

Company: Aruba Networks, Inc.

Test of: APIN0334, APIN0335 Wireless Access Point

To: FCC Part 15.247 (DTS) & IC RSS-247

Report No.: ARUB196-U16 Rev A Bluetooth BLE

## TEST REPORT





Test of: Aruba Networks, Inc. APIN0334, APIN0335

to

To: FCC CFR 47 Part 15 Subpart C 15.247 (DTS) & IC RSS-247

Test Report Serial No.: ARUB196-U16 Rev A Bluetooth BLE

Note: this report contains data with regard to 2400-2483.5 MHz Bluetooth BLE operational mode of the Aruba Networks APIN0334 and APIN0335 Wireless Access Point. Additional 802.11 modes for this product are reported in the following MiCOM Labs test reports 2400-2483.5 MHz ARUB196-U3, UNII-1 & UNII-3 ARUB196-U7 and UNII-2A and UNII-2C (DFS Bands) ARUB196-U10.

This report supersedes: NONE

Applicant: Aruba Networks, Inc.  
1344 Crossman Ave.  
Sunnyvale California 94089  
USA

Product Function: Wireless access point

Issue Date: 5<sup>th</sup> May 2016

**This Test Report is Issued Under the Authority of:**

**MiCOM Labs, Inc.**  
575 Boulder Court  
Pleasanton California 94566  
USA  
Phone: +1 (925) 462-0304  
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[www.micomlabs.com](http://www.micomlabs.com)



**MiCOM Labs is an ISO 17025 Accredited Testing Laboratory**



**Title:** Aruba Networks, Inc AP-335  
**To:** FCC Part 15.247 (DTS) & IC RSS-247  
**Serial #:** ARUB196-U16 Rev A  
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## 1. ACCREDITATION, LISTINGS & RECOGNITION

### 1.1. Testing Accreditation

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2005. The company is accredited by the American Association for Laboratory Accreditation (A2LA) [www.a2la.org](http://www.a2la.org) test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



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## 1.2. Recognition

MiCOM Labs, Inc has widely recognized wireless testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA countries. MiCOM Labs test reports are accepted globally.

| Country   | Recognition Body   | Status | Phase      | Identification No.                      |
|-----------|--|--------|------------|---|
| USA       | Federal Communications Commission (FCC)  | TCB    | -          | US0159<br>Listing #: 102167             |
| Canada    | Industry Canada (IC)   | FCB    | APEC MRA 2 | US0159<br>Listing #: 4143A-2<br>4143A-3 |
| Japan     | MIC (Ministry of Internal Affairs and Communication)   | CAB    | APEC MRA 2 | RCB 210                                 |
|           | VCCI   | --     | --         | A-0012                                  |
| Europe    | European Commission  | NB     | EU MRA     | NB 2280                                 |
| Australia | Australian Communications and Media Authority (ACMA)   | CAB    | APEC MRA 1 | US0159                                  |
| Hong Kong | Office of the Telecommunication Authority (OFTA)   | CAB    | APEC MRA 1 |   |
| Korea     | Ministry of Information and Communication Radio Research Laboratory (RRL)                        | CAB    | APEC MRA 1 |   |
| Singapore | Infocomm Development Authority (IDA)   | CAB    | APEC MRA 1 |   |
| Taiwan    | National Communications Commission (NCC)<br>Bureau of Standards, Metrology and Inspection (BSMI) | CAB    | APEC MRA 1 |   |
| Vietnam   | Ministry of Communication (MIC)  | CAB    | APEC MRA 1 |   |

EU MRA – European Union Mutual Recognition Agreement.

NB – Notified Body

APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. Recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.

Phase I - recognition for product testing

Phase II – recognition for both product testing and certification

### 1.3. Product Certification

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. The company is accredited by the American Association for Laboratory Accreditation (A2LA) [www.a2la.org](http://www.a2la.org) test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



United States of America – Telecommunication Certification Body (TCB)  
Industry Canada – Certification Body, CAB Identifier – US0159  
Europe – Notified Body (NB), NB Identifier - 2280  
Japan – Recognized Certification Body (RCB), RCB Identifier - 210



**Title:** Aruba Networks, Inc AP-335  
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## 2. DOCUMENT HISTORY

| Document History |                             |                 |
|------------------|-----------------------------|-----------------|
| Revision         | Date                        | Comments        |
| Draft            | 22 <sup>nd</sup> March 2016 |                 |
| Rev A            | 5 <sup>th</sup> May 2016    | Initial release |
|                  |                             |                 |
|                  |                             |                 |
|                  |                             |                 |
|                  |                             |                 |
|                  |                             |                 |

In the above table the latest report revision will replace all earlier versions.

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### 3. TEST RESULT CERTIFICATE

**Manufacturer:** Aruba Networks, Inc  
1344 Crossman Ave.  
Sunnyvale California 94089  
USA

**Tested By:** MiCOM Labs, Inc.  
575 Boulder Court  
Pleasanton California 94566  
USA

**Model(s):** APIN0334, APIN0335 - Bluetooth BLE

**Telephone:** +1 925 462 0304  
**Fax:** +1 925 462 0306

**Equipment Type:** Wireless Access Point with Bluetooth BLE

**S/N's:** DT0000447 | DT0000334

**Test Date(s):** 16<sup>th</sup> February – 22<sup>nd</sup> March 2016

**Website:** [www.micomlabs.com](http://www.micomlabs.com)

#### STANDARD(S)

FCC CFR 47 Part 15 Subpart C 15.247 (DTS) &  
Industry Canada RSS-247

#### TEST RESULTS

EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

#### Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.
2. Details of test methods used have been recorded and kept on file by the laboratory.
3. Test results apply only to the item(s) tested.

**Approved & Released for MiCOM Labs, Inc. by:**

Graeme Grieve  
Quality Manager MiCOM Labs, Inc.

Gordon Hurst  
President & CEO MiCOM Labs, Inc.



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## **4. REFERENCES AND MEASUREMENT UNCERTAINTY**

### **4.1. Normative References**

| REF. | PUBLICATION            | YEAR                        | TITLE   |
|------|------------------------|-----------------------------|---|
| I    | KDB 662911             | Oct 31 2013                 | Guidance for measurement of output emission of devices that employ single transmitter with multiple outputs or systems with multiple transmitters operating simultaneously in the same frequency band |
| II   | KDB 558074 D01 v03r05  | 8 <sup>th</sup> April, 2016 | Guidance for performing compliance measurements on Digital Transmission Systems (DTS) operating under section 15.247.   |
| III  | A2LA                   | February 2016               | R105 - Requirement's When Making Reference to A2LA Accreditation Status   |
| IV   | ANSI C63.10            | 2013                        | American National Standard for Testing Unlicensed Wireless Devices  |
| V    | ANSI C63.4             | 2014                        | American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz                                  |
| VI   | CISPR 22               | 2008                        | Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement  |
| VII  | ETSI TR 100 028        | 2001-12                     | Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics  |
| VIII | FCC 47 CFR Part 15.247 | 2014                        | Radio Frequency Devices; Subpart C – Intentional Radiators  |
| IX   | ICES-003               | Issue 6 Jan 2012            | Spectrum Management and Telecommunications; Interference-Causing Equipment Standard. Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement.              |
| X    | M 3003                 | Edition 3 Nov. 2012         | Expression of Uncertainty and Confidence in Measurements  |
| XI   | RSS-247 Issue 1        | May 2015                    | Digital Transmission Systems (DTSs), Frequency Hopping System (FHSs) and Licence-Exempt Local Area Network (LE-LEN) Devices   |
| XII  | RSS-Gen Issue 4        | November 2014               | General Requirements and Information for the Certification of Radiocommunication Equipment  |
| XIII | KDB 644545 D03 v01     | August 14th 2014            | Guidance for IEEE 802.11ac New Rules  |
| XIV  | FCC 47 CFR Part 2.1033 | 2014                        | FCC requirements and rules regarding photographs and test setup diagrams.   |



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#### **4.2. Test and Uncertainty Procedure**

Conducted and radiated emission measurements were conducted in accordance with American National Standards Institute ANSI C63.4, listed in the Normative References section of this report.

Measurement uncertainty figures are calculated in accordance with ETSI TR 100 028 Parts 1 and 2.

Measurement uncertainties stated are based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95 % in accordance with UKAS document M 3003 listed in the Normative References section of this report.

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## 5. PRODUCT DETAILS AND TEST CONFIGURATIONS

### 5.1. Technical Details

| Details                          | Description  |
|----------------------------------|--|
| Purpose:                         | Test of the Aruba Networks, Inc APIN0334 and APIN0335 to FCC CFR 47 Part 15 Subpart C 15.247 (DTS) and Industry Canada RSS-247                           |
| Applicant:                       | Aruba Networks, Inc<br>1344 Crossman Ave.<br>Sunnyvale California 94089 USA  |
| Manufacturer:                    | As Applicant   |
| Laboratory performing the tests: | MiCOM Labs, Inc.<br>575 Boulder Court<br>Pleasanton California 94566 USA   |
| Test report reference number:    | ARUB196-U16  |
| Date EUT received:               | 16 <sup>th</sup> February 2016   |
| Standard(s) applied:             | FCC CFR 47 Part 15 Subpart C 15.247 (DTS) & Industry Canada RSS-247  |
| Dates of test (from - to):       | 16 <sup>th</sup> February – 22 <sup>nd</sup> March 2016  |
| No of Units Tested:              | 1  |
| Type of Equipment:               | 802.11 wireless access point with Bluetooth BLE  |
| Product Family Name:             | Wireless Access Point  |
| Model(s):                        | APIN0334, APIN0335   |
| Location for use:                | Indoor   |
| Declared Frequency Range(s):     | 2400 - 2483.5 MHz;   |
| Primary function of equipment:   | Wireless access point  |
| Secondary function of equipment: | Bluetooth connection   |
| Type of Modulation:              | GFSK   |
| EUT Modes of Operation:          | Bluetooth BLE  |
| Transmit/Receive Operation:      | Transceiver - Half Duplex  |
| Rated Input Voltage and Current: | DC only (Battery operated / external supply) 48Vdc   |
| Operating Temperature Range:     | Declared Range 0°C to 40°C   |
| ITU Emission Designator:         | 1M1G1D   |
| Equipment Dimensions:            | APIN0334: 225mm (W) x 224mm (D) x 52mm (H) /8.9" (W) x 8.9" (D) x 2.0" (H)<br>APIN0335: 225mm (W) x 224mm (D) x 52mm (H) /8.9" (W) x 8.9" (D) x 2.0" (H) |
| Weight:                          | APIN0334: 1.146 kg<br>APIN0335: 1.160 kg   |
| Hardware Rev:                    | 2  |
| Software Rev:                    | SmartRF Studio 7 Version 2.0.0   |

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## **5.2. Scope Of Test Program**

### **Aruba Networks, Inc APIN0335, APIN0335**

The scope of the test program was to test the Aruba Networks, Inc APIN0334, APIN0335, 802.11 wireless access point with Bluetooth configurations in the frequency ranges 2400 - 2483.5 MHz; for compliance against the following Bluetooth BLE specification:

### **FCC CFR 47 Part 15 Subpart C 15.247 (DTS)**

Radio Frequency Devices; Subpart C – Intentional Radiators

### **Industry Canada RSS-247**

Digital Transmission Systems (DTSs), Frequency Hopping System (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

### **Product Family**

Bluetooth BLE operates using an integral antenna – see Section 5.4 Antenna Details for antenna gain

### **Aruba Networks, Inc. APIN0334 External Antenna**



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**Aruba Networks, Inc. APIN0335 Integral Antenna**



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**Aruba Networks, Inc APIN0334 & APIN0335 (rear)**





### 5.3. Equipment Model(s) and Serial Number(s)

| Type | Description                   | Manufacturer   | Model    | Serial no. | Delivery Date                  |
|------|-------------------------------|----------------|----------|------------|--------------------------------|
| EUT  | WLAN Access Point - Bluetooth | Aruba Networks | APIN0334 | DT0000447  | 16 <sup>th</sup> February 2016 |
| EUT  | WLAN Access Point - Bluetooth | Aruba Networks | APIN0335 | DT0000334  | 16 <sup>th</sup> February 2016 |

### 5.4. Antenna Details

| Type     | Manufacturer   | Model       | Family | Gain (dBi) | BF Gain | Dir BW | X-Pol | Frequency Band (MHz) |
|----------|----------------|-------------|--------|------------|---------|--------|-------|----------------------|
| APIN0335 | Aruba Networks | Metal Sheet | OMNI   | 2.7        | -       | -      | -     | 2400 - 2483.5        |
| APIN0334 | Aruba Networks | Metal Sheet | OMNI   | 5.1        | -       | -      | -     | 2400 - 2483.5        |

BF Gain - Beamforming Gain  
Dir BW - Directional BeamWidth  
X-Pol - Cross Polarization

### 5.5. Cabling and I/O Ports

| Port Type | Max Cable Length | # Of Ports | Screened | Conn Type | Data Type   |
|-----------|------------------|------------|----------|-----------|-------------|
| Ethernet  | 100m             | 2          | N        | RJ-45     | Packet Data |
| USB       | 5m               | 1          | Y        | USB       | Digital     |

### 5.6. Test Configurations

Results for the following configurations are provided in this report:

| Operational Mode(s) | Data Rate with Highest Power MBit/s | Channel Frequency (MHz) |      |      |
|---------------------|-------------------------------------|-------------------------|------|------|
|                     |                                     | Low                     | Mid  | High |
| 2400 - 2483.5 MHz   |                                     |                         |      |      |
| BLE                 | -                                   | 2402                    | 2442 | 2480 |





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### **5.7. Equipment Modifications**

The following modifications were required to bring the equipment into compliance:

1. NONE

### **5.8. Deviations from the Test Standard**

The following deviations from the test standard were required in order to complete the test program:

