

Test of Juniper Networks WLA322 Wireless LAN  
Access Point

To: FCC 47 CFR Part 15.407 & IC RSS-210

Test Report Serial No.: JNIP19-U2 Rev A





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to

To FCC 47 CFR Part 15.407 & IC RSS-210

Test Report Serial No.: JNIP19-U2 Rev A

Note: this report contains data with regard to the 5,150 to 5,250 MHz band for Juniper Networks, WLA322 Wireless Access Point. 2.4 and 5.8 GHz test data are reported in MiCOM Labs test report JNIP19-U1

This report supersedes None

Applicant: Juniper Networks, Inc  
1194 North Mathilda Avenue  
Sunnyvale  
California 94089, USA

Product Function: Wireless Access Point

Copy No: pdf Issue Date: 5th June 2012

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

**MiCOM Labs, Inc.**  
440 Boulder Court, Suite 200  
Pleasanton, CA 94566 USA  
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TEST CERTIFICATE #2381.01

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



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## **ACCREDITATION, LISTINGS & RECOGNITION**

### **TESTING ACCREDITATION**

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



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## **RECOGNITION**

MiCOM Labs, Inc has widely recognized Electrical testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA\*\* countries. Our test reports are widely accepted for global type approvals.

| Country   | Recognition Body                                                                                 | Status | Phase      | Identification No. |
|-----------|--------------------------------------------------------------------------------------------------|--------|------------|--------------------|
| USA       | Federal Communications Commission (FCC)                                                          | TCB    | -          | Listing #: 102167  |
| Canada    | Industry Canada (IC)                                                                             | FCB    | APEC MRA 2 | Listing #: 4143A-2 |
| Japan     | MIC (Ministry of Internal Affairs and Communication)                                             | CAB    | APEC MRA 2 | 210                |
|           | VCCI                                                                                             | --     | --         | No. 2959           |
| 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 |                    |

\*\*APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.

Is a 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

N/A – Not Applicable

\*\*EU MRA – European Union Mutual Recognition Agreement.

Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

\*\*NB – Notified Body

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## **PRODUCT CERTIFICATION**

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC Guide 65. 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>



**USA Telecommunication Certification Body (TCB)** - TCB Identifier – US0159

**Industry Canada Certification Body** - CAB Identifier – US0159

**European Notified Body** - Notified Body Identifier - 2280

**Japan – Recognized Certification Body (RCB)** - RCB Identifier - 210

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## DOCUMENT HISTORY

| Document History |                           |                                           |
|------------------|---------------------------|-------------------------------------------|
| Revision         | Date                      | Comments                                  |
| Draft            |                           |                                           |
| Rev A            | 5 <sup>th</sup> June 2012 | Initial release 5150 – 5250 MHz data only |
|                  |                           |                                           |
|                  |                           |                                           |

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## 1. TEST RESULT CERTIFICATE

|               |                                                                                           |            |                                                                                            |
|---------------|-------------------------------------------------------------------------------------------|------------|--------------------------------------------------------------------------------------------|
| Applicant:    | Juniper Networks, Inc<br>1194 North Mathilda Avenue<br>Sunnyvale<br>California 94089, USA | Tested By: | MiCOM Labs, Inc.<br>440 Boulder Court<br>Suite 200<br>Pleasanton<br>California, 94566, USA |
| EUT:          | Product Description                                                                       | Tel:       | +1 925 462 0304                                                                            |
| Model:        | WLA322-US                                                                                 | Fax:       | +1 925 462 0306                                                                            |
| S/N:          | Conducted S/N MN3512070068:<br>Radiated S/N: MN3512070051                                 |            |                                                                                            |
| Test Date(s): | 5th to 25th May 2012                                                                      | Website:   | www.micomlabs.com                                                                          |

| STANDARD(S)                         | TEST RESULTS       |
|-------------------------------------|--------------------|
| FCC 47 CFR Part 15.407 & IC RSS-210 | EQUIPMENT COMPLIES |

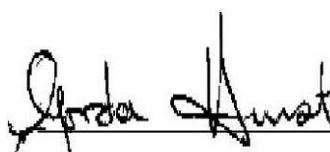
MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

### 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,

  
\_\_\_\_\_  
Gordon Hurst  
President & CEO MiCOM Labs, Inc.



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## 2. REFERENCES AND MEASUREMENT UNCERTAINTY

### 2.1. Normative References

| Ref.   | Publication                    | Year                            | Title                                                                                                                                                                |
|--------|--------------------------------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (i)    | FCC 47 CFR Part 15.407         | 2010                            | Code of Federal Regulations                                                                                                                                          |
| (ii)   | FCC 06-96                      | June 2006                       | Memorandum Opinion and Order                                                                                                                                         |
| (iii)  | FCC OET KDB 662911             | 4 <sup>th</sup> April 2011      | Emissions Testing of Transmitters with Multiple Outputs in the Same Band                                                                                             |
| (iv)   | Industry Canada RSS-210        | 2010                            | Low Power License-Exempt Radiocommunication Devices (All Frequency Bands): Category 1 Equipment                                                                      |
| (v)    | Industry Canada RSS-Gen        | 2010                            | General Requirements and Information for the Certification of Radiocommunication Equipment                                                                           |
| (vi)   | ANSI C63.4                     | 2009                            | 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 |
| (vii)  | CISPR 22/ EN 55022             | 2008<br>2006+A1:2007            | Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment                                                          |
| (viii) | M 3003                         | Edition 1 Dec. 1997             | Expression of Uncertainty and Confidence in Measurements                                                                                                             |
| (ix)   | LAB34                          | Edition 1 Aug 2002              | The expression of uncertainty in EMC Testing                                                                                                                         |
| (x)    | ETSI TR 100 028                | 2001                            | Parts 1 and 2<br>Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics          |
| (xi)   | A2LA                           | 14 <sup>th</sup> September 2005 | Reference to A2LA Accreditation Status – A2LA Advertising Policy                                                                                                     |
| (xii)  | FCC Public Notice – DA 02-2138 | 2002                            | Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices                                                                              |

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## **2.2. Test and Uncertainty Procedures**

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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### 3. PRODUCT DETAILS AND TEST CONFIGURATIONS

#### 3.1. Technical Details

| Details                                           | Description                                                                                                                                                         |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Purpose:                                          | Test of the Juniper Networks WLA322 Wireless LAN Access Point in the frequency range 5,150 to 5,250 MHz to FCC Part 15.407 and Industry Canada RSS-210 regulations. |
| Applicant:                                        | Juniper Networks, Inc<br>1194 North Mathilda Avenue<br>Sunnyvale<br>California 94089, USA                                                                           |
| Manufacturer:                                     | As applicant                                                                                                                                                        |
| Laboratory performing the tests:                  | MiCOM Labs, Inc.<br>440 Boulder Court, Suite 200<br>Pleasanton, California 94566 USA                                                                                |
| Test report reference number:                     | JNIP19-U2 Rev A                                                                                                                                                     |
| Date EUT received:                                | 5th May 2012                                                                                                                                                        |
| Standard(s) applied:                              | FCC 47 CFR Part 15.407 & IC RSS-210                                                                                                                                 |
| Dates of test (from - to):                        | 5th to 25th May 2012                                                                                                                                                |
| No of Units Tested:                               | 2                                                                                                                                                                   |
| Type of Equipment:                                | Wireless LAN Access Point, 2x2 Spatial Multiplexing MIMO configuration                                                                                              |
| Applicants Trade Name:                            | Wireless Access Point                                                                                                                                               |
| Model(s):                                         | WLA322-US and WLA322-WW                                                                                                                                             |
| Location for use:                                 | Indoor                                                                                                                                                              |
| Declared Frequency Range(s):                      | 5,150 – 5,250                                                                                                                                                       |
| Software Release                                  | 7.7.2.0.031                                                                                                                                                         |
| Type of Modulation:                               | Per 802.11 – OFDM                                                                                                                                                   |
| Declared Nominal Output Power:<br>(Average Power) | 802.11a: Legacy +18 dBm<br>802.11n: HT-20 +18 dBm<br>802.11n: HT-40 +18 dBm                                                                                         |
| EUT Modes of Operation:                           | Legacy 802.11a, 802.11n HT-20, HT-40                                                                                                                                |
| Transmit/Receive Operation:                       | Time Division Duplex                                                                                                                                                |
| System Beam Forming:                              | WLA322 has no capability for beam forming                                                                                                                           |
| Rated Input Voltage and Current:                  | POE 48 Vdc 0.625 A                                                                                                                                                  |
| Operating Temperature Range:                      | Declared range 0° to +40°C                                                                                                                                          |
| ITU Emission Designator:                          | 802.11a 18M8D1D<br>802.11n HT-20 19M9D1D<br>802.11n HT-40 36M7D1D                                                                                                   |
| Equipment Dimensions:                             | 5.6 in (H) x 5.4 in (W) x 1.9 in (D)                                                                                                                                |
| Weight:                                           | 8.5 oz                                                                                                                                                              |
| Primary function of equipment:                    | Wireless Access Point for transmitting data                                                                                                                         |

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### **3.2. Scope of Test Program**

#### **Juniper Networks WLA322 Access Point RF Testing**

The scope of the test program was to test the Juniper Networks WLA322 Wireless LAN Access Point, 2x2 Spatial Multiplexing MIMO configurations in the frequency range 5,150 to 5,250 and 5,470 – 5,725 MHz for compliance against FCC 47 CFR Part 15.407 and Industry Canada RSS-210 specifications.

WLA322-US (for US distribution)

WLA322-WW, WLA322-XX (where –XX can be any alphanumeric, for world wide distribution)

#### **FCC OET KDB Implementation**

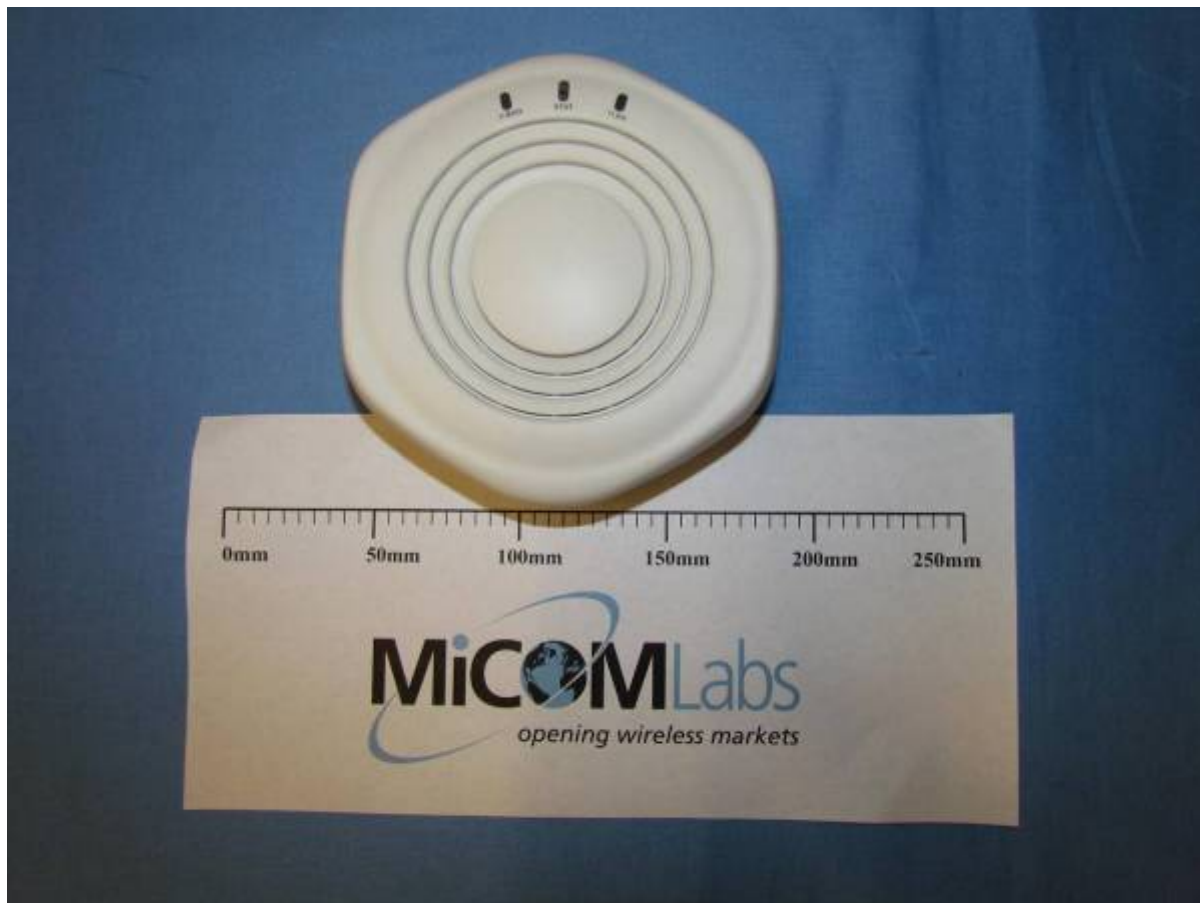
This test program implements the following FCC KDB – 662911 4/4/2011;

#### ***Emissions Testing of Transmitters with Multiple Outputs in the Same Band***

The KDB document provides guidance for measurements of conducted output emissions of devices that employ a single transmitter with multiple outputs in the same band, with the outputs occupying the same or overlapping frequency ranges. It applies to EMC compliance measurements on devices that transmit on multiple antennas simultaneously in the same or overlapping frequency ranges through a coordinated process. Examples include, but are not limited to, devices employing beam forming or multiple-input and multiple-output (MIMO.) This guidance applies to both licensed and unlicensed devices wherever the FCC rules call for conducted output measurements. Guidance is provided for in-band, out-of-band and spurious emission measurements.

This guidance does not apply to the multiple transmitters included in a composite device, such as a device that combines an 802.11 modem with a cell phone in one enclosure with each driving its own antenna.

### WLA322-WW Wireless LAN Access Point





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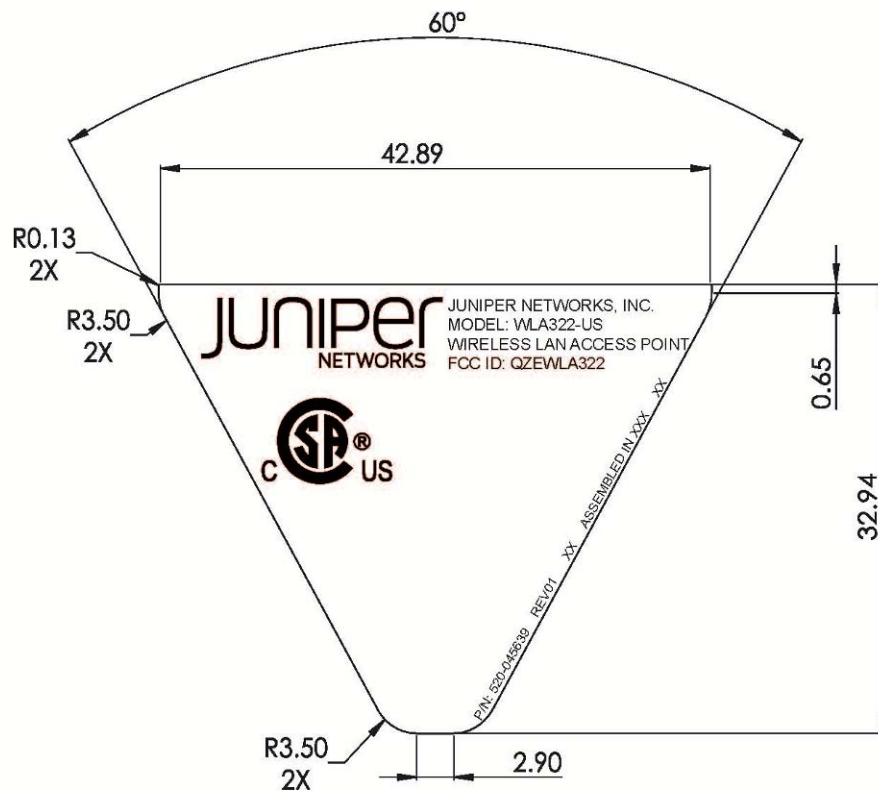
### WLA322-WW Wireless LAN Access Point



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### WLA322-WW Wireless LAN Access Point Label





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

| Type<br>(EUT/<br>Support) | Equipment<br>Description<br>(Including Brand<br>Name) | Mfr                 | Model No. | Serial No.                                                |
|---------------------------|-------------------------------------------------------|---------------------|-----------|-----------------------------------------------------------|
| EUT                       | Wireless LAN<br>Access Point                          | Juniper<br>Networks | WLA322    | Conducted S/N MN3512070068:<br>Radiated S/N: MN3512070051 |
| Support                   | Laptop PC                                             | IBM                 | Thinkpad  | None                                                      |

### 3.4. Antenna Details

- Integral Single Band: Gain 5 GHz 0 dBi (average)

### 3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 1 x 10/100/1000 Ethernet includes POE (Power over Ethernet +48 Vdc)

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### 3.6. Test Configurations

Testing was performed to determine the highest power level versus bit rate. The variant with the highest power was used to exercise the product.

Matrix of test configurations

| Operational Mode(s)<br>(802.11) | Variant | Data Rates with Highest<br>Power | Frequencies<br>(MHz)  |
|---------------------------------|---------|----------------------------------|-----------------------|
| a,n                             | Legacy  | 6 MBit/s                         | 5,180 / 5,200 / 5,240 |
|                                 | HT-20   | 6.5 MCS                          |                       |
|                                 | HT-40   | 13.5 MCS                         | 5,190 / 5,230         |

#### **Antenna Test Configurations for Radiated Emissions and Band-Edge**

The following measurements were performed on all antenna configurations identified in Section 3.4 Antenna Details.

#### **Spurious Emission and Band-Edge Test Strategy Bands 5,150 – 5250 MHz**

| 11a     | 11n HT-20 | 11n HT-40 |
|---------|-----------|-----------|
| SE 5180 | SE 5180   | SE 5190   |
| SE 5200 | SE 5200   |           |
| SE 5240 | SE 5240   | SE 5230   |
| BE 5150 | BE 5150   | BE 5150   |



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### **3.7. Equipment Modifications**

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

1. NONE

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

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

1. NONE

### **3.9. Subcontracted Testing or Third Party Data**

1. NONE

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## 4. TEST SUMMARY

### List of Measurements

The following table represents the list of measurements required under the **FCC CFR47 Part 15.407** and **Industry Canada RSS-210** and **Industry Canada RSS-Gen**.

| Section(s)                                                   | Test Items                         | Description                                                                   | Condition             | Result   | Test Report Section |
|--------------------------------------------------------------|------------------------------------|-------------------------------------------------------------------------------|-----------------------|----------|---------------------|
| <b>15.407(a)</b><br><b>A9.2(2)</b><br><b>4.4</b>             | 26dB and 99% Emission BW           | Emission bandwidth measurement                                                | Conducted             | Complies | 5.1.1               |
| <b>15.407(a)</b><br><b>A9.2(2)</b><br><b>4.6</b>             | Transmit Output Power              | Power Measurement                                                             | Conducted             | Complies | 5.1.2               |
| <b>15.407(a)</b><br><b>A9.2(2)</b>                           | Peak Power Spectral Density        | PPSD                                                                          | Conducted             | Complies | 5.1.3               |
| <b>15.407(a)(6)</b>                                          | Peak Excursion Ratio               | <13dB in any 1MHz bandwidth                                                   | Conducted             | Complies | 5.1.4               |
| <b>15.407(g)</b><br><b>15.31</b><br><b>2.1</b><br><b>4.5</b> | Frequency Stability                | Limits: contained within band of operation at all times.                      | Applicant declaration | Complies | 5.1.5               |
| <b>15.407(f)</b><br><b>5.5</b>                               | Radio Frequency Radiation Exposure | Exposure to radio frequency energy levels, Maximum Permissible Exposure (MPE) | Conducted             | Complies | 5.1.6               |

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### List of Measurements (continued)

The following table represents the list of measurements required under the **FCC CFR47 Part 15.407** and **Industry Canada RSS-210** and **Industry Canada RSS-Gen**.

| Section(s)                                                                                                                    | Test Items                                        | Description                  | Condition | Result         | Test Report Section |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------|-----------|----------------|---------------------|
| <b>15.407(b)(2)</b><br><b>15.205(a)</b><br><b>15.209(a)</b><br><b>2.2</b><br><b>2.6</b><br><b>A9.3(2)</b><br><b>4.7</b>       | Radiated Emissions                                |                              | Radiated  |                | 5.1.7               |
|                                                                                                                               | Transmitter Radiated Spurious Emissions           | Emissions above 1 GHz        |           | Complies       | 5.1.7.1             |
|                                                                                                                               | Radiated Band Edge                                | Band edge results            |           | Complies       | 5.1.7.1             |
|                                                                                                                               | Receiver Radiated Spurious Emissions              | Emissions above 1 GHz        |           | Complies       | 5.1.7.2             |
|                                                                                                                               | Radiated Emissions                                | Emissions <1 GHz (30M-1 GHz) |           | Complies       | 5.1.7.3             |
| Industry Canada only<br><b>RSS-Gen §4.10, §6</b><br><b>15.407(b)(6)</b><br><b>15.205(a)</b><br><b>15.209(a)</b><br><b>2.2</b> |                                                   |                              |           |                |                     |
| <b>15.407(b)(6)</b><br><b>15.207</b><br><b>7.2.2</b>                                                                          | AC Wireline Conducted Emissions<br>150 kHz–30 MHz | Conducted Emissions          | Conducted | Not Applicable | 5.1.8               |

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## List of Measurements (cont'd)

### Dynamic Frequency Selection (DFS)

The following table represents the list of measurements required under the **FCC CFR47 Part 15.407(h)(2)** and **FCC Memorandum Opinion and Order FCC 06-96 (Compliance Measurement procedures for Unlicensed National Information Infrastructure devices operating in the 5250-5350 MHz and 5470-5725 MHz bands incorporating dynamic frequency selection)**.

### Tests performed on Master Device

| Section | Test Items                                   | Description                                                                                             | Condition | Result         | Test Report Section |
|---------|----------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------|----------------|---------------------|
|         | Dynamic Frequency Selection – Not Applicable |                                                                                                         |           |                |                     |
| 7.8.1   | Detection Bandwidth                          | UNII Detection Bandwidth                                                                                | Conducted | Not Applicable |                     |
| 7.8.2.1 | Performance Requirements Check               | Initial Channel Availability Check Time                                                                 | Conducted | Not Applicable |                     |
| 7.8.2.2 |                                              | Radar Burst at the Beginning of the Channel Availability Check Time                                     | Conducted | Not Applicable |                     |
| 7.8.2.3 |                                              | Radar Burst at the End of the Channel Availability Check Time                                           | Conducted | Not Applicable |                     |
| 7.8.3   | In-Service Monitoring                        | In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period | Conducted | Not Applicable |                     |
| 7.8.4   | Radar Detection                              | Statistical Performance Check                                                                           | Conducted | Not Applicable |                     |

Note 1: Test results reported in this document relate only to the items tested

Note 2: The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria

Note 3: Section 3.7 Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix

## 5. TEST RESULTS

### 5.1. Device Characteristics

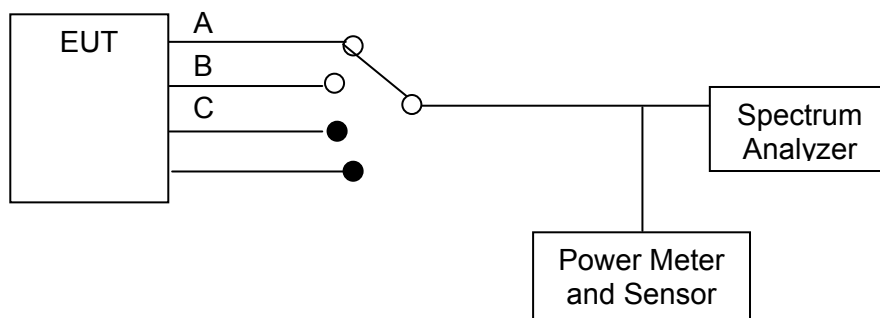
#### 5.1.1. 26 dB and 99 % Bandwidth

**FCC, Part 15 Subpart C §15.407(a)**  
**Industry Canada RSS-210 § A9.2(2)**  
**Industry Canada RSS-Gen 4.4**

#### Test Procedure

The bandwidth at 26 dB and 99 % is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

#### Test Measurement Set up



Measurement set up for 26 dB and 99 % bandwidth test

#### Radio Parameters

Duty Cycle: 100%

Output: Modulated Carrier

Power: Maximum Default Power



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### Measurement Results for 26 dB and 99 % Operational Bandwidth(s)

Ambient conditions.

