



TEST REPORT

No. I18Z62335-EMC04

HMD Global OY

Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN

GSM 850,900,1800,1900 WCDMA : 1, 5, 8

LTE :1,3,5,7,8,20,28,38,40,41(120MHz)mobile phone,

Bluetooth 4.2,WIFI 802.11 b/g/n

Model Name: TA-1157

FCC ID: 2AJOTTA-1157

with

Hardware Version: 89571_1_12

Software Version: 00XX_1_XXX

Issued Date: 2019-01-23



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.

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I18Z62335-EMC04	Rev.0	1 st edition	2019-01-23

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1. Test Laboratory

1.1. Testing Location

CTTL (BDA)

Address: No.18A, Kangding Street, Beijing Economic-Technology Development Area, Beijing, P. R. China 100176

1.2. Testing Environment

Normal Temperature: 15-35°C

Relative Humidity: 20-75%

1.3. Project data

Testing Start Date: 2018-12-29

Testing End Date: 2019-01-16

1.4. Signature



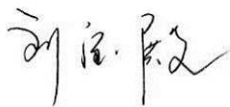
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2. Client Information

2.1. Applicant Information

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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	Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN GSM 850,900, 1800,1900 WCDMA : 1, 5, 8 LTE : 1,3, 5,7,8,20,28,38,40,41(120MHz) mobile phone, Bluetooth 4.2, WIFI 802.11 b/g/n
Model Name	TA-1157
FCC ID	2AJOTTA-1157
Extreme vol. Limits	3.6VDC to 4.40VDC (nominal: 3.9VDC)

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
EUT3	352900100025100/	89571_1_12	00XX_1_XXX
	352900100025118		
EUT8	352900100048789/	89571_1_12	00XX_1_XXX
	352900100048797		

*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	Battery	/	/
AE3	Charger	/	/
AE4	Charger	/	NO TEST
AE5	USB Cable	/	/
AE6	USB Cable	/	/
AE7	Headset	/	/

AE1

Model	WT330
Manufacturer	Jiade Energy Technology(Zhuhai) Co.,Ltd.
Capacitance	3000mAh
Nominal voltage	3.85V

AE2

Model	WT330
Manufacturer	Sunwoda Electronic Co.,Ltd
Capacitance	3000mAh
Nominal voltage	3.85V

AE3

Model	CH-35U
Manufacturer	Shenzhen Tianyin Electronics Co.,Ltd
Length of cable	/

AE4

Model	CH-35E
Manufacturer	Shenzhen Tianyin Electronics Co.,Ltd
Length of cable	/
AE5	
Model	CB-35A
Manufacturer	Leagtech Electronics Co.,Ltd
Length of cable	/
AE6	
Model	CB-35A
Manufacturer	Shenzhen BRL Technology Co.,Ltd.
Length of cable	/
AE7	
Model	/ □
Manufacturer	/
Length of cable	/

Note: The USB cables are shielded.

3.4. EUT set-ups

EUT set-up No.	Combination of EUT and AE	Remarks
Set.1	EUT3 + AE1 + AE3 + AE5/AE6 + AE7	Charger mode+ FM
Set.2	EUT3 + AE1 + AE3 + AE5/AE6	USB mode+MP3+GPS
Set.3	EUT8 + AE1 + AE3 + AE5/AE6	USB mode

Note1

EUT3 is memory 3+32G, EUT8 is memory 2+16G.

According to the declaration of changes, the following items are tested on Set.3

Mode or Feature	EUT set-up No	Test Item
USB	Set.3	Radiated Emission

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	2016
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 3000 MHz

Semi-anechoic chamber SAC-2 (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 MΩ
Ground system resistance	< 4 Ω
Normalised site attenuation (NSA)	< ± 4 dB, 3m 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 3000 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

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

7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE	CALIBRATI ON INTERVAL
1	Test Receiver	ESU26	100376	R&S	2019-11-27	1 year
2	Test Receiver	ESCI	100766	R&S	2019-04-06	1 year
3	Universal Radio Communication Tester	CMW500	127406	R&S	2019-02-19	1 year
4	LISN	ESH3-Z5	825562/028	R&S	2019-08-22	1 year
5	EMI Antenna	VULB9163	9163-482	Schwarzbeck	2019-09-21	1 year
6	EMI Antenna	3117	00139065	ETS-Lindgren	2019-11-15	1 year
7	Signal Generator	SMF100A	101295	R&S	2019-11-27	1 year
8	Printer	P1606dn	VNC3L52122	HP	N/A	N/A
9	Keyboard	KU-1601	2048361	Lenovo	N/A	N/A
10	Mouse	EMS-537A	8021S3MC	Lenovo	N/A	N/A

