

# NORTHWEST EMC

**APDM, Inc.**

**Opal**

**FCC 15.247:2016**

**2.4 GHz DTS Radio**

**Report # APDM0008.2**



NVLAP Lab Code: 200630-0

*This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America. This Report may only be duplicated in its entirety*

# CERTIFICATE OF TEST

Last Date of Test: February 10, 2016  
APDM, Inc.  
Model: Opal

## Radio Equipment Testing

### Standards

| Specification   | Method           |
|-----------------|------------------|
| FCC 15.247:2016 | ANSI C63.10:2013 |

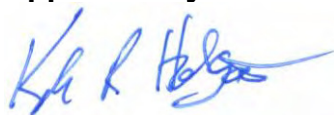
### Results

| Method Clause              | Test Description              | Applied | Results | Comments                                |
|----------------------------|-------------------------------|---------|---------|-----------------------------------------|
| 6.2                        | Powerline Conducted Emissions | No      | N/A     | Not required for a battery powered EUT. |
| 6.5, 6.6, 11.12.1, 11.13.2 | Spurious Radiated Emissions   | Yes     | Pass    |                                         |
| 6.10.4                     | Band Edge Compliance          | Yes     | Pass    |                                         |
| 11.6                       | Duty Cycle                    | Yes     | Pass    |                                         |
| 11.8.2                     | Occupied Bandwidth            | Yes     | Pass    |                                         |
| 11.9                       | Output Power                  | Yes     | Pass    |                                         |
| 11.10                      | Power Spectral Density        | Yes     | Pass    |                                         |
| 11.12.1                    | Out of Band Emissions         | Yes     | Pass    |                                         |

### Deviations From Test Standards

None

### Approved By:



Kyle Holgate, Operations Manager

*Product compliance is the responsibility of the client; therefore, the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test. This report reflects only those tests from the referenced standards shown in the certificate of test. It does not include inspection or verification of labels, identification, marking or user information.*

# REVISION HISTORY

| Revision Number |  | Description | Date | Page Number |
|-----------------|--|-------------|------|-------------|
| 00              |  | None        |      |             |

# ACCREDITATIONS AND AUTHORIZATIONS

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## United States

**FCC** - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

**A2LA** - Accredited by A2LA to ISO / IEC 17065 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

**NVLAP** - Each laboratory is accredited by NVLAP to ISO 17025

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## Canada

**IC** - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

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## European Union

**European Commission** – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

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## Australia/New Zealand

**ACMA** - Recognized by ACMA as a CAB for the acceptance of test data.

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## Korea

**MSIP / RRA** - Recognized by KCC's RRA as a CAB for the acceptance of test data.

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## Japan

**VCCI** - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

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## Taiwan

**BSMI** – Recognized by BSMI as a CAB for the acceptance of test data.

**NCC** - Recognized by NCC as a CAB for the acceptance of test data.

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## Singapore

**IDA** – Recognized by IDA as a CAB for the acceptance of test data.

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## Israel

**MOC** – Recognized by MOC as a CAB for the acceptance of test data.

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## Hong Kong

**OFCA** – Recognized by OFCA as a CAB for the acceptance of test data.

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## Vietnam

**MIC** – Recognized by MIC as a CAB for the acceptance of test data.

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## SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/accreditations/>  
<http://gsi.nist.gov/global/docs/cabs/designations.html>

# MEASUREMENT UNCERTAINTY

## Measurement Uncertainty

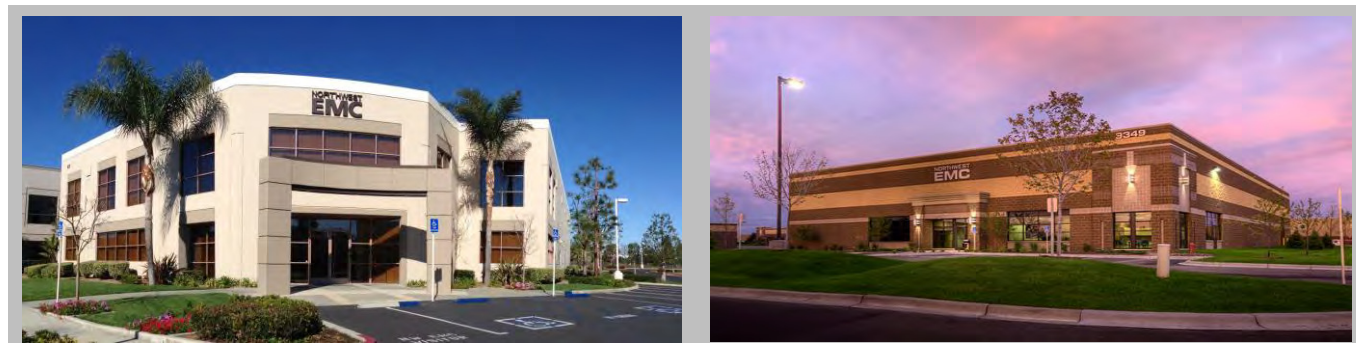
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) for each test is on each data sheet. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-2 as applicable), and are available upon request.

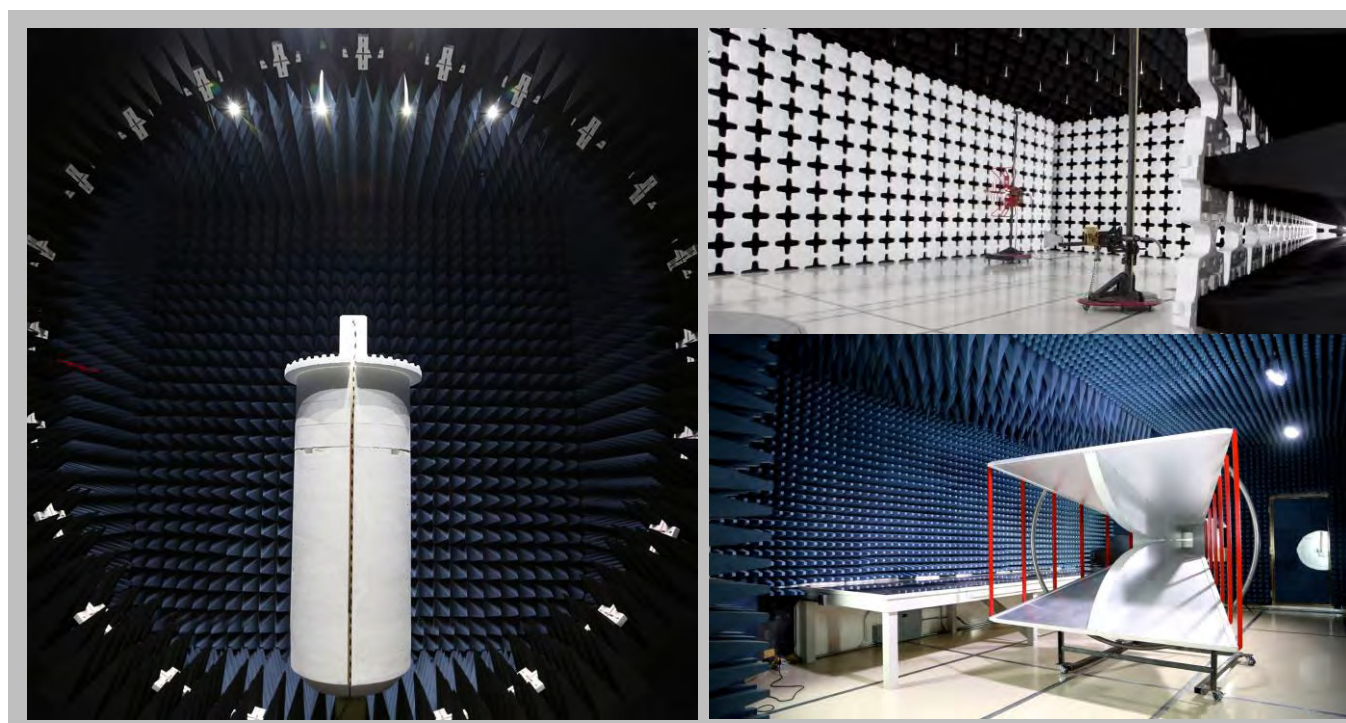
The following table represents the Measurement Uncertainty (MU) budgets for each of the tests that may be contained in this report.

| <b>Test</b>                           | <b>+ MU</b> | <b>- MU</b> |
|---------------------------------------|-------------|-------------|
| Frequency Accuracy (Hz)               | 0.0007%     | -0.0007%    |
| Amplitude Accuracy (dB)               | 1.2 dB      | -1.2 dB     |
| Conducted Power (dB)                  | 0.3 dB      | -0.3 dB     |
| Radiated Power via Substitution (dB)  | 0.7 dB      | -0.7 dB     |
| Temperature (degrees C)               | 0.7°C       | -0.7°C      |
| Humidity (% RH)                       | 2.5% RH     | -2.5% RH    |
| Voltage (AC)                          | 1.0%        | -1.0%       |
| Voltage (DC)                          | 0.7%        | -0.7%       |
| Field Strength (dB)                   | 5.2 dB      | -5.2 dB     |
| AC Powerline Conducted Emissions (dB) | 2.4 dB      | -2.4 dB     |

# FACILITIES



|                                                                                     |                                                                                                             |                                                                                            |                                                                                                   |                                                                                        |                                                                                                           |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>California</b><br>Labs OC01-13<br>41 Tesla<br>Irvine, CA 92618<br>(949) 861-8918 | <b>Minnesota</b><br>Labs MN01-08, MN10<br>9349 W Broadway Ave.<br>Brooklyn Park, MN 55445<br>(612)-638-5136 | <b>New York</b><br>Labs NY01-04<br>4939 Jordan Rd.<br>Elbridge, NY 13060<br>(315) 554-8214 | <b>Oregon</b><br>Labs EV01-12<br>22975 NW Evergreen Pkwy<br>Hillsboro, OR 97124<br>(503) 844-4066 | <b>Texas</b><br>Labs TX01-09<br>3801 E Plano Pkwy<br>Plano, TX 75074<br>(469) 304-5255 | <b>Washington</b><br>Labs NC01-05<br>19201 120 <sup>th</sup> Ave NE<br>Bothell, WA 98011<br>(425)984-6600 |
| <b>NVLAP</b>                                                                        |                                                                                                             |                                                                                            |                                                                                                   |                                                                                        |                                                                                                           |
| NVLAP Lab Code: 200676-0                                                            | NVLAP Lab Code: 200881-0                                                                                    | NVLAP Lab Code: 200761-0                                                                   | NVLAP Lab Code: 200630-0                                                                          | NVLAP Lab Code:201049-0                                                                | NVLAP Lab Code: 200629-0                                                                                  |
| <b>Industry Canada</b>                                                              |                                                                                                             |                                                                                            |                                                                                                   |                                                                                        |                                                                                                           |
| 2834B-1, 2834B-3                                                                    | 2834E-1                                                                                                     | N/A                                                                                        | 2834D-1, 2834D-2                                                                                  | 2834G-1                                                                                | 2834F-1                                                                                                   |
| <b>BSMI</b>                                                                         |                                                                                                             |                                                                                            |                                                                                                   |                                                                                        |                                                                                                           |
| SL2-IN-E-1154R                                                                      | SL2-IN-E-1152R                                                                                              | N/A                                                                                        | SL2-IN-E-1017                                                                                     | SL2-IN-E-1158R                                                                         | SL2-IN-E-1153R                                                                                            |
| <b>VCCI</b>                                                                         |                                                                                                             |                                                                                            |                                                                                                   |                                                                                        |                                                                                                           |
| A-0029                                                                              | A-0109                                                                                                      | N/A                                                                                        | A-0108                                                                                            | A-0201                                                                                 | A-0110                                                                                                    |
| <b>Recognized Phase I CAB for ACMA, BSMI, IDA, KCC/RRR, MIC, MOC, NCC, OFCA</b>     |                                                                                                             |                                                                                            |                                                                                                   |                                                                                        |                                                                                                           |
| US0158                                                                              | US0175                                                                                                      | N/A                                                                                        | US0017                                                                                            | US0191                                                                                 | US0157                                                                                                    |



# PRODUCT DESCRIPTION

## Client and Equipment Under Test (EUT) Information

|                                 |                                |
|---------------------------------|--------------------------------|
| <b>Company Name:</b>            | APDM, Inc.                     |
| <b>Address:</b>                 | 2828 SW Corbett Ave. Suite 135 |
| <b>City, State, Zip:</b>        | Portland, 97201                |
| <b>Test Requested By:</b>       | Jennifer Guyot                 |
| <b>Model:</b>                   | Opal                           |
| <b>First Date of Test:</b>      | February 02, 2016              |
| <b>Last Date of Test:</b>       | February 10, 2016              |
| <b>Receipt Date of Samples:</b> | February 02, 2016              |
| <b>Equipment Design Stage:</b>  | Production                     |
| <b>Equipment Condition:</b>     | No Damage                      |

## Information Provided by the Party Requesting the Test

|                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Functional Description of the EUT:</b>                                                                                                                                                                                                        |
| Patient worn monitor that contains a proprietary 2.4 GHz GFSK radio that communicates with an access point (AP). The AP is wired via USB to a Dock that provides an interface via USB to a PC. The Dock is powered by an AC-DC wall bug adapter. |
| <b>Testing Objective:</b>                                                                                                                                                                                                                        |
| To demonstrate compliance of the 2.4 GHz DTS radio to FCC 15.247 requirements.                                                                                                                                                                   |

# CONFIGURATIONS

## Configuration APDM0008- 2

| EUT                                                     |              |                   |               |
|---------------------------------------------------------|--------------|-------------------|---------------|
| Description                                             | Manufacturer | Model/Part Number | Serial Number |
| Wearable wirelessly synchronized human movement monitor | APDM Inc.    | Opal v2.6         | SMTTC1630731  |

| Cables     |        |            |         |              |              |
|------------|--------|------------|---------|--------------|--------------|
| Cable Type | Shield | Length (m) | Ferrite | Connection 1 | Connection 2 |
| USB        | Yes    | 1.0m       | Yes     | Opal         | Unterminated |

# MODIFICATIONS

## Equipment Modifications

| Item | Date      | Test                        | Modification                         | Note                                                                | Disposition of EUT                                |
|------|-----------|-----------------------------|--------------------------------------|---------------------------------------------------------------------|---------------------------------------------------|
| 1    | 2/3/2016  | Spurious Radiated Emissions | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Northwest EMC following the test. |
| 2    | 2/3/2016  | Out of Band Emissions       | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Northwest EMC following the test. |
| 3    | 2/10/2016 | Duty Cycle                  | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Northwest EMC following the test. |
| 4    | 2/10/2016 | Occupied Bandwidth          | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Northwest EMC following the test. |
| 5    | 2/10/2016 | Output Power                | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Northwest EMC following the test. |
| 6    | 2/10/2016 | Power Spectral Density      | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | EUT remained at Northwest EMC following the test. |
| 7    | 2/10/2016 | Band Edge Compliance        | Tested as delivered to Test Station. | No EMI suppression devices were added or modified during this test. | Scheduled testing was completed.                  |

