Test of Juniper Networks WLA321 Wireless LAN Access Point

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

Test Report Serial No.: JNIP16-U2 Rev A

TEST REPORT

FROM

Test of Juniper Networks WLA321 Wireless LAN Access Point

to

To FCC 47 CFR Part 15.407 & IC RSS-210

Test Report Serial No.: JNIP16-U2 Rev A

Note: this report contains data with regard to the 5,150 to 5,250 MHz band for Juniper Networks, WLA321 Wireless Access Point. 2.4 and 5.8 GHz test data are reported in MiCOM Labs test report JNIP16-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: 28th March 2012

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
440 Boulder Court, Suite 200
Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
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ACCREDITED
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 test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

ilac-MRA

A2LA World Class Accreditation

The American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

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

Presented this 27th day of March 2012.

President & CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2013

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

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) 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

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 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

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	28th March 2012	Initial release.

1. TEST RESULT CERTIFICATE

Applicant:	Juniper Networks, Inc 1194 North Mathilda Avenue Sunnyvale California 94089, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	Product Description	Tel:	+1 925 462 0304
Model:	WLA321-US	Fax:	+1 925 462 0306
S/N:	Conducted unit: not available Radiated: MA351110064		
Test Date(s):	2nd February to 11th March 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.

ACCREDITED
TESTING CERTIFICATE #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

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	4th 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 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 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(xi)	A2LA	14th 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

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.

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the Juniper Networks WLA321 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 1194 North Mathilda Avenue Sunnyvale California 94089, USA
Manufacturer:	As applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	JNIP16-U2 Rev A
Date EUT received:	2nd February 2012
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210
Dates of test (from - to):	2nd February to 11th March 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):	WLA321
Location for use:	Indoor
Declared Frequency Range(s):	5,150 to 5,250 MHz
Software Release	7.7.1
Type of Modulation:	Per 802.11 – OFDM
Declared Nominal Output Power: (Average Power)	802.11a: Legacy +18 dBm 802.11n: HT-20 +18 dBm 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:	WLA321 has no capability for beam forming
Rated Input Voltage and Current:	POE 48 Vdc 0.625 A
Operating Temperature Range:	Declared range 0° to +50°C
ITU Emission Designator:	802.11a 18M8D1D 802.11n HT-20 19M9D1D 802.11n HT-40 36M7D1D
Equipment Dimensions:	5.6in (H) x 5.4in (W) x 1.9in (D)
Weight:	8 oz
Primary function of equipment:	Wireless Access Point for transmitting data and voice.

3.2. Scope of Test Program

Juniper Networks WLA321 Access Point RF Testing
The scope of the test program was to test the Juniper Networks WLA321 Wireless LAN Access Point, 2x2 Spatial Multiplexing MIMO configurations in the frequency range 5,150 to 5,250 MHz for compliance against FCC 47 CFR Part 15.407 and Industry Canada RSS-210 specifications.

WLA321-US (for US distribution)
WLA321-WW, WLA321-XX (where –XX can be any alphanumeric, for world wide distribution)

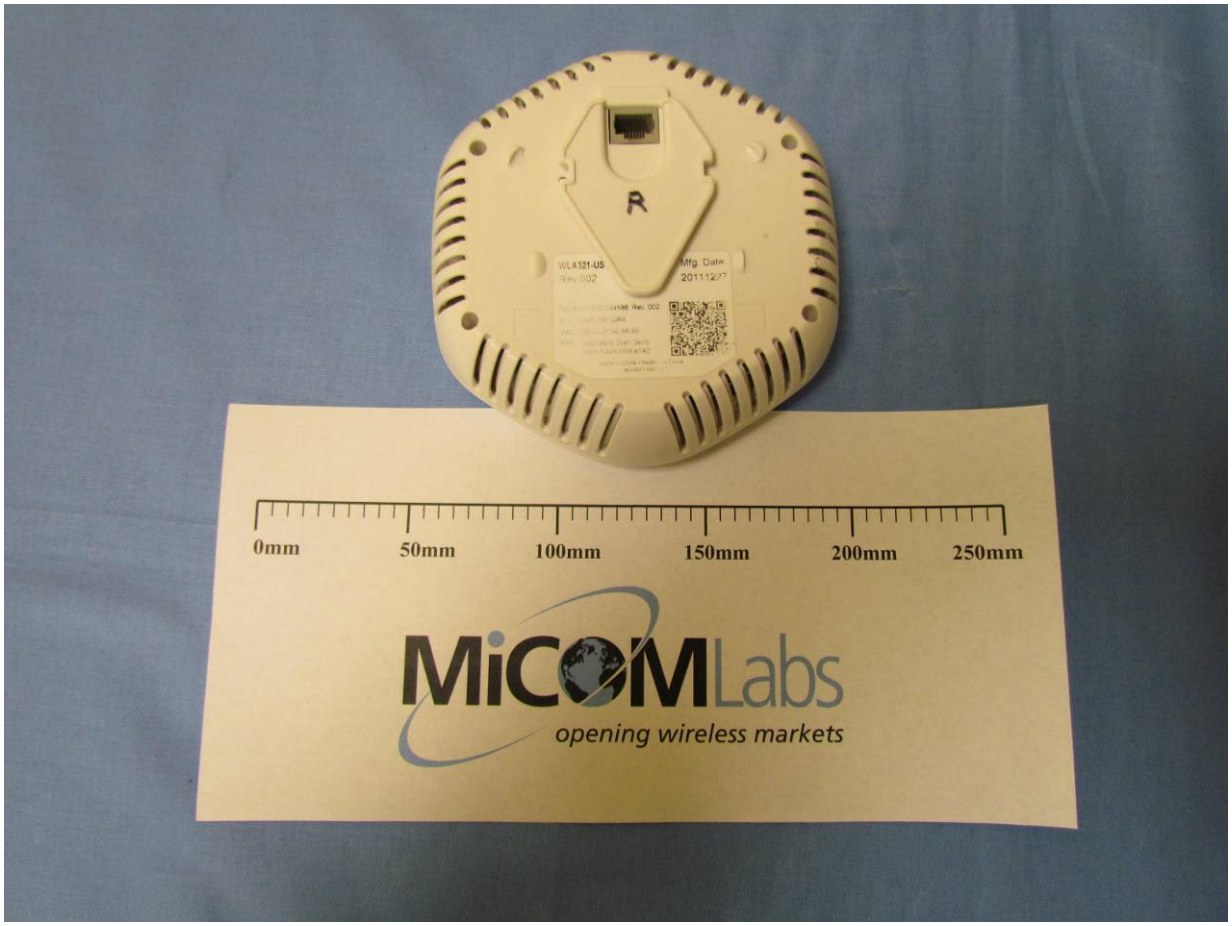
FCC OET KDB Implementation
This test program implements the following FCC KDB – 662911 4/4/2011;
Emissions Testing of Transmitters with Multiple Outputs in the Same Band

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.

WLA321 802.11 a/b/g/n Wireless Access Point

WLA321 802.11 a/b/g/n Wireless Access Point



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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Wireless LAN Access Point	Juniper Networks	WLA321	Conducted unit: not available
EUT	Wireless LAN Access Point	Juniper Networks	WLA321	Radiated - MA351110064
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)

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) (802.11)	Variant	Data Rates with Highest Power	Frequencies (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
Band 5,250 – 5,350

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

3.7. Equipment Modifications

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

The following modifications were required to bring the equipment into compliance. Section 5.1.2 Transmit Output Power identifies the total conducted power levels measured per antenna port and sums the powers. The tables in Section 5.1.2 includes the following power reduction and reports the maximum possible operating power levels.

1. Band-Edge Power Reduction

During radiated band-edge emission testing the output power was reduced in order to comply with the Restricted Band criteria. At 5.15 – 5.35 GHz restricted bands are 4,500 – 5,150 MHz and 5,320 – 5,460 MHz.

5 GHz Band-Edge Power Settings – Nominal Setting was NART = 18 all modes

Frequency Range	Mode	Channel	Band-Edge Frequency (MHz)	Power Setting (NART)
5,150 – 5,350	802.11a	36	5,150.0	17
		64	5,350.0	Maximum
	802.11n HT-20	36	5,150.0	16
		64	5,350.0	Maximum
	802.11n HT-40	36	5,150.0	14
		64	5,350.0	15

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

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

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
15.407(b)(2) **15.205(a)** **15.209(a)** **2.2** **2.6** **A9.3(2)** **4.7**	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*
Industry Canada only **RSS-Gen §4.10, §6**	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.7.2*
15.407(b)(6) **15.205(a)** **15.209(a)** **2.2**	Radiated Emissions	Emissions <1 GHz (30M-1 GHz)		Complies	*5.1.7.3*
15.407(b)(6) **15.207** **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	Complies	5.1.8

5. TEST RESULTS

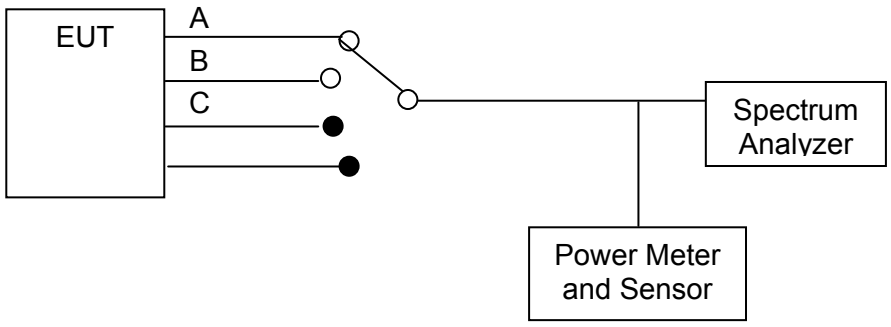
5.1. Device Characteristics

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

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**

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

26 dB Bandwidth

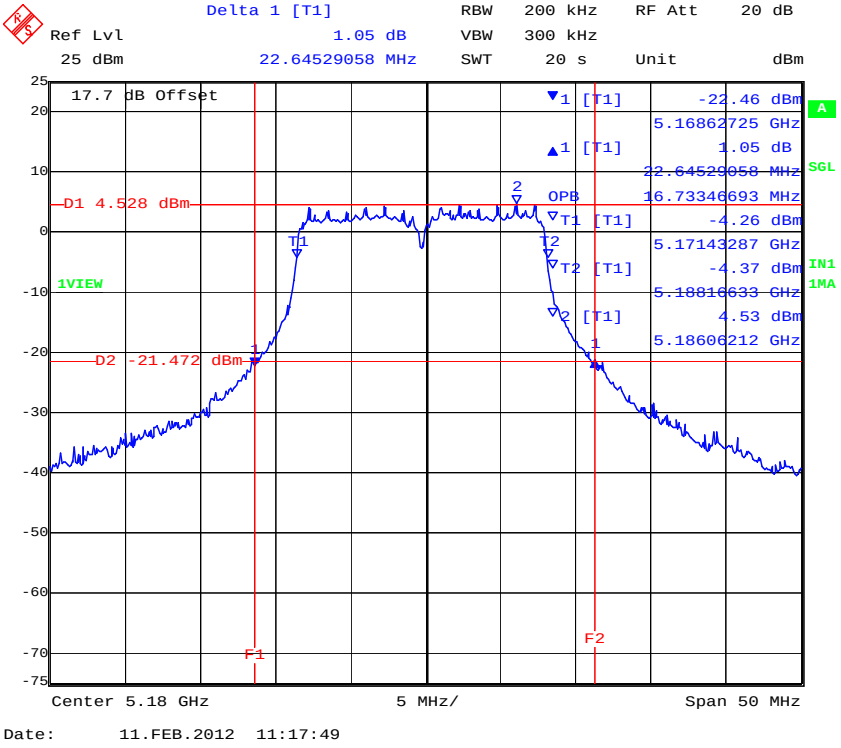
Test Frequency	26 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5180	22.645000	23.146000	--	--	500	0.5	-22.145000
5200	22.044000	22.946000	--	--			-21.544000
5240	21.944000	22.745000	--	--			-21.444000

99% Bandwidth

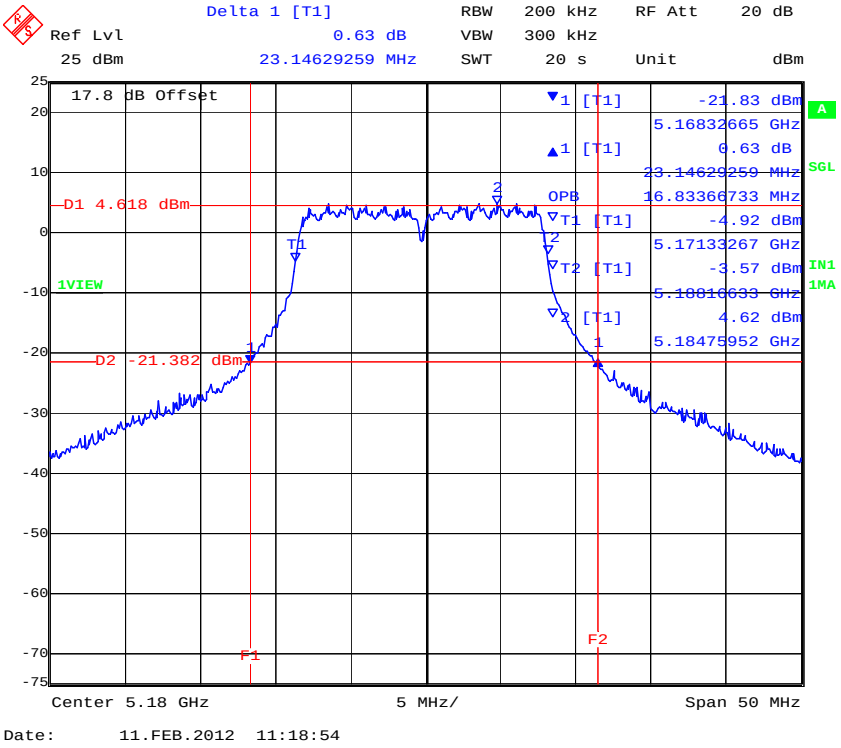
Test Frequency	99 % Bandwidth						
	MHz						
MHz	**a**	**b**	**c**	**d**			
5180	16.733000	16.834000	--	--			
5200	16.733000	16.834000	--	--			
5240	16.633000	16.834000	--	--			

Measurement uncertainty:	±2.81 dB

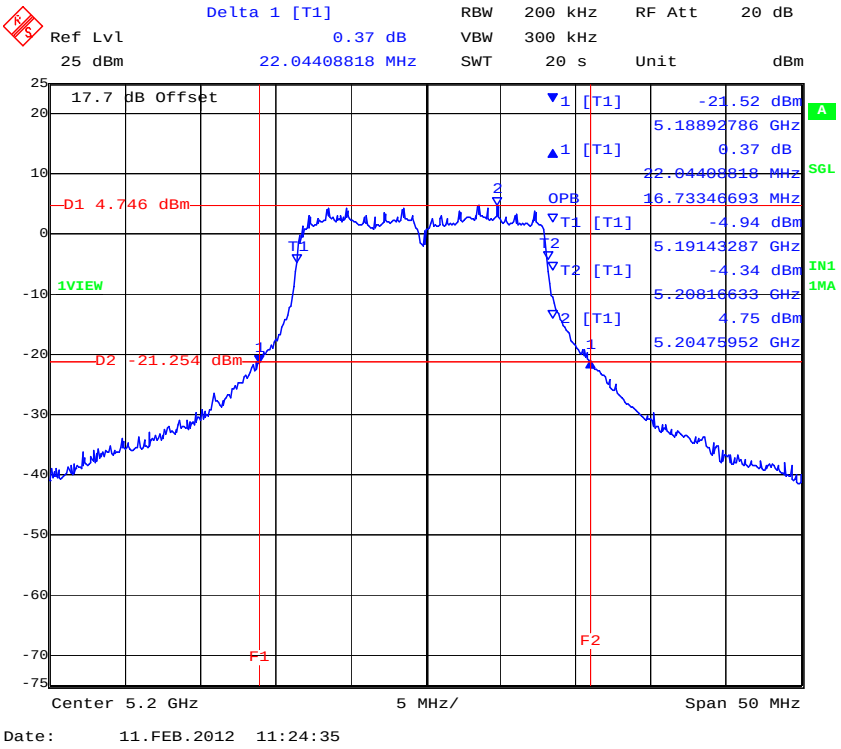
PORT A 5,180 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



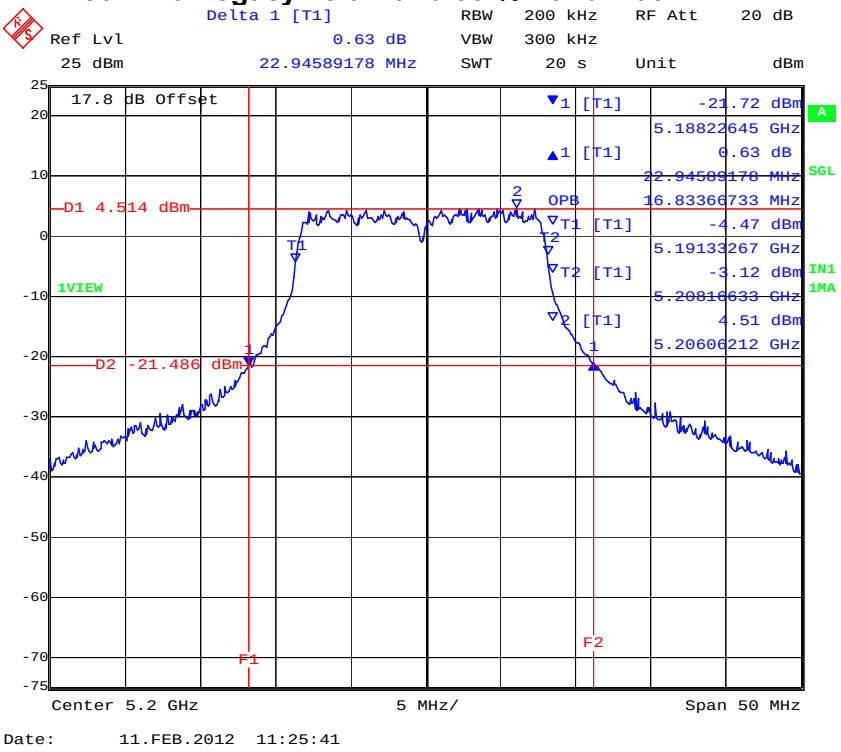
PORT B 5,180 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



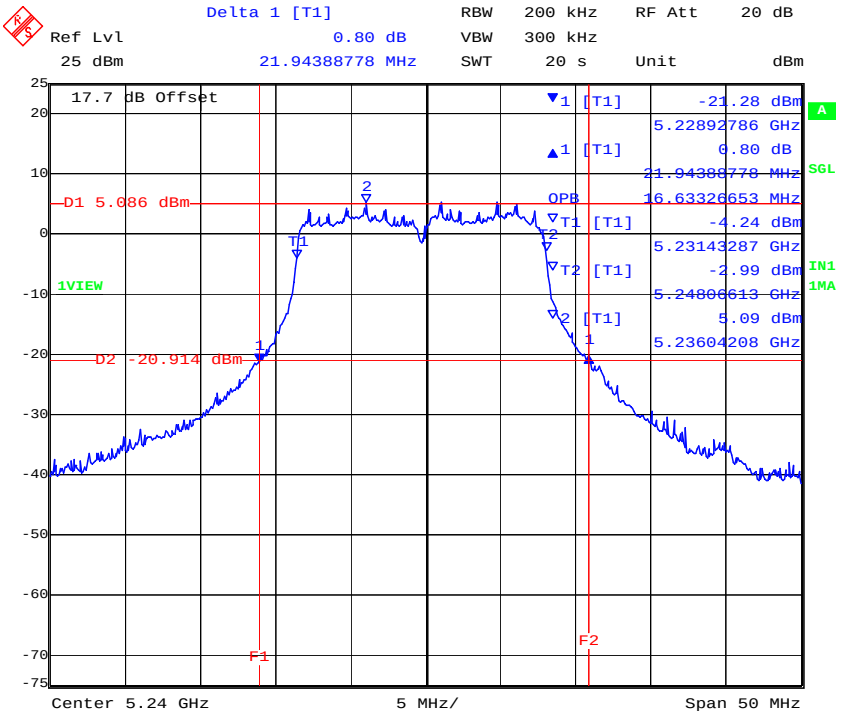
PORT A 5,200 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