Test Item	Test Software and Version	Software Vendor
Radiated Continuous Emission	EMC32 V9.01	R&S
Conducted Emission	EMC32 V8.52.0	R&S

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(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 3/10 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. During the charging mode the FM application is started up. During the USB mode The EUT is keeping on playing MP3 and the GNSS application is started up. The model of the PC is Lenovo M4000e-17, and the serial number of the PC is M706RMW2. 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 ($\mu\text{V/m}$)		
	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/1MHz	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:

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

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:

Charging 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)
17097.000	39.7	-25.5	41.3	23.88	54.0	14.3	H
17109.000	39.7	-25.5	41.3	23.87	54.0	14.3	V
17108.250	39.7	-25.5	41.3	23.81	54.0	14.3	V
17119.500	39.6	-25.5	41.3	23.81	54.0	14.4	V
17981.250	39.6	-25.3	40.8	24.12	54.0	14.4	V
17095.500	39.6	-25.5	41.3	23.73	54.0	14.4	H

Charging 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)
17154.000	52.0	-25.6	41.3	36.34	74.0	22.0	V
17959.500	51.7	-25.0	40.8	35.91	74.0	22.3	V
17962.500	51.6	-25.0	40.8	35.84	74.0	22.4	V
17983.500	51.5	-25.3	40.8	36.00	74.0	22.5	V
17505.750	51.5	-25.4	41.2	35.65	74.0	22.5	V
17145.750	51.5	-25.5	41.3	35.73	74.0	22.5	H

Measurement results for Set.2:
USB Mode +MP3+GNSS /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)
17101.500	39.9	-25.5	41.3	24.07	54.0	14.1	H
17099.250	39.7	-25.5	41.3	23.85	54.0	14.3	V
17083.500	39.7	-25.5	41.3	23.84	54.0	14.3	V
17095.500	39.6	-25.5	41.3	23.80	54.0	14.4	V
17106.750	39.6	-25.5	41.3	23.77	54.0	14.4	V
17121.750	39.6	-25.5	41.3	23.76	54.0	14.4	V

USB Mode +MP3+GNSS /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)
3585.750	53.9	-34.2	33.5	54.56	74.0	20.1	H
3593.250	53.0	-34.2	33.5	53.68	74.0	21.0	H
3594.000	52.6	-34.2	33.5	53.29	74.0	21.4	H
17478.750	52.2	-25.3	41.2	36.29	74.0	21.8	V
17964.750	52.2	-25.1	40.8	36.41	74.0	21.8	H
3588.000	52.0	-34.2	33.5	52.74	74.0	22.0	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)
17102.250	39.7	-25.5	41.3	23.85	54.0	14.3	V
17089.500	39.6	-25.5	41.3	23.78	54.0	14.4	H
17094.750	39.6	-25.5	41.3	23.74	54.0	14.4	H
17096.250	39.5	-25.5	41.3	23.65	54.0	14.5	V
17985.000	39.5	-25.3	40.8	24.03	54.0	14.5	H
17117.250	39.5	-25.5	41.3	23.63	54.0	14.5	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)
3594.000	55.1	-34.2	33.5	55.75	74.0	18.9	H
3596.250	54.7	-34.1	33.5	55.37	74.0	19.3	H
17109.750	52.0	-25.5	41.3	36.16	74.0	22.0	V
3586.500	51.8	-34.2	33.5	52.50	74.0	22.2	H
17079.750	51.8	-25.5	41.3	35.94	74.0	22.2	V
17055.000	51.8	-25.5	41.4	35.92	74.0	22.2	V

Note: The measurement results of Set.1, Set.2 and Set.3 showed here are worst cases of the combinations of different USB cables.