1. NONE

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## 6. TEST SUMMARY

### List of Measurements

| Test Header                                       | Result                                     | Data Link                 |
|---|--|---------------------------|
| <b>Conducted Testing</b>                          |  |                           |
| 15.247(a)(2) 6 dB & 99% Bandwidth                 | Complies                                   | <a href="#">View Data</a> |
| 15.247(b), 15.31(e) Conducted Output Power        | Complies                                   | <a href="#">View Data</a> |
| 15.247(d) Emissions                               | Complies                                   | -                         |
| (1) Conducted Emissions                           | Complies                                   | -                         |
| (i) Conducted Spurious Emissions                  | Complies                                   | <a href="#">View Data</a> |
| (ii) Conducted Band-Edge Emissions                | Complies                                   | <a href="#">View Data</a> |
| 15.247(e) Power Spectral Density                  | Complies                                   | <a href="#">View Data</a> |
| <b>Radiated Testing</b>                           |  |                           |
| (i) 15.205 Radiated Spurious Emissions            | Complies                                   | <a href="#">View Data</a> |
| (ii) 15.205 Radiated Spurious Band-Edge Emissions | Complies                                   | <a href="#">View Data</a> |
| <b>Digital Emissions</b>                          |  |                           |
|   | See Report ARUB196-U26 Part 15B & ICES-003 |                           |
| 15.209 Digital Emissions                          | Complies                                   |                           |
| <b>AC Wireline Emissions</b>                      |  |                           |
|   | See Report ARUB196-U26 Part 15B & ICES-003 |                           |
| 15.207 AC Wireline Emissions                      | Complies                                   |                           |

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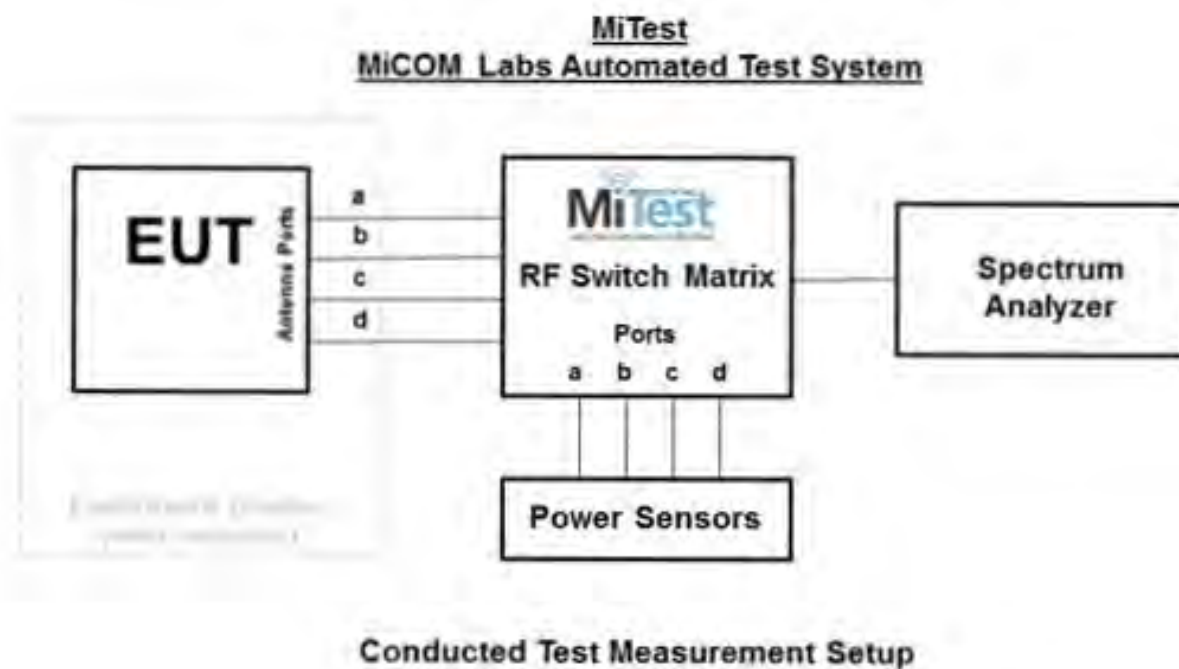
## **7. TEST EQUIPMENT CONFIGURATION(S)**

### **7.1. Conducted**

Conducted RF Emission Test Set-up(s)

The following tests were performed using the conducted test set-up shown in the diagram below.

1. 6 dB & 99% Bandwidth
2. Conducted Output Power
3. Power Spectral Density
4. Conducted Emissions (including Band-Edge)



A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.



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| Asset#           | Description                                    | Manufacturer         | Model#                         | Serial#          | Calibration Due Date |
|------------------|--|----------------------|--------------------------------|------------------|----------------------|
| 158              | Barometer/Thermometer                          | Control Company      | 4196                           | E2846            | 01 Dec 2016          |
| 249              | Resistance Thermometer                         | Thermotronics        | GR2105-02                      | 9340 #2          | 23 Oct 2016          |
| 287              | Rohde & Schwarz 40 GHz Receiver                | Rhode & Schwarz      | ESIB40                         | 100201           | 27 Aug 2016          |
| 361              | Desktop for RF#1, Labview Software installed   | Dell                 | Vostro 220                     | WS RF#1          | Not Required         |
| 378              | Rohde & Schwarz 40 GHz Receiver with Generator | Rhode & Schwarz      | ESIB40                         | 100107/040       | 04 Aug 2016          |
| 380              | 4x4 RF Switch Box                              | MiCOM Labs           | MiTest RF Switch Box           | MIC001           | 18 Jun 2016          |
| 390              | USB Power Head 50MHz - 24GHz -60 to +20dBm     | Agilent              | U2002A                         | MY50000103       | 17 Oct 2016          |
| 398              | Test Software                                  | MiCOM                | MiTest ATS                     | Version 3.0.0.16 | Not Required         |
| 405              | DC Power Supply 0-60V                          | Agilent              | 6654A                          | MY4001826        | Cal when used        |
| 408              | USB to GPIB interface                          | National Instruments | GPIB-USB HS                    | 14C0DE9          | Not Required         |
| 436              | USB Wideband Power Sensor                      | Boonton              | 55006                          | 8731             | 31 Jul 2016          |
| 437              | USB Wideband Power Sensor                      | Boonton              | 55006                          | 8759             | 31 Jul 2016          |
| 445              | PoE Injector                                   | D-Link               | DPE-101GL                      | QTAH1E2000625    | Not Required         |
| 461              | Spectrum Analyzer                              | Agilent              | E4440A                         | MY46185537       | 13 Aug 2016          |
| 75               | Environmental Chamber                          | Thermatron           | SE-300-2-2                     | 27946            | 24 Nov 2016          |
| RF#1 GPIB#1      | GPIB cable to Power Supply                     | HP                   | GPIB                           | None             | Not Required         |
| RF#1 SMA SA #452 | Precision SMA Male RG-402 Spectrun Analyzer    | Fairview Microwave   | Precision SMA Male RG 402 coax | None             | 18 Jun 2016          |
| RF#1 SMA#1       | EUT to Mitest box port 1                       | Flexco               | SMA Cable port1                | None             | 18 Jun 2016          |
| RF#1 SMA#2       | EUT to Mitest box port 2                       | Flexco               | SMA Cable port2                | None             | 18 Jun 2016          |
| RF#1 SMA#3       | EUT to Mitest box port 3                       | Flexco               | SMA Cable port3                | None             | 18 Jun 2016          |
| RF#1 SMA#4       | EUT to Mitest box port 4                       | Flexco               | SMA Cable port4                | None             | 18 Jun 2016          |
| RF#1 USB#1       | USB Cable to Mitest Box                        | Dynex                | USB Cable                      | None             | Not Required         |

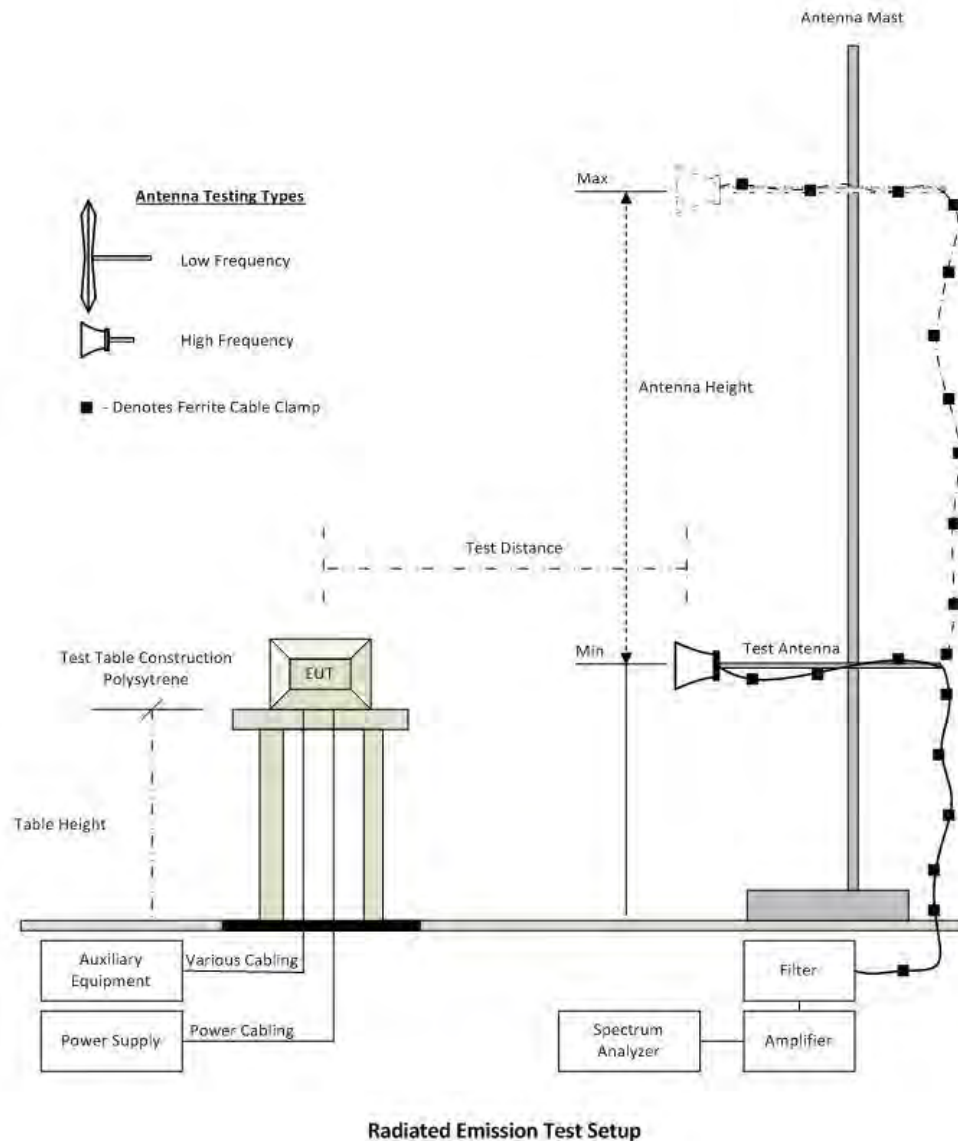
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## 7.2. Radiated Spurious Emissions

The following tests were performed using the radiated test set-up shown in the diagram below.

### 1. Radiated Spurious and Band-Edge Emissions

#### Radiated Emission Measurement Setup Pictorial Representation



A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.



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| Asset# | Description                                       | Manufacturer         | Model#                                     | Serial#     | Calibration Due Date      |
|--------|---|----------------------|--|-------------|---------------------------|
| 158    | Barometer/Thermometer                             | Control Company      | 4196                                       | E2846       | 04 Dec 2016               |
| 170    | Video System Controller for Semi Anechoic Chamber | Panasonic            | WV-CY101                                   | 04R08507    | Not Required              |
| 287    | Rohde & Schwarz 40 GHz Receiver                   | Rhode & Schwarz      | ESIB40                                     | 100201      | 27 Aug 2016               |
| 338    | Sunol 30 to 3000 MHz Antenna                      | Sunol                | JB3  | A052907     | 15 Aug 2016               |
| 396    | 2.4 GHz Notch Filter                              | Microtronics         | BRM50701                                   | 001         | 18 Aug 2016               |
| 397    | Amp 10 - 2500MHz                                  | MiCOM Labs           | Amp 10 - 2500 MHz                          | NA          | 24 Feb 2016               |
| 399    | ETS 1-18 GHz Horn Antenna                         | ETS                  | 3117                                       | 00154575    | 18 <sup>th</sup> Oct 2016 |
| 406    | Amplifier for Radiated Emissions                  | MiCOM Labs           | 40dB 1 to 18GHz Amp                        | 0406        | 28 May 2016               |
| 410    | Desktop Computer                                  | Dell                 | Inspiron 620                               | WS38        | Not Required              |
| 411    | Mast/Turntable Controller                         | Sunol Sciences       | SC98V                                      | 060199-1D   | Not Required              |
| 412    | USB to GPIB Interface                             | National Instruments | GPIB-USB HS                                | 11B8DC2     | Not Required              |
| 413    | Mast Controller                                   | Sunol Science        | TWR95-4                                    | 030801-3    | Not Required              |
| 415    | Turntable Controller                              | Sunol Sciences       | Turntable Controller                       | None        | Not Required              |
| 447    | Rad Emissions Test Software                       | MiCOM                | Rad Emissions Test Software Version 1.0.73 | 447         | Not Required              |
| 462    | Schwarzbeck cable from Antenna to Amplifier.      | Schwarzbeck          | AK 9513                                    | 462         | 25 Feb 2016               |
| 463    | Schwarzbeck cable from Amplifier to Bulkhead.     | Schwarzbeck          | AK 9513                                    | 463         | 25 Feb 2016               |
| 464    | Schwarzbeck cable from Bulkhead to Receiver       | Schwarzbeck          | AK 9513                                    | 464         | 25 Feb 2016               |
| 465    | Low Pass Filter DC-1000 MHz                       | Mini-Circuits        | NLP-1200+                                  | VUU01901402 | 18 Aug 2016               |
| 480    | Cable - Bulkhead to Amp                           | SRC Haverhill        | 157-157-3050360                            | 480         | 11 Aug 2016               |
| 481    | Cable - Bulkhead to Receiver                      | SRC Haverhill        | 151-151-3050787                            | 481         | 11 Aug 2016               |
| 482    | Cable - Amp to Antenna                            | SRC Haverhill        | 157-157-3051574                            | 482         | 11 Aug 2016               |

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## 8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by [MiTest](#). [MiTest](#) is an automated test system developed by MiCOM Labs. [MiTest](#) is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.



