



TEST REPORT

No.I18Z60917-EMC04

for

Lenovo PC HK Limited

Portable Tablet Computer

Model Name: Lenovo TB-X104F

FCC ID: O57TBX104F

Hardware Version: Lenovo Tablet TB-X104F

Software Version: TB-X104F_RF01_20180506

Issued Date: 2018-07-02



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.

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I18Z60917-EMC04	Rev.0	1st edition	2018-06-22
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1. Test Laboratory

1.1. Testing Location

Location 1: CTTL(huayuan North Road)

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

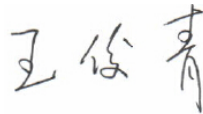
1.2. Testing Environment

Normal Temperature: 15-35°C
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

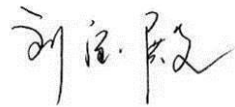
1.4. Signature



Wang Junqing
(Prepared this test report)



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(Reviewed this test report)



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Deputy Director of the laboratory
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2. Client Information

2.1. Applicant Information

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2.2. Manufacturer Information

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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-X104F
FCC ID	O57TBX104F
Extreme vol. Limits	3.5VDC to 4.2VDC (nominal: 3.85VDC)

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

3.2. Internal Identification of EUT

EUT ID*	SN or IMEI	HW Version	SW Version
EUT1	ZQ6005B	Lenovo Tablet TB-X104F	TB-X104F_RF01_20180506

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

3.3. Internal Identification of AE

AE ID*	Description		
AE1	Battery	/	/
AE2	Battery	/	/
AE3	Charger	/	/
AE4	Charger	/	/
AE5	Charger	/	/
AE1			
Model		L16D1P34	
Manufacturer		SCUD	
Capacitance		4850 mAh	
Nominal voltage		3.85 V	
AE2			
Model		L16D1P34	
Manufacturer		Suwnoda	
Capacitance		4850 mAh	
Nominal voltage		3.85 V	
AE3			
Model		C-P35	
Manufacturer		Acbel	
Length of cable		/	
AE4			
Model		SC-41	
Manufacturer		Salom	
Length of cable		/	
AE5			



Model	SC-41
Manufacturer	Acbel
Length of cable	/

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

3.4. EUT set-ups

EUT set-up No.	Combination of EUT and AE	Remarks
Set.1	EUT1+ AE1 + AE3+ AE11/AE12	Charger
Set.2	EUT1+ AE1 + AE4+ AE11/AE12	Charger
Set.3	EUT1+ AE1 + AE5+ AE11/AE12	Charger
Set.4	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.

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 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
Location Column	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 ($\mu\text{V}/\text{m}$)		
	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: 4.86dB, 1GHz-18GHz: 4.3 dB, $k=2$.

Measurement results for Set.1

Charging Mode/Average detector

Frequency(MHz)	Result(dB μ V/m)	G_{PL} (dB)	G_A (dB/m)	P_{Mea} (dB μ V)	Polarity
17992.633	41.0	-17.7	45.6	13.100	H
17998.867	40.6	-17.7	45.6	12.700	V
17984.700	40.5	-17.7	45.6	12.600	V
17979.600	40.4	-17.7	45.6	12.500	H
17988.667	40.4	-17.7	45.6	12.500	H
17978.467	40.4	-17.7	45.6	12.500	H

Charging Mode/Peak detector

Frequency(MHz)	Result(dB μ V/m)	G_{PL} (dB)	G_A (dB/m)	P_{Mea} (dB μ V)	Polarity
17882.700	52.1	-18.5	45.6	25.000	H
17709.300	52.1	-18.9	45.6	25.400	H
18000.000	51.9	-45.6	44.5	52.966	V
17875.333	51.9	-18.5	45.6	24.800	H
17854.367	51.6	-18.5	45.6	24.500	V
17989.233	51.5	-17.7	45.6	23.600	H

Measurement results for Set.2

Charging Mode/Average detector

Frequency(MHz)	Result(dB μ V/m)	G_{PL} (dB)	G_A (dB/m)	P_{Mea} (dB μ V)	Polarity
17977.333	40.5	-17.7	45.6	12.600	H
17985.267	40.4	-17.7	45.6	12.500	V
17995.467	40.4	-17.7	45.6	12.500	V
17992.067	40.3	-17.7	45.6	12.400	H
17996.033	40.3	-17.7	45.6	12.400	V
17976.767	40.3	-17.7	45.6	12.400	V

