

Report No.SH16030055W15

FCC RF TEST REPORT

Issued to

TRIMBLE EUROPE B.V.

For

Rugged Smart Phone

Model Name : MobileMapper50_4G
Trade Name : Spectra Precision
Brand Name : Spectra Precision
Standard : 47 CFR Part 15,Subpart C
ANSI C63.10-2013
RSS 210 Issue 8
RSS GEN Issue 4
FCC ID : NZI-10900300
IC ID : 9288A-10900300
Test date : May.7,2016 to May.9,2016
Issue date : Jul.12,2016

by

Shanghai Skylabs Co., Ltd.

Tested by Wu Hongfei

Approved by Guo Jiefeng

Review by Lernard Bao



The report refers only to the sample tested and does not apply to the bulk. This report is issued in confidence to the client and it will be strictly treated as such by the Shanghai Skylabs Co., Ltd. It may not be reproduced rather in its entirety or in part and it may not be used for advertizing. The client to whom the report is issued may, however, show or send it or a certified copy thereof prepared by the Shanghai Skylabs Co., Ltd to his customer. Supplier or others persons directly concerned. Shanghai Skylabs Co., Ltd will not, without the consent of the client enter into any discussion of correspondence with any third party concerning the contents of the report. In the event of the improper use of the report, Shanghai Skylabs Co., Ltd reserves the rights to withdraw it and to adopt any other remedies which may be appropriate.



DIRECTORY

1.	General Information	4
1.1	Applicant	4
1.2	Manufacturer	4
1.3	Description of EUT	4
2.	Facilities and Accreditations	5
2.1	Test Facility	5
2.2	Environmental Conditions	5
2.3	Measurement Uncertainty	5
2.4	List of Equipments Used.....	5
3.	Test Standards and Results	6
4.	Test Result.....	7
4.1	Spectrum mask	7
4.2	20dB Bandwidth	9
4.3	Frequency tolerance	10
4.4	Conducted Emission	11
4.5	Radiated Emission.....	14
Annex A	Photos of the EUT	18
Annex B	Photos of Setup	19

**Change History**

Issue	Date	Reason for change
1.0	May.10,2016	First edition
2.0	Jul.12,2016	Second edition



1. General Information

1.1 Applicant

TRIMBLE EUROPE B.V.

European Regional Fulfilment Centre
Meerheide, 45
5521DZ Eersel
THE NETHERLANDS

1.2 Manufacturer

TRIMBLE EUROPE B.V.

European Regional Fulfilment Centre
Meerheide, 45
5521DZ Eersel
THE NETHERLANDS

1.3 Description of EUT

EUT Name.....: Rugged Smart Phone
Model Name.....: MobileMapper50_4G
Brand Name.....: Spectra Precision
Trade Name.....: Spectra Precision
Hardware Version.....: MM50.4G_V1.0
Software Version.....: MM50.4G.16.22.39
Modulation Type.....: ASK
Frequency Range.....: 13.56MHz
EUT Stage.....: Production Unit
Antenna Type.....: Internal loop antenna

NOTE 1:

For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacture.



2. Facilities and Accreditations

2.1 Test Facility

Shanghai Skylabs Co., Ltd. Skylabs Laboratory is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L6644. A 9*6*6(m) full/semi-anechoic chamber was used for the radiated emissions test.

2.2 Environmental Conditions

Ambient temperature: 15~35°C

Relative humidity: 30~60%

Atmosphere pressure: 86-106kPa

2.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission: $\pm 1.76\text{dB}$

Uncertainty of Radiated Emission: $\pm 3.16\text{dB}$

2.4 List of Equipments Used

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	R&S	FSU26	200880	2016.2.25	1year
Attenuator 1	Resnet	10dB	(n.a.)	(n.a.)	(n.a.)
Attenuator 2	Resnet	3dB	(n.a.)	(n.a.)	(n.a.)
Full/Semi-Anechoic Chamber	CHENGYU	9.2×6.25×6.15m	SAR	2015.9.14	3year
EMI Test Receiver	R&S	ESCI7	100787	2016.2.55	1year
LISN	TESEQ	NNB 51	33285	2016.2.25	1year
Personal Computer	HP	(n.a.)	(n.a.)	(n.a.)	(n.a.)
Temperature Chamber	YinHe Experimental Equipment	HL4003T	(n.a.)	2015.9.22	1year
Test Antenna-Horn	Schwarzbeck	BBHA9170	BBHA91970171	2015.9.22	1year
Test Antenna-Log	Schwarzbeck	VULB 9163	9163-561	2015.9.25	1year
Test Antenna-Loop	Rohde&Schwarz	HFH2-Z2	860004/001	2015.9.22	1year
Test Antenna-Horn	Schwarzbeck	BBHA 9120D	9120D-1033	2015.7.25	1year

NOTE:

Equipments listed above have been calibrated and are in the period of validation.



3. Test Standards and Results

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

FCC Part 15 Subpart C §15.247

ANSI C63.10-2013

RSS 210 Issue 8

RSS GEN Issue 4

NOTE:

(1) All test items were verified and recorded according to the standards and without any deviation during the test.

