



# TESTREPORT

No.I18Z60895-EMC02

for

**Lenovo PC HK Limited**

**Portable Tablet Computer**

**Model Name: Lenovo TB-7104F**

**FCC ID:O57TB7104F**

**Hardware Version: Lenovo Tablet TB-7104F**

**Software Version: TB-7104F\_RF01\_180623**

**Issued Date: 2018-06-20**



**Note:**

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I18Z60895-EMC02	Rev.0	1st edition	2018-06-20



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## **1. Test Laboratory**

### **1.1. TestingLocation**

Location 1:CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,  
P. R. China100191

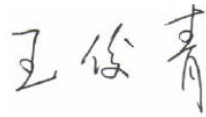
## 1.2. TestingEnvironment

Normal Temperature: 15-35°C  
Extreme Temperature: -10/+55°C  
Relative Humidity: 20-75%

## 1.3. Project data

Testing Start Date: 2018-05-31  
Testing End Date: 2018-06-15

## 1.4. Signature



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Wang Junqing  
(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: Lenovo(Shanghai) Electronics Technology Co., Ltd.  
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City: Shanghai  
Postal Code: 200131  
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### **2.2. Manufacturer Information**

Company Name: Lenovo PC HK Limited  
Address /Post: 23/F, Lincoln House, Taikoo Place  
979 King's Road, Quarry Bay, Hong Kong  
Country: China  
Contact Person Spring Zhou  
Contact Email zhoucb1@lenovo.com  
Telephone: +86-21-50504500-8281  
Fax: +86-21-50807240



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

#### **3.1. About EUT**

Description	Portable Tablet Computer
Model Name	Lenovo TB-7104F
FCC ID	O57TB7104F
Extreme vol. Limits	3.5VDC to 4.4VDC (nominal: 3.8VDC)

Note: Photographs of EUT are shown in ANNEX A of this test report.

#### **3.2. Internal Identification of EUT**

<b>EUT ID*</b>	<b>SN or IMEI</b>	<b>HW Version</b>	<b>SW Version</b>
EUT4	HAOWKX3J(11)	Lenovo Tablet TB-7104F	TB-7104F_RF01_180623

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

#### **3.3. Internal Identification of AE**

<b>AE ID*</b>	<b>Description</b>	<b>SN</b>
AE1	Battery	/
AE2	Battery	/
AE3	Charger	/
AE4	Charger	/
AE11	USB Cable	/
AE12	USB Cable	/
<b>AE1</b>		
Model	SB18C31688	
Manufacturer	ATL	
Capacitance	2750mAh	
Nominal voltage	3.82V	
<b>AE2</b>		
Model	SB18C31689	
Manufacturer	SCUD	
Capacitance	2750mAh	
Nominal voltage	3.82V	
<b>AE3</b>		
Model	C-P57	
Manufacturer	huntkey	
Length of cable	/	
<b>AE4</b>		



Model C-P57  
Manufacturer Acbel  
Length of cable /

AE11

Model SWT-A087A  
Manufacturer Saibao  
Length of cable 95cm

AE12

Model A4P989950000-2  
Manufacturer Ying-tong  
Length of cable 95cm

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

**3.4. EUT set-ups**

<b>EUT set-up No.</b>	<b>Combination of EUT and AE</b>	<b>Remarks</b>
Set.1	EUT1+ AE1 + AE3+ AE11/AE12	Charger
Set.2	EUT1+ AE1 + AE4+ AE11/AE12	Charger
Set.3	EUT1+ AE1 + AE11/AE12	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 M
Ground system resistance	< 4
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

**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 M
Ground system resistance	< 4

## 6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:		
Verdict Column	P	Pass
	NA	Not applicable
	F	Fail
LocationColumn	Huanyuan North Road	The test is performed in test location Huanyuan North Road which is described in section 1.1 of this report

Items	Test Name	Clause in FCC rules	Section in this report	Verdict	Test Location
1	Radiated Emission	15.109(a)	B.1	P	Huanyuan North Road
2	Conducted Emission	15.107(a)	B.2	P	Huanyuan North Road