The MiCOM Labs "[MiTest](#)" Automated Test System" (Patent Pending)

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## 9. TEST RESULTS

### 9.1. 6 dB & 99% Bandwidth

| Conducted Test Conditions for 6 dB and 99% Bandwidth   |                          |                     |             |
|--|--------------------------|---------------------|-------------|
| Standard:  | FCC CFR 47:15.247        | Ambient Temp. (°C): | 24.0 - 27.5 |
| Test Heading:  | 6 dB and 99 % Bandwidth  | Rel. Humidity (%):  | 32 - 45     |
| Standard Section(s):   | 15.247 (a)(2)            | Pressure (mBars):   | 999 - 1001  |
| Reference Document(s):   | See Normative References |                     |             |
| <p>Test Procedure for 6 dB and 99% Bandwidth Measurement</p> <p>The bandwidth at 6 dB and 99 % was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.</p> <p>Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.</p> <p>Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.</p> <p><b>Limits for 6 dB and 99% Bandwidth</b></p> <p>(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:</p> <p>(2) Systems using digital modulation techniques may operate in the 902-928 MHz and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.</p> |                          |                     |             |

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#### Equipment Configuration for 6 dB & 99% Bandwidth

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | DTS            | <b>Duty Cycle (%):</b>            | 99             |
| <b>Data Rate:</b>              | Not Applicable | <b>Antenna Gain (dBi):</b>        | 2.7            |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | SB             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured 6 dB Bandwidth (MHz) |    |    |    | 6 dB Bandwidth (MHz) |        | Limit  | Lowest Margin |
|----------------|-------------------------------|----|----|----|----------------------|--------|--------|---------------|
|                | Port(s)                       |    |    |    | Highest              | Lowest | KHz    | MHz           |
| MHz            | a                             | b  | c  | d  |                      |        |        |               |
| 2402.0         | <a href="#">0.705</a>         | -- | -- | -- | 0.705                | 0.705  | ≥500.0 | -0.20         |
| 2442.0         | <a href="#">0.705</a>         | -- | -- | -- | 0.705                | 0.705  | ≥500.0 | -0.20         |
| 2480.0         | <a href="#">0.697</a>         | -- | -- | -- | 0.697                | 0.697  | ≥500.0 | -0.20         |

| Test Frequency | Measured 99% Bandwidth (MHz) |     |     |     | Maximum 99% Bandwidth (MHz) |  |  |
|----------------|------------------------------|-----|-----|-----|-----------------------------|--|--|
|                | Port(s)                      |     |     |     |                             |  |  |
| MHz            | a                            | b   | c   | d   |                             |  |  |
| 2402.0         | <a href="#">1.098</a>        | --- | --- | --- | 1.098                       |  |  |
| 2442.0         | <a href="#">1.082</a>        | --- | --- | --- | 1.082                       |  |  |
| 2480.0         | <a href="#">1.082</a>        | --- | --- | --- | 1.082                       |  |  |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                  |
|--------------------------|----------------------------------|
| Work Instruction:        | WI-03 MEASURING RF SPECTRUM MASK |
| Measurement Uncertainty: | ±2.81 dB                         |

Note: click the links in the above matrix to view the graphical image (plot).

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## 9.2. Conducted Output Power

| Conducted Test Conditions for Fundamental Emission Output Power |                          |                     |             |
|---|--------------------------|---------------------|-------------|
| Standard:   | FCC CFR 47:15.247        | Ambient Temp. (°C): | 24.0 - 27.5 |
| Test Heading:   | Output Power             | Rel. Humidity (%):  | 32 - 45     |
| Standard Section(s):  | 15.247 (b) & (c)         | Pressure (mBars):   | 999 - 1001  |
| Reference Document(s):  | See Normative References |                     |             |

Test Procedure for Fundamental Emission Output Power Measurement  
In the case of average power measurements an average power sensor was utilized.

For peak power measurements the spectrum analyzer built-in power function was used to integrate peak power over the 20 dB bandwidth.

Testing was performed under ambient conditions at nominal voltage only. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured, summed ( $\Sigma$ ) and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Supporting Information  
Calculated Power = A + G + Y+ 10 log (1/x) dBm

A = Total Power [10\*Log10 (10<sup>a/10</sup> + 10<sup>b/10</sup> + 10<sup>c/10</sup> + 10<sup>d/10</sup>)]  
G = Antenna Gain  
Y = Beamforming Gain  
x = Duty Cycle (average power measurements only)

**Limits for Fundamental Emission Output Power**  
(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following for non-frequency hopping systems:

(3) For systems using digital modulation in the 902-928 MHz and 2400-2483.5 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(1)(i) and (c)(1)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point

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operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, i.e., the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.



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#### Equipment Configuration for Peak Output Power

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | DTS            | <b>Duty Cycle (%):</b>            | 99.0           |
| <b>Data Rate:</b>              | Not Applicable | <b>Antenna Gain (dBi):</b>        | 2.7            |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | SB             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured Output Power + DCCF (+0.04 dB) (dBm) |    |    |    | Calculated Total Power $\Sigma$ Port(s) | Limit | Margin | EUT Power Setting |
|----------------|---|----|----|----|---|-------|--------|-------------------|
|                | Port(s)                                       |    |    |    |   |       |        |                   |
| MHz            | a   | b  | c  | d  | dBm                                     | dBm   | dB     |                   |
| 2402.0         | 4.46  | -- | -- | -- | 4.46                                    | 30.00 | -25.54 | 4.00              |
| 2442.0         | 3.81  | -- | -- | -- | 3.81                                    | 30.00 | -26.19 | 4.00              |
| 2480.0         | 3.47  | -- | -- | -- | 3.47                                    | 30.00 | -26.53 | 4.00              |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                 |
|--------------------------|---------------------------------|
| Work Instruction:        | WI-01 MEASURING RF OUTPUT POWER |
| Measurement Uncertainty: | $\pm 1.33$ dB                   |

DCCF - Duty Cycle Correction Factor

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### **9.3. Conducted Spurious Emissions**

#### **9.3.1. Conducted Spurious Emissions**

| Conducted Test Conditions for Transmitter Conducted Spurious and Band-Edge Emissions |                              |                     |             |
|--|------------------------------|---------------------|-------------|
| Standard:  | FCC CFR 47:15.247            | Ambient Temp. (°C): | 24.0 - 27.5 |
| Test Heading:  | Max Unwanted Emission Levels | Rel. Humidity (%):  | 32 - 45     |
| Standard Section(s):   | 15.247 (d)                   | Pressure (mBars):   | 999 - 1001  |
| Reference Document(s):   | See Normative References     |                     |             |

**Test Procedure for Transmitter Conducted Spurious and Band-Edge Emissions Measurement**

Transmitter Conducted Spurious and Band-Edge emissions were measured at a limit of 30 dBc (average detector) or 20 dBc (peak detector) below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Measurements were made while EUT was operating in transmit mode of operation at the appropriate centre frequency closest to the band-edge. Emissions were maximized during the measurement and limits derived from the peak spectral power and drawn on each plot.

Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. Testing was performed under ambient conditions at nominal voltage only.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

**Limits Transmitter Conducted Spurious and Band-Edge Emissions**

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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#### Equipment Configuration for Transmitter Conducted Spurious Emissions

|                                |                |                               |                |
|--------------------------------|----------------|-------------------------------|----------------|
| <b>Variant:</b>                | DTS            | <b>Duty Cycle (%):</b>        | 99             |
| <b>Data Rate:</b>              | Not Applicable | <b>Antenna Gain (dBi):</b>    | 2.7            |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>             | SB             |
| <b>Engineering Test Notes:</b> |                |                               |                |

#### Test Measurement Results

| Test Frequency | Frequency Range | Transmitter Conducted Spurious Emissions (dBm) |        |        |       |        |       |        |       |
|----------------|-----------------|--|--------|--------|-------|--------|-------|--------|-------|
|                |                 | Port a   |        | Port b |       | Port c |       | Port d |       |
|                |                 | SE   | Limit  | SE     | Limit | SE     | Limit | SE     | Limit |
| 2402.0         | 30.0 - 26000.0  | <a href="#">-48.920</a>                        | -18.00 | --     | --    | --     | --    | --     | --    |
| 2442.0         | 30.0 - 26000.0  | <a href="#">-51.550</a>                        | -18.00 | --     | --    | --     | --    | --     | --    |
| 2480.0         | 30.0 - 26000.0  | <a href="#">-53.900</a>                        | -19.00 | --     | --    | --     | --    | --     | --    |

#### Traceability to Industry Recognized Test Methodologies

|                          |   |
|--------------------------|---|
| Work Instruction:        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| Measurement Uncertainty: | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

Note: click the links in the above matrix to view the graphical image (plot).

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### 9.3.2. Conducted Band-Edge Emissions

#### Equipment Configuration for Conducted Low Band-Edge Emissions - Peak

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | DTS            | <b>Duty Cycle (%):</b>            | 99.0           |
| <b>Data Rate:</b>              | Not Applicable | <b>Antenna Gain (dBi):</b>        | 2.7            |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | SB             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| <b>Channel Frequency:</b>    | 2402.0 MHz                  |                     |                       |                    |                        |                 |
|------------------------------|-----------------------------|---------------------|-----------------------|--------------------|------------------------|-----------------|
| <b>Band-Edge Frequency:</b>  | 2400.0 MHz                  |                     |                       |                    |                        |                 |
| <b>Test Frequency Range:</b> | 2350.0 - 2422.0 MHz         |                     |                       |                    |                        |                 |
| Port(s)                      | Band-Edge Markers and Limit |                     |                       | Revised Limit      |                        | Margin<br>(MHz) |
|                              | M1 Amplitude<br>(dBm)       | Plot Limit<br>(dBm) | M2 Frequency<br>(MHz) | Amplitude<br>(dBm) | M2A Frequency<br>(MHz) |                 |
| a                            | <a href="#">-32.91</a>      | -17.00              | 2401.20               | --                 | --                     | -1.200          |

#### Traceability to Industry Recognized Test Methodologies

|                          |   |
|--------------------------|---|
| Work Instruction:        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| Measurement Uncertainty: | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

Note: click the links in the above matrix to view the graphical image (plot).

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#### Equipment Configuration for Conducted High Band-Edge Emissions - Peak

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | DTS            | <b>Duty Cycle (%):</b>            | 99.0           |
| <b>Data Rate:</b>              | Not Applicable | <b>Antenna Gain (dBi):</b>        | 2.7            |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | SB             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| <b>Channel Frequency:</b>    | 2480.0 MHz                  |                  |                    |                 |                     |        |
|------------------------------|-----------------------------|------------------|--------------------|-----------------|---------------------|--------|
| <b>Band-Edge Frequency:</b>  | 2483.5 MHz                  |                  |                    |                 |                     |        |
| <b>Test Frequency Range:</b> | 2452.0 - 2524.0 MHz         |                  |                    |                 |                     |        |
| Port(s)                      | Band-Edge Markers and Limit |                  |                    | Revised Limit   |                     | Margin |
|                              | M3 Amplitude (dBm)          | Plot Limit (dBm) | M2 Frequency (MHz) | Amplitude (dBm) | M2A Frequency (MHz) | (MHz)  |
| a                            | <a href="#">-49.92</a>      | -17.00           | 2480.60            | --              | --                  | -2.900 |

#### Traceability to Industry Recognized Test Methodologies

|                          |   |
|--------------------------|---|
| Work Instruction:        | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS       |
| Measurement Uncertainty: | <=40 GHz $\pm 2.37$ dB, > 40 GHz $\pm 4.6$ dB |

Note: click the links in the above matrix to view the graphical image (plot).

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## 9.4. Power Spectral Density

| Conducted Test Conditions for Power Spectral Density |                          |                     |             |
|--|--------------------------|---------------------|-------------|
| Standard:  | FCC CFR 47:15.247        | Ambient Temp. (°C): | 24.0 - 27.5 |
| Test Heading:  | Power Spectral Density   | Rel. Humidity (%):  | 32 - 45     |
| Standard Section(s):                                 | 15.247 (e)               | Pressure (mBars):   | 999 - 1001  |
| Reference Document(s):                               | See Normative References |                     |             |

**Test Procedure for Power Spectral Density**

The transmitter output was connected to a spectrum analyzer and the measured made in a 3 kHz resolution bandwidth using the analyzer auto-coupled sweep-time. A peak value was found over the full emission bandwidth and the spectrum downloaded for post processing purposes.

Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. The Peak Power Spectral Density is the highest level found across the emission bandwidth. With multiple antenna port measurements the numerical analyzer data from each port is summed (â) and a link to this additional graphic is provided.

Testing was performed under ambient conditions at nominal voltage only.

Test configuration and setup used for the measurement was per the Conducted Test Set-up specified in this document.

Measure and sum the spectra across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The individual spectra are then summed mathematically in linear power units. Unlike in-band power measurements, in which the sum involves a single measured value (output power) from each output, measurements for compliance with PSD limits involve summing entire spectra across corresponding frequency bins on the various outputs. Consistency is maintained for any device with multiple transmitter outputs to be certain the individual outputs are all aligned with the same span and same number of points. In this instance, the linear power spectrum value within the first spectral bin of output 0 is summed with that in the first spectral bin of output 1, and the first spectral bin of output 2, and so on up to the Nth output to obtain the true value for the first frequency bin of the summed spectrum. The summed spectrum value for each frequency bin is computed in this fashion. These summed spectral values were post processed and the resulting numerical and graphical data presented.

NOTE:

It may be observed that the spectrum in some antenna port plots break the limit line however this in itself does NOT constitute a failure. In all cases a spectrum summation plot is provided in order to prove compliance. A failure occurs only after the summation of all spectrum plots have been summed and are found to be greater than the limit line.

**Supporting Information**

Calculated Power = A + 10 log (1/x) dBm  
A = Total Power Spectral Density [10 Log10 (10<sup>a/10</sup> + 10<sup>b/10</sup> + 10<sup>c/10</sup> + 10<sup>d/10</sup>)]  
x = Duty Cycle

**Limits Power Spectral Density**

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.



