TEST REPORT

No. I18Z60490-EMC01

for

LG Electronics MobileComm USA, Inc.

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

Model Name:

LM-X410FC,LMX410FC,X410FC;LM-X410FO,LMX410FO,X410FO

FCC ID: ZNFX410FC

with

Hardware Version: Rev.1.0

Software Version: V09p

Issued Date: 2018-04-20

TESTING
NVLAP LAB CODE 600118-0

Note:

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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
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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I18Z60490-EMC01	Rev.0	1st edition	2018-04-20

CONTENTS

1. Test Laboratory

1.1. Testing Location

Location1: CTTL(huayuan North Road)

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

Location2: 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: 2018-03-24

Testing End Date: 2018-04-11

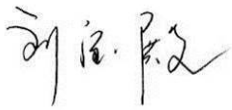
1.4. Signature

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 MobileComm USA, Inc.
Address /Post:	1000 Sylvan Avenue, Englewood Cliffs NJ 07632
City:	Englewood
Postal Code:	/
Country:	U.S.A
Telephone:	/
Fax:	/

2.2. Manufacturer Information

Company Name:	LG Electronics Inc.
Address /Post:	LG Twin Tower 20, Yeouido-dong, Yeongdeungpo-gu Seoul, Korea 150-721
City:	Seoul
Postal Code:	/
Country:	Korea
Telephone:	/
Fax:	/

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

3.1. About EUT

Description	Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN
Model Name	LM-X410FC,LMX410FC,X410FC;LM-X410FO,LMX410FO,X410FO
FCC ID	ZNFX410FC
Extreme vol. Limits	3.6VDC to 4.2VDC (nominal: 3.8VDC)

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
EUT2	/	Rev.1.0	V09p

*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	USB cable	/	/

AE1

Model	BL-T36
Manufacturer	Shenzhen BYD Lithium Battery Company Limited
Capacitance	3000mAh
Nominal voltage	3.85V

AE2

Model	BL-T36
Manufacturer	TOCAD
Capacitance	3000mAh
Nominal voltage	3.85V

AE3

Model	EAY62768908
Manufacturer	Sunlin Electronics Co.,Ltd.
Length of cable	/

AE4

Model	EAD62377927
Manufacturer	/
Length of cable	/

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

Note: The USB cables are shielded.

3.4. EUT set-ups

EUT set-up No.	Combination of EUT and AE	Remarks
Set.1	EUT2+AE1/ AE2+AE3+AE4	Charger
Set.2	EUT2+AE1/ AE2+AE4	USB mode

Note: Multi-band GSM/WCDMA/LTE phone with Bluetooth,WLAN LM-X410FC,LMX410FC, X410FC;LM-X410FO,LMX410FO,X410FO manufactured by LG Electronics MobileComm USA, Inc. is a variant model based on LM-X410HC,LMX410HC,X410HC;LM-X410RC,LMX410RC, X410RC for conformance test. According to the declaration of changes, no test needs to been performed, all results are cited from the initial model. The report number for initial model is I18Z60356-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×17meters×10meters) 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, 10 m 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 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(huayuan North Road)

7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE	CALIBRATION INTERVAL
1	Test Receiver	ESU26	100376	R&S	2018-12-17	1 year
2	Test Receiver	ESCI 7	100344	R&S	2019-02-28	1 year
3	Universal Radio Communication Tester	CMW500	116588	R&S	2018-11-26	1 year
4	Universal Radio Communication Tester	CMW500	159408	R&S	2019-04-12	1 year
5	LISN	ENV216	101200	R&S	2018-07-04	1 year
6	EMI Antenna	VULB9163	9163-514	Schwarzbeck	2020-02-03	3 years
7	EMI Antenna	3117	00139065	ETS-Lindgren	2020-11-15	3 years
8	PC	OPTIPLEX 380	2X1YV2X	DELL	N/A	N/A
9	Printer	P1606dn	VNC3L52122	HP	N/A	N/A
10	Keyboard	L100	CN0RH659658907ATOI40	DELL	N/A	N/A
11	Mouse	M-UAE119	LZ935220ZRC	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. The model of the PC is DELL OPTIPLEX 380, and the serial number of the PC is 2X1YV2X. 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/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:

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：4.86dB, 1GHz-18GHz：5.26dB, *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)
17948.250	39.2	-25.2	41.4	23.04	54.0	14.8	H
17960.250	39.2	-25.1	41.4	22.97	54.0	14.8	H
17954.250	39.2	-25.2	41.4	22.94	54.0	14.8	V
17964.000	39.2	-25.1	41.4	22.87	54.0	14.8	V
17957.250	39.1	-25.2	41.4	22.89	54.0	14.9	V
17961.000	39.1	-25.1	41.4	22.86	54.0	14.9	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)
17940.000	51.8	-25.3	41.4	35.67	74.0	22.2	H
17945.250	51.8	-25.2	41.4	35.61	74.0	22.2	V
17052.000	51.7	-26.0	41.8	36.00	74.0	22.3	V
17007.000	51.4	-25.9	41.8	35.49	74.0	22.6	V
17972.250	51.3	-25.1	41.4	35.01	74.0	22.7	H
17906.250	51.3	-25.5	41.4	35.38	74.0	22.7	V

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)
17946.750	39.2	-25.2	41.4	22.97	54.0	14.8	H
17955.750	39.1	-25.2	41.4	22.88	54.0	14.9	V
17968.500	39.1	-25.1	41.4	22.78	54.0	14.9	V
17963.250	39.1	-25.1	41.4	22.81	54.0	14.9	V
17947.500	39.1	-25.2	41.4	22.89	54.0	14.9	H
17945.250	39.1	-25.2	41.4	22.89	54.0	14.9	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)
16929.000	51.7	-25.8	41.8	35.77	74.0	22.3	V
17018.250	51.7	-26.0	41.8	35.85	74.0	22.3	H
17656.500	51.5	-25.3	41.5	35.36	74.0	22.5	V
16696.500	51.5	-25.9	41.6	35.76	74.0	22.5	H
17116.500	51.5	-26.2	41.7	35.93	74.0	22.5	V
17133.750	51.4	-26.2	41.7	35.90	74.0	22.6	H

