6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:		
Verdict Column	P	Pass
	NA	Not applicable
	BR	Re-use test data from basic model report.
	F	Fail

Items	Test Name	Clause in FCC rules	Section in this report	Verdict	Test Location
1	Radiated Emission	15.109(a)	A.1	BR	**CTTL(BDA)**
2	Conducted Emission	15.107(a)	A.2	BR	**CTTL(BDA)**

7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE	CALIBRATION INTERVAL
1	Test Receiver	ESU26	100376	R&S	2019-11-27	1 year
2	Test Receiver	ESCI	100766	R&S	2019-04-06	1 year
3	Universal Radio Communication Tester	CMW500	127406	R&S	2019-02-19	1 year
4	LISN	ESH3-Z5	825562/028	R&S	2019-08-22	1 year
5	EMI Antenna	VULB9163	9163-482	Schwarzbeck	2019-09-21	1 year
6	EMI Antenna	3117	00139065	ETS-Lindgren	2019-11-15	1 year
7	Signal Generator	SMF100A	101295	R&S	2019-11-27	1 year
8	Printer	P1606dn	VNC3L52122	HP	N/A	N/A
9	Keyboard	KU-1601	2048361	Lenovo	N/A	N/A
10	Mouse	EMS-537A	8021S3MC	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. During the charging mode the FM application is started up. During the USB mode The EUT is keeping on playing MP3 and the GNSS application is started up. The model of the PC is Lenovo M4000e-17, and the serial number of the PC is M706RMW2. 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：5.16dB, 1GHz-18GHz：5.44dB, *k*=2.

Measurement results for Set.1:

Charging Mode+ FM /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)
17097.000	39.7	-25.5	41.3	23.88	54.0	14.3	H
17109.000	39.7	-25.5	41.3	23.87	54.0	14.3	V
17108.250	39.7	-25.5	41.3	23.81	54.0	14.3	V
17119.500	39.6	-25.5	41.3	23.81	54.0	14.4	V
17981.250	39.6	-25.3	40.8	24.12	54.0	14.4	V
17095.500	39.6	-25.5	41.3	23.73	54.0	14.4	H

Charging Mode+ FM/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)
17154.000	52.0	-25.6	41.3	36.34	74.0	22.0	V
17959.500	51.7	-25.0	40.8	35.91	74.0	22.3	V
17962.500	51.6	-25.0	40.8	35.84	74.0	22.4	V
17983.500	51.5	-25.3	40.8	36.00	74.0	22.5	V
17505.750	51.5	-25.4	41.2	35.65	74.0	22.5	V
17145.750	51.5	-25.5	41.3	35.73	74.0	22.5	H

Measurement results for Set.2:

USB Mode +MP3+GNSS /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)
17101.500	39.9	-25.5	41.3	24.07	54.0	14.1	H
17099.250	39.7	-25.5	41.3	23.85	54.0	14.3	V
17083.500	39.7	-25.5	41.3	23.84	54.0	14.3	V
17095.500	39.6	-25.5	41.3	23.80	54.0	14.4	V
17106.750	39.6	-25.5	41.3	23.77	54.0	14.4	V
17121.750	39.6	-25.5	41.3	23.76	54.0	14.4	V

USB Mode +MP3+GNSS /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)
3585.750	53.9	-34.2	33.5	54.56	74.0	20.1	H
3593.250	53.0	-34.2	33.5	53.68	74.0	21.0	H
3594.000	52.6	-34.2	33.5	53.29	74.0	21.4	H
17478.750	52.2	-25.3	41.2	36.29	74.0	21.8	V
17964.750	52.2	-25.1	40.8	36.41	74.0	21.8	H
3588.000	52.0	-34.2	33.5	52.74	74.0	22.0	H

Measurement results for Set.3:

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)
17102.250	39.7	-25.5	41.3	23.85	54.0	14.3	V
17089.500	39.6	-25.5	41.3	23.78	54.0	14.4	H
17094.750	39.6	-25.5	41.3	23.74	54.0	14.4	H
17096.250	39.5	-25.5	41.3	23.65	54.0	14.5	V
17985.000	39.5	-25.3	40.8	24.03	54.0	14.5	H
17117.250	39.5	-25.5	41.3	23.63	54.0	14.5	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)
3594.000	55.1	-34.2	33.5	55.75	74.0	18.9	H
3596.250	54.7	-34.1	33.5	55.37	74.0	19.3	H
17109.750	52.0	-25.5	41.3	36.16	74.0	22.0	V
3586.500	51.8	-34.2	33.5	52.50	74.0	22.2	H
17079.750	51.8	-25.5	41.3	35.94	74.0	22.2	V
17055.000	51.8	-25.5	41.4	35.92	74.0	22.2	V