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

## MODES OF OPERATION

Continuous Tx, GFSK Low Ch.2 2402 MHz  
Continuous Tx, GFSK Mid Ch.40 2440 MHz  
Continuous Tx, GFSK High Ch.81 2481 MHz

## POWER SETTINGS INVESTIGATED

Battery

## CONFIGURATIONS INVESTIGATED

APDM0008 - 2

## FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz Stop Frequency 26500 MHz

## SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

## TEST EQUIPMENT

| Description                  | Manufacturer    | Model                     | ID  | Last Cal. | Interval |
|------------------------------|-----------------|---------------------------|-----|-----------|----------|
| Cable                        | ESM Cable Corp. | KMKM-72                   | EVY | 11/4/2015 | 12 mo    |
| Amplifier - Pre-Amplifier    | Miteq           | AMF-6F-18002650-25-10P    | AVU | 11/4/2015 | 12 mo    |
| Antenna - Standard Gain      | ETS Lindgren    | 3160-09                   | AIV | NCR       | 0 mo     |
| Amplifier - Pre-Amplifier    | Miteq           | AMF-6F-12001800-30-10P    | AVD | 4/16/2015 | 12 mo    |
| Antenna - Standard Gain      | ETS Lindgren    | 3160-08                   | AHV | NCR       | 0 mo     |
| Cable                        | None            | Standard Gain Horns Cable | EVF | 4/20/2015 | 12 mo    |
| Amplifier - Pre-Amplifier    | Miteq           | AMF-6F-08001200-30-10P    | AVC | 4/20/2015 | 12 mo    |
| Antenna - Standard Gain      | ETS Lindgren    | 3160-07                   | AHU | NCR       | 0 mo     |
| Cable                        | N/A             | Double Ridge Horn Cables  | EVB | 4/16/2015 | 12 mo    |
| Amplifier - Pre-Amplifier    | Miteq           | AMF-3D-00100800-32-13P    | PAG | 4/16/2015 | 12 mo    |
| Antenna - Double Ridge       | EMCO            | 3115                      | AHC | 6/13/2014 | 24 mo    |
| Cable                        | N/A             | Bilog Cables              | EVA | 2/10/2015 | 12 mo    |
| Amplifier - Pre-Amplifier    | Miteq           | AM-1616-1000              | AOL | 2/10/2015 | 12 mo    |
| Antenna - Biconilog          | EMCO            | 3141                      | AXE | 8/29/2014 | 24 mo    |
| Attenuator                   | Coaxicom        | 3910-20                   | AXZ | 5/24/2015 | 12 mo    |
| Filter - High Pass           | Micro-Tronics   | HPM50111                  | HFO | 3/31/2015 | 12 mo    |
| Filter - Low Pass            | Micro-Tronics   | LPM50004                  | LFD | 5/24/2015 | 12 mo    |
| Analyzer - Spectrum Analyzer | Agilent         | E4446A                    | AAQ | 3/10/2015 | 12 mo    |

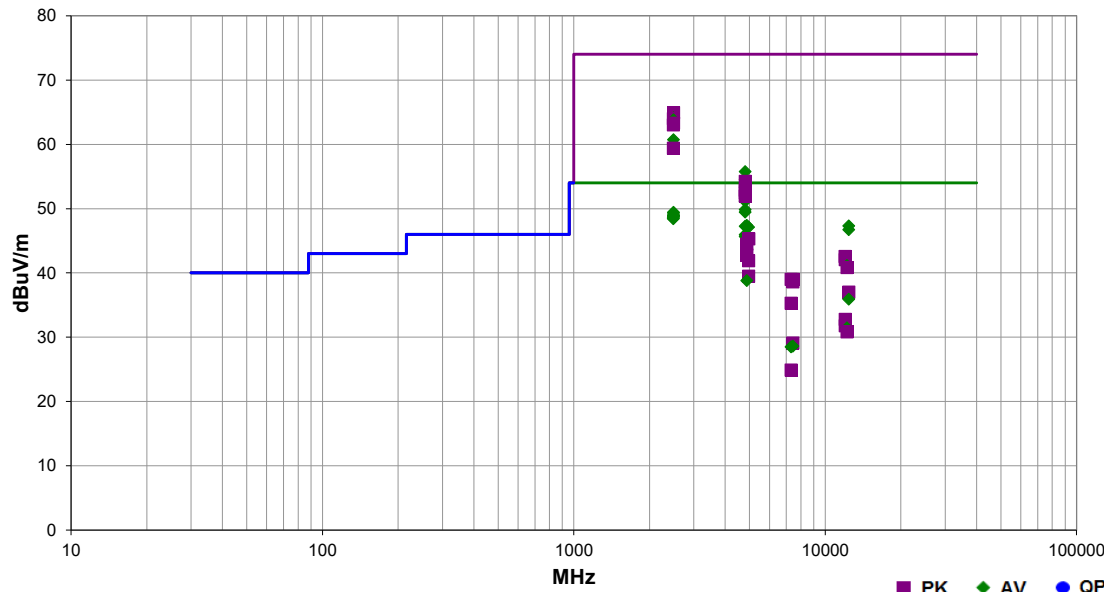
## TEST DESCRIPTION

The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

|                 |                                                                                 |                   |           |                                                                                    |
|-----------------|---------------------------------------------------------------------------------|-------------------|-----------|------------------------------------------------------------------------------------|
| Work Order:     | APDM0008                                                                        | Date:             | 02/03/16  |  |
| Project:        | None                                                                            | Temperature:      | 19.8 °C   |                                                                                    |
| Job Site:       | EV01                                                                            | Humidity:         | 37.8% RH  |                                                                                    |
| Serial Number:  | SMTC1630731                                                                     | Barometric Pres.: | 1021 mbar |                                                                                    |
| EUT:            | Opal                                                                            |                   |           |                                                                                    |
| Configuration:  | 2                                                                               |                   |           |                                                                                    |
| Customer:       | APDM, Inc.                                                                      |                   |           |                                                                                    |
| Attendees:      | Andrew Greenberg, Gavin Gallino, Dave Camarillo, Tim Brandon, and Chris Andrews |                   |           |                                                                                    |
| EUT Power:      | Battery                                                                         |                   |           |                                                                                    |
| Operating Mode: | Continuous Tx                                                                   |                   |           |                                                                                    |
| Deviations:     | None                                                                            |                   |           |                                                                                    |
| Comments:       | See comments for EUT position, channel, and frequency                           |                   |           |                                                                                    |

|                     |                  |
|---------------------|------------------|
| Test Specifications | Test Method      |
| FCC 15.247:2016     | ANSI C63.10:2013 |

|       |    |                   |   |                   |           |         |      |
|-------|----|-------------------|---|-------------------|-----------|---------|------|
| Run # | 17 | Test Distance (m) | 3 | Antenna Height(s) | 1 to 4(m) | Results | Pass |
|-------|----|-------------------|---|-------------------|-----------|---------|------|



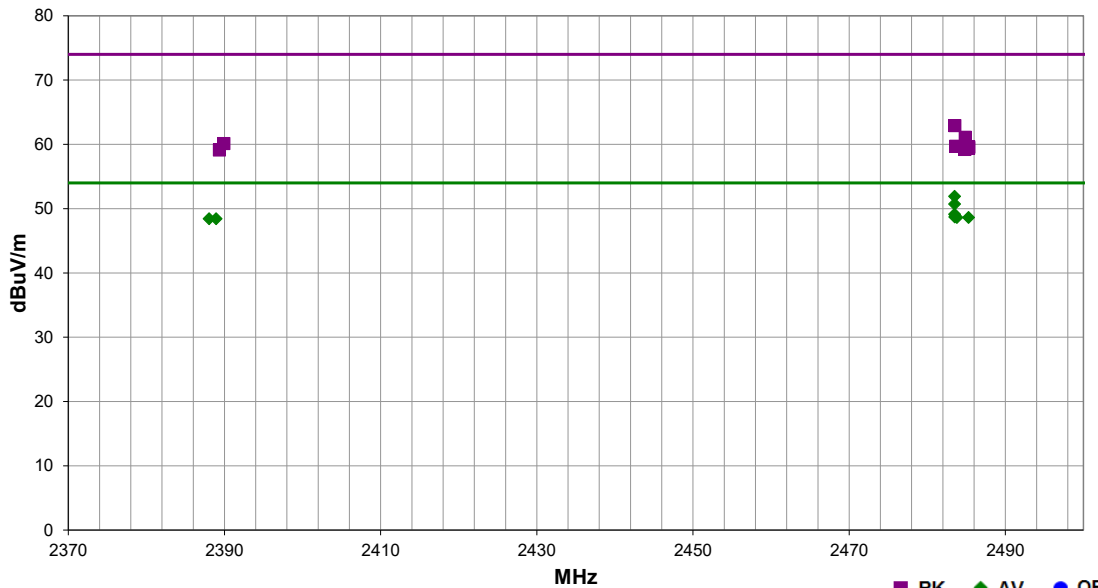
| Freq (MHz) | Amplitude (dBuV) | Factor (dB) | Antenna Height (meters) | Azimuth (degrees) | Test Distance (meters) | External Attenuation (dB) | Polarity/Transducer Type | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments                             |
|------------|------------------|-------------|-------------------------|-------------------|------------------------|---------------------------|--------------------------|----------|--------------------------|-------------------|----------------------|------------------------|--------------------------------------|
| 4804.010   | 43.6             | 7.5         | 1.0                     | 330.0             | 3.0                    | 0.0                       | Horz                     | AV       | 0.0                      | 51.1              | 54.0                 | -2.9                   | Channel 2, 2402 MHz, EUT Horizontal  |
| 4804.010   | 42.3             | 7.5         | 1.0                     | 185.0             | 3.0                    | 0.0                       | Vert                     | AV       | 0.0                      | 49.8              | 54.0                 | -4.2                   | Channel 2, 2402 MHz, EUT On Side     |
| 4803.960   | 41.9             | 7.5         | 1.0                     | 43.0              | 3.0                    | 0.0                       | Horz                     | AV       | 0.0                      | 49.4              | 54.0                 | -4.6                   | Channel 2, 2402 MHz, EUT Vertical    |
| 2490.690   | 31.9             | -2.5        | 1.0                     | 106.0             | 3.0                    | 20.0                      | Vert                     | AV       | 0.0                      | 49.4              | 54.0                 | -4.6                   | Channel 81, 2481 MHz, EUT Vertical   |
| 2490.697   | 31.8             | -2.5        | 1.0                     | 287.0             | 3.0                    | 20.0                      | Horz                     | AV       | 0.0                      | 49.3              | 54.0                 | -4.7                   | Channel 81, 2481 MHz, EUT Horizontal |
| 2490.840   | 31.5             | -2.5        | 1.0                     | 174.0             | 3.0                    | 20.0                      | Horz                     | AV       | 0.0                      | 49.0              | 54.0                 | -5.0                   | Channel 40, 2440 MHz, EUT Horizontal |
| 2490.720   | 31.4             | -2.5        | 1.0                     | 261.0             | 3.0                    | 20.0                      | Vert                     | AV       | 0.0                      | 48.9              | 54.0                 | -5.1                   | Channel 2, 2402 MHz, EUT Vertical    |
| 2490.727   | 31.3             | -2.5        | 1.0                     | 207.0             | 3.0                    | 20.0                      | Horz                     | AV       | 0.0                      | 48.8              | 54.0                 | -5.2                   | Channel 2, 2402 MHz, EUT Horizontal  |
| 2490.707   | 31.3             | -2.5        | 1.0                     | 121.0             | 3.0                    | 20.0                      | Vert                     | AV       | 0.0                      | 48.8              | 54.0                 | -5.2                   | Channel 40, 2440 MHz, EUT Vertical   |
| 2490.527   | 31.1             | -2.5        | 1.0                     | 296.0             | 3.0                    | 20.0                      | Vert                     | AV       | 0.0                      | 48.6              | 54.0                 | -5.4                   | Channel 81, 2481 MHz, EUT On Side    |
| 2490.467   | 31.0             | -2.5        | 1.0                     | 171.0             | 3.0                    | 20.0                      | Horz                     | AV       | 0.0                      | 48.5              | 54.0                 | -5.5                   | Channel 81, 2481 MHz, EUT On Side    |
| 2490.217   | 30.9             | -2.5        | 3.6                     | 129.0             | 3.0                    | 20.0                      | Vert                     | AV       | 0.0                      | 48.4              | 54.0                 | -5.6                   | Channel 81, 2481 MHz, EUT Horizontal |
| 4804.050   | 39.7             | 7.5         | 1.0                     | 317.0             | 3.0                    | 0.0                       | Horz                     | AV       | 0.0                      | 47.2              | 54.0                 | -6.8                   | Channel 2, 2402 MHz, EUT On Side     |
| 4803.895   | 38.4             | 7.5         | 1.0                     | 263.0             | 3.0                    | 0.0                       | Vert                     | AV       | 0.0                      | 45.9              | 54.0                 | -8.1                   | Channel 2, 2402 MHz, EUT Vertical    |
| 4803.980   | 38.1             | 7.5         | 4.0                     | 243.0             | 3.0                    | 0.0                       | Vert                     | AV       | 0.0                      | 45.6              | 54.0                 | -8.4                   | Channel 2, 2402 MHz, EUT Horizontal  |
| 2490.713   | 47.4             | -2.5        | 1.0                     | 106.0             | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 64.9              | 74.0                 | -9.1                   | Channel 81, 2481 MHz, EUT Vertical   |
| 2490.620   | 46.6             | -2.5        | 1.0                     | 287.0             | 3.0                    | 20.0                      | Horz                     | PK       | 0.0                      | 64.1              | 74.0                 | -9.9                   | Channel 81, 2481 MHz, EUT Horizontal |
| 2490.443   | 46.5             | -2.5        | 1.0                     | 207.0             | 3.0                    | 20.0                      | Horz                     | PK       | 0.0                      | 64.0              | 74.0                 | -10.0                  | Channel 2, 2402 MHz, EUT Horizontal  |
| 2490.727   | 46.3             | -2.5        | 1.0                     | 174.0             | 3.0                    | 20.0                      | Horz                     | PK       | 0.0                      | 63.8              | 74.0                 | -10.2                  | Channel 40, 2440 MHz, EUT Horizontal |
| 2490.660   | 45.8             | -2.5        | 1.0                     | 261.0             | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 63.3              | 74.0                 | -10.7                  | Channel 2, 2402 MHz, EUT Vertical    |
| 2490.333   | 45.5             | -2.5        | 1.0                     | 121.0             | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 63.0              | 74.0                 | -11.0                  | Channel 40, 2440 MHz, EUT Vertical   |
| 4879.908   | 42.8             | 0.0         | 1.0                     | 320.0             | 3.0                    | 0.0                       | Horz                     | AV       | 0.0                      | 42.8              | 54.0                 | -11.2                  | Channel 40, 2440 MHz, EUT Horizontal |
| 4961.950   | 41.9             | 0.0         | 1.0                     | 49.0              | 3.0                    | 0.0                       | Horz                     | AV       | 0.0                      | 41.9              | 54.0                 | -12.1                  | Channel 81, 2481 MHz, EUT Horizontal |
| 2490.903   | 43.2             | -2.5        | 1.0                     | 296.0             | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 60.7              | 74.0                 | -13.3                  | Channel 81, 2481 MHz, EUT On Side    |
| 2490.610   | 42.5             | -2.5        | 1.0                     | 171.0             | 3.0                    | 20.0                      | Horz                     | PK       | 0.0                      | 60.0              | 74.0                 | -14.0                  | Channel 81, 2481 MHz, EUT On Side    |
| 4962.142   | 39.5             | 0.0         | 1.0                     | 187.0             | 3.0                    | 0.0                       | Vert                     | AV       | 0.0                      | 39.5              | 54.0                 | -14.5                  | Channel 81, 2481 MHz, EUT on side    |
| 2489.747   | 41.9             | -2.5        | 1.0                     | 89.0              | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 59.4              | 74.0                 | -14.6                  | Channel 81, 2481 MHz, EUT Horizontal |
| 4879.950   | 38.8             | 0.0         | 1.0                     | 184.0             | 3.0                    | 0.0                       | Vert                     | AV       | 0.0                      | 38.8              | 54.0                 | -15.2                  | Channel 40, 2440 MHz, EUT on side    |