Charging Mode + FM, Set.1

15B RE 30MHz-1GHz

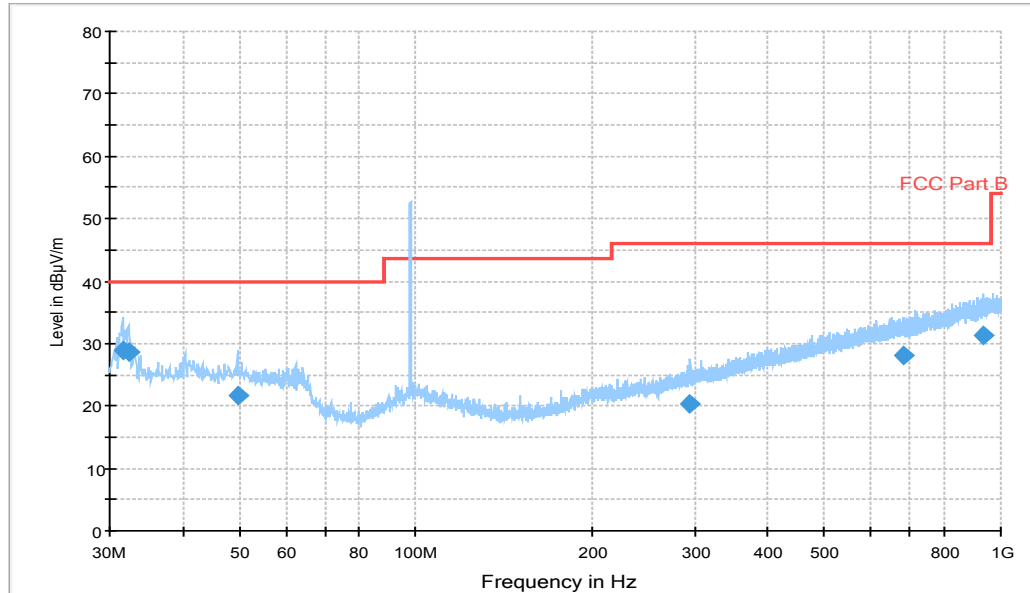


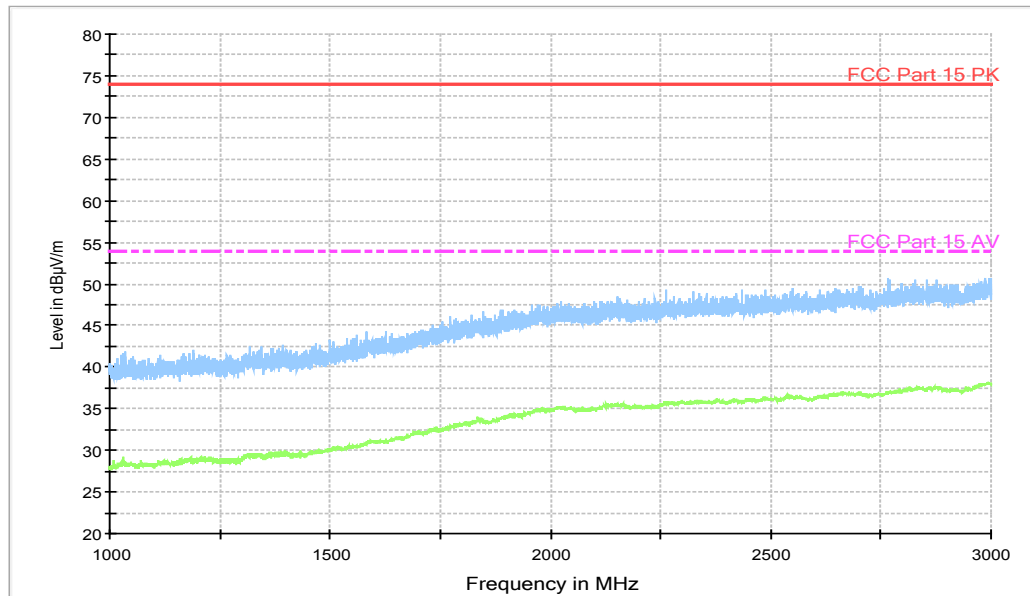
Figure A.1 Radiated Emission from 30MHz to 1GHz

Note: the spike (98MHz) over the limit is coming from FM signal source.

