FCC PART 15B
TEST REPORT

No. I22Z60036-EMC01

for

HMD Global Oy

Smart Phone

Model name: N150DL

FCC ID: 2AJOTTA-1500

with

Hardware Version: V1.0

Software Version: 02US_0_131

Issued Date: 2022-03-07

Note:

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of CTTL.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S.Government.

Test Laboratory:

CTTL-Telecommunication Technology Labs, CAICT

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

Tel:+86(0)10-62304633-2512, Fax:+86(0)10-62304633-2504

Email: cttl_terminals@caict.ac.cn, website: www.caict.ac.cn

REPORT HISTORY

Report Number	Revision	Description	Issue Date
I22Z60036-EMC01	Rev.0	1st edition	2022-03-07

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

CONTENTS

1. Test Laboratory

1.1. Testing Location

CTTL (huayuan North Road)

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

1.2. Testing Environment

Normal Temperature: 15-35°C

Relative Humidity: 20-75%

1.3. Project data

Testing Start Date: 2022-02-13

Testing End Date: 2022-02-23

1.4. Signature

Wang Xue

(Prepared this test report)

Zhang Ying

(Reviewed this test report)

Zhang Xia

(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name:	HMD Global Oy
Address:	Bertel Jungin aukio 9, 02600 Espoo, Finland
Contact Person	Reza Serafat
Contact Email	reza.serafat@hmdglobal.com
Telephone:	+491735287964
Fax:	+491735287964

2.2. Manufacturer Information

Company Name:	HMD Global Oy
Address:	Bertel Jungin aukio 9, 02600 Espoo, Finland
Contact Person	Reza Serafat
Contact Email	reza.serafat@hmdglobal.com
Telephone:	+491735287964
Fax:	+491735287964

3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	Smart Phone
Model Name	N150DL
FCC ID:	2AJOTTA-1500

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*	SN or IMEI	HW Version	SW Version
EUT1	351116900014084	V1.0	02US_0_131

*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	Remarks
AE1	Battery	/	/
AE2	USB Cable	/	/
AE3	Charger	/	/
AE4	Headset	/	/

AE1

Model	TN-BP5000N1
Manufacturer	Guangdong Fenghua new energy co.,ltd.
Capacity	5000mAh
Nominal Voltage	3.85V

AE2

Model	TN-TC2A1MFB
Manufacturer	Saibao(Jiangxi) Communication Industrial Co., Ltd
Length of cable	/

AE3

Model	1-CHUSQ302-097
Manufacturer	HUIZHOU PUAN ELECTRONICS CO LTD
Length of cable	/

AE4

Model	/
Manufacturer	/
Length of cable	/

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

3.4. EUT set-ups

EUT set-up No.	Combination of EUT and AE	Remarks
Set.1	EUT1 + AE1 + AE2 + AE3	Charger1 + REAR Camera + GSM 850 idle

Set.2	EUT1 + AE1 + AE2 + AE4	Charger1 + MP4 + WCDMA 850 idle
Set.3	EUT1 + AE1 + AE2 + AE5	USB + front camera +LTE B5 idle + FM

Note:
Equipment Under Test (EUT) is a model of Smart Phone with integrated antenna.
It supports

GSM Frequency Band	GSM 900/GSM 1800/GSM 1900/GSM 850
UMTS Frequency Band	FDD Band II(W1900) /FDD Band IV(W1700)/FDD Band V(W850)
LTE Frequency Band	LTE FDD Bands 2/4/5/7/12/13/17/66/71, LTE FDD Band 41.

It has MP3, Camera, USB memory, FM, Bluetooth 5.0, Wi-Fi (802.11b/g/n/a/ac, 802.11n supports 20MHz and 40MHz bandwidth,802.11ac supports 20MHz, 40MHz and 80MHz bandwidth) ,GPS functions

The device contains receivers which tune and operate between 30MHz-960MHz in the following bands: GSM850, WCDMA850, LTE Band 5/12/13/17/71. All licensed band receivers that tune in the range of 30MHz-960MHz are investigated. Only the worst-case emissions are reported.

