



FCC Part15 Subpart B & ICES-003

TEST REPORT

For

Electron 2G/3G Global

MODEL NUMBER: E310D, ELC314

REPORT NUMBER: 4789723883.1-2

ISSUE DATE: December 25, 2020

Prepared for

**Particle Industries, Inc.
26 Post St, 4th floor, San Francisco, CA 94108, USA**

Prepared by

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Revision History

<u>Rev.</u>	<u>Issue Date</u>	<u>Revisions</u>	<u>Revised By</u>
V0	12/25/2020	Initial Issue	

Note: This is a copy report base on 4788749548.1-2 which is issued by UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch on January 24, 2019. The customer need to add a new series model ELC314 which is all the same with the original model E310D except for the manufacturer of the embedded SIM card. We update the test report directly without any test. For more informaton, please refer to the original report.



Summary of Test Results				
Standard	Test Item	Limit	Result	Remark
FCC Part15, Subpart B ICES-003 Issue 6 ANSI C63.4-2014	Conducted Disturbance	Class B	PASS	
	Radiated Disturbance below 1 GHz	Class B	PASS	
	Radiated Disturbance above 1 GHz	Class B	PASS	NOTE (1) NOTE (2)

Note:

(1) "N/A" denotes test is not applicable in this Test Report

(2) If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. If the highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz, measurement shall only be made up to 5 GHz. If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 40 GHz, whichever is less.

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Particle Industries, Inc.
Address: 26 Post St, 4th floor, San Francisco, CA 94108, USA

Manufacturer Information

Company Name: Particle Industries, Inc.
Address: 26 Post St, 4th floor, San Francisco, CA 94108, USA

EUT Information

EUT Name: Electron 2G/3G Global
Model: E310D
Series Model: ELC314
Model Difference: Please refer to clause 5.1 Description of EUT
Brand: Particle
Sample Status: Normal
Sample ID: N/A
Sample Received Date: November 09, 2018
Date of Tested: November 10 2018~ November 26 2018

APPLICABLE STANDARDS	
STANDARDS	TEST RESULTS
FCC Part15, Subpart B ICES-003 Issue 6 ANSI C63.4-2014	PASS

Prepared by:

(Engineer: Gary Zhang)

Reviewed by:

(Laboratory Leader: Shawn Wen)

Approved By:

(Laboratory Manager: Stephen Guo)



2. TEST METHODOLOGY

All tests were performed in accordance with the standard FCC Part15 Subpart B, ICES-003 Issue 6 and ANSI C63.4-2014.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	<p>A2LA (Certificate No.: 4338.01) Shenzhen STS Test Services Co., Ltd. has been assessed and proved to be in compliance with A2LA.</p> <p>CNAS (Registration No.: L7649) Shenzhen STS Test Services Co., Ltd. has been assessed and proved to be in compliance with CNAS.</p> <p>FCC (FCC Designation No.: 625569) Shenzhen STS Test Services Co., Ltd. has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules</p> <p>IC(Company No.: 12108A) Shenzhen STS Test Services Co., Ltd. has been registered and fully described in a report filed with Industry Canada. The Company Number is 12108A.</p>
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Note: All tests measurement facilities use to collect the measurement data are located at1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China



4. CALIBRATION AND UNCERTAINTY

4.1. Measuring Instrument Calibration

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	2.67 dB
Radiated disturbance Test	Below 1GHz	2	3.92 dB
Radiated disturbance Test	Above 1GHz	2	3.31 dB

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



5. EQUIPMENT UNDER TEST

5.1. Description of EUT

EUT Name	Electron 2G/3G Global		
EUT Discriptior	The device is a Electron 2G/3G Global.		
Model	E310D		
Series Model	ELC314		
Model Difference	The schematic and PCB of the ELC314 is completely the same with E310D, and these two models of HW&SW is the same. Because changing the MVNO's E-SIM card (embedded SIM card) provider from Kore to Twilio. The differences are as follows: E310D uses eSIM of Kore. ELC314 uses eSIM of Twilio.		
Power Supply	DC 3.6V to 5.5V	Input:	DC 5V 500mA

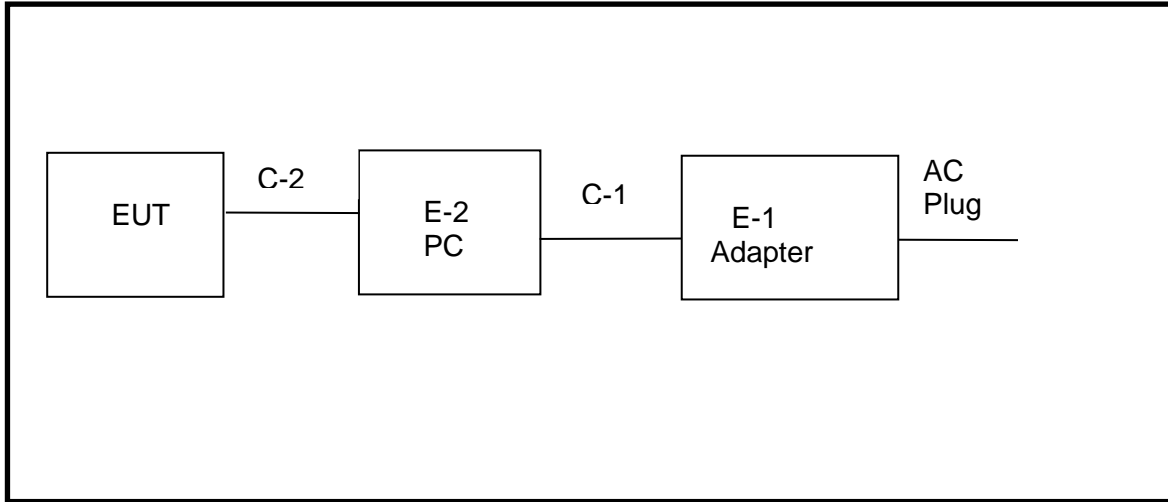
5.2. Test Mode

Test Mode	Description
Mode 1	WCDMA Band I
Mode 2	WCDMA Band VIII
Mode 3	GPRS 900 Mode
Mode 4	GSM 900 Mode
Mode 5	EDGE 900 Mode
Mode 6	GSM 1800 Mode
Mode 7	GPRS 1800 Mode
Mode 8	EDGE 1800 Mode
Mode 9	Charging Mode

5.3. EUT Accessory

Item	Accessory	Brand Name	Model Name	Description
1	USB Cable	Particle	E310D	120cm

5.4. Block Diagram Showing the Configuration of System Tested



The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Specification	Series No.
N/A	N/A	N/A	N/A	N/A	N/A