## 7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE	CALIBRATION INTERVAL
1	Test Receiver	ESU26	100235	R&S	2019-03-31	1 year
2	Test Receiver	ESCI	100948	R&S	2018-07-25	1 Year
3	Universal Radio Communication Tester	CMW500	143008	R&S	2018-11-26	1 year
4	Universal Radio Communication Tester	CMW500	155415	R&S	2019-01-15	1 year
5	LISN	ENV216	101200	R&S	2018-08-03	1 year
6	EMI Antenna	VULB 9163	9163-301	Schwarzbeck	2019-01-03	3 years
7	EMI Antenna	3115	00167250	ETS-Lindgren	2018-11-30	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

## **ANNEX A: MEASUREMENT Test 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 (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 charging mode. During the test MS is connected to a charger in the case of charging mode.

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:

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

Where

$G_A$ : Antenna factor of receive antenna

$G_{PL}$ : PathLoss

$P_{\text{Mea}}$ : Measurement result on receiver.

Measurement uncertainty (worst case): 30MHz-1GHz: 4.86dB, 1GHz-18GHz: 4.3dB,  $k=2$ .

#### Measurement results for Set.1

##### Charging Mode/Average detector

Frequency(MHz)	Result(dB $\mu$ V/m)	$G_{PL}$ (dB)	$G_A$ (dB/m)	$P_{\text{Mea}}$ (dB $\mu$ V)	Polarity
17998.500	41.1	-17.7	45.6	13.200	H
18000.000	41.0	-45.6	44.5	42.066	V
17977.500	40.9	-17.7	45.6	13.000	V
17997.000	40.9	-17.7	45.6	13.000	H
17995.500	40.9	-17.7	45.6	13.000	H
17994.000	40.8	-17.7	45.6	12.900	H

##### Charging Mode/Peak detector

Frequency(MHz)	Result(dB $\mu$ V/m)	$G_{PL}$ (dB)	$G_A$ (dB/m)	$P_{\text{Mea}}$ (dB $\mu$ V)	Polarity
17995.500	52.8	-17.7	45.6	24.900	H
17860.500	52.4	-18.5	45.6	25.300	H
17998.500	52.4	-17.7	45.6	24.500	V
17908.500	52.3	-18.5	45.6	25.200	H
17943.000	52.1	-17.7	45.6	24.200	V
17889.000	52.0	-18.5	45.6	24.900	H

#### Measurement results for Set.2

##### Charging Mode/Average detector

Frequency(MHz)	Result(dB $\mu$ V/m)	$G_{PL}$ (dB)	$G_A$ (dB/m)	$P_{\text{Mea}}$ (dB $\mu$ V)	Polarity
17998.500	41.3	-17.7	45.6	13.400	H
17997.000	41.2	-17.7	45.6	13.300	V
18000.000	41.0	-45.6	44.5	42.066	V
17995.500	41.0	-17.7	45.6	13.100	H
17911.500	41.0	-18.5	45.6	13.900	V
17898.000	41.0	-18.5	45.6	13.900	V

**Charging 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
17970.000	52.4	-17.7	45.6	24.500	V
17974.500	52.3	-17.7	45.6	24.400	V
17746.500	52.2	-18.5	45.6	25.100	H
17899.500	52.2	-18.5	45.6	25.100	H
17998.500	52.0	-17.7	45.6	24.100	V
17835.000	52.0	-18.5	45.6	24.900	H

**Measurement results for Set.3**

**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
17847.000	41.3	-18.5	45.6	26.300	H
17992.500	41.1	-17.7	45.6	24.800	V
17913.000	41.1	-18.5	45.6	25.200	V
17988.000	41.1	-17.7	45.6	24.400	H
17890.500	41.0	-18.5	45.6	25.100	V
17820.000	41.0	-18.5	45.6	25.100	V

**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
17965.500	53.0	-17.7	45.6	25.100	V
17962.500	52.9	-17.7	45.6	25.000	H
17997.000	52.6	-17.7	45.6	24.700	H
17943.000	52.5	-17.7	45.6	24.600	V
17823.000	52.4	-18.5	45.6	25.300	V
17938.500	52.3	-17.7	45.6	24.400	V

