

# ltron, Inc.

REVISED TEST REPORT TO 103786-2

**ORRNC**  
**Model: RN-EGM**

**Tested to The Following Standards:**

**FCC Part 15 Subpart C Section(s)**

**15.207 & 15.247**  
**(DTS 2400-2483.5 MHz)**

**Report No.: 103786-2A**

**Date of issue: July 16, 2020**



**Test Certificate # 803.01**

This test report bears the accreditation symbol indicating that the testing performed herein meets the test and reporting requirements of ISO/IEC 17025 under the applicable scope of testing for CKC Laboratories, Inc.

We strive to create long-term, trust based relationships by providing sound, adaptive, customer first testing services. We embrace each of our customers' unique EMC challenges, not as an interruption to set processes, but rather as the reason we are in business.

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## ADMINISTRATIVE INFORMATION

### Test Report Information

**REPORT PREPARED FOR:**

Ittron, Inc.  
2111 N. Molter Road  
Liberty Lake, WA 99019

Representative: Jay Holcomb  
Customer Reference Number: 205550

**DATE OF EQUIPMENT RECEIPT:****DATE(S) OF TESTING:****REPORT PREPARED BY:**

Darcy Thompson  
CKC Laboratories, Inc.  
5046 Sierra Pines Drive  
Mariposa, CA 95338

Project Number: 103786

May 7, 2020

May 7-15, 2020 and July 7 and 10, 2020

### Revision History

**Original:** Testing of the ORRNC Model: RN-EGM to FCC Part 15 Subpart C Section(s) 15.207 & 15.247 (DTS 2400-2483.5 MHz).

**Revision A:** Updated the test equipment table in Section 15.247(b)(3) Power Output, revised calculation statements in Sections 15.247(b)(3) Power Output and Section 15.247(e) PSD and replaced Section 15.247(d) Band Edge results table, plot data and datasheet. Added new test dates.

### Report Authorization

The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the equipment provided by the client, tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



**Steve Behm**  
*Director of Quality Assurance & Engineering Services*  
CKC Laboratories, Inc.

## Test Facility Information



Our laboratories are configured to effectively test a wide variety of product types. CKC utilizes first class test equipment, anechoic chambers, data acquisition and information services to create accurate, repeatable and affordable test results.

TEST LOCATION(S):  
CKC Laboratories, Inc.  
22116 23rd Drive S.E., Suite A  
Canyon Park, Bothell, WA 98021

## Software Versions

| CKC Laboratories Proprietary Software | Version |
|---------------------------------------|---------|
| EMITest Emissions                     | 5.03.12 |
| EMITest Emissions                     | 5.03.19 |

## Site Registration & Accreditation Information

| Location                 | *NIST CB # | FCC    | Japan  |
|--------------------------|------------|--------|--------|
| Canyon Park, Bothell, WA | US0081     | US1022 | A-0136 |
| Brea, CA                 | US0060     | US1025 | A-0136 |
| Fremont, CA              | US0082     | US1023 | A-0136 |
| Mariposa, CA             | US0103     | US1024 | A-0136 |

\*CKC's list of NIST designated countries can be found at: <https://standards.gov/cabs/designations.html>

## SUMMARY OF RESULTS

### Standard / Specification: FCC Part 15 Subpart C - 15.247 (DTS)

| Test Procedure | Description                        | Modifications | Results |
|----------------|------------------------------------|---------------|---------|
| 15.247(a)(2)   | 6dB Bandwidth                      | NA            | Pass    |
| 15.247(b)(3)   | Output Power                       | NA            | Pass    |
| 15.247(e)      | Power Spectral Density             | NA            | Pass    |
| 15.247(d)      | RF Conducted Emissions & Band Edge | NA            | NA1     |
| 15.247(d)      | Radiated Emissions & Band Edge     | NA            | Pass    |
| 15.207         | AC Conducted Emissions             | NA            | Pass    |

NA = Not Applicable

NA1 = Not applicable because EUT has an integral antenna.

#### ISO/IEC 17025 Decision Rule

The declaration of pass or fail herein is based upon assessment to the specification(s) listed above, including where applicable, assessment of measurement uncertainties. For performance related tests, equipment was monitored for specified criteria identified in that section of testing.

## Modifications During Testing

This list is a summary of the modifications made to the equipment during testing.

#### Summary of Conditions

No modifications were made during testing.

**Modifications listed above must be incorporated into all production units.**

## Conditions During Testing

This list is a summary of the conditions noted to the equipment during testing.

#### Summary of Conditions

None

## EQUIPMENT UNDER TEST (EUT)

During testing, numerous configurations may have been utilized. The configurations listed below support compliance to the standard(s) listed in the Summary of Results section.

### Configuration 1

#### Equipment Tested:

| Device | Manufacturer | Model # | S/N   |
|--------|--------------|---------|-------|
| ORRNC  | Itron, Inc.  | RN-EGM  | FCC-1 |

#### Support Equipment:

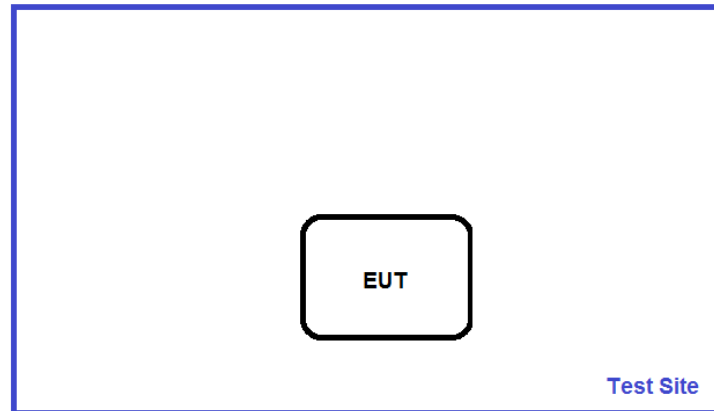
| Device                | Manufacturer | Model #       | S/N |
|-----------------------|--------------|---------------|-----|
| Antenna (Transceiver) | PCTEL        | BOA9022NM-ITR | NA  |
| Antenna (Receiver)    | PCTEL        | BOA9025NM-ITR | NA  |

### General Product Information:

| Product Information                | Manufacturer-Provided Details                                                                                                                |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Equipment Type:                    | Stand-Alone Equipment                                                                                                                        |
| Type of Wideband System:           | 802.11b/g/n20/n40                                                                                                                            |
| Operating Frequency Range:         | 2412-2462MHz                                                                                                                                 |
| Modulation Type(s):                | 802.11b 1M (DBPSK)<br>802.11b 5M (CCK)<br>802.11b 11M (CCK)<br>802.11g 54M (OFDM)<br>802.11n20 65M/MCS7 (64-QAM)<br>802.11n40 MCS11 (16-QAM) |
| Maximum Duty Cycle:                | Assume 100% as worst case                                                                                                                    |
| Number of TX Chains:               | 1                                                                                                                                            |
| Antenna Type(s) and Gain:          | Trace, -5dBi                                                                                                                                 |
| Beamforming Type:                  | NA                                                                                                                                           |
| Antenna Connection Type:           | Integral                                                                                                                                     |
| Nominal Input Voltage:             | 115VAC Nominal (85-264VAC supported)                                                                                                         |
| Firmware / Software used for Test: | TeraTerm v4.104<br>Calibrator 0.8<br>Test FW 0.0.0.0 (current as of 4/27/2020)                                                               |

**Block Diagram of Test Setup(s)**

**Test Setup Block Diagram**



## FCC Part 15 Subpart C

### 15.247(a)(2) 6dB Bandwidth

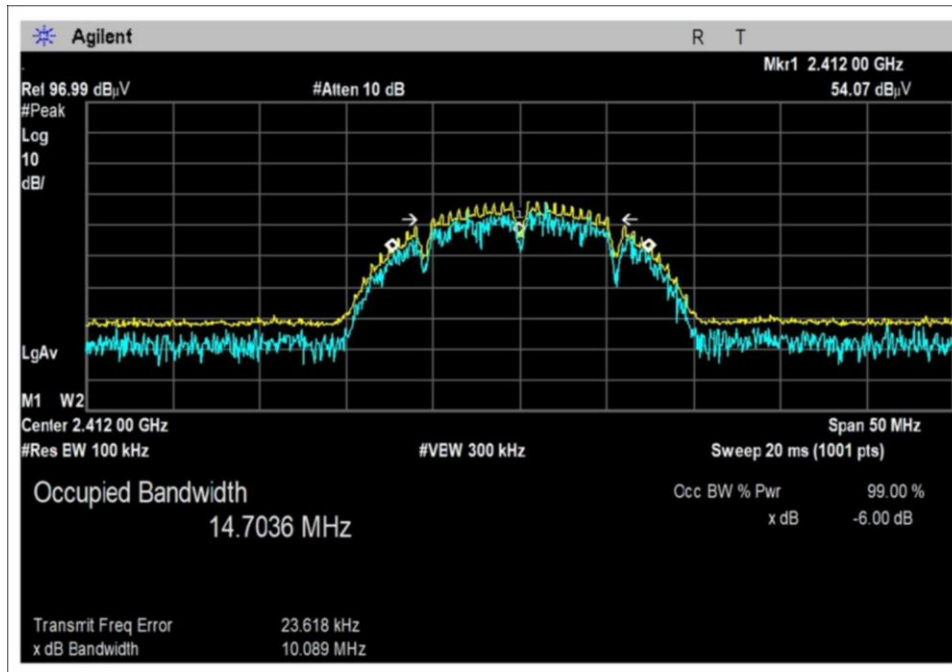
| Test Setup/Conditions |                                                                                                                                          |                |             |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|
| Test Location:        | Bothell Lab C3                                                                                                                           | Test Engineer: | M. Atkinson |
| Test Method:          | ANSI C63.10 (2013), KDB 558074<br>v05r02: 04/02/2019                                                                                     | Test Date(s):  | 5/12/2020   |
| Configuration:        | 1                                                                                                                                        |                |             |
| Test Setup:           | The equipment under test (EUT) is placed on the tabletop.<br>The EUT is transmitting at its rated output power through integral antenna. |                |             |

| Environmental Conditions |    |                        |       |
|--------------------------|----|------------------------|-------|
| Temperature (°C)         | 24 | Relative Humidity (%): | 100.5 |

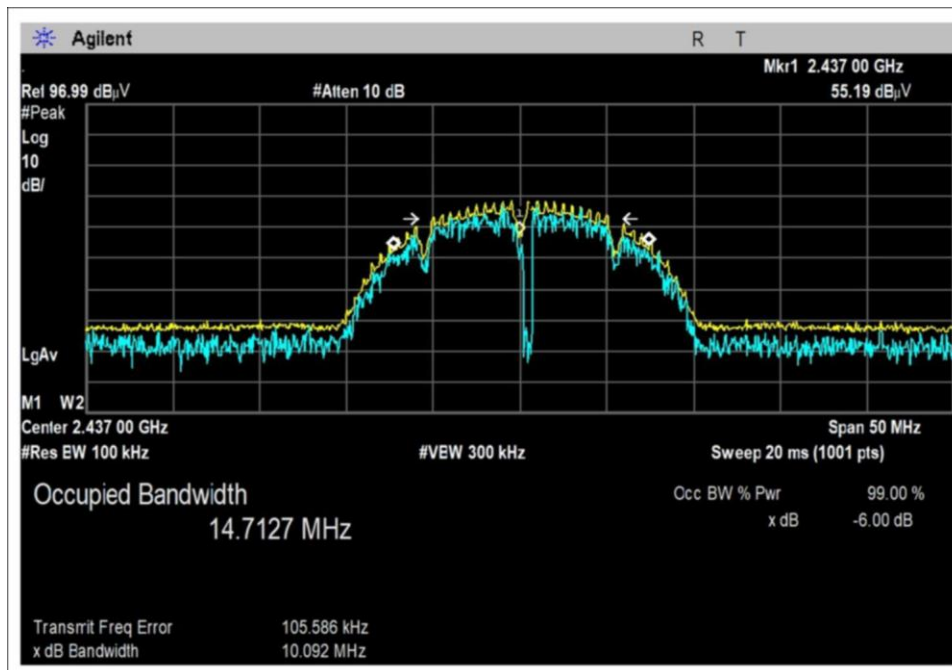
| Test Equipment |                   |              |        |           |           |
|----------------|-------------------|--------------|--------|-----------|-----------|
| Asset#         | Description       | Manufacturer | Model  | Cal Date  | Cal Due   |
| 02673          | Spectrum Analyzer | Agilent      | E4446A | 2/22/2019 | 2/22/2021 |
| P06540         | Cable             | Andrews      | Heliac | 8/23/2019 | 8/23/2021 |
| P06515         | Cable             | Andrews      | Heliac | 6/29/2018 | 6/29/2020 |
| 01467          | Horn Antenna      | EMCO         | 3115   | 7/5/2019  | 7/5/2021  |

| Test Data Summary |              |                   |                |             |         |
|-------------------|--------------|-------------------|----------------|-------------|---------|
| Frequency (MHz)   | Antenna Port | Modulation        | Measured (MHz) | Limit (MHz) | Results |
| 2412              | 1            | 802.11b 1Mbps     | 10.089         | ≥0.500      | Pass    |
| 2437              | 1            | 802.11b 1Mbps     | 10.092         | ≥0.500      | Pass    |
| 2462              | 1            | 802.11b 1Mbps     | 10.083         | ≥0.500      | Pass    |
| 2412              | 1            | 802.11b 5Mbps     | 9.675          | ≥0.500      | Pass    |
| 2437              | 1            | 802.11b 5Mbps     | 9.786          | ≥0.500      | Pass    |
| 2462              | 1            | 802.11b 5Mbps     | 10.446         | ≥0.500      | Pass    |
| 2412              | 1            | 802.11b 11Mbps    | 9.930          | ≥0.500      | Pass    |
| 2437              | 1            | 802.11b 11Mbps    | 11.050         | ≥0.500      | Pass    |
| 2462              | 1            | 802.11b 11Mbps    | 10.983         | ≥0.500      | Pass    |
| 2412              | 1            | 802.11g 54Mbps    | 15.419         | ≥0.500      | Pass    |
| 2437              | 1            | 802.11g 54Mbps    | 15.704         | ≥0.500      | Pass    |
| 2462              | 1            | 802.11g 54Mbps    | 15.443         | ≥0.500      | Pass    |
| 2412              | 1            | 802.11n20 (MCS7)  | 15.442         | ≥0.500      | Pass    |
| 2437              | 1            | 802.11n20 (MCS7)  | 15.066         | ≥0.500      | Pass    |
| 2462              | 1            | 802.11n20 (MCS7)  | 15.147         | ≥0.500      | Pass    |
| 2422              | 1            | 802.11n40 (MCS11) | 33.952         | ≥0.500      | Pass    |
| 2437              | 1            | 802.11n40 (MCS11) | 33.962         | ≥0.500      | Pass    |
| 2452              | 1            | 802.11n40 (MCS11) | 33.768         | ≥0.500      | Pass    |