Item	Type of cable	Shielded Type	Ferrite Core	Length
1	USB Cable	YES	NO	120cm

**6. MEASURING EQUIPMENT AND SOFTWARE USED**

Conducted Disturbance						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESCI	101427	2018.10.13	2019.10.12
<input checked="" type="checkbox"/>	LISN	R&S	ENV216	101242	2018.10.11	2019.10.10
<input checked="" type="checkbox"/>	LISN	ETS	3810/2NM	00023625	2018.10.11	2019.10.10
<input checked="" type="checkbox"/>	Absorbing Clamp	R&S	MDS-21	100668	2018.10.17	2019.10.16
<input checked="" type="checkbox"/>	Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12
<input checked="" type="checkbox"/>	CE Cable	N/A	C01	N/A	2018.10.13	2019.10.12
<input checked="" type="checkbox"/>	Temperature & Humidity	Mieo	HH660	N/A	2018.10.11	2019.10.10
Software						
Used	Description	Manufacturer	Name	Version		
<input checked="" type="checkbox"/>	Test Software for Conducted Emissions	Farad	EZ-EMC	Ver. UL-3A1		
Radiated Disturbance						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESCI	101427	2018.10.13	2019.10.12
<input checked="" type="checkbox"/>	Bilog Antenna	TESEQ	CBL6111D	45873	2017.11.02	2020.11.01
<input checked="" type="checkbox"/>	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1343	2018.10.19	2021.10.18
<input checked="" type="checkbox"/>	Pre-mpifier(1G-18G)	SKET	LNPA-01018G-45	SK2018080901	2018.10.13	2019.10.12
<input checked="" type="checkbox"/>	Pre-mpifier(0.1M-3GHz)	EM	EM330	060665	2018.07.10	2019.07.09
<input checked="" type="checkbox"/>	Spectrum Analyzer	Agilent	N9020A	MY49100060	2018.10.13	2019.10.12
<input checked="" type="checkbox"/>	Universal Radio Communication Tester	R&S	CMW500	117239	2018.10.13	2019.10.12
<input checked="" type="checkbox"/>	RE Cable (9K-1G)	N/A	R01	N/A	2018.10.13	2019.10.12
<input checked="" type="checkbox"/>	RE Cable (1G-18G)	N/A	R02	N/A	2018.10.13	2019.10.12
<input checked="" type="checkbox"/>	Temperature & Humidity	Mieo	HH660	N/A	2018.10.11	2019.10.10
Software						
Used	Description	Manufacturer	Name	Version		
<input checked="" type="checkbox"/>	Test Software for Radiated Emissions	Farad	EZ-EMC	Ver. UL-3A1		

7. EMISSION TEST

7.1. Conducted Disturbance Measurement

7.1.1. Limits of conducted disturbance voltage

FREQUENCY (MHz)	<input type="checkbox"/> Class A (dB μ V)		<input checked="" type="checkbox"/> Class B (dB μ V)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.
- (3) The test result calculated as following:
 Measurement Value = Reading Level + Correct Factor
 Correct Factor = Insertion Loss + Cable Loss + Attenuator Factor
 Margin Level = Measurement Value - Limit Value

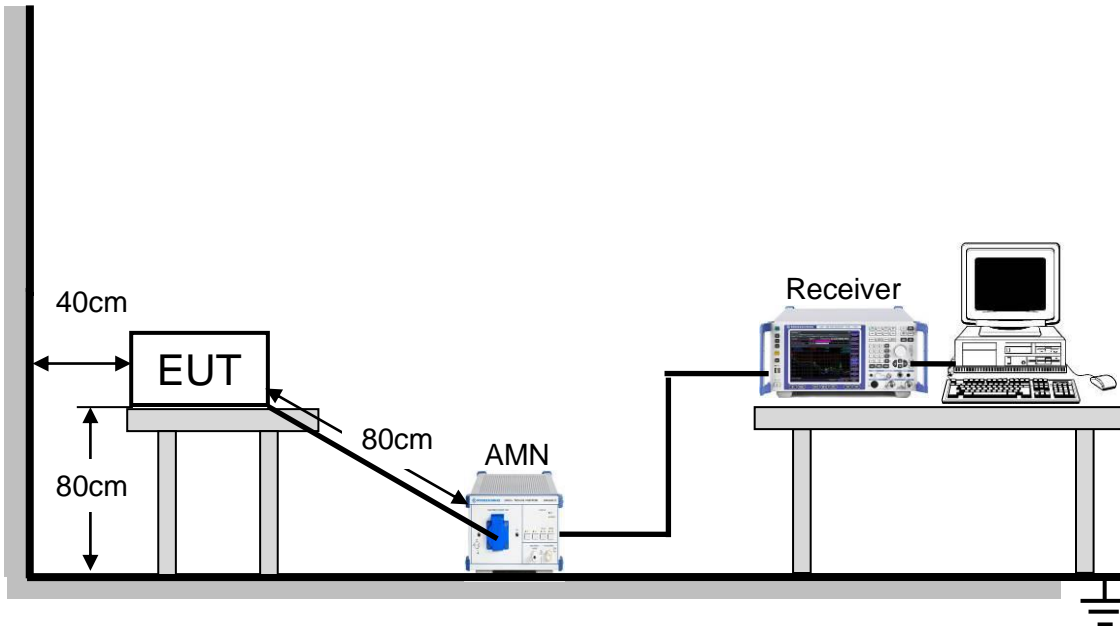
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

7.1.2. Test Procedure

- a. The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item:EUT Test Photos.

7.1.3. Test Setup



For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

7.1.4. Test Environment

Temperature:	23.5°C
Humidity:	59%
ATM pressure:	101kPa

7.1.5. Test Mode

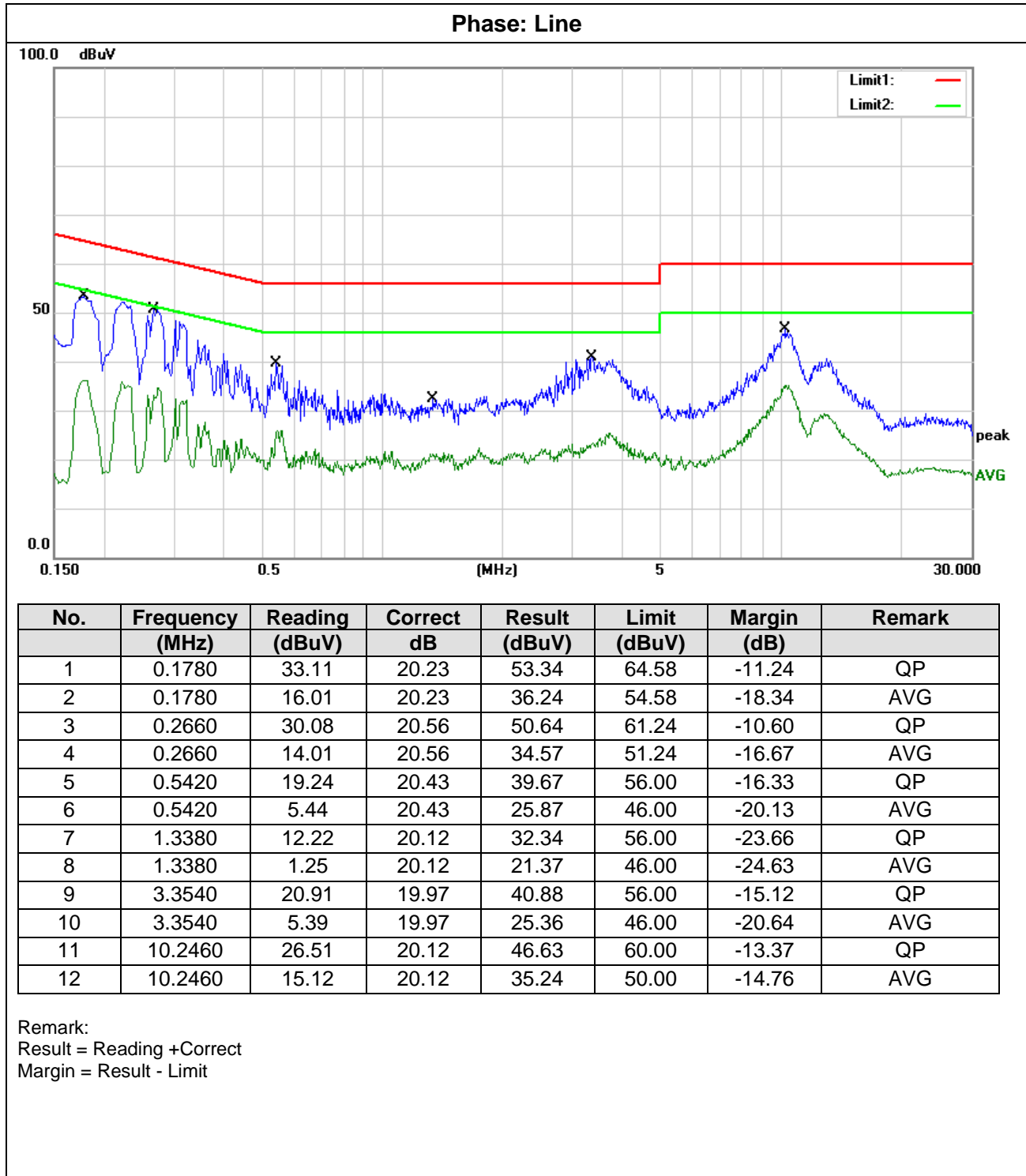
Pre-test Mode:	Mode 1 ~ Mode 9
Final Test Mode:	Mode 1