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



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

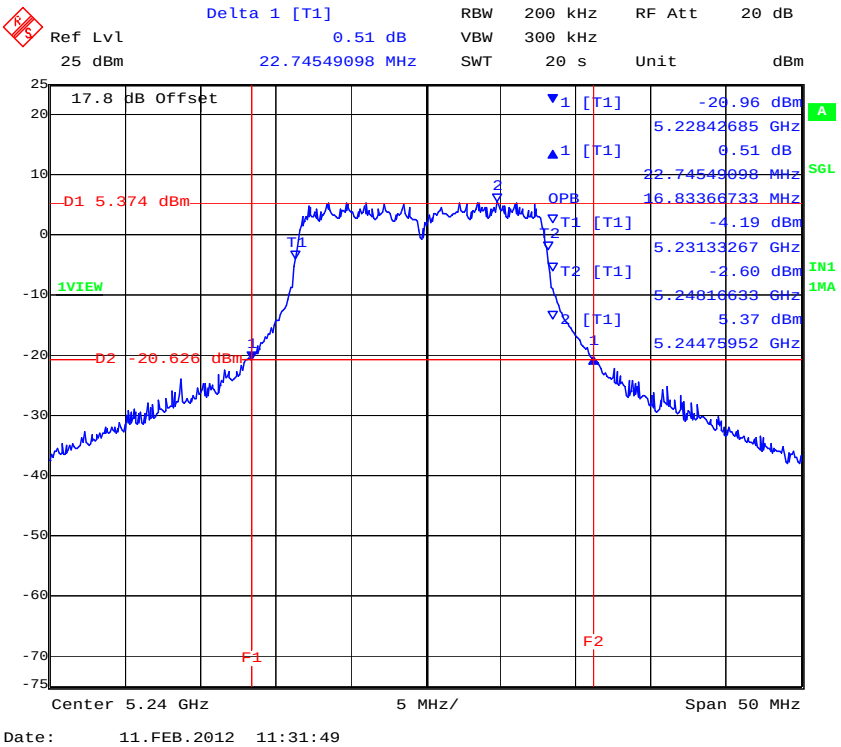


TABLE OF RESULTS – **802.11n HT-20 5150 – 5250 MHz**

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

26 dB Bandwidth

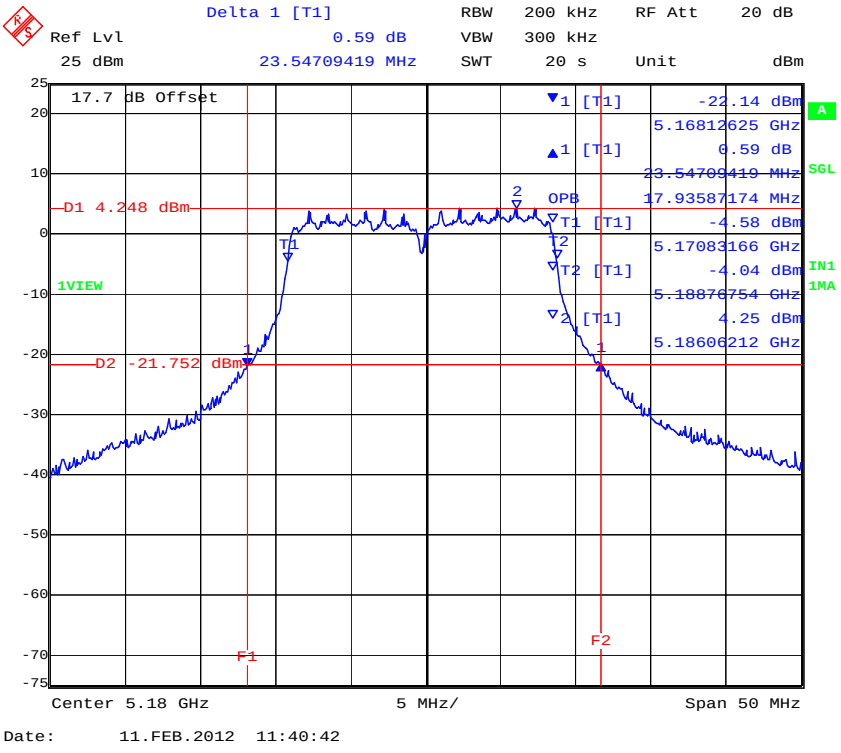
Test Frequency	26 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5180	23.547000	24.048000	--	--	500	0.5	-23.047000
5200	23.046000	23.848000	--	--			-22.546000
5240	22.645000	23.747000	--	--			-22.145000

99% Bandwidth

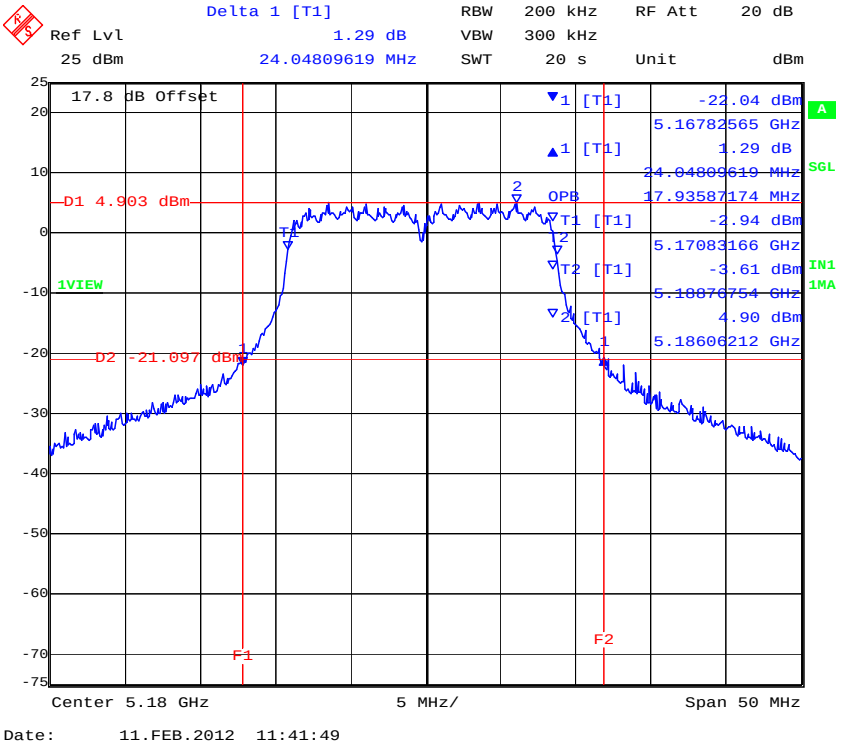
Test Frequency	99 % Bandwidth						
	MHz						
MHz	**a**	**b**	**c**	**d**			
5180	17.936000	17.936000	--	--			
5200	17.936000	17.936000	--	--			
5240	17.836000	17.936000	--	--			

Measurement uncertainty:	±2.81 dB

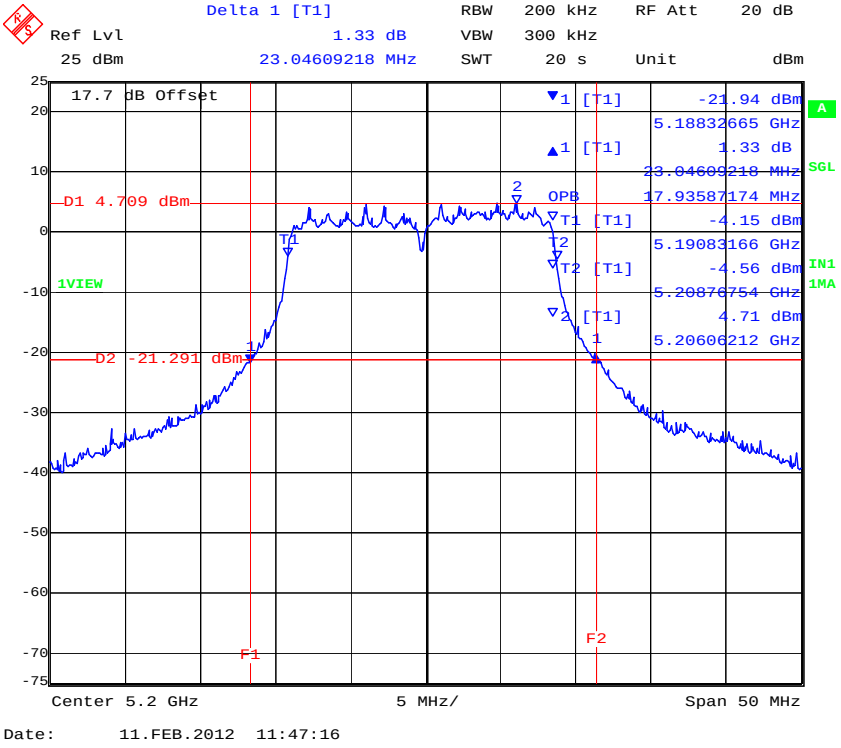
PORT A 5,180 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



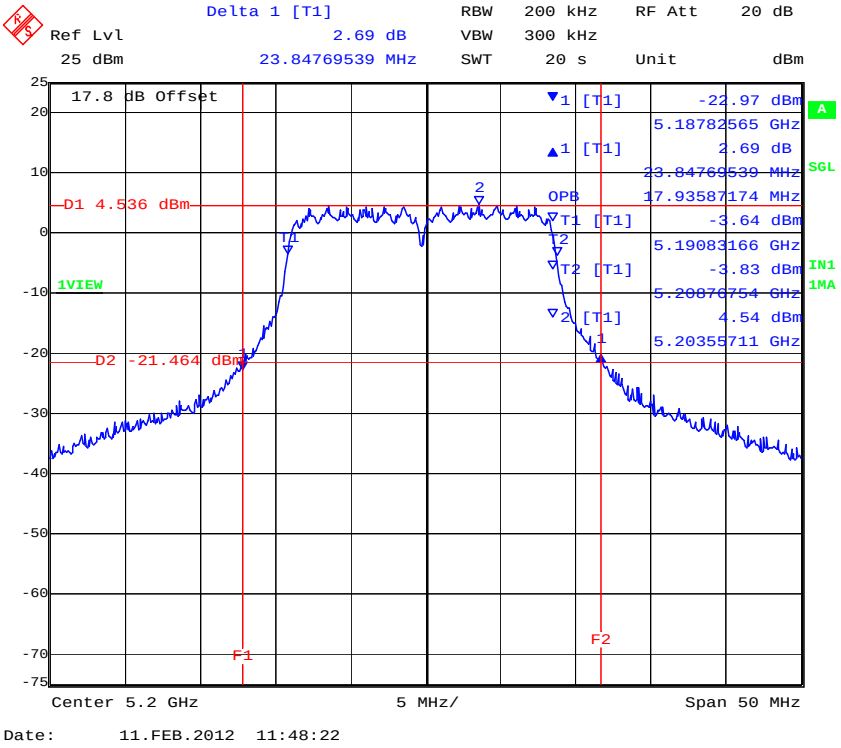
PORT B 5,180 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



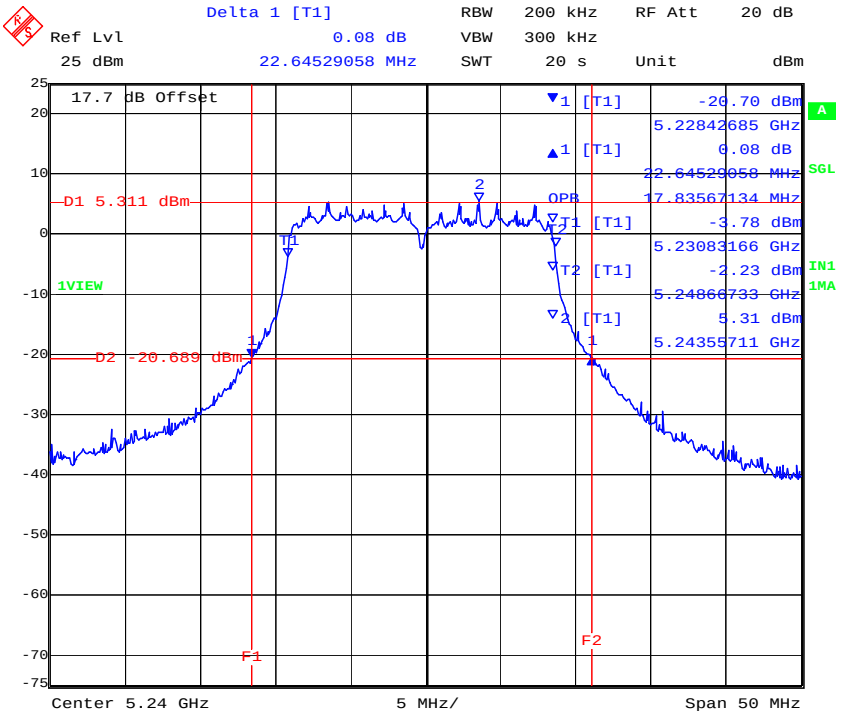
PORT A 5,200 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



PORT B 5,200 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



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

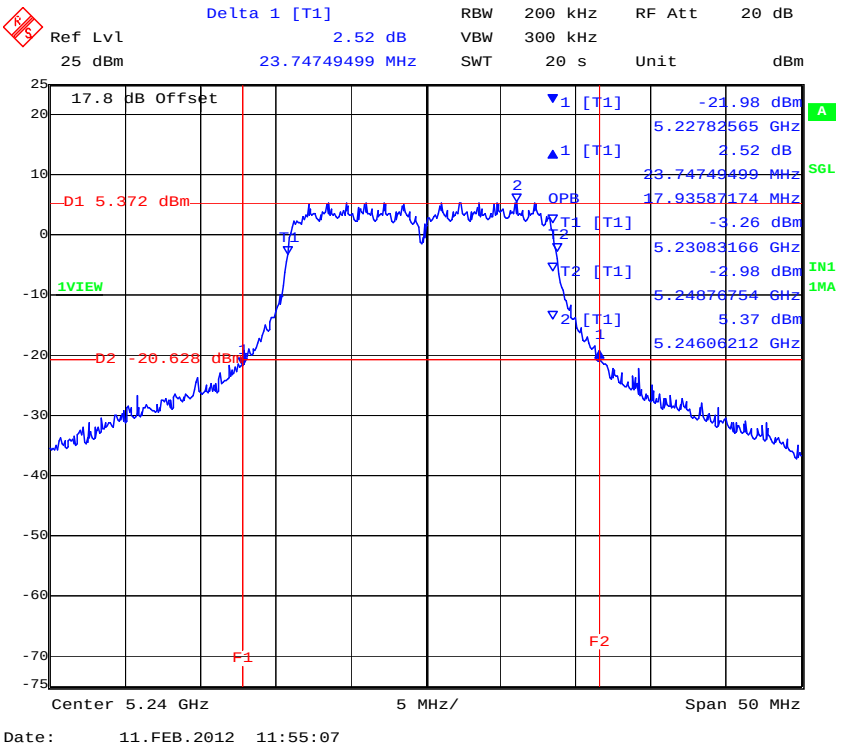


TABLE OF RESULTS – **802.11n HT-40 5150 – 5250 MHz**

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

26 dB Bandwidth

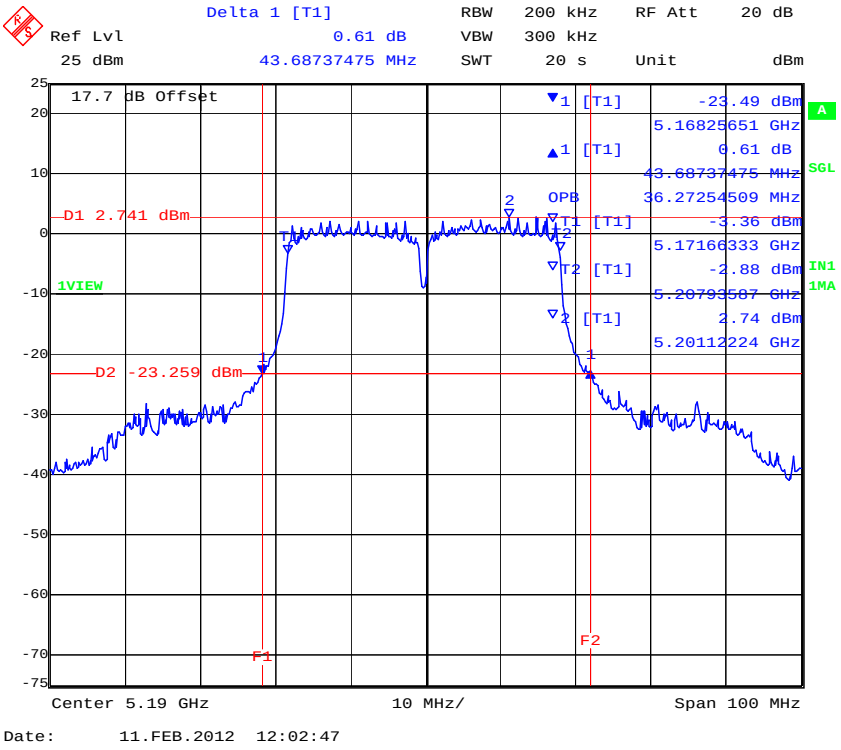
Test Frequency	26 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5190	43.687000	44.689000	--	--	500	0.5	-43.187000
5230	44.088000	46.293000	--	--			-43.588000

99% Bandwidth

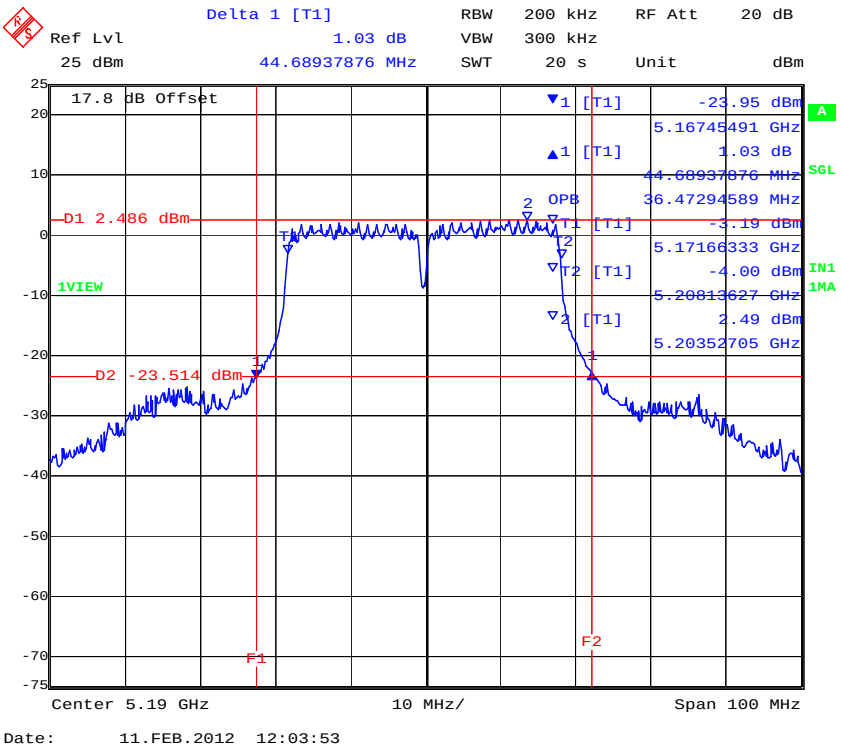
Test Frequency	99 % Bandwidth						
	MHz						
MHz	**a**	**b**	**c**	**d**			
5190	36.273000	36.473000	--	--			
5230	36.473000	36.473000	--	--			

Measurement uncertainty:	±2.81 dB

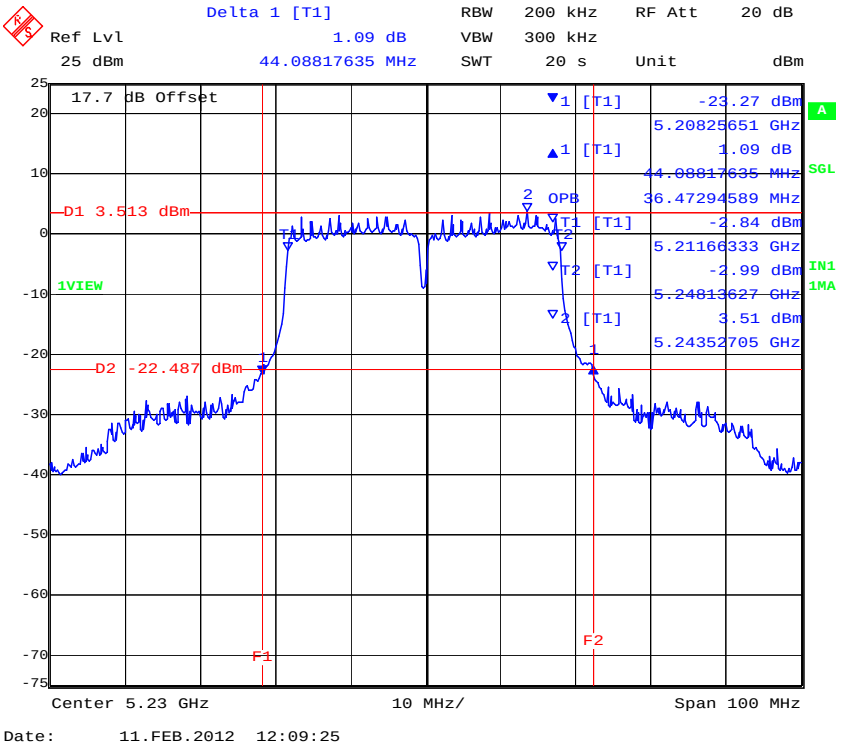
PORT A 5,190 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