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

Charging Mode, Set.1

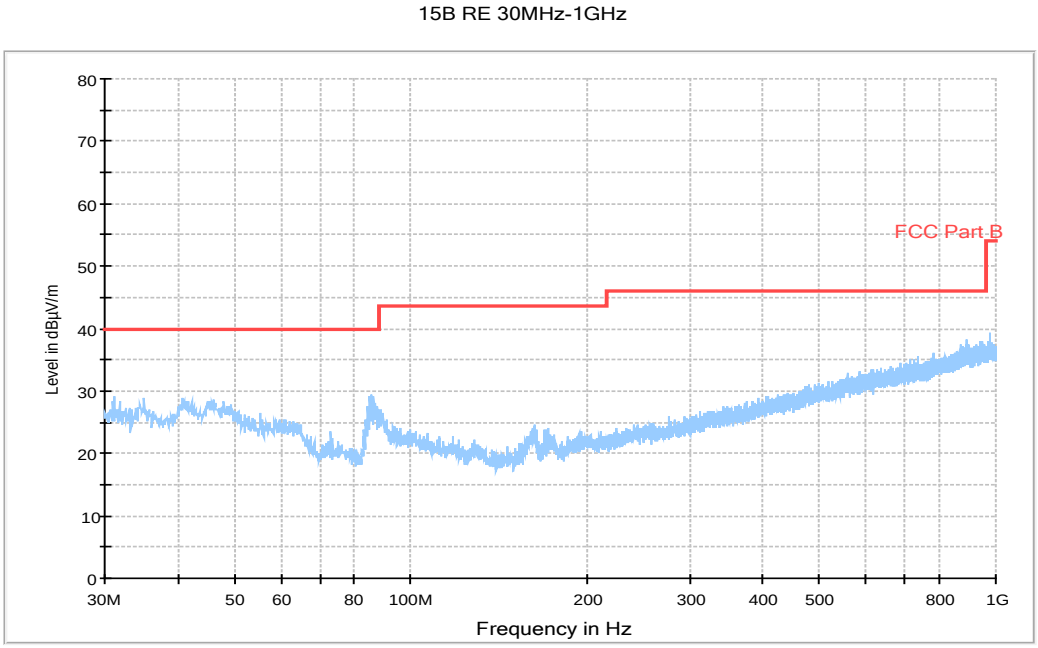


Figure A.1 Radiated Emission from 30MHz to 1GHz

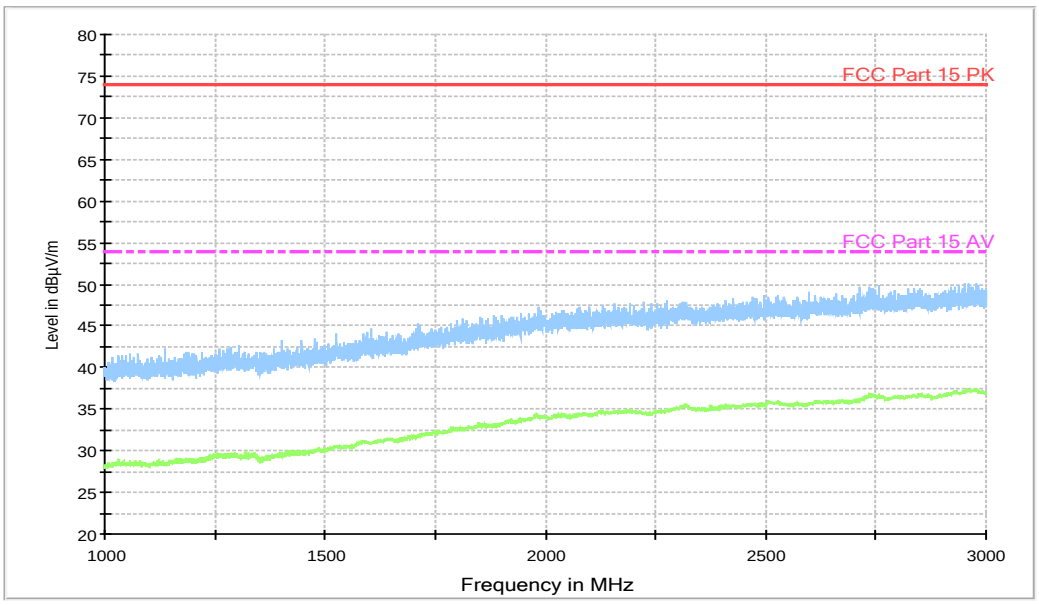


Figure A.2 Radiated Emission from 1GHz to 3GHz

15b RE - 3GHz-18GHz

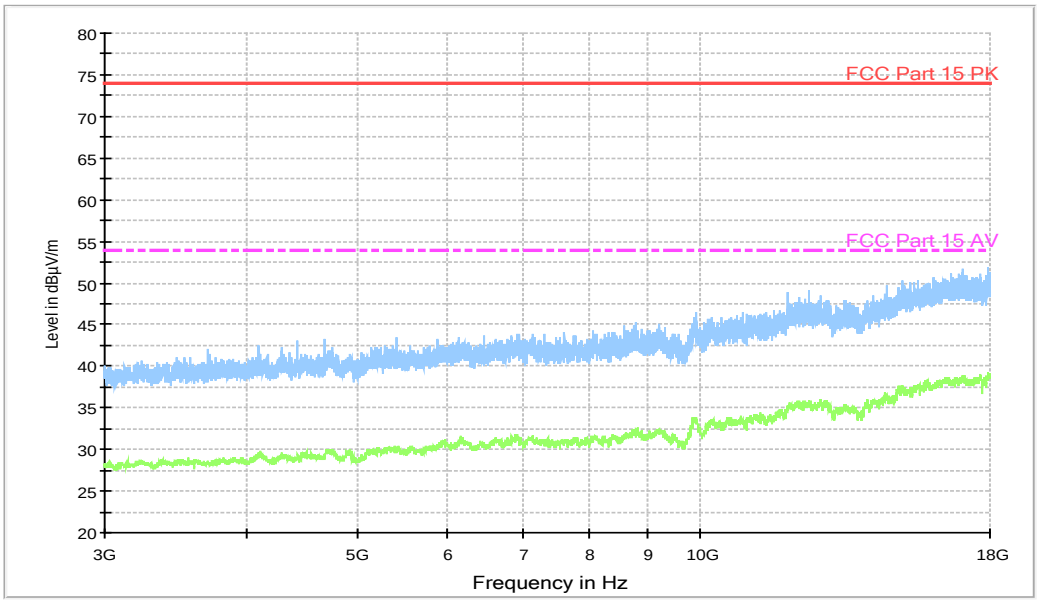


