TEST REPORT

No. I21Z61291-EMC01

for

HMD Global Oy

GSM/WCDMA/LTE phone

Model Name: N139DL

FCC ID: 2AJOTTA-1398

with

Hardware Version: 1.0

Software Version: 00.2131.11.01

Issued Date: 2021-10-21

Note:

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Test Laboratory:

CTTL-Telecommunication Technology Labs, CAICT

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I21Z61291-EMC01	Rev.0	1st edition	2021-10-21

Note: the latest revision of the test report supersedes all previous versions.

CONTENTS

1. Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2017 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (ISED#: 24849). The detail accreditation scope can be found on NVLAP website.

1.2. Testing Location

CTTL (huayuan North Road)

Address: No. 52 Huayuan North Road, Haidian District, Beijing 100191, P.R. China

1.3. Testing Environment

Normal Temperature: 15-35°C

Relative Humidity: 20-75%

1.4. Project data

Testing Start Date: 2021-08-18

Testing End Date: 2021-10-21

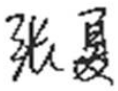
1.5. Signature

Li Yan

(Prepared this test report)

Zhang Ying

(Reviewed this test report)



Zhang Xia

Deputy Director of the laboratory

(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	HMD Global Oy
Address:	Bertel Jungin aukio 9, 02600 Espoo, FINLAND
City:	/
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Country:	/
Contact:	Mikko Kahlos
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2.2. Manufacturer Information

Company Name:	HMD Global Oy
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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	GSM/WCDMA/LTE phone
Model Name	N139DL
FCC ID	2AJOTTA-1398
Extreme vol. Limits	3.6VDC to 4.4VDC (nominal: 3.85VDC)

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of CTTL, Telecommunication Technology Labs, CAICT.

3.2. Internal Identification of EUT used during the test

EUT ID*	IME/SNI	HW Version	SW Version
EUT1	358712910008208	1.0	00.2131.11.01
EUT2	358712910008059	1.0	00.2131.11.01

*EUT ID: is used to identify the test sample in the lab internally.

3.3. Internal Identification of AE used during the test

AE ID*	Description	SN	Remark
AE1	SWITCHING ADAPTER	/	/
AE2	HEADSET	/	/
AE3	BATTERY	/	/
AE4	USB CABLE	/	/

AE1

Model	DSA-5PF18-05 FUS 050100
Manufacturer	DVE
Length of cable	/

AE2

Type	WH-108
Manufacturer	Rongtaifeng
Length of cable	/

AE3

Type	HE402
Manufacturer	SHENZHEN UTILITY ENERGY CO., LTD.

Note1: The USB cables are shielded.
Note2: AE4 is not the AE of EUT, provided by lab for relevant testing.

3.4. General Description

The device contains receivers which tune and operate between 30MHz-960MHz in the following bands: GSM850, WCDMA B5, LTE BAND 5, LTE BAND 12, LTE BAND 13, LTE BAND 17 and LTE BAND 71.

3.5. EUT set-ups

EUT set-up No.	Combination of EUT and AE	Remarks
Set.1	EUT2 + AE1 + AE3 + AE2	ADAPTER + Camera+ RX mode
Set.2	EUT1 + AE1 + AE3 + AE2	ADAPTER + MP4+ RX mode
Set.3	EUT2 + AE2 + AE3 + AE4	USB mode +FM

4. Reference Documents

4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

Reference	Title	Version
FCC Part 15, Subpart B	Radio frequency devices - Unintentional Radiators	2019
ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2014

Note: The test methods have no deviation with standards.

5. LABORATORY ENVIRONMENT

Semi-anechoic chamber SAC-1 (23 meters×17 meters×10 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 15 %, Max. = 75 %
Shielding effectiveness	0.014MHz - 1MHz, >60dB; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω
Normalised site attenuation (NSA)	**<** ± 4 dB, 3m/10m distance, from 30 to 1000 MHz
Site voltage standing-wave ratio (S_{VSWR})	Between 0 and 6 dB, from 1GHz to 18GHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

Shielded room did not exceed following limits along the EMC testing:

Temperature	Min. = 15 ˚C, Max. = 35 ˚C
Relative humidity	Min. = 20 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz, >60dB; 1MHz－1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4 Ω

6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:		
Verdict Column	P	Pass
	NA	Not applicable
	F	Fail
	BR	Re-use test data from basic model report.

