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# FCC RADIO TEST REPORT

| | |
|---|---|
| Applicant's company | **Roku, Inc.** |
| Applicant Address | 150 Winchester Circle, Los Gatos, CA 95032 |
| FCC ID | **TC2-R1013** |
| Manufacturer's company | **Lite-On Network Communication (Dongguan) Limited** |
| Manufacturer Address | 30#Keji Rd., Yin Hu Industrial Area, Qingxi Town, DongGuan City, Guangdong, China |

| | |
|---|---|
| Product Name | 4640X, 4630X, 4620X |
| Brand Name | Roku |
| Model No. | 4640X, 4630X, 4620X |
| Test Rule | 47 CFR FCC Part 15 Subpart C § 15.247 |
| Test Freq. Range | 2400 ~ 2483.5MHz |
| Received Date | Jun. 16, 2016 |
| Final Test Date | Jul. 27, 2016 |
| Submission Type | Original Equipment |

## Statement

**Test result included in this report is for the IEEE 802.11n and IEEE 802.11b/g 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**, **KDB558074 D01 v03r05** and **KDB 662911 D01 v02r01**.

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 |
|---|---|---|---|
| FR662329AA | Rev. 01 | Initial issue of report | Jul. 29, 2016 |
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# 1. VERIFICATION OF COMPLIANCE

| | | |
|---|---|---|
| Product Name | : | 4640X, 4630X, 4620X |
| Brand Name | : | Roku |
| Model No. | : | 4640X, 4630X, 4620X |
| Applicant | : | Roku, 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 Jun. 16, 2016 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** |
| 4.1 | 15.207 | AC Power Line Conducted Emissions | Complies |
| 4.2 | 15.247(b)(3) | Maximum Conducted Output Power | Complies |
| 4.3 | 15.247(e) | Power Spectral Density | Complies |
| 4.4 | 15.247(a)(2) | 6dB Spectrum Bandwidth | Complies |
| 4.5 | 15.247(d) | Radiated Emissions | Complies |
| 4.6 | 15.247(d) | Band Edge Emissions | Complies |
| 4.7 | 15.203 | Antenna Requirements | Complies |

# 3. GENERAL INFORMATION

## 3.1. Product Details

| Items | Description |
|---|---|
| Product Type | IEEE 802.11b/g: WLAN (1TX, 1RX)<br>IEEE 802.11n: WLAN (2TX, 2RX) |
| Radio Type | Intentional Transceiver |
| Power Type | From power adapter |
| Modulation | IEEE 802.11b: DSSS<br>IEEE 802.11g: OFDM<br>IEEE 802.11n: see the below table |
| Data Modulation | IEEE 802.11b: DSSS (BPSK / QPSK / CCK)<br>IEEE 802.11g/n: OFDM (BPSK / QPSK / 16QAM / 64QAM) |
| Data Rate (Mbps) | IEEE 802.11b: DSSS (1/ 2/ 5.5/11)<br>IEEE 802.11g: OFDM (6/9/12/18/24/36/48/54)<br>IEEE 802.11n: see the below table |
| Frequency Range | 2400 ~ 2483.5MHz |
| Channel Number | 11 for 20MHz bandwidth |
| Channel Bandwidth (99%) | IEEE 802.11b: 11.20 MHz<br>IEEE 802.11g: 17.45 MHz<br>IEEE 802.11n MCS0 (HT20): 18.76 MHz |
| Maximum Conducted Output Power | IEEE 802.11b: 22.03 dBm<br>IEEE 802.11g: 20.63 dBm<br>IEEE 802.11n MCS0 (HT20): 23.03 dBm |
| Carrier Frequencies | Please refer to section 3.4 |
| Antenna | Please refer to section 3.3 |

| Items | Description | |
|---|---|---|
| Beamforming Function | ☐ With beamforming | ☒ Without beamforming |

**Antenna and Bandwidth**

| Antenna | Single (TX) | Two (TX) |
|---|---|---|
| Bandwidth Mode | 20 MHz | 20 MHz |
| IEEE 802.11b | V | X |
| IEEE 802.11g | V | X |
| IEEE 802.11n | X | V |

**IEEE 11n Spec.**

| Protocol | Number of Transmit Chains (NTX) | Data Rate / MCS |
|---|---|---|
| 802.11n (HT20) | 2 | MCS 0-15 |
| Note 1: IEEE Std. 802.11n modulation consists of HT20 (HT: High Throughput). Then EUT supports HT20. Note 2: Modulation modes consist of below configuration: HT20: IEEE 802.11n | | |

## 3.2. Accessories

N/A

## 3.3. Table for Filed Antenna

| Ant. | Brand | Part Number | Antenna Type | Connector | Gain (dBi) |
|---|---|---|---|---|---|
| 1 | Airgain | M2450LNTSU2 | PIFA Antenna | I-PEX | 1.4 |
| 2 | Airgain | M2450LNTSU2 | PIFA Antenna | I-PEX | 0.8 |

Note: The EUT has two antennas.

**For IEEE 802.11b/g mode (1TX, 1RX):**

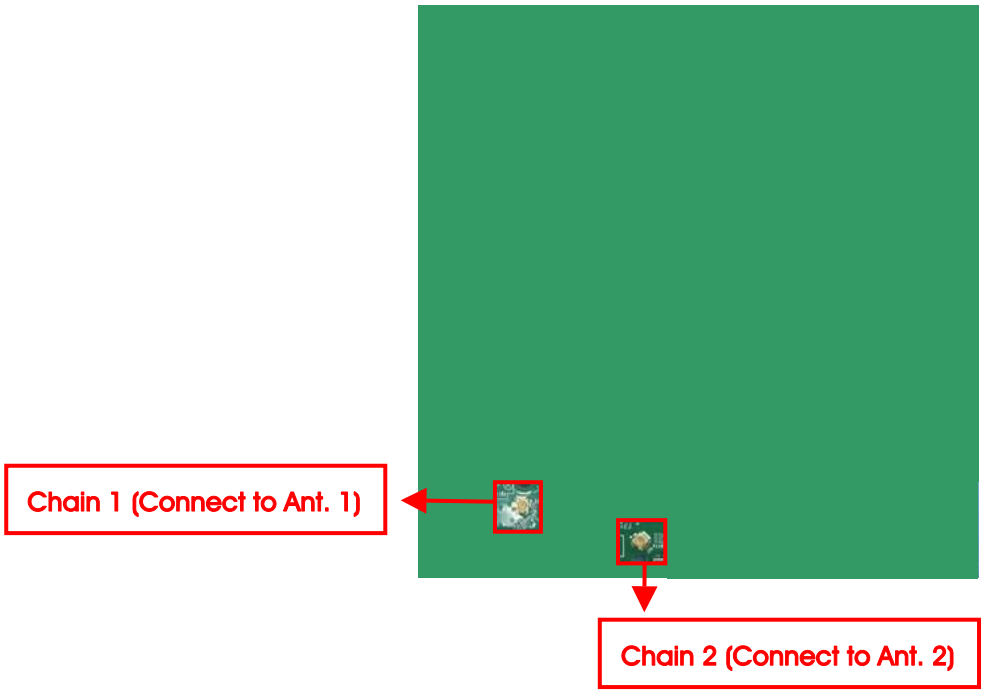
The EUT supports the antenna with TX and RX diversity functions.

Both Chain 1 and Chain 2 support transmit and receive functions, but only one of them will be used at one time.

The Chain 1 generated the worst case, so it was selected to test and record in the report.

**For IEEE 802.11n mode (2TX, 2RX):**

Both chain 1 and chain 2 could transmit/receive simultaneously.



## 3.4. Table for Carrier Frequencies

There is a bandwidth system.

For 20MHz bandwidth systems, use Channel 1~Channel 11.

| Frequency Band | Channel No. | Frequency | Channel No. | Frequency |
|---|---|---|---|---|
| 2400~2483.5MHz | 1 | 2412 MHz | 7 | 2442 MHz |
| | 2 | 2417 MHz | 8 | 2447 MHz |
| | 3 | 2422 MHz | 9 | 2452 MHz |
| | 4 | 2427 MHz | 10 | 2457 MHz |
| | 5 | 2432 MHz | 11 | 2462 MHz |
| | 6 | 2437 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 | CTX | - | - | - |
| Maximum Conducted Output Power | 11b/CCK | 1 Mbps | 1/6/11 | 1 |
| | 11g/BPSK | 6 Mbps | 1/6/11 | 1 |
| | 11n HT20 | MCS0 | 1/6/11 | 1+2 |
| Power Spectral Density | 11b/CCK | 1 Mbps | 1/6/11 | 1 |
| | 11g/BPSK | 6 Mbps | 1/6/11 | 1 |
| | 11n HT20 | MCS0 | 1/6/11 | 1+2 |
| 6dB Spectrum Bandwidth | 11b/CCK | 1 Mbps | 1/6/11 | 1 |
| | 11g/BPSK | 6 Mbps | 1/6/11 | 1 |
| | 11n HT20 | MCS0 | 1/6/11 | 1+2 |
| Radiated Emissions 9kHz~1GHz | CTX | - | - | - |
| Radiated Emissions 1GHz~10$^{th}$ Harmonic | 11b/CCK | 1 Mbps | 1/6/11 | 1 |
| | 11g/BPSK | 6 Mbps | 1/6/11 | 1 |
| | 11n HT20 | MCS0 | 1/6/11 | 1+2 |
| Band Edge Emissions | 11b/CCK | 1 Mbps | 1/6/11 | 1 |
| | 11g/BPSK | 6 Mbps | 1/6/11 | 1 |
| | 11n HT20 | MCS0 | 1/6/11 | 1+2 |

Note: All the specification of test configurations and test modes were based on customer's request.

The following test modes were performed for all tests:

**For Conducted Emission and Radiated Emission test**

Mode 1. CTX - EUT 1 in Z axis - 2.4G

## 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 Designation No.** | **IC File No.** |
| 03CH01-CB | SAC | Hsin Chu | TW0006 | IC 4086D |
| CO01-CB | Conduction | Hsin Chu | TW0006 | IC 4086D |
| TH01-CB | OVEN Room | Hsin Chu | - | - |

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

## 3.7. Table for Multiple Listing

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

| EUT | Model Name | Ethernet Connector | Remote Locator | Micro SD Connector | USB 2.0 Host Connector | Digital Audio Out Connector (Optical) |
|---|---|---|---|---|---|---|
| 1 | 4640X | V | V | V | V | V |
| 2 | 4630X | V | X | V | X | X |
| 3 | 4620X | X | X | X | X | X |

From the above models, model: 4640X was selected as representative model for the test and its data was recorded in this report.

## 3.8. Table for Supporting Units

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

| Support Unit | Brand | Model | FCC ID |
|---|---|---|---|
| Notebook | DELL | E6430 | DoC |
| Flash disk3.0 | Transcend | JetFlash-700 | DoC |
| Micro SD Card | Transcend | TS16GUSDHC10 | DoC |
| Adapter | Roku | PA-1120-42RU -ROHS | DoC |

**For Test Site No: 03CH01-CB and TH01-CB**

| Support Unit | Brand | Model | FCC ID |
|---|---|---|---|
| Notebook | DELL | E4300 | DoC |
| Adapter | Roku | PA-1120-42RU -ROHS | 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.

| Test Software Version | Mtool_2.0.2.3 | | |
|---|---|---|---|
| Mode | Test Frequency (MHz) | | |
| | NCB: 20MHz | | |
| | 2412 MHz | 2437 MHz | 2462 MHz |
| 802.11b | 71 | 80 | 80 |
| 802.11g | 66 | 80 | 74 |
| 802.11n MCS0 HT20 | 58 | 79 | 69 |

## 3.10. EUT Operation during Test

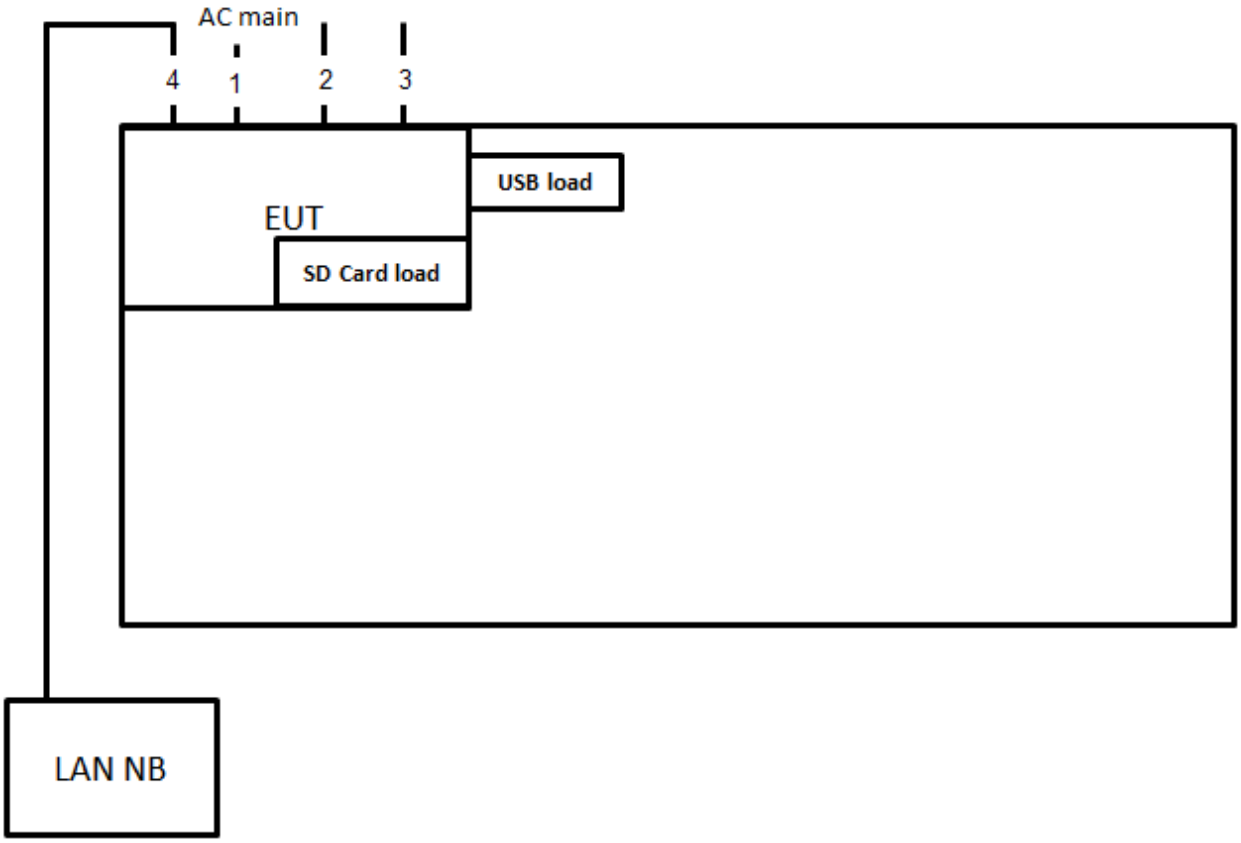
The EUT was programmed to be in continuously transmitting mode.

