# FCC / ISED Test Report

**For:**
Geotab Inc.

**Model #:**
GP9-LTE

**Product Description:**
GO9 Telematics device with on-board Wi-Fi hotspot functionality

**FCC ID:** 2AV57GP9LTE
**IC ID:** 11140A-GP9LTE

**Applied Rules and Standards:**
47 CFR Part 15.247 (DTS)
RSS-247 Issue 2 (DTSs) & RSS-Gen Issue 5

**REPORT #:** EMC_GEOTA_032_20001_FCC_15.247_ISED_Wi-Fi_DTS

**DATE:** 6/12/2020

**A2LA Accredited**

**IC recognized # 3462B-2**

***CETECOM* Inc.**
411 Dixon Landing Road ◆ Milpitas, CA 95035 ◆ U.S.A.
Phone: + 1 (408) 586 6200 ◆ Fax: + 1 (408) 586 6299 ◆ E-mail: info@cetecom.com ◆ http://www.cetecom.com
*CETECOM* Inc. is a Delaware Corporation with Corporation number: 2905571

**TABLE OF CONTENTS**

# 1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.247 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-247.

No deviations were ascertained.

| Company | Description | Model # |
|---|---|---|
| Geotab Inc. | GO9 Telematics device with on-board Wi-Fi hotspot functionality | GP9-LTE |

**Responsible for Testing Laboratory:**

| Date | Section | Name | Signature |
|---|---|---|---|
| 12/06/2020 | Compliance | Li, Cindy (EMC Lab Manager) | Cindy Li Digitally signed by cindy.li@cetecom.com DN: CN=cindy.li@cetecom.com Reason: I am approving this document Location: Date: 2020-06-12 15:34:54 |

**Responsible for the Report:**

| Date | Section | Name | Signature |
|---|---|---|---|
| 12/06/2020 | Compliance | Ghanma, Issa (EMC Engineer) | Digitally signed by: Issa W Ghanma DN: CN = Issa W Ghanma email = Issaghanma@cetecom.com C = US O = CETECOM Inc. OU = EMC Date: 2020.06.12 12:49:43 -07'00' |

# 2 Administrative Data

## 2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

| | |
|---|---|
| **Company Name:** | CETECOM Inc. |
| **Department:** | Compliance |
| **Street Address:** | 411 Dixon Landing Road |
| **City/Zip Code** | Milpitas, CA 95035 |
| **Country** | USA |
| **Telephone:** | +1 (408) 586 6200 |
| **Fax:** | +1 (408) 586 6299 |
| **EMC Lab Manager:** | Li, Cindy |
| **Responsible Project Leader:** | Sivaraman, Sangeetha |

## 2.2 Identification of the Client

| | |
|---|---|
| **Applicant's Name:** | Geotab Inc. |
| **Street Address:** | 2440 Winston Park Drive |
| **City/Zip Code** | Oakville, ON L6H 7V2 |
| **Country** | Canada |

## 2.3 Identification of the Manufacturer

| | |
|---|---|
| **Manufacturer's Name:** | Same as Client /---------- |
| **Manufacturers Address:** | ---------- |
| **City/Zip Code** | ---------- |
| **Country** | ---------- |

# 3 Equipment Under Test (EUT)

## 3.1 EUT Specifications

| | |
|---|---|
| **Model No:** | GP9-LTE |
| **FCC-ID :** | 2AV57GP9LTE |
| **IC-ID:** | 11140A-GP9LTE |
| **HW Version :** | A |
| **SW Version :** | 123 |
| **HVIN:** | GP9-LTE |
| **PMN:** | GP9-LTE |
| **Product Description:** | GO9 Telematics device with on-board Wi-Fi hotspot functionality |
| **Frequency Range / number of channels:** | Nominal band: 2400 MHz – 2483.5 MHz;<br>Center to center: 2412 MHz (ch 1) – 2462 MHz (ch 11), 11 channels |
| **Type(s) of Modulation:** | Wi-Fi: 802.11b/ g/ n |
| **Modes of Operation:** | 802.11b,g,n |
| **Antenna Information as declared:** | Max Gain: 4.2 dBi |
| **Max. Conducted Output Power:** | Peak measurement: 23.37 dBm |
| **Power Supply/ Rated Operating Voltage Range:** | Vehicle: 12, 24 V DC |
| **Operating Temperature Range** | -40ºC to 85 ºC |

| | |
|---|---|
| **Other Radios included in the device:** | ❖ Cellular:<br>• Module Name : Wistron NeWeb<br>• Model Number : M18Q2F-1<br>• FCC \ IC ID : NKRM18Q2 \ 4441A-M18Q2<br>❖ GPS Receiver:<br>• 72-channel engine<br>(GPS/GLONASS/Beidou/Galileo/SBAS/WAAS/EGNOSMSAS/GAGAN) |
| **Sample Revision** | ☐Prototype Unit; ☐Production Unit; ■Pre-Production |

### 3.2 EUT Sample details

| EUT # | Serial Number | HW Version | SW Version | Notes/Comments |
|---|---|---|---|---|
| **1** | GP9000001 | A | 123 | Conducted RF |
| **2** | GP9000002 | A | 123 | Radiated |

### 3.3 Accessory Equipment (AE) details

| AE # | Type | Model | Manufacturer | Serial Number |
|---|---|---|---|---|
| N/A | - | - | - | - |

### 3.4 Test Sample Configuration

| EUT Set-up # | Combination of AE used for test set up | Comments |
|---|---|---|
| **1** | EUT#1 | The EUT was connected to an engineering test harnesses for test setup.<br>These harnesses allow Powering the device on a bench setup and AT commands access. |
| **2** | EUT#2 | The EUT was connected to an engineering test harnesses for test setup.<br>These harnesses allow Powering the device on a bench setup and AT commands access. |

## 3.5 Mode of Operation details

| Mode of Operation | Description of Operating modes | Additional Information |
|---|---|---|
| **Op. 1** | Wi-Fi 2.4 GHz | ❖ "QRCT 4" software tool was provided by the client, to configure the Wi-Fi 2.4GHz radio:<br>▪ Mode: b/g/n<br>▪ Transmit mode: Continuous TX<br>▪ Duty cycle: 100%<br>▪ Power: Max Power (Based on "**Wi-Fi TX Operation mode**" table below)<br>▪ Hopping: No<br>▪ Hopping Type: Single Frequency<br>▪ Channel: Low , Mid, High, Channel # 11<br>▪ Data rate: (Based on "**Wi-Fi TX Operation mode**" table below)<br>❖ The measurement equipment was connected to the 50 ohm RF port of the EUT. |

| Mode | Rate (Mbps) | MOD. | target power | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel (HT20) | | | CH1 | CH2 | CH3 | CH4 | CH5 | CH6 | CH7 | CH8 | CH9 | CH10 | CH11 |
| 11b | 1 | DSSS-1 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | 2 | DSSS-2 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | 5.5 | CCK-5_5 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| | 11 | CCK-11 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| 11g | 6 | OFDM-6 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 9 | OFDM-9 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 12 | OFDM-12 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 18 | OFDM-18 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 24 | OFDM-24 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 36 | OFDM-36 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 48 | OFDM-48 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | 54 | OFDM-54 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| 11n | 6.5 | MCS0 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | 13 | MCS1 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | 19.5 | MCS2 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | 26 | MCS3 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | 39 | MCS4 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | 52 | MCS5 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | 58.5 | MCS6 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |
| | 65 | MCS7 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 | 14 |

Note: For 40 MHz channel bandwidth, target power used same as for 20 MHz channel bandwidth listed in the table above.

## 3.6 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on low, mid and high channels, and highest possible duty cycle and output power.

For radiated measurements;

- All data in this report show the worst case of Wi-Fi radio in simultaneous transmission mode with Cellular, transmitting at the highest output power band (FCC/IC ID: NKRM18Q2/4441A-M18Q2).
- All data in this report show the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT.

## 4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.247 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-247 of ISED Canada.

This test report is to support a request for new equipment authorization under the FCC ID: 2AV57GP9LTE IC ID: 11140A-GP9LTE

Testing procedures are based on 558074 D01 15.247 Meas Guidance v05r02 – "GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES" - April 2, 2019, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.

## 5 Measurement Results Summary

| Test Specification | Test Case | Temperature and Voltage Conditions | Mode | Pass | NA | NP | Result |
|---|---|---|---|---|---|---|---|
| §15.247(a)(1)<br>RSS-247 5.2(a) | Emission Bandwidth | Nominal | Op. 1 | ■ | ☐ | ☐ | Complies |
| §15.247(e)<br>RSS-247 5.2(b) | Power Spectral Density | Nominal | Op. 1 | ■ | ☐ | ☐ | Complies |
| §15.247(b)(1)<br>RSS-247 5.4(d) | Maximum Conducted Output Power and EIRP | Nominal | Op. 1 | ■ | ☐ | ☐ | Complies |
| §15.247(d)<br>RSS-247 5.5 | Band edge compliance Unrestricted Band Edges | Nominal | Op. 1 | ■ | ☐ | ☐ | Complies |
| §15.247; 15.209; 15.205<br>RSS-Gen 8.9; 8.10 | Band edge compliance Restricted Band Edges | Nominal | Op. 1 | ■ | ☐ | ☐ | Complies |
| §15.247(d); §15.209<br>RSS-Gen 6.13 | TX Spurious emissions-Radiated | Nominal | Op. 2 | ■ | ☐ | ☐ | Complies |
| §15.207(a)<br>RSS Gen 8.8 | AC Conducted Emissions | Nominal | N/A | ☐ | ☐ | ■ | See note1<br>See note 2 |

**Note1:** NA= Not Applicable; NP= Not Performed.
**Note2:** This device is powered by Vehicle: 12, 24 V DC; hence this test is not applicable.

# 6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=1.

Radiated measurement

| | |
|---|---|
| 9 kHz to 30 MHz | ±2.5 dB (Magnetic Loop Antenna) |
| 30 MHz to 1000 MHz | ±2.0 dB (Biconilog Antenna) |
| 1 GHz to 40 GHz | ±2.3 dB (Horn Antenna) |

Conducted measurement

| | |
|---|---|
| 150 kHz to 30 MHz | ±0.7 dB (LISN) |
| RF conducted measurement | ±0.5 dB |

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3 dB to the limit.

## 6.1 Environmental Conditions During Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25° C
- Relative humidity: 40-60%

## 6.2 Dates of Testing:

03/24/2020 – 04/17/2020

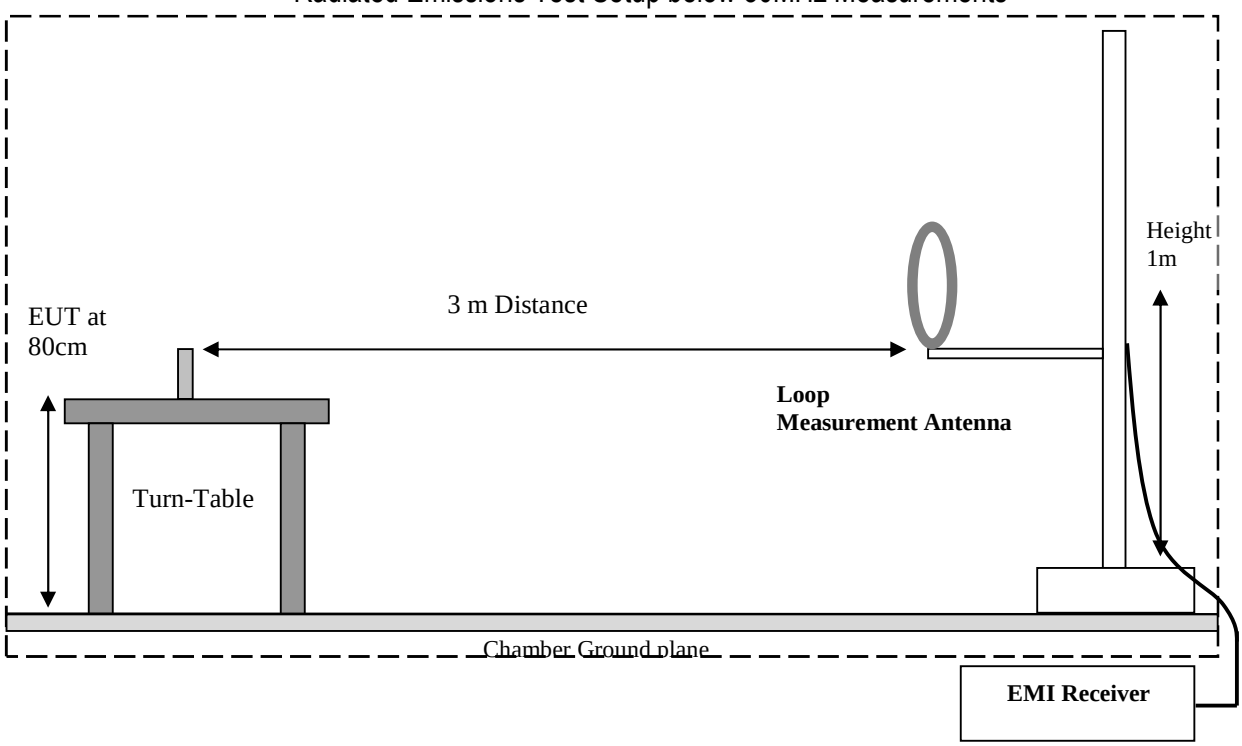
# 7 Measurement Procedures

## 7.1 Radiated Measurement

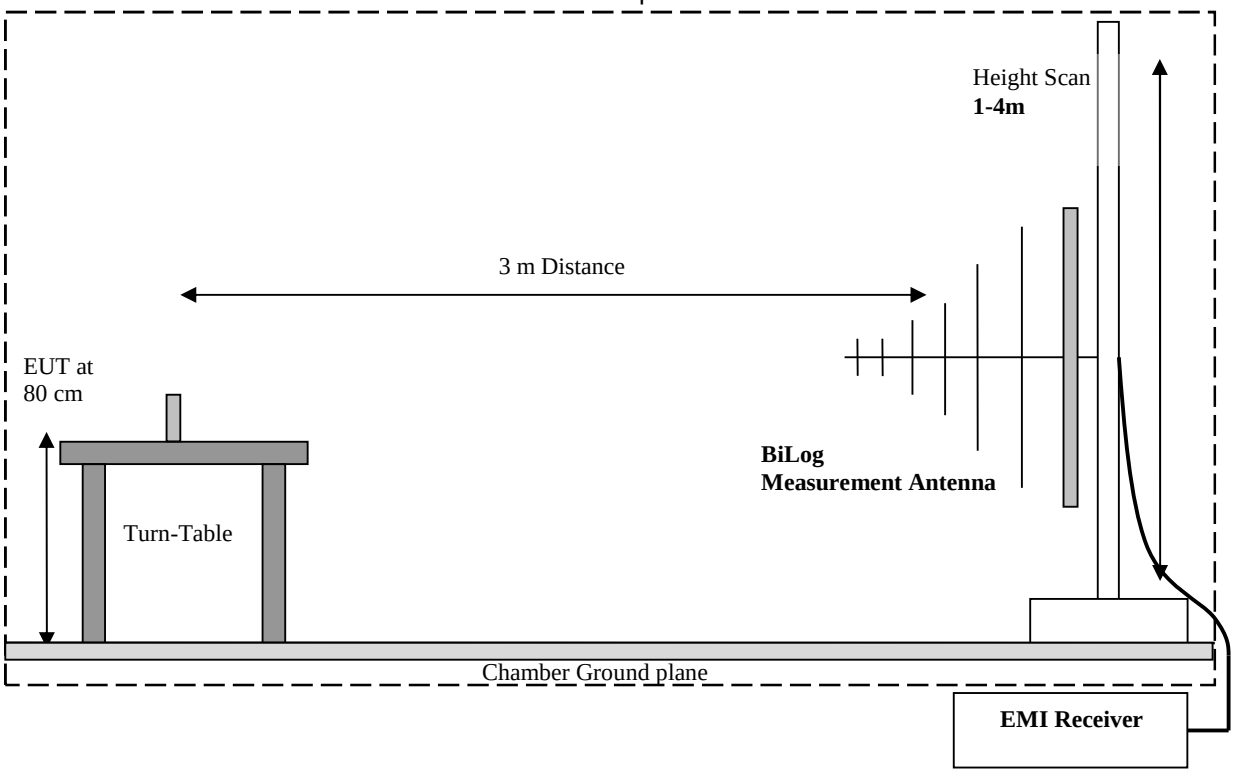
The radiated measurement is performed according to ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 360º continuous measurement of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

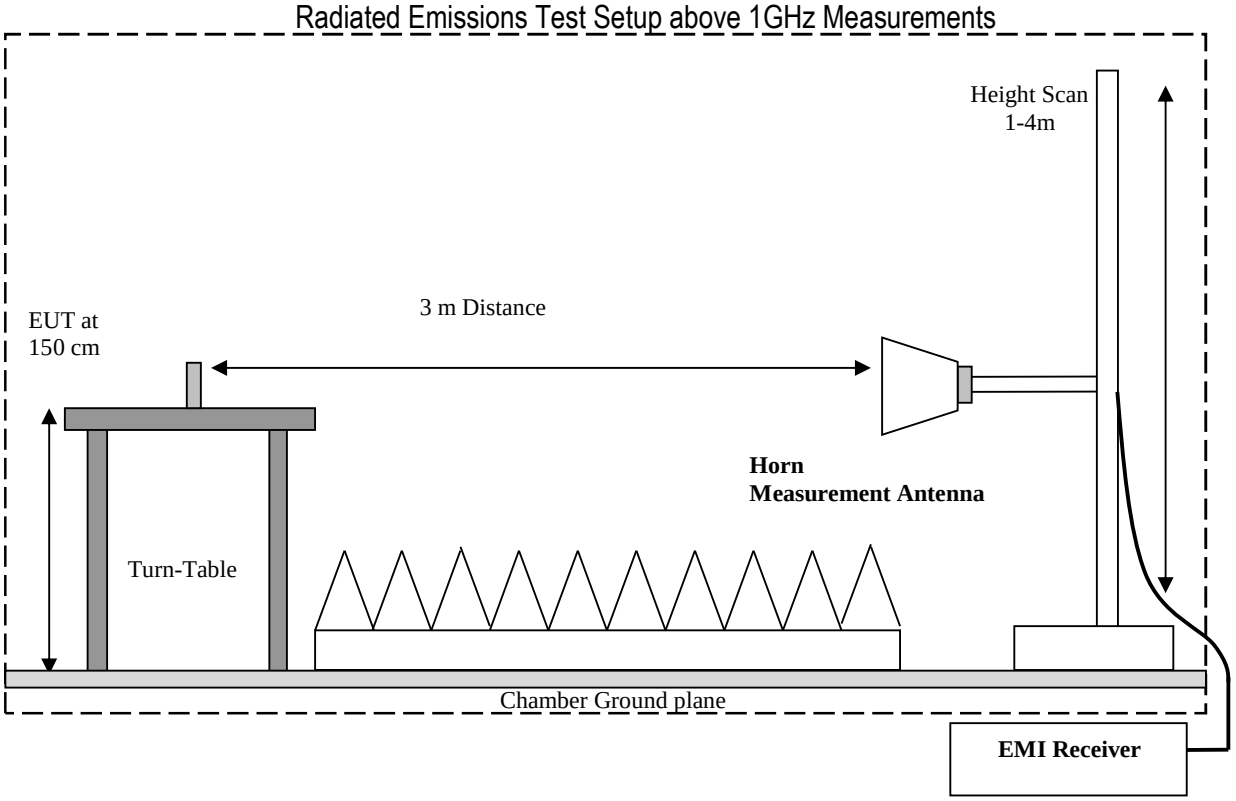
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements




Radiated Emissions Test Setup above 1GHz Measurements



### 7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV) + Cable Loss (dB) + Antenna Factor (dB/m)

Example:

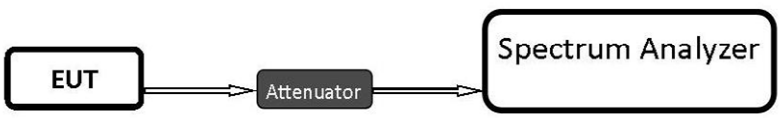
| Frequency (MHz) | Measured SA (dBµV) | Cable Loss (dB) | Antenna Factor Correction (dB) | Field Strength Result (dBµV/m) |
|---|---|---|---|---|
| 1000 | 80.5 | 3.5 | 14 | 98.0 |

## 7.2 Power Line Conducted Measurement Procedure

AC Power Line conducted emissions measurements performed according to: ANSI C63.4 (2014)

## 7.3 RF Conducted Measurement Procedure

Testing procedures are based on 558074 D01 15.247 Meas Guidance v05r02 – "GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES" - April 2, 2019, by the Federal Communications Commission, Office of Engineering and Technology, Laboratory Division.




- Connect the equipment as shown in the above diagram.
- Adjust the settings of the SA (Rohde-Schwarz Spectrum Analyzer) to connect the EUT at the required mode of test.
- Measurements are to be performed with the EUT set to the low, middle and high channels and for worst case modulation schemes.

# 8 Test Result Data

## 8.1 Duty Cycle

### 8.1.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02;

Measurements of duty cycle and transmission duration shall be performed using one of the following technique:

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 transmitted signal.

1. Set the center frequency of the instrument to the center frequency of the transmission.
2. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.
3. Set detector = peak or average.
4. 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.)

### 8.1.2 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Antenna Gain |
|---|---|---|---|---|
| 23.8°C | 1 | Op.1 | 12 VDC | 4.2 dBi |

### 8.1.3 Measurement result:

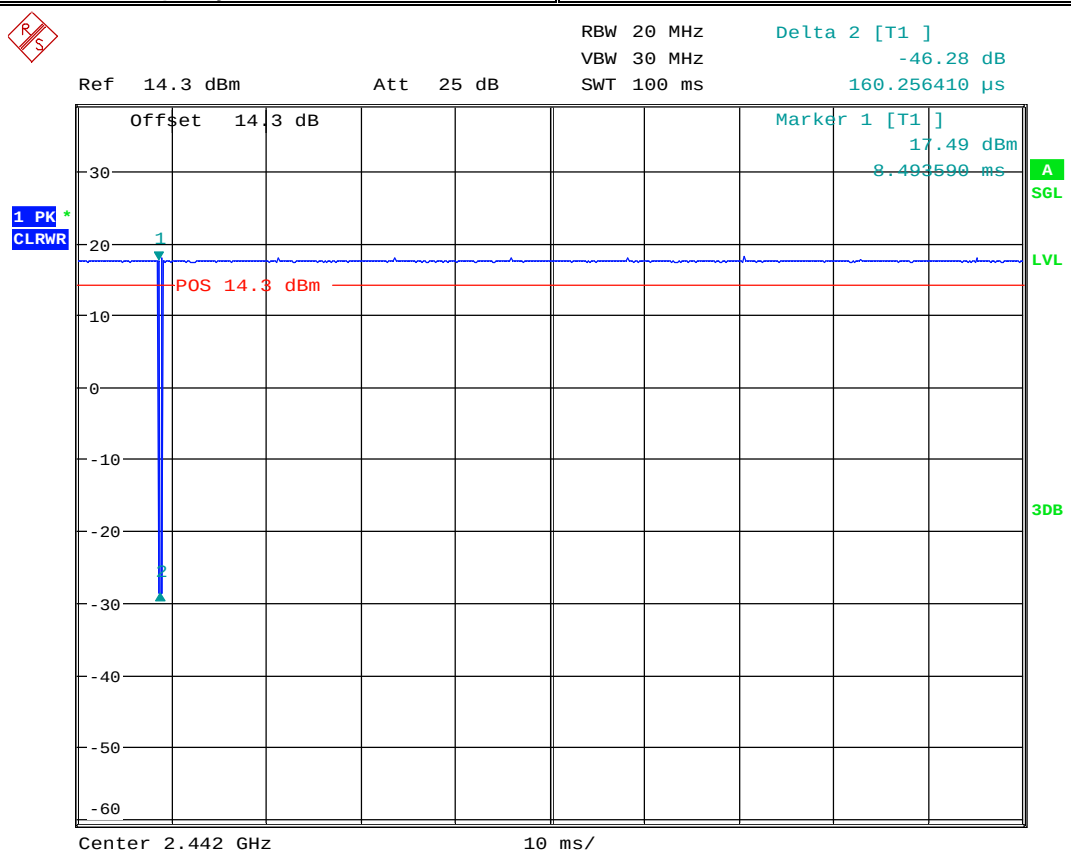
| Plot # | Mode | TX Frequency | Data Rate | Off-time over 100 ms *1 | Duty cycle |
|---|---|---|---|---|---|
| 1 | 802.11b | 2442 MHz | 1 Mb/s | 160.3 µs *2 | 99.84 % |
| 2 | 802.11g | 2442 MHz | 6 Mb/s | 480.5 µs *2 | 99.52 % |
| 3 | 802.11n HT20 | 2442 MHz | 6.5 Mb/s | 320.3 µs *2 | 99.68 % |
| 4 | 80211n HT40 | 2437 | 6.5 Mb/s | 244.4 µs *2 | 99.76 % |

***1: Milliseconds.**
***2: Microseconds.**

### 8.1.4 Measurement plots:

**Plot # 1**

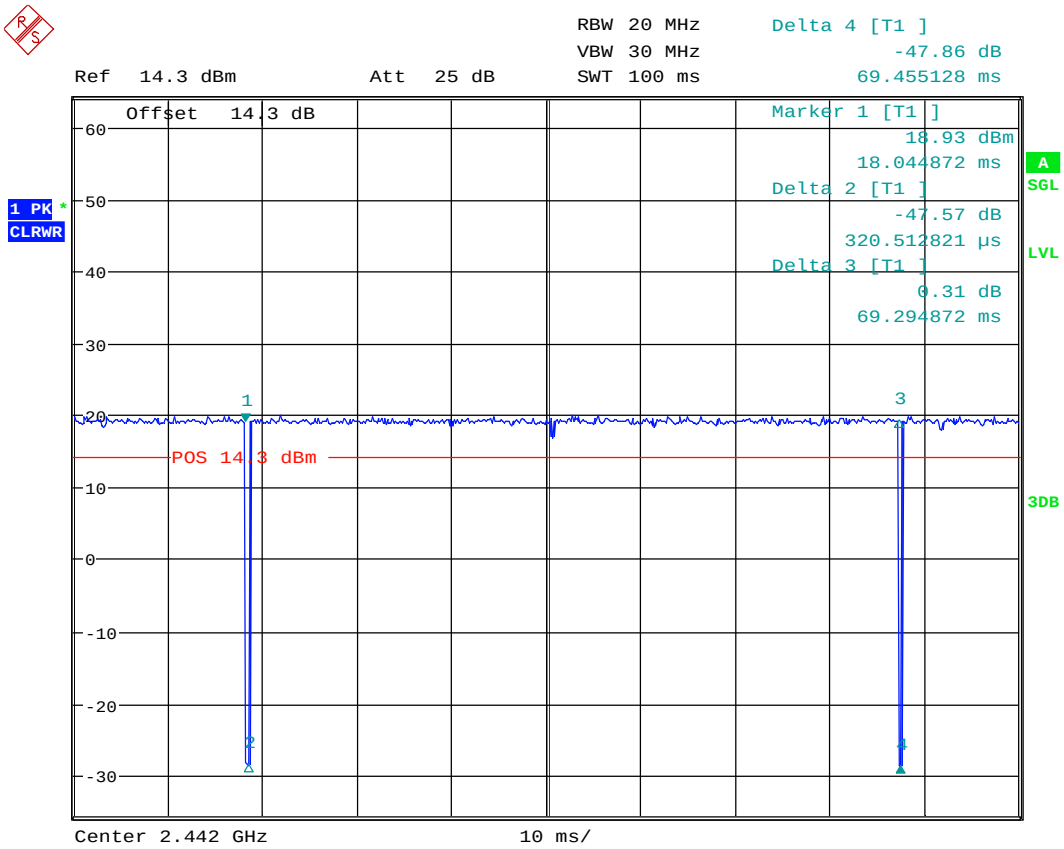
| Tx Frequency: 2442 MHz | Mode: 802.11b |
|---|---|




Date: 24.APR.2020 11:50:02

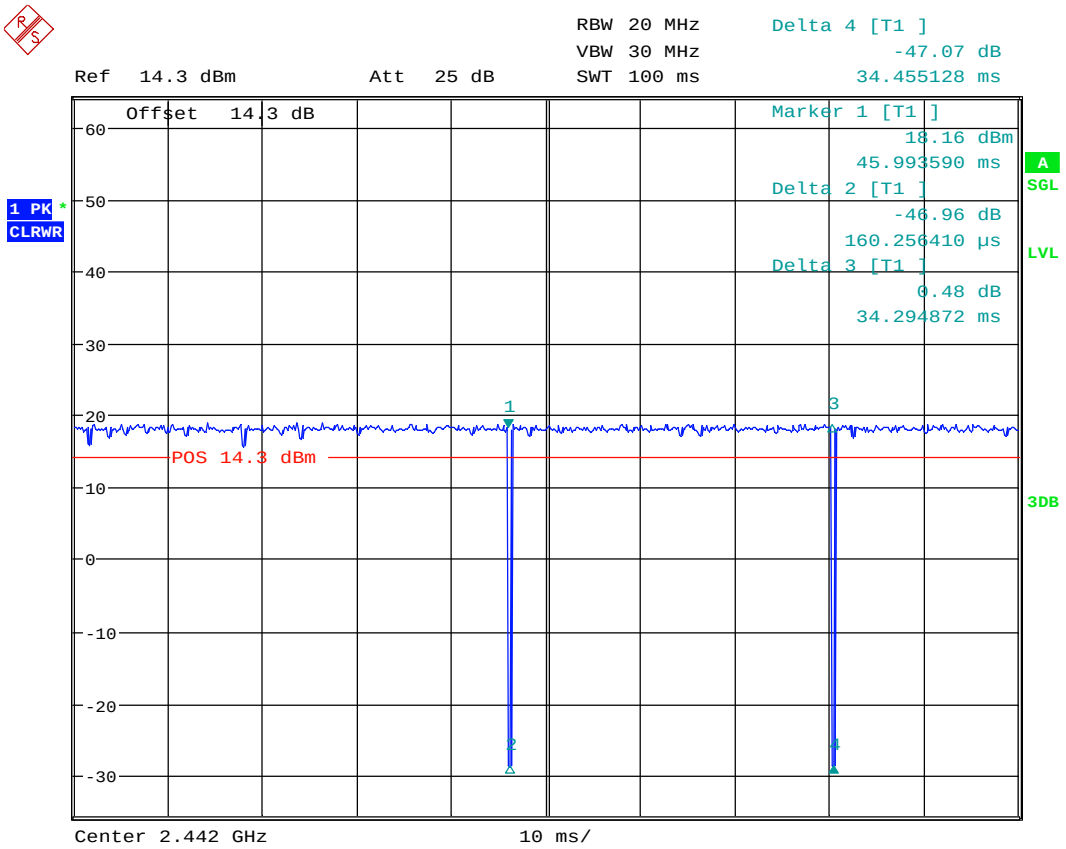
## Plot # 2

| Tx Frequency: 2442 MHz | Mode: 802.11g |
|---|---|



## Plot # 3

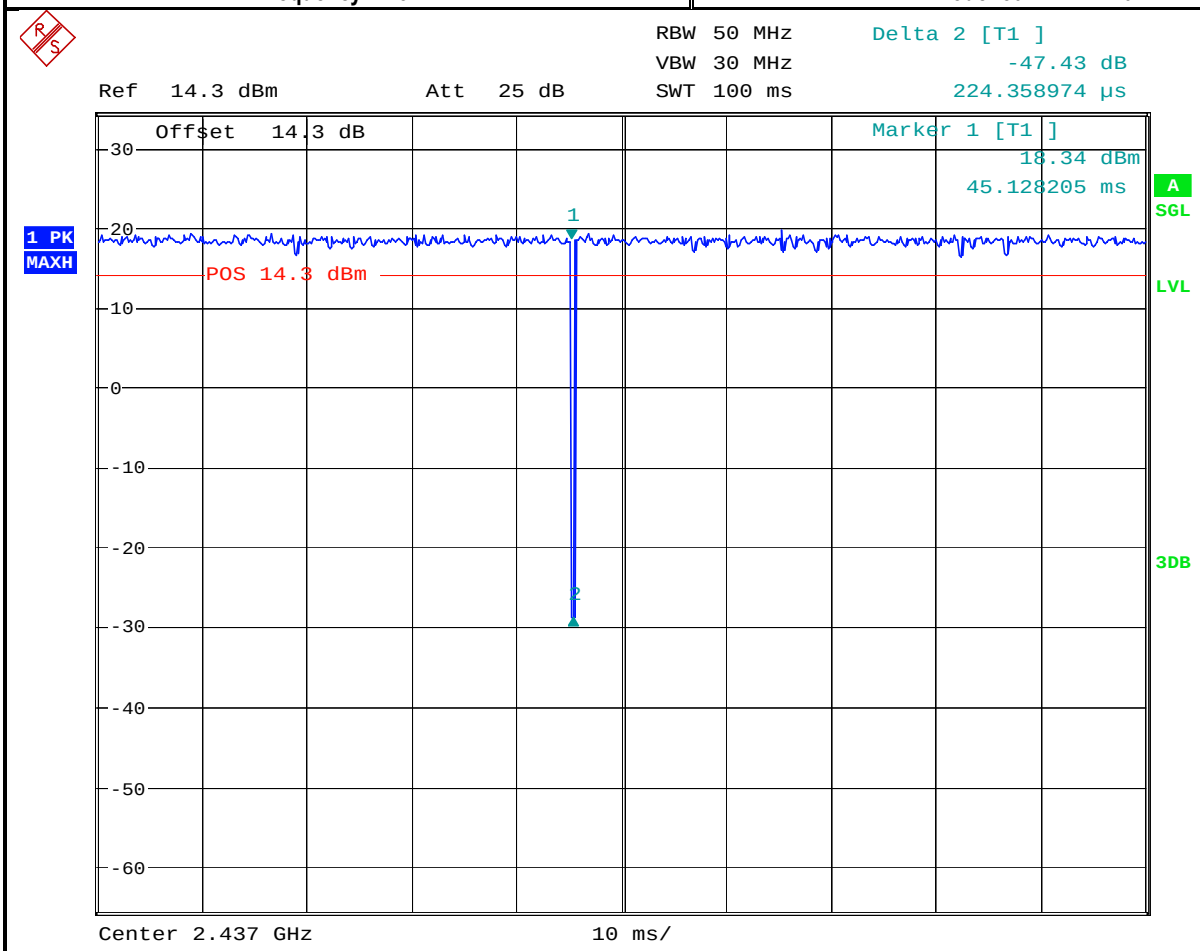
| Tx Frequency: 2437 MHz | Mode: 802.11n HT20 |
|---|---|




Date: 24.APR.2020 12:13:33

## Plot # 4

**Tx Frequency: 2437 MHz** | **Mode: 802.11n HT20**




Date: 1.JUN.2020 16:21:16

## 8.2 Emission Bandwidth 6dB and 99% Occupied Bandwidth

### 8.2.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

**Spectrum Analyzer settings:**

6dB (DTS) Bandwidth:

- Set RBW = 100 kHz
- Set the video bandwidth (VBW) ≥ 3 x RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- 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.