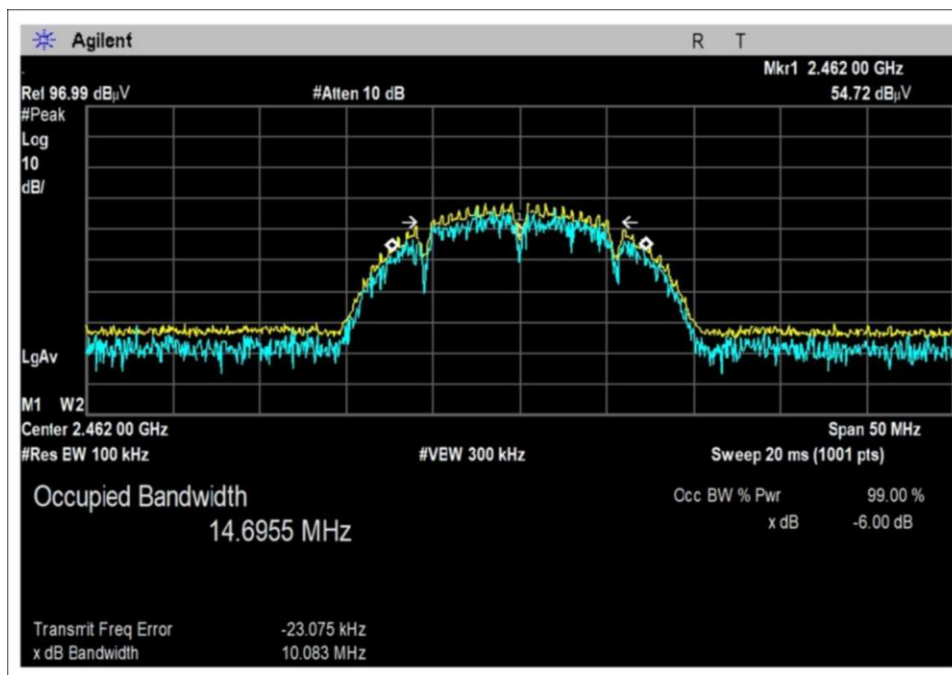
Plot(s)



