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# FCC RADIO TEST REPORT

| | |
|---|---|
| Applicant's company | **TRENDnet, Inc.** |
| Applicant Address | 20675 Manhattan Place, Torrance, CA 90501, USA |
| FCC ID | **XU8TBW106-107V2** |
| Manufacturer's company | **TRENDnet, Inc.** |
| Manufacturer Address | 20675 Manhattan Place, Torrance, CA 90501, USA |

| | |
|---|---|
| Product Name | Micro Bluetooth USB Adapter |
| Brand Name | TRENDnet |
| Model Name | TBW-106 / TBW-107 |
| Test Rule | 47 CFR FCC Part 15 Subpart C § 15.247 |
| Test Freq. Range | 2402 ~ 2480MHz |
| Received Date | Apr. 30, 2014 |
| Final Test Date | May 21, 2014 |
| 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 C63.10-2009**, **47 CFR FCC Part 15 Subpart C** and **KDB 558074 D01 v03r01**.

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 |
|---|---|---|---|
| FR442508AB | Rev. 01 | Initial issue of report | Jun. 26, 2014 |
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Certificate No.: CB10306033

# 1. CERTIFICATE OF COMPLIANCE

| | | |
|---|---|---|
| Product Name | : | Micro Bluetooth USB Adapter |
| Brand Name | : | TRENDnet |
| Model No. | : | TBW-106 / TBW-107 |
| Applicant | : | TRENDnet, 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 Apr. 30, 2014 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

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 | 7.78 dB |
| 4.2 | 15.247(b)(3) | Maximum Conducted Output Power | Complies | 23.51 dB |
| 4.3 | 15.247(e) | Power Spectral Density | Complies | 15.91 dB |
| 4.4 | 15.247(a)(2) | 6dB Spectrum Bandwidth | Complies | - |
| 4.5 | 15.247(d) | Radiated Emissions | Complies | 1.68 dB |
| 4.6 | 15.247(d) | Band Edge Emissions | Complies | 0.11 dB |
| 4.7 | 15.203 | Antenna Requirements | Complies | - |

# 3. GENERAL INFORMATION

## 3.1. Product Details

| Items | Description |
|---|---|
| Power Type | From host system |
| Modulation | DSSS |
| Data Rate (Mbps) | GFSK: 1 |
| Frequency Range | 2402 ~ 2480MHz |
| Channel Number | 40 (37 hopping + 3 advertising channel) |
| Channel Band Width (99%) | 1.068 MHz |
| Maximum Conducted Output Power | 6.49 dBm |
| Carrier Frequencies | Please refer to section 3.4 |
| Antenna | Please refer to section 3.3 |

## 3.2. Accessories

N/A

## 3.3. Table for Filed Antenna

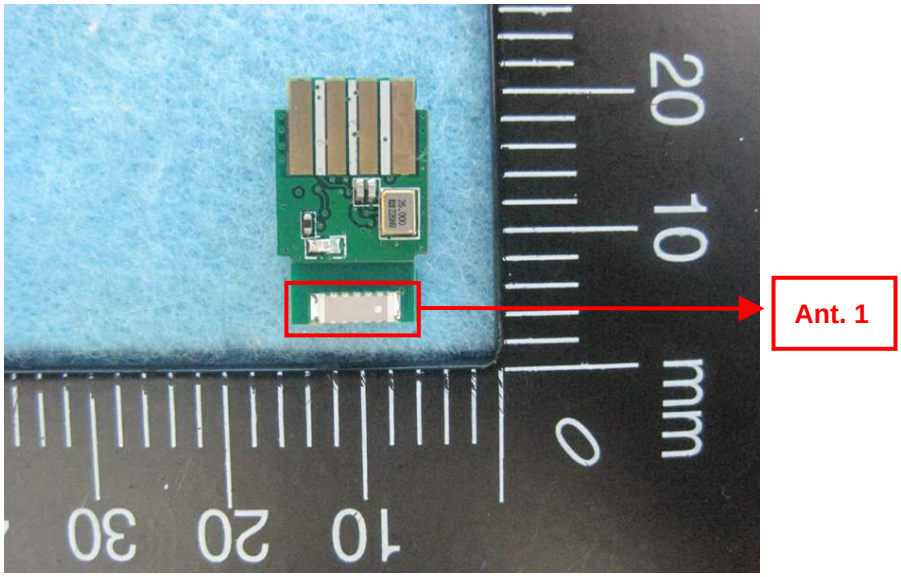
**For EUT1:**

| Ant. | Brand Holder | Model Name | Antenna Type | Connector | Gain (dBi) |
|---|---|---|---|---|---|
| 1 | ZHEJIANG ZHENGYUAN ELECTRIC CO. , LTD | LA5220P2450-A04 | Chip Antenna | N/A | 2 |

Note: The EUT has one antenna.

**For Bluetooth mode (1TX/1RX)**

Ant. 1 can be used as transmitting/receiving antenna.



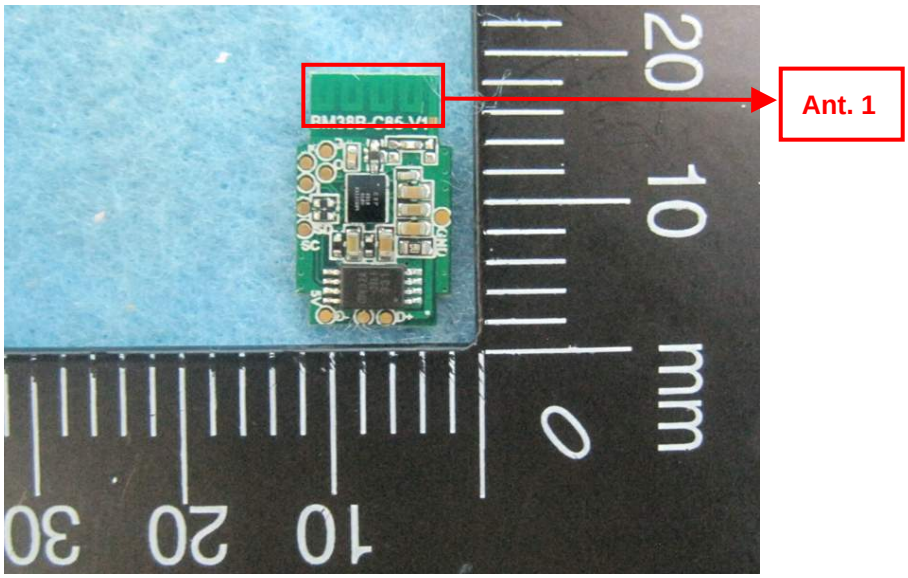
**For EUT2:**

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) |
|---|---|---|---|---|---|
| 1 | - | - | PCB Antenna | N/A | 2 |

Note: The EUT has one antenna.

**For Bluetooth mode (1TX/1RX)**

Ant. 1 can be used as transmitting/receiving antenna.



## 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 | Antenna |
|---|---|---|---|---|
| AC Power Line Conducted Emissions | CTX | - | - | - |
| Maximum Conducted Output Power<br>Power Spectral Density | GFSK | 1 Mbps | 0/20/39 | 1 |
| 6dB Spectrum Bandwidth | GFSK | 1 Mbps | 0/20/39 | 1 |
| Radiated Emissions 9kHz~1GHz | CTX | - | - | - |
| Radiated Emissions 1GHz~10$^{th}$ Harmonic | GFSK | 1 Mbps | 0/20/39 | 1 |
| Band Edge Emissions | GFSK | 1 Mbps | 0/20/39 | 1 |

The following test modes were performed for all tests:

**For Conducted Emission test:**

Mode 1. CTX-EUT 1

Mode 2. CTX-EUT 2

Mode 2 is the worst case, so it was selected to record in this test report

**For Radiated Emission test:**

For EUT1:

It were performed at its 3-axis and the worst-case was found at z-axis.

For EUT2:

It were performed at its 3-axis and the worst-case was found at y-axis.

Mode 1. CTX-Place EUT 1 in z axis

Mode 2. CTX-Place EUT 2 in y axis

**For Maximum Conducted Output Power Measurement, Power Spectral Density Measurement, 6dB Spectrum Bandwidth Measurement:**

EUT 1 and EUT 2 antennas are the same gain, so only "EUT 1" was tested and recorded in this test report.

## 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 Multiple List

The brand/model names in the following table are all refer to the identical product.

| Brand Name | Model Name | Chip antenna | PCB antenna |
|---|---|---|---|
| TRENDnet | TBW-106 | V | X |
| | TBW-107 | X | V |

## 3.8. Table for Supporting Units

**For Test Site No: 03CH01-CB**

| Support Unit | Brand | Model | FCC ID |
|---|---|---|---|
| Notebook | DELL | M1330 | DoC |

**For Test Site No: CO01-CB and TH01-CB**

| Support Unit | Brand | Model | FCC ID |
|---|---|---|---|
| Notebook | DELL | E6430 | DoC |

## 3.9. 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:**

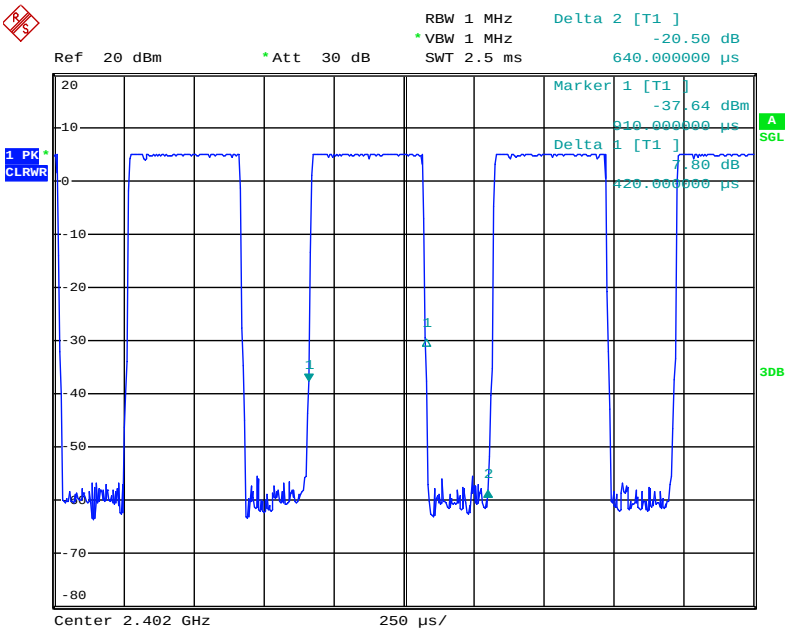
| Test Software Version | Broadcom BlueTool V1.8.4.8 | | |
|---|---|---|---|
| Frequency | 2402 MHz | 2442 MHz | 2480 MHz |
| Power Parameters | Default | Default | Default |

## 3.10. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

## 3.11. Duty Cycle

| Mode | On Time(ms) | On+Off Time(ms) | Duty Cycle(%) | 1/T Minimum VBW (kHz) |
|---|---|---|---|---|
| GFSK | 0.420 | 0.640 | 65.63% | 2.38 |