Temperature: 17 to 23 °C      Relative humidity: 31 to 57 %      Pressure: 999 to 1012 mbar

#### TABLE OF RESULTS – 802.11a Legacy 5150 – 5250 MHz

|                               |               |                            |     |    |      |
|-------------------------------|---------------|----------------------------|-----|----|------|
| <b>Test Conditions:</b>       | 15.247 (a)(2) | <b>Rel. Humidity (%):</b>  | 35  | to | 42   |
| <b>Variant:</b>               | 802.11a       | <b>Ambient Temp. (°C):</b> | 19  | to | 22   |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998 | to | 1003 |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (x):</b>     | 100 |    |      |
| <b>Beam Forming Gain (Y):</b> | N/A      dB   | <b>Antenna Gain:</b>       | 0   |    | dBi  |
| <b>Applied Voltage:</b>       | 48.0      Vdc |                            |     |    |      |
| <b>Notes 1:</b>               |               |                            |     |    |      |
| <b>Notes 2:</b>               |               |                            |     |    |      |

#### 26 dB Bandwidth

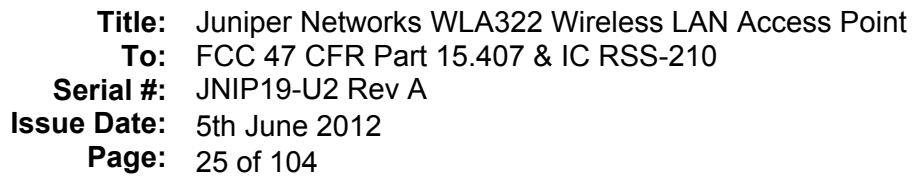
| Test Frequency | 26 dB Bandwidth |        |    |    | Minimum 6dB Bandwidth Limit |     | Margin     |
|----------------|-----------------|--------|----|----|-----------------------------|-----|------------|
|                | MHz             |        |    |    |                             |     |            |
| MHz            | a               | b      | c  | d  | kHz                         | MHz | MHz        |
| 5180           | 23.747          | 22.044 | -- | -- | 500                         | 0.5 | -21.544000 |
| 5200           | 23.447          | 22.244 | -- | -- |                             |     | -21.744000 |
| 5240           | 26.453          | 22.745 | -- | -- |                             |     | -22.245000 |

#### 99% Bandwidth

| Test Frequency | 99 % Bandwidth |        |    |    |  |  |  |
|----------------|----------------|--------|----|----|--|--|--|
|                | MHz            |        |    |    |  |  |  |
| MHz            | a              | b      | c  | d  |  |  |  |
| 5180           | 16.934         | 16.834 | -- | -- |  |  |  |
| 5200           | 16.934         | 16.834 | -- | -- |  |  |  |
| 5240           | 16.934         | 16.834 | -- | -- |  |  |  |

|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±2.81 dB |
|---------------------------------|----------|

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[illegible]

Ref Lvl 28 dBm

Delta 1 [T1] 1.04 dB

22.04408818 MHz

RBW 200 kHz

VBW 300 kHz

SWT 20 s

RF Att 20 dB

Unit dBm

19.3 dB Offset

D1 6.424 dBm

1VIEW

D2 -19.576 dBm

F1

F2

Center 5.18 GHz

5 MHz/

Span 50 MHz

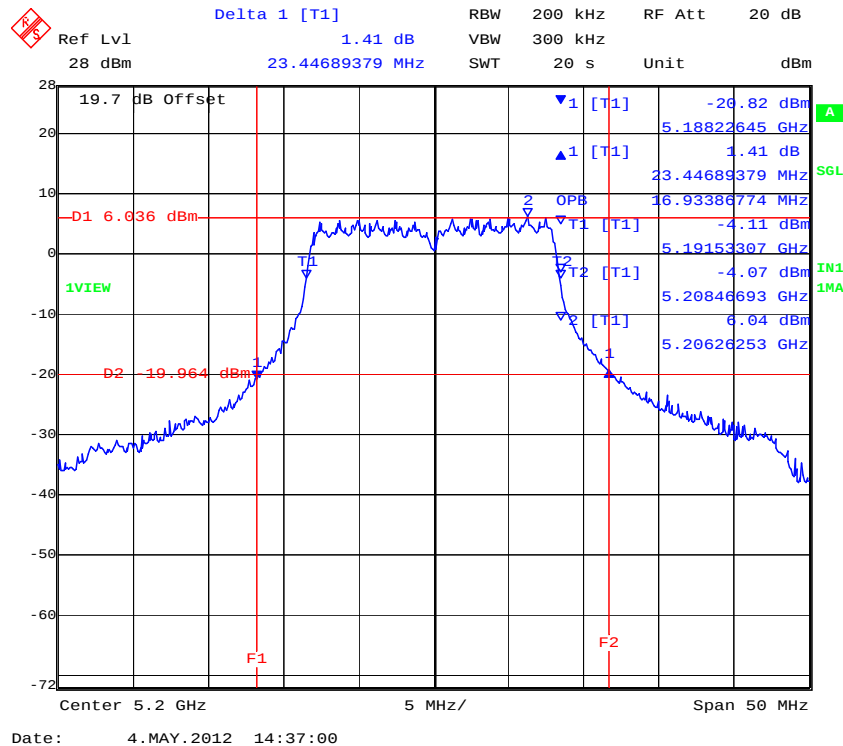
Date: 4.MAY.2012 14:31:00

MiCOM Labs, 440 Boulder Court, Suite 200, Pleasanton, CA 94566 USA, Phone: 925.462.0304, Fax: 925.462.0306, [www.micomlabs.com](http://www.micomlabs.com)

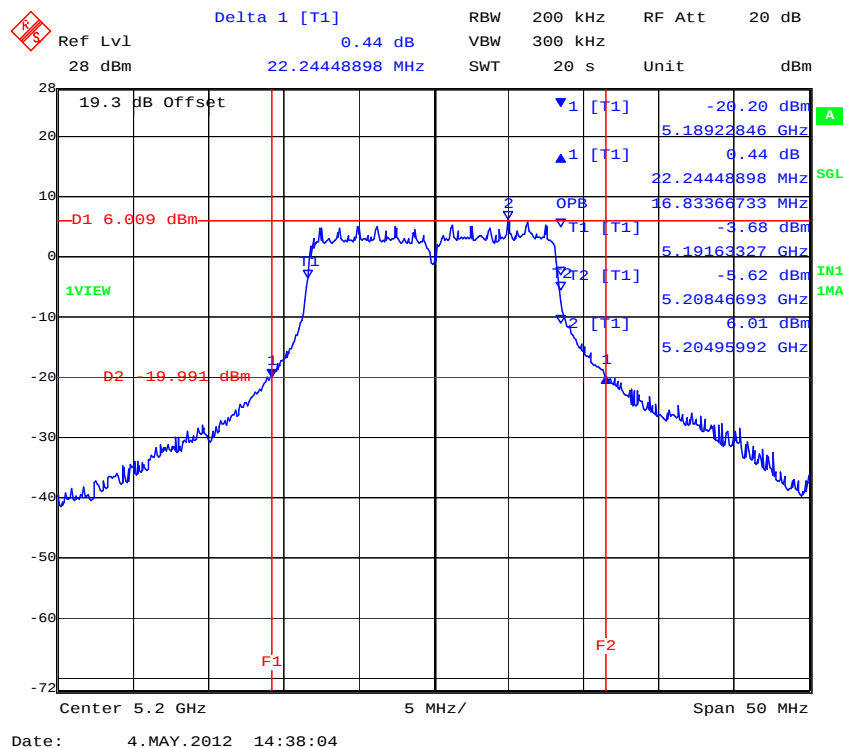


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### PORT A 5,200 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



### PORT B 5,200 MHz 802.11a Legacy 26 dB and 99 % Bandwidth

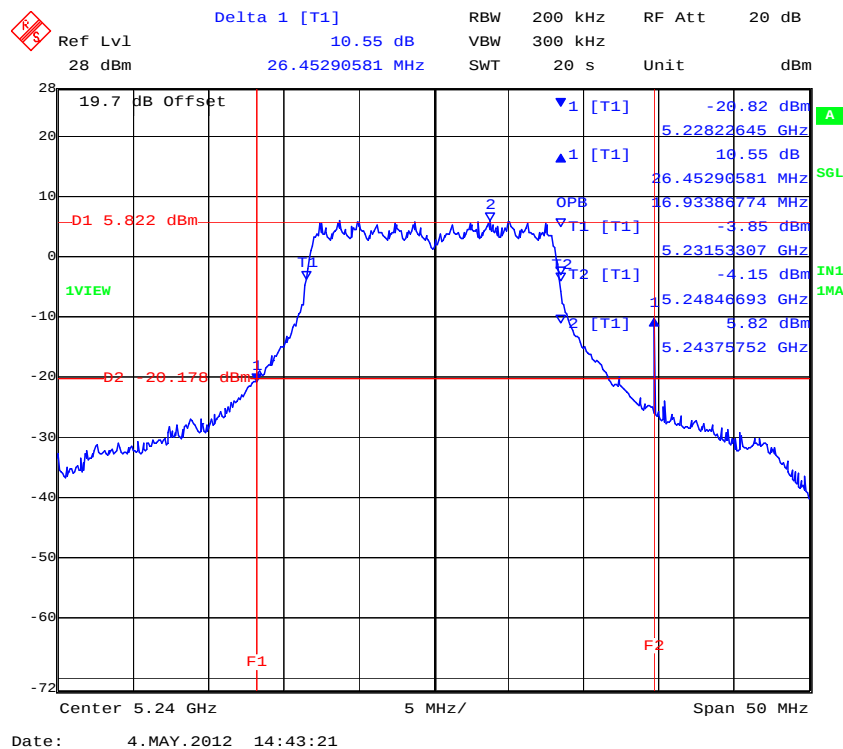


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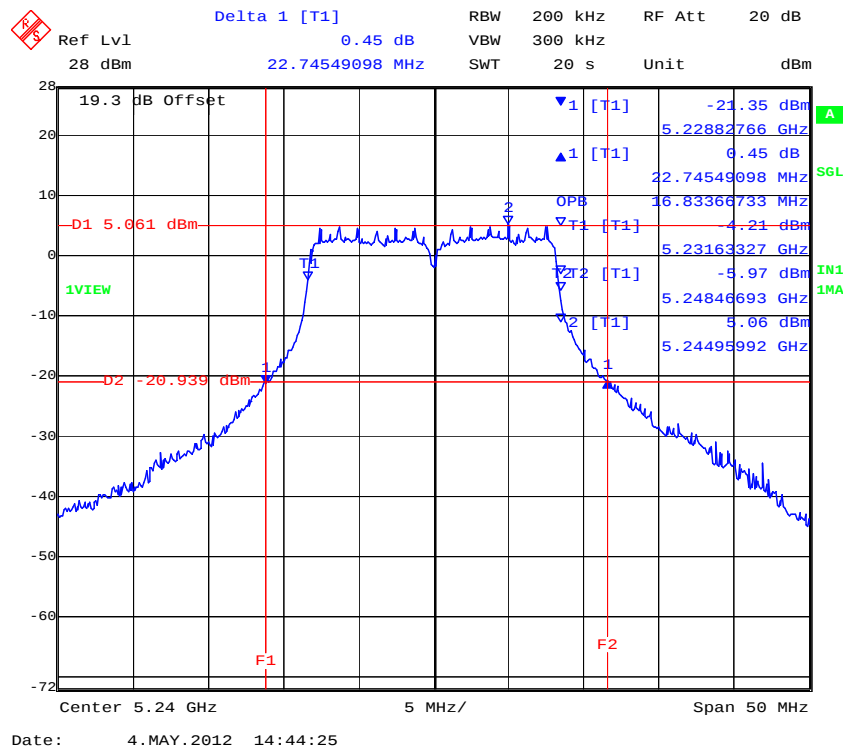


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### PORT A 5,240 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



### PORT B 5,240 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



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# TABLE OF RESULTS – 802.11n HT-20 5150 – 5250 MHz

|                               |               |                            |             |
|-------------------------------|---------------|----------------------------|-------------|
| <b>Test Conditions:</b>       | 15.247 (a)(2) | <b>Rel. Humidity (%):</b>  | 35 to 42    |
| <b>Variant:</b>               | 802.11n HT-20 | <b>Ambient Temp. (°C):</b> | 19 to 22    |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998 to 1003 |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (x):</b>     | 100         |
| <b>Beam Forming Gain (Y):</b> | N/A dB        | <b>Antenna Gain:</b>       | 0 dBi       |
| <b>Applied Voltage:</b>       | 48.0 Vdc      |                            |             |
| <b>Notes 1:</b>               |               |                            |             |
| <b>Notes 2:</b>               |               |                            |             |

## 26 dB Bandwidth

| Test Frequency | 26 dB Bandwidth |        |    |    | Minimum 6dB Bandwidth Limit |     | Margin     |
|----------------|-----------------|--------|----|----|-----------------------------|-----|------------|
|                | MHz             |        |    |    |                             |     |            |
| MHz            | a               | b      | c  | d  | kHz                         | MHz | MHz        |
| 5180           | 24.048          | 23.146 | -- | -- | 500                         | 0.5 | -22.646000 |
| 5200           | 24.048          | 22.946 | -- | -- |                             |     | -22.446000 |
| 5240           | 23.848          | 23.347 | -- | -- |                             |     | -22.847000 |

## 99% Bandwidth

| Test Frequency | 99 % Bandwidth |        |    |    |  |  |  |
|----------------|----------------|--------|----|----|--|--|--|
|                | MHz            |        |    |    |  |  |  |
| MHz            | a              | b      | c  | d  |  |  |  |
| 5180           | 18.036         | 17.936 | -- | -- |  |  |  |
| 5200           | 18.036         | 17.936 | -- | -- |  |  |  |
| 5240           | 17.936         | 17.936 | -- | -- |  |  |  |

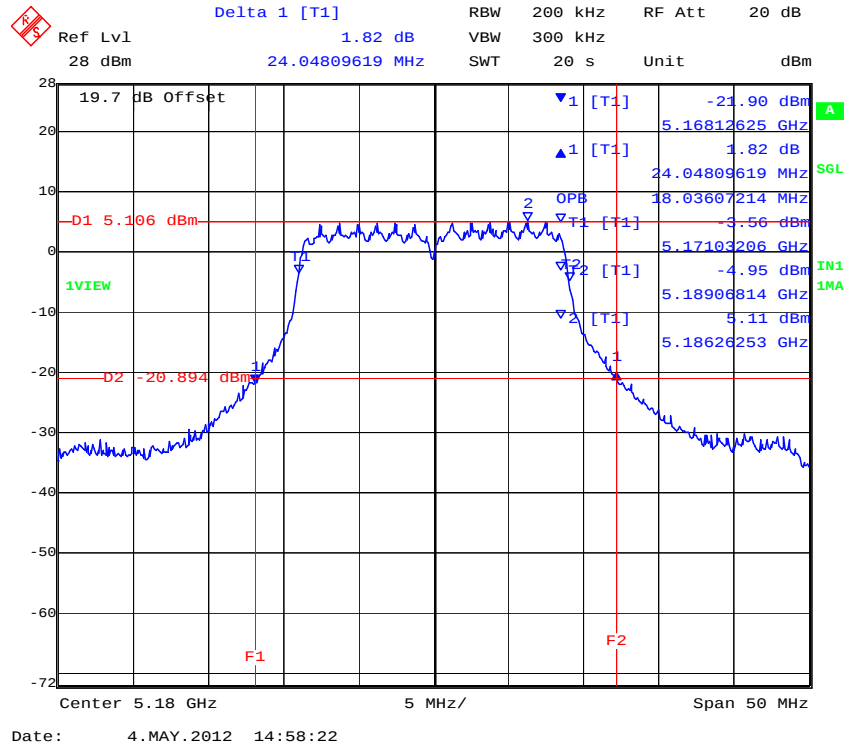
|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±2.81 dB |
|---------------------------------|----------|

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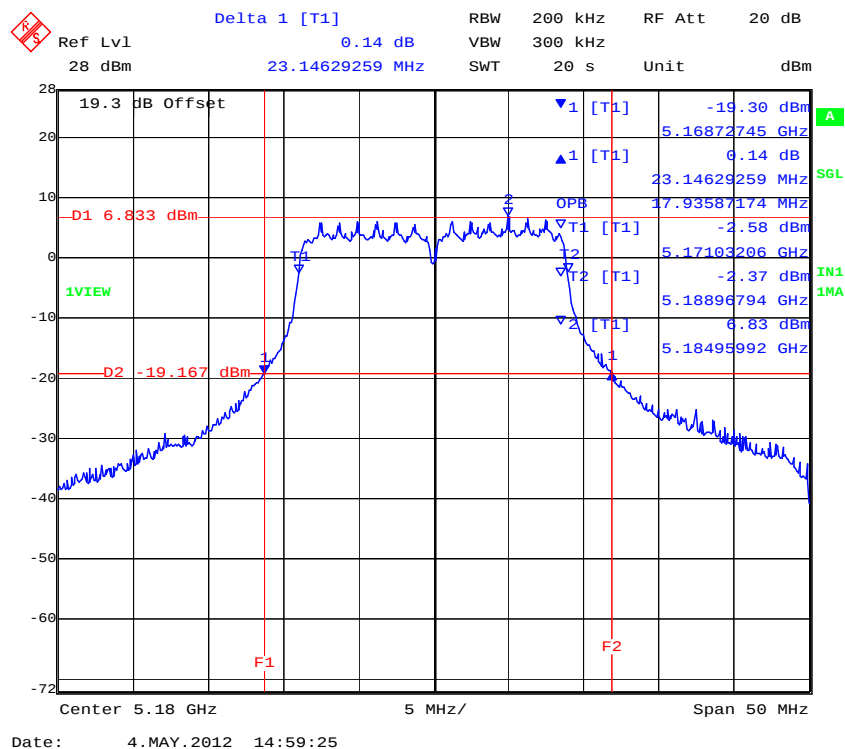


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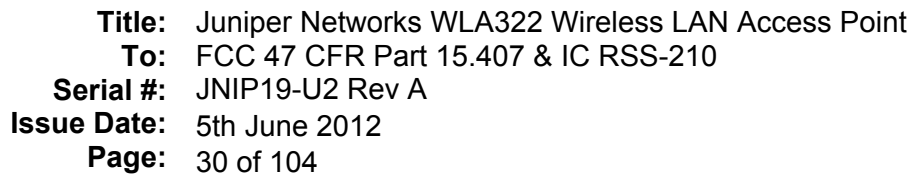
### PORT A 5,180 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



### PORT B 5,180 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



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Ref Lvl 28 dBm

Delta 1 [T1] 2.45 dB

RBW 200 kHz

RF Att 20 dB

VBW 300 kHz

SWT 20 s

Unit dBm

19.7 dB Offset

D1 6.182 dBm

D2 -19.818 dBm

1VIEW

F1

F2

Center 5.2 GHz

5 MHz/

Span 50 MHz

1 [T1] -21.62 dBm

2 [T1] 5.18802605 GHz

1 [T1] 2.45 dB

24.04809619 MHz

2 OPB 18.03607214 MHz

1 [T1] -2.29 dBm

2 [T1] 5.19103206 GHz

1 [T1] -3.97 dBm

2 [T1] 5.20906814 GHz

1 [T1] 6.18 dBm

2 [T1] 5.20626253 GHz

A

SGL

IN1

1MA

Date: 4. MAY. 2012 15:04:59

Delta 1 [T1] 0.13 dB

RBW 200 kHz VBW 300 kHz RF Att 20 dB

Ref Lvl 28 dBm Unit dBm SWT 20 s

19.3 dB Offset

D1 6.302 dBm

1VIEW

D2 -19.698 dBm

F1 F2

Center 5.2 GHz 5 MHz/ Span 50 MHz

▼1 [T1] -19.80 dBm 5.18882766 GHz

▲1 [T1] 0.13 dB 22.94589178 MHz

OPB 17.93587174 MHz

▼T1 [T1] -3.29 dBm 5.19103206 GHz

▼T2 [T1] -3.12 dBm 5.20896794 GHz

▼T [T1] 6.30 dBm 5.20495992 GHz

IN1 1MA

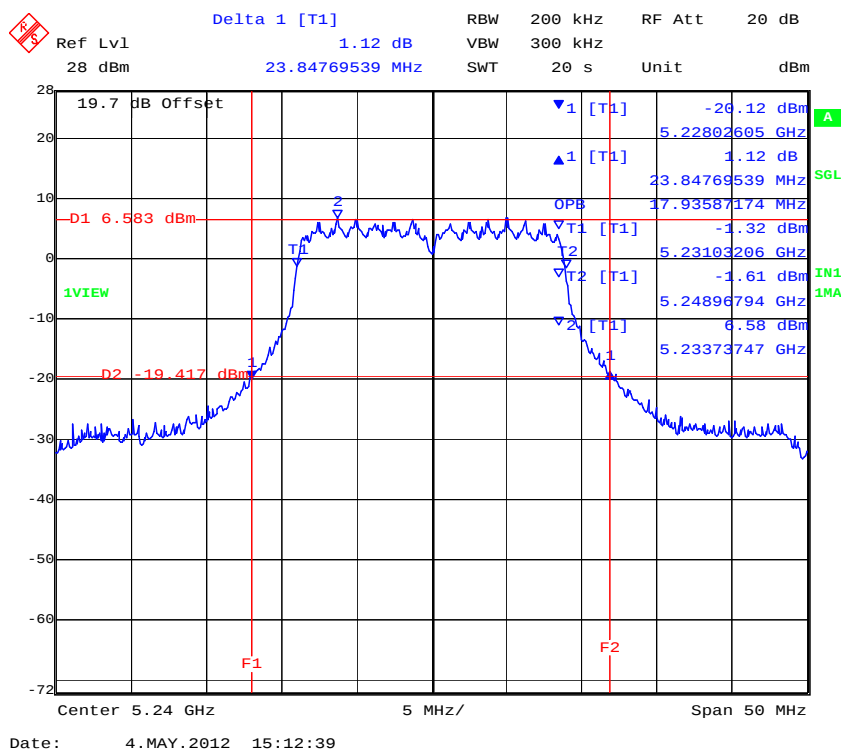
Date: 4. MAY. 2012 15:06:02

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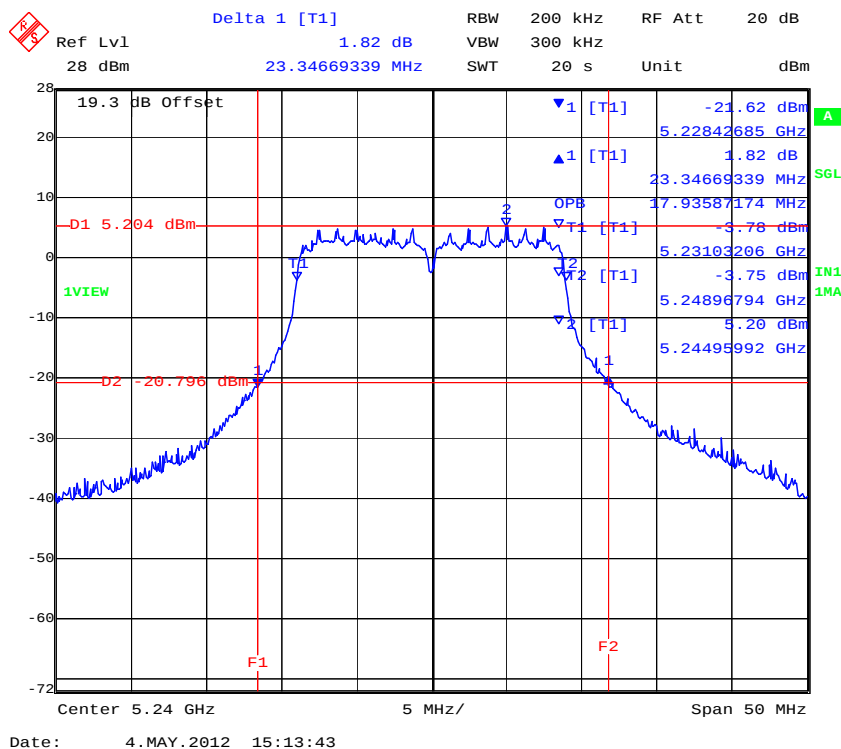


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### PORT A 5,240 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



### PORT B 5,240 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



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**TABLE OF RESULTS – 802.11n HT-40 5150 – 5250 MHz**

|                               |               |                            |             |
|-------------------------------|---------------|----------------------------|-------------|
| <b>Test Conditions:</b>       | 15.247 (a)(2) | <b>Rel. Humidity (%):</b>  | 35 to 42    |
| <b>Variant:</b>               | 802.11n HT-40 | <b>Ambient Temp. (°C):</b> | 19 to 22    |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998 to 1003 |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (x):</b>     | 100         |
| <b>Beam Forming Gain (Y):</b> | N/A dB        | <b>Antenna Gain:</b>       | 0 dBi       |
| <b>Applied Voltage:</b>       | 48.0 Vdc      |                            |             |
| <b>Notes 1:</b>               |               |                            |             |
| <b>Notes 2:</b>               |               |                            |             |

**26 dB Bandwidth**

| Test Frequency | 26 dB Bandwidth |        |    |    | Minimum 6dB Bandwidth Limit |     | Margin     |
|----------------|-----------------|--------|----|----|-----------------------------|-----|------------|
|                | MHz             |        |    |    |                             |     |            |
| MHz            | a               | b      | c  | d  | kHz                         | MHz | MHz        |
| 5190           | 75.351          | 44.289 | -- | -- | 500                         | 0.5 | -43.789000 |
| 5230           | 72.946          | 44.289 | -- | -- |                             |     | -43.789000 |

**99% Bandwidth**

| 99 % Bandwidth |                |        |    |    |  |  |  |
|----------------|----------------|--------|----|----|--|--|--|
| Test Frequency | 99 % Bandwidth |        |    |    |  |  |  |
|                | MHz            |        |    |    |  |  |  |
| MHz            | a              | b      | c  | d  |  |  |  |
| 5190           | 36.673         | 36.473 | -- | -- |  |  |  |
| 5230           | 36.673         | 36.473 | -- | -- |  |  |  |

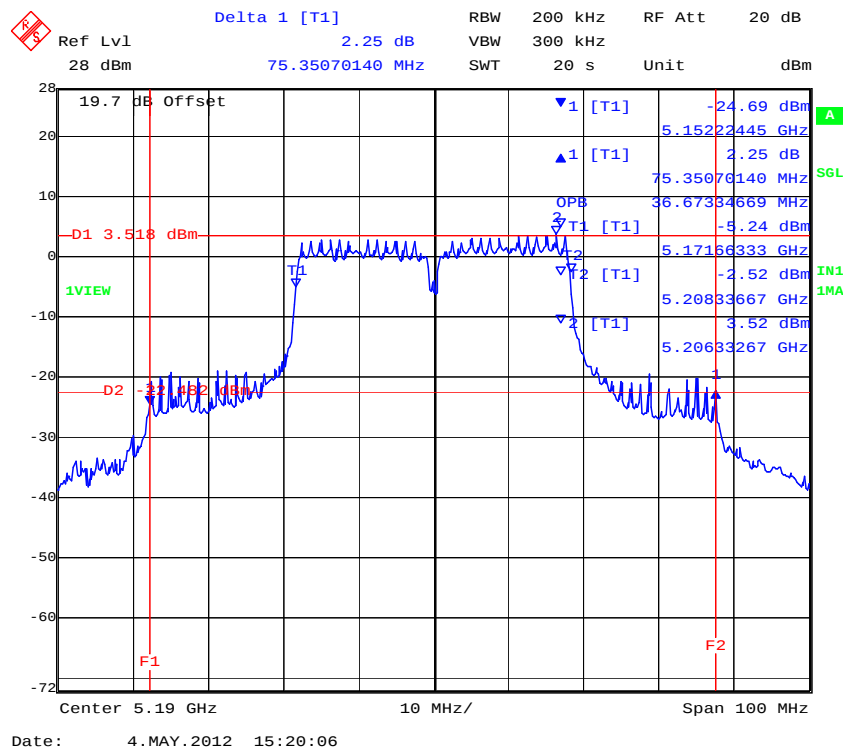
|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±2.81 dB |
|---------------------------------|----------|

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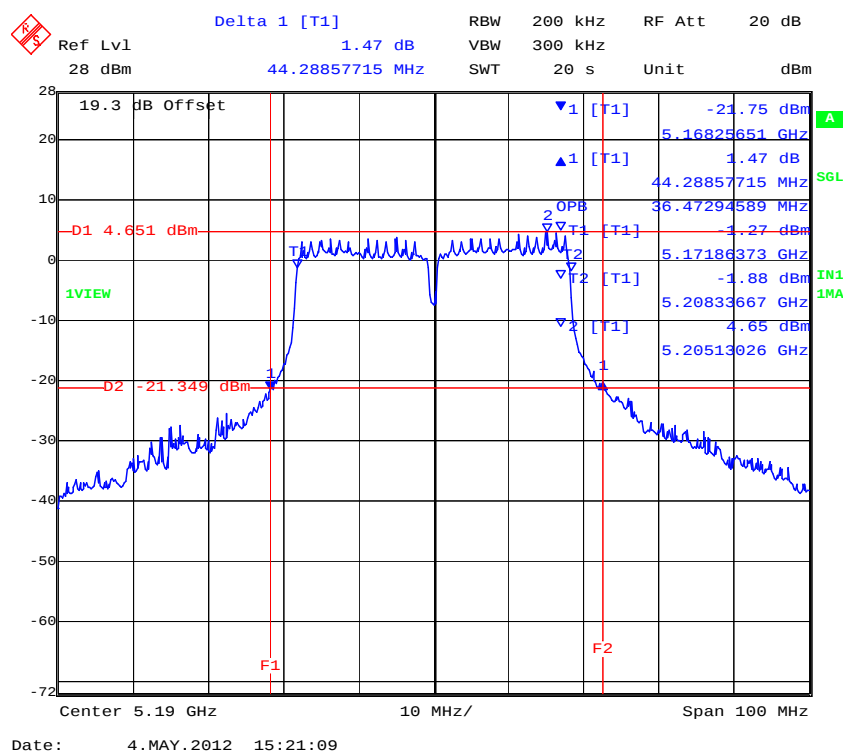


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### PORT A 5,190 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



### PORT B 5,190 MHz 802.11n HT-40 26 dB and 99 % Bandwidth

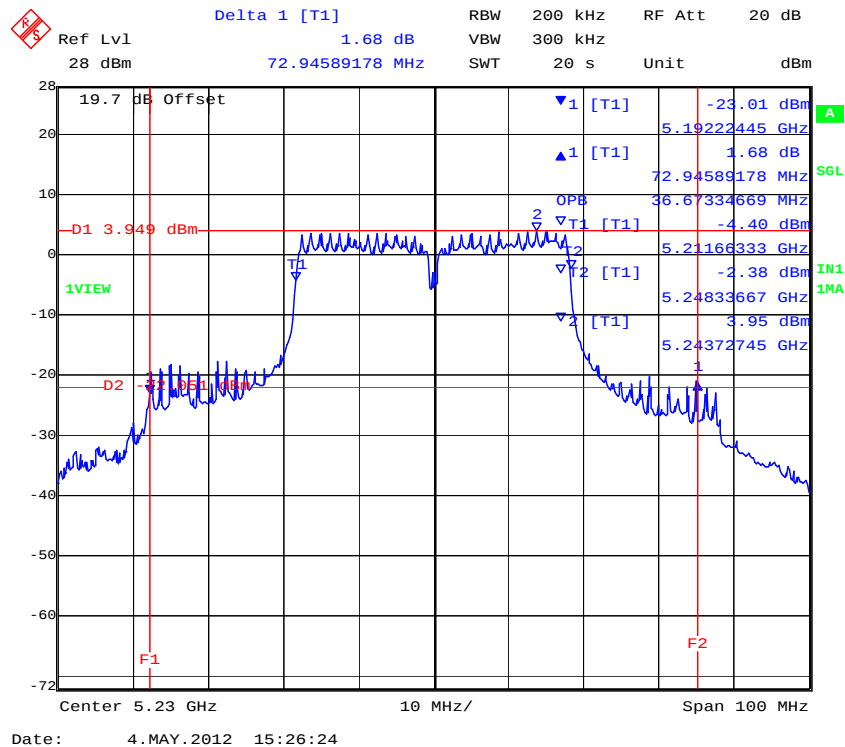


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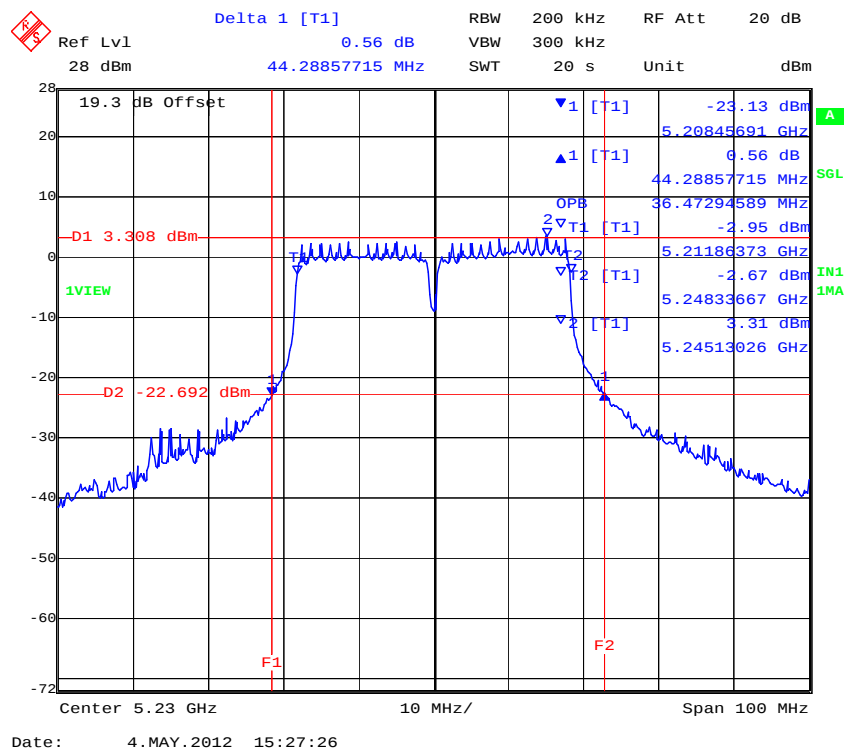


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### PORT A 5,230 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



### PORT B 5,230 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



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## Specification

### Limits

#### **FCC, Part 15 §15.407 (a)(1), (a)(2) and Industry Canada RSS-210 § A9.2(2)**

**(a)(1)** For the band 5.15-5.25 GHz the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or +4 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed +4 dBm in any 1 megahertz band.