## 3.11. Duty Cycle

| Mode | On Time (ms) | On+Off Time (ms) | Duty Cycle (%) | Duty Factor (dB) | 1/T Minimum VBW (kHz) |
|---|---|---|---|---|---|
| 802.11b | 0.896 | 1.024 | 87.50 | 0.58 | 1.12 |
| 802.11g | 2.054 | 2.106 | 97.57 | 0.11 | 0.49 |
| 802.11n MCS0 HT20 | 1.907 | 1.958 | 97.39 | 0.12 | 0.52 |

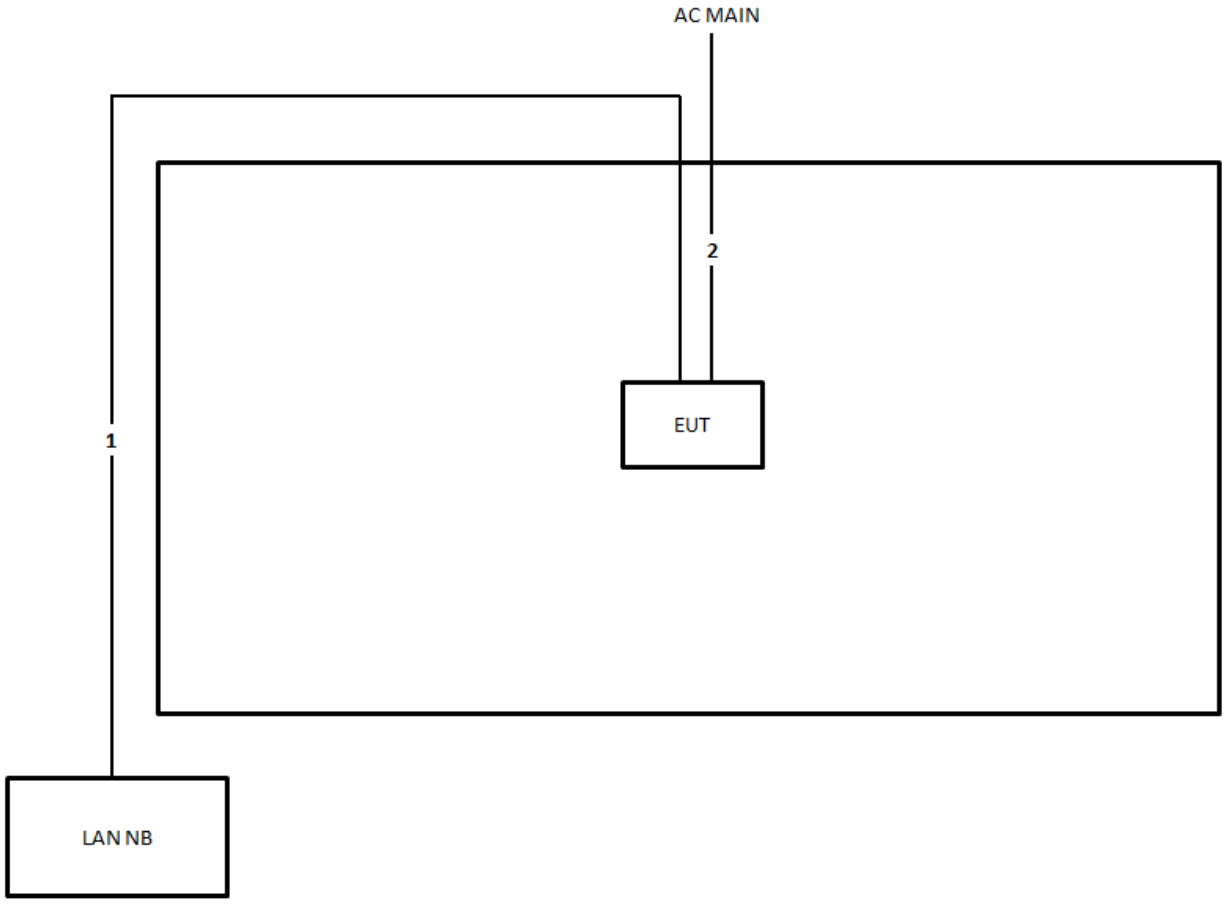
## 3.12. Test Configurations

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




| Item | Connection | Shielded | Length |
|---|---|---|---|
| 1 | Power cable | No | 1.5m |
| 2 | HDMI cable | Yes | 1.5m |
| 3 | Audio cable | No | 1.3m |
| 4 | RJ-45 cable | No | 10m |

### 3.12.2. Radiation Emissions Test Configuration




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

# 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

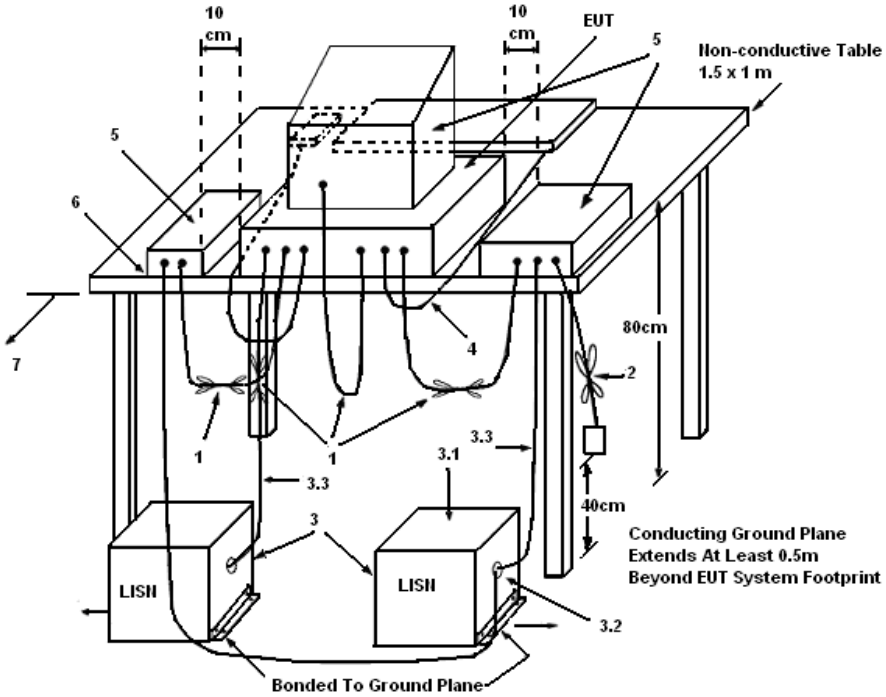
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

| 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

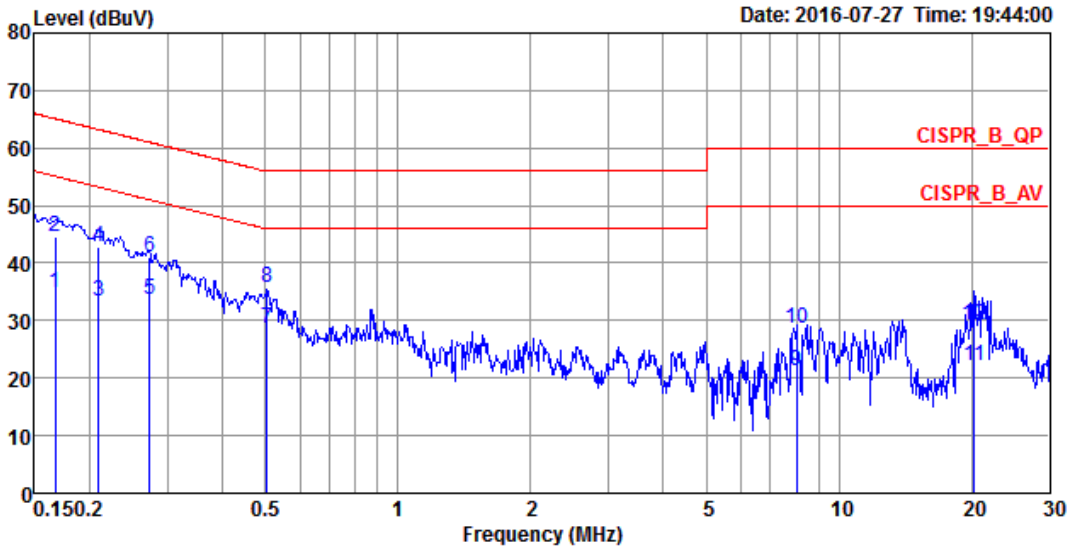
There is no deviation with the original standard.

### 4.1.6. EUT Operation during Test

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

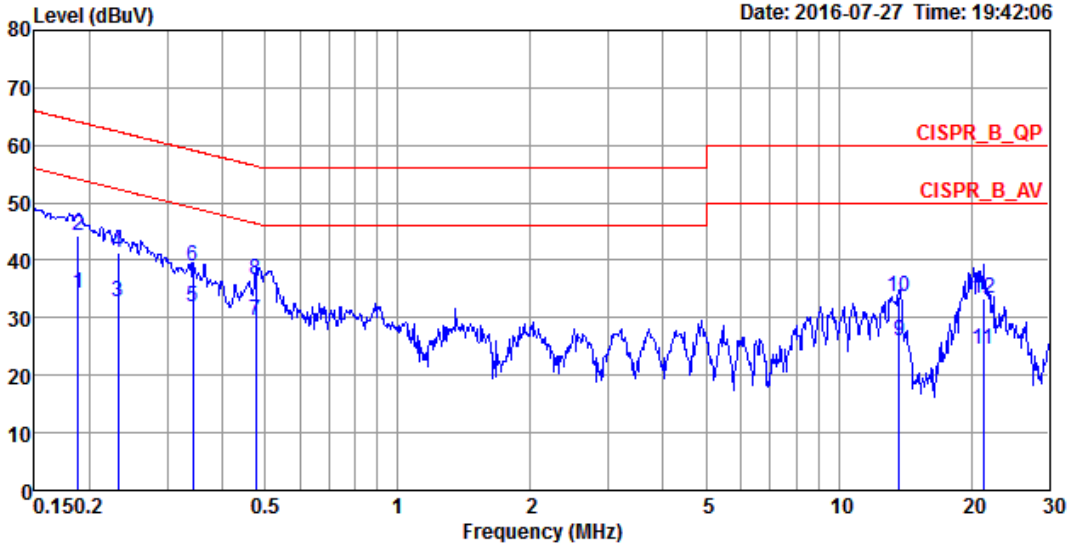
## 4.1.7. Results of AC Power Line Conducted Emissions Measurement

| Temperature | 22℃ | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Edison Lin | Phase | Line |
| Configuration | CTX | Test Mode | 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 | 0.1668 | 34.78 | -20.34 | 55.12 | 24.59 | 10.02 | 0.17 | LINE | Average |
| 2 | 0.1668 | 44.64 | -20.48 | 65.12 | 34.45 | 10.02 | 0.17 | LINE | QP |
| 3 | 0.2094 | 33.28 | -19.95 | 53.23 | 23.18 | 9.92 | 0.18 | LINE | Average |
| 4 | 0.2094 | 42.88 | -20.35 | 63.23 | 32.78 | 9.92 | 0.18 | LINE | QP |
| 5 | 0.2730 | 33.72 | -17.31 | 51.03 | 23.69 | 9.92 | 0.11 | LINE | Average |
| 6 | 0.2730 | 41.08 | -19.95 | 61.03 | 31.05 | 9.92 | 0.11 | LINE | QP |
| 7 | 0.5047 | 28.72 | -17.28 | 46.00 | 18.61 | 9.92 | 0.19 | LINE | Average |
| 8 | 0.5047 | 35.68 | -20.32 | 56.00 | 25.57 | 9.92 | 0.19 | LINE | QP |
| 9 | 8.0198 | 21.33 | -28.67 | 50.00 | 11.09 | 10.10 | 0.14 | LINE | Average |
| 10 | 8.0198 | 28.49 | -31.51 | 60.00 | 18.25 | 10.10 | 0.14 | LINE | QP |
| 11 | 20.2696 | 22.22 | -27.78 | 50.00 | 11.66 | 10.32 | 0.24 | LINE | Average |
| 12 | 20.2696 | 29.24 | -30.76 | 60.00 | 18.68 | 10.32 | 0.24 | LINE | QP |

| Temperature | 22℃ | Humidity | 60% |
|---|---|---|---|
| Test Engineer | Edison Lin | Phase | Neutral |
| Configuration | CTX | Test Mode | 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 | 0.1884 | 34.25 | -19.86 | 54.11 | 24.15 | 9.92 | 0.18 | NEUTRAL | Average |
| 2 | 0.1884 | 44.32 | -19.79 | 64.11 | 34.22 | 9.92 | 0.18 | NEUTRAL | QP |
| 3 | 0.2316 | 32.69 | -19.70 | 52.39 | 22.62 | 9.92 | 0.15 | NEUTRAL | Average |
| 4 | 0.2316 | 41.40 | -20.99 | 62.39 | 31.33 | 9.92 | 0.15 | NEUTRAL | QP |
| 5 | 0.3428 | 31.78 | -17.35 | 49.13 | 21.81 | 9.92 | 0.05 | NEUTRAL | Average |
| 6 | 0.3428 | 38.98 | -20.15 | 59.13 | 29.01 | 9.92 | 0.05 | NEUTRAL | QP |
| 7 | 0.4761 | 29.66 | -16.75 | 46.41 | 19.59 | 9.92 | 0.15 | NEUTRAL | Average |
| 8 | 0.4761 | 36.54 | -19.87 | 56.41 | 26.47 | 9.92 | 0.15 | NEUTRAL | QP |
| 9 | 13.6952 | 25.88 | -24.12 | 50.00 | 15.47 | 10.21 | 0.20 | NEUTRAL | Average |
| 10 | 13.6952 | 33.63 | -26.37 | 60.00 | 23.22 | 10.21 | 0.20 | NEUTRAL | QP |
| 11 | 21.2596 | 24.45 | -25.55 | 50.00 | 13.86 | 10.34 | 0.25 | NEUTRAL | Average |
| 12 | 21.2596 | 33.24 | -26.76 | 60.00 | 22.65 | 10.34 | 0.25 | 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