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

Charging Mode + FM, Set.1

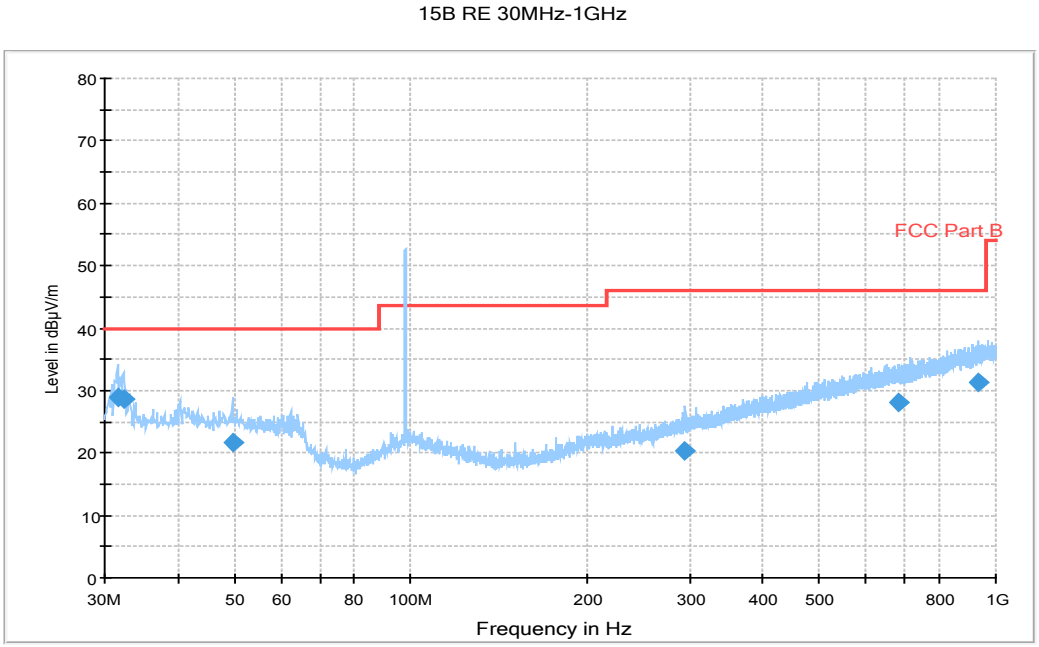

Figure A.1 Radiated Emission from 30MHz to 1GHz

Note: the spike（98MHz）over the limit is coming from FM signal source.

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
31.552000	28.8	100.0	V	89.0	-1.2	11.2	40.0
32.328000	28.5	100.0	H	123.0	-1.1	12.5	40.0
49.594000	21.6	194.0	V	123.0	0.8	18.4	40.0
294.81000	20.2	100.0	V	-21.0	1.3	25.8	46.0
683.39200	28.2	225.0	V	-25.0	9.7	17.8	46.0
934.13700	31.4	110.0	V	-18.0	12.5	14.6	46.0