**(a)(2)** For the 5.25-5.35 GHz band the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or +11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed +11 dBm in any 1 megahertz band.

#### **Industry Canada RSS-Gen 4.4**

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

## Laboratory Measurement Uncertainty for Spectrum Measurement

|                         |          |
|-------------------------|----------|
| Measurement uncertainty | ±2.81 dB |
|-------------------------|----------|

## Traceability

| Method                                                                              | Test Equipment Used                            |
|-------------------------------------------------------------------------------------|------------------------------------------------|
| Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask' | 0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117 |

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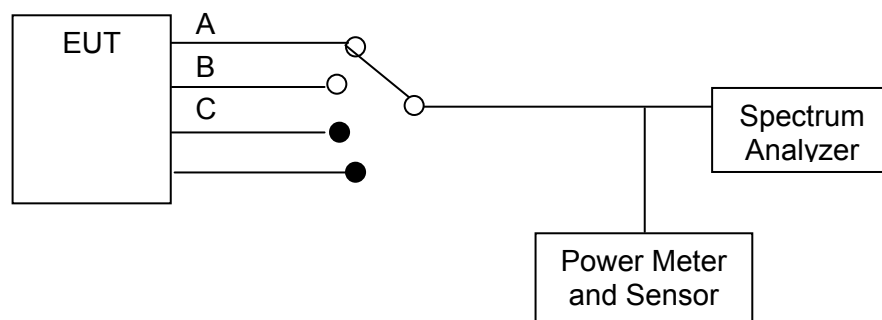
### 5.1.2. Transmit Output Power

**FCC, Part 15 Subpart C §15.407(a)**  
**Industry Canada RSS-210 §9.9(2)**  
**Industry Canada RSS-Gen 4.6**

#### Test Procedure

The transmitter terminal of EUT was connected to the input of an average power meter. Measurements were made while EUT was operating in a continuous transmission mode i.e. 100 % duty cycle at the appropriate center frequency. All cable losses and offsets were taken into consideration in the measured result.

#### Test Measurement Set up



Measurement set up for Transmitter Output Power



### Antenna Beam and Non-Beam Forming Power Levels

15. 407 (a)(1), (a) (2) Operation with directional antenna gains greater than 6 dBi.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. Further FCC KDB 662911 D01 Multiple Transmitter Output v01 requires that the gain of antennas transmitting the same data (legacy 802.11a mode) must be increased by  $10 * \log(N)$  when N is the number of antenna elements.

### Operating Frequency Band 5150-5250 MHz

| Antenna  | Gain  | Max. Allowable Conducted Peak Power (dBm) |              | Maximum EIRP |
|----------|-------|-------------------------------------------|--------------|--------------|
| (dB)     | (dBi) | Non-Beam Forming                          | Beam Forming | (dBm)        |
| Integral | 0.0   | +17.0                                     | +12.23       | +23.0        |

### MIMO Operation 5250-5350 and 5470 – 5725 MHz

| Antenna  | Gain  | Max. Allowable Conducted Peak Power (dBm) |              | Maximum EIRP |
|----------|-------|-------------------------------------------|--------------|--------------|
| (dB)     | (dBi) | Non-Beam Forming                          | Beam Forming | (dBm)        |
| Integral | 0.0   | +24.00                                    | +19.23       | +24.00       |

The WLA322 does not implement beam-forming



## Maximum Transmit (Conducted) Power, FCC Limits and Industry Canada Limits

### Bands 5150 – 5250 MHz

#### FCC Limits

Conducted Power Limit lesser of: 50 mW or 4 dBm + 10 log (B) dBm. B is the 26 dB emission bandwidth in MHz.

| Mode  | Frequency Range (MHz) | Minimum 26 dB Bandwidth (MHz) | 4 + 10 Log (B) (dBm) | Limit (dBm) |
|-------|-----------------------|-------------------------------|----------------------|-------------|
| a     | 5150 – 5250           | 20.04                         | +17.02               | +17.00      |
| HT-20 |                       | 22.95                         | +17.61               | +17.00      |
| HT-40 |                       | 44.29                         | +20.46               | +17.00      |

#### Industry Canada Limits

EIRP Limit 5150 – 5250 MHz: Lesser of 200 mW (+23 dBm) or 10 + 10 Log (B) dBm. B is the 99% emission bandwidth in MHz.

| Mode  | Frequency Range (MHz) | Minimum 99 % Bandwidth (MHz) | 4 + 10 Log (B) (dBm) | EIRP Limit (dBm) |
|-------|-----------------------|------------------------------|----------------------|------------------|
| a     | 5150 – 5250           | 16.834                       | +16.25               | +22.26           |
| HT-20 |                       | 17.936                       | +16.41               | +22.54           |
| HT-40 |                       | 36.473                       | +25.62               | +23.00           |



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### Measurement Results for Transmit Output Power

Ambient conditions.

Temperature: 17 to 23 °C      Relative humidity: 31 to 57 %      Pressure: 999 to 1012 mbar

EUT parameters.

Power Level: Maximum

Duty Cycle: 100%

Temperature: Ambient

### TABLE OF RESULTS – 802.11a Legacy 5150 – 5250 MHz

|                               |               |                            |     |    |       |
|-------------------------------|---------------|----------------------------|-----|----|-------|
| <b>Test Conditions:</b>       | 15.407 (a)(1) | <b>Rel. Humidity (%):</b>  | 35  | to | 42    |
| <b>Variant:</b>               | 802.11a       | <b>Ambient Temp. (°C):</b> | 19  | to | 22    |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998 | to | 1003  |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (x):</b>     | 100 |    |       |
| <b>Beam Forming Gain (Y):</b> | N/A      dB   | <b>Antenna Gain:</b>       |     |    | 0 dBi |
| <b>Applied Voltage:</b>       | 48.0      Vdc |                            |     |    |       |
| <b>Notes 1:</b>               |               |                            |     |    |       |
| <b>Notes 2:</b>               |               |                            |     |    |       |

| Test Frequency | Measured Peak Power |       |    |    | Total Power (dBm) |            | Limit | Margin |
|----------------|---------------------|-------|----|----|-------------------|------------|-------|--------|
|                | RF Port (dBm)       |       |    |    |                   |            |       |        |
| MHz            | a                   | b     | c  | d  | Combined          | Calculated | dBm   | dB     |
| 5180           | 13.47               | 14.44 | -- | -- | N/A               | 16.99      | 17.00 | -0.01  |
| 5200           | 14.11               | 13.70 | -- | -- | N/A               | 16.92      | 17.00 | -0.08  |
| 5240           | 14.34               | 13.29 | -- | -- | N/A               | 16.86      | 17.00 | -0.14  |

|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±1.33 dB |
|---------------------------------|----------|

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# TABLE OF RESULTS – 802.11n HT20 5150 – 5250 MHz

|                               |               |                            |       |    |      |
|-------------------------------|---------------|----------------------------|-------|----|------|
| <b>Test Conditions:</b>       | 15.407 (a)(1) | <b>Rel. Humidity (%):</b>  | 35    | to | 42   |
| <b>Variant:</b>               | 802.11n HT-20 | <b>Ambient Temp. (°C):</b> | 19    | to | 22   |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998   | to | 1003 |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (x):</b>     | 100   |    |      |
| <b>Beam Forming Gain (Y):</b> | N/A dB        | <b>Antenna Gain:</b>       | 0 dBi |    |      |
| <b>Applied Voltage:</b>       | 48.0 Vdc      |                            |       |    |      |
| <b>Notes 1:</b>               |               |                            |       |    |      |
| <b>Notes 2:</b>               |               |                            |       |    |      |

| Test Frequency | Measured Peak Power |       |    |    | Total Power (dBm) |            | Limit | Margin |
|----------------|---------------------|-------|----|----|-------------------|------------|-------|--------|
|                | RF Port (dBm)       |       |    |    | Combined          | Calculated |       |        |
| MHz            | a                   | b     | c  | d  |                   |            | dBm   | dB     |
| 5180           | 13.45               | 14.30 | -- | -- | N/A               | 16.91      | 17.00 | -0.09  |
| 5200           | 14.19               | 13.72 | -- | -- | N/A               | 16.97      | 17.00 | -0.03  |
| 5240           | 14.35               | 13.23 | -- | -- | N/A               | 16.84      | 17.00 | -0.16  |

|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±1.33 dB |
|---------------------------------|----------|

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TABLE OF RESULTS – 802.11n HT40 5150 – 5250 MHz

|                               |               |                            |       |    |      |
|-------------------------------|---------------|----------------------------|-------|----|------|
| <b>Test Conditions:</b>       | 15.407 (a)(1) | <b>Rel. Humidity (%):</b>  | 35    | to | 42   |
| <b>Variant:</b>               | 802.11n HT-40 | <b>Ambient Temp. (°C):</b> | 19    | to | 22   |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998   | to | 1003 |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (x):</b>     | 100   |    |      |
| <b>Beam Forming Gain (Y):</b> | N/A dB        | <b>Antenna Gain:</b>       | 0 dBi |    |      |
| <b>Applied Voltage:</b>       | 48.0 Vdc      |                            |       |    |      |
| <b>Notes 1:</b>               |               |                            |       |    |      |
| <b>Notes 2:</b>               |               |                            |       |    |      |

| Test Frequency | Measured Peak Power |       |    |    | Total Power (dBm) |            | Limit | Margin |
|----------------|---------------------|-------|----|----|-------------------|------------|-------|--------|
|                | RF Port (dBm)       |       |    |    |                   |            |       |        |
| MHz            | a                   | b     | c  | d  | Combined          | Calculated | dBm   | dB     |
| 5190           | 13.25               | 14.42 | -- | -- | N/A               | 16.88      | 17.00 | -0.12  |
| 5230           | 13.89               | 13.99 | -- | -- | N/A               | 16.95      | 17.00 | -0.05  |

|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±1.33 dB |
|---------------------------------|----------|

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## Specification

### Limits

#### **FCC, Part 15 §15.407 (a)(1), (a)(2) and Industry Canada RSS-210 § A9.2(2)**

**(a)(1)** For the band 5.15-5.25 GHz the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or  $+4 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed +4 dBm in any 1 megahertz band.

**(a)(2)** For the 5.25-5.35 and 5470-5725 MHz GHz band the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $+11 \text{ dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed +11 dBm in any 1 megahertz band.

#### **Industry Canada RSS-210 §A9.2(2)**

For the band 5150-5250 MHz, the maximum equivalent isotropically radiated power (e.i.r.p.) shall not exceed 200 mW or  $10 + 10 \log_{10} B$ , dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

For the band 5250-5350 MHz and 5470-5725 MHz, the maximum conducted output power shall not exceed 250 mW or  $11 + 10 \log_{10} B$ , dBm, whichever power is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band. The maximum e.i.r.p. shall not exceed 1.0 W or  $17 + 10 \log_{10} B$ , dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

#### **Industry Canada RSS-Gen 4.4**

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

## Laboratory Measurement Uncertainty for Power Measurements

|                         |                       |
|-------------------------|-----------------------|
| Measurement uncertainty | $\pm 1.33 \text{ dB}$ |
|-------------------------|-----------------------|

## Traceability

| Method                                                                        | Test Equipment Used                            |
|-------------------------------------------------------------------------------|------------------------------------------------|
| Measurements were made per work instruction WI-01 'Measuring RF Output Power' | 0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117 |

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### **5.1.3. Peak Power Spectral Density**

**FCC, Part 15 Subpart C §15.407(a)**  
**Industry Canada RSS-210 § A9.2(2)**

#### **Test Procedure**

The transmitter output was connected to a spectrum analyzer and the peak power spectral density measured. Method 2 Sample Detection and power averaging, specified in FCC document DA 02-2138 (Normative Reference (ix) Section 2.1 “Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices”) was used to determine the peak power spectral density of the emission for each antenna port. The Peak Power Spectral Density is the highest level found across the emission in a 1 MHz resolution bandwidth.

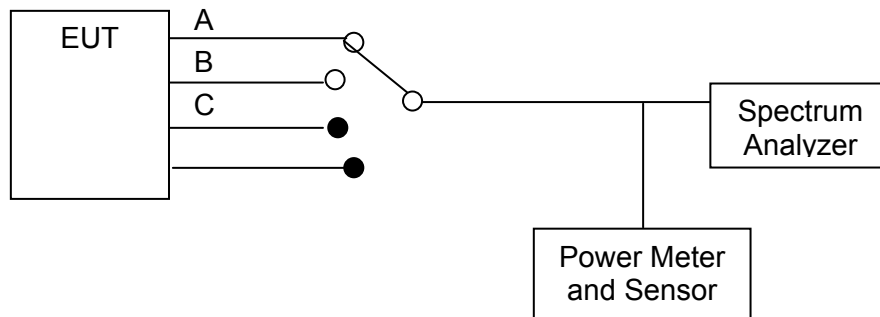
### **Emissions Testing of Transmitters with Multiple Outputs in the Same Band**

The In-Band power spectral density was measured using the measure and sum approach per FCC KDB 662911 (D01 Multiple Transmitter Output v01.)

(1) 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 [i.e., for a device with N transmitter outputs, if the spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value (in watts or milliwatts) in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the Nth output to obtain the value for the first frequency bin of the summed spectrum. The summed spectrum value for each of the other frequency bins is computed in the same way.

The summed spectral values were calculated on a computer and the results read as a data file by the spectrum analyzer to produce plot of total power density across the spectra.

### Test Measurement Set up



Measurement set up for Peak Power Spectral Density

### Measurement Results for Peak Power Spectral Density

Ambient conditions.

Temperature: 17 to 23 °C

Relative humidity: 31 to 57 %

Pressure: 999 to 1012 mbar

### Radio Parameters

Duty Cycle: 100%

Output: Modulated Carrier

Power: Maximum Default Power



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**TABLE OF RESULTS – 802.11a Legacy 5150 – 5250 MHz**

|                        |            |                     |       |    |      |
|------------------------|------------|---------------------|-------|----|------|
| Test Conditions:       | 15.407 (a) | Rel. Humidity (%):  | 35    | to | 42   |
| Variant:               | 802.11a    | Ambient Temp. (°C): | 19    | to | 22   |
| TPC:                   | HIGH       | Pressure (mBars):   | 998   | to | 1003 |
| Modulation:            | ON         | Duty Cycle (%):     | 100   |    |      |
| Beam Forming Gain (Y): | N/A dB     | Antenna Gain:       | 0 dBi |    |      |
| Applied Voltage:       | 48.0 Vdc   | Antenna Ports (N):  | 2     |    |      |
| Notes 1:               |            |                     |       |    |      |
| Notes 2:               |            |                     |       |    |      |

| Test Frequency | Measured Peak Power |      |    |    | Correction factor | Peak Power Spectral Density | Limit | Margin |
|----------------|---------------------|------|----|----|-------------------|-----------------------------|-------|--------|
|                | RF Port (dBm)       |      |    |    |                   |                             |       |        |
| MHz            | a                   | b    | c  | d  | 10Log(N)          | dBm                         | dBm   | dB     |
| 5180           | 0.09                | 0.04 | -- | -- | 3.01              | 3.10                        | 4.00  | -0.90  |
| 5200           | 1.19                | 1.05 | -- | -- | 3.01              | 3.43                        | 4.00  | -0.57  |
| 5240           | 1.19                | 0.20 | -- | -- | 3.01              | 3.28                        | 4.00  | -0.72  |

|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±1.33 dB |
|---------------------------------|----------|

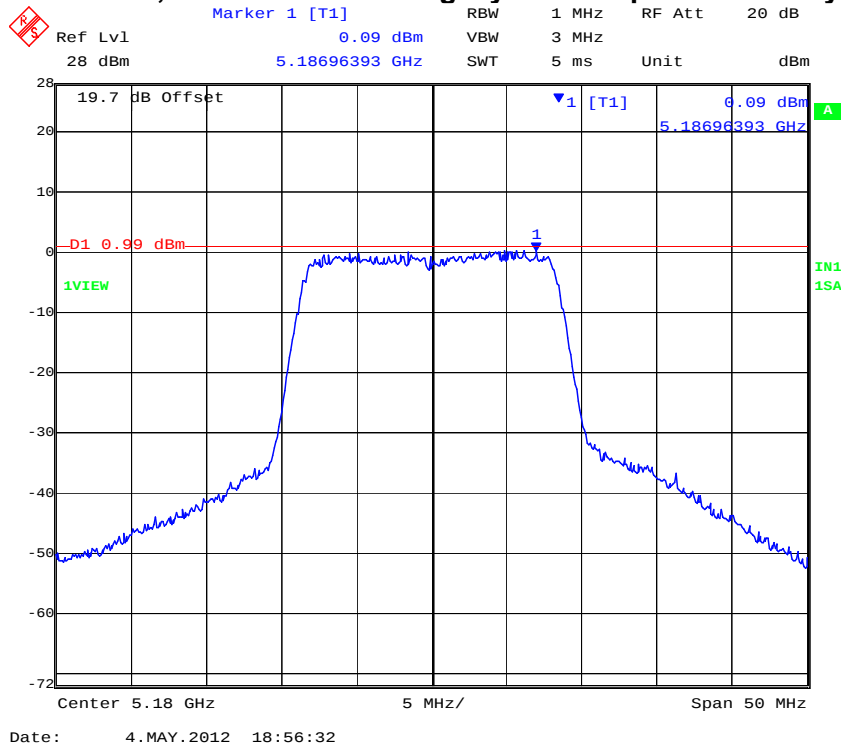
NOTE: For frequencies 5200 and 5240 MHz an arithmetic summation of spectrum (Chain a and b) was required in order to prove compliance. Plots for the individual contribution and summation configurations have been included.

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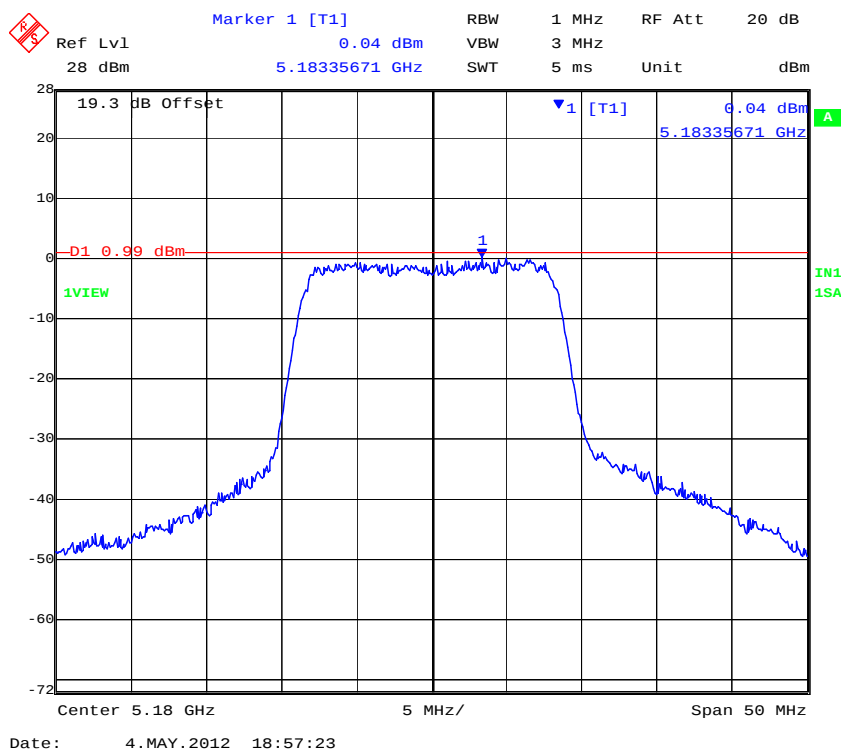


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### PORT A 5,180 MHz 802.11a Legacy Power Spectral Density



### PORT B 5,180 MHz 802.11a Legacy Power Spectral Density

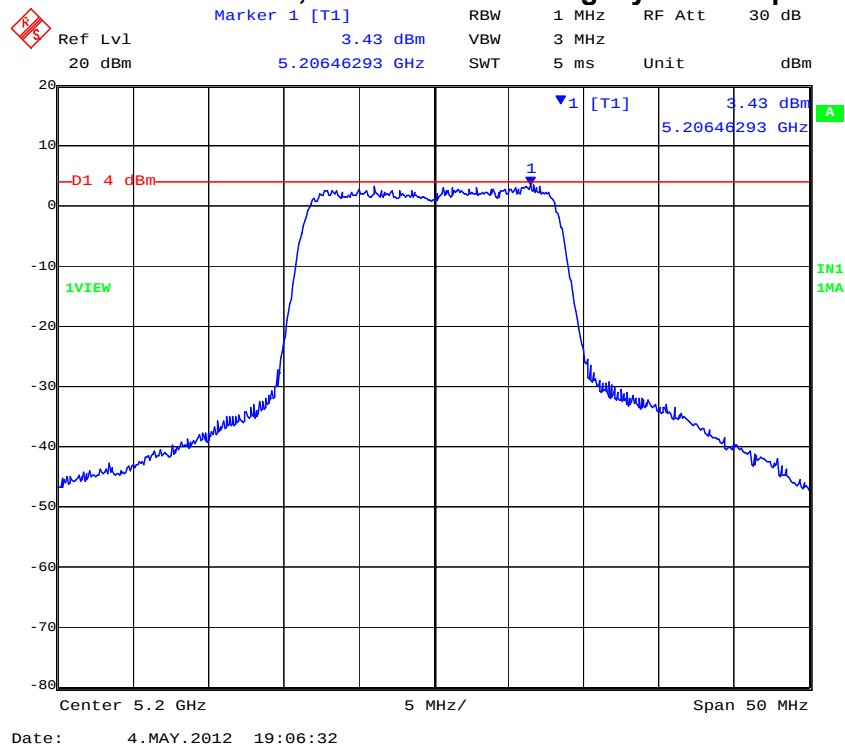


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### SUMMATION PORT A and B 5,200 MHz 802.11a Legacy Power Spectral Density

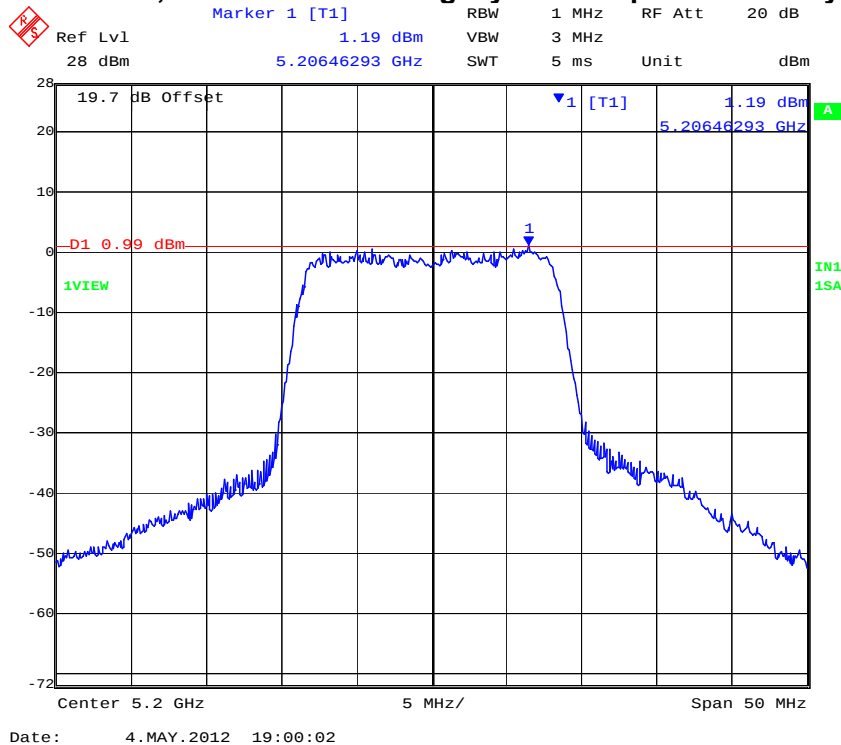


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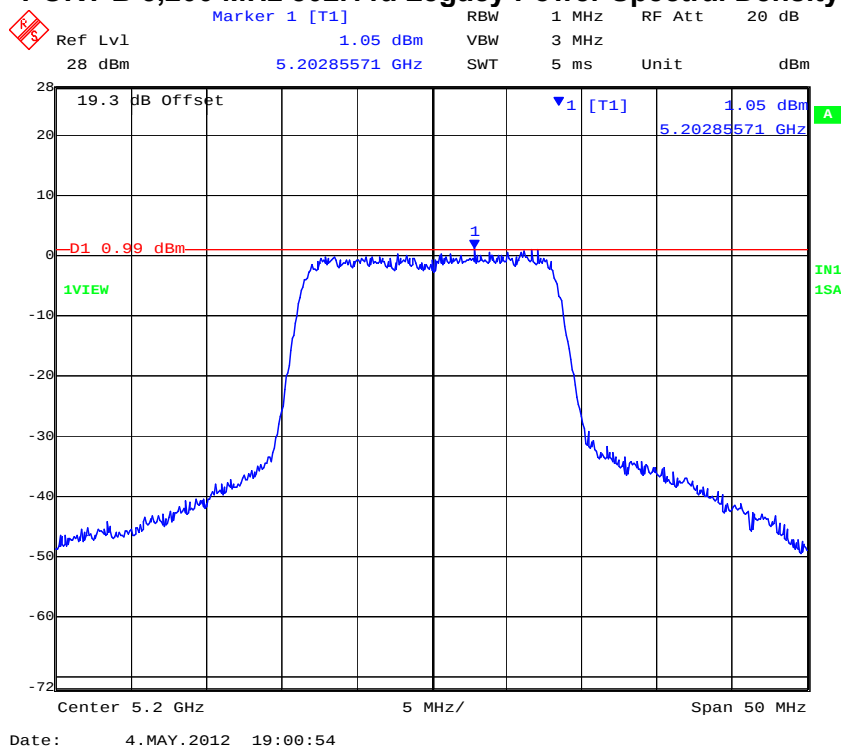