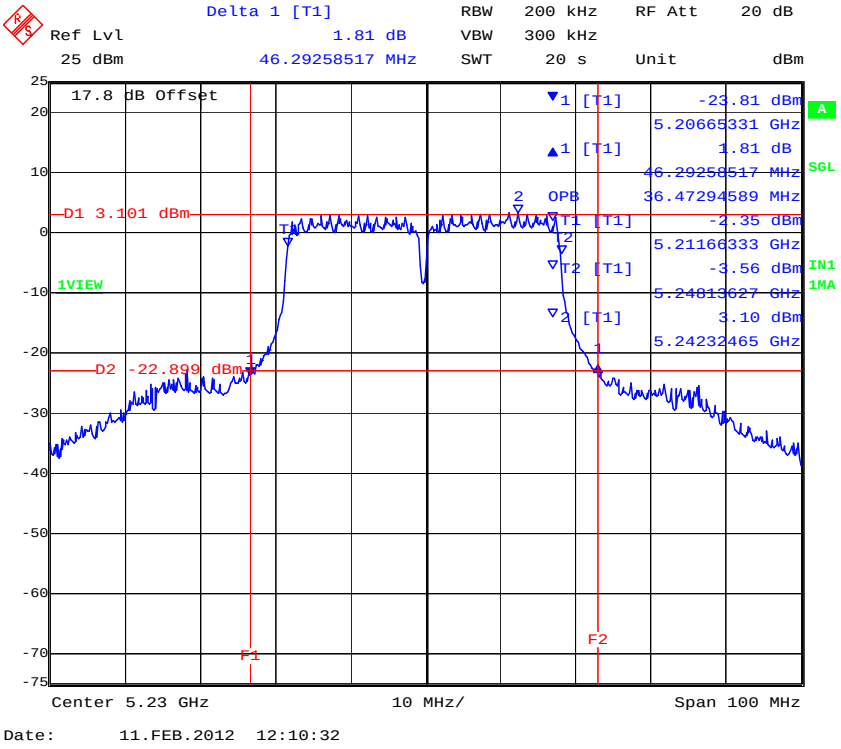
PORT B 5,190 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



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



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

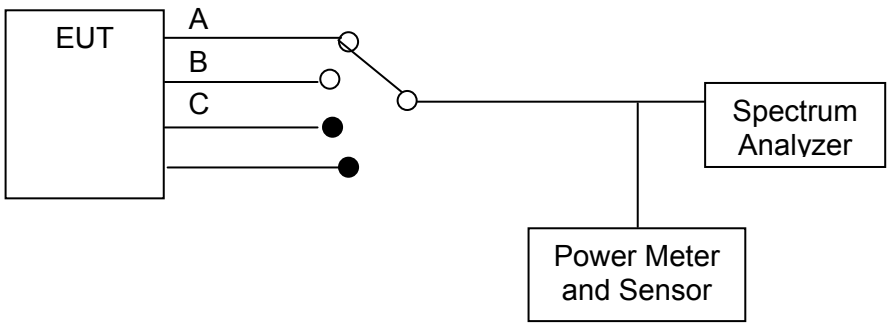
5.1.2. Transmit Output Power

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

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)	Maximum 26 dB Bandwidth (MHz)	4 + 10 Log (B) (dBm)	Limit (dBm)
a	5150 – 5250	23.1	+17.64	+17.00
HT-20		32.5	+19.12	+17.00
HT-40		36.7	+19.65	+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)	Maximum 99 % Bandwidth (MHz)	4 + 10 Log (B) (dBm)	EIRP Limit (dBm)
a	5150 – 5250	16.8	+16.25	+23.00
HT-20		17.4	+16.41	+23.00
HT-40		20.4	+17.10	+23.00

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

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**

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

Test Frequency	**Measured Peak Power RF Port (dBm)**				**Total Power (dBm)**		**Limit**	**Margin**
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
5180	12.96	13.45	--	--	N/A	16.22	17.00	-0.78
5200	13.02	13.33	--	--	N/A	16.19	17.00	-0.81
5240	12.89	13.28	--	--	N/A	16.10	17.00	-0.90

Measurement uncertainty:	±1.33 dB

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

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

Test Frequency	**Measured Peak Power RF Port (dBm)**				**Total Power (dBm)**		**Limit**	**Margin**
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
5180	12.84	13.12	--	--	N/A	15.99	17.00	-1.01
5200	13.02	13.64	--	--	N/A	16.35	17.00	-0.65
5240	13.05	13.71	--	--	N/A	16.40	17.00	-0.60

Measurement uncertainty:	±1.33 dB

TABLE OF RESULTS – **802.11n HT40 5150 – 5250 MHz**

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

Test Frequency	**Measured Peak Power RF Port (dBm)**				**Total Power (dBm)**		**Limit**	**Margin**
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
5190	12.55	13.21	--	--	N/A	15.90	17.00	-1.10
5230	13.53	14.10	--	--	N/A	16.83	17.00	-0.17

Measurement uncertainty:	±1.33 dB

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 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 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 log10 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 log10 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 log10 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	±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

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.

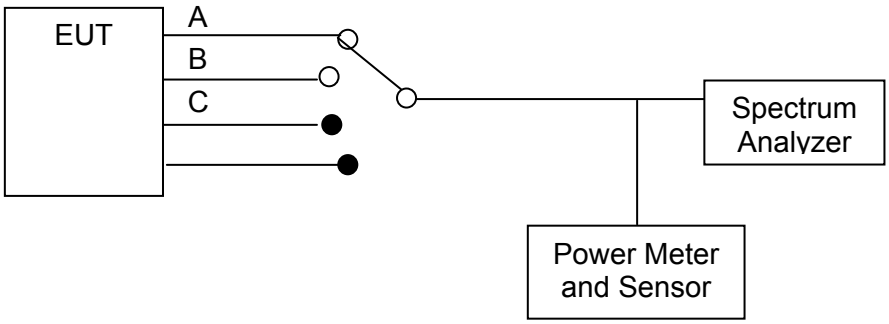
Emissions Testing of Transmitters with Multiple Outputs in the Same Band

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

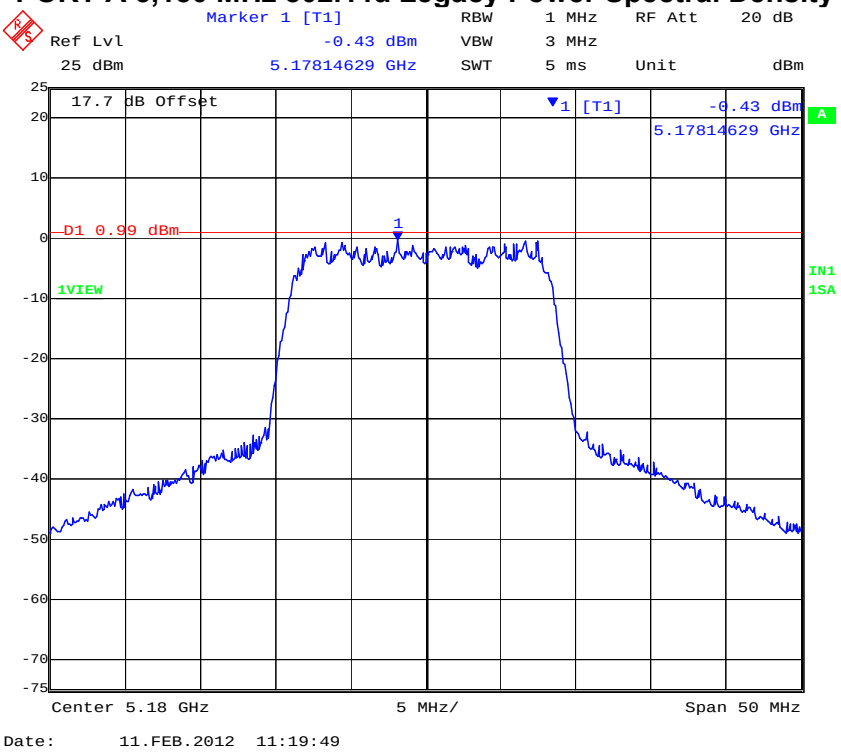
TABLE OF RESULTS – **802.11a Legacy 5150 – 5250 MHz**

Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11a	**Ambient Temp. (ºC):**	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 RF Port (dBm)				Correction factor	Maximum Peak Power Spectral Density	Limit	Margin
MHz	**a**	**b**	**c**	**d**	**10Log(N)**	**dBm**	**dBm**	**dB**
5180	-0.43	0.73	--	--	3.01	0.73	0.99	-0.26
5200	0.58	0.81	--	--	3.01	0.81	0.99	-0.18
5240	-0.16	0.65	--	--	3.01	0.65	0.99	-0.34

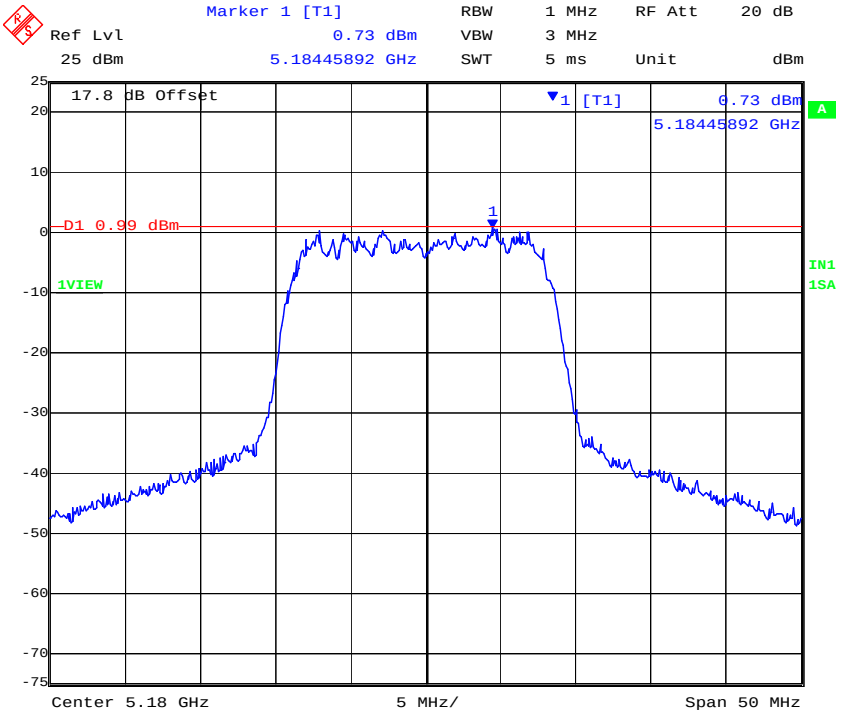
Measurement uncertainty:	±1.33 dB

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



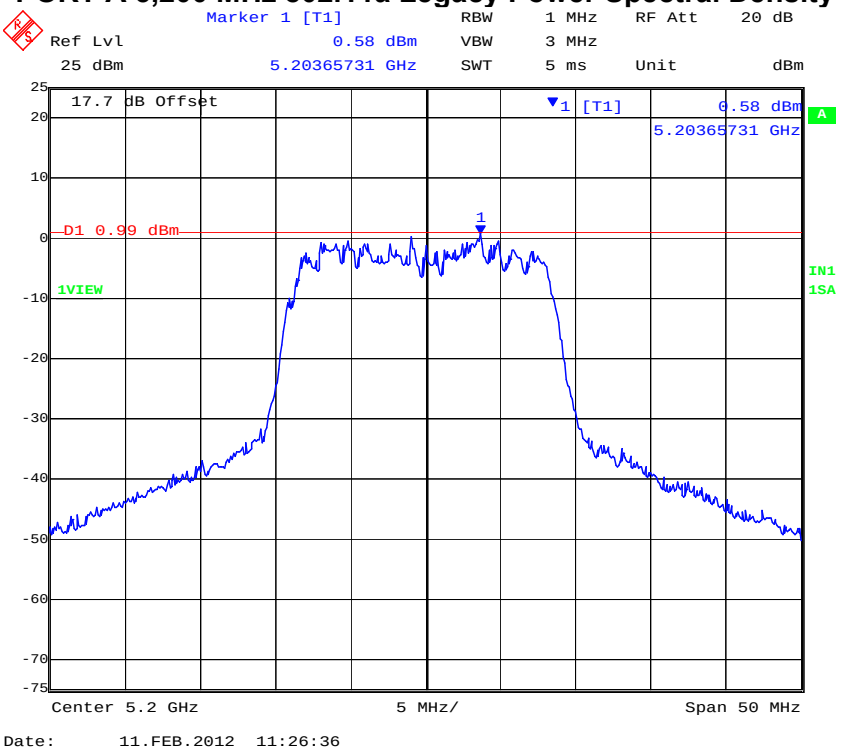
Date: 11.FEB.2012 11:19:49

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



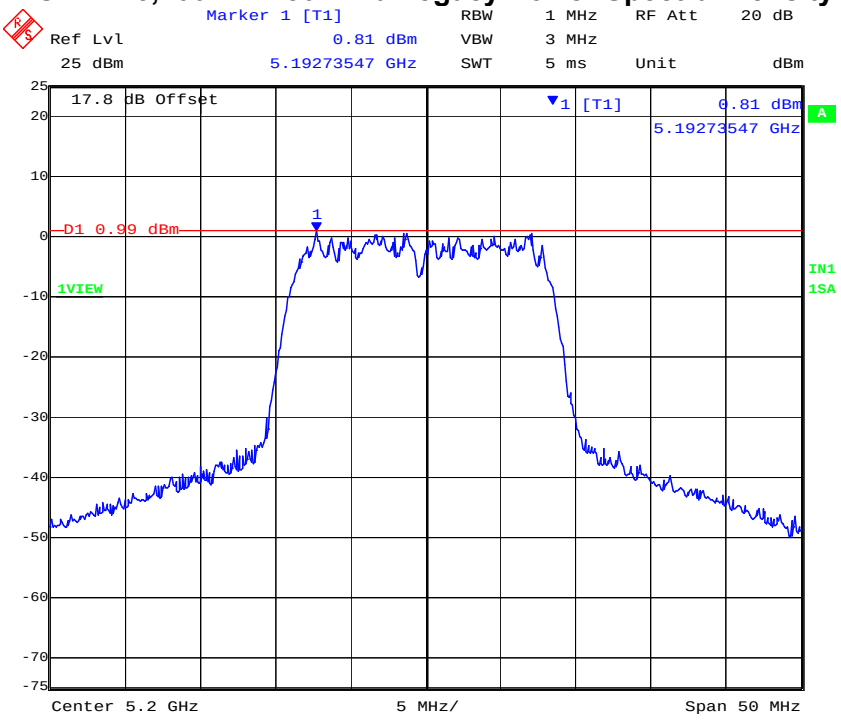
Date: 11.FEB.2012 11:20:42

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



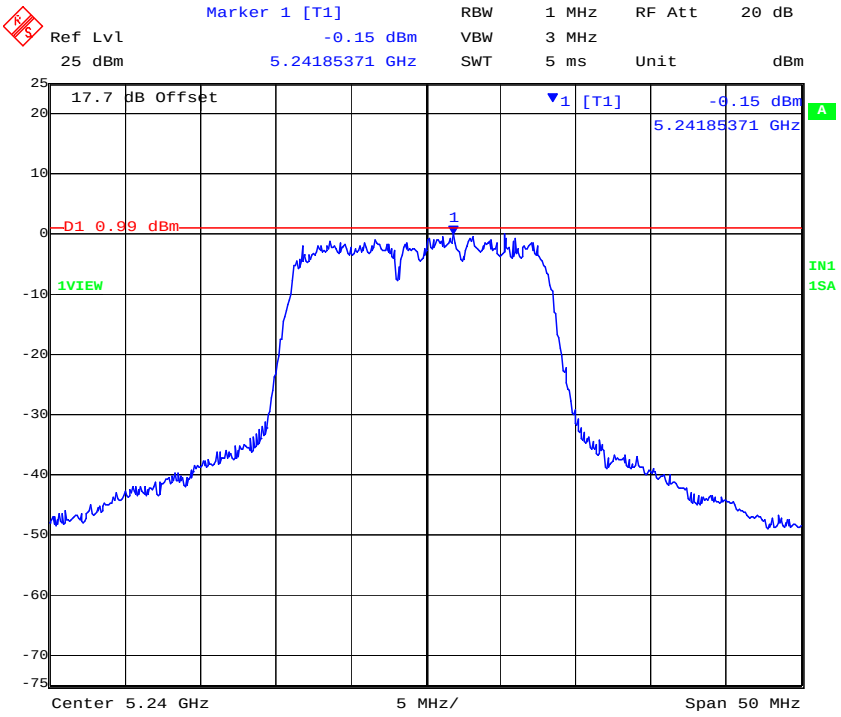
Date: 11.FEB.2012 11:26:36

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



Date: 11.FEB.2012 11:27:29

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



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

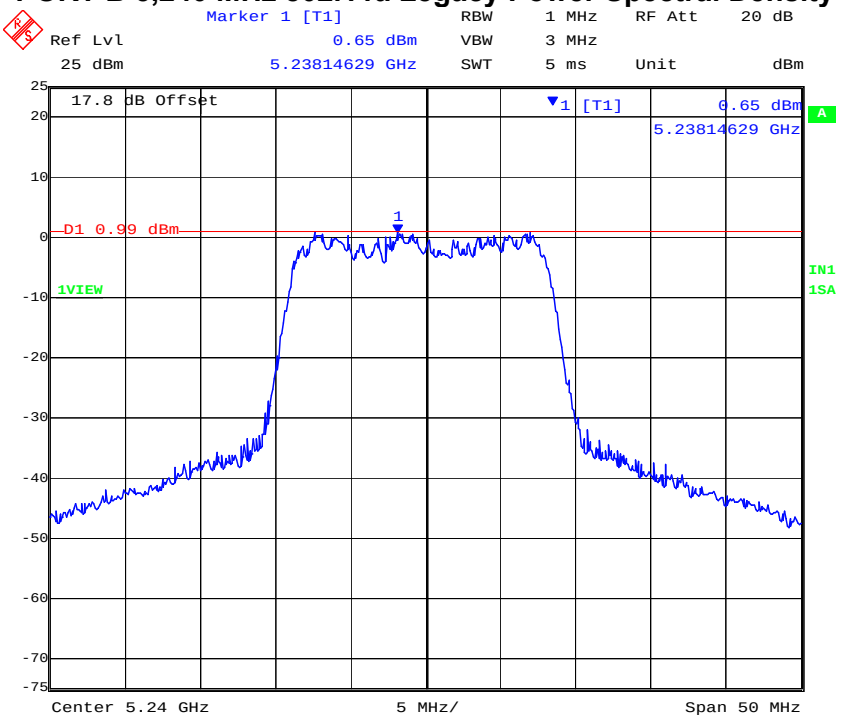


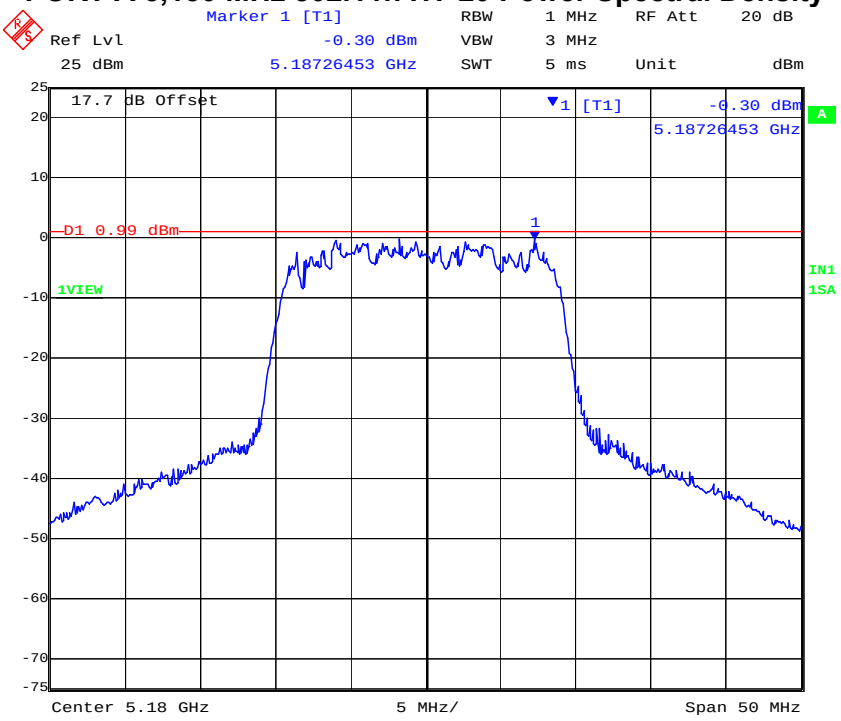
TABLE OF RESULTS – **802.11n HT-20 5150 – 5250 MHz**

Test Conditions:	15.407 (a)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11n HT-20		**Ambient Temp. (ºC):**	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:					

