TEST REPORT

No. I22Z62189-EMC01

for

HMD Global Oy

Smart phone

Model Name: N156DL

FCC ID: 2AJOTTA-1560

with

Hardware Version: V1.0

Software Version: 02US_0_043

Issued Date: 2023-01-17

Note:

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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

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I22Z62189-EMC01	Rev.0	1st edition	2023-01-17

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

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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: 2022-12-27

Testing End Date: 2022-12-29

1.4. Signature

Wang Xue

(Prepared this test report)

Zhang Ying

(Reviewed this test report)

Zhang Xia

(Approved this test report)

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2. Client Information

2.1. Applicant Information

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

2.2. Manufacturer Information

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

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

3.1. About EUT

Description	Smart phone
Model Name	N156DL
FCC ID:	2AJOTTA-1560

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	350817210018134	V1.0	02US_0_043

*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
AE1	Battery
AE2	Battery
AE3	USB Cable
AE4	Charger1

AE1

Model	TN-BP3000N1
Manufacturer	Guangdong Fenghua new energy co.,ltd.
Capacity	typ 3050mAh
Nominal Voltage	3.85V

AE2

Model	TN-BP3000N1
Manufacturer	Dongguan Ganfeng Electronics Co., Ltd
Capacity	typ 3050mAh
Nominal Voltage	3.85V

AE3

Model	TN-TC2A1MFB
Manufacturer	SAIBAO(JIANGXI) INDUSTRIAL CO.,LTD
Length of cable	/

AE4

Model	AD-005U
Manufacturer	Shenzhen Baijunda Electronic Co.， Ltd
Length of cable	/

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

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EUT set-ups

EUT set-up No.	Combination of EUT and AE	Remarks
Set.1	EUT1+ AE1/2+AE3+ AE4	Charger1+ Rear Camera +GSM 850 idle
Set.2	EUT1+ AE1/2+AE3+ AE4	Charger2 + MP4+WCDMA 850 idle
Set.3	EUT1+ AE1/2+AE3+ HEADSET	USB+ front camera +LTE B5 idle + FM

Note:

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

It supports

GSM Band	GSM 850/1900
UMTS Band	FDD Band II(W1900) /FDD Band IV(W1700)/FDD Band V(W850)
LTE Band	FDD 2/4/5/12/13/66/71, TDD 41.

It has camera, MP3, Bluetooth V5.0, Wi-Fi (802.11a/b/g/n/ac, 802.11n supports 20MHz and 40MHz bandwidth,802.11ac supports 20MHz, 40MHz and 80MHz bandwidth) and GPS functions.

The device contains receivers which tune and operate between 30MHz-960MHz in the following bands: GSM 850, WCDMA850, LTE Band 5/12/13/71. All licensed band receivers that tune in the range of 30MHz-960MHz are investigated. Only the worst-case emissions are reported.

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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.

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

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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)**

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7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE	CALIBRATION INTERVAL
1	Test Receiver	ESW44	103015	R&S	2023-01-23	1 year
2	Universal Radio Communication Tester	CMW500	163975	R&S	2023-01-10	1 year
3	EMI Antenna	VULB 9163	01223	SCHWARZBECK	2023-07-25	1 year
4	EMI Antenna	3115	00167250	ETS-Lindgren	2023-06-20	1 year
5	LISN	ENV216	101200	R&S	2023-06-29	1 year
6	Test Receiver	ESCI 7	100344	R&S	2023-03-21	1 Year
7	Software	EMC32	/	R&S	/	/

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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

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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 = 5.54 dB, k=2.

Measurement results for Set.1:

Charging 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)
17995.920	41.20	-29.06	46.66	23.60	54.00	12.80	H
17929.620	41.10	-29.40	46.66	23.84	54.00	12.90	V
17995.580	41.00	-29.06	46.66	23.40	54.00	13.00	V
17988.780	41.00	-29.06	46.66	23.40	54.00	13.00	H
17908.540	40.90	-29.33	45.95	24.27	54.00	13.10	H
17984.360	40.90	-29.06	46.66	23.30	54.00	13.10	V

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)
17937.780	53.70	-29.40	46.66	36.44	74.00	20.30	H
17992.860	52.60	-29.06	46.66	35.00	74.00	21.40	H
17439.000	51.90	-29.71	44.35	37.26	74.00	22.10	V
17976.200	51.70	-29.06	46.66	34.10	74.00	22.30	H
17908.540	51.60	-29.33	45.95	34.97	74.00	22.40	V
17984.700	51.50	-29.06	46.66	33.90	74.00	22.50	H

