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# FCC RADIO TEST REPORT

| | |
|---|---|
| Applicant's company | **Cisco Systems, Inc.** |
| Applicant Address | 170 West Tasman Drive San Jose, CA 95134 USA |
| FCC ID | **UDX-60041010** |
| Manufacturer's company | **Accton Technology Corporation** |
| Manufacturer Address | 1, Creation Road 3, Hsinchu Science Park Hsinchu 20077, Taiwan R.O.C. |

| | |
|---|---|
| Product Name | 802.11a/b/g/n/ac Wireless Access Point |
| Brand Name | CISCO |
| Model Name | MR52-HW |
| Test Rule | 47 CFR FCC Part 15 Subpart C § 15.247 |
| Test Freq. Range | 2402 ~ 2480MHz |
| Received Date | Aug. 31, 2015 |
| Final Test Date | Dec. 22, 2015 |
| Submission Type | Original Equipment |

## Statement

**Test result included is only for the Bluetooth LE of the product.**

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2013**, **47 CFR FCC Part 15 Subpart C** and **KDB558074 D01 v03r04**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.

Testing Laboratory
1190

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# History of This Test Report

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|---|---|---|---|
| FR590419AC | Rev. 01 | Initial issue of report | Jan. 15, 2016 |
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# 1. VERIFICATION OF COMPLIANCE

| | | |
|---|---|---|
| Product Name | : | 802.11a/b/g/n/ac Wireless Access Point |
| Brand Name | : | CISCO |
| Model No. | : | MR52-HW |
| Applicant | : | Cisco Systems, Inc. |
| Test Rule Part(s) | : | 47 CFR FCC Part 15 Subpart C § 15.247 |

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Aug. 31, 2015 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.

Sam Chen

Sam Chen

SPORTON INTERNATIONAL INC.

## 2. SUMMARY OF THE TEST RESULT

| Applied Standard: 47 CFR FCC Part 15 Subpart C | | | | |
|---|---|---|---|---|
| Part | Rule Section | Description of Test | Result | Under Limit |
| 4.1 | 15.207 | AC Power Line Conducted Emissions | Complies | 7.67 dB |
| 4.2 | 15.247(b)(3) | Maximum Conducted Output Power | Complies | 28.38 dB |
| 4.3 | 15.247(e) | Power Spectral Density | Complies | 27.28 dB |
| 4.4 | 15.247(a)(2) | 6dB Spectrum Bandwidth | Complies | - |
| 4.5 | 15.247(d) | Radiated Emissions | Complies | 3.17 dB |
| 4.6 | 15.247(d) | Band Edge Emissions | Complies | 3.07 dB |
| 4.7 | 15.203 | Antenna Requirements | Complies | - |

# 3. GENERAL INFORMATION

## 3.1. Product Details

| Items | Description |
|---|---|
| Power Type | From power adapter or PoE |
| Modulation | DSSS |
| Data Rate (Mbps) | GFSK: 1 |
| Frequency Range | 2402 ~ 2480MHz |
| Channel Number | 40 (37 hopping + 3 advertising channel) |
| Channel Band Width (99%) | 1.06 MHz |
| Maximum Conducted Output Power | 1.62 dBm |
| Carrier Frequencies | Please refer to section 3.4 |
| Antenna | Please refer to section 3.3 |

## 3.2. Accessories

Wall-mounted rack*1

## 3.3. Table for Filed Antenna

| Radio | Ant. | Brand | P/N | Antenna Type | Connector | Gain | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | 2.4GHz | 5GHz | Buletooth |
| Radio 1 | 1 | Accton | 120G00000132A | Metal | MHF | Note | | - |
| | 2 | Accton | 120G00000132A | Metal | MHF | | | |
| | 3 | Accton | 120G00000132A | Metal | MHF | | | |
| | 4 | Accton | 120G00000132A | Metal | MHF | | | |
| Radio 2 | 5 | Accton | 120G00000132A | Metal | MHF | | | |
| | 6 | Accton | 120G00000132A | Metal | MHF | | | |
| | 7 | Accton | 120G00000132A | Metal | MHF | | | |
| | 8 | Accton | 120G00000132A | Metal | MHF | | | |
| Radio 3 | 9 | Accton | 120G00000134A | Metal | MHF | 4.32 | 5.72 | - |
| Radio 4 | 10 | Accton | 120G00000133A | Metal | MHF | - | - | 4.99 |

Note:

<Radio 1>

| Ant. | Frequency (MHz) | | |
|---|---|---|---|
| | 2412, 2422 | 2437 | 2452, 2462 |
| 1 | 2.97 | 3.72 | 3.89 |
| 2 | 3.34 | 3.62 | 3.51 |
| 3 | 3.42 | 3.69 | 4.10 |
| 4 | 4.99 | 5.04 | 4.38 |

| Frequency (MHz) | Correlated Composite Gain | | | Uncorrelated Composite Gain |
|---|---|---|---|---|
| | (4TX, 1S) | (4TX, 2S) | (4TX, 3S) | (4TX, 4S) |
| 2412, 2422 | 7.15 | 4.43 | 2.67 | 1.42 |
| 2437 | 7.02 | 4.45 | 2.68 | 1.44 |
| 2452, 2462 | 6.87 | 4.44 | 2.68 | 1.43 |

<Radio 2>

| Ant. | Band 1 | Band 4 |
|---|---|---|
| 5 | 3.85 | 5.58 |
| 6 | 5.24 | 5.74 |
| 7 | 4.97 | 6.44 |
| 8 | 5.05 | 5.10 |

| Band | Correlated Composite Gain | | | Uncorrelated Composite Gain |
|---|---|---|---|---|
| | (4TX, 1S) | (4TX, 2S) | (4TX, 3S) | (4TX, 4S) |
| 1 | 6.97 | 4.94 | 3.18 | 1.93 |
| 4 | 10.05 | 7.16 | 5.40 | 4.15 |

Note: The EUT has ten antennas.

The EUT has four radios, Radio 1 supports WLAN 2.4GHz, Radio 2 supports WLAN 5GHz, Radio 3 supports WLAN 2.4GHz + 5GHz (scanning radio) and Radio 4 supports Bluetooth function.

<For Radio 1 / 2.4GHz Function>

Chain 1, Chain 2, Chain 3 and Chain 4 can be used as transmitting/receiving antenna.

Chain 1, Chain 2, Chain 3 and Chain 4 could transmit/receive simultaneously.

<For Radio 2 / 5GHz Function>

Chain 5, Chain 6, Chain 7 and Chain 8 can be used as transmitting/receiving antenna.

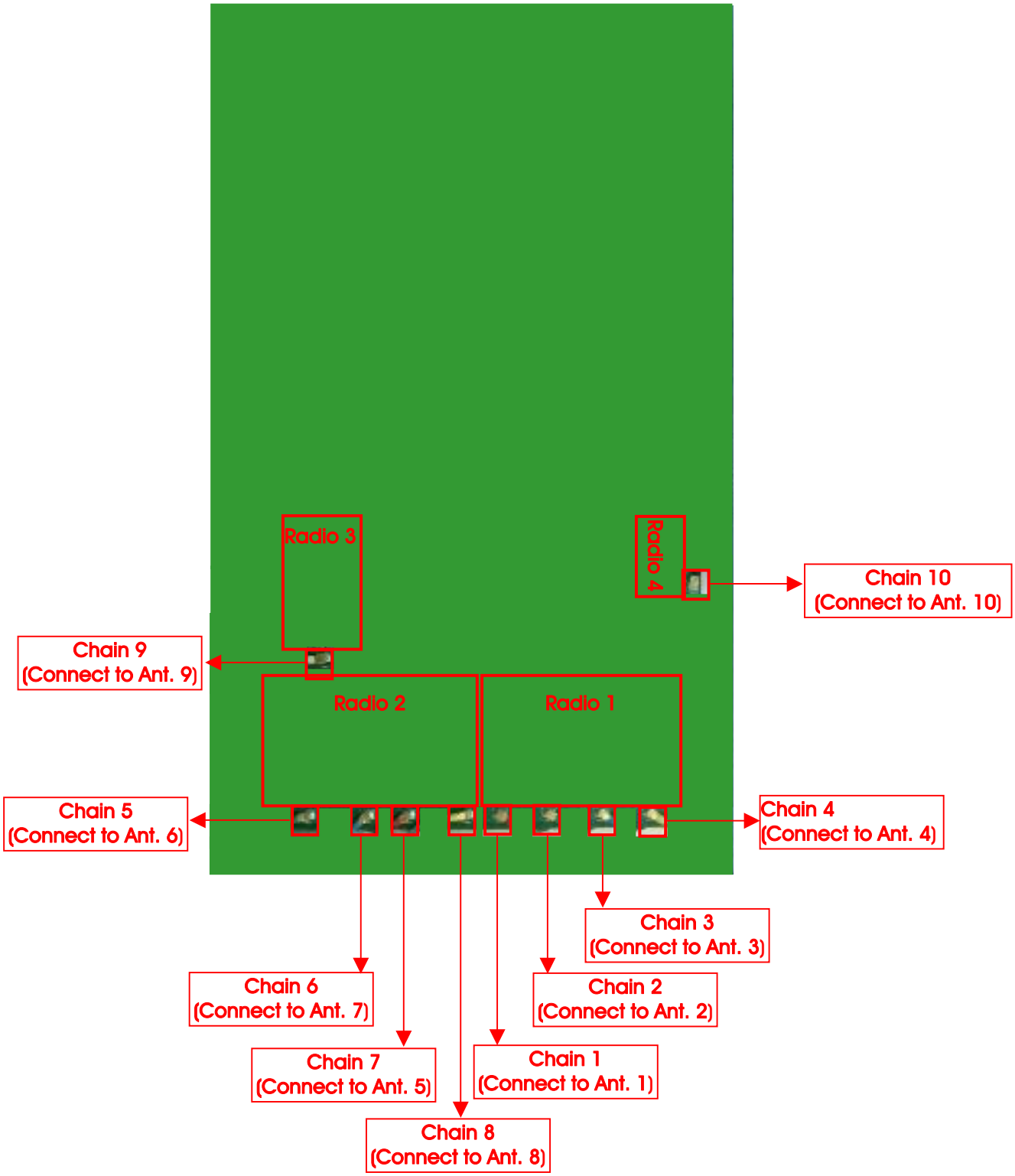
Chain 5, Chain 6, Chain 7 and Chain 8 could transmit/receive simultaneously.

<<For Radio 3 Mode> / 2.4GHz + 5GHz Functions>

Only Chain 9 could transmit/receive.

<For Radio 4 / Bluetooth Functions>

Only Chain 10 could transmit/receive.


Radio 3
Radio 4
Chain 10
(Connect to Ant. 10)
Chain 9
(Connect to Ant. 9)
Radio 2
Radio 1
Chain 5
(Connect to Ant. 6)
Chain 4
(Connect to Ant. 4)
Chain 3
(Connect to Ant. 3)
Chain 6
(Connect to Ant. 7)
Chain 2
(Connect to Ant. 2)
Chain 7
(Connect to Ant. 5)
Chain 1
(Connect to Ant. 1)
Chain 8
(Connect to Ant. 8)

## 3.4. Table for Carrier Frequencies

| Frequency Band | Channel No. | Frequency | Channel No. | Frequency |
|---|---|---|---|---|
| 2400~2483.5MHz | 0 | 2402 MHz | 20 | 2442 MHz |
| | 1 | 2404 MHz | : | : |
| | 2 | 2406 MHz | 37 | 2476 MHz |
| | : | : | 38 | 2478 MHz |
| | 18 | 2438 MHz | 39 | 2480 MHz |
| | 19 | 2440 MHz | - | - |

## 3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Test Items | Mode | Data Rate | Channel | Chain |
|---|---|---|---|---|
| AC Power Line Conducted Emissions | Normal Link | - | - | - |
| Maximum Conducted Output Power<br>Power Spectral Density | GFSK | 1 Mbps | 0/20/39 | 10 |
| 6dB Spectrum Bandwidth | GFSK | 1 Mbps | 0/20/39 | 10 |
| Radiated Emissions 9kHz~1GHz | Normal Link | - | - | - |
| Radiated Emissions 1GHz~10th Harmonic | GFSK | 1 Mbps | 0/20/39 | 10 |
| Band Edge Emissions | GFSK | 1 Mbps | 0/20/39 | 10 |

Note: Adapter and PoE information as below, and the Adapter and PoE are for measurement only, would not be marketed.

| Power | Brand | Model |
|---|---|---|
| Adapter | ITE | MU30-5120250-A1 |
| Adapter | APD | WA-30B12FU |
| PoE | Motorola | PD-7001G |

The following test modes were performed for all tests:

| Conducted Emission test | |
|---|---|
| Mode | Description |
| 1 | Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (2.4GHz WLAN function) + Bluetooth with Adapter |
| 2 | Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (5GHz WLAN function) + Bluetooth with Adapter |
| Mode 1 generated the worst test result, so it was recorded in this report. | |

| Radiated Emission test<Below 1GHz> | |
|---|---|
| Mode | Description |
| 1 | Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (2.4GHz WLAN function) + Bluetooth with Adapter - Z axis |
| 2 | Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (2.4GHz WLAN function) + Bluetooth with Adapter - Y axis |
| Mode 2 has been evaluated to be the worst case between Mode 1~2, thus measurement for Mode 3 will follow this same test mode. | |
| 3 | Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (2.4GHz WLAN function) + Bluetooth with PoE - Y axis |
| Mode 3 has been evaluated to be the worst case among Mode 1~3, thus measurement for Mode 4 will follow this same test mode. | |
| 4 | Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (5GHz WLAN function) + Bluetooth with PoE - Y axis |
| Mode 3 generated the worst test result, so it was recorded in this report. | |

| Radiated Emission test<Above 1GHz> | |
|---|---|
| The EUT was performed at X axis, Y axis and Z axis position for Radiated emission above 1GHz test, and the worst case was found at Y axis. So the measurement will follow this same test configuration. | |
| Mode | Description |
| 1 | CTX - Y axis |

| Co-location MPE and Radiated Emission Co-location Test | |
|---|---|
| Mode | Description |
| 1 | Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (2.4GHz WLAN function) + Bluetooth |
| 2 | Radio 1 (2.4GHz WLAN function) + Radio 2 (5GHz WLAN function) + Radio 3 (5GHz WLAN function) + Bluetooth |
| Therefore Co-location Maximum Permissible Exposure (Please refer to FA590419) and Radiated Emission Co-location (please refer to Appendix B) tests are added for simultaneously transmit. | |

## 3.6. Table for Testing Locations

| Test Site Location | | | | |
|---|---|---|---|---|
| Address: | No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C. | | | |
| TEL: | 886-3-656-9065 | | | |
| FAX: | 886-3-656-9085 | | | |
| Test Site No. | Site Category | Location | FCC Reg. No. | IC File No. |
| 03CH01-CB | SAC | Hsin Chu | 262045 | IC 4086D |
| CO01-CB | Conduction | Hsin Chu | 262045 | IC 4086D |
| TH01-CB | OVEN Room | Hsin Chu | - | - |

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).

