

TEST REPORT

Report No.: SHE20090007-02CE

Date: 2021-03-10

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Applicant : Sonim Technologies, Inc.
Address of Applicant : 6836 Bee Cave Road, Building 1, Suite 279, Austin, Texas 78746, USA

Product Name : Rugged Smart Phone
Model No. : RS60
Sample No. : E20090007-01#01
FCC ID : WYPRS60
ISED Number : 8090A-RS60
Standards : FCC CFR47 Part 15, Subpart C
RSS-Gen (Issue 5, March 2019)
RSS-210 (Issue 10, December 2019)

Date of Receipt : 2020-08-31
Date of Test : 2020-08-31 ~ 2021-03-10
Date of Issue : 2021-03-10

Remark:

This report details the results of the testing carried out on one sample, the results contained in this report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

Prepared by: Jennifer Zhou Reviewed by: Oliver Xiang Approved by: Guoyou Chi
(Jennifer Zhou) (Oliver Xiang) (Authorized signatory: Guoyou Chi)

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1 General Information

1.1 Testing Laboratory

Company Name	ICAS Testing Technology Service(Shanghai) Co., Ltd.
Address	155 Pingbei Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

1.2 Details of Application

Company Name	Sonim Technologies, Inc.
Address	6836 Bee Cave Road, Building 1, Suite 279, Austin, Texas 78746, USA
Contact Person	Avena.Xu
Telephone	1-650-378-8100
Email	avena.xu@sonimtech.com

1.3 Details of EUT

Product Name	Rugged Smart Phone
Brand Name	Sonim
Model No.	RS60
FCC ID	WYPRS60
Mode of Operation	NFC
Frequency Range	13.56MHz
Modulation Type	ASK
Hardware version	V1.0
Software version	60.0.0-01-10.0.0-00.01.01
Antenna Type	Internal Antenna
Extreme Temperature Range	-20°C~ +55°C
Test Voltage	High:DC 4.35V Normal:DC 3.8V Low:DC 3.7V

1.4 Test Methodology

47 CFR Part 15, Subpart C (10-1-16 Edition)	Miscellaneous Wireless Communications Services
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Note(s):

All test items were verified and recorded according to the standards and without any addition/deviation/exclusion during the test.

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1.5 Test Verdict

No.	FCC Part No.	ISED Part No.	Description	Test Result	Verdict
1	15.203	RSS-Gen7.1.4	Antenna Requirement	Clause 4.1.1	PASS
2	15.225(e)	RSS-210 B.6	Frequency Tolerance	Clause 4.1.2	PASS
3	2.1049	RSS-Gen	20dB Bandwidth and 99% Bandwidth	Clause 4.1.3	PASS
4	15.225	RSS-210 B.6	Radiated Emission	Clause 4.1.4	PASS
5	15.207	RSS-Gen	Conducted Emission	Clause 4.1.5	PASS

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2 Test Condition

2.1 Environmental conditions

Temperature (°C)	18-25
Humidity (%RH)	40-65
Barometric Pressure (mbar)	960-1060

2.2 Equipment List

Name of Equipment	Manufacturer	Model	Serial No.	Cal. Due Date
Spectrum Analyzer	Keysight	N9020B	MY59260184	2021-08-18
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2021-06-08
V-network	SCHWARZBECK	NSLK 8127	8127-902	2021-07-28
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2021-06-08
Loop Antenna	SCHWARZBECK	FMZB 1513	N/A	2021-11-22
EMC chamber 9*6*6 (L*W*H)	CHANGNING	966	N/A	2021-06-08
Shielded Enclosure 8*5*4 (L*W*H)	CHANGNING	854	N/A	2021-06-08
Test Software	BL	BL410_E	N/A	N/A

2.3 Measurement Uncertainty

Parameter	Frequency	Uncertainty
Antenna Port Conducted Emission	150kHz-30MHz	± 1.96 dB
Radiated Emission	30 MHz – 1 GHz	± 3.42 dB
	> 1GHz	± 4.20 dB

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3 Test Set-up and Operation Modes

3.1 Details of Test Mode

Using test software was control EUT work in continuous transmitter and receiver mode. Select test channel as below:

Channel	Frequency
Test channel	13.56MHz

The basic operation modes are:

- A. On
 - 1. test mode
 - a. Transmitting
 - i. Test Channel
- B. Standby
- C. Off