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#### Equipment Configuration for Power Spectral Density - Peak

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | DTS            | <b>Duty Cycle (%):</b>            | 99.0           |
| <b>Data Rate:</b>              | Not Applicable | <b>Antenna Gain (dBi):</b>        | 2.7            |
| <b>Modulation:</b>             | FHSS           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | SB             |
| <b>Engineering Test Notes:</b> |                |                                   |                |

#### Test Measurement Results

| Test Frequency | Measured Power Spectral Density |     |     |     | Amplitude Summation | Limit    | Margin |
|----------------|---------------------------------|-----|-----|-----|---------------------|----------|--------|
|                | Port(s) (dBm/3KHz)              |     |     |     |                     |          |        |
| MHz            | a                               | b   | c   | d   | dBm/3KHz            | dBm/3KHz | dB     |
| 2402.0         | <a href="#">-9.018</a>          | --- | --- | --- | Not Applicable      | 8.0      | -17.0  |
| 2442.0         | <a href="#">-11.081</a>         | --- | --- | --- | Not Applicable      | 8.0      | -19.1  |
| 2480.0         | <a href="#">-10.271</a>         | --- | --- | --- | Not Applicable      | 8.0      | -18.3  |

#### Traceability to Industry Recognized Test Methodologies

|                          |                                  |
|--------------------------|----------------------------------|
| Work Instruction:        | WI-03 MEASURING RF SPECTRUM MASK |
| Measurement Uncertainty: | ±2.81 dB                         |

Note: click the links in the above matrix to view the graphical image (plot).

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## 9.5. Radiated Emissions

| Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions (Restricted Bands) |   |                            |             |
|---|---|----------------------------|-------------|
| <b>Standard:</b>  | FCC CFR 47 Part 15 Subpart C 15.247 (DTS) | <b>Ambient Temp. (°C):</b> | 20.0 - 24.5 |
| <b>Test Heading:</b>  | Radiated Spurious and Band-Edge Emissions | <b>Rel. Humidity (%):</b>  | 32 - 45     |
| <b>Standard Section(s):</b>   | 15.205, 15.209                            | <b>Pressure (mBars):</b>   | 999 - 1001  |
| <b>Reference Document(s):</b>   | See Normative References                  |                            |             |

### Test Procedure for Radiated Spurious and Band-Edge Emissions (Restricted Bands)

Radiated emissions for restricted bands above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned. Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.

Test configuration and setup for Radiated Spurious and Band-Edge Measurement were per the Radiated Test Set-up specified in this document.

#### Limits for Restricted Bands

Peak emission: 74 dBuV/m

Average emission: 54 dBuV/m

#### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. All factors are included in the reported data.

$$FS = R + AF + CORR - FO$$

where:

FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss or Waveguide Loss

Example:

Given receiver input reading of 51.5 dBmV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength (FS) of the measured emission is:

$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 \text{ dBmV/m}$$

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are as follows:

$$\text{Level (dBmV/m)} = 20 * \text{Log (level (mV/m))}$$

$$40 \text{ dBmV/m} = 100 \text{ mV/m}$$

$$48 \text{ dBmV/m} = 250 \text{ mV/m}$$

### Restricted Bands of Operation (15.205)

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



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

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to §15.213.

(4) Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of subparts D or F of this part.



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(7) Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in §15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in §15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of §15.245 shall not exceed the limits specified in §15.245(b).

---

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### 9.5.1. Restricted Band Spurious Emissions

#### Equipment Configuration for Radiated Spurious - Restricted Band Emissions

|                                 |                  |                        |                |
|---------------------------------|------------------|------------------------|----------------|
| <b>Antenna:</b>                 | APIN0335 Antenna | <b>Variant:</b>        | BLE            |
| <b>Antenna Gain (dBi):</b>      | 2.70             | <b>Modulation:</b>     | GFSK           |
| <b>Beam Forming Gain (Y):</b>   | Not Applicable   | <b>Duty Cycle (%):</b> | 99             |
| <b>Channel Frequency (MHz):</b> | 2402.00          | <b>Data Rate:</b>      | Not Applicable |
| <b>Power Setting:</b>           | 4                | <b>Tested By:</b>      | SB             |

#### Test Measurement Results

| Num | Frequency MHz | Raw dBμV | Cable Loss | AF dB  | Level dBμV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBμV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|------------|--------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| #1  | 1397.64       | 36.66    | 2.26       | -15.56 | 23.36        | Max Avg          | Vertical | 100    | 202     | 54.0         | -30.6     | Pass       |
| #2  | 1397.64       | 58.04    | 2.26       | -15.56 | 44.74        | Max Peak         | Vertical | 100    | 202     | 74.0         | -29.3     | Pass       |

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|  |
|--|
| <b>Equipment Configuration for Radiated Spurious - Restricted Band Emissions</b> |
|--|

|                                 |                  |                        |                |
|---------------------------------|------------------|------------------------|----------------|
| <b>Antenna:</b>                 | APIN0335 Antenna | <b>Variant:</b>        | BLE            |
| <b>Antenna Gain (dBi):</b>      | 2.70             | <b>Modulation:</b>     | GFSK           |
| <b>Beam Forming Gain (Y):</b>   | Not Applicable   | <b>Duty Cycle (%):</b> | 99             |
| <b>Channel Frequency (MHz):</b> | 2442.00          | <b>Data Rate:</b>      | Not Applicable |
| <b>Power Setting:</b>           | 4                | <b>Tested By:</b>      | SB             |

|                                 |
|---------------------------------|
| <b>Test Measurement Results</b> |
|---------------------------------|

|  |
|--|
| <a href="#">Click here to view measurement data...</a> |
|--|

---

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#### Equipment Configuration for Radiated Spurious - Restricted Band Emissions

|                                 |                  |                        |                |
|---------------------------------|------------------|------------------------|----------------|
| <b>Antenna:</b>                 | APIN0335 Antenna | <b>Variant:</b>        | BLE            |
| <b>Antenna Gain (dBi):</b>      | 2.70             | <b>Modulation:</b>     | GFSK           |
| <b>Beam Forming Gain (Y):</b>   | Not Applicable   | <b>Duty Cycle (%):</b> | 99             |
| <b>Channel Frequency (MHz):</b> | 2480.00          | <b>Data Rate:</b>      | Not Applicable |
| <b>Power Setting:</b>           | 4                | <b>Tested By:</b>      | SB             |

#### Test Measurement Results

| Num | Frequency MHz | Raw dBμV | Cable Loss | AF dB  | Level dBμV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBμV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|------------|--------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| #1  | 1791.95       | 53.28    | 2.46       | -13.80 | 41.94        | Peak (NRB)       | Vertical | 101    | 0       | --           | --        | Pass       |
| #2  | 1791.95       | 37.18    | 2.46       | -13.80 | 25.84        | Max Avg          | Vertical | 102    | 299     | 54.0         | -28.2     | Pass       |
| #3  | 1791.95       | 62.72    | 2.46       | -13.80 | 51.38        | Max Peak         | Vertical | 102    | 299     | 74.0         | -22.6     | Pass       |

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#### 9.5.2. Restricted Band-Edge Spurious Emissions

| Aruba Networks Metal Sheet |                           | Band-Edge Freq | Limit 54.0dB $\mu$ V/m | Limit 74.0dB $\mu$ V/m | Power Setting |
|----------------------------|---------------------------|----------------|------------------------|------------------------|---------------|
| Operational Mode           | Operating Frequency (MHz) | MHz            | dB $\mu$ V/m           | dB $\mu$ V/m           |               |
| BLE                        | 2402.00                   | 2390.00        | 36.82                  | 49.33                  | 4             |
| BLE                        | 2480.00                   | 2483.50        | 45.16                  | 55.89                  | 4             |

---

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#### Equipment Configuration for Radiated - Lower Restricted Band-Edge Emissions

|                                 |                  |                        |                |
|---------------------------------|------------------|------------------------|----------------|
| <b>Antenna:</b>                 | APIN0335 Antenna | <b>Variant:</b>        | BLE            |
| <b>Antenna Gain (dBi):</b>      | 2.70             | <b>Modulation:</b>     | GFSK           |
| <b>Beam Forming Gain (Y):</b>   | Not Applicable   | <b>Duty Cycle (%):</b> | 99             |
| <b>Channel Frequency (MHz):</b> | 2402.00          | <b>Data Rate:</b>      | Not Applicable |
| <b>Power Setting:</b>           | 4                | <b>Tested By:</b>      | SB             |

#### Test Measurement Results

| Num | Frequency<br>MHz | Raw<br>dBμV | Cable<br>Loss | AF dB | Level<br>dBμV/m | Measurement<br>Type | Pol        | Hgt<br>cm | Azt<br>Deg | Limit<br>dBμV/m | Margin<br>dB | Pass<br>/Fail |
|-----|------------------|-------------|---------------|-------|-----------------|---------------------|------------|-----------|------------|-----------------|--------------|---------------|
| #1  | 2338.08          | 2.43        | 2.69          | 31.70 | 36.82           | Max Avg             | Horizontal | 159       | 13         | 54.0            | -17.2        | Pass          |
| #2  | 2389.59          | 14.60       | 2.69          | 32.04 | 49.33           | Max Peak            | Horizontal | 159       | 13         | 74.0            | -24.7        | Pass          |
| #3  | 2390.00          | --          | --            | --    | --              | Band-Edge           | --         | --        | --         | --              | --           | --            |

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#### Equipment Configuration for Radiated - Upper Restricted Band-Edge Emissions

|                                 |                            |                        |                |
|---------------------------------|----------------------------|------------------------|----------------|
| <b>Antenna:</b>                 | Aruba Networks Metal Sheet | <b>Variant:</b>        | BLE            |
| <b>Antenna Gain (dBi):</b>      | 2.70                       | <b>Modulation:</b>     | GFSK           |
| <b>Beam Forming Gain (Y):</b>   | Not Applicable             | <b>Duty Cycle (%):</b> | 99             |
| <b>Channel Frequency (MHz):</b> | 2480.00                    | <b>Data Rate:</b>      | Not Applicable |
| <b>Power Setting:</b>           | 4                          | <b>Tested By:</b>      | SB             |

#### Test Measurement Results

| Num | Frequency<br>MHz | Raw<br>dBμV | Cable<br>Loss | AF dB | Level<br>dBμV/m | Measurement<br>Type | Pol        | Hgt<br>cm | Azt<br>Deg | Limit<br>dBμV/m | Margin<br>dB | Pass<br>/Fail |
|-----|------------------|-------------|---------------|-------|-----------------|---------------------|------------|-----------|------------|-----------------|--------------|---------------|
| #1  | 2483.50          | 10.06       | 2.73          | 32.37 | 45.16           | Max Avg             | Horizontal | 159       | 17         | 54.0            | -8.8         | Pass          |
| #2  | 2483.50          | 20.79       | 2.73          | 32.37 | 55.89           | Max Peak            | Horizontal | 159       | 17         | 74.0            | -18.1        | Pass          |
| #3  | 2483.50          | --          | --            | --    | --              | Band-Edge           | --         | --        | --         | --              | --           | --            |

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## **A. APPENDIX - GRAPHICAL IMAGES**

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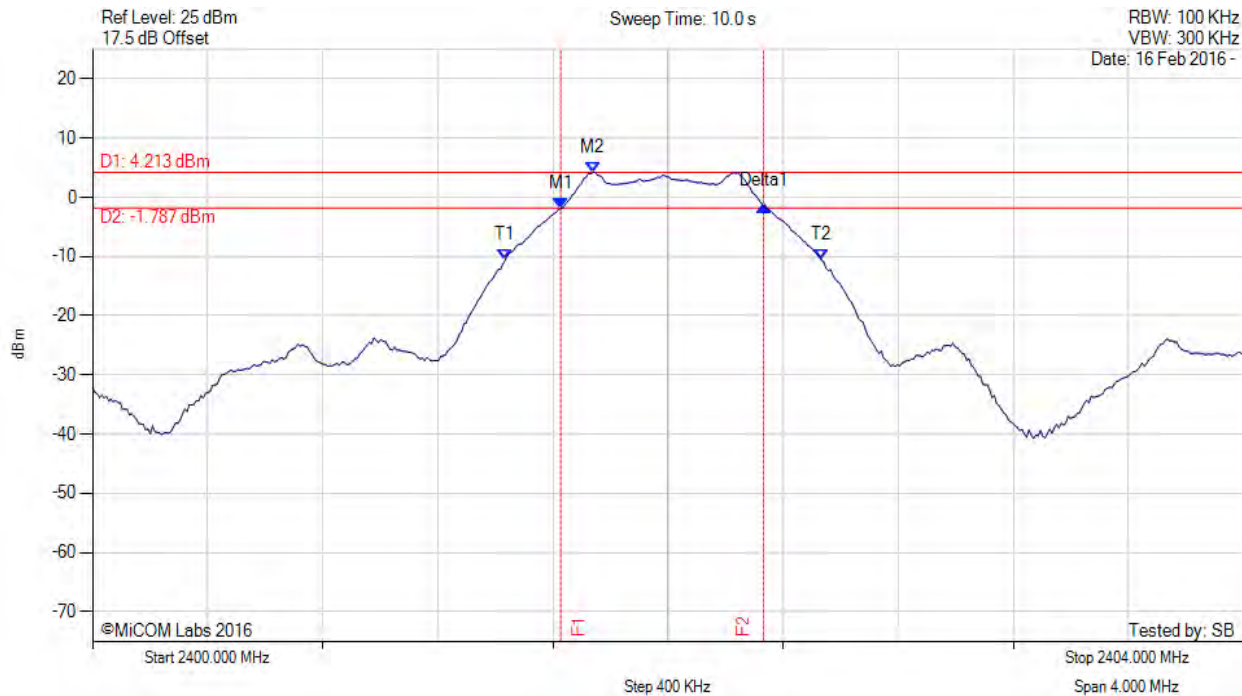