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 (10 meters×6.7meters×6.1meters) 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 M
Ground system resistance	< 4
Normalised site attenuation (NSA)	< ±4 dB, 3m distance
Site voltage standing-wave ratio (S_{VSWR})	Between 0 and 6 dB, from 1GHz to 6GHz
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 M
Ground system resistance	< 4

6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:		
Verdict Column	P	Pass
	NA	Not applicable
	F	Fail

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

7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE	CALIBRATION INTERVAL
1	Test Receiver	ESW44	103023	R&S	2022-10-28	1 Year
2	Test Receiver	ESW44	103015	R&S	2022-09-03	1 Year
3	LISN	ENV216	101200	R&S	2022-05-30	1 year
4	Universal Radio Communication Tester	CMW500	116588	R&S	2022-12-20	1 year
5	Test Receiver	ESCI 7	100766	R&S	2022-04-09	1 Year
6	EMI Antenna	VULB 9163	01223	Schwarzbeck	2022-03-22	1 year
7	EMI Antenna	3115	00167250	ETS-Lindgren	2022-07-01	1 year
8	Signal Generator	SMBV100A	260613	R&S	2023-01-09	1 year

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 3 meters 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 3/10 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 and charging mode. During the test MS is connected to a PC via a USB cable in the case of USB mode and is connected to a charger in the case of charging 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 section 3.4, are investigated. Only the worst case emissions 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.

The model of the PC is M4000E-17, and the serial number of the PC is M706GWXD. 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.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): U = 4.74 dB, k=2.

Measurement results for Set.1:

Charing Mode/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)
17967.020	44.10	-29.06	46.66	26.50	54.00	9.90	V
17996.940	44.10	-29.06	46.66	26.50	54.00	9.90	H
17988.780	44.00	-29.06	46.66	26.40	54.00	10.00	H
17946.280	43.90	-28.94	46.66	26.18	54.00	10.10	H
17945.260	43.90	-28.94	46.66	26.18	54.00	10.10	V
17944.240	43.90	-28.94	46.66	26.18	54.00	10.10	H

Charging Mode/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)
17793.280	55.80	-29.89	45.95	39.73	74.00	18.20	H
17859.240	55.60	-29.34	45.95	38.98	74.00	18.40	V
17640.620	55.40	-29.60	45.25	39.75	74.00	18.60	H
17939.480	55.40	-29.40	46.66	38.14	74.00	18.60	H
17990.820	55.20	-29.06	46.66	37.60	74.00	18.80	H
17951.720	55.10	-28.94	46.66	37.38	74.00	18.90	H

Measurement results for Set.2:

Charing Mode/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)
17955.460	44.20	-28.94	46.66	26.48	54.00	9.80	H
17940.840	44.10	-28.94	46.66	26.38	54.00	9.90	H
17959.880	44.00	-28.94	46.66	26.28	54.00	10.00	V
17949.340	44.00	-28.94	46.66	26.28	54.00	10.00	V
17981.980	44.00	-29.06	46.66	26.40	54.00	10.00	V
17916.700	43.90	-29.33	46.66	26.57	54.00	10.10	H

Charging Mode/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)
17969.400	55.80	-29.06	46.66	38.20	74.00	18.20	V
17968.720	55.80	-29.06	46.66	38.20	74.00	18.20	H
17985.720	55.50	-29.06	46.66	37.90	74.00	18.50	V
17980.280	55.50	-29.06	46.66	37.90	74.00	18.50	V
17981.300	55.40	-29.06	46.66	37.80	74.00	18.60	H
17969.740	55.40	-29.06	46.66	37.80	74.00	18.60	H

Measurement results for Set.3:

USB Mode/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)
17947.300	44.40	-28.94	46.66	26.68	54.00	9.60	V
17976.200	44.30	-29.06	46.66	26.70	54.00	9.70	V
17947.640	44.20	-28.94	46.66	26.48	54.00	9.80	H
17961.920	44.20	-29.06	46.66	26.60	54.00	9.80	V
17960.900	44.20	-29.06	46.66	26.60	54.00	9.80	V
17995.240	44.10	-29.06	46.66	26.50	54.00	9.90	V

USB Mode/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)
17954.440	56.30	-28.94	46.66	38.58	74.00	17.70	V
17997.960	56.00	-29.06	46.66	38.40	74.00	18.00	V
17656.940	55.80	-29.60	45.25	40.15	74.00	18.20	H
17890.520	55.60	-29.53	45.95	39.18	74.00	18.40	V
17961.580	55.60	-29.06	46.66	38.00	74.00	18.40	V
17959.200	55.50	-28.94	46.66	37.78	74.00	18.50	H

Measurement results for Set.1:

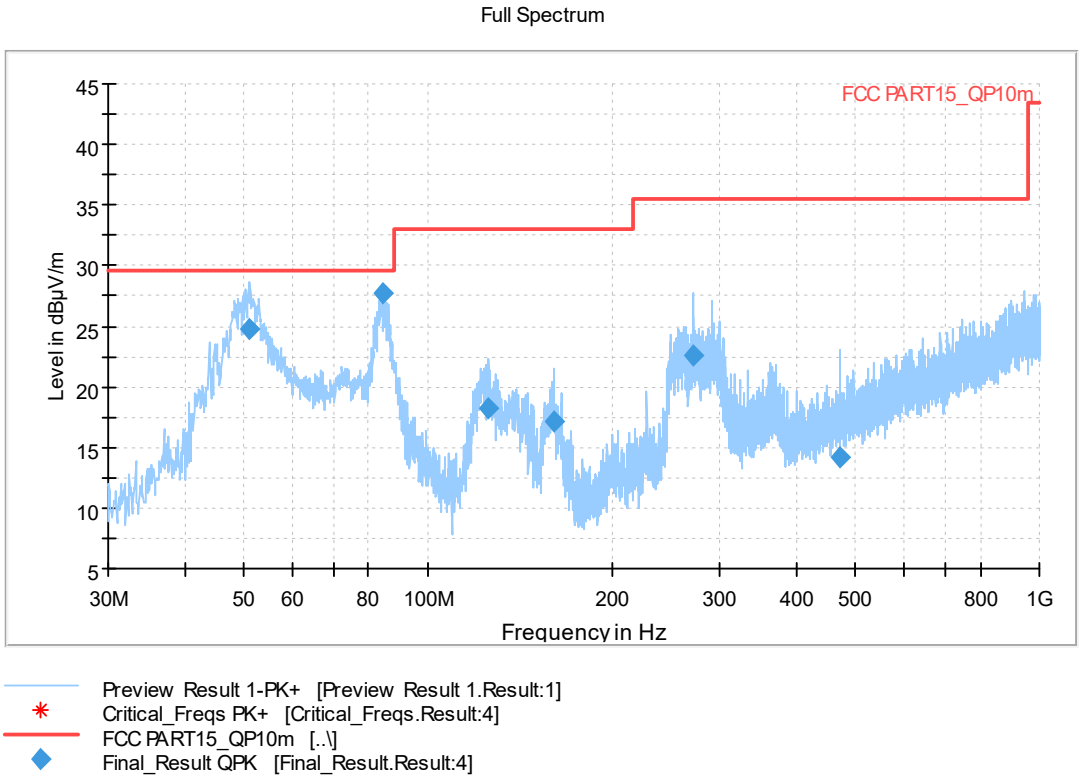

Fig A.1 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
51.146000	24.71	29.54	4.83	2000.0	120.000	95.0	V	300.0
84.126000	27.76	29.54	1.78	2000.0	120.000	125.0	V	261.0
125.836000	18.29	33.06	14.77	2000.0	120.000	95.0	V	-3.0
161.144000	17.11	33.06	15.95	2000.0	120.000	103.0	V	-10.0
271.821000	22.65	35.56	12.91	2000.0	120.000	102.0	V	61.0
471.544000	14.26	35.56	21.30	2000.0	120.000	325.0	V	100.0