Items	Test Name	Clause in FCC rules	Section in this report	Verdict	Test Location
1	Radiated Emission	15.109(a)	A.1	P	**CTTL(huayuan North Road)**
2	Conducted Emission	15.107(a)	A.2	P	**CTTL(huayuan North Road)**

7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE	CALIBRATION INTERVAL
1	Test Receiver	ESCI	100344	R&S	2022-12-07	1 year
2	LISN	ENV216	101200	R&S	2022-05-30	1 year
3	Universal Radio Communication Tester	CMW500	116588	R&S	2021-12-07	1 year
4	Test Receiver	ESU26	100235	R&S	2022-02-23	1 year
5	EMI Antenna	VULB9163	01223	Schwarzbeck	2022-03-22	1 year
6	EMI Antenna	3115	6914	ETS-Lindgren	2022-02-03	1 year
7	PC	OPTIPLEX 380	2X1YV2X	DELL	N/A	N/A
8	Printer	P1606dn	VNC3L52122	HP	N/A	N/A
9	Keyboard	L100	CN0RH659658907ATOI40	DELL	N/A	N/A
10	Mouse	M-UAE119	LZ935220ZRC	Lenovo	N/A	N/A

ANNEX A: MEASUREMENT RESULTS

A.1 Radiated Emission

Reference

FCC: CFR Part 15.109(a).

A.1.1 Method of measurement

The field strength of radiated emissions from the unintentional radiator (USB mode of MS and charging mode of MS) at distances of 10 meters(for 30MHz-1GHz) and 3 meters (for above 1GHz) is tested. Tested in accordance with the procedures of ANSI C63.4 – 2014, section 8.3.

The EUT was placed on a non-conductive table. The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

A.1.2 EUT Operating Mode

The MS is operating in the USB mode, charging mode, MP4, CAMERA, FM and License RX band mode.

The EUT was tested while operating in licensed band RX mode. All licensed band receivers that tune in the range of 30MHz-960MHz, as listed in the Section 3.4, are investigated. Only the worst case emissions are reported.

The FM radio mode radiated testing was performed with the Low/Mid/High channel. Only the worst cases are reported.

All equipment is placed on the test table top and arranged in a typical configuration in accordance with ANSI C63.4-2014 and manipulated to obtain worst case emissions.

Note：I/O information：Printer – USB, Mouse – PS/2, Keyboard – USB.

A.1.3 Measurement Limit

Frequency range (MHz)	Field strength limit (μV/m)		
	Quasi-peak	Average	Peak
30-88	100		
88-216	150		
216-960	200		
960-1000	500		
>1000		500	5000

Note: the above limit is for 3 meters test distance. 10 meters' limit is got by converting.

A.1.4 Test Condition

Frequency range (MHz)	RBW/VBW	Sweep Time (s)	Detector
30-1000	120kHz (IF Bandwidth)	5	Peak/Quasi-peak
Above 1000	1MHz/3MHz	15	Peak, Average

A.1.5 Measurement Results

A "reference path loss" is established and the A_{Rpl} is the attenuation of “reference path loss”. It includes the antenna factor of receive antenna and the path loss.

The measurement results are obtained as described below:

Result = $P_{Mea} + A_{Rpl} = P_{Mea} + G_A + G_{PL}$

Where

G_A: Antenna factor of receive antenna

G_{PL}: Path Loss

P_{Mea}: Measurement result on receiver.

Measurement uncertainty (worst case): 30MHz-1GHz：5.16dB, 1GHz-18GHz：5.44dB, *k*=2.

Measurement results for Set.1:

ADAPTER+ Camera+ RX GSM850 /Average detector

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)
17929.733	46.9	-29.4	46.7	29.639	54.0	7.1	V
17946.733	46.8	-28.9	46.7	29.083	54.0	7.2	V
17985.833	46.7	-29.1	46.7	29.098	54.0	7.3	V
17986.967	46.7	-29.1	46.7	29.098	54.0	7.3	H
17949.567	46.7	-28.9	46.7	28.983	54.0	7.3	V
17990.933	46.5	-29.1	46.7	28.898	54.0	7.5	V

ADAPTER + Camera+ RX GSM850 /Peak detector

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)
17960.900	55.5	-29.1	46.7	37.901	74.0	18.5	V
17979.033	55.2	-29.1	46.7	37.601	74.0	18.8	V
17991.500	55.2	-29.1	46.7	37.598	74.0	18.8	V
17949.567	55.2	-28.9	46.7	37.483	74.0	18.8	H
17981.300	55.0	-29.1	46.7	37.398	74.0	19.0	V
18000.000	55.0	-29.2	47.0	37.243	74.0	19.0	H

