# TEST REPORT

**Test Report No.: 20171010651**

| | |
|---|---|
| **Applicant:** | **Hangzhou Shining3D Tech Co., Ltd** |
| **Manufacturer:** | **Hangzhou Shining3D Tech Co., Ltd** |
| **Factory:** | **/** |
| **Name of the sample:** | **3D Printer** |
| **Brand Name:** | **Shining3D** |
| **Model:** | **Einstart-c** |

**Test Result:** **PASS**

**STATEMENT**

1. This test report shall not be reproduced in full or partial without the written approval of Jiangsu Electronic Information Product Quality Supervision and Inspection Institute.
2. The test results presented in this report relate only to the sample and the item tested.
3. This test report is ineffective if it is without special inspection seal of the test laboratory.
4. If you have any question or comment, please bring them to our attention within 15 days, after you receive the test report.(Please lodge them to the assignment department if the task is consigned by the government.)
5. Please retake the samples in 60 days after you receive the report, the laboratory will dispose the samples after exceeding the time limit.
6. The test items in the report with accreditation symbols have already been accrediated by related accreditation bodys(except for the items with *)

**Date of test:** 05/05/2017~22/5/2017

**Tested by:** Lu Jie Lu Jie **Checked by:** He Fei He Fei

**Approved by:** Qin Feng Qin Feng **Date:** Jun. 29 2017

**Issued By:** Jiangsu Electronic Information Product Quality Supervision & Inspection Institute

**LAB Address:** No.100 Jinshui Road, WuXi, Jiangsu, P.R.China

**Test standard:**

FCC 47 CFR，PART 15 SUBPART C Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ANSCI C63.10(2013) American National Standard for Testing Uncliensed Wireless Devices

KDB 558074 D01 DTS Meas Guidance v03r05 Guidance for Performing Compliance Measurements on Digital Transmission Systems(DTS) Operating Under §15.247

**Test item description:**

| | |
|---|---|
| Model/Type reference: | Einstart-c |
| Ratings: | AC 100V~240V, 50/60Hz |

**Possible test case verdicts:**

| | |
|---|---|
| - test case does not apply to the test object: | N/A |
| - test object does meet the requirement: | P (Pass) |
| - test object does not meet the requirement: | F (Fail) |

**General product information:**

EUT is a 3D Printer, model number is Einstart-c (FCC ID:2AMG4-EINSTART-C).The Highest Operation Frequency is 2462MHz. The main ports are as follows: USB port.

# CONTENTS

# 1 General Description

## 1.1 Testing Facility

All measurement facilities used to collect the measurement data are located at
No.100 Jinshui Road, WuXi, Jiangsu, P.R.China
***The FCC Site Registration No. is 399439***
***The IC Site Registration No. is 12843A-1***

## 1.2 Applicant

Name: Hangzhou Shining3D Tech Co., Ltd
Address: No.1398 Xiangbin Rd., Wenyan St., Xiaoshan District, Hangzhou, P.R. China 311258

## 1.3 Manufacturer

Name: Hangzhou Shining3D Tech Co., Ltd
Address: No.1398 Xiangbin Rd., Wenyan St., Xiaoshan District, Hangzhou, P.R. China 311258

## 1.4 Product Feature of Equipment Under Test

Product Name: 3D Printer Brand Name: Shining3D
Model No.: Einstart-c FCC ID: 2AMG4-EINSTART-C
Note: The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications and user's manual.

## 1.5 Modification of EUT

No modifications are made to the EUT during all test items.

## 1.6 Standards Applicable for Testing

The EUT is a RF Product. According to the specification of the manufacturer, it must comply with the requirements of the following standards:
FCC 47 CFR，PART 15 SUBPART C
ANSCI C63.10(2013)
KDB 558074 D01 DTS Meas Guidance v03r05

# 2 Test Configuration of Equipment Under Test

Frequency range investigated:

Conducted Emission: 150kHz ~30MHz

Radiated Emission: 9kHz to the 10th harmonic of the highest fundamental frequency or to 40GHz, whichever is lower

Pre-Scan has been conducted to determine the worst-case mode across all the data rates and modulation modes under section 2.2.

Based on the worst configuration found above, different channels and data rates were selected for the final test as listed in section 2.3.

## 2.1 Carrier Frequency Channel

| Frequency Band | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---|---|---|---|---|
| 2400-2483.5 MHz | 1 | 2412 | 7 | 2442 |
| | 2 | 2417 | 8 | 2447 |
| | 3 | 2422 | 9 | 2452 |
| | 4 | 2427 | 10 | 2457 |
| | 5 | 2432 | 11 | 2462 |
| | 6 | 2437 | - | - |

## 2.2 Pre-Scanned RF Power

The manufacturer provides special test software named UTF-8 TeraTerm Pro to make the EUT transmit continuously with a constant duty cycle,control TX duty cycle >98% for TX test. Preliminary tests were performed in different data rate. Results with different data rate associated with the highest power were shown in the following tables.

| IEEE 802.11b RF Power(dBm) | | | | |
|---|---|---|---|---|
| Channel | Data Rate(Mbps) | | | |
| | 1Mbps | 2Mbps | 5.5Mbps | 11Mbps |
| 1 | **18.2** | 18.1 | 17.3 | 17.5 |
| 6 | 17.9 | -- | -- | -- |
| 11 | 18.0 | -- | -- | -- |

| IEEE 802.11g RF Power(dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Channel | Data Rate(Mbps) | | | | | | | |
| | 6 | 9 | 12 | 18 | 24 | 36 | 48 | 54 |
| 1 | **20.5** | 20.4 | 20.1 | 20.1 | 20.3 | 19.7 | 20.1 | 20.2 |
| 6 | 20.2 | -- | -- | -- | -- | -- | -- | -- |
| 11 | 19.9 | -- | -- | -- | -- | -- | -- | -- |

| IEEE 802.11n HT20 RF Power(dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Channel | MCS Index | | | | | | | |
| | MCS 0 | MCS1 | MCS 2 | MCS 3 | MCS 4 | MCS 5 | MCS 6 | MCS 7 |
| 1 | **20.6** | 20.5 | 20.5 | 20.1 | 20.4 | 19.9 | 20.3 | 20.2 |
| 6 | 20.5 | -- | -- | -- | -- | -- | -- | -- |
| 11 | 20.1 | -- | -- | -- | -- | -- | -- | -- |

| IEEE 802.11n HT40 RF Power(dBm) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Channel | MCS Index | | | | | | | |
| | MCS 0 | MCS1 | MCS 2 | MCS 3 | MCS 4 | MCS 5 | MCS 6 | MCS 7 |
| 3 | **20.5** | 19.5 | 19.6 | 19.5 | 19.6 | 20.2 | 20.2 | 19.0 |
| 6 | 20.7 | -- | -- | -- | -- | -- | -- | -- |
| 9 | 20.1 | -- | -- | -- | -- | -- | -- | -- |

## 2.3 Test Mode

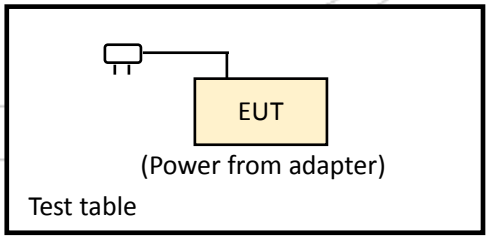
Based on the worst configuration found in the Preliminary tests, Final results of test modes, data rates and test channels are shown in the following table.

| Test Cases | | | |
|---|---|---|---|
| **Test Items** | **Mode** | **Data Rate** | **Test Channel** |
| Maximum Peak Conducted Output Power | 802.11b | 1Mbps | 1/6/11 |
| | 802.11g | 6Mbps | 1/6/11 |
| | 802.11n HT20 | MCS0 | 1/6/11 |
| | 802.11n HT40 | MCS0 | 3/6/9 |
| Peak Power Spectral Density | 802.11b | 1Mbps | 1/11 |
| | 802.11g | 6Mbps | 1/11 |
| | 802.11n HT20 | MCS0 | 1/6/11 |
| | 802.11n HT40 | MCS0 | 3/6/9 |
| 6dB and 99% Bandwidth Measurement | 802.11b | 1Mbps | 1/6/11 |
| | 802.11g | 6Mbps | 1/6/11 |
| | 802.11n HT20 | MCS0 | 1/6/11 |
| | 802.11n HT40 | MCS0 | 3/6/9 |
| Band-edge Measurement for RF Conducted Emission | 802.11b | 1Mbps | 1/11 |
| | 802.11g | 6Mbps | 1/11 |
| | 802.11n HT20 | MCS0 | 1/11 |
| | 802.11n HT40 | MCS0 | 3/9 |
| Radiated Band Edge | 802.11b | 1Mbps | 1/11 |
| | 802.11g | 6Mbps | 1/11 |
| | 802.11n HT20 | MCS0 | 1/11 |
| | 802.11n HT40 | MCS0 | 3/9 |

| Test Case | | | |
|---|---|---|---|
| **Test Items** | **Mode** | **Data Rate** | **Test Channel** |
| Spurious RF Conducted Emission | 802.11b | 1Mbps | 1/6/11 |
| | 802.11g | 6Mbps | 1/6/11 |
| | 802.11n HT20 | MCS0 | 1/6/11 |
| | 802.11n HT40 | MCS0 | 3/6/9 |
| Radiated Spurious Emission | 802.11b | 1Mbps | 1/6/11 |
| | 802.11g | 6Mbps | 1/6/11 |
| | 802.11n HT20 | MCS0 | 1/6/11 |
| | 802.11n HT40 | MCS0 | 3/6/9 |
| AC Conducted Emission Measurement | 802.11b | 1Mbps | 1 |
| Maximum Permissible Exposure(MPE) | 802.11b | 1Mbps | 1 |
| | 802.11g | 6Mbps | 1 |
| | 802.11n HT20 | MCS0 | 1 |
| | 802.11n HT40 | MCS0 | 3 |

Note: For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

## 2.4 Connection Diagram of Test System




## 2.5 Test Equipment List

The EUT has been tested as an independent unit.

| Instrument | Manufacturer | Model No. | S/N | Calibration Due | Calibration Interval |
|---|---|---|---|---|---|
| EMI Test Receiver | R&S | ESU | 100186 | 2018.4.29 | 1 year |
| Broad-band antenna | ETS | 3142C | 00098968 | 2018.01.12 | 3 year |
| Horn antenna | Schwarz beck | BBHA9120D | 9120D-513 | 2017.07.01 | 3 year |
| Horn antenna | TOYO Corporation | HAP06-18W | 9120c-528 | 2018.12.26 | 3 year |
| Horn antenna | TOYO Corporation | HAP18-26W | 00000032 | 2018.12.26 | 3 year |
| Loop antenna | R&S | HFH2-Z2 | 100256 | 2017.6.16 | 3 year |

| Instrument | Manufacturer | Model No. | S/N | Calibration Due | Calibration Interval |
|---|---|---|---|---|---|
| Preamplifier | Compliance Direction | PAP-1G18 | 8487 | 2018.4.29 | 1 year |
| Spectrum Analyzer | R&S | FSU43 | 100050 | 2018.3.6 | 1 year |
| EMI Test Receiver | R&S | ESCI7 | 100820 | 2018.2.24 | 1 year |
| EMI Test Receiver | R&S | ESCI | 100065 | 2018.2.24 | 1 year |
| Artificial mains | R&S | ENV216 | 100497 | 2018.2.24 | 1 year |
| Shielded room | P.R.China | PB-4.95m×4m×3.3m | PB-05 | 2018.2.7 | 1 year |
| Shielded room | P.R.China | PB-7.7m×3.5m×3.3m | PB-06 | 2018.2.7 | 1 year |
| Shielded room | P.R.China | PB-4.4m×7.9m×2.8m | PB-04 | 2018.2.7 | 1 year |
| Semi-anechoic chamber | ETS | RFD-F/A-100 | 4400 | 2018.4.29 | 1 year |
| Semi-anechoic chamber | ETS | FACT-3 | 601 | 2018.2.24 | 1 year |
| Power Sensor | Keysight | U2021XA | MY54480008 | 2017.11.4 | 1 year |
| TOYO EMI SoftWare | TOYO Corporation | TOYO EMI Software | Ver 5.5.1 | / | / |

## 2.5 Support Equipment List

| Equipment | Manufacturer | Model No. | S/N | NOTES |
|---|---|---|---|---|
| PC | HP Inc. | HSTNN-I62C-7 | CNU0110JCY | Doc |
| AC Adapter | DELTA ELECTRONICS (JIANGSU) LTD. | PPP012D-S | WCNXF0AAR5K5QQ | / |

## 2.6 Measurement Results Explanation Example

**For all conducted test items:**

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example: The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 6.3 dB and 10dB attenuator.

*Offset(dB) = RF cable loss(dB) + attenuator factor(dB).*= 6.3 + 10 = 16.3(dB)

# 3 Summary of Test Result

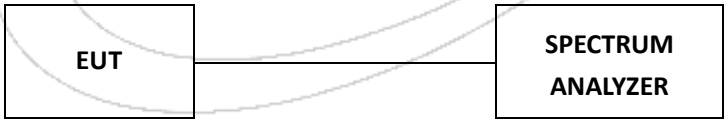
The EUT has been tested according to the following specifications:

| FCC Rules | Description of Test | Result |
|---|---|---|
| §15.203 | Antenna Requirement | Compliance |
| §15.247(b)(3) | Maximum Peak Conducted Output Power | Compliance |
| §15.247(e) | Peak Power Spectral Density | Compliance |
| §15.247(a)(2) | 6dB and 99% Bandwidth Measurement | Compliance |
| §15.247(d) | Band-edge Measurement for RF Conducted Emission | Compliance |
| §15.247(d) | Radiated Band Edge | Compliance |
| §15.247(d) | Spurious RF Conducted Emission | Compliance |
| §15.247(d) | Radiated Spurious Emission | Compliance |
| §15.207(a) | AC Conducted Emission Measurement | Compliance |
| §15.247(i), §1.1307(b)(1)& §2.1091 | Maximum Permissible Exposure(MPE) | Compliance |

# 4 Test Result

## 4.1Duty Cycle

**TEST CONFIGURATION**




**TEST PROCEDURE**

a. A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on and off times of the transmitted signal.

b. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

**LIMIT**

The Maximum Peak Output Power Measurement is 30dBm.

Preferably, all measurements of maximum conducted (average) output power will be performed with the

EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).

When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternate procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle. Within this guidance document, the duty cycle refers to the fraction of time over which the transmitter is on and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ± 2 percent, otherwise the duty cycle is considered to be non-constant.

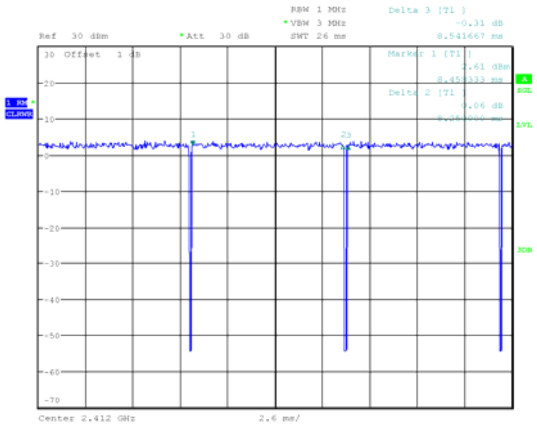
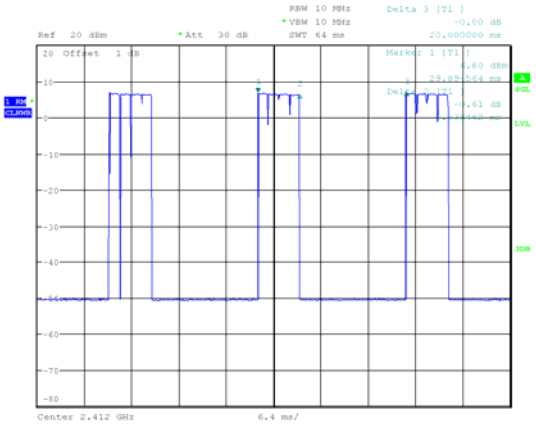
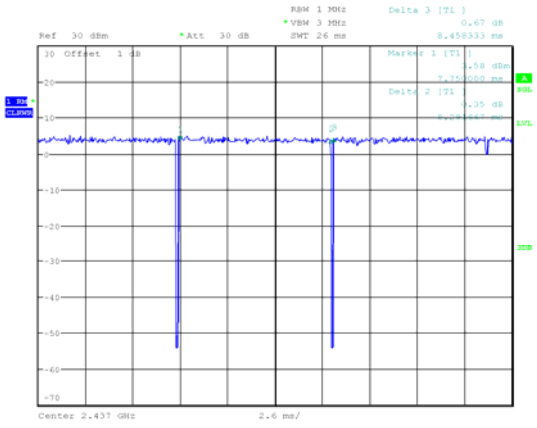
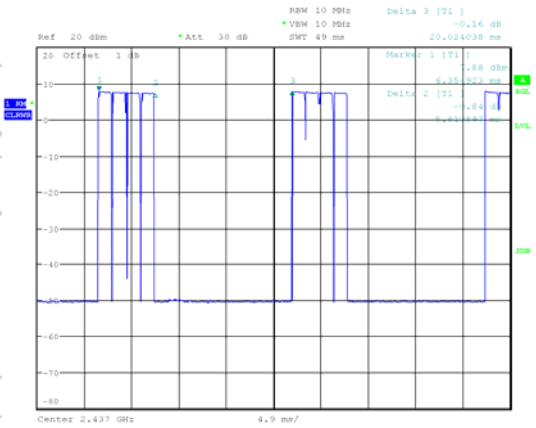
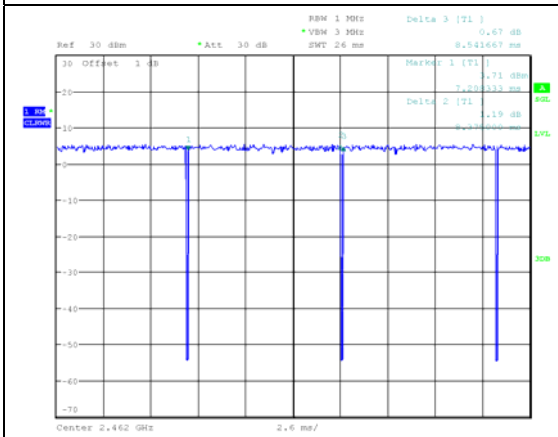
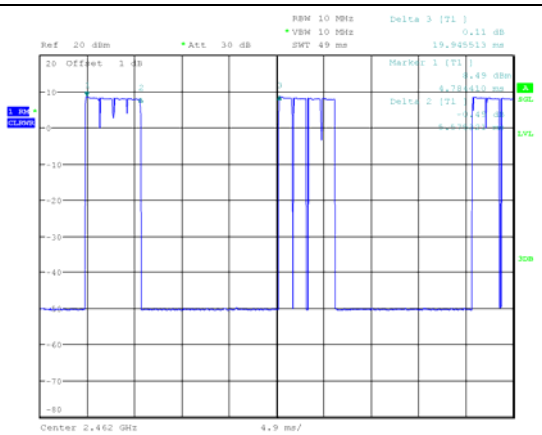
**TEST RESULTS**