Note: According to pre-test results, the final test mode is each independent function's worst case and only shown in the report.



7.1.6. Test Results

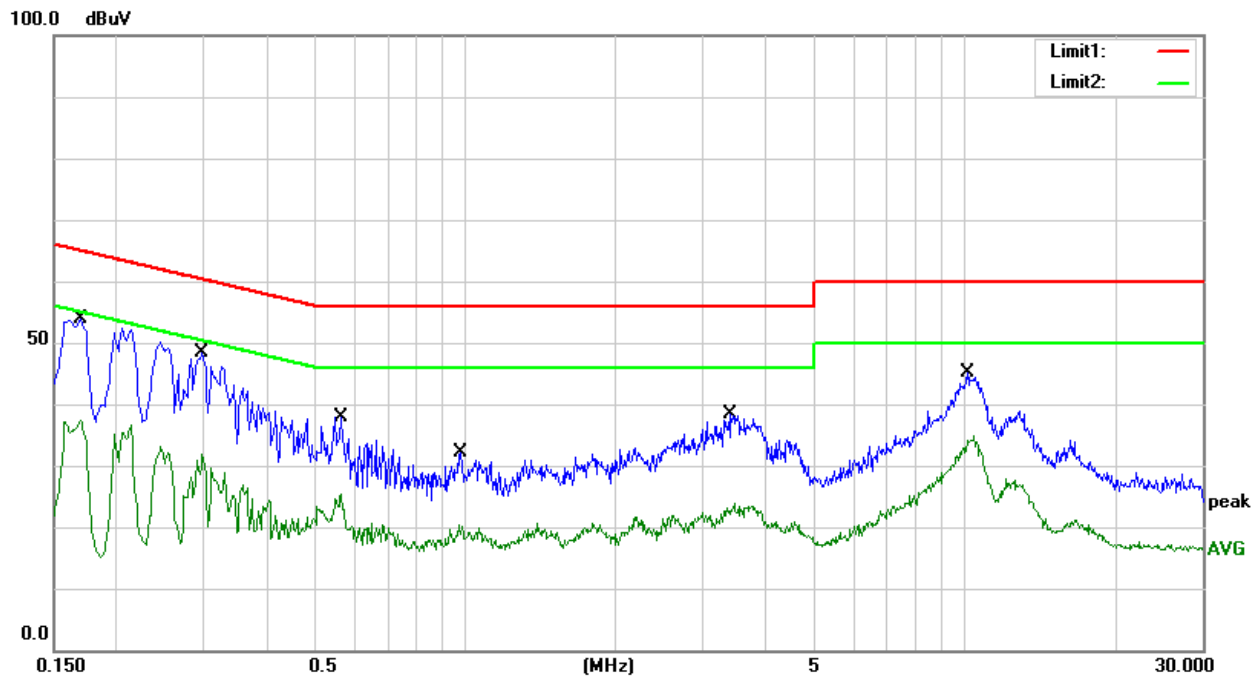
Test Mode:	Mode 1
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Test Mode:	Mode 1
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Phase: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1700	33.57	20.23	53.80	64.96	-11.16	QP
2	0.1700	17.14	20.23	37.37	54.96	-17.59	AVG
3	0.2980	27.66	20.71	48.37	60.30	-11.93	QP
4	0.2980	11.13	20.71	31.84	50.30	-18.46	AVG
5	0.5660	17.56	20.41	37.97	56.00	-18.03	QP
6	0.5660	5.05	20.41	25.46	46.00	-20.54	AVG
7	0.9820	11.90	20.16	32.06	56.00	-23.94	QP
8	0.9820	0.28	20.16	20.44	46.00	-25.56	AVG
9	3.4060	18.31	19.97	38.28	56.00	-17.72	QP
10	3.4060	3.97	19.97	23.94	46.00	-22.06	AVG
11	10.1620	24.99	20.13	45.12	60.00	-14.88	QP
12	10.1620	14.78	20.13	34.91	50.00	-15.09	AVG

Remark:
 Result = Reading +Correct
 Margin = Result – Limit

7.2. Radiated Disturbance Measurement

7.2.1. Limits of radiated disturbance measurement

Below 1 GHz

Measurement Method and Applied Limits:

ANSI C63.4:

Frequency (MHz)	<input type="checkbox"/> Class A		<input checked="" type="checkbox"/> Class B
	Field strength (dBuV/m) (at 3m)	Field strength (dBuV/m) (at 3m)	Field strength (dBuV/m) (at 3m)
30 - 88	90	49.5	40
88 - 216	150	53.9	43.5
216 - 960	210	56.9	46
Above 960	300	60	54

Above 1 GHz

Measurement Method and Applied Limits:

ANSI C63.4:

Frequency (MHz)	<input type="checkbox"/> Class A				<input checked="" type="checkbox"/> Class B	
	(dBuV/m) (at 3m)		(dBuV/m) (at 10m)		(dBuV/m) (at 3m)	
	Peak	Average	Peak	Average	Peak	Average
Above 1000	80	60	69.5	49.5	74	54

Frequency Range of Radiated Disturbance Measurement

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	5 th harmonic of the highest frequency or 40 GHz, whichever is lower

NOTE:

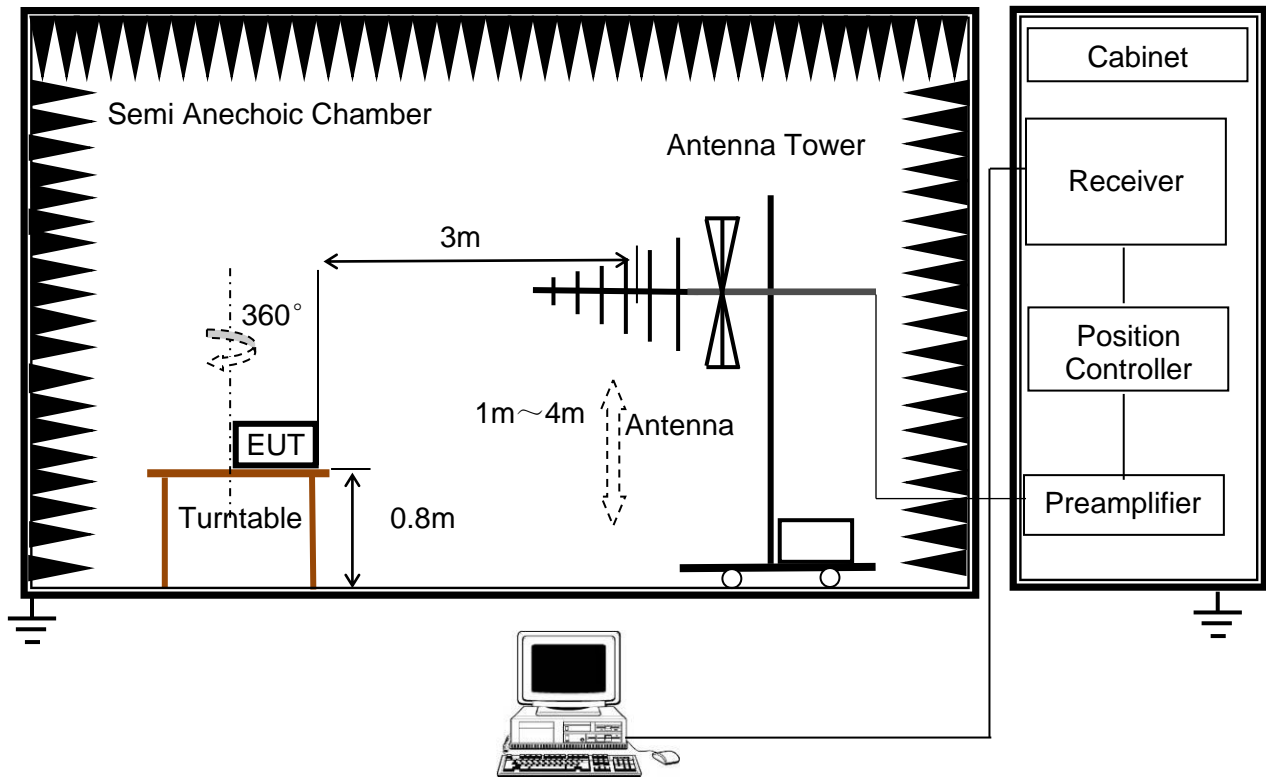
- (1) The limit for radiated test was performed according to FCC Part 15, Subpart B;
- (2) The tighter limit applies at the band edges;
- (3) Emission level (dBuV/m) = 20log Emission level (uV/m),
3m Emission level = 10m Emission level + 20log(10m/3m);
- (4) The test result calculated as following:
Measurement Value = Reading Level + Correct Factor,
Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain(if use),
Margin Level = Measurement Value - Limit Value.

7.2.2. Test Procedure

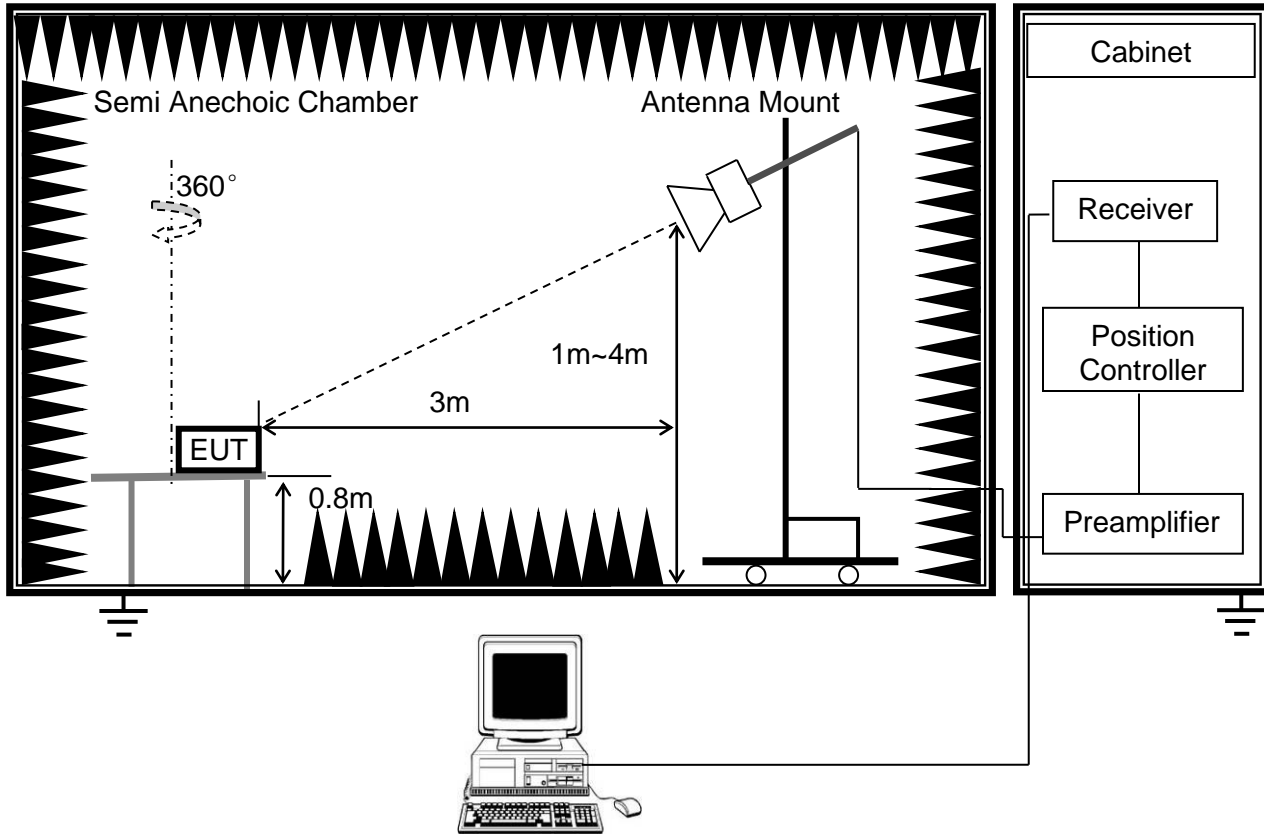
- a. The measuring distance of at 3m shall be used for measurements at frequency up to 1GHz.
- b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For the actual test configuration, please refer to the related Item:EUT Test Photos.

7.2.3. Test Setup

(a) Radiated Disturbance Test Set-Up Frequency 30MHz - 1GHz



(b) Radiated Disturbance Test Set-Up Frequency above 1GHz



For the actual test configuration, please refer to Appendix I: Photographs of the Test Configuration.

7.2.4. Test Environment

Radiated Disturbance - below 1 GHz		Radiated Disturbance - above 1 GHz	
Temperature:	24.6°C	Temperature:	N/A
Humidity:	58%	Humidity:	N/A
ATM pressure:	101kPa	ATM pressure:	N/A

