FCC EMC Test Report

Applicant:	Netradyne Inc.
Address of Applicant:	9191 Towne Centre Drive, Suite 200, San Diego, CA United States 92122
Equipment Under Test (EUT)	
Product Name:	Lumia 2.0
Model No.:	DCM-NA1-200
FCC ID:	2AM8R-DCM-NA1-200
Applicable standards:	FCC CFR Title 47 Part 15 Subpart B
Date of sample receipt:	21 Jan., 2022
Date of Test:	22 Jan., 2022 to 17 Feb., 2022
Date of report issued:	18 Feb., 2022
Test Result:	PASS *

Tested by:	Mike.ou ***Test Engineer***	***Date:***	*18 Feb., 2022*
Reviewed by:	Winner Zhang ***Project Engineer***	***Date:***	*18 Feb., 2022*
Approved by:	***Manager***	***Date:***	*18 Feb., 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.

2 Version

Version No.	Date	Description
00	*18 Feb., 2022*	*Original*

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4 General Information

4.1 Client Information

Applicant:	Netradyne Inc.
Address:	9191 Towne Centre Drive, Suite 200, San Diego, CA United States 92122
Manufacturer:	Netradyne Inc.
Address:	9191 Towne Centre Drive, Suite 200, San Diego, CA United States 92122

4.2 General Description of E.U.T.

Product Name:	Lumia 2.0
Model No.:	DCM-NA1-200
Power supply:	DC 12V
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

4.3 Test Mode and test samples plans

Operating mode	Detail description
Working mode	Keep the EUT in ON + Working mode(Worst case)
GPS mode	Keep the EUT in GPS receiver 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.	

4.4 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
Liteon technology co.,ltd	Laptop	PA-1061-0	N/A	N/A

4.5 escription of Cable Used

Cable Type	Description	Length	From	To
N/A	N/A	N/A	N/A	N/A

4.6 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
Radiated Emission (30MHz ~ 1GHz) (10m SAC)	±4.32 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.*	

4.7 Additions to, Deviations, or Exclusions from the Method

No

4.8 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

4.9 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://www.ccis-cb.com

4.10 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	01-19-2021	01-18-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	03-03-2021	03-02-2022
Biconical Antenna	Schwarzbeck	VUBA9117	WXJ002-1	06-20-2021	06-19-2022
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	03-03-2021	03-02-2022
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
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXG001-3	03-07-2021	03-06-2022
Pre-amplifier (18GHz ~ 40GHz)	RF System	TRLA-180400G45B	WXG001-9	03-07-2021	03-06-2022
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	03-03-2021	03-02-2022
Spectrum Analyzer	KEYSIGHT	N9010B	WXJ004-2	11-27-2021	11-26-2022
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	03-07-2021	03-06-2022
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	03-07-2021	03-06-2022
Coaxial Cable (18GHz ~ 40GHz)	JYTSZ	JYT3M-40G-SS-8M	WXG001-7	03-07-2021	03-06-2022
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		

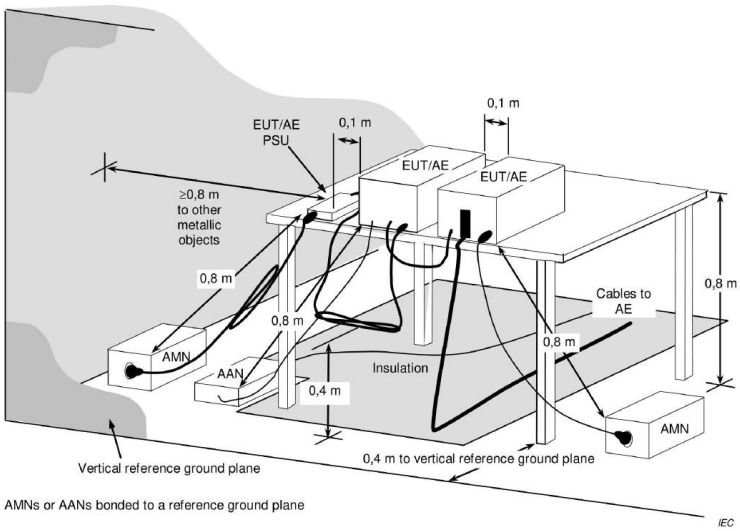
Radiated Emission(10m SAC):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
10m SAC	ETS	RFSD-100-F/A	WXJ090	04-28-2021	04-27-2024
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-1	04-02-2021	04-01-2022
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-2	04-02-2021	04-01-2022
EMI Test Receiver	R&S	ESR 3	WXJ090-3	04-08-2021	04-07-2022
EMI Test Receiver	R&S	ESR 3	WXJ090-4	04-08-2021	04-07-2022
Low Pre-amplifier	Bost	LNA 0920N	WXG002-3	04-06-2021	04-05-2022
Low Pre-amplifier	Bost	LNA 0920N	WXG002-4	04-06-2021	04-05-2022
Cable	Bost	JYT10M-1G-NN-10M	XG002-7	04-02-2021	04-01-2022
Cable	Bost	JYT10M-1G-NN-10M	XG002-8	04-02-2021	04-01-2022
Test Software	R&S	EMC32	Version: 10.50.40		