Figure A.3 Radiated Emission from 3GHz to 18GHz

USB Mode, Set.2

15B RE 30MHz-1GHz

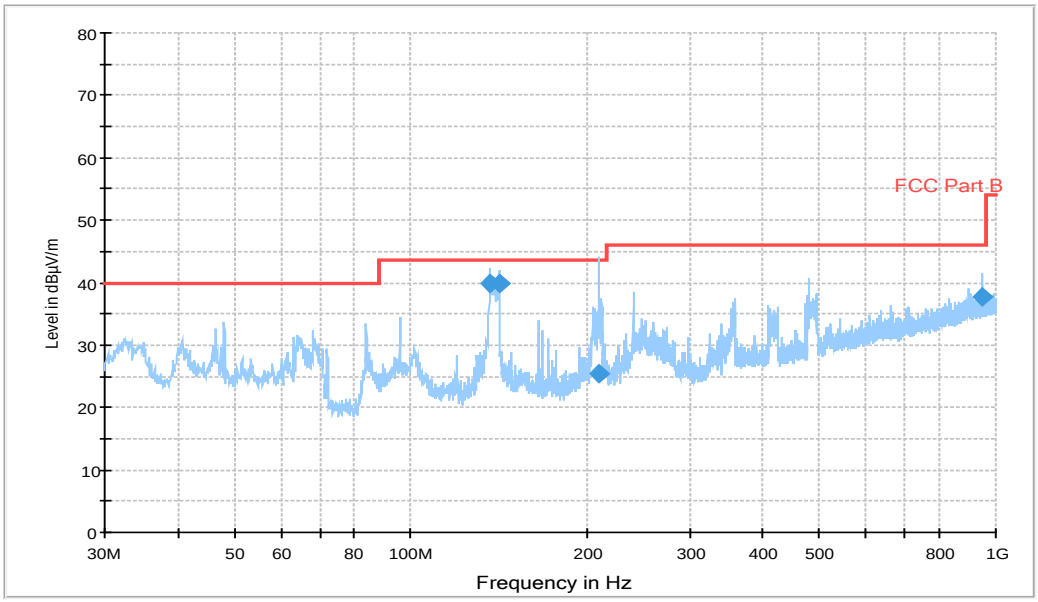


Figure A.4 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
136.40900	39.8	125.0	H	49.0	-4.4	3.7	43.5
141.45300	39.8	125.0	H	49.0	-4.7	3.7	43.5
209.35300	25.3	125.0	V	281.0	-1.4	18.2	43.5
949.36600	37.8	100.0	H	87.0	13.1	8.2	46.0