## 3.7. Table for Supporting Units

For Test Site No: 03CH01-CB (Below 1GHz)

| Support Unit | Brand | Model | FCC ID |
|---|---|---|---|
| NB*5 | DELL | E4300 | DoC |
| NB | Apple | Mac Book | DoC |
| PoE | Motorola | PD-7001G | DoC |
| Bluetooth dongle | WPI | CC2540 | DoC |

For Test Site No: 03CH01-CB (Above 1GHz)

| Support Unit | Brand | Model | FCC ID |
|---|---|---|---|
| NB | DELL | E4300 | DoC |
| Adapter | APD | WA-30B12FU | N/A |

For Test Site No: CO01-CB

| Support Unit | Brand | Model | FCC ID |
|---|---|---|---|
| NB*6 | DELL | E6430 | DoC |
| Bluetooth dongle | WPI | CC2540 | DoC |
| Adapter | ITE | MU30-5120250-A1 | N/A |

For Test Site No: TH01-CB

| Support Unit | Brand | Model | FCC ID |
|---|---|---|---|
| NB | DELL | E4300 | DoC |
| Adapter | ITE | MU30-5120250-A1 | N/A |

## 3.8. Table for Parameters of Test Software Setting

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power Parameters:

| Test Software Version | Terminal Version 5.1 | | |
|---|---|---|---|
| Frequency | 2402 MHz | 2442 MHz | 2480 MHz |
| Power Parameters | 3 | 3 | 3 |

## 3.9. EUT Operation during Test

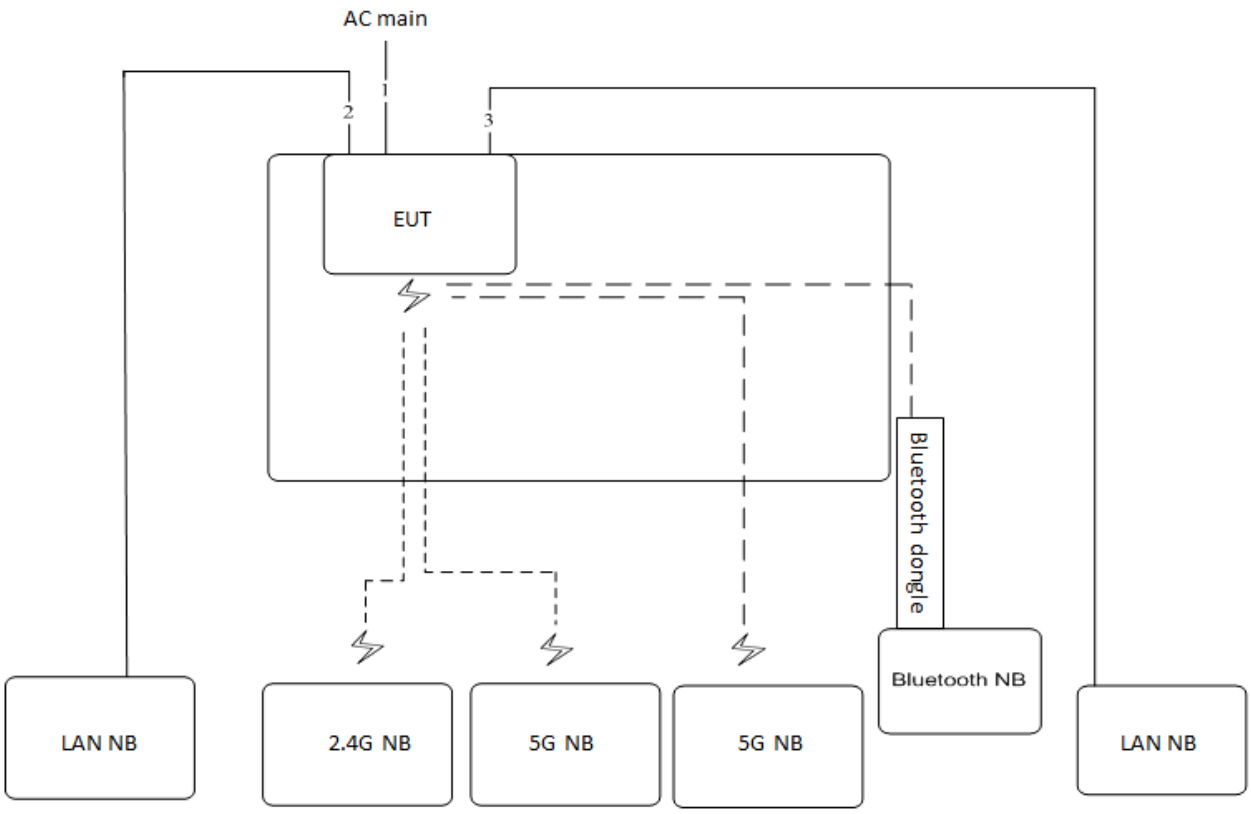
The EUT was programmed to be in continuously transmitting mode.

## 3.10. Duty Cycle

| Mode | On Time (ms) | On+Off Time (ms) | Duty Cycle (%) | Duty Factor (dB) | 1/T Minimum VBW (kHz) |
|---|---|---|---|---|---|
| GFSK | 0.080 | 0.625 | 12.80% | 7.81 | 12.50 |

## 3.11.Test Configurations

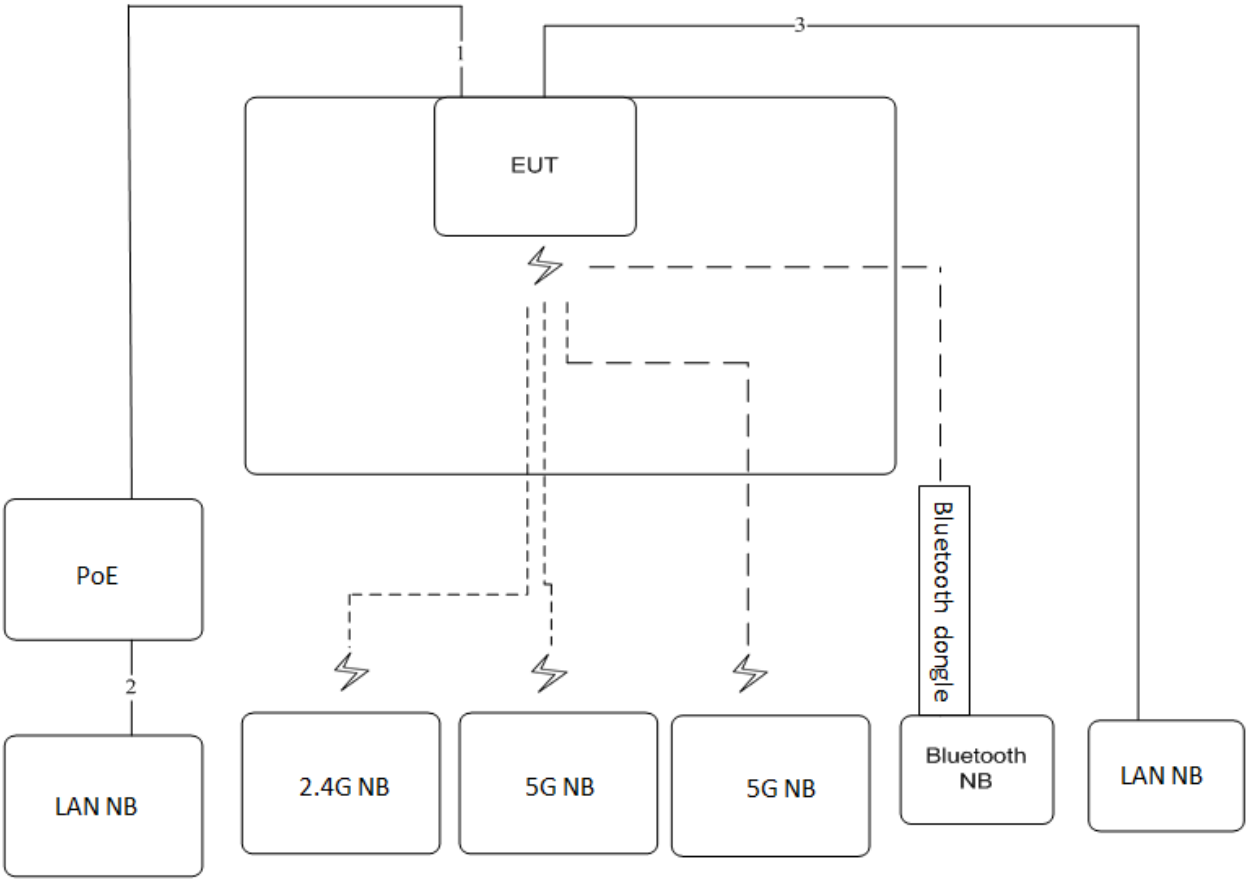
### 3.11.1. AC Power Line Conduction Emissions Test Configuration




| Item | Connection | Shielded | Length |
|---|---|---|---|
| 1 | Power cable | No | 1.5m |
| 2 | RJ-45 cable | No | 100m |
| 3 | RJ-45 cable | No | 50m |

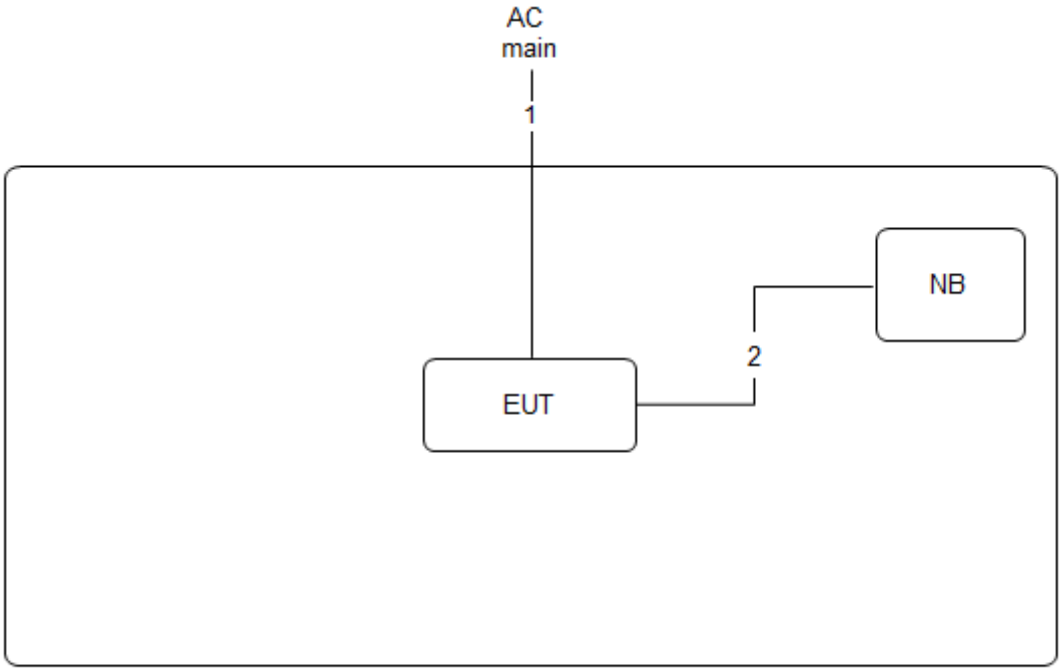
### 3.11.2. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz




| Item | Connection | Shielded | Length |
|---|---|---|---|
| 1 | RJ-45 cable | No | 10m |
| 2 | RJ-45 cable | No | 1.5m |
| 3 | RJ-45 cable | No | 10m |

Test Configuration: above 1GHz




| Item | Connection | Shielded | Length |
|---|---|---|---|
| 1 | Power cable | No | 1.9m |
| 2 | Console cable | No | 3.7m |

# 4. TEST RESULT

## 4.1. AC Power Line Conducted Emissions Measurement

### 4.1.1. Limit

For this product which is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

| Frequency (MHz) | QP Limit (dBuV) | AV Limit (dBuV) |
|---|---|---|
| 0.15~0.5 | 66~56 | 56~46 |
| 0.5~5 | 56 | 46 |
| 5~30 | 60 | 50 |

### 4.1.2. Measuring Instruments and Setting

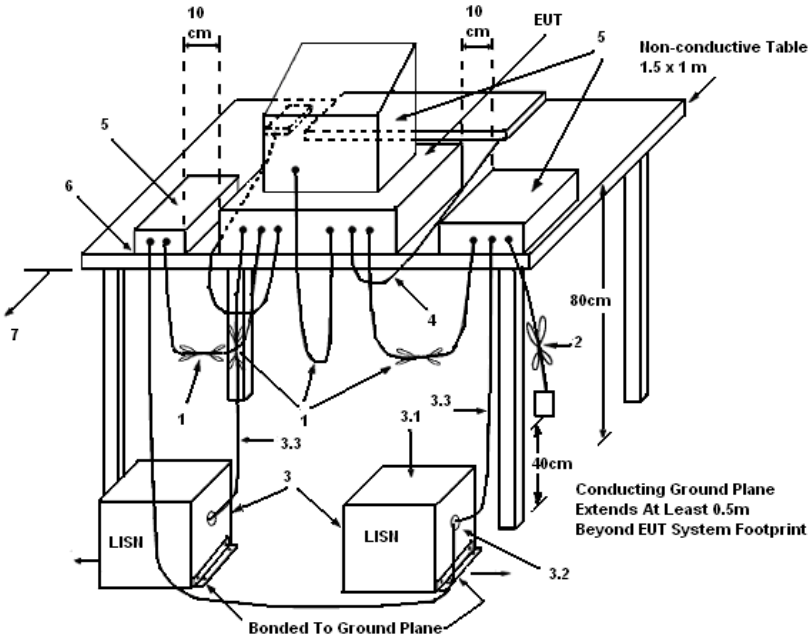
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

### 4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

### 4.1.4. Test Setup Layout




LEGEND:

(1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

(2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

(3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω. LISN can be placed on top of, or immediately beneath, reference ground plane.