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### PORT A 5,200 MHz 802.11a Legacy Power Spectral Density



### PORT B 5,200 MHz 802.11a Legacy Power Spectral Density

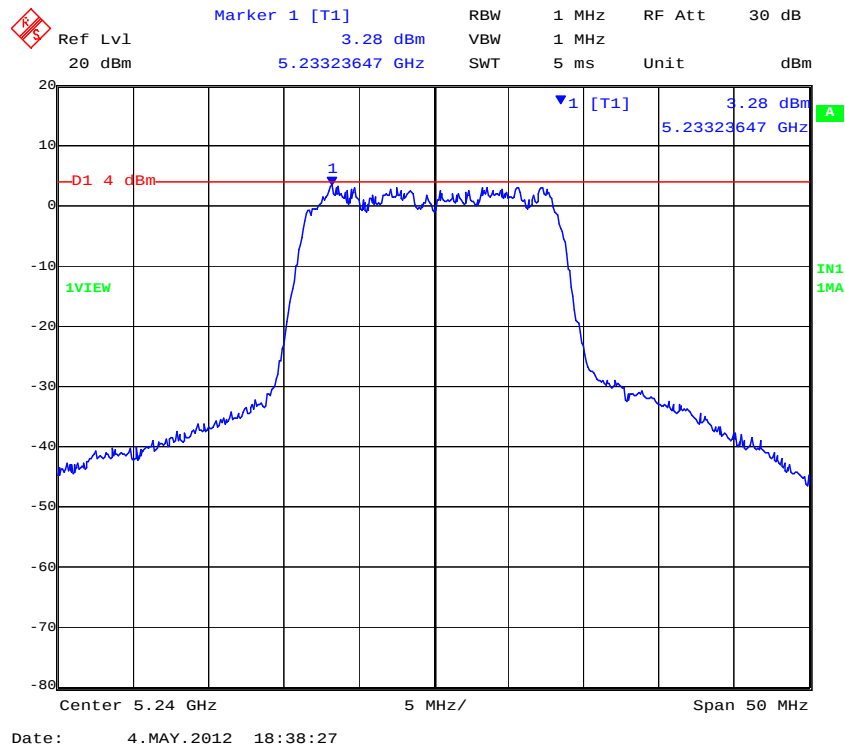


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### SUMMATION PORT A and B 5,240 MHz 802.11a Legacy Power Spectral Density

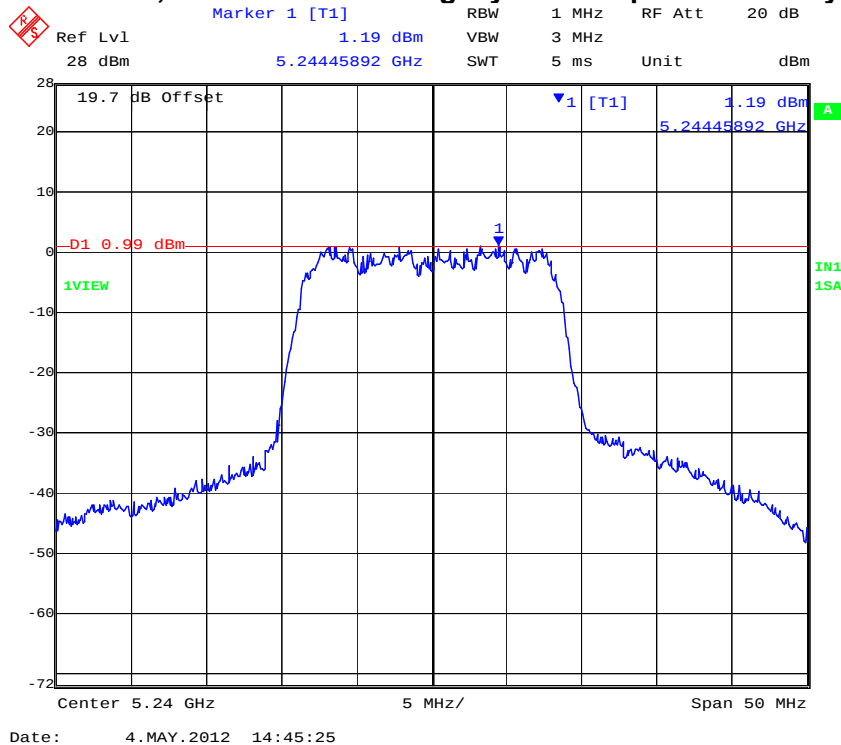


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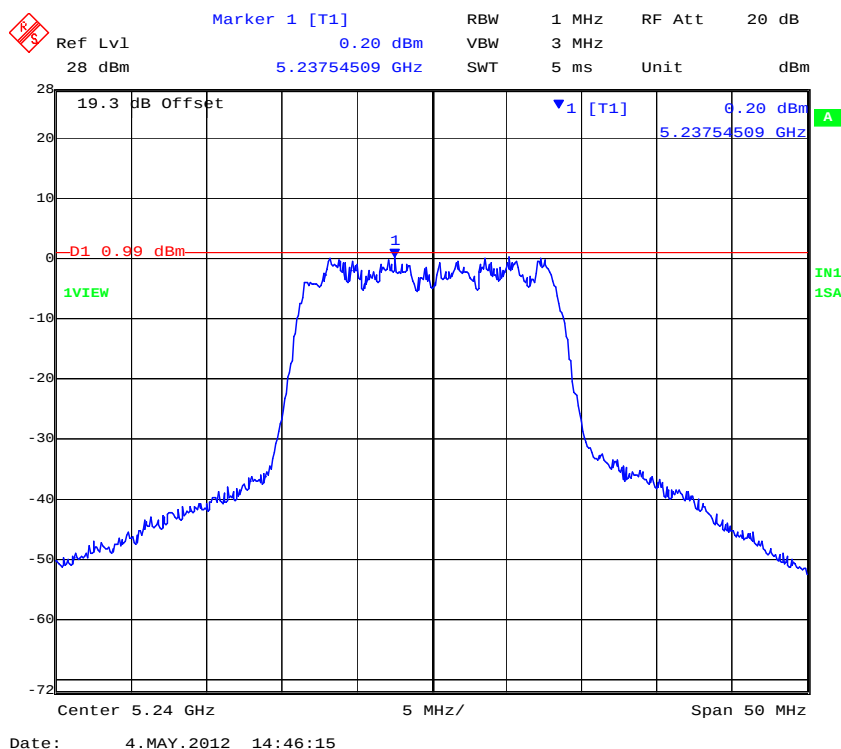


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### PORT A 5,240 MHz 802.11a Legacy Power Spectral Density



### PORT B 5,240 MHz 802.11a Legacy Power Spectral Density



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**TABLE OF RESULTS – 802.11n HT-20 5150 – 5250 MHz**

|                               |               |                            |       |    |      |
|-------------------------------|---------------|----------------------------|-------|----|------|
| <b>Test Conditions:</b>       | 15.407 (a)    | <b>Rel. Humidity (%):</b>  | 35    | to | 42   |
| <b>Variant:</b>               | 802.11n HT-20 | <b>Ambient Temp. (°C):</b> | 19    | to | 22   |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998   | to | 1003 |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (%):</b>     | 100   |    |      |
| <b>Beam Forming Gain (Y):</b> | N/A dB        | <b>Antenna Gain:</b>       | 0 dBi |    |      |
| <b>Applied Voltage:</b>       | 48.0 Vdc      | <b>Antenna Ports (N):</b>  | 2     |    |      |
| <b>Notes 1:</b>               |               |                            |       |    |      |
| <b>Notes 2:</b>               |               |                            |       |    |      |

| Test Frequency | Measured Peak Power |       |    |    | Correction factor | Peak Power Spectral Density | Limit | Margin |
|----------------|---------------------|-------|----|----|-------------------|-----------------------------|-------|--------|
|                | RF Port (dBm)       |       |    |    |                   |                             |       |        |
| MHz            | a                   | b     | c  | d  | 10Log(N)          | dBm                         | dBm   | dB     |
| 5180           | 0.29                | 1.65  | -- | -- | 3.01              | 3.47                        | 4.00  | -0.53  |
| 5200           | 1.55                | 0.83  | -- | -- | 3.01              | 3.53                        | 4.00  | -0.47  |
| 5240           | 0.87                | -0.68 | -- | -- | 3.01              | 3.88                        | 4.00  | -0.12  |

|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±1.33 dB |
|---------------------------------|----------|

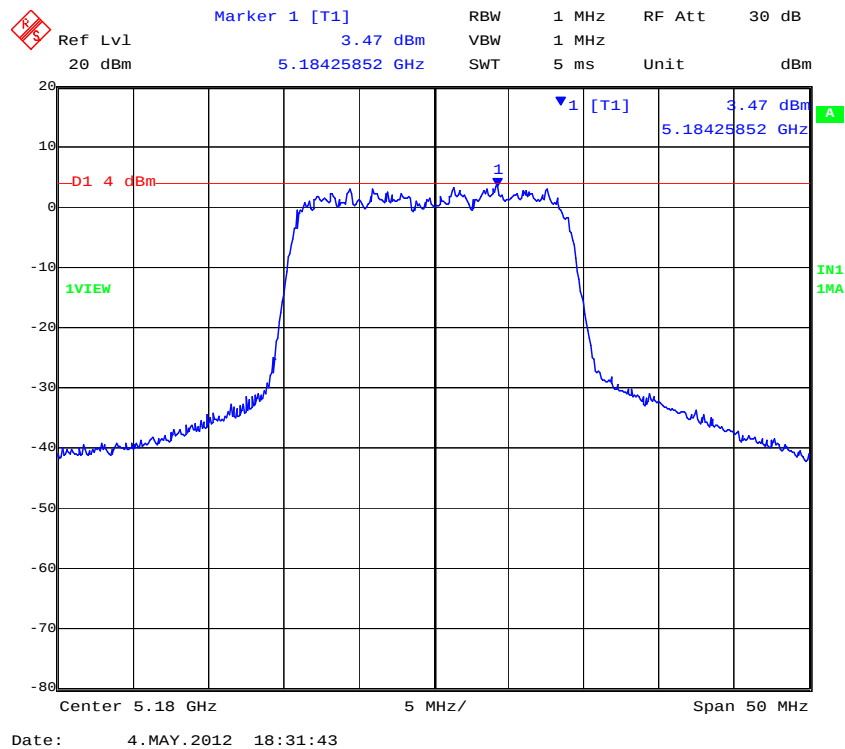
NOTE: For frequencies 5180 and 5200 MHz an arithmetic summation of spectrum (Chain a and b) was required in order to prove compliance. Plots for the individual contribution and summation configurations have been included

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### SUMMATION PORT A and B 5,180 MHz 802.11n HT-20 Power Spectral Density

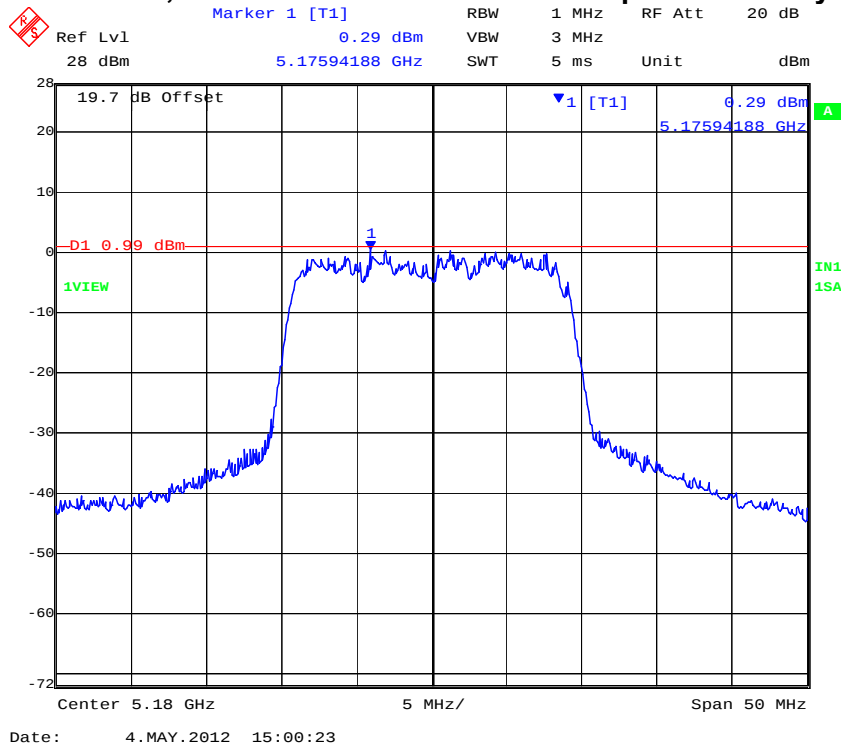


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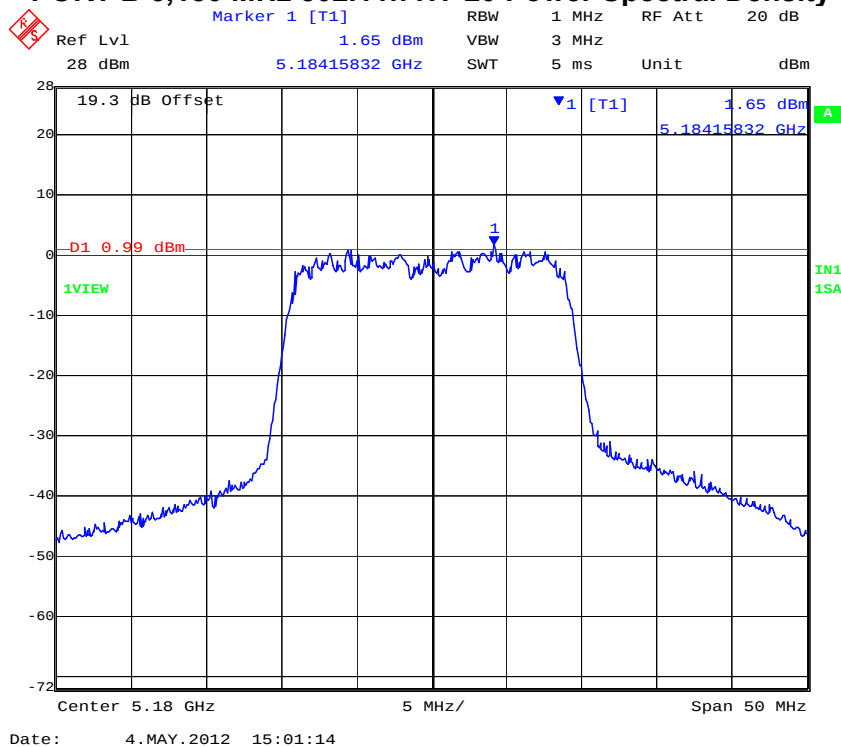


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### PORT A 5,180 MHz 802.11n HT-20 Power Spectral Density



### PORT B 5,180 MHz 802.11n HT-20 Power Spectral Density

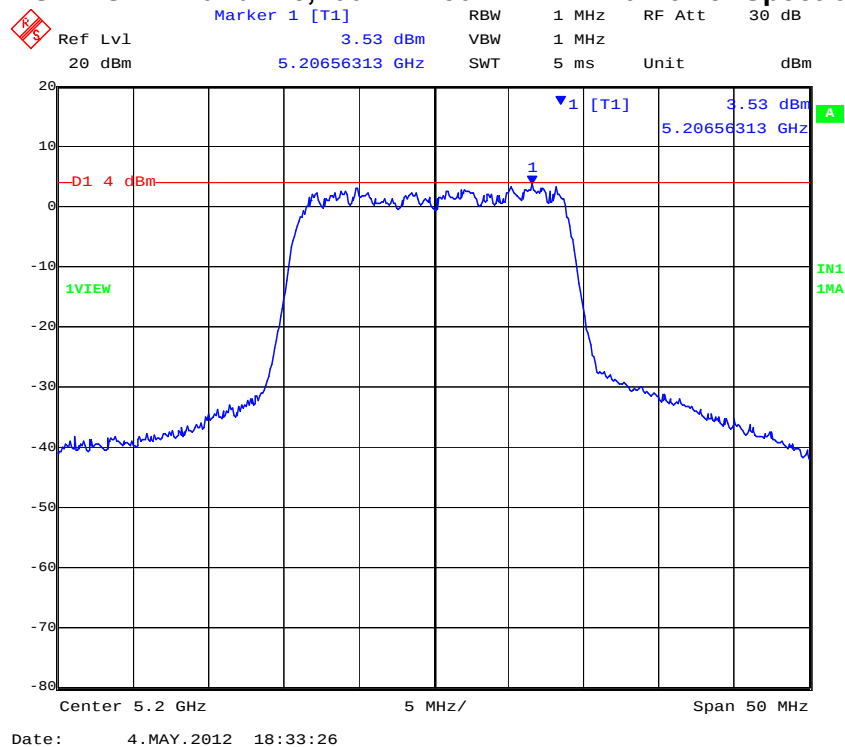


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### SUMMATION PORT A and B 5,200 MHz 802.11n HT-20 Power Spectral Density

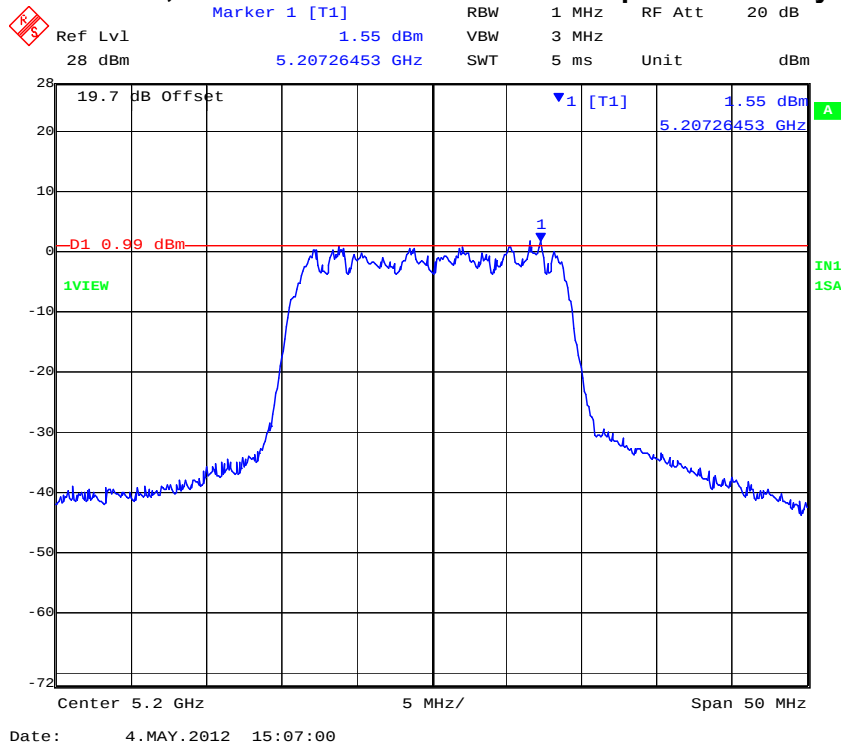


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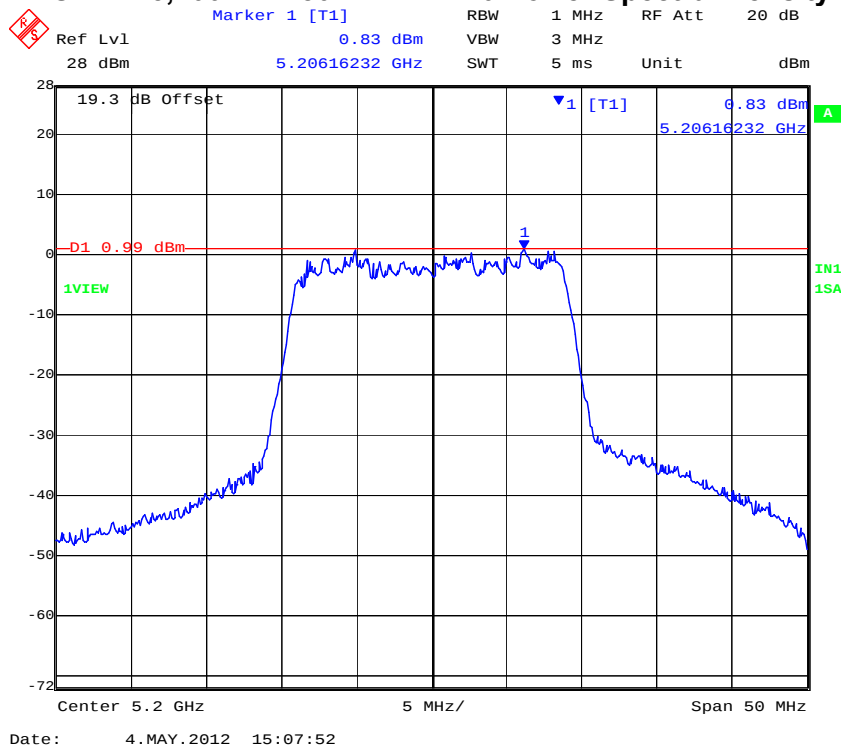


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### PORT A 5,200 MHz 802.11n HT-20 Power Spectral Density



### PORT A 5,200 MHz 802.11n HT-20 Power Spectral Density

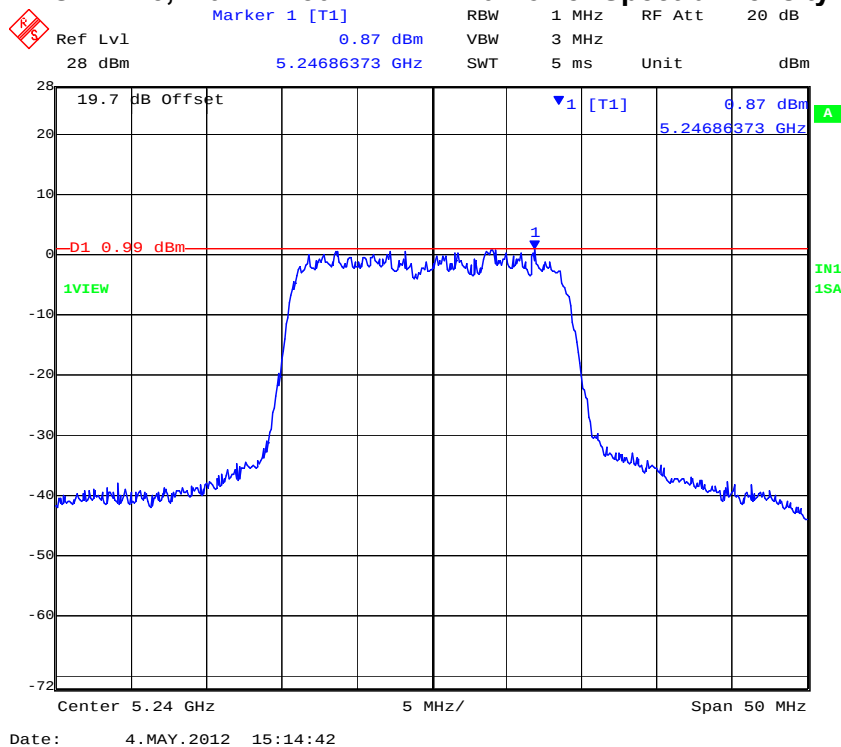


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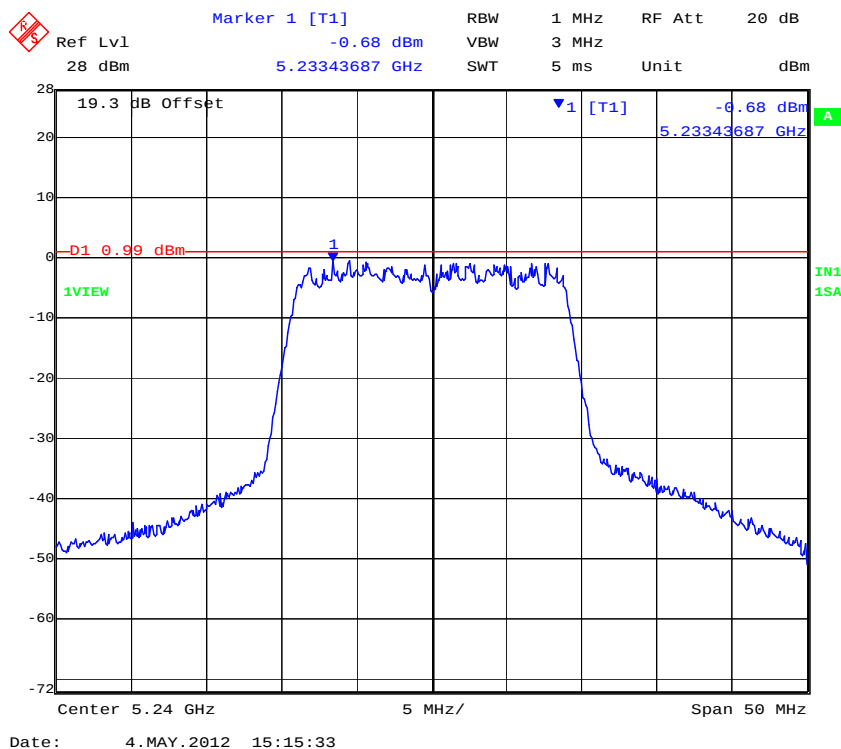


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### PORT A 5,240 MHz 802.11n HT-20 Power Spectral Density



### PORT B 5,240 MHz 802.11n HT-20 Power Spectral Density



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**TABLE OF RESULTS – 802.11n HT-40 5150 – 5250 MHz**

|                               |               |                            |       |    |      |
|-------------------------------|---------------|----------------------------|-------|----|------|
| <b>Test Conditions:</b>       | 15.407 (a)    | <b>Rel. Humidity (%):</b>  | 35    | to | 42   |
| <b>Variant:</b>               | 802.11n HT-40 | <b>Ambient Temp. (°C):</b> | 19    | to | 22   |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998   | to | 1003 |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (%):</b>     | 100   |    |      |
| <b>Beam Forming Gain (Y):</b> | N/A dB        | <b>Antenna Gain:</b>       | 0 dBi |    |      |
| <b>Applied Voltage:</b>       | 48.0 Vdc      | <b>Antenna Ports (N):</b>  | 2     |    |      |
| <b>Notes 1:</b>               |               |                            |       |    |      |
| <b>Notes 2:</b>               |               |                            |       |    |      |

| Test Frequency | Measured Peak Power |       |    |    | Correction factor | Peak Power Spectral Density | Limit | Margin |
|----------------|---------------------|-------|----|----|-------------------|-----------------------------|-------|--------|
|                | RF Port (dBm)       |       |    |    |                   |                             |       |        |
| MHz            | a                   | b     | c  | d  | 10Log(N)          | dBm                         | dBm   | dB     |
| 5190           | -2.49               | -1.42 | -- | -- | 3.01              | 1.59                        | 4.00  | -2.41  |
| 5230           | -1.43               | -1.73 | -- | -- | 3.01              | 1.58                        | 4.00  | -2.42  |