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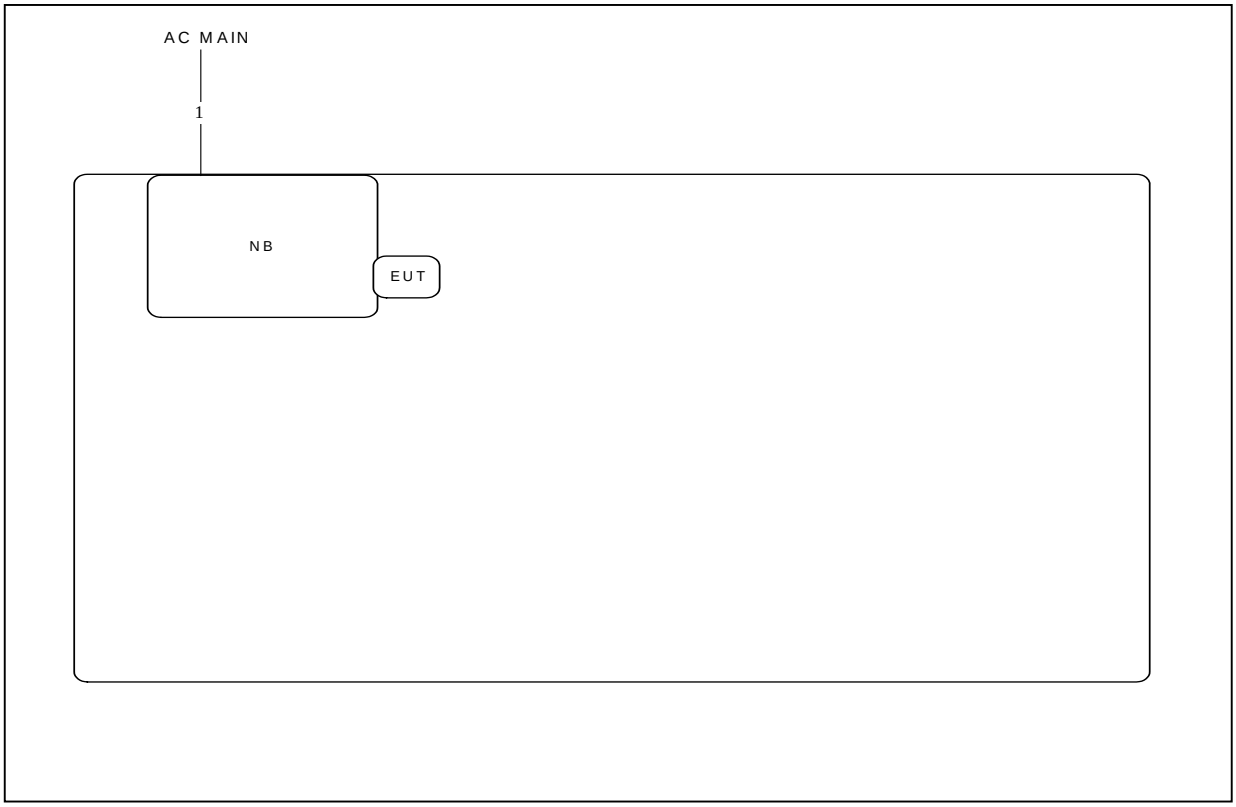
## 3.12. Test Configurations

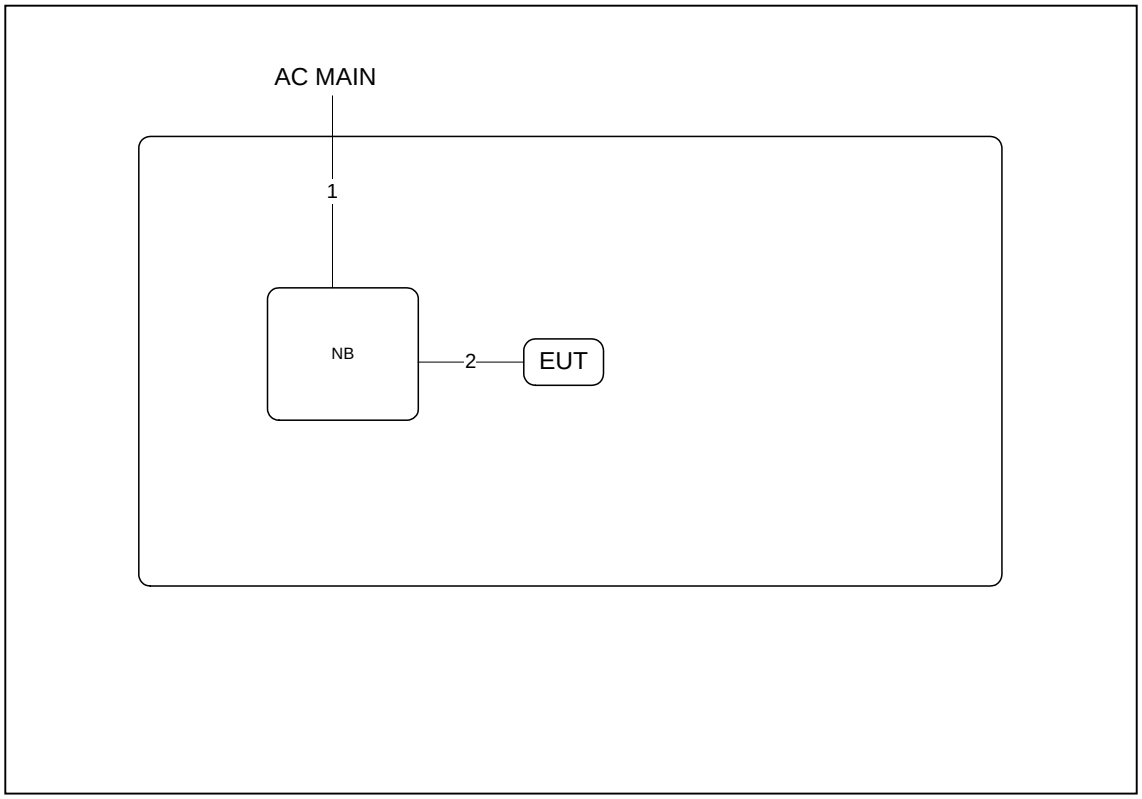
### 3.12.1. AC Power Line Conduction Emissions Test Configuration

Test Mode: Mode 2




| Item | Connection | Shield | Length |
|---|---|---|---|
| 1 | Power cable | No | 1.8m |

### 3.12.2. Radiation Emissions Test Configuration




| Item | Connection | Shield | Length |
|---|---|---|---|
| 1 | Power cable | No | 2m |
| 2 | USB cable | Yes | 1m |

# 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

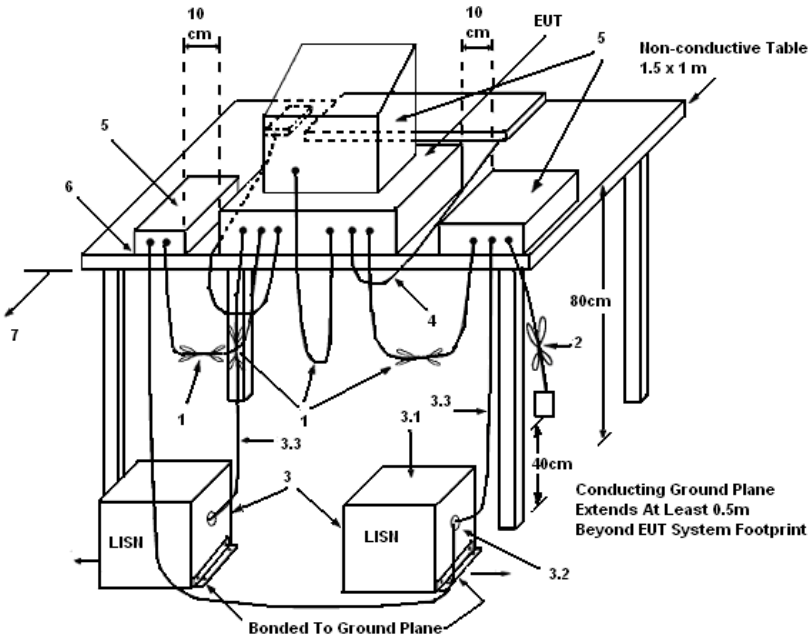
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

| 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

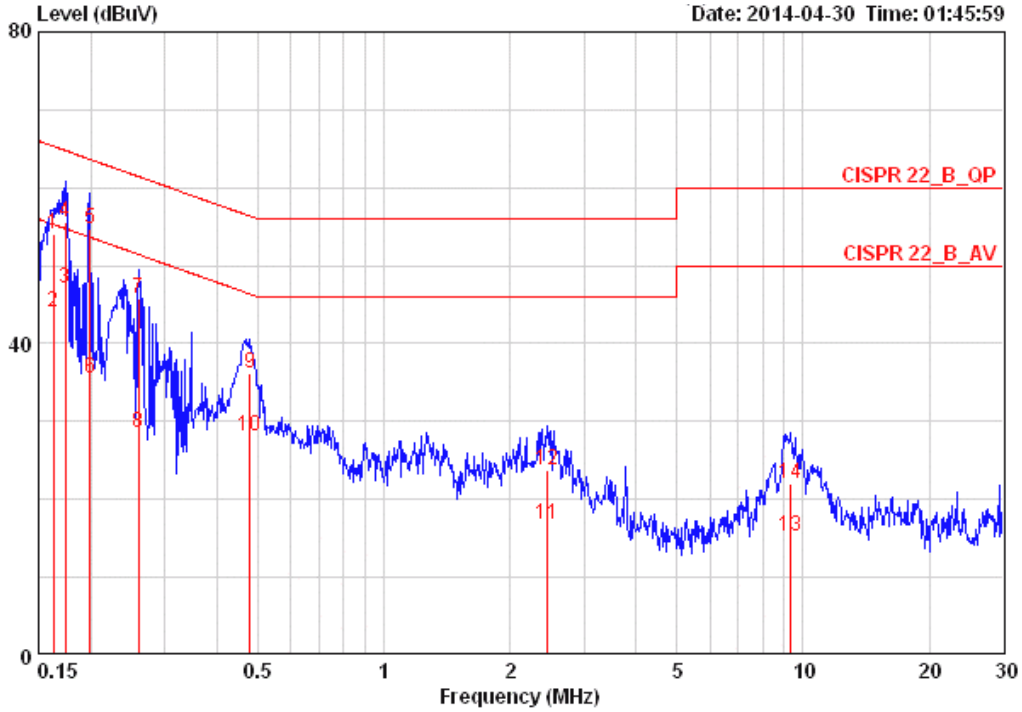
There is no deviation with the original standard.

### 4.1.6. EUT Operation during Test

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

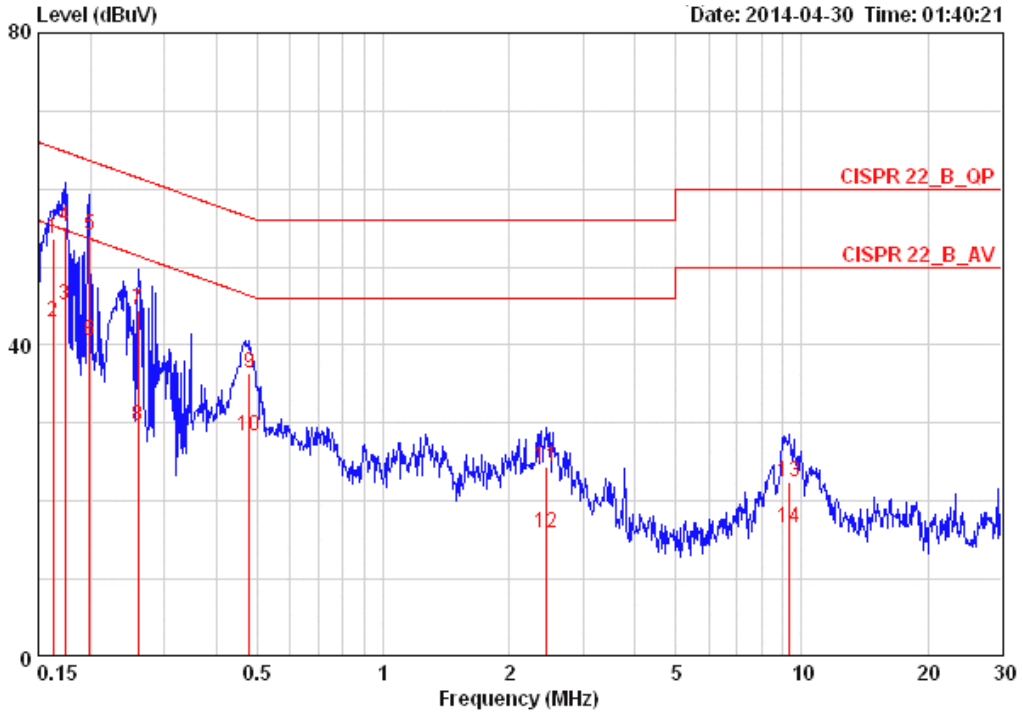
## 4.1.7. Results of AC Power Line Conducted Emissions Measurement