3.2 Special Accessories and Auxiliary Equipment

Description	Manufacturer	Model No.	Serial No.
Laptop	Lenovo	TP00083A	N/A

3.3 Support Software

Description	Manufacturer	Software Name
Software	/	/

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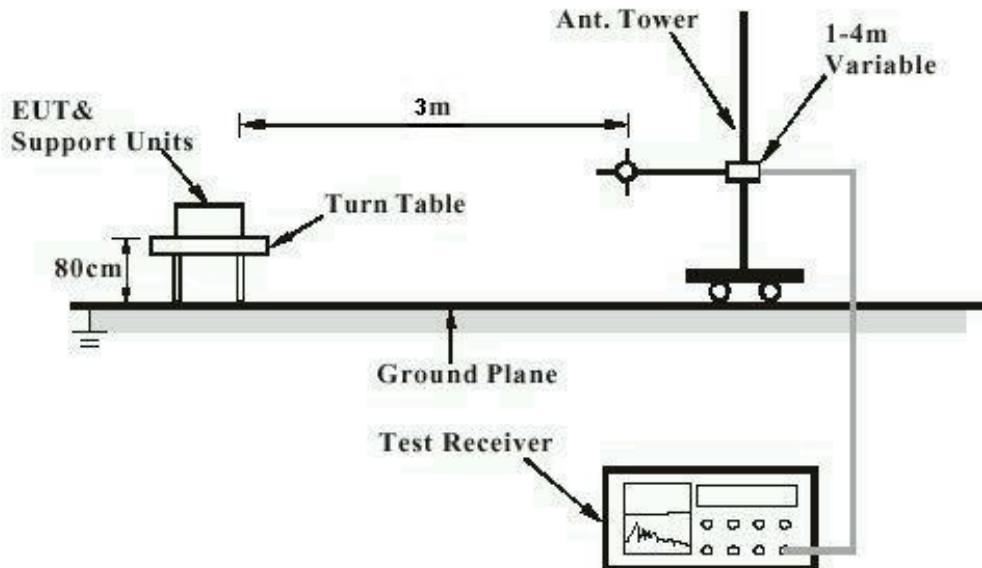
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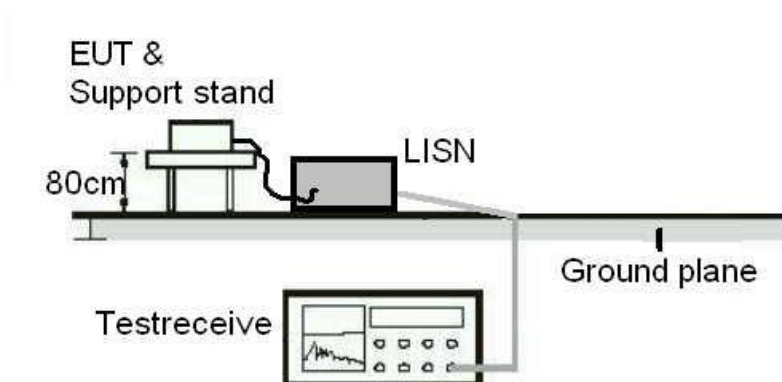
3.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 30MHz are done with a table height of 0.8m.

Diagram of Measurement Equipment Configuration for Conduction Measurement



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4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

RESULT:

PASS

Test standard : Part 15.203

Requirement : The use of approved antennas only with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a gain of 0 dBi. The antenna is an internal antenna with no possibility of replacement with a non-approved antenna by the end-user.

Therefore, the EUT is considered to comply with this provision.

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4.1.2 Frequency Tolerance

RESULT:

PASS

Test standard : FCC Part 15.225(e)

Requirement : ANSI C63.10-2013

Kind of test site : Shielded room

Test setup

Test Channel : Test channel

Operation Mode : A.1.a

Ambient temperature : 25°C

Relative humidity : 50%

Test Procedure

- 1.The test is performed in a Temperature Chamber.
- 2.The EUT is configured as MS + DC Power Supply.

Table 1: Frequency Tolerance

Temperature (°C)	Voltage (VDC)	Measured		Deviation Limit
		Frequency (MHz)	Tolerance (ppm)	
-20	3.8	13.559280	53.09735	±0.01%
-10		13.559380	45.72271	
0		13.559240	56.04720	
+10		13.559230	56.78466	
+20		13.559170	61.20944	
+40		13.559300	51.62242	
+50		13.559050	70.05900	
+20	2.8	13.559430	42.03540	
+20	4.35	13.559190	59.73451	

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4.1.3 20dB Bandwidth and 99% Bandwidth

RESULT:

PASS

Test standard : FCC Part 2.1049

Requirement : ANSI C63.10-2013

Kind of test site : Chamber

Test setup

Test Channel : Test channel

Operation Mode : A.1.a

Ambient temperature : 25°C

Relative humidity : 50%

Test procedure

The 20dB bandwidth is measured with a spectrum analyzer connected via a receiver antenna placed near the EUT while the EUT is operating in transmission mode.

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth RBW \geq 1% of the 20 dB bandwidth

VBW \geq RBW

Sweep = auto

Detector function = peak Trace = max hold.