Charging Mode/Peak detector

Frequency(MHz)	Result(dB μ V/m)	G _{PL} (dB)	G _A (dB/m)	P _{Mea} (dB μ V)	Polarity
17990.367	52.4	-17.7	45.6	24.500	V
17917.267	52.3	-17.7	45.6	24.400	V
17985.267	52.2	-17.7	45.6	24.300	H
17977.900	51.8	-17.7	45.6	23.900	H
17970.533	51.7	-17.7	45.6	23.800	V
17979.033	51.6	-17.7	45.6	23.700	H

Measurement results for Set.3

Charging Mode/Average detector

Frequency(MHz)	Result(dB μ V/m)	G _{PL} (dB)	G _A (dB/m)	P _{Mea} (dB μ V)	Polarity
17980.167	40.6	-17.7	45.6	12.700	H
17980.733	40.5	-17.7	45.6	12.600	V
17988.667	40.3	-17.7	45.6	12.400	V
17977.333	40.3	-17.7	45.6	12.400	H
17983.000	40.3	-17.7	45.6	12.400	H
17986.400	40.2	-17.7	45.6	12.300	H

Charging Mode/Peak detector

Frequency(MHz)	Result(dB μ V/m)	G _{PL} (dB)	G _A (dB/m)	P _{Mea} (dB μ V)	Polarity
17996.600	51.7	-17.7	45.6	23.800	H
17980.733	51.7	-17.7	45.6	23.800	H
17978.467	51.6	-17.7	45.6	23.700	V
17971.100	51.5	-17.7	45.6	23.600	H
17888.933	51.5	-18.5	45.6	24.400	V
17991.500	51.4	-17.7	45.6	23.500	H

Measurement results for Set.4

USB Mode/Average detector

Frequency(MHz)	Result(dB μ V/m)	G _{PL} (dB)	G _A (dB/m)	P _{Mea} (dB μ V)	Polarity
17980.733	41.0	-17.7	45.6	13.100	H
17990.367	40.8	-17.7	45.6	12.900	V
17982.433	40.7	-17.7	45.6	12.800	V
17988.100	40.7	-17.7	45.6	12.800	H
17983.567	40.7	-17.7	45.6	12.800	V
17981.867	40.6	-17.7	45.6	12.700	V

USB Mode/Peak detector

Frequency(MHz)	Result(dB μ V/m)	G _{PL} (dB)	G _A (dB/m)	P _{Mea} (dB μ V)	Polarity
17996.600	52.3	-17.7	45.6	24.400	V
17984.133	52.1	-17.7	45.6	24.200	H
17994.333	52.0	-17.7	45.6	24.100	H
17990.367	51.7	-17.7	45.6	23.800	V
17969.967	51.7	-17.7	45.6	23.800	V
17771.067	51.5	-18.5	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