(2) This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart C

Test items and the results are as bellow:

No.	FCC Rules	IC Rules	Description	Result
1	15.225 (a) – (d)	RSS-210 A2.6	Spectrum mask	Pass
2	15.215 (c)	RSS-210 A1.1.3	20dB Bandwidth	Pass
3	15.225 (e)	RSS-210 A2.6	Frequency tolerance	Pass
4	15.207 (a)	RSS-GEN 8.8	Conducted Emission	Pass
5	15.205 (a) 15.209 (a)	RSS-GEN 8.9 RSS-210 A2.6	Radiated Emission	Pass



4. Test Result

4.1 Spectrum mask

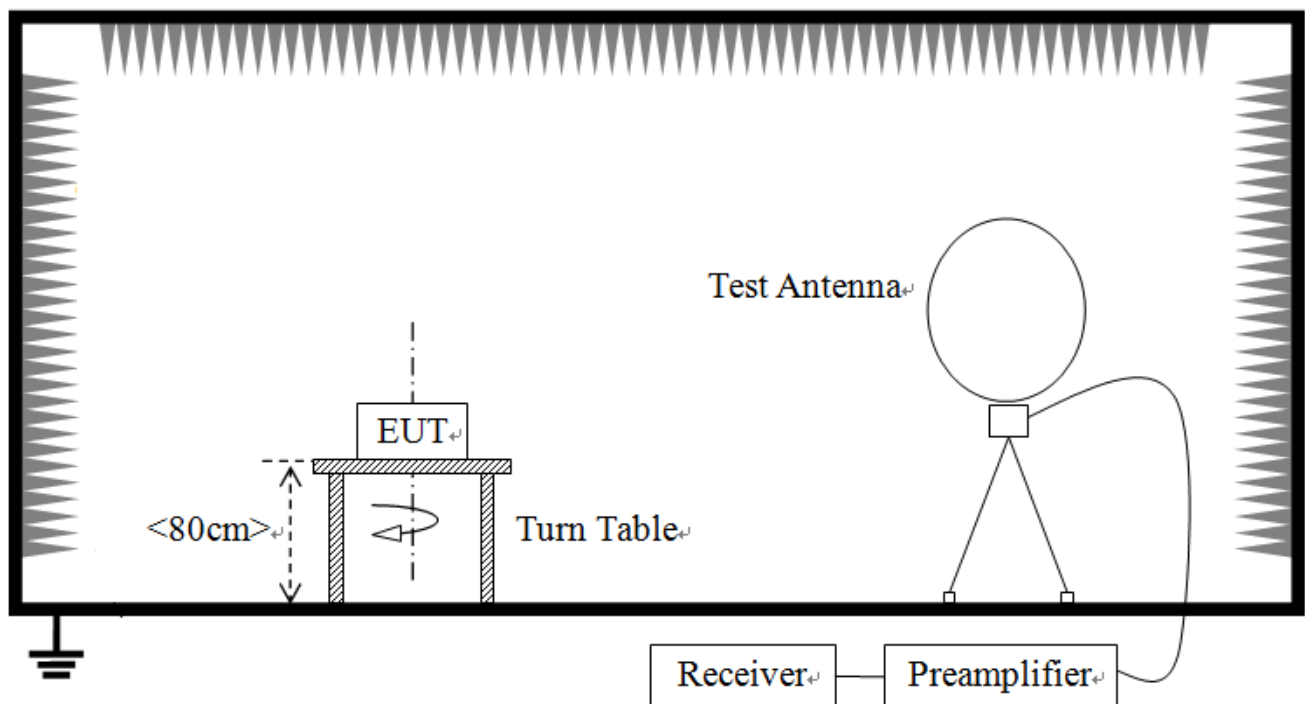
4.1.1 Requirement

According to FCC section 15.225(a)-(d),

- (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 emissions shall not exceed 334 microvolts/meter 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.

