# FCC Test Report

Report No.: AGC03703180502FE03

| | | |
|---|---|---|
| **FCC ID** | : | 2APYD-NLBLLIGHTSV01 |
| **APPLICATION PURPOSE** | : | Original Equipment |
| **PRODUCT DESIGNATION** | : | LED String Lights with WIRELESS SMART CONTROL |
| **BRAND NAME** | : | N/A |
| **MODEL NAME** | : | See Page 4 |
| **CLIENT** | : | Novolink Inc. |
| **DATE OF ISSUE** | : | Jun. 08, 2018 |
| **STANDARD(S)**<br>**TEST PROCEDURE(S)** | : | FCC Part 15 Subpart C Section 15.249 |
| **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 | / | Jun. 08, 2018 | Valid | Initial release |

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## 1. VERIFICATION OF CONFORMITY

| | |
|---|---|
| **Applicant** | Novolink Inc. |
| **Address** | 14860Central Ave, Chino, CA 91710, USA |
| **Manufacturer** | Novolink Inc. |
| **Address** | 14860Central Ave, Chino, CA 91710, USA |
| **Product Designation** | LED String Lights with WIRELESS SMART CONTROL |
| **Brand Name** | N/A |
| **Test Model** | SL-200-8-BLE-WW |
| **Series Model** | SL-200-8-BLE-CW, SL-200-8-BLE-MC, SL-IC-80-5-BLE, ICS-200-8-BLE-M, ICS-200-8-BLE-W, SL-200-8-EXT-WW, SL-200-8-EXT-CW, SL-200-8-EXT-MC, ICS-200-8-EXT-M, ICS-200-8-EXT-W, IC-80-5-EXT-MC |
| **Difference description** | Only the number of LED is different, the color of the lamp is mild and the size is different. |
| **Date of test** | May 29, 2018 to Jun. 04, 2018 |
| **Deviation** | None |
| **Condition of Test Sample** | Normal |
| **Report Template** | AGCRT-US-BR/RF |

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, the energy emitted by the sample tested as described in this report is in compliance with the requirements of FCC Rules Part 15.249. The test results of this report relate only to the tested sample identified in this report.

Tested By Henry Zhang

Henry Zhang(Zhang Zhuorui) Jun. 04, 2018

Reviewed By cool cheng

Cool Cheng(Cheng Mengguo) Jun. 08, 2018

Approved By Forrest Lei

Forrest Lei(Lei Yonggang)
Authorized Officer Jun. 08, 2018

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# 2. GENERAL INFORMATION

## 2.1. PRODUCT DESCRIPTION

A major technical description of EUT is described as following

| | |
|---|---|
| **Operation Frequency** | 2.402 GHz to 2.480GHz |
| **RF Output Power** | -4.24dBm(Max EIRP Power=Max radiation field-95.2) |
| **Bluetooth Version** | V4.0 |
| **Modulation** | BR ☐GFSK, EDR ☐π /4-DQPSK, ☐8DPSK<br>BLE ☒GFSK |
| **Number of channels** | 40 for BLE |
| **Hardware Version** | V1.0 |
| **Software Version** | V1.0 |
| **Antenna Designation** | PCB Antenna |
| **Antenna Gain** | 2dBi |
| **Power Supply (by adapter)** | Model: JT-DC300V0400-F<br>Input:120V 60Hz, 0.50A<br>Output: 30V 0.40A |

## 2.2. TABLE OF CARRIER FREQUENCYS

BLE Channel List

| Frequency Band | Channel Number | Frequency |
|---|---|---|
| 2400~2483.5MHz | 0 | 2402MHz |
| | 1 | 2404MHz |
| | : | : |
| | 38 | 2478 MHz |
| | 39 | 2480 MHz |

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## 3. MEASUREMENT UNCERTAINTY

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

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB

## 4. DESCRIPTION OF TEST MODES

| NO. | TEST MODE DESCRIPTION |
|---|---|
| 1 | Low channel GFSK |
| 2 | Middle channel GFSK |
| 3 | High channel GFSK |
| 4 | BT Link |

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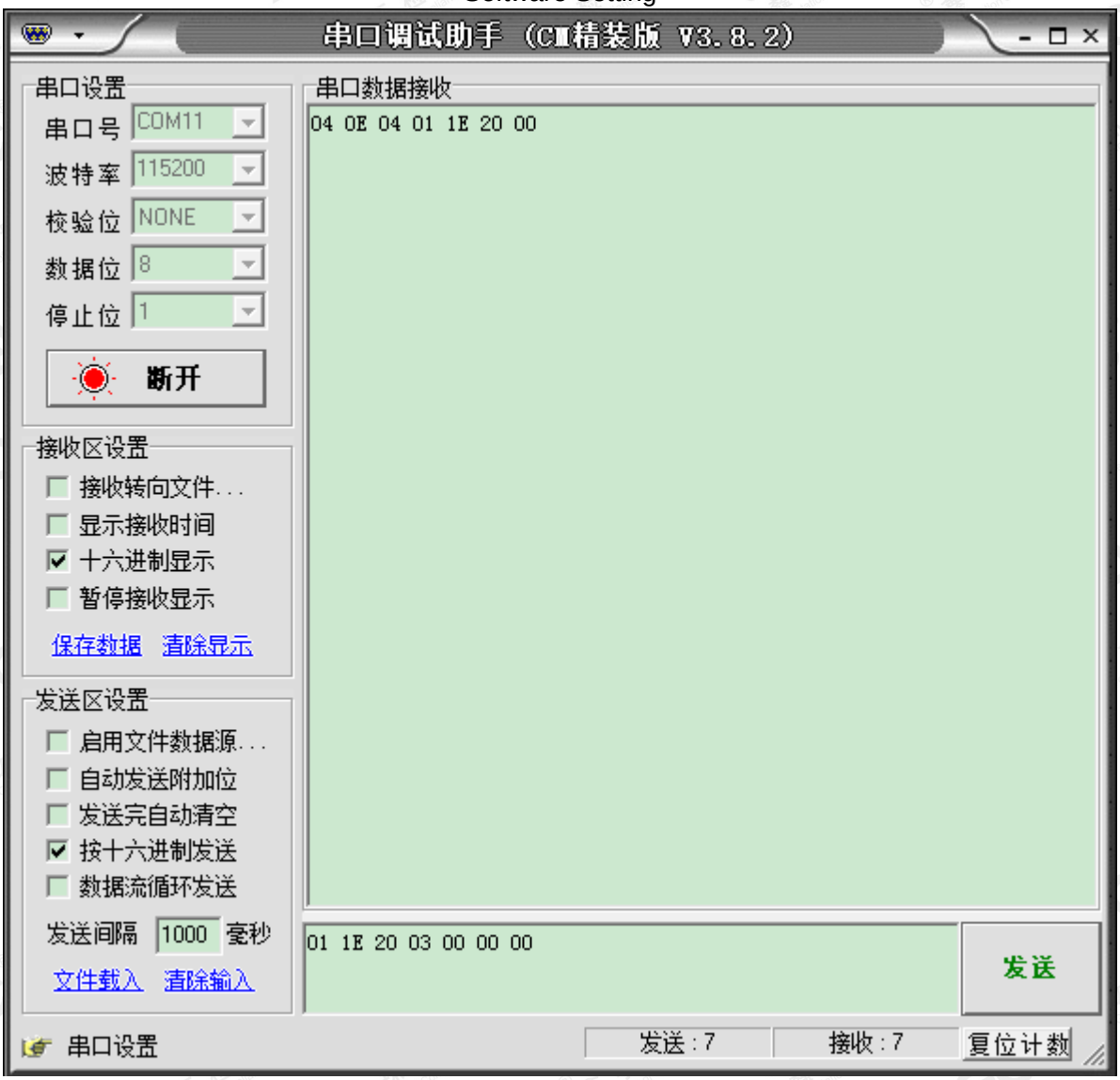
Software Setting

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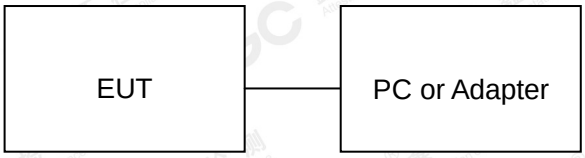
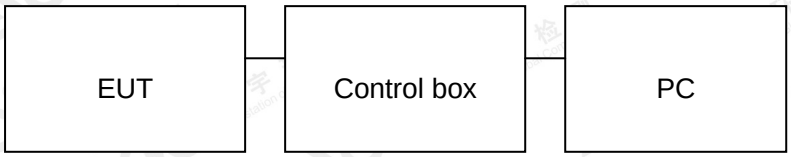
# 5. SYSTEM TEST CONFIGURATION

## 5.1. CONFIGURATION OF EUT SYSTEM

Configure 1: (Normal hopping)




Configure 2: (Control continuous TX)




## 5.2. EQUIPMENT USED IN EUT SYSTEM

| Item | Equipment | Mfr/Brand | Model/Type No. | Remark |
|---|---|---|---|---|
| 1 | LED String Lights with WIRELESS SMART CONTROL | Novolink Inc. | SL-200-8-BLE-WW | EUT |
| 2 | PC | APPLE | A1465 | A.E |
| 3 | Control box | SERIAL | N/A | A.E |
| 4 | USB Cable | N/A | 1m unshielded | A.E |
| 5 | Mobile Phone | HUAWEI | V9 | A.E |
| 6 | Adapter | CZJUTAI | JT-DC300V0400-F | Accessory |

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## 5.3. SUMMARY OF TEST RESULTS

| FCC RULES | DESCRIPTION OF TEST | RESULT |
|---|---|---|
| §15.249(a)<br>§15.209 | Radiated Emission | Compliant |
| §15.249(d) | Band Edges | Compliant |
| §15.207 | Conduction Emission | Compliant |
| §15.215 | Bandwidth | Compliant |

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## 6. TEST FACILITY

| | |
|---|---|
| **Test Site** | Attestation of Global Compliance (Shenzhen) Co., Ltd |
| **Location** | 1-2F., Bldg.2, No.1-4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District B112-B113, Bldg.12, Baoan Bldg Materials Center, No.1 of Xixiang Inner Ring Road, Baoan District, Shenzhen 518012 |
| **NVLAP Lab Code** | 600153-0 |
| **Designation Number** | CN5028 |
| **Test Firm Registration Number** | 682566 |
| **Description** | Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by National Voluntary Laboratory Accreditation program, NVLAP Code 600153-0 |

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## 7. TEST METHOD

All measurements contained in this report were conducted with ANSI C63.10-2013

## 8. TEST EQUIPMENT LIST

### TEST EQUIPMENT OF CONDUCTED EMISSION TEST

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| TEST RECEIVER | R&S | ESPI | 101206 | Jun.20, 2017 | Jun.19, 2018 |
| LISN | R&S | ESH2-Z5 | 100086 | Aug.21, 2017 | Aug.20, 2018 |

### TEST EQUIPMENT OF RADIATED EMISSION TEST

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| TEST RECEIVER | R&S | ESCI | 10096 | Jun.20, 2017 | Jun.19, 2018 |
| EXA Signal Analyzer | Aglient | N9010A | MY53470504 | Dec.08, 2017 | Dec.07, 2018 |
| Horn antenna | SCHWARZBECK | BBHA 9170 | #768 | Sep.20, 2017 | Sep.19, 2018 |
| preamplifier | ChengYi | EMC184045SE | 980508 | Sep.15, 2017 | Sep.14, 2018 |
| Double-Ridged Waveguide Horn | ETS LINDGREN | 3117 | 00034609 | May 18, 2017 | May 17, 2019 |
| Broadband Preamplifier | SCHWARZBECK | BBV 9718 | 9718-205 | Jun.20, 2017 | Jun.19, 2018 |
| ANTENNA | SCHWARZBECK | VULB9168 | D69250 | Sep.28, 2017 | Sep.27, 2018 |
| Loop Antenna | A.H.Systems,Inc | SAS-562B | -- | Mar. 01, 2018 | Feb. 28, 2019 |
| Radiation Cable 1 | MXT | RS1 | R005 | June 6, 2017 | June 5, 2018 |
| Radiation Cable 2 | MXT | RS1 | R006 | June 6, 2017 | June 5, 2018 |
| Filter (2.4-2.483GHz) | Micro-tronics | 087 | -- | Jun.20, 2017 | Jun.19, 2018 |

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# 9. RADIATED EMISSION

## 9.1TEST LIMIT

**Standard FCC15.249**

| Fundamental Frequency | Field Strength of Fundamental (millivolts/meter) | Field Strength of Harmonics (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 (MHz) | Distance Meters | Field Strengths Limit | |
|---|---|---|---|
| | | μ V/m | dB(μV)/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(μV)/m (Peak) 54.0 dB(μV)/m (Average) | |

Remark: (1) Emission level dBμ V = 20 log Emission level μ 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.

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## 9.2. MEASUREMENT PROCEDURE

1. The measuring distance of 3m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation(Below 1GHz)
2. The measuring distance of 3m shall used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation(Above 1GHz)
3. The height of the test antenna shall vary between 1m to 4m.Both horizontal and vertical polarization Of the antenna are set to make the measurement.
4. The initial step in collecting radiated emission data is a receive peak detector mode. Pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
5. All readings are peak unless otherwise stated QP in column of Note. Peak denoted that the Peak reading compliance with the QP limits and then QP Mode measurement didn't perform(Below 1GHz)
6. All readings are Peak mode value unless otherwise stated AVG in column of Note. If the Peak mode measured value compliance with the Peak limits and lower than AVG Limits, the EUT shall be deemed to meet Peak & AVG limits and then only Peak mode was measured, but AVG mode didn't perform.(Above 1GHz)

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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 | Fundamental: 2.4~2.483GHz<br>RBW 2MHz/ VBW 6MHz for Peak,<br>RBW 2MHz/ VBW 10Hz for Average<br>Harmonics: 1GHz~25GHz<br>RBW 1MHz/ VBW 3MHz for Peak,<br>RBW 1MHz/ VBW 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 |

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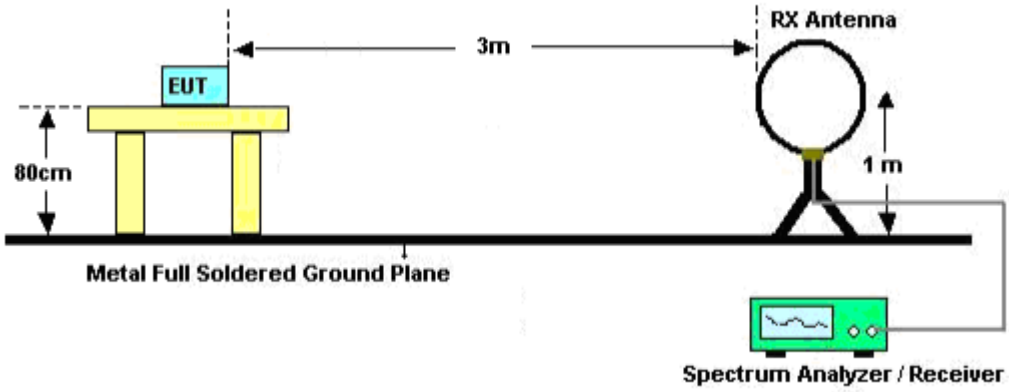
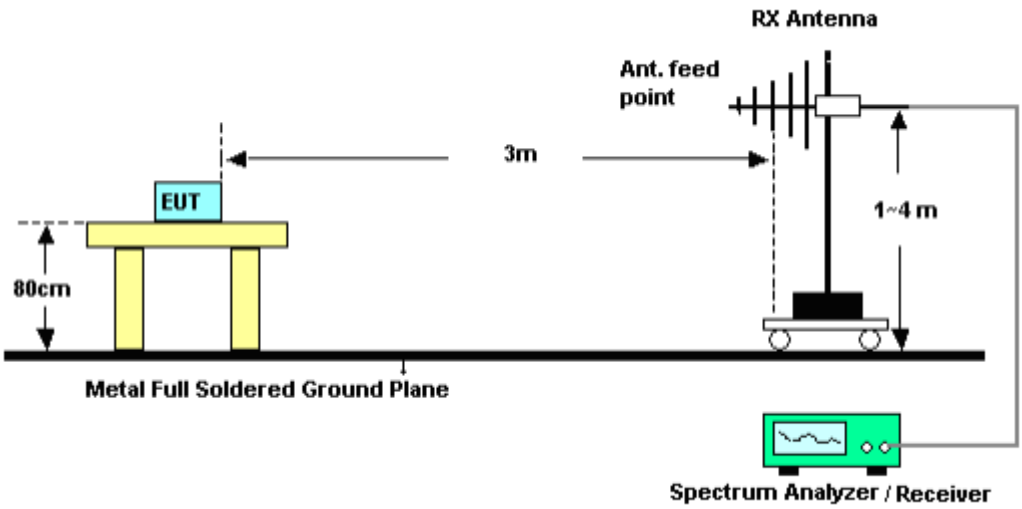
## 9.3. TEST SETUP

Radiated Emission Test-Setup Frequency Below 30MHz




RADIATED EMISSION TEST SETUP 30MHz-1000MHz

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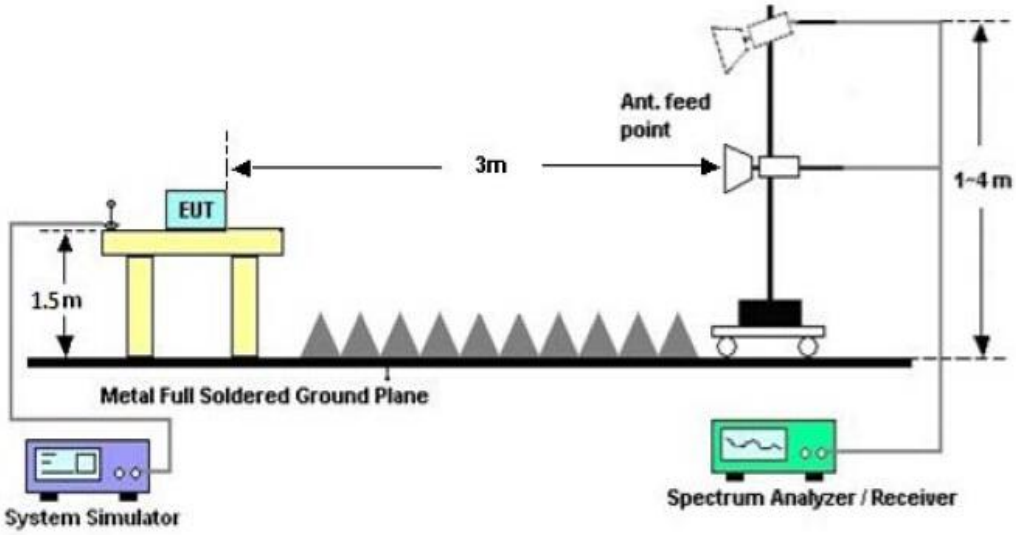
RADIATED EMISSION TEST SETUP ABOVE 1000MHz