(3.1) All other equipment powered from additional LISN(s).

(3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

(3.3) LISN at least 80 cm from nearest part of EUT chassis.

(4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.

(5) Non-EUT components of EUT system being tested.

(6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

(7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

### 4.1.5. Test Deviation

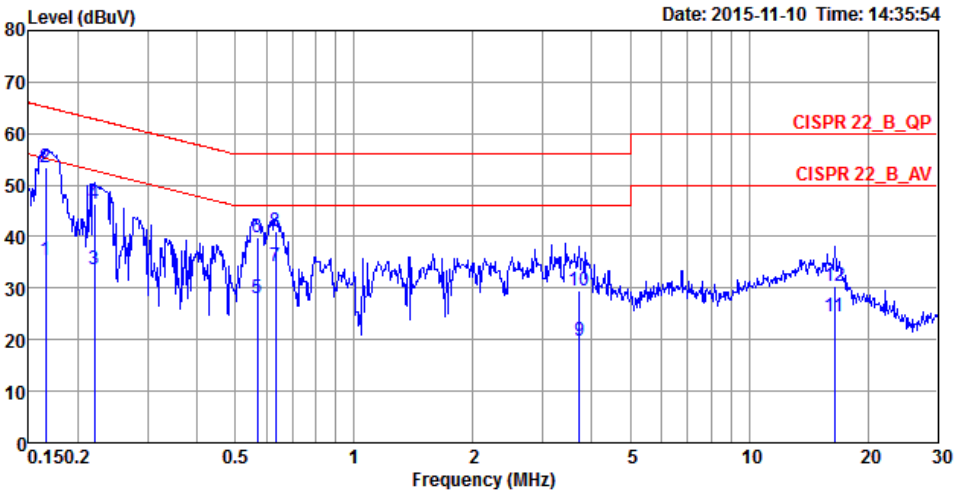
There is no deviation with the original standard.

### 4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

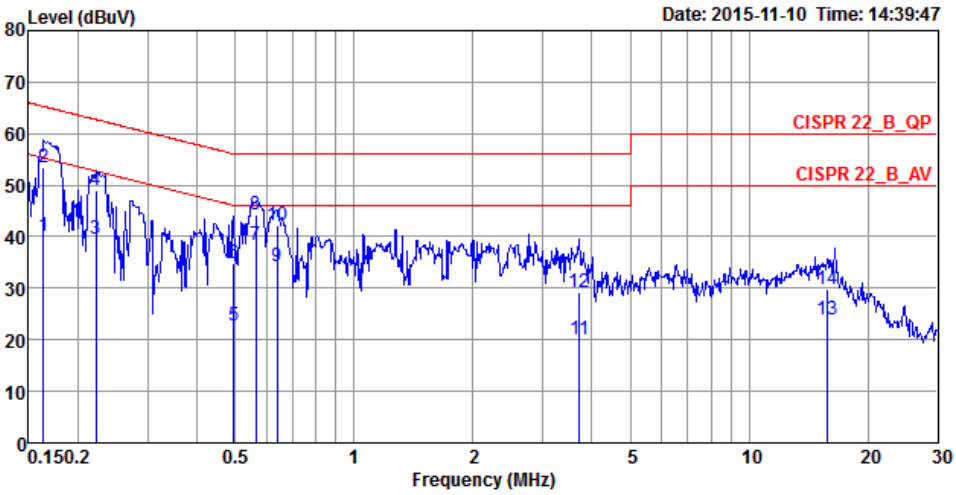
### 4.1.7. Results of AC Power Line Conducted Emissions Measurement

| Temperature | 23°C | Humidity | 63% |
|---|---|---|---|
| Test Engineer | Parody Lin | Phase | Line |
| Configuration | Normal Link / Mode 1 | | |




| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | | |
| 1 | 0.1659 | 35.57 | -19.59 | 55.16 | 25.62 | 9.93 | 0.02 | LINE | Average |
| 2 | 0.1659 | 53.42 | -11.74 | 65.16 | 43.47 | 9.93 | 0.02 | LINE | QP |
| 3 | 0.2197 | 33.58 | -19.25 | 52.83 | 23.63 | 9.93 | 0.02 | LINE | Average |
| 4 | 0.2197 | 46.27 | -16.56 | 62.83 | 36.32 | 9.93 | 0.02 | LINE | QP |
| 5 | 0.5701 | 28.16 | -17.84 | 46.00 | 18.18 | 9.94 | 0.04 | LINE | Average |
| 6 | 0.5701 | 39.87 | -16.13 | 56.00 | 29.89 | 9.94 | 0.04 | LINE | QP |
| 7 | 0.6338 | 34.28 | -11.72 | 46.00 | 24.30 | 9.94 | 0.04 | LINE | Average |
| 8 | 0.6338 | 40.93 | -15.07 | 56.00 | 30.95 | 9.94 | 0.04 | LINE | QP |
| 9 | 3.7198 | 19.74 | -26.26 | 46.00 | 9.66 | 10.02 | 0.06 | LINE | Average |
| 10 | 3.7198 | 29.40 | -26.60 | 56.00 | 19.32 | 10.02 | 0.06 | LINE | QP |
| 11 | 16.4856 | 24.45 | -25.55 | 50.00 | 13.82 | 10.37 | 0.26 | LINE | Average |
| 12 | 16.4856 | 30.43 | -29.57 | 60.00 | 19.80 | 10.37 | 0.26 | LINE | QP |

| Temperature | 23°C | Humidity | 63% |
|---|---|---|---|
| Test Engineer | Parody Lin | Phase | Neutral |
| Configuration | Normal Link / Mode 1 | | |




| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | | |
| 1 | 0.1633 | 40.17 | -15.13 | 55.30 | 30.37 | 9.78 | 0.02 | NEUTRAL | Average |
| 2 | 0.1633 | 53.57 | -11.73 | 65.30 | 43.77 | 9.78 | 0.02 | NEUTRAL | QP |
| 3 | 0.2220 | 39.47 | -13.27 | 52.74 | 29.65 | 9.79 | 0.03 | NEUTRAL | Average |
| 4 | 0.2220 | 49.15 | -13.59 | 62.74 | 39.33 | 9.79 | 0.03 | NEUTRAL | QP |
| 5 | 0.4967 | 22.71 | -23.34 | 46.05 | 12.88 | 9.79 | 0.04 | NEUTRAL | Average |
| 6 | 0.4967 | 34.82 | -21.23 | 56.05 | 24.99 | 9.79 | 0.04 | NEUTRAL | QP |
| 7 | 0.5641 | 38.33 | -7.67 | 46.00 | 28.49 | 9.80 | 0.04 | NEUTRAL | Average |
| 8 | 0.5641 | 44.40 | -11.60 | 56.00 | 34.56 | 9.80 | 0.04 | NEUTRAL | QP |
| 9 | 0.6372 | 34.21 | -11.79 | 46.00 | 24.37 | 9.80 | 0.04 | NEUTRAL | Average |
| 10 | 0.6372 | 42.12 | -13.88 | 56.00 | 32.28 | 9.80 | 0.04 | NEUTRAL | QP |
| 11 | 3.7198 | 19.93 | -26.07 | 46.00 | 10.00 | 9.87 | 0.06 | NEUTRAL | Average |
| 12 | 3.7198 | 29.21 | -26.79 | 56.00 | 19.28 | 9.87 | 0.06 | NEUTRAL | QP |
| 13 | 15.8014 | 23.91 | -26.09 | 50.00 | 13.53 | 10.12 | 0.26 | NEUTRAL | Average |
| 14 | 15.8014 | 29.86 | -30.14 | 60.00 | 19.48 | 10.12 | 0.26 | NEUTRAL | QP |

Note: Level = Read Level + LISN Factor + Cable Loss.

## 4.2. Maximum Conducted Output Power Measurement

### 4.2.1. Limit

The limit for output power is 30dBm.

### 4.2.2. Measuring Instruments and Setting

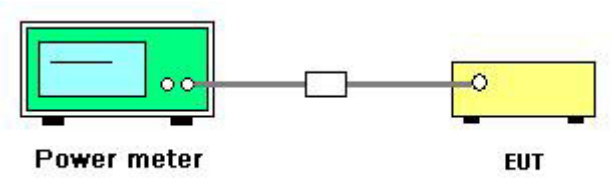
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

| Power Meter Parameter | Setting |
|---|---|
| Bandwidth | 50MHz bandwidth is greater than the EUT emission bandwidth |
| Detector | Average |

### 4.2.3. Test Procedures

1. Test procedures refer KDB558074 D01 v03r04 section 9.2.3.2.
2. This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector.

### 4.2.4. Test Setup Layout




### 4.2.5. Test Deviation

There is no deviation with the original standard.

### 4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 4.2.7. Test Result of Maximum Conducted Output Power

| Temperature | 25°C | Humidity | 45% |
|---|---|---|---|
| Test Engineer | Mars Lin | Configurations | GFSK |
| Test Date | Sep. 11, 2015 ~ Dec. 22, 2015 | | |

| Channel | Frequency | Conducted Power (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| 0 | 2402 MHz | 1.62 | 30.00 | Complies |
| 20 | 2442 MHz | 1.33 | 30.00 | Complies |
| 39 | 2480 MHz | 1.09 | 30.00 | Complies |

## 4.3. Power Spectral Density Measurement

### 4.3.1. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 4.3.2. Measuring Instruments and Setting

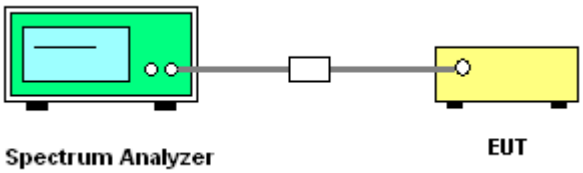
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 5-30 % greater than the DTS channel bandwidth. |
| RBW | 3 kHz ≤ RBW ≤ 100kHz |
| VBW | ≥ 3 x RBW |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto couple |

### 4.3.3. Test Procedures

1. Test was performed in accordance with KDB558074 D01 v03r04 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 10.2 Method PKPSD (peak PSD).
2. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW (use of a greater number of measurement points than this minimum requirement is recommended).
4. Use the peak marker function to determine the maximum level in any 3 kHz band segment within the fundamental EBW.
5. The resulting PSD level must be ≤ 8 dBm.

### 4.3.4. Test Setup Layout



### 4.3.5. Test Deviation

There is no deviation with the original standard.

### 4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 4.3.7. Test Result of Power Spectral Density

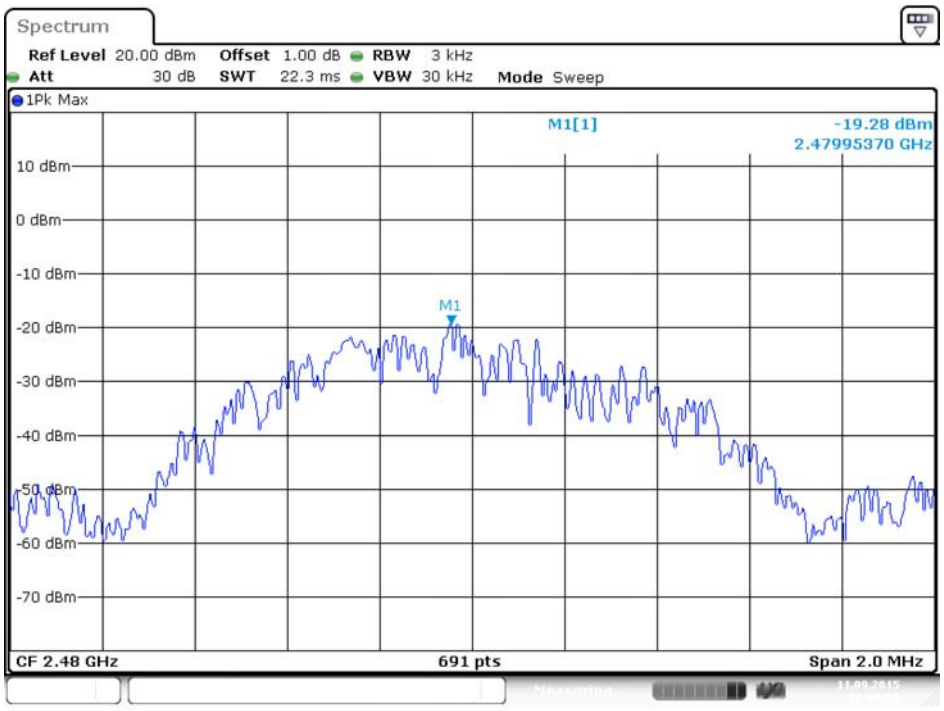
| Temperature | 25°C | Humidity | 45% |
|---|---|---|---|
| Test Engineer | Mars Lin | Configurations | GFSK |

| Channel | Frequency | Power Density (dBm/3kHz) | Power Density Limit (dBm/3kHz) | Result |
|---|---|---|---|---|
| 0 | 2402 MHz | -20.87 | 8.00 | Complies |
| 20 | 2442 MHz | -20.57 | 8.00 | Complies |
| 39 | 2480 MHz | -19.28 | 8.00 | Complies |

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

Power Density Plot on Configuration Bluetooth / 2480 MHz




Date: 11.SEP.2015 18:00:10

## 4.4. 6dB Spectrum Bandwidth Measurement

### 4.4.1. Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

### 4.4.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| 6dB Spectrum Bandwidth | |
|---|---|
| **Spectrum Parameters** | **Setting** |
| Attenuation | Auto |
| Span Frequency | > 6dB Bandwidth |
| RBW | 100kHz |
| VBW | ≥ 3 x RBW |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |
| **99% Occupied Bandwidth** | |
| **Spectrum Parameters** | **Setting** |
| Span | 1.5 times to 5.0 times the OBW |
| RBW | 1 % to 5 % of the OBW |
| VBW | ≥ 3 x RBW |
| Detector | Peak |
| Trace | Max Hold |

### 4.4.3. Test Procedures

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB558074 D01 v03r04 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 8.0 DTS bandwidth=> 8.1 Option 1.
3. Measured the spectrum width with power higher than 6dB below carrier.