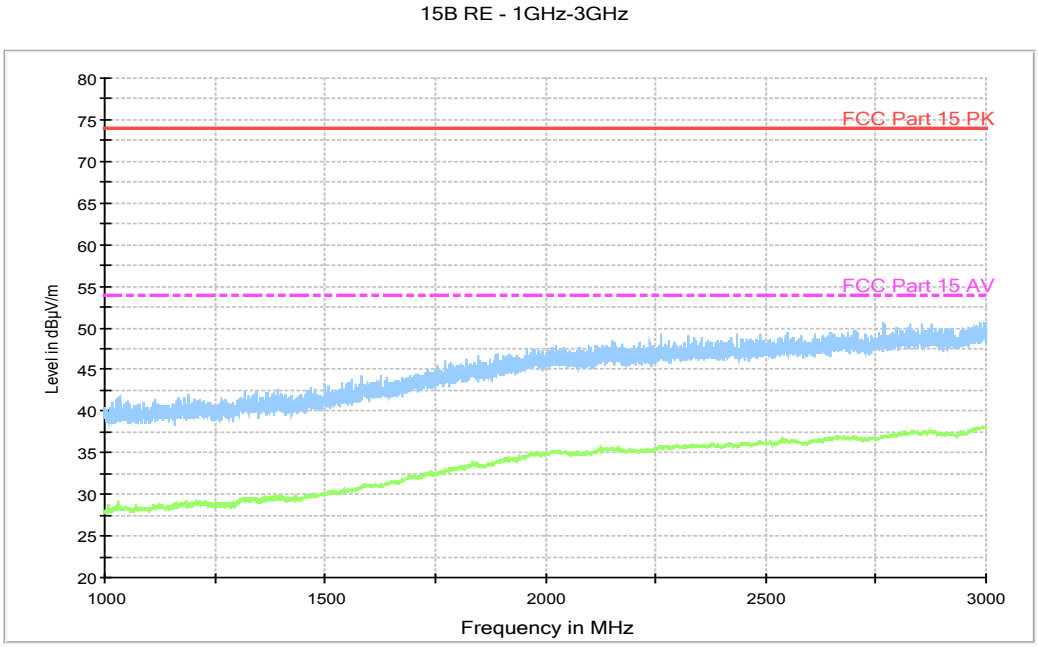

Figure A.2 Radiated Emission from 1GHz to 3GHz

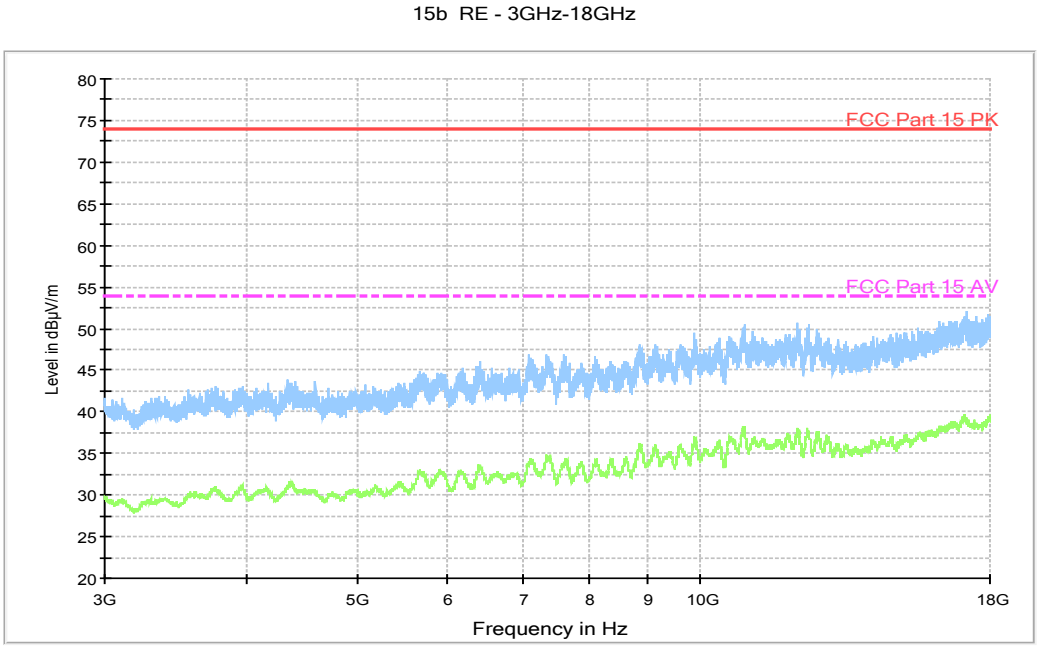

Figure A.3 Radiated Emission from 3GHz to 18GHz

USB Mode +MP3+GNSS, Set.2

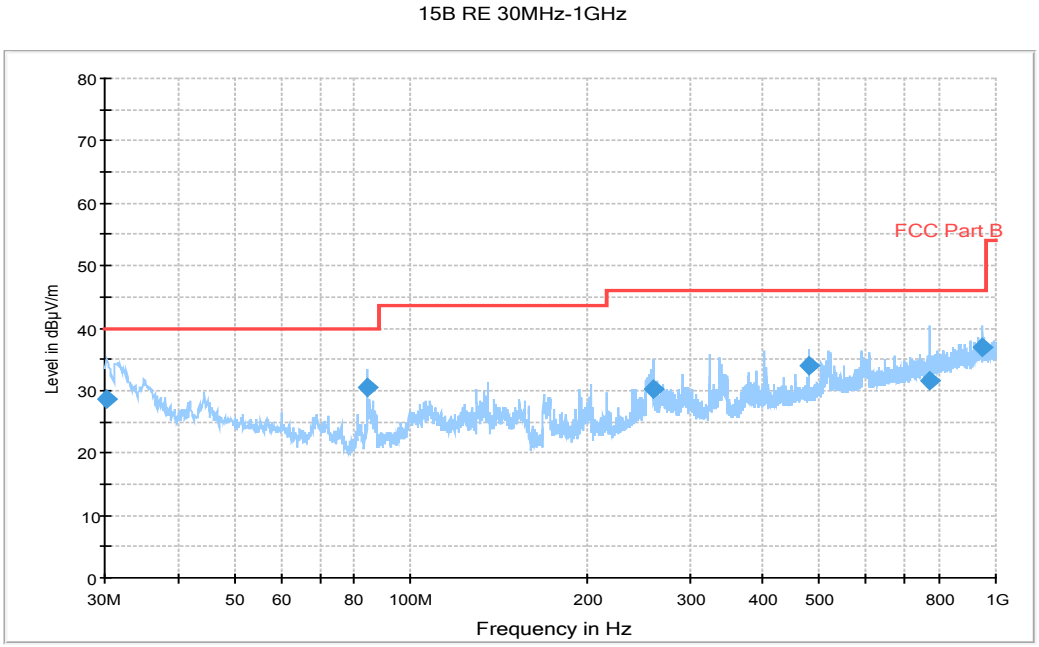

Figure A.4 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.194000	28.6	100.0	V	114.0	-1.6	11.4	40.0
84.320000	30.4	225.0	H	62.0	-4.7	9.6	40.0
259.59900	30.2	175.0	V	3.0	-0.1	15.8	46.0
479.98300	33.9	125.0	H	45.0	6.6	12.1	46.0
768.07300	31.6	100.0	H	10.0	10.7	14.4	46.0
949.07500	37.0	100.0	H	72.0	12.8	9.0	46.0