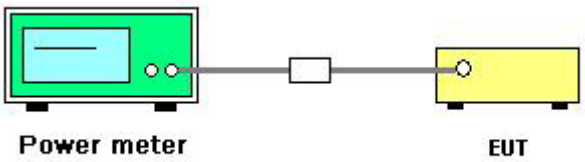
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

| 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 v03r05 section 9.2.3.2 Measurement using a power meter (PM).
2. Multiple antenna systems was performed in accordance with KDB 662911 D01 v02r01 Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
3. 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℃ | Humidity | 57% |
|---|---|---|---|
| Test Engineer | Paul Chen | Test Date | Jul. 07, 2016 |

| Mode | Frequency | Conducted Power (dBm) | Max. Limit (dBm) | Result |
|---|---|---|---|---|
| | | Chain 1 | | |
| 802.11b | 2412 MHz | 18.83 | 30.00 | Complies |
| | 2437 MHz | 22.03 | 30.00 | Complies |
| | 2462 MHz | 21.74 | 30.00 | Complies |
| 802.11g | 2412 MHz | 16.72 | 30.00 | Complies |
| | 2437 MHz | 20.63 | 30.00 | Complies |
| | 2462 MHz | 18.79 | 30.00 | Complies |

| Mode | Frequency | Conducted Power (dBm) | | | Max. Limit (dBm) | Result |
|---|---|---|---|---|---|---|
| | | Chain 1 | Chain 2 | Total | | |
| 802.11n MCS0 HT20 | 2412 MHz | 14.60 | 14.53 | 17.58 | 30.00 | Complies |
| | 2437 MHz | 20.07 | 19.96 | 23.03 | 30.00 | Complies |
| | 2462 MHz | 17.27 | 17.23 | 20.26 | 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

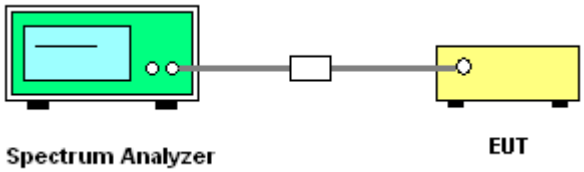
Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Span Frequency | Set the span to 1.5 times 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 v03r05 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 10.2 Method PKPSD (peak PSD) and KDB 662911 D01 v02r01 section In-Band Power Spectral Density (PSD) Measurements option (b) Measure 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 | 25℃ | Humidity | 57% |
|---|---|---|---|
| Test Engineer | Paul Chen | | |

| Mode | Frequency | Power Density (dBm/3kHz) | Power Density Limit (dBm/3kHz) | Result |
|---|---|---|---|---|
| | | Chain 1 | | |
| 802.11b | 2412 MHz | -3.91 | 8.00 | Complies |
| | 2437 MHz | -0.12 | 8.00 | Complies |
| | 2462 MHz | 1.87 | 8.00 | Complies |
| 802.11g | 2412 MHz | -8.37 | 8.00 | Complies |
| | 2437 MHz | -5.38 | 8.00 | Complies |
| | 2462 MHz | -6.46 | 8.00 | Complies |

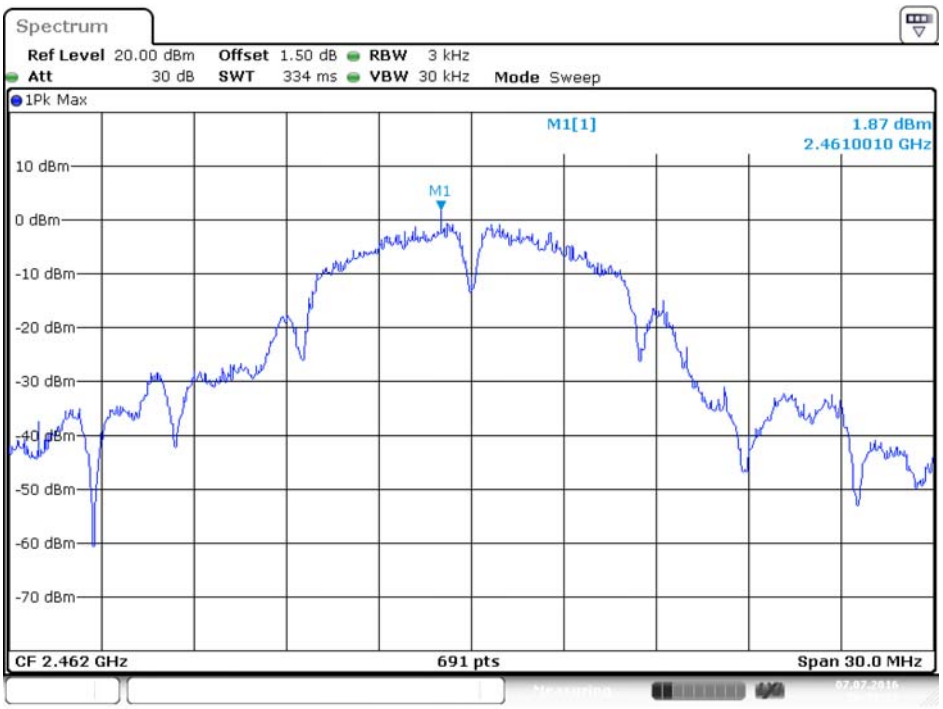
| Mode | Frequency | Power Density (dBm/3kHz) | | | Power Density Limit (dBm/3kHz) | Result |
|---|---|---|---|---|---|---|
| | | Chain 1 | Chain 2 | Total | | |
| 802.11n MCS0 HT20 | 2412 MHz | -10.58 | -10.42 | -7.49 | 8.00 | Complies |
| | 2437 MHz | -5.59 | -6.07 | -2.81 | 8.00 | Complies |
| | 2462 MHz | -7.59 | -7.39 | -4.48 | 8.00 | Complies |

Note: $DirectionalGain = 10 \cdot \log\left[\frac{\sum_{j=1}^{N_{SS}}\left\{\sum_{k=1}^{N_{ANT}} g_{j,k}\right\}^2}{N_{ANT}}\right]$ =4.12dBi <6dBi, so the limit doesn't reduce.

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

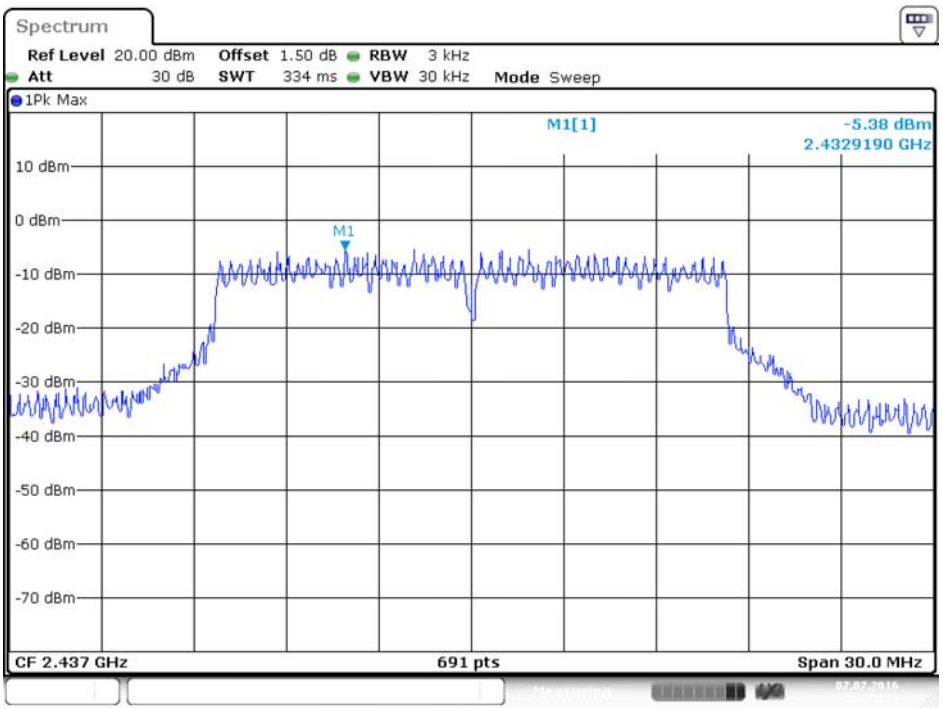
For plots, only the channel with worse result was shown.

## Power Density Plot on Configuration IEEE 802.11b / 2462 MHz / Chain 1



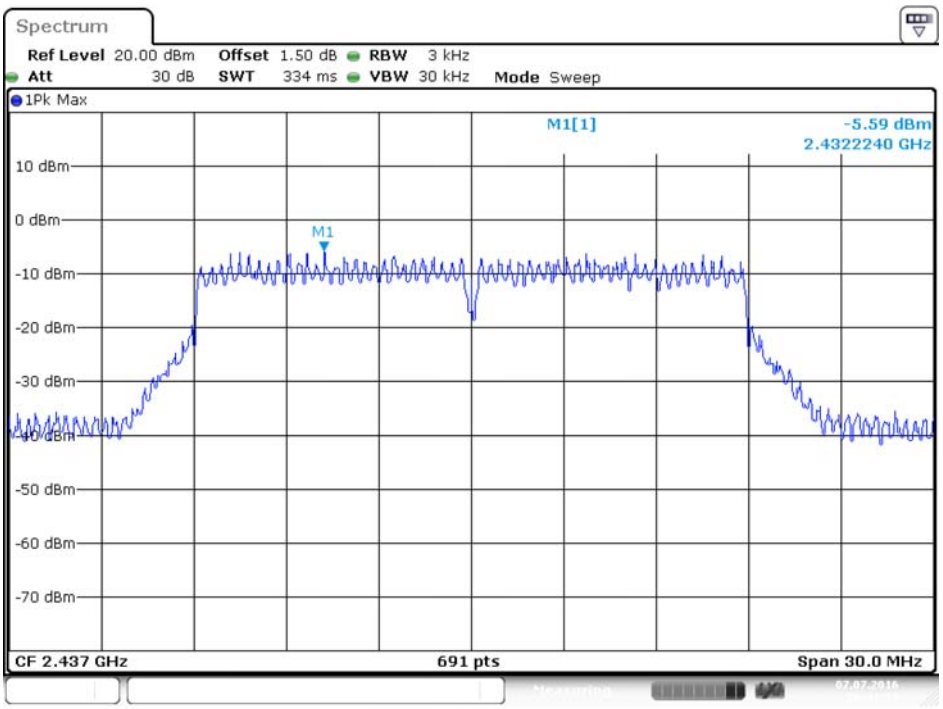

Date: 7.JUL.2016 20:31:22

## Power Density Plot on Configuration IEEE 802.11g / 2437 MHz / Chain 1



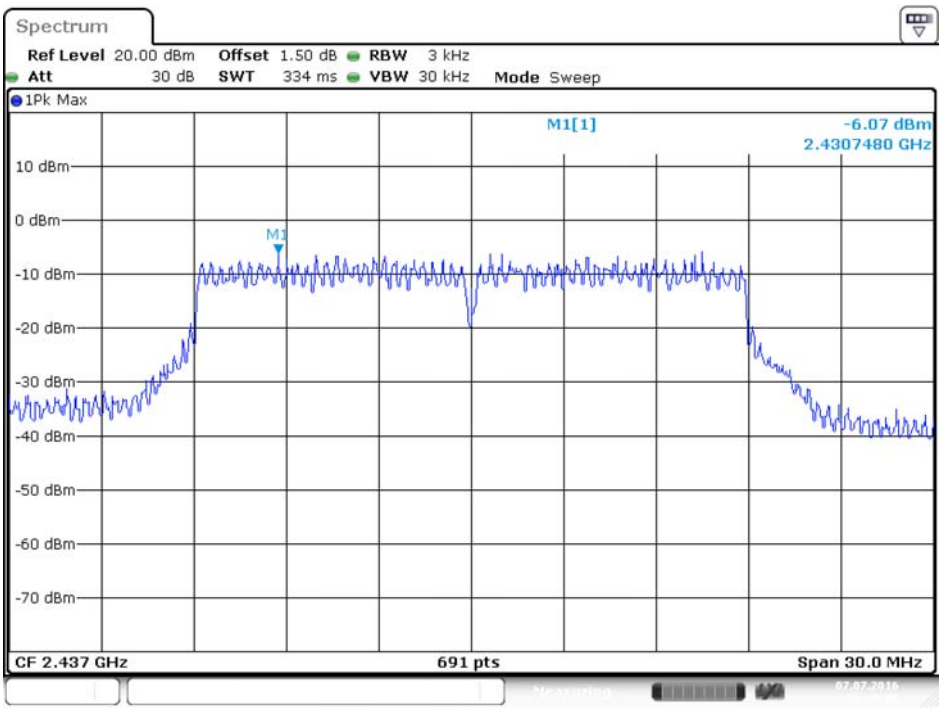

Date: 7.JUL.2016 20:35:28

## Power Density Plot on Configuration IEEE 802.11n MCS0 HT20 / 2437 MHz / Chain 1




Date: 7.JUL.2016 20:41:13

## Power Density Plot on Configuration IEEE 802.11n MCS0 HT20 / 2437 MHz / Chain 2




Date: 7.JUL.2016 20:40:25

## 4.4. 6dB Spectrum Bandwidth Measurement

### 4.4.1. Limit

For digital modulation systems, the minimum 6 dB 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

For Radiated 6dB Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB558074 D01 v03r05 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 8.0 DTS bandwidth=> 8.1 Option 1.
3. Multiple antenna system was performed in accordance with KDB 662911 D01 v02r01 Emissions Testing of Transmitters with Multiple Outputs in the Same Band.
4. 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