Full Spectrum

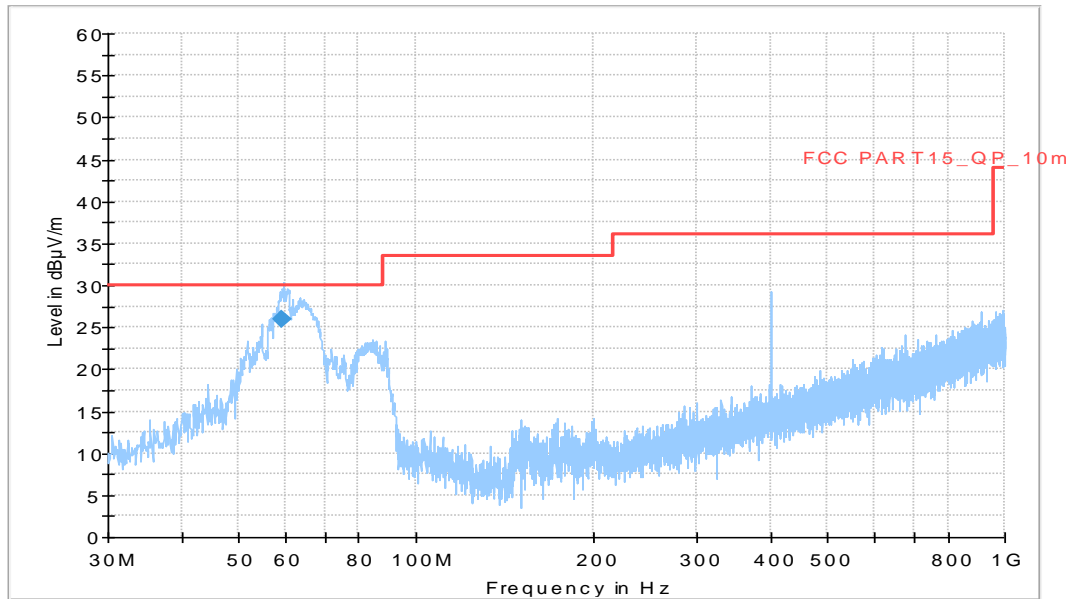


Fig A.1 Radiated Emission from 30MHz to 1GHz

Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
59.262000	25.86	30.00	4.14	1000.	120.000	108.0	V	120.0

