



# TEST REPORT

## No. I18Z60435-EMC01

for

**LG Electronics MobileComm USA, Inc.**

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

**Model Name:**

**LM-X410HT, LMX410HT, X410HT; LM-X410RT, LMX410RT, X410RT**

**FCC ID: ZNFX410HT**

with

**Hardware Version: Rev.1.0**

**Software Version: V09p**

**Issued Date: 2018-04-13**



**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

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I18Z60435-EMC01	Rev.0	1 <sup>st</sup> edition	2018-04-13

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## **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

### **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**



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Li Yan

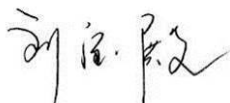
(Prepared this test report)



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Zhang Ying

(Reviewed this test report)



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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-X410HT,LMX410HT,X410HT;LM-X410RT,LMX410RT,X410RT
FCC ID	ZNFX410HT
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, Academy of Telecommunication Research, MIIT.

#### **3.2. Internal Identification of EUT used during the test**

EUT ID*	SN or IMEI	HW Version	SW Version
EUT2	355673090002689	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+AE3+AE4	Charger
Set.2	EUT2+AE1+AE4	USB mode



## **4. Reference Documents**

### **4.1. Reference Documents for testing**

The following documents listed in this section are referred for testing.

<b>Reference</b>	<b>Title</b>	<b>Version</b>
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(huayuan North Road)
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	100235	R&S	2019-02-28	1 year
2	Test Receiver	ESU26	100376	R&S	2019-02-28	1 year
3	Test Receiver	ESCI 7	100344	R&S	2019-02-28	1 year
4	Universal Radio Communication Tester	CMW500	116588	R&S	2018-11-26	1 year
5	LISN	ENV216	101200	R&S	2018-08-03	1 year
6	EMI Antenna	VULB9163	9163-301	Schwarzbeck	2019-02-03	3 years
7	EMI Antenna	3115	00167250	ETS-Lindgren	2020-05-21	3 years
8	PC	OPTIPLEX 380	2X1YV2X	DELL	N/A	N/A
9	Printer	P1606dn	VNC3L52122	HP	N/A	N/A
10	Keyboard	L100	CN0RH6596589 07ATOI40	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 10 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 ( $\mu\text{V/m}$ )		
	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

$G_{\text{PL}}$ : Path Loss

$P_{\text{Mea}}$ : 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)	Result(dB $\mu$ V/m)	$G_{\text{PL}}$ (dB)	$G_A$ (dB/m)	$P_{\text{Mea}}$ (dB $\mu$ V)	Polarity
17884.967	47.4	-18.5	45.6	20.300	H
17386.867	47.3	-19.5	41.5	25.300	H
17858.333	47.3	-18.5	45.6	20.200	V
17904.233	47.3	-18.5	45.6	20.200	H
17912.167	47.3	-18.5	45.6	20.200	H
17458.833	47.3	-19.2	41.5	25.000	H

#### Charging Mode/Peak detector

Frequency(MHz)	Result(dB $\mu$ V/m)	$G_{\text{PL}}$ (dB)	$G_A$ (dB/m)	$P_{\text{Mea}}$ (dB $\mu$ V)	Polarity
17781.267	59.8	-18.5	45.6	32.700	H
17696.267	59.1	-18.9	45.6	32.400	H
17882.700	59.1	-18.5	45.6	32.000	V
17853.800	59.0	-18.5	45.6	31.900	H
17476.967	59.0	-19.2	41.5	36.700	H
17499.067	58.9	-19.2	41.5	36.600	H

