



TEST REPORT

No. I20Z70192-EMC02

for

Samsung Electronics Co., Ltd.

Wearable device

Model Name: SM-R220

FCC ID: ZCASMR220

with

Hardware Version: Aj85c

Software Version: NEAT-FTY_V25

Issued Date: 2020-07-03

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.

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.

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I20Z70192-EMC02	Rev.0	1 st edition	2020-07-03

Note: the latest revision of the test report supersedes all previous version.



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1. Test Laboratory

1.1. Introduction & Accreditation

Telecommunication Technology Labs, CAICT is an ISO/IEC 17025:2005 accredited test laboratory under NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM (NVLAP) with lab code 600118-0, and is also an FCC accredited test laboratory (CN5017), and ISED accredited test laboratory (CN0066). The detail accreditation scope can be found on NVLAP website.

1.2. Testing Location

CTTL (BDA)

Address: No.18A, Kangding Street, Beijing Economic-Technology
Development Area, Beijing, P. R. China 100176

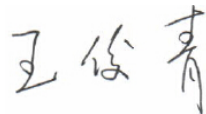
1.3. Testing Environment

Normal Temperature: 15-35° C
Relative Humidity: 20-75%

1.4. Project data

Testing Start Date: 2020-06-15
Testing End Date: 2020-07-03

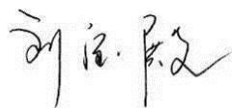
1.5. Signature



Wang Junqing
(Prepared this test report)



Zhang Ying
(Reviewed this test report)



Liu Baodian
Deputy Director of the laboratory
(Approved this test report)



2. Client Information

2.1. Applicant Information

Company Name: Samsung Electronics. Co., Ltd.
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Contact Person Jenni Chun
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Fax: /

2.2. Manufacturer Information

Company Name: Samsung Electronics Co., Ltd.
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443 742, Korea
Contact Person JP KIM
Contact Email jp426.kim@samsung.com
Telephone: +82-10-4376-0326
Fax: /

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

3.1. About EUT

Description	Wearable device
Model Name	SM-R220
FCC ID	ZCASMR220
Extreme vol. Limits	3.7VDC to 4.35VDC (nominal: 3.85VDC)

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of CTTL, Telecommunication Technology Labs, CAICT.

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version
UT02a	/	Aj85c	NEAT-FTY_V25

*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	HQ-506N	inbuilt
AE2	Charger accessory	/	/
AE3	Charger accessory	/	/

AE1

Model	Secondary Li-ion Battery
Manufacturer	Dongguan Amperex Technology Limited
Capacitance	154mAh
Nominal voltage	3.85V

AE2

Model	USB-POGO-W-100-HF
Manufacturer	Strong Power Electronics Technology CO.,Ltd
Length of cable	/

AE3

Model	SHQ-A065A
Manufacturer	Shenzhen Saibao Communication Industrial Co., Ltd
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.F1	UT02a+ AE1+ AE2 +PC	Charger
Set.F2	UT02a+ AE1+ AE3 +PC	Charger

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	2019
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-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
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 6000 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)	B.1	P	CTTL(BDA)
2	Conducted Emission	15.107(a)	B.2	P	CTTL(BDA)

7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE	CALIBRATION INTERVAL
1	Test Receiver	ESU26	100376	R&S	2020-10-30	1 Year
2	LISN	ENV216	101459	R&S	2021-03-17	1 year
3	Universal Radio Communication Tester	CMW500	159408	R&S	2021-03-04	1 year
4	Test Receiver	ESCI	100766	R&S	2021-03-10	1 Year
5	EMI Antenna	VULB 9163	9163-514	Schwarzbeck	2021-02-24	1 year
6	EMI Antenna	3117	00139065	ETS-Lindgren	2020-11-10	1 year

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 (charging mode of MS) at distances of 3 meters 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 wearable device is operating in the charging mode. During the test wearable device is connected to a charging device in the case of charging mode.

All equipment is placed on the test table top and arranged in a typical configuration in accordance with ANSI C63.4-2014 and manipulated to obtain worst case emissions.

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): $U = 4.74 \text{ dB}$, $k=2$.

