

TEST REPORT

No. I19Z61557-EMC01

LG Electronics Inc.

Multi-band GSM/WCDMA/LTE phone with Bluetooth, Wlan and NFC

Model Name: LM-X540EMW

FCC ID: ZNFX540EMW

with

Issued Date: 2019-09-24

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

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I19Z61557-EMC01	Rev.0	1 st edition	2019-09-24

CONTENTS

1. TEST LABORATORY	4
1.1. INTRODUCTION & ACCREDITATION	4
1.2. TESTING LOCATION	4
1.3. TESTING ENVIRONMENT	4
1.4. PROJECT DATA	4
1.5. SIGNATURE	4
2. CLIENT INFORMATION	5
2.1. APPLICANT INFORMATION	5
2.2. MANUFACTURER INFORMATION	5
3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE)	6
3.1. ABOUT EUT	6
3.2. INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST	6
3.3. INTERNAL IDENTIFICATION OF AE USED DURING THE TEST	6
3.4. EUT SET-UPS	7
4. REFERENCE DOCUMENTS	8
4.1. REFERENCE DOCUMENTS FOR TESTING	8
5. LABORATORY ENVIRONMENT	9
6. SUMMARY OF TEST RESULTS	10
7. TEST EQUIPMENTS UTILIZED	11
ANNEX A: MEASUREMENT RESULTS	12
ANNEX B: PERSONS INVOLVED IN THIS TESTING	22

1. Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005 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 (CN0066). The detail accreditation scope can be found on NVLAP website.

1.2. Testing Location

CTTL (BDA)

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

1.3. Testing Environment

Normal Temperature: 15-35°C
Relative Humidity: 20-75%

1.4. Project data

Testing Start Date: 2019-08-20
Testing End Date: 2019-09-10

1.5. Signature



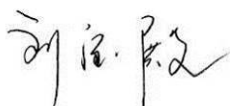
Li Yan

(Prepared this test report)



Zhang Ying

(Reviewed this test report)



Liu Baodian

Deputy Director of the laboratory
(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name: LG Electronics USA, Inc
Address /Post: 1000 Sylvan Avenue, Englewood Cliffs NJ 07632
City: /
Postal Code: /
Country: /
Telephone: /
Fax: /

2.2. Manufacturer Information

Company Name: LG Electronics Inc.
Address /Post: LG Twin Towers, 128, Yeoui-daero, Yeongdeungpo-gu
City: /
Postal Code: /
Country: /
Telephone: +82-2-6946-1675
Fax: /

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

3.1. About EUT

Description	Multi-band GSM/WCDMA/LTE phone with Bluetooth, Wlan and NFC
Model Name	LM-X540EMW
FCC ID	ZNFX540EMW
Extreme vol. Limits	3.6VDC to 4.2VDC (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*	SN or IMEI
EUT4	/

*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	Charger	/	/
AE3	USB Cable	/	/
AE4	Headset	/	/
AE1			
	Model	BL-T45	
	Manufacturer	Lishen	
	Capacitance	4000mAh	
	Nominal voltage	3.85v	
AE2			
	Model	MCS-V01WR	
	Manufacturer	Sunlin Electrocnis	
	Length of cable	/	
AE3			
	Model	DC15WB-G	
	Manufacturer	Ningbo	
	Length of cable	/	
AE4			
	Model	EMB-LGE41STGWE	
	Manufacturer	Cresyn	
	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	EUT4+ AE1 + AE2+ AE3	Charger+MP3+GNSS
Set.2	EUT4+ AE1 + AE3	USB mode

Note: The Equipment Under Test (EUT) model LM-X540EMW(FCC ID: ZNFX540EMW) is a variant model based on LM-X540BMW (FCC ID: ZNFX540HM), According to the declaration of changes provided by the applicant and FCC KDB publication 484596 D01; all results are cited from the initial model. The report number for initial model is I19Z61530-EMC01.