Measurement results for Set.2:

ADAPTER + MP4+ RX LTE Band12 /Average detector

Frequency (MHz)	Measurement Result (dBµV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Limit (dBµV/m)	Margin (dB)	Antenna Pol. (H/V)
17986.400	47.4	-29.1	46.7	29.798	54.0	6.6	H
17941.067	46.9	-28.9	46.7	29.183	54.0	7.1	V
17955.800	46.8	-28.9	46.7	29.083	54.0	7.2	H
17969.400	46.6	-29.1	46.7	29.001	54.0	7.4	H
17998.867	46.4	-29.1	46.7	28.798	54.0	7.6	H
17955.233	46.4	-28.9	46.7	28.683	54.0	7.6	V

ADAPTER + MP4+ RX LTE Band12 /Peak detector

Frequency (MHz)	Measurement Result (dBµV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBµV)	Limit (dBµV/m)	Margin (dB)	Antenna Pol. (H/V)
17983.6	55.3	-29.1	46.7	37.698	74.0	18.7	H
17966.0	55.0	-29.1	46.7	37.401	74.0	19.0	V
17982.4	54.9	-29.1	46.7	37.298	74.0	19.1	V
17972.2	54.9	-29.1	46.7	37.301	74.0	19.1	H
17990.4	54.9	-29.1	46.7	37.298	74.0	19.1	H
17980.7	54.7	-29.1	46.7	37.098	74.0	19.3	H

Measurement results for Set.3:

USB mode +FM /Average detector

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)
17966.567	43.1	-29.1	46.7	25.501	54.0	10.9	V
17954.667	42.5	-28.9	46.7	24.783	54.0	11.5	H
17906.500	42.3	-29.3	46.0	25.672	54.0	11.7	H
17946.733	42.3	-28.9	46.7	24.583	54.0	11.7	V
17937.667	42.2	-29.4	46.7	24.939	54.0	11.8	V
17998.867	42.2	-29.1	46.7	24.598	54.0	11.8	V

USB mode + FM /Peak detector

Frequency (MHz)	Measurement Result (dBμV/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dBμV)	Limit (dBμV/m)	Margin (dB)	Antenna Pol. (H/V)
17963.733	50.4	-29.1	46.7	32.801	74.0	23.6	V
17916.700	50.2	-29.3	46.7	32.865	74.0	23.8	V
17969.967	50.1	-29.1	46.7	32.501	74.0	23.9	V
17896.300	50.1	-29.5	46.0	33.680	74.0	23.9	V
17848.700	50.1	-29.3	46.0	33.482	74.0	23.9	H
17988.667	50.1	-29.1	46.7	32.498	74.0	23.9	V