Full Spectrum

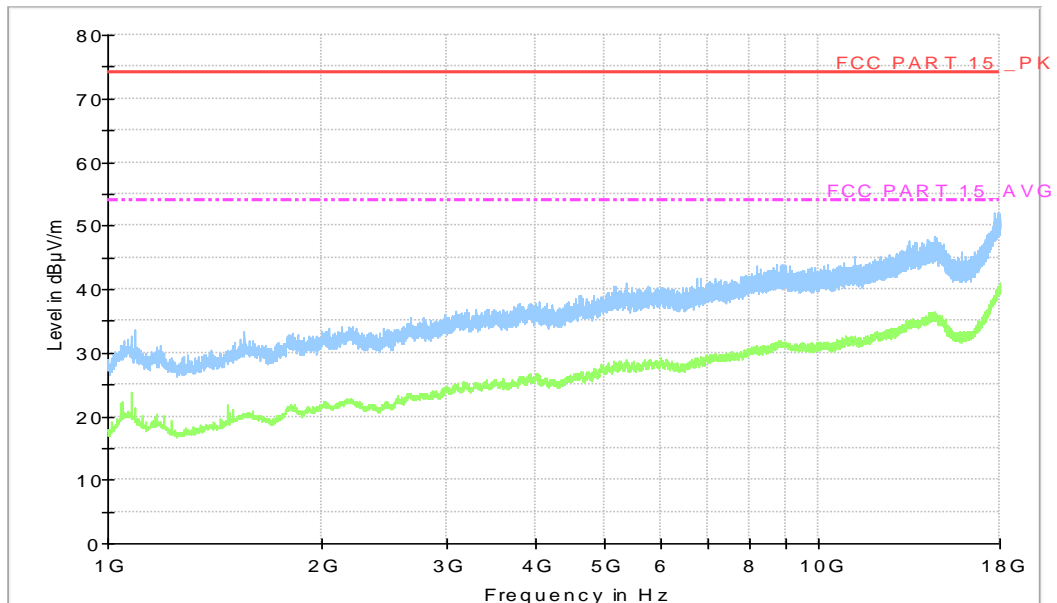


Fig A.2 Radiated Emission from 1GHz to 18GHz

Charging Mode, Set.2

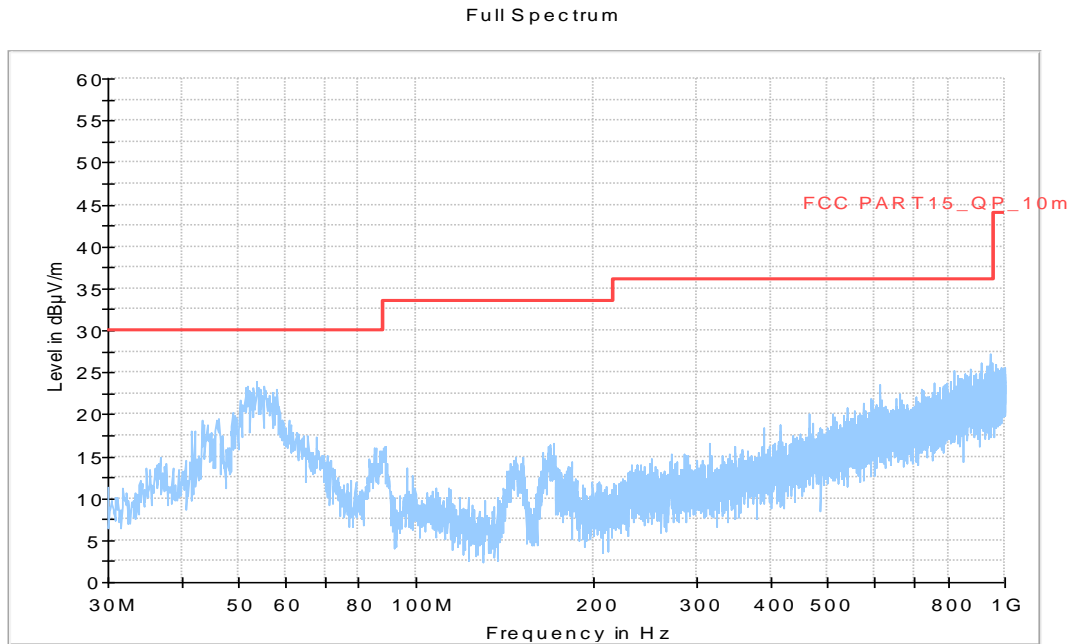


Fig A.3 Radiated Emission from 30MHz to 1GHz

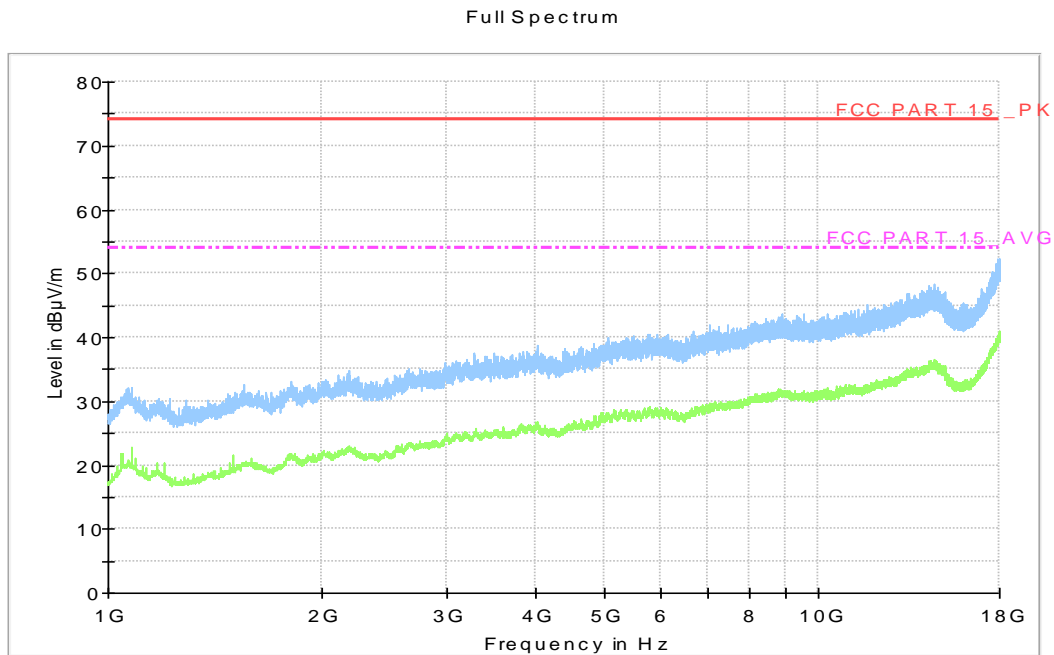


Fig A.4 Radiated Emission from 1GHz to 18GHz