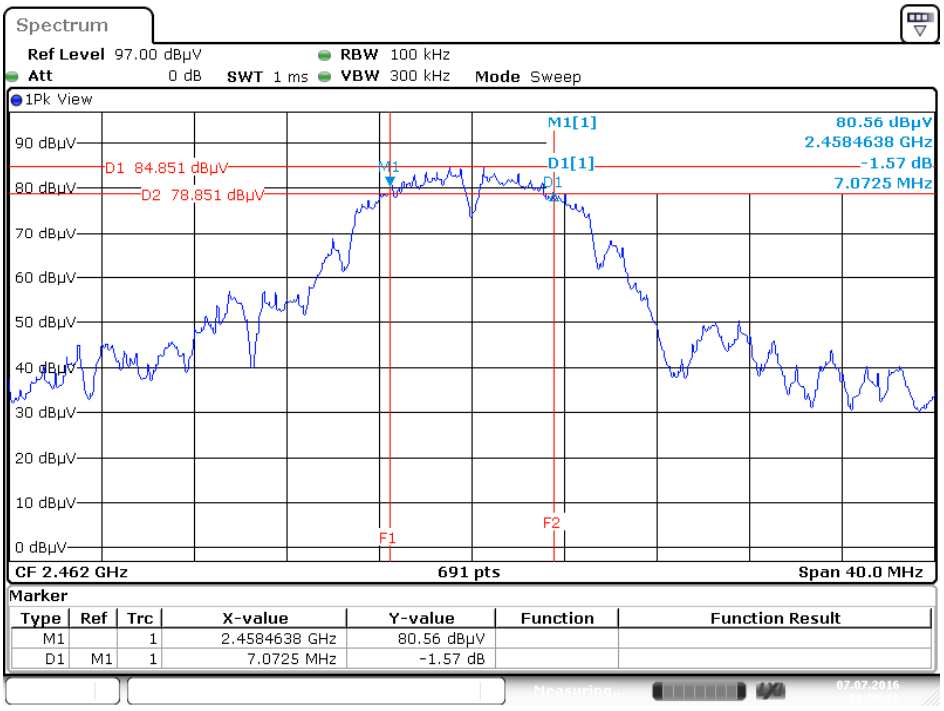
| Temperature | 25℃ | Humidity | 57% |
|---|---|---|---|
| Test Engineer | Paul Chen | | |

| Mode | Frequency | 6dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Min. Limit (kHz) | Test Result |
|---|---|---|---|---|---|
| 802.11b | 2412 MHz | 7.13 | 11.11 | 500 | Complies |
| | 2437 MHz | 8.06 | 11.20 | 500 | Complies |
| | 2462 MHz | 7.07 | 10.94 | 500 | Complies |
| 802.11g | 2412 MHz | 16.29 | 17.19 | 500 | Complies |
| | 2437 MHz | 16.35 | 17.45 | 500 | Complies |
| | 2462 MHz | 16.41 | 17.37 | 500 | Complies |
| 802.11n MCS0 HT20 | 2412 MHz | 16.46 | 17.71 | 500 | Complies |
| | 2437 MHz | 15.88 | 18.76 | 500 | Complies |
| | 2462 MHz | 15.71 | 17.89 | 500 | Complies |

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

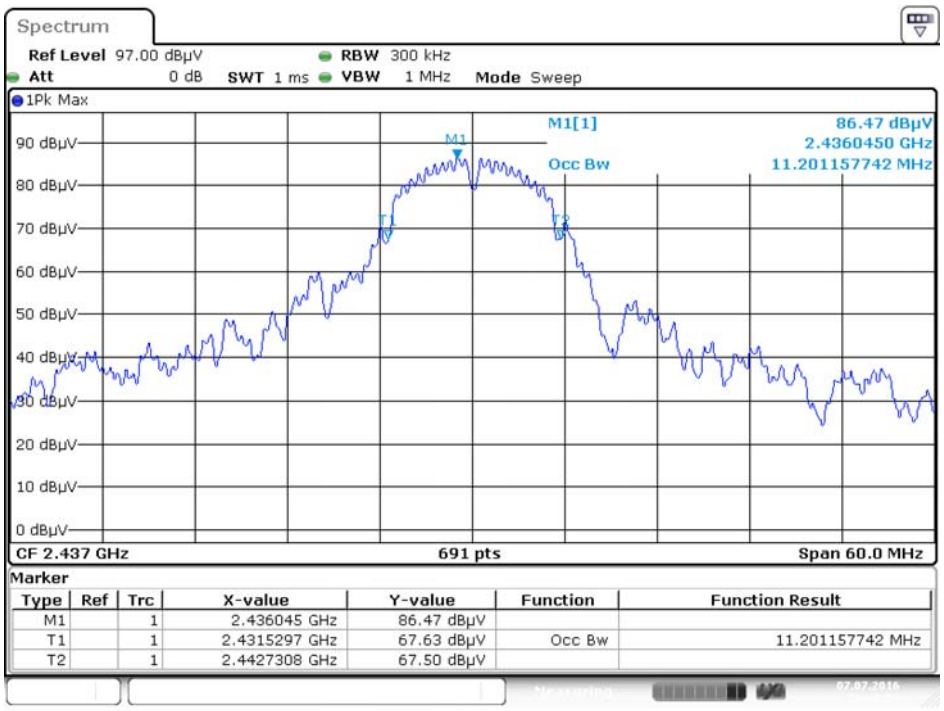
For plots, only the channel with worse result was shown.

## 6 dB Bandwidth Plot on Configuration IEEE 802.11b / 2462 MHz / Chain 1



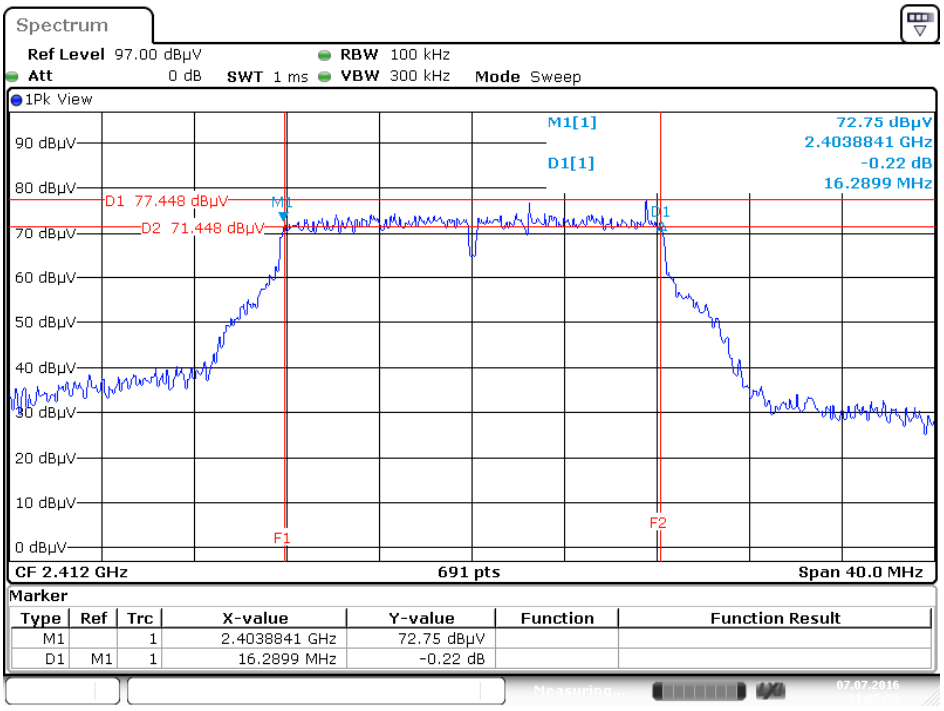

Date: 7.JUL.2016 21:08:29

## 99% Occupied Bandwidth Plot on Configuration IEEE 802.11b / 2437 MHz / Chain 1



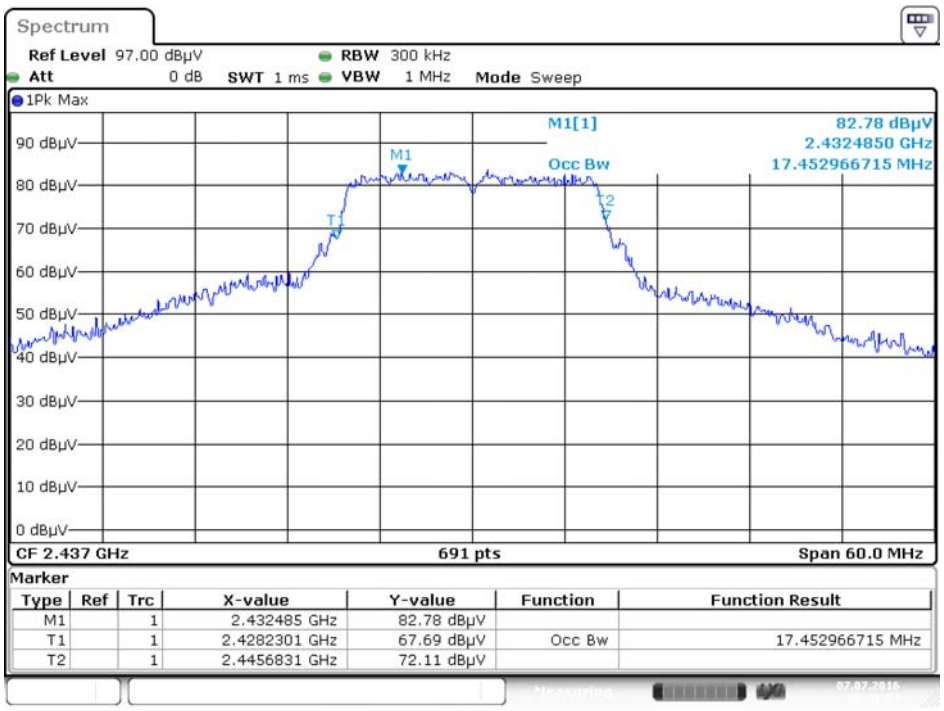

Date: 7.JUL.2016 20:48:54

## 6 dB Bandwidth Plot on Configuration IEEE 802.11g / 2412 MHz / Chain 1



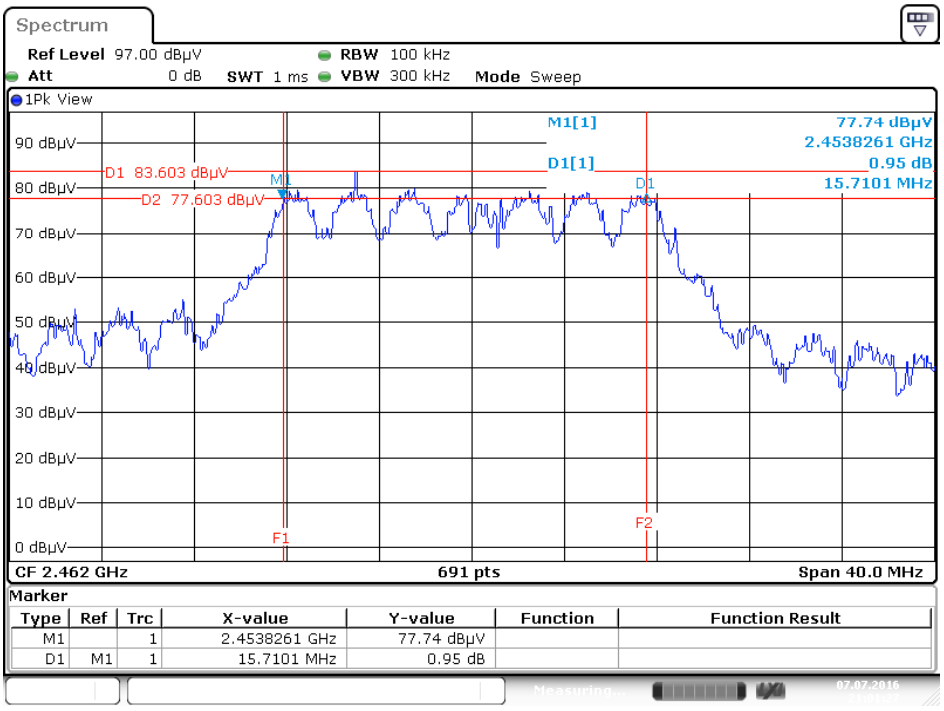

Date: 7.JUL.2016 21:05:52

## 99% Occupied Bandwidth Plot on Configuration IEEE 802.11g / 2437 MHz / Chain 1



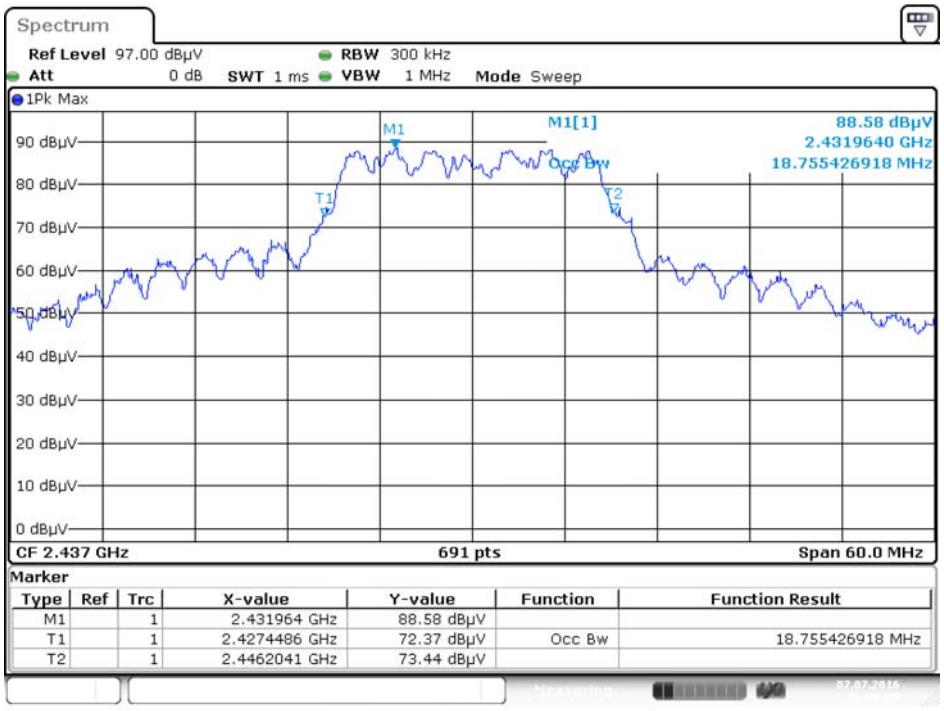

Date: 7.JUL.2016 20:51:54

## 6 dB Bandwidth Plot on Configuration IEEE 802.11n MCS0 HT20 / 2462 MHz / Chain 1 + Chain 2




Date: 7.JUL.2016 21:01:27

## 99% Occupied Bandwidth Plot on Configuration IEEE 802.11n MCS0 HT20 / 2437 MHz / Chain 1 + Chain 2




Date: 7.JUL.2016 20:56:28

## 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 |

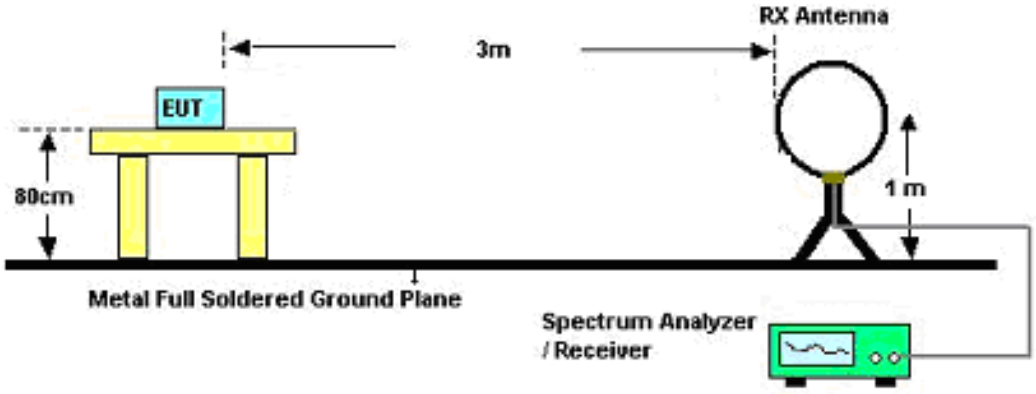
| Receiver Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RBW 200Hz for QP |
| Start ~ Stop Frequency | 150kHz~30MHz / RBW 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RBW 120kHz for QP |