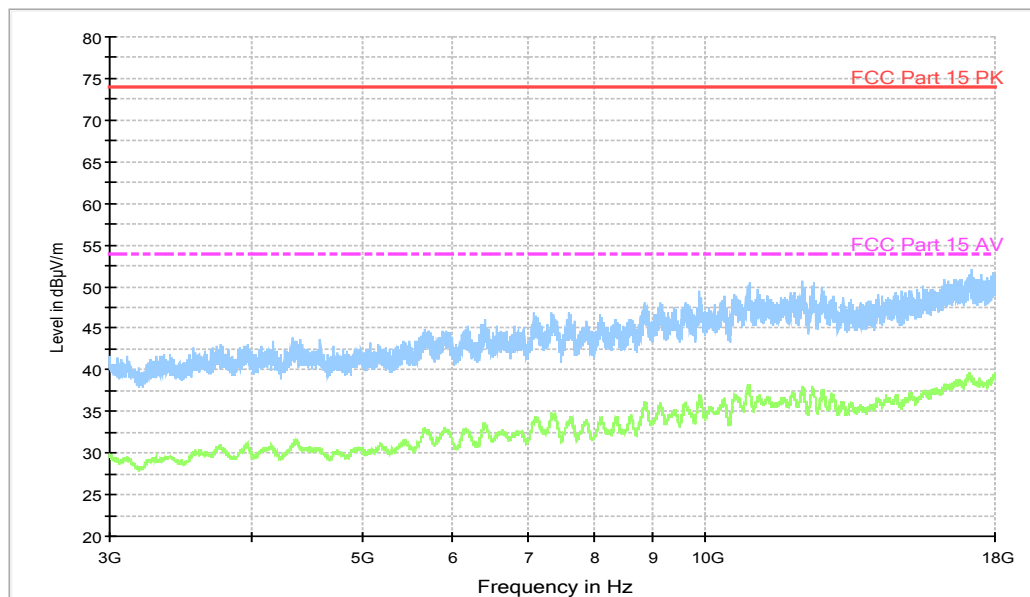
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
31.552000	28.8	100.0	V	89.0	-1.2	11.2	40.0
32.328000	28.5	100.0	H	123.0	-1.1	12.5	40.0
49.594000	21.6	194.0	V	123.0	0.8	18.4	40.0
294.81000	20.2	100.0	V	-21.0	1.3	25.8	46.0
683.39200	28.2	225.0	V	-25.0	9.7	17.8	46.0
934.13700	31.4	110.0	V	-18.0	12.5	14.6	46.0

15B RE - 1GHz-3GHz


Figure A.2 Radiated Emission from 1GHz to 3GHz

15b RE - 3GHz-18GHz


Figure A.3 Radiated Emission from 3GHz to 18GHz

USB Mode +MP3+GNSS, Set.2

15B RE 30MHz-1GHz

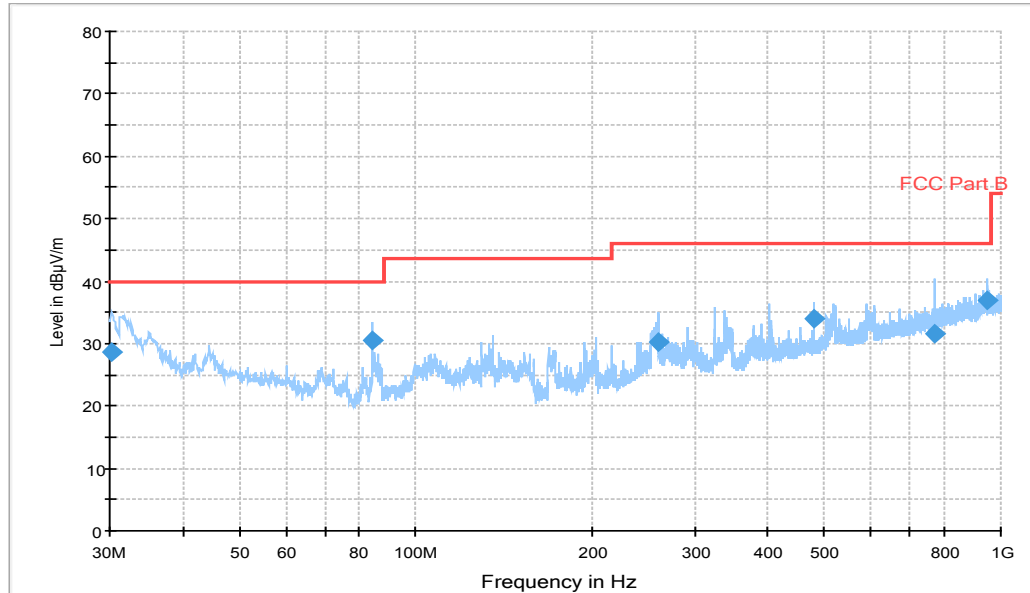
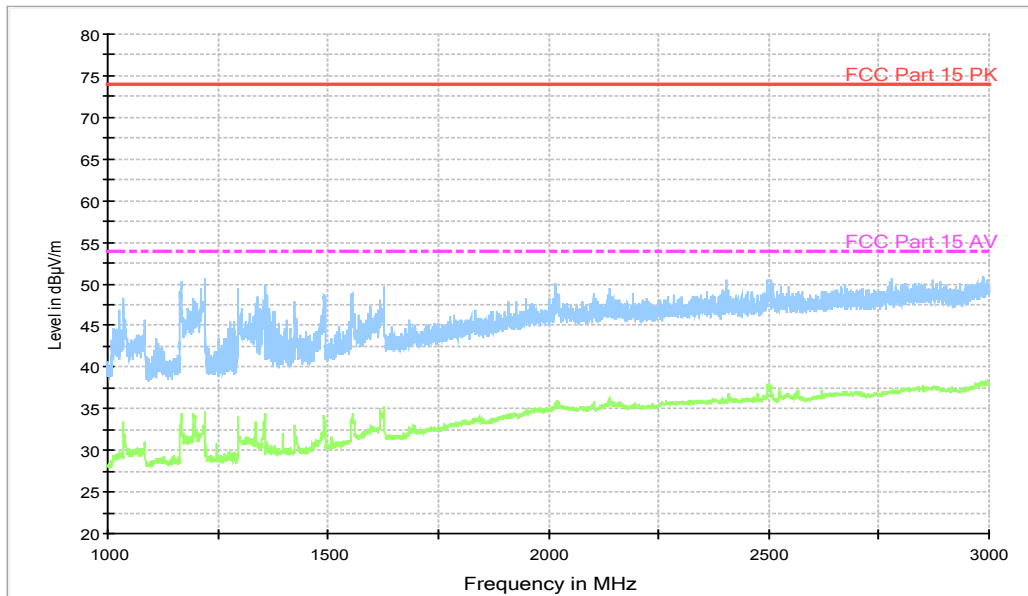