| Temperature | 25°C | Humidity | 52% |
|---|---|---|---|
| Test Engineer | Parody Lin | Phase | Line |
| Configuration | CTX / Mode 2 | | |




| | Freq | Level | Over Limit | Limit Line | LISN Factor | Read Level | Cable Loss | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dB | dBuV | dB | | |
| 1 | 0.16241 | 54.04 | -11.30 | 65.34 | 0.08 | 53.80 | 0.16 | LINE | QP |
| 2 | 0.16241 | 44.01 | -11.33 | 55.34 | 0.08 | 43.77 | 0.16 | LINE | AVERAGE |
| 3 @ | 0.17399 | 46.99 | -7.78 | 54.77 | 0.08 | 46.75 | 0.16 | LINE | AVERAGE |
| 4 @ | 0.17399 | 55.56 | -9.21 | 64.77 | 0.08 | 55.32 | 0.16 | LINE | QP |
| 5 @ | 0.19863 | 54.77 | -8.89 | 63.67 | 0.08 | 54.53 | 0.16 | LINE | QP |
| 6 | 0.19863 | 35.62 | -18.04 | 53.67 | 0.08 | 35.38 | 0.16 | LINE | AVERAGE |
| 7 | 0.26026 | 45.70 | -15.72 | 61.42 | 0.08 | 45.45 | 0.17 | LINE | QP |
| 8 | 0.26026 | 28.55 | -22.87 | 51.42 | 0.08 | 28.30 | 0.17 | LINE | AVERAGE |
| 9 | 0.47865 | 36.28 | -20.09 | 56.36 | 0.08 | 36.01 | 0.18 | LINE | QP |
| 10 | 0.47865 | 28.23 | -18.14 | 46.36 | 0.08 | 27.96 | 0.18 | LINE | AVERAGE |
| 11 | 2.461 | 16.70 | -29.30 | 46.00 | 0.13 | 16.31 | 0.26 | LINE | AVERAGE |
| 12 | 2.461 | 23.67 | -32.33 | 56.00 | 0.13 | 23.28 | 0.26 | LINE | QP |
| 13 | 9.352 | 15.29 | -34.71 | 50.00 | 0.25 | 14.66 | 0.38 | LINE | AVERAGE |
| 14 | 9.352 | 21.96 | -38.04 | 60.00 | 0.25 | 21.33 | 0.38 | LINE | QP |

| Temperature | 25°C | Humidity | 52% |
|---|---|---|---|
| Test Engineer | Parody Lin | Phase | Neutral |
| Configuration | CTX / Mode 2 | | |




| | Freq | Level | Over Limit | Limit Line | LISN Factor | Read Level | Cable Loss | Pol/Phase | Remark |
|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dB | dBuV | dB | | |
| 1 | 0.16241 | 53.57 | -11.77 | 65.34 | 0.08 | 53.33 | 0.16 | NEUTRAL | QP |
| 2 | 0.16241 | 42.96 | -12.38 | 55.34 | 0.08 | 42.72 | 0.16 | NEUTRAL | AVERAGE |
| 3 @ | 0.17399 | 45.07 | -9.70 | 54.77 | 0.08 | 44.83 | 0.16 | NEUTRAL | AVERAGE |
| 4 @ | 0.17399 | 55.16 | -9.61 | 64.77 | 0.08 | 54.92 | 0.16 | NEUTRAL | QP |
| 5 @ | 0.19863 | 54.05 | -9.61 | 63.67 | 0.08 | 53.81 | 0.16 | NEUTRAL | QP |
| 6 | 0.19863 | 40.61 | -13.05 | 53.67 | 0.08 | 40.37 | 0.16 | NEUTRAL | AVERAGE |
| 7 | 0.26026 | 44.42 | -17.00 | 61.42 | 0.08 | 44.17 | 0.17 | NEUTRAL | QP |
| 8 | 0.26026 | 29.70 | -21.72 | 51.42 | 0.08 | 29.45 | 0.17 | NEUTRAL | AVERAGE |
| 9 | 0.47865 | 36.48 | -19.88 | 56.36 | 0.09 | 36.21 | 0.18 | NEUTRAL | QP |
| 10 | 0.47865 | 28.42 | -17.94 | 46.36 | 0.09 | 28.15 | 0.18 | NEUTRAL | AVERAGE |
| 11 | 2.461 | 24.31 | -31.69 | 56.00 | 0.13 | 23.92 | 0.26 | NEUTRAL | QP |
| 12 | 2.461 | 16.01 | -29.99 | 46.00 | 0.13 | 15.62 | 0.26 | NEUTRAL | AVERAGE |
| 13 | 9.352 | 22.50 | -37.50 | 60.00 | 0.25 | 21.87 | 0.38 | NEUTRAL | QP |
| 14 | 9.352 | 16.64 | -33.36 | 50.00 | 0.25 | 16.01 | 0.38 | NEUTRAL | AVERAGE |

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

## 4.2. Maximum Conducted Output Power Measurement

### 4.2.1. Limit

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

### 4.2.2. Measuring Instruments and Setting

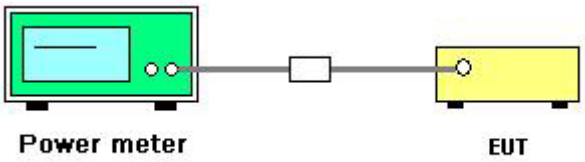
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

| 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 KDB 558074 D01 v03r01 section 9.2.2.
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 | 26°C | Humidity | 63% |
|---|---|---|---|
| Test Engineer | Wen Chao | Configurations | GFSK |
| Test Date | May 21, 2014 | | |

| Channel | Frequency | Conducted Power (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| 0 | 2402 MHz | 4.57 | 30.00 | Complies |
| 20 | 2442 MHz | 5.86 | 30.00 | Complies |
| 39 | 2480 MHz | 6.49 | 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

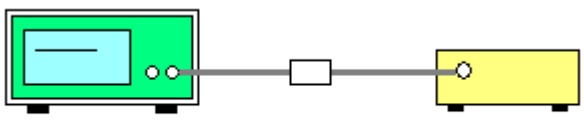
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| 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 procedures refer KDB 558074 D01 v03r01 section 10.2 Method PKPSD (peak PSD) and sum spectral maximal across the outputs.
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

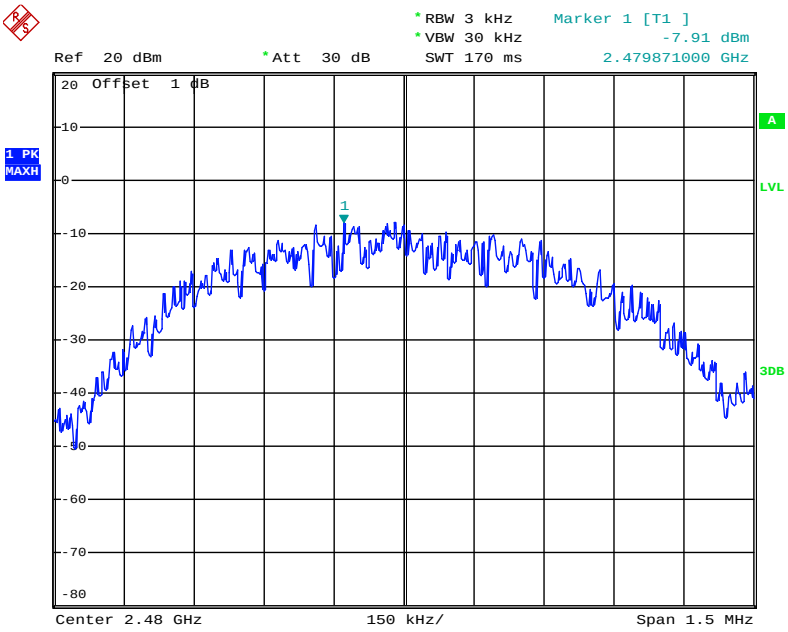
| Temperature | 26°C | Humidity | 63% |
|---|---|---|---|
| Test Engineer | Wen Chao | Configurations | GFSK |

| Channel | Frequency | Power Density (dBm/3kHz) | Power Density Limit (dBm/3kHz) | Result |
|---|---|---|---|---|
| | | Ant. 1 | | |
| 0 | 2402 MHz | -9.65 | 8.00 | Complies |
| 20 | 2442 MHz | -8.34 | 8.00 | Complies |
| 39 | 2480 MHz | -7.91 | 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

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## 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.

| Spectrum Parameters | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | > 6dB Bandwidth |
| RBW | 100kHz |
| VBW | ≥ 3 x RBW |
| Detector | Peak |
| Trace | Max Hold |
| Sweep Time | Auto |

### 4.4.3. Test Procedures

For Radiated 6dB Bandwidth Measurement:

7. The transmitter was radiated to the spectrum analyzer in peak hold mode.
8. Test was performed in accordance with KDB 558074 D01 v03r01 for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8.0 DTS 6-dB signal bandwidth option 1.
9. Measured the spectrum width with power higher than 6dB below carrier.

### 4.4.4. Test Setup Layout

For Radiated 6dB Bandwidth Measurement:

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

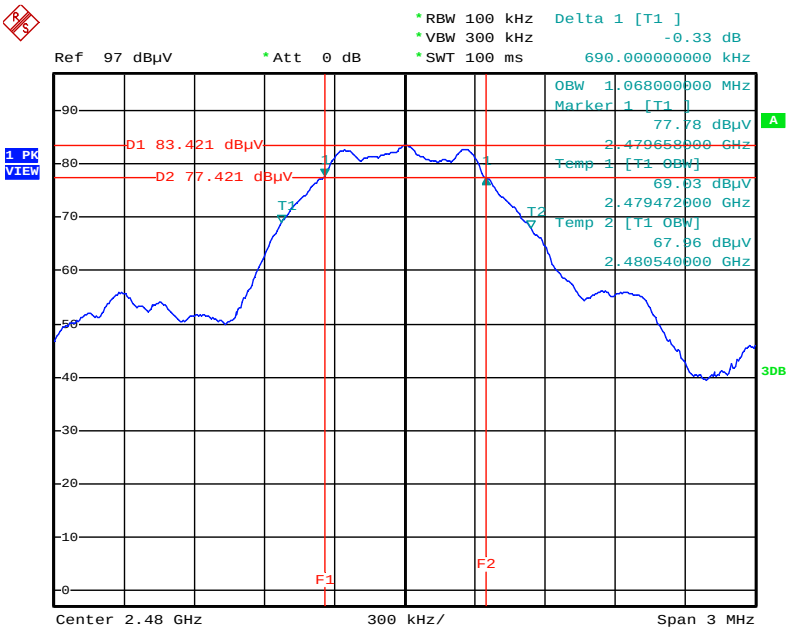
| Temperature | 26°C | Humidity | 63% |
|---|---|---|---|
| Test Engineer | Wen Chao | Configurations | GFSK |

| Channel | Frequency | 6dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Min. Limit (kHz) | Test Result |
|---|---|---|---|---|---|
| 0 | 2402 MHz | 0.696 | 1.050 | 500 | Complies |
| 20 | 2442 MHz | 0.690 | 1.056 | 500 | Complies |
| 39 | 2480 MHz | 0.690 | 1.068 | 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: 21.MAY.2014 11:43:44

## 4.5. Radiated Emissions Measurement

### 4.5.1. Limit

20dBc 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>Please refer to section 3.11 for Average |
| RBW / VBW (Emission in non-restricted band) | 100kHz / 300kHz for peak |