| Freq (MHz) | Amplitude (dBuV) | Factor (dB) | Antenna Height (meters) | Azimuth (degrees) | Test Distance (meters) | External Attenuation (dB) | Polarity/ Transducer Type | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments                             |
|------------|------------------|-------------|-------------------------|-------------------|------------------------|---------------------------|---------------------------|----------|--------------------------|-------------------|----------------------|------------------------|--------------------------------------|
| 12403.710  | 28.2             | 8.8         | 1.0                     | 160.0             | 3.0                    | 0.0                       | Vert                      | AV       | 0.0                      | 37.0              | 54.0                 | -17.0                  | Channel 81, 2481 MHz, EUT On Side    |
| 12404.400  | 27.1             | 8.8         | 2.0                     | 163.0             | 3.0                    | 0.0                       | Horz                      | AV       | 0.0                      | 35.9              | 54.0                 | -18.1                  | Channel 81, 2481 MHz, EUT Horizontal |
| 4804.535   | 48.2             | 7.5         | 1.0                     | 330.0             | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 55.7              | 74.0                 | -18.3                  | Channel 2, 2402 MHz, EUT Horizontal  |
| 4804.400   | 47.0             | 7.5         | 1.0                     | 185.0             | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 54.5              | 74.0                 | -19.5                  | Channel 2, 2402 MHz, EUT On Side     |
| 4803.525   | 46.7             | 7.5         | 1.0                     | 43.0              | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 54.2              | 74.0                 | -19.8                  | Channel 2, 2402 MHz, EUT Vertical    |
| 4803.755   | 45.3             | 7.5         | 1.0                     | 317.0             | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 52.8              | 74.0                 | -21.2                  | Channel 2, 2402 MHz, EUT On Side     |
| 12001.410  | 32.7             | 0.1         | 1.0                     | 220.0             | 3.0                    | 0.0                       | Vert                      | AV       | 0.0                      | 32.8              | 54.0                 | -21.2                  | Channel 2, 2402 MHz, EUT on side     |
| 4803.580   | 44.9             | 7.5         | 4.0                     | 243.0             | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 52.4              | 74.0                 | -21.6                  | Channel 2, 2402 MHz, EUT Horizontal  |
| 4803.650   | 44.4             | 7.5         | 1.0                     | 263.0             | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 51.9              | 74.0                 | -22.1                  | Channel 2, 2402 MHz, EUT Vertical    |
| 12001.180  | 31.7             | 0.1         | 2.8                     | 221.0             | 3.0                    | 0.0                       | Horz                      | AV       | 0.0                      | 31.8              | 54.0                 | -22.2                  | Channel 2, 2402 MHz, EUT Horizontal  |
| 12201.360  | 30.3             | 1.1         | 1.0                     | 40.0              | 3.0                    | 0.0                       | Vert                      | AV       | 0.0                      | 31.4              | 54.0                 | -22.6                  | Channel 40, 2440 MHz, EUT on side    |
| 12201.530  | 29.7             | 1.1         | 1.0                     | 321.0             | 3.0                    | 0.0                       | Horz                      | AV       | 0.0                      | 30.8              | 54.0                 | -23.2                  | Channel 40, 2440 MHz, EUT Horizontal |
| 7442.517   | 29.1             | 0.0         | 1.0                     | 149.0             | 3.0                    | 0.0                       | Vert                      | AV       | 0.0                      | 29.1              | 54.0                 | -24.9                  | Channel 81, 2481 MHz, EUT on side    |
| 7443.142   | 28.6             | 0.0         | 1.1                     | 285.0             | 3.0                    | 0.0                       | Horz                      | AV       | 0.0                      | 28.6              | 54.0                 | -25.4                  | Channel 81, 2481 MHz, EUT Horizontal |
| 7319.383   | 28.5             | 0.0         | 1.0                     | 295.0             | 3.0                    | 0.0                       | Horz                      | AV       | 0.0                      | 28.5              | 54.0                 | -25.5                  | Channel 40, 2440 MHz, EUT Horizontal |
| 4879.633   | 47.4             | 0.0         | 1.0                     | 320.0             | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 47.4              | 74.0                 | -26.6                  | Channel 40, 2440 MHz, EUT Horizontal |
| 12405.920  | 38.5             | 8.8         | 1.0                     | 160.0             | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 47.3              | 74.0                 | -26.7                  | Channel 81, 2481 MHz, EUT On Side    |
| 4961.408   | 47.1             | 0.0         | 1.0                     | 49.0              | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 47.1              | 74.0                 | -26.9                  | Channel 81, 2481 MHz, EUT Horizontal |
| 12404.440  | 37.9             | 8.8         | 2.0                     | 163.0             | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 46.7              | 74.0                 | -27.3                  | Channel 81, 2481 MHz, EUT Horizontal |
| 4962.650   | 45.3             | 0.0         | 1.0                     | 187.0             | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 45.3              | 74.0                 | -28.7                  | Channel 81, 2481 MHz, EUT on side    |
| 7319.483   | 24.9             | 0.0         | 1.0                     | 246.0             | 3.0                    | 0.0                       | Vert                      | AV       | 0.0                      | 24.9              | 54.0                 | -29.1                  | Channel 40, 2440 MHz, EUT on side    |
| 4879.733   | 44.5             | 0.0         | 1.0                     | 184.0             | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 44.5              | 74.0                 | -29.5                  | Channel 40, 2440 MHz, EUT on side    |
| 12000.230  | 42.5             | 0.1         | 1.0                     | 220.0             | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 42.6              | 74.0                 | -31.4                  | Channel 2, 2402 MHz, EUT on side     |
| 12001.090  | 42.0             | 0.1         | 2.8                     | 221.0             | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 42.1              | 74.0                 | -31.9                  | Channel 2, 2402 MHz, EUT Horizontal  |
| 12201.450  | 40.0             | 1.1         | 1.0                     | 321.0             | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 41.1              | 74.0                 | -32.9                  | Channel 40, 2440 MHz, EUT Horizontal |
| 12201.280  | 39.7             | 1.1         | 1.0                     | 40.0              | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 40.8              | 74.0                 | -33.2                  | Channel 40, 2440 MHz, EUT on side    |
| 7443.600   | 39.0             | 0.0         | 1.0                     | 149.0             | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 39.0              | 74.0                 | -35.0                  | Channel 81, 2481 MHz, EUT on side    |
| 7319.733   | 39.0             | 0.0         | 1.0                     | 295.0             | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 39.0              | 74.0                 | -35.0                  | Channel 40, 2440 MHz, EUT Horizontal |
| 7443.092   | 38.6             | 0.0         | 1.1                     | 285.0             | 3.0                    | 0.0                       | Horz                      | PK       | 0.0                      | 38.6              | 74.0                 | -35.4                  | Channel 81, 2481 MHz, EUT Horizontal |
| 7321.525   | 35.3             | 0.0         | 1.0                     | 246.0             | 3.0                    | 0.0                       | Vert                      | PK       | 0.0                      | 35.3              | 74.0                 | -38.7                  | Channel 40, 2440 MHz, EUT on side    |

|                 |                                                                                 |                   |           |                                                                                    |
|-----------------|---------------------------------------------------------------------------------|-------------------|-----------|------------------------------------------------------------------------------------|
| Work Order:     | APDM0008                                                                        | Date:             | 02/03/16  |  |
| Project:        | None                                                                            | Temperature:      | 19.8 °C   |                                                                                    |
| Job Site:       | EV01                                                                            | Humidity:         | 37.8% RH  |                                                                                    |
| Serial Number:  | SMTC1630731                                                                     | Barometric Pres.: | 1021 mbar |                                                                                    |
| EUT:            | Opal                                                                            |                   |           |                                                                                    |
| Configuration:  | 2                                                                               |                   |           |                                                                                    |
| Customer:       | APDM, Inc.                                                                      |                   |           |                                                                                    |
| Attendees:      | Andrew Greenberg, Gavin Gallino, Dave Camarillo, Tim Brandon, and Chris Andrews |                   |           |                                                                                    |
| EUT Power:      | Battery                                                                         |                   |           |                                                                                    |
| Operating Mode: | Continuous Tx                                                                   |                   |           |                                                                                    |
| Deviations:     | None                                                                            |                   |           |                                                                                    |
| Comments:       | See comments for EUT position, channel, and frequency                           |                   |           |                                                                                    |

| Test Specifications | Test Method      |
|---------------------|------------------|
| FCC 15.247:2016     | ANSI C63.10:2013 |

| Run # | 19 | Test Distance (m) | 3 | Antenna Height(s) | 1 to 4(m) | Results | Pass |
|-------|----|-------------------|---|-------------------|-----------|---------|------|
|-------|----|-------------------|---|-------------------|-----------|---------|------|



| Freq (MHz) | Amplitude (dBuV) | Factor (dB) | Antenna Height (meters) | Azimuth (degrees) | Test Distance (meters) | External Attenuation (dB) | Polarity/ Transducer Type | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBuV/m) | Compared to Spec. (dB) | Comments                             |
|------------|------------------|-------------|-------------------------|-------------------|------------------------|---------------------------|---------------------------|----------|--------------------------|-------------------|----------------------|------------------------|--------------------------------------|
| 2483.500   | 34.4             | -2.5        | 1.0                     | 103.0             | 3.0                    | 20.0                      | Vert                      | AV       | 0.0                      | 51.9              | 54.0                 | -2.1                   | Channel 81, 2481 MHz, EUT Vertical   |
| 2483.500   | 33.2             | -2.5        | 1.0                     | 216.0             | 3.0                    | 20.0                      | Horz                      | AV       | 0.0                      | 50.7              | 54.0                 | -3.3                   | Channel 81, 2481 MHz, EUT Horizontal |
| 2483.503   | 31.6             | -2.5        | 1.0                     | 327.0             | 3.0                    | 20.0                      | Vert                      | AV       | 0.0                      | 49.1              | 54.0                 | -4.9                   | Channel 81, 2481 MHz, EUT On Side    |
| 2483.530   | 31.2             | -2.5        | 1.0                     | 346.0             | 3.0                    | 20.0                      | Horz                      | AV       | 0.0                      | 48.7              | 54.0                 | -5.3                   | Channel 81, 2481 MHz, EUT Vertical   |
| 2485.290   | 31.1             | -2.5        | 1.0                     | 14.0              | 3.0                    | 20.0                      | Horz                      | AV       | 0.0                      | 48.6              | 54.0                 | -5.4                   | Channel 81, 2481 MHz, EUT On Side    |
| 2483.803   | 31.1             | -2.5        | 1.0                     | 262.0             | 3.0                    | 20.0                      | Vert                      | AV       | 0.0                      | 48.6              | 54.0                 | -5.4                   | Channel 81, 2481 MHz, EUT Horizontal |
| 2388.927   | 31.1             | -2.7        | 1.0                     | 34.0              | 3.0                    | 20.0                      | Horz                      | AV       | 0.0                      | 48.4              | 54.0                 | -5.6                   | Channel 2, 2402 MHz, EUT Horizontal  |
| 2388.047   | 31.1             | -2.7        | 1.0                     | 100.0             | 3.0                    | 20.0                      | Vert                      | AV       | 0.0                      | 48.4              | 54.0                 | -5.6                   | Channel 2, 2402 MHz, EUT Vertical    |
| 2483.523   | 45.4             | -2.5        | 1.0                     | 103.0             | 3.0                    | 20.0                      | Vert                      | PK       | 0.0                      | 62.9              | 74.0                 | -11.1                  | Channel 81, 2481 MHz, EUT Vertical   |
| 2484.873   | 43.6             | -2.5        | 1.0                     | 216.0             | 3.0                    | 20.0                      | Horz                      | PK       | 0.0                      | 61.1              | 74.0                 | -12.9                  | Channel 81, 2481 MHz, EUT Horizontal |
| 2389.933   | 42.8             | -2.7        | 1.0                     | 34.0              | 3.0                    | 20.0                      | Horz                      | PK       | 0.0                      | 60.1              | 74.0                 | -13.9                  | Channel 2, 2402 MHz, EUT Horizontal  |
| 2483.643   | 42.2             | -2.5        | 1.0                     | 327.0             | 3.0                    | 20.0                      | Vert                      | PK       | 0.0                      | 59.7              | 74.0                 | -14.3                  | Channel 81, 2481 MHz, EUT On Side    |
| 2485.333   | 42.1             | -2.5        | 1.0                     | 14.0              | 3.0                    | 20.0                      | Horz                      | PK       | 0.0                      | 59.6              | 74.0                 | -14.4                  | Channel 81, 2481 MHz, EUT On Side    |
| 2485.297   | 41.9             | -2.5        | 1.0                     | 346.0             | 3.0                    | 20.0                      | Horz                      | PK       | 0.0                      | 59.4              | 74.0                 | -14.6                  | Channel 81, 2481 MHz, EUT Vertical   |
| 2484.817   | 41.7             | -2.5        | 1.0                     | 262.0             | 3.0                    | 20.0                      | Vert                      | PK       | 0.0                      | 59.2              | 74.0                 | -14.8                  | Channel 81, 2481 MHz, EUT Horizontal |
| 2389.353   | 41.8             | -2.7        | 1.0                     | 100.0             | 3.0                    | 20.0                      | Vert                      | PK       | 0.0                      | 59.1              | 74.0                 | -14.9                  | Channel 2, 2402 MHz, EUT Vertical    |

# BAND EDGE COMPLIANCE

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

| Description                  | Manufacturer | Model                    | ID  | Last Cal. | Interval (mo) |
|------------------------------|--------------|--------------------------|-----|-----------|---------------|
| Analyzer - Spectrum Analyzer | Agilent      | E4446A                   | AAQ | 3/10/2015 | 12            |
| Cable                        | N/A          | Double Ridge Horn Cables | EVB | 4/16/2015 | 12            |
| Antenna - Double Ridge       | EMCO         | 3115                     | AHC | 6/13/2014 | 24            |

## TEST DESCRIPTION

The EUT was set to low and high transmit frequencies. The spurious RF conducted emissions at the edges of the authorized bands were measured with the EUT set to low and high transmit frequencies in each available band. The channels closest to the band edges were selected. The measurement was made in a radiated configuration in a semi-anechoic chamber with the fundamental of the carrier full maximized for its highest radiated power. The EUT was transmitting at the data rate(s) listed in the datasheet.

