Test of Wistron 802.11 a/b/g/n Wireless Module

To: FCC 47 CFR Part 15.247/15.407 & IC RSS-210

Test Report Serial No.: CBIS11-A2 Rev A

TEST REPORT

FROM

Test of Wistron 802.11 a/b/g/n Wireless Module
to
To: FCC 47 CFR Part 15.247/15.407 & IC RSS-210

Class II Permissive Change, FCC ID: RTP-DNMA83

Additional Antenna

Test Report Serial No.: CBIS11-A2 Rev A

This report supersedes NONE

Applicant: Colubris Networks Inc
200 West Street, Suite 300
Waltham
MA 02451, USA

Product Function: 802.11a/b/g/n Wireless Access Card

Copy No: pdf Issue Date: 2nd February 2009

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

ACCREDITED
CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION, LISTINGS & RECOGNITION

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

ilac-MRA

THE AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION

ACCREDITED LABORATORY

A2LA has accredited

MICOM LABS
Pleasanton, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 18 June 2005*).

Presented this 26th day of February 2008.

President
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2009

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

LISTINGS

MiCOM Labs test facilities are listed by the following organizations;

North America

United States of America
Federal Communications Commission (FCC) Listing #: 102167

Canada

Industry Canada (IC) Listing #:4143A-2

Japan Registration

VCCI Membership Number: 2959

- Radiation 3 meter site; Registration No. R-2881
- Line Conducted, Registration Nos. C-3181 & T-1470
- Emissions; Registration Nos. C-3180 & T-1469

RECOGNITION

APEC MRA (Asia-Pacific Economic Community Mutual Recognition Agreement)

Conformity Assessment Body (CAB) – MiCOM Labs

Test data generated by MiCOM Labs is accepted in the following countries under the APEC MRA.

Country	Recognition Body	Phase	CAB Identification No.
Australia	Australian Communications and Media Authority (ACMA)	I	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	I	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	I	
Singapore	Infocomm Development Authority (IDA)	I	
Taiwan	Directorate General of Telecommunications (DGT) Bureau of Standards, Metrology and Inspection (BSMI)	I I	

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	18th February '09	Initial Release

1. TEST RESULT CERTIFICATE

Applicant:	Colubris Networks Inc 200 West Street, Suite 300 Waltham MA 02451, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	Wireless Access Card	Telephone:	+1 925 462 0304
Model:	Wistron DNMA-83	Fax:	+1 925 462 0306
S/N:	D027814A010EC01		
Test Date(s):	22nd Dec '08 to 2nd Jan '09	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 15.247/15.407 & IC RSS-210 Radiated Testing of Additional Integral Antenna (Laird Technologies SM24513P)	EQUIPMENT COMPLIES

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

Notes:

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

ACCREDITED
CERTIFICATE #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part Sub-Part C 15.247 Sub-Part E 15.407	2007	Code of Federal Regulations
(ii)	FCC 06-96	June 2006	Memorandum Opinion and Order
(iii)	Industry Canada RSS-210	Issue 7 June 2007	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands): Category 1 Equipment
(iv)	Industry Canada RSS-Gen	Issue 2 June 2007	General Requirements and Information for the Certification of Radiocommunication Equipment
(v)	ANSI C63.4	2003	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	1997 1998	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	14th September 2005	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

2.2. Test and Uncertainty Procedures

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

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

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

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the Wistron 802.11 a/b/g/n Wireless Module in the frequency ranges 2,400 – 2,483.5, 5150 – 5350, 5470 – 5725 and 5725 – 5,850 MHz to FCC Part(s) 15.247, 15.407 and Industry Canada RSS-210 regulations.
Applicant:	Colubris Networks Inc 200 West Street, Suite 300 Waltham MA 02451, USA
Manufacturer:	Winstron NEWEB Corp
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	CBIS11-A2 Rev A
Date EUT received:	12th August 2008
Standard(s) applied:	FCC 47 CFR Part 15.247/15.407 & IC RSS-210
Dates of test (from - to):	12th August to 16th September 2008
No of Units Tested:	1
Type of Equipment:	802.11a/b/g/n Wireless Access Card, 3x3 Spatial Multiplexing MIMO configuration
Applicants Trade Name:	WLAN a+b+g+n mini-PCI Module
Model(s):	DNMA-83
Software Release	5.3
Hardware Release:	-030
Declared Frequency Range(s):	5,250 to 5,350 MHz 5,470 to 5,725 MHz
Type of Modulation:	Per 802.11 –CCK, BPSK, QPSK, DSSS, OFDM
Declared Nominal Output Power: (Average Power)	802.11a: Legacy +17 dBm 802.11n: HT-20 +19 dBm 802.11n: HT-40 +19 dBm
EUT Modes of Operation:	Legacy 802.11a/b/g, 802.11n HT-20, HT-40
Transmit/Receive Operation:	Time Division Duplex
Rated Input Voltage and Current:	Power Supply 3.3 Vdc @ 1 A
Operating Temperature Range:	Declared range 0 to +40ºC
ITU Emission Designator:	802.11a Legacy 16M9W7D 802.11n HT-20 18M1W7D 802.11n HT-40 37M3W7D
Frequency Stability:	±20 ppm max
Equipment Dimensions:	2.5” x 2.5”
Weight:	2oz
Primary function of equipment:	Wireless Access Card for transmitting data and voice

3.2. Scope of Test Program

RF Testing

The scope of the compliance program was to test an additional antenna for the Wistron 802.11 a/b/g/n wireless module, 3x3 Spatial Multiplexing MIMO configurations in the frequency ranges 2,400 – 2,483.5, 5150 – 5350, 5470 – 5725 and 5725 – 5,850 MHz for compliance against FCC 47 CFR Part 15.247/ 15.407 and Industry Canada RSS-210 specifications.

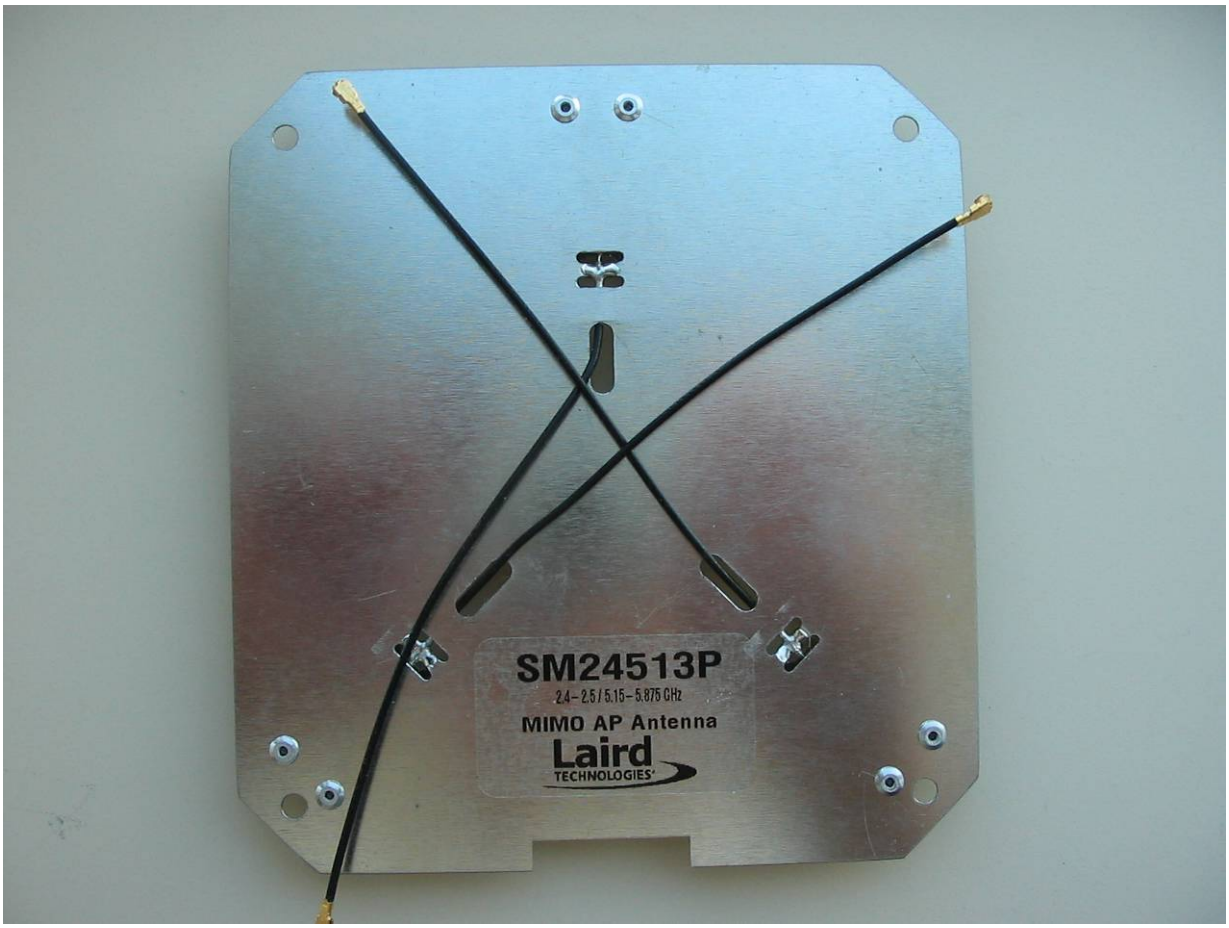
The antenna tested is detailed in section 3.4 “Antenna Details”.

Although this is for a Limited Modular Approval (LMA) the module was tested in a host device (Colubris MSN410).

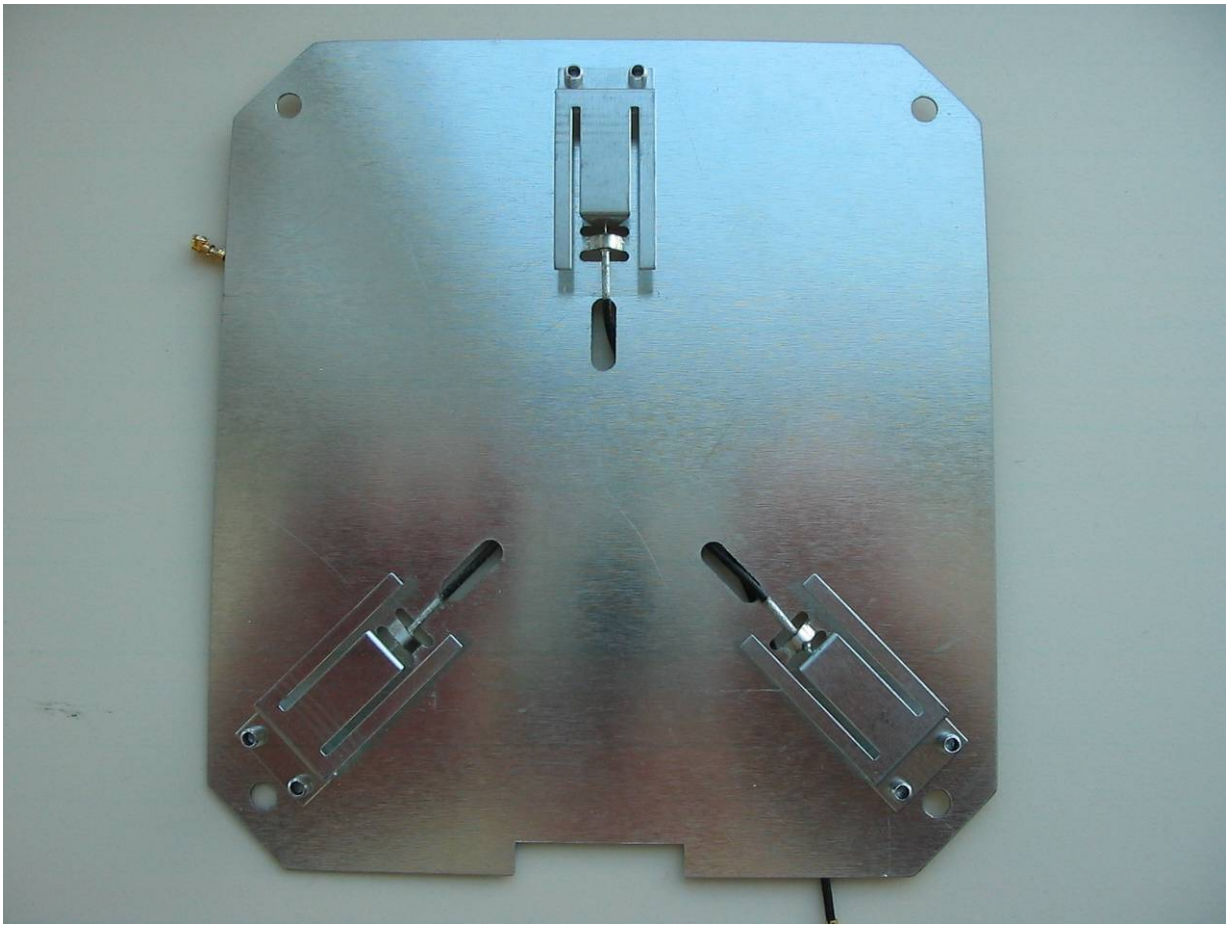
Dynamic Frequency Selection

It was determined that the gain of the tested antenna (4.06 dBi) was higher than the 2.6 dBi antenna selected as the lowest gain antenna for DFS testing. DFS testing was therefore excluded from the test program.

