

Test of MRLBB-1003 802.11a/b/g/n Wireless
Access Module

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

Test Report Serial No.: WISC01-U3 Rev A



TEST REPORT

FROM



Test of MRLBB-1003 802.11a/b/g/n Wireless Access Module
to
To: Requirements of FCC 47 CFR Part 15.407 & IC RSS-210

Test Report Serial No.: WISC01-U3 Rev A

This report supersedes None

Applicant: Hewlett-Packard Co.
153 Taylor Street
Littleton
Massachusetts 01460-1407, USA

Product Function: Wireless Access Card for transmitting
data and voice

Copy No: pdf Issue Date: 26th July 2011

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
Fax: +1 (925) 462-0306
www.micomlabs.com



TESTING 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>



The American Association for Laboratory Accreditation

World Class 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 14th day of April 2010.



President & CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2011

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

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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
Japan	MIC	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

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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 test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-02.pdf>



The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence as a

Product Certification Body

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC Guide 65:1996 *General requirements for bodies operating product certification systems*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system for a Telecommunications Certification Body (TCB) meeting FCC (U.S.), and IC (Canada) requirements.



Presented this 24th day of June 2010.

President & CEO
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2011

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

United States of America – Telecommunication Certification Body (TCB)

TCB Identifier – US0159

Industry Canada – Certification Body

CAB Identifier – US0159

Europe – 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	26 th July 2011	Initial release.

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1. TEST RESULT CERTIFICATE

Applicant:	Hewlett-Packard Co. 153 Taylor Street Littleton Massachusetts 01460-1407, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	802.11a/b/g/n Wireless Module	Telephone:	+1 925 462 0304
Model:	MRLBB-1003	Fax:	+1 925 462 0306
S/N:	N/A		
Test Date(s):	8th June to 19th July 2011	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 15.407 & IC RSS-210 NOTE: Module does not transmit in the 5600 – 5650 MHz Radar Weather Band	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:



TESTING CERTIFICATE #2381.01



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)	Industry Canada RSS-210	Issue 8 December 2010	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands): Category 1 Equipment
(iv)	Industry Canada RSS-Gen	Issue 3 December 2010	General Requirements and Information for the Certification of Radiocommunication Equipment
(v)	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
(vi)	CISPR 22/ EN 55022	2008 2006+A1:2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(vii)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(viii)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(ix)	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
(x)	A2LA	9 th June 2010	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(xi)	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:	Compliance testing of the MRLBB-1003 802.11a/b/g/n Wireless Access Module requirements of FCC Part 15.407 and Industry Canada RSS-210 regulations for two additional antennas in the frequency ranges 5150 – 5250, 5250 – 5350 and 5470 – 5725 MHz
Applicant:	Hewlett-Packard Co. 153 Taylor Street Littleton Massachusetts 01460-1407, USA
Manufacturer:	As applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	WISC01-U3 Rev A
Date EUT received:	18 th May 2011
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210
Dates of test (from - to):	8th June to 19th July 2011
No of Units Tested:	2 (calibration issue with initial module)
Type of Equipment:	802.11a/b/g/n Wireless Access Card
Applicants Trade Name:	Hewlett-Packard
Model(s):	MRLBB-1003
ART Software Release	2.13
Location for use:	Indoor/outdoor
Declared Frequency Range(s):	5,150 to 5,250 MHz 5,250 – 5,350 MHz 5,470 – 5,725 MHz
Type of Modulation:	Per 802.11 – OFDM
Transmit/Receive Operation:	Legacy 802.11a; 802.11n HT-20, HT-40
Operating Temperature Range:	Declared range 0 to +55°C
Frequency Stability:	±20 ppm
Equipment Dimensions:	2.25" x 1.25" (57mm x 32mm)
Weight:	3oz
Primary function of equipment:	Wireless Access Card for transmitting data and voice

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3.2. Scope of Test Program

The scope of the test program was to verify compliance of the Hewlett Packard MRLBB-1003 wireless Access Card in the frequency ranges 5,150 – 5,250, 5,250 – 5,350 and 5,470 – 5,725 MHz against the requirements of FCC 47 CFR Part 15.407 RSS-210.

This program was a Class II Permissive 'Change to add a single antenna in the 5 GHz bands.

The wireless module has the capability to operate in two distinct modes;

- 1).. Non-Beam Forming, and
- 2).. Beam-Forming

Measurement results for both modes have been included. Further within each of these modes all operational 802.11 modes in both frequency bands were exercised. Power levels, spurious emissions and band-edge.

The MRLBB-1003 802.11a/b/g/n Wireless Access Module can be set up to operate in the following configurations;-

3x3:3 (3 transmit antennas, 3 receive antennas, using 3 spatial streams).

2x3:2 (2 transmit antennas, 3 receive antennas, using only 2 spatial streams)

DFS testing was performed with the radio card operating in the 3X3:3 configuration and reported in the initial filing. MiCOM Labs DFS test report HWPDP14-U1 Rev B MSM466 FCC DFS Report 1st June 2011 was submitted in the initial filing.

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

Type (EUT/Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	802.11 a/b/g/n Wireless Access Card	HP	MRLBB-1003	N/A
Support	Laptop PC	Dell	--	--

3.4. Antenna Details

Gain (dBi)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
8	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna	Laird	OP51508T-HP1	N/A

3.5. Cabling and I/O Ports

Number and type of I/O ports on supporting MSM466 wireless Access Card.

1. 3 x MIMO Antenna Ports 2.4 and 5 GHz

3.6. Equipment Modifications

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

1. 802.11b Radiated Band-Edge Issue

Initial wireless module had an issue with band-edge spikes. A second module which was re-calibrated to Atheros ART version 2.13 was used to complete the program.



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3.7. Deviations from the Test Standard

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

1. NONE

3.8. Subcontracted Testing or Third Party Data

The following subcontracted testing was required in order to complete the test program:

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
15.407(a) A9.2(2) 4.6	Transmit Output Power	Power Measurement	Conducted	Complies	5.1.1
15.407(b)(2) 15.205(a) 15.209(a) 2.2 2.6 A9.3(2) 4.7	Radiated Emissions		Radiated		5.2.1
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.2.1.1
	Radiated Band Edge	Band edge results			
Industry Canada only RSS-Gen §4.10, §6 15.407(b)(6) 15.205(a) 15.209(a) 2.2	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.2.1.2

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

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5. MEASUREMENT RESULTS

5.1. Conducted Testing

5.1.1. Peak Output Power

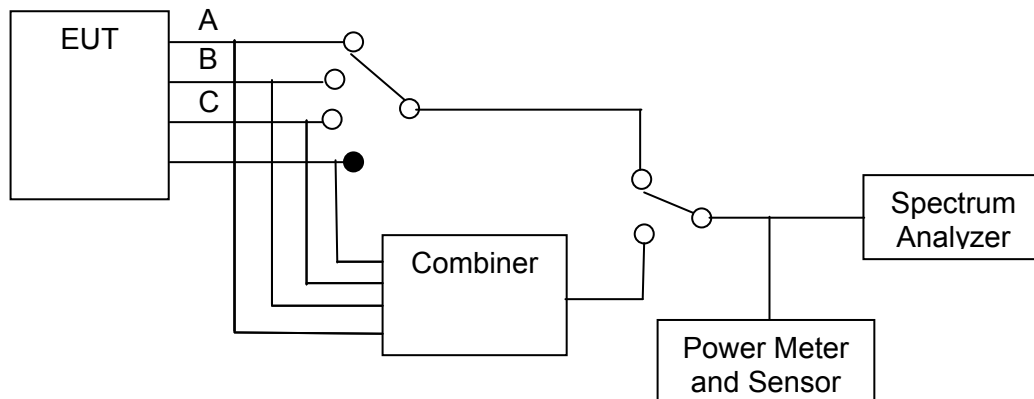
FCC, Part 15 Subpart C 15.247(b)(3), 15.31(e)
Industry Canada RSS-210 A8.4(4)

Test Procedure

The transmitter terminal of EUT was connected to the input of the spectrum analyzer set to measure peak power. Output power was measured following the latest FCC KDB 662911 D01 Multiple Transmitter Output v01.

Power measurement results are provided for individual ports and a calculated power is provided taking all ports into consideration. All cable losses and offsets were taken into consideration in the final result.

Test Measurement Set up



Measurement set up for Transmitter Peak Output Power

Ambient test 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

Calculated Power = $A + G + 10 \log (1/x)$ dBm

A = Total Power [$10 \log_{10} (10^{a/10} + 10^{b/10} + 10^{c/10})$], G = Antenna Gain,

x = Duty Cycle

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Maximum Transmit Power, FCC Limits

Limit 5150 – 5250 MHz: Lesser of 50 mW (+17dBm) or $4 + 10 \log (B)$ dBm

Frequency Range (MHz)	Maximum 26 dB Bandwidth (MHz)	$4 + 10 \log (B)$ (dBm)	Limit (dBm)
5150 – 5250 (a, HT-20)	24.58	+17.91	+17.00
5150 – 5250 (HT-40)	47.00	+20.72	+17.00

Industry Canada Limits

Limit 5150 – 5250 MHz: Lesser of 200 mW (+23 dBm) or $10 + 10 \log (B)$ dBm

Frequency Range (MHz)	Maximum 99% Bandwidth (MHz)	$10 + 10 \log (B)$ (dBm)	EIRP Limit (dBm)
5150 – 5250 (a, HT-20)	24.58	+23.79	+23.00
5150 – 5250 (HT-40)	47.00	+26.72	+23.00

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

Bands 5250 – 5350 and 5470 – 5725 MHz

Limit lesser of: 250 mW or $11 \text{ dBm} + 10 \log (B)$ dBm

Mode	Frequency Range (MHz)	Maximum 26 dB Bandwidth (MHz)	$11 + 10 \log (B)$ (dBm)	Limit (dBm)
a	5250 – 5350	24.67	+24.92	+24.00
HT-20		25.92	+25.14	+24.00
HT-40	5470 – 5725	48.50	+27.86	+24.00

NOTE: Operational bandwidths were extracted from the test reports supporting the original grants ADT Test Report #: RF990622C09-1 Section 4.3.7 Issued 11th October 2010



5.1.1.1. Antenna Non-Beam Forming

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.

Antenna Laird OP51508T-HP1 (5 GHz)

MIMO Operation 5150-5250 MHz

Gain	Antenna Gain >6dBi	Max. Allowable Conducted Peak Power (dBm)		Maximum EIRP
(dBi)	(dB)	Non-Beam Forming	Beam Forming	(dBm)
+8.0	Yes	+15.0	+10.23	+23.0

MIMO Operation 5250-5350 and 5470 – 5725 MHz

Gain	Antenna Gain >6dBi	Max. Allowable Conducted Peak Power (dBm)		Maximum EIRP
(dBi)	(dB)	Non-Beam Forming	Beam Forming	(dBm)
+8.0	Yes	+22.0	+17.23	+30.0

Non-MIMO Operation (Legacy) 5150-5250 MHz

Gain	Increased Gain V's No. Antenna Ports		Total Gain	Total Gain - 6 dBi	Max. Allowable Conducted Peak Power	Maximum EIRP
dBi	Ports	dB	dBi	dB	(dBm)	(dBm)
+8.0	3	4.77	12.77	6.77	+10.23	+23.0

Non-MIMO Operation (Legacy) 5250-5350 and 5470 – 5725 MHz

Gain	Increased Gain V's No. Antenna Ports		Total Gain	Total Antenna Gain - 6 dBi	Max. Allowable Conducted Peak Power	Maximum EIRP
dBi	Ports	dB	dBi	dB	(dBm)	(dBm)
+8.0	3	4.77	12.77	6.77	+17.23	+30.0

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5.1.1.1.1. 5150 - 5250 GHz Non-Beam Forming Operation

Test Conditions:	15.407 (a) (1)	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Non-Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	dBm	dBm	dB	
5180	6.5	5.42	5.66	4.28	--	N/A	9.93	23.00	-0.30
5200	6.5	5.51	5.88	4.36	--	N/A	10.07	23.00	-0.16
5240	6.5	5.39	5.81	4.66	--	N/A	10.08	23.00	-0.15

Measurement uncertainty:	±1.33 dB
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NOTE: Legacy mode operation 802.11a requires 4.77 dB added to the antenna gain. In this mode total antenna gain = 12.77 dB



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Test Conditions:	15.407 (a) (1)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-20	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Non-Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5180	10.0	10.52	10.52	9.20	--	N/A	14.89	23.00	-0.11
5200	10.0	9.97	11.10	9.33	--	N/A	14.97	23.00	-0.03
5240	10.0	10.25	11.04	9.21	--	N/A	15.00	23.00	-0.00

Measurement uncertainty:	±1.33 dB
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Test Conditions:	15.407 (a) (1)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-40	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Non-Beam Forming		
Notes 2:			

Test Freq	Compliant Power Level	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5190	11.5	10.39	10.68	9.00	--	N/A	14.85	23.00	-0.15
5230	11.0	10.02	10.68	8.97	--	N/A	14.72	23.00	-0.28

Measurement uncertainty:	±1.33 dB
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5.1.1.1.2. 5250 - 5350 GHz Non-Beam Forming Operation

Test Conditions:	15.407 (a) (2)	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Non-Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d			dBm	dB
5260	14.0	11.63	12.13	11.19	--	N/A	16.44	30.00	-0.79
5300	15.0	12.04	11.82	11.59	--	N/A	16.59	30.00	-0.64
5320	15.0	11.77	11.89	11.57	--	N/A	16.52	30.00	-0.71

Measurement uncertainty:	±1.33 dB
---------------------------------	----------

NOTE: Legacy mode operation 802.11a requires 4.77 dB added to the antenna gain. In this mode total antenna gain = 12.77 dB



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Test Conditions:	15.407 (a) (2)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-20	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Non-Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5260	Max Pwr	11.55	13.43	12.92	--	N/A	19.47	30.00	-2.53
5300	Max Pwr	11.33	11.73	12.42	--	N/A	18.62	30.00	-3.38
5320	Max Pwr	10.53	11.28	11.91	--	N/A	18.05	30.00	-3.95

Measurement uncertainty:	±1.33 dB
---------------------------------	----------

Any power reduction from Max Pwr (ART Target Power) is due to the equipment power levels reduced due to band-edge compliance issues.

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Test Conditions:	15.407 (a) (2)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-40	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Non-Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5270	Max Pwr	10.98	12.00	11.88	--	N/A	18.41	30.00	-3.59
5310	11.5	9.55	10.37	10.82	--	N/A	17.05	30.00	-4.95

Measurement uncertainty:	±1.33 dB
---------------------------------	----------

Any power reduction from Max Pwr (ART Target Power) is due to the equipment power levels reduced due to band-edge compliance issues.

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5.1.1.1.3. 5470 - 5725 GHz Non-Beam Forming Operation

Test Conditions:	15.407 (a) (2)	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Non-Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d				
5500	Max Pwr	10.53	11.60	12.00	--	N/A	16.19	30.00	-1.04
5600	Max Pwr	11.57	12.51	11.23	--	N/A	16.58	30.00	-0.65
5700	Max Pwr	10.76	10.80	10.53	--	N/A	15.47	30.00	-1.76

Measurement uncertainty:	±1.33 dB
---------------------------------	----------

Any power reduction from Max Pwr (ART Target Power) is due to the equipment power levels reduced due to band-edge compliance issues.

NOTE: Legacy mode operation 802.11a requires 4.77 dB added to the antenna gain. In this mode total antenna gain = 12.77 dB



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Test Conditions:	15.407 (a) (2)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-20	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Non-Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5500	Max Pwr	10.55	11.46	11.73	--	N/A	16.05	30.00	-5.95
5600	Max Pwr	11.40	12.27	11.04	--	N/A	16.37	30.00	-5.63
5700	Max Pwr	11.48	11.88	11.53	--	N/A	16.40	30.00	-5.60

Measurement uncertainty:	±1.33 dB
---------------------------------	----------

Any power reduction from Max Pwr (ART Target Power) is due to the equipment power levels reduced due to band-edge compliance issues.

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Test Conditions:	15.407 (a) (2)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-40	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Non-Beam Forming		
Notes 2:			

Test Freq	Compliant Power Level	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d				
5510	Max Pwr	9.43	10.55	10.99	--	N/A	15.14	30.00	-6.86
5610	Max Pwr	10.80	11.34	10.50	--	N/A	15.67	30.00	-6.33
5690	Max Pwr	10.75	11.16	10.74	--	N/A	15.66	30.00	-6.34

Measurement uncertainty:	±1.33 dB
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Any power reduction from Max Pwr (ART Target Power) is due to the equipment power levels reduced due to band-edge compliance issues.

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5.1.1.2. Antenna Beam Forming

5.1.1.2.1. 5150 - 5250 GHz Beam Forming Operation

Test Conditions:	15.407 (a) (1)	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5180	6.5	5.20	5.46	4.14	--	N/A	9.74	23.00	-0.49
5200	6.5	5.22	5.55	4.03	--	N/A	9.75	23.00	-0.48
5240	6.5	5.17	5.53	4.40	--	N/A	9.83	23.00	-0.40

Measurement uncertainty:	±1.33 dB
---------------------------------	----------

NOTE: Legacy mode operation 802.11a requires 4.77 dB added to the antenna gain. In this mode total antenna gain = 12.77 dB



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Test Conditions:	15.407 (a) (1)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-20	Ambient Temp. (°C):	19 to 22
TPC:	HIGH	Pressure (mBars):	998 to 1003
Modulation:	ON	Duty Cycle (%):	100
Beam Forming Gain (Y):	4.77 dB	Antenna Gain:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5180	6.5	5.25	5.50	4.13	--	N/A	9.77	23.00	-0.46
5200	6.5	5.43	5.84	4.22	--	N/A	9.99	23.00	-0.24
5240	6.5	5.36	5.56	4.50	--	N/A	9.94	23.00	-0.29

Measurement uncertainty:	±1.33 dB
---------------------------------	----------

NOTE: MIMO Beam Forming (correlation) requires the addition of 4.77 dB to the antenna gain. In this mode total antenna gain = 12.77 dB

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Test Conditions:	15.407 (a) (1)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-40	Ambient Temp. (°C):	19 to 22
TPC:	HIGH	Pressure (mBars):	998 to 1003
Modulation:	ON	Duty Cycle (%):	100
Beam Forming Gain (Y):	4.77 dB	Antenna Gain:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Beam Forming		
Notes 2:			

Test Freq	Compliant Power Level	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d				
5190	6.0	5.24	5.32	4.08	--	N/A	9.69	23.00	-0.54
5230	6.0	5.20	5.48	4.13	--	N/A	9.75	23.00	-0.48

Measurement uncertainty:	±1.33 dB
---------------------------------	----------

NOTE: MIMO Beam Forming (correlation) requires the addition of 4.77 dB to the antenna gain, In this mode total antenna gain = 12.77 dB

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5.1.1.2.2. 5250 - 5350 GHz Beam Forming Operation

Test Conditions:	15.407 (a) (2)	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d			dBm	dB
5260	14.0	11.85	12.27	11.36	--	N/A	16.61	30.00	-0.62
5300	15.0	12.30	11.97	11.78	--	N/A	16.79	30.00	-0.44
5320	16.0	12.24	12.34	12.18	--	N/A	17.03	30.00	-0.20

Measurement uncertainty:	±1.33 dB
---------------------------------	----------

NOTE: Legacy mode operation 802.11a requires 4.77 dB added to the antenna gain. In this mode total antenna gain = 12.77 dB



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Test Conditions:	15.407 (a) (2)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-20	Ambient Temp. (°C):	19 to 22
TPC:	HIGH	Pressure (mBars):	998 to 1003
Modulation:	ON	Duty Cycle (%):	100
Beam Forming Gain (Y):	4.77 dB	Antenna Gain:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5260	14.0	11.76	12.21	11.38	--	N/A	16.57	30.00	-0.66
5300	14.0	11.60	11.29	11.10	--	N/A	16.11	30.00	-1.12
5320	14.5	11.34	11.61	11.32	--	N/A	16.20	30.00	-1.03

Measurement uncertainty:	±1.33 dB
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NOTE: MIMO Beam Forming (correlation) requires the addition of 4.77 dB to the antenna gain. In this mode total antenna gain = 12.77 dB

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Test Conditions:	15.407 (a) (2)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-40	Ambient Temp. (°C):	19 to 22
TPC:	HIGH	Pressure (mBars):	998 to 1003
Modulation:	ON	Duty Cycle (%):	100
Beam Forming Gain (Y):	4.77 dB	Antenna Gain:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combine _d	Calculated		
MHz	ART #	a	b	c	d				
5270	13.5	11.74	12.06	11.00	--	N/A	16.39	30.00	-0.84
5310	14.5	11.84	11.64	11.44	--	N/A	16.41	30.00	-0.82

Measurement uncertainty:	±1.33 dB
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NOTE: MIMO Beam Forming (correlation) requires the addition of 4.77 dB to the antenna gain. In this mode total antenna gain = 12.77 dB

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5.1.1.2.3. 5470 - 5725 GHz Beam Forming Operation

Test Conditions:	15.407 (a) (2)	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:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d			dBm	dB
5500	15.5	11.85	11.69	12.06	--	N/A	16.64	30.00	-0.59
5600	15.0	11.81	12.12	11.92	--	N/A	16.72	30.00	-0.51
5700	15.0	11.98	11.00	11.67	--	N/A	16.34	30.00	-0.89

Measurement uncertainty:	±1.33 dB
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NOTE: Legacy mode operation 802.11a requires 4.77 dB added to the antenna gain. In this mode total antenna gain = 12.77 dB



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Test Conditions:	15.407 (a) (2)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-20	Ambient Temp. (°C):	19 to 22
TPC:	HIGH	Pressure (mBars):	998 to 1003
Modulation:	ON	Duty Cycle (%):	100
Beam Forming Gain (Y):	4.77 dB	Antenna Gain:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Beam Forming		
Notes 2:			

Test Freq	Compliant Power Setting	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5500	15.0	11.55	11.18	11.73	--	N/A	16.26	30.00	-0.97
5600	14.0	11.18	11.57	11.51	--	N/A	16.19	30.00	-1.04
5700	15.0	11.88	10.86	11.64	--	N/A	16.25	30.00	-0.98

Measurement uncertainty:	±1.33 dB
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NOTE: MIMO Beam Forming (correlation) requires the addition of 4.77 dB to the antenna gain. In this mode total antenna gain = 12.77 dB

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Test Conditions:	15.407 (a) (2)	Rel. Humidity (%):	35 to 42
Variant:	802.11n HT-40	Ambient Temp. (°C):	19 to 22
TPC:	HIGH	Pressure (mBars):	998 to 1003
Modulation:	ON	Duty Cycle (%):	100
Beam Forming Gain (Y):	4.77 dB	Antenna Gain:	8 dBi
Applied Voltage:	3.3 Vdc		
Notes 1:	Beam Forming		
Notes 2:			

Test Freq	Compliant Power Level	Measured Peak Power				Total Power (dBm)		EIRP Limit	Margin
		RF Port (dBm)				Combined	Calculated		
MHz	ART #	a	b	c	d	Combined	Calculated	dBm	dB
5510	15.0	11.59	11.23	11.69	--	N/A	16.28	30.00	-0.95
5610	14.5	11.33	11.84	11.89	--	N/A	16.47	30.00	-0.76
5690	14.5	11.61	10.72	11.34	--	N/A	16.01	30.00	-1.22

Measurement uncertainty:	±1.33 dB
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NOTE: MIMO Beam Forming (correlation) requires the addition of 4.77 dB to the antenna gain. In this mode total antenna gain = 12.77 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 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. If directional antennas greater than 6 dBi are used both the maximum conducted power and the peak power spectral density shall be reduced by the amount in dB that exceeds the directional gain.