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
	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	BR	CTTL(BDA)
2	Conducted Emission	15.107(a)	A.2	BR	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	2020-03-20	1 year
3	Universal Radio Communication Tester	CMW500	127406	R&S	2020-01-19	1 year
4	LISN	ENV216	101459	R&S	2020-04-10	1 year
5	EMI Antenna	VULB9163	9163-514	Schwarzbeck	2020-02-03	1 year
6	EMI Antenna	3117	00139065	ETS-Lindgren	2019-10-15	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 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/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:

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

Where

G_A : Antenna factor of receive antenna

G_{PL} : Path Loss

P_{Mea} : Measurement result on receiver.

Measurement uncertainty (worst case): 30MHz-1GHz: 5.40dB, 1GHz-18GHz: 4.32dB, $k=2$.

Measurement results for Set.1:

Charging 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)
17108.000	38.64	-26.0	41.6	23.06	54.0	15.4	H
17088.500	38.54	-26.1	41.6	23.07	54.0	15.5	H
17082.500	38.52	-26.2	41.6	23.07	54.0	15.5	V
17095.500	38.50	-26.1	41.6	22.99	54.0	15.5	V
17123.000	38.50	-26.0	41.6	22.94	54.0	15.5	V
17978.000	38.49	-25.9	41.3	23.05	54.0	15.5	V

Charging +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)
17119.500	51.1	-26.0	41.6	35.51	74.0	22.9	V
16698.500	50.8	-26.7	41.5	36.03	74.0	23.2	V
17116.000	50.7	-26.0	41.6	35.13	74.0	23.3	V
17098.500	50.5	-26.1	41.6	34.97	74.0	23.5	H
17091.000	50.4	-26.1	41.6	34.90	74.0	23.6	V
17126.000	50.4	-26.0	41.6	34.84	74.0	23.6	H

Measurement results for Set.2:
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)
17090.500	38.61	-26.1	41.6	23.13	54.0	15.4	V
17114.000	38.49	-26.0	41.6	22.88	54.0	15.5	V
17121.500	38.48	-26.0	41.6	22.91	54.0	15.5	V
17097.000	38.48	-26.1	41.6	22.96	54.0	15.5	H
17113.500	38.44	-26.0	41.6	22.83	54.0	15.6	H
17107.000	38.42	-26.0	41.6	22.84	54.0	15.6	H

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)
17093.000	51.23	-26.1	41.6	35.73	74.0	22.8	H
17501.500	51.22	-26.3	41.2	36.35	74.0	22.8	H
16615.000	50.73	-26.5	41.4	35.88	74.0	23.3	V
17942.500	50.63	-26.0	41.3	35.34	74.0	23.4	H
16756.500	50.55	-26.7	41.5	35.77	74.0	23.4	V
17122.000	50.43	-26.0	41.6	34.86	74.0	23.6	H