15B RE - 1GHz-3GHz

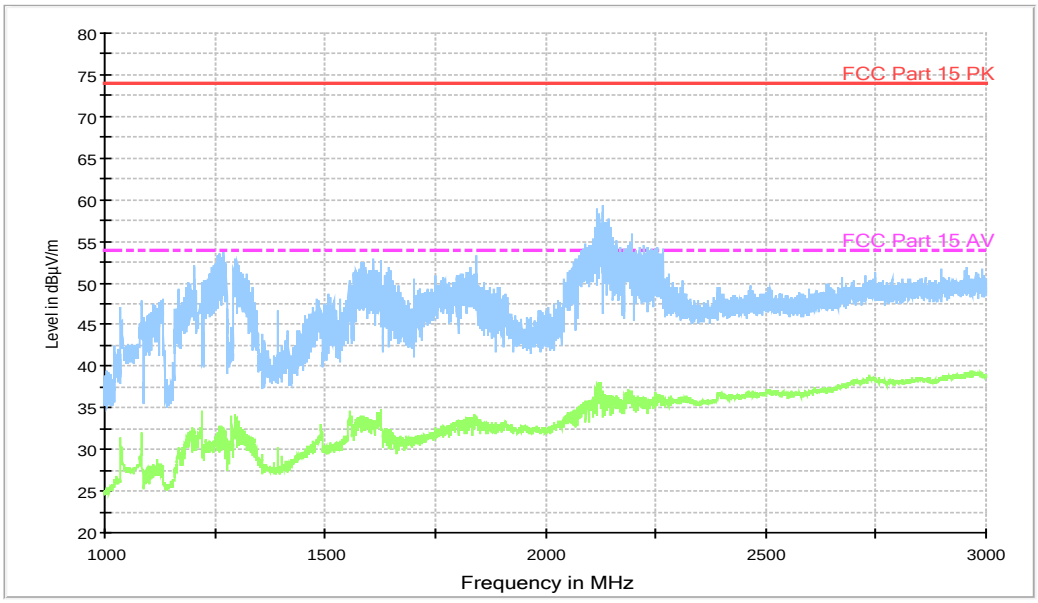


Figure A.5 Radiated Emission from 1GHz to 3GHz

15b RE - 3GHz-18GHz

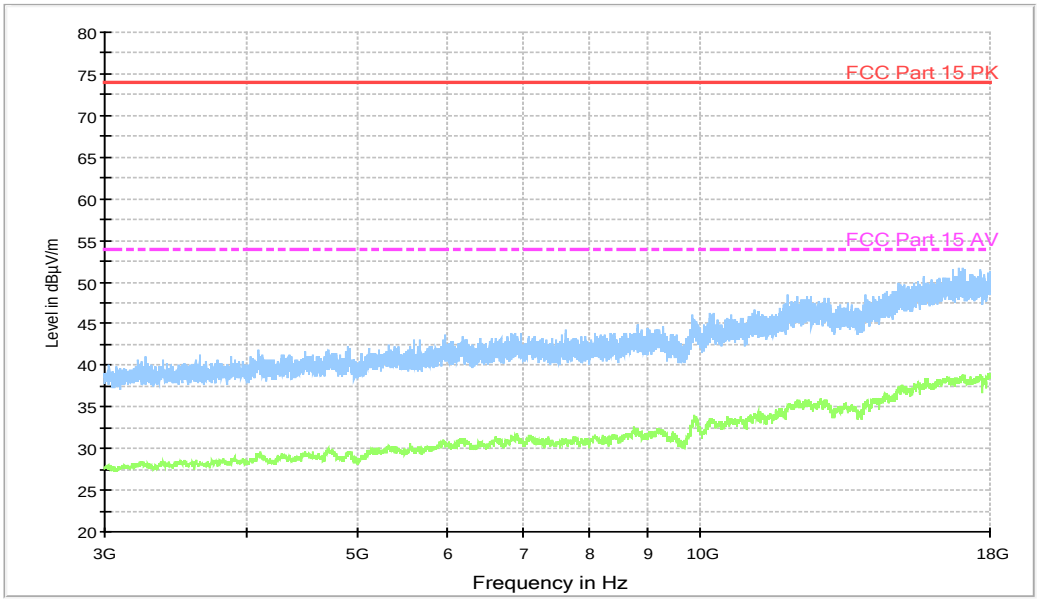


Figure A.6 Radiated Emission from 3GHz to 18GHz

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. The model of the PC is DELL OPTIPLEX 380, and the serial number of the PC is 2X1YV2X. 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*= 2.9 dB, *k*=2.