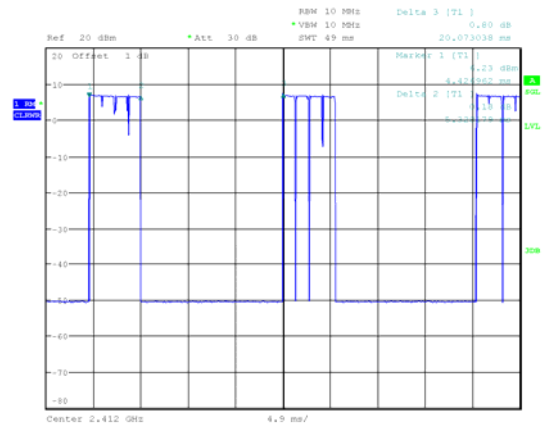
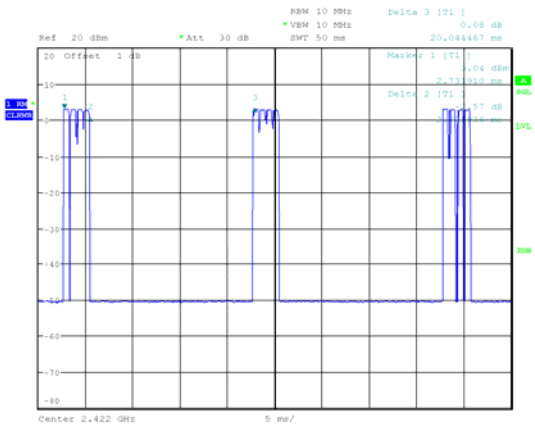
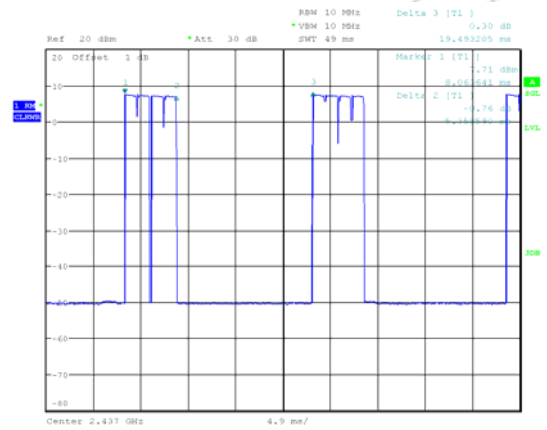
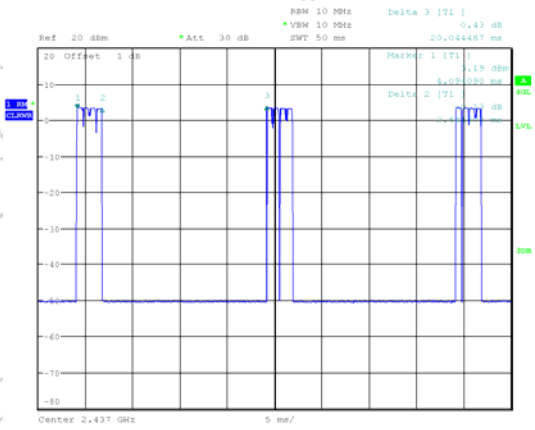
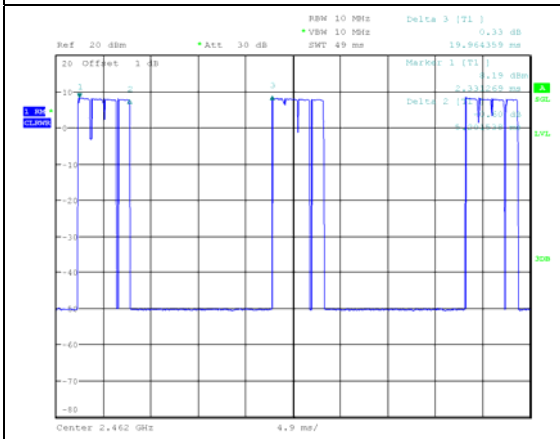
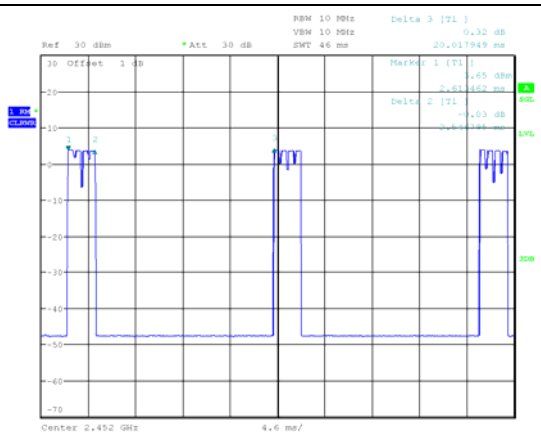
The Manufacturer provides test software to enter engineer test mode;

| Test Mode | Channel | Frequency (MHz) | Duty Cycle | Duty Cycle Factor (dB) |
|---|---|---|---|---|
| IEEE 802.11 b | 1 | 2412 | 96.59% | 0.2 |
| | 6 | 2437 | 98.03% | 0.1 |
| | 11 | 2462 | 98.05% | 0.1 |
| IEEE 802.11 g | 1 | 2412 | 27.69% | 5.6 |
| | 6 | 2437 | 29.02% | 5.4 |
| | 11 | 2462 | 27.95% | 5.5 |
| IEEE 802.11 n HT20 | 1 | 2412 | 26.54% | 5.8 |
| | 6 | 2437 | 27.49% | 5.6 |
| | 11 | 2462 | 26.05% | 5.8 |
| IEEE 802.11 n HT40 | 3 | 2422 | 13.58% | 8.7 |
| | 6 | 2437 | 13.18% | 8.8 |
| | 9 | 2452 | 12.72% | 9.0 |

Note:

1. Duty Cycle Factor = 10*log (1/Duty Cycle)

| Duty Cycle | |
|---|---|
| *IEEE 802.11b* | *IEEE 802.11g* |
|  |  |
| *2412 MHz* | *2412 MHz* |
|  |  |
| *2437 MHz* | *2437 MHz* |
|  |  |
| *2462 MHz* | *2462 MHz* |

| ***Duty Cycle*** | |
|---|---|
| *IEEE 802.11n HT20* | *IEEE 802.11n HT40* |
|  |  |
| *2412 MHz* | *2422 MHz* |
|  |  |
| *2437 MHz* | *2437 MHz* |
|  |  |
| *2462 MHz* | *2452 MHz* |

## 4.2 Antenna Requirement

**LIMIT**

For intentional device, according to FCC 47 CFR Section 15.203, 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.

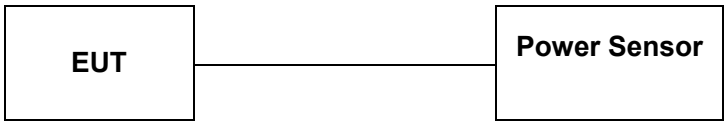
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

**EUT Antenna:**The EUT has an antenna arrangement for wifi，which the antenna maximum gain is 3.0 dBi，fulfill the requirement of this section。Please refer to the EUT photos.

**Result:** Compliance

## 4.3 Maximum Peak Conducted Output Power

**TEST CONFIGURATION**




**TEST PROCEDURE**

According to KDB558074 D01 DTS Meas Guidance v03r05:

PKPM1 Peak power meter method: The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

**LIMIT**

The Maximum Peak Output Power Measurement is 30dBm.

**TEST RESULTS**

| Test Mode | Channel | Frequency (MHz) | Measured Output Peak Power (dBm) | Limits (dBm) | Result |
|---|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | 18.2 | 30 | Compliance |
| | 6 | 2437 | 17.9 | | |
| | 11 | 2462 | 18.0 | | |
| IEEE 802.11g | 1 | 2412 | 20.5 | 30 | Compliance |
| | 6 | 2437 | 20.2 | | |
| | 11 | 2462 | 19.9 | | |
| IEEE 802.11n HT20 | 1 | 2412 | 20.6 | 30 | Compliance |
| | 6 | 2437 | 20.5 | | |
| | 11 | 2462 | 20.1 | | |
| IEEE 802.11n HT40 | 3 | 2422 | 20.5 | 30 | Compliance |
| | 6 | 2437 | 20.7 | | |
| | 9 | 2452 | 20.1 | | |

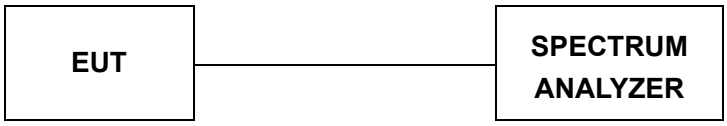
Note:

1. Measured output power at difference data rate for each mode and recorded worst case for each mode.

2.Test results including cable loss;

## 4.4 Peak Power Spectral Density

**TEST CONFIGURATION**




**TEST PROCEDURE**

According to KDB558074 D01 DTS Meas Guidance v03r05:

Method PKPSD (peak PSD): This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

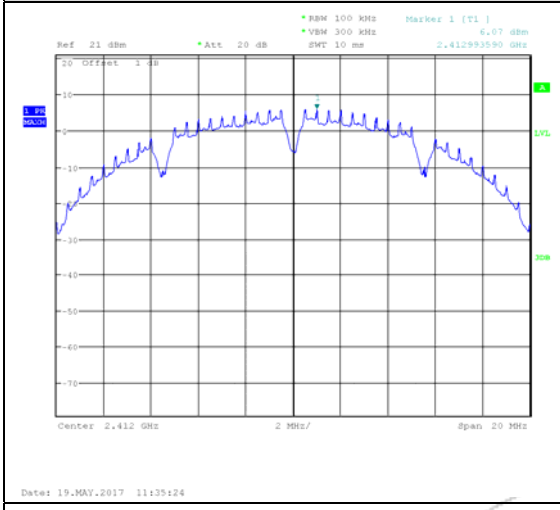
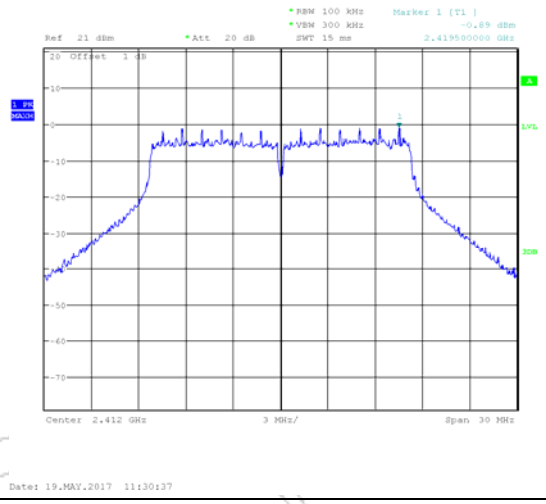
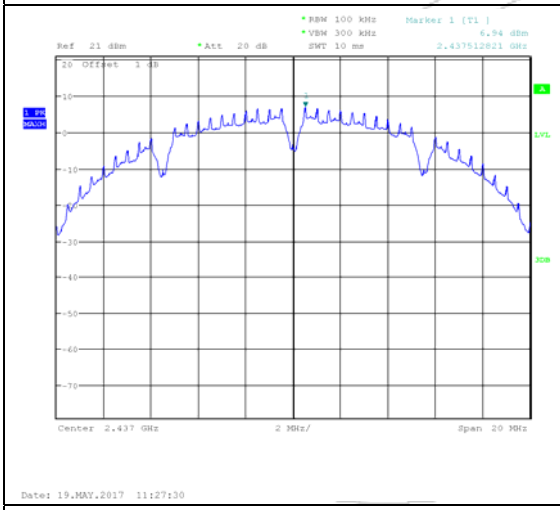
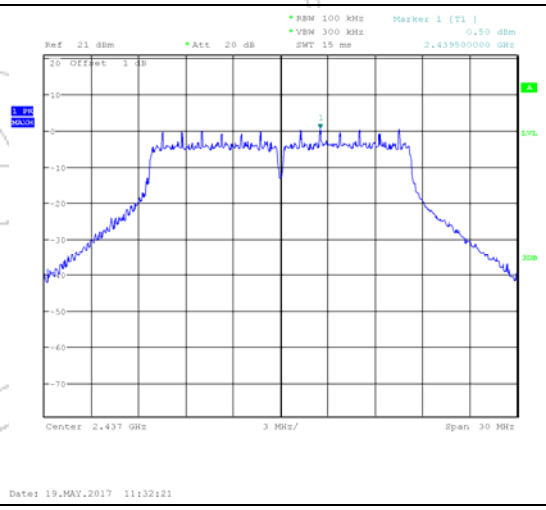
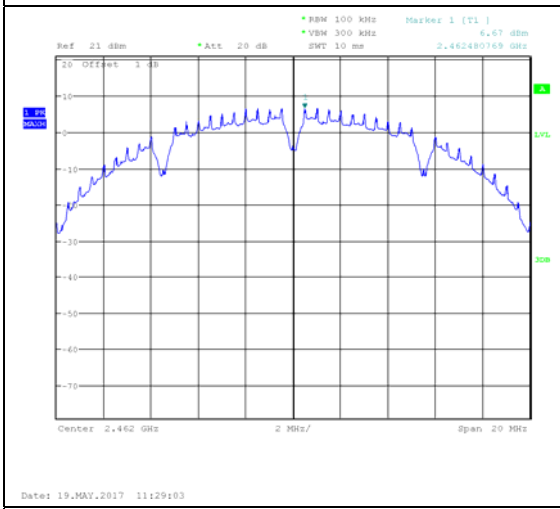
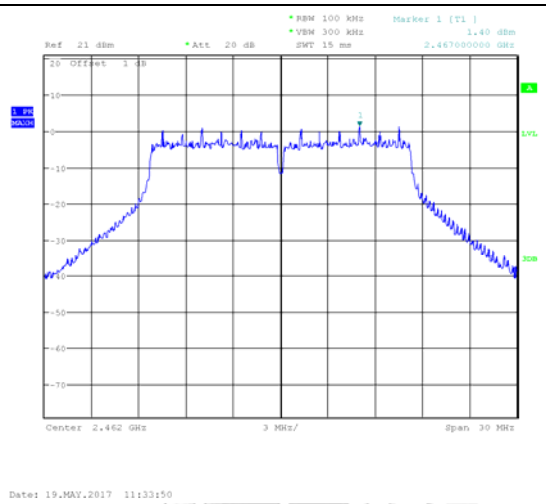
**LIMIT**

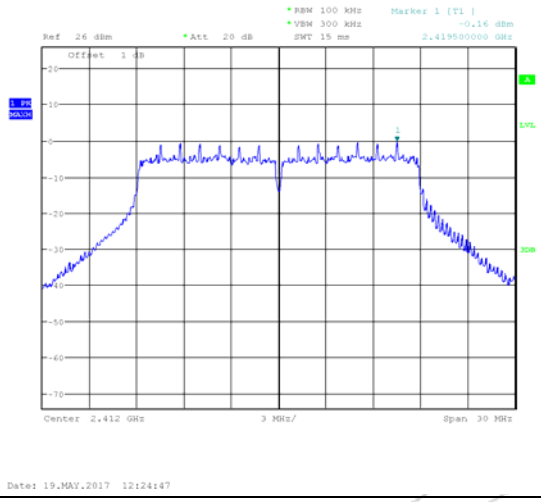
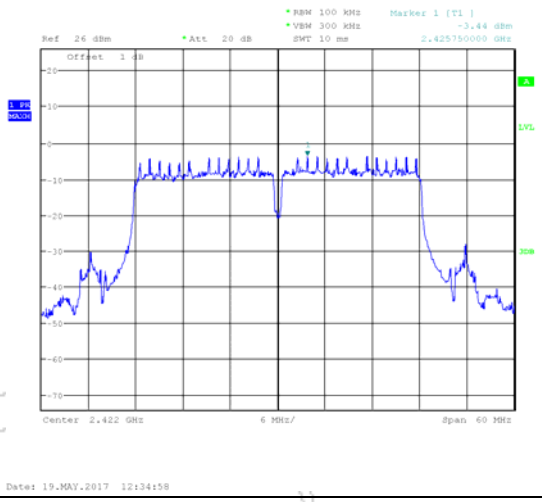
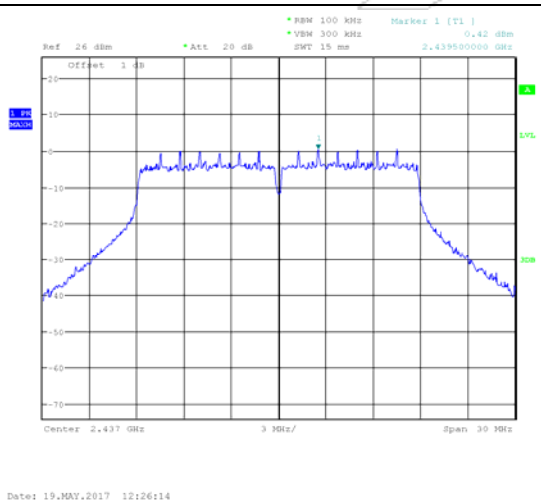
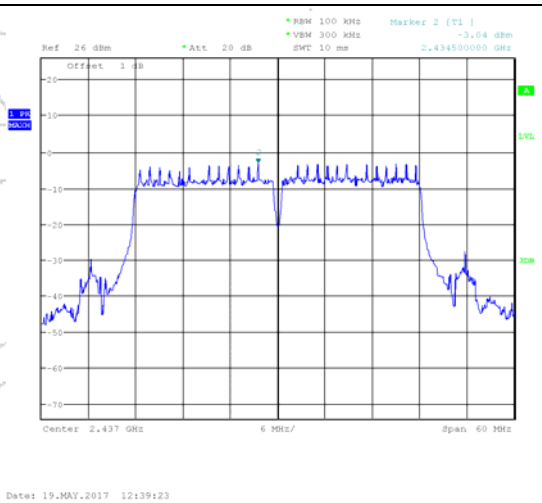
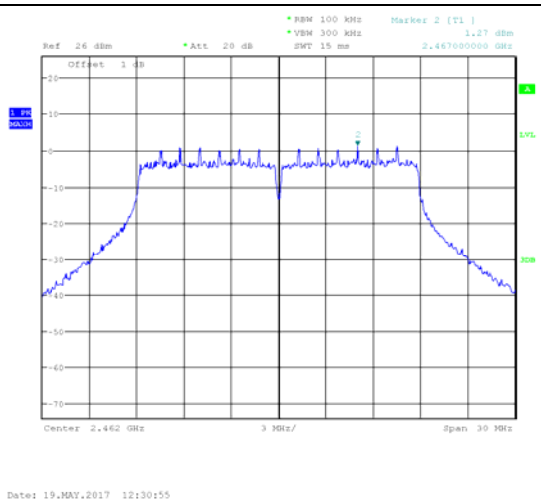
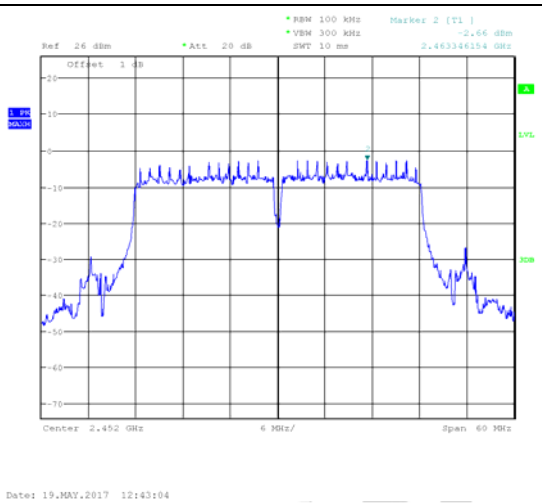
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

