



TEST REPORT

No. I17Z60904-EMC04

for

Lenovo(Shanghai) Electronics Technology Co., Ltd.

Portable Tablet Computer

Model Name: Lenovo TB-7304F

Marketing Name: Lenovo Tab 7 Essential

FCC ID: O57TB7304F

IC Number: 10407A-TB7304F

with

Hardware Version: Lenovo Tablet TB-7304F

Software Version: TB-7304F_RF01_170602

Issued Date: 2017-03-26

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.

Test Laboratory:

FCC 2.948 Listed: No.525429

IC O.A.T.S listed: No.12389A-1

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

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I17Z60904-EMC04	Rev.0	1 st edition	2017-07-06



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1. Test Laboratory

1.1. Testing Location

Location: 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

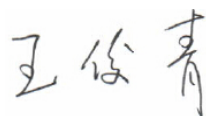
Relative Humidity: 20-75%

1.3. Project data

Testing Start Date: 2017-06-26

Testing End Date: 2017-07-05

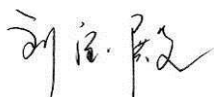
1.4. Signature



Wang Junqing
(Prepared this test report)



Qu Pengfei
(Reviewed this test report)



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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Postal Code: 200131
Country: P. R. China
Contact Person: Spring Zhou
Contact Email: zhoucb1@lenovo.com
Telephone: +86-21-50504500-8281
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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
City: Shanghai
Postal Code: 201203
Country: P. R. China
Contact Person: Jason Wang
Contact Email: wangjun28@lenovo.com
Telephone: +86-10-57877542
Fax: +86-10-58863425

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

3.1. About EUT

Description	Portable Tablet Computer
Model Name	Lenovo TB-X304F
FCC ID	O57TB7304F
IC Number	10407A-TB7304F
Extreme vol. Limits	3.45VDC to 4.3VDC (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
EUT1	HGCE7ESK	Lenovo Tablet TB-7304F	TB-7304F_RF01_170602

*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	Charger	/	/
AE9	Charger	/	/
AE10	Charger	/	/
AE11	Charger	/	/
AE12	Charger	/	/
AE13	Charger	/	/
AE14	USB Cable	/	/
AE15	USB Cable	/	/

AE1

Model	L13D1P31
Manufacturer	Sunwoda
Capacitance	3450 mAh
Nominal voltage	3.8 V

AE2

Model	L13D1P31
Manufacturer	SCUD
Capacitance	3450 mAh
Nominal voltage	3.8 V

AE3

Model	C-P56
Manufacturer	Huntkey
Length of cable	/



AE4

Model	C-P57
Manufacturer	Huntkey
Length of cable	/

AE9

Model	C-P56
Manufacturer	Acbel
Length of cable	/

AE10

Model	C-P57
Manufacturer	Acbel
Length of cable	/

AE11

Model	C-P58
Manufacturer	/
Length of cable	/

AE12

Model	C-P58
Manufacturer	Acbel
Length of cable	/

AE13

Model	C-P59
Manufacturer	/
Length of cable	/

AE14

Model	L29B-05100070
Manufacturer	LIQI
Length of cable	80cm

AE15

Model	S29B-05100070
Manufacturer	SAIBAO
Length of cable	80cm

*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.17	EUT1+ AE3+ AE11/AE12	Charger
Set.23	EUT1+ AE9+ AE11/AE12	Charger
Set.25	EUT1+ AE11	USB

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	10-1-15 Edition
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
ICES-003	Information Technology Equipment(ITE)-Limits and methods of measurement	Issue 6

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

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
Location Column	huayuan North Road	The test is performed in test location huayuan 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	1
2	Conducted Emission	15.107(a)	B.2	P	1

7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE	CALIBRATION INTERVAL
1	Test Receiver	ESU26	100235	R&S	2018-03-01	1 year
2	Test Receiver	ESCI 7	100344	R&S	2018-03-15	1 year
3	Universal Radio Communication Tester	CMW500	143008	R&S	2017-12-01	1 year
4	Universal Radio Communication Tester	CMW500	155415	R&S	2018-02-15	1 year
5	LISN	ENV216	101200	R&S	2017-07-10	1 year
6	EMI Antenna	VULB 9163	9163-301	Schwarzbeck	2017-12-16	3 years
7	EMI Antenna	3115	6914	ETS-Lindgren	2017-12-15	3 years
8	PC	OPTIPLEX 380	2X1YV2X	DELL	N/A	N/A
9	Printer	P1606dn	VNC3L52122	HP	N/A	N/A
10	Keyboard	L100	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).

