

Company: Hewlett Packard Enterprise

Test of: APINH303  
To: FCC CFR 47 Part 15.247 (DTS) & IC RSS-247

Report No.: HWP85-U2 Rev A Bluetooth BLE



# TEST REPORT

FROM



Test of: Hewlett Packard Enterprise APINH303  
to

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

Test Report Serial No.: HWPD85-U2 Rev A Bluetooth BLE

This report supersedes: NONE

Applicant: Hewlett Packard Enterprise  
3000 Hanover St.  
Palo Alto, California 94034  
USA

Product Function: 802.11 a/b/g/n/ac Wireless Access  
Point & BLE

Issue Date: 1st December 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**



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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>



### Accredited Laboratory

A2LA has accredited

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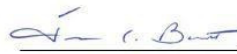
for technical competence in the field of

**Electrical Testing**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 4<sup>th</sup> day of February 2016.



Senior Director of Quality & Communications  
For the Accreditation Council  
Certificate Number 2381.01  
Valid to November 30, 2017

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

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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

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### 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>



## Accredited Product Certification Body

A2LA has accredited

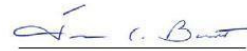
**MICOM LABS**

Pleasanton, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Requirements for bodies certifying products, processes and services*. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.



Presented this 4<sup>th</sup> day of February 2016.



Senior Director of Quality & Communications  
For the Accreditation Council  
Certificate Number 2381.02  
Valid to November 30, 2017

*For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.*

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

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## 2. DOCUMENT HISTORY

| Report History |                               |                  |
|----------------|-------------------------------|------------------|
| Revision       | Date                          | Comments         |
| Draft          |                               |                  |
| Rev A          | 1 <sup>st</sup> December 2016 | Initial release. |
|                |                               |                  |
|                |                               |                  |
|                |                               |                  |
|                |                               |                  |
|                |                               |                  |

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### 3. TEST RESULT CERTIFICATE

|  |   |
|--|---|
| <b>Manufacturer:</b> Hewlett Packard Enterprise<br>3000 Hanover St.<br>Palo Alto<br>California 94034 USA | <b>Tested By:</b> MiCOM Labs, Inc.<br>575 Boulder Court<br>Pleasanton<br>California 94566 USA |
| <b>Model:</b> APINH303   | <b>Telephone:</b> +1 925 462 0304<br><b>Fax:</b> +1 925 462 0306                              |
| <b>Type Of Equipment:</b> 802.11a/b/g/n/ac Wireless Access<br>Point & BLE                                |   |
| <b>S/N's:</b> CNC7K2R00X   |   |
| <b>Test Date(s):</b> 31 <sup>st</sup> October – 4 <sup>th</sup> November 2016                            | <b>Website:</b> www.micomlabs.com   |

| STANDARD(S)                               | TEST RESULTS       |
|---|--------------------|
| FCC CFR 47 Part 15.247 (DTS) & IC RSS-247 | 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.

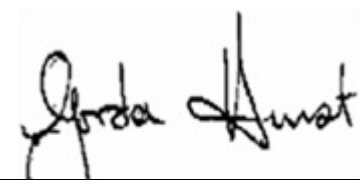
**Notes:**

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 D01 & D02   | 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  | 8th April 2016     | Guidance for performing compliance measurements on Digital Transmission Systems (DTS) operating under section 15.247.   |
| III  | A2LA                   | June 2015          | 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 2016   | 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 Hewlett Packard Enterprise APINH303 to FCC CFR 47 Part 15 Subpart C 15.247 (DTS) & IC RSS-247 |
| Applicant:                       | Hewlett Packard Enterprise<br>3000 Hanover St., Palo Alto California 94034 USA                            |
| Manufacturer:                    | As Applicant  |
| Laboratory performing the tests: | MiCOM Labs, Inc.<br>575 Boulder Court, Pleasanton California 94566 USA                                    |
| Test report reference number:    | HWP85-U2 Rev A  |
| Date EUT received:               | 31st October 2016   |
| Standard(s) applied:             | FCC CFR 47 Part 15.247 (DTS) & IC RSS-247   |
| Dates of test (from - to):       | 31st October – 4th November 2016  |
| No of Units Tested:              | 2   |
| Type of Equipment:               | 802.11 a/b/g/n/ac & BLE Wireless Access Point   |
| Product Family Name:             | Access Point  |
| Model(s):                        | APINH303  |
| Location for use:                | Indoor  |
| Declared Frequency Range(s):     | 2400 - 2483.5 MHz;  |
| Primary function of equipment:   | Transmission of voice and/ or data  |
| Secondary function of equipment: | None Provided   |
| Type of Modulation:              | GFSK  |
| EUT Modes of Operation:          | GFSK  |
| Transmit/Receive Operation:      | Transceiver - Full Duplex   |
| Rated Input Voltage and Current: | AC/ DC adaptor (adaptor NOT sold with unit) 48Vdc   |
| Operating Temperature Range:     | Declared Range 0°C to 40°C  |
| ITU Emission Designator:         | BLE: 1M1G1D   |
| Equipment Dimensions:            | 150mm x 86mm X 38mm   |
| Weight:                          | 0.26kg (0.6 lbs)  |
| Hardware Rev:                    | P2-2  |
| Software Image:                  | ipq40xxqdart.ari.abeaudin-rd-sw-inst2-wip (Time Stamp 11/03/16 14:08)                                     |
| Firmware                         | Smart RF Studio 7 2.2.1 (firmware Rev. 0025)  |

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

### **Hewlett Packard Enterprise APINH303**

The scope of the test program was to test the Hewlett Packard Enterprise APINH303 Bluetooth BLE configurations in the frequency ranges 2400 - 2483.5 MHz; for compliance against the following specifications:

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

Radio Frequency Devices; Subpart C – Intentional Radiators

#### **Industry Canada RSS-247 Issue 1**

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

### **Hewlett Packard Enterprise APINH303 EUT\_MAIN\_PICTURE**



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

| Type    | Description                                   | Manufacturer                  | Model    | Serial no. | Delivery Date                 |
|---------|---|-------------------------------|----------|------------|-------------------------------|
| EUT     | 802.11 a/b/g/n/ac/ac<br>Wireless Access Point | Hewlett Packard<br>Enterprise | APINH303 | CNC7K2R00X | 31 <sup>st</sup> October 2016 |
| Support | Laptop PC                                     | DELL                          | E7450    | None       | N/A                           |

### 5.4. Antenna Details

| Type     | Manufacturer | Model          | Family | Gain<br>(dBi) | BF Gain | Dir BW | X-Pol | Frequency<br>Band (MHz) |
|----------|--------------|----------------|--------|---------------|---------|--------|-------|-------------------------|
| integral | Aruba        | Metal<br>sheet | PCB    | 3.2           | 3.0     | 360    | -     | 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<br>Length | # Of Ports | Screened | Conn Type | Data Type   |
|-----------|---------------------|------------|----------|-----------|-------------|
| Ethernet  | 100                 | 3          | N        | RJ45      | Packet Data |

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## 5.6. Test Configurations

Results for the following configurations are provided in this report:

| Operational Mode(s) (GFSK) | Data Rate with Highest Power MBit/s | Channel Frequency (MHz) |         |         |
|----------------------------|-------------------------------------|-------------------------|---------|---------|
|                            |                                     | Low                     | Mid     | High    |
| 2400 - 2483.5 MHz          |                                     |                         |         |         |
| GFSK                       | 1.00                                | 2402.00                 | 2440.00 | 2480.00 |

## 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                 |
|---|----------------------|---------------------------|
| Conducted Results                           |                      |                           |
| 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                         |                      |                           |
| (1) Conducted Emissions                     |                      |                           |
| (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> |
| Radiated Emissions                          |                      |                           |
| (i) 15.205 Restricted Band Emissions        | Complies             | <a href="#">View Data</a> |
| (ii) 15.205 Restricted Band-Edge Emissions  | Complies             | <a href="#">View Data</a> |
| Digital Emissions                           | See Report HWPD85-G4 |                           |
| (3) 15.209 Digital Emissions (0.03 - 1 GHz) | Complies             |                           |
| AC Wireline                                 | See Report HWPD85-G4 |                           |
| 15.207 AC Wireline Emissions                | Complies             |                           |

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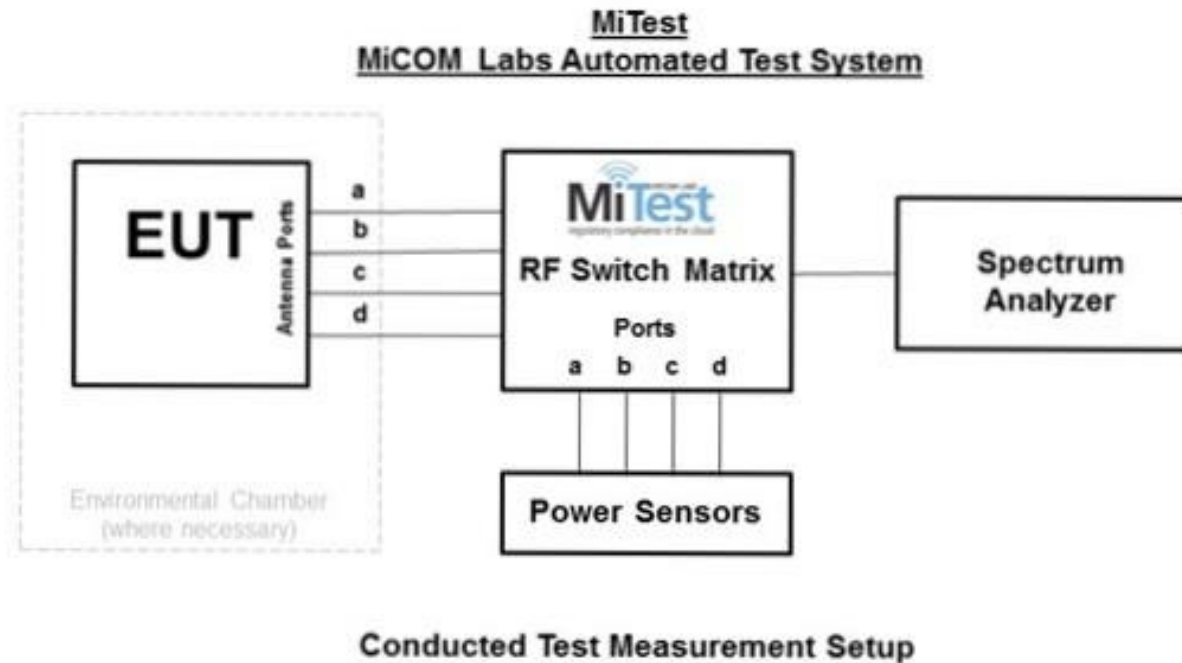
## **7. TEST EQUIPMENT CONFIGURATION(S)**

### **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. Peak Output Power
3. Power Spectral Density- Peak
4. Conducted Low Band-Edge Emission - Peak
5. Conducted Spurious Emissions - Peak
6. Conducted High Band-Edge Emission - Peak