4.1.2 Test Description

A. Test Setup:





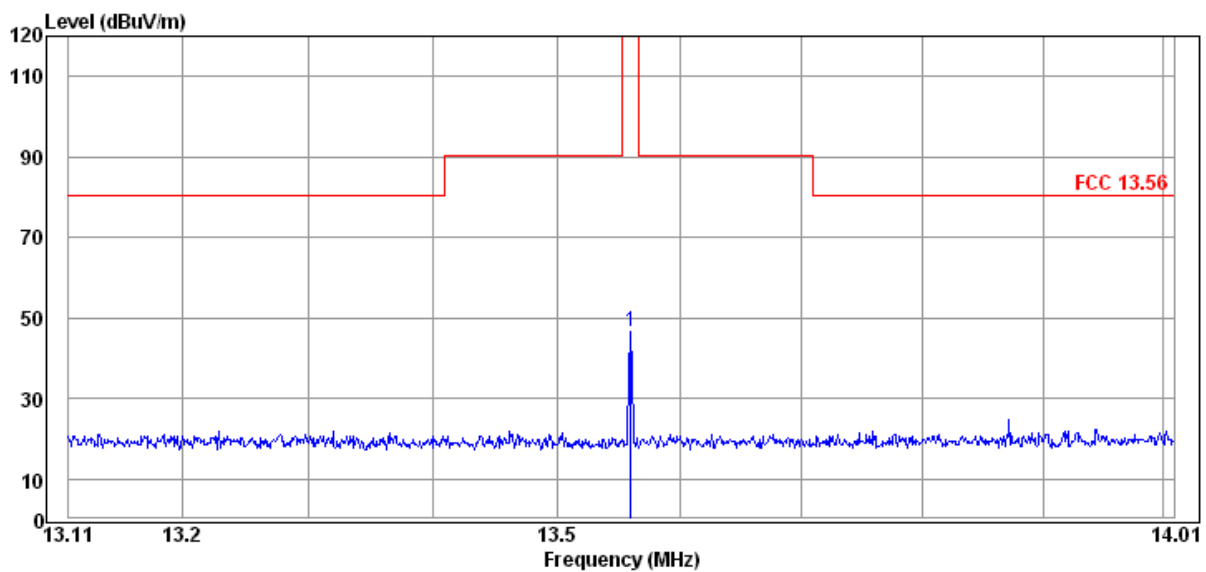
4.1.3 Test Result

A. Test Verdict:

Frequency (MHz)	Quasi-Peak Level (dB μ V/m) at 3m	Limit (dB μ V/m) at 3m	Refer to plot	Verdict
13.56	46.5	124	Plot A	Pass

Note: The level at 30m was calculated using the dB μ V/m measurement at 3m and extrapolating this result to produce a level at 30m. This value was then converted to obtain the value in μ V/m.

B. Test Plots:



Plot A



4.2 20dB Bandwidth

4.2.1 Requirement

According to FCC section 15.215(c), for intentional radiators operating under the alternative provisions to the general emission limits the requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

4.2.2 Test Description

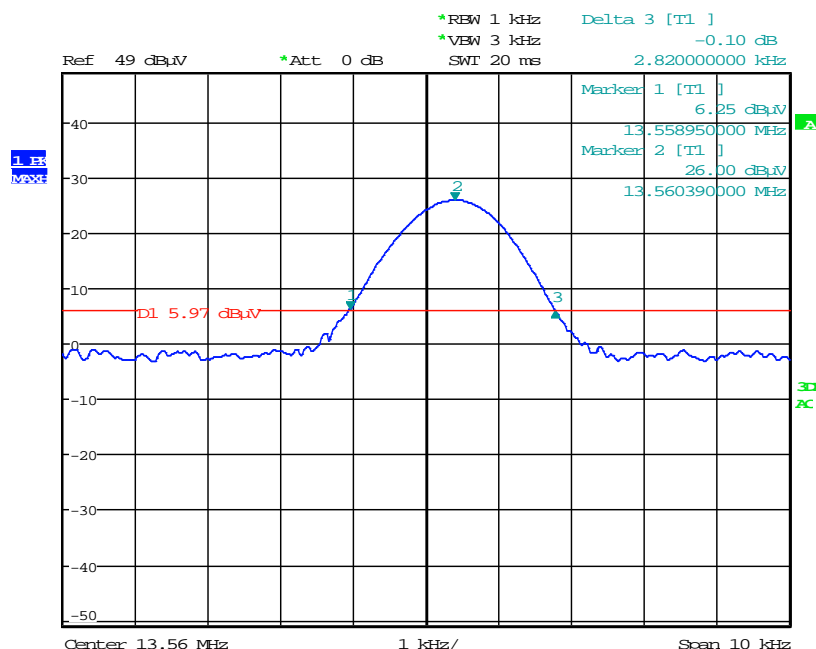
See section 4.1.2 of this report.

4.2.3 Test Result

A. Test Verdict:

Frequency (MHz)	20dB Bandwidth (kHz)	Refer to plot
13.56	2.82	Plot A

B. Test Plots:



Date: 9.MAY.2016 13:31:32

Plot A

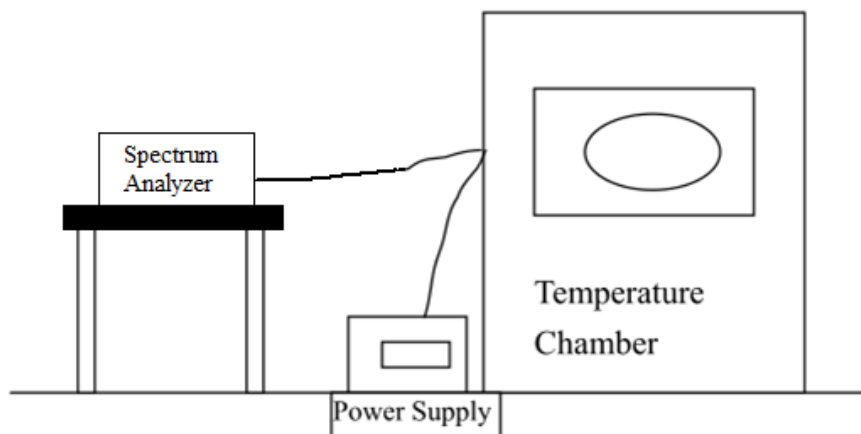


4.3 Frequency tolerance

4.3.1 Requirement

According to FCC section 15.225 (e), the frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