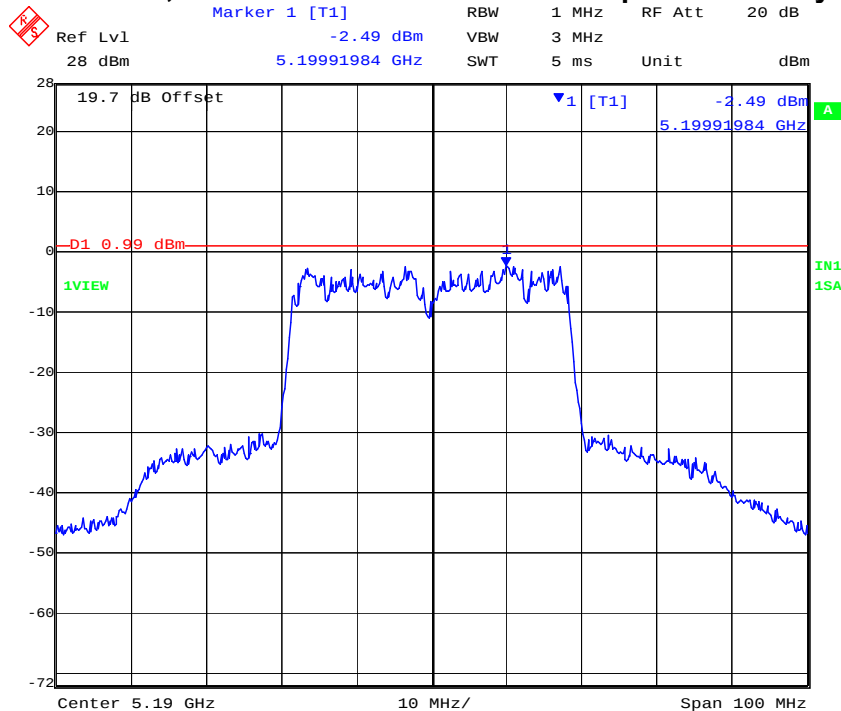
|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±1.33 dB |
|---------------------------------|----------|

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### PORT A 5,190 MHz 802.11n HT-40 Power Spectral Density



Date: 4.MAY.2012 15:22:06

### PORT B 5,190 MHz 802.11n HT-40 Power Spectral Density



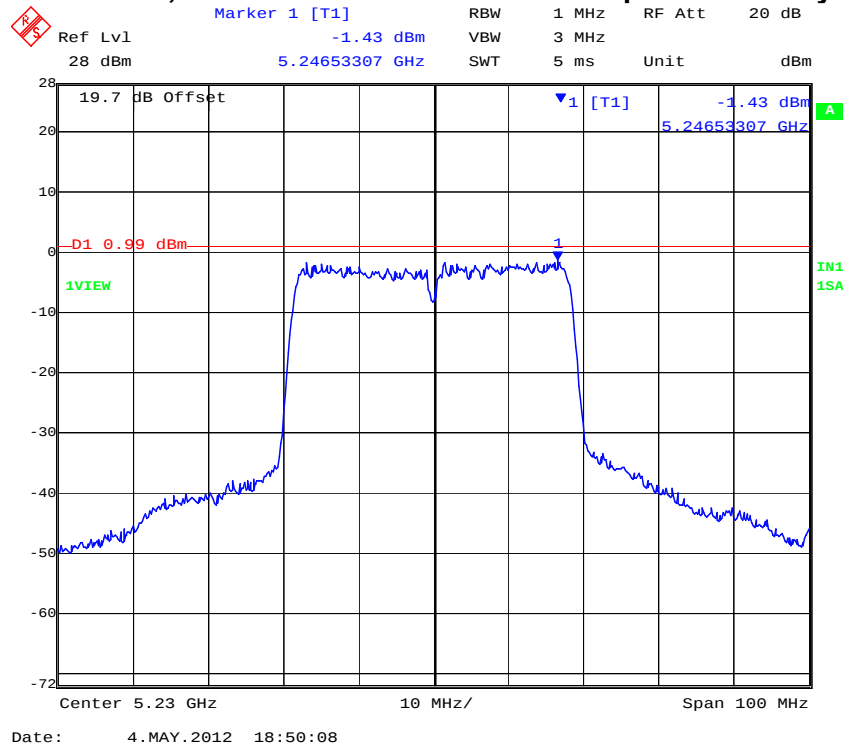
Date: 4.MAY.2012 15:22:58

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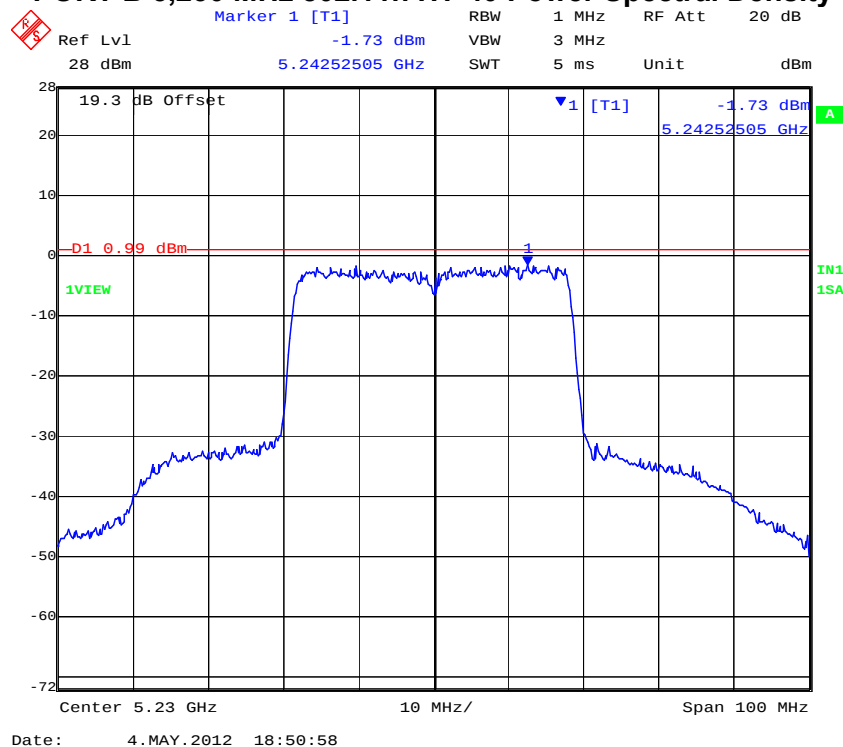


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### PORT A 5,230 MHz 802.11n HT-40 Power Spectral Density



### PORT B 5,230 MHz 802.11n HT-40 Power Spectral Density



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## Specification

### **FCC, Part 15 §15.407 (a)(1), (a)(2)**

#### **5150 – 5250 MHz**

**(a)(1)** The peak power spectral density shall not exceed +4 dBm in any 1 megahertz band.

#### **5250 – 5350 MHz & 5470 – 5725 MHz**

**(a)(2)** The peak power spectral density shall not exceed +11 dBm in any 1 megahertz band.

### **Industry Canada RSS-210 § A9.2(1), A9.2(2)**

#### **5150 – 5250 MHz**

**§ A9.2(1)** The eirp spectral density shall not exceed +10 dBm in any 1 MHz band

#### **5250 – 5350 MHz & 5470 – 5725 MHz**

**§ A9.2(2)** The power spectral density shall not exceed +11 dBm in any 1 MHz band

## Laboratory Measurement Uncertainty for Spectral Density

|                         |               |
|-------------------------|---------------|
| Measurement uncertainty | $\pm 1.33$ dB |
|-------------------------|---------------|

## Traceability

| Method                                                                        | Test Equipment Used                            |
|-------------------------------------------------------------------------------|------------------------------------------------|
| Measurements were made per work instruction WI-01 'Measuring RF Output Power' | 0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117 |

---

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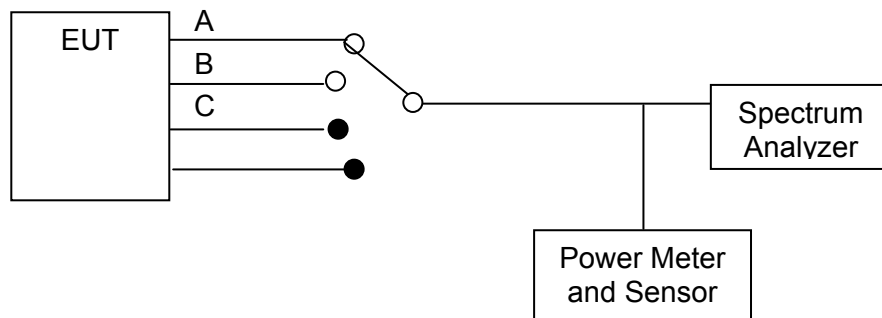
#### 5.1.4. Peak Excursion Ratio

##### **FCC, Part 15 Subpart C §15.407(a)(6)**

#### **Test Procedure**

Normative Reference (xi) Section 2.1 Measurement Procedure DA 02-2138 "Measurement Procedure Updated for Peak Transmit Power in the UNII Bands" was implemented to determine the Peak Excursion Ratio. This is a conducted measurement using a spectrum analyzer. The Peak Excursion Ratio is the difference in amplitude (dB) between the two traces.

#### **Test Measurement Set up**



Measurement set up for Peak Excursion Ratio

#### **Measurement Results for Peak Excursion Ratio**

Ambient conditions.

Temperature: 17 to 23 °C Relative humidity: 31 to 57% Pressure: 999 to 1012 mbar

#### **Radio Parameters**

Duty Cycle: 100%

Output: Modulated Carrier

Power: Maximum Default Power



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**TABLE OF RESULTS – 802.11a Legacy 5150 – 5250 MHz**

|                               |            |                            |       |    |      |
|-------------------------------|------------|----------------------------|-------|----|------|
| <b>Test Conditions:</b>       | 15.407 (a) | <b>Rel. Humidity (%):</b>  | 35    | to | 42   |
| <b>Variant:</b>               | 802.11a    | <b>Ambient Temp. (°C):</b> | 19    | to | 22   |
| <b>TPC:</b>                   | HIGH       | <b>Pressure (mBars):</b>   | 998   | to | 1003 |
| <b>Modulation:</b>            | ON         | <b>Duty Cycle (%):</b>     | 100   |    |      |
| <b>Beam Forming Gain (Y):</b> | N/A dB     | <b>Antenna Gain:</b>       | 0 dBi |    |      |
| <b>Applied Voltage:</b>       | 48.0 Vdc   |                            |       |    |      |
| <b>Notes 1:</b>               |            |                            |       |    |      |
| <b>Notes 2:</b>               |            |                            |       |    |      |

| Test Frequency | Trace Δ Marker |        |        |        | Limit  | Margin |
|----------------|----------------|--------|--------|--------|--------|--------|
|                | Port A         | Port B | Port C | Port D |        |        |
| MHz            | dB             | dB     | dB     | dB     | dB     | dB     |
| 5180           | -12.64         | -11.79 | --     | --     | -13.00 | -0.36  |
| 5200           | -11.75         | -11.12 | --     | --     |        | -1.25  |
| 5240           | -11.73         | -12.85 | --     | --     |        | -0.15  |

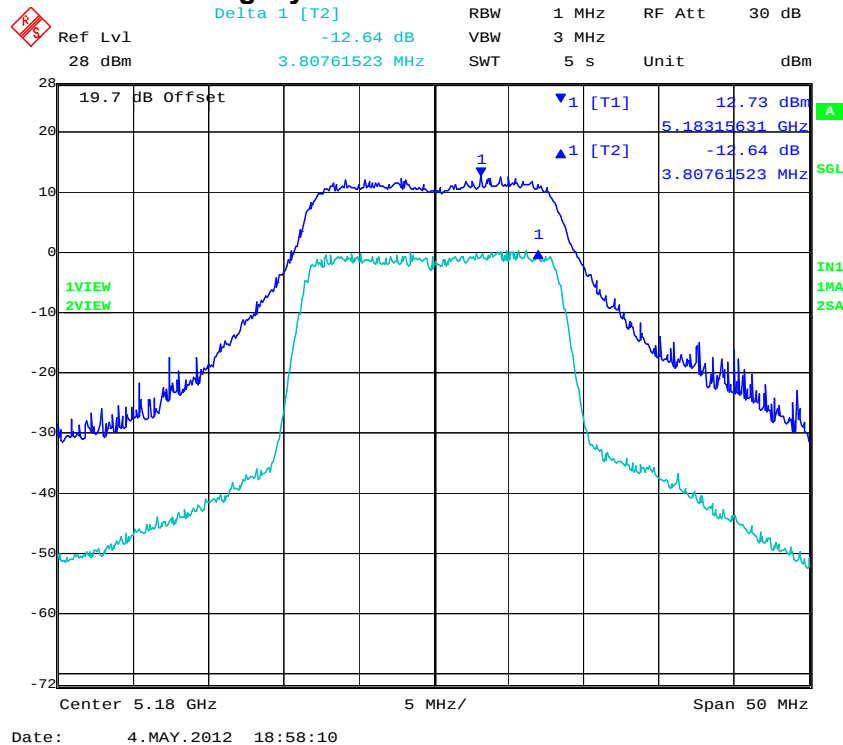
|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±1.33 dB |
|---------------------------------|----------|

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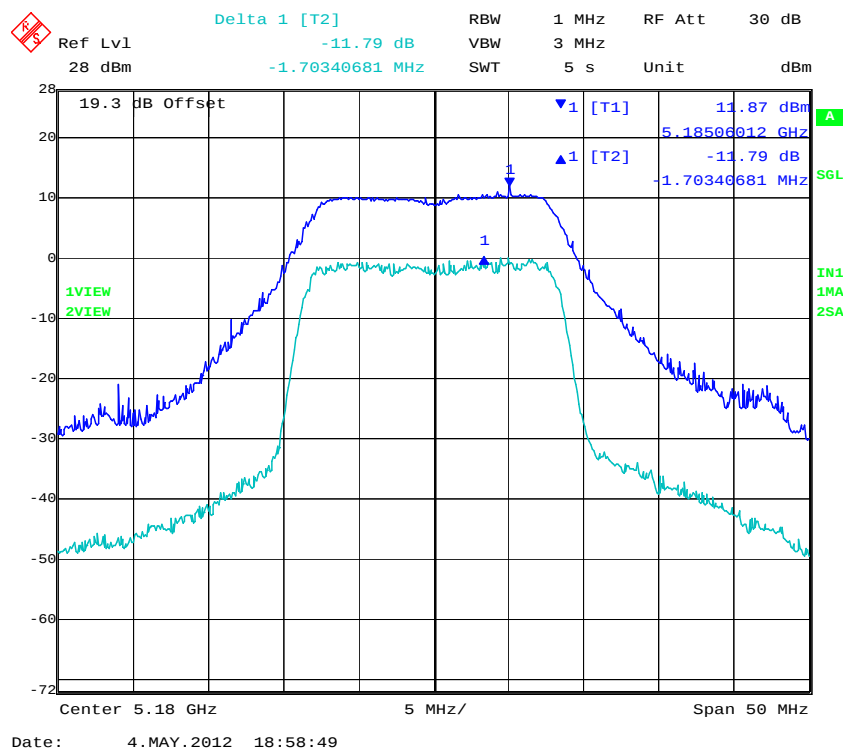


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### PORT A 5,180 MHz 802.11a Legacy Peak Excursion Ratio



### PORT B 5,180 MHz 802.11a Legacy Peak Excursion Ratio

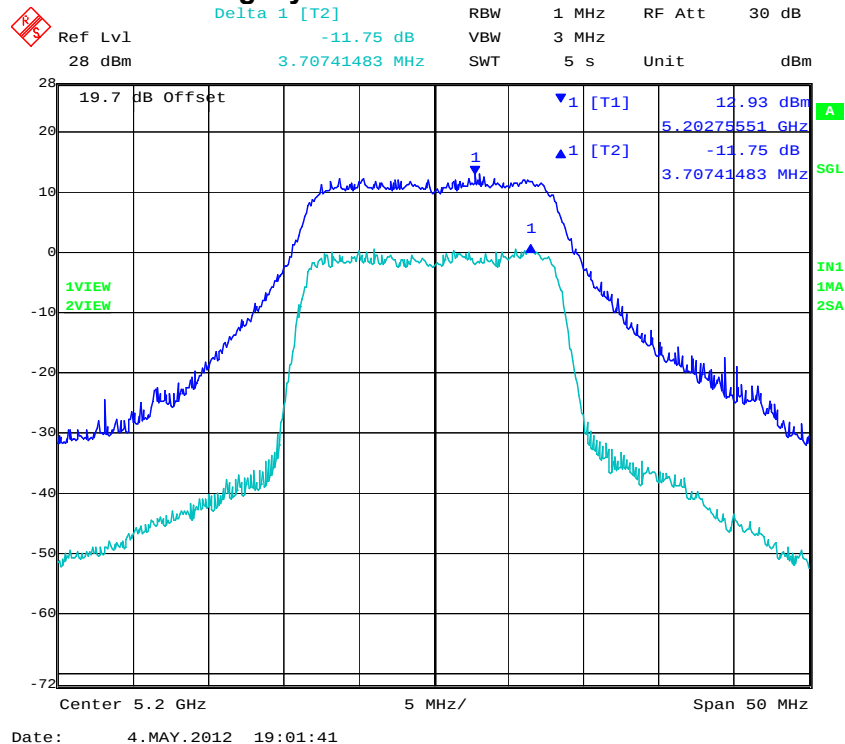


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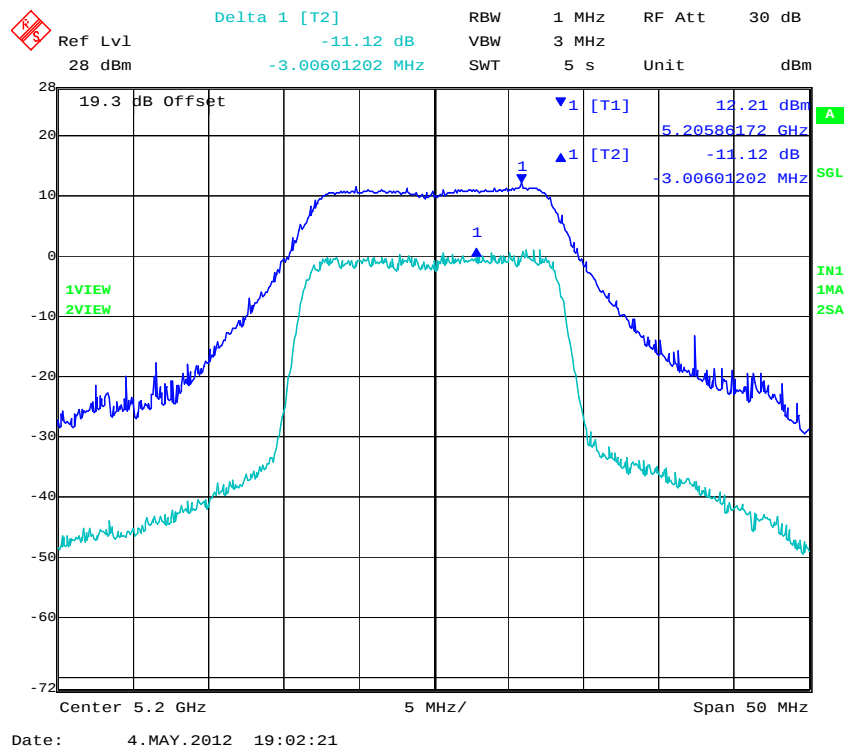


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### PORT A 5,200 MHz 802.11a Legacy Peak Excursion Ratio



### PORT B 5,200 MHz 802.11a Legacy Peak Excursion Ratio

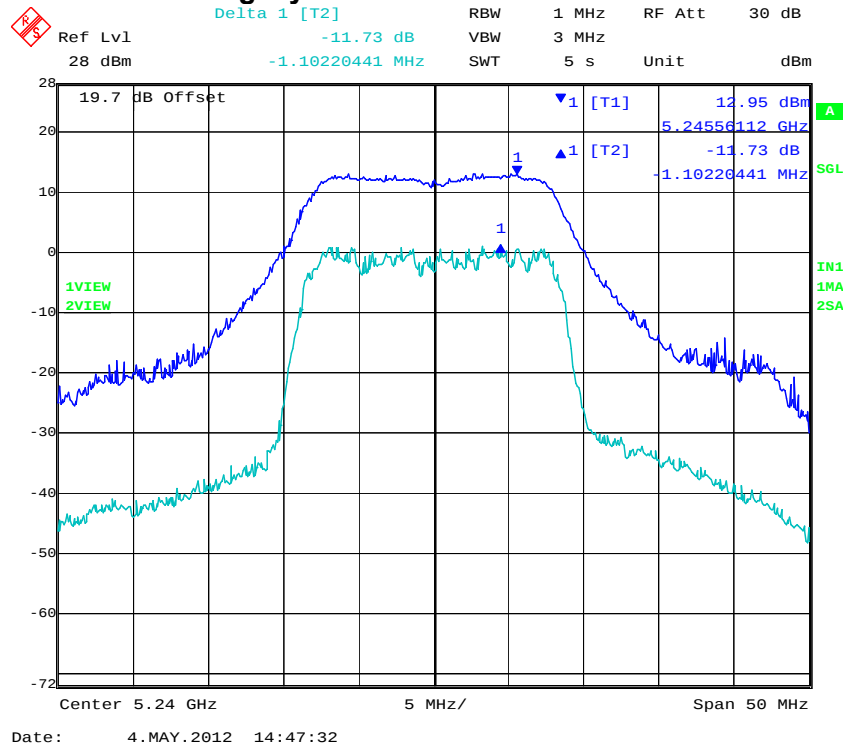


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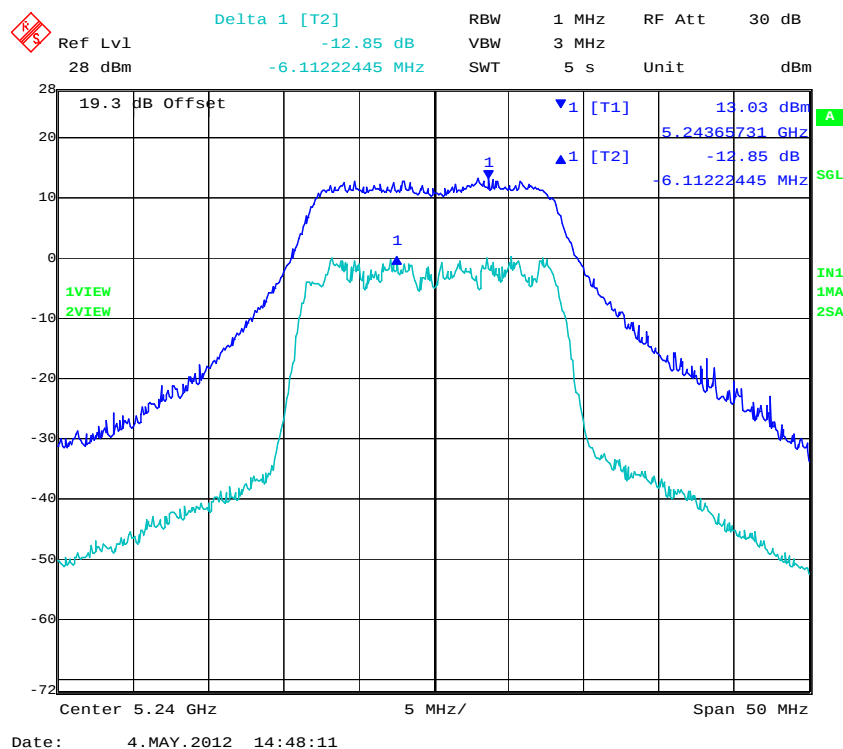


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### PORT A 5,240 MHz 802.11a Legacy Peak Excursion Ratio



### PORT B 5,240 MHz 802.11a Legacy Peak Excursion Ratio



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**TABLE OF RESULTS – 802.11n HT-20 5150 – 5250 MHz**

|                               |               |                            |       |    |      |
|-------------------------------|---------------|----------------------------|-------|----|------|
| <b>Test Conditions:</b>       | 15.407 (a)    | <b>Rel. Humidity (%):</b>  | 35    | to | 42   |
| <b>Variant:</b>               | 802.11n HT-20 | <b>Ambient Temp. (°C):</b> | 19    | to | 22   |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998   | to | 1003 |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (%):</b>     | 100   |    |      |
| <b>Beam Forming Gain (Y):</b> | N/A dB        | <b>Antenna Gain:</b>       | 0 dBi |    |      |
| <b>Applied Voltage:</b>       | 48.0 Vdc      |                            |       |    |      |
| <b>Notes 1:</b>               |               |                            |       |    |      |
| <b>Notes 2:</b>               |               |                            |       |    |      |

| Test Frequency | Trace Δ Marker |        |        |        | Limit  | Margin |
|----------------|----------------|--------|--------|--------|--------|--------|
|                | Port A         | Port B | Port C | Port D |        |        |
| MHz            | dB             | dB     | dB     | dB     | dB     | dB     |
| 5180           | -11.60         | -11.49 | --     | --     | -13.00 | -1.40  |
| 5200           | -10.58         | -11.63 | --     | --     |        | -1.37  |
| 5240           | -11.82         | -12.37 | --     | --     |        | -0.63  |

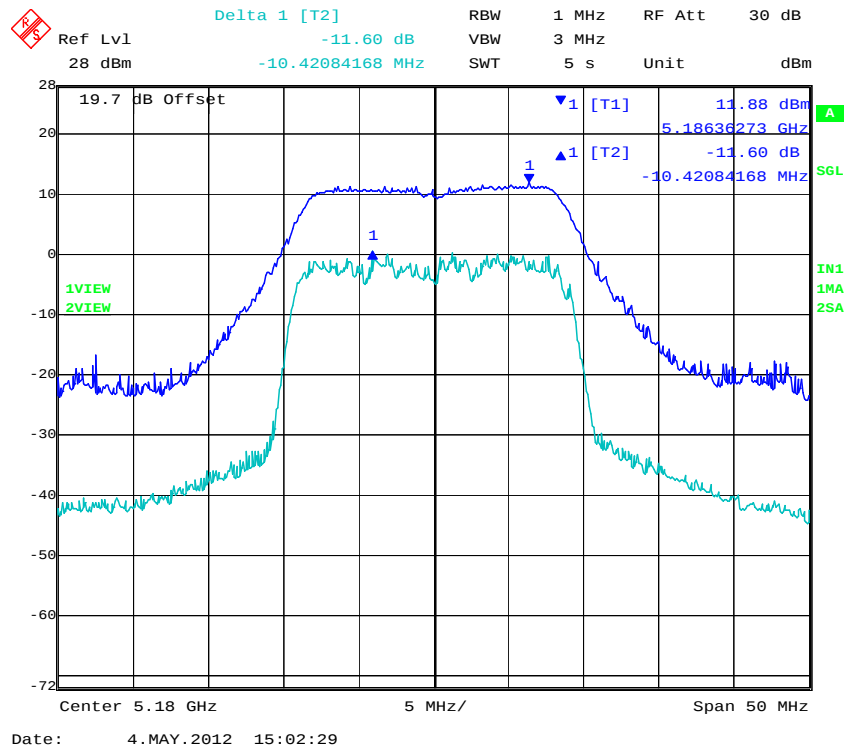
|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±1.33 dB |
|---------------------------------|----------|