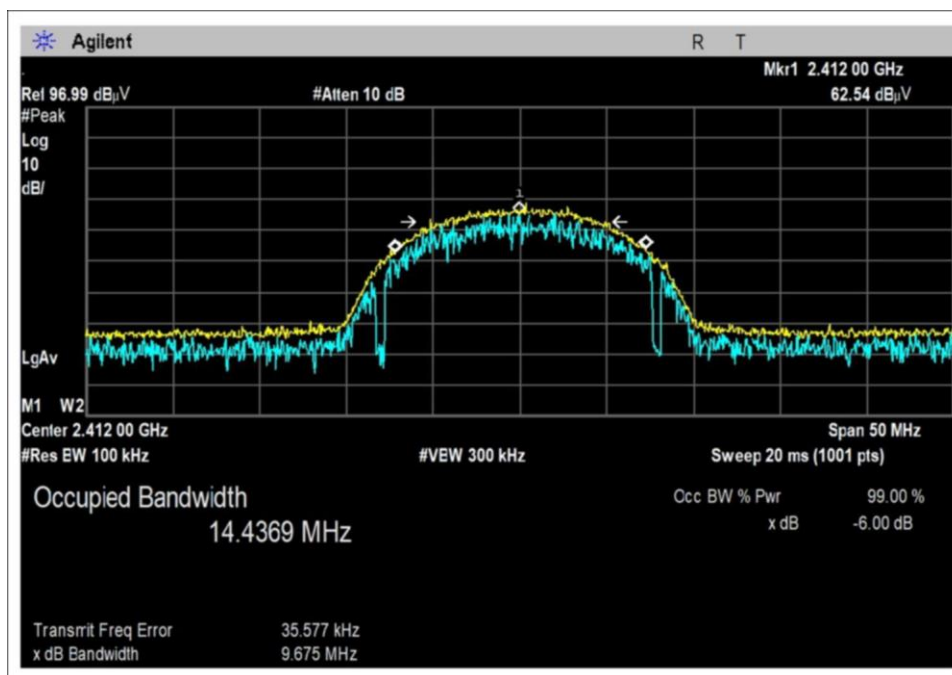
802.11b 1Mbps Low Channel



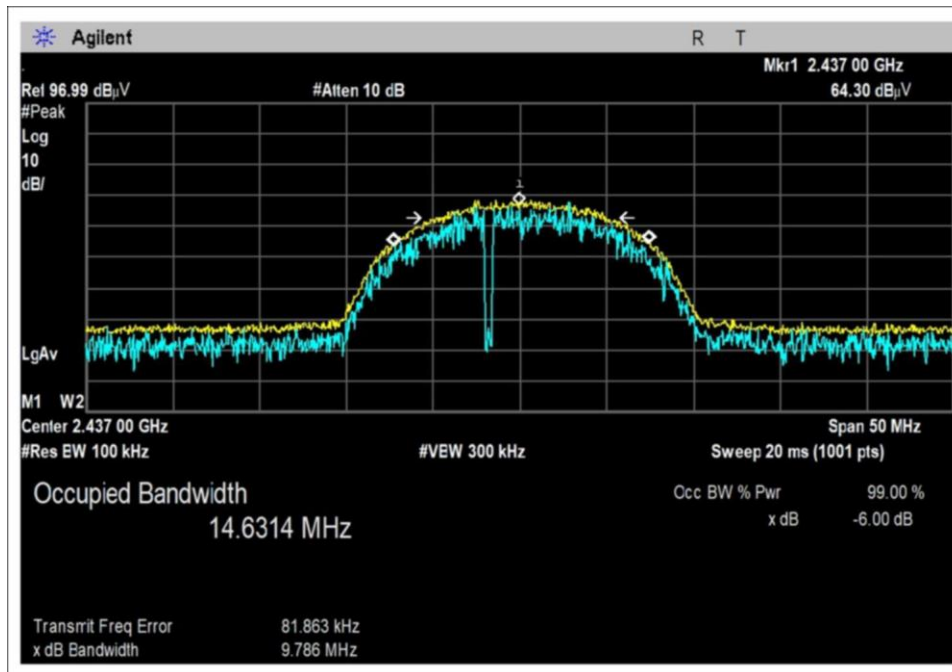
802.11b 1Mbps Middle Channel



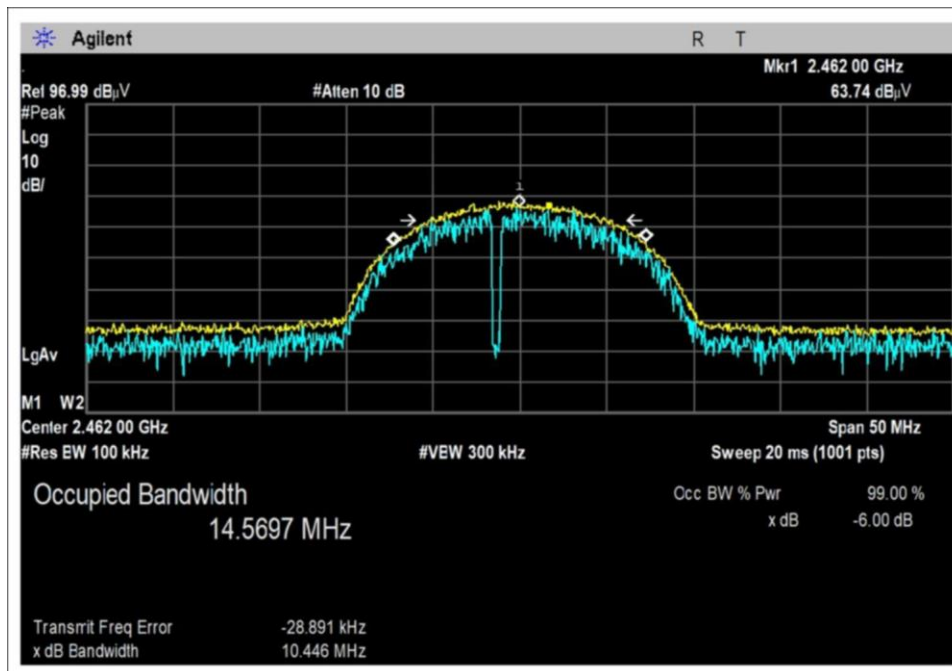
802.11b 1Mbps High Channel



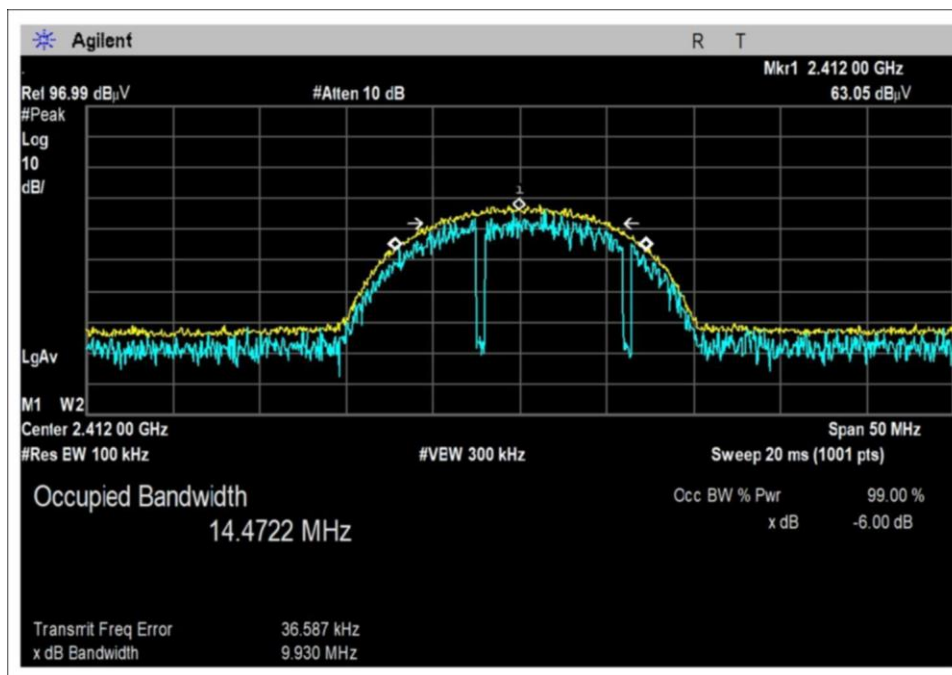
802.11b 5Mbps Low Channel



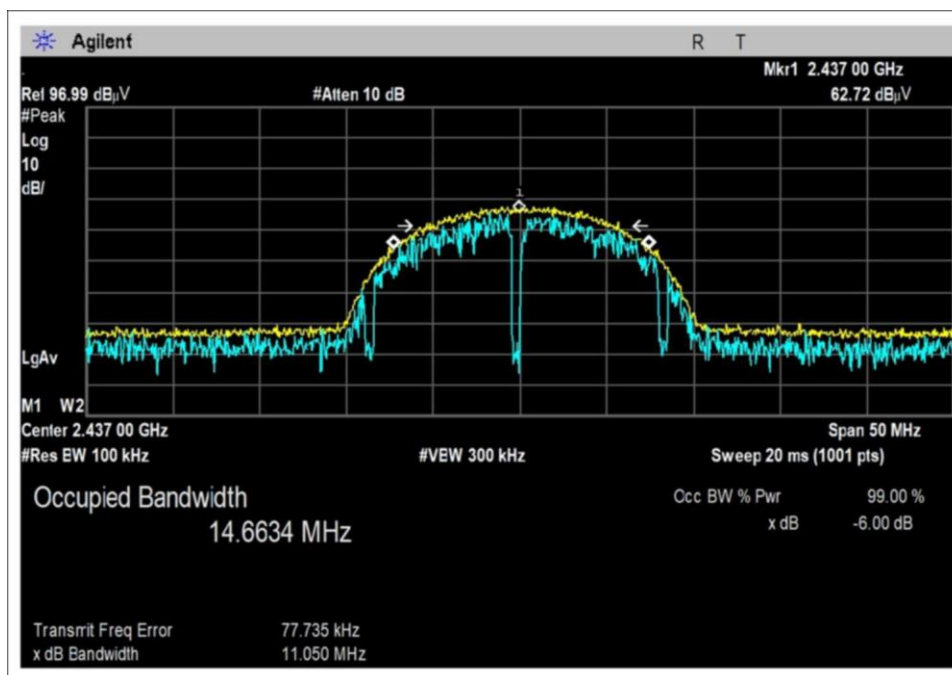
802.11b 5Mbps Middle Channel



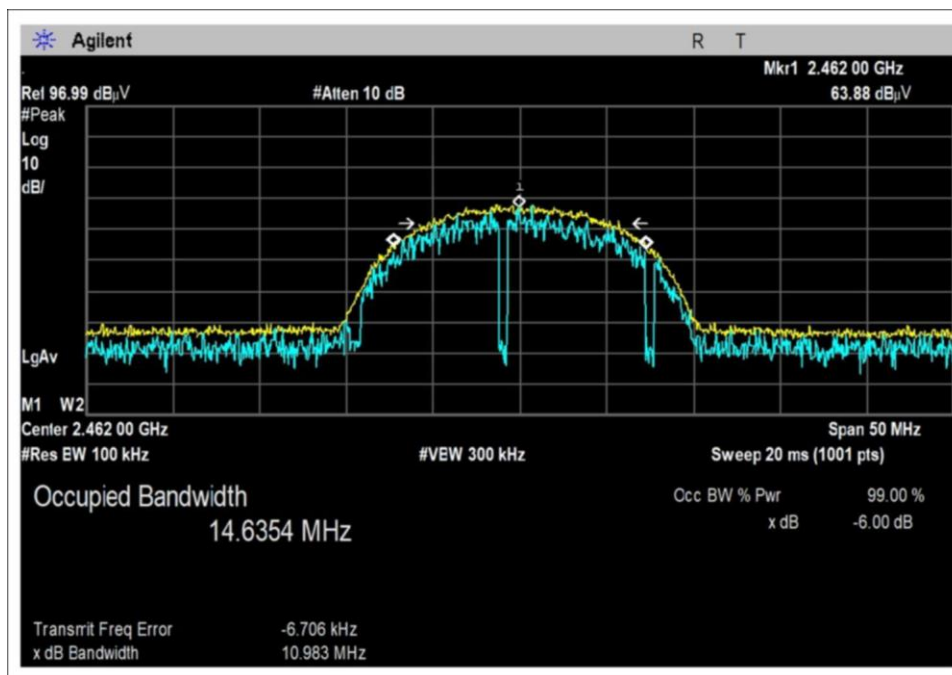
802.11b 5Mbps High Channel



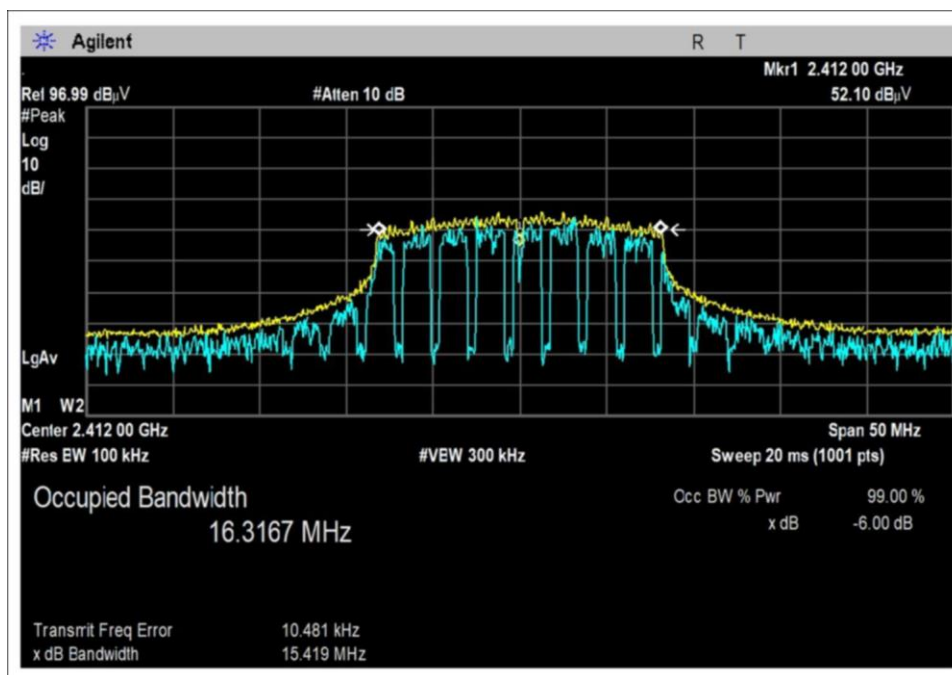
802.11b 11Mbps Low Channel



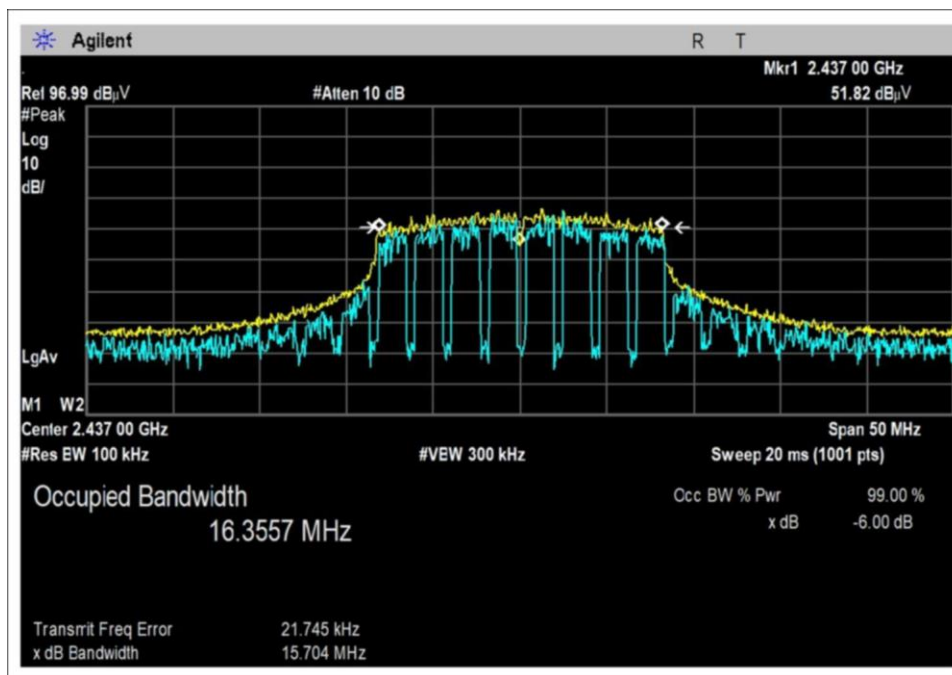
802.11b 11Mbps Middle Channel



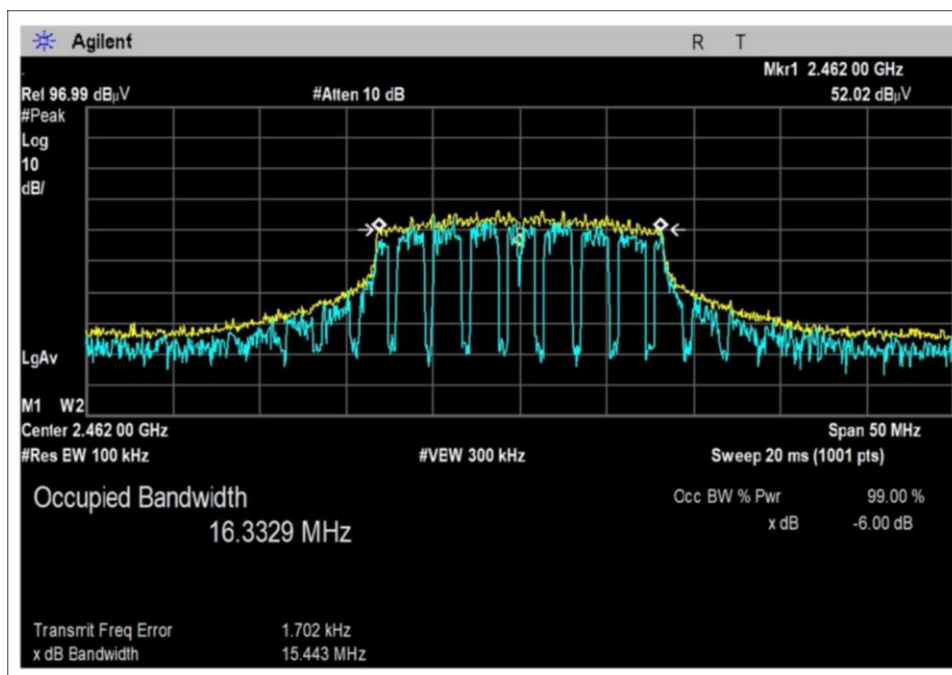
802.11b 11Mbps High Channel



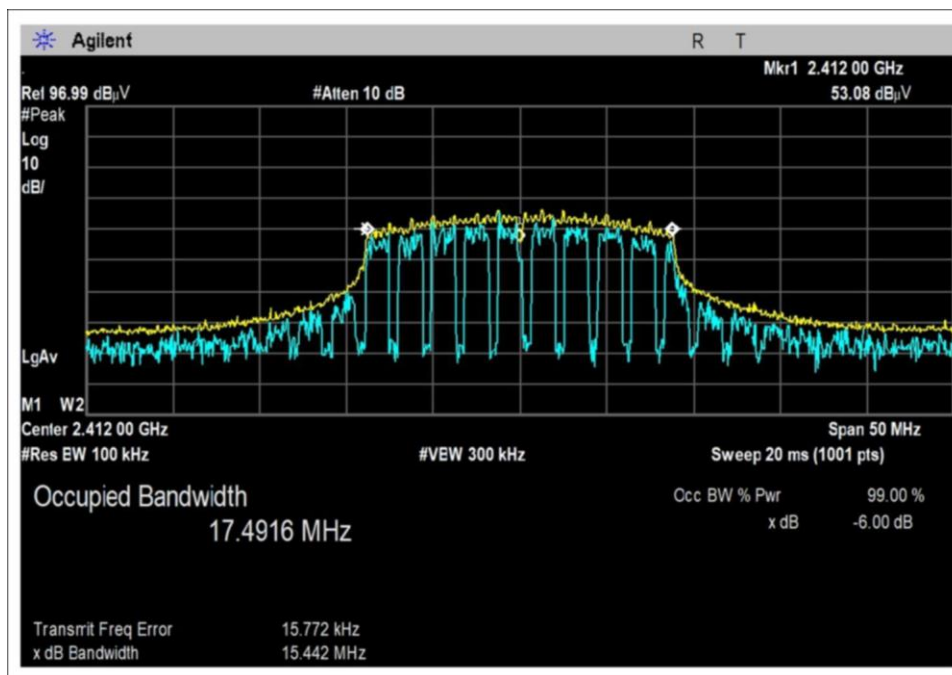
802.11g 54Mbps Low Channel



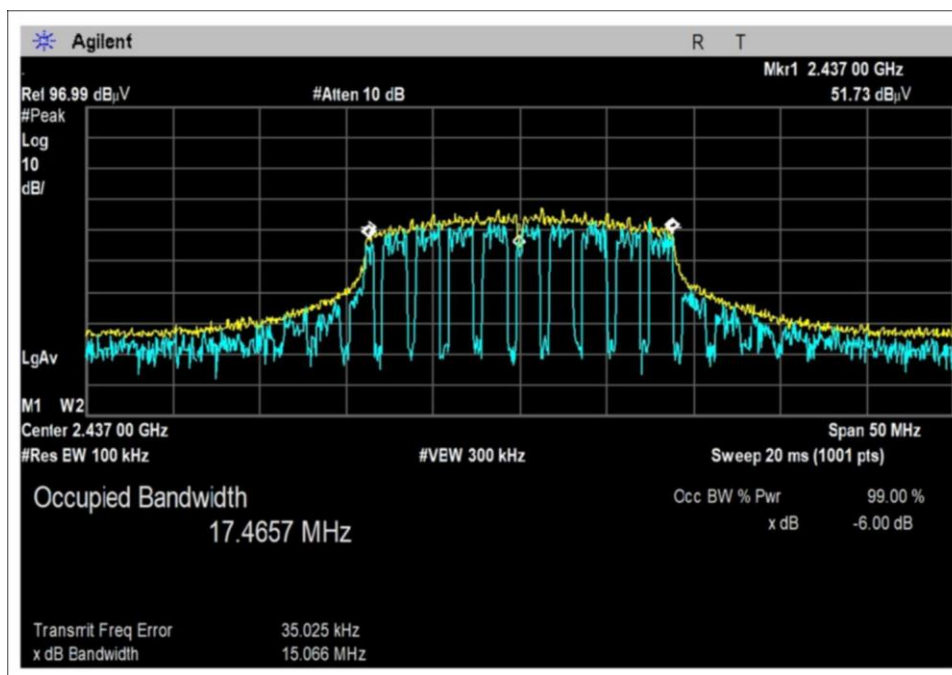
802.11g 54Mbps Middle Channel



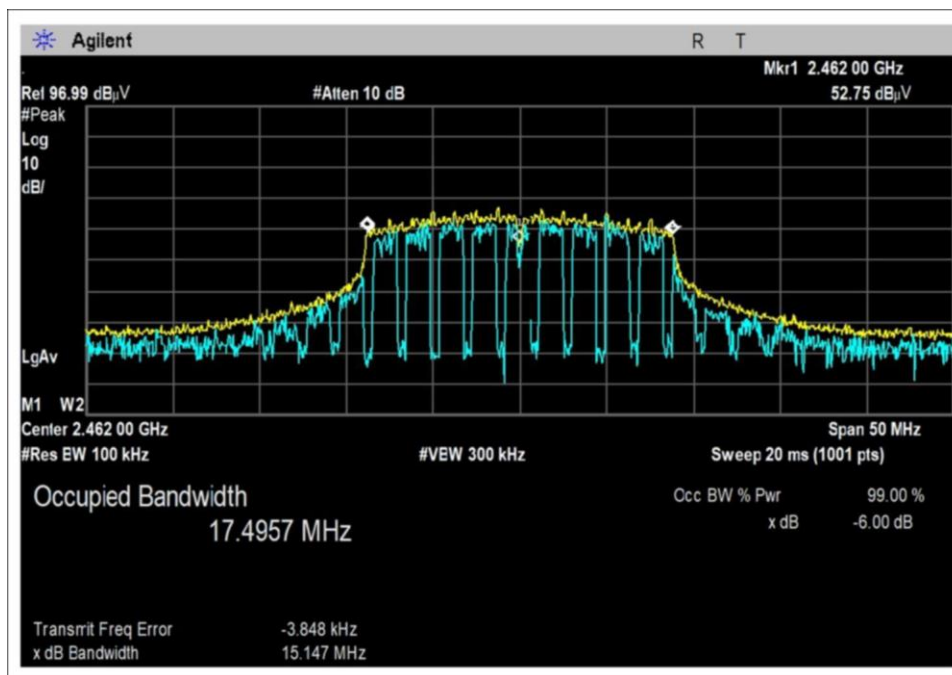
802.11g 54Mbps High Channel



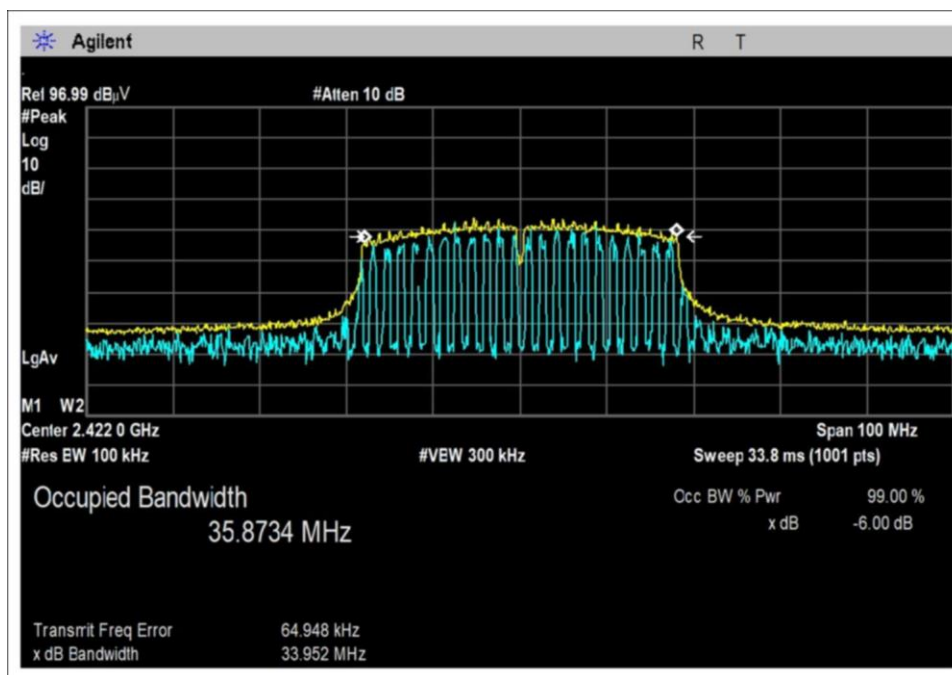
802.11n20 Low Channel



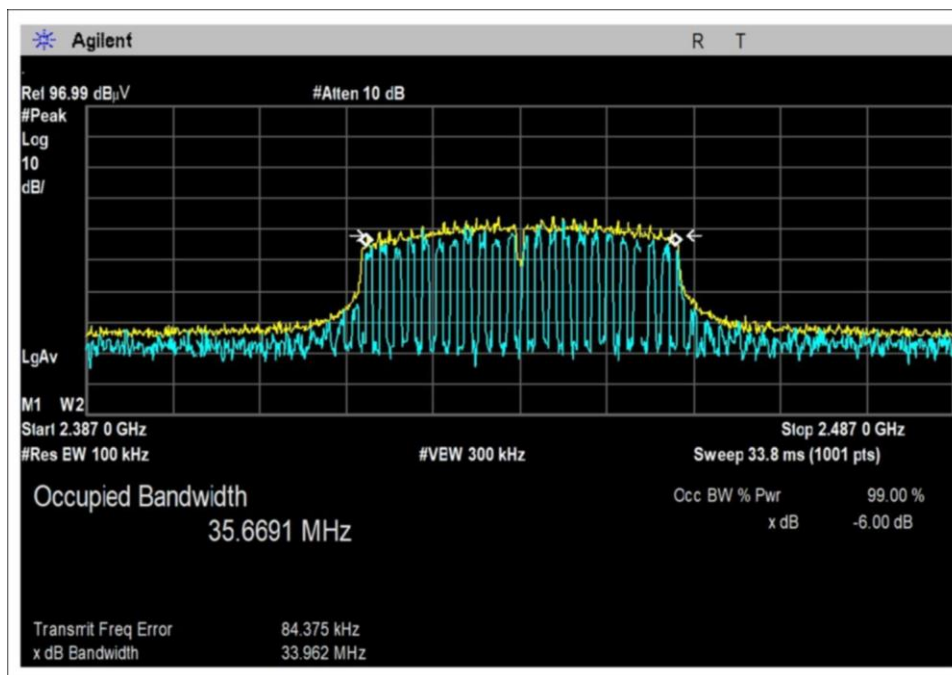
802.11n20 Middle Channel



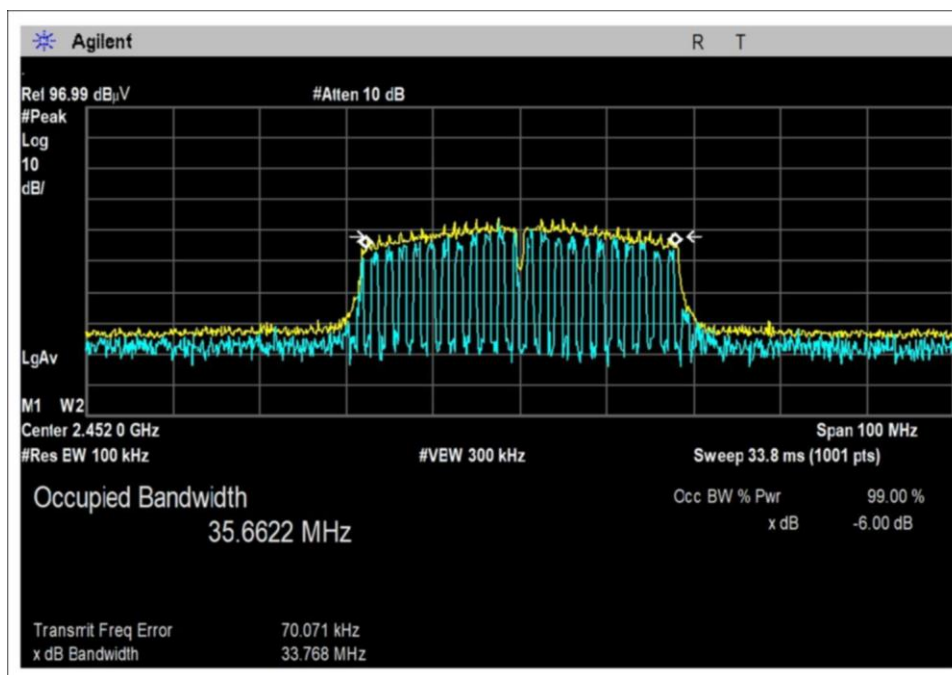
802.11n20 High Channel



802.11n40 Low Channel



802.11n40 Middle Channel



802.11n40 High Channel

Test Setup Photo(s)



## 15.247(b)(3) Output Power

| Test Data Summary - Voltage Variations |                       |                            |                            |                            |                                              |
|----------------------------------------|-----------------------|----------------------------|----------------------------|----------------------------|----------------------------------------------|
| Frequency (MHz)                        | Modulation / Ant Port | V <sub>Minimum</sub> (dBm) | V <sub>Nominal</sub> (dBm) | V <sub>Maximum</sub> (dBm) | Max Deviation from V <sub>Nominal</sub> (dB) |
| 2412                                   | 802.11b 1Mbps         | 24.2                       | 24.2                       | 24.2                       | 0                                            |
| 2437                                   | 802.11b 1Mbps         | 25.2                       | 25.2                       | 25.2                       | 0                                            |
| 2462                                   | 802.11b 1Mbps         | 24.8                       | 24.8                       | 24.8                       | 0                                            |
| 2422                                   | 802.11n40 (MCS11)     | 24.8                       | 24.7                       | 24.9                       | 0.2                                          |
| 2437                                   | 802.11n40 (MCS11)     | 25.1                       | 25                         | 25.2                       | 0.2                                          |
| 2452                                   | 802.11n40 (MCS11)     | 24.8                       | 24.7                       | 24.9                       | 0.2                                          |

Test performed using operational mode with the highest output power, representing worst case.

### ***Parameter Definitions:***

Measurements performed at input voltage according to manufacturer specification.

| Parameter              | Value |
|------------------------|-------|
| V <sub>Nominal</sub> : | 115   |
| V <sub>Minimum</sub> : | 85    |
| V <sub>Maximum</sub> : | 264   |

| Test Data Summary - Radiated Measurement |                   |                        |                             |                  |             |         |
|------------------------------------------|-------------------|------------------------|-----------------------------|------------------|-------------|---------|
| Measurement Option: PKPM1                |                   |                        |                             |                  |             |         |
| Frequency (MHz)                          | Modulation        | Ant. Type / Gain (dBi) | Field Strength (dBuV/m @3m) | Calculated (dBm) | Limit (dBm) | Results |
| 2412                                     | 802.11b 1Mbps     | Trace, -5dBi           | 114.4                       | 24.2             | ≤30         | Pass    |
| 2437                                     | 802.11b 1Mbps     | Trace, -5dBi           | 115.4                       | 25.2             | ≤30         | Pass    |
| 2462                                     | 802.11b 1Mbps     | Trace, -5dBi           | 115                         | 24.8             | ≤30         | Pass    |
| 2412                                     | 802.11b 5Mbps     | Trace, -5dBi           | 114.4                       | 24.2             | ≤30         | Pass    |
| 2437                                     | 802.11b 5Mbps     | Trace, -5dBi           | 115.4                       | 25.2             | ≤30         | Pass    |
| 2462                                     | 802.11b 5Mbps     | Trace, -5dBi           | 114.9                       | 24.7             | ≤30         | Pass    |
| 2412                                     | 802.11b 11Mbps    | Trace, -5dBi           | 114.4                       | 24.2             | ≤30         | Pass    |
| 2437                                     | 802.11b 11Mbps    | Trace, -5dBi           | 115.3                       | 25.1             | ≤30         | Pass    |
| 2462                                     | 802.11b 11Mbps    | Trace, -5dBi           | 114.9                       | 24.7             | ≤30         | Pass    |
| 2412                                     | 802.11g 54Mbps    | Trace, -5dBi           | 114.1                       | 23.9             | ≤30         | Pass    |
| 2437                                     | 802.11g 54Mbps    | Trace, -5dBi           | 115.1                       | 24.9             | ≤30         | Pass    |
| 2462                                     | 802.11g 54Mbps    | Trace, -5dBi           | 114.8                       | 24.6             | ≤30         | Pass    |
| 2412                                     | 802.11n20 (MCS7)  | Trace, -5dBi           | 114.3                       | 24.1             | ≤30         | Pass    |