Charging Mode, Set.3

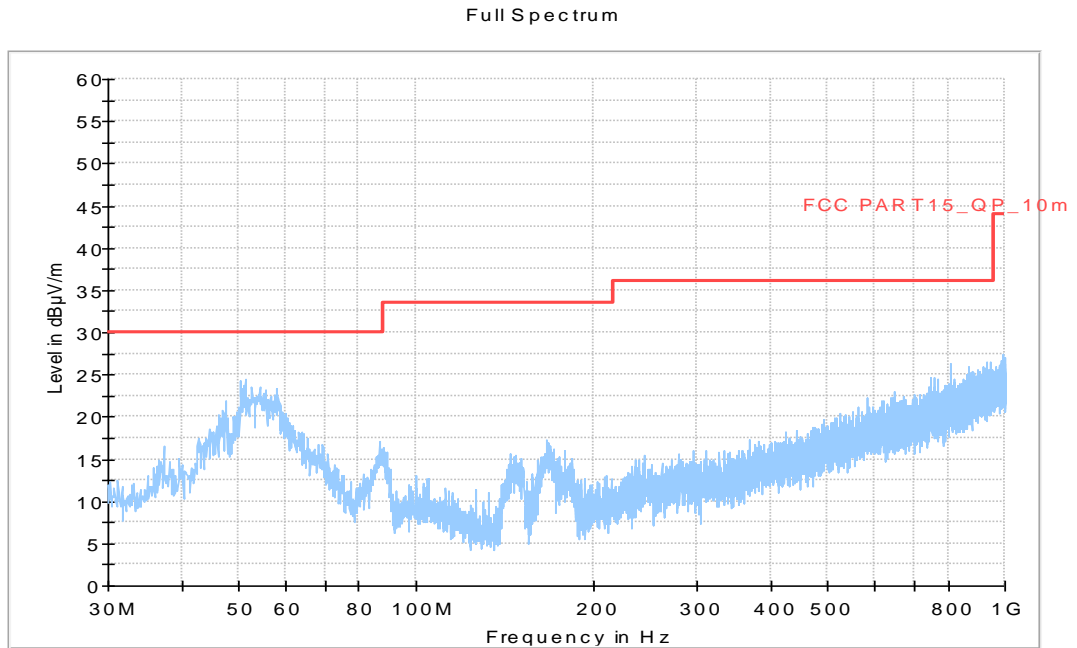


Fig A.5 Radiated Emission from 30MHz to 1GHz

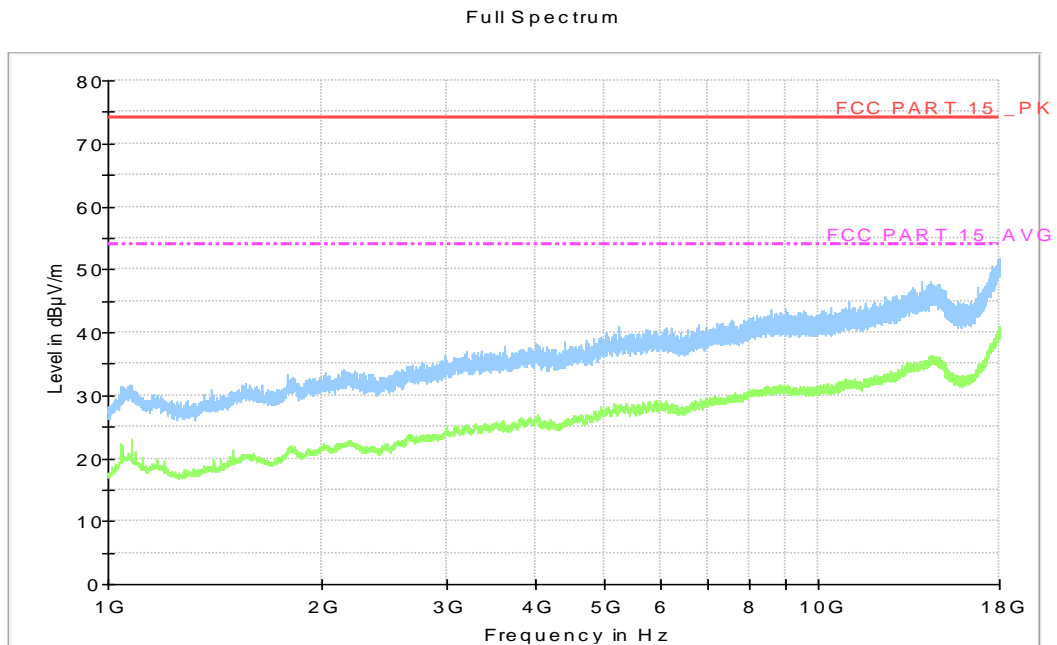


Fig A.6 Radiated Emission from 1GHz to 18GHz

USB Mode, Set.4

Full Spectrum

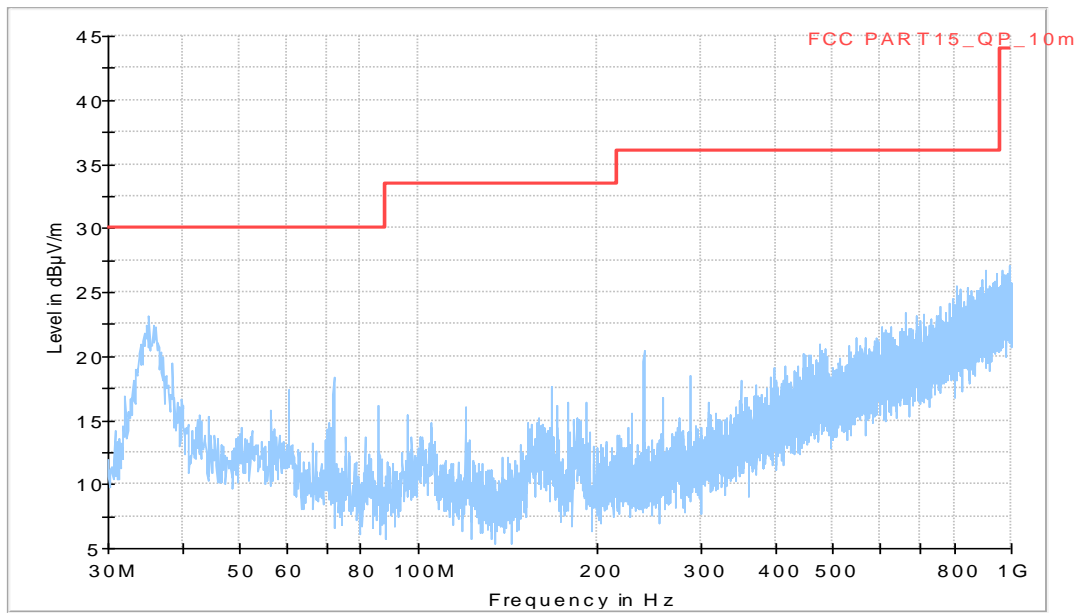