Measurement results for Set.F1:

Charging Mode/Average detector

Frequency (MHz)	Measurement Result (dB μ V/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dB μ V)	Limit (dB μ V/m)	Margin (dB)	Antenna Pol. (H/V)
17700.500	39.96	-22.2	41.2	20.90	54.0	14.0	V
17705.500	39.96	-22.2	41.2	20.91	54.0	14.0	V
17693.000	39.94	-22.2	41.2	20.86	54.0	14.1	H
17687.500	39.93	-22.1	41.2	20.85	54.0	14.1	H
17777.500	39.88	-22.4	41.3	20.98	54.0	14.1	V
17686.000	39.86	-22.1	41.2	20.77	54.0	14.1	V

Charging Mode/Peak detector

Frequency (MHz)	Measurement Result (dB μ V/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dB μ V)	Limit (dB μ V/m)	Margin (dB)	Antenna Pol. (H/V)
17708.500	50.8	-22.2	41.2	31.80	74.0	23.2	V
16930.500	50.8	-23.0	41.7	32.19	74.0	23.2	H
17659.000	50.8	-22.1	41.2	31.69	74.0	23.2	V
17222.500	50.8	-22.9	41.5	32.24	74.0	23.2	V
17746.500	50.8	-22.3	41.2	31.88	74.0	23.2	H
17903.000	50.8	-22.6	41.3	32.18	74.0	23.2	V

Measurement results for Set.F2:
Charging Mode/Average detector

Frequency (MHz)	Measurement Result (dB μ V/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dB μ V)	Limit (dB μ V/m)	Margin (dB)	Antenna Pol. (H/V)
17742.000	39.86	-22.3	41.2	20.88	54.0	14.1	H
17708.500	39.84	-22.2	41.2	20.80	54.0	14.2	H
17696.500	39.82	-22.2	41.2	20.75	54.0	14.2	V
17710.000	39.82	-22.2	41.2	20.78	54.0	14.2	H
17689.000	39.80	-22.2	41.2	20.71	54.0	14.2	V
17694.500	39.80	-22.2	41.2	20.72	54.0	14.2	V

Charging Mode/Peak detector

Frequency (MHz)	Measurement Result (dB μ V/m)	Cable loss (dB)	Antenna Factor (dB/m)	Receiver Reading (dB μ V)	Limit (dB μ V/m)	Margin (dB)	Antenna Pol. (H/V)
17542.500	52.70	-22.6	41.2	34.12	74.0	21.3	H
16929.000	52.61	-23.0	41.7	33.96	74.0	21.4	V
17072.500	52.28	-23.0	41.6	33.69	74.0	21.7	H
17700.000	52.10	-22.2	41.2	33.04	74.0	21.9	H
16890.500	52.00	-23.0	41.6	33.37	74.0	22.0	H
17852.500	51.89	-22.5	41.3	33.14	74.0	22.1	H

Measurement results for Set.F1:

15B RE 30MHz-1GHz

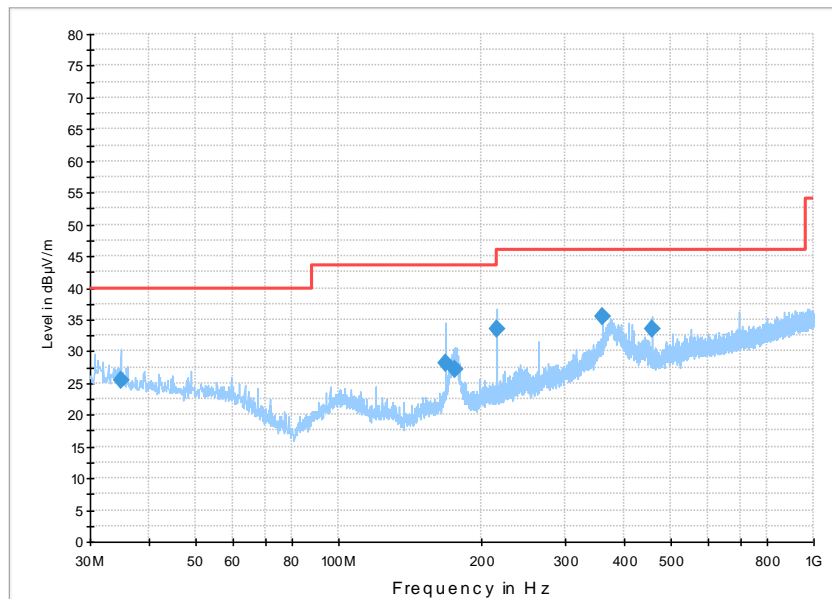
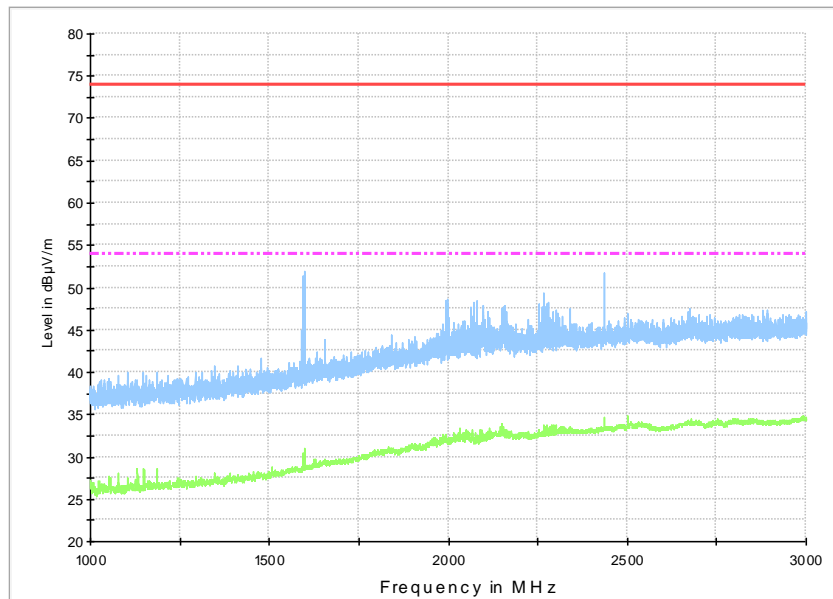


Fig A.1 Radiated Emission from 30MHz to 1GHz

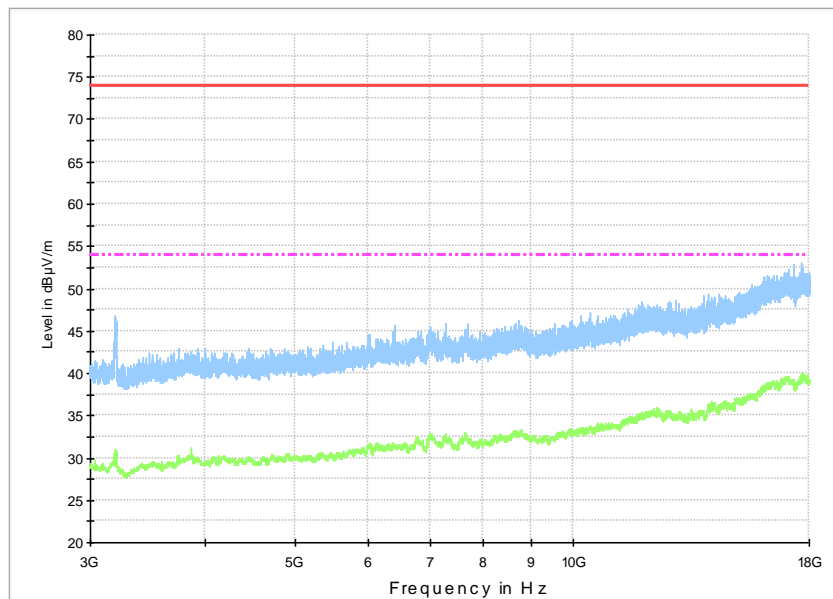
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
34.753000	25.4	100.0	V	273.0	-1.1	14.6	40.0	
167.934000	28.1	100.0	V	284.0	-3.8	15.4	43.5	
176.179000	27.2	125.0	H	249.0	-3.5	16.3	43.5	
215.949000	33.5	125.0	H	-7.0	-1.2	10.0	43.5	
359.994000	35.4	100.0	H	59.0	3.0	10.6	46.0	
456.024000	33.6	100.0	V	4.0	5.1	12.4	46.0	