Table 2: 20dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
ASK	13.56	432.7	497.8

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Figure: 20dB Bandwidth

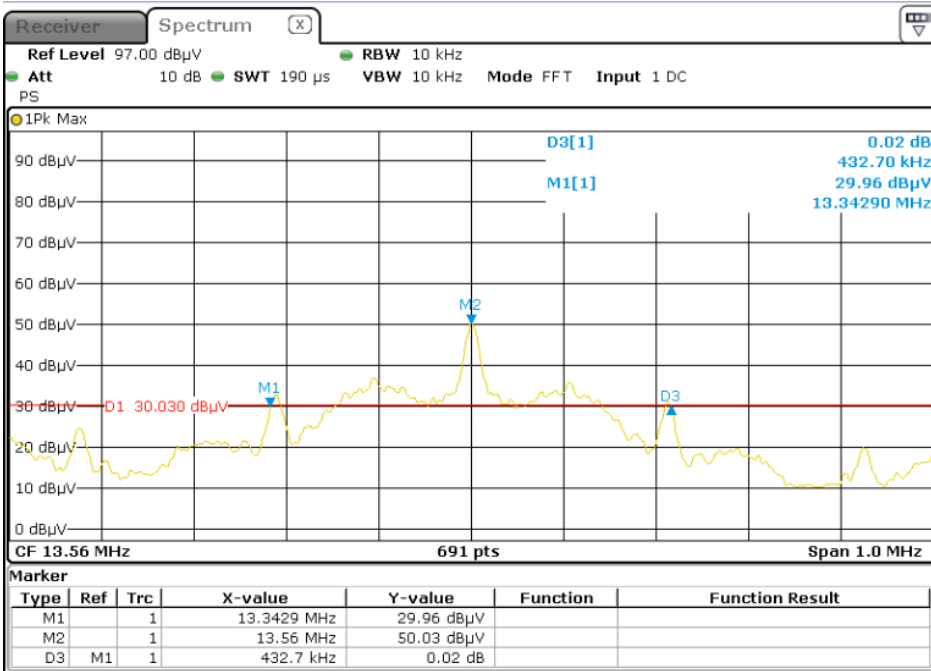
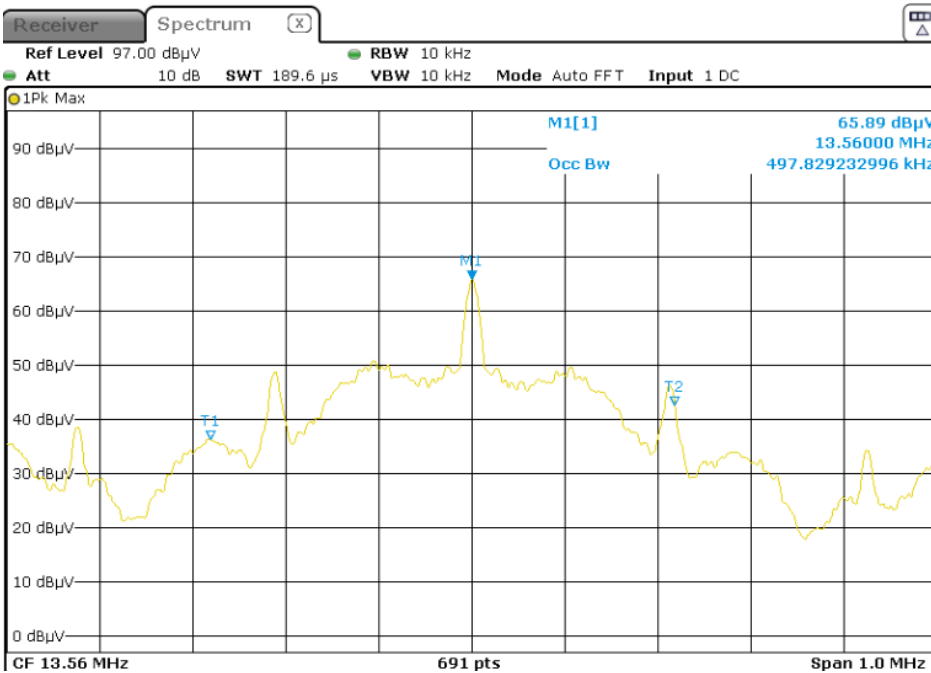


Figure: 99% Bandwidth



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4.1.4 Radiated Emission

RESULT:

PASS

Test standard : FCC Part 15.225
Requirement : ANSI C63.10-2013
Kind of test site : 3m Semi-Anechoic Chamber

Test setup

Test Channel : Test channel
Operation Mode : A
Ambient temperature : 25°C
Relative humidity : 50%

Notes:

Operation within the band 13.110-14.010 MHz as contained in §15.225:

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

FREQUENCY MHz	DISTANCE Meters	FIELD STRENGTHS LIMIT	
		$\mu\text{V}/\text{m}$	$\text{dB}(\mu\text{V})/\text{m}$
0.009 ~ 0.490	300	2400/F(KHz)	67.6-20log(F)
0.490 ~ 1.705	30	24000/F(KHz)	87.6-20log(F)
1.705 ~ 13.110	30	30	29.54
13.110 ~ 13.410	30	106	40.51
13.410~ 13.553	30	334	50.47
13.553~13.567	30	15848	84.00
13.567~13.710	30	334	50.47
13.710~14.010	30	106	40.51
14.010~30	30	30	29.54
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0

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(1) The emission limits shown in the above table are based on measurements employing a CISPR QP detector except for the frequency bands 9-90KHz, 110-490KHz and above 1000MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

(2) At frequencies below 30MHz, measurement may be performed at a distance closer than that specified, and the limit at closer measurement distance can be extrapolated by below formula:

$$\text{Limit}_{3m}(\text{dBuV/m}) = \text{Limit}_{300m}(\text{dBuV/m}) + 40\text{Log}(300m/3m) = \text{Limit}_{300m}(\text{dBuV/m}) + 80$$

$$\text{Limit}_{3m}(\text{dBuV/m}) = \text{Limit}_{30m}(\text{dBuV/m}) + 40\text{Log}(30m/3m) = \text{Limit}_{30m}(\text{dBuV/m}) + 40$$

(3) EUT was placed on a non-metallic table, 100 cm above the ground plane inside a semi-anechoic chamber.

(4) Test antenna was located 3m from the EUT on an adjustable mast

According ANSI C63.10:2013 clause 6.4.4.2 and 6.5.3, for measurements below 30 MHz, the loop antenna was positioned with its plane vertical from the EUT and rotated about its vertical axis for maximum response at each azimuth position around the EUT. And the loop antenna also be positioned with its plane horizontal at the specified distance from the EUT. The center of the loop is 1 m above the ground. for measurement above 30MHz, the Trilog Broadband Antenna or Horn Antenna was located 3m from EUT, Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

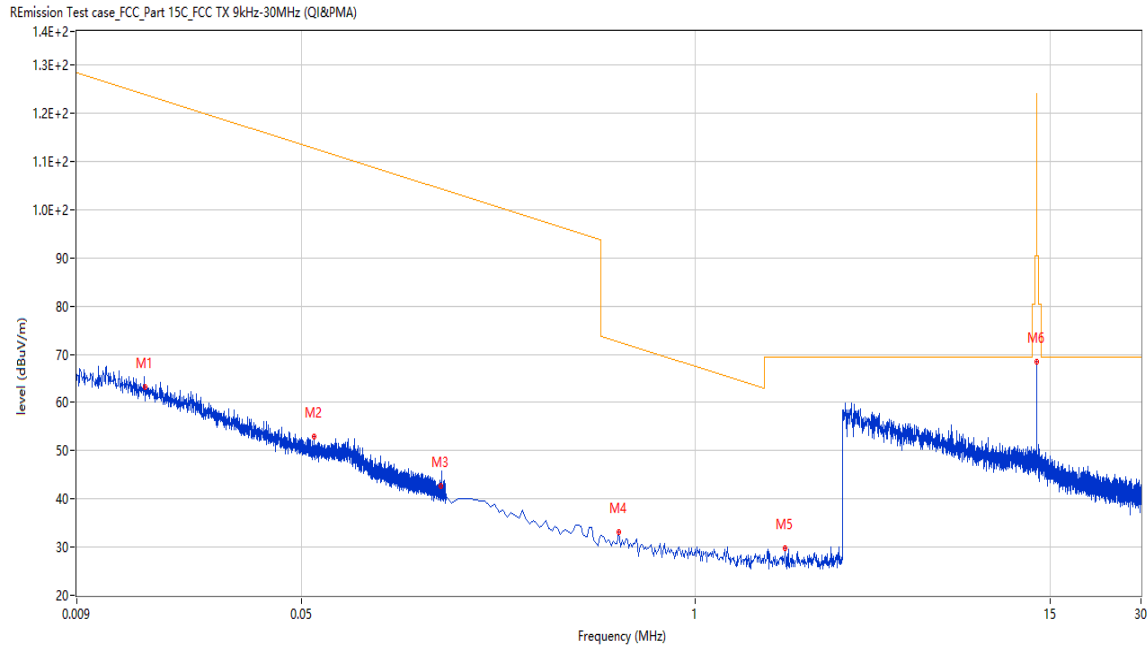
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Test data :