IC: ICES-003 Section 5.

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: 5.26dB, $k=2$.

Measurement results for Set.17:

Charging Mode/Average detector

Frequency(MHz)	Result(dB μ V/m)	G_{PL} (dB)	G_A (dB/m)	P_{Mea} (dB μ V)	Polarity
17969.400	43.6	-17.7	45.6	15.700	H
17957.500	43.6	-17.7	45.6	15.700	H
17923.500	43.5	-17.7	45.6	15.600	H
17976.200	43.4	-17.7	45.6	15.500	H
17850.400	43.4	-18.5	45.6	16.300	H
17959.767	43.4	-17.7	45.6	15.500	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
17948.433	55.3	-17.7	45.6	27.400	H
17852.100	54.6	-18.5	45.6	27.500	H
17992.067	54.5	-17.7	45.6	26.600	H
17929.733	54.2	-17.7	45.6	26.300	H
17955.800	54.2	-17.7	45.6	26.300	H
17984.133	54.0	-17.7	45.6	26.100	H

Sample calculation: Peak detector, 17984.133MHz

$$\text{Result} = P_{\text{Mea}} (26.1\text{dB}\mu\text{V}) + G_A (45.6\text{dB/m}) + G_{\text{PL}}(-17.7 \text{ dB}) = 54.0\text{dB}\mu\text{V/m}$$

Measurement results for Set.23:

Charging Mode/Average detector

Frequency(MHz)	Result(dB μ V/m)	G_{PL} (dB)	G_A (dB/m)	P_{Mea} (dB μ V)	Polarity
17951.833	43.5	-17.7	45.6	15.600	H
17948.433	43.4	-17.7	45.6	15.500	H
17966.567	43.4	-17.7	45.6	15.500	V
17952.400	43.4	-17.7	45.6	15.500	H
17962.600	43.4	-17.7	45.6	15.500	H
17937.100	43.3	-17.7	45.6	15.400	H

Charging Mode/Peak detector

Frequency(MHz)	Result(dBμV/m)	G _{PL} (dB)	G _A (dB/m)	P _{Mea} (dBμV)	Polarity
17949.567	54.6	-17.7	45.6	26.700	H
17841.333	54.6	-18.5	45.6	27.500	H
17968.833	54.3	-17.7	45.6	26.400	H
17953.533	54.2	-17.7	45.6	26.300	H
17944.467	54.2	-17.7	45.6	26.300	H
17975.633	54.1	-17.7	45.6	26.200	H

Sample calculation: Peak detector, 17975.633MHz

$$\text{Result} = P_{\text{Mea}} (26.2\text{dB}\mu\text{V}) + G_A (45.6\text{dB/m}) + G_{\text{PL}}(-17.7 \text{ dB}) = 54.1\text{dB}\mu\text{V/m}$$

Measurement results for Set.25:

USB Mode/Average detector

Frequency(MHz)	Result(dBμV/m)	G _{PL} (dB)	G _A (dB/m)	P _{Mea} (dBμV)	Polarity
17947.300	43.8	-17.7	45.6	15.900	H
17943.900	43.6	-17.7	45.6	15.700	H
17895.733	43.5	-18.5	45.6	16.400	H
17973.933	43.5	-17.7	45.6	15.600	H
17858.900	43.4	-18.5	45.6	16.300	H
17947.867	43.4	-17.7	45.6	15.500	V

USB Mode/Peak detector

Frequency(MHz)	Result(dBμV/m)	G _{PL} (dB)	G _A (dB/m)	P _{Mea} (dBμV)	Polarity
17971.667	55.7	-17.7	45.6	27.800	H
17938.233	55.4	-17.7	45.6	27.500	H
17959.200	55.3	-17.7	45.6	27.400	V
17934.267	55.2	-17.7	45.6	27.300	V
17868.533	55.1	-18.5	45.6	28.000	H
17947.300	55.0	-17.7	45.6	27.100	H