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Measurement results for Set.2:

Charging 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)
17990.480	41.40	-29.06	46.66	23.80	54.00	12.60	V
17997.960	41.20	-29.06	46.66	23.60	54.00	12.80	V
17981.640	41.10	-29.06	46.66	23.50	54.00	12.90	H
17908.880	41.10	-29.33	45.95	24.47	54.00	12.90	H
17921.800	41.00	-29.40	46.66	23.74	54.00	13.00	V
17965.320	41.00	-29.06	46.66	23.40	54.00	13.00	V

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)
17635.180	52.50	-29.40	45.25	36.65	74.00	21.50	H
17925.200	52.20	-29.40	46.66	34.94	74.00	21.80	V
17793.620	51.80	-29.89	45.95	35.73	74.00	22.20	V
17950.020	51.70	-28.94	46.66	33.98	74.00	22.30	V
17630.080	51.60	-29.40	45.25	35.75	74.00	22.40	H
17909.900	51.60	-29.33	45.95	34.97	74.00	22.40	V

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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)
17974.500	41.50	-29.06	46.66	23.90	54.00	12.50	V
17513.120	41.20	-29.26	44.35	26.10	54.00	12.80	V
17999.320	41.10	-29.06	46.66	23.50	54.00	12.90	H
17993.540	41.00	-29.06	46.66	23.40	54.00	13.00	V
17979.260	41.00	-29.06	46.66	23.40	54.00	13.00	H
17997.280	41.00	-29.06	46.66	23.40	54.00	13.00	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)
17986.060	51.70	-29.06	46.66	34.10	74.00	22.30	H
17943.220	51.40	-28.94	46.66	33.68	74.00	22.60	H
17919.080	51.40	-29.33	46.66	34.07	74.00	22.60	V
17906.840	51.40	-29.33	45.95	34.77	74.00	22.60	V
17946.620	51.30	-28.94	46.66	33.58	74.00	22.70	V
17986.400	51.20	-29.06	46.66	33.60	74.00	22.80	H

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Measurement results for Set.1:

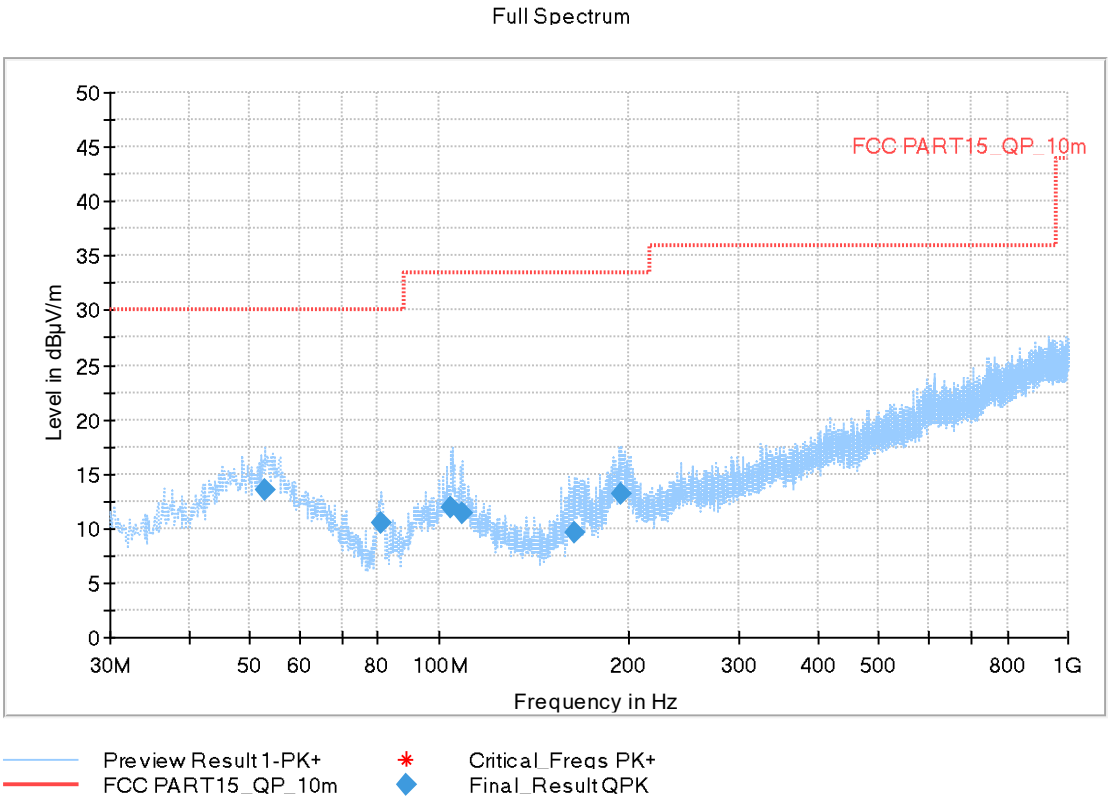

Fig A.1 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
52.795000	13.52	30.00	16.48	120.000	108.0	V	176.0	-11.0
80.731000	10.57	30.00	19.43	120.000	100.0	V	60.0	-17.6
104.302000	12.00	33.52	21.52	120.000	125.0	V	202.0	-12.3
109.152000	11.46	33.52	22.06	120.000	125.0	V	278.0	-12.7
164.442000	9.66	33.52	23.86	120.000	100.0	V	45.0	-14.8
194.027000	13.20	33.52	20.32	120.000	100.0	V	135.0	-12.0

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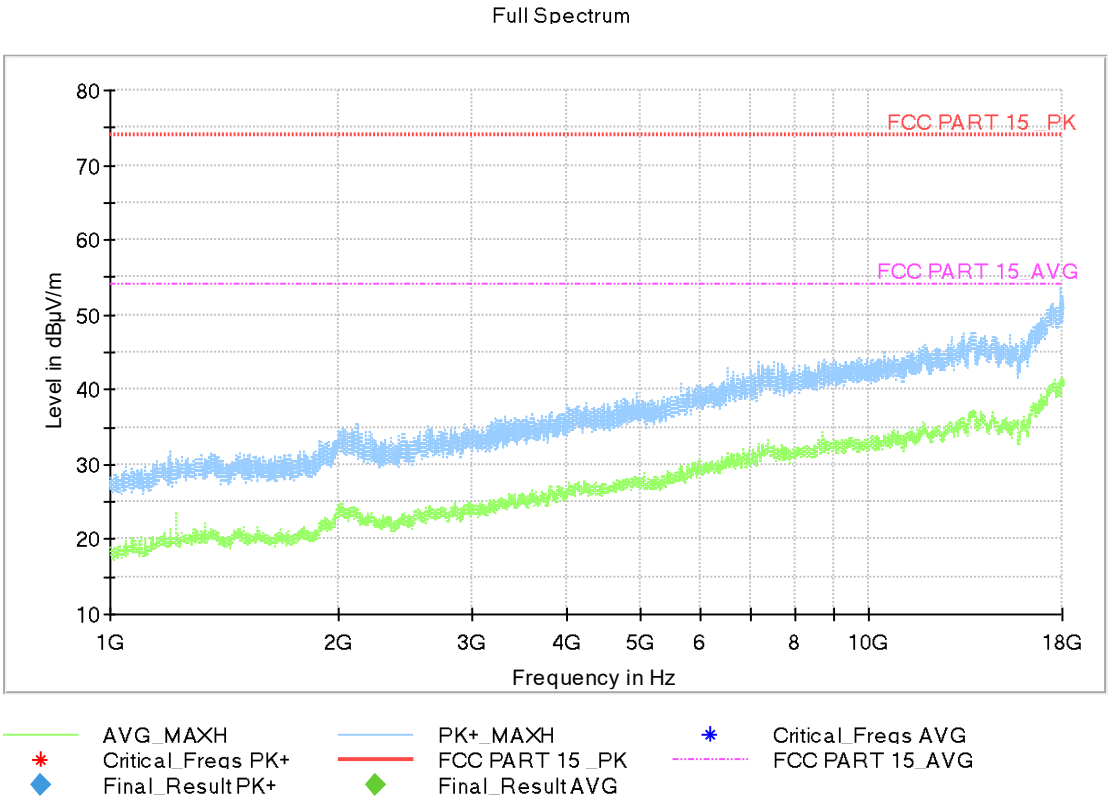

Fig A.2 Radiated Emission from 1GHz to 18GHz

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Measurement results for Set.2:

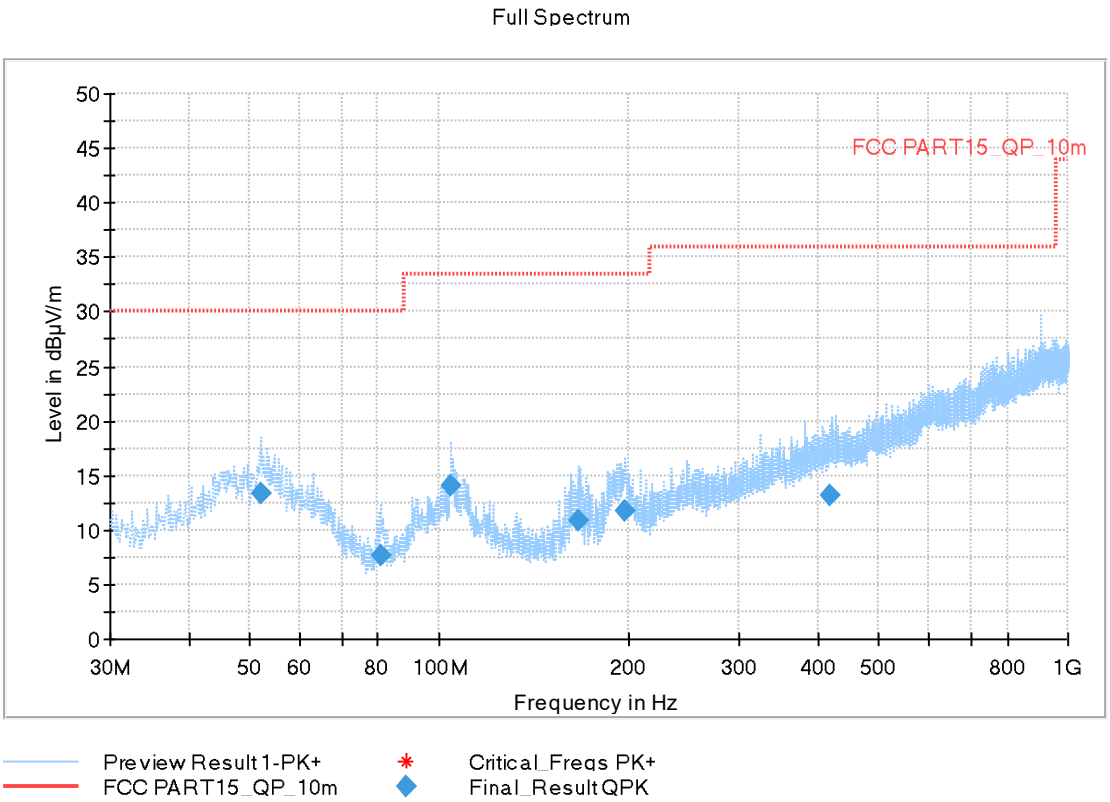

Fig A.3 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
52.019000	13.41	30.00	16.59	120.000	100.0	V	86.0	-10.9
80.634000	7.65	30.00	22.35	120.000	100.0	V	8.0	-17.6
104.593000	14.00	33.52	19.52	120.000	125.0	V	135.0	-12.3
166.188000	10.89	33.52	22.63	120.000	125.0	V	47.0	-14.7
197.325000	11.72	33.52	21.80	120.000	175.0	V	45.0	-11.5
417.127000	13.22	36.02	22.80	120.000	275.0	V	-45.0	-5.2