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## 9.4. TEST RESULT

**RADIATED EMISSION BELOW 30MHz**

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

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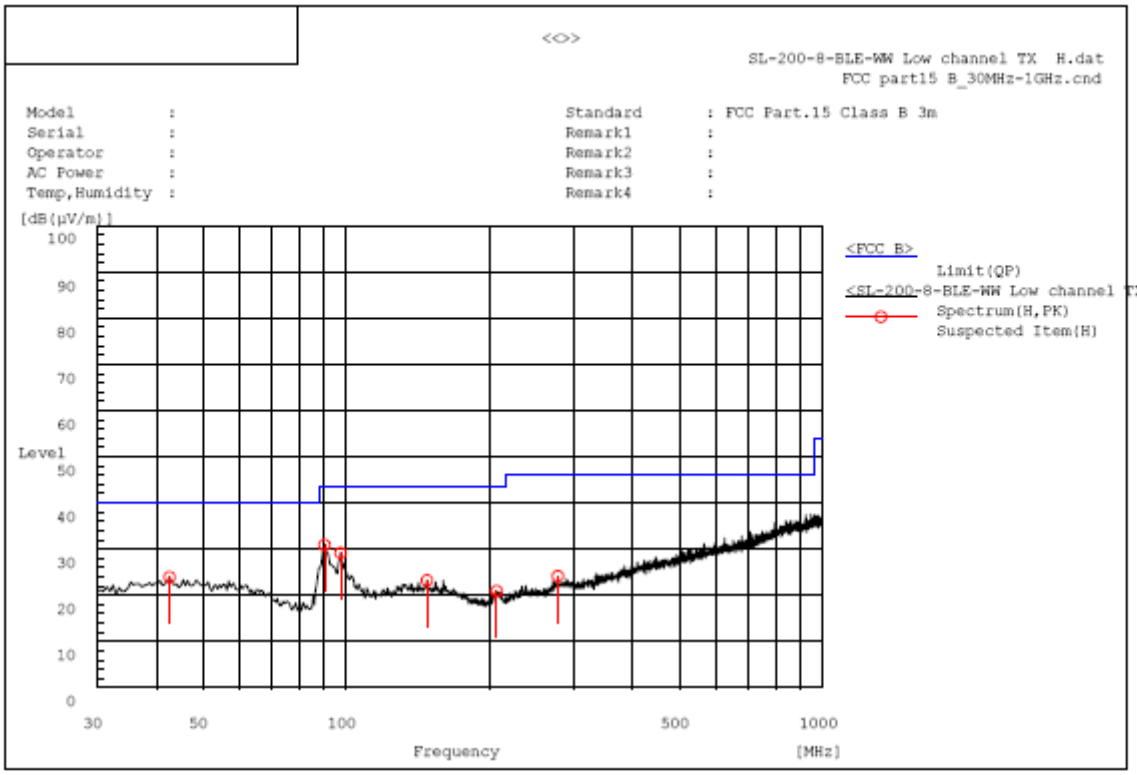
## RADIATED EMISSION BELOW 1GHz

RADIATED EMISSION TEST- (30MHz-1GHz)-LOW CHANNEL-HORIZONTAL




### A. Suspected List:

| Frequency MHz | Polarization | Reading dB(uV) | Factor dB (1/m) | Level dB(uV/m) PK | Limit dB(uV/m) QP | Margin dB | Pass/Fail | Height cm | Angle deg |
|---|---|---|---|---|---|---|---|---|---|
| 42.610 | H | 6.6 | 17.4 | 24.0 | 40.0 | 16.0 | Pass | 200.0 | 197.5 |
| 90.140 | H | 18.6 | 12.3 | 30.9 | 43.5 | 12.6 | Pass | 200.0 | 136.4 |
| 97.415 | H | 16.2 | 13.0 | 29.2 | 43.5 | 14.3 | Pass | 200.0 | 231.0 |
| 147.855 | H | 6.7 | 16.6 | 23.3 | 43.5 | 20.2 | Pass | 200.0 | 190.2 |
| 207.025 | H | 7.3 | 13.7 | 21.0 | 43.5 | 22.5 | Pass | 150.0 | 241.4 |
| 278.320 | H | 6.5 | 17.7 | 24.2 | 46.0 | 21.8 | Pass | 100.0 | 156.6 |

**RESULT: PASS**

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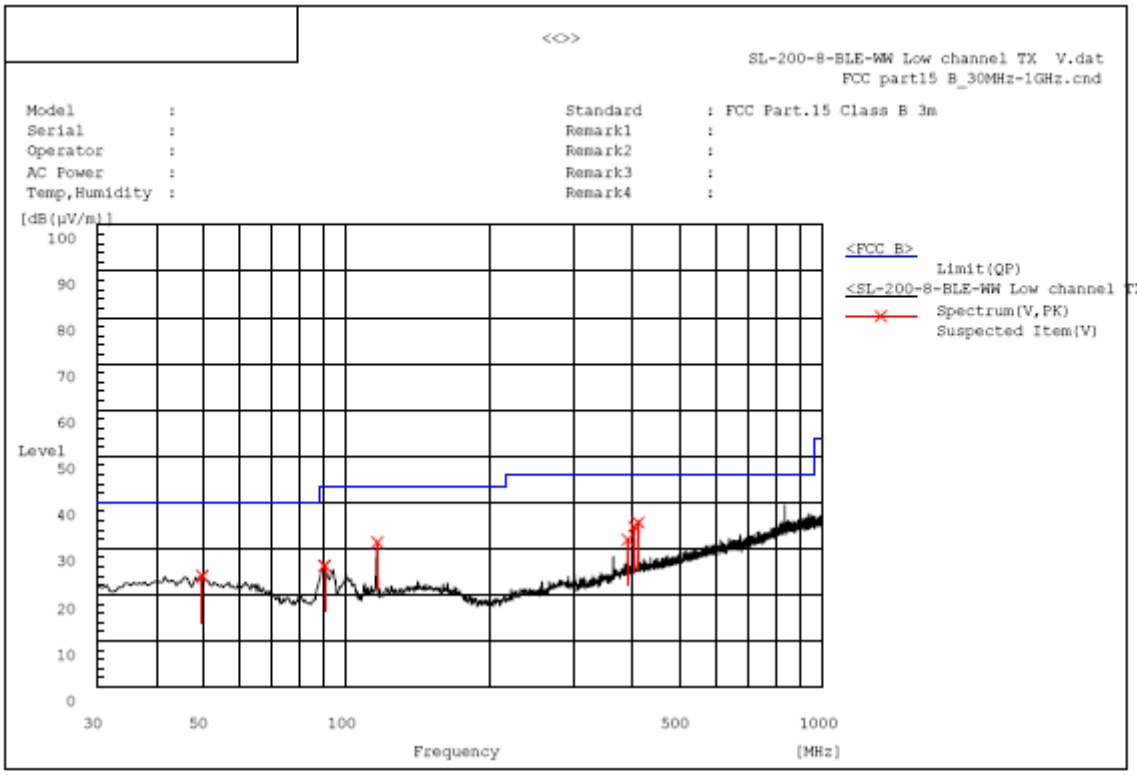
RADIATED EMISSION TEST- (30MHz-1GHz)-LOW CHANNEL -VERTICAL




**A. Suspected List:**

| Frequency MHz | Polarization | Reading dB(uV) | Factor dB (1/m) | Level dB(uV/m) PK | Limit dB(uV/m) QP | Margin dB | Pass/Fail | Height cm | Angle deg |
|---|---|---|---|---|---|---|---|---|---|
| 49.885 | V | 7.0 | 17.1 | 24.1 | 40.0 | 15.9 | Pass | 100.0 | 186.0 |
| 90.140 | V | 14.0 | 12.3 | 26.3 | 43.5 | 17.2 | Pass | 100.0 | 79.7 |
| 116.330 | V | 16.3 | 15.1 | 31.4 | 43.5 | 12.1 | Pass | 200.0 | 350.5 |
| 390.355 | V | 11.4 | 20.5 | 31.9 | 46.0 | 14.1 | Pass | 150.0 | 356.6 |
| 402.480 | V | 13.9 | 20.9 | 34.8 | 46.0 | 11.2 | Pass | 150.0 | 356.6 |
| 410.725 | V | 14.4 | 21.2 | 35.6 | 46.0 | 10.4 | Pass | 150.0 | 356.6 |

**RESULT: PASS**

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

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

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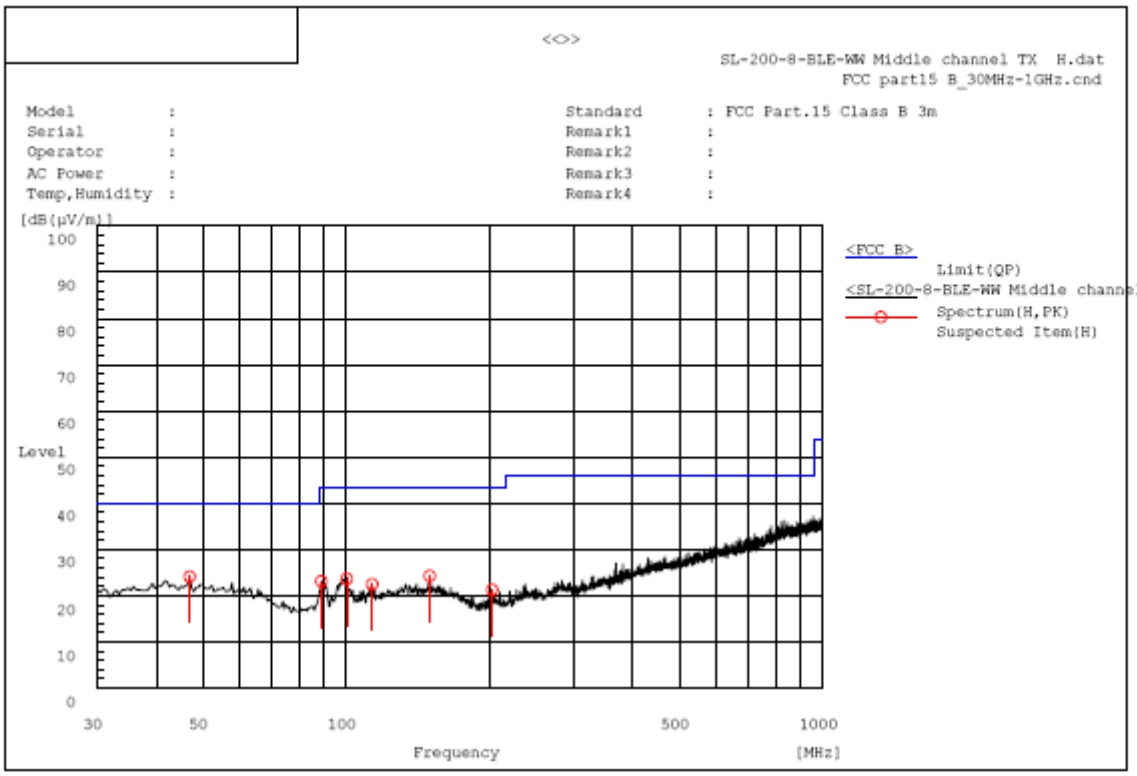
RADIATED EMISSION TEST- (30MHz-1GHz)-MIDDLE CHANNEL-HORIZONTAL




## A. Suspected List:

| Frequency MHz | Polarization | Reading dB(uV) | Factor dB (1/m) | Level dB(uV/m) PK | Limit dB(uV/m) QP | Margin dB | Pass/Fail | Height cm | Angle deg |
|---|---|---|---|---|---|---|---|---|---|
| 46.975 | H | 6.9 | 17.2 | 24.1 | 40.0 | 15.9 | Pass | 100.0 | 157.4 |
| 88.685 | H | 10.9 | 12.3 | 23.2 | 43.5 | 20.3 | Pass | 100.0 | 107.2 |
| 100.325 | H | 10.3 | 13.4 | 23.7 | 43.5 | 19.8 | Pass | 100.0 | 258.0 |
| 113.420 | H | 7.7 | 14.8 | 22.5 | 43.5 | 21.0 | Pass | 150.0 | 258.0 |
| 149.795 | H | 7.7 | 16.6 | 24.3 | 43.5 | 19.2 | Pass | 200.0 | 199.8 |
| 202.660 | H | 7.7 | 13.6 | 21.3 | 43.5 | 22.2 | Pass | 100.0 | 253.9 |

**RESULT: PASS**

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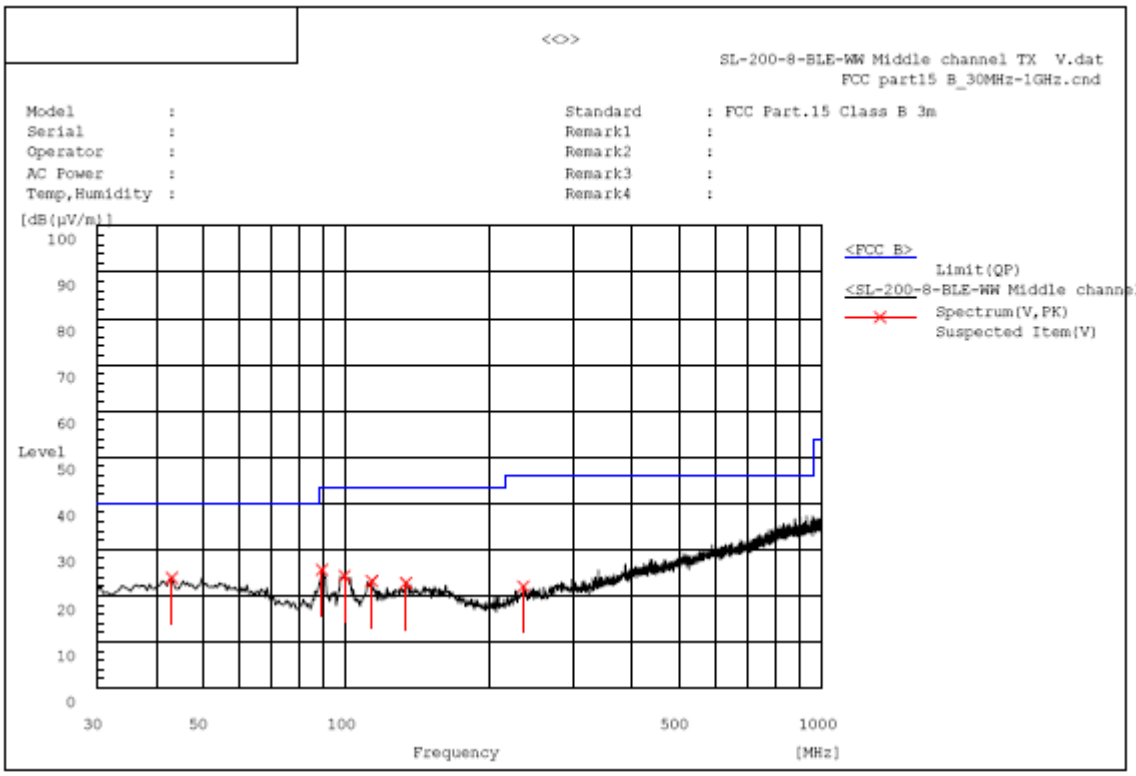
RADIATED EMISSION TEST- (30MHz-1GHz)- MIDDLE CHANNEL -VERTICAL




**A. Suspected List:**

| Frequency MHz | Polarization | Reading dB(uV) | Factor dB (1/m) | Level dB(uV/m) PK | Limit dB(uV/m) QP | Margin dB | Pass/Fail | Height cm | Angle deg |
|---|---|---|---|---|---|---|---|---|---|
| 43.095 | V | 6.5 | 17.4 | 23.9 | 40.0 | 16.1 | Pass | 200.0 | 264.7 |
| 89.170 | V | 13.3 | 12.3 | 25.6 | 43.5 | 17.9 | Pass | 100.0 | 327.0 |
| 99.355 | V | 11.0 | 13.3 | 24.3 | 43.5 | 19.2 | Pass | 100.0 | 318.4 |
| 113.420 | V | 8.4 | 14.8 | 23.2 | 43.5 | 20.3 | Pass | 200.0 | 331.3 |
| 133.790 | V | 6.3 | 16.5 | 22.8 | 43.5 | 20.7 | Pass | 150.0 | 97.4 |
| 236.125 | V | 5.9 | 16.1 | 22.0 | 46.0 | 24.0 | Pass | 100.0 | 167.4 |

**RESULT: PASS**

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

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

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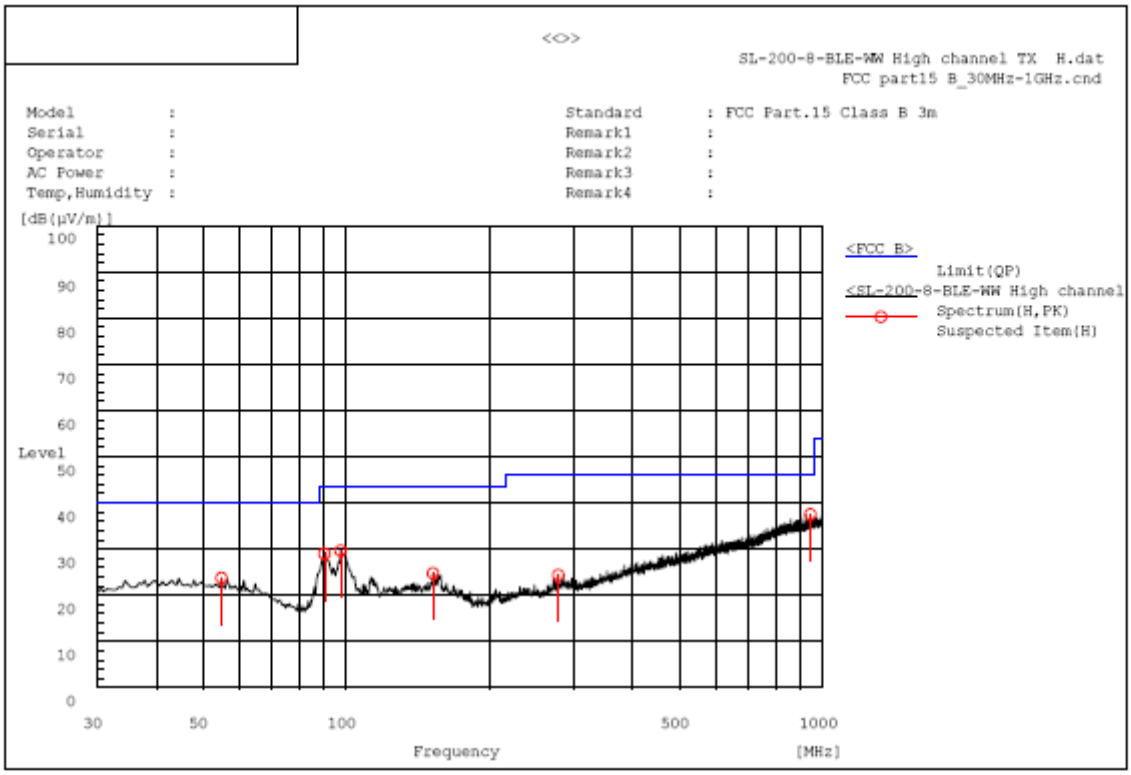
RADIATED EMISSION TEST- (30MHz-1GHz)-HIGH CHANNEL-HORIZONTAL




## A. Suspected List:

| Frequency MHz | Polarization | Reading dB(uV) | Factor dB (1/m) | Level dB(uV/m) PK | Limit dB(uV/m) QP | Margin dB | Pass/Fail | Height cm | Angle deg |
|---|---|---|---|---|---|---|---|---|---|
| 54.735 | H | 7.1 | 16.7 | 23.8 | 40.0 | 16.2 | Pass | 100.0 | 41.0 |
| 90.140 | H | 16.7 | 12.3 | 29.0 | 43.5 | 14.5 | Pass | 200.0 | 99.1 |
| 97.415 | H | 16.7 | 13.0 | 29.7 | 43.5 | 13.8 | Pass | 200.0 | 200.2 |
| 152.220 | H | 8.2 | 16.6 | 24.8 | 43.5 | 18.7 | Pass | 100.0 | 192.0 |
| 278.805 | H | 6.7 | 17.7 | 24.4 | 46.0 | 21.6 | Pass | 150.0 | 123.5 |
| 943.255 | H | 7.0 | 30.6 | 37.6 | 46.0 | 8.4 | Pass | 150.0 | 284.5 |