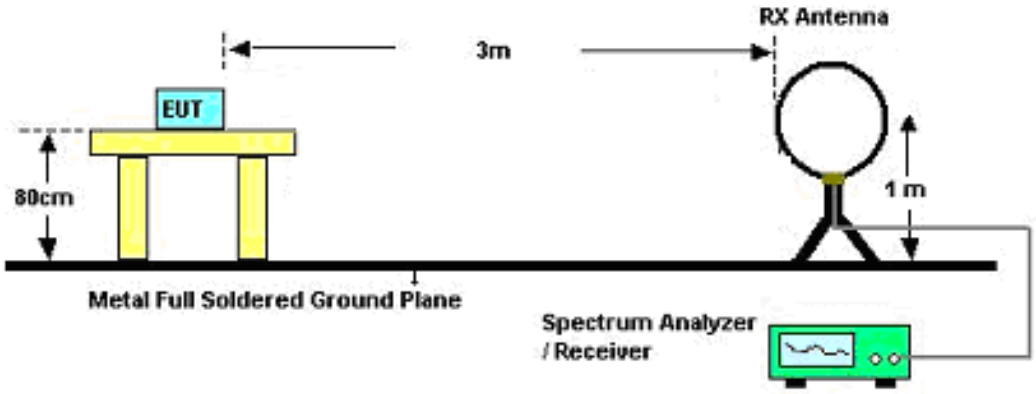
| Receiver Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RBW 200Hz for QP |
| Start ~ Stop Frequency | 150kHz~30MHz / RBW 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RBW 120kHz for QP |

### 4.5.3. Test Procedures

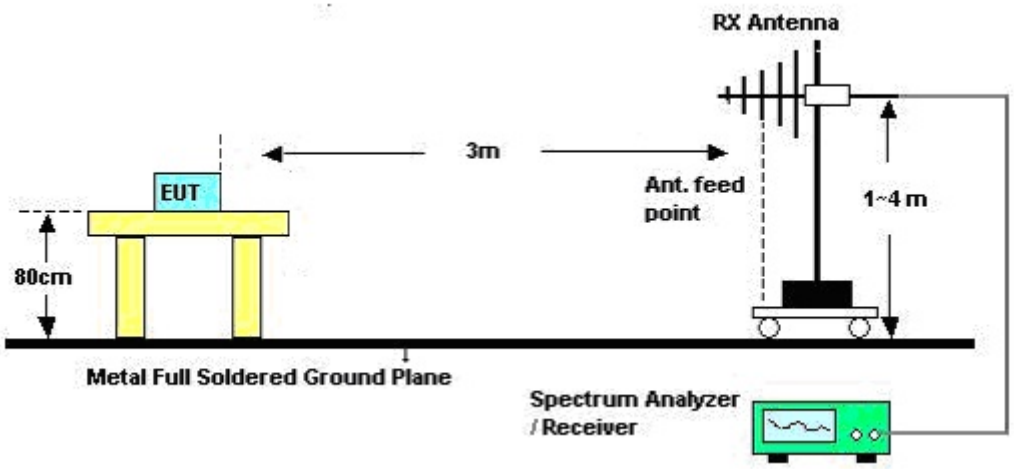
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 10Hz 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

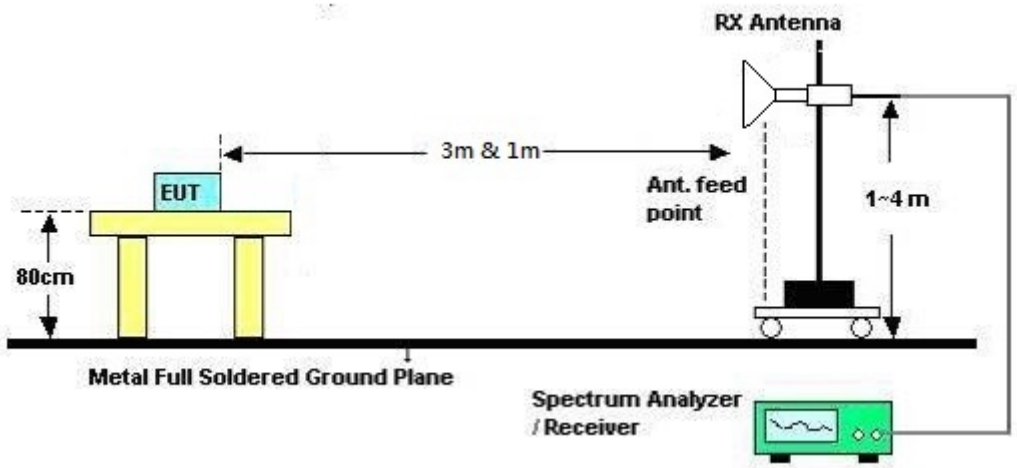
For Radiated Emissions: 9kHz ~30MHz




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 | 25°C | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | CTX |
| Test Date | May 10, 2014 | Test Date | Mode 1 ~ Mode 2 |

| 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.

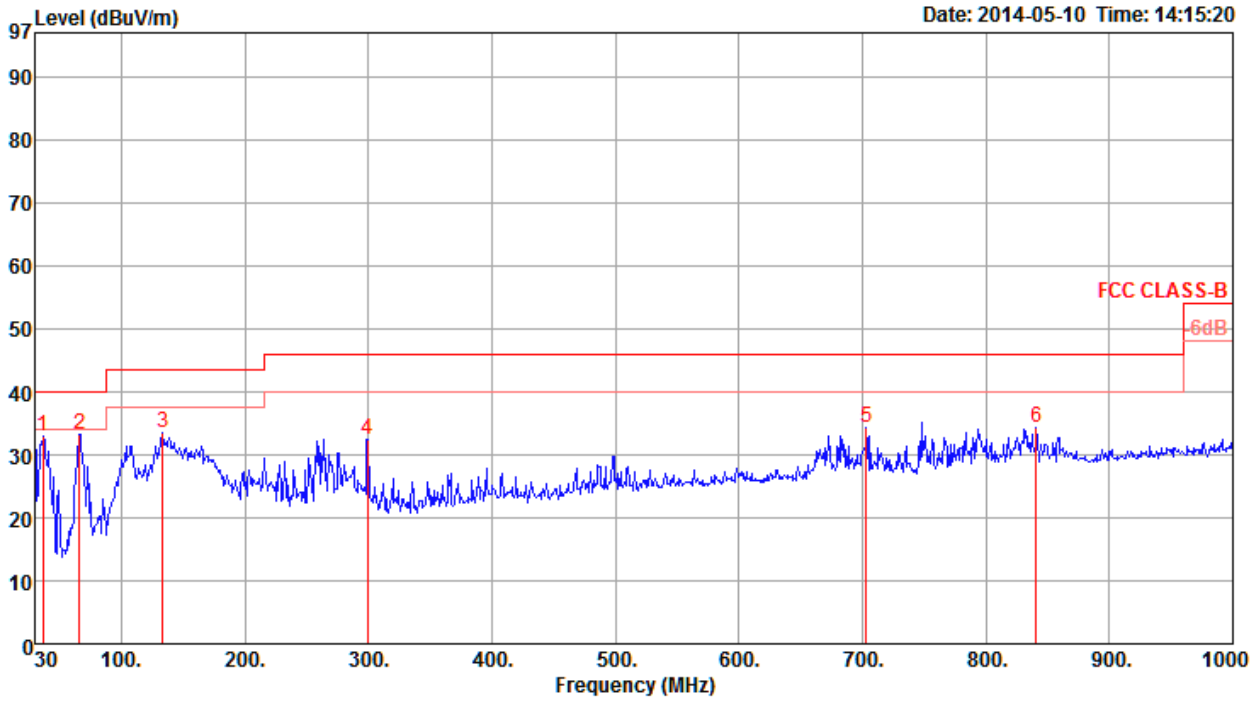
Distance extrapolation factor = 40 log (specific distance / test distance) (dB);

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

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

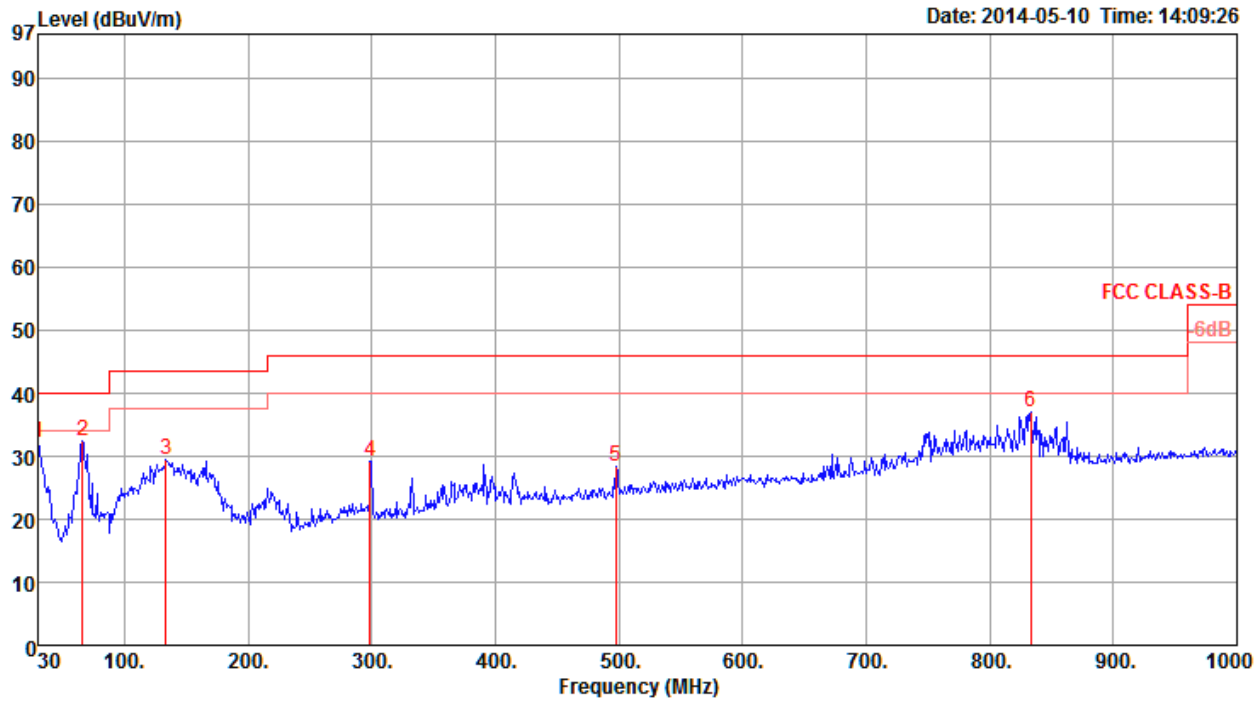
| Temperature | 25°C | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | CTX |
| Test Mode | Mode 1 | | |

*Horizontal*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 36.79 | 32.87 | 40.00 | -7.13 | 44.30 | 0.95 | 15.62 | 28.00 | Peak | 0 | 100 | HORIZONTAL |
| 2 | 65.89 | 33.29 | 40.00 | -6.71 | 53.19 | 1.22 | 6.84 | 27.96 | Peak | 0 | 100 | HORIZONTAL |
| 3 | 133.79 | 33.59 | 43.50 | -9.91 | 46.98 | 1.69 | 12.52 | 27.60 | Peak | 0 | 100 | HORIZONTAL |
| 4 | 299.66 | 32.49 | 46.00 | -13.51 | 43.01 | 2.51 | 13.80 | 26.83 | Peak | 0 | 100 | HORIZONTAL |
| 5 | 703.18 | 34.27 | 46.00 | -11.73 | 37.18 | 4.16 | 20.01 | 27.08 | Peak | 0 | 100 | HORIZONTAL |
| 6 | 840.92 | 34.19 | 46.00 | -11.81 | 35.54 | 4.42 | 21.13 | 26.90 | Peak | 0 | 100 | HORIZONTAL |

*Vertical*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 30.00 | 32.20 | 40.00 | -7.80 | 39.44 | 0.83 | 19.90 | 27.97 | Peak | 0 | 400 | VERTICAL |
| 2 | 65.89 | 32.31 | 40.00 | -7.69 | 52.21 | 1.22 | 6.84 | 27.96 | Peak | 0 | 400 | VERTICAL |
| 3 | 133.79 | 29.36 | 43.50 | -14.14 | 42.75 | 1.69 | 12.52 | 27.60 | Peak | 0 | 400 | VERTICAL |
| 4 | 298.69 | 29.23 | 46.00 | -16.77 | 39.75 | 2.51 | 13.80 | 26.83 | Peak | 0 | 400 | VERTICAL |
| 5 | 497.54 | 28.28 | 46.00 | -17.72 | 35.09 | 3.37 | 17.75 | 27.93 | Peak | 0 | 400 | VERTICAL |
| 6 | 833.16 | 37.05 | 46.00 | -8.95 | 38.47 | 4.41 | 21.07 | 26.90 | Peak | 0 | 400 | VERTICAL |