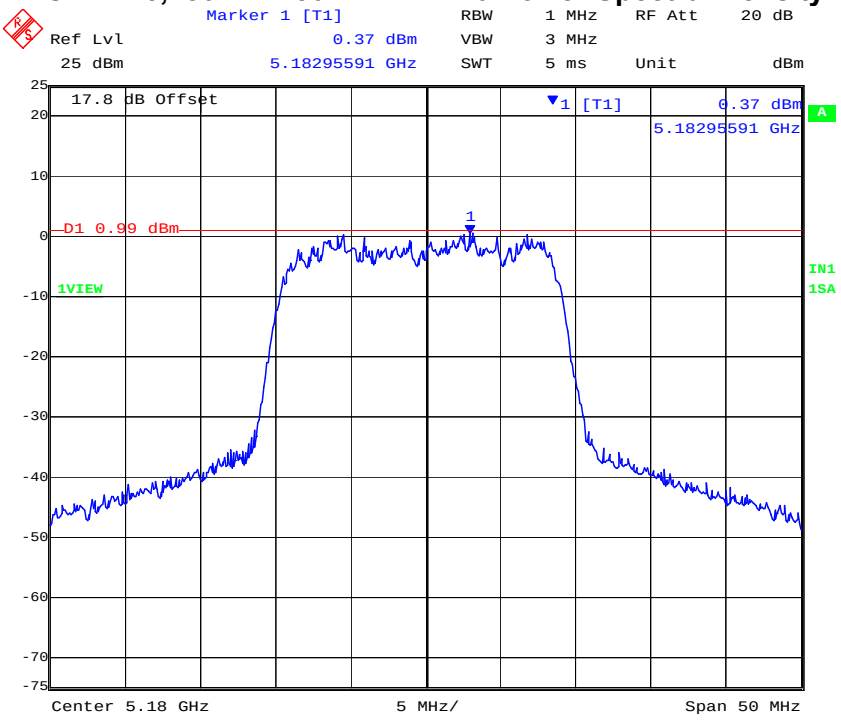
Test Frequency	Measured Peak Power RF Port (dBm)				Correction factor	Maximum Peak Power Spectral Density	Limit	Margin
MHz	**a**	**b**	**c**	**d**	**10Log(N)**	**dBm**	**dBm**	**dB**
5180	-0.30	0.37	--	--	3.01	0.37	0.99	-0.62
5200	0.19	0.78	--	--	3.01	0.78	0.99	-0.21
5240	-0.18	0.46	--	--	3.01	0.46	0.99	-0.53

Measurement uncertainty:	±1.33 dB

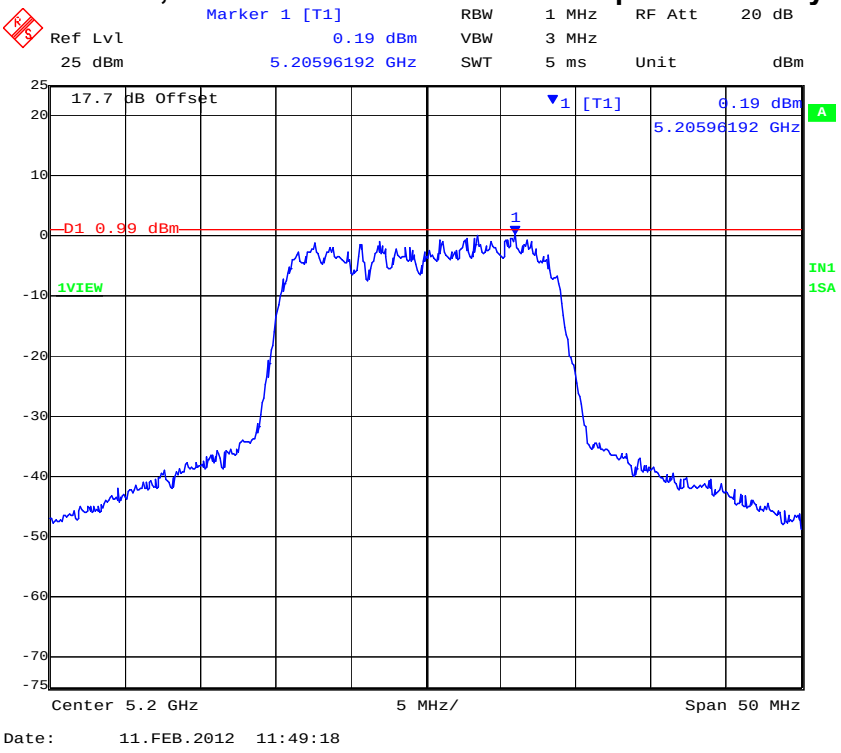
PORT A 5,180 MHz 802.11n HT-20 Power Spectral Density



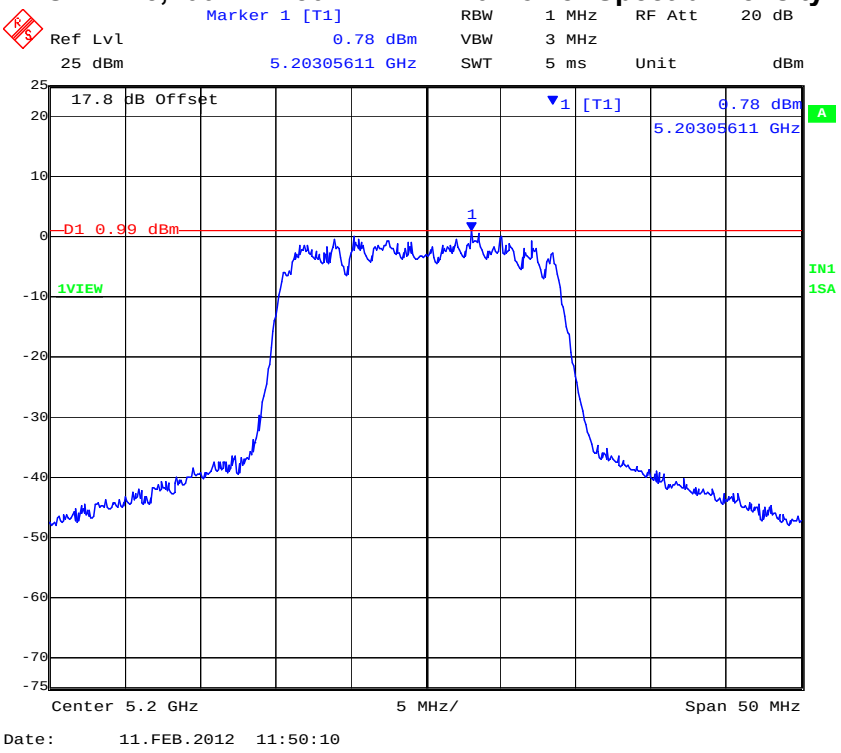
PORT B 5,180 MHz 802.11n HT-20 Power Spectral Density



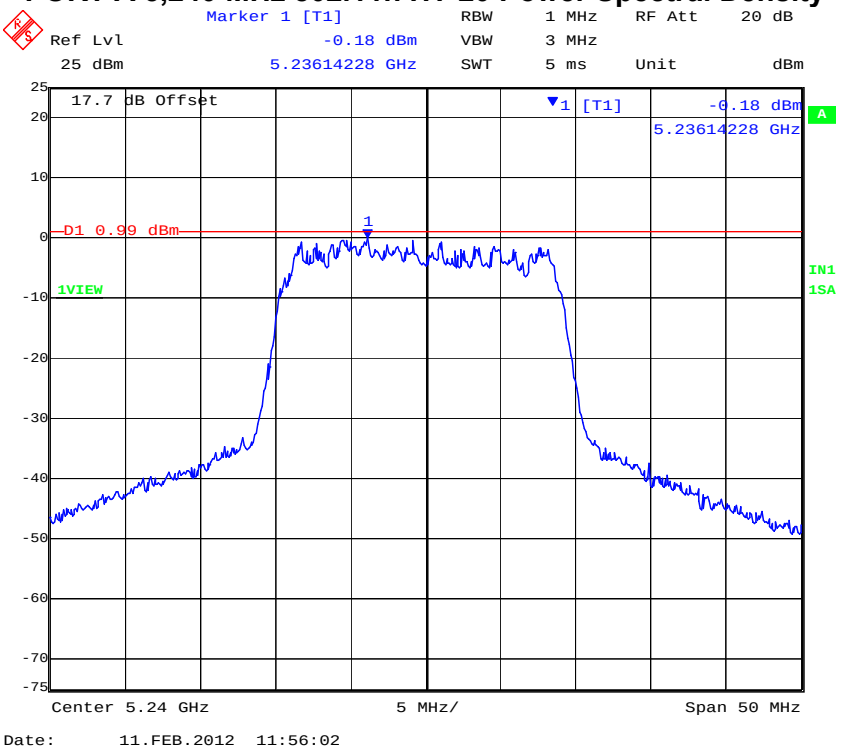
PORT A 5,200 MHz 802.11n HT-20 Power Spectral Density



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



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



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

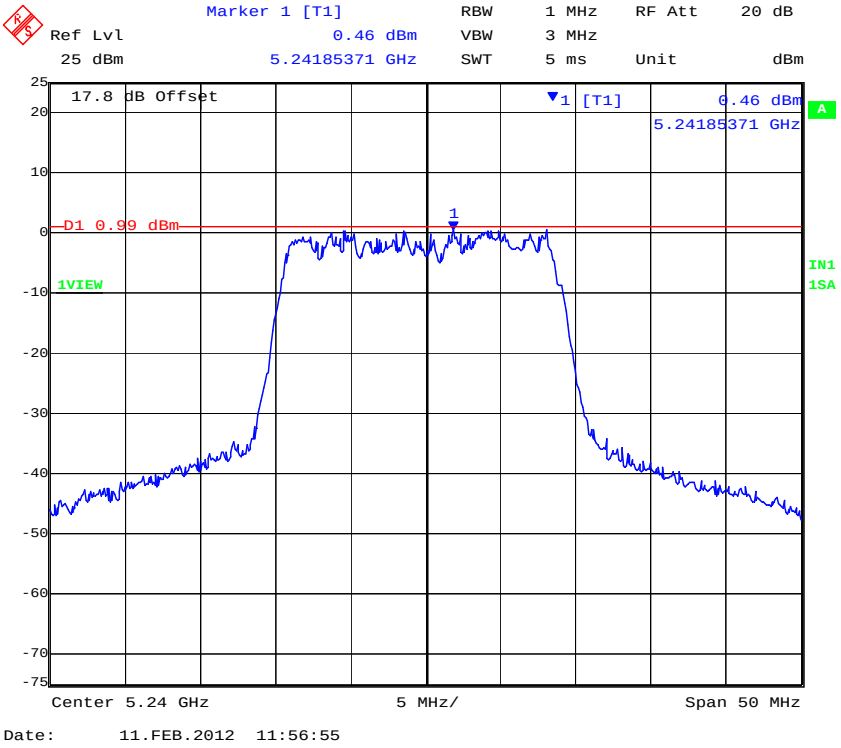


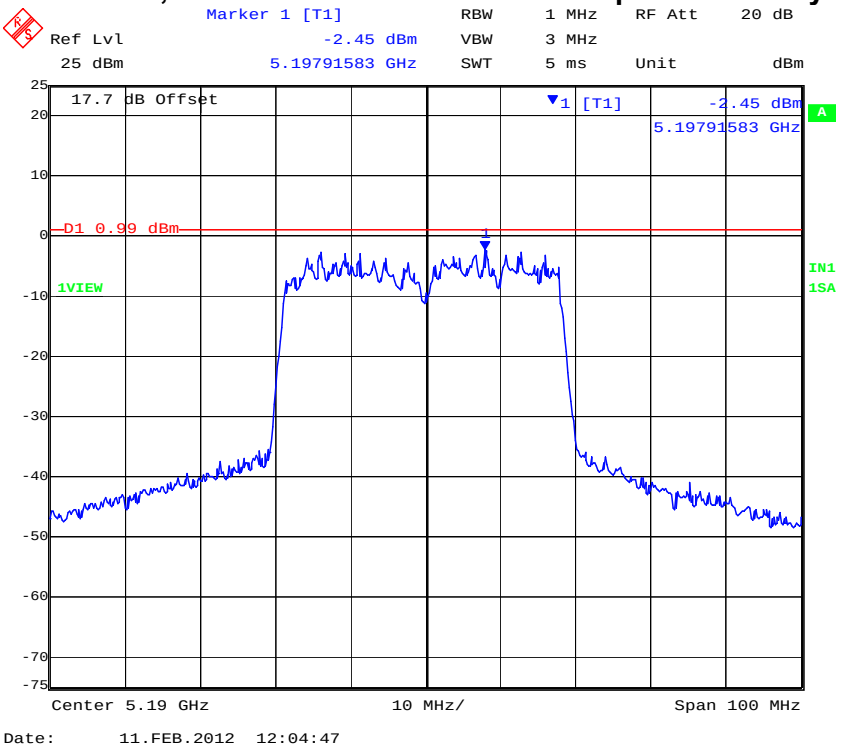
TABLE OF RESULTS – **802.11n HT-40 5150 – 5250 MHz**

Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n HT-40	**Ambient Temp. (ºC):**	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 RF Port (dBm)				Correction factor	Maximum Peak Power Spectral Density	Limit	Margin
MHz	**a**	**b**	**c**	**d**	**10Log(N)**	**dBm**	**dBm**	**dB**
5190	-2.45	-2.63	--	--	3.01	-2.63	0.99	-3.62
5230	-2.57	-1.21	--	--	3.01	-1.21	0.99	-2.20

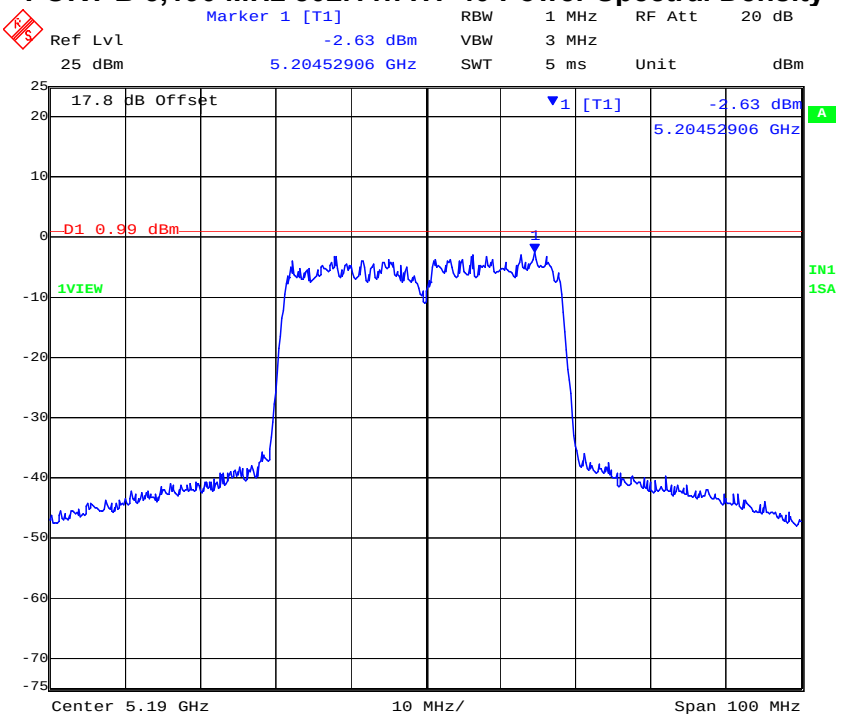
Measurement uncertainty:	±1.33 dB

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



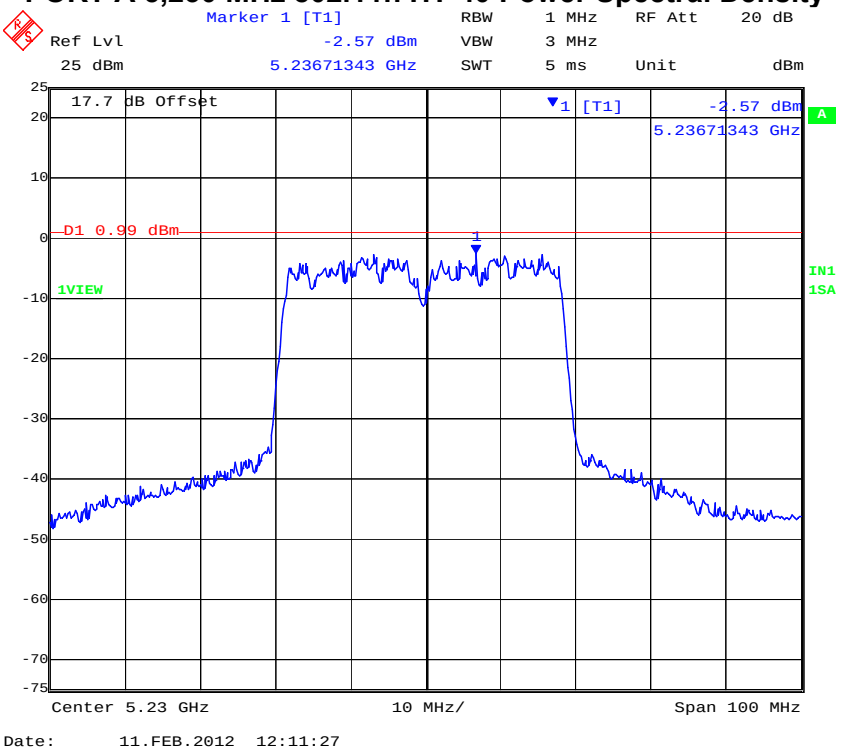
Date: 11.FEB.2012 12:04:47

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

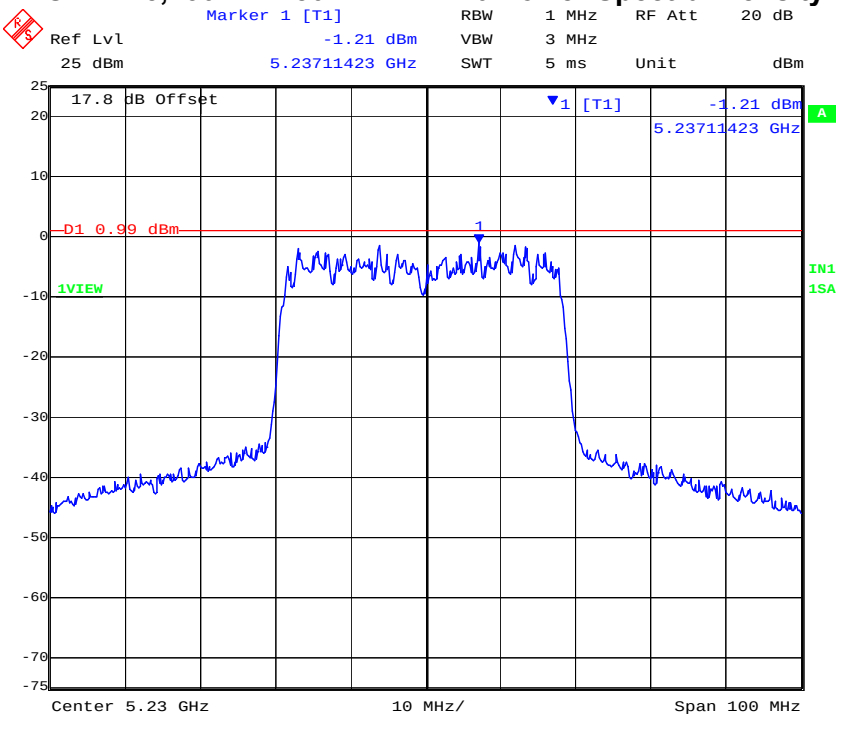


Date: 11.FEB.2012 12:05:40

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



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



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	±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

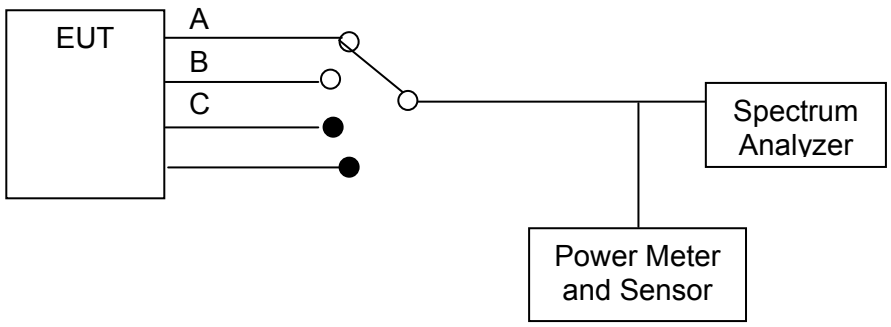
5.1.4. Peak Excursion Ratio

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

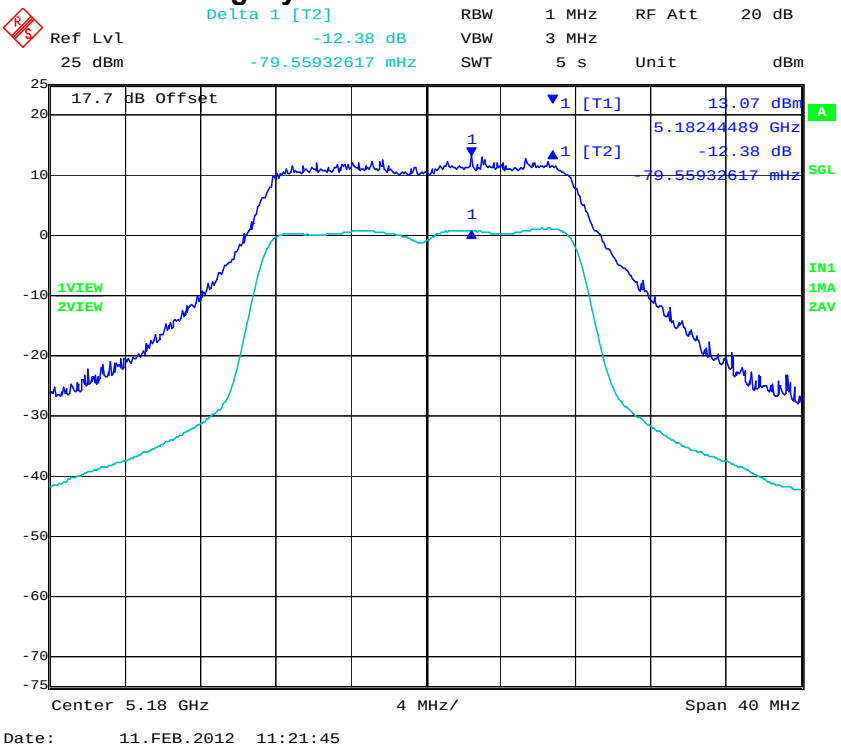
TABLE OF RESULTS – **802.11a Legacy 5150 – 5250 MHz**