7.2.5. Test Mode

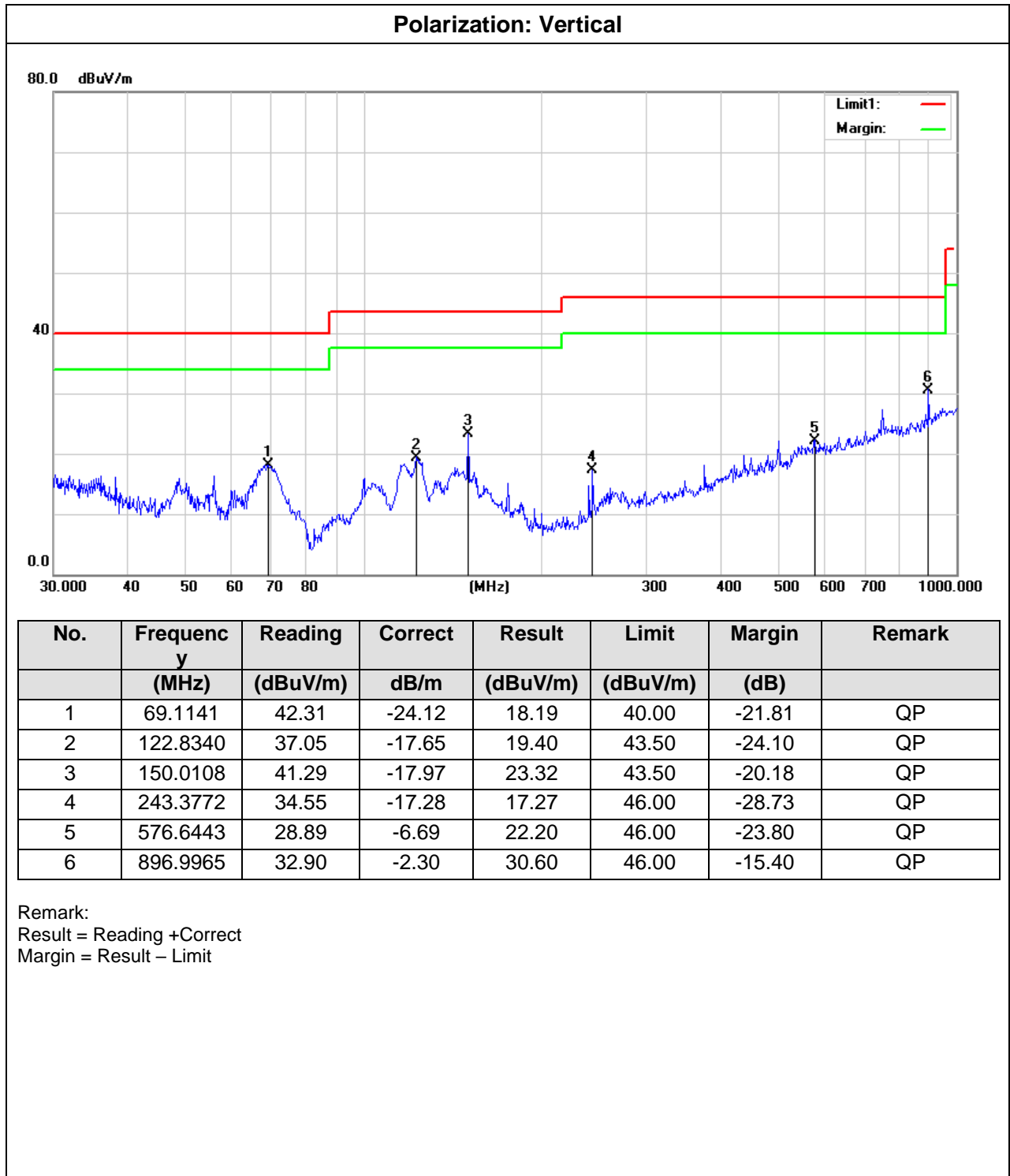
Radiated Disturbance - below 1 GHz		Radiated Disturbance - above 1 GHz	
Pre-test Mode:	Mode 1	Pre-test Mode:	N/A
Final Test Mode:	Mode 1	Final Test Mode:	N/A

Note: According to pre-test results, the final test mode is each independent function's worst case and only shown in the report.



7.2.6. Test Results – below 1GHz

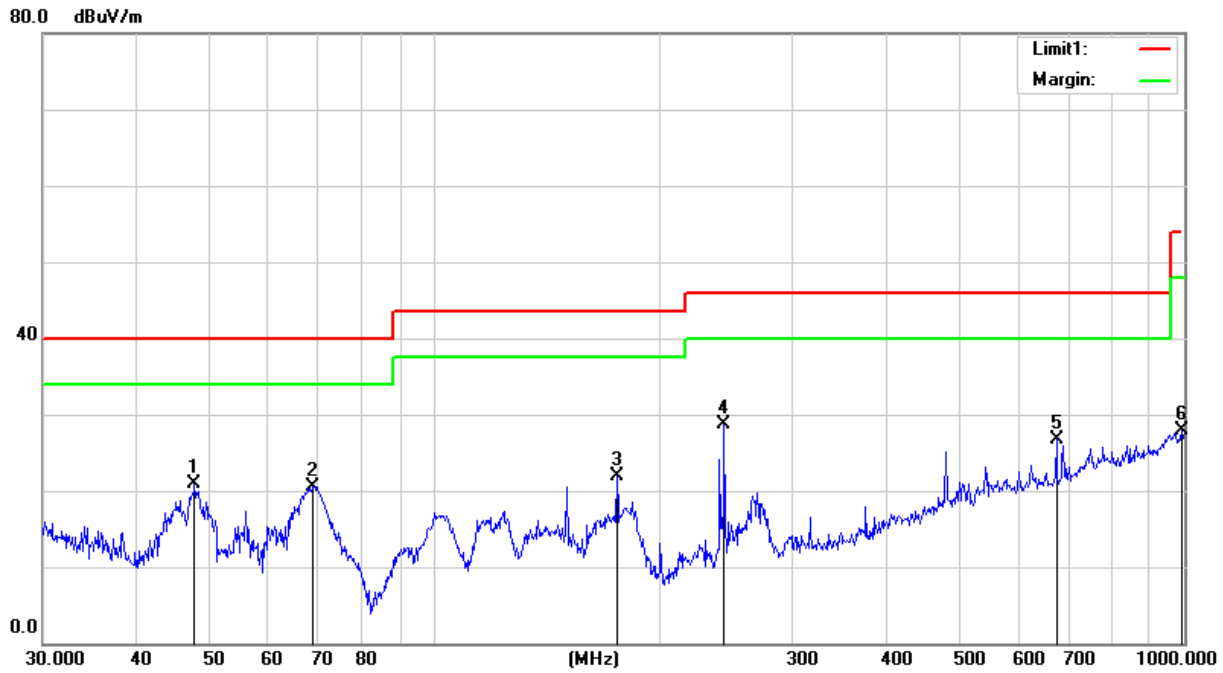
Test Mode:	Mode 1
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Test Mode:	Mode 1
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Polarization: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	47.8260	41.28	-20.36	20.92	40.00	-19.08	QP
2	68.8721	44.72	-24.13	20.59	40.00	-19.41	QP
3	175.0365	41.33	-19.38	21.95	43.50	-21.55	QP
4	243.3771	45.94	-17.28	28.66	46.00	-17.34	QP
5	675.2080	32.48	-5.87	26.61	46.00	-19.39	QP
6	993.0113	28.02	-0.10	27.92	54.00	-26.08	QP