ADAPTER + Camera+ RX GSM850, Set.1

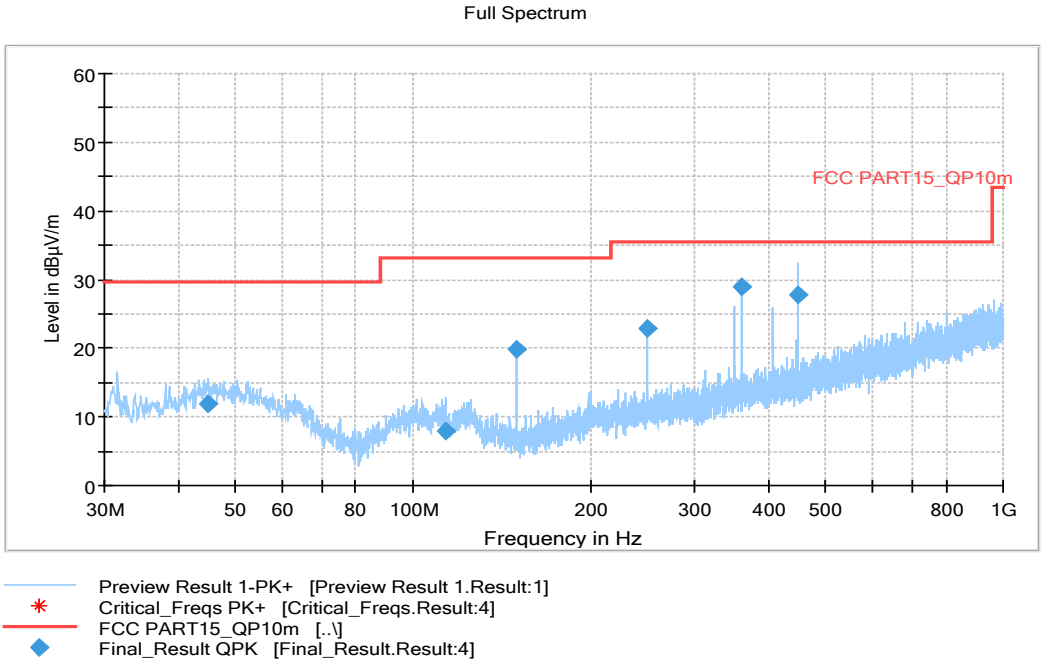

Figure A.1 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
45.035000	11.83	29.54	17.71	1000.0	120.000	310.0	V	90.0
113.61400	8.00	33.06	25.06	1000.0	120.000	100.0	V	0.0
149.98900	19.81	33.06	13.25	1000.0	120.000	205.0	V	90.0
249.99600	22.95	35.56	12.61	1000.0	120.000	100.0	V	0.0
359.99400	28.87	35.56	6.69	1000.0	120.000	100.0	V	90.0
450.01000	27.75	35.56	7.81	1000.0	120.000	310.0	V	0.0