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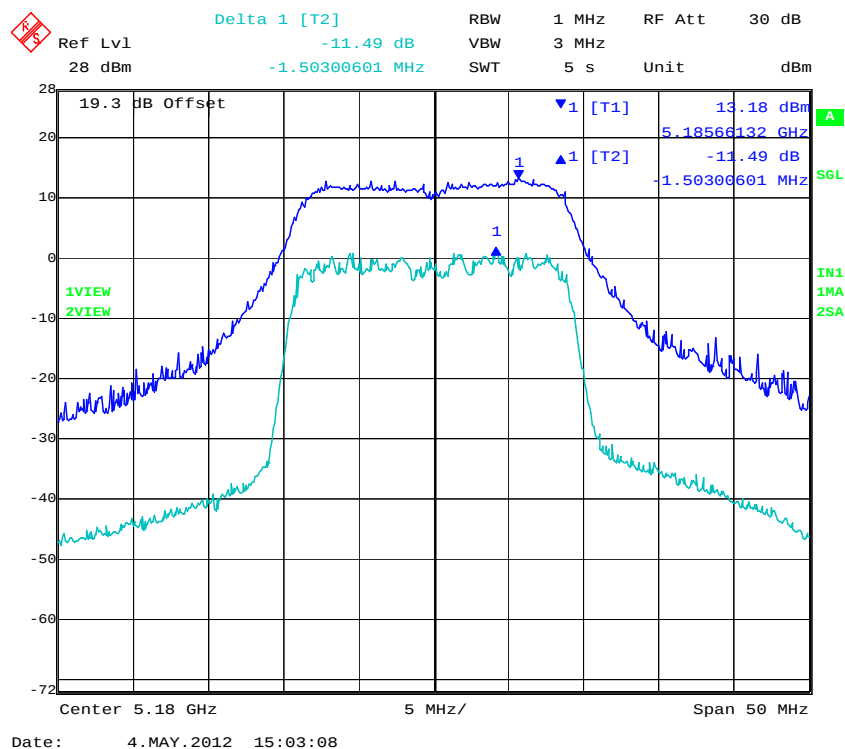


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### PORT A 5,180 MHz 802.11n HT-20 Peak Excursion Ratio



### PORT B 5,180 MHz 802.11n HT-20 Peak Excursion Ratio

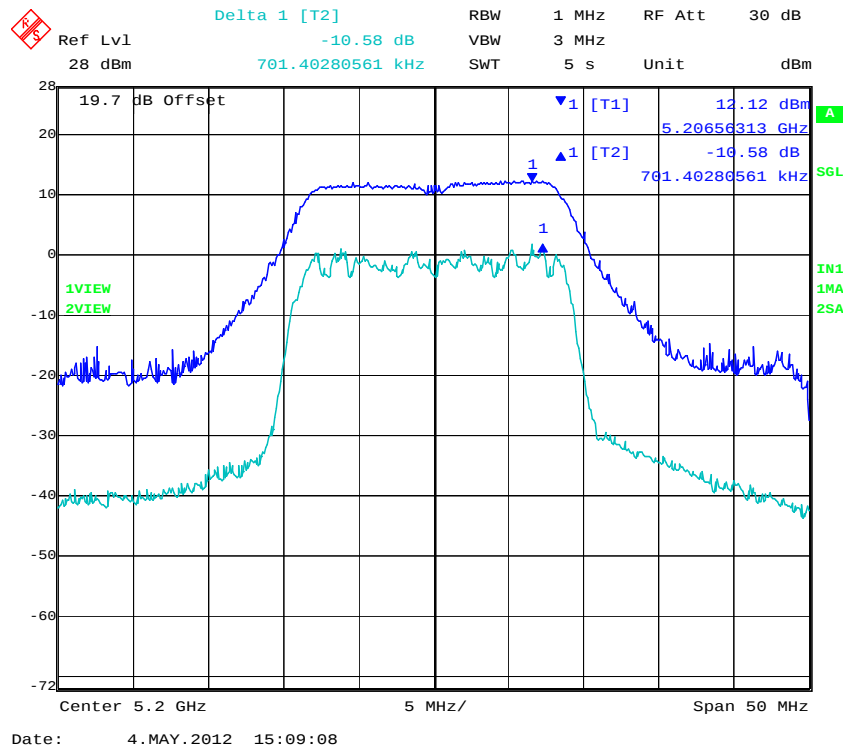


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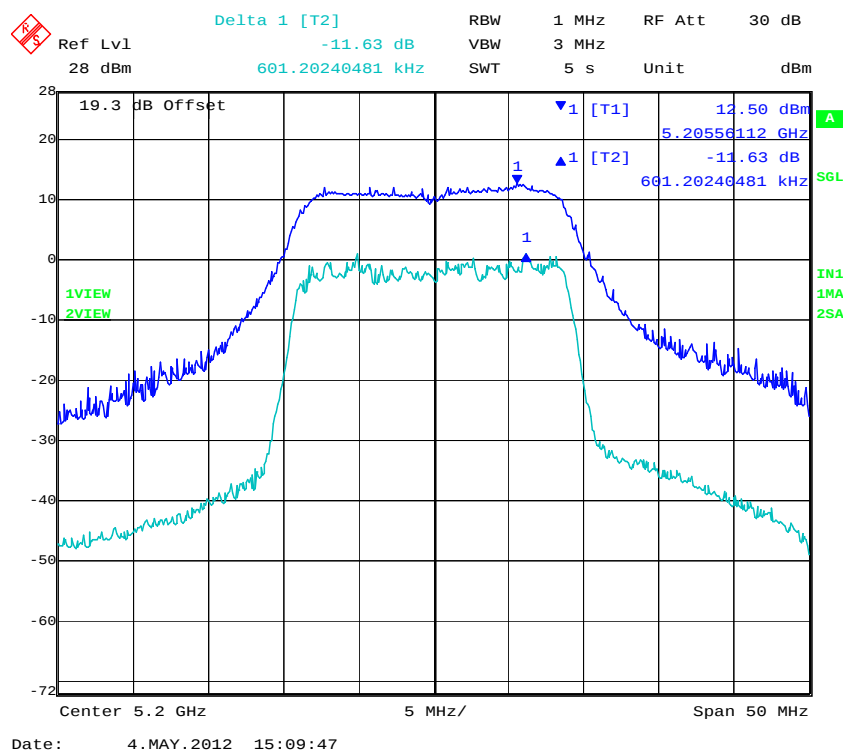


**Title:** Juniper Networks WLA322 Wireless LAN Access Point  
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### PORT A 5,200 MHz 802.11n HT-20 Peak Excursion Ratio



### PORT B 5,200 MHz 802.11n HT-20 Peak Excursion Ratio

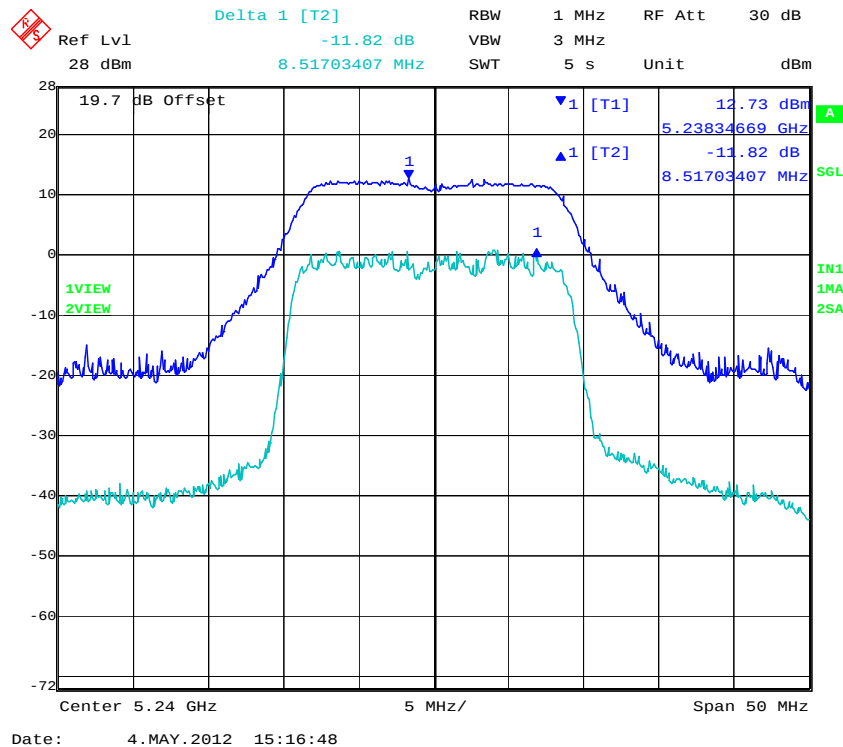


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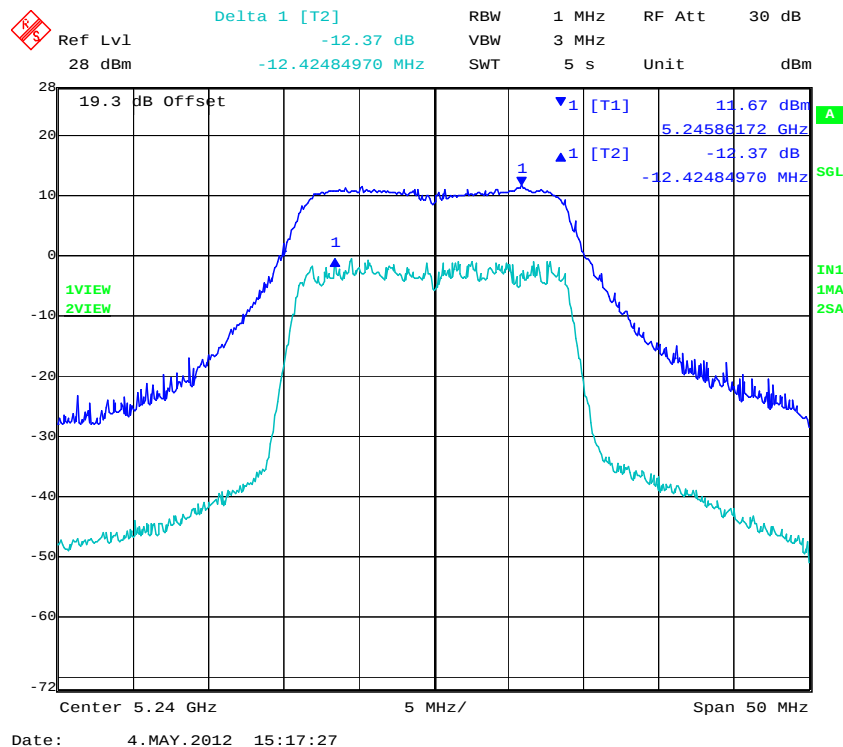


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### PORT A 5,240 MHz 802.11n HT-20 Peak Excursion Ratio



### PORT B 5,240 MHz 802.11n HT-20 Peak Excursion Ratio



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TABLE OF RESULTS – 802.11n HT-40 5150 – 5250 MHz

|                               |               |                            |       |    |      |
|-------------------------------|---------------|----------------------------|-------|----|------|
| <b>Test Conditions:</b>       | 15.407 (a)    | <b>Rel. Humidity (%):</b>  | 35    | to | 42   |
| <b>Variant:</b>               | 802.11n HT-40 | <b>Ambient Temp. (°C):</b> | 19    | to | 22   |
| <b>TPC:</b>                   | HIGH          | <b>Pressure (mBars):</b>   | 998   | to | 1003 |
| <b>Modulation:</b>            | ON            | <b>Duty Cycle (%):</b>     | 100   |    |      |
| <b>Beam Forming Gain (Y):</b> | N/A dB        | <b>Antenna Gain:</b>       | 0 dBi |    |      |
| <b>Applied Voltage:</b>       | 48.0 Vdc      |                            |       |    |      |
| <b>Notes 1:</b>               |               |                            |       |    |      |
| <b>Notes 2:</b>               |               |                            |       |    |      |

| Test Frequency | Trace Δ Marker |        |        |        | Limit  | Margin |
|----------------|----------------|--------|--------|--------|--------|--------|
|                | Port A         | Port B | Port C | Port D |        |        |
| MHz            | dB             | dB     | dB     | dB     | dB     | dB     |
| 5190           | -11.49         | -12.85 | --     | --     | -13.00 | -0.15  |
| 5230           | -10.30         | -10.24 | --     | --     |        | -2.70  |

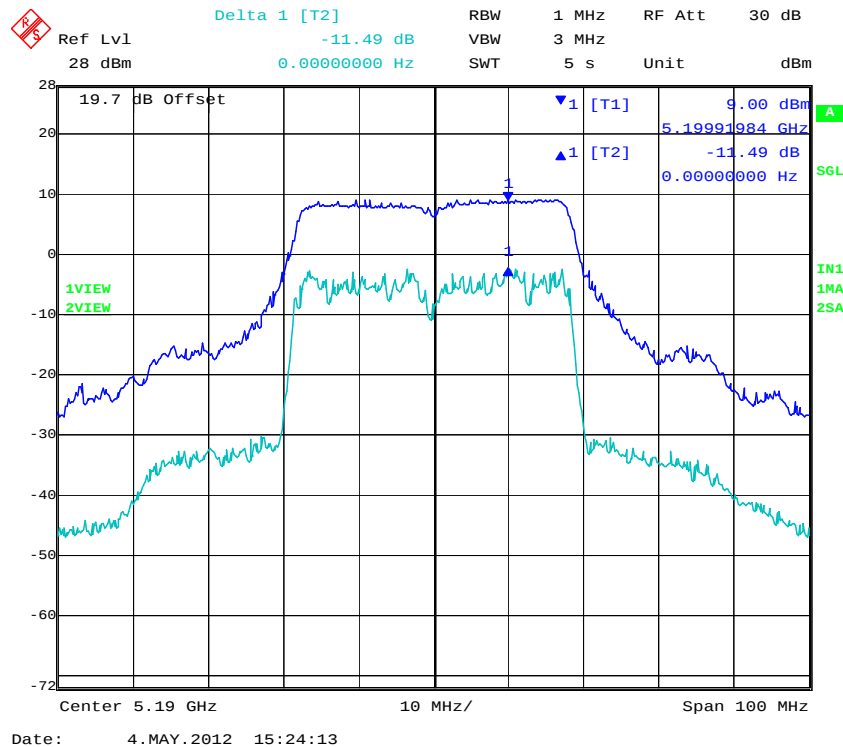
|                                 |          |
|---------------------------------|----------|
| <b>Measurement uncertainty:</b> | ±1.33 dB |
|---------------------------------|----------|

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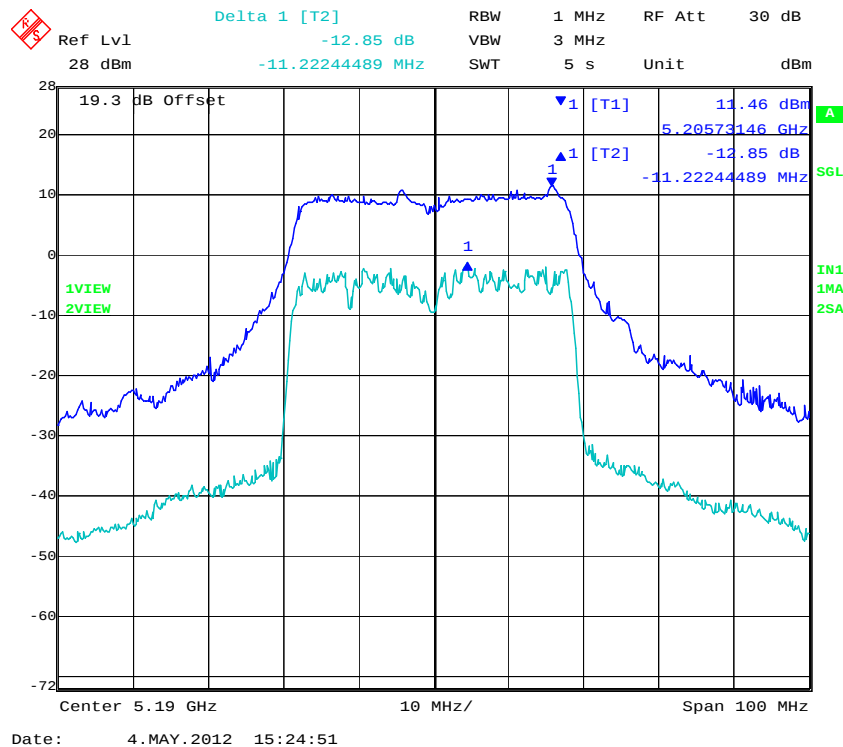


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### PORT A 5,190 MHz 802.11n HT-40 Peak Excursion Ratio



### PORT B 5,190 MHz 802.11n HT-40 Peak Excursion Ratio

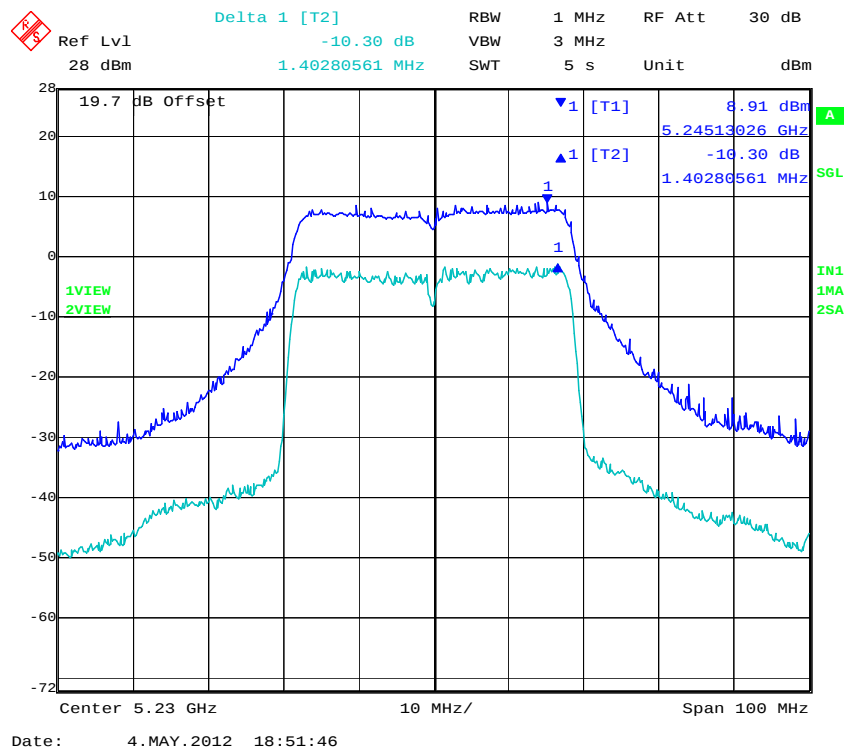


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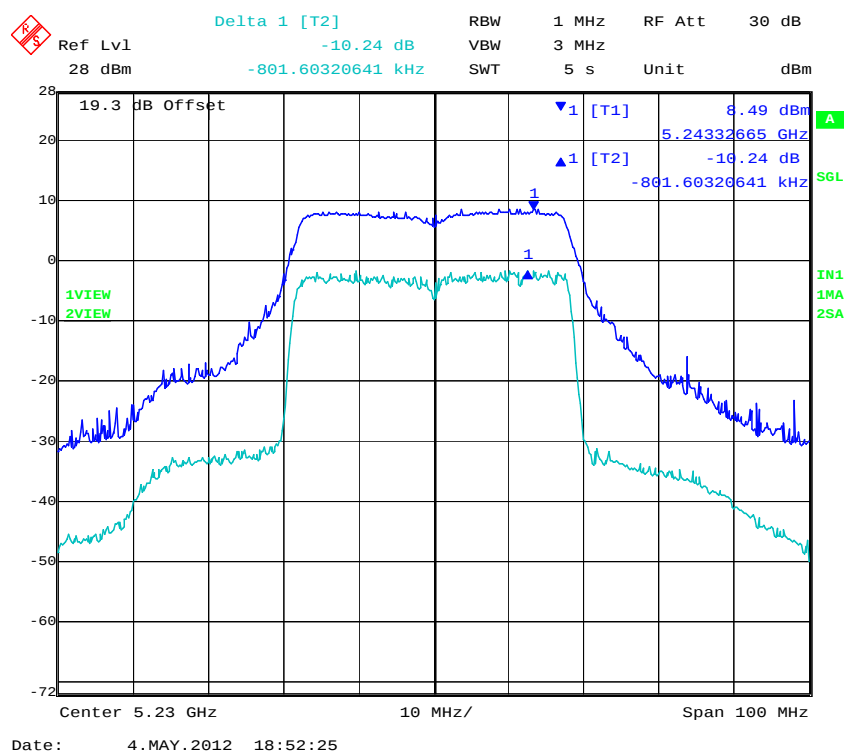


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### PORT A 5,230 MHz 802.11n HT-40 Peak Excursion Ratio



### PORT B 5,230 MHz 802.11n HT-40 Peak Excursion Ratio



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## Specification

### Limits

**§15.407 (a)(6)** The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified in this paragraph) shall not exceed 13dB across any 1MHz bandwidth or the emission bandwidth whichever is less

## Laboratory Measurement Uncertainty for Spectrum Measurement

|                         |                     |
|-------------------------|---------------------|
| Measurement uncertainty | $\pm 2.81\text{dB}$ |
|-------------------------|---------------------|

### Traceability

| Method                                                                              | Test Equipment Used                            |
|-------------------------------------------------------------------------------------|------------------------------------------------|
| Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask' | 0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117 |

---

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#### **5.1.5. Frequency Stability**

**FCC, Part 15 Subpart C §15.407(g)**  
**Industry Canada RSS-210 §2.1**

#### **Test Procedure**

The manufacturer of the equipment is responsible for ensuring that the frequency stability is such that emissions are always maintained within the band of operation under all conditions.

#### **Manufacturer Declaration**

The frequency stability of the reference oscillator sets the frequency stability of the RF transceiver signals. Therefore all of the RF signals should have  $\pm 20$ ppm stability.

This stability accounts for room temp tolerance of the crystal oscillator circuit, frequency variation across temperature, and crystal ageing.

$\pm 20$ ppm at 5.250 GHz translates to a maximum frequency shift of  $\pm 105$  KHz. As the edge of the channels is at least one MHz from either of the band edges,  $\pm 105$  KHz is more than sufficient to guarantee that the intentional emission will remain in the band over the entire operating range of the EUT.

#### **Specification**

#### **Limits**

**§15.407 (g)** Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.



#### 5.1.6. Maximum Permissible Exposure

##### **FCC, Part 15 Subpart C §15.407(f)**

##### **Industry Canada RSS-Gen §5.5**

#### **Calculations for Maximum Permissible Exposure Levels**

$$\text{Power Density} = P_d (\text{mW/cm}^2) = \text{EIRP} / (4\pi d^2)$$

$$\text{EIRP} = P * G$$

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

$$\text{Numeric Gain} = 10^{(G (\text{dBi})/10)}$$

The Juniper WLA322 has three transmitters operating in each band. The peak power in the table below is calculated by assuming a worst case scenario where all transmitters are operating simultaneously.

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm<sup>2</sup>

| Freq. Band (MHz) | Antenna Gain (dBi) | Numeric Gain (numeric) | Peak Output Power (dBm) | Peak Output Power (mW) | Power Density Distance @ 20cm | Minimum Separation Distance (cm) |
|------------------|--------------------|------------------------|-------------------------|------------------------|-------------------------------|----------------------------------|
| 5150 - 5250      | 0.0                | 1.00                   | +16.99                  | 50.00                  | 0.010                         | 20.00                            |

**Note:** for mobile or fixed location transmitters the minimum separation distance is 20cm, even if calculations indicate the MPE distance to be less.

#### **Specification**

#### **Maximum Permissible Exposure Limits**

**FCC §1.1310** Limit = 1mW / cm<sup>2</sup> from 1.310 Table 1

**RSS-Gen §5.5** Before equipment certification is granted, the application requirements of RSS-102 shall be met.

#### **Laboratory Measurement Uncertainty for Power Measurements**

|                         |          |
|-------------------------|----------|
| Measurement uncertainty | ±1.33 dB |
|-------------------------|----------|



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#### 5.1.7. Radiated Emissions

**FCC, Part 15 Subpart C §15.407(b)(2), §15.205(a)/15.209(a)**  
**Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7**

##### **Test Procedure**

Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak hold mode. Depending on the frequency band spanned a notch filter and/or waveguide filter was used to remove the fundamental frequency.

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR compliant receiver. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Emissions from 30 MHz – 1000 MHz are measured utilizing a CISPR compliant quasi-peak detector with a tuned receiver, using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed.

##### **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.

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

FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

$$CORR = \text{Correction Factor} = CL - AG + NFL$$

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation Example:

Given receiver input reading of 51.5 dB $\mu$ V; 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 of the measured emission is:

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

Conversion between dB $\mu$ V/m (or dB $\mu$ V) and  $\mu$ V/m (or  $\mu$ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log (level (\mu V/m))}$$

$$40 \text{ dB}\mu\text{V/m} = 100 \mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250 \mu\text{V/m}$$

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The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength (dBμV/m);

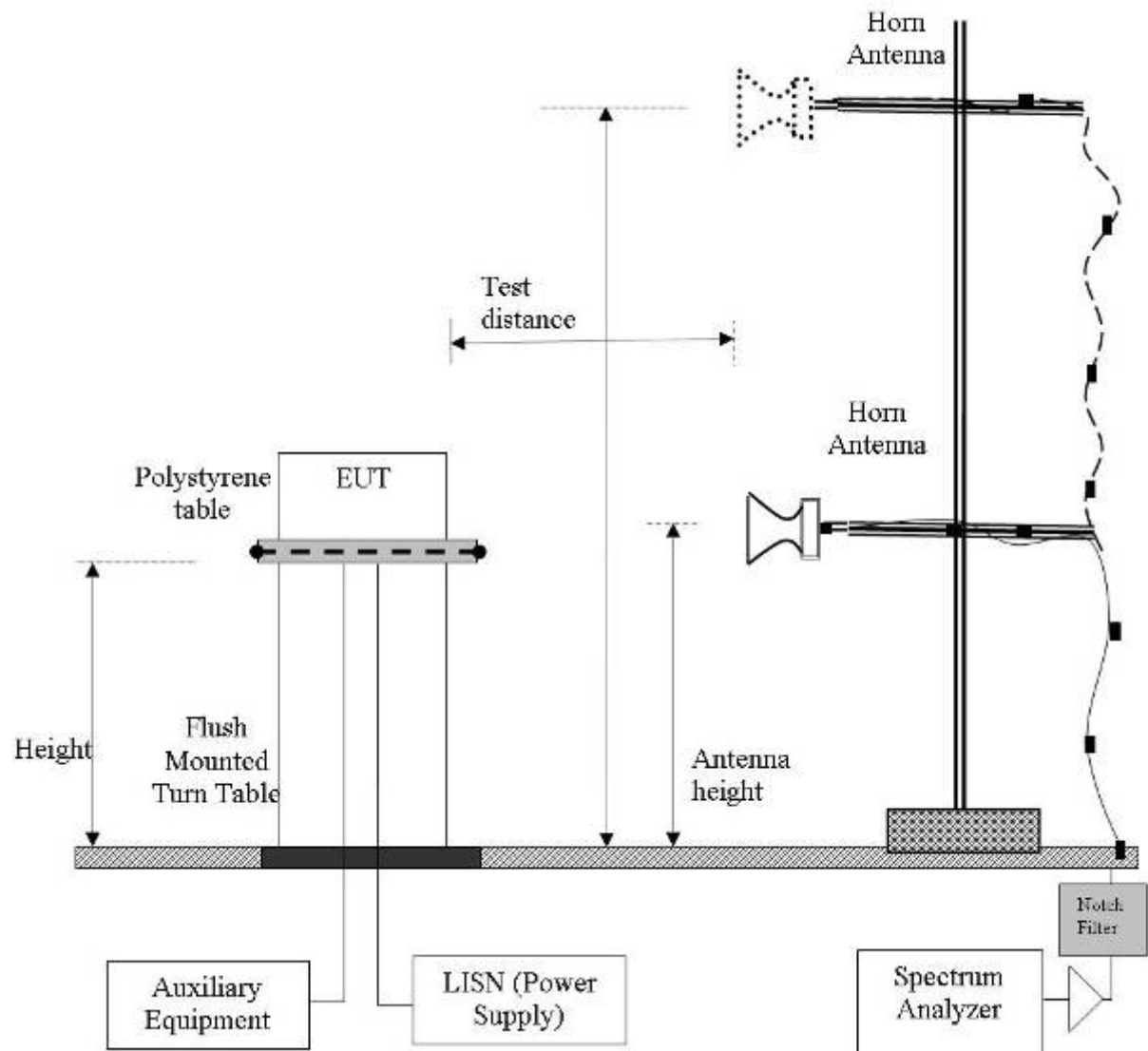
$$E = 1000000 \times \sqrt{30P} / 3 \mu\text{V/m}$$

where P is the EIRP in Watts

Therefore: -27 dBm/MHz = 68.23 dBuV/m

**Note:** The data in this Section identifies that the EUT is in compliance with the -27dBm/MHz EIRP limit (68.23 dBμV/m) for out of band emissions. All out of band emissions are less than 68.23 dB μV/m.