Fig A.7 Radiated Emission from 30MHz to 1GHz

Full Spectrum

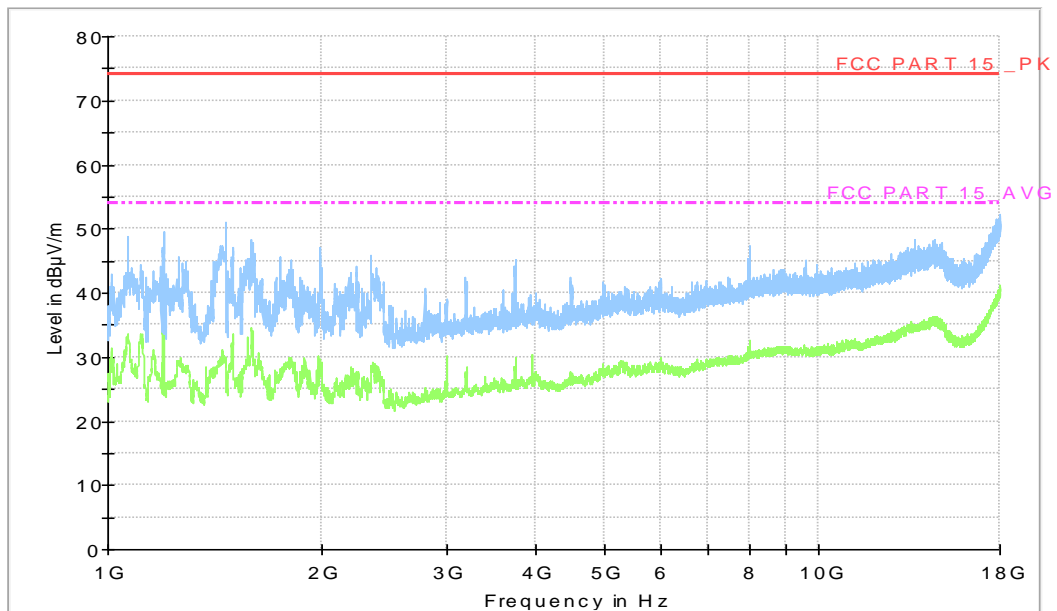


Fig A.8 Radiated Emission from 1GHz to 18GHz

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 μ 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: $U= 2.9$ dB, $k=2$.