4.3.2 Test Description



4.3.3 Test Result

Temperature (° C)	Supply Voltage (V)	Frequency (MHz)	Deviation (%)	Limit (%)	Result
50	3.8	13.56039	0	± 0.01	Pass
40	3.8	13.56039	0	± 0.01	Pass
30	3.8	13.56037	-0.00014	± 0.01	Pass
20	3.6	13.56039	0	± 0.01	Pass
	3.8	13.56039	0	± 0.01	Pass
	4.2	13.56037	-0.00014	± 0.01	Pass
10	3.8	13.56039	0	± 0.01	Pass
0	3.8	13.56041	0.00014	± 0.01	Pass
-10	3.8	13.56037	-0.00014	± 0.01	Pass
-20	3.8	13.56039	0	± 0.01	Pass



4.4 Conducted Emission

4.4.1 Requirement

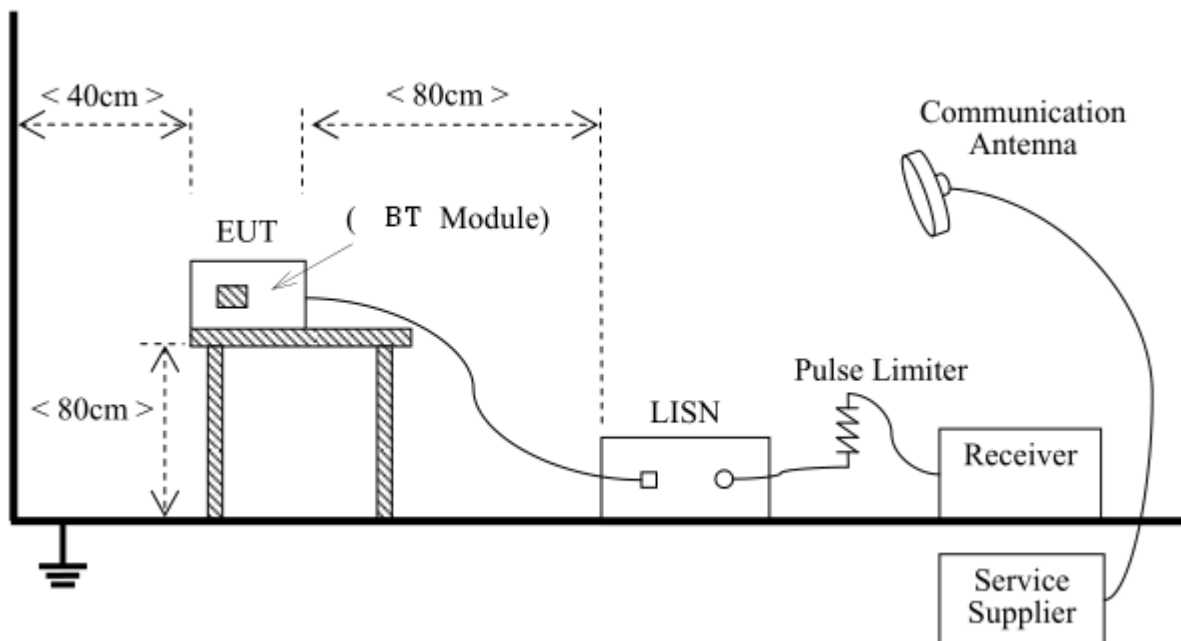
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network(LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

4.4.2 Test Description



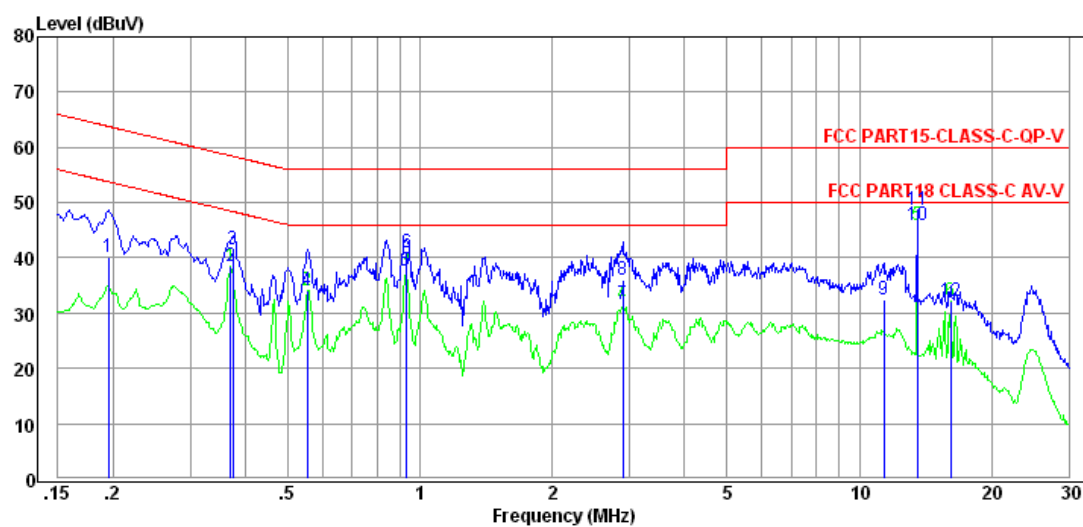
The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10-2013