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
RF Switch	TOP PRECISION	RSU0301	WXG003	03-03-2021	03-02-2022
LISN	Rohde & Schwarz	ENV432	WXJ005-2	03-03-2021	03-02-2022
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
Test Software	AUDIX	E3	Version: 6.110919b		

5 Measurement setup and procedure

5.1 Test setup

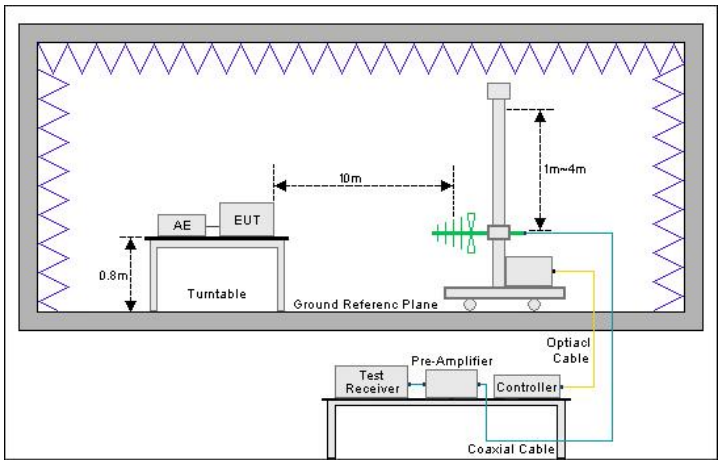
1) Conducted emission measurement:



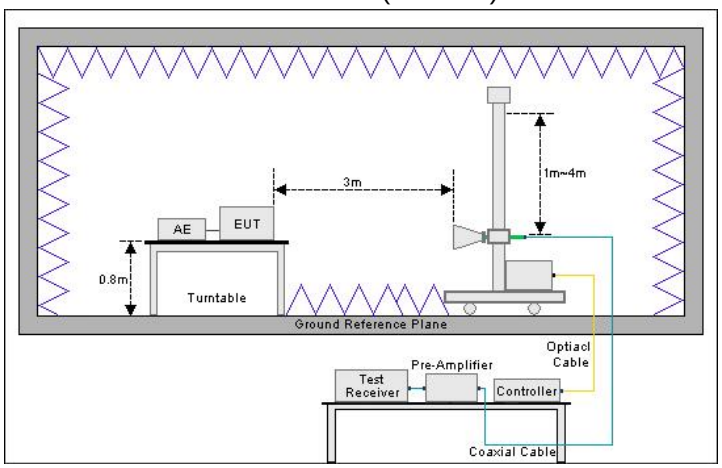
Note: The 0.8 m distance specified between EUT/AE/PSU and AMN/AAN, is applicable only to the EUT being measured. If the device is AE then it shall be >0.8 m.

2) Radiated emission measurement:

Below 1GHz (10m SAC)



Above 1GHz (3m SAC)



5.2 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 or 10 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m or 10 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 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.

6 Test Results

6.1 Summary

6.1.1 Clause and data summary

Test Items	FCC Part Section(s)	Test Data	Result
Conducted Emission	Part 15.107	See Section 6.2	Pass
Radiated Emission	Part 15.109	See Section 6.3	Pass
Remark: *1. Pass: The EUT complies with the essential requirements in the standard.*			
Test Method:	*ANSI C63.4:2014*		

6.1.2 Test Limit

Items: Conducted Emission

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	60	50
* Decreases with the logarithm of the frequency.		