### Radiated Emission Measurement Setup – Above 1 GHz



**NOTE:** KDB 662911 was implemented for Out-of-Band measurements. Where necessary Option (2) Measure and add  $10 \log(N)$  dB was implemented



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## Specification

### Radiated Spurious Emissions

**15.407 (b)(2).** All emissions outside of the 5,150-5,350MHz band shall not exceed an EIRP of -27dBm/MHz.

**FCC §15.205 (a)** Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

**FCC §15.205 (a)** Except as shown 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 Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

**FCC §15.209 (a)** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

**RSS-210 §A9.3(2)** For transmitters operating in the 5250-5350 MHz band, all emissions outside the 5150-5350 MHz band shall not exceed -27 dBm/MHz e.i.r.p. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band shall not exceed out of band emission limit of 27 dBm/MHz e.i.r.p. in the 5150-5250 MHz band in order to operate indoor/outdoor, or alternatively shall comply with the spectral power density for operation within the 5150-5250 MHz band and shall be labeled "for indoor use only".

**RSS-Gen §4.7** The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz, whichever is the lowest frequency, to the 5<sup>th</sup> harmonic of the highest frequency generated without exceeding 40 GHz.

#### **RSS-Gen §6** Receiver Spurious Emission Standard

If a radiated measurement is made, all spurious emissions shall comply with the limits of the following Table. The resolution bandwidth of the spectrum analyzer shall be 100 kHz for spurious emission measurements below 1.0 GHz and 1.0 MHz for measurements above 1.0 GHz



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**Table 1: FCC 15.209 Spurious Emissions Limits**

| Frequency (MHz) | Field Strength ( $\mu\text{V/m}$ ) | Field Strength ( $\text{dB}\mu\text{V/m}$ ) | Measurement Distance (meters) |
|-----------------|------------------------------------|---------------------------------------------|-------------------------------|
| 30-88           | 100                                | 40.0                                        | 3                             |
| 88-216          | 150                                | 43.5                                        | 3                             |
| 216-960         | 200                                | 46.0                                        | 3                             |
| Above 960       | 500                                | 54.0                                        | 3                             |

**Laboratory Measurement Uncertainty for Spectrum Measurement**

|                                |               |
|--------------------------------|---------------|
| <b>Measurement Uncertainty</b> | +5.6/ -4.5 dB |
|--------------------------------|---------------|

**Traceability:**

| Method                 | Test Equipment Used                            |
|------------------------|------------------------------------------------|
| Work instruction WI-03 | 0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312 |

---

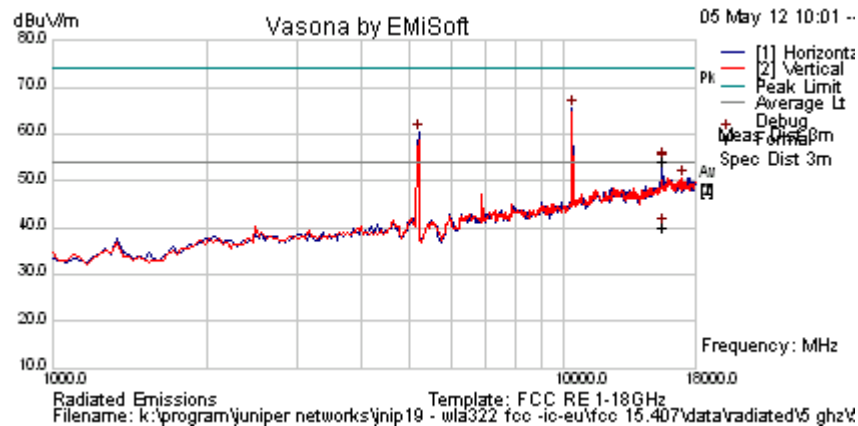
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#### 5.1.7.1. Integral Antenna

|               |                        |                |      |
|---------------|------------------------|----------------|------|
| Test Freq.    | 5180 MHz               | Engineer       | GMH  |
| Variant       | 802.11a; 6 Mbs         | Temp (°C)      | 18.5 |
| Freq. Range   | 1000 MHz - 18000 MHz   | Rel. Hum.(%)   | 33   |
| Power Setting | ART = 18               | Press. (mBars) | 1013 |
| Antenna       | Integral 0 dBi Average | Duty Cycle (%) | 100  |
| Test Notes 1  |                        |                |      |
| Test Notes 2  |                        |                |      |



#### Formally measured emission peaks

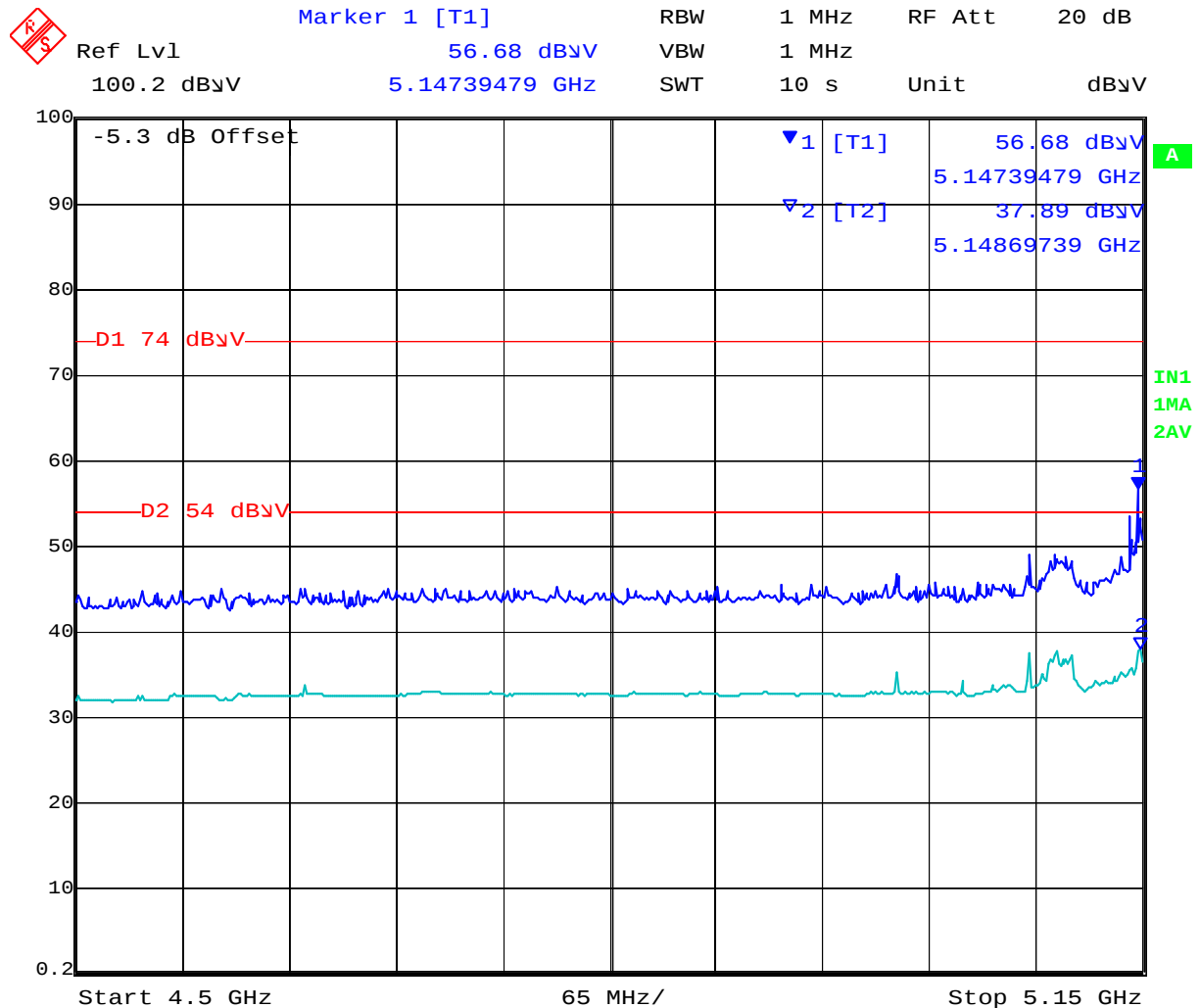
| Frequency MHz                                                                                           | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 10368.737                                                                                               | 61.3     | 6.7        | -2.5  | 65.5         | Peak [Scan]      | H   |        |         |              |           | Pass       | NRB      |
| 5190.381                                                                                                | 65.5     | 4.6        | -9.9  | 60.2         | Peak [Scan]      | H   |        |         |              |           |            | FUND     |
| 17012.024                                                                                               | 41.7     | 8.5        | 0.3   | 50.5         | Peak [Scan]      | V   | 100    | 0       | 54.0         | -3.5      | Pass       | NOISE    |
| 15547.835                                                                                               | 46.5     | 8.3        | -0.6  | 54.2         | Peak Max         | H   | 98     | 333     | 74.0         | -19.9     | Pass       | RB       |
| 15547.835                                                                                               | 32.3     | 8.3        | -0.6  | 40.0         | Average Max      | H   | 98     | 333     | 54.0         | -14.0     | Pass       | RB       |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission |          |            |       |              |                  |     |        |         |              |           |            |          |
| NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205                |          |            |       |              |                  |     |        |         |              |           |            |          |

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### 802.11a 5150 Restricted Band-edge



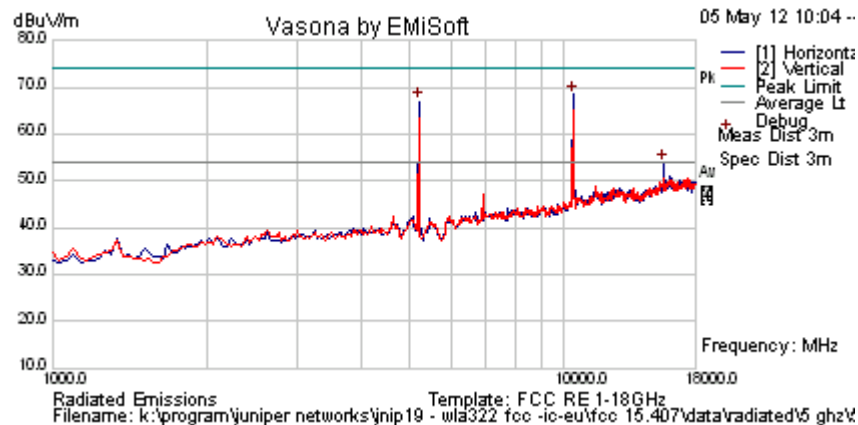
Date: 5.MAY.2012 12:01:45

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|               |                        |                |      |
|---------------|------------------------|----------------|------|
| Test Freq.    | 5200 MHz               | Engineer       | GMH  |
| Variant       | 802.11a; 6 Mbs         | Temp (°C)      | 18.5 |
| Freq. Range   | 1000 MHz - 18000 MHz   | Rel. Hum.(%)   | 33   |
| Power Setting | ART = 18               | Press. (mBars) | 1013 |
| Antenna       | Integral 0 dBi Average | Duty Cycle (%) | 100  |
| Test Notes 1  |                        |                |      |
| Test Notes 2  |                        |                |      |



#### Formally measured emission peaks

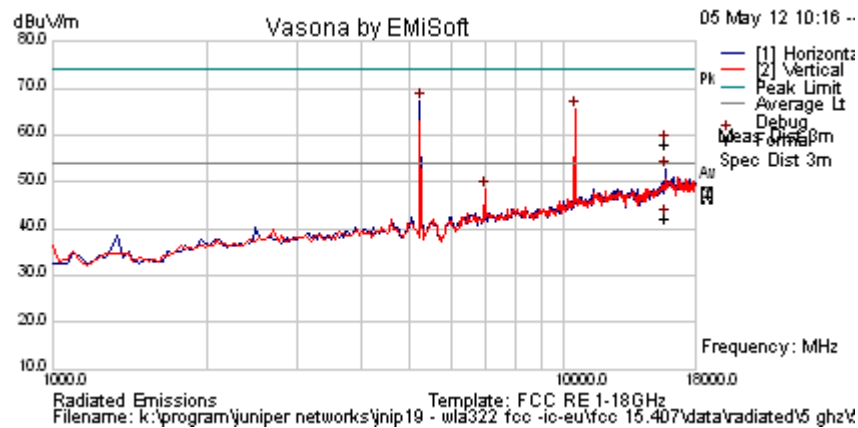
| Frequency MHz                                                                                                                                                                                       | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 10402.806                                                                                                                                                                                           | 64.2     | 6.7        | -2.5  | 68.5         | Peak [Scan]      | H   |        |         |              |           | Pass       | NRB      |
| 5190.381                                                                                                                                                                                            | 72.3     | 4.6        | -9.9  | 67.0         | Peak [Scan]      | H   |        |         |              |           |            | FUND     |
| 15595.270                                                                                                                                                                                           | 47.1     | 8.4        | -0.6  | 54.9         | Peak Max         | H   | 102    | 27      | 74.0         | -19.1     | Pass       | RB       |
| 15595.270                                                                                                                                                                                           | 33.2     | 8.4        | -0.6  | 41.0         | Average Max      | H   | 102    | 27      | 54.0         | -13.0     | Pass       | RB       |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission<br>NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205 |          |            |       |              |                  |     |        |         |              |           |            |          |

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|               |                        |                |      |
|---------------|------------------------|----------------|------|
| Test Freq.    | 5240 MHz               | Engineer       | GMH  |
| Variant       | 802.11a; 6 Mbs         | Temp (°C)      | 18.5 |
| Freq. Range   | 1000 MHz - 18000 MHz   | Rel. Hum.(%)   | 33   |
| Power Setting | ART = 18               | Press. (mBars) | 1013 |
| Antenna       | Integral 0 dBi Average | Duty Cycle (%) | 100  |
| Test Notes 1  |                        |                |      |
| Test Notes 2  |                        |                |      |



#### Formally measured emission peaks

| Frequency MHz | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 5224.449      | 72.5     | 4.6        | -9.8  | 67.3         | Peak [Scan]      | H   |        |         |              |           |            | FUND     |
| 10470.942     | 61.2     | 6.8        | -2.5  | 65.5         | Peak [Scan]      | V   |        |         |              |           | Pass       | NRB      |
| 6995.992      | 49.3     | 5.4        | -6.4  | 48.3         | Peak [Scan]      | V   | 100    | 0       | 54.0         | -5.7      | Pass       | NRB      |
| 15717.435     | 50.1     | 8.6        | -0.4  | 58.2         | Peak Max         | H   | 100    | 41      | 74.0         | -15.8     | Pass       | RB       |
| 15717.435     | 34.0     | 8.6        | -0.4  | 42.2         | Average Max      | H   | 100    | 41      | 54.0         | -11.8     | Pass       | RB       |

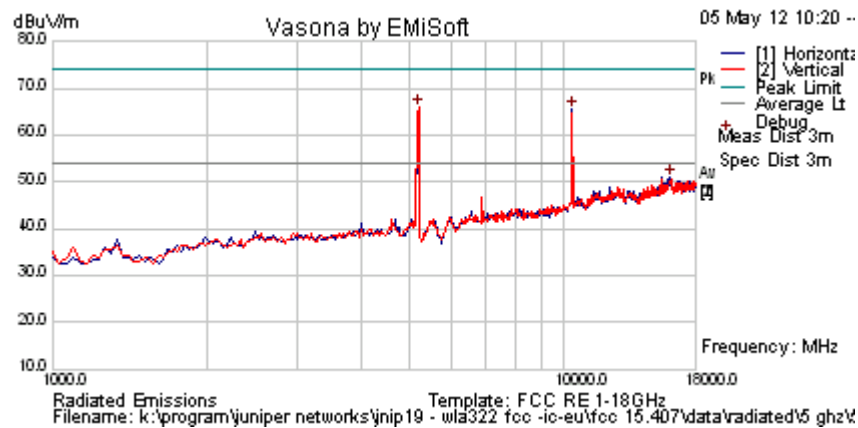
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission  
 NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

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|               |                        |                |      |
|---------------|------------------------|----------------|------|
| Test Freq.    | 5180 MHz               | Engineer       | GMH  |
| Variant       | 802.11n HT-20; 6.5 MCS | Temp (°C)      | 18.5 |
| Freq. Range   | 1000 MHz - 18000 MHz   | Rel. Hum.(%)   | 33   |
| Power Setting | ART = 18               | Press. (mBars) | 1013 |
| Antenna       | INTERNAL               | Duty Cycle (%) | 100  |
| Test Notes 1  |                        |                |      |
| Test Notes 2  |                        |                |      |



#### Formally measured emission peaks

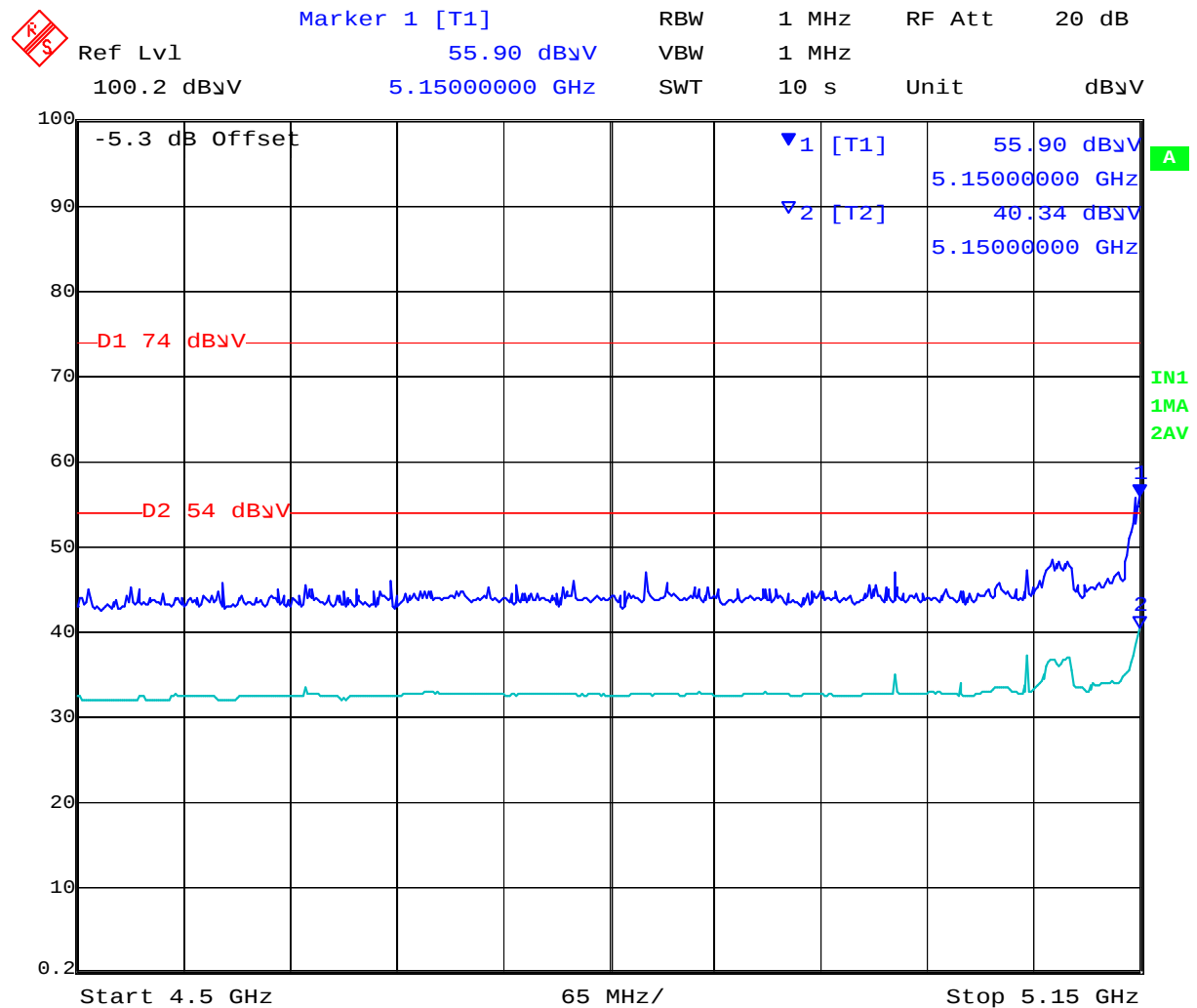
| Frequency MHz                                                                                           | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 5190.381                                                                                                | 71.1     | 4.6        | -9.9  | 65.8         | Peak [Scan]      | V   |        |         |              |           |            | FUND     |
| 10368.737                                                                                               | 61.2     | 6.7        | -2.5  | 65.4         | Peak [Scan]      | H   |        |         |              |           | Pass       | NRB      |
| 16092.184                                                                                               | 41.7     | 9.0        | 0.3   | 51.0         | Peak [Scan]      | H   | 100    | 0       | 54.0         | -3.0      | Pass       | NOISE    |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission |          |            |       |              |                  |     |        |         |              |           |            |          |
| NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205                |          |            |       |              |                  |     |        |         |              |           |            |          |

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## 802.11n HT-20 5150 Restricted Band-edge



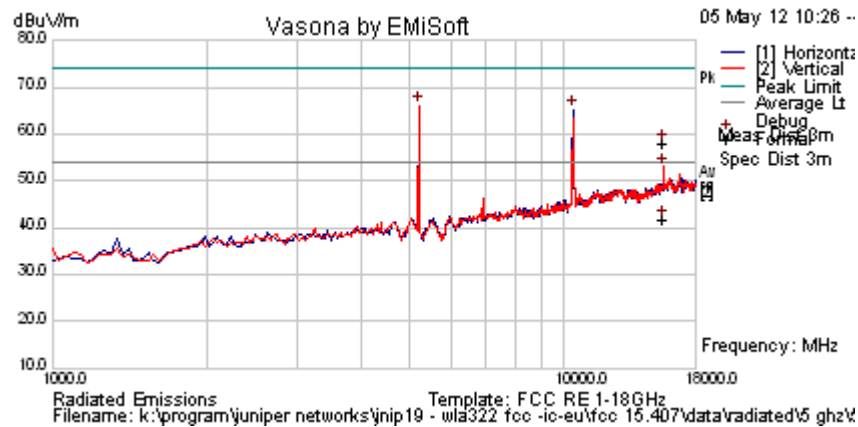
Date: 5.MAY.2012 12:02:49

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|               |                        |                |      |
|---------------|------------------------|----------------|------|
| Test Freq.    | 5200 MHz               | Engineer       | GMH  |
| Variant       | 802.11n HT-20; 6.5 MCS | Temp (°C)      | 18.5 |
| Freq. Range   | 1000 MHz - 18000 MHz   | Rel. Hum.(%)   | 33   |
| Power Setting | ART = 18               | Press. (mBars) | 1013 |
| Antenna       | Integral 0 dBi Average | Duty Cycle (%) | 100  |
| Test Notes 1  |                        |                |      |
| Test Notes 2  |                        |                |      |



#### Formally measured emission peaks

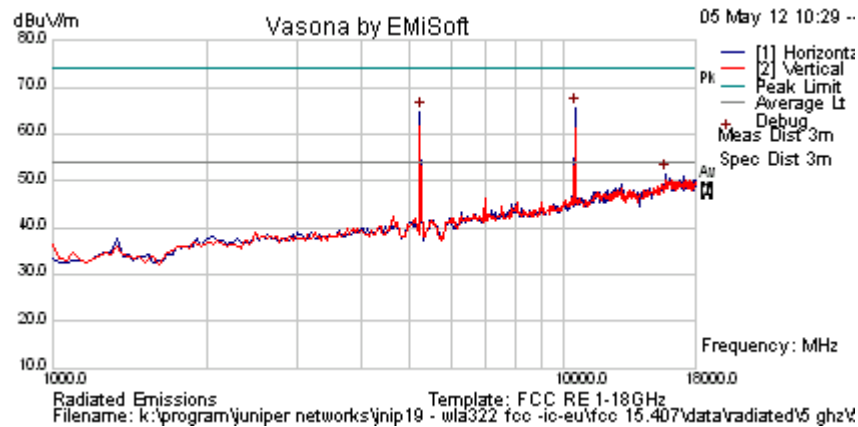
| Frequency MHz                                                                                                                                                                                       | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 5190.381                                                                                                                                                                                            | 71.3     | 4.6        | -9.9  | 66.0         | Peak [Scan]      | V   |        |         |              |           |            | FUND     |
| 10402.806                                                                                                                                                                                           | 61.1     | 6.7        | -2.5  | 65.3         | Peak [Scan]      | H   |        |         |              |           | Pass       | NRB      |
| 15598.597                                                                                                                                                                                           | 50.5     | 8.4        | -0.6  | 58.2         | Peak Max         | V   | 112    | 0       | 74.0         | -15.8     | Pass       | RB       |
| 15598.597                                                                                                                                                                                           | 34.0     | 8.4        | -0.6  | 41.8         | Average Max      | V   | 112    | 0       | 54.0         | -12.2     | Pass       | RB       |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission<br>NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205 |          |            |       |              |                  |     |        |         |              |           |            |          |

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|               |                        |                |      |
|---------------|------------------------|----------------|------|
| Test Freq.    | 5240 MHz               | Engineer       | GMH  |
| Variant       | 802.11n HT-20; 6.5 MCS | Temp (°C)      | 18.5 |
| Freq. Range   | 1000 MHz - 18000 MHz   | Rel. Hum.(%)   | 33   |
| Power Setting | ART = 18               | Press. (mBars) | 1013 |
| Antenna       | Integral 0 dBi Average | Duty Cycle (%) | 100  |
| Test Notes 1  |                        |                |      |
| Test Notes 2  |                        |                |      |



#### Formally measured emission peaks

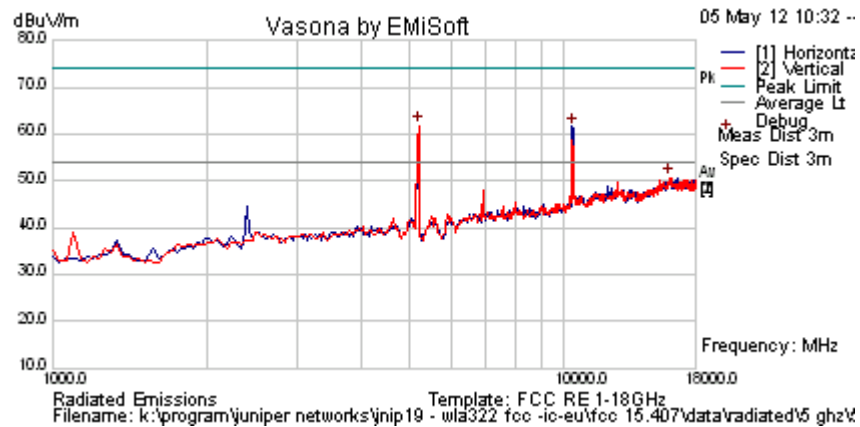
| Frequency MHz                                                                                                                                                                                       | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 10470.942                                                                                                                                                                                           | 61.4     | 6.8        | -2.5  | 65.7         | Peak [Scan]      | H   |        |         |              |           | Pass       | NRB      |
| 5224.449                                                                                                                                                                                            | 70.0     | 4.6        | -9.8  | 64.8         | Peak [Scan]      | H   |        |         |              |           |            | FUND     |
| 15751.503                                                                                                                                                                                           | 43.3     | 8.6        | -0.3  | 51.6         | Peak [Scan]      | H   | 100    | 0       | 54.0         | -2.4      | Pass       | NOISE    |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission<br>NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205 |          |            |       |              |                  |     |        |         |              |           |            |          |

