054.37	56.16	-7.70	48.46	74.00	25.54	PK	Vertical
4	5054.37	47.03	-7.70	39.33	54.00	14.67	AV	Vertical
5	5926.87	47.09	-4.28	42.81	54.00	11.19	AV	Vertical
6	5926.87	54.66	-4.28	50.38	74.00	23.62	PK	Vertical

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

Product Name:	Nebra HNT 5G Gateway	**Product Model:**	NEBHNT-5G-915-1
Test By:	Mike	**Test mode:**	Working mode
Test Frequency:	1000 MHz ~ 6000 MHz	**Polarization:**	Horizontal
Test Voltage:	AC 120V/60Hz		



Suspected Data List								
NO.	Freq. [MHz]	Reading [dBµV/m]	Factor [dB]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	4721.25	56.82	-9.05	47.77	74.00	26.23	PK	Horizontal
2	4721.25	45.93	-9.05	36.88	54.00	17.12	AV	Horizontal
3	5598.12	45.92	-6.01	39.91	54.00	14.09	AV	Horizontal
4	5598.12	56.02	-6.01	50.01	74.00	23.99	PK	Horizontal
5	5841.87	55.86	-4.58	51.28	74.00	22.72	PK	Horizontal
6	5841.87	46.29	-4.58	41.71	54.00	12.29	AV	Horizontal

Remark:

1. Level = Reading + Factor(Antenna Factor + Cable Loss – Preamplifier Factor).

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