Figure A.4 Radiated Emission from 30MHz to 1GHz

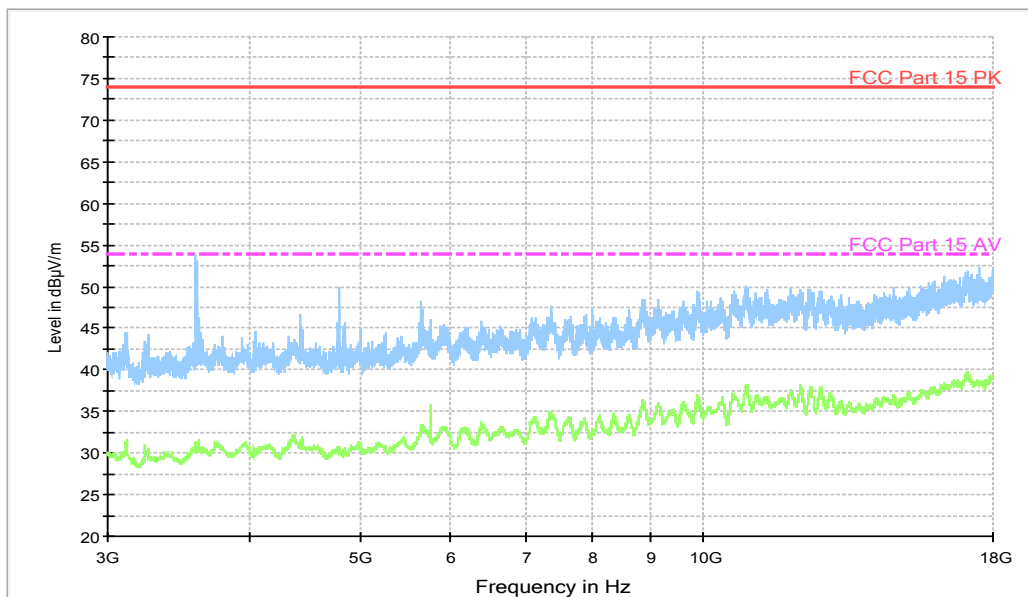
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.194000	28.6	100.0	V	114.0	-1.6	11.4	40.0
84.320000	30.4	225.0	H	62.0	-4.7	9.6	40.0
259.59900	30.2	175.0	V	3.0	-0.1	15.8	46.0
479.98300	33.9	125.0	H	45.0	6.6	12.1	46.0
768.07300	31.6	100.0	H	10.0	10.7	14.4	46.0
949.07500	37.0	100.0	H	72.0	12.8	9.0	46.0