**TEST RESULTS**

| Test Mode | Channel | Frequency (MHz) | Measured Peak Power Spectral Density (dBm/100kHz) | Limits (dBm/3kHz) | Result |
|---|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | 6.07 | 8 | Compliance |
| | 6 | 2437 | 6.94 | | |
| | 11 | 2462 | 6.67 | | |
| IEEE 802.11g | 1 | 2412 | -0.89 | 8 | Compliance |
| | 6 | 2437 | -0.50 | | |
| | 11 | 2462 | 1.40 | | |

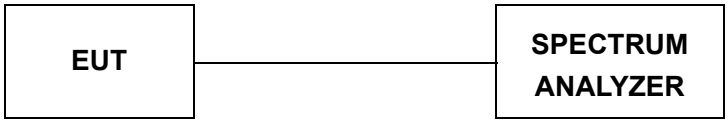
| Test Mode | Channel | Frequency (MHz) | Measured Peak Power Spectral Density (dBm/100kHz) | Limits (dBm/3kHz) | Result |
|---|---|---|---|---|---|
| IEEE 802.11n HT20 | 1 | 2412 | -0.16 | 8 | Compliance |
| | 6 | 2437 | 0.42 | | |
| | 11 | 2462 | 1.27 | | |
| IEEE 802.11n HT40 | 3 | 2422 | -3.44 | 8 | Compliance |
| | 6 | 2437 | -3.04 | | |
| | 9 | 2452 | -2.66 | | |

| Peak Power Spectral Density(dBm/100kHz) | |
|---|---|
| *IEEE 802.11b* | *IEEE 802.11g* |
|  |  |
| *2412 MHz* | *2412 MHz* |
|  |  |
| *2437 MHz* | *2437 MHz* |
|  |  |
| *2462 MHz* | *2462 MHz* |

| Peak Power Spectral Density | |
|---|---|
| IEEE 802.11 n HT20 | IEEE 802.11 n HT40 |
|  |  |
| 2412 MHz | 2422 MHz |
|  |  |
| 2437 MHz | 2437 MHz |
|  |  |
| 2462 MHz | 2452 MHz |

## 4.5 6dB Bandwidth Measurement

**TEST CONFIGURATION**




**TEST PROCEDURE**

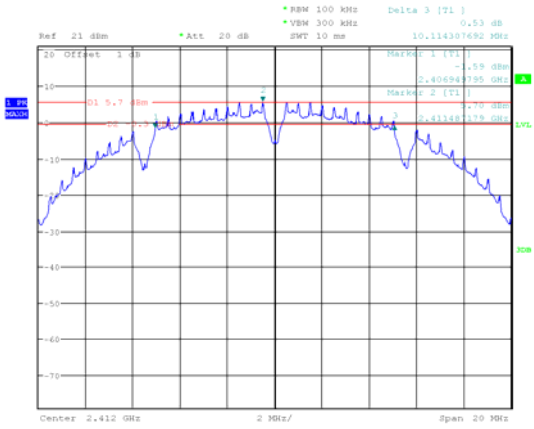
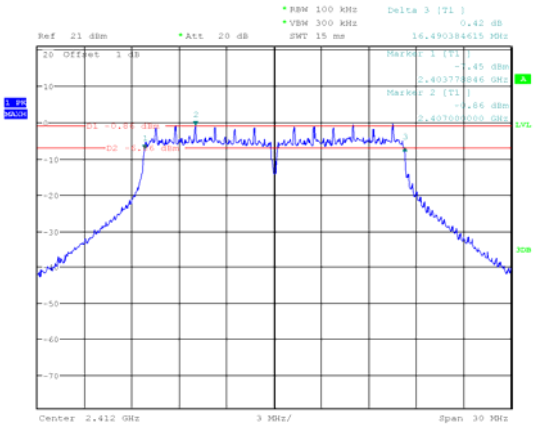
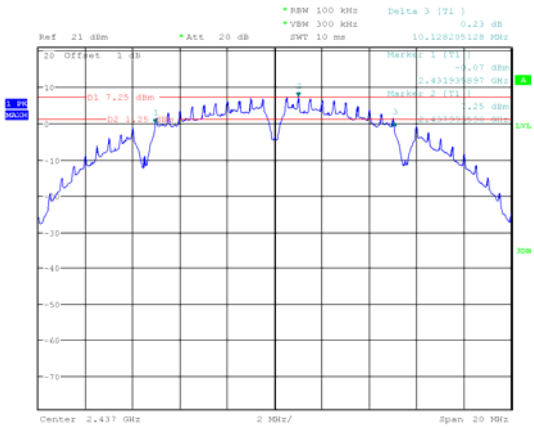
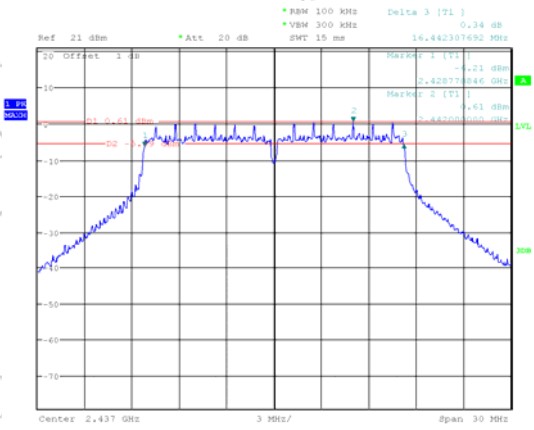
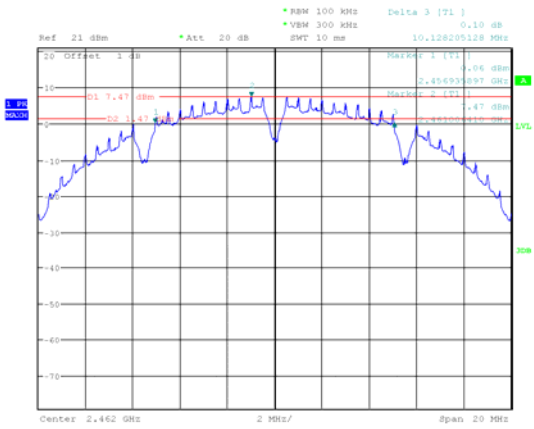
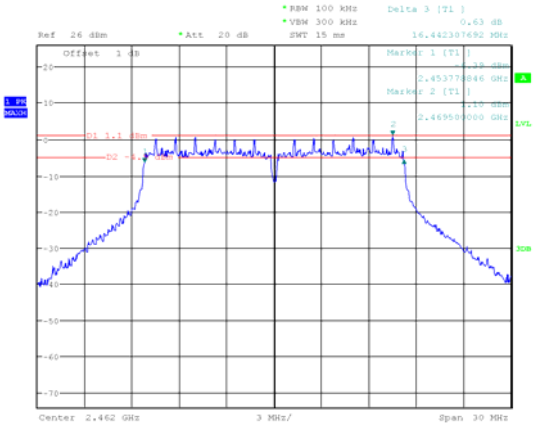
According to KDB558074 D01 DTS Meas Guidance v03r05:
DTS Bandwidth Option1:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

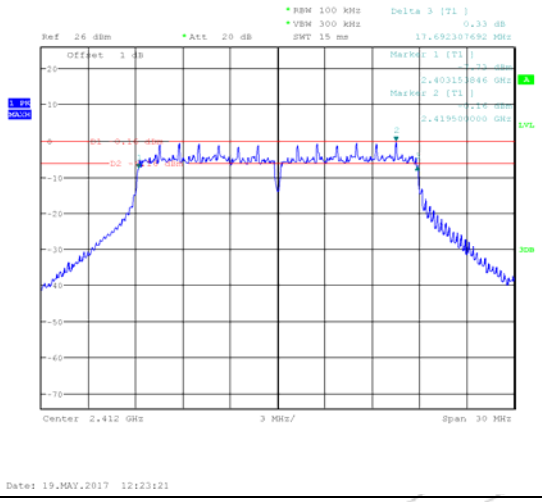
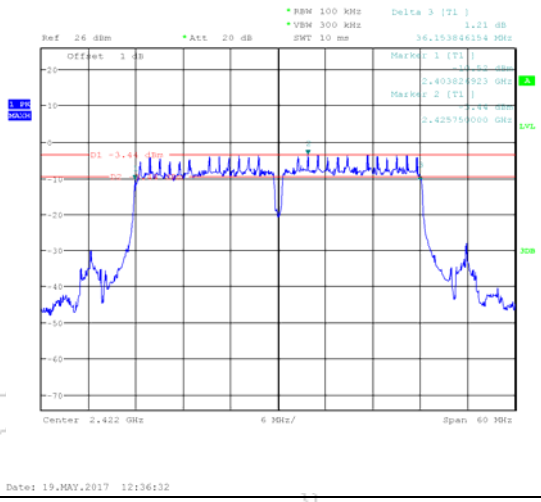
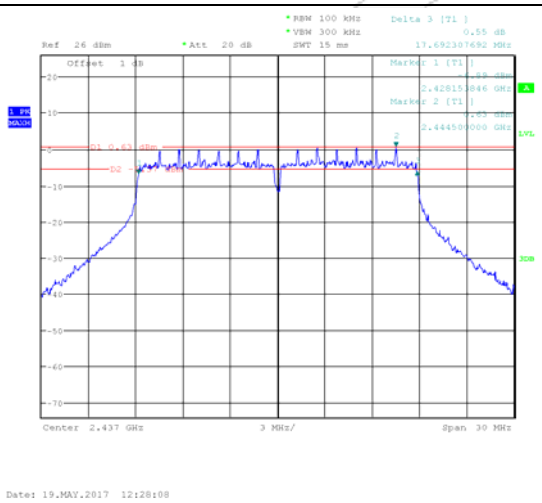
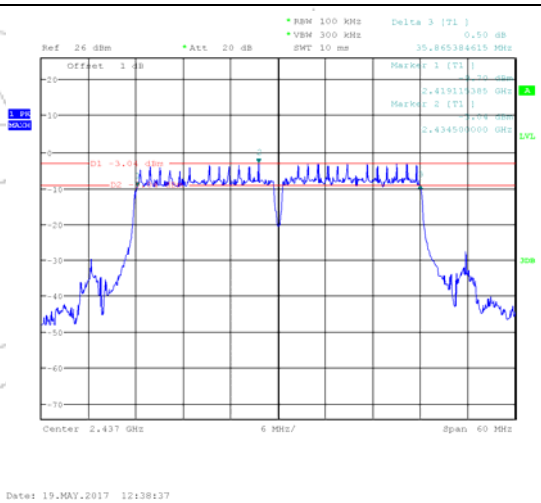
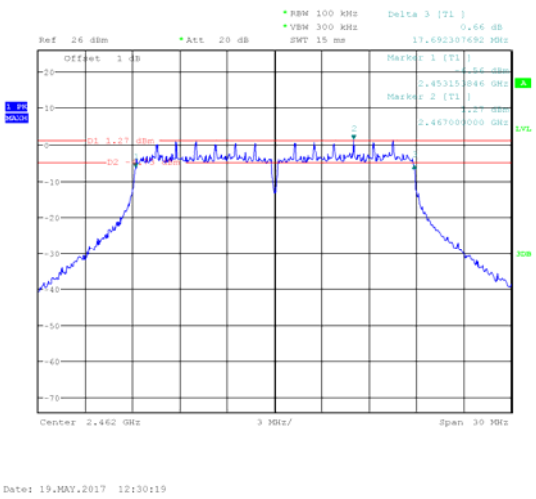
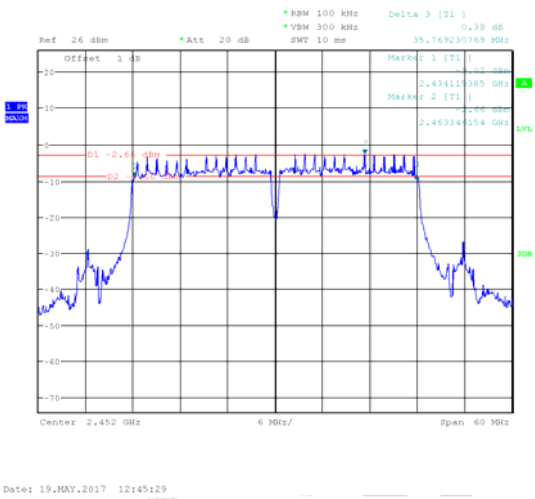
**LIMIT**

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

**TEST RESULTS**

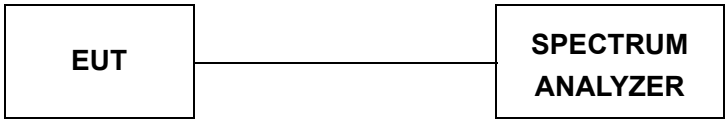
| Test Mode | Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Limits (MHz) | Result |
|---|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | 10.11 | ≥0.5 | Compliance |
| | 6 | 2437 | 10.13 | | |
| | 11 | 2462 | 10.13 | | |
| IEEE 802.11g | 1 | 2412 | 16.49 | ≥0.5 | Compliance |
| | 6 | 2437 | 16.44 | | |
| | 11 | 2462 | 16.44 | | |
| IEEE 802.11n HT20 | 1 | 2412 | 17.69 | ≥0.5 | Compliance |
| | 6 | 2437 | 17.69 | | |
| | 11 | 2462 | 17.69 | | |
| IEEE 802.11n HT40 | 3 | 2422 | 36.15 | ≥0.5 | Compliance |
| | 6 | 2437 | 35.87 | | |
| | 9 | 2452 | 35.77 | | |

| 6 dB Bandwidth | |
|---|---|
| *IEEE 802.11b* | *IEEE 802.11g* |
|  |  |
| *2412 MHz* | *2412 MHz* |
|  |  |
| *2437 MHz* | *2437 MHz* |
|  |  |
| *2462 MHz* | *2462 MHz* |

| ***6 dB Bandwidth*** | |
|---|---|
| *IEEE 802.11n HT20* | *IEEE 802.11n HT40* |
|  |  |
| *2412 MHz* | *2422 MHz* |
|  |  |
| *2437 MHz* | *2437 MHz* |
|  |  |
| *2462 MHz* | *2452 MHz* |

## 4.6 Band-edge Measurements for RF Conducted Emissions

**TEST CONFIGURATION**




**TEST PROCEDURE**

According to KDB558074 D01 DTS Meas Guidance v03r05:

1. Set RBW to 100kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100kHz bandwidth from band edge.

2.Decteor = Peak; Sweep time = auto couple; Trace mode = max hold;

3. Allow trace to fully stabilize, the measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

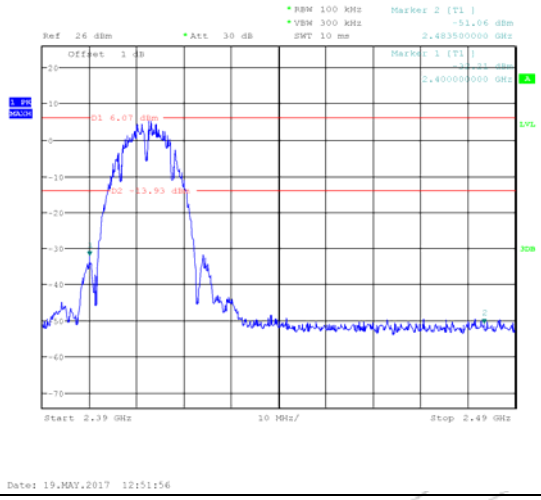
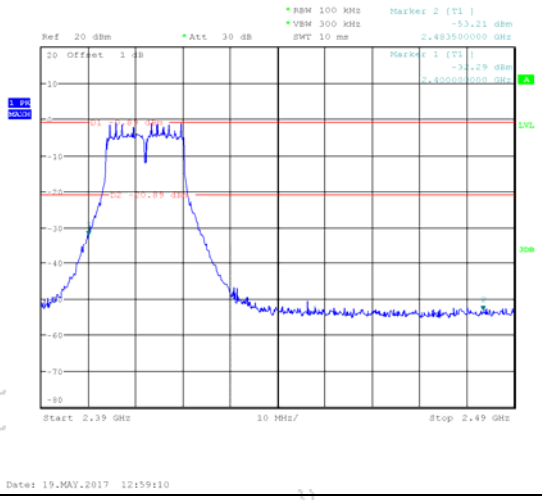
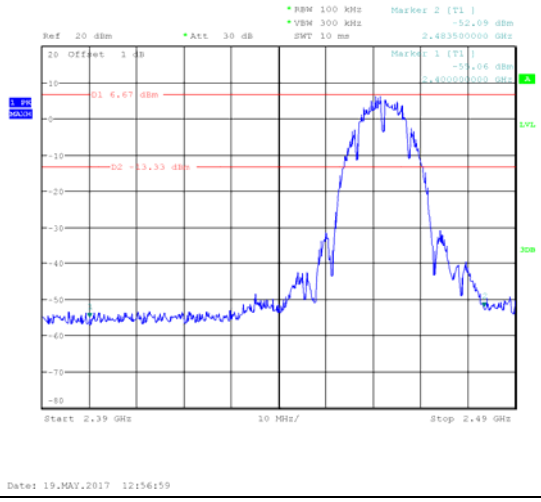
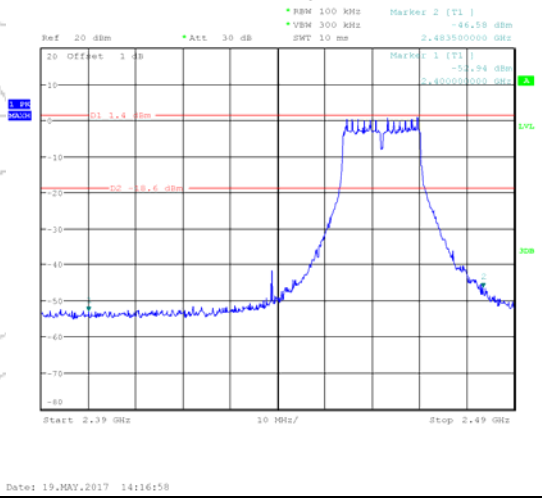
4. Repeat above procedures until all measured frequencies were complete.