The spectrum was scanned below the lower band edge and above the higher band edge.

# BAND EDGE COMPLIANCE

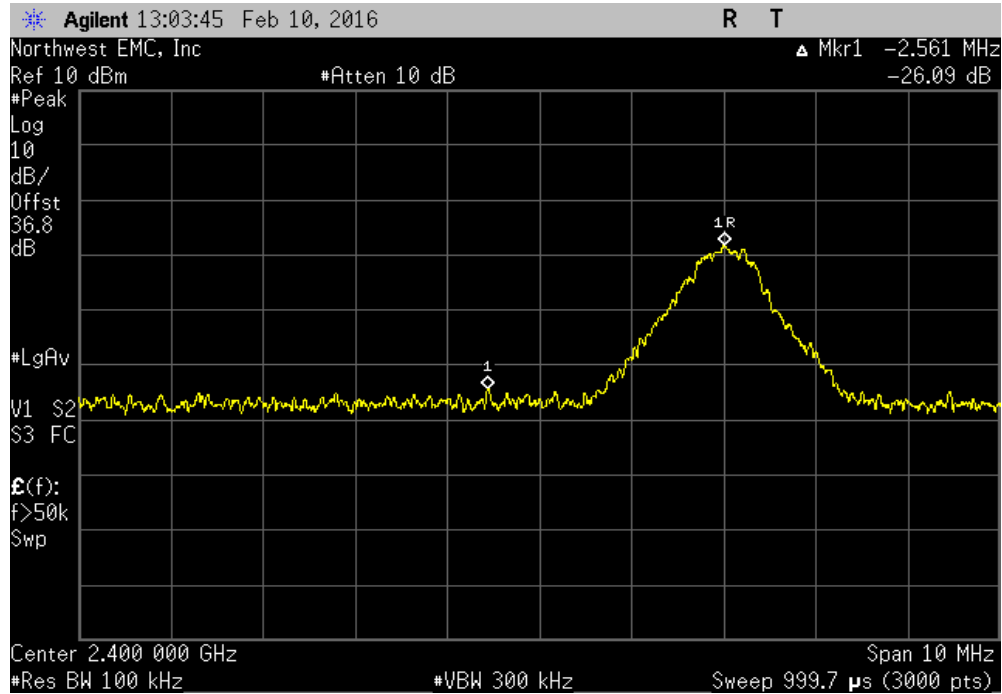


XMR 2015.01.14

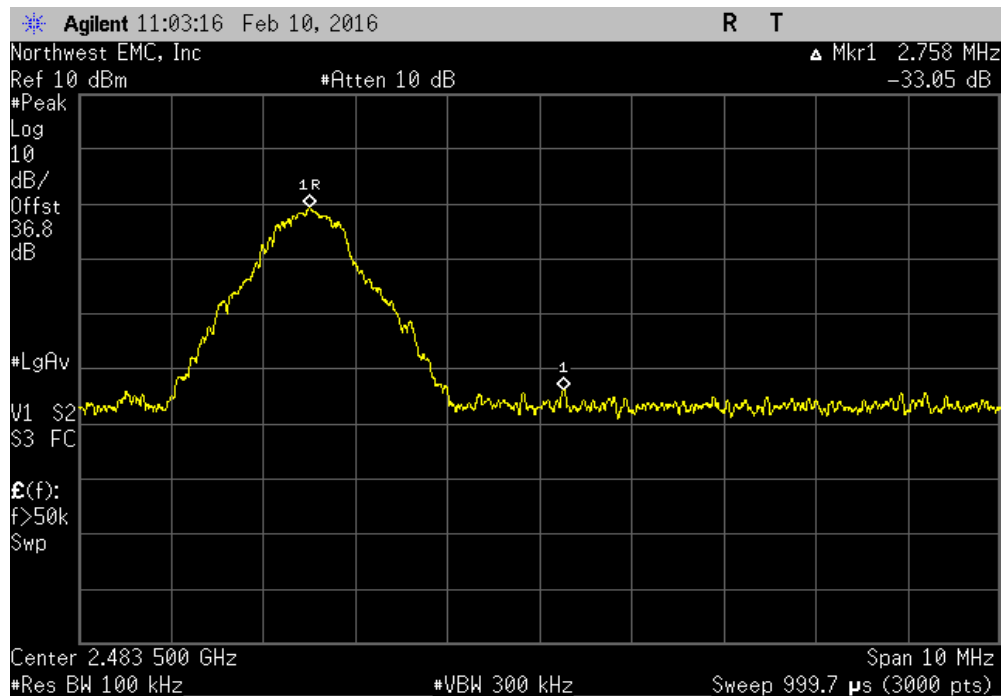
|                                                                                    |                |                                                                                             |                      |
|------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------|----------------------|
| EUT: Opal                                                                          |                | Work Order: ADPM0008                                                                        |                      |
| Serial Number: SMTc1630731                                                         |                | Date: 02/10/16                                                                              |                      |
| Customer: APDM, Inc.                                                               |                | Temperature: 22.2°C                                                                         |                      |
| Attendees: Andrew Greenberg, Gavin Gallino                                         |                | Humidity: 41%                                                                               |                      |
| Project: None                                                                      |                | Barometric Pres.: 1022.7                                                                    |                      |
| Tested by: Brandon Hobbs                                                           | Power: Battery | Job Site: EV01                                                                              |                      |
| TEST SPECIFICATIONS                                                                |                |                                                                                             |                      |
| FCC 15.247:2016                                                                    |                | Test Method                                                                                 |                      |
|                                                                                    |                | ANSI C63.10:2013                                                                            |                      |
| COMMENTS                                                                           |                |                                                                                             |                      |
| The EUT was maximized to its single highest orientation for radiated measurements. |                |                                                                                             |                      |
| DEVIATIONS FROM TEST STANDARD                                                      |                |                                                                                             |                      |
| None                                                                               |                |                                                                                             |                      |
| Configuration #                                                                    | 2              | Signature  |                      |
|                                                                                    |                | Value (dBc)                                                                                 | Limit ≤ (dBc) Result |
| 2400 MHz - 2483.5 MHz Band                                                         |                |                                                                                             |                      |
| Zigbee GFSK                                                                        |                |                                                                                             |                      |
| Low Channel 2, 2402 MHz                                                            |                | -26.09                                                                                      | -20 Pass             |
| High Channel 81, 2481 MHz                                                          |                | -33.05                                                                                      | -20 Pass             |

# BAND EDGE COMPLIANCE

| 2400 MHz - 2483.5 MHz Band, Zigbee GFSK, Low Channel 2, 2402 MHz |  |  |  |                |                  |        |
|------------------------------------------------------------------|--|--|--|----------------|------------------|--------|
|                                                                  |  |  |  | Value<br>(dBc) | Limit<br>≤ (dBc) | Result |
|                                                                  |  |  |  | -26.09         | -20              | Pass   |



| 2400 MHz - 2483.5 MHz Band, Zigbee GFSK, High Channel 81, 2481 MHz |  |  |  |                |                  |        |
|--------------------------------------------------------------------|--|--|--|----------------|------------------|--------|
|                                                                    |  |  |  | Value<br>(dBc) | Limit<br>≤ (dBc) | Result |
|                                                                    |  |  |  | -33.05         | -20              | Pass   |



# DUTY CYCLE

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

| Description                  | Manufacturer | Model                    | ID  | Last Cal. | Interval (mo) |
|------------------------------|--------------|--------------------------|-----|-----------|---------------|
| Cable                        | N/A          | Double Ridge Horn Cables | EVB | 4/16/2015 | 12            |
| Antenna - Double Ridge       | EMCO         | 3115                     | AHC | 6/13/2014 | 24            |
| Analyzer - Spectrum Analyzer | Agilent      | E4446A                   | AAQ | 3/10/2015 | 12            |

## TEST DESCRIPTION

The Duty Cycle (x) of the single channel operation of the radio as controlled by the provided test software was measured for each of the EUT operating modes.

There is no compliance requirement to be met by this test, so therefore no Pass / Fail criteria.

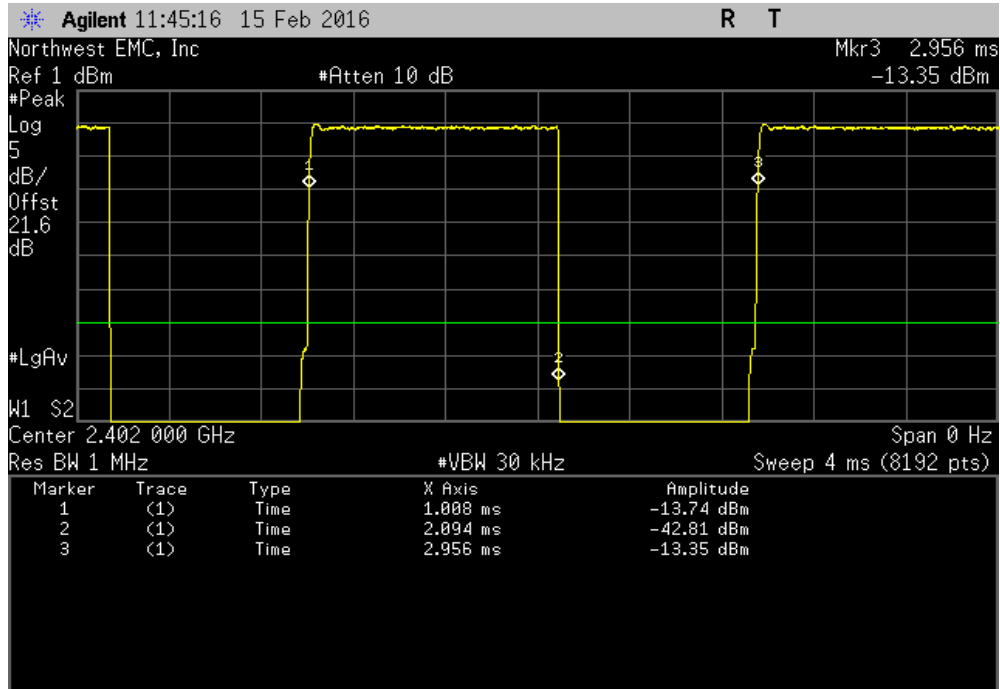
The measurements were made using a zero span on the spectrum analyzer to see the pulses in the time domain. The transmit power was set to its default maximum. The duty cycle was measured radiated in the RF chamber.

# DUTY CYCLE

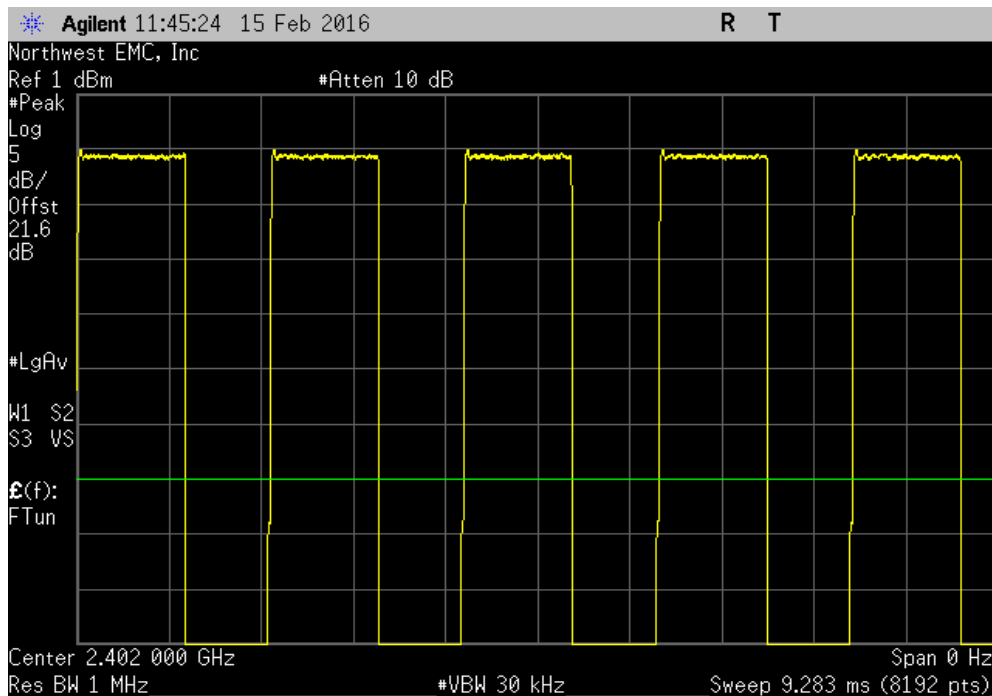
|                                                                             |                            |                                                                                             |           |
|-----------------------------------------------------------------------------|----------------------------|---------------------------------------------------------------------------------------------|-----------|
| EUT: Opal                                                                   |                            | Work Order: APDM0008                                                                        |           |
| Serial Number: SMTC1630731                                                  |                            | Date: 02/10/16                                                                              |           |
| Customer: APDM, Inc.                                                        |                            | Temperature: 22.3°C                                                                         |           |
| Attendees: Andrew Greenberg, Gavin Gallino, Dave Camarillo, and Tim Brandon |                            | Humidity: 41%                                                                               |           |
| Project: None                                                               |                            | Barometric Pres.: 1022.7                                                                    |           |
| Tested by: Brandon Hobbs                                                    | Power: Battery             | Job Site: EV01                                                                              |           |
| TEST SPECIFICATIONS                                                         |                            | Test Method                                                                                 |           |
| FCC 15.247:2016                                                             |                            | ANSI C63.10:2013                                                                            |           |
| COMMENTS                                                                    |                            |                                                                                             |           |
| Continuous Broadcast modes were provided by the client.                     |                            |                                                                                             |           |
| DEVIATIONS FROM TEST STANDARD                                               |                            |                                                                                             |           |
| None                                                                        |                            |                                                                                             |           |
| Configuration #                                                             | 2                          | Signature  |           |
|                                                                             |                            | Pulse Width                                                                                 | Period    |
|                                                                             |                            | Number of Pulses                                                                            | Value (%) |
|                                                                             |                            | Limit (%)                                                                                   | Results   |
| Normal Temperature Conditions                                               |                            |                                                                                             |           |
| Zigbee GFSK                                                                 |                            |                                                                                             |           |
|                                                                             | Low Channel, 2, 2402 MHz   | 1.086 ms                                                                                    | 1.948 ms  |
|                                                                             | Low Channel, 2, 2402 MHz   | N/A                                                                                         | N/A       |
|                                                                             | Mid Channel, 40, 2440 MHz  | 1.087 ms                                                                                    | 1.95 ms   |
|                                                                             | Mid Channel, 40, 2440 MHz  | N/A                                                                                         | N/A       |
|                                                                             | High Channel, 81, 2481 MHz | 1.087 ms                                                                                    | 1.948 ms  |
|                                                                             | High Channel, 81, 2481 MHz | N/A                                                                                         | N/A       |
|                                                                             |                            | 5                                                                                           | N/A       |