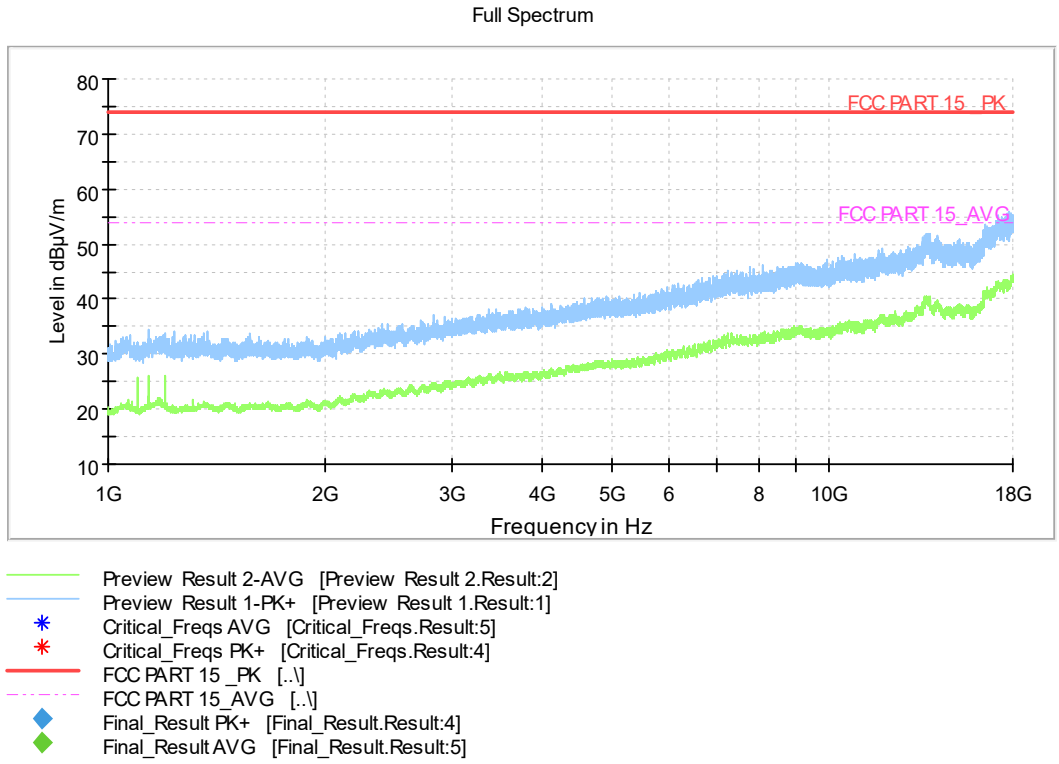

Fig A.2 Radiated Emission from 1GHz to 18GHz

Measurement results for Set.2:

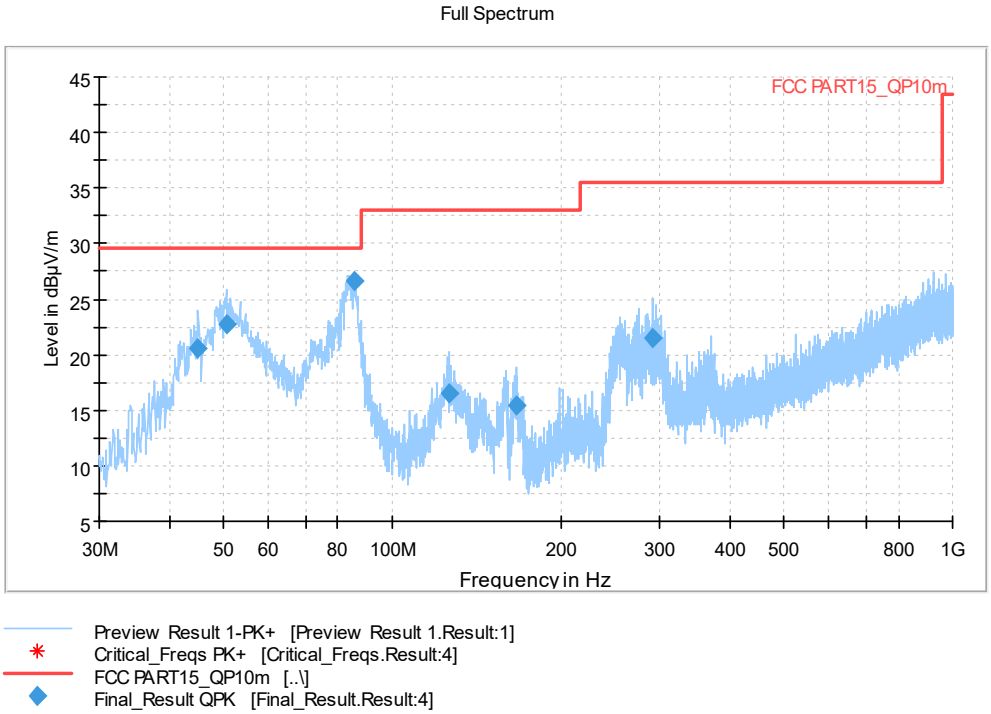

Fig A.3 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
45.035000	20.49	29.54	9.05	2000.0	120.000	95.0	V	60.0
50.564000	22.67	29.54	6.87	2000.0	120.000	103.0	V	190.0
85.581000	26.56	29.54	2.98	2000.0	120.000	175.0	V	280.0
126.515000	16.47	33.06	16.59	2000.0	120.000	103.0	V	-28.0
166.188000	15.47	33.06	17.59	2000.0	120.000	95.0	V	-8.0
290.736000	21.50	35.56	14.06	2000.0	120.000	325.0	H	81.0