## A.1. 6 dB & 99% Bandwidth



### 6 dB & 99% BANDWIDTH

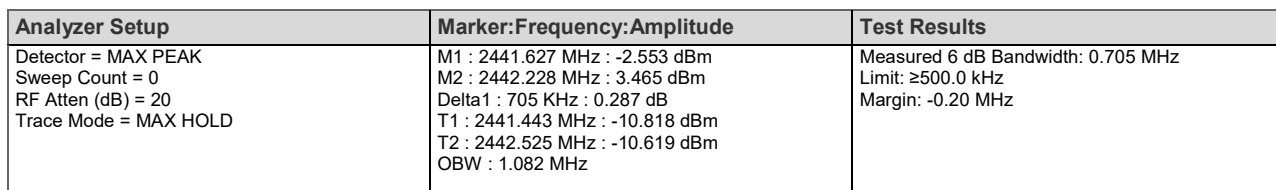
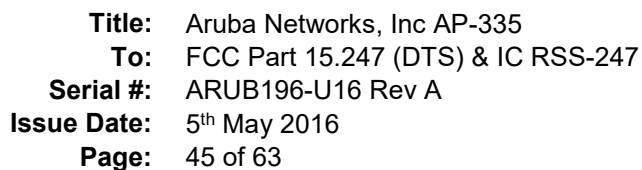
Variant: DTS, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude  | Test Results   |
|---|---|--|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = MAX HOLD | M1 : 2401.627 MHz : -1.953 dBm<br>M2 : 2401.739 MHz : 4.213 dBm<br>Delta1 : 705 KHz : 0.456 dB<br>T1 : 2401.435 MHz : -10.513 dBm<br>T2 : 2402.533 MHz : -10.572 dBm<br>OBW : 1.098 MHz | Measured 6 dB Bandwidth: 0.705 MHz<br>Limit: ≥500.0 kHz<br>Margin: -0.20 MHz |

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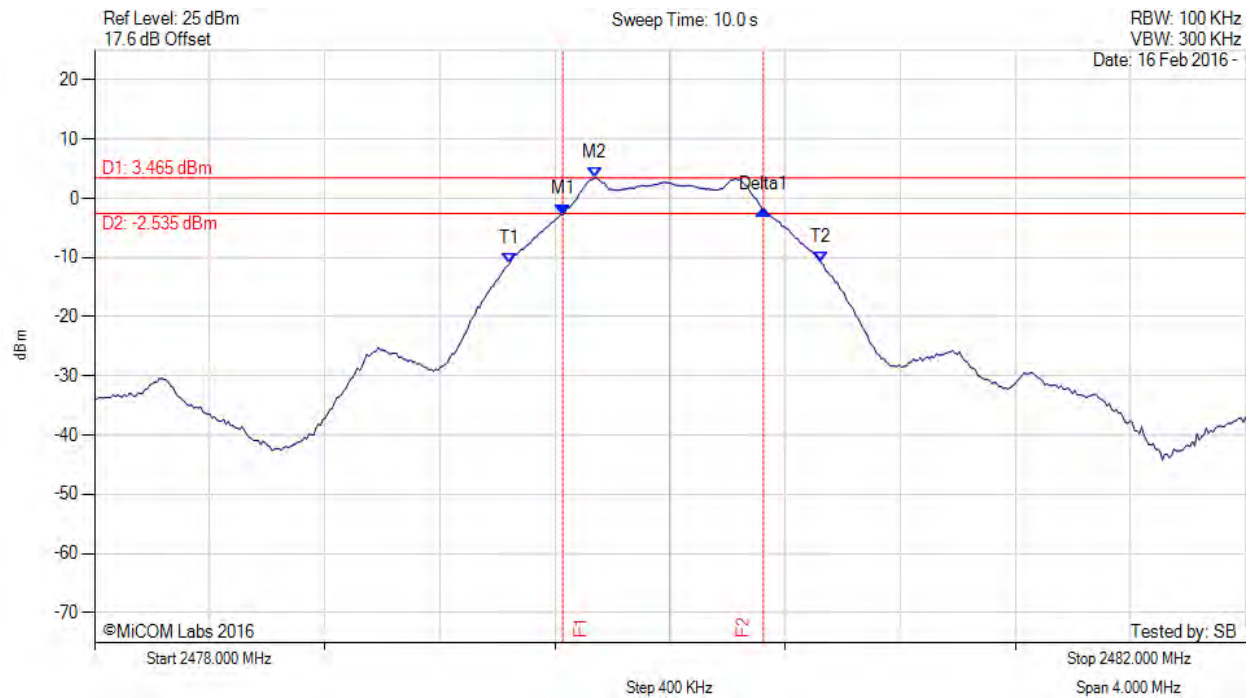


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6 dB & 99% BANDWIDTH

Variant: DTS, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude  | Test Results   |
|---|---|--|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = MAX HOLD | M1 : 2479.627 MHz : -2.722 dBm<br>M2 : 2479.739 MHz : 3.465 dBm<br>Delta1 : 697 KHz : 0.789 dB<br>T1 : 2479.443 MHz : -10.967 dBm<br>T2 : 2480.525 MHz : -10.849 dBm<br>OBW : 1.082 MHz | Measured 6 dB Bandwidth: 0.697 MHz<br>Limit: ≥500.0 kHz<br>Margin: -0.20 MHz |

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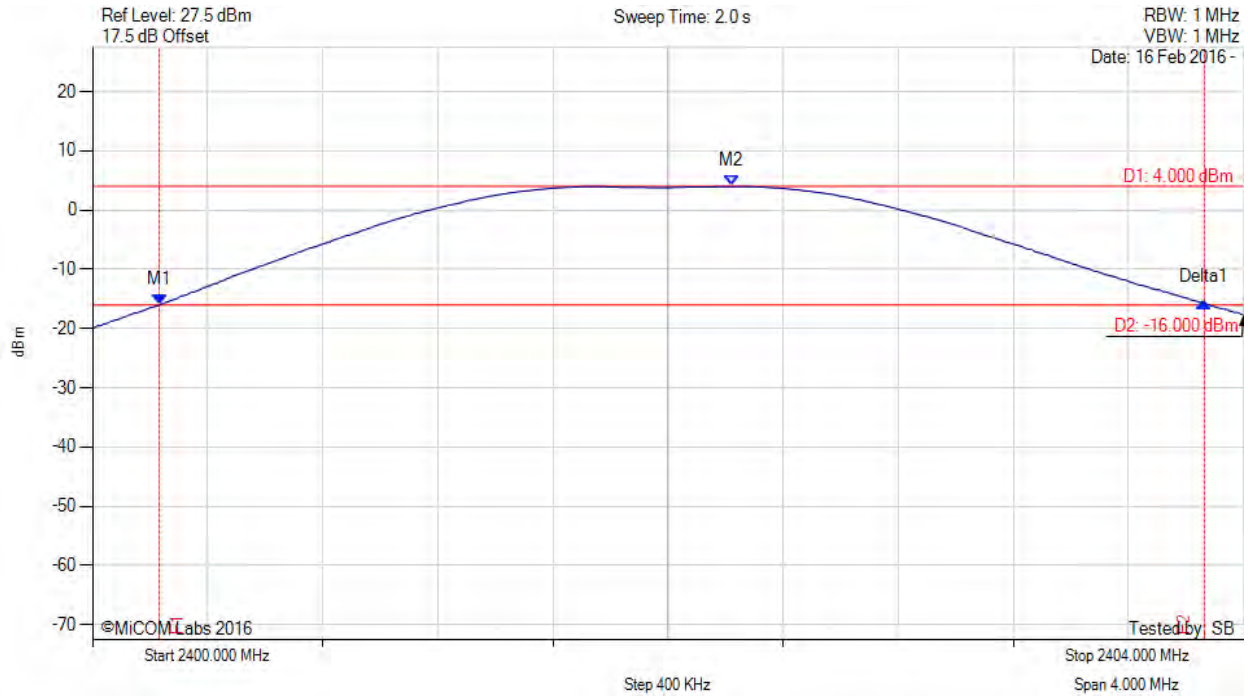
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## A.2. Conducted Output Power



### PEAK OUTPUT POWER

Variant: DTS, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude  | Test Results  |
|---|---|---|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 2400.232 MHz : -16.006 dBm<br>M2 : 2402.220 MHz : 4.000 dBm<br>Delta1 : 3.631 MHz : 0.399 dB | Channel Power: 4.46 dBm<br>Limit: 30.00 dBm<br>Margin: dB |

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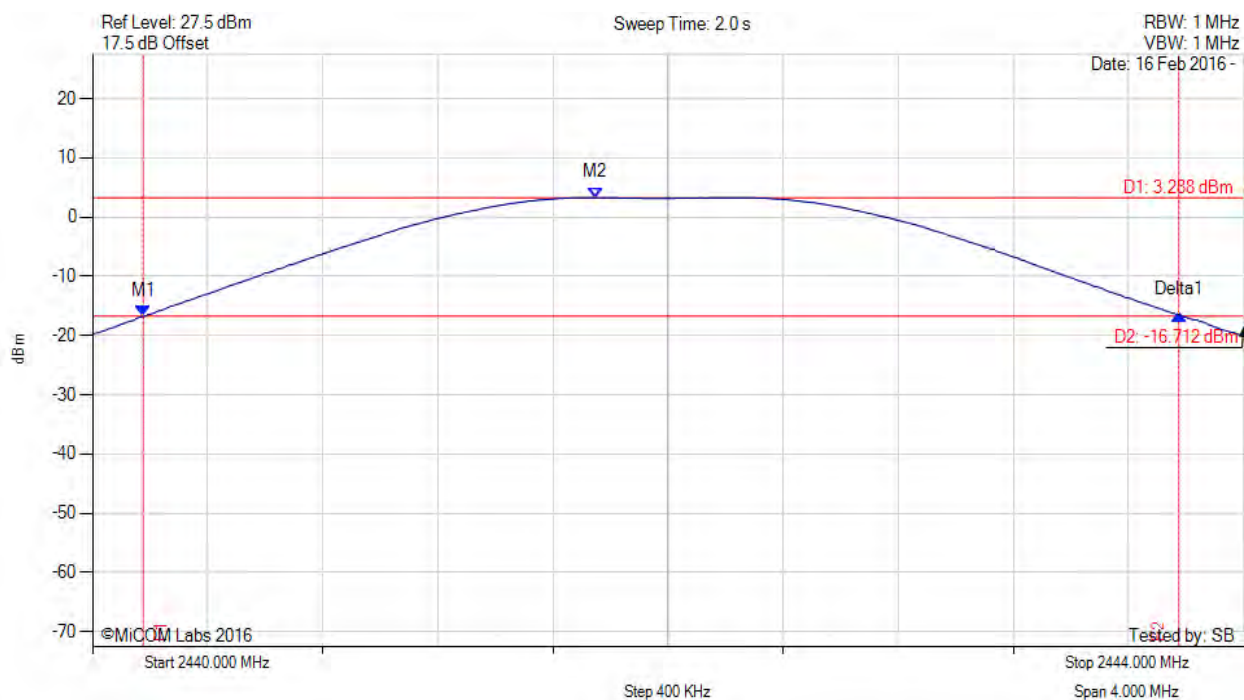


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#### PEAK OUTPUT POWER

Variant: DTS, Channel: 2442.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude  | Test Results  |
|---|---|---|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 2440.176 MHz : -16.762 dBm<br>M2 : 2441.747 MHz : 3.288 dBm<br>Delta1 : 3.599 MHz : 0.226 dB | Channel Power: 3.81 dBm<br>Limit: 30.00 dBm<br>Margin: dB |

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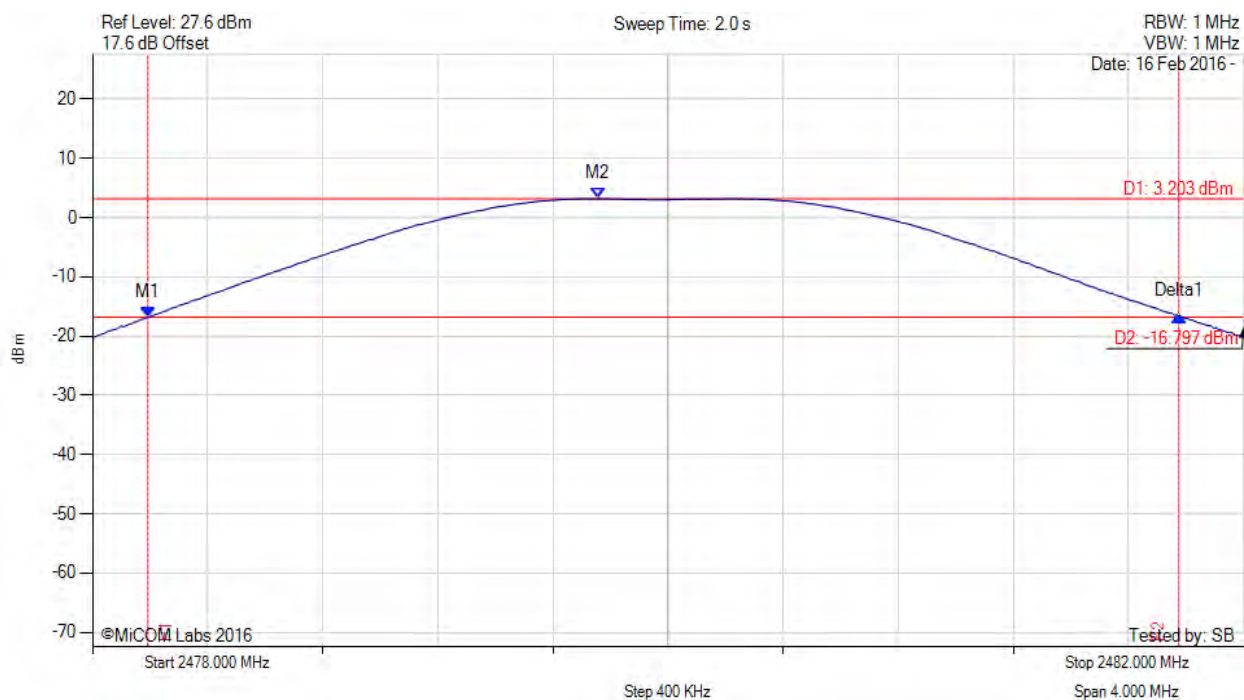


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#### PEAK OUTPUT POWER

Variant: DTS, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude  | Test Results  |
|---|---|---|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 2478.192 MHz : -16.841 dBm<br>M2 : 2479.756 MHz : 3.203 dBm<br>Delta1 : 3.583 MHz : 0.262 dB | Channel Power: 3.47 dBm<br>Limit: 30.00 dBm<br>Margin: dB |