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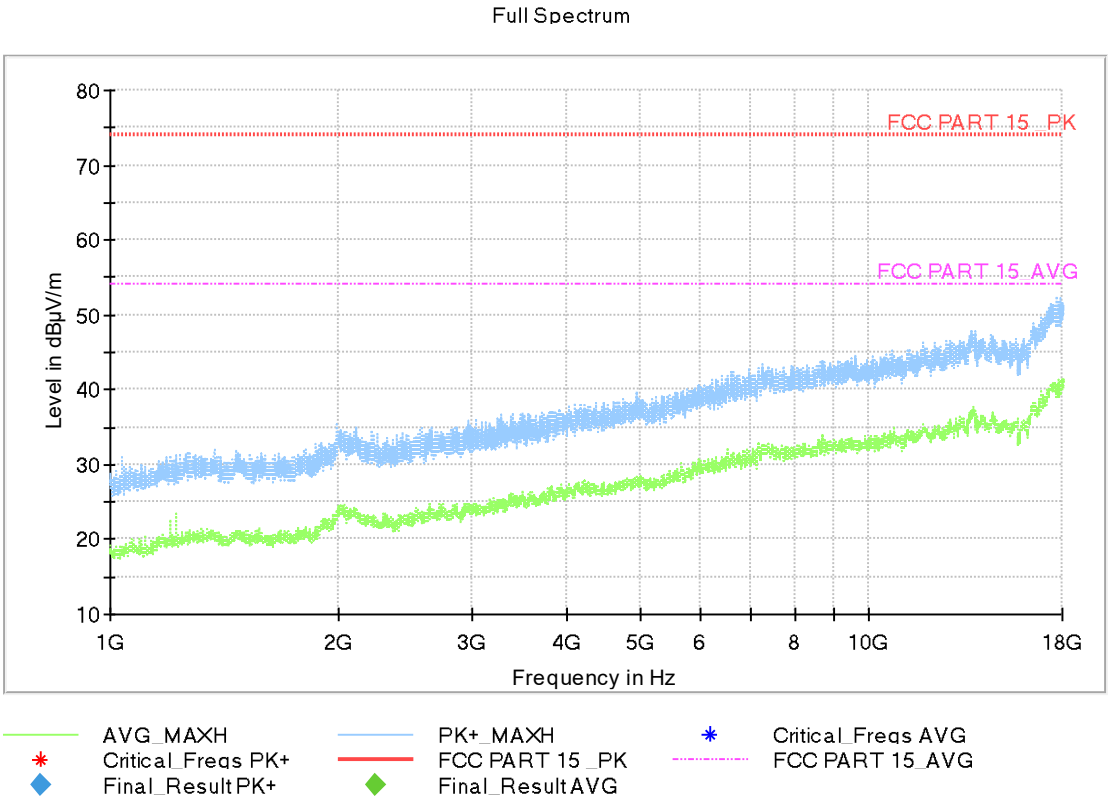

Fig A.4 Radiated Emission from 1GHz to 18GHz

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Measurement results for Set.3:

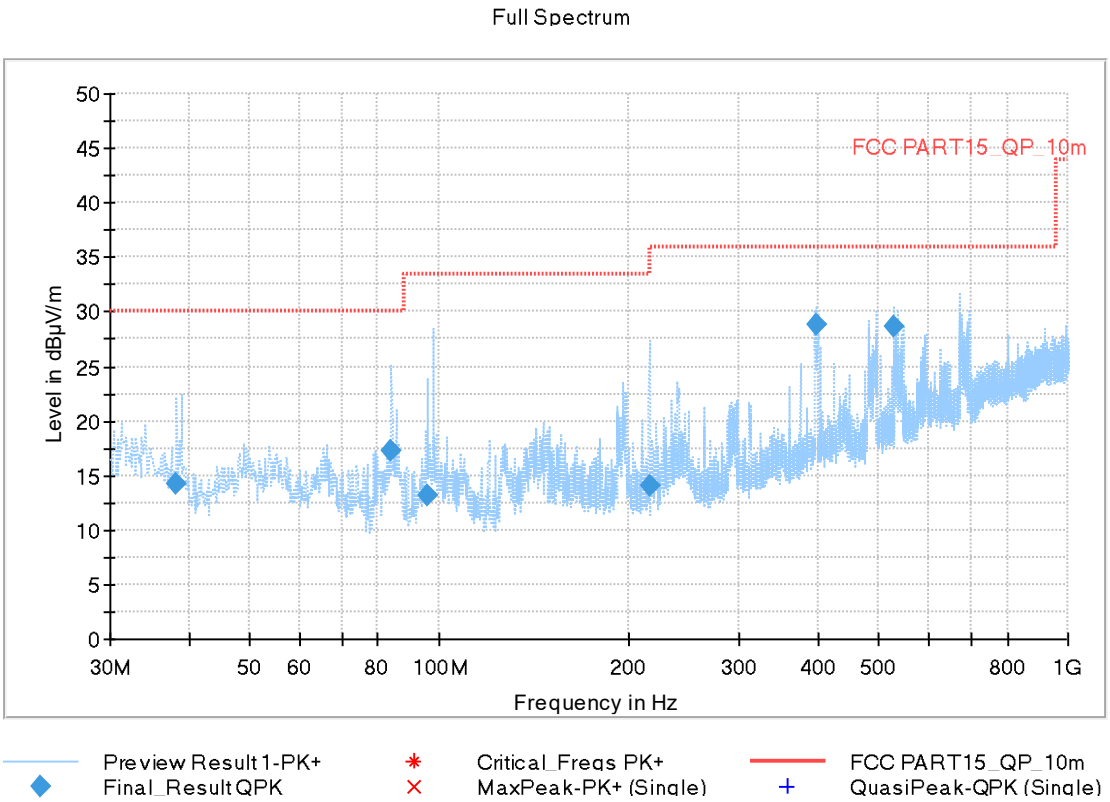

Fig A.5 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
38.245000	14.30	30.00	15.70	120.000	125.0	V	125.0	-12.8
84.029000	17.24	30.00	12.76	120.000	125.0	V	252.0	-16.9
96.057000	13.11	33.52	19.41	120.000	283.0	H	252.0	-13.0
215.755000	14.11	33.52	19.41	120.000	100.0	V	203.0	-11.9
399.376000	28.80	36.02	7.22	120.000	100.0	V	283.0	-5.7
528.968000	28.68	36.02	7.34	120.000	275.0	V	-5.0	-2.9

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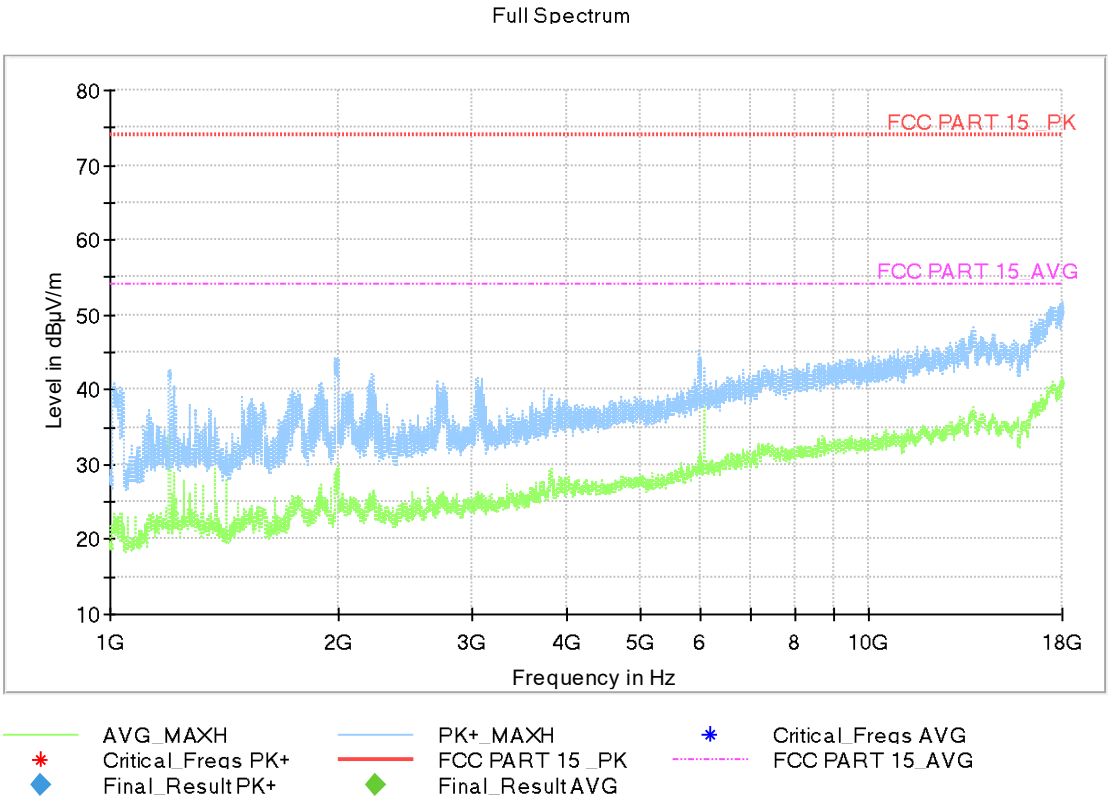

Fig A.6 Radiated Emission from 1GHz to 3GHz

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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

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A.2.5 Measurement Results

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

Charging Mode, Set.1 :

