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# FCC Test Report

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Report No.: AGC03158150802FE03

**FCC ID** : ZJEST  
**APPLICATION PURPOSE** : Original Equipment  
**PRODUCT DESIGNATION** : 2.4GHz Receiver  
**BRAND NAME** : N/A  
**MODEL NAME** : ST-Receiver01  
**CLIENT** : Shenzhen Star Sources Electronic Technology Co., Limited  
**DATE OF ISSUE** : Sep.2, 2015  
**STANDARD(S)** : FCC Part 15 Rules  
**TEST PROCEDURE(S)**  
**REPORT VERSION** : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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### Report Revise Record

| Report Version | Revise Time | Issued Date | Valid Version | Notes           |
|----------------|-------------|-------------|---------------|-----------------|
| V1.0           | /           | Sep.2, 2015 | Valid         | Original Report |

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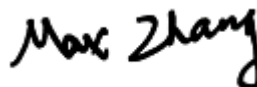
## 1. VERIFICATION OF CONFORMITY

|                                 |  |
|---------------------------------|--|
| <b>Applicant</b>                | Shenzhen Star Sources Electronic Technology Co., Limited   |
| <b>Address</b>                  | RM2001 MeiLan Business Center, intersection between the road of XiXiang and Qianjin, BaoAn District, Shenzhen, China    Postcode: 518100 |
| <b>Manufacturer</b>             | Shenzhen Star Sources Electronic Technology Co., Limited   |
| <b>Address</b>                  | RM2001 MeiLan Business Center, intersection between the road of XiXiang and Qianjin, BaoAn District, Shenzhen, China    Postcode: 518100 |
| <b>Product Designation</b>      | 2.4GHz Receiver  |
| <b>Brand Name</b>               | N/A  |
| <b>Test Model</b>               | ST-Receiver01  |
| <b>Date of test</b>             | Aug.27, 2015 to Aug.28, 2015   |
| <b>Deviation</b>                | None   |
| <b>Condition of Test Sample</b> | Normal   |
| <b>Report Template</b>          | AGCRT-US-BR/RF   |

We hereby certify that:

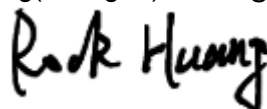
The above equipment was tested by Dongguan Precise Testing Service Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2009) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.249.

Tested by



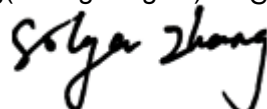
Max Zhang(Zhang Yi)    Sep.2, 2015

Reviewed by



Rock Huang(Huang Dinglue)    Sep.2, 2015

Approved by



Solger Zhang(Zhang Hongyi)    Sep.2, 2015  
Authorized Officer

## 2. GENERAL INFORMATION

### 2.1. PRODUCT DESCRIPTION

A major technical description of EUT is described as following

|                               |   |
|-------------------------------|---|
| <b>Operation Frequency</b>    | 2.409 GHz to 2.476GHz                               |
| <b>Maximum field strength</b> | 81.93dBuV/m@3m(AV)                                  |
| <b>Modulation</b>             | GFSK  |
| <b>Number of channels</b>     | 8   |
| <b>Antenna Gain</b>           | 0dBi  |
| <b>Antenna Designation</b>    | Integrated Antenna (Met 15.203 Antenna requirement) |
| <b>Hardware Version</b>       | N/A   |
| <b>Software Version</b>       | N/A   |
| <b>Power Supply</b>           | DC5V by USB port                                    |

2.2. TABLE OF CARRIER FREQUENCY

| Channel | Frequency (GHz) | Channel | Frequency (GHz) |
|---------|-----------------|---------|-----------------|
| 01      | 2.409           | 05      | 2.445           |
| 02      | 2.417           | 06      | 2.455           |
| 03      | 2.426           | 07      | 2.460           |
| 04      | 2.440           | 08      | 2.476           |

### 3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expanded uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95 %.

| No. | Item                    | Uncertainty             |
|-----|-------------------------|-------------------------|
| 1   | Conducted Emission Test | $\pm 3.18\text{dB}$     |
| 2   | All emissions, radiated | $\pm 3.91\text{dB}$     |
| 3   | Temperature             | $\pm 0.5^\circ\text{C}$ |
| 4   | Humidity                | $\pm 2\%$               |

### 4. DESCRIPTION OF TEST MODES

| NO. | TEST MODE DESCRIPTION                |
|-----|--------------------------------------|
| 1   | Low channel TX in GFSK modulation    |
| 2   | Middle channel TX in GFSK modulation |
| 3   | High channel TX in GFSK modulation   |
| 4   | TX OFF                               |

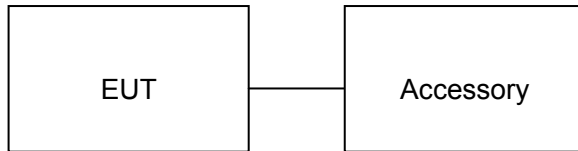
Note:

1. All the test modes can be supply by battery, only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

## 5. SYSTEM TEST CONFIGURATION

### 5.1. CONFIGURATION OF EUT SYSTEM

Configure :



### 5.2. EQUIPMENT USED IN EUT SYSTEM

| Item | Equipment       | Model No.   | ID or Specification | Remark  |
|------|-----------------|-------------|---------------------|---------|
| 1    | 2.4GHz Receiver | N/A         | ST-Receiver01       | EUT     |
| 2    | PC              | ASUS-R454LJ | N/A                 | Support |

### 5.3. SUMMARY OF TEST RESULTS

| FCC RULES | DESCRIPTION OF TEST     | RESULT    |
|-----------|-------------------------|-----------|
| §15.249   | Radiated Emission       | Compliant |
| §15.249   | Band Edges              | Compliant |
| §15.215   | 20dB bandwidth          | Compliant |
| §15.207   | Line Conducted Emission | Compliant |

## 6. TEST FACILITY

|                             |  |
|-----------------------------|--|
| <b>Site</b>                 | Dongguan Precise Testing Service Co., Ltd.   |
| <b>Location</b>             | Building D, Baoding Technology Park, Guangming Road2, Dongcheng District, Dongguan, Guangdong, China.  |
| <b>FCC Registration No.</b> | 371540   |
| <b>Description</b>          | The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2009. |

## ALL TEST EQUIPMENT LIST

| Radiated Emission Test Site         |                 |              |               |                  |                 |
|-------------------------------------|-----------------|--------------|---------------|------------------|-----------------|
| Name of Equipment                   | Manufacturer    | Model Number | Serial Number | Last Calibration | Due Calibration |
| EMI Test Receiver                   | Rohde & Schwarz | ESCI         | 101417        | July 4, 2015     | July 3, 2016    |
| Trilog Broadband Antenna (25M-1GHz) | SCHWARZBECK     | VULB9160     | 9160-3355     | July 4, 2015     | July 3, 2016    |
| Signal Amplifier                    | SCHWARZBECK     | BBV 9475     | 9745-0013     | July 4, 2015     | July 3, 2016    |
| RF Cable                            | SCHWARZBECK     | AK9515E      | 96221         | July 4, 2015     | July 3, 2016    |
| 3m Anechoic Chamber                 | CHENGYU         | 966          | PTS-001       | June 6, 2015     | June 5, 2016    |
| MULTI-DEVICE Positioning Controller | Max-Full        | MF-7802      | MF780208339   | N/A              | N/A             |
| Active loop antenna (9K-30MHz)      | Schwarzbeck     | FMZB1519     | 1519-038      | June 6, 2015     | June 5, 2016    |
| Spectrum analyzer                   | Agilent         | E4407B       | MY46185649    | June 6, 2015     | June 5, 2016    |
| Horn Antenna (1G-18GHz)             | SCHWARZBECK     | BBHA9120D    | 9120D-1246    | June 6, 2015     | June 5, 2016    |
| Horn Ant (18G-40GHz)                | Schwarzbeck     | BBHA 9170    | 9170-181      | June 6, 2015     | June 5, 2016    |

| Conducted Emission Test Site   |                 |              |               |                  |                 |
|--------------------------------|-----------------|--------------|---------------|------------------|-----------------|
| Name of Equipment              | Manufacturer    | Model Number | Serial Number | Last Calibration | Due Calibration |
| EMI Test Receiver              | Rohde & Schwarz | ESCI         | 101417        | July 4, 2015     | July 3, 2016    |
| Artificial Mains Network       | Narda           | L2-16B       | 000WX31025    | July 8, 2015     | July 7, 2016    |
| Artificial Mains Network (AUX) | Narda           | L2-16B       | 000WX31026    | July 8, 2015     | July 7, 2016    |
| RF Cable                       | SCHWARZBECK     | AK9515E      | 96222         | July 4, 2015     | July 3, 2016    |
| Shielded Room                  | CHENGYU         | 843          | PTS-002       | June 6, 2015     | June 5, 2016    |

## 7. RADIATED EMISSION

### 7.1 TEST LIMIT

#### Standard FCC15.249

| Fundamental Frequency | Field Strength of Fundamental<br>(millivolts/meter) | Field Strength of Harmonics<br>(microvolts/meter) |
|-----------------------|---|---|
| 900-928MHz            | 50  | 500   |
| 2400-2483.5MHz        | 50  | 500   |
| 5725-5875MHz          | 50  | 500   |
| 24.0-24.25GHz         | 250   | 2500  |

#### Standard FCC 15.209

| Frequency<br>(MHz) | Distance<br>Meters | Field Strengths Limit   |                |
|--------------------|--------------------|---|----------------|
|                    |                    | $\mu$ V/m   | dB( $\mu$ V)/m |
| 0.009 ~ 0.490      | 300                | 2400/F(kHz)   | ---            |
| 0.490 ~ 1.705      | 30                 | 24000/F(kHz)  | ---            |
| 1.705 ~ 30         | 30                 | 30  | ---            |
| 30 ~ 88            | 3                  | 100   | 40.0           |
| 88 ~ 216           | 3                  | 150   | 43.5           |
| 216 ~ 960          | 3                  | 200   | 46.0           |
| 960 ~ 1000         | 3                  | 500   | 54.0           |
| Above 1000         | 3                  | Other: 74.0 dB( $\mu$ V)/m (Peak) 54.0 dB( $\mu$ V)/m (Average) |                |

Remark:

- (1) Emission level dB  $\mu$  V = 20 log Emission level  $\mu$  V/m
- (2) The smaller limit shall apply at the cross point between two frequency bands.
- (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

## 7.2. MEASUREMENT PROCEDURE

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

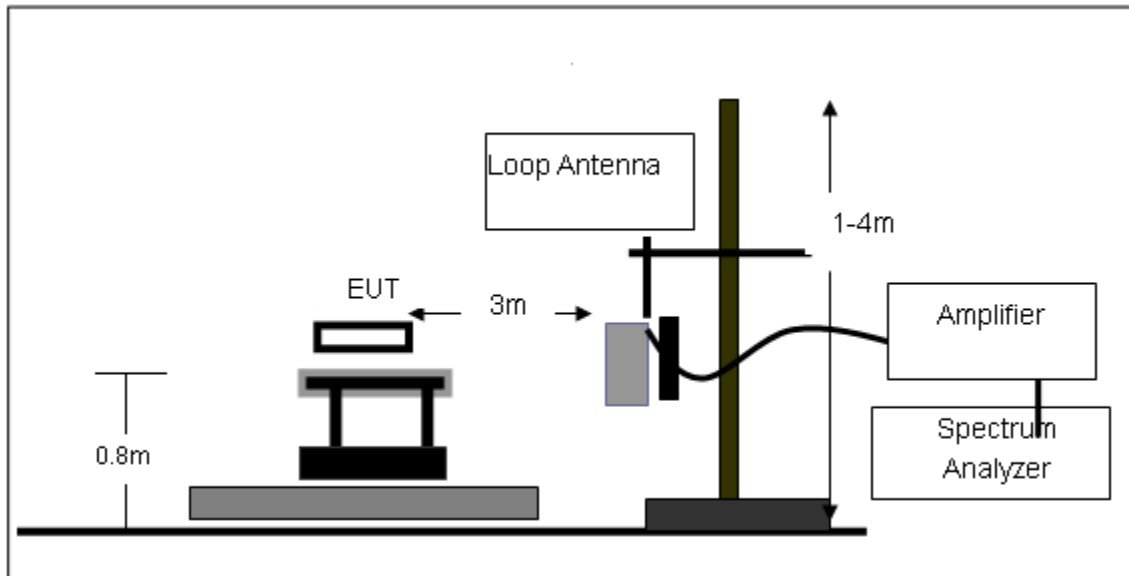
The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter    | Setting   |
|-----------------------|---|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP                               |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP                               |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP                            |
| Start ~Stop Frequency | 1GHz~26.5GHz<br>1MHz/1MHz for Peak, 1MHz/10Hz for Average |

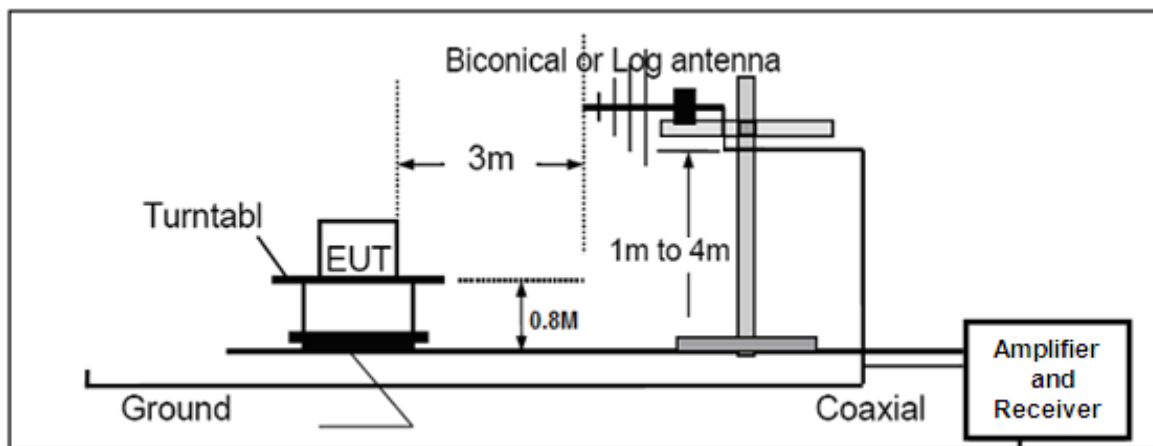
| Receiver Parameter    | Setting                        |
|-----------------------|--------------------------------|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP    |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP    |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP |

### 7.3. TEST SETUP

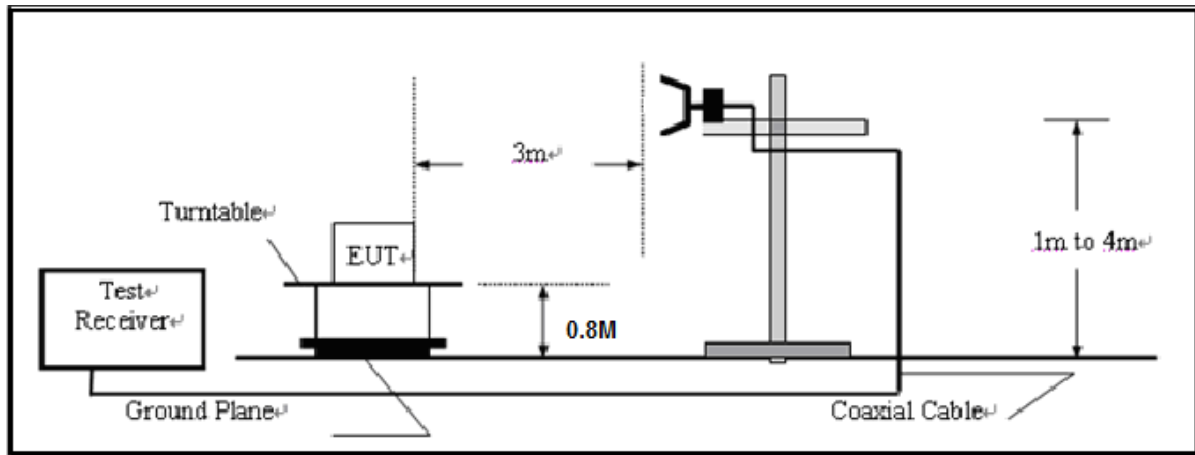
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



### RADIATED EMISSION TEST SETUP ABOVE 1000MHz



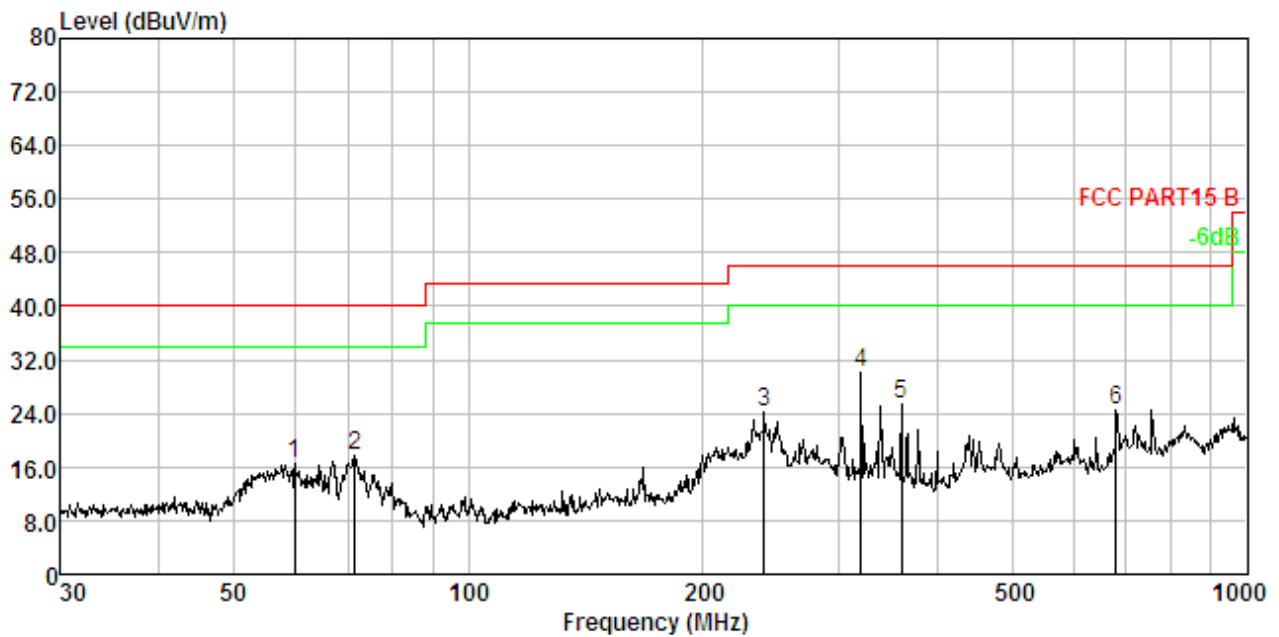
## 7.4. TEST RESULT

### RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

### RADIATED EMISSION 30MHz- 1GHZ

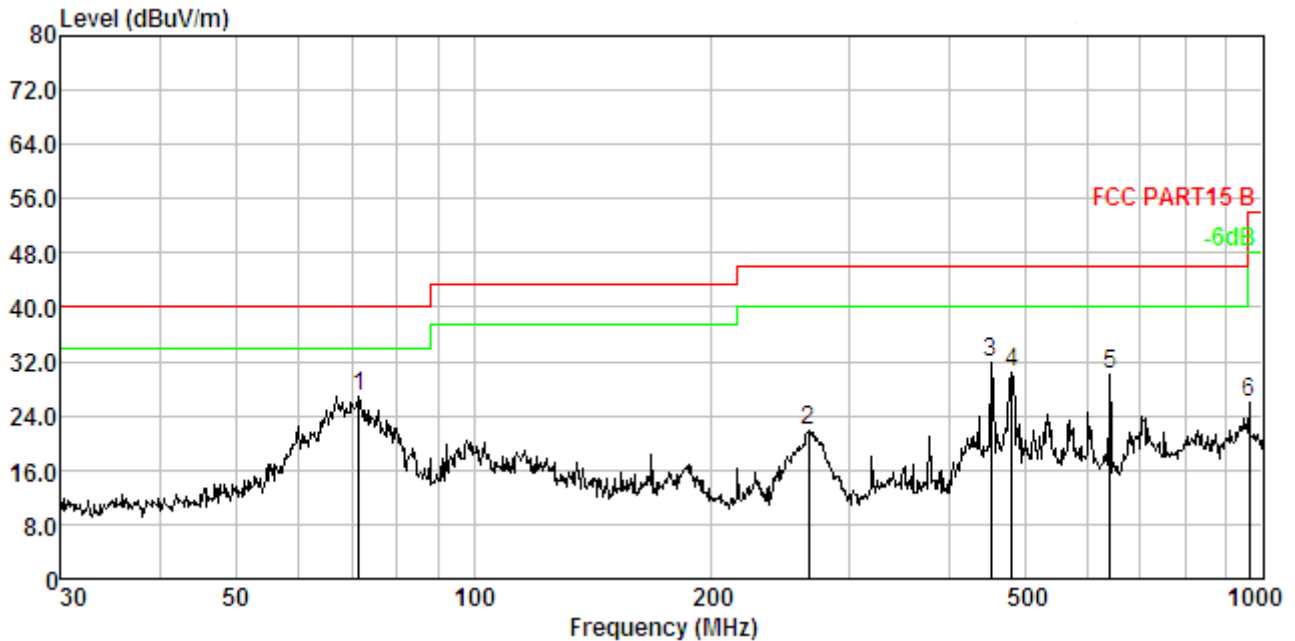
|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 °C           | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 1          | Polarization :      | Horizontal    |



| No. | Freq MHz | Cable Loss dB | ANT Factor dB/m | Receiver Reading dBuV | Preamplifier Factor dB | Emission Level dBuV/m | Limit dBuV/m | Over Limit dB | Remark |
|-----|----------|---------------|-----------------|-----------------------|------------------------|-----------------------|--------------|---------------|--------|
| 1.  | 59.859   | 1.68          | 12.16           | 32.85                 | 30.21                  | 16.48                 | 40.00        | -23.52        | Peak   |
| 2.  | 71.581   | 1.84          | 9.95            | 36.30                 | 30.27                  | 17.82                 | 40.00        | -22.18        | Peak   |
| 3.  | 239.987  | 2.94          | 11.71           | 40.13                 | 30.69                  | 24.09                 | 46.00        | -21.91        | Peak   |
| 4.  | 319.937  | 3.20          | 13.65           | 44.11                 | 30.79                  | 30.17                 | 46.00        | -15.83        | Peak   |
| 5.  | 360.448  | 3.31          | 14.40           | 38.57                 | 30.83                  | 25.45                 | 46.00        | -20.55        | Peak   |
| 6.  | 679.960  | 3.88          | 19.88           | 31.87                 | 31.06                  | 24.57                 | 46.00        | -21.43        | Peak   |

**RESULT: PASS**

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 °C           | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 1          | Polarization :      | Vertical      |



| No. | Freq<br>MHz | Cable<br>Loss<br>dB | ANT<br>Factor<br>dB/m | Receiver<br>Reading<br>dBuV | Preamp<br>Factor<br>dB | Emission<br>Level<br>dBuV/m | Limit<br>dBuV/m | Over<br>Limit<br>dB | Remark |
|-----|-------------|---------------------|-----------------------|-----------------------------|------------------------|-----------------------------|-----------------|---------------------|--------|
| 1.  | 71.581      | 1.84                | 9.95                  | 45.27                       | 30.27                  | 26.79                       | 40.00           | -13.21              | Peak   |
| 2.  | 265.676     | 3.03                | 12.33                 | 37.32                       | 30.73                  | 21.95                       | 46.00           | -24.05              | Peak   |
| 3.  | 452.720     | 3.51                | 16.40                 | 42.88                       | 30.91                  | 31.88                       | 46.00           | -14.12              | Peak   |
| 4.  | 480.528     | 3.57                | 16.89                 | 40.87                       | 30.94                  | 30.39                       | 46.00           | -15.61              | Peak   |
| 5.  | 640.611     | 3.83                | 19.45                 | 37.95                       | 31.04                  | 30.19                       | 46.00           | -15.81              | Peak   |
| 6.  | 962.162     | 4.20                | 23.43                 | 29.57                       | 31.18                  | 26.02                       | 54.00           | -27.98              | Peak   |

## RESULT: PASS

### Note:

Factor=Antenna Factor + Cable loss, Margin=Result-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

The mode 1 is the worst case, and only the data of the worst case recorded in this test report.

## RADIATED EMISSION ABOVE 1GHZ

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 ℃            | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 1          | Polarization :      | Horizontal    |

| Frequency   | Meter Reading | Factor | Emission Level | Limits   | Margin | Value Type |
|---|---------------|--------|----------------|----------|--------|------------|
| (MHz)   | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |            |
| 2409.013  | 97.15         | -9.37  | 87.78          | 114      | -26.22 | peak       |
| 2409.013  | 87.38         | -9.37  | 78.01          | 94       | -15.99 | AVG        |
| 4818.026  | 42.76         | 3.74   | 46.5           | 74       | -27.5  | peak       |
| 4818.026  | 30.19         | 3.74   | 33.93          | 54       | -20.07 | AVG        |
| 7227.039  | 40.29         | 8.14   | 48.43          | 74       | -25.57 | peak       |
| 7227.039  | 29.68         | 8.14   | 37.82          | 54       | -16.18 | AVG        |
| Remark:   |               |        |                |          |        |            |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. |               |        |                |          |        |            |

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 ℃            | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 1          | Polarization :      | Vertical      |

| Frequency   | Meter Reading | Factor | Emission Level | Limits   | Margin | Value Type |
|---|---------------|--------|----------------|----------|--------|------------|
| (MHz)   | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |            |
| 2409.013  | 99.25         | -9.37  | 89.88          | 114      | -24.12 | peak       |
| 2409.013  | 91.25         | -9.37  | 81.88          | 94       | -12.12 | AVG        |
| 4818.026  | 43.86         | 3.74   | 47.6           | 74       | -26.4  | peak       |
| 4818.026  | 31.98         | 3.74   | 35.72          | 54       | -18.28 | AVG        |
| 7227.039  | 41.28         | 8.14   | 49.42          | 74       | -24.58 | peak       |
| 7227.039  | 31.25         | 8.14   | 39.39          | 54       | -14.61 | AVG        |
| Remark:   |               |        |                |          |        |            |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. |               |        |                |          |        |            |

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 ℃            | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 2          | Polarization :      | Horizontal    |

| Frequency   | Meter Reading | Factor | Emission Level | Limits   | Margin | Value Type |
|---|---------------|--------|----------------|----------|--------|------------|
| (MHz)   | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |            |
| 2440.016  | 97.24         | -9.63  | 87.61          | 114      | -26.39 | peak       |
| 2440.016  | 89.13         | -9.63  | 79.5           | 94       | -14.5  | AVG        |
| 4880.032  | 42.86         | 3.76   | 46.62          | 74       | -27.38 | peak       |
| 4880.032  | 31.57         | 3.76   | 35.33          | 54       | -18.67 | AVG        |
| 7320.048  | 40.12         | 8.17   | 48.29          | 74       | -25.71 | peak       |
| 7320.048  | 29.43         | 8.17   | 37.6           | 54       | -16.4  | AVG        |
| Remark:   |               |        |                |          |        |            |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. |               |        |                |          |        |            |

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 ℃            | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 2          | Polarization :      | Vertical      |

| Frequency   | Meter Reading | Factor | Emission Level | Limits   | Margin | Value Type |
|---|---------------|--------|----------------|----------|--------|------------|
| (MHz)   | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |            |
| 2440.016  | 101.28        | -9.63  | 91.65          | 114      | -22.35 | peak       |
| 2440.016  | 91.56         | -9.63  | 81.93          | 94       | -12.07 | AVG        |
| 4880.032  | 42.86         | 3.76   | 46.62          | 74       | -27.38 | peak       |
| 4880.032  | 32.17         | 3.76   | 35.93          | 54       | -18.07 | AVG        |
| 7320.048  | 40.12         | 8.17   | 48.29          | 74       | -25.71 | peak       |
| 7320.048  | 30.07         | 8.17   | 38.24          | 54       | -15.76 | AVG        |
| Remark:   |               |        |                |          |        |            |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. |               |        |                |          |        |            |

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 °C           | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 3          | Polarization :      | Horizontal    |

| Frequency<br>(MHz)                                    | Meter Reading<br>(dBμV) | Factor<br>(dB) | Emission Level<br>(dBμV/m) | Limits<br>(dBμV/m) | Margin<br>(dB) | Value Type |
|---|-------------------------|----------------|----------------------------|--------------------|----------------|------------|
| 2476.021  | 98.52                   | -9.61          | 88.91                      | 114                | -25.09         | peak       |
| 2476.021  | 89.13                   | -9.61          | 79.52                      | 94                 | -14.48         | AVG        |
| 4952.042  | 43.28                   | 3.83           | 47.11                      | 74                 | -26.89         | peak       |
| 4952.042  | 33.54                   | 3.83           | 37.37                      | 54                 | -16.63         | AVG        |
| 7428.063  | 37.59                   | 8.21           | 45.8                       | 74                 | -28.2          | peak       |
| 7428.063  | 28.79                   | 8.21           | 37                         | 54                 | -17            | AVG        |
| Remark:   |                         |                |                            |                    |                |            |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. |                         |                |                            |                    |                |            |

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 °C           | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 3          | Polarization :      | Vertical      |

| Frequency<br>(MHz)                                    | Meter Reading<br>(dBμV) | Factor<br>(dB) | Emission Level<br>(dBμV/m) | Limits<br>(dBμV/m) | Margin<br>(dB) | Value Type |
|---|-------------------------|----------------|----------------------------|--------------------|----------------|------------|
| 2476.021  | 99.73                   | -9.61          | 90.12                      | 114                | -23.88         | peak       |
| 2476.021  | 89.35                   | -9.61          | 79.74                      | 94                 | -14.26         | AVG        |
| 4952.042  | 43.89                   | 3.83           | 47.72                      | 74                 | -26.28         | peak       |
| 4952.042  | 32.76                   | 3.83           | 36.59                      | 54                 | -17.41         | AVG        |
| 7428.063  | 41.86                   | 8.21           | 50.07                      | 74                 | -23.93         | peak       |
| 7428.063  | 32.56                   | 8.21           | 40.77                      | 54                 | -13.23         | AVG        |
| Remark:   |                         |                |                            |                    |                |            |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. |                         |                |                            |                    |                |            |

**Note:** Other emission from 8G to 25 GHz are considered as ambient noise. No recording in the test report.  
Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.  
The “Factor” value can be calculated automatically by software of measurement system.  
The spurious emission of mode 4 are considered as ambient noise. No recording in the test report.

## 8. BAND EDGE EMISSION

### 8.1. MEASUREMENT PROCEDURE

1The EUT operates at hopping-off test mode. The lowest or highest channels are tested to verify the largest transmission and spurious emissions power at the continuous transmission mode.

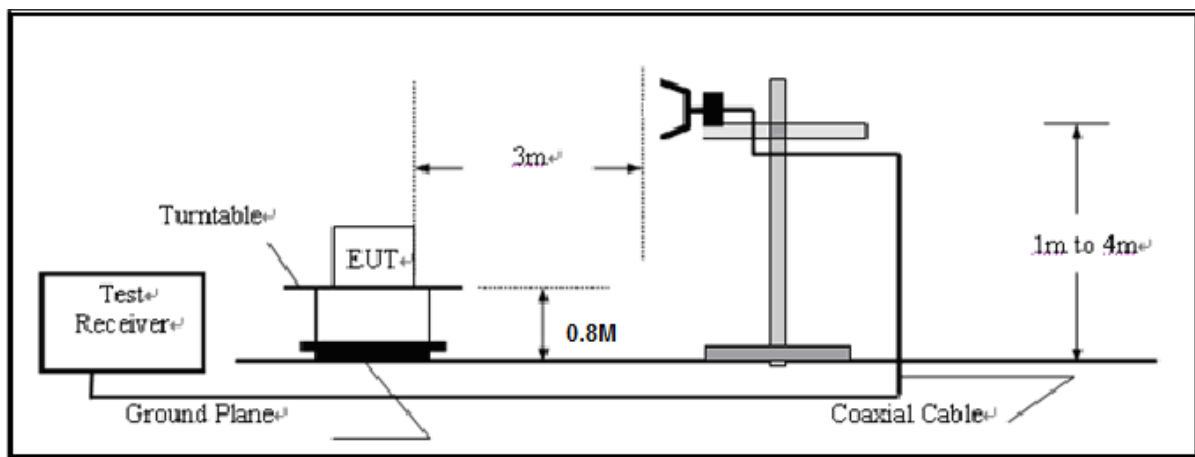
2Max hold the trace of the setp 1,and the EUT operates at hopping-on test mode to verify the largest spurious emissions power.

3Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission: (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

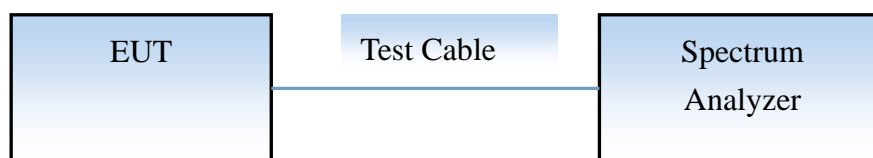
(b) AVERAGE: RBW=1MHz ; VBW=1/on time(1KHz) / Sweep=AUTO

### 8.2 TEST SETUP

RADIATED EMISSION TEST SETUP

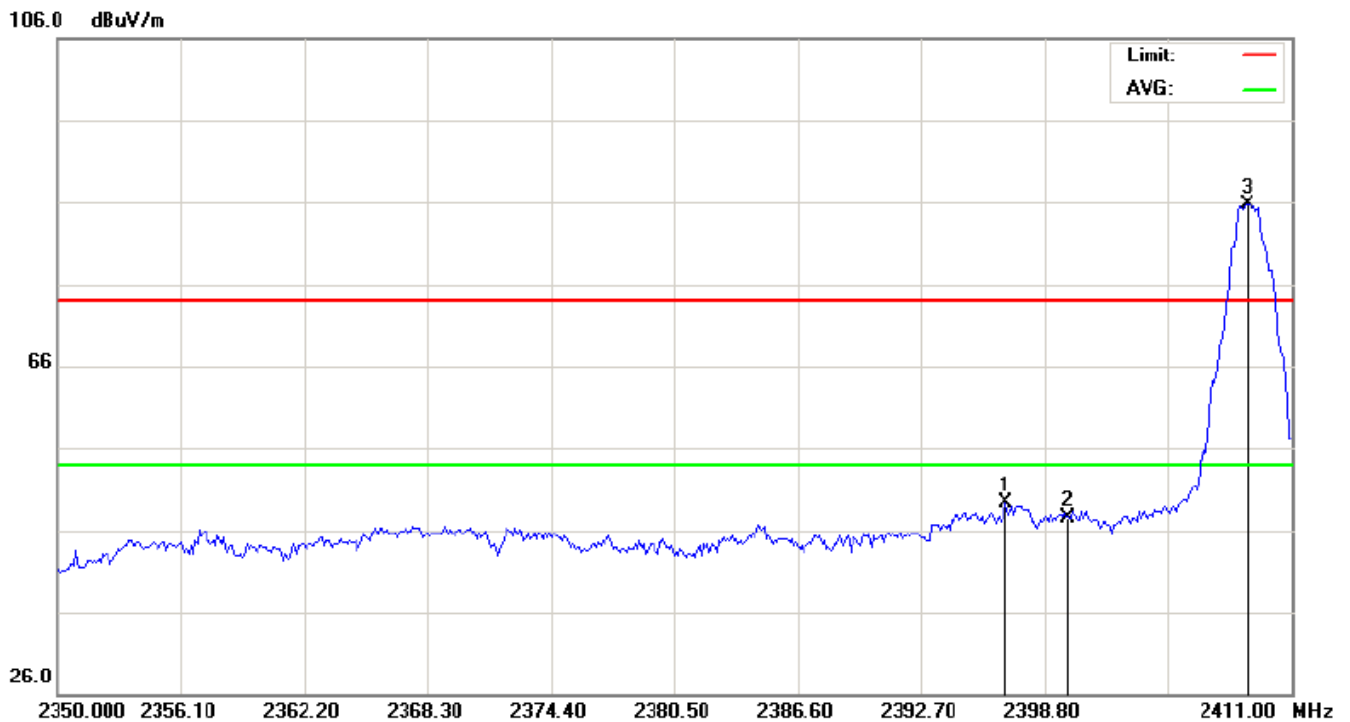


CONDUCTED TEST SETUP



### 8.3 RADIATED TEST RESULT

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 ℃            | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 1          | Polarization :      | Horizontal    |

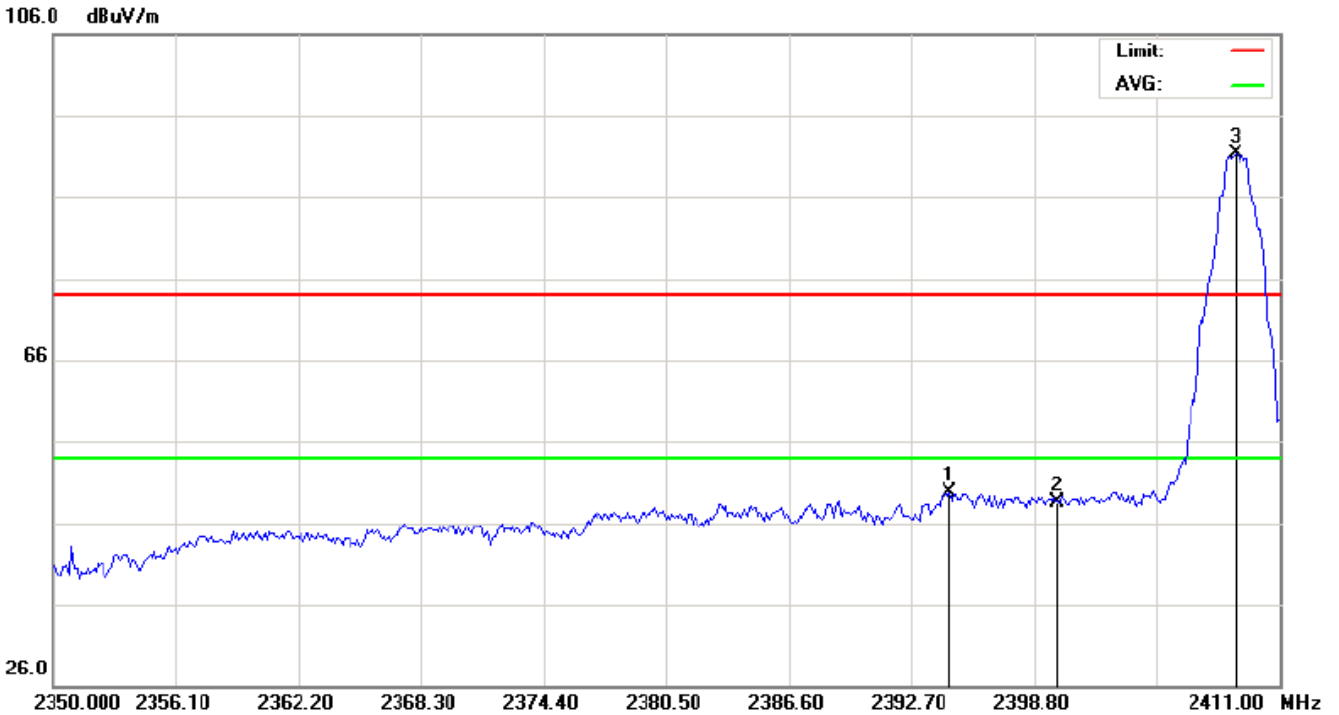


| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Value Type |
|-----------|---------------|--------|----------------|----------|--------|------------|
| (MHz)     | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |            |
| 2396.868  | 62.76         | -13.00 | 49.76          | 74       | -24.24 | peak       |
| 2400.000  | 60.15         | -12.99 | 47.16          | 74       | -26.84 | peak       |
|           |               |        |                |          |        |            |
|           |               |        |                |          |        |            |

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 °C           | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 1          | Polarization :      | Vertical      |

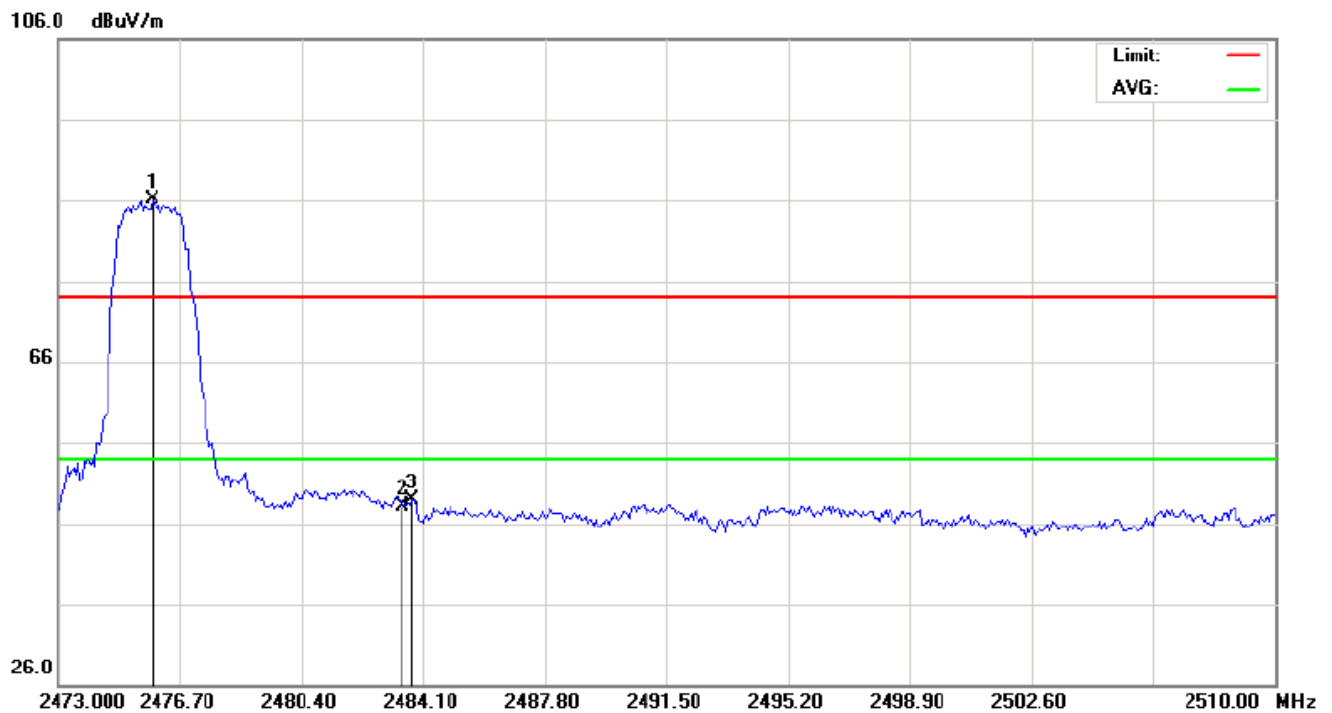


| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Value Type |
|-----------|---------------|--------|----------------|----------|--------|------------|
| (MHz)     | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |            |
| 2395.286  | 62.35         | -13.00 | 49.35          | 74       | -24.65 | peak       |
| 2400.000  | 61.76         | -12.99 | 48.77          | 74       | -25.23 | peak       |
|           |               |        |                |          |        |            |
|           |               |        |                |          |        |            |

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 °C           | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 3          | Polarization :      | Horizontal    |

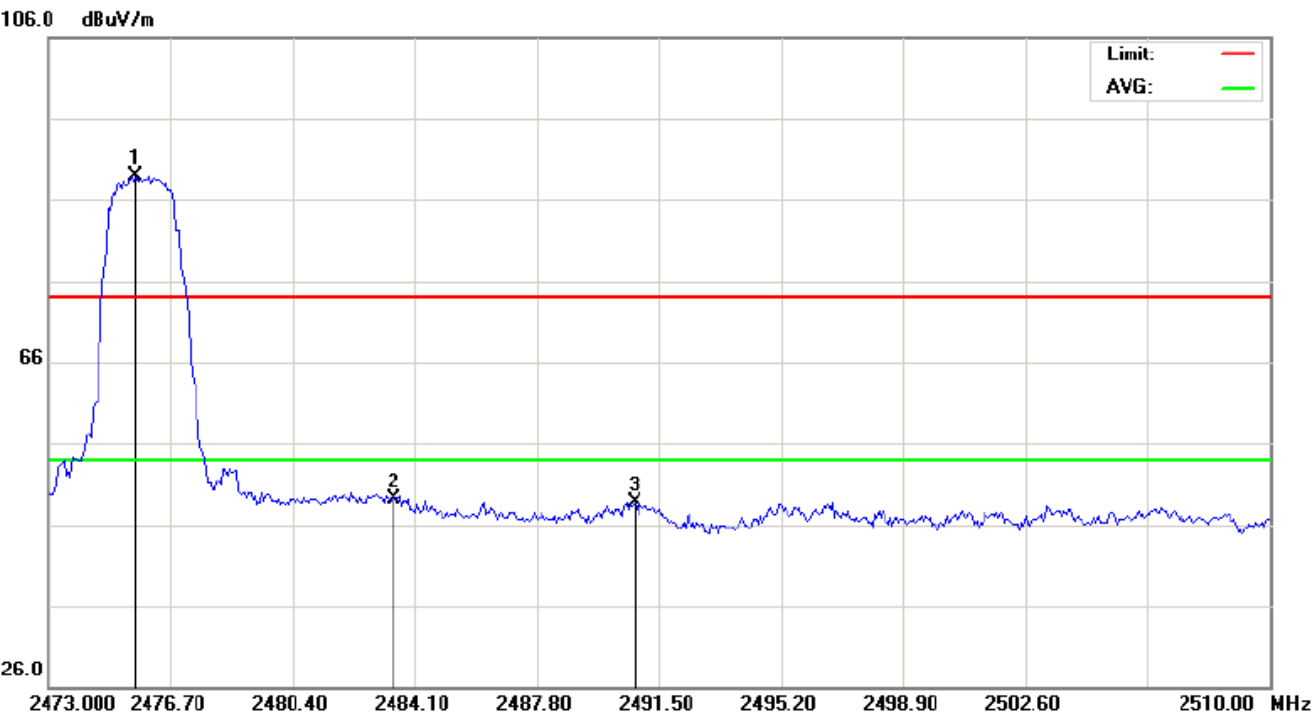


| Frequency | Meter Reading | Factor | Emission Level | Limits   | Margin | Value Type |
|-----------|---------------|--------|----------------|----------|--------|------------|
| (MHz)     | (dBμV)        | (dB)   | (dBμV/m)       | (dBμV/m) | (dB)   |            |
| 2483.500  | 61.26         | -12.78 | 48.48          | 74       | -25.52 | peak       |
| 2483.800  | 61.39         | -12.77 | 48.62          | 74       | -25.38 | peak       |
|           |               |        |                |          |        |            |
|           |               |        |                |          |        |            |

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

|               |                 |                     |               |
|---------------|-----------------|---------------------|---------------|
| EUT :         | 2.4GHz Receiver | Model Name. :       | ST-Receiver01 |
| Temperature : | 20 °C           | Relative Humidity : | 48%           |
| Pressure :    | 1010 hPa        | Test Voltage :      | DC5V          |
| Test Mode :   | Mode 3          | Polarization :      | Vertical      |



| Frequency<br>(MHz)                                    | Meter Reading<br>(dBμV) | Factor<br>(dB) | Emission Level<br>(dBμV/m) | Limits<br>(dBμV/m) | Margin<br>(dB) | Value Type |
|---|-------------------------|----------------|----------------------------|--------------------|----------------|------------|
| 2483.500  | 62.09                   | -12.78         | 49.31                      | 74                 | -24.69         | peak       |
| 2490.760  | 61.06                   | -12.77         | 48.29                      | 74                 | -25.71         | peak       |
|   |                         |                |                            |                    |                |            |
|   |                         |                |                            |                    |                |            |
| Remark:   |                         |                |                            |                    |                |            |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. |                         |                |                            |                    |                |            |

**Note:**

Factor=Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

The PK emission level are less than AV limit, so the AV emission level are not recorded.

9. 20DB BANDWIDTH

9.1. MEASUREMENT PROCEDURE

1.

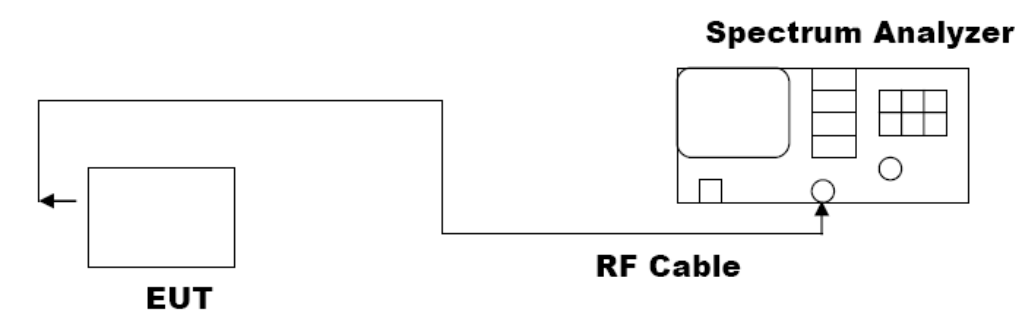
Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2.

Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3.

Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW $\geq$ 3 $\times$ RBW.
4.

Set SPA Trace 1 Max hold, then View.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

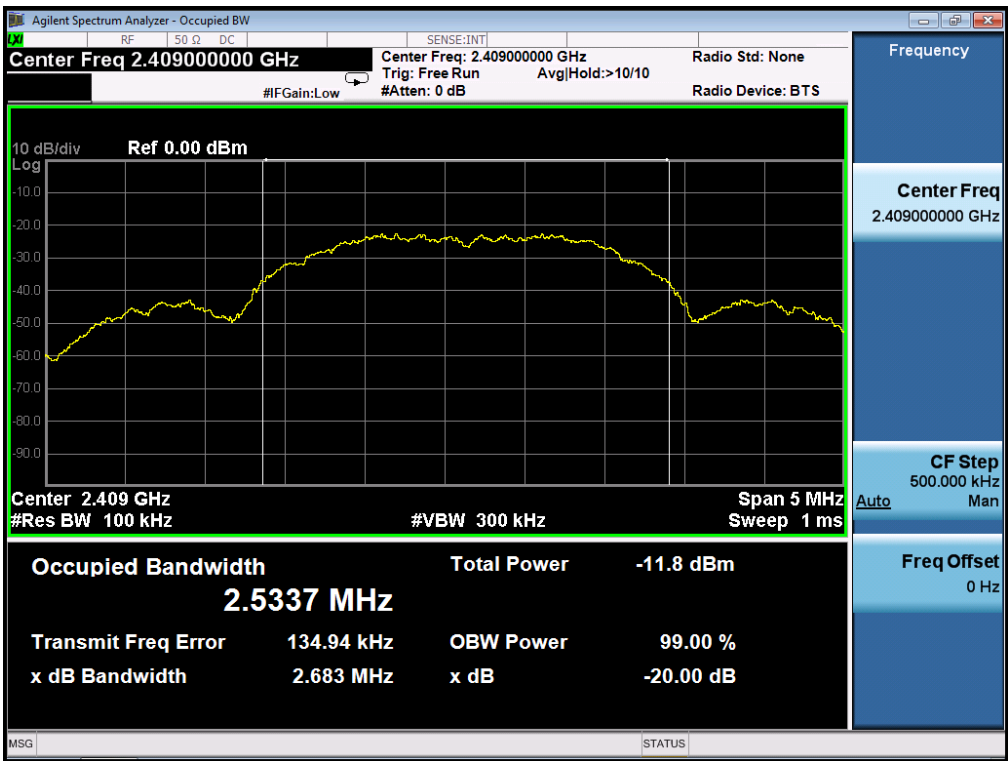


9.3. MEASUREMENT RESULTS

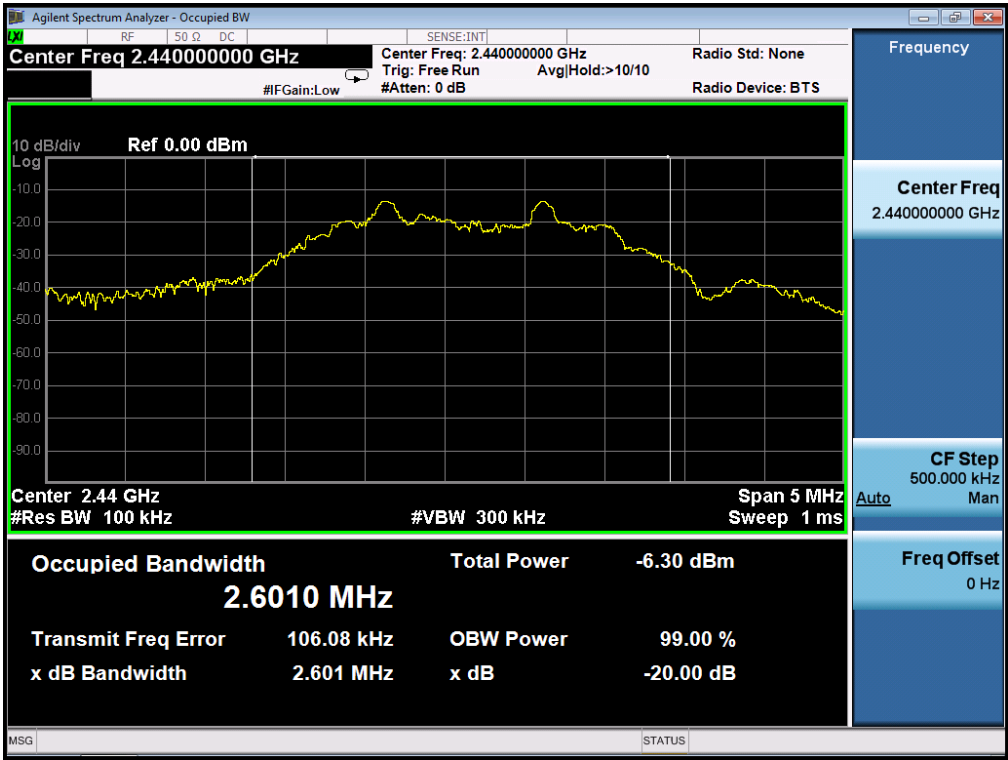
|           |                   |
|-----------|-------------------|
| TEST ITEM | 20DB BANDWIDTH    |
| TEST MODE | Mode1;Mode2;Mode3 |

| Test Data (MHz) |       | Criteria |
|-----------------|-------|----------|
| Low Channel     | 2.683 | PASS     |
| Middle Channel  | 2.601 | PASS     |
| High Channel    | 2.518 | PASS     |

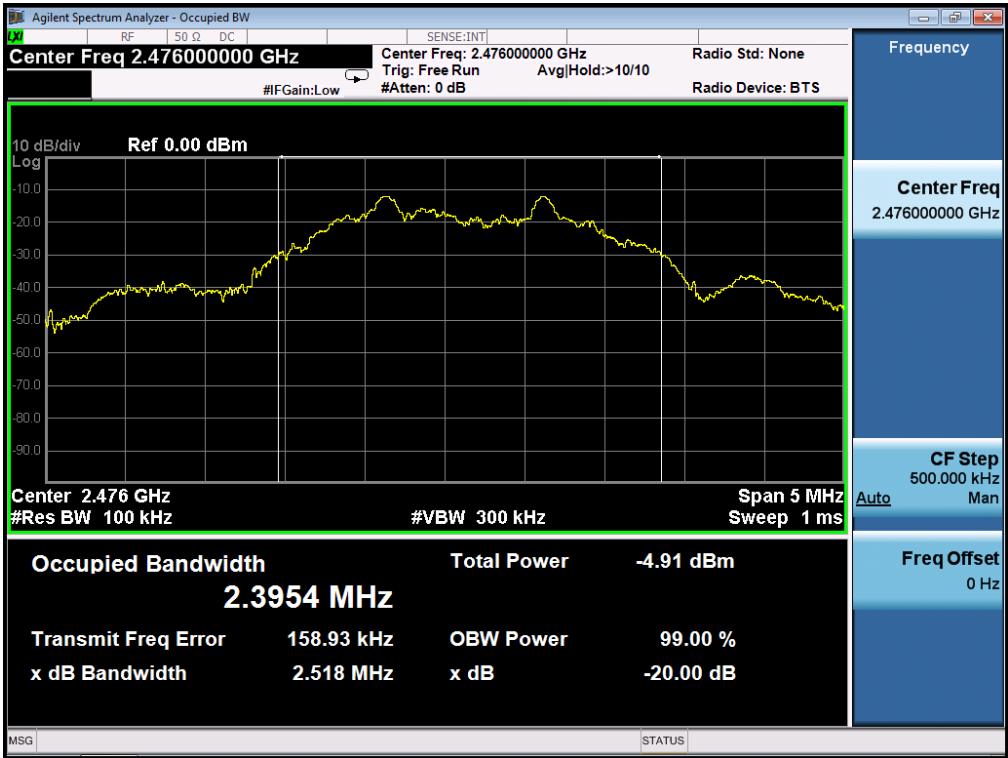
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



## 10. LINE CONDUCTED EMISSION TEST

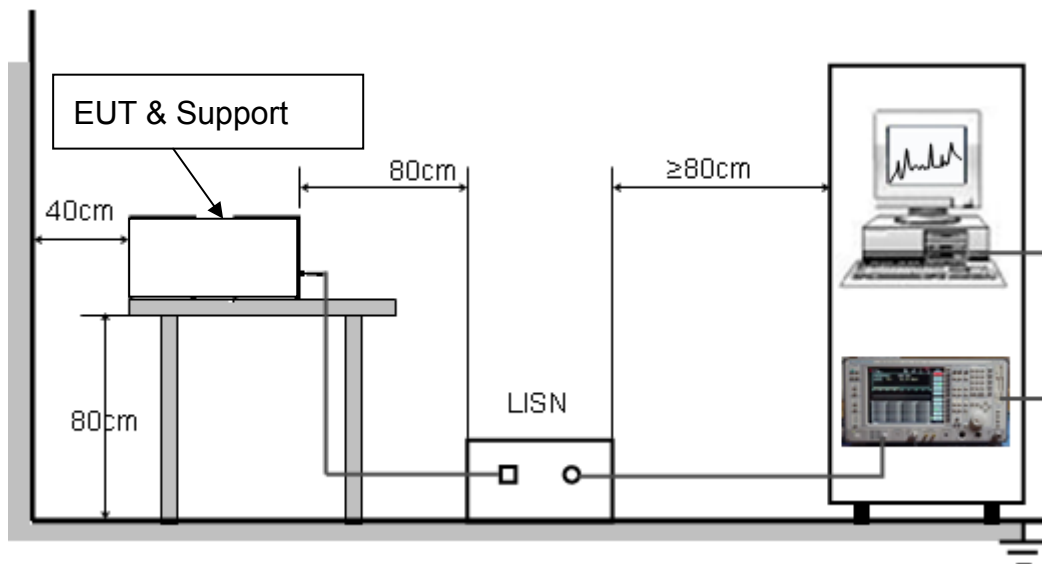
### 10.1. LIMITS OF LINE CONDUCTED EMISSION TEST

| Frequency     | Maximum RF Line Voltage |                |
|---------------|-------------------------|----------------|
|               | Q.P.( dBuV)             | Average( dBuV) |
| 150kHz~500kHz | 66-56                   | 56-46          |
| 500kHz~5MHz   | 56                      | 46             |
| 5MHz~30MHz    | 60                      | 50             |

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 10.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



### **10.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST**

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.4.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received DC charging voltage by PC which received 120V/60Hz power by a LISN..
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

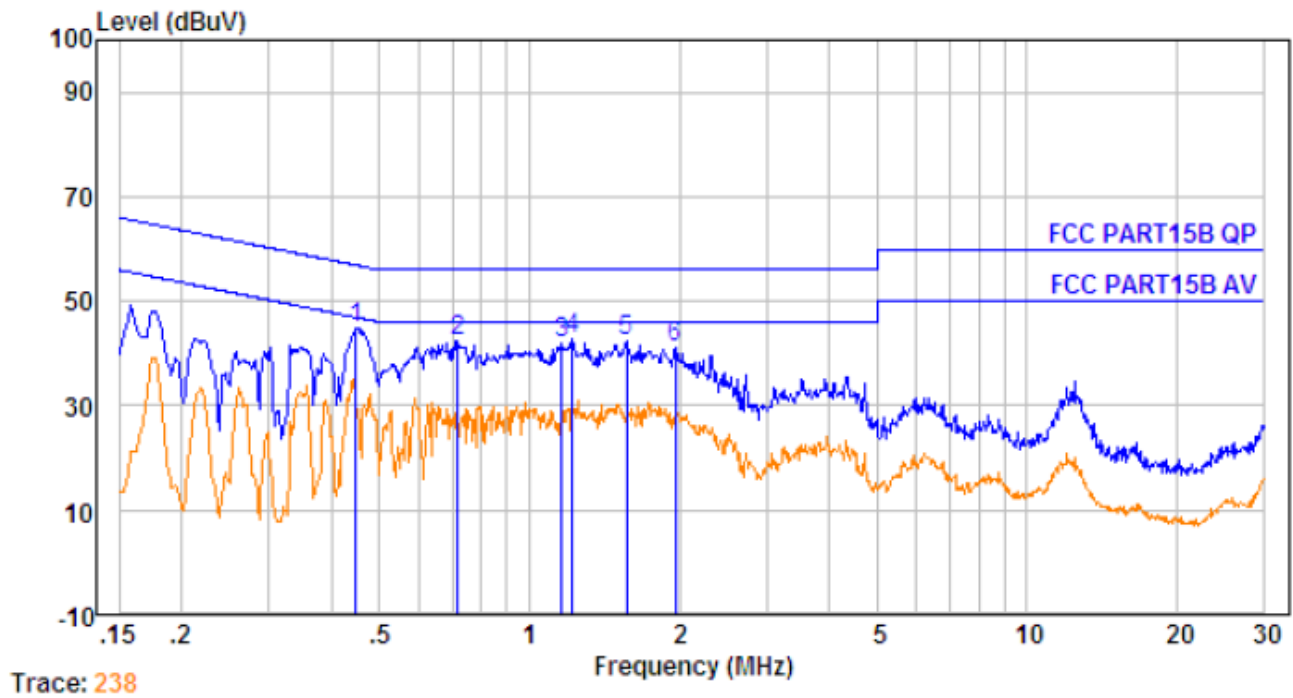
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

### **10.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST**

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less -2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

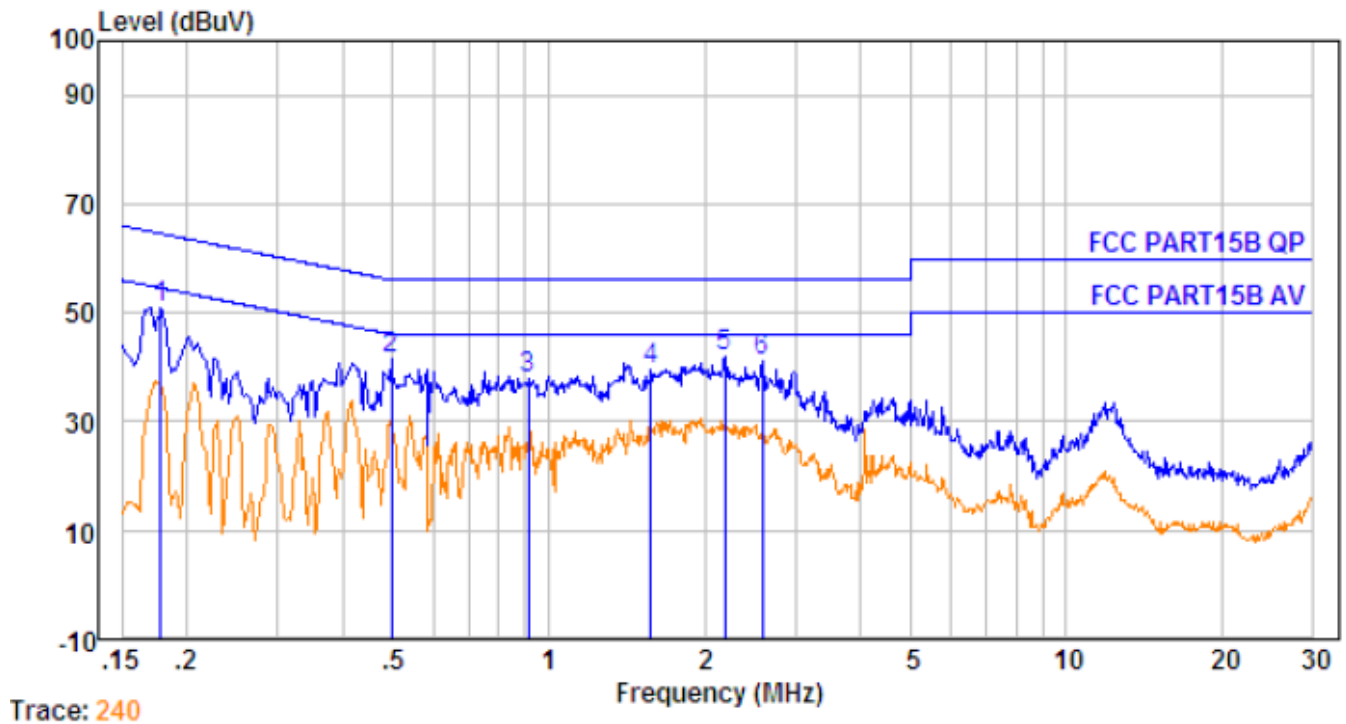
## 10.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

Line Conducted Emission Test Line 1-L



| No. | Freq<br>MHz | Cable<br>Loss<br>dB | AMN<br>Factor<br>dB | Receiver<br>Reading<br>dBuV | Emission<br>Level<br>dBuV | Limit<br>dBuV | Over<br>Limit<br>dB | Remark |
|-----|-------------|---------------------|---------------------|-----------------------------|---------------------------|---------------|---------------------|--------|
| 1.  | 0.449       | 10.64               | 0.60                | 33.39                       | 44.63                     | 56.89         | -12.26              | Peak   |
| 2.  | 0.720       | 10.66               | 0.60                | 31.16                       | 42.42                     | 56.00         | -13.58              | Peak   |
| 3.  | 1.160       | 10.68               | 0.60                | 30.58                       | 41.86                     | 56.00         | -14.14              | Peak   |
| 4.  | 1.223       | 10.68               | 0.60                | 31.34                       | 42.62                     | 56.00         | -13.38              | Peak   |
| 5.  | 1.568       | 10.69               | 0.60                | 31.26                       | 42.55                     | 56.00         | -13.45              | Peak   |
| 6.  | 1.970       | 10.70               | 0.60                | 29.84                       | 41.14                     | 56.00         | -14.86              | Peak   |

Line Conducted Emission Test Line 2-N

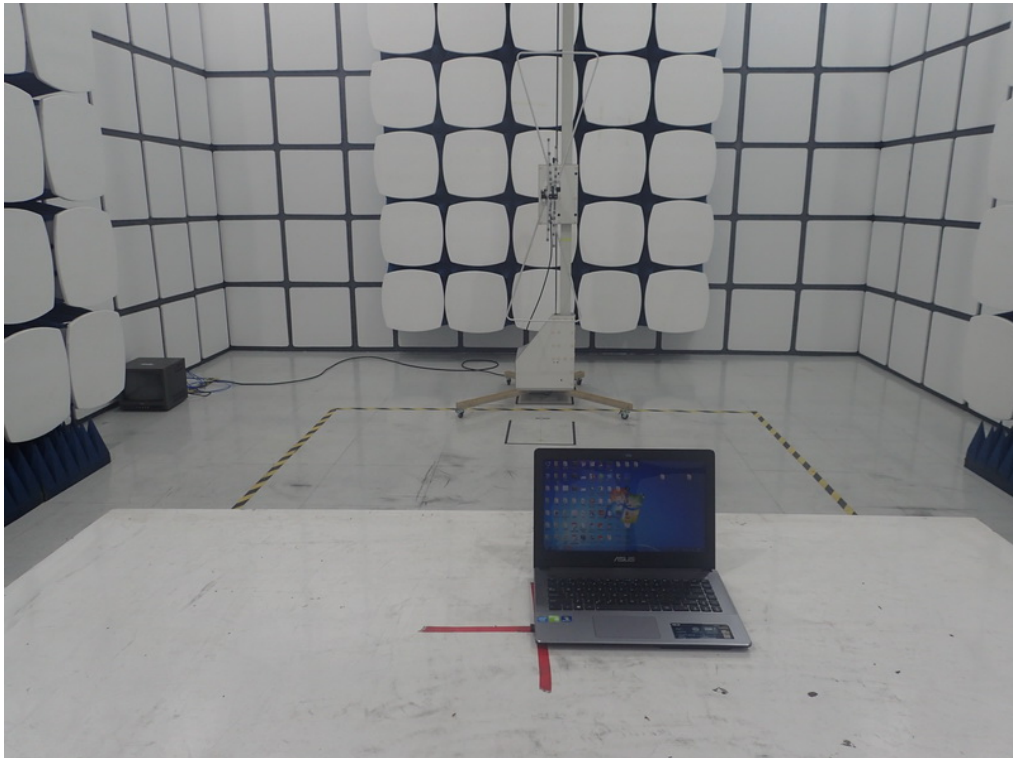


| No. | Freq<br>MHz | Cable<br>Loss<br>dB | AMN<br>Factor<br>dB | Receiver<br>Reading<br>dBuV | Emission<br>Level<br>dBuV | Limit<br>dBuV | Over<br>Limit<br>dB | Remark |
|-----|-------------|---------------------|---------------------|-----------------------------|---------------------------|---------------|---------------------|--------|
| 1.  | 0.178       | 10.61               | 0.60                | 39.75                       | 50.96                     | 64.59         | -13.63              | Peak   |
| 2.  | 0.497       | 10.65               | 0.60                | 30.32                       | 41.57                     | 56.05         | -14.48              | Peak   |
| 3.  | 0.914       | 10.67               | 0.60                | 26.77                       | 38.04                     | 56.00         | -17.96              | Peak   |
| 4.  | 1.577       | 10.69               | 0.60                | 28.36                       | 39.65                     | 56.00         | -16.35              | Peak   |
| 5.  | 2.190       | 10.70               | 0.60                | 30.60                       | 41.90                     | 56.00         | -14.10              | Peak   |
| 6.  | 2.594       | 10.71               | 0.60                | 29.83                       | 41.14                     | 56.00         | -14.86              | Peak   |

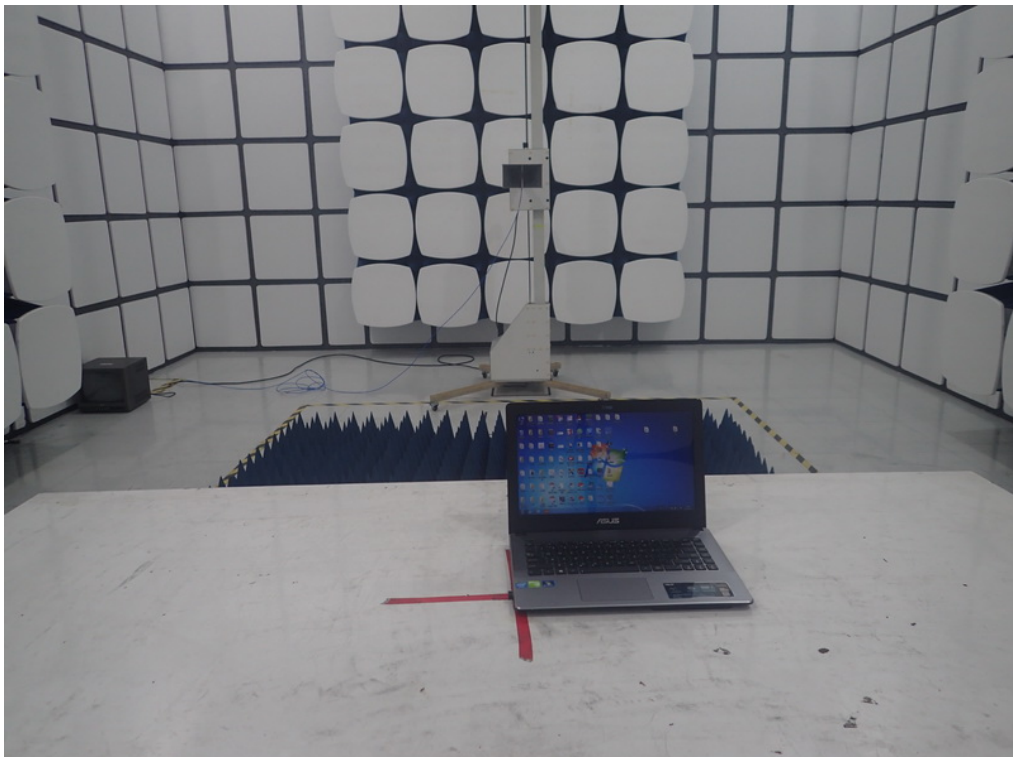
RESULT: PASS

## APPENDIX A: PHOTOGRAPHS OF TEST SETUP

### RADIATED EMISSION TEST SETUP BELOW 1GHz

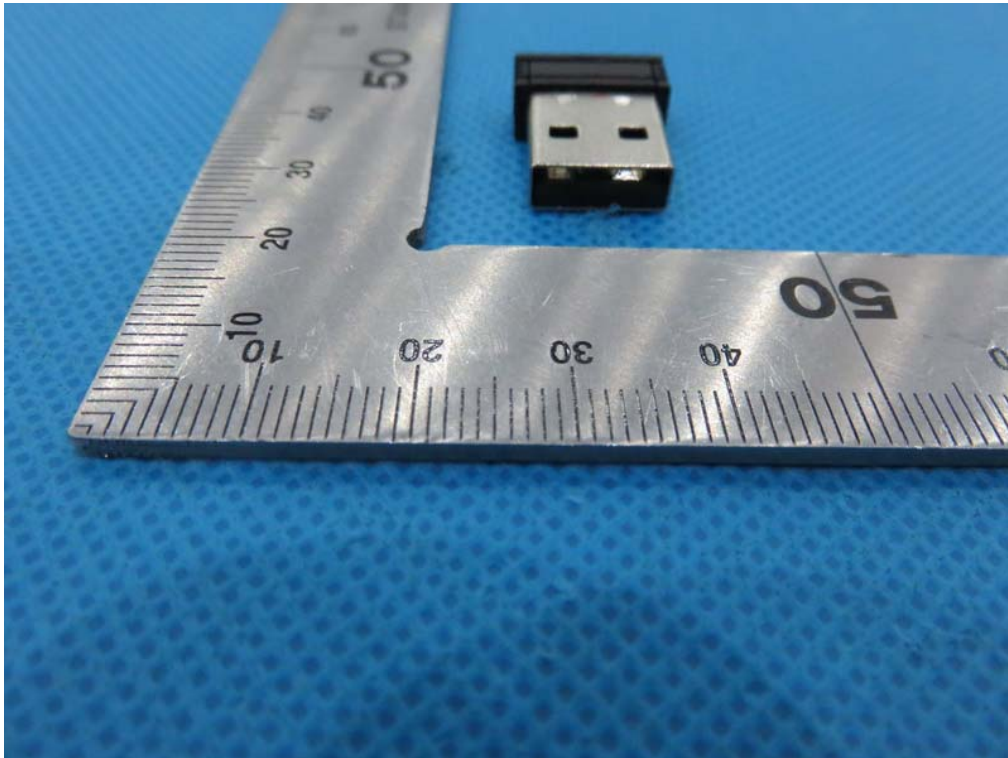


### RADIATED EMISSION TEST SETUP ABOVE 1GHz

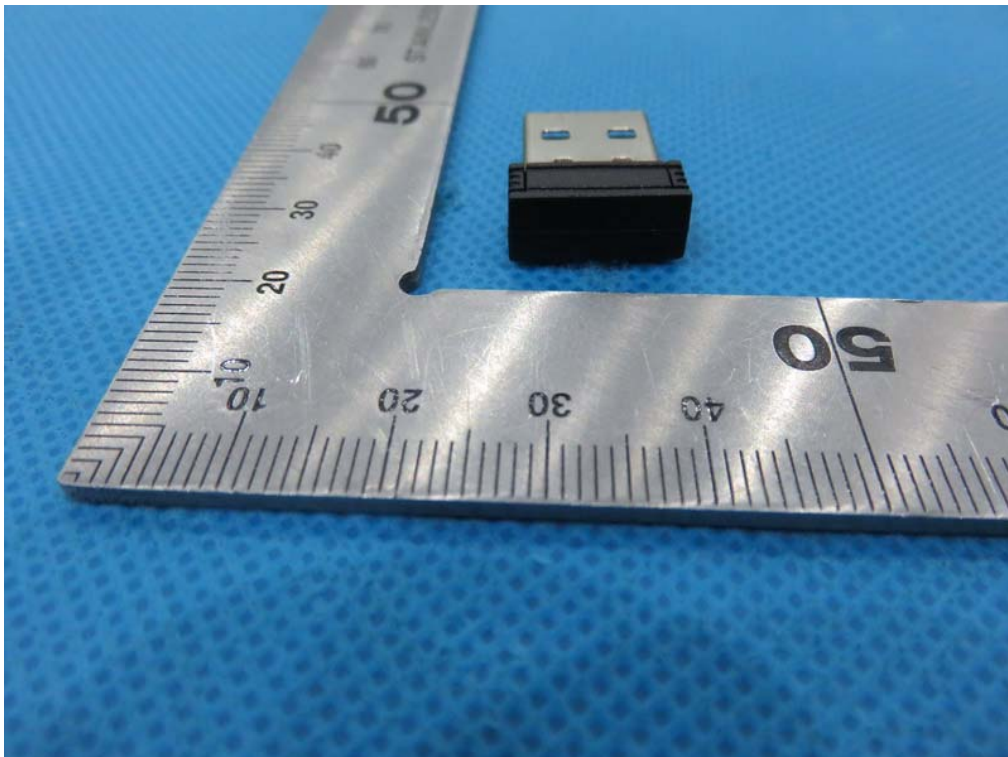


## APPENDIX B: PHOTOGRAPHS OF EUT

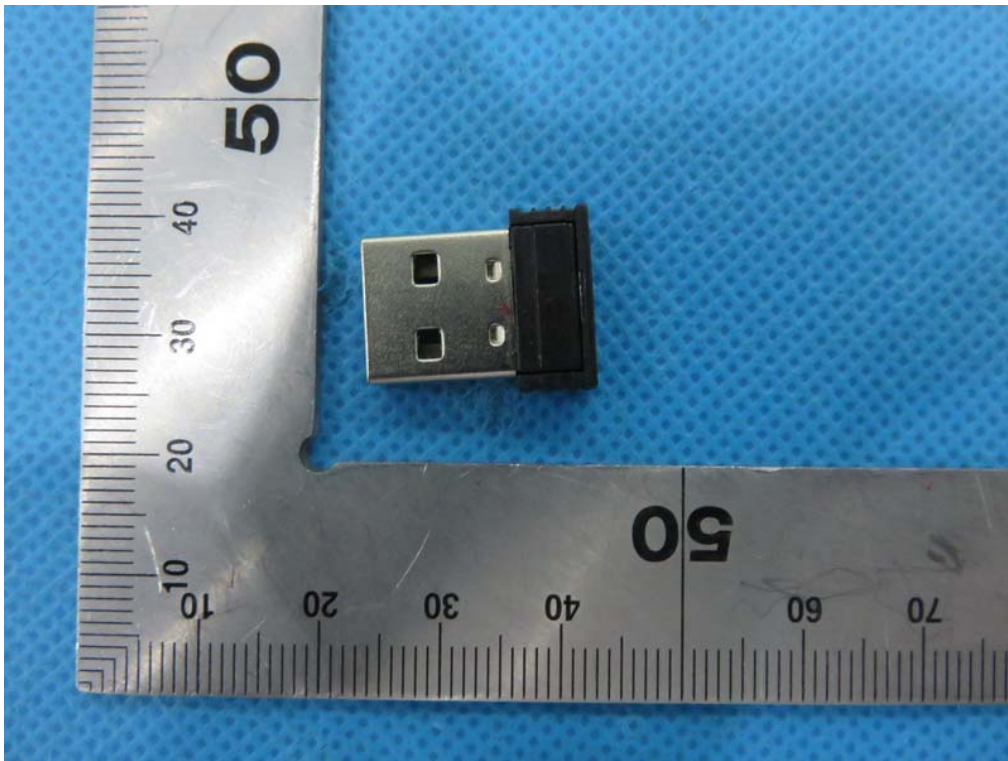
TOP VIEW OF EUT



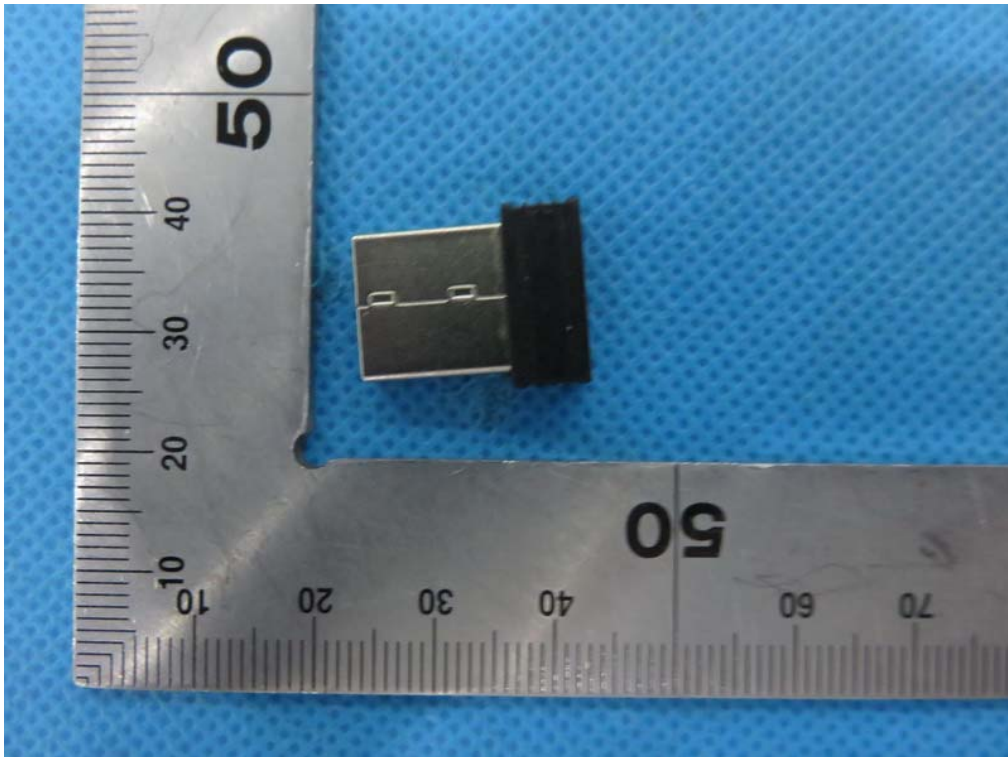
BOTTOM VIEW OF EUT



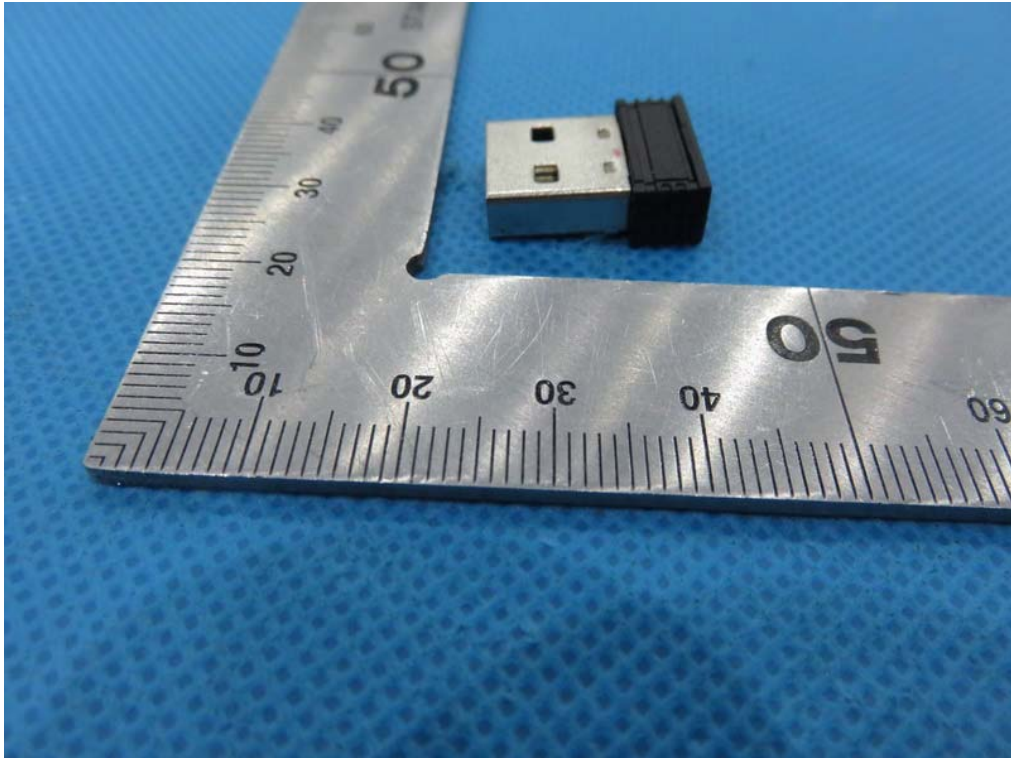
FRONT VIEW OF EUT



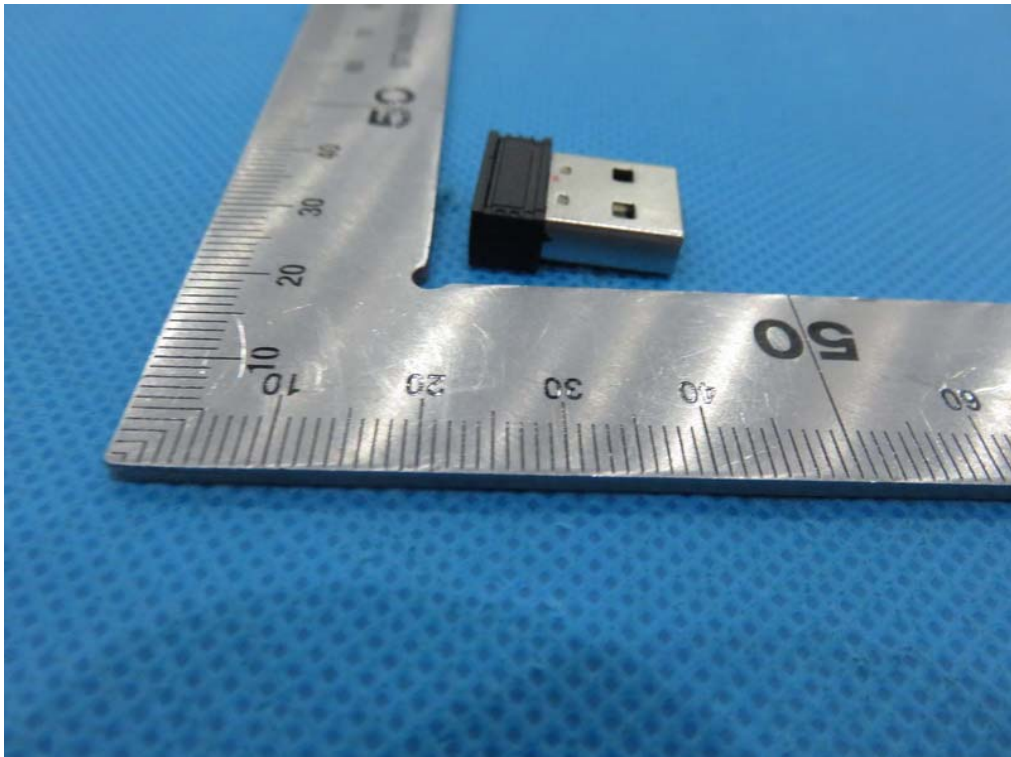
BACK VIEW OF EUT



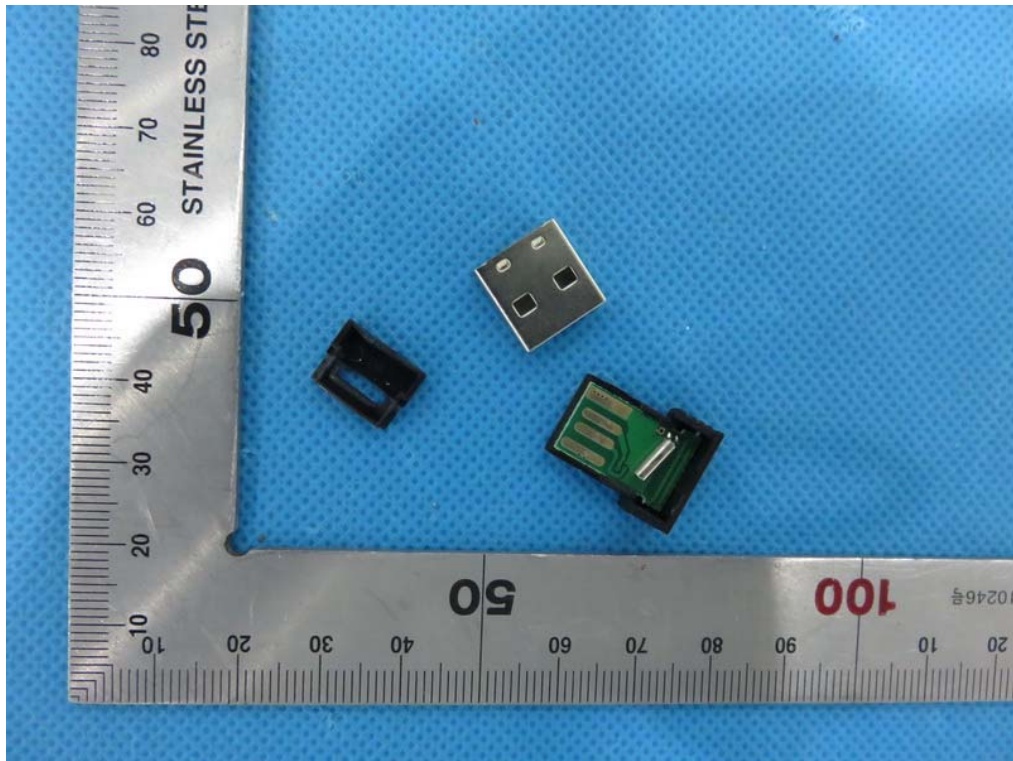
LEFT VIEW OF EUT



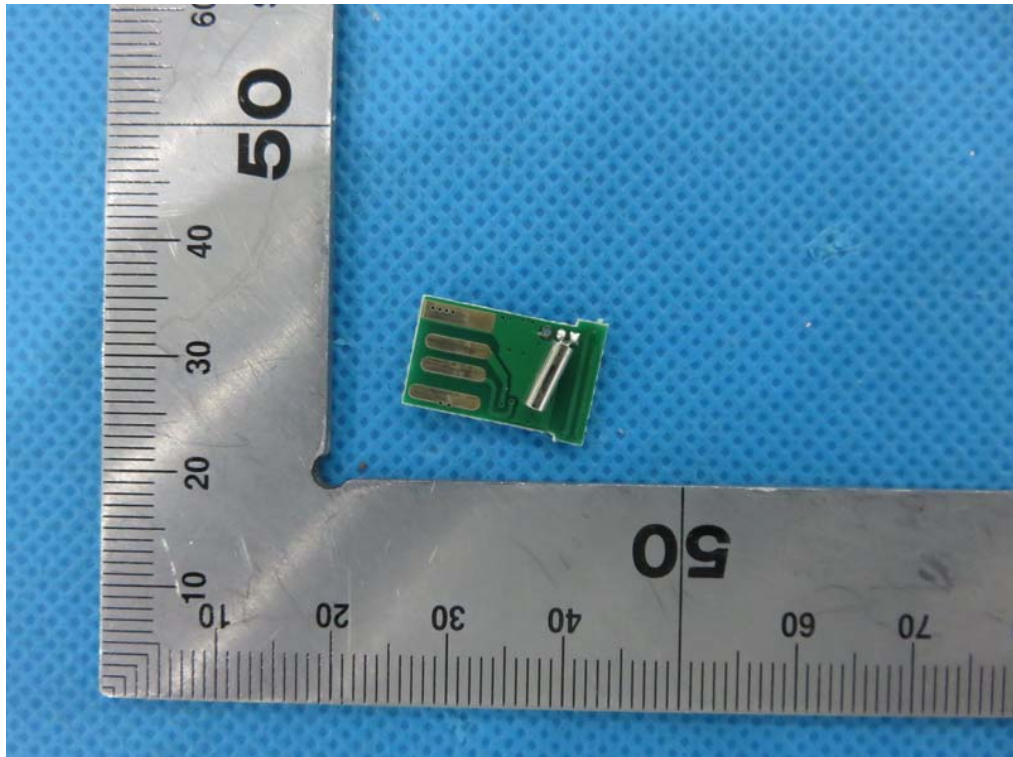
RIGHT VIEW OF EUT



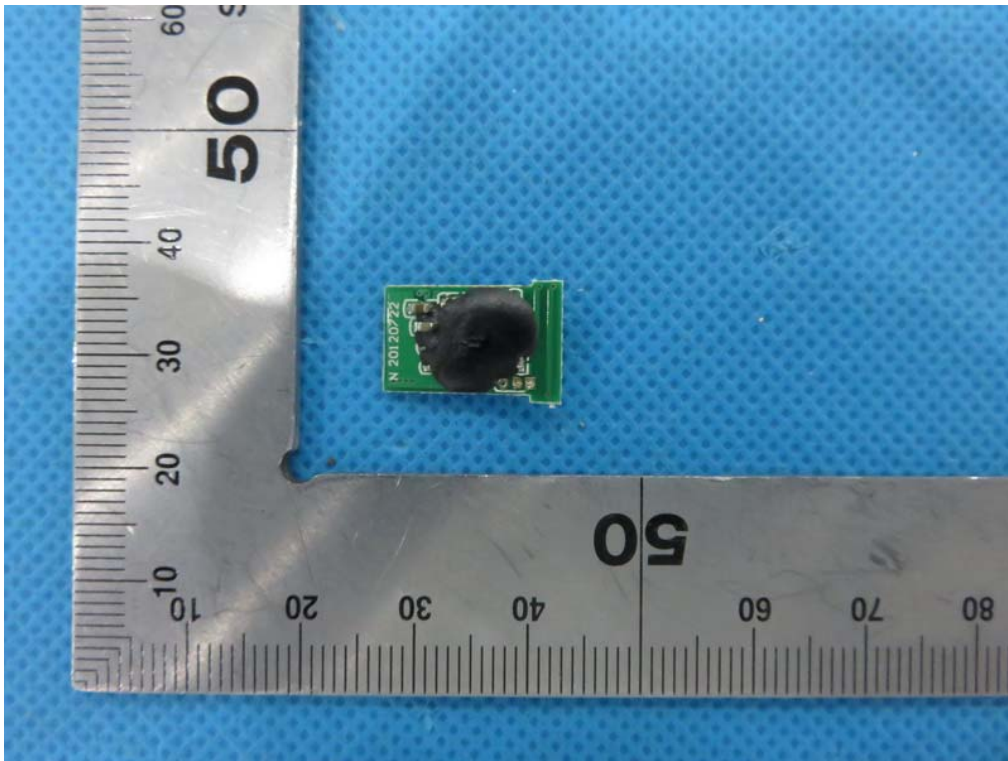
OPEN VIEW OF EUT



INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



----END OF REPORT----