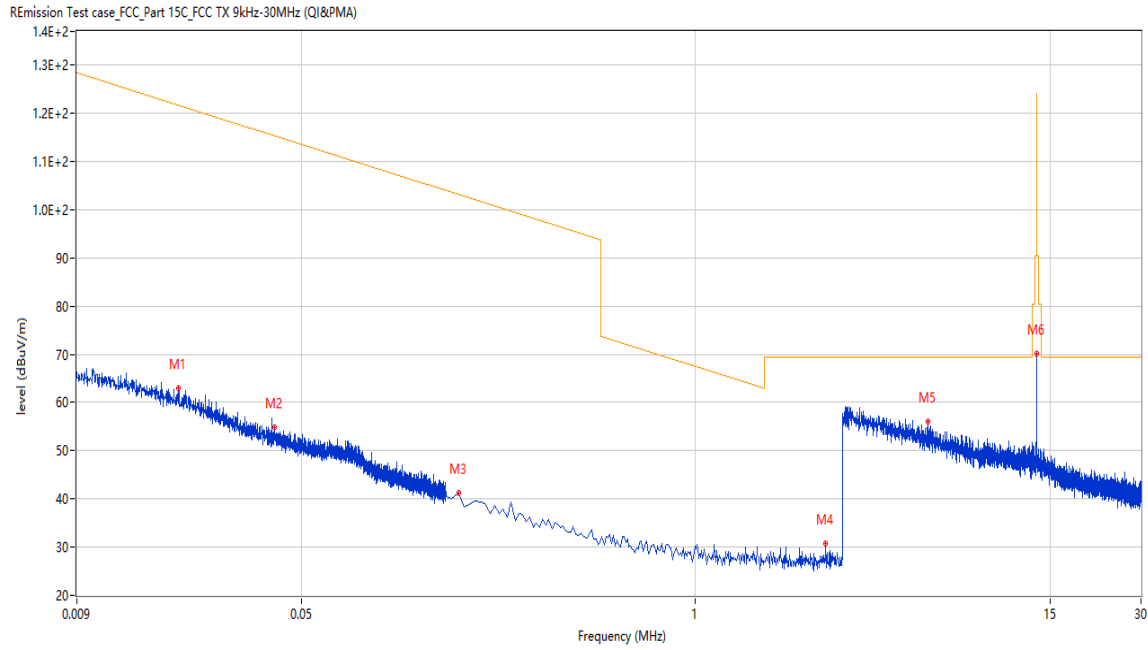
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	0.015	62.65	19.63	123.9	-61.25	Peak	191.50	100	Horizontal	Pass
2	0.055	52.25	20.05	112.7	-60.45	Peak	19.50	100	Horizontal	Pass
3	0.145	42.63	19.98	104.3	-61.67	Peak	184.80	100	Horizontal	Pass
4	0.560	33.16	19.89	72.5	-39.34	Peak	360.00	100	Horizontal	Pass
5	1.985	29.85	19.85	69.5	-39.65	Peak	170.40	100	Horizontal	Pass
6	13.557	68.55	19.88	124.0	-55.45	Peak	31.10	100	Horizontal	Pass

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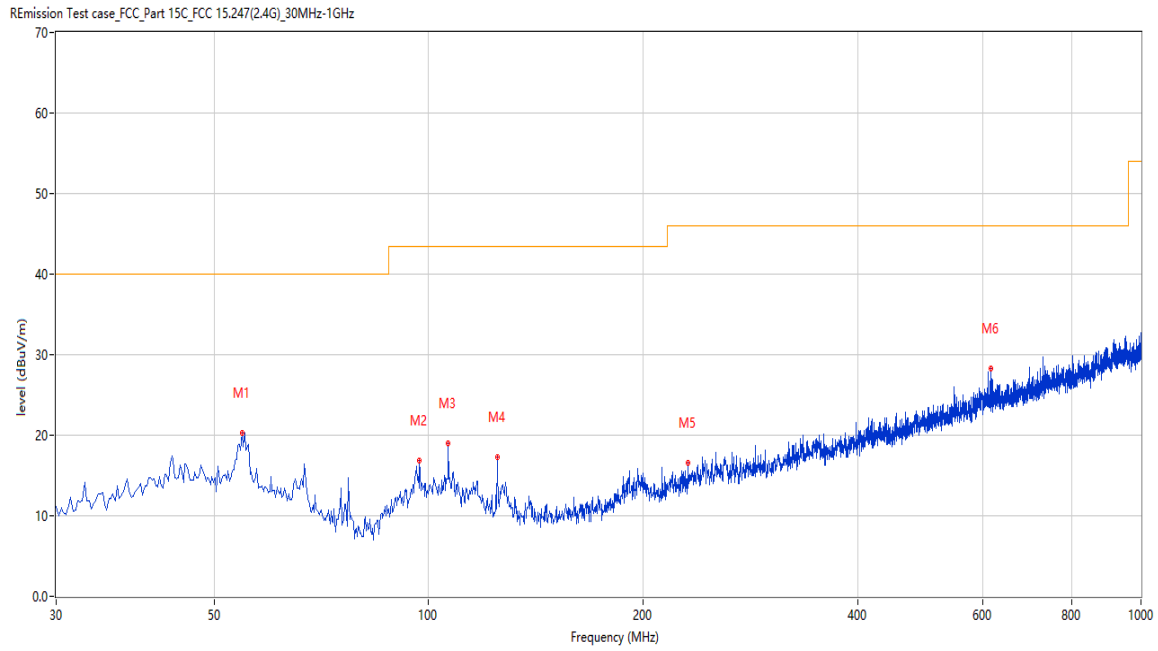
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	0.019	61.54	19.75	121.8	-60.26	Peak	359.00	100	Vertical	Pass
2	0.041	52.37	20.01	115.4	-63.03	Peak	250.00	100	Vertical	Pass
3	0.165	41.21	19.97	103.2	-61.99	Peak	0.00	100	Vertical	Pass
4	2.716	30.67	19.85	69.5	-38.83	Peak	192.00	100	Vertical	Pass
5	5.895	56.10	19.88	69.5	-13.40	Peak	0.00	100	Vertical	Pass
6	13.557	70.08	19.88	124.0	-53.92	Peak	28.30	100	Vertical	Pass