Sample calculation: Peak detector, 17947.300MHz

$$\text{Result} = P_{\text{Mea}} (27.1\text{dB}\mu\text{V}) + G_A (45.6\text{dB/m}) + G_{\text{PL}}(-17.7 \text{ dB}) = 55.0\text{dB}\mu\text{V/m}$$

Note: The measurement results of Set.17, Set.23 and Set.25 showed here are worst cases of the combinations of different batteries and USB cables.

Charging Mode, Set.17

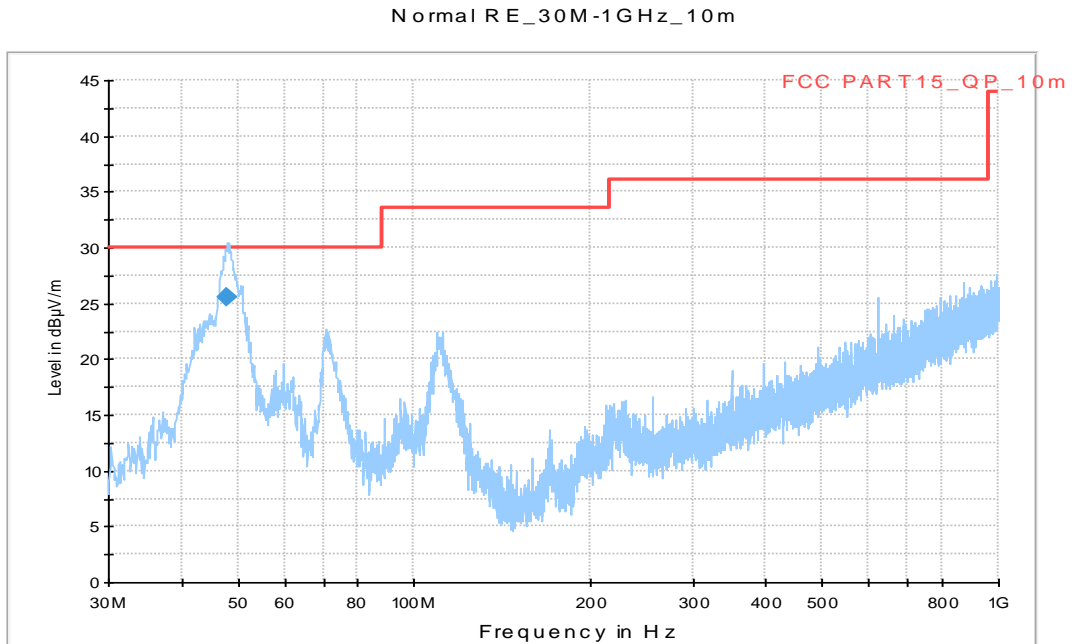


Figure A.1 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	PoI	Azimuth (deg)
47.682000	25.6	30.00	4.4	1000.	120.000	125.0	V	30.0