(a)(2) For the 5.25-5.35 and 5.47–5.725 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. If directional antennas greater than 6 dBi are used both the maximum conducted power and the peak power spectral density shall be reduced by the amount in dB that exceeds the directional gain.

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.

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB
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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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5.2. Radiated Testing

5.2.1. Transmitter Radiated Spurious Emissions (above 1 GHz) and Radiated Band-Edge (Restricted /bands)

FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209

Industry Canada RSS-210 §A8.5, §2.2, §2.6

Industry Canada RSS-Gen §4.7

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

Field Strength Calculation

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

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

where: FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss or Waveguide Loss

For example:

Given receiver input reading of 51.5 dB μ 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 μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

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

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

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



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

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

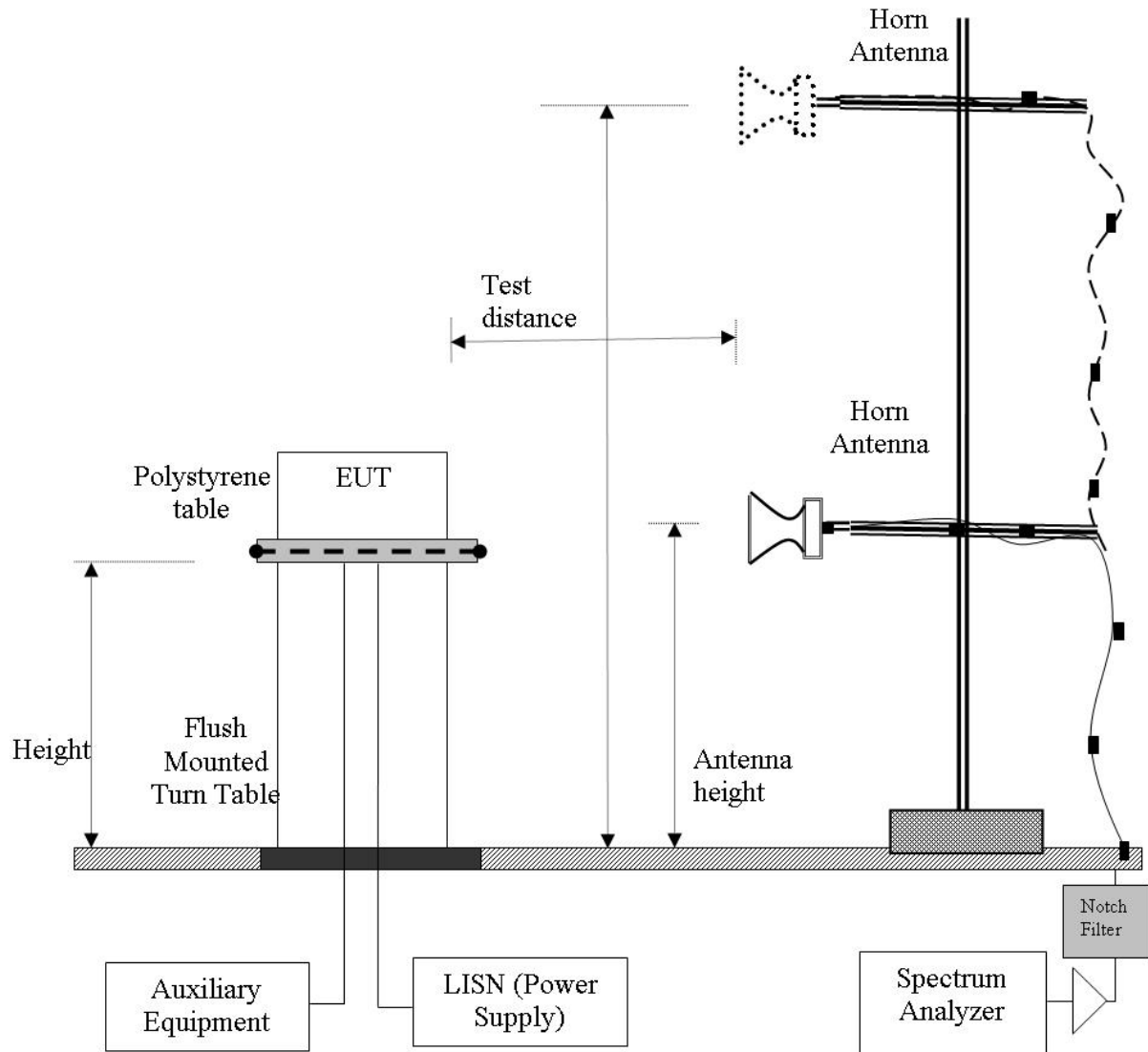
where P is the EIRP in Watts

Therefore: -27 dBm/MHz = 68.23 dB μ V/m

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

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Radiated Emission Measurement Setup – Above 1 GHz

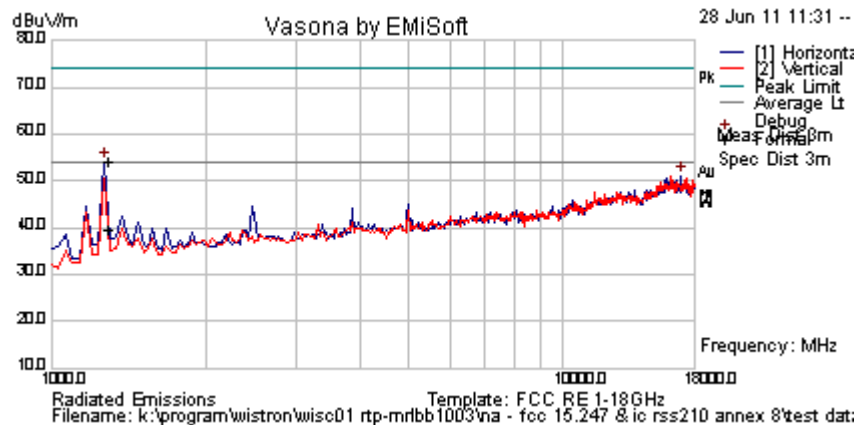


NOTE: All spurious emission and band-edge testing was performed at maximum power levels i.e. Target Power. The actual permissible power levels for each frequency band are reported in Section 5.1 Peak Output Power.



When performing testing for spurious emissions above 1 GHz a Restricted Band frequency 1296.763 MHz consistently appeared in every plot. To save evaluating this frequency with each scan a single separate scan was completed to characterize the emission as shown below.

Test Freq.		Engineer	
Variant		Temp (°C)	
Freq. Range		Rel. Hum.(%)	
Power Setting		Press. (mBars)	
Antenna	8dBi Laird OP51508T-HP1	Duty Cycle (%)	
Test Notes 1	Laptop running ART2 on EUT table with device and antenna.		
Test Notes 2	Single Restricted Band Frequency Evaluation		



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
1296.763	66.0	2.2	-14.2	54.0	Peak	H	99	246	74.0	-20.0	Pass	
1296.763	51.6	2.2	-14.2	39.6	Average	H	99	246	54.0	-14.4	Pass	

Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
 NRB = Non-Restricted Band. RB = Restricted Band.

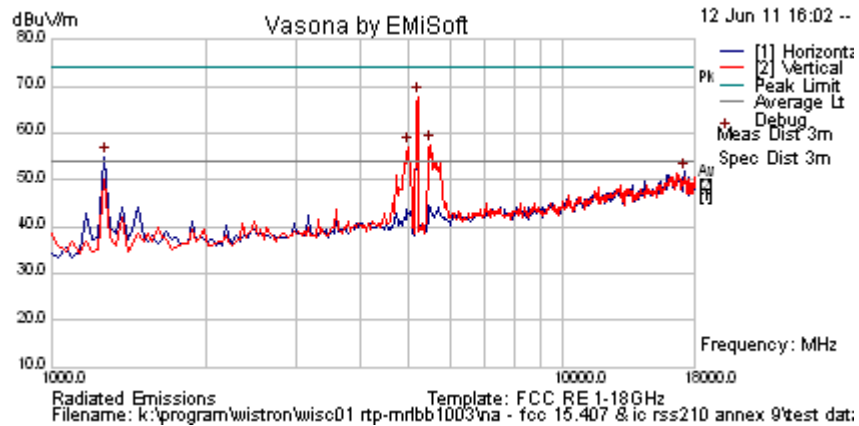
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5.2.1.1. Antenna Non-Beam Forming

5.2.1.1.1. 5150 – 5250 MHz Non-Beam Forming Operation

Test Freq.	5180 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		

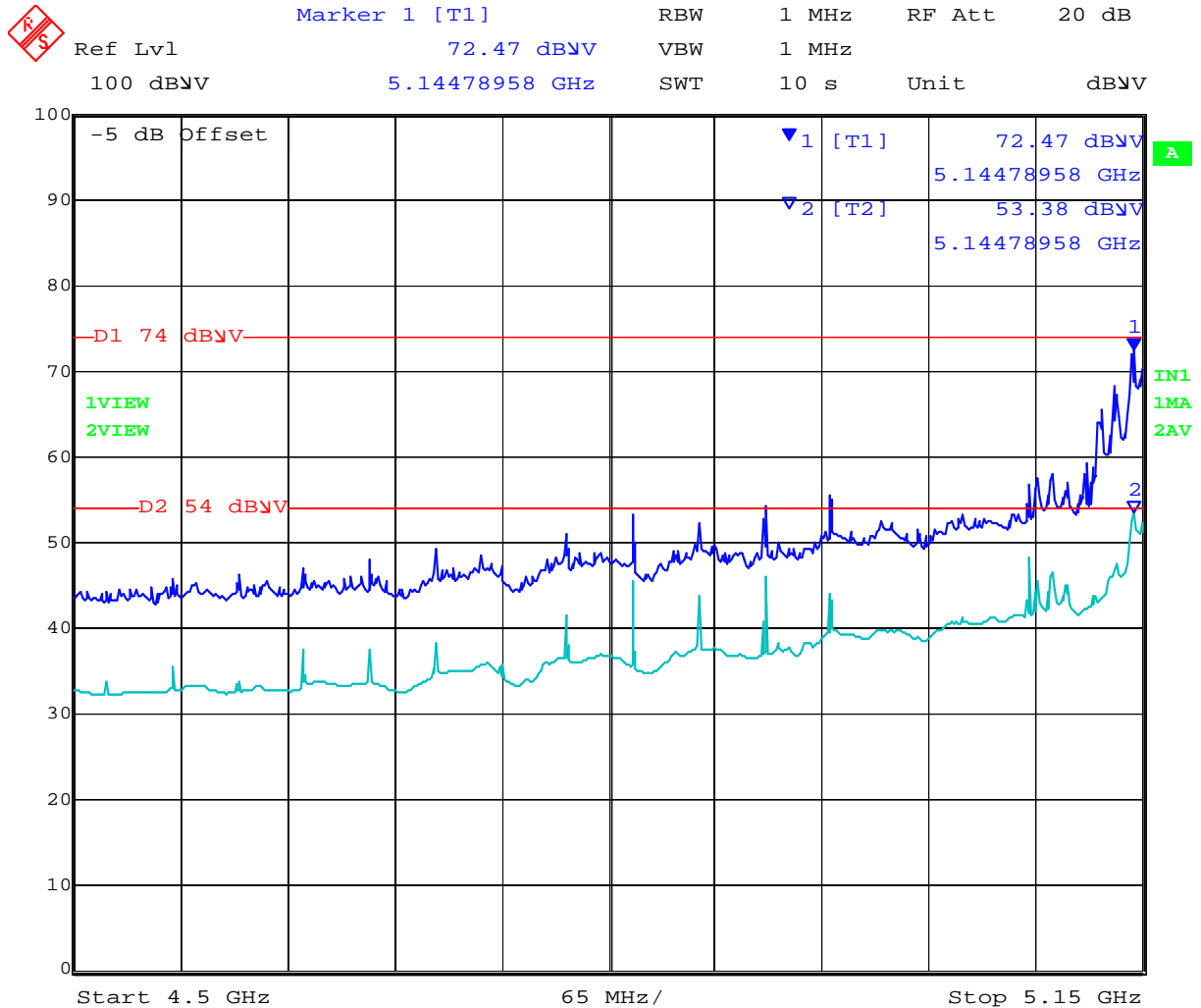


Formally measured emission peaks

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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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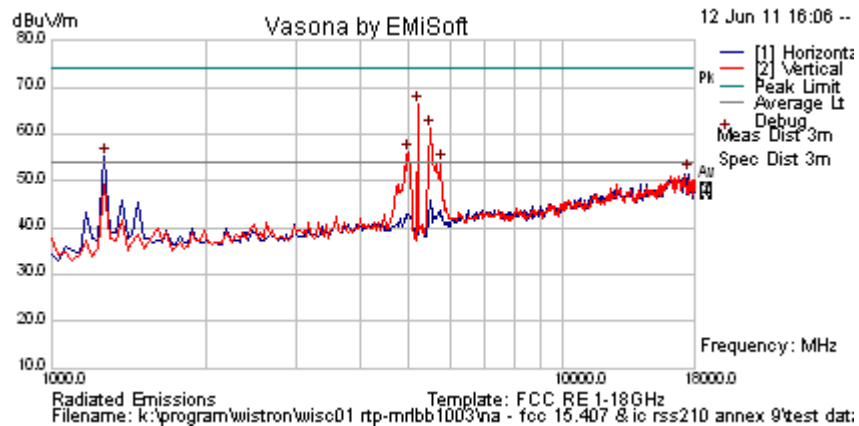
Date: 25.JUN.2011 15:05:45

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Test Freq.	5200 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

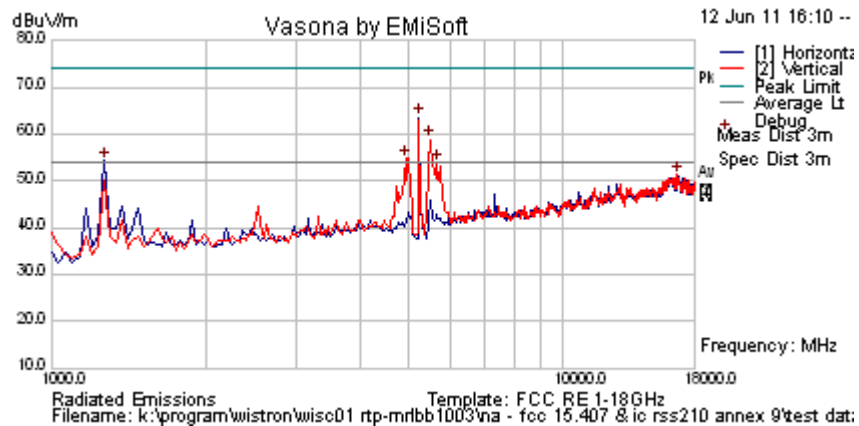
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5240 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

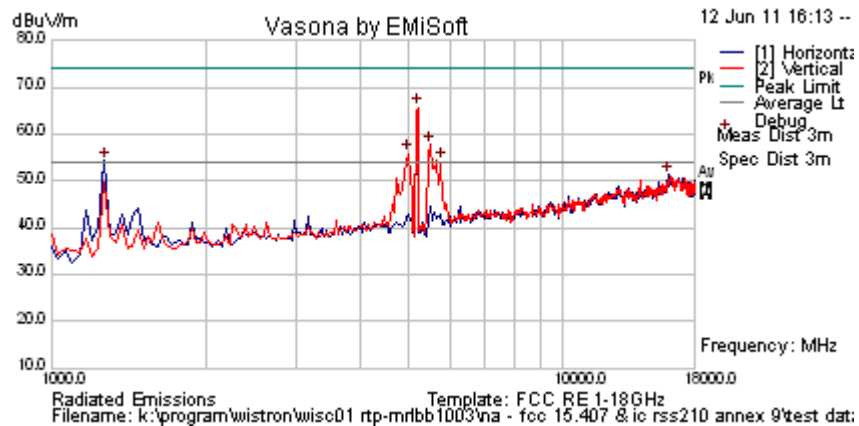
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Test Freq.	5180 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		

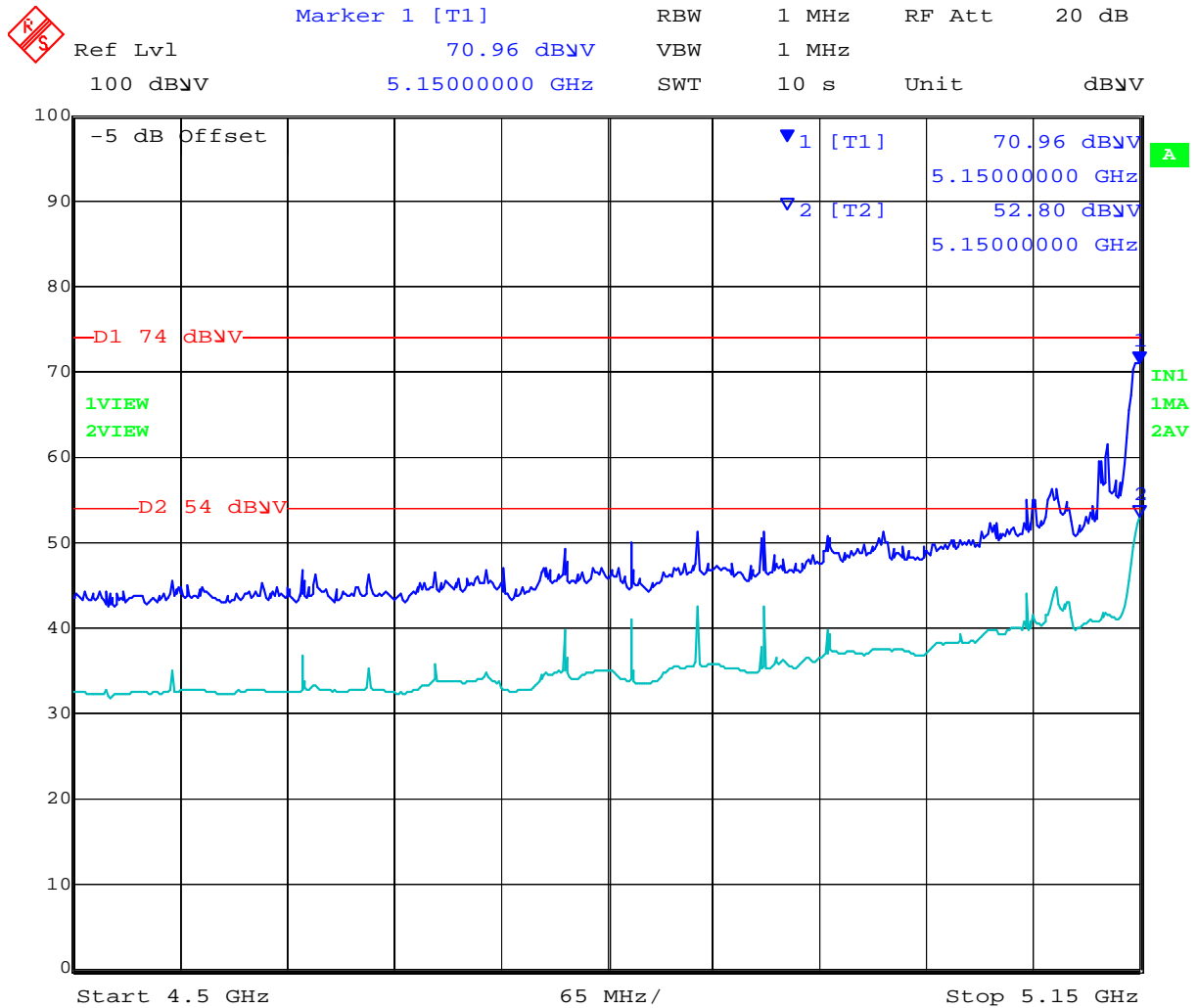


Formally measured emission peaks

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
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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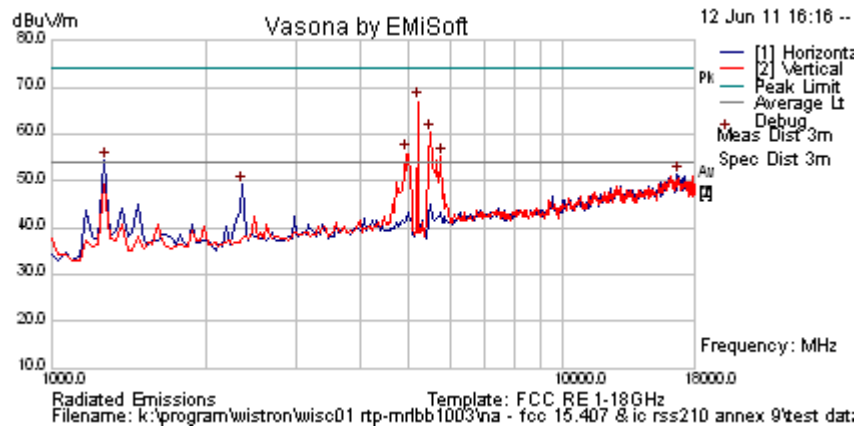
Date: 25.JUN.2011 15:03:24

