

# TEST REPORT

Product Name: Switch/Fob  
FCC ID: 2ATM75709  
Trademark: YoLink  
Model Number: YS5709-UC, YS3615-UC, YS3616-UC  
Prepared For: YoSmart Inc.  
Address: 15375 Barranca Parkway, Ste G-105 Irvine, CA 92618, USA  
Manufacturer: YoSmart Inc.  
Address: 15375 Barranca Parkway, Ste G-105 Irvine, CA 92618, USA  
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Sample Received Date: Aug. 01, 2023  
Sample tested Date: Aug. 01, 2023 to Aug. 11, 2023  
Issue Date: Aug. 11, 2023  
Report No.: CTB230811044RF  
Test Standards: FCC Part15.249  
ANSI C63.10:2013  
Test Results: PASS  
Remark: This is LoRa radio test report.

Compiled by:

*Zhou kui*Zhou Kui

Reviewed by:

*Arron Liu*Arron Liu

Approved by:

Bin Mei / Director

Note: If there is any objection to the inspection results in this report, please submit a written report to the company within 15 days from the date of receiving the report. The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client. "\*" indicates the testing items were fulfilled by subcontracted lab. "#" indicates the items are not in CNAS accreditation scope.

**TABLE OF CONTENT**

Test Report Declaration	Page
<b>1. VERSION</b> .....	3
<b>2. TEST SUMMARY</b> .....	4
<b>3. MEASUREMENT UNCERTAINTY</b> .....	5
<b>4. PRODUCT INFORMATION AND TEST SETUP</b> .....	6
4.1 Product Information .....	6
4.2 Test Setup Configuration .....	6
4.3 Support Equipment .....	6
4.4 Channel List .....	7
4.5 Test Mode .....	7
4.6 Test Environment .....	7
<b>5. TEST FACILITY AND TEST INSTRUMENT USED</b> .....	8
5.1 Test Facility .....	8
5.2 Test Instrument Used .....	8
<b>6. AC POWER LINE CONDUCTED EMISSION</b> .....	10
6.1 Block Diagram Of Test Setup .....	10
6.2 Limit .....	10
6.3 Test procedure .....	10
6.4 Test Result .....	12
<b>7. RADIATED SPURIOUS EMISSION</b> .....	13
7.1 Block Diagram Of Test Setup .....	13
7.2 Limit .....	13
7.3 Test procedure .....	14
7.4 Test Result .....	15
<b>8. BAND EDGE EMISSION</b> .....	18
8.1 Block Diagram Of Test Setup .....	18
8.2 Limit .....	18
8.3 Test procedure .....	19
8.4 Test Result .....	20
<b>9. BANDWIDTH TEST</b> .....	22
9.1 Block Diagram Of Test Setup .....	22
9.2 Limit .....	22
9.3 Test procedure .....	22
9.4 Test Result .....	22
<b>10. ANTENNA REQUIREMENT</b> .....	24
<b>11. EUT TEST SETUP PHOTOGRAPHS</b> .....	25

(Note: N/A means not applicable)

**1. VERSION**

Report No.	Issue Date	Description	Approved
CTB230811044RF	Aug. 11, 2023	Original	Valid

**2. TEST SUMMARY**

3. The Product has been tested according to the following specifications:

<b>Standard Section</b>	<b>Test Item</b>	<b>Judgment</b>	<b>Remark</b>
<b>15.207</b>	<b>Conducted Emission</b>	<b>N/A</b>	
<b>15.215</b>	<b>20dB Bandwidth</b>	<b>PASS</b>	
<b>15.249</b>	<b>Fundamental &amp;Radiated Spurious Emission Measurement</b>	<b>PASS</b>	
<b>15.205</b>	<b>Band Edge Emission</b>	<b>PASS</b>	
<b>15.203</b>	<b>Antenna Requirement</b>	<b>PASS</b>	

Remark:

Test according to ANSI C63.10-2013.

#### 4. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Item	Uncertainty
Occupancy bandwidth	54.3kHz
Conducted output power Above 1G	0.9dB
Conducted output power below 1G	0.9dB
Power Spectral Density , Conduction	0.9dB
Conduction spurious emissions	2.0dB
Out of band emission	2.0dB
3m chamber Radiated spurious emission(9KHz-30MHz)	4.8dB
3m chamber Radiated spurious emission(30MHz-1GHz)	4.6dB
3m chamber Radiated spurious emission(1GHz-18GHz)	5.1dB
3m chamber Radiated spurious emission(18GHz-40GHz)	3.4dB
humidity uncertainty	5.5%
Temperature uncertainty	0.63°C
frequency	1×10 <sup>-7</sup>
Conducted Emission (150KHz-30MHz)	3.2 dB
Radiated Emission(30MHz ~ 1000MHz)	4.8 dB
Radiated Emission(1GHz ~6GHz)	4.9 dB

**5. PRODUCT INFORMATION AND TEST SETUP**

**4.1 Product Information**

Model(s): YS5709-UC, YS3615-UC, YS3616-UC  
 Model Description: All the model are the same circuit and RF module, only for model name. Test sample model: YS5709-UC  
 Hardware Version: V1.0  
 Software Version: V0901  
 Operation Frequency: 910.3 MHz  
 Type of Modulation: LoRa  
 Antenna installation: PCB antenna  
 Antenna Gain: 1.0dBi  
 Ratings: DC 3V by battery

**4.2 Test Setup Configuration**

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

**4.3 Support Equipment**

Item	Equipment	Mfr/Brand	Model/Type No.	Series	Note
/	/	/	/	/	/

**Notes:**

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer’s requirements and conditions for the intended use.

#### 4.4 Channel List

CH	Frequency (MHz)
1	910.3

#### 4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Test mode
1	910.3MHz

#### 4.6 Test Environment

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Normal Voltage(DC):	3V
Normal Temperature(°C)	23
Low Temperature(°C)	-20
High Temperature(°C)	54

## 6. TEST FACILITY AND TEST INSTRUMENT USED

### 5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

FCC Test Firm Registration Number: 292923

IC Registered No.:25587

CAB identifier: CN0098

### 5.2 Test Instrument Used

Item	Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	2024.07.05
2	Power Sensor	Agilent	U2021XA	MY56120032	2024.07.05
3	Power Sensor	Agilent	U2021XA	MY56120034	2024.07.05
4	Communication test set	R&S	CMW500	108058	2024.07.05
5	Spectrum Analyzer	KEYSIGHT	N9020A	MY51289897	2024.07.05
6	Signal Generator	Agilent	N5181A	MY50140365	2024.07.05
7	Vector signal generator	Agilent	N5182A	MY47420195	2024.07.05
8	Communication test set	Agilent	E5515C	MY50102567	2024.07.06
9	2.4 GHz Filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	2024.07.05
10	5 GHz Filter	Shenxiang	MSF5150-5850 MS-1155	20181015001	2024.07.06
11	Filter	Xingbo	XBLBQ-DZA120	190821-1-1	2024.07.06
12	BT&WI-FI Automatic test software	Microwave	MTS8000	Ver. 2.0.0.0	/
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	2023.10.30
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	2024.07.05
15	234G Automatic test software	Microwave	MTS8200	Ver. 2.0.0.0	/
16	966 chamber	C.R.T.	966	/	2024.08.11
17	Receiver	R&S	ESPI	100362	2024.07.05
18	Amplifier	HP	8447E	2945A02747	2024.07.05
19	Amplifier	Agilent	8449B	3008A01838	2024.07.05

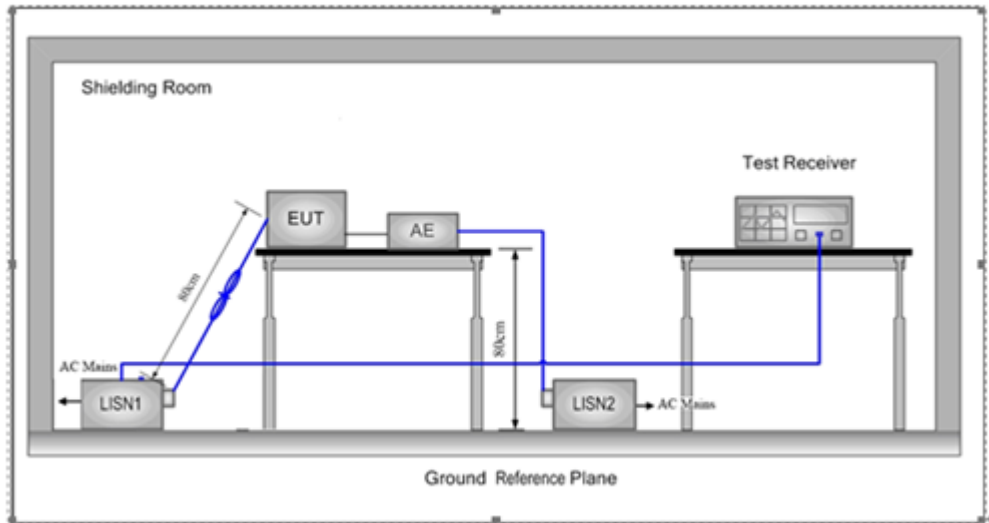


20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	2024.07.08
21	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA9120D	01911	2024.07.08
22	EMI test software	Fala	EZ-EMC	FA-03A2 RE	/
23	Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-224	2024.07.08
24	loop antenna	ZHINAN	ZN30900A	GTS534	/
25	40G Horn antenna	A/H/System	SAS-574	588	2023.10.30
26	Amplifier	AEROFLEX	Aeroflex	097	2023.10.30

Radiated emission				
Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	01911	2024.07.08
TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	00869	2024.07.08
Amplifier	Agilent	8449B	3008A01838	2024.07.05
Amplifier	HP	8447E	2945A02747	2024.07.05
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI	100428/003	2024.07.05
Coaxial cable	ETS	RFC-SNS-100-NMS-80 NI	/	2024.07.05
Coaxial cable	ETS	RFC-SNS-100-NMS-20 NI	/	2024.07.05
Coaxial cable	ETS	RFC-SNS-100-SMS-20 NI	/	2024.07.05
Coaxial cable	ETS	RFC-NNS-100-NMS-300 NI	/	2024.07.05
Communication test set	Agilent	E5515C	MY50102567	2024.07.05
Communication test set	R&S	CMW500	108058	2024.07.05
EZ-EMC	Frad	EMC-con3A1.1	/	/

## 6. AC POWER LINE CONDUCTED EMISSION

### 6.1 Block Diagram Of Test Setup



### 6.2 Limit

**Table 4 – AC power-line conducted emissions limits**

Frequency (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 <sup>Note 1</sup>	56 to 46 <sup>Note 1</sup>
0.5 - 5	56	46
5 - 30	60	50

**Note 1:** The level decreases linearly with the logarithm of the frequency.

\* Decreasing linearly with the logarithm of the frequency

### 6.3 Test procedure

- 1) The mains terminal disturbance voltage test was conducted in a shielded room.
- 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50 $\Omega$ /50 $\mu$ H + 5 $\Omega$  linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
- 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
- 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane.

This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

- 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.
- 6) All modes were tested at AC 120V and 240V, only the worst result of AC 120V 60Hz was reported.
- 7) If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.

#### 6.4 Test Result

N/A

NOTE: This EUT is powered by DC power only, this test item is not applicable

## 7. RADIATED SPURIOUS EMISSION

### 7.1 Block Diagram Of Test Setup

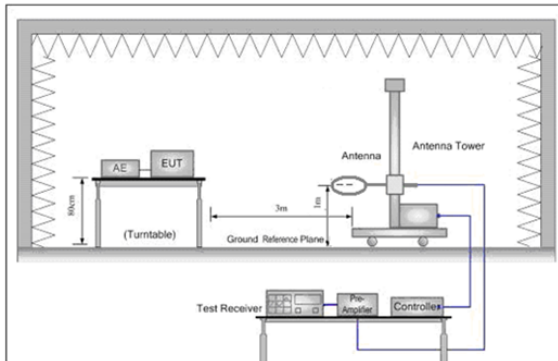


Figure 1. Below 30MHz

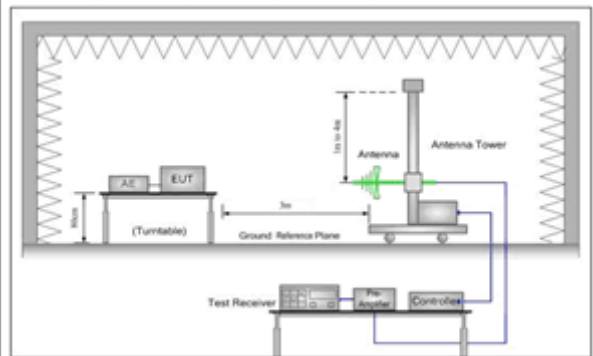
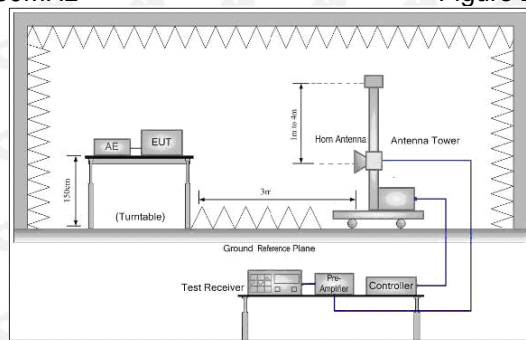


Figure 2. 30MHz to 1GHz



### 7.2 Limit

#### Spurious Emissions:

Frequency	Field strength (microvolt/meter)	Limit (dB $\mu$ V/m )	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

7.3 Test procedure

**Below 1GHz test procedure as below:**

- a.The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c.The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d.For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f.If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

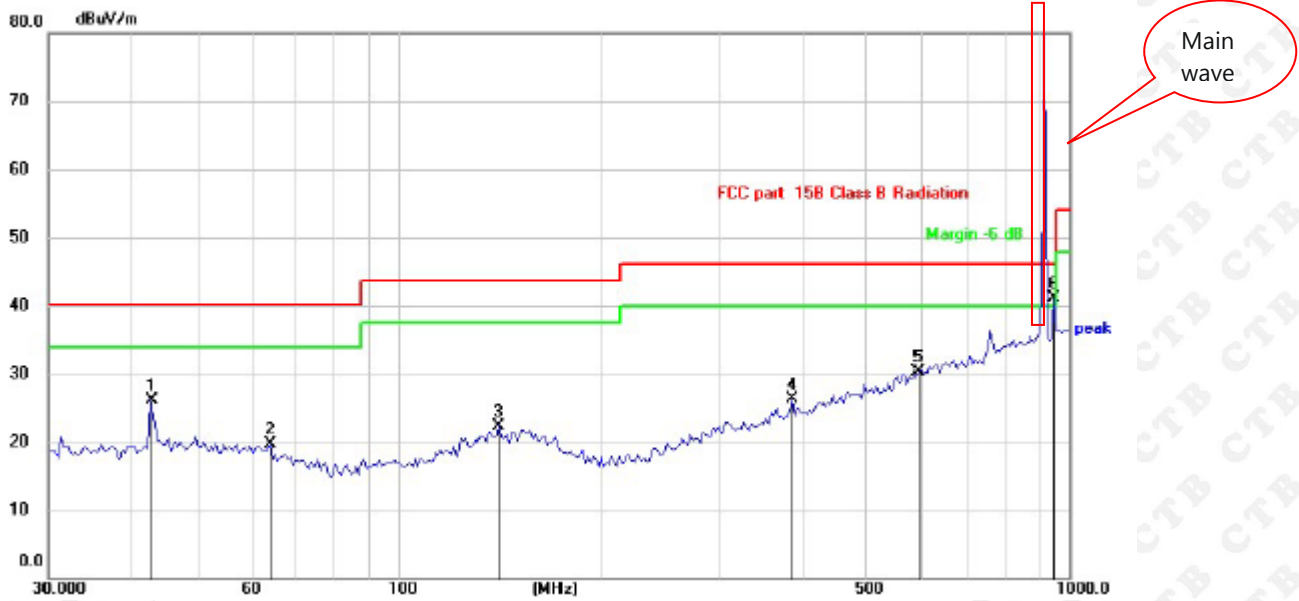
**Above 1GHz test procedure as below:**

- g.Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter( Above 18GHz the distance is 1 meter and table is 1.5 meter).
  - h.Test the EUT in the lowest channel ,the middle channel ,the Highest channel
  - j.Repeat above procedures until all frequencies measured was complete.
  - j. Full battery is used during test
- Receiver set:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	120 kHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

7.4 Test Result

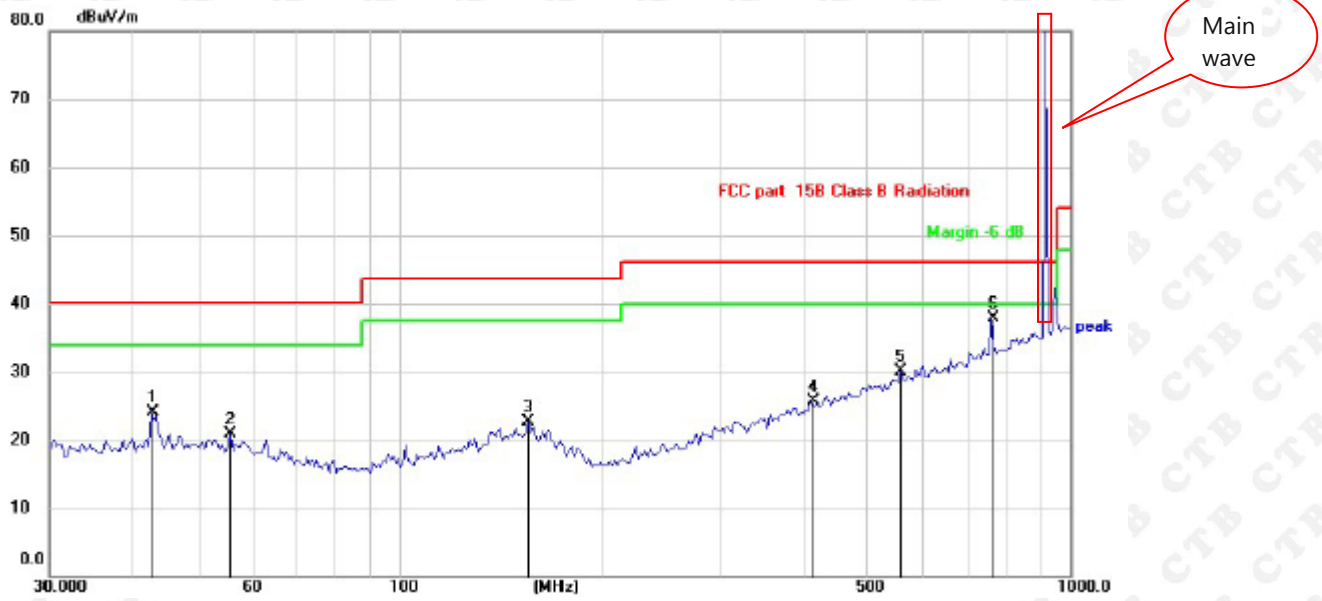
Below 1GHz Test Results:  
Antenna polarity: H



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		42.6000	32.26	-6.19	26.07	40.00	-13.93	QP
2		64.3201	27.19	-7.49	19.70	40.00	-20.30	QP
3		141.5777	26.96	-4.56	22.40	43.50	-21.10	QP
4		387.9919	27.89	-1.67	26.22	46.00	-19.78	QP
5		596.1772	26.06	4.16	30.22	46.00	-15.78	QP
6	*	948.7609	31.06	10.04	41.10	46.00	-4.90	QP

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement – Limit

Antenna polarity: V



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		42.6000	30.30	-6.19	24.11	40.00	-15.89	QP
2		55.9026	27.39	-6.52	20.87	40.00	-19.13	QP
3		155.9101	27.10	-4.46	22.64	43.50	-20.86	QP
4		412.5467	26.76	-0.96	25.80	46.00	-20.20	QP
5		560.6928	26.89	3.20	30.09	46.00	-15.91	QP
6	*	762.0385	30.55	7.29	37.84	46.00	-8.16	QP

Remark: 1. Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement – Limit

2. The margin of 9K-30MH measurement exceeds 20dB, so the test chart is not included.



## Above 1 GHz Test Results:

910.3MHz

Polar (H/V)	Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	
V	1820.6	59.88	-3.57	56.31	74	-17.69	Pk
V	1820.6	48.44	-3.57	44.87	54	-9.13	AV
V	2730.9	58.46	-3.84	54.62	74	-19.38	Pk
V	2730.9	48.22	-3.84	44.38	54	-9.62	AV
V	3641.2	58.07	-4.59	53.48	74	-20.52	Pk
V	3641.2	48.54	-4.59	43.95	54	-10.05	AV
H	1820.6	61.69	-3.62	58.07	74	-15.93	Pk
H	1820.6	49.28	-3.62	45.66	54	-8.34	AV
H	2730.9	61.83	-3.93	57.90	74	-16.10	Pk
H	2730.9	50.52	-3.93	46.59	54	-7.41	AV
H	3641.2	60.30	-3.57	56.73	74	-17.27	Pk
H	3641.2	48.14	-3.57	44.57	54	-9.43	AV

Remark:  
 Absolute Level= ReadingLevel+ Factor, Margin= Limit- Absolute Level  
 Other harmonics emissions are lower than 20dB below the allowable limit.

## 8. BAND EDGE EMISSION

### 8.1 Block Diagram Of Test Setup

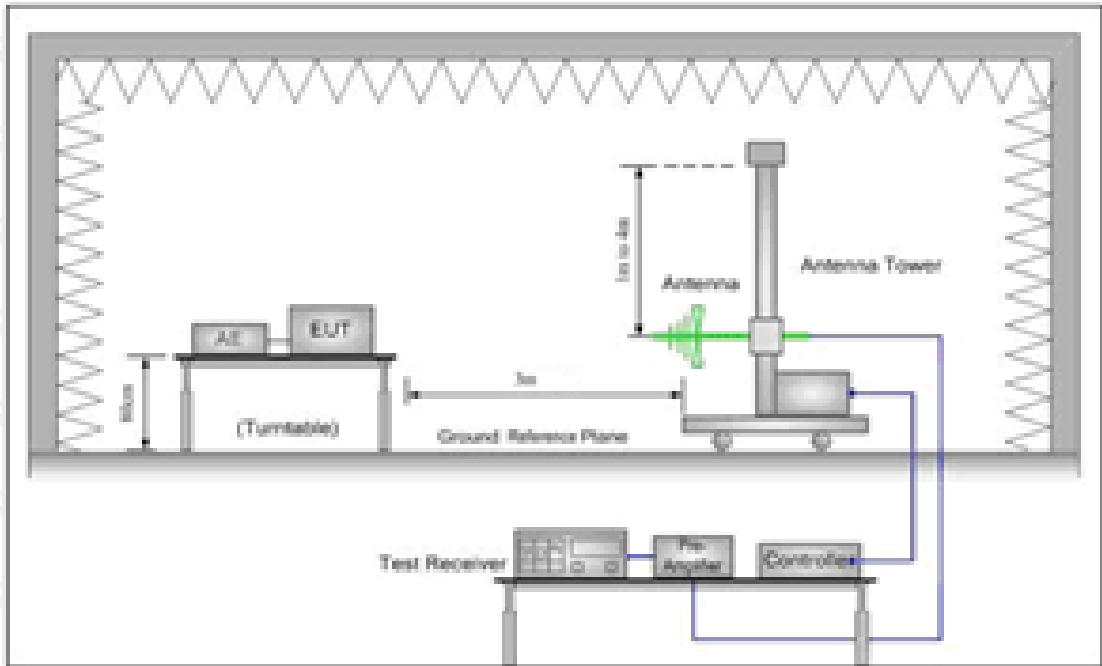


Figure 2. 30MHz to 1GHz

### 8.2 Limit

#### Spurious Emissions:

Frequency	Field strength (microvolt/meter)	Limit (dB $\mu$ V/m )	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

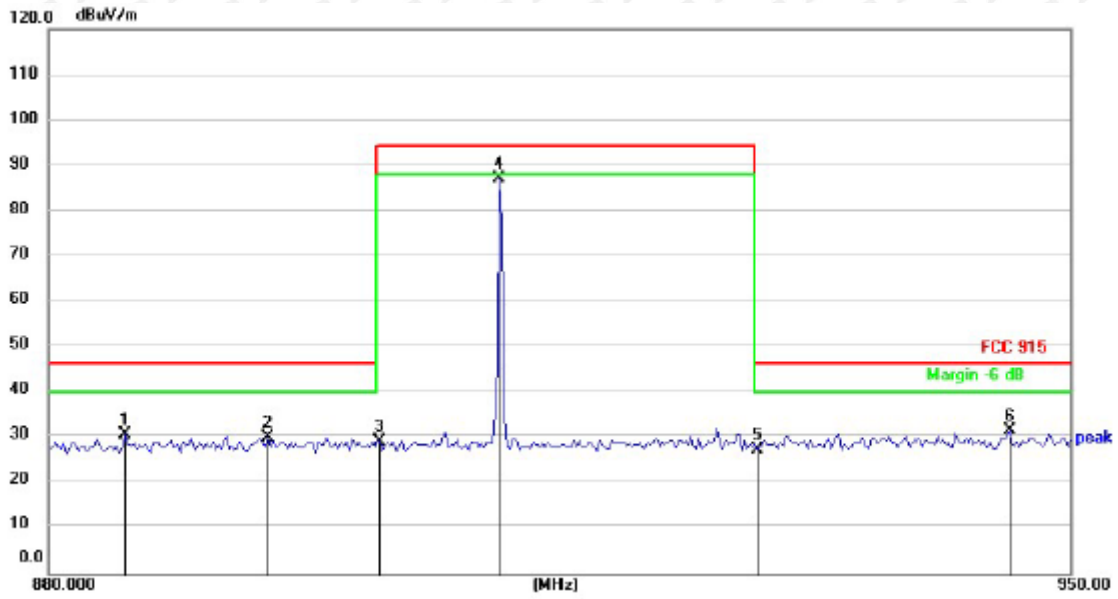
8.3 Test procedure

- a.The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c.The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d.For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f.If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Frequency	Detector	RBW	VBW	Remark
880MHz-950MHz	Quasi-peak	120 kHz	300KHz	Quasi-peak

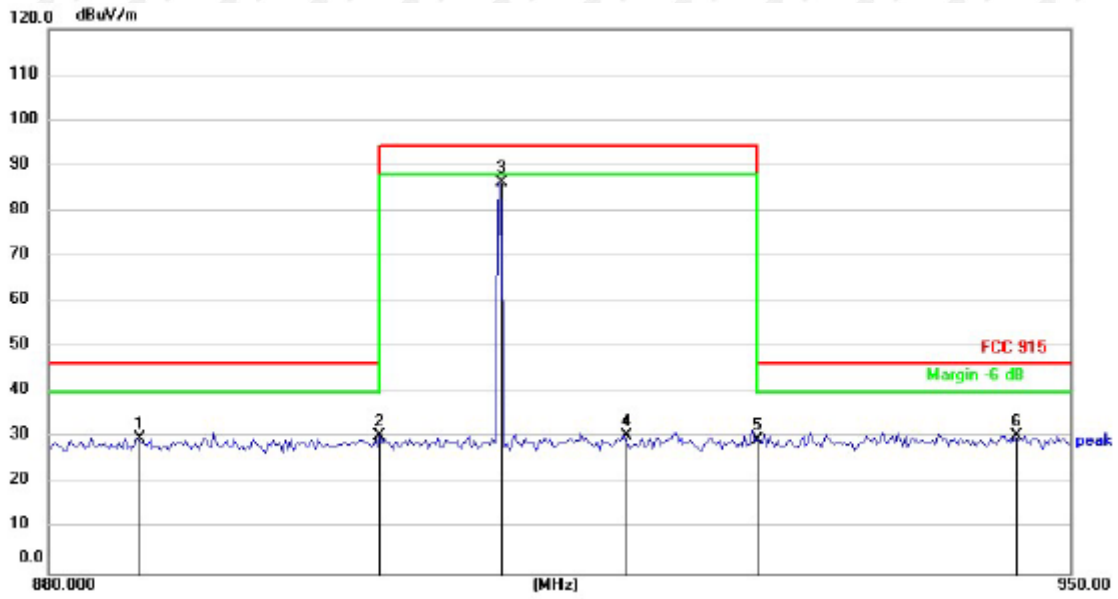
8.4 Test Result

910.3MHz Horizontal



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		885.0661	21.43	9.24	30.67	46.00	-15.33	QP
2		894.6011	20.91	9.37	30.28	46.00	-15.72	QP
3		902.0000	19.79	9.46	29.25	46.00	-16.75	QP
4	*	910.3151	77.72	9.57	87.29	94.00	-6.71	QP
5		928.0000	17.53	9.78	27.31	46.00	-18.69	QP
6		945.6472	21.55	10.00	31.55	46.00	-14.45	QP

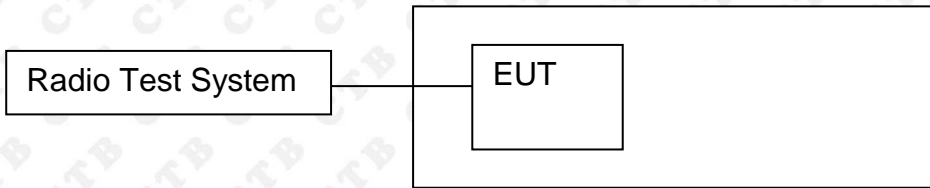
### 910.3MHz Vertical



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1		885.9134	20.49	9.25	29.74	46.00	-16.26	QP
2		902.0000	20.99	9.46	30.45	46.00	-15.55	QP
3	*	910.3152	76.78	9.57	86.35	94.00	-7.65	QP
4		918.8906	20.81	9.67	30.48	94.00	-63.52	QP
5		928.0000	19.87	9.78	29.65	46.00	-16.35	QP
6		946.0092	20.58	10.01	30.59	46.00	-15.41	QP

## 9. BANDWIDTH TEST

### 9.1 Block Diagram Of Test Setup



### 9.2 Limit

FCC Part15 (15.249) , Subpart C			
Section	Test Item	Frequency Range (MHz)	Result
15.249	Bandwidth	902~928	PASS

### 9.3 Test procedure

The following procedure shall be used for measuring (99 %) power bandwidth:

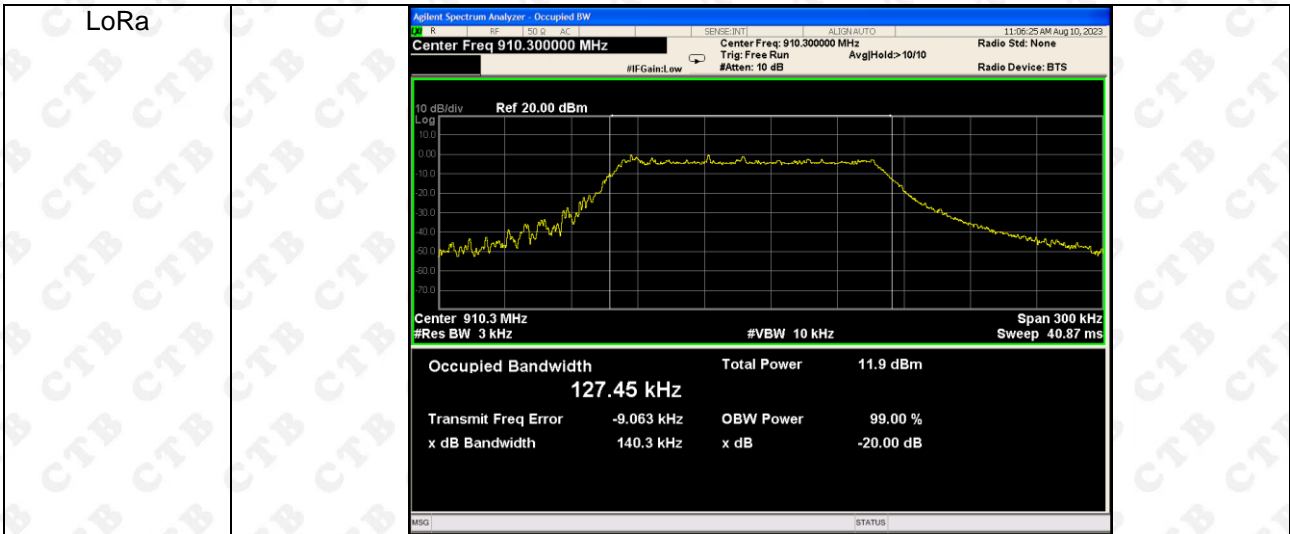
1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW  $\geq 3 \cdot$  RBW
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument (if available).
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

### 9.4 Test Result

Test Mode	Frequency (MHz)	99% Bandwidth (MHz)	Result
LoRa	910.3	0.12745	PASS

Note: All modes of operation were Pre-scan and the worst-case emissions are reported.

Test Graph:



## 10. ANTENNA REQUIREMENT

### 15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

### 15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### EUT Antenna:

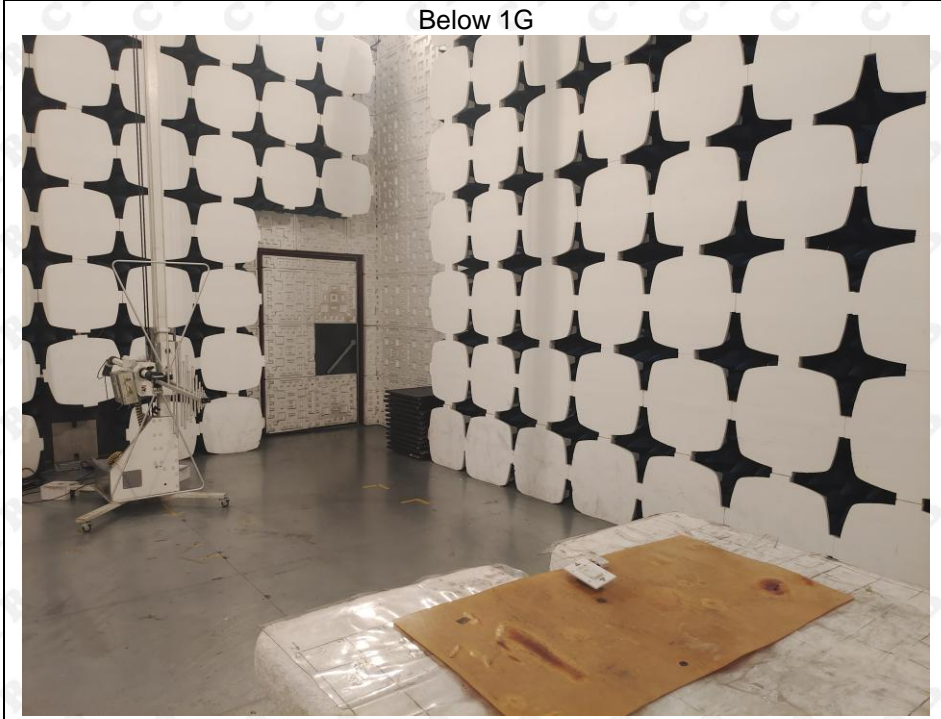
The antenna is PCB antenna. The best case gain of the antenna is 1.0dBi.



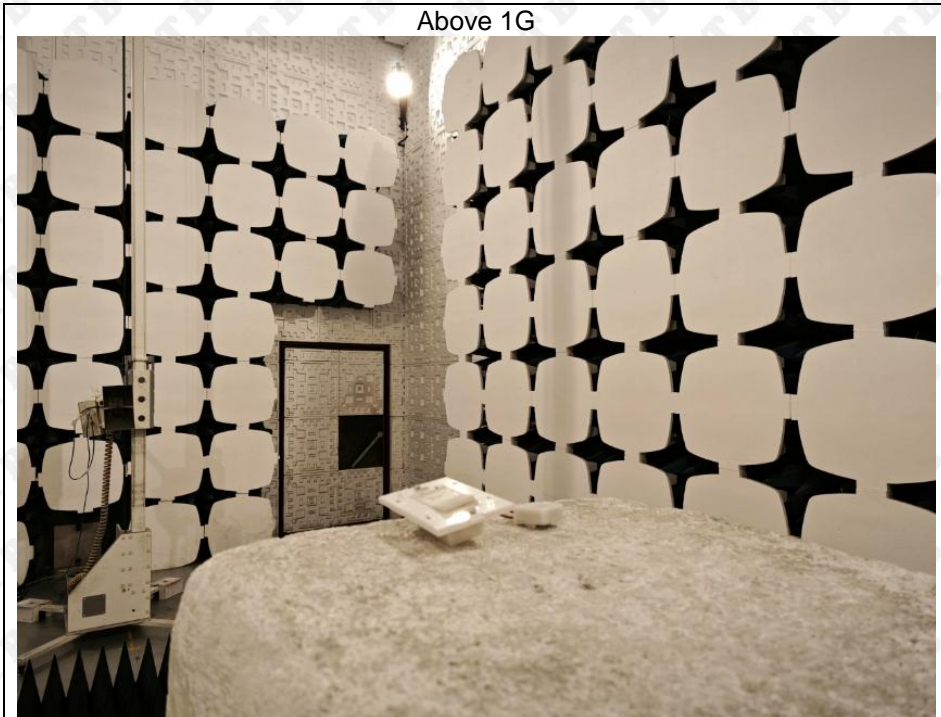
## 11. EUT TEST SETUP PHOTOGRAPHS

### Radiated Emissions

Below 1G



Above 1G



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