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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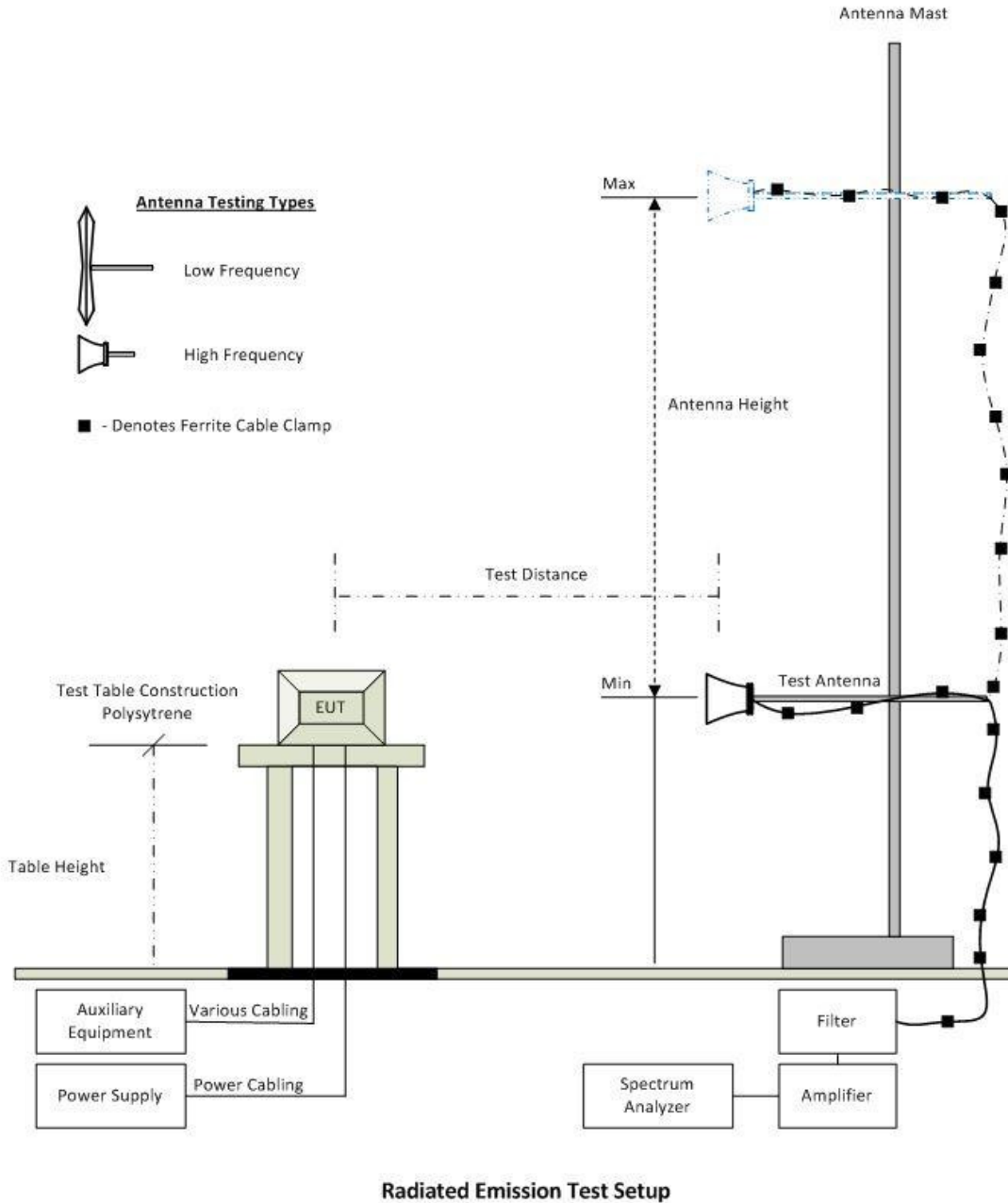
| Asset#      | Description                                    | Manufacturer         | Model#               | Serial#       | Calibration Due Date |
|-------------|--|----------------------|----------------------|---------------|----------------------|
| 127         | Power Supply                                   | HP                   | 6674A                | US36370530    | Cal when used        |
| 158         | Barometer/Thermometer                          | Control Company      | 4196                 | E2846         | 01 Dec 2016          |
| 248         | Resistance Thermometer                         | Thermotronics        | GR2105-02            | 9340 #1       | 21 Oct 2017          |
| 287         | Rohde & Schwarz 40 GHz Receiver                | Rhode & Schwarz      | ESIB40               | 100201        | 02 May 2017          |
| 376         | USB 10MHz - 18GHz Average Power Sensor         | Agilent              | U2000A               | MY51440005    | 23 Oct 2017          |
| 378         | Rohde & Schwarz 40 GHz Receiver with Generator | Rhode & Schwarz      | ESIB40               | 100107/040    | 04 Aug 2017          |
| 381         | 4x4 RF Switch Box                              | MiCOM Labs           | MiTest RF Switch Box | MIC002        | 18 Nov 2016          |
| 419         | Laptop with Labview Software                   | Lenova               | W520                 | TS02          | Not Required         |
| 420         | USB to GPIB Interface                          | National Instruments | GPIB-USB HS          | 1346738       | Not Required         |
| 440         | USB Wideband Power Sensor                      | Boonton              | 55006                | 9178          | 25 Dec 2016          |
| 442         | USB Wideband Power Sensor                      | Boonton              | 55006                | 9181          | 06 Oct 2017          |
| 445         | PoE Injector                                   | D-Link               | DPE-101GL            | QTAH1E2000625 | Not Required         |
| 460         | Dell Computer                                  | Dell                 | Optiplex330          | BC944G1       | Not Required         |
| 461         | Spectrum Analyzer                              | Agilent              | E4440A               | MY46185537    | 13 Aug 2017          |
| 493         | USB Wideband Power Sensor                      | Boonton              | 55006                | 9634          | 10 Mar 2017          |
| 494         | USB Wideband Power Sensor                      | Boonton              | 55006                | 9726          | 10 Mar 2017          |
| 74          | Environmental Chamber Chamber 3                | Tenney               | TTC                  | 12808-1       | 29 Sep 2017          |
| RF#2 GPIB#1 | GPIB cable to Power Supply                     | HP                   | GPIB                 | None          | Not Required         |
| RF#2 SMA#1  | EUT to Mitest box port 1                       | Flexco               | SMA Cable port1      | None          | 18 Nov 2016          |
| RF#2 SMA#2  | EUT to Mitest box port 2                       | Flexco               | SMA Cable port2      | None          | 18 Nov 2016          |
| RF#2 SMA#3  | EUT to Mitest box port 3                       | Flexco               | SMA Cable port3      | None          | 18 Nov 2016          |
| RF#2 SMA#4  | EUT to Mitest box port 4                       | Flexco               | SMA Cable port4      | None          | 18 Nov 2016          |
| RF#2 SMA#SA | Mitest box to SA                               | Flexco               | SMA Cable SA         | None          | 18 Nov 2016          |
| RF#2 USB#1  | USB Cable to Mitest Box                        | Dynex                | USB Cable            | None          | Not Required         |

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## 7.2. Radiated Emissions - 3m Chamber

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

Radiated emissions below 1GHz.  
 Radiated Emissions above 1GHz.



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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.

| Asset# | Description                                       | Manufacturer    | Model#              | Serial#    | Calibration Due Date |
|--------|---|-----------------|---------------------|------------|----------------------|
| 158    | Barometer/Thermometer                             | Control Company | 4196                | E2846      | 01 Dec 2016          |
| 170    | Video System Controller for Semi Anechoic Chamber | Panasonic       | WV-CU101            | 04R08507   | Not Required         |
| 287    | Rohde & Schwarz 40 GHz Receiver                   | Rhode & Schwarz | ESIB40              | 100201     | 02 May 2017          |
| 301    | 5470 to 5725 MHz Notch Filter                     | Microtronics    | RBC50704            | 001        | 16 Aug 2017          |
| 302    | 5150 to 5350 MHz Notch Filter                     | Microtronics    | BRC50703            | 002        | 16 Aug 2017          |
| 303    | 5725 to 5875 MHz Notch filter                     | Microtronics    | BRC50705            | 003        | 16 Aug 2017          |
| 330    | Variac 0-280 Vac                                  | Staco Energy Co | 3PN1020B            | 0546       | Cal when used        |
| 336    | Active loop Ant 10kHz to 30 MHz                   | EMCO            | EMCO 6502           | 00060498   | 26 Sep 2017          |
| 338    | Sunol 30 to 3000 MHz Antenna                      | Sunol           | JB3                 | A052907    | 15 Aug 2017          |
| 341    | 900MHz Notch Filter                               | EWT             | EWT-14-0199         | H1         | 16 Aug 2017          |
| 342    | 2.4 GHz Notch Filter                              | EWT             | EWT-14-0203         | H1         | 16 Aug 2017          |
| 343    | 5.15 GHz Notch Filter                             | EWT             | EWT-14-0200         | H1         | 16 Aug 2017          |
| 344    | 5.35 GHz Notch Filter                             | EWT             | EWT-14-0201         | H1         | 16 Aug 2017          |
| 345    | 5.46 GHz Notch Filter                             | EWT             | EWT-14-0202         | H1         | 16 Aug 2017          |
| 346    | 1.6 TO 10GHz High Pass Filter                     | EWT             | EWT-57-0112         | H1         | 16 Aug 2017          |
| 373    | 26III RMS Multimeter                              | Fluke           | Fluke 26 series III | 76080720   | 26 Oct 2017          |
| 377    | Band Rejection Filter 5150 to 5880MHz             | Microtronics    | BRM50716            | 034        | 16 Aug 2017          |
| 378    | Rohde & Schwarz 40 GHz Receiver with Generator    | Rhode & Schwarz | ESIB40              | 100107/040 | 04 Aug 2017          |
| 393    | DC - 1050 MHz Low Pass Filter                     | Microcircuits   | VLFX-1050           | N/A        | 16 Aug 2017          |
| 396    | 2.4 GHz Notch Filter                              | Microtronics    | BRM50701            | 001        | 16 Aug 2017          |
| 397    | Amp 10 - 2500MHz                                  | MiCOM Labs      | Amp 10 - 2500 MHz   | NA         | 09 Jun 2017          |
| 399    | ETS 1-18 GHz Horn Antenna                         | ETS             | 3117                | 00154575   | 10 Jan 2017          |
| 406    | Amplifier for Radiated Emissions                  | MiCOM Labs      | 40dB 1 to 18GHz Amp | 0406       | 09 Jun 2017          |
| 410    | Desktop Computer                                  | Dell            | Inspiron 620        | WS38       | Not Required         |

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|          |   |                      |   |                    |               |
|----------|---|----------------------|---|--------------------|---------------|
| 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  |
| 414      | DC Power Supply 0-60V                         | HP                   | 6274  | 1029A01285         | Cal when used |
| 415      | Turntable Controller                          | Sunol Sciences       | Turntable Controller                        | None               | Not Required  |
| 416      | Gigabit ethernet filter                       | ETS-Lingren          | Gigafoil 260366                             | None               | Not Required  |
| 447      | Rad Emissions Test Software                   | MiCOM                | Rad Emissions Test Software Version 1.0.109 | 447                | Not Required  |
| 462      | Schwarzbeck cable from Antenna to Amplifier.  | Schwarzbeck          | AK 9513                                     | 462                | 31 May 2017   |
| 463      | Schwarzbeck cable from Amplifier to Bulkhead. | Schwarzbeck          | AK 9513                                     | 463                | 31 May 2017   |
| 464      | Schwarzbeck cable from Bulkhead to Receiver   | Schwarzbeck          | AK 9513                                     | 464                | 31 May 2017   |
| 465      | Low Pass Filter DC-1000 MHz                   | Mini-Circuits        | NLP-1200+                                   | VUU01901402        | 02 Jun 2017   |
| 466      | Low Pass Filter DC-1500 MHz                   | Mini-Circuits        | NLP-1750+                                   | VUU10401438        | 02 Jun 2017   |
| 467      | 2495 to 2650 MHz notch filter                 | MicroTronics         | BRM50709                                    | 011                | 16 Aug 2017   |
| 468      | Low pass filter                               | Mini Circuits        | SLP-550                                     | None               | 16 Aug 2017   |
| 469      | Low pass filter                               | Mini Circuit         | SLP-1000                                    | None               | 16 Aug 2017   |
| 470      | High Pass filter                              | Mini Circuits        | SHP-700                                     | None               | 16 Aug 2017   |
| 476      | Low Pass dc-2200MHz filter                    | Mini Circuits        | 15542 NLP-2400+                             | VUU13801345        | 16 Aug 2017   |
| 480      | Cable - Bulkhead to Amp                       | SRC Haverhill        | 157-157-3050360                             | 480                | 02 Jun 2017   |
| 481      | Cable - Bulkhead to Receiver                  | SRC Haverhill        | 151-151-3050787                             | 481                | 02 Jun 2017   |
| 482      | Cable - Amp to Antenna                        | SRC Haverhill        | 157-157-3051574                             | 482                | 02 Jun 2017   |
| 502      | Test Software for Radiated Emissions          | EMISoft              | Vasona                                      | Version 5 Build 59 | Not Required  |
| 87       | Uninterruptible Power Supply                  | Falcon Electric      | ED2000-1/2LC                                | F3471 02/01        | Cal when used |
| VLF-1700 | Low pass filter DC-1700 MHz                   | Mini Circuits        | VLF-1700                                    | None               | 31 May 2017   |

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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.



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 |                          |                            |             |
|--|--------------------------|----------------------------|-------------|
| <b>Standard:</b>                                     | FCC CFR 47:15.247        | <b>Ambient Temp. (°C):</b> | 24.0 - 27.5 |
| <b>Test Heading:</b>                                 | 6 dB and 99 % Bandwidth  | <b>Rel. Humidity (%):</b>  | 32 - 45     |
| <b>Standard Section(s):</b>                          | 15.247 (a)(2)            | <b>Pressure (mBars):</b>   | 999 - 1001  |
| <b>Reference Document(s):</b>                        | See Normative References |                            |             |

Test Procedure for 6 dB and 99% Bandwidth Measurement  
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.

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.

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

**Limits for 6 dB and 99% Bandwidth**

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(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.