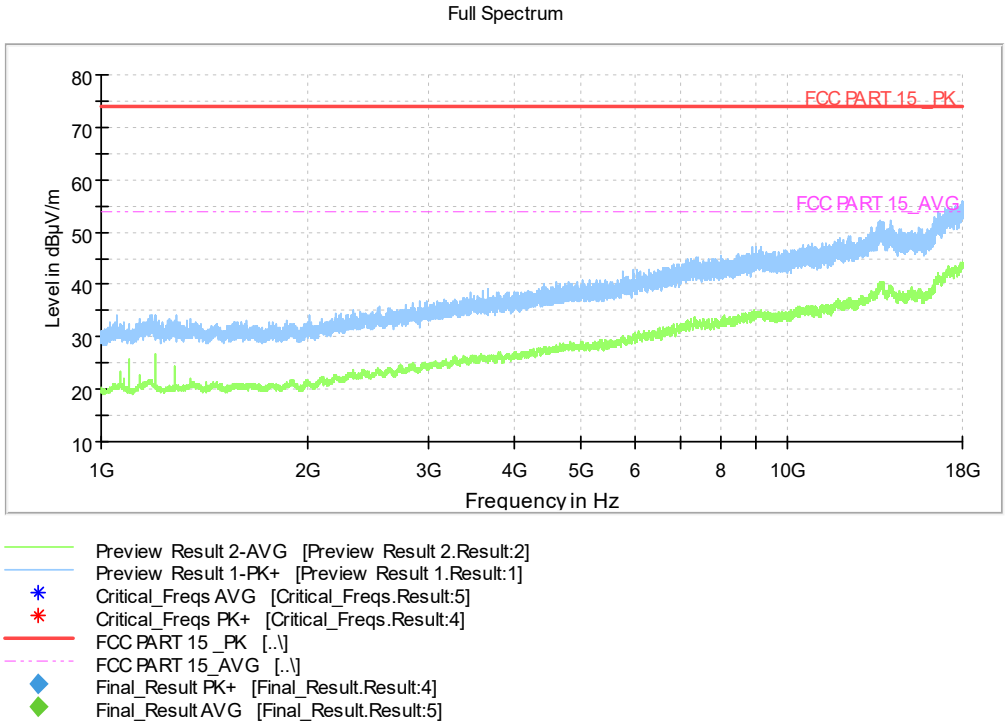

Fig A.4 Radiated Emission from 1GHz to 18GHz

Measurement results for Set.3:

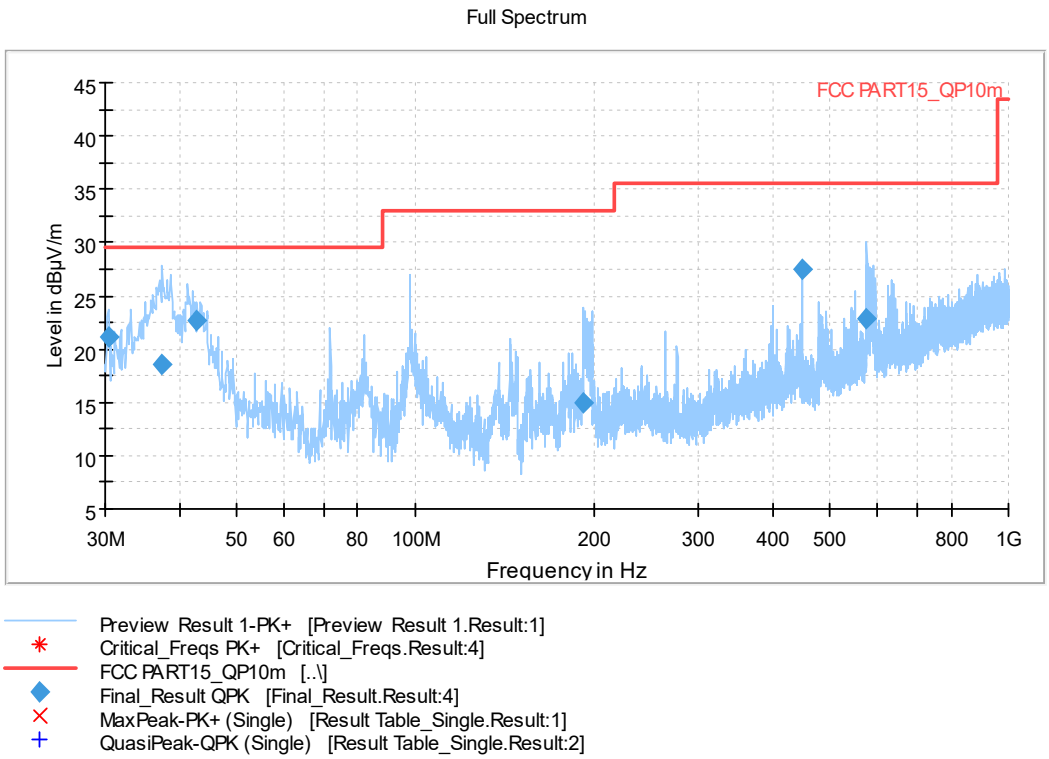

Fig A.5 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
30.388000	21.07	29.54	8.47	2000.0	120.000	103.0	V	280.0
37.469000	18.52	29.54	11.02	2000.0	120.000	95.0	V	120.0
42.901000	22.63	29.54	6.91	2000.0	120.000	103.0	V	100.0
192.184000	15.01	33.06	18.05	2000.0	120.000	183.0	V	171.0
450.010000	27.44	35.56	8.12	2000.0	120.000	175.0	H	170.0
577.468000	22.79	35.56	12.77	2000.0	120.000	225.0	V	-29.0