Items: Radiated Emission

Limit:

Below 1GHz (Measurement distance for 3 m):

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value

Below 1GHz (Measurement distance for 10 m):

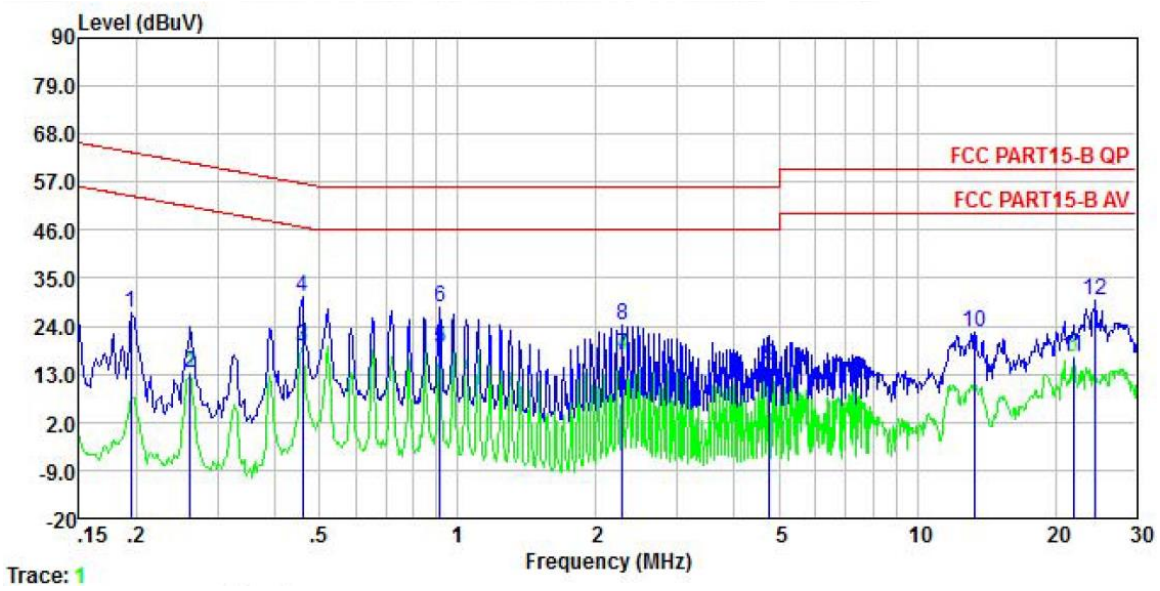
Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	30.0	Quasi-peak Value
88MHz-216MHz	33.5	Quasi-peak Value
216MHz-960MHz	36.0	Quasi-peak Value
960MHz-1GHz	44.0	Quasi-peak Value

Above 1GHz (Measurement distance for 3 m):

Frequency	Limit (dBuV/m @3m)	Remark
Above 1GHz	54.0	Average Value
	74.0	Peak Value

6.2 Conducted Emission

Product name:	Lumia 2.0	**Product model:**	DCM-NA1-200
Test by:	Mike	**Test mode:**	Working mode
Test frequency:	150 kHz ~ 30 MHz	**Phase:**	Line
Test voltage:	DC 12V		