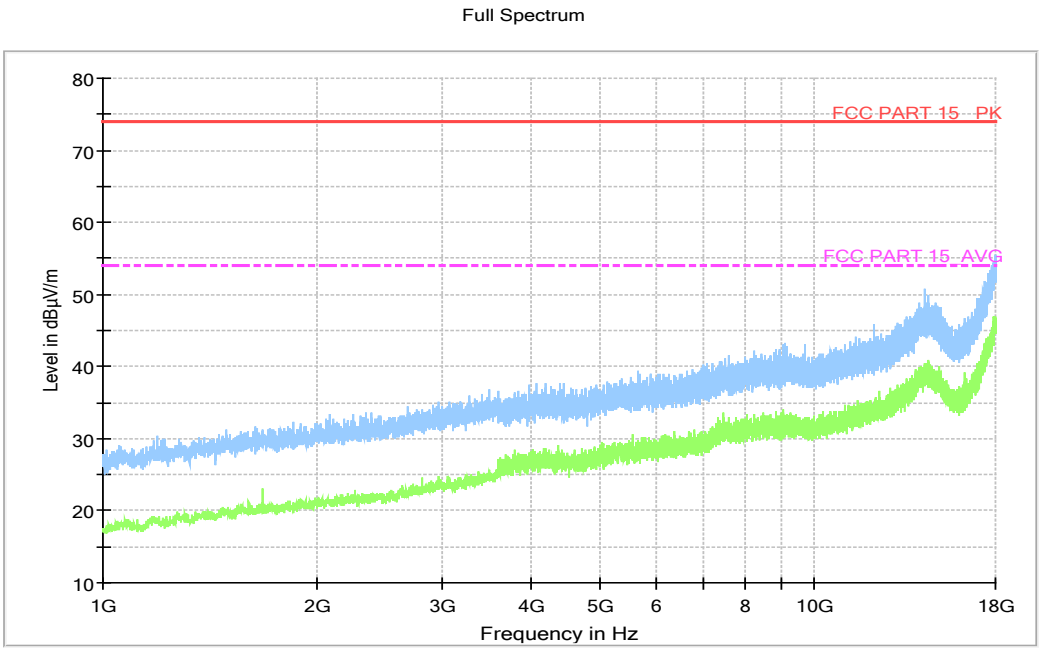

Figure A.2 Radiated Emission from 1GHz to 18GHz

ADAPTER +MP4+ RX LTE Band12, Set.2

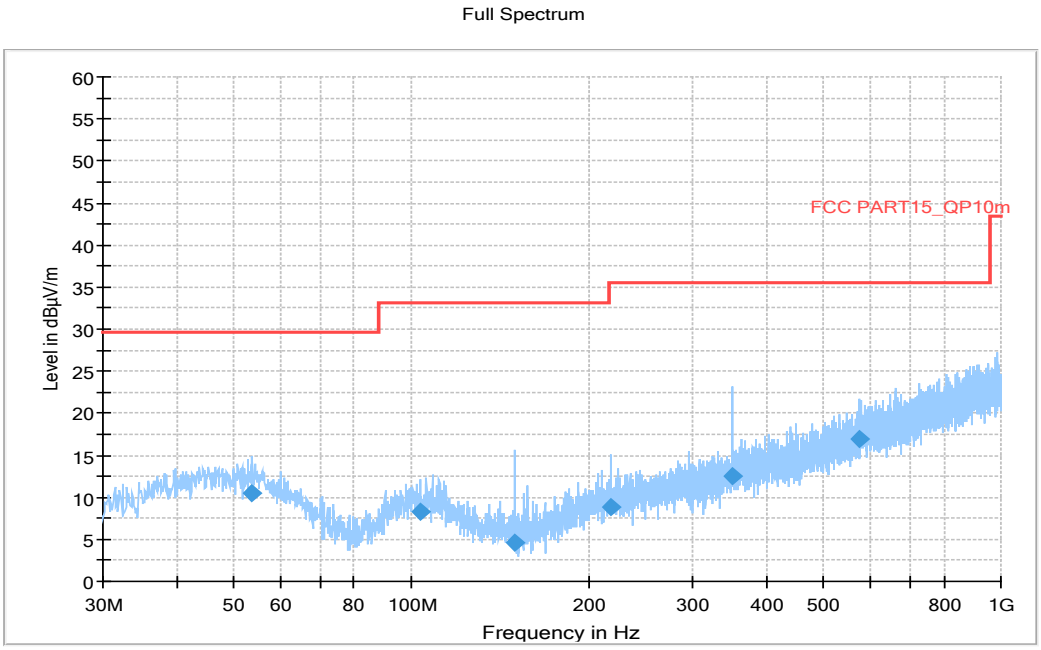

Figure A.3 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
53.765000	10.52	29.50	19.02	1000.0	120.000	120.0	V	179.0
103.72000	8.29	33.10	24.77	1000.0	120.000	235.0	V	170.0
149.98900	4.51	33.10	28.55	1000.0	120.000	118.0	V	84.0
218.47100	8.80	35.60	26.76	1000.0	120.000	125.0	V	108.0
350.00300	12.48	35.60	23.08	1000.0	120.000	125.0	V	241.0
577.17700	16.95	35.60	18.61	1000.0	120.000	125.0	V	265.0