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

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | GFSK           | <b>Duty Cycle (%):</b>            | 99             |
| <b>Data Rate:</b>              | 1.00 MBit/s    | <b>Antenna Gain (dBi):</b>        | Not Applicable |
| <b>Modulation:</b>             | GFSK           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> | None           |                                   |                |

**Test Measurement Results**

| Test Frequency | Measured 6 dB Bandwidth (MHz) |    |    |    | 6 dB Bandwidth (MHz) |        | Limit  | Lowest Margin |
|----------------|-------------------------------|----|----|----|----------------------|--------|--------|---------------|
|                | Port(s)                       |    |    |    | Highest              | Lowest |        |               |
| MHz            | a                             | b  | c  | d  |                      |        | KHz    | MHz           |
| 2402.0         | <a href="#">0.709</a>         | -- | -- | -- | 0.709                | 0.709  | ≥500.0 | -0.21         |
| 2440.0         | <a href="#">0.709</a>         | -- | -- | -- | 0.709                | 0.709  | ≥500.0 | -0.21         |
| 2480.0         | <a href="#">0.709</a>         | -- | -- | -- | 0.709                | 0.709  | ≥500.0 | -0.21         |

| Test Frequency | Measured 99% Bandwidth (MHz) |    |    |    | Maximum 99% Bandwidth (MHz) |  |  |
|----------------|------------------------------|----|----|----|-----------------------------|--|--|
|                | Port(s)                      |    |    |    |                             |  |  |
| MHz            | a                            | b  | c  | d  |                             |  |  |
| 2402.0         | <a href="#">1.074</a>        | -- | -- | -- | 1.074                       |  |  |
| 2440.0         | <a href="#">1.078</a>        | -- | -- | -- | 1.078                       |  |  |
| 2480.0         | <a href="#">1.078</a>        | -- | -- | -- | 1.078                       |  |  |

**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 |                          |                            |             |
|---|--------------------------|----------------------------|-------------|
| <b>Standard:</b>  | FCC CFR 47:15.247        | <b>Ambient Temp. (°C):</b> | 24.0 - 27.5 |
| <b>Test Heading:</b>  | Output Power             | <b>Rel. Humidity (%):</b>  | 32 - 45     |
| <b>Standard Section(s):</b>                                     | 15.247 (b) & (c)         | <b>Pressure (mBars):</b>   | 999 - 1001  |
| <b>Reference Document(s):</b>                                   | 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 [ $10 \cdot \text{Log}_{10} (10^{a/10} + 10^{b/10} + 10^{c/10} + 10^{d/10})$ ]  
 $G$  = 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>                | GFSK           | <b>Duty Cycle (%):</b>            | 99.0           |
| <b>Data Rate:</b>              | 1.00 MBit/s    | <b>Antenna Gain (dBi):</b>        | 3.2            |
| <b>Modulation:</b>             | GFSK           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> | None           |                                   |                |

**Test Measurement Results**

| Test Frequency | Measured Output Power (dBm) |    |    |    | Calculated Total Power $\Sigma$ Port(s) | Limit | Margin | EUT Power Setting |
|----------------|-----------------------------|----|----|----|---|-------|--------|-------------------|
|                | Port(s)                     |    |    |    |   |       |        |                   |
| MHz            | a                           | b  | c  | d  | dBm                                     | dBm   | dB     |                   |
| 2402.0         | 0.91                        | -- | -- | -- | 0.91                                    | 30.00 | -29.09 | 4.00              |
| 2440.0         | 0.92                        | -- | -- | -- | 0.92                                    | 30.00 | -29.08 | 4.00              |
| 2480.0         | 0.93                        | -- | -- | -- | 0.93                                    | 30.00 | -29.07 | 4.00              |

**Traceability to Industry Recognized Test Methodologies**

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

The above measurements are true pulse readings and therefore a Duty Cycling correction factor is not required.

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### 9.3 Conducted Spurious Emissions

#### 9.3.1 Conducted Emissions

| Conducted Test Conditions for Transmitter Conducted Spurious and Band-Edge Emissions |                              |                            |             |
|--|------------------------------|----------------------------|-------------|
| <b>Standard:</b>   | FCC CFR 47:15.247            | <b>Ambient Temp. (°C):</b> | 24.0 - 27.5 |
| <b>Test Heading:</b>   | Max Unwanted Emission Levels | <b>Rel. Humidity (%):</b>  | 32 - 45     |
| <b>Standard Section(s):</b>  | 15.247 (d)                   | <b>Pressure (mBars):</b>   | 999 - 1001  |
| <b>Reference Document(s):</b>  | 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>                | GFSK           | <b>Duty Cycle (%):</b>        | 99             |
| <b>Data Rate:</b>              | 1.00 MBit/s    | <b>Antenna Gain (dBi):</b>    | 3.2            |
| <b>Modulation:</b>             | GFSK           | <b>Beam Forming Gain (Y):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>             | CC             |
| <b>Engineering Test Notes:</b> | None           |                               |                |

**Test Measurement Results**

| Test Frequency         | Frequency Range | Transmitter Conducted Spurious Emissions (dBm) |        |        |       |        |       |        |       |
|------------------------|-----------------|--|--------|--------|-------|--------|-------|--------|-------|
|                        |                 | Port a   |        | Port b |       | Port c |       | Port d |       |
| MHz                    | MHz             | SE   | Limit  | SE     | Limit | SE     | Limit | SE     | Limit |
| <a href="#">2402.0</a> | 30.0 - 26000.0  | <a href="#">-40.504</a>                        | -20.00 | --     | --    | --     | --    | --     | --    |
| <a href="#">2440.0</a> | 30.0 - 26000.0  | <a href="#">-40.618</a>                        | -20.00 | --     | --    | --     | --    | --     | --    |
| <a href="#">2480.0</a> | 330.0 - 26000.0 | <a href="#">-41.206</a>                        | -22.00 | --     | --    | --     | --    | --     | --    |

**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

Low Band-Edge Emissions

|   |
|---|
| <b>Equipment Configuration for Conducted Low Band-Edge Emissions - Peak</b> |
|---|

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | GFSK           | <b>Duty Cycle (%):</b>            | 99.0           |
| <b>Data Rate:</b>              | 1.00 MBit/s    | <b>Antenna Gain (dBi):</b>        | 3.2            |
| <b>Modulation:</b>             | GFSK           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> | None           |                                   |                |

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

| <b>Channel Frequency:</b>    | 2402.0 MHz                  |                  |                    |                 |                     |        |
|------------------------------|-----------------------------|------------------|--------------------|-----------------|---------------------|--------|
| <b>Band-Edge Frequency:</b>  | 2400.0 MHz                  |                  |                    |                 |                     |        |
| <b>Test Frequency Range:</b> | 2350.0 - 2405.0 MHz         |                  |                    |                 |                     |        |
| Port(s)                      | Band-Edge Markers and Limit |                  |                    | Revised Limit   |                     | Margin |
|                              | M1 Amplitude (dBm)          | Plot Limit (dBm) | M2 Frequency (MHz) | Amplitude (dBm) | M2A Frequency (MHz) | (MHz)  |
| a                            | <a href="#">-39.98</a>      | -19.00           | 2401.40            | --              | --                  | -1.400 |

| Traceability to Industry Recognized Test Methodologies |   |
|--|---|
| Work Instruction:                                      | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS |
| Measurement Uncertainty:                               | <=40 GHz ±2.37 dB, > 40 GHz ±4.6 dB     |

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

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High Band-Edge Emissions

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

|                                |                |                                   |                |
|--------------------------------|----------------|-----------------------------------|----------------|
| <b>Variant:</b>                | GFSK           | <b>Duty Cycle (%):</b>            | 99.0           |
| <b>Data Rate:</b>              | 1.00 MBit/s    | <b>Antenna Gain (dBi):</b>        | Not Applicable |
| <b>Modulation:</b>             | GFSK           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> | None           |                                   |                |

**Test Measurement Results**

|                              |                                    |                         |                           |                        |                            |               |
|------------------------------|------------------------------------|-------------------------|---------------------------|------------------------|----------------------------|---------------|
| <b>Channel Frequency:</b>    | 2480.0 MHz                         |                         |                           |                        |                            |               |
| <b>Band-Edge Frequency:</b>  | 2483.5 MHz                         |                         |                           |                        |                            |               |
| <b>Test Frequency Range:</b> | 2475.0 - 2524.0 MHz                |                         |                           |                        |                            |               |
| <b>Port(s)</b>               | <b>Band-Edge Markers and Limit</b> |                         |                           | <b>Revised Limit</b>   |                            | <b>Margin</b> |
|                              | <b>M3 Amplitude (dBm)</b>          | <b>Plot Limit (dBm)</b> | <b>M2 Frequency (MHz)</b> | <b>Amplitude (dBm)</b> | <b>M2A Frequency (MHz)</b> | <b>(MHz)</b>  |
| <b>a</b>                     | <a href="#">-46.65</a>             | -20.00                  | 2480.60                   | --                     | --                         | -2.900        |

|   |   |
|---|---|
| <b>Traceability to Industry Recognized Test Methodologies</b> |   |
| Work Instruction:   | WI-05 MEASUREMENT OF SPURIOUS EMISSIONS |
| Measurement Uncertainty:                                      | <=40 GHz ±2.37 dB, > 40 GHz ±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 |                          |                            |             |
|--|--------------------------|----------------------------|-------------|
| <b>Standard:</b>                                     | FCC CFR 47:15.247        | <b>Ambient Temp. (°C):</b> | 24.0 - 27.5 |
| <b>Test Heading:</b>                                 | Power Spectral Density   | <b>Rel. Humidity (%):</b>  | 32 - 45     |
| <b>Standard Section(s):</b>                          | 15.247 (e)               | <b>Pressure (mBars):</b>   | 999 - 1001  |
| <b>Reference Document(s):</b>                        | 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 ( $\hat{a}$ ) 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 [ $10 \log_{10} (10^{a/10} + 10^{b/10} + 10^{c/10} + 10^{d/10})$ ]

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>                | GFSK           | <b>Duty Cycle (%):</b>            | 99.0           |
| <b>Data Rate:</b>              | 1.00 MBit/s    | <b>Antenna Gain (dBi):</b>        | 3.2            |
| <b>Modulation:</b>             | GFSK           | <b>Beam Forming Gain (Y)(dB):</b> | Not Applicable |
| <b>TPC:</b>                    | Not Applicable | <b>Tested By:</b>                 | CC             |
| <b>Engineering Test Notes:</b> | None           |                                   |                |

**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="#">-11.230</a>         | -- | -- | -- | <a href="#">-11.230</a> | 8.0      | -19.2  |
| 2440.0         | <a href="#">-12.802</a>         | -- | -- | -- | <a href="#">-12.802</a> | 8.0      | -20.8  |
| 2480.0         | <a href="#">-12.996</a>         | -- | -- | -- | <a href="#">-12.996</a> | 8.0      | -21.0  |

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

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(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 Emissions

#### Equipment Configuration for TX Spurious & Restricted Band Emissions

|                                 |                   |                        |             |
|---------------------------------|-------------------|------------------------|-------------|
| <b>Antenna:</b>                 | Aruba Metal sheet | <b>Variant:</b>        | GFSK        |
| <b>Antenna Gain (dBi):</b>      | 3.2               | <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>      | 1.00 MBit/s |
| <b>Power Setting:</b>           | 4                 | <b>Tested By:</b>      | JMH         |

#### Test Measurement Results

| 1000.00 - 18000.00 MHz |               |          |               |       |              |                  |          |        |         |              |           |            |
|------------------------|---------------|----------|---------------|-------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| Num                    | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
| #1                     | 7205.55       | 48.49    | 4.26          | -7.35 | 45.40        | Peak (NRB)       | Vertical | 101    | 1       | --           | --        | Pass       |

Test Notes: EUT on 150 cm table powered by host laptop via CC debugger.

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**Equipment Configuration for TX Spurious & Restricted Band Emissions**

|                                 |                   |                        |             |
|---------------------------------|-------------------|------------------------|-------------|
| <b>Antenna:</b>                 | Aruba Metal sheet | <b>Variant:</b>        | GFSK        |
| <b>Antenna Gain (dBi):</b>      | 3.2               | <b>Modulation:</b>     | GFSK        |
| <b>Beam Forming Gain (Y):</b>   | Not Applicable    | <b>Duty Cycle (%):</b> | 99          |
| <b>Channel Frequency (MHz):</b> | 2440.00           | <b>Data Rate:</b>      | 1.00 MBit/s |
| <b>Power Setting:</b>           | 4                 | <b>Tested By:</b>      | JMH         |

**Test Measurement Results**

**1000.00 - 18000.00 MHz**

| Num | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol        | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|---------------|-------|--------------|------------------|------------|--------|---------|--------------|-----------|------------|
| #1  | 7319.24       | 55.14    | 4.26          | -7.27 | 52.13        | Max Peak         | Horizontal | 134    | 0       | 74.0         | -21.9     | Pass       |
| #2  | 7319.24       | 44.75    | 4.26          | -7.27 | 41.74        | Max Avg          | Horizontal | 134    | 0       | 54.0         | -12.3     | Pass       |

Test Notes: EUT on 150 cm table powered by host laptop via CC debugger.

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**Equipment Configuration for TX Spurious & Restricted Band Emissions**

|                                 |                   |                        |             |
|---------------------------------|-------------------|------------------------|-------------|
| <b>Antenna:</b>                 | Aruba Metal sheet | <b>Variant:</b>        | GFSK        |
| <b>Antenna Gain (dBi):</b>      | 3.2               | <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>      | 1.00 MBit/s |
| <b>Power Setting:</b>           | 4                 | <b>Tested By:</b>      | JMH         |

**Test Measurement Results**

**1000.00 - 18000.00 MHz**

| Num | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|---------------|-------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| #1  | 7439.43       | 52.57    | 4.31          | -7.13 | 49.75        | Max Peak         | Vertical | 138    | 340     | 74.0         | -24.3     | Pass       |
| #2  | 7439.43       | 42.04    | 4.31          | -7.13 | 39.22        | Max Avg          | Vertical | 138    | 340     | 54.0         | -14.8     | Pass       |

Test Notes: EUT on 150 cm table powered by host laptop via CC debugger.