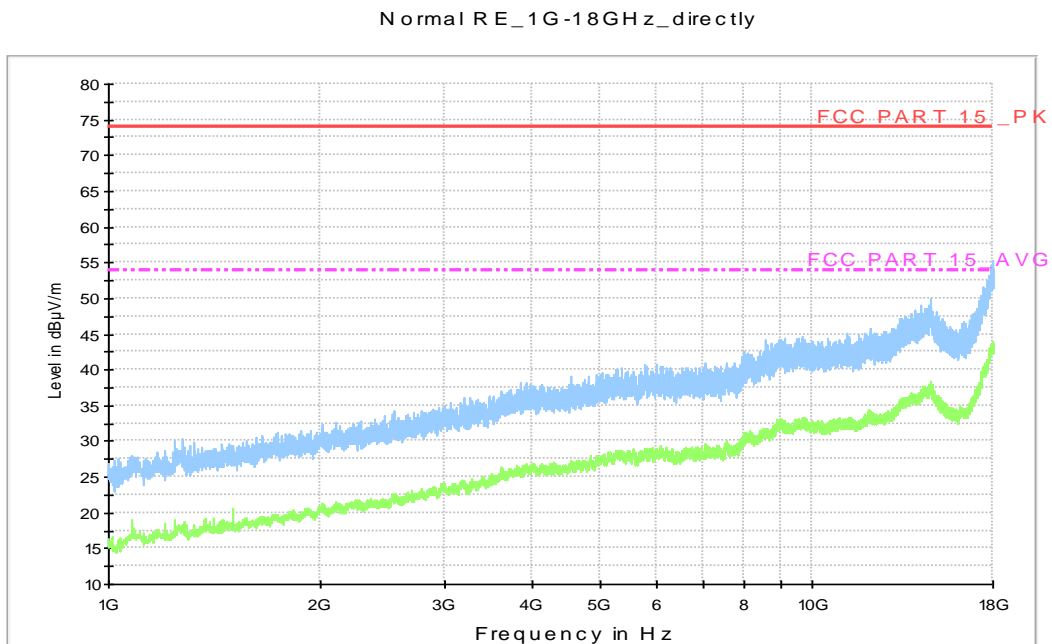


Figure A.2 Radiated Emission from 1GHz to 18GHz

Charging Mode, Set.23

Normal RE_30M-1GHz_10m

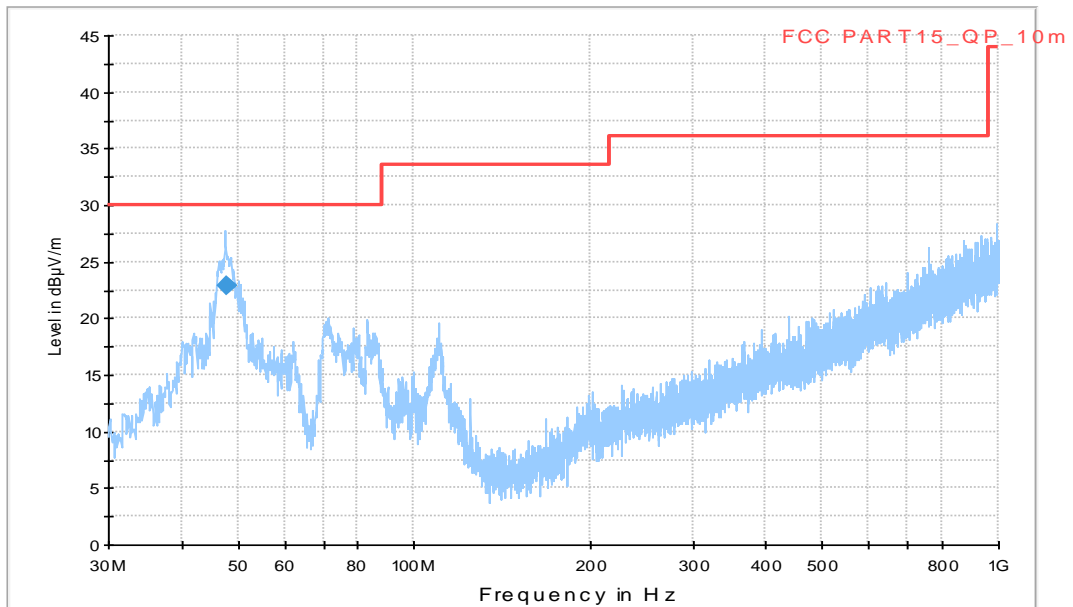


Figure A.3 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
47.977000	22.8	30.00	7.2	1000.	120.000	125.0	V	196.0