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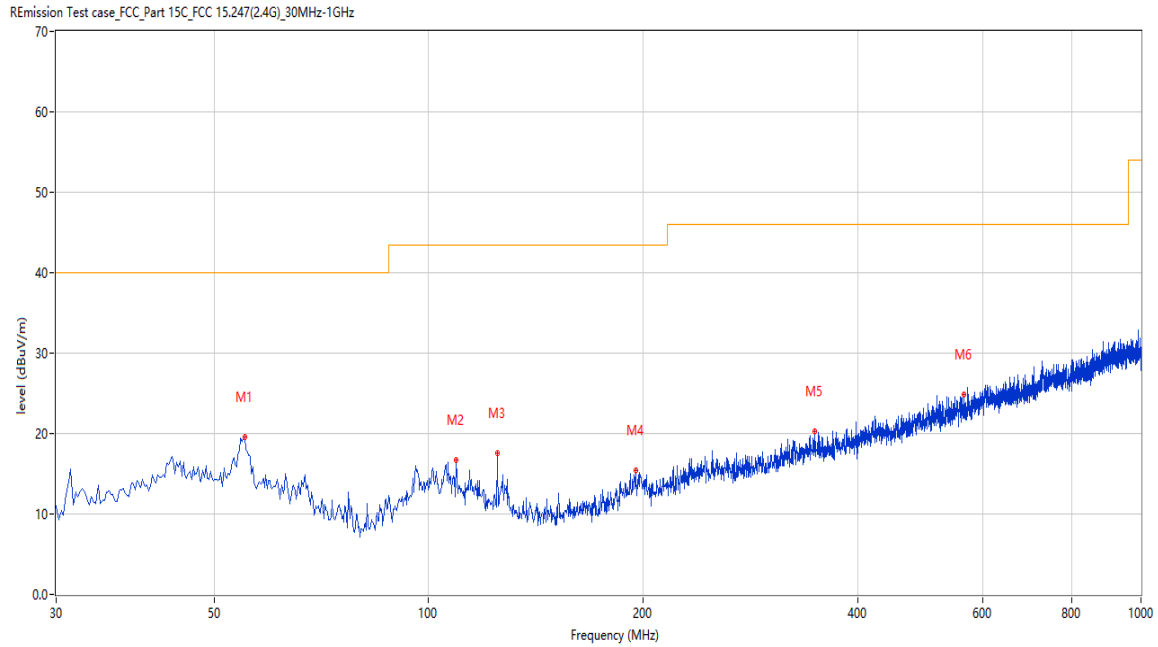
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	54.729	20.35	-19.94	40.0	-19.65	Peak	191.90	100	Horizontal	Pass
2	97.156	16.87	-20.84	43.5	-26.63	Peak	135.40	100	Horizontal	Pass
3	106.611	18.98	-20.79	43.5	-24.52	Peak	333.40	100	Horizontal	Pass
4	124.794	17.27	-23.36	43.5	-26.23	Peak	246.90	100	Horizontal	Pass
5	231.225	16.51	-19.77	46.0	-29.49	Peak	39.40	100	Horizontal	Pass
6	616.461	28.30	-9.35	46.0	-17.70	Peak	180.50	100	Horizontal	Pass