15B RE - 1GHz-3GHz


Figure A.5 Radiated Emission from 1GHz to 3GHz

15b RE - 3GHz-18GHz


Figure A.6 Radiated Emission from 3GHz to 18GHz

USB Mode, Set.3

15B RE 30MHz-1GHz

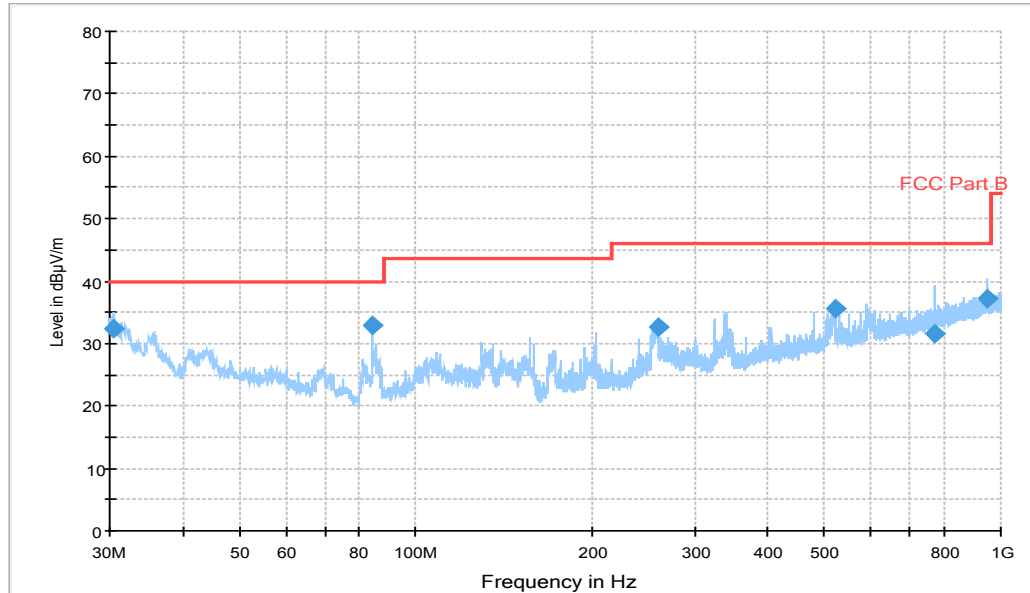


Figure A.4 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
30.485000	32.3	100.0	V	297.0	-1.5	7.7	40.0
84.320000	33.0	219.0	H	271.0	-4.7	7.0	40.0
260.08400	32.6	125.0	V	-25.0	-0.1	13.4	46.0
519.85000	35.5	119.0	H	-32.0	7.4	10.5	46.0
768.07300	31.6	125.0	H	1.0	10.7	14.4	46.0
949.26900	37.3	100.0	H	59.0	12.8	8.7	46.0

