# FCC TEST REPORT
for
Guangdong Guanglian Electronic Technology Co., LTD.

500M Powerline Wireless Router
Model No.: GL-PH500R, GL-PH500E

| | | |
|---|---|---|
| Prepared for | : | Guangdong Guanglian Electronic Technology Co., LTD. |
| Address | : | Area B, 3/F, Building 13, Waihuan East Road 232, Guangzhou Higher Education Mega Center, Panyu District, Guangzhou, China |

| | | |
|---|---|---|
| Prepared By | : | Shenzhen Anbotek Compliance Laboratory Limited |
| Address | : | 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China<br>Tel: (86) 755-26066544<br>Fax: (86) 755-26014772 |

| | | |
|---|---|---|
| Report Number | : | R011503381E |
| Date of Test | : | Apr. 21~ May 05, 2015 |
| Date of Report | : | May 06, 2015 |

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# TEST REPORT

| | | |
|---|---|---|
| Applicant | : | Guangdong Guanglian Electronic Technology Co., LTD. |
| Manufacturer | : | Guangdong Guanglian Electronic Technology Co., LTD. |
| EUT | : | 500M Powerline Wireless Router |
| Model No. | : | GL-PH500R, GL-PH500E |
| Serial No. | : | N.A. |
| Trade Mark | : | GLEXER |
| Rating | : | AC 100-240V, 50/60Hz, 0.1A |

Measurement Procedure Used:
FCC Part15 Subpart C, Paragraph 15.247

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the FCC Part 15 Subpart C requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : Apr. 21~ May 05, 2015

Prepared by : Kebo Zhang
(Tested Engineer / Kebo Zhang)

Reviewer : Amy Ding
(Project Manager / Amy Ding)

Approved & Authorized Signer : Tom Chen
(Manager / Tom Chen)

# 1. GENERAL INFORMATION

## 1.1. Description of Device (EUT)

| | | |
|---|---|---|
| EUT | : | 500M Powerline Wireless Router |
| Model Number | : | GL-PH500R, GL-PH500E<br>(Note: All samples are the same except the model number, so we prepare "GL-PH500R" for test only.) |
| Test Power Supply | : | AC 120V, 60Hz |
| RF Transmission Frequency | : | 2412MHz~2462MHz (802.11b/802.11g/802.11n(HT20))<br>2422MHz~2452MHz ( 802.11n(HT40)) |
| Channels | : | 11 For (802.11b/802.11g/802.11n(HT20))<br>7 For (802.11n(HT40)) |
| Modulation | | 802.11b CCK<br>802.11g OFDM<br>802.11n MCS |
| Antenna Gain: | : | 3dBi |
| Applicant | : | Guangdong Guanglian Electronic Technology Co., LTD. |
| Address | : | Area B, 3/F, Building 13, Waihuan East Road 232, Guangzhou Higher Education Mega Center, Panyu District, Guangzhou, China |
| Manufacturer | : | Guangdong Guanglian Electronic Technology Co., LTD. |
| Address | : | Area B, 3/F, Building 13, Waihuan East Road 232, Guangzhou Higher Education Mega Center, Panyu District, Guangzhou, China |
| Factory | : | Guangdong Guanglian Electronic Technology Co., LTD. |
| Address | : | Area B, 3/F, Building 13, Waihuan East Road 232, Guangzhou Higher Education Mega Center, Panyu District, Guangzhou, China |
| Date of receipt | : | Apr. 21, 2015 |
| Date of Test | : | Apr. 21~ May 05, 2015 |

## 1.2. Auxiliary Equipment Used during Test

N/A

## 1.3. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

**CNAS - LAB Code: L3503**
Shenzhen Anbotek Compliance Laboratory Limited., Laboratory has been assessed and in compliance with CNAS/CL01: 2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

**FCC-Registration No.: 752021**
Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 752021, July 10, 2013.

**IC-Registration No.: 8058A-1**
Shenzhen Anbotek Compliance Laboratory Limited., EMC Laboratory has been registered and fully described in a report filed with the (IC) Industry Canada. The acceptance letter from the IC is maintained in our files. Registration 8058A, February 22, 2013.

**Test Location**
All Emissions tests were performed at
Shenzhen Anbotek Compliance Laboratory Limited. at 1/F., Building 1, SEC Industrial Park, No.0409 Qianhai Road, Nanshan District, Shenzhen, Guangdong, China

## 1.4. Measurement Uncertainty

| | | |
|---|---|---|
| Radiation Uncertainty | : | Ur = 4.1 dB (Horizontal)<br>Ur = 4.3 dB (Vertical) |
| Conduction Uncertainty | : | Uc = 3.4dB |

# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC Part 15, Paragraph 15.247.

## 2.1. Summary of Test Results

The EUT has been tested according to the following specifications:

| Standard | Test Type | Result | Notes |
|---|---|---|---|
| FCC Part 15, Paragraph 15.107, 15.207 | Conducted Emission Test | PASS | Complies |
| FCC Part 15, Paragraph 15.247(b)(1) | Maximum Output Power | PASS | Complies |
| FCC Part 15, Paragraph 15.247(a)(2) | 6dB Bandwidth | PASS | Complies |
| FCC Part 15, Paragraph 15.247(c) | 100kHz Bandwidth of Frequency Band Edges | PASS | Complies |
| FCC Part 15, Paragraph 15.209(a)(f) | Spurious Emission | PASS | Complies |
| FCC Part 15, Paragraph 15.247(a)(1) | Frequency Separation | - | N/A |
| FCC Part 15, Paragraph 15.247(a)(1)(iii) | Number of Hopping Frequency | - | N/A |
| FCC Part 15, Paragraph 15.247(a)(1)(iii) | Time of Occupancy | - | N/A |
| FCC Part 15, Paragraph 15.247(c) | Peak Power Density | PASS | Complies |

## 2.2. Description of Test Modes

The EUT has been tested under operating condition.
Software used to control the EUT for staying in continuous transmitting and receiving mode isprogrammed.
IEEE802.11b: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 1 Mbps lowest data rate (worst case) are chosen for the final testing.
IEEE802.11g: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6 Mbps lowest data rate (the worst case) are chosen for the final testing.
IEEE802.11n (HT20): Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with MCS 0 Mbps lowest data rate (the worst case) are chosen for the final testing.
IEEE802.11n (HT40): Channel 3(2422MHz), Channel 6(2437MHz) and Channel 9(2452MHz) with MCS 0 Mbps lowest data rate (the worst case) are chosen for the final testing.

## 2.3. List of channels:

√ - available

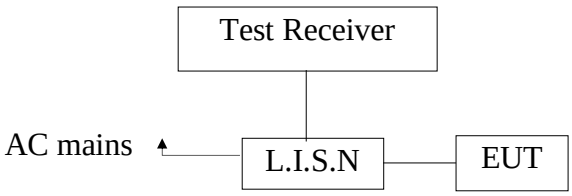
X - tested

| Number | Frequency(MHz) | | 802.11 b/g/n （HT20） | 802.11 b/g/n （HT40） |
|---|---|---|---|---|
| 1 | 2412 | √ | X | |
| 2 | 2417 | √ | | |
| 3 | 2422 | √ | | X |
| 4 | 2427 | √ | | |
| 5 | 2432 | √ | | |
| 6 | 2437 | √ | X | X |
| 7 | 2442 | √ | | |
| 8 | 2447 | √ | | |
| 9 | 2452 | √ | | X |
| 10 | 2457 | √ | | |
| 11 | 2462 | √ | X | |

# 3. Conducted Emission Test

## 3.1. Block Diagram of Test Setup

### 3.1.1. Block diagram of connection between the EUT and simulators




## 3.2. Power Line Conducted Emission Measurement Limits (15.207)

| Frequency MHz | Limits dB(μV) | |
|---|---|---|
| | Quasi-peak Level | Average Level |
| 0.15 ~ 0.50 | 66 ~ 56* | 56 ~ 46* |
| 0.50 ~ 5.00 | 56 | 46 |
| 5.00 ~ 30.00 | 60 | 50 |

Notes: 1. *Decreasing linearly with logarithm of frequency.
2. The lower limit shall apply at the transition frequencies.

## 3.3. Configuration of EUT on Measurement

The following equipments are installed on Power Line Conducted Emission Measurement to meet the commission requirement and operating regulations in a manner which tends to maximize its emission characteristics in a normal application.

## 3.4. Operating Condition of EUT

3.4.1. Setup the EUT and simulator as shown as Section 3.1.

3.4.2. Turn on the power of all equipment.

3.4.3. Let the EUT work in test mode (On) and measure it.

## 3.5. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2013 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9KHz.

The frequency range from 150KHz to 30MHz is checked.

The test results are reported on Section 3.6.

## 3.6. Test equipment

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | Two-Line V-network | Rohde & Schwarz | ENV216 | 100055 | Apr. 17, 2015 | 1 Year |
| 2. | EMI Test Receiver | Rohde & Schwarz | ESCI | 100627 | Apr. 17, 2015 | 1 Year |
| 3. | RF Switching Unit | Compliance Direction | RSU-M2 | 38303 | Apr. 17, 2015 | 1 Year |

## 3.7. Power Line Conducted Emission Measurement Results

**PASS.**

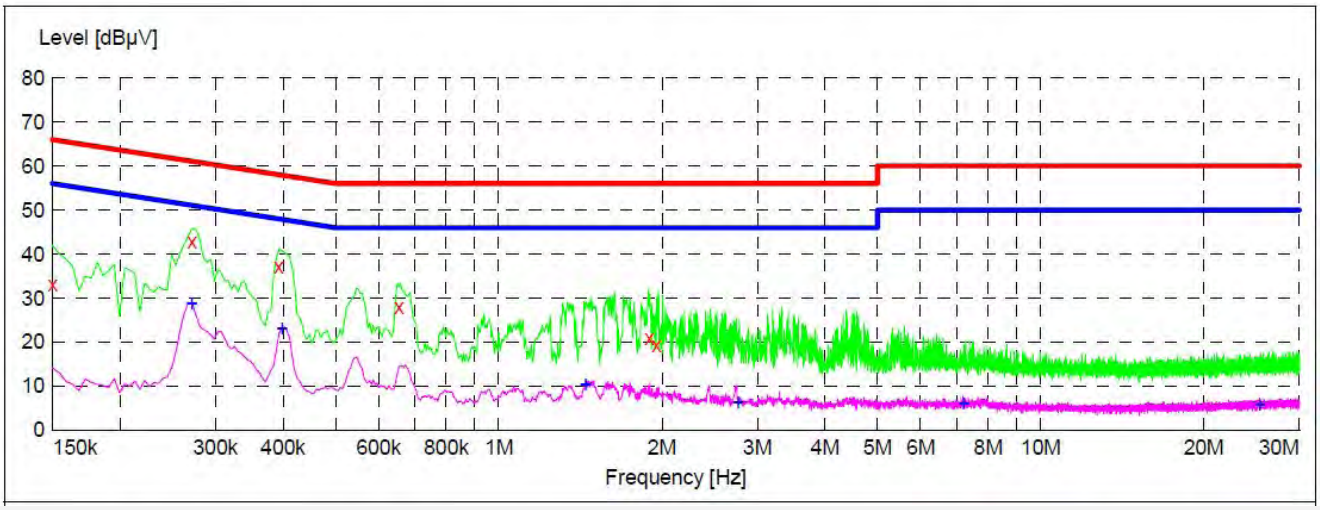
The frequency range from 150KHz to 30 MHz is investigated.

Please refer the following pages.

## *CONDUCTED EMISSION TEST DATA*

| | |
|---|---|
| Test Site: | 1# Shielded Room |
| Operating Condition: | On |
| Test Specification: | AC 120V, 60Hz |
| Comment: | Live Line |
| | Tem.:25℃ Hum.:50% |

**SCAN TABLE: "Voltage(150K~30M)FIN"**
Short Description: 150K-30M Disturbance Voltages



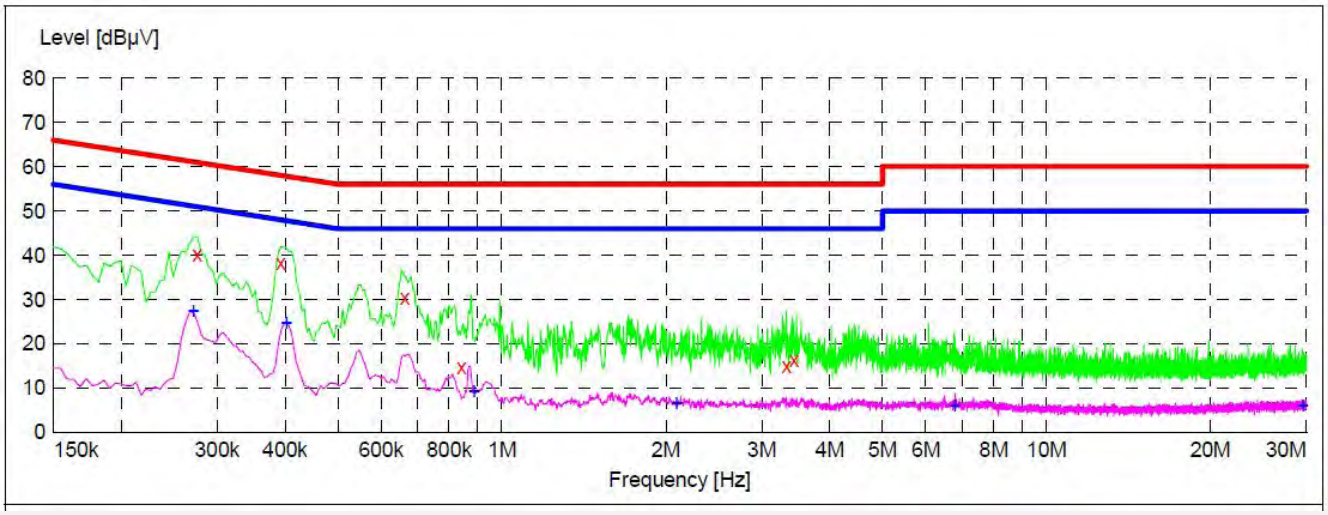

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.150000 | 33.10 | 20.1 | 66 | 32.9 | QP | L1 | GND |
| 0.271500 | 42.90 | 20.1 | 61 | 18.2 | QP | L1 | GND |
| 0.393000 | 37.20 | 20.1 | 58 | 20.8 | QP | L1 | GND |
| 0.654000 | 27.90 | 20.1 | 56 | 28.1 | QP | L1 | GND |
| 1.895500 | 20.90 | 20.3 | 56 | 35.1 | QP | L1 | GND |
| 1.954000 | 19.40 | 20.3 | 56 | 36.6 | QP | L1 | GND |

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.271500 | 28.80 | 20.1 | 51 | 22.3 | AV | L1 | GND |
| 0.397500 | 23.20 | 20.1 | 48 | 24.7 | AV | L1 | GND |
| 1.445500 | 10.50 | 20.3 | 46 | 35.5 | AV | L1 | GND |
| 2.764000 | 6.40 | 20.4 | 46 | 39.6 | AV | L1 | GND |
| 7.201000 | 6.00 | 20.5 | 50 | 44.0 | AV | L1 | GND |
| 25.318000 | 5.80 | 20.9 | 50 | 44.2 | AV | L1 | GND |

## *CONDUCTED EMISSION TEST DATA*

| | |
|---|---|
| Test Site: | 1# Shielded Room |
| Operating Condition: | On |
| Test Specification: | AC 120V, 60Hz |
| Comment: | Neutral Line |
| | Tem.:25℃ Hum.:50% |

**SCAN TABLE: "Voltage(150K~30M)FIN"**
Short Description: 150K-30M Disturbance Voltages

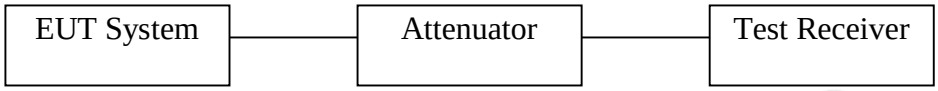



| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.276000 | 40.20 | 20.1 | 61 | 20.7 | QP | N | GND |
| 0.393000 | 38.30 | 20.1 | 58 | 19.7 | QP | N | GND |
| 0.663000 | 30.60 | 20.1 | 56 | 25.4 | QP | N | GND |
| 0.843000 | 14.60 | 20.1 | 56 | 41.4 | QP | N | GND |
| 3.331000 | 14.90 | 20.4 | 56 | 41.1 | QP | N | GND |
| 3.439000 | 16.40 | 20.4 | 56 | 39.6 | QP | N | GND |

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.271500 | 27.40 | 20.1 | 51 | 23.7 | AV | N | GND |
| 0.402000 | 24.70 | 20.1 | 48 | 23.1 | AV | N | GND |
| 0.888000 | 9.20 | 20.1 | 46 | 36.8 | AV | N | GND |
| 2.093500 | 6.60 | 20.3 | 46 | 39.4 | AV | N | GND |
| 6.778000 | 6.10 | 20.5 | 50 | 43.9 | AV | N | GND |
| 29.588500 | 6.00 | 20.9 | 50 | 44.0 | AV | N | GND |

# 4. FCC Part 15.247 Requirements for DSSS & OFDM Modulation

## 4.1 Test Setup




## 4.2 6dB Bandwidth

**a. Limit**

For the direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz.

**b.Test Procedure**

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as:
   RBW = 100kHz, VBW≥3*RBW =300kHz,
   Detector= Peak
   Trace mode= Max hold.
   Sweep- auto couple.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

**20dB Bandwidth:**
**C63.10**
**Occupied Bandwidth (OBW=20dB Bandwidth**

1. Set RBW=1%~5% OBW
2. Set the VBW≥3*RBW
3. Set the span range between 2 times and 5 times of the OBW
4. Sweep Time= Auto
   Detector= Peak
   Trace= Max hold
5. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce the worst case (i.e. the widest) bandwidth. Unless otherwise specified for an unlicensed wireless device, measure the bandwidth at the -20dB levels with respect to the reference level.

**c. Test Setup See 4.1**

**d. Test Equipment**

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | Spectrum Analysis | Agilent | E4407B | US39390582 | Apr. 17, 2015 | 1 Year |
| 2. | Preamplifier | Instruments corporation | EMC011830 | 980100 | Apr. 17, 2015 | 1 Year |
| 3. | EMI Test Receiver | Rohde & Schwarz | ESPI | 101604 | Apr. 17, 2015 | 1 Year |
| 4. | Double Ridged Horn Antenna | Instruments corporation | GTH-0118 | 351600 | Apr. 20, 2015 | 1 Year |
| 5. | Bilog Broadband Antenna | Schwarzbeck | VULB9163 | VULB 9163-289 | Apr. 20, 2015 | 1 Year |
| 6. | Pre-amplifier | SONOMA | 310N | 186860 | Apr. 17, 2015 | 1 Year |
| 7. | EMI Test Software EZ-EMC | SHURPLE | N/A | N/A | N/A | N/A |

**e. Test Results**

Pass.

**f. Test Data**

**6dB Bandwidth**

Test mode: IEEE 802.11b

| Channel | Frequency (MHz) | Bandwidth (MHz) | Limit (kHz) | Results |
|---|---|---|---|---|
| Low | 2412 | 11.76 | | Pass |
| Mid | 2437 | 11.76 | >500 | Pass |
| High | 2462 | 11.76 | | Pass |

Test mode: IEEE 802.11g

| Channel | Frequency (MHz) | Bandwidth (MHz) | Limit (kHz) | Results |
|---|---|---|---|---|
| Low | 2412 | 16.56 | | Pass |
| Mid | 2437 | 16.52 | >500 | Pass |
| High | 2462 | 16.56 | | Pass |

Test mode: IEEE 802.11n (HT20)

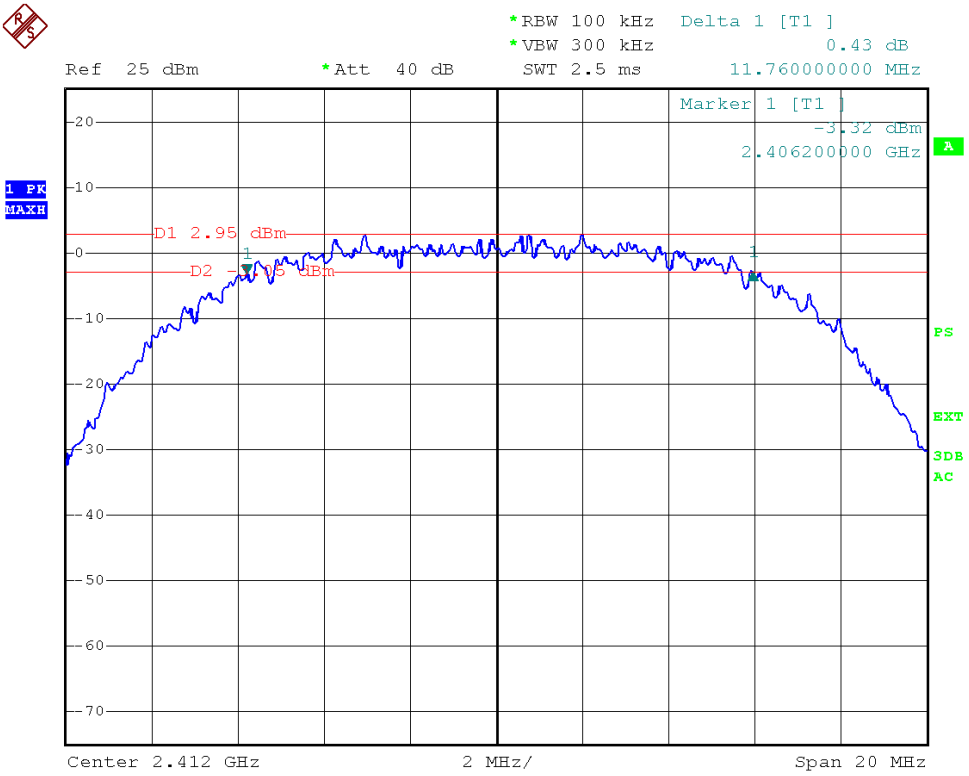
| Channel | Frequency (MHz) | Bandwidth (MHz) | Limit (kHz) | Results |
|---|---|---|---|---|
| Low | 2412 | 17.76 | | Pass |
| Mid | 2437 | 17.76 | >500 | Pass |
| High | 2462 | 17.76 | | Pass |

Test mode: IEEE 802.11n (HT40)

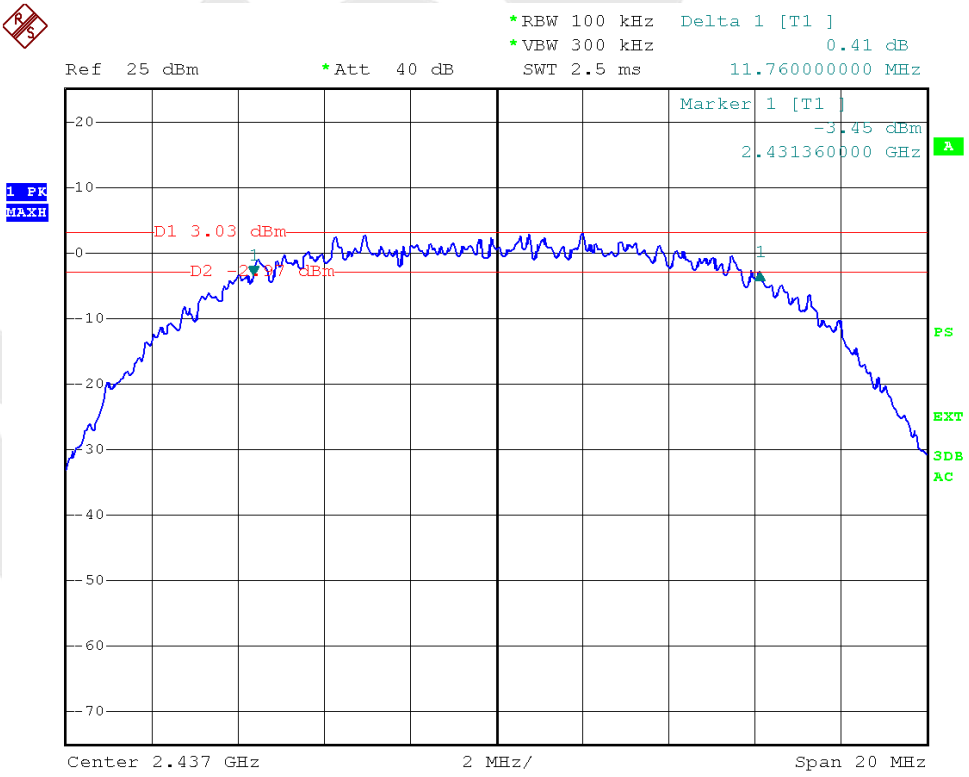
| Channel | Frequency (MHz) | Bandwidth (MHz) | Limit (kHz) | Results |
|---|---|---|---|---|
| Low | 2422 | 36.56 | | Pass |
| Mid | 2437 | 36.56 | >500 | Pass |
| High | 2452 | 36.56 | | Pass |

Test Plots See the following page.

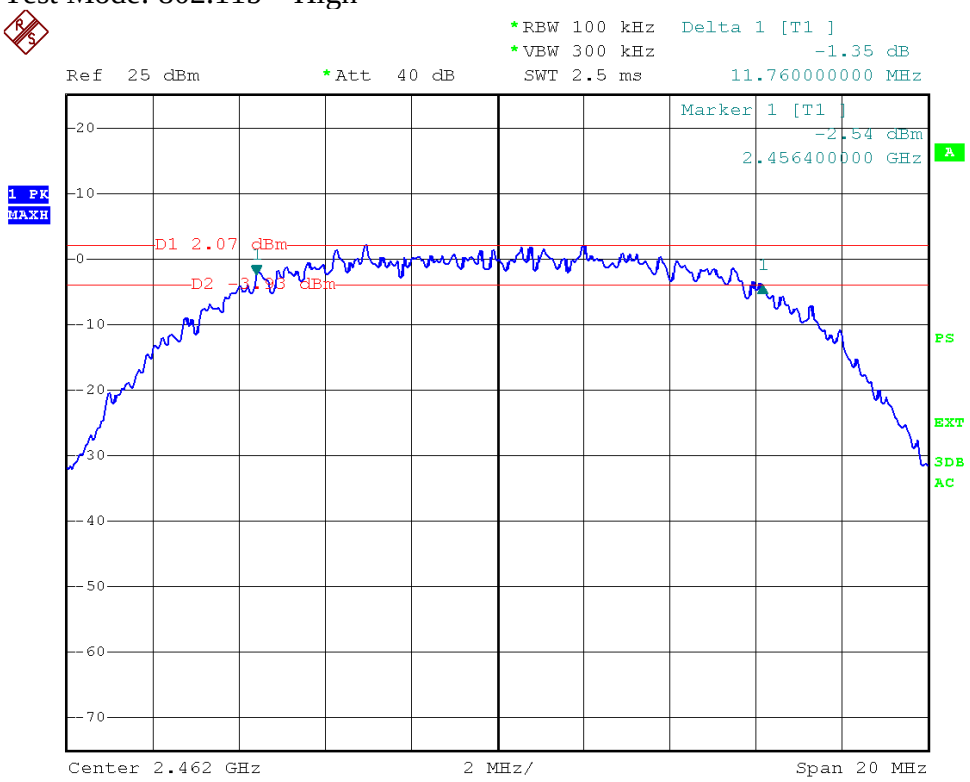
Test Mode: 802.11b---Low



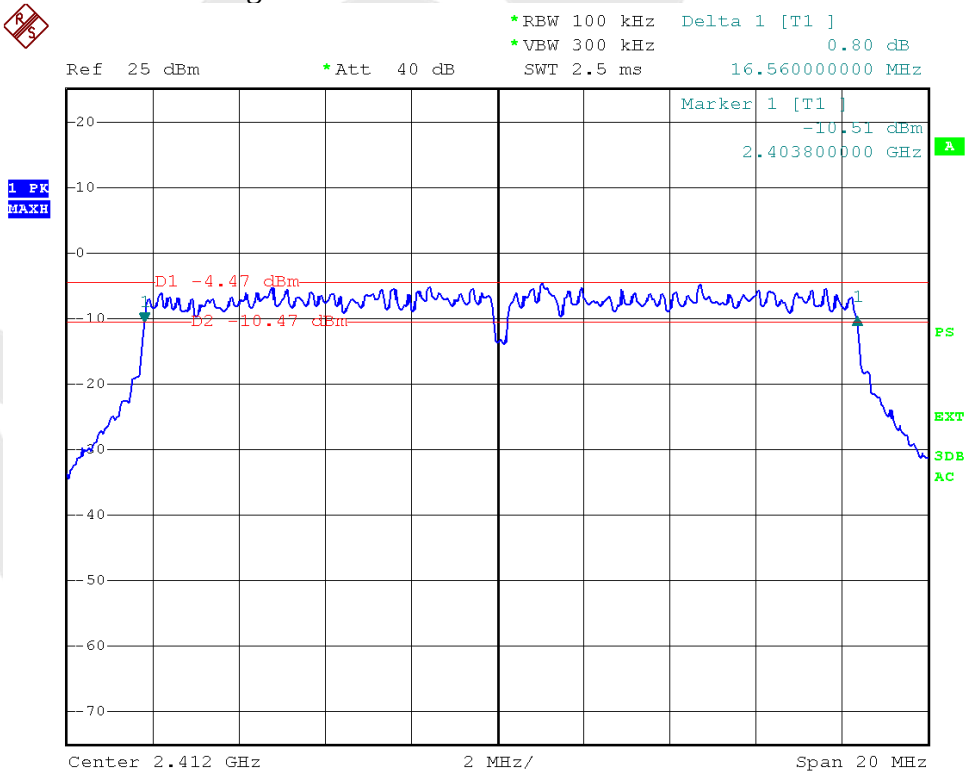

Test Mode: 802.11b---Mid



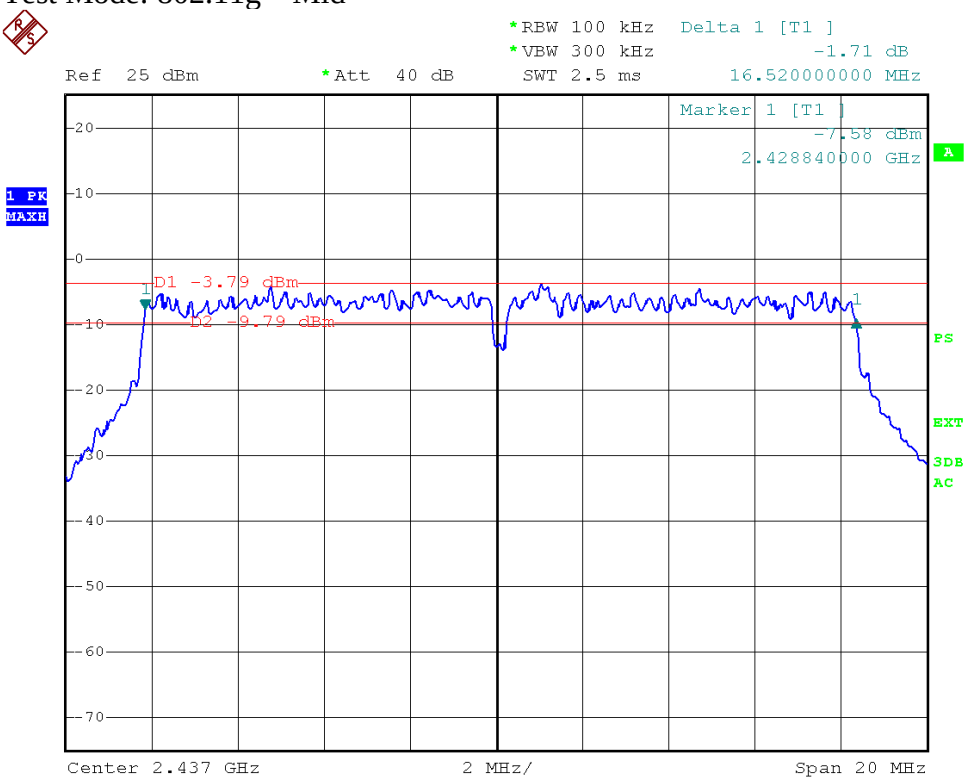
Test Mode: 802.11b---High



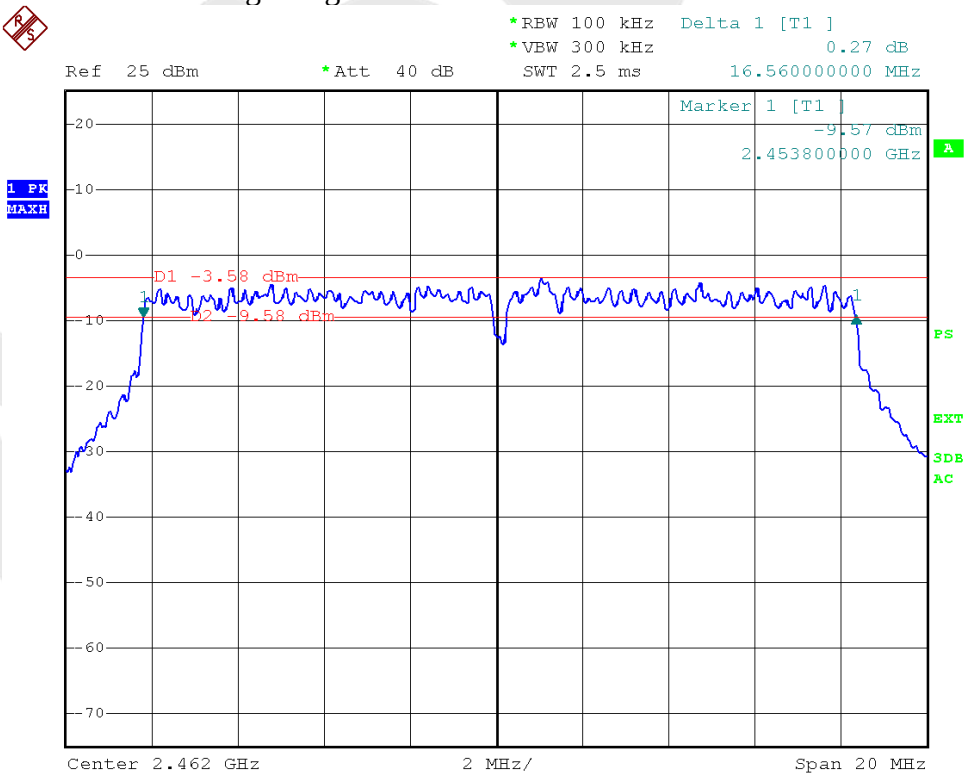

Test Mode: 802.11g---Low



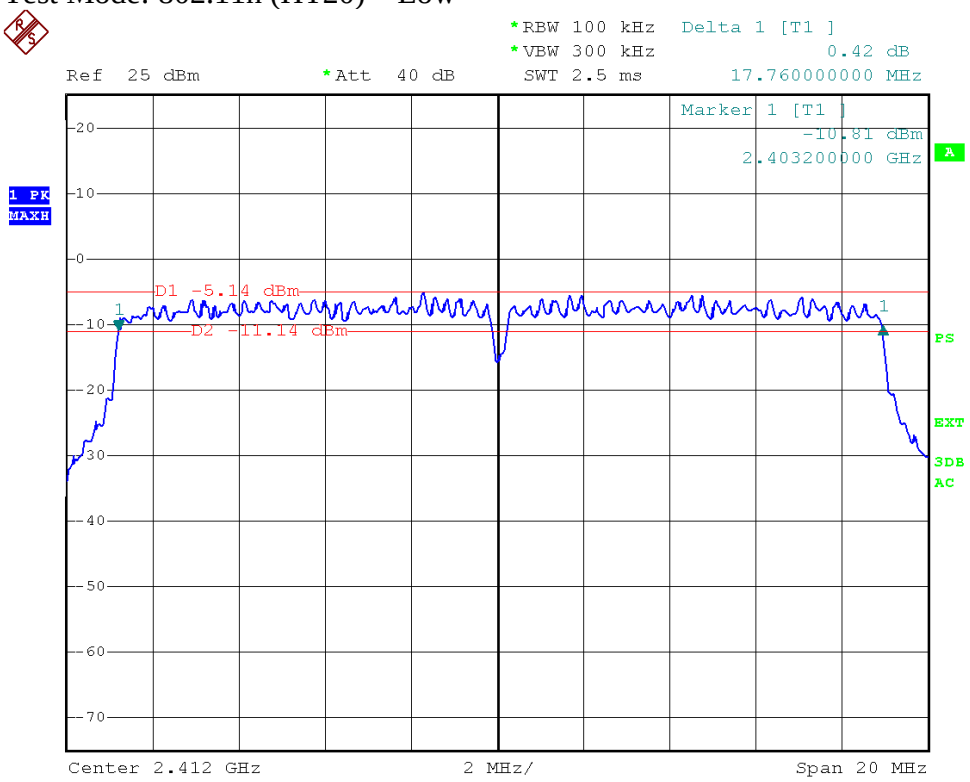
Test Mode: 802.11g---Mid



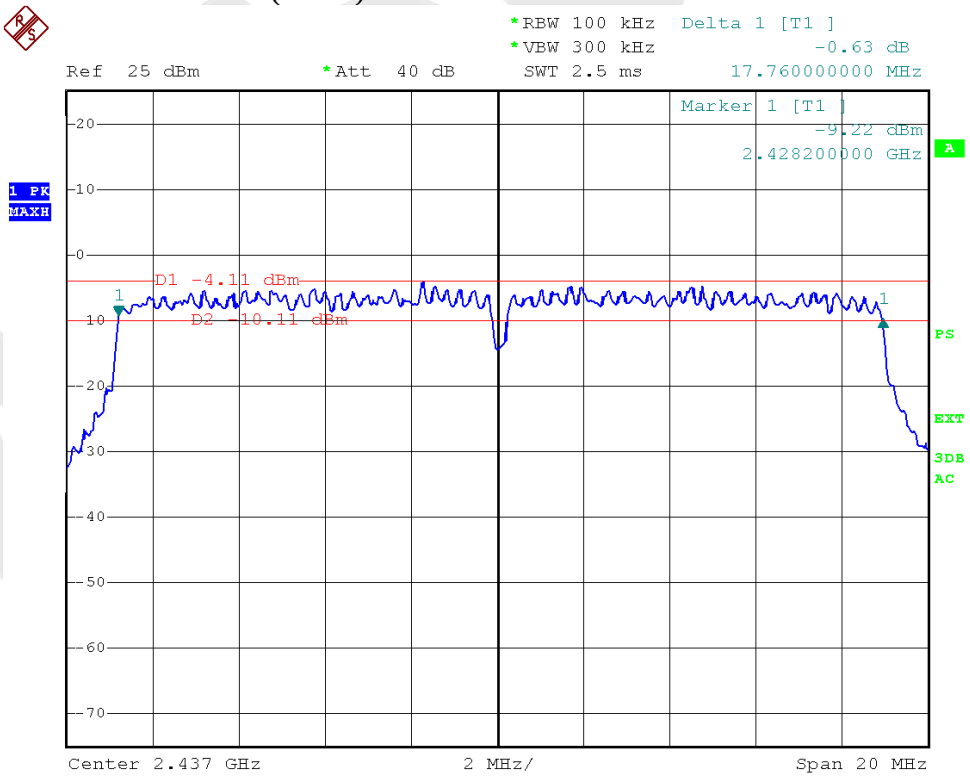

Test Mode: 802.11g---High



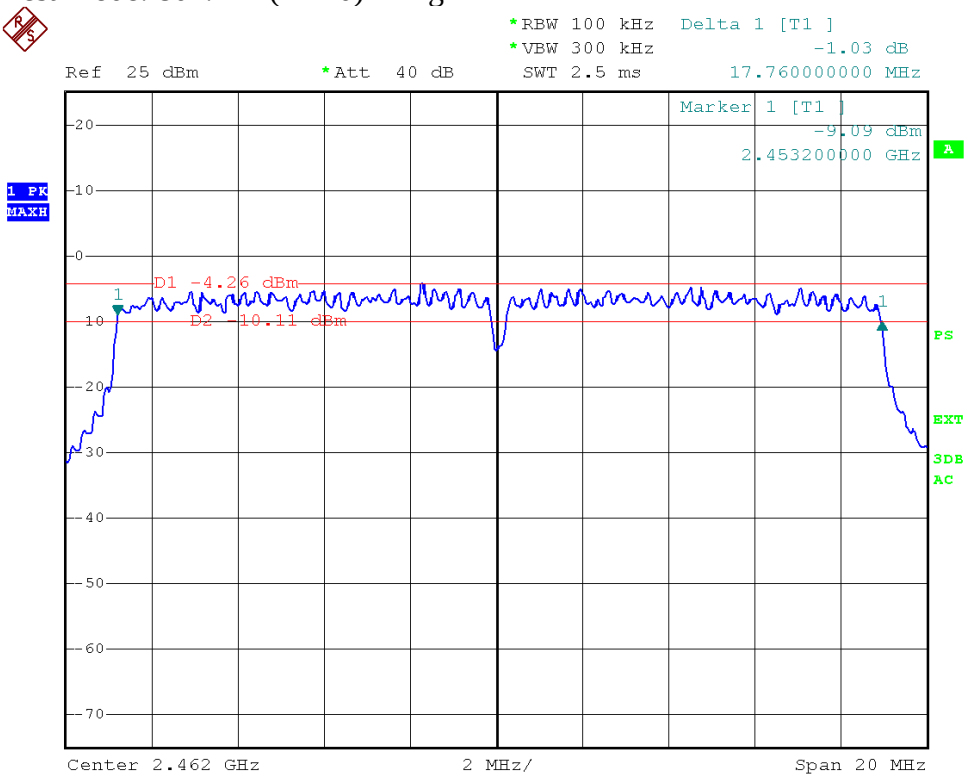
Test Mode: 802.11n (HT20)---Low



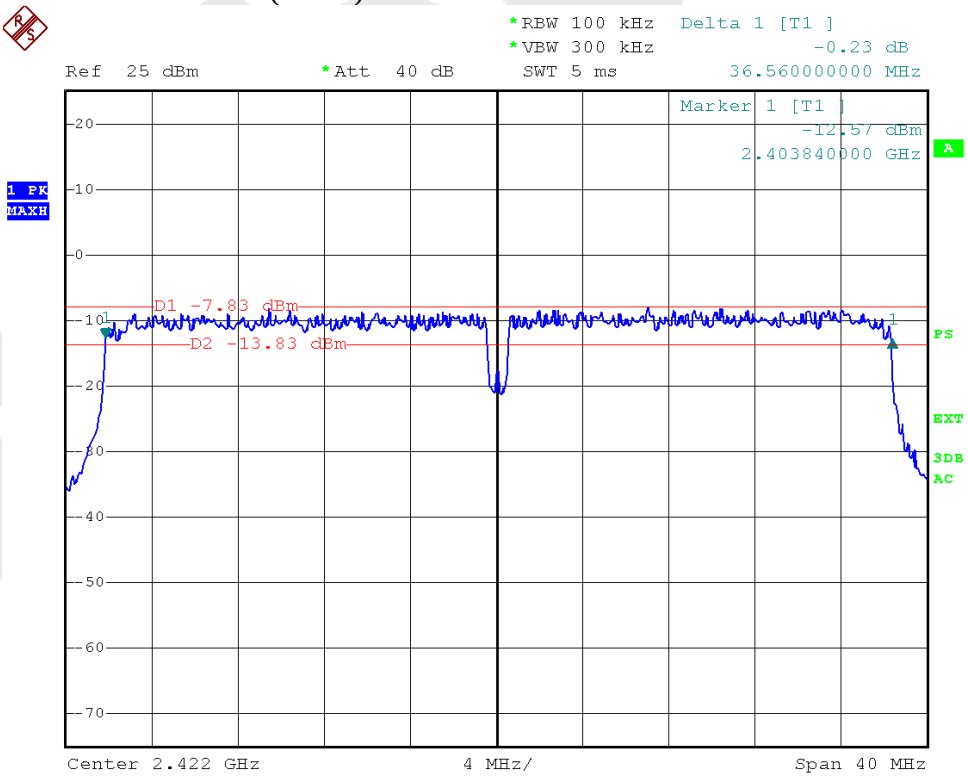

Test Mode: 802.11n (HT20)---Mid



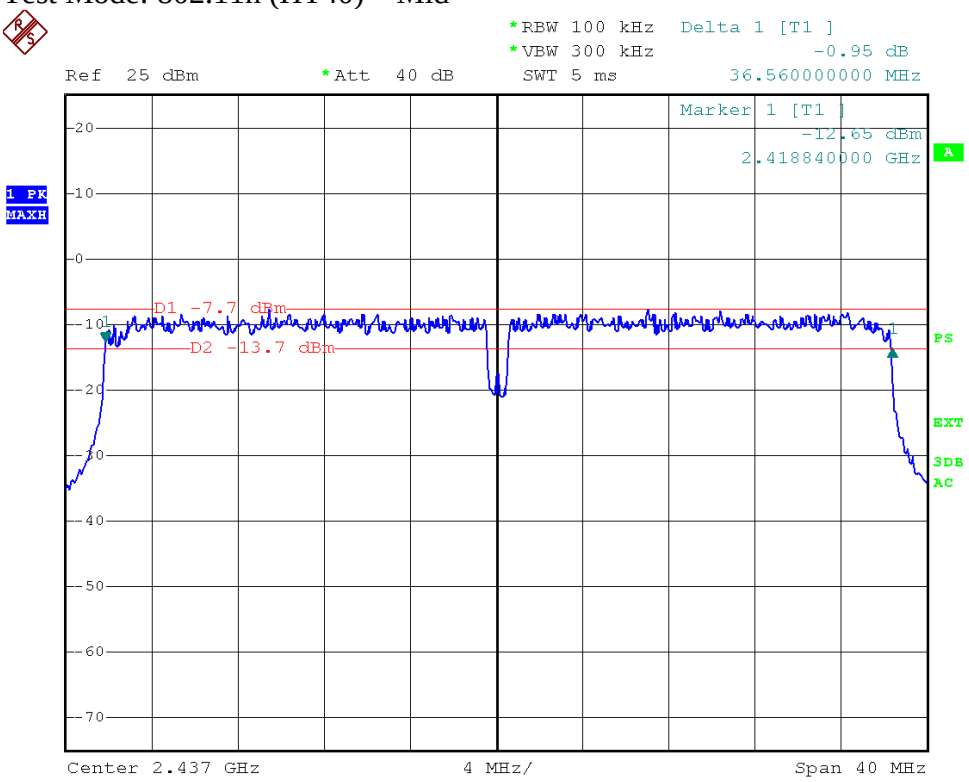
Test Mode: 802.11n (HT20)---High



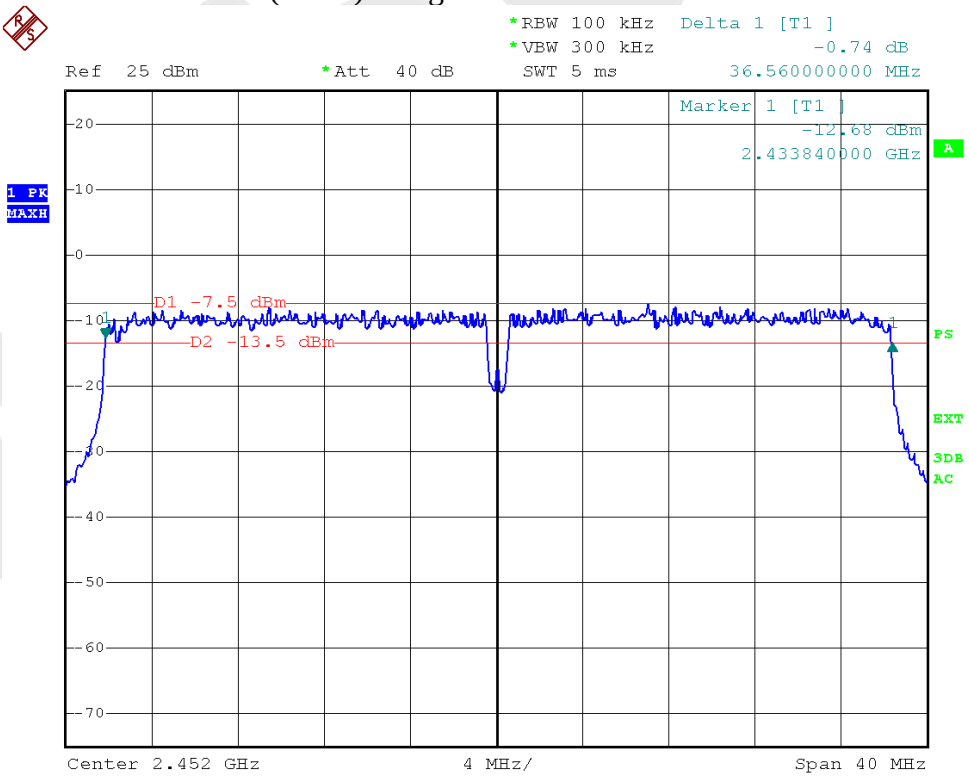

Test Mode: 802.11n (HT40)---Low



Test Mode: 802.11n (HT40)---Mid




Test Mode: 802.11n (HT40)---High



**20dB Bandwidth**

Test mode: IEEE 802.11b

| Channel | Frequency (MHz) | Bandwidth (MHz) | Results |
|---|---|---|---|
| Low | 2412 | 19.04 | Pass |
| Mid | 2437 | 19.04 | Pass |
| High | 2462 | 18.96 | Pass |

Test mode: IEEE 802.11g

| Channel | Frequency (MHz) | Bandwidth (MHz) | Results |
|---|---|---|---|
| Low | 2412 | 22.32 | Pass |
| Mid | 2437 | 22.64 | Pass |
| High | 2462 | 22.32 | Pass |

Test mode: IEEE 802.11n (HT20)

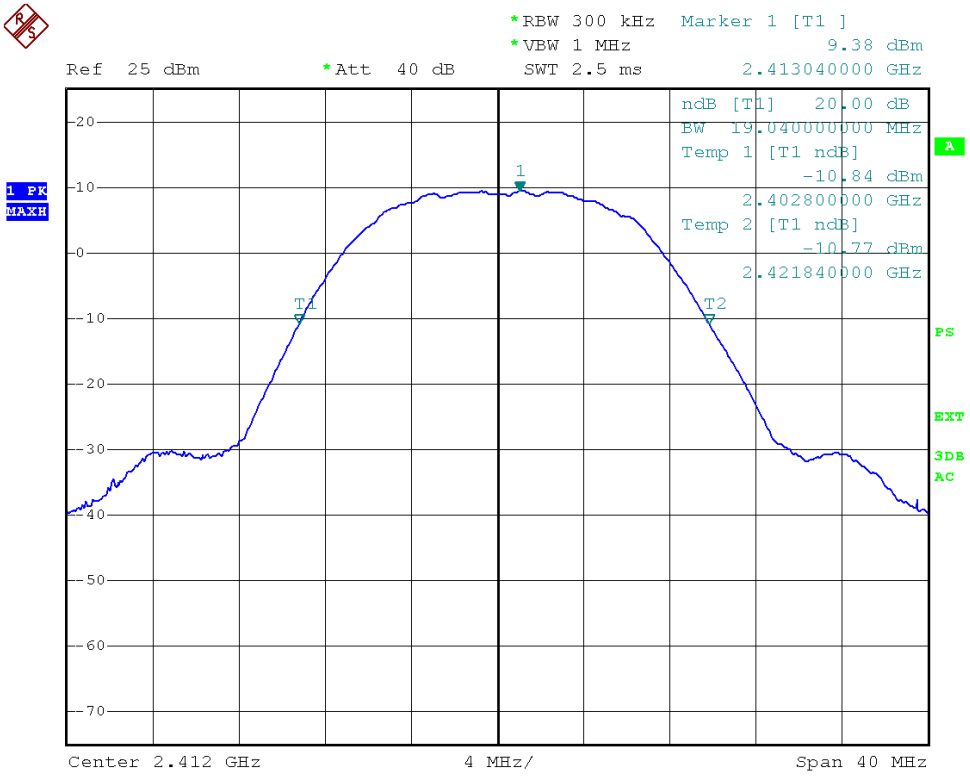
| Channel | Frequency (MHz) | Bandwidth (MHz) | Results |
|---|---|---|---|
| Low | 2412 | 23.12 | Pass |
| Mid | 2437 | 23.20 | Pass |
| High | 2462 | 23.12 | Pass |

Test mode: IEEE 802.11n (HT40)

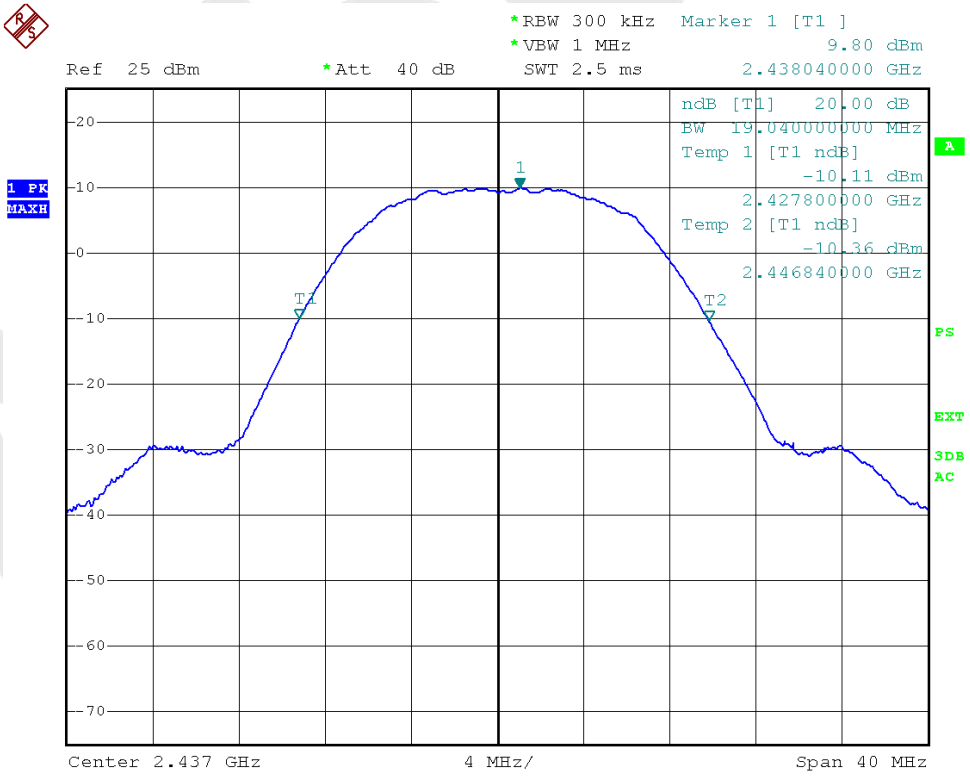
| Channel | Frequency (MHz) | Bandwidth (MHz) | Results |
|---|---|---|---|
| Low | 2422 | 42.24 | Pass |
| Mid | 2437 | 42.24 | Pass |
| High | 2452 | 42.24 | Pass |

Test Plots See the following page.

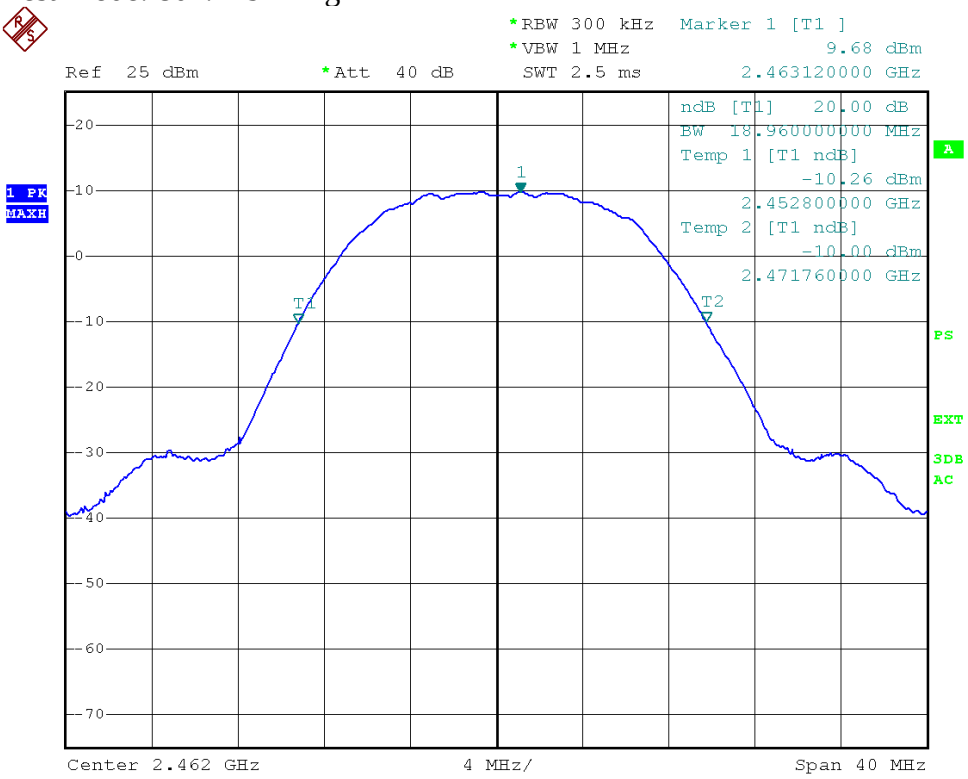
Test Mode: 802.11b---Low



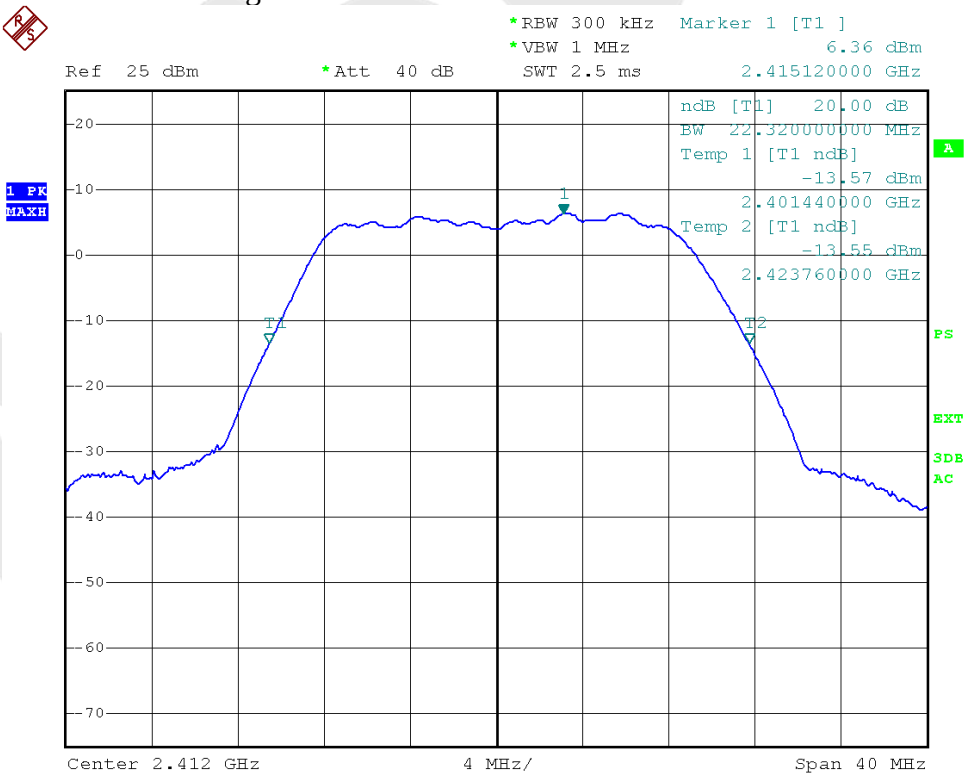

Test Mode: 802.11b---Mid



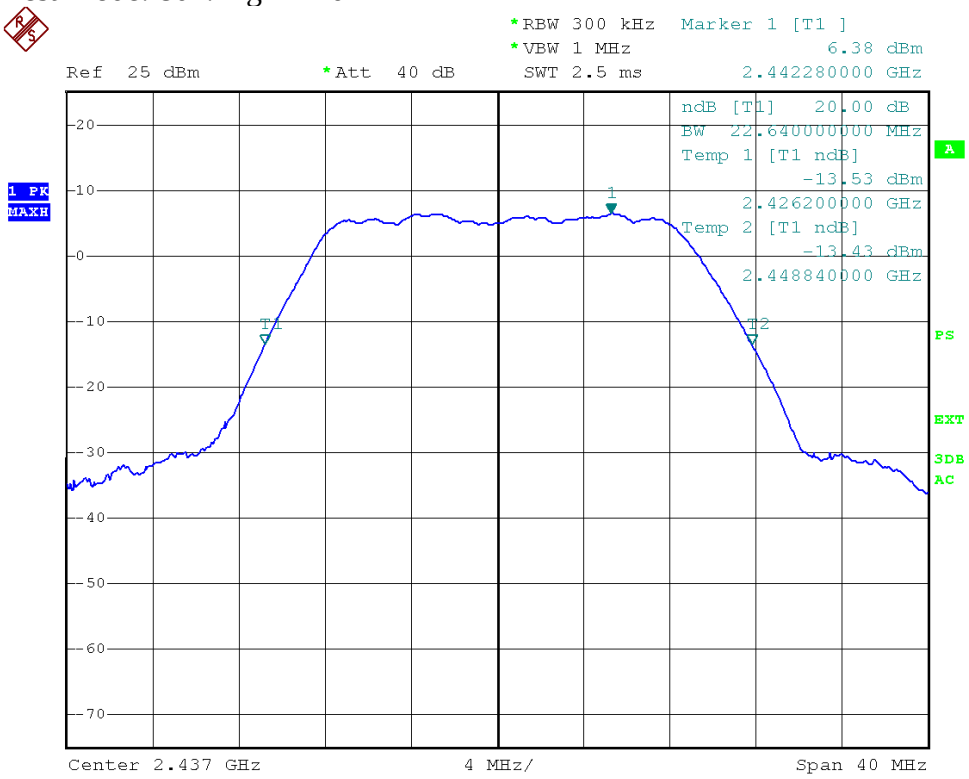
Test Mode: 802.11b---High



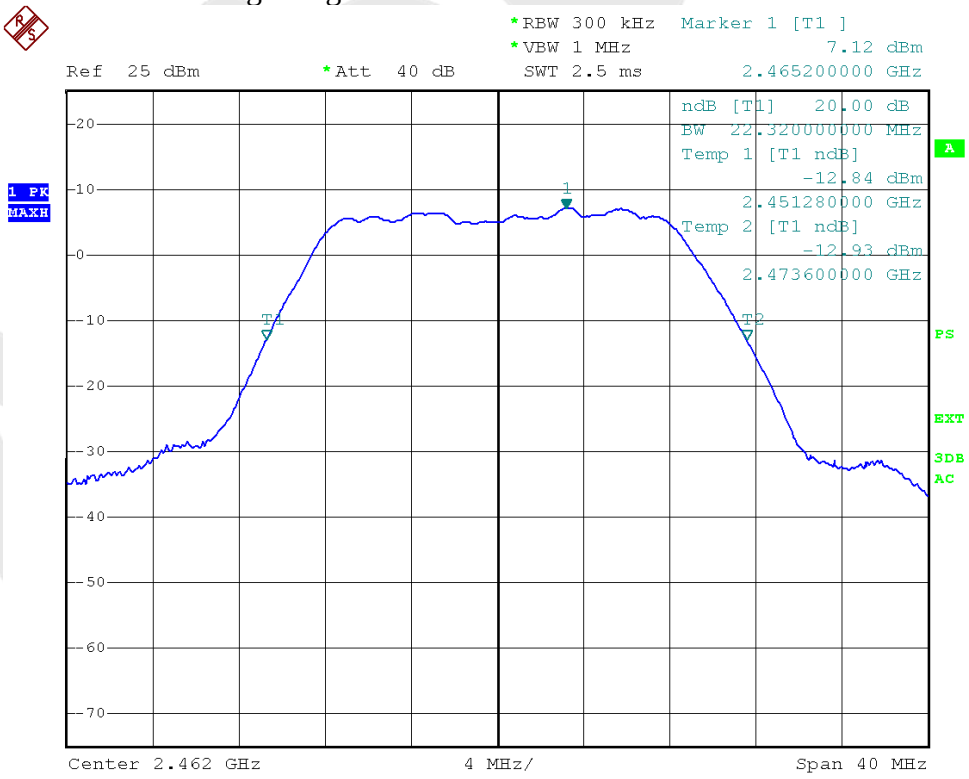

Test Mode: 802.11g---Low



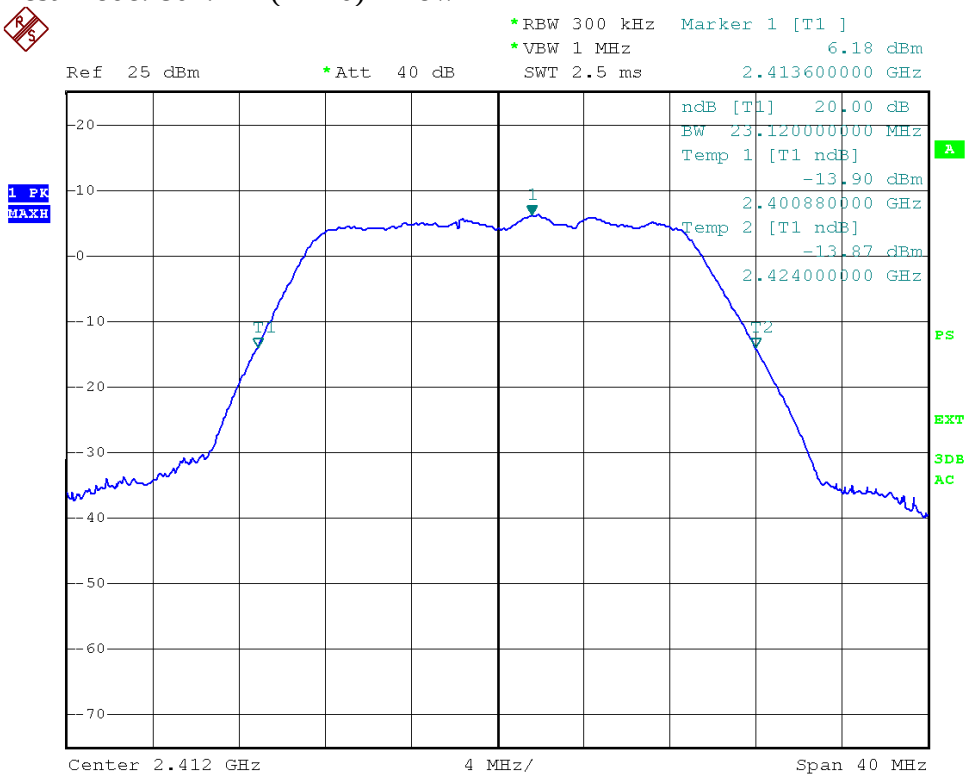
Test Mode: 802.11g---Mid



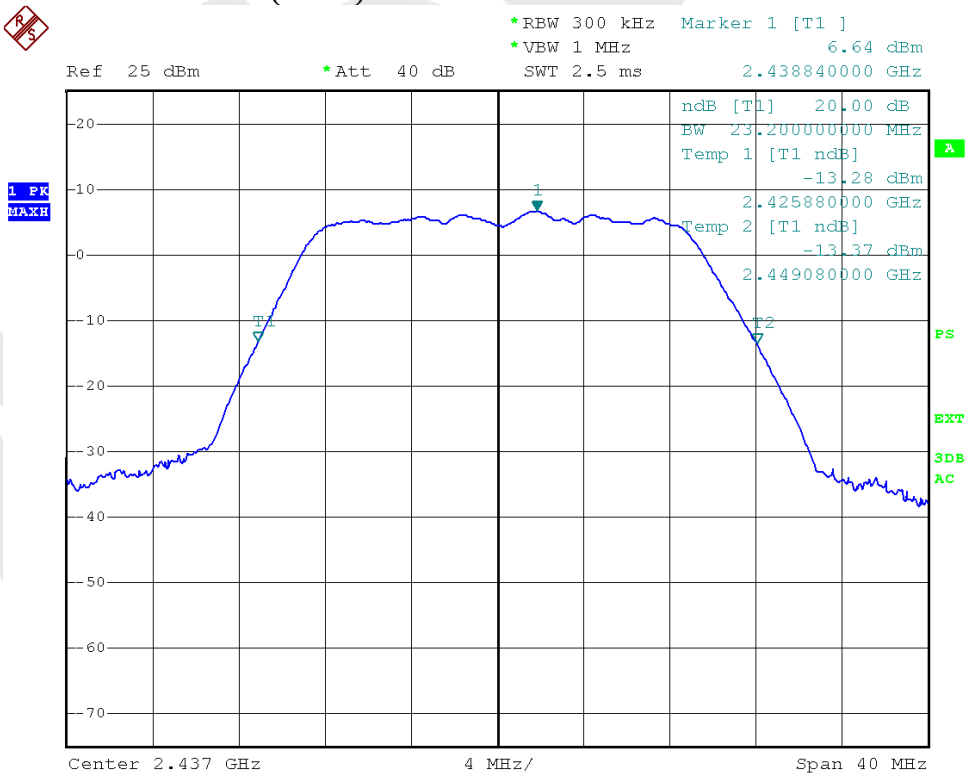

Test Mode: 802.11g---High



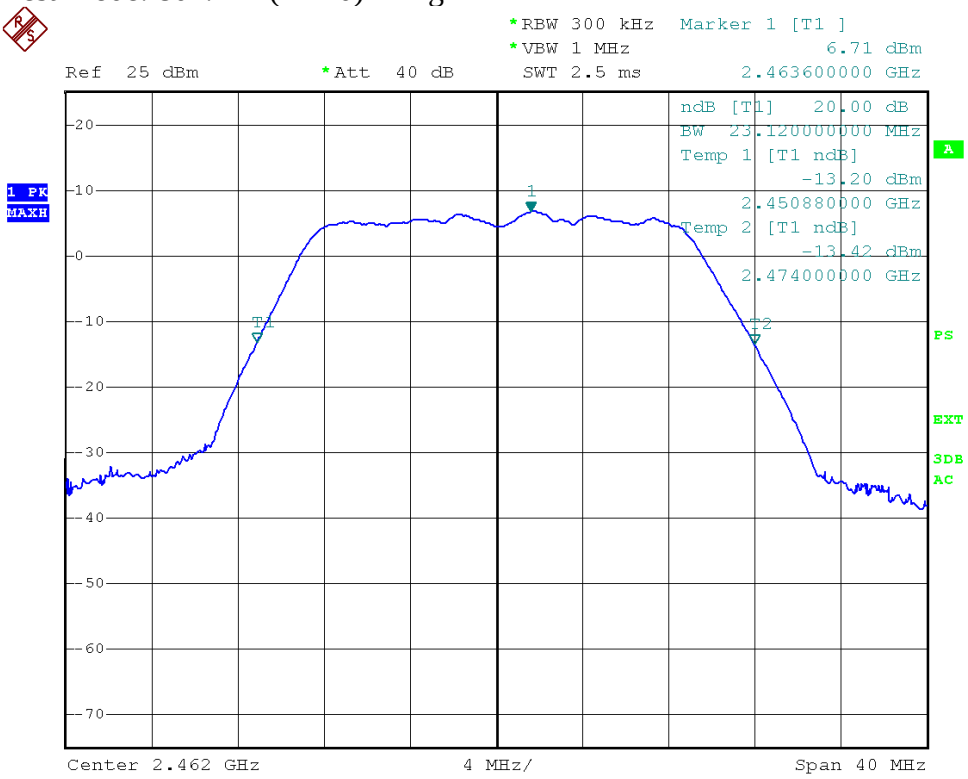
Test Mode: 802.11n (HT20)---Low



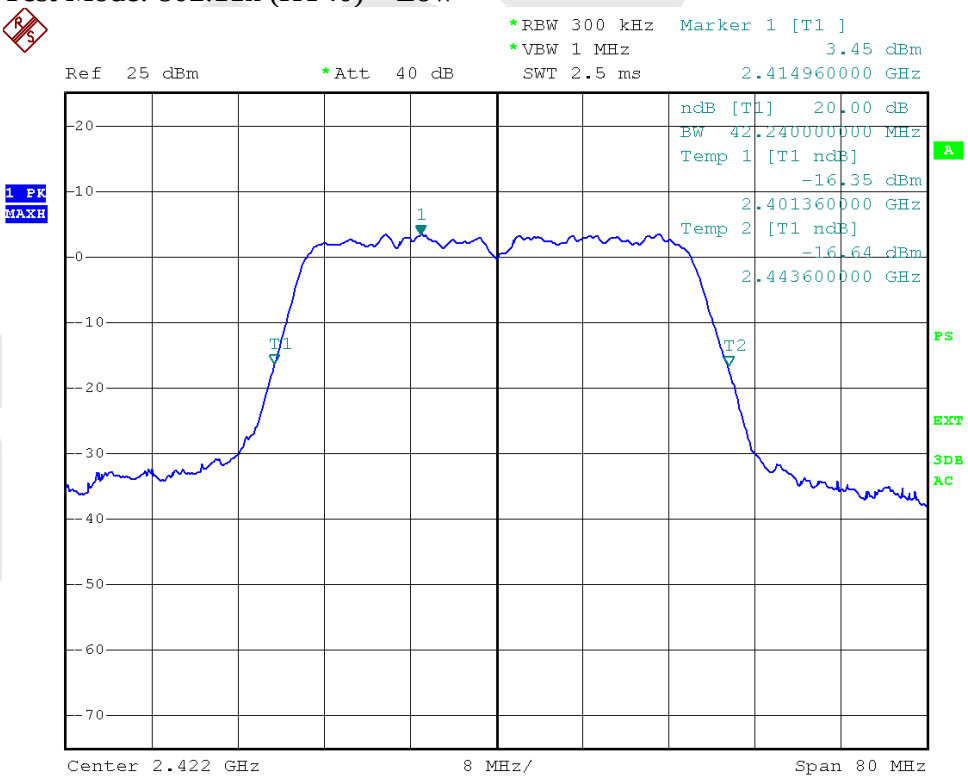

Test Mode: 802.11n (HT20)---Mid



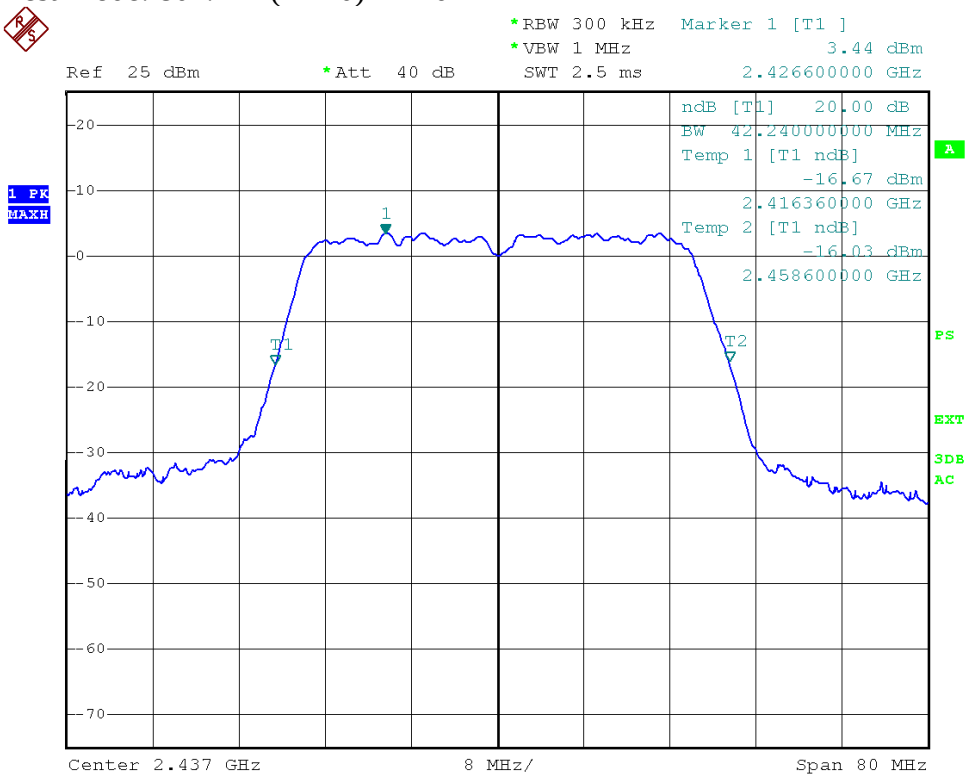
Test Mode: 802.11n (HT20)---High



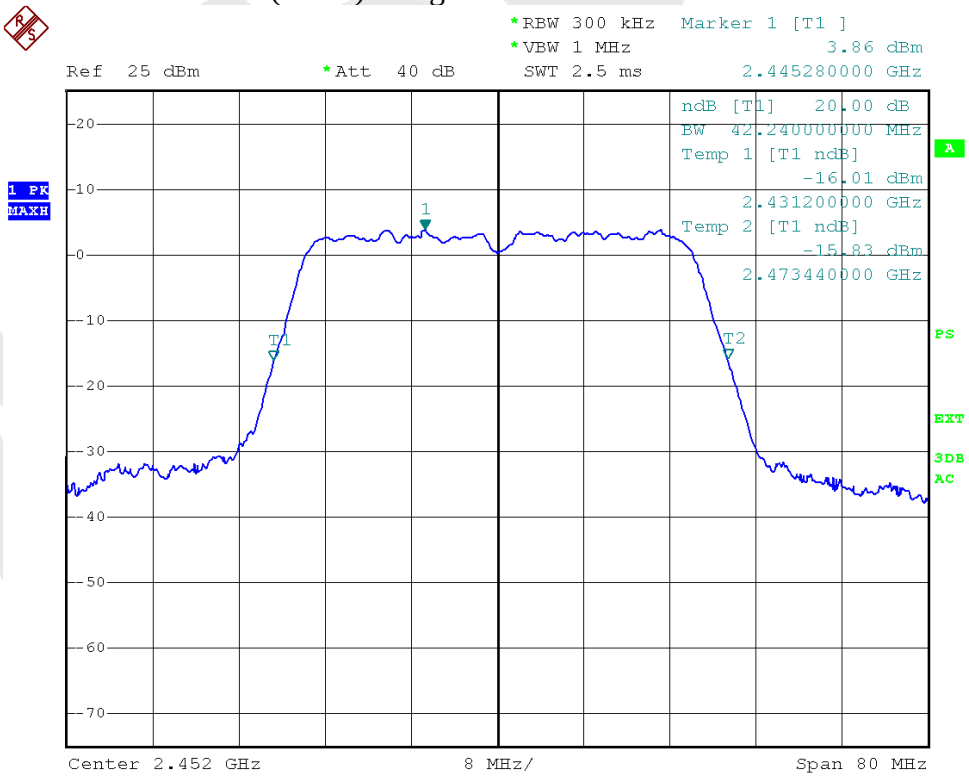

Test Mode: 802.11n (HT40)---Low



Test Mode: 802.11n (HT40)---Mid




Test Mode: 802.11n (HT40)---High

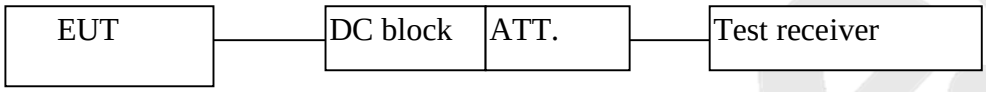


## 4.3. Maximum Output Power Test

**a. Limit**

The maximum output power of the intentional radiator shall not exceed the following:
1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt (30dBm).
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antenna of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

**b. Configuration of Measurement**




**c. Data Rates**

IEEE802.11b: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 1 Mbps data rate (worst case) are chosen for the final testing.
IEEE802.11g: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6 Mbps data rate (the worst case) are chosen for the final testing.
IEEE802.11n（HT20: Channel 1(2412MHz), Channel 6(2437MHz) and Channel 11(2462MHz) with 6.5Mbps data rate (the worst case) are chosen for the final testing.
IEEE802.11n（HT40: Channel 3(2422MHz), Channel 6(2437MHz) and Channel 9(2452MHz) with 13.5Mbps data rate (the worst case) are chosen for the final testing.

**d. Test Procedure**

**This test was according the kDB 558074 9.2.2**:
1. Set span to at least 1.5 times the OBW.
2. Set the RBW =1~5% of the OBW, not to exceed 1MHz.
3. Set VBW≥3*RBW.
4. Detector = Average.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.

**e. Test Equipment**

Same as the equipment listed in 4.2.

**f. Test Results**

Pass.

**g. Test Data**

Test mode: IEEE 802.11b

| Channel | Frequency (MHz) | Maximum transmit power (dBm) | Limit (dBm) | Limit (watts) | Result |
|---|---|---|---|---|---|
| Low | 2412 | 14.66 | 30 | 1 | Pass |
| Mid | 2437 | 14.55 | | | Pass |
| High | 2462 | 14.17 | | | Pass |

Test mode: IEEE 802.11g

| Channel | Frequency (MHz) | Maximum transmit power (dBm) | Limit (dBm) | Limit (watts) | Result |
|---|---|---|---|---|---|
| Low | 2412 | 10.36 | 30 | 1 | Pass |
| Mid | 2437 | 10.73 | | | Pass |
| High | 2462 | 10.76 | | | Pass |

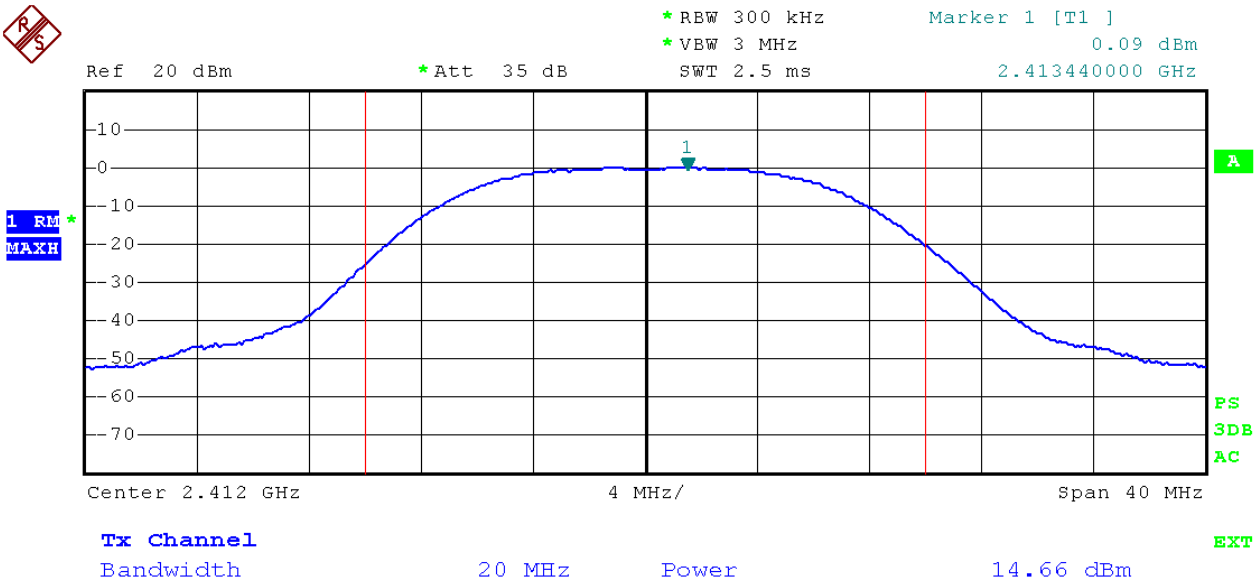
Test mode: IEEE 802.11n (HT20)

| Channel | Frequency (MHz) | Maximum transmit power (dBm) | Limit (dBm) | Limit (watts) | Result |
|---|---|---|---|---|---|
| Low | 2412 | 9.98 | 30 | 1 | Pass |
| Mid | 2437 | 10.29 | | | Pass |
| High | 2462 | 10.82 | | | Pass |

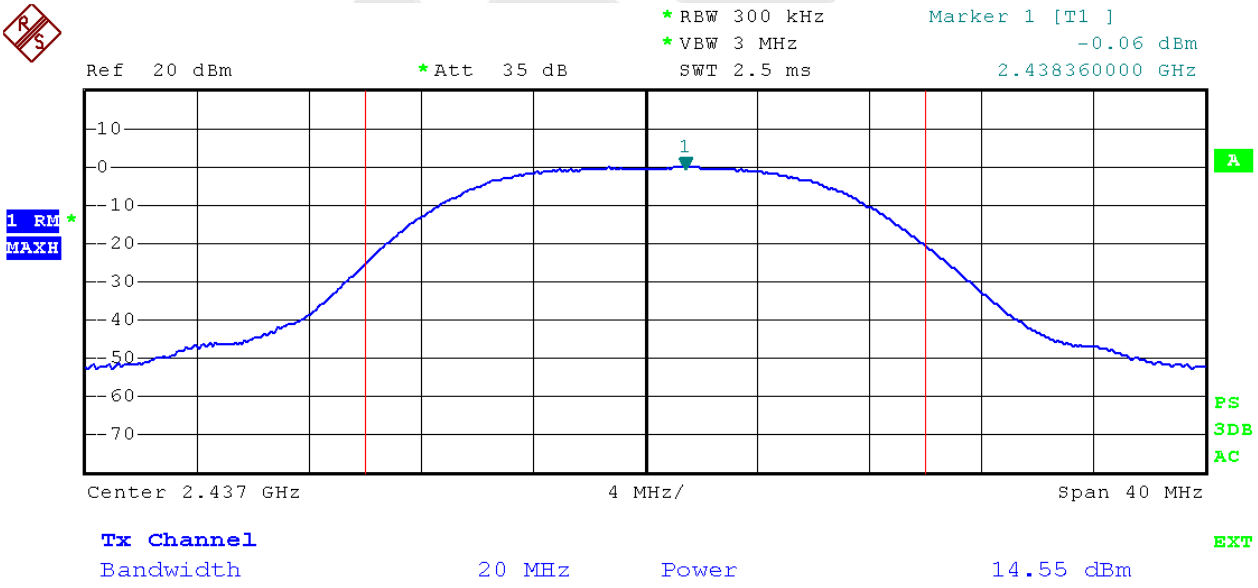
Test mode: IEEE 802.11n (HT40)

| Channel | Frequency (MHz) | Maximum transmit power (dBm) | Limit (dBm) | Limit (watts) | Result |
|---|---|---|---|---|---|
| Low | 2422 | 9.40 | 30 | 1 | Pass |
| Mid | 2437 | 9.59 | | | Pass |
| High | 2452 | 9.97 | | | Pass |

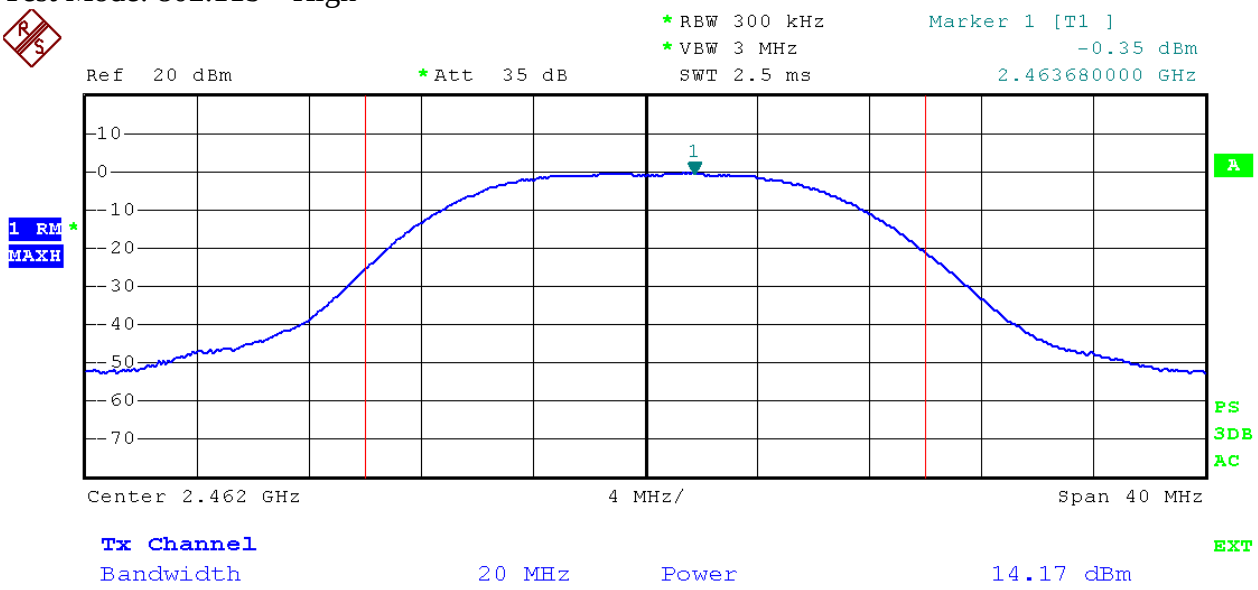
Test Mode: 802.11b---Low



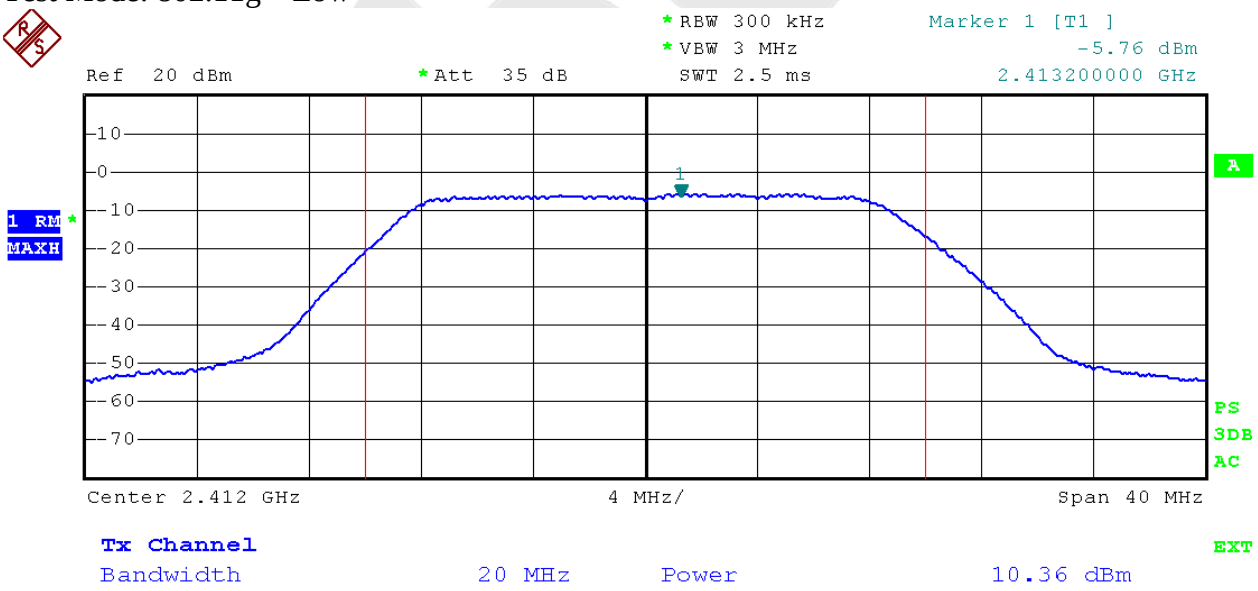

Test Mode: 802.11b---Mid



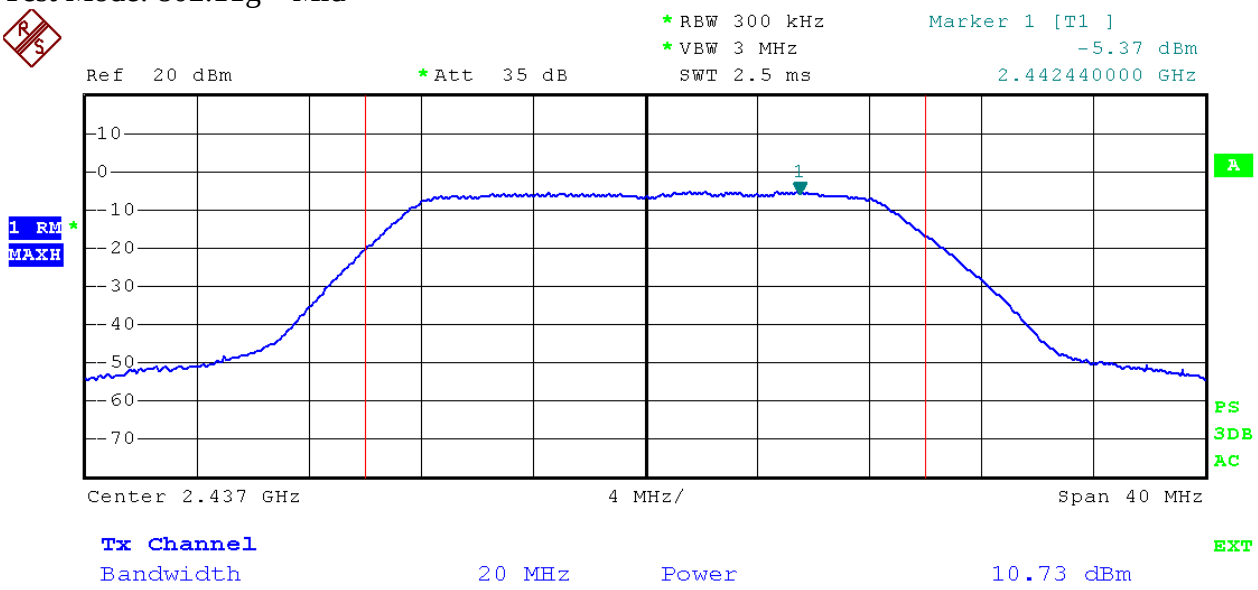
Test Mode: 802.11b---High



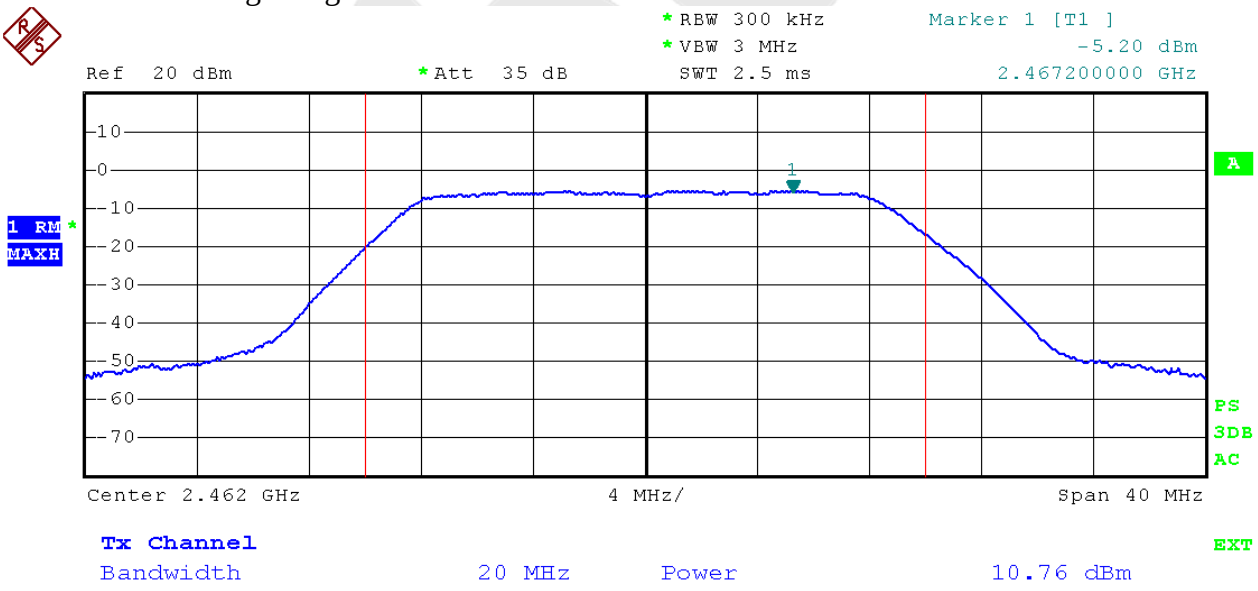

Test Mode: 802.11g---Low



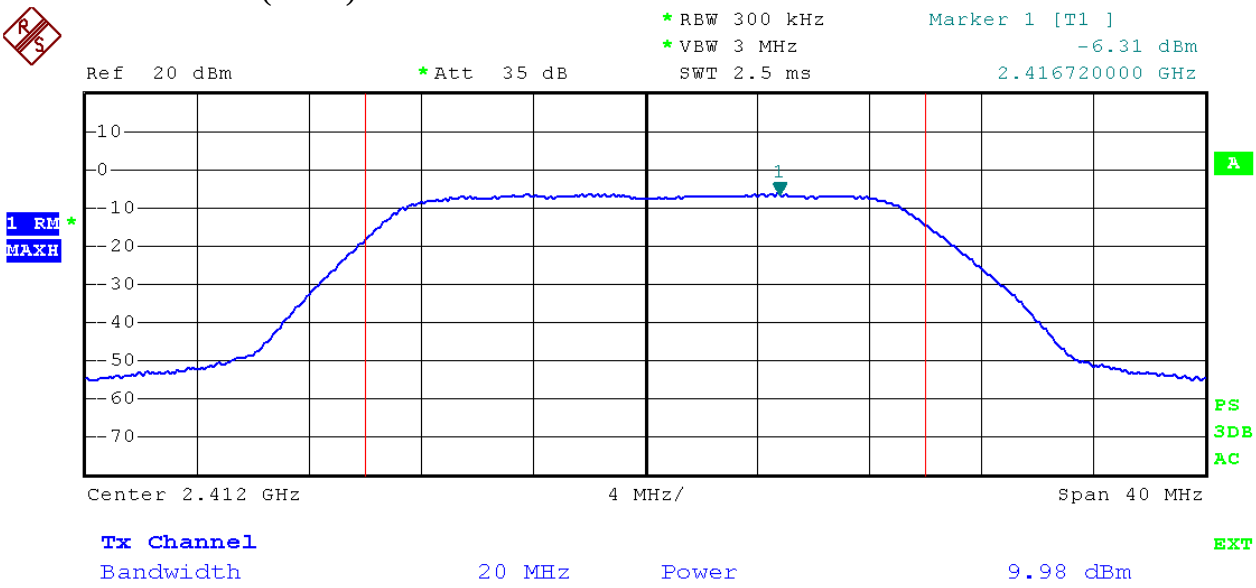
Test Mode: 802.11g---Mid



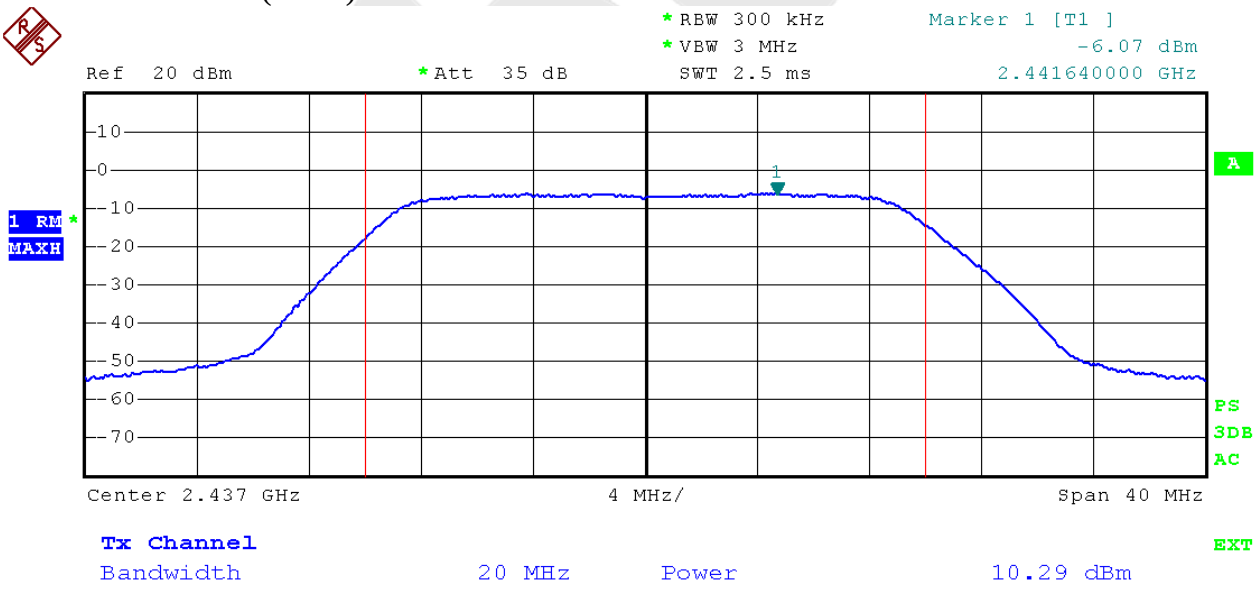

Test Mode: 802.11g---High



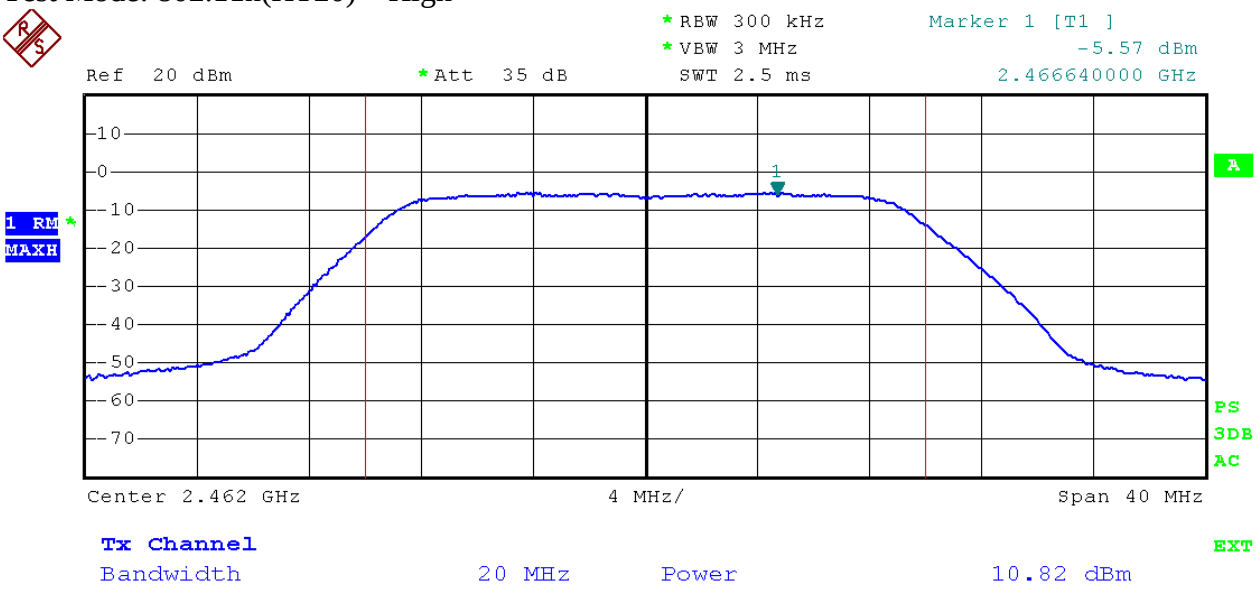
Test Mode: 802.11n(HT20)---Low



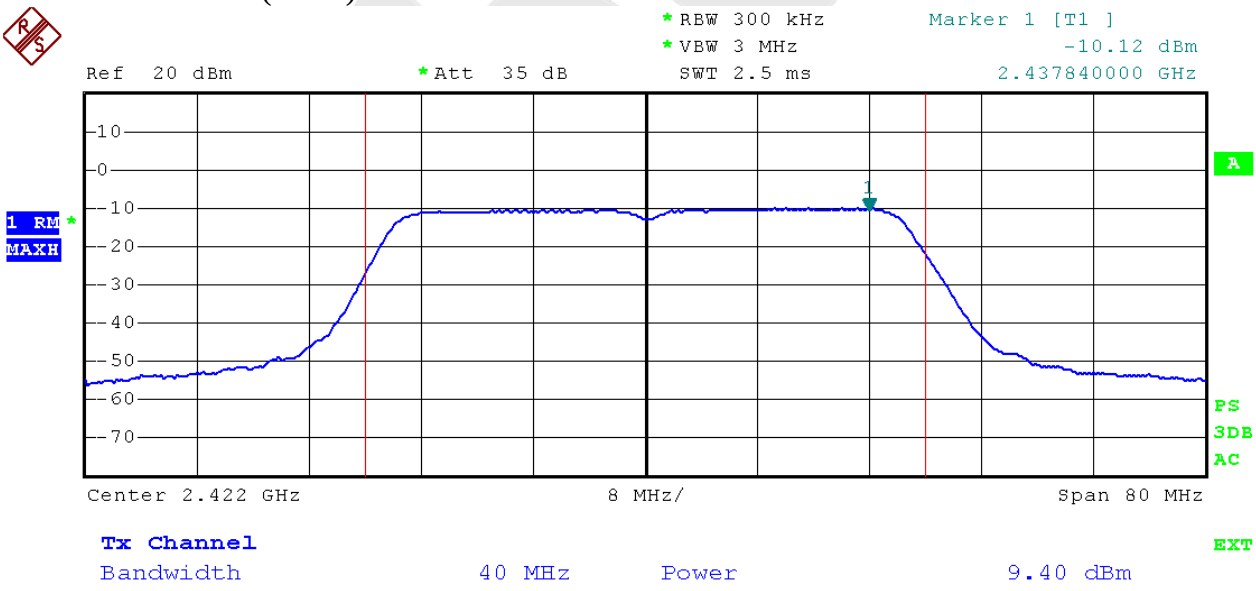

Test Mode: 802.11n(HT20)---Mid



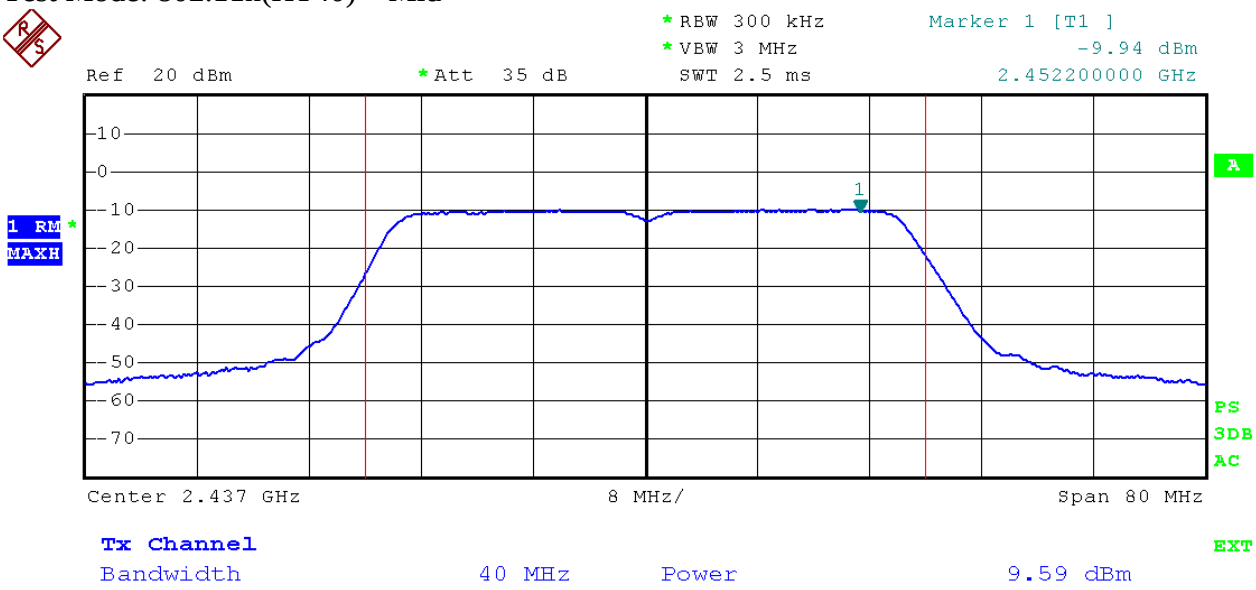
Test Mode: 802.11n(HT20)---High



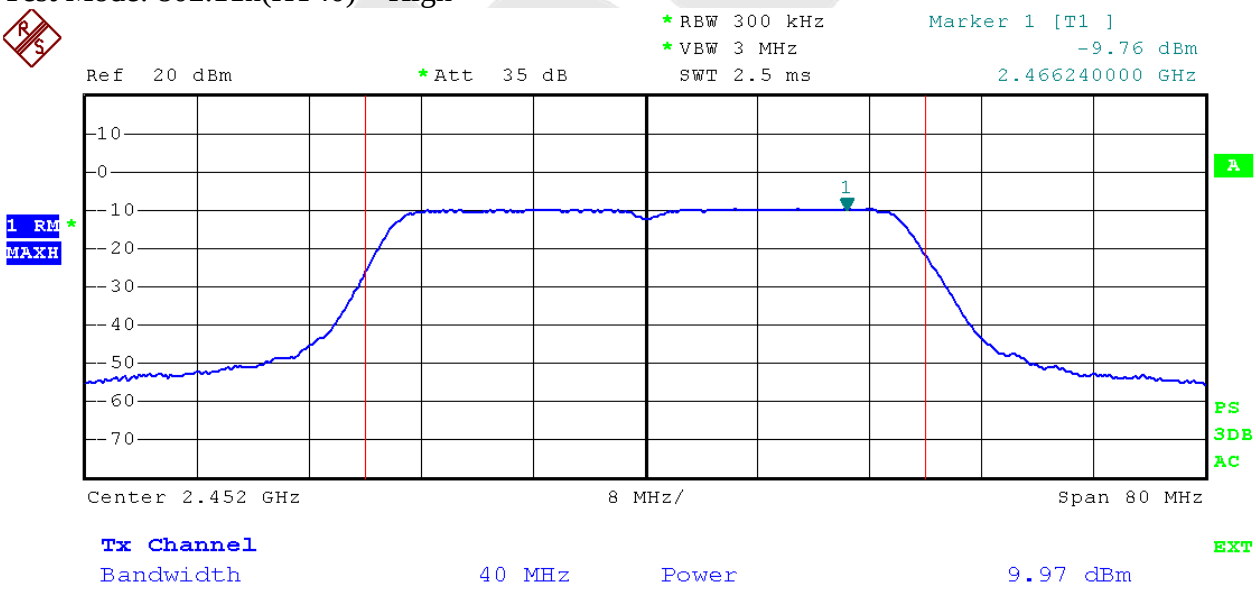

Test Mode: 802.11n(HT40)---Low



Test Mode: 802.11n(HT40)---Mid




Test Mode: 802.11n(HT40)---High



## 4.4. Band Edges Measurement

**a. Limit**

According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

**b. Test Procedure**

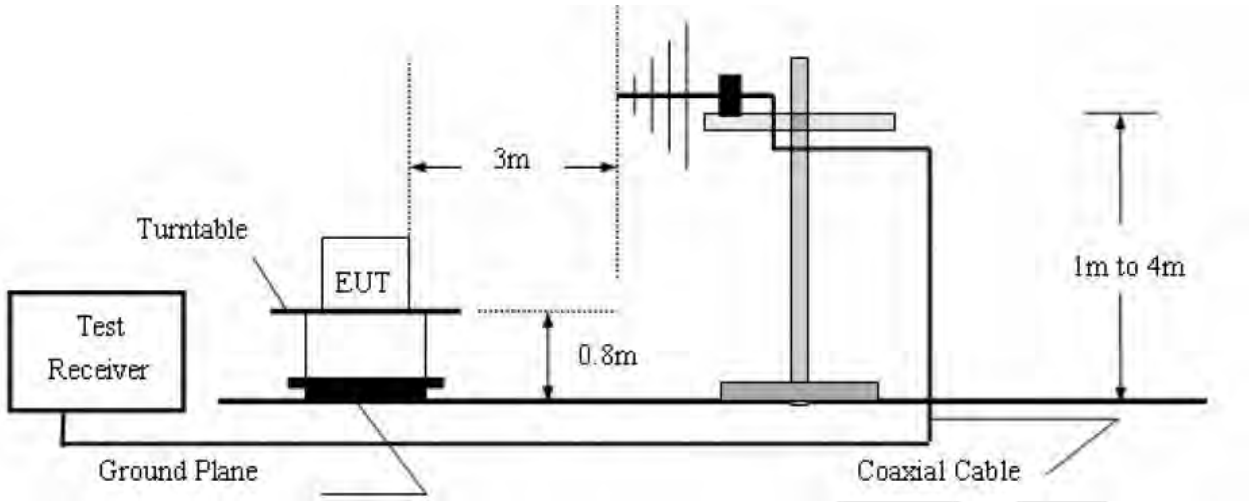
1. Conducted Method:

1) Set RBW=100KHz, VBW=300KHz
2) Detector=peak
3) Sweep time= auto
4) Trace mode=max hold.

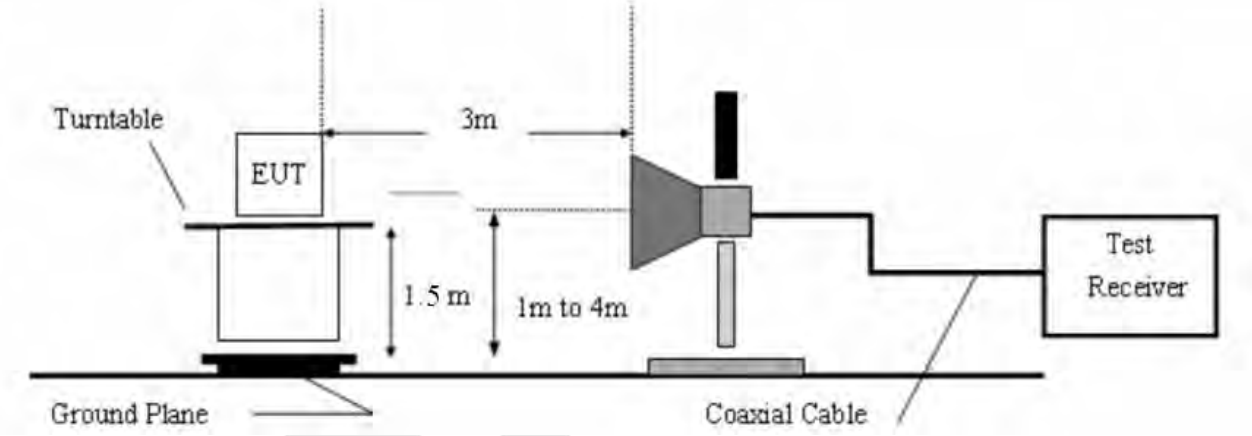
2. Radiated Method:

1) For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane. The EUT is tested in 9*6*6 Chamber.
   For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane. The EUT is tested in 9*6*6 Chamber.
2) The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3) EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4) Peak detector: RBW=1MHz, VBW=3MHz, SWT=AUTO
   Average detector: RBW=1MHz, VBW=10Hz, SWT=AUTO
   The EUT is tested in 9*6*6 Chamber.
5) Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

30M to 1G emissions:




1G to 40G emissions:




**c. Test Equipment**

Same as the equipment listed in 4.2.

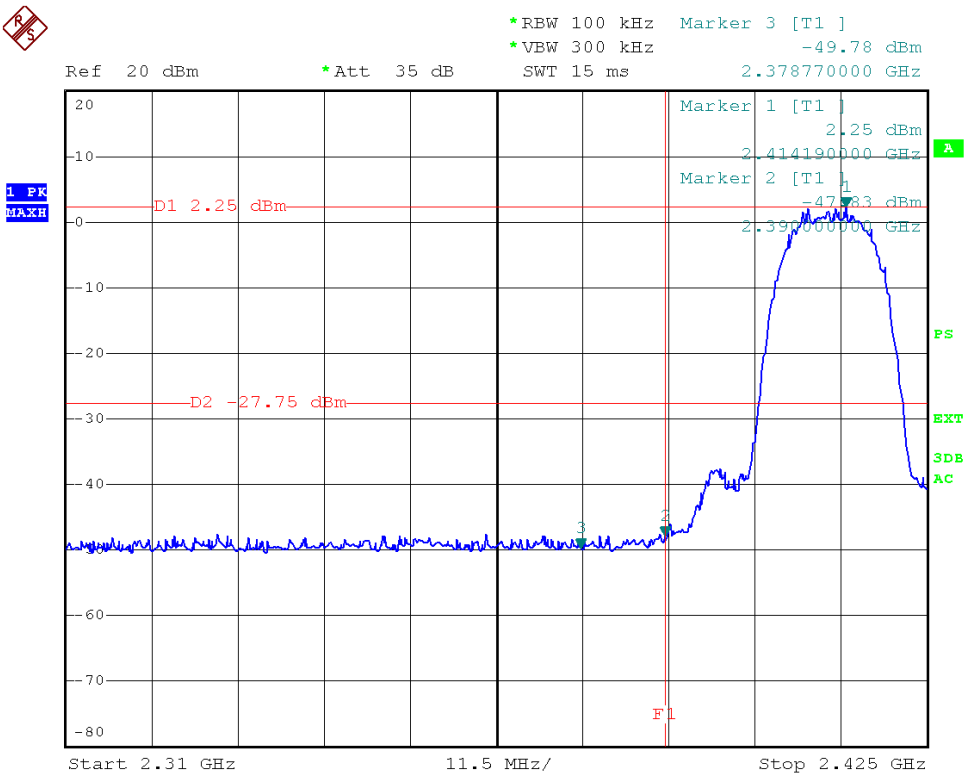
**d. Test Results**

Pass.

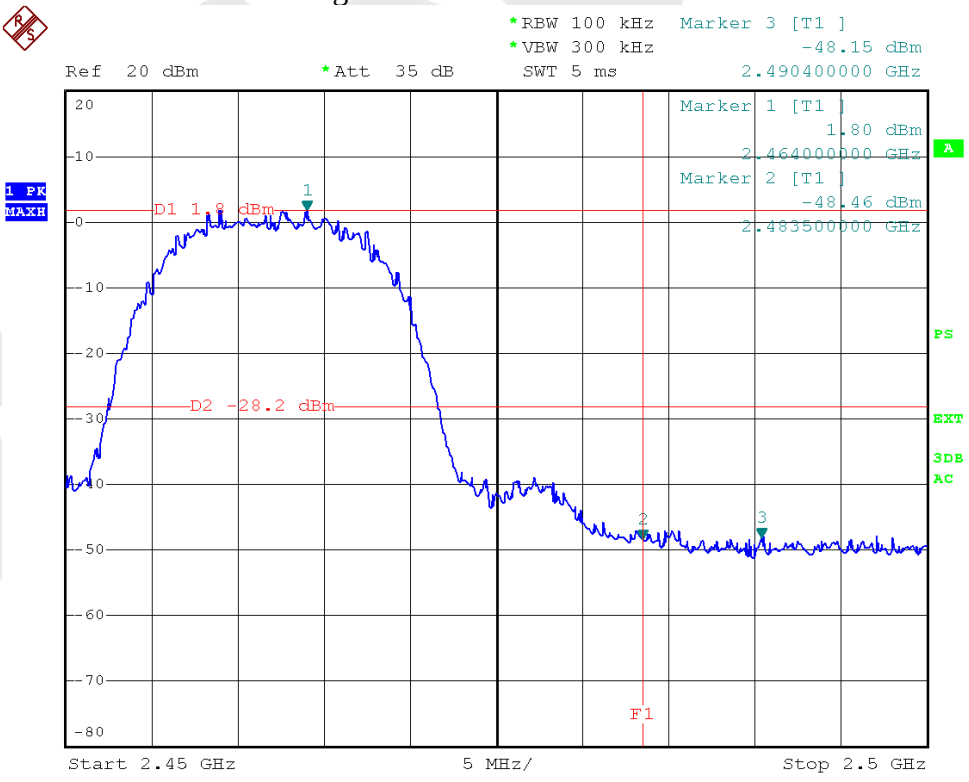
**e. Test Plots**

See the following page.

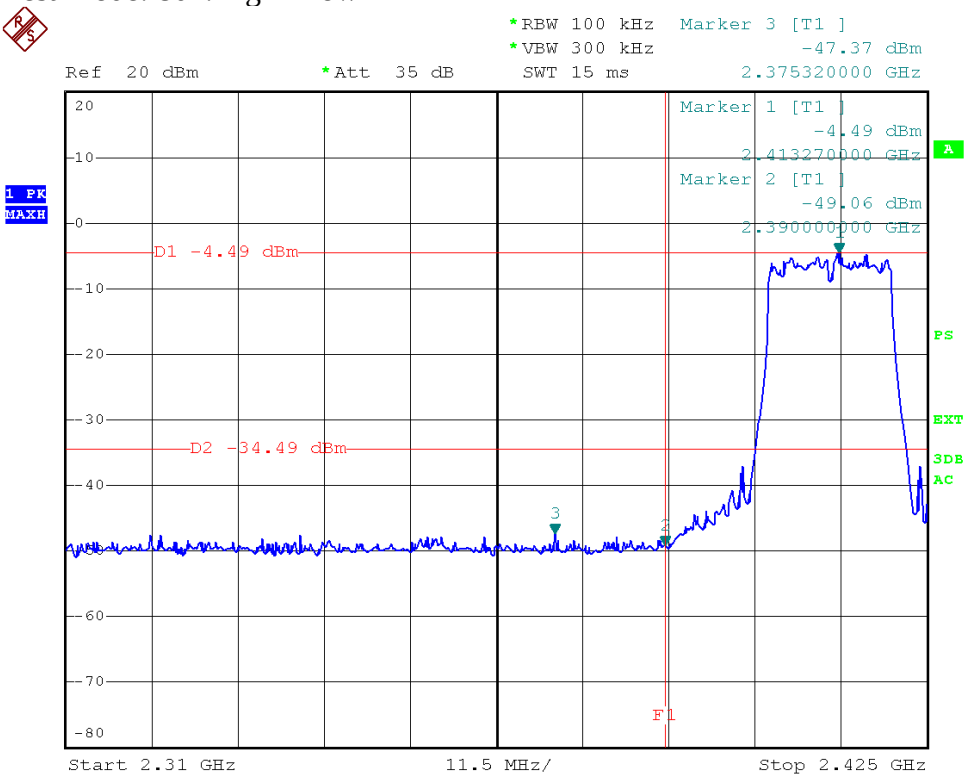
Test Mode: 802.11b ---Low



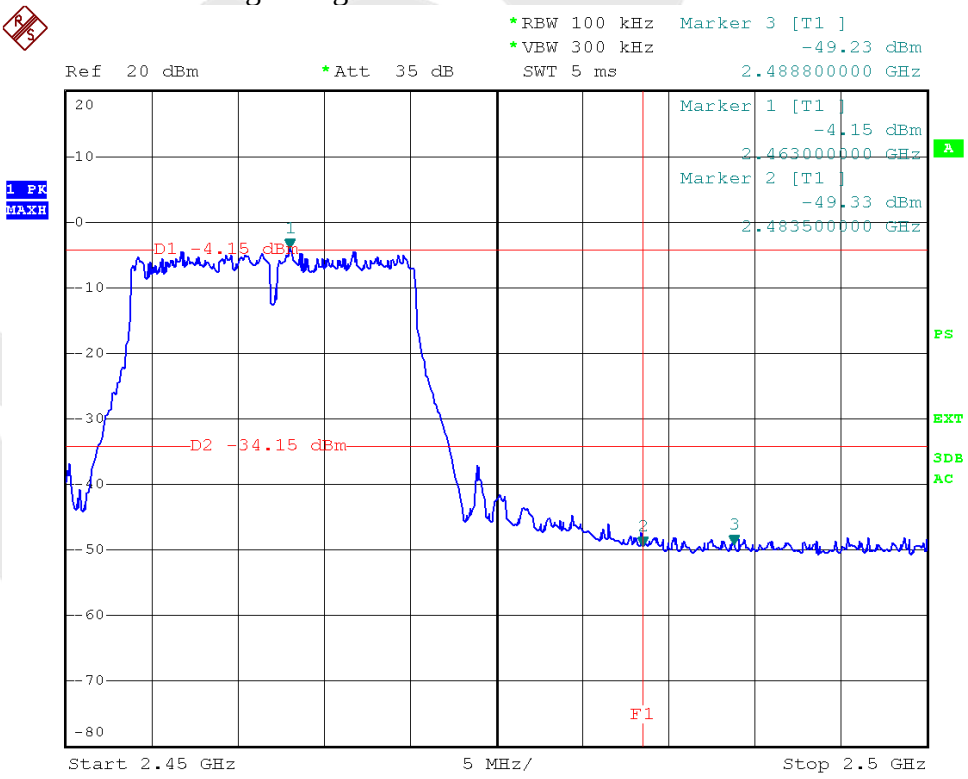

Test Mode: 802.11b ---High



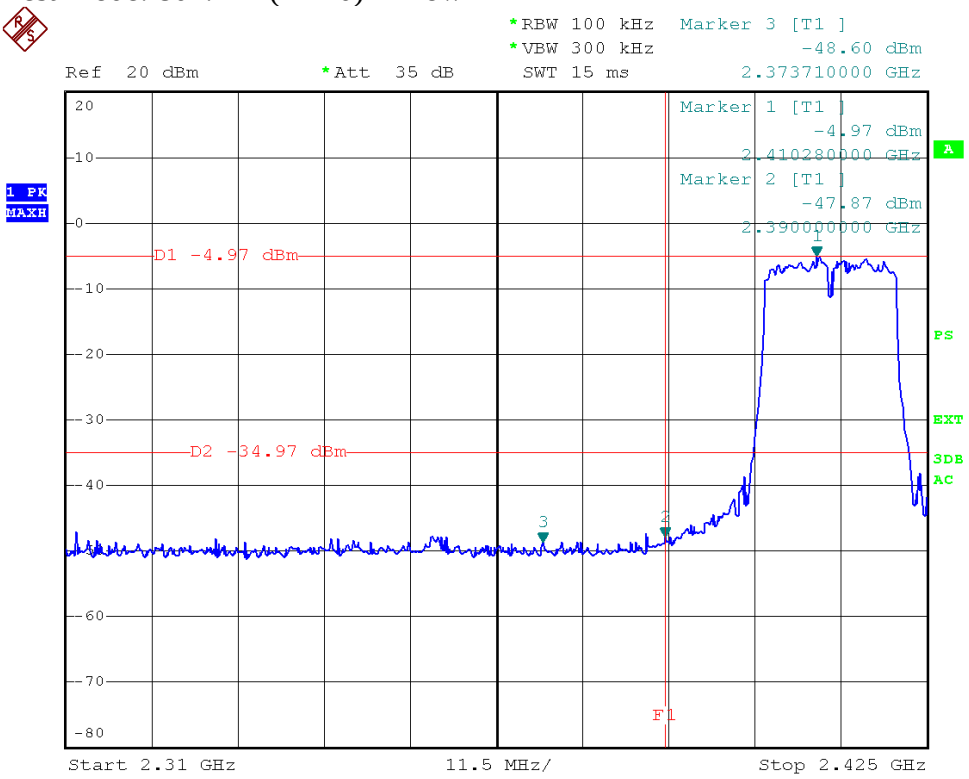
Test Mode: 802.11g ---Low



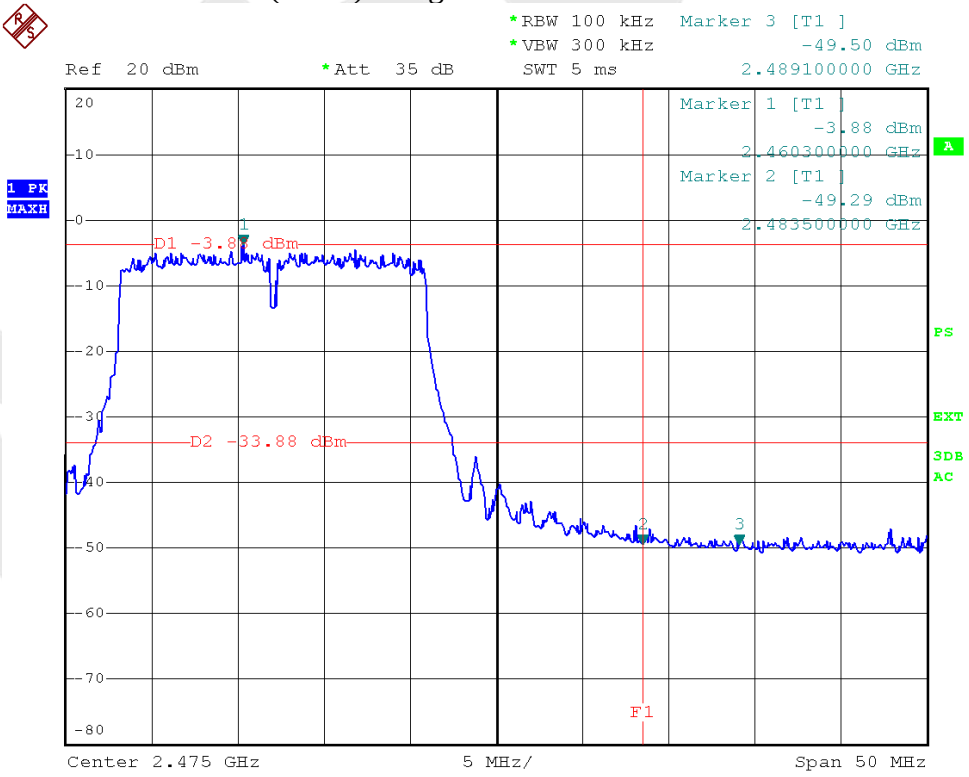

Test Mode: 802.11g ---High



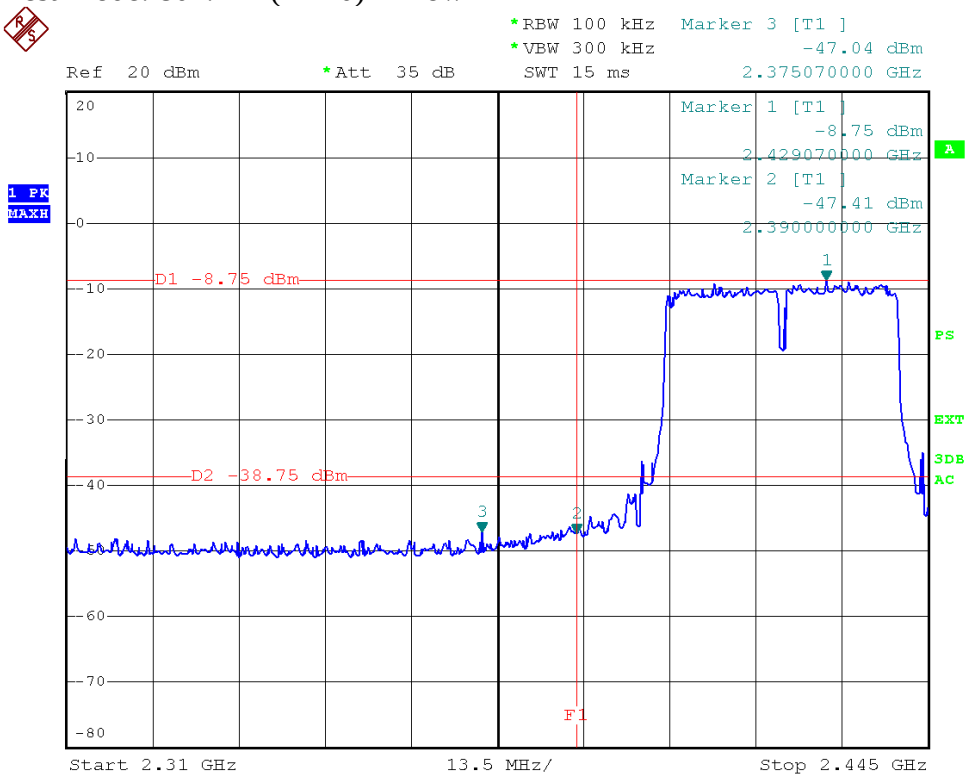
Test Mode: 802.11n (HT20) ---Low



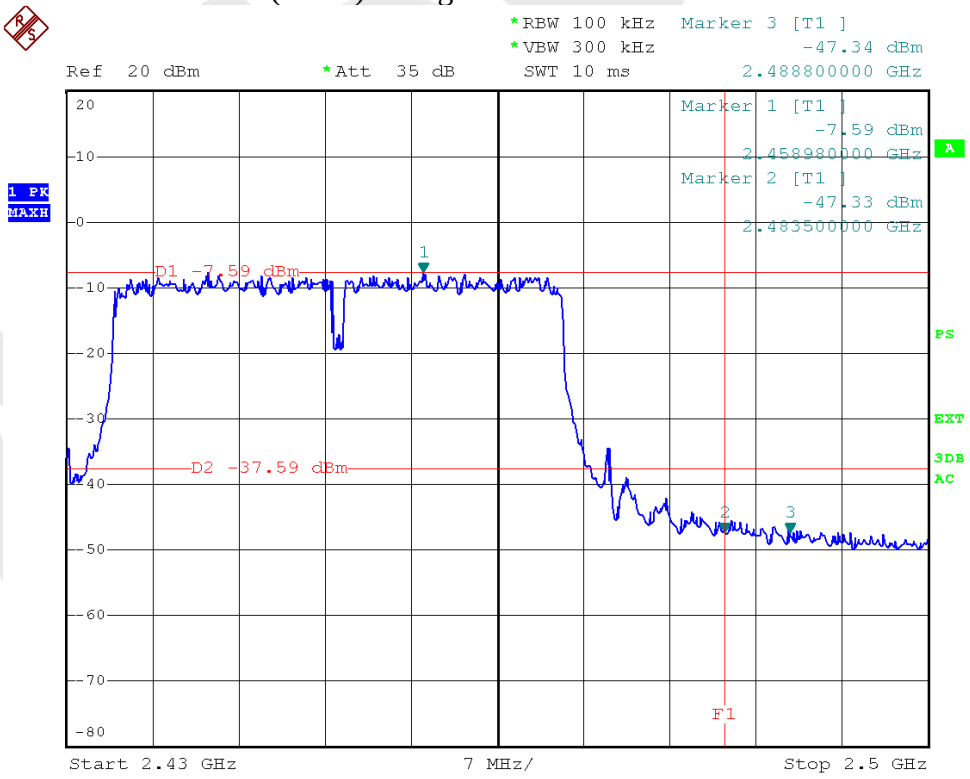

Test Mode: 802.11n (HT20)---High



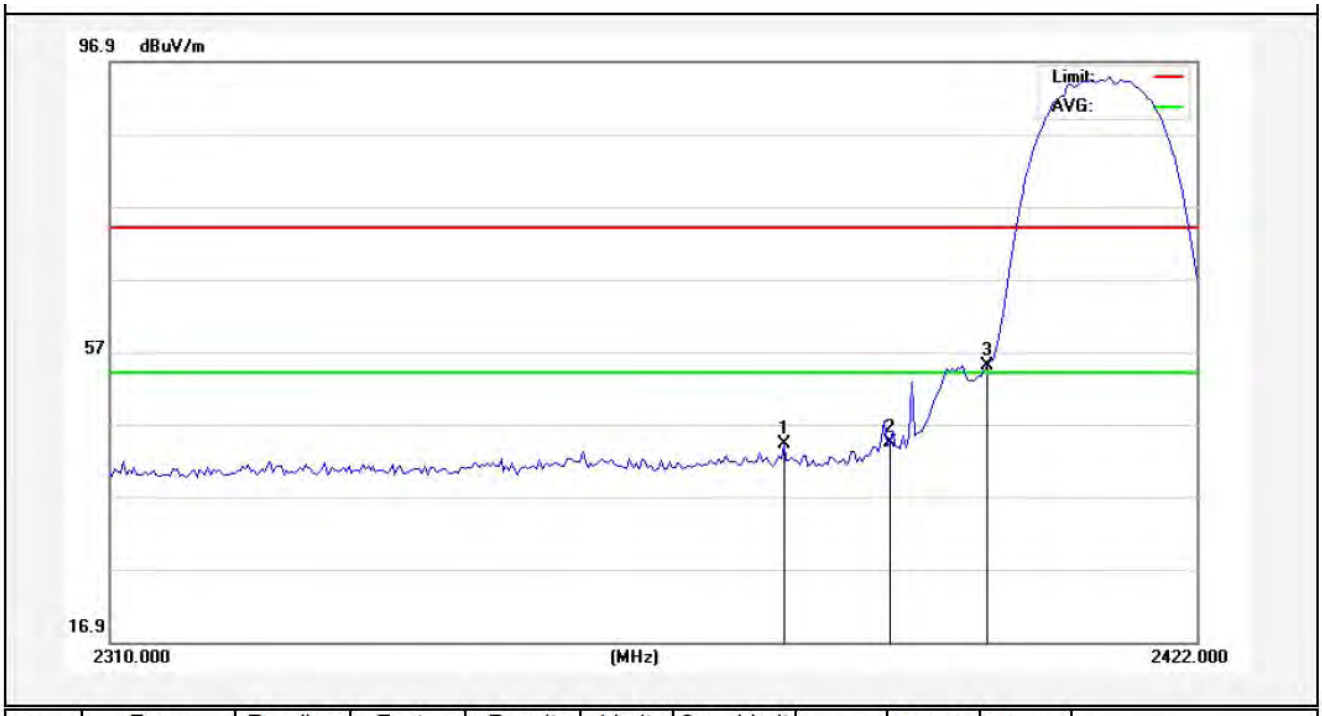
Test Mode: 802.11n (HT40) ---Low




Test Mode: 802.11n (HT40) ---High

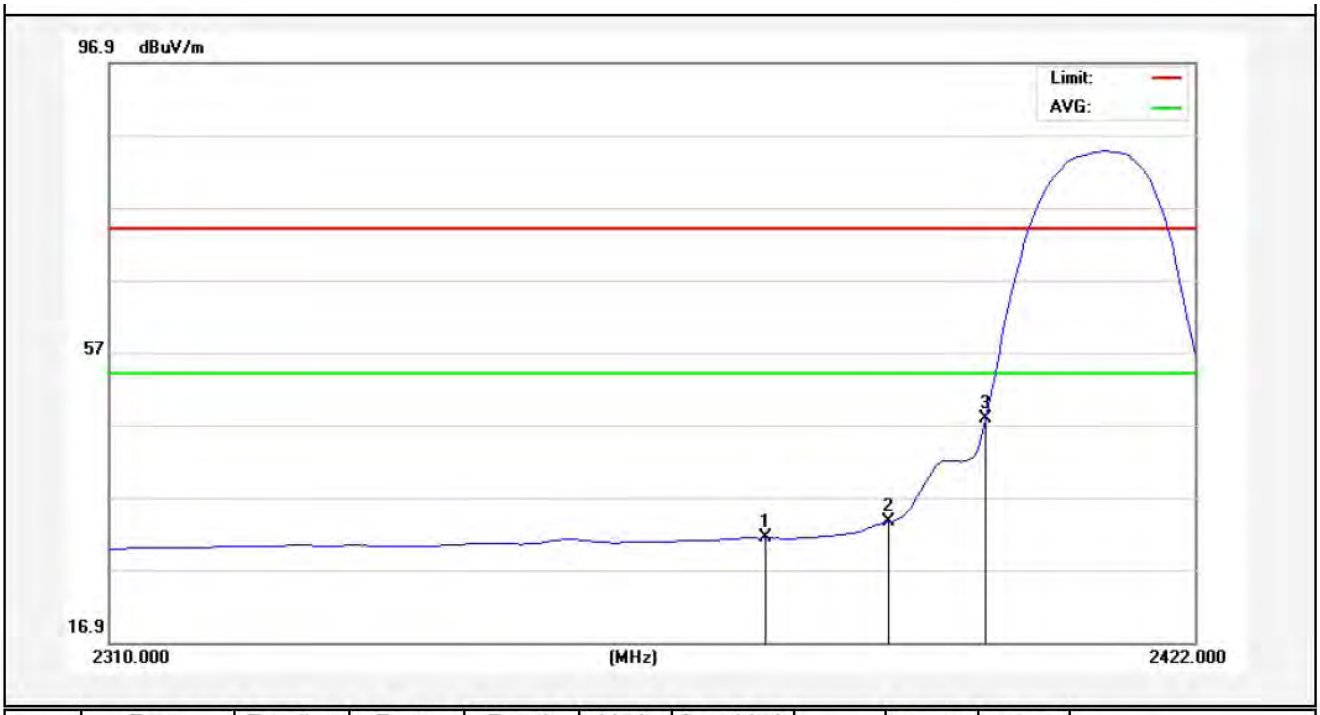


Test Mode: 802.11b
2412MHz
Horizontal-PEAK:



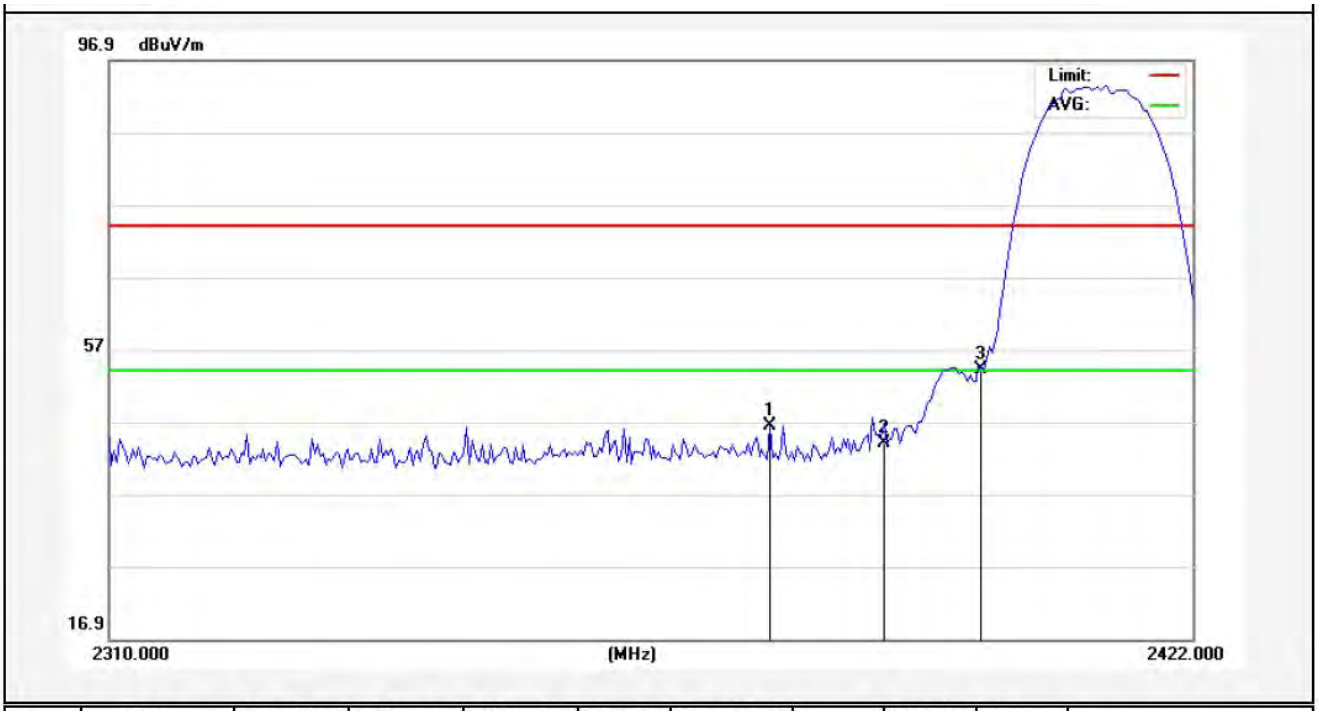

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2378.880 | 46.78 | -2.54 | 44.24 | 74.00 | -29.76 | peak | | | |
| 2 | 2390.000 | 46.82 | -2.51 | 44.31 | 74.00 | -29.69 | peak | | | |
| 3 | 2400.000 | 57.49 | -2.49 | 55.00 | 74.00 | -19.00 | peak | | | |

Horizontal-AV:



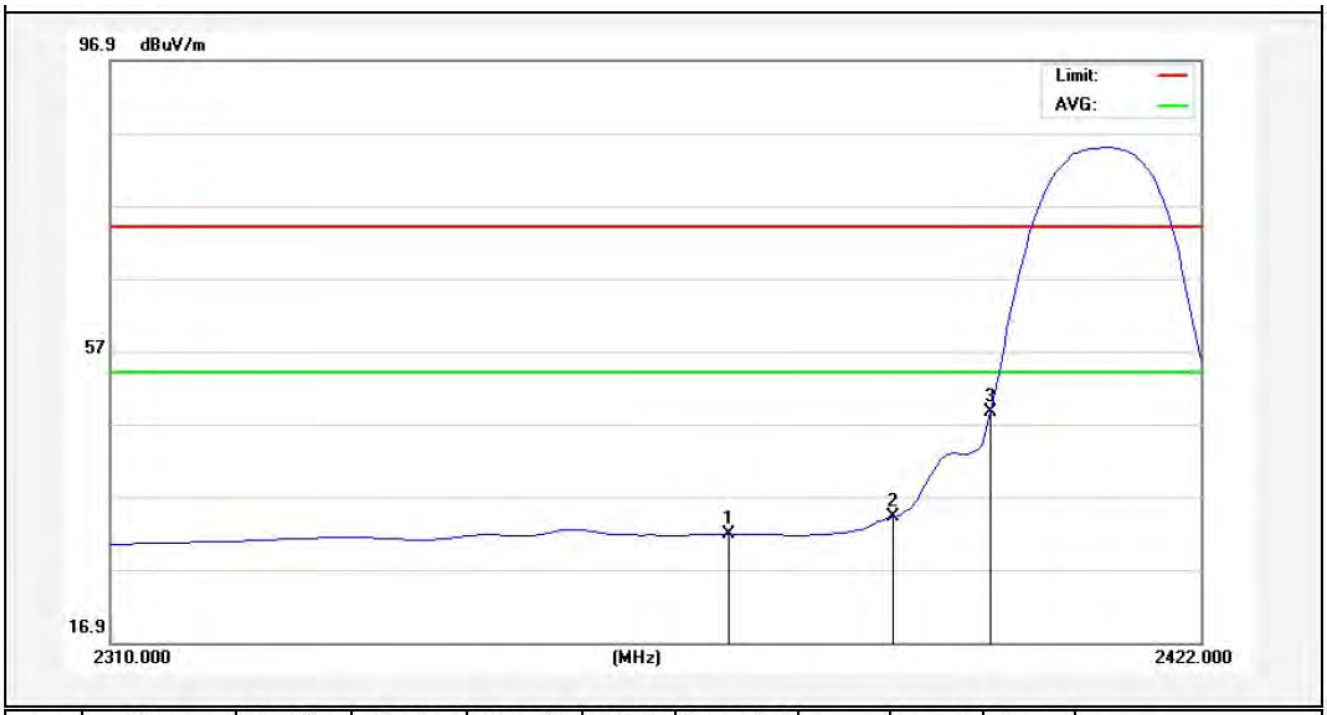

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2377.200 | 33.88 | -2.54 | 31.34 | 54.00 | -22.66 | AVG | | | |
| 2 | 2390.000 | 36.02 | -2.51 | 33.51 | 54.00 | -20.49 | AVG | | | |
| 3 | 2400.000 | 50.27 | -2.49 | 47.78 | 54.00 | -6.22 | AVG | | | |

Test Mode: 802.11b
2412MHz
Vertical-PEAK:



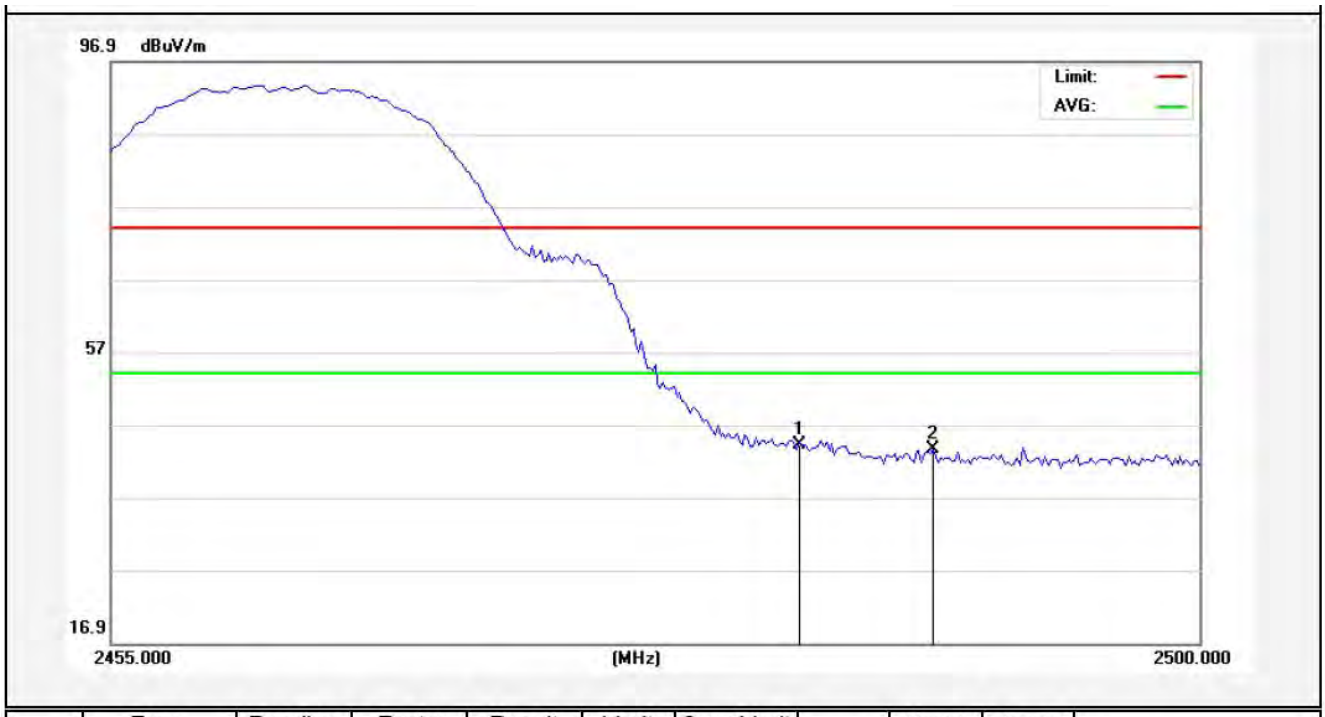

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2377.760 | 49.02 | -2.54 | 46.48 | 74.00 | -27.52 | peak | | | |
| 2 | 2390.000 | 46.58 | -2.51 | 44.07 | 74.00 | -29.93 | peak | | | |
| 3 | 2400.000 | 56.64 | -2.49 | 54.15 | 74.00 | -19.85 | peak | | | |

Vertical-AV:



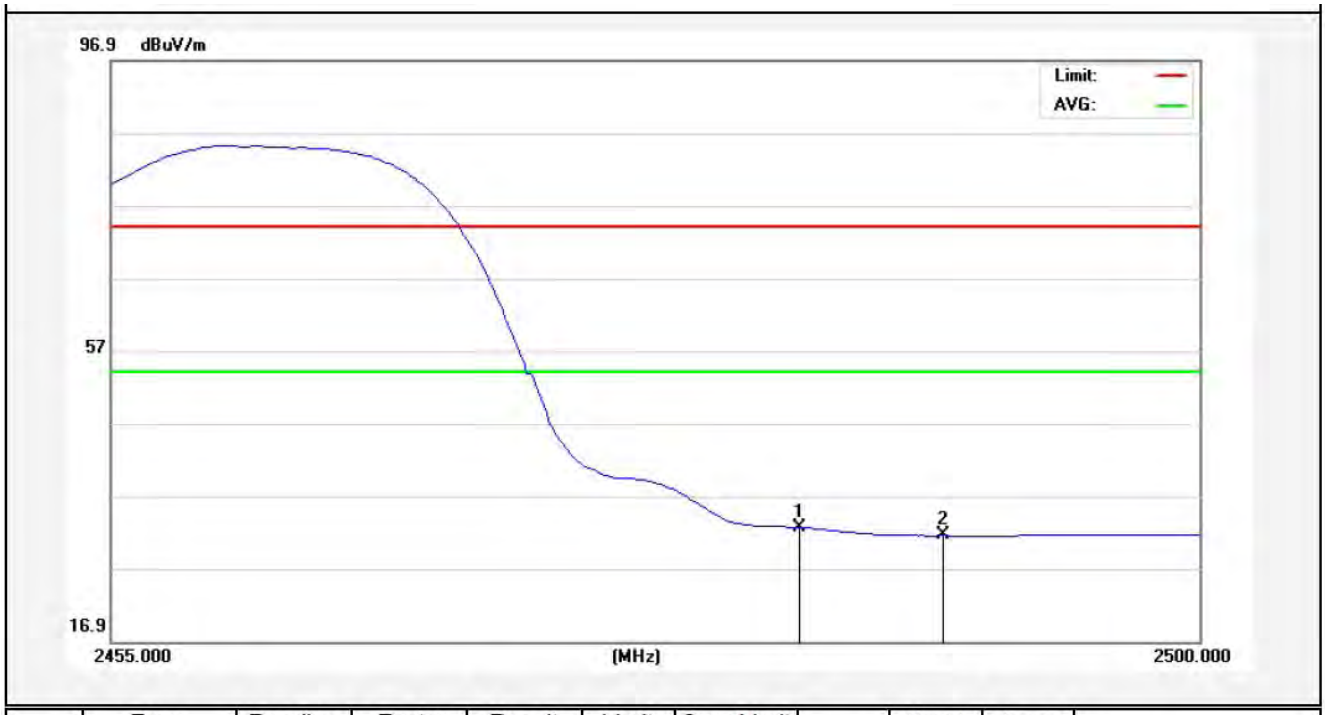

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2373.000 | 34.42 | -2.55 | 31.87 | 54.00 | -22.13 | AVG | | | |
| 2 | 2390.000 | 36.67 | -2.51 | 34.16 | 54.00 | -19.84 | AVG | | | |
| 3 | 2400.000 | 51.11 | -2.49 | 48.62 | 54.00 | -5.38 | AVG | | | |

Test Mode: 802.11b
2462MHz
Horizontal-PEAK:



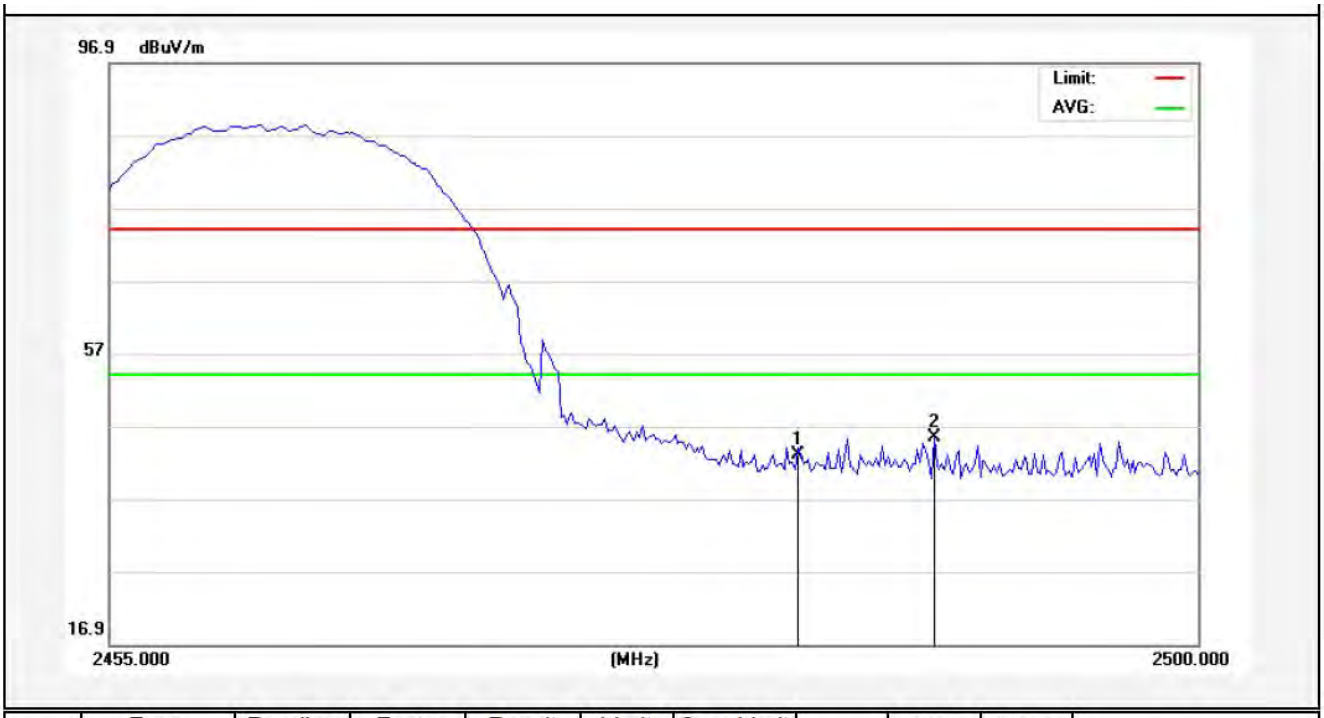

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 46.60 | -2.31 | 44.29 | 74.00 | -29.71 | peak | | | |
| 2 | 2488.975 | 45.92 | -2.29 | 43.63 | 74.00 | -30.37 | peak | | | |

Horizontal-AV:



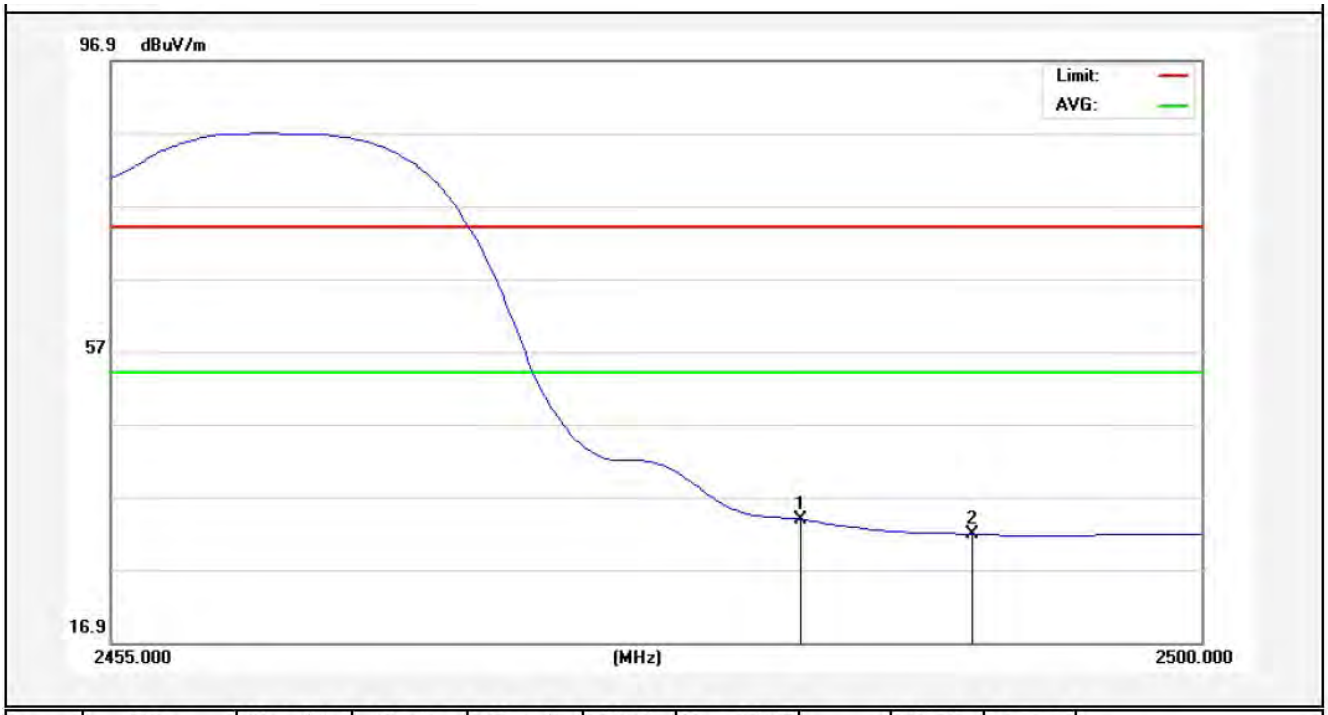

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 34.89 | -2.31 | 32.58 | 54.00 | -21.42 | AVG | | | |
| 2 | 2489.425 | 33.80 | -2.29 | 31.51 | 54.00 | -22.49 | AVG | | | |

Test Mode: 802.11b
2462MHz
Vertical-PEAK:



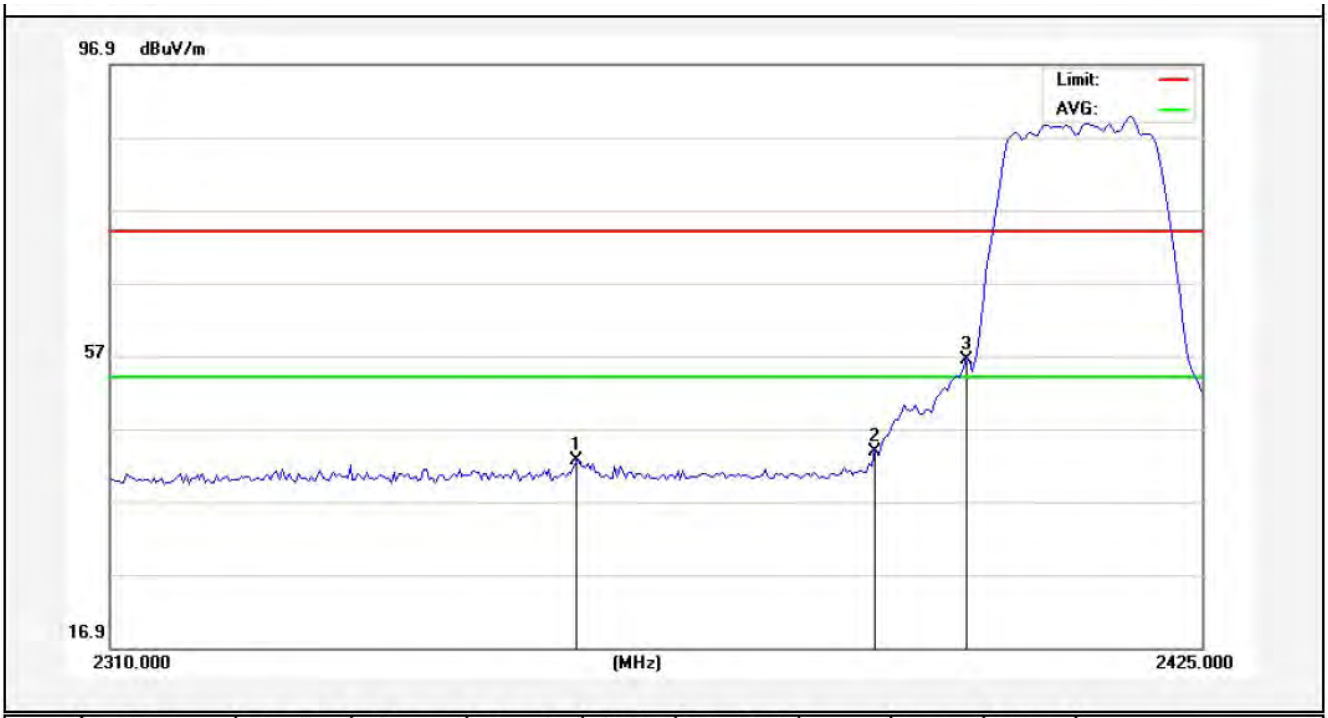

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 45.25 | -2.31 | 42.94 | 74.00 | -31.06 | peak | | | |
| 2 | 2489.088 | 47.62 | -2.29 | 45.33 | 74.00 | -28.67 | peak | | | |

Vertical-AV:



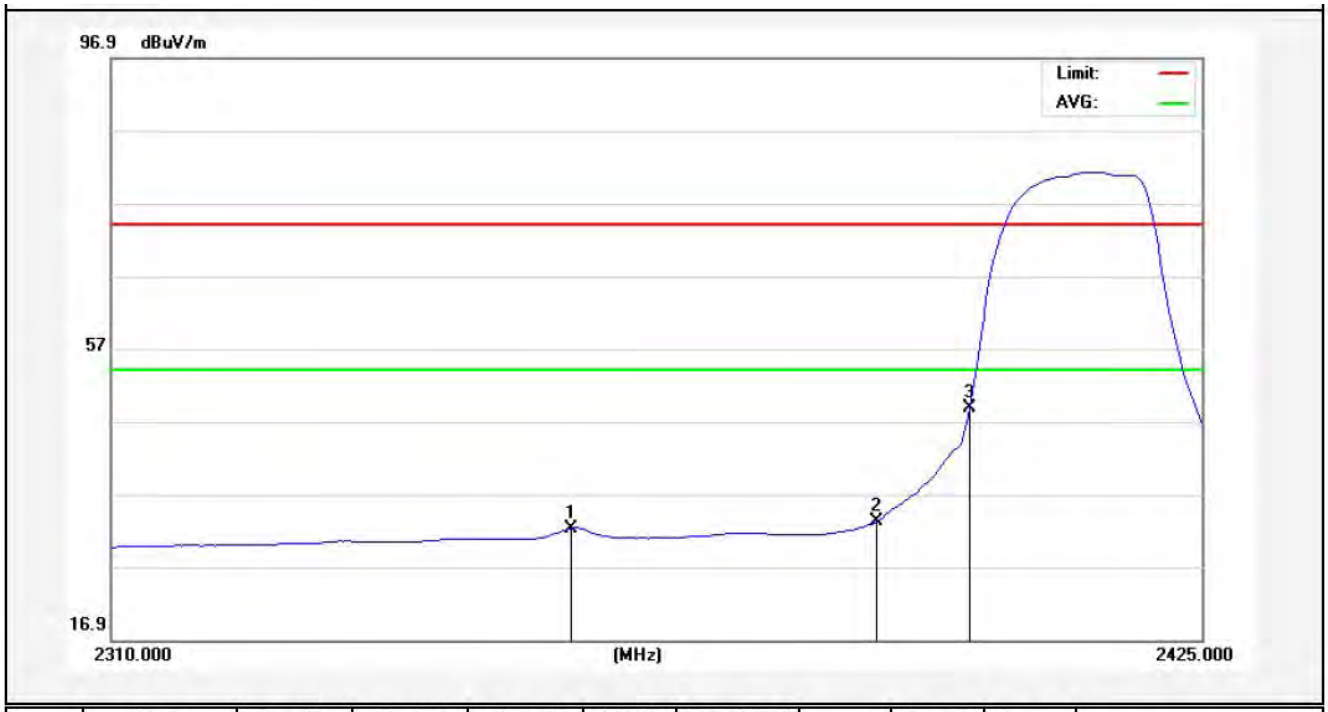

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 36.09 | -2.31 | 33.78 | 54.00 | -20.22 | AVG | | | |
| 2 | 2490.550 | 34.10 | -2.29 | 31.81 | 54.00 | -22.19 | AVG | | | |

Test Mode: 802.11g
2412MHz
Horizontal-PEAK:



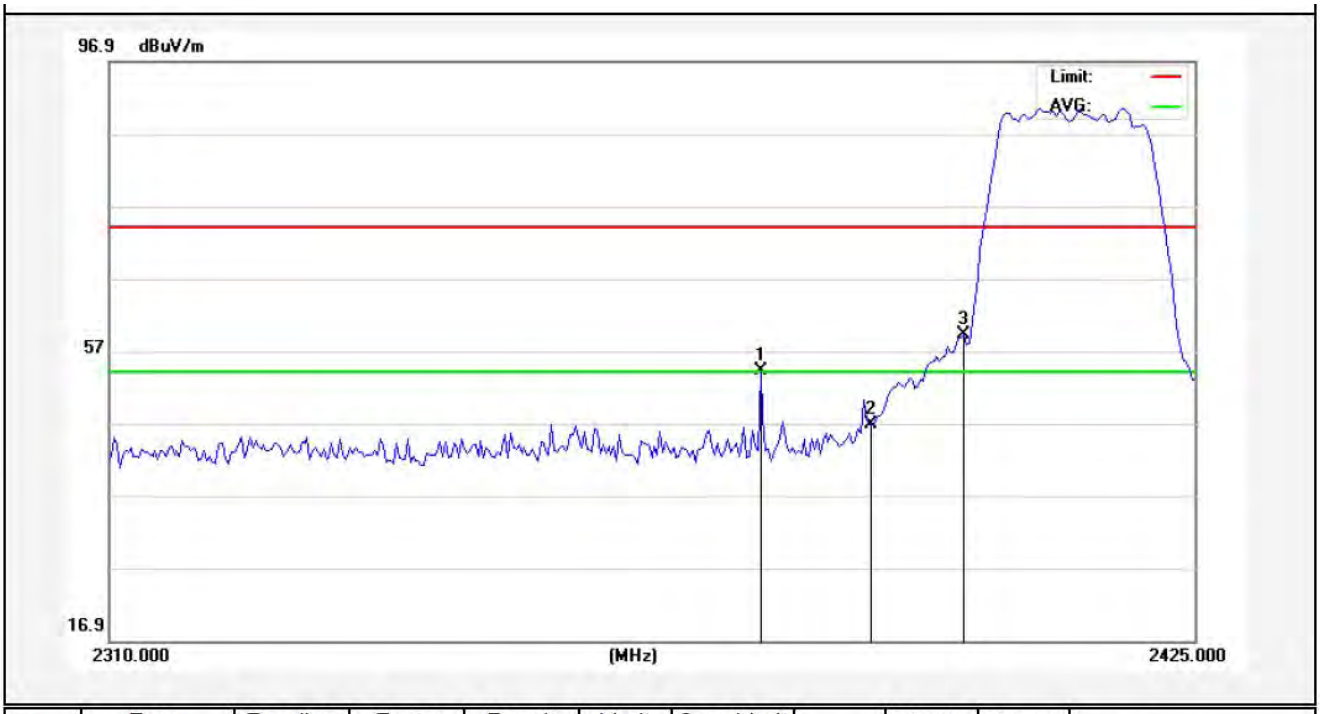

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2358.588 | 45.14 | -2.58 | 42.56 | 74.00 | -31.44 | peak | | | |
| 2 | 2390.000 | 46.25 | -2.51 | 43.74 | 74.00 | -30.26 | peak | | | |
| 3 | 2400.000 | 58.93 | -2.49 | 56.44 | 74.00 | -17.56 | peak | | | |

Horizontal-AV:



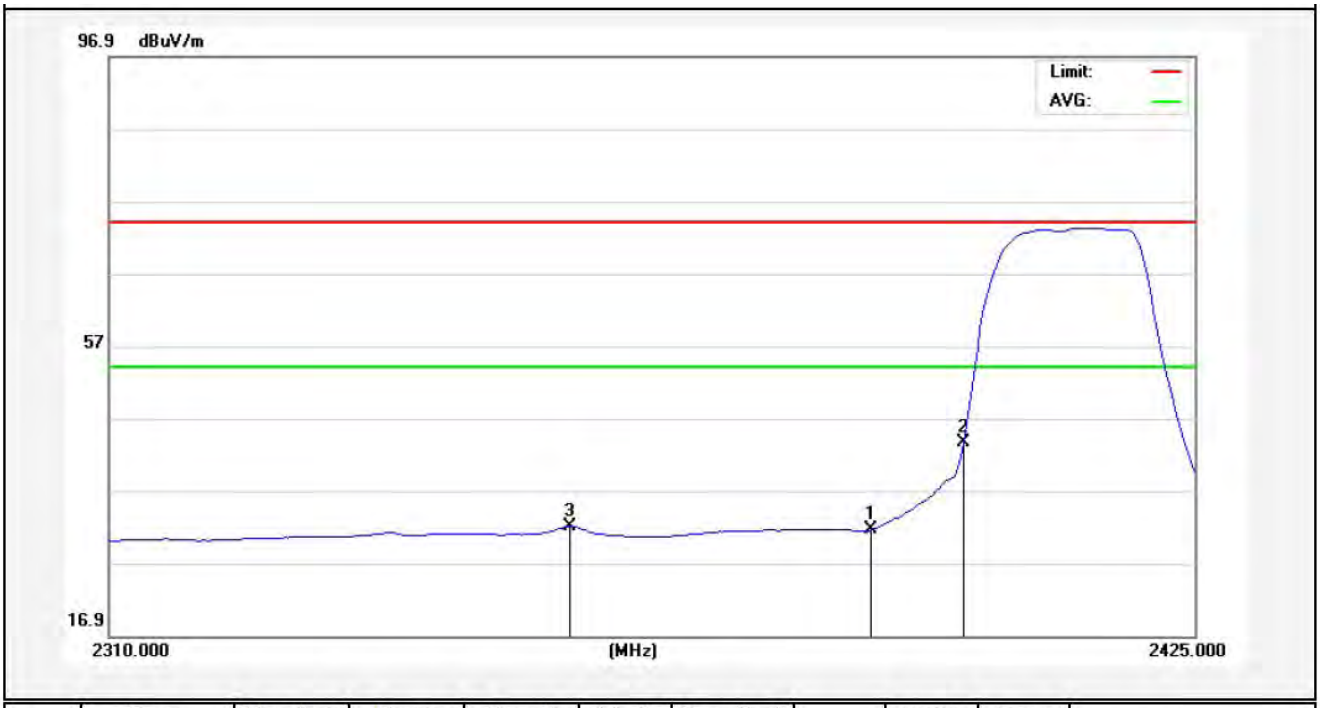

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2358.012 | 34.88 | -2.59 | 32.29 | 54.00 | -21.71 | AVG | | | |
| 2 | 2390.000 | 35.77 | -2.51 | 33.26 | 54.00 | -20.74 | AVG | | | |
| 3 | 2400.000 | 51.29 | -2.49 | 48.80 | 54.00 | -5.20 | AVG | | | |

Test Mode: 802.11g
2412MHz
Vertical-PEAK:



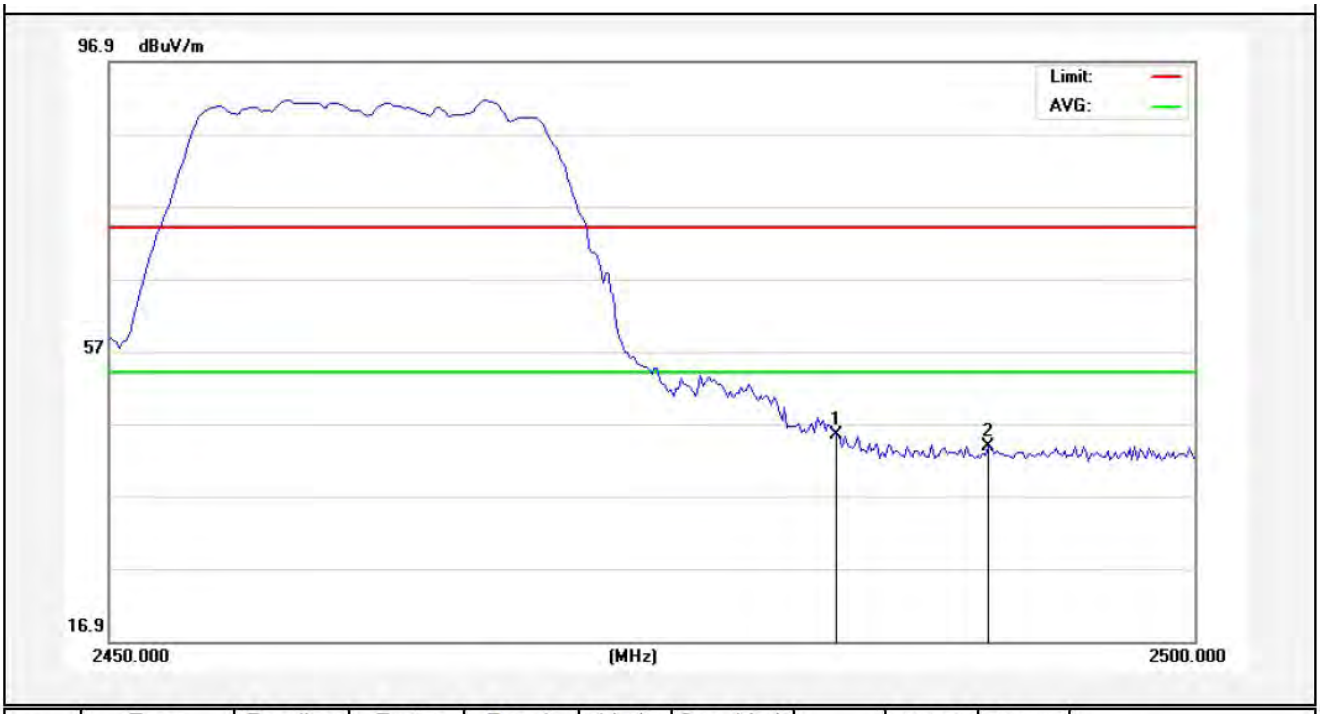

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2378.425 | 56.79 | -2.54 | 54.25 | 74.00 | -19.75 | peak | | | |
| 2 | 2390.000 | 49.33 | -2.51 | 46.82 | 74.00 | -27.18 | peak | | | |
| 3 | 2400.000 | 61.65 | -2.49 | 59.16 | 74.00 | -14.84 | peak | | | |

Vertical-AV:



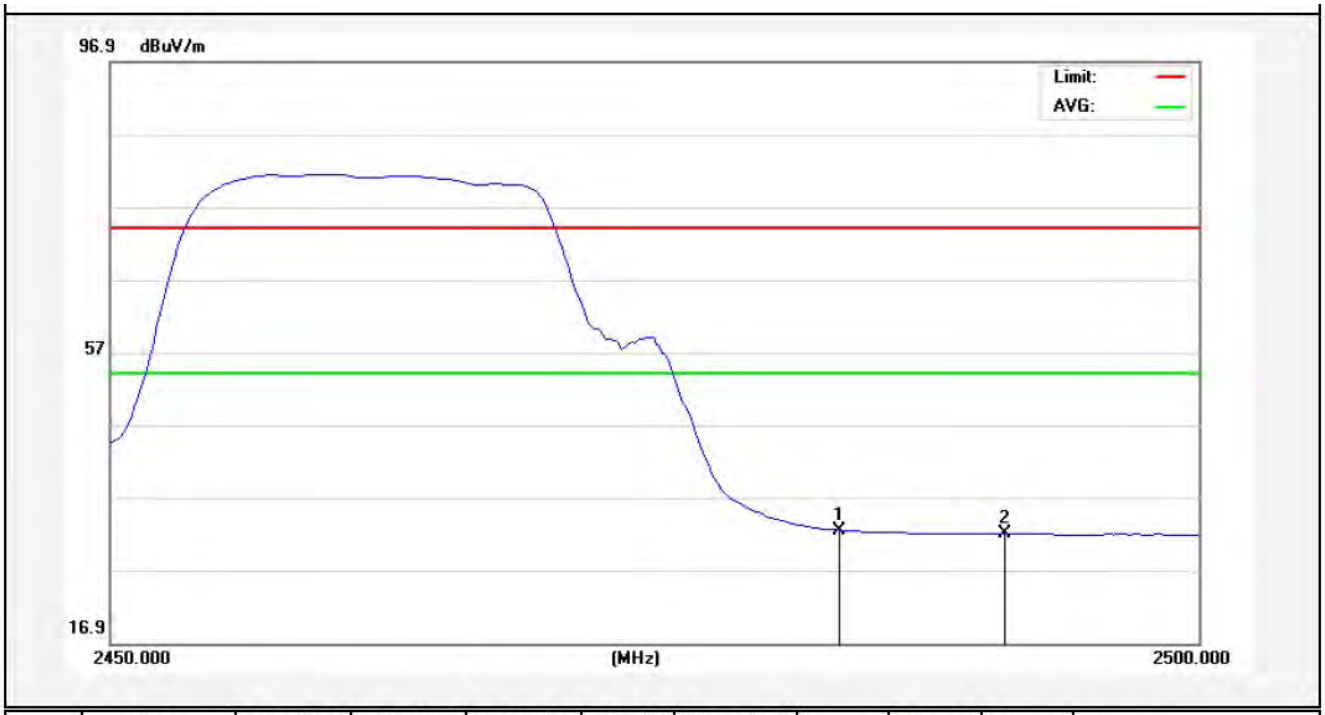

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2390.000 | 34.10 | -2.51 | 31.59 | 54.00 | -22.41 | AVG | | | |
| 2 | 2400.000 | 46.14 | -2.49 | 43.65 | 54.00 | -10.35 | AVG | | | |
| 3 | 2358.300 | 34.62 | -2.58 | 32.04 | 54.00 | -21.96 | AVG | | | |

Test Mode: 802.11g
2462MHz
Horizontal-PEAK:



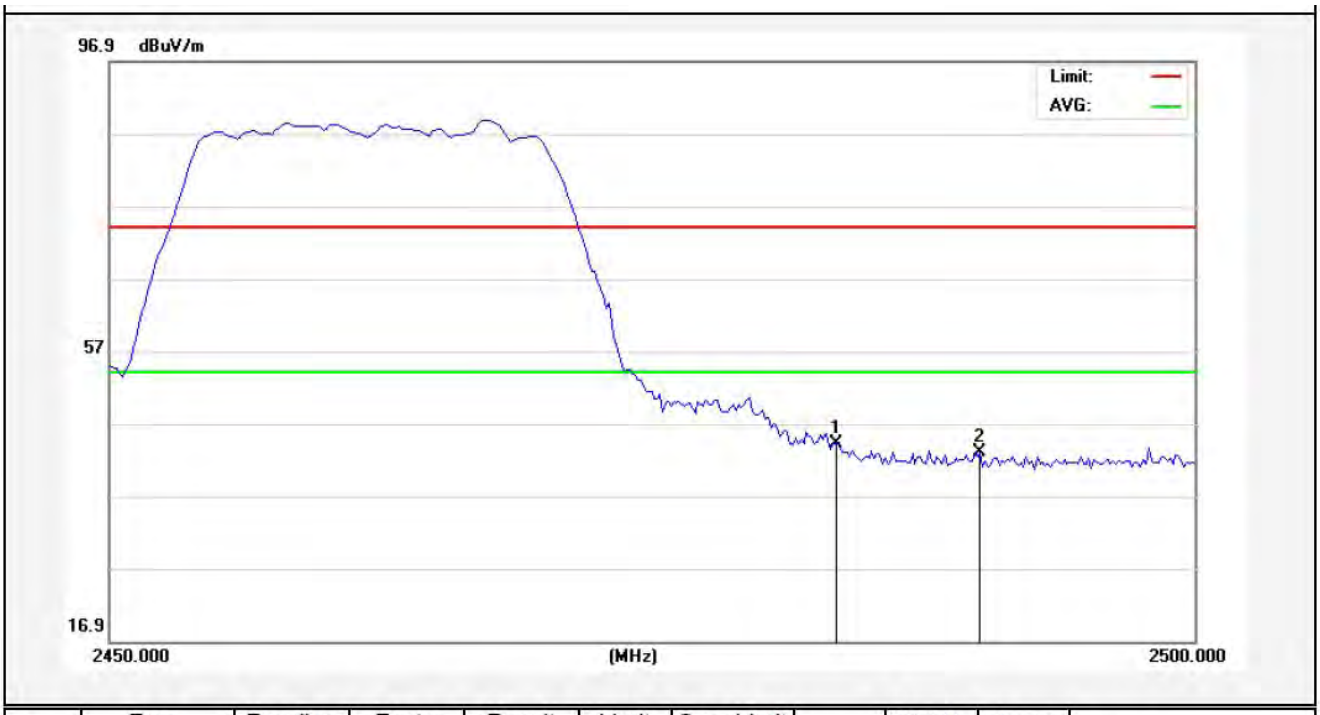

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 47.64 | -2.31 | 45.33 | 74.00 | -28.67 | peak | | | |
| 2 | 2490.500 | 46.13 | -2.29 | 43.84 | 74.00 | -30.16 | peak | | | |

Horizontal-AV:



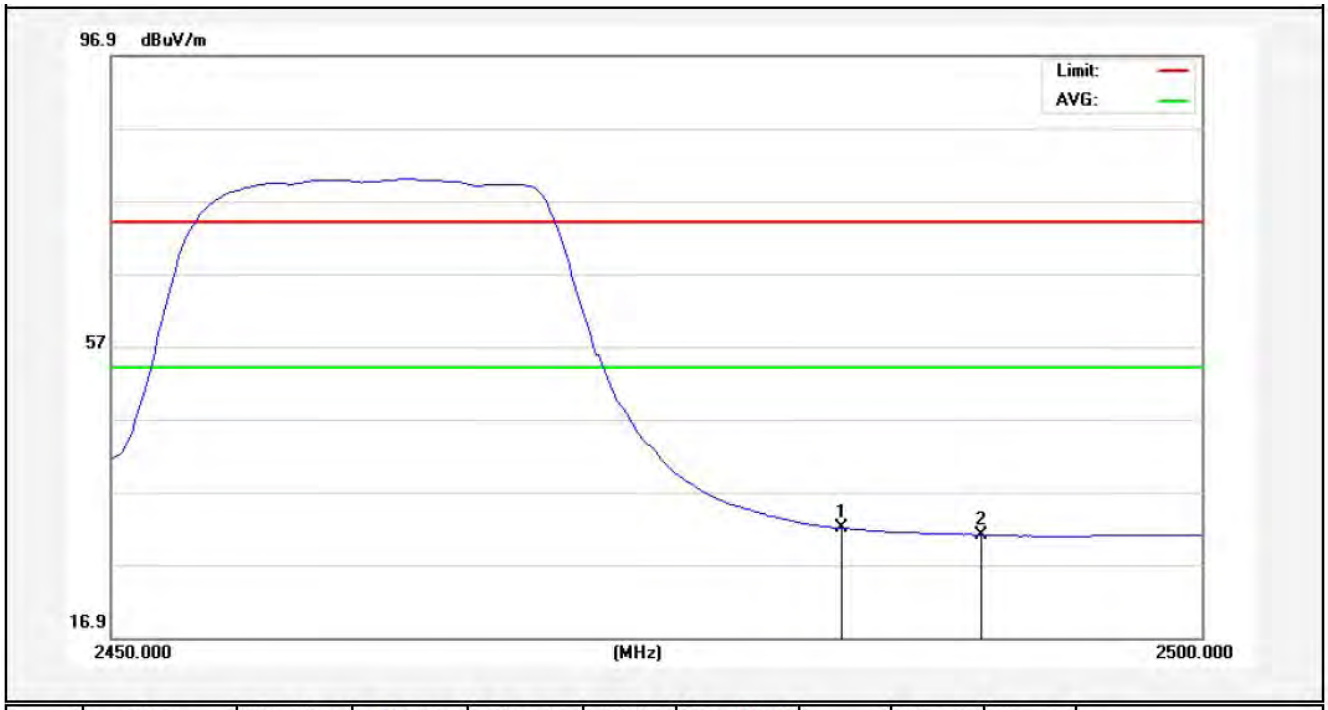

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 34.79 | -2.31 | 32.48 | 54.00 | -21.52 | AVG | | | |
| 2 | 2491.125 | 34.27 | -2.29 | 31.98 | 54.00 | -22.02 | AVG | | | |

Test Mode: 802.11g
2462MHz
Vertical-PEAK:



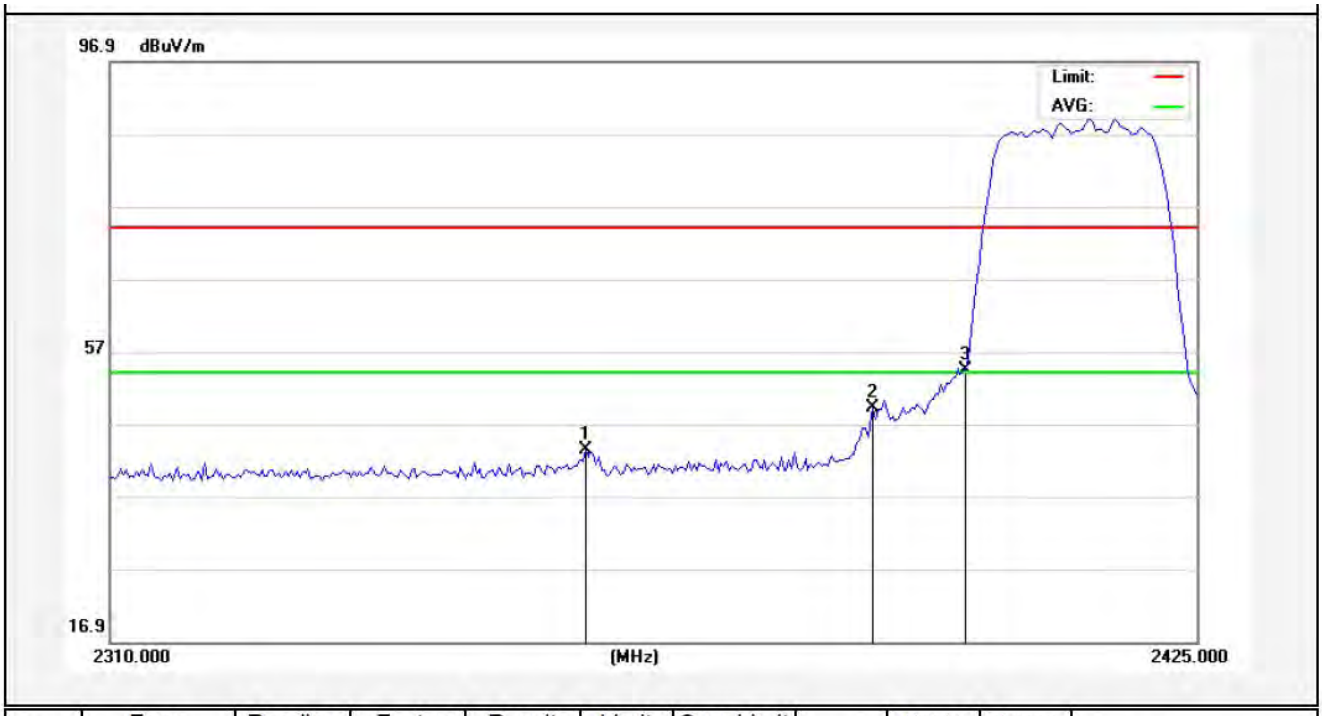

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 46.53 | -2.31 | 44.22 | 74.00 | -29.78 | peak | | | |
| 2 | 2490.125 | 45.30 | -2.29 | 43.01 | 74.00 | -30.99 | peak | | | |

Vertical-AV:



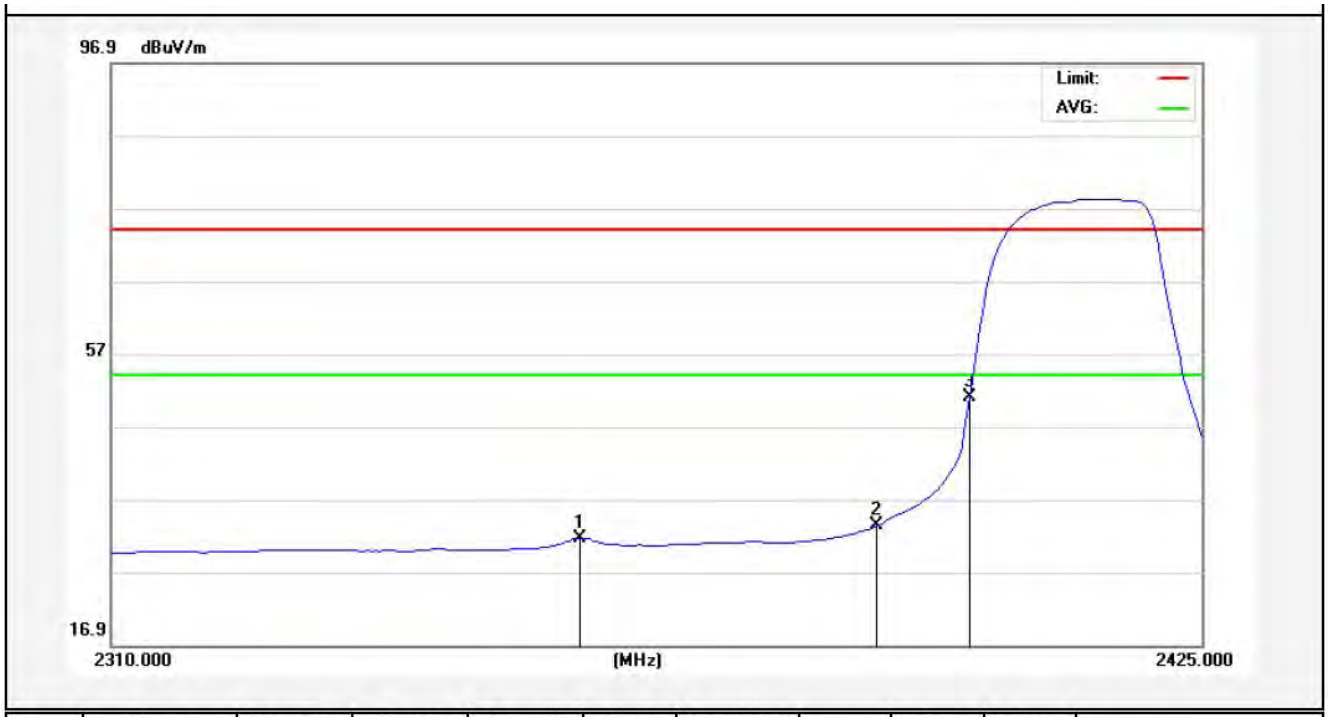

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 34.29 | -2.31 | 31.98 | 54.00 | -22.02 | AVG | | | |
| 2 | 2489.875 | 33.34 | -2.29 | 31.05 | 54.00 | -22.95 | AVG | | | |

Test Mode: 802.11n (HT20)
2412MHz
Horizontal-PEAK:



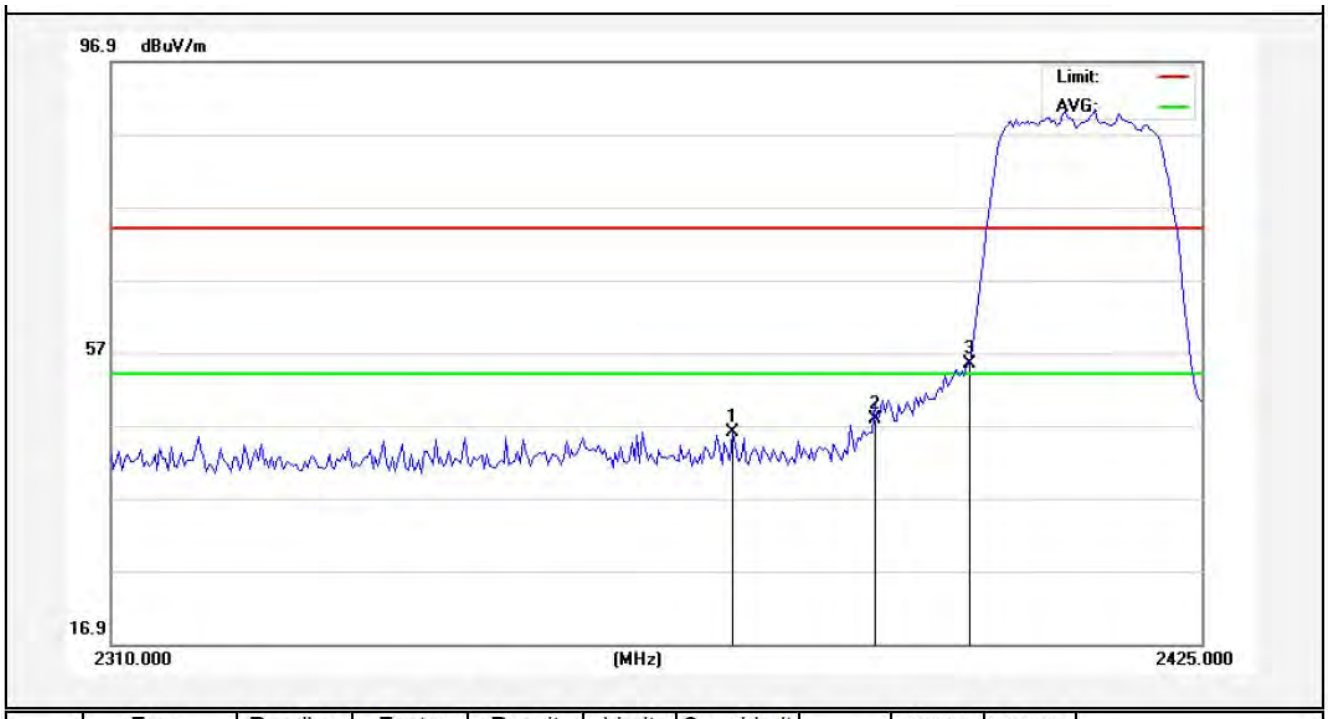

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2359.738 | 45.92 | -2.58 | 43.34 | 74.00 | -30.66 | peak | | | |
| 2 | 2390.000 | 51.70 | -2.51 | 49.19 | 74.00 | -24.81 | peak | | | |
| 3 | 2400.000 | 56.81 | -2.49 | 54.32 | 74.00 | -19.68 | peak | | | |

Horizontal-AV:



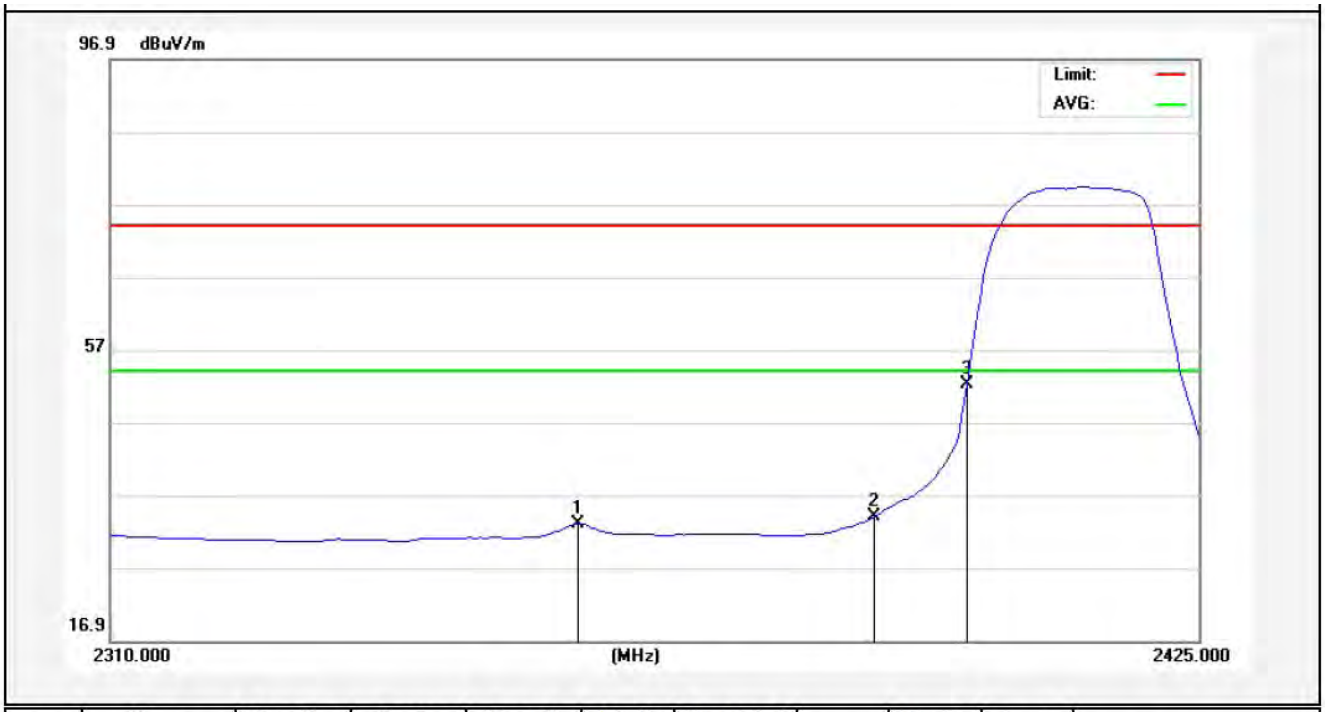

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2358.875 | 34.26 | -2.58 | 31.68 | 54.00 | -22.32 | AVG | | | |
| 2 | 2390.000 | 35.82 | -2.51 | 33.31 | 54.00 | -20.69 | AVG | | | |
| 3 | 2400.000 | 53.48 | -2.49 | 50.99 | 54.00 | -3.01 | AVG | | | |

Test Mode: 802.11n (HT20)
2412MHz
Vertical-PEAK:



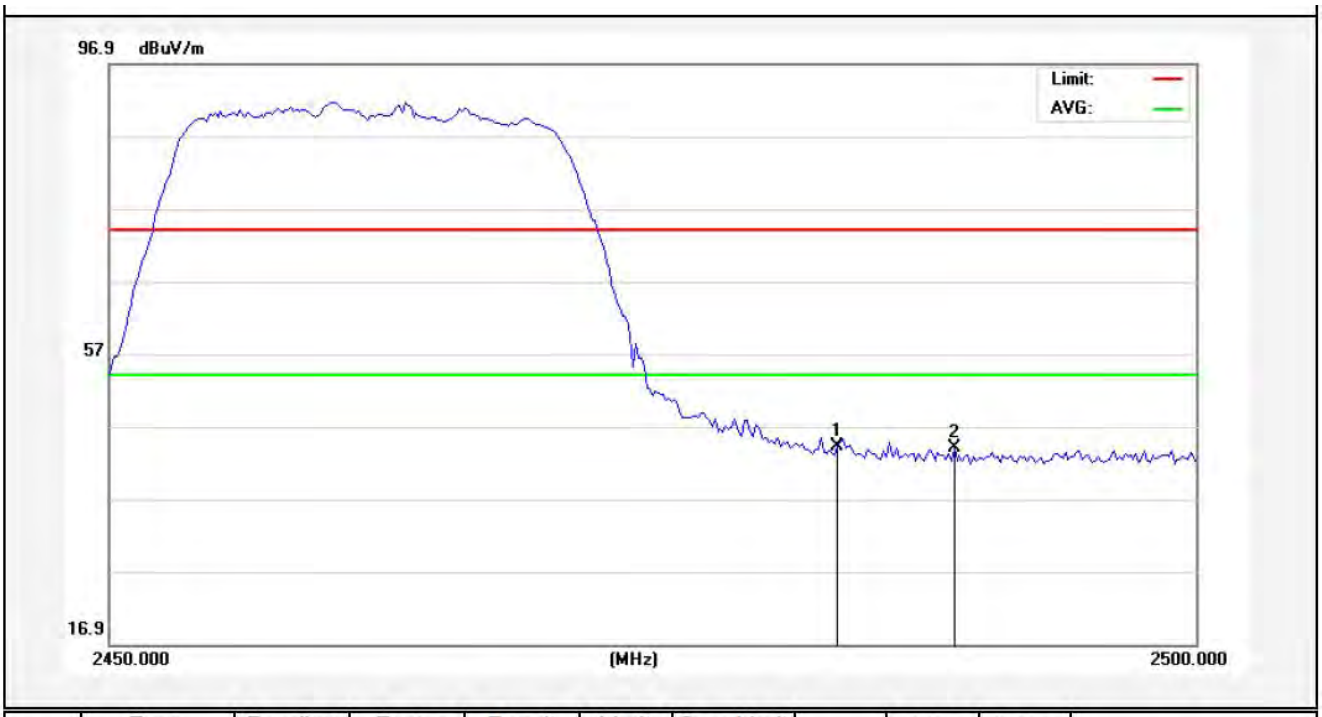

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2374.975 | 48.60 | -2.55 | 46.05 | 74.00 | -27.95 | peak | | | |
| 2 | 2390.000 | 50.25 | -2.51 | 47.74 | 74.00 | -26.26 | peak | | | |
| 3 | 2400.000 | 57.86 | -2.49 | 55.37 | 74.00 | -18.63 | peak | | | |

Vertical-AV:



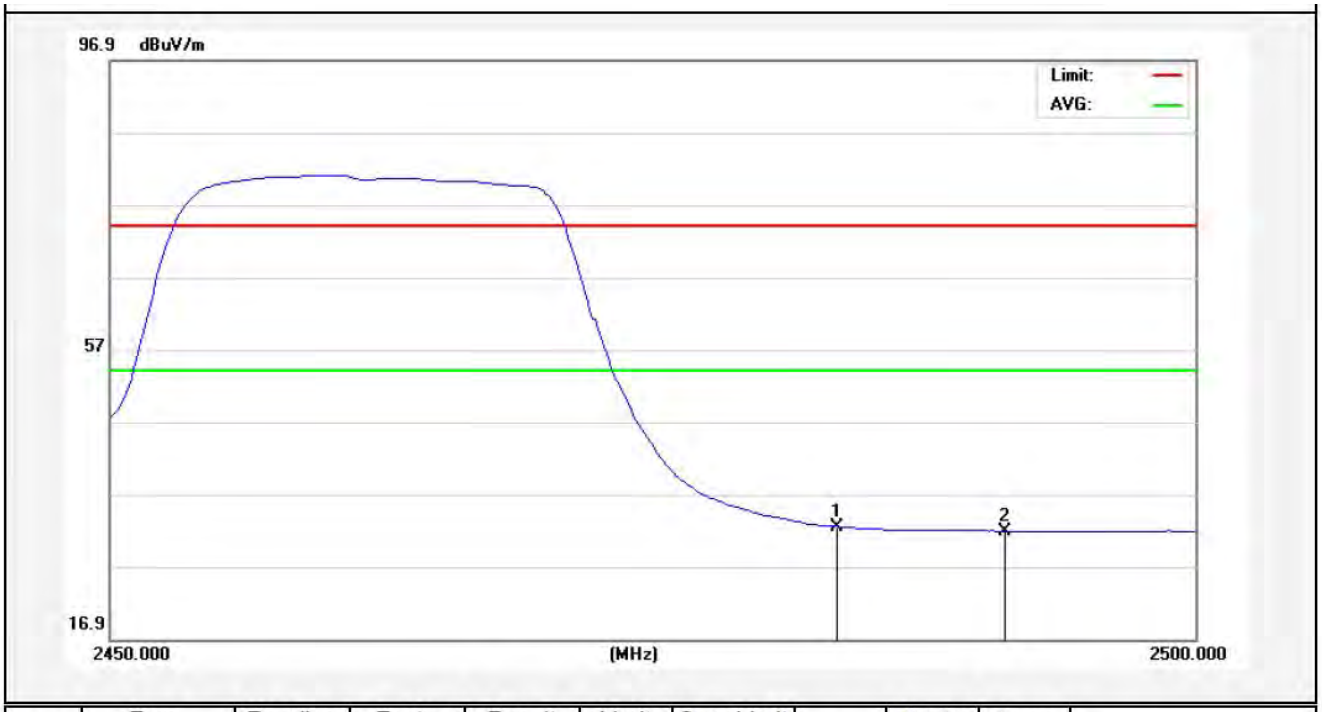

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2358.875 | 35.65 | -2.58 | 33.07 | 54.00 | -20.93 | AVG | | | |
| 2 | 2390.000 | 36.51 | -2.51 | 34.00 | 54.00 | -20.00 | AVG | | | |
| 3 | 2400.000 | 54.75 | -2.49 | 52.26 | 54.00 | -1.74 | AVG | | | |

Test Mode: 802.11n (HT20)
2462MHz
Horizontal-PEAK:



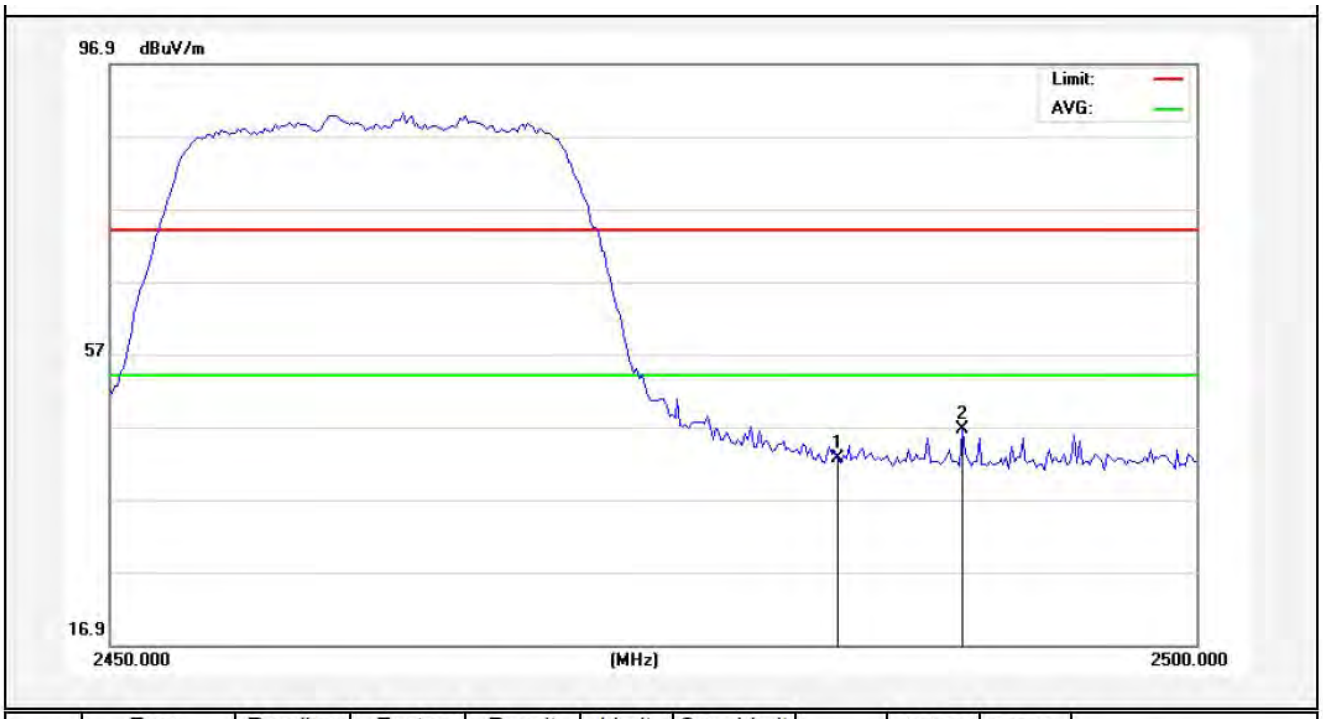

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 46.60 | -2.31 | 44.29 | 74.00 | -29.71 | peak | | | |
| 2 | 2488.875 | 46.21 | -2.29 | 43.92 | 74.00 | -30.08 | peak | | | |

Horizontal-AV:



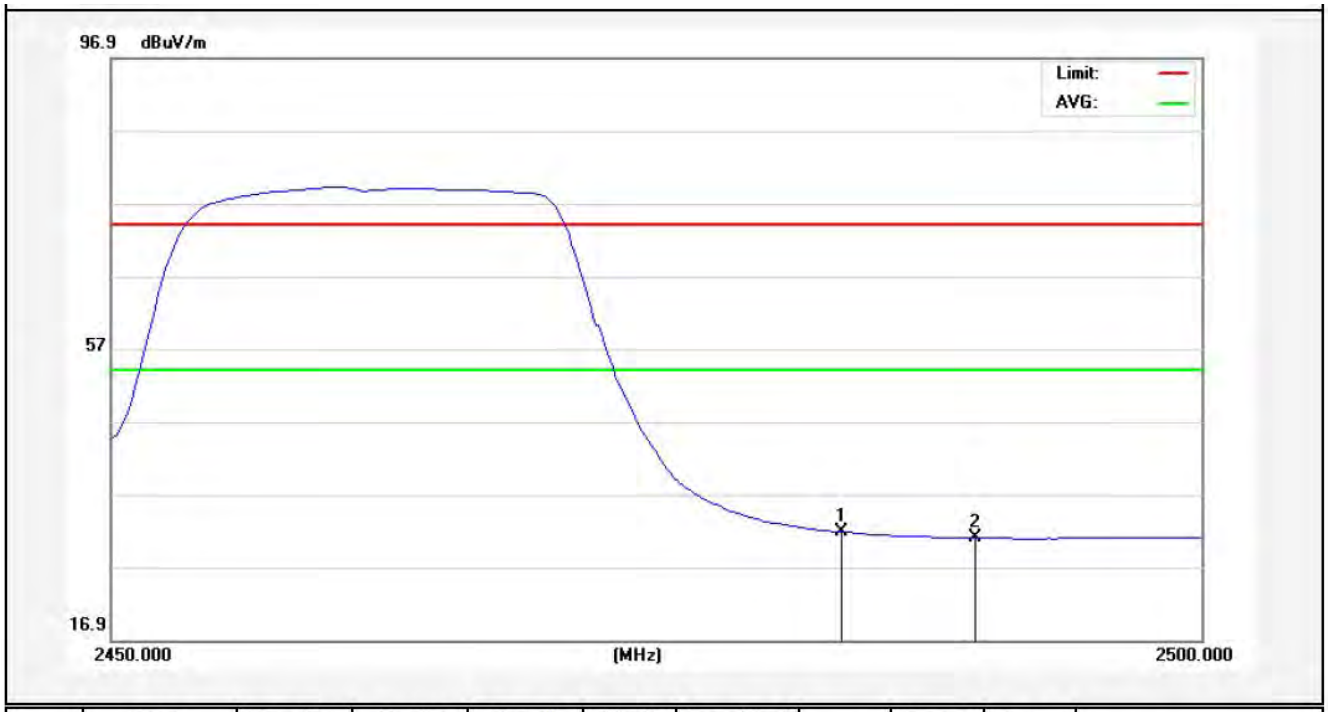

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 34.81 | -2.31 | 32.50 | 54.00 | -21.50 | AVG | | | |
| 2 | 2491.250 | 34.15 | -2.29 | 31.86 | 54.00 | -22.14 | AVG | | | |

Test Mode: 802.11n (HT20)
2462MHz
Vertical-PEAK:



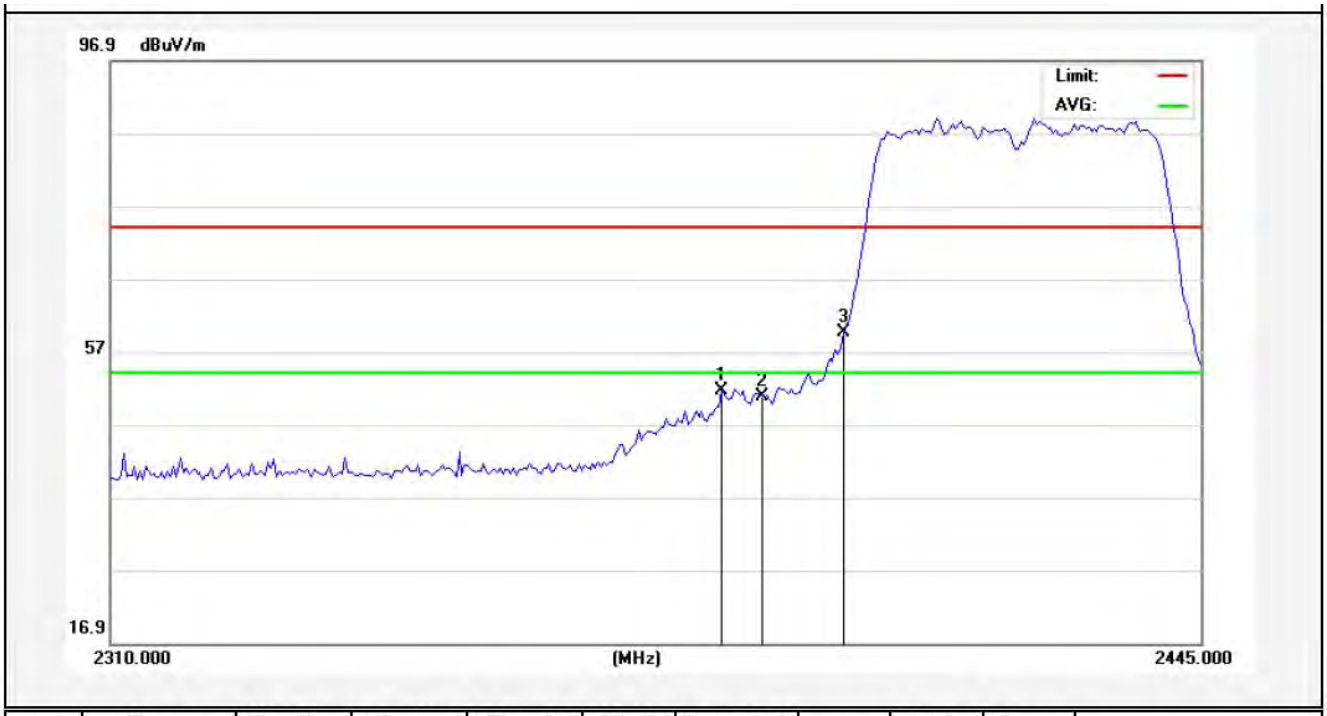

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 44.84 | -2.31 | 42.53 | 74.00 | -31.47 | peak | | | |
| 2 | 2489.250 | 48.95 | -2.29 | 46.66 | 74.00 | -27.34 | peak | | | |

Vertical-AV:



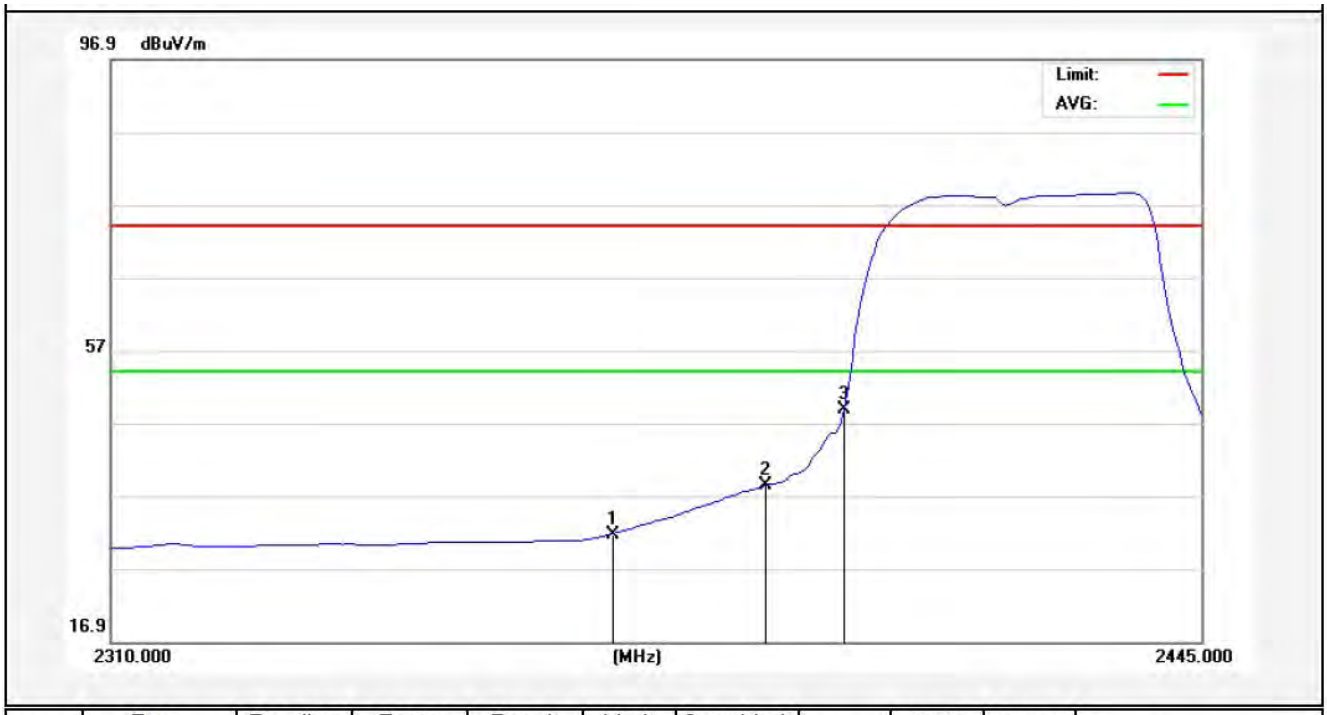

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 34.09 | -2.31 | 31.78 | 54.00 | -22.22 | AVG | | | |
| 2 | 2489.625 | 33.31 | -2.29 | 31.02 | 54.00 | -22.98 | AVG | | | |

Test Mode: 802.11n (HT40)
2422MHz
Horizontal-PEAK:



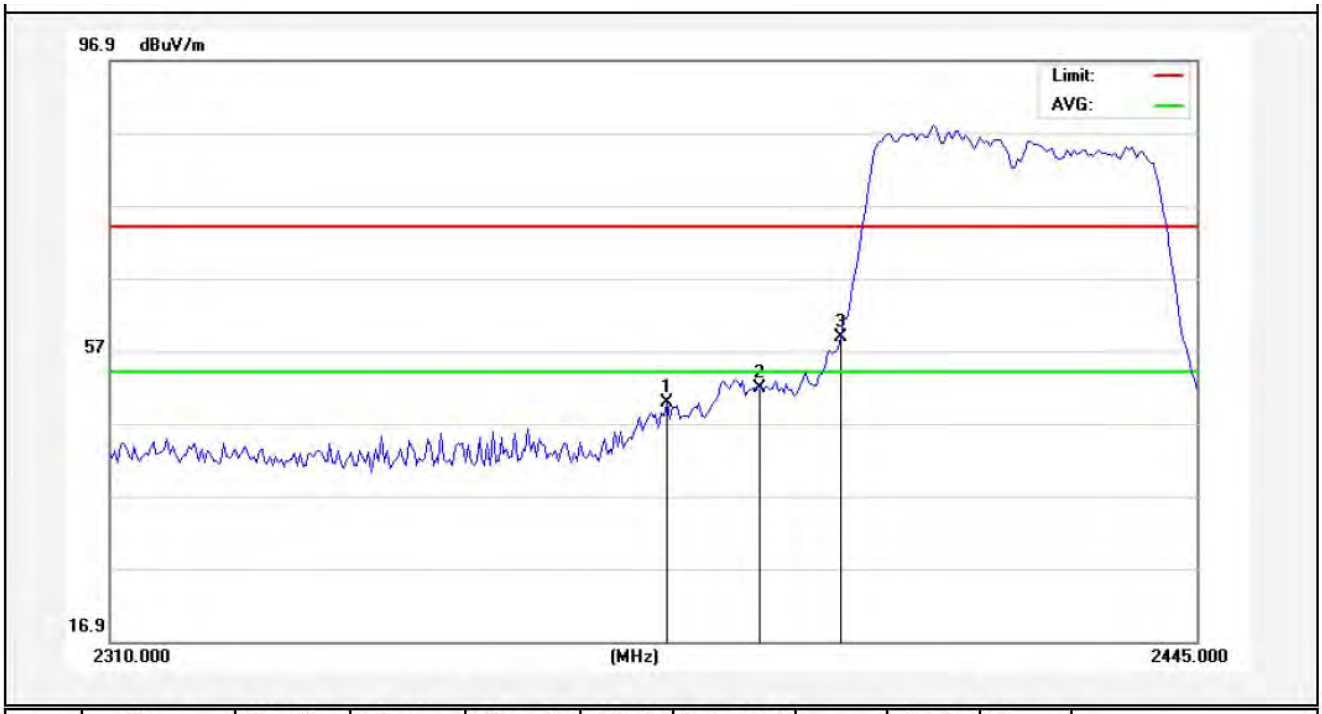

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2384.925 | 54.09 | -2.53 | 51.56 | 74.00 | -22.44 | peak | | | |
| 2 | 2390.000 | 53.32 | -2.51 | 50.81 | 74.00 | -23.19 | peak | | | |
| 3 | 2400.000 | 62.05 | -2.49 | 59.56 | 74.00 | -14.44 | peak | | | |

Horizontal-AV:



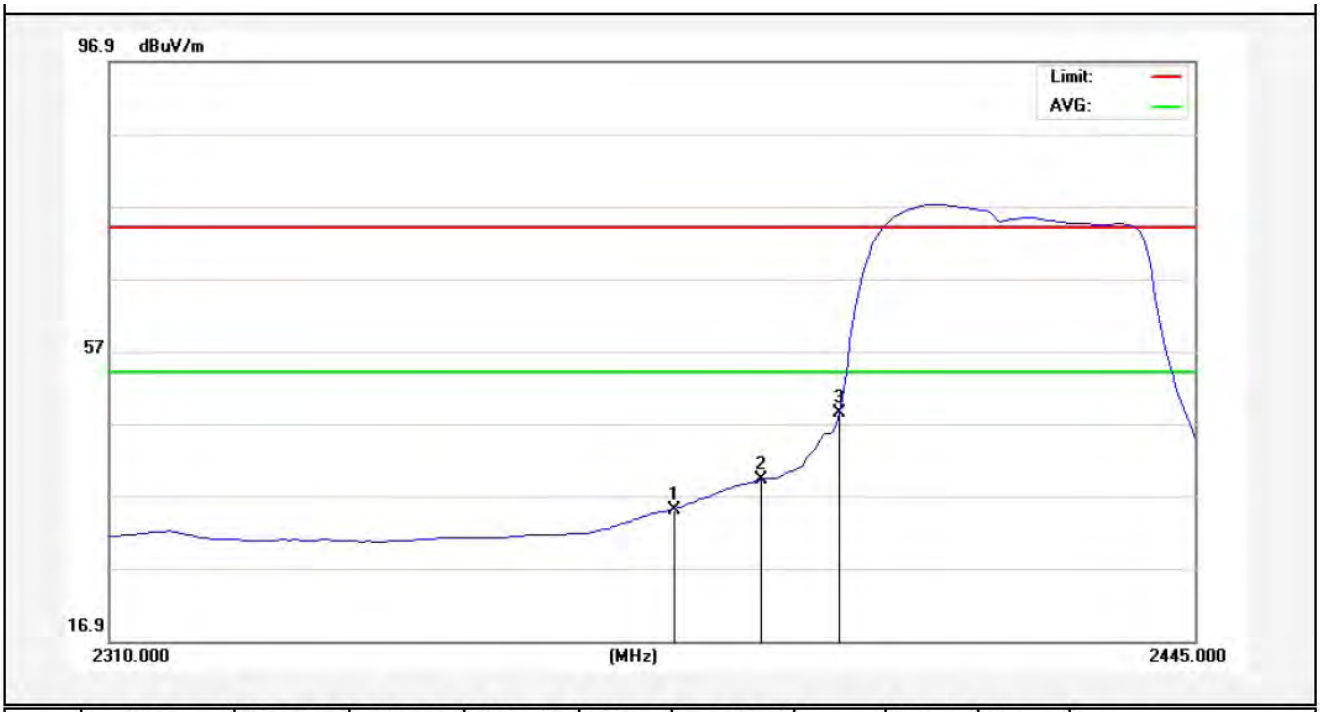

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2371.088 | 34.19 | -2.56 | 31.63 | 54.00 | -22.37 | AVG | | | |
| 2 | 2390.000 | 40.92 | -2.51 | 38.41 | 54.00 | -15.59 | AVG | | | |
| 3 | 2400.000 | 51.36 | -2.49 | 48.87 | 54.00 | -5.13 | AVG | | | |

Test Mode: 802.11n (HT40)
2422MHz
Vertical-PEAK:




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2378.512 | 52.35 | -2.54 | 49.81 | 74.00 | -24.19 | peak | | | |
| 2 | 2390.000 | 54.39 | -2.51 | 51.88 | 74.00 | -22.12 | peak | | | |
| 3 | 2400.000 | 61.35 | -2.49 | 58.86 | 74.00 | -15.14 | peak | | | |

Vertical-AV:

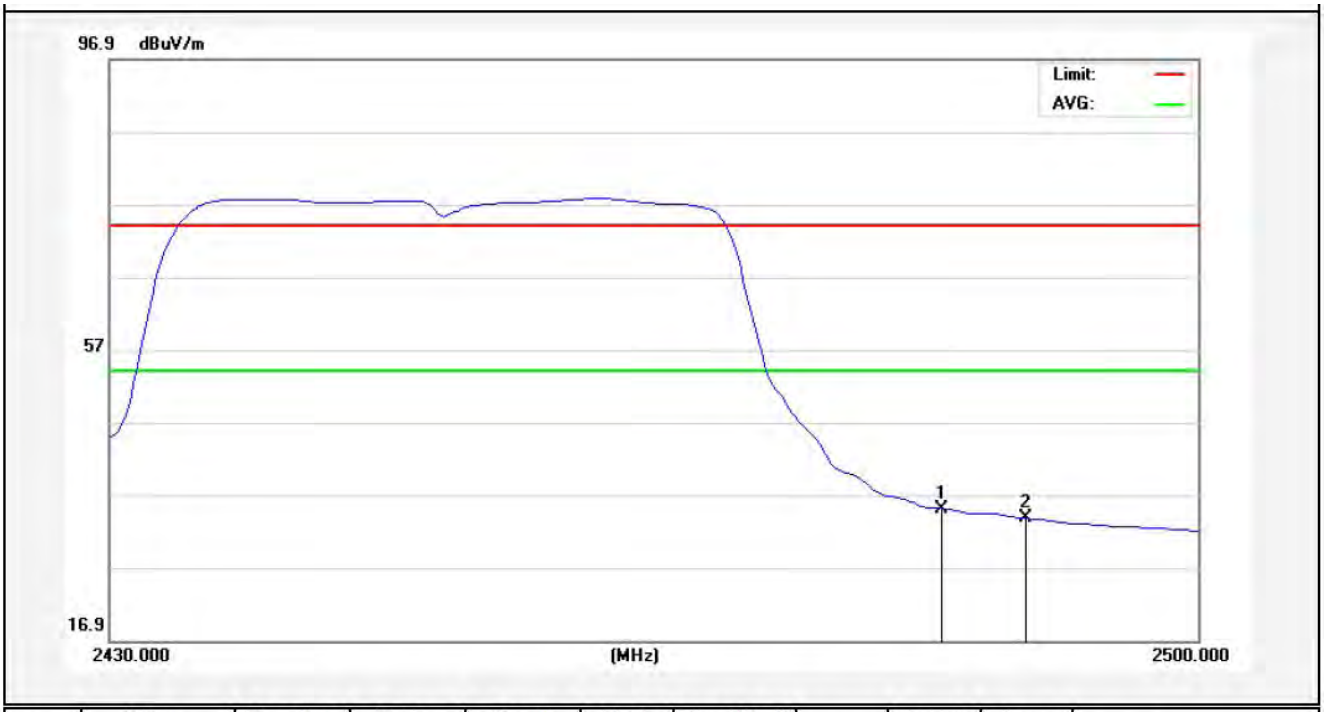



| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2379.188 | 37.62 | -2.54 | 35.08 | 54.00 | -18.92 | AVG | | | |
| 2 | 2390.000 | 41.72 | -2.51 | 39.21 | 54.00 | -14.79 | AVG | | | |
| 3 | 2400.000 | 50.93 | -2.49 | 48.44 | 54.00 | -5.56 | AVG | | | |

Test Mode: 802.11n (HT40)
2452MHz
Horizontal-PEAK:

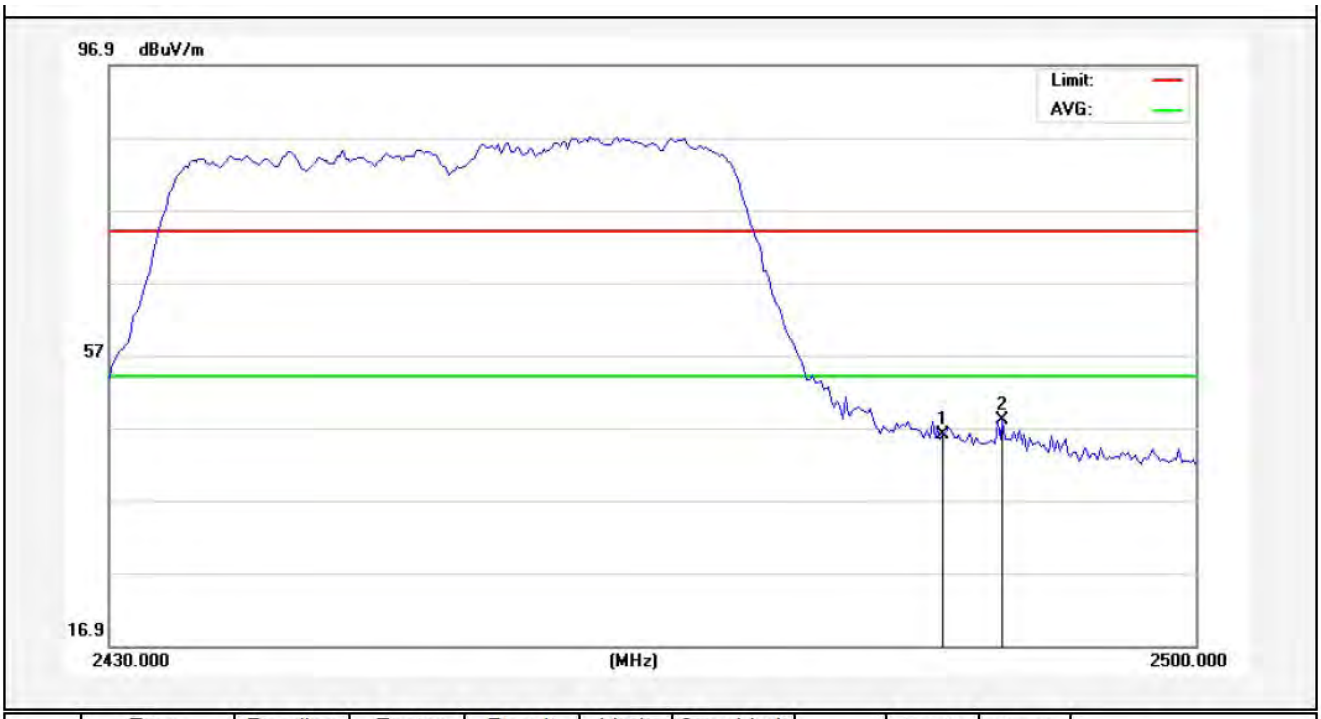

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 48.98 | -2.31 | 46.67 | 74.00 | -27.33 | peak | | | |
| 2 | 2490.725 | 48.60 | -2.29 | 46.31 | 74.00 | -27.69 | peak | | | |

Horizontal-AV:



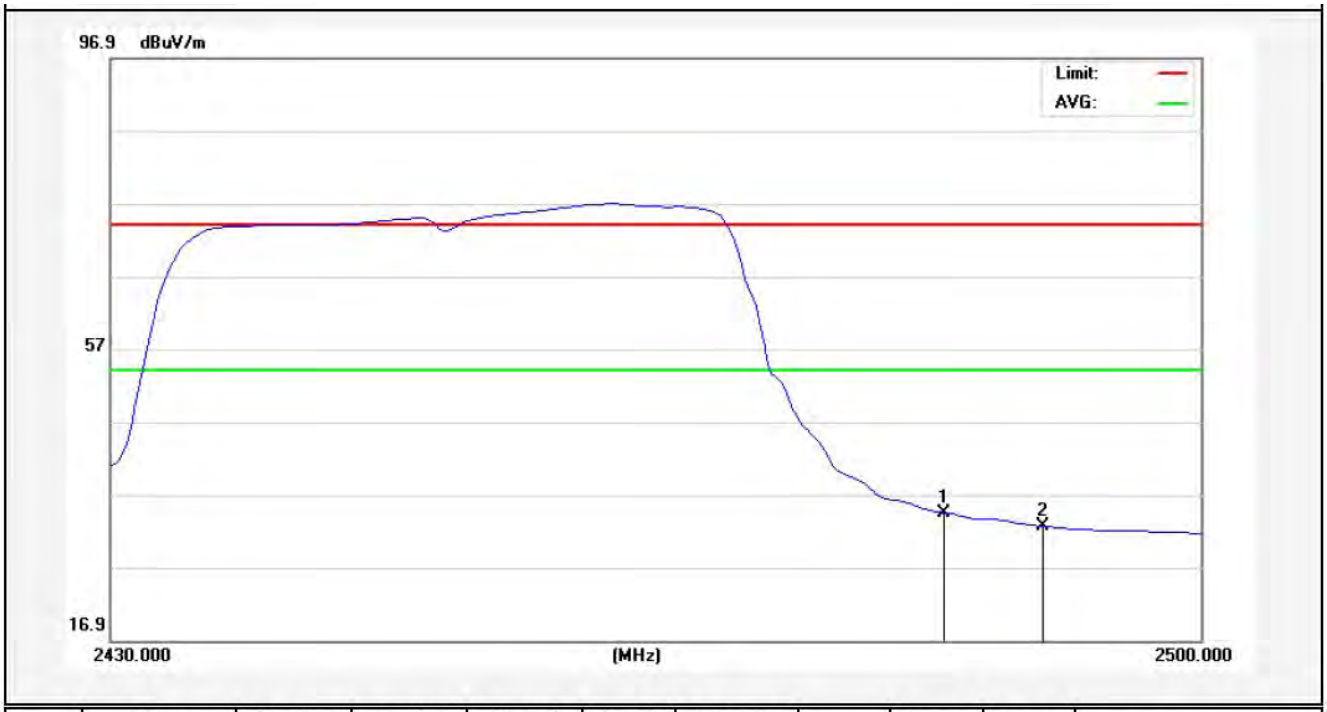

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 37.40 | -2.31 | 35.09 | 54.00 | -18.91 | AVG | | | |
| 2 | 2488.975 | 36.01 | -2.29 | 33.72 | 54.00 | -20.28 | AVG | | | |

Test Mode: 802.11n (HT40)
2452MHz
Vertical-PEAK:




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 48.27 | -2.31 | 45.96 | 74.00 | -28.04 | peak | | | |
| 2 | 2487.575 | 50.29 | -2.30 | 47.99 | 74.00 | -26.01 | peak | | | |

Vertical-AV:




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2483.500 | 36.74 | -2.31 | 34.43 | 54.00 | -19.57 | AVG | | | |
| 2 | 2489.850 | 34.96 | -2.29 | 32.67 | 54.00 | -21.33 | AVG | | | |

## 4.5. Peak Power Spectral Density

**a. Limit**

1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

**b. Test Procedure**

1. Place the EUT on the table and set it in transmitting mode. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 1.5 times DTS BW, Sweep=500s
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

**c. Test Equipment**

Same as the equipment listed in 4.2.

**d. Test Setup**

See 4.1

**e. Test Results**

Pass

**f. Test Data**

Please refer to the following data.

**g. Test Plot** See the following pages

Test mode: IEEE 802.11b

| Channel | Frequency (MHz) | PPSD (dBm/3KHz) | ∑PPSD (dBm/3KHz) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| Low | 2412 | -12.51 | - | | Pass |
| Mid | 2437 | -12.02 | - | 8.00 | Pass |
| High | 2462 | -12.13 | - | | Pass |

Test mode: IEEE 802.11g

| Channel | Frequency (MHz) | PPSD (dBm) | ∑PPSD (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| Low | 2412 | -18.96 | - | | Pass |
| Mid | 2437 | -18.18 | - | 8.00 | Pass |
| High | 2462 | -17.85 | - | | Pass |

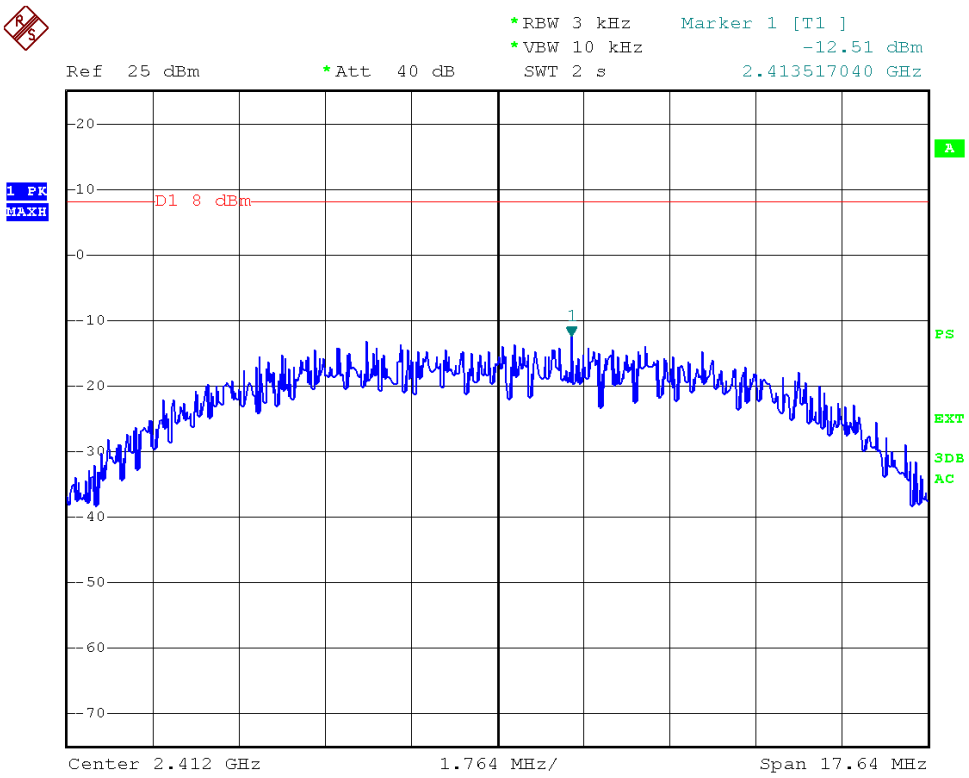
Test mode: IEEE 802.11n (HT20)

| Channel | Frequency (MHz) | PPSD (dBm/3KHz) | ∑PPSD (dBm/3KHz) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| Low | 2412 | -19.48 | - | | Pass |
| Mid | 2437 | -18.93 | - | 8.00 | Pass |
| High | 2462 | -18.39 | - | | Pass |

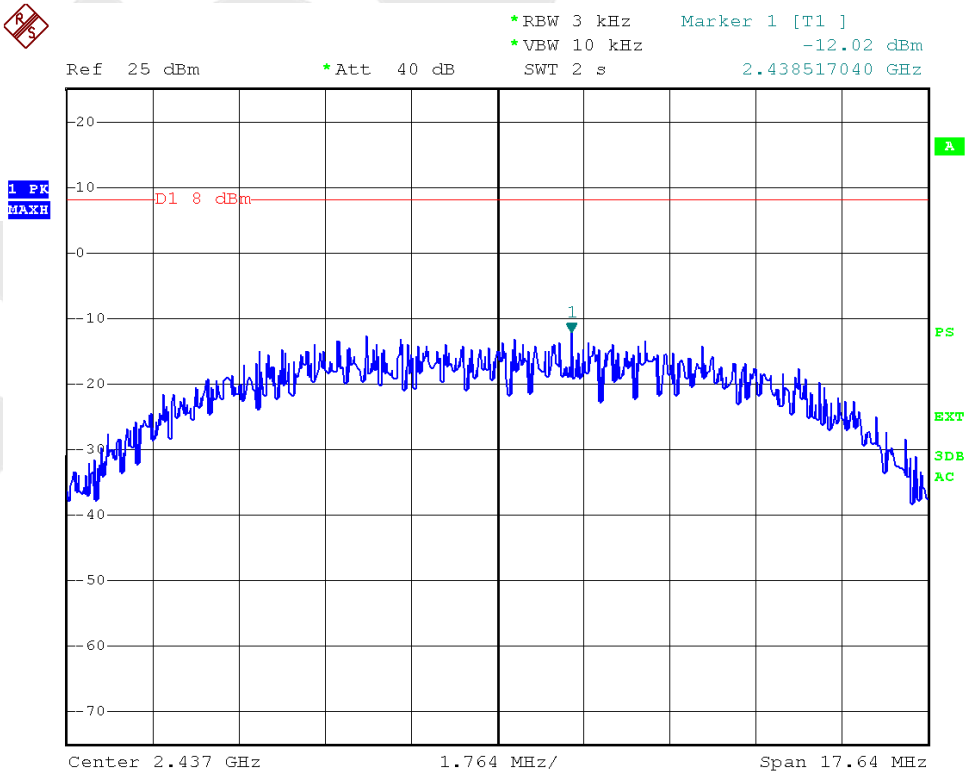
Test mode: IEEE 802.11n (HT40)

| Channel | Frequency (MHz) | PPSD (dBm/3KHz) | ∑PPSD (dBm/3KHz) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| Low | 2422 | -20.77 | - | | Pass |
| Mid | 2437 | -21.17 | - | 8.00 | Pass |
| High | 2452 | -20.65 | - | | Pass |

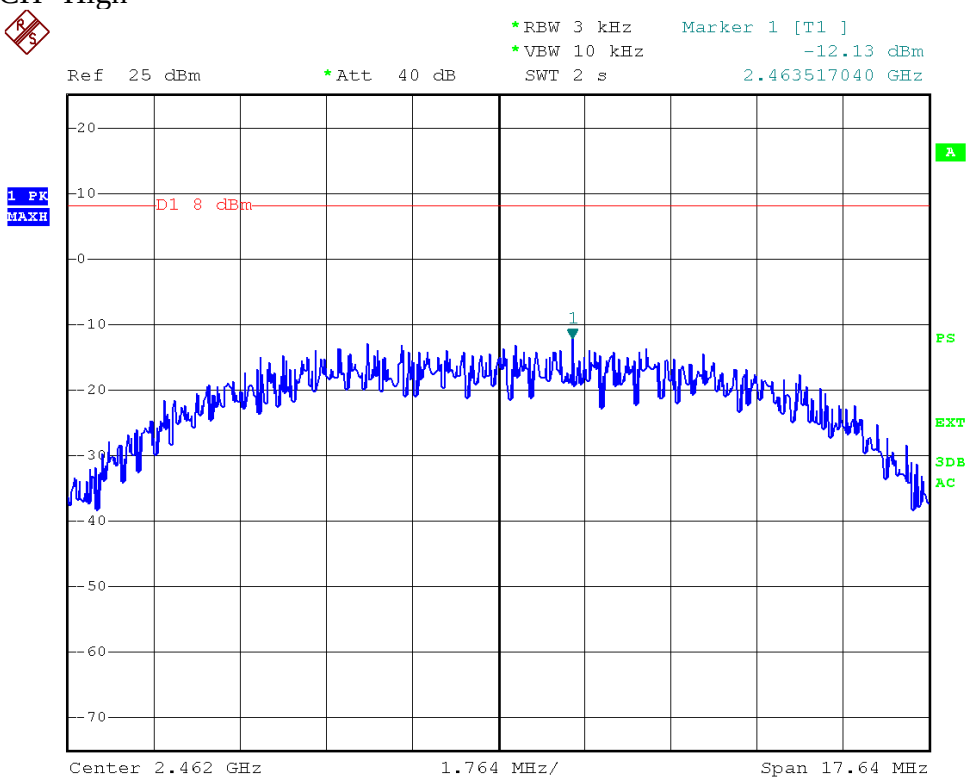
802.11 b CH--Low



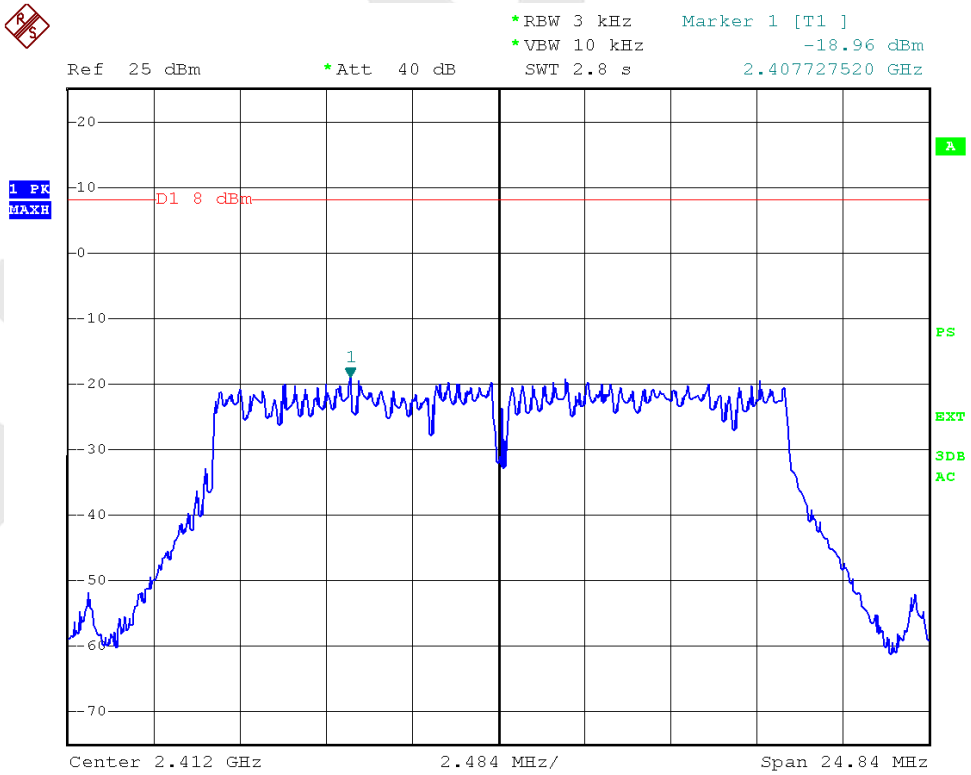

802.11 b CH--Mid



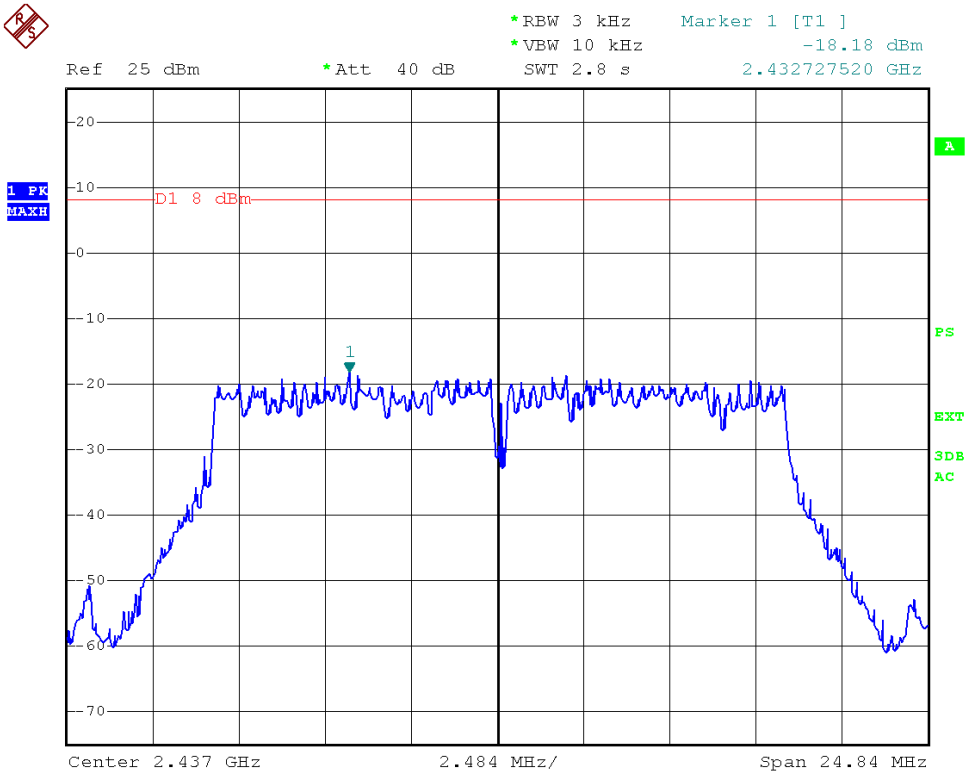
802.11 b CH--High



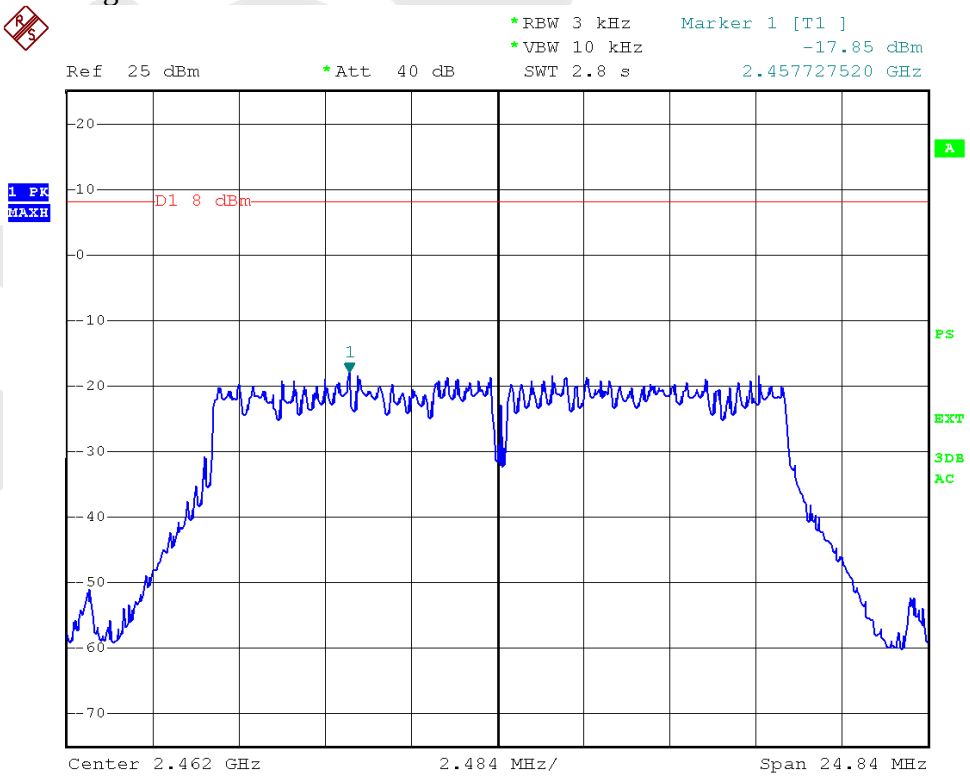

802.11g CH--Low



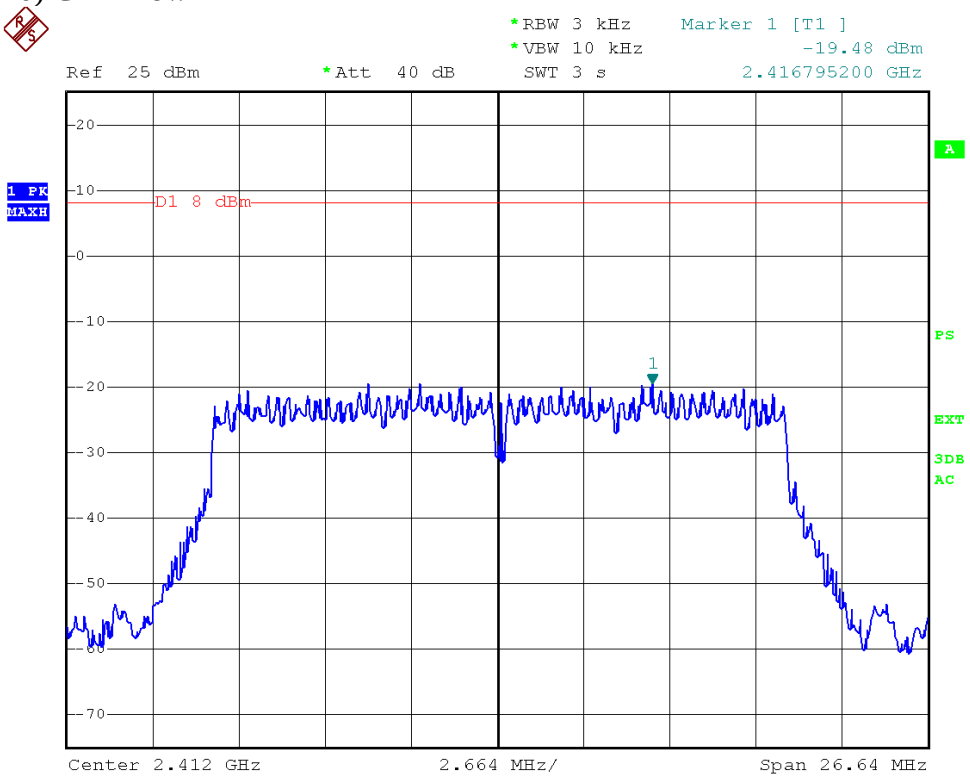
802.11g CH--Mid



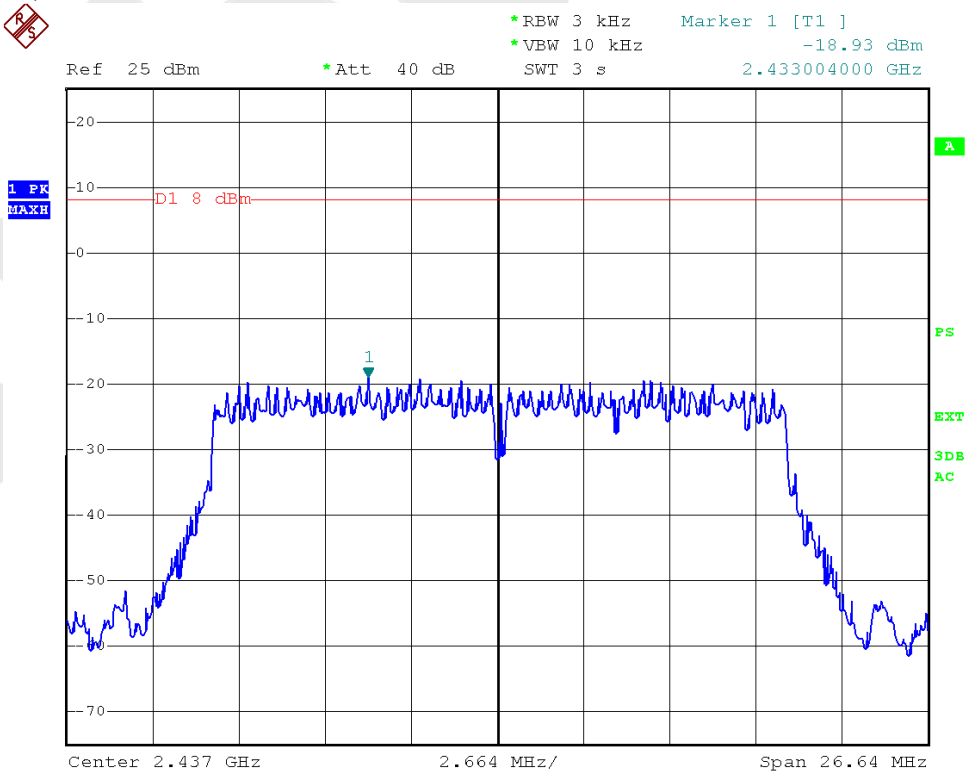

802.11g CH--High



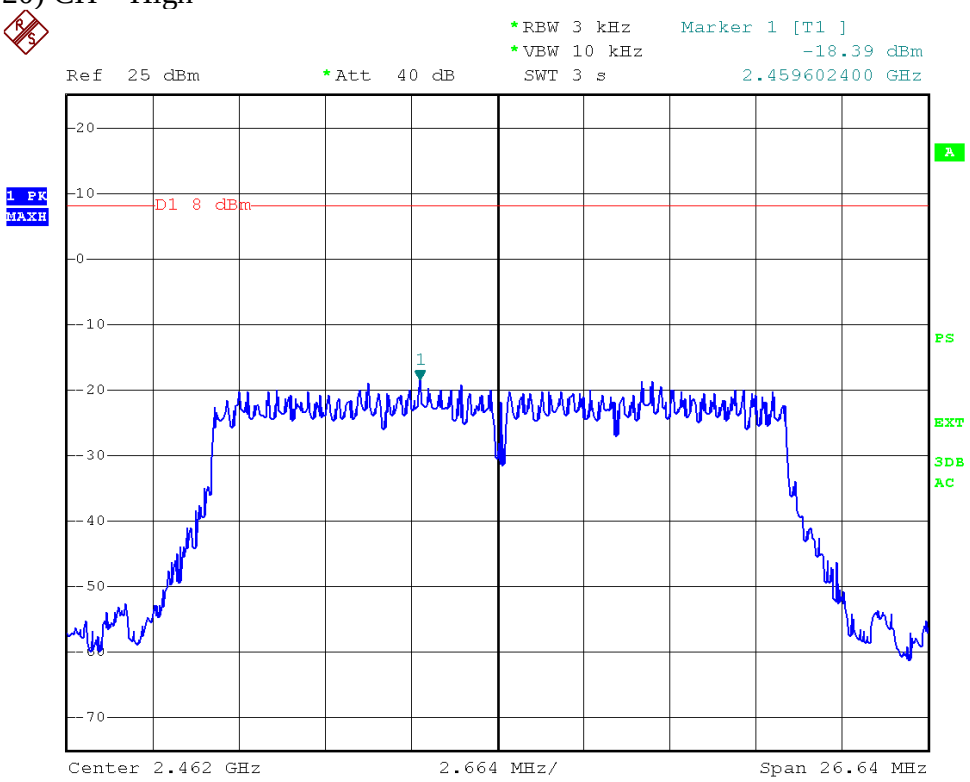
802.11n (HT20) CH—Low



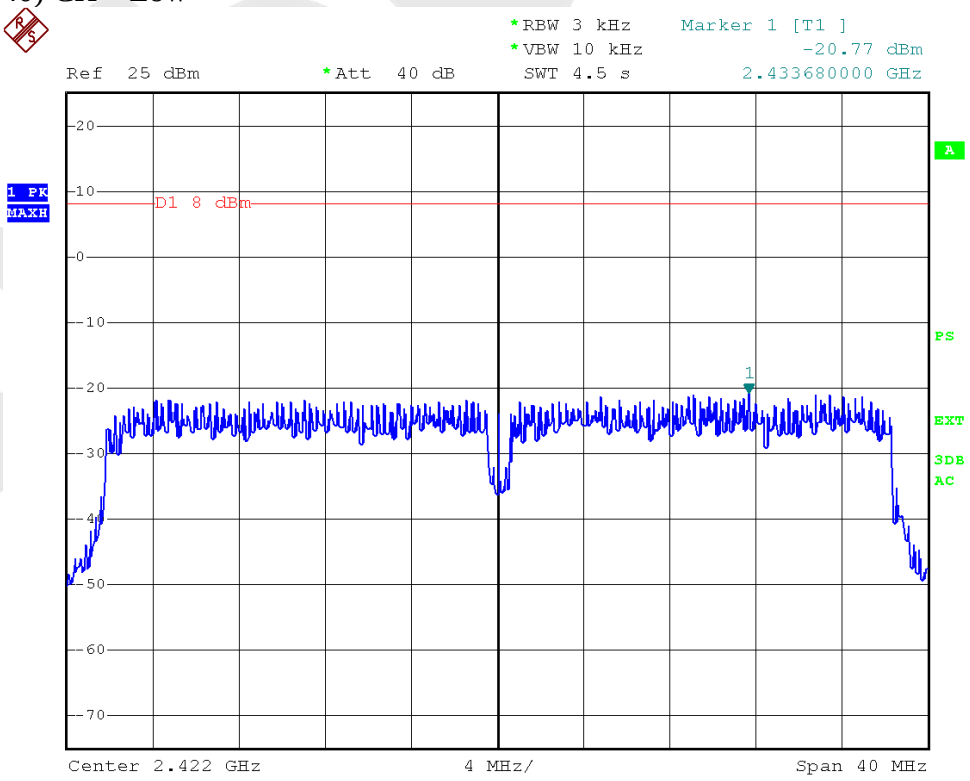

802.11n (HT20) CH—Mid



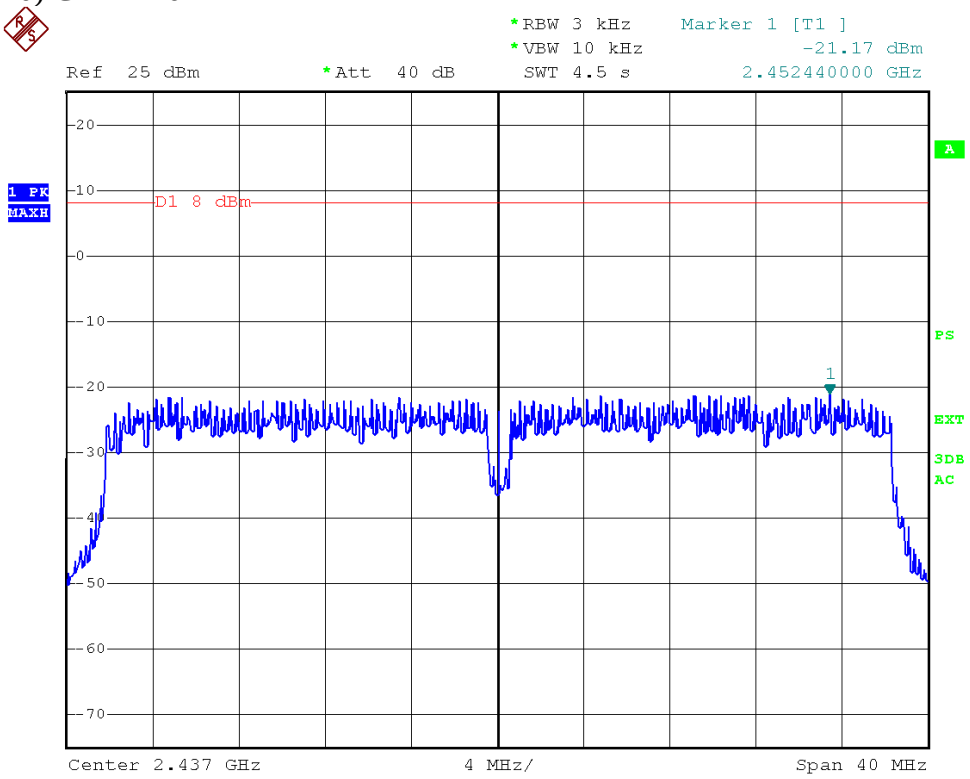
802.11n (HT20) CH—High



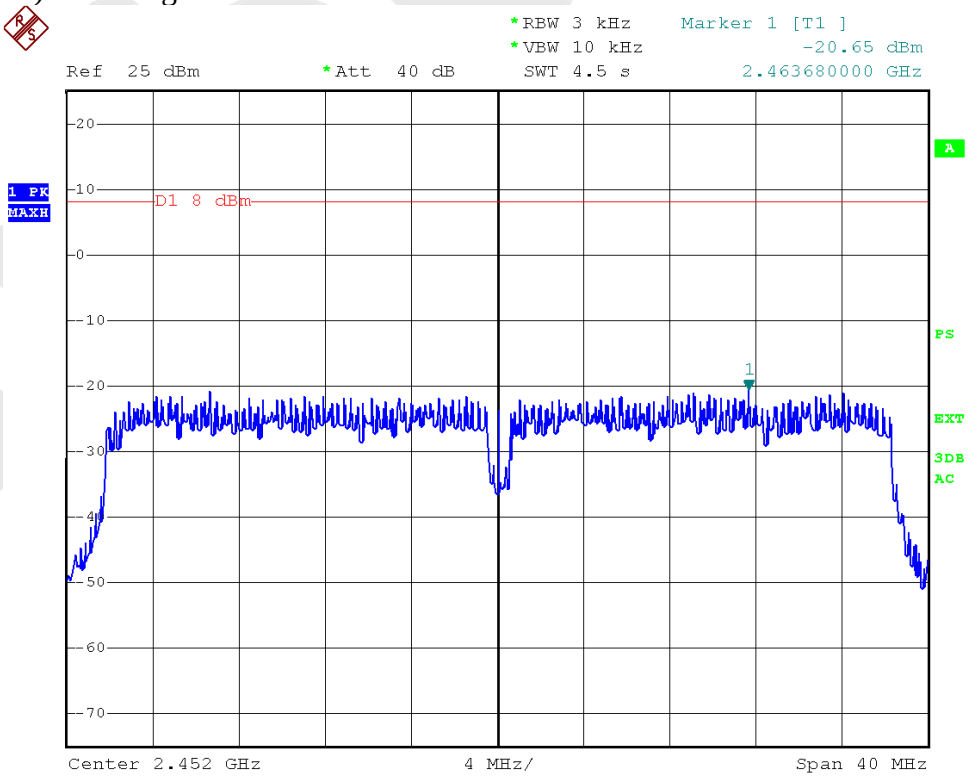

802.11n (HT40) CH—Low



802.11n (HT40) CH—Mid




802.11n (HT40) CH—High



## 4.6. Radiated Emissions

4.6.1.1. Test Limits (< 30 MHZ)

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meter) |
|---|---|---|
| 0.009-0.490 | 2400/F(kHz) | 300 |
| 0.490-1.705 | 24000/F(kHz) | 30 |
| 1.705-30.0 | 30 | 30 |

4.6.1.2. Test Limits (≥ 30 MHZ)

| | | | |
|---|---|---|---|
| FIELD STRENGTH of Fundamental: @3M | FIELD STRENGTH of Harmonics | S15.209 30 - 88 MHz | 40 dBuV/m |
| 902-928 MHZ | | 88 - 216 MHz | 43.5 |
| 2.4-2.4835 GHz | | 216 - 960 MHz | 46 |
| 94 dBμV/m @3m | 54 dBμV/m @3m | ABOVE 960 MHz | 54dBuV/m |

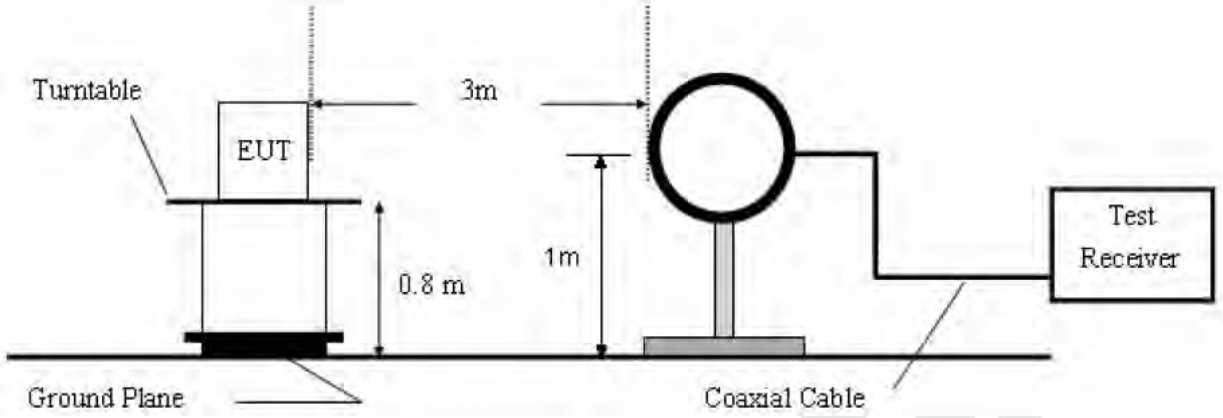
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Test Equipment

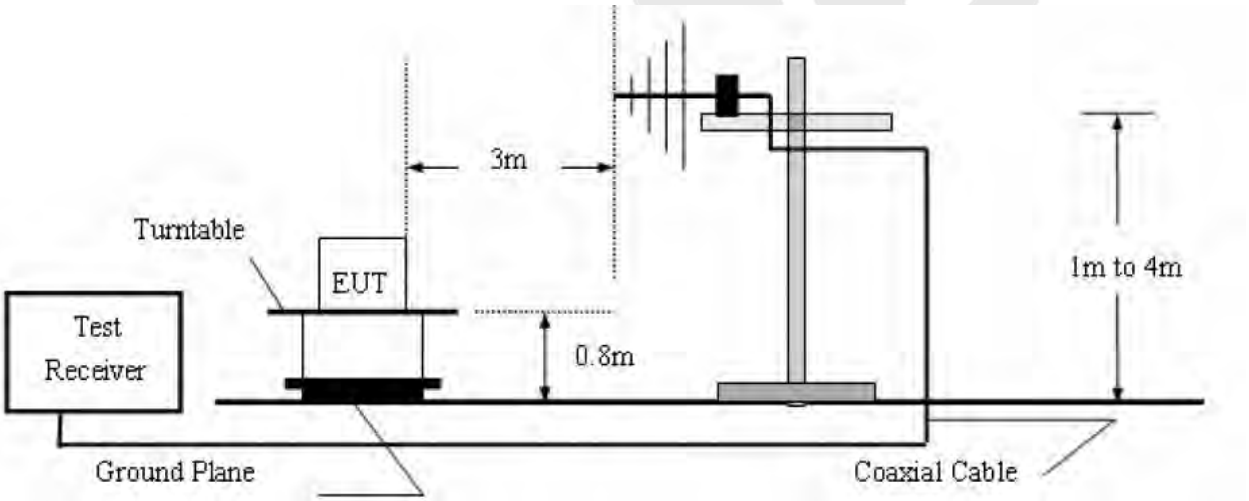
| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|---|
| 1. | Spectrum Analysis | Agilent | E4407B | US39390582 | Apr. 17, 2015 | 1 Year |
| 2. | Preamplifier | Instruments corporation | EMC011830 | 980100 | Apr. 17, 2015 | 1 Year |
| 3. | EMI Test Receiver | Rohde & Schwarz | ESPI | 101604 | Apr. 17, 2015 | 1 Year |
| 4. | Double Ridged Horn Antenna | Instruments corporation | GTH-0118 | 351600 | Apr. 20, 2015 | 1 Year |
| 5. | Bilog Broadband Antenna | Schwarzbeck | VULB9163 | VULB 9163-289 | Apr. 20, 2015 | 1 Year |
| 6. | Pre-amplifier | SONOMA | 310N | 186860 | Apr. 17, 2015 | 1 Year |
| 7. | EMI Test Software EZ-EMC | SHURPLE | N/A | N/A | N/A | N/A |

## 4.6.2. Test Configuration:

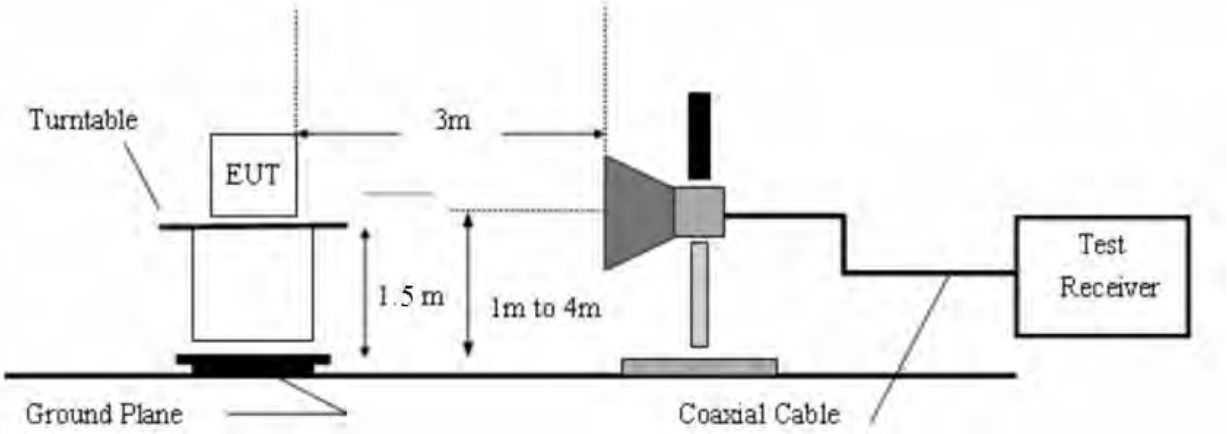
### 4.6.2.1. 9k to 30MHz emissions:




### 4.6.2.2. 30M to 1G emissions:




### 4.6.2.3. 1G to 40G emissions:



### 4.6.3. Test Procedure

The EUT is placed on a turn table which is 0.8 meter high above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Both horizontal and vertical polarization of the antenna are set on test.

Measurements are made on 9KHz to 30MHz and 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

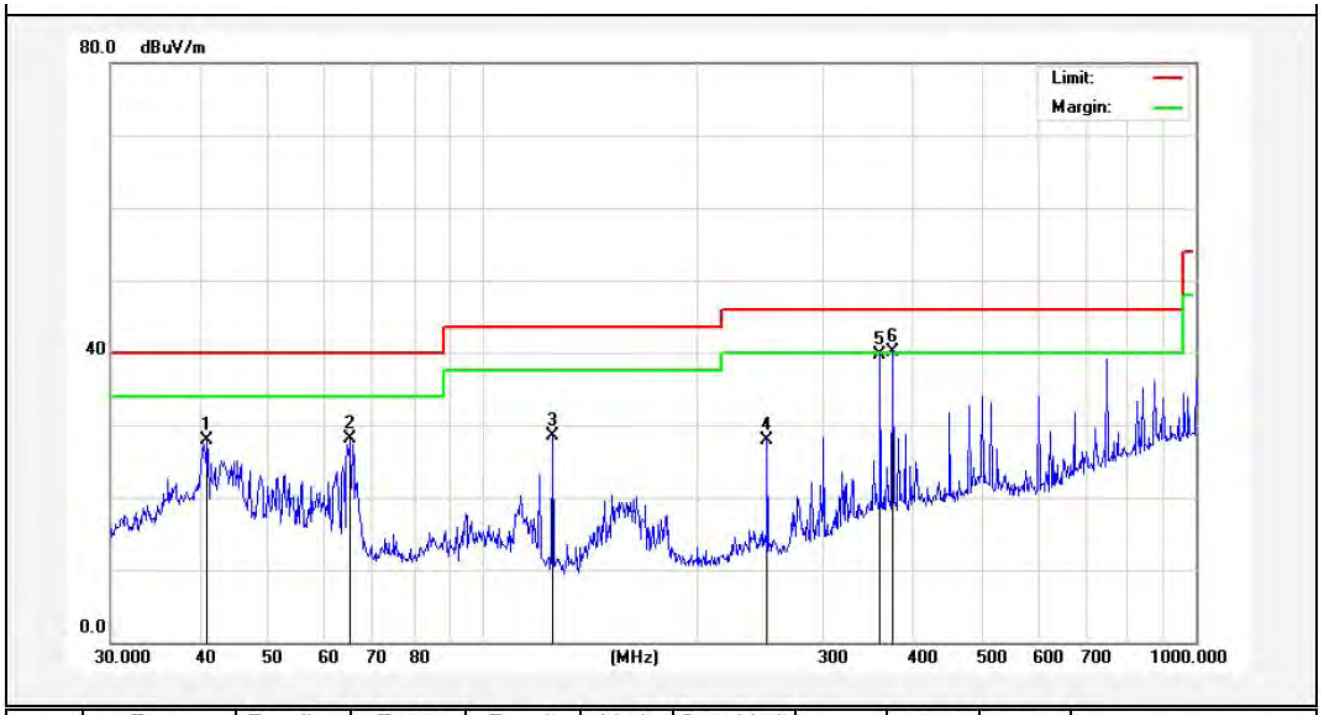
All readings from 30MHz to 1GHz are quasi-peak values with a resolution bandwidth of 120kHz. All reading are above 1GHz, peak & average values with a resolution bandwidth of 1MHz.
The EUT is tested in 9*6*6 Chamber.

The test results are listed in Section 4.6.4.

### 4.6.4. Test Results

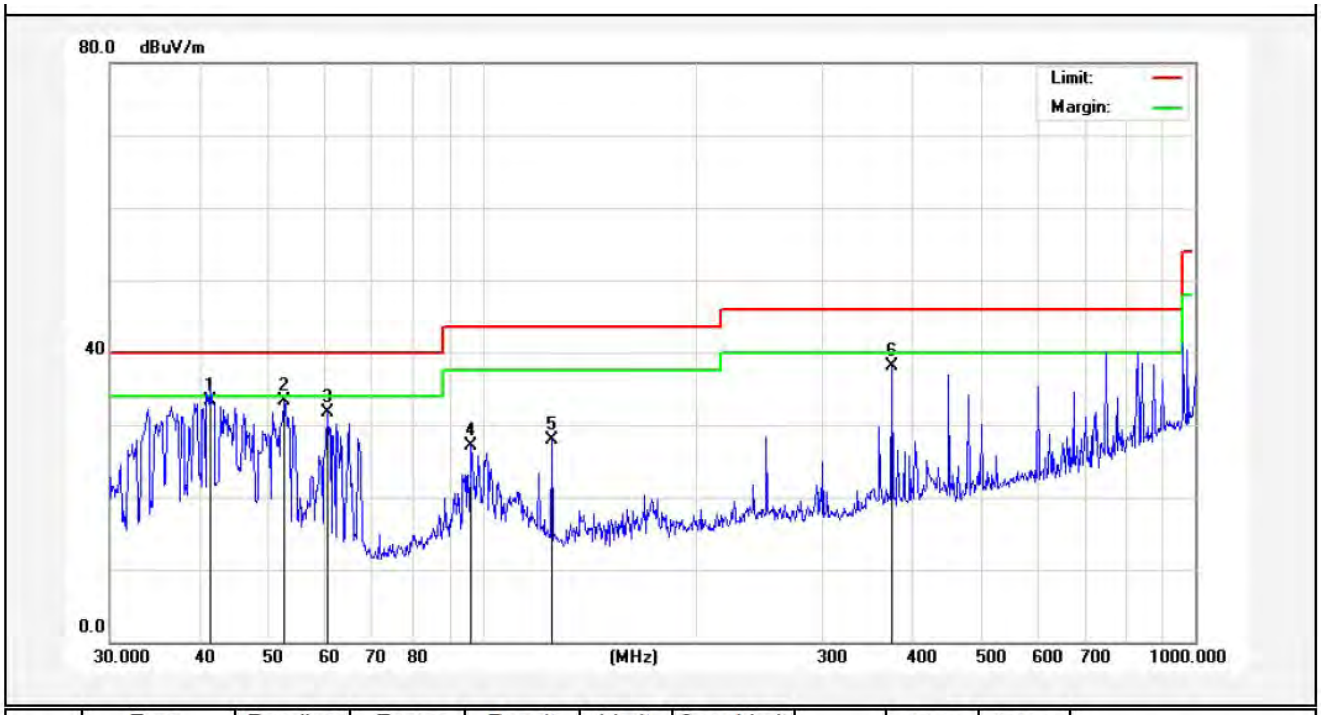
Please refer to the following pages.

| | | | |
|---|---|---|---|
| **Job No.:** | **011503381E** | **Polarization:** | **Horizontal** |
| **Standard:** | **(RE)FCC PART15 C _3m** | **Power Source:** | **AC 120V, 60Hz** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Test Mode:** | **On** | **Distance:** | **3m** |



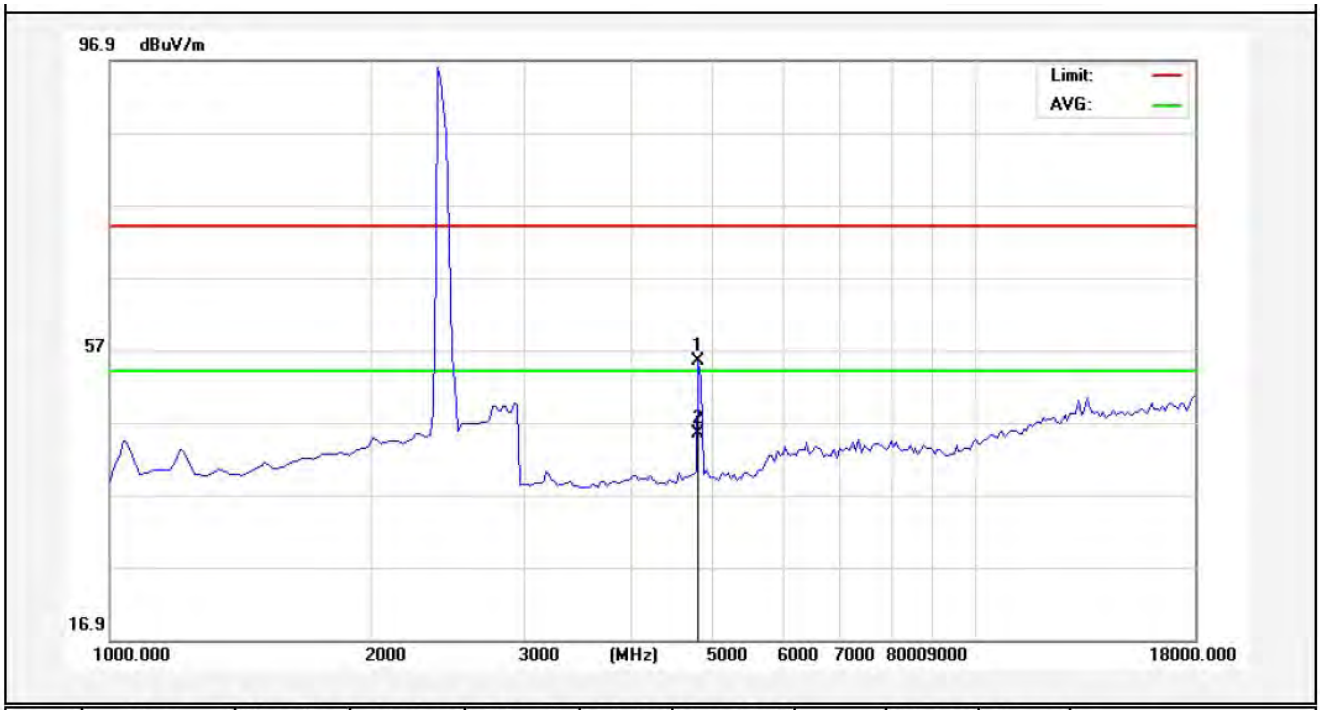

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 40.9881 | 38.63 | -10.77 | 27.86 | 40.00 | -12.14 | peak | | | |
| 2 | 65.1145 | 45.58 | -17.52 | 28.06 | 40.00 | -11.94 | peak | | | |
| 3 | 125.0066 | 50.65 | -22.08 | 28.57 | 43.50 | -14.93 | peak | | | |
| 4 | 250.3011 | 46.51 | -18.56 | 27.95 | 46.00 | -18.05 | peak | | | |
| 5 | 360.4476 | 53.45 | -13.65 | 39.80 | 46.00 | -6.20 | peak | | | |
| 6 | 375.9384 | 53.47 | -13.35 | 40.12 | 46.00 | -5.88 | QP | 100 | 0 | |

| | | | |
|---|---|---|---|
| **Job No.:** | **011503381E** | **Polarization:** | **Vertical** |
| **Standard:** | **(RE)FCC PART15 C _3m** | **Power Source:** | **AC 120V, 60Hz** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Test Mode:** | **On** | **Distance:** | **3m** |



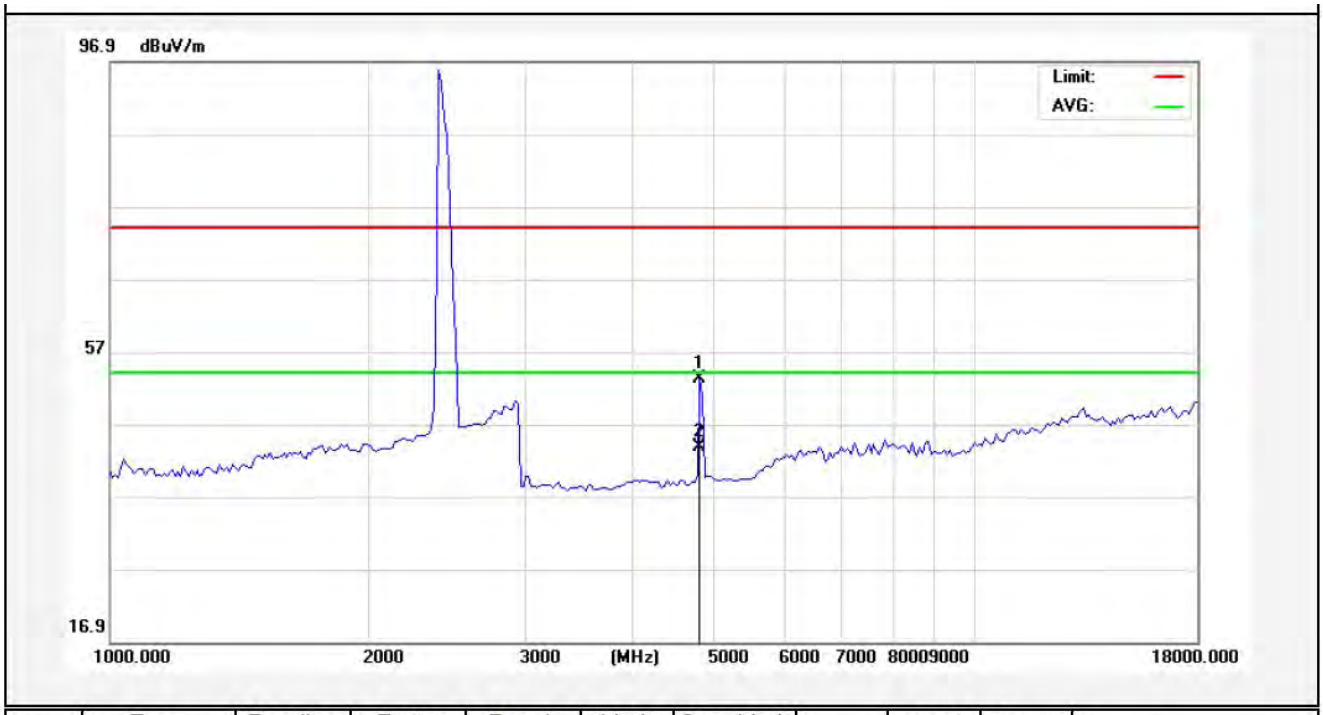

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 41.5670 | 44.22 | -10.99 | 33.23 | 40.00 | -6.77 | QP | 100 | 0 | |
| 2 | 52.7600 | 48.14 | -14.77 | 33.37 | 40.00 | -6.63 | peak | | | |
| 3 | 60.4919 | 47.21 | -15.60 | 31.61 | 40.00 | -8.39 | peak | | | |
| 4 | 96.4362 | 43.10 | -15.95 | 27.15 | 43.50 | -16.35 | peak | | | |
| 5 | 125.0066 | 44.91 | -17.08 | 27.83 | 43.50 | -15.67 | peak | | | |
| 6 | 375.9385 | 50.40 | -12.35 | 38.05 | 46.00 | -7.95 | peak | | | |

| | | | |
|---|---|---|---|
| **Job No.:** | **011503381E** | **Polarization:** | **Horizontal** |
| **Standard:** | **(RE)FCC PART15 C _3m** | **Power Source:** | **AC 120V, 60Hz** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Note:** | **802.11b(2412MHz)** | **Distance:** | **3m** |



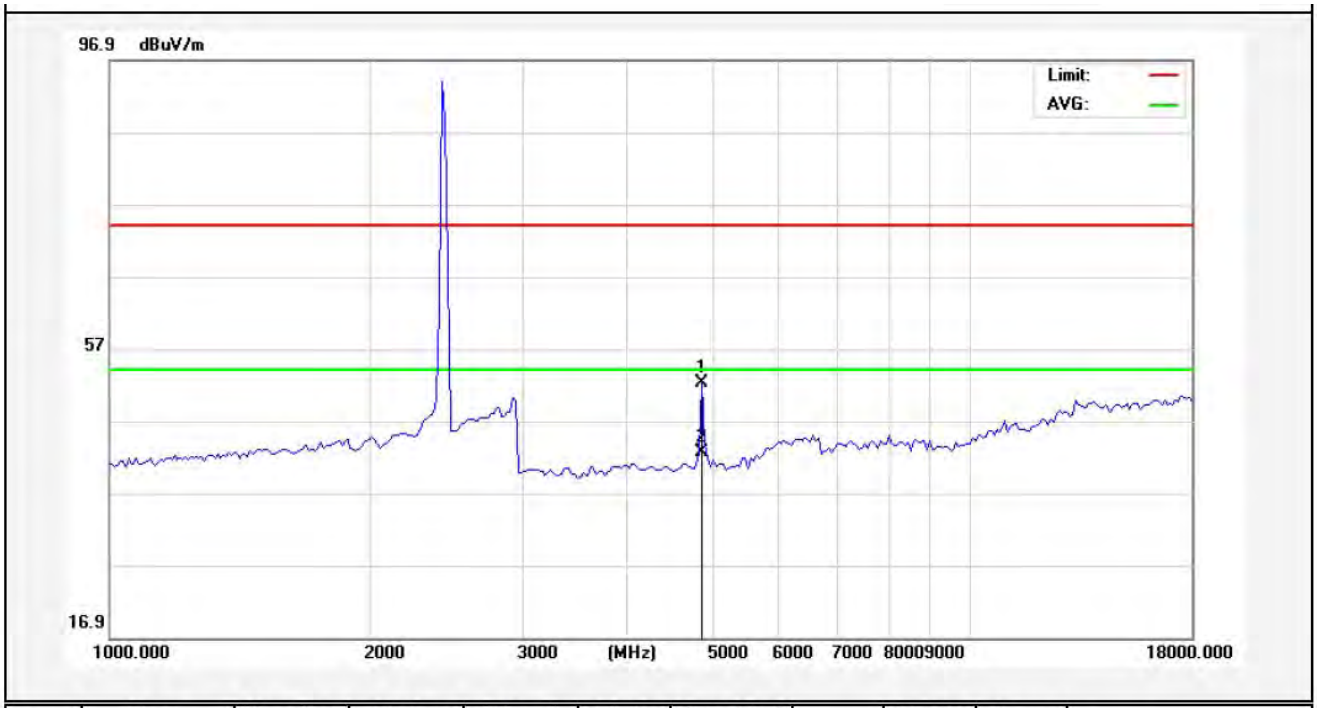

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4825.000 | 52.10 | 3.34 | 55.44 | 74.00 | -18.56 | peak | | | |
| 2 | 4825.000 | 42.02 | 3.34 | 45.36 | 54.00 | -8.64 | AVG | | | |

| | | | |
|---|---|---|---|
| **Job No.:** | **011503381E** | **Polarization:** | **Vertical** |
| **Standard:** | **(RE)FCC PART15 C _3m** | **Power Source:** | **AC 120V, 60Hz** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Note:** | **802.11b(2412MHz)** | **Distance:** | **3m** |



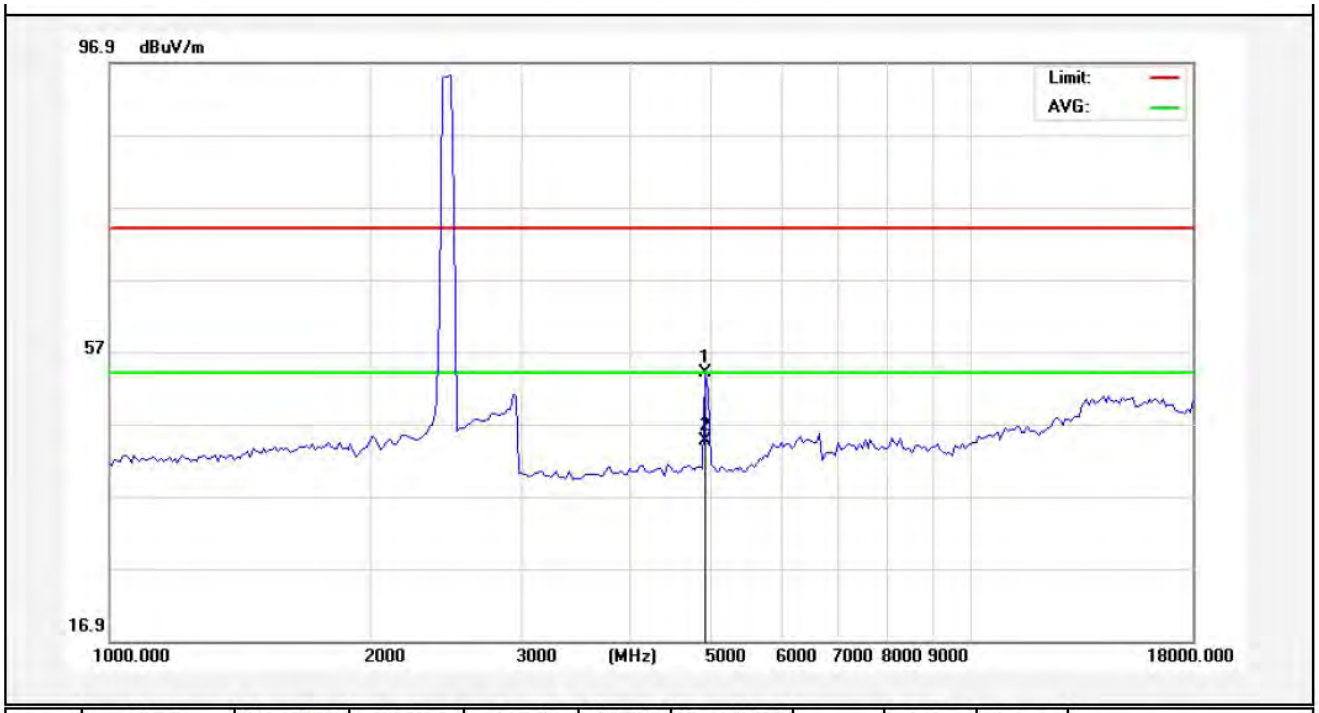

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4825.000 | 49.87 | 3.34 | 53.21 | 74.00 | -20.79 | peak | | | |
| 2 | 4825.000 | 40.40 | 3.34 | 43.74 | 54.00 | -10.26 | AVG | | | |

| | | | |
|---|---|---|---|
| **Job No.:** | **011503381E** | **Polarization:** | **Horizontal** |
| **Standard:** | **(RE)FCC PART15 C _3m** | **Power Source:** | **AC 120V, 60Hz** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Note:** | **802.11b(2437MHz)** | **Distance:** | **3m** |



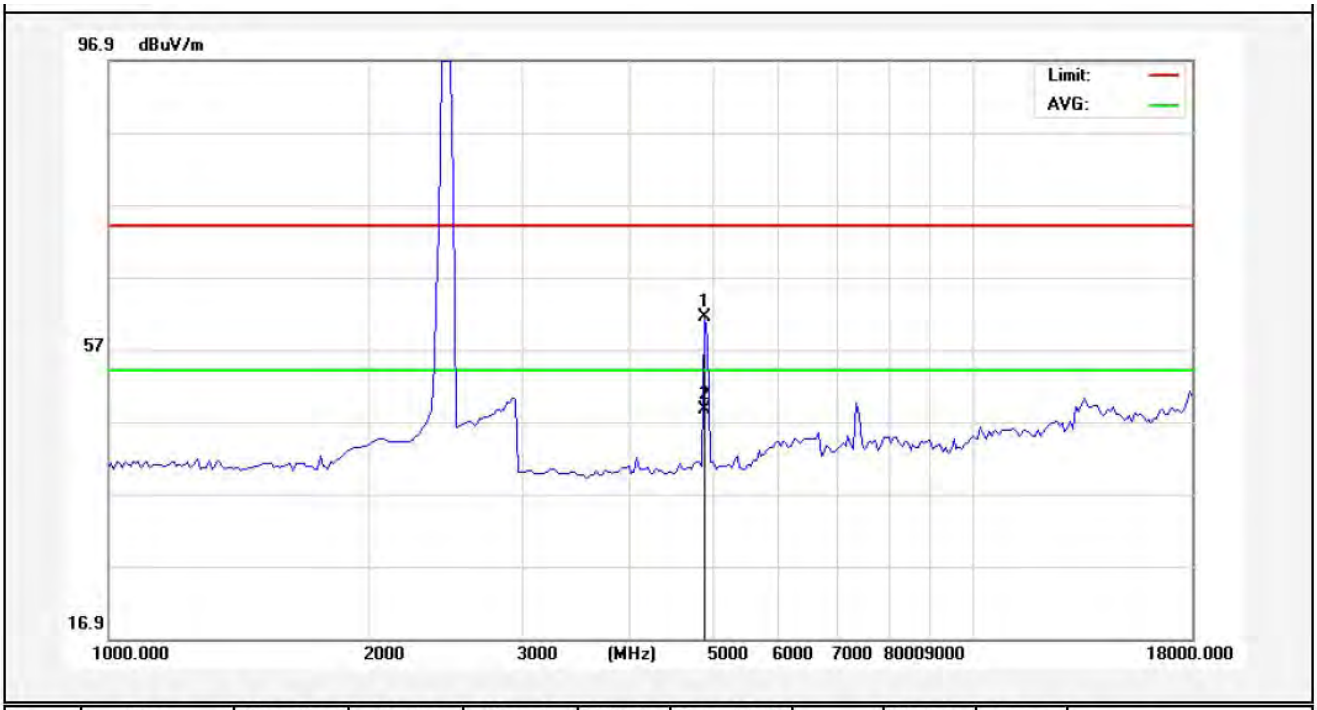

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4867.500 | 48.89 | 3.41 | 52.30 | 74.00 | -21.70 | peak | | | |
| 2 | 4867.500 | 39.24 | 3.41 | 42.65 | 54.00 | -11.35 | AVG | | | |

| | | | |
|---|---|---|---|
| **Job No.:** | **011503381E** | **Polarization:** | **Vertical** |
| **Standard:** | **(RE)FCC PART15 C _3m** | **Power Source:** | **AC 120V, 60Hz** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Note:** | **802.11b(2437MHz)** | **Distance:** | **3m** |



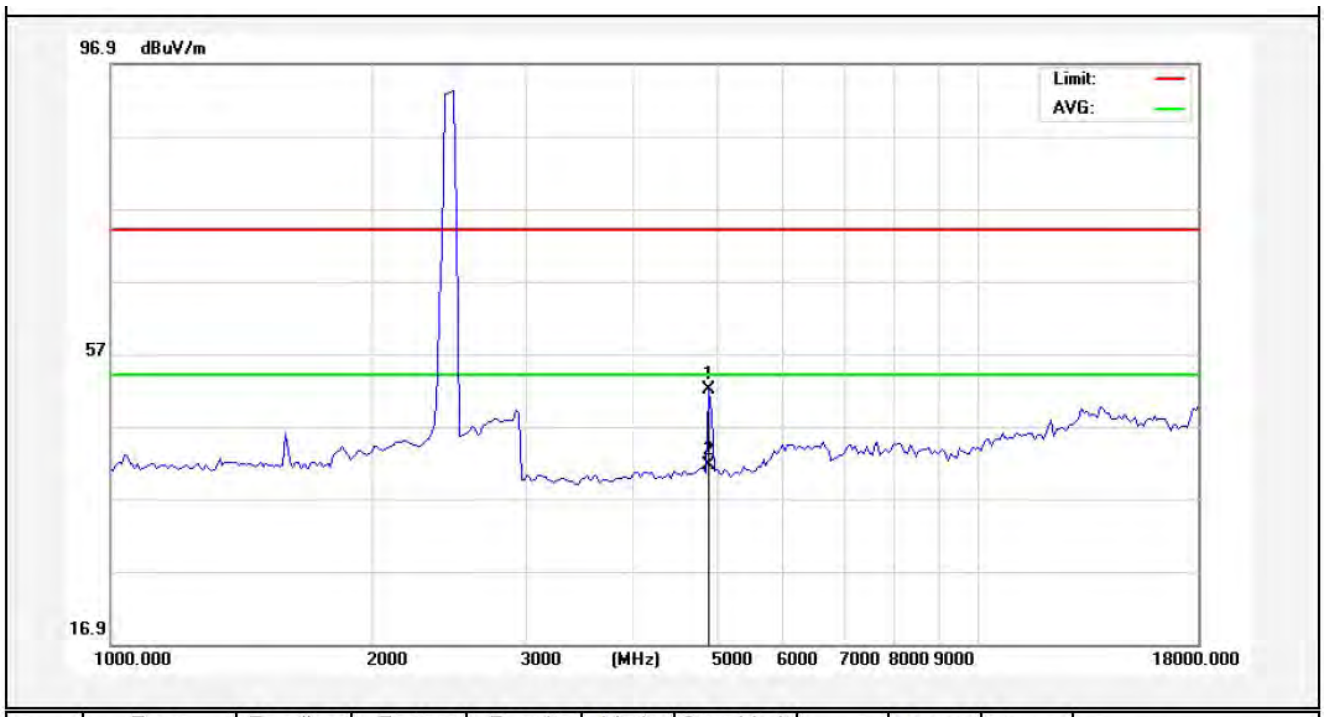

| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4910.000 | 50.53 | 3.49 | 54.02 | 74.00 | -19.98 | peak | | | |
| 2 | 4910.000 | 41.19 | 3.49 | 44.68 | 54.00 | -9.32 | AVG | | | |

| | | | |
|---|---|---|---|
| **Job No.:** | **011503381E** | **Polarization:** | **Horizontal** |
| **Standard:** | **(RE)FCC PART15 C _3m** | **Power Source:** | **AC 120V, 60Hz** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Note:** | **802.11b(2462MHz)** | **Distance:** | **3m** |




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4910.000 | 57.87 | 3.49 | 61.36 | 74.00 | -12.64 | peak | | | |
| 2 | 4910.000 | 45.16 | 3.49 | 48.65 | 54.00 | -5.35 | AVG | | | |

| | | | |
|---|---|---|---|
| **Job No.:** | **011503381E** | **Polarization:** | **Vertical** |
| **Standard:** | **(RE)FCC PART15 C _3m** | **Power Source:** | **AC 120V, 60Hz** |
| **Test item:** | **Radiation Test** | **Temp.(C)/Hum.(%RH):** | **24.3(C)/55%RH** |
| **Note:** | **802.11b(2462MHz)** | **Distance:** | **3m** |




| No. | Freq. (MHz) | Reading (dBuV/m) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/ | Over Limit (dB) | Detector | Height (cm) | degree (deg) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 4902.300 | 48.46 | 3.48 | 51.94 | 74.00 | -22.06 | peak | | | |
| 2 | 4902.300 | 38.17 | 3.48 | 41.65 | 54.00 | -12.35 | AVG | | | |

# 5. ANTENNA APPLICATION

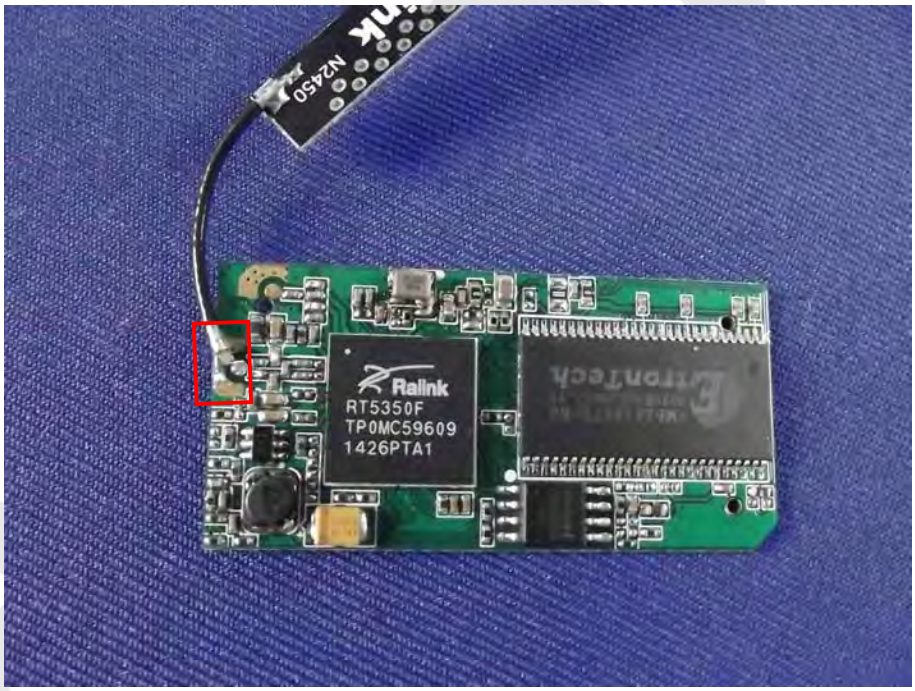
## 5.1. Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C 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 a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

## 5.2. Result

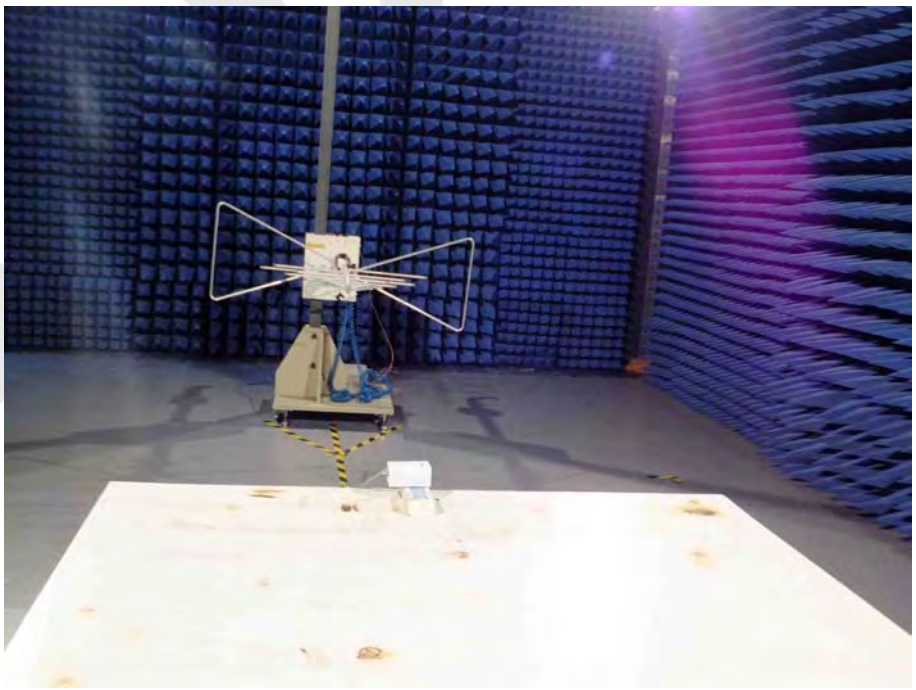
The EUT's antenna used a PCB antenna which is permanently attached, The antenna's gain is 3dBi and meets the requirement.

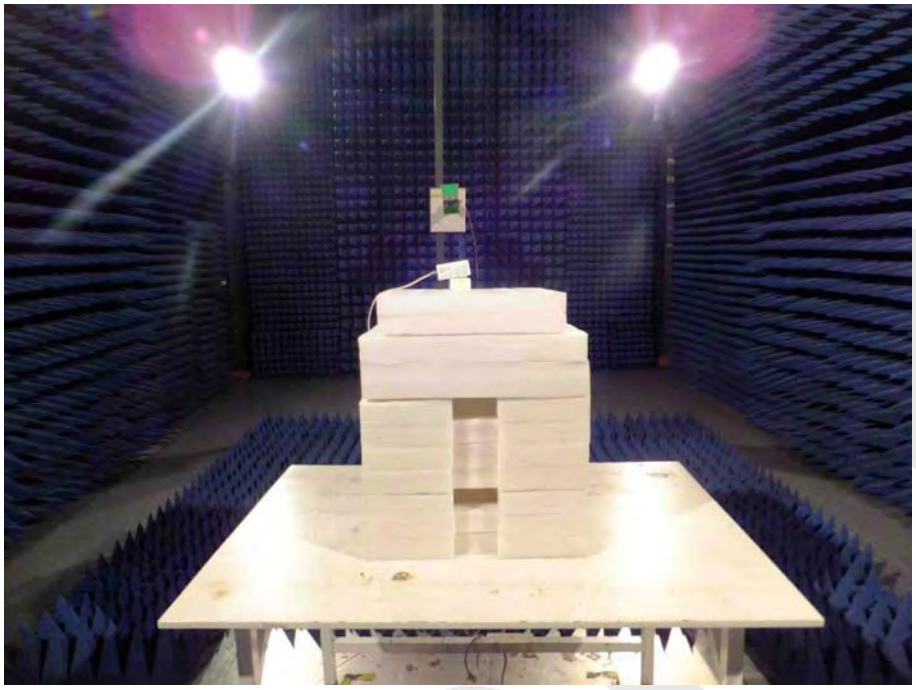


# 6. PHOTOGRAPH

## 6.1. Photo of Conducted Emission Measurement

## 6.2. Photo of Radiation Emission Test





# APPENDIX I (EXTERNAL PHOTOS)

Figure 1
The EUT-Front View


Figure 2
The EUT-Back View

Figure 3
The EUT-Top View

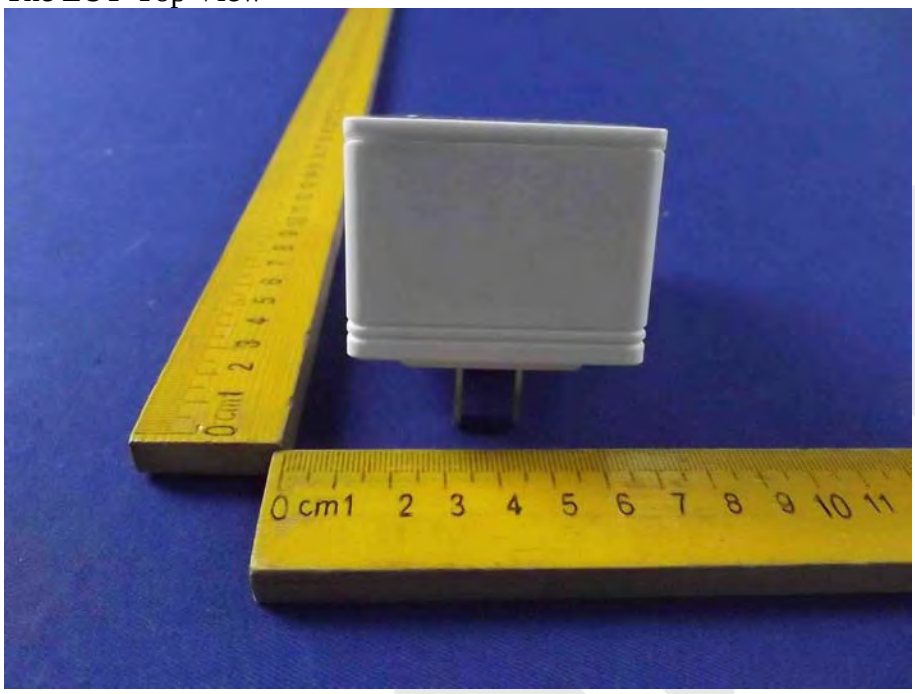



Figure 4
The EUT-Bottom View

Figure 5
The EUT-Right View


Figure 6
The EUT-Left View

# APPENDIX Ⅱ(INTERNAL PHOTOS)

Figure 7
The EUT-Inside View

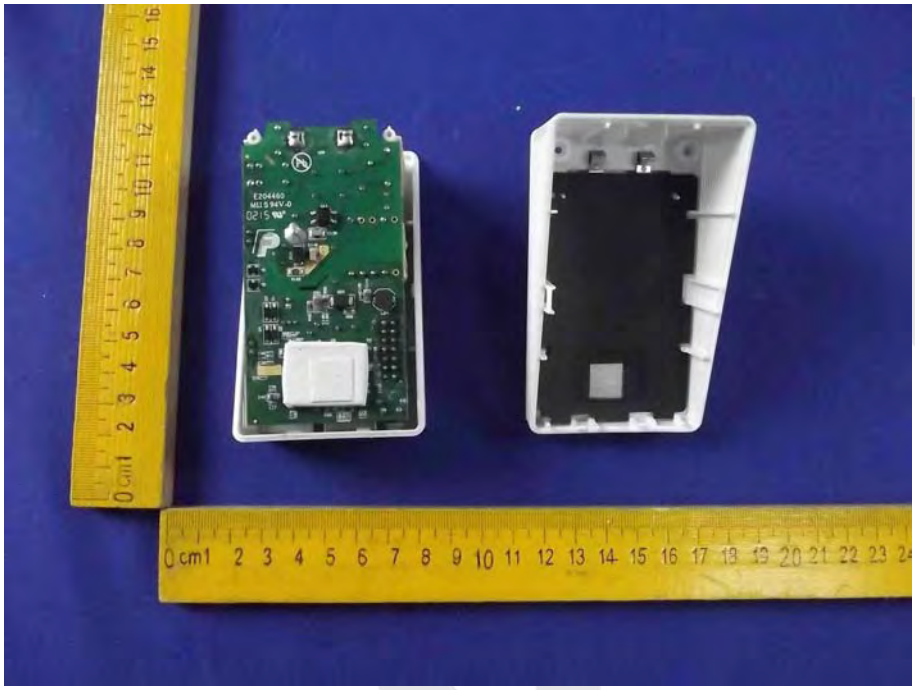


Figure 8
PCB of the EUT-Front View

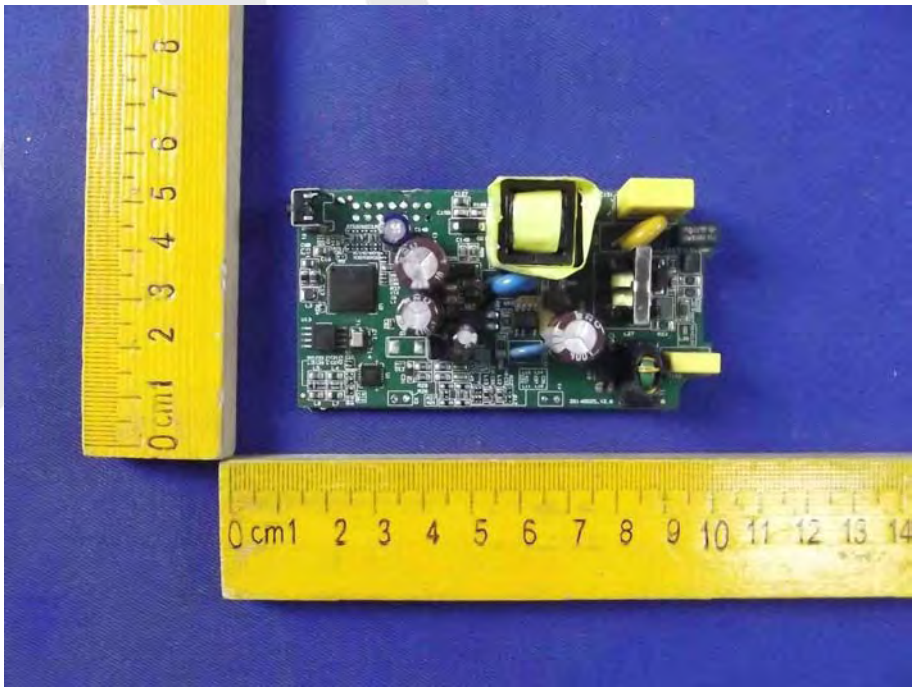


Figure 9
PCB of the EUT-Back View

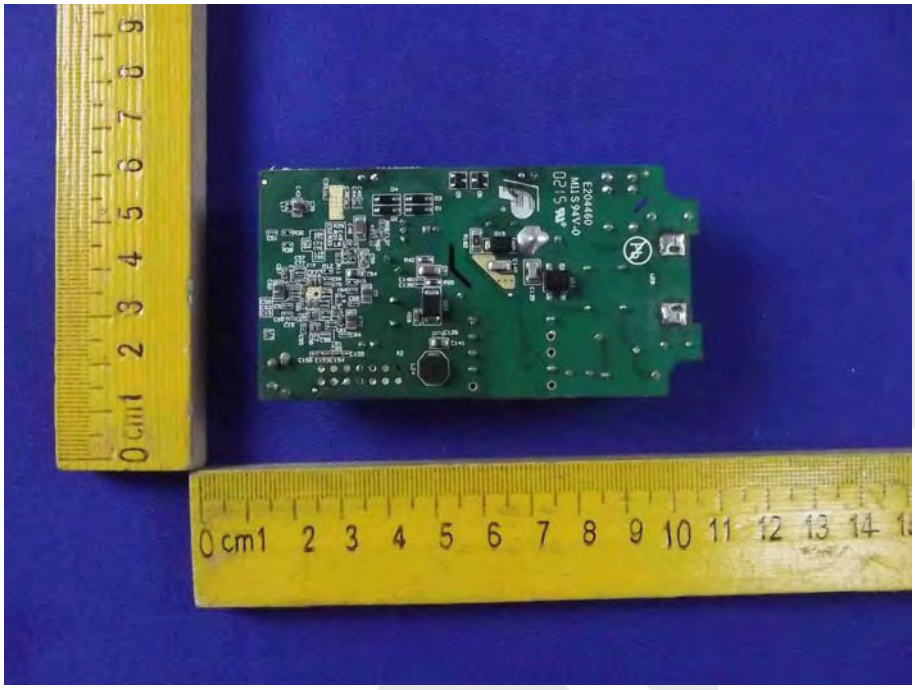


Figure 10
PCB of the EUT-Front View

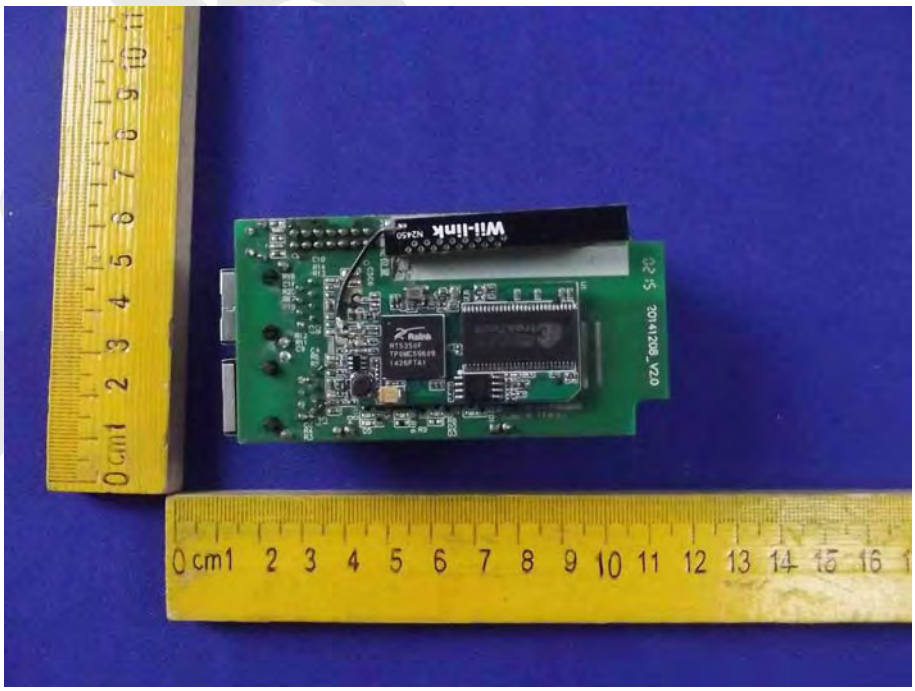


Figure 11
PCB of the EUT-Back View

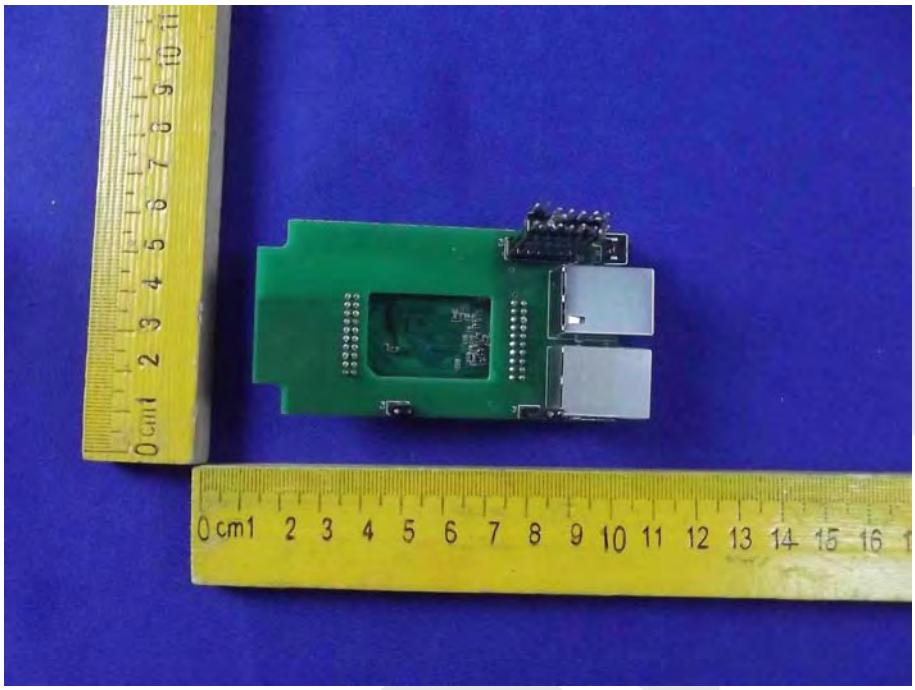



Figure 12
PCB of the EUT-Front View

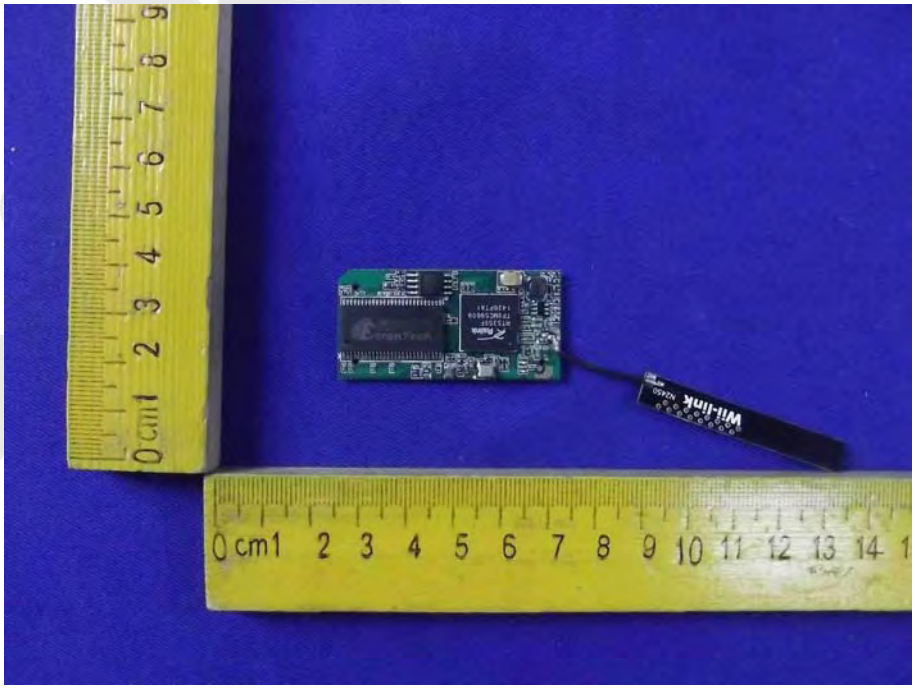


Figure 13
PCB of the EUT-Back View

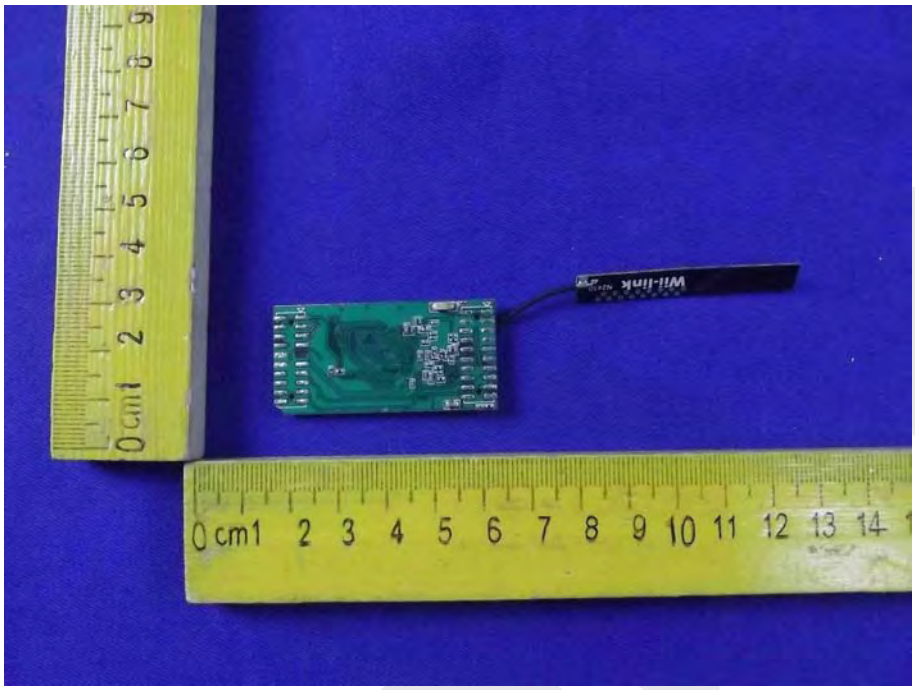



Figure 14
PCB of the EUT-Front View

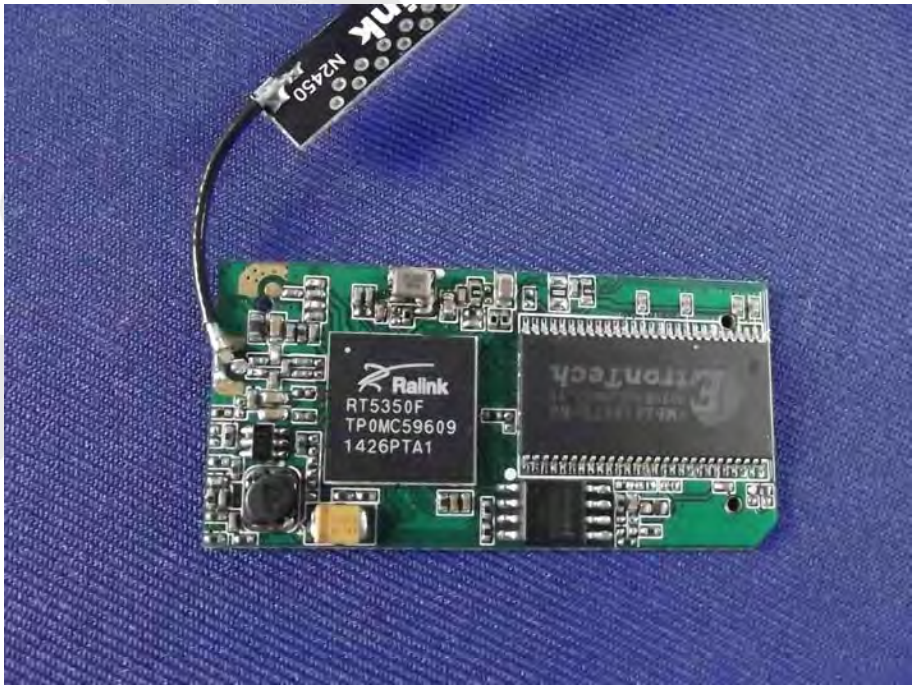


Figure 15
PCB of the EUT-Back View