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### 9.5.2 Restricted Band-Edge Emissions

| Aruba Metal sheet |                           | Band-Edge Freq | Limit 74.0dB $\mu$ V/m | Limit 54.0dB $\mu$ V/m | Power Setting |
|-------------------|---------------------------|----------------|------------------------|------------------------|---------------|
| Operational Mode  | Operating Frequency (MHz) | MHz            | dB $\mu$ V/m           | dB $\mu$ V/m           |               |
| GFSK              | 2402.00                   | 2390.00        | 60.90                  | 46.16                  | 4             |
| GFSK              | 2480.00                   | 2483.50        | 61.35                  | 48.82                  | 4             |

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

|                                 |                   |                        |             |
|---------------------------------|-------------------|------------------------|-------------|
| <b>Antenna:</b>                 | Aruba Metal sheet | <b>Variant:</b>        | GFSK        |
| <b>Antenna Gain (dBi):</b>      | 3.2               | <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>      | 1.00 MBit/s |
| <b>Power Setting:</b>           | 4                 | <b>Tested By:</b>      | JMH         |

**Test Measurement Results**

**2310.00 - 2410.00 MHz**

| Num | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|---------------|-------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| #1  | 2382.16       | 26.24    | 2.69          | 31.97 | 60.90        | Max Peak         | Vertical | 156    | 30      | 74.0         | -13.1     | Pass       |
| #2  | 2390.00       | 11.43    | 2.69          | 32.04 | 46.16        | Max Avg          | Vertical | 156    | 30      | 54.0         | -7.8      | Pass       |
| #3  | 2390.00       | --       | --            | --    | --           | Restricted-Band  | --       | --     | --      | --           | --        | --         |

Test Notes: EUT on 150 cm table powered by host laptop via CC debugger.

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

|                                 |                   |                        |             |
|---------------------------------|-------------------|------------------------|-------------|
| <b>Antenna:</b>                 | Aruba Metal sheet | <b>Variant:</b>        | GFSK        |
| <b>Antenna Gain (dBi):</b>      | 3.2               | <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>      | 1.00 MBit/s |
| <b>Power Setting:</b>           | 4                 | <b>Tested By:</b>      | JMH         |

**Test Measurement Results**

**2472.00 - 2500.00 MHz**

| Num | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
|-----|---------------|----------|---------------|-------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| #1  | 2483.50       | 13.72    | 2.73          | 32.37 | 48.82        | Max Avg          | Vertical | 151    | 47      | 54.0         | -5.2      | Pass       |
| #2  | 2483.50       | 26.25    | 2.73          | 32.37 | 61.35        | Max Peak         | Vertical | 151    | 47      | 74.0         | -12.7     | Pass       |
| #3  | 2483.50       | --       | --            | --    | --           | Restricted-Band  | --       | --     | --      | --           | --        | --         |

Test Notes: EUT on 150 cm table powered by host laptop via CC debugger.

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**Title:** Hewlett Packard Enterprise APINH303  
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## **A. APPENDIX - GRAPHICAL IMAGES**

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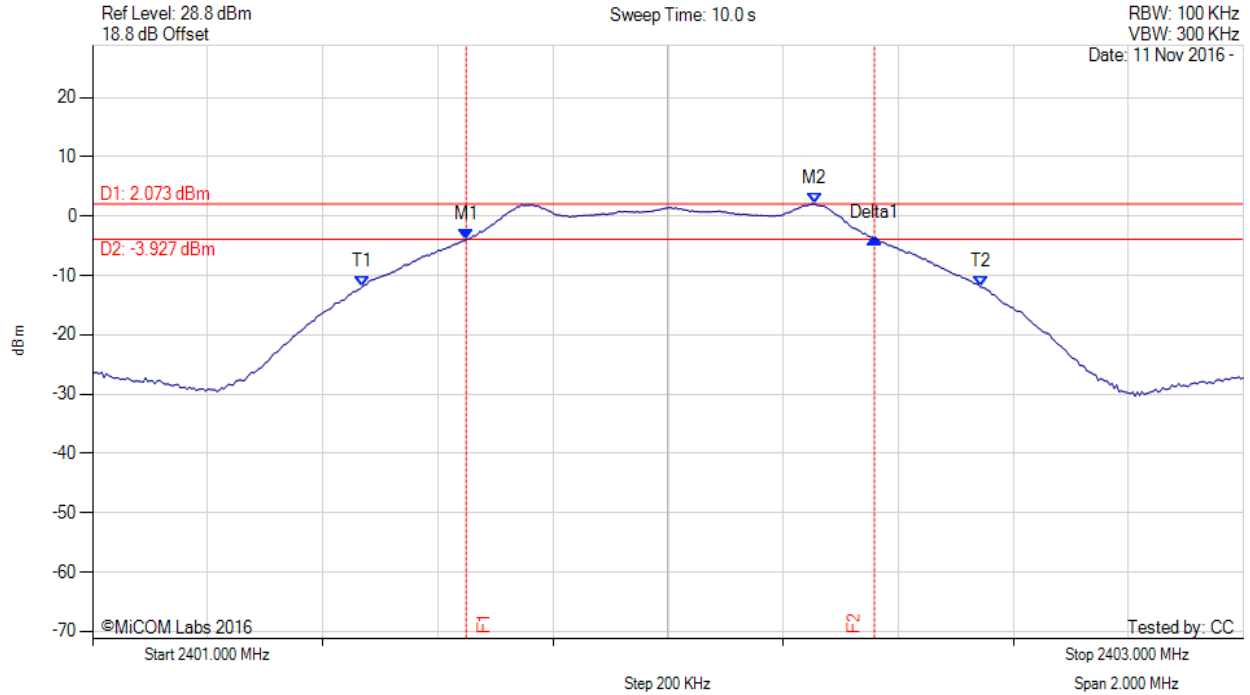


### A.1. 6 dB & 99% Bandwidth



#### 6 dB & 99% BANDWIDTH

Variation: GFSK, Channel: 2402.00 MHz, Chain a, Temp: 20, 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 : 2401.649 MHz : -3.964 dBm<br>M2 : 2402.255 MHz : 2.073 dBm<br>Delta1 : 709 KHz : 0.189 dB<br>T1 : 2401.469 MHz : -11.838 dBm<br>T2 : 2402.543 MHz : -11.944 dBm<br>OBW : 1.074 MHz | Measured 6 dB Bandwidth: 0.709 MHz<br>Limit: $\geq 500.0$ kHz<br>Margin: -0.21 MHz |

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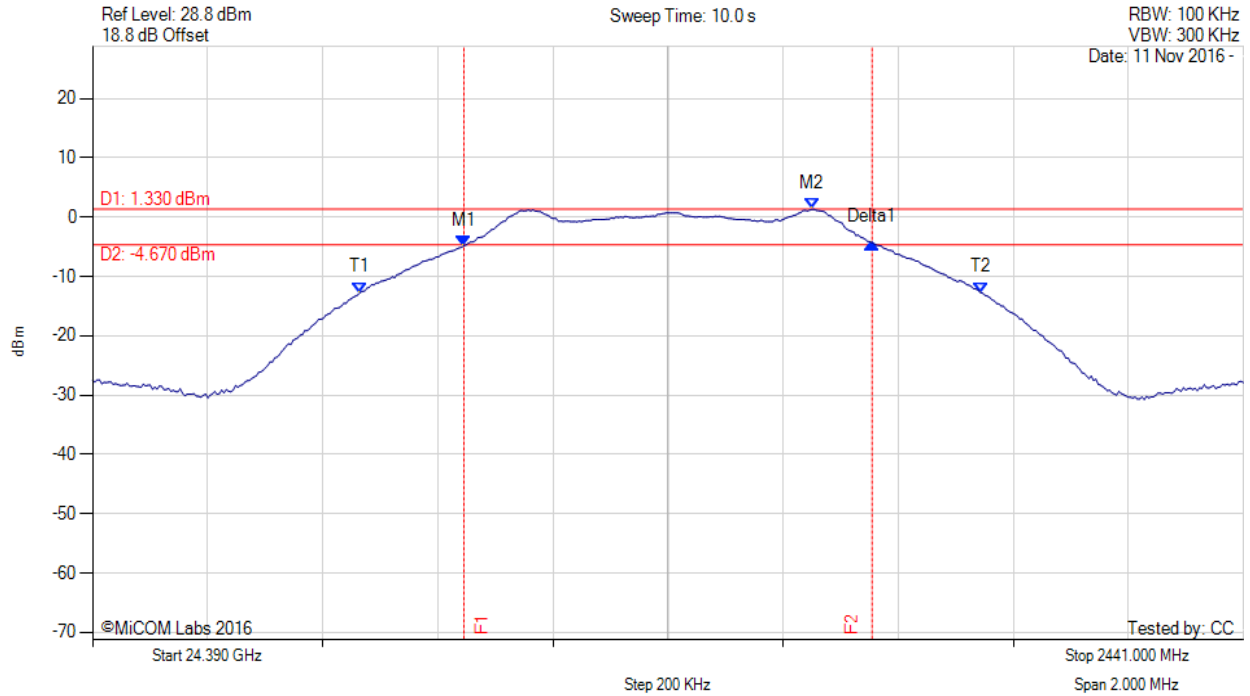


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6 dB & 99% BANDWIDTH

Variant: GFSK, Channel: 2440.00 MHz, Chain a, Temp: 20, 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 : 2439.645 MHz : -4.861 dBm<br>M2 : 2440.251 MHz : 1.330 dBm<br>Delta1 : 709 KHz : 0.565 dB<br>T1 : 2439.465 MHz : -12.703 dBm<br>T2 : 2440.543 MHz : -12.719 dBm<br>OBW : 1.078 MHz | Measured 6 dB Bandwidth: 0.709 MHz<br>Limit: ≥500.0 kHz<br>Margin: -0.21 MHz |

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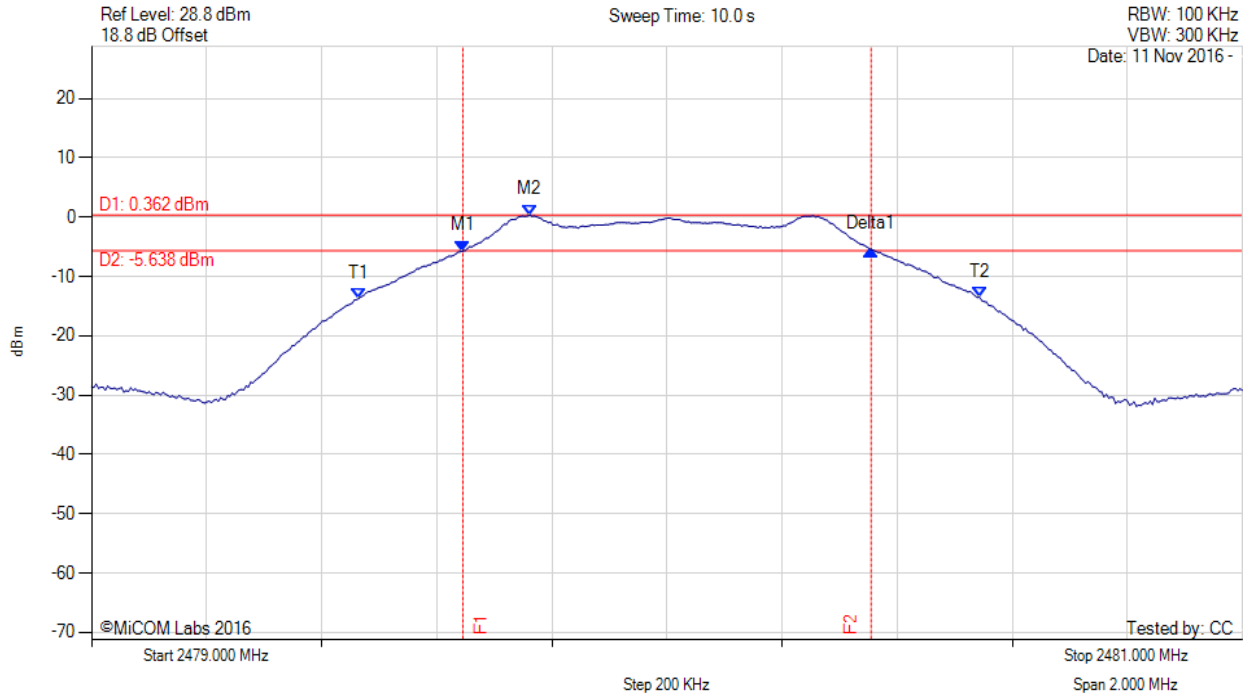


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6 dB & 99% BANDWIDTH

Variant: GFSK, Channel: 2480.00 MHz, Chain a, Temp: 20, 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 : 2479.645 MHz : -5.690 dBm<br>M2 : 2479.762 MHz : 0.362 dBm<br>Delta1 : 709 KHz : 0.212 dB<br>T1 : 2479.465 MHz : -13.669 dBm<br>T2 : 2480.543 MHz : -13.488 dBm<br>OBW : 1.078 MHz | Measured 6 dB Bandwidth: 0.709 MHz<br>Limit: ≥500.0 kHz<br>Margin: -0.21 MHz |