Normal RE_1G-18GHz_directly

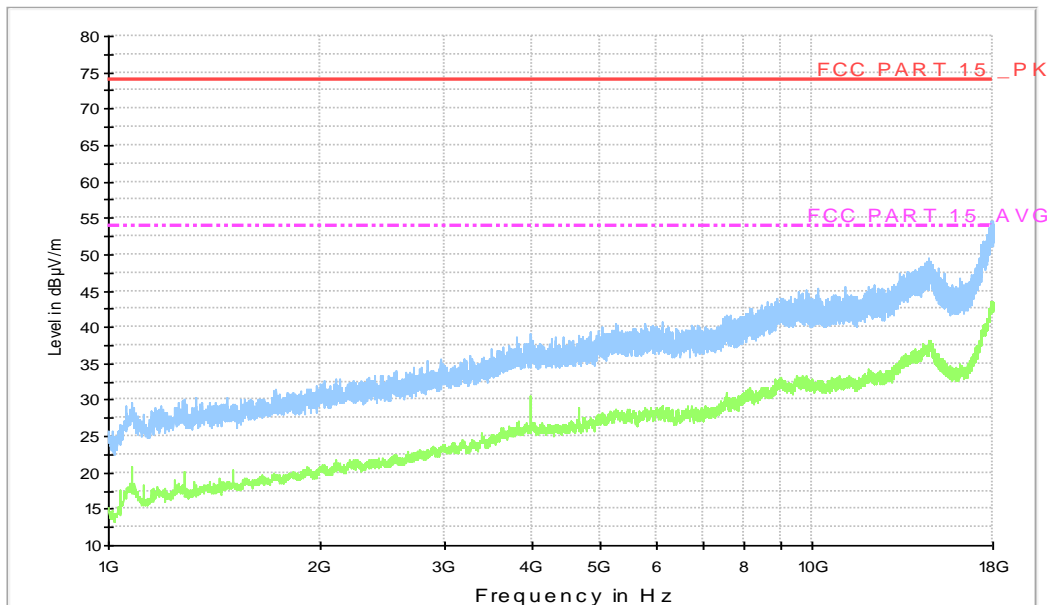


Figure A.4 Radiated Emission from 1GHz to 18GHz

USB Mode, Set.25

Normal RE_30M-1GHz_10m_Class B

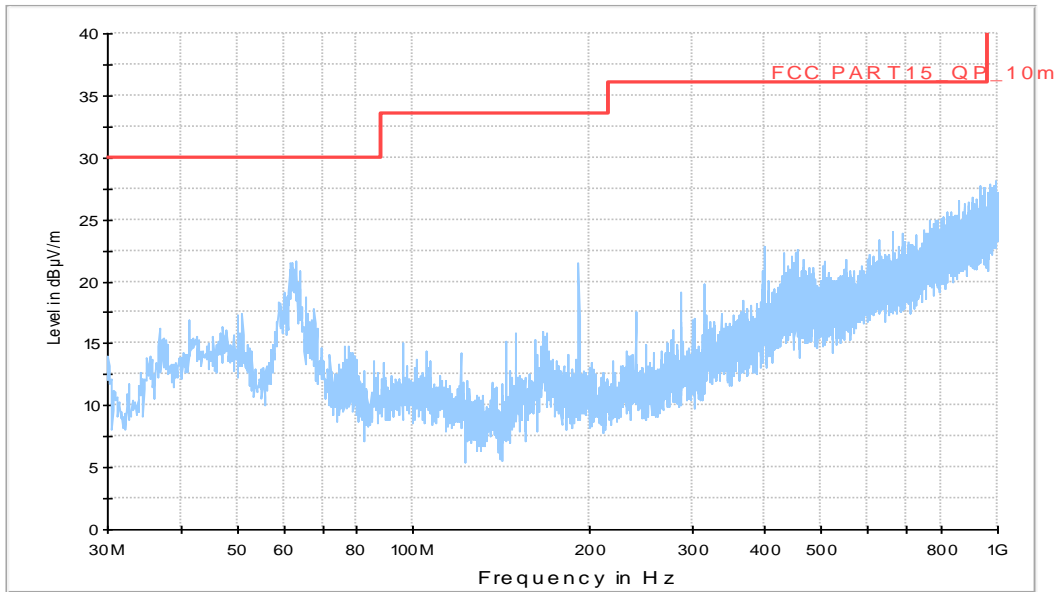


Figure A.5 Radiated Emission from 30MHz to 1GHz