15B RE - 1GHz-3GHz

**Fig A.2 Radiated Emission from 1GHz to 3GHz**

15b RE - 3GHz-18GHz

**Fig A.3 Radiated Emission from 3GHz to 6GHz**

Measurement results for Set.F2:

15B RE 30MHz-1GHz

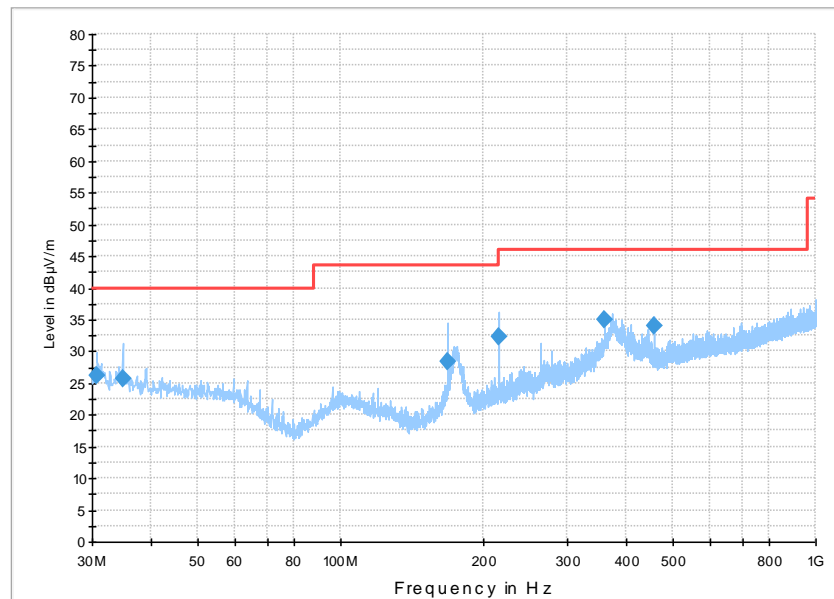


Fig A.4 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
30.679000	26.2	100.0	V	39.0	-1.9	13.8	40.0	
34.753000	25.6	100.0	V	288.0	-1.1	14.4	40.0	
167.934000	28.4	100.0	V	315.0	-3.8	15.1	43.5	
215.949000	32.4	125.0	H	1.0	-1.2	11.1	43.5	
359.994000	35.0	100.0	H	69.0	3.0	11.0	46.0	
456.024000	33.9	119.0	V	25.0	5.1	12.1	46.0	