| 2437                                     | 802.11n20 (MCS7)  | Trace, -5dBi           | 115.2                       | 25               | ≤30         | Pass    |
| 2462                                     | 802.11n20 (MCS7)  | Trace, -5dBi           | 114.8                       | 24.6             | ≤30         | Pass    |
| 2422                                     | 802.11n40 (MCS11) | Trace, -5dBi           | 114.9                       | 24.7             | ≤30         | Pass    |
| 2437                                     | 802.11n40 (MCS11) | Trace, -5dBi           | 115.2                       | 25               | ≤30         | Pass    |
| 2452                                     | 802.11n40 (MCS11) | Trace, -5dBi           | 114.9                       | 24.7             | ≤30         | Pass    |

Conducted RF output power calculated in accordance with ANSI C63.10.

$$P(W) = \frac{(E \cdot d)^2}{30 G}$$

Or equivalently, in logarithmic form:

$$P(dBm) = E(dBuV/m) + 20LOG(d) - G - 104.77$$

The above equation was used to calculate conducted power from the peak field strength reading assuming d = 3 meters and G = -5dBi

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717  
 Customer: **Itron, Inc.**  
 Specification: **15.247(b) Power Output (2400-2483.5 MHz DTS)**  
 Work Order #: **103786** Date: 5/14/2020  
 Test Type: **Maximized Emissions** Time: 15:00:36  
 Tested By: Michael Atkinson Sequence#: 102  
 Software: EMITest 5.03.12

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

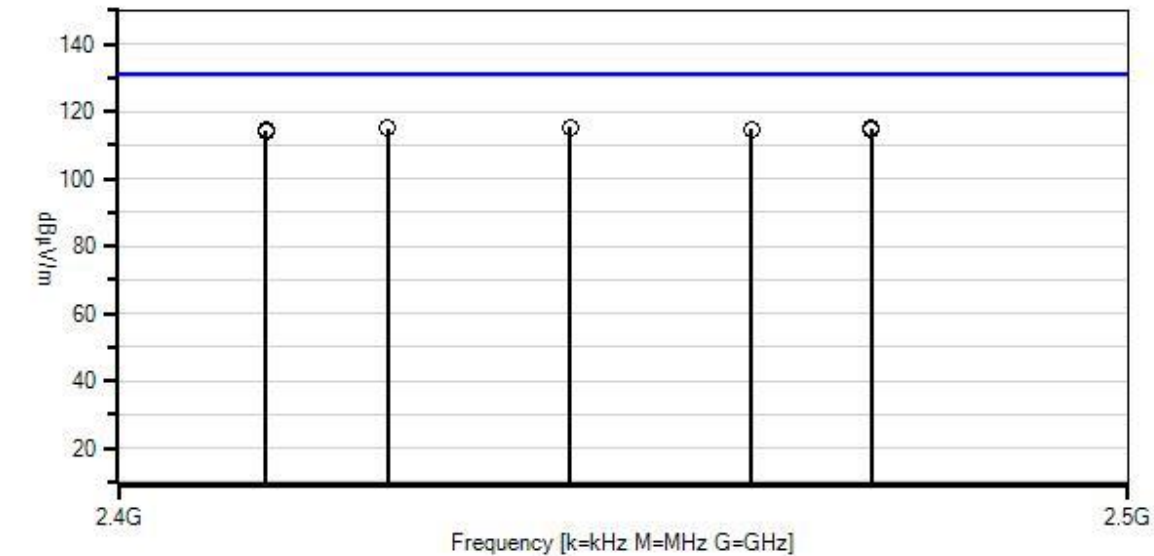
#### Support Equipment:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Test Conditions / Notes:

Vertical and horizontal polarity investigated, worst case reported.

Itron, Inc. W/O#: 103786 Sequence#: 102 Date: 5/14/2020  
 15.247(b) Power Output (2400-2483.5 MHz DTS) Test Distance: 3 Meters Horiz



— Readings  
 × QP Readings  
 ▼ Ambient  
 — 1 - 15.247(b) Power Output (2400-2483.5 MHz DTS)

○ Peak Readings  
 \* Average Readings  
 Software Version: 5.03.12

**Test Equipment:**

| ID | Asset #  | Description                            | Model        | Calibration Date | Cal Due Date |
|----|----------|----------------------------------------|--------------|------------------|--------------|
|    | 03477    | *Power Sensor                          | NRP-Z81      | 11/7/2019        | 11/7/2020    |
| T2 | ANP06540 | Cable                                  | Heliast      | 8/23/2019        | 8/23/2021    |
| T3 | ANP06515 | Cable                                  | Heliast      | 6/29/2018        | 6/29/2020    |
| T4 | AN01467  | Horn Antenna-ANSI<br>C63.5 Calibration | 3115         | 7/5/2019         | 7/5/2021     |
|    | 01314    | AC Power Supply                        | 345AMXT-UPC3 | 8/13/2019        | 8/13/2021    |

\* Power Sensor functions as a Peak Power Meter

**Measurement Data:** Reading listed by margin.

Test Distance: 3 Meters

| #  | Freq<br>MHz | Rdng<br>dBμV | T1<br>dB | T2<br>dB | T3<br>dB | T4<br>dB | Dist<br>Table | Corr<br>dBμV/m | Spec<br>dBμV/m | Margin<br>dB | Polar<br>Ant |
|----|-------------|--------------|----------|----------|----------|----------|---------------|----------------|----------------|--------------|--------------|
| 1  | 2437.000M   | 84.6         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 115.4          | 131.2<br>1M    | -15.8        | Horiz        |
| 2  | 2437.000M   | 84.6         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 115.4          | 131.2<br>5M    | -15.8        | Horiz        |
| 3  | 2437.000M   | 84.5         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 115.3          | 131.2<br>11M   | -15.9        | Horiz        |
| 4  | 2437.000M   | 84.4         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 115.2          | 131.2<br>65M   | -16.0        | Horiz        |
| 5  | 2437.000M   | 84.4         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 115.2          | 131.2<br>n40   | -16.0        | Horiz        |
| 6  | 2437.000M   | 84.3         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 115.1          | 131.2<br>54M   | -16.1        | Horiz        |
| 7  | 2462.000M   | 84.1         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 115.0          | 131.2<br>1M    | -16.2        | Horiz        |
| 8  | 2462.000M   | 84.0         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 114.9          | 131.2<br>11M   | -16.3        | Horiz        |
| 9  | 2462.000M   | 84.0         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 114.9          | 131.2<br>5M    | -16.3        | Horiz        |
| 10 | 2422.000M   | 84.1         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 114.9          | 131.2<br>n40   | -16.3        | Horiz        |
| 11 | 2462.000M   | 83.9         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 114.8          | 131.2<br>65M   | -16.4        | Horiz        |
| 12 | 2462.000M   | 83.9         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 114.8          | 131.2<br>54M   | -16.4        | Horiz        |
| 13 | 2452.000M   | 84.0         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 114.8          | 131.2<br>n40   | -16.4        | Horiz        |
| 14 | 2412.000M   | 83.6         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 114.4          | 131.2<br>1M    | -16.8        | Horiz        |
| 15 | 2412.000M   | 83.6         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 114.4          | 131.2<br>5M    | -16.8        | Horiz        |
| 16 | 2412.000M   | 83.6         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 114.4          | 131.2<br>11M   | -16.8        | Horiz        |
| 17 | 2412.000M   | 83.5         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 114.3          | 131.2<br>65M   | -16.9        | Horiz        |
| 18 | 2412.000M   | 83.3         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 114.1          | 131.2<br>54M   | -17.1        | Horiz        |

Test Setup Photo(s)