99% Occupied Bandwidth:

- Set frequency = nominal EUT channel center frequency
- Set Span = 1.5 x to 5.0 x OBW
- Set RBW = 1% to 5% of OBW
- Set the video bandwidth (VBW) ≈ 3 x RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth
- If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.

### 8.2.2 Limits:

FCC §15.247(a)(1) and RSS-247 5.2(1)

- Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 8.2.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---|---|---|---|
| 23.8°C | 1 | Op.1 | 12 VDC |

### 8.2.4 Measurement result:

| Plot # | Frequency (MHz) | EUT Operating Mode | 6dB Emission Bandwidth (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|---|
| 5 | 2412 | 802.11b | 8.54 | > 0.5 | Pass |
| 6 | 2442 | 802.11b | 8.59 | > 0.5 | Pass |
| 7 | 2462 | 802.11b | 8.58 | > 0.5 | Pass |
| 8 | 2412 | 802.11g | 15.92 | > 0.5 | Pass |
| 9 | 2442 | 802.11g | 15.77 | > 0.5 | Pass |
| 10 | 2462 | 802.11g | 15.71 | > 0.5 | Pass |
| 11 | 2412 | 802.11n HT20 | 16.03 | > 0.5 | Pass |
| 12 | 2442 | 802.11n HT20 | 16.00 | > 0.5 | Pass |
| 13 | 2462 | 802.11n HT20 | 15.75 | > 0.5 | Pass |
| 14 | 2422 | 802.11n HT40 | 34.97 | > 0.5 | Pass |
| 15 | 2462 | 802.11n HT40 | 33.80 | > 0.5 | Pass |

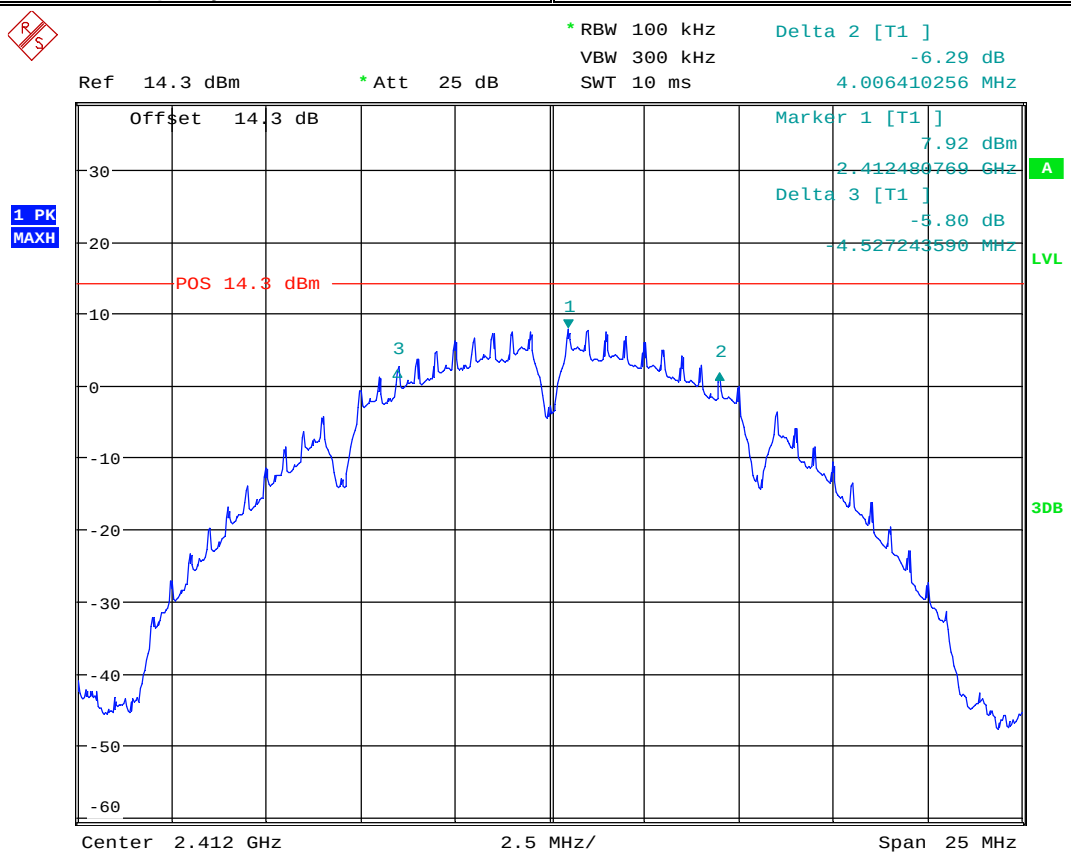
| Plot # | Frequency (MHz) | EUT Operating Mode | 99% Occupied Bandwidth (MHz) | Limit (MHz) | Result |
|---|---|---|---|---|---|
| 16 | 2412 | 802.11b | 13.101 | > 0.5 | Pass |
| 17 | 2442 | 802.11b | 13.181 | > 0.5 | Pass |
| 18 | 2462 | 802.11b | 13.141 | > 0.5 | Pass |
| 19 | 2412 | 802.11g | 16.31 | > 0.5 | Pass |
| 20 | 2442 | 802.11g | 16.27 | > 0.5 | Pass |
| 21 | 2462 | 802.11g | 17.35 | > 0.5 | Pass |
| 22 | 2412 | 802.11n HT20 | 17.47 | > 0.5 | Pass |
| 23 | 2442 | 802.11n HT20 | 17.39 | > 0.5 | Pass |
| 24 | 2462 | 802.11n HT20 | 16.27 | > 0.5 | Pass |
| 25 | 2422 | 802.11n HT40 | 35.65 | > 0.5 | Pass |
| 26 | 2462 | 802.11n HT40 | 35.60 | > 0.5 | Pass |

### 8.2.5 Measurement Plots:

**6 dB Emission Bandwidth**

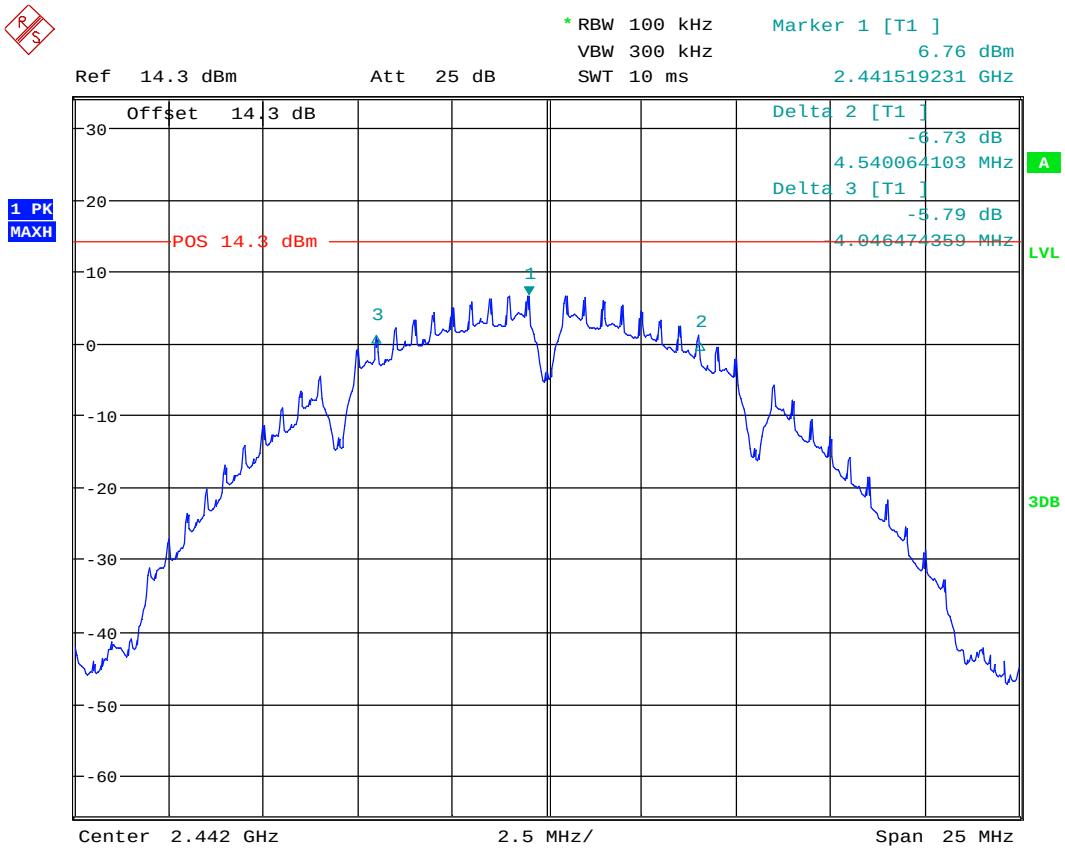
**Plot # 5**

| Tx Frequency: 2412 MHz | Mode: 802.11b |
|---|---|



## Plot # 6

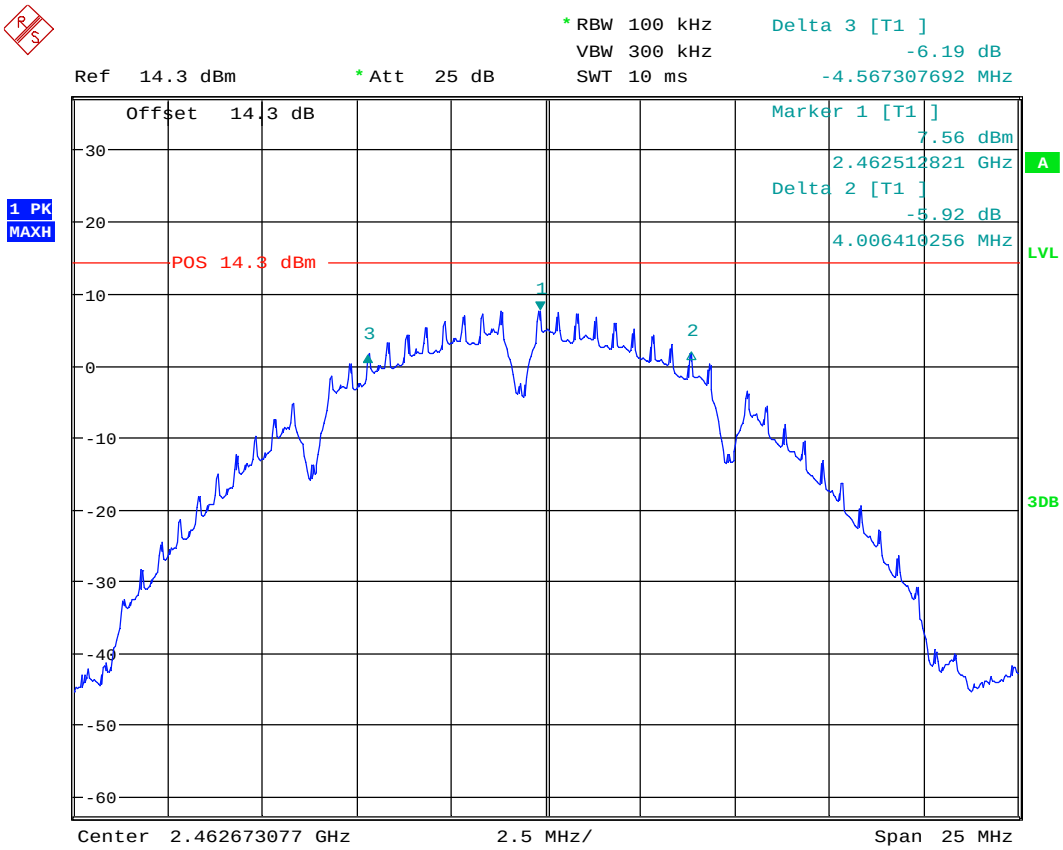
| Tx Frequency: 2442 MHz | Mode: 802.11b |
|---|---|




Date: 24.MAR.2020 16:27:21

## Plot # 7

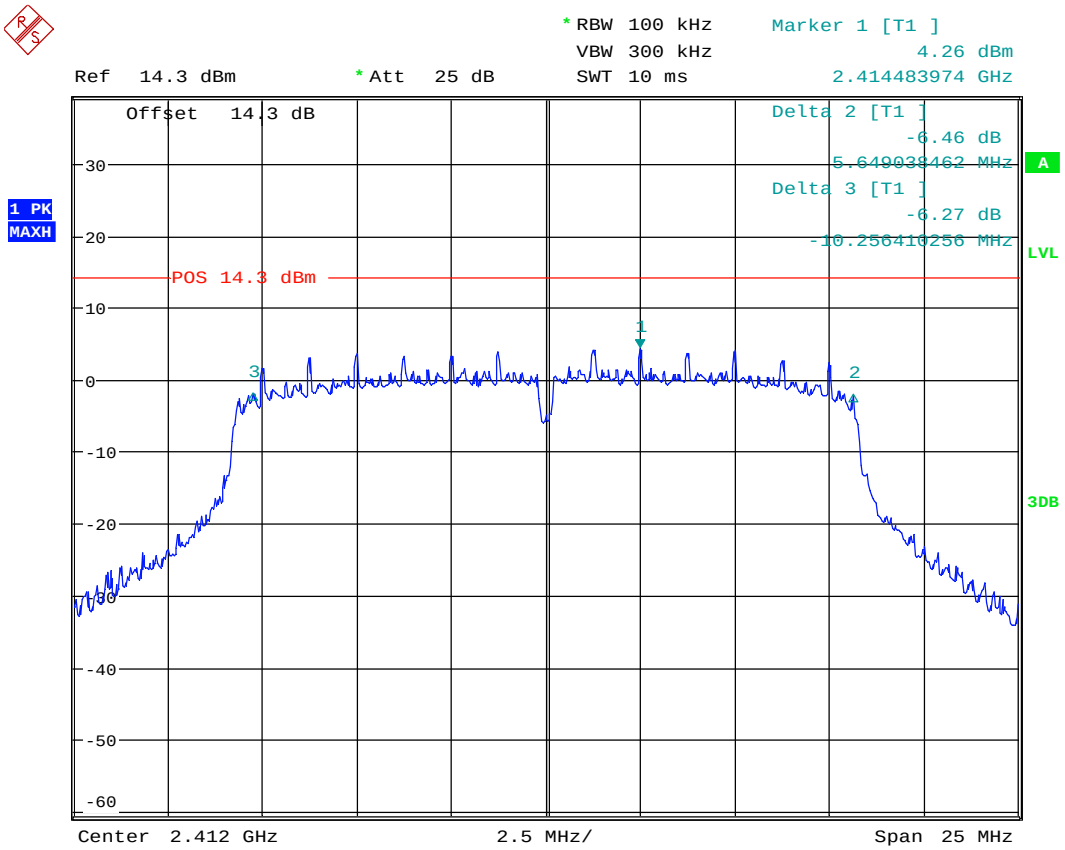
**Tx Frequency: 2462 MHz** | **Mode: 802.11b**




Date: 30.MAR.2020 14:56:01

## Plot # 8

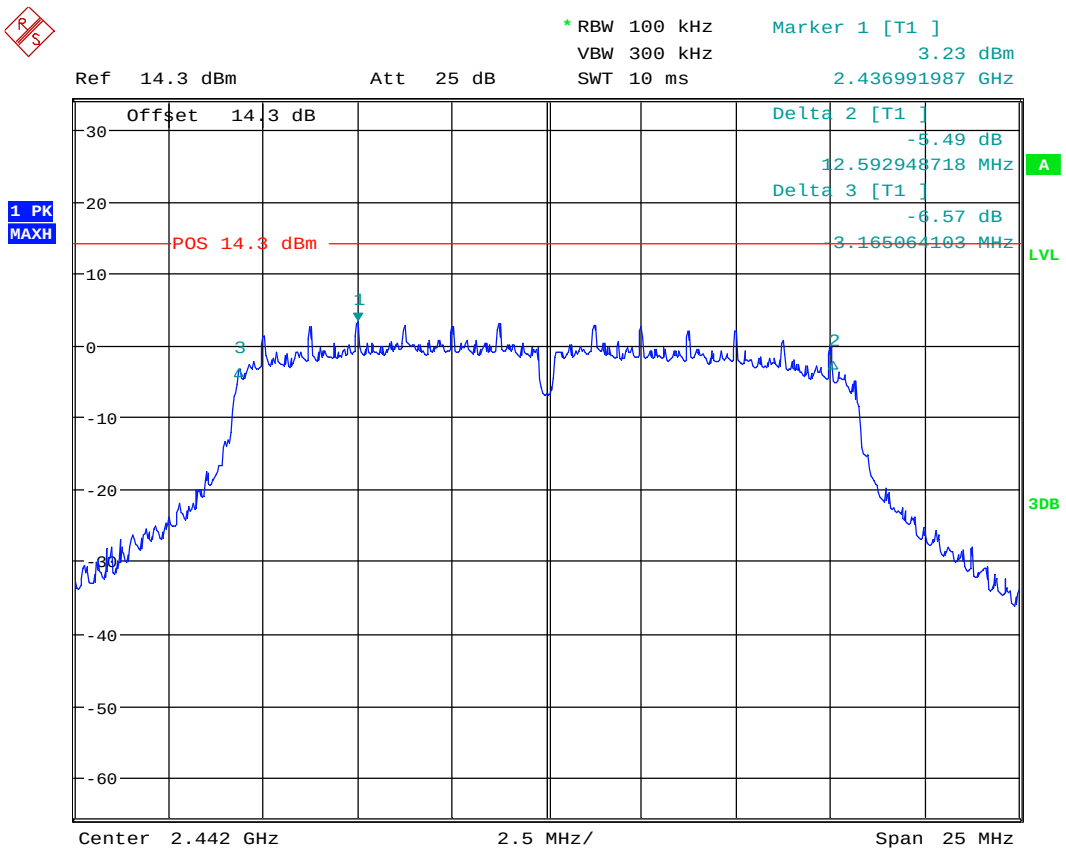
| Tx Frequency: 2412 MHz | Mode: 802.11g |
|---|---|




Date: 26.MAR.2020 18:08:05

## Plot # 9

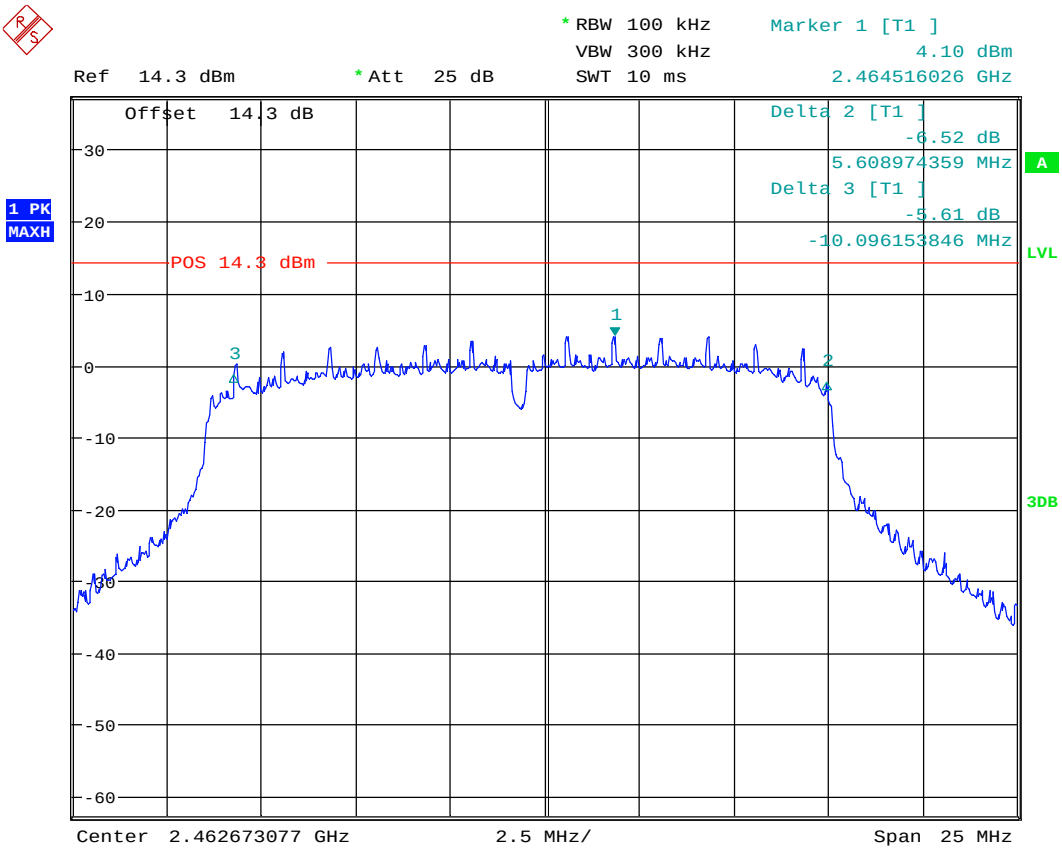
**Tx Frequency: 2442 MHz** | **Mode: 802.11g**




Date: 24.MAR.2020 16:31:25

## Plot # 10

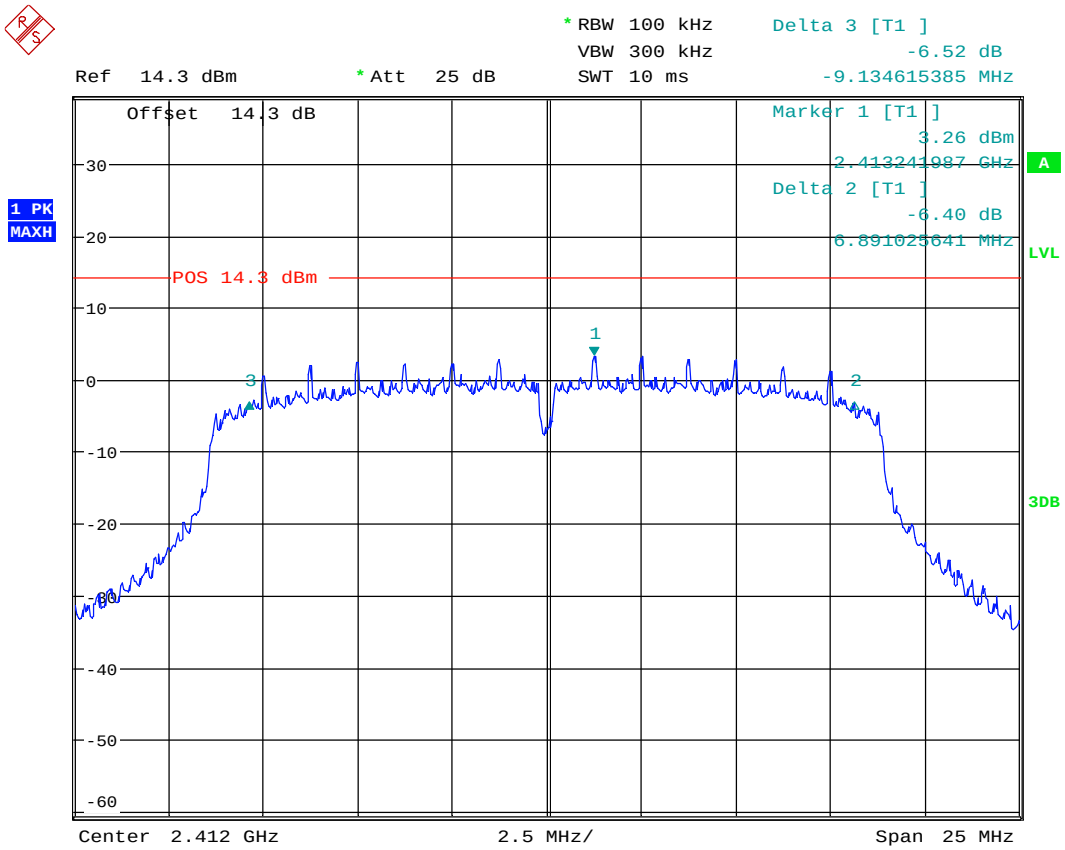
| Tx Frequency: 2462 MHz | Mode: 802.11g |
|---|---|




Date: 30.MAR.2020 15:00:51

## Plot # 11

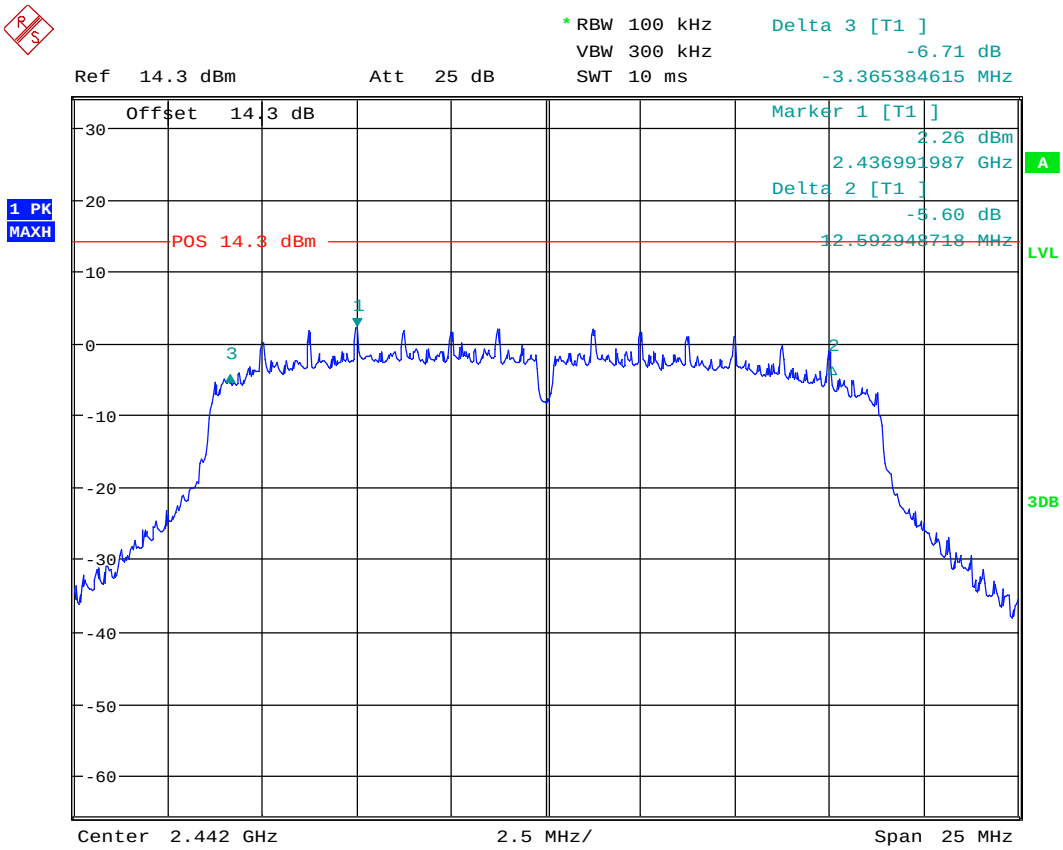
| Tx Frequency: 2412 MHz | Mode: 802.11n HT20 |
|---|---|