### 4.5.3. Test Procedures

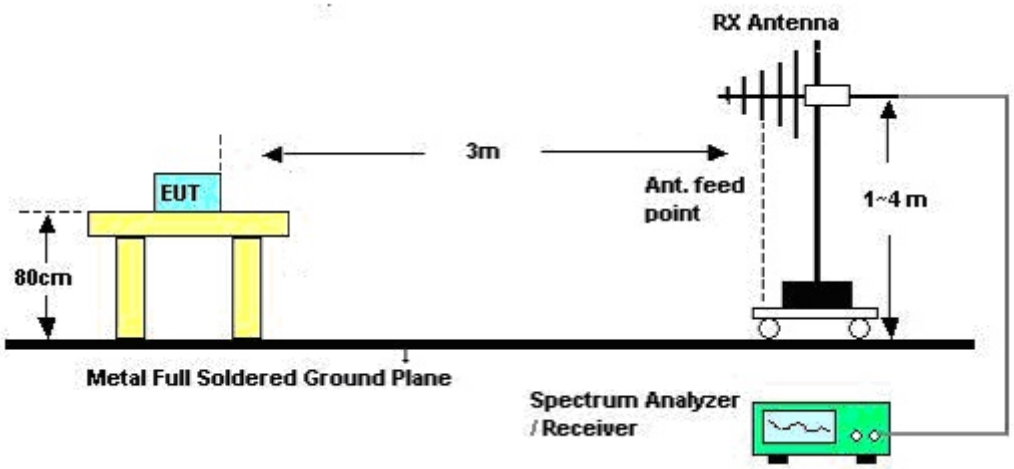
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting 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

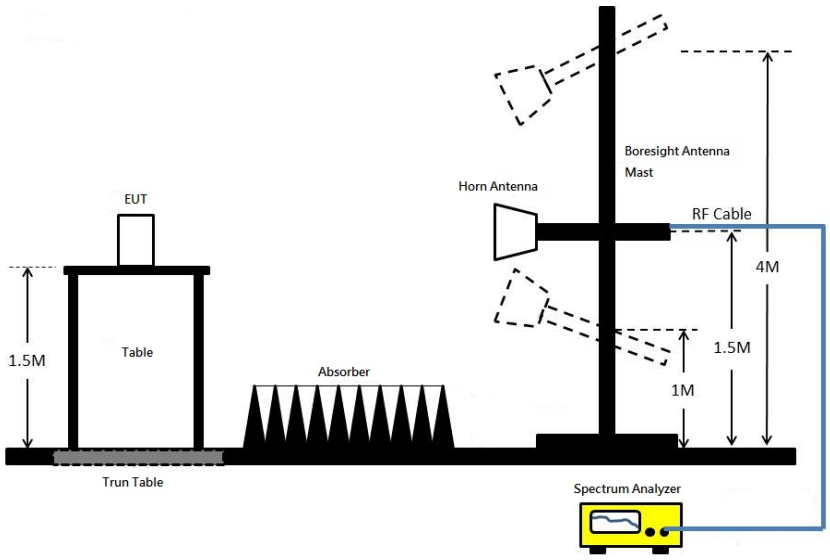
### For Radiated Emissions: 9kHz ~30MHz




### For Radiated Emissions: 30MHz~1GHz



**For Radiated Emissions: Above 1GHz**




## 4.5.5. Test Deviation

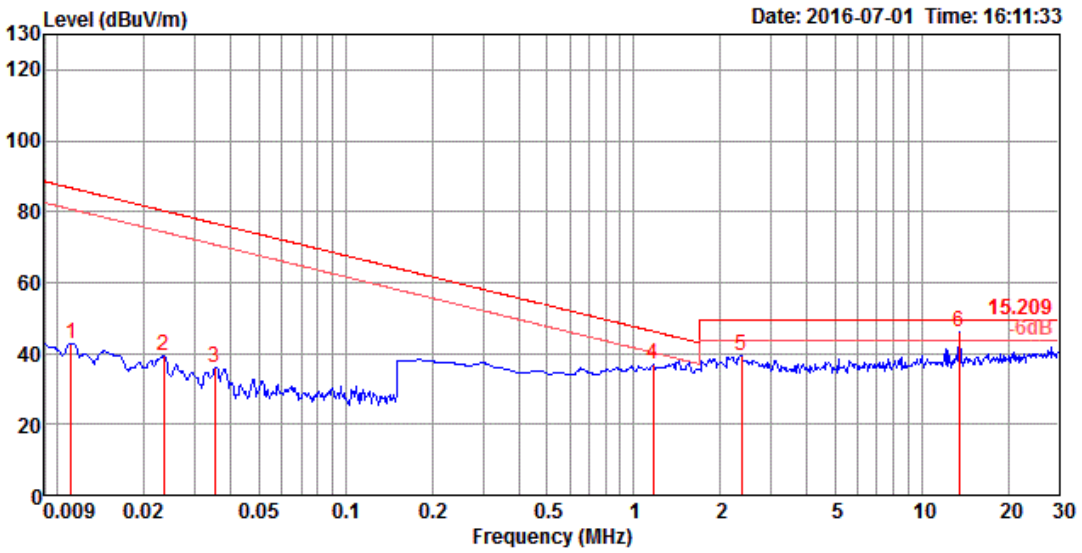
There is no deviation with the original standard.

## 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 | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | CTX |
| Test Mode | Mode 1 | | |




| | Freq | Level | Limit Line | Over Limit | Read Level | Cable Loss | Antenna Factor | A/Pos | T/Pos | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | cm | deg | |
| 1 | 0.01 | 42.78 | 86.69 | -43.91 | 20.36 | 1.00 | 21.42 | 100 | 241 | Peak |
| 2 | 0.02 | 39.25 | 80.24 | -40.99 | 16.70 | 1.00 | 21.55 | 100 | 74 | Peak |
| 3 | 0.04 | 36.02 | 76.67 | -40.65 | 13.58 | 1.00 | 21.44 | 100 | 37 | Peak |
| 4 | 1.17 | 36.70 | 46.24 | -9.54 | 15.38 | 1.03 | 20.29 | 100 | 176 | Peak |
| 5 | 2.37 | 39.39 | 49.54 | -10.15 | 18.47 | 1.07 | 19.85 | 100 | 222 | Peak |
| 6 | 13.55 | 45.85 | 49.54 | -3.69 | 22.76 | 1.38 | 21.71 | 100 | 356 | Peak |

Note:

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

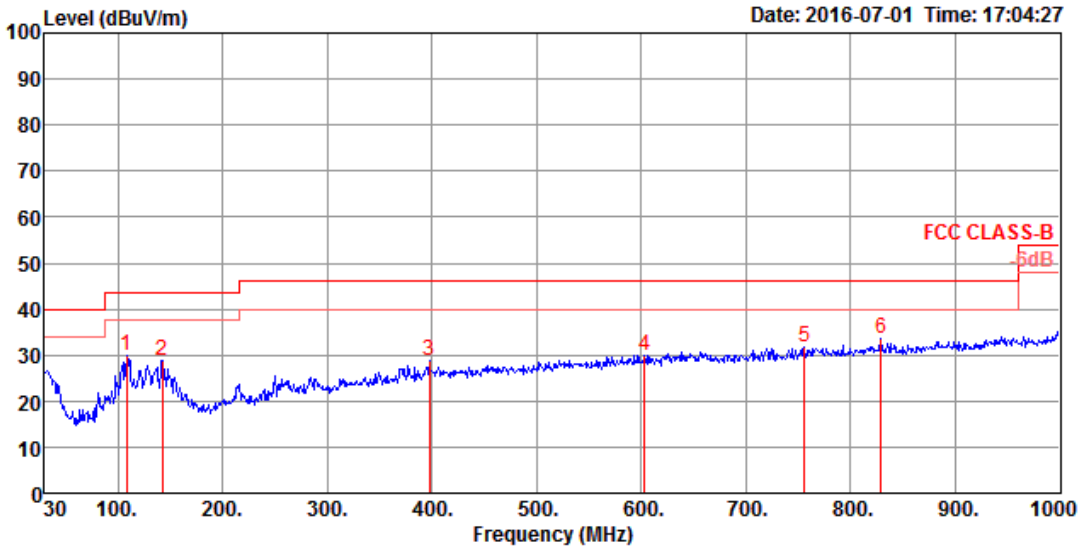
Emission level (dBuV/m) = 20 log Emission level (uV/m).

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

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

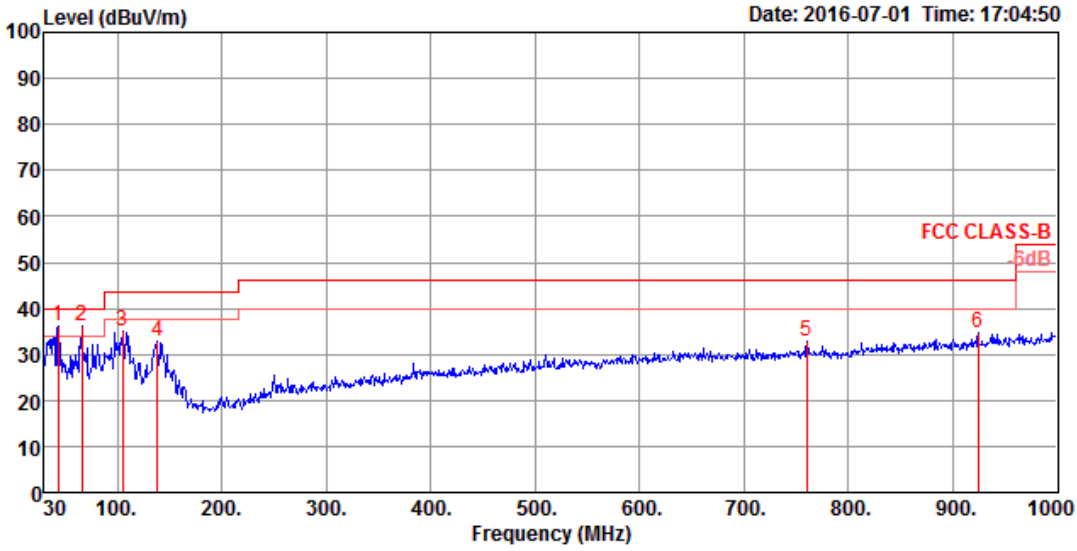
| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | CTX |
| Test Mode | Mode 1 | | |

*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 | 108.57 | 29.73 | 43.50 | -13.77 | 42.58 | 0.90 | 18.63 | 32.38 | 100 | 107 | Peak | HORIZONTAL |
| 2 | 142.52 | 28.88 | 43.50 | -14.62 | 42.24 | 1.02 | 17.98 | 32.36 | 100 | 231 | Peak | HORIZONTAL |
| 3 | 397.63 | 28.72 | 46.00 | -17.28 | 36.70 | 1.72 | 22.63 | 32.33 | 100 | 100 | Peak | HORIZONTAL |
| 4 | 603.27 | 29.91 | 46.00 | -16.09 | 34.73 | 2.13 | 25.46 | 32.41 | 100 | 140 | Peak | HORIZONTAL |
| 5 | 755.56 | 31.91 | 46.00 | -14.09 | 35.38 | 2.38 | 26.44 | 32.29 | 100 | 327 | Peak | HORIZONTAL |
| 6 | 829.28 | 33.62 | 46.00 | -12.38 | 36.05 | 2.50 | 27.17 | 32.10 | 100 | 327 | 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 | 43.58 | 36.05 | 40.00 | -3.95 | 49.87 | 0.58 | 18.01 | 32.41 | 100 | 135 | Peak | VERTICAL |
| 2 | 65.89 | 36.18 | 40.00 | -3.82 | 54.65 | 0.70 | 13.23 | 32.40 | 100 | 178 | Peak | VERTICAL |
| 3 | 104.69 | 35.09 | 43.50 | -8.41 | 48.44 | 0.88 | 18.16 | 32.39 | 100 | 0 | Peak | VERTICAL |
| 4 | 138.64 | 32.98 | 43.50 | -10.52 | 46.07 | 1.01 | 18.26 | 32.36 | 100 | 101 | Peak | VERTICAL |
| 5 | 760.41 | 32.68 | 46.00 | -13.32 | 36.09 | 2.39 | 26.49 | 32.29 | 100 | 41 | Peak | VERTICAL |
| 6 | 924.34 | 34.78 | 46.00 | -11.22 | 35.75 | 2.62 | 27.91 | 31.50 | 100 | 358 | Peak | VERTICAL |

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB 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 | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11b CH 1 / Chain 1 |
| Test Date | Jun. 16, 2016 | | |

*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 | 4823.80 | 48.51 | 74.00 | -25.49 | 41.91 | 7.22 | 31.12 | 31.74 | 103 | 172 | Peak | HORIZONTAL |
| 2 | 4824.00 | 37.54 | 54.00 | -16.46 | 30.94 | 7.22 | 31.12 | 31.74 | 103 | 172 | 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 | 4823.96 | 37.73 | 54.00 | -16.27 | 31.13 | 7.22 | 31.12 | 31.74 | 100 | 140 | Average | VERTICAL |
| 2 | 4824.00 | 47.48 | 74.00 | -26.52 | 40.88 | 7.22 | 31.12 | 31.74 | 100 | 140 | Peak | VERTICAL |

| Temperature | 22℃ | Humidity | 54 % |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11b CH 6 / Chain 1 |
| Test Date | Jun. 16, 2016 | | |

*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 | 4873.96 | 40.81 | 54.00 | -13.19 | 34.12 | 7.20 | 31.21 | 31.72 | 100 | 152 | Average | HORIZONTAL |
| 2 | 4873.96 | 48.59 | 74.00 | -25.41 | 41.90 | 7.20 | 31.21 | 31.72 | 100 | 152 | Peak | HORIZONTAL |