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

Charging Mode, Set.1

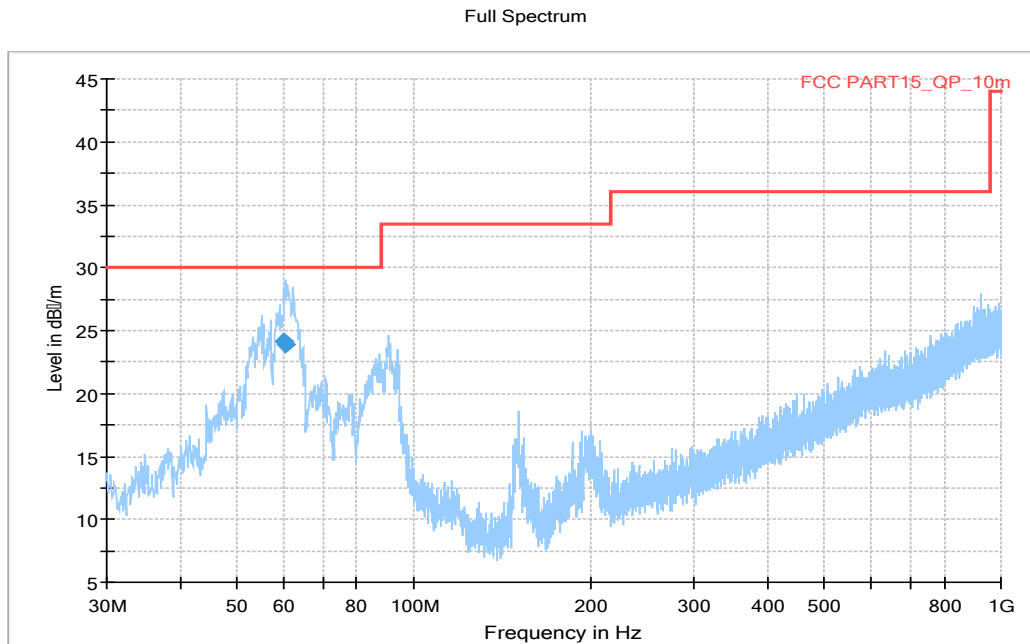


Fig A.1 Radiated Emission from 30MHz to 1GHz

FinalResult

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
59.858000	24.10	30.00	5.90	1000.	120.000	103.0	V	115.0
60.703000	23.95	30.00	6.05	1000.	120.000	103.0	V	98.0