### 4.4.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.5.4.

### 4.4.5. Test Deviation

There is no deviation with the original standard.

### 4.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 4.4.7. Test Result of 6dB Spectrum Bandwidth

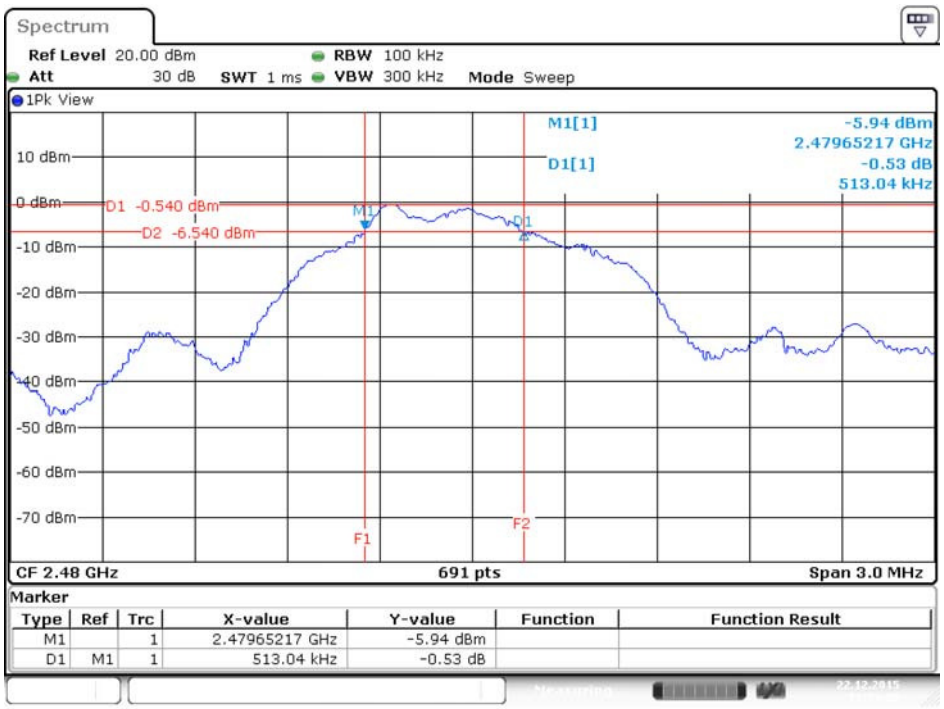
| Temperature | 25°C | Humidity | 45% |
|---|---|---|---|
| Test Engineer | Mars Lin | Configurations | GFSK |

| Channel | Frequency | 6dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Min. Limit (kHz) | Test Result |
|---|---|---|---|---|---|
| 0 | 2402 MHz | 0.52 | 1.06 | 500 | Complies |
| 20 | 2442 MHz | 0.52 | 1.06 | 500 | Complies |
| 39 | 2480 MHz | 0.51 | 1.06 | 500 | Complies |

Note: All the test values were listed in the report.

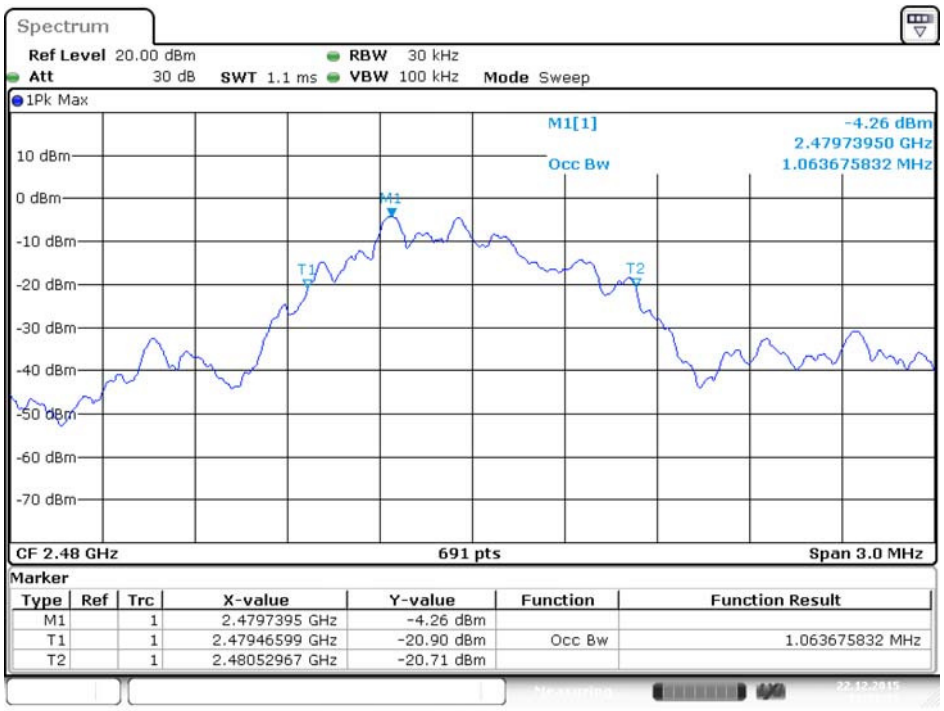
For plots, only the channel with worse result was shown.

## 6 dB Bandwidth Plot on Configuration Bluetooth / 2480 MHz




Date: 22.DEC.2015 11:54:30

## 99% Occupied Bandwidth Plot on Configuration Bluetooth / 2480 MHz




Date: 22.DEC.2015 11:52:31

## 4.5. Radiated Emissions Measurement

### 4.5.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies (MHz) | Field Strength (micorvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009~0.490 | 2400/F(kHz) | 300 |
| 0.490~1.705 | 24000/F(kHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 4.5.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start Frequency | 1000 MHz |
| Stop Frequency | 10th carrier harmonic |
| RBW / VBW (Emission in restricted band) | 1MHz / 3MHz for Peak,<br>1MHz / 1/T for Average |
| RBW / VBW (Emission in non-restricted band) | 100kHz / 300kHz for peak |

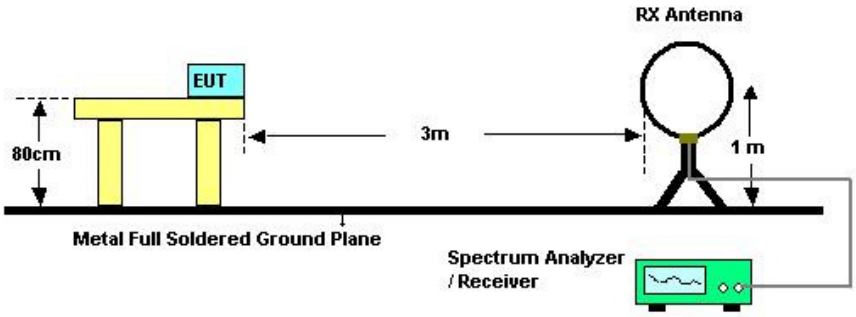
| Receiver Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RBW 200Hz for QP |
| Start ~ Stop Frequency | 150kHz~30MHz / RBW 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RBW 120kHz for QP |

### 4.5.3. Test Procedures

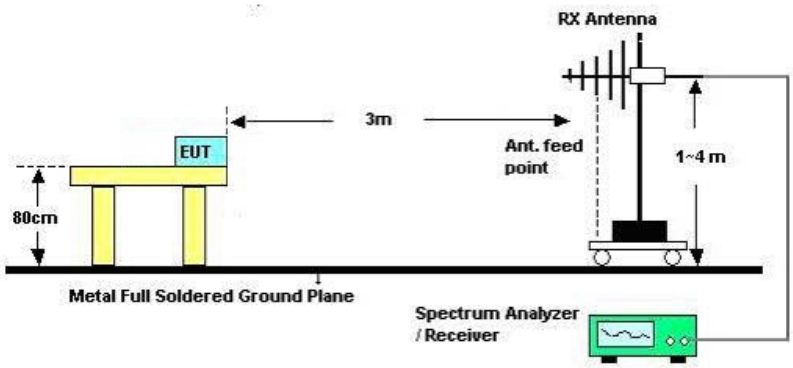
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting 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 3MHz RBW for peak reading. Then 1MHz RBW and 1/T VBW for average reading in spectrum analyzer.
7. 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.
8. 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.
9. 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.

### 4.5.4. Test Setup Layout

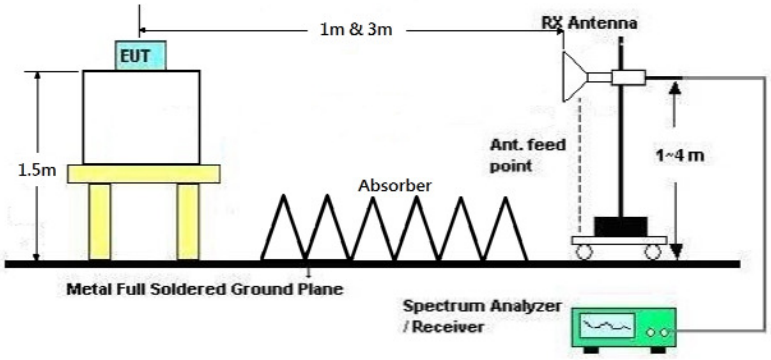
For Radiated Emissions: 9kHz ~30MHz




For Radiated Emissions: 30MHz~1GHz




For Radiated Emissions: Above 1GHz




### 4.5.5. Test Deviation

There is no deviation with the original standard.

### 4.5.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 4.5.7. Results of Radiated Emissions (9kHz~30MHz)

| Temperature | 26°C | Humidity | 57% |
|---|---|---|---|
| Test Engineer | Roki Liu | Configurations | Normal Link / Mode 3 |
| Test Date | Nov. 19, 2015 | | |

| Freq. (MHz) | Level (dBuV) | Over Limit (dB) | Limit Line (dBuV) | Remark |
|---|---|---|---|---|
| - | - | - | - | See Note |

Note:

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

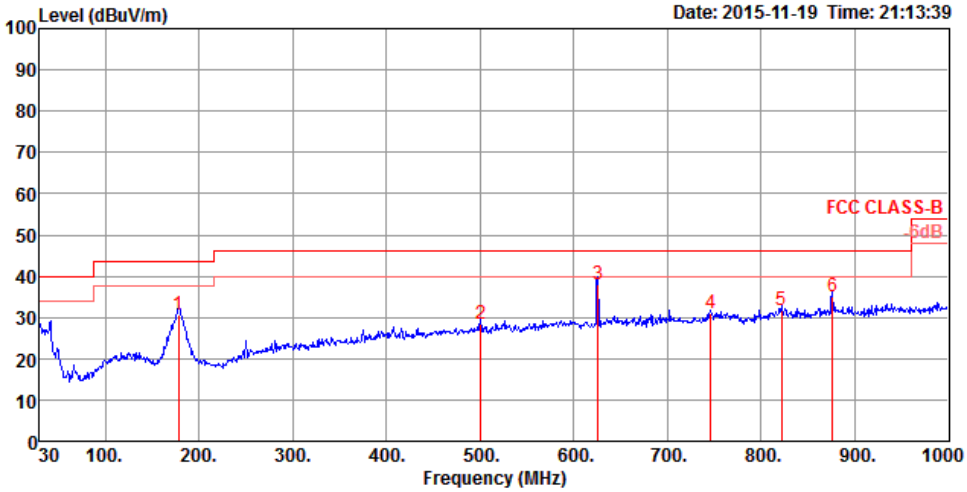
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

## 4.5.8. Results of Radiated Emissions (30MHz~1GHz)

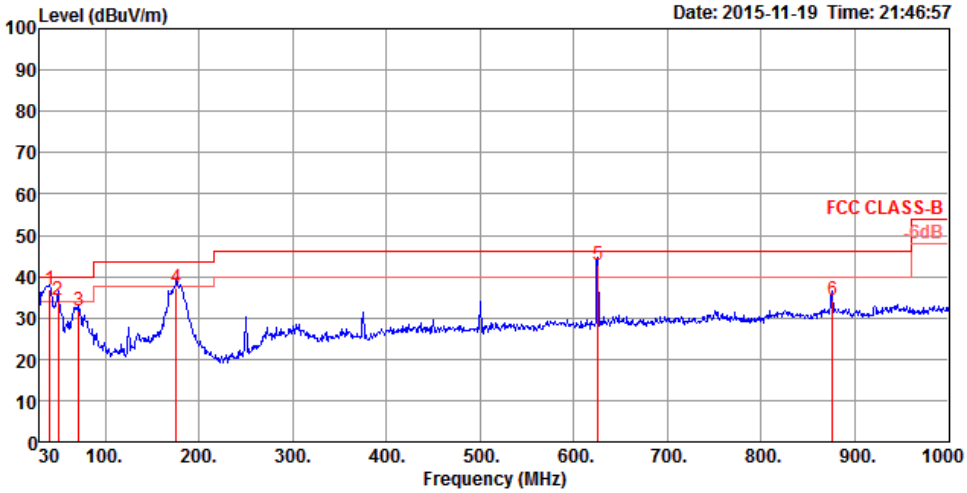
| Temperature | 26°C | Humidity | 57% |
|---|---|---|---|
| Test Engineer | Roki Liu | Configurations | Normal Link / Mode 3 |