*Vertical*

| | Freq | Level | Limi Line | Limit | Level | Loss | Factor | Factor | /Pos | T/Pos | Remark | Pol/Phase |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dBuV/m | dB | dBuV | dB | dB/m | dB | cm | deg | | |
| 1 | 4873.96 | 40.76 | 54.00 | -13.24 | 34.07 | 7.20 | 31.21 | 31.72 | 100 | 146 | Average | VERTICAL |
| 2 | 4874.08 | 48.90 | 74.00 | -25.10 | 42.21 | 7.20 | 31.21 | 31.72 | 100 | 146 | Peak | VERTICAL |

| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11b CH 11 / Chain 1 |
| Test Date | Jun. 16, 2016 | | |

*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 | 4923.76 | 50.54 | 74.00 | -23.46 | 43.77 | 7.18 | 31.29 | 31.70 | 100 | 151 | Peak | HORIZONTAL |
| 2 | 4923.96 | 44.59 | 54.00 | -9.41 | 37.82 | 7.18 | 31.29 | 31.70 | 100 | 151 | 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 | 4923.76 | 49.72 | 74.00 | -24.28 | 42.95 | 7.18 | 31.29 | 31.70 | 295 | 60 | Peak | VERTICAL |
| 2 | 4924.00 | 42.90 | 54.00 | -11.10 | 36.13 | 7.18 | 31.29 | 31.70 | 295 | 60 | Average | VERTICAL |

| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11g CH 1 / Chain 1 |
| Test Date | Jul. 01, 2016 | | |

*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 | 4823.05 | 35.32 | 54.00 | -18.68 | 29.16 | 8.00 | 31.09 | 32.93 | 102 | 108 | Average | HORIZONTAL |
| 2 | 4824.72 | 49.29 | 74.00 | -24.71 | 43.13 | 8.00 | 31.09 | 32.93 | 102 | 108 | 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 | 4819.38 | 48.35 | 74.00 | -25.65 | 42.19 | 8.00 | 31.09 | 32.93 | 102 | 114 | Peak | VERTICAL |
| 2 | 4824.49 | 35.45 | 54.00 | -18.55 | 29.29 | 8.00 | 31.09 | 32.93 | 102 | 114 | Average | VERTICAL |

| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11g CH 6 / Chain 1 |
| Test Date | Jun. 16, 2016 | | |

*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 | 4871.92 | 47.49 | 74.00 | -26.51 | 40.80 | 7.20 | 31.21 | 31.72 | 152 | 231 | Peak | HORIZONTAL |
| 2 | 4878.16 | 35.50 | 54.00 | -18.50 | 28.80 | 7.20 | 31.21 | 31.71 | 152 | 231 | 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 | 4867.96 | 48.20 | 74.00 | -25.80 | 41.51 | 7.20 | 31.21 | 31.72 | 190 | 219 | Peak | VERTICAL |
| 2 | 4881.32 | 34.80 | 54.00 | -19.20 | 28.09 | 7.19 | 31.23 | 31.71 | 190 | 219 | Average | VERTICAL |

| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11g CH 11 / Chain 1 |
| Test Date | Jul. 01, 2016 | | |

*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 | 4924.90 | 35.53 | 54.00 | -18.47 | 29.12 | 8.11 | 31.22 | 32.92 | 138 | 284 | Average | HORIZONTAL |
| 2 | 4927.07 | 49.53 | 74.00 | -24.47 | 43.12 | 8.11 | 31.22 | 32.92 | 138 | 284 | 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 | 4923.90 | 35.57 | 54.00 | -18.43 | 29.16 | 8.11 | 31.22 | 32.92 | 241 | 72 | Average | VERTICAL |
| 2 | 4928.75 | 48.38 | 74.00 | -25.62 | 41.97 | 8.11 | 31.22 | 32.92 | 241 | 72 | Peak | VERTICAL |

| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11n MCS0 HT20 CH 1 / Chain 1 + Chain 2 |
| Test Date | Jul. 01, 2016 | | |

*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 | 4920.57 | 35.49 | 54.00 | -18.51 | 29.11 | 8.10 | 31.20 | 32.92 | 183 | 200 | Average | HORIZONTAL |
| 2 | 4923.52 | 48.31 | 74.00 | -25.69 | 41.93 | 8.10 | 31.20 | 32.92 | 183 | 200 | 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 | 4922.42 | 35.50 | 54.00 | -18.50 | 29.12 | 8.10 | 31.20 | 32.92 | 117 | 149 | Average | VERTICAL |
| 2 | 4923.93 | 48.75 | 74.00 | -25.25 | 42.34 | 8.11 | 31.22 | 32.92 | 117 | 149 | Peak | VERTICAL |

| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11n MCS0 HT20 CH 6 / Chain 1 + Chain 2 |
| Test Date | Jun. 16, 2016 | | |

*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 | 4873.28 | 48.36 | 74.00 | -25.64 | 41.67 | 7.20 | 31.21 | 31.72 | 210 | 100 | Peak | HORIZONTAL |
| 2 | 4878.08 | 34.98 | 54.00 | -19.02 | 28.28 | 7.20 | 31.21 | 31.71 | 210 | 100 | 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 | 4872.68 | 35.79 | 54.00 | -18.21 | 29.10 | 7.20 | 31.21 | 31.72 | 214 | 268 | Average | VERTICAL |
| 2 | 4883.88 | 48.82 | 74.00 | -25.18 | 42.11 | 7.19 | 31.23 | 31.71 | 214 | 268 | Peak | VERTICAL |

| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11n MCS0 HT20 CH 11 / Chain 1 + Chain 2 |
| Test Date | Jul. 01, 2016 | | |

*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 | 4921.66 | 35.56 | 54.00 | -18.44 | 29.18 | 8.10 | 31.20 | 32.92 | 244 | 182 | Average | HORIZONTAL |
| 2 | 4925.81 | 48.19 | 74.00 | -25.81 | 41.78 | 8.11 | 31.22 | 32.92 | 244 | 182 | 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 | 4919.34 | 35.69 | 54.00 | -18.31 | 29.31 | 8.10 | 31.20 | 32.92 | 151 | 250 | Average | VERTICAL |
| 2 | 4925.64 | 49.21 | 74.00 | -24.79 | 42.80 | 8.11 | 31.22 | 32.92 | 151 | 250 | 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 v03r05 for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 11.0 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 | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11b CH 1, 6, 11 / Chain 1 |
| Test Date | Jun. 16, 2016 | | |

**Channel 1**

| | 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 | 2386.00 | 60.59 | 74.00 | -13.41 | 29.21 | 4.33 | 27.05 | 0.00 | 100 | 82 | Peak | HORIZONTAL |
| 2 | 2387.20 | 53.33 | 54.00 | -0.67 | 21.95 | 4.33 | 27.05 | 0.00 | 100 | 82 | Average | HORIZONTAL |
| 3 | 2411.20 | 104.49 | | | 73.03 | 4.35 | 27.11 | 0.00 | 100 | 82 | Average | HORIZONTAL |
| 4 | 2411.20 | 108.03 | | | 76.57 | 4.35 | 27.11 | 0.00 | 100 | 82 | Peak | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2412 MHz.

**Channel 6**

| | 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 | 2390.00 | 46.66 | 54.00 | -7.34 | 15.28 | 4.33 | 27.05 | 0.00 | 107 | 81 | Average | HORIZONTAL |
| 2 | 2390.00 | 57.42 | 74.00 | -16.58 | 26.04 | 4.33 | 27.05 | 0.00 | 107 | 81 | Peak | HORIZONTAL |
| 3 | 2436.20 | 107.98 | | | 76.45 | 4.37 | 27.16 | 0.00 | 107 | 81 | Average | HORIZONTAL |
| 4 | 2438.20 | 111.49 | | | 79.96 | 4.37 | 27.16 | 0.00 | 107 | 81 | Peak | HORIZONTAL |
| 5 | 2483.50 | 45.22 | 54.00 | -8.78 | 13.53 | 4.42 | 27.27 | 0.00 | 107 | 81 | Average | HORIZONTAL |
| 6 | 2483.50 | 55.91 | 74.00 | -18.09 | 24.22 | 4.42 | 27.27 | 0.00 | 107 | 81 | Peak | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2437 MHz.

**Channel 11**

| | 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 | 2461.20 | 104.78 | | | 73.16 | 4.40 | 27.22 | 0.00 | 101 | 82 | Average | HORIZONTAL |
| 2 | 2462.80 | 108.38 | | | 76.76 | 4.40 | 27.22 | 0.00 | 101 | 82 | Peak | HORIZONTAL |
| 3 | 2483.50 | 53.62 | 54.00 | -0.38 | 21.93 | 4.42 | 27.27 | 0.00 | 101 | 82 | Average | HORIZONTAL |
| 4 | 2483.50 | 60.05 | 74.00 | -13.95 | 28.36 | 4.42 | 27.27 | 0.00 | 101 | 82 | Peak | HORIZONTAL |

Item 1, 2 are the fundamental frequency at 2462 MHz.

| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11g CH 1, 6, 11 / Chain 1 |
| Test Date | Jun. 16, 2016 | | |

**Channel 1**

| | 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 | 2389.20 | 66.13 | 74.00 | -7.87 | 34.75 | 4.33 | 27.05 | 0.00 | 100 | 84 | Peak | HORIZONTAL |
| 2 | 2390.00 | 53.51 | 54.00 | -0.49 | 22.13 | 4.33 | 27.05 | 0.00 | 100 | 84 | Average | HORIZONTAL |
| 3 | 2407.60 | 106.62 | | | 75.17 | 4.35 | 27.10 | 0.00 | 100 | 84 | Peak | HORIZONTAL |
| 4 | 2409.20 | 97.02 | | | 65.57 | 4.35 | 27.10 | 0.00 | 100 | 84 | Average | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2412 MHz.

**Channel 6**

| | 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 | 2387.00 | 66.87 | 74.00 | -7.13 | 35.49 | 4.33 | 27.05 | 0.00 | 105 | 81 | Peak | HORIZONTAL |
| 2 | 2389.80 | 53.25 | 54.00 | -0.75 | 21.87 | 4.33 | 27.05 | 0.00 | 105 | 81 | Average | HORIZONTAL |
| 3 | 2435.00 | 110.41 | | | 78.88 | 4.37 | 27.16 | 0.00 | 105 | 81 | Peak | HORIZONTAL |
| 4 | 2441.40 | 101.11 | | | 69.55 | 4.38 | 27.18 | 0.00 | 105 | 81 | Average | HORIZONTAL |
| 5 | 2483.50 | 50.68 | 54.00 | -3.32 | 18.99 | 4.42 | 27.27 | 0.00 | 105 | 81 | Average | HORIZONTAL |
| 6 | 2483.50 | 61.90 | 74.00 | -12.10 | 30.21 | 4.42 | 27.27 | 0.00 | 105 | 81 | Peak | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2437 MHz.

**Channel 11**

| | 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 | 2459.00 | 97.82 | | | 66.22 | 4.39 | 27.21 | 0.00 | 100 | 83 | Average | HORIZONTAL |
| 2 | 2460.20 | 108.11 | | | 76.51 | 4.39 | 27.21 | 0.00 | 100 | 83 | Peak | HORIZONTAL |
| 3 | 2483.50 | 53.88 | 54.00 | -0.12 | 22.19 | 4.42 | 27.27 | 0.00 | 100 | 83 | Average | HORIZONTAL |
| 4 | 2483.50 | 66.52 | 74.00 | -7.48 | 34.83 | 4.42 | 27.27 | 0.00 | 100 | 83 | Peak | HORIZONTAL |

Item 1, 2 are the fundamental frequency at 2462 MHz.

| Temperature | 22℃ | Humidity | 54% |
|---|---|---|---|
| Test Engineer | Steven Liang | Configurations | IEEE 802.11n MCS0 HT20 CH 1, 6, 11 / Chain 1 + Chain 2 |
| Test Date | Jun. 16, 2016 | | |

**Channel 1**

| | 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 | 2390.00 | 53.92 | 54.00 | -0.08 | 22.54 | 4.33 | 27.05 | 0.00 | 134 | 55 | Average | HORIZONTAL |
| 2 | 2390.00 | 69.18 | 74.00 | -4.82 | 37.80 | 4.33 | 27.05 | 0.00 | 134 | 55 | Peak | HORIZONTAL |
| 3 | 2405.20 | 96.73 | | | 65.28 | 4.35 | 27.10 | 0.00 | 134 | 55 | Average | HORIZONTAL |
| 4 | 2408.80 | 106.28 | | | 74.83 | 4.35 | 27.10 | 0.00 | 134 | 55 | Peak | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2412 MHz.

**Channel 6**

| | 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 | 2383.80 | 67.33 | 74.00 | -6.67 | 35.95 | 4.33 | 27.05 | 0.00 | 100 | 54 | Peak | HORIZONTAL |
| 2 | 2388.60 | 52.91 | 54.00 | -1.09 | 21.53 | 4.33 | 27.05 | 0.00 | 100 | 54 | Average | HORIZONTAL |
| 3 | 2430.60 | 101.54 | | | 70.03 | 4.37 | 27.14 | 0.00 | 100 | 54 | Average | HORIZONTAL |
| 4 | 2440.20 | 111.34 | | | 79.78 | 4.38 | 27.18 | 0.00 | 100 | 54 | Peak | HORIZONTAL |
| 5 | 2483.80 | 49.64 | 54.00 | -4.36 | 17.95 | 4.42 | 27.27 | 0.00 | 100 | 54 | Average | HORIZONTAL |
| 6 | 2484.60 | 62.09 | 74.00 | -11.91 | 30.40 | 4.42 | 27.27 | 0.00 | 100 | 54 | Peak | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2437 MHz.

**Channel 11**

| | 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 | 2464.40 | 110.06 | | | 78.44 | 4.40 | 27.22 | 0.00 | 100 | 346 | Peak | HORIZONTAL |
| 2 | 2464.80 | 99.72 | | | 68.10 | 4.40 | 27.22 | 0.00 | 100 | 346 | Average | HORIZONTAL |
| 3 | 2484.40 | 53.10 | 54.00 | -0.90 | 21.41 | 4.42 | 27.27 | 0.00 | 100 | 346 | Average | HORIZONTAL |
| 4 | 2484.40 | 68.94 | 74.00 | -5.06 | 37.25 | 4.42 | 27.27 | 0.00 | 100 | 346 | Peak | HORIZONTAL |

Item 1, 2 are the fundamental frequency at 2462 MHz.