15B RE - 1GHz-3GHz

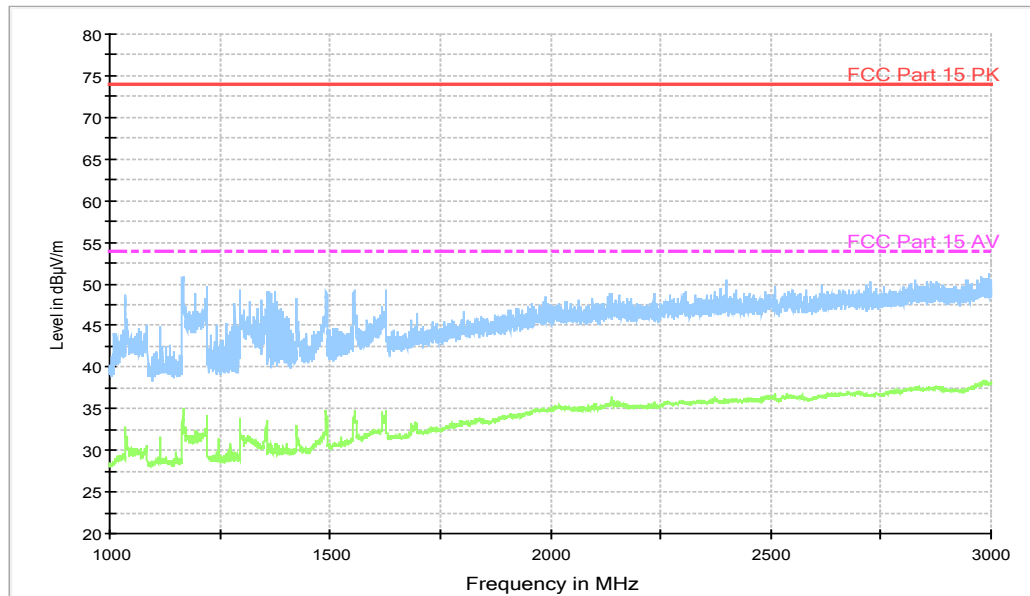


Figure A.5 Radiated Emission from 1GHz to 3GHz

15b RE - 3GHz-18GHz

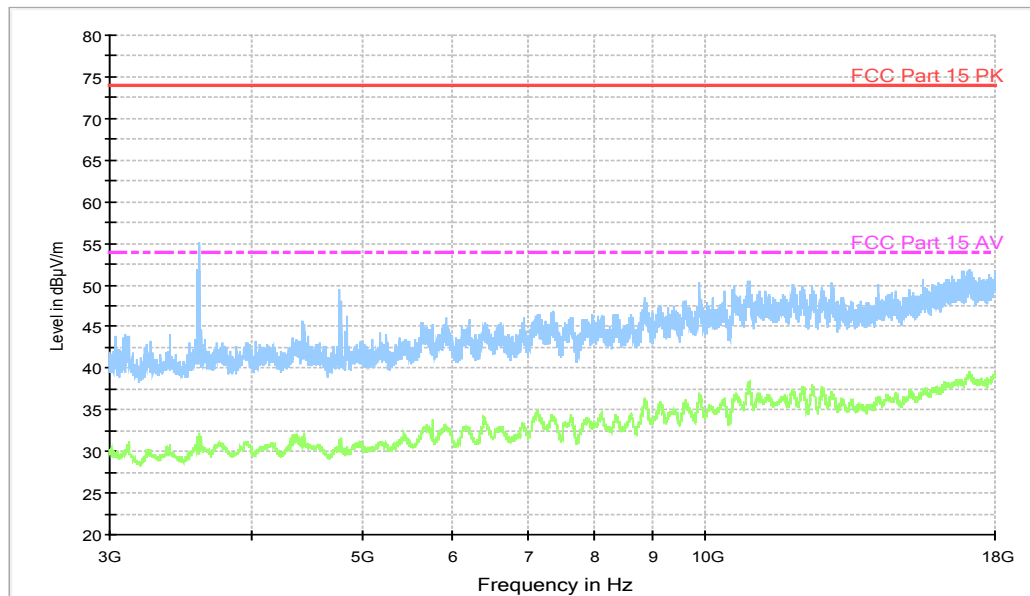


Figure A.6 Radiated Emission from 3GHz to 18GHz

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. During the charging mode the FM application is started up. During the USB mode The EUT is keeping on playing MP3 and the GNSS application is started up. The model of the PC is Lenovo M4000e-17, and the serial number of the PC is M706RMW2. 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: $U = 3.08 \text{ dB}$, $k=2$.