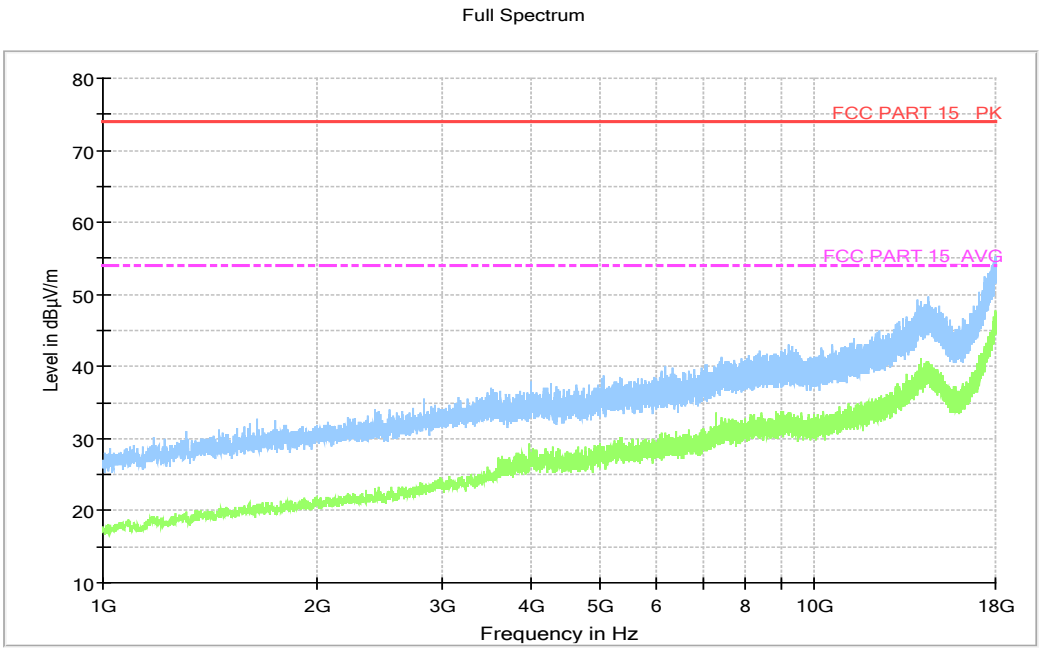

Figure A.4 Radiated Emission from 1GHz to 18GHz

USB mode +FM, Set.3

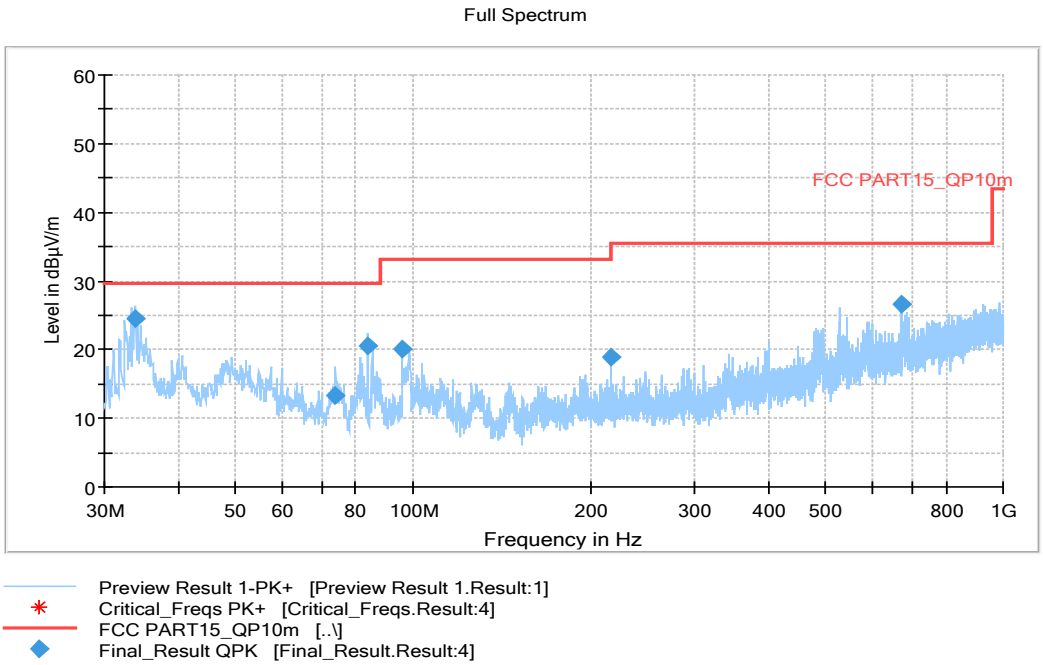

Figure A.5 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
33.880000	24.59	29.54	4.95	1000.0	120.000	310.0	V	180.0
73.941000	13.40	29.54	16.14	1000.0	120.000	205.0	V	180.0
83.932000	20.46	29.54	9.08	1000.0	120.000	100.0	V	180.0
95.863000	20.18	33.06	12.88	1000.0	120.000	100.0	V	180.0
216.04600	18.98	35.56	16.58	1000.0	120.000	310.0	V	180.0
673.59500	26.57	35.56	8.99	1000.0	120.000	205.0	V	270.0

