# FCC Test Report

**Report No.:** ARFR-ESH-P20030602B-1

**FCC ID:** 2ANDLTY-R8813

**Product:** Smart Camera

**Test Model:** SC012-WK2

**Received Date:** Mar.06, 2020

**Test Date:** Mar.09 to Apr.13, 2020

**Issued Date:** Apr.14, 2020

**Applicant:** Hangzhou Tuya Information Technology Co., Ltd

**Address:** Room701, Building3, More Center,No.87 GuDun Road, Hangzhou, Zhejiang, China

**Issued By:** BUREAU VERITAS ADT (Shanghai) Corporation

**Lab Address:** No. 829, Xinzhuan Road, Shanghai, P.R.China (201612)



ACCREDITED
Test Lab
Cert 2343.01

## Table of Contents

## Release Control Record

| Issue No. | Description | Date Issued |
|---|---|---|
| ARFR-ESH-P20030602B-1 | Original release | Apr.13,2020 |

## 1 Certificate of Conformity

**Product:** Smart Camera

**Brand:** --

**Test Model:** SC012-WK2

**Applicant:** Hangzhou Tuya Information Technology Co., Ltd

**Test Date:** Mar.09 to Apr.13, 2020

**Standards:** 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2013

The above equipment has been tested by **BUREAU VERITAS ADT (Shanghai) Corporation**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**Prepared by :** , **Date:** Apr.14, 2020

Will Yan

Project Engineer

**Approved by :** , **Date:** Apr.14, 2020

Daniel Sun

EMC Lab Manager

## 2 Summary of Test Results

The EUT has been tested according to the following specifications:

| 47 CFR FCC Part 15, Subpart C (SECTION 15.247) | | | |
|---|---|---|---|
| FCC Clause | Test Item | Result | Remarks |
| 15.207 | AC Power Conducted Emission | PASS | Meet the requirement of limit. |
| 15.205 / 15.209 / 15.247(d) | Radiated Emissions Measurement | PASS | Meet the requirement of limit. |
| 15.247(d) | Emissions in non-restricted frequency bands | PASS | Meet the requirement of limit. |
| 15.247(a)(2) | 6dB bandwidth | PASS | Meet the requirement of limit. |
| 15.247(b) | Conducted power | PASS | Meet the requirement of limit. |
| 15.247(e) | Power Spectral Density | PASS | Meet the requirement of limit. |
| 15.203 | Antenna Requirement | PASS | No antenna connector is used. |

## 2.1 Test Instruments

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|---|---|---|---|---|---|
| Hybrid antenna(25MHz-1.5GHz) | Schwarzbeck | VULB9168 | E1A1012 | Feb.08,20 | Feb.07,21 |
| Horn Antenna(1GHz -18GHz) | Schwarzbeck | BBHA9120D | E1A1017 | Aug.26,19 | Aug.25,20 |
| Pre-Amplifier(100kHz-1.3GHz) | Agilent | 8447D | E1A2001 | Oct.18, 19 | Oct.17, 20 |
| Pre-Amplifier(1GHz-26.5GHz) | Agilent | 8449B | E1A2002 | Mar. 25, 20 | Mar. 24, 21 |
| EMI test recerver | R&S | ESR7 | E1R1005 | Dec.04, 19 | Dec.03, 20 |
| Spectrum Analyzer | Keysight | N9030B | E1S1003 | Jul.23,19 | Jul.22, 20 |
| EMI test recerver | R&S | ESCS30 | E1R1001 | Mar.25, 20 | Mar.24, 21 |
| LISN | R&S | ENV216 | E1L1011 | Jul.18, 19 | Jul.17, 20 |
| Humidity&Temp Tester | Baolima | WS508 | E1H1011 | Apr. 04, 19 | Apr. 03, 20 |
| Test Software | ADT | ADT_COND_V 7.3.1 | N/A | N/A | N/A |
| Test Software | Toscend | JS32-RE | N/A | N/A | N/A |
| Test Software | Toscend | JS1120 | N/A | N/A | N/A |

## 2.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

| Measurement | Frequency | Expanded Uncertainty (k=2) (±) |
|---|---|---|
| Conducted Emissions at mains ports | 150kHz ~ 30MHz | 1.83 dB |
| Radiated Emissions up to 1 GHz | 30MHz ~ 1GHz | 5.36 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 6GHz | 3.47 dB |
| | 6GHz ~ 18GHz | 3.75 dB |
| | 18GHz ~ 40GHz | 3.30 dB |

## 2.3 Modification Record

There were no modifications required for compliance.

## 3 General Information

### 3.1 General Description of EUT

| | |
|---|---|
| Product | Smart Camera |
| Brand | -- |
| Test Model | SC012-WK2 |
| Serial Model: | -- |
| Power Rating | 5VDC/2A with adaptor 100-240V~,50/60Hz |
| Modulation Type | CCK, DQPSK, DBPSK for DSSS<br>64QAM, 16QAM, QPSK, BPSK for OFDM |
| Modulation Technology | DSSS, OFDM |
| Operating Frequency | See clause 3.2 |
| Number of Channel | See clause 3.2 |
| Antenna Type | Ceramic Antenna |
| Antenna Connector | -- |
| Antenna Gain | 3.0dBi |

Note:1. For more details, please refer to the User's manual of the EUT.

| Modulation Mode | TX /RX Function |
|---|---|
| 802.11b | 1TX / 1RX |
| 802.11g | 1TX / 1RX |
| 802.11n (HT20) | 1TX / 1RX |

### 3.2 Description of Test Modes

13 channels are provided for 802.11b, 802.11g and 802.11n (HT20).

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

### 3.2.1 Test Mode Applicability:

| EUT Configure Mode | Applicable to | | | | Description |
|---|---|---|---|---|---|
| | RE ≥ 1G | RE < 1G | PLC | APCM | |
| - | √ | √ | √ | √ | - |

Where **RE≥1G:** Radiated Emission above 1GHz **RE≤1G:** Radiated Emission below 1GHz

**PLC:** Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

**Radiated Emission Test (Above 1 GHz):**

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

| EUT CONFIGURE MODE | MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|---|
| - | 802.11b | 1 to 11 | 1, 6, 11 | DSSS | DBPSK | 1.0 |
| - | 802.11g | 1 to 11 | 1, 6, 11 | OFDM | BPSK | 6.0 |
| - | 802.11n (HT20) | 1 to 11 | 1, 6, 11 | OFDM | BPSK | 6.5 |

**Radiated Emission Test (Below 1 GHz):**

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

**Power Line Conducted Emission Test:**

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

| EUT CONFIGURE MODE | MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|---|
| - | 802.11b | 1 to 11 | 1 | DSSS | DBPSK | 1.0 |

**Antenna Port Conducted Measurement**

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

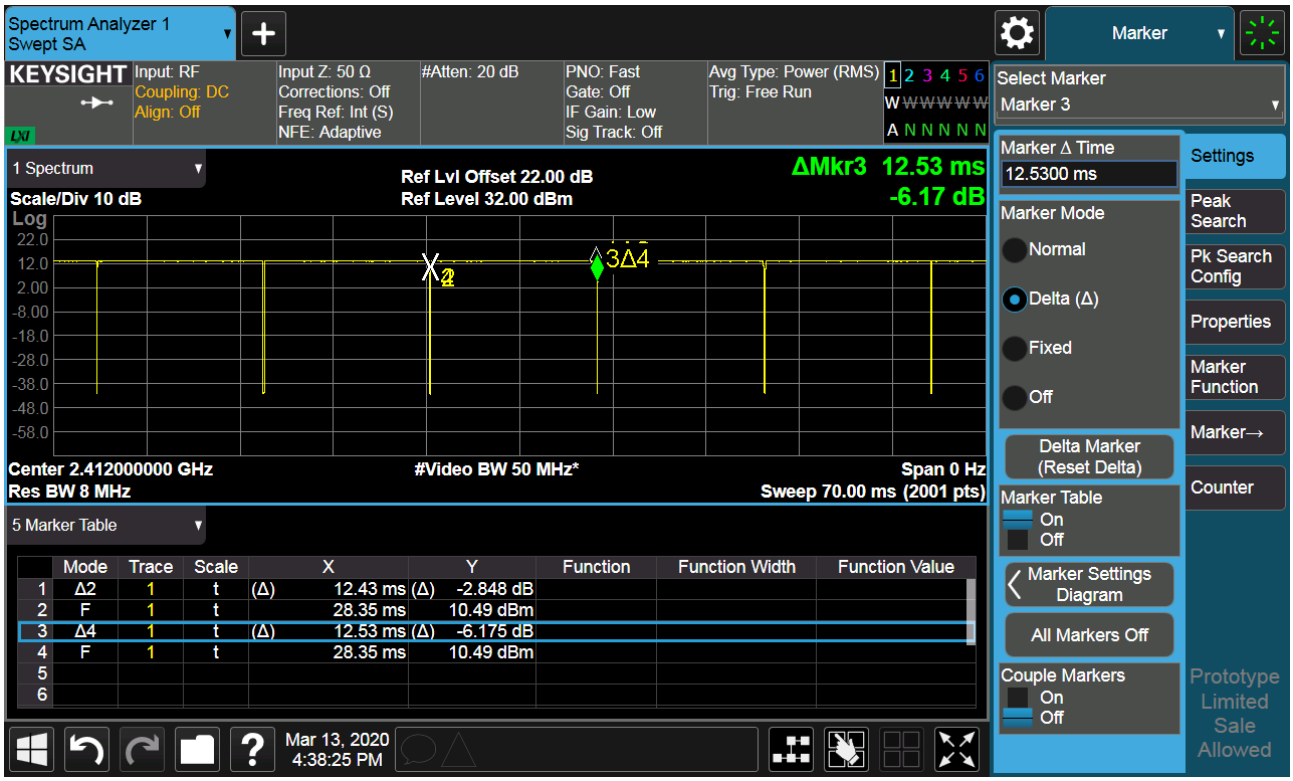
| EUT CONFIGURE MODE | MODE | AVAILABLE CHANNEL | TESTED CHANNEL | MODULATION TECHNOLOGY | MODULATION TYPE | DATA RATE (Mbps) |
|---|---|---|---|---|---|---|
| - | 802.11b | 1 to 11 | 1, 6, 11 | DSSS | DBPSK | 1.0 |
| - | 802.11g | 1 to 11 | 1, 6, 11 | OFDM | BPSK | 6.0 |
| - | 802.11n (HT20) | 1 to 11 | 1, 6, 11 | OFDM | BPSK | 6.5 |

### 3.2.2 Test Condition:

| Applicable to | Normal Environmental Conditions | Normal Input Power |
|---|---|---|
| **RE ≥ 1G** | 25deg. C, 60%RH | 120Vac, 60Hz |
| **RE < 1G** | 25deg. C, 60%RH | 120Vac, 60Hz |
| **PLC** | 25deg. C, 60%RH | 120Vac, 60Hz |
| **APCM** | 25deg. C, 60%RH | 120Vac, 60Hz |

## 3.3 Duty Cycle of Test Signal

The Duty Cycle of the EUT is 99.20%.




Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

## 3.4 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standard:

**FCC Part 15, Subpart C (15.247)**

**KDB 558074 D01 DTS Meas Guidance v05r02**

**ANSI C63.10:2013**

All relaxed test items have been performed and recorded as per the above standard.

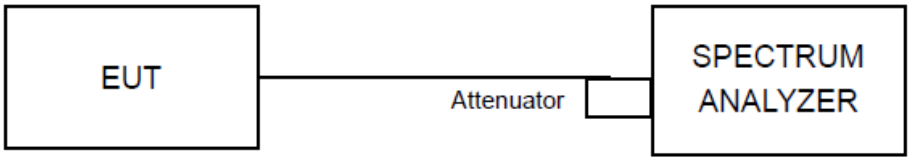
# 4 Test Procedure and Results

## 4.1 6dB Bandwidth Measurement

### 4.1.1 Limit

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

### 4.1.2 Test Setup




### 4.1.3 Test Procedures

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” for compliance to FCC 47CFR 15.247 requirements (clause 8.2).

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 · RBW, peak detector with maximum hold) is implemented by the instrumentation function.

### 4.1.4 Deviation of Test Standard

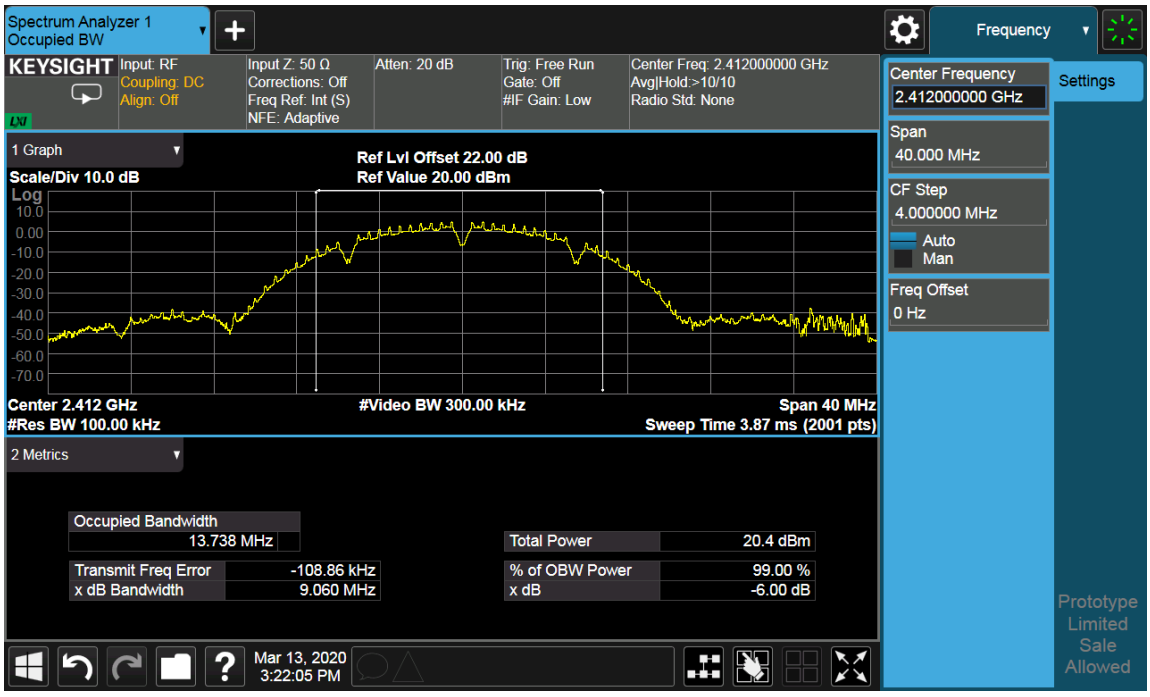
No deviation.

### 4.1.5 Test Results

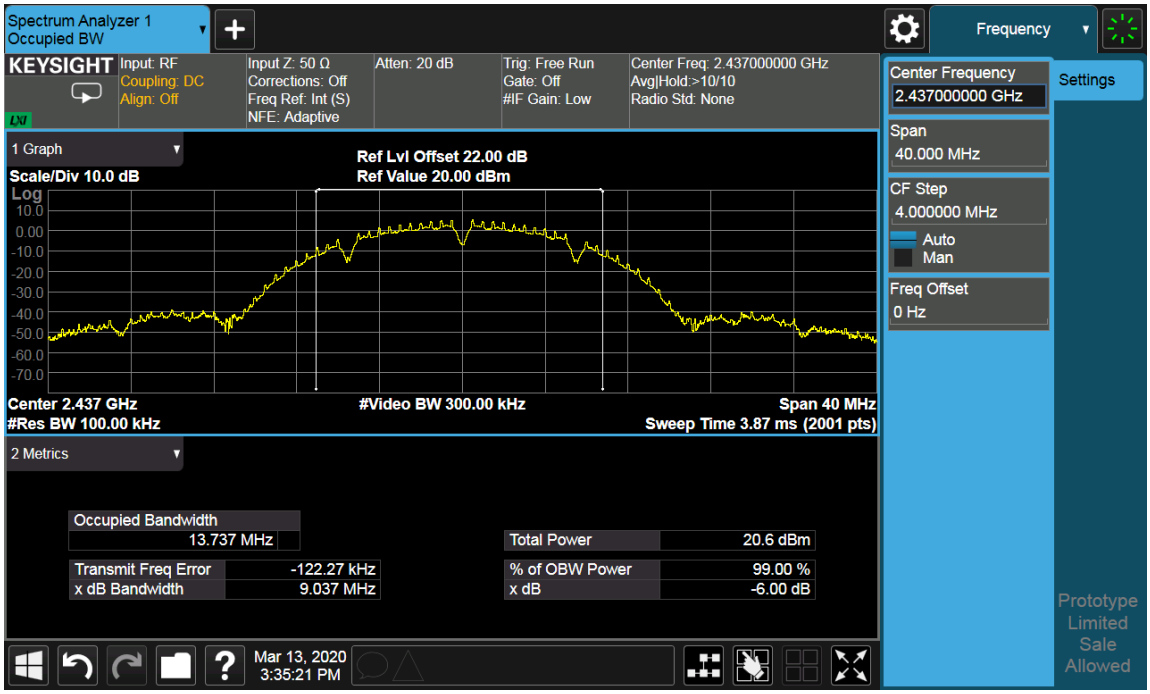
802.11b

| Channel | Frequency (MHz) | 99% Occpuied Bandwidth (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|
| 1 | 2412 | 13.738 | 9.060 | 0.5 | Pass |
| 6 | 2437 | 13.737 | 9.037 | 0.5 | Pass |
| 11 | 2462 | 13.688 | 9.069 | 0.5 | Pass |

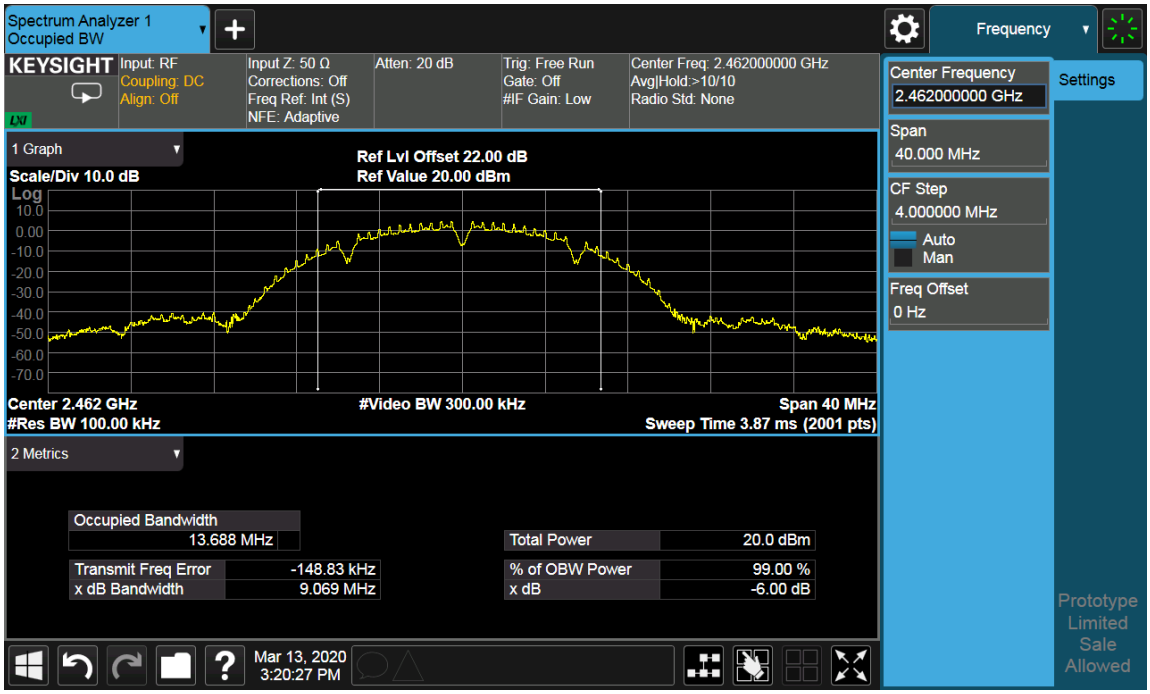
| Spectrum Plot |
|---|
| 802.11b(2412MHz) |



## 802.11b(2437MHz)



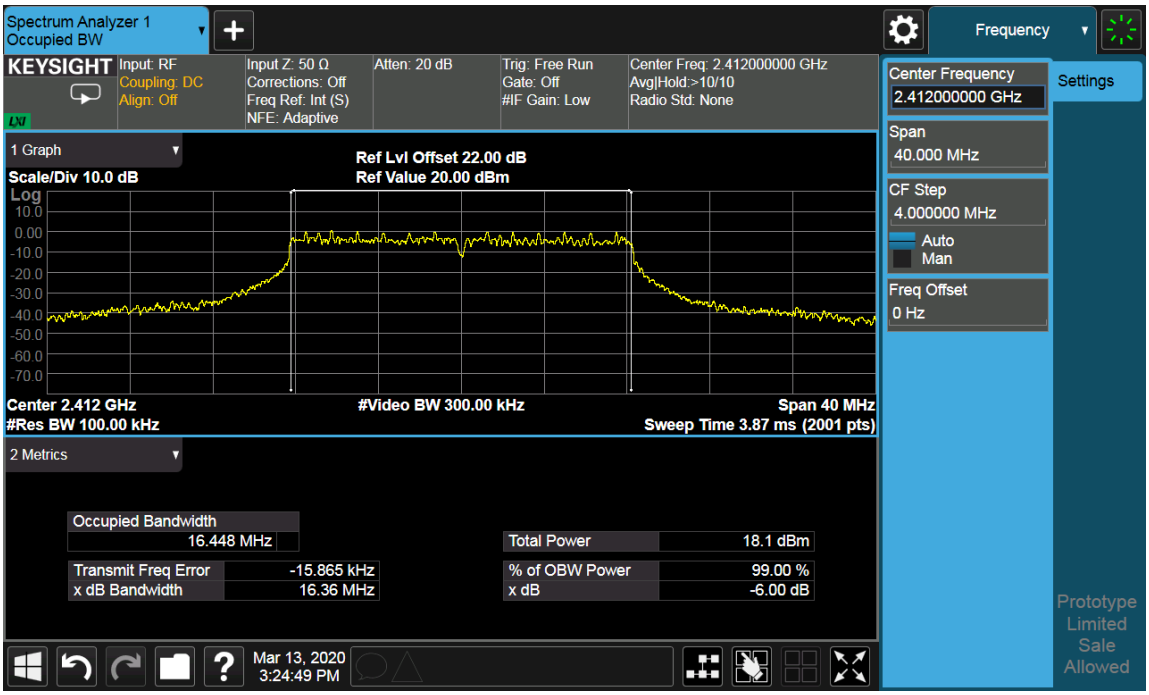

## 802.11b(2462MHz)



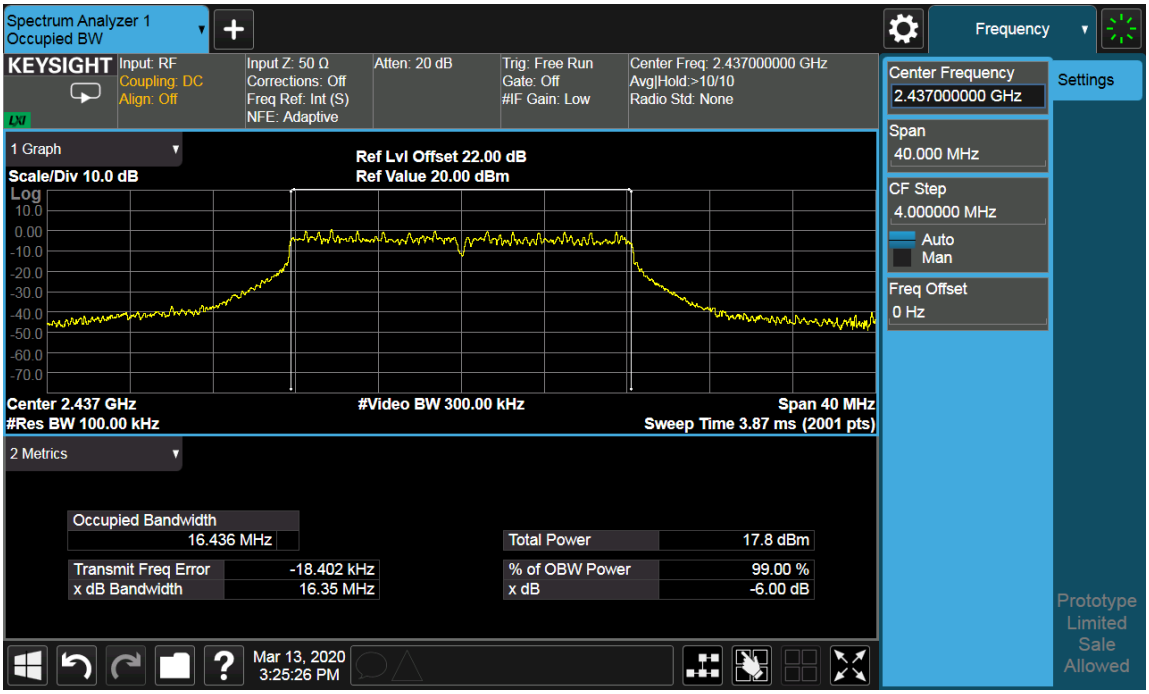
## 802.11g

| Channel | Frequency (MHz) | 99% Occpuied Bandwidth (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|
| 1 | 2412 | 16.448 | 16.360 | 0.5 | Pass |
| 6 | 2437 | 16.436 | 16.350 | 0.5 | Pass |
| 11 | 2462 | 16.428 | 16.450 | 0.5 | Pass |

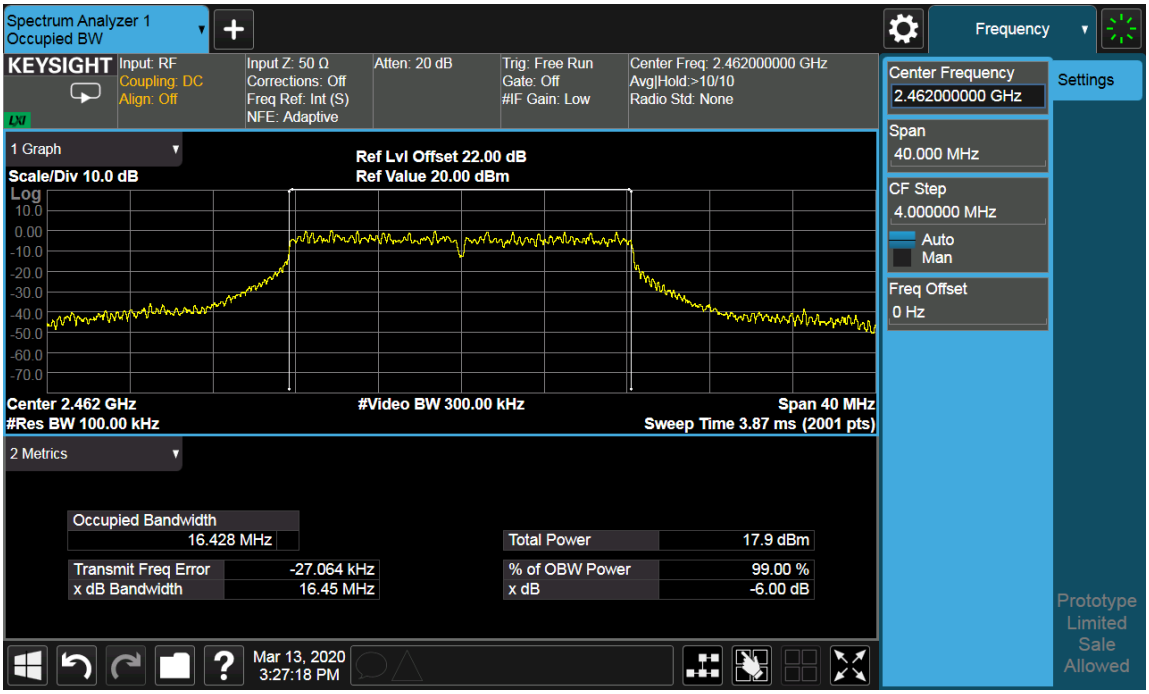
| Spectrum Plot |
|---|
| 802.11g(2412MHz) |



## 802.11g(2437MHz)



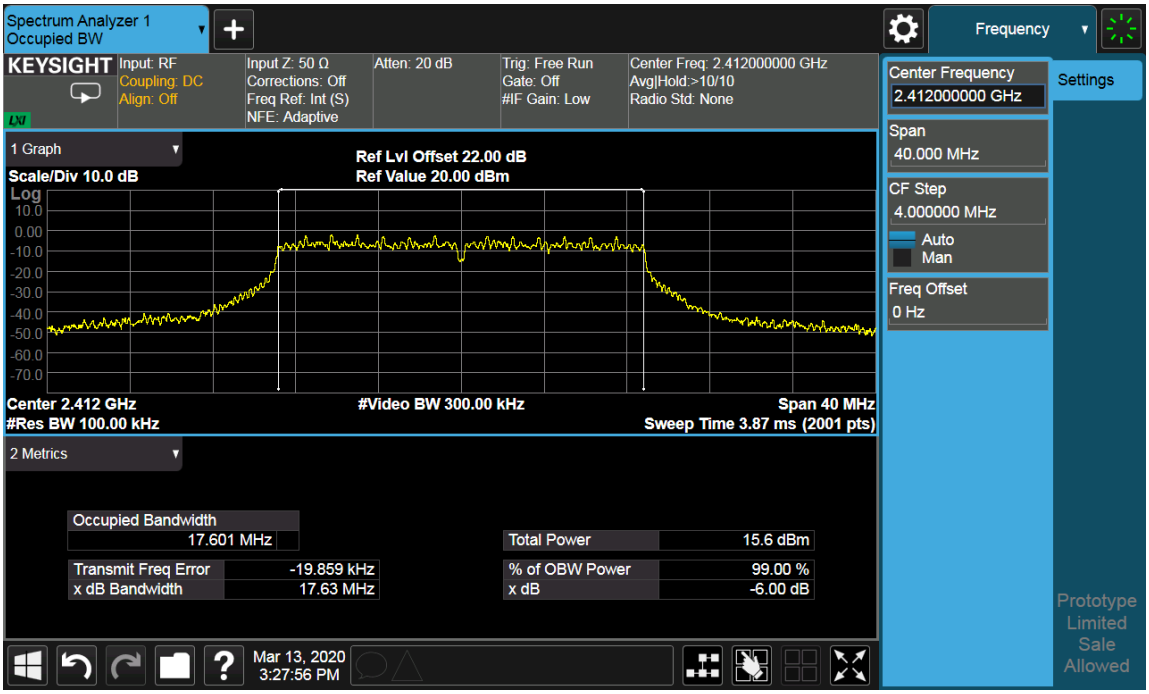

## 802.11g(2462MHz)



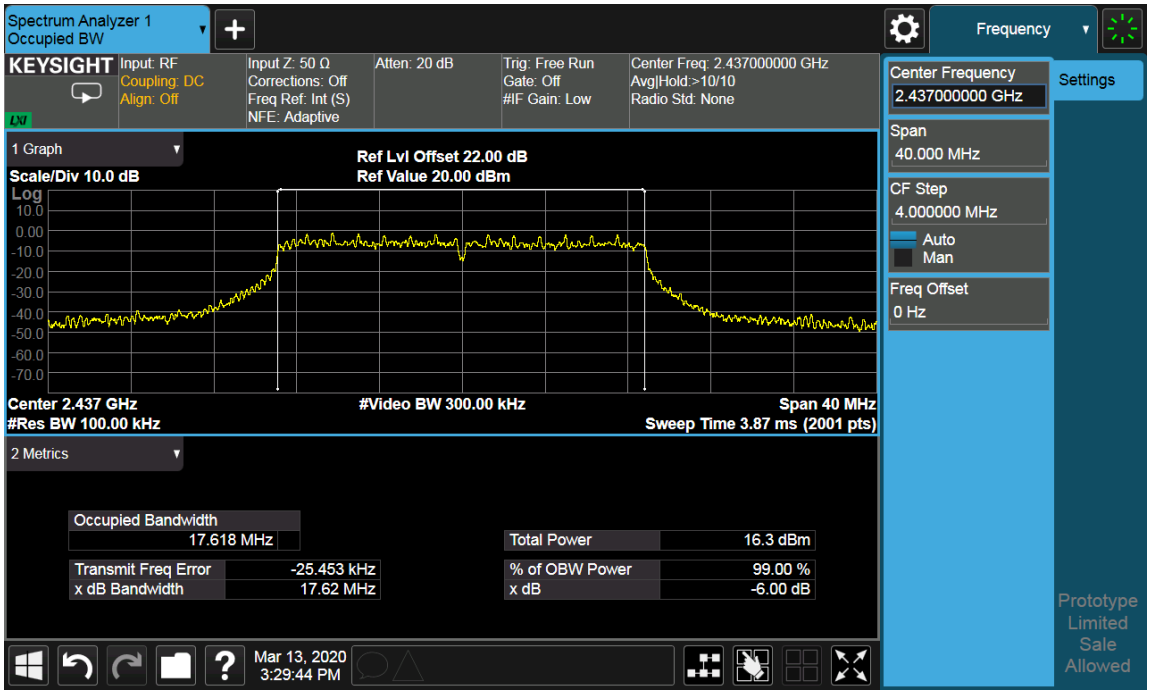
## 802.11n(HT20)

| Channel | Frequency (MHz) | 99% Occpuied Bandwidth (MHz) | 6 dB Bandwidth (MHz) | Minimum Limit (MHz) | Pass / Fail |
|---|---|---|---|---|---|
| 1 | 2412 | 17.061 | 17.630 | 0.5 | Pass |
| 6 | 2437 | 17.618 | 17.620 | 0.5 | Pass |
| 11 | 2462 | 17.668 | 17.630 | 0.5 | Pass |

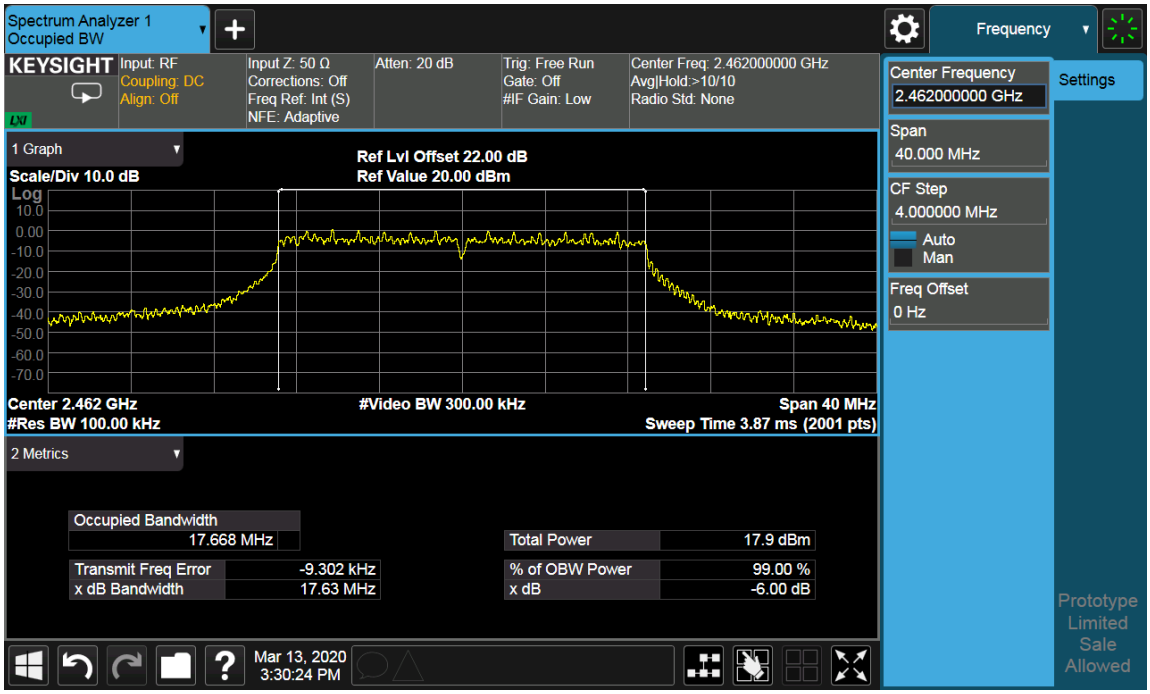
| Spectrum Plot |
|---|
| 802.11n(HT20)(2412MHz) |



## 802.11n(HT20)(2437MHz)




## 802.11n(HT20)(2462MHz)

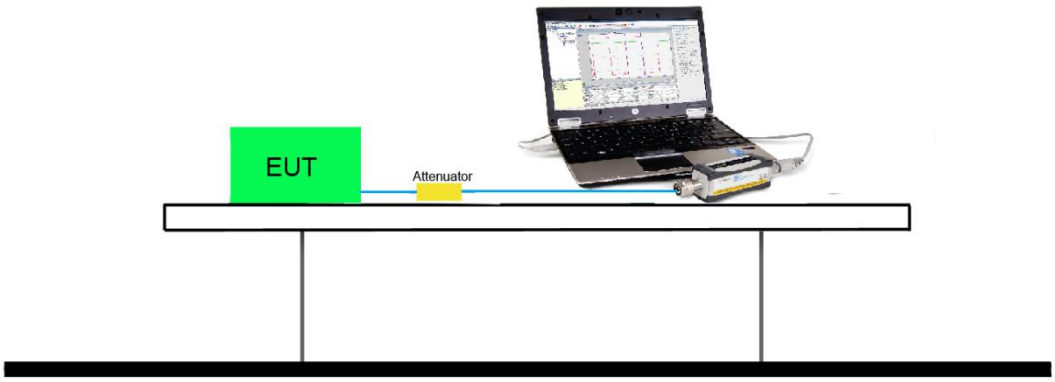


## 4.2 Conducted Output Power Measurement

### 4.2.1 Limit

For systems using digital modulation in the 2400 – 2483.5 MHz bands: 1 Watt (30 dBm)

### 4.2.2 Test Setup




### 4.2.3 Test Procedures

**Method PKPM1 (Peak Power Measurement)**

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

**Method AVGPM-G (Measurement using a gated RF average-reading power meter)**

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required

### 4.2.4 Deviation of Test Standard

No deviation.

### 4.2.5 Test Results

**802.11b**

| Channel | Frequency (MHz) | Peak Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|
| 1 | 2412 | 14.74 | 30 | Pass |
| 6 | 2437 | 14.47 | 30 | Pass |
| 11 | 2462 | 14.06 | 30 | Pass |

**802.11g**

| Channel | Frequency (MHz) | Peak Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|
| 1 | 2412 | 11.53 | 30 | Pass |
| 6 | 2437 | 11.23 | 30 | Pass |
| 11 | 2462 | 11.20 | 30 | Pass |

**802.11n(HT20)**

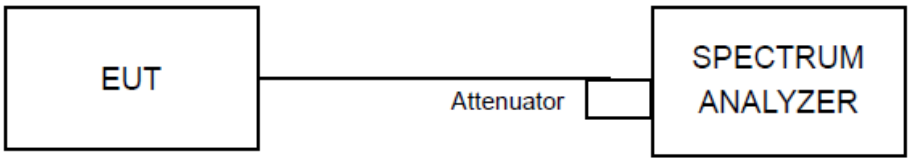
| Channel | Frequency (MHz) | Peak Power (dBm) | Limit (dBm) | Pass / Fail |
|---|---|---|---|---|
| 1 | 2412 | 11.69 | 30 | Pass |
| 6 | 2437 | 12.08 | 30 | Pass |
| 11 | 2462 | 11.04 | 30 | Pass |

## 4.3 Power Spectral Density Measurement

### 4.3.1 Limit

The Maximum of Power Spectral Density Measurement is 8 dBm in any 3 kHz band.

### 4.3.2 Test Setup




### 4.3.3 Test Procedures

The power output per FCC § 15.247(e) was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 10.5) for compliance to FCC 47CFR 15.247 requirements.

a) Measure the duty cycle (x) of the transmitter output signal.

b) Set instrument center frequency to DTS channel center frequency.

c) Set span to at least 1.5 OBW.

d) Set RBW to: 3 kHz $\leqslant$ RBW $\leqslant$ 100 kHz.

e) Set VBW $\geqslant$ 3 RBW.

f) Detector = power averaging (RMS) or sample detector (when RMS not available).

g) Ensure that the number of measurement points in the sweep $\geqslant$ 2 span/RBW.

h) Sweep time = auto couple.

i) Do not use sweep triggering. Allow sweep to "free run".

j) Employ trace averaging (RMS) mode over a minimum of 100 traces.

k) Use the peak marker function to determine the maximum amplitude level.

l) Add 10 log (1/x), where x is the duty cycle measured in step (a, to the measured PSD to compute the average PSD during the actual transmission time.

m) If resultant value exceeds the limit, then reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

### 4.3.4 Deviation of Test Standard

No deviation.

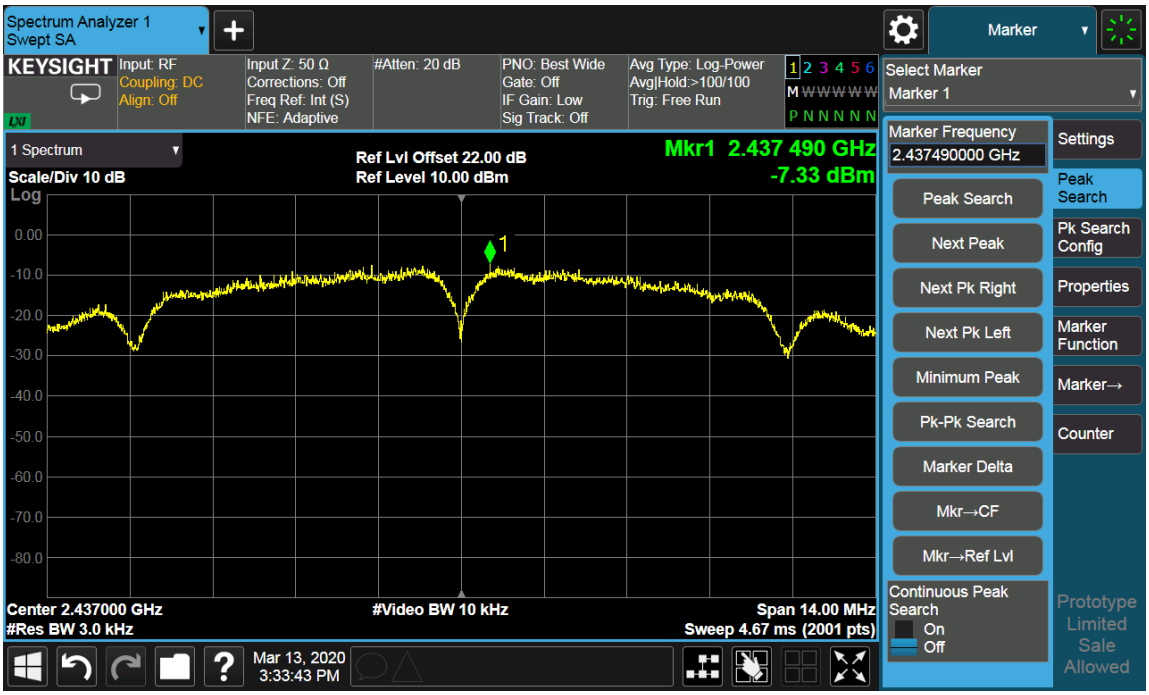
### 4.3.5 Test Results

802.11b

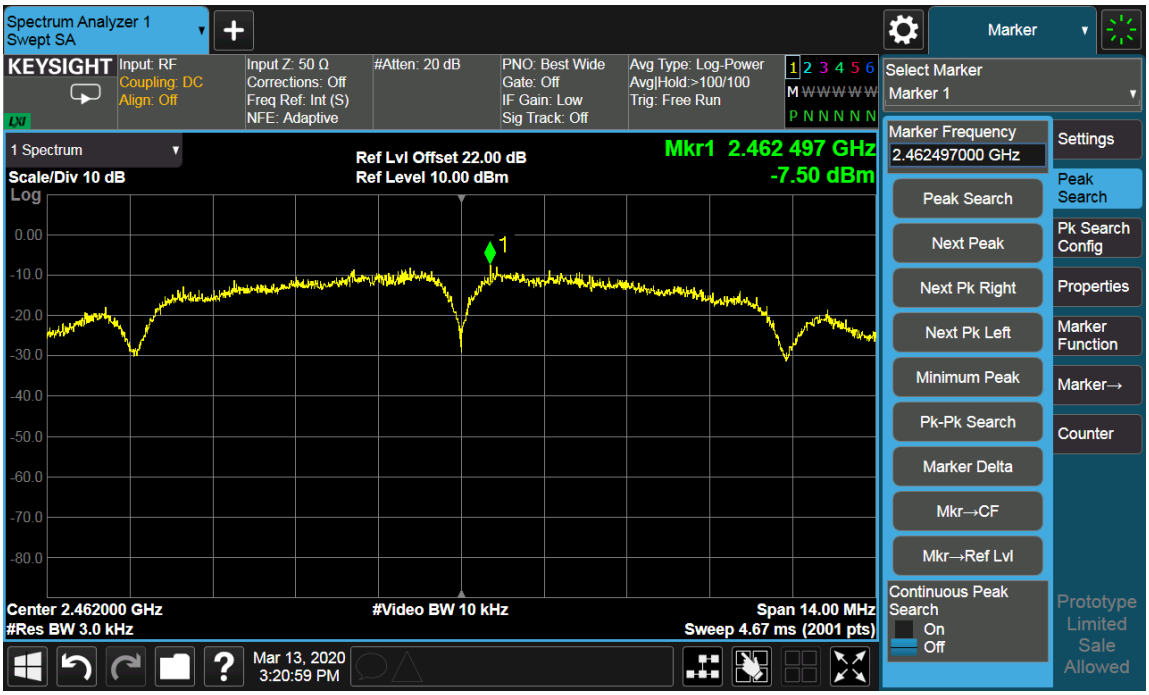
| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Pass / Fail |
|---|---|---|---|---|
| 1 | 2412 | -6.98 | 8 | Pass |
| 6 | 2437 | -7.33 | 8 | Pass |
| 11 | 2462 | -7.50 | 8 | Pass |

| Spectrum Plot |
|---|
| 802.11b(2412MHz) |

## 802.11b(2437MHz)



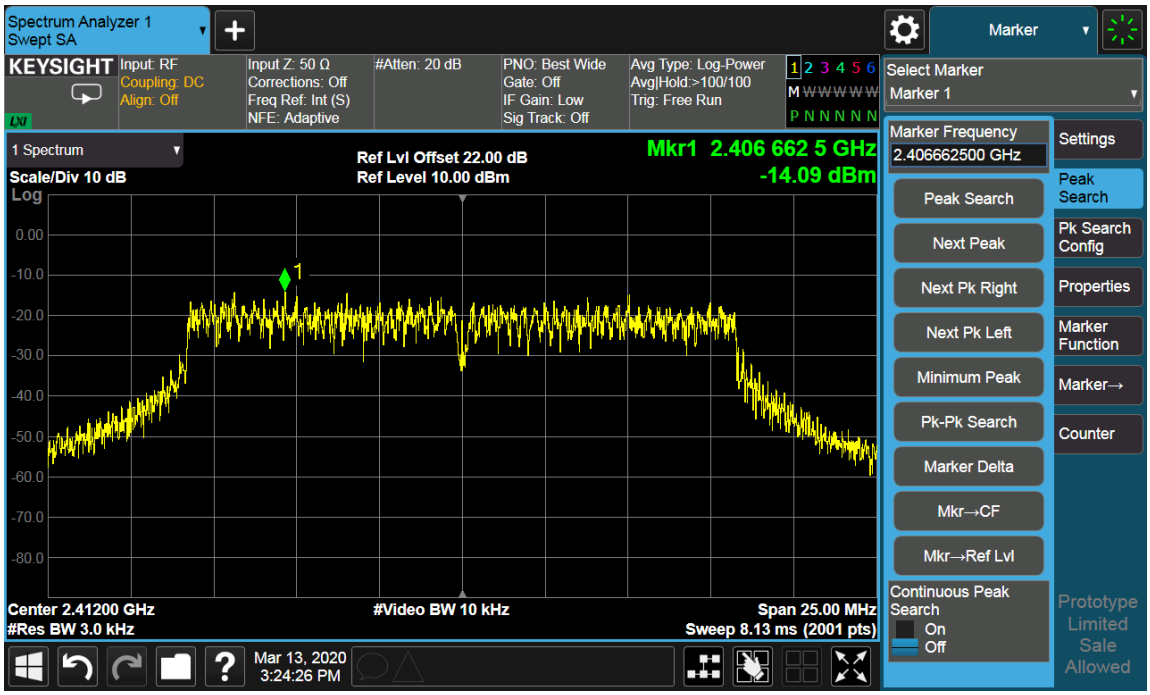

## 802.11b(2462MHz)



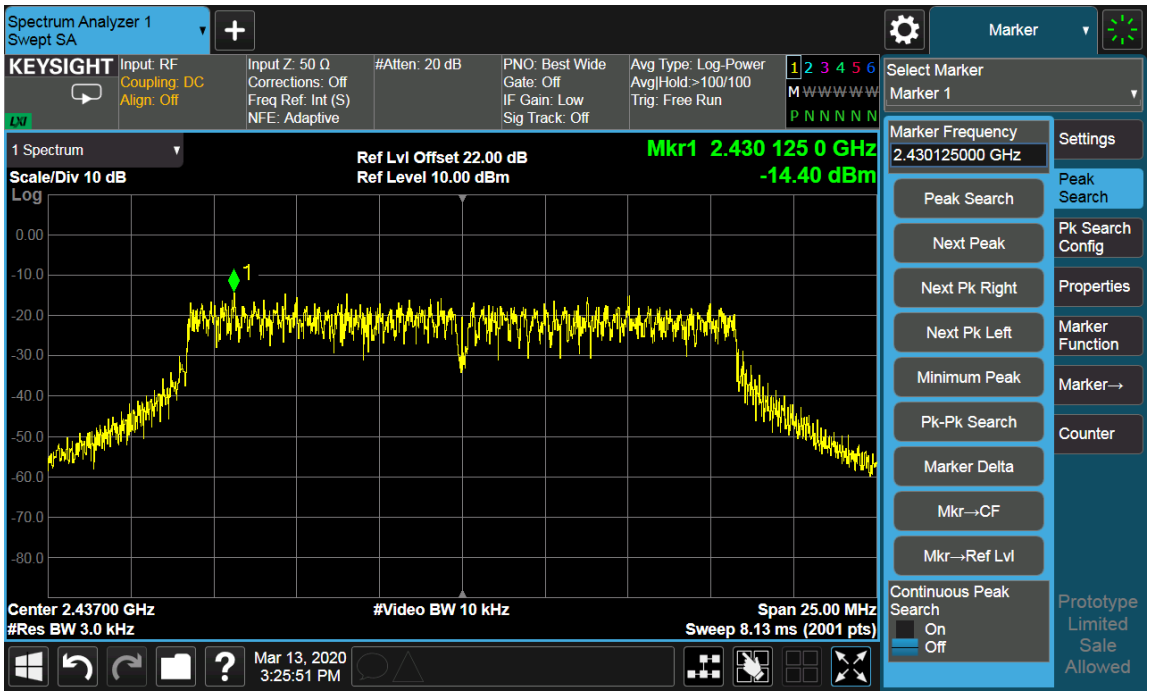
## 802.11g

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Pass / Fail |
|---|---|---|---|---|
| 1 | 2412 | -14.09 | 8 | Pass |
| 6 | 2437 | -14.40 | 8 | Pass |
| 11 | 2462 | -14.86 | 8 | Pass |

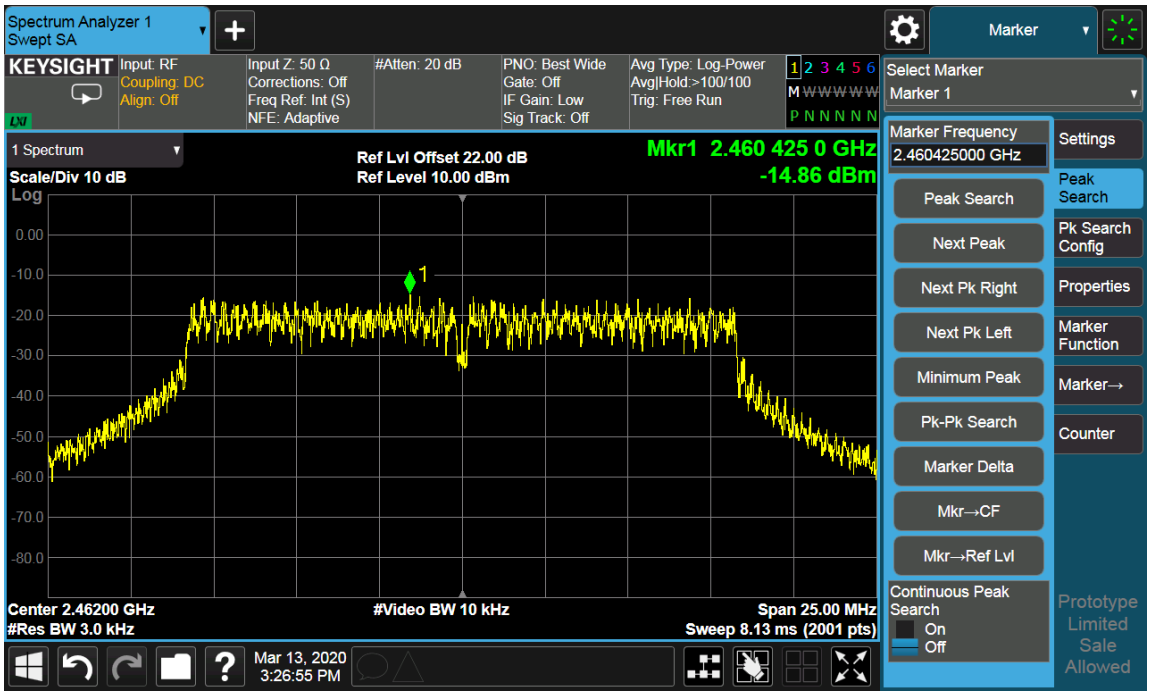
| Spectrum Plot |
|---|
| 802.11g(2412MHz) |



## 802.11g(2437MHz)



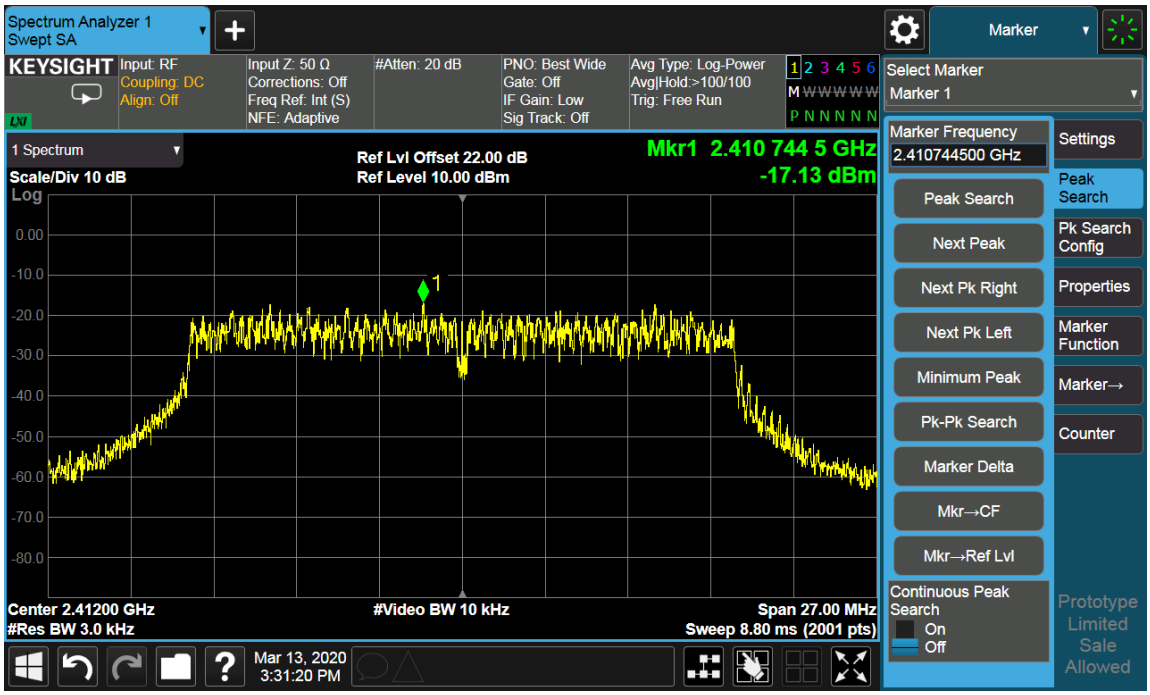

## 802.11g(2462MHz)



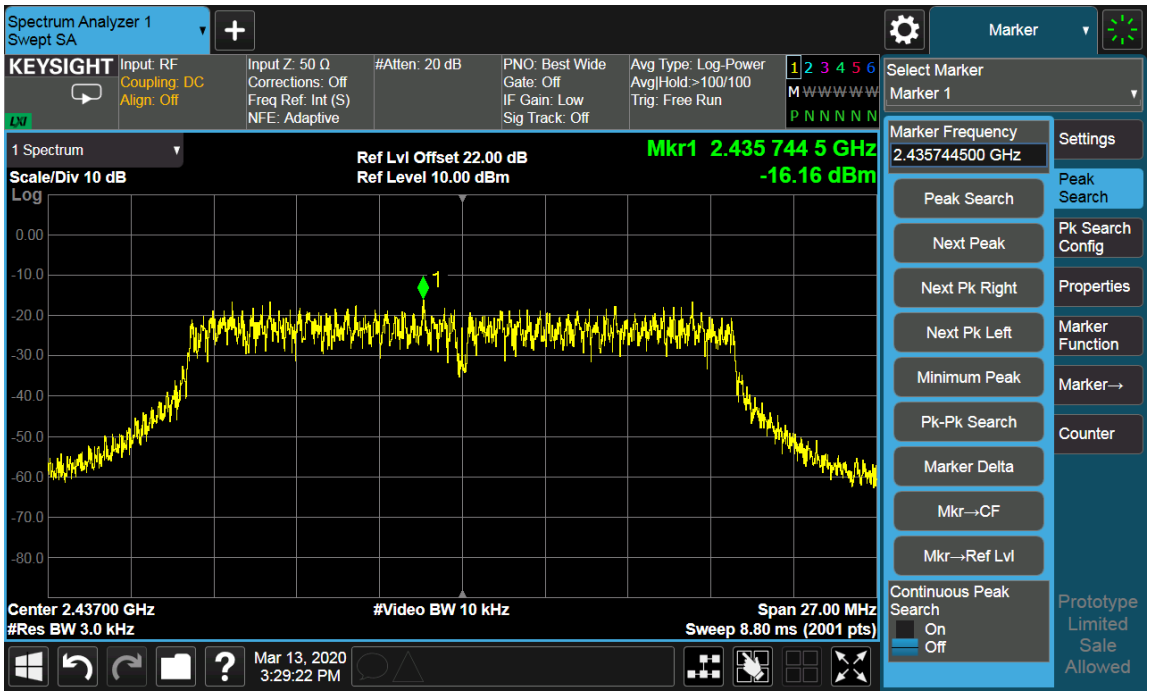
## 802.11n (HT20)

| Channel | Frequency (MHz) | PSD (dBm/3kHz) | Limit (dBm/3kHz) | Pass / Fail |
|---|---|---|---|---|
| 1 | 2412 | -17.13 | 8 | Pass |
| 6 | 2437 | -16.16 | 8 | Pass |
| 11 | 2462 | -14.30 | 8 | Pass |

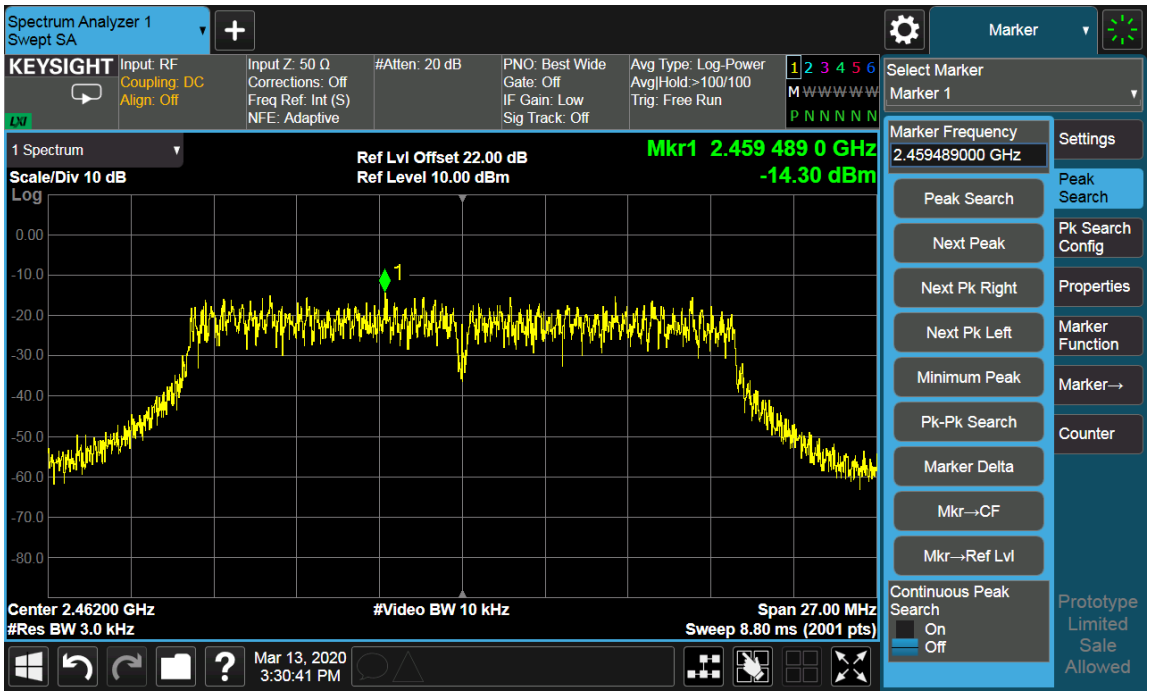
| Spectrum Plot |
|---|
| 802.11n(HT20)(2412MHz) |



## 802.11n(HT20)(2437MHz)




## 802.11n(HT20)(2462MHz)

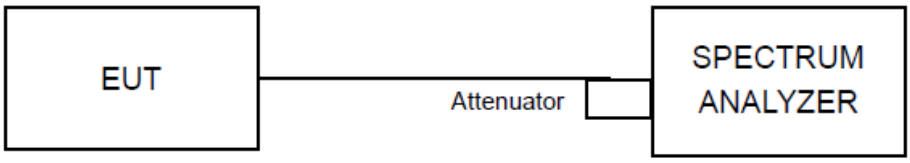


## 4.4 Emissions in non-restricted frequency bands

### 4.4.1 Limit

Below 30 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

### 4.4.2 Test Setup




### 4.4.3 Test Procedures

The EUT was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

**MEASUREMENT PROCEDURE REF**

1. Set the RBW = 100 kHz.
2. Set the VBW ⩾ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

**MEASUREMENT PROCEDURE OOBE**

1. Set RBW = 100 kHz.
2. Set VBW ⩾ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.

6. Allow trace to fully stabilize.

7. Use the peak marker function to determine the maximum amplitude level.

### 4.4.4 Deviation of Test Standard

No deviation.

### 4.4.5 Test Results

**802.11b**

| Channel | Frequency (MHz) | Pass / Fail |
|---|---|---|
| 1 | 2412 | Pass |
| 6 | 2437 | Pass |
| 11 | 2462 | Pass |

**Spectrum Plot**

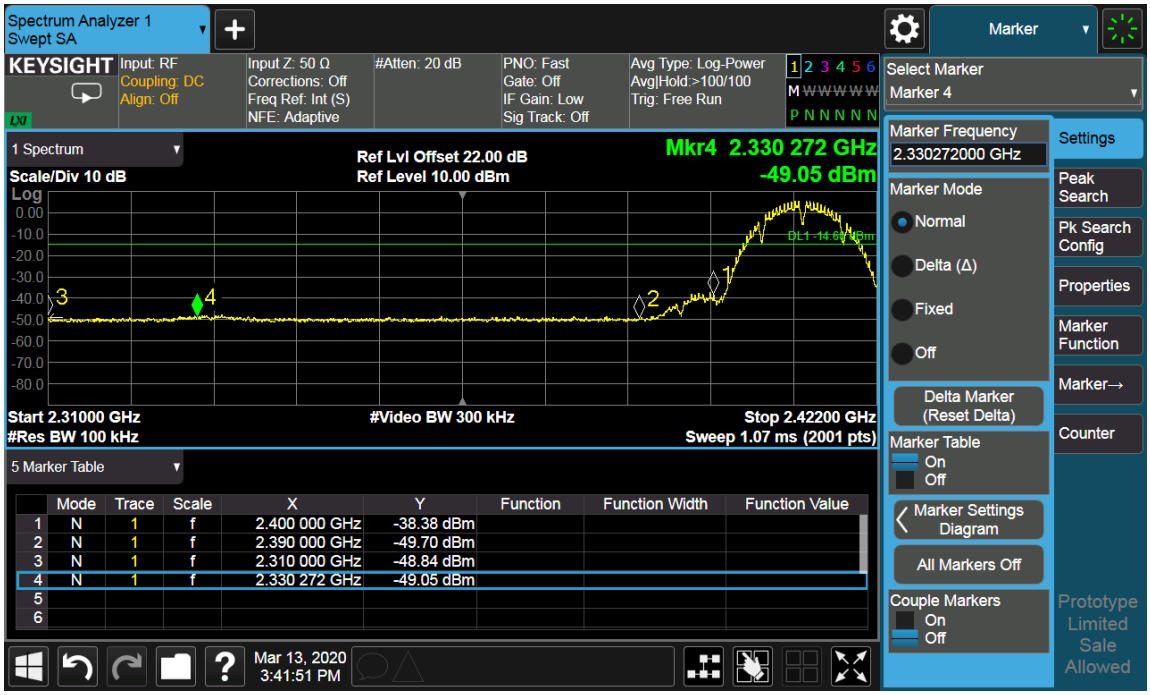
**802.11b(2412MHz)**

## 802.11b(2437MHz)

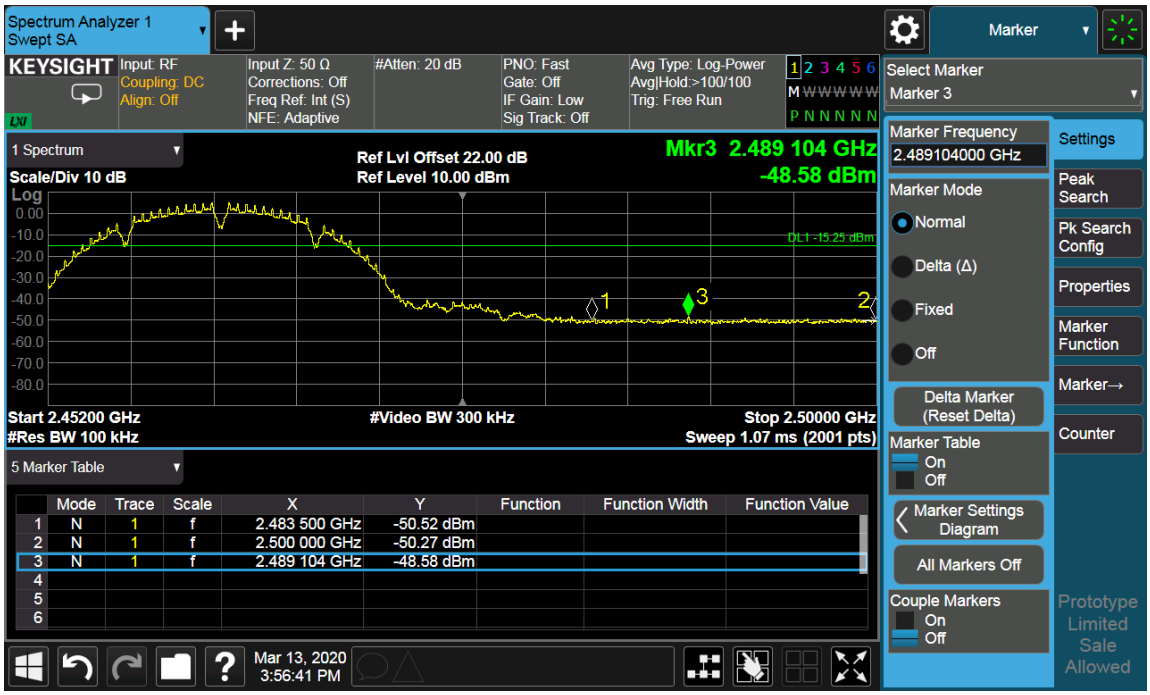

## 802.11b(2462MHz)

## Spectrum Plot

### 802.11b(2412MHz) Band Edge

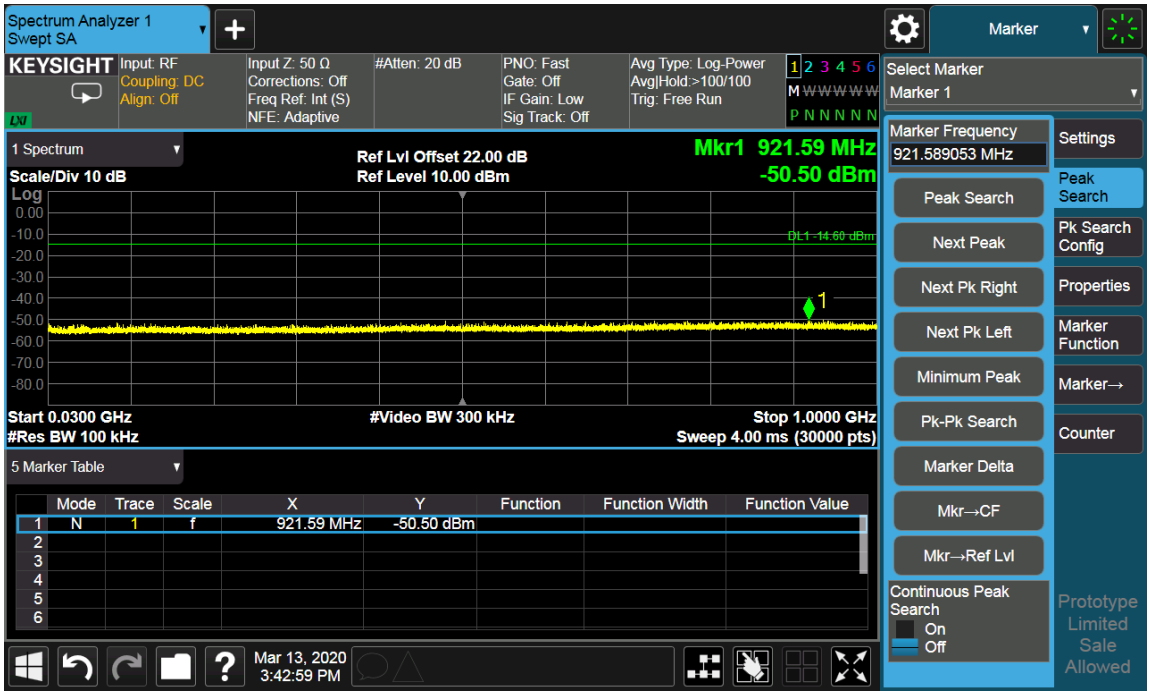


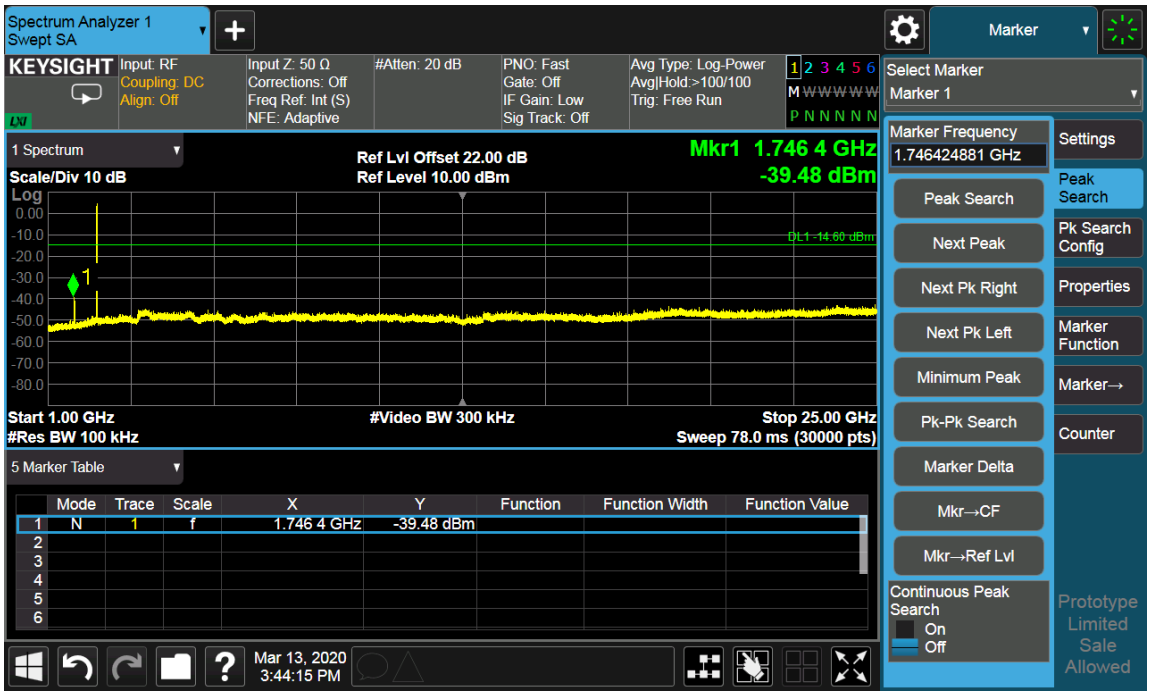

### 802.11b(2462MHz) Band Edge



## Spectrum Plot

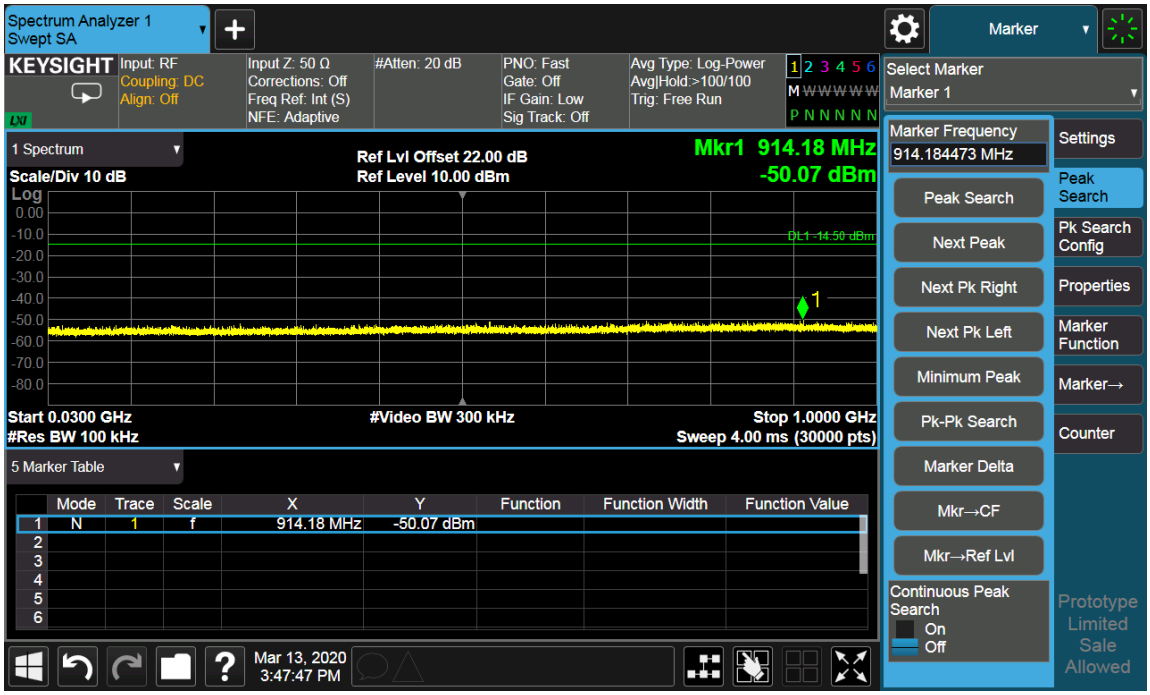
### 802.11b(2412MHz) Out-of-Band Emissions



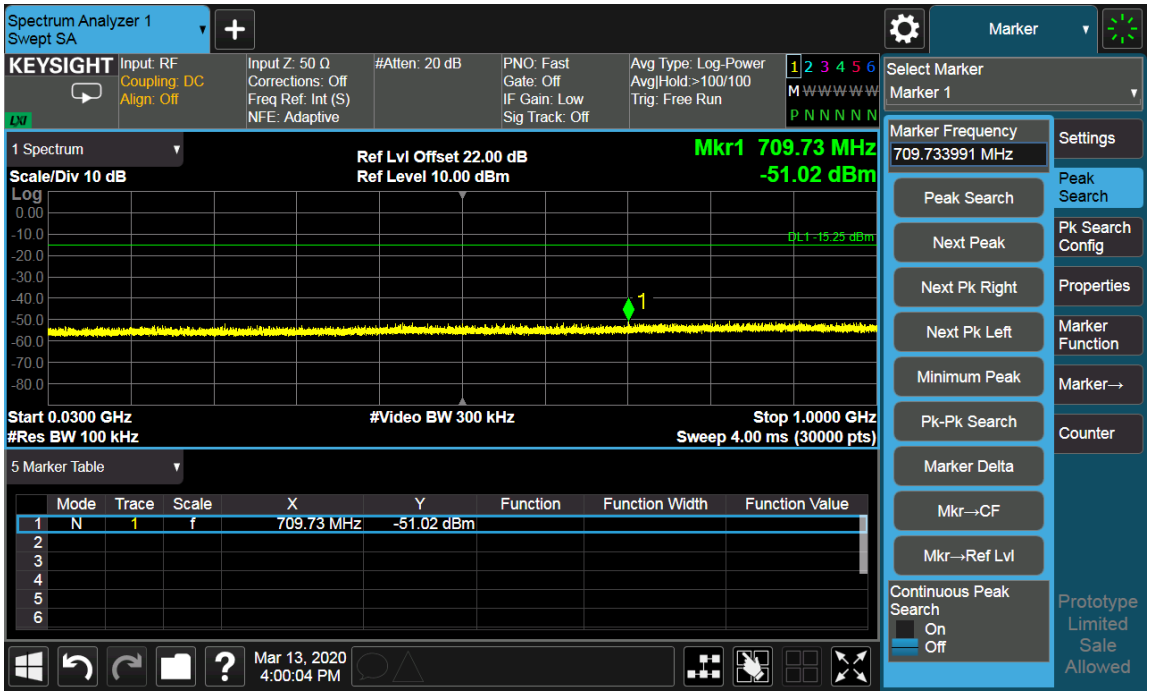
## Spectrum Plot

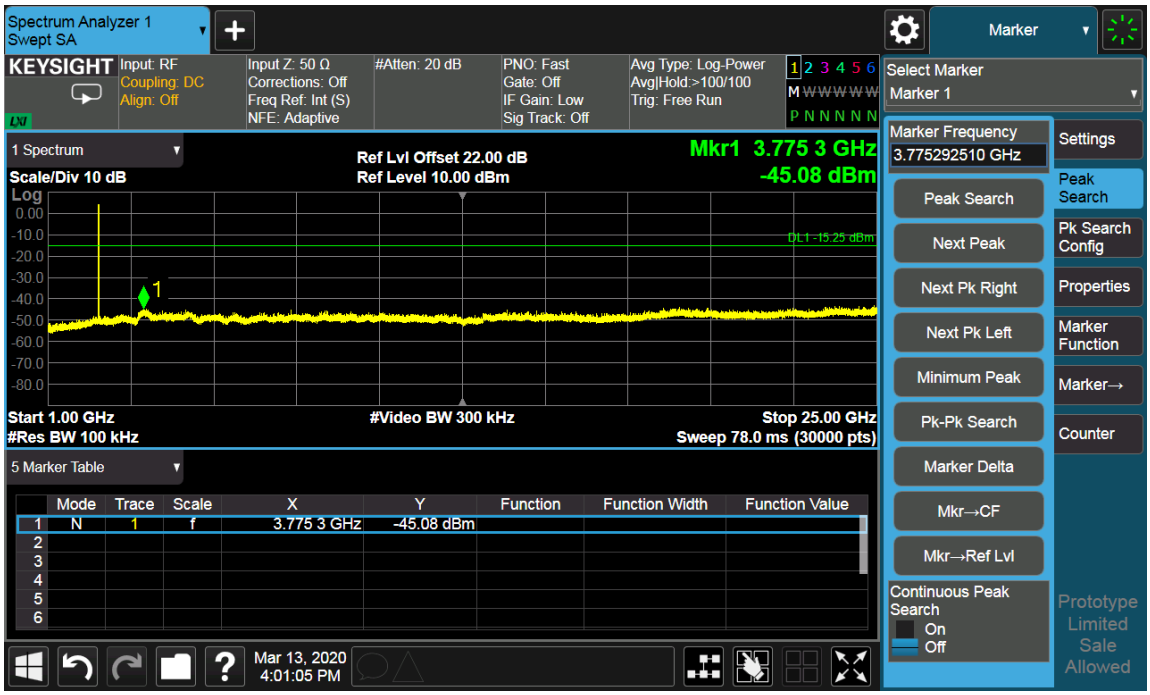
### 802.11b(2437MHz) Out-of-Band Emissions




## Spectrum Plot

### 802.11b(2462MHz) Out-of-Band Emissions



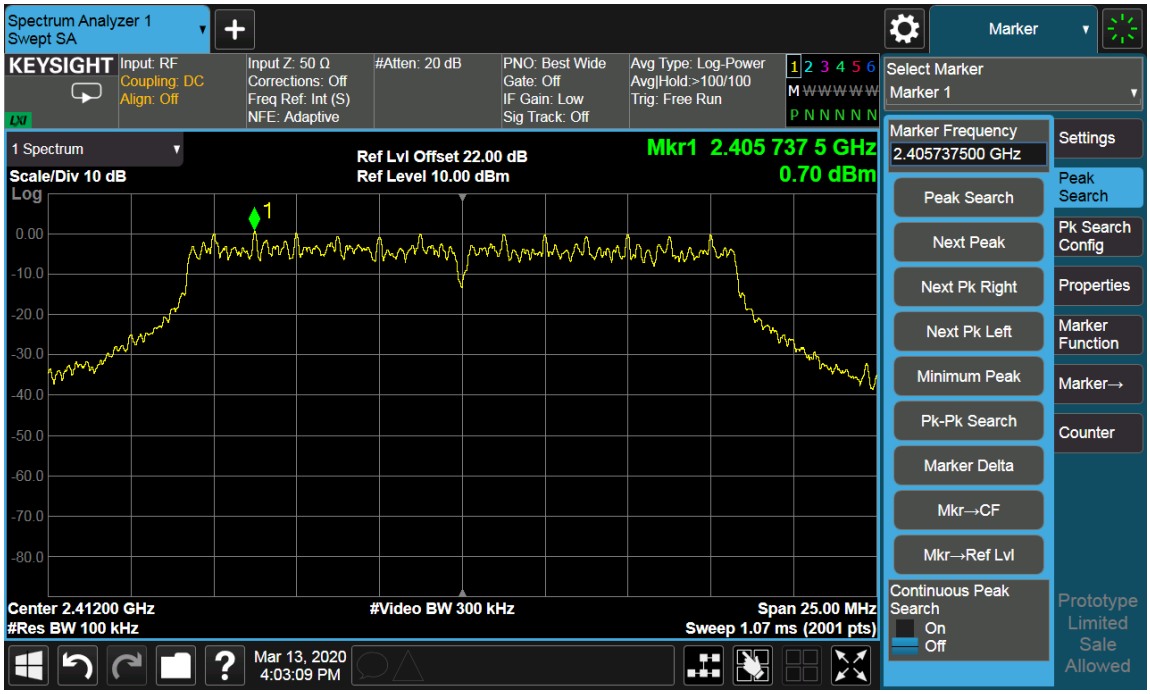



## 802.11g

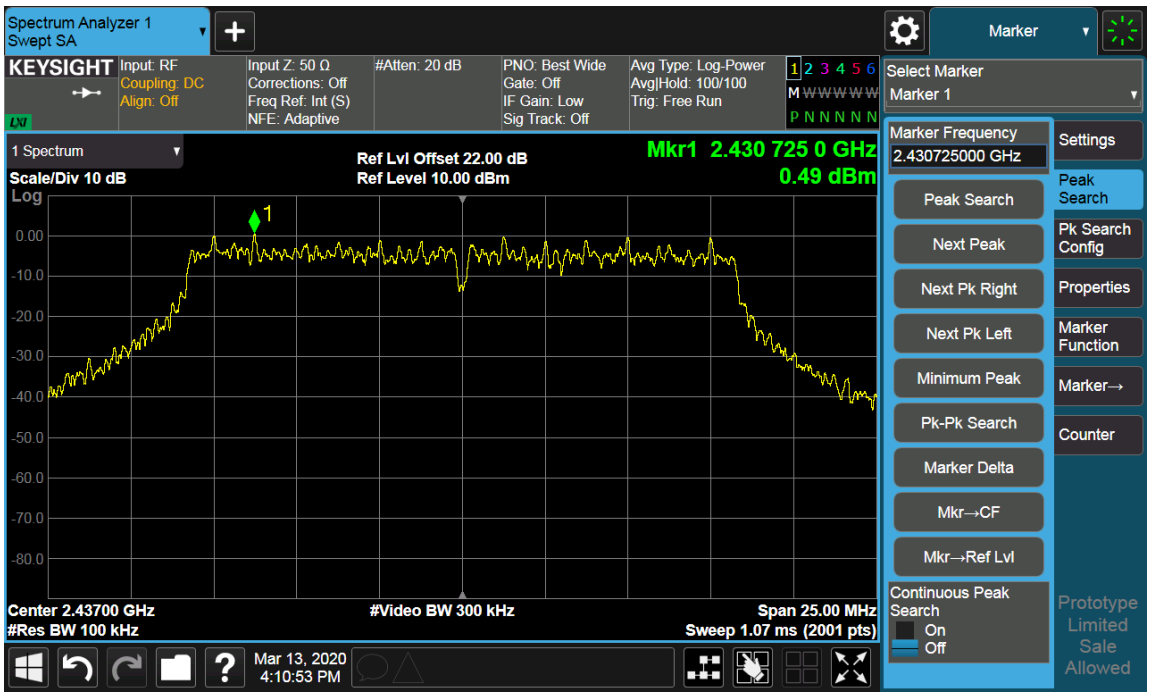
| Channel | Frequency (MHz) | Pass / Fail |
|---|---|---|
| 1 | 2412 | Pass |
| 6 | 2437 | Pass |
| 11 | 2462 | Pass |

**Spectrum Plot**

**802.11g(2412MHz)**

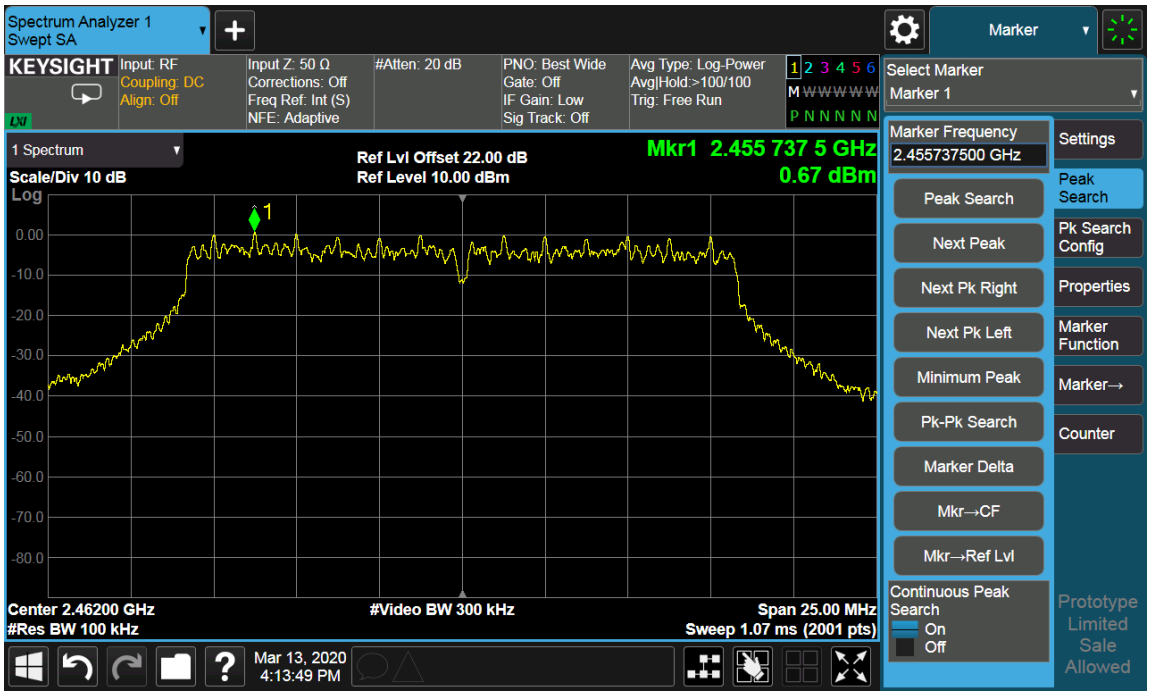


## 802.11g(2437MHz)




**Spectrum Plot**

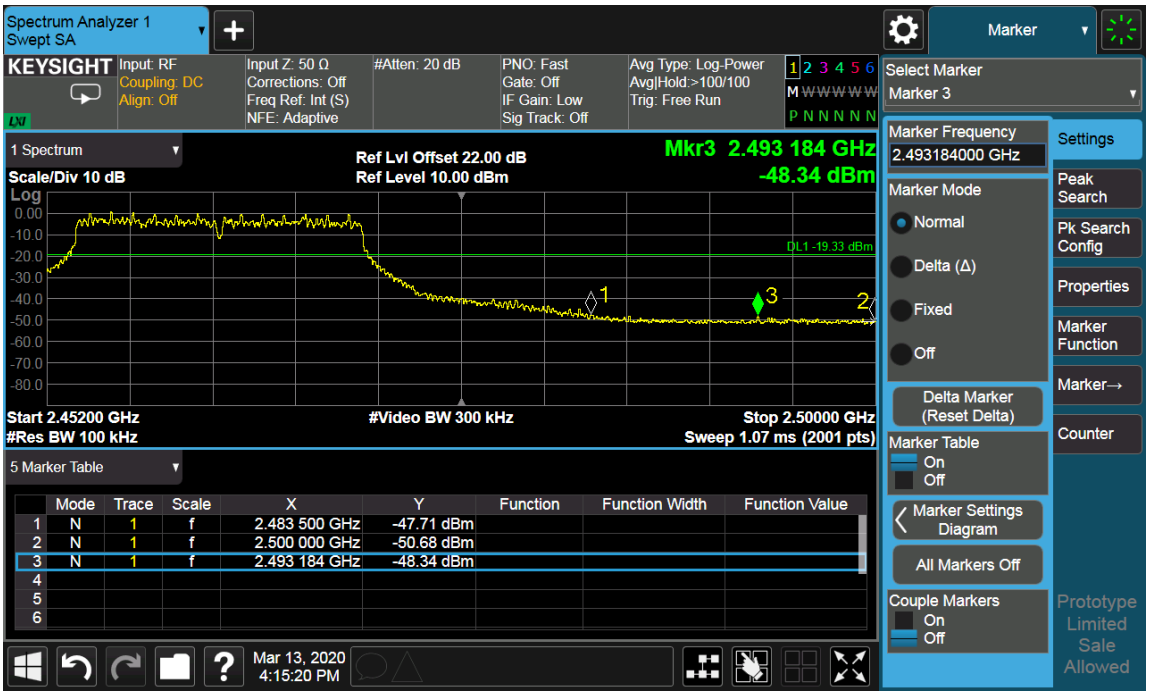
## 802.11g(2462MHz)



## Spectrum Plot

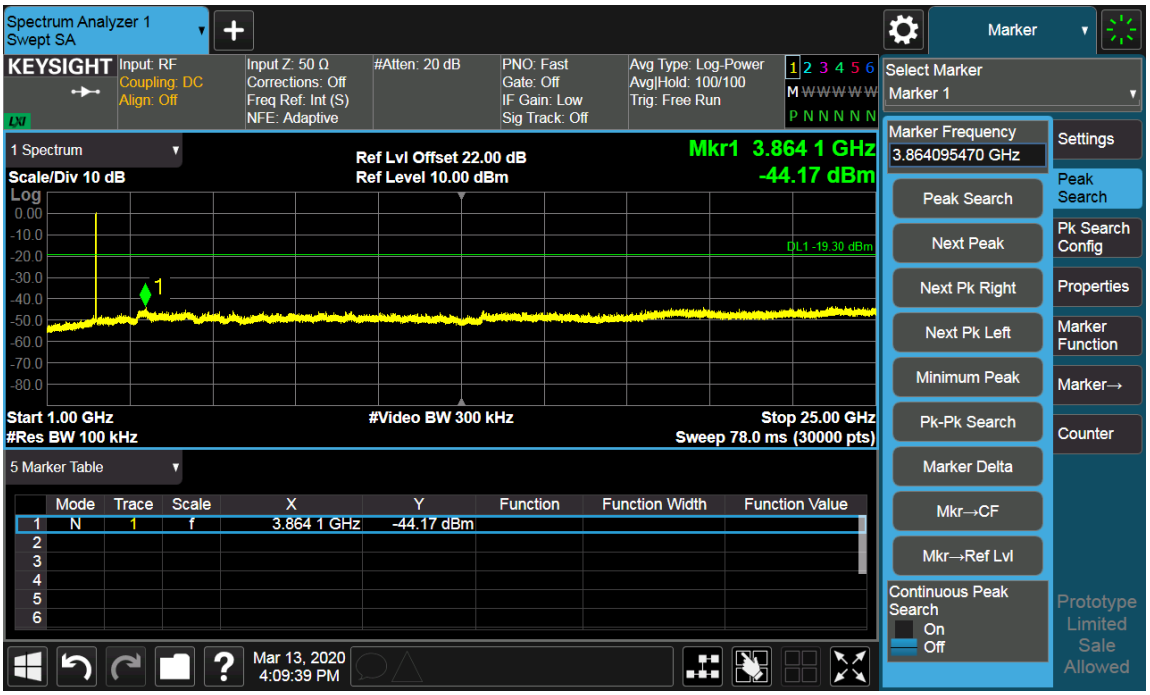
### 802.11g(2412MHz) Band Edge


### 802.11g(2462MHz) Band Edge



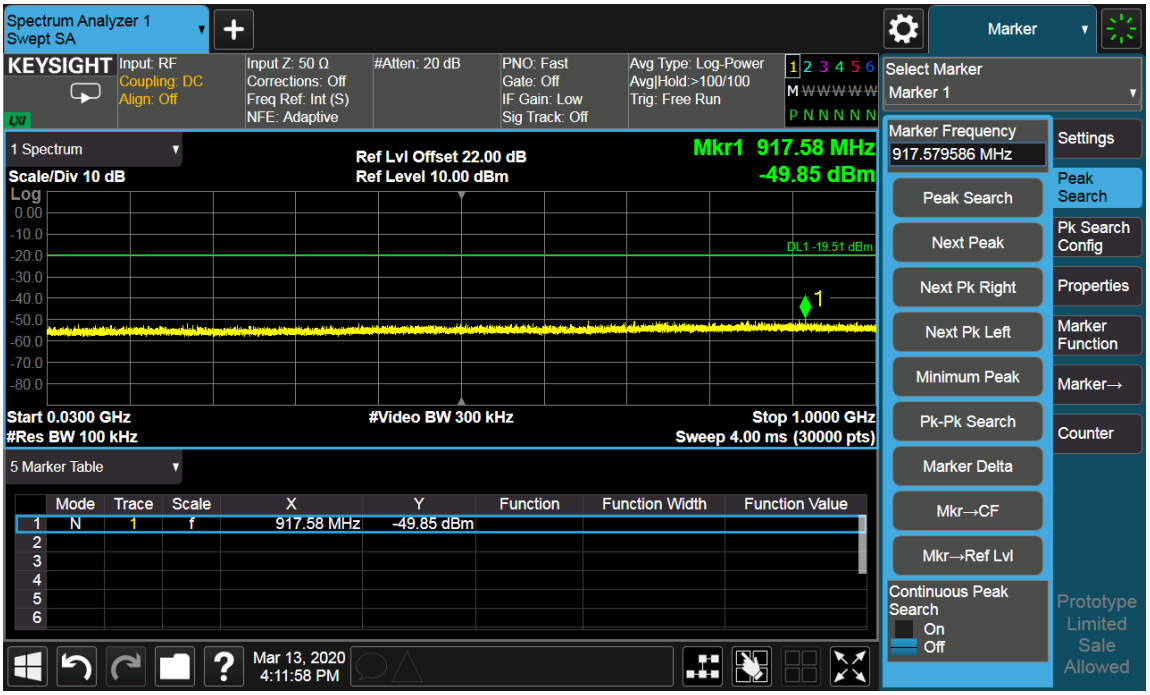
## Spectrum Plot

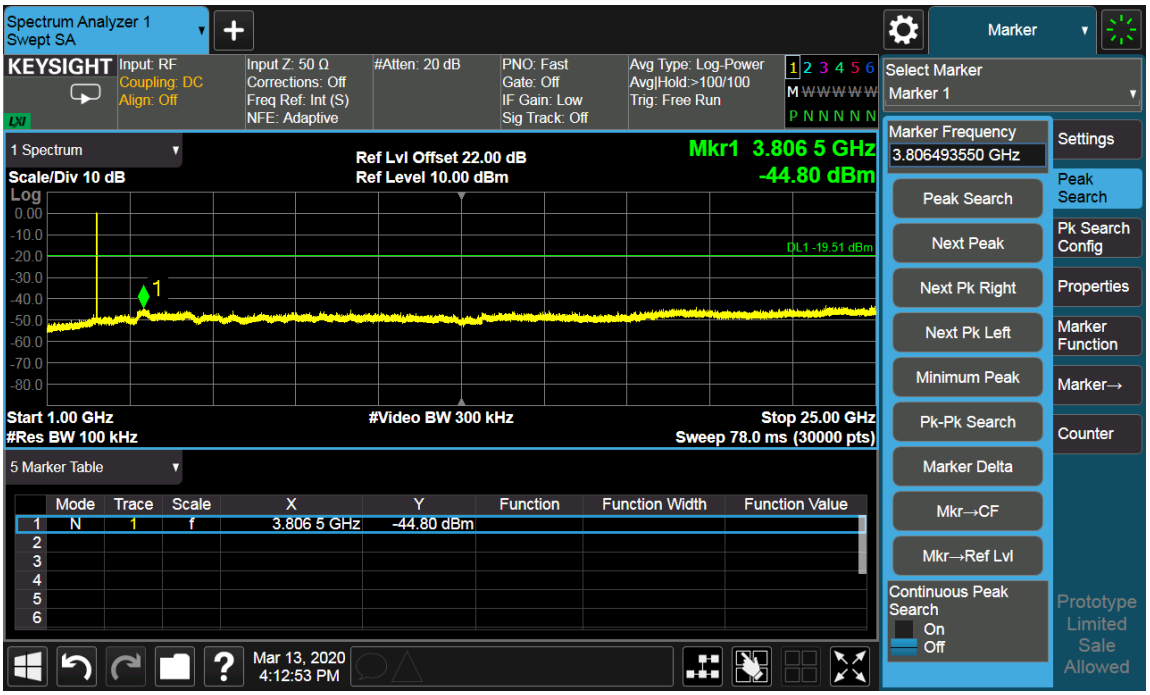
### 802.11g(2412MHz) Out-of-Band Emissions

## Spectrum Plot

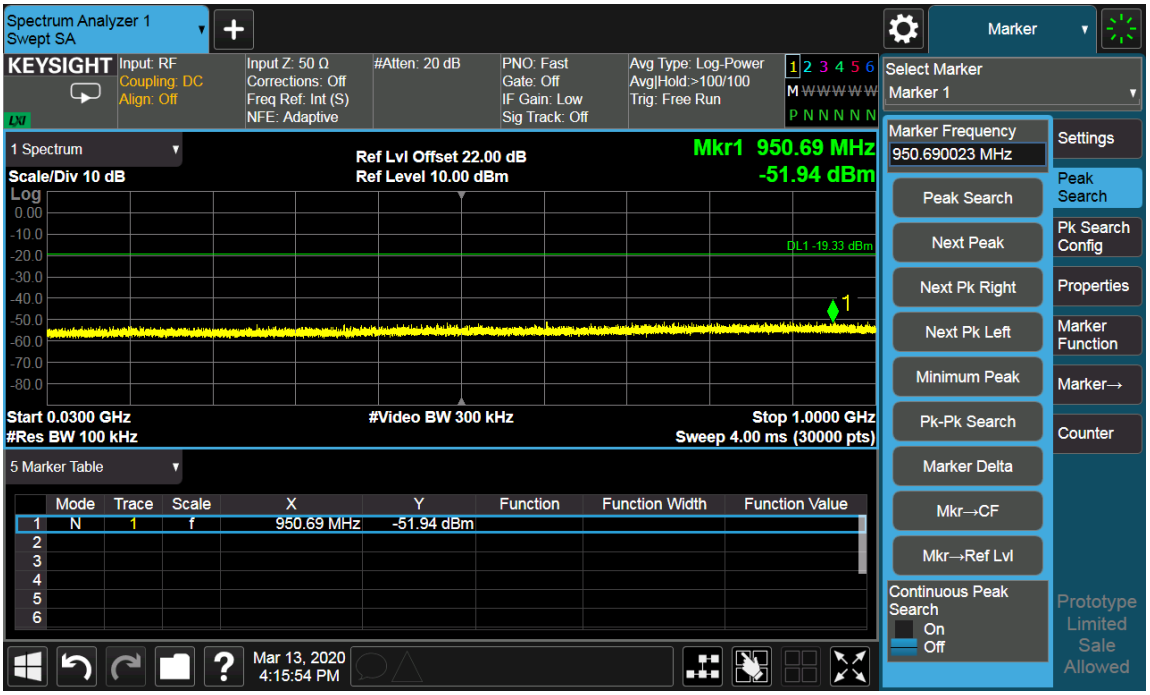
### 802.11g(2437MHz) Out-of-Band Emissions



## Spectrum Plot

### 802.11g(2462MHz) Out-of-Band Emissions



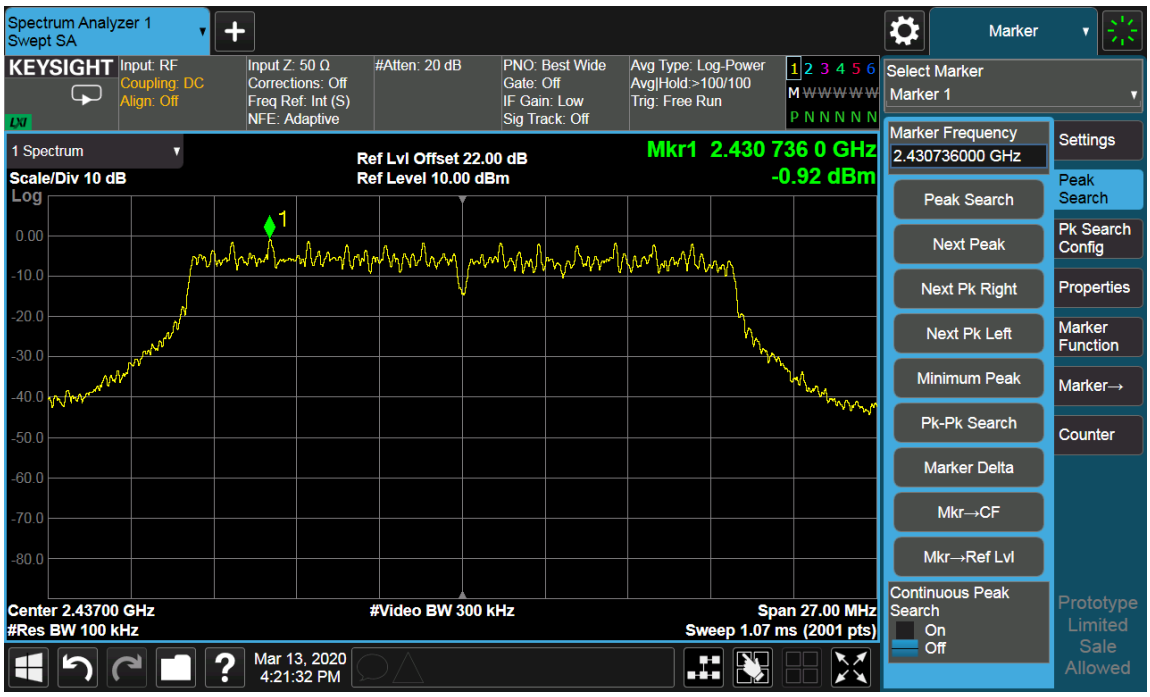

## 802.11n (HT20)

| Channel | Frequency (MHz) | Pass / Fail |
|---|---|---|
| 1 | 2412 | Pass |
| 6 | 2437 | Pass |
| 11 | 2462 | Pass |

**Spectrum Plot**

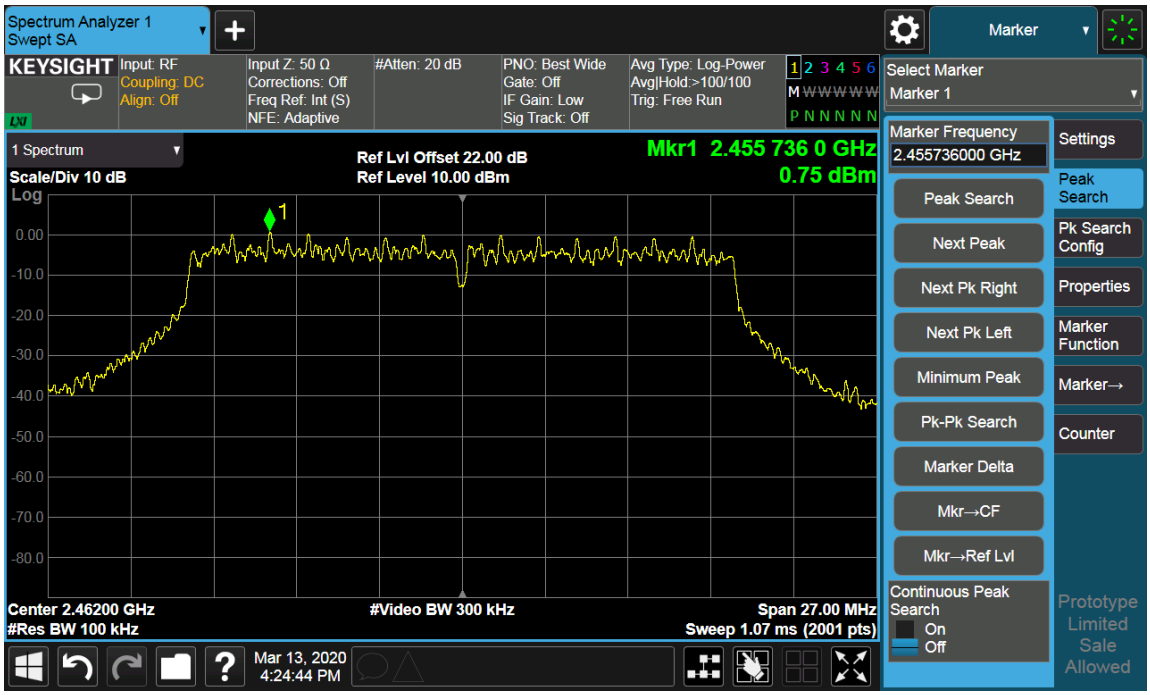
**802.11n(HT20)(2412MHz)**

## 802.11n(HT20)(2437MHz)



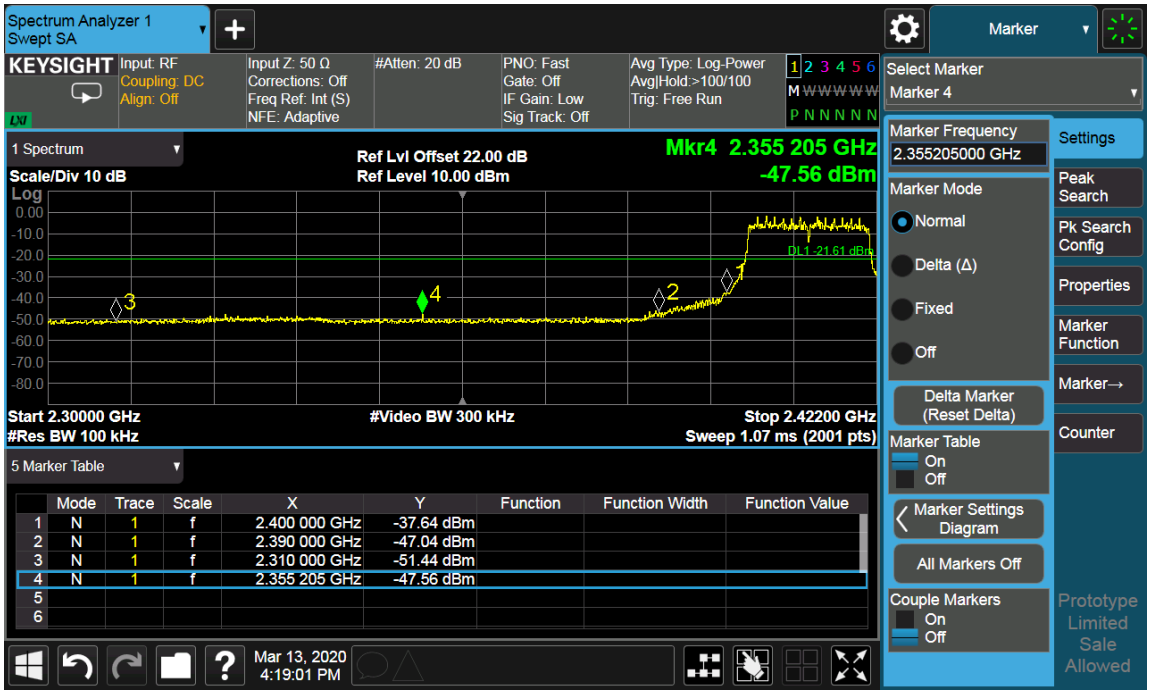

## Spectrum Plot

## 802.11n(HT20)(2462MHz)

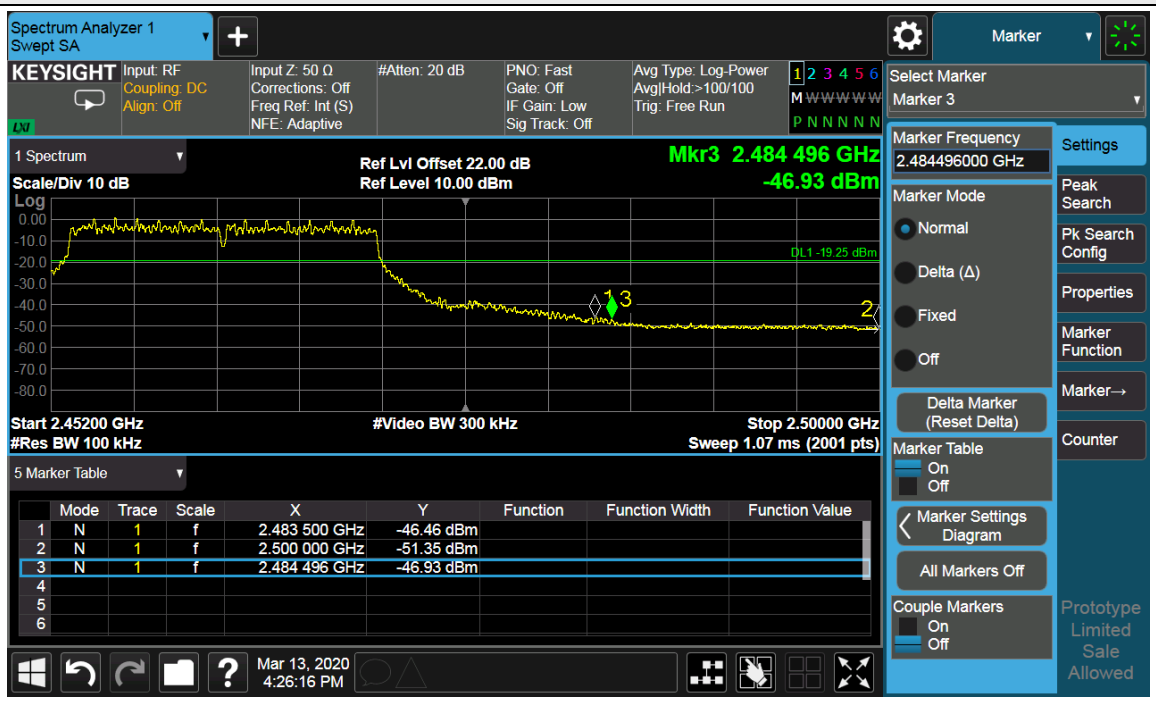


## Spectrum Plot

### 802.11n(HT20)(2412MHz) Band Edge

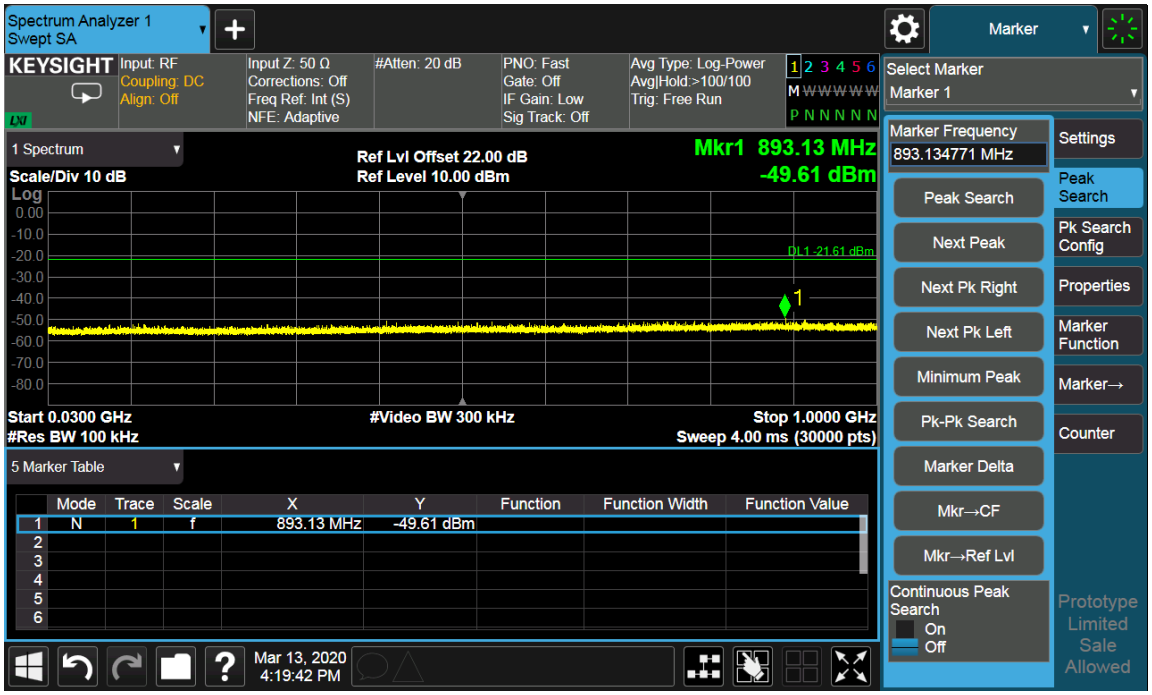


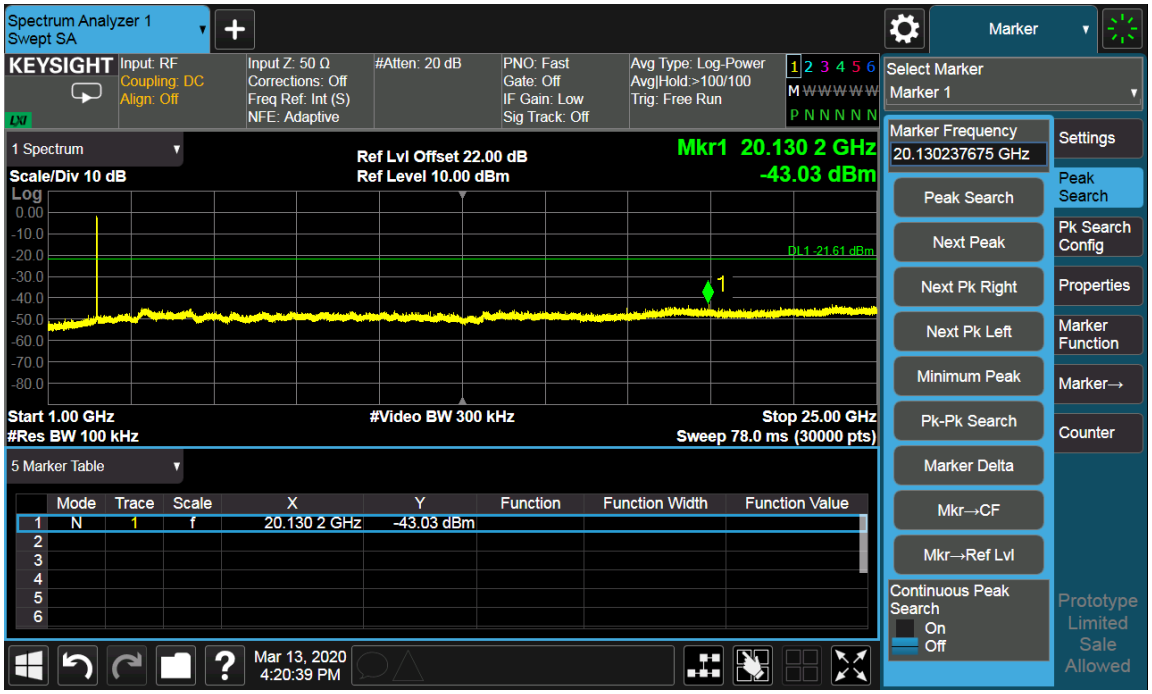
## 802.11n(HT20)(2462MHz) Band Edge



## Spectrum Plot

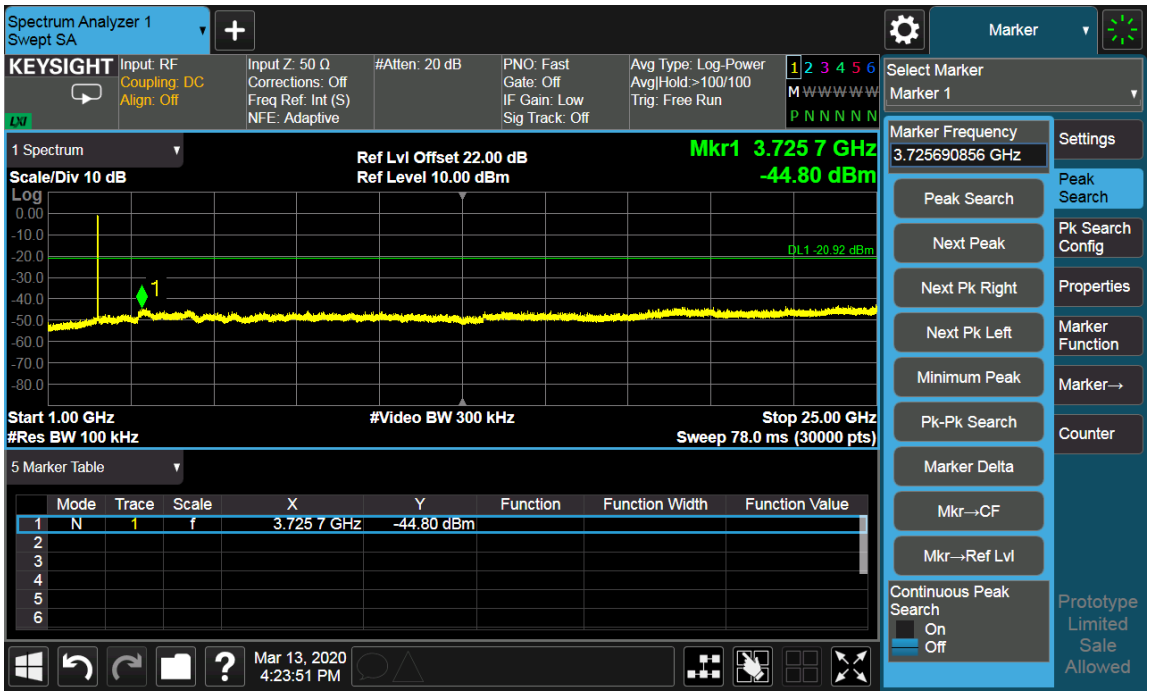
### 802.11n(HT20)(2412MHz) Out-of-Band Emissions



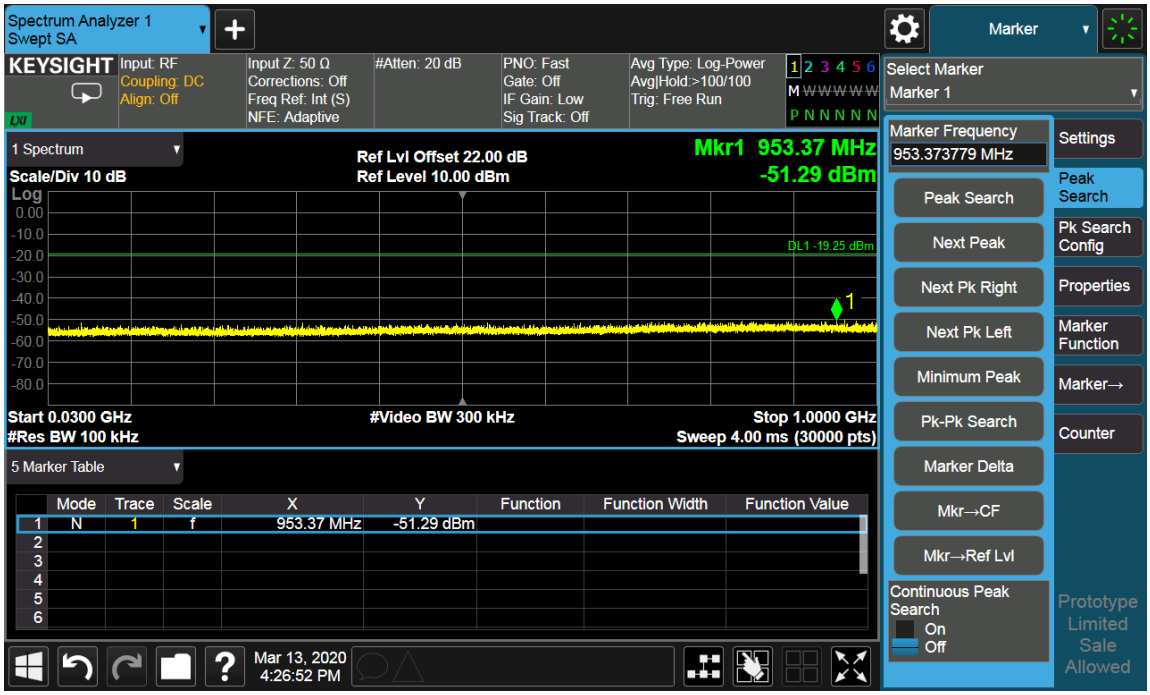
## Spectrum Plot

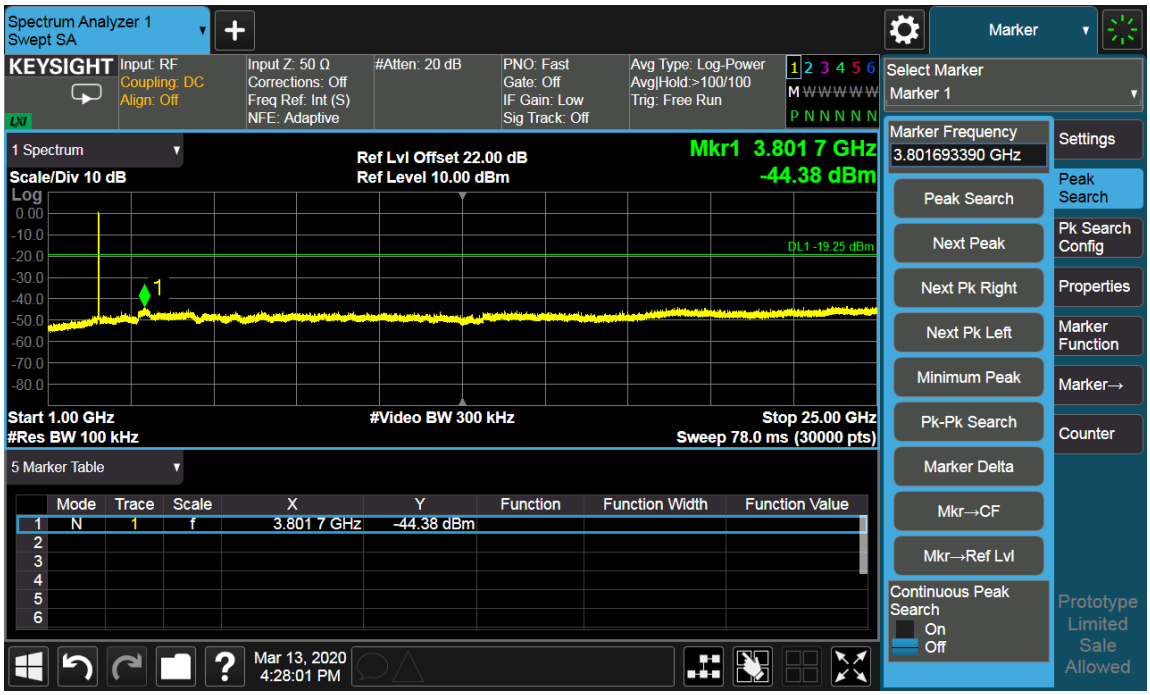
### 802.11n(HT20)(2437MHz) Out-of-Band Emissions

## Spectrum Plot

### 802.11n(HT20)(2462MHz) Out-of-Band Emissions



## 4.5 Radiated Emission Measurement

### 4.5.1 Limits

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 ~ 0.490 | 2400/F (kHz) | 300 |
| 0.490 ~ 1.705 | 24000/F (kHz) | 30 |
| 1.705 ~ 30.0 | 30 | 30 |
| 30 ~ 88 | 100 | 3 |
| 88 ~ 216 | 150 | 3 |
| 216 ~ 960 | 200 | 3 |
| Above 960 | 500 | 3 |

**NOTE**:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

### 4.5.2 Test Procedures

**For Radiated emission below 30MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degree to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotate table was turned from

0 degree to 360 degree to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

**Note:**

The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

**For Radiated emission above 30MHz**

a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

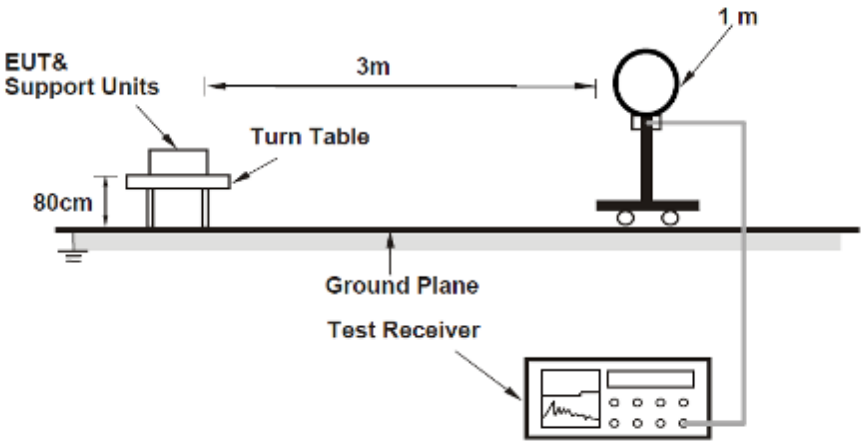
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360 kHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for RMS Average (Duty cycle < 98 %) for Peak detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle $\geqslant$ 98 %) for Average detection (AV) at frequency above 1 GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

### 4.5.3 Deviation from Test Standard

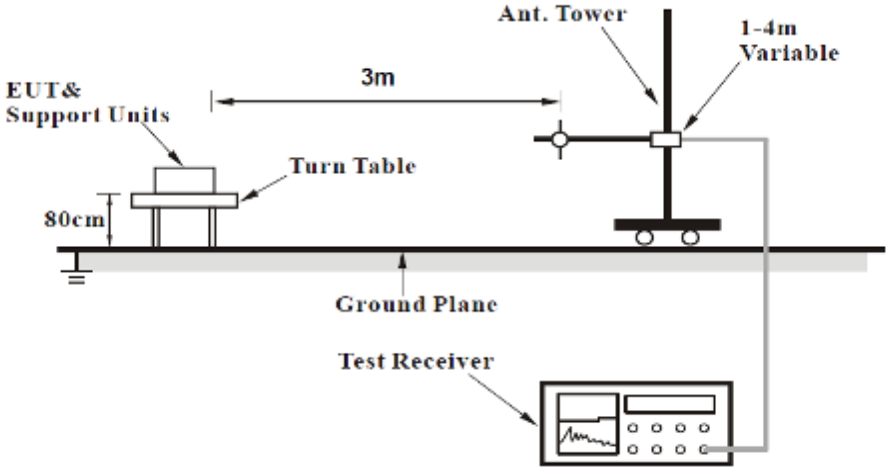
No deviation.

### 4.5.4 Test Setup

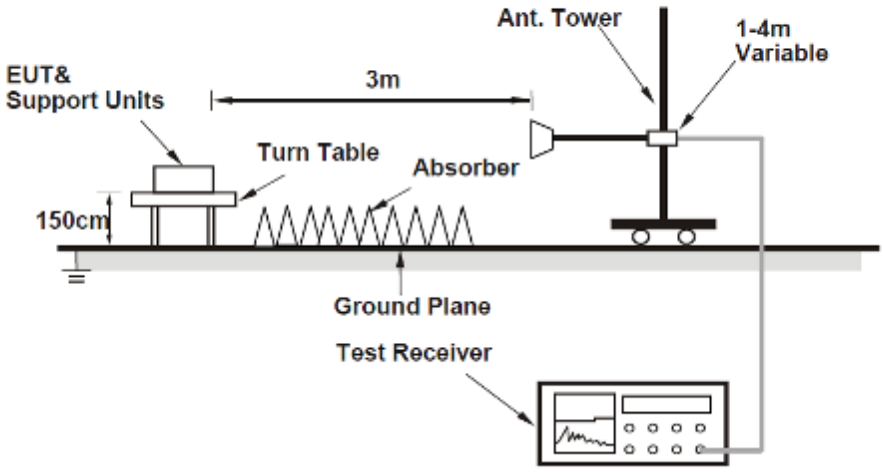
For Radiated emission below 30MHz




For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz




For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 4.5.5 EUT Operating Conditions

a. Placed the EUT on a testing table.

b. Use the software to control the EUT under transmission condition continuously at specific channel frequency.

### 4.5.6 Test Results

**Radiated Emissions Range 9kHz~30MHz**

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

**Radiated Emissions Range 30MHz~1GHz**

| | | | |
|---|---|---|---|
| **Mode** | 802.11b-2412MHz | **Detector Function** | Quasi-Peak (QP) |
| **Frequency Range** | 30MHz ~ 1GHz | **Antenna Polarity** | Horizontal |

| Spurious Emission Level | | | | | |
|---|---|---|---|---|---|
| **No.** | **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Correction Factor (dB/m)** |
| 1 | 50.5640 | 16.78 | 40.00 | -23.22 | -9.75 |
| 2 | 135.5360 | 31.06 | 43.50 | -12.44 | -10.43 |
| 3 | 166.5760 | 30.74 | 43.50 | -12.76 | -9.22 |
| 4 | 269.5900 | 18.00 | 46.50 | -28.50 | -9.90 |
| 5 | 520.8200 | 20.84 | 46.50 | -25.66 | -5.41 |
| 6 | 708.4180 | 34.51 | 46.50 | -11.99 | -2.43 |

**REMARKS:**

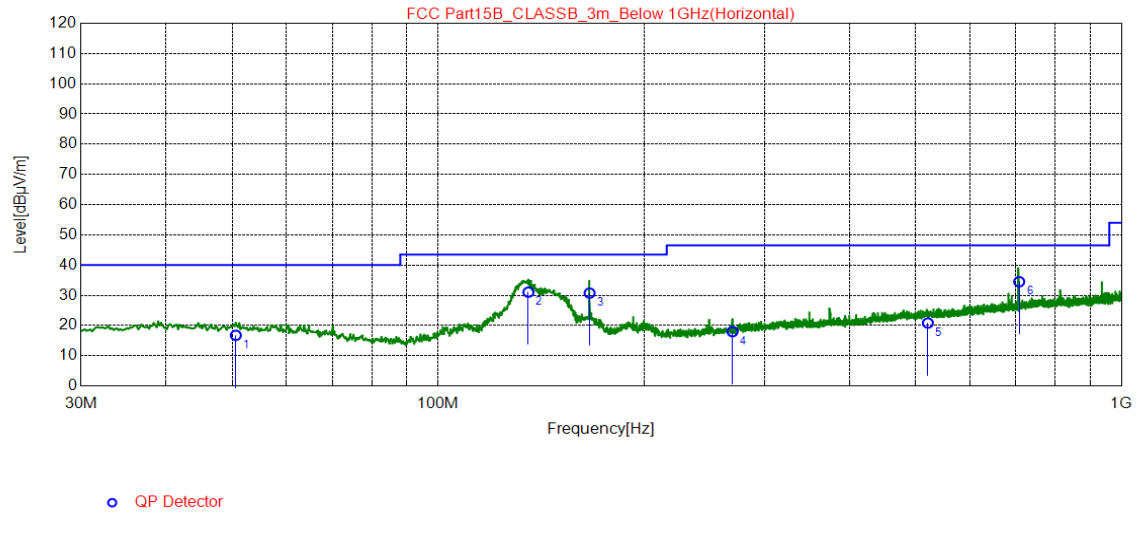
1. Emission Level(dBuV/m) = Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

Test Plot:



| Mode | 802.11b-2412MHz | Detector Function | Quasi-Peak (QP) |
|---|---|---|---|
| Frequency Range | 30MHz ~ 1GHz | Antenna Polarity | Vertical |

| Spurious Emission Level | | | | | |
|---|---|---|---|---|---|
| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Correction Factor (dB/m) |
| 1 | 39.3120 | 22.85 | 40.00 | -17.15 | -9.54 |
| 2 | 52.5040 | 22.89 | 40.00 | -17.11 | -9.92 |
| 3 | 133.0140 | 31.13 | 43.50 | -12.37 | -10.57 |
| 4 | 193.3480 | 26.69 | 43.50 | -16.81 | -12.07 |
| 5 | 486.8700 | 23.07 | 46.50 | -23.43 | -5.71 |
| 6 | 818.4160 | 29.03 | 46.50 | -17.47 | -1.07 |

**REMARKS:**

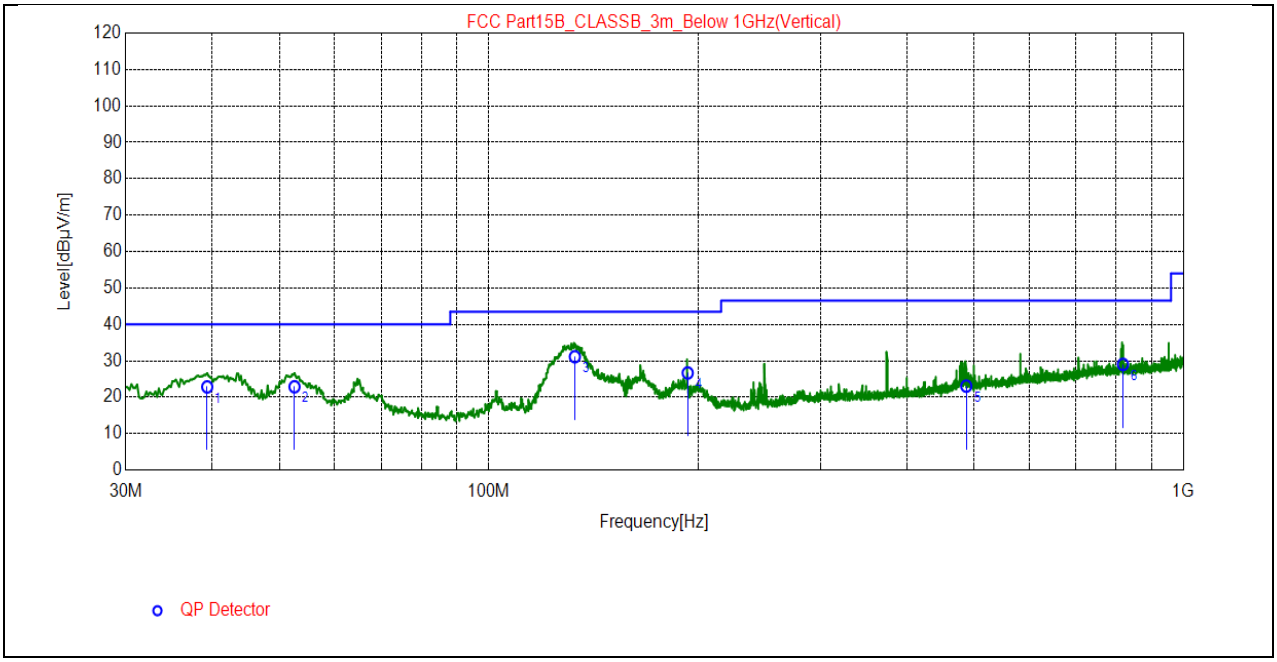
1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

Test Plot:



## Radiated Emission Range 1GHz~10th Harmonic

### 802.11b

| | | | |
|---|---|---|---|
| **Channel** | TX Channel 1 | **Detector Function** | Peak (PK) |
| **Frequency Range** | 1GHz ~ 25GHz | | Average (AV) |

| Spurious Emission Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| **No.** | **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Correction Factor (dB/m)** | **Antenna Polarity** | **Detector** |
| 1 | 4824.1500 | 37.45 | 74.00 | -36.55 | -9.40 | H | PK |
| 2 | 4825.0000 | 34.40 | 54.00 | -19.60 | -9.40 | H | AV |
| 3 | 4823.3000 | 36.94 | 74.00 | -37.06 | -9.40 | V | PK |
| 4 | 4825.0000 | 34.26 | 54.00 | -19.74 | -9.40 | V | AV |

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

| | | | |
|---|---|---|---|
| **Channel** | TX Channel 6 | **Detector Function** | Peak (PK) |
| **Frequency Range** | 1GHz ~ 25GHz | | Average (AV) |

| Spurious Emission Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| **No.** | **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Correction Factor (dB/m)** | **Antenna Polarity** | **Detector** |
| 1 | 4874.3000 | 38.64 | 74.00 | -35.36 | -9.33 | H | PK |
| 2 | 4875.1500 | 34.98 | 54.00 | -19.02 | -9.33 | H | AV |
| 3 | 4874.3000 | 39.11 | 74.00 | -34.89 | -9.33 | V | PK |
| 4 | 4875.1500 | 36.06 | 54.00 | -17.94 | -9.33 | V | AV |

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

| | | | |
|---|---|---|---|
| **Channel** | TX Channel 11 | **Detector Function** | Peak (PK) |
| **Frequency Range** | 1GHz ~ 25GHz | | Average (AV) |

| Spurious Emission Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| **No.** | **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Correction Factor (dB/m)** | **Antenna Polarity** | **Detector** |
| 1 | 4923.6000 | 42.10 | 74.00 | -31.90 | -9.27 | H | PK |
| 2 | 4924.4500 | 38.96 | 54.00 | -15.04 | -9.27 | H | AV |
| 3 | 4923.6000 | 39.84 | 74.00 | -34.16 | -9.27 | V | PK |
| 4 | 4924.4500 | 37.75 | 54.00 | -16.25 | -9.27 | V | AV |

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

## 802.11g

| Channel | TX Channel 1 | Detector Function | Peak (PK) |
|---|---|---|---|
| Frequency Range | 1GHz ~ 25GHz | | Average (AV) |

| Spurious Emission Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Correction Factor (dB/m) | Antenna Polarity | Detector |
| 1 | 4825.0000 | 27.21 | 54.00 | -26.79 | -9.40 | H | PK |
| 2 | 4834.3500 | 33.49 | 74.00 | -40.51 | -9.38 | H | AV |
| 3 | 4825.8500 | 35.33 | 74.00 | -38.67 | -9.40 | V | PK |
| 4 | 4828.4000 | 29.31 | 54.00 | -24.69 | -9.39 | V | AV |

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

| Channel | TX Channel 6 | Detector Function | Peak (PK) |
|---|---|---|---|
| Frequency Range | 1GHz ~ 25GHz | | Average (AV) |

| Spurious Emission Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Correction Factor (dB/m) | Antenna Polarity | Detector |
| 1 | 4874.3000 | 34.92 | 74.00 | -39.08 | -9.33 | H | PK |
| 2 | 4875.1500 | 28.84 | 54.00 | -25.16 | -9.33 | H | AV |
| 3 | 4878.5500 | 33.95 | 74.00 | -40.05 | -9.32 | V | PK |
| 4 | 4878.5500 | 27.44 | 54.00 | -26.56 | -9.32 | V | AV |

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

| Channel | TX Channel 11 | Detector Function | Peak (PK) |
|---|---|---|---|
| Frequency Range | 1GHz ~ 25GHz | | Average (AV) |

| Spurious Emission Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Correction Factor (dB/m) | Antenna Polarity | Detector |
| 1 | 4924.4500 | 35.71 | 74.00 | -38.29 | -9.27 | H | PK |
| 2 | 4926.1500 | 30.01 | 54.00 | -23.99 | -9.26 | H | AV |
| 3 | 4942.3000 | 35.48 | 74.00 | -38.52 | -9.25 | V | PK |
| 4 | 4943.1500 | 28.90 | 54.00 | -25.10 | -9.25 | V | AV |

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

## 802.11n(HT20)

| Channel | TX Channel 1 | Detector Function | Peak (PK) |
|---|---|---|---|
| Frequency Range | 1GHz ~ 25GHz | | Average (AV) |

| Spurious Emission Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Correction Factor (dB/m) | Antenna Polarity | Detector |
| 1 | 4834.3500 | 32.45 | 74.00 | -41.55 | -9.38 | H | PK |
| 2 | 4823.3000 | 25.21 | 54.00 | -28.79 | -9.40 | H | AV |
| 3 | 4940.6000 | 35.71 | 74.00 | -38.29 | -9.25 | V | PK |
| 4 | 4941.4500 | 28.05 | 54.00 | -25.95 | -9.25 | V | AV |

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

| Channel | TX Channel 6 | Detector Function | Peak (PK) |
|---|---|---|---|
| Frequency Range | 1GHz ~ 25GHz | | Average (AV) |

| Spurious Emission Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| No. | Frequency (MHz) | Emission Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Correction Factor (dB/m) | Antenna Polarity | Detector |
| 1 | 4870.9000 | 27.84 | 54.00 | -26.16 | -9.33 | H | PK |
| 2 | 4874.3000 | 34.84 | 74.00 | -39.16 | -9.33 | H | AV |
| 3 | 4873.4500 | 35.27 | 74.00 | -38.73 | -9.33 | V | PK |
| 4 | 4875.1500 | 28.06 | 54.00 | -25.94 | -9.33 | V | AV |

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

| | | | |
|---|---|---|---|
| **Channel** | TX Channel 11 | **Detector Function** | Peak (PK) |
| **Frequency Range** | 1GHz ~ 25GHz | | Average (AV) |

| Spurious Emission Level | | | | | | | |
|---|---|---|---|---|---|---|---|
| **No.** | **Frequency (MHz)** | **Emission Level (dBuV/m)** | **Limit (dBuV/m)** | **Margin (dB)** | **Correction Factor (dB/m)** | **Antenna Polarity** | **Detector** |
| 1 | 4924.4500 | 37.34 | 74.00 | -36.66 | -9.27 | H | PK |
| 2 | 4925.3000 | 31.35 | 54.00 | -22.65 | -9.27 | H | AV |
| 3 | 4920.2000 | 39.36 | 74.00 | -34.64 | -9.27 | V | PK |
| 4 | 4921.0500 | 33.28 | 54.00 | -20.72 | -9.27 | V | AV |

**REMARKS:**

1. Emission Level(dBuV/m) = Original Spectrum reading (dBuV) + Correction Factor(dB/m)

2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)

3. The other emission levels were very low against the limit.

4. Margin value = Emission Level – Limit value

## 4.6 Conducted Emission Measurement

### 4.6.1 Limits

| Frequency (MHz) | Conducted Limit (dBuV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 - 0.5 | 66 - 56 | 56 - 46 |
| 0.50 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

### 4.6.2 Test Procedures

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

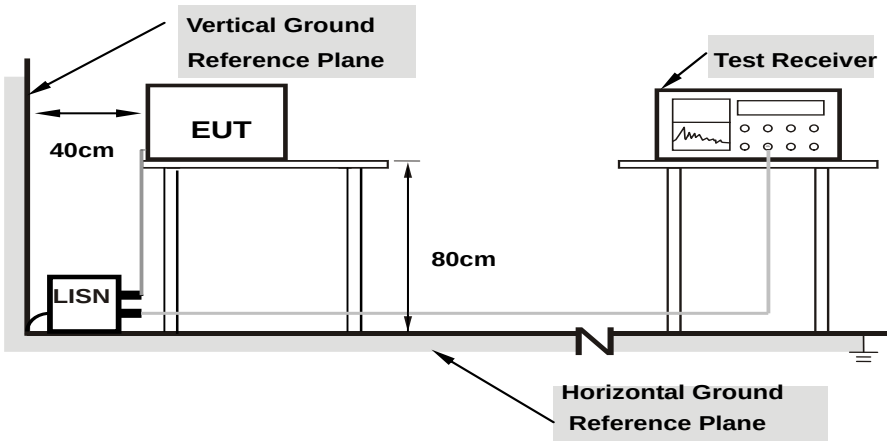
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

**NOTE:** The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

### 4.6.3 Deviation from Test Standard

No deviation.

### 4.6.4 Test Setup




**Note: 1.Support units were connected to second LISN.**

For the actual test configuration, please refer to the attached file (Test Setup Photo).

### 4.6.5 EUT Operating Conditions

Same as 4.1.6.

**4.6.6** Test Results

**Working While Charging**

**120Vac/60Hz**

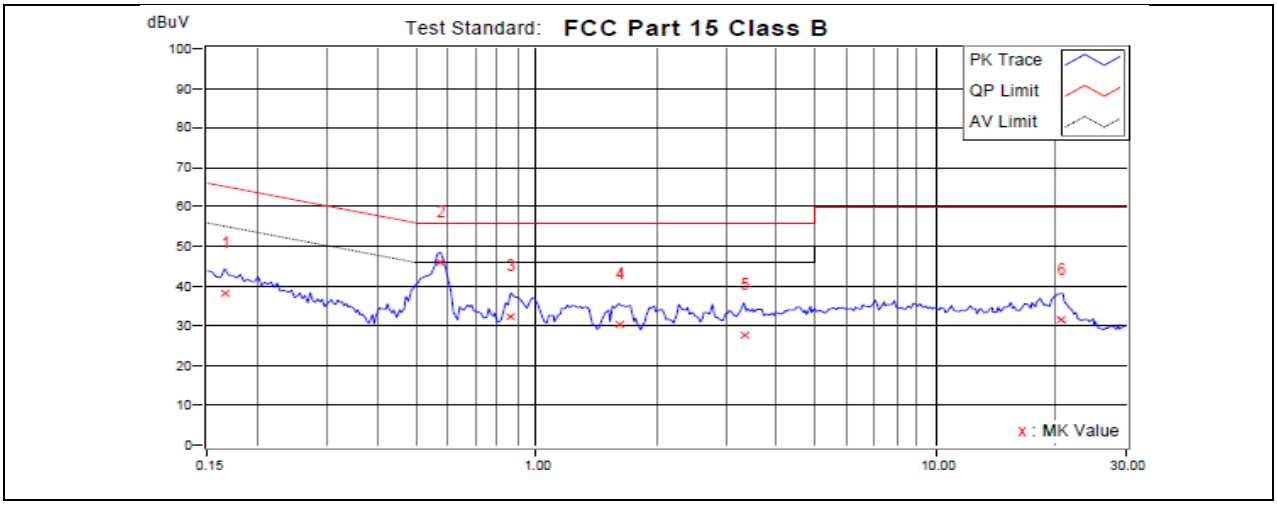
| Phase | Line (L) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|---|---|---|---|

| No | Freq. | Corr. Factor | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.16564 | 9.85 | 28.50 | 14.19 | 38.35 | 24.04 | 65.18 | 55.18 | -26.83 | -31.14 |
| 2 | 0.57619 | 9.67 | 36.46 | 28.37 | 46.13 | 38.04 | 56.00 | 46.00 | -9.87 | -7.96 |
| 3 | 0.86162 | 9.59 | 22.68 | 13.92 | 32.27 | 23.51 | 56.00 | 46.00 | -23.73 | -22.49 |
| 4 | 1.60996 | 9.70 | 20.85 | 11.94 | 30.55 | 21.64 | 56.00 | 46.00 | -25.45 | -24.36 |
| 5 | 3.31472 | 9.89 | 17.65 | 6.48 | 27.54 | 16.37 | 56.00 | 46.00 | -28.46 | -29.63 |
| 6 | 20.58437 | 10.23 | 21.44 | 9.79 | 31.67 | 20.02 | 60.00 | 50.00 | -28.33 | -29.98 |

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

Test Plot:



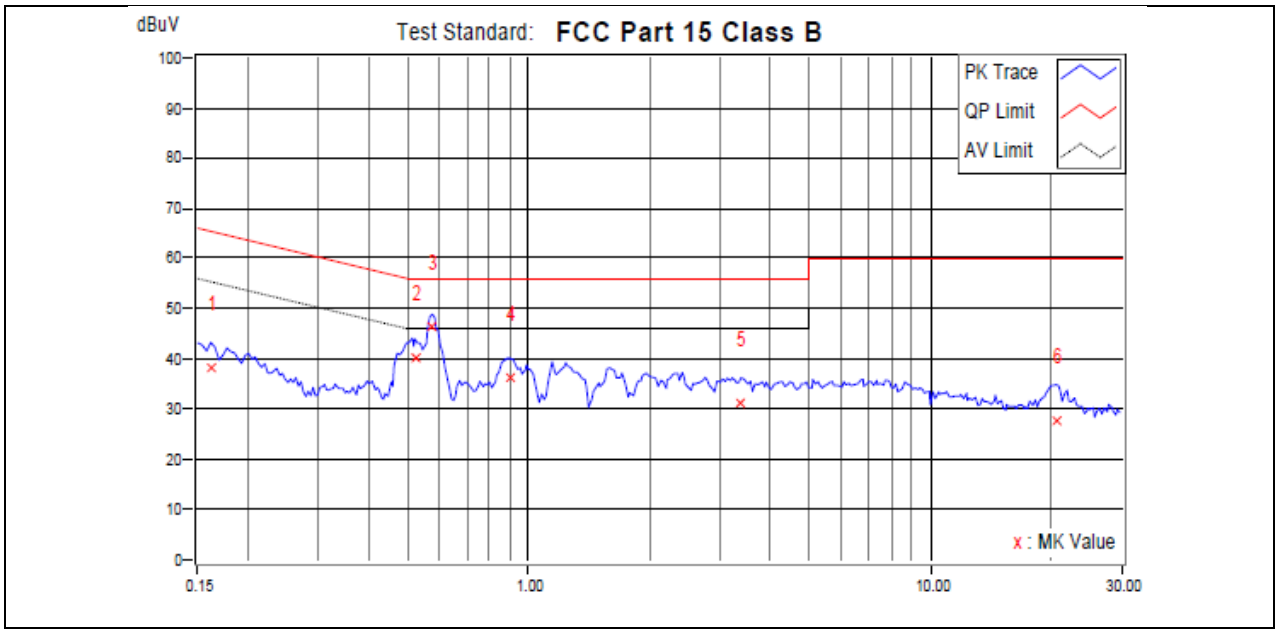
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|---|---|---|---|

| No | Freq. | Corr. Factor | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.16173 | 9.84 | 28.50 | 18.16 | 38.34 | 28.00 | 65.37 | 55.37 | -27.04 | -27.38 |
| 2 | 0.52145 | 9.84 | 30.49 | 25.67 | 40.33 | 35.51 | 56.00 | 46.00 | -15.67 | -10.49 |
| 3 | 0.57619 | 9.83 | 36.46 | 31.75 | 46.29 | 41.58 | 56.00 | 46.00 | -9.71 | -4.42 |
| 4 | 0.89681 | 9.89 | 26.41 | 21.90 | 36.30 | 31.79 | 56.00 | 46.00 | -19.70 | -14.21 |
| 5 | 3.38119 | 9.97 | 21.30 | 15.64 | 31.27 | 25.61 | 56.00 | 46.00 | -24.73 | -20.39 |
| 6 | 20.59610 | 10.38 | 17.28 | 3.62 | 27.66 | 14.00 | 60.00 | 50.00 | -32.34 | -36.00 |

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

Test Plot:



**240Vac/50Hz**

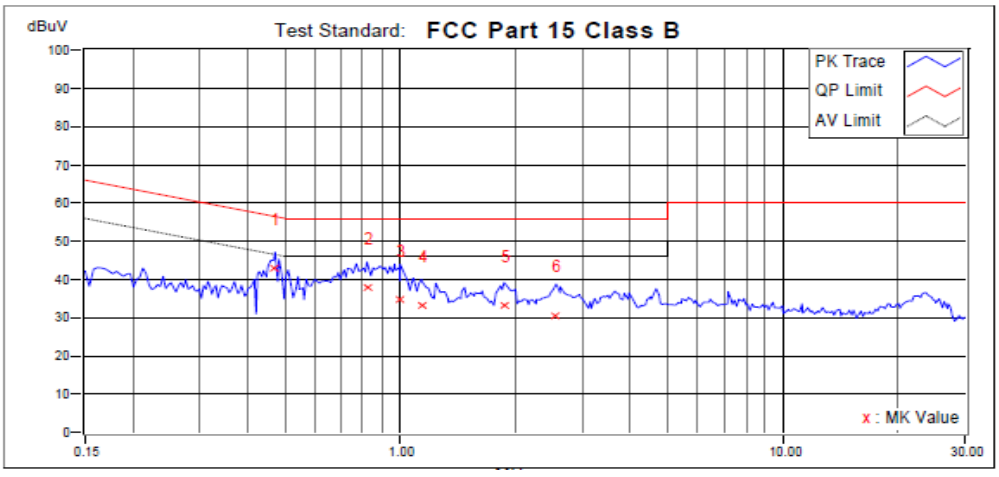
| Phase | Line (L) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|---|---|---|---|

| No | Freq. | Corr. Factor | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.47062 | 9.72 | 33.11 | 23.13 | 42.83 | 32.85 | 56.50 | 46.50 | -13.67 | -13.65 |
| 2 | 0.81861 | 9.59 | 28.14 | 19.09 | 37.73 | 28.68 | 56.00 | 46.00 | -18.27 | -17.32 |
| 3 | 1.00000 | 9.59 | 25.34 | 15.31 | 34.93 | 24.90 | 56.00 | 46.00 | -21.07 | -21.10 |
| 4 | 1.13685 | 9.61 | 23.69 | 13.94 | 33.30 | 23.55 | 56.00 | 46.00 | -22.70 | -22.45 |
| 5 | 1.86802 | 9.75 | 23.41 | 8.59 | 33.16 | 18.34 | 56.00 | 46.00 | -22.84 | -27.66 |
| 6 | 2.55227 | 9.82 | 20.62 | 10.62 | 30.44 | 20.44 | 56.00 | 46.00 | -25.56 | -25.56 |

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

Test Plot:



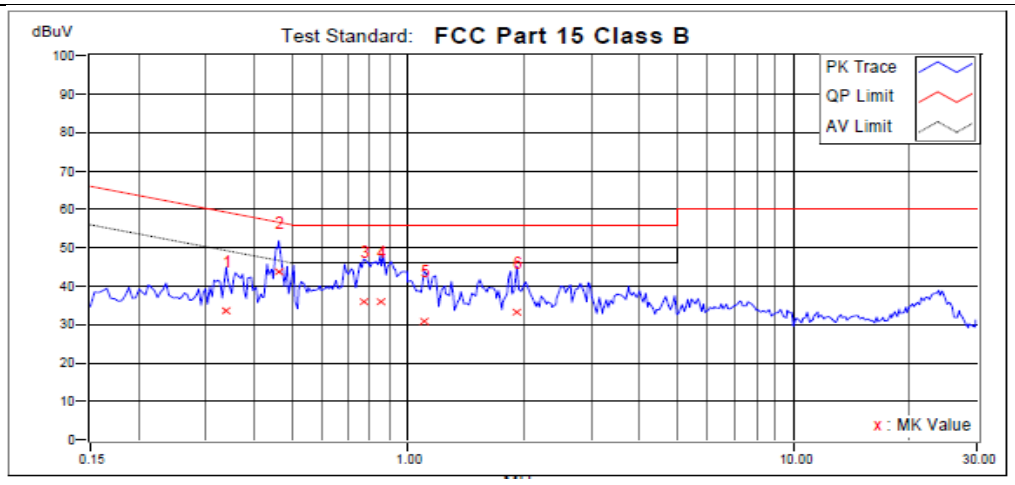
| Phase | Neutral (N) | Detector Function | Quasi-Peak (QP) / Average (AV) |
|---|---|---|---|

| No | Freq. | Corr. Factor | Reading Value [dB (uV)] | | Emission Level [dB (uV)] | | Limit [dB (uV)] | | Margin (dB) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | [MHz] | (dB) | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. | Q.P. | AV. |
| 1 | 0.33768 | 9.87 | 23.82 | 13.53 | 33.69 | 23.40 | 59.26 | 49.26 | -25.57 | -25.86 |
| 2 | 0.4628 | 9.85 | 33.78 | 23.87 | 43.63 | 33.72 | 56.64 | 46.64 | -13.01 | -12.92 |
| 3 | 0.76778 | 9.86 | 26.05 | 15.97 | 35.91 | 25.83 | 56.00 | 46.00 | -20.09 | -20.17 |
| 4 | 0.84989 | 9.89 | 26.04 | 15.63 | 35.93 | 25.52 | 56.00 | 46.00 | -20.07 | -20.48 |
| 5 | 1.10166 | 9.89 | 20.96 | 9.03 | 30.85 | 18.92 | 56.00 | 46.00 | -25.15 | -27.08 |
| 6 | 1.91885 | 9.94 | 23.29 | 12.10 | 33.23 | 22.04 | 56.00 | 46.00 | -22.77 | -23.96 |

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

Test Plot:



## 4.7 Radiated Restricted Band Edge Measurement

### 4.7.1 Test Limit

**For 15.205 requirement:**

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part15, must also comply with the radiated emission limits specified in Section 15.209(a).

| Frequency (MHz) | Frequency (MHz) | Frequency (MHz) | Frequency (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 - 156.525 | 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 | (2) |
| 13.36 - 13.41 | -- | -- | -- |

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47CFR must not exceed the limits shown in Table per Section 15.209.

| FCC Part 15 Subpart C Paragraph 15.209 | | |
|---|---|---|
| Frequency [MHz] | Field Strength [uV/m] | Measured Distance [Meters] |
| 0.009 - 0.490 | 2400/F (kHz) | 300 |
| 0.490 - 1.705 | 24000/F (kHz) | 30 |
| 1.705 - 30 | 30 | 30 |
| 30 - 88 | 100 | 3 |
| 88 - 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

**4.7.2 Test Procedure Reference**

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

**4.7.3 Test Procedures**

**Peak Field Strength Measurements**

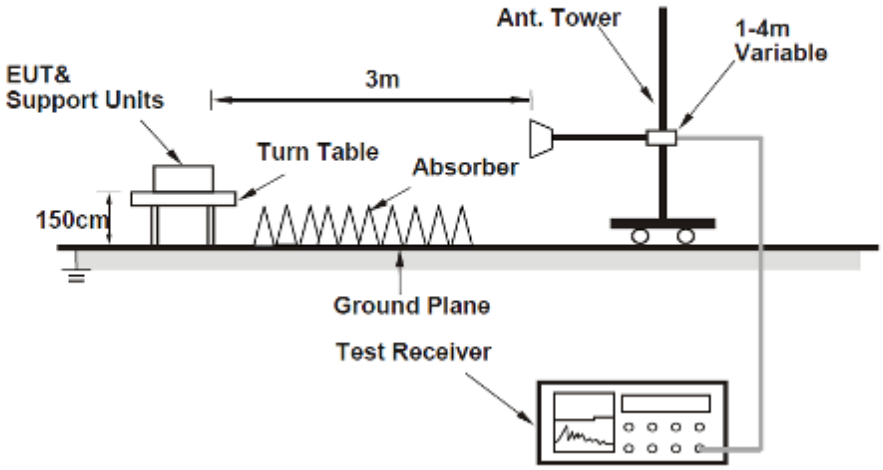
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

**Average Measurements above 1GHz (Method VB)**

8. 1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
9. 2. RBW = 1MHz
10. 3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.
11. If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.
12. 4. Detector = Peak
13. 5. Sweep time = auto
14. 6. Trace mode = max hold
15. 7. Trace was allowed to stabilize

### 4.7.4 Test Setup

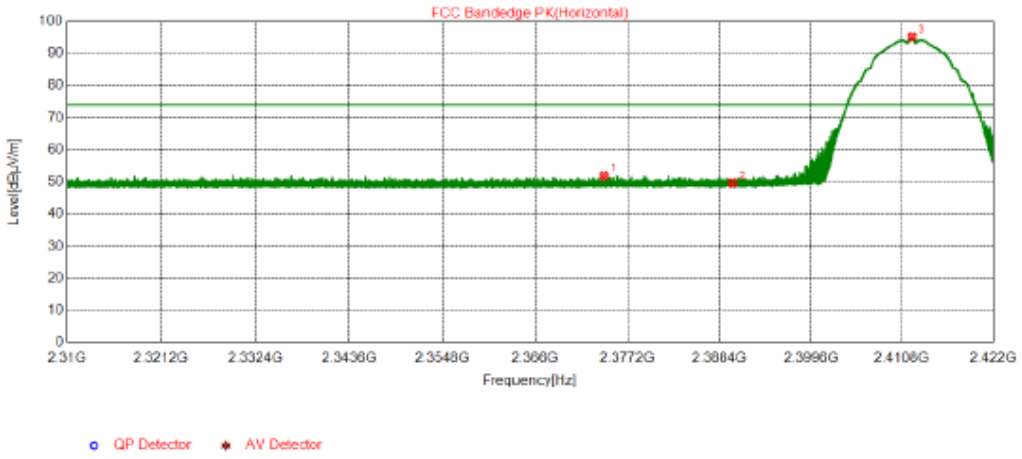
**For Radiated emission above 1GHz**



### 4.7.5 Test Results

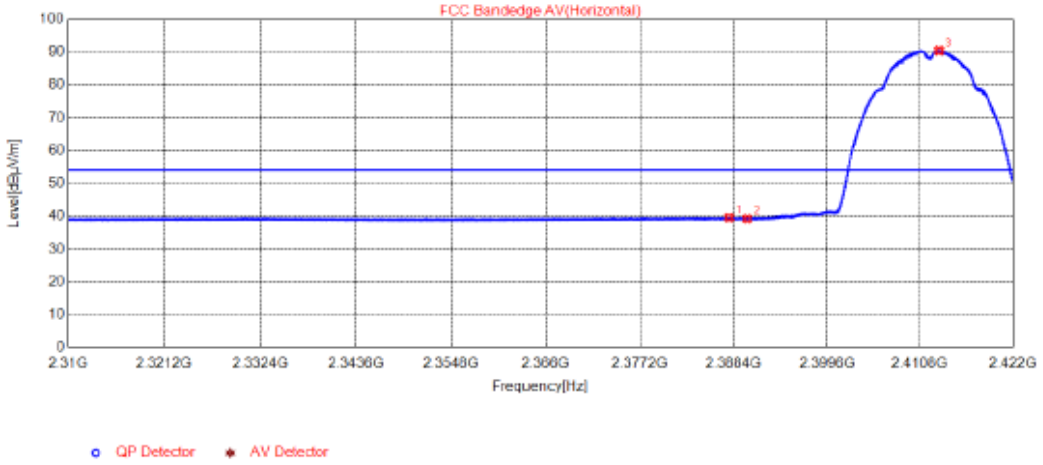
| Test Plot |
| --- |
| b-2412MHz/ Horizontal |

Test Graph




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2374.3216 | 47.01 | 51.90 | 74.00 | 22.10 | 165 | 285 | Horizontal | PK |
| 2 | 2390.0016 | 44.70 | 49.62 | 74.00 | 24.38 | 175 | 91 | Horizontal | PK |
| 3 | 2412.0320 | 90.13 | 95.10 | 74.00 | -21.10 | 175 | 176 | Horizontal | PK |

## Test Graph

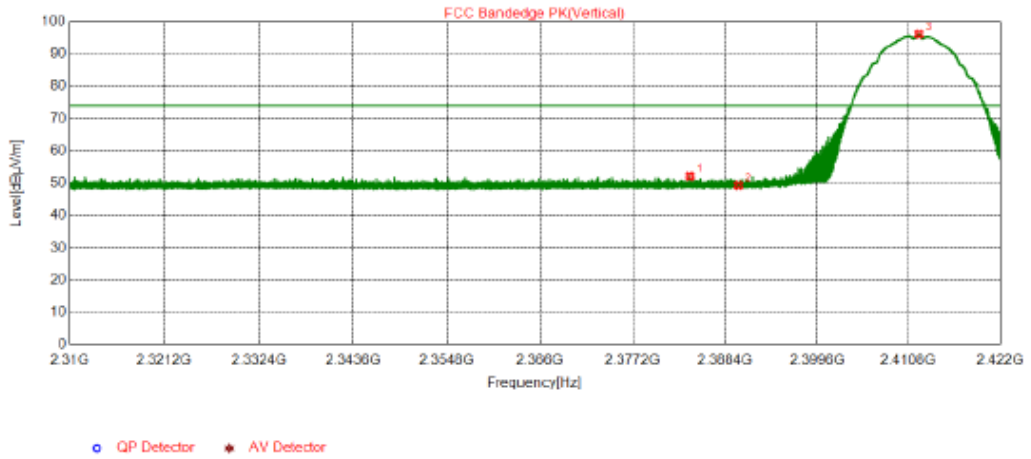



| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2387.8400 | 34.65 | 39.57 | 54.00 | 14.43 | 165 | 157 | Horizontal | AV |
| 2 | 2390.0016 | 34.26 | 39.18 | 54.00 | 14.82 | 175 | 135 | Horizontal | AV |
| 3 | 2413.1016 | 85.46 | 90.43 | 54.00 | -36.43 | 155 | 219 | Horizontal | AV |

## Test Plot

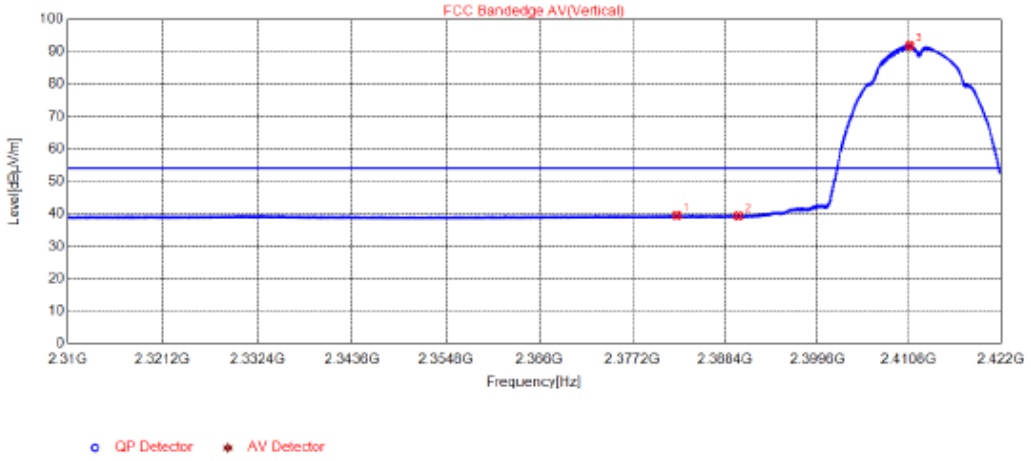
### b-2412MHz/ Vertical

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2384.0992 | 47.23 | 52.14 | 74.00 | 21.86 | 165 | 201 | Vertical | PK |
| 2 | 2390.0016 | 44.44 | 49.36 | 74.00 | 24.64 | 155 | 343 | Vertical | PK |
| 3 | 2412.0600 | 91.20 | 96.17 | 74.00 | -22.17 | 165 | 134 | Vertical | PK |

## Test Graph

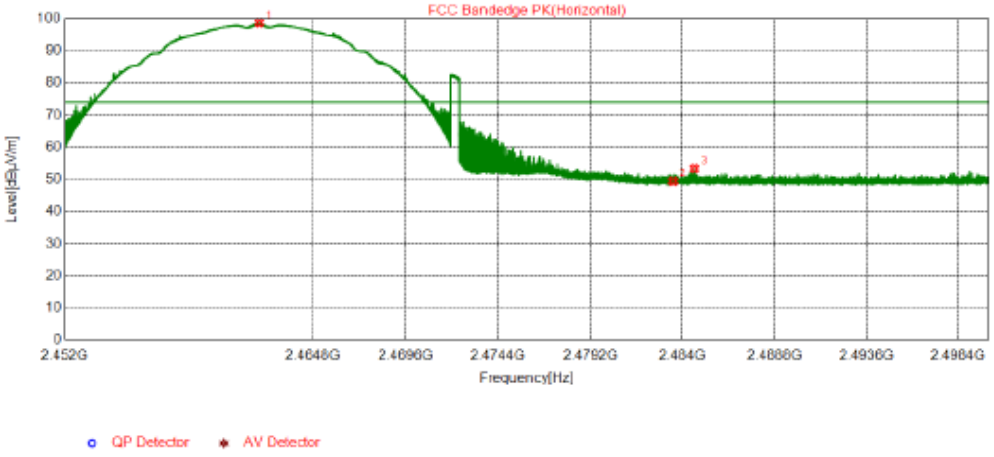



| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2382.5368 | 34.63 | 39.54 | 54.00 | 14.46 | 165 | 309 | Vertical | AV |
| 2 | 2390.0016 | 34.44 | 39.36 | 54.00 | 14.64 | 165 | 73 | Vertical | AV |
| 3 | 2410.8392 | 86.96 | 91.92 | 54.00 | -37.92 | 165 | 140 | Vertical | AV |

## Test Plot

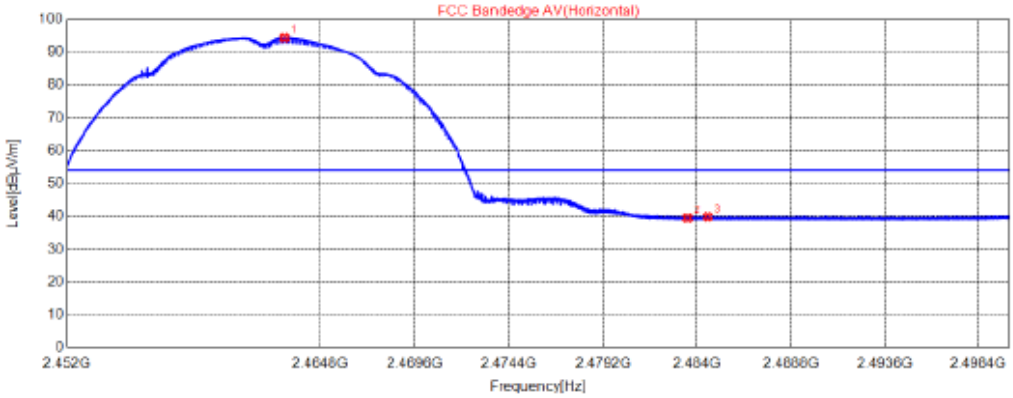
### b-2462MHz/ Horizontal

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2462.0272 | 93.72 | 98.77 | 74.00 | -24.77 | 165 | 176 | Horizontal | PK |
| 2 | 2483.5000 | 44.36 | 49.45 | 74.00 | 24.55 | 155 | 150 | Horizontal | PK |
| 3 | 2484.6040 | 48.24 | 53.33 | 74.00 | 20.67 | 155 | 184 | Horizontal | PK |

## Test Graph



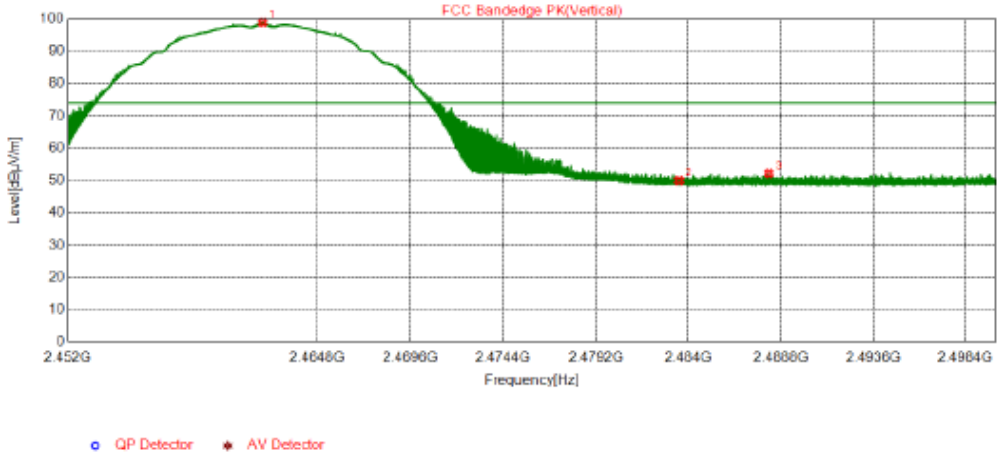

QP Detector  AV Detector

| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2462.9968 | 89.39 | 94.44 | 54.00 | -40.44 | 175 | 159 | Horizontal | AV |
| 2 | 2483.5000 | 34.42 | 39.51 | 54.00 | 14.49 | 155 | 174 | Horizontal | AV |
| 3 | 2484.5368 | 34.83 | 39.92 | 54.00 | 14.08 | 155 | 207 | Horizontal | AV |

## Test Plot

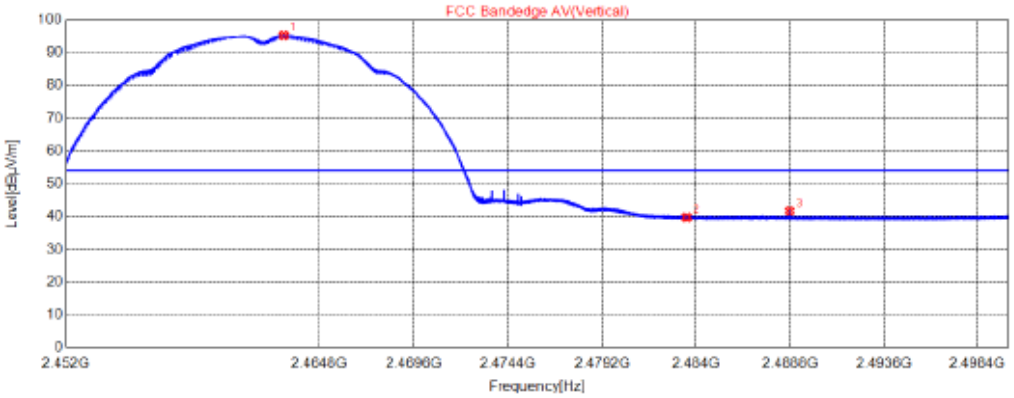
### b-2462MHz/ Vertical

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2461.9912 | 93.94 | 98.99 | 74.00 | -24.99 | 155 | 126 | Vertical | PK |
| 2 | 2483.5000 | 44.88 | 49.97 | 74.00 | 24.03 | 165 | 334 | Vertical | PK |
| 3 | 2488.1584 | 47.06 | 52.16 | 74.00 | 21.84 | 175 | 60 | Vertical | PK |

## Test Graph

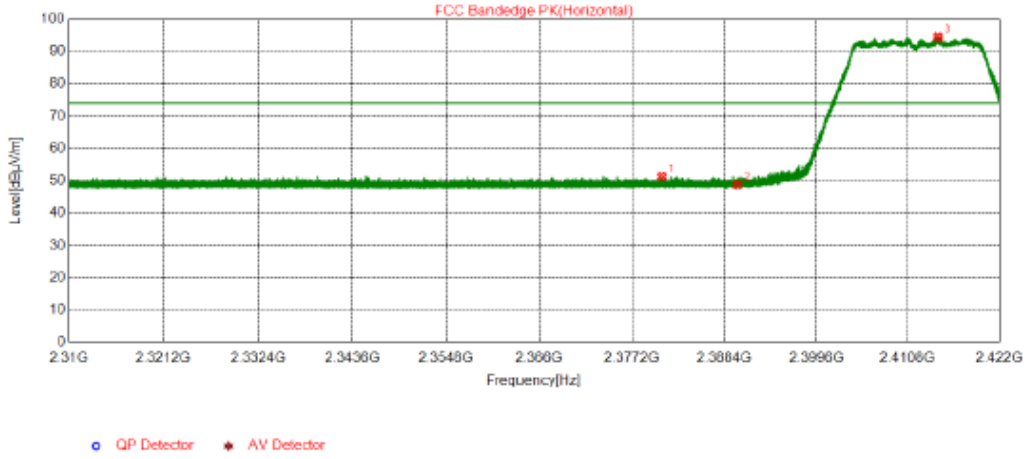



| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2463.0088 | 90.20 | 95.25 | 54.00 | -41.25 | 155 | 134 | Vertical | AV |
| 2 | 2483.5000 | 34.71 | 39.80 | 54.00 | 14.20 | 155 | 68 | Vertical | AV |
| 3 | 2488.7728 | 36.59 | 41.69 | 54.00 | 12.31 | 165 | 207 | Vertical | AV |

## Test Plot

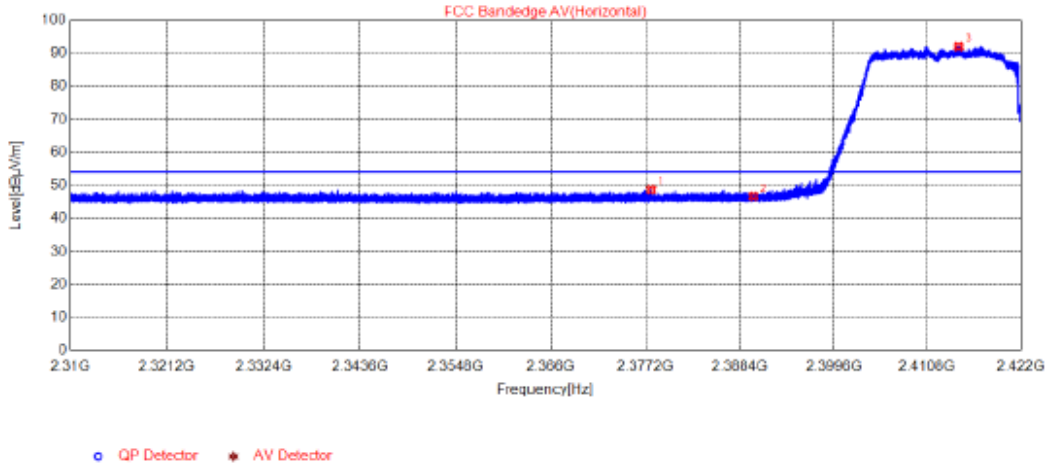
### g-2412MHz/ Horizontal

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2380.7896 | 46.39 | 51.29 | 74.00 | 22.71 | 165 | 293 | Horizontal | PK |
| 2 | 2390.0016 | 43.79 | 48.71 | 74.00 | 25.29 | 165 | 76 | Horizontal | PK |
| 3 | 2414.4960 | 89.51 | 94.48 | 74.00 | -20.48 | 175 | 200 | Horizontal | PK |

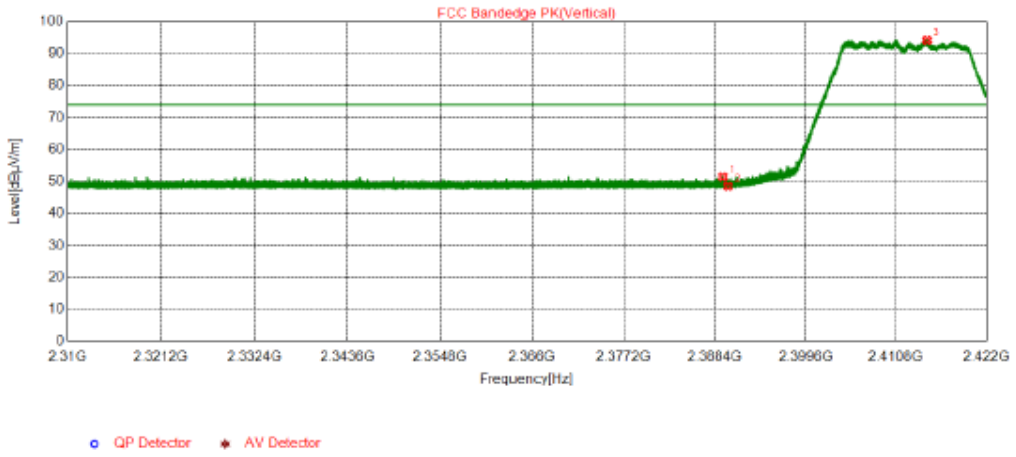
## Test Graph




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2377.8328 | 43.74 | 48.64 | 54.00 | 5.36 | 175 | 226 | Horizontal | AV |
| 2 | 2390.0016 | 41.79 | 46.71 | 54.00 | 7.29 | 155 | 193 | Horizontal | AV |
| 3 | 2414.5520 | 87.08 | 92.05 | 54.00 | -38.05 | 175 | 159 | Horizontal | AV |

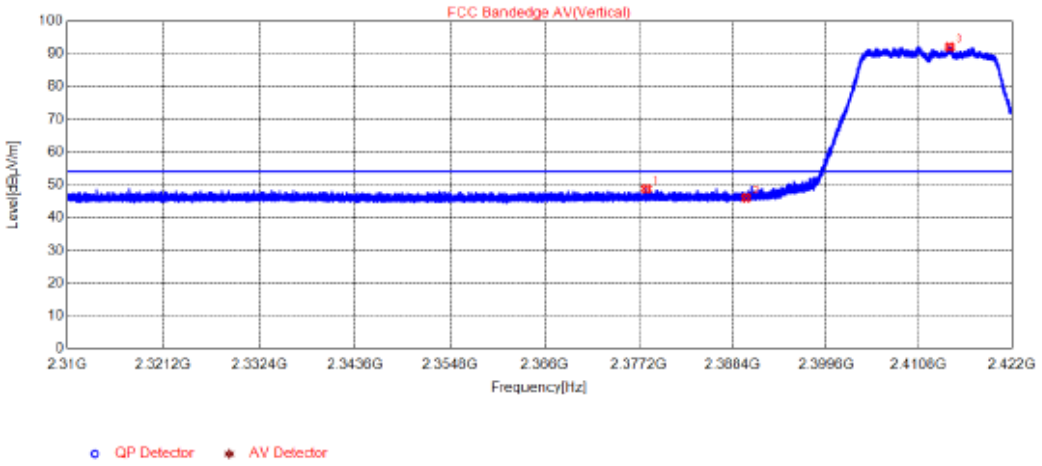
| Test Plot |
| --- |
| g-2412MHz/ Vertical |

Test Graph




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2389.3632 | 46.55 | 51.47 | 74.00 | 22.53 | 165 | 59 | Vertical | PK |
| 2 | 2390.0016 | 43.53 | 48.45 | 74.00 | 25.55 | 165 | 9 | Vertical | PK |
| 3 | 2414.6360 | 89.24 | 94.21 | 74.00 | -20.21 | 165 | 126 | Vertical | PK |

## Test Graph

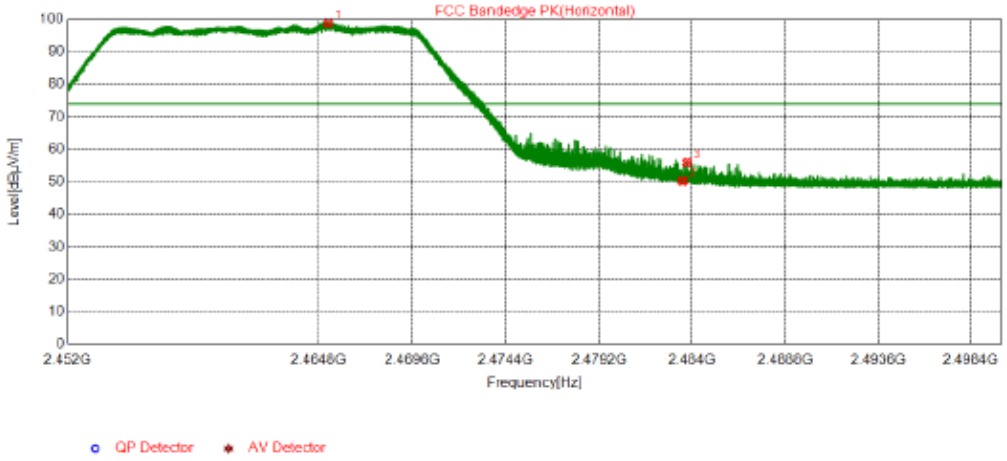



| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2378.0736 | 43.85 | 48.75 | 54.00 | 5.25 | 165 | 117 | Vertical | AV |
| 2 | 2390.0016 | 41.05 | 45.97 | 54.00 | 8.03 | 175 | 43 | Vertical | AV |
| 3 | 2414.5184 | 87.13 | 92.10 | 54.00 | -38.10 | 165 | 134 | Vertical | AV |

## Test Plot

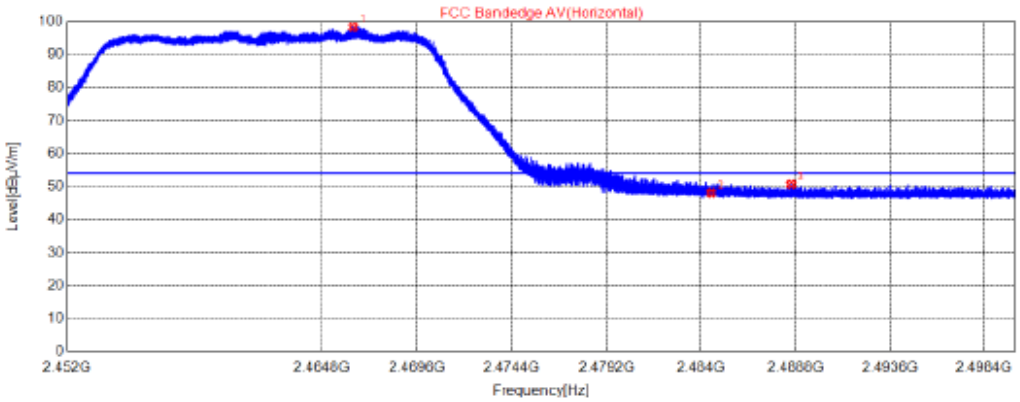
### g-2462MHz/ Horizontal

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2465.3056 | 93.89 | 98.95 | 74.00 | -24.95 | 165 | 184 | Horizontal | PK |
| 2 | 2483.5000 | 45.13 | 50.22 | 74.00 | 23.78 | 155 | 310 | Horizontal | PK |
| 3 | 2483.7352 | 50.89 | 55.98 | 74.00 | 18.02 | 175 | 9 | Horizontal | PK |

## Test Graph

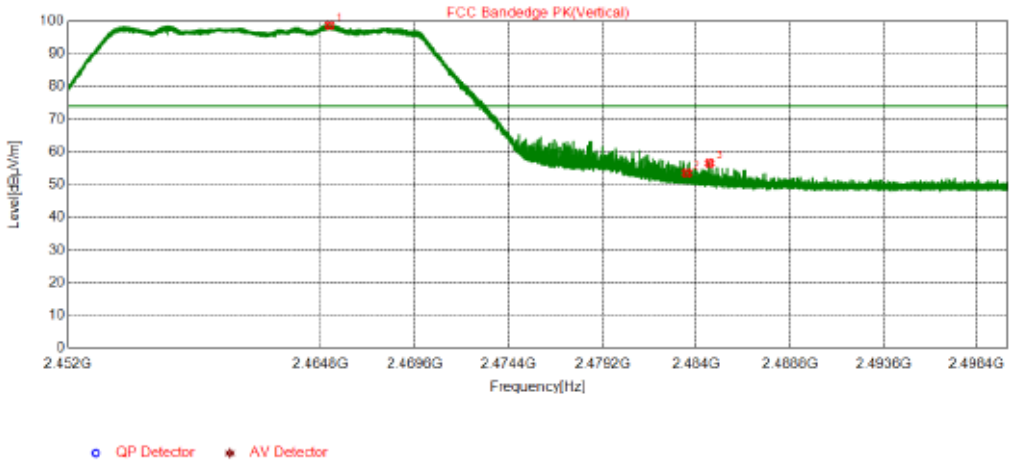



| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2466.3712 | 93.31 | 98.37 | 54.00 | -44.37 | 165 | 160 | Horizontal | AV |
| 2 | 2484.5008 | 42.92 | 48.01 | 54.00 | 5.99 | 175 | 217 | Horizontal | AV |
| 3 | 2488.5616 | 45.56 | 50.66 | 54.00 | 3.34 | 175 | 318 | Horizontal | AV |

## Test Plot

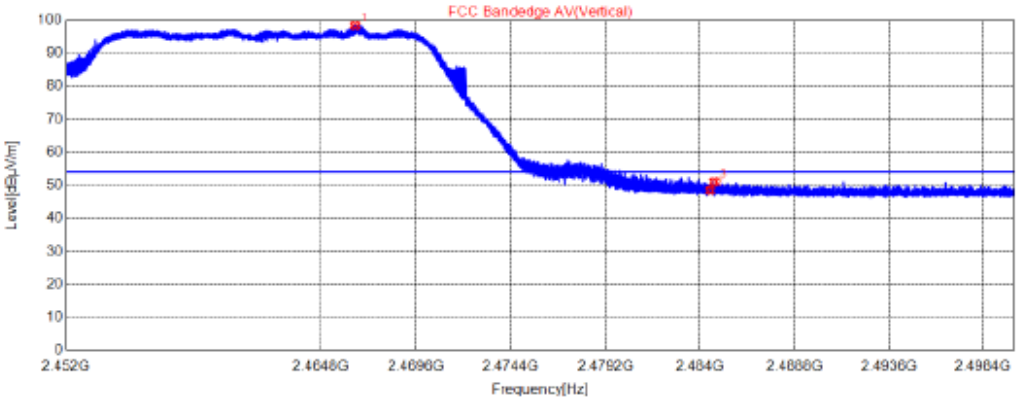
### g-2462MHz/ Vertical

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2465.2720 | 93.73 | 98.79 | 74.00 | -24.79 | 155 | 127 | Vertical | PK |
| 2 | 2483.5000 | 48.41 | 53.50 | 74.00 | 20.50 | 175 | 127 | Vertical | PK |
| 3 | 2484.6592 | 51.50 | 56.59 | 74.00 | 17.41 | 175 | 127 | Vertical | PK |

## Test Graph



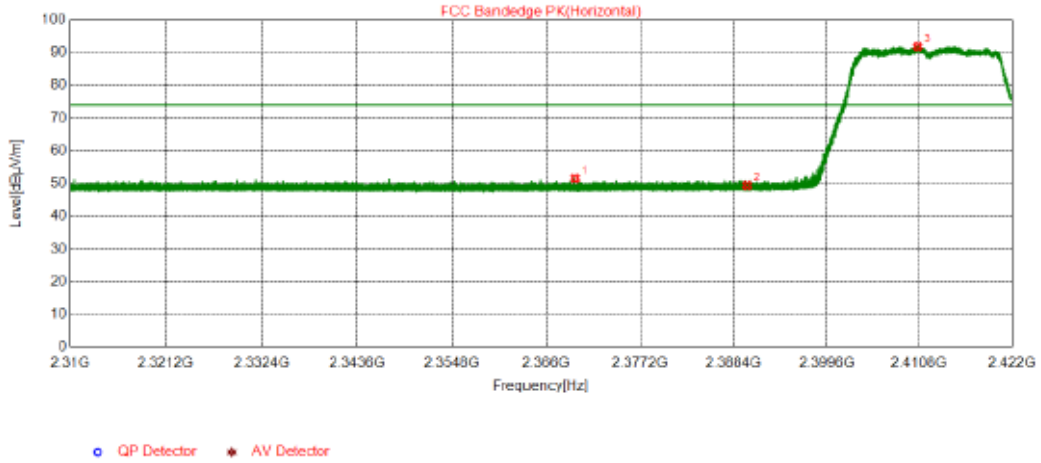

QP Detector  AV Detector

| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2466.5344 | 93.36 | 98.42 | 54.00 | -44.42 | 155 | 126 | Vertical | AV |
| 2 | 2484.5008 | 43.36 | 48.45 | 54.00 | 5.55 | 165 | 34 | Vertical | AV |
| 3 | 2484.6880 | 45.93 | 51.02 | 54.00 | 2.98 | 155 | 42 | Vertical | AV |

## Test Plot

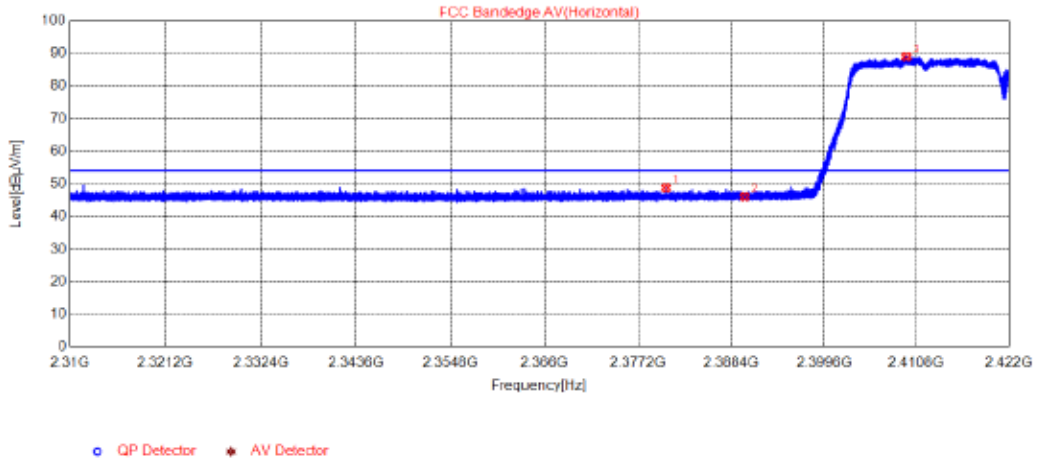
### n20-2412MHz/ Horizontal

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2369.3992 | 46.72 | 51.60 | 74.00 | 22.40 | 155 | 110 | Horizontal | PK |
| 2 | 2390.0016 | 44.55 | 49.47 | 74.00 | 24.53 | 155 | 177 | Horizontal | PK |
| 3 | 2410.5760 | 86.92 | 91.88 | 74.00 | -17.88 | 175 | 177 | Horizontal | PK |

## Test Graph

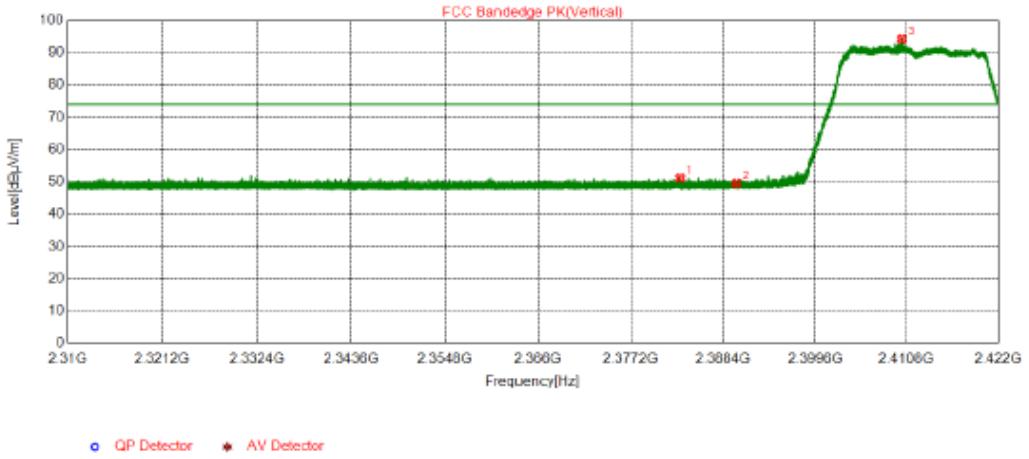



| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2380.5320 | 43.85 | 48.75 | 54.00 | 5.25 | 155 | 50 | Horizontal | AV |
| 2 | 2390.0016 | 41.08 | 46.00 | 54.00 | 8.00 | 165 | 310 | Horizontal | AV |
| 3 | 2409.5792 | 84.05 | 89.01 | 54.00 | -35.01 | 175 | 200 | Horizontal | AV |

## Test Plot

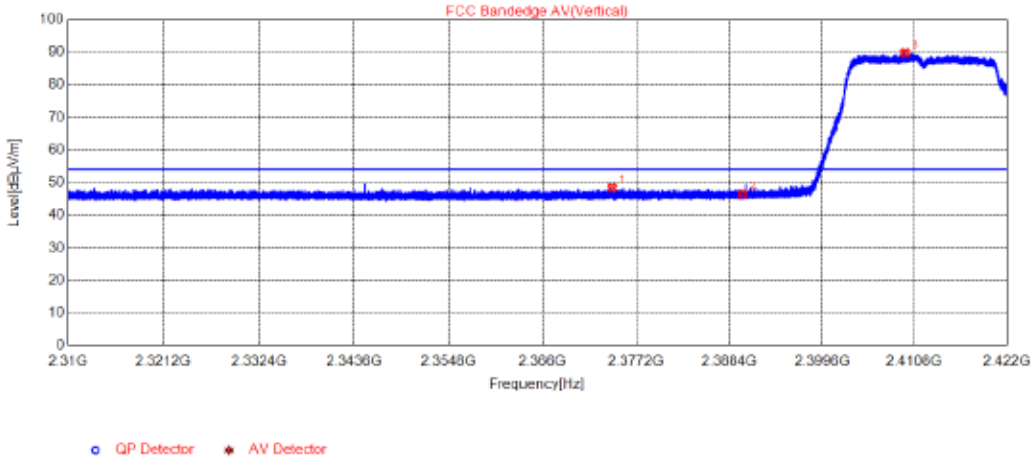
### n20-2412MHz/ Vertical

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2383.1808 | 46.25 | 51.16 | 74.00 | 22.84 | 155 | 244 | Vertical | PK |
| 2 | 2390.0016 | 44.65 | 49.57 | 74.00 | 24.43 | 175 | 127 | Vertical | PK |
| 3 | 2410.1952 | 89.36 | 94.32 | 74.00 | -20.32 | 175 | 27 | Vertical | PK |

## Test Graph

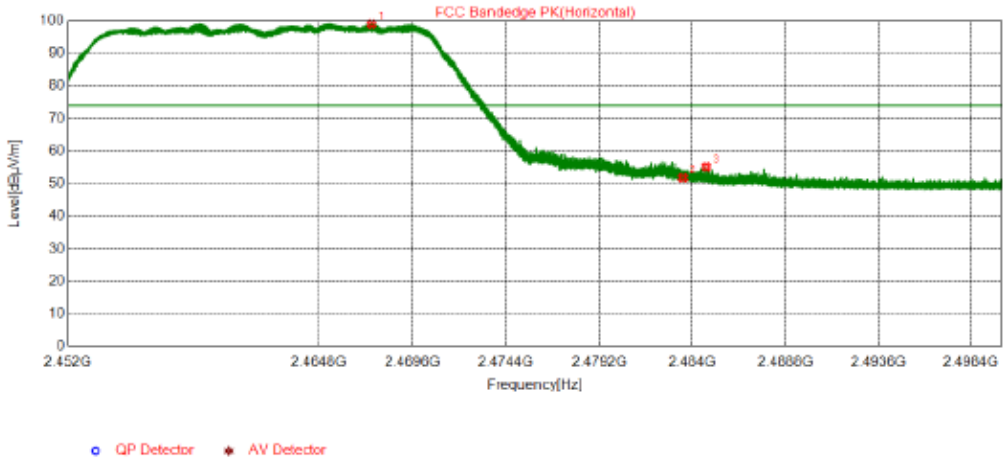



| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2374.2880 | 43.47 | 48.36 | 54.00 | 5.64 | 155 | 17 | Vertical | AV |
| 2 | 2390.0016 | 41.54 | 46.46 | 54.00 | 7.54 | 155 | 349 | Vertical | AV |
| 3 | 2409.6464 | 84.87 | 89.83 | 54.00 | -35.83 | 165 | 127 | Vertical | AV |

## Test Plot

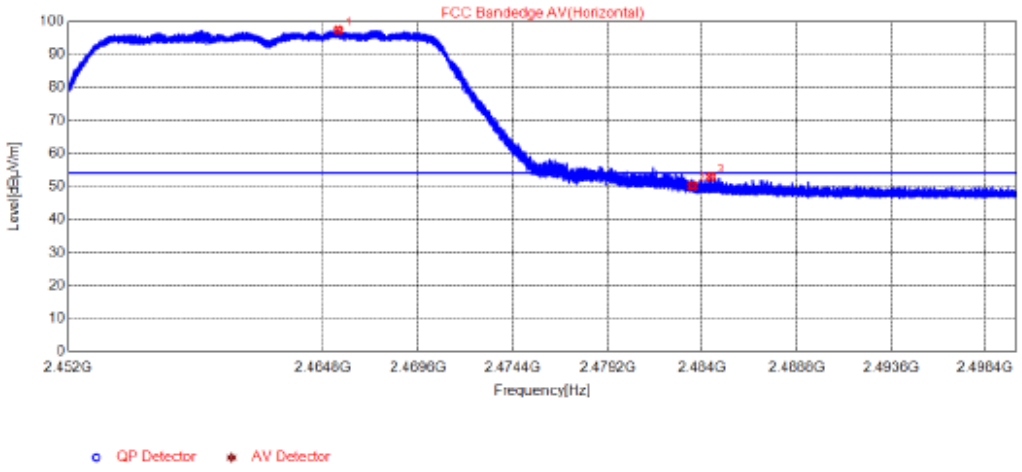
### n20-2462MHz/ Horizontal

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2467.5016 | 93.99 | 99.05 | 74.00 | -25.05 | 165 | 160 | Horizontal | PK |
| 2 | 2483.5000 | 46.74 | 51.83 | 74.00 | 22.17 | 155 | 187 | Horizontal | PK |
| 3 | 2484.6928 | 49.97 | 55.06 | 74.00 | 18.94 | 165 | 160 | Horizontal | PK |

## Test Graph

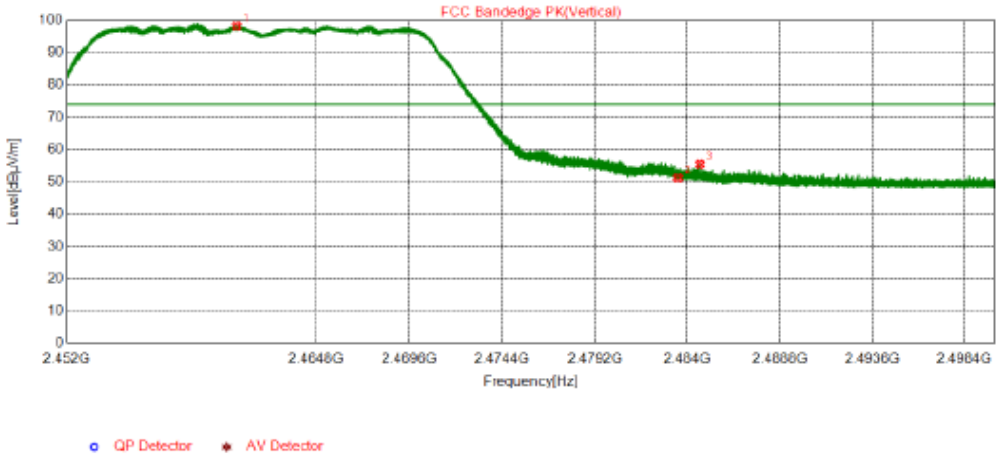



| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2465.5768 | 92.26 | 97.32 | 54.00 | -43.32 | 155 | 210 | Horizontal | AV |
| 2 | 2483.5000 | 45.08 | 50.17 | 54.00 | 3.83 | 165 | 183 | Horizontal | AV |
| 3 | 2484.4384 | 47.78 | 52.87 | 54.00 | 1.13 | 165 | 183 | Horizontal | AV |

## Test Plot

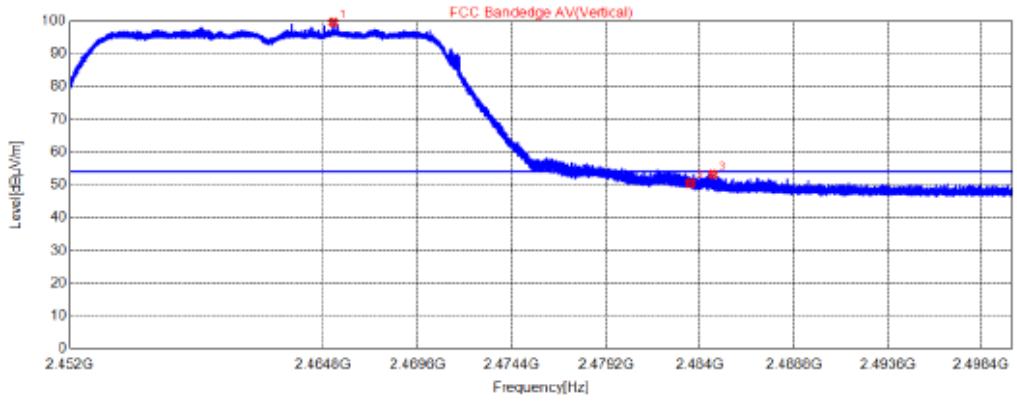
### n20-2462MHz/ Vertical

**Test Graph**




| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2460.7096 | 93.18 | 98.23 | 74.00 | -24.23 | 165 | 150 | Vertical | PK |
| 2 | 2483.5000 | 46.13 | 51.22 | 74.00 | 22.78 | 175 | 110 | Vertical | PK |
| 3 | 2484.6352 | 50.31 | 55.40 | 74.00 | 18.60 | 155 | 11 | Vertical | PK |

## Test Graph




QP Detector  AV Detector

| NO. | Freq. [MHz] | Reading [dBµV/m] | Level [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Polarity | Detector |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2465.3296 | 94.53 | 99.59 | 54.00 | -45.59 | 175 | 143 | Vertical | AV |
| 2 | 2483.5000 | 45.36 | 50.45 | 54.00 | 3.55 | 175 | 143 | Vertical | AV |
| 3 | 2484.6352 | 48.04 | 53.13 | 54.00 | 0.87 | 165 | 67 | Vertical | AV |

## 5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

---------- END ----------