15B RE - 1GHz-3GHz

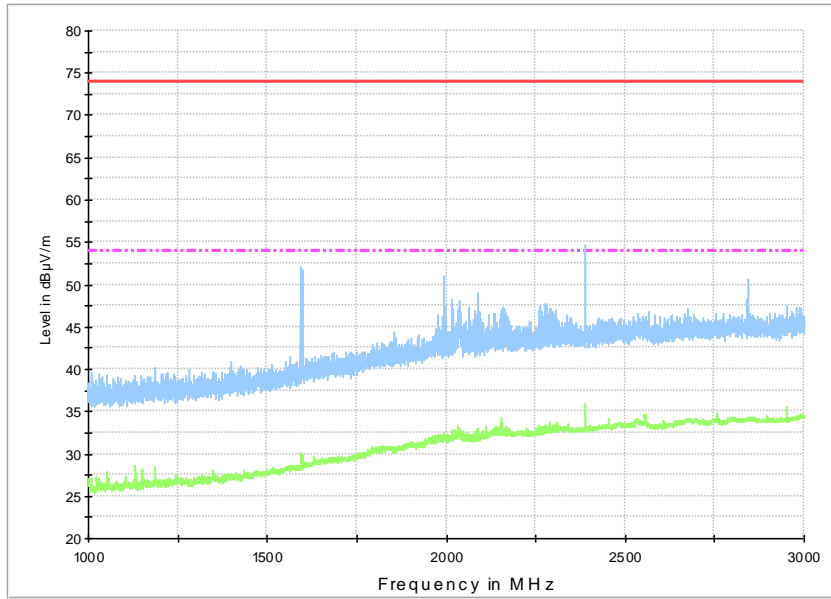


Fig A.5 Radiated Emission from 1GHz to 3GHz

15b RE - 3GHz-18GHz

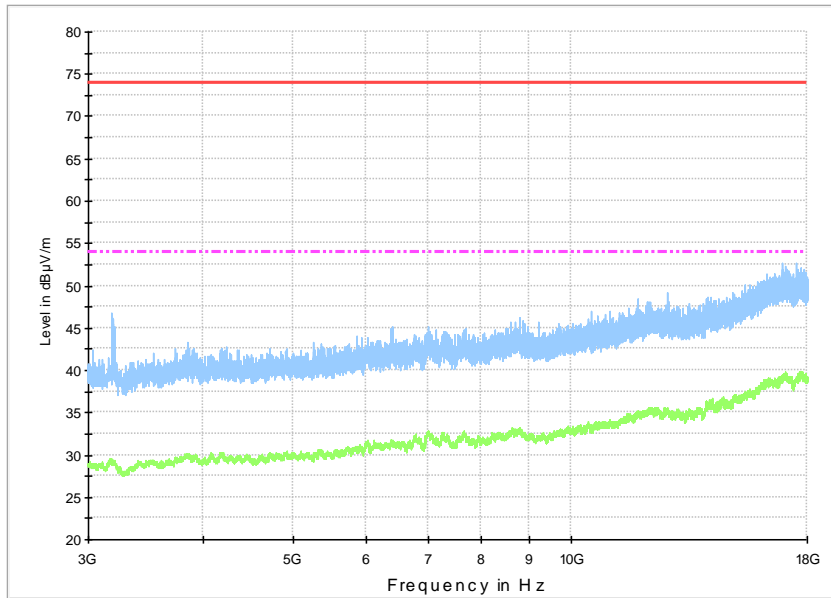


Fig A.6 Radiated Emission from 3GHz to 6GHz

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 Wearable Device is operating in the charging mode. During the test Wearable Device is connected to a charging device 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: $U= 3.1 \text{ dB}$, $k=2$.

Charging Mode, Set.F1:

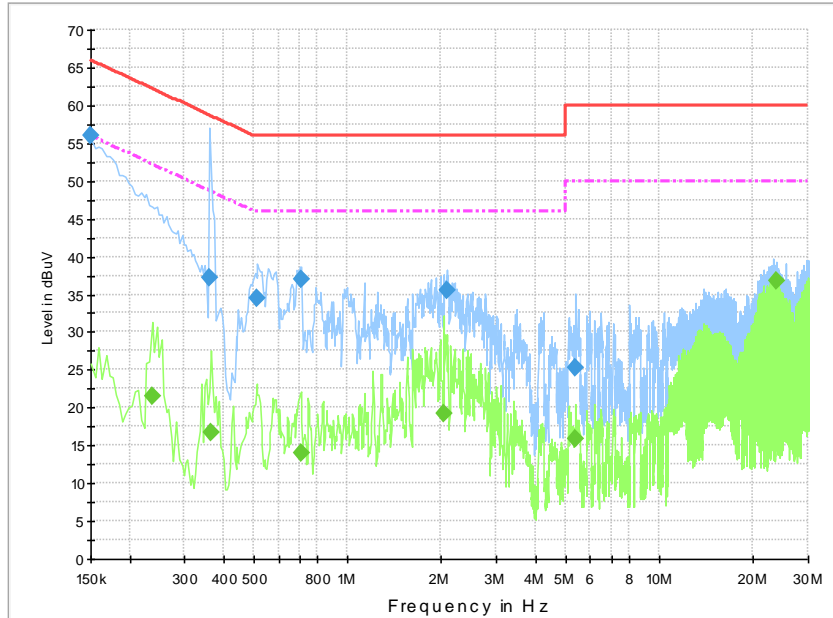


Fig A.7 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.150000	56.0	10000.0	9.000	On	N	19.8	10.0	66.0	
0.361500	37.1	10000.0	9.000	On	N	19.9	21.6	58.7	
0.514500	34.5	10000.0	9.000	On	L1	20.0	21.5	56.0	
0.708000	37.0	10000.0	9.000	On	L1	19.9	19.0	56.0	
2.080500	35.5	10000.0	9.000	On	L1	19.8	20.5	56.0	
5.406000	25.4	10000.0	9.000	On	N	19.8	34.6	60.0	