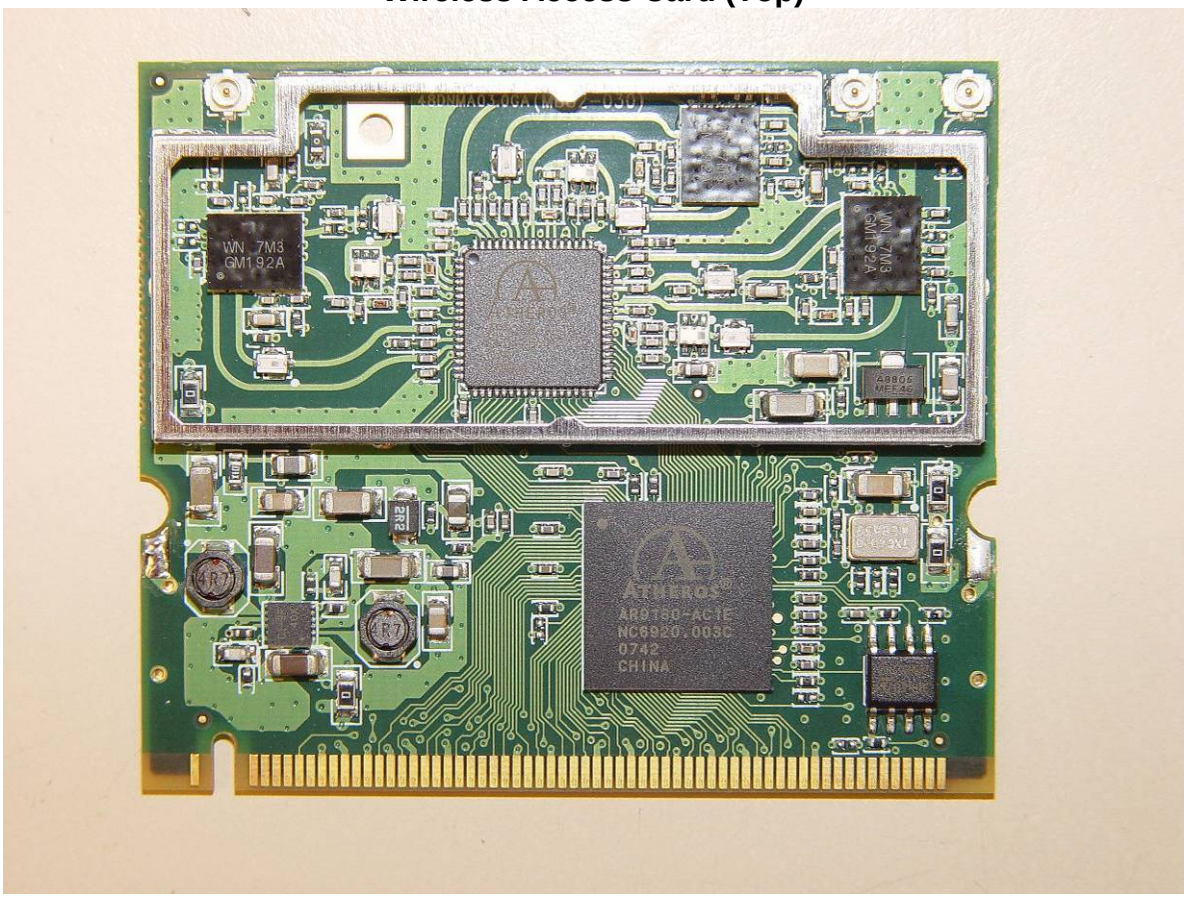
Laird Technologies SM24513P MIMO Antenna



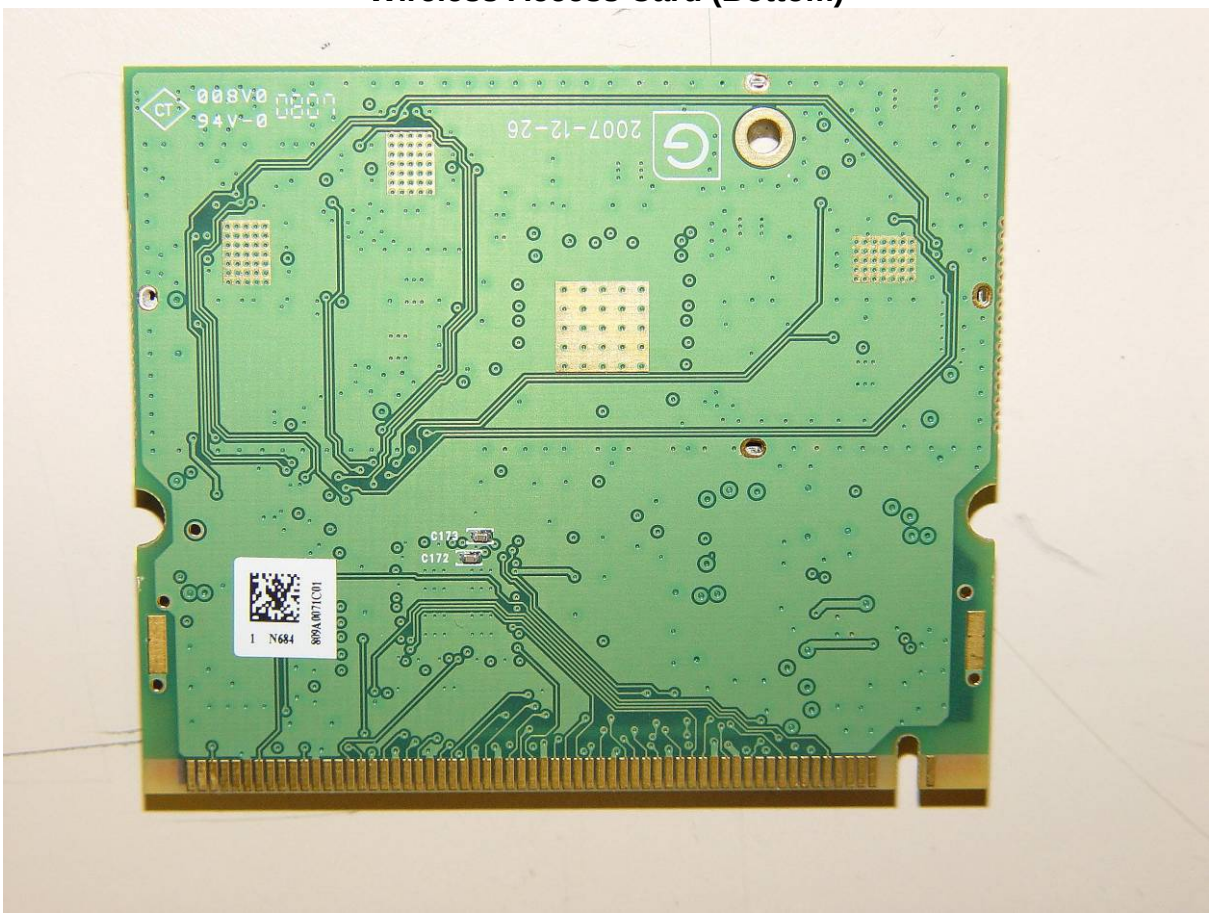
Laird Technologies SM24513P MIMO Antenna



Wistron 802.11 a/b/g/n wireless card
Wireless Access Card (Top)



Wistron 802.11 a/b/g/n wireless card
Wireless Access Card (Bottom)



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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Access Card	Wistron	DNMA-83	D027814A010EC01
Support	Wireless Access Point	Colubris Networks	MSM410	230394
Support	Laptop PC	HP		

3.4. Antenna Details

1. Laird Technologies SM24513P MIMO AP Antenna
   - Maximum Gain 2,400 – 2,483.5 MHz, 2.73 dBi
   - Maximum Gain 5,150 – 5,875 MHz, 6.45 dBi

3.5. Cabling and I/O Ports

Number and type of I/O ports on supporting wireless access point

1. 2 X RJ-45 , 10/100/1000 BASE-T Ethernet, Auto MDX

3.6. Test Configurations

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

Matrix of test configurations

Operational Mode(s) (802.11)	Variant	Data Rates with Highest Power	Frequencies (MHz)
b	Legacy	1 MBit/s	2,412 2,437 2,462
g,n	Legacy	6 MBit/s	
	HT-20	6.5 MCS	
	HT-40	13.5 MCS	2,422 2,442 2,452
a,n	Legacy	6 MBit/s	5,180 5,220 5,240
	HT-20	6.5 MCS	
	HT-40	13.5 MCS	5,190 5.230
a,n	Legacy	6 MBit/s	5,260 5,300 5,320
	HT-20	6.5 MCS	
	HT-40	13.5 MCS	5,270 5.310
a,n	Legacy	6 MBit/s	5,500 5,600 5,700
	HT-20	6.5 MCS	
	HT-40	13.5 MCS	5,510 5,620 5,690

3.7. Equipment Modifications

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

1. None

3.8. Deviations from the Test Standard

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

1. None

3.9. Subcontracted Testing or Third Party Data

1. NONE

4. TEST SUMMARY

List of Measurements (continued)

The following table represents the list of measurements required under the **FCC CFR47 Part 15.247, Industry Canada RSS-210,** and **Industry Canada RSS-Gen.**

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.247(d) **15.205 /** **15.209** **A8.5** **2.2** **2.6** **4.7**	Radiated Emissions	Restricted Bands	Radiated	Complies	5.1.1
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.1.1*
	Radiated Band Edge	Band-edge results		Complies	*5.1.1.1*
		Peak Emissions			
Industry Canada only **RSS-Gen §4.8, §6**	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.1.2*

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 modifications that were required to bring the product into compliance with the above test matrix*

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(b)(2) **15.205(a)** **15.209(a)** **2.2** **2.6** **A9.3(2)** **4.7**	Radiated Emissions		Radiated		5.1.2
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.2.1*
	Radiated Band Edge	Band edge results		Complies	*5.1.2.1*
RSS-GEN **§4.8, §6**	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.2.2*

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*

5. TEST RESULTS

5.1. Device Characteristics

5.1.1. Radiated Emissions (15.247, RSS-210)

5.1.1.1. Transmitter Radiated Spurious Emissions (above 1 GHz) and Radiated Band Edge Measurements (Restricted Bands)

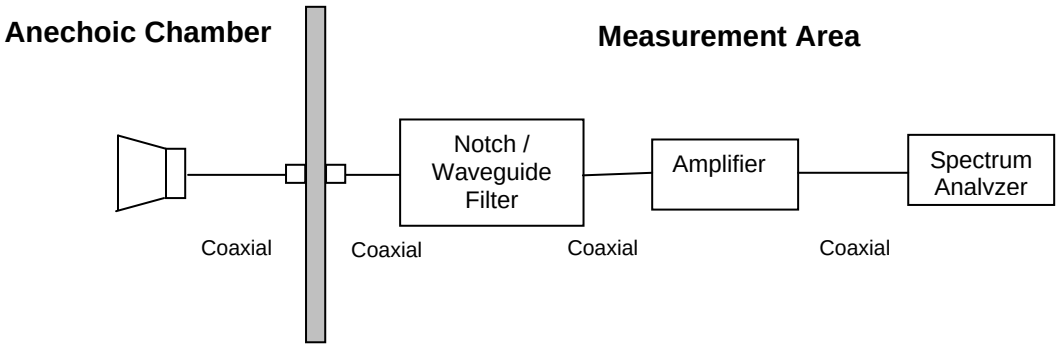
FCC, Part 15 Subpart C §15.247(d) 15.205; 15.209
Industry Canada RSS-210 §A8.5, §2.2, §2.6
Industry Canada RSS-Gen §4.7

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.

Test Measurement Set up



Measurement set up for Radiated Emission Test

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 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

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

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

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

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

Radio Parameters
Duty Cycle: 100%
Output: Modulated Carrier

Radiated Spurious Emissions above 1 GHz

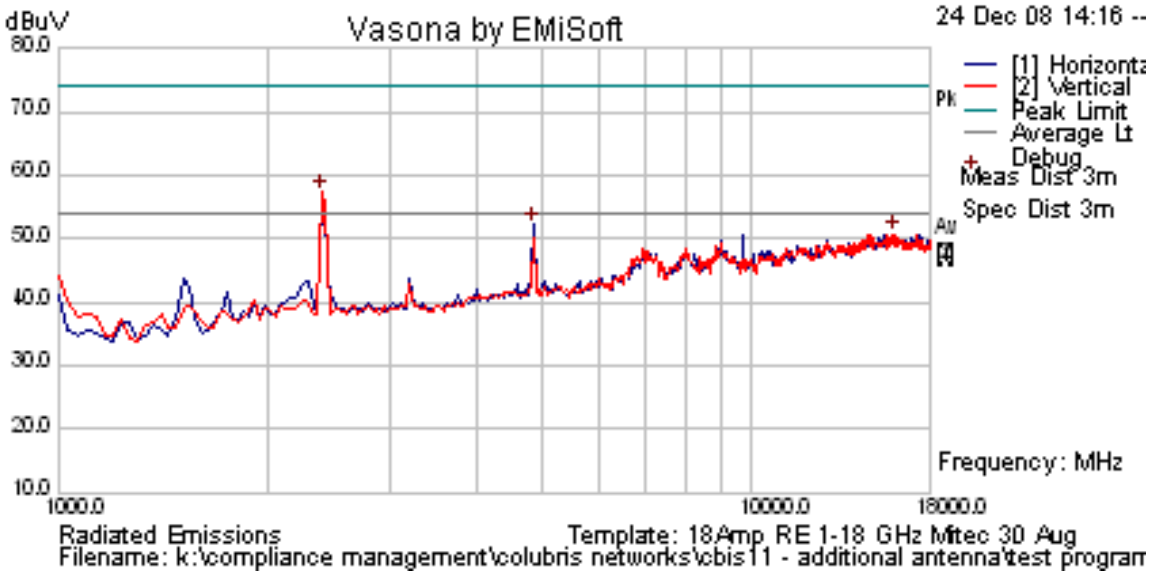
TABLE OF RESULTS – 802.11b, 1Mb/s Channel 1 (2,412 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2386.79359	Power Setting = maximum			58.68	Peak Max	V	--	--	74	-15.32	Pass	Band Edge
2386.31263				50.14	Average Max	V	--	--	54	-3.86	Pass	Band Edge
4844.033	59.75	4.48	-8.77	55.46	Peak Max	H	169	72	74	-18.54	Pass	RB
4844.033	56.37	4.48	-8.77	52.09	Average Max	H	169	72	54	-1.91	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



Band Edge Emissions for 802.11b –2,412 MHz

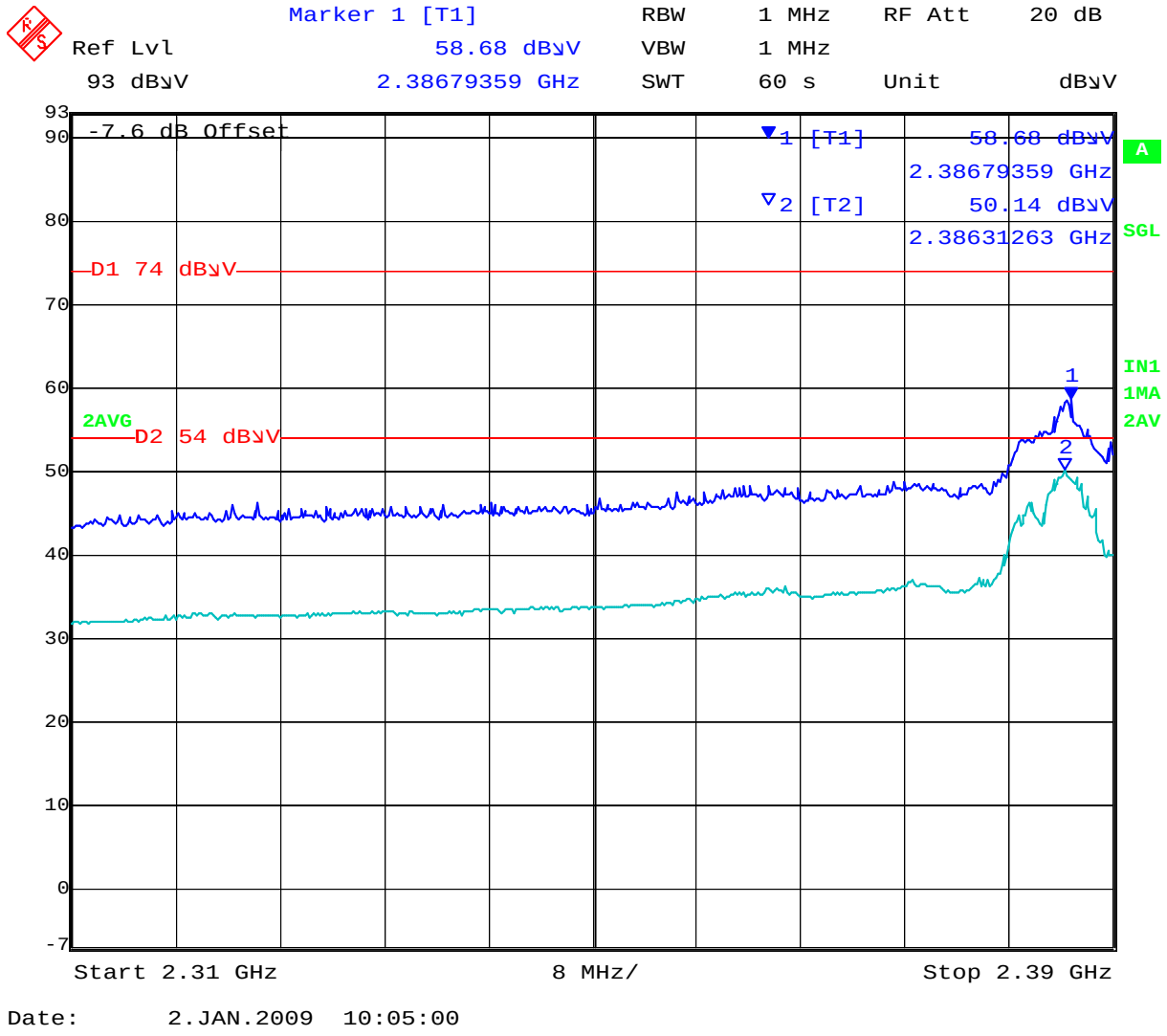


TABLE OF RESULTS – 802.11b, 1Mb/s Channel 6 (2,442 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
4883.123	54.37	4.52	-8.74	50.15	Peak Max	H	169	72	74	-23.85	Pass	RB
4883.123	50.45	4.52	-8.74	46.23	Average Max	H	169	72	54	-7.77	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

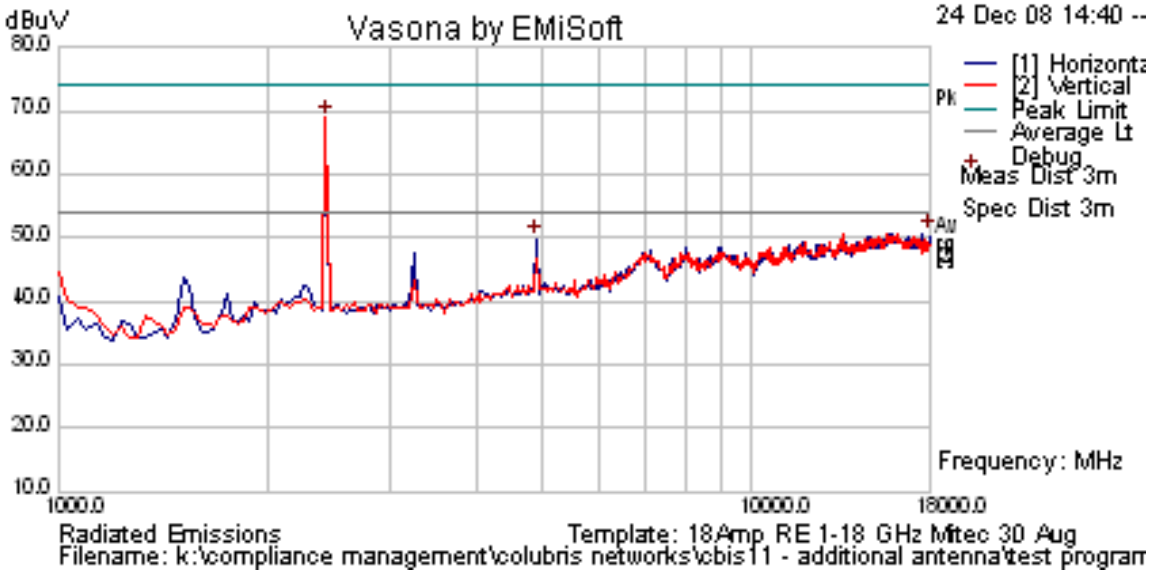


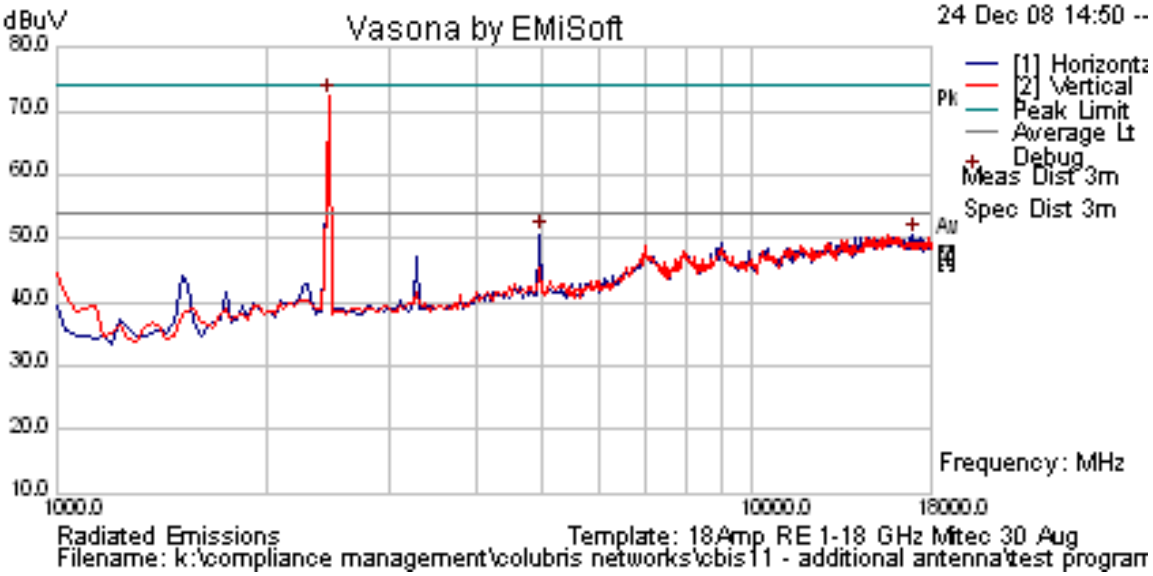
TABLE OF RESULTS – 802.11b, 1Mb/s Channel 11 (2,462 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2487.865	Power Setting = maximum			59.59	Peak Max	V	--	--	74	-14.41	Pass	Band Edge
2487.964				47.06	Average Max	V	--	--	54	-6.94	Pass	Band Edge
4923.165	54.22	4.62	-8.69	50.15	Peak Max	H	169	270	74	-3.85	Pass	RB
4923.165	51.39	4.62	-8.69	47.32	Average Max	H	169	270	54	-6.68	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



Band Edge Emissions for 802.11b –2,462MHz

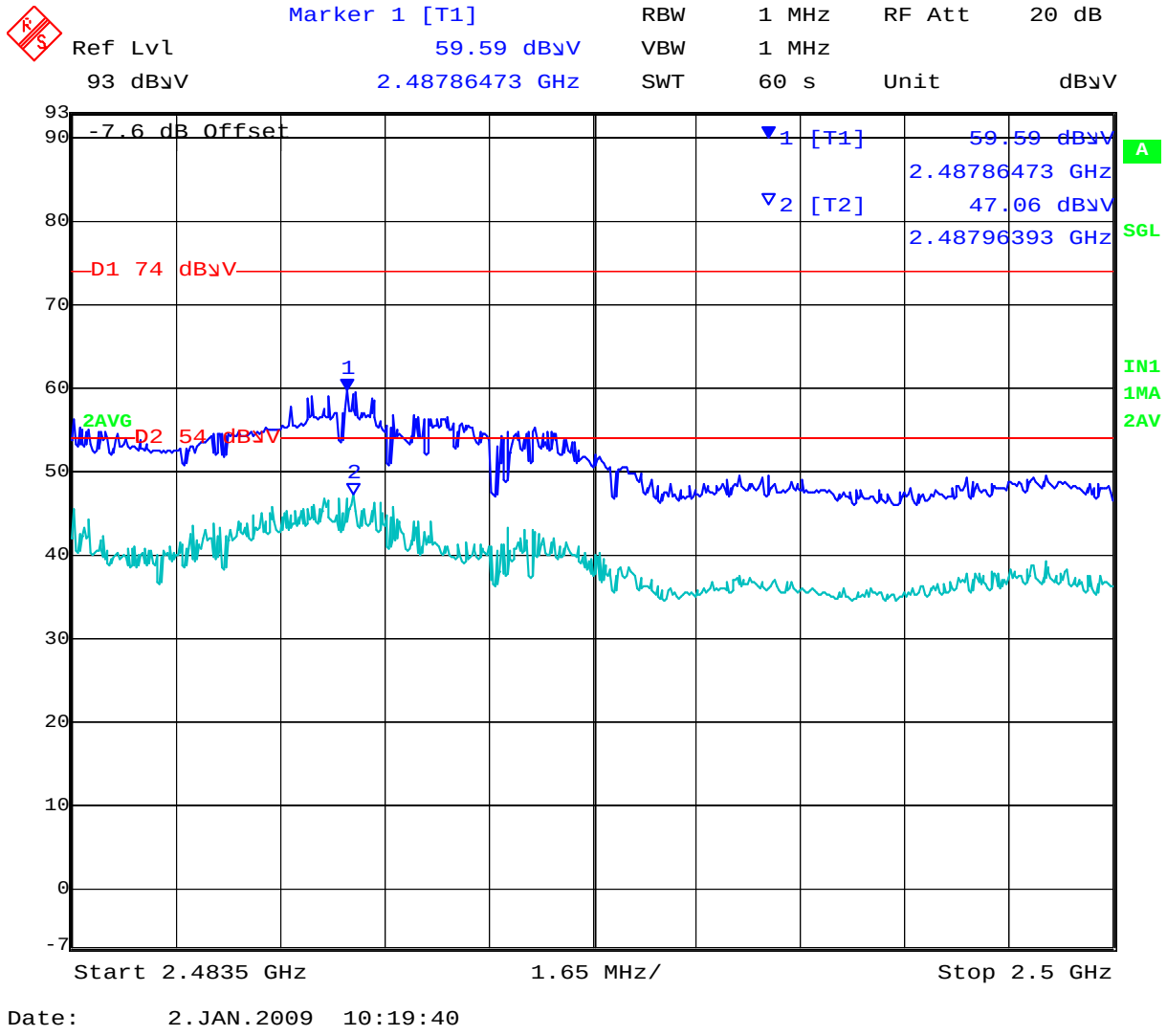


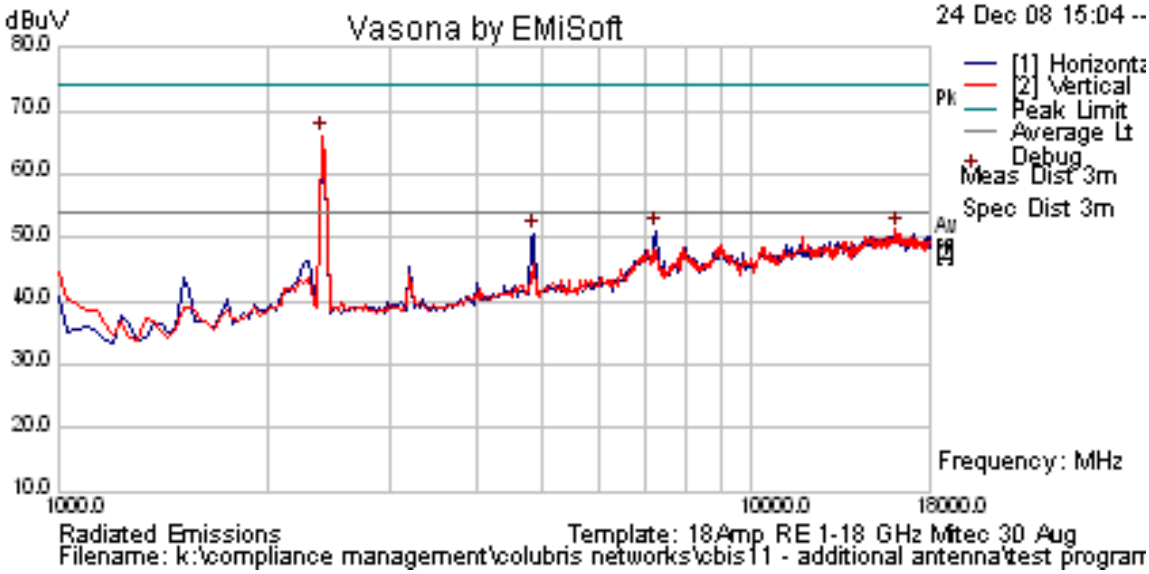
TABLE OF RESULTS – 802.11g, 6Mb/s Channel 1 (2,412 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2388.397	Power Setting = maximum			72.61	Peak Max	V	--	--	74	-1.39	Pass	Band Edge
2390.00				50.50	Average Max	V	--	--	54	-3.50	Pass	Band Edge
7259.399	51.9	5.43	-2.58	54.75	Peak Max	H	128	297	74	-19.25	Pass	RB
7258.197	35.4	5.43	-2.58	38.26	Average	H	128	297	54	-15.74	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



Band Edge Emissions for 802.11g – 2,412 MHz

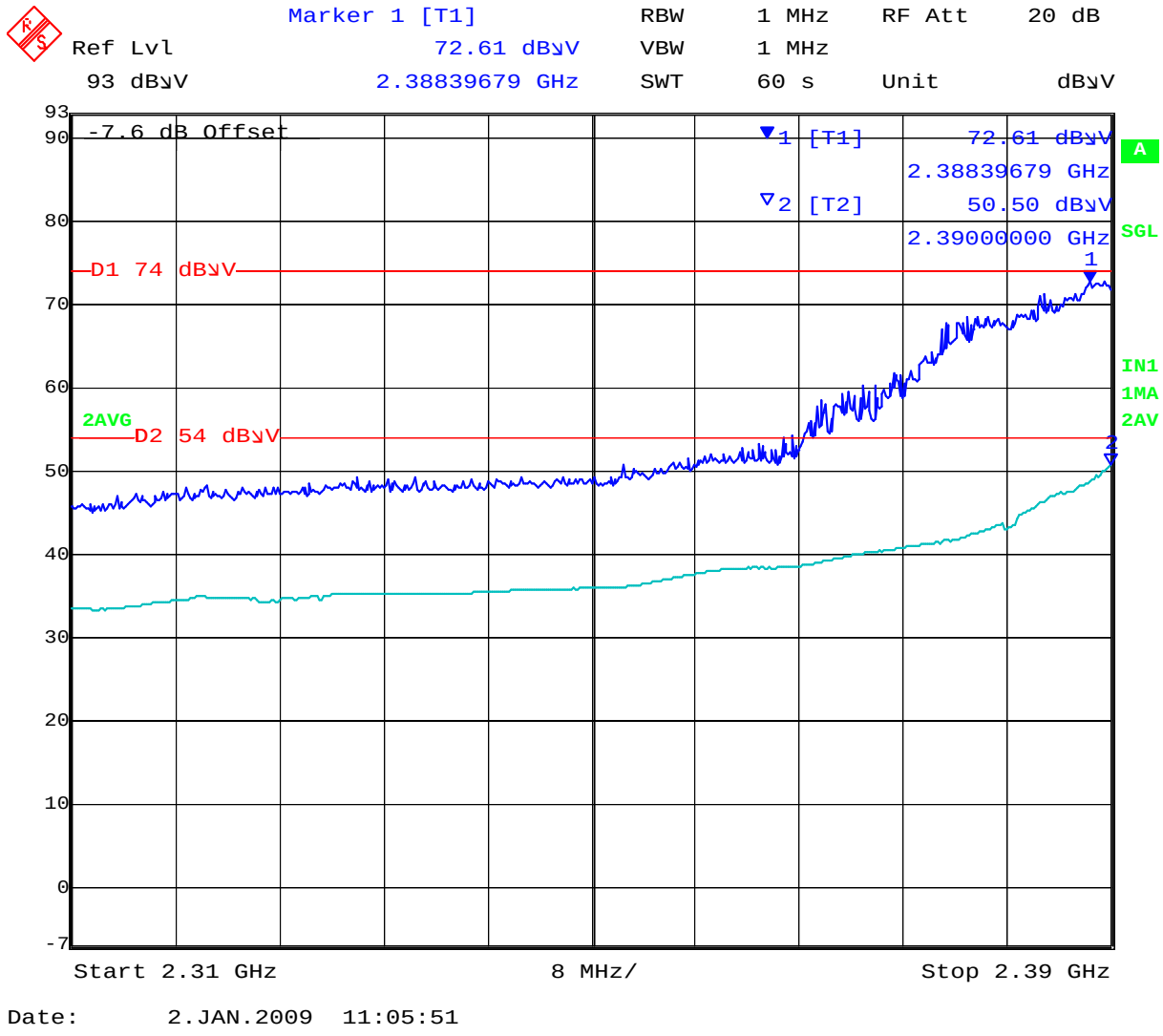


TABLE OF RESULTS – 802.11g, 6Mb/s Channel 6 (2,437 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2388.397	Power Setting = maximum			72.61	Peak Max	V	--	--	74	-1.39	Pass	Band Edge
2390.00				50.50	Average Max	V	--	--	54	-3.50	Pass	Band Edge
7259.399	51.9	5.43	-2.58	54.75	Peak Max	H	128	297	74	-19.25	Pass	RB
7258.197	35.4	5.43	-2.58	38.26	Average	H	128	297	54	-15.74	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

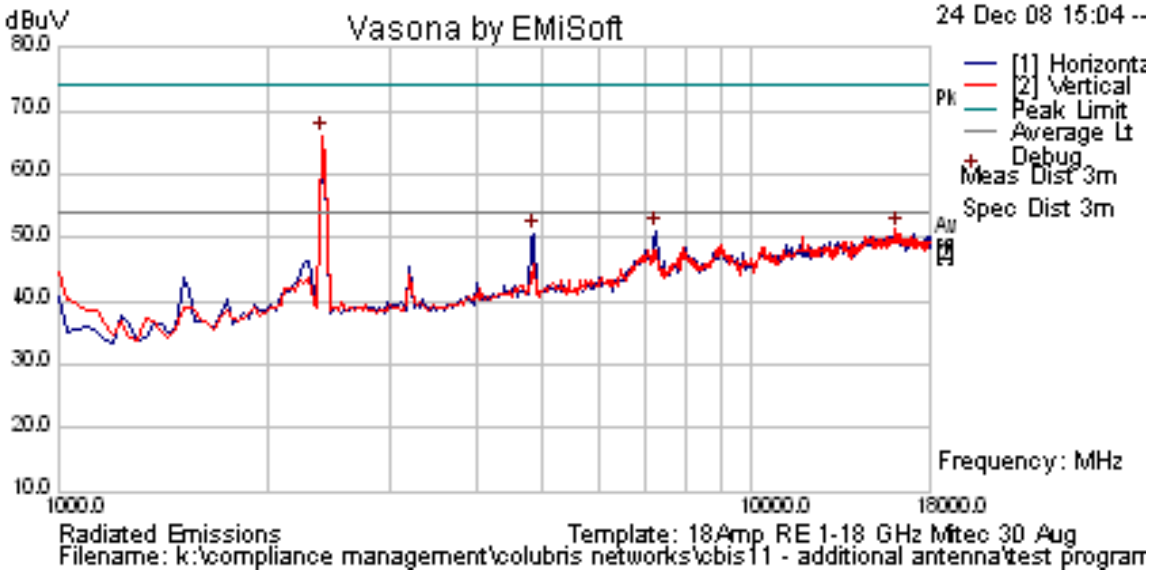


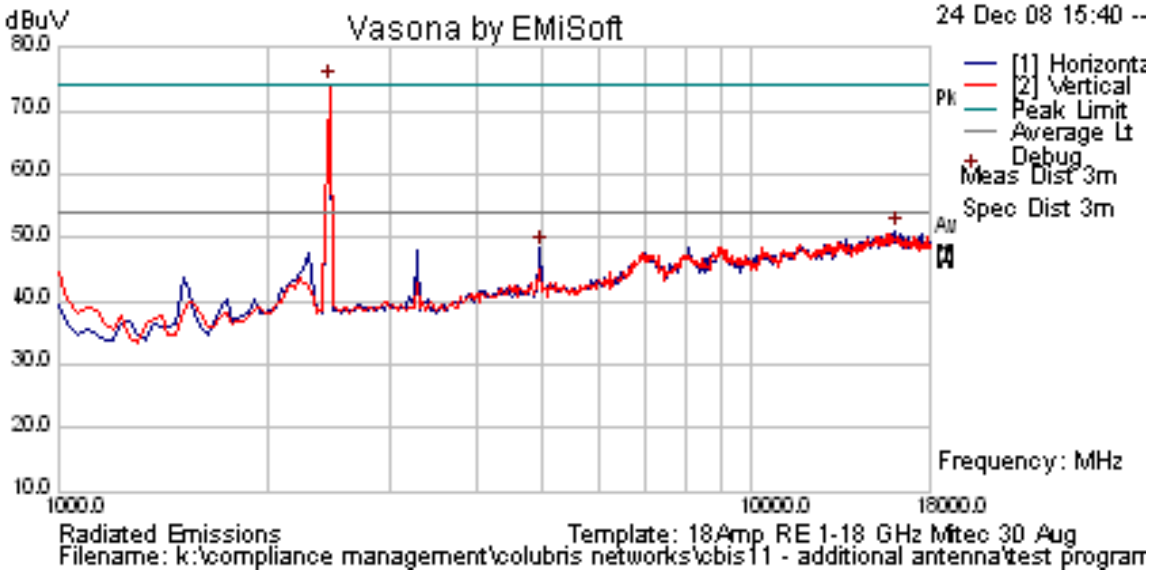
TABLE OF RESULTS – 802.11g, 6Mb/s Channel 11 (2,462 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2483.500	Power Setting = maximum			72.54	Peak Max	V	--	--	74	-1.46	Pass	Band Edge
2483.533				48.14	Average Max	V	--	--	54	-586	Pass	Band Edge
4923.165	54.22	4.62	-8.69	50.15	Peak Max	H	169	270	74	-3.85	Pass	RB
4923.165	51.39	4.62	-8.69	47.32	Average Max	H	169	270	54	-6.68	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



Band Edge Emissions for 802.11g – 2,462 MHz

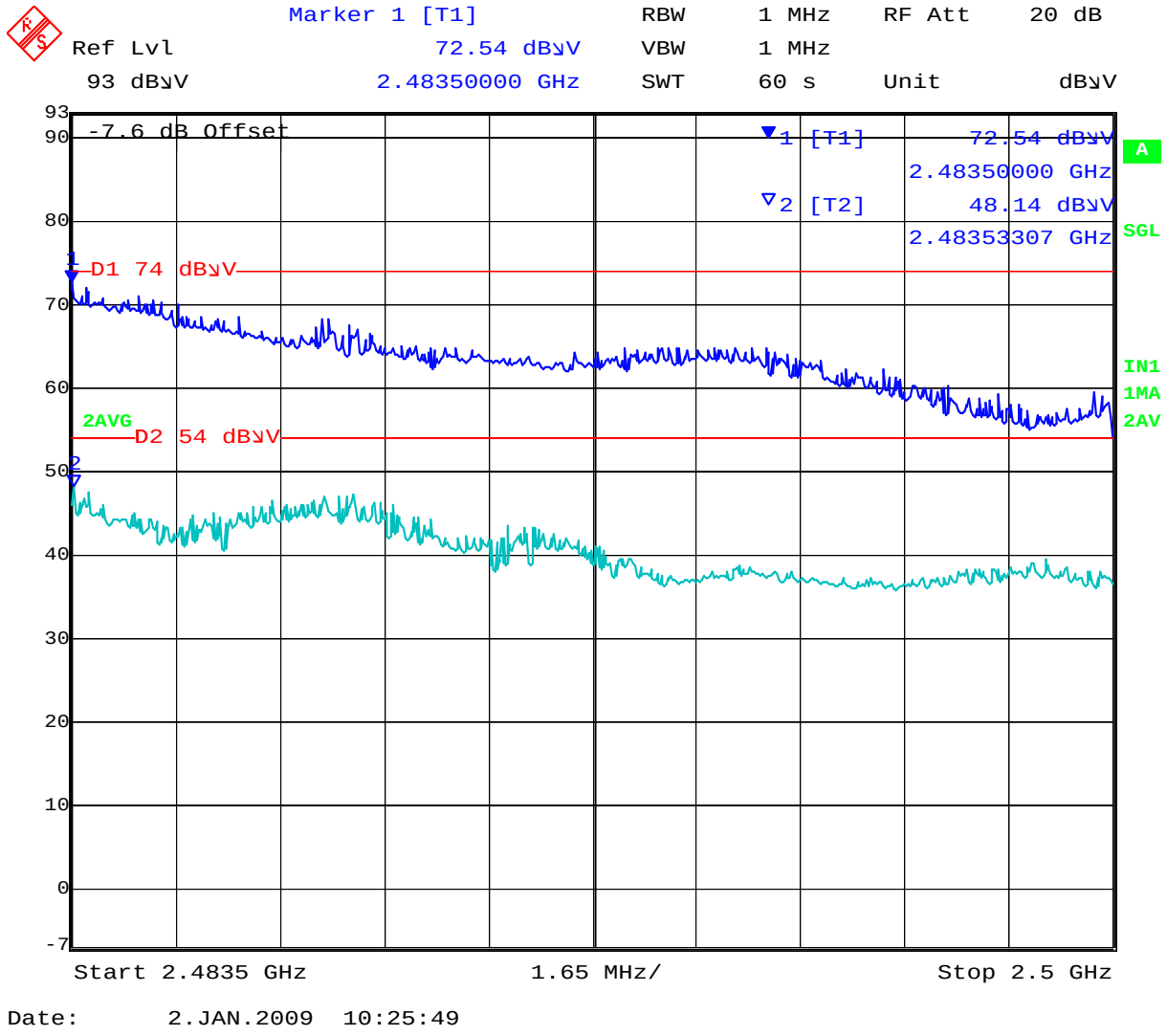


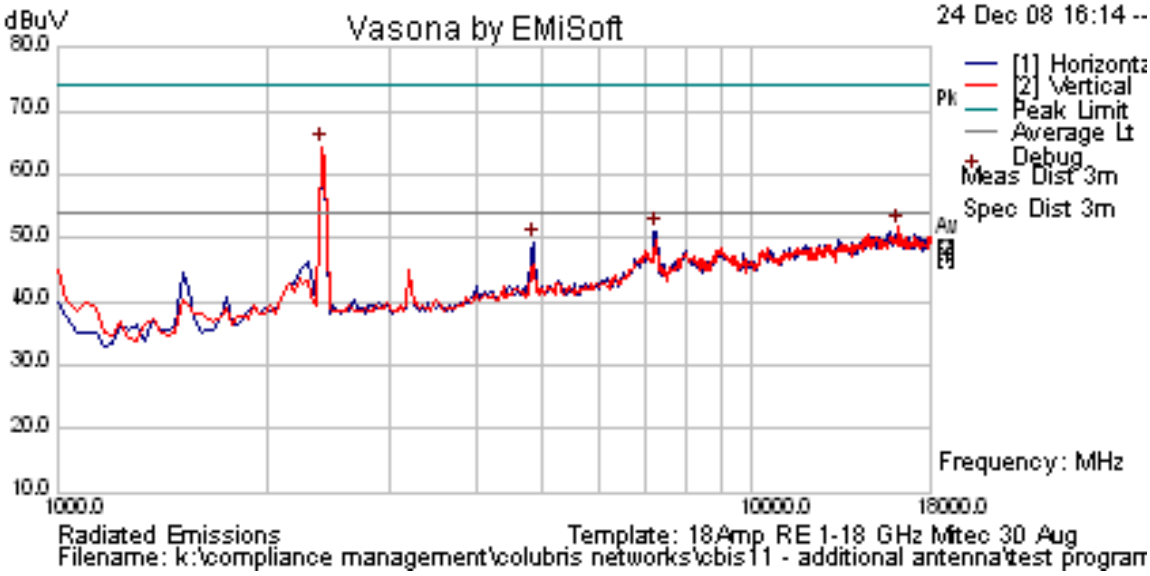
TABLE OF RESULTS – 802.11g HT-20, 6.5 MCS Channel 1 (2,412 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2388.397	Power Setting = maximum			73.87	Peak Max	V	--	--	74	-0.13	Pass	Band Edge
2390.00				50.99	Average Max	V	--	--	54	-3.01	Pass	Band Edge
4823.976	55.52	4.49	-8.78	51.23	Peak Max	H	169	73	74	-22.77	Pass	RB
4823.976	51.07	4.49	-8.78	46.78	Average	H	169	73	54	-7.22	Pass	RB
7259.399	50.14	5.43	-2.46	53.11	Peak Max	H	128	297	74	-20.89	Pass	RB
7258.197	44.29	5.43	-2.46	47.26	Average	H	128	297	54	-6.74	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



Band Edge Emissions for 802.11g HT-20, 6.5 MCS – 2,412 MHz

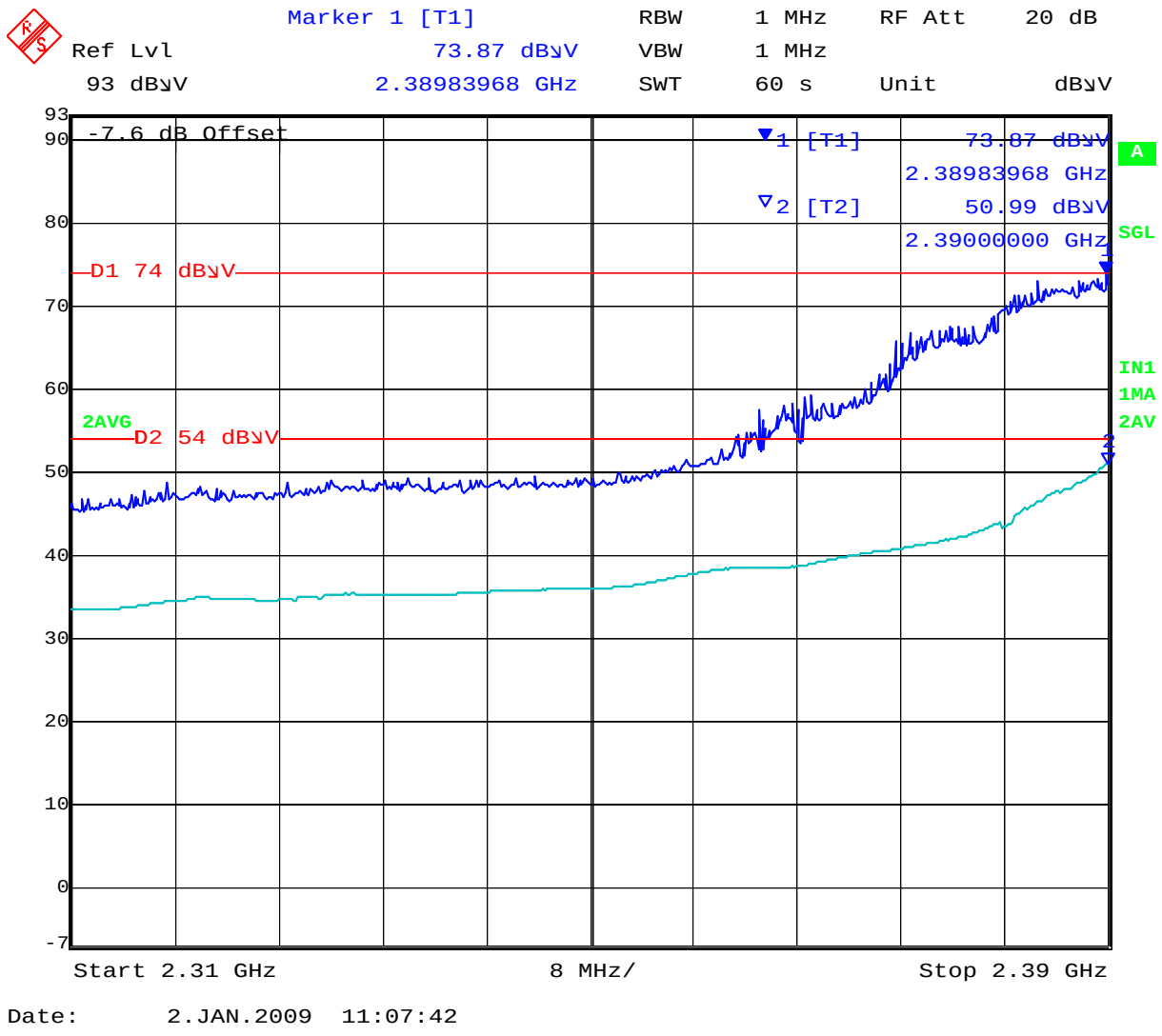


TABLE OF RESULTS – 802.11g HT-20, 6.5 MCS Channel 6 (2,437 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were observed within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

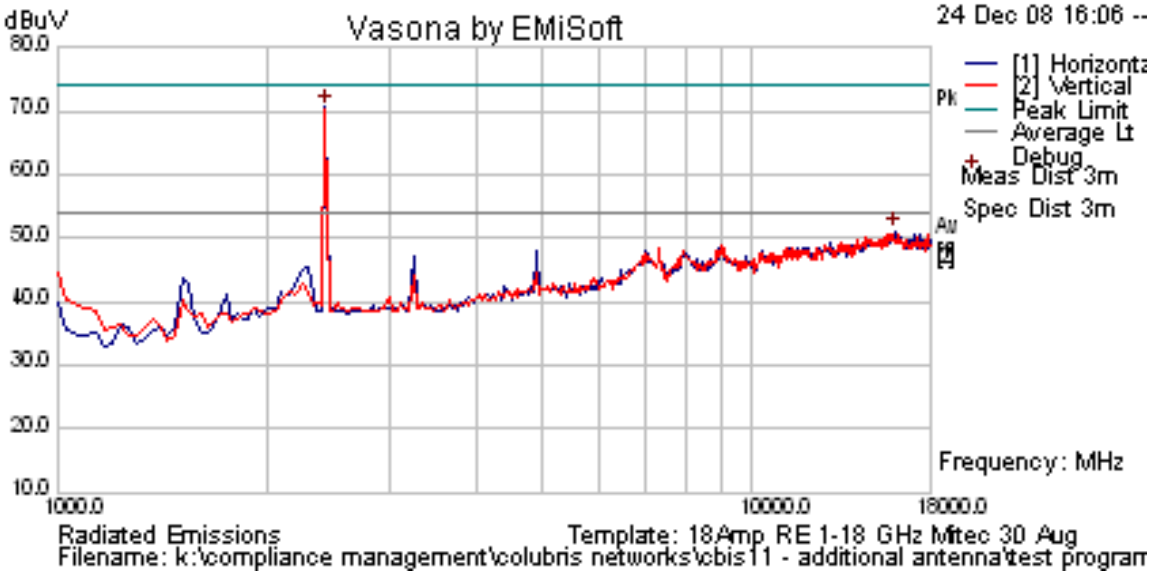


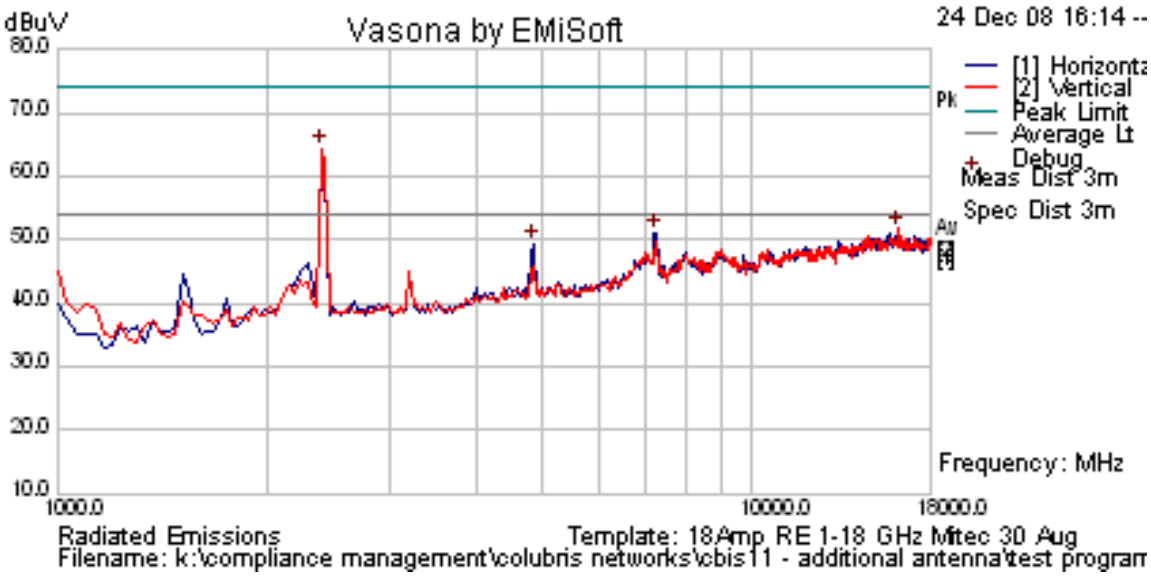
TABLE OF RESULTS – 802.11g HT-20, 6.5 MCS Channel 11 (2,462 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2483.500	Power Setting = maximum			71.65	Peak Max	V	--	--	74	-2.35	Pass	Band Edge
2483.533				50.57	Average Max	V	--	--	54	-3.43	Pass	Band Edge
4923.237	54.22	4.62	-8.69	50.15	Peak Max	H	169	270	74	-3.85	Pass	RB
4923.237	51.39	4.62	-8.69	47.32	Average Max	H	169	270	54	-6.68	Pass	RB
7385.469	49.19	5.43	-2.46	52.16	Peak Max	H	169	270	74	-21.84	Pass	RB
7385.469	43.16	5.43	-2.46	46.13	Average Max	H	169	270	54	-7.87	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



Band Edge Emissions for 802.11g HT-20, 6.5 MCS – 2,462 MHz

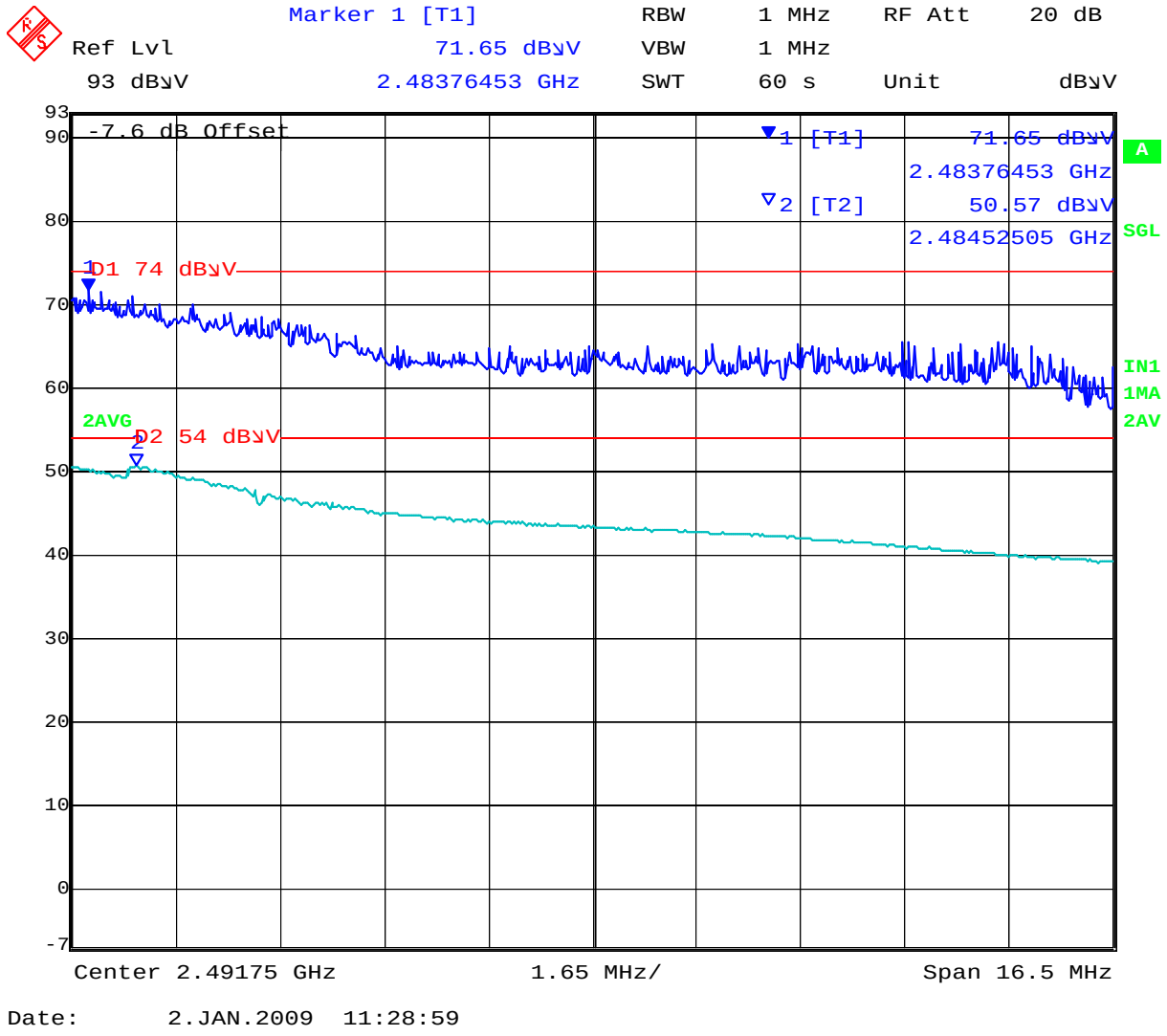


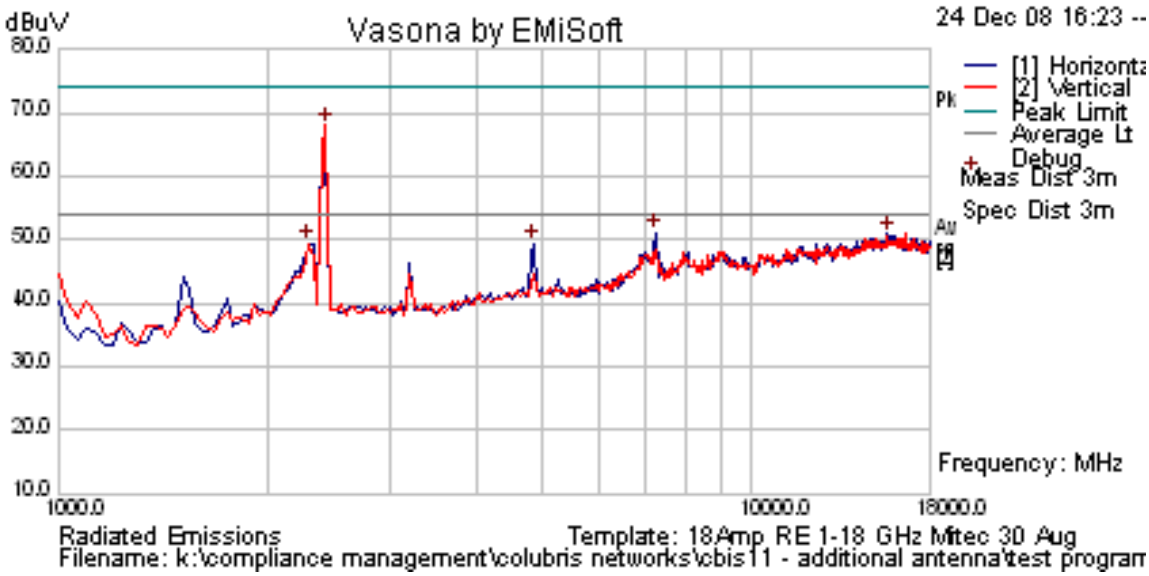
TABLE OF RESULTS – 802.11g HT-40, 13.5 MCS Channel 3 (2,422 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2386.473	Power Setting = maximum			69.46	Peak Max	V	--	--	74	-4.54	Pass	Band Edge
2390.00				52.37	Average Max	V	--	--	54	-1.63	Pass	Band Edge
4849.699	54.94	4.49	-8.78	50.65	Peak Max	H	167	70	74	-23.35	Pass	RB
4849.699	45.51	4.49	-8.78	45.22	Average	H	167	70	54	-8.78	Pass	RB
7268.342	49.18	5.43	-2.46	52.15	Peak Max	H	128	297	74	-21.85	Pass	RB
7268.342	42.24	5.43	-2.46	45.21	Average	H	128	297	54	-8.79	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



Band Edge Emissions for 802.11g HT-40, 13.5 MCS – 2,422 MHz

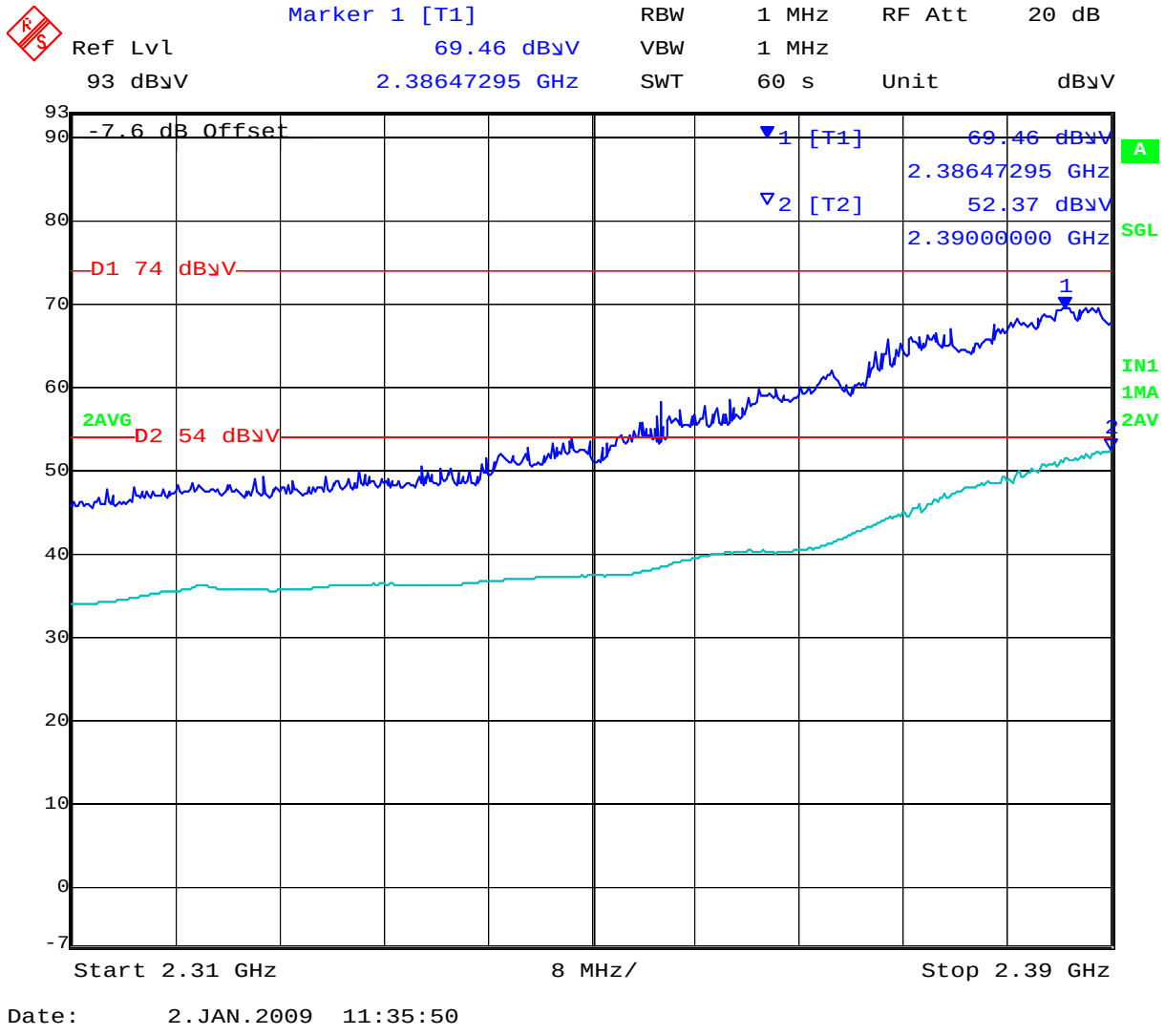


TABLE OF RESULTS – 802.11g HT-40, 13.5 MCS Channel 6 (2,437 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
3249.434	57.25	3.49	-11.13	49.61	Peak Max	H	203	283	74	-24.39	Pass	RB
3249.434	53.57	3.49	-11.13	45.93	Average Max	H	203	283	54	-8.07	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

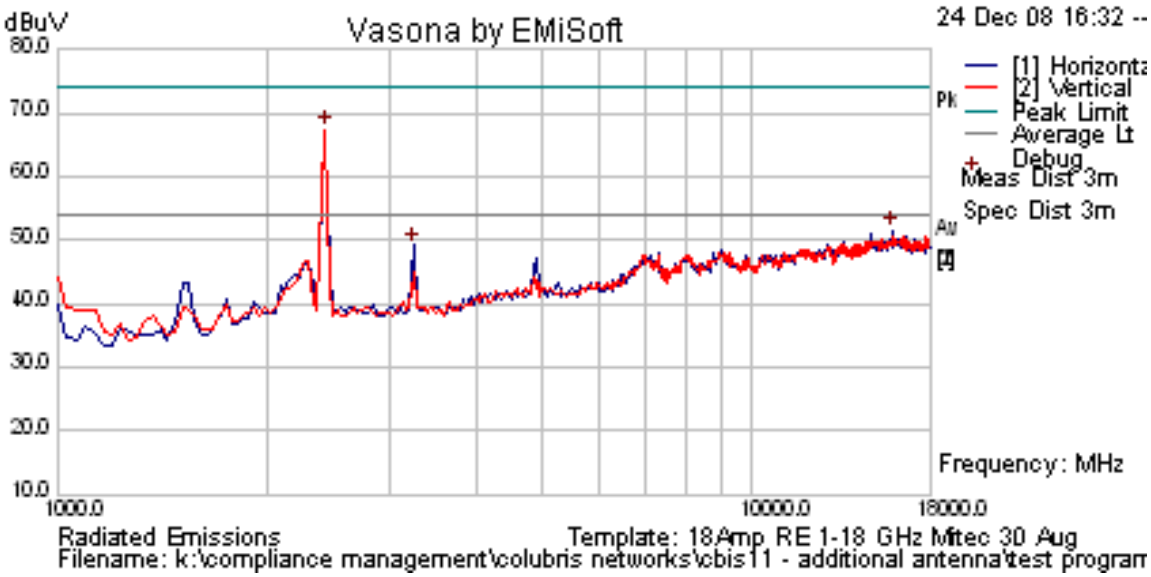


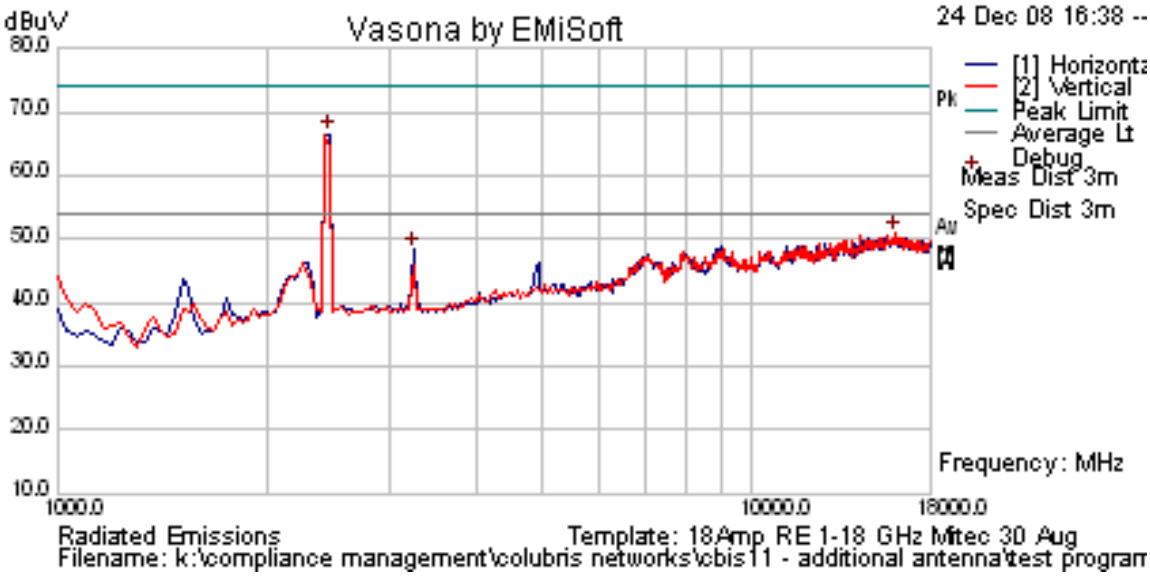
TABLE OF RESULTS – 802.11g HT-40, 13.5 MCS Channel 9 (2,452 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
2483.500	Power Setting = maximum			72.37	Peak Max	V	--	--	74	-1.63	Pass	Band Edge
2483.533				50.86	Average Max	V	--	--	54	-3.14	Pass	Band Edge
3249.434	57.25	3.49	-11.13	49.61	Peak Max	H	203	283	74	-24.39	Pass	RB
3249.434	53.57	3.49	-11.13	45.93	Average Max	H	203	283	54	-8.07	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



Band Edge Emissions for 802.11g HT-40, 13.5 MCS – 2,452 MHz

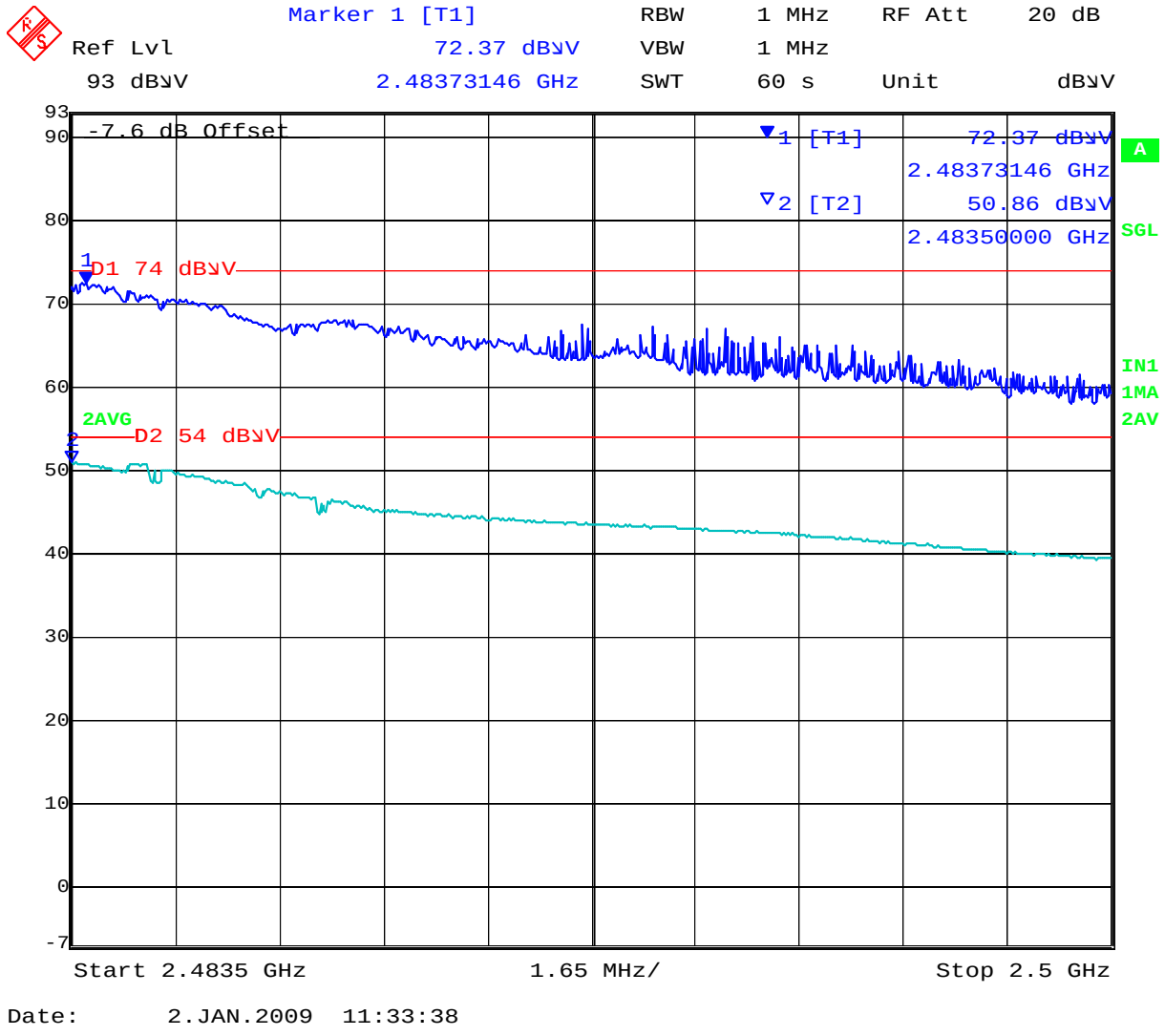


TABLE OF RESULTS – 802.11a, 6Mb/s Channel 149 (5,745 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

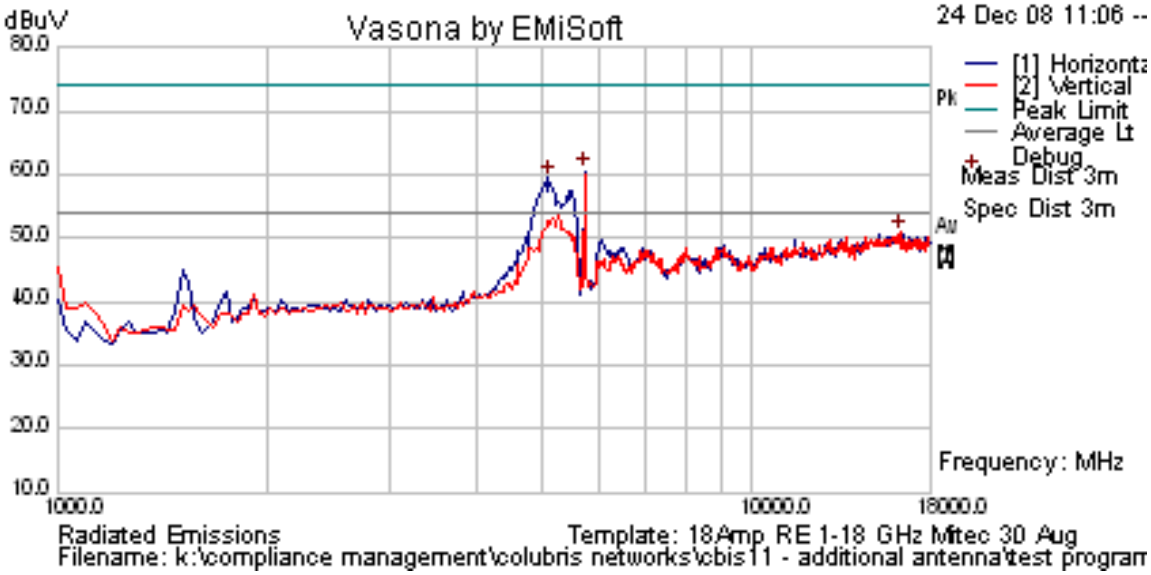


TABLE OF RESULTS – 802.11a, 6Mb/s Channel 157 (5,785 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
11570.725	47.08	6.81	-1.1	52.78	Peak Max	H	110	323	74	-21.22	Pass	RB
11570.725	33.89	6.81	-1.1	39.59	Average Max	H	110	323	54	-14.41	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

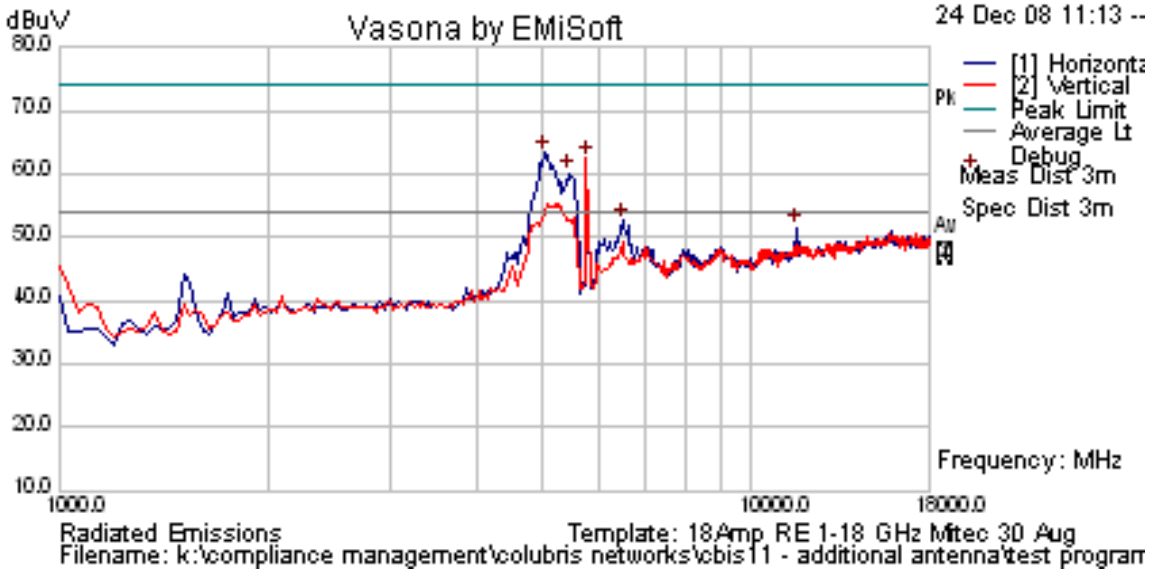


TABLE OF RESULTS – 802.11a, 6Mb/s Channel 165 (5,825 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
11648.738	50.86	6.83	-1.01	56.68	Peak Max	V	106	338	74	-17.32	Pass	RB
11648.738	37.59	6.83	-1.01	43.41	Average Max	V	106	338	54	-10.59	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

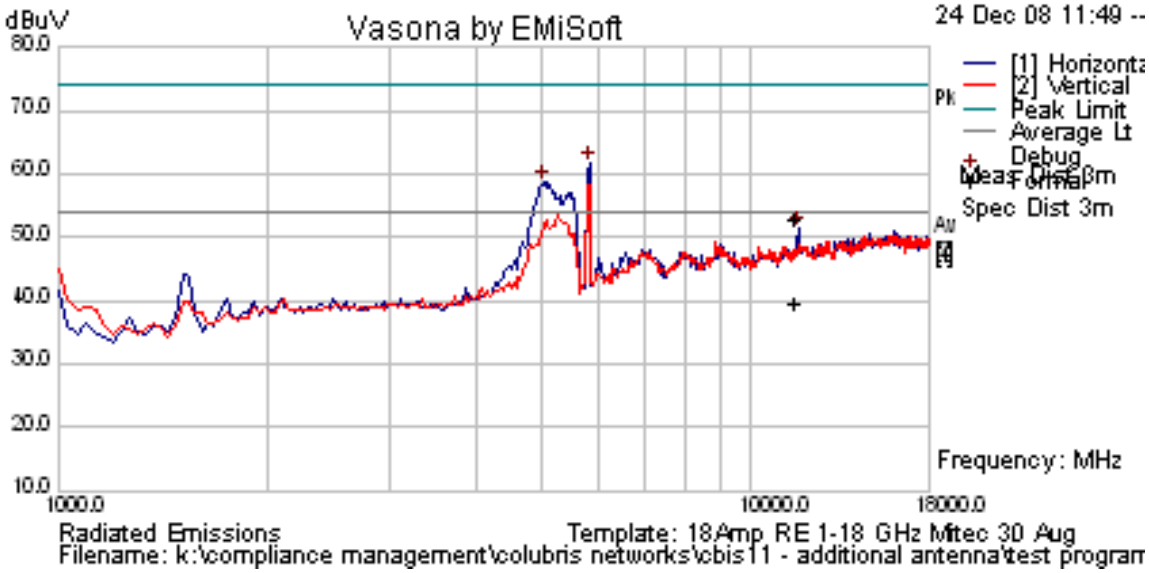


TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 149 (5,745 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

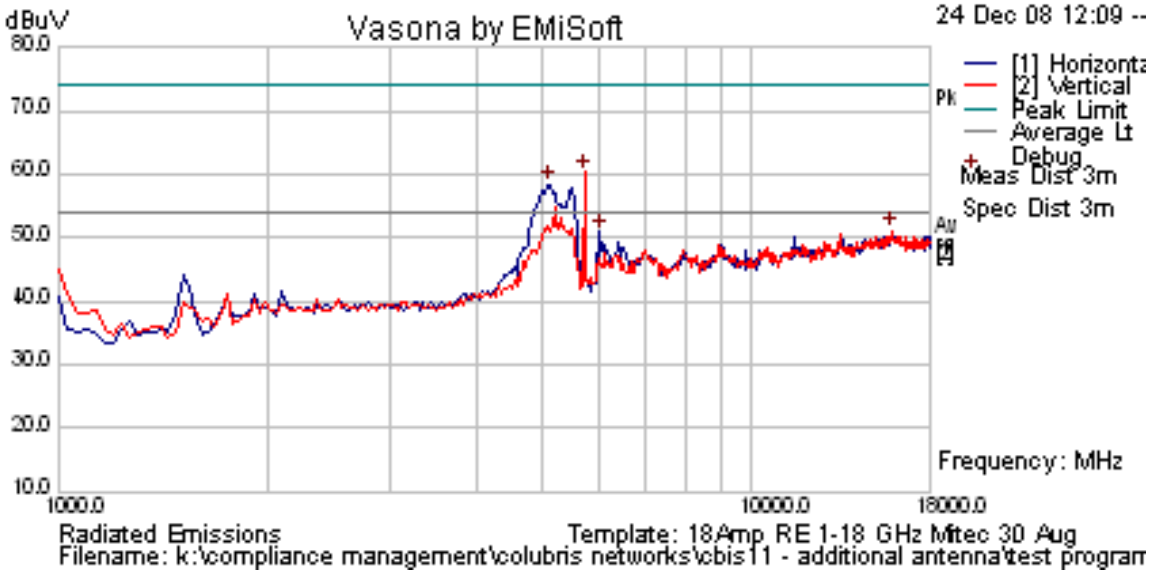


TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 157 (5,785 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

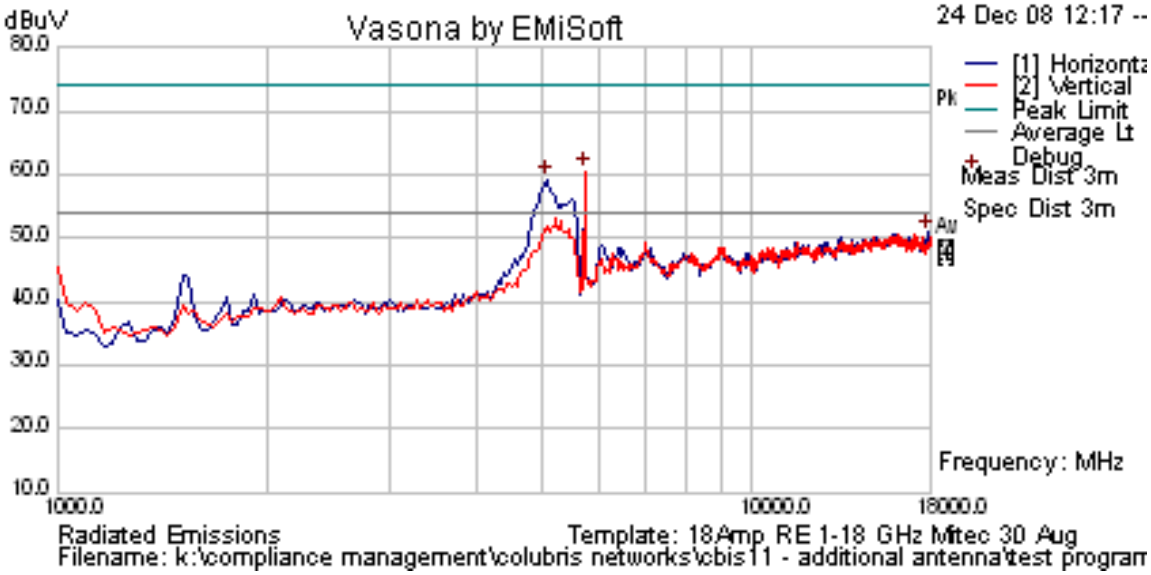


TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 165 (5,825 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
11648.738	50.86	6.83	-1.01	56.68	Peak Max	V	106	338	74	-17.32	Pass	RB
11648.738	37.59	6.83	-1.01	43.41	Average Max	V	106	338	54	-10.59	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

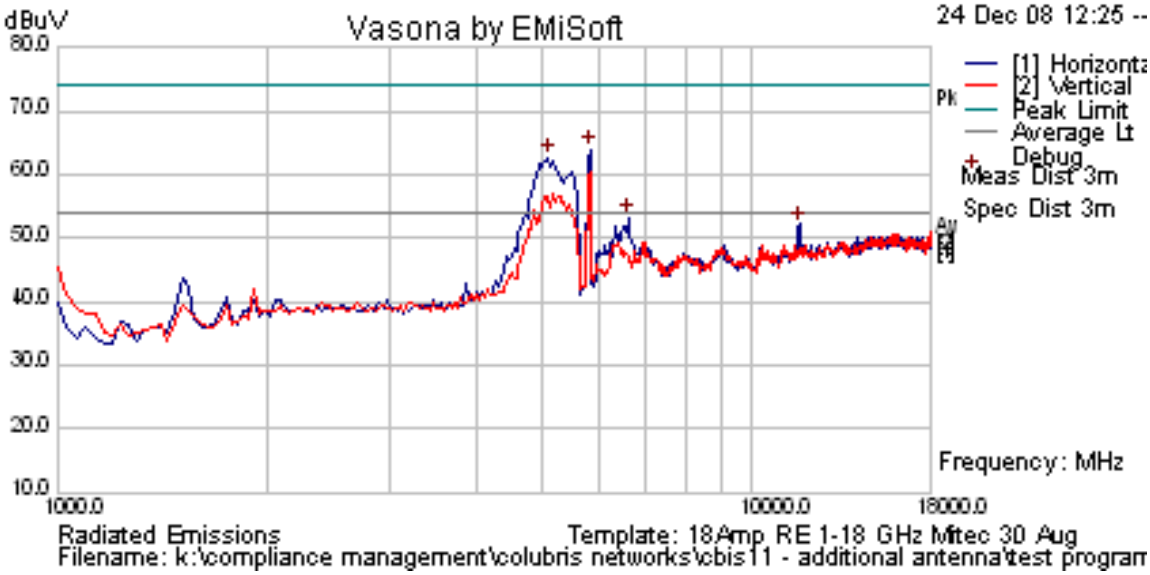


TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,755 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

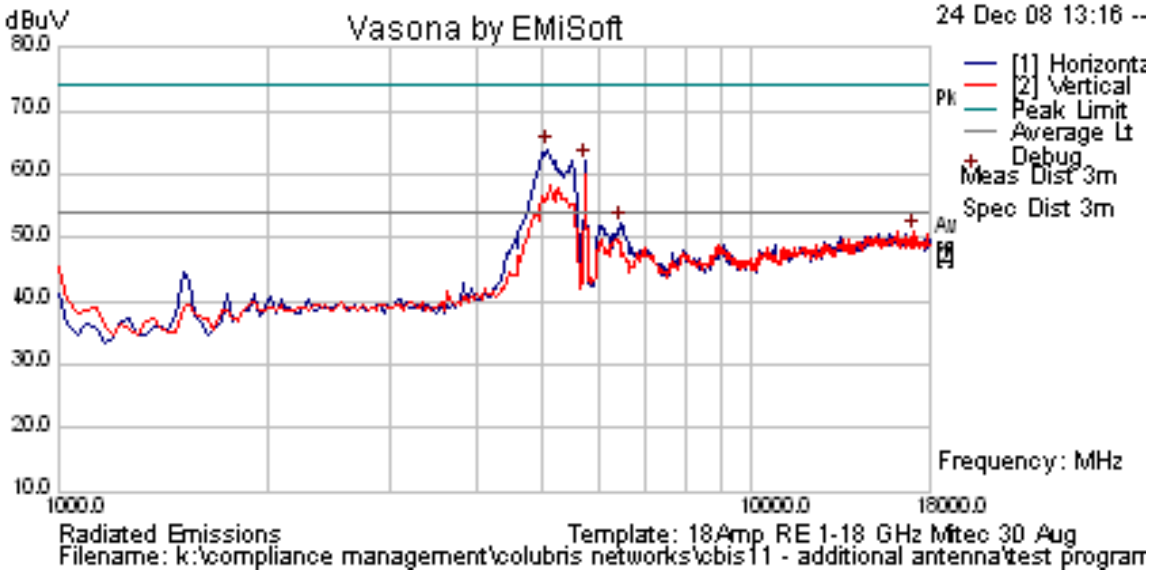


TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 157 5,785 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions

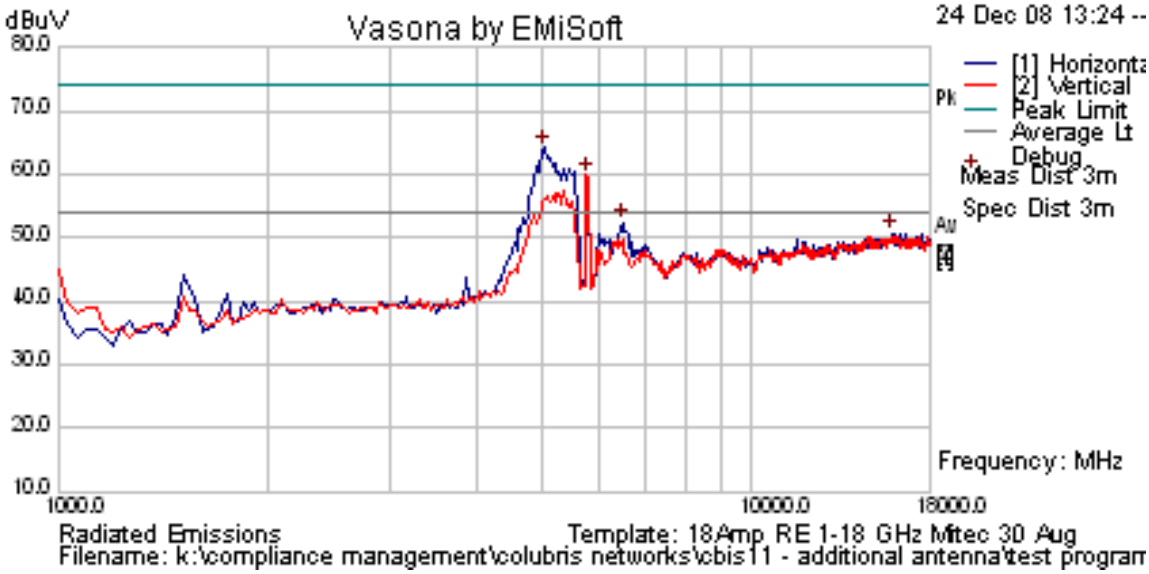


TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,815 MHz

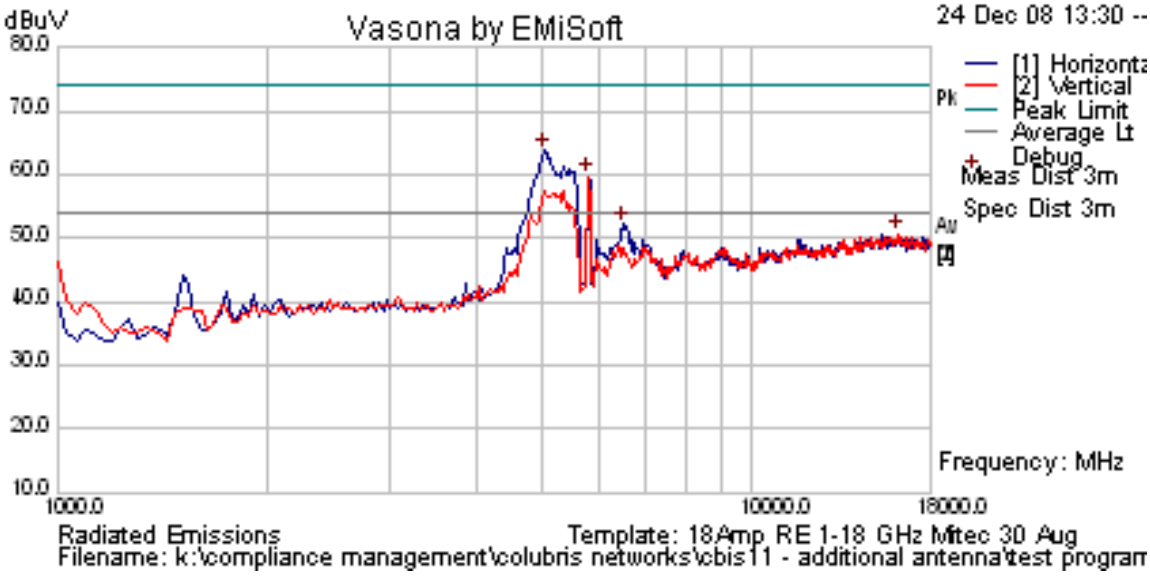
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
												RB
												RB

No emissions were found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



5.1.1.2. Receiver Radiated Spurious Emissions (above 1 GHz)

Industry Canada RSS-Gen §4.8, §6

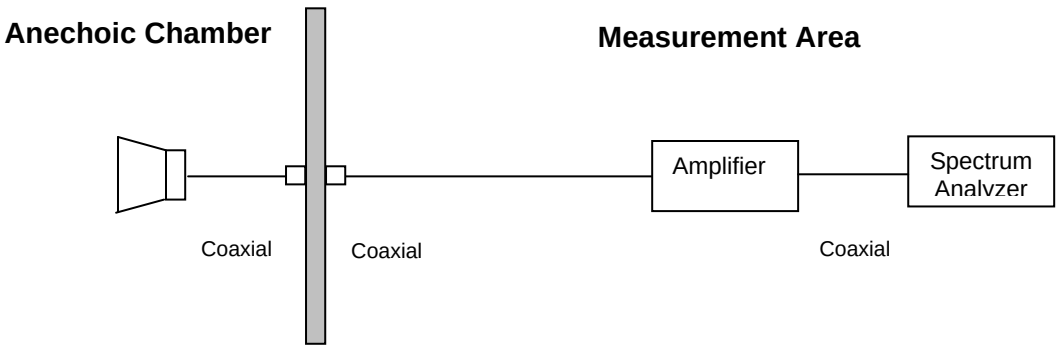
Test Procedure

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 simulatneously

Test Measurement Set up



Measurement set up for Radiated Emission Test

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 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

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

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

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

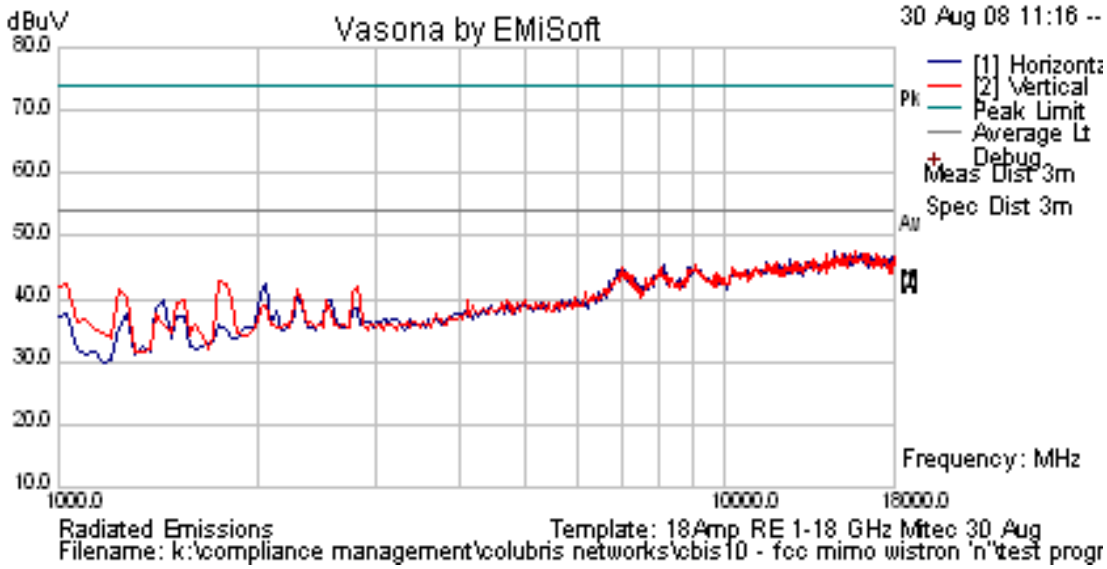
Receiver Radiated Spurious Emissions above 1 GHz

Channel 2437

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were found within 6 dB of the limit line

Channel 2437 MHz b/g Leg/g HT-20/g HT-40
Receiver Radiated Emissions



The above plot is peak emissions only

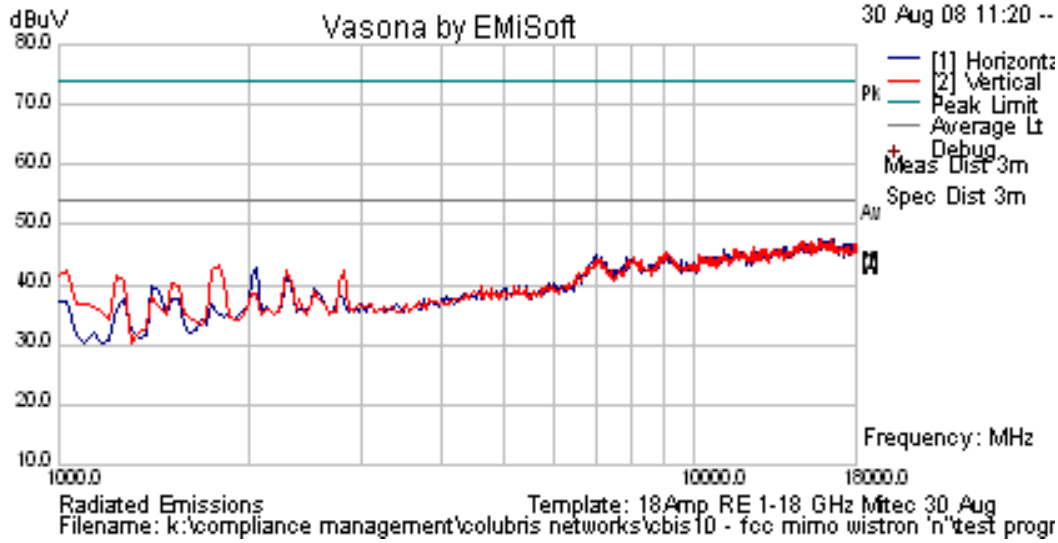
Receiver Radiated Spurious Emissions above 1 GHz

Channel 5785

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were found within 6 dB of the limit line

Channel 5785 MHz Leg/HT-20/HT-40
Receiver Radiated Emissions



The above plot is peak emissions only

5.1.2. Radiated Emissions (15.407, RSS-210)

5.1.2.1. Transmitter Radiated Spurious Emissions (above 1 GHz) and Radiated Band Edge Measurements – Restricted Bands

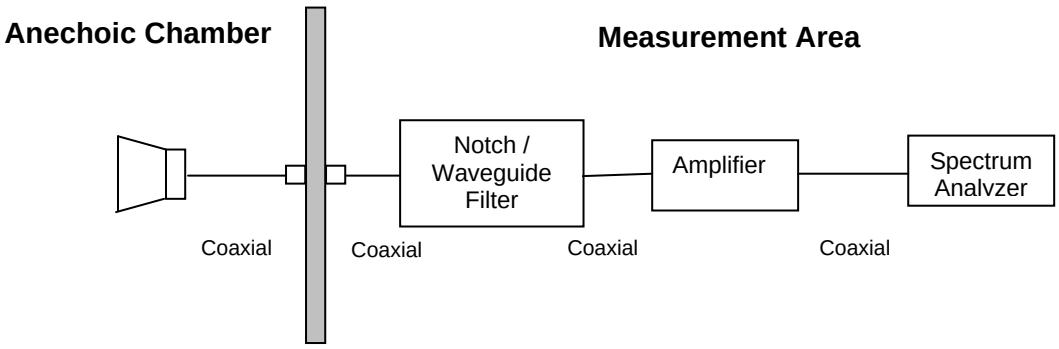
FCC, Part 15 Subpart C §15.407(b)(2), §15.205(a)/15.209(a)
Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7

Test Procedure

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.

Test Measurement Set up



Measurement set up for Radiated Emission Test

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 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

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

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

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

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

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

where P is the EIRP in Watts

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

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

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

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

TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 36 (5,180 MHz)

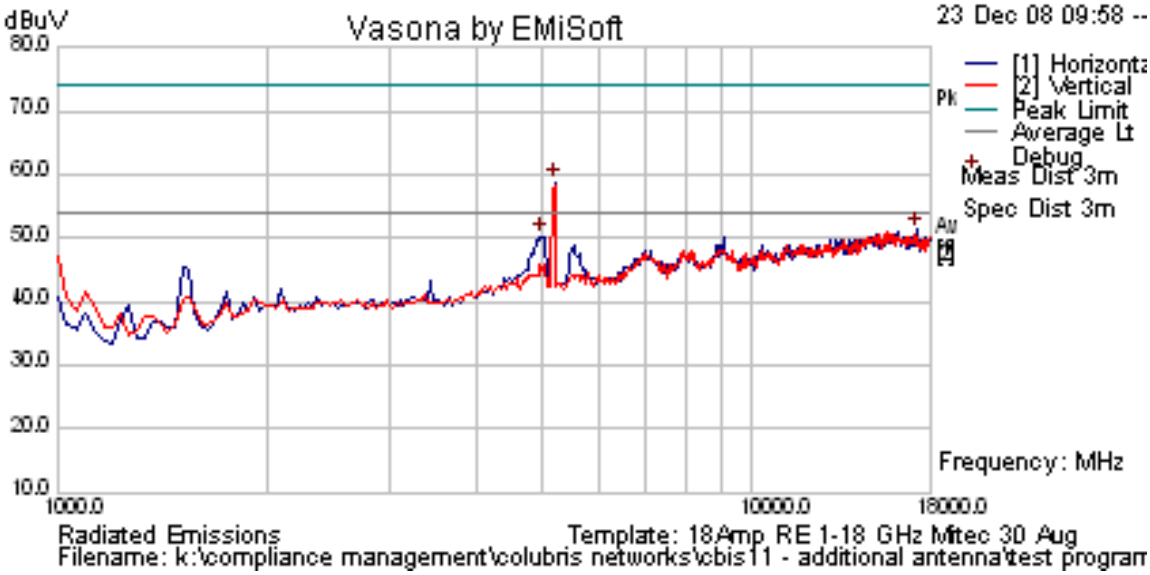
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 40 (5,200 MHz)