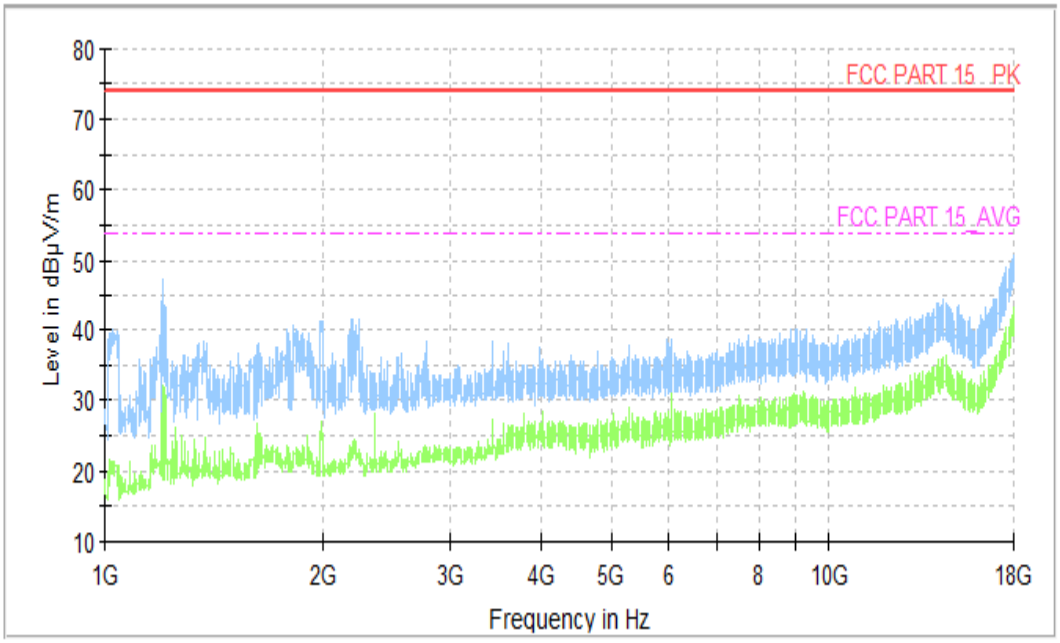

Figure A.6 Radiated Emission from 1GHz to 18GHz

A.2 Conducted Emission

Reference

FCC: CFR Part 15.107(a).

A.2.1 Method of measurement

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits. Tested in accordance with the procedures of ANSI C63.4 – 2014, section 7.3.

A.2.2 EUT Operating Mode

The MS is operating in the USB mode, charging mode.

The software is used to let the PC keep on copying data to MS, reading and erasing the data after copy action was finished.

Note：I/O information：Printer – USB, Mouse – PS/2, Keyboard – USB.

A.2.3 Measurement Limit

Frequency of emission (MHz)	Conducted limit (dBμV)	
	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		

A.2.4 Test Condition in charging mode

Voltage（V）	Frequency（Hz）
120	60

RBW/IF bandwidth	Sweep Time(s)
9kHz	1

A.2.5 Measurement Results

Measurement uncertainty: *U*= 3.08 dB, *k*=2.

Charging mode, Set.1

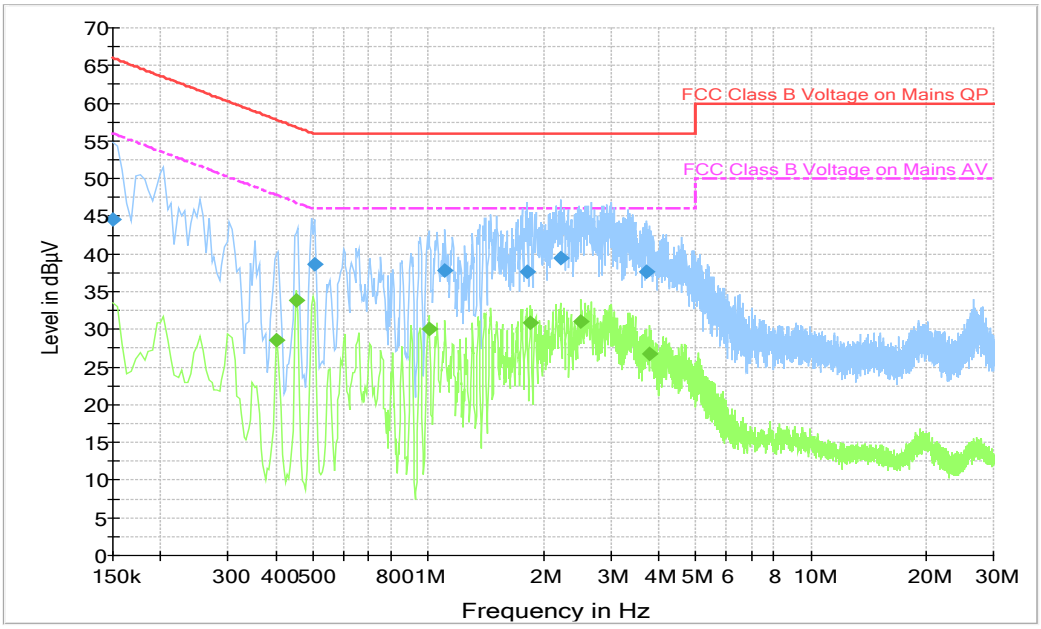

Figure A.7 Conducted Emission

Note: The graphic result above is the maximum of the measurements for both phase line and neutral line