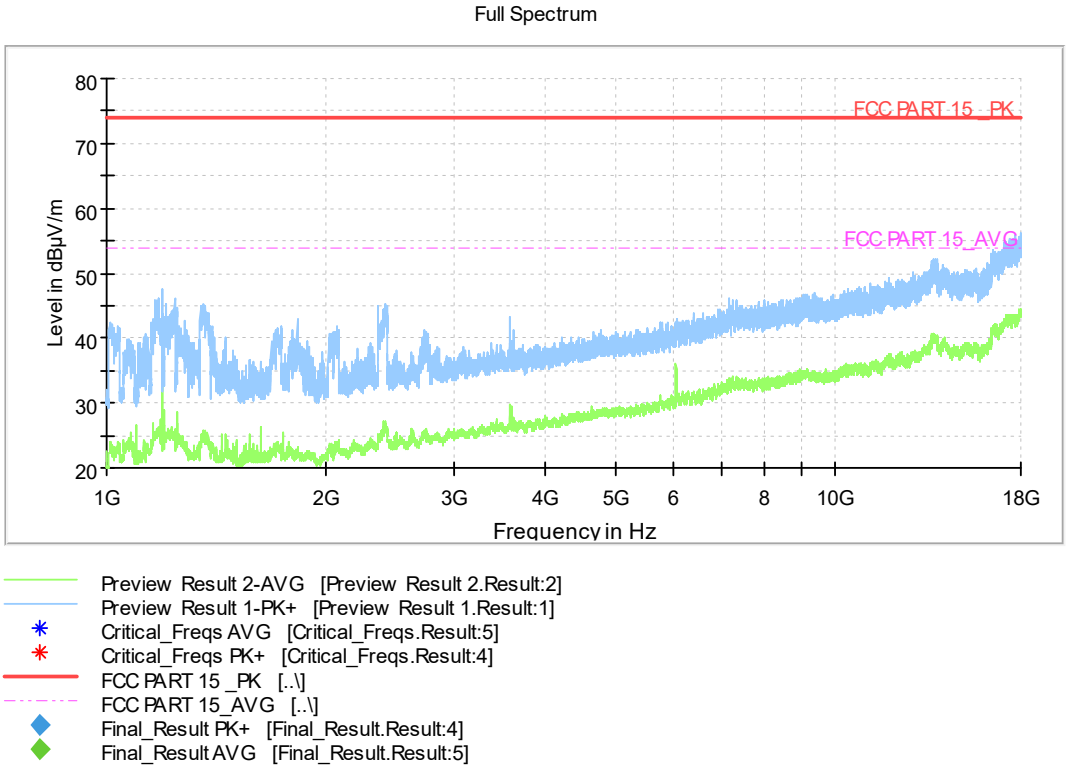

Fig A.6 Radiated Emission from 1GHz to 18GHz

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 and charging mode. During the test MS is connected to a PC via a USB cable in the case of USB mode and is connected to a charger in the case of charging mode. The model of the PC is DELL M4000E-17, and the serial number of the PC is M706GWXD. 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*= 3.1 dB, *k*=2.

Charging Mode, Set.1:

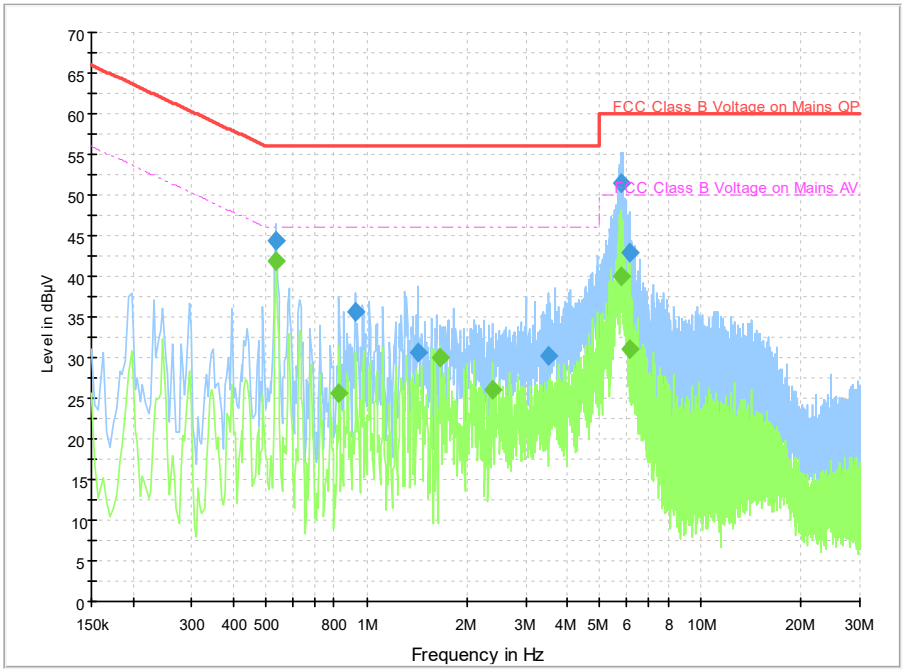

Fig A.7 Conducted Emission from 150kHz to 30MHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.538000	44.4	5000.0	9.000	On	L1	19.9	11.6	56.0	
0.926000	35.6	5000.0	9.000	On	N	19.8	20.4	56.0	
1.426000	30.7	5000.0	9.000	On	N	19.8	25.3	56.0	
3.514000	30.1	5000.0	9.000	On	L1	19.5	25.9	56.0	
5.794000	51.5	5000.0	9.000	On	L1	19.5	8.5	60.0	
6.146000	42.8	5000.0	9.000	On	L1	19.6	17.2	60.0	

Final Result 2

Frequency (MHz)	Average (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.534000	41.9	5000.0	9.000	On	L1	19.9	4.1	46.0	
0.826000	25.6	5000.0	9.000	On	N	19.8	20.4	46.0	
1.658000	30.0	5000.0	9.000	On	L1	19.5	16.0	46.0	
2.390000	26.0	5000.0	9.000	On	L1	19.5	20.0	46.0	
5.798000	39.9	5000.0	9.000	On	L1	19.5	10.1	50.0	
6.146000	31.1	5000.0	9.000	On	L1	19.6	19.0	50.0	

Charging Mode, Set.2:

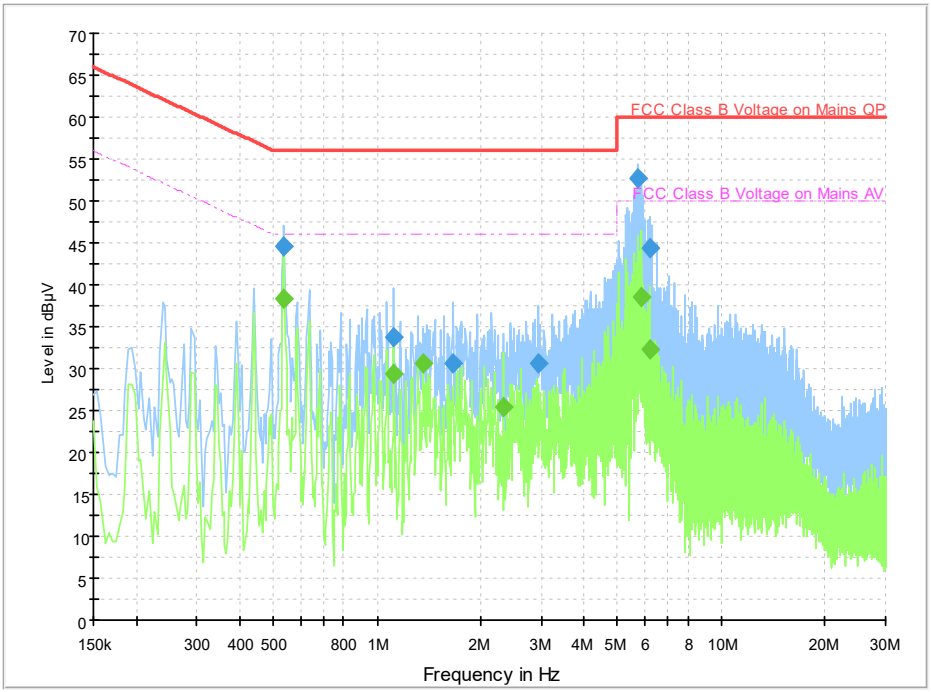

Fig A.8 Conducted Emission from 150kHz to 30MHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.538000	44.5	5000.0	9.000	On	N	19.9	11.5	56.0	
1.118000	33.7	5000.0	9.000	On	N	19.8	22.3	56.0	
1.666000	30.7	5000.0	9.000	On	N	19.8	25.3	56.0	
2.946000	30.5	5000.0	9.000	On	N	19.7	25.5	56.0	
5.738000	52.7	5000.0	9.000	On	L1	19.5	7.3	60.0	
6.194000	44.5	5000.0	9.000	On	L1	19.6	15.5	60.0	