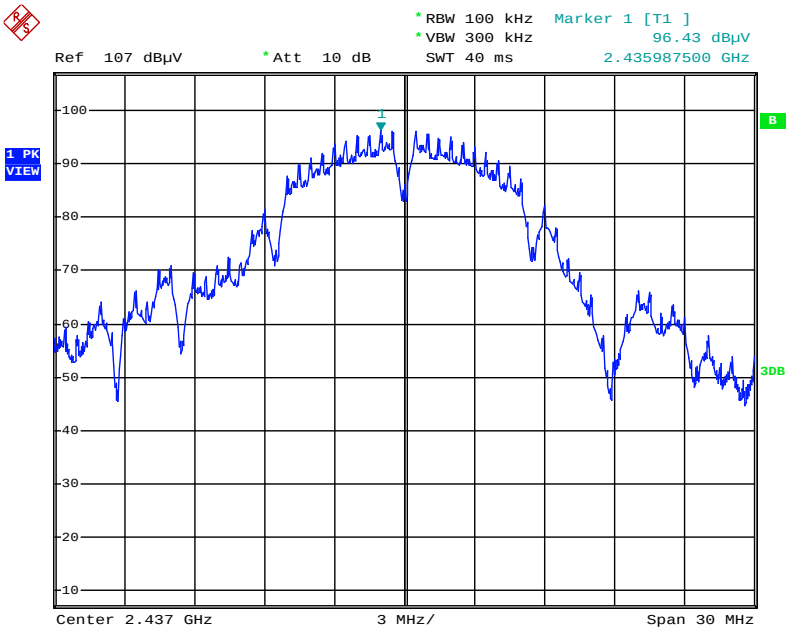
Note:

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

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

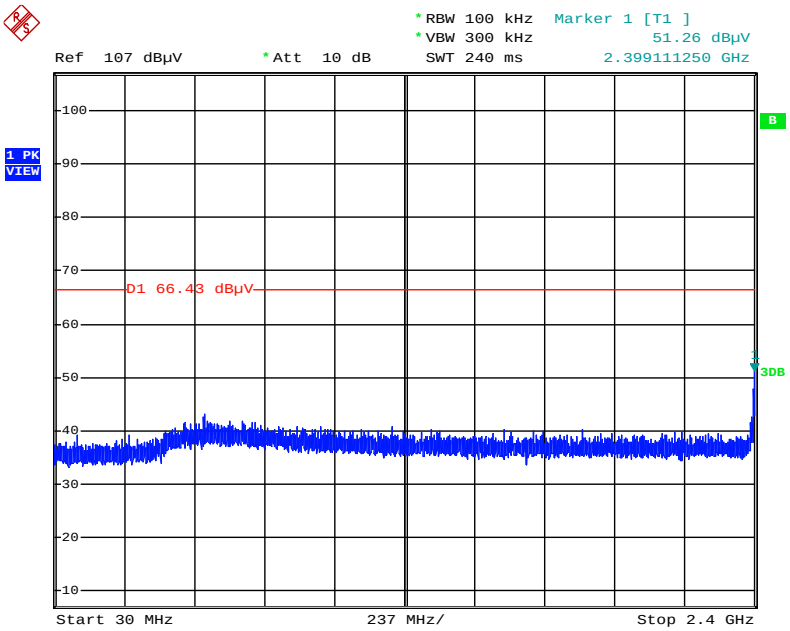
## For Emission not in Restricted Band

### Plot on Configuration IEEE 802.11b / Reference Level



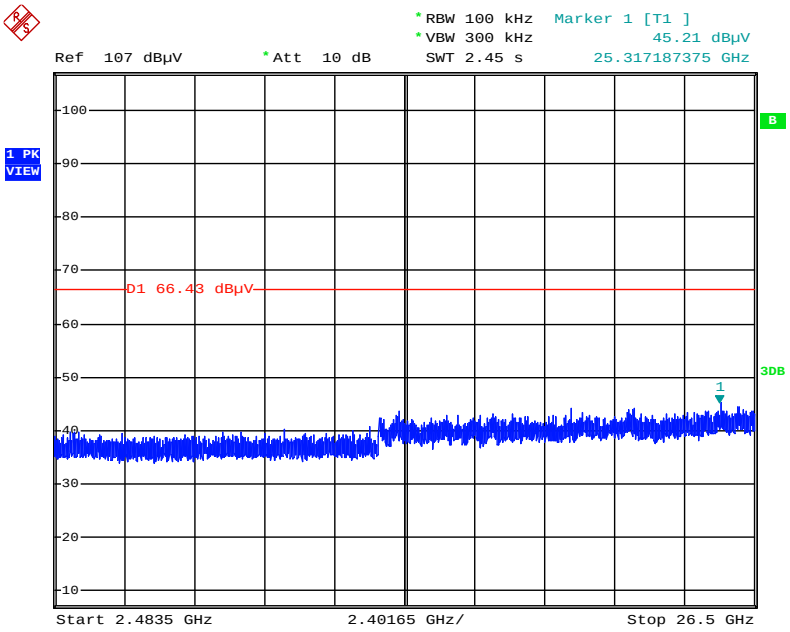

Date: 1.JUL.2016 20:36:15

### Plot on Configuration IEEE 802.11b / CH 1 / 30MHz~2400MHz (down 30dBc)



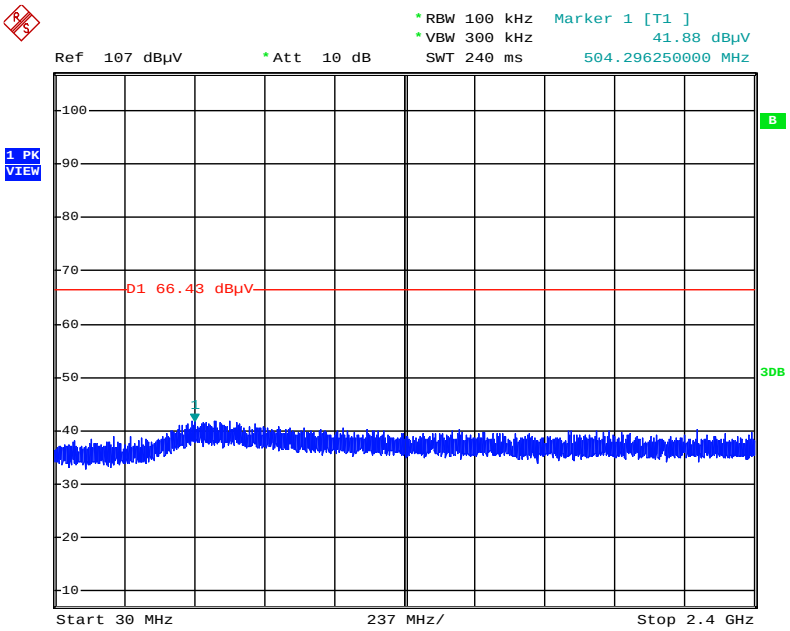

Date: 1.JUL.2016 20:39:15

## Plot on Configuration IEEE 802.11b / CH 1 / 2483.5MHz~26500MHz (down 30dBc)



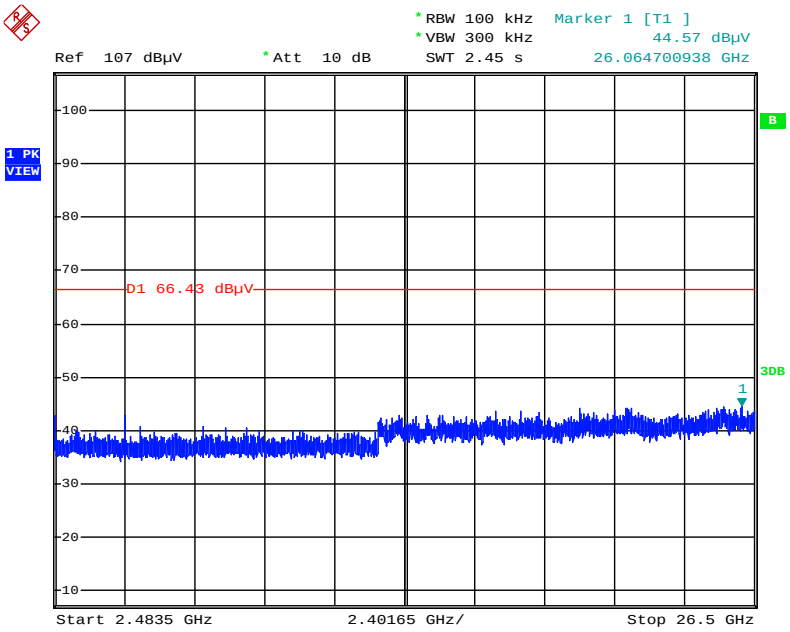

Date: 1.JUL.2016 20:38:24

## Plot on Configuration IEEE 802.11b / CH 11 / 30MHz~2400MHz (down 30dBc)



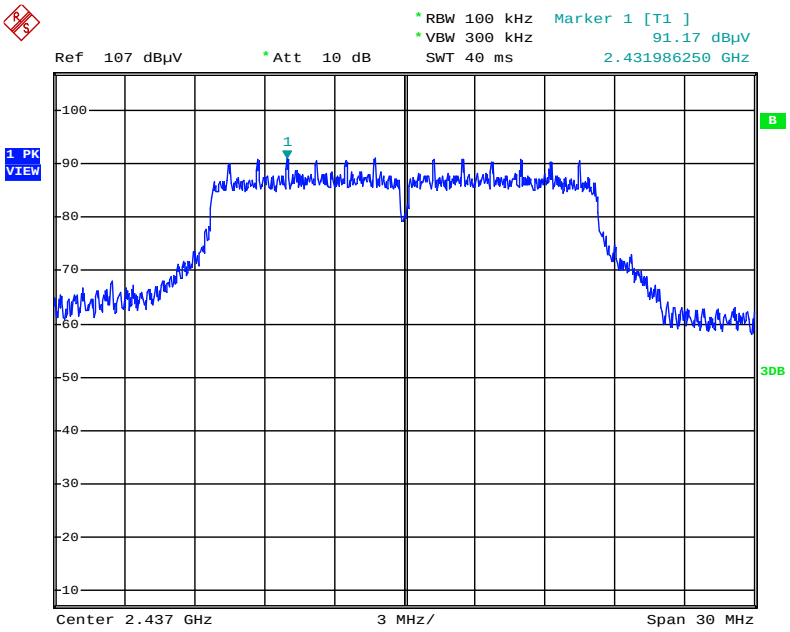

Date: 1.JUL.2016 20:40:34

## Plot on Configuration IEEE 802.11b / CH 11 / 2483.5MHz~26500MHz (down 30dBc)



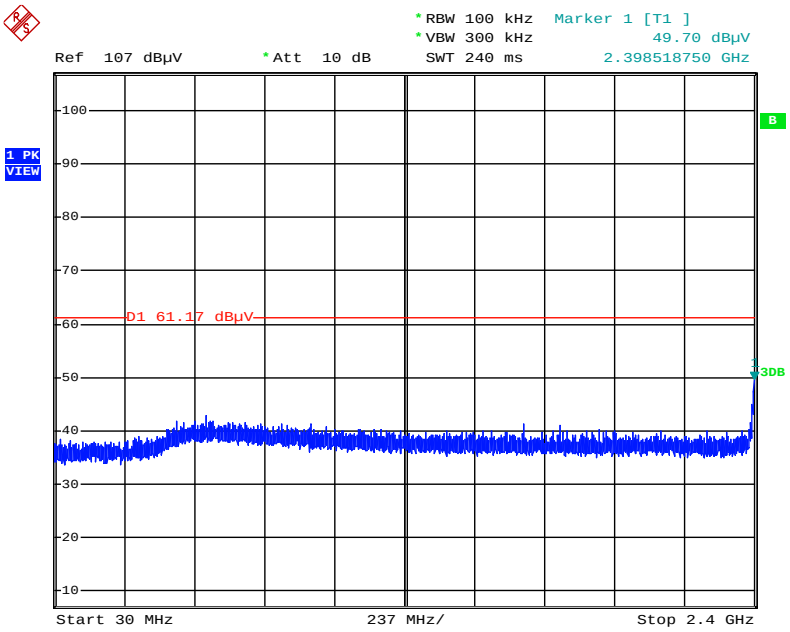

Date: 1.JUL.2016 20:41:08

## Plot on Configuration IEEE 802.11g / Reference Level



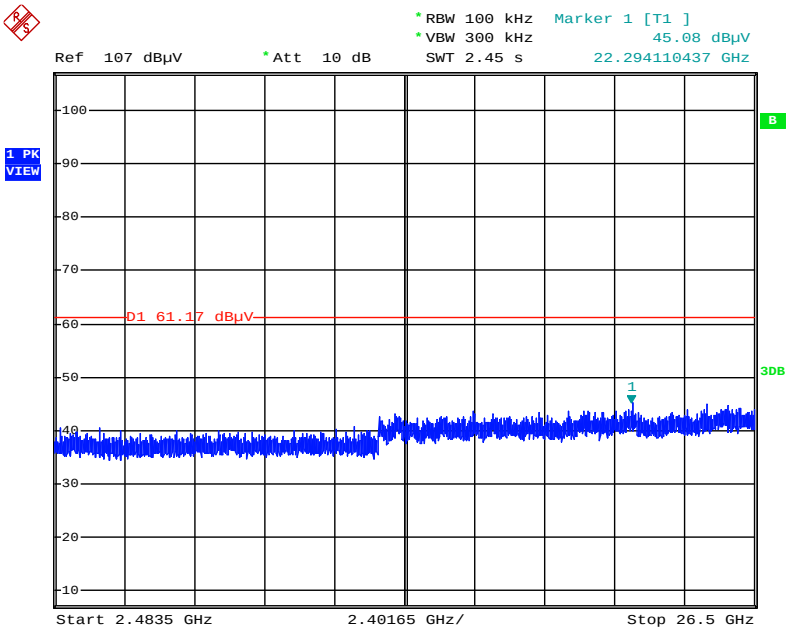

Date: 1.JUL.2016 20:45:50

## Plot on Configuration IEEE 802.11g / CH 1 / 30MHz~2400MHz (down 30dBc)



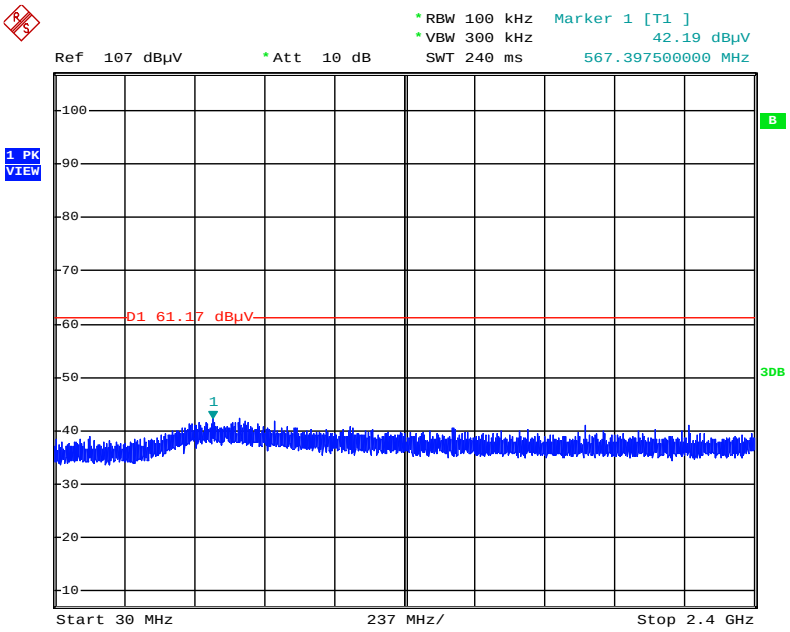

Date: 1.JUL.2016 20:47:23

## Plot on Configuration IEEE 802.11g / CH 1 / 2483.5MHz~26500MHz (down 30dBc)



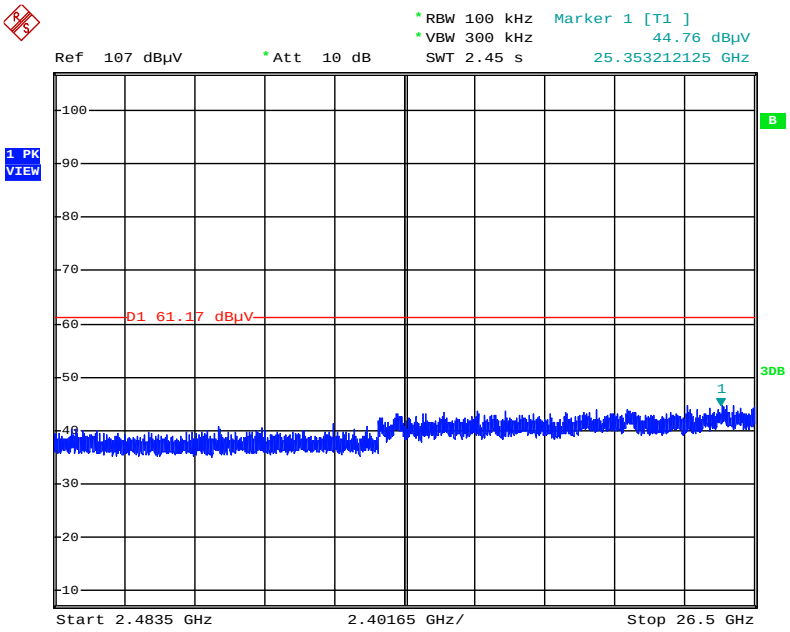

Date: 1.JUL.2016 20:48:06

## Plot on Configuration IEEE 802.11g / CH 11 / 30MHz~2400MHz (down 30dBc)



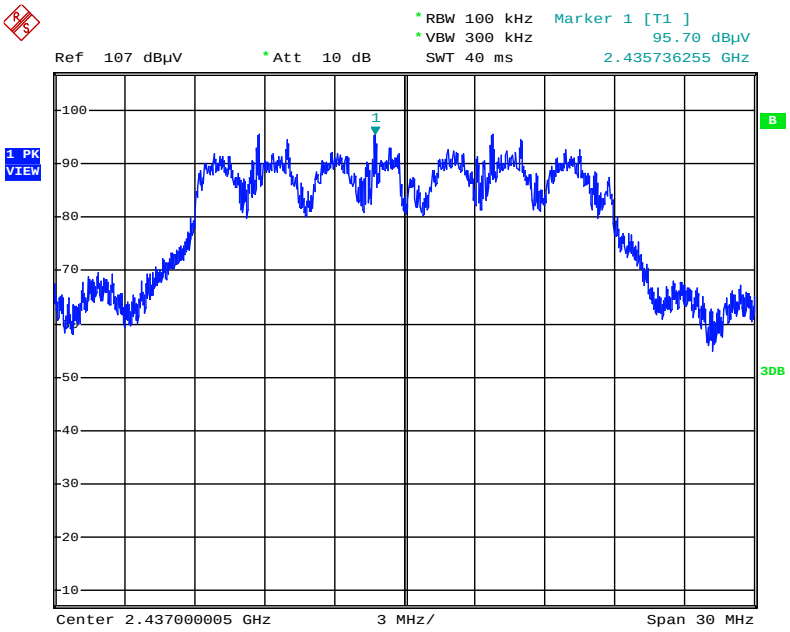

Date: 1.JUL.2016 20:50:00

## Plot on Configuration IEEE 802.11g / CH 11 / 2483.5MHz~26500MHz (down 30dBc)



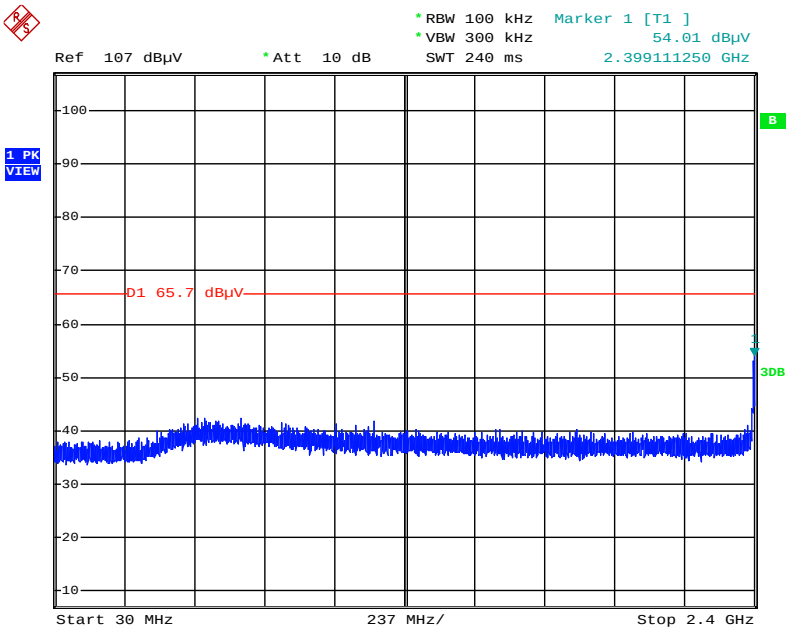

Date: 1.JUL.2016 20:49:21

## Plot on Configuration IEEE 802.11n MCS0 HT20 / Reference Level



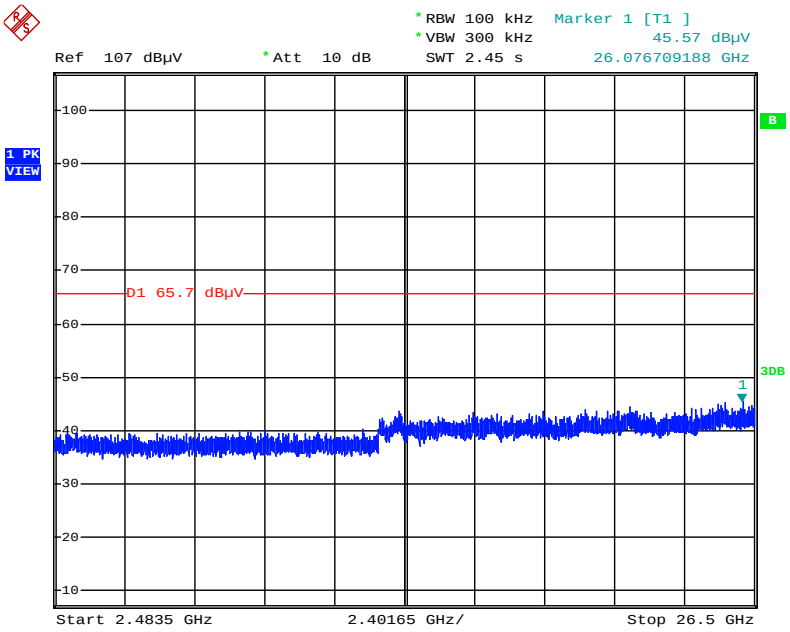

Date: 1.JUL.2016 20:52:50

## Plot on Configuration IEEE 802.11n MCS0 HT20 / CH 1 / 30MHz~2400MHz (down 30dBc)



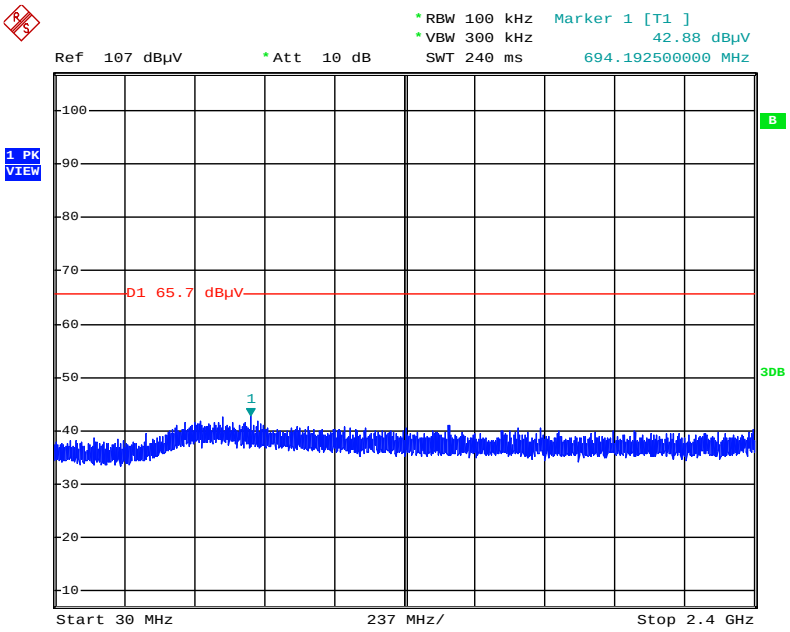

Date: 1.JUL.2016 20:54:12

## Plot on Configuration IEEE 802.11n MCS0 HT20 / CH 1 / 2483.5MHz~26500MHz (down 30dBc)



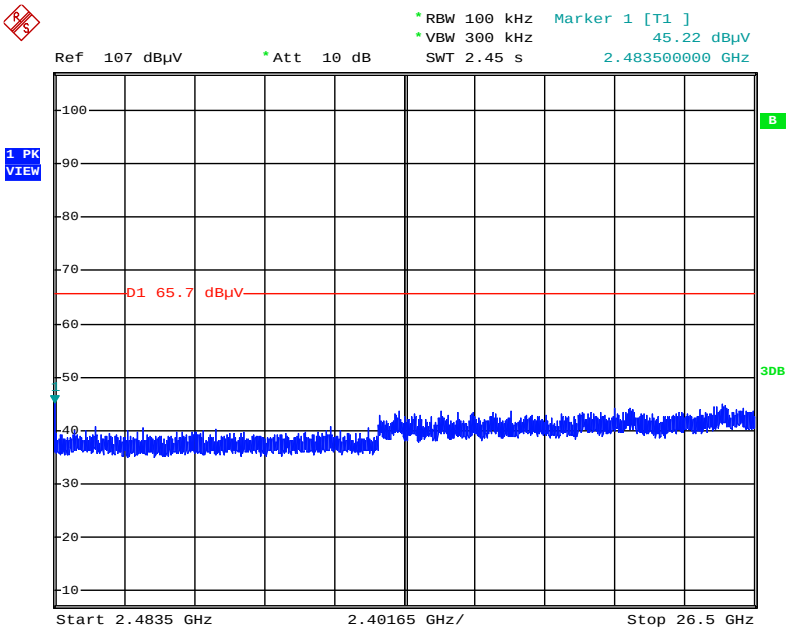

Date: 1.JUL.2016 20:54:51

## Plot on Configuration IEEE 802.11n MCS0 HT20 / CH 11 / 30MHz~2400MHz (down 30dBc)




Date: 1.JUL.2016 20:56:47

## Plot on Configuration IEEE 802.11n MCS0 HT20 / CH 11 / 2483.5MHz~26500MHz (down 30dBc)




Date: 1.JUL.2016 20:57:27

## 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 Receiver | Agilent | N9038A | My52260123 | 9kHz ~ 8.45GHz | Jan. 27, 2016 | Conduction (CO01-CB) |
| LISN | F.C.C. | FCC-LISN-50-16-2 | 04083 | 150kHz ~ 100MHz | Dec. 08, 2015 | Conduction (CO01-CB) |
| LISN | Schwarzbeck | NSLK 8127 | 8127647 | 9kHz ~ 30MHz | Dec. 23, 2015 | Conduction (CO01-CB) |
| COND Cable | Woken | Cable | 01 | 150kHz ~ 30MHz | May 24, 2016 | Conduction (CO01-CB) |
| Software | Audix | E3 | 6.120210n | - | N.C.R. | Conduction (CO01-CB) |
| BILOG ANTENNA | TESEQ | CBL6112D | 37880 | 20MHz ~ 2GHz | Sep. 03, 2015 | Radiation (03CH01-CB) |
| Loop Antenna | Teseq | HLA 6120 | 24155 | 9kHz - 30 MHz | Mar. 16, 2016* | 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 | Mar. 15, 2016 | Radiation (03CH01-CB) |
| Pre-Amplifier | Agilent | 8449B | 3008A02310 | 1GHz ~ 26.5GHz | Jan. 18, 2016 | Radiation (03CH01-CB) |
| Pre-Amplifier | WM | TF-130N-R1 | 923365 | 26GHz ~ 40GHz | Nov. 13, 2015 | Radiation (03CH01-CB) |
| Spectrum Analyzer | R&S | FSP40 | 100056 | 9kHz ~ 40GHz | Oct. 27, 2015 | Radiation (03CH01-CB) |
| EMI Test | R&S | ESCS | 100355 | 9kHz ~ 2.75GHz | May 16, 2016 | 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. 02, 2015 | 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 | 18GHz ~ 40 GHz | Nov. 02, 2015 | Radiation (03CH01-CB) |
| RF Cable-high | Woken | High Cable-40G-2 | N/A | 18GHz ~ 40 GHz | Nov. 02, 2015 | Radiation (03CH01-CB) |
| Test Software | Audix | E3 | 6.2009-I0-7 | N/A | N/A | Radiation (03CH01-CB) |
| Spectrum analyzer | R&S | FSV40 | 100979 | 9kHz~40GHz | Dec. 09, 2015 | Conducted (TH01-CB) |
| Temp. and Humidity Chamber | Ten Billion | TTH-D3SP | TBN-931011 | -30~100 degree | Jun. 03, 2016 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-6 | 1 GHz – 26.5 GHz | Nov. 02, 2015 | 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. 02, 2015 | Conducted (TH01-CB) |
| RF Cable-high | Woken | RG402 | High Cable-9 | 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-10 | 1 GHz – 26.5 GHz | Nov. 02, 2015 | 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% |