4.4.3 Test result

L line:

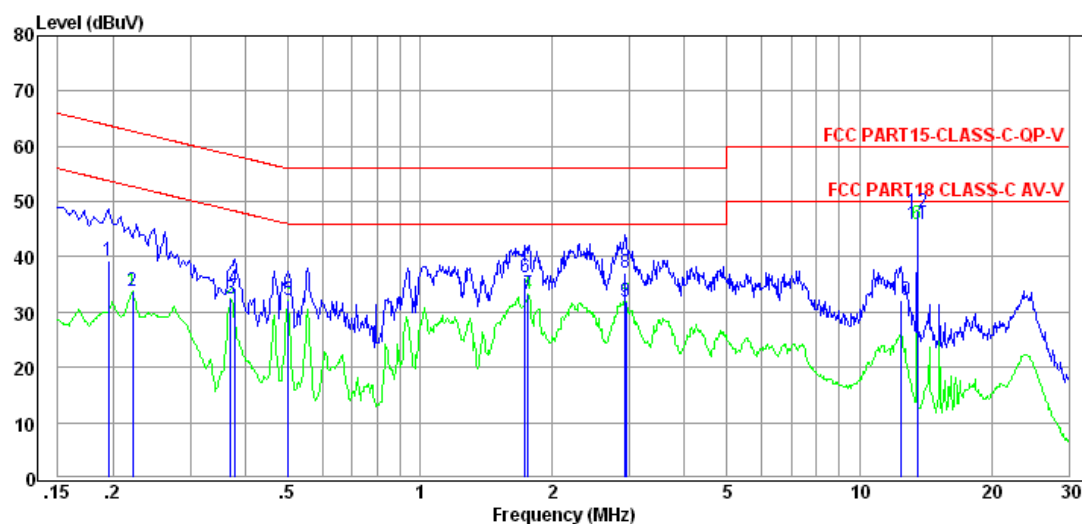
Freq MHz	Result dBuV	Limit dBuV	Margin dB	Detector
0.20	40.00	63.80	23.80	QP
0.37	38.53	48.47	9.94	Average
0.38	41.47	58.39	16.92	QP
0.56	34.08	46.00	11.92	Average
0.93	37.57	46.00	8.43	Average
0.93	40.87	56.00	15.13	QP
2.90	31.52	46.00	14.48	Average
2.90	36.03	56.00	19.97	QP
11.38	32.38	60.00	27.62	QP
13.55	45.97	50.00	4.03	Average
13.55	48.55	60.00	11.45	Peak
16.14	32.16	50.00	17.84	Average





N line

Freq MHz	Result dBuV	Limit dBuV	Margin dB	Detector
0.20	39.35	63.80	24.45	QP
0.22	33.83	52.74	18.91	Average
0.37	32.51	48.47	15.96	Average
0.38	34.32	58.30	23.98	QP
0.50	32.22	46.00	13.78	Average
1.73	36.42	56.00	19.58	QP
1.76	33.21	46.00	12.79	Average
2.93	36.99	56.00	19.01	QP
2.95	32.03	46.00	13.97	Average
12.45	32.09	60.00	27.91	QP
13.55	45.99	50.00	4.01	Average
13.55	48.11	60.00	11.89	Peak





4.5 Radiated Emission

4.5.1 Requirement

According to FCC section 15.247(c), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