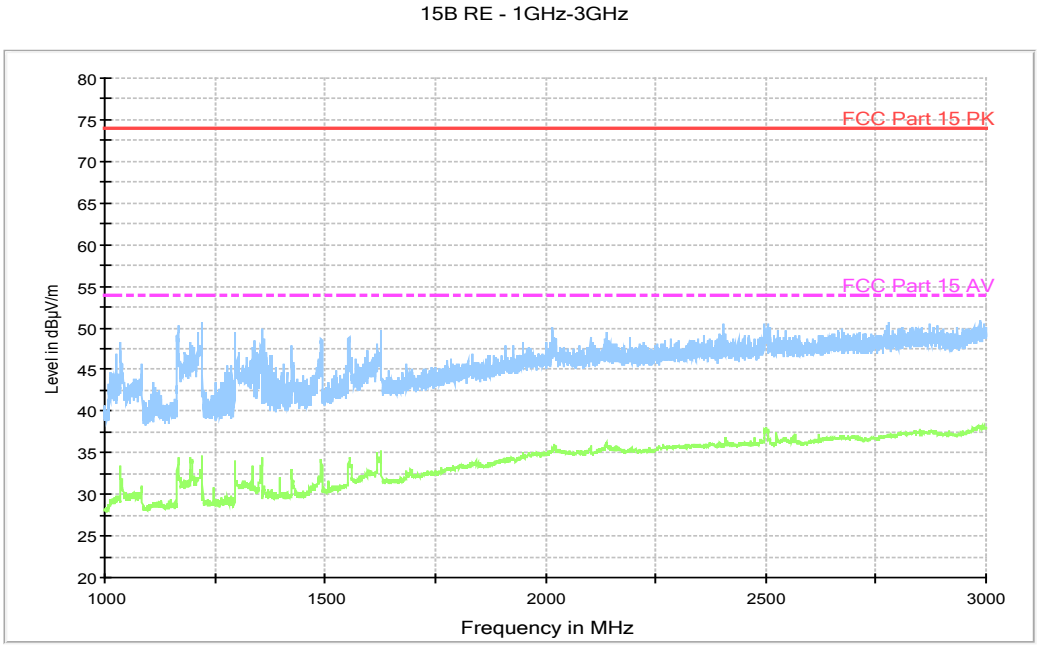

Figure A.5 Radiated Emission from 1GHz to 3GHz

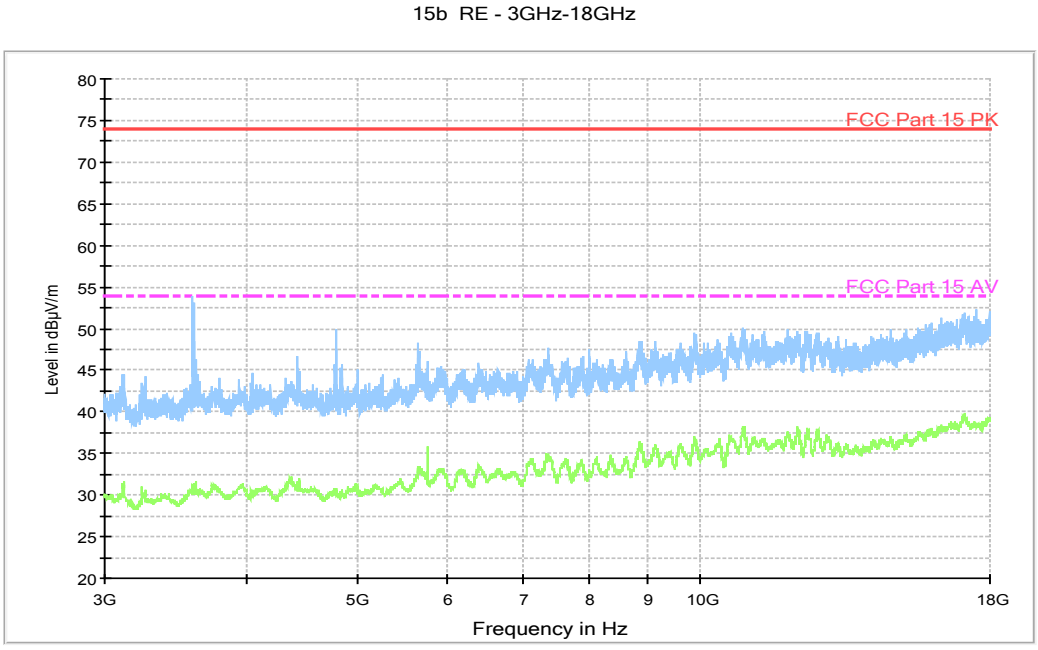

Figure A.6 Radiated Emission from 3GHz to 18GHz

USB Mode, Set.3

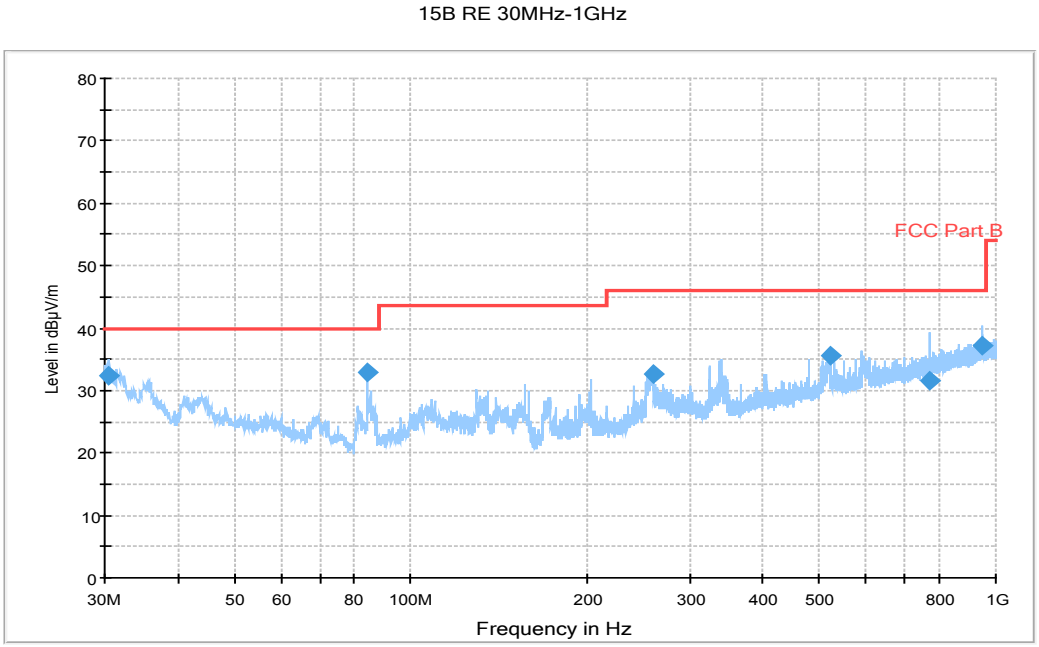

Figure A.4 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.485000	32.3	100.0	V	297.0	-1.5	7.7	40.0
84.320000	33.0	219.0	H	271.0	-4.7	7.0	40.0
260.08400	32.6	125.0	V	-25.0	-0.1	13.4	46.0
519.85000	35.5	119.0	H	-32.0	7.4	10.5	46.0
768.07300	31.6	125.0	H	1.0	10.7	14.4	46.0
949.26900	37.3	100.0	H	59.0	12.8	8.7	46.0