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No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	55.214	19.60	-20.00	40.0	-20.40	Peak	355.90	100	Vertical	Pass
2	109.278	16.66	-21.14	43.5	-26.84	Peak	164.30	100	Vertical	Pass
3	124.794	17.63	-23.36	43.5	-25.87	Peak	294.10	100	Vertical	Pass
4	195.344	15.48	-20.10	43.5	-28.02	Peak	312.60	100	Vertical	Pass
5	348.808	20.28	-15.67	46.0	-25.72	Peak	142.70	100	Vertical	Pass
6	564.821	24.89	-11.28	46.0	-21.11	Peak	334.20	100	Vertical	Pass

Note : margin (Over Limit) >10dB,so do not need to test by QP Detector

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4.2 Mains Emissions

4.2.1 Conducted Emission on AC Mains

RESULT:

PASS

Test standard : FCC Part 15.207(a)

Requirement : ANSI C63.10-2013

Kind of test site : Shielded room

Test setup

Input Voltage : AC 120V, 60Hz; AC 240V, 50Hz

Operation Mode : A.1.a

Earthing : Not Connected

Ambient temperature : 25°C

Relative humidity : 50%

For details refer to following test plot.

Note:

The all configurations were tested respectively, but only the worst configuration shown here.

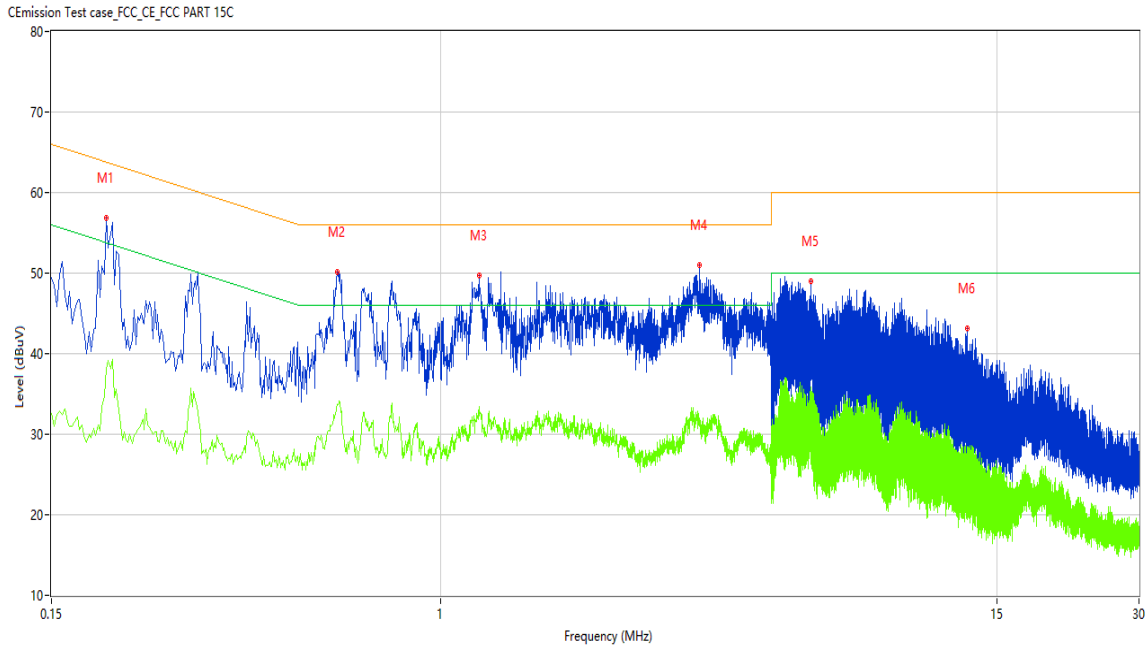
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Figure 1: Conducted Emission on AC Mains, L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.196	61.37	9.65	63.78	-2.41	Peak	L	Pass
1*	0.196	50.34	9.65	63.78	-13.44	QP	L	Pass
1**	0.196	38.07	9.65	53.78	-15.71	AV	L	Pass
2	0.604	52.35	9.76	56.00	-3.65	Peak	L	Pass
2*	0.604	44.42	9.76	56.00	-11.58	QP	L	Pass
2**	0.604	33.70	9.76	46.00	-12.30	AV	L	Pass
3	1.204	47.84	9.66	56.00	-8.16	Peak	L	Pass
3*	1.204	41.17	9.66	56.00	-14.83	QP	L	Pass
3**	1.204	32.36	9.66	46.00	-13.64	AV	L	Pass
4	3.528	49.64	9.68	56.00	-6.36	Peak	L	Pass
4*	3.528	41.56	9.68	56.00	-14.44	QP	L	Pass
4**	3.528	31.25	9.68	46.00	-14.75	AV	L	Pass
5	6.062	46.52	9.69	60.00	-13.48	Peak	L	Pass
5*	6.062	37.66	9.69	60.00	-22.34	QP	L	Pass
5**	6.062	35.85	9.69	50.00	-14.15	AV	L	Pass
6	12.972	42.97	9.61	60.00	-17.03	Peak	L	Pass
6*	12.972	34.82	9.61	60.00	-25.18	QP	L	Pass
6**	12.972	27.78	9.61	50.00	-22.22	AV	L	Pass