Normal RE_1G-18GHz_directly

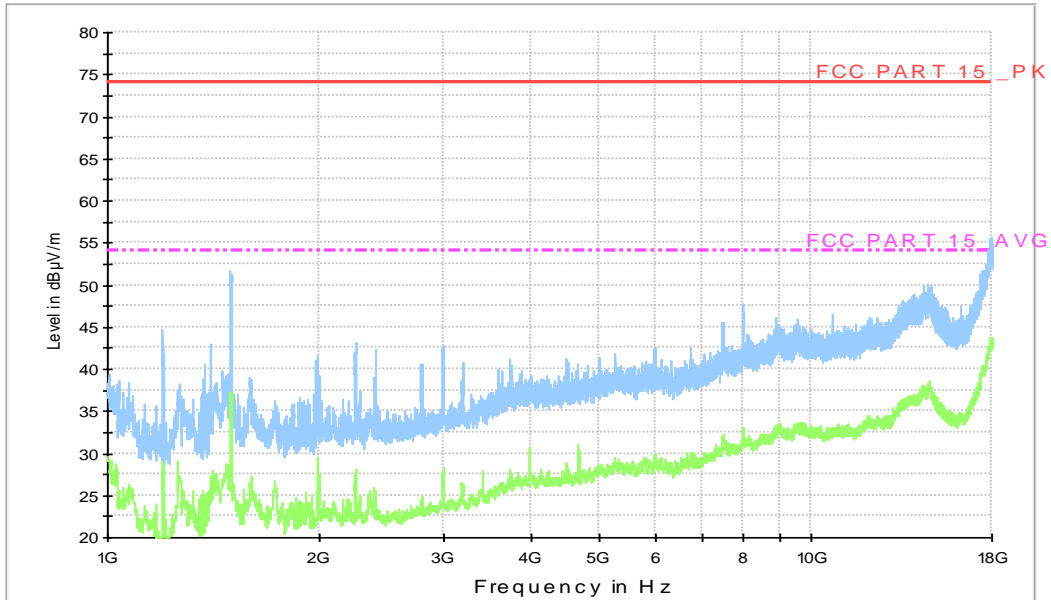


Figure A.6 Radiated Emission from 1GHz to 18GHz

A.2 Conducted Emission

Reference

FCC: CFR Part 15.107(a).

IC: ICES-003 Section 5.

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: $U= 3.38\text{dB}$, $k=2$.