Final Result 2

Frequency (MHz)	Average (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.538000	38.3	5000.0	9.000	On	N	19.9	7.7	46.0	
1.118000	29.5	5000.0	9.000	On	L1	19.5	16.6	46.0	
1.362000	30.6	5000.0	9.000	On	L1	19.5	15.4	46.0	
2.334000	25.4	5000.0	9.000	On	L1	19.5	20.6	46.0	
5.842000	38.5	5000.0	9.000	On	L1	19.5	11.5	50.0	
6.178000	32.3	5000.0	9.000	On	L1	19.6	17.7	50.0	

USB Mode, Set.3:

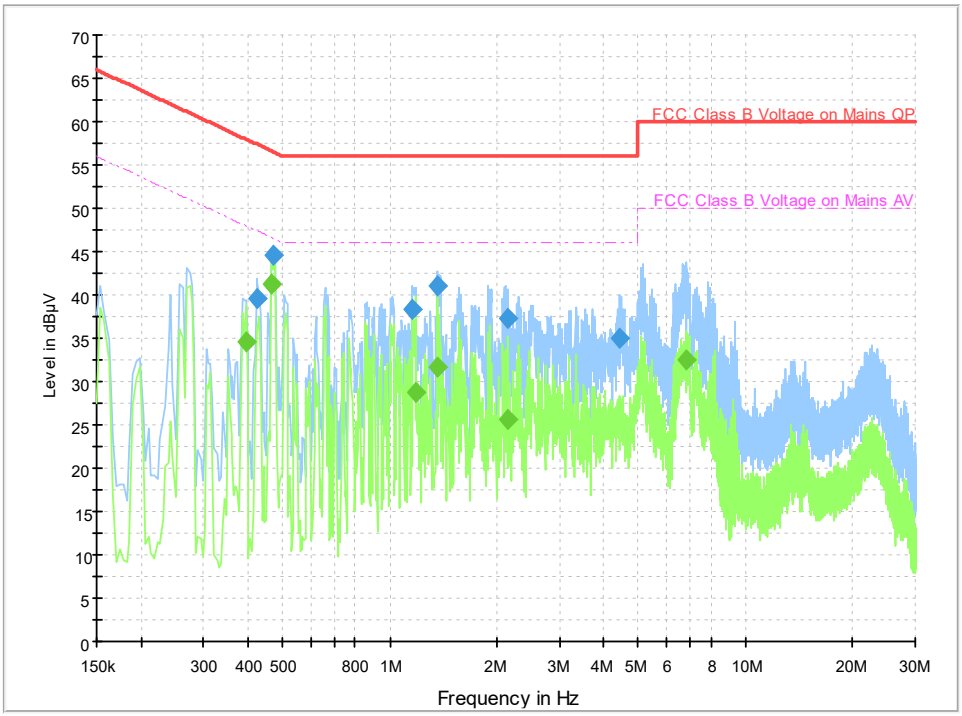

Fig A.9 Conducted Emission from 150kHz to 30MHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.422000	39.5	5000.0	9.000	On	L1	19.9	17.9	57.4	
0.470000	44.5	5000.0	9.000	On	L1	19.9	12.0	56.5	
1.150000	38.4	5000.0	9.000	On	N	19.8	17.6	56.0	
1.362000	41.0	5000.0	9.000	On	L1	19.5	15.0	56.0	
2.138000	37.2	5000.0	9.000	On	N	19.8	18.8	56.0	
4.430000	35.1	5000.0	9.000	On	N	19.7	20.9	56.0	

Final Result 2

Frequency (MHz)	Average (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.394000	34.5	5000.0	9.000	On	L1	19.9	13.5	48.0	
0.466000	41.3	5000.0	9.000	On	L1	19.9	5.3	46.6	
1.186000	28.7	5000.0	9.000	On	L1	19.5	17.3	46.0	
1.362000	31.7	5000.0	9.000	On	L1	19.5	14.3	46.0	
2.138000	25.5	5000.0	9.000	On	N	19.8	20.5	46.0	
6.846000	32.6	5000.0	9.000	On	L1	19.5	17.4	50.0	

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