Remark:
 Result = Reading +Correct
 Margin = Result – Limit

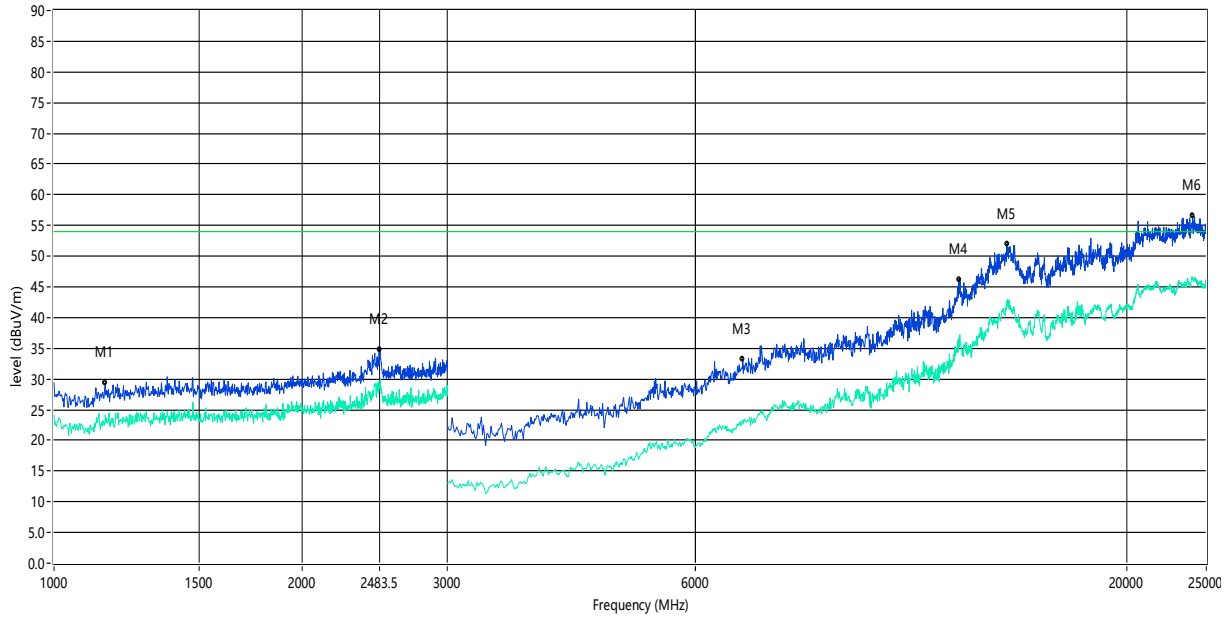


7.2.7. Test Results – above 1GHz

Test Mode:	Mode 1
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Polarization: Vertical

RE_FCC Test Case_FCC 15B 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1**	1154.000	24.13	-19.84	54.0	-29.87	AV	9.00	100	V	Pass
1	1154.000	29.26	-19.84	74.0	-44.74	Peak	9.00	100	V	Pass
2**	2480.000	29.47	-13.63	54.0	-24.53	AV	11.00	100	V	Pass
2	2480.000	34.80	-13.63	74.0	-39.20	Peak	11.00	100	V	Pass
3**	6850.000	23.23	7.39	54.0	-30.77	AV	12.00	100	V	Pass
3	6850.000	33.21	7.39	74.0	-40.79	Peak	12.00	100	V	Pass
4**	12519.999	36.68	19.89	54.0	-17.32	AV	7.00	100	V	Pass
4	12519.999	46.19	19.89	74.0	-27.81	Peak	7.00	100	V	Pass
5**	14320.000	42.66	24.92	54.0	-11.34	AV	1.00	100	V	Pass
5	14320.000	51.95	24.92	74.0	-22.05	Peak	1.00	100	V	Pass
6**	24075.999	46.42	23.28	54.0	-7.58	AV	4.00	100	V	Pass
6	24075.999	56.50	23.28	74.0	-17.50	Peak	4.00	100	V	Pass

Remark:

Result = Reading +Correct

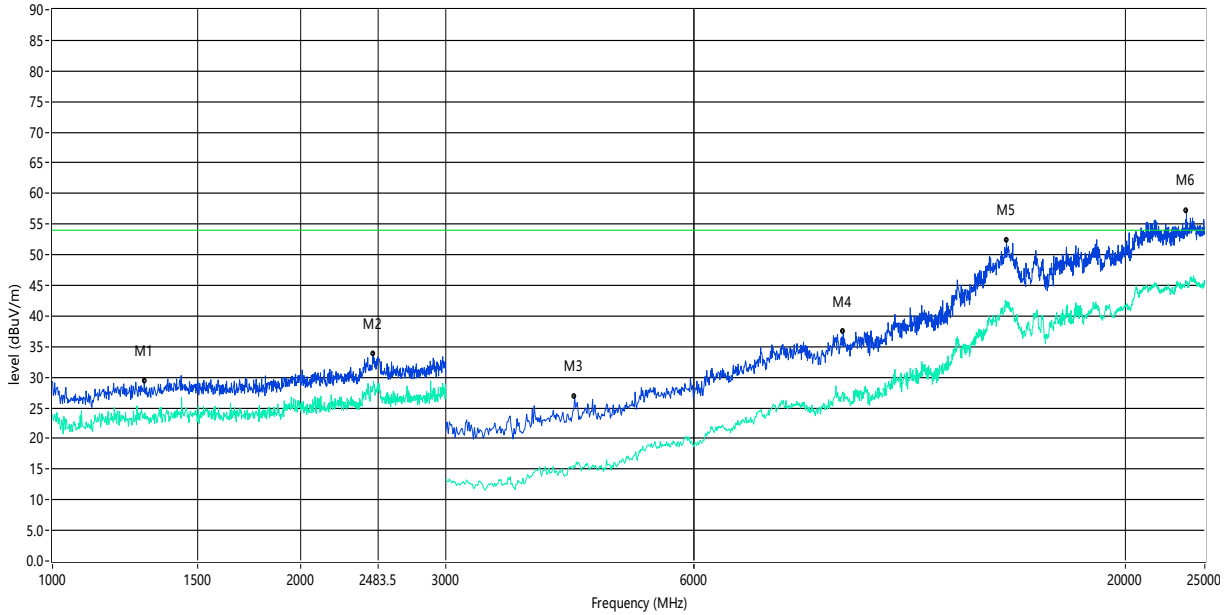
Margin = Result - Limit



Test Mode:	Mode 1
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Polarization: Horizontal

RE_FCC Test Case_FCC 15B 1GHz-25GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1**	1292.000	23.19	-19.44	54.0	-30.81	AV	10.00	100	H	Pass
1	1292.000	29.28	-19.44	74.0	-44.72	Peak	10.00	100	H	Pass
2**	2450.000	28.51	-13.79	54.0	-25.49	AV	15.00	100	H	Pass
2	2450.000	33.81	-13.79	74.0	-40.19	Peak	15.00	100	H	Pass
3**	4300.000	15.27	1.29	54.0	-38.73	AV	4.00	100	H	Pass
3	4300.000	26.84	1.29	74.0	-47.16	Peak	4.00	100	H	Pass
4**	9110.000	26.70	12.36	54.0	-27.30	AV	9.00	100	H	Pass
4	9110.000	37.44	12.36	74.0	-36.56	Peak	9.00	100	H	Pass
5**	14368.000	41.92	24.92	54.0	-12.08	AV	13.00	100	H	Pass
5	14368.000	52.42	24.92	74.0	-21.58	Peak	13.00	100	H	Pass
6**	23751.999	45.34	23.39	54.0	-8.66	AV	8.00	100	H	Pass
6	23751.999	57.19	23.39	74.0	-16.81	Peak	8.00	100	H	Pass

Remark:

Result = Reading +Correct

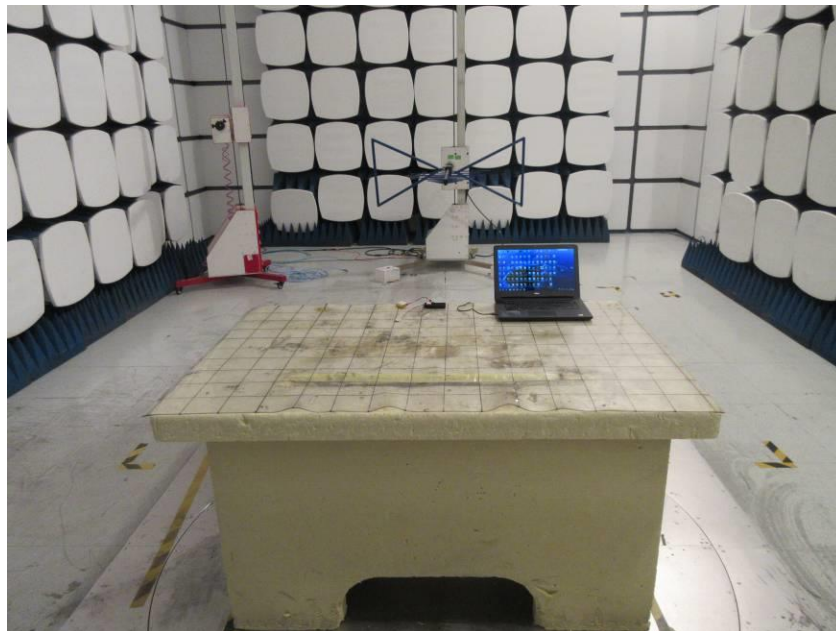
Margin = Result - Limit

Appendix I: Photographs of EMC Test Configuration

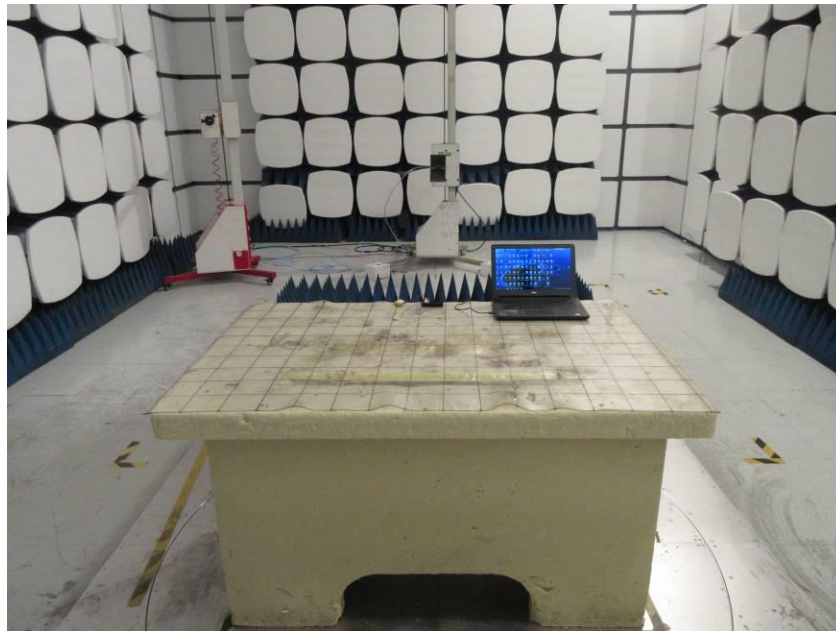
Conducted Disturbance



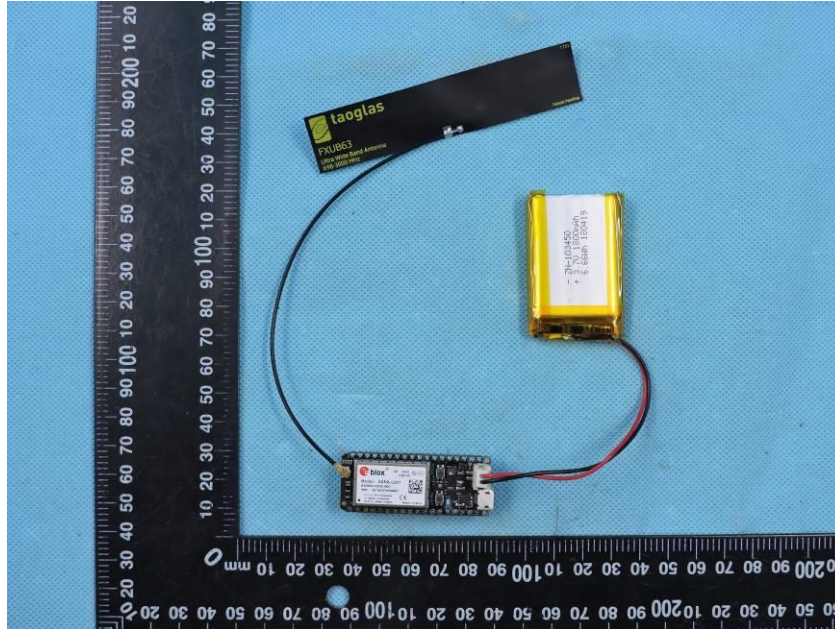
Radiated Disturbance below 1GHz

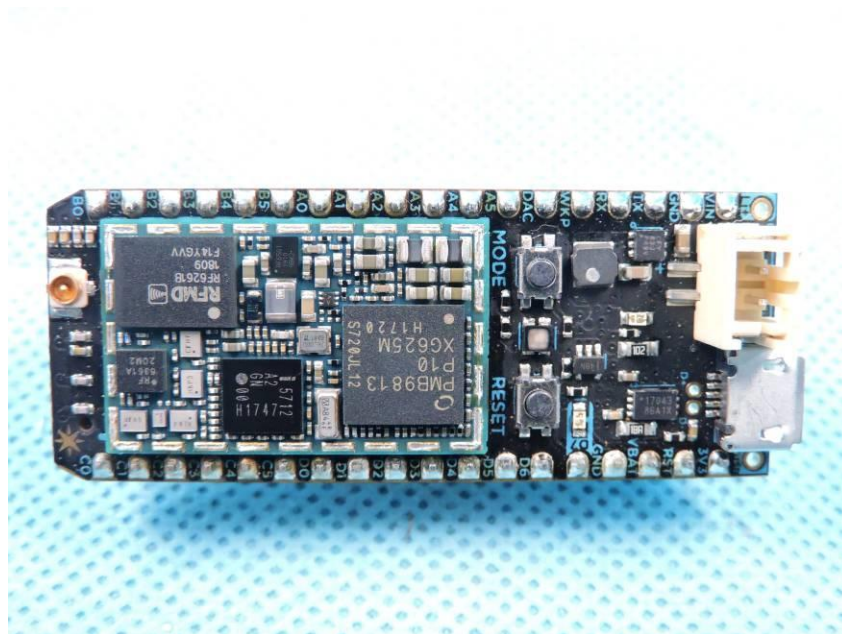
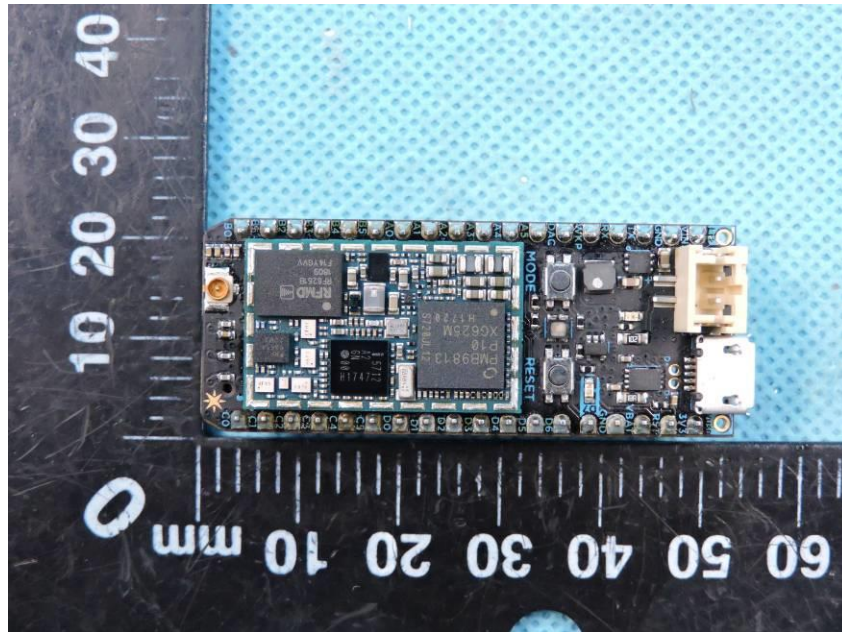


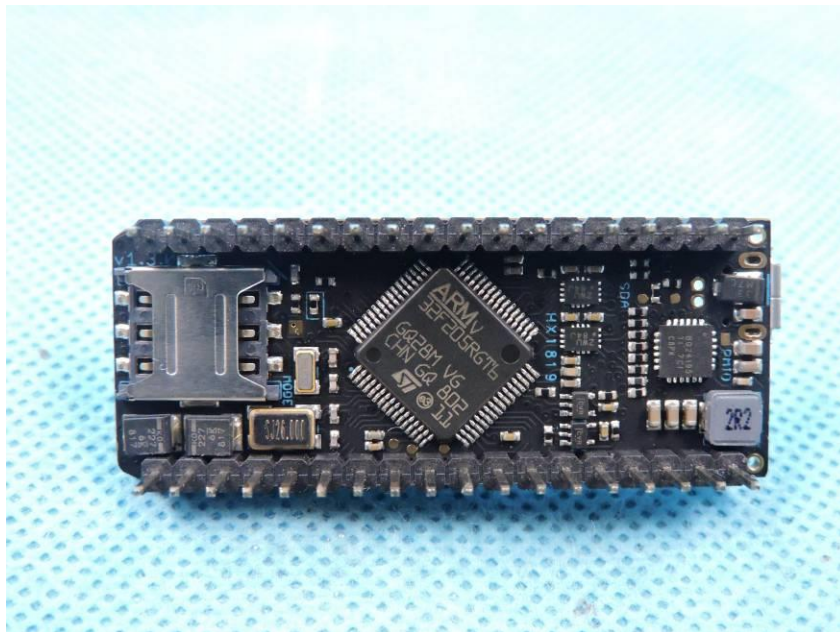
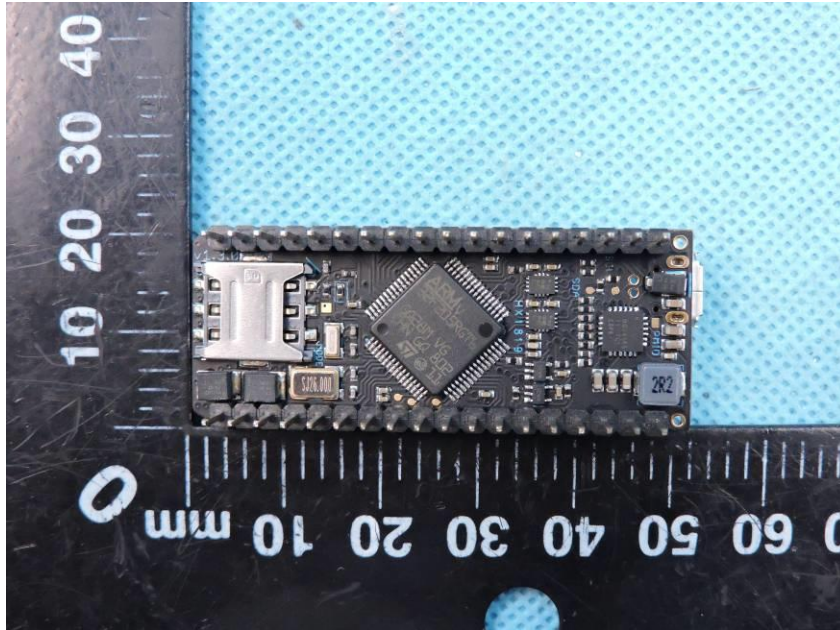
Radiated Disturbance above 1GHz

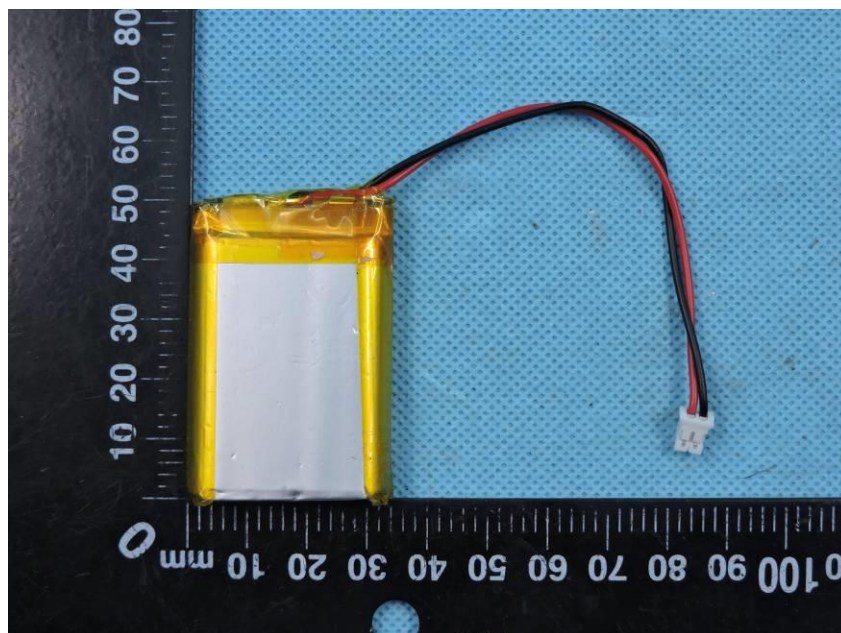
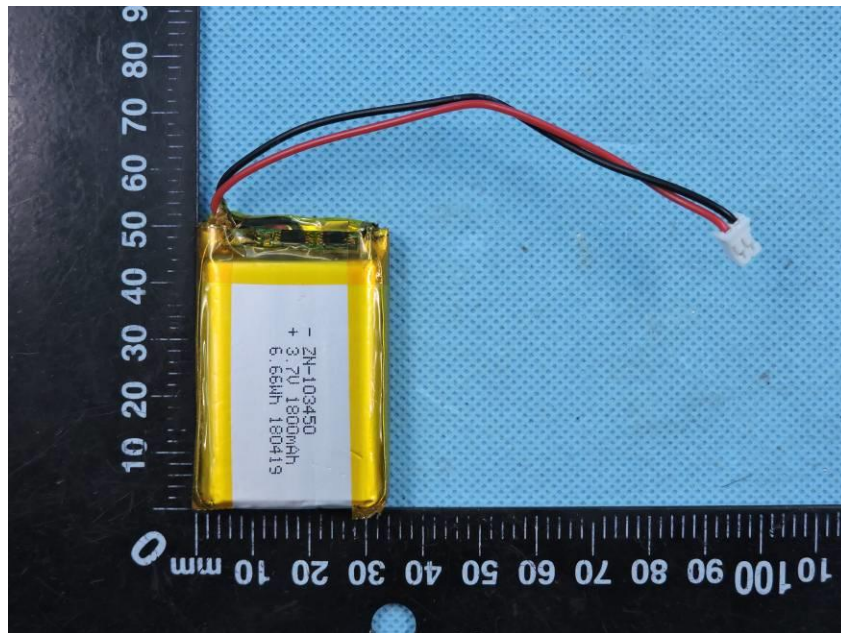


Appendix II: Photographs of the EUT











END OF REPORT