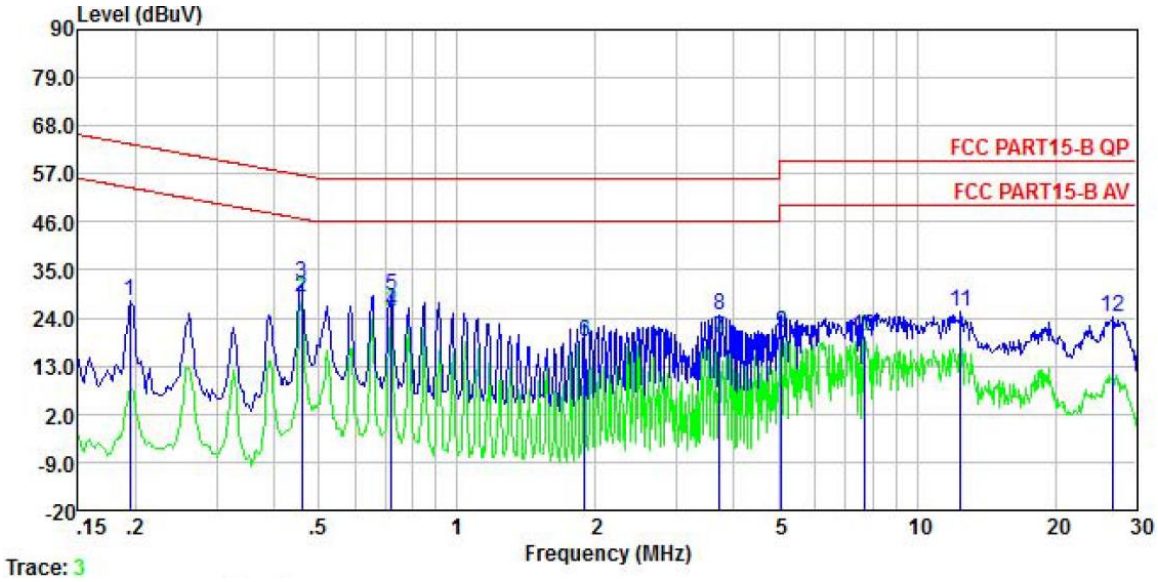


	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.194	27.06	0.04	0.03	27.13	63.84	-36.71	QP
2	0.262	13.10	0.04	0.01	13.15	51.38	-38.23	Average
3	0.459	19.27	0.04	0.03	19.34	46.71	-27.37	Average
4	0.459	30.51	0.04	0.03	30.58	56.71	-26.13	QP
5	0.914	19.06	0.05	0.04	19.15	46.00	-26.85	Average
6	0.914	28.13	0.05	0.04	28.22	56.00	-27.78	QP
7	2.285	17.23	0.08	0.16	17.47	46.00	-28.53	Average
8	2.285	24.12	0.08	0.16	24.36	56.00	-31.64	QP
9	4.772	14.61	0.12	0.09	14.82	46.00	-31.18	Average
10	13.337	22.23	0.25	0.11	22.59	60.00	-37.41	QP
11	21.830	16.54	0.34	0.16	17.04	50.00	-32.96	Average
12	24.400	29.56	0.36	0.18	30.10	60.00	-29.90	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:	Lumia 2.0	Product model:	DCM-NA1-200
Test by:	Mike	Test mode:	Working mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	DC 12V		



	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.194	27.91	0.04	0.03	27.98	63.84	-35.86	QP
2	0.459	28.53	0.04	0.03	28.60	46.71	-18.11	Average
3	0.459	31.79	0.04	0.03	31.86	56.71	-24.85	QP
4	0.720	25.22	0.04	0.03	25.29	46.00	-20.71	Average
5	0.720	29.07	0.04	0.03	29.14	56.00	-26.86	QP
6	1.898	18.21	0.06	0.20	18.47	46.00	-27.53	Average
7	3.720	19.24	0.09	0.08	19.41	46.00	-26.59	Average
8	3.720	24.30	0.09	0.08	24.47	56.00	-31.53	QP
9	5.085	20.51	0.10	0.09	20.70	50.00	-29.30	Average
10	7.687	19.65	0.15	0.10	19.90	50.00	-30.10	Average
11	12.449	25.05	0.22	0.11	25.38	60.00	-34.62	QP
12	26.699	23.58	0.37	0.20	24.15	60.00	-35.85	QP