**Measurement results for Set.2:****USB Mode/Average detector**

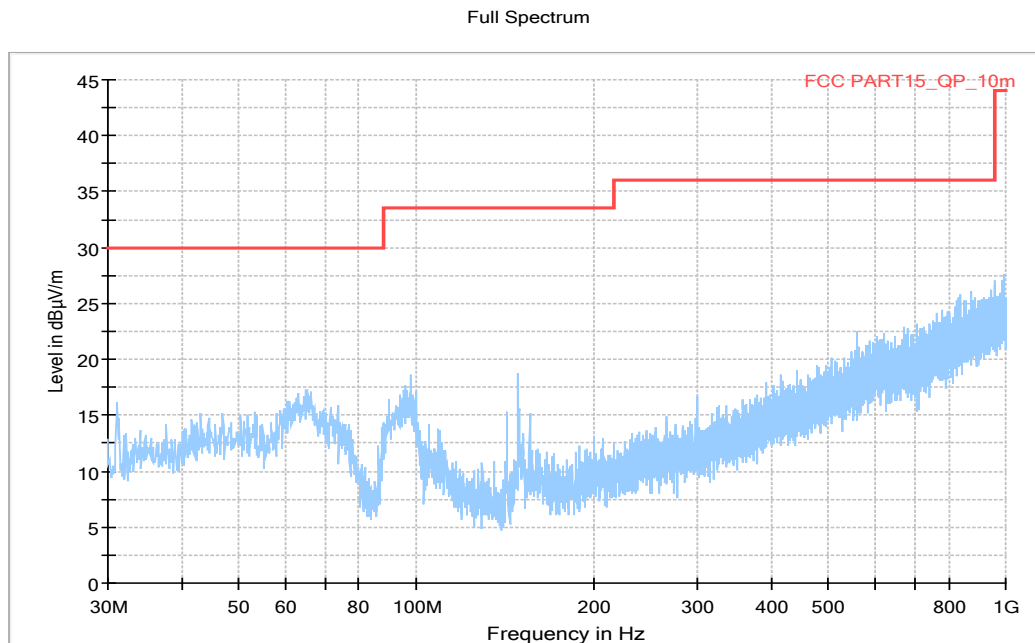
Frequency(MHz)	Result(dB $\mu$ V/m)	G <sub>PL</sub> (dB)	G <sub>A</sub> (dB/m)	P <sub>Mea</sub> (dB $\mu$ V)	Polarity
2250.067	41.2	-38.1	27.7	51.600	H
17847.567	37.8	-18.5	45.6	10.700	H
17877.033	37.7	-18.5	45.6	10.600	V
17879.300	37.6	-18.5	45.6	10.500	H
17900.267	37.5	-18.5	45.6	10.400	H
17896.300	37.5	-18.5	45.6	10.400	H

**USB Mode/Peak detector**

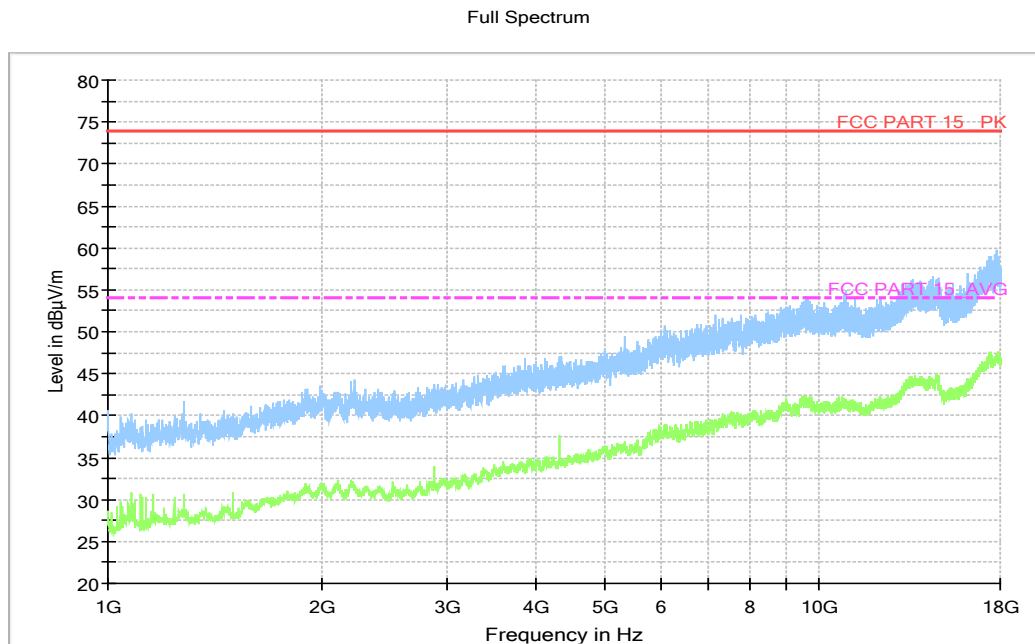
Frequency(MHz)	Result(dB $\mu$ V/m)	G <sub>PL</sub> (dB)	G <sub>A</sub> (dB/m)	P <sub>Mea</sub> (dB $\mu$ V)	Polarity
17876.467	49.9	-18.5	45.6	22.800	H
17154.533	49.1	-19.8	41.5	27.400	H
17697.967	49.1	-18.9	45.6	22.400	V
17645.833	48.9	-18.9	45.6	22.200	H
17492.833	48.8	-19.2	41.5	26.500	H
17679.833	48.8	-18.9	45.6	22.100	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**