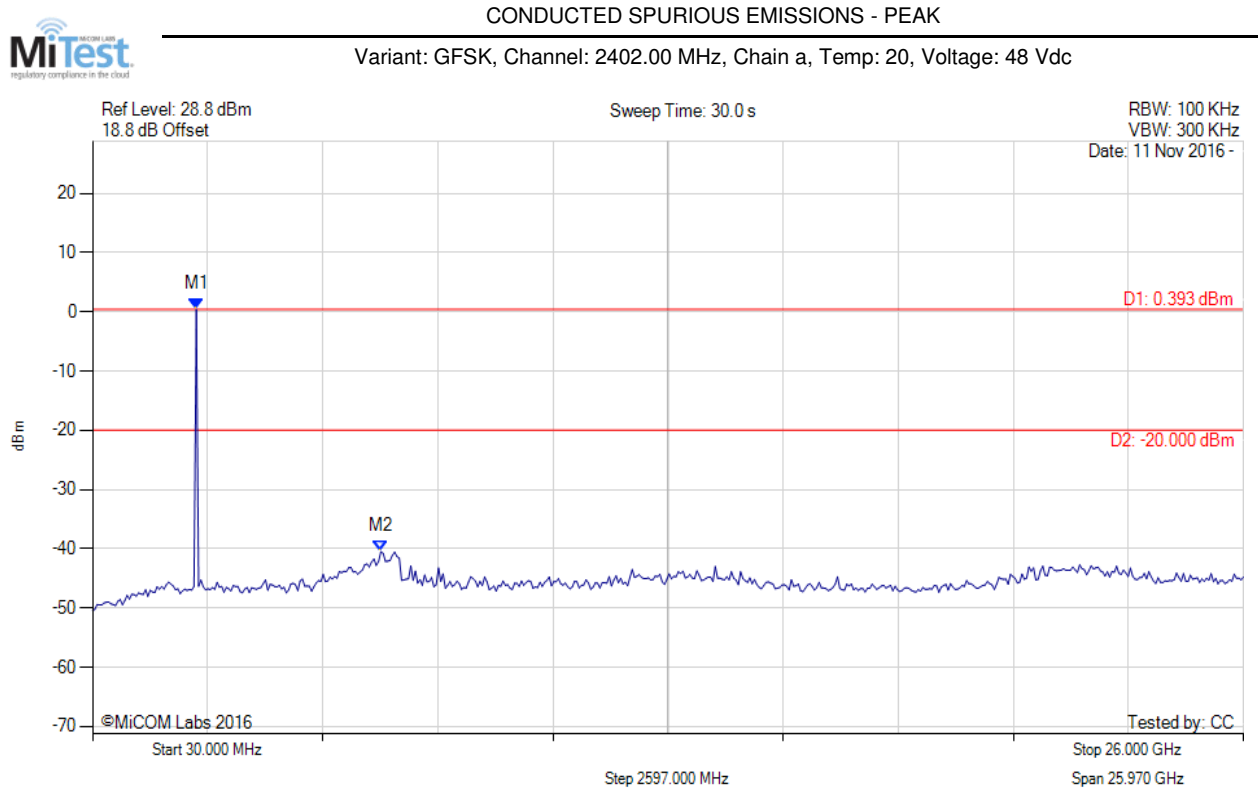
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## A.2. Conducted Emissions

### A.2.1 Conducted Spurious Emissions



| Analyzer Setup  | Marker:Frequency:Amplitude                                       | Test Results                           |
|---|--|--|
| Detector = MAX PEAK<br>Sweep Count = 0<br>RF Atten (dB) = 20<br>Trace Mode = VIEW | M1 : 2371.984 MHz : 0.393 dBm<br>M2 : 6535.511 MHz : -40.504 dBm | Limit: -20.00 dBm<br>Margin: -20.50 dB |

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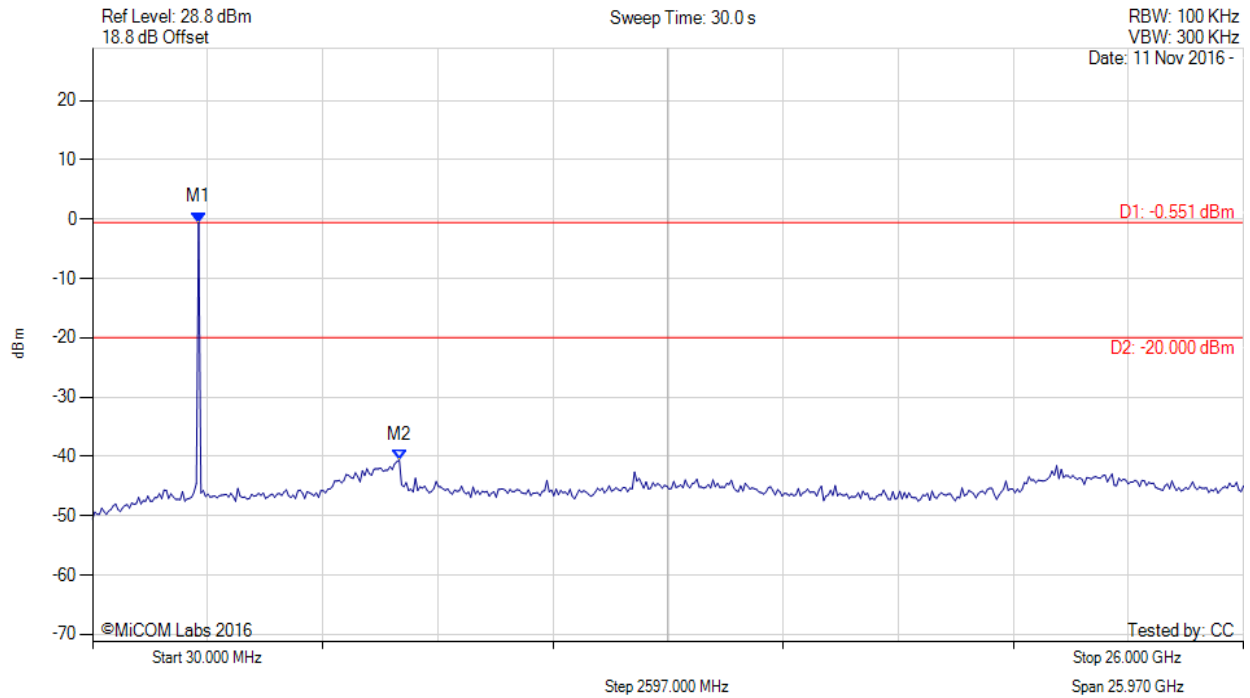


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CONDUCTED SPURIOUS EMISSIONS - PEAK



Variant: GFSK, Channel: 2440.00 MHz, Chain a, Temp: 20, 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 : 2424.028 MHz : -0.551 dBm<br>M2 : 6951.864 MHz : -40.618 dBm | Limit: -20.00 dBm<br>Margin: -20.62 dB |

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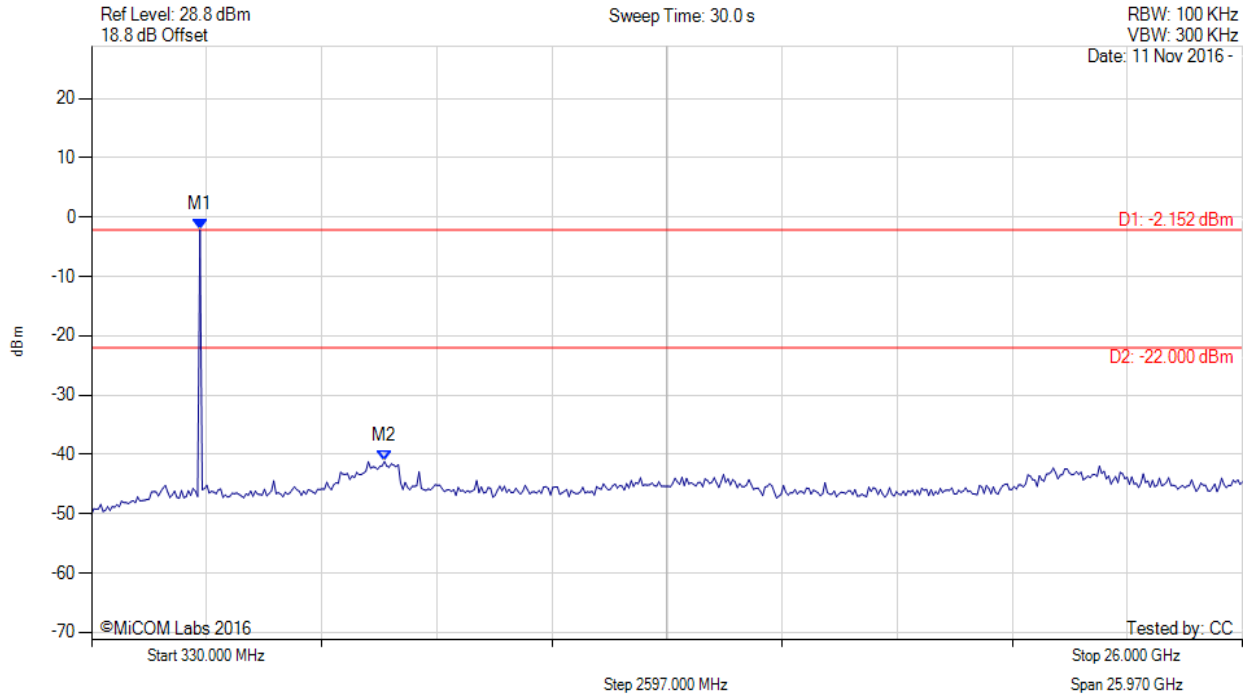


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CONDUCTED SPURIOUS EMISSIONS - PEAK



Variant: GFSK, Channel: 2480.00 MHz, Chain a, Temp: 20, 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 : 2476.072 MHz : -2.152 dBm<br>M2 : 6639.599 MHz : -41.206 dBm | Limit: -22.00 dBm<br>Margin: -19.21 dB |

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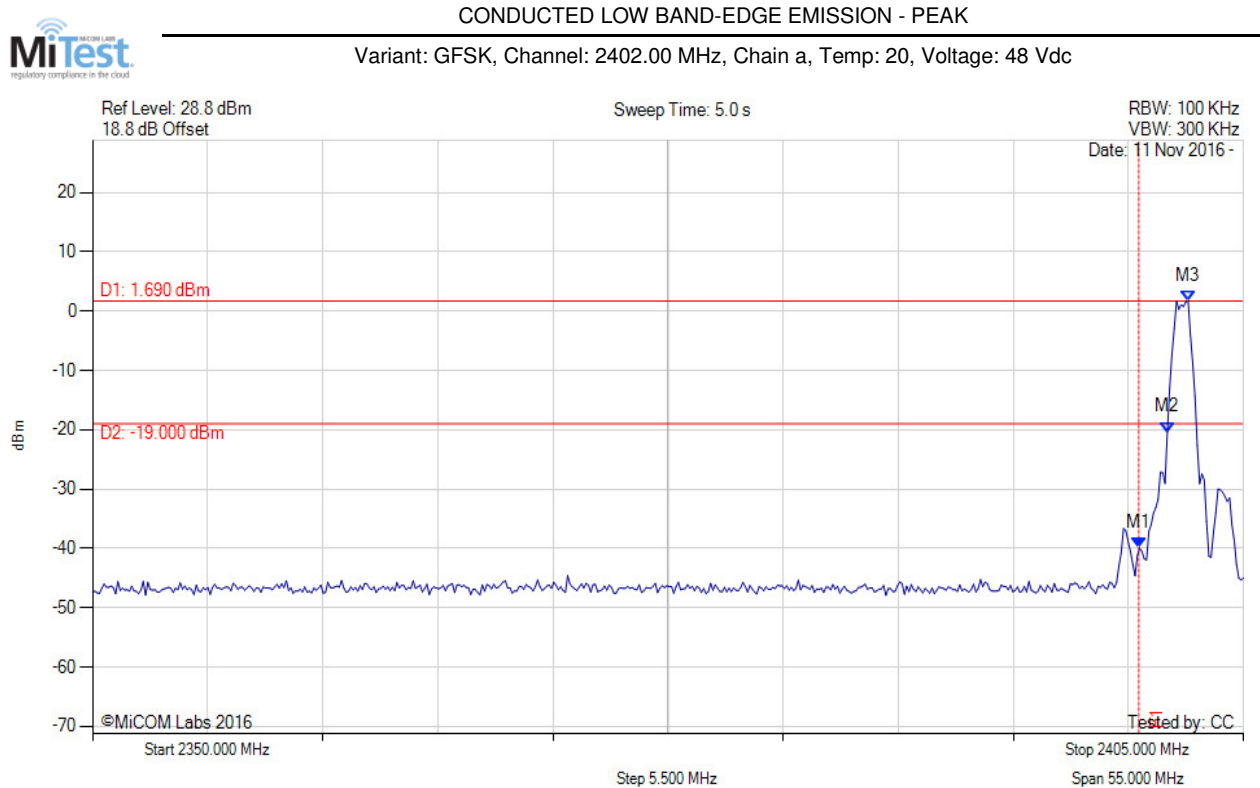
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## A.2.2 Conducted Band Edge Emissions

### Low Band-Edge Emissions



| 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 : -39.981 dBm<br>M2 : 2401.363 MHz : -20.427 dBm<br>M3 : 2402.355 MHz : 1.690 dBm | Channel Frequency: 2402.00 MHz |