Charging Mode+MP3+GNSS, Set.1

15B RE 30MHz-1GHz

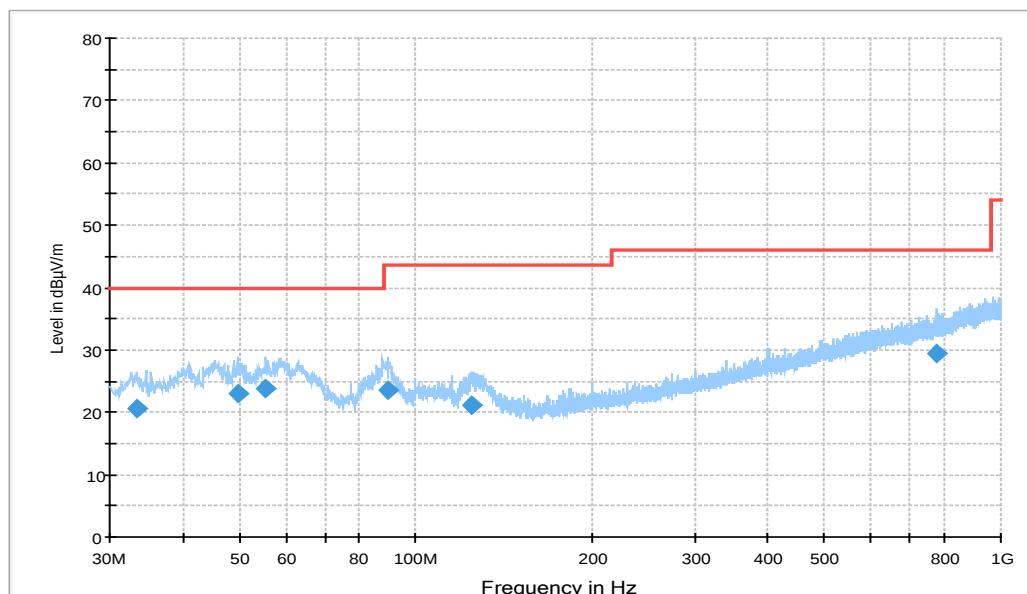


Figure A.1 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
33.298000	20.7	100.0	V	100.0	-0.4	19.3	40.0
49.594000	23.0	100.0	V	65.0	0.9	17.0	40.0
55.511000	23.8	100.0	V	102.0	0.4	16.2	40.0
89.461000	23.6	100.0	V	193.0	-3.2	19.9	43.5
124.47800	21.3	100.0	V	17.0	-3.4	22.2	43.5
775.44500	29.5	100.0	V	45.0	10.9	16.5	46.0