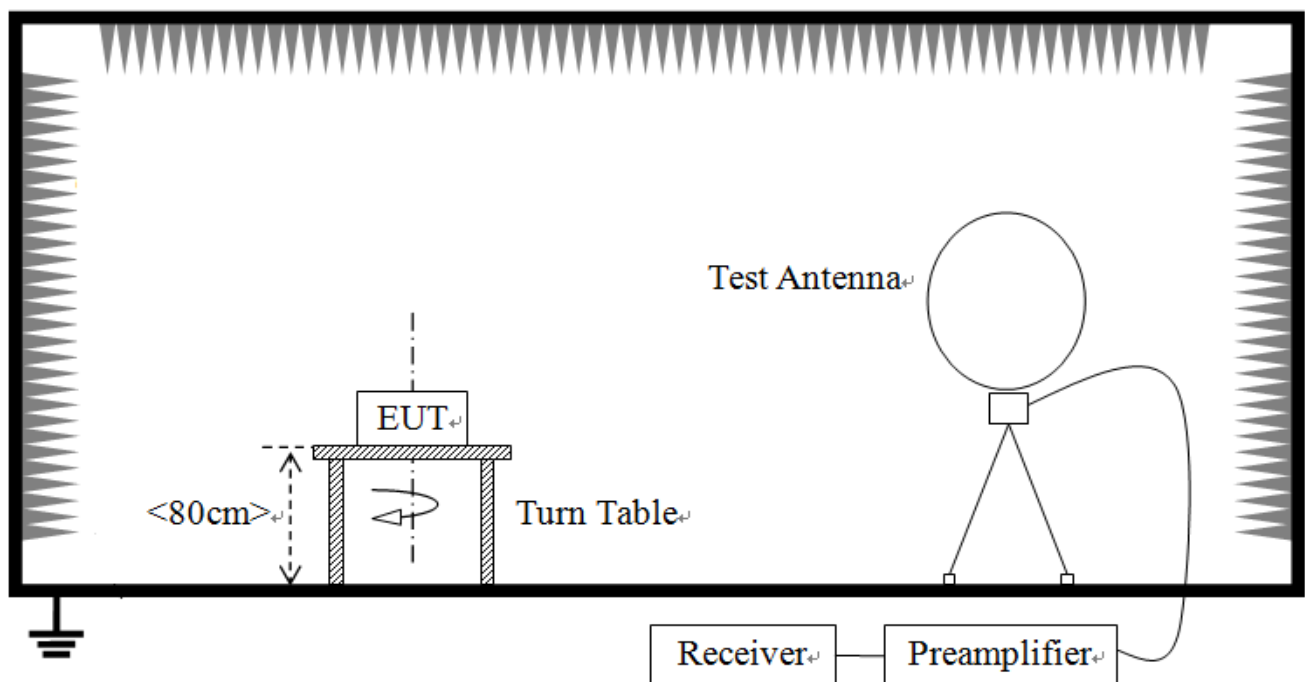
According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)	Limit(dB $\mu\text{V/m}$)	Detector
0.009-0.490	2400/F(kHz)	300	/	/
0.490-1.705	24000/F(kHz)	30	/	/
1.705-30	30	30	/	/
30 - 88	100	3	40	QP
88 - 216	150	3	43.5	QP
216 - 960	200	3	46	QP
960 - 1000	500	3	54	QP
Above 1000	500	3	54	AV

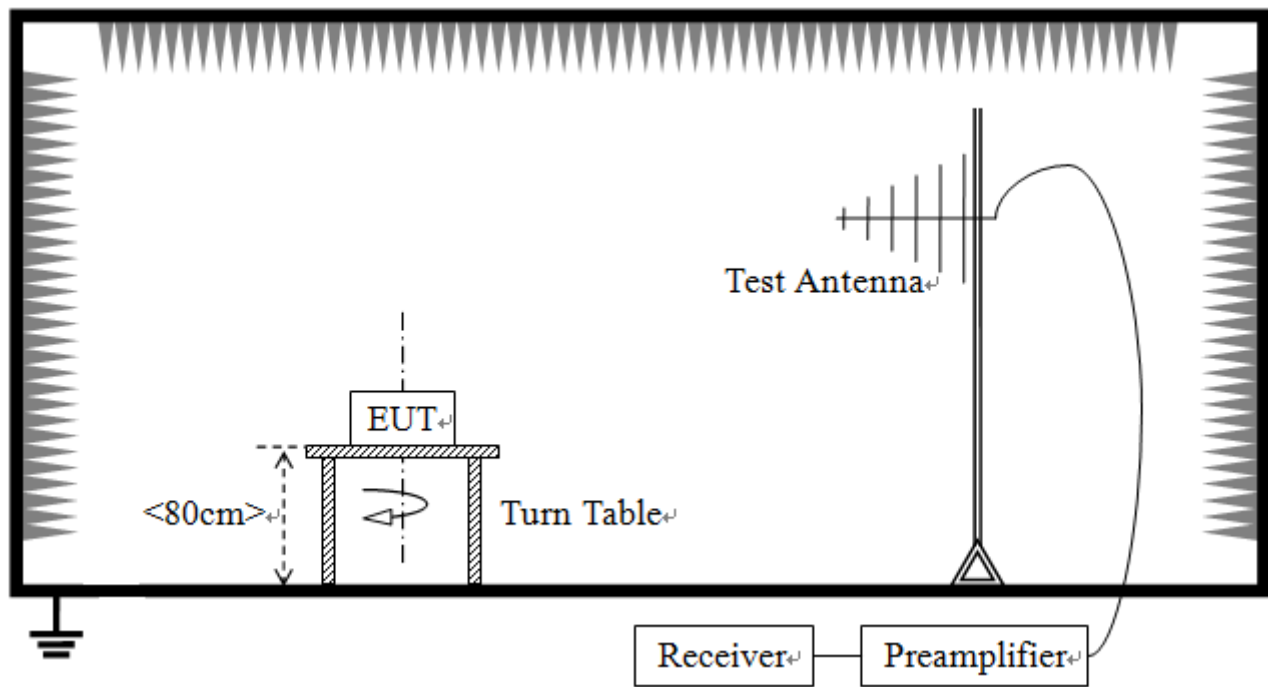
In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

According to FCC section 15.33(a) (1), if the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. So, Frequency range of radiated measurement is from 9kHz to 136MHz

4.5.2 Test setup



Radiated Emissions Below 30MHz



Radiated Emissions 30-1000MHz

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10-2013. Below 1GHz, the EUT was set-up on insulator 80cm above the Ground Plane. Above 1GHz, the EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10

The EUT is powered by the Battery. The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading. During the measurement, the NFC Module is activated.