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	44.5	1000.0	9.000	On	N	20.0	21.5	66.0
0.505500	38.6	1000.0	9.000	On	L1	19.9	17.4	56.0
1.108500	37.8	1000.0	9.000	On	L1	19.5	18.2	56.0
1.810500	37.6	1000.0	9.000	On	L1	19.5	18.4	56.0
2.211000	39.5	1000.0	9.000	On	L1	19.5	16.5	56.0
3.718500	37.6	1000.0	9.000	On	L1	19.5	18.4	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.402000	28.5	1000.0	9.000	On	L1	19.9	19.3	47.8
0.451500	33.9	1000.0	9.000	On	L1	19.9	13.0	46.8
1.005000	30.1	1000.0	9.000	On	L1	19.6	15.9	46.0
1.855500	30.9	1000.0	9.000	On	L1	19.5	15.1	46.0
2.512500	31.1	1000.0	9.000	On	L1	19.5	14.9	46.0
3.777000	26.7	1000.0	9.000	On	L1	19.5	19.3	46.0

USB mode, Set.3

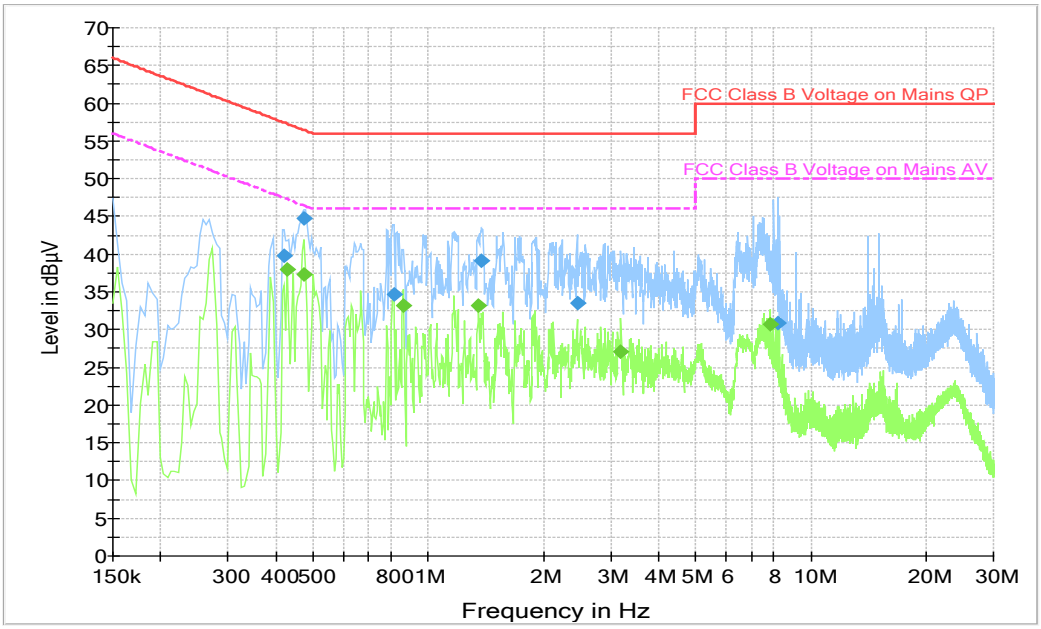

Figure A.8 Conducted Emission

Note: The graphic result above is the maximum of the measurements for both phase line and neutral line

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.420000	39.7	1000.0	9.000	On	L1	19.9	17.7	57.4
0.474000	44.7	1000.0	9.000	On	N	20.0	11.8	56.4
0.811500	34.6	1000.0	9.000	On	L1	19.6	21.4	56.0
1.383000	39.1	1000.0	9.000	On	N	19.8	16.9	56.0
2.449500	33.5	1000.0	9.000	On	N	19.7	22.5	56.0
8.223000	30.9	1000.0	9.000	On	L1	19.5	29.1	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.429000	37.9	1000.0	9.000	On	N	19.9	9.4	47.3
0.474000	37.2	1000.0	9.000	On	N	20.0	9.2	46.4
0.861000	33.2	1000.0	9.000	On	N	19.8	12.8	46.0
1.356000	33.2	1000.0	9.000	On	N	19.8	12.8	46.0
3.192000	27.1	1000.0	9.000	On	N	19.7	18.9	46.0
7.813500	30.7	1000.0	9.000	On	N	19.8	19.3	50.0

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ANNEX B: Persons involved in this testing

Test Item	Tester
Radiated Emission	ZHANG Tianli
Conducted Emission	LI Pengfei

*****END OF REPORT*****