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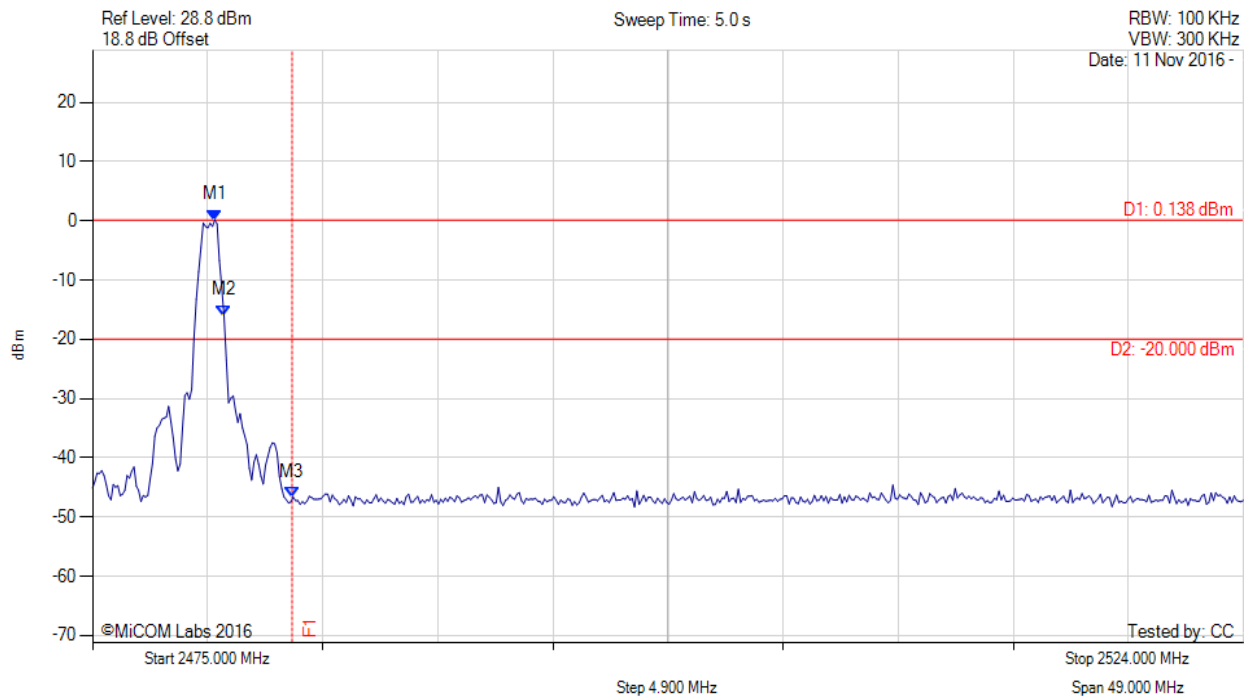


### High Band-Edge Emissions



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

Variant: GFSK, Channel: 2480.00 MHz, Chain a, Temp: 20, 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 : 2480.204 MHz : 0.138 dBm<br>M2 : 2480.597 MHz : -15.989 dBm<br>M3 : 2483.500 MHz : -46.646 dBm | Channel Frequency: 2480.00 MHz |

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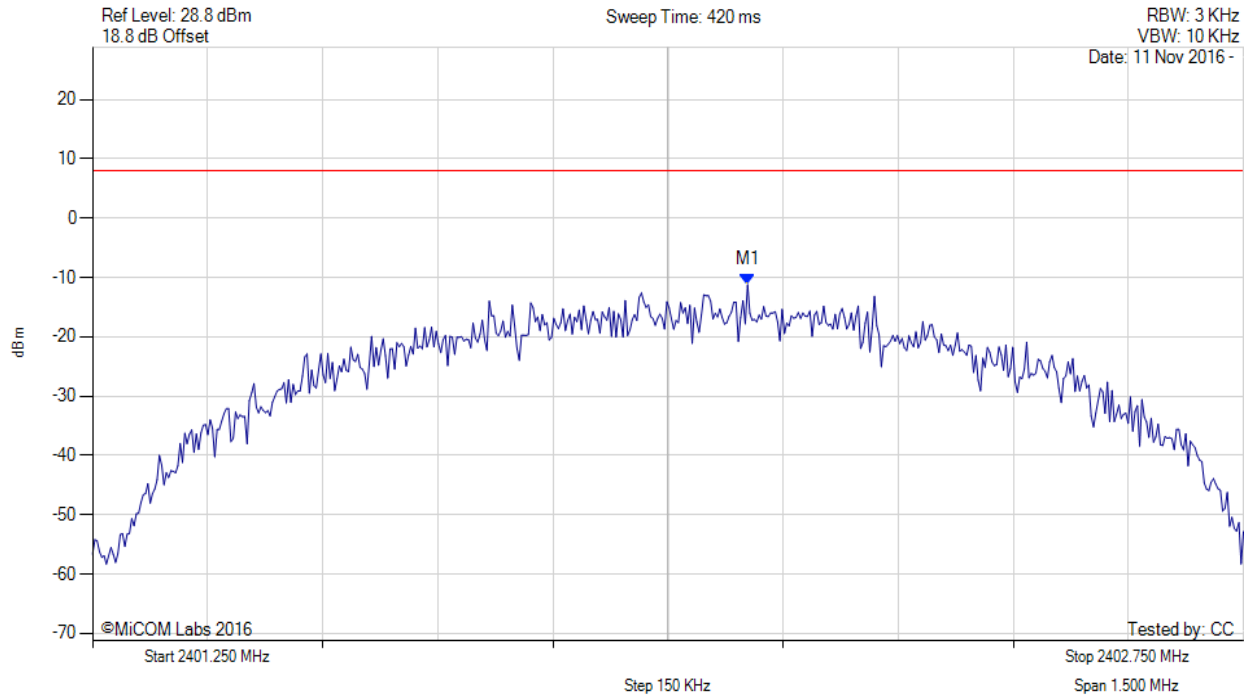


### A.3. Power Spectral Density



#### POWER SPECTRAL DENSITY - PEAK

Variant: GFSK, Channel: 2402.00 MHz, Chain a, Temp: 20, 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 : 2402.104 MHz : -11.230 dBm | Limit: $\leq 8.000$ dBm<br>Margin: 19.23 dB |

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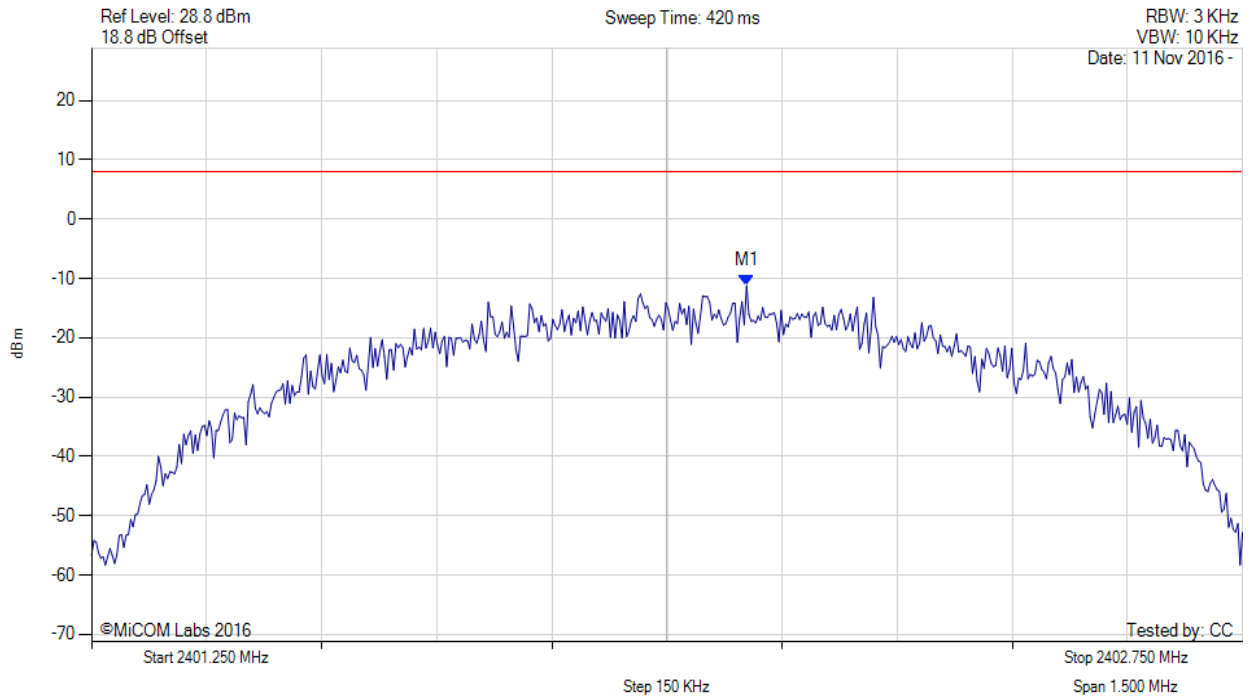


**Title:** Hewlett Packard Enterprise APINH303  
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POWER SPECTRAL DENSITY - PEAK



Variant: GFSK, Channel: 2402.00 MHz, SUM, Temp: 20, 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 : 2402.104 MHz : -11.230 dBm | Limit: $\leq 8.0$ dBm<br>Margin: -19.2 dB |

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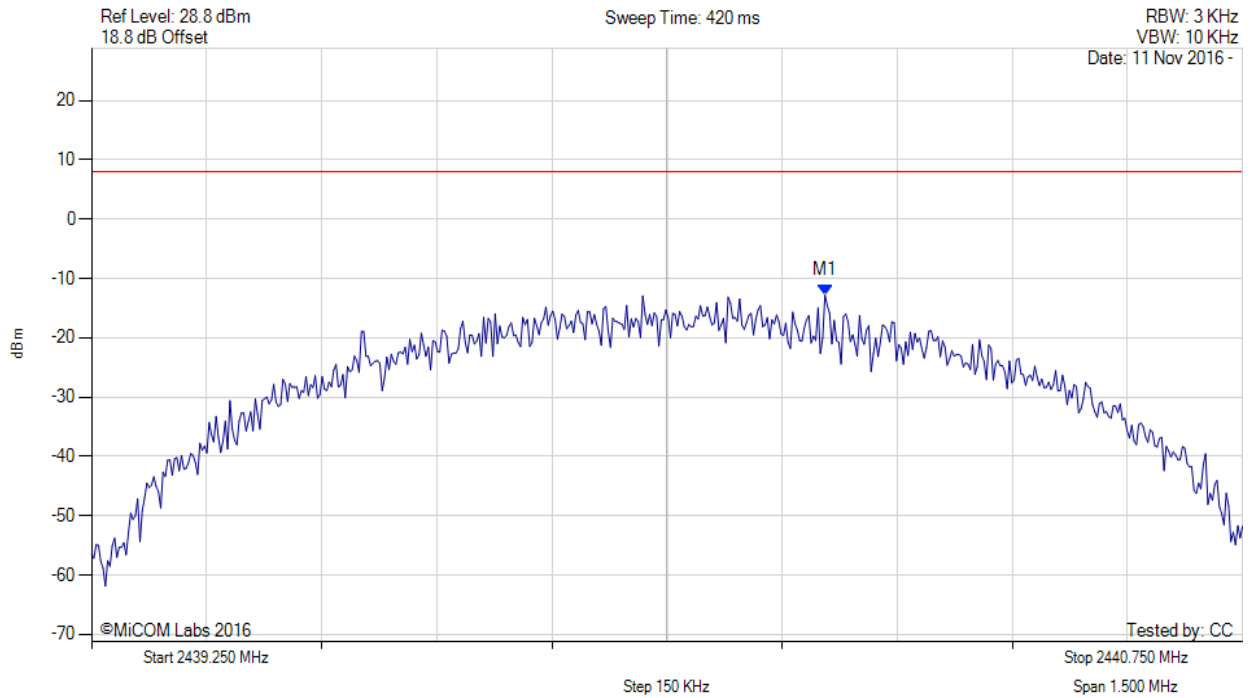


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POWER SPECTRAL DENSITY - PEAK



Variant: GFSK, Channel: 2440.00 MHz, Chain a, Temp: 20, 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 : 2440.206 MHz : -12.802 dBm | Limit: $\leq 8.000$ dBm<br>Margin: 20.80 dB |