## 15.247(e) Power Spectral Density

| PSD Test Data Summary - Radiated Measurement |                   |                        |                             |                        |                  |         |
|----------------------------------------------|-------------------|------------------------|-----------------------------|------------------------|------------------|---------|
| Measurement Method: PKPSD                    |                   |                        |                             |                        |                  |         |
| Frequency (MHz)                              | Modulation        | Ant. Type / Gain (dBi) | Field Strength (dBuV/m @3m) | Calculated (dBm/51kHz) | Limit (dBm/3kHz) | Results |
| 2412                                         | 802.11b 1Mbps     | Trace, -5dBi           | 95.7                        | 5.5                    | ≤8               | Pass    |
| 2437                                         | 802.11b 1Mbps     | Trace, -5dBi           | 95.8                        | 5.6                    | ≤8               | Pass    |
| 2462                                         | 802.11b 1Mbps     | Trace, -5dBi           | 95.8                        | 5.6                    | ≤8               | Pass    |
| 2412                                         | 802.11b 5Mbps     | Trace, -5dBi           | 94.1                        | 3.9                    | ≤8               | Pass    |
| 2437                                         | 802.11b 5Mbps     | Trace, -5dBi           | 95.1                        | 4.9                    | ≤8               | Pass    |
| 2462                                         | 802.11b 5Mbps     | Trace, -5dBi           | 94.7                        | 4.5                    | ≤8               | Pass    |
| 2412                                         | 802.11b 11Mbps    | Trace, -5dBi           | 93.8                        | 3.6                    | ≤8               | Pass    |
| 2437                                         | 802.11b 11Mbps    | Trace, -5dBi           | 94.5                        | 4.3                    | ≤8               | Pass    |
| 2462                                         | 802.11b 11Mbps    | Trace, -5dBi           | 94                          | 3.8                    | ≤8               | Pass    |
| 2412                                         | 802.11g 54Mbps    | Trace, -5dBi           | 91.3                        | 1.1                    | ≤8               | Pass    |
| 2437                                         | 802.11g 54Mbps    | Trace, -5dBi           | 92.6                        | 2.4                    | ≤8               | Pass    |
| 2462                                         | 802.11g 54Mbps    | Trace, -5dBi           | 91.9                        | 1.7                    | ≤8               | Pass    |
| 2412                                         | 802.11n20 (MCS7)  | Trace, -5dBi           | 91.7                        | 1.5                    | ≤8               | Pass    |
| 2437                                         | 802.11n20 (MCS7)  | Trace, -5dBi           | 93                          | 2.8                    | ≤8               | Pass    |
| 2462                                         | 802.11n20 (MCS7)  | Trace, -5dBi           | 92.1                        | 1.9                    | ≤8               | Pass    |
| 2422                                         | 802.11n40 (MCS11) | Trace, -5dBi           | 89.4                        | -0.8                   | ≤8               | Pass    |
| 2437                                         | 802.11n40 (MCS11) | Trace, -5dBi           | 90.3                        | 0.1                    | ≤8               | Pass    |
| 2452                                         | 802.11n40 (MCS11) | Trace, -5dBi           | 89.2                        | -1.0                   | ≤8               | Pass    |

51kHz measurement RBW used as worst case compared to 3kHz RBW limit

Conducted RF output power calculated in accordance with ANSI C63.10.

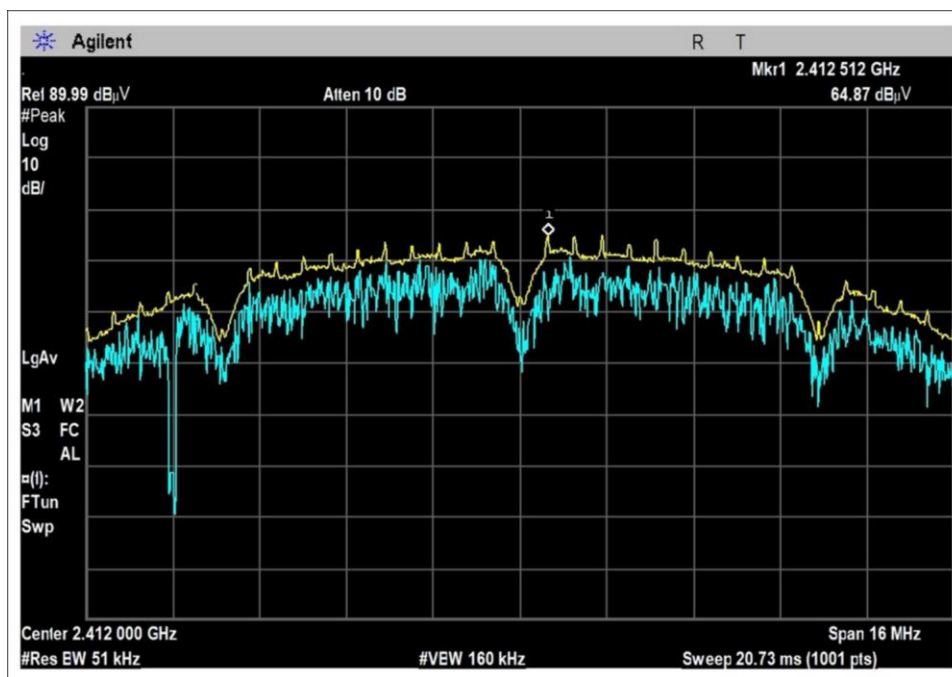
$$P(W) = \frac{(E \cdot d)^2}{30 G}$$

Or equivalently, in logarithmic form:

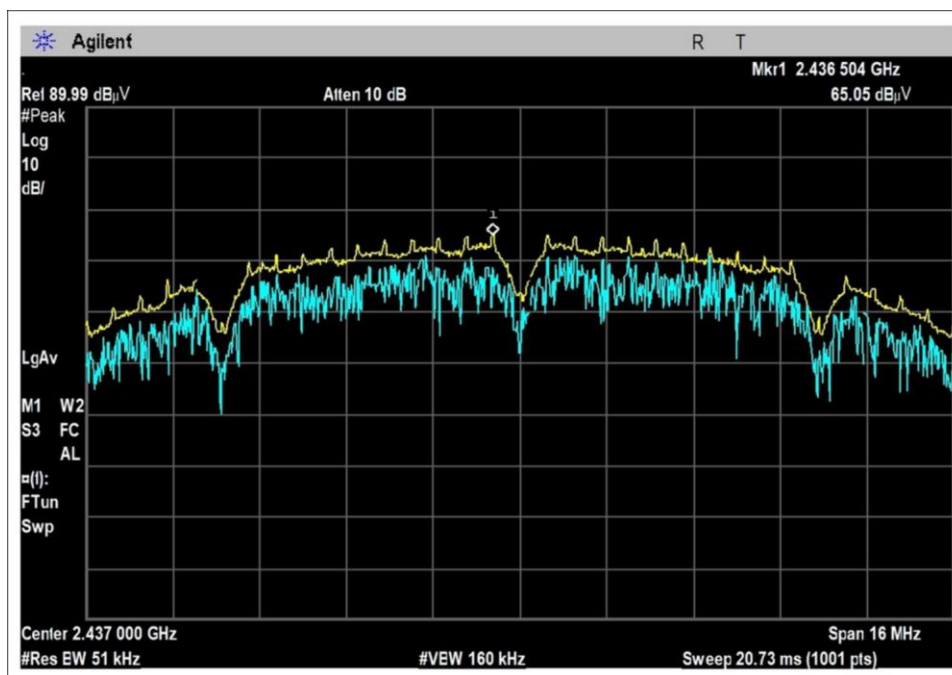
$$P(dBm) = E(dBuV/m) + 20LOG(d) - G - 104.77$$

The above equation was used to calculate conducted power from the peak field strength reading assuming d = 3 meters and G = -5dBi