Final Result 2

Frequency (MHz)	Average (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.235500	21.5	10000.0	9.000	On	L1	19.9	30.8	52.3	
0.366000	16.7	10000.0	9.000	On	L1	19.9	31.9	48.6	
0.708000	14.0	10000.0	9.000	On	L1	19.9	32.0	46.0	
2.035500	19.3	10000.0	9.000	On	L1	19.8	26.7	46.0	
5.397000	16.0	10000.0	9.000	On	N	19.8	34.0	50.0	
23.694000	36.7	10000.0	9.000	On	N	20.0	13.3	50.0	

Charging Mode, Set.F2:

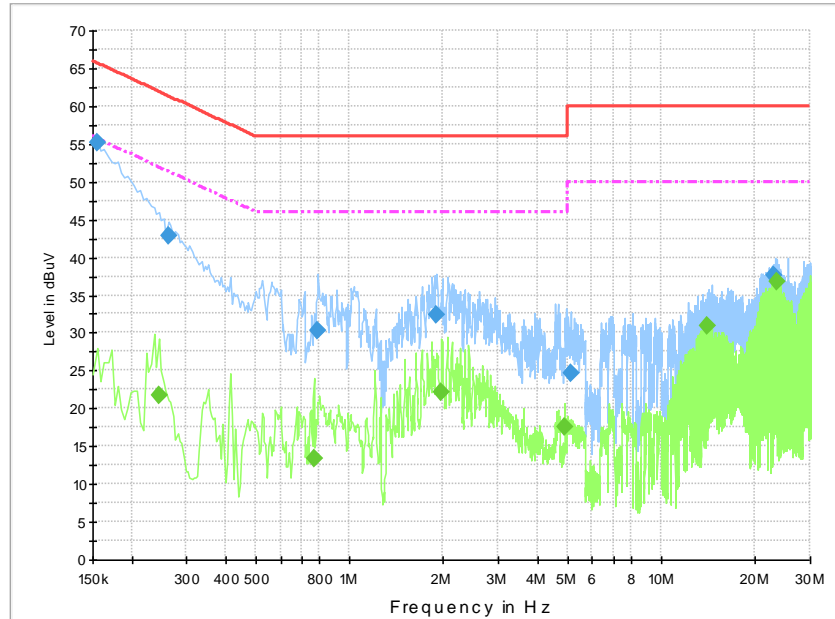


Fig A.8 Radiated Emission from 30MHz to 1GHz

Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.154500	55.2	10000.0	9.000	On	N	19.9	10.5	65.8	
0.262500	42.7	10000.0	9.000	On	N	19.9	18.6	61.4	
0.793500	30.3	10000.0	9.000	On	N	19.9	25.7	56.0	
1.905000	32.5	10000.0	9.000	On	L1	19.8	23.5	56.0	
5.145000	24.7	10000.0	9.000	On	N	19.8	35.3	60.0	
22.794000	37.5	10000.0	9.000	On	N	20.0	22.5	60.0	

Final Result 2

Frequency (MHz)	Average (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)	Comment
0.244500	21.7	10000.0	9.000	On	L1	19.9	30.2	51.9	
0.771000	13.4	10000.0	9.000	On	N	19.9	32.6	46.0	
1.977000	22.2	10000.0	9.000	On	L1	19.8	23.8	46.0	
4.906500	17.5	10000.0	9.000	On	N	19.8	28.5	46.0	
14.037000	31.0	10000.0	9.000	On	N	20.0	19.0	50.0	
23.581500	36.9	10000.0	9.000	On	N	20.0	13.1	50.0	



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	Guo Qian
Radiated Emission	EMC32 V9.01.00	R&S	Zhao Wenhui

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