Charging Mode, Set.17

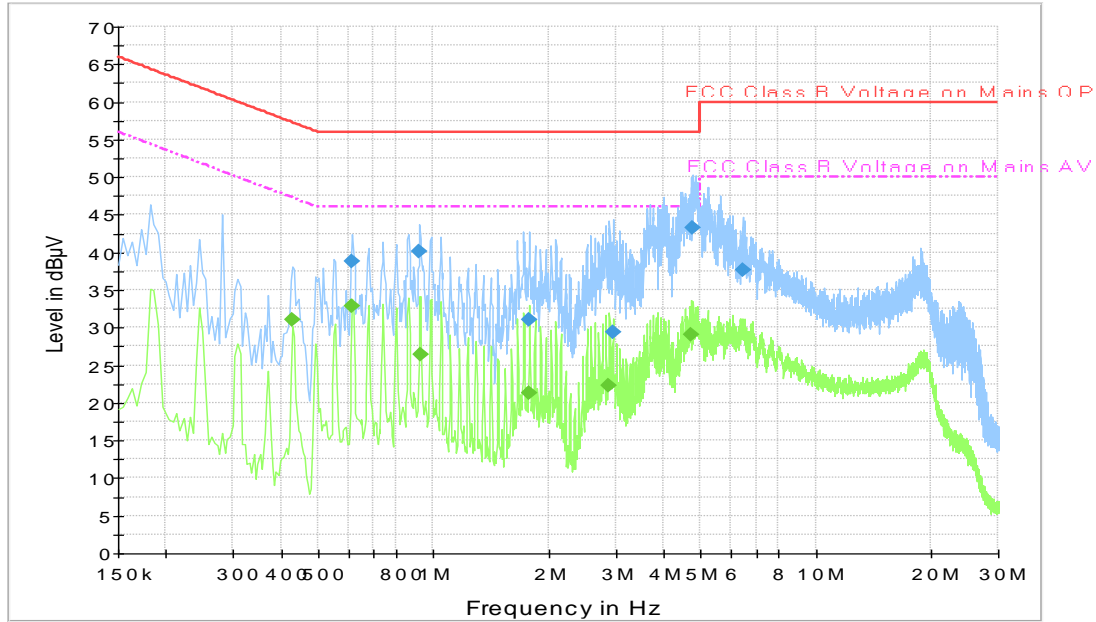


Figure A.7 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.613500	38.9	2000.0	9.000	On	L1	19.8	17.1	56.0
0.919500	40.1	2000.0	9.000	On	L1	19.8	15.9	56.0
1.783500	31.0	2000.0	9.000	On	L1	19.7	25.0	56.0
2.953500	29.4	2000.0	9.000	On	N	19.1	26.6	56.0
4.785000	43.3	2000.0	9.000	On	L1	19.6	12.7	56.0
6.427500	37.7	2000.0	9.000	On	N	19.6	22.3	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.429000	31.0	2000.0	9.000	On	L1	19.9	16.2	47.3
0.613500	32.9	2000.0	9.000	On	L1	19.8	13.1	46.0
0.924000	26.4	2000.0	9.000	On	L1	19.8	19.6	46.0
1.783500	21.3	2000.0	9.000	On	L1	19.7	24.7	46.0
2.886000	22.3	2000.0	9.000	On	L1	18.9	23.7	46.0
4.726500	29.0	2000.0	9.000	On	L1	19.6	17.0	46.0