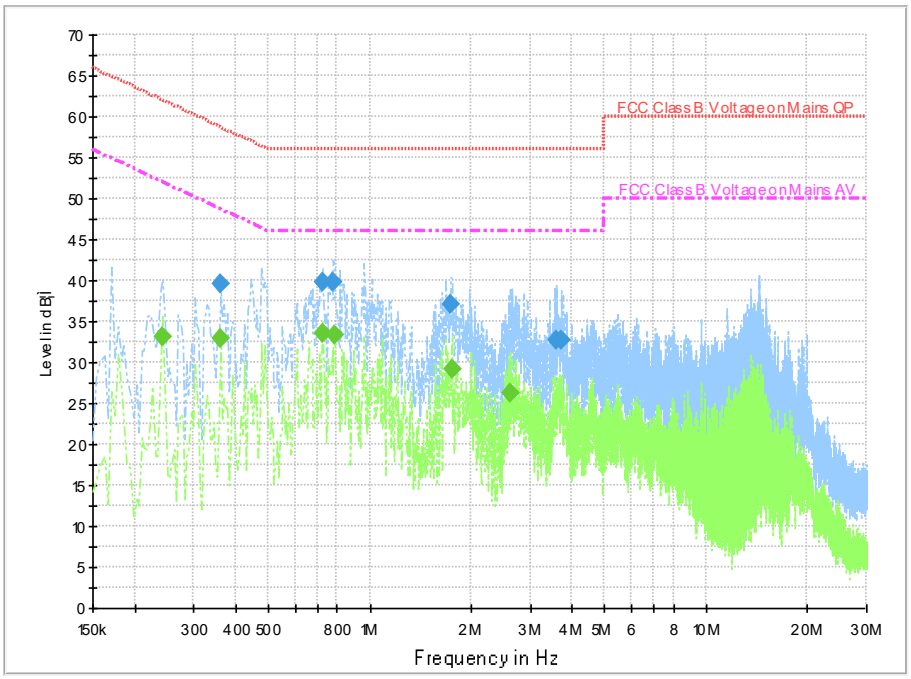

Fig A.7 Conducted Emission from 150kHz to 30MHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.362000	39.7	9.000	On	L1	19.7	19.0	58.7	
0.722000	39.9	9.000	On	L1	19.7	16.1	56.0	
0.782000	39.8	9.000	On	N	19.7	16.2	56.0	
1.746000	37.0	9.000	On	L1	19.6	19.0	56.0	
3.586000	32.7	9.000	On	N	19.6	23.3	56.0	
3.698000	32.7	9.000	On	N	19.6	23.3	56.0	

Final Result 2

Frequency (MHz)	Average (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.242000	33.1	9.000	On	L1	19.7	19.0	52.0	
0.362000	32.9	9.000	On	L1	19.7	15.8	48.7	
0.722000	33.5	9.000	On	L1	19.7	12.5	46.0	
0.786000	33.3	9.000	On	L1	19.7	12.7	46.0	
1.750000	29.1	9.000	On	L1	19.6	16.9	46.0	
2.606000	26.1	9.000	On	L1	19.6	19.9	46.0	

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Charging Mode, Set.2 :