Note:

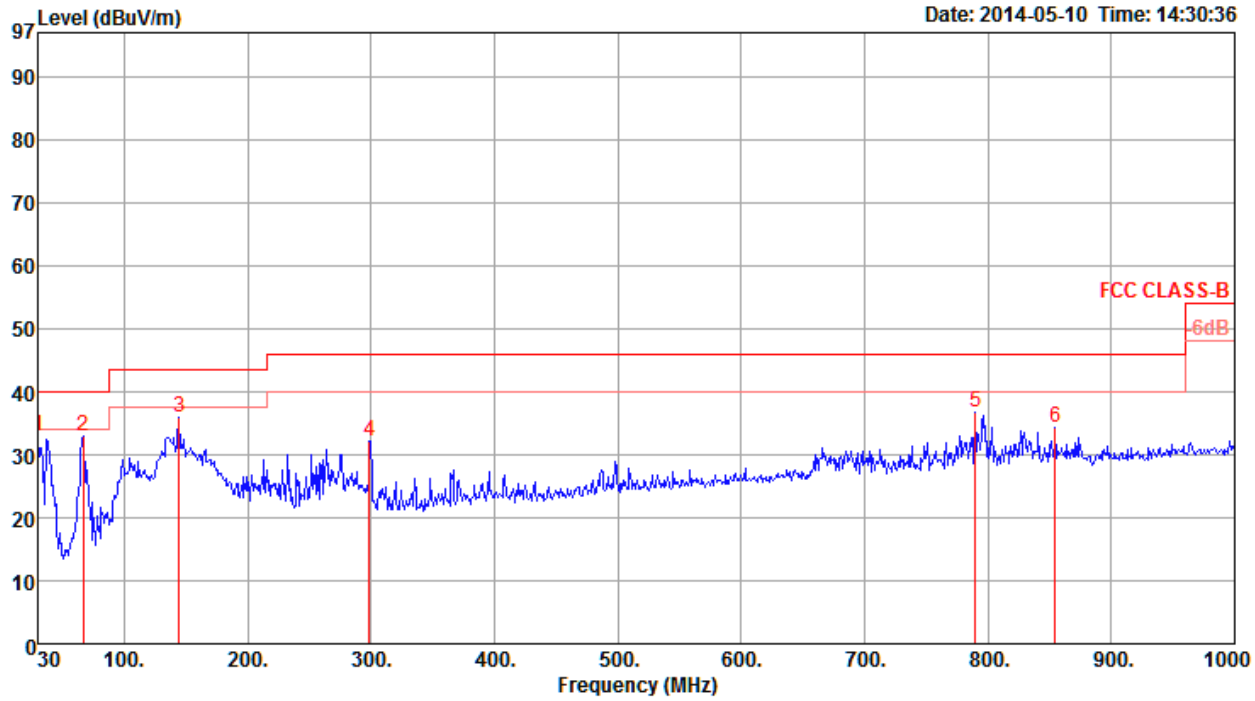
The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

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

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

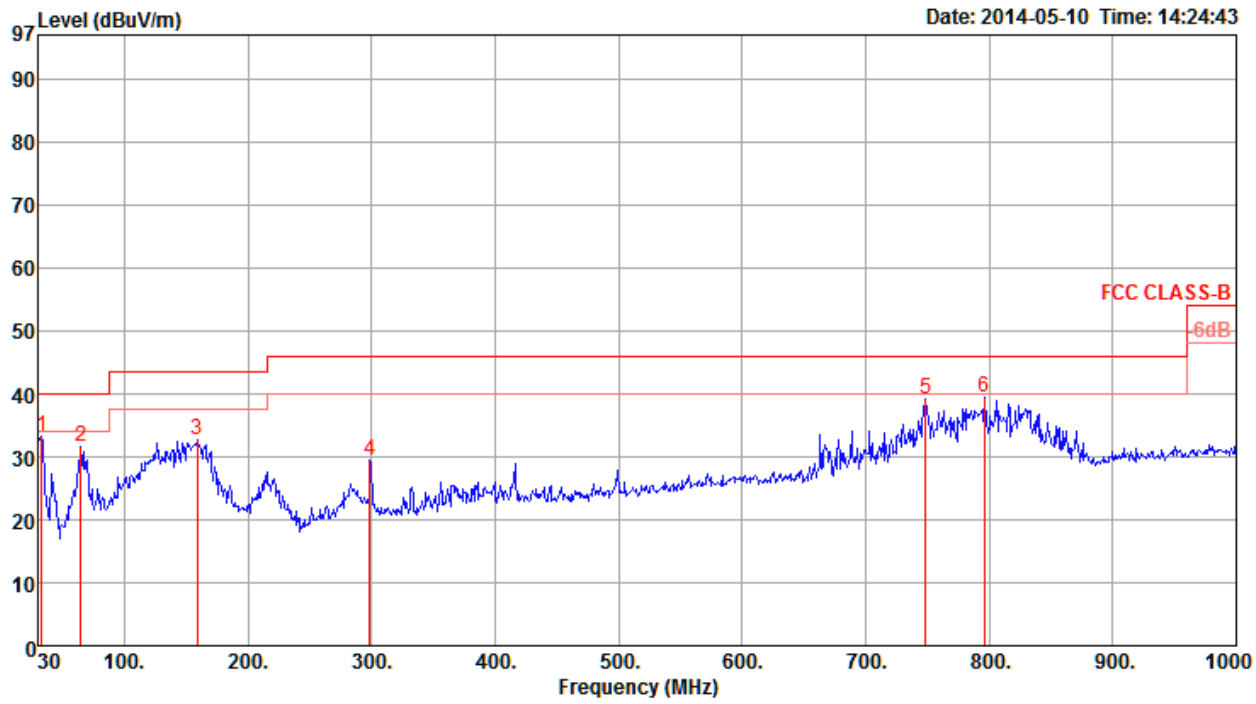
| Temperature | 25°C | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | CTX |
| Test Mode | Mode 2 | | |

*Horizontal*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 30.00 | 32.88 | 40.00 | -7.12 | 40.12 | 0.83 | 19.90 | 27.97 | Peak | 0 | 100 | HORIZONTAL |
| 2 | 66.86 | 32.85 | 40.00 | -7.15 | 52.74 | 1.23 | 6.83 | 27.95 | Peak | 0 | 100 | HORIZONTAL |
| 3 | 144.46 | 35.81 | 43.50 | -7.69 | 49.90 | 1.75 | 11.69 | 27.53 | Peak | 0 | 100 | HORIZONTAL |
| 4 | 298.69 | 32.08 | 46.00 | -13.92 | 42.60 | 2.51 | 13.80 | 26.83 | Peak | 0 | 100 | HORIZONTAL |
| 5 | 789.51 | 36.87 | 46.00 | -9.13 | 38.81 | 4.33 | 20.67 | 26.94 | Peak | 0 | 100 | HORIZONTAL |
| 6 | 854.50 | 34.23 | 46.00 | -11.77 | 35.44 | 4.45 | 21.23 | 26.89 | Peak | 0 | 100 | HORIZONTAL |

*Vertical*




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 32.91 | 33.23 | 40.00 | -6.77 | 42.24 | 0.88 | 18.10 | 27.99 | Peak | 0 | 400 | VERTICAL |
| 2 | 64.92 | 31.66 | 40.00 | -8.34 | 51.57 | 1.20 | 6.85 | 27.96 | Peak | 0 | 400 | VERTICAL |
| 3 | 159.01 | 32.77 | 43.50 | -10.73 | 47.66 | 1.87 | 10.66 | 27.42 | Peak | 0 | 400 | VERTICAL |
| 4 | 298.69 | 29.51 | 46.00 | -16.49 | 40.03 | 2.51 | 13.80 | 26.83 | Peak | 0 | 400 | VERTICAL |
| 5 | 748.77 | 39.29 | 46.00 | -6.71 | 42.00 | 4.21 | 20.20 | 27.12 | Peak | 0 | 400 | VERTICAL |
| 6 | 796.30 | 39.57 | 46.00 | -6.43 | 41.38 | 4.35 | 20.75 | 26.91 | Peak | 0 | 400 | 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 | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | Channel 0 |
| Test Date | May 08, 2014 | Test Mode | Mode 1 |

*Horizontal*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4803.88 | 39.31 | 54.00 | -14.69 | 37.29 | 4.20 | 32.52 | 34.70 | Average | 241 | 123 | HORIZONTAL |
| 2 | 4804.21 | 49.59 | 74.00 | -24.41 | 47.57 | 4.20 | 32.52 | 34.70 | Peak | 241 | 123 | HORIZONTAL |

*Vertical*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4804.03 | 44.83 | 54.00 | -9.17 | 42.81 | 4.20 | 32.52 | 34.70 | Average | 282 | 106 | VERTICAL |
| 2 | 4804.66 | 51.79 | 74.00 | -22.21 | 49.77 | 4.20 | 32.52 | 34.70 | Peak | 282 | 106 | VERTICAL |

| Temperature | 25℃ | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | Channel 20 |
| Test Date | May 08, 2014 | Test Mode | Mode 1 |

*Horizontal*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4879.11 | 49.66 | 74.00 | -24.34 | 47.45 | 4.22 | 32.66 | 34.67 | Peak | 190 | 174 | HORIZONTAL |
| 2 | 4879.95 | 40.65 | 54.00 | -13.35 | 38.44 | 4.22 | 32.66 | 34.67 | Average | 190 | 174 | HORIZONTAL |
| 3 | 7319.02 | 55.28 | 74.00 | -18.72 | 47.78 | 5.35 | 37.09 | 34.94 | Peak | 290 | 180 | HORIZONTAL |
| 4 | 7319.96 | 45.79 | 54.00 | -8.21 | 38.29 | 5.35 | 37.09 | 34.94 | Average | 290 | 180 | HORIZONTAL |

*Vertical*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4879.46 | 51.48 | 74.00 | -22.52 | 49.27 | 4.22 | 32.66 | 34.67 | Peak | 265 | 163 | VERTICAL |
| 2 | 4880.03 | 42.78 | 54.00 | -11.22 | 40.57 | 4.22 | 32.66 | 34.67 | Average | 265 | 163 | VERTICAL |
| 3 | 7319.34 | 55.51 | 74.00 | -18.49 | 48.01 | 5.35 | 37.09 | 34.94 | Peak | 146 | 170 | VERTICAL |
| 4 | 7319.88 | 45.51 | 54.00 | -8.49 | 38.01 | 5.35 | 37.09 | 34.94 | Average | 146 | 170 | VERTICAL |

| Temperature | 25℃ | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | Channel 39 |
| Test Date | May 08, 2014 | Test Mode | Mode 1 |

*Horizontal*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4959.46 | 46.96 | 74.00 | -27.04 | 44.54 | 4.23 | 32.83 | 34.64 | Peak | 337 | 200 | HORIZONTAL |
| 2 | 4960.01 | 33.85 | 54.00 | -20.15 | 31.43 | 4.23 | 32.83 | 34.64 | Average | 337 | 200 | HORIZONTAL |
| 3 | 7439.31 | 56.35 | 74.00 | -17.65 | 48.72 | 5.37 | 37.24 | 34.98 | Peak | 318 | 162 | HORIZONTAL |
| 4 | 7439.93 | 46.86 | 54.00 | -7.14 | 39.23 | 5.37 | 37.24 | 34.98 | Average | 318 | 162 | HORIZONTAL |

*Vertical*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4959.48 | 46.14 | 74.00 | -27.86 | 43.72 | 4.23 | 32.83 | 34.64 | Peak | 268 | 169 | VERTICAL |
| 2 | 4959.79 | 35.04 | 54.00 | -18.96 | 32.62 | 4.23 | 32.83 | 34.64 | Average | 268 | 169 | VERTICAL |
| 3 | 7439.31 | 54.28 | 74.00 | -19.72 | 46.65 | 5.37 | 37.24 | 34.98 | Peak | 256 | 167 | VERTICAL |
| 4 | 7440.07 | 43.73 | 54.00 | -10.27 | 36.10 | 5.37 | 37.24 | 34.98 | Average | 256 | 167 | 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.