*Horizontal*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 178.41 | 30.68 | 43.50 | -12.82 | 51.98 | 1.15 | 9.89 | 32.34 | 150 | 278 | QP | HORIZONTAL |
| 2 | 500.45 | 28.56 | 46.00 | -17.44 | 40.85 | 1.94 | 18.12 | 32.35 | 150 | 261 | QP | HORIZONTAL |
| 3 | 625.58 | 37.99 | 46.00 | -8.01 | 48.82 | 2.16 | 19.41 | 32.40 | 100 | 304 | QP | HORIZONTAL |
| 4 | 745.86 | 30.82 | 46.00 | -15.18 | 40.43 | 2.36 | 20.34 | 32.31 | 150 | 44 | QP | HORIZONTAL |
| 5 | 821.52 | 31.82 | 46.00 | -14.18 | 40.45 | 2.49 | 21.02 | 32.14 | 100 | 161 | QP | HORIZONTAL |
| 6 | 875.84 | 35.12 | 46.00 | -10.88 | 42.98 | 2.55 | 21.45 | 31.86 | 100 | 198 | QP | HORIZONTAL |

*Vertical*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 40.67 | 36.83 | 40.00 | -3.17 | 55.00 | 0.55 | 13.69 | 32.41 | 100 | 225 | QP | VERTICAL |
| 2 | 49.40 | 34.37 | 40.00 | -5.63 | 56.78 | 0.61 | 9.39 | 32.41 | 100 | 192 | QP | VERTICAL |
| 3 | 71.71 | 31.75 | 40.00 | -8.25 | 56.55 | 0.73 | 6.87 | 32.40 | 150 | 208 | QP | VERTICAL |
| 4 | 175.50 | 37.39 | 43.50 | -6.11 | 58.57 | 1.14 | 10.02 | 32.34 | 100 | 6 | QP | VERTICAL |
| 5 | 625.58 | 42.66 | 46.00 | -3.34 | 53.49 | 2.16 | 19.41 | 32.40 | 125 | 171 | QP | VERTICAL |
| 6 | 875.84 | 34.43 | 46.00 | -11.57 | 42.29 | 2.55 | 21.45 | 31.86 | 100 | 66 | QP | VERTICAL |

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

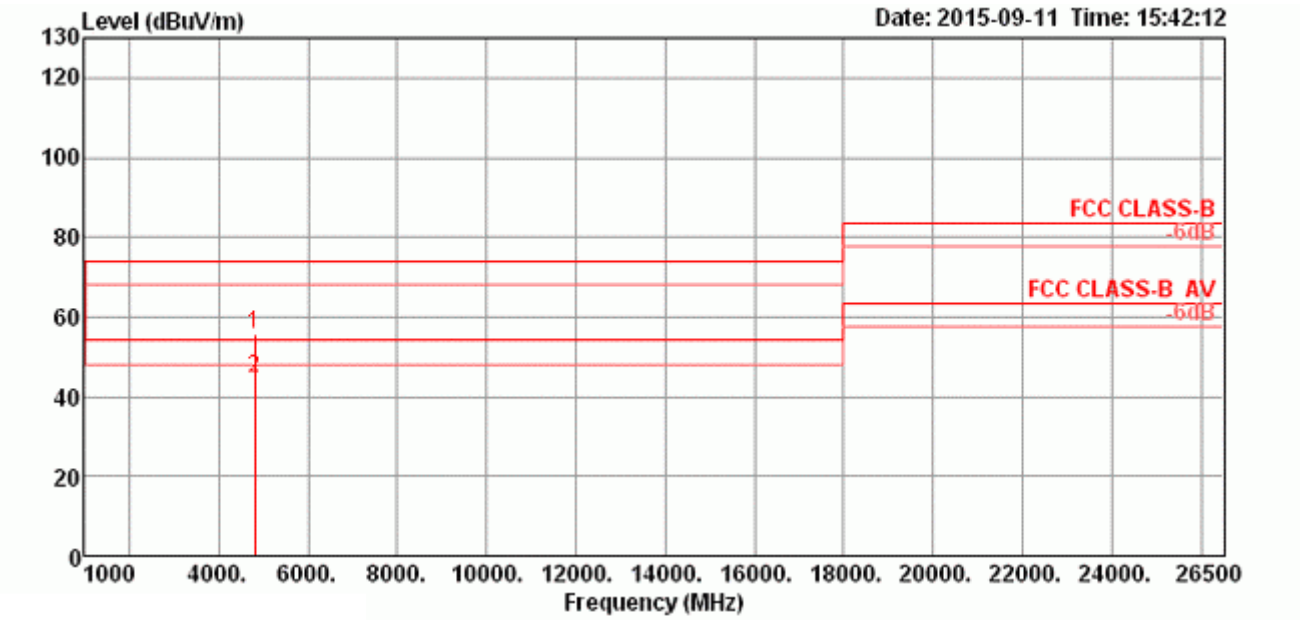
Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

### 4.5.9. Results for Radiated Emissions (1GHz~10th Harmonic)

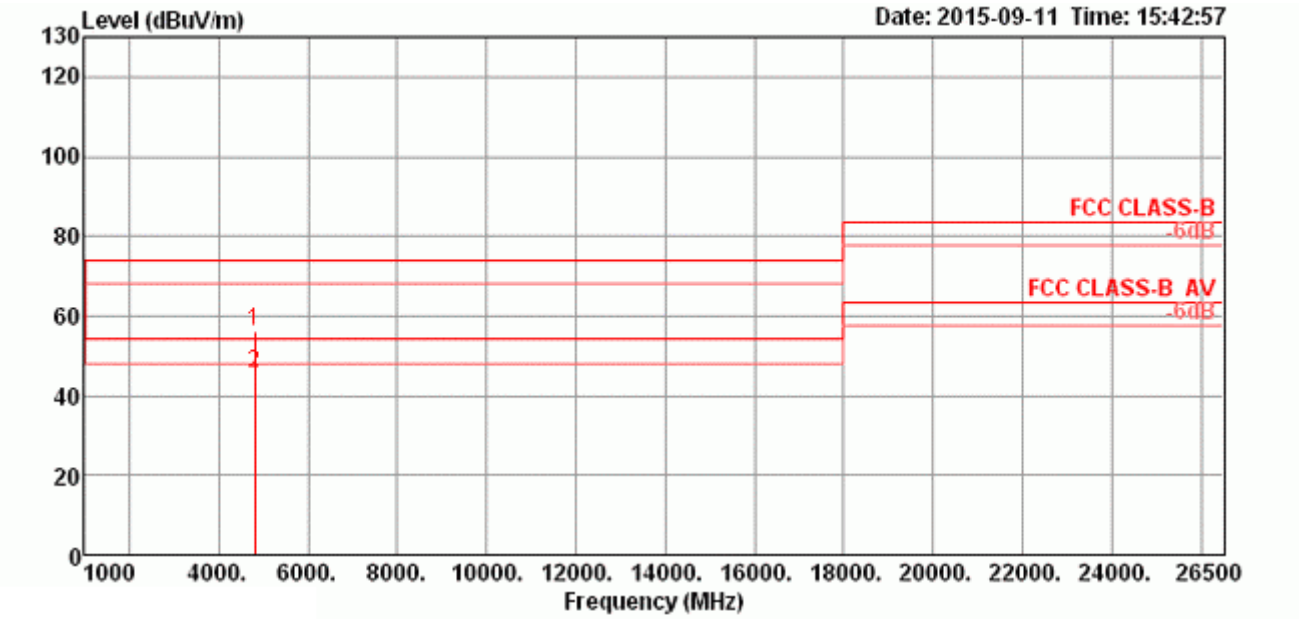
| Temperature | 25°C | Humidity | 59% |
|---|---|---|---|
| Test Engineer | Paul Chen | Configurations | Channel 0 |

*Horizontal*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 4804.85 | 55.52 | 74.00 | -18.48 | 49.40 | 6.13 | 33.08 | 33.09 | 141 | 268 | Peak | HORIZONTAL |
| 2 | 4806.37 | 44.50 | 54.00 | -9.50 | 38.38 | 6.13 | 33.08 | 33.09 | 141 | 268 | Average | HORIZONTAL |

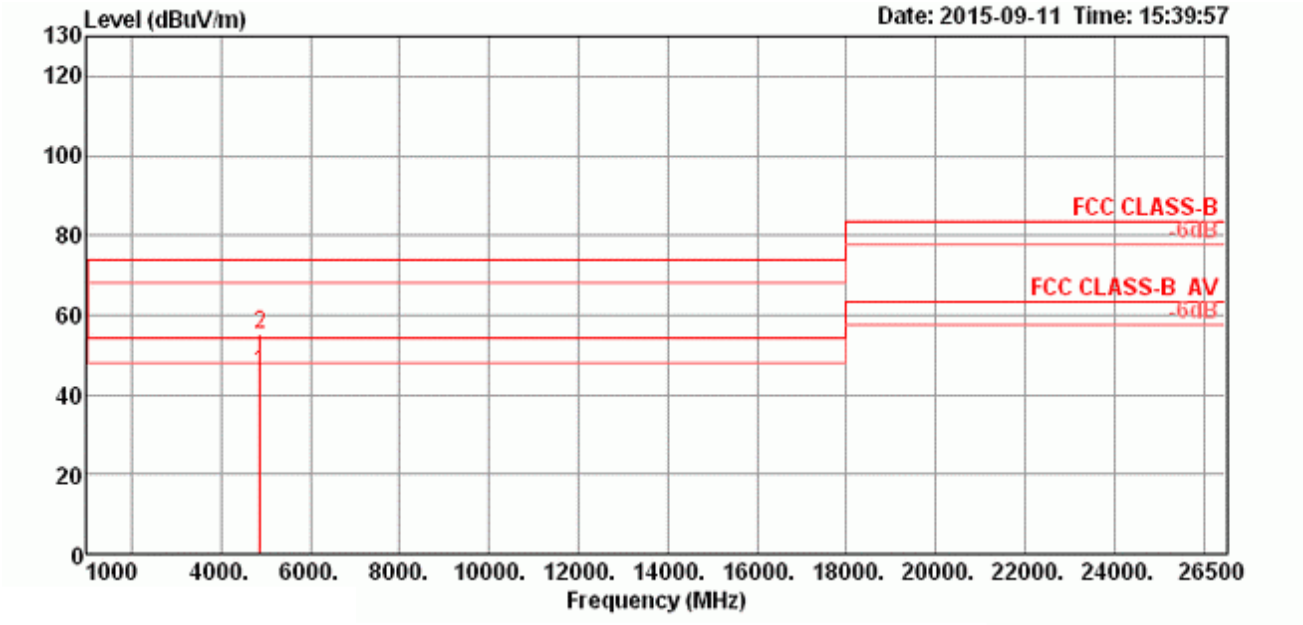
*Vertical*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 4803.27 | 56.17 | 74.00 | -17.83 | 50.05 | 6.13 | 33.08 | 33.09 | 190 | 136 | Peak | VERTICAL |
| 2 | 4804.79 | 45.50 | 54.00 | -8.50 | 39.38 | 6.13 | 33.08 | 33.09 | 190 | 136 | Average | VERTICAL |

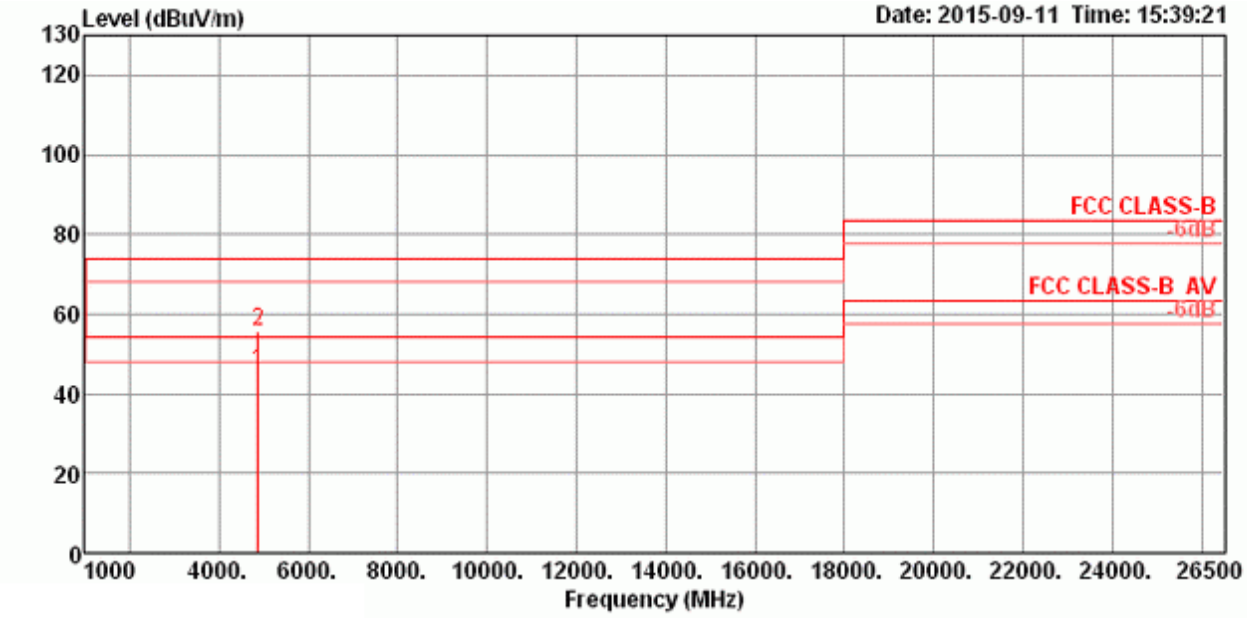
| Temperature | 25℃ | Humidity | 59% |
|---|---|---|---|
| Test Engineer | Paul Chen | Configurations | Channel 20 |