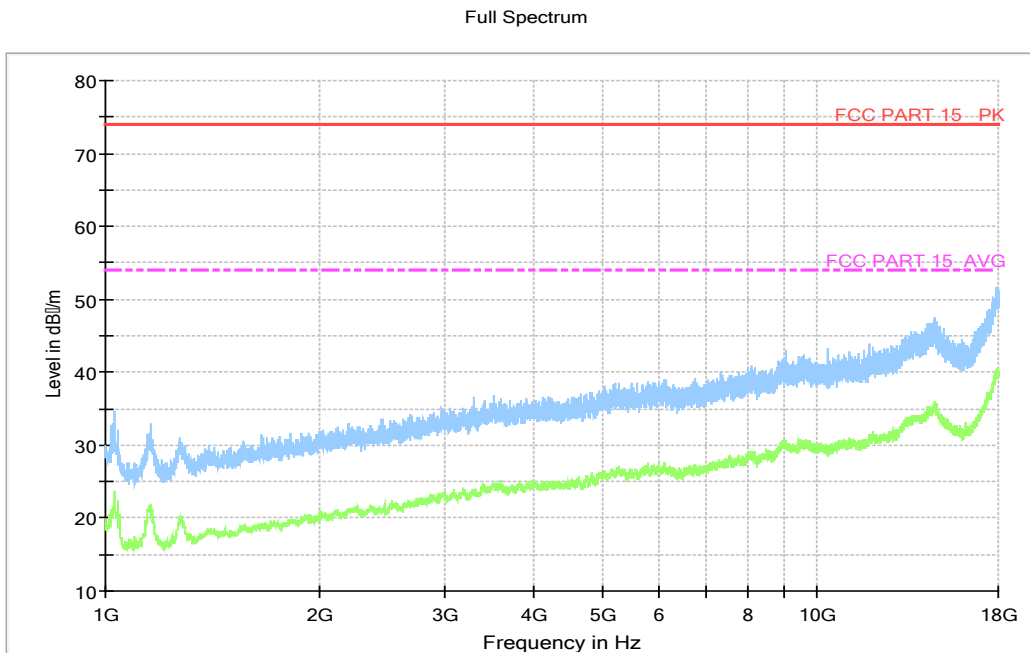


Fig A.2 Radiated Emission from 1GHz to 18GHz



Charging Mode, Set.2

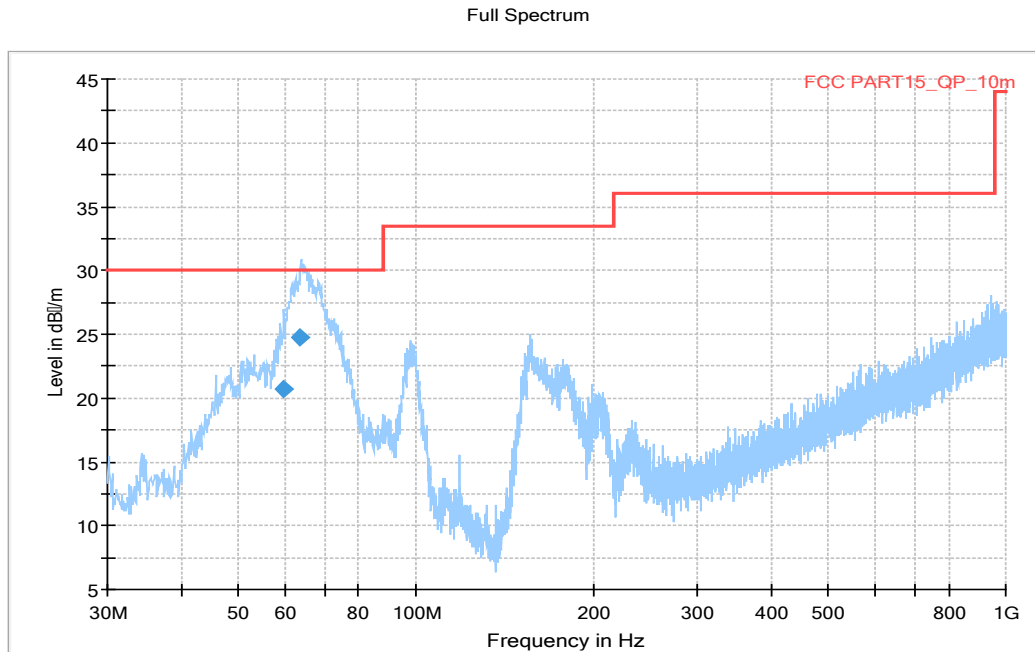


Fig A.3 Radiated Emission from 30MHz to 1GHz

FinalResult

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
59.839000	20.71	30.00	9.29	1000.	120.000	121.0	V	120.0
63.613000	24.75	30.00	5.25	1000.	120.000	316.0	V	-3.0