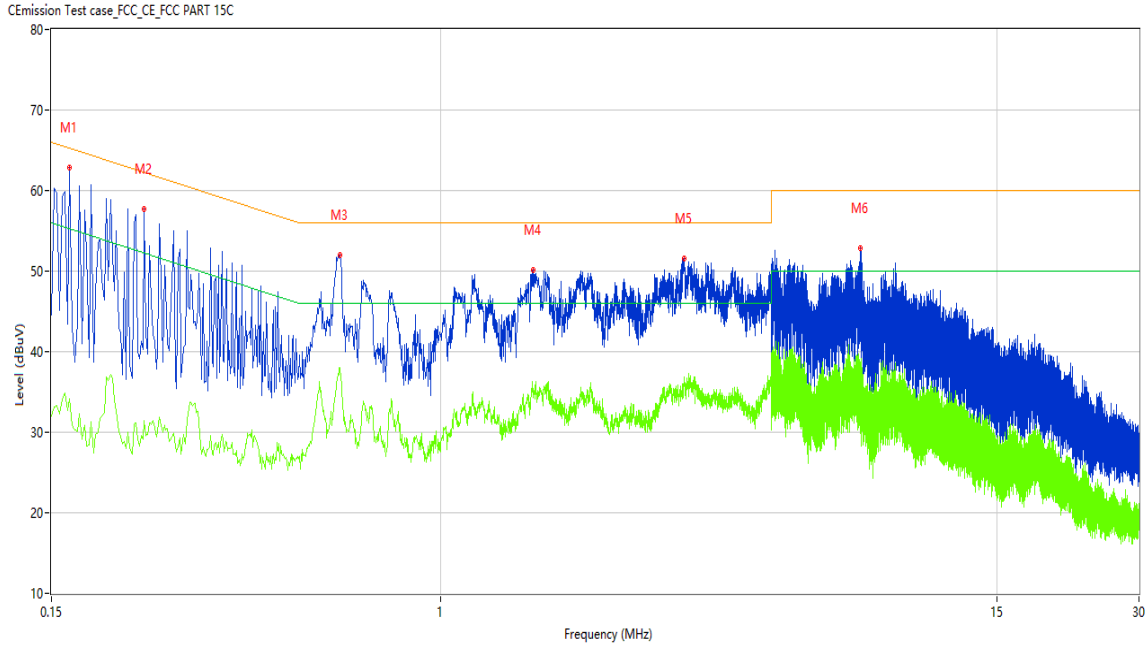
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Figure: Conducted Emission on AC Mains, N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.158	64.07	9.67	65.57	-1.50	Peak	N	Pass
1*	0.158	52.23	9.67	65.57	-13.34	QP	N	Pass
1**	0.158	34.16	9.67	55.57	-21.41	AV	N	Pass
2	0.236	60.16	9.68	62.24	-2.08	Peak	N	Pass
2*	0.236	46.63	9.68	62.24	-15.61	QP	N	Pass
2**	0.236	31.49	9.68	52.24	-20.75	AV	N	Pass
3	0.612	52.75	9.76	56.00	-3.25	Peak	N	Pass
3*	0.612	49.86	9.76	56.00	-6.14	QP	N	Pass
3**	0.612	37.96	9.76	46.00	-8.04	AV	N	Pass
4	1.568	50.41	9.67	56.00	-5.59	Peak	N	Pass
4*	1.568	45.87	9.67	56.00	-10.13	QP	N	Pass
4**	1.568	35.33	9.67	46.00	-10.67	AV	N	Pass
5	3.272	52.36	9.69	56.00	-3.64	Peak	N	Pass
5*	3.272	46.28	9.69	56.00	-9.72	QP	N	Pass
5**	3.272	36.76	9.69	46.00	-9.24	AV	N	Pass
6	7.712	51.99	9.67	60.00	-8.01	Peak	N	Pass
6*	7.712	44.92	9.67	60.00	-15.08	QP	N	Pass
6**	7.712	35.57	9.67	50.00	-14.43	AV	N	Pass

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5 Appendixes

5.1 Photographs of the Sample



Front of the sample



Rear of the sample

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5.2 Photographs of the Test Set-up

Below 30MHz



Above 30MHz



End of the report