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Test Freq.	5200 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

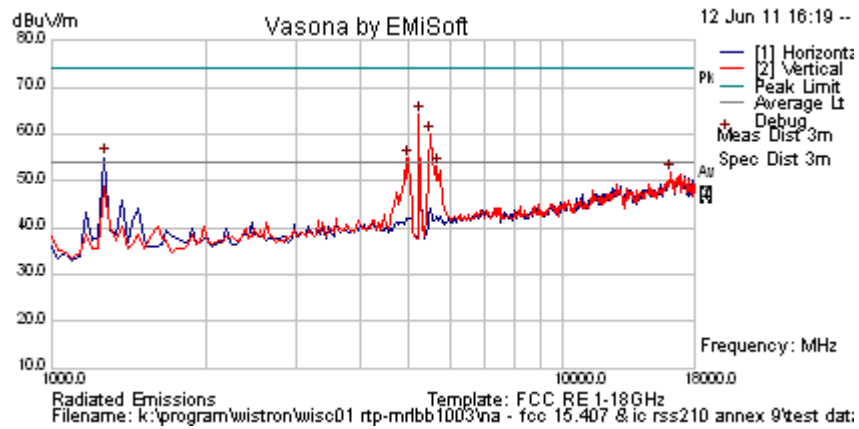
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5240 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

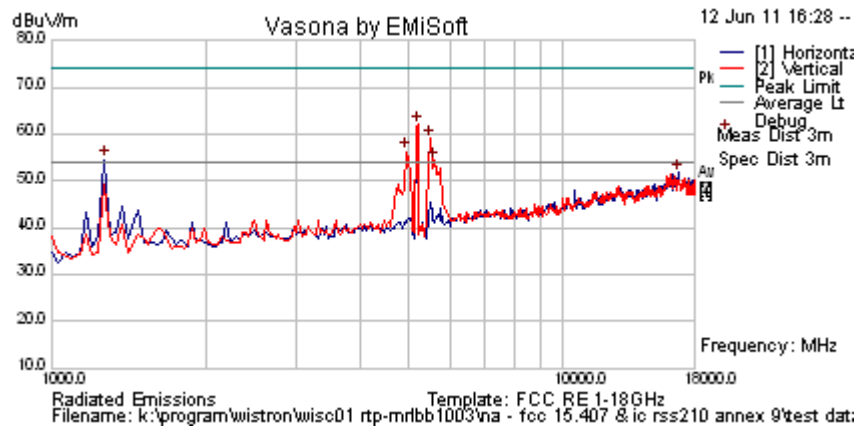
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Test Freq.	5190 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		

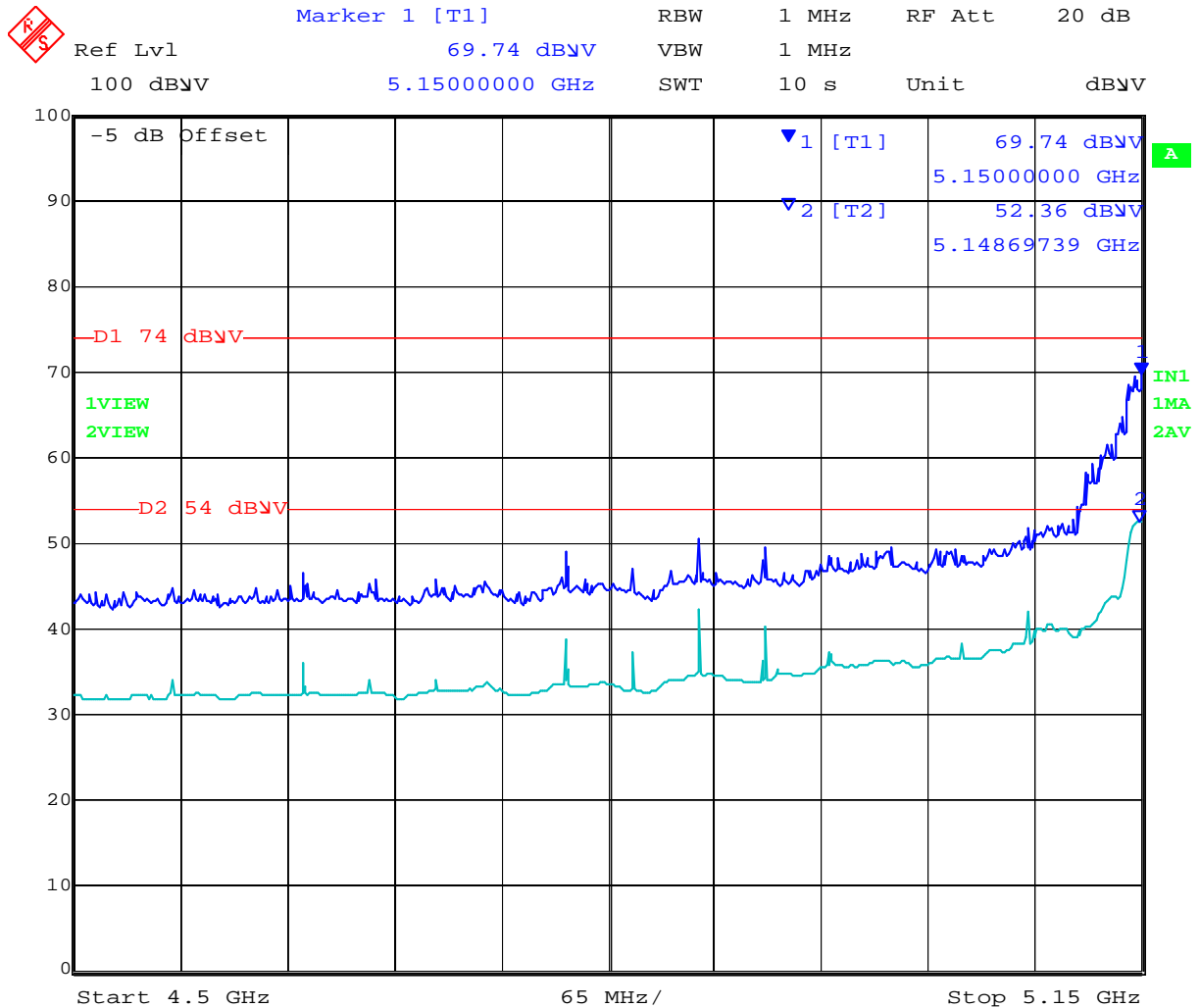


Formally measured emission peaks

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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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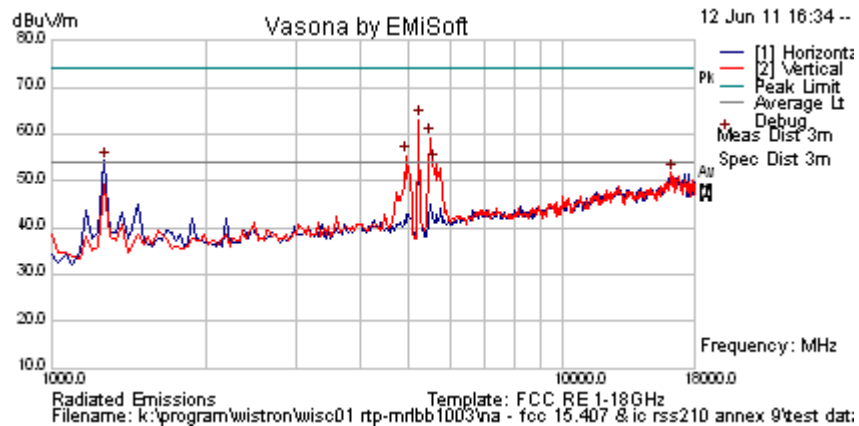
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Test Freq.	5230 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

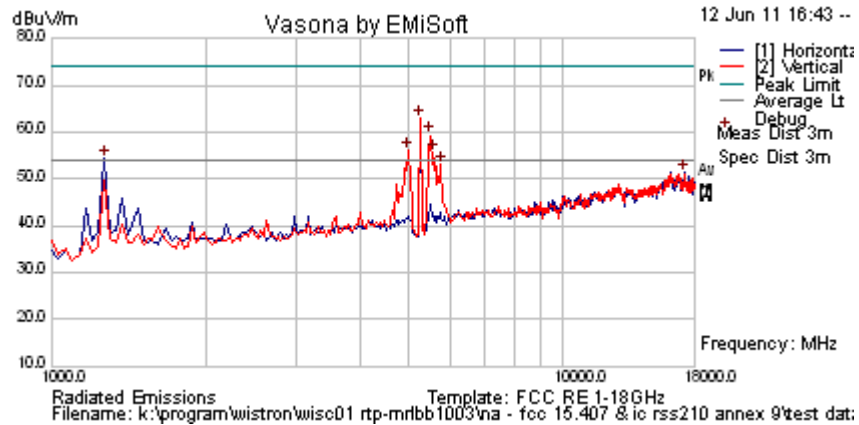
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5.2.1.1.2. 5250 – 5350 MHz Non-Beam Forming Operation

Test Freq.	5260 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

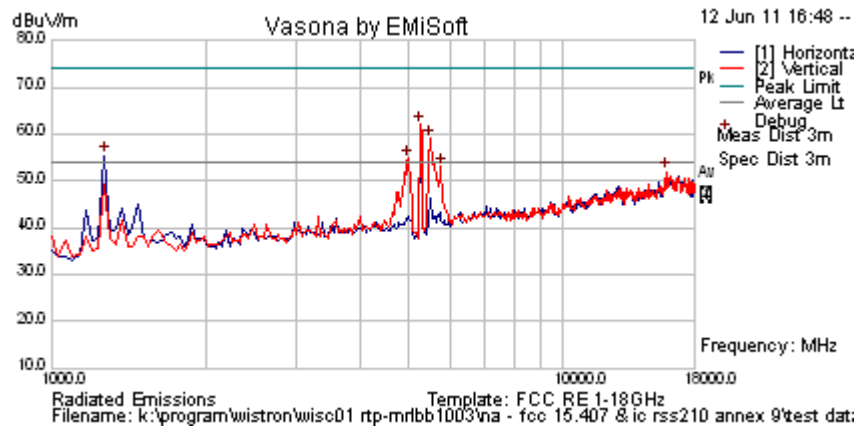
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Test Freq.	5300 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

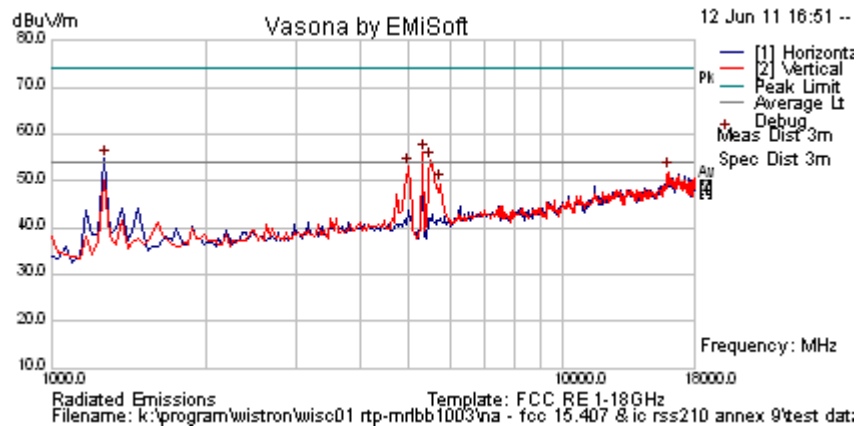
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5320 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		

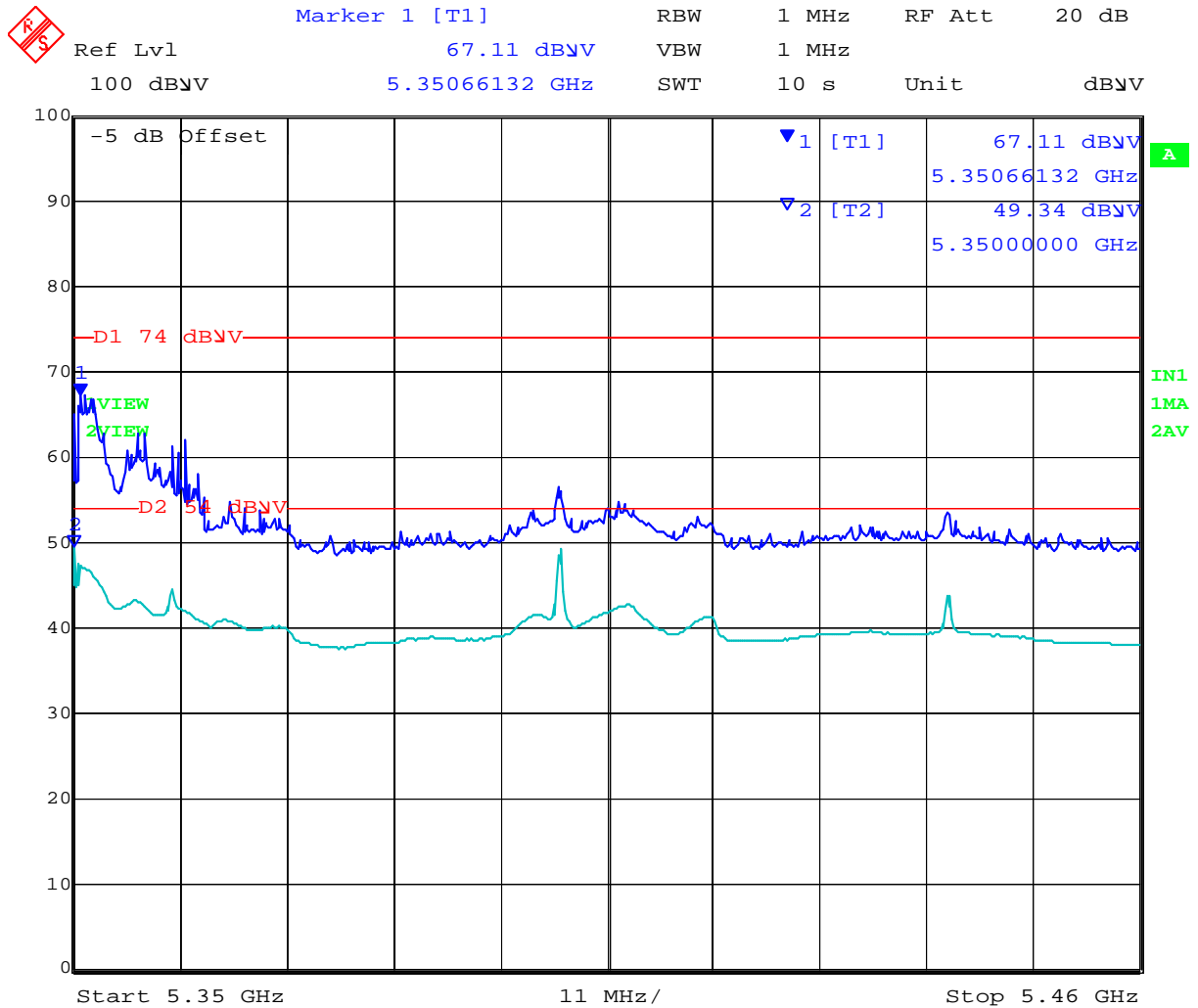


Formally measured emission peaks

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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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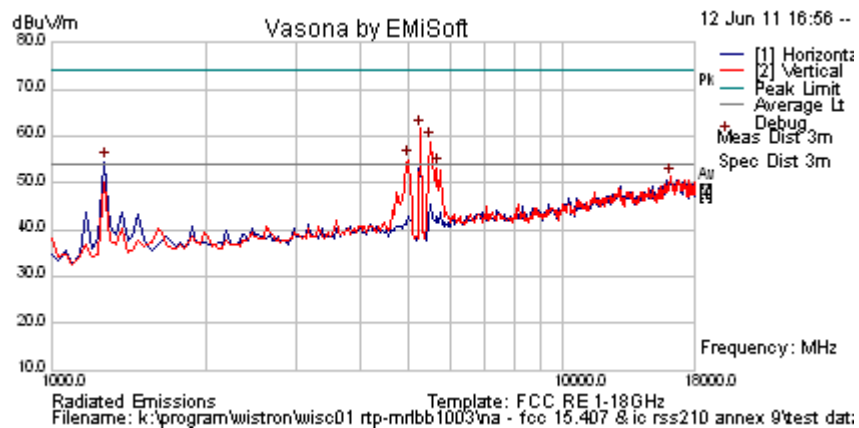
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Test Freq.	5260 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

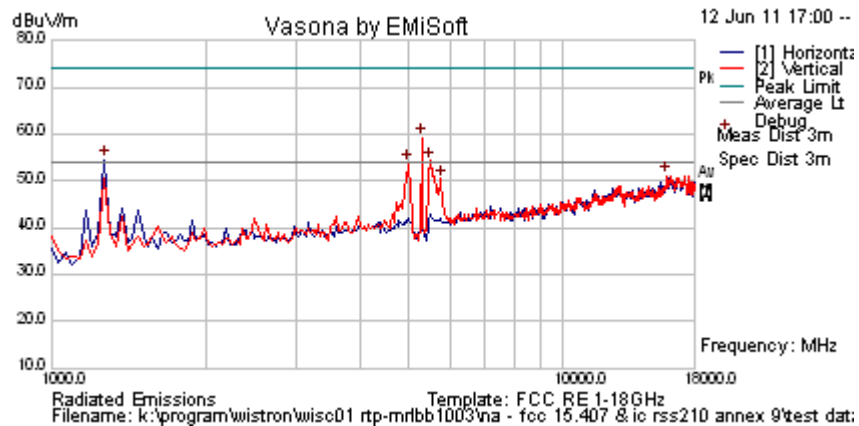
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Test Freq.	5300 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

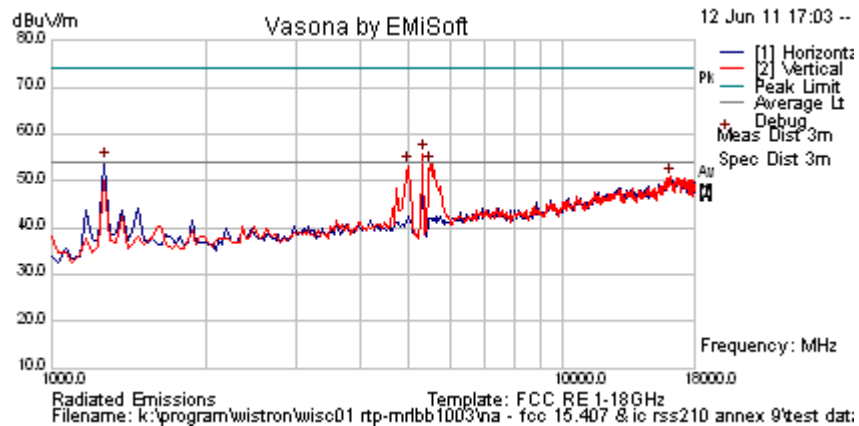
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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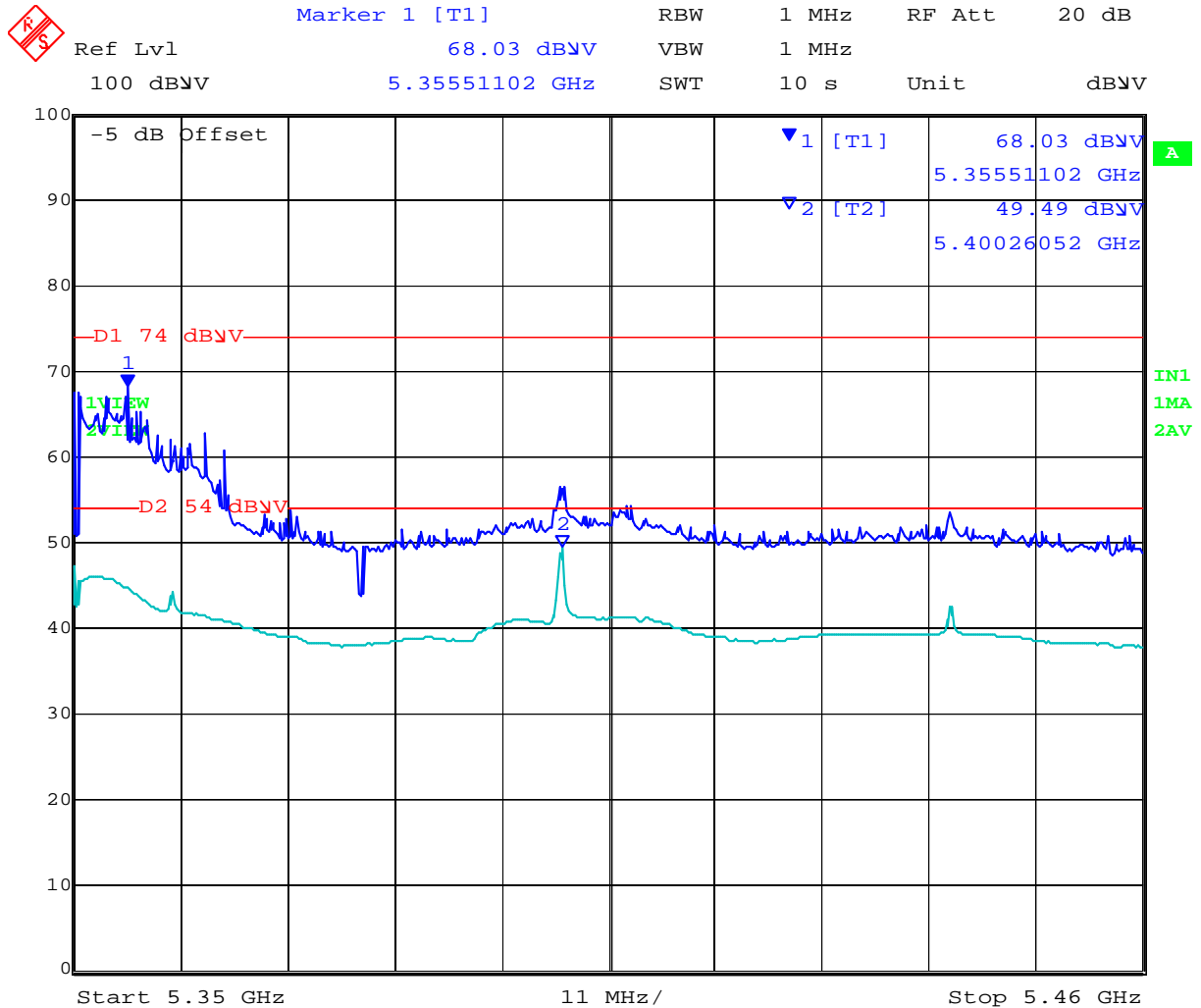
Test Freq.	5320 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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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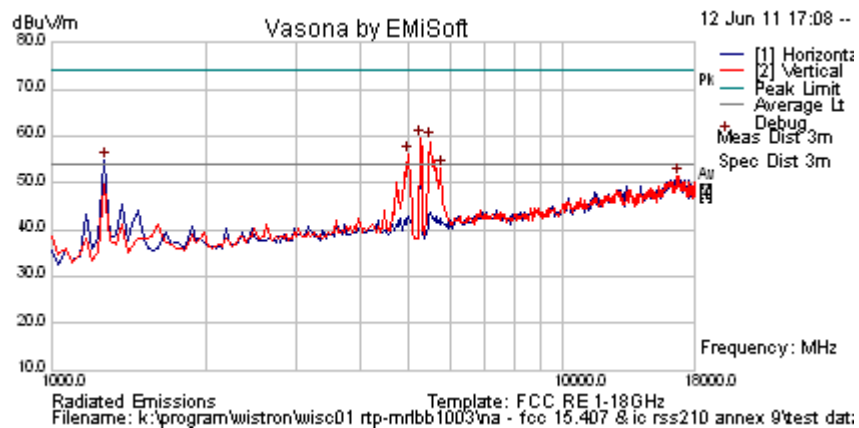
Date: 25.JUN.2011 15:16:40