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

Charging Mode, Set.23

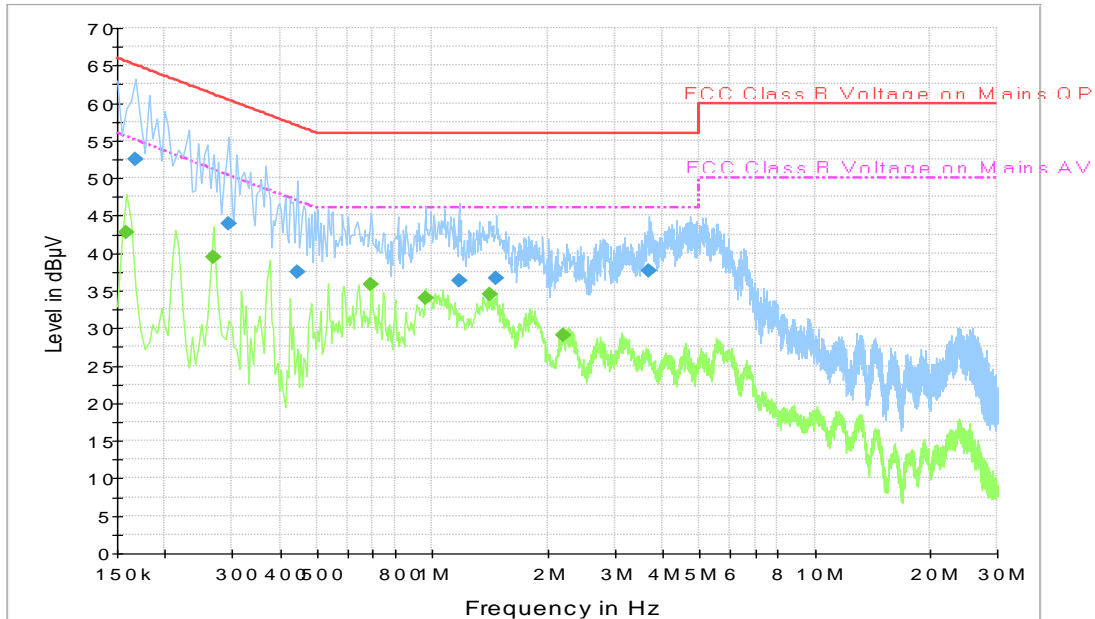


Figure A.8 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.168000	52.5	2000.0	9.000	On	N	19.9	12.6	65.1
0.294000	43.9	2000.0	9.000	On	N	19.8	16.5	60.4
0.442500	37.5	2000.0	9.000	On	N	19.9	19.6	57.0
1.176000	36.3	2000.0	9.000	On	N	19.7	19.7	56.0
1.468500	36.6	2000.0	9.000	On	N	19.7	19.4	56.0
3.691500	37.7	2000.0	9.000	On	N	19.5	18.3	56.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.159000	42.8	2000.0	9.000	On	L1	19.9	12.7	55.5
0.267000	39.5	2000.0	9.000	On	L1	19.8	11.7	51.2
0.690000	35.8	2000.0	9.000	On	L1	19.8	10.2	46.0
0.960000	34.0	2000.0	9.000	On	L1	19.8	12.0	46.0
1.414500	34.5	2000.0	9.000	On	L1	19.7	11.5	46.0
2.206500	29.1	2000.0	9.000	On	L1	19.3	16.9	46.0

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

USB Mode, Set.25

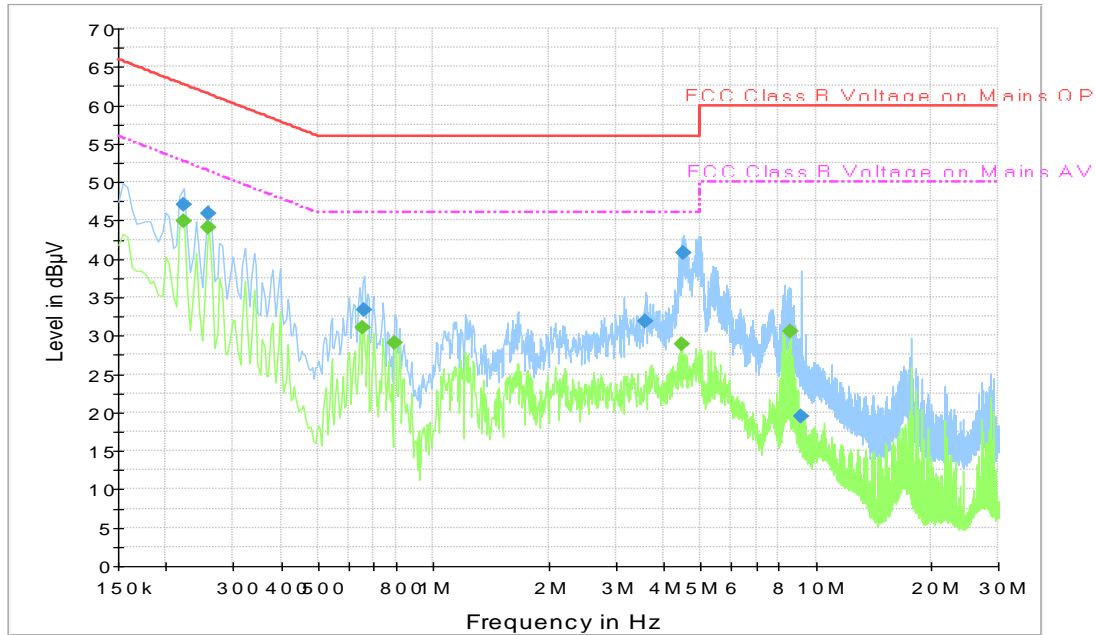


Figure A.9 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.222000	47.1	2000.0	9.000	On	N	19.8	15.7	62.7
0.258000	45.9	2000.0	9.000	On	N	19.8	15.6	61.5
0.658500	33.4	2000.0	9.000	On	N	19.8	22.6	56.0
3.592500	31.9	2000.0	9.000	On	N	19.5	24.1	56.0
4.506000	40.7	2000.0	9.000	On	L1	19.6	15.3	56.0
9.145500	19.4	2000.0	9.000	On	N	19.7	40.6	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.222000	44.9	2000.0	9.000	On	N	19.8	7.8	52.7
0.258000	44.1	2000.0	9.000	On	N	19.8	7.4	51.5
0.654000	31.0	2000.0	9.000	On	N	19.8	15.0	46.0
0.793500	29.1	2000.0	9.000	On	N	19.8	16.9	46.0
4.483500	28.8	2000.0	9.000	On	N	19.6	17.2	46.0
8.601000	30.5	2000.0	9.000	On	L1	19.6	19.5	50.0

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

END OF REPORT