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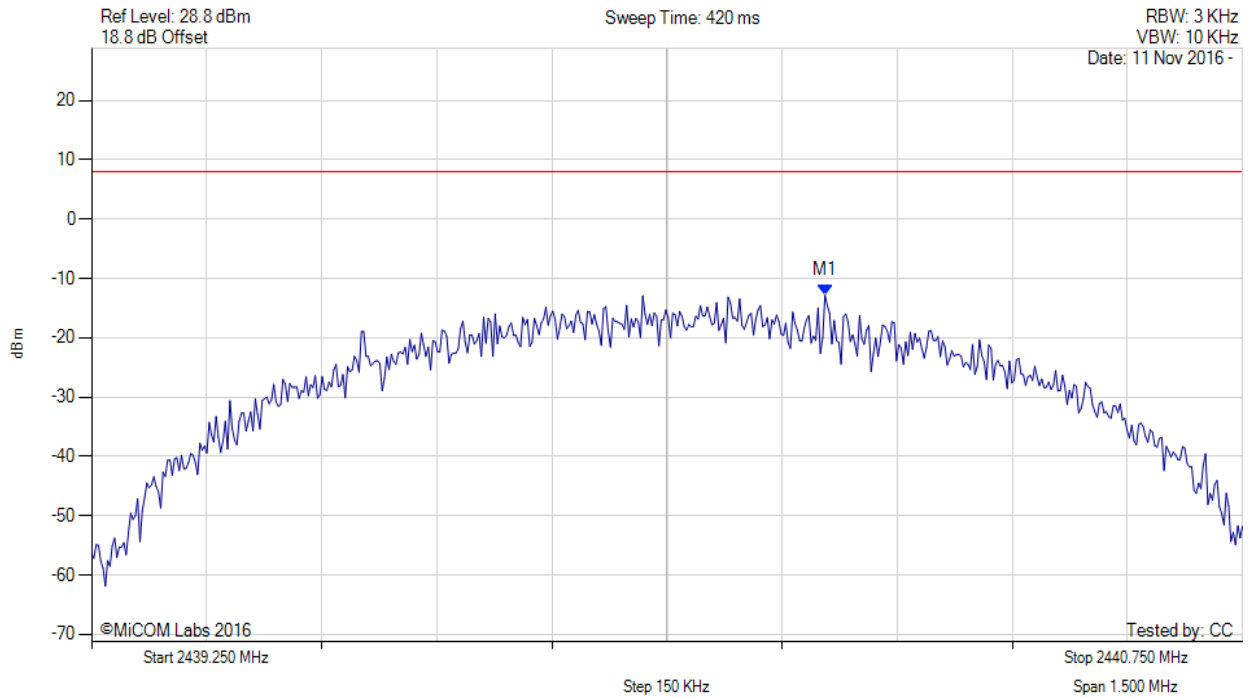


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POWER SPECTRAL DENSITY - PEAK



Variant: GFSK, Channel: 2440.00 MHz, SUM, Temp: 20, 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 : 2440.206 MHz : -12.802 dBm | Limit: $\leq 8.0$ dBm<br>Margin: -20.8 dB |

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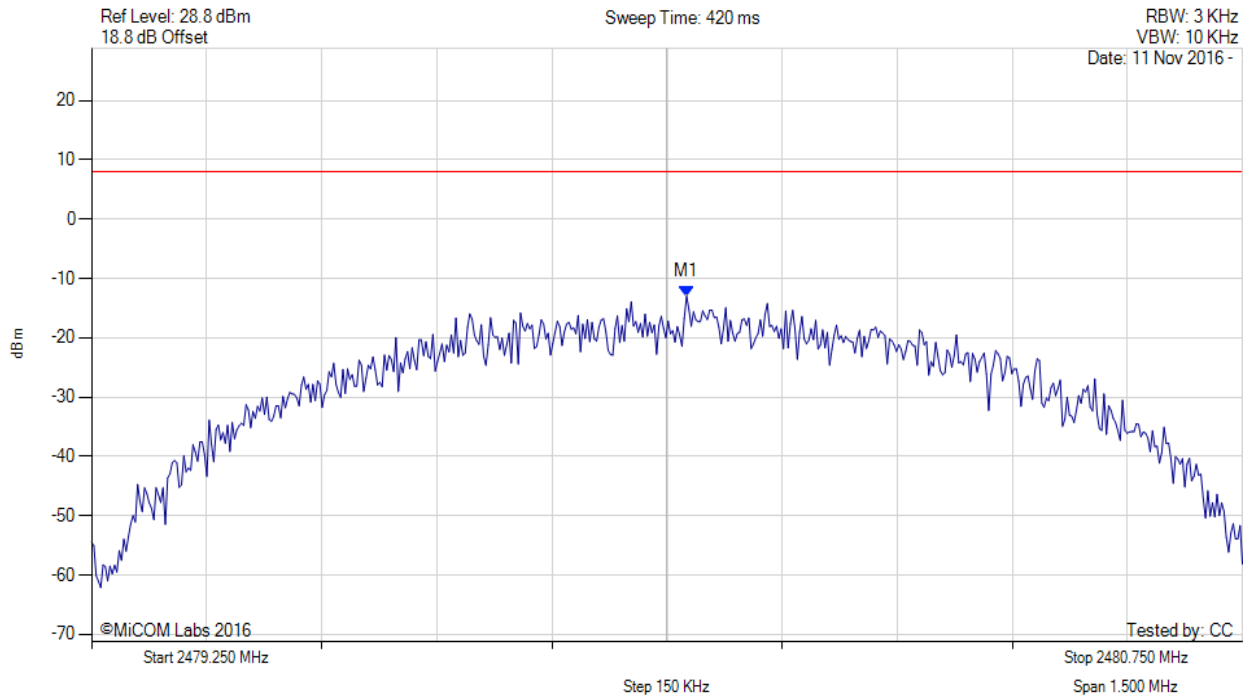


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POWER SPECTRAL DENSITY - PEAK



Variant: GFSK, Channel: 2480.00 MHz, Chain a, Temp: 20, 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 : 2480.026 MHz : -12.996 dBm | Limit: $\leq 8.000$ dBm<br>Margin: 21.00 dB |

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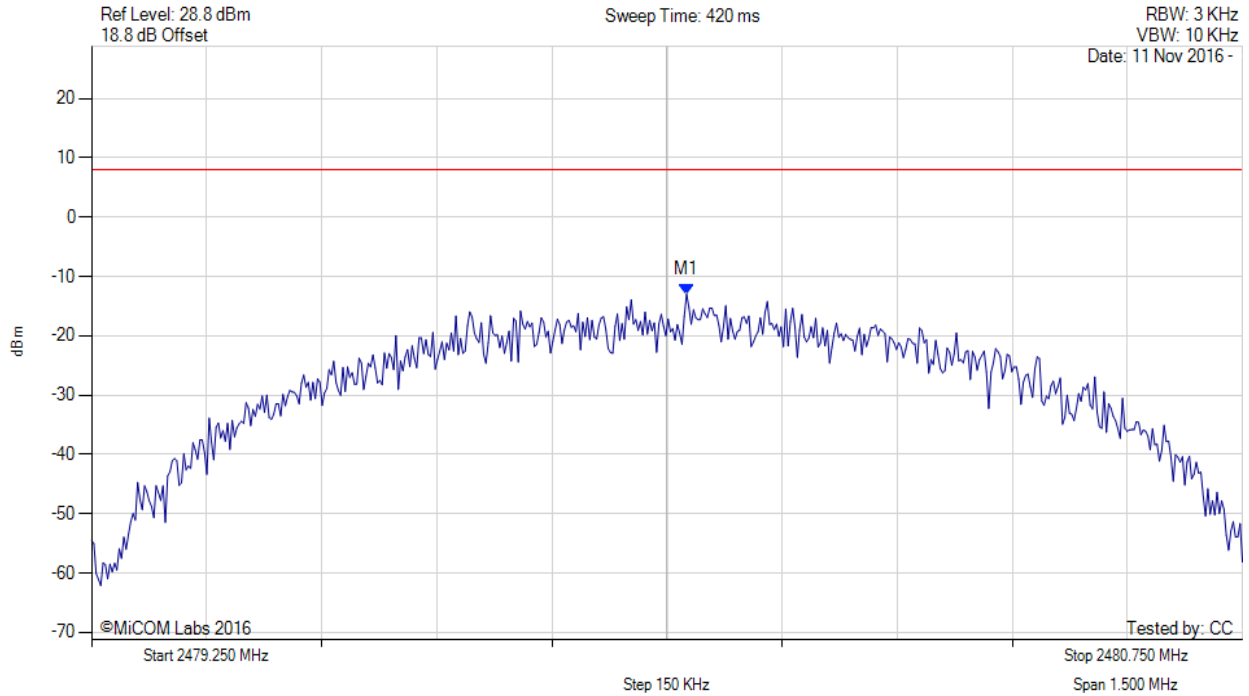


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POWER SPECTRAL DENSITY - PEAK



Variant: GFSK, Channel: 2480.00 MHz, SUM, Temp: 20, 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 : 2480.026 MHz : -12.996 dBm | Limit: $\leq 8.0$ dBm<br>Margin: -21.0 dB |

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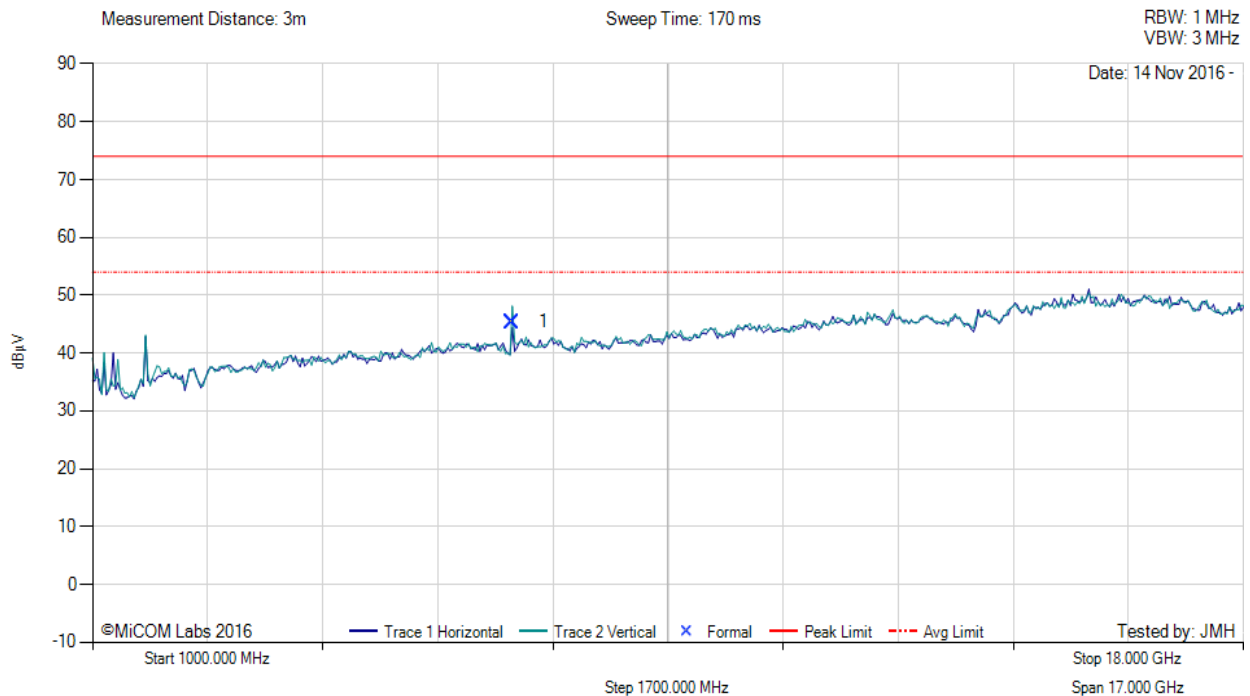
## A.4. Radiated Emissions

### A.4.1. TX Spurious & Restricted Band Emissions



#### TX SPURIOUS & RESTRICTED BAND EMISSIONS

Variant: GFSK, Test Freq: 2402.00 MHz, Antenna: Aruba Metal sheet, Power Setting: 4, Duty Cycle (%): 99



| 1000.00 - 18000.00 MHz |               |          |               |       |              |                  |          |        |         |              |           |            |
|------------------------|---------------|----------|---------------|-------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| Num                    | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
| 1                      | 7205.55       | 48.49    | 4.26          | -7.35 | 45.40        | Peak (NRB)       | Vertical | 101    | 1       | --           | --        | Pass       |

**Test Notes:** EUT on 150 cm table powered by host laptop via CC debugger.

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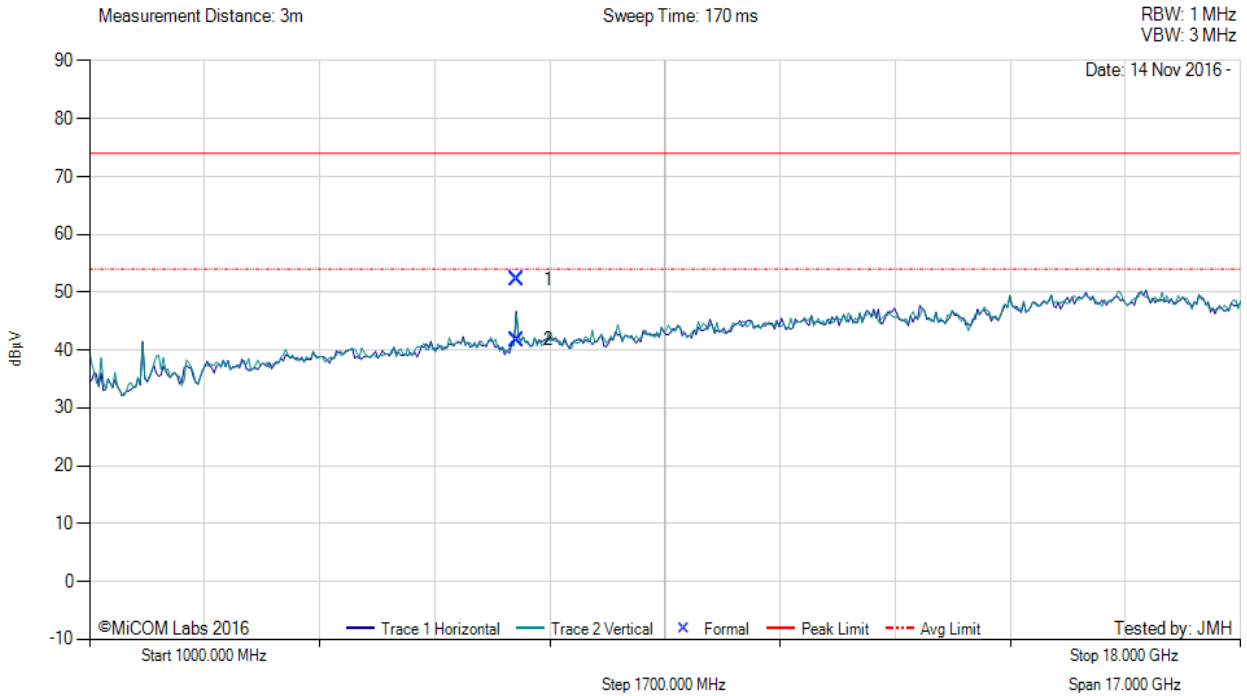