15B RE - 1GHz-3GHz

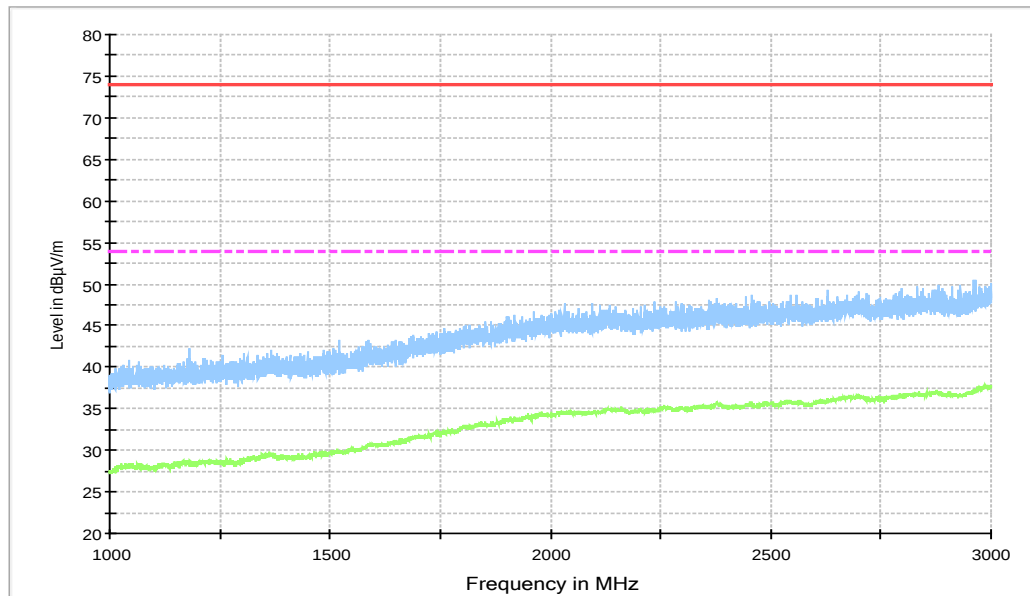


Figure A.2 Radiated Emission from 1GHz to 3GHz

RE - 3GHz-18GHz

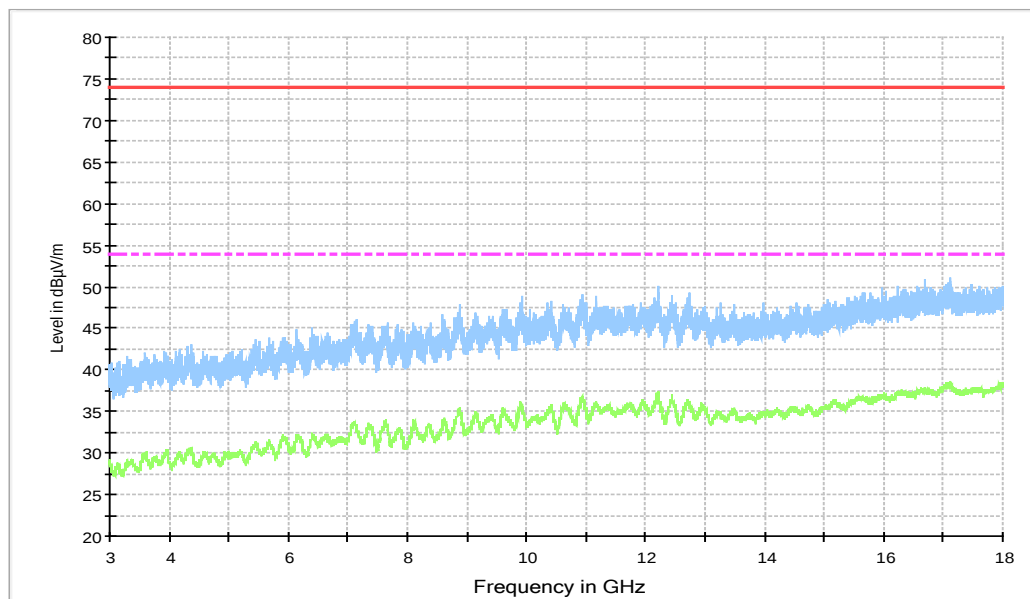


Figure A.3 Radiated Emission from 3GHz to 18GHz

USB Mode, Set.2

15B RE 30MHz-1GHz

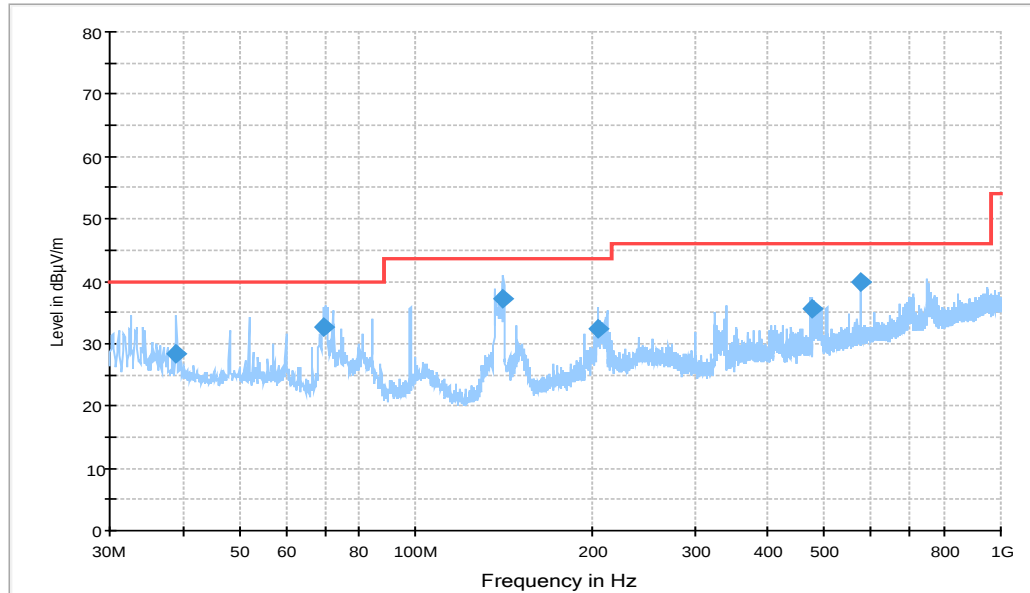


Figure A.4 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
39.021000	28.4	100.0	V	232.0	0.4	11.6	40.0
69.770000	32.8	100.0	V	97.0	-4.2	7.2	40.0
141.35600	37.2	100.0	V	135.0	-4.5	6.3	43.5
204.60000	32.4	119.0	H	183.0	-1.3	11.1	43.5
477.17000	35.6	100.0	V	152.0	6.7	10.4	46.0
576.01300	39.8	100.0	H	225.0	8.7	6.2	46.0