Charging Mode, Set.1

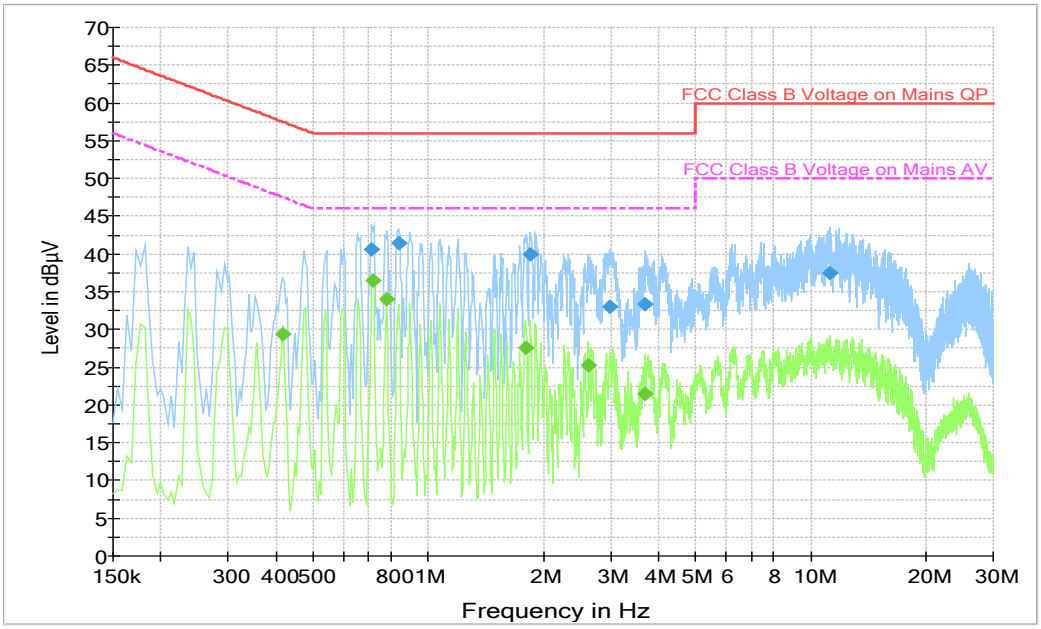


Figure A.5 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.712500	40.6	2000.0	9.000	On	L1	19.8	15.4
0.834000	41.4	2000.0	9.000	On	L1	19.7	14.6
1.855500	39.9	2000.0	9.000	On	L1	19.7	16.1
2.971500	33.0	2000.0	9.000	On	L1	19.7	23.0
3.687000	33.3	2000.0	9.000	On	L1	19.6	22.7
11.206500	37.4	2000.0	9.000	On	L1	19.9	22.6

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.415500	29.4	2000.0	9.000	On	L1	19.9	18.1
0.717000	36.5	2000.0	9.000	On	L1	19.8	9.5
0.775500	34.0	2000.0	9.000	On	L1	19.7	12.0
1.792500	27.5	2000.0	9.000	On	L1	19.7	18.5
2.625000	25.3	2000.0	9.000	On	L1	19.7	20.7
3.687000	21.4	2000.0	9.000	On	L1	19.6	24.6

USB Mode, Set.2

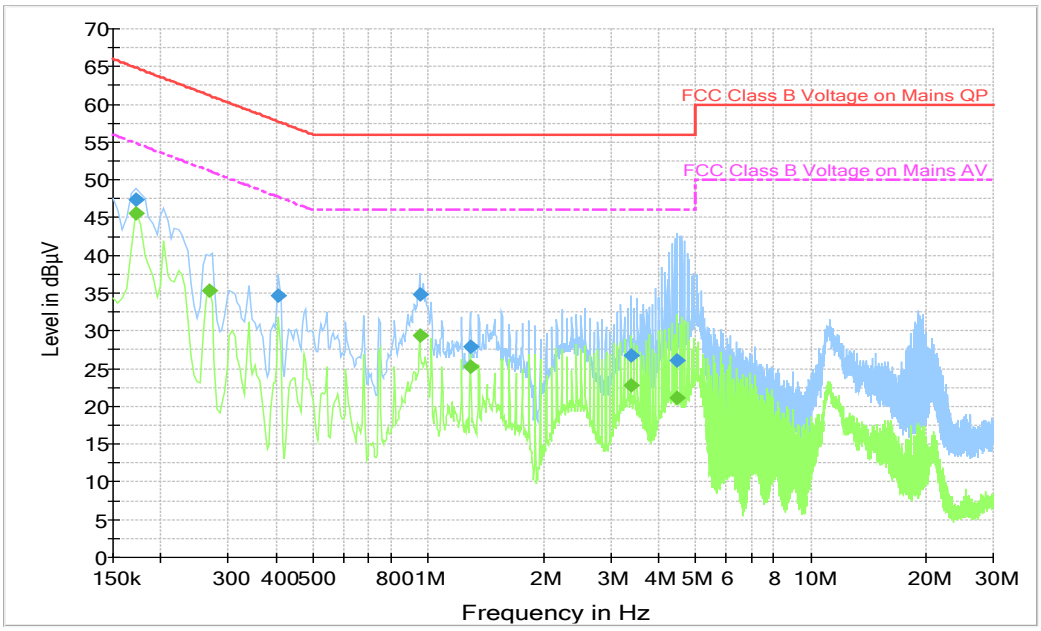


Figure A.6 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.172500	47.4	2000.0	9.000	On	N	19.8	17.5
0.406500	34.6	2000.0	9.000	On	N	19.9	23.1
0.951000	34.9	2000.0	9.000	On	N	19.7	21.1
1.288500	27.8	2000.0	9.000	On	N	19.6	28.2
3.394500	26.7	2000.0	9.000	On	N	19.7	29.3
4.479000	26.1	2000.0	9.000	On	N	19.7	29.9

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.172500	45.6	2000.0	9.000	On	N	19.8	9.2
0.267000	35.3	2000.0	9.000	On	L1	19.8	15.9
0.951000	29.4	2000.0	9.000	On	N	19.7	16.6
1.288500	25.3	2000.0	9.000	On	N	19.6	20.7
3.394500	22.8	2000.0	9.000	On	N	19.7	23.2
4.479000	21.1	2000.0	9.000	On	N	19.7	24.9

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