Date: 26.MAR.2020 17:58:01

## Plot # 12

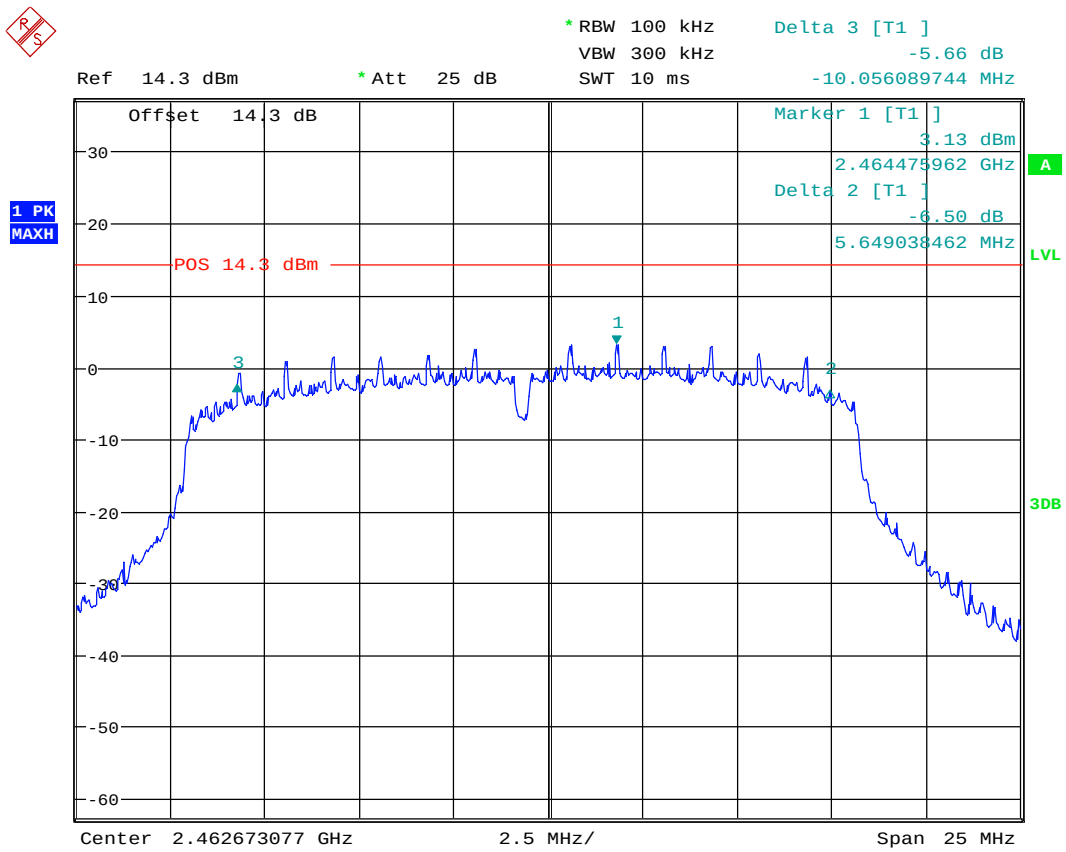
| Tx Frequency: 2442 MHz | Mode: 802.11n HT20 |
|---|---|




Date: 24.MAR.2020 16:34:51

## Plot # 13

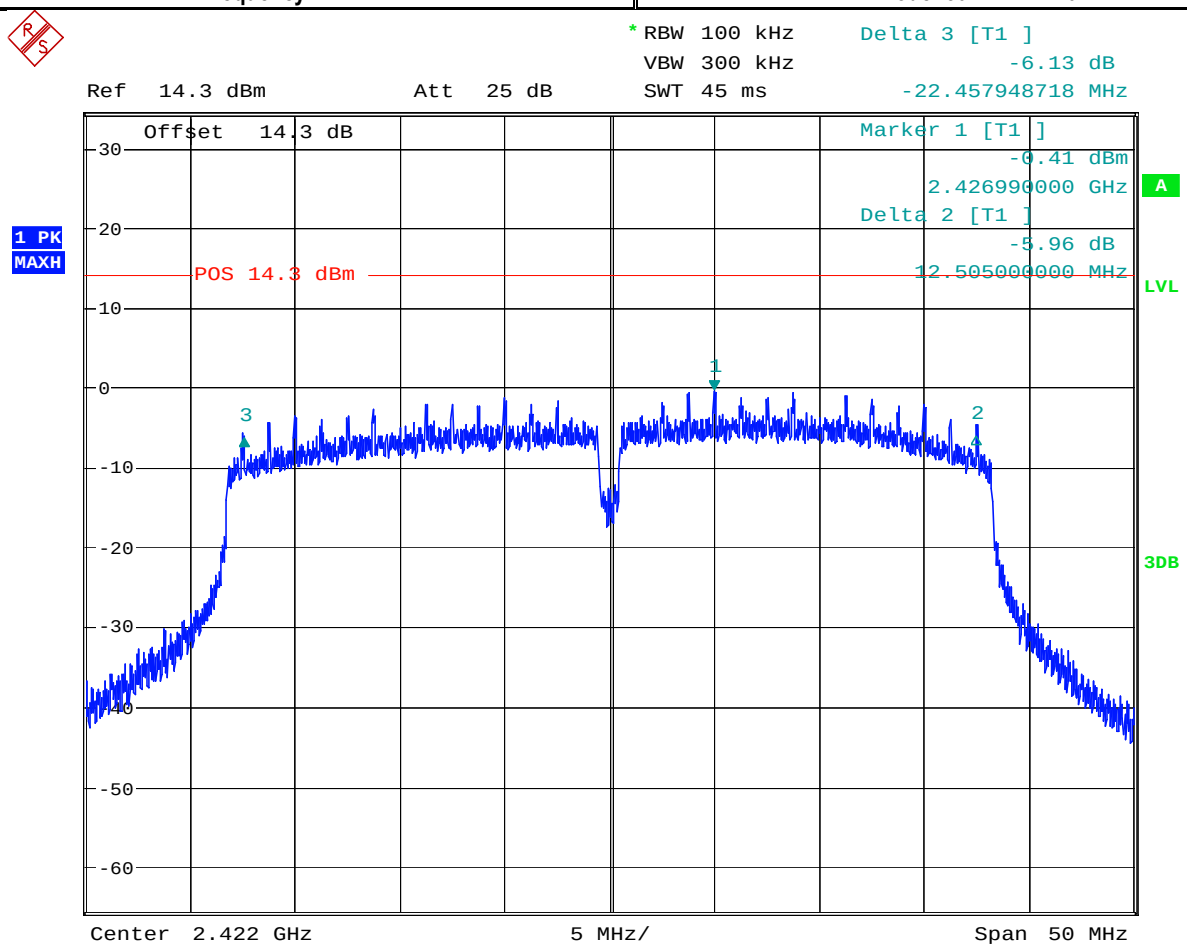
**Tx Frequency: 2462 MHz** | **Mode: 802.11n HT20**




Date: 30.MAR.2020 15:03:14

## Plot # 14

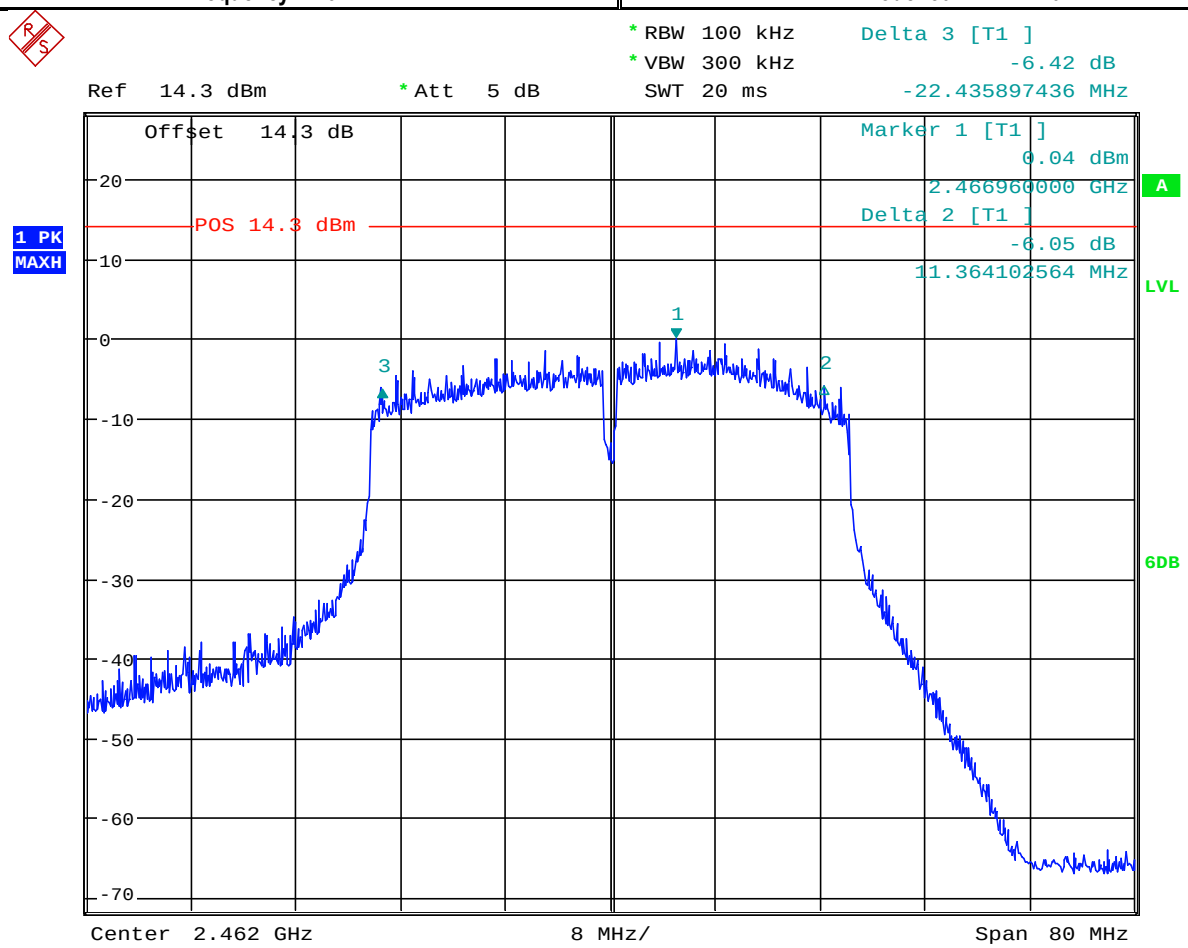
| Tx Frequency: 2422 MHz | Mode: 802.11n HT40 |
|---|---|




Date: 1.JUN.2020 16:57:11

## Plot # 15

| Tx Frequency: 2462 MHz | Mode: 802.11n HT40 |
|---|---|

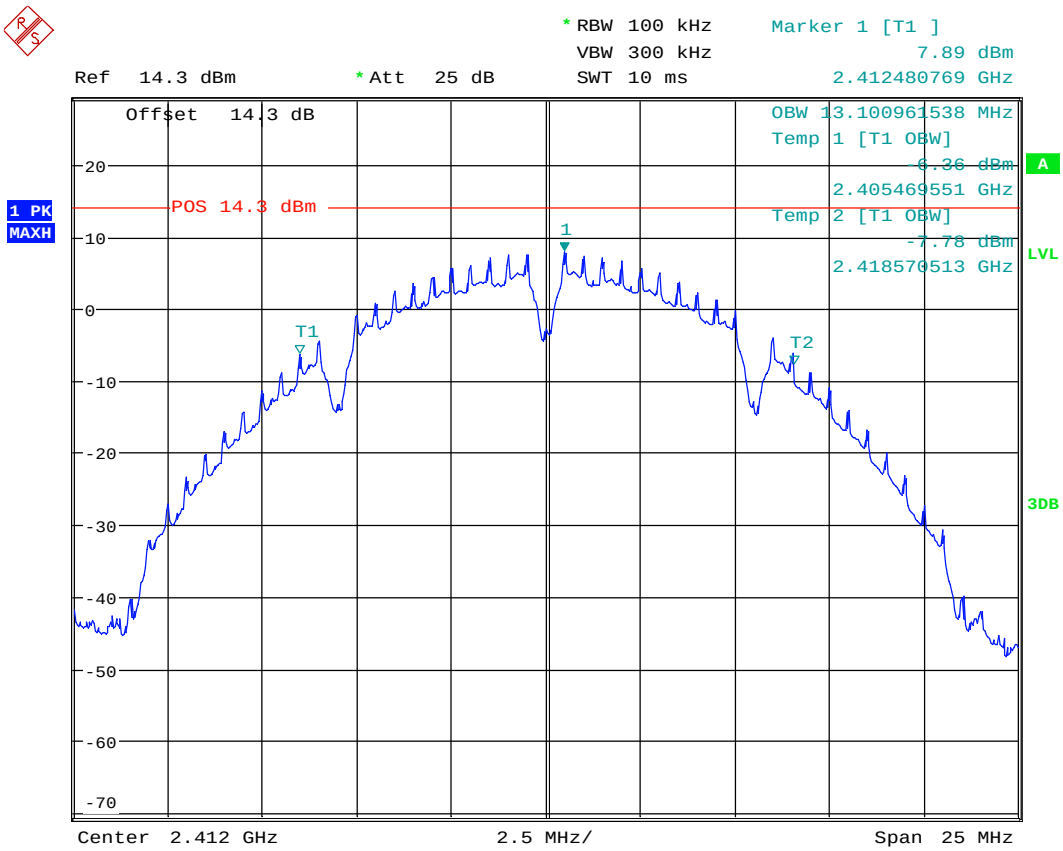



Date: 1.JUN.2020 12:03:09

## 99% Occupied Bandwidth

### Plot # 16

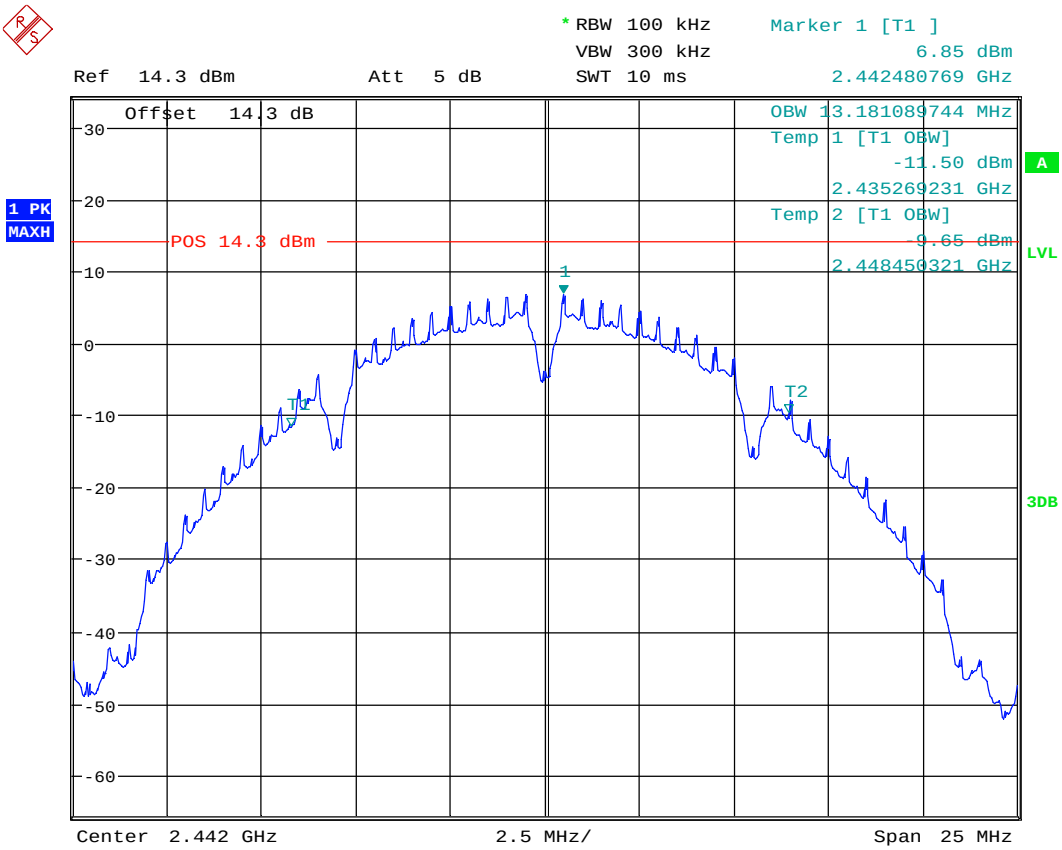
| Tx Frequency: 2412 MHz | Mode: 802.11b |
|---|---|




Date: 26.MAR.2020 17:24:40

## Plot # 17

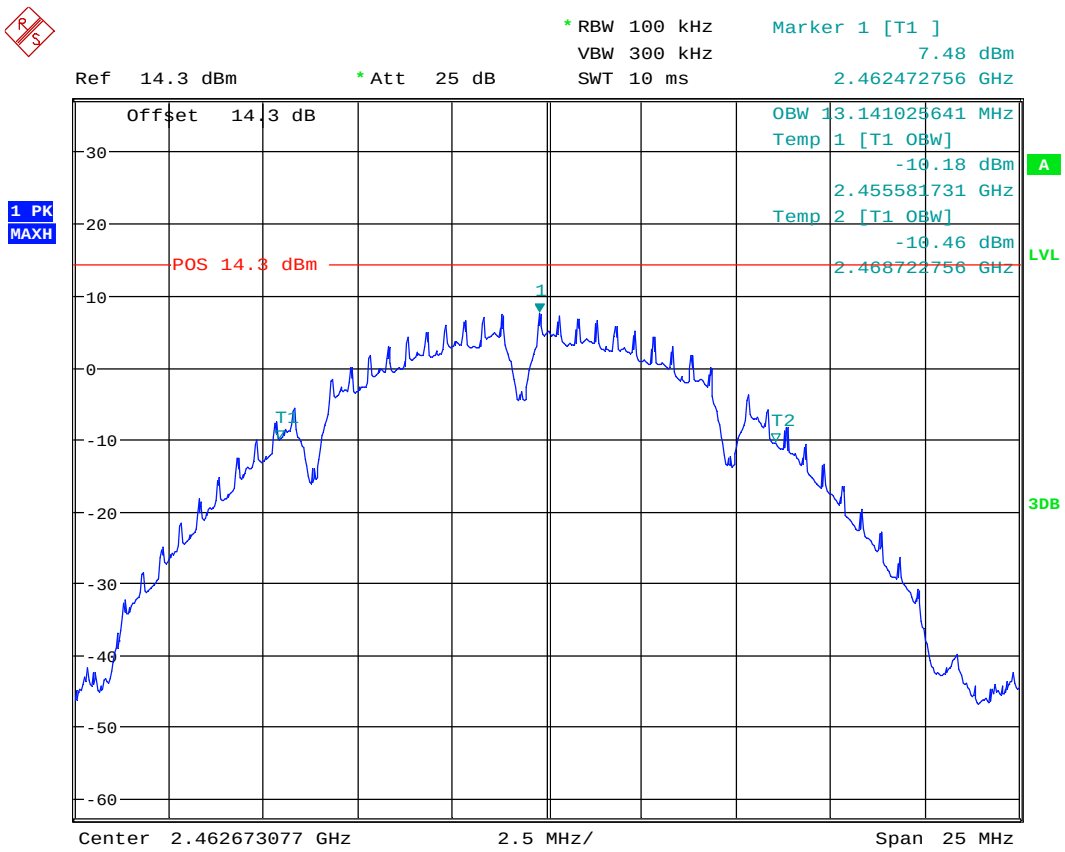
| Tx Frequency: 2442 MHz | Mode: 802.11b |
|---|---|




Date: 24.MAR.2020 16:20:08

## Plot # 18

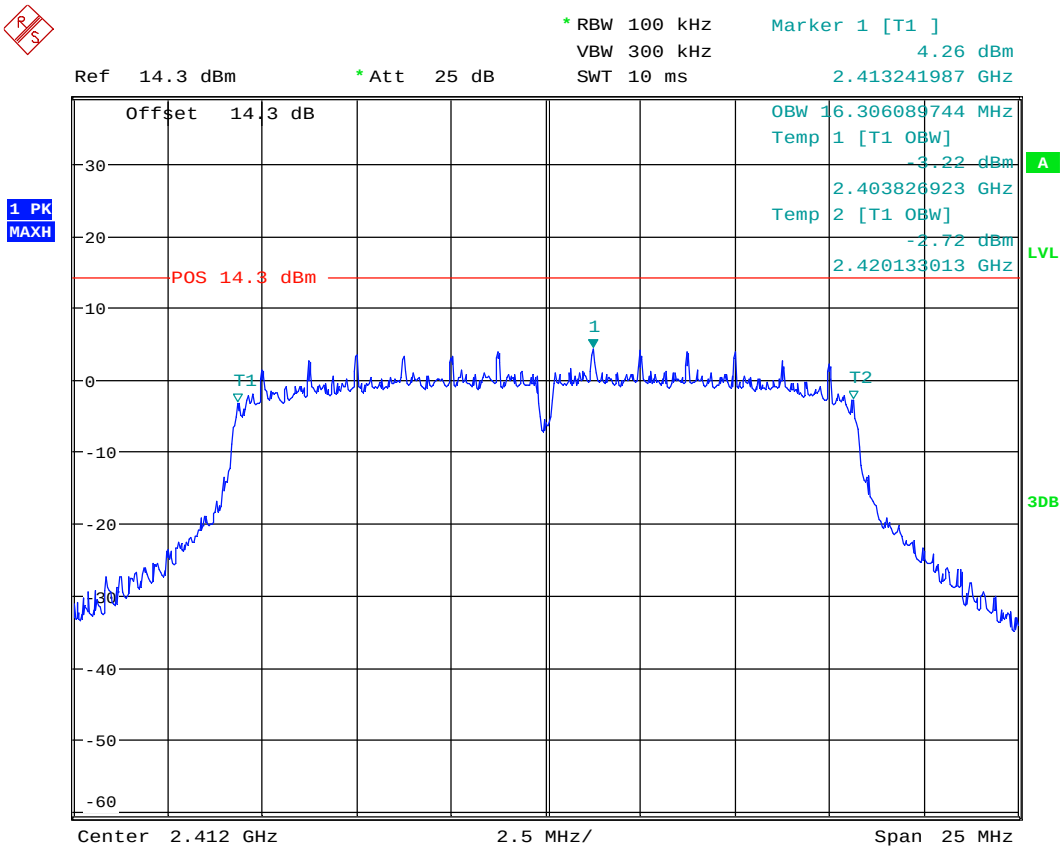
| Tx Frequency: 2462 MHz | Mode: 802.11b |
|---|---|




Date: 30.MAR.2020 15:09:48

## Plot # 19

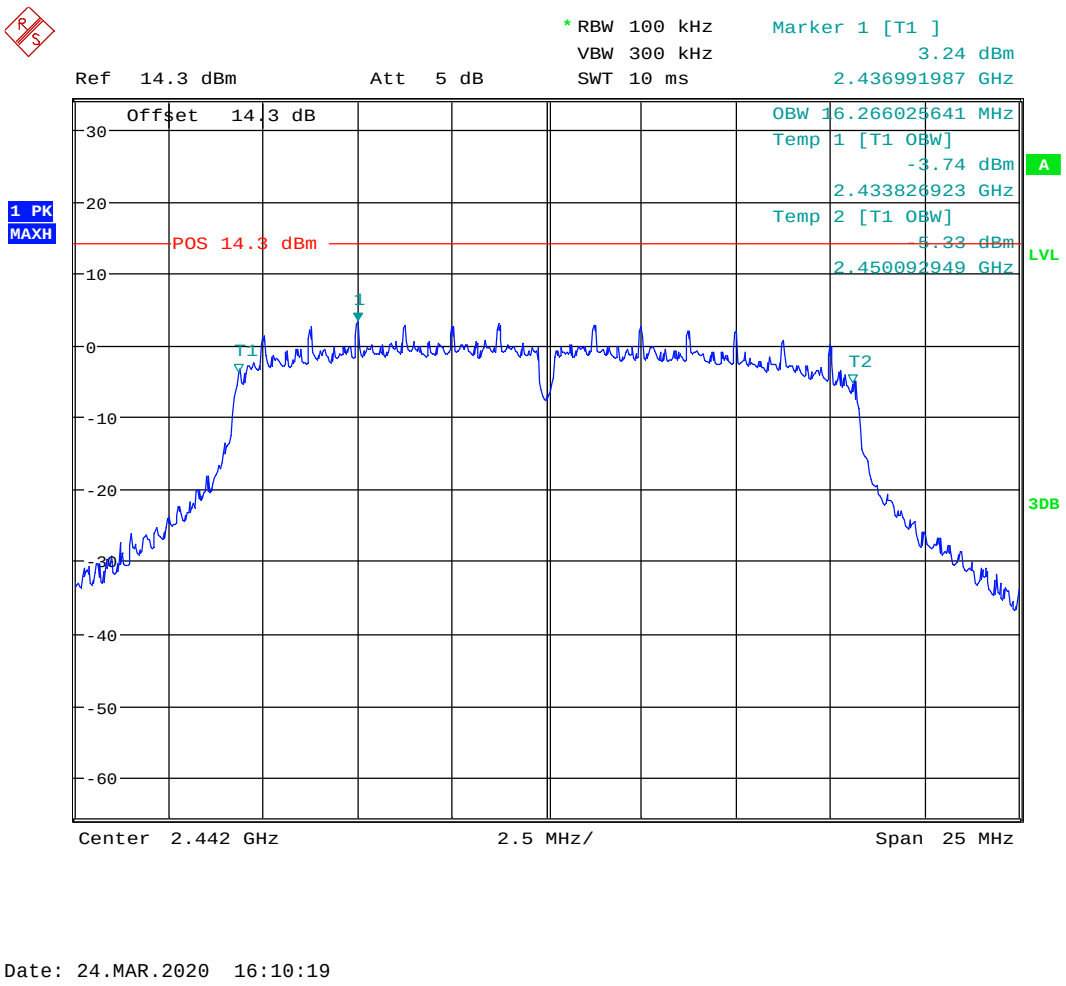
| Tx Frequency: 2412 MHz | Mode: 802.11g |
|---|---|




Date: 26.MAR.2020 17:43:34

## Plot # 20

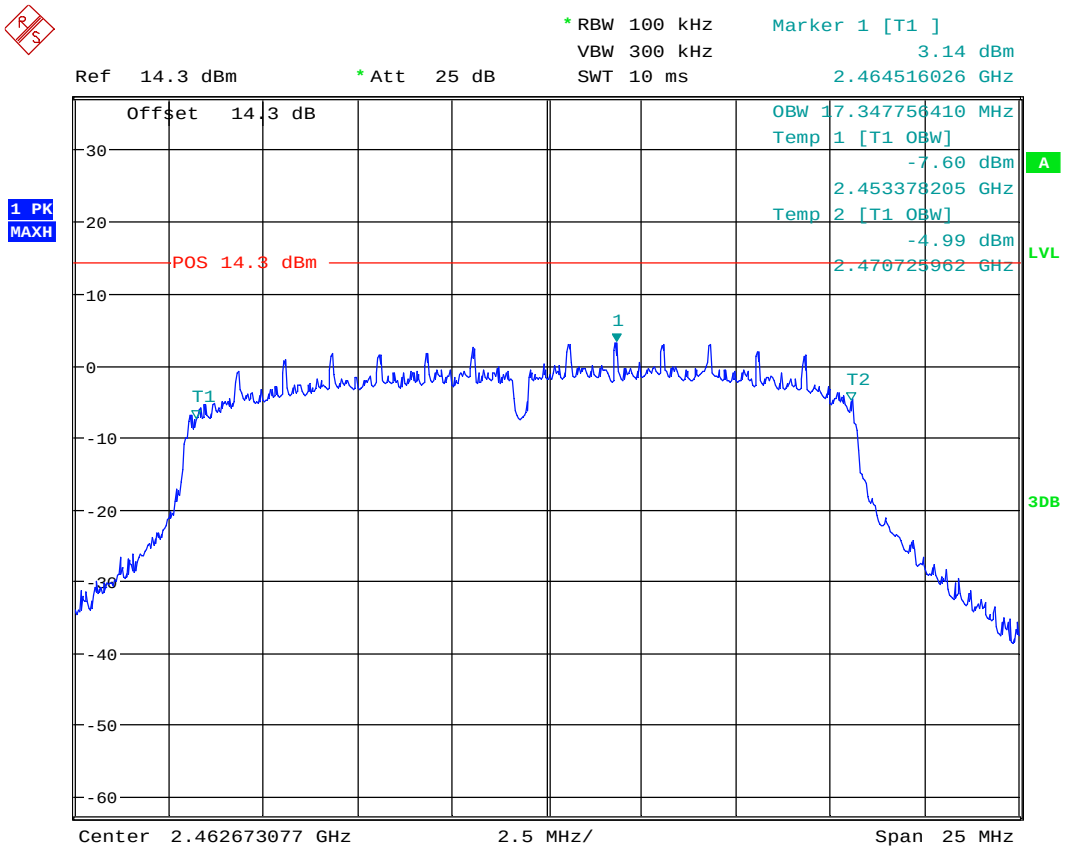
| Tx Frequency: 2442 MHz | Mode: 802.11g |
|---|---|