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

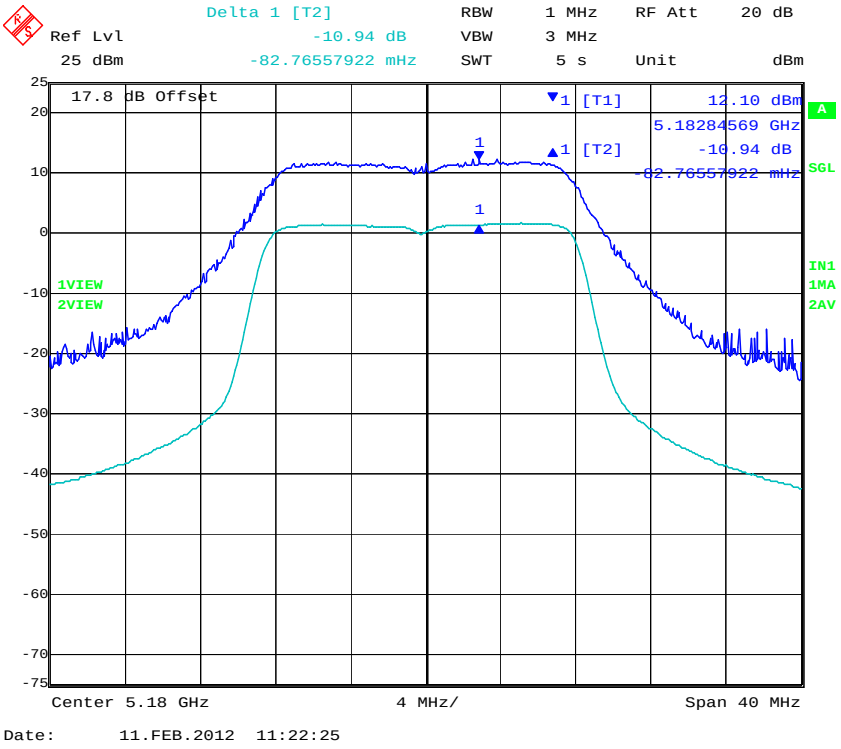
Test Frequency	Trace Δ Marker				Limit	Margin
	Port A	Port B	Port C	Port D		
MHz	dB	dB	dB	dB	dB	dB
5180	-12.38	-10.94	--	--	-13.00	-0.63
5200	-12.30	-11.00	--	--		-0.70
5240	-12.88	-11.11	--	--		-0.12

Measurement uncertainty:	±1.33 dB

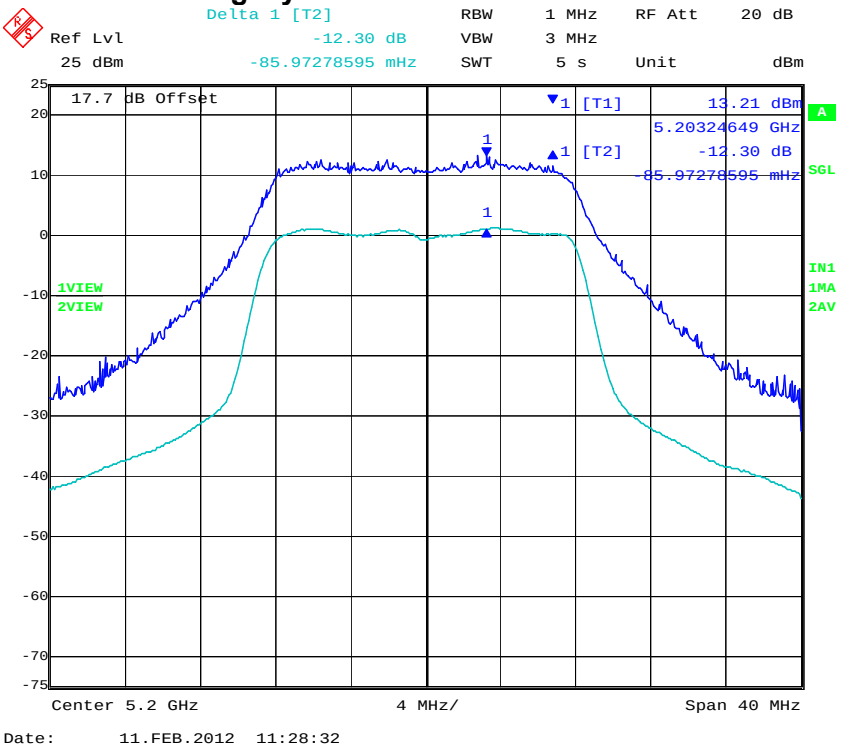
PORT A 5,180 MHz 802.11a Legacy Peak Excursion Ratio



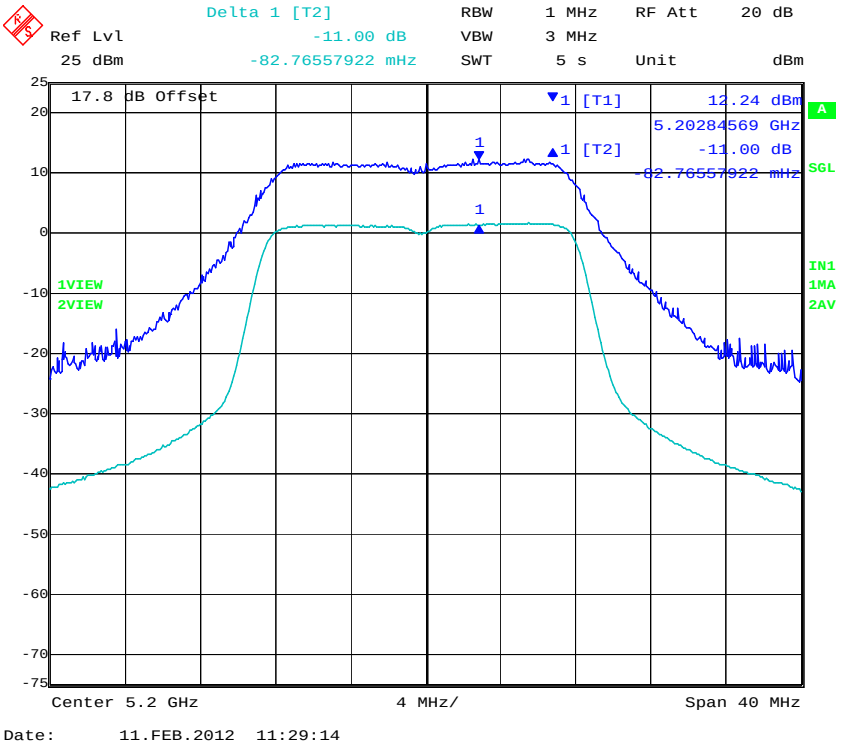
PORT B 5,180 MHz 802.11a Legacy Peak Excursion Ratio



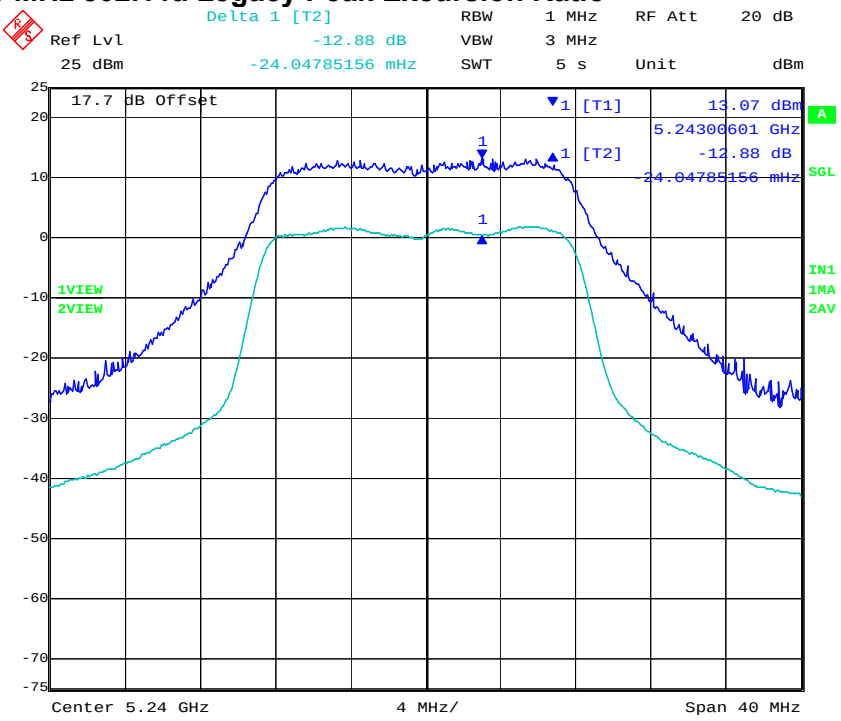
PORT A 5,200 MHz 802.11a Legacy Peak Excursion Ratio



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

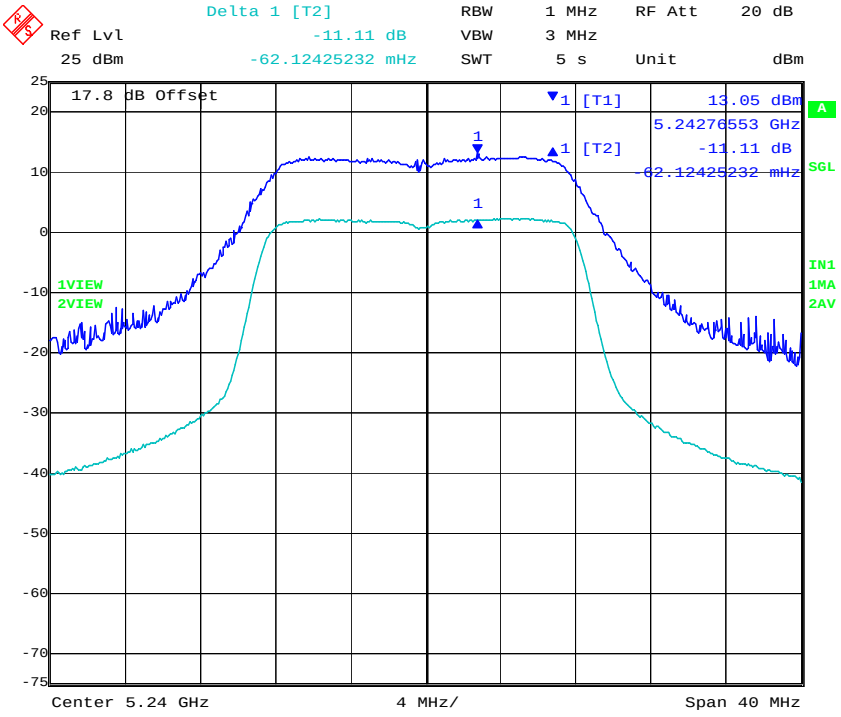


PORT A 5,240 MHz 802.11a Legacy Peak Excursion Ratio



Date: 11.FEB.2012 11:34:43

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



Date: 11.FEB.2012 11:35:22

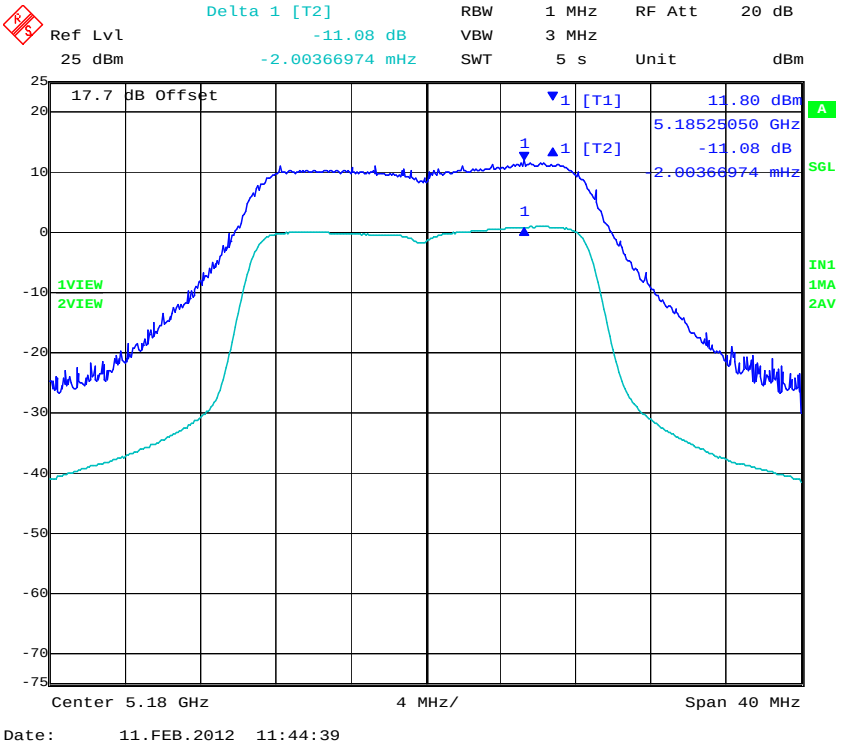
TABLE OF RESULTS – **802.11n HT-20 5150 – 5250 MHz**

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

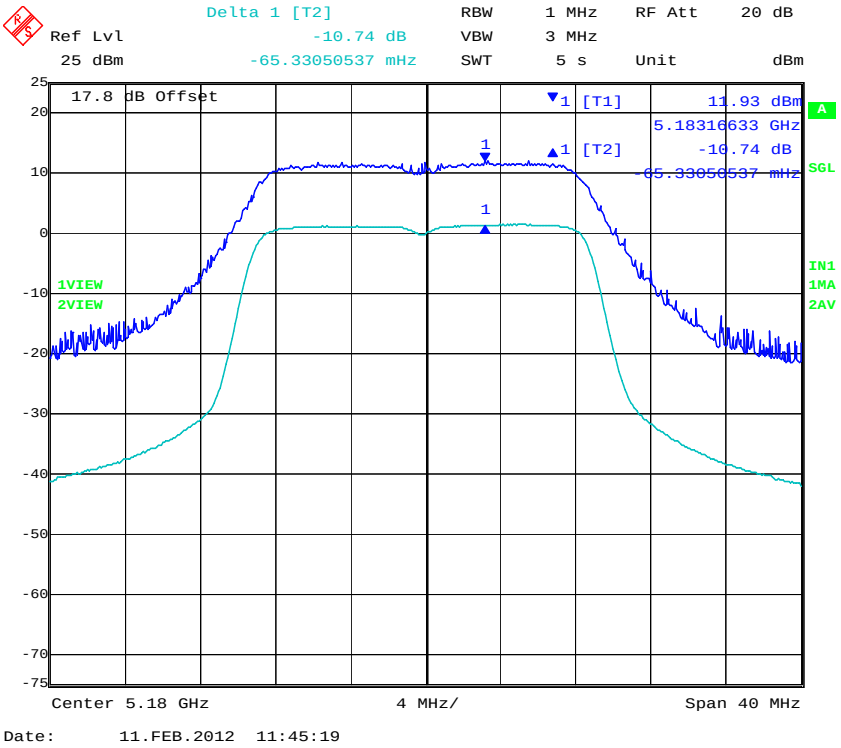
Test Frequency	Trace Δ Marker				Limit	Margin
	Port A	Port B	Port C	Port D		
MHz	dB	dB	dB	dB	dB	dB
5180	-11.08	-10.74	--	--	-13.00	-1.92
5200	-10.79	-11.07	--	--		-1.93
5240	-11.78	-10.68	--	--		-1.22

Measurement uncertainty:	±1.33 dB

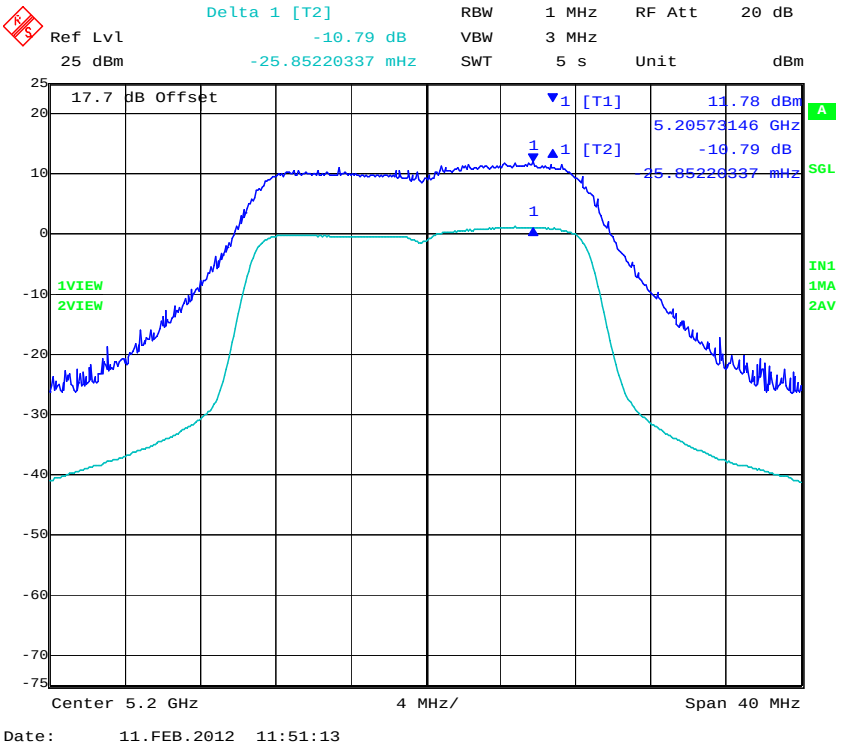
PORT A 5,180 MHz 802.11n HT-20 Peak Excursion Ratio



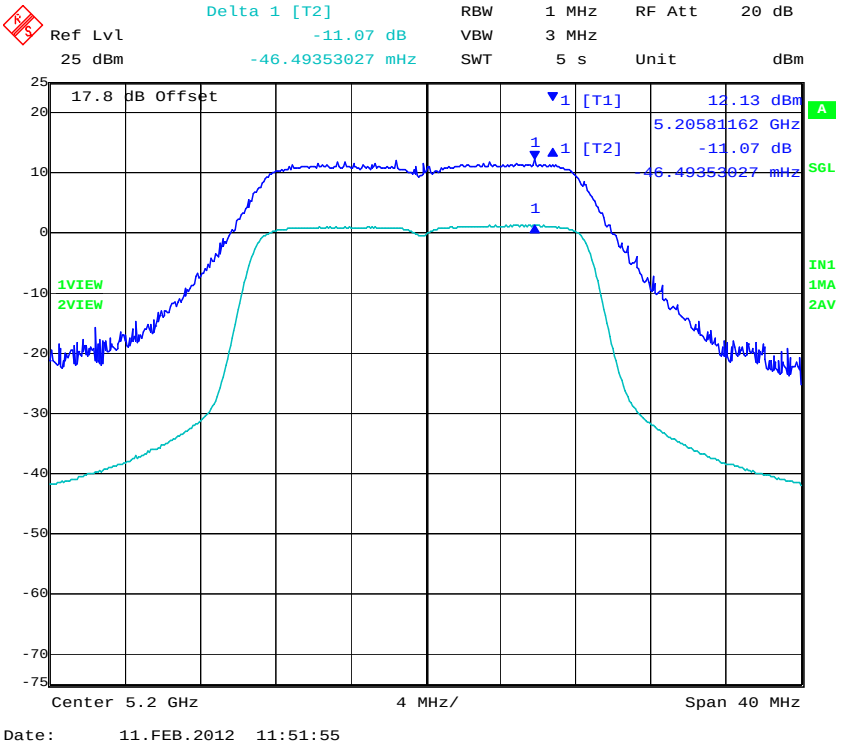
PORT B 5,180 MHz 802.11n HT-20 Peak Excursion Ratio