*Horizontal*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 4882.14 | 45.43 | 54.00 | -8.57 | 39.20 | 6.08 | 33.23 | 33.08 | 153 | 158 | Average | HORIZONTAL |
| 2 | 4882.23 | 55.25 | 74.00 | -18.75 | 49.02 | 6.08 | 33.23 | 33.08 | 153 | 158 | Peak | HORIZONTAL |

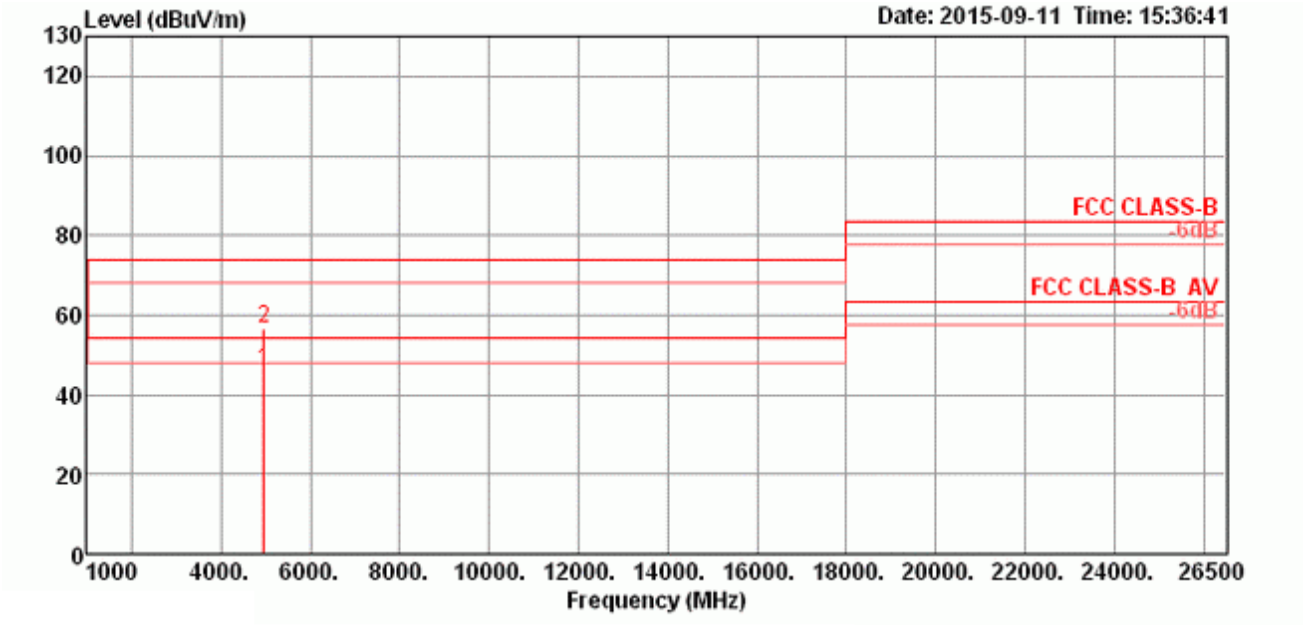
*Vertical*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 4881.77 | 45.59 | 54.00 | -8.41 | 39.36 | 6.08 | 33.23 | 33.08 | 165 | 214 | Average | VERTICAL |
| 2 | 4883.41 | 55.71 | 74.00 | -18.29 | 49.48 | 6.08 | 33.23 | 33.08 | 165 | 214 | Peak | VERTICAL |

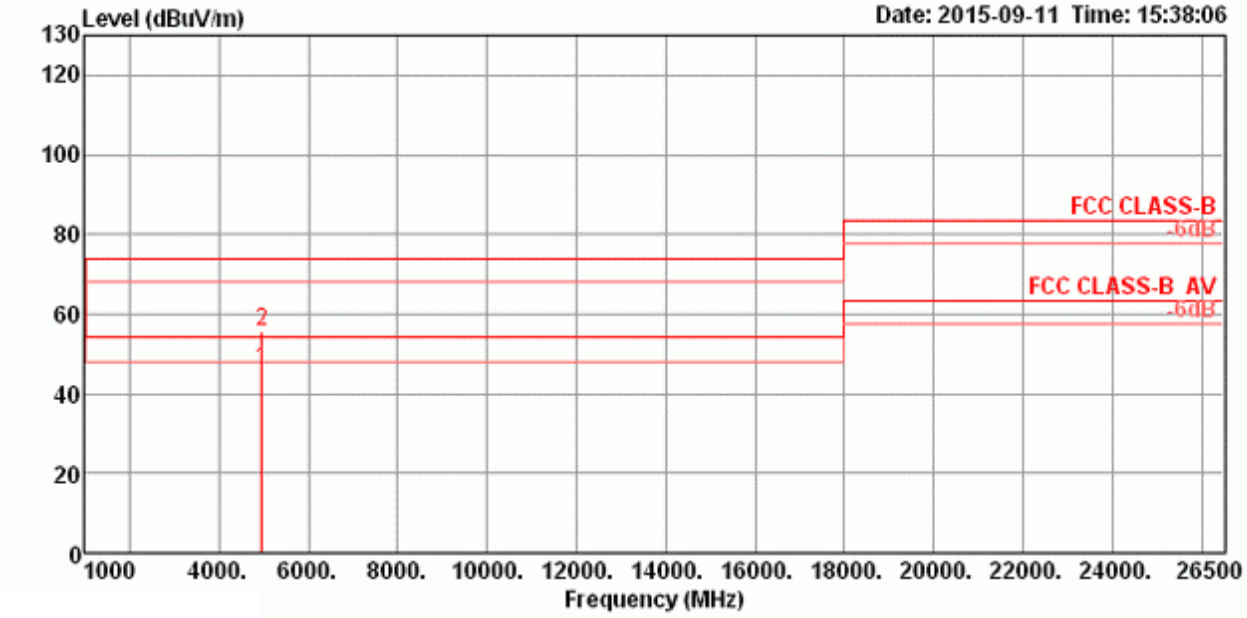
| Temperature | 25℃ | Humidity | 59% |
|---|---|---|---|
| Test Engineer | Paul Chen | Configurations | Channel 39 |

*Horizontal*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 4957.94 | 46.20 | 54.00 | -7.80 | 39.80 | 6.04 | 33.42 | 33.06 | 203 | 35 | Average | HORIZONTAL |
| 2 | 4958.77 | 56.83 | 74.00 | -17.17 | 50.43 | 6.04 | 33.42 | 33.06 | 203 | 35 | Peak | HORIZONTAL |

*Vertical*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 4957.96 | 46.01 | 54.00 | -7.99 | 39.61 | 6.04 | 33.42 | 33.06 | 189 | 295 | Average | VERTICAL |
| 2 | 4960.49 | 55.72 | 74.00 | -18.28 | 49.32 | 6.04 | 33.42 | 33.06 | 189 | 295 | Peak | VERTICAL |

Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

## 4.6. Emissions Measurement

### 4.6.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies (MHz) | Field Strength (micorvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009~0.490 | 2400/F(kHz) | 300 |
| 0.490~1.705 | 24000/F(kHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 4.6.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | 100 MHz |
| RBW / VBW (Emission in restricted band) | 1MHz / 3MHz for Peak,<br>1MHz / 1/T for Average |
| RBW / VBW (30dBc in any 100 kHz bandwidth emission) | 100 kHz / 300 kHz for Peak |

### 4.6.3. Test Procedures

For Radiated band edges Measurement:

1. The test procedure is the same as section 4.5.3.

For Radiated Out of Band Emission Measurement:

1. Test was performed in accordance with KDB558074 D01 v03r04 for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10.1 Unwanted Emissions into Non-Restricted Frequency Bands Measurement Procedure.

### 4.6.4. Test Setup Layout

For Radiated band edges Measurement:

This test setup layout is the same as that shown in section 4.5.4.

For Radiated Out of Band Emission Measurement:

This test setup layout is the same as that shown in section 4.5.4.

### 4.6.5. Test Deviation

There is no deviation with the original standard.

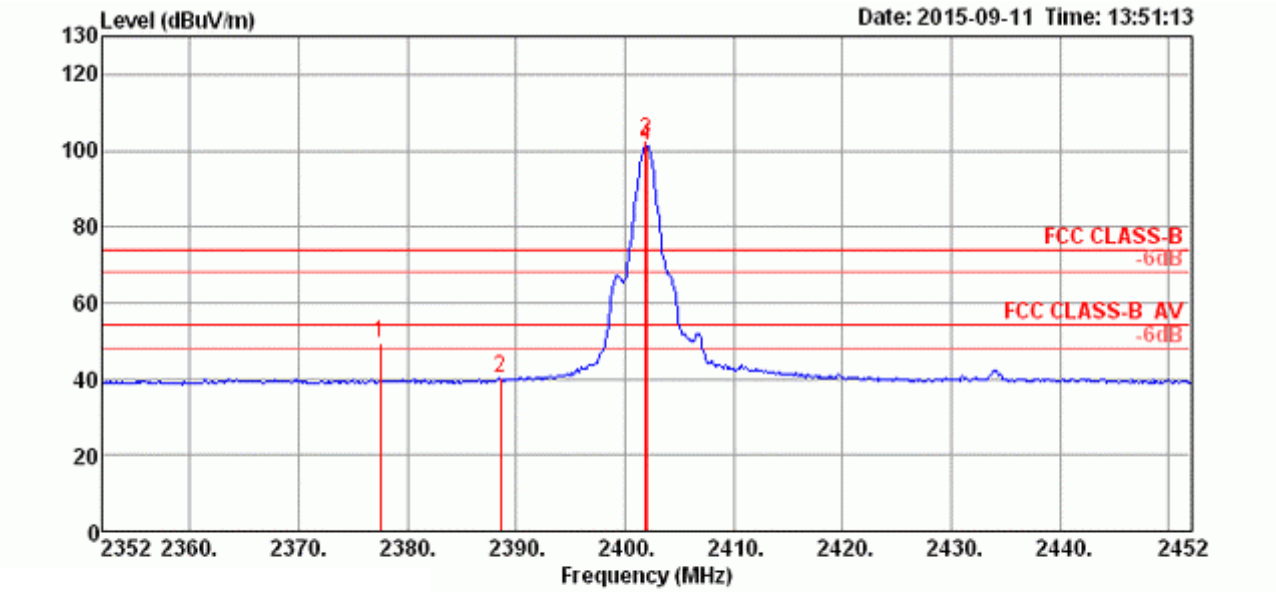
### 4.6.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

### 4.6.7. Test Result of Band Edge and Fundamental Emissions

| Temperature | 25°C | Humidity | 59% |
|---|---|---|---|
| Test Engineer | Paul Chen | Configurations | Channel 0, 20, 39 |

Channel 0

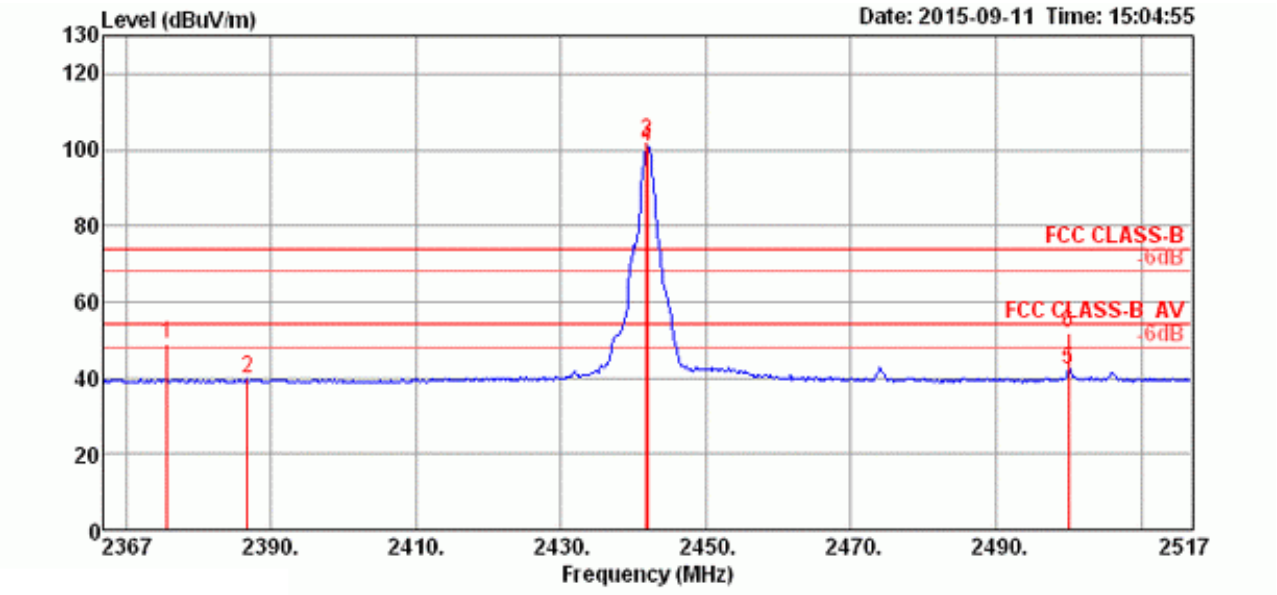



| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 2377.48 | 49.53 | 74.00 | -24.47 | 49.90 | 4.37 | 28.28 | 33.02 | 194 | 307 | Peak | VERTICAL |
| 2 | 2388.54 | 40.28 | 54.00 | -13.72 | 40.62 | 4.37 | 28.31 | 33.02 | 194 | 307 | Average | VERTICAL |
| 3 | 2401.84 | 102.84 | | | 103.15 | 4.41 | 28.31 | 33.03 | 194 | 307 | Peak | VERTICAL |
| 4 | 2402.00 | 101.41 | | | 101.72 | 4.41 | 28.31 | 33.03 | 194 | 307 | Average | VERTICAL |

Item 3, 4 are the fundamental frequency at 2402 MHz.