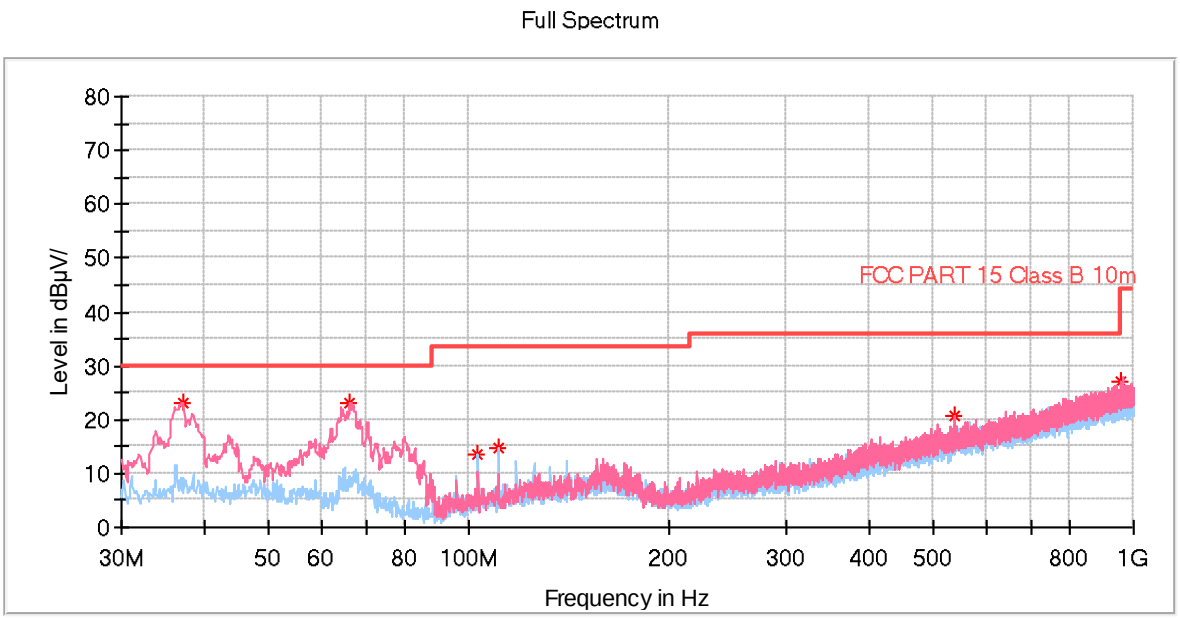
Notes:

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 Radiated Emission

Below 1GHz:

Product name:	Lumia 2.0	**Product model:**	DCM-NA1-200
Test By:	Mike	**Test mode:**	Working mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical & Horizontal
Test Voltage:	DC 12V		



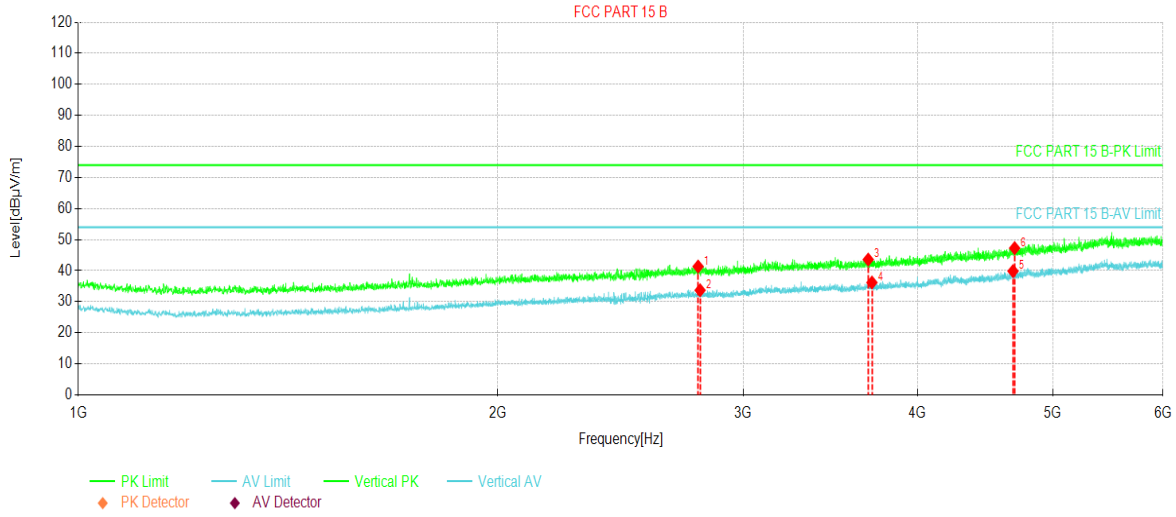
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
110.510000	14.89	33.50	18.61	100.0	H	53.0	-18.0
103.138000	13.41	33.50	20.09	100.0	H	131.0	-18.6
954.992000	26.94	36.00	9.06	100.0	V	0.0	0.0
66.181000	23.16	30.00	6.84	100.0	V	88.0	-17.5
37.081000	23.06	30.00	6.94	100.0	V	92.0	-16.2
536.922000	20.71	36.00	15.29	100.0	V	295.0	-8.0