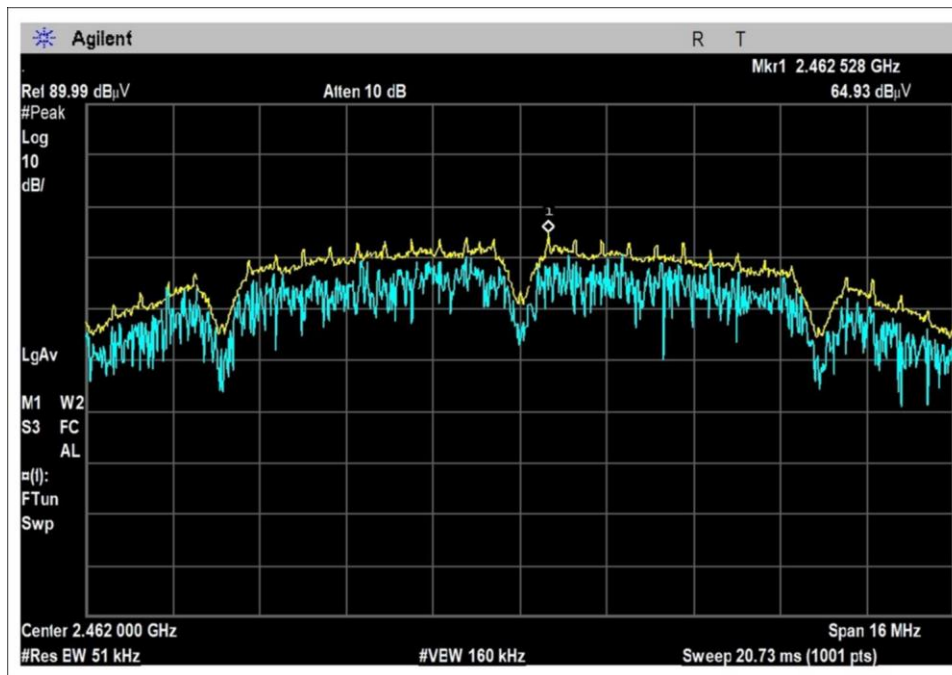
## Plots



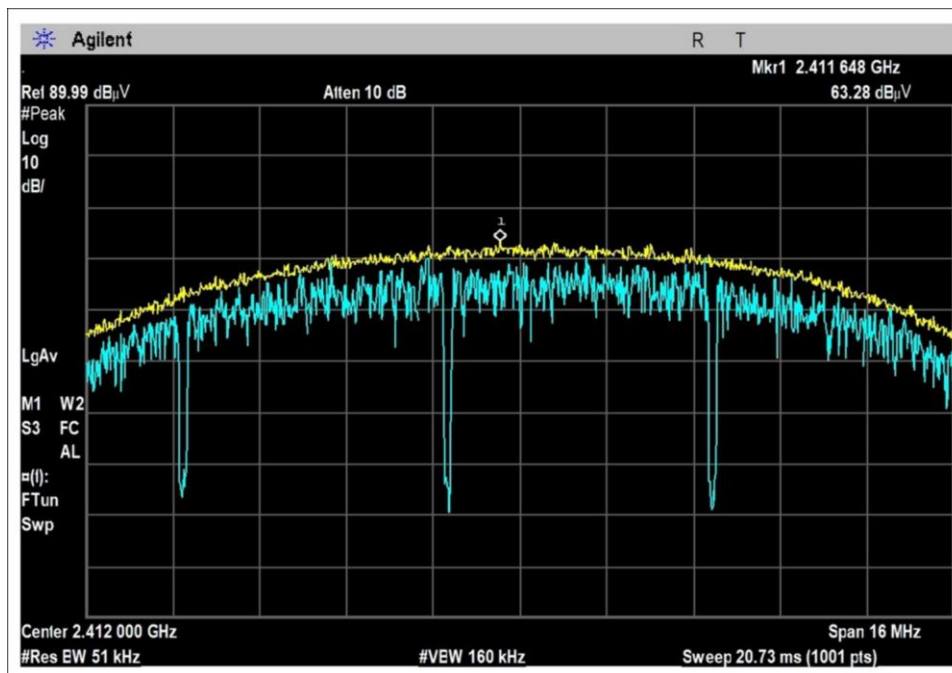
802.11b 1Mbps Low Channel



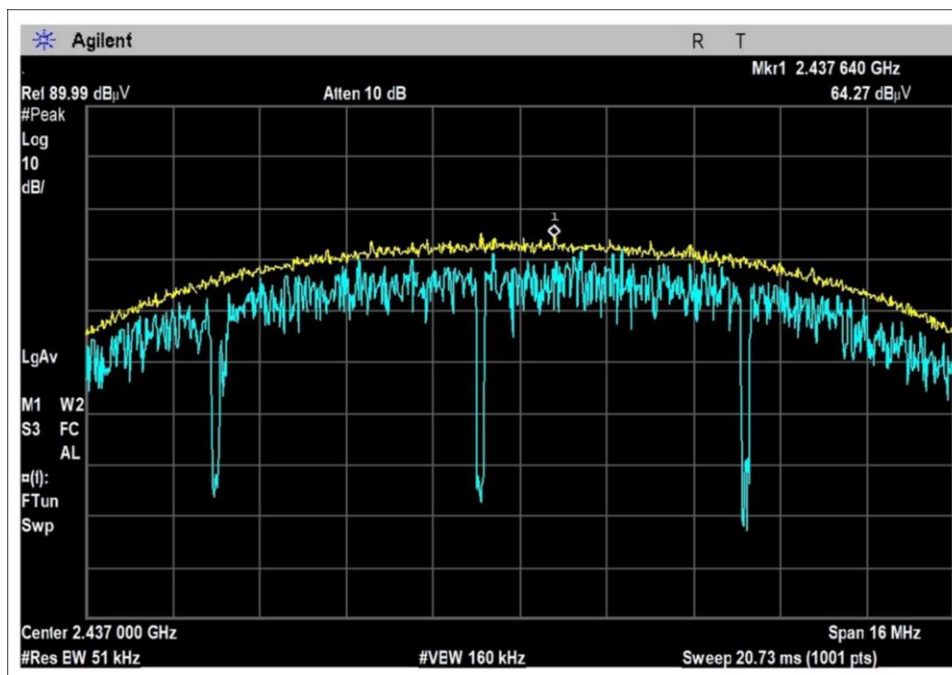
802.11b 1Mbps Middle Channel



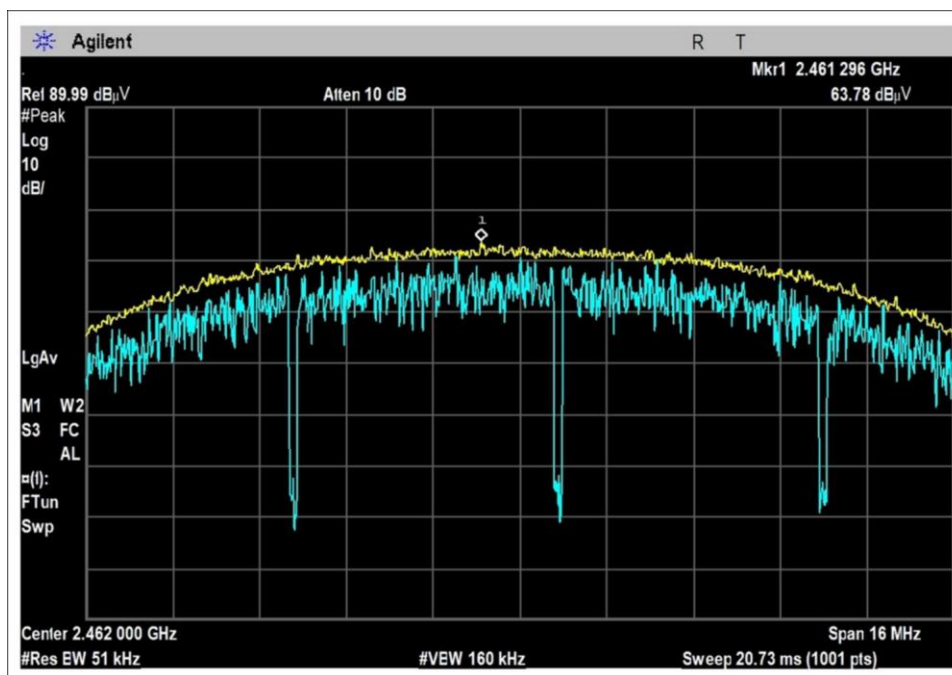
802.11b 1Mbps High Channel



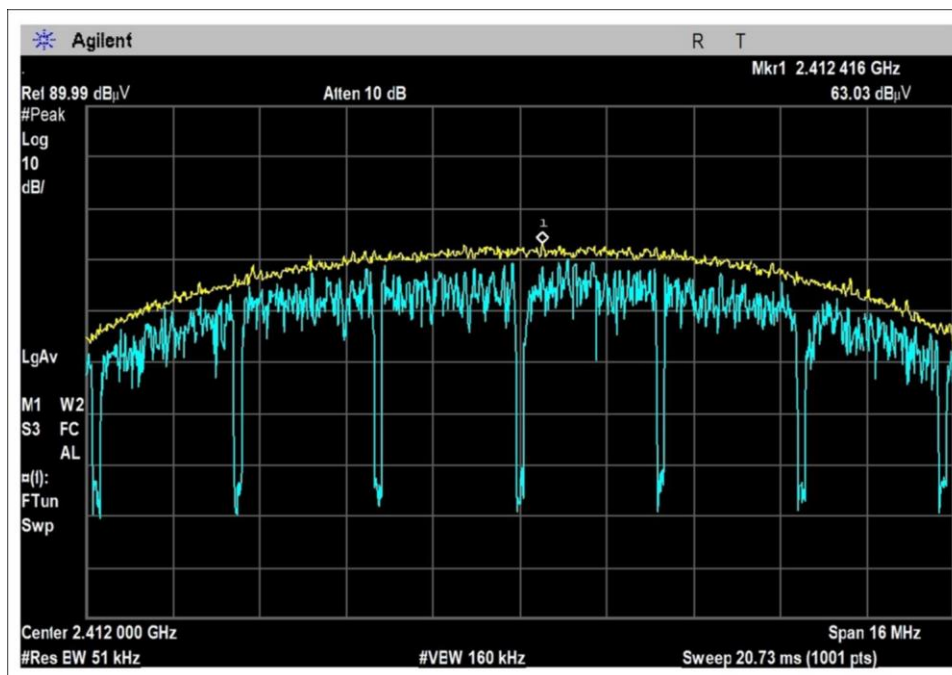
802.11b 5Mbps Low Channel



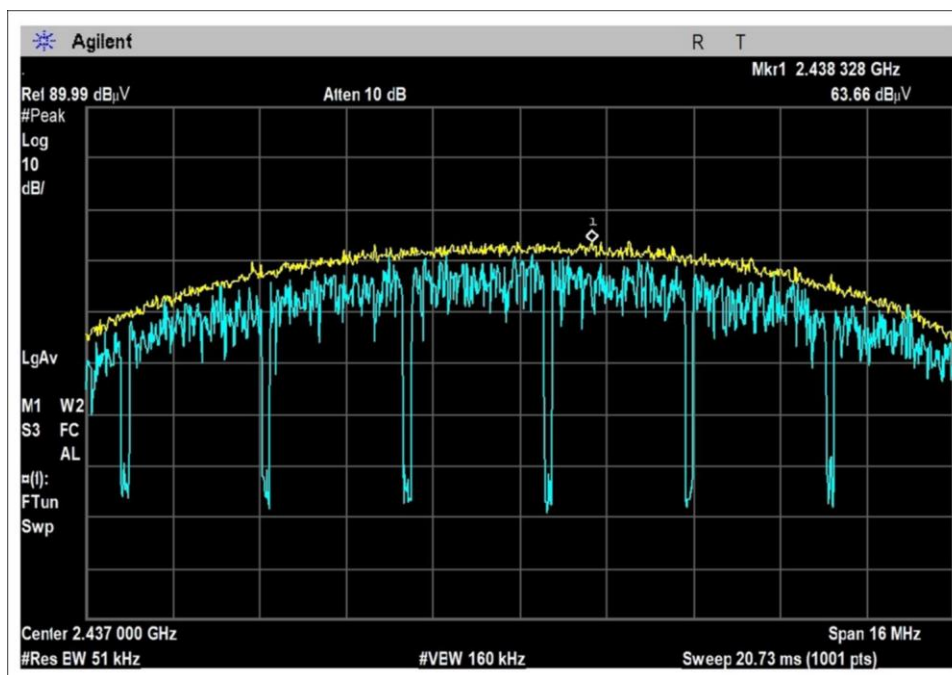
802.11b 5Mbps Middle Channel



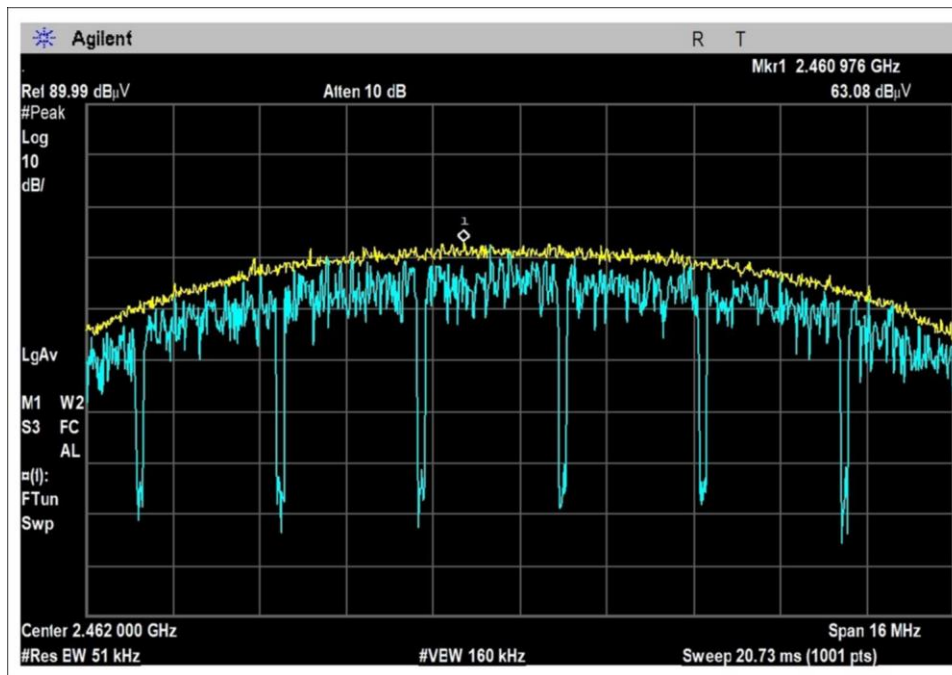
802.11b 5Mbps High Channel



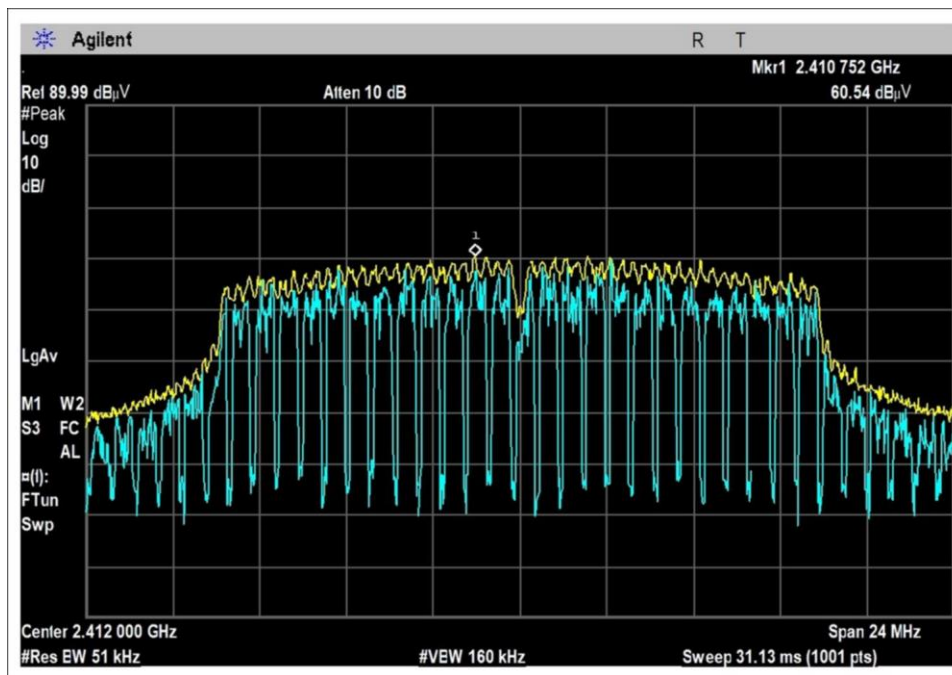
802.11b 11Mbps Low Channel



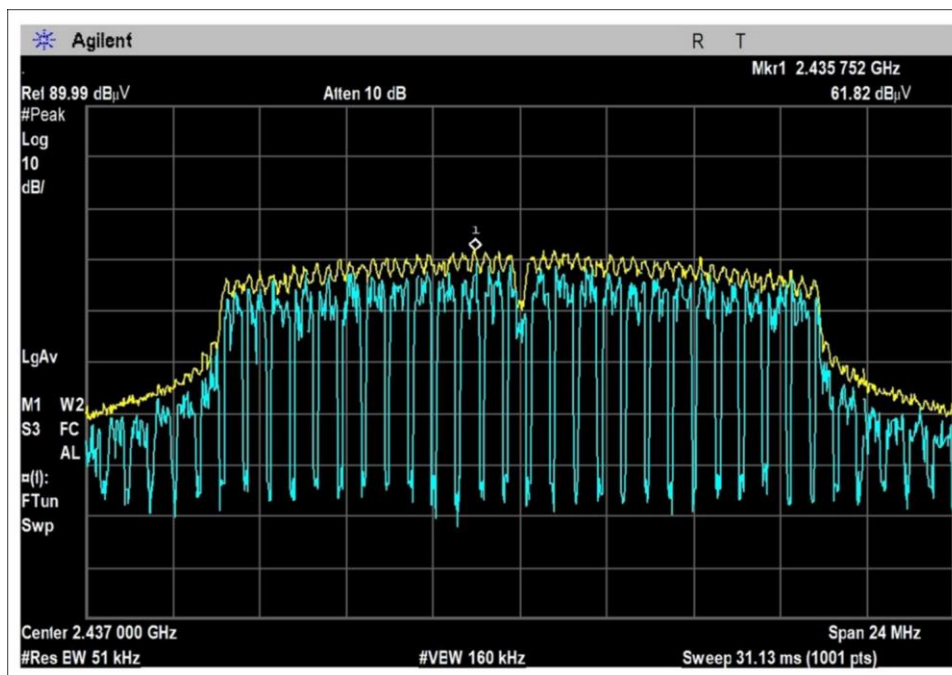
802.11b 11Mbps Middle Channel



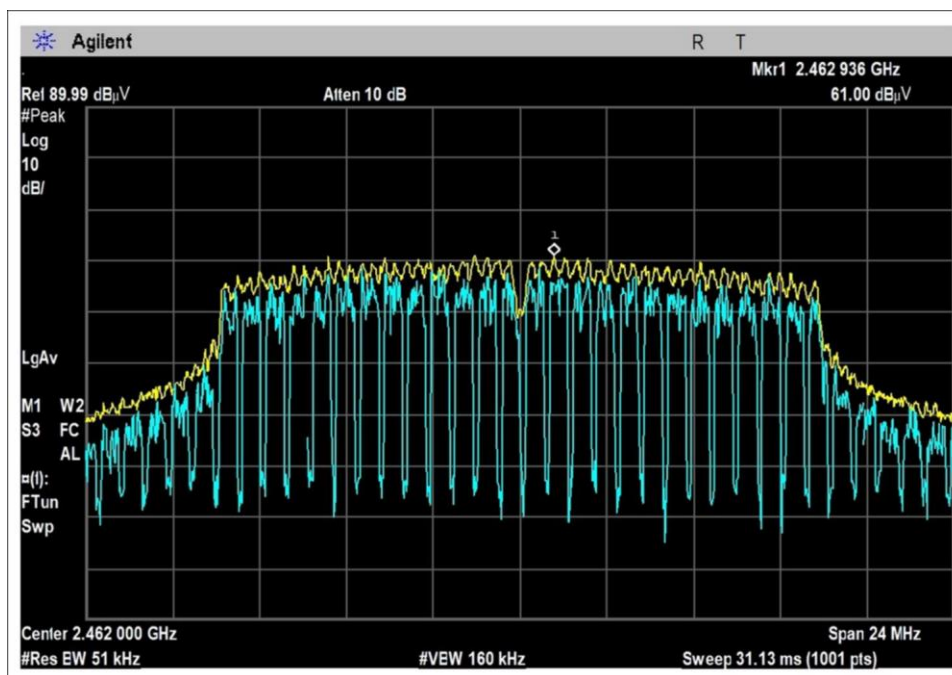
802.11b 11Mbps High Channel



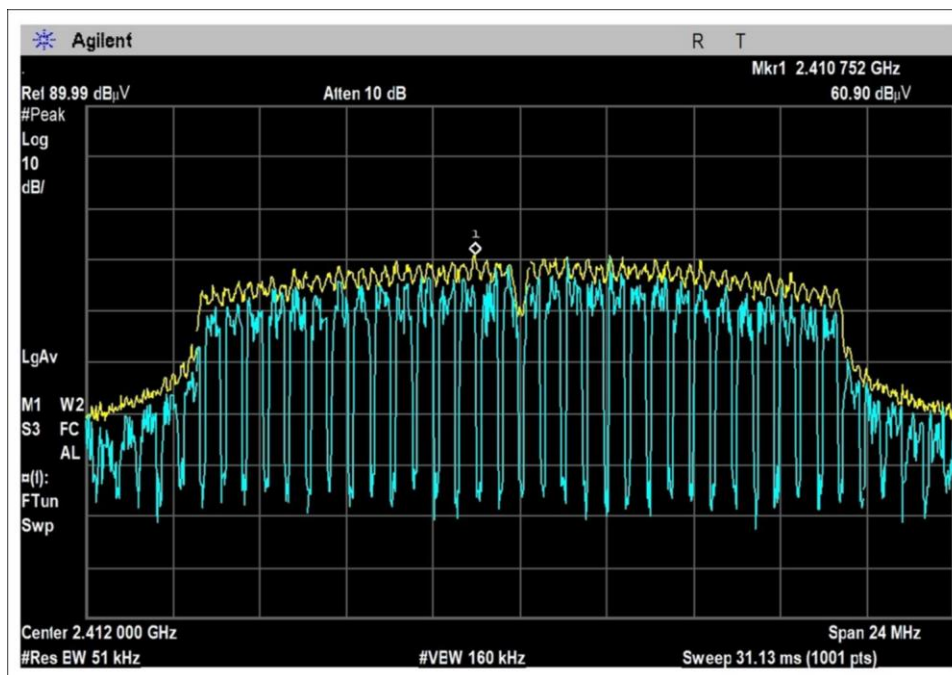
802.11g 54Mbps Low Channel



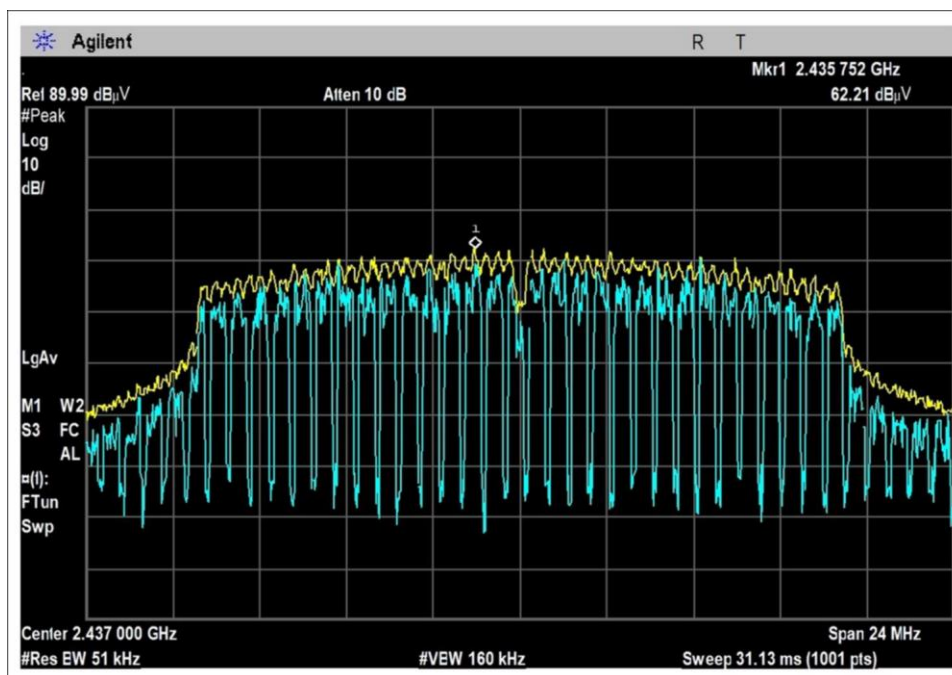
802.11g 54Mbps Middle Channel



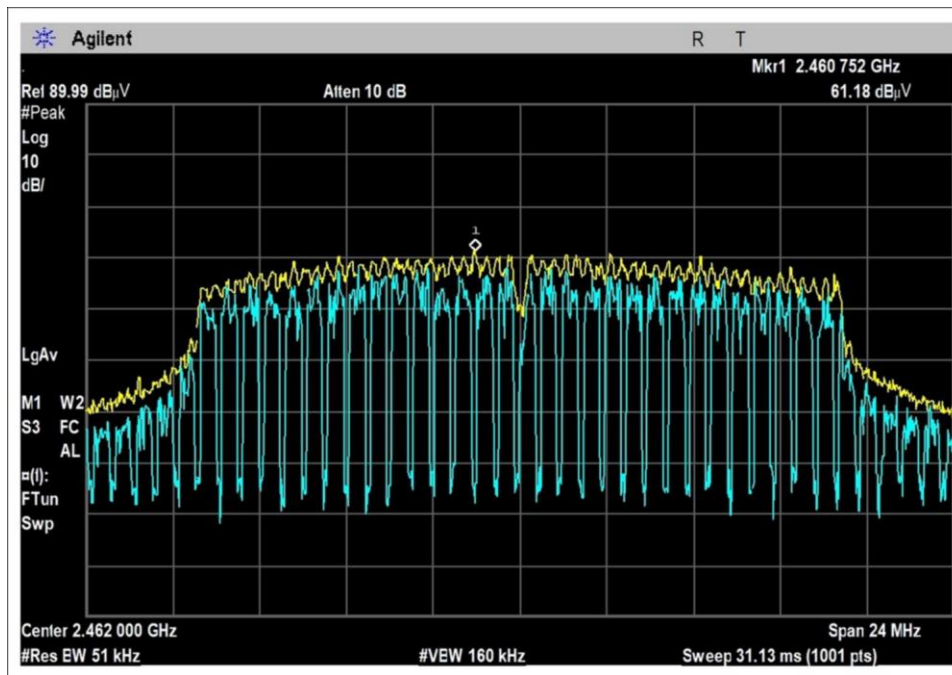
802.11g 54Mbps High Channel



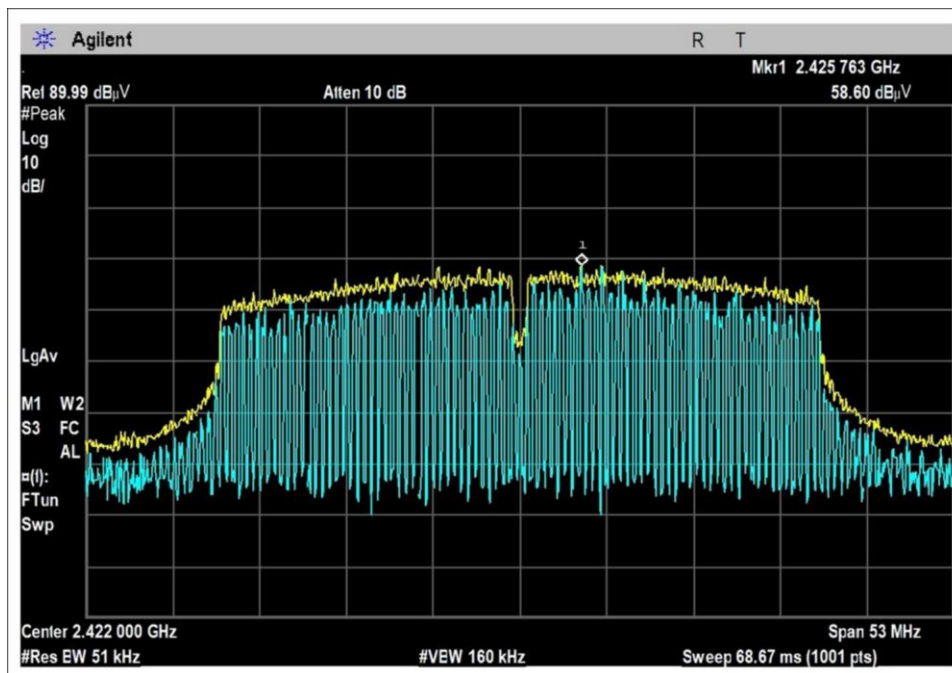
802.11n20 Low Channel