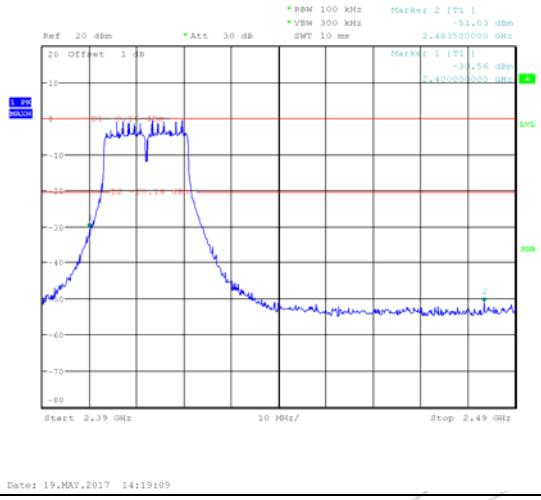
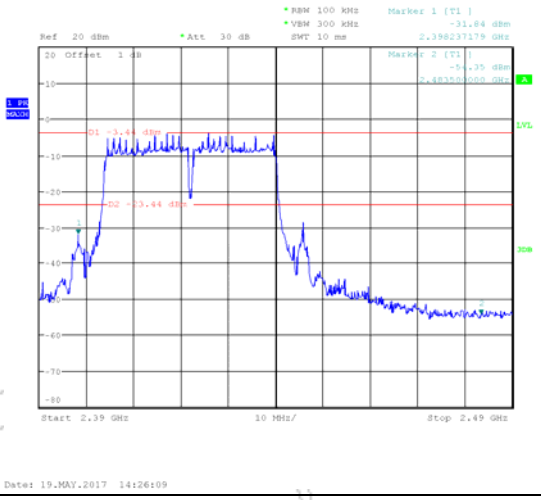
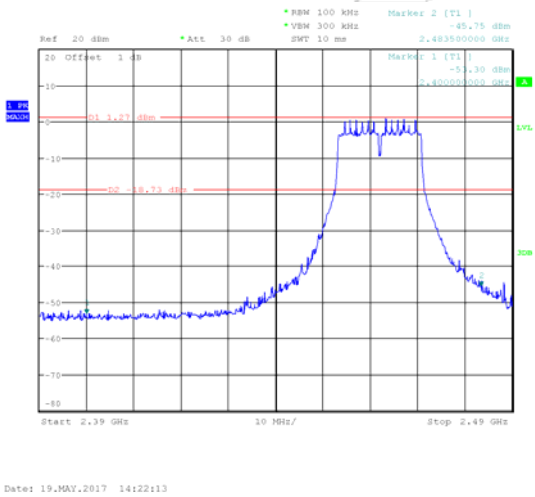
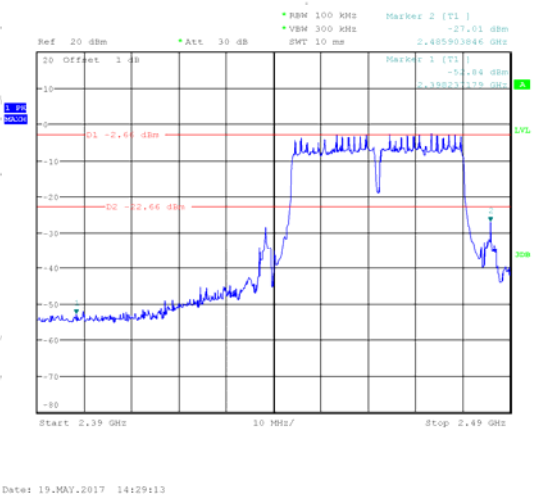
**LIMIT**

Below -20dB of the highest emission level in operating band.

**TEST RESULTS**

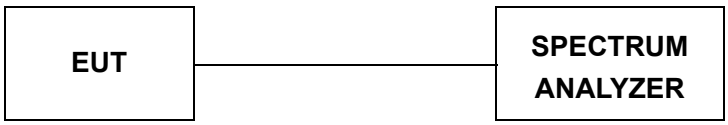
| Test Mode | Channel | Frequency (MHz) | Conducted Band-edge Emission (dBc) | Limits (dBc) | Result |
|---|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | <-20dBc | -20 | Compliance |
| | 11 | 2462 | <-20dBc | -20 | |
| IEEE 802.11g | 1 | 2412 | <-20dBc | -20 | Compliance |
| | 11 | 2462 | <-20dBc | -20 | |
| IEEE 802.11n HT20 | 1 | 2412 | <-20dBc | -20 | Compliance |
| | 11 | 2462 | <-20dBc | -20 | |
| IEEE 802.11n HT40 | 3 | 2422 | <-20dBc | -20 | Compliance |
| | 9 | 2452 | <-20dBc | -20 | |

| ***Band-edge Measurements for RF Conducted Emissions*** | |
|---|---|
| *IEEE 802.11b* | *IEEE 802.11g* |
|  |  |
| *2412 MHz* | *2412 MHz* |
|  |  |
| *2462 MHz* | *2462 MHz* |

| ***Band-edge Measurements for RF Conducted Emissions*** | |
|---|---|
| *IEEE 802.11n HT20* | *IEEE 802.11n HT40* |
|  |  |
| *2412 MHz* | *2422 MHz* |
|  |  |
| *2462 MHz* | *2452 MHz* |

## 4.7 Radiated Band Edge

**TEST CONFIGURATION**




**TEST PROCEDURE**

According to KDB558074 D01 DTS Meas Guidance v03r05:

Antenna-port conducted measurements: Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

2. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)

Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).

3. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).

4. Convert the resultant EIRP level to an equivalent electric field strength using the following relationship: $E = EIRP - 20\log D + 104.8$

Where:

E = electric field strength in dBμV/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

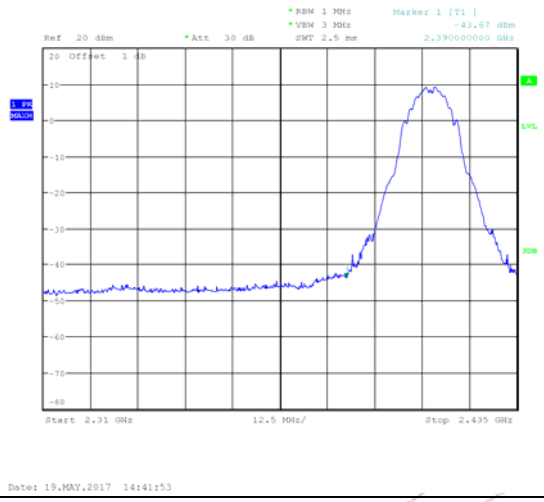
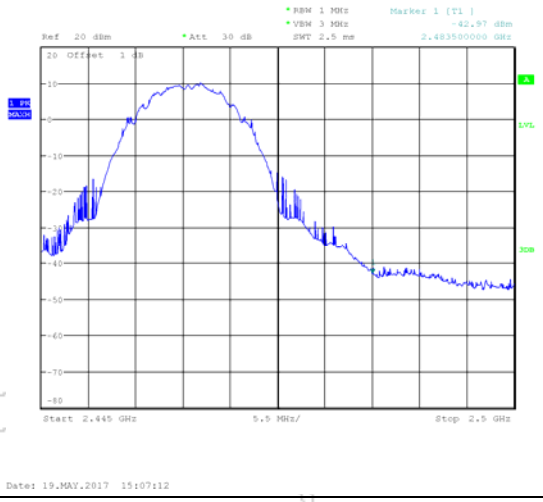
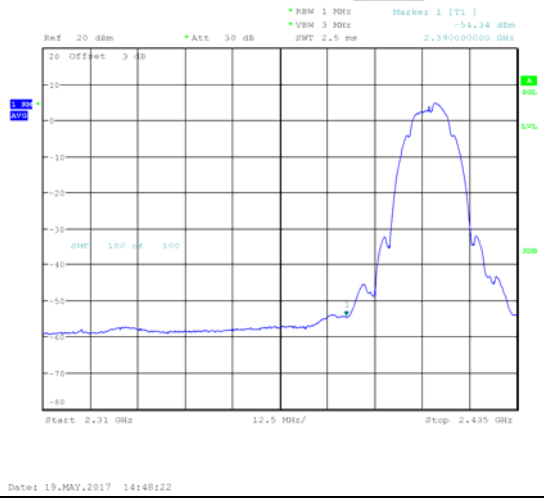
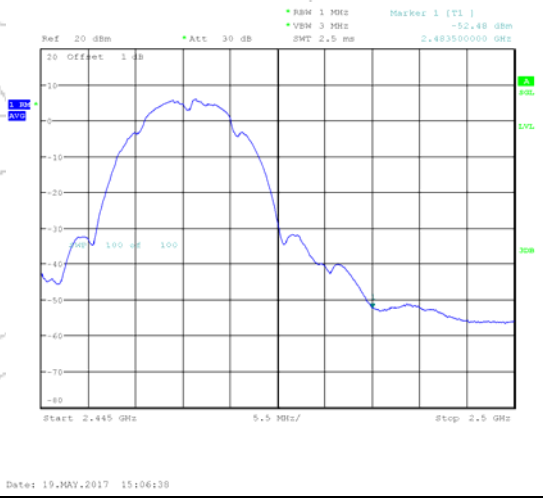
5. Compare the resultant electric field strength level to the applicable regulatory limit.

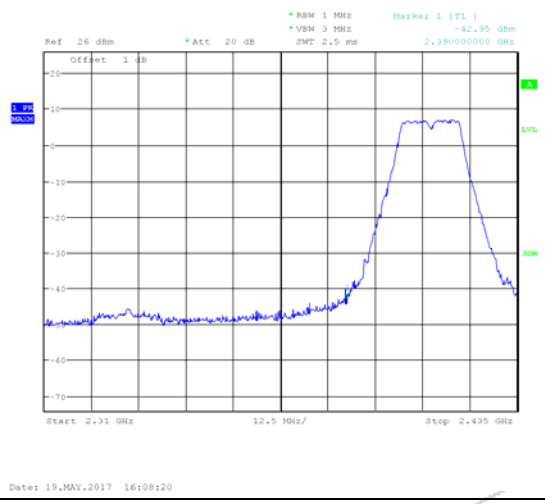
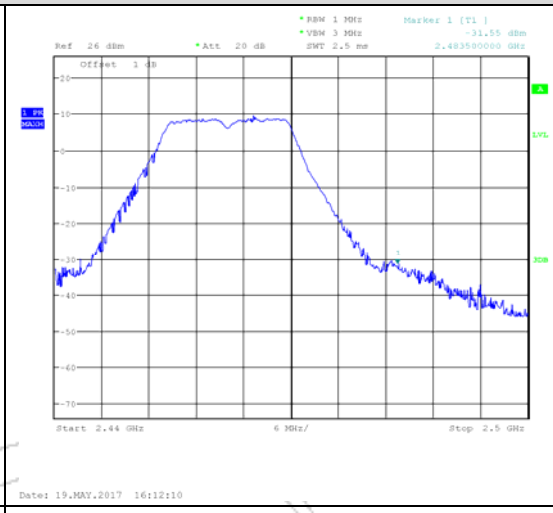
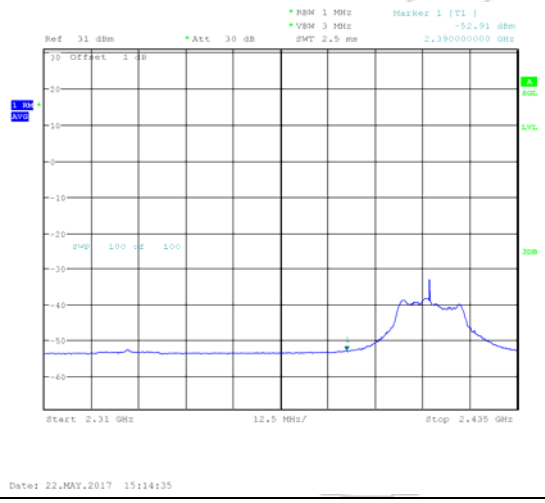
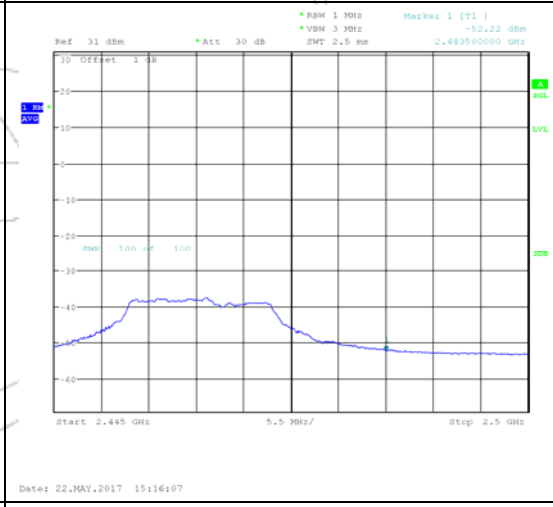
**LIMIT**

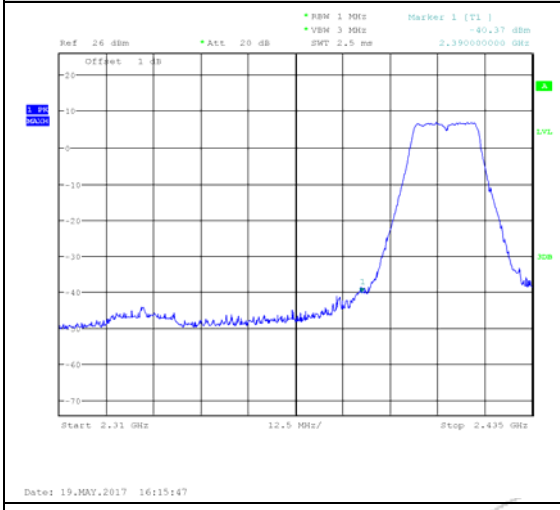
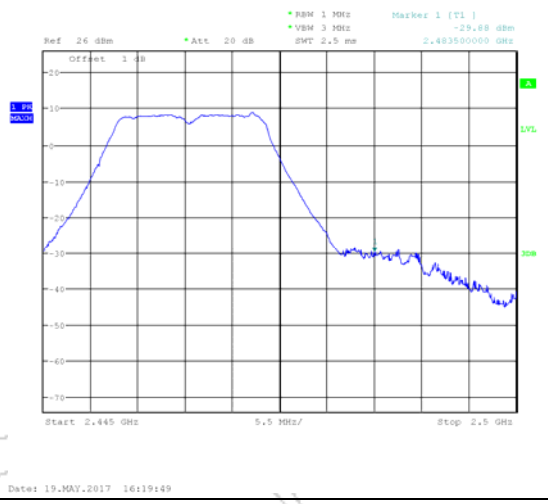
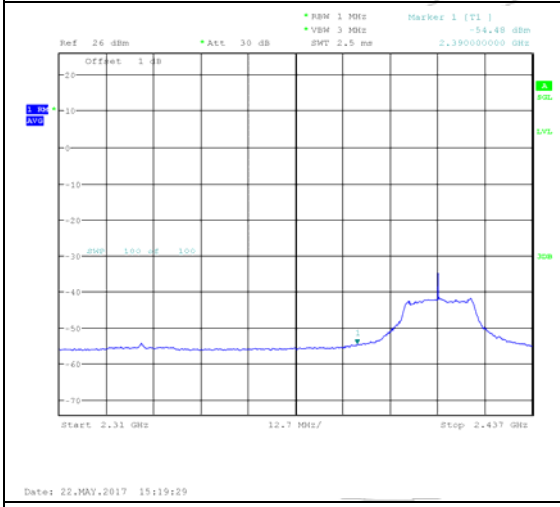
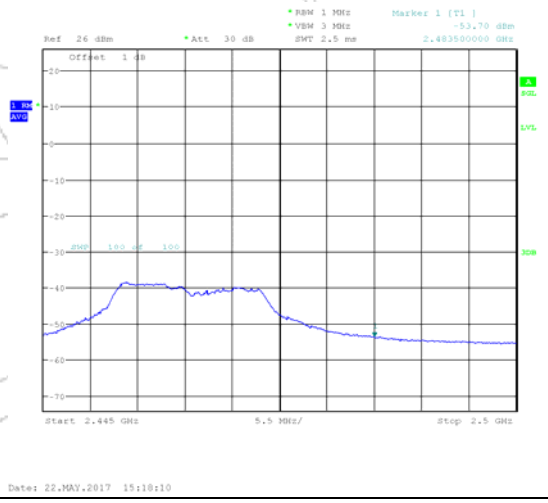
Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply With the radiated emission limits specified in § 15.209(a)

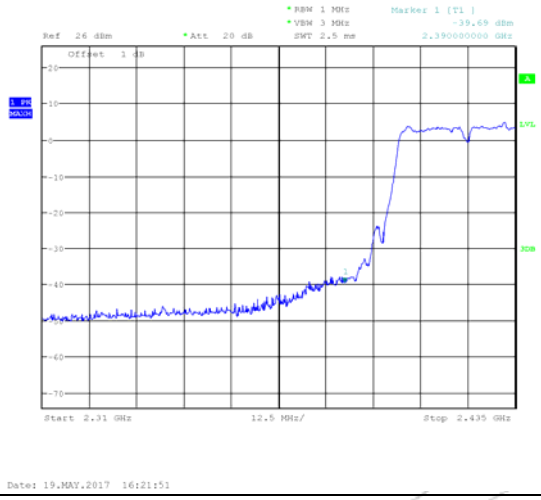
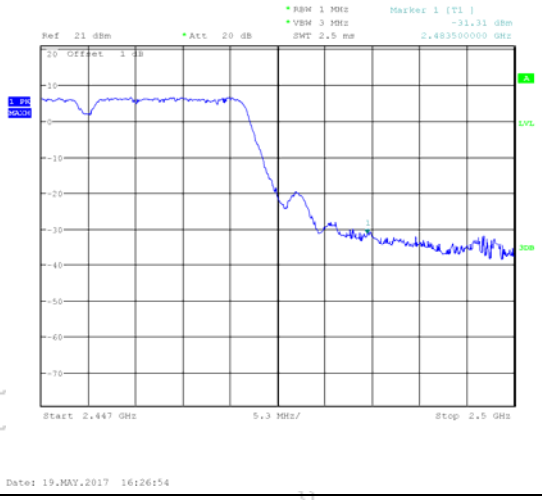
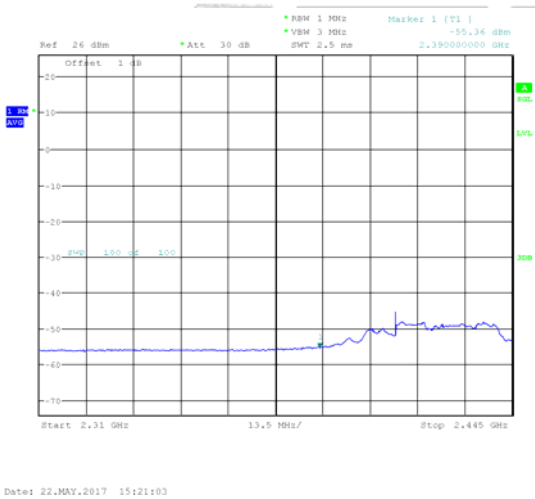
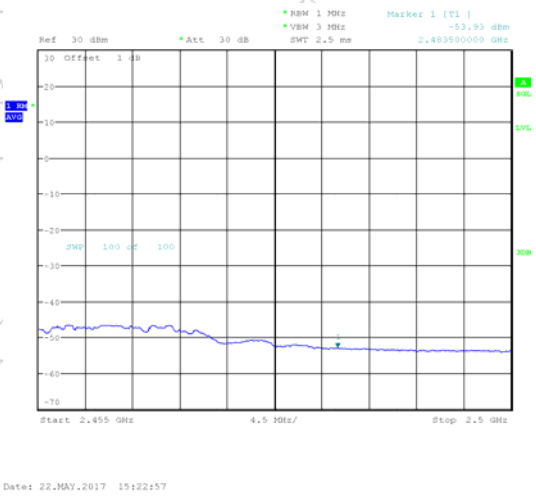
**TEST RESULTS**

| Channel | Frequency (MHz) | Conducted Power (dBm) | Antenna Gain (dBi) | Duty Cycle Factor (dB) | Covert Radiated E Level At 3m (dBuV/m) | Detector | Limit (dBuV/m) |
|---|---|---|---|---|---|---|---|
| Test Mode: IEEE 802.11b | | | | | | | |
| 1 | 2390.0 | -43.7 | 3.0 | 0.0 | 54.6 | Peak | 74.0 |
| 1 | 2390.0 | -54.3 | 3.0 | 0.0 | 44.0 | AV | 54.0 |
| 11 | 2483.5 | -43.0 | 3.0 | 0.0 | 55.3 | Peak | 74.0 |
| 11 | 2483.5 | -52.5 | 3.0 | 0.0 | 45.8 | AV | 54.0 |
| Result: Compliance | | | | | | | |
| Test Mode: IEEE 802.11g | | | | | | | |
| 1 | 2390.0 | -43.0 | 3.0 | 5.6 | 55.3 | Peak | 74.0 |
| 1 | 2390.0 | -52.9 | 3.0 | 5.6 | 51.0 | AV | 54.0 |
| 11 | 2483.5 | -31.6 | 3.0 | 5.5 | 66.7 | Peak | 74.0 |
| 11 | 2483.5 | -52.2 | 3.0 | 5.5 | 51.6 | AV | 54.0 |
| Result: Compliance | | | | | | | |
| Test Mode: IEEE 802.11n HT20 | | | | | | | |
| 1 | 2390.0 | -40.4 | 3.0 | 5.8 | 57.9 | Peak | 74.0 |
| 1 | 2390.0 | -54.5 | 3.0 | 5.8 | 49.6 | AV | 54.0 |
| 11 | 2483.5 | -29.9 | 3.0 | 5.8 | 68.4 | Peak | 74.0 |
| 11 | 2483.5 | -53.7 | 3.0 | 5.8 | 50.4 | AV | 54.0 |
| Result: Compliance | | | | | | | |
| Test Mode: IEEE 802.11n HT40 | | | | | | | |
| 3 | 2390.0 | -39.7 | 3.0 | 8.7 | 58.6 | Peak | 74.0 |
| 3 | 2390.0 | -55.4 | 3.0 | 8.7 | 51.6 | AV | 54.0 |
| 9 | 2483.5 | -31.3 | 3.0 | 9.0 | 67.0 | Peak | 74.0 |
| 9 | 2483.5 | -53.9 | 3.0 | 9.0 | 53.4 | AV | 54.0 |
| Result: Compliance | | | | | | | |

| ***Radiated Band-edge*** | |
|---|---|
| *IEEE 802.11b* | |
|  |  |
| *2412 MHz – Peak* | *2462 MHz – Peak* |
|  |  |
| *2412 MHz – Average* | *2462 MHz – Average* |

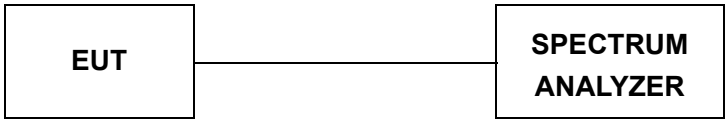
| ***Radiated Band-edge*** | |
|---|---|
| *IEEE 802.11g* | |
|  |  |
| *2412 MHz – Peak* | *2462 MHz – Peak* |
|  |  |
| *2412 MHz – Average* | *2462 MHz – Average* |

| ***Radiated Band-edge*** | |
|---|---|
| *IEEE 802.11n HT20* | |
|  |  |
| *2412 MHz – Peak* | *2462 MHz – Peak* |
|  |  |
| *2412 MHz – Average* | *2462 MHz – Average* |

| ***Radiated Band-edge*** | |
|---|---|
| *IEEE 802.11n HT40* | |
|  |  |
| *2422 MHz – Peak* | *2452 MHz – Peak* |
|  |  |
| *2422 MHz – Average* | *2452 MHz – Average* |

## 4.8 Spurious RF Conducted Emission

**TEST CONFIGURATION**




**TEST PROCEDURE**

According to KDB558074 D01 DTS Meas Guidance v03r05:

1. Set RBW to 100kHz and VBW of spectrum analyzer to 300 kHz with a measurement frequency range from30MHz to 25GHz.

2.Decteor = Peak; Sweep time = auto couple; Trace mode = max hold;

3. Allow trace to fully stabilize, the measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.

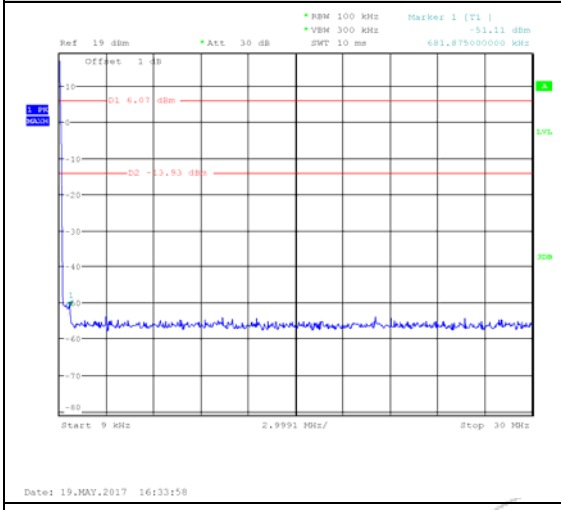
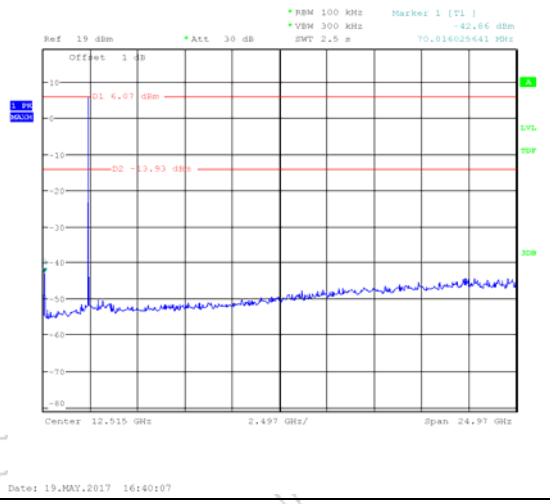
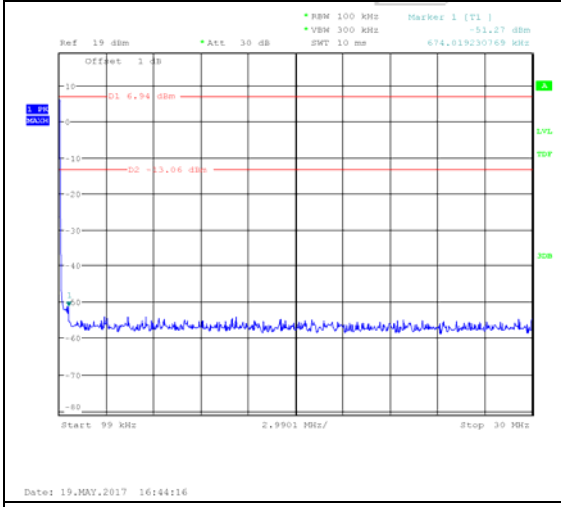
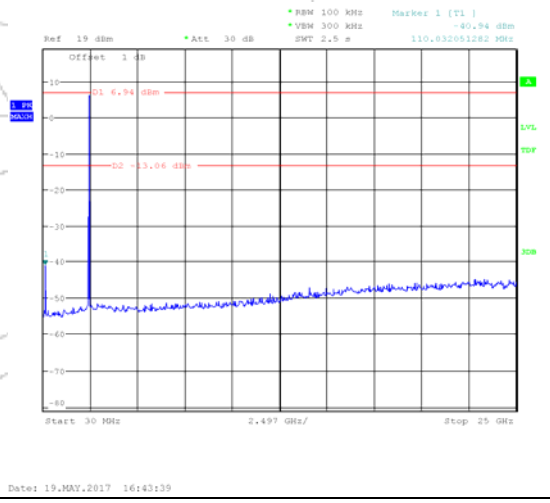
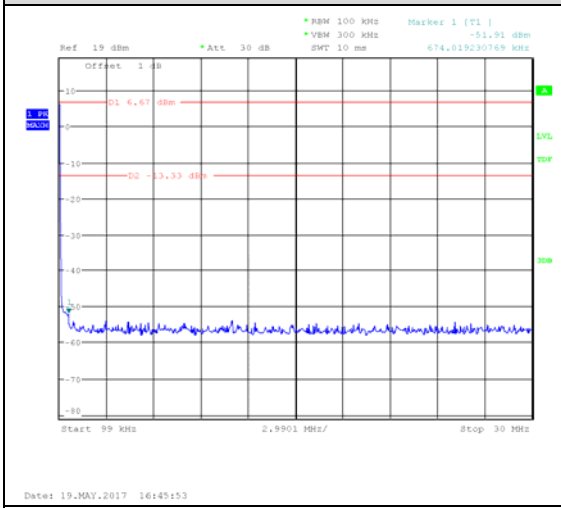
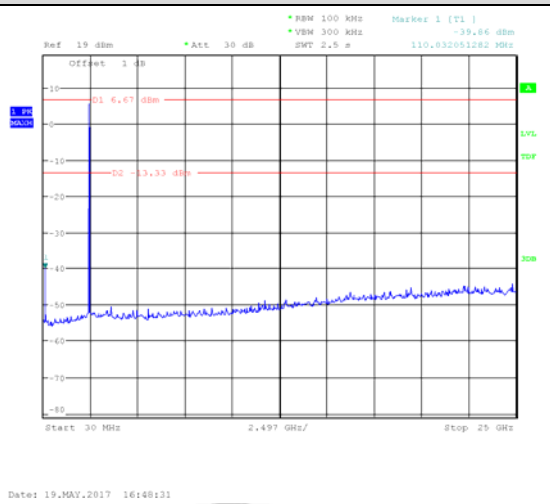
4. Repeat above procedures until all measured frequencies were complete.

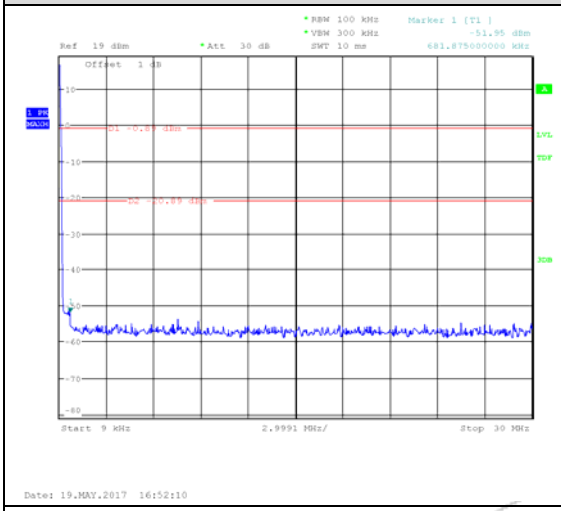
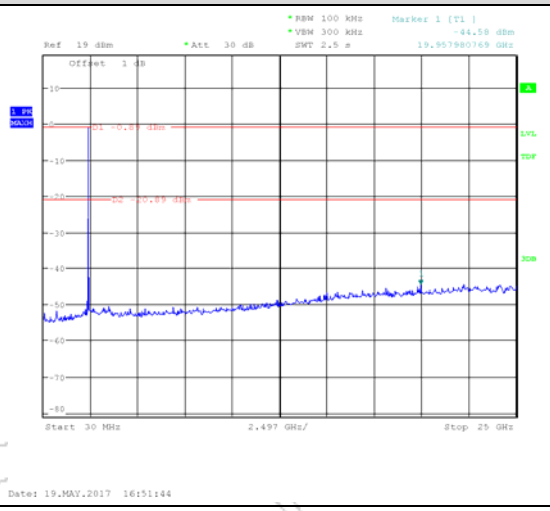
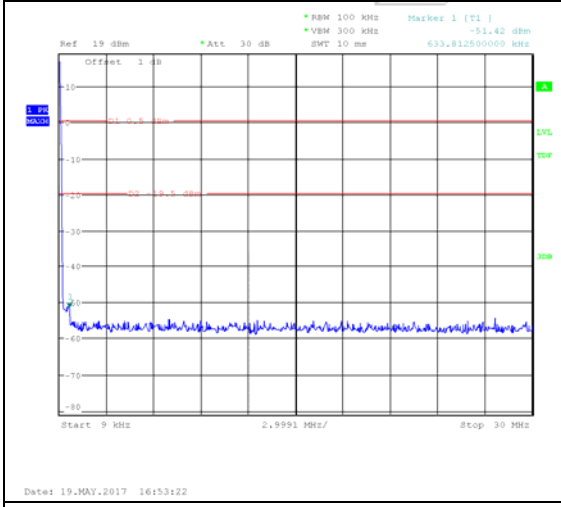
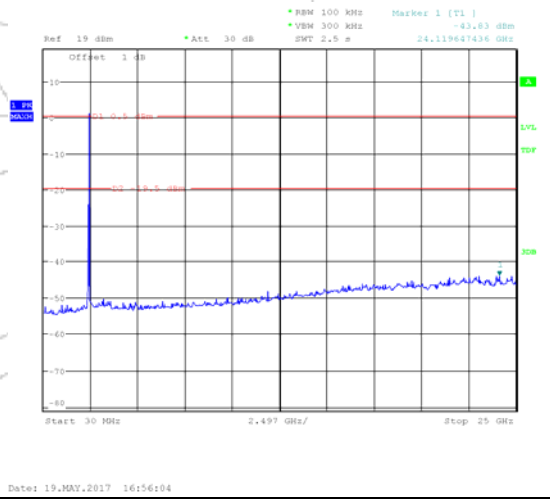
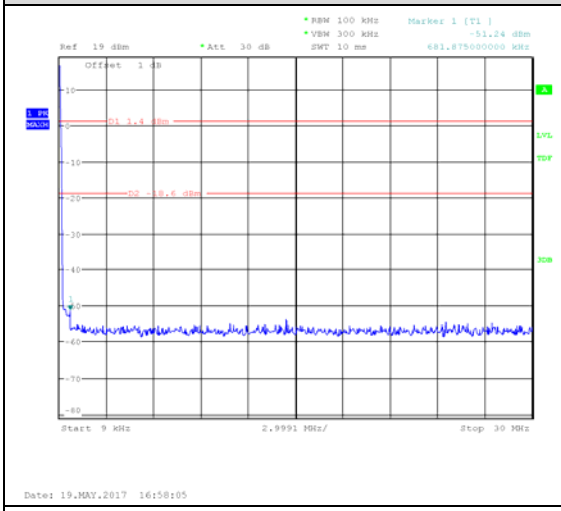
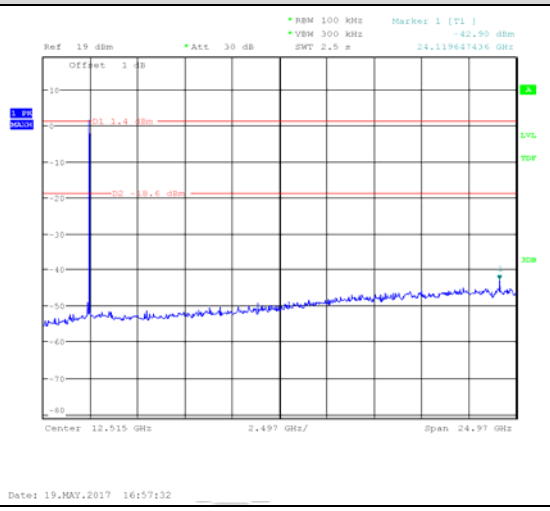
**LIMIT**

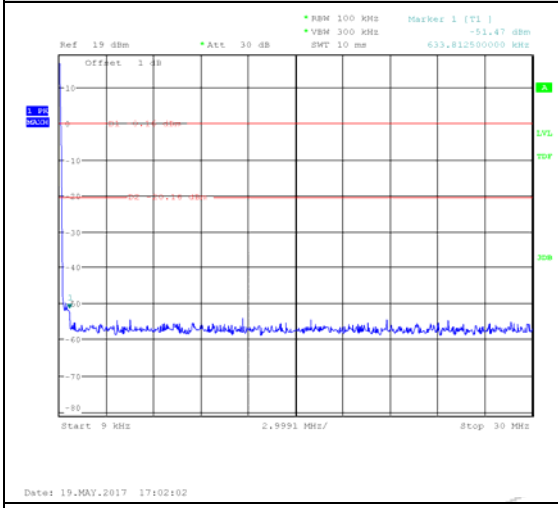
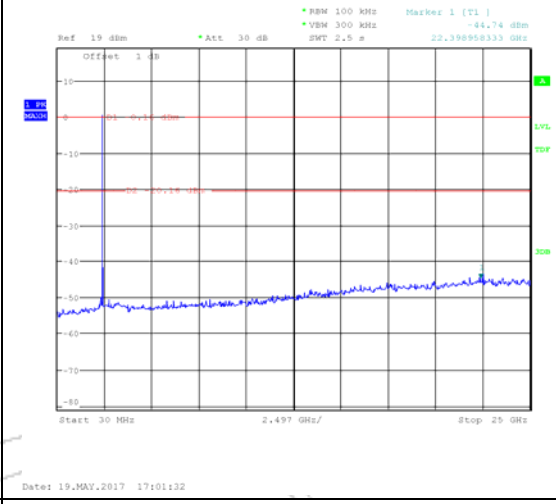
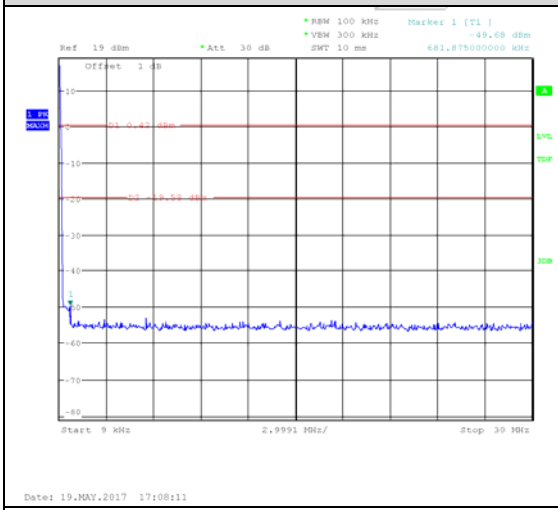
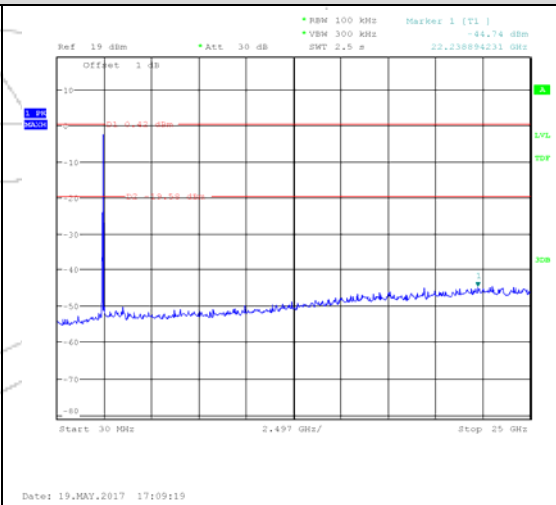
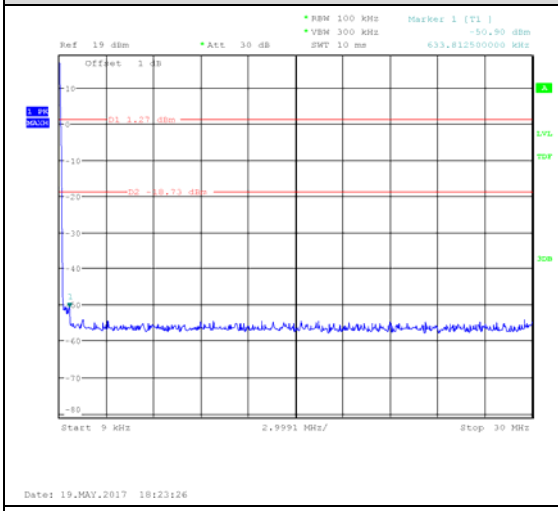
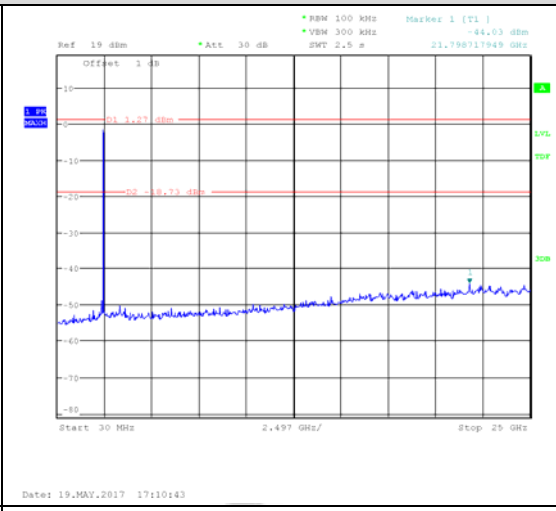
Below -20dB of the highest emission level in operating band.

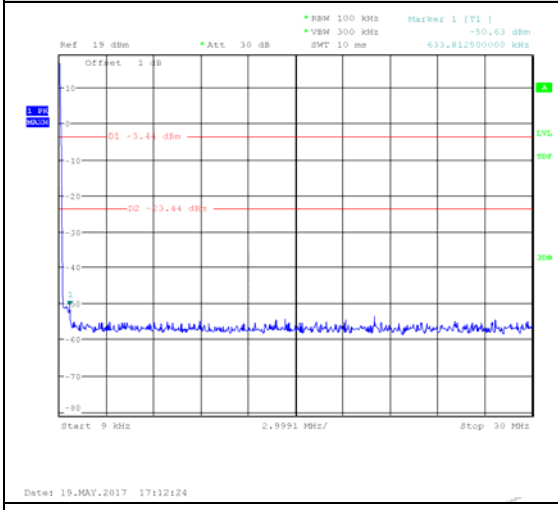
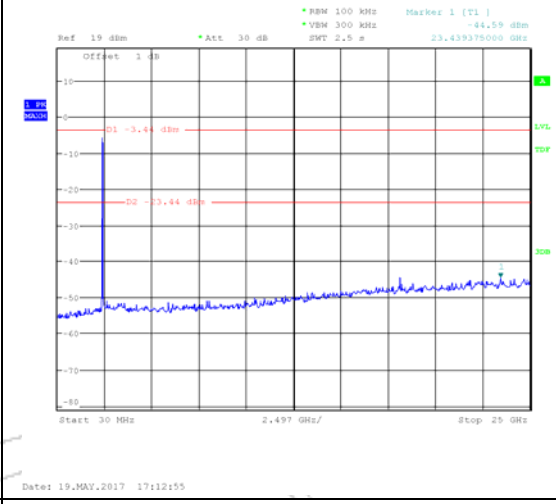
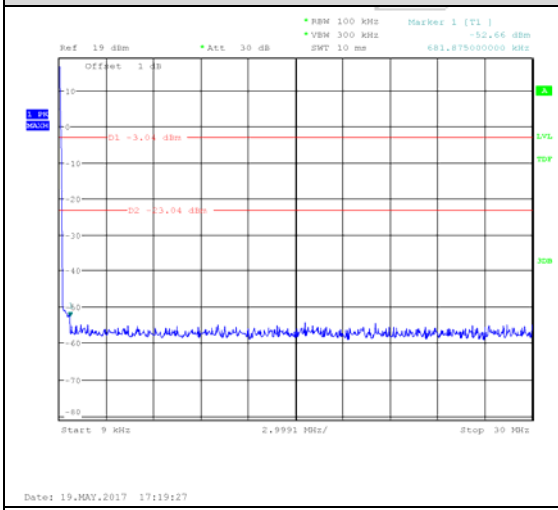
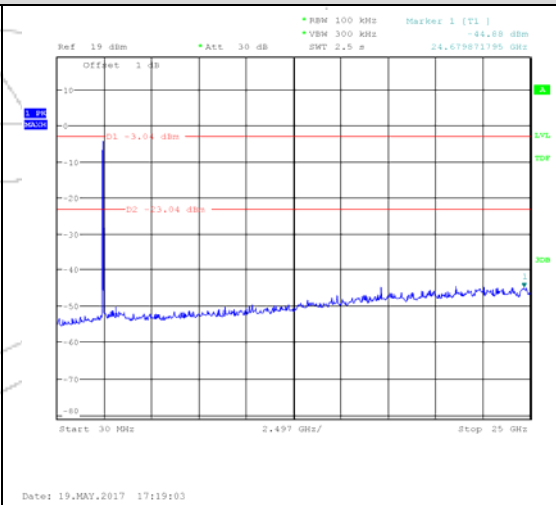
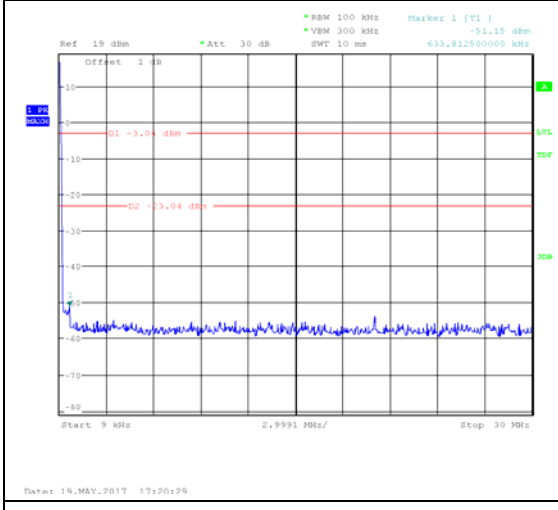
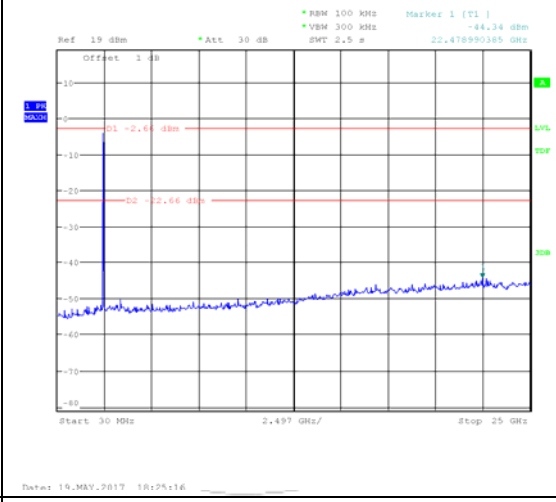
**TEST RESULTS**

| Test Mode | Channel | Frequency (MHz) | Spurious RF Conducted Emission (dBc) | Limits (dBc) | Result |
|---|---|---|---|---|---|
| IEEE 802.11b | 1 | 2412 | <-20dBc | -20 | Compliance |
| | 6 | 2437 | <-20dBc | -20 | |
| | 11 | 2462 | <-20dBc | -20 | |
| IEEE 802.11g | 1 | 2412 | <-20dBc | -20 | Compliance |
| | 6 | 2437 | <-20dBc | -20 | |
| | 11 | 2462 | <-20dBc | -20 | |
| IEEE 802.11n HT20 | 1 | 2412 | <-20dBc | -20 | Compliance |
| | 6 | 2437 | <-20dBc | -20 | |
| | 11 | 2462 | <-20dBc | -20 | |
| IEEE 802.11n HT40 | 3 | 2422 | <-20dBc | -20 | Compliance |
| | 6 | 2437 | <-20dBc | -20 | |
| | 9 | 2452 | <-20dBc | -20 | |

| ***Spurious RF Conducted Emission*** | |
|---|---|
| *IEEE 802.11b 2412MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |
| *IEEE 802.11b 2437 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |
| *IEEE 802.11b 2462 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |

| ***Spurious RF Conducted Emission*** | |
|---|---|
| *IEEE 802.11g 2412 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |
| *IEEE 802.11g 2437 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |
| *IEEE 802.11g 2462 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |

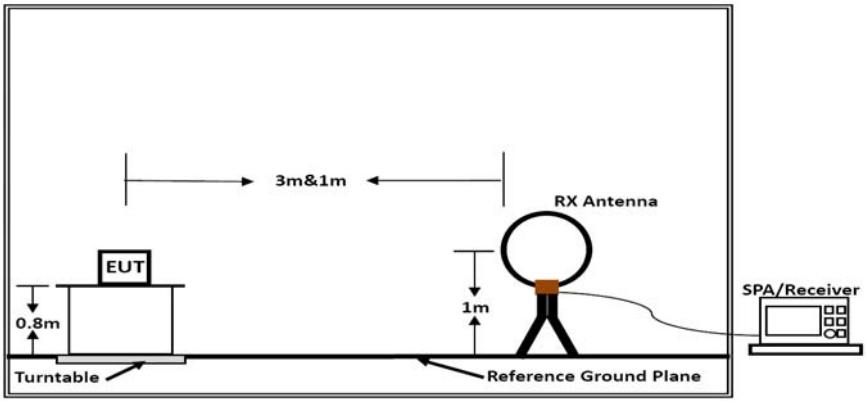
| ***Spurious RF Conducted Emissions*** | |
|---|---|
| *IEEE 802.11n HT20 2412 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |
| *IEEE 802.11n HT20 2437 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |
| *IEEE 802.11n HT20 2462 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |

| ***Spurious RF Conducted Emissions*** | |
|---|---|
| *IEEE 802.11n HT40 2422 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |
| *IEEE 802.11n HT40 2437 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |
| *IEEE 802.11n HT40 2462 MHz* | |
|  |  |
| *9kHz – 30MHz* | *30MHz – 25GHz* |

## 4.9 Radiated Spurious Emission

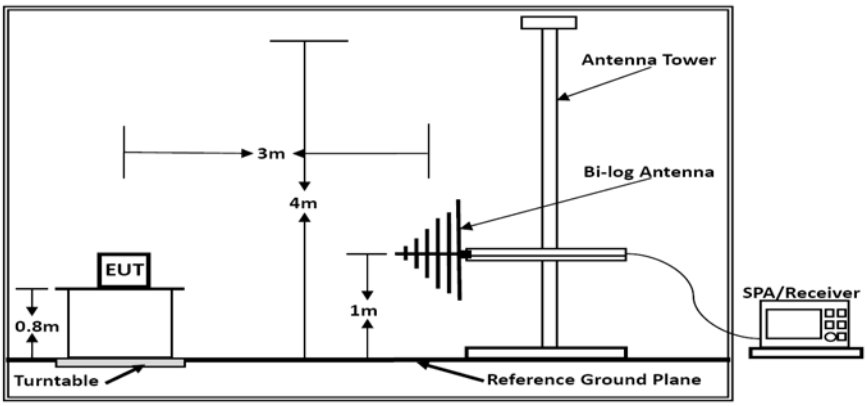
**TEST CONFIGURATION**

Frequency range: 9KHz – 30MHz



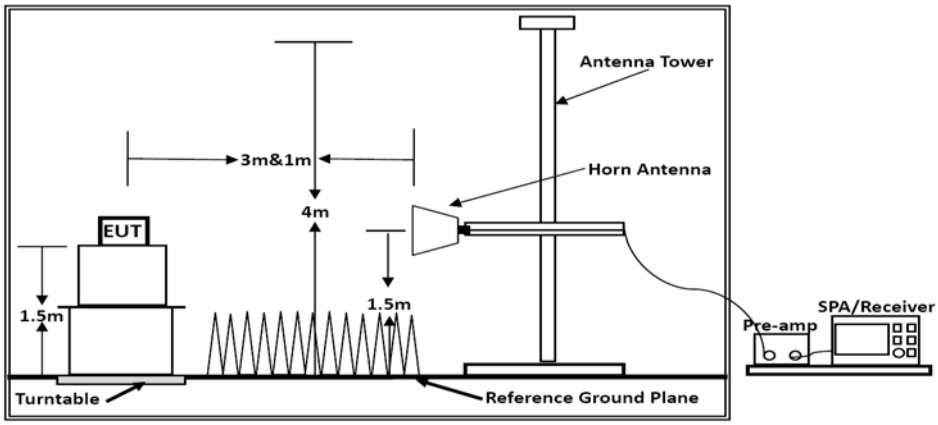

Below 30MHz

Frequency range: 30MHz – 1000MHz




Below 1GHz

Frequency range: 1GHz-25GHz




Above 1GHz

**TEST PROCEDURE**

According to the guidance in ANSI C63.10-2010:

To measure the maximum emission while the EUT is situated in three orthogonal planes (if appropriate), adjust the measurement antenna height and polarization etc. Measure frequency range from 9kHz to 25GHz.

1. The EUT was placed on a turn table which is 0.8m above ground plane for below 1GHz and 1.50m above ground plane for above 1GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT maximum operation frequency was 2462MHz.so radiated emission test frequency range from 9 KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

| Test Frequency range | Test Antenna Type | Test Distance |
|---|---|---|
| 9KHz-30MHz | Loop Antenna | 3 |
| 30MHz-1GHz | Broadband Antenna | 3 |
| 1GHz-18GHz | Horn Antenna | 3 |
| 18GHz-25GHz | Horn Antenna | 1 |

7. Setting test receiver/spectrum as following table states:

| Test Frequency range | Test Receiver/Spectrum Setting | Detector |
|---|---|---|
| 9KHz-150KHz | RBW=200Hz/VBW=3KHz,Sweep time=Auto | QP |
| 150KHz-30MHz | RBW=9KHz/VBW=100KHz,Sweep time=Auto | QP |
| 30MHz-1GHz | RBW=120KHz/VBW=1000KHz,Sweep time=Auto | QP |
| 1GHz-40GHz | Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto | Peak |
| | Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto | Peak |

More procure as follows:

**1) Sequence of testing 9 kHz to 30 MHz**

**Premeasurement:**

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions.

**Final measurement:**

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, turntable position, Ant position , margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

**2) Sequence of testing 30 MHz to 1 GHz**

**Premeasurement:**

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

**Final measurement:**

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, turntable position, Ant position , margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

**3) Sequence of testing 1 GHz to 18 GHz**

**Premeasurement:**

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

**Final measurement:**

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, turntable position, Ant position , margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

**4) Sequence of testing above 18 GHz**

**Premeasurement:**

--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

**Final measurement:**

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, turntable position, Ant position , margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

**LIMIT**

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

| Frequency (MHz) | Distance (Meters) | Radiated (dBμV/m) | Radiated (μV/m) |
|---|---|---|---|
| 0.009-0.49 | 300 | 20log(2400/F(KHz))+80 | 2400/F(KHz) |
| 0.49-1.705 | 30 | 20log(24000/F(KHz))+40 | 24000/F(KHz) |
| 1.705-30 | 30 | 20log(30)+40 | 30 |
| 30-88 | 3 | 40.0 | 100 |
| 88-216 | 3 | 43.5 | 150 |
| 216-960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

Note:

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

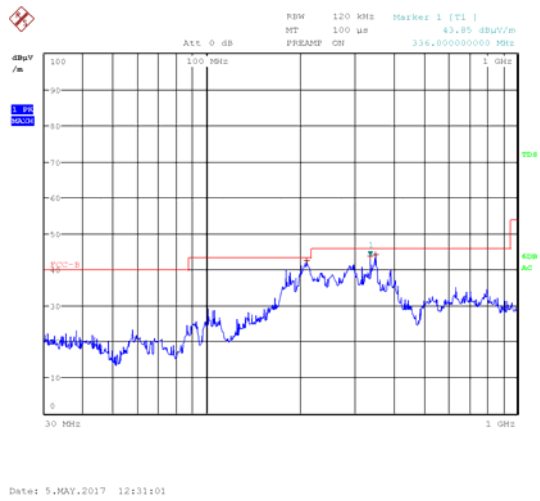
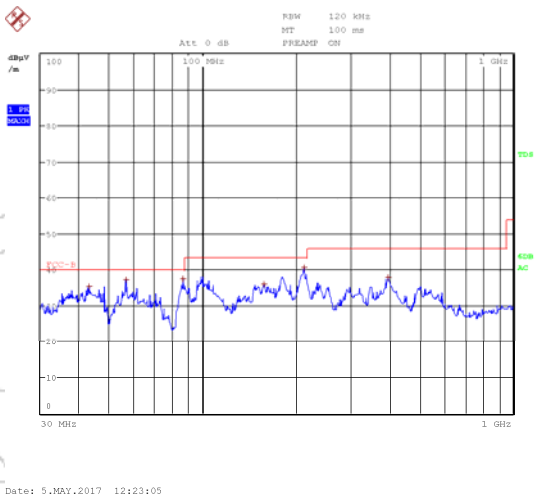
Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [9.5 dB].

**Test Result**

This DUT has two configurations for the MCU board. Preliminary tests were performed under different configurations. The worst test data are as follows:

**Below 1GHz**

| *Radiated Spurious Emission* | |
|---|---|
| *IEEE 802.11b 2412 MHz* | |
| *Horizontal* | *Vertical* |
|  |  |

| Frequency (MHz) | Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Ant pos (cm) | Table Pos (deg) | Antenna Polarity [H/V] | remark |
|---|---|---|---|---|---|---|---|
| 209.605 | 37.8 | 5.7 | 43.5 | 120.1 | 0.0 | H | QP |
| 348.94 | 39.5 | 6.5 | 46.0 | 100.2 | 60.4 | H | QP |
| 335.982 | 41.8 | 4.2 | 46.0 | 106.4 | 83.2 | H | QP |
| 56.520 | 31.1 | 8.9 | 40.0 | 100.0 | 92.3 | V | QP |
| 86.397 | 36.5 | 3.5 | 40.0 | 100.0 | 16.1 | V | QP |
| 211.184 | 38.2 | 5.3 | 43.5 | 100.0 | 183.1 | V | QP |
| Result: Compliance | | | | | | | |

Note:

1) Pre-scan all mode and recorded the worst case results in this report (IEEE 802.11b (2412MHz)).

2) The amplitude of spurious emissions between 9kHz~30MHz which are attenuated by more than 20 dB below the permissible value has no need to be reported.

**Above 1GHz**

| Frequency (MHz) | Read Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Ant pos (cm) | Table Pos (deg) | Antenna Polarity [H/V] | remark |
|---|---|---|---|---|---|---|---|
| *Test Mode: IEEE 802.11b* | | | | *Test Channel: 1(2412MHz)* | | | |
| 3102.0 | 44.6 | 29.4 | 74.0 | 128.3 | 264.8 | H | Peak |
| 3102.0 | 31.4 | 22.6 | 54.0 | 128.3 | 264.8 | H | Average |
| 3925.0 | 46.5 | 27.5 | 74.0 | 114.7 | 323.6 | V | Peak |
| 3925.0 | 34.7 | 19.3 | 54.0 | 114.7 | 323.6 | V | Average |
| 4825.0 | 49.7 | 24.3 | 74.0 | 125.7 | 327.6 | V | Peak |
| 4825.0 | 35.2 | 18.8 | 54.0 | 125.7 | 327.6 | H | Average |
| 4895.0 | 49.3 | 24.7 | 74.0 | 122.9 | 297.7 | V | Peak |
| 4895.0 | 32.2 | 21.8 | 54.0 | 122.9 | 297.7 | V | Average |
| 5673.2 | 48.8 | 25.2 | 74.0 | 126.4 | 215.9 | V | Peak |
| 5673.2 | 35.0 | 19.0 | 54.0 | 126.4 | 215.9 | V | Average |
| 5824.7 | 48.0 | 26.0 | 74.0 | 119.4 | 274.0 | H | Peak |
| 5824.7 | 34.7 | 19.3 | 54.0 | 119.4 | 274.0 | H | Average |
| Result: Compliance | | | | | | | |
| *Test Mode: IEEE 802.11b* | | | | *Test Channel: 6(2437MHz)* | | | |
| 3901.5 | 44.9 | 29.1 | 74.0 | 108.2 | 144.5 | H | Peak |
| 3901.5 | 31.7 | 22.3 | 54.0 | 108.2 | 144.5 | H | Average |
| 4003.2 | 44.3 | 29.7 | 74.0 | 136.4 | 315.9 | V | Peak |
| 4003.2 | 31.7 | 22.3 | 54.0 | 136.4 | 315.9 | V | Average |
| 4874.1 | 46.1 | 27.9 | 74.0 | 165.9 | 328.9 | V | Peak |
| 4874.1 | 40.1 | 13.9 | 54.0 | 165.9 | 328.9 | V | Average |
| 4905.5 | 39.4 | 34.6 | 74.0 | 180.9 | 324.2 | H | Peak |
| 4905.5 | 26.3 | 27.7 | 54.0 | 180.9 | 324.2 | H | Average |
| 6542.0 | 47.2 | 26.8 | 74.0 | 250.0 | 92.2 | V | Peak |
| 6542.0 | 31.2 | 22.8 | 54.0 | 250.0 | 92.2 | V | Average |
| 6631.2 | 47.0 | 27.0 | 74.0 | 150.0 | 12.2 | H | Peak |
| 6631.2 | 30.5 | 23.5 | 54.0 | 150.0 | 12.2 | H | Average |
| Result: Compliance | | | | | | | |

| Frequency (MHz) | Read Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Ant pos (cm) | Table Pos (deg) | Antenna Polarity [H/V] | remark |
|---|---|---|---|---|---|---|---|
| *Test Mode: IEEE 802.11b* | | | | *Test Channel: 11(2462MHz)* | | | |
| 2163.0 | 44.2 | 29.8 | 74.0 | 100.1 | 145.2 | V | Peak |
| 2163.0 | 30.7 | 23.3 | 54.0 | 100.1 | 145.2 | V | Average |
| 2205.0 | 42.2 | 31.8 | 74.0 | 124.2 | 247.8 | H | Peak |
| 2205.0 | 30.6 | 23.4 | 54.0 | 124.2 | 247.8 | H | Average |
| 4922.7 | 50.0 | 24.0 | 74.0 | 106.3 | 145.2 | V | Peak |
| 4922.7 | 35.2 | 18.8 | 54.0 | 106.3 | 145.2 | H | Average |
| 4923.6 | 49.6 | 24.4 | 74.0 | 122.9 | 297.7 | V | Peak |
| 4923.6 | 32.1 | 21.9 | 54.0 | 122.9 | 297.7 | V | Average |
| 5012.2 | 48.8 | 25.2 | 74.0 | 123.2 | 209.7 | H | Peak |
| 5012.2 | 35.2 | 18.8 | 54.0 | 123.2 | 209.7 | H | Average |
| 5013.0 | 51.2 | 22.8 | 74.0 | 126.4 | 340.5 | V | Peak |
| 5013.0 | 36.8 | 37.2 | 54.0 | 126.4 | 340.5 | V | Average |
| Result: Compliance | | | | | | | |
| *Test Mode: IEEE 802.11g* | | | | *Test Channel: 1(2412MHz)* | | | |
| 3902.5 | 47.9 | 26.1 | 74.0 | 109.7 | 236.4 | H | Peak |
| 3902.5 | 33.8 | 20.2 | 54.0 | 109.7 | 236.4 | H | Average |
| 4542.8 | 46.5 | 27.5 | 74.0 | 119.6 | 349.8 | V | Peak |
| 4542.8 | 32.4 | 21.6 | 54.0 | 119.6 | 349.8 | V | Average |
| 4824.0 | 49.8 | 24.2 | 74.0 | 192.4 | 316.1 | H | Peak |
| 4824.0 | 38.0 | 18.8 | 54.0 | 192.4 | 316.1 | H | Average |
| 4825.3 | 48.7 | 25.3 | 74.0 | 168.3 | 309.4 | V | Peak |
| 4825.3 | 36.4 | 17.6 | 54.0 | 168.3 | 309.4 | V | Average |
| 6518.2 | 47.3 | 26.7 | 74.0 | 270.1 | 13.7 | V | Peak |
| 6518.2 | 33.1 | 20.9 | 54.0 | 270.1 | 13.7 | V | Average |
| 6555.6 | 47.2 | 26.8 | 74.0 | 250.0 | 164.1 | H | Peak |
| 6555.6 | 33.3 | 20.7 | 54.0 | 250.0 | 164.1 | H | Average |
| Result: Compliance | | | | | | | |

| Frequency (MHz) | Read Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Ant pos (cm) | Table Pos (deg) | Antenna Polarity [H/V] | remark |
|---|---|---|---|---|---|---|---|
| *Test Mode: IEEE 802.11g* | | | | *Test Channel: 6(2437MHz)* | | | |
| 3989.8 | 45.9 | 28.1 | 74.0 | 120.4 | 353.9 | V | Peak |
| 3989.8 | 32.9 | 21.1 | 54.0 | 120.4 | 353.9 | V | Average |
| 3998.8 | 48.3 | 25.7 | 74.0 | 119.3 | 341.7 | H | Peak |
| 3998.8 | 28.3 | 25.7 | 54.0 | 119.3 | 341.7 | H | Average |
| 4874.0 | 45.3 | 28.7 | 74.0 | 270.6 | 345.8 | V | Peak |
| 4874.0 | 37.9 | 16.1 | 54.0 | 270.6 | 345.8 | V | Average |
| 4874.0 | 42.9 | 31.1 | 74.0 | 189.6 | 327.2 | H | Peak |
| 4874.0 | 36.5 | 17.5 | 54.0 | 189.6 | 327.2 | H | Average |
| 6460.4 | 46.7 | 27.3 | 74.0 | 270.0 | 176.1 | V | Peak |
| 6460.4 | 32.8 | 21.2 | 54.0 | 270.0 | 176.1 | V | Average |
| 6491.0 | 46.7 | 27.3 | 74.0 | 270.0 | 224.0 | H | Peak |
| 6491.0 | 33.2 | 20.8 | 54.0 | 270.0 | 224.0 | H | Average |
| Result: Compliance | | | | | | | |
| *Test Mode: IEEE 802.11g* | | | | *Test Channel: 11(2462MHz)* | | | |
| 4020.7 | 52.8 | 21.2 | 74.0 | 118.0 | 356.4 | H | Peak |
| 4020.7 | 30.2 | 23.8 | 54.0 | 118.0 | 356.4 | H | Average |
| 4036.7 | 55.0 | 19.0 | 74.0 | 116.8 | 354.0 | V | Peak |
| 4036.7 | 29.0 | 25.0 | 54.0 | 116.8 | 354.0 | V | Average |
| 4924.0 | 41.9 | 32.1 | 74.0 | 242.6 | 344.6 | V | Peak |
| 4924.0 | 33.7 | 20.3 | 54.0 | 242.6 | 344.6 | V | Average |
| 4924.1 | 45.8 | 28.2 | 74.0 | 214.9 | 330.6 | H | Peak |
| 4924.1 | 35.2 | 18.8 | 54.0 | 214.9 | 330.6 | H | Average |
| 6470.6 | 47.0 | 27.0 | 74.0 | 150.0 | 350.3 | V | Peak |
| 6470.6 | 34.9 | 19.1 | 54.0 | 150.0 | 350.3 | V | Average |
| 6484.2 | 46.9 | 27.1 | 74.0 | 270.0 | 257.0 | H | Peak |
| 6484.2 | 33.4 | 20.6 | 54.0 | 270.0 | 257.0 | H | Average |
| Result: Compliance | | | | | | | |

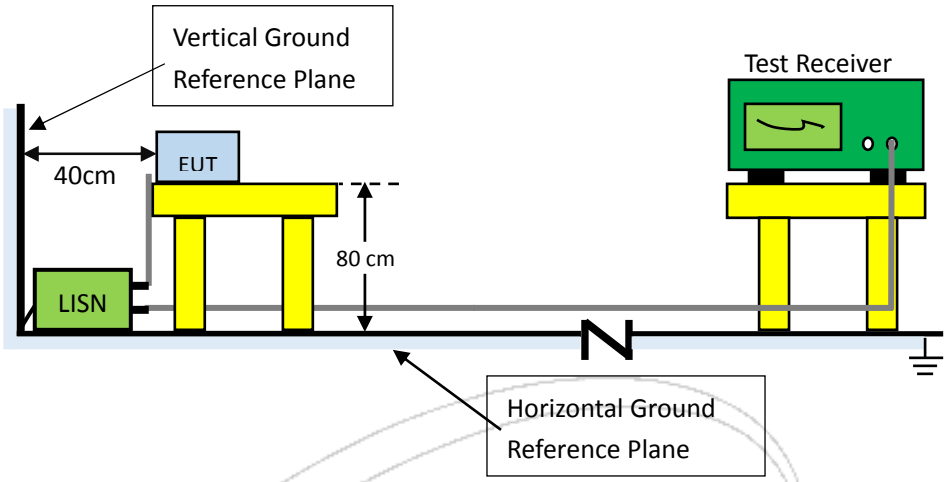
| Frequency (MHz) | Read Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Ant pos (cm) | Table Pos (deg) | Antenna Polarity [H/V] | remark |
|---|---|---|---|---|---|---|---|
| *Test Mode: IEEE 802.11n HT20* | | | | *Test Channel: 1(2412MHz)* | | | |
| 4022.6 | 54.9 | 19.1 | 74.0 | 106.4 | 358.1 | V | Peak |
| 4022.6 | 32.4 | 21.6 | 54.0 | 106.4 | 358.1 | V | Average |
| 4036.2 | 51.2 | 22.8 | 74.0 | 106.1 | 338.4 | H | Peak |
| 4036.2 | 30.3 | 23.7 | 54.0 | 106.1 | 338.4 | H | Average |
| 4824.0 | 43.4 | 30.6 | 74.0 | 217.6 | 312.4 | H | Peak |
| 4824.0 | 33.5 | 20.5 | 54.0 | 217.6 | 312.4 | H | Average |
| 4824.0 | 42.0 | 32.0 | 74.0 | 268.7 | 340.6 | V | Peak |
| 4824.0 | 36.0 | 18.0 | 54.0 | 268.7 | 340.6 | V | Average |
| 6501.2 | 46.6 | 27.4 | 74.0 | 200.0 | 186.5 | V | Peak |
| 6501.2 | 32.6 | 21.4 | 54.0 | 200.0 | 186.5 | V | Average |
| 6518.2 | 48.9 | 25.1 | 74.0 | 250.0 | 152.3 | H | Peak |
| 6518.2 | 31.8 | 22.2 | 54.0 | 250.0 | 152.3 | H | Average |
| Result: Compliance | | | | | | | |
| *Test Mode: IEEE 802.11n HT20* | | | | *Test Channel: 6(2437MHz)* | | | |
| 3990.2 | 55.8 | 18.2 | 74.0 | 120.4 | 358.4 | V | Peak |
| 3990.2 | 31.8 | 22.2 | 54.0 | 120.4 | 358.4 | V | Average |
| 4038.4 | 51.2 | 22.8 | 74.0 | 103.2 | 359.8 | H | Peak |
| 4038.4 | 28.0 | 26.0 | 54.0 | 103.2 | 359.8 | H | Average |
| 4874.0 | 49.1 | 24.9 | 74.0 | 262.1 | 332.0 | V | Peak |
| 4874.0 | 37.9 | 16.1 | 54.0 | 262.1 | 332.0 | V | Average |
| 4958.1 | 43.6 | 30.4 | 74.0 | 191.1 | 310.3 | H | Peak |
| 4958.1 | 33.4 | 20.6 | 54.0 | 191.1 | 310.3 | H | Average |
| 6429.8 | 47.1 | 26.9 | 74.0 | 200.0 | 190.3 | V | Peak |
| 6429.8 | 31.6 | 22.4 | 54.0 | 200.0 | 190.3 | V | Average |
| 6450.2 | 47.0 | 27.0 | 74.0 | 169.4 | 6.3 | H | Peak |
| 6450.2 | 32.7 | 21.3 | 54.0 | 169.4 | 6.3 | H | Average |
| Result: Compliance | | | | | | | |

| Frequency (MHz) | Read Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Ant pos (cm) | Table Pos (deg) | Antenna Polarity [H/V] | remark |
|---|---|---|---|---|---|---|---|
| *Test Mode: IEEE 802.11n HT20* | | | | *Test Channel: 11(2462MHz)* | | | |
| 3976.1 | 55.3 | 18.7 | 74.0 | 122.2 | 355.2 | V | Peak |
| 3976.1 | 31.4 | 22.6 | 54.0 | 122.2 | 355.2 | V | Average |
| 3995.2 | 52.1 | 21.9 | 74.0 | 100.1 | 359.3 | H | Peak |
| 3995.2 | 30.4 | 23.6 | 54.0 | 100.1 | 359.3 | H | Average |
| 4909.8 | 40.2 | 33.8 | 74.0 | 176.3 | 343.1 | V | Peak |
| 4909.8 | 30.6 | 23.4 | 54.0 | 176.3 | 343.1 | V | Average |
| 4933.2 | 39.6 | 34.4 | 74.0 | 199.9 | 342.9 | H | Peak |
| 4933.2 | 34.5 | 19.5 | 54.0 | 199.9 | 342.9 | H | Average |
| 6542.0 | 48.5 | 25.5 | 74.0 | 150.6 | 289.3 | H | Peak |
| 6542.0 | 33.6 | 20.4 | 54.0 | 150.6 | 289.3 | H | Average |
| 6555.6 | 48.2 | 25.8 | 74.0 | 159.3 | 179.9 | V | Peak |
| 6555.6 | 32.2 | 21.8 | 54.0 | 159.3 | 179.9 | V | Average |
| Result: Compliance | | | | | | | |
| *Test Mode: IEEE 802.11n HT40* | | | | *Test Channel: 3(2422MHz)* | | | |
| 3991.8 | 55.0 | 19.0 | 74.0 | 113.1 | 356.8 | V | Peak |
| 3991.8 | 33.2 | 20.8 | 54.0 | 113.1 | 356.8 | V | Average |
| 4015.8 | 50.4 | 23.6 | 74.0 | 109.2 | 338.2 | H | Peak |
| 4015.8 | 30.7 | 23.3 | 54.0 | 109.2 | 338.2 | H | Average |
| 4843.2 | 49.7 | 24.3 | 74.0 | 207.2 | 347.3 | H | Peak |
| 4843.2 | 33.9 | 20.1 | 54.0 | 207.2 | 347.3 | H | Average |
| 4850.8 | 48.6 | 25.4 | 74.0 | 161.3 | 74.5 | V | Peak |
| 4850.8 | 32.6 | 21.4 | 54.0 | 161.3 | 74.5 | V | Average |
| 6416.2 | 47.5 | 26.5 | 74.0 | 200.0 | 157.8 | H | Peak |
| 6416.2 | 32.9 | 21.1 | 54.0 | 200.0 | 157.8 | H | Average |
| 6542.0 | 47.8 | 26.2 | 74.0 | 200.0 | 283.4 | V | Peak |
| 6542.0 | 31.6 | 22.4 | 54.0 | 200.0 | 283.4 | V | Average |
| Result: Compliance | | | | | | | |

| Frequency (MHz) | Read Level (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Ant pos (cm) | Table Pos (deg) | Antenna Polarity [H/V] | remark |
|---|---|---|---|---|---|---|---|
| *Test Mode: IEEE 802.11n HT40* | | | | *Test Channel: 6(2437MHz)* | | | |
| 3985.2 | 49.7 | 24.3 | 74.0 | 120.4 | 358.4 | V | Peak |
| 3985.2 | 30.9 | 23.1 | 54.0 | 120.4 | 358.4 | V | Average |
| 4039.6 | 55.4 | 18.6 | 74.0 | 112.3 | 356.1 | H | Peak |
| 4039.6 | 35.2 | 18.8 | 54.0 | 112.3 | 356.1 | H | Average |
| 4872.8 | 39.9 | 34.1 | 74.0 | 112.5 | 98.0 | V | Peak |
| 4872.8 | 32.4 | 21.6 | 54.0 | 112.5 | 98.0 | V | Average |
| 4874.9 | 43.2 | 30.8 | 74.0 | 200.3 | 334.2 | H | Peak |
| 4874.9 | 32.5 | 21.5 | 54.0 | 200.3 | 334.2 | H | Average |
| 6514.8 | 47.7 | 26.3 | 74.0 | 150.3 | 226.4 | V | Peak |
| 6514.8 | 33.6 | 20.4 | 54.0 | 150.3 | 226.4 | V | Average |
| 6528.4 | 48.1 | 25.9 | 74.0 | 165.1 | 288.8 | H | Peak |
| 6528.4 | 31.6 | 22.4 | 54.0 | 165.1 | 288.8 | H | Average |
| Result: Compliance | | | | | | | |
| *Test Mode: IEEE 802.11n HT40* | | | | *Test Channel: 9(2452MHz)* | | | |
| 3988.6 | 51.3 | 22.7 | 74.0 | 110.3 | 337.8 | H | Peak |
| 3988.6 | 29.2 | 24.8 | 54.0 | 110.3 | 337.8 | H | Average |
| 4012.4 | 54.8 | 19.2 | 74.0 | 106.2 | 356.5 | V | Peak |
| 4012.4 | 34.1 | 19.9 | 54.0 | 106.2 | 356.5 | V | Average |
| 4927.2 | 48.6 | 25.4 | 74.0 | 184.0 | 341.2 | H | Peak |
| 4927.2 | 32.6 | 21.4 | 54.0 | 184.0 | 341.2 | H | Average |
| 4931.4 | 46.8 | 27.2 | 74.0 | 198.8 | 271.5 | V | Peak |
| 4931.4 | 31.9 | 22.1 | 54.0 | 198.8 | 271.5 | V | Average |
| 6491.0 | 47.9 | 26.1 | 74.0 | 250.0 | 61.0 | V | Peak |
| 6491.0 | 32.6 | 21.4 | 54.0 | 250.0 | 61.0 | V | Average |
| 6504.6 | 47.5 | 26.5 | 74.0 | 155.3 | 280.6 | H | Peak |
| 6504.6 | 31.9 | 22.1 | 54.0 | 155.3 | 280.6 | H | Average |
| Result: Compliance | | | | | | | |

## 4.10 AC Conducted Emission Measurement

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.Emission levels under (Limit – 20dB)was not recorded.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

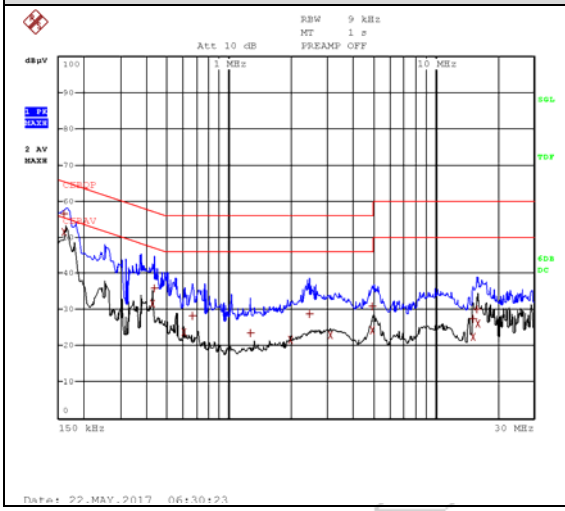
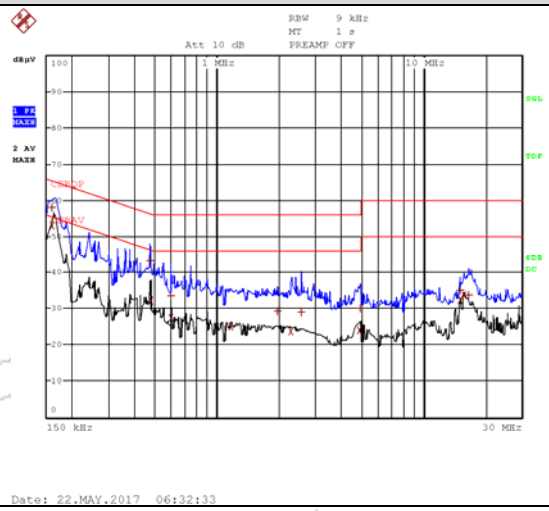
**Limit**

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following:

| Frequency (MHz) | Maximum RF Line Voltage (dBμV) | | | |
|---|---|---|---|---|
| | CLASS A | | CLASS B | |
| | Q.P. | Ave. | Q.P. | Ave. |
| 0.15 - 0.50 | 79 | 66 | 66-56* | 56-46* |
| 0.50 - 5.00 | 73 | 60 | 56 | 46 |
| 5.00 - 30.0 | 73 | 60 | 60 | 50 |

Note:* means decreasing linearly with the logarithm of the frequency

**TEST RESULT**

| *AC Conducted Emission Measurement* | |
|---|---|
| *AC 120V/60Hz* | |
| *Line* | *Neutral* |
|  |  |

| Phase | Quasi-Peak | | | Average | | |
|---|---|---|---|---|---|---|
| | Frequency (MHz) | Limits (dBμV) | Result (dBμV) | Frequency (MHz) | Limits (dBμV) | Result (dBμV) |
| Line | 0.162 | 65.4 | 56.6 | 0.162 | 55.4 | 51.6 |
| | 0.434 | 57.2 | 35.7 | 0.426 | 57.3 | 31.6 |
| | 4.994 | 56.0 | 30.8 | 4.986 | 46.0 | 24.2 |
| | Result: Compliance | | | | | |
| Neutral | 0.162 | 65.4 | 58.2 | 0.162 | 55.4 | 53.2 |
| | 0.474 | 56.4 | 43.1 | 0.478 | 46.4 | 32.1 |
| | 0.598 | 56.0 | 33.5 | 15.644 | 50.0 | 33.7 |
| | Result: Compliance | | | | | |

Note: The adapter was connected to both AC 120V/60Hz and AC 240V/60Hz power source and the worst case result (AC 120V/60Hz) was recorded in this report.

## 4.11 Maximum Permissible Exposure(MPE)

**LIMIT**

According to subpart 15.247(i)and subpart§1.1310,system operating under the provisions if this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for Maximum Permissible Exposure(MPE)( §1.1310, §2.1093)

| (B)Limits for General Population/uncontrolled Exposure | | | | |
|---|---|---|---|---|
| Frequency Range(MHz) | Electric Field Strength(V/m) | Magnetic Field Strength(A/m) | Power Density($mW/cm^2$) | Averaging Time(minutes) |
| 0.3-1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34-30 | 824/f | 2.19/f | *($180/f^2$) | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | | | f/1500 | 30 |
| 1500-100,000 | | | 1.0 | 30 |

F=frequency in MHz;*=Plane-wave equivalent power density

According to §1.1310, §2.1093 RF exposure is calculated.

Calculated Formulary:

Predication of MPE limit at a given distance

$S=PG/4\pi R^2$=power density（in appropriate units，e.g. $mW/cm^2$）;

P=power input to the antenna(in appropriate units，e.g., mW);

G=power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain;

R = distance to the center of radiation of the antenna(appropriate units, e.g., cm)

**TEST RESULT**

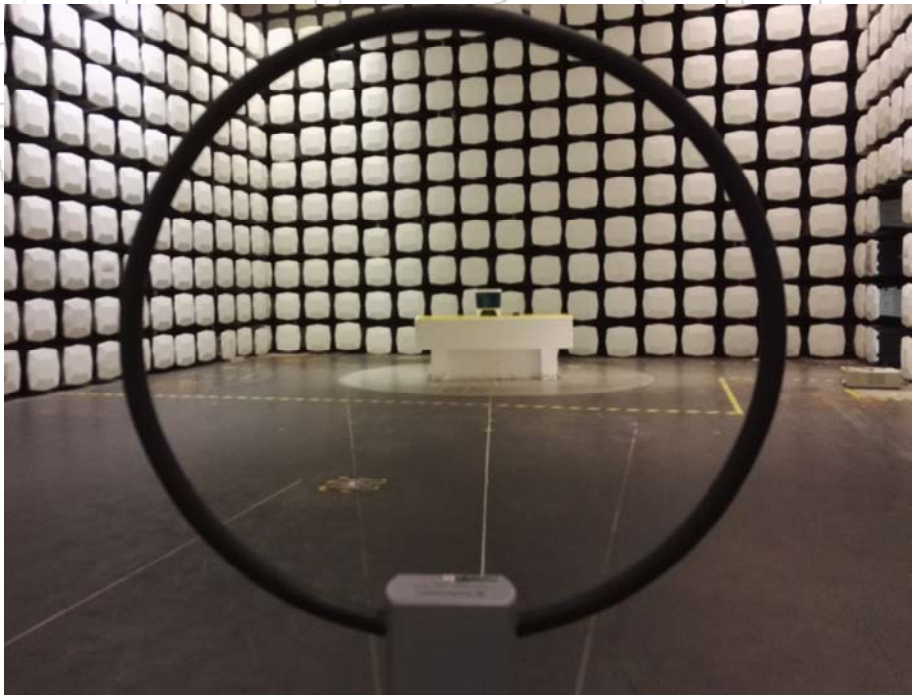
| Mode | Frequency band (MHz) | Antenna Gain | | Target Power | | Evaluation Distance（cm） | Power Density（$mW/cm^2$） | MPE Limit（$mW/cm^2$） |
|---|---|---|---|---|---|---|---|---|
| | | dBi | numeric | dBm | mW | | | |
| 802.11 b | 2412-2462 | 3.0 | 2.0 | 17.0 | 50.12 | 20 | 0.0199 | 1 |
| 802.11 g | 2412-2462 | 3.0 | 2.0 | 15.0 | 31.62 | 20 | 0.0189 | 1 |
| 802.11n HT20 | 2412-2462 | 3.0 | 2.0 | 14.0 | 25.12 | 20 | 0.0150 | 1 |
| 802.11n HT40 | 2422-2452 | 3.0 | 2.0 | 14.0 | 25.12 | 20 | 0.0150 | 1 |
| Result: Compliance | | | | | | | | |

Note：

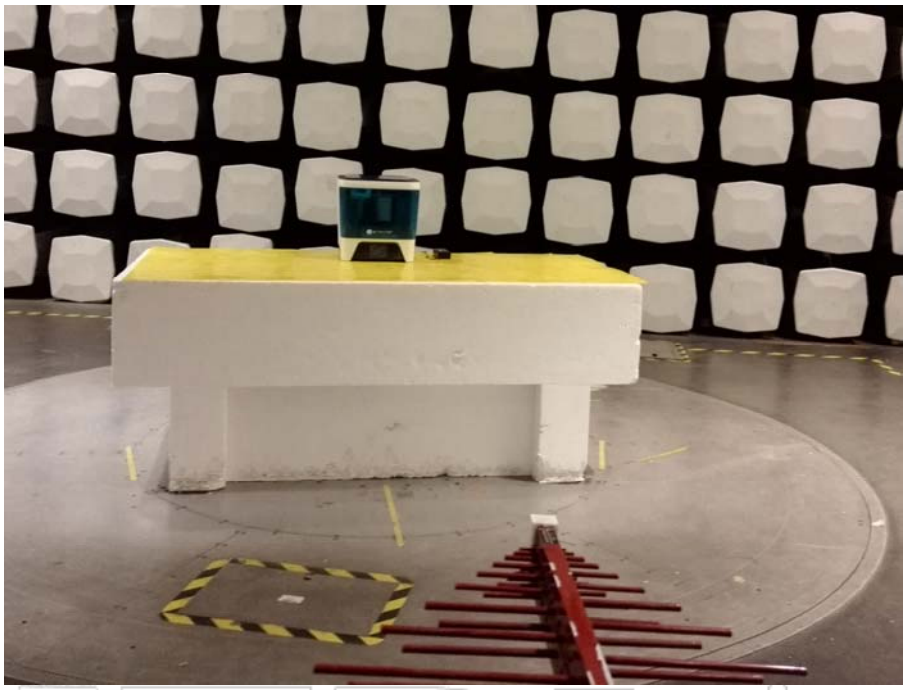
The target power(Average)： 802.11b:16dB±1dBm
802.11g:14dB±1dBm
802.11n:13dB±1dBm
which declared by the Manufacturer.

# 5 Photographs-Test Setup

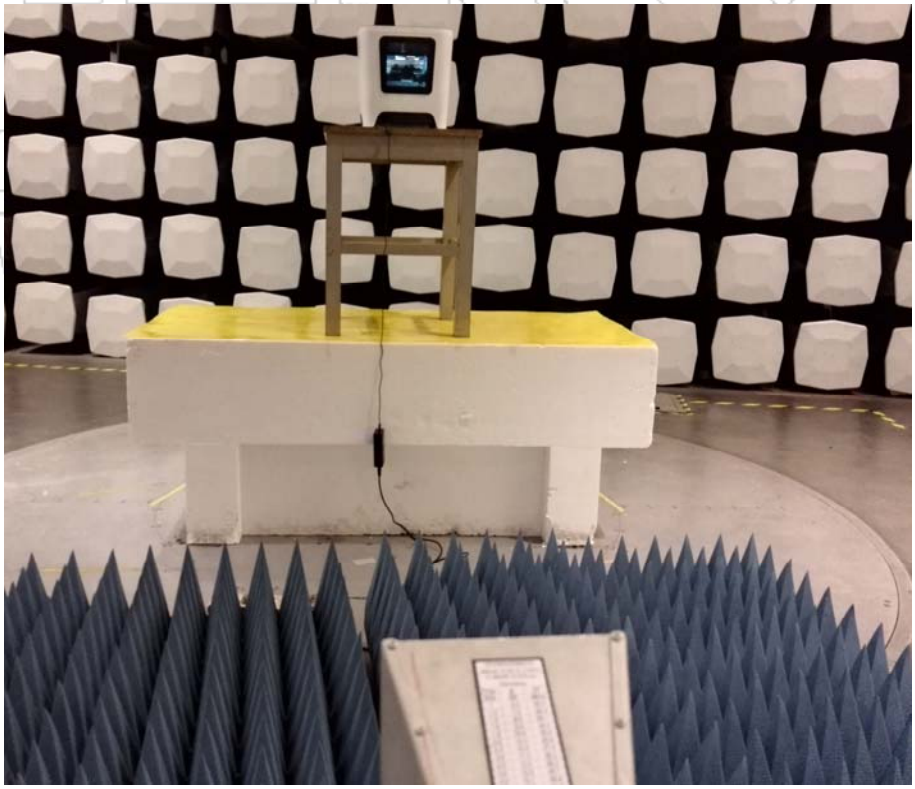
**AC Conducted Emission Measurement**



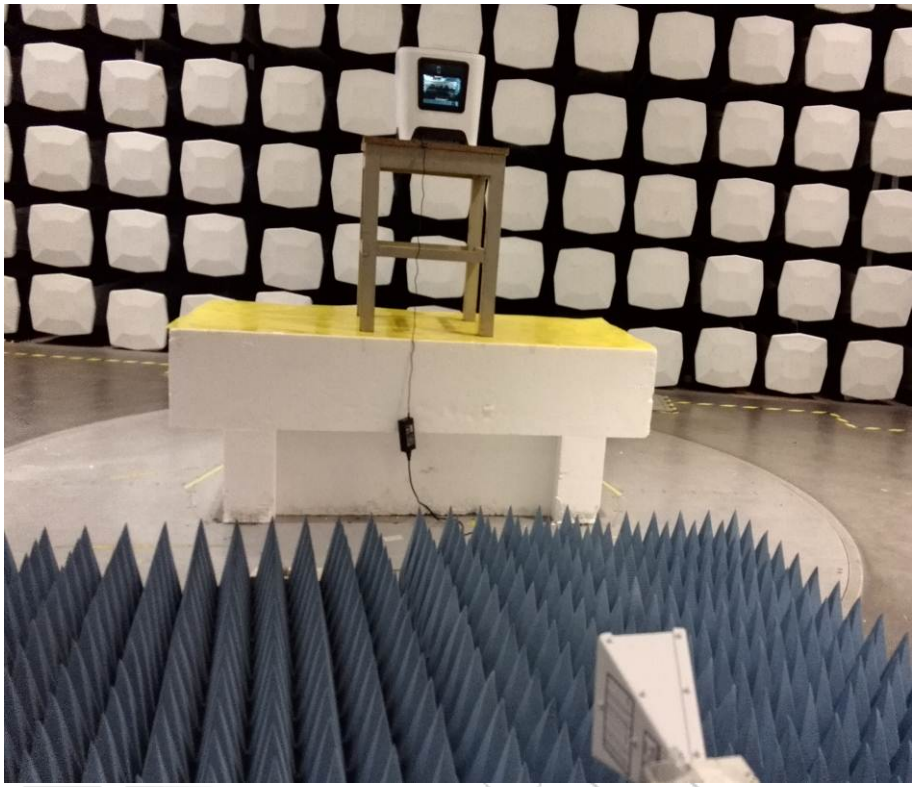
**Radiated Spurious Emission(9kHz~30MHz)**



**Radiated Spurious Emission(30MHz~1GHz)**



**Radiated Spurious Emission(1GHz~18GHz)**



**Radiated Spurious Emission(18GHz~25GHz)**