Remark:

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

Above 1GHz:

Product name:	Lumia 2.0	**Product model:**	DCM-NA1-200
Test By:	Mike	**Test mode:**	Working mode
Test Frequency:	1000 MHz ~ 6000 MHz	**Polarization:**	Vertical
Test Voltage:	DC 12V		

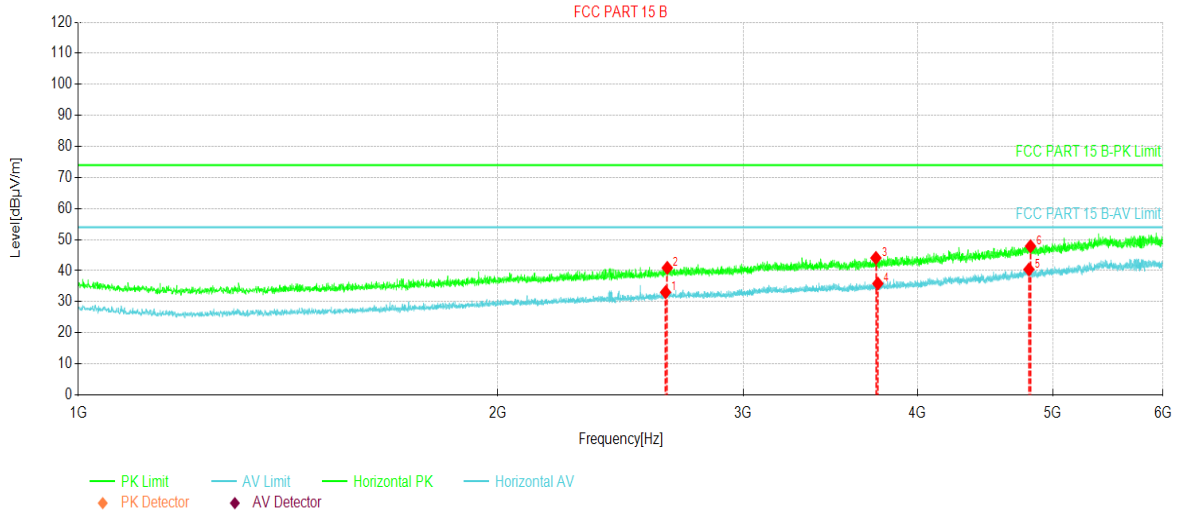


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	2784.17	58.88	41.33	-17.55	74.00	32.67	PK	Vertical
2	2793.17	51.24	33.70	-17.54	54.00	20.30	AV	Vertical
3	3687.26	58.12	43.59	-14.53	74.00	30.41	PK	Vertical
4	3709.77	50.60	36.18	-14.42	54.00	17.82	AV	Vertical
5	4683.36	49.69	39.86	-9.83	54.00	14.14	AV	Vertical
6	4696.36	56.99	47.25	-9.74	74.00	26.75	PK	Vertical

Remark:

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

Product name:	Lumia 2.0	Product model:	DCM-NA1-200
Test By:	Mike	Test mode:	Working mode
Test Frequency:	1000 MHz ~ 6000 MHz	Polarization:	Horizontal
Test Voltage:	DC 12V		



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	2638.16	50.92	33.04	-17.88	54.00	20.96	AV	Horizontal
2	2645.66	58.75	40.90	-17.85	74.00	33.10	PK	Horizontal
3	3734.27	58.37	44.10	-14.27	74.00	29.90	PK	Horizontal
4	3746.27	50.04	35.84	-14.20	54.00	18.16	AV	Horizontal
5	4808.38	49.58	40.39	-9.19	54.00	13.61	AV	Horizontal
6	4820.88	57.00	47.86	-9.14	74.00	26.14	PK	Horizontal

Remark:

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