# DUTY CYCLE

| Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz |             |          |                  |           |           |         |
|----------------------------------------------------------------------|-------------|----------|------------------|-----------|-----------|---------|
|                                                                      | Pulse Width | Period   | Number of Pulses | Value (%) | Limit (%) | Results |
|                                                                      | 1.086 ms    | 1.948 ms | 1                | 55.8      | N/A       | N/A     |

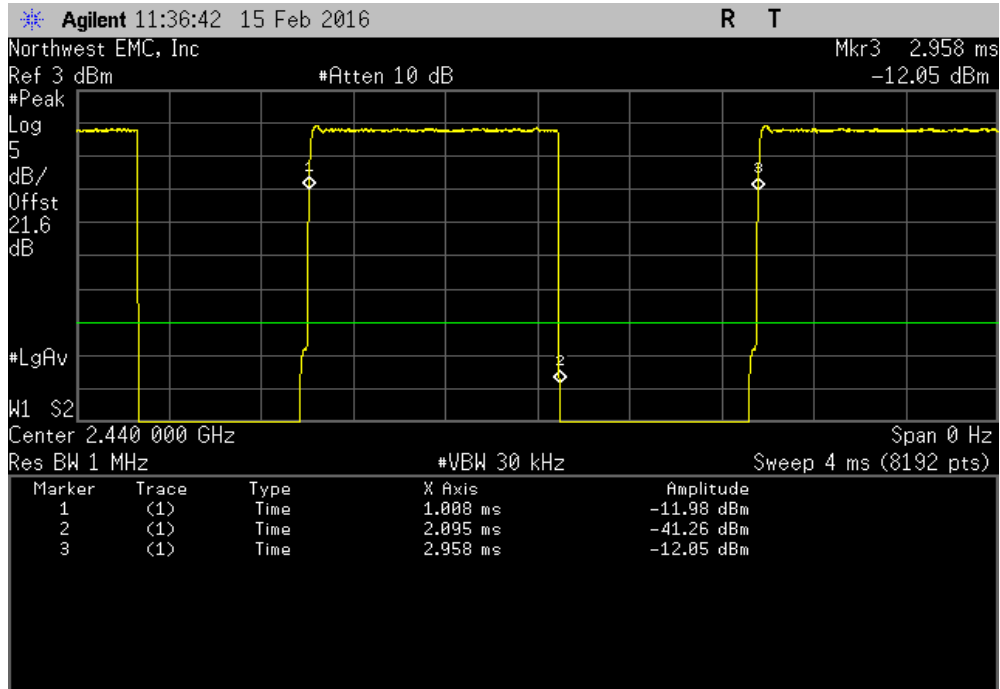


| Normal Temperature Conditions, Zigbee GFSK, Low Channel, 2, 2402 MHz |             |        |                  |           |           |         |
|----------------------------------------------------------------------|-------------|--------|------------------|-----------|-----------|---------|
|                                                                      | Pulse Width | Period | Number of Pulses | Value (%) | Limit (%) | Results |
|                                                                      | N/A         | N/A    | 5                | N/A       | N/A       | N/A     |

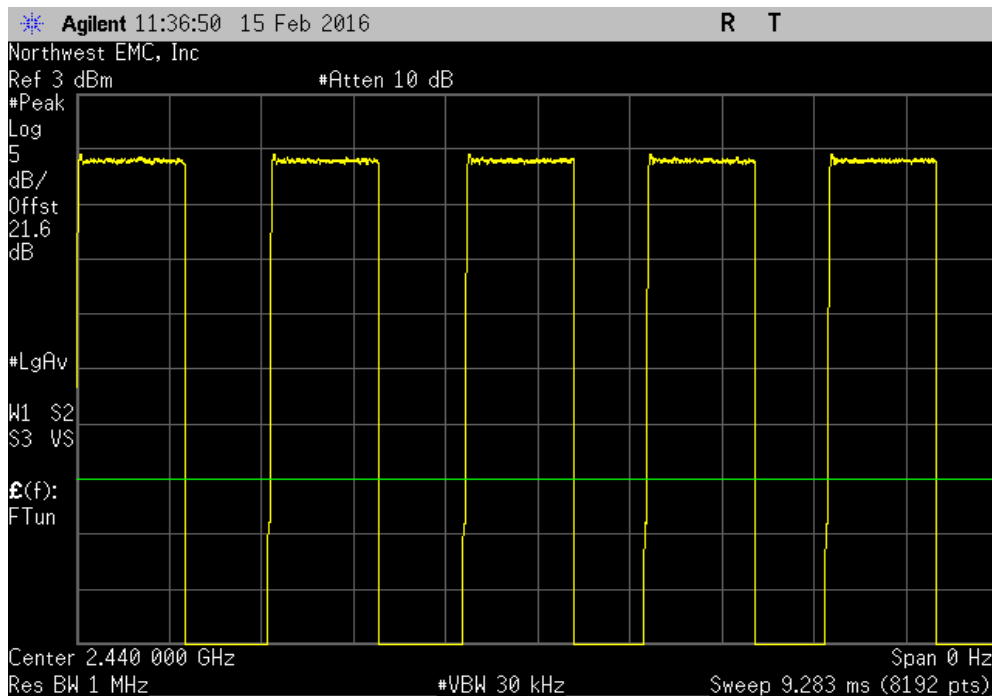


# DUTY CYCLE

| Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz |             |         |                  |           |           |         |
|-----------------------------------------------------------------------|-------------|---------|------------------|-----------|-----------|---------|
|                                                                       | Pulse Width | Period  | Number of Pulses | Value (%) | Limit (%) | Results |
|                                                                       | 1.087 ms    | 1.95 ms | 1                | 55.7      | N/A       | N/A     |

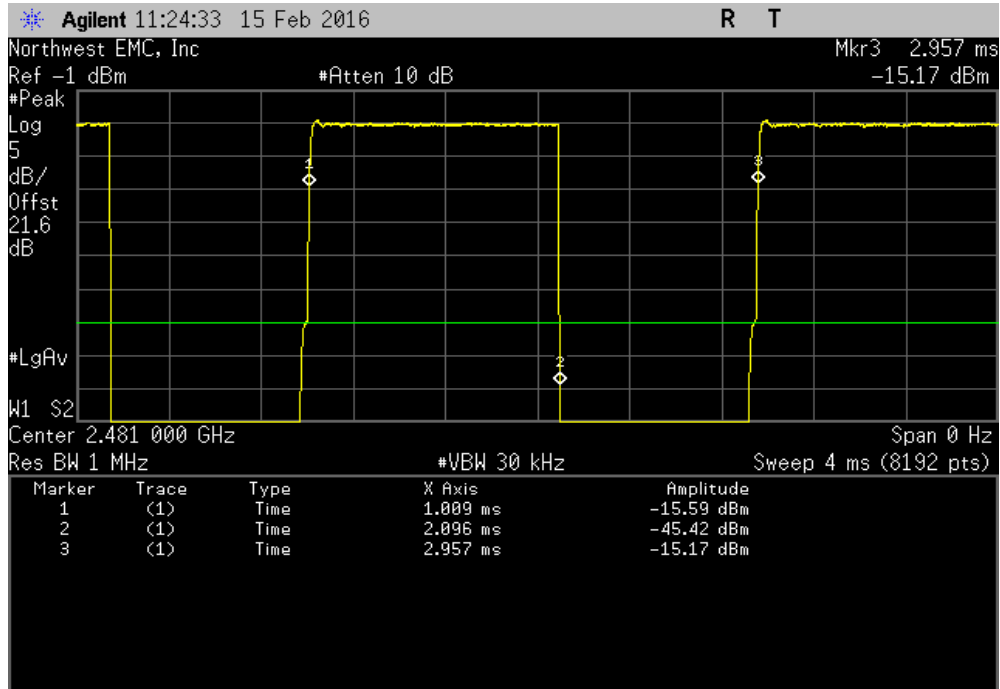


| Normal Temperature Conditions, Zigbee GFSK, Mid Channel, 40, 2440 MHz |             |        |                  |           |           |         |
|-----------------------------------------------------------------------|-------------|--------|------------------|-----------|-----------|---------|
|                                                                       | Pulse Width | Period | Number of Pulses | Value (%) | Limit (%) | Results |
|                                                                       | N/A         | N/A    | 5                | N/A       | N/A       | N/A     |

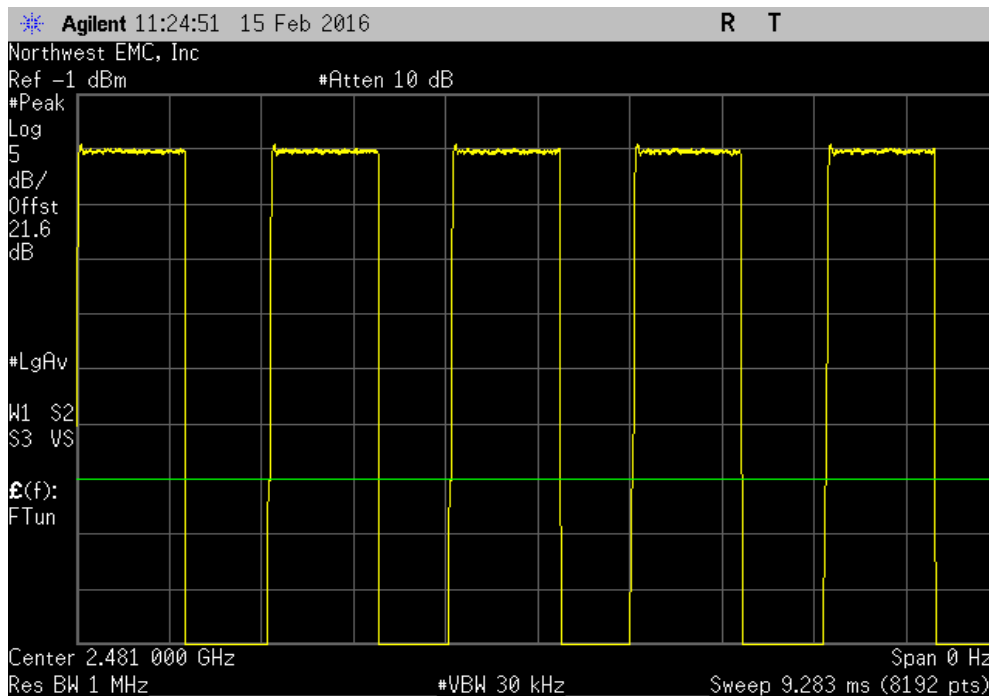


# DUTY CYCLE

| Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz |             |          |                  |           |           |         |
|------------------------------------------------------------------------|-------------|----------|------------------|-----------|-----------|---------|
|                                                                        | Pulse Width | Period   | Number of Pulses | Value (%) | Limit (%) | Results |
|                                                                        | 1.087 ms    | 1.948 ms | 1                | 55.8      | N/A       | N/A     |



| Normal Temperature Conditions, Zigbee GFSK, High Channel, 81, 2481 MHz |             |        |                  |           |           |         |
|------------------------------------------------------------------------|-------------|--------|------------------|-----------|-----------|---------|
|                                                                        | Pulse Width | Period | Number of Pulses | Value (%) | Limit (%) | Results |
|                                                                        | N/A         | N/A    | 5                | N/A       | N/A       | N/A     |



# OCCUPIED BANDWIDTH

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

| Description                  | Manufacturer | Model                    | ID  | Last Cal. | Interval (mo) |
|------------------------------|--------------|--------------------------|-----|-----------|---------------|
| Cable                        | N/A          | Double Ridge Horn Cables | EVB | 4/16/2015 | 12            |
| Antenna - Double Ridge       | EMCO         | 3115                     | AHC | 6/13/2014 | 24            |
| Analyzer - Spectrum Analyzer | Agilent      | E4446A                   | AAQ | 3/10/2015 | 12            |

## TEST DESCRIPTION

The 6dB occupied bandwidth was measured using 100 kHz resolution bandwidth and 300 kHz video bandwidth. The 99% emission bandwidth (EBW) was also measured at the the same time.

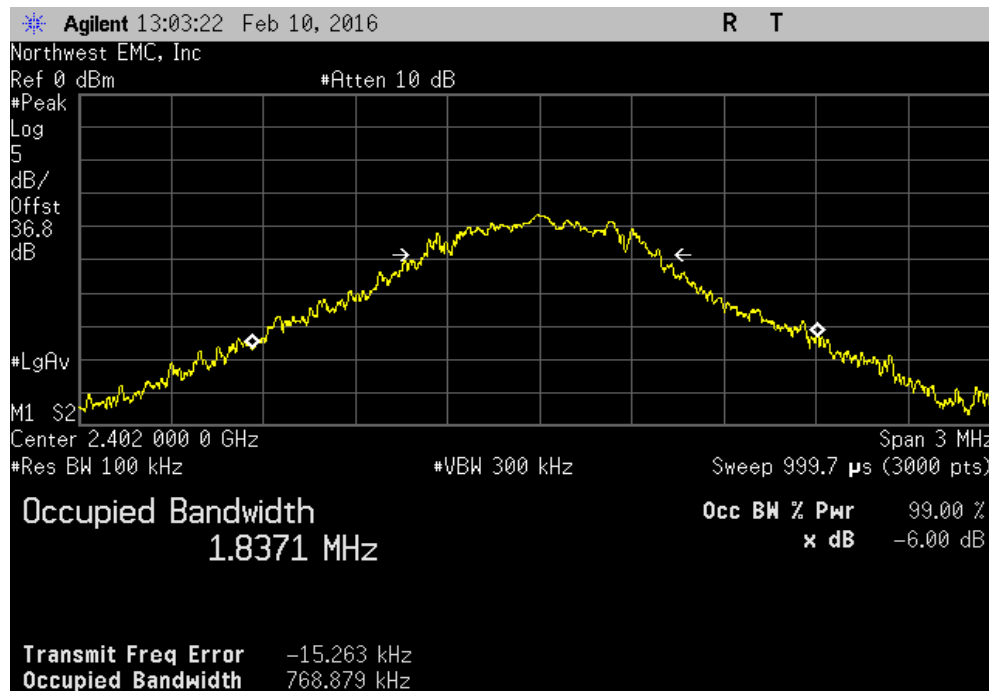
The EUT was set to low, medium and high transmit frequencies. The measurement was made in a radiated configuration in a semi-anechoic chamber with the fundamental of the carrier full maximized for its highest radiated power. The EUT was transmitting at the data rate(s) listed in the datasheet.