Note: Both antenna polarizations have been tested and only the worst case was recorded in test report.

Channel 20

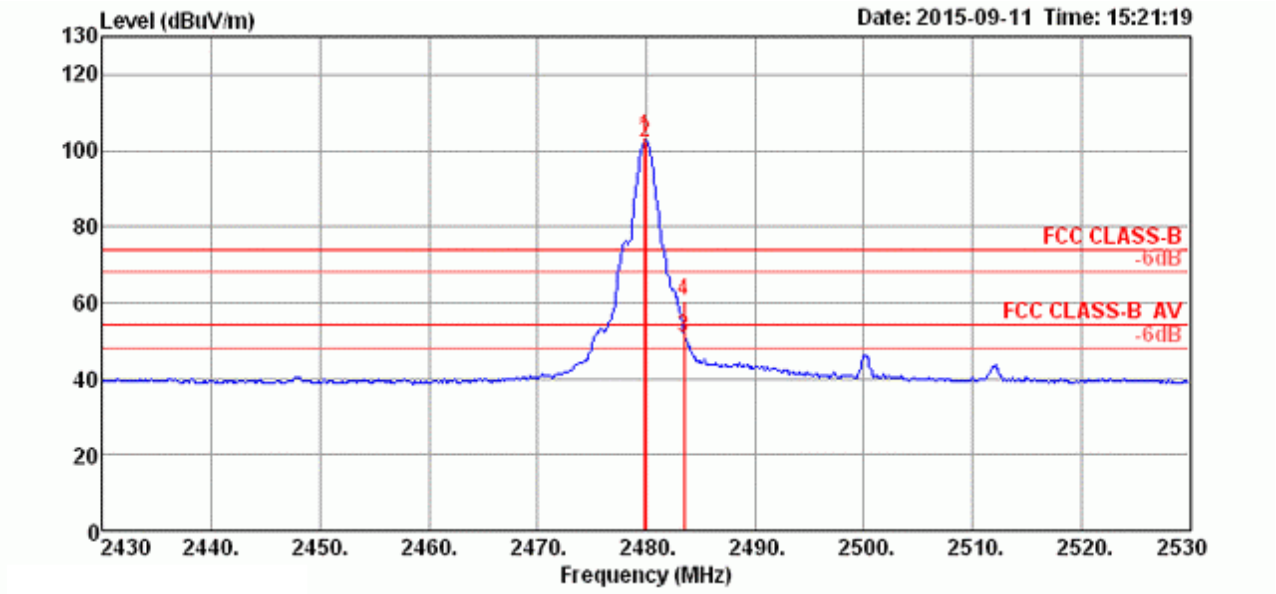



| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 2375.65 | 48.94 | 74.00 | -25.06 | 49.31 | 4.37 | 28.28 | 33.02 | 134 | 305 | Peak | HORIZONTAL |
| 2 | 2386.71 | 39.69 | 54.00 | -14.31 | 40.03 | 4.37 | 28.31 | 33.02 | 134 | 305 | Average | HORIZONTAL |
| 3 | 2441.76 | 102.33 | | | 102.49 | 4.48 | 28.41 | 33.05 | 134 | 305 | Peak | HORIZONTAL |
| 4 | 2442.00 | 100.87 | | | 101.03 | 4.48 | 28.41 | 33.05 | 134 | 305 | Average | HORIZONTAL |
| 5 | 2500.00 | 42.29 | 54.00 | -11.71 | 42.31 | 4.55 | 28.50 | 33.07 | 134 | 305 | Average | HORIZONTAL |
| 6 | 2500.00 | 51.86 | 74.00 | -22.14 | 51.88 | 4.55 | 28.50 | 33.07 | 134 | 305 | Peak | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2442 MHz.

Note: Both antenna polarizations have been tested and only the worst case was recorded in test report.

Channel 39




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | A/Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 2479.84 | 103.84 | | | 103.92 | 4.51 | 28.47 | 33.06 | 142 | 299 | Peak | VERTICAL |
| 2 | 2480.00 | 102.40 | | | 102.48 | 4.51 | 28.47 | 33.06 | 142 | 299 | Average | VERTICAL |
| 3 | 2483.50 | 50.93 | 54.00 | -3.07 | 51.01 | 4.51 | 28.47 | 33.06 | 142 | 299 | Average | VERTICAL |
| 4 | 2483.50 | 60.40 | 74.00 | -13.60 | 60.48 | 4.51 | 28.47 | 33.06 | 142 | 299 | Peak | VERTICAL |

Item 1, 2 are the fundamental frequency at 2480 MHz.

Note: Both antenna polarizations have been tested and only the worst case was recorded in test report.

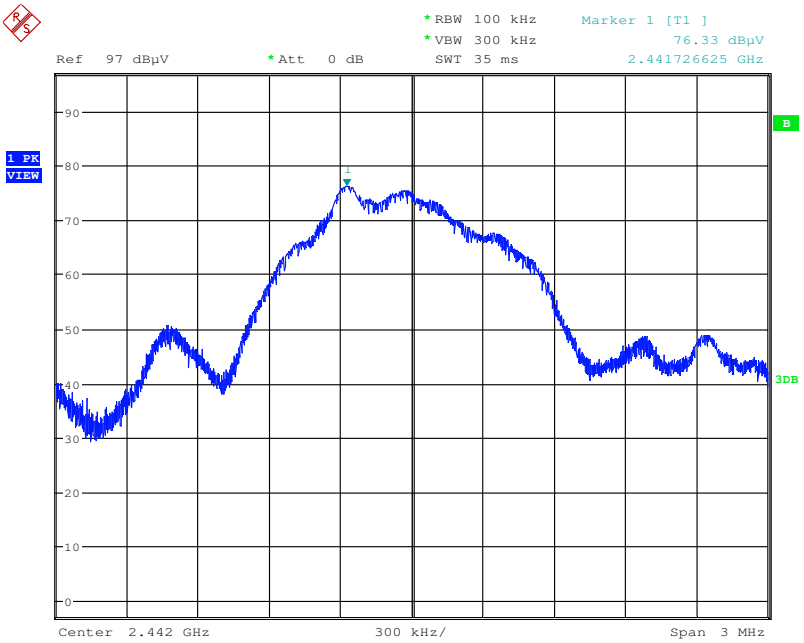
Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

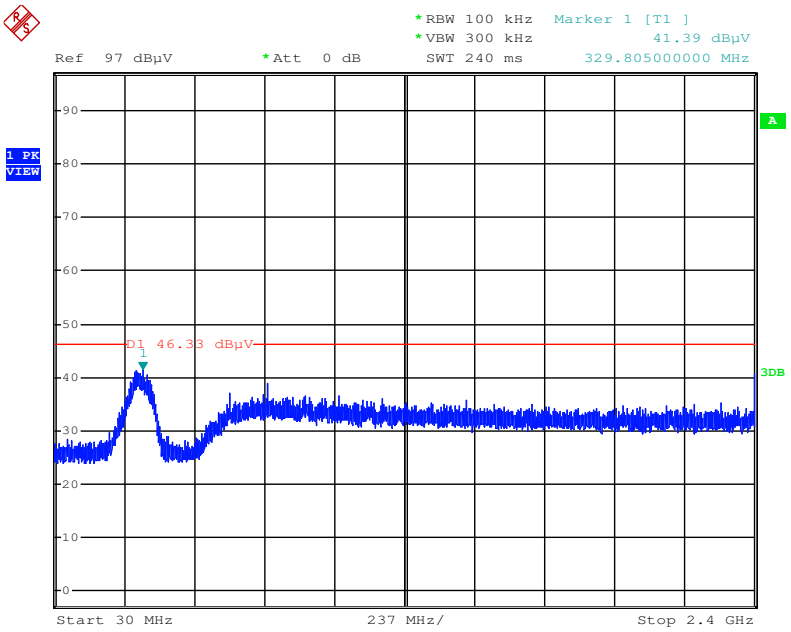
## For Emission not in Restricted Band

## Plot on Configuration / Reference Level - Horizontal




Date: 11.SEP.2015 17:10:20

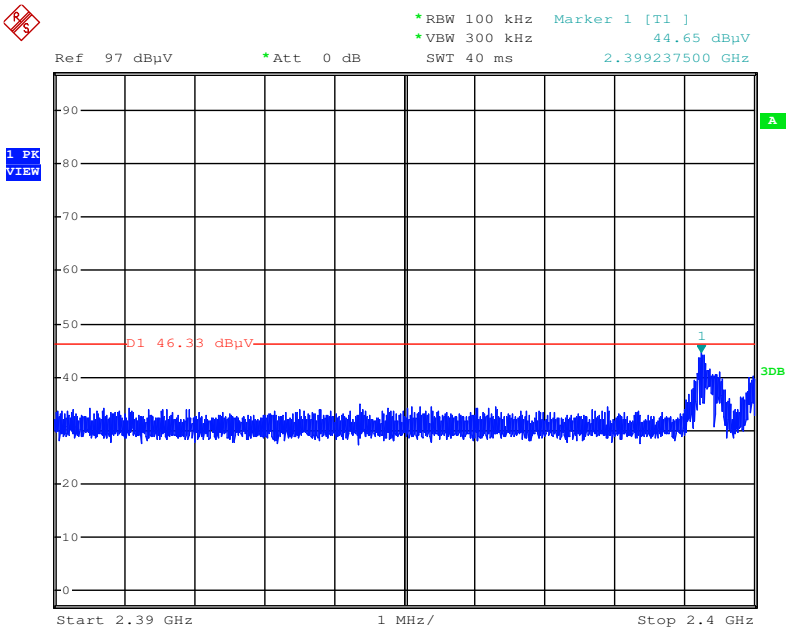
## Plot on Configuration For Bluetooth 4.0 / Channel 0 / 30MHz~2400MHz (down 30dBc) - Horizontal




Date: 19.DEC.2015 11:02:00

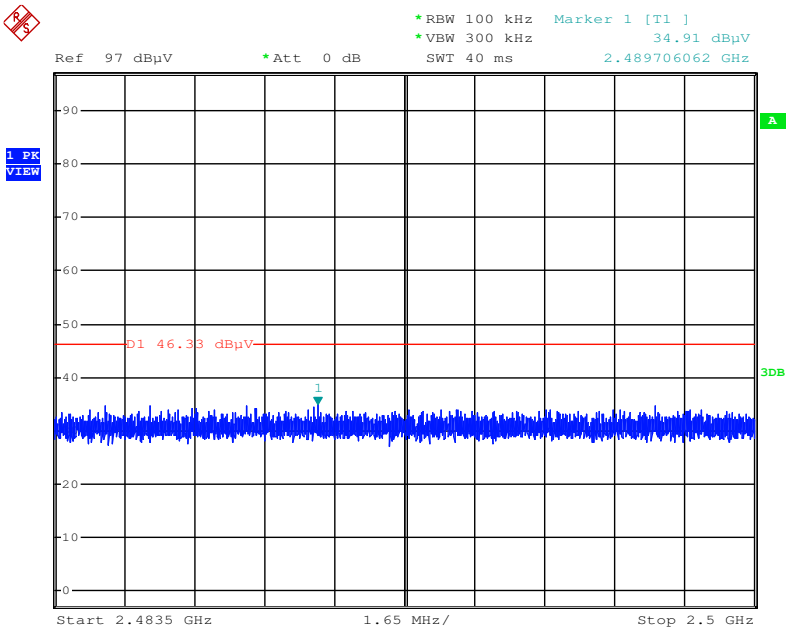
Note: Only the worse polarization (Horizontal) is tested and recorded in test report.

## Plot on Configuration For Bluetooth 4.0 / Channel 0 / 2390MHz~2400MHz (down 30dBc) - Horizontal




Date: 19.DEC.2015 11:09:55

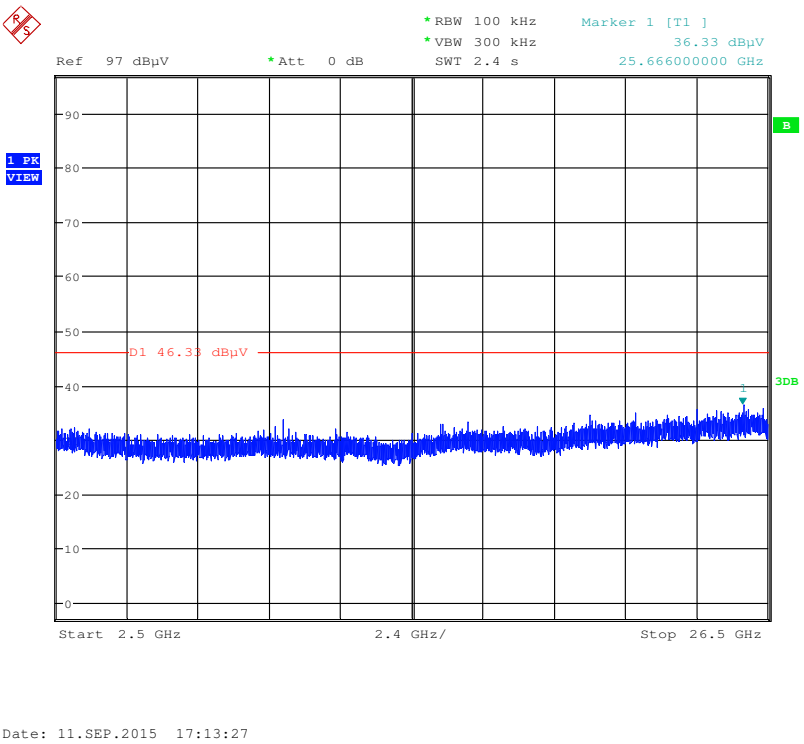
## Plot on Configuration For Bluetooth 4.0 / Channel 0 / 2483.5MHz~2500MHz (down 30dBc) - Horizontal




Date: 19.DEC.2015 11:10:47

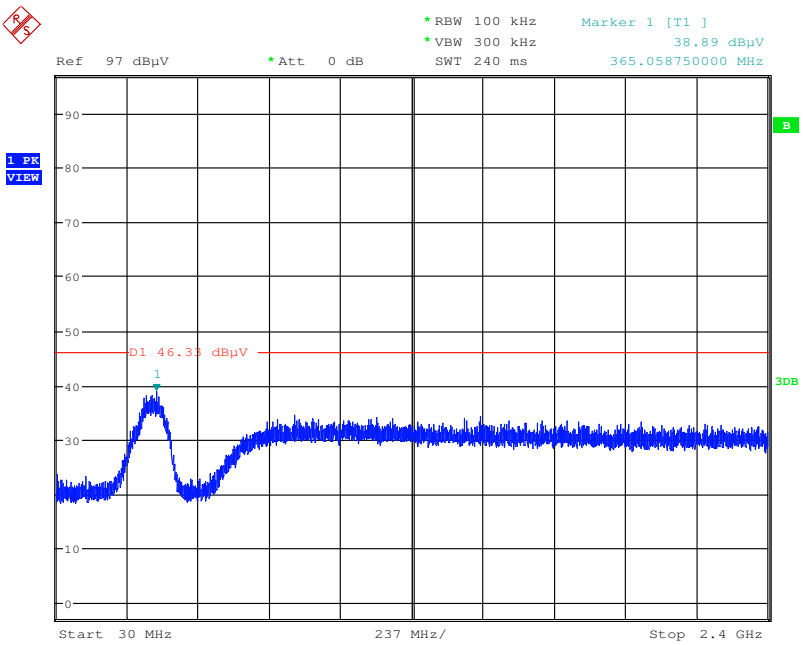
Note: Only the worse polarization (Horizontal) is tested and recorded in test report.