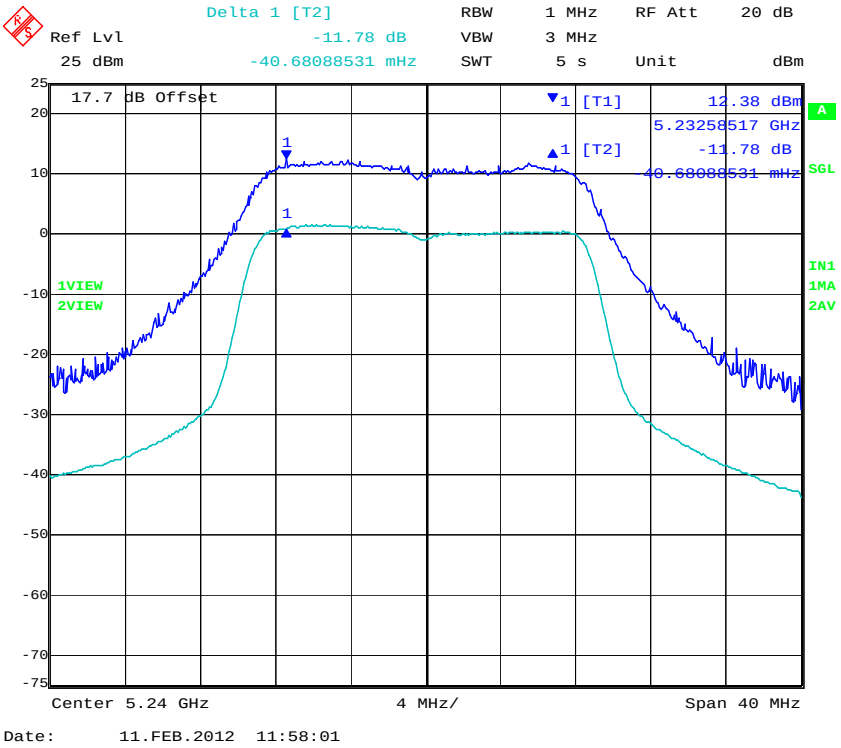
PORT A 5,200 MHz 802.11n HT-20 Peak Excursion Ratio



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



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



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

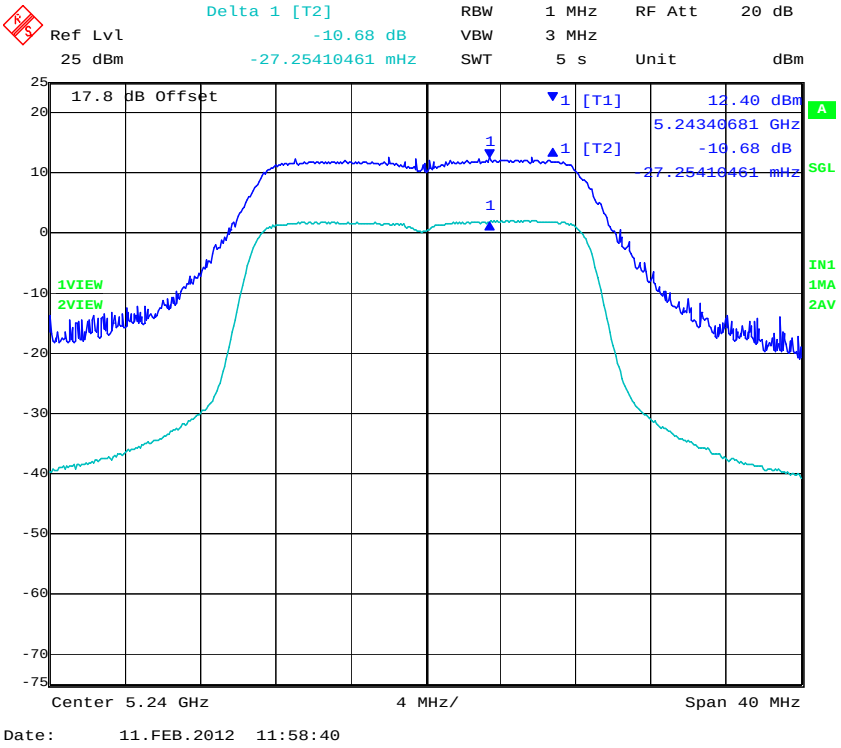


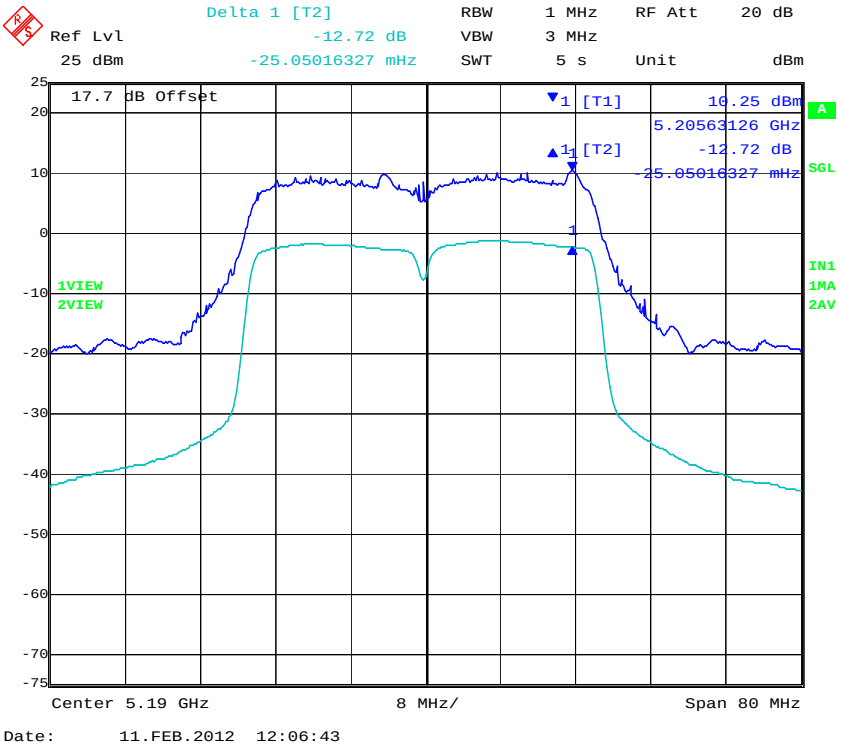
TABLE OF RESULTS – **802.11n HT-40 5150 – 5250 MHz**

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

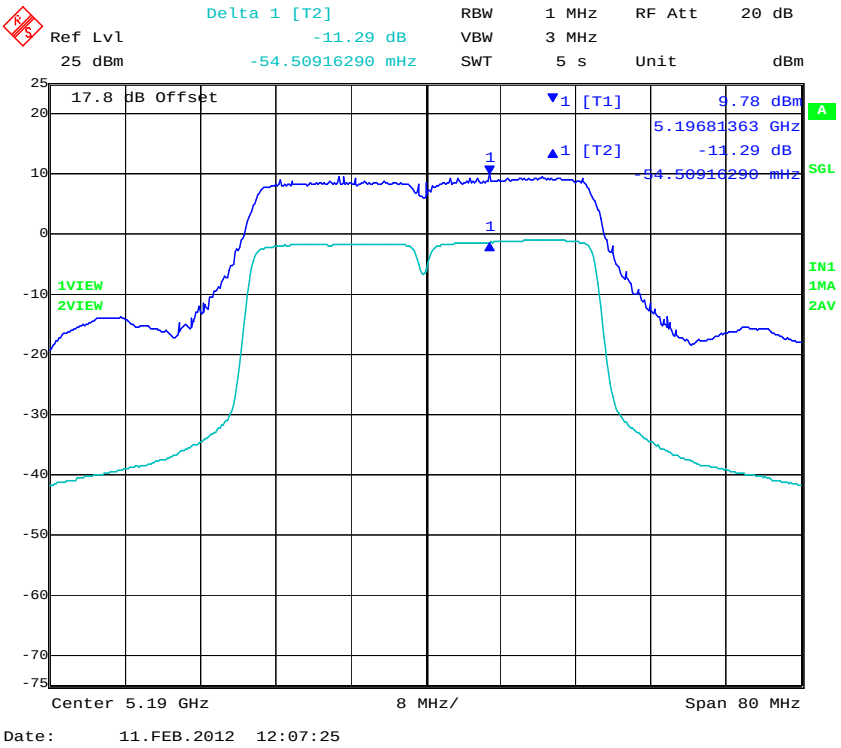
Test Frequency	Trace Δ Marker				Limit	Margin
	Port A	Port B	Port C	Port D		
MHz	dB	dB	dB	dB	dB	dB
5190	-12.72	-11.29	--	--	-13.00	-0.28
5230	-11.00	-11.39	--	--		-1.61

Measurement uncertainty:	±1.33 dB

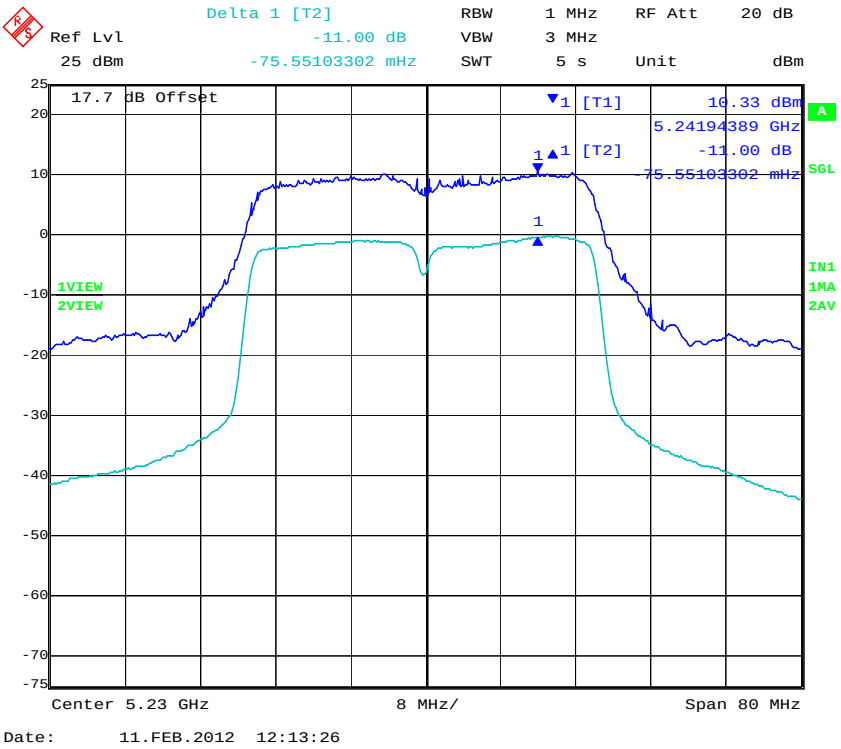
PORT A 5,190 MHz 802.11n HT-40 Peak Excursion Ratio



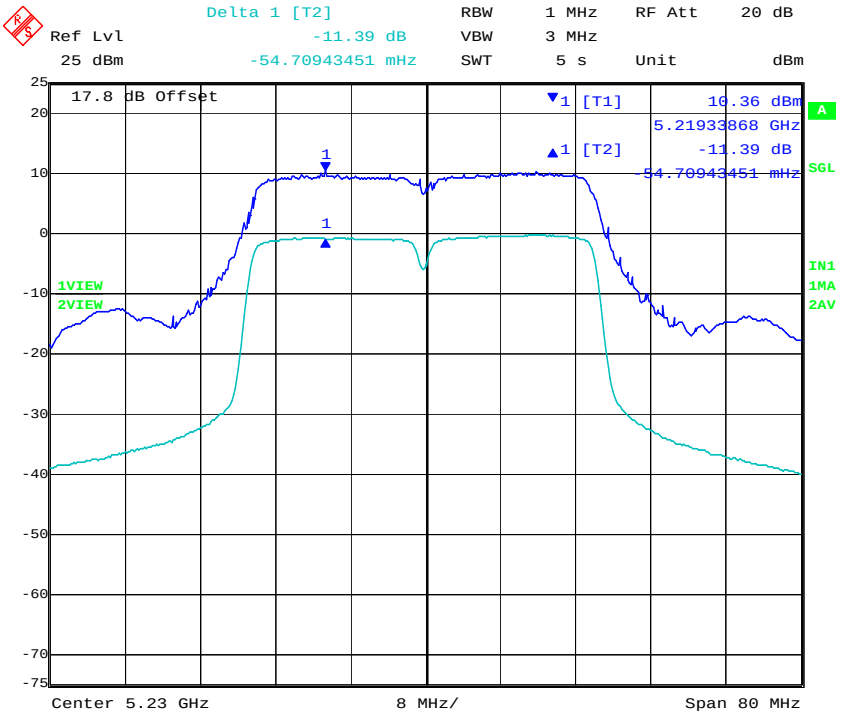
PORT B 5,190 MHz 802.11n HT-40 Peak Excursion Ratio



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



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



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	± 2.81dB

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

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 ±20ppm stability.
This stability accounts for room temp tolerance of the crystal oscillator circuit, frequency variation across temperature, and crystal ageing.

±20ppm at 5.250 GHz translates to a maximum frequency shift of ±105 KHz. As the edge of the channels is at least one MHz from either of the band edges, ±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

Power Density = Pd (mW/cm^2) = $EIRP/(4\pi d^2)$

EIRP = P * G

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

Numeric Gain = 10 ^ (G (dBi)/10)

The Juniper WLA321 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^2

Freq. Band (MHz)	Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm^2 Limit(cm)	Minimum Separation Distance (cm)
5150 - 5250	0.0	1.00	+16.83	48.2	1.96	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^2 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

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 = 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 dBμV; 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 dBμV/m

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

Level (dBμV/m) = 20 * Log (level (μV/m))

40 dBμV/m = 100 μV/m
48 dBμV/m = 250 μV/m

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

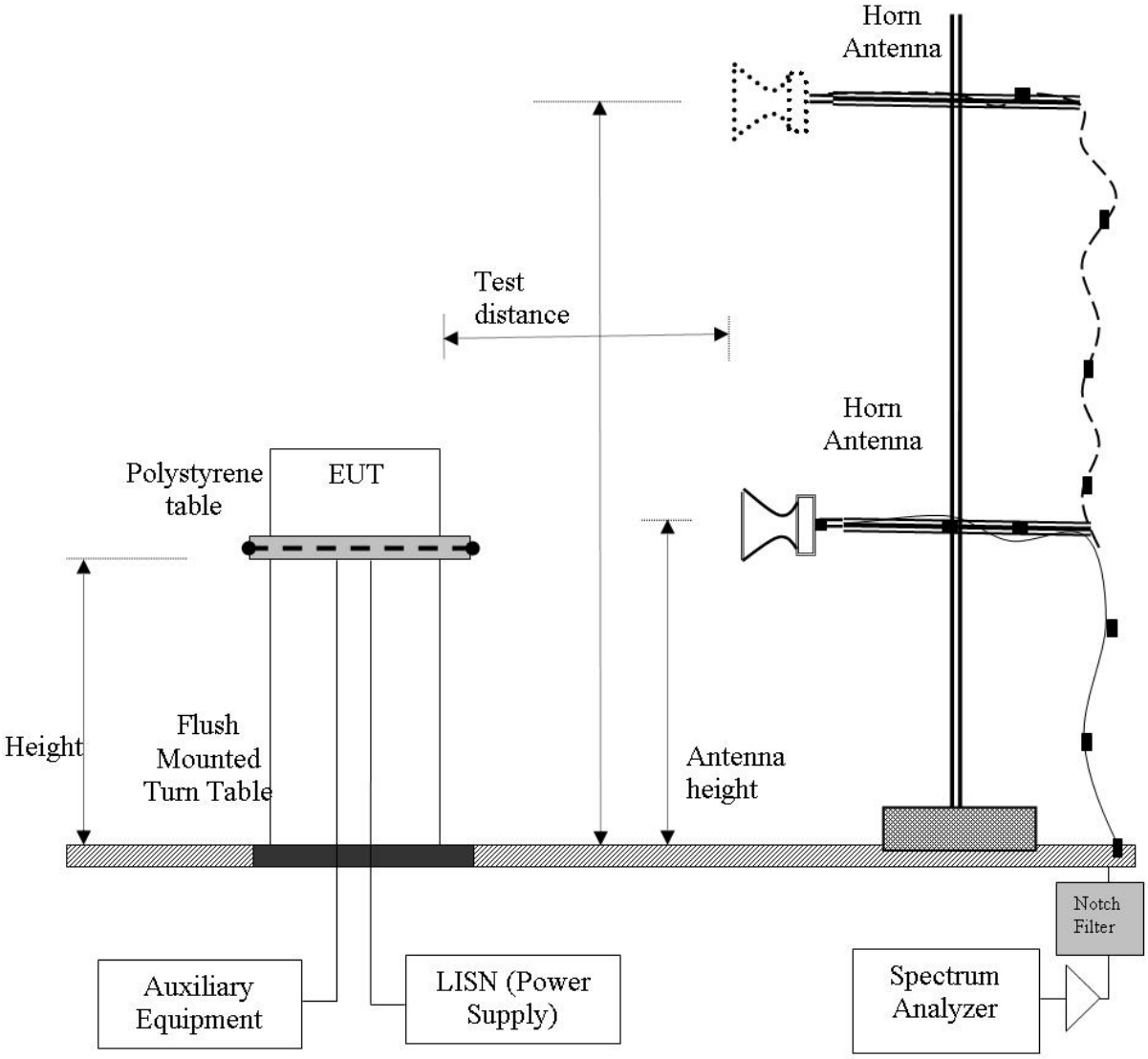
$$E = 1000000 \times \sqrt{30P} / 3 \ \mu V/m$$

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

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 5th 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

Table 1: FCC 15.209 Spurious Emissions Limits

Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/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

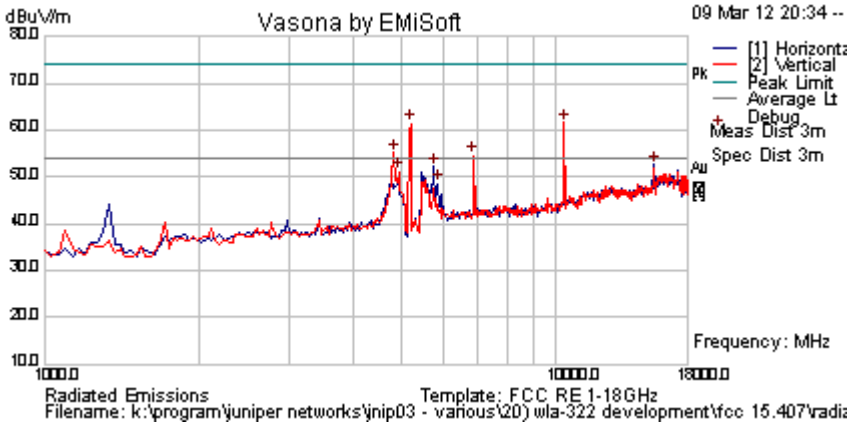
Measurement Uncertainty	+5.6/ -4.5 dB

Traceability:

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

5.1.7.1. Integral Antenna

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	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			