# OCCUPIED BANDWIDTH

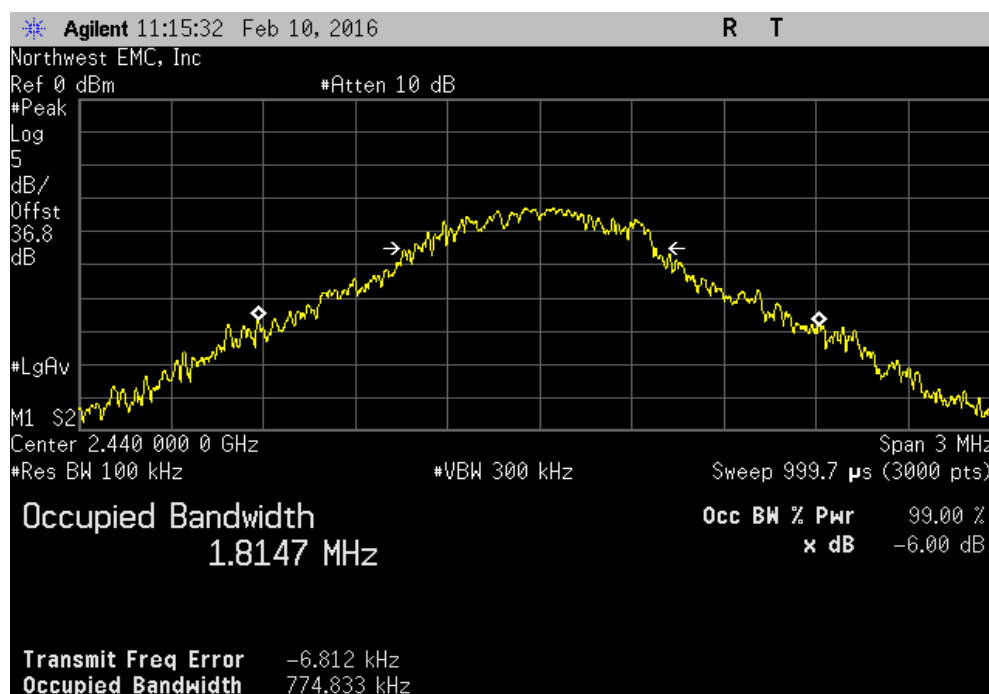
|                                                                                    |                |                                                                                             |              |
|------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------|--------------|
| EUT: Opal                                                                          |                | Work Order: APDM0008                                                                        |              |
| Serial Number: SMTC1630731                                                         |                | Date: 02/10/16                                                                              |              |
| Customer: APDM, Inc.                                                               |                | Temperature: 22.3°C                                                                         |              |
| Attendees: Andrew Greenberg, Gavin Gallino, Dave Camarillo, and Tim Brandon        |                | Humidity: 41%                                                                               |              |
| Project: None                                                                      |                | Barometric Pres.: 1022.7                                                                    |              |
| Tested by: Brandon Hobbs                                                           | Power: Battery | Job Site: EV01                                                                              |              |
| TEST SPECIFICATIONS                                                                |                | Test Method                                                                                 |              |
| FCC 15.247:2016                                                                    |                | ANSI C63.10:2013                                                                            |              |
| COMMENTS                                                                           |                |                                                                                             |              |
| The EUT was maximized to its single highest orientation for radiated measurements. |                |                                                                                             |              |
| DEVIATIONS FROM TEST STANDARD                                                      |                |                                                                                             |              |
| None                                                                               |                |                                                                                             |              |
| Configuration #                                                                    | 2              | Signature  |              |
|                                                                                    |                | Value                                                                                       | Limit<br>(>) |
| 2400 MHz - 2483.5 MHz Band                                                         |                |                                                                                             | Result       |
| Zigbee GFSK                                                                        |                |                                                                                             |              |
| Low Channel 2, 2402 MHz                                                            |                | 768.879 kHz                                                                                 | 500 kHz Pass |
| Mid Channel 40, 2440 MHz                                                           |                | 774.833 kHz                                                                                 | 500 kHz Pass |
| High Channel 81, 2481 MHz                                                          |                | 834.03 kHz                                                                                  | 500 kHz Pass |

# OCCUPIED BANDWIDTH

| 2400 MHz - 2483.5 MHz Band, Zigbee GFSK, Low Channel 2, 2402 MHz |  |  |  |             |              |        |
|------------------------------------------------------------------|--|--|--|-------------|--------------|--------|
|                                                                  |  |  |  | Value       | Limit<br>(>) | Result |
|                                                                  |  |  |  | 768.879 kHz | 500 kHz      | Pass   |

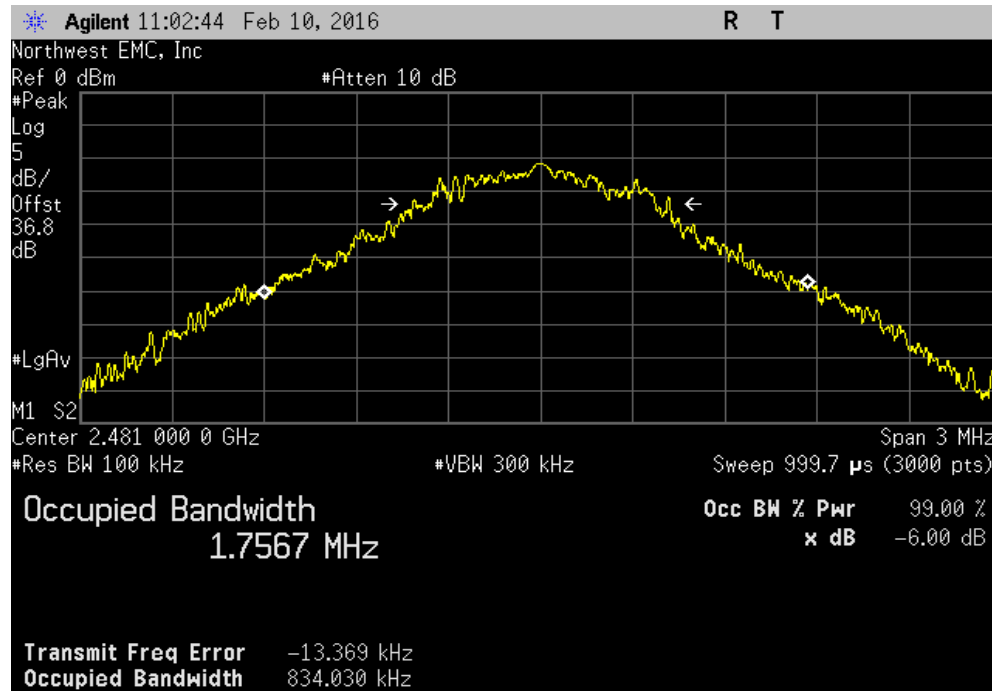


| 2400 MHz - 2483.5 MHz Band, Zigbee GFSK, Mid Channel 40, 2440 MHz |  |  |  |             |              |        |
|-------------------------------------------------------------------|--|--|--|-------------|--------------|--------|
|                                                                   |  |  |  | Value       | Limit<br>(>) | Result |
|                                                                   |  |  |  | 774.833 kHz | 500 kHz      | Pass   |



# OCCUPIED BANDWIDTH

| 2400 MHz - 2483.5 MHz Band, Zigbee GFSK, High Channel 81, 2481 MHz |  |  |  |         |        |  |
|--------------------------------------------------------------------|--|--|--|---------|--------|--|
| Value                                                              |  |  |  | Limit   | Result |  |
|                                                                    |  |  |  | (>)     |        |  |
| 834.03 kHz                                                         |  |  |  | 500 kHz | Pass   |  |



## OUTPUT POWER - RADIATED

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

### MODES OF OPERATION

Continuous Tx, GFSK Ch.2 2402 MHz

Continuous Tx, GFSK Ch.40 2440 MHz

Continuous Tx, GFSK Ch.81 2481 MHz

### POWER SETTINGS INVESTIGATED

Battery

### CONFIGURATIONS INVESTIGATED

APDM0008 - 2

### FREQUENCY RANGE INVESTIGATED

Start Frequency 2380 MHz

Stop Frequency 2500 MHz

### SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

### TEST EQUIPMENT

| Description                  | Manufacturer | Model                    | ID  | Last Cal. | Interval |
|------------------------------|--------------|--------------------------|-----|-----------|----------|
| Cable                        | N/A          | Double Ridge Horn Cables | EVB | 4/16/2015 | 12 mo    |
| Antenna - Double Ridge       | EMCO         | 3115                     | AHC | 6/13/2014 | 24 mo    |
| Analyzer - Spectrum Analyzer | Agilent      | E4446A                   | AAQ | 3/10/2015 | 12 mo    |

### TEST DESCRIPTION

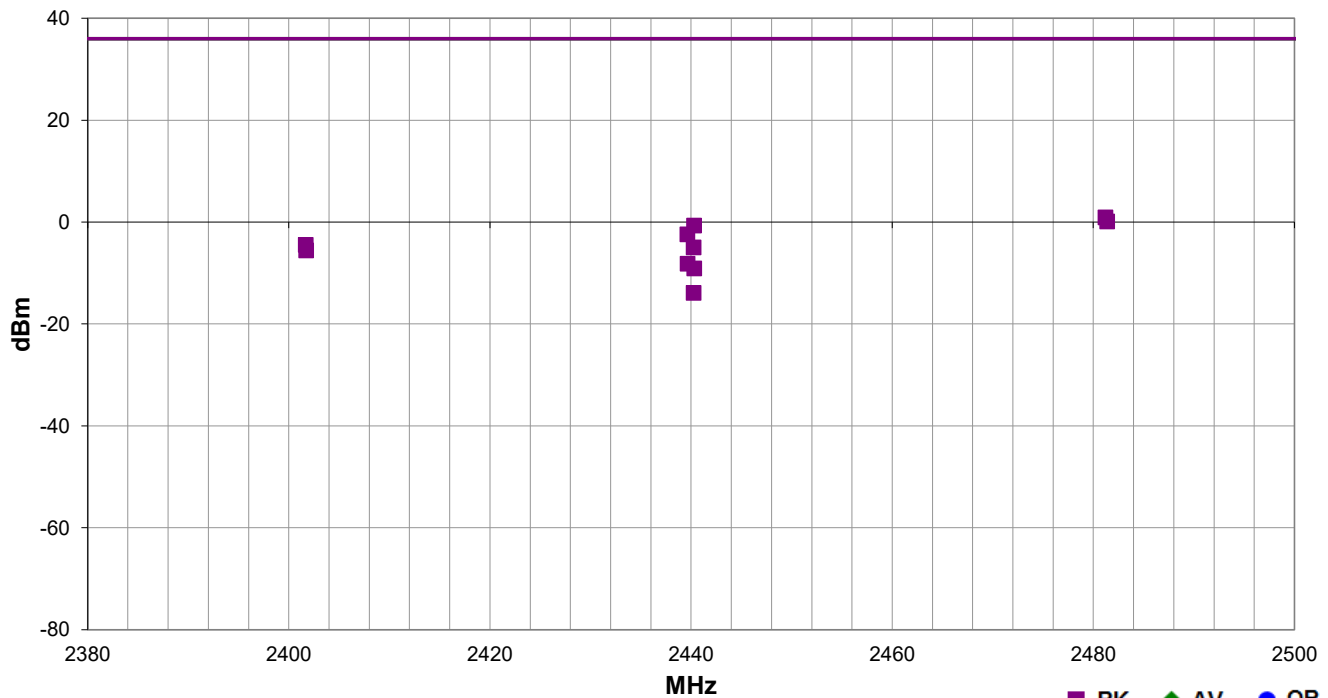
The peak output power was measured with the EUT set to low, medium and high transmit frequencies. A field strength measurement was made of the fundamental with the carrier fully maximized for its highest radiated power.

The final data was converted from field strength to a radiated power value using equations found in ANSI C63.10:2013 Annex G.2

|                 |                                                                                            |                   |           |                                                                                    |
|-----------------|--------------------------------------------------------------------------------------------|-------------------|-----------|------------------------------------------------------------------------------------|
| Work Order:     | APDM0008                                                                                   | Date:             | 02/10/16  |  |
| Project:        | None                                                                                       | Temperature:      | 20.9 °C   |                                                                                    |
| Job Site:       | EV01                                                                                       | Humidity:         | 41.5% RH  |                                                                                    |
| Serial Number:  | SMTC1630731                                                                                | Barometric Pres.: | 1025 mbar | Tested by: Brandon Hobbs                                                           |
| EUT:            | Opal                                                                                       |                   |           |                                                                                    |
| Configuration:  | 2                                                                                          |                   |           |                                                                                    |
| Customer:       | APDM, Inc.                                                                                 |                   |           |                                                                                    |
| Attendees:      | Andrew Greenberg, Gavin Gallino, Dave Camarillo, and Tim Brandon                           |                   |           |                                                                                    |
| EUT Power:      | Battery                                                                                    |                   |           |                                                                                    |
| Operating Mode: | Continuous Tx, GFSK Please reference the data comments for further operational information |                   |           |                                                                                    |
| Deviations:     | None                                                                                       |                   |           |                                                                                    |
| Comments:       | Please reference the data comments for EUT orientation, frequency and channel.             |                   |           |                                                                                    |

|                     |                  |
|---------------------|------------------|
| Test Specifications | Test Method      |
| FCC 15.247:2016     | ANSI C63.10:2013 |

|       |    |                   |   |                   |           |         |      |
|-------|----|-------------------|---|-------------------|-----------|---------|------|
| Run # | 75 | Test Distance (m) | 3 | Antenna Height(s) | 1 to 4(m) | Results | Pass |
|-------|----|-------------------|---|-------------------|-----------|---------|------|



| Freq (MHz) | Antenna Height (meters) | Azimuth (degrees) | Polarity/ Transducer Type | Detector | EIRP (Watts) | EIRP (dBm) | Spec. Limit (dBm) | Compared to Spec. (dB) | Comments                       |
|------------|-------------------------|-------------------|---------------------------|----------|--------------|------------|-------------------|------------------------|--------------------------------|
| 2481.195   | 1.2                     | 98.0              | Horz                      | PK       | 1.23E-03     | 0.9        | 36.0              | -35.1                  | High Ch.81 2481MHz, EUT Horz   |
| 2481.365   | 1.0                     | 94.0              | Vert                      | PK       | 1.03E-03     | 0.1        | 36.0              | -35.9                  | High Ch.81 2481MHz, EUT Vert   |
| 2440.300   | 1.0                     | 278.0             | Vert                      | PK       | 8.54E-04     | -0.7       | 36.0              | -36.7                  | Mid Ch.40 2440Mhz, EUT Vert    |
| 2439.625   | 1.0                     | 187.0             | Horz                      | PK       | 5.77E-04     | -2.4       | 36.0              | -38.4                  | Mid Ch.40 2440Mhz, EUT Horz    |
| 2401.695   | 1.0                     | 95.0              | Horz                      | PK       | 3.57E-04     | -4.5       | 36.0              | -40.5                  | Low Ch.2 2402MHz, EUT Horz     |
| 2440.260   | 1.0                     | 140.0             | Horz                      | PK       | 3.17E-04     | -5.0       | 36.0              | -41.0                  | Mid Ch.40 2440Mhz, EUT On Side |
| 2401.733   | 1.0                     | 95.0              | Vert                      | PK       | 2.77E-04     | -5.6       | 36.0              | -41.6                  | Low Ch.2 2402MHz, EUT Horz     |
| 2439.645   | 4.0                     | 81.0              | Vert                      | PK       | 1.52E-04     | -8.2       | 36.0              | -44.2                  | Mid Ch.40 2440Mhz, EUT On Side |
| 2440.310   | 3.9                     | 308.0             | Vert                      | PK       | 1.23E-04     | -9.1       | 36.0              | -45.1                  | Mid Ch.40 2440Mhz, EUT Horz    |
| 2440.250   | 1.0                     | 58.0              | Horz                      | PK       | 4.09E-05     | -13.9      | 36.0              | -49.9                  | Mid Ch.40 2440Mhz, EUT Vert    |