Date: 24.MAR.2020 16:10:19

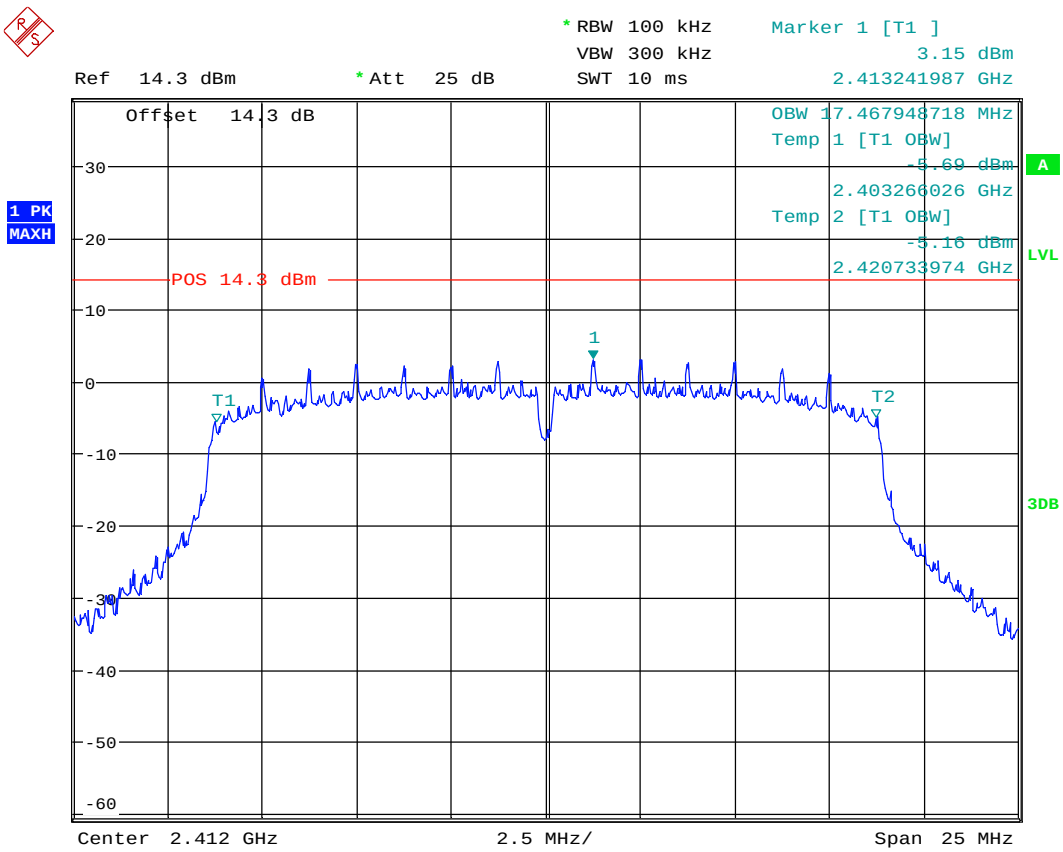
## Plot # 21

**Tx Frequency: 2462 MHz** | **Mode: 802.11g**



## Plot # 22

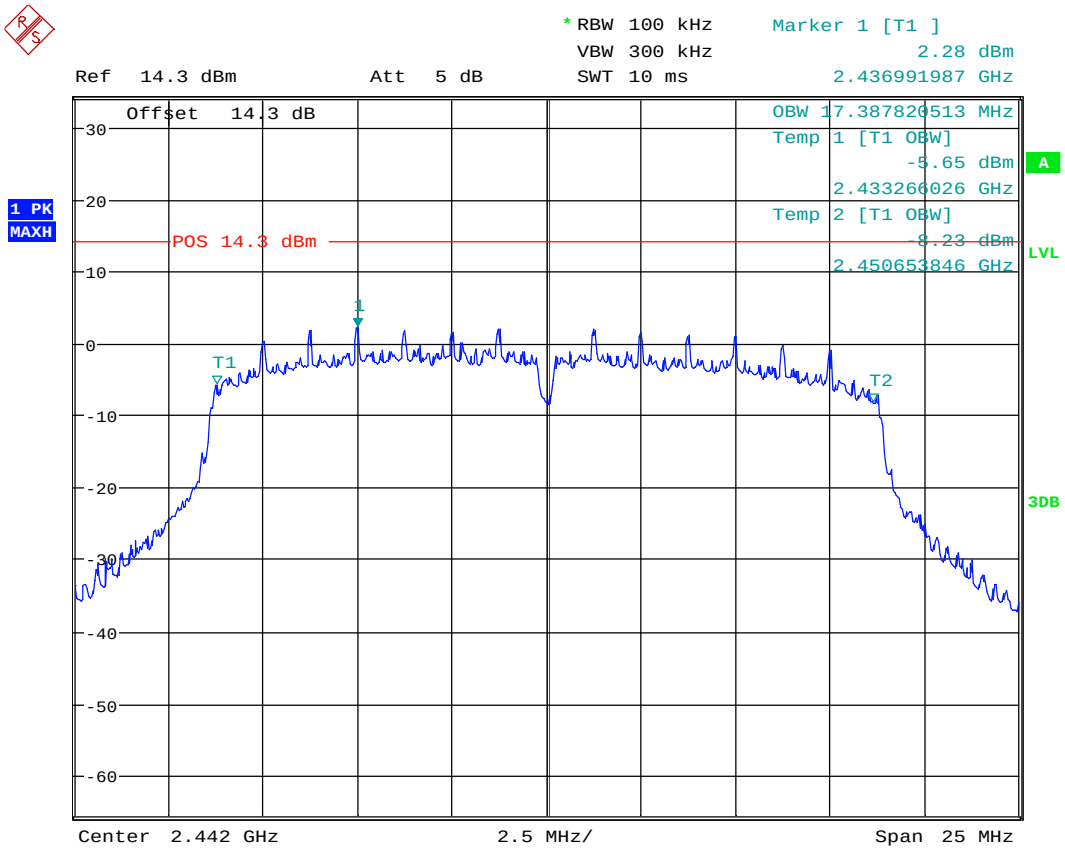
| Tx Frequency: 2412 MHz | Mode: 802.11n HT20 |
|---|---|




Date: 26.MAR.2020 17:45:18

## Plot # 23

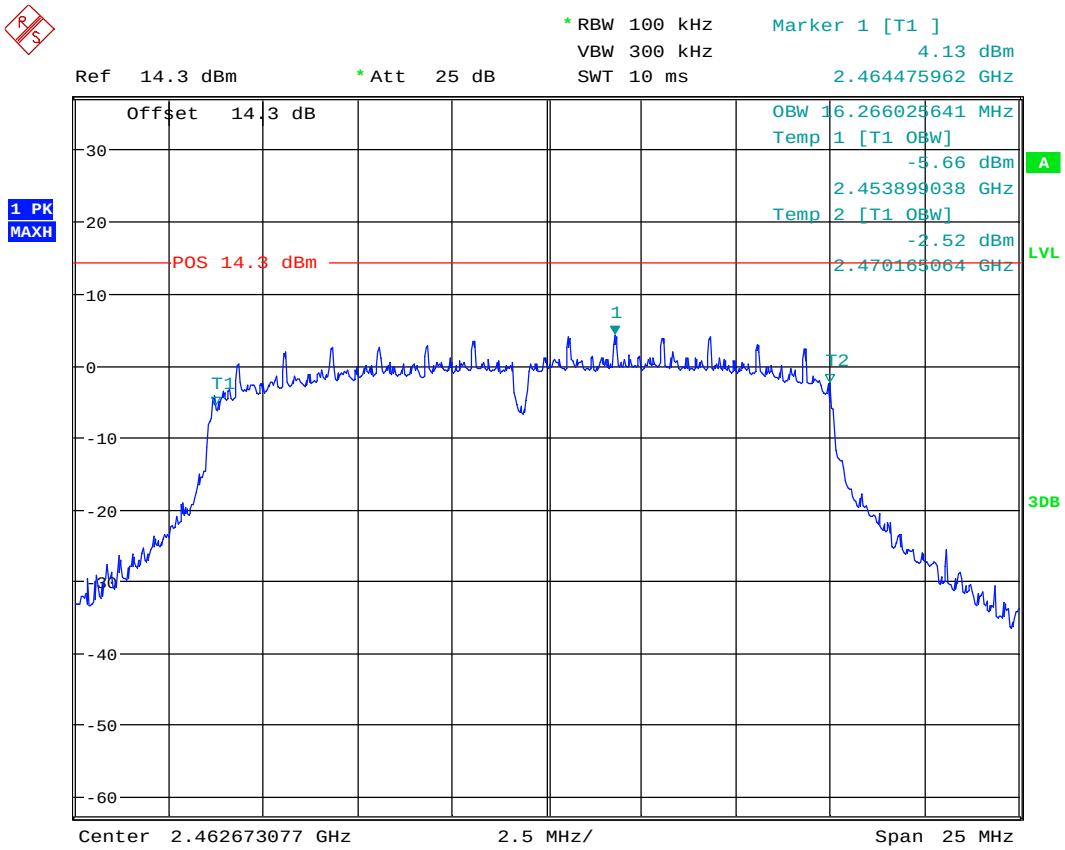
| Tx Frequency: 2442 MHz | Mode: 802.11n HT20 |
|---|---|




Date: 24.MAR.2020 16:16:27

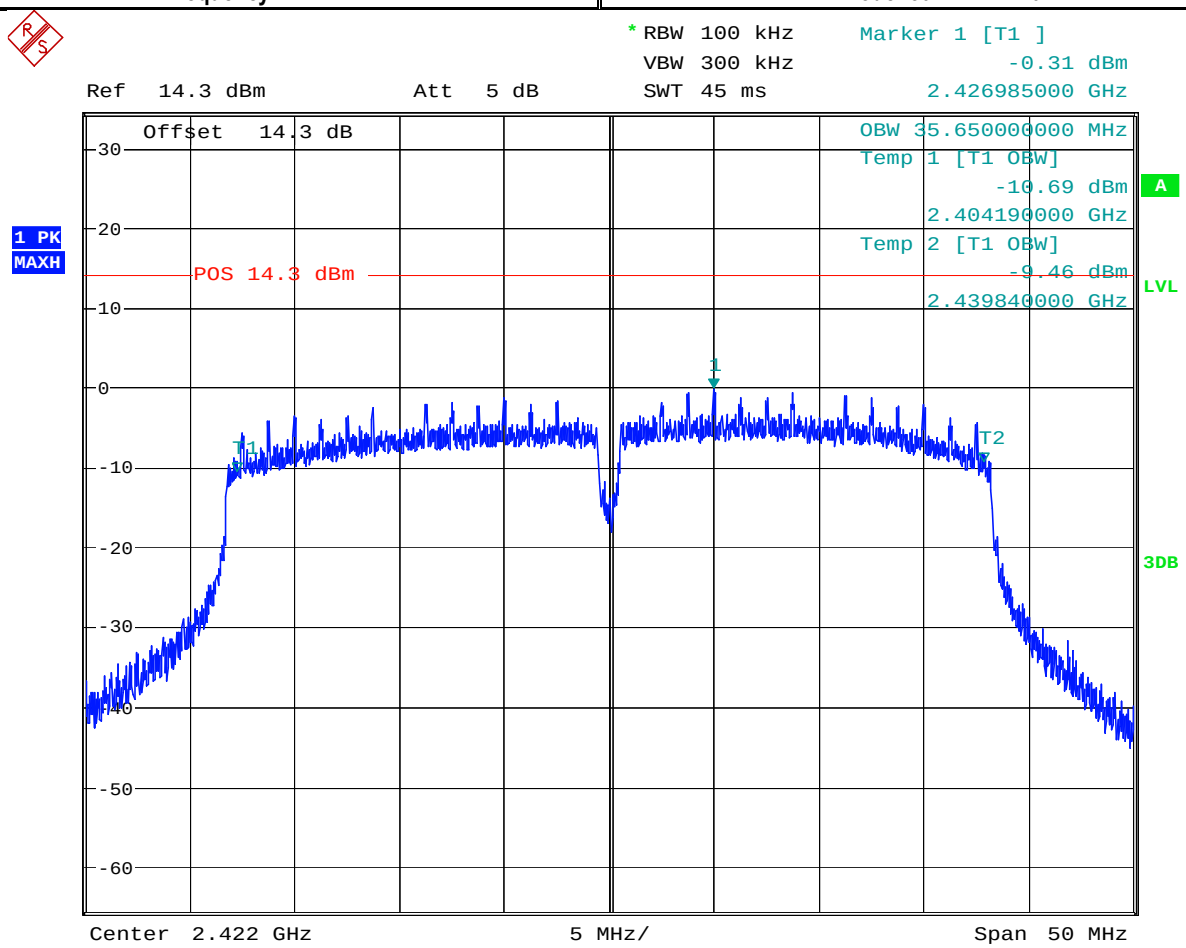
## Plot # 24

**Tx Frequency: 2462 MHz** | **Mode: 802.11n HT20**



## Plot # 25

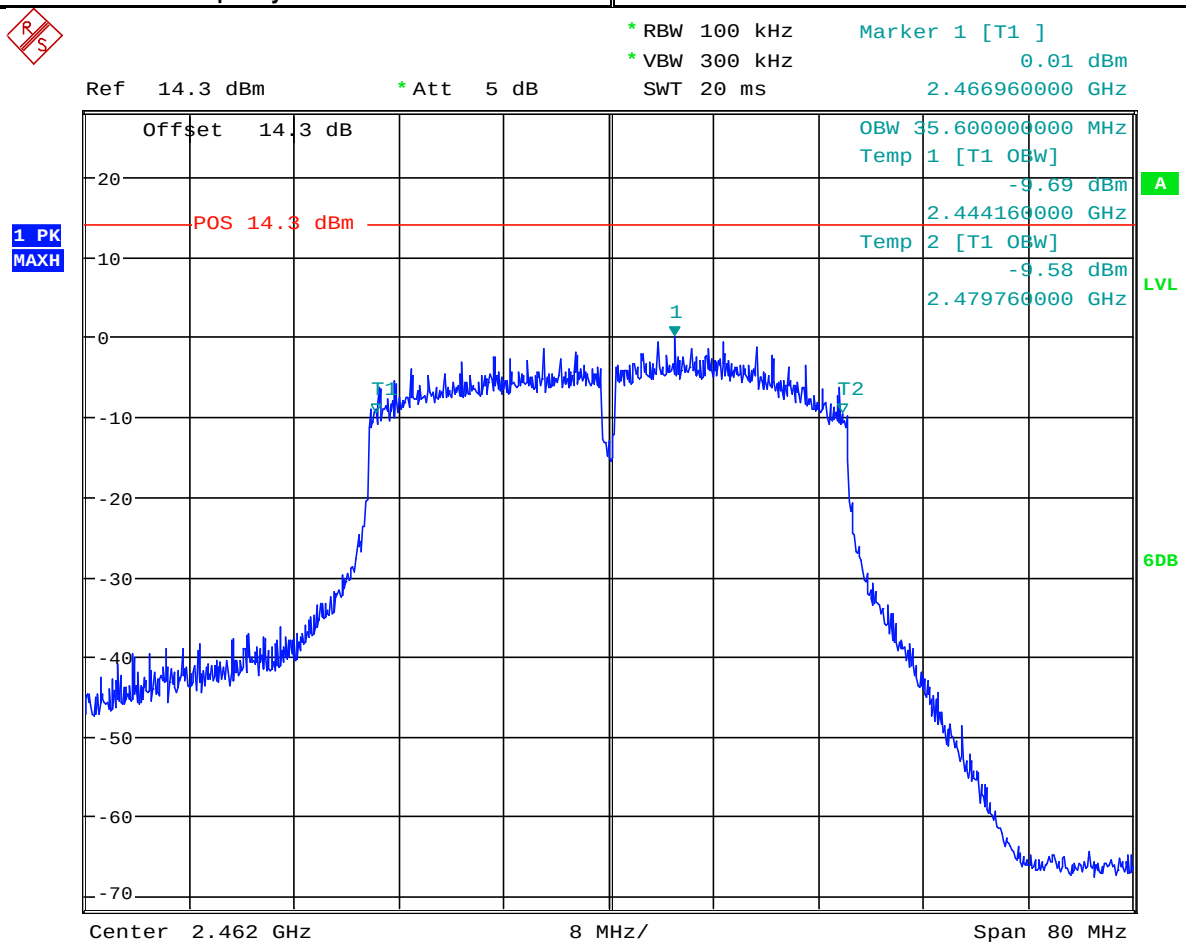
**Tx Frequency: 2422 MHz** | **Mode: 802.11n HT40**




Date: 1.JUN.2020 17:00:02

## Plot # 26

| Tx Frequency: 2462 MHz | Mode: 802.11n HT40 |
|---|---|




Date: 1.JUN.2020 12:01:39

## 8.3 Maximum peak conducted output power

### 8.3.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

**ANSI_C63.10-2013 Subclause 11.9.1.2 Integrated band power method**

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

- Set the RBW = 1 MHz.
- Set VBW ≥ [3 x RBW].
- Set span ≥ [1.5 x DTS Bandwidth].
- Detector function = peak.
- Sweep time = Auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the instrument's band/channel power measurement function with the band limit set equal to the DTS bandwidth edges.

### 8.3.2 Limits:

**Maximum Output Power:**

- FCC §15.247 (b)(1): 1 W
- IC RSS-247: 1 W

### 8.3.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Antenna Gain |
|---|---|---|---|---|
| 23.8°C | 1 | Op.1 | 12 VDC | 4.2 dBi |

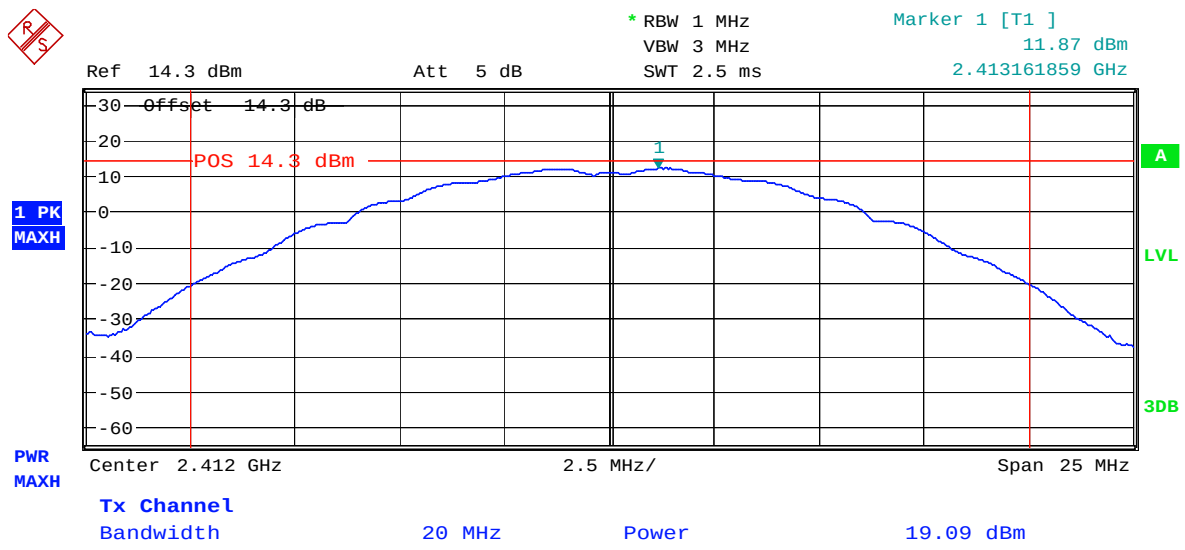
### 8.3.4 Measurement result:

| Plot # | Frequency (MHz) | EUT Operating Mode | Output Power Conducted / EIRP (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| 27 | 2412 | 802.11b | 19.09 / 23.29 | 30 (Pk) / 36 (EIRP) | Pass |
| 28 | 2437 | 802.11b | 18.0 / 22.20 | 30 (Pk) / 36 (EIRP) | Pass |
| 29 | 2462 | 802.11b | 18.76 / 22.96 | 30 (Pk) / 36 (EIRP) | Pass |
| 30 | 2412 | 802.11g | **23.37 / 27.57** | 30 (Pk) / 36 (EIRP) | Pass |
| 31 | 2437 | 802.11g | 22.15 / 26.35 | 30 (Pk) / 36 (EIRP) | Pass |
| 32 | 2462 | 802.11g | 23.05 / 27.25 | 30 (Pk) / 36 (EIRP) | Pass |
| 33 | 2412 | 802.11n HT20 | 22.17 / 26.37 | 30 (Pk) / 36 (EIRP) | Pass |
| 34 | 2437 | 802.11n HT20 | 20.93 / 25.13 | 30 (Pk) / 36 (EIRP) | Pass |
| 35 | 2462 | 802.11n HT20 | 21.86 / 26.06 | 30 (Pk) / 36 (EIRP) | Pass |
| 36 | 2422 | 802.11n HT40 | 21.57 / 25.77 | 30 (Pk) / 36 (EIRP) | Pass |
| 37 | 2462 | 802.11n HT40 | 22.70 / 26.90 | 30 (Pk) / 36 (EIRP) | Pass |

### 8.3.5 Measurement Plots:

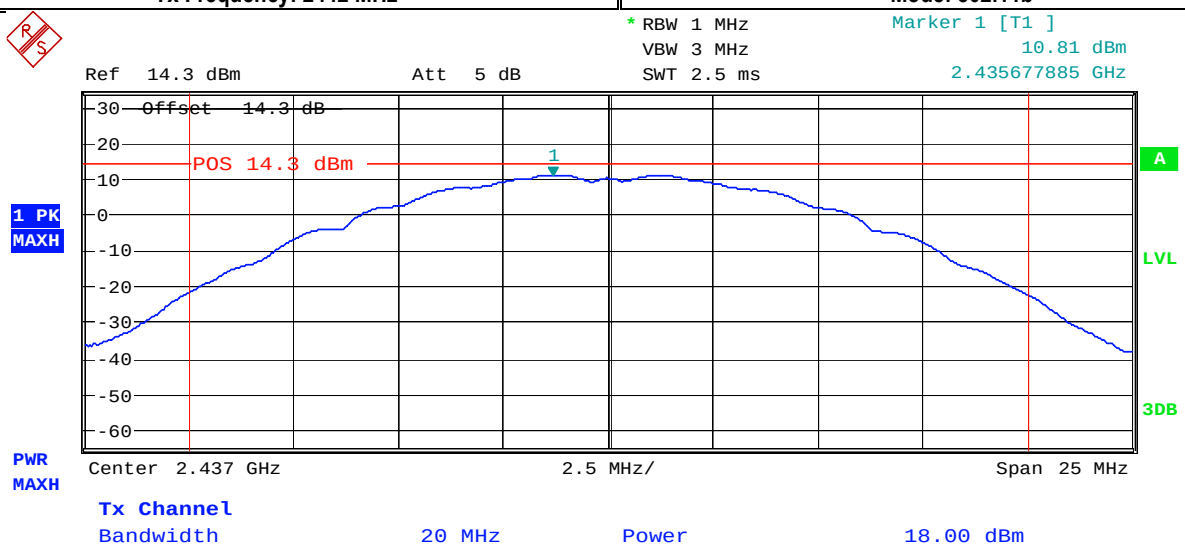
**Plot # 27**

| Tx Frequency: 2412 MHz | Mode: 802.11b |
|---|---|



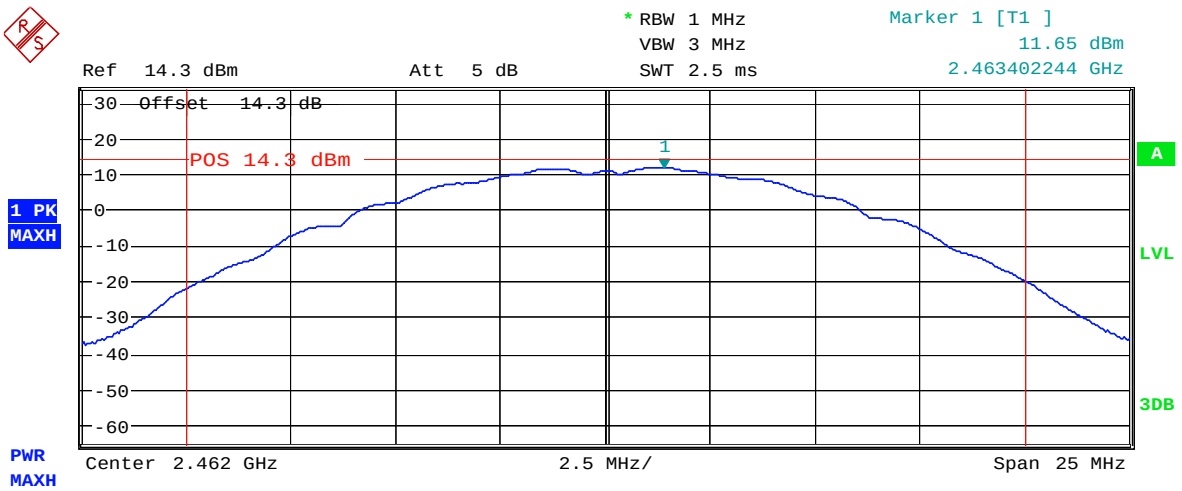

**Plot # 28**

| Tx Frequency: 2442 MHz | Mode: 802.11b |
|---|---|



## Plot # 29

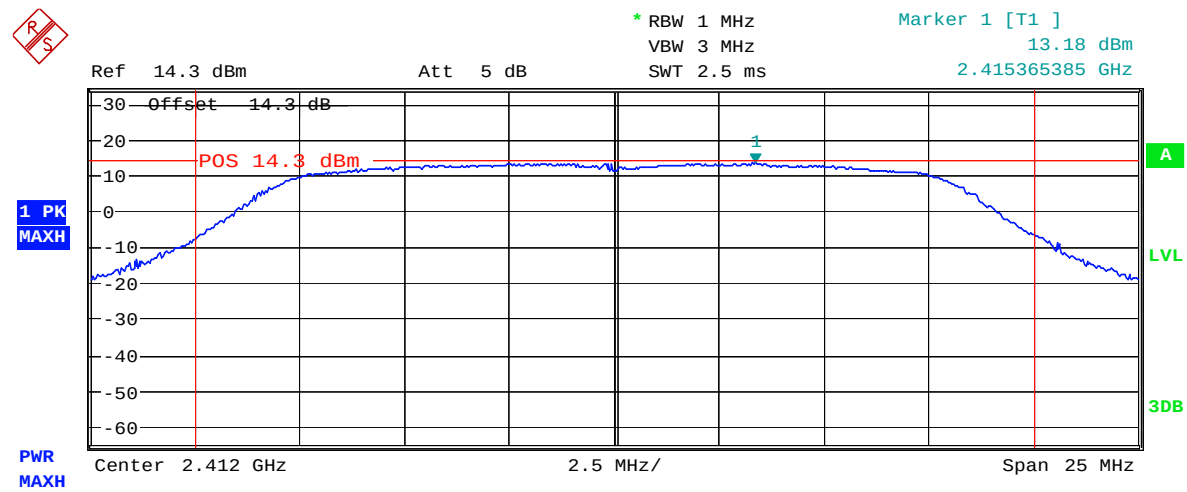
| Tx Frequency: 2462 MHz | Mode: 802.11b |
|---|---|




Tx Channel
Bandwidth 20 MHz Power 18.76 dBm

## Plot # 30

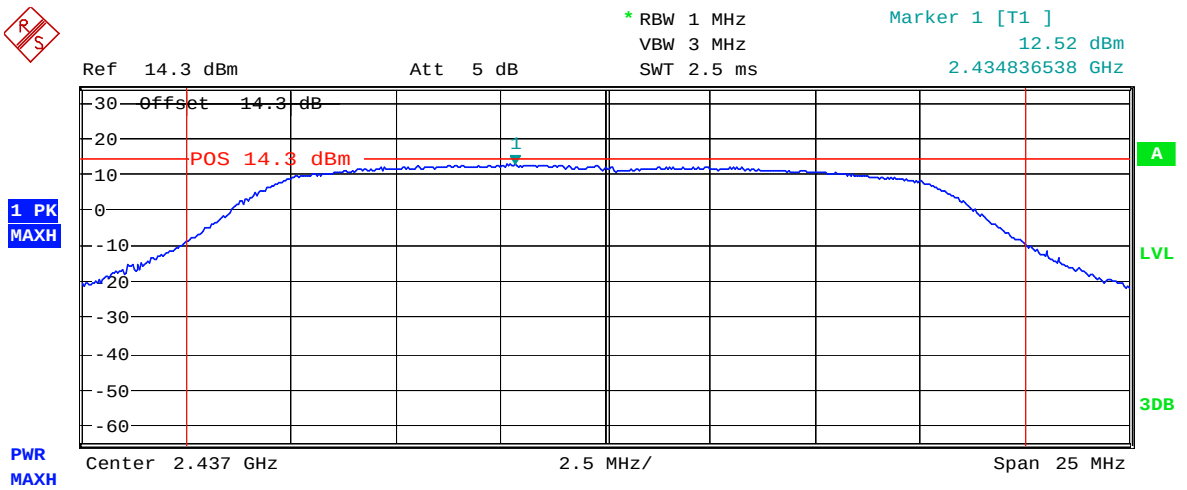
| Tx Frequency: 2412 MHz | Mode: 802.11g |
|---|---|




Tx Channel
Bandwidth 20 MHz Power 23.35 dBm

## Plot # 31

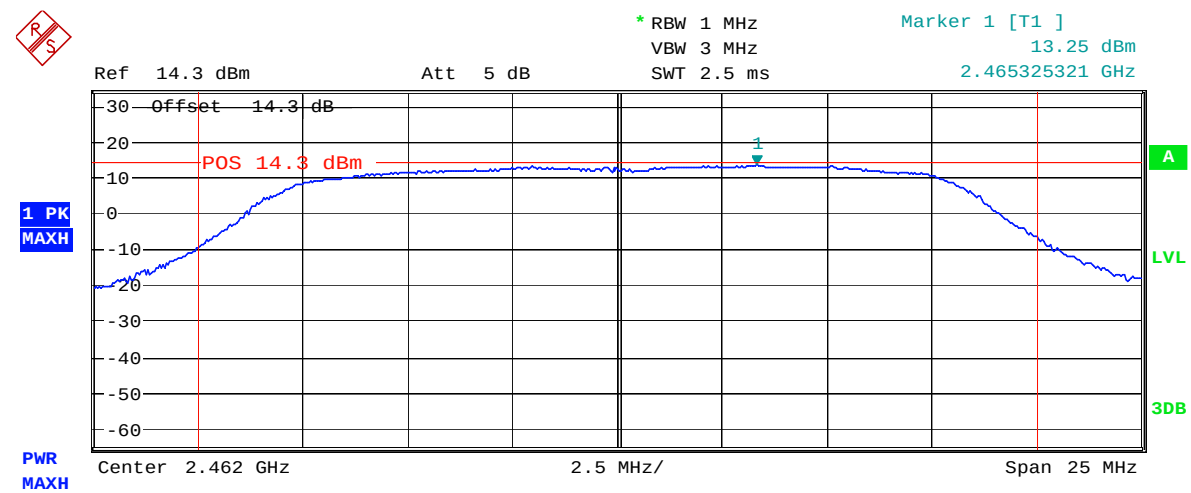
| Tx Frequency: 2442 MHz | Mode: 802.11g |
|---|---|