Charging Mode, Set.1

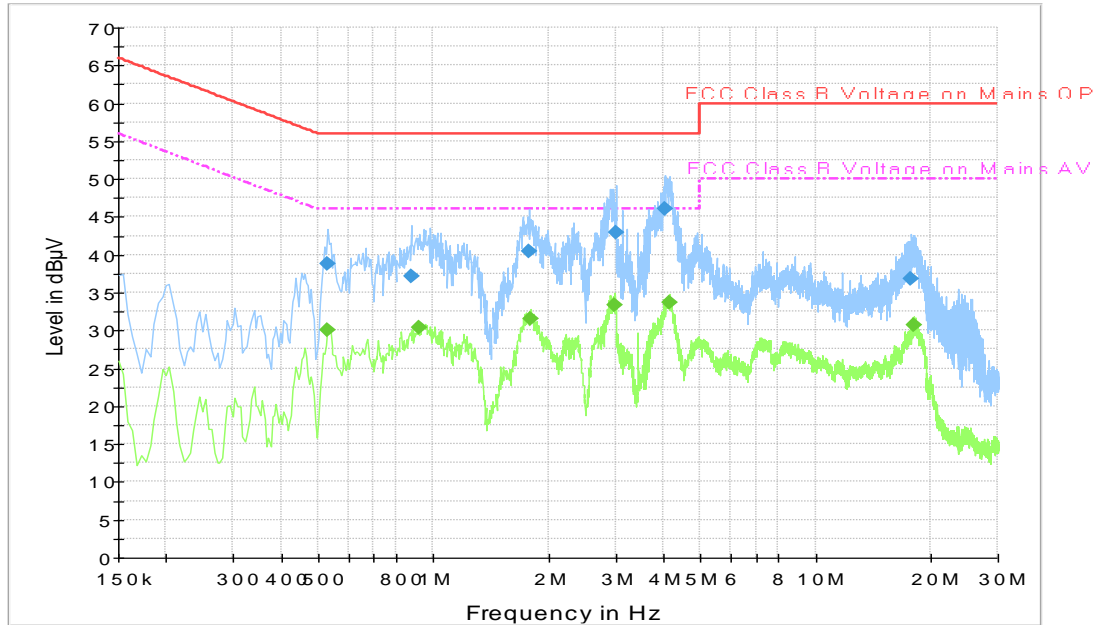


Fig A.9 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.528000	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

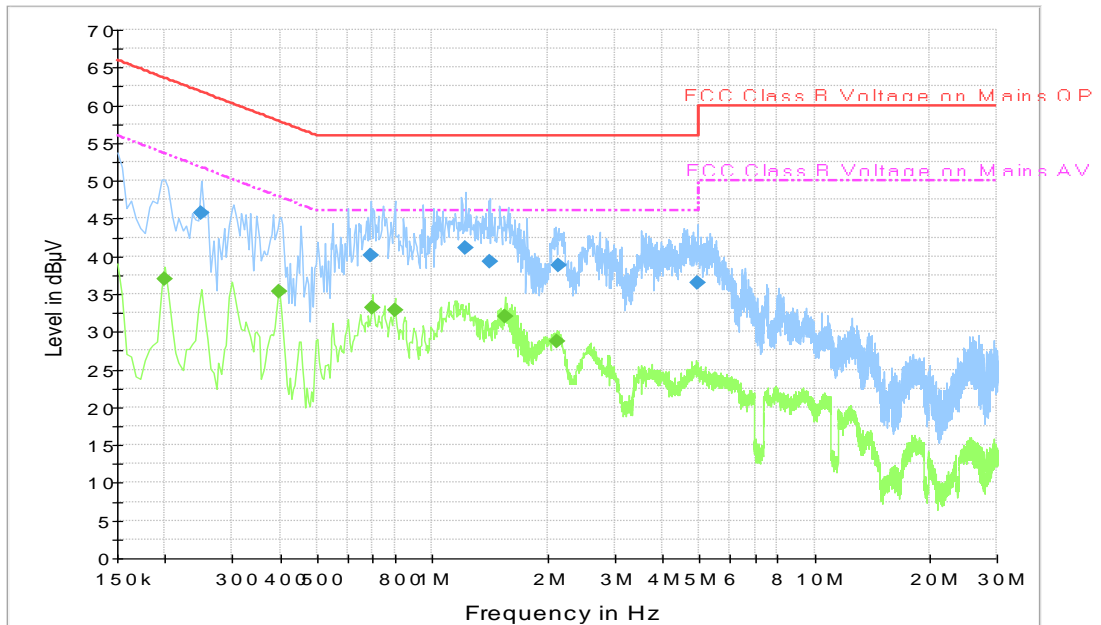


Fig A.10 Conducted Emission

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.