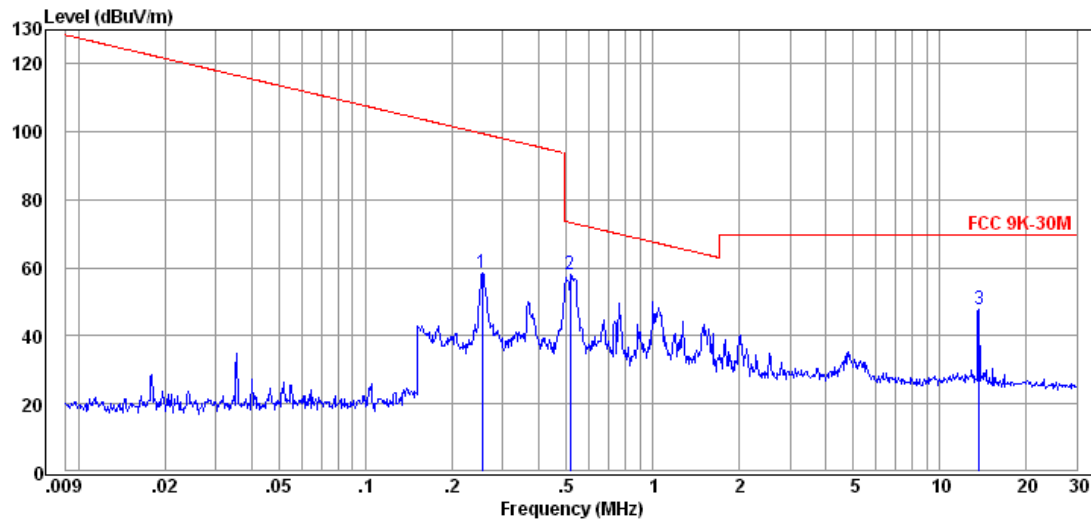
For the Test Antenna: In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) is used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength, the azimuth range of turntable was 0° to 360°, the receive antenna has two polarizations horizontal and vertical. When doing measurements above 1GHz, the EUT was placed within the 3dB beam width range of the horn antenna, and the EUT was tested in 3 orthogonal positions as recommended in ANSI C63.10 for Radiated Emissions and the worst-case data was presented.



4.5.3 Test Result

Radiated Emissions 9kHz – 30MHz

Freq MHz	Result dBuV	Limit dBuV	Margin dB	Detector
0.25	58.32	99.49	41.17	Peak
0.52	58.10	73.36	15.26	Peak
13.66	47.81	69.50	21.69	Peak

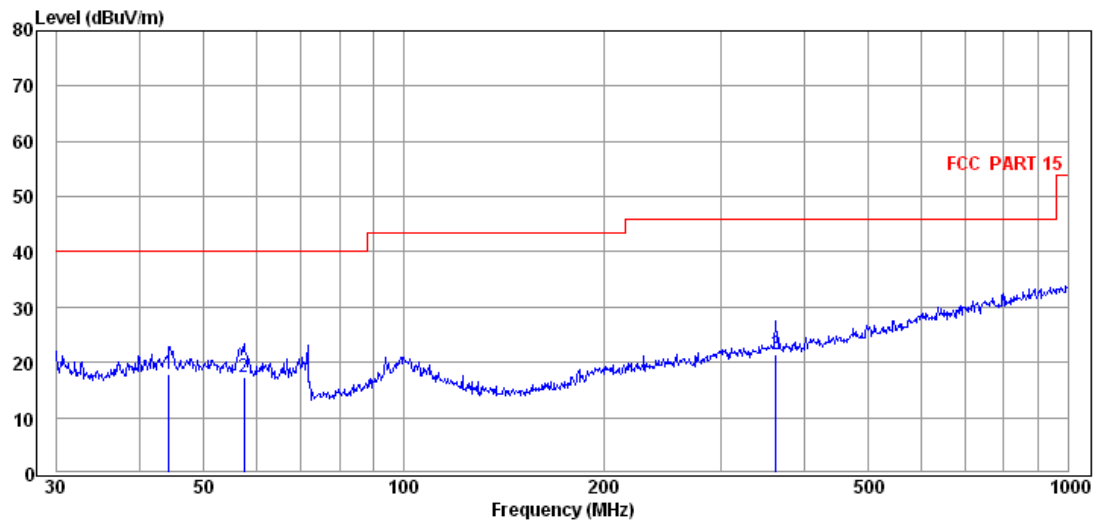


Note:

- a) Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);
- b) Limit line = specific limits (dBuV) + distance extrapolation factor.