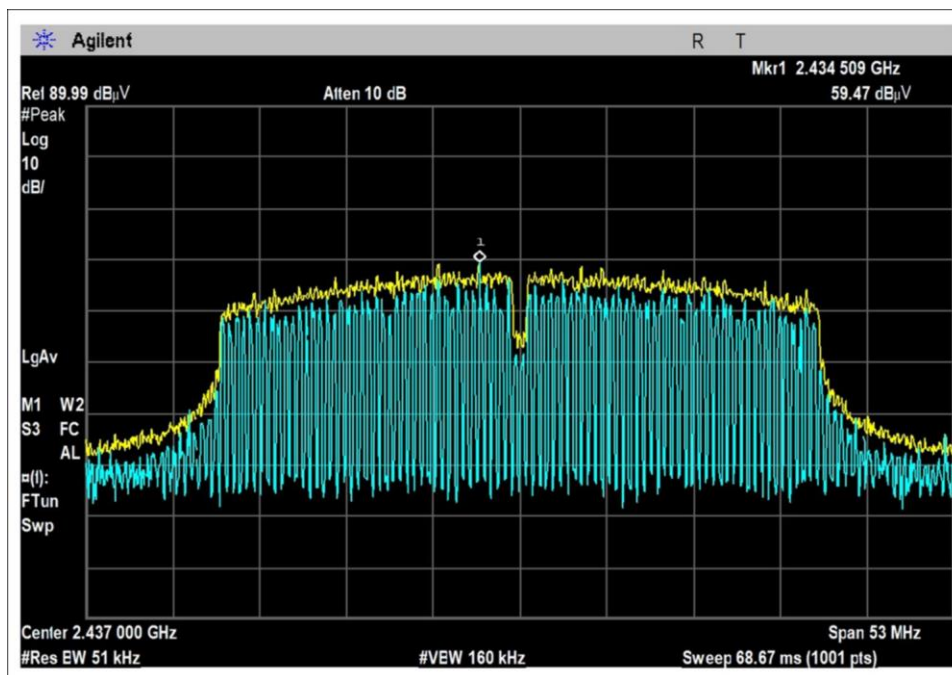
802.11n20 Middle Channel



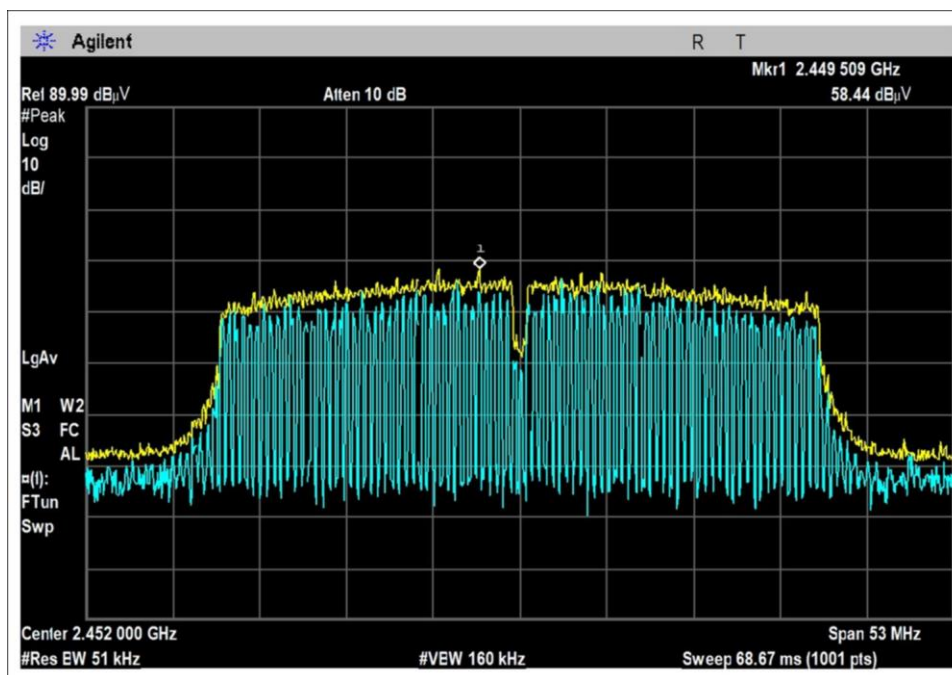
802.11n20 High Channel



802.11n40 Low Channel



802.11n40 Middle Channel



802.11n40 High Channel

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717  
 Customer: **Itron, Inc.**  
 Specification: **15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)**  
 Work Order #: **103786** Date: 5/15/2020  
 Test Type: **Maximized Emissions** Time: 16:29:00  
 Tested By: Michael Atkinson Sequence#: 103  
 Software: EMITest 5.03.12

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Support Equipment:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

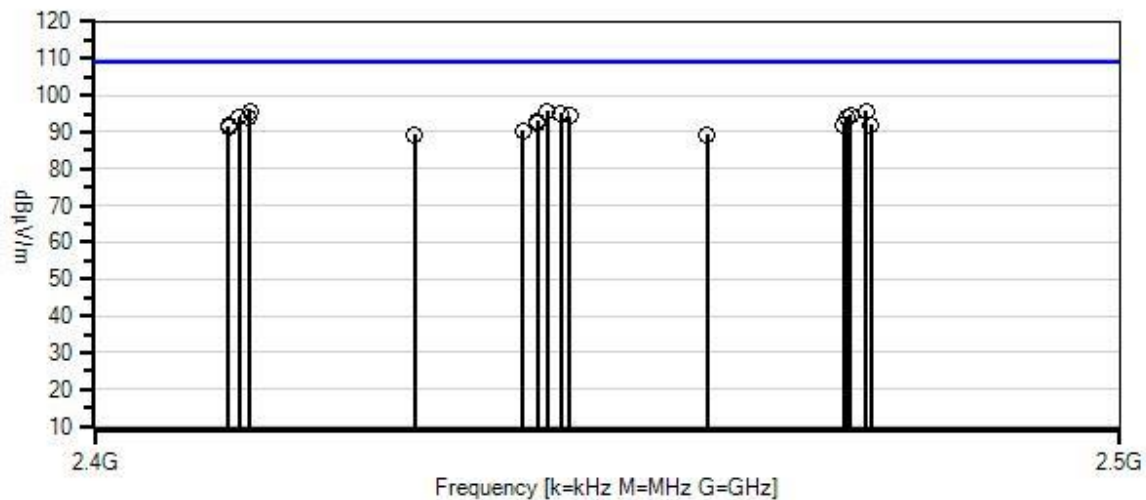
#### Test Conditions / Notes:

Vertical and horizontal polarity investigated, worst case reported.

The equipment under test (EUT) is placed on the tabletop. The EUT is transmitting continuously at its rated output power through integral antenna.