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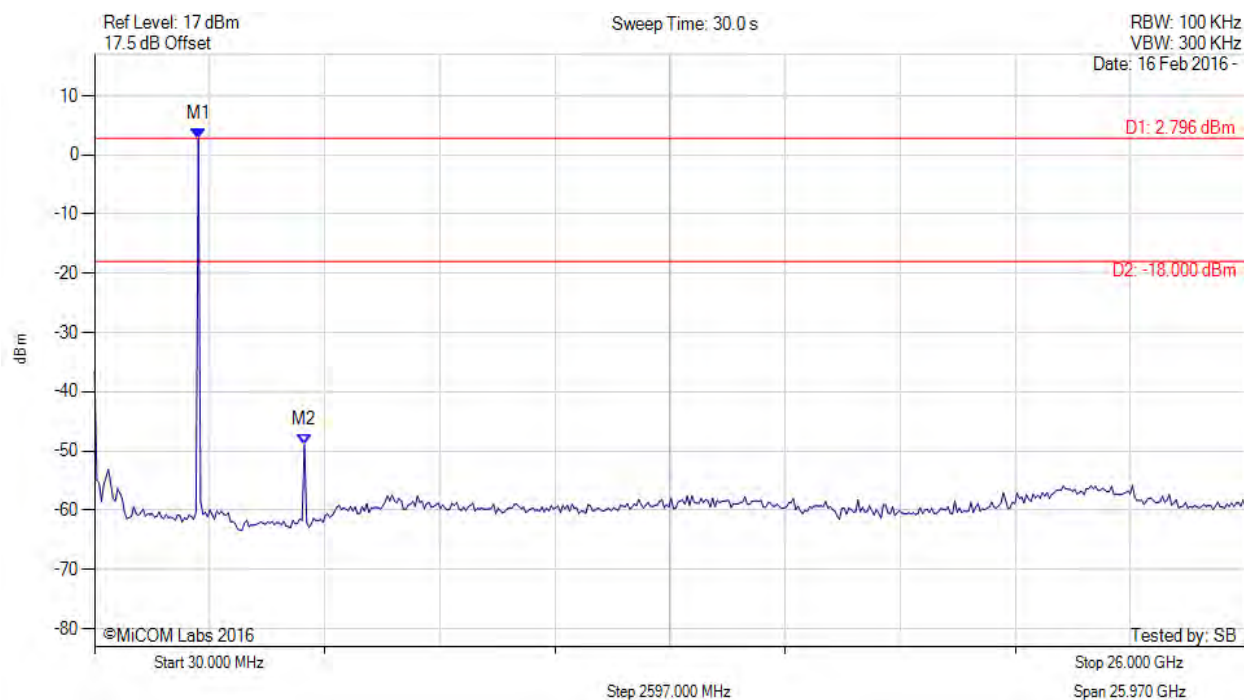
## A.3. Emissions

### A.3.1. Conducted Spurious Emissions



#### CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: DTS, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude                                       | Test Results                           |
|---|--|--|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 2371.984 MHz : 2.796 dBm<br>M2 : 4766.012 MHz : -48.920 dBm | Limit: -18.00 dBm<br>Margin: -30.92 dB |

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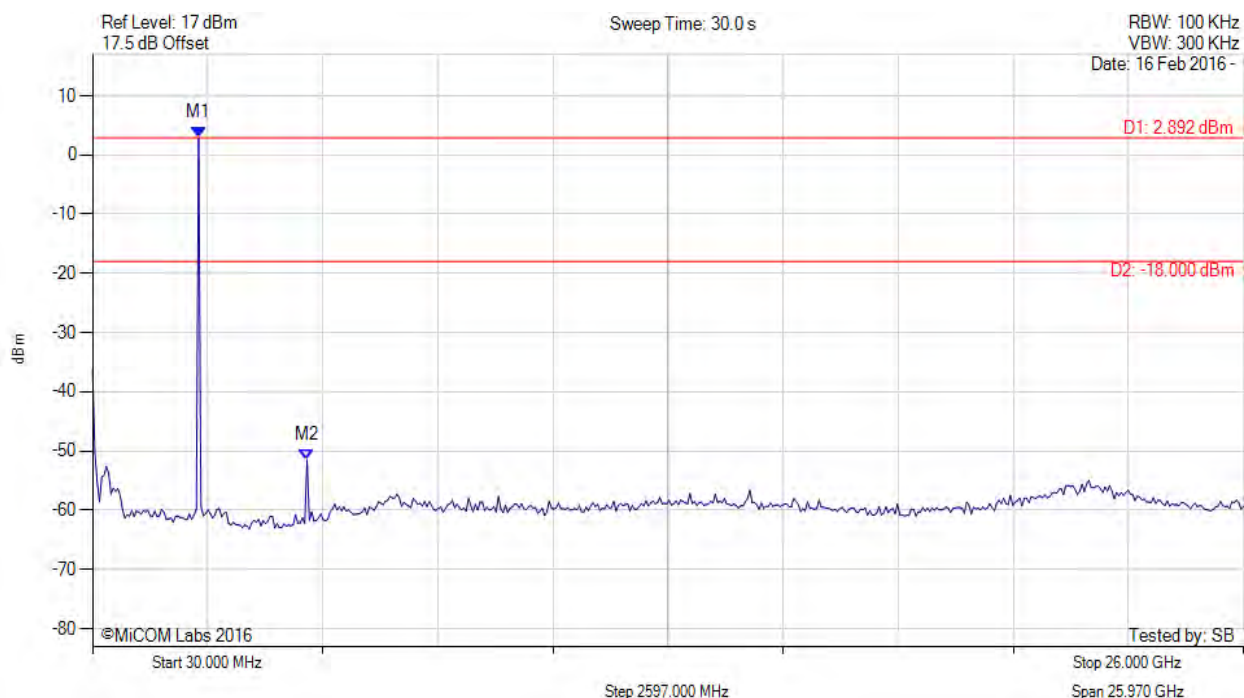


**Title:** Aruba Networks, Inc AP-335  
**To:** FCC Part 15.247 (DTS) & IC RSS-247  
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#### CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: DTS, Channel: 2442.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude                                       | Test Results                           |
|---|--|--|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 2424.028 MHz : 2.892 dBm<br>M2 : 4870.100 MHz : -51.550 dBm | Limit: -18.00 dBm<br>Margin: -33.55 dB |

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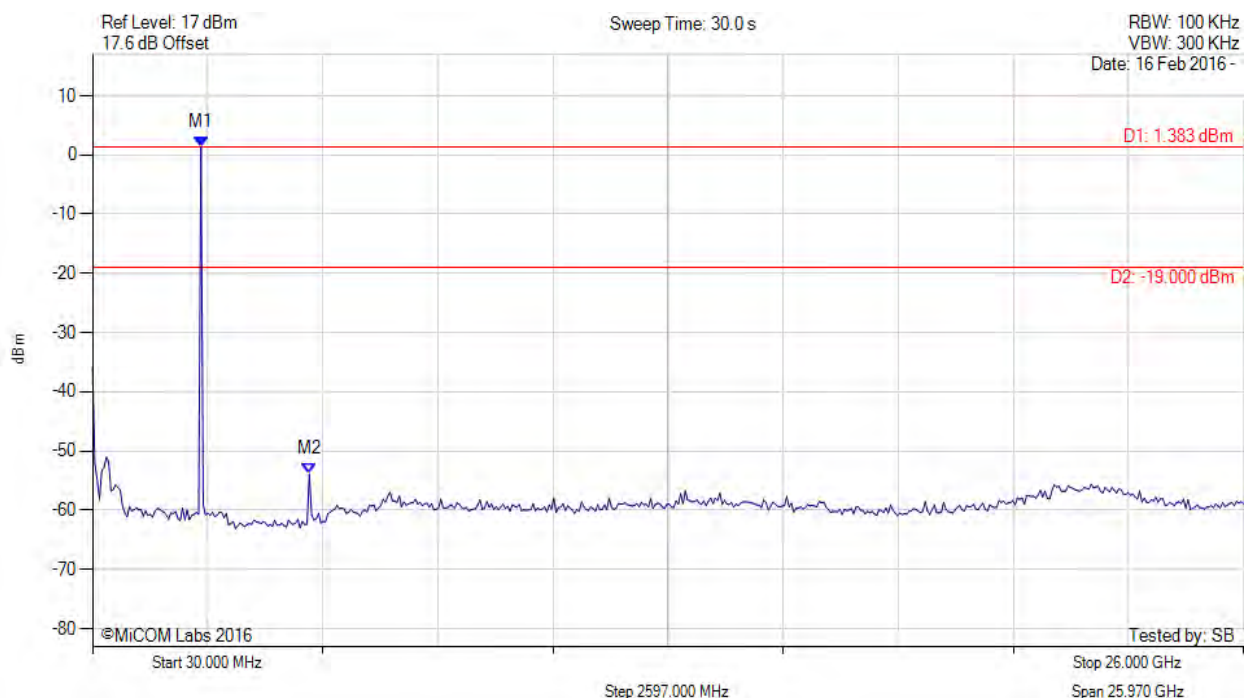


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#### CONDUCTED SPURIOUS EMISSIONS - PEAK

Variant: DTS, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude                                       | Test Results                           |
|---|--|--|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 10<br>Trace Mode = VIEW | M1 : 2476.072 MHz : 1.383 dBm<br>M2 : 4922.144 MHz : -53.900 dBm | Limit: -19.00 dBm<br>Margin: -34.90 dB |

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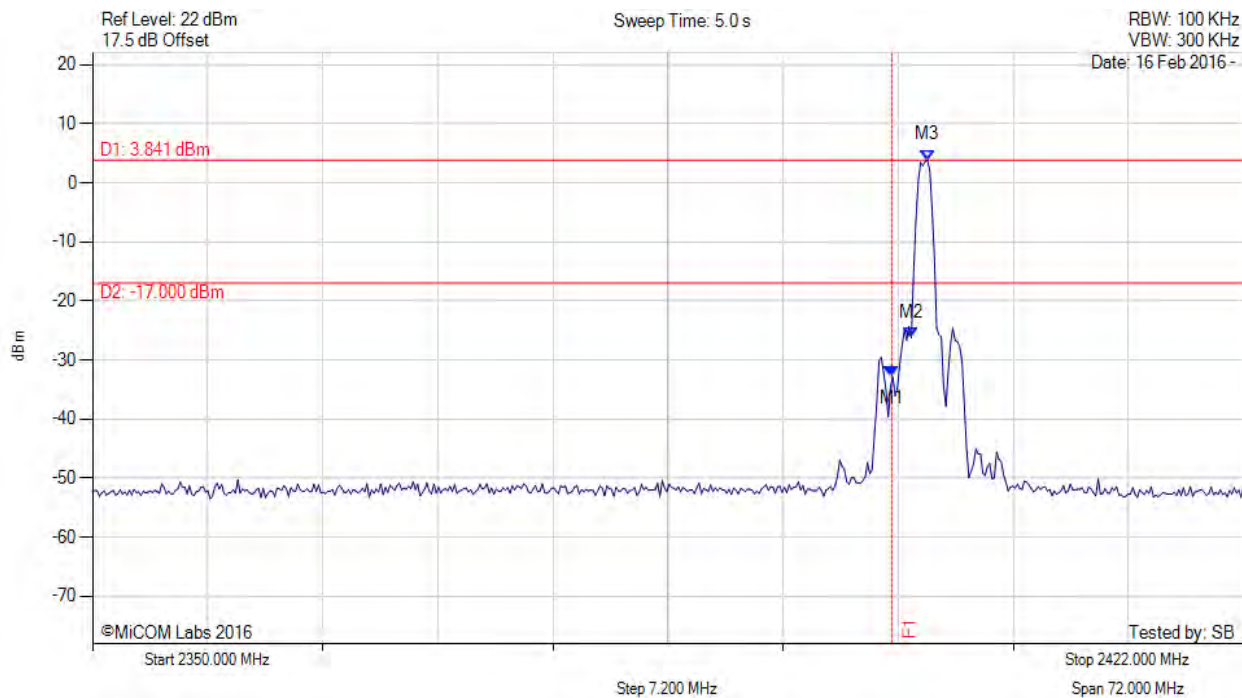
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### A.3.2. Conducted Band-Edge Emissions



#### CONDUCTED LOW BAND-EDGE EMISSION - PEAK

Variant: DTS, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude  | Test Results                   |
|---|---|--------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 2400.000 MHz : -32.907 dBm<br>M2 : 2401.222 MHz : -26.259 dBm<br>M3 : 2402.232 MHz : 3.841 dBm | Channel Frequency: 2402.00 MHz |

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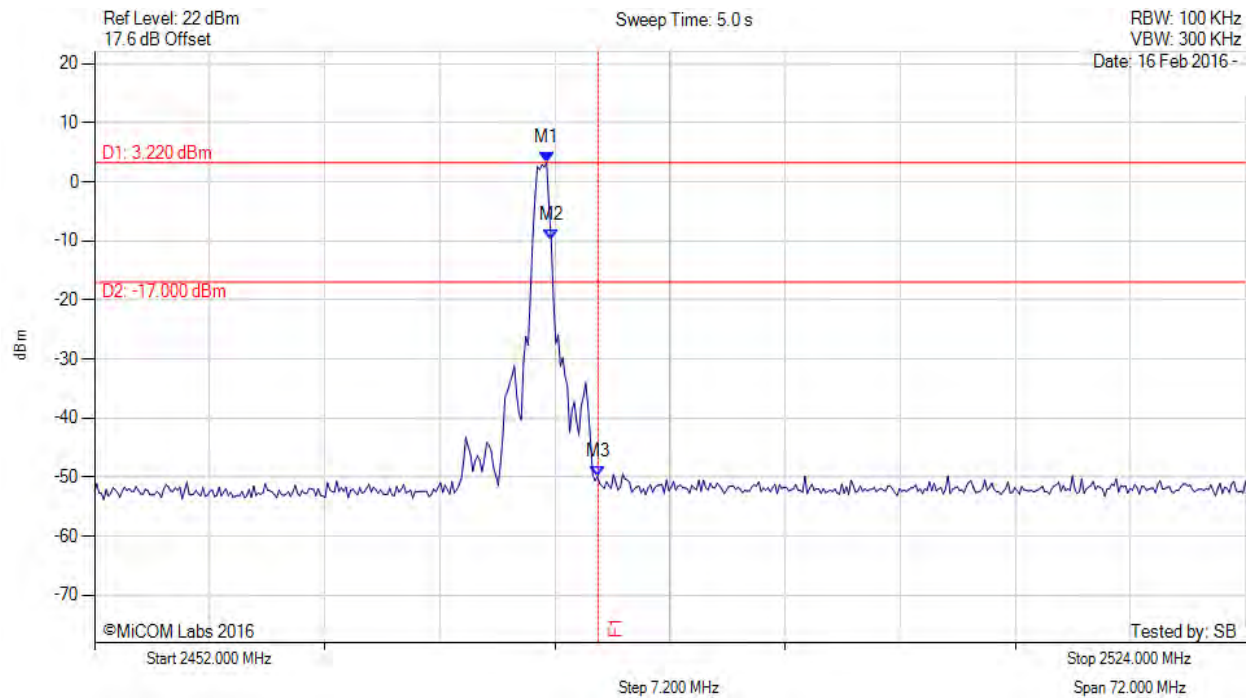