| Temperature | 25℃ | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | Channel 0 |
| Test Date | May 10, 2014 | Test Mode | Mode 2 |

*Horizontal*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4804.09 | 40.65 | 54.00 | -13.35 | 38.63 | 4.20 | 32.52 | 34.70 | Average | 354 | 100 | HORIZONTAL |
| 2 | 4804.59 | 49.54 | 74.00 | -24.46 | 47.52 | 4.20 | 32.52 | 34.70 | Peak | 354 | 100 | HORIZONTAL |

*Vertical*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4804.03 | 49.01 | 54.00 | -4.99 | 46.99 | 4.20 | 32.52 | 34.70 | Average | 274 | 100 | VERTICAL |
| 2 | 4804.56 | 57.09 | 74.00 | -16.91 | 55.07 | 4.20 | 32.52 | 34.70 | Peak | 274 | 100 | VERTICAL |

| Temperature | 25℃ | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | Channel 20 |
| Test Date | May 10, 2014 | Test Mode | Mode 2 |

*Horizontal*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4879.50 | 50.25 | 74.00 | -23.75 | 48.04 | 4.22 | 32.66 | 34.67 | Peak | 350 | 100 | HORIZONTAL |
| 2 | 4879.97 | 41.98 | 54.00 | -12.02 | 39.77 | 4.22 | 32.66 | 34.67 | Average | 350 | 100 | HORIZONTAL |
| 3 | 7319.44 | 37.41 | 54.00 | -16.59 | 29.91 | 5.35 | 37.09 | 34.94 | Average | 295 | 100 | HORIZONTAL |
| 4 | 7319.87 | 49.98 | 74.00 | -24.02 | 42.48 | 5.35 | 37.09 | 34.94 | Peak | 295 | 100 | HORIZONTAL |

*Vertical*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4879.41 | 57.36 | 74.00 | -16.64 | 55.15 | 4.22 | 32.66 | 34.67 | Peak | 296 | 121 | VERTICAL |
| 2 | 4879.95 | 52.32 | 54.00 | -1.68 | 50.11 | 4.22 | 32.66 | 34.67 | Average | 296 | 121 | VERTICAL |
| 3 | 7319.35 | 50.74 | 74.00 | -23.26 | 43.24 | 5.35 | 37.09 | 34.94 | Peak | 90 | 110 | VERTICAL |
| 4 | 7319.62 | 38.24 | 54.00 | -15.76 | 30.74 | 5.35 | 37.09 | 34.94 | Average | 90 | 110 | VERTICAL |

| Temperature | 25℃ | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | Channel 39 |
| Test Date | May 10, 2014 | Test Mode | Mode 2 |

*Horizontal*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4960.00 | 41.41 | 54.00 | -12.59 | 38.99 | 4.23 | 32.83 | 34.64 | Average | 14 | 100 | HORIZONTAL |
| 2 | 4960.63 | 49.15 | 74.00 | -24.85 | 46.73 | 4.23 | 32.83 | 34.64 | Peak | 14 | 100 | HORIZONTAL |
| 3 | 7439.67 | 50.36 | 74.00 | -23.64 | 42.73 | 5.37 | 37.24 | 34.98 | Peak | 316 | 100 | HORIZONTAL |
| 4 | 7440.64 | 37.60 | 54.00 | -16.40 | 29.97 | 5.37 | 37.24 | 34.98 | Average | 316 | 100 | HORIZONTAL |

*Vertical*

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 4959.50 | 54.73 | 74.00 | -19.27 | 52.31 | 4.23 | 32.83 | 34.64 | Peak | 305 | 116 | VERTICAL |
| 2 | 4959.99 | 49.45 | 54.00 | -4.55 | 47.03 | 4.23 | 32.83 | 34.64 | Average | 305 | 116 | VERTICAL |
| 3 | 7439.39 | 39.01 | 54.00 | -14.99 | 31.38 | 5.37 | 37.24 | 34.98 | Average | 38 | 100 | VERTICAL |
| 4 | 7439.84 | 51.38 | 74.00 | -22.62 | 43.75 | 5.37 | 37.24 | 34.98 | Peak | 38 | 100 | 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

20dBc 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>Please refer to section 3.11 for Average |
| RBW / VBW (Emission in non-restricted band) | 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, only the frequency range investigated is limited to 100MHz around band edges.

For Radiated Out of Band Emission Measurement:

1. Test was performed in accordance with KDB 558074 D01 v03r01 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.
2. The radiated emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.
   Only worst data of each operating mode is presented.

### 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 | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | Channel 0, 20, 39 |
| Test Date | May 08, 2014 | Test Mode | Mode 1 |

**Channel 0**

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 2390.00 | 52.18 | 74.00 | -21.82 | 21.35 | 2.91 | 27.92 | 0.00 | Peak | 279 | 104 | HORIZONTAL |
| 2 | 2390.00 | 43.29 | 54.00 | -10.71 | 12.46 | 2.91 | 27.92 | 0.00 | Average | 279 | 104 | HORIZONTAL |
| 3 | 2402.00 | 98.63 | | | 67.80 | 2.91 | 27.92 | 0.00 | Average | 279 | 104 | HORIZONTAL |
| 4 | 2402.40 | 103.64 | | | 72.81 | 2.91 | 27.92 | 0.00 | Peak | 279 | 104 | HORIZONTAL |

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

**Channel 20**

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 2390.00 | 53.43 | 74.00 | -20.57 | 22.60 | 2.91 | 27.92 | 0.00 | Peak | 204 | 100 | HORIZONTAL |
| 2 | 2390.00 | 43.18 | 54.00 | -10.82 | 12.35 | 2.91 | 27.92 | 0.00 | Average | 204 | 100 | HORIZONTAL |
| 3 | 2440.00 | 104.13 | | | 73.33 | 2.94 | 27.86 | 0.00 | Peak | 204 | 100 | HORIZONTAL |
| 4 | 2440.00 | 99.15 | | | 68.35 | 2.94 | 27.86 | 0.00 | Average | 204 | 100 | HORIZONTAL |
| 5 | 2483.50 | 52.05 | 74.00 | -21.95 | 21.27 | 2.96 | 27.82 | 0.00 | Peak | 204 | 100 | HORIZONTAL |
| 6 | 2483.50 | 43.09 | 54.00 | -10.91 | 12.31 | 2.96 | 27.82 | 0.00 | Average | 204 | 100 | HORIZONTAL |

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

**Channel 39**

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 2480.00 | 105.62 | | | 74.84 | 2.96 | 27.82 | 0.00 | Peak | 278 | 100 | HORIZONTAL |
| 2 | 2480.00 | 100.60 | | | 69.82 | 2.96 | 27.82 | 0.00 | Average | 278 | 100 | HORIZONTAL |
| 3 | 2483.50 | 66.05 | 74.00 | -7.95 | 35.27 | 2.96 | 27.82 | 0.00 | Peak | 278 | 100 | HORIZONTAL |
| 4 | 2483.50 | 53.89 | 54.00 | -0.11 | 23.11 | 2.96 | 27.82 | 0.00 | Average | 278 | 100 | HORIZONTAL |

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

Note:

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

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

| Temperature | 25℃ | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Kenneth Huang | Configurations | Channel 0, 20, 39 |
| Test Date | May 10, 2014 | Test Mode | Mode 2 |

**Channel 0**

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 2390.00 | 52.26 | 74.00 | -21.74 | 21.43 | 2.91 | 27.92 | 0.00 | Peak | 321 | 136 | VERTICAL |
| 2 | 2390.00 | 42.78 | 54.00 | -11.22 | 11.95 | 2.91 | 27.92 | 0.00 | Average | 321 | 136 | VERTICAL |
| 3 | 2402.00 | 94.25 | | | 63.42 | 2.91 | 27.92 | 0.00 | Average | 321 | 136 | VERTICAL |
| 4 | 2402.40 | 99.08 | | | 68.25 | 2.91 | 27.92 | 0.00 | Peak | 321 | 136 | VERTICAL |

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

**Channel 20**

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 2390.00 | 53.10 | 74.00 | -20.90 | 22.27 | 2.91 | 27.92 | 0.00 | Peak | 185 | 107 | HORIZONTAL |
| 2 | 2390.00 | 42.74 | 54.00 | -11.26 | 11.91 | 2.91 | 27.92 | 0.00 | Average | 185 | 107 | HORIZONTAL |
| 3 | 2440.00 | 98.88 | | | 68.08 | 2.94 | 27.86 | 0.00 | Peak | 185 | 107 | HORIZONTAL |
| 4 | 2440.00 | 94.12 | | | 63.32 | 2.94 | 27.86 | 0.00 | Average | 185 | 107 | HORIZONTAL |
| 5 | 2483.50 | 51.07 | 74.00 | -22.93 | 20.29 | 2.96 | 27.82 | 0.00 | Peak | 185 | 107 | HORIZONTAL |
| 6 | 2483.50 | 42.65 | 54.00 | -11.35 | 11.87 | 2.96 | 27.82 | 0.00 | Average | 185 | 107 | HORIZONTAL |

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

**Channel 39**

| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | Preamp Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | | deg | cm | |
| 1 | 2479.80 | 103.84 | | | 73.06 | 2.96 | 27.82 | 0.00 | Peak | 268 | 133 | VERTICAL |
| 2 | 2480.00 | 98.78 | | | 68.00 | 2.96 | 27.82 | 0.00 | Average | 268 | 133 | VERTICAL |
| 3 | 2483.50 | 60.73 | 74.00 | -13.27 | 29.95 | 2.96 | 27.82 | 0.00 | Peak | 268 | 133 | VERTICAL |
| 4 | 2483.50 | 50.01 | 54.00 | -3.99 | 19.23 | 2.96 | 27.82 | 0.00 | Average | 268 | 133 | VERTICAL |

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

Note:

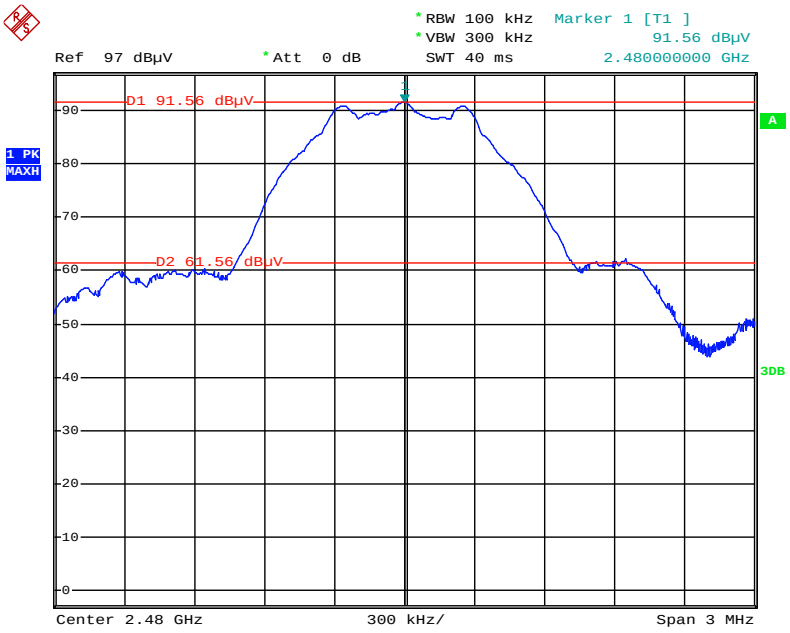
Emission level (dBuV/m) = 20 log Emission level (uV/m).