Tx Channel
Bandwidth 20 MHz Power 22.15 dBm

## Plot # 32

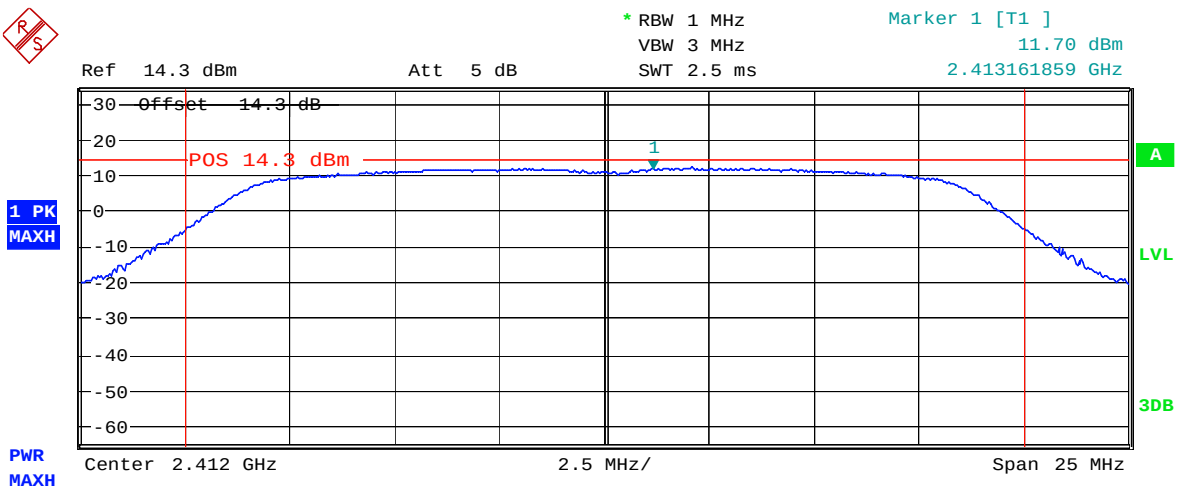
| Tx Frequency: 2462 MHz | Mode: 802.11g |
|---|---|




Tx Channel
Bandwidth 20 MHz Power 23.05 dBm

## Plot # 33

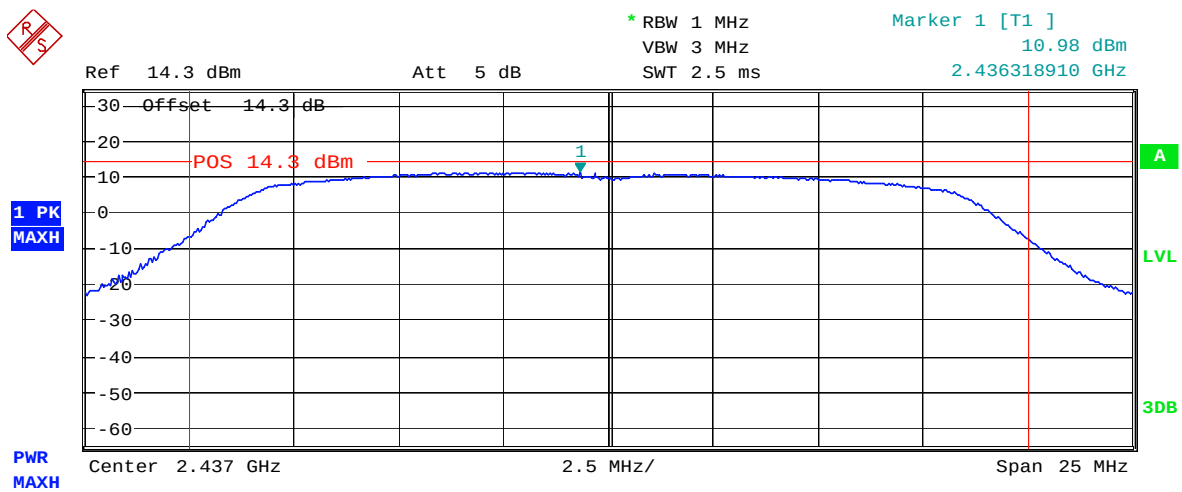
| Tx Frequency: 2412 MHz | Mode: 802.11n HT20 |
|---|---|




Tx Channel
Bandwidth 20 MHz Power 22.17 dBm

## Plot # 34

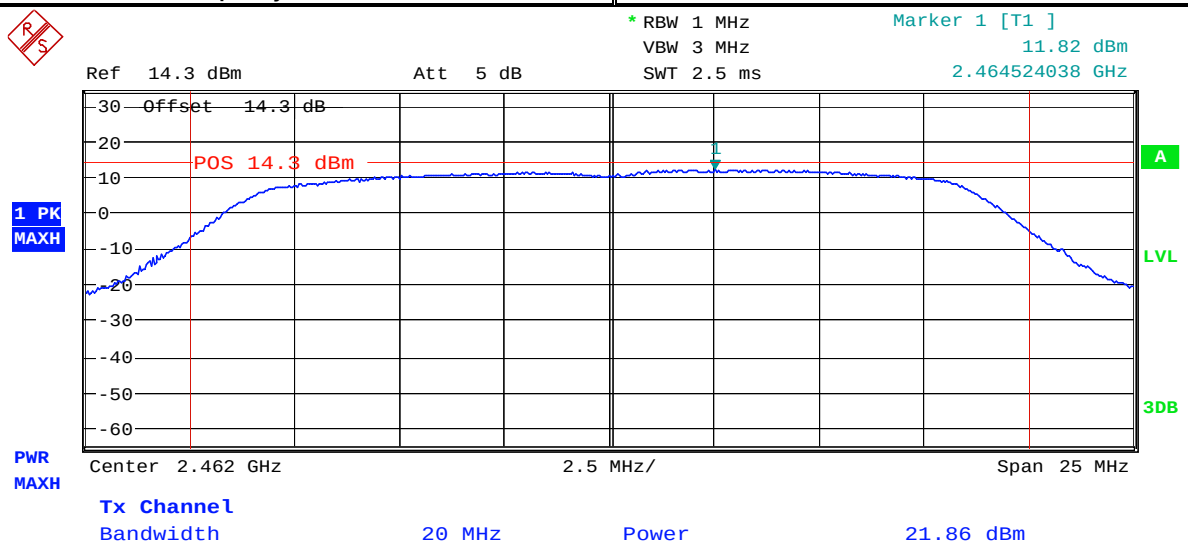
| Tx Frequency: 2442 MHz | Mode: 802.11n HT20 |
|---|---|




Tx Channel
Bandwidth 20 MHz Power 20.93 dBm

## Plot # 35

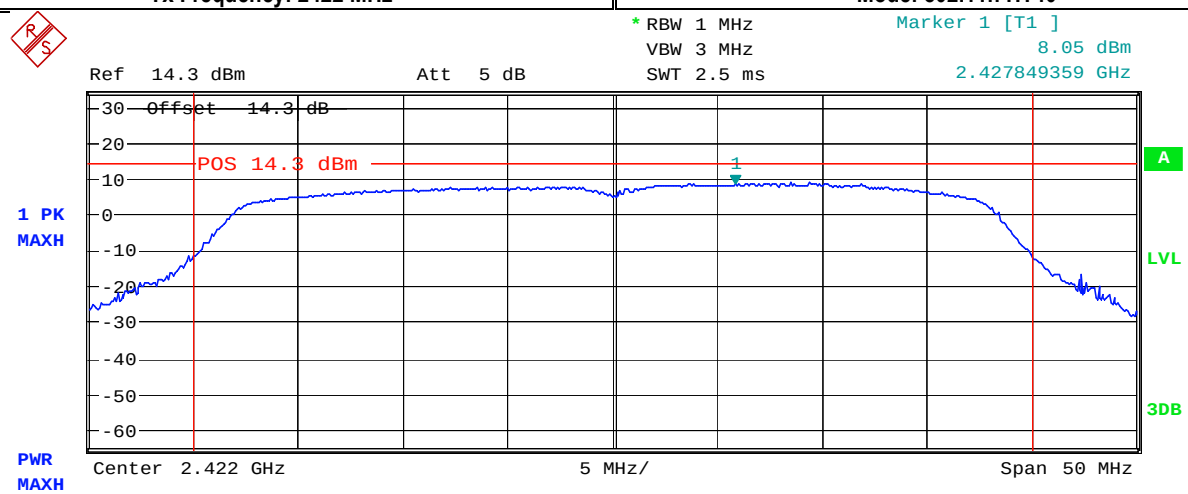
| Tx Frequency: 2462 MHz | Mode: 802.11n HT20 |
|---|---|




Tx Channel
Bandwidth 20 MHz Power 21.86 dBm

## Plot # 36

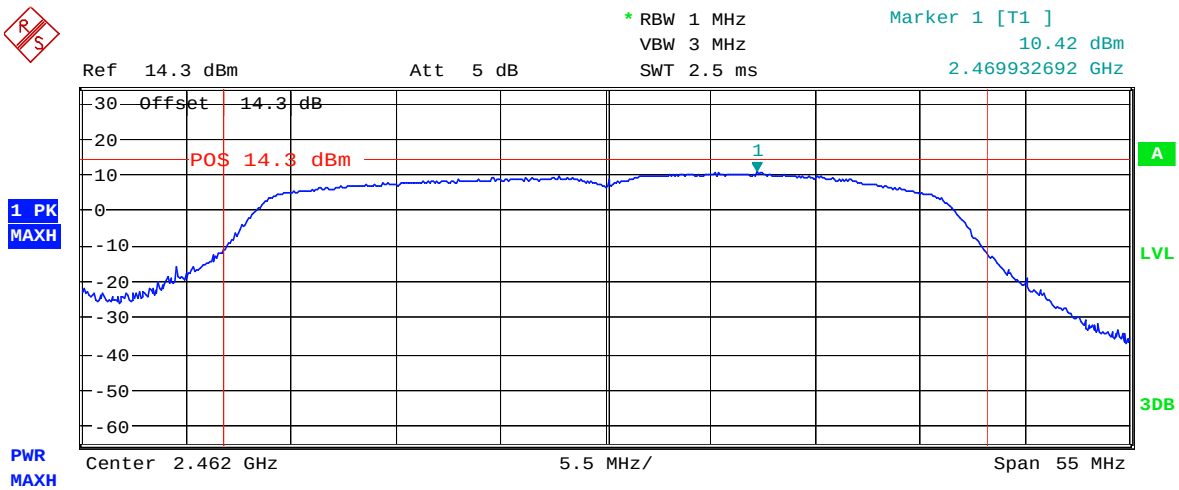
| Tx Frequency: 2422 MHz | Mode: 802.11n HT40 |
|---|---|




Tx Channel
Bandwidth 40 MHz Power 21.57 dBm

## Plot # 37

| Tx Frequency: 2462 MHz | Mode: 802.11n HT40 |
|---|---|



## 8.4 Power Spectral Density

### 8.4.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

**ANSI C63.10 Subclause 11.10.2 Method PKPSD (peak PSD)**

The following procedure shall be used if maximum peak conducted output power was used to determine compliance, and it is optional if the maximum conducted (average) output power was used to determine compliance:

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
- Set the VBW ≥ [3 x RBW].
- Detector = Peak.
- Sweep time = Auto couple.
- Trace mode = Max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, then reduce RBW (but no less than 3 kHz) and repeat.

### 8.4.2 Limits:

FCC§15.247(e) & RSS-247 5.2(2)

- For digitally modulated systems, the peak 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.

### 8.4.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Antenna Gain |
|---|---|---|---|---|
| 23.8°C | 1 | Op.1 | 12 VDC | 4.2 dBi |

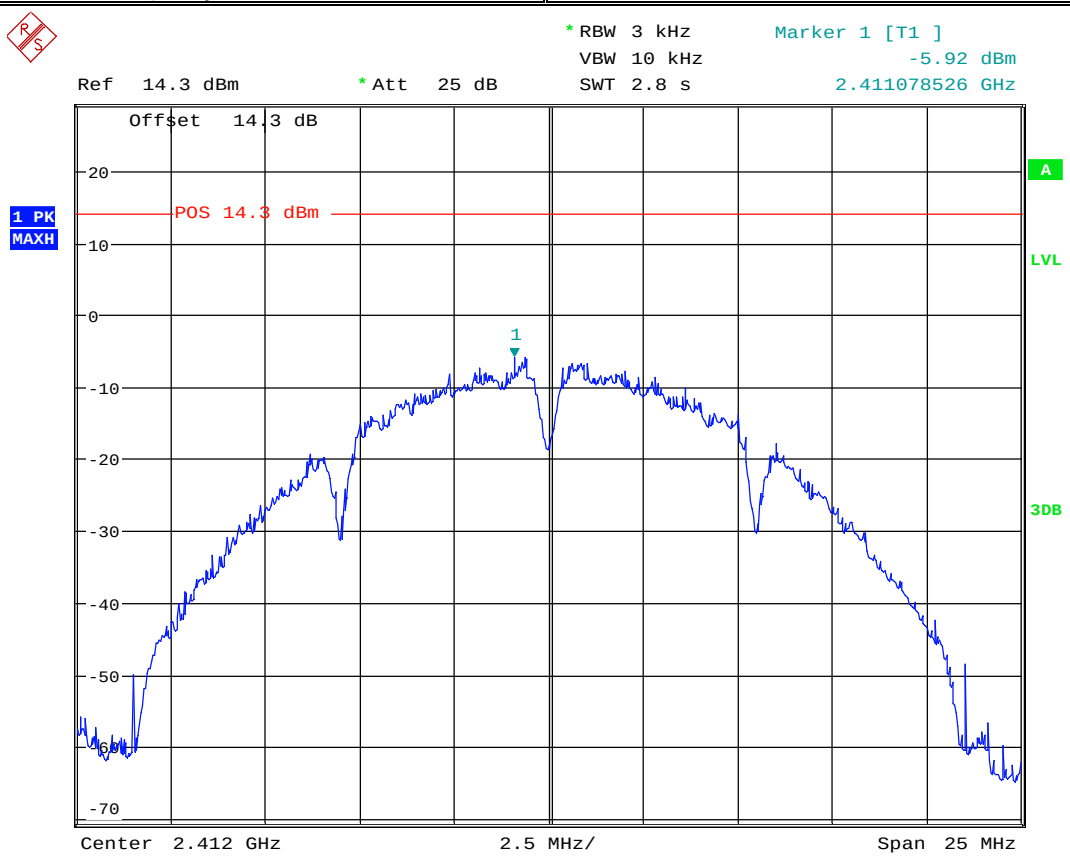
### 8.4.4 Measurement result:

| Plot # | Frequency (MHz) | EUT Operating Mode | PSD (dBm / 3 KHz) | Limit (dBm / 3 kHz) | Result |
|---|---|---|---|---|---|
| 38 | 2412 | 802.11b | -5.92 | 8 | Pass |
| 39 | 2442 | 802.11b | -6.83 | 8 | Pass |
| 40 | 2462 | 802.11b | **-5.62** | 8 | Pass |
| 41 | 2412 | 802.11g | -8.72 | 8 | Pass |
| 42 | 2442 | 802.11g | -9.74 | 8 | Pass |
| 43 | 2462 | 802.11g | -9.16 | 8 | Pass |
| 44 | 2412 | 802.11n HT20 | -10.81 | 8 | Pass |
| 45 | 2442 | 802.11n HT20 | -12.30 | 8 | Pass |
| 46 | 2462 | 802.11n HT20 | -11.06 | 8 | Pass |
| 47 | 2422 | 802.11n HT40 | -8.94 | 8 | Pass |
| 48 | 2462 | 802.11n HT40 | -12.95 | 8 | Pass |

### 8.4.5 Measurement Plots:

**Plot # 38**

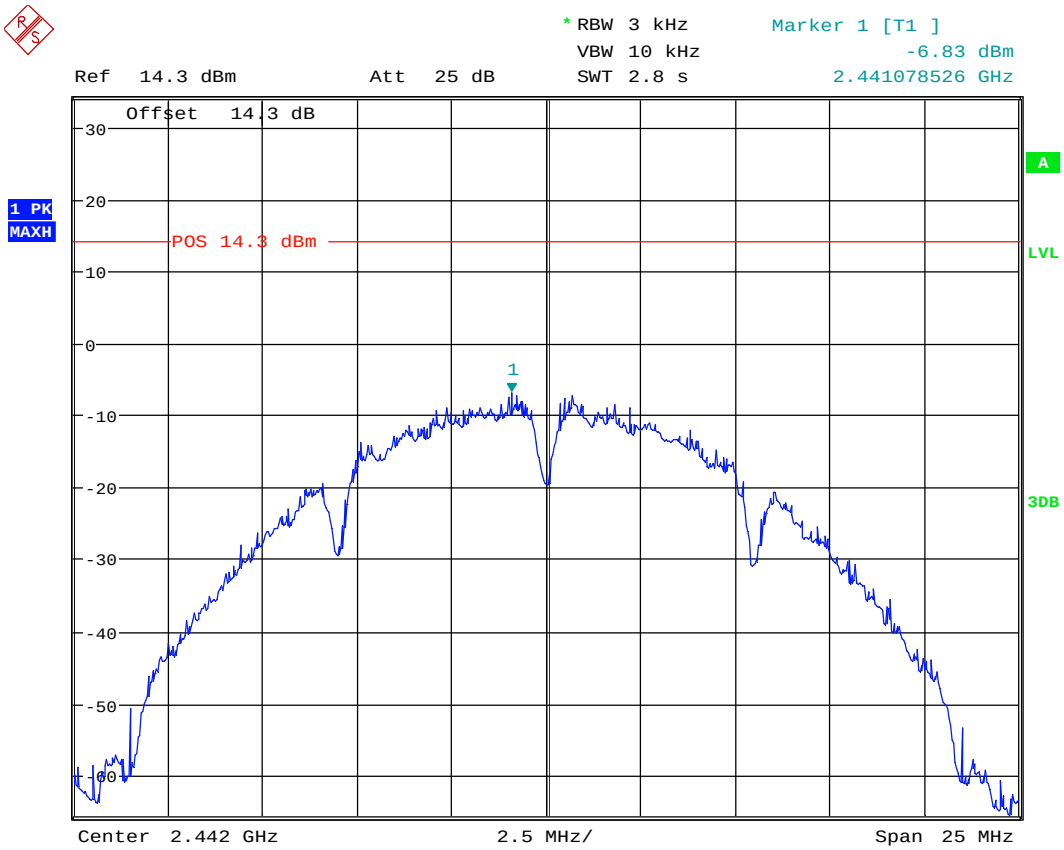
| Tx Frequency: 2412 MHz | Mode: 802.11b |
|---|---|




Date: 26.MAR.2020 17:35:15

## Plot # 39

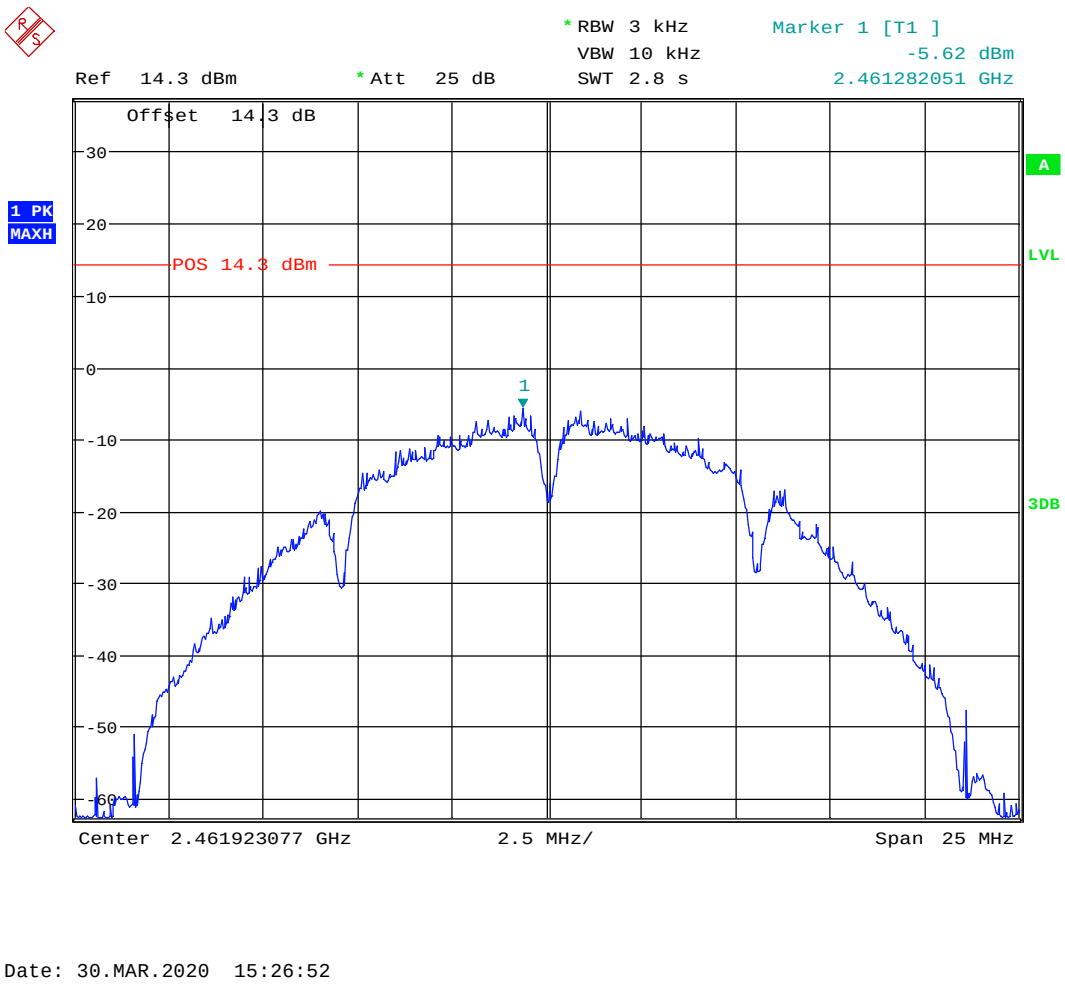
| Tx Frequency: 2442 MHz | Mode: 802.11b |
|---|---|




Date: 24.MAR.2020 17:18:05

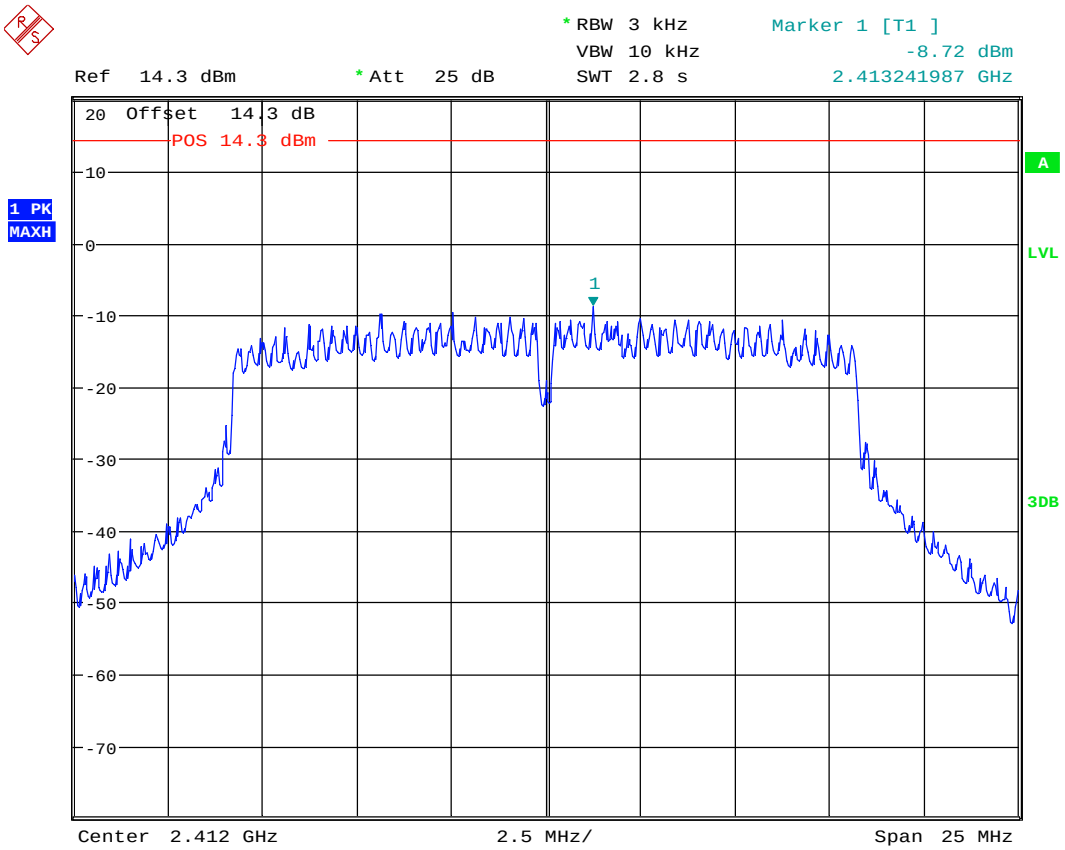
## Plot # 40

| Tx Frequency: 2462 MHz | Mode: 802.11b |
|---|---|



## Plot # 41

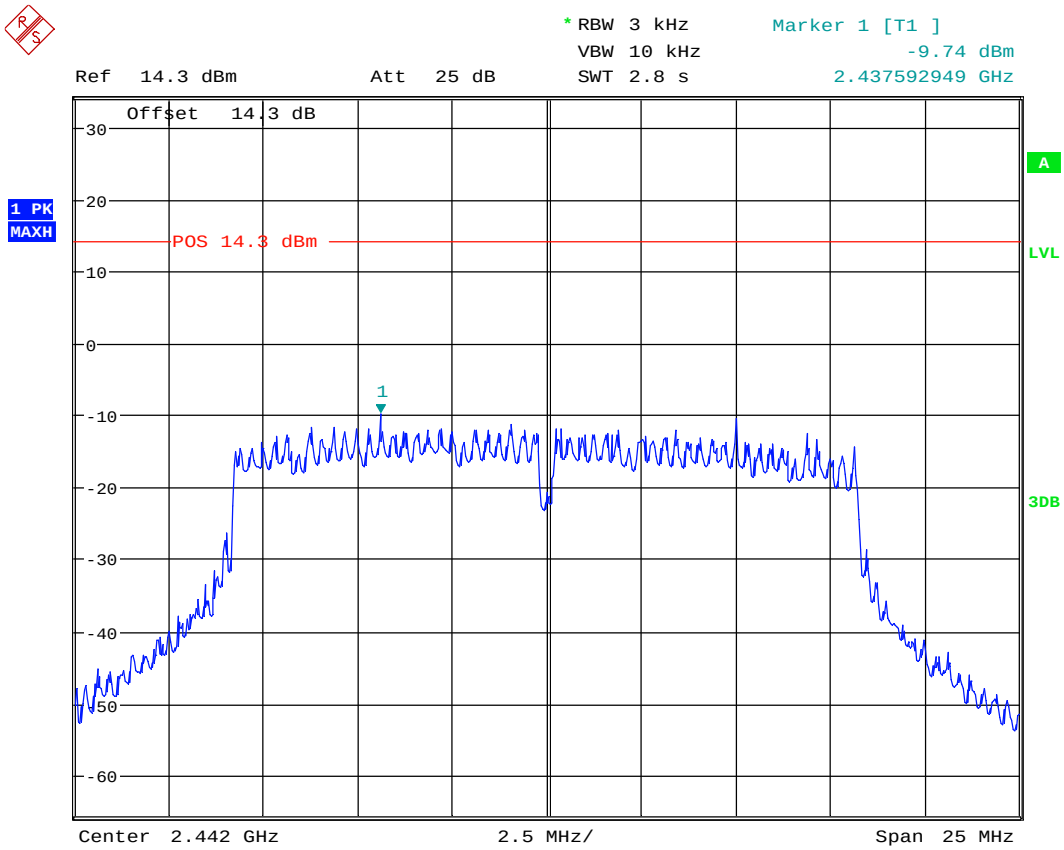
| Tx Frequency: 2412 MHz | Mode: 802.11g |
|---|---|




Date: 26.MAR.2020 18:29:39

## Plot # 42

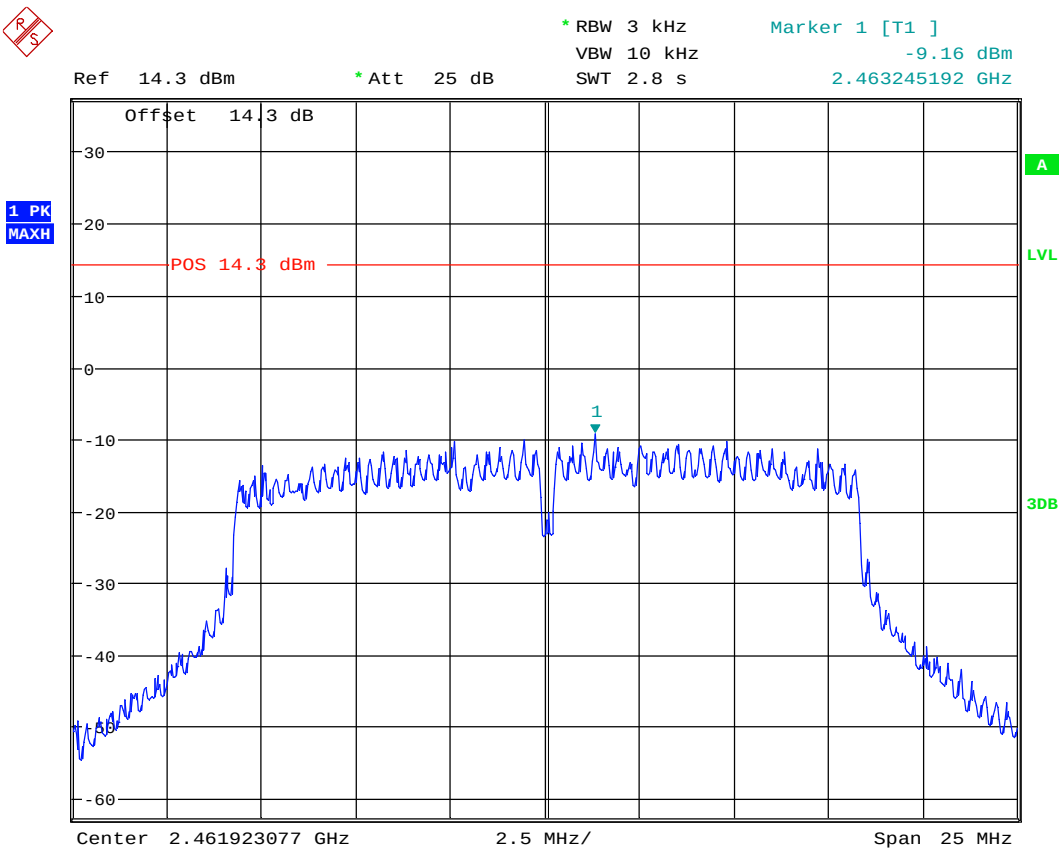
| Tx Frequency: 2442 MHz | Mode: 802.11g |
|---|---|