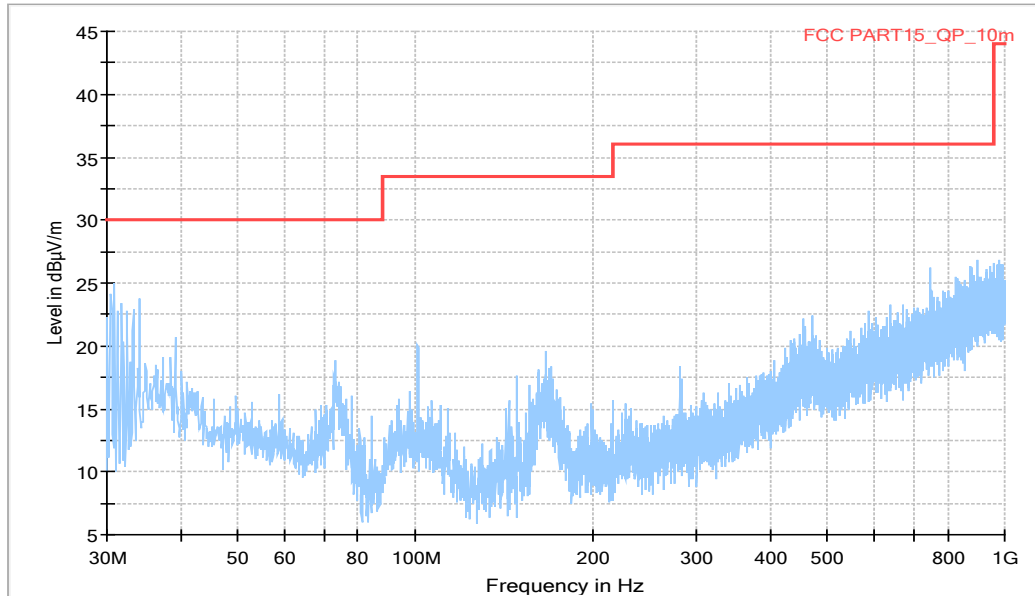


**Figure A.2 Radiated Emission from 1GHz to 18GHz**



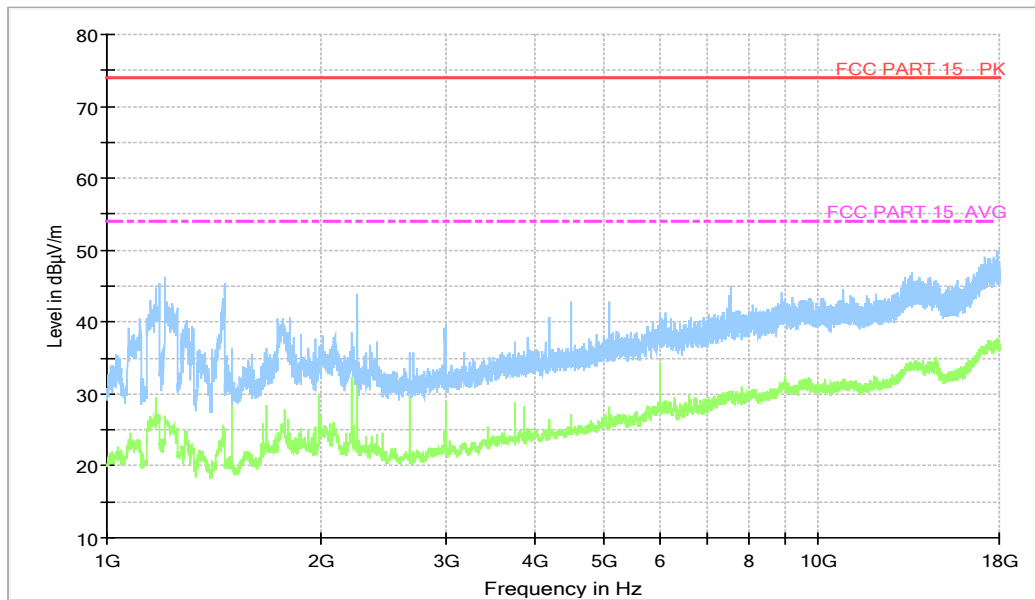
## USB Mode, Set.2

Full Spectrum



**Figure A.3 Radiated Emission from 30MHz to 1GHz**

Full Spectrum



**Figure A.4 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 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:  $U = 2.9 \text{ dB}$ ,  $k=2$ .