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Test Freq.	5270 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

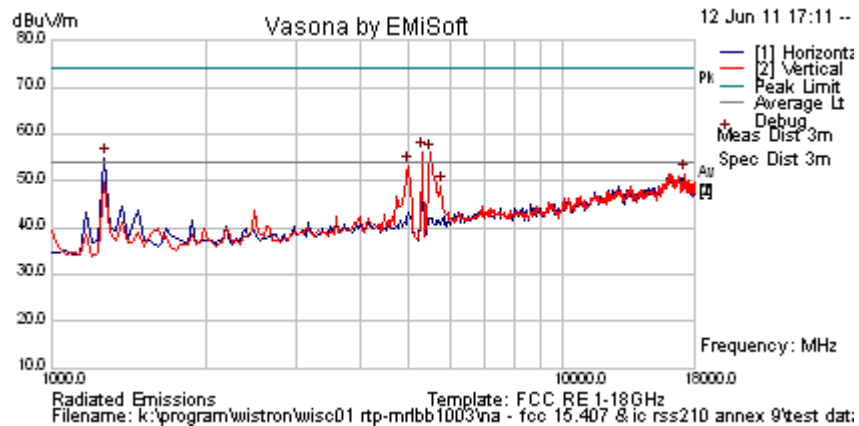
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5310 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		

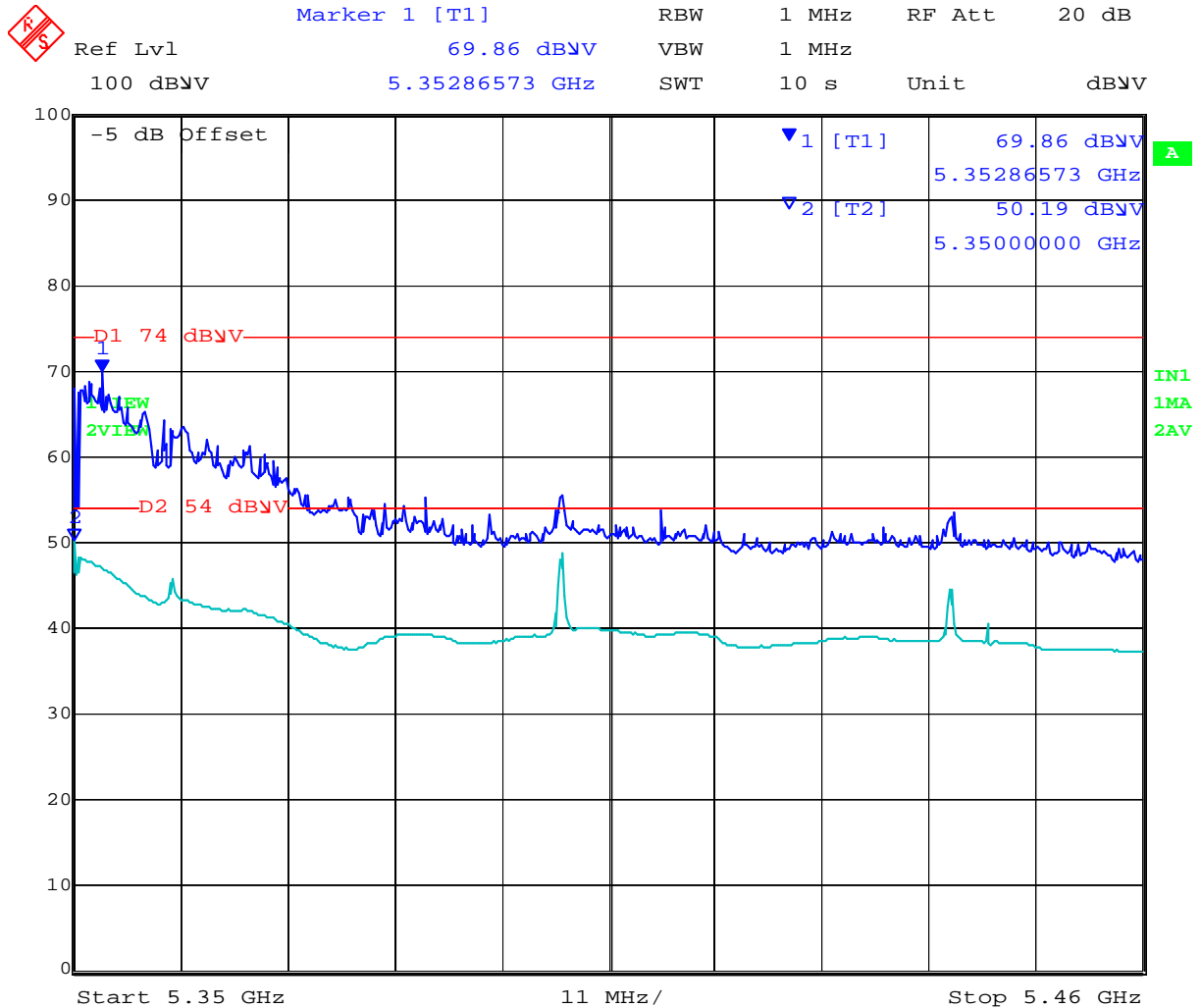


Formally measured emission peaks

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
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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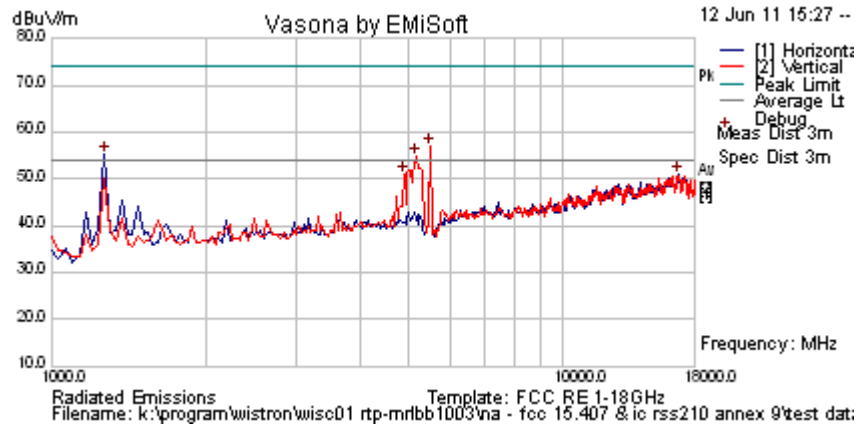
Date: 25.JUN.2011 15:22:22

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5.2.1.1.3. 5470 – 5725 MHz Non-Beam Forming Operation

Test Freq.	5500 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	26
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	41
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		

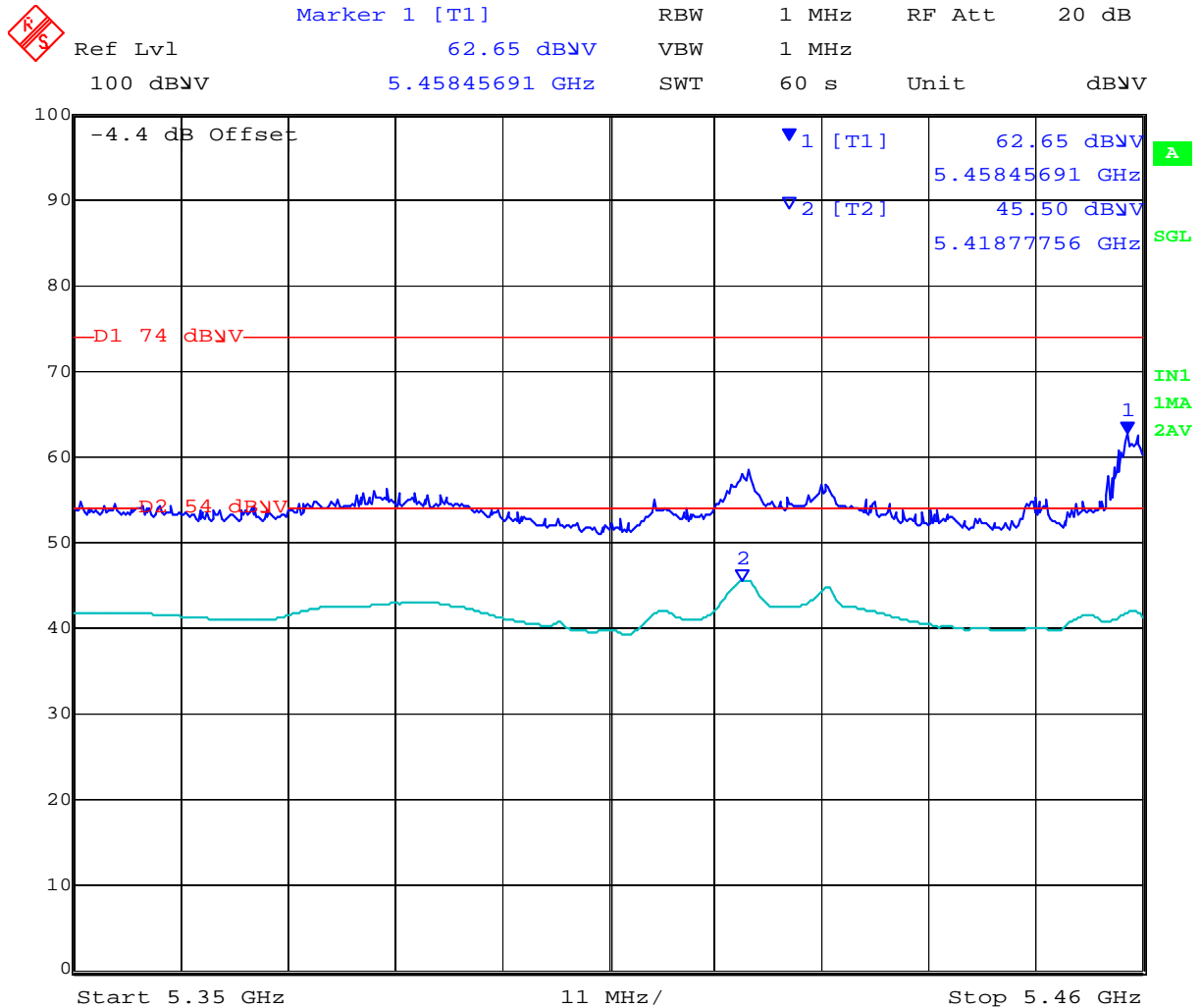


Formally measured emission peaks

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
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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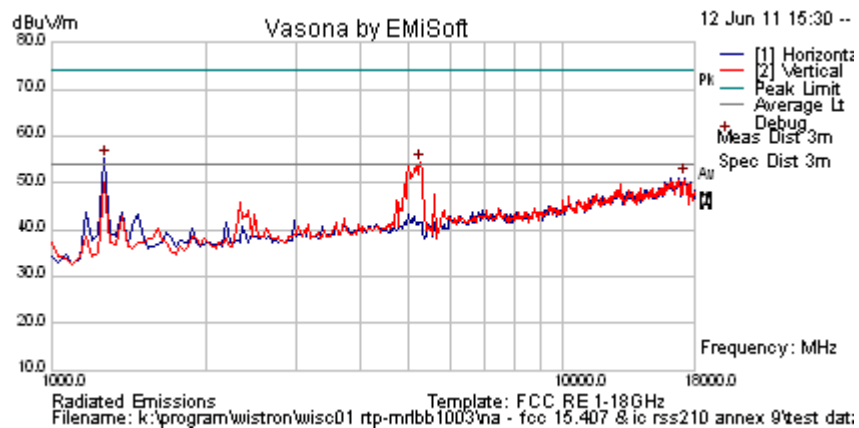
Date: 28.JUN.2011 14:03:30

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Test Freq.	5580 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	26
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	41
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

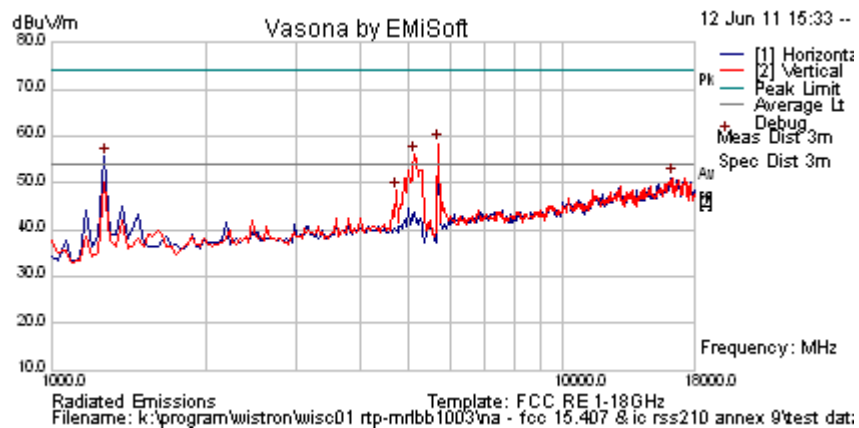
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5700 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	26
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	41
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

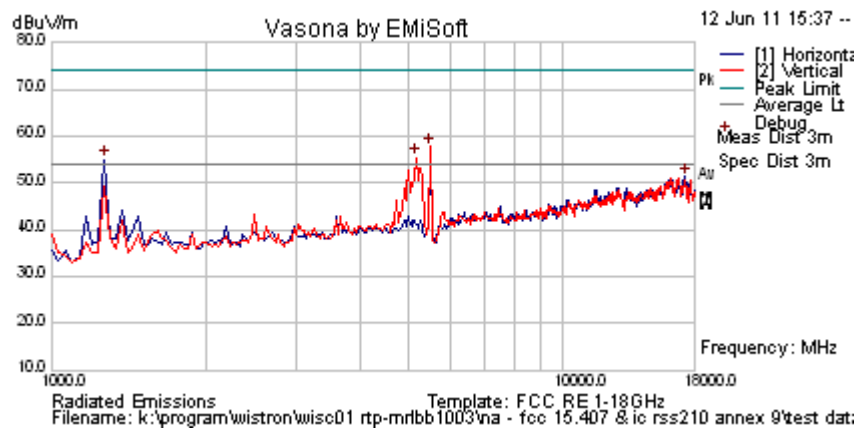
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5500 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	26
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	41
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		

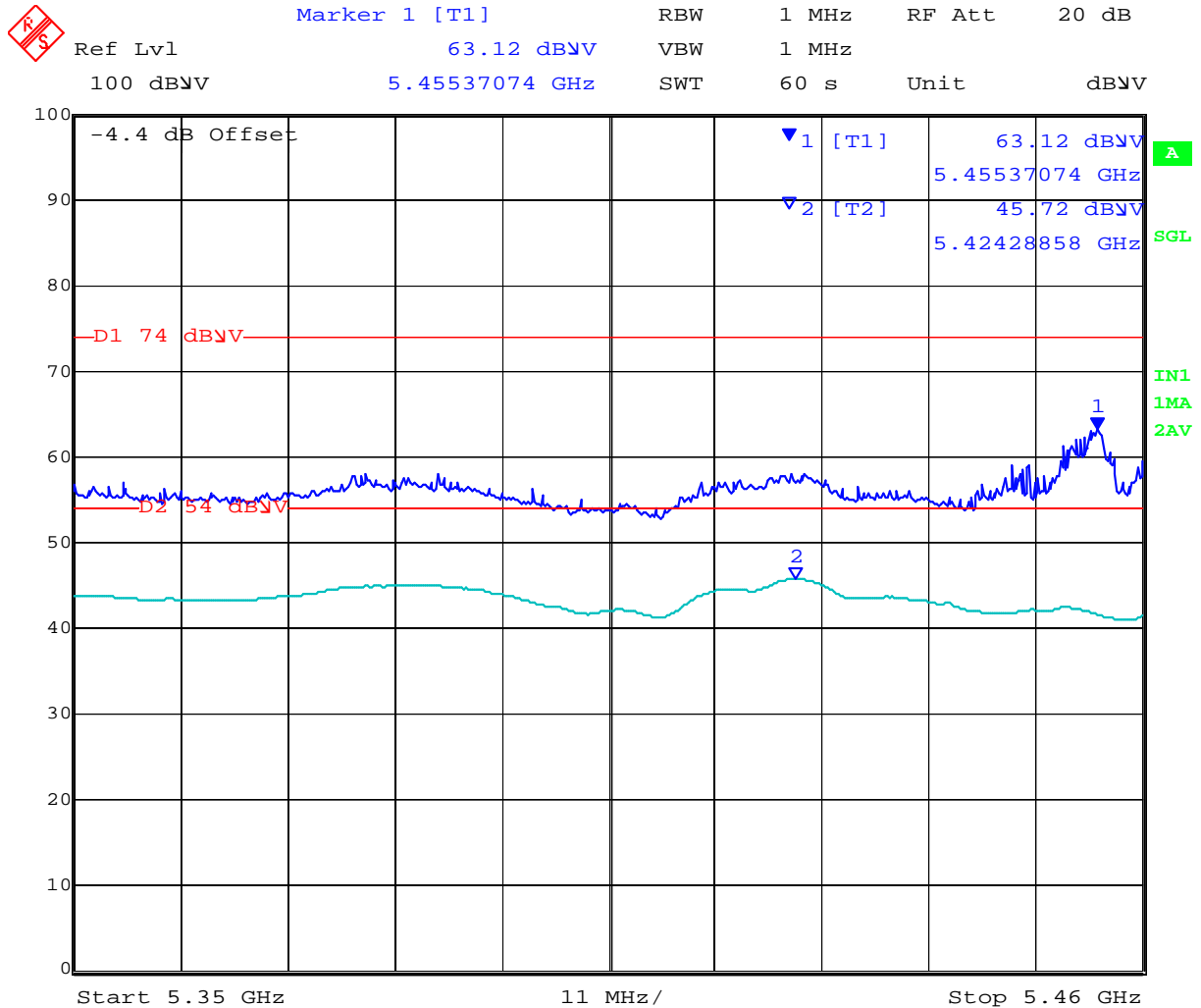


Formally measured emission peaks

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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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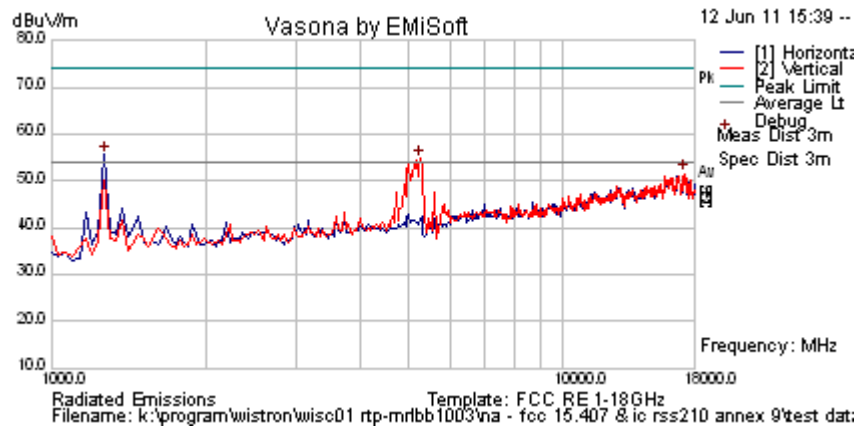
Date: 28.JUN.2011 13:51:23

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Test Freq.	5580 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	26
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	41
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

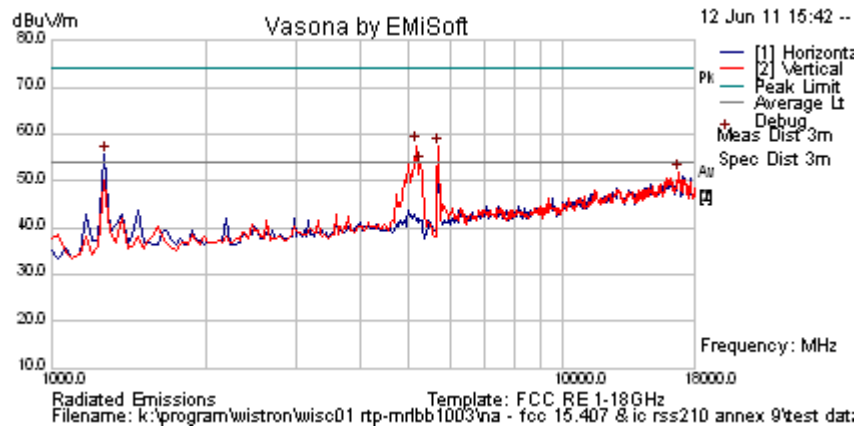
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5700 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	26
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	41
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