**RESULT: PASS**

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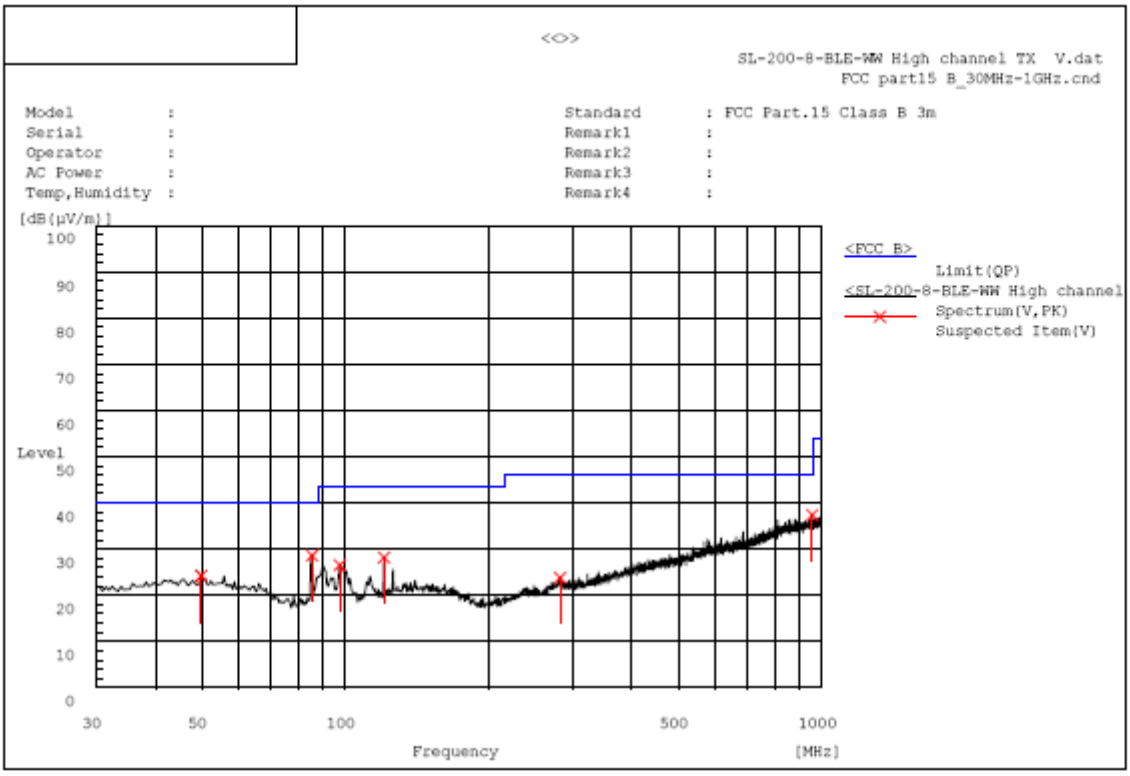
RADIATED EMISSION TEST- (30MHz-1GHz)-HIGH CHANNEL -VERTICAL




**A. Suspected List:**

| Frequency MHz | Polarization | Reading dB(uV) | Factor dB (1/m) | Level dB(uV/m) PK | Limit dB(uV/m) QP | Margin dB | Pass/Fail | Height cm | Angle deg |
|---|---|---|---|---|---|---|---|---|---|
| 49.885 | V | 7.2 | 17.1 | 24.3 | 40.0 | 15.7 | Pass | 200.0 | 100.8 |
| 85.290 | V | 16.3 | 12.3 | 28.6 | 40.0 | 11.4 | Pass | 100.0 | 9.8 |
| 97.415 | V | 13.6 | 13.0 | 26.6 | 43.5 | 16.9 | Pass | 200.0 | 288.8 |
| 120.695 | V | 12.8 | 15.4 | 28.2 | 43.5 | 15.3 | Pass | 200.0 | 357.2 |
| 282.685 | V | 6.2 | 17.7 | 23.9 | 46.0 | 22.1 | Pass | 100.0 | 82.9 |
| 956.350 | V | 6.8 | 30.7 | 37.5 | 46.0 | 8.5 | Pass | 150.0 | 18.4 |

**RESULT: PASS**

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

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

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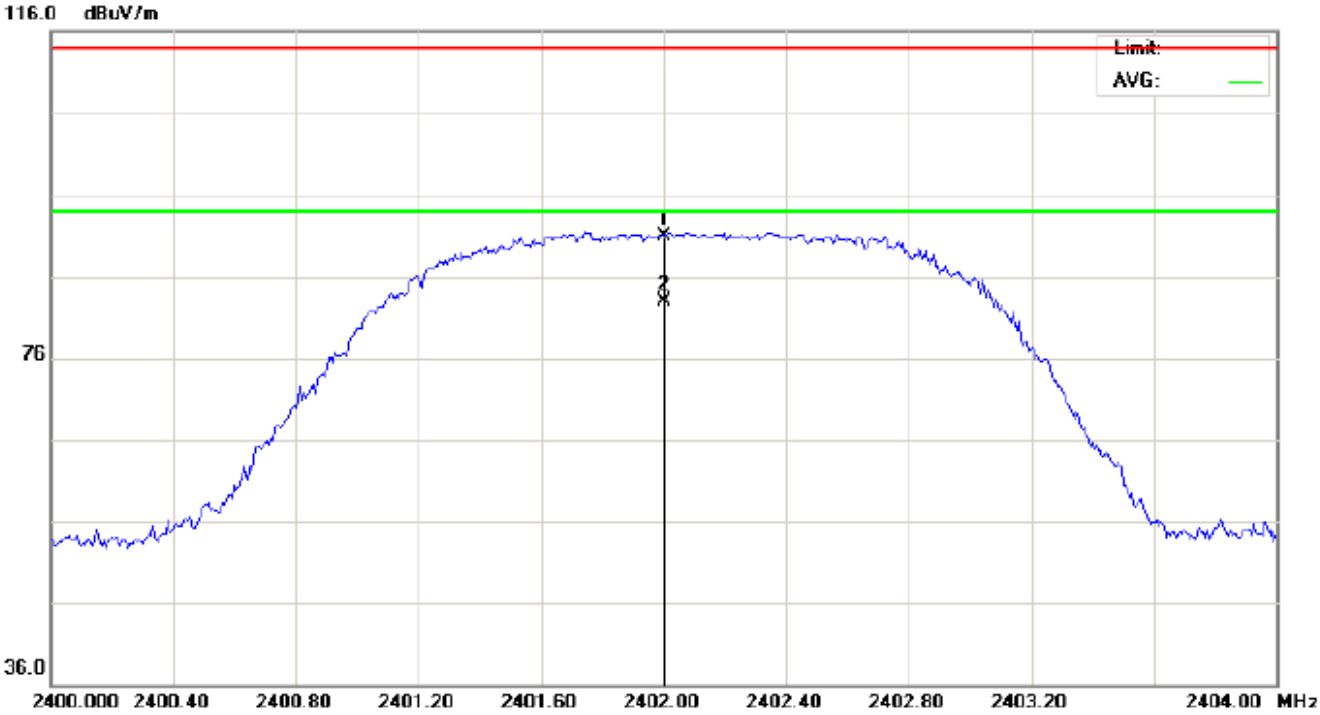
## RADIATED EMISSION ABOVE 1GHz

### For Fundamental

RADIATED EMISSION TEST- (ABOVE 1GHz)-LOW CHANNEL-HORIZONTAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2402.000 | 80.64 | 10.32 | 90.96 | 114.00 | -23.04 | peak | | | |
| 2 | * | 2402.000 | 72.66 | 10.32 | 82.98 | 94.00 | -11.02 | AVG | 100 | 330 | |

**RESULT: PASS**

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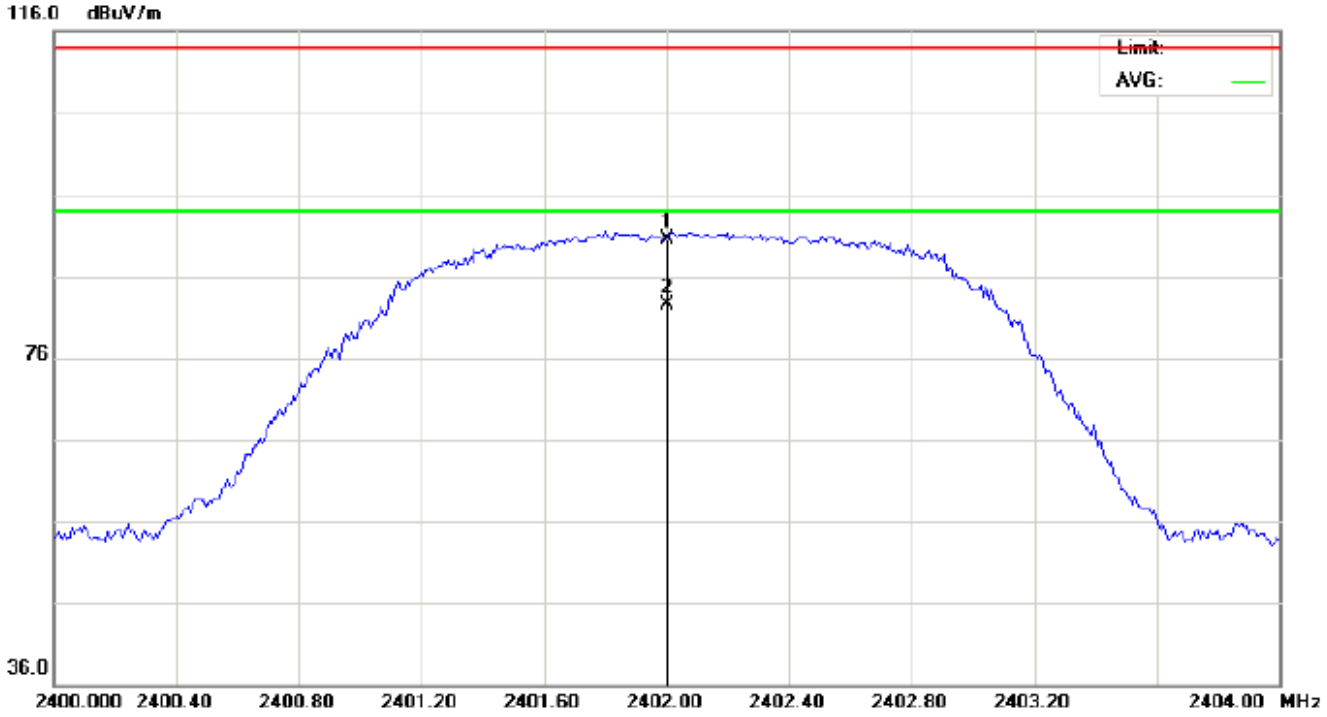
RADIATED EMISSION TEST- (ABOVE 1GHz)-LOW CHANNEL- VERTICAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | . | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2402.000 | 80.17 | 10.32 | 90.49 | 114.00 | -23.51 | peak | | | |
| 2 | * | 2402.000 | 72.14 | 10.32 | 82.46 | 94.00 | -11.54 | AVG | 100 | 106 | |

**RESULT: PASS**

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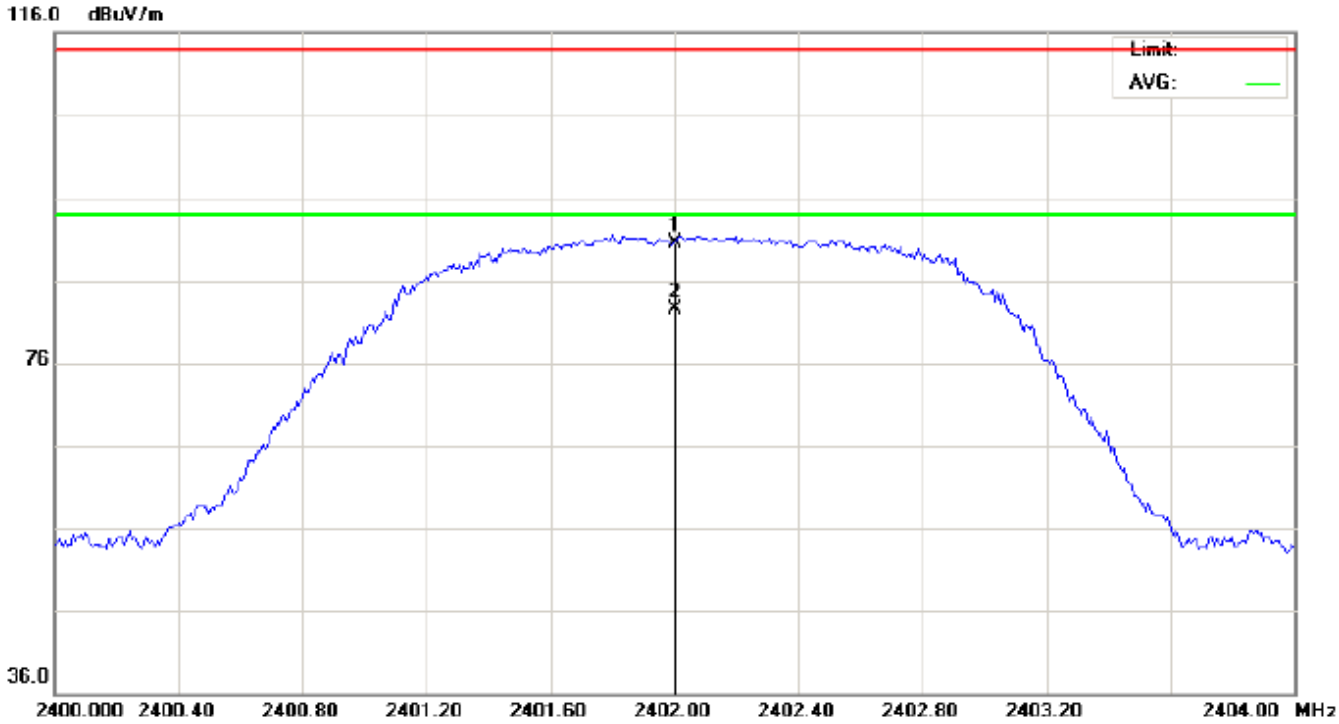
RADIATED EMISSION TEST- (ABOVE 1GHz)-MIDDLE CHANNEL-HORIZONTAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | . | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2440.000 | 79.88 | 10.36 | 90.24 | 114.00 | -23.76 | peak | | | |
| 2 | * | 2440.000 | 71.94 | 10.36 | 82.30 | 94.00 | -11.70 | AVG | 100 | 334 | |

**RESULT: PASS**

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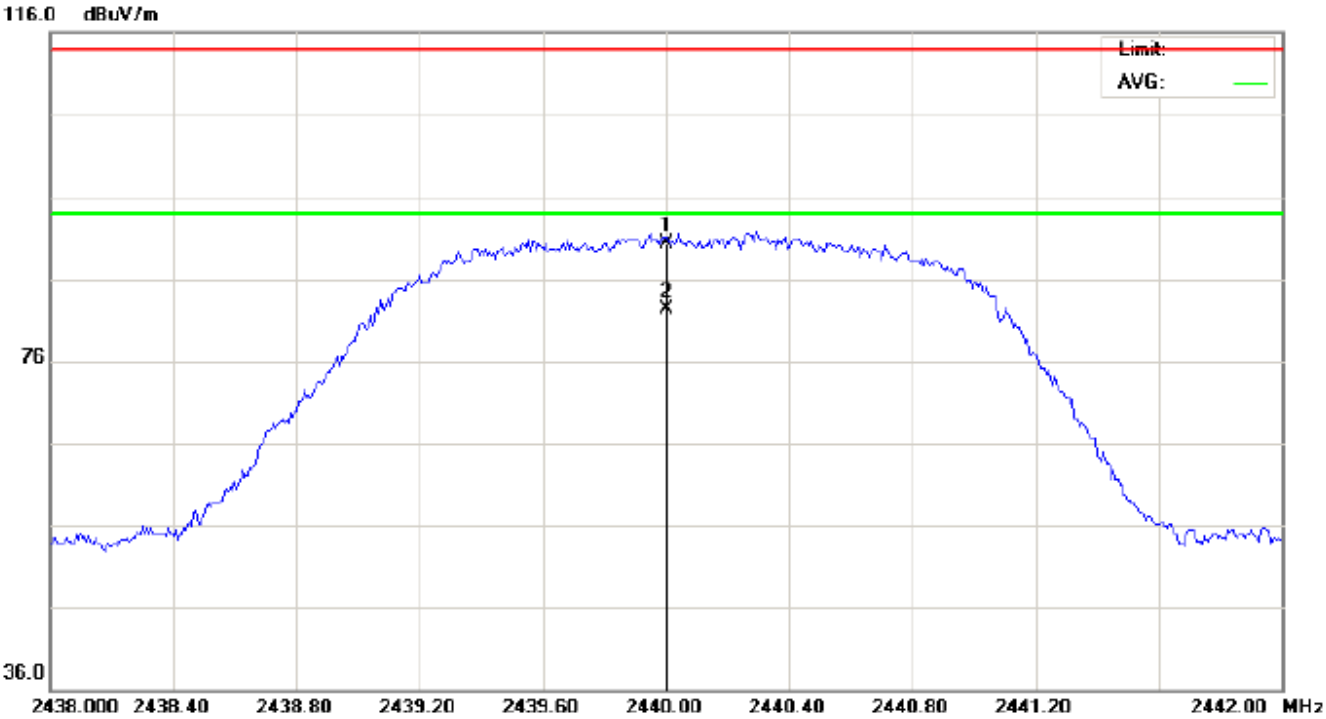
RADIATED EMISSION TEST- (ABOVE 1GHz)-MIDDLE CHANNEL- VERTICAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2440.000 | 79.46 | 10.36 | 89.82 | 114.00 | -24.18 | peak | | | |
| 2 | * | 2440.000 | 71.42 | 10.36 | 81.78 | 94.00 | -12.22 | AVG | 100 | 109 | |

**RESULT: PASS**

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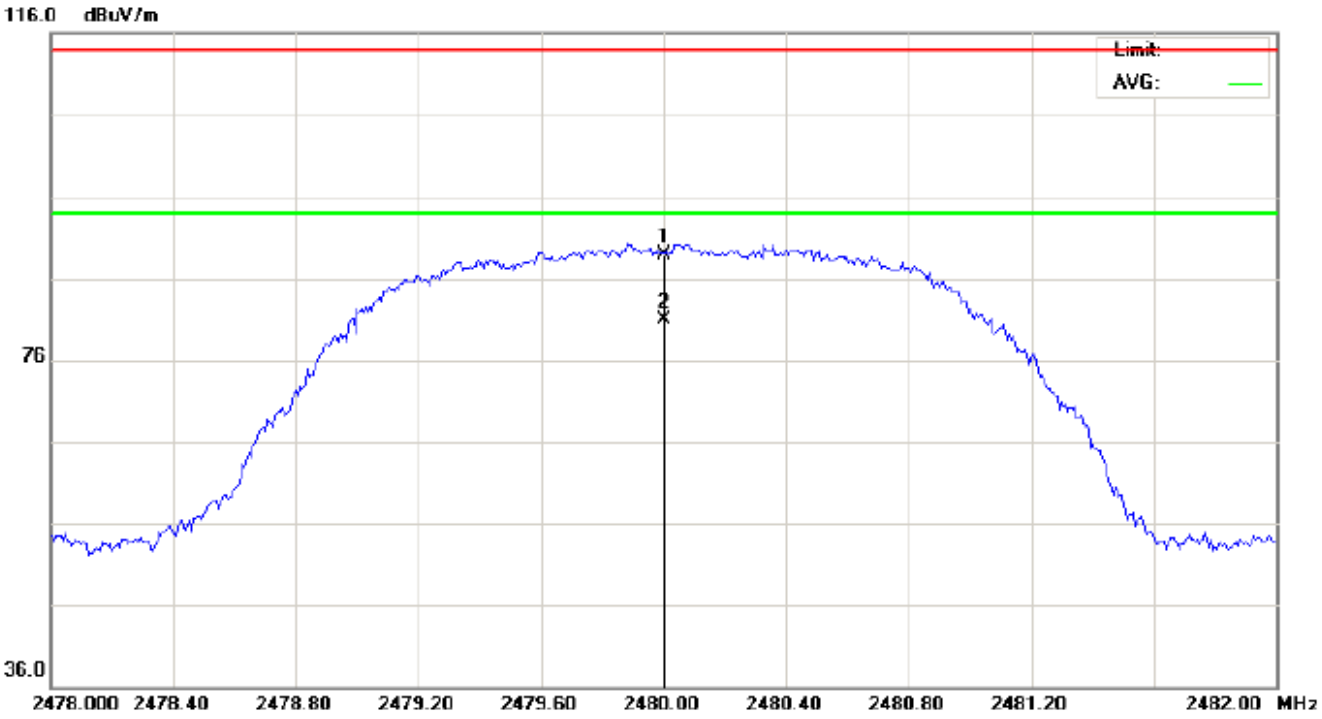
RADIATED EMISSION TEST- (ABOVE 1GHz)-HIGH CHANNEL-HORIZONTAL




| No. | Mk. | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2480.000 | 78.54 | 10.41 | 88.95 | 114.00 | -25.05 | peak | | | |
| 2 | * | 2480.000 | 70.56 | 10.41 | 80.97 | 94.00 | -13.03 | AVG | 100 | 107 | |