## Plot on Configuration For Bluetooth 4.0 / Channel 0 / 2500MHz~26500MHz (down 30dBc) - Horizontal



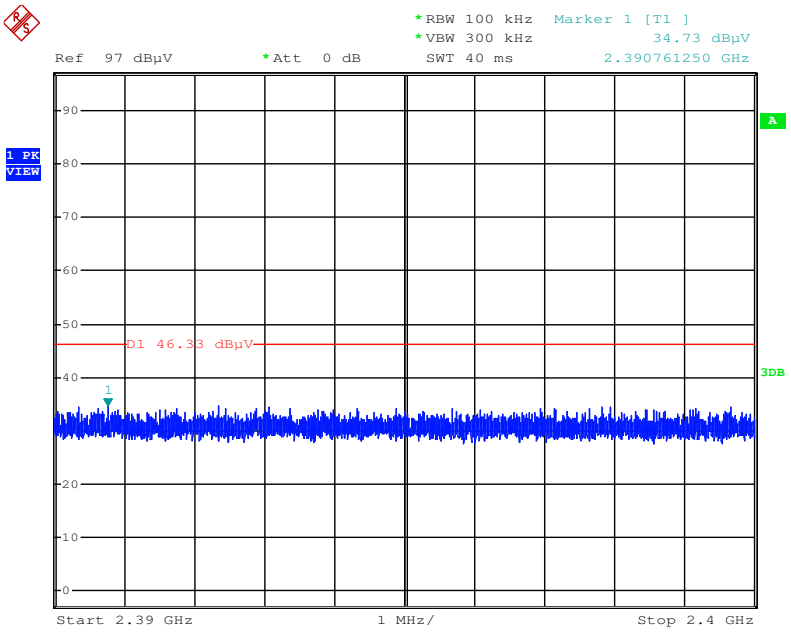

Note: Only the worse polarization (Horizontal) is tested and recorded in test report.

## Plot on Configuration For Bluetooth 4.0 / Channel 39 / 30MHz~2400MHz (down 30dBc) - Horizontal



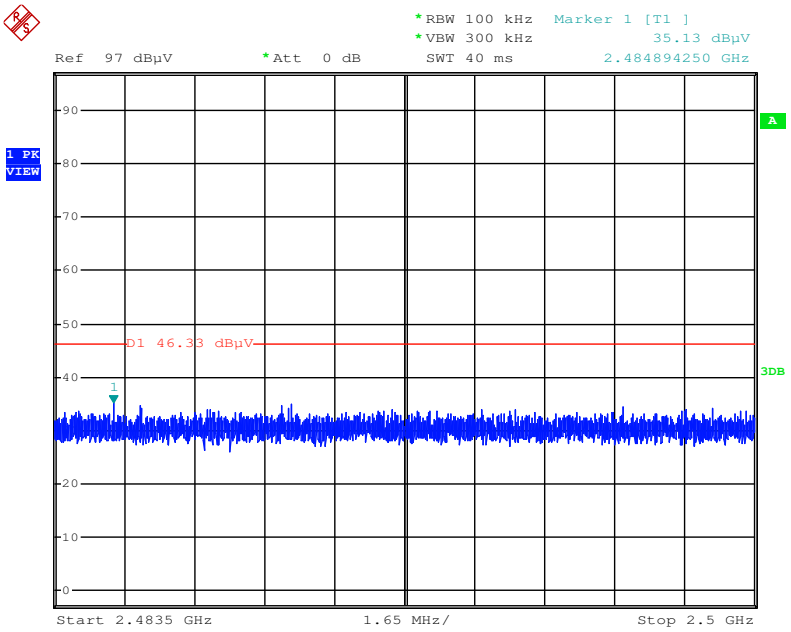

Date: 11.SEP.2015 17:14:57

## Plot on Configuration For Bluetooth 4.0 / Channel 39 / 2390MHz~2400MHz (down 30dBc) - Horizontal



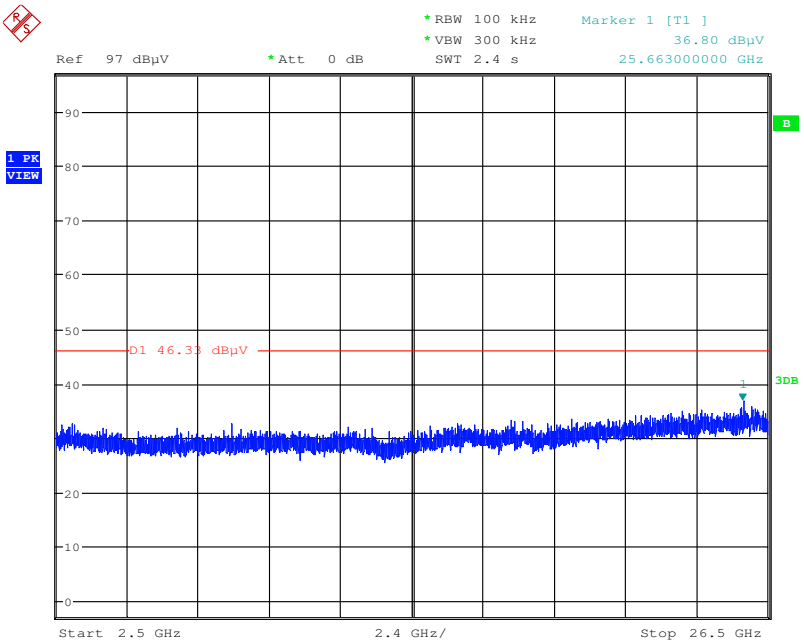

Date: 19.DEC.2015 11:12:58

## Plot on Configuration For Bluetooth 4.0 / Channel 39 / 2483.5MHz~2500MHz (down 30dBc) - Horizontal




Date: 19.DEC.2015 11:13:23

## Plot on Configuration For Bluetooth 4.0 / Channel 39 / 2500MHz~26500MHz (down 30dBc) - Horizontal




Date: 11.SEP.2015 17:15:32

Note: Only the worse polarization (Horizontal) is tested and recorded in test report.

## 4.7. Antenna Requirements

### 4.7.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

### 4.7.2. Antenna Connector Construction

Please refer to section 3.3 in this test report; antenna connector complied with the requirements.

# 5. LIST OF MEASURING EQUIPMENTS

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| EMI Test Receiver | R&S | ESCS 30 | 100355 | 9kHz ~ 2.75GHz | Apr. 22, 2015 | Conduction (CO01-CB) |
| LISN | F.C.C. | FCC-LISN-50-16-2 | 04083 | 150kHz ~ 100MHz | Dec. 02, 2014 | Conduction (CO01-CB) |
| LISN | Schwarzbeck | NSLK 8127 | 8127647 | 9kHz ~ 30MHz | Dec. 02, 2014 | Conduction (CO01-CB) |
| COND Cable | Woken | Cable | 01 | 150kHz ~ 30MHz | Dec. 03, 2014 | Conduction (CO01-CB) |
| Software | Audix | E3 | 6.120210n | - | N.C.R. | Conduction (CO01-CB) |
| Bilog Antenna | Schaffner | CBL6112D | 37880 | 20MHz ~ 2GHz | Sep. 03, 2015 | Radiation (03CH01-CB) |
| Loop Antenna | Teseq | HLA 6120 | 24155 | 9kHz - 30 MHz | Mar. 12, 2015* | Radiation (03CH01-CB) |
| Horn Antenna | EMCO | 3115 | 00075790 | 750MHz ~ 18GHz | Oct. 28, 2014 | Radiation (03CH01-CB) |
| Horn Antenna | EMCO | 3115 | 00075790 | 750MHz ~ 18GHz | Oct. 22, 2015 | Radiation (03CH01-CB) |
| Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170252 | 15GHz ~ 40GHz | Jul. 21, 2015 | Radiation (03CH01-CB) |
| Pre-Amplifier | Agilent | 8447D | 2944A10991 | 0.1MHz ~ 1.3GHz | Feb. 24, 2015 | Radiation (03CH01-CB) |
| Pre-Amplifier | Agilent | 8449B | 3008A02310 | 1GHz ~ 26.5GHz | Jan. 12, 2015 | Radiation (03CH01-CB) |
| Pre-Amplifier | WM | TF-130N-R1 | 923365 | 26GHz ~ 40GHz | Feb.10, 2015 | Radiation (03CH01-CB) |
| Spectrum Analyzer | R&S | FSP40 | 100056 | 9kHz ~ 40GHz | Nov. 06, 2014 | Radiation (03CH01-CB) |
| Spectrum Analyzer | R&S | FSP40 | 100056 | 9kHz ~ 40GHz | Oct. 27, 2015 | Radiation (03CH01-CB) |
| EMI Receiver | Agilent | N9038A | MY52260123 | 9kHz ~ 8.4GHz | Jan. 21, 2015 | Radiation (03CH01-CB) |
| RF Cable-low | Woken | Low Cable-1 | N/A | 30 MHz ~ 1 GHz | Nov. 02, 2015 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-16 | N/A | 1 GHz ~ 18 GHz | Nov. 15, 2014 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-16 | N/A | 1 GHz ~ 18 GHz | Nov. 02, 2015 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-17 | N/A | 1 GHz ~ 18 GHz | Nov. 15, 2014 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-17 | N/A | 1 GHz ~ 18 GHz | Nov. 02, 2015 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-40G-1 | N/A | 1 GHz ~ 40 GHz | Nov. 15, 2014 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-40G-1 | N/A | 18GHz ~ 40 GHz | Nov. 02, 2015 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-40G-2 | N/A | 1 GHz ~ 40 GHz | Nov. 15, 2014 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-40G-2 | N/A | 18GHz ~ 40 GHz | Nov. 02, 2015 | Radiation (03CH01-CB) |
| Spectrum analyzer | R&S | FSP40 | 100979 | 9kHz~40GHz | Dec. 12, 2014 | Conducted (TH01-CB) |
| Spectrum Analyzer | R&S | FSP40 | 100142 | 9kHz~40GHz | Oct. 13, 2015 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-7 | 1 GHz – 26.5 GHz | Nov. 15, 2014 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-7 | 1 GHz – 26.5 GHz | Nov. 02, 2015 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-8 | 1 GHz – 26.5 GHz | Nov. 15, 2014 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-8 | 1 GHz – 26.5 GHz | Nov. 02, 2015 | Conducted (TH01-CB) |

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| RF Cable-high | Woken | RG402 | High Cable-9 | 1 GHz – 26.5 GHz | Nov. 15, 2014 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-9 | 1 GHz – 26.5 GHz | Nov. 02, 2015 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-10 | 1 GHz – 26.5 GHz | Nov. 15, 2014 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-10 | 1 GHz – 26.5 GHz | Nov. 02, 2015 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-6 | 1 GHz – 26.5 GHz | Nov. 15, 2014 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-6 | 1 GHz – 26.5 GHz | Nov. 02, 2015 | Conducted (TH01-CB) |
| Power Sensor | Agilent | U2021XA | MY53410001 | 50MHz~18GHz | Nov. 03, 2014 | Conducted (TH01-CB) |
| Power Sensor | Agilent | U2021XA | MY53410001 | 50MHz~18GHz | Nov. 02, 2015 | Conducted (TH01-CB) |

Note: Calibration Interval of instruments listed above is one year.

"*" Calibration Interval of instruments listed above is two years.

N.C.R. means Non-Calibration required.

# 6. MEASUREMENT UNCERTAINTY

| Test Items | Uncertainty | Remark |
|---|---|---|
| Conducted Emission (150kHz ~ 30MHz) | 3.2 dB | Confidence levels of 95% |
| Radiated Emission (30MHz ~ 1,000MHz) | 3.6 dB | Confidence levels of 95% |
| Radiated Emission (1GHz ~ 18GHz) | 3.7 dB | Confidence levels of 95% |
| Radiated Emission (18GHz ~ 40GHz) | 3.5 dB | Confidence levels of 95% |
| Conducted Emission | 1.7 dB | Confidence levels of 95% |