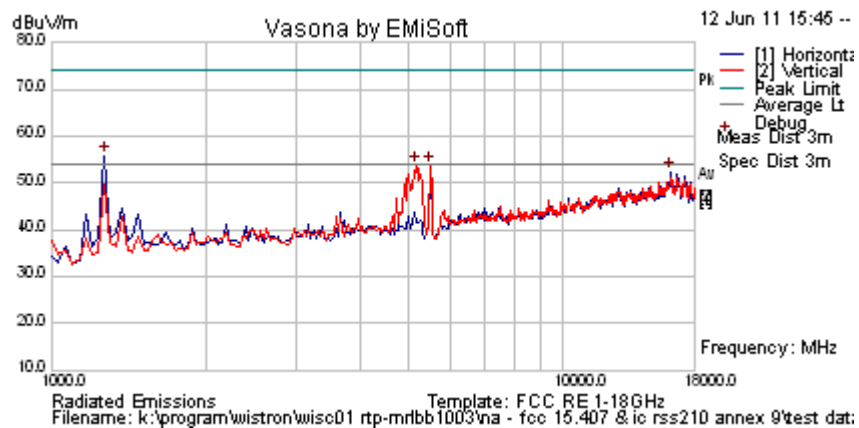
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Test Freq.	5510 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	26
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	41
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		

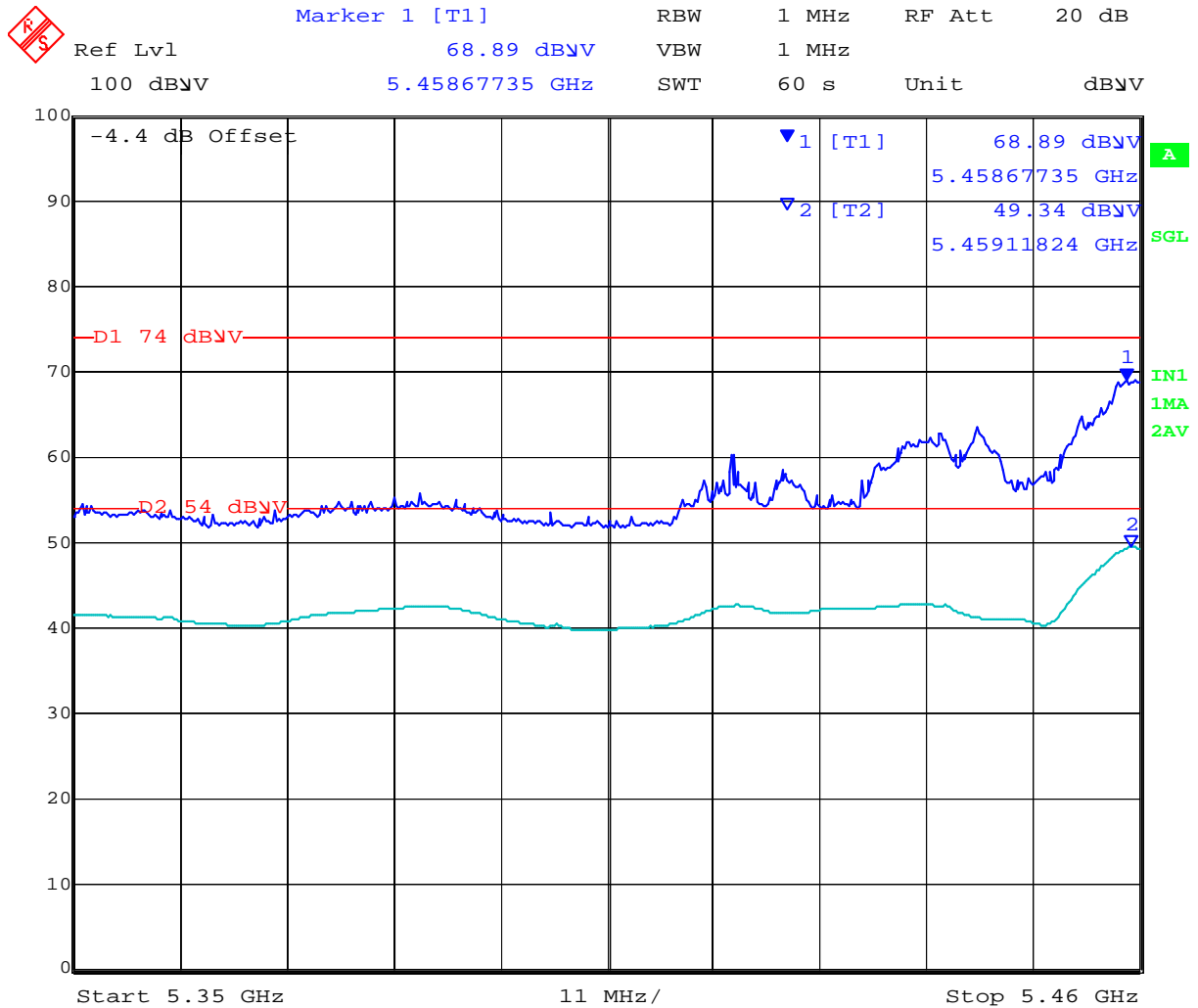


Formally measured emission peaks

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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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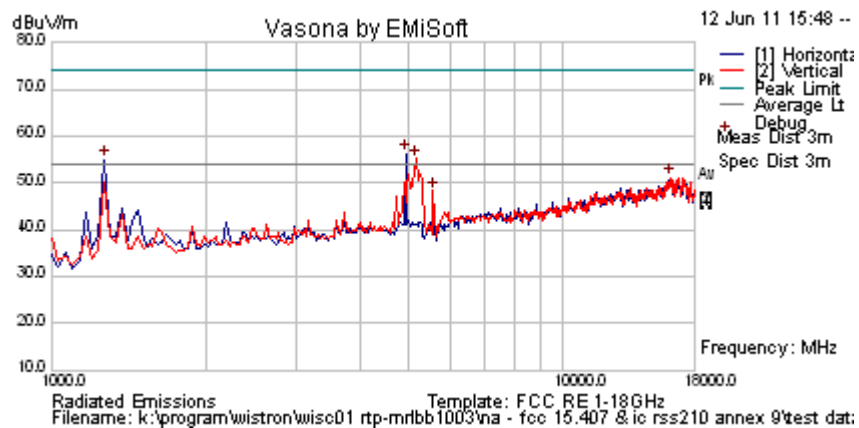
Date: 28.JUN.2011 14:00:27

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Test Freq.	5590 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	26
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	41
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

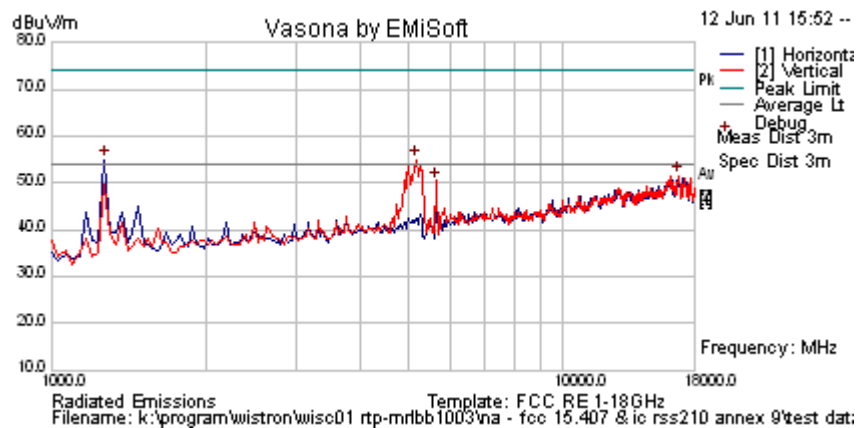
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Test Freq.	5690 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	26
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	41
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Non-Beamforming Operation		



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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

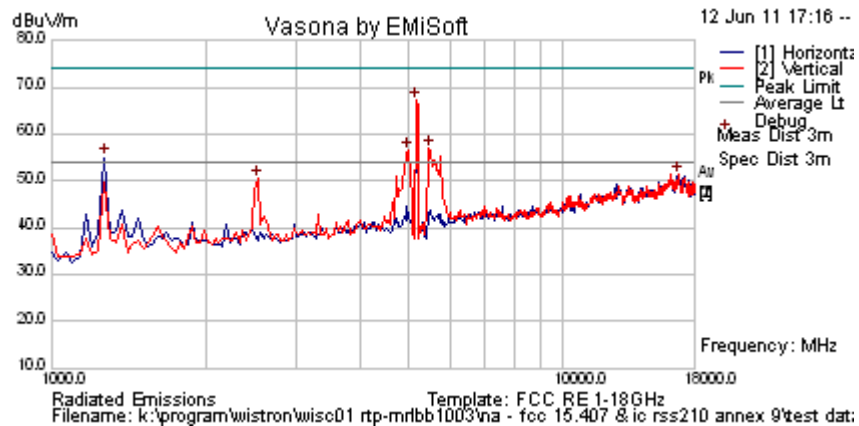
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5.2.1.2. Antenna Beam Forming

5.2.1.2.1. 5150 – 5250 MHz Beam Forming Operation

Test Freq.	5180 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		

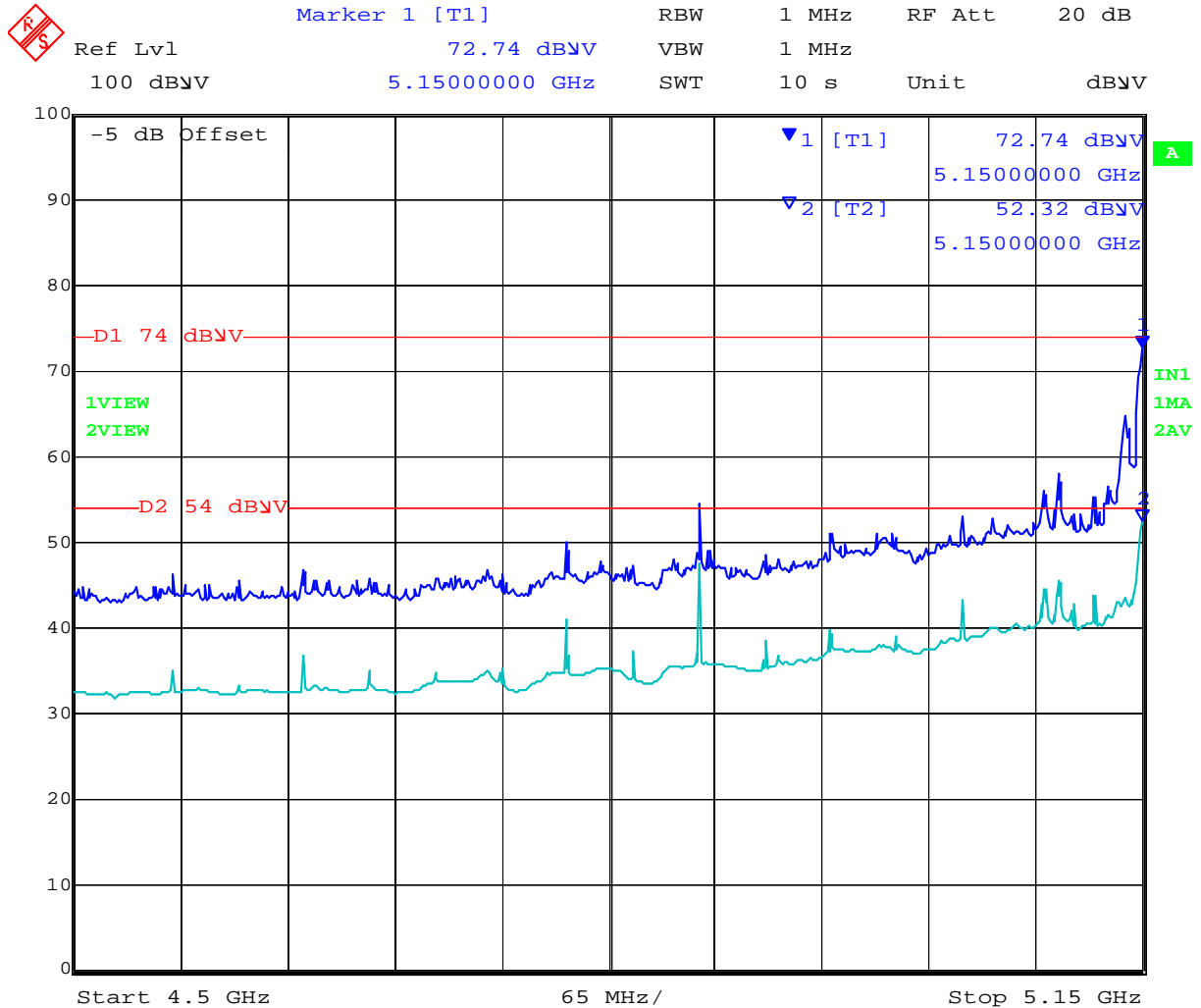


Formally measured emission peaks

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
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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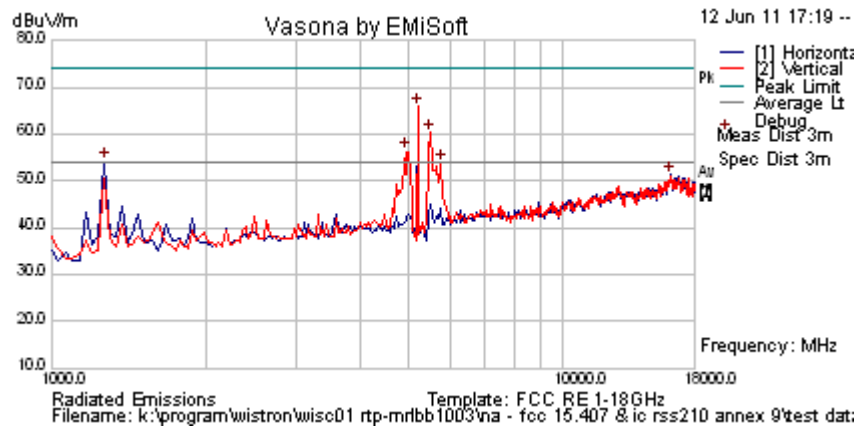
Date: 25.JUN.2011 14:50:37

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Test Freq.	5200 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

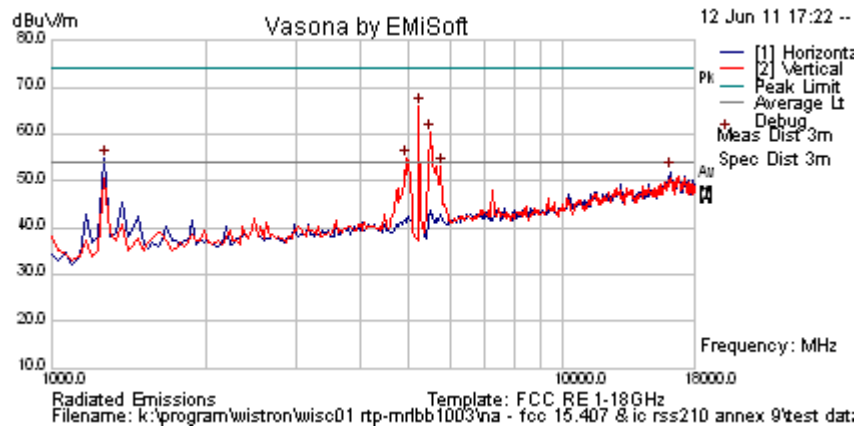
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Test Freq.	5240 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

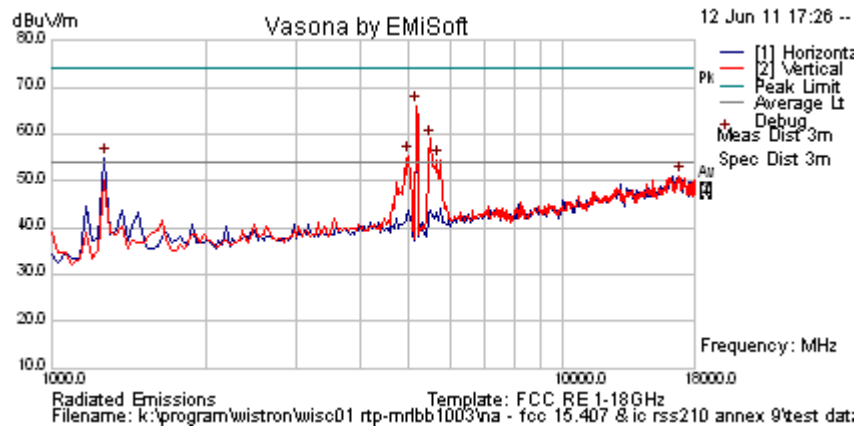
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5180 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		

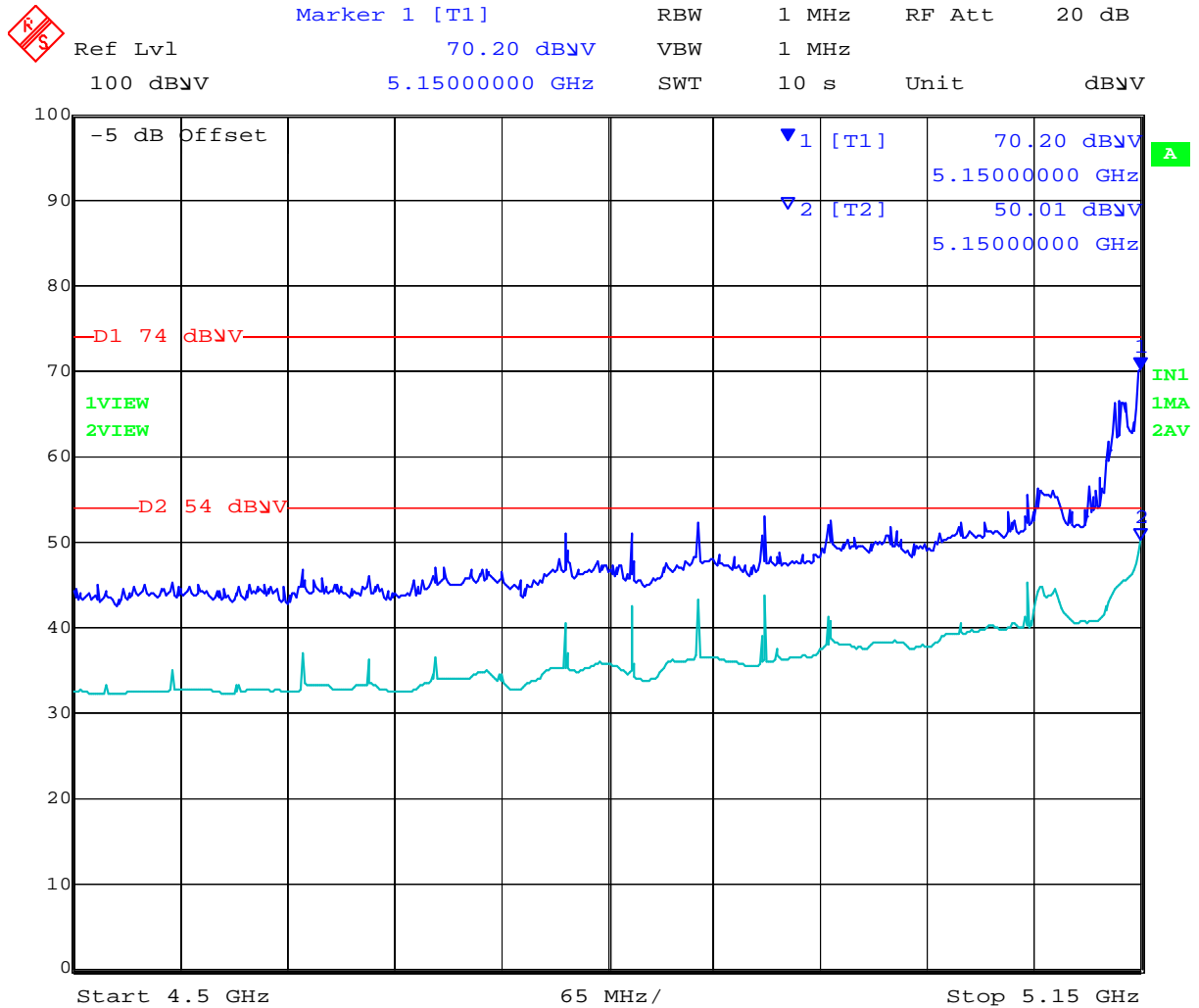


Formally measured emission peaks

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
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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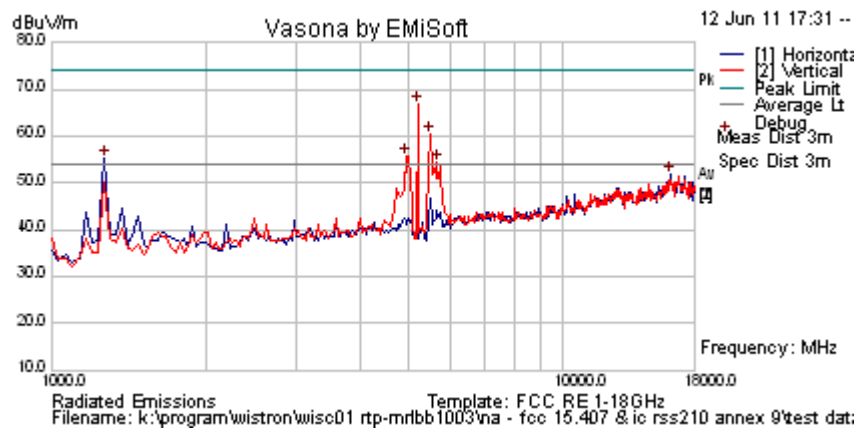
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Test Freq.	5200 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

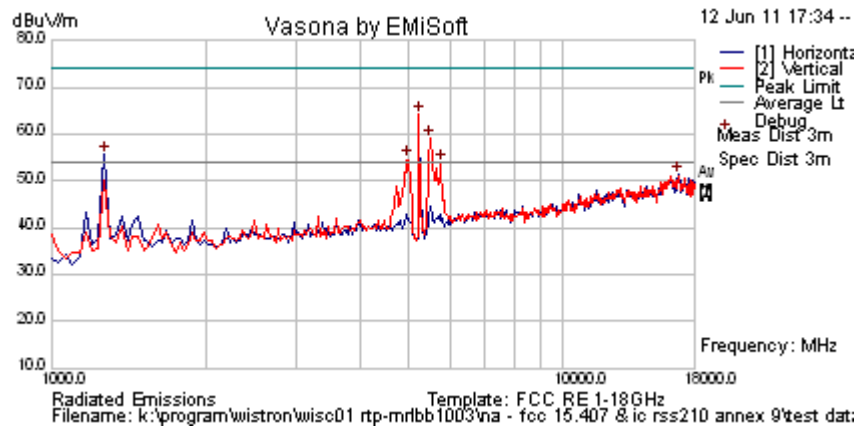
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Test Freq.	5240 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

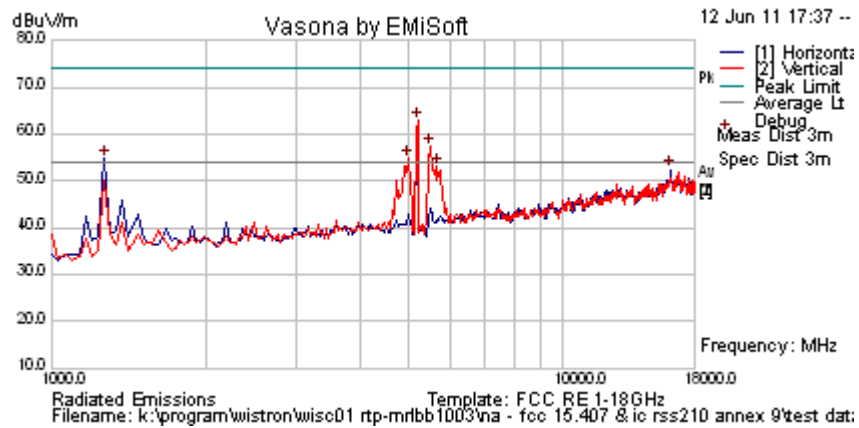
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5190 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		

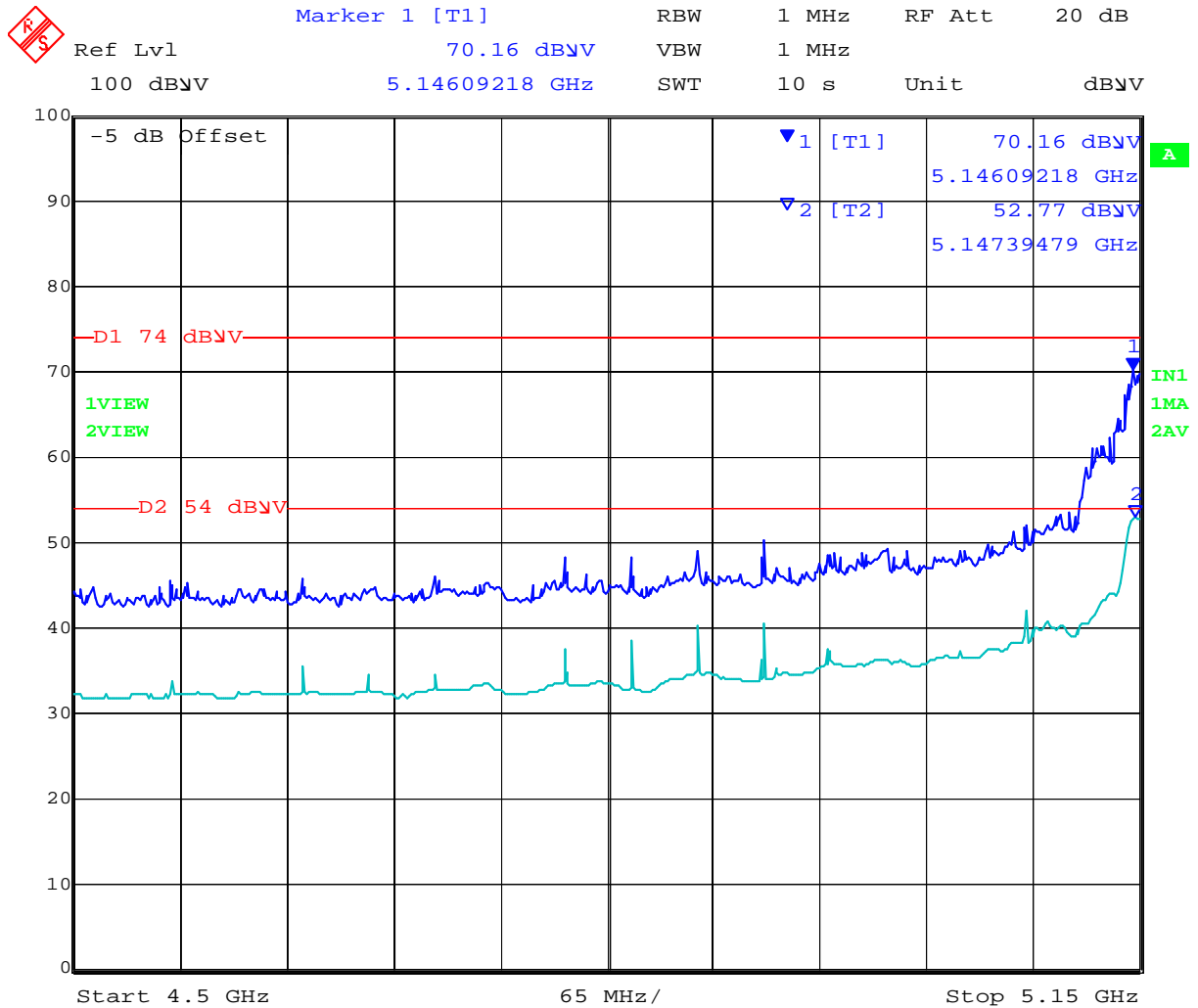


Formally measured emission peaks

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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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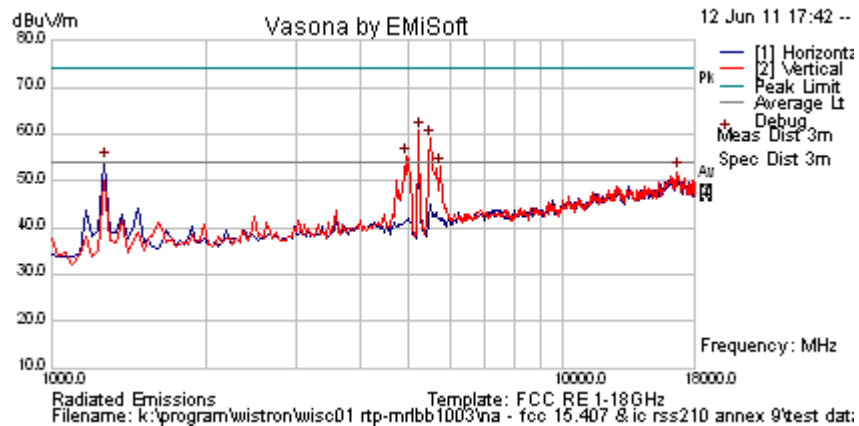
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Test Freq.	5230 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

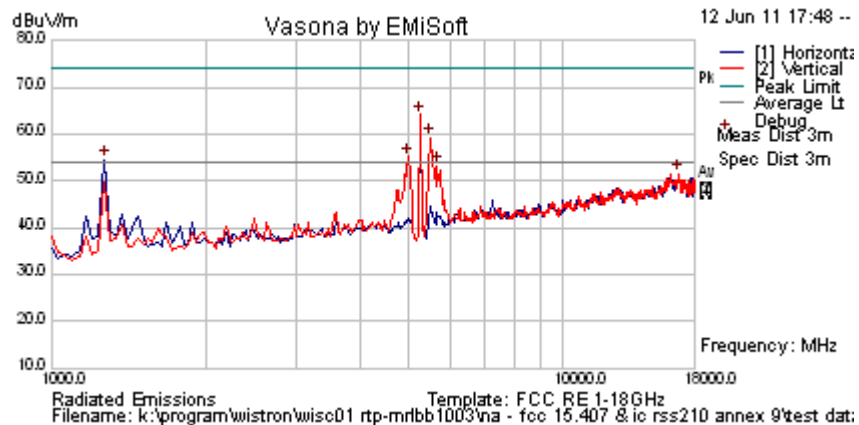
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5.2.1.2.2. 5250 – 5350 MHz Beam Forming Operation

Test Freq.	5260 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

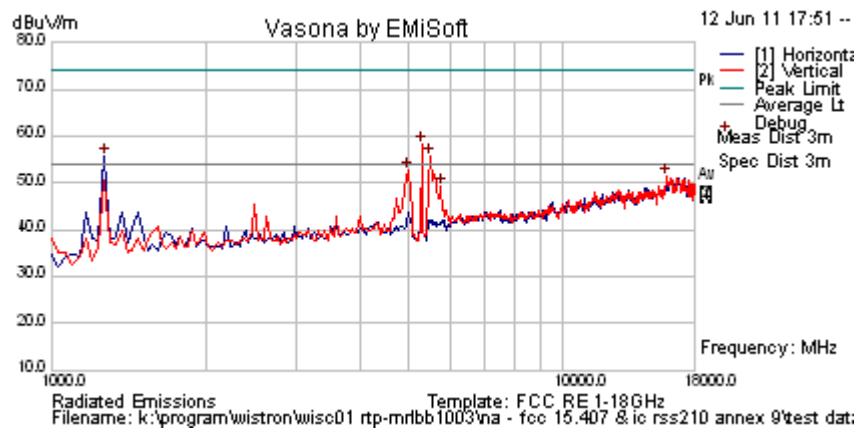
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5300 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

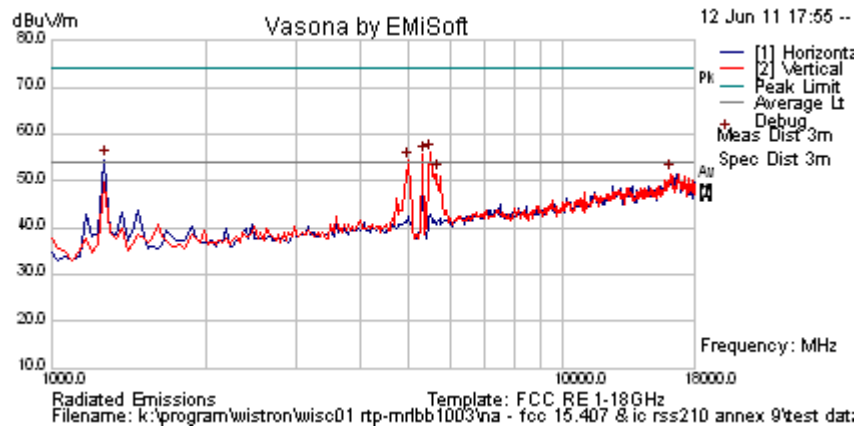
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Test Freq.	5320 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		

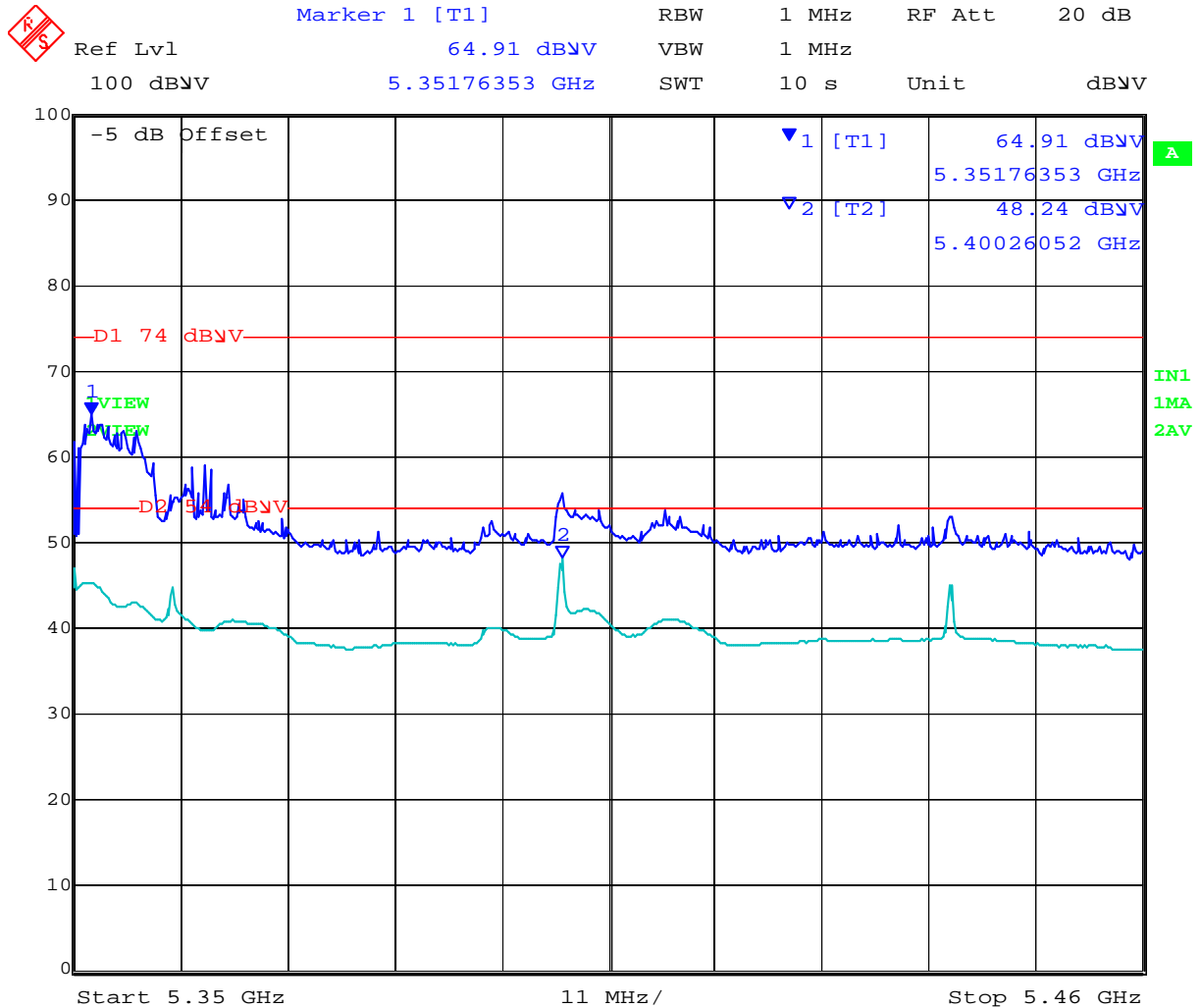


Formally measured emission peaks

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
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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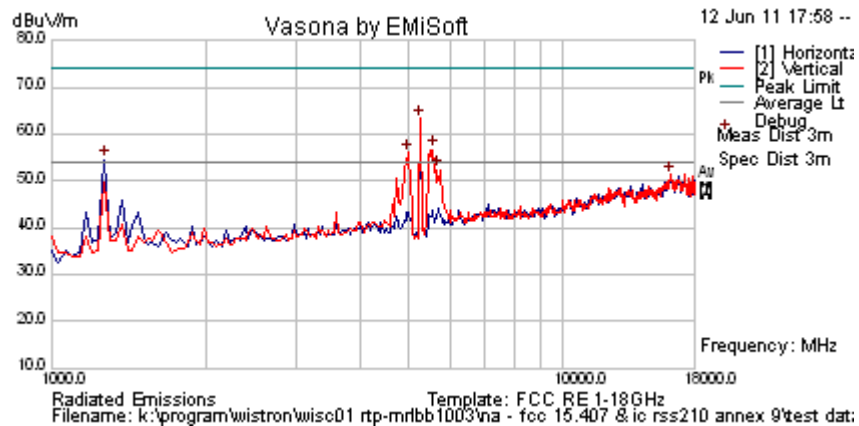
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Test Freq.	5260 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

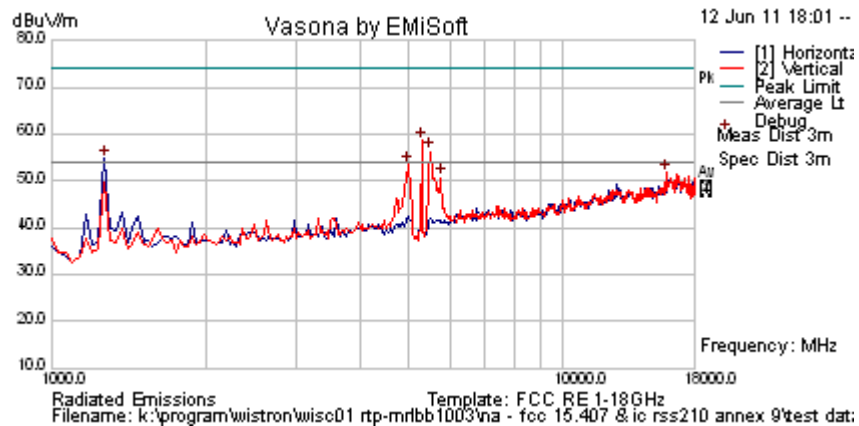
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Test Freq.	5300 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

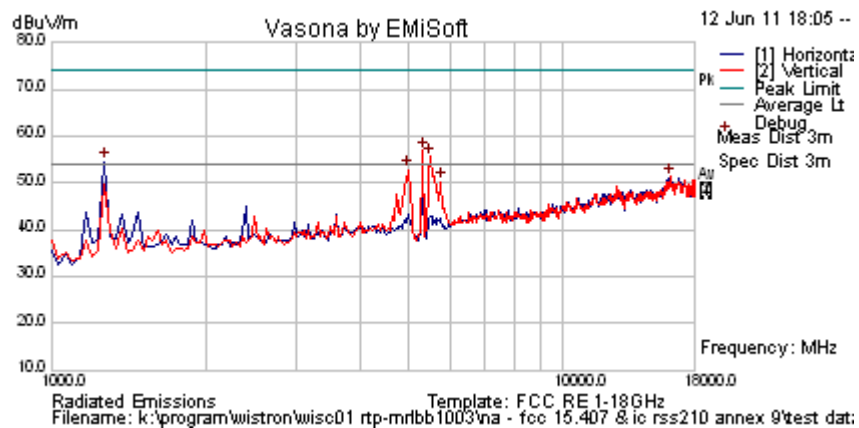
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Test Freq.	5320 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		

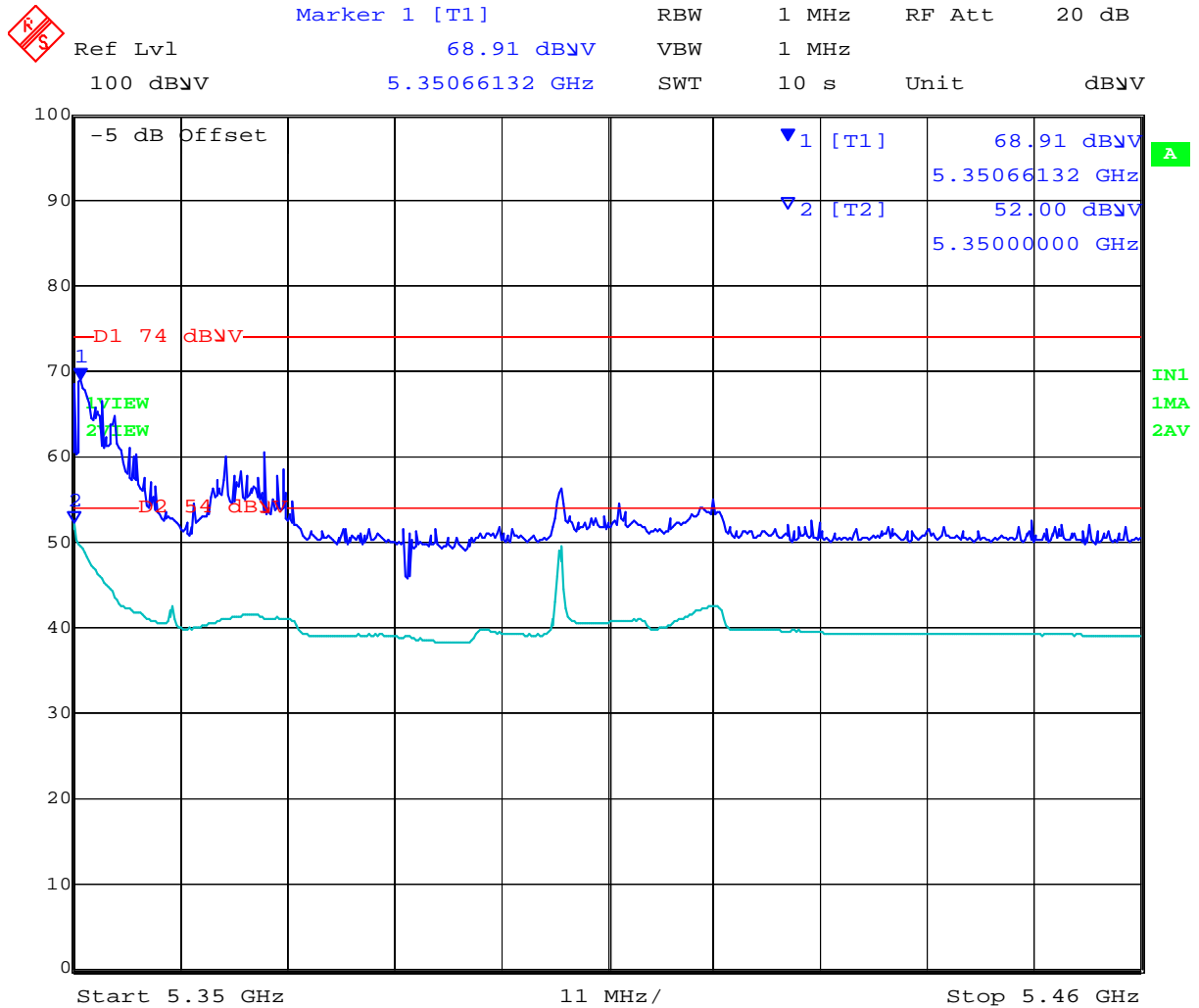


Formally measured emission peaks

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
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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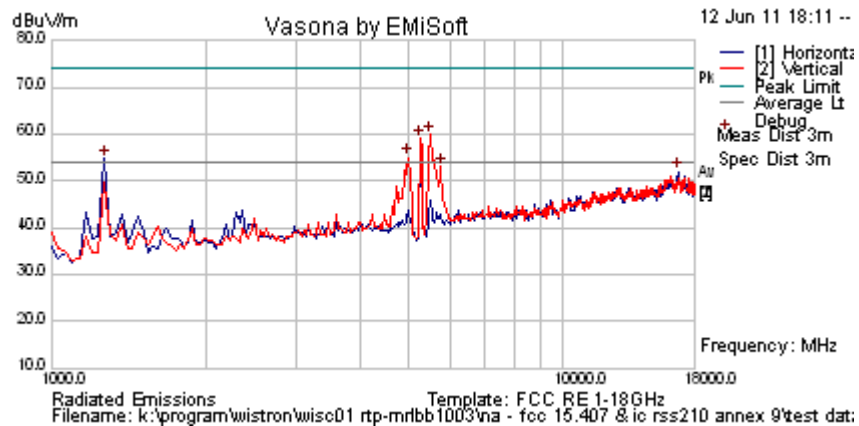
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Test Freq.	5270 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

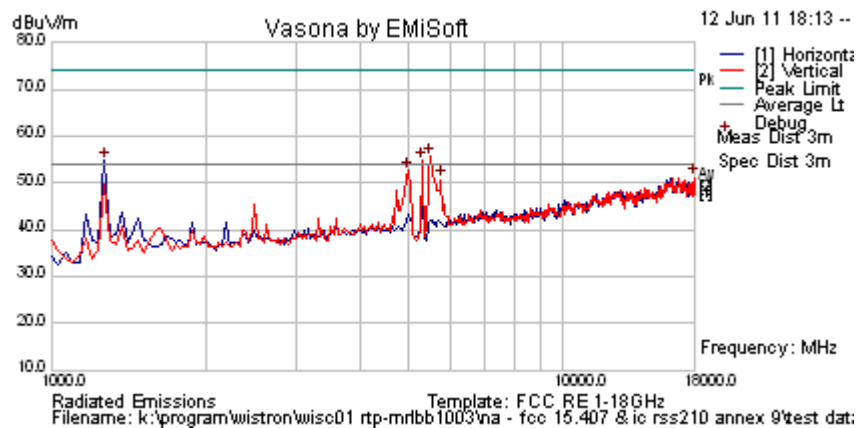
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Test Freq.	5310 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna		Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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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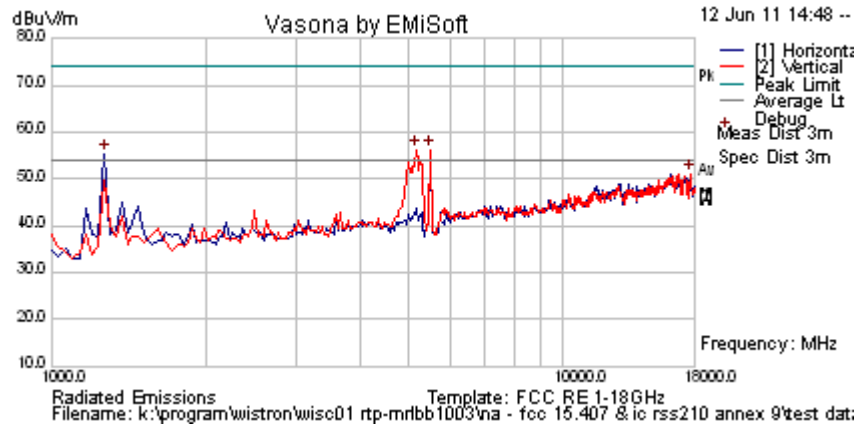
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5.2.1.2.3. 5470 – 5725 MHz Beam Forming Operation

Test Freq.	5500 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		

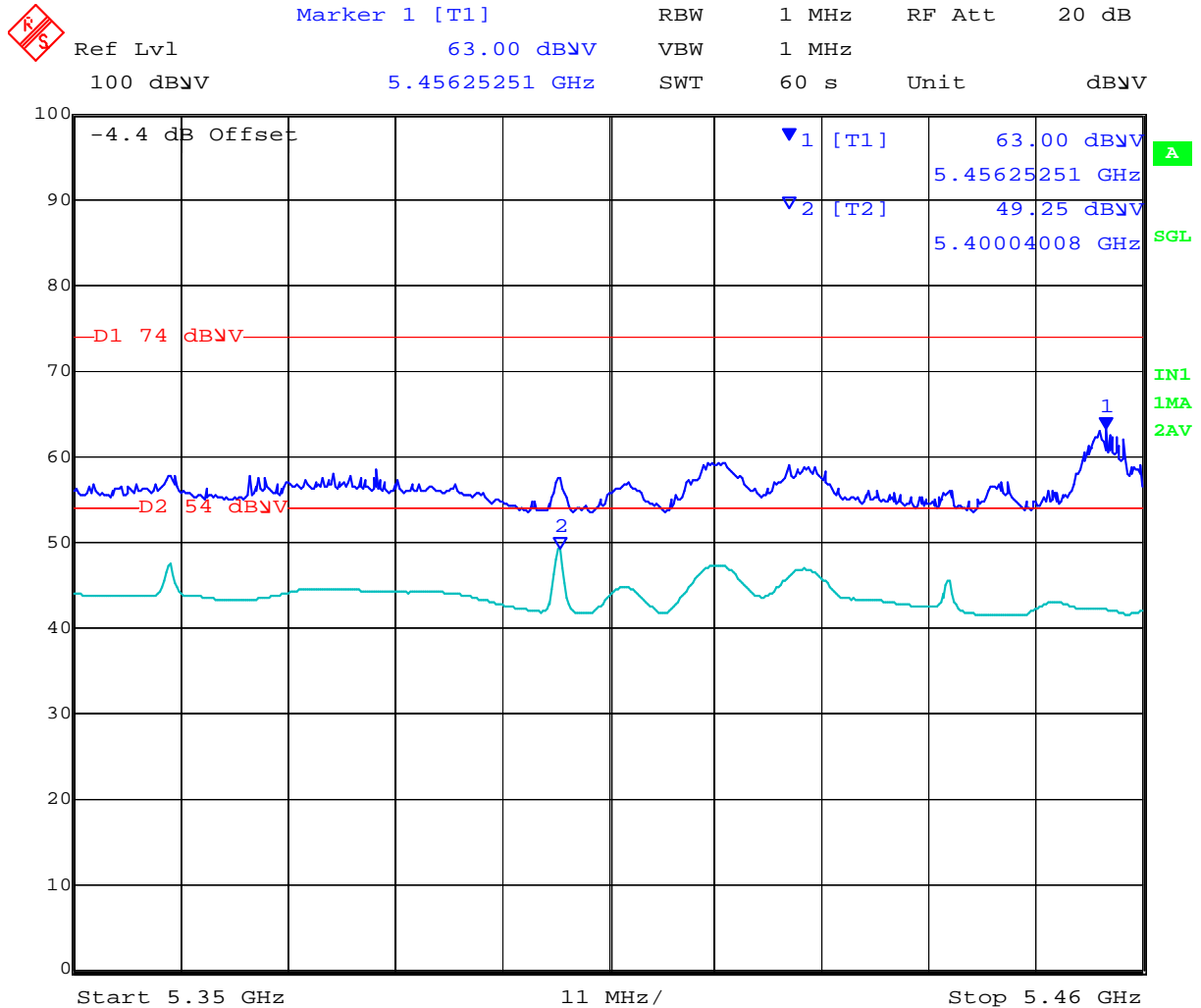


Formally measured emission peaks

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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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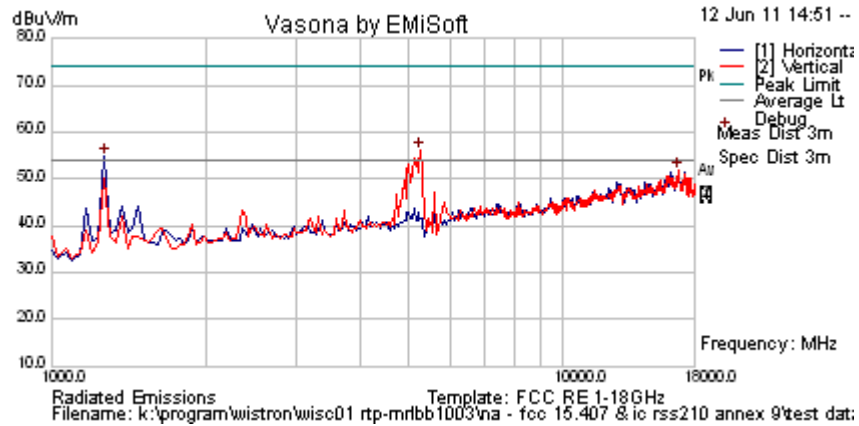
Date: 28.JUN.2011 14:09:36

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Title: MRLBB-1003 802.11a/b/g/n Wireless Access Module
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Serial #: WISC01-U3 Rev A
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Test Freq.	5600 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

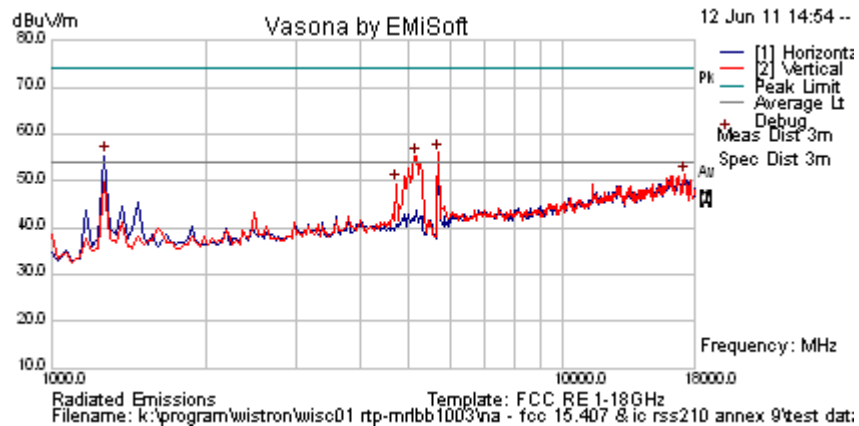
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5700 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

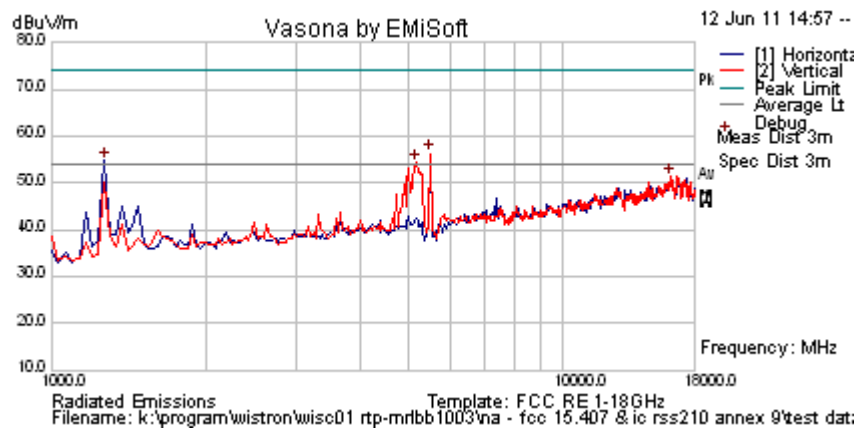
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5500 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		

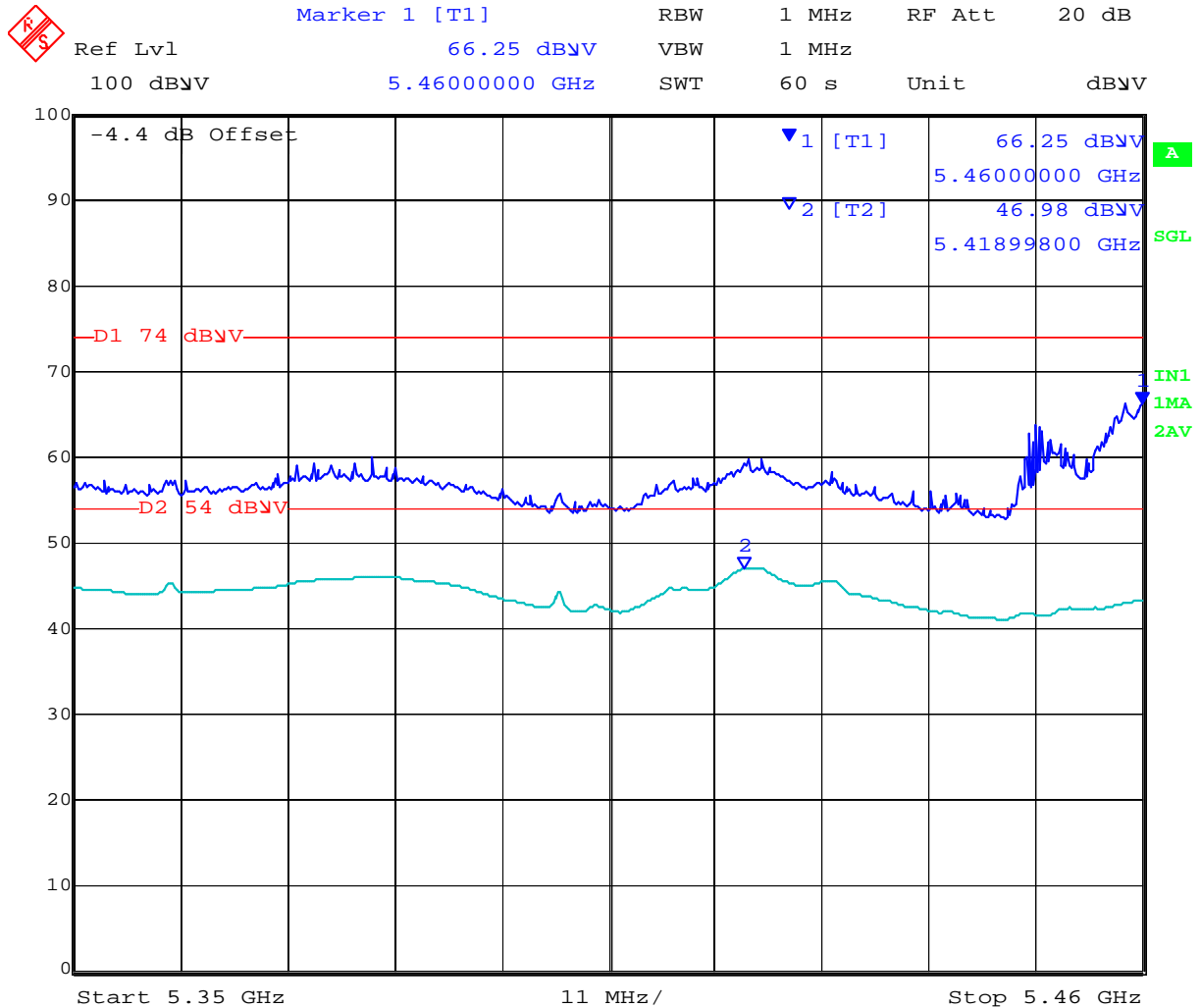


Formally measured emission peaks

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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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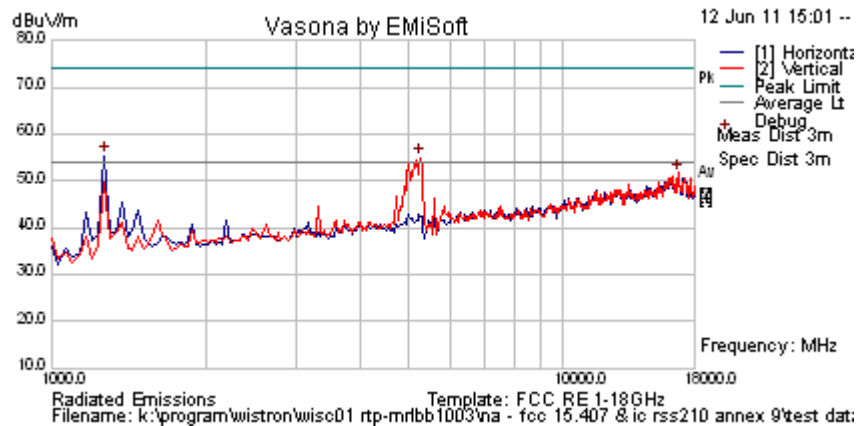
Date: 28.JUN.2011 14:21:35

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Test Freq.	5580 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

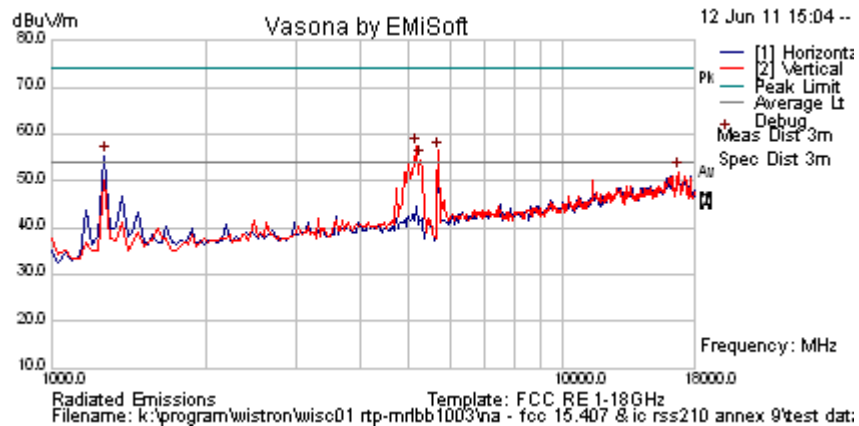
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5700 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



Formally measured emission peaks

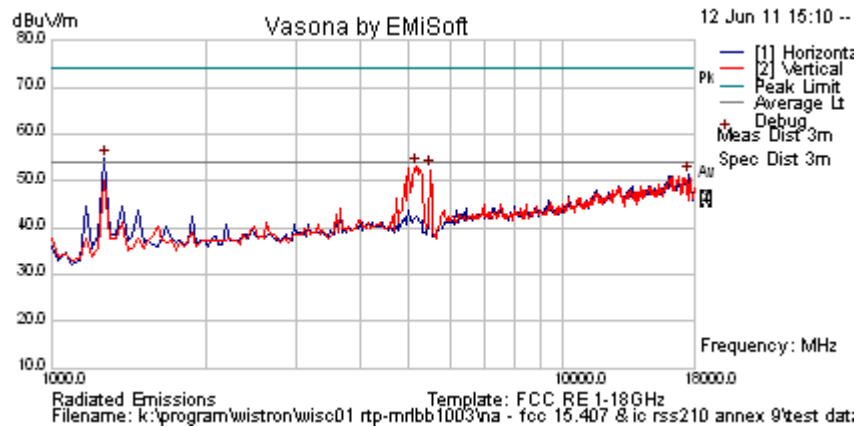
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission												
NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5510 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		

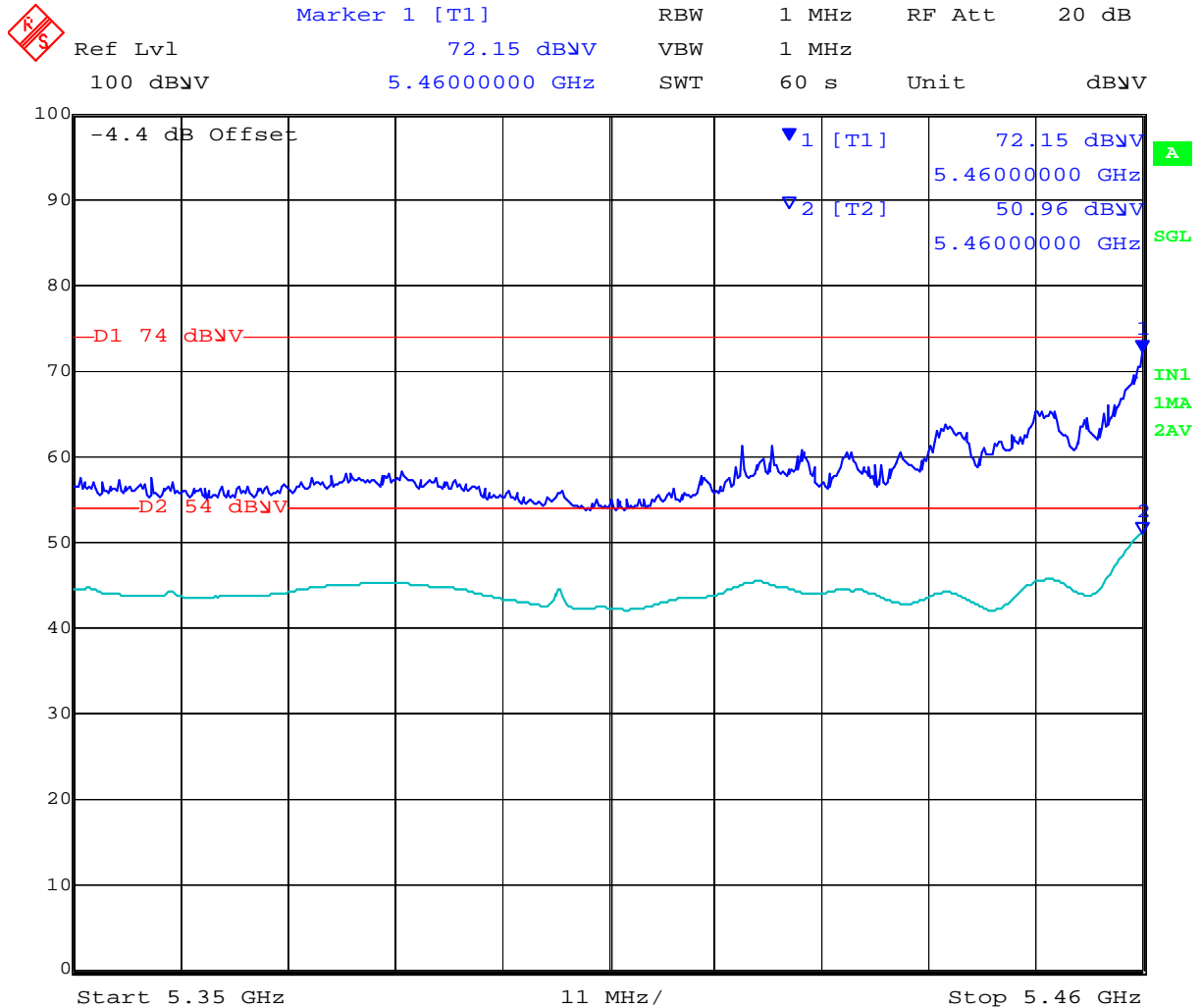


Formally measured emission peaks

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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental are evaluated separately.

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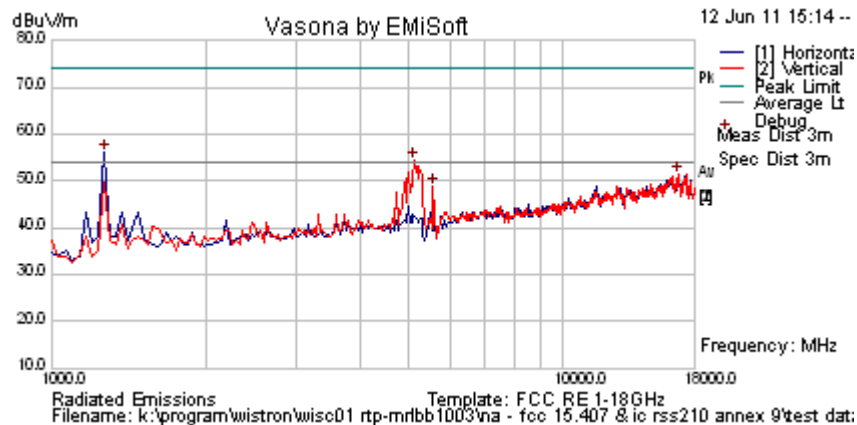
Date: 28.JUN.2011 14:24:24

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Test Freq.	5590 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

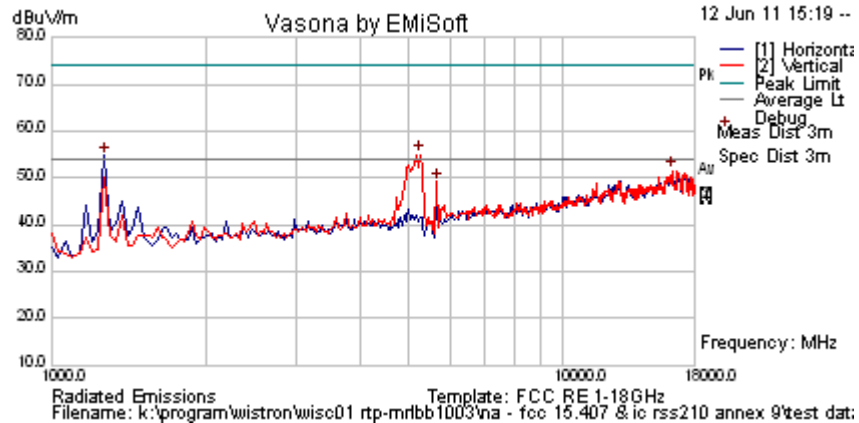
The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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Test Freq.	5690 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (°C)	25.5
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	40
Power Setting	Target	Press. (mBars)	998
Antenna	Laird OP51508T-HP1 8dBi	Duty Cycle (%)	100
Test Notes 1	5150 - 5875 MHz 3-Port MIMO Outdoor Antenna		
Test Notes 2	Beamforming Operation		



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
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												

The above plot identifies peak emissions only. Any emission falling within 6 dB of the limit line will be formally evaluated (Peak Max or Average Max). The large emission above is the fundamental frequency breaking through the notch filter. The band-edge frequencies (either side of the fundamental) are evaluated separately.

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5.2.2. Receiver Spurious Emissions

Industry Canada RSS-Gen §4.10, §6

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

All Sectors of the EUT were tested simultaneously

Field Strength Calculation

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

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

where: FS = Field Strength

R = Measured Spectrum analyzer Input Amplitude

AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss

AG = Amplifier Gain

FO = Distance Falloff Factor

NFL = Notch Filter Loss or Waveguide Loss

For example:

Given receiver input reading of 51.5 dB μ 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:

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

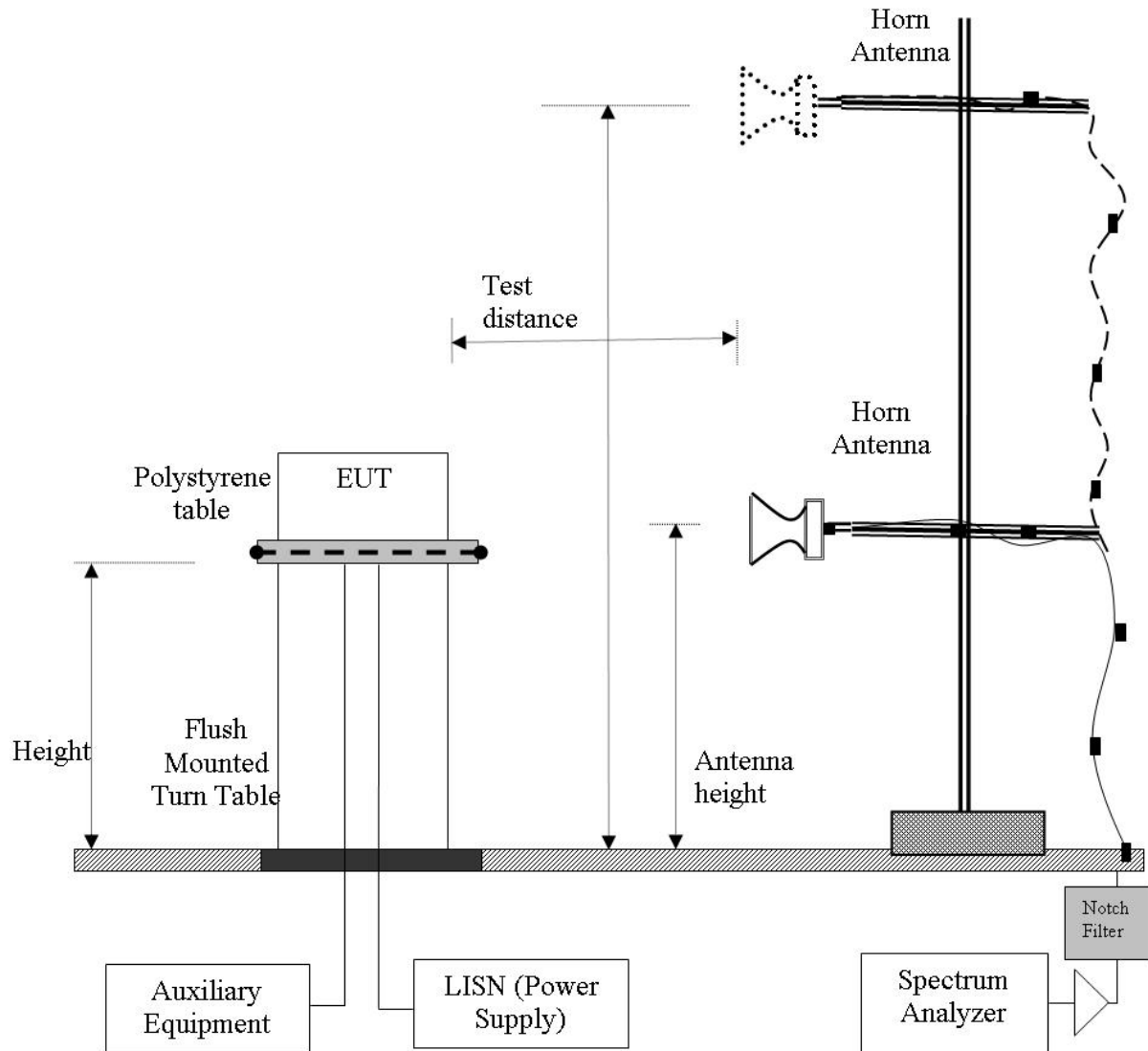
Conversion between dB μ V/m (or dB μ V) and μ V/m (or μ V) are done as:

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

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

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

Radiated Emission Measurement Setup – Above 1 GHz

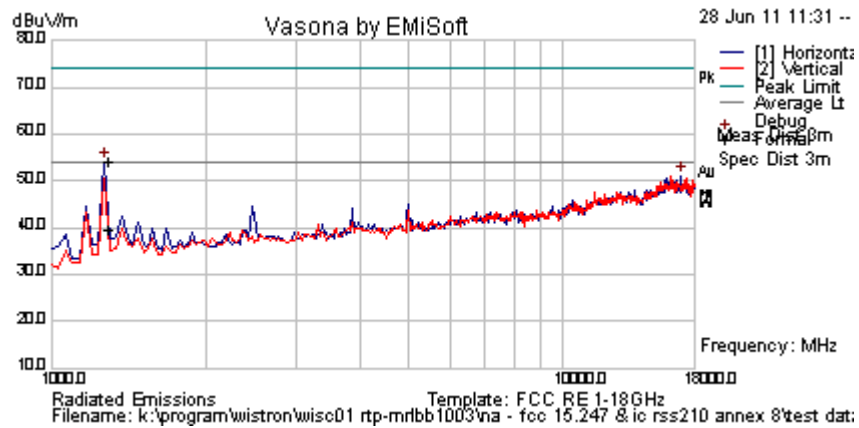


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Test Freq.	5200 MHz	Engineer	CSB
Variant	Receiver	Temp (°C)	26.5
Freq. Range	1000 - 18000 MHz	Rel. Hum.(%)	33
Power Setting	N/A	Press. (mBars)	995
Antenna	8dBi Laird OP51508T-HP1	Duty Cycle (%)	100
Test Notes 1	Laptop running ART2 on EUT table with device and antenna.		
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
1296.763	66.0	2.2	-14.2	54.0	Peak	H	99	246	74.0	-20.0	Pass	
1296.763	51.6	2.2	-14.2	39.6	Average	H	99	246	54.0	-14.4	Pass	

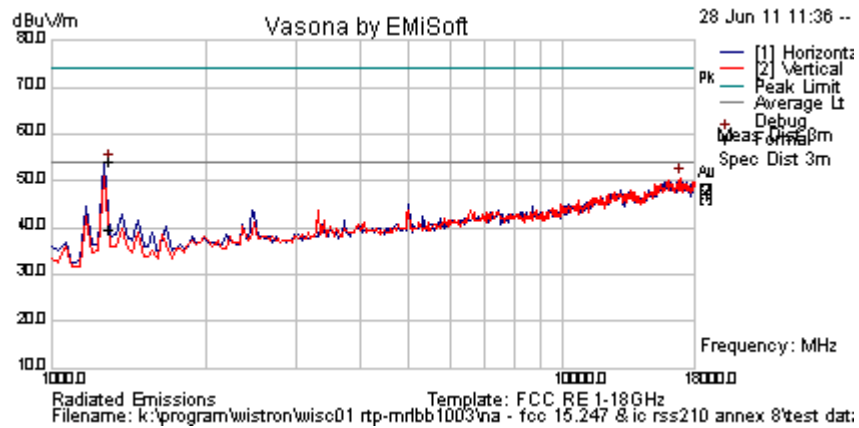
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
 NRB = Non-Restricted Band. RB = Restricted Band.

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Test Freq.	5300 MHz	Engineer	CSB
Variant	Receiver	Temp (°C)	26.5
Freq. Range	1000 - 18000 MHz	Rel. Hum.(%)	33
Power Setting	N/A	Press. (mBars)	995
Antenna	8dBi Laird OP51508T-HP1	Duty Cycle (%)	100
Test Notes 1	Laptop running ART2 on EUT table with device and antenna.		
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
1296.763	66.0	2.2	-14.2	54.0	Peak	H	99	246	74.0	-20.0	Pass	
1296.763	51.6	2.2	-14.2	39.6	Average	H	99	246	54.0	-14.4	Pass	

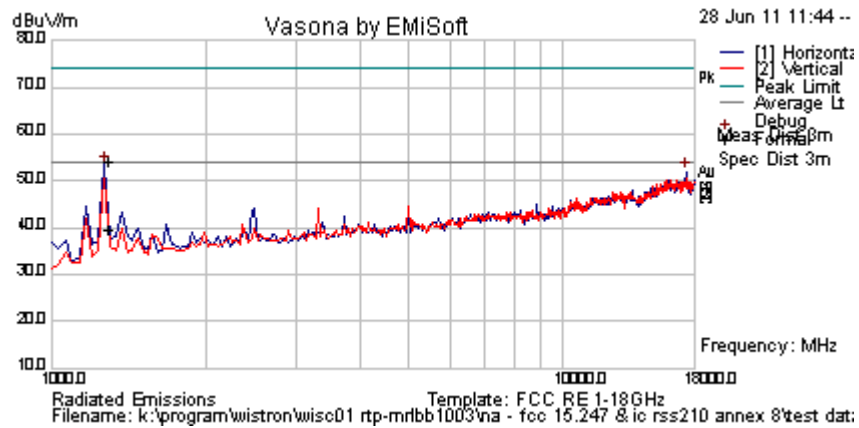
Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
 NRB = Non-Restricted Band. RB = Restricted Band.

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Test Freq.	5600 MHz	Engineer	CSB
Variant	Receiver	Temp (°C)	26.5
Freq. Range	1000 - 18000 MHz	Rel. Hum.(%)	33
Power Setting	N/A	Press. (mBars)	995
Antenna	8dBi Laird OP51508T-HP1	Duty Cycle (%)	100
Test Notes 1	Laptop running ART2 on EUT table with device and antenna.		
Test Notes 2			



Formally measured emission peaks

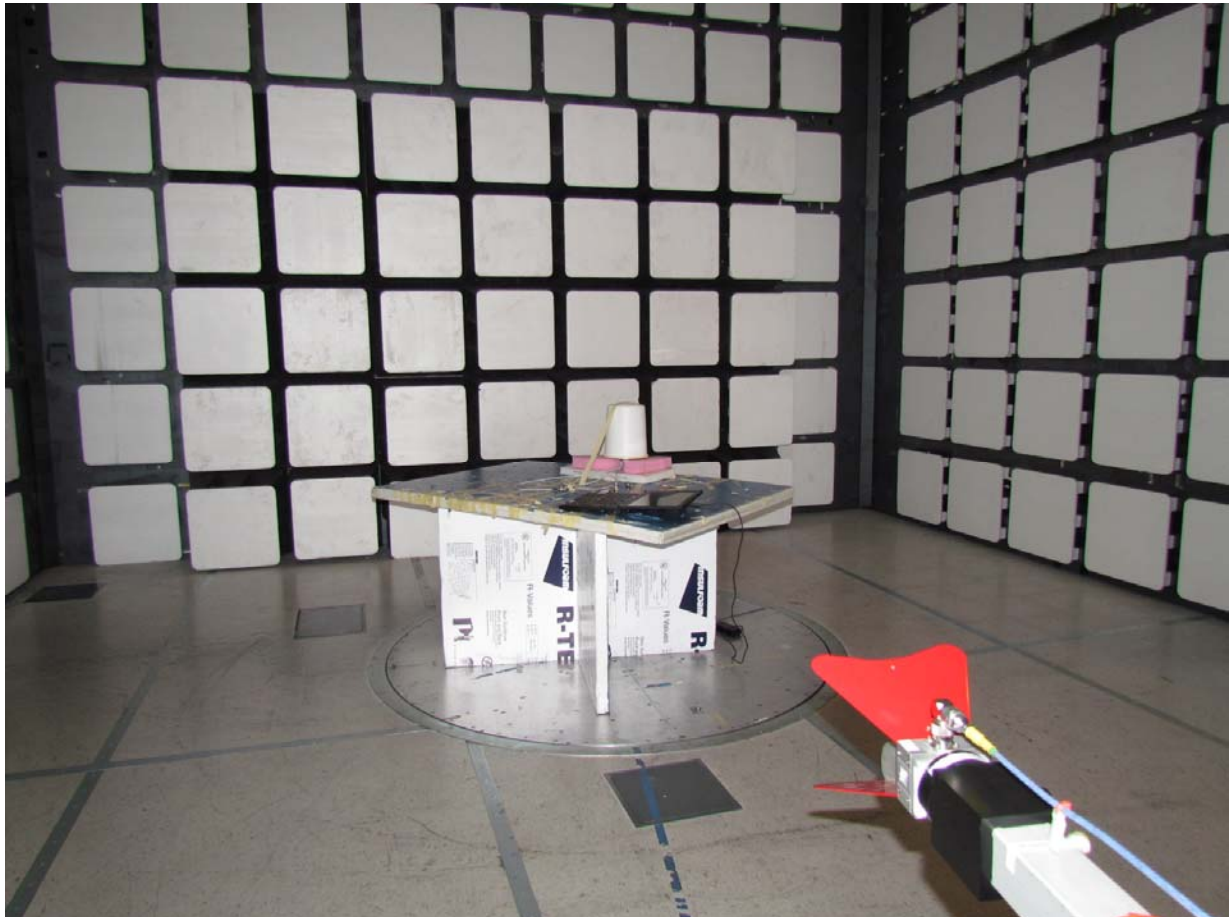
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1296.763	66.0	2.2	-14.2	54.0	Peak	H	99	246	74.0	-20.0	Pass	
1296.763	51.6	2.2	-14.2	39.6	Average	H	99	246	54.0	-14.4	Pass	

Legend: TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
 NRB = Non-Restricted Band. RB = Restricted Band.

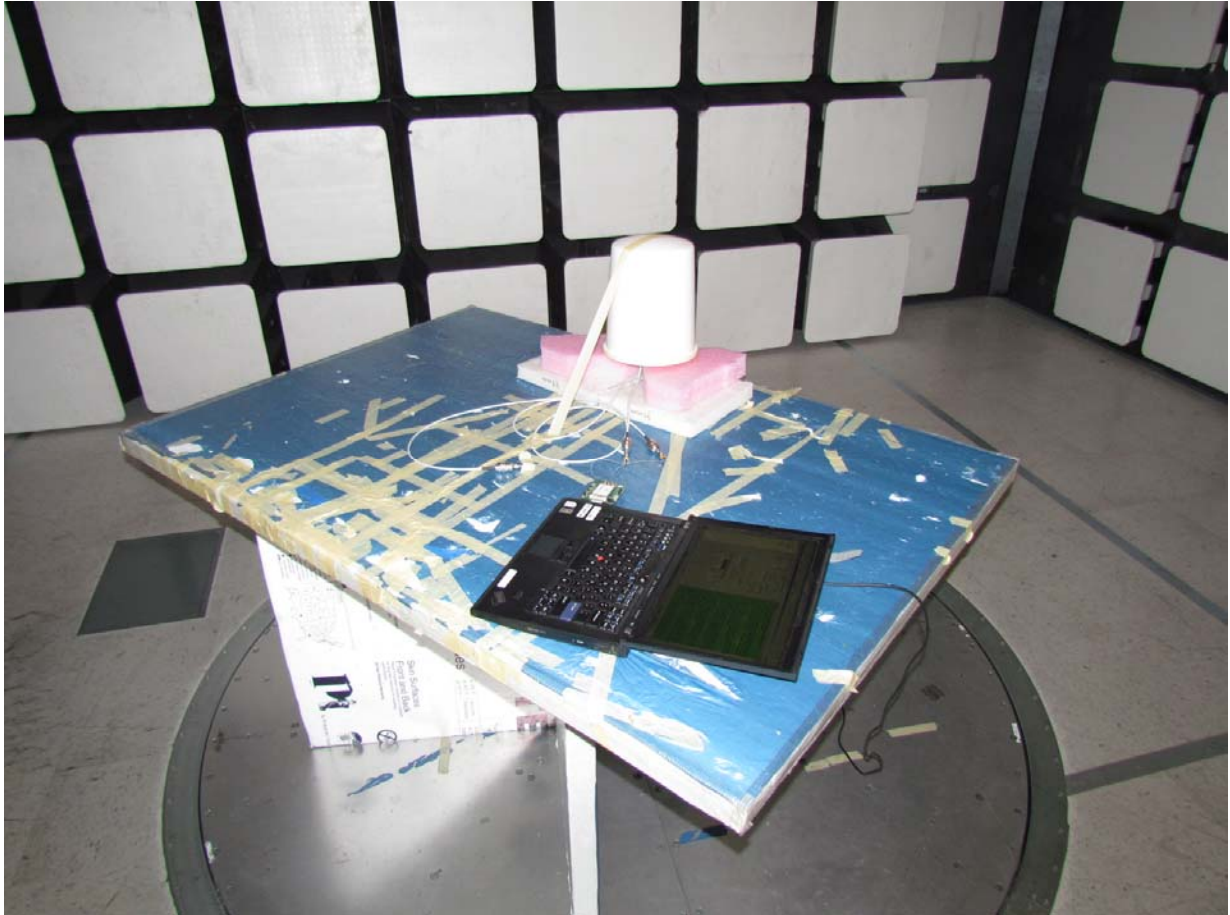
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6. PHOTOGRAPHS

6.1. Radiated Spurious Emissions



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7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Model #	Serial #	Calibration Date
0070	Power Meter	Hewlett Packard	437B	3125U11552	16 Nov 10
0116	Power Sensor	Hewlett Packard	8485A	3318A19694	17 Nov 10
0117	Power Sensor	Hewlett Packard	8487D	3318A00371	22 Nov 10
0158	Barometer /Thermometer	Control Co.	4196	E2844	8 Jan 11
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52	N/A
0252	K-Cable	Megaphase	Sucoflex 104	Unknown	15 Apr 11
0287	Receiver	Rhode & Schwarz	ESIB40	100201	16 Nov 10
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001	15 Apr 11
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001	15 Apr 11

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440 Boulder Court, Suite 200
Pleasanton, CA 94566, USA
Tel: 1.925.462.0304
Fax: 1.925.462.0306
www.micomlabs.com