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

## For Emission not in Restricted Band

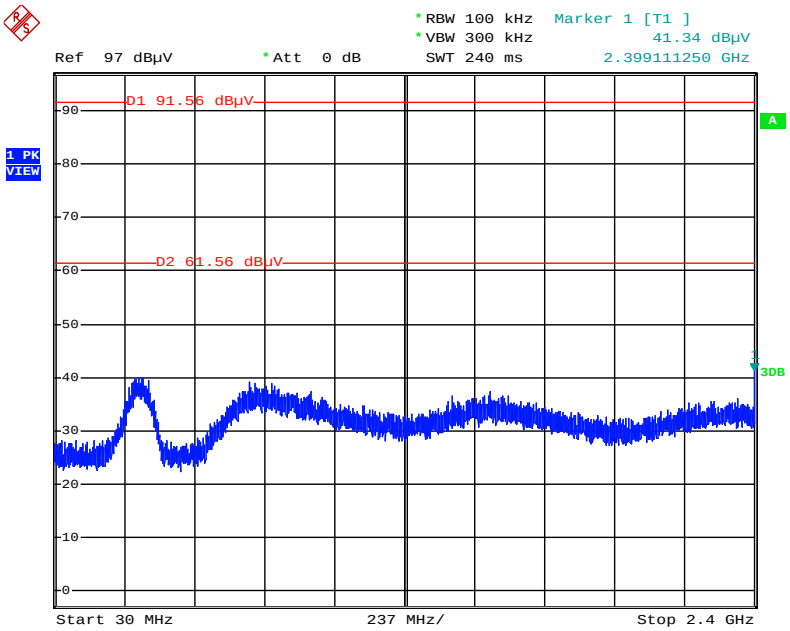
## Test Mode: Mode 1

## Plot on Configuration / Reference Level



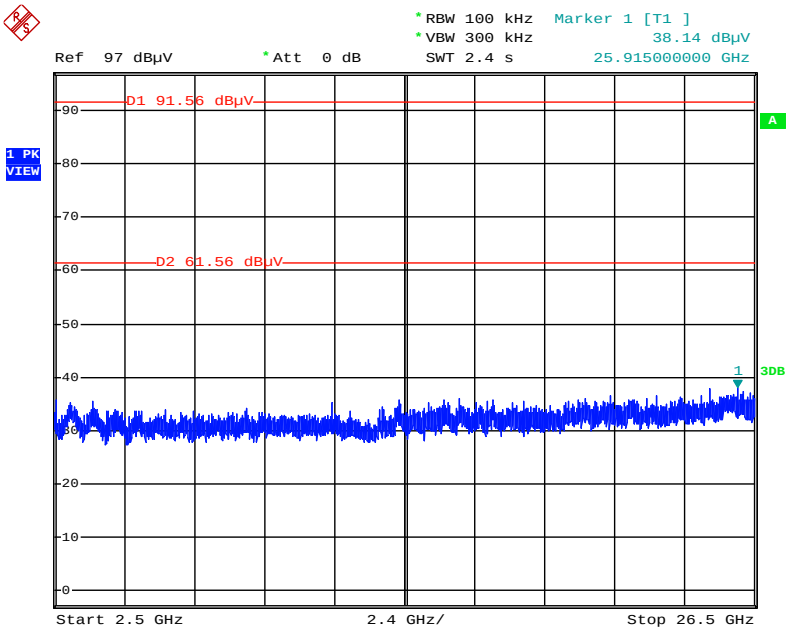

Date: 8.MAY.2014 17:30:18

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



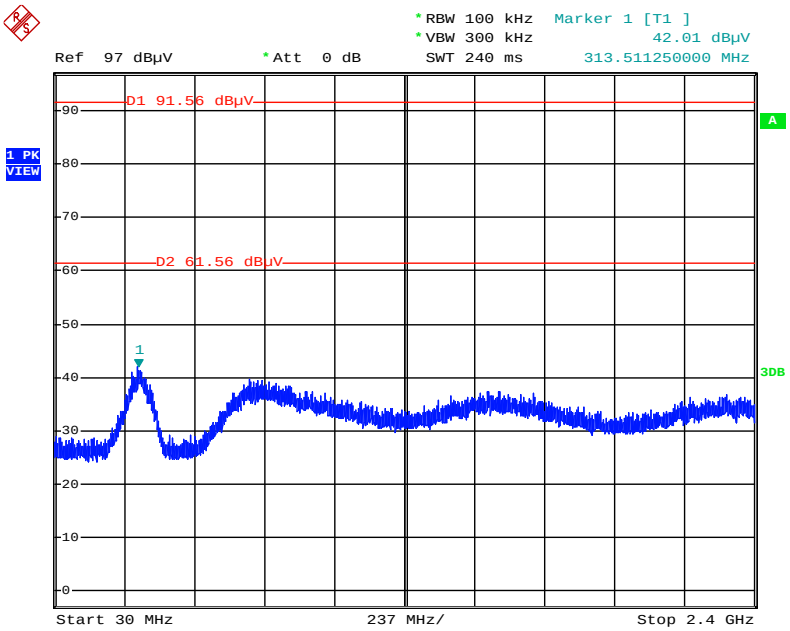

Date: 8.MAY.2014 17:32:23

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



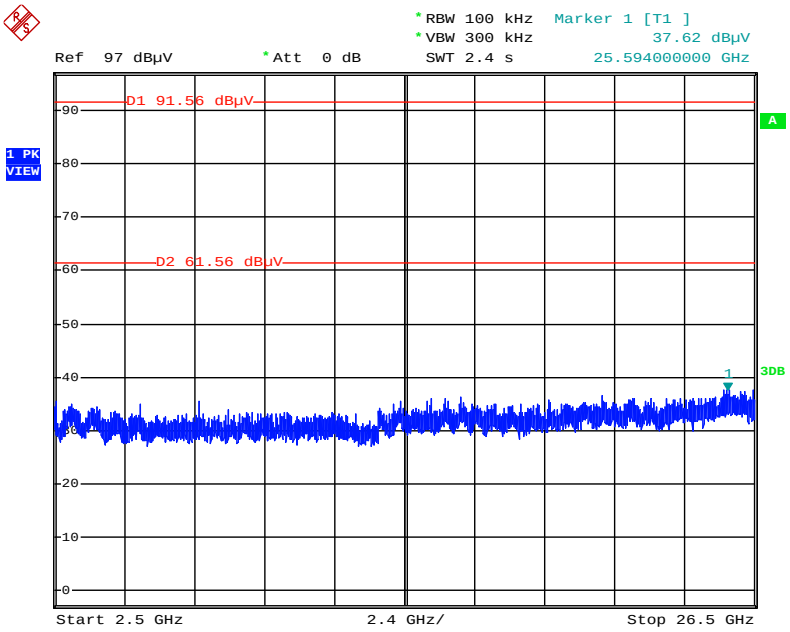

Date: 8.MAY.2014 17:33:36

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




Date: 8.MAY.2014 17:31:20

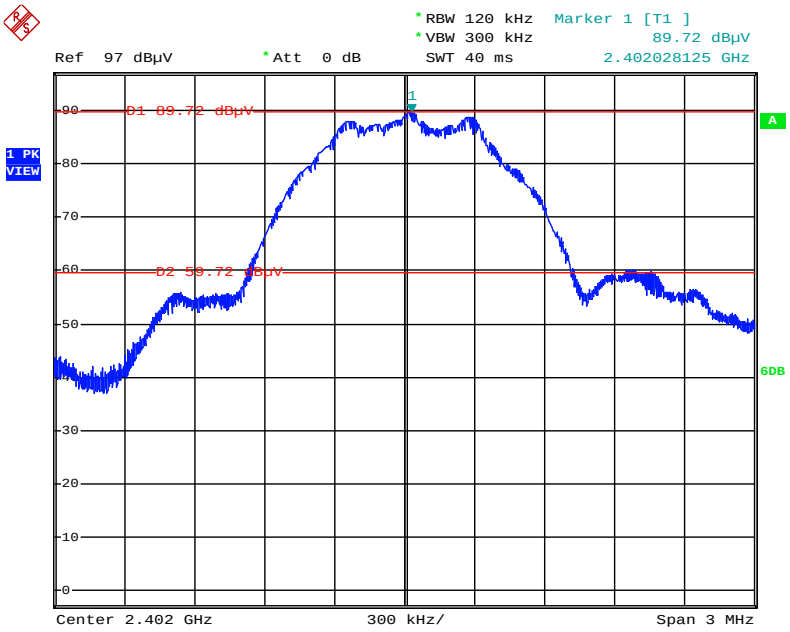
## Plot on Configuration For Bluetooth 4.0 / Channel 39 / 2500MHz~26500MHz (down 30dBc)