Date: 24.MAR.2020 17:20:41

## Plot # 43

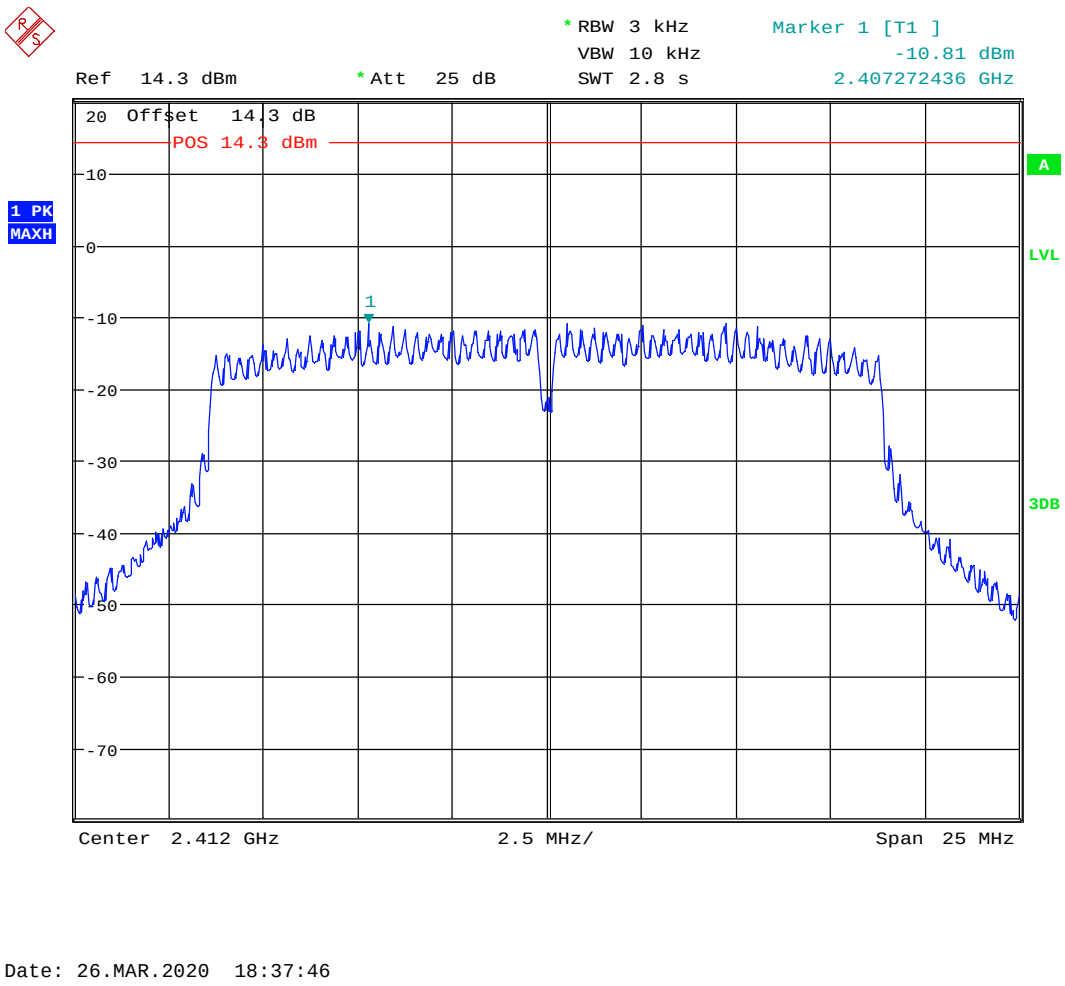
| Tx Frequency: 2462 MHz | Mode: 802.11g |
|---|---|




Date: 30.MAR.2020 15:22:37

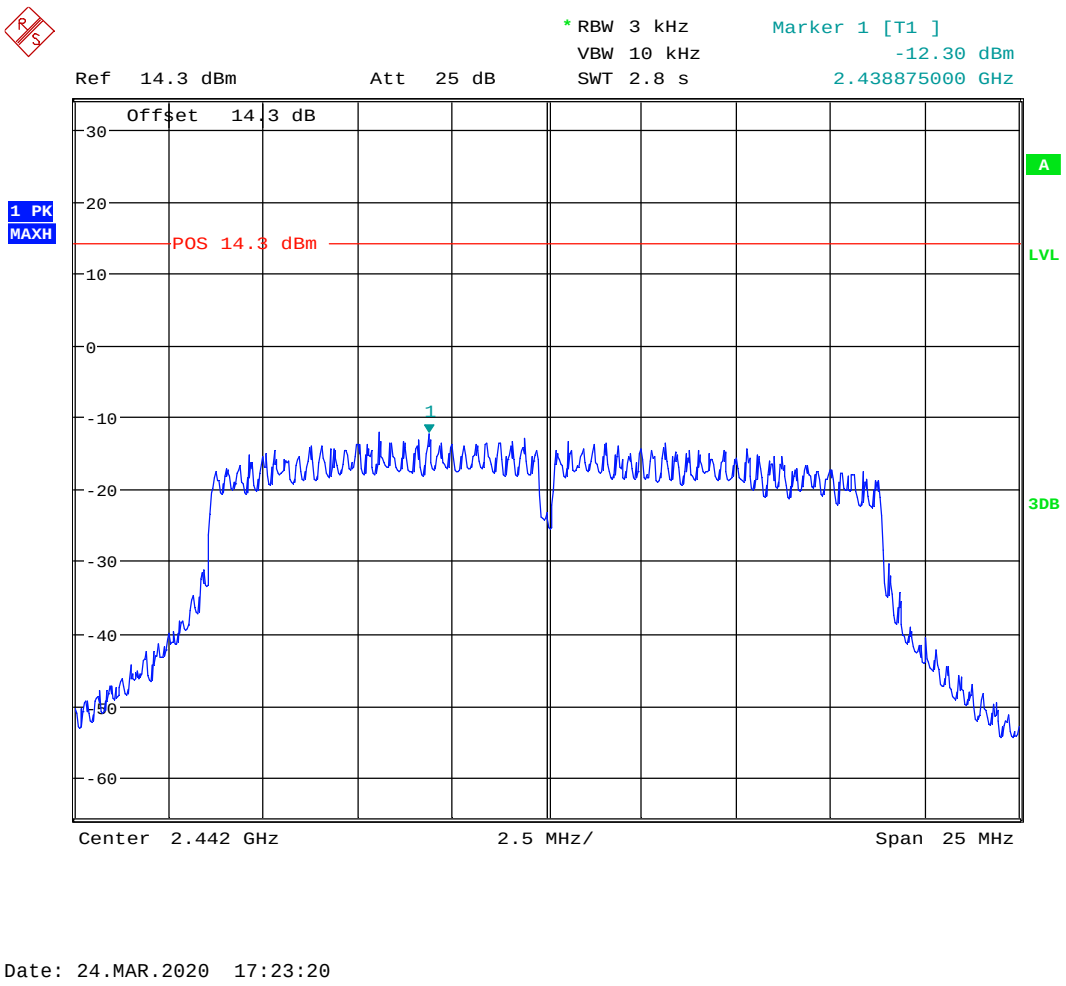
## Plot # 44

| Tx Frequency: 2412 MHz | Mode: 802.11n HT20 |
|---|---|



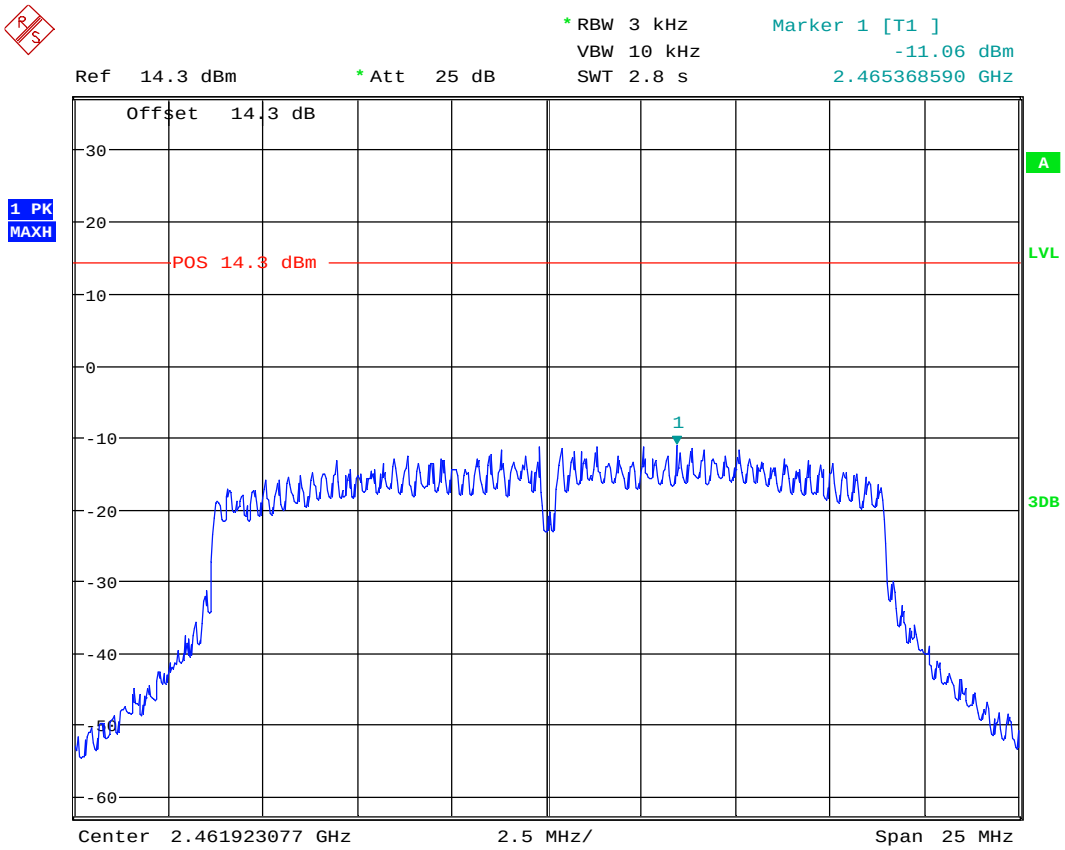
## Plot # 45

| Tx Frequency: 2442 MHz | Mode: 802.11n HT20 |
|---|---|



## Plot # 46

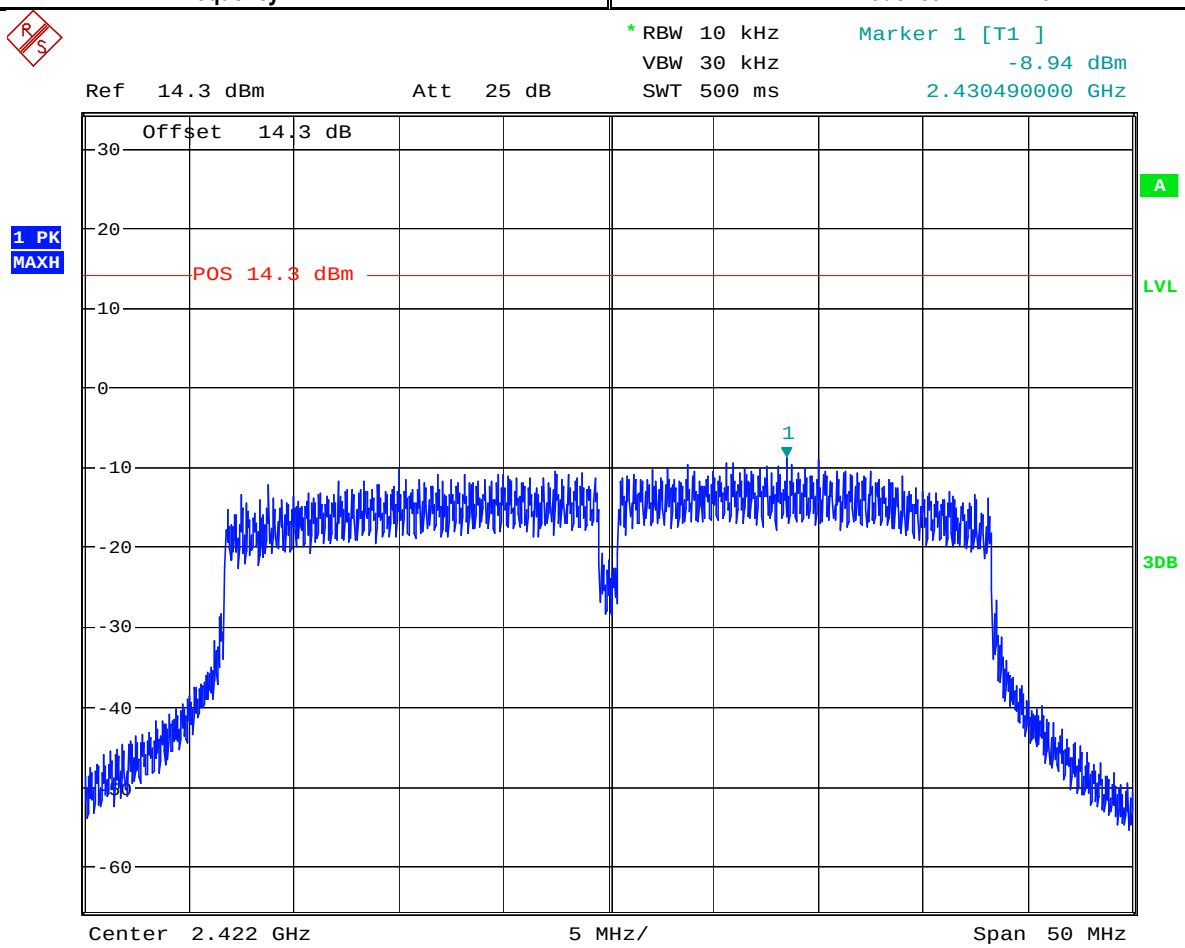
| Tx Frequency: 2462 MHz | Mode: 802.11n HT20 |
|---|---|




Date: 30.MAR.2020 15:19:48

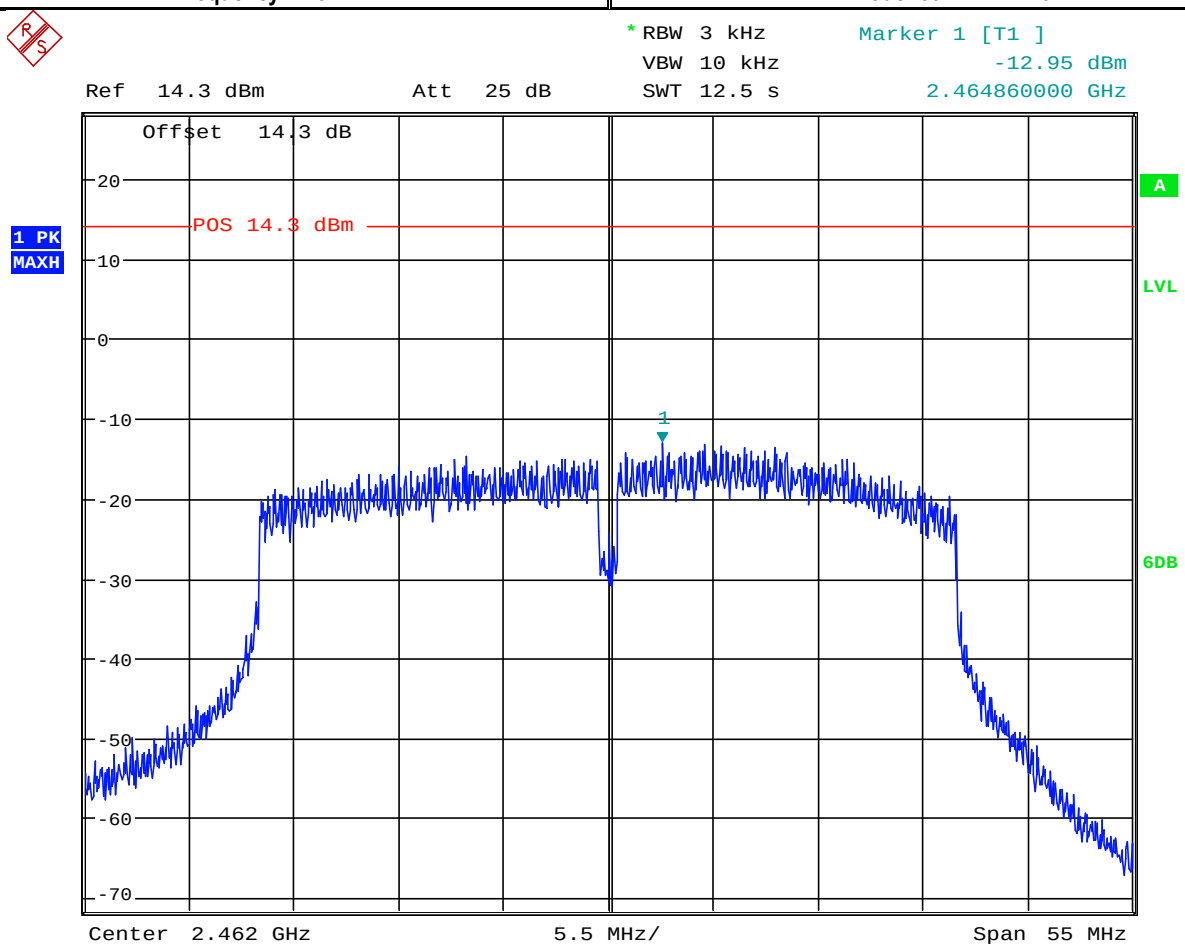
## Plot # 47

| Tx Frequency: 2422 MHz | Mode: 802.11n HT40 |
|---|---|



## Plot # 48

| Tx Frequency: 2462 MHz | Mode: 802.11n HT40 |
|---|---|




Date: 1.JUN.2020 12:32:53

## 8.5 Band Edge Compliance

### 8.5.1 Measurement according to FCC 558074 D01 15.247 Meas Guidance v05r02

**Spectrum Analyzer settings for band edge:**

- Set the center frequency and span to encompass frequency range to be measured
- RBW = 100 kHz
- VBW ≥ 3 x RBW
- Sweep Time: Auto couple
- Detector = Peak
- Trace = Max hold
- Allow trace to fully stabilize
- Use the peak marker function to determine the maximum amplitude level
- Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge

### 8.5.2 Limits non restricted band:

FCC§15.247 (d)

- 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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 in §15.209(a) (see §15.205(c)).

RSS-247 5/5

- 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30dB instead of 20dB.

**Spectrum Analyzer settings for restricted band:**

- Peak measurements are made using a peak detector and RBW=1 MHz

### 8.5.3 Limits restricted band §15.247/15.209/15.205 and RSS-Gen 8.9/8.10

- *PEAK LIMIT= 74 dBµV/m @3m =-21.23 dBm
- *AVG. LIMIT= 54 dBµV/m @3m =-41.23 dBm
- Start frequency & stop frequency according to frequency range specified in the restricted band table in FCC section 15.205 & RSS-Gen 8.10
- Measurements with a peak detector were used to show compliance to average limits, thus showing compliance to both peak and average limits.

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| [1]0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | Above 38.6 |
| 13.36-13.41 | | | |

### 8.5.4 Test conditions and setup:

Non-Restricted Band:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Antenna Gain |
|---|---|---|---|---|
| 23.8°C | 1 | Op. 1 | 12 VDC | 4.2 dBi |

Restricted Band:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input | Antenna Gain |
|---|---|---|---|---|
| 23.8°C | 1 | Op. 1 | 12 VDC | 4.2 dBi |

### 8.5.5 Measurement result:

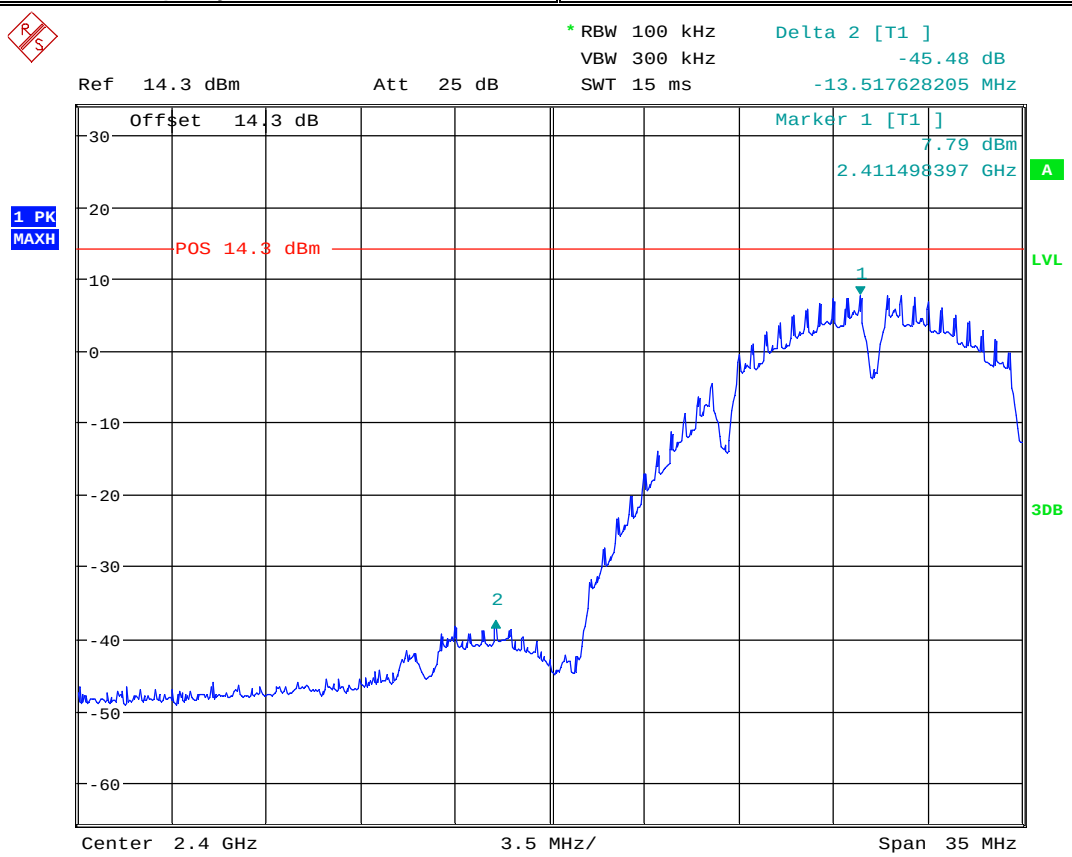
| Plot # | EUT operating mode | Band Edge | Band Edge Delta (dBc) | Limit (dBc) | Result |
|---|---|---|---|---|---|
| 49 | 802.11b | Lower, Non-restricted | -45.48 | 20 | Pass |
| 50 | 802.11g | Lower, Non-restricted | -35.52 | 20 | Pass |
| 51 | 802.11n HT20 | Lower, Non-restricted | -31.18 | 20 | Pass |
| 52 | 802.11n HT40 | Lower, Non-restricted | -32.10 | 20 | Pass |

| Plot # | EUT operating mode | Band Edge | Measured Peak/AVG Value (dBm) | Corrected by Antenna Gain (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|
| 53 | 802.11b | Upper Restricted | Peak: -42.85 | Peak: -38.65 | Peak: -21.23 | Pass |
| | | | AVG: -53.60 | AVG: -49.40 | AVG: -41.23 | |
| 54 | 802.11g | Upper Restricted | Peak: -38.72 | Peak: -34.62 | Peak: -21.23 | Pass |
| | | | AVG: -50.57 | AVG: -46.37 | AVG: -41.23 | |
| 55 | 802.11n HT20 | Upper Restricted | Peak: -41.15 | Peak: -36.95 | Peak: -21.23 | Pass |
| | | | AVG: -46.65 | AVG: -42.45 | AVG: -41.23 | |
| 56 | 802.11n HT40 | Upper Restricted | Peak: -33.78 | Peak: -29.58 | Peak: -21.23 | Pass |
| | | | AVG: -46.72 | AVG: -42.52 | AVG: -41.23 | |

### 8.5.6 Measurement Plots:

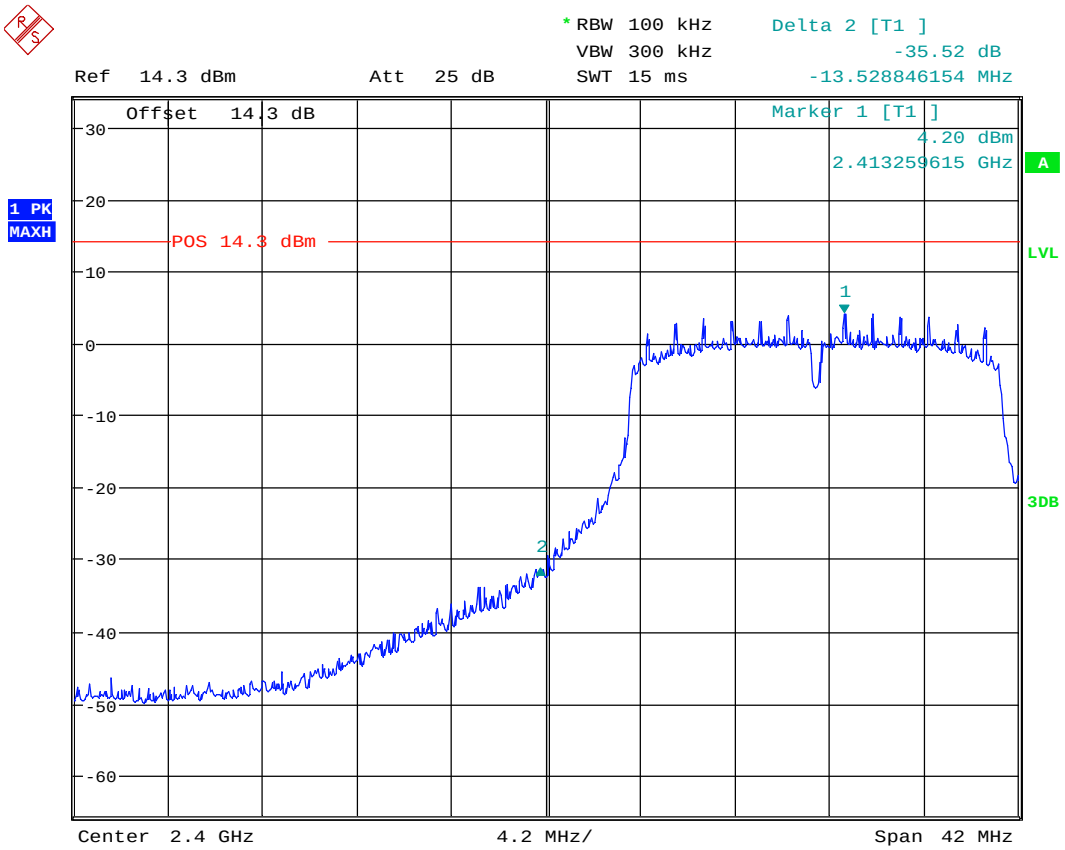
**Plot # 49**

| Tx Frequency: 2412 MHz | Mode: 802.11b |
|---|---|



## Plot # 50

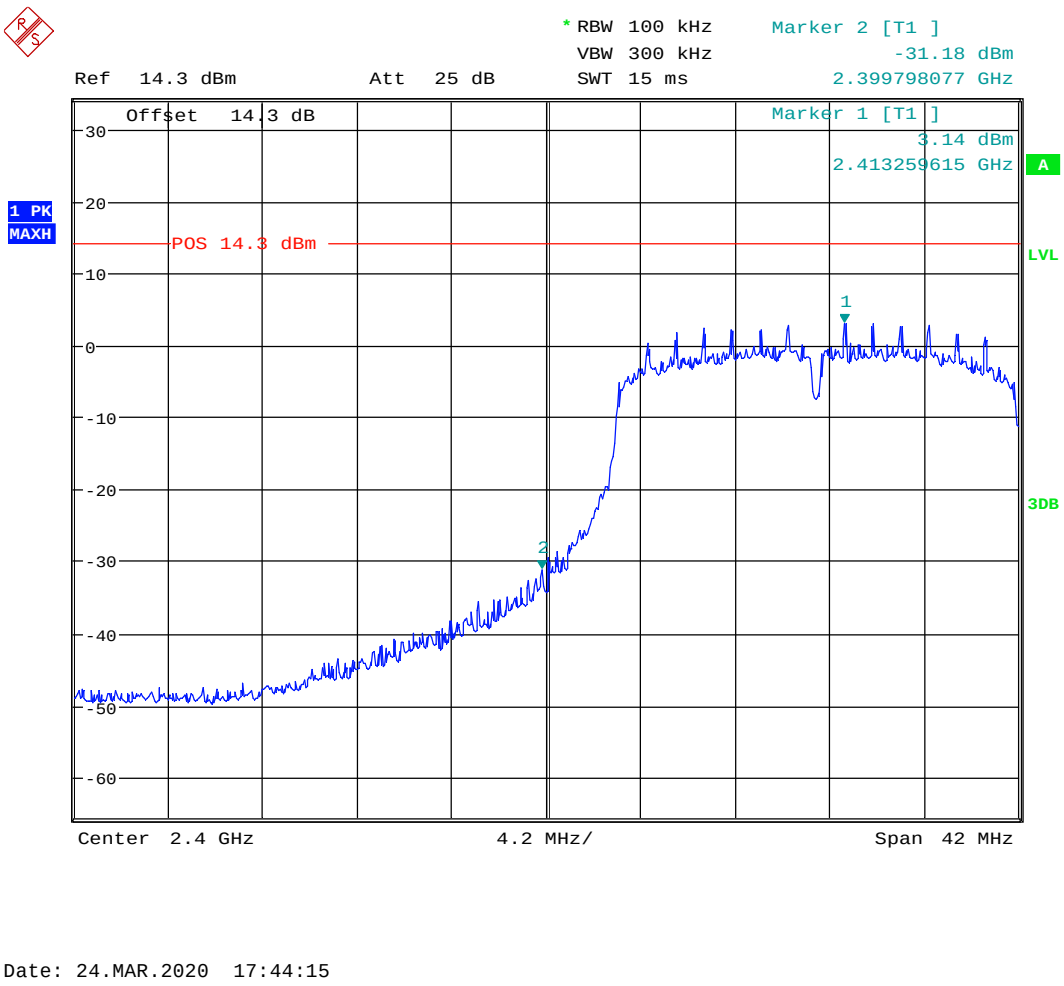
**Tx Frequency: 2412 MHz** | **Mode: 802.11g**