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#### CONDUCTED HIGH BAND-EDGE EMISSION - PEAK

Variant: DTS, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude   | Test Results                   |
|---|--|--------------------------------|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 2480.281 MHz : 3.220 dBm<br>M2 : 2480.569 MHz : -9.846 dBm<br>M3 : 2483.500 MHz : -49.919 dBm | Channel Frequency: 2480.00 MHz |

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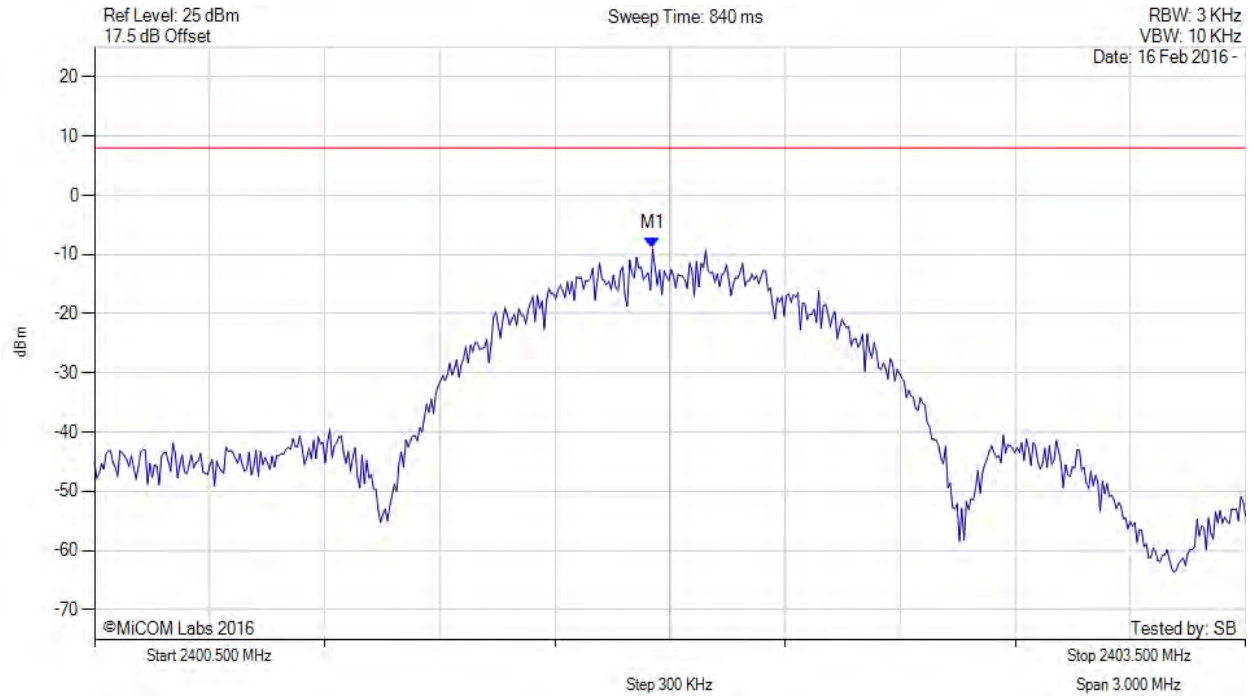
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## A.4. Power Spectral Density



### POWER SPECTRAL DENSITY - PEAK

Variant: DTS, Channel: 2402.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude     | Test Results                           |
|---|--------------------------------|--|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 2401.955 MHz : -9.018 dBm | Limit: ≤ 8.000 dBm<br>Margin: 17.02 dB |

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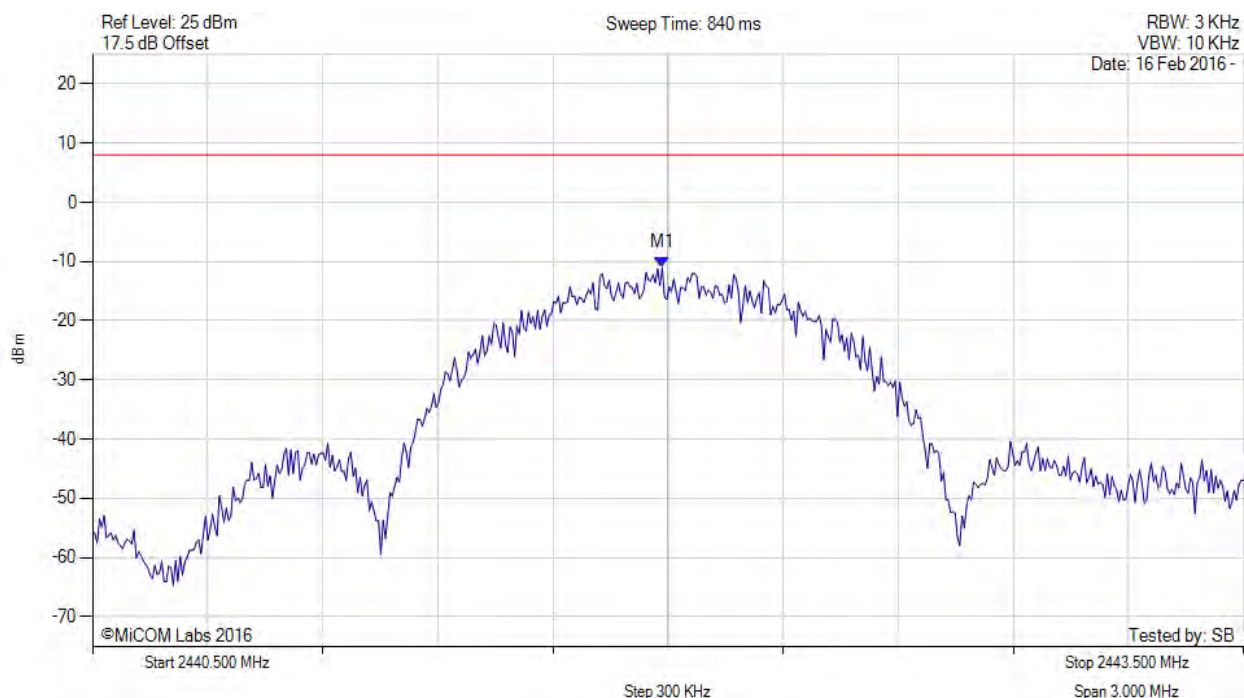


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#### POWER SPECTRAL DENSITY - PEAK

Variant: DTS, Channel: 2442.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude      | Test Results                                |
|---|---------------------------------|---|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 2441.985 MHz : -11.081 dBm | Limit: $\leq 8.000$ dBm<br>Margin: 19.08 dB |

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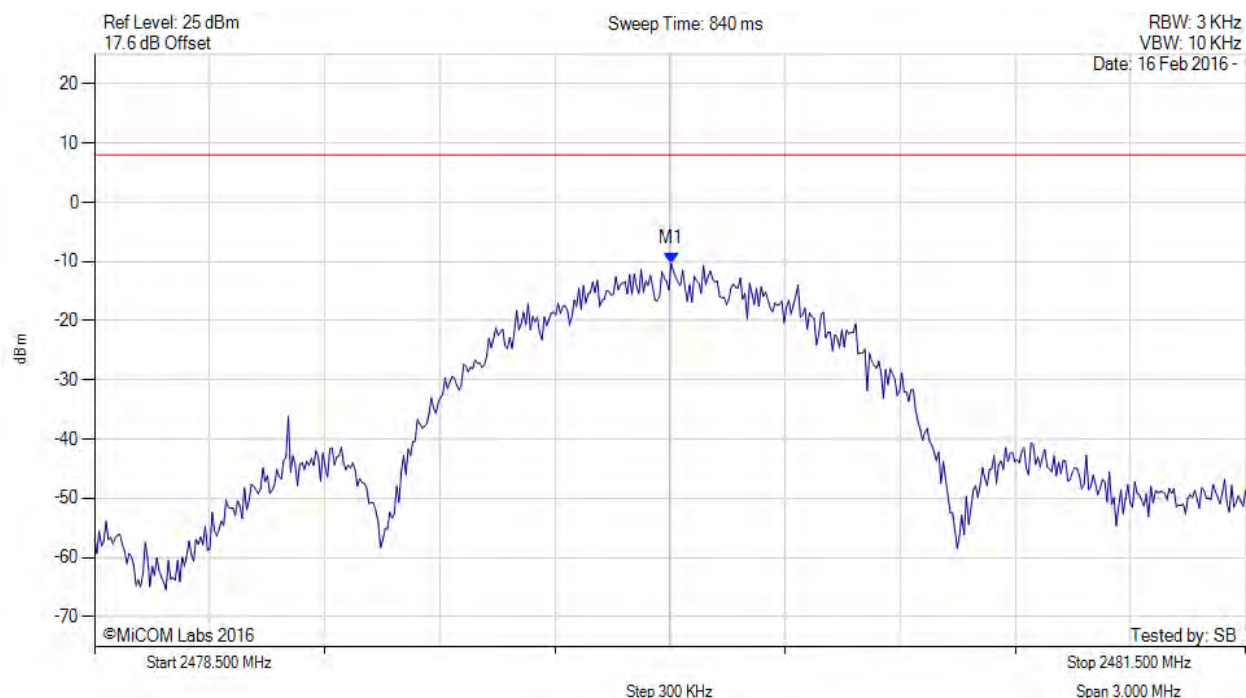
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# POWER SPECTRAL DENSITY - PEAK

Variant: DTS, Channel: 2480.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



| Analyzer Setup  | Marker:Frequency:Amplitude      | Test Results                           |
|---|---------------------------------|--|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 2480.003 MHz : -10.271 dBm | Limit: ≤ 8.000 dBm<br>Margin: 18.27 dB |

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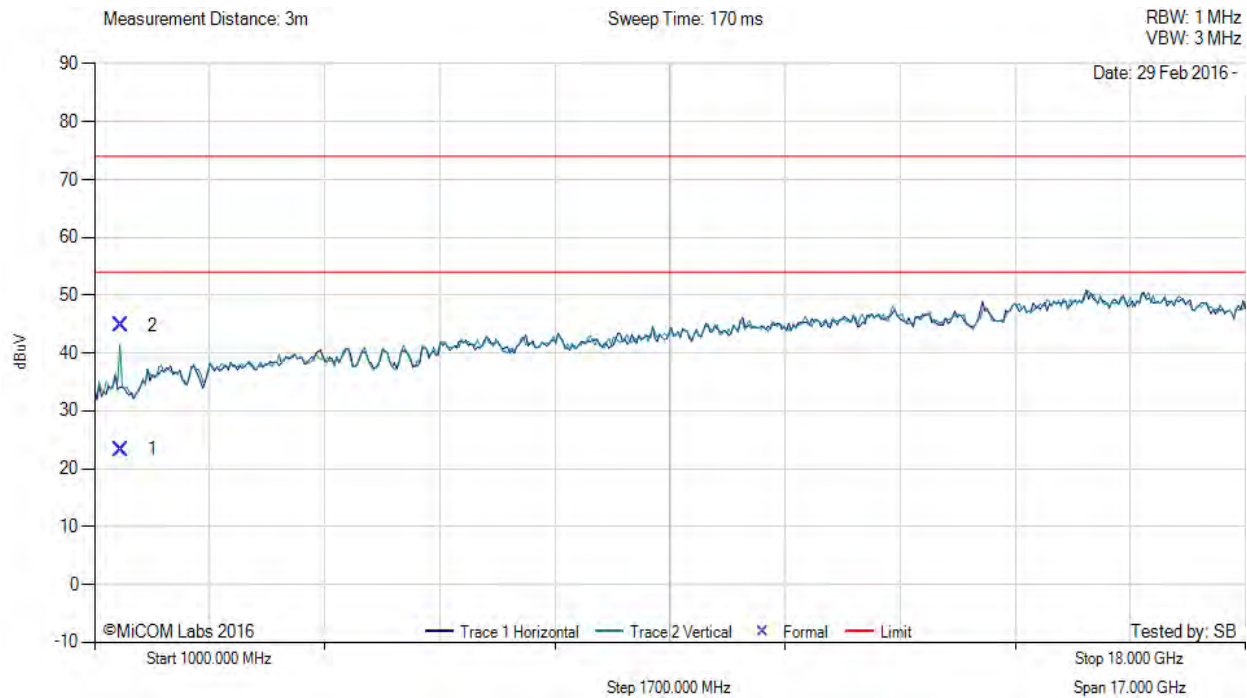
## A.5. Radiated Spurious Emissions

### A.5.1. Restricted Band Emissions



#### RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS

Variant: BLE, Test Freq: 2402.00 MHz, Antenna: APIN0335, Power Setting: 4, Duty Cycle (%): 99



| Num | Frequency MHz | Raw dBμV | Cable Loss | AF dB  | Level dBμV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBμV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|------------|--------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| 1   | 1397.64       | 36.66    | 2.26       | -15.56 | 23.36        | Max Avg          | Vertical | 100    | 202     | 54.0         | -30.6     | Pass       |
| 2   | 1397.64       | 58.04    | 2.26       | -15.56 | 44.74        | Max Peak         | Vertical | 100    | 202     | 74.0         | -29.3     | Pass       |