15B RE - 1GHz-3GHz

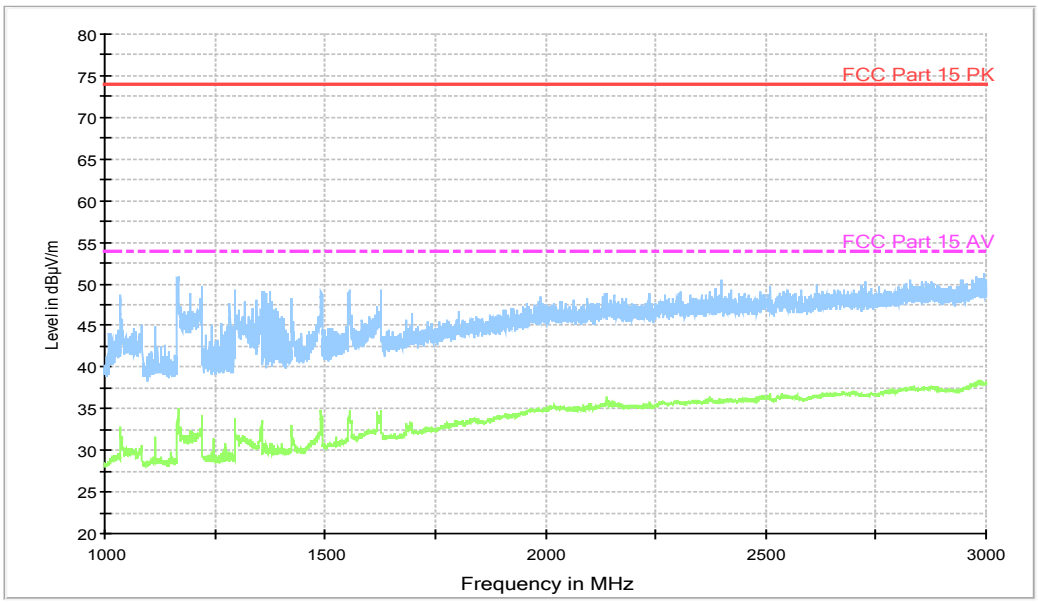

Figure A.5 Radiated Emission from 1GHz to 3GHz

15b RE - 3GHz-18GHz

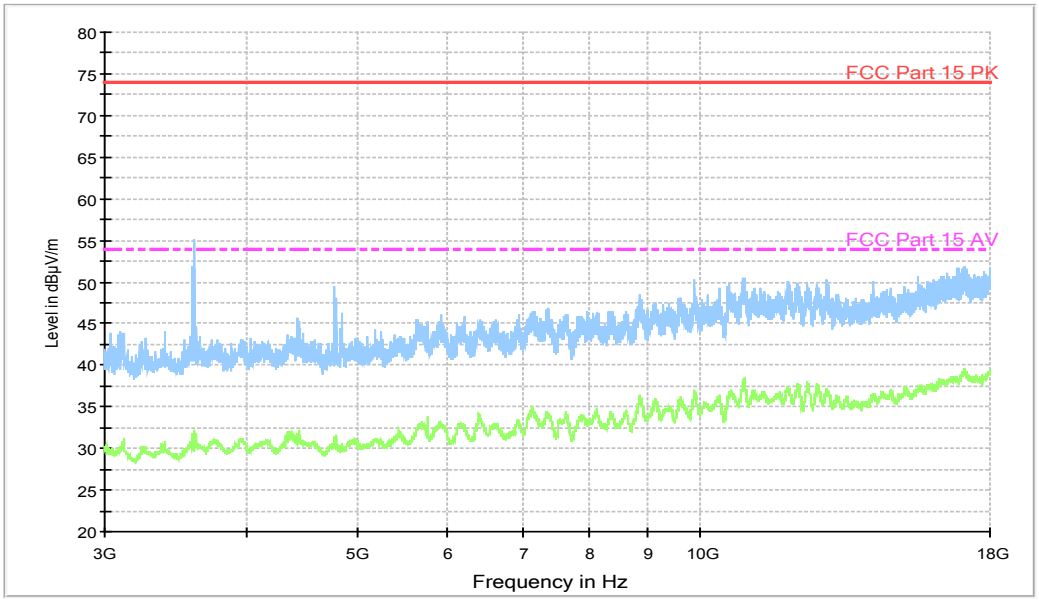

Figure A.6 Radiated Emission from 3GHz to 18GHz

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. During the charging mode the FM application is started up. During the USB mode The EUT is keeping on playing MP3 and the GNSS application is started up. The model of the PC is Lenovo M4000e-17, and the serial number of the PC is M706RMW2. 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*= 3.08 dB, *k*=2.