15B RE - 1GHz-3GHz

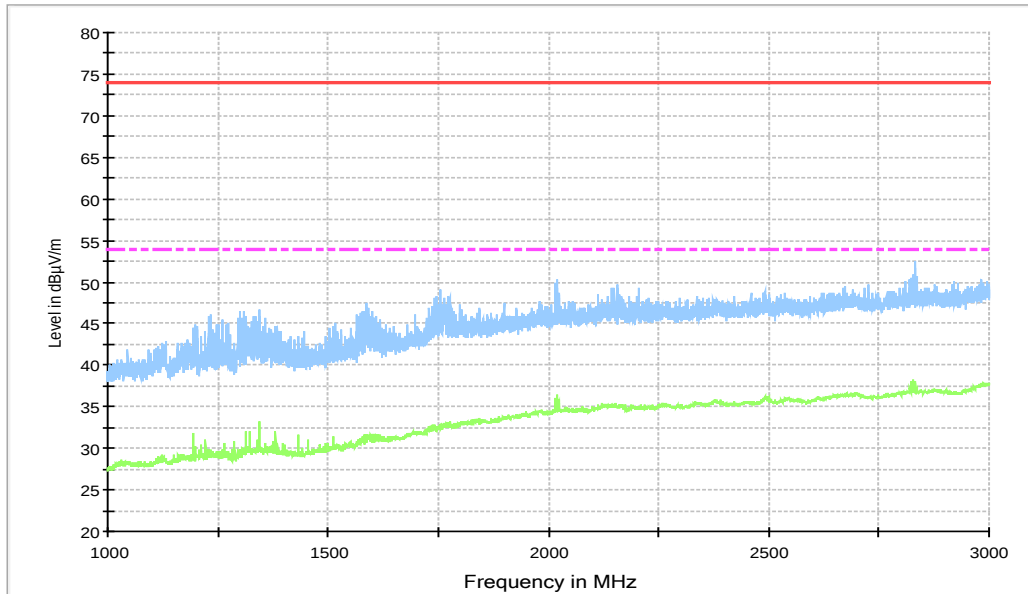


Figure A.5 Radiated Emission from 1GHz to 3GHz

RE - 3GHz-18GHz

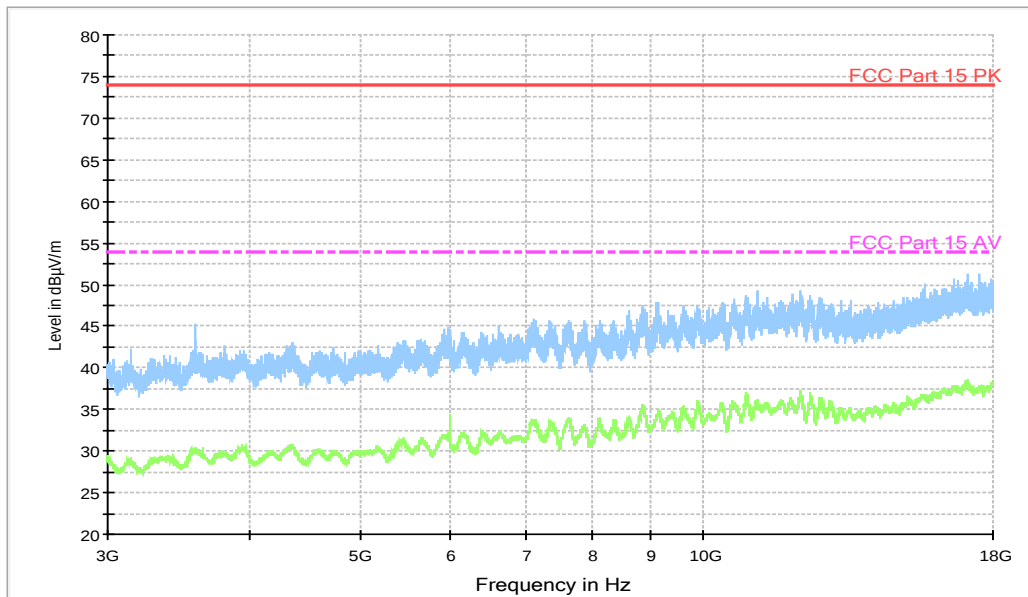


Figure A.6 Radiated Emission from 3GHz to 18GHz

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 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: $U= 3.10$ dB, $k=2$.

Charging Mode+MP3+GNSS, Set.1

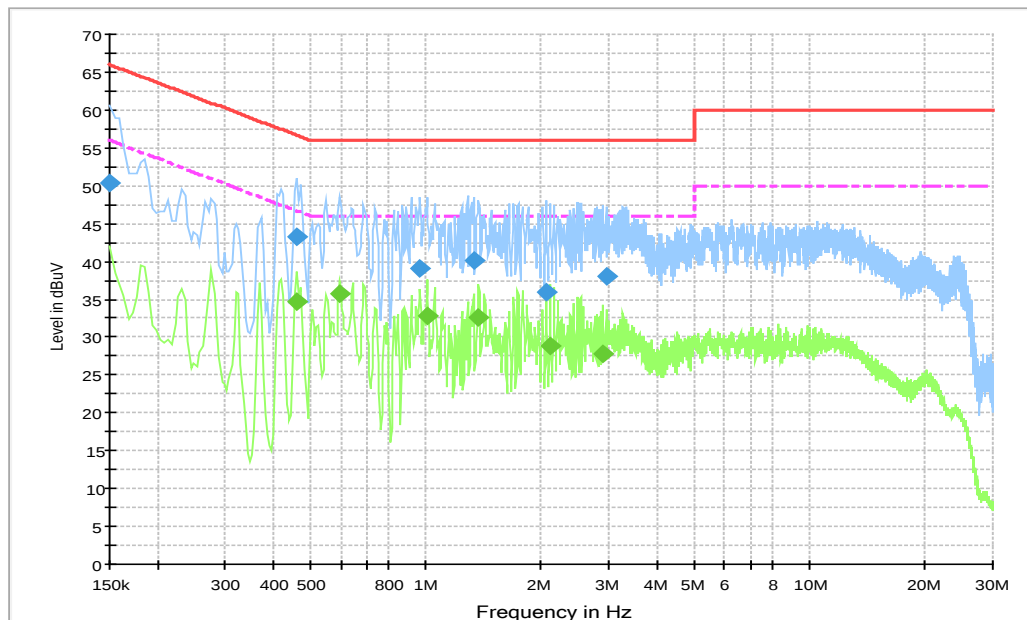


Figure A.7 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	50.3	10000.0	9.000	On	L1	28.9	15.7	66.0
0.460500	43.3	10000.0	9.000	On	L1	20.0	13.4	56.7
0.964500	39.1	10000.0	9.000	On	N	19.9	16.9	56.0
1.329000	40.2	10000.0	9.000	On	N	19.8	15.8	56.0
2.062500	35.9	10000.0	9.000	On	L1	19.8	20.1	56.0
2.949000	38.0	10000.0	9.000	On	N	19.8	18.0	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.460500	34.6	10000.0	9.000	On	L1	20.0	12.0	46.7
0.595500	35.7	10000.0	9.000	On	L1	20.0	10.3	46.0
1.009500	32.9	10000.0	9.000	On	L1	19.8	13.1	46.0
1.374000	32.5	10000.0	9.000	On	L1	19.8	13.5	46.0
2.107500	28.9	10000.0	9.000	On	L1	19.8	17.1	46.0
2.899500	27.8	10000.0	9.000	On	L1	19.8	18.2	46.0