Charging Mode, Set.3

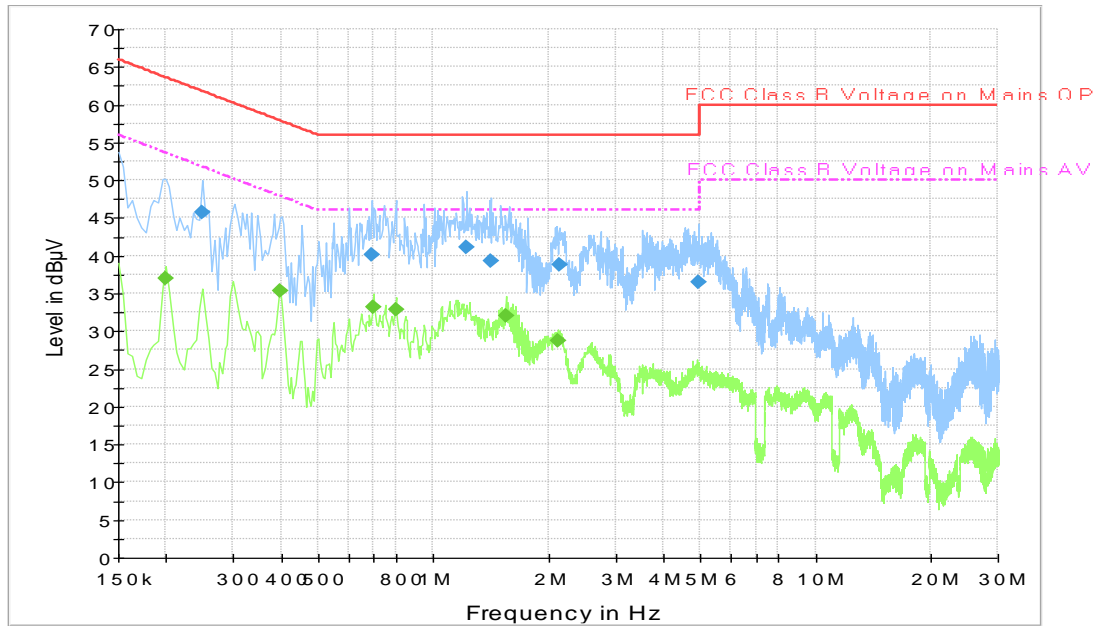


Fig A.11 Conducted Emission

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.4

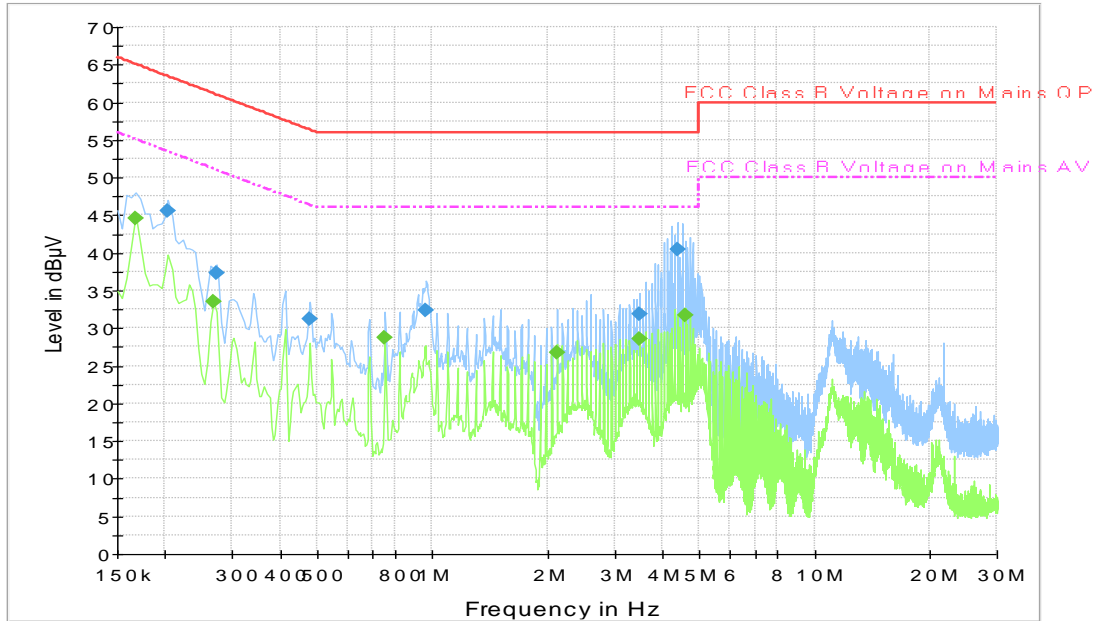


Fig A.12 Conducted Emission

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

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

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