Date: 8.MAY.2014 17:33:49

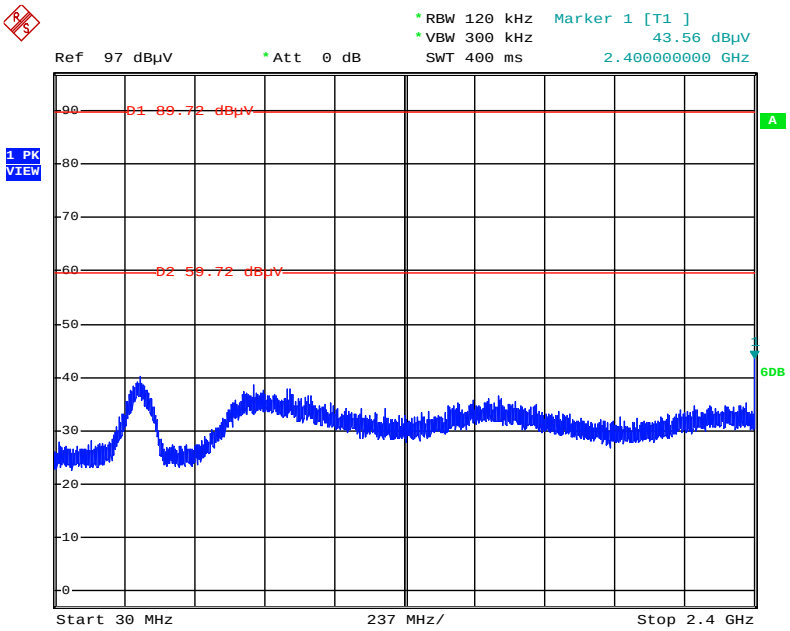
## Test Mode: Mode 2

### Plot on Configuration / Reference Level



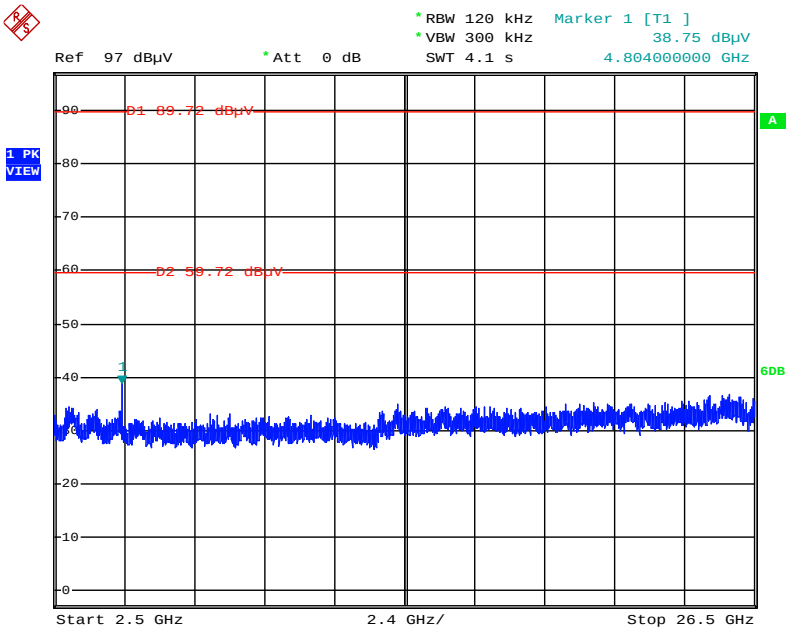

Date: 10.MAY.2014 13:49:42

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



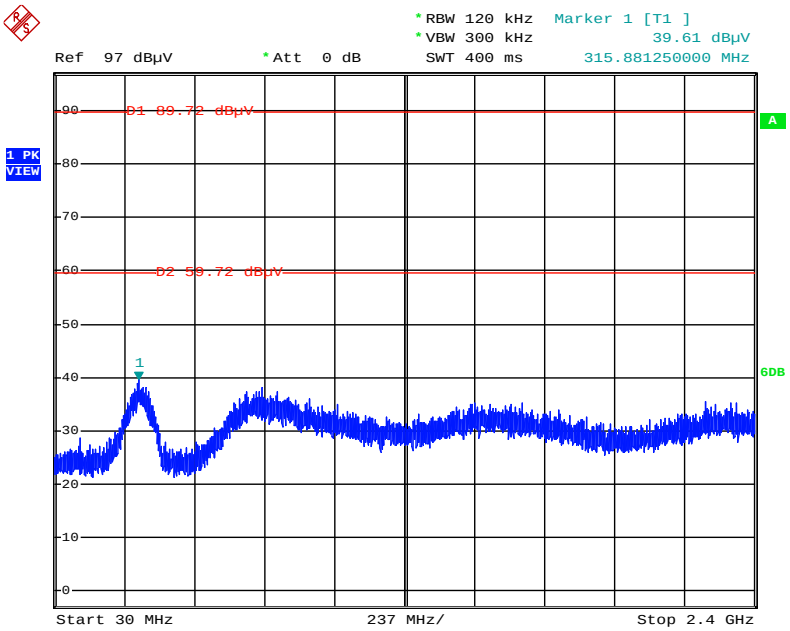

Date: 10.MAY.2014 13:50:18

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



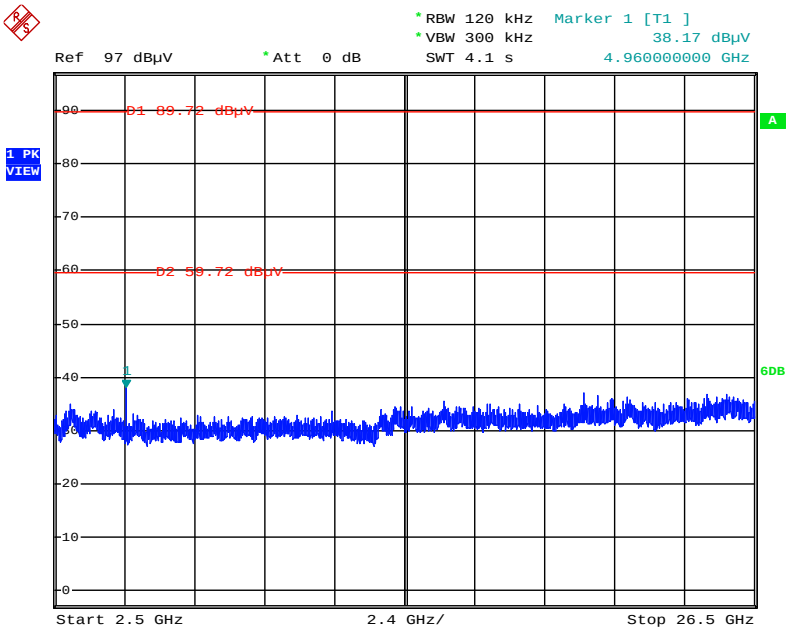

Date: 10.MAY.2014 13:50:40

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




Date: 10.MAY.2014 13:51:26

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




Date: 10.MAY.2014 13:51:14

## 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 | 9 kHz ~ 2.75 GHz | Apr. 23, 2014 | Conduction (CO01-CB) |
| LISN | F.C.C. | FCC-LISN-50-16-2 | 04083 | 150 kHz ~ 100 MHz | Nov. 23, 2013 | Conduction (CO01-CB) |
| LISN | Schwarzbeck | NSLK 8127 | 8127478 | 9kHz ~ 30MHz | Nov. 11, 2013 | Conduction (CO01-CB) |
| COND Cable | Woken | Cable | 01 | 150 kHz ~ 30 MHz | Dec. 04, 2013 | Conduction (CO01-CB) |
| Software | Audix | E3 | 5.410e | - | N.C.R. | Conduction (CO01-CB) |
| BILOG ANTENNA | Schaffner | CBL6112D | 2888 | 20MHz ~ 2GHz | Jan. 15, 2014 | Radiation (03CH01-CB) |
| Loop Antenna | Teseq | HLA 6120 | 24155 | 9 kHz - 30 MHz | Nov. 05, 2012* | Radiation (03CH01-CB) |
| Horn Antenna | EMCO | 3115 | 00075790 | 750MHz~18GHz | Nov. 01, 2013 | Radiation (03CH01-CB) |
| Horn Antenna | SCHWARZBEAK | BBHA 9170 | BBHA9170252 | 15GHz ~ 40GHz | Dec. 17, 2013 | Radiation (03CH01-CB) |
| Pre-Amplifier | Agilent | 8447D | 2944A10991 | 0.1MHz ~ 1.3GHz | Nov. 12, 2013 | Radiation (03CH01-CB) |
| Pre-Amplifier | Agilent | 8449B | 3008A02310 | 1GHz ~ 26.5GHz | Dec. 16, 2013 | Radiation (03CH01-CB) |
| Pre-Amplifier | WM | TF-130N-R1 | 923365 | 26GHz ~ 40GHz | Oct. 23, 2013 | Radiation (03CH01-CB) |
| Spectrum analyzer | R&S | FSP40 | 100019 | 9kHz~40GHz | Dec. 02, 2013 | Radiation (03CH01-CB) |
| EMI Test Receiver | Agilent | N9038A | MY52260123 | 9kHz ~ 8GHz | Dec. 12, 2013 | Radiation (03CH01-CB) |
| Turn Table | INN CO | CO 2000 | N/A | 0 ~ 360 degree | N.C.R | Radiation (03CH01-CB) |
| Antenna Mast | INN CO | CO2000 | N/A | 1 m - 4 m | N.C.R | Radiation (03CH01-CB) |
| RF Cable-low | Woken | Low Cable-1 | N/A | 30 MHz - 1 GHz | Nov. 17, 2013 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-1 | N/A | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-2 | N/A | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-3 | N/A | 1 GHz - 40 GHz | Nov. 17, 2013 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-4 | N/A | 1 GHz - 40 GHz | Nov. 17, 2013 | Radiation (03CH01-CB) |
| Signal analyzer | R&S | FSV40 | 100979 | 9kHz~40GHz | Nov. 29, 2013 | Conducted (TH01-CB) |
| RF Power Divider | Woken | 2 Way | 0120A02056002D | 2GHz ~ 18GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Power Divider | Woken | 3 Way | MDC2366 | 2GHz ~ 18GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Power Divider | Woken | 4 Way | 0120A04056002D | 2GHz ~ 18GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Cable-high | Woken | High Cable-7 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| RF Cable-high | Woken | High Cable-8 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Cable-high | Woken | High Cable-9 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Cable-high | Woken | High Cable-10 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| RF Cable-high | Woken | High Cable-11 | - | 1 GHz – 26.5 GHz | Nov. 17, 2013 | Conducted (TH01-CB) |
| Power Sensor | Anritsu | MA2411B | 0917223 | 300MHz~40GHz | Sep. 18, 2013 | Conducted (TH01-CB) |
| Power Meter | Anritsu | ML2495A | 1035008 | 300MHz~40GHz | Sep. 18, 2013 | 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

Uncertainty of Conducted Emission Measurement (150kHz ~ 30MHz)

| Contribution | Uncertainty of $x_i$ | | | $u(x_i)$ |
|---|---|---|---|---|
| | Value | Unit | Probability Distribution k | |
| Receiver reading | 0.026 | dB | normal(k=2) | 0.013 |
| Cable loss | 0.002 | dB | normal(k=2) | 0.001 |
| AMN/LISN specification | 1.200 | dB | normal(k=2) | 0.600 |
| Mismatch<br>Receiver VSWR 1=<br>AMN/LISN VSWR 2= | -0.080 | dB | U-shaped | 0.060 |
| Combined standard uncertainty Uc(y) | | | | 1.2 |
| Measuring uncertainty for a level of confidence of 95% U=2Uc(y) | | | | 2.4 |

Uncertainty of Radiated Emission Measurement (30MHz ~ 1,000MHz)

| Contribution | Uncertainty of $x_i$ | | | $u(x_i)$ |
|---|---|---|---|---|
| | Value | Unit | Probability Distribution k | |
| Receiver reading | ±0.173 | dB | k=1 | 0.086 |
| Cable loss | ±0.174 | dB | k=2 | 0.087 |
| Antenna gain | ±0.169 | dB | k=2 | 0.084 |
| Site imperfection | ±0.433 | dB | Triangular | 0.214 |
| Pre-amplifier gain | ±0.366 | dB | k=2 | 0.183 |
| Transmitter antenna | ±1.200 | dB | Rectangular | 0.600 |
| Signal generator | ±0.461 | dB | Rectangular | 0.231 |
| Mismatch | ±0.080 | dB | U-shape | 0.040 |
| Spectrum analyzer | ±0.500 | dB | Rectangular | 0.250 |
| Combined standard uncertainty Uc(y) | | | | 1.778 |
| Measuring uncertainty for a level of confidence of 95% U=2Uc(y) | | | | 3.555 |

Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

| Contribution | Uncertainty of $x_i$ | | | $u(x_i)$ |
|---|---|---|---|---|
| | Value | Unit | Probability Distribution k | |
| Receiver reading | ±0.191 | dB | k=1 | 0.095 |
| Cable loss | ±0.169 | dB | k=2 | 0.084 |
| Antenna gain | ±0.191 | dB | k=2 | 0.096 |
| Site imperfection | ±0.582 | dB | Triangular | 0.291 |
| Pre-amplifier gain | ±0.304 | dB | k=2 | 0.152 |
| Transmitter antenna | ±1.200 | dB | Rectangular | 0.600 |
| Signal generator | ±0.461 | dB | Rectangular | 0.231 |
| Mismatch | ±0.080 | dB | U-shape | 0.040 |
| Spectrum analyzer | ±0.500 | dB | Rectangular | 0.250 |
| Combined standard uncertainty Uc(y) | | | | 1.839 |
| Measuring uncertainty for a level of confidence of 95% U=2Uc(y) | | | | 3.678 |

Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

| Contribution | Uncertainty of $x_i$ | | | $u(x_i)$ |
|---|---|---|---|---|
| | Value | Unit | Probability Distribution k | |
| Receiver reading | ±0.186 | dB | k=1 | 0.093 |
| Cable loss | ±0.167 | dB | k=2 | 0.083 |
| Antenna gain | ±0.190 | dB | k=2 | 0.095 |
| Site imperfection | ±0.488 | dB | Triangular | 0.244 |
| Pre-amplifier gain | ±0.269 | dB | k=2 | 0.134 |
| Transmitter antenna | ±1.200 | dB | Rectangular | 0.600 |
| Signal generator | ±0.461 | dB | Rectangular | 0.231 |
| Mismatch | ±0.080 | dB | U-shape | 0.040 |
| Spectrum analyzer | ±0.500 | dB | Rectangular | 0.250 |
| Combined standard uncertainty Uc(y) | | | | 1.771 |
| Measuring uncertainty for a level of confidence of 95% U=2Uc(y) | | | | 3.541 |

**Uncertainty of Conducted Emission Measurement**

| Contribution | Uncertainty of $x_i$ | | | $u(x_i)$ |
|---|---|---|---|---|
| | Value | Unit | Probability Distribution k | |
| Cable loss | ±0.038 | dB | k=2 | 0.019 |
| Attenuator | ±0.047 | dB | k=2 | 0.024 |
| Power Meter specification | ±0.300 | dB | Triangular | 0.150 |
| Power Sensor specification | ±0.300 | dB | Rectangular | 0.150 |
| Signal generator | ±0.461 | dB | Rectangular | 0.231 |
| Mismatch | ±0.080 | dB | U-shape | 0.040 |
| Spectrum analyzer | ±0.500 | dB | Rectangular | 0.250 |
| Combined standard uncertainty Uc(y) | | | | 0.863 |
| Measuring uncertainty for a level of confidence of 95% U=2Uc(y) | | | | 1.726 |