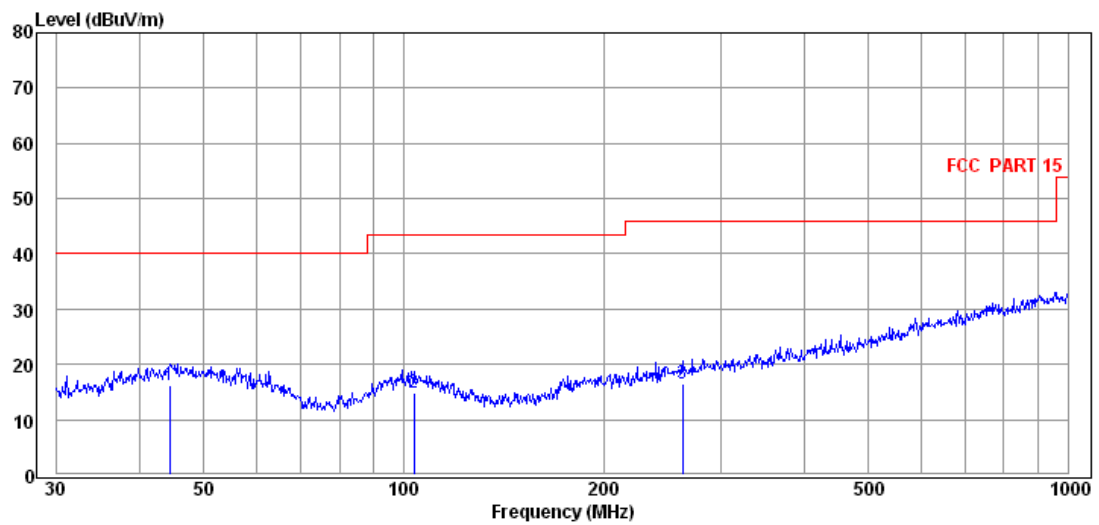
Radiated Emissions 9kHz – 30MHz (Vertical)

Freq MHz	Result dBuV	Limit dBuV	Margin dB	Detector
44.28	17.74	40.00	22.26	QP
57.39	17.43	40.00	22.57	QP
362.98	21.48	46.00	24.52	QP



Radiated Emissions 9kHz – 30MHz (horizontal)

Freq MHz	Result dBuV	Limit dBuV	Margin dB	Detector
44.43	16.14	40.00	23.86	QP
103.44	14.78	43.50	28.72	QP
262.90	16.48	46.00	29.52	QP





Annex A Photos of the EUT





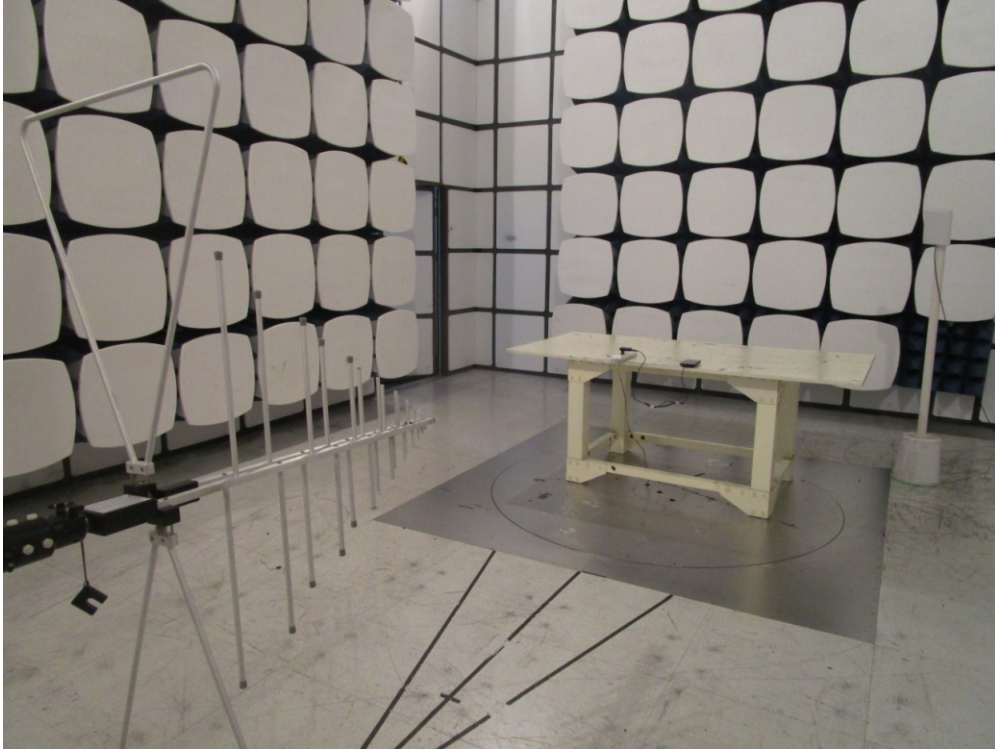
Annex B Photos of Setup

1. Conducted Emission



2. Radiated Emission





**** END OF REPORT ****