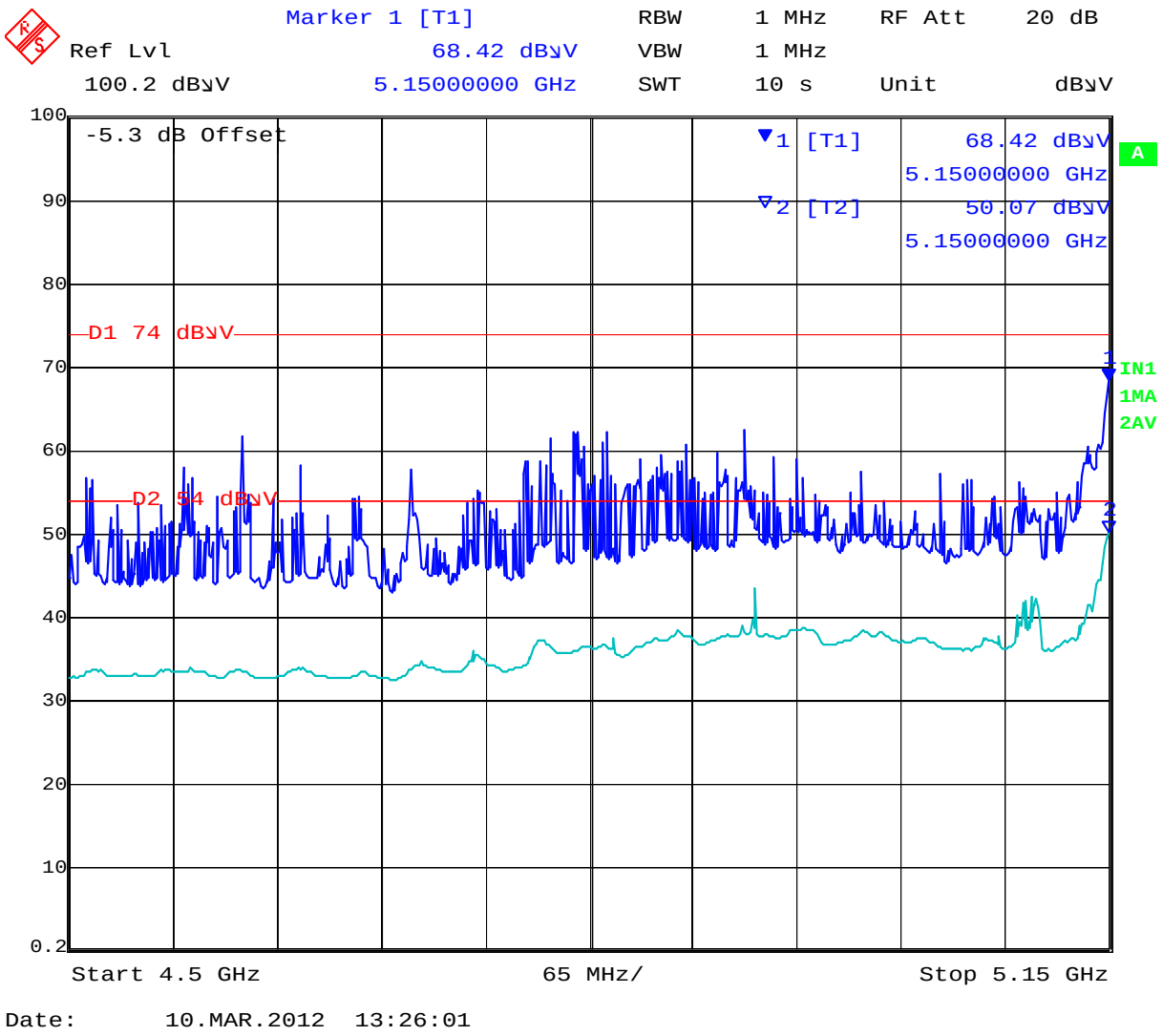


Formally measured emission peaks

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
10368.737	57.3	6.7	-2.5	61.5	Peak [Scan]	V					Pass	NRB
5190.381	66.6	4.6	-9.9	61.3	Peak [Scan]	V						BE
4815.631	60.4	4.5	-9.7	55.2	Peak [Scan]	V					Pass	BE
6893.788	55.7	5.3	-6.5	54.5	Peak [Scan]	V					Pass	NRB
5769.539	57.0	4.8	-9.5	52.3	Peak [Scan]	H					Pass	BE
4917.836	56.4	4.6	-9.8	51.2	Peak [Scan]	V					Pass	BE
5871.743	52.8	4.8	-9.1	48.5	Peak [Scan]	H					Pass	BE
15538.397	48.1	8.3	-0.6	55.8	Peak Max	H	114	345	74.0	-18.2	Pass	RB
15538.397	33.8	8.3	-0.6	41.5	Average Max	H	114	345	54.0	-12.5	Pass	RB

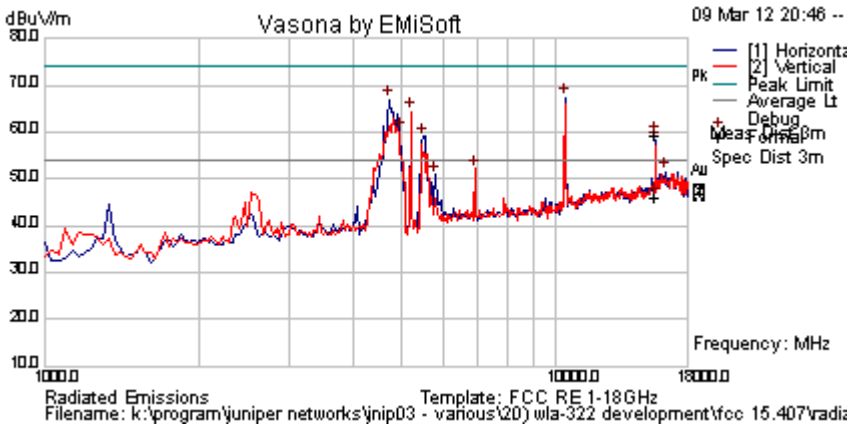
Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

802.11a 5150 Restricted Band-edge



Power reduction required ART = 17

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	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			

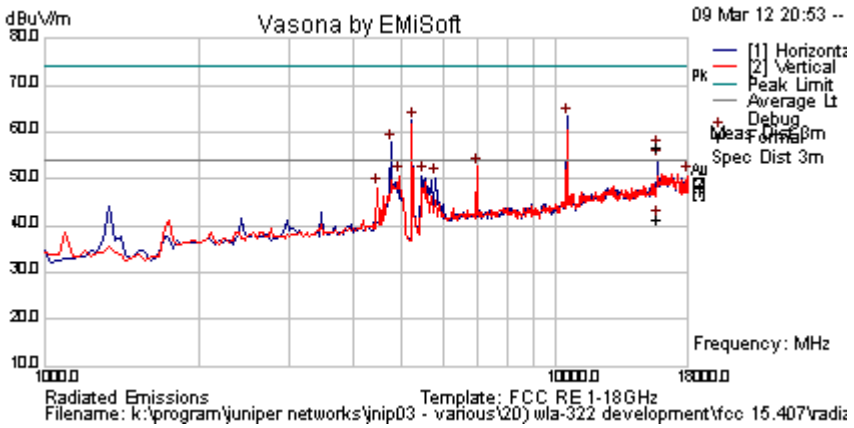


Formally measured emission peaks

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
10402.806	63.1	6.7	-2.5	67.3	Peak [Scan]	H					Pass	NRB
4713.427	72.3	4.4	-9.8	66.9	Peak [Scan]	H					Pass	BE
5190.381	69.6	4.6	-9.9	64.4	Peak [Scan]	V						FUND
4951.904	65.5	4.6	-9.8	60.2	Peak [Scan]	H					Pass	BE
5496.994	64.1	4.6	-9.6	59.1	Peak [Scan]	H					Pass	BE
6927.856	53.4	5.4	-6.5	52.3	Peak [Scan]	V	100	0	54.0	-1.7	Pass	NRB
16296.593	42.5	8.9	0.2	51.5	Peak [Scan]	H	100	0	54.0	-2.5	Pass	NOISE
5803.607	55.6	4.8	-9.4	51.0	Peak [Scan]	H					Pass	BE
15598.957	51.5	8.4	-0.6	59.3	Peak Max	H	142	0	74.0	-14.7	Pass	RB
15598.957	38.1	8.4	-0.6	45.9	Average Max	H	142	0	54.0	-8.1	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

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	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			

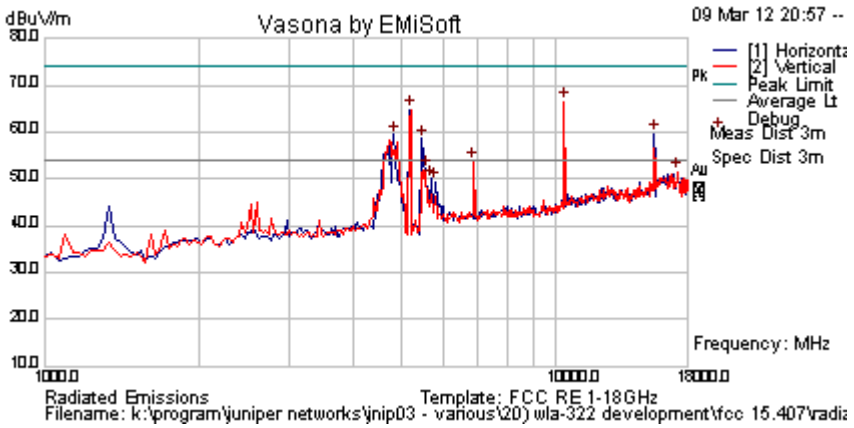


Formally measured emission peaks

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
10470.942	58.9	6.8	-2.5	63.2	Peak [Scan]	H					Pass	NRB
5224.449	67.6	4.6	-9.8	62.4	Peak [Scan]	H						FUND
4747.495	63.0	4.4	-9.7	57.7	Peak [Scan]	H					Pass	BE
6995.992	53.5	5.4	-6.4	52.5	Peak [Scan]	V	100	0	54.0	-1.5	Pass	NRB
18000.000	41.5	8.8	0.7	51.0	Peak [Scan]	V	100	0	54.0	-3.0	Pass	NOISE
4917.836	55.9	4.6	-9.8	50.7	Peak [Scan]	H					Pass	BE
5462.926	55.7	4.6	-9.7	50.6	Peak [Scan]	H					Pass	BE
5803.607	54.9	4.8	-9.4	50.3	Peak [Scan]	H					Pass	BE
4474.950	54.5	4.2	-10.5	48.2	Peak [Scan]	V	100	0	54.0	-5.8	Pass	BE
15728.257	48.4	8.6	-0.4	56.6	Peak Max	H	98	58	74.0	-17.4	Pass	RB
15728.257	33.1	8.6	-0.4	41.2	Average Max	H	98	58	54.0	-12.8	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

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11n HT-20; 6.5 MCS	**Temp (ºC)**	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			

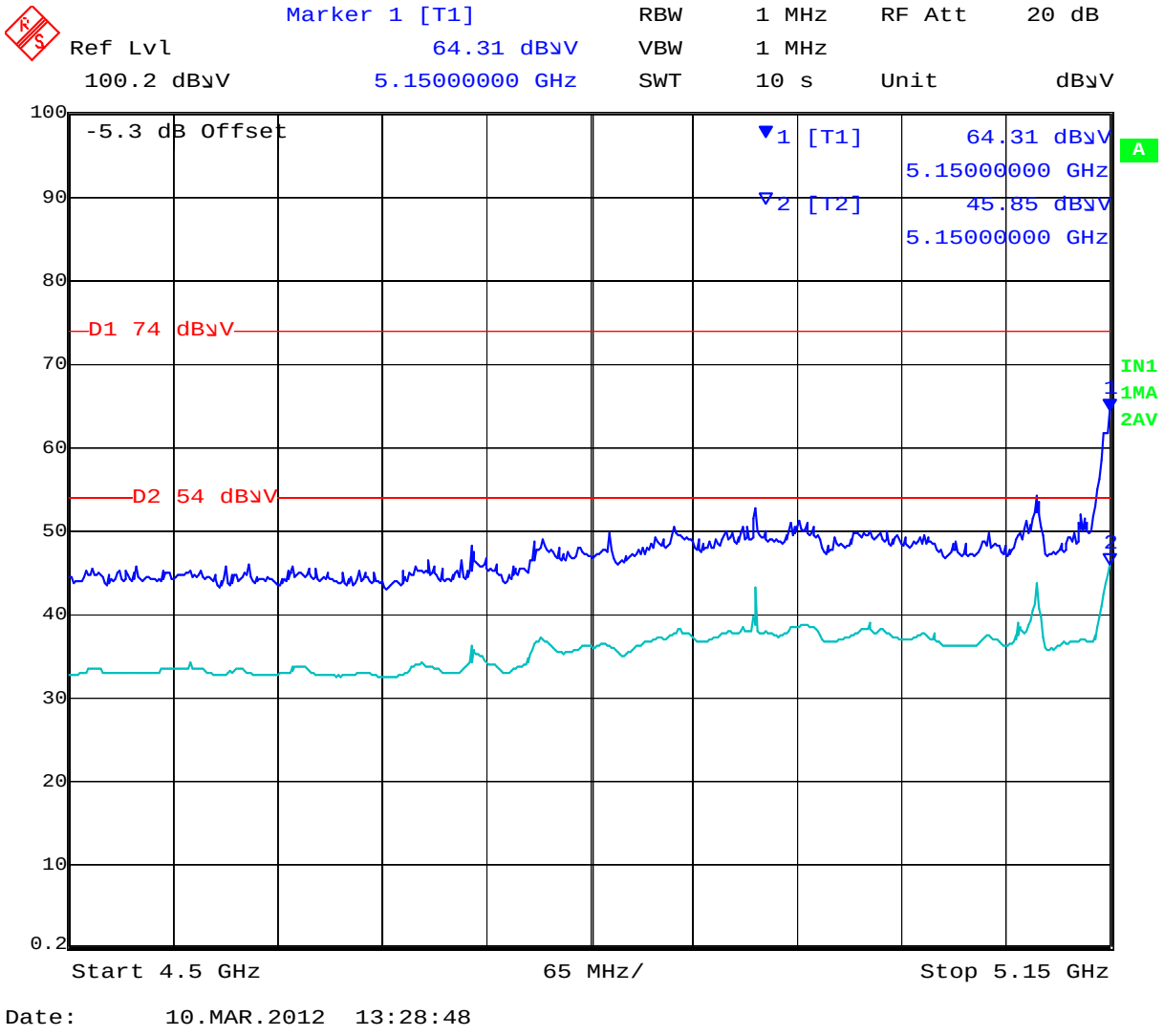


Formally measured emission peaks

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
10368.737	62.4	6.7	-2.5	66.6	Peak [Scan]	H					Pass	NRB
5190.381	70.1	4.6	-9.9	64.9	Peak [Scan]	V						FUND
4815.631	64.7	4.5	-9.7	59.5	Peak [Scan]	H					Pass	BE
5462.926	63.7	4.6	-9.7	58.7	Peak [Scan]	H					Pass	BE
6893.788	55.2	5.3	-6.5	54.0	Peak [Scan]	V	100	0	54.0	0.0	Pass	NRB
5565.130	57.0	4.7	-9.7	52.0	Peak [Scan]	V					Pass	BE
17216.433	42.2	8.6	0.9	51.6	Peak [Scan]	V	100	0	54.0	-2.4	Pass	NOISE
5701.403	54.9	4.7	-9.6	50.0	Peak [Scan]	H					Pass	BE
5803.607	53.9	4.8	-9.4	49.3	Peak [Scan]	H					Pass	BE
15537.194	54.3	8.3	-0.6	62.0	Peak Max	H	121	348	74.0	-12.0	Pass	RB
15537.194	38.9	8.3	-0.6	46.5	Average Max	H	121	348	54.0	-7.5	Pass	RB

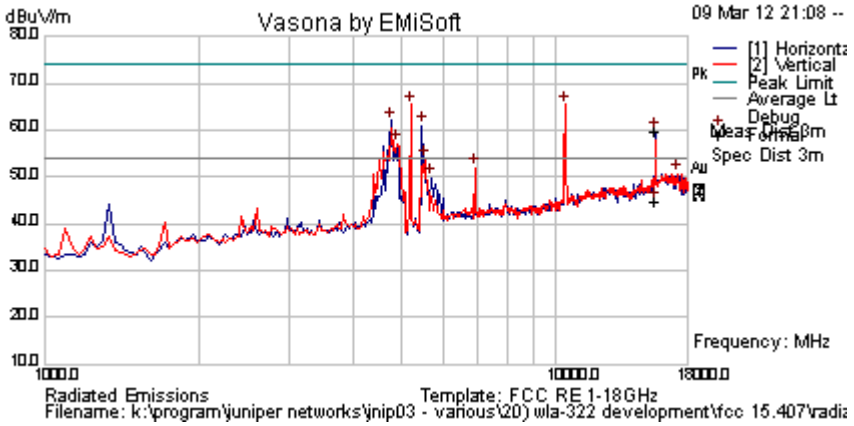
Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

802.11n HT-20 5150 Restricted Band-edge



Power reduction required ART = 16

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

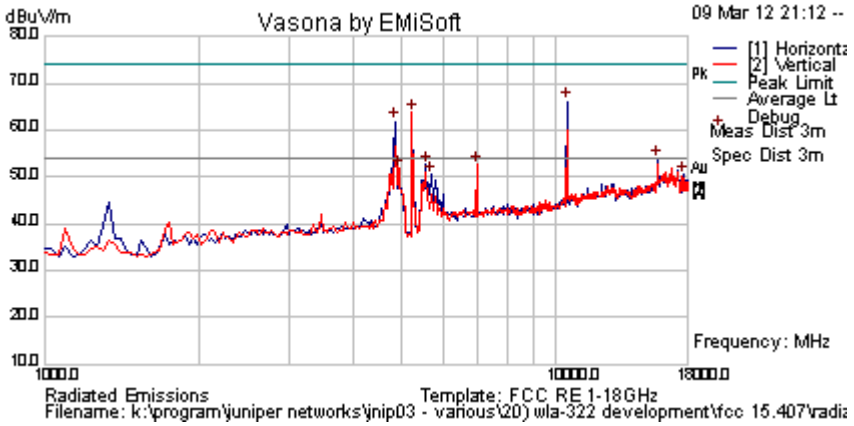


Formally measured emission peaks

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	70.7	4.6	-9.9	65.5	Peak [Scan]	V						FUND
10402.806	61.2	6.7	-2.5	65.4	Peak [Scan]	V					Pass	NRB
4747.495	67.4	4.4	-9.7	62.1	Peak [Scan]	H					Pass	BE
5462.926	66.1	4.6	-9.7	61.0	Peak [Scan]	H					Pass	BE
4883.768	62.4	4.5	-9.7	57.2	Peak [Scan]	V					Pass	BE
5531.062	59.0	4.6	-9.7	53.9	Peak [Scan]	V					Pass	BE
6927.856	53.2	5.4	-6.5	52.1	Peak [Scan]	V	100	0	54.0	-2.0	Pass	NRB
17250.501	41.1	8.6	1.0	50.7	Peak [Scan]	H	100	0	54.0	-3.3	Pass	NOISE
5701.403	54.6	4.7	-9.6	49.8	Peak [Scan]	H					Pass	BE
15597.434	52.0	8.4	-0.6	59.8	Peak Max	H	108	355	74.0	-14.2	Pass	RB
15597.434	37.1	8.4	-0.6	44.9	Average Max	H	108	355	54.0	-9.1	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

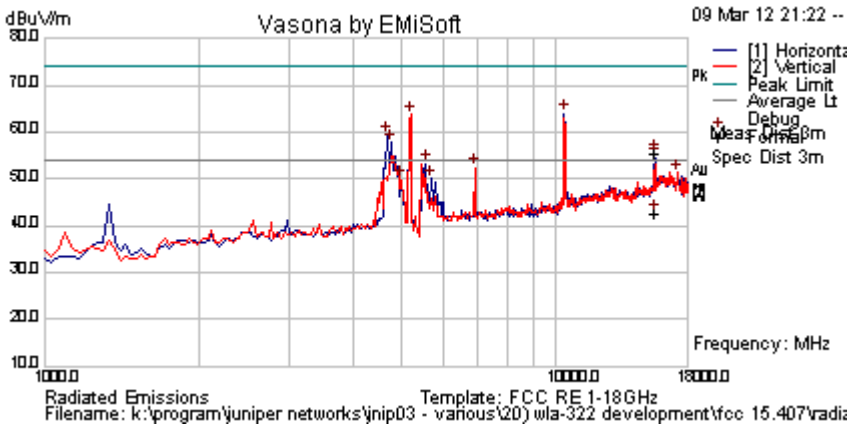
Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11n HT-20; 6.5 MCS	**Temp (ºC)**	18.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	33
Power Setting	ART = 18	**Press. (mBars)**	1013
Antenna	INTERNAL	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



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
10470.942	61.9	6.8	-2.5	66.2	Peak [Scan]	H					Pass	NRB
5224.449	69.0	4.6	-9.8	63.8	Peak [Scan]	V						FUND
4849.699	66.9	4.5	-9.7	61.8	Peak [Scan]	H					Pass	BE
5565.130	57.7	4.7	-9.7	52.7	Peak [Scan]	H					Pass	BE
6995.992	53.5	5.4	-6.4	52.5	Peak [Scan]	V	100	0	54.0	-1.5	Pass	NRB
4917.836	56.9	4.6	-9.8	51.7	Peak [Scan]	V					Pass	BE
5701.403	55.4	4.7	-9.6	50.6	Peak [Scan]	H					Pass	BE
17659.319	41.3	8.8	0.4	50.5	Peak [Scan]	H	100	0	54.0	-3.5	Pass	NOISE
15732.505	50.6	8.6	-0.4	58.8	Peak Max	H	109	46	74.0	-15.2	Pass	RB
15732.505	33.4	8.6	-0.4	41.6	Average Max	H	109	46	54.0	-12.5	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											

Test Freq.	5190 MHz	**Engineer**	GMH
Variant	802.11n HT-40; 13.5 MCS	**Temp (ºC)**	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			