Charging Mode +FM, Set.1

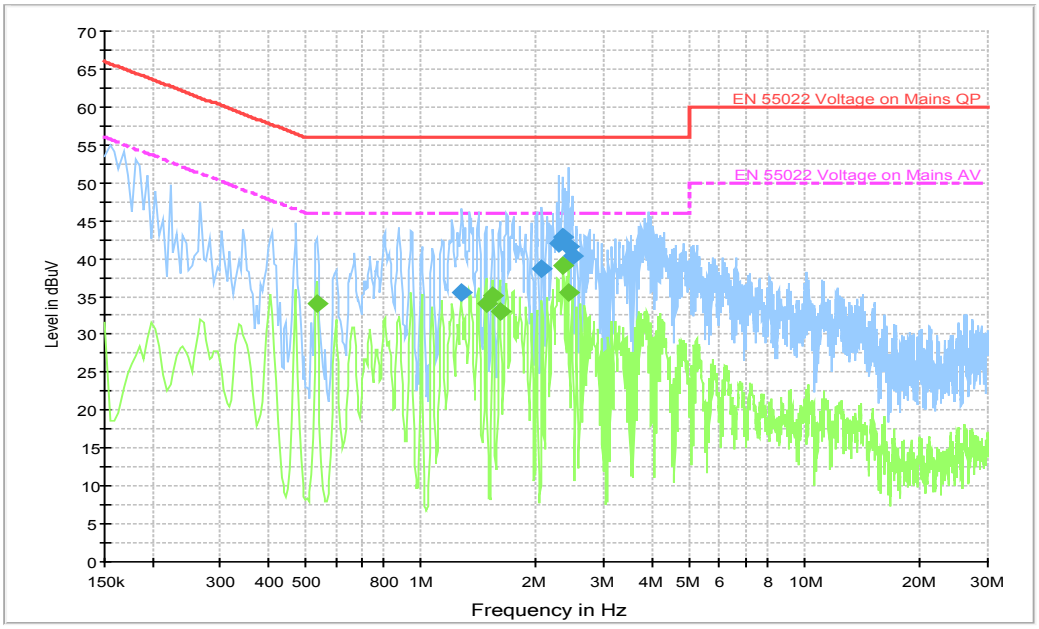

Figure A.7 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
1.279500	35.5	2000.0	9.000	GND	N	10.4	20.5	56.0
2.071500	38.7	2000.0	9.000	GND	N	10.4	17.3	56.0
2.283000	42.0	2000.0	9.000	GND	L1	10.4	14.0	56.0
2.346000	42.8	2000.0	9.000	GND	N	10.4	13.2	56.0
2.422500	41.6	2000.0	9.000	GND	N	10.4	14.4	56.0
2.485500	40.4	2000.0	9.000	GND	N	10.4	15.6	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.537000	34.2	2000.0	9.000	GND	L1	10.3	11.8	46.0
1.477500	34.1	2000.0	9.000	GND	L1	10.4	11.9	46.0
1.540500	35.0	2000.0	9.000	GND	L1	10.4	11.0	46.0
1.608000	32.9	2000.0	9.000	GND	L1	10.4	13.1	46.0
2.346000	39.0	2000.0	9.000	GND	L1	10.4	7.0	46.0
2.418000	35.6	2000.0	9.000	GND	L1	10.4	10.4	46.0

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

.USB Mode +MP3+GNSS, Set.2

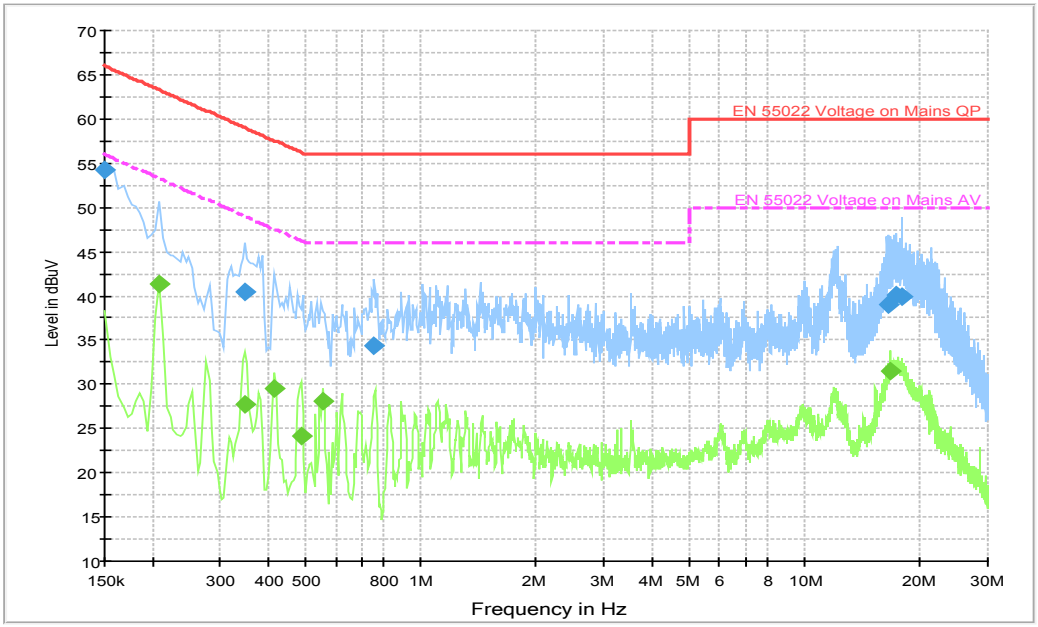

Figure A.8 Conducted Emission

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	54.2	2000.0	9.000	GND	L1	10.2	11.8	66.0
0.348000	40.5	2000.0	9.000	GND	L1	10.3	18.5	59.0
0.757500	34.3	2000.0	9.000	GND	N	10.4	21.7	56.0
16.548000	39.1	2000.0	9.000	GND	L1	11.2	20.9	60.0
17.362500	40.1	2000.0	9.000	GND	L1	11.2	19.9	60.0
17.965500	40.0	2000.0	9.000	GND	L1	11.3	20.0	60.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Meas. Time	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.208500	41.3	2000.0	9.000	GND	N	10.3	12.0	53.3
0.348000	27.7	2000.0	9.000	GND	N	10.3	21.3	49.0
0.415500	29.5	2000.0	9.000	GND	L1	10.3	18.0	47.5
0.487500	24.2	2000.0	9.000	GND	N	10.3	22.0	46.2
0.555000	28.1	2000.0	9.000	GND	L1	10.3	17.9	46.0
16.638000	31.5	2000.0	9.000	GND	L1	11.2	18.5	50.0

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

ANNEX B: Persons involved in this testing

Test Item	Tester
Radiated Emission	Li Zongliang
Conducted Emission	Li Zongliang

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