### Charging Mode, Set.1

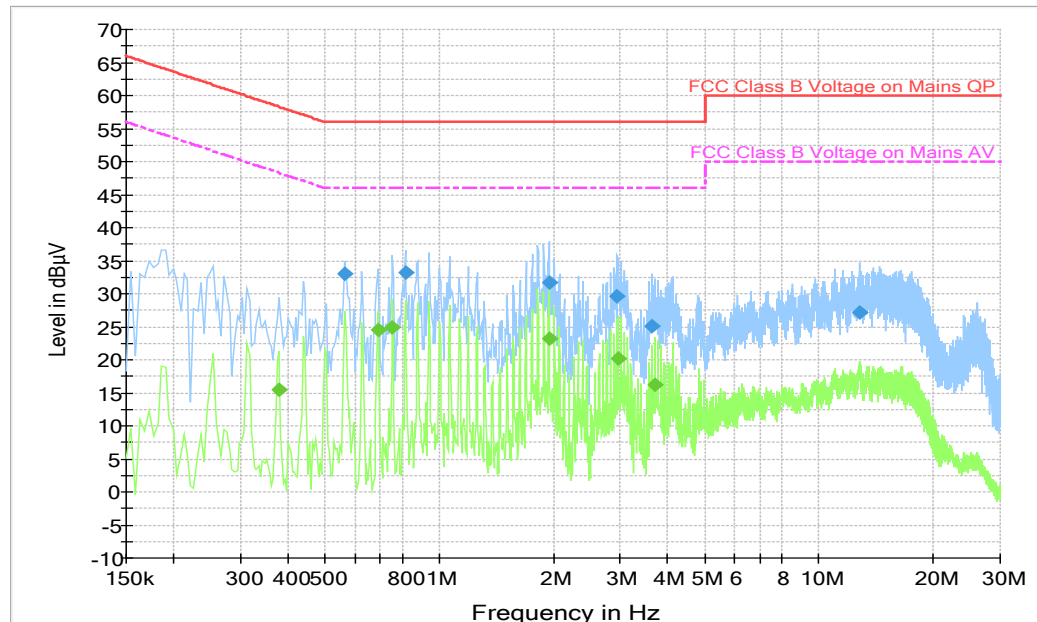


Figure A.5 Conducted Emission

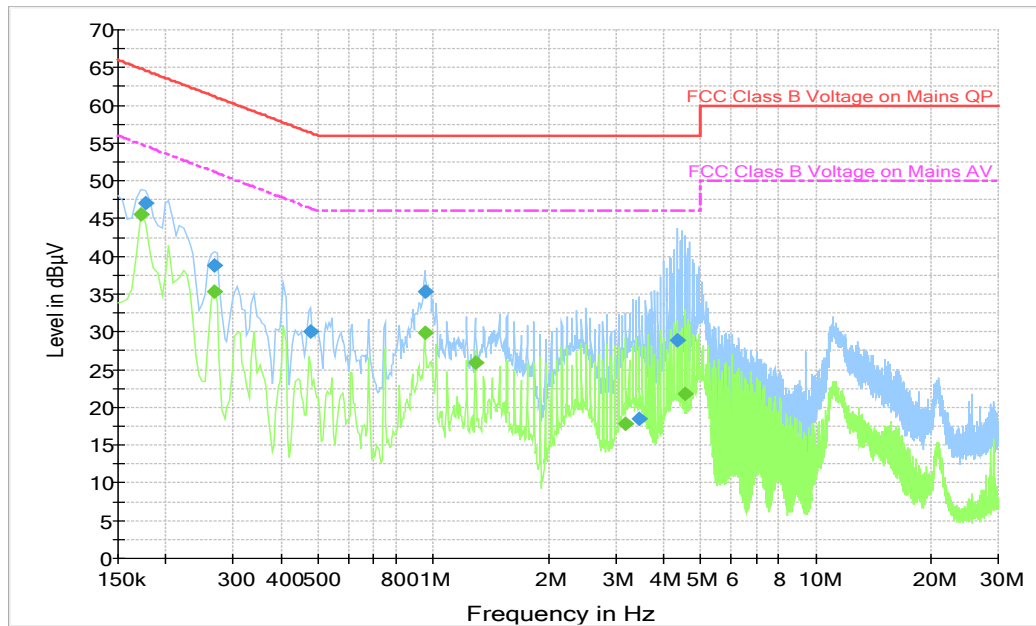
#### Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.564000	33.0	GND	L1	10.0	23.0	56.0
0.816000	33.1	GND	L1	10.0	22.9	56.0
1.945500	31.7	GND	L1	10.1	24.3	56.0
2.944500	29.7	GND	L1	10.1	26.3	56.0
3.642000	25.0	GND	L1	10.1	31.0	56.0
12.826500	27.2	GND	L1	10.5	32.8	60.0

#### Final Result 2

Frequency (MHz)	Average (dBμV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.379500	15.6	GND	L1	10.0	32.7	48.3
0.690000	24.6	GND	L1	10.0	21.4	46.0
0.753000	24.9	GND	L1	10.0	21.1	46.0
1.945500	23.3	GND	L1	10.1	22.7	46.0
2.949000	20.2	GND	L1	10.1	25.8	46.0
3.705000	16.3	GND	L1	10.1	29.7	46.0

## 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)
0.177000	47.0	2000.0	9.000	N	19.8	17.6	64.6
0.267000	38.9	2000.0	9.000	L1	19.8	22.4	61.2
0.478500	30.1	2000.0	9.000	L1	19.9	26.3	56.4
0.951000	35.4	2000.0	9.000	N	19.7	20.6	56.0
3.457500	18.5	2000.0	9.000	L1	19.7	37.5	56.0
4.344000	29.0	2000.0	9.000	N	19.7	27.0	56.0

### 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	N	19.8	9.2	54.8
0.267000	35.4	2000.0	9.000	L1	19.8	15.8	51.2
0.951000	29.9	2000.0	9.000	N	19.7	16.1	46.0
1.288500	25.9	2000.0	9.000	N	19.6	20.1	46.0
3.187500	17.8	2000.0	9.000	L1	19.7	28.2	46.0
4.546500	21.8	2000.0	9.000	N	19.7	24.2	46.0

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