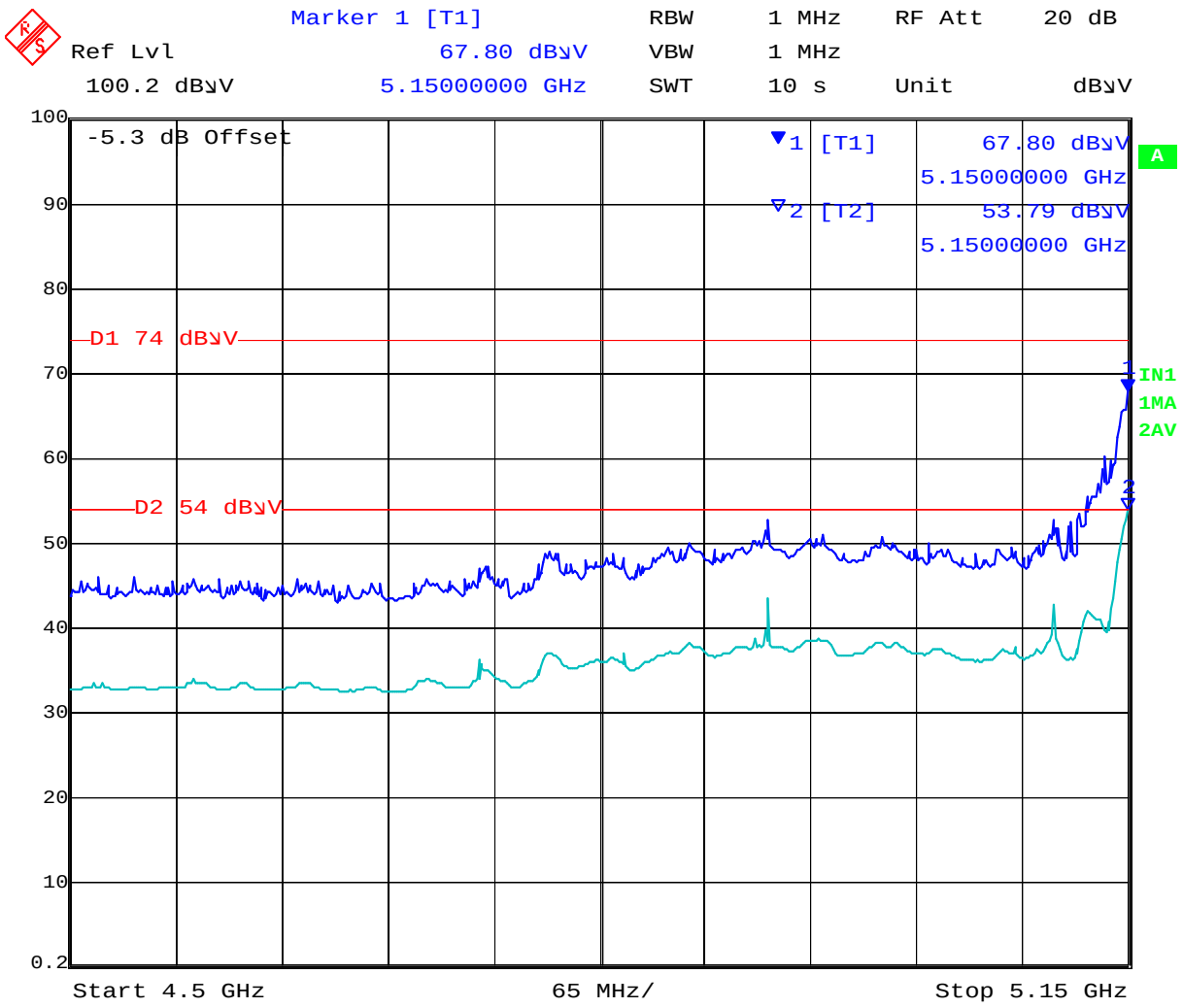


Formally measured emission peaks

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
10368.737	59.8	6.7	-2.5	64.0	Peak [Scan]	H					Pass	NRB
5190.381	69.1	4.6	-9.9	63.9	Peak [Scan]	V						FUND
4679.359	64.7	4.3	-9.9	59.2	Peak [Scan]	H					Pass	BE
4747.495	63.0	4.4	-9.7	57.7	Peak [Scan]	H					Pass	BE
5565.130	58.3	4.7	-9.7	53.2	Peak [Scan]	H					Pass	BE
6927.856	53.6	5.4	-6.5	52.4	Peak [Scan]	V	100	0	54.0	-1.6	Pass	NRB
17216.433	41.8	8.6	0.9	51.3	Peak [Scan]	V	100	0	54.0	-2.7	Pass	NOISE
5701.403	55.0	4.7	-9.6	50.1	Peak [Scan]	H					Pass	BE
4985.972	55.2	4.6	-9.9	49.9	Peak [Scan]	V					Pass	BE
15575.951	47.6	8.3	-0.6	55.4	Peak Max	H	101	345	74.0	-18.6	Pass	RB
15575.951	34.9	8.3	-0.6	42.6	Average Max	H	101	345	54.0	-11.4	Pass	RB

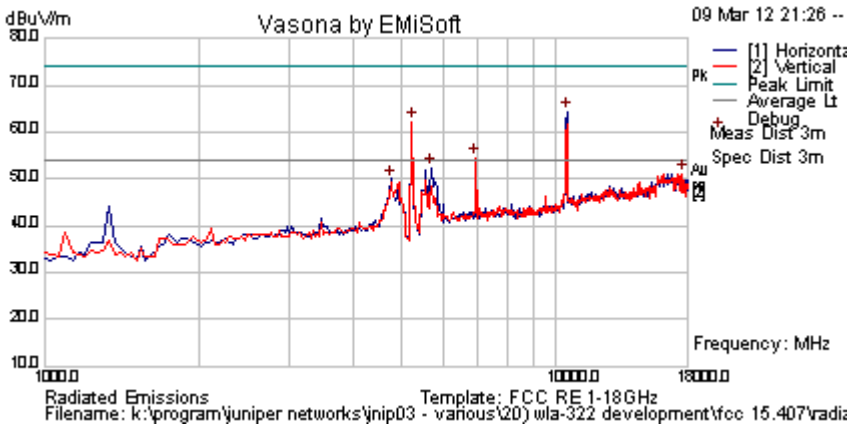
Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

802.11n HT-40 5150 Restricted Band-edge



Power reduction required ART = 14

Test Freq.	5230 MHz	**Engineer**	GMH
Variant	802.11n HT-40; 13.5 MCS	**Temp (ºC)**	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
10470.942	60.2	6.8	-2.5	64.5	Peak [Scan]	H					Pass	NRB
5224.449	67.5	4.6	-9.8	62.3	Peak [Scan]	H						FUND
6961.924	55.5	5.4	-6.4	54.5	Peak [Scan]	V					Pass	NRB
5701.403	57.2	4.7	-9.6	52.3	Peak [Scan]	H					Pass	BE
17625.251	41.8	8.8	0.5	51.1	Peak [Scan]	V	100	0	54.0	-2.9	Pass	NOISE
4747.495	55.4	4.4	-9.7	50.1	Peak [Scan]	H					Pass	BE

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

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 51.5dBμV; 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:

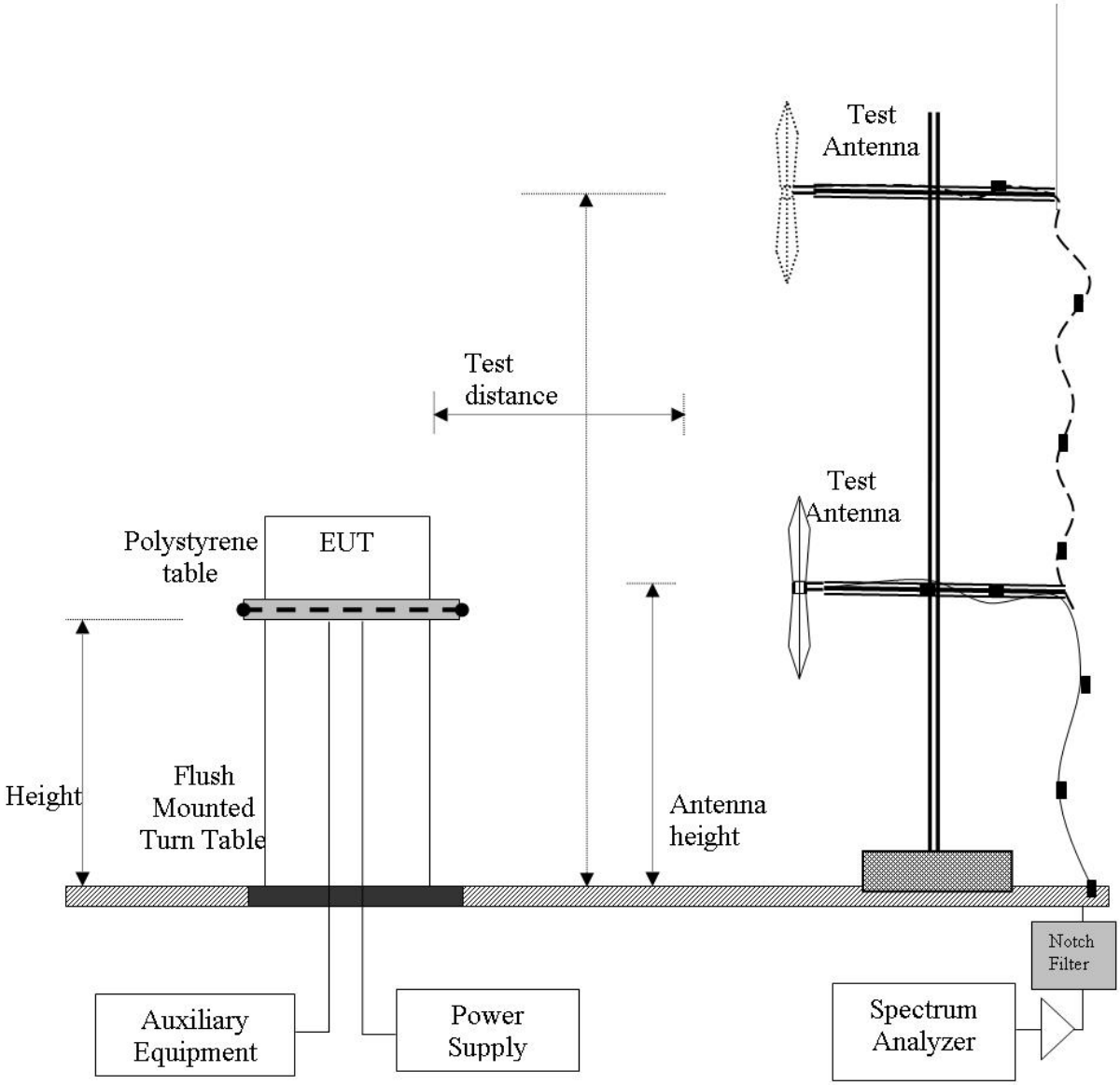
$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 dB\mu V/m$$

Conversion between dBμV/m (or dBμV) and μV/m (or μV) are done as:

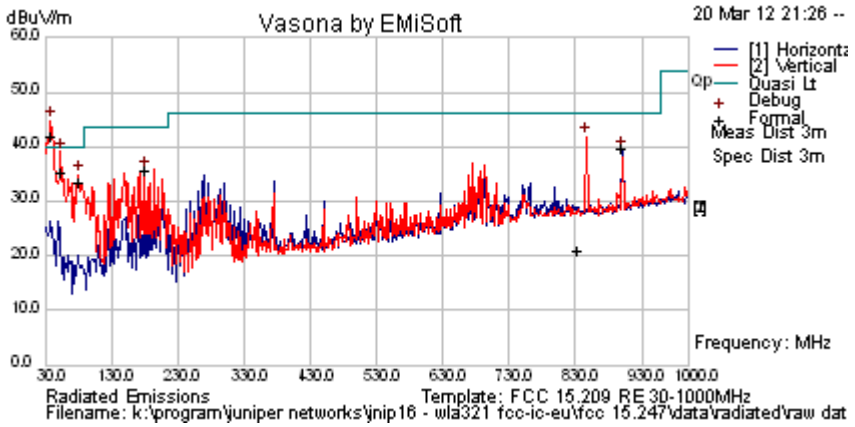
$$Level\ (dB\mu V/m) = 20 * Log\ (level\ (\mu V/m))$$

40 dBμV/m = 100μV/m
48 dBμV/m = 250μV/m

Radiated Emission Measurement Setup – Below 1 GHz



Test Freq.	Ch 36 (5180 MHz)	**Engineer**	GMH
Variant	Digital Emissions	**Temp (ºC)**	22
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	38
Power Setting	16	**Press. (mBars)**	1007
Antenna	integral		
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
38.920	51.9	3.6	-16.6	38.9	Quasi Max	V	98	98	40	-1.1	Pass	
54.179	55.5	3.7	-24.0	35.2	Quasi Max	V	104	104	40.0	-4.8	Pass	
834.588	22.4	6.9	-8.5	20.8	Quasi Max	V	186	186	46.0	-25.2	Pass	
81.188	53.1	4.0	-23.7	33.4	Quasi Max	V	113	113	40.0	-6.6	Pass	
179.749	51.3	4.5	-19.9	35.8	Peak [Scan]	V	113	113	43.5	-7.7	Pass	
900.849	40.3	7.1	-7.8	39.6	Peak [Scan]	V	113	113	46.0	-6.4	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

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 (μV/m)	Field Strength (dBμV/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 Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

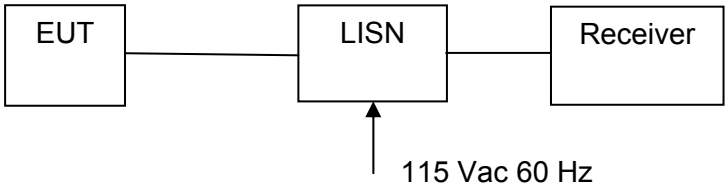
Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of Radiated Emissions'	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

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.

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 μΩ 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 (dBμV)	
	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	±2.64 dB

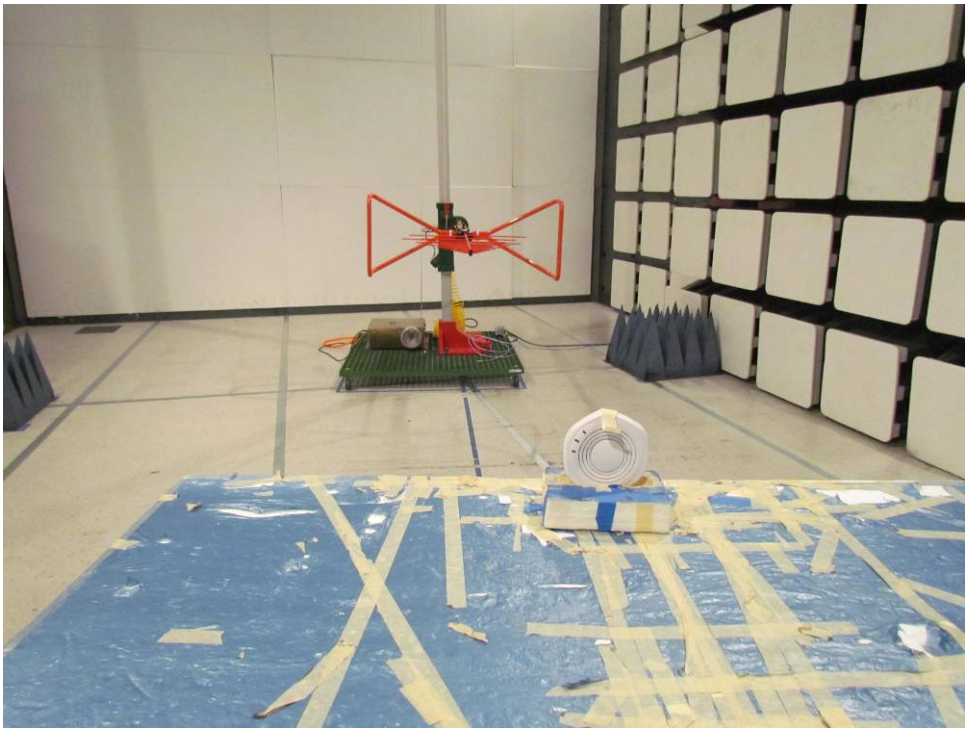
Traceability

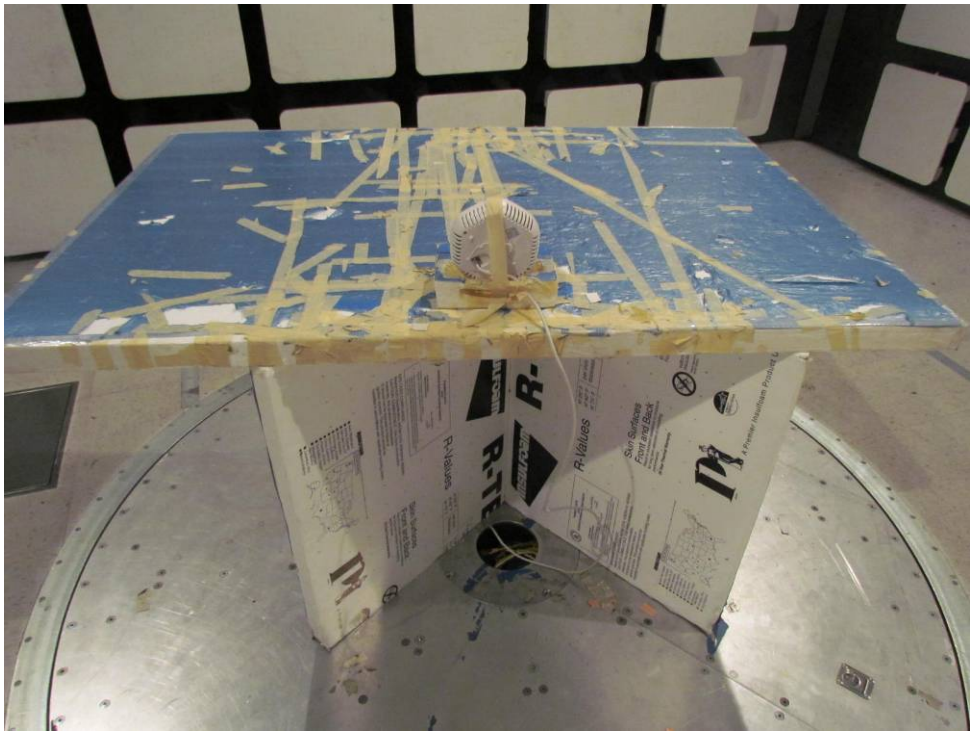
Method	Test Equipment Used
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'	0158, 0184, 0287, 0190, 0293, 0307

6. PHOTOGRAPHS

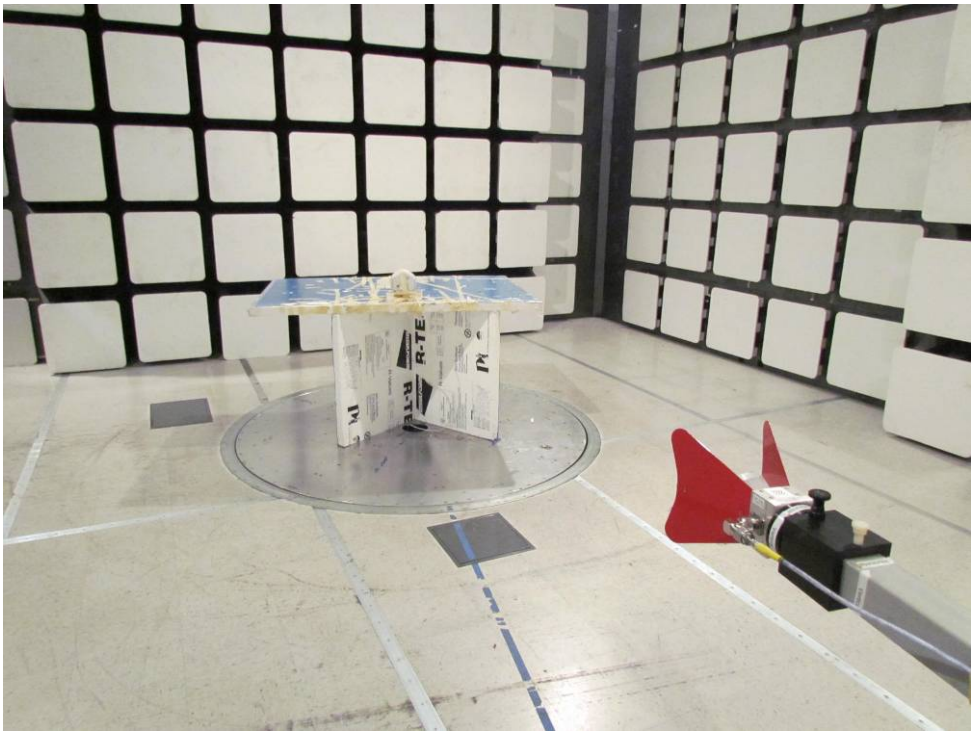
6.1. Conducted Test Setup

6.2. Radiated Test Setup < 1 GHz





6.3. Radiated Test Setup > 1 GHz



7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #	Calibration Due Date
0070	Power Meter	Hewlett Packard	437B	3125U11552	28th Nov 12
0117	Power Sensor	Hewlett Packard	8487D	3318A00371	15th Nov 12
0223	Power Meter	Hewlett Packard	EPM-442A	US37480256	15th Nov 12
0374	Power Sensor	Hewlett Packard	8485A	3318A19694	29th Nov 12
0158	Barometer /Thermometer	Control Co.	4196	E2846	8th Dec 12
0193	EMI Receiver	Rhode & Schwartz	ESI 7	838496/007	2nd Dec 12
0287	EMI Receiver	Rhode & Schwartz	ESIB40	100201	16th Nov 12
0338	30 - 3000 MHz Antenna	Sunol	JB3	A052907	8th Nov 12
0335	1-18 GHz Horn Antenna	EMCO	3117	00066580	7th 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-0-0787-3G03G0	209089-001	N/A
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001	N/A
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623	N/A
0301	5.6 GHz Notch Filter	Micro-Tronics	RBC50704	001	N/A
0302	5.25 GHz Notch Filter	Micro-Tronics	BRC50703	002	N/A
0303	5.8 GHz Notch Filter	Micro-Tronics	BRC50705	003	N/A
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	001	N/A

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