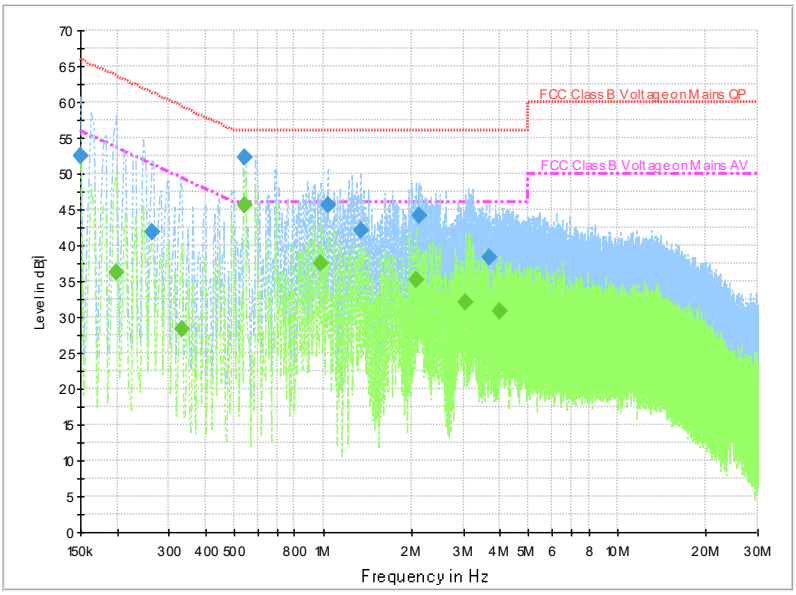

Fig A.8 Conducted Emission from 150kHz to 30MHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.362000	38.4	9.000	On	N	19.6	20.3	58.7	
0.722000	40.1	9.000	On	L1	19.7	15.9	56.0	
0.786000	40.7	9.000	On	L1	19.7	15.3	56.0	
1.690000	36.2	9.000	On	N	19.6	19.8	56.0	
2.722000	36.2	9.000	On	N	19.6	19.8	56.0	
3.634000	34.3	9.000	On	N	19.6	21.7	56.0	

Final Result 2

Frequency (MHz)	Average (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.358000	31.0	9.000	On	L1	19.7	17.8	48.8	
0.722000	34.3	9.000	On	L1	19.7	11.7	46.0	
0.786000	33.8	9.000	On	L1	19.7	12.2	46.0	
1.686000	30.4	9.000	On	L1	19.6	15.6	46.0	
2.722000	23.7	9.000	On	N	19.6	22.3	46.0	
3.626000	26.5	9.000	On	L1	19.6	19.5	46.0	

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USB Mode, Set.3 :

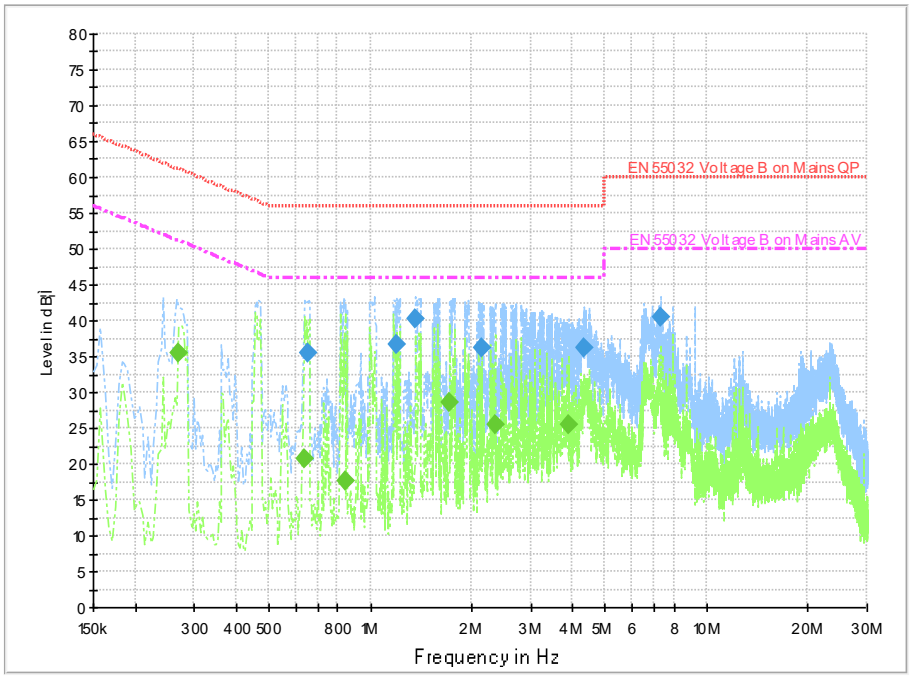

Fig A.9 Conducted Emission from 150kHz to 30MHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.654000	35.4	9.000	On	L1	19.7	20.6	56.0	
1.202000	36.8	9.000	On	N	19.6	19.2	56.0	
1.362000	40.2	9.000	On	N	19.6	15.8	56.0	
2.154000	36.2	9.000	On	N	19.6	19.8	56.0	
4.334000	36.3	9.000	On	N	19.6	19.8	56.0	
7.278000	40.5	9.000	On	N	19.6	19.5	60.0	

Final Result 2

Frequency (MHz)	Average (dBuV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.270000	35.4	9.000	On	N	19.7	15.7	51.1	
0.634000	20.7	9.000	On	N	19.6	25.3	46.0	
0.842000	17.6	9.000	On	N	19.6	28.4	46.0	
1.722000	28.5	9.000	On	L1	19.6	17.5	46.0	
2.346000	25.6	9.000	On	N	19.6	20.4	46.0	
3.894000	25.4	9.000	On	N	19.6	20.6	46.0	

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

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