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**TX SPURIOUS & RESTRICTED BAND EMISSIONS**

Variant: GFSK, Test Freq: 2440.00 MHz, Antenna: Aruba Metal sheet, Power Setting: 4, Duty Cycle (%): 99



| 1000.00 - 18000.00 MHz |               |          |               |       |              |                  |            |        |         |              |           |            |
|------------------------|---------------|----------|---------------|-------|--------------|------------------|------------|--------|---------|--------------|-----------|------------|
| Num                    | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol        | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
| 1                      | 7319.24       | 55.14    | 4.26          | -7.27 | 52.13        | Max Peak         | Horizontal | 134    | 0       | 74.0         | -21.9     | Pass       |
| 2                      | 7319.24       | 44.75    | 4.26          | -7.27 | 41.74        | Max Avg          | Horizontal | 134    | 0       | 54.0         | -12.3     | Pass       |

**Test Notes:** EUT on 150 cm table powered by host laptop via CC debugger.

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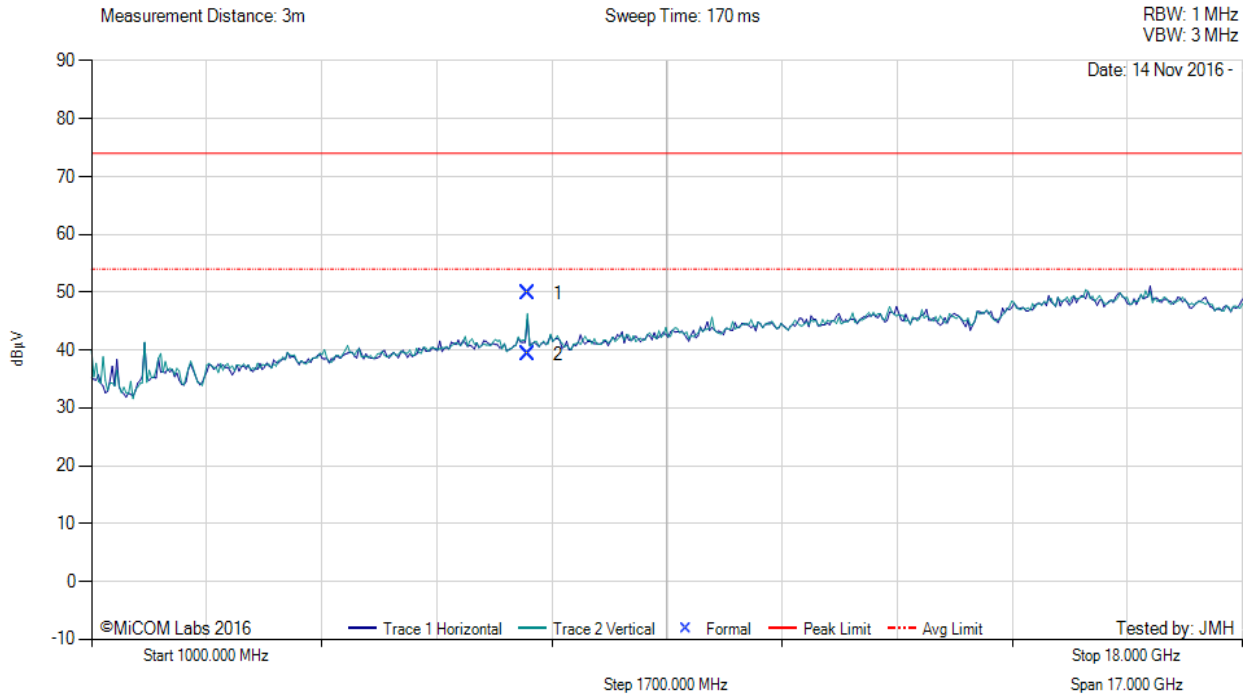


**Title:** Hewlett Packard Enterprise APINH303  
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**TX SPURIOUS & RESTRICTED BAND EMISSIONS**

Variant: GFSK, Test Freq: 2480.00 MHz, Antenna: Aruba Metal sheet, Power Setting: 4, Duty Cycle (%): 99



| 1000.00 - 18000.00 MHz |               |          |               |       |              |                  |          |        |         |              |           |            |
|------------------------|---------------|----------|---------------|-------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| Num                    | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
| 1                      | 7439.43       | 52.57    | 4.31          | -7.13 | 49.75        | Max Peak         | Vertical | 138    | 340     | 74.0         | -24.3     | Pass       |
| 2                      | 7439.43       | 42.04    | 4.31          | -7.13 | 39.22        | Max Avg          | Vertical | 138    | 340     | 54.0         | -14.8     | Pass       |

**Test Notes:** EUT on 150 cm table powered by host laptop via CC debugger.

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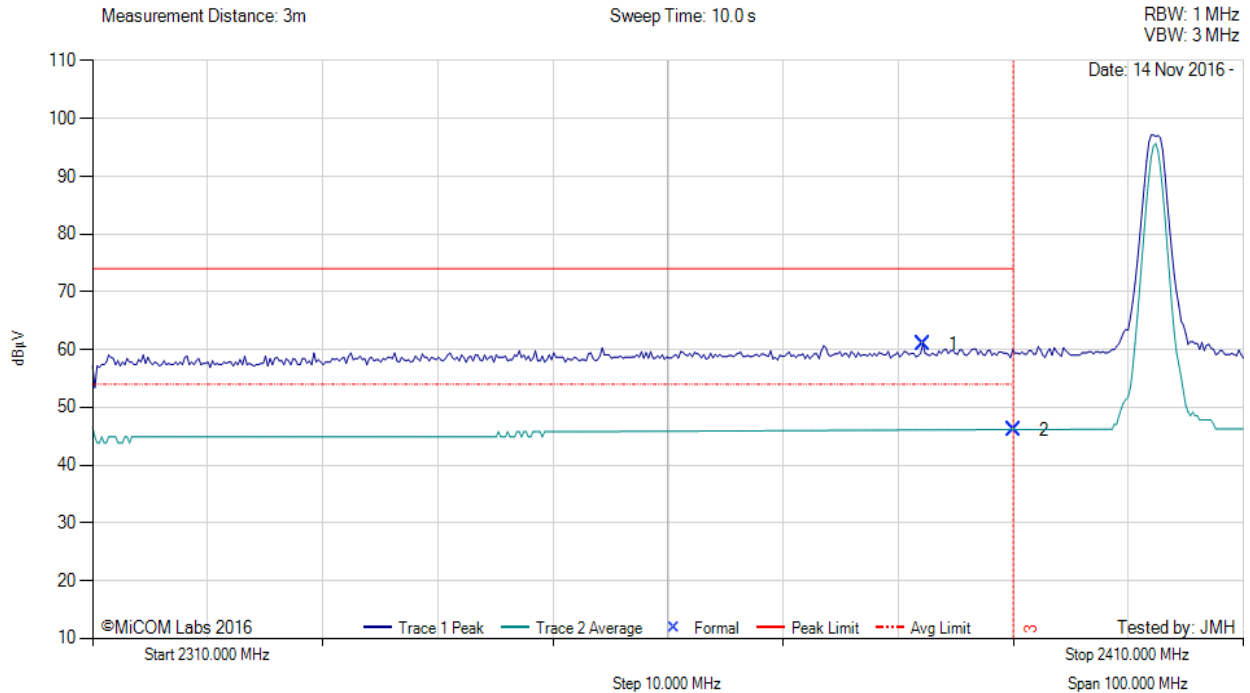


#### A.4.2. Restricted Edge & Band-Edge Emissions



#### RADIATED - LOWER RESTRICTED BAND-EDGE EMISSIONS

Variant: GFSK, Test Freq: 2402.00 MHz, Antenna: Aruba Metal sheet, Power Setting: 4, Duty Cycle (%): 99



| 2310.00 - 2410.00 MHz |               |          |               |       |              |                  |          |        |         |              |           |            |
|-----------------------|---------------|----------|---------------|-------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| Num                   | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
| 1                     | 2382.16       | 26.24    | 2.69          | 31.97 | 60.90        | Max Peak         | Vertical | 156    | 30      | 74.0         | -13.1     | Pass       |
| 2                     | 2390.00       | 11.43    | 2.69          | 32.04 | 46.16        | Max Avg          | Vertical | 156    | 30      | 54.0         | -7.8      | Pass       |
| 3                     | 2390.00       | --       | --            | --    | --           | Restricted-Band  | --       | --     | --      | --           | --        | --         |

**Test Notes:** EUT on 150 cm table powered by host laptop via CC debugger.

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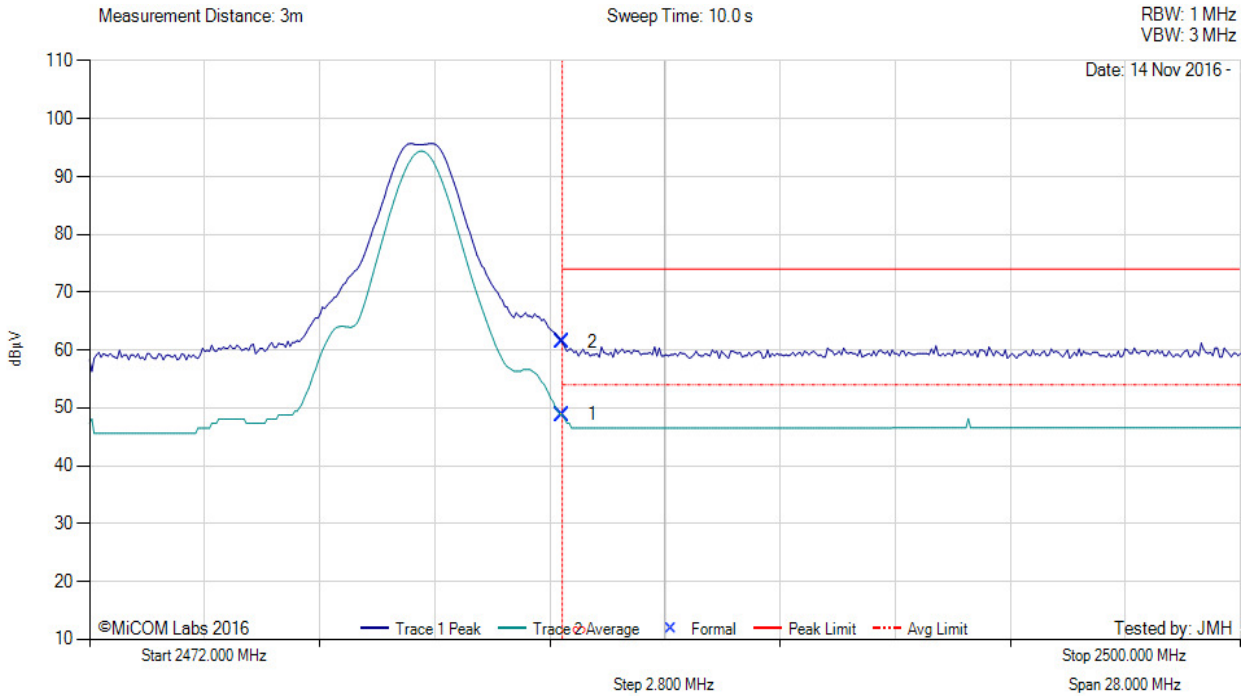


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**RADIATED - UPPER RESTRICTED BAND-EDGE EMISSIONS**

Variant: GFSK, Test Freq: 2480.00 MHz, Antenna: Aruba Metal sheet, Power Setting: 4, Duty Cycle (%): 99



| 2472.00 - 2500.00 MHz |               |          |               |       |              |                  |          |        |         |              |           |            |
|-----------------------|---------------|----------|---------------|-------|--------------|------------------|----------|--------|---------|--------------|-----------|------------|
| Num                   | Frequency MHz | Raw dBµV | Cable Loss dB | AF dB | Level dBµV/m | Measurement Type | Pol      | Hgt cm | Azt Deg | Limit dBµV/m | Margin dB | Pass /Fail |
| 1                     | 2483.50       | 13.72    | 2.73          | 32.37 | 48.82        | Max Avg          | Vertical | 151    | 47      | 54.0         | -5.2      | Pass       |
| 2                     | 2483.50       | 26.25    | 2.73          | 32.37 | 61.35        | Max Peak         | Vertical | 151    | 47      | 74.0         | -12.7     | Pass       |
| 3                     | 2483.50       | --       | --            | --    | --           | Restricted-Band  | --       | --     | --      | --           | --        | --         |

**Test Notes:** EUT on 150 cm table powered by host laptop via CC debugger.

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