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|               |                         |                |      |
|---------------|-------------------------|----------------|------|
| Test Freq.    | 5190 MHz                | Engineer       | GMH  |
| Variant       | 802.11n HT-40; 13.5 MCS | Temp (°C)      | 18.5 |
| Freq. Range   | 1000 MHz - 18000 MHz    | Rel. Hum.(%)   | 33   |
| Power Setting | ART = 18                | Press. (mBars) | 1013 |
| Antenna       | Integral 0 dBi Average  | Duty Cycle (%) | 100  |
| Test Notes 1  |                         |                |      |
| Test Notes 2  |                         |                |      |



#### Formally measured emission peaks

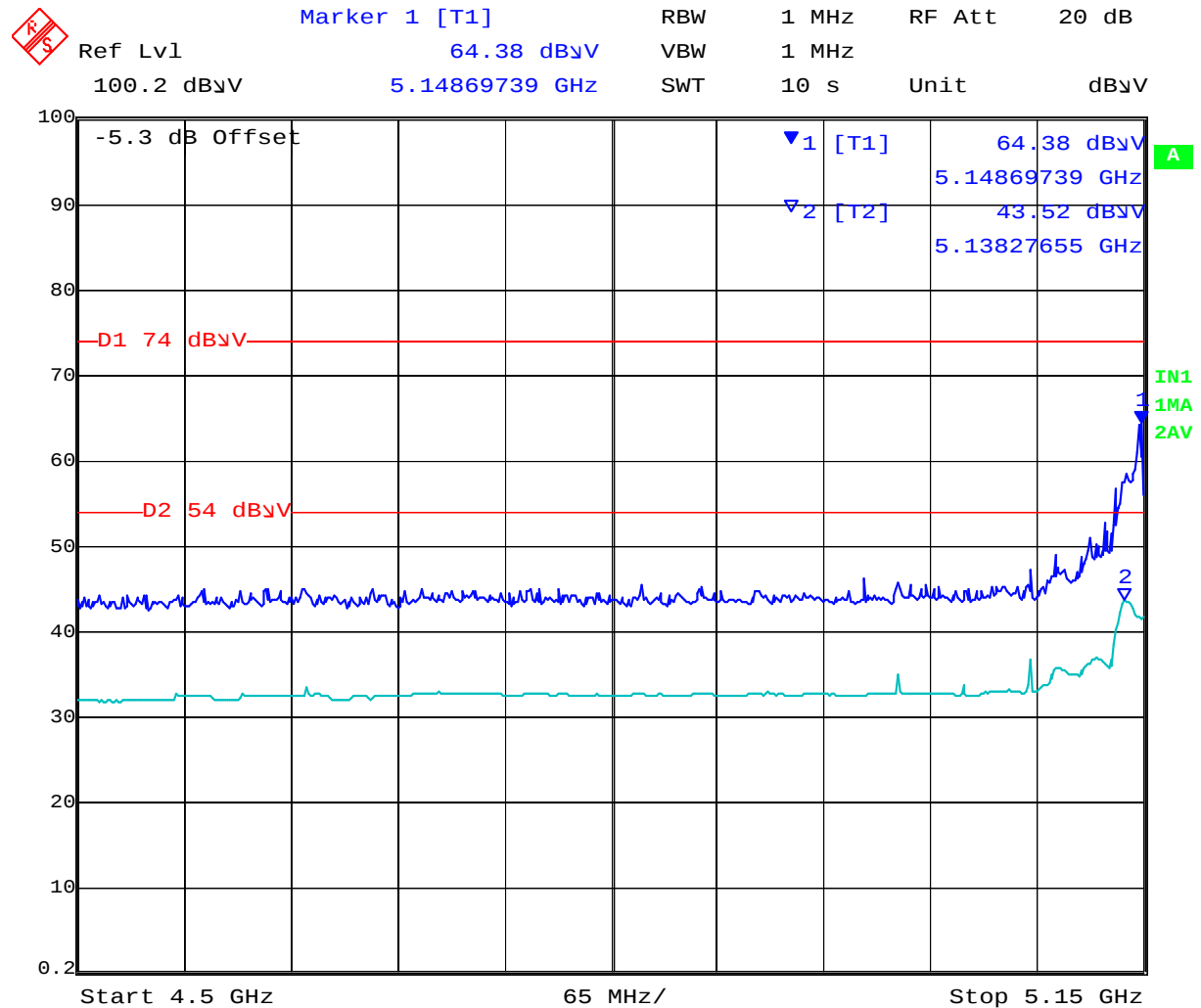
| Frequency MHz                                                                                           | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 5190.381                                                                                                | 67.0     | 4.6        | -9.9  | 61.8         | Peak [Scan]      | V   |        |         |              |           |            | FUND     |
| 10368.737                                                                                               | 57.5     | 6.7        | -2.5  | 61.7         | Peak [Scan]      | H   |        |         |              |           | Pass       | NRB      |
| 16058.116                                                                                               | 41.5     | 9.0        | 0.3   | 50.8         | Peak [Scan]      | H   | 100    | 0       | 54.0         | -3.2      | Pass       | NOISE    |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission |          |            |       |              |                  |     |        |         |              |           |            |          |
| NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205                |          |            |       |              |                  |     |        |         |              |           |            |          |

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## 802.11n HT-40 5150 Restricted Band-edge



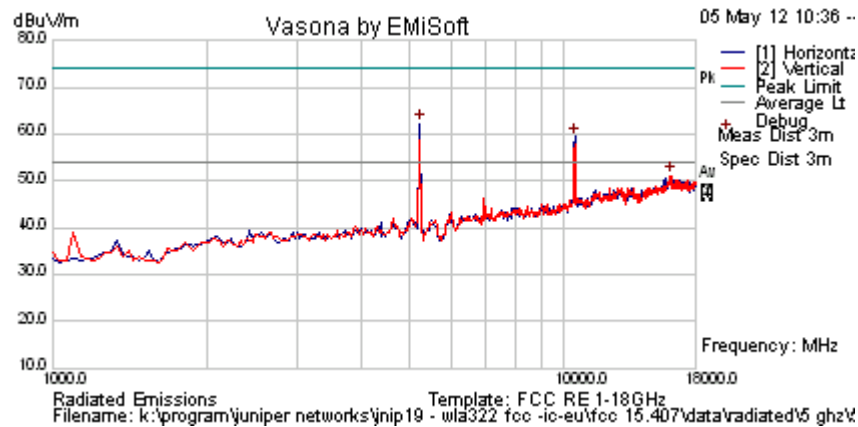
Date: 5.MAY.2012 12:03:22

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|               |                         |                |      |
|---------------|-------------------------|----------------|------|
| Test Freq.    | 5230 MHz                | Engineer       | GMH  |
| Variant       | 802.11n HT-40; 13.5 MCS | Temp (°C)      | 18.5 |
| Freq. Range   | 1000 MHz - 18000 MHz    | Rel. Hum.(%)   | 33   |
| Power Setting | ART = 18                | Press. (mBars) | 1013 |
| Antenna       | Integral 0 dBi Average  | Duty Cycle (%) | 100  |
| Test Notes 1  |                         |                |      |
| Test Notes 2  |                         |                |      |



#### Formally measured emission peaks

| Frequency MHz                                                                                           | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|---------------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 5224.449                                                                                                | 67.5     | 4.6        | -9.8  | 62.3         | Peak [Scan]      | H   |        |         |              |           |            | FUND     |
| 10470.942                                                                                               | 55.1     | 6.8        | -2.5  | 59.4         | Peak [Scan]      | H   |        |         |              |           | Pass       | NRB      |
| 16160.321                                                                                               | 42.1     | 9.0        | 0.2   | 51.2         | Peak [Scan]      | V   | 100    | 0       | 54.0         | -2.8      | Pass       | NOISE    |
| Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission |          |            |       |              |                  |     |        |         |              |           |            |          |
| NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205                |          |            |       |              |                  |     |        |         |              |           |            |          |

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#### 5.1.7.2. Radiated Spurious Emissions – 30MHz – 1000MHz

**FCC, Part 15 Subpart C §15.205/ §15.209**  
**Industry Canada RSS-210 §2.2**

##### Test Procedure

Testing 30M-1 GHz was performed in a 3-meter anechoic chamber using a CISPR compliant receiver. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. To further maximize emissions the receive antenna was varied between 1 and 4 meters. The emissions are recorded with receiver in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

The EUT had two methods of powering on ac/dc converter and Power over Ethernet (POE). Both modes were tested for emissions below 1GHz.

##### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. In this test facility, the Antenna Factor, Cable Loss, and Amplifier Gains are loaded into the Rohde & Schwarz Receiver and the corrected field strength can be read directly on the receiver.

$$FS = R + AF + CORR$$

where:

FS = Field Strength

R = Measured Receiver Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

For example:

Given a Receiver input reading of 51.5dB $\mu$ V; Antenna Factor of 8.5dB; Cable Loss of 1.3dB; Falloff Factor of 0dB, an Amplifier Gain of 26dB and Notch Filter Loss of 1dB. The Field Strength of the measured emission is:

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

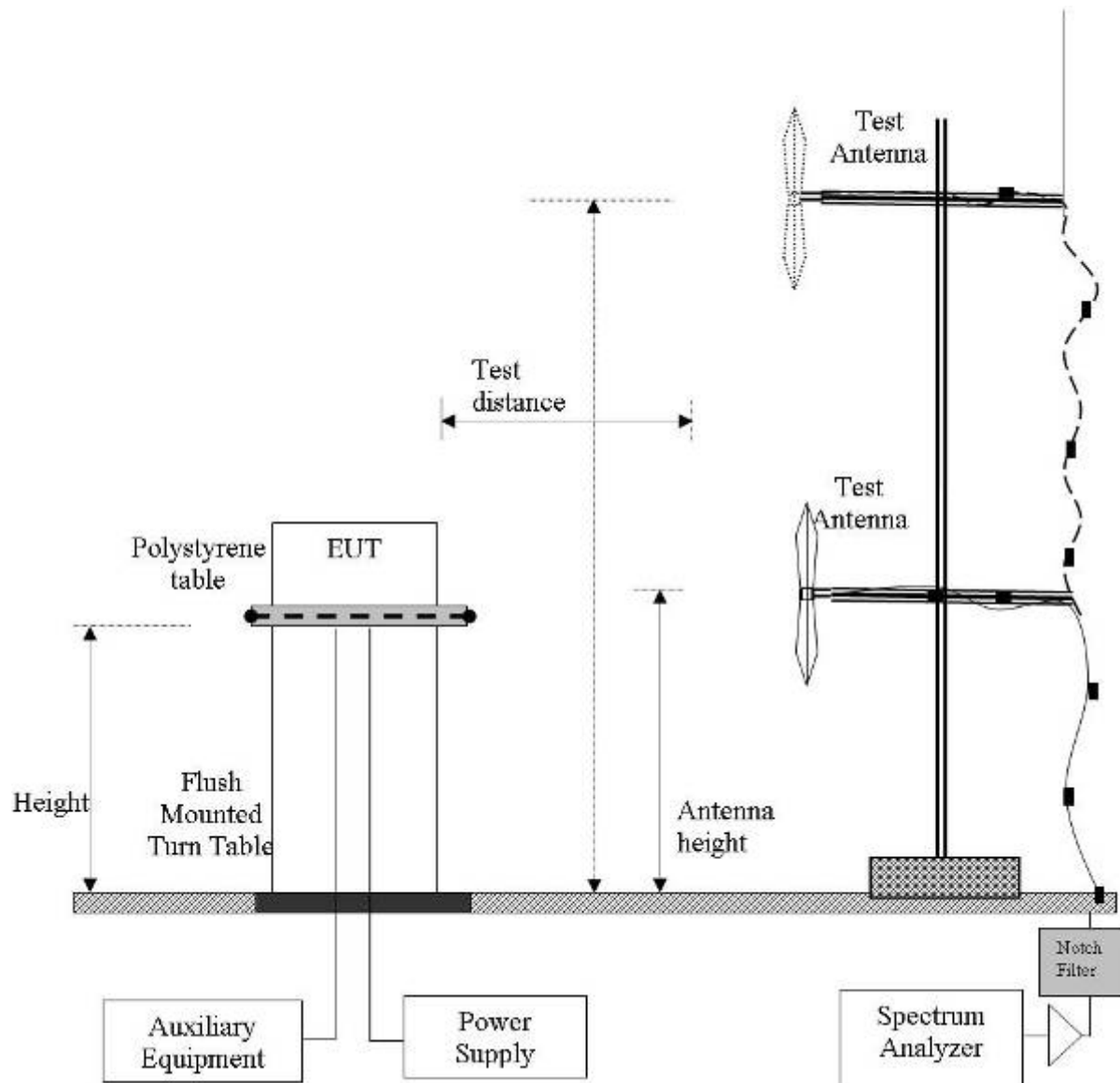
Conversion between dB $\mu$ V/m (or dB $\mu$ V) and  $\mu$ V/m (or  $\mu$ V) are done as:

$$\text{Level (dB}\mu\text{V/m)} = 20 * \text{Log (level (\mu V/m))}$$

$$40 \text{ dB}\mu\text{V/m} = 100\mu\text{V/m}$$

$$48 \text{ dB}\mu\text{V/m} = 250\mu\text{V/m}$$

## Radiated Emission Measurement Setup – Below 1 GHz

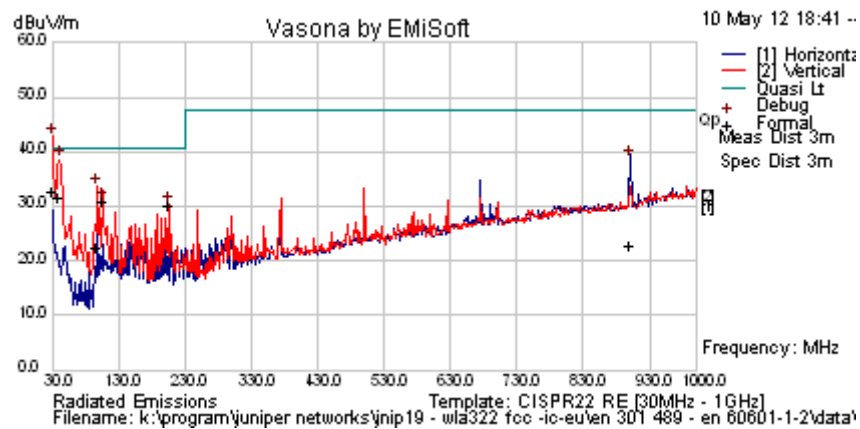


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|               |                                     |                |      |
|---------------|-------------------------------------|----------------|------|
| Test Freq.    | N/A                                 | Engineer       | GMH  |
| Variant       | Digital Emissions                   | Temp (°C)      | 27.5 |
| Freq. Range   | 30 MHz - 1000 MHz                   | Rel. Hum.(%)   | 30   |
| Power Setting | N/A                                 | Press. (mBars) | 996  |
| Antenna       | Integral antenna 0 dBi average gain |                |      |
| Test Notes 1  | Receiver Operational                |                |      |
| Test Notes 2  |                                     |                |      |



#### Formally measured emission peaks

| Frequency MHz                                                                                  | Raw dBuV | Cable Loss | AF dB | Level dBuV/m | Measurement Type | Pol | Hgt cm | Azt Deg | Limit dBuV/m | Margin dB | Pass /Fail | Comments |
|------------------------------------------------------------------------------------------------|----------|------------|-------|--------------|------------------|-----|--------|---------|--------------|-----------|------------|----------|
| 106.894                                                                                        | 48.8     | 4.1        | -19.4 | 33.4         | Quasi Max        | V   | 102    | 320     | 40.5         | -7.1      | Pass       |          |
| 30.000                                                                                         | 38.9     | 3.5        | -9.7  | 32.7         | Quasi Max        | V   | 101    | 11      | 40.5         | -7.8      | Pass       |          |
| 39.719                                                                                         | 45.2     | 3.6        | -17.3 | 31.5         | Quasi Max        | V   | 111    | 30      | 40.5         | -9.0      | Pass       |          |
| 204.979                                                                                        | 44.2     | 4.7        | -19.6 | 29.3         | Quasi Max        | V   | 216    | 0       | 40.5         | -11.2     | Pass       |          |
| 97.949                                                                                         | 40.2     | 4.1        | -21.9 | 22.5         | Quasi Max        | V   | 122    | 334     | 40.5         | -18.0     | Pass       |          |
| 900.679                                                                                        | 23.7     | 7.1        | -7.8  | 23.0         | Quasi Max        | H   | 291    | 84      | 47.5         | -24.5     | Pass       |          |
| Legend: DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency |          |            |       |              |                  |     |        |         |              |           |            |          |
| NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band              |          |            |       |              |                  |     |        |         |              |           |            |          |

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## Specification

### Limits

**§15.205 (a)** Except as shown in paragraph (d) of 15.205 (a), only spurious emissions are permitted in any of the frequency bands listed.

**§15.205 (a)** Except as shown 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 Section §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

**§15.209 (a)** Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table.

### §15.209 (a) and RSS-Gen §2.2 Limit Matrix

| Frequency(MHz) | Field Strength<br>( $\mu$ V/m) | Field Strength<br>(dB $\mu$ V/m) | Measurement Distance<br>(meters) |
|----------------|--------------------------------|----------------------------------|----------------------------------|
| 30-88          | 100                            | 40.0                             | 3                                |
| 88-216         | 150                            | 43.5                             | 3                                |
| 216-960        | 200                            | 46.0                             | 3                                |
| Above 960      | 500                            | 54.0                             | 3                                |

### Laboratory Measurement Uncertainty for Radiated Emissions

|                         |               |
|-------------------------|---------------|
| Measurement uncertainty | +5.6/ -4.5 dB |
|-------------------------|---------------|

### Traceability

| Method                                                                                | Test Equipment Used                            |
|---------------------------------------------------------------------------------------|------------------------------------------------|
| Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions' | 0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312 |

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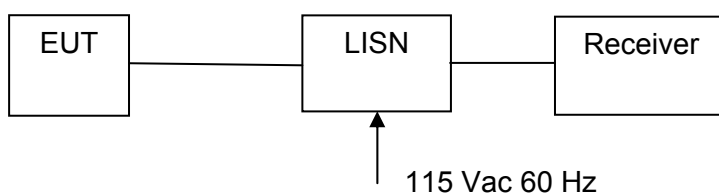
#### **5.1.8. AC Wireline Conducted Emissions (150 kHz – 30 MHz)**

**FCC, Part 15 Subpart C §15.207**  
**Industry Canada RSS-Gen §7.2.2**

##### **Test Procedure**

The EUT is configured in accordance with ANSI C63.4. The conducted emissions are measured in a shielded room with a spectrum analyzer in peak hold in the first instance. Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation. The highest emissions relative to the limit are listed.

##### **Test Measurement Set up**



Measurement set up for AC Wireline Conducted Emissions Test

#### **Measurement Results for AC Wireline Conducted Emissions (150 kHz – 30 MHz)**

Ambient conditions.

Temperature: 17 to 23 °C      Relative humidity: 31 to 57 %      Pressure: 999 to 1012 mbar

**Not required - EUT is POE only.**



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## Specification

### Limit

**§15.207 (a)** Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu\Omega$  line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

### **RSS-Gen §7.2.2**

The radio frequency voltage that is conducted back into the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The tighter limit applies at the frequency range boundaries.

### **§15.207 (a)** and **RSS-Gen §7.2.2** Limit Matrix

The lower limit applies at the boundary between frequency ranges

| Frequency of Emission (MHz) | Conducted Limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

\* Decreases with the logarithm of the frequency

### Laboratory Measurement Uncertainty for Conducted Emissions

|                         |               |
|-------------------------|---------------|
| Measurement uncertainty | $\pm 2.64$ dB |
|-------------------------|---------------|

### Traceability

| Method                                                                                     | Test Equipment Used                |
|--------------------------------------------------------------------------------------------|------------------------------------|
| Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions' | 0158, 0184, 0287, 0190, 0293, 0307 |

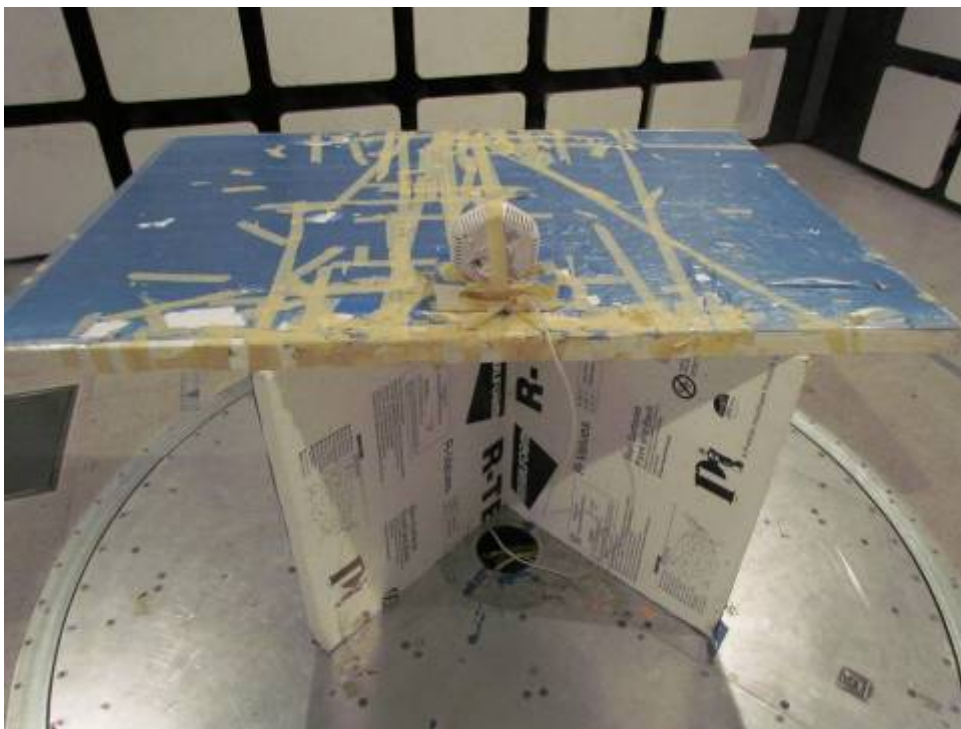
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## 6. PHOTOGRAPHS

### 6.1. Conducted Test Setup



## 6.2. Radiated Test Setup < 1 GHz



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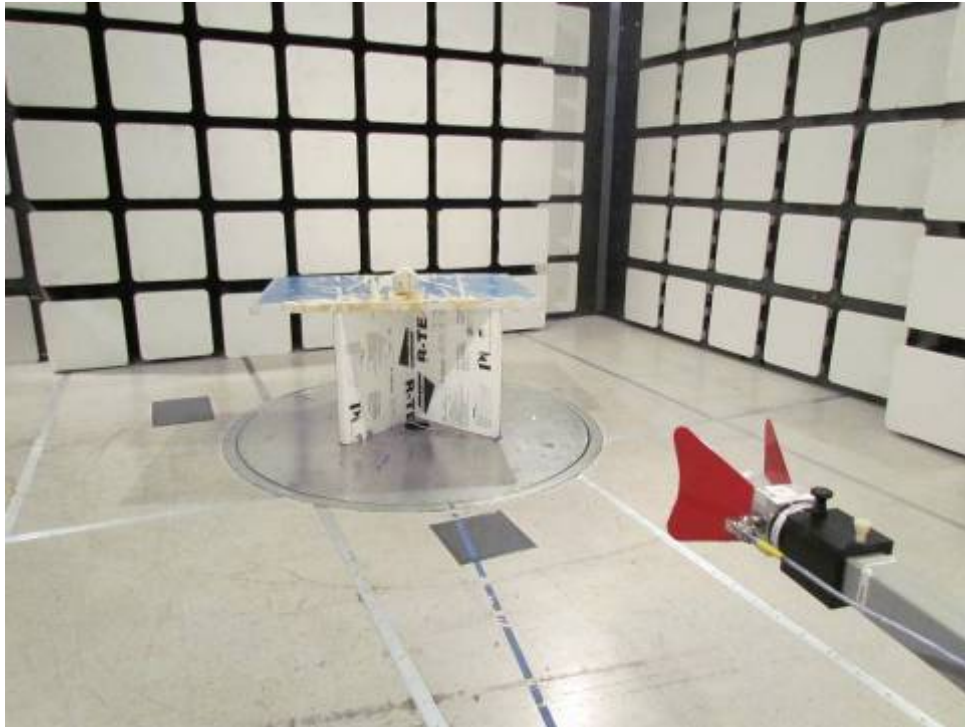
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### 6.3. Radiated Test Setup > 1 GHz



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#### 6.4. Dynamic Frequency Selection (DFS)







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## 7. TEST EQUIPMENT DETAILS

| Asset # | Instrument                | Manufacturer        | Part #                    | Serial #   | Calibration Due Date    |
|---------|---------------------------|---------------------|---------------------------|------------|-------------------------|
| 0070    | Power Meter               | Hewlett Packard     | 437B                      | 3125U11552 | 28 <sup>th</sup> Nov 12 |
| 0117    | Power Sensor              | Hewlett Packard     | 8487D                     | 3318A00371 | 15 <sup>th</sup> Nov 12 |
| 0223    | Power Meter               | Hewlett Packard     | EPM-442A                  | US37480256 | 15 <sup>th</sup> Nov 12 |
| 0374    | Power Sensor              | Hewlett Packard     | 8485A                     | 3318A19694 | 29 <sup>th</sup> Nov 12 |
| 0158    | Barometer<br>/Thermometer | Control Co.         | 4196                      | E2846      | 8 <sup>th</sup> Dec 12  |
| 0193    | EMI Receiver              | Rhode &<br>Schwartz | ESI 7                     | 838496/007 | 2 <sup>nd</sup> Dec 12  |
| 0287    | EMI Receiver              | Rhode &<br>Schwartz | ESIB40                    | 100201     | 16 <sup>th</sup> Nov 12 |
| 0338    | 30 - 3000 MHz<br>Antenna  | Sunol               | JB3                       | A052907    | 8 <sup>th</sup> Nov 12  |
| 0335    | 1-18 GHz Horn<br>Antenna  | EMCO                | 3117                      | 00066580   | 7 <sup>th</sup> Nov 12  |
| 0252    | SMA Cable                 | Megaphase           | Sucoflex 104              | None       | N/A                     |
| 0293    | BNC Cable                 | Megaphase           | 1689 1GVT4                | 15F50B001  | N/A                     |
| 0307    | BNC Cable                 | Megaphase           | 1689 1GVT4                | 15F50B002  | N/A                     |
| 0310    | 2m SMA Cable              | Micro-Coax          | UFA210A-0-<br>0787-3G03G0 | 209089-001 | N/A                     |
| 0312    | 3m SMA Cable              | Micro-Coax          | UFA210A-1-<br>1181-3G0300 | 209092-001 | N/A                     |
| 0314    | 30dB N-Type<br>Attenuator | ARRA                | N9444-30                  | 1623       | N/A                     |
| 0301    | 5.6 GHz Notch Filter      | Micro-Tronics       | RBC50704                  | 001        | N/A                     |
| 0302    | 5.25 GHz Notch<br>Filter  | Micro-Tronics       | BRC50703                  | 002        | N/A                     |
| 0303    | 5.8 GHz Notch Filter      | Micro-Tronics       | BRC50705                  | 003        | N/A                     |
| 0304    | 2.4GHzHz Notch<br>Filter  | Micro-Tronics       | --                        | 001        | N/A                     |

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