# POWER SPECTRAL DENSITY

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

## TEST EQUIPMENT

| Description                  | Manufacturer | Model                    | ID  | Last Cal. | Interval (mo) |
|------------------------------|--------------|--------------------------|-----|-----------|---------------|
| Cable                        | N/A          | Double Ridge Horn Cables | EVB | 4/16/2015 | 12            |
| Antenna - Double Ridge       | EMCO         | 3115                     | AHC | 6/13/2014 | 24            |
| Analyzer - Spectrum Analyzer | Agilent      | E4446A                   | AAQ | 3/10/2015 | 12            |

## TEST DESCRIPTION

The maximum power spectral density measurements were measured with the EUT set to the required transmit frequencies in each band. The EUT was transmitting at the lowest, middle, and maximum data rate for each modulation type available.

The final data was converted from a field strength to a radiated power value. The equations in section 9.5 of ANSI C63.10:2013, were used to derive this conversion formula:

$$\text{dBm/m (field strength)} + 11.77 = \text{dBm EIRP}$$

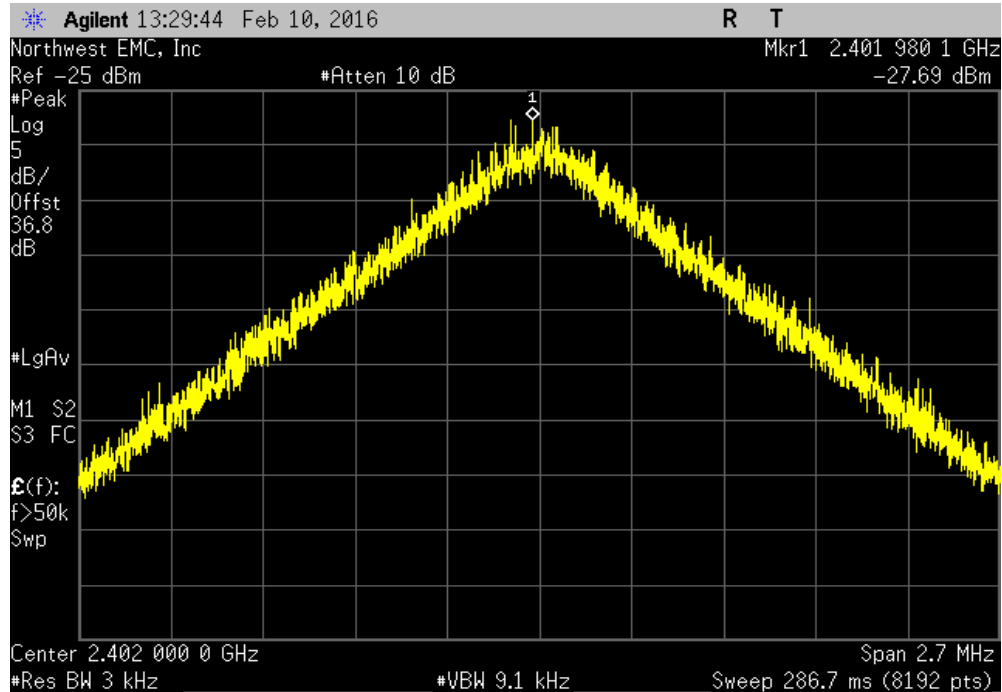
Per the procedure outlined in ANSI C63.10:2013 Section 11.10.2, the peak power spectral density was measured.

# POWER SPECTRAL DENSITY

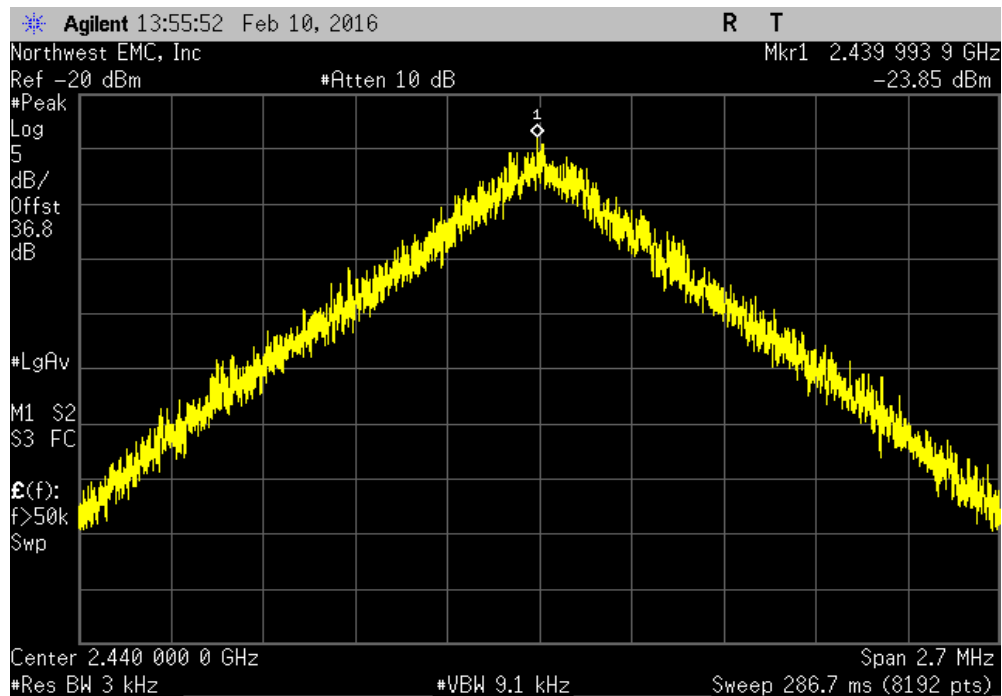
|                                                                                                                                                                |                |                                                                                             |                     |   |      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------|---------------------|---|------|
| EUT: Opal                                                                                                                                                      |                | Work Order: APDM0008                                                                        |                     |   |      |
| Serial Number: SMTC1630731                                                                                                                                     |                | Date: 02/10/16                                                                              |                     |   |      |
| Customer: APDM, Inc.                                                                                                                                           |                | Temperature: 22.3°C                                                                         |                     |   |      |
| Attendees: Andrew Greenberg, Gavin Gallino, Dave Camarillo, and Tim Brandon                                                                                    |                | Humidity: 41%                                                                               |                     |   |      |
| Project: None                                                                                                                                                  |                | Barometric Pres.: 1022.7                                                                    |                     |   |      |
| Tested by: Brandon Hobbs                                                                                                                                       | Power: Battery | Job Site: EV01                                                                              |                     |   |      |
| TEST SPECIFICATIONS                                                                                                                                            |                | Test Method                                                                                 |                     |   |      |
| FCC 15.247:2016                                                                                                                                                |                | ANSI C63.10:2013                                                                            |                     |   |      |
| COMMENTS                                                                                                                                                       |                |                                                                                             |                     |   |      |
| The EUT was maximized to its single highest orientation for radiated measurements. The Friis equation was used to convert field strength measurements to EIRP. |                |                                                                                             |                     |   |      |
| DEVIATIONS FROM TEST STANDARD                                                                                                                                  |                |                                                                                             |                     |   |      |
| None                                                                                                                                                           |                |                                                                                             |                     |   |      |
| Configuration #                                                                                                                                                | 2              | Signature  |                     |   |      |
|                                                                                                                                                                |                | Value<br>dBm/3kHz                                                                           | dBm/m to<br>dBm     |   |      |
| 2400 MHz - 2483.5 MHz Band                                                                                                                                     |                | EIRP<br>dBm/3kHz                                                                            | Limit<br>< dBm/3kHz |   |      |
| Zigbee GFSK                                                                                                                                                    |                |                                                                                             | Results             |   |      |
| Low Channel 2, 2402 MHz                                                                                                                                        | -27.69         | 11.77                                                                                       | -15.92              | 8 | Pass |
| Mid Channel 40, 2440 MHz                                                                                                                                       | -23.851        | 11.77                                                                                       | -12.081             | 8 | Pass |
| High Channel 81, 2481 MHz                                                                                                                                      | -22.753        | 11.77                                                                                       | -10.983             | 8 | Pass |

# POWER SPECTRAL DENSITY

| 2400 MHz - 2483.5 MHz Band, Zigbee GFSK, Low Channel 2, 2402 MHz |          |          |          |            |         |  |
|------------------------------------------------------------------|----------|----------|----------|------------|---------|--|
|                                                                  | Value    | dBm/m to | EIRP     | Limit      | Results |  |
|                                                                  | dBm/3kHz | dBm      | dBm/3kHz | < dBm/3kHz |         |  |
|                                                                  | -27.69   | 11.77    | -15.92   | 8          | Pass    |  |

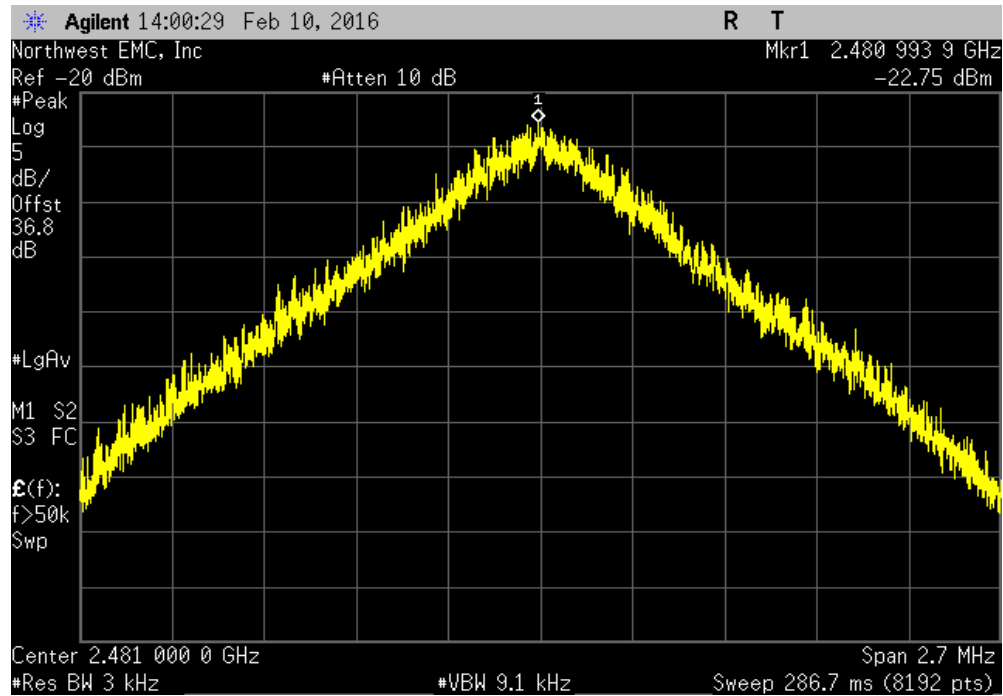


| 2400 MHz - 2483.5 MHz Band, Zigbee GFSK, Mid Channel 40, 2440 MHz |          |          |          |            |         |  |
|-------------------------------------------------------------------|----------|----------|----------|------------|---------|--|
|                                                                   | Value    | dBm/m to | EIRP     | Limit      | Results |  |
|                                                                   | dBm/3kHz | dBm      | dBm/3kHz | < dBm/3kHz |         |  |
|                                                                   | -23.851  | 11.77    | -12.081  | 8          | Pass    |  |



# POWER SPECTRAL DENSITY

| 2400 MHz - 2483.5 MHz Band, Zigbee GFSK, High Channel 81, 2481 MHz |          |          |          |            |         |
|--------------------------------------------------------------------|----------|----------|----------|------------|---------|
|                                                                    | Value    | dBm/m to | EIRP     | Limit      | Results |
|                                                                    | dBm/3kHz | dBm      | dBm/3kHz | < dBm/3kHz |         |
|                                                                    | -22.753  | 11.77    | -10.983  | 8          | Pass    |