Date: 24.MAR.2020 17:46:13

## Plot # 51

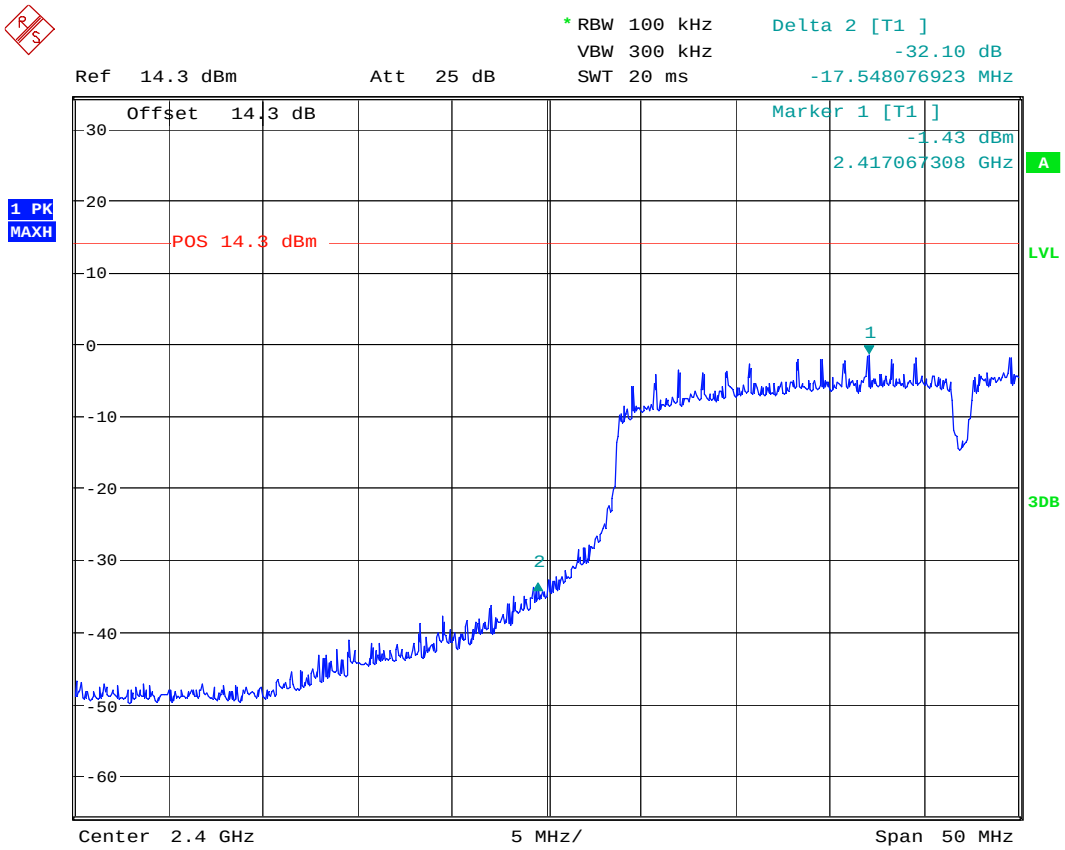
| Tx Frequency: 2412 MHz | Mode: 802.11n HT20 |
|---|---|




Date: 24.MAR.2020 17:44:15

## Plot # 52

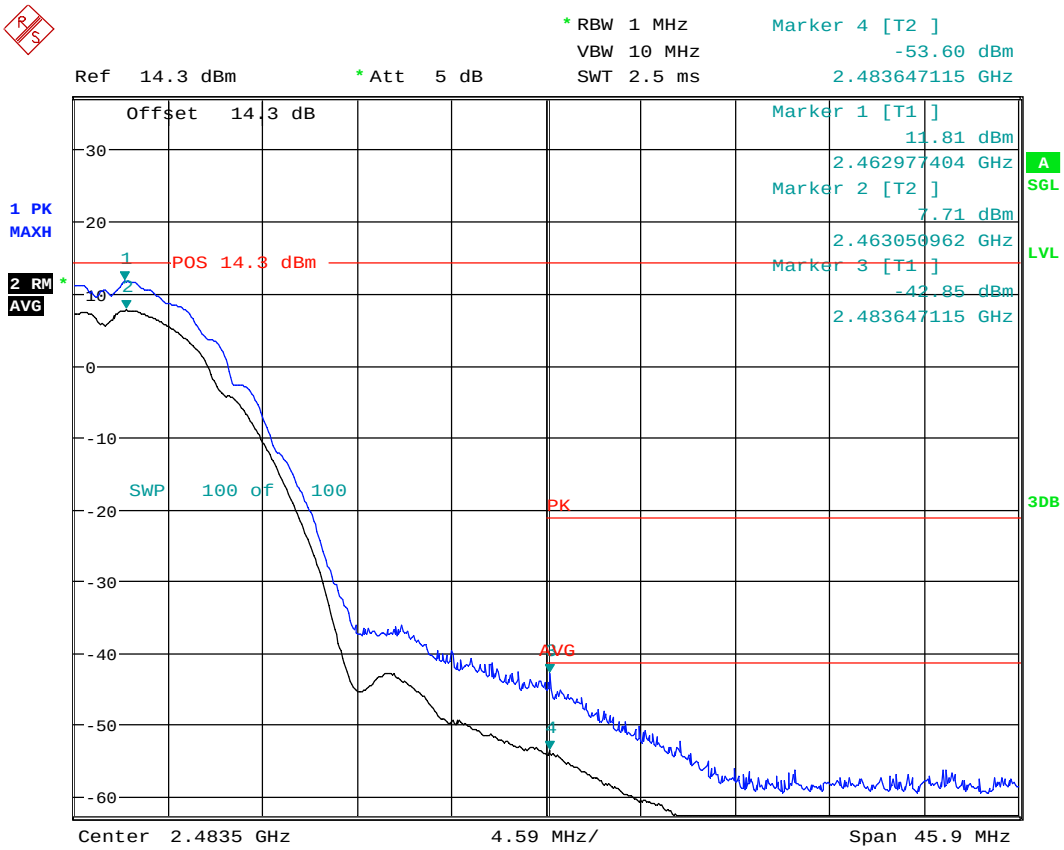
| Tx Frequency: 2422 MHz | Mode: 802.11n HT40 |
|---|---|




Date: 1.JUN.2020 16:26:40

## Plot # 53

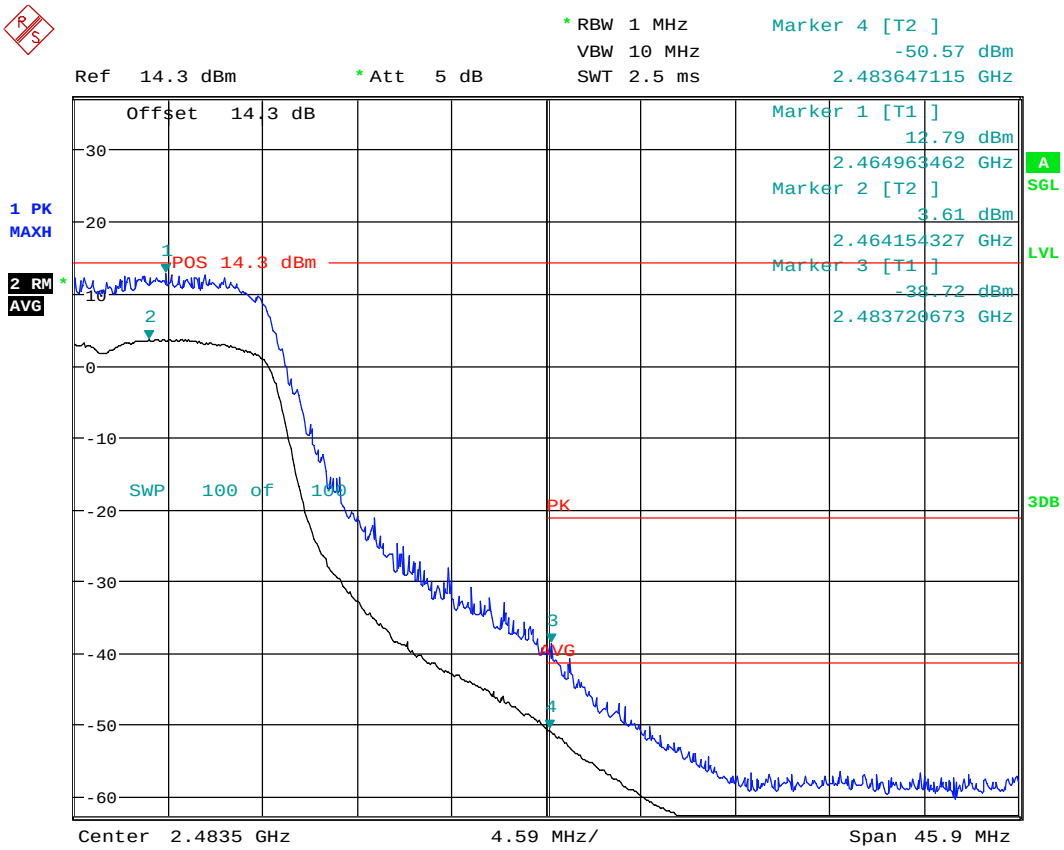
| Tx Frequency: 2462 MHz | Mode: 802.11b |
|---|---|




Date: 30.MAR.2020 16:05:30

## Plot # 54

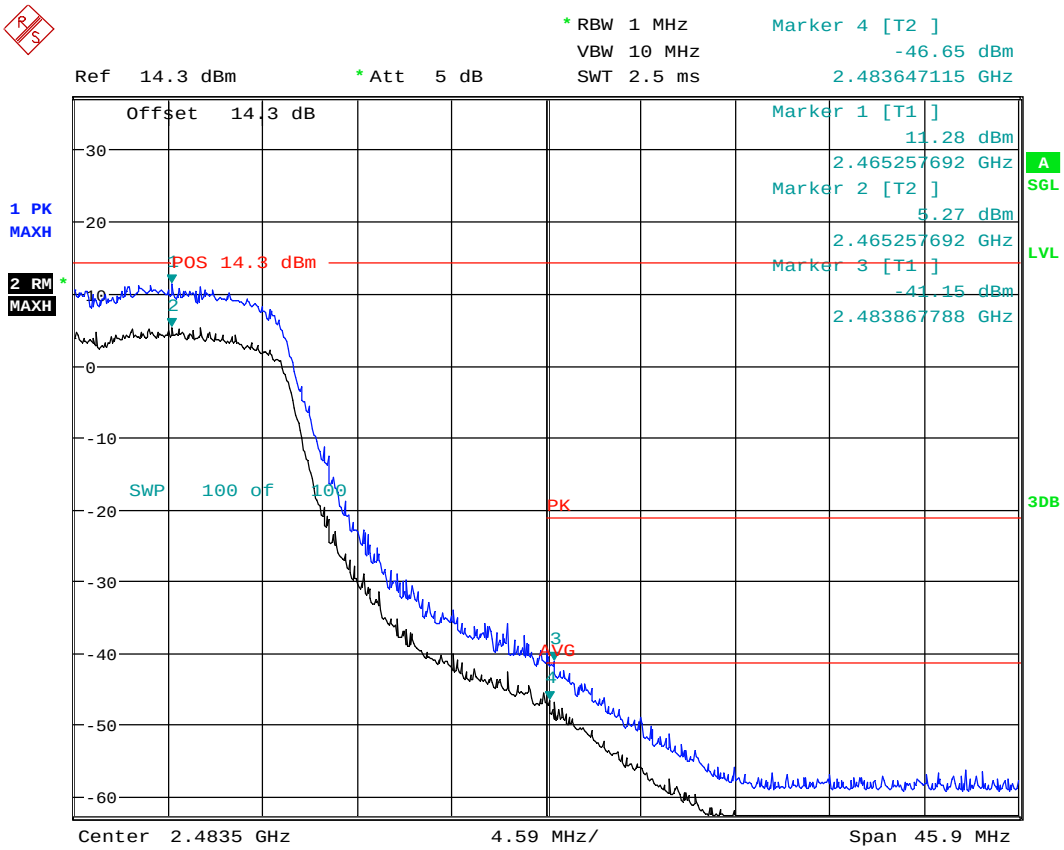
**Tx Frequency: 2462 MHz** | **Mode: 802.11g**




Date: 30.MAR.2020 16:03:16

## Plot # 55

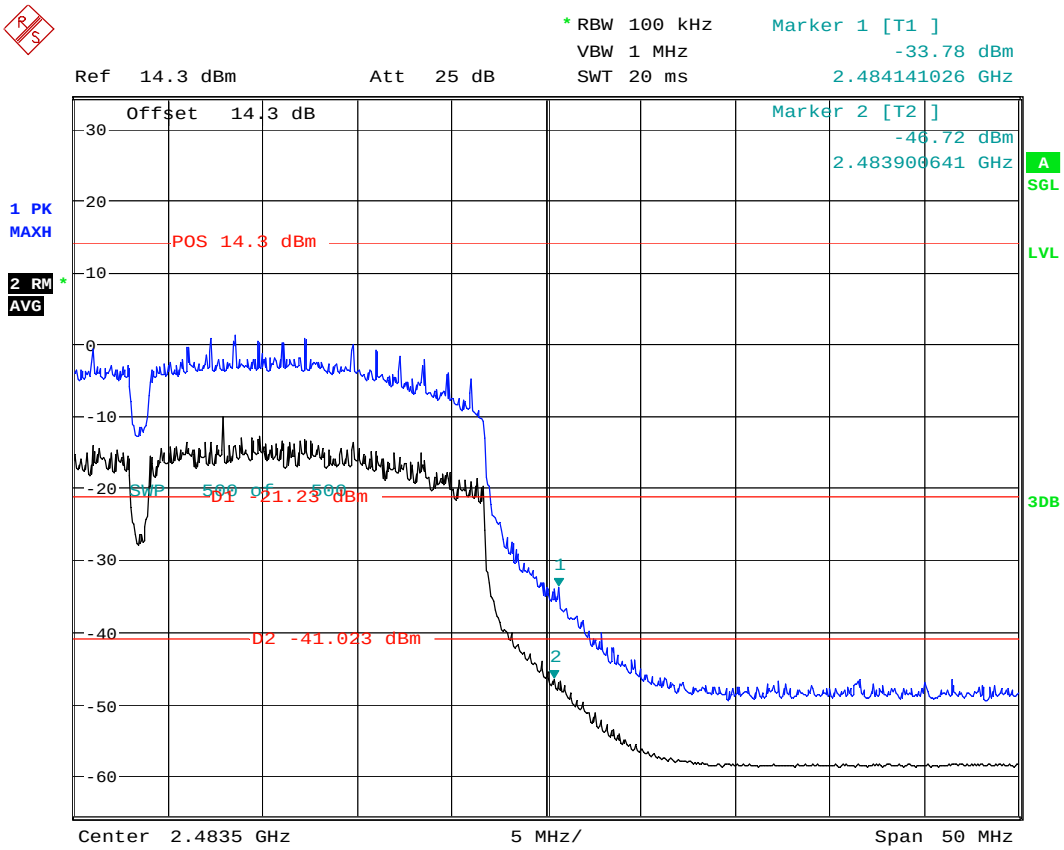
| Tx Frequency: 2462 MHz | Mode: 802.11n HT20 |
|---|---|




Date: 30.MAR.2020 16:07:35

## Plot # 56

| Tx Frequency: 2462 MHz | Mode: 802.11n HT40 |
|---|---|




Date: 1.JUN.2020 16:31:47

## 8.6 Radiated Transmitter Spurious Emissions and Restricted Bands

### 8.6.1 Measurement according to ANSI C63.10 (2013)

**Spectrum Analyzer Settings:**

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation factor as follow: Conversion factor (CF) = 40 log (D/d) = 40 log (300m / 3m) = 80dB

### 8.6.2 Limits:

FCC §15.247

- 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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 in §15.209(a) (see §15.205(c)).

FCC §15.209 & RSS-Gen 8.9

- Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency of emission (MHz) | Field strength (µV/m) | Measurement Distance (m) | Field strength @ 3m (dBµV/m) |
|---|---|---|---|
| 0.009–0.490 | 2400/F(kHz) / --------- | 300 | - |
| 0.490–1.705 | 24000/F(kHz) / -------- | 30 | - |
| 1.705–30.0 | 30 / (29.5) | 30 | - |
| 30–88 | 100 | 3 | 40 dBµV/m |
| 88–216 | 150 | 3 | 43.5 dBµV/m |
| 216–960 | 200 | 3 | 46 dBµV/m |
| Above 960 | 500 | 3 | 54 dBµV/m |

FCC §15.205 & RSS-Gen 8.10

- Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| [1]0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | Above 38.6 |
| 13.36-13.41 | | | |

- 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) (see §15.205(c)).
  *PEAK LIMIT= 74 dBµV/m
  *AVG. LIMIT= 54 dBµV/m

### 8.6.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---|---|---|---|
| 23.8°C | 2 | Op. 1 | 12 VDC |

### 8.6.4 Measurement result:

| Plot # | Channel # | Scan Frequency | Limit | Result |
|---|---|---|---|---|
| 46 – 48 | Low | 30 MHz – 18 GHz | See section 8.6.2 | Pass |
| 49 – 53 | Mid | 9 kHz – 26 GHz | See section 8.6.2 | Pass |
| 54 – 56 | High | 30 MHz – 18 GHz | See section 8.6.2 | Pass |

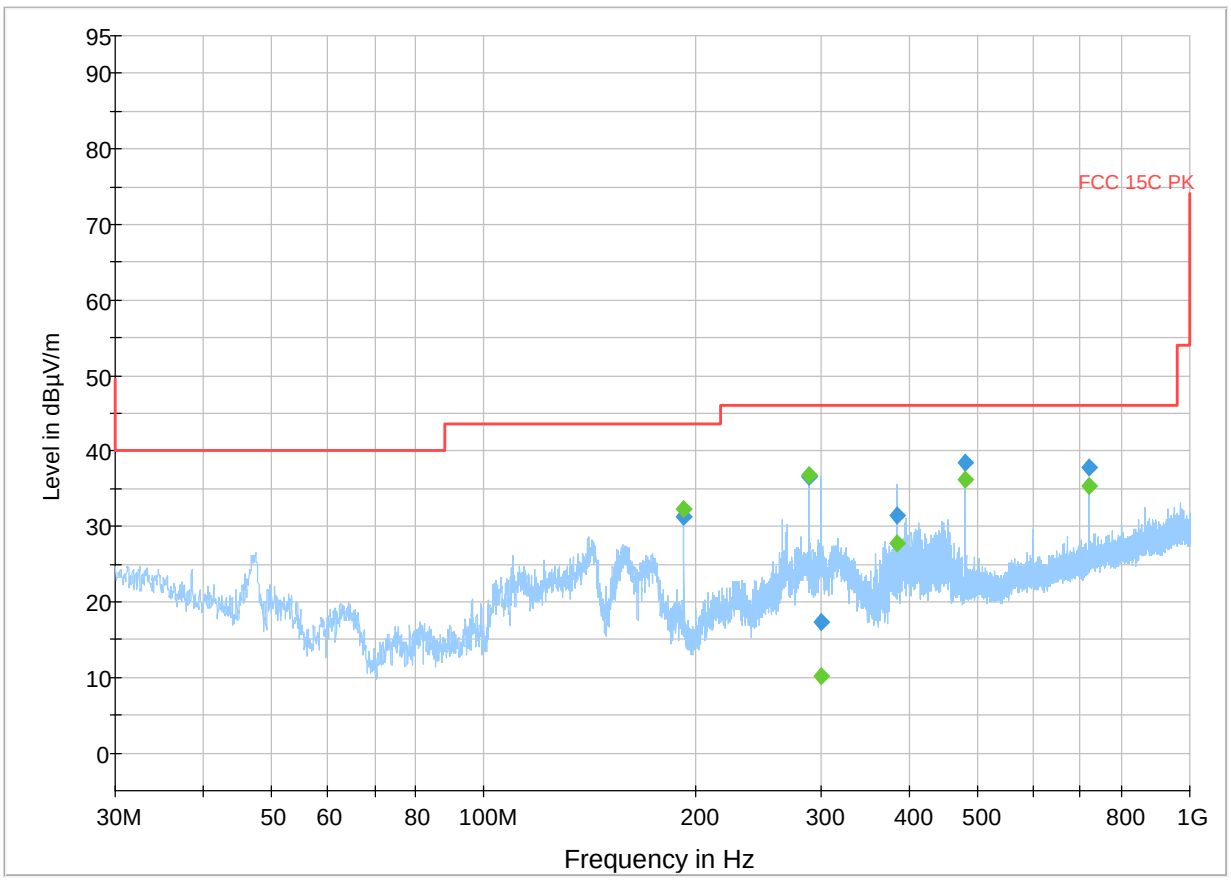
### 8.6.5 Measurement Plots:

**Plot # 57 Radiated Emissions: 30 MHz – 1 GHz**

| Tx Frequency: 2412 MHz | Mode: 802.11g |
|---|---|

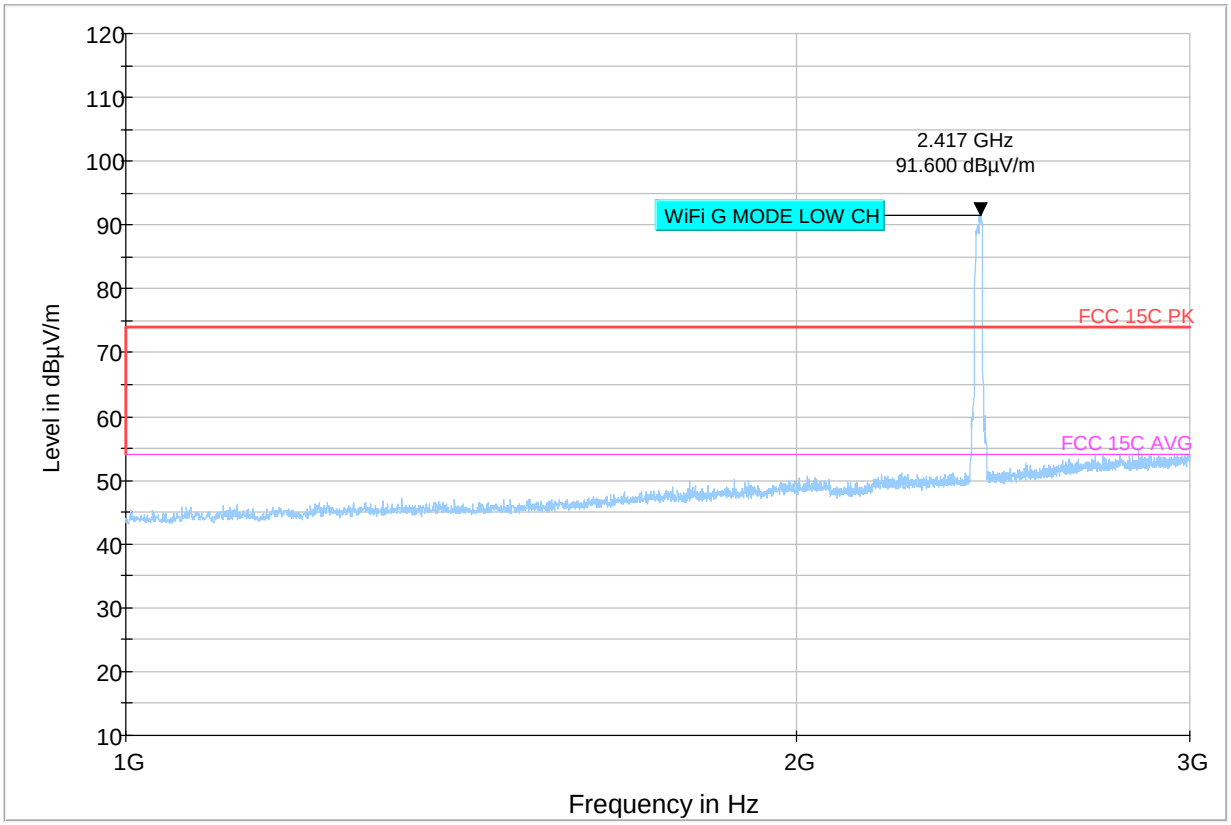
## Final_Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 192.012 | 31.21 | --- | 43.50 | 12.29 | 500.0 | 120.000 | 124.0 | H | -20.4 |
| 192.012 | --- | 32.34 | --- | --- | 500.0 | 120.000 | 124.0 | H | -20.4 |
| 288.007 | --- | 36.73 | --- | --- | 500.0 | 120.000 | 145.0 | H | -17.7 |
| 288.007 | 36.51 | --- | 46.00 | 9.49 | 500.0 | 120.000 | 145.0 | H | -17.7 |
| 300.281 | 17.35 | --- | 46.00 | 28.65 | 500.0 | 120.000 | 209.0 | H | -17.4 |
| 300.281 | --- | 10.09 | --- | --- | 500.0 | 120.000 | 209.0 | H | -17.4 |
| 384.024 | 31.40 | --- | 46.00 | 14.60 | 500.0 | 120.000 | 100.0 | H | -14.8 |
| 384.024 | --- | 27.70 | --- | --- | 500.0 | 120.000 | 100.0 | H | -14.8 |
| 480.010 | 38.41 | --- | 46.00 | 7.59 | 500.0 | 120.000 | 300.0 | H | -12.5 |
| 480.010 | --- | 36.17 | --- | --- | 500.0 | 120.000 | 300.0 | H | -12.5 |
| 720.036 | --- | 35.38 | --- | --- | 500.0 | 120.000 | 124.0 | H | -8.3 |
| 720.036 | 37.85 | --- | 46.00 | 8.15 | 500.0 | 120.000 | 124.0 | H | -8.3 |



## Plot # 58 Radiated Emissions: 1 – 3 GHz

| Tx Frequency: 2412 MHz | Mode: 802.11g |
|---|---|

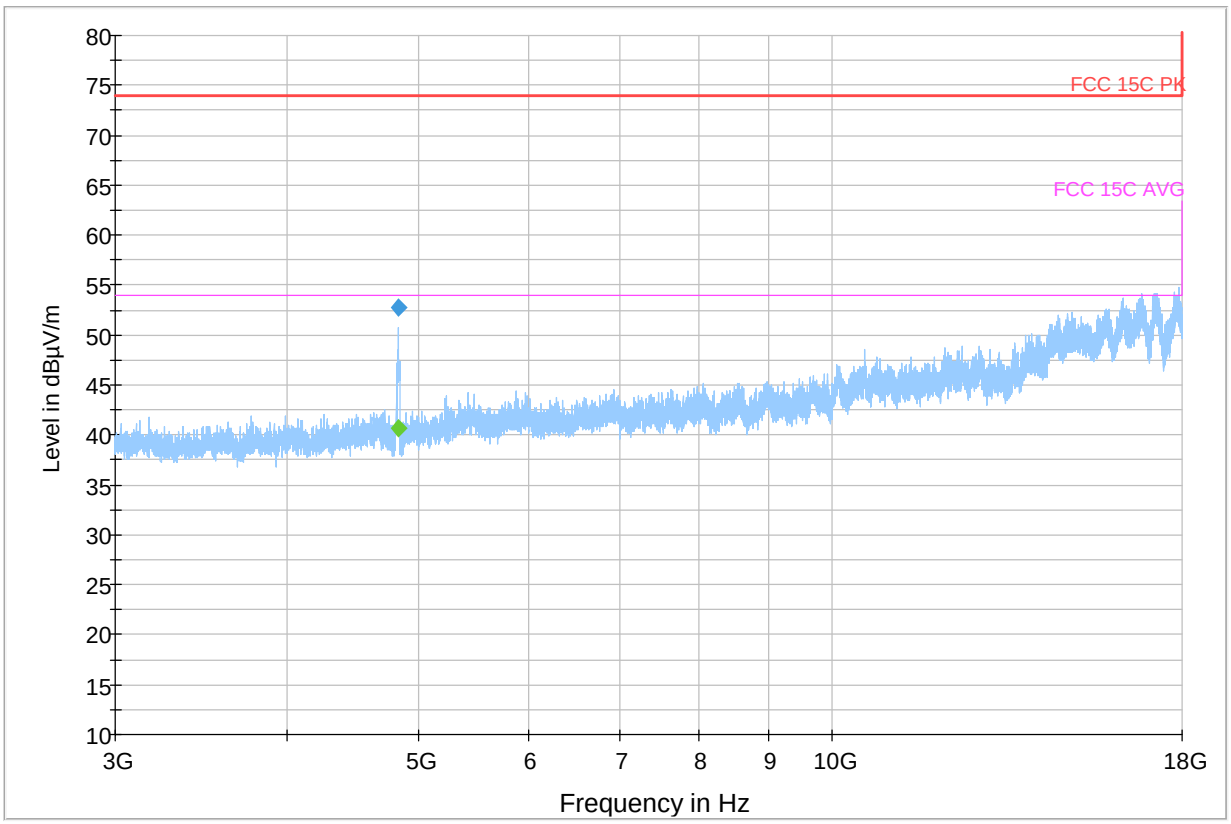


## Plot # 59 Radiated Emissions: 3 – 18 GHz

**Tx Frequency: 2412 MHz** | **Mode: 802.11g**

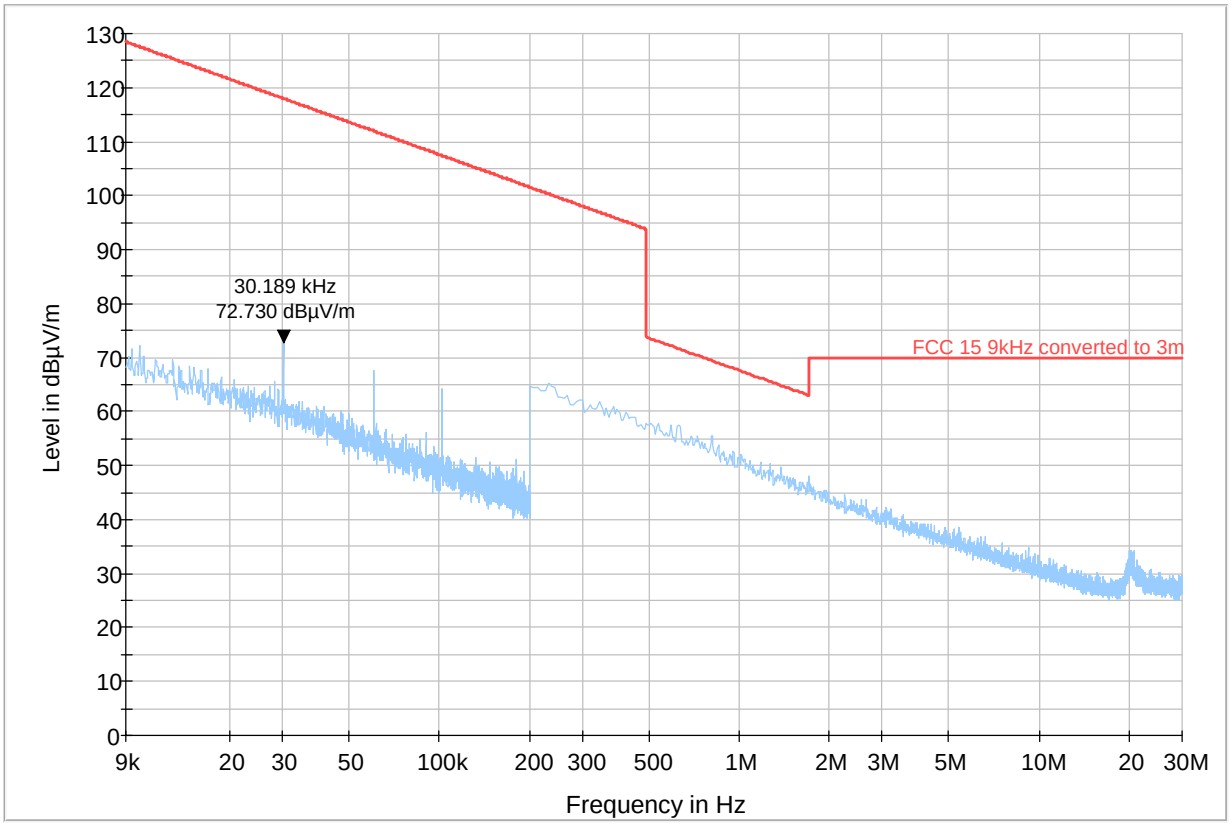
### Final_Result

| Frequency (MHz) | MaxPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4822.651 | --- | 40.683 | 53.98 | 13.30 | 500.0 | 1000.000 | 125.0 | V | 59.0 | -6.0 | 3:00:48 PM - 4/15/2020 |
| 4822.651 | 52.774 | --- | 73.99 | 21.21 | 500.0 | 1000.000 | 125.0 | V | 59.0 | -6.0 | 3:00:48 PM - 4/15/2020 |



## Plot # 60 Radiated Emissions: 9 KHz – 30 MHz

| Tx Frequency: 2437 MHz | Mode: 802.11g |
|---|---|

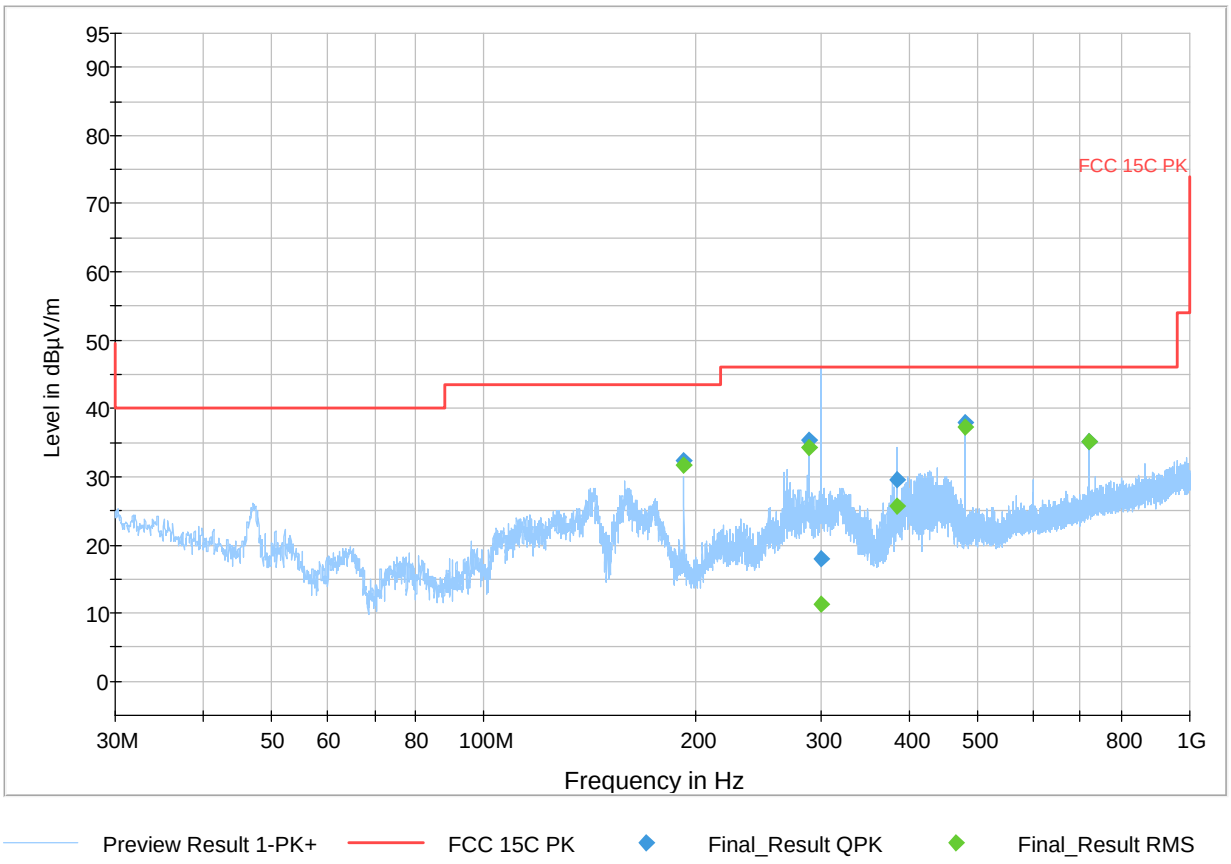


## Plot # 61 Radiated Emissions: 30 MHz – 1 GHz

**Tx Frequency: 2437 MHz** | **Mode: 802.11g**

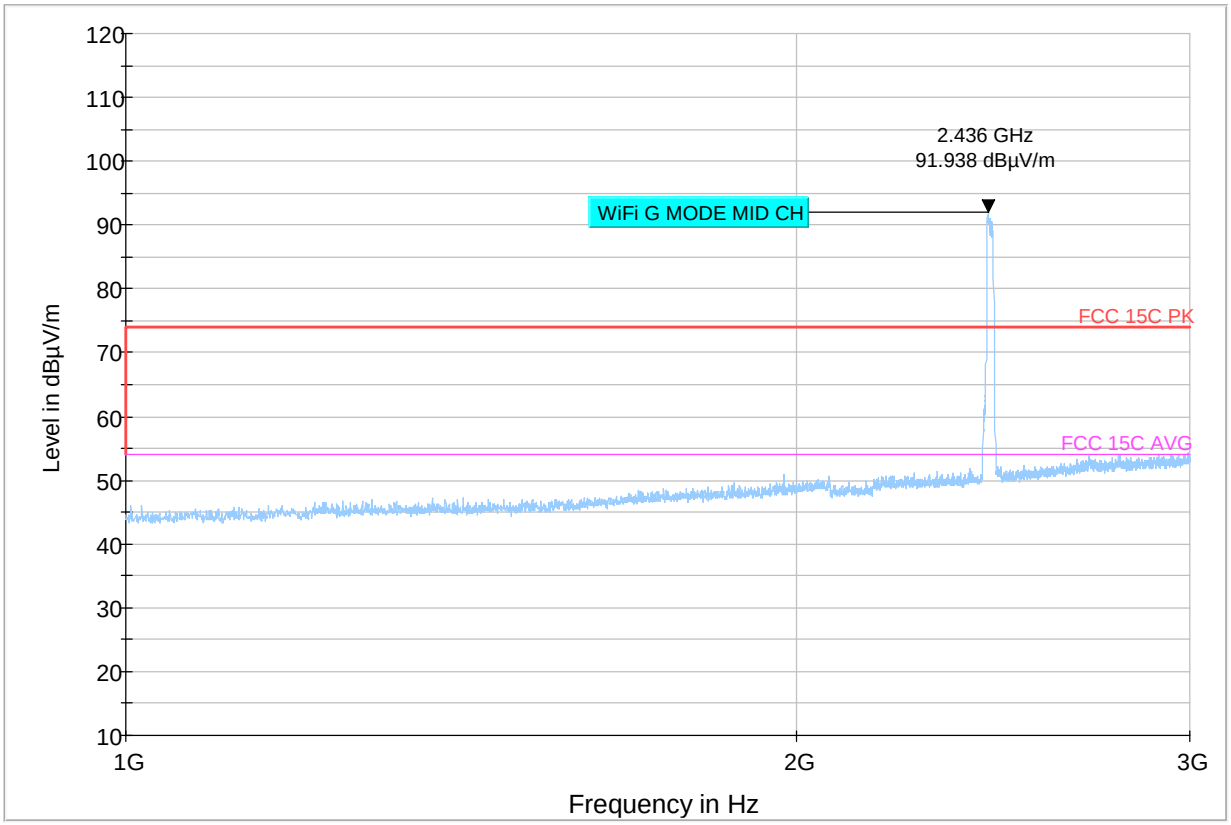
## Final_Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 191.994 | 32.266 | --- | 43.50 | 11.23 | 500.0 | 120.000 | 300.0 | H | -20.4 |
| 191.994 | --- | 31.645 | --- | --- | 500.0 | 120.000 | 300.0 | H | -20.4 |
| 288.001 | --- | 34.279 | --- | --- | 500.0 | 120.000 | 124.0 | H | -17.7 |
| 288.001 | 35.330 | --- | 46.00 | 10.67 | 500.0 | 120.000 | 124.0 | H | -17.7 |
| 300.293 | 17.909 | --- | 46.00 | 28.09 | 500.0 | 120.000 | 124.0 | H | -17.4 |
| 300.293 | --- | 11.244 | --- | --- | 500.0 | 120.000 | 124.0 | H | -17.4 |
| 384.002 | --- | 25.712 | --- | --- | 500.0 | 120.000 | 156.0 | H | -14.8 |
| 384.002 | 29.636 | --- | 46.00 | 16.36 | 500.0 | 120.000 | 156.0 | H | -14.8 |
| 480.010 | 37.870 | --- | 46.00 | 8.13 | 500.0 | 120.000 | 234.0 | H | -12.5 |
| 480.010 | --- | 37.350 | --- | --- | 500.0 | 120.000 | 234.0 | H | -12.5 |
| 720.033 | 35.171 | --- | 46.00 | 10.83 | 500.0 | 120.000 | 130.0 | H | -8.3 |
| 720.033 | --- | 35.101 | --- | --- | 500.0 | 120.000 | 130.0 | H | -8.3 |



## Plot # 62 Radiated Emissions: 1 – 3 GHz

| Tx Frequency: 2437 MHz | Mode: 802.11g |
|---|---|

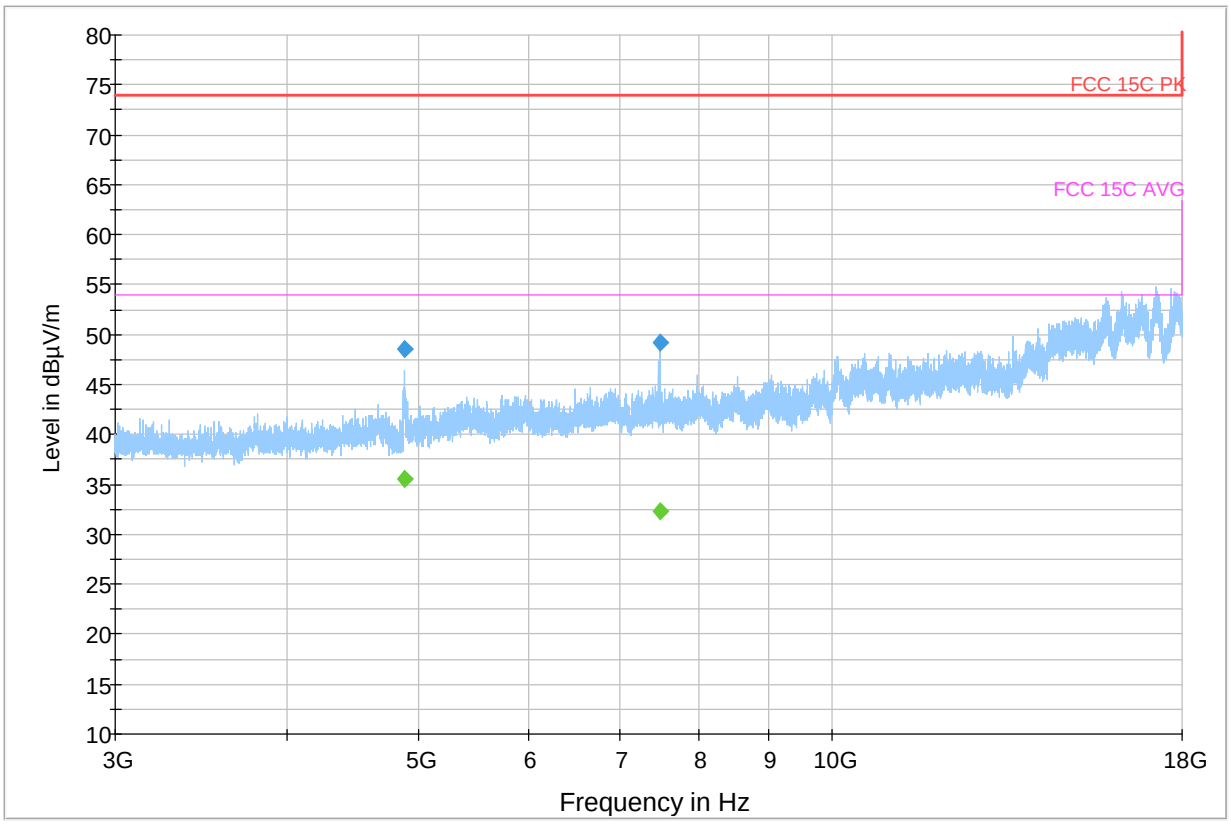


## Plot # 63 Radiated Emissions: 3 – 18 GHz

**Tx Frequency: 2437 MHz** | **Mode: 802.11g**

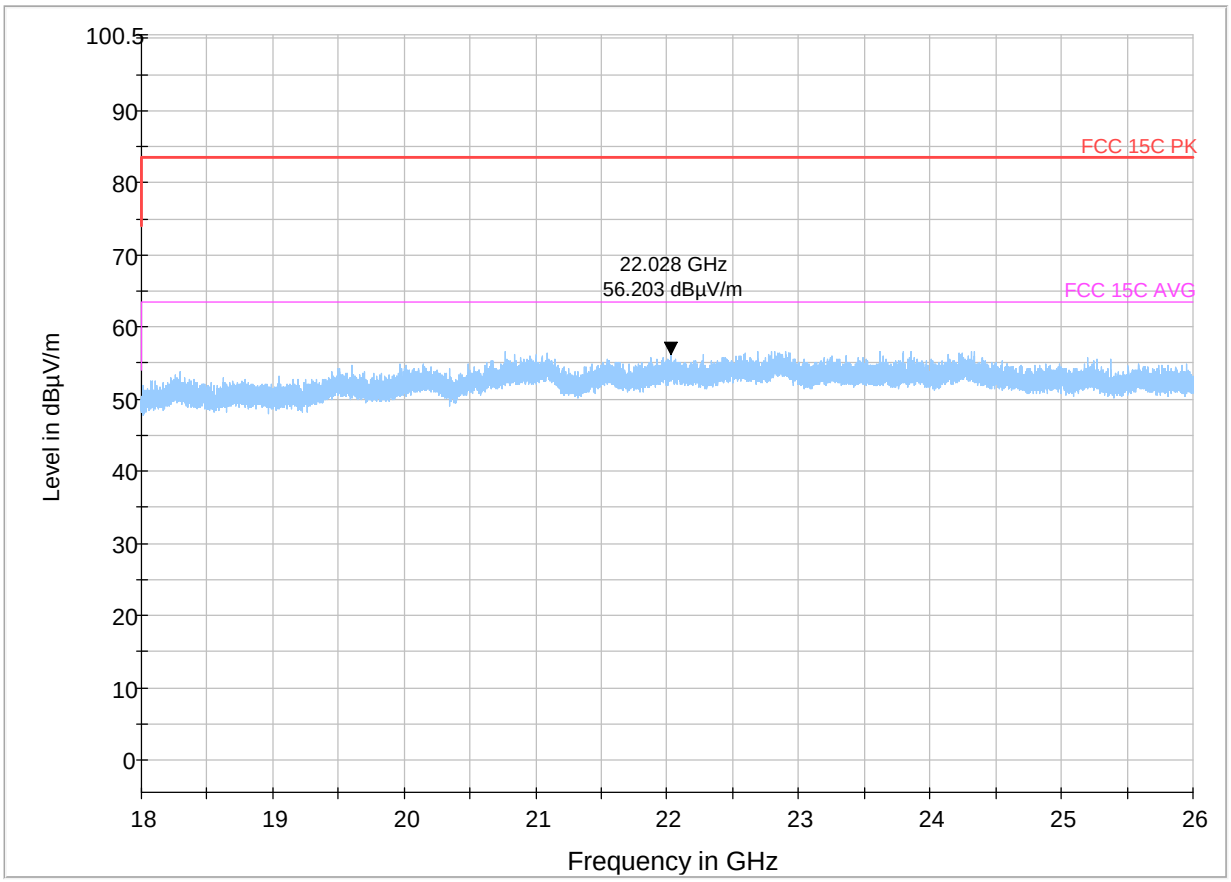
### Final_Result

| Frequency (MHz) | MaxPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4878.044 | --- | 35.584 | 53.98 | 18.40 | 500.0 | 1000.000 | 210.0 | V | 224.0 | -5.7 | 2:41:35 PM - 4/15/2020 |
| 4878.044 | 48.627 | --- | 73.99 | 25.36 | 500.0 | 1000.000 | 210.0 | V | 224.0 | -5.7 | 2:41:35 PM - 4/15/2020 |
| 7493.666 | --- | 32.253 | 53.98 | 21.73 | 500.0 | 1000.000 | 142.0 | V | 342.0 | -2.0 | 2:44:44 PM - 4/15/2020 |
| 7493.666 | 49.156 | --- | 73.99 | 24.83 | 500.0 | 1000.000 | 142.0 | V | 342.0 | -2.0 | 2:44:44 PM - 4/15/2020 |



## Plot # 64 Radiated Emissions: 18 – 26 GHz

| Tx Frequency: 2437 MHz | Mode: 802.11g |
|---|---|

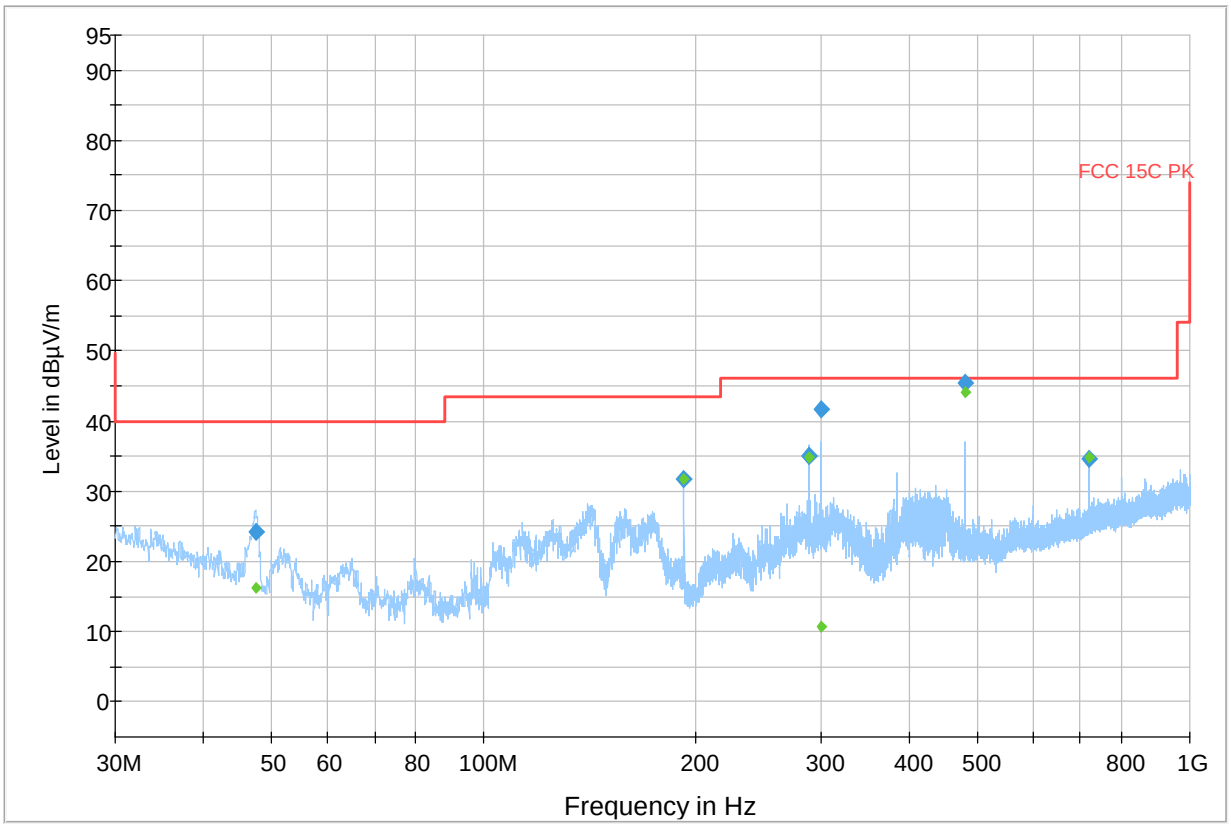


## Plot # 65 Radiated Emissions: 30 MHz – 1 GHz

**Tx Frequency: 2462 MHz** | **Mode: 802.11g**

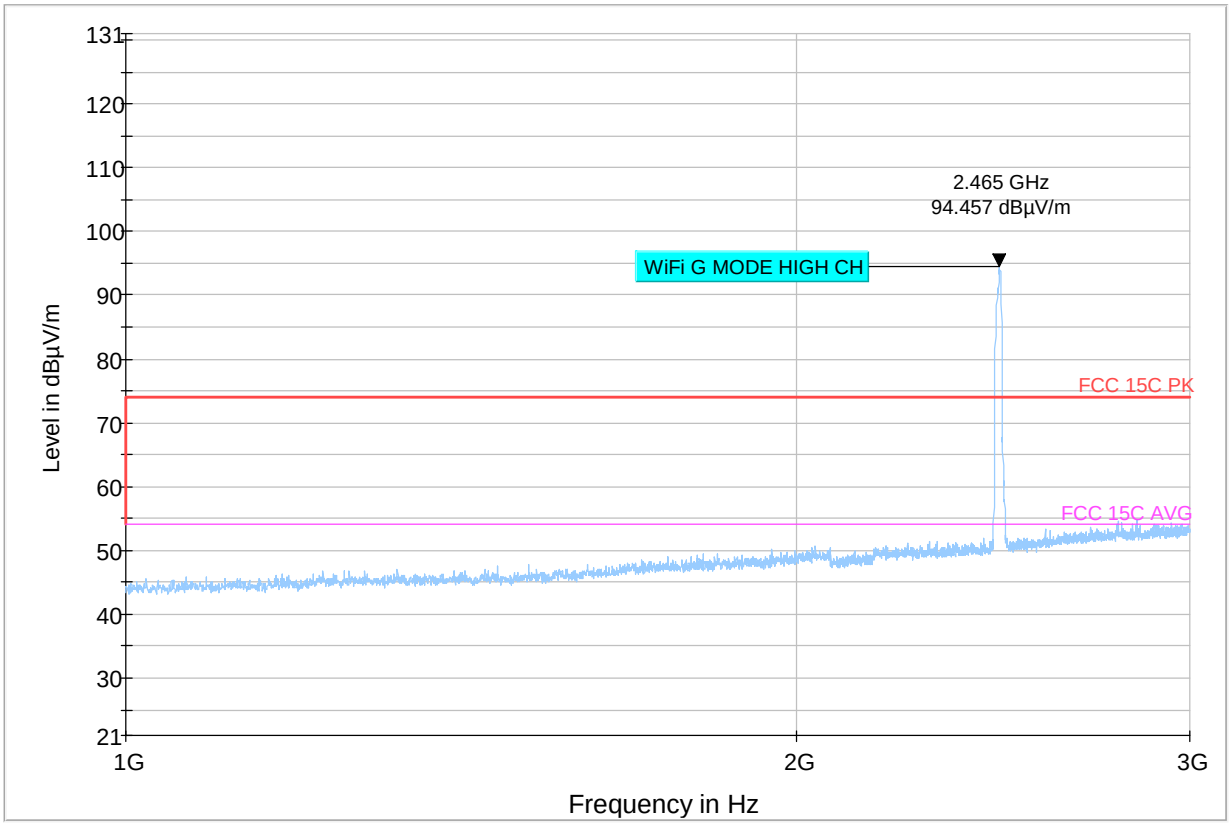
### Final_Result

| Frequency (MHz) | QuasiPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|
| 47.483 | 24.15 | --- | 40.00 | 15.85 | 500.0 | 120.000 | 100.0 | V | -18.0 |
| 47.483 | --- | 16.25 | --- | --- | 500.0 | 120.000 | 100.0 | V | -18.0 |
| 192.000 | 31.71 | --- | 43.50 | 11.79 | 500.0 | 120.000 | 295.0 | H | -20.4 |
| 192.000 | --- | 31.69 | --- | --- | 500.0 | 120.000 | 295.0 | H | -20.4 |
| 288.014 | 35.02 | --- | 46.00 | 10.98 | 500.0 | 120.000 | 193.0 | H | -17.7 |
| 288.014 | --- | 34.92 | --- | --- | 500.0 | 120.000 | 193.0 | H | -17.7 |
| 300.299 | --- | 10.71 | --- | --- | 500.0 | 120.000 | 107.0 | H | -17.4 |
| 300.299 | 41.60 | --- | 46.00 | 4.40 | 500.0 | 120.000 | 107.0 | H | -17.4 |
| 480.011 | --- | 44.15 | --- | --- | 500.0 | 120.000 | 268.0 | H | -12.5 |
| 480.011 | 45.37 | --- | 46.00 | 0.63 | 500.0 | 120.000 | 268.0 | H | -12.5 |
| 720.033 | 34.67 | --- | 46.00 | 11.33 | 500.0 | 120.000 | 118.0 | H | -8.3 |
| 720.033 | --- | 34.83 | --- | --- | 500.0 | 120.000 | 118.0 | H | -8.3 |



## Plot # 66 Radiated Emissions: 1 – 3 GHz

| Tx Frequency: 2462 MHz | Mode: 802.11g |
|---|---|

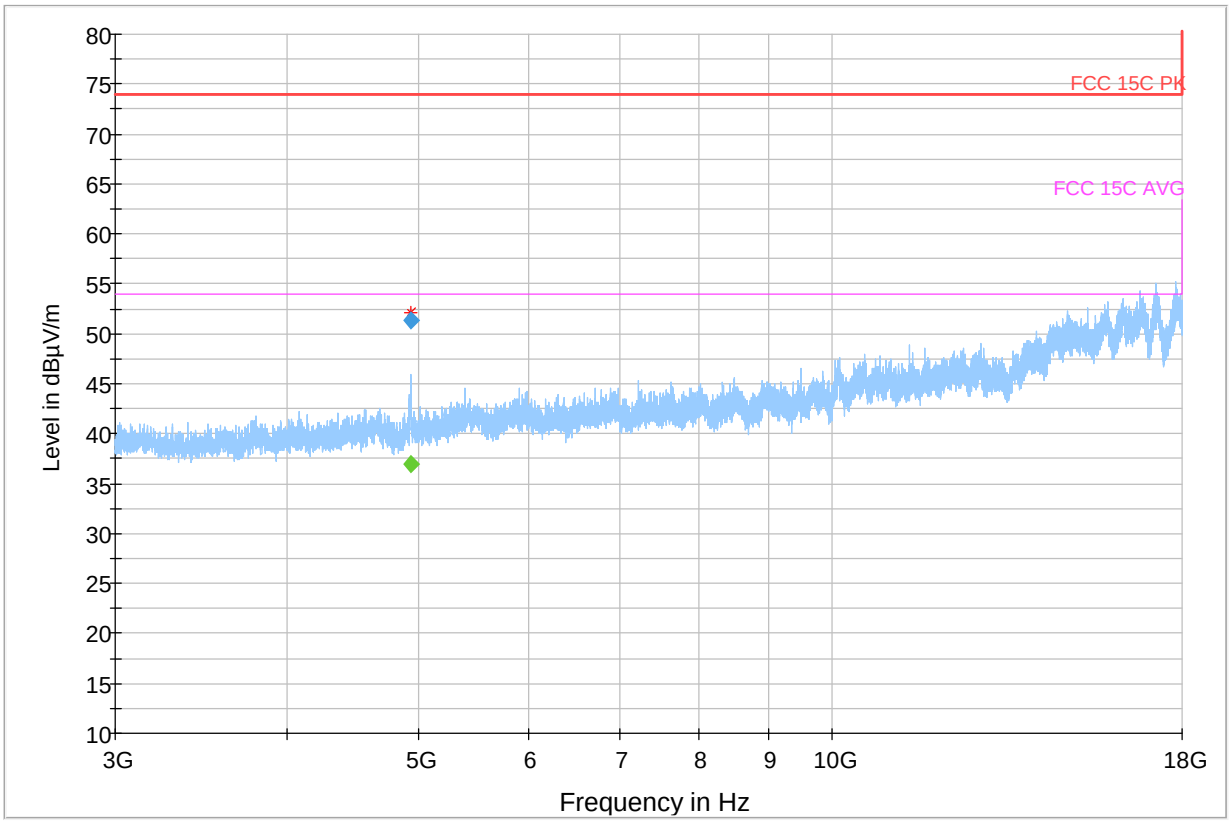


## Plot # 67 Radiated Emissions: 3 – 18 GHz

**Tx Frequency: 2462 MHz** | **Mode: 802.11g**

### Final_Result

| Frequency (MHz) | MaxPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 4931.535 | --- | 36.895 | 53.98 | 17.08 | 500.0 | 1000.000 | 141.0 | H | 338.0 | -5.5 | 3:13:02 PM - 4/15/2020 |
| 4931.535 | 51.317 | --- | 73.99 | 22.67 | 500.0 | 1000.000 | 141.0 | H | 338.0 | -5.5 | 3:13:02 PM - 4/15/2020 |



## 9 Test setup photos

Setup photos are included in supporting file name: "EMC_GEOTA_032_20001_Setup_Photos.pdf"

## 10 Test Equipment And Ancillaries Used For Testing

| Equipment Type | Manufacturer | Model | Serial # | Calibration Cycle | Last Calibration Date |
|---|---|---|---|---|---|
| ACTIVE LOOP ANTENNA | ETS LINDGREN | 6507 | 00161344 | 3 YEARS | 10/26/2017 |
| BILOG ANTENNA | TESEO | CBL 6141B | 41106 | 3 YEARS | 11/01/2017 |
| HORN ANTENNA | EMCO | 3115 | 00035111 | 3 YEARS | 04/17/2019 |
| HORN ANTENNA | ETS LINDGREN | 3117 | 00169547 | 3 YEARS | 08/08/2017 |
| HORN ANTENNA | ETS LINDGREN | 3116C | 00169535 | 3 YEARS | 09/24/2017 |
| SIGNAL ANALYZER | R&S | FSV 40 | 101022 | 3 YEARS | 07/16/2019 |
| Spectrum Analyzer | R&S | FSU26 | 200065 | 3 YEARS | 07/16/2019 |
| THERMOMETER HUMIDITY MONITOR | CONTROL COMPANY | 36934-164 | 181230565 | 2 YEARS | 01/10/2019 |

**Note:** Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels. Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated "N/A" for cal status either do not specifically require calibration or is internally characterized before use.

## 11 History

| Date | Report Name | Changes to report | Report prepared by |
|---|---|---|---|
| 6/12/2020 | EMC_GEOTA_032_20001_FCC_15.247_ISED_WIFI_DTS | Initial Version | Issa Ghanma |

<<< The End >>>