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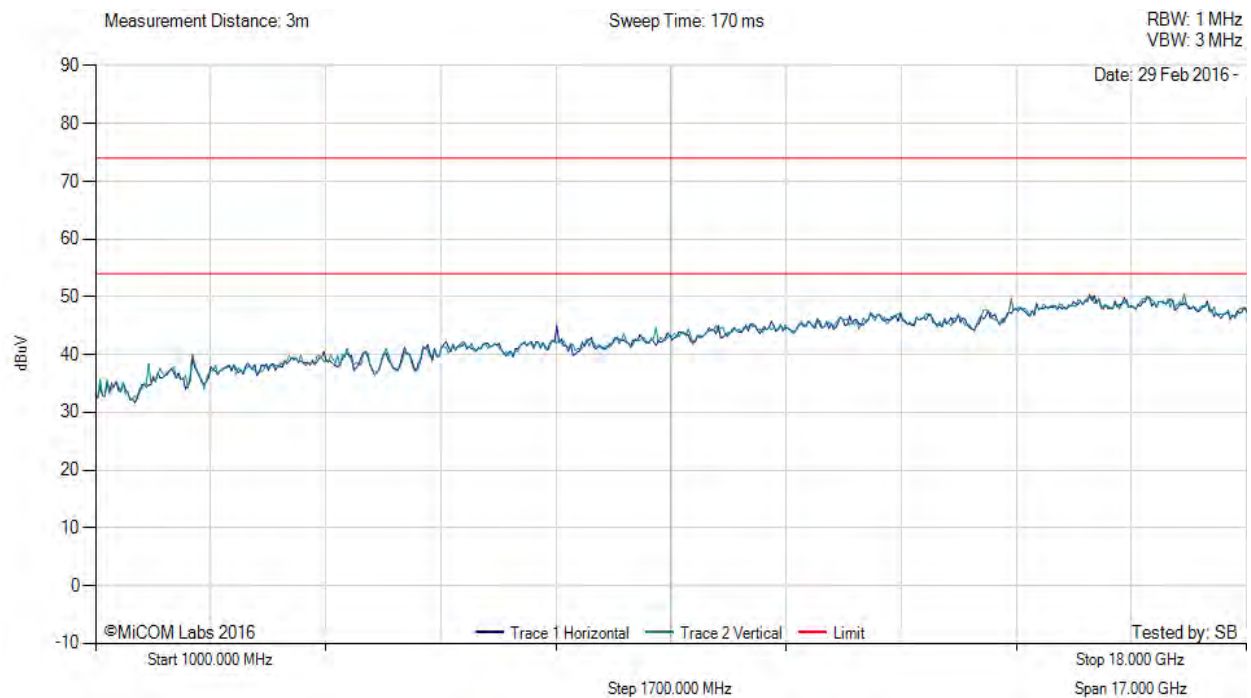


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#### RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS



Variant: BLE, Test Freq: 2442.00 MHz, Antenna: APIN0335, Power Setting: 4, Duty Cycle (%): 99



There are no emissions found within 6dB of the limit line.

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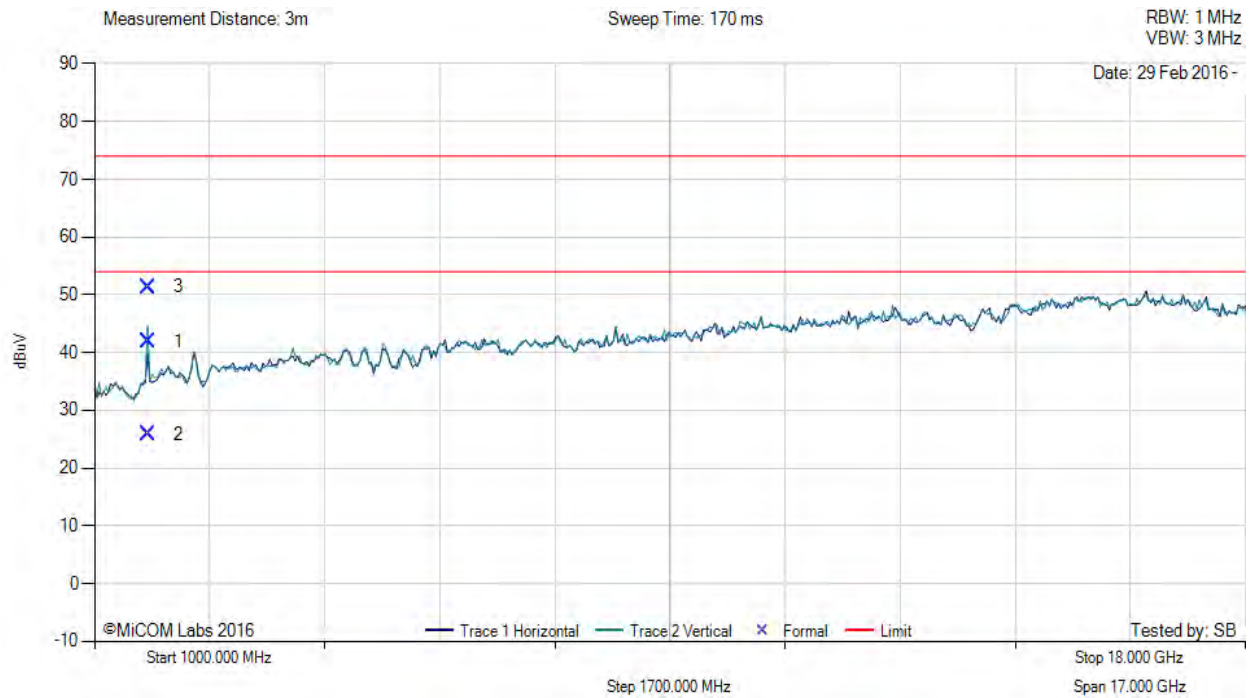


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#### RADIATED SPURIOUS - RESTRICTED BAND EMISSIONS

Variant: BLE, Test Freq: 2480.00 MHz, Antenna: APIN0335, Power Setting: 4, Duty Cycle (%): 99



| Num | Frequency MHz | Raw dBμV | Cable Loss | AF dB  | Level dBμV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBμV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|------------|--------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| 1   | 1791.95       | 53.28    | 2.46       | -13.80 | 41.94        | Peak (NRB)       | Vertical | 101    | 0       | --           | --        | Pass       |
| 2   | 1791.95       | 37.18    | 2.46       | -13.80 | 25.84        | Max Avg          | Vertical | 102    | 299     | 54.0         | -28.2     | Pass       |
| 3   | 1791.95       | 62.72    | 2.46       | -13.80 | 51.38        | Max Peak         | Vertical | 102    | 299     | 74.0         | -22.6     | Pass       |

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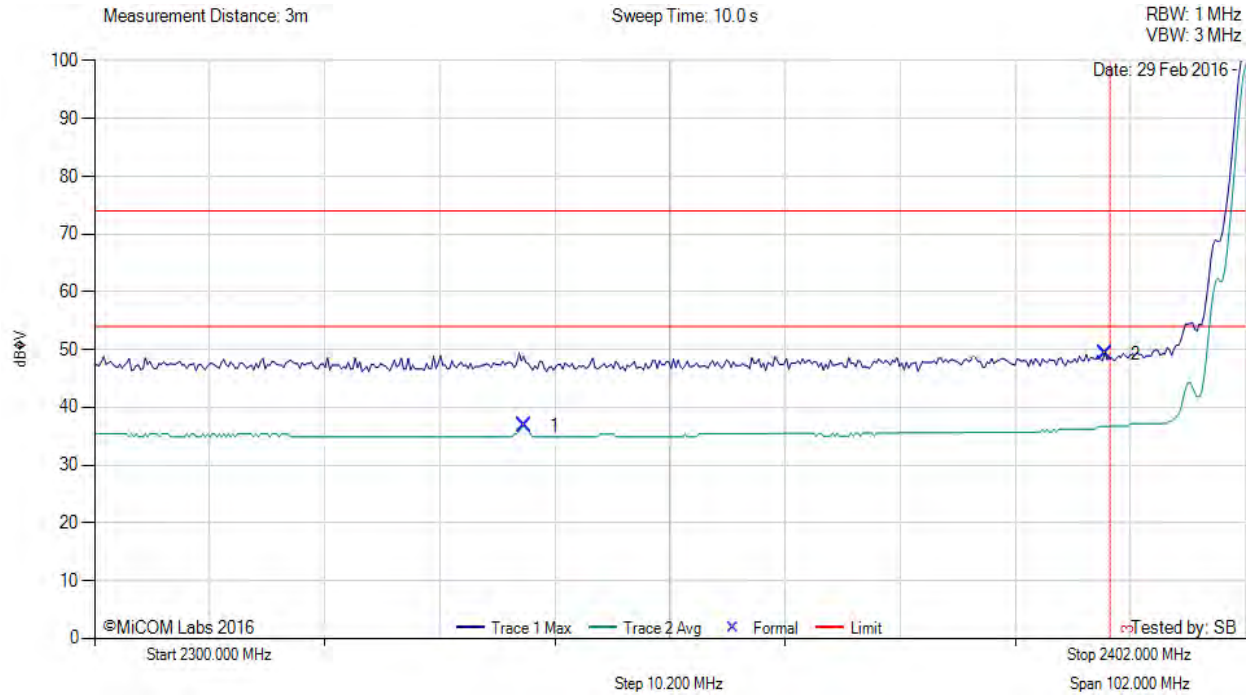
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## A.5.2. Restricted Band-Edge Emissions



### RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS

Variant: BLE, Test Freq: 2402.00 MHz, Antenna: APIN0335, Power Setting: 4, Duty Cycle (%): 99



| Num | Frequency MHz | Raw dBμV | Cable Loss | AF dB | Level dBμV/m | Measurement Type | Pol        | Hgt cm | Azt Deg | Limit dBμV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|------------|-------|--------------|------------------|------------|--------|---------|--------------|-----------|------------|
| 1   | 2338.08       | 2.43     | 2.69       | 31.70 | 36.82        | Max Avg          | Horizontal | 159    | 13      | 54.0         | -17.2     | Pass       |
| 2   | 2389.59       | 14.60    | 2.69       | 32.04 | 49.33        | Max Peak         | Horizontal | 159    | 13      | 74.0         | -24.7     | Pass       |
| 3   | 2390.00       | --       | --         | --    | --           | Band-Edge        | --         | --     | --      | --           | --        | --         |

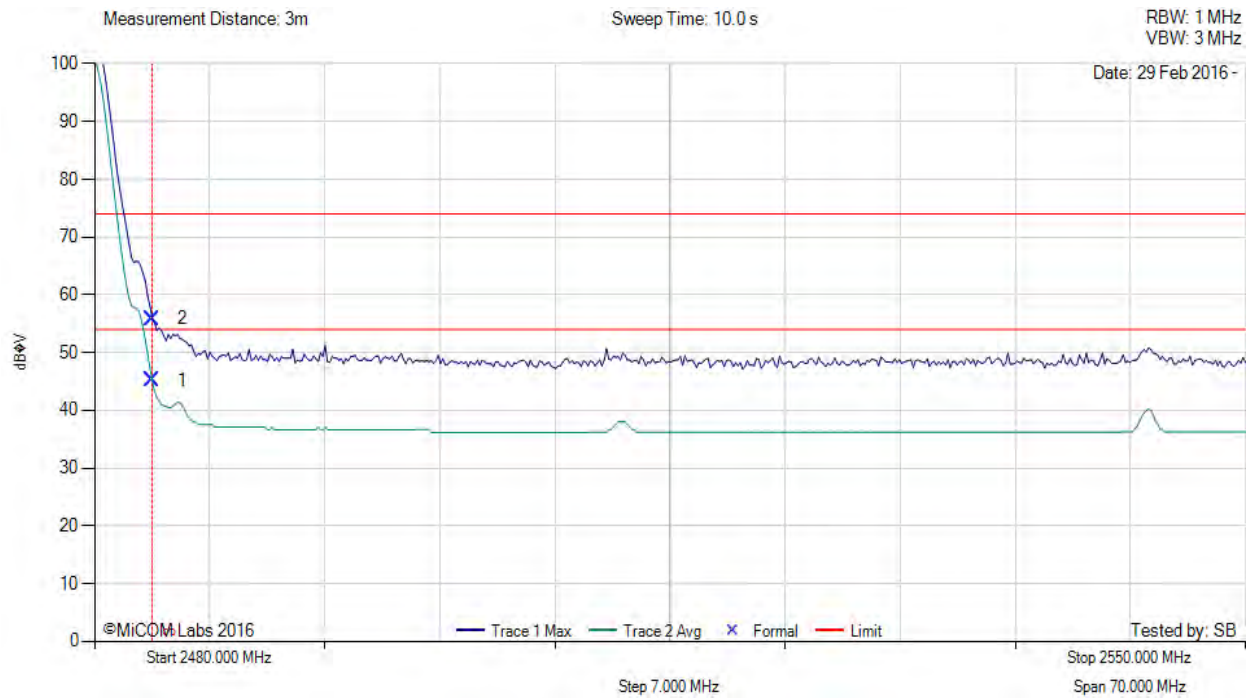
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# RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS



Variant: BLE, Test Freq: 2480.00 MHz, Antenna: APIN0335, Power Setting: 4, Duty Cycle (%): 99



| Num | Frequency MHz | Raw dBμV | Cable Loss | AF dB | Level dBμV/m | Measurement Type | Pol        | Hgt cm | Azt Deg | Limit dBμV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|------------|-------|--------------|------------------|------------|--------|---------|--------------|-----------|------------|
| 1   | 2483.50       | 10.06    | 2.73       | 32.37 | 45.16        | Max Avg          | Horizontal | 159    | 17      | 54.0         | -8.8      | Pass       |
| 2   | 2483.50       | 20.79    | 2.73       | 32.37 | 55.89        | Max Peak         | Horizontal | 159    | 17      | 74.0         | -18.1     | Pass       |
| 3   | 2483.50       | --       | --         | --    | --           | Band-Edge        | --         | --     | --      | --           | --        | --         |

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