# OUT OF BAND EMISSIONS

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

## MODES OF OPERATION

Continuous Tx, GFSK Low Ch.2 2402 MHz

Continuous Tx, GFSK Mid Ch.40 2440 MHz

Continuous Tx, GFSK High Ch.81 2481 MHz

## POWER SETTINGS INVESTIGATED

Battery

## CONFIGURATIONS INVESTIGATED

APDM0008 - 2

## FREQUENCY RANGE INVESTIGATED

Start Frequency 30 MHz

Stop Frequency 26500 MHz

## SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

## TEST EQUIPMENT

| Description                  | Manufacturer    | Model                     | ID  | Last Cal. | Interval |
|------------------------------|-----------------|---------------------------|-----|-----------|----------|
| Cable                        | ESM Cable Corp. | KMKM-72                   | EVY | 11/4/2015 | 12 mo    |
| Amplifier - Pre-Amplifier    | Miteq           | AMF-6F-18002650-25-10P    | AVU | 11/4/2015 | 12 mo    |
| Antenna - Standard Gain      | ETS Lindgren    | 3160-09                   | AIV | NCR       | 0 mo     |
| Amplifier - Pre-Amplifier    | Miteq           | AMF-6F-12001800-30-10P    | AVD | 4/16/2015 | 12 mo    |
| Antenna - Standard Gain      | ETS Lindgren    | 3160-08                   | AHV | NCR       | 0 mo     |
| Cable                        | None            | Standard Gain Horns Cable | EVF | 4/20/2015 | 12 mo    |
| Amplifier - Pre-Amplifier    | Miteq           | AMF-6F-08001200-30-10P    | AVC | 4/20/2015 | 12 mo    |
| Antenna - Standard Gain      | ETS Lindgren    | 3160-07                   | AHU | NCR       | 0 mo     |
| Cable                        | N/A             | Double Ridge Horn Cables  | EVB | 4/16/2015 | 12 mo    |
| Amplifier - Pre-Amplifier    | Miteq           | AMF-3D-00100800-32-13P    | PAG | 4/16/2015 | 12 mo    |
| Antenna - Double Ridge       | EMCO            | 3115                      | AHC | 6/13/2014 | 24 mo    |
| Cable                        | N/A             | Bilog Cables              | EVA | 2/10/2015 | 12 mo    |
| Amplifier - Pre-Amplifier    | Miteq           | AM-1616-1000              | AOL | 2/10/2015 | 12 mo    |
| Antenna - Biconilog          | EMCO            | 3141                      | AXE | 8/29/2014 | 24 mo    |
| Attenuator                   | Coaxicom        | 3910-20                   | AXZ | 5/24/2015 | 12 mo    |
| Filter - High Pass           | Micro-Tronics   | HPM50111                  | HFO | 3/31/2015 | 12 mo    |
| Filter - Low Pass            | Micro-Tronics   | LPM50004                  | LFD | 5/24/2015 | 12 mo    |
| Analyzer - Spectrum Analyzer | Agilent         | E4446A                    | AAQ | 3/10/2015 | 12 mo    |

## TEST DESCRIPTION

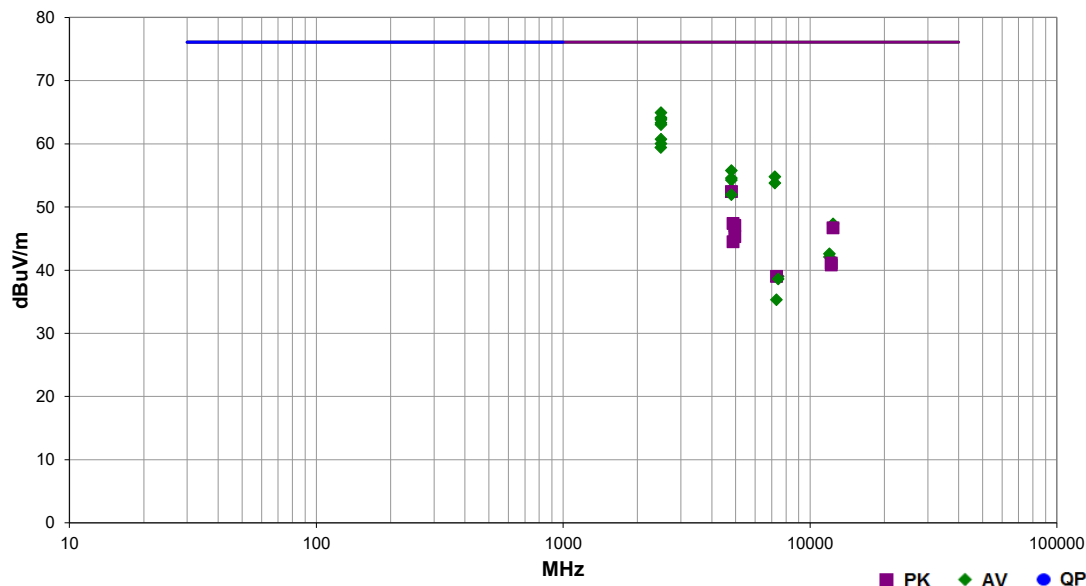
The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made across the band to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization. A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

The Limit was derived from the highest maximized point of the fundamental output power then placed 20dBc down from that point. Compliance was determined by comparing the peak emissions to the maximum fundamental value.

|                 |                                                                                                                                                                                                                                                                                                                                                |                   |               |                                                                                    |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|------------------------------------------------------------------------------------|
| Work Order:     | APDM0008                                                                                                                                                                                                                                                                                                                                       | Date:             | 02/03/16      |  |
| Project:        | None                                                                                                                                                                                                                                                                                                                                           | Temperature:      | 19.8 °C       |                                                                                    |
| Job Site:       | EV01                                                                                                                                                                                                                                                                                                                                           | Humidity:         | 37.8% RH      |                                                                                    |
| Serial Number:  | SMT1630731                                                                                                                                                                                                                                                                                                                                     | Barometric Pres.: | 1021 mbar     |                                                                                    |
| EUT:            | Opal                                                                                                                                                                                                                                                                                                                                           | Tested by:        | Brandon Hobbs |                                                                                    |
| Configuration:  | 2                                                                                                                                                                                                                                                                                                                                              |                   |               |                                                                                    |
| Customer:       | APDM, Inc.                                                                                                                                                                                                                                                                                                                                     |                   |               |                                                                                    |
| Attendees:      | Andrew Greenberg, Gavin Gallino                                                                                                                                                                                                                                                                                                                |                   |               |                                                                                    |
| EUT Power:      | Battery                                                                                                                                                                                                                                                                                                                                        |                   |               |                                                                                    |
| Operating Mode: | Continuous Tx                                                                                                                                                                                                                                                                                                                                  |                   |               |                                                                                    |
| Deviations:     | None                                                                                                                                                                                                                                                                                                                                           |                   |               |                                                                                    |
| Comments:       | The Limit was derived from the maximized output power of the fundamental. The limit line seen in the graph below represents the 20dBc from the maximized fundamental output power is the data. See comments for EUT position, channel, and frequency All points seen in the unrestricted bands were more then 20dB below the 20dBc limit line. |                   |               |                                                                                    |

|                     |                  |
|---------------------|------------------|
| Test Specifications | Test Method      |
| FCC 15.247:2016     | ANSI C63.10:2013 |

|       |    |                   |   |                   |           |         |      |
|-------|----|-------------------|---|-------------------|-----------|---------|------|
| Run # | 17 | Test Distance (m) | 3 | Antenna Height(s) | 1 to 4(m) | Results | Pass |
|-------|----|-------------------|---|-------------------|-----------|---------|------|



| Freq (MHz) | Amplitude (dBuV) | Factor (dB) | Antenna Height (meters) | Azimuth (degrees) | Test Distance (meters) | External Attenuation (dB) | Polarity/Transducer Type | Detector | Distance Adjustment (dB) | Adjusted (dBuV/m) | Spec. Limit (dBc) | Compared to Spec. (dBc) | Comments                                                       |
|------------|------------------|-------------|-------------------------|-------------------|------------------------|---------------------------|--------------------------|----------|--------------------------|-------------------|-------------------|-------------------------|----------------------------------------------------------------|
| 2481.195   | 59.2             | 36.9        | 1.2                     | 98.0              | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 96.1              |                   |                         | High Ch.81 2481MHz, EUT Horz, Maximum fundamental output power |
| 2490.713   | 47.4             | -2.5        | 1.0                     | 106.0             | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 64.9              | -20.0             | -31.2                   | Channel 81, 2481 MHz, EUT Vertical                             |
| 2490.620   | 46.6             | -2.5        | 1.0                     | 287.0             | 3.0                    | 20.0                      | Horz                     | PK       | 0.0                      | 64.1              | -20.0             | -32.0                   | Channel 81, 2481 MHz, EUT Horizontal                           |
| 2490.443   | 46.5             | -2.5        | 1.0                     | 207.0             | 3.0                    | 20.0                      | Horz                     | PK       | 0.0                      | 64.0              | -20.0             | -32.1                   | Channel 2, 2402 MHz, EUT Horizontal                            |
| 2490.727   | 46.3             | -2.5        | 1.0                     | 174.0             | 3.0                    | 20.0                      | Horz                     | PK       | 0.0                      | 63.8              | -20.0             | -32.3                   | Channel 40, 2440 MHz, EUT Horizontal                           |
| 2490.660   | 45.8             | -2.5        | 1.0                     | 261.0             | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 63.3              | -20.0             | -32.8                   | Channel 2, 2402 MHz, EUT Vertical                              |
| 2490.333   | 45.5             | -2.5        | 1.0                     | 121.0             | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 63.0              | -20.0             | -33.1                   | Channel 40, 2440 MHz, EUT Vertical                             |
| 2490.903   | 43.2             | -2.5        | 1.0                     | 296.0             | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 60.7              | -20.0             | -35.4                   | Channel 81, 2481 MHz, EUT On Side                              |
| 2490.610   | 42.5             | -2.5        | 1.0                     | 171.0             | 3.0                    | 20.0                      | Horz                     | PK       | 0.0                      | 60.0              | -20.0             | -36.1                   | Channel 81, 2481 MHz, EUT On Side                              |
| 2489.747   | 41.9             | -2.5        | 1.0                     | 89.0              | 3.0                    | 20.0                      | Vert                     | PK       | 0.0                      | 59.4              | -20.0             | -36.7                   | Channel 81, 2481 MHz, EUT Horizontal                           |
| 4804.535   | 48.2             | 7.5         | 1.0                     | 330.0             | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 55.7              | -20.0             | -40.4                   | Channel 2, 2402 MHz, EUT Horizontal                            |
| 7206.105   | 41.0             | 13.8        | 1.0                     | 61.0              | 3.0                    | 0.0                       | Vert                     | PK       | 0.0                      | 54.8              | -20.0             | -41.4                   | Channel 2, 2402 MHz, EUT On Side                               |
| 4804.400   | 47.0             | 7.5         | 1.0                     | 185.0             | 3.0                    | 0.0                       | Vert                     | PK       | 0.0                      | 54.5              | -20.0             | -41.6                   | Channel 2, 2402 MHz, EUT On Side                               |
| 4803.525   | 46.7             | 7.5         | 1.0                     | 43.0              | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 54.2              | -20.0             | -41.9                   | Channel 2, 2402 MHz, EUT Vertical                              |
| 7206.835   | 40.0             | 13.8        | 1.0                     | 295.0             | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 53.8              | -20.0             | -42.4                   | Channel 2, 2402 MHz, EUT Horizontal                            |
| 4803.755   | 45.3             | 7.5         | 1.0                     | 317.0             | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 52.8              | -20.0             | -43.3                   | Channel 2, 2402 MHz, EUT On Side                               |
| 4803.580   | 44.9             | 7.5         | 4.0                     | 243.0             | 3.0                    | 0.0                       | Vert                     | PK       | 0.0                      | 52.4              | -20.0             | -43.7                   | Channel 2, 2402 MHz, EUT Horizontal                            |
| 4803.650   | 44.4             | 7.5         | 1.0                     | 263.0             | 3.0                    | 0.0                       | Vert                     | PK       | 0.0                      | 51.9              | -20.0             | -44.2                   | Channel 2, 2402 MHz, EUT Vertical                              |
| 4879.633   | 47.4             | 0.0         | 1.0                     | 320.0             | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 47.4              | -20.0             | -48.7                   | Channel 40, 2440 MHz, EUT Horizontal                           |
| 12405.920  | 38.5             | 8.8         | 1.0                     | 160.0             | 3.0                    | 0.0                       | Vert                     | PK       | 0.0                      | 47.3              | -20.0             | -48.8                   | Channel 81, 2481 MHz, EUT On Side                              |
| 4961.408   | 47.1             | 0.0         | 1.0                     | 49.0              | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 47.1              | -20.0             | -49.0                   | Channel 81, 2481 MHz, EUT Horizontal                           |
| 12404.440  | 37.9             | 8.8         | 2.0                     | 163.0             | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 46.7              | -20.0             | -49.4                   | Channel 81, 2481 MHz, EUT Horizontal                           |
| 4962.650   | 45.3             | 0.0         | 1.0                     | 187.0             | 3.0                    | 0.0                       | Vert                     | PK       | 0.0                      | 45.3              | -20.0             | -50.8                   | Channel 81, 2481 MHz, EUT on side                              |
| 4879.733   | 44.5             | 0.0         | 1.0                     | 184.0             | 3.0                    | 0.0                       | Vert                     | PK       | 0.0                      | 44.5              | -20.0             | -51.6                   | Channel 40, 2440 MHz, EUT on side                              |
| 12000.230  | 42.5             | 0.1         | 1.0                     | 220.0             | 3.0                    | 0.0                       | Vert                     | PK       | 0.0                      | 42.6              | -20.0             | -53.6                   | Channel 2, 2402 MHz, EUT on side                               |
| 12001.090  | 42.0             | 0.1         | 2.8                     | 221.0             | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 42.1              | -20.0             | -54.1                   | Channel 2, 2402 MHz, EUT Horizontal                            |
| 12201.450  | 40.0             | 1.1         | 1.0                     | 321.0             | 3.0                    | 0.0                       | Horz                     | PK       | 0.0                      | 41.1              | -20.0             | -55.0                   | Channel 40, 2440 MHz, EUT Horizontal                           |
| 12201.280  | 39.7             | 1.1         | 1.0                     | 40.0              | 3.0                    | 0.0                       | Vert                     | PK       | 0.0                      | 40.8              | -20.0             | -55.3                   | Channel 40, 2440 MHz, EUT on side                              |

| Freq<br>(MHz) | Amplitude<br>(dBuV) | Factor<br>(dB) | Antenna<br>Height<br>(meters) | Azimuth<br>(degrees) | Test Distance<br>(meters) | External<br>Attenuation<br>(dB) | Polarity/<br>Transducer<br>Type | Detector | Distance<br>Adjustment<br>(dB) | Adjusted<br>(dBuV/m) | Spec. Limit<br>(dBc) | Compared to<br>Spec.<br>(dBc) | Comments                             |
|---------------|---------------------|----------------|-------------------------------|----------------------|---------------------------|---------------------------------|---------------------------------|----------|--------------------------------|----------------------|----------------------|-------------------------------|--------------------------------------|
| 7443.600      | 39.0                | 0.0            | 1.0                           | 149.0                | 3.0                       | 0.0                             | Vert                            | PK       | 0.0                            | 39.0                 | -20.0                | -57.1                         | Channel 81, 2481 MHz, EUT on side    |
| 7319.733      | 39.0                | 0.0            | 1.0                           | 295.0                | 3.0                       | 0.0                             | Horz                            | PK       | 0.0                            | 39.0                 | -20.0                | -57.1                         | Channel 40, 2440 MHz, EUT Horizontal |
| 7443.092      | 38.6                | 0.0            | 1.1                           | 285.0                | 3.0                       | 0.0                             | Horz                            | PK       | 0.0                            | 38.6                 | -20.0                | -57.5                         | Channel 81, 2481 MHz, EUT Horizontal |
| 7321.525      | 35.3                | 0.0            | 1.0                           | 246.0                | 3.0                       | 0.0                             | Vert                            | PK       | 0.0                            | 35.3                 | -20.0                | -60.8                         | Channel 40, 2440 MHz, EUT on side    |