USB Mode, Set.2

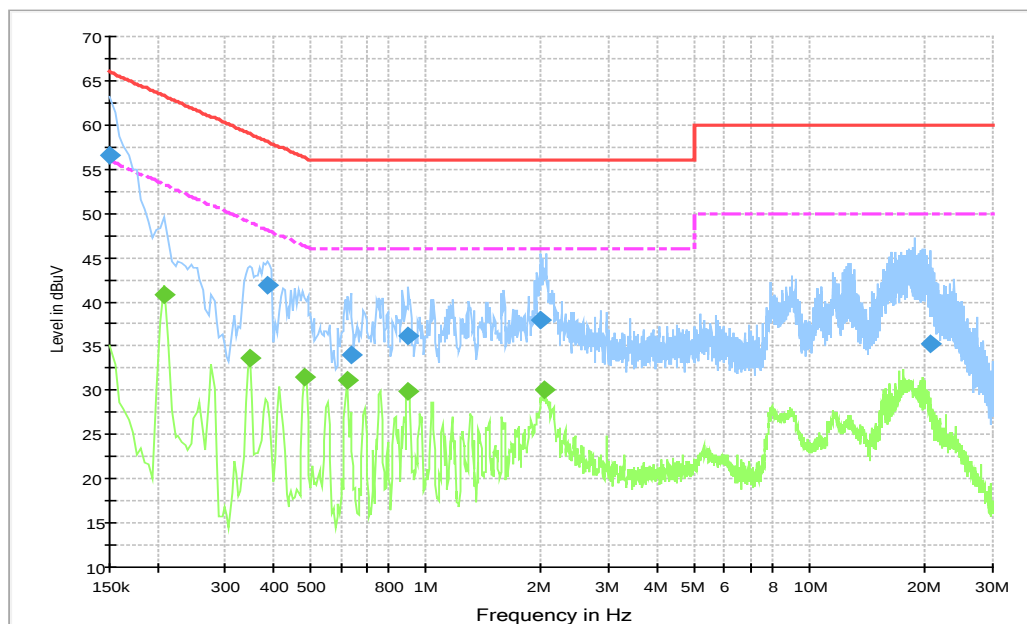


Figure A.8 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	56.6	10000.0	9.000	On	N	28.9	9.4	66.0
0.388500	41.8	10000.0	9.000	On	L1	20.0	16.3	58.1
0.636000	34.0	10000.0	9.000	On	N	20.0	22.0	56.0
0.901500	36.1	10000.0	9.000	On	N	19.9	19.9	56.0
1.999500	37.9	10000.0	9.000	On	N	19.8	18.1	56.0
20.607000	35.3	10000.0	9.000	On	N	20.1	24.7	60.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.208500	40.9	10000.0	9.000	On	N	19.9	12.4	53.3
0.348000	33.6	10000.0	9.000	On	N	20.0	15.5	49.0
0.483000	31.5	10000.0	9.000	On	N	20.0	14.8	46.3
0.622500	31.1	10000.0	9.000	On	N	20.0	14.9	46.0
0.901500	29.9	10000.0	9.000	On	N	19.9	16.1	46.0
2.031000	30.1	10000.0	9.000	On	N	19.8	15.9	46.0

ANNEX B: Persons involved in this testing

Test Item	Tester
Radiated Emission	Li Zongliang
Conducted Emission	Guo Qian

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