Charging Mode +FM, Set.1

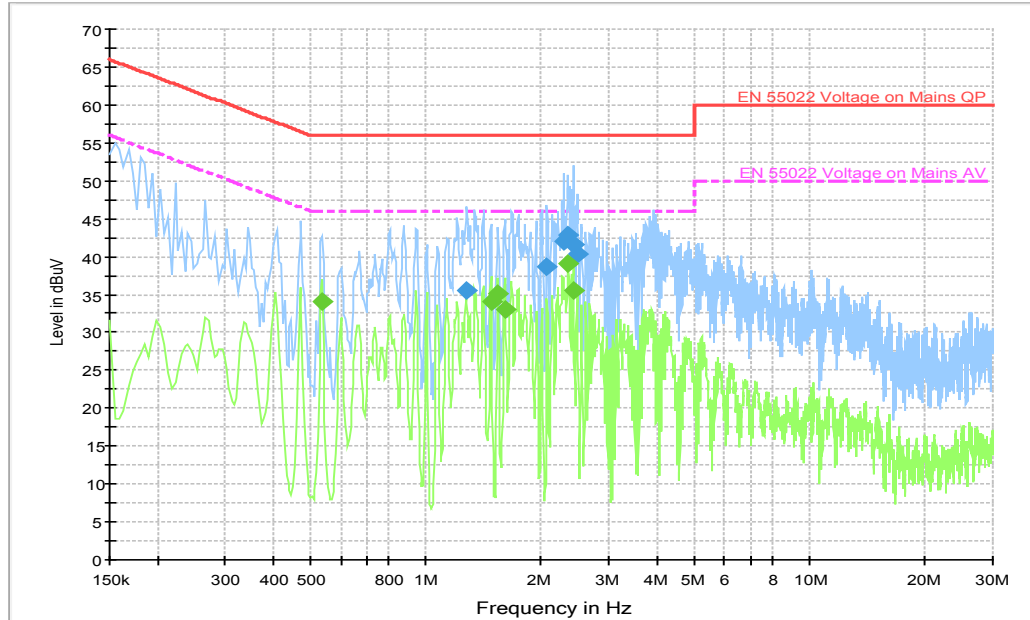


Figure A.7 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
1.279500	35.5	2000.0	9.000	GND	N	10.4	20.5	56.0
2.071500	38.7	2000.0	9.000	GND	N	10.4	17.3	56.0
2.283000	42.0	2000.0	9.000	GND	L1	10.4	14.0	56.0
2.346000	42.8	2000.0	9.000	GND	N	10.4	13.2	56.0
2.422500	41.6	2000.0	9.000	GND	N	10.4	14.4	56.0
2.485500	40.4	2000.0	9.000	GND	N	10.4	15.6	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.537000	34.2	2000.0	9.000	GND	L1	10.3	11.8	46.0
1.477500	34.1	2000.0	9.000	GND	L1	10.4	11.9	46.0
1.540500	35.0	2000.0	9.000	GND	L1	10.4	11.0	46.0
1.608000	32.9	2000.0	9.000	GND	L1	10.4	13.1	46.0
2.346000	39.0	2000.0	9.000	GND	L1	10.4	7.0	46.0
2.418000	35.6	2000.0	9.000	GND	L1	10.4	10.4	46.0

Note: The measurement results showed here are worst cases of the combinations of different USB cables.

USB Mode +MP3+GNSS, Set.2

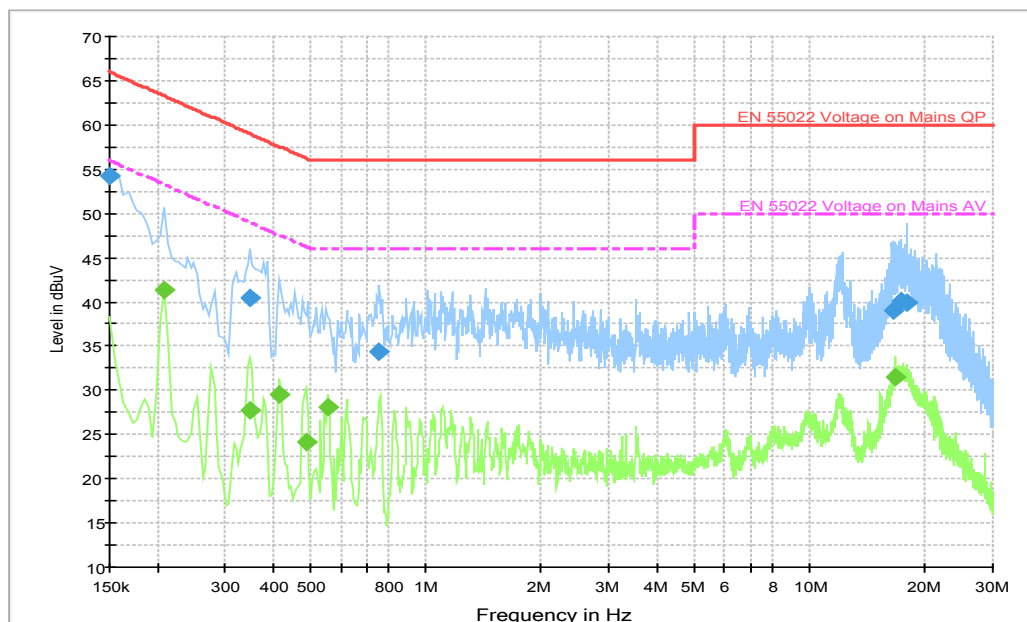


Figure A.8 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	54.2	2000.0	9.000	GND	L1	10.2	11.8	66.0
0.348000	40.5	2000.0	9.000	GND	L1	10.3	18.5	59.0
0.757500	34.3	2000.0	9.000	GND	N	10.4	21.7	56.0
16.548000	39.1	2000.0	9.000	GND	L1	11.2	20.9	60.0
17.362500	40.1	2000.0	9.000	GND	L1	11.2	19.9	60.0
17.965500	40.0	2000.0	9.000	GND	L1	11.3	20.0	60.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.208500	41.3	2000.0	9.000	GND	N	10.3	12.0	53.3
0.348000	27.7	2000.0	9.000	GND	N	10.3	21.3	49.0
0.415500	29.5	2000.0	9.000	GND	L1	10.3	18.0	47.5
0.487500	24.2	2000.0	9.000	GND	N	10.3	22.0	46.2
0.555000	28.1	2000.0	9.000	GND	L1	10.3	17.9	46.0
16.638000	31.5	2000.0	9.000	GND	L1	11.2	18.5	50.0

Note: The measurement results showed here are worst cases of the combinations of different USB cables.

ANNEX B: Persons involved in this testing

Test Item	Tester
Radiated Emission	Li Zongliang
Conducted Emission	Li Zongliang

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