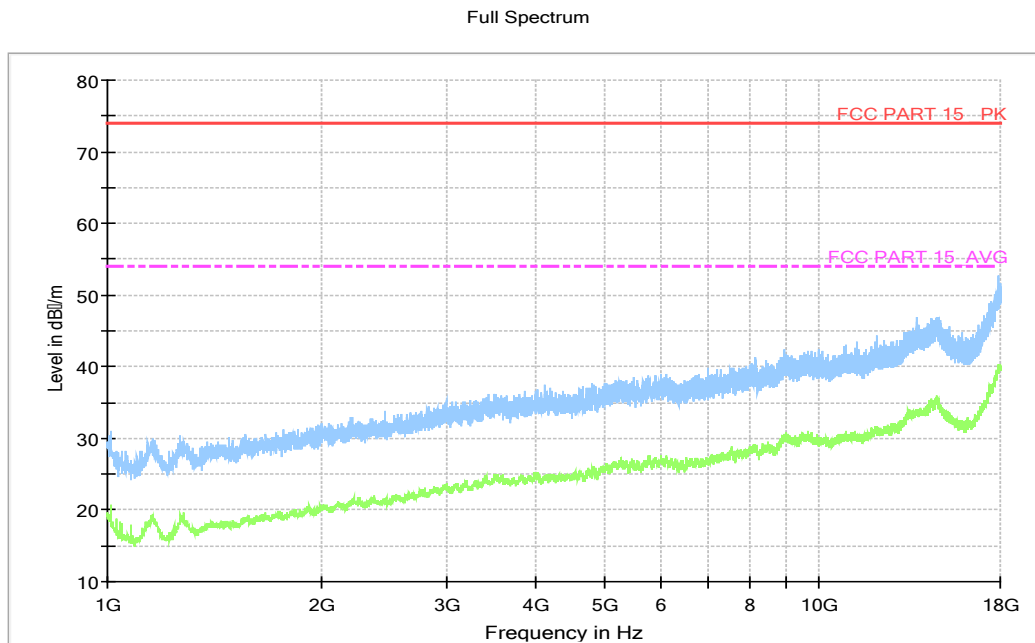


Fig A.4 Radiated Emission from 1GHz to 18GHz

USB Mode, Set.3

Full Spectrum

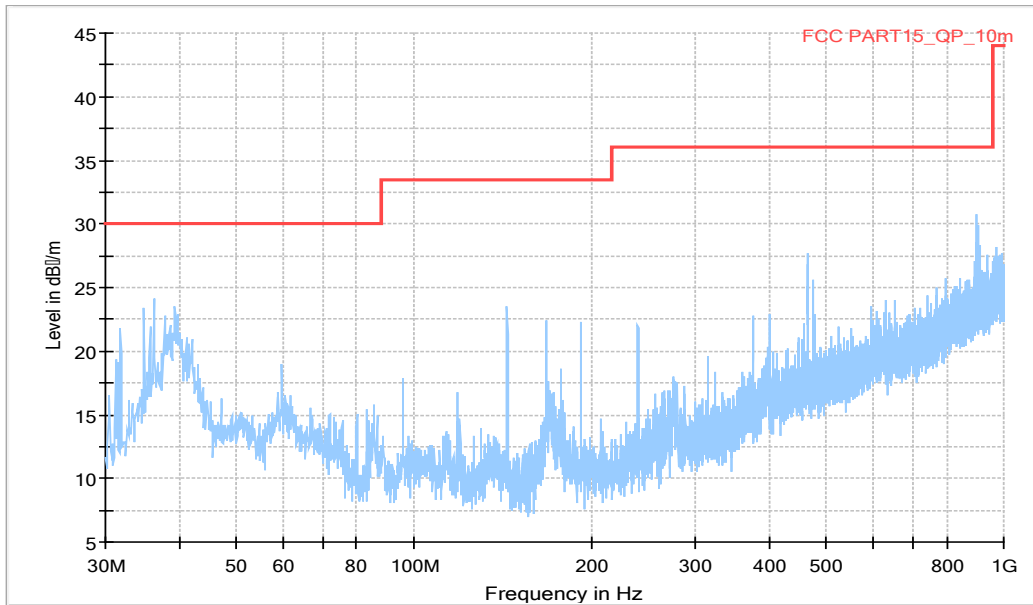


Fig A.5 Radiated Emission from 30MHz to 1GHz

Full Spectrum

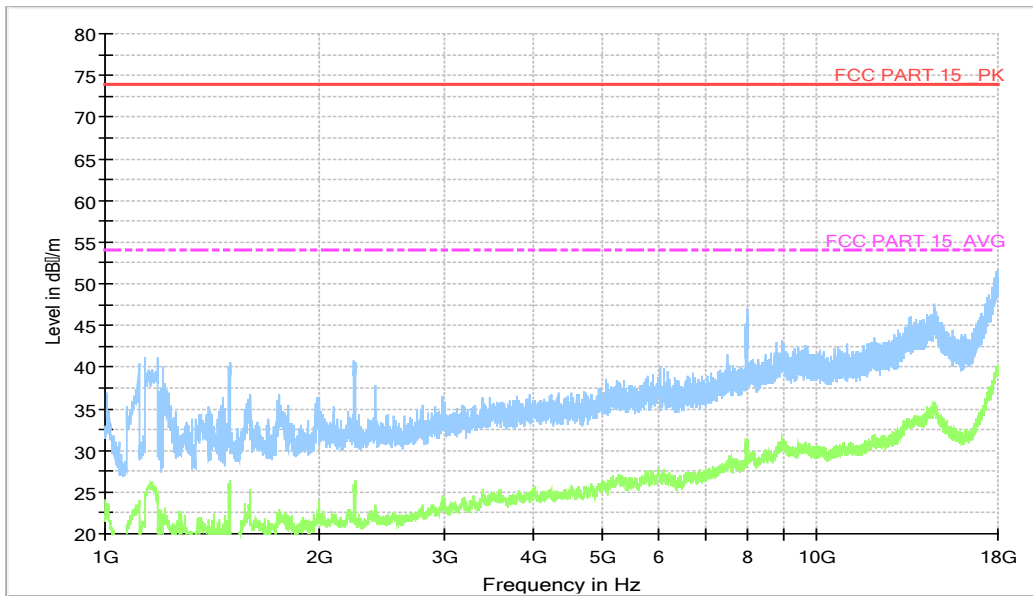


Fig A.6 Radiated Emission from 1GHz to 18GHz

## 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 charging mode. During the test MS is connected to a charger in the case of charging mode.

### A.2.3 Measurement Limit

Frequency of emission (MHz)	Conducted limit (dB $\mu$ V)	
	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

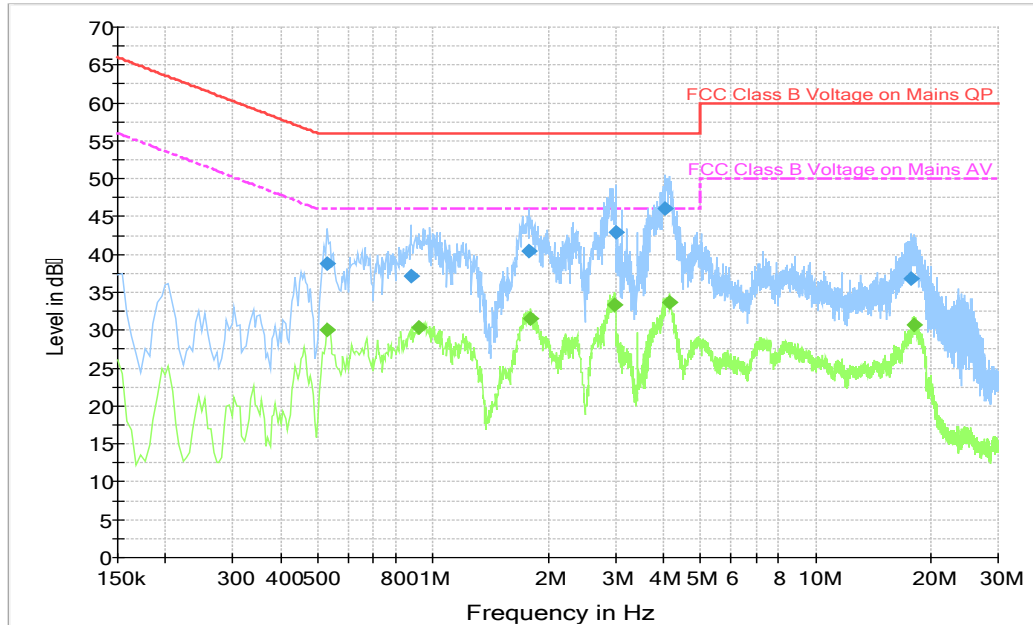


Fig A.7 Conducted Emission

#### Final Result 1

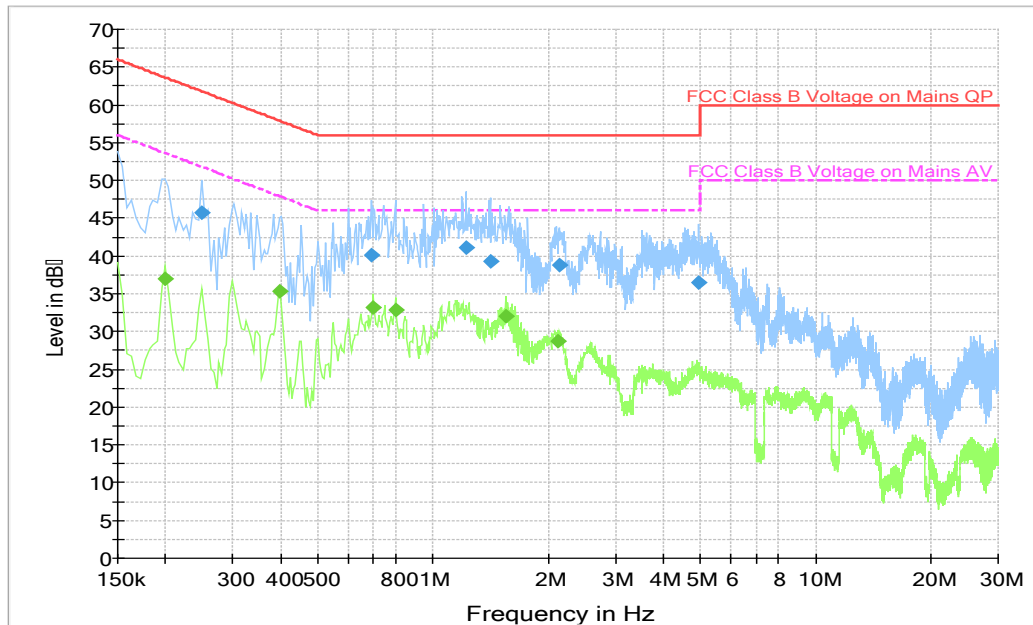
Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.528000	38.7	2000.0	9.000	L1	19.9	17.3	56.0
0.874500	37.2	2000.0	9.000	L1	19.7	18.8	56.0
1.779000	40.4	2000.0	9.000	L1	19.7	15.6	56.0
3.003000	42.8	2000.0	9.000	L1	19.7	13.2	56.0
4.042500	46.0	2000.0	9.000	L1	19.6	10.0	56.0
17.839500	36.8	2000.0	9.000	L1	20.0	23.2	60.0

#### Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.528000	30.1	2000.0	9.000	L1	19.9	15.9	46.0
0.919500	30.4	2000.0	9.000	L1	19.7	15.6	46.0
1.801500	31.6	2000.0	9.000	L1	19.7	14.4	46.0
2.994000	33.3	2000.0	9.000	L1	19.7	12.7	46.0
4.150500	33.7	2000.0	9.000	L1	19.6	12.3	46.0
18.055500	30.7	2000.0	9.000	L1	20.0	19.3	50.0

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

**Charging Mode, Set.2**



**Fig A.8 Conducted Emission**

**Final Result 1**

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.249000	45.8	2000.0	9.000	N	19.8	16.0	61.8
0.690000	40.2	2000.0	9.000	N	19.9	15.8	56.0
1.221000	41.0	2000.0	9.000	N	19.6	15.0	56.0
1.410000	39.3	2000.0	9.000	N	19.6	16.7	56.0
2.134500	38.7	2000.0	9.000	N	19.6	17.3	56.0
4.956000	36.5	2000.0	9.000	N	19.7	19.5	56.0

**Final Result 2**

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.199500	37.0	2000.0	9.000	L1	19.8	16.7	53.6
0.397500	35.3	2000.0	9.000	N	19.9	12.6	47.9
0.699000	33.3	2000.0	9.000	N	19.9	12.7	46.0
0.798000	32.8	2000.0	9.000	N	19.8	13.2	46.0
1.545000	32.0	2000.0	9.000	L1	19.7	14.0	46.0
2.125500	28.6	2000.0	9.000	L1	19.7	17.4	46.0

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

USB Mode, Set.3

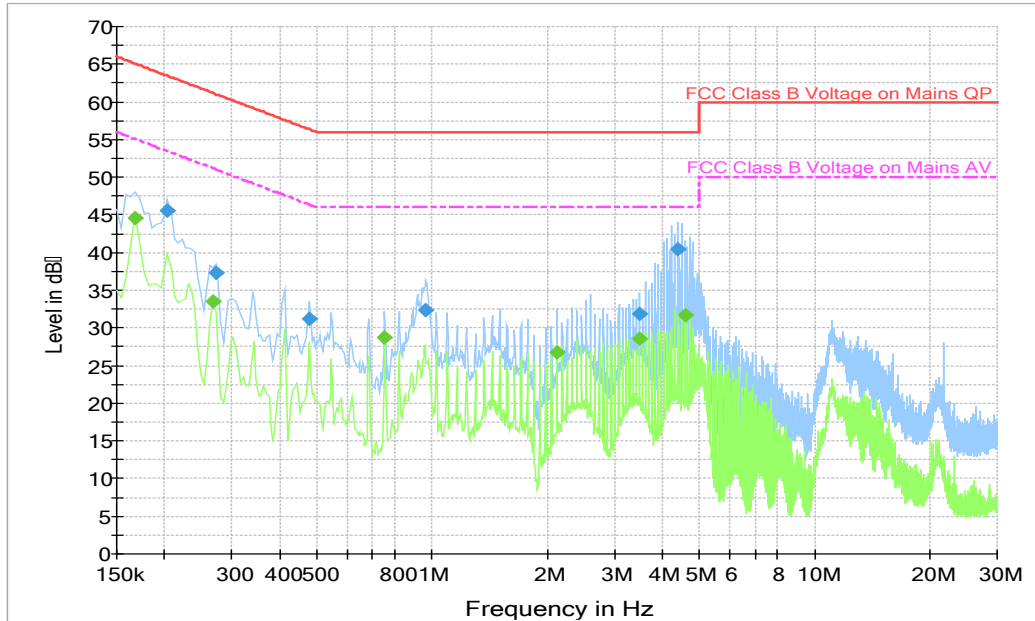


Fig A.9 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.204000	45.5	2000.0	9.000	L1	19.8	17.9	63.4
0.271500	37.4	2000.0	9.000	L1	19.8	23.7	61.1
0.478500	31.2	2000.0	9.000	L1	19.9	25.2	56.4
0.964500	32.4	2000.0	9.000	L1	19.6	23.6	56.0
3.489000	31.8	2000.0	9.000	N	19.7	24.2	56.0
4.380000	40.4	2000.0	9.000	N	19.7	15.6	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.168000	44.6	2000.0	9.000	L1	19.8	10.5	55.1
0.267000	33.4	2000.0	9.000	L1	19.8	17.8	51.2
0.753000	28.7	2000.0	9.000	N	19.8	17.3	46.0
2.121000	26.7	2000.0	9.000	N	19.6	19.3	46.0
3.489000	28.6	2000.0	9.000	L1	19.7	17.4	46.0
4.582500	31.7	2000.0	9.000	N	19.7	14.3	46.0

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



**ANNEX B: PERSONS INVOLVED IN THIS TESTING**

<b>Test Item</b>	<b>Test Software and Version</b>	<b>Software Vendor</b>	<b>Test operator</b>
Conducted Emission	EMC32 V8.5.2	R&S	Wang Huan
Radiated Emission	EMC32 V9.01.00	R&S	Li Jinpeng

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