Test Location: Bothell Lab C3  
 Temperature (°C): 25  
 Relative Humidity (%): 33%  
 Test Method: ANSI C63.10 (2013), KDB 558074 v05r02: 04/02/2019

Itron, Inc. WD#: 103786 Sequence#: 103 Date: 5/15/2020  
15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS) Test Distance: 3 Meters Horiz



— Readings  
○ Peak Readings  
× QP Readings  
\* Average Readings  
▼ Ambient  
Software Version: 5.03.12  
— 1 - 15.247(e) Peak Power Spectral Density (2400-2483.5 MHz DTS)

**Test Equipment:**

| ID | Asset #  | Description                         | Model  | Calibration Date | Cal Due Date |
|----|----------|-------------------------------------|--------|------------------|--------------|
| T1 | AN02673  | Spectrum Analyzer                   | E4446A | 2/22/2019        | 2/22/2021    |
| T2 | ANP06540 | Cable                               | Heliac | 8/23/2019        | 8/23/2021    |
| T3 | ANP06515 | Cable                               | Heliac | 6/29/2018        | 6/29/2020    |
| T4 | AN01467  | Horn Antenna-ANSI C63.5 Calibration | 3115   | 7/5/2019         | 7/5/2021     |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| #  | Freq<br>MHz | Rdng<br>dBμV | T1<br>dB | T2<br>dB | T3<br>dB | T4<br>dB | Dist<br>Table | Corr<br>dBμV/m | Spec<br>dBμV/m | Margin<br>dB | Polar<br>Ant |
|----|-------------|--------------|----------|----------|----------|----------|---------------|----------------|----------------|--------------|--------------|
| 1  | 2436.504M   | 65.0         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 95.8           | 109.2<br>1M    | -13.4        | Horiz        |
| 2  | 2462.528M   | 64.9         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 95.8           | 109.2<br>1M    | -13.4        | Horiz        |
| 3  | 2412.512M   | 64.9         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 95.7           | 109.2<br>1M    | -13.5        | Horiz        |
| 4  | 2437.640M   | 64.3         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 95.1           | 109.2<br>5M    | -14.1        | Horiz        |
| 5  | 2461.296M   | 63.8         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 94.7           | 109.2<br>5M    | -14.5        | Horiz        |
| 6  | 2438.328M   | 63.7         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 94.5           | 109.2<br>11M   | -14.7        | Horiz        |
| 7  | 2411.648M   | 63.3         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 94.1           | 109.2<br>5M    | -15.1        | Horiz        |
| 8  | 2460.976M   | 63.1         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 94.0           | 109.2<br>11M   | -15.2        | Horiz        |
| 9  | 2412.416M   | 63.0         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 93.8           | 109.2<br>11M   | -15.4        | Horiz        |
| 10 | 2435.752M   | 62.2         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 93.0           | 109.2<br>65M   | -16.2        | Horiz        |
| 11 | 2435.752M   | 61.8         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 92.6           | 109.2<br>54M   | -16.6        | Horiz        |
| 12 | 2460.752M   | 61.2         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 92.1           | 109.2<br>65M   | -17.1        | Horiz        |
| 13 | 2462.936M   | 61.0         | +0.0     | +0.6     | +2.7     | +27.6    | +0.0          | 91.9           | 109.2<br>54M   | -17.3        | Horiz        |
| 14 | 2410.752M   | 60.9         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 91.7           | 109.2<br>65M   | -17.5        | Horiz        |
| 15 | 2410.752M   | 60.5         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 91.3           | 109.2<br>54M   | -17.9        | Horiz        |
| 16 | 2434.509M   | 59.5         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 90.3           | 109.2<br>n40   | -18.9        | Horiz        |
| 17 | 2425.763M   | 58.6         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 89.4           | 109.2<br>n40   | -19.8        | Horiz        |
| 18 | 2449.509M   | 58.4         | +0.0     | +0.6     | +2.6     | +27.6    | +0.0          | 89.2           | 109.2<br>n40   | -20.0        | Horiz        |

Test Setup Photo(s)



## 15.247(d) Radiated Emissions & Band Edge

### Test Setup / Conditions / Data

Test Location: CKC Laboratories, Inc. • 22116 23rd Drive SE • Bothell, WA 98201 • 435-402-1717  
 Customer: **Itron, Inc.**  
 Specification: **15.247(d) / 15.209 Radiated Spurious Emissions**  
 Work Order #: **103786** Date: 5/14/2020  
 Test Type: **Maximized Emissions** Time: 07:04:37  
 Tested By: Michael Atkinson Sequence#: 101  
 Software: EMITest 5.03.12

#### Equipment Tested:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

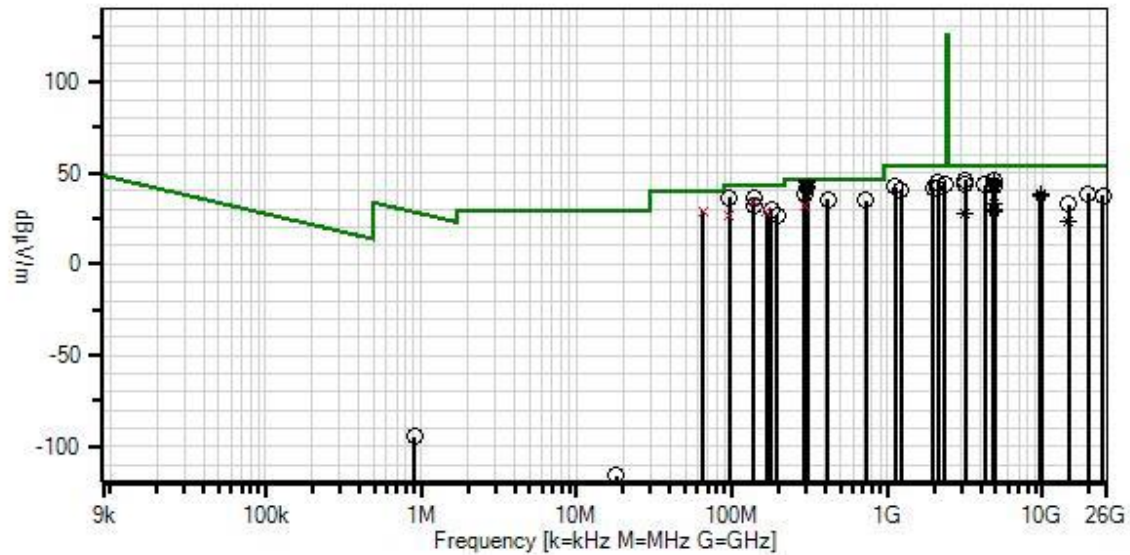
#### Support Equipment:

| Device          | Manufacturer | Model # | S/N |
|-----------------|--------------|---------|-----|
| Configuration 1 |              |         |     |

#### Test Conditions / Notes:

Temperature: 22°C  
 Pressure: 102.0kPa  
 Humidity: 35%  
 Frequency: 9kHz-25GHz  
 Test Method: ANSI 63.10 (2013)  
 Set up:  
 Vertical and horizontal polarity investigated above 30MHz. 3 x orthogonal axes investigated below 30MHz.  
 Worst case reported.  
 EUT is on the test bench mounted on a pole stand.  
 Transmitting continuously, multiple modulations invested, Low-Mid-High channels investigated. Worst case spur reported for each modulation.  
 Emission marked as ambient if determined unrelated to radio function and is to be ignored against this limit, verified by turning radio function off and no change observed to marked emission amplitude.

Itron, Inc. WO#: 103786 Sequence#: 101 Date: 5/14/2020  
15.247(d) / 15.209 Radiated Spurious Emissions Test Distance: 3 Meters Various



— Readings  
× QP Readings  
▼ Ambient  
○ Peak Readings  
\* Average Readings  
Software Version: 5.03.12  
1 - 15.247(d) / 15.209 Radiated Spurious Emissions

**Test Equipment:**

| ID  | Asset #  | Description                         | Model                    | Cal Date   | Cal Due Date |
|-----|----------|-------------------------------------|--------------------------|------------|--------------|
| T1  | AN03540  | Preamp                              | 83017A                   | 5/13/2019  | 5/13/2021    |
| T2  | AN01467  | Horn Antenna-ANSI C63.5 Calibration | 3115                     | 7/5/2019   | 7/5/2021     |
| T3  | ANP06515 | Cable                               | Heliac                   | 6/29/2018  | 6/29/2020    |
| T4  | ANP06540 | Cable                               | Heliac                   | 8/23/2019  | 8/23/2021    |
| T5  | ANP07504 | Cable                               | CLU40-KMKM-02.00F        | 1/17/2019  | 1/17/2021    |
| T6  | AN02872  | Spectrum Analyzer                   | E4440A                   | 11/18/2019 | 11/18/2021   |
| T7  | AN03116  | High Pass Filter                    | 11SH10-00313             | 1/22/2019  | 1/22/2021    |
| T8  | AN02741  | Active Horn Antenna                 | AMFW-5F-12001800-20-10P  | 4/26/2019  | 4/26/2021    |
| T9  | AN02673  | Spectrum Analyzer                   | E4446A                   | 2/22/2019  | 2/22/2021    |
| T10 | AN02742  | Active Horn Antenna                 | AMFW-5F-18002650-20-10P  | 10/16/2018 | 10/16/2020   |
| T11 | ANP06678 | Cable                               | 32026-29801-29801-144    | 2/20/2020  | 2/20/2022    |
| T12 | ANP05305 | Cable                               | ETSI-50T                 | 9/6/2019   | 9/6/2021     |
| T13 | AN02307  | Preamp                              | 8447D                    | 1/10/2020  | 1/10/2022    |
| T14 | ANP05360 | Cable                               | RG214                    | 2/3/2020   | 2/3/2022     |
| T15 | ANP06123 | Attenuator                          | 18N-6                    | 4/5/2019   | 4/5/2021     |
| T16 | AN03628  | Biconilog Antenna                   | 3142E                    | 6/11/2019  | 6/11/2021    |
| T17 | AN03170  | High Pass Filter                    | HM1155-11SS              | 10/23/2019 | 10/23/2021   |
| T18 | AN03727  | Band Reject Filter                  | 10NSL33-2441.3/E79.4-O/O | 2/6/2020   | 2/6/2022     |
| T19 | AN00052  | Loop Antenna                        | 6502                     | 5/4/2020   | 5/4/2022     |

**Measurement Data:**

Reading listed by margin.

Test Distance: 3 Meters

| # | Freq                | Rdng | T1<br>T5<br>T9<br>T13<br>T17          | T2<br>T6<br>T10<br>T14<br>T18         | T3<br>T7<br>T11<br>T15<br>T19        | T4<br>T8<br>T12<br>T16        | Dist  | Corr   | Spec              | Margin | Polar |
|---|---------------------|------|---------------------------------------|---------------------------------------|--------------------------------------|-------------------------------|-------|--------|-------------------|--------|-------|
|   | MHz                 | dBμV | dB                                    | dB                                    | dB                                   | dB                            | Table | dBμV/m | dBμV/m            | dB     | Ant   |
| 1 | 305.500M<br>Ambient | 49.6 | +0.0<br>+0.0<br>+0.0<br>-27.1<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+1.1<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.2<br>+0.0<br>+0.9<br>+13.4 | +0.0  | 43.9   | 46.0              | -2.1   | Horiz |
| 2 | 305.151M<br>Ambient | 48.5 | +0.0<br>+0.0<br>+0.0<br>-27.1<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+1.1<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.2<br>+0.0<br>+0.9<br>+13.4 | +0.0  | 42.8   | 46.0              | -3.2   | Horiz |
| 3 | 304.800M<br>Ambient | 46.4 | +0.0<br>+0.0<br>+0.0<br>-27.1<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+1.1<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.2<br>+0.0<br>+0.9<br>+13.3 | +0.0  | 40.6   | 46.0              | -5.4   | Vert  |
| 4 | 305.074M<br>Ambient | 45.4 | +0.0<br>+0.0<br>+0.0<br>-27.1<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+1.1<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.2<br>+0.0<br>+0.9<br>+13.4 | +0.0  | 39.7   | 46.0              | -6.3   | Vert  |
| 5 | 96.300M             | 49.3 | +0.0<br>+0.0<br>+0.0<br>-27.7<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+0.6<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.1<br>+0.0<br>+0.5<br>+7.7  | +0.0  | 36.3   | 43.5              | -7.2   | Vert  |
| 6 | 291.900M            | 44.8 | +0.0<br>+0.0<br>+0.0<br>-27.0<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+1.1<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.2<br>+0.0<br>+0.8<br>+13.0 | +0.0  | 38.7   | 46.0              | -7.3   | Vert  |
| 7 | 3189.000M           | 45.4 | -34.0<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +29.5<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +3.1<br>+1.0<br>+0.0<br>+0.0<br>+0.0 | +0.8<br>+0.0<br>+0.0<br>+0.0  | +0.0  | 46.3   | 54.0              | -7.7   | Vert  |
| 8 | 138.300M            | 47.7 | +0.0<br>+0.0<br>+0.0<br>-27.5<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+0.7<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.1<br>+0.0<br>+0.5<br>+8.4  | +0.0  | 35.7   | 43.5              | -7.8   | Vert  |
| 9 | 4873.850M           | 40.5 | -33.6<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +32.5<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +4.2<br>+0.6<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0  | +0.0  | 45.6   | 54.0<br>1Mbps Mid | -8.4   | Vert  |

|    |                  |      |                                       |                                       |                                      |                                       |      |      |                   |       |       |
|----|------------------|------|---------------------------------------|---------------------------------------|--------------------------------------|---------------------------------------|------|------|-------------------|-------|-------|
| 10 | 4874.028M<br>Ave | 39.2 | -33.6<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +32.5<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +4.2<br>+0.6<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | +0.0 | 44.3 | 54.0<br>1Mbps Mid | -9.7  | Horiz |
| 11 | 2126.000M        | 47.1 | -34.4<br>+0.2<br>+0.0<br>+0.0<br>+0.5 | +27.8<br>+0.0<br>+0.0<br>+0.0<br>+0.1 | +2.4<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.6<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | +0.0 | 44.3 | 54.0              | -9.7  | Vert  |
| 12 | 138.681M<br>QP   | 45.6 | +0.0<br>+0.0<br>+0.0<br>-27.5<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+0.7<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.1<br>+0.0<br>+0.5<br>+8.4<br>+0.0  | +0.0 | 33.6 | 43.5              | -9.9  | Vert  |
| 13 | 4874.025M<br>Ave | 38.5 | -33.6<br>+0.5<br>+0.0<br>+0.0<br>+0.6 | +32.5<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +4.2<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | +0.0 | 43.6 | 54.0<br>5M Mid    | -10.4 | Horiz |
| 14 | 4253.000M        | 40.1 | -33.7<br>+0.4<br>+0.0<br>+0.0<br>+0.0 | +31.6<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +3.8<br>+0.6<br>+0.0<br>+0.0<br>+0.0 | +0.8<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | +0.0 | 43.6 | 54.0              | -10.4 | Vert  |
| 15 | 416.400M         | 37.2 | +0.0<br>+0.0<br>+0.0<br>-27.7<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+1.3<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.2<br>+0.0<br>+1.0<br>+17.7<br>+0.0 | +0.0 | 35.5 | 46.0              | -10.5 | Vert  |
| 16 | 4824.086M<br>Ave | 38.6 | -33.6<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +32.4<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +4.1<br>+0.6<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | +0.0 | 43.5 | 54.0<br>1Mbps Low | -10.5 | Horiz |
| ^  | 4824.030M        | 42.9 | -33.6<br>+0.5<br>+0.0<br>+0.0<br>+0.0 | +32.4<br>+0.0<br>+0.0<br>+0.0<br>+0.0 | +4.1<br>+0.6<br>+0.0<br>+0.0<br>+0.0 | +0.9<br>+0.0<br>+0.0<br>+0.0<br>+0.0  | +0.0 | 47.8 | 54.0<br>1Mbps Low | -6.2  | Horiz |
| 18 | 65.600M<br>QP    | 42.7 | +0.0<br>+0.0<br>+0.0<br>-27.8<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+0.5<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.1<br>+0.0<br>+0.4<br>+7.5<br>+0.0  | +0.0 | 29.2 | 40.0              | -10.8 | Vert  |
| ^  | 65.600M          | 47.5 | +0.0<br>+0.0<br>+0.0<br>-27.8<br>+0.0 | +0.0<br>+0.0<br>+0.0<br>+0.5<br>+0.0  | +0.0<br>+0.0<br>+0.0<br>+5.8<br>+0.0 | +0.1<br>+0.0<br>+0.4<br>+7.5<br>+0.0  | +0.0 | 34.0 | 40.0              | -6.0  | Vert  |