**RESULT: PASS**

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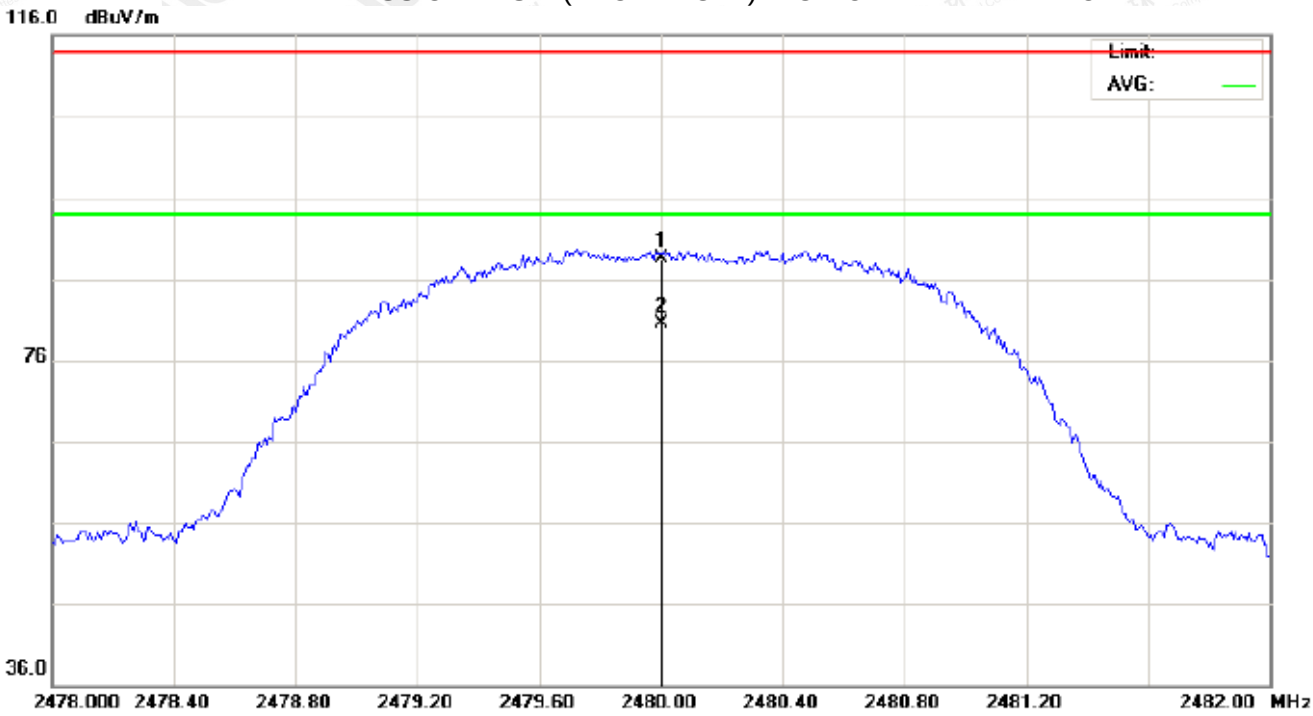
RADIATED EMISSION TEST- (ABOVE 1GHz)-HIGH CHANNEL- VERTICAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | - | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2480.000 | 78.09 | 10.41 | 88.50 | 114.00 | -25.50 | peak | | | |
| 2 | * | 2480.000 | 70.07 | 10.41 | 80.48 | 94.00 | -13.52 | AVG | 100 | 106 | |

**RESULT: PASS**

**Note:** Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.

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

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**Field strength of the fundamental signal**

**1Mbps Result:**

**Peak value**

| Frequency | Reading Level | Factor | Measurement | Limit | Over | Antenna |
|---|---|---|---|---|---|---|
| (MHz) | (dBuv) | (dB/m) | (dBuv/m) | (dBuv/m) | (dB) | Polarization |
| 2402 | 80.64 | 10.32 | 90.96 | 114 | -23.04 | Horizontal |
| 2402 | 80.17 | 10.32 | 90.49 | 114 | -23.51 | Vertical |
| 2440 | 79.88 | 10.36 | 90.24 | 114 | -23.76 | Horizontal |
| 2440 | 79.46 | 10.36 | 89.82 | 114 | -24.18 | Vertical |
| 2480 | 78.54 | 10.41 | 88.95 | 114 | -25.05 | Horizontal |
| 2480 | 78.09 | 10.41 | 88.50 | 114 | -25.50 | Vertical |

**Average value**

| Frequency | Reading Level | Factor | Measurement | Limit | Over | Antenna |
|---|---|---|---|---|---|---|
| (MHz) | (dBuv) | (dB/m) | (dBuv/m) | (dBuv/m) | (dB) | Polarization |
| 2402 | 72.66 | 10.32 | 82.98 | 94 | -11.02 | Horizontal |
| 2402 | 72.14 | 10.32 | 82.46 | 94 | -11.54 | Vertical |
| 2440 | 71.94 | 10.36 | 82.30 | 94 | -11.70 | Horizontal |
| 2440 | 71.42 | 10.36 | 81.78 | 94 | -12.22 | Vertical |
| 2480 | 70.56 | 10.41 | 80.97 | 94 | -13.03 | Horizontal |
| 2480 | 70.07 | 10.41 | 80.48 | 94 | -13.52 | Vertical |

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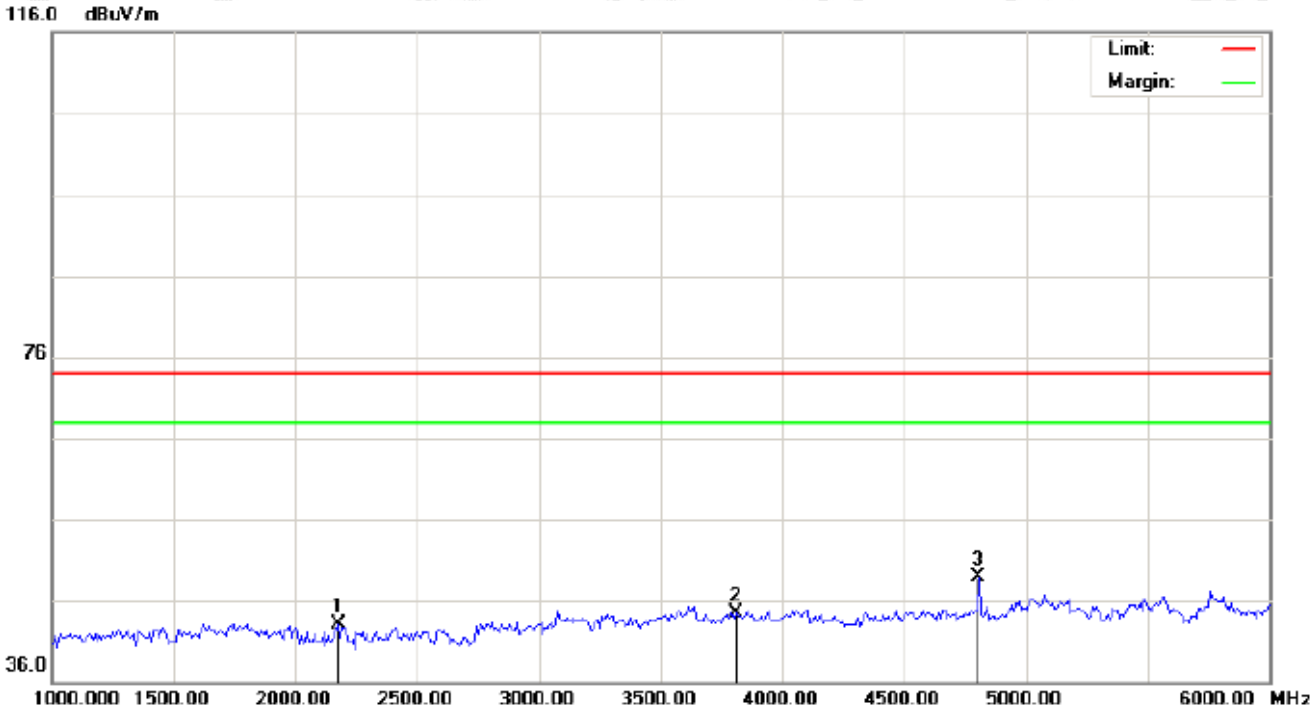
**For Harmonics**

RADIATED EMISSION TEST- (ABOVE 1GHz)-LOW CHANNEL-HORIZONTAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | - | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2175.000 | 33.00 | 10.07 | 43.07 | 74.00 | -30.93 | peak | | | |
| 2 | | 3808.333 | 30.44 | 14.01 | 44.45 | 74.00 | -29.55 | peak | | | |
| 3 | * | 4804.000 | 41.21 | 7.69 | 48.90 | 74.00 | -25.10 | peak | | | |

**RESULT: PASS**

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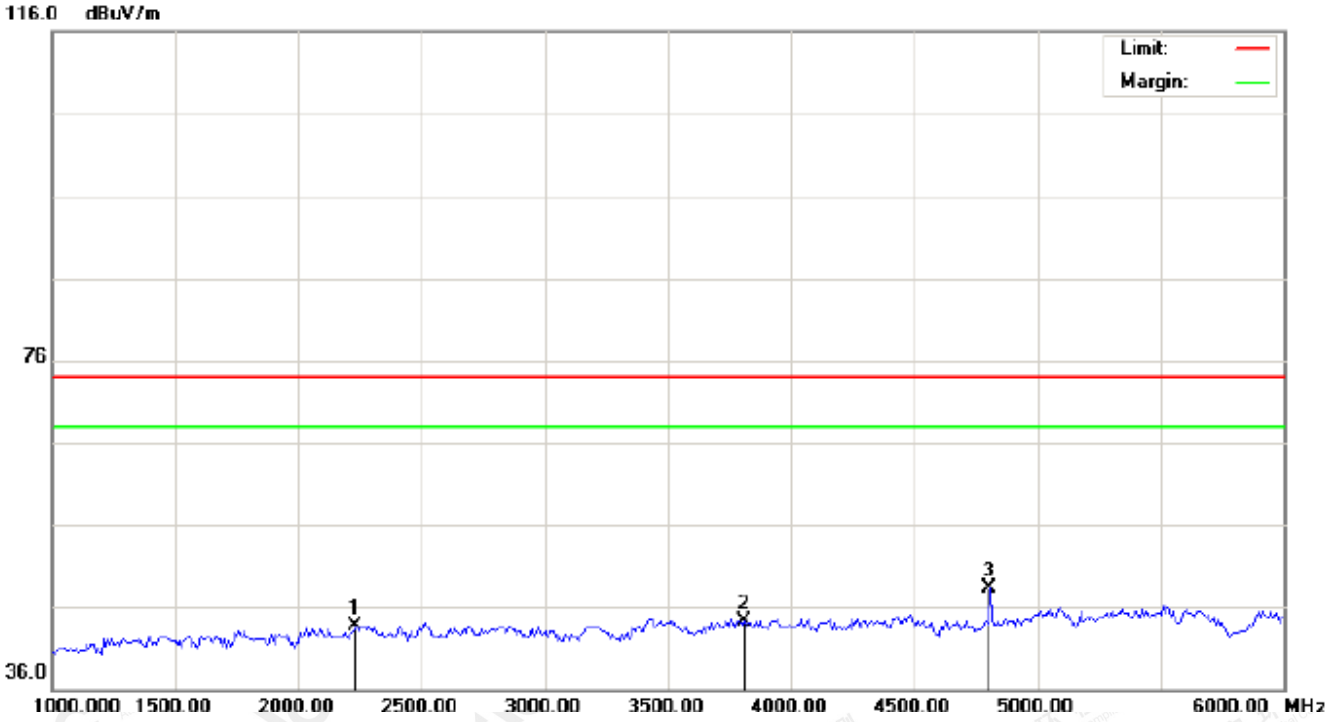
RADIATED EMISSION TEST- (ABOVE 1GHz)-LOW CHANNEL- VERTICAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | . | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2233.333 | 33.55 | 10.14 | 43.69 | 74.00 | -30.31 | peak | | | |
| 2 | | 3808.333 | 30.37 | 14.01 | 44.38 | 74.00 | -29.62 | peak | | | |
| 3 | * | 4804.000 | 40.55 | 7.69 | 48.24 | 74.00 | -25.76 | peak | | | |

**RESULT: PASS**

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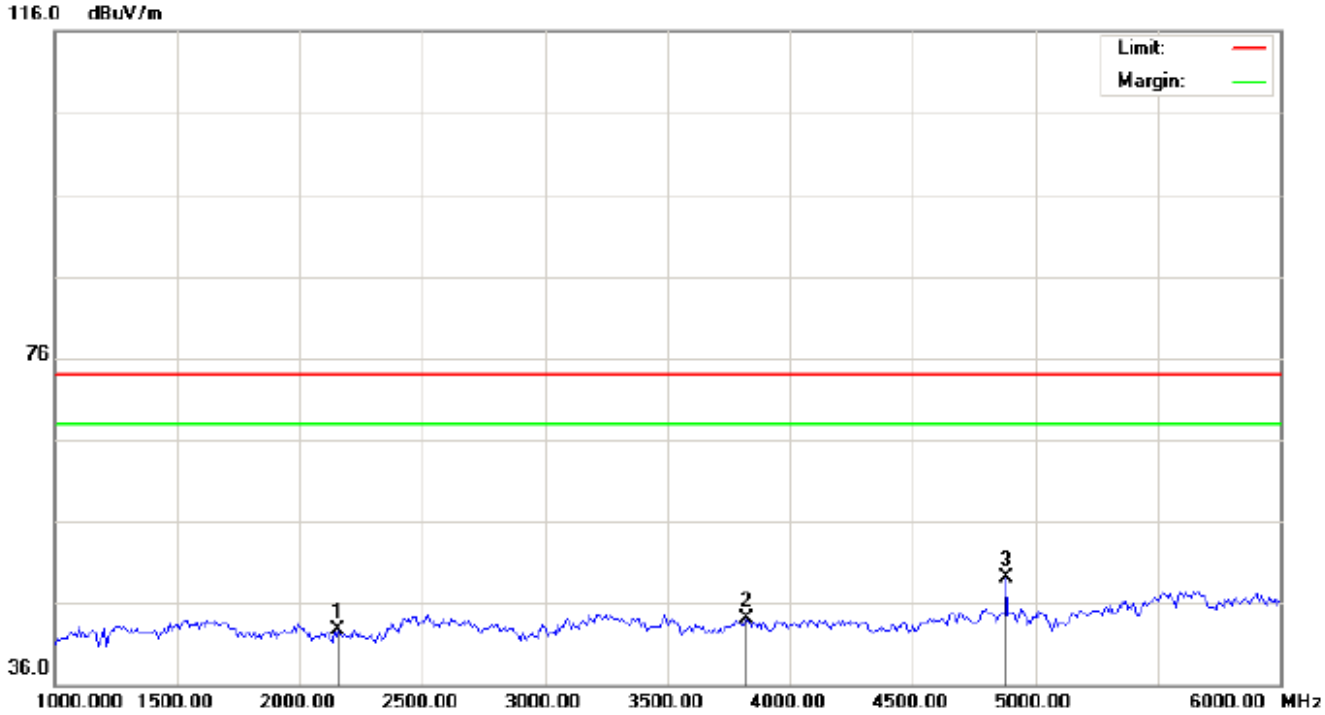
RADIATED EMISSION TEST- (ABOVE 1GHz)-MIDDLE CHANNEL-HORIZONTAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2158.333 | 32.58 | 10.05 | 42.63 | 74.00 | -31.37 | peak | | | |
| 2 | | 3825.000 | 29.90 | 14.11 | 44.01 | 74.00 | -29.99 | peak | | | |
| 3 | * | 4880.000 | 41.16 | 7.89 | 49.05 | 74.00 | -24.95 | peak | | | |

**RESULT: PASS**

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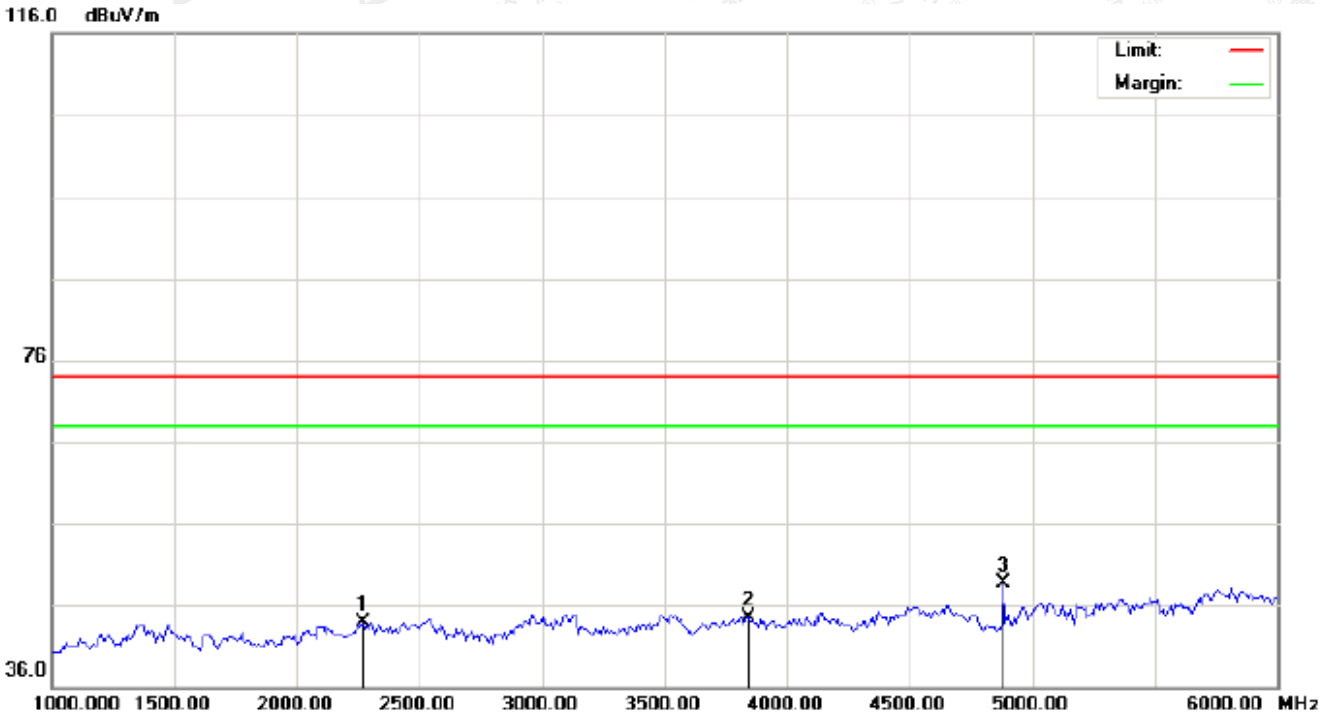
RADIATED EMISSION TEST- (ABOVE 1GHz)-MIDDLE CHANNEL- VERTICAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | - | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2266.667 | 33.83 | 10.17 | 44.00 | 74.00 | -30.00 | peak | | | |
| 2 | | 3841.667 | 30.36 | 14.21 | 44.57 | 74.00 | -29.43 | peak | | | |
| 3 | * | 4880.000 | 40.89 | 7.89 | 48.78 | 74.00 | -25.22 | peak | | | |

**RESULT: PASS**

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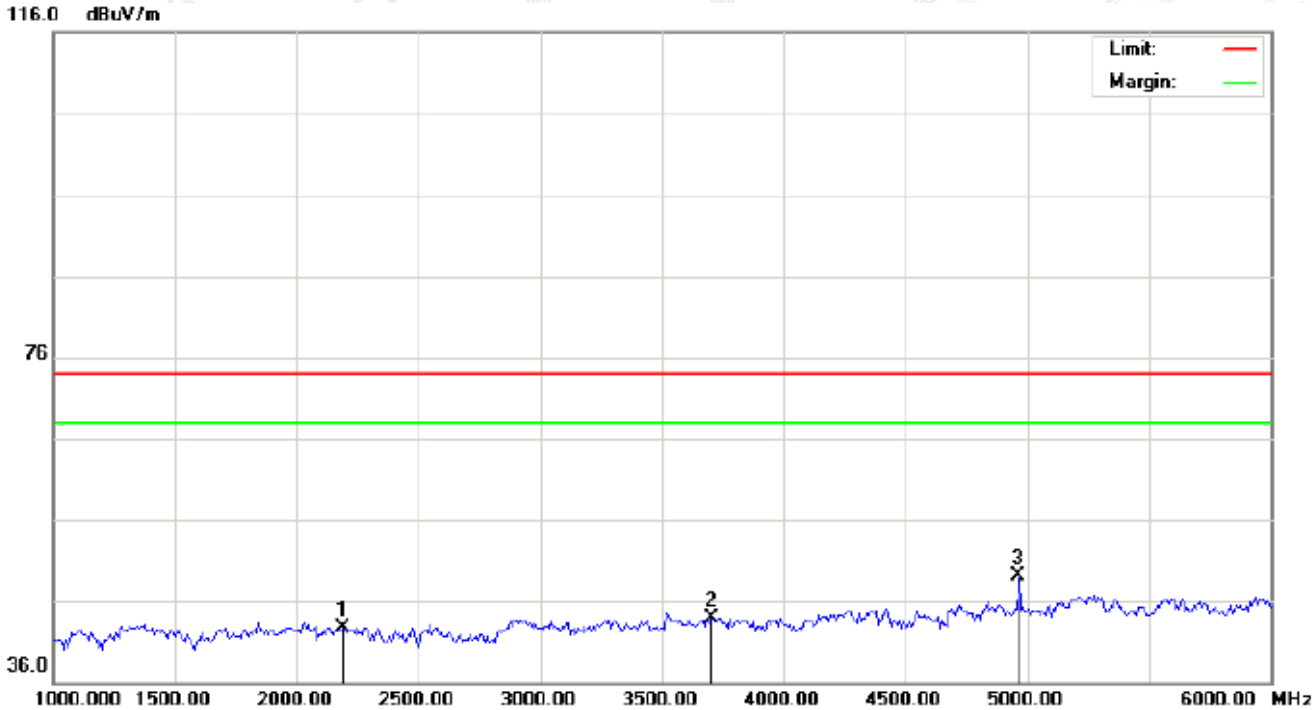
RADIATED EMISSION TEST- (ABOVE 1GHz)-HIGH CHANNEL-HORIZONTAL




| No. | Mk. | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2191.667 | 32.61 | 10.09 | 42.70 | 74.00 | -31.30 | peak | | | |
| 2 | | 3700.000 | 30.55 | 13.34 | 43.89 | 74.00 | -30.11 | peak | | | |
| 3 | * | 4960.000 | 41.10 | 8.09 | 49.19 | 74.00 | -24.81 | peak | | | |

**RESULT: PASS**

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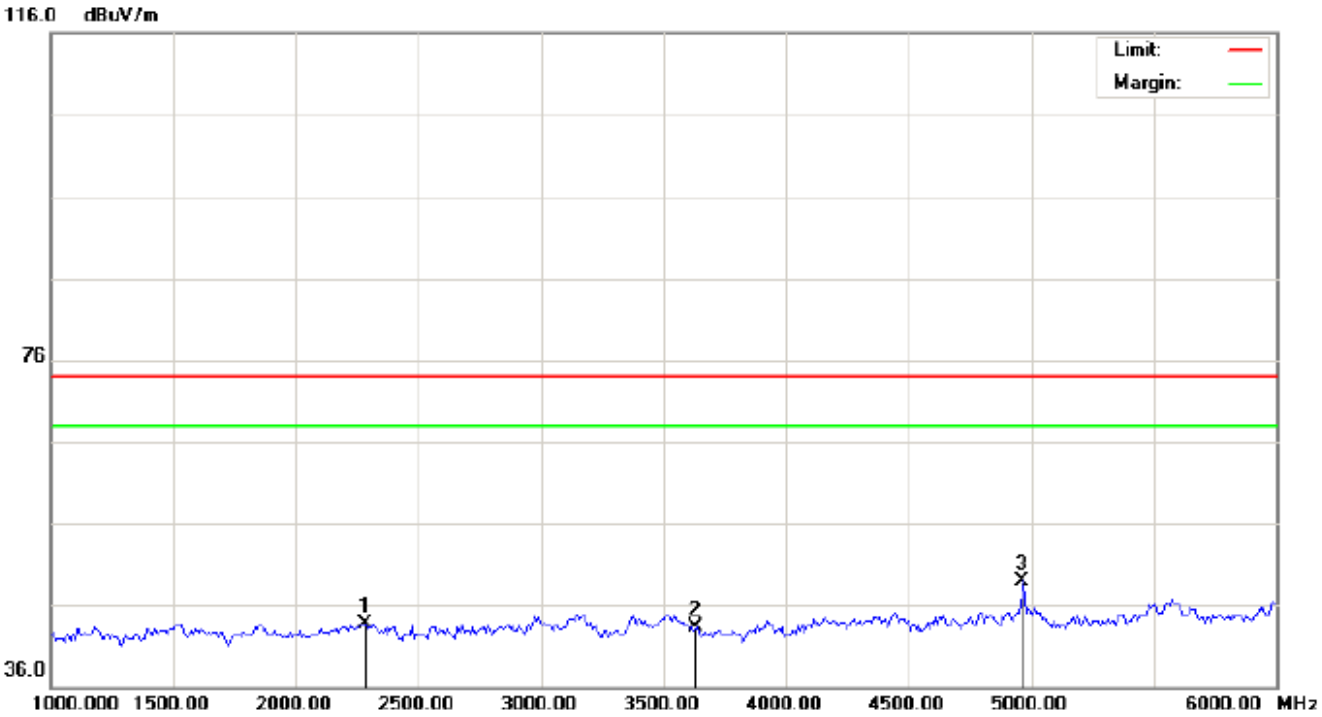
RADIATED EMISSION TEST- (ABOVE 1GHz)-HIGH CHANNEL- VERTICAL




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2283.333 | 33.55 | 10.19 | 43.74 | 74.00 | -30.26 | peak | | | |
| 2 | | 3633.333 | 30.31 | 12.93 | 43.24 | 74.00 | -30.76 | peak | | | |
| 3 | * | 4960.000 | 40.91 | 8.09 | 49.00 | 74.00 | -25.00 | peak | | | |

**RESULT: PASS**

**Note:** 6~25GHz at least have 20dB margin. 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.

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# 10. BAND EDGE EMISSION

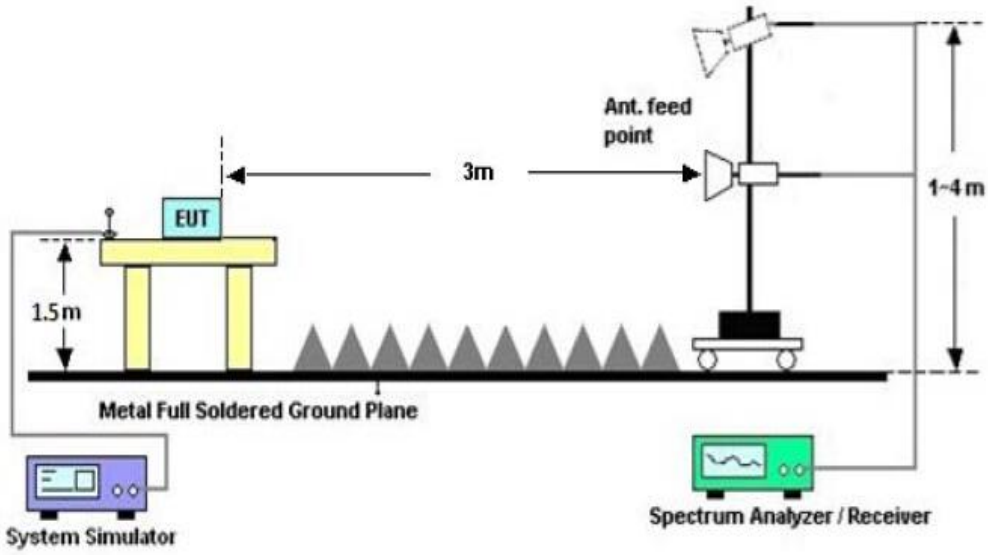
## 10.1. MEASUREMENT PROCEDURE

1. The 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.
2. Max hold the trace of the setup 1, and the EUT operates at hopping-on test mode to verify the largest spurious emissions power.
3. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission.

| Start frequency(MHz) | Stop frequency(MHz) |
|---|---|
| 2200 | 2405 |
| 2478 | 2500 |

## 10.2 TEST SETUP

RADIATED EMISSION TEST SETUP

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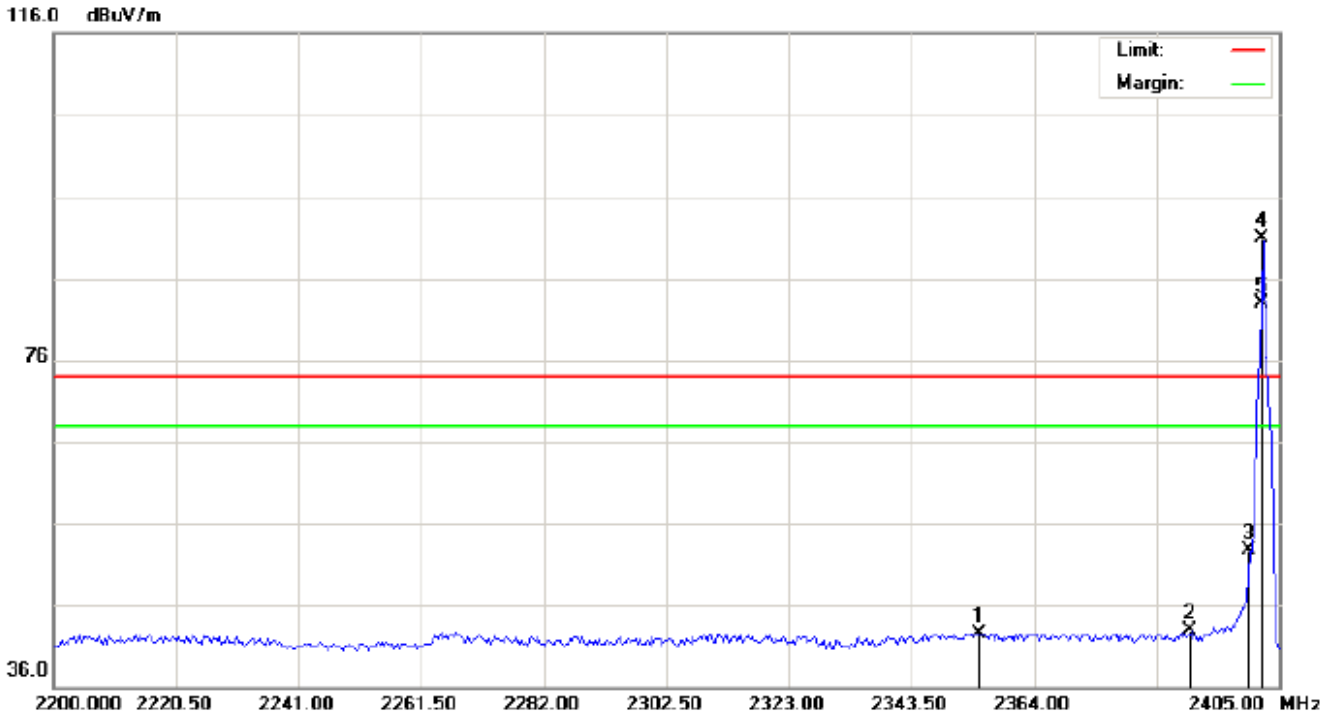
## 10.3 RADIATED TEST RESULT

TEST PLOT OF BAND EDGE FOR LOW CHANNEL-Horizontal




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | - | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2354.775 | 32.30 | 10.27 | 42.57 | 74.00 | -31.43 | peak | | | |
| 2 | | 2390.000 | 32.50 | 10.31 | 42.81 | 74.00 | -31.19 | peak | | | |
| 3 | | 2400.000 | 42.47 | 10.32 | 52.79 | 74.00 | -21.21 | peak | | | |
| 4 | * | 2402.000 | 80.61 | 10.32 | 90.93 | 74.00 | 16.93 | peak | | | |
| 5 | X | 2402.000 | 72.63 | 10.32 | 82.95 | 74.00 | 8.95 | AVG | 100 | 152 | |

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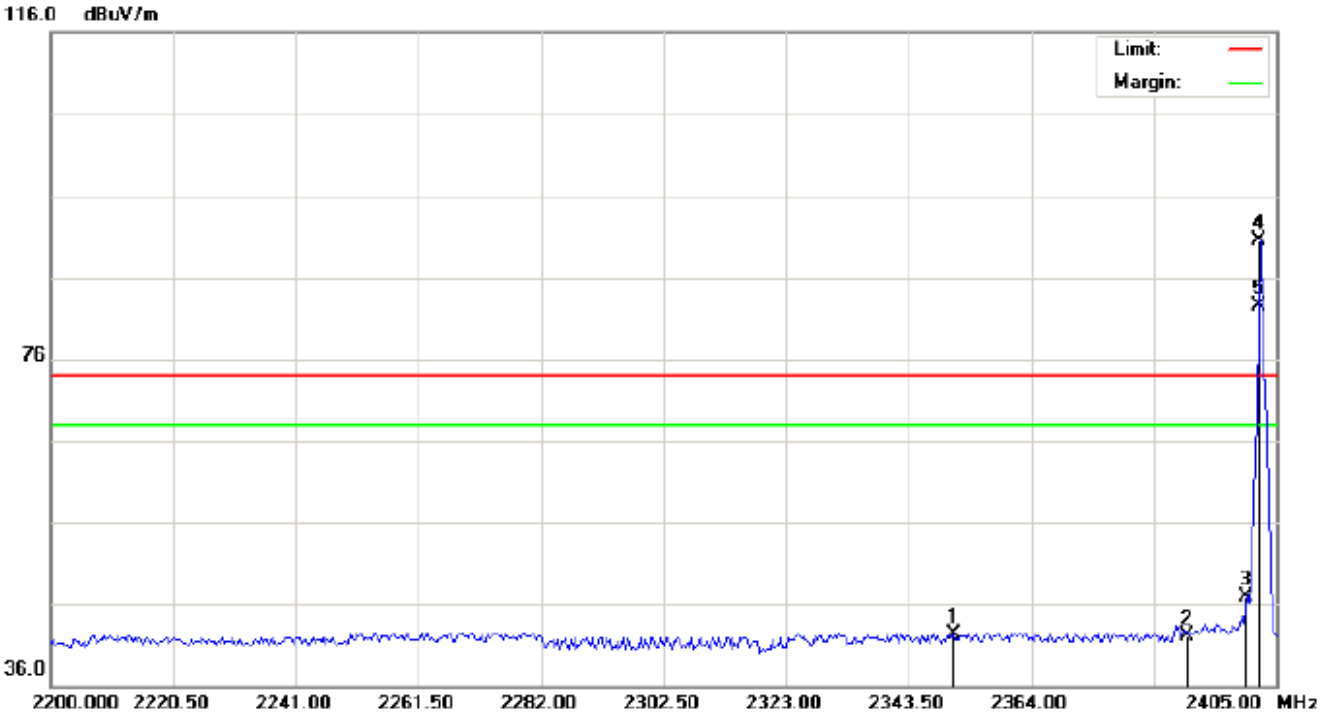
TEST PLOT OF BAND EDGE FOR LOW CHANNEL -Vertical




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | - | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 2351.017 | 32.09 | 10.27 | 42.36 | 74.00 | -31.64 | peak | | | |
| 2 | | 2390.000 | 31.71 | 10.31 | 42.02 | 74.00 | -31.98 | peak | | | |
| 3 | | 2400.000 | 36.56 | 10.32 | 46.88 | 74.00 | -27.12 | peak | | | |
| 4 | * | 2402.000 | 80.13 | 10.32 | 90.45 | 74.00 | 16.45 | peak | | | |
| 5 | X | 2402.000 | 72.10 | 10.32 | 82.42 | 74.00 | 8.42 | AVG | 100 | 330 | |

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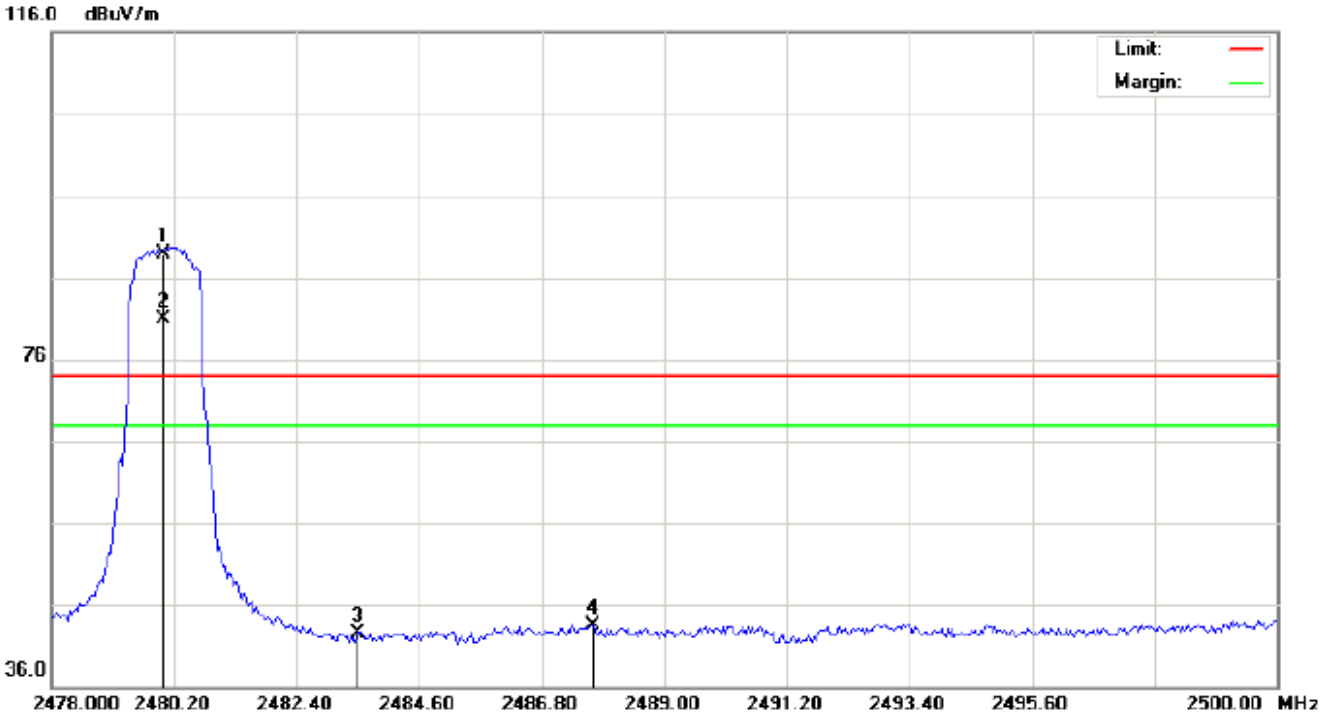
TEST PLOT OF BAND EDGE FOR HIGH CHANNEL -Horizontal




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | - | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | * | 2480.000 | 78.49 | 10.41 | 88.90 | 74.00 | 14.90 | peak | | | |
| 2 | X | 2480.000 | 70.53 | 10.41 | 80.94 | 74.00 | 6.94 | AVG | 100 | 155 | |
| 3 | | 2483.500 | 32.19 | 10.41 | 42.60 | 74.00 | -31.40 | peak | | | |
| 4 | | 2487.716 | 33.18 | 10.42 | 43.60 | 74.00 | -30.40 | peak | | | |

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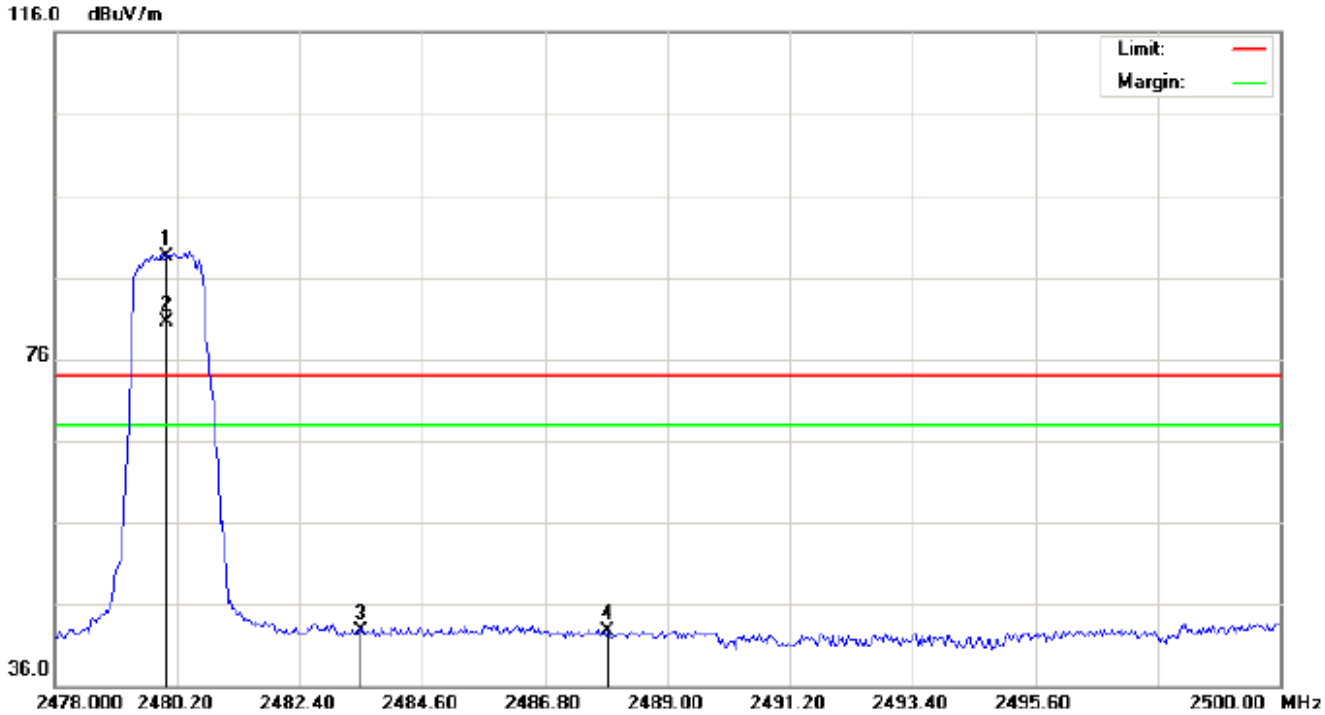
TEST PLOT OF BAND EDGE FOR HIGH CHANNEL-Vertical




| No. | Mk. | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | * | 2480.000 | 78.13 | 10.41 | 88.54 | 74.00 | 14.54 | peak | | | |
| 2 | X | 2480.000 | 70.04 | 10.41 | 80.45 | 74.00 | 6.45 | AVG | 100 | 331 | |
| 3 | | 2483.500 | 32.26 | 10.41 | 42.67 | 74.00 | -31.33 | peak | | | |
| 4 | | 2487.937 | 32.37 | 10.42 | 42.79 | 74.00 | -31.21 | peak | | | |

**RESULT: PASS**

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

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

Hopping on mode and Hopping off mode have been tested, but only worst case reported.

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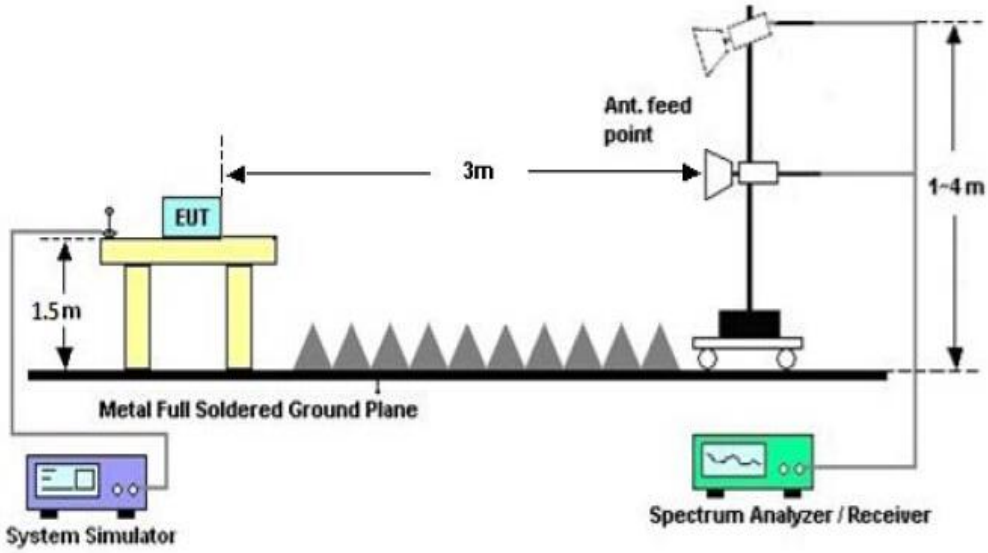
# 11. 20DB BANDWIDTH

## 11.1. MEASUREMENT PROCEDURE

1. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
2. Set Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hoping channel RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ 3RBW; Sweep = auto; Detector function = peak
3. Set SPA Trace 1 Max hold, then View.

## 11.2. TEST SET-UP




## 11.3. LIMITS AND MEASUREMENT RESULTS

| BLUETOOTH 1MBPS LIMITS AND MEASUREMENT RESULT | | | | |
|---|---|---|---|---|
| Applicable Limits | Measurement Result | | | |
| | Test Data (MHz) | | | Result |
| | | 99%OBW (MHz) | -20dB BW(MHz) | |
| N/A | Low Channel | 1.108 | 1.217 | PASS |
| | Middle Channel | 1.111 | 1.225 | PASS |
| | High Channel | 1.114 | 1.212 | PASS |

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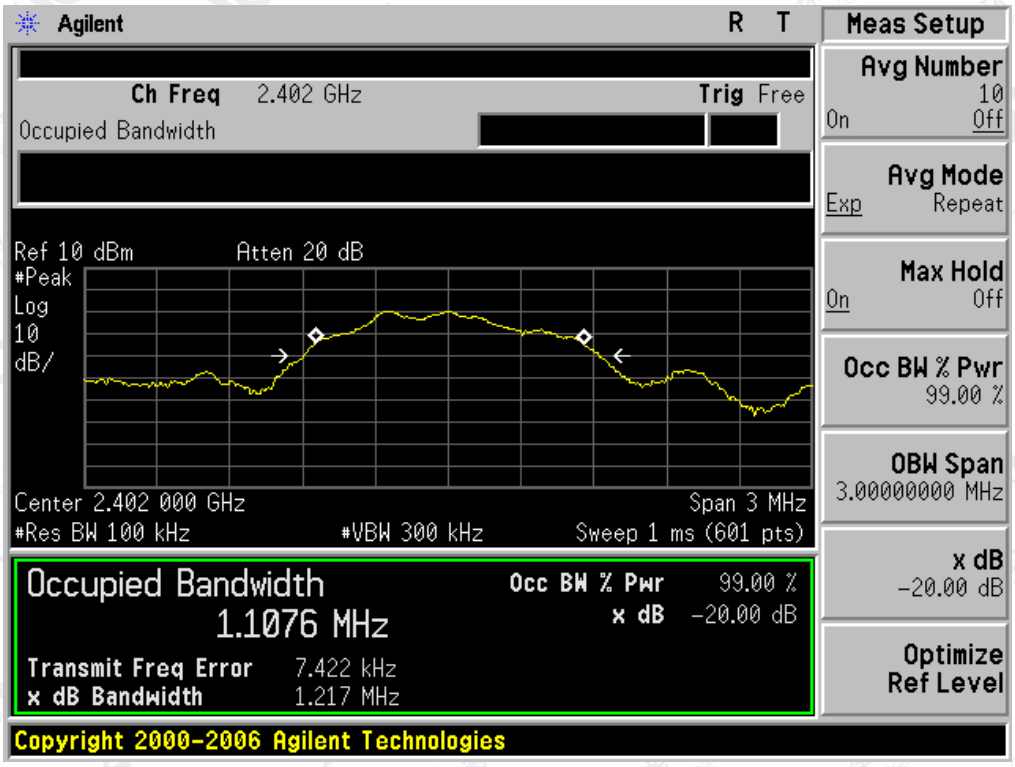
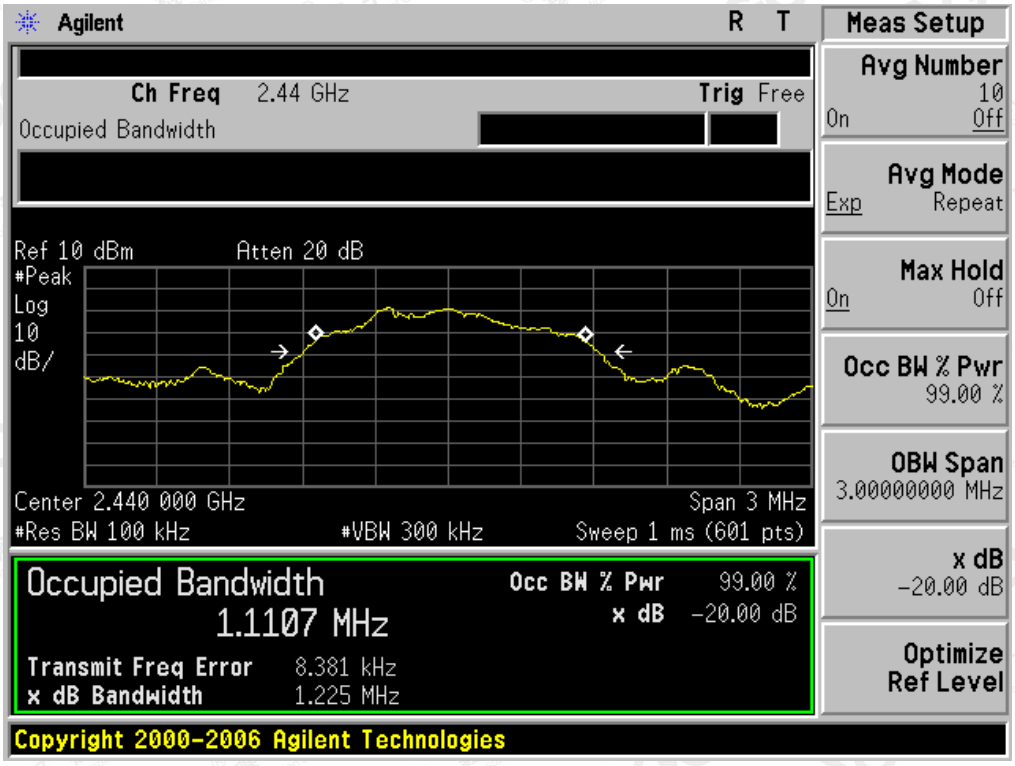
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL




TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

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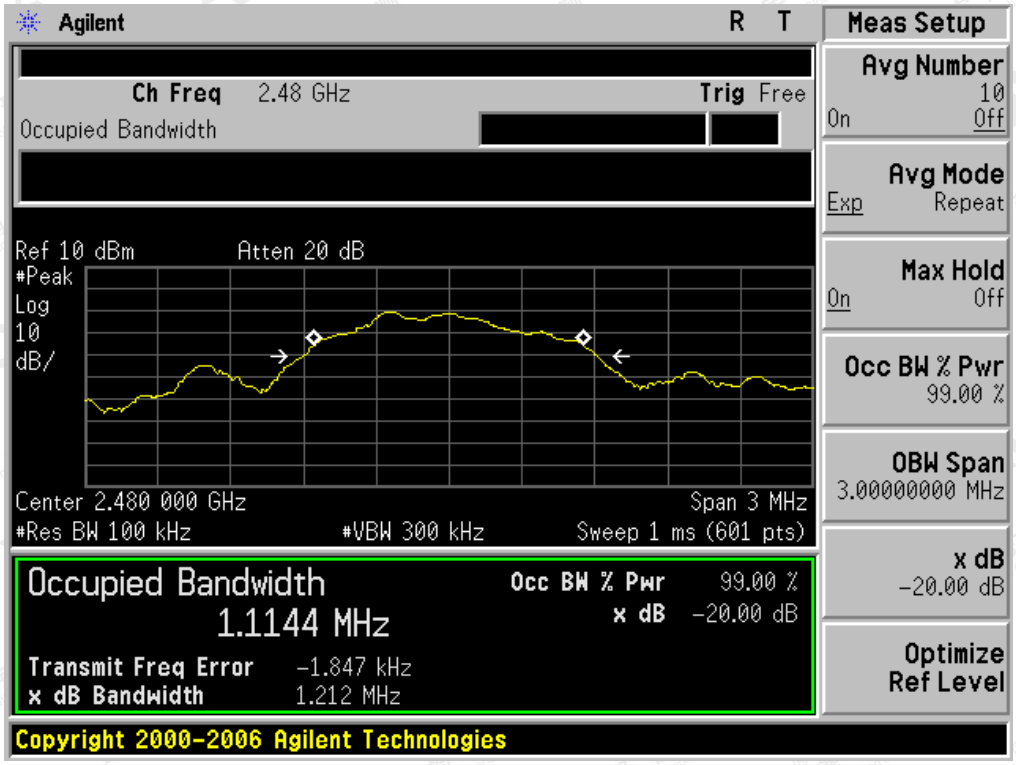
TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

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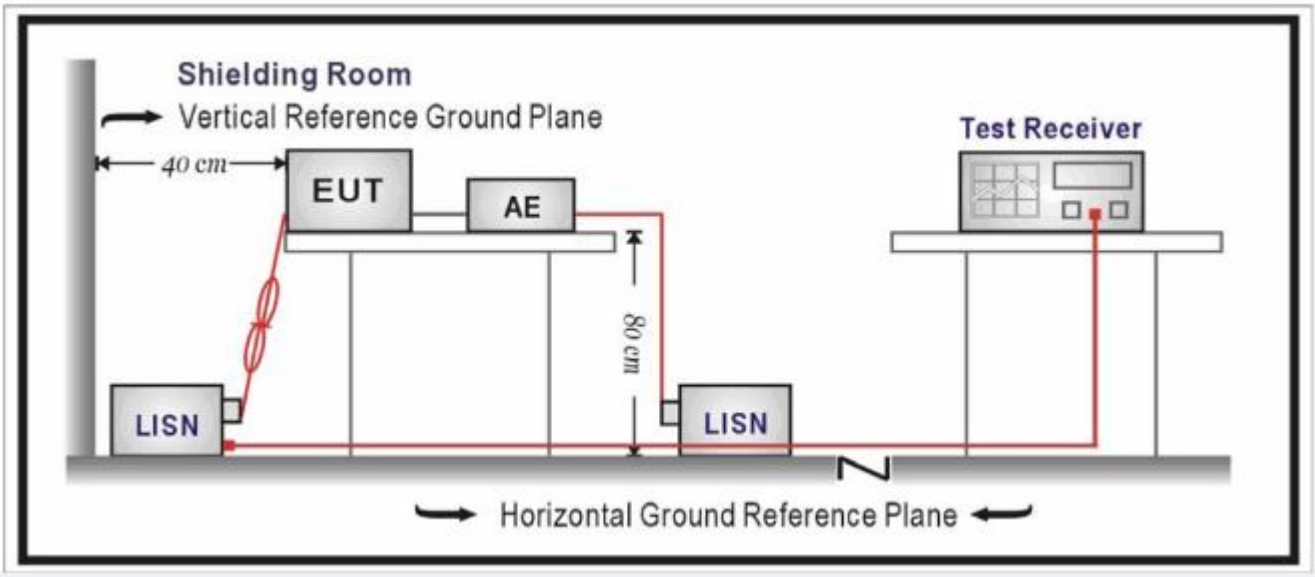
# 12. FCC LINE CONDUCTED EMISSION TEST

## 12.1. 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.

## 12.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST

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## 12.3. 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 C63.10 (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 C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received voltage by adapter or PC which received 120V/60Hzpower 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.

## 12.4. 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.

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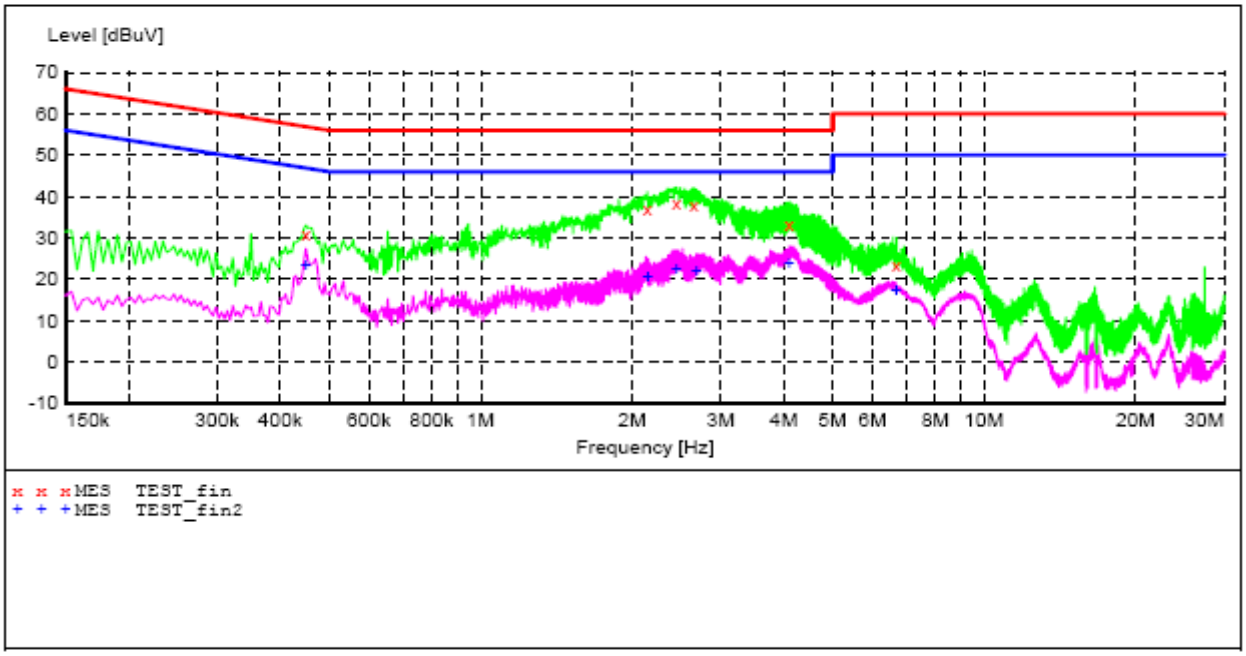
## 12.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

**By adapter(worst case)**

**FOR BR/EDR**

Line Conducted Emission Test Line 1-L




***MEASUREMENT RESULT:***

| Frequency MHz | Level dBuV | Transd dB | Limit dBuV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.450000 | 31.10 | 10.1 | 57 | 25.8 | QP | L1 | FLO |
| 2.142000 | 37.10 | 10.1 | 56 | 18.9 | QP | L1 | FLO |
| 2.450000 | 38.30 | 10.0 | 56 | 17.7 | QP | L1 | FLO |
| 2.654000 | 37.80 | 10.0 | 56 | 18.2 | QP | L1 | FLO |
| 4.102000 | 33.10 | 10.2 | 56 | 22.9 | QP | L1 | FLO |
| 6.698000 | 23.60 | 10.3 | 60 | 36.4 | QP | L1 | FLO |

***MEASUREMENT RESULT:***

| Frequency MHz | Level dBuV | Transd dB | Limit dBuV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.450000 | 23.60 | 10.1 | 47 | 23.3 | AV | L1 | FLO |
| 2.150000 | 20.60 | 10.1 | 46 | 25.4 | AV | L1 | FLO |
| 2.446000 | 22.70 | 10.0 | 46 | 23.3 | AV | L1 | FLO |
| 2.682000 | 22.10 | 10.0 | 46 | 23.9 | AV | L1 | FLO |
| 4.102000 | 23.90 | 10.2 | 46 | 22.1 | AV | L1 | FLO |
| 6.690000 | 17.50 | 10.3 | 50 | 32.5 | AV | L1 | FLO |

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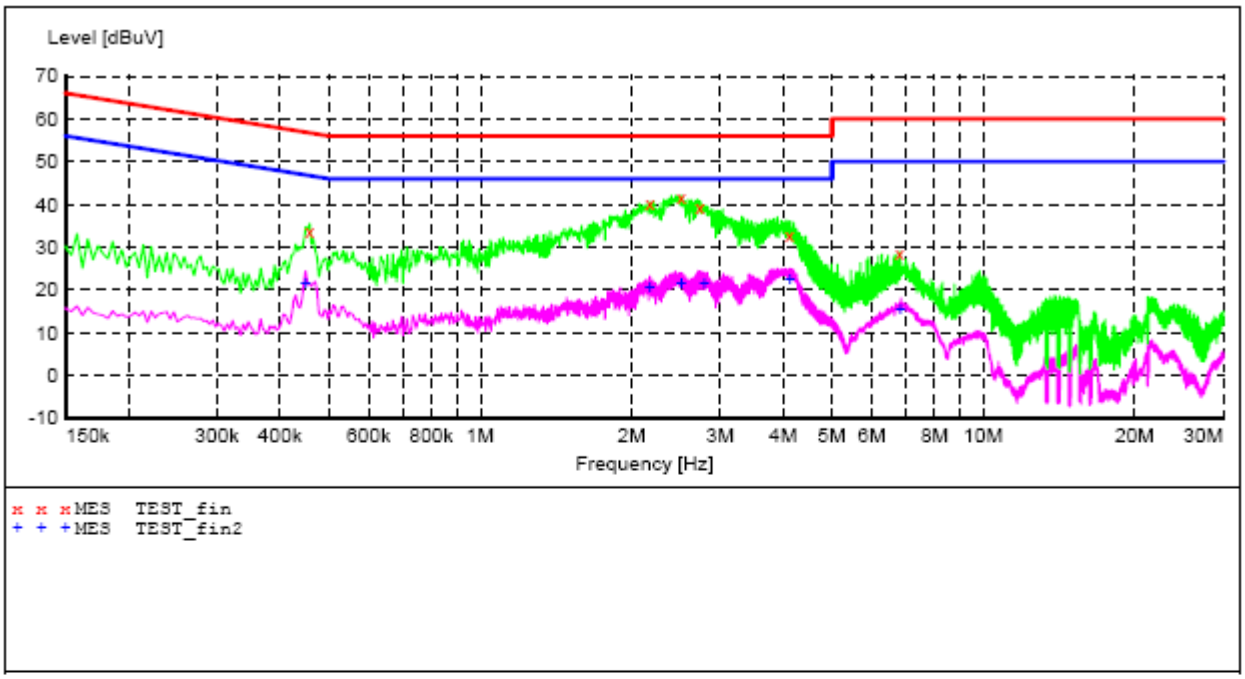
Line Conducted Emission Test Line 2-N




***MEASUREMENT RESULT:***

| Frequency MHz | Level dBuV | Transd dB | Limit dBuV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.458000 | 33.80 | 20.0 | 57 | 22.9 | QP | N | FLO |
| 2.174000 | 40.10 | 19.8 | 56 | 15.9 | QP | N | FLO |
| 2.510000 | 41.50 | 19.8 | 56 | 14.5 | QP | N | FLO |
| 2.734000 | 39.40 | 19.8 | 56 | 16.6 | QP | N | FLO |
| 4.118000 | 32.60 | 19.9 | 56 | 23.4 | QP | N | FLO |
| 6.822000 | 28.50 | 19.9 | 60 | 31.5 | QP | N | FLO |

***MEASUREMENT RESULT:***

| Frequency MHz | Level dBuV | Transd dB | Limit dBuV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.450000 | 21.40 | 20.0 | 47 | 25.5 | AV | N | FLO |
| 2.174000 | 20.70 | 19.8 | 46 | 25.3 | AV | N | FLO |
| 2.510000 | 21.70 | 19.8 | 46 | 24.3 | AV | N | FLO |
| 2.790000 | 21.50 | 19.8 | 46 | 24.5 | AV | N | FLO |
| 4.126000 | 22.50 | 19.9 | 46 | 25.5 | AV | N | FLO |
| 6.850000 | 15.50 | 19.9 | 50 | 34.5 | AV | N | FLO |

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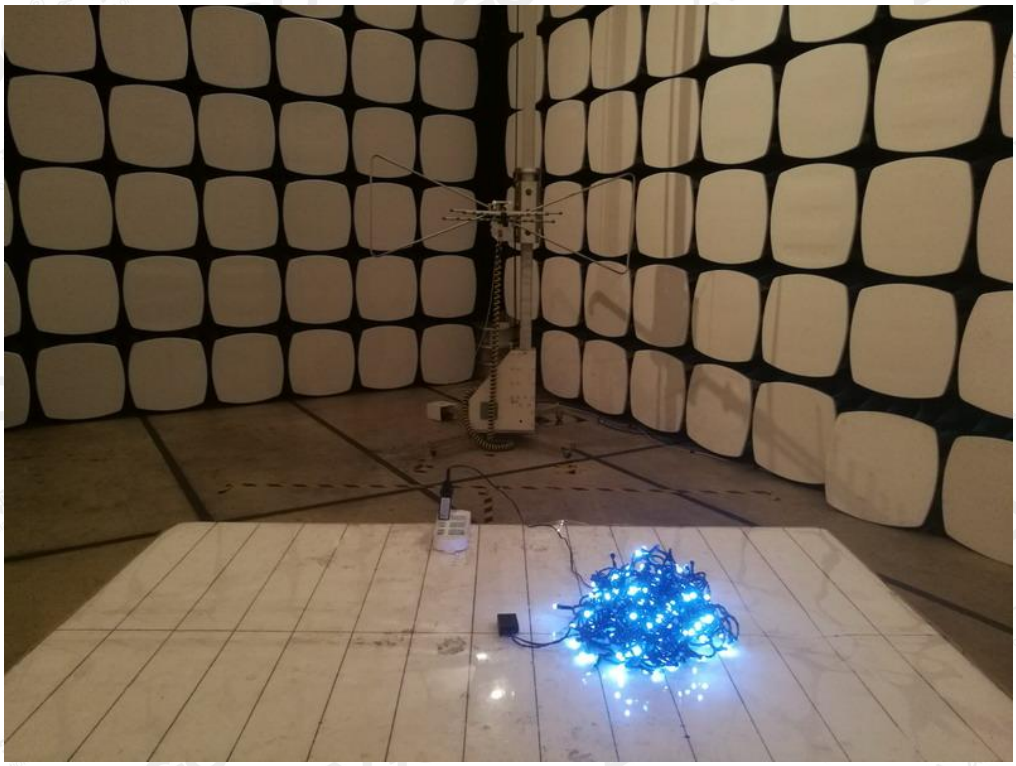
# APPENDIX A: PHOTOGRAPHS OF TEST SETUP

FCC LINE CONDUCTED EMISSION TEST SETUP

FCC RADIATED EMISSION TEST SETUP



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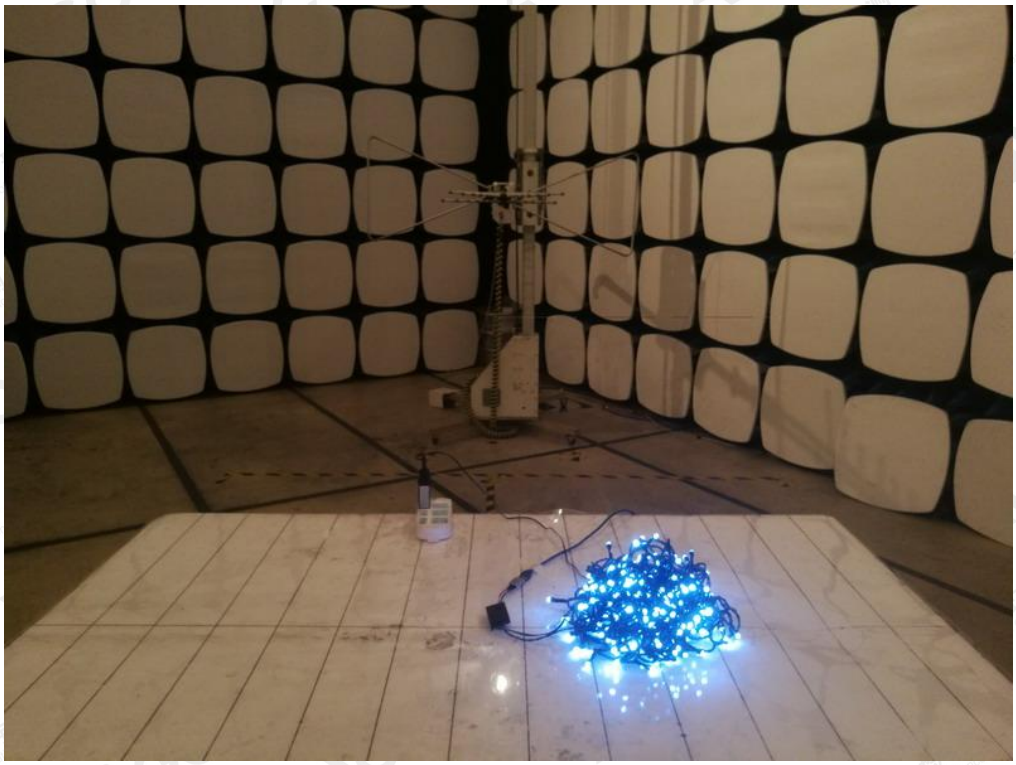

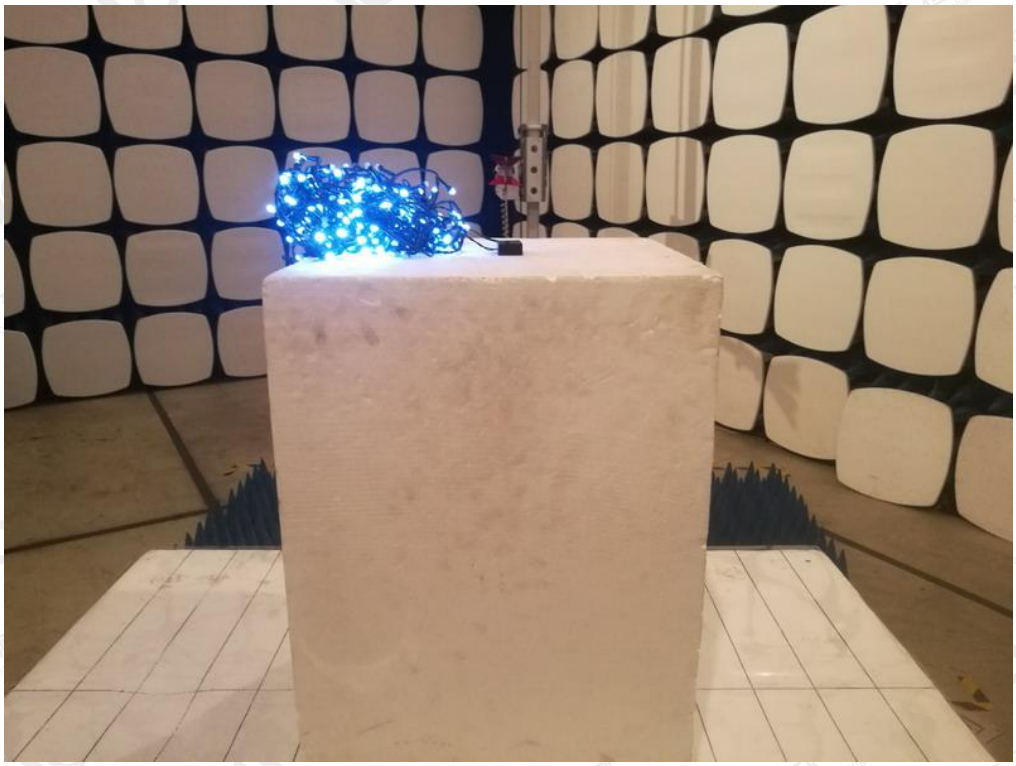

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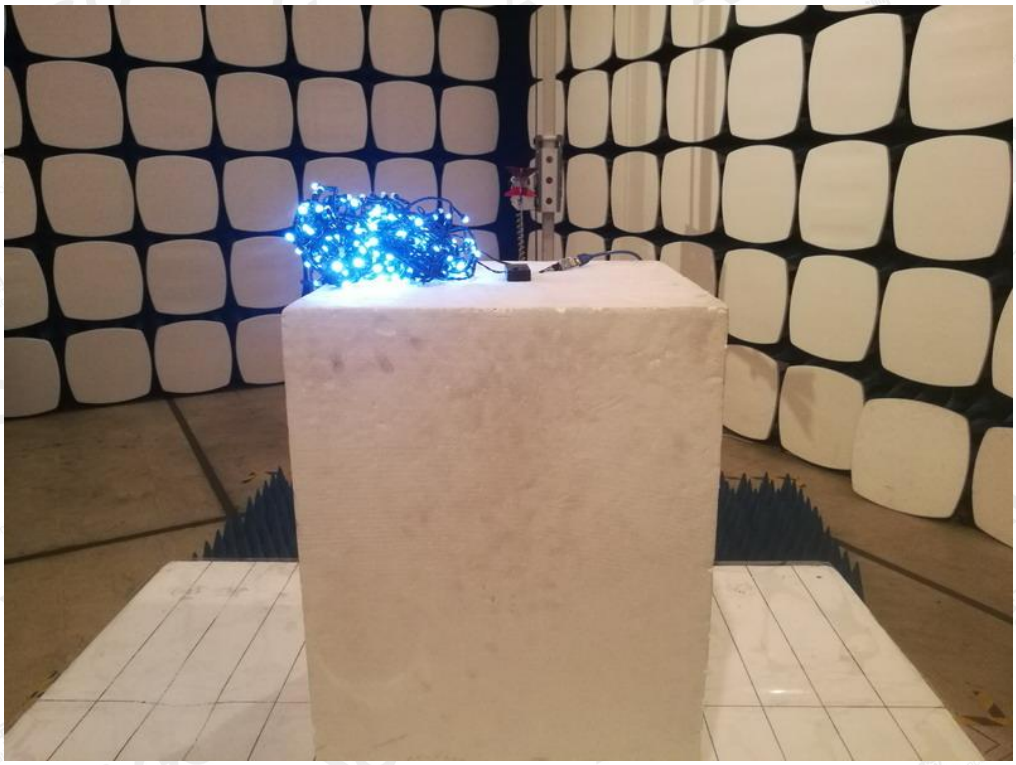

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# APPENDIX B: PHOTOGRAPHS OF EUT

TOTAL VIEW OF EUT

TOP VIEW OF EUT

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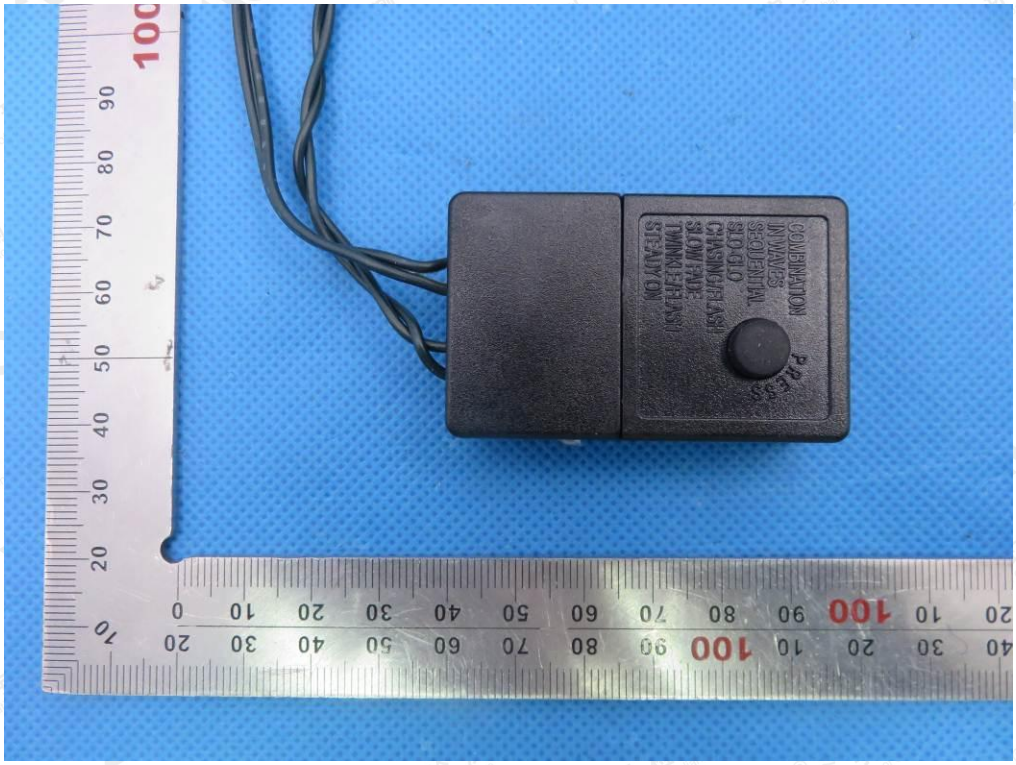
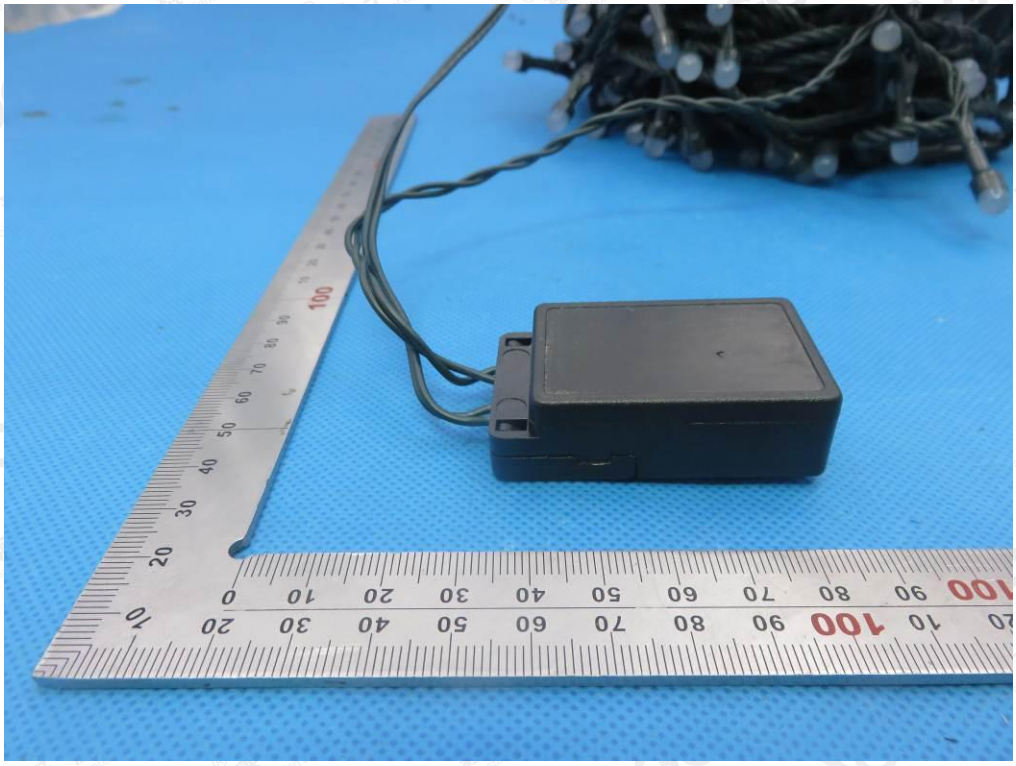
BOTTOM VIEW OF EUT




FRONT VIEW OF EUT



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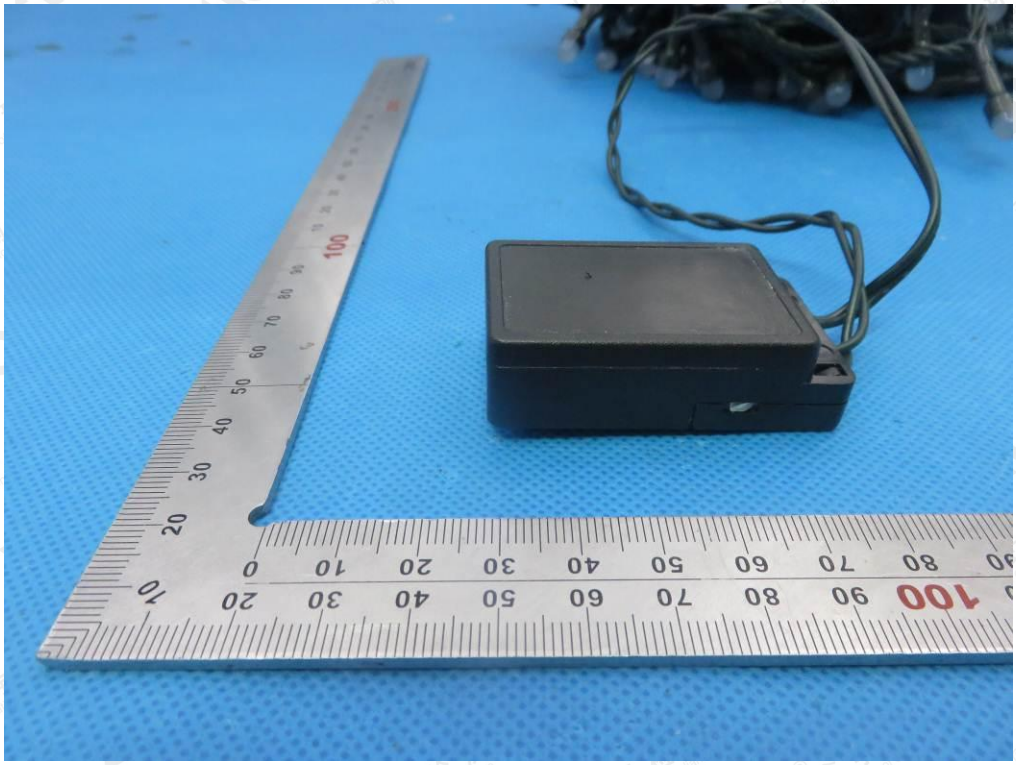
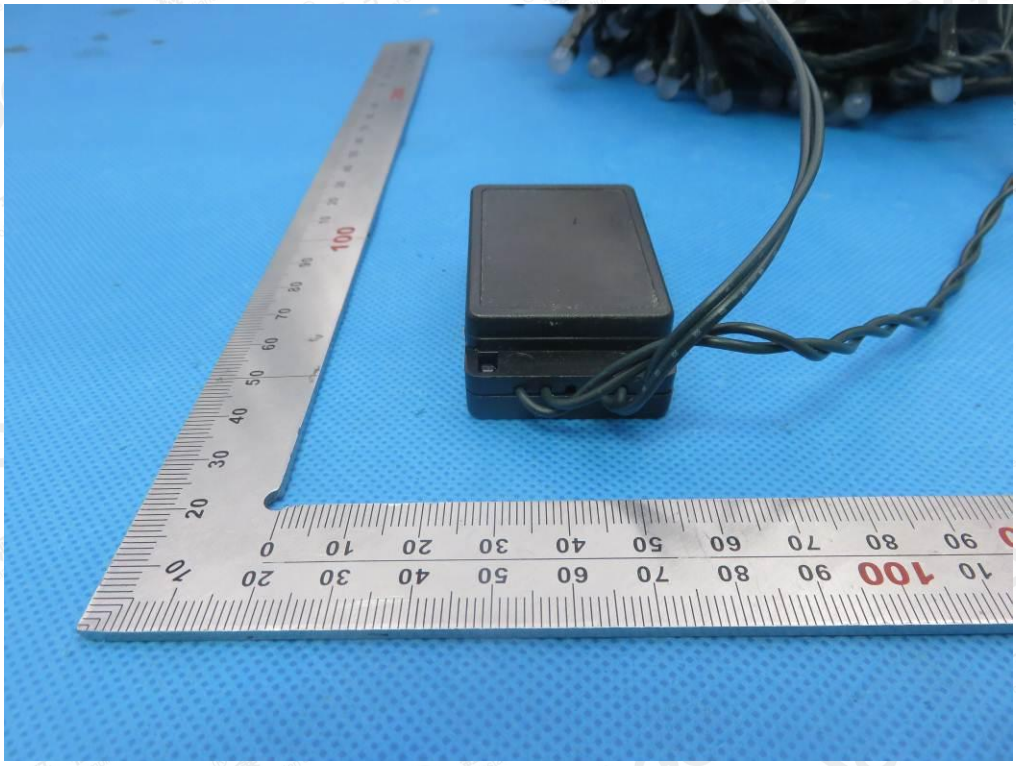
BACK VIEW OF EUT



LEFT VIEW OF EUT



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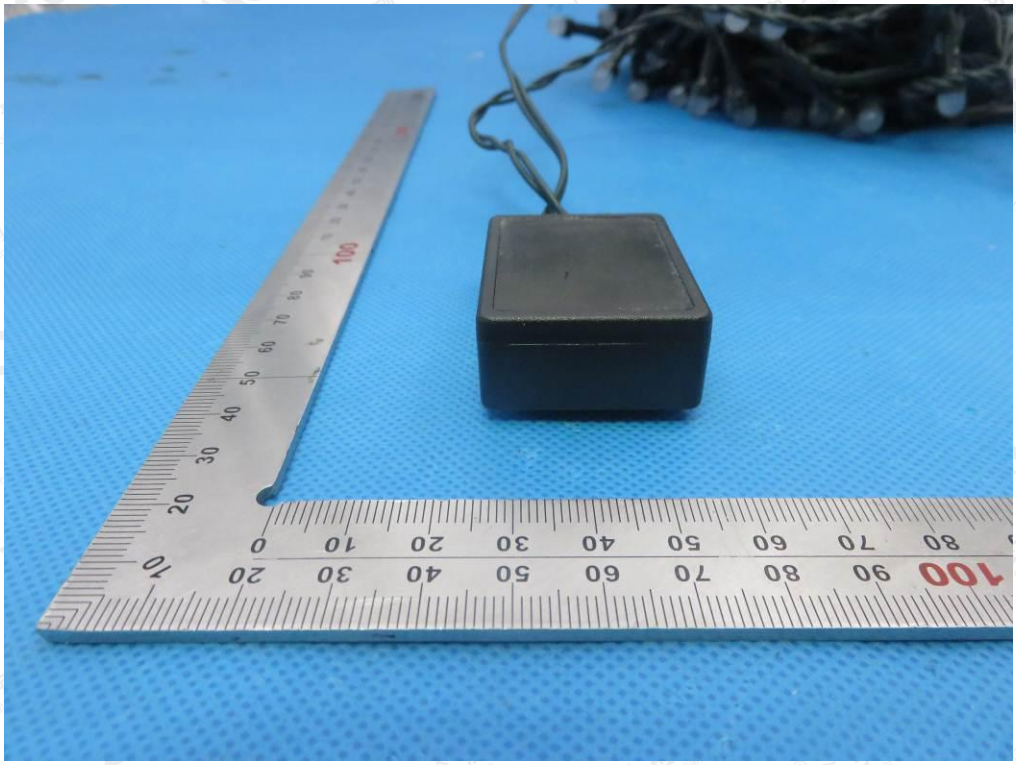
RIGHT VIEW OF EUT



VIEW OF EUT (PORT)

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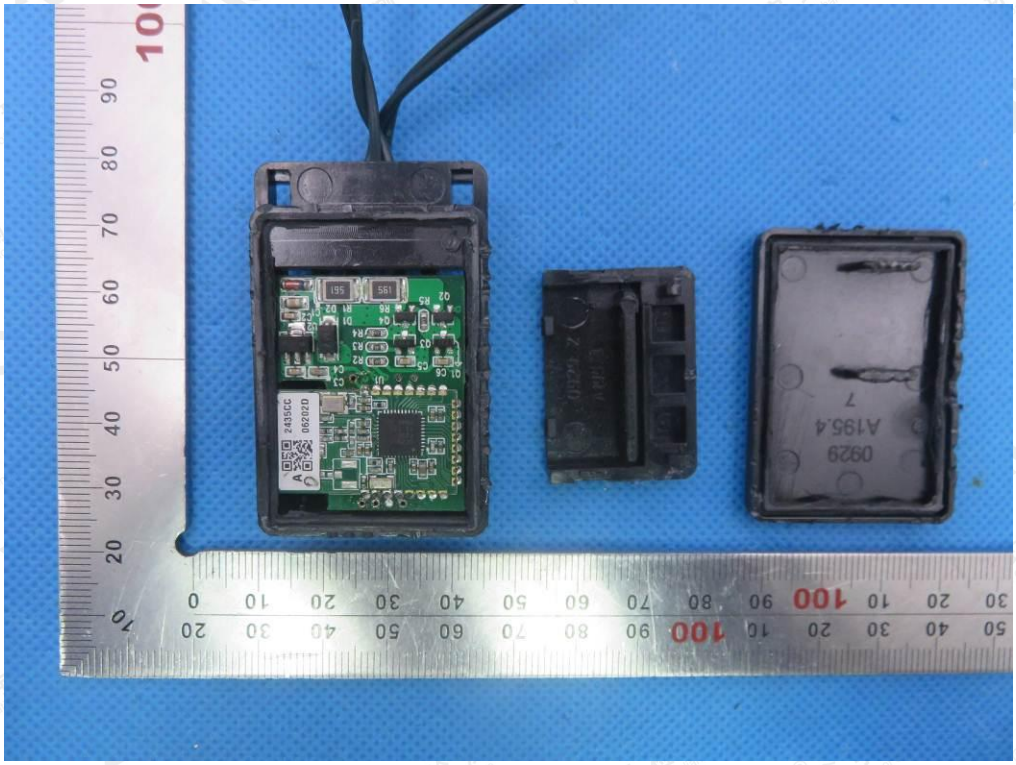
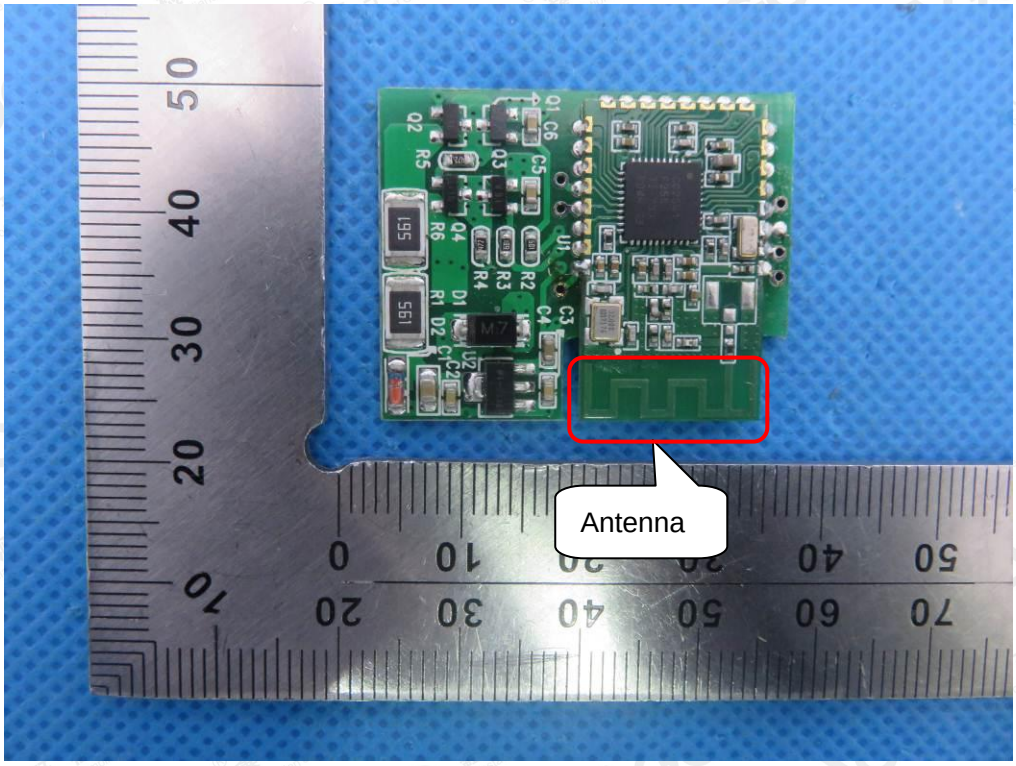
OPEN VIEW OF EUT



INTERNAL VIEW OF EUT-1

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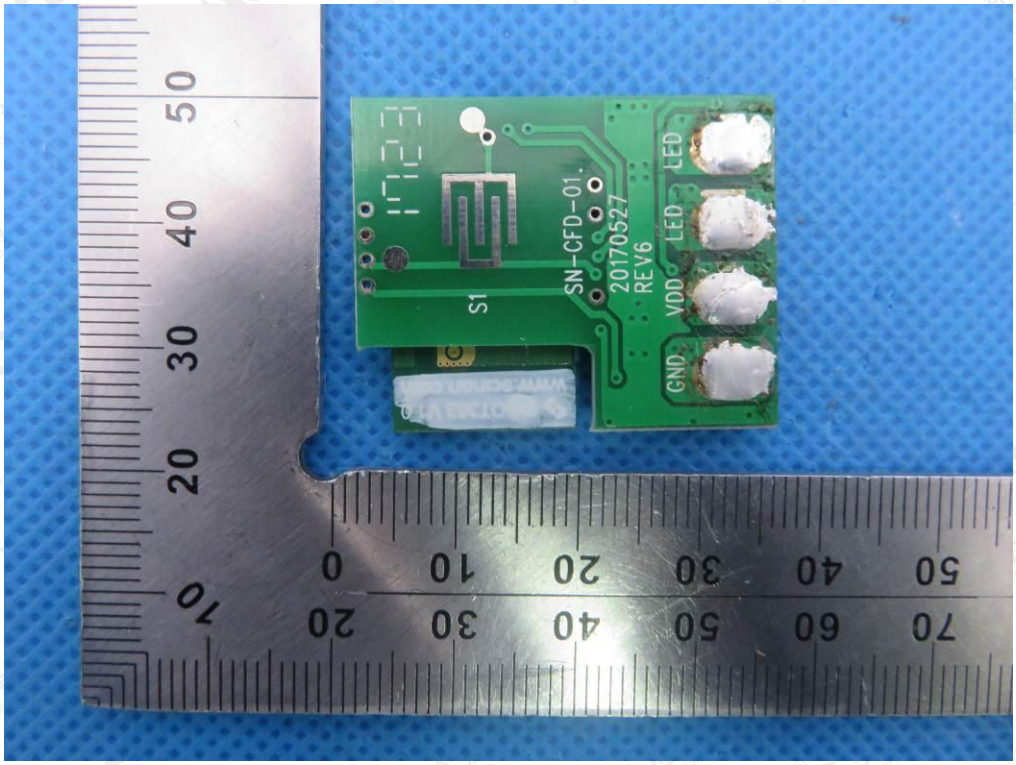
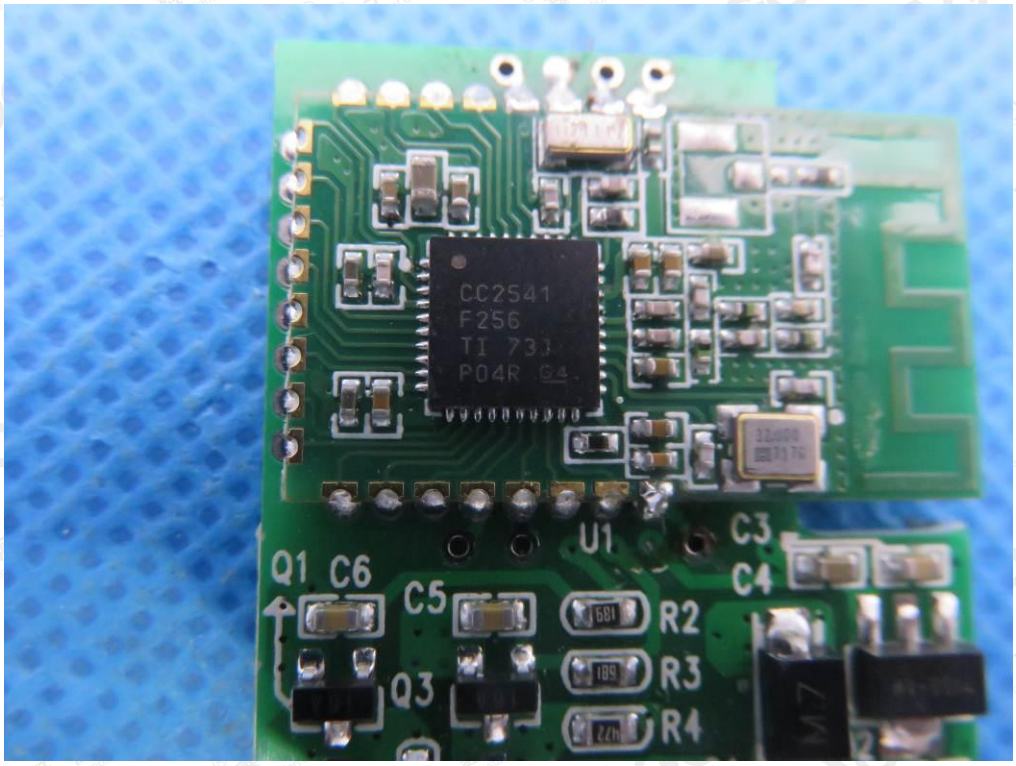
INTERNAL VIEW OF EUT-2




INTERNAL VIEW OF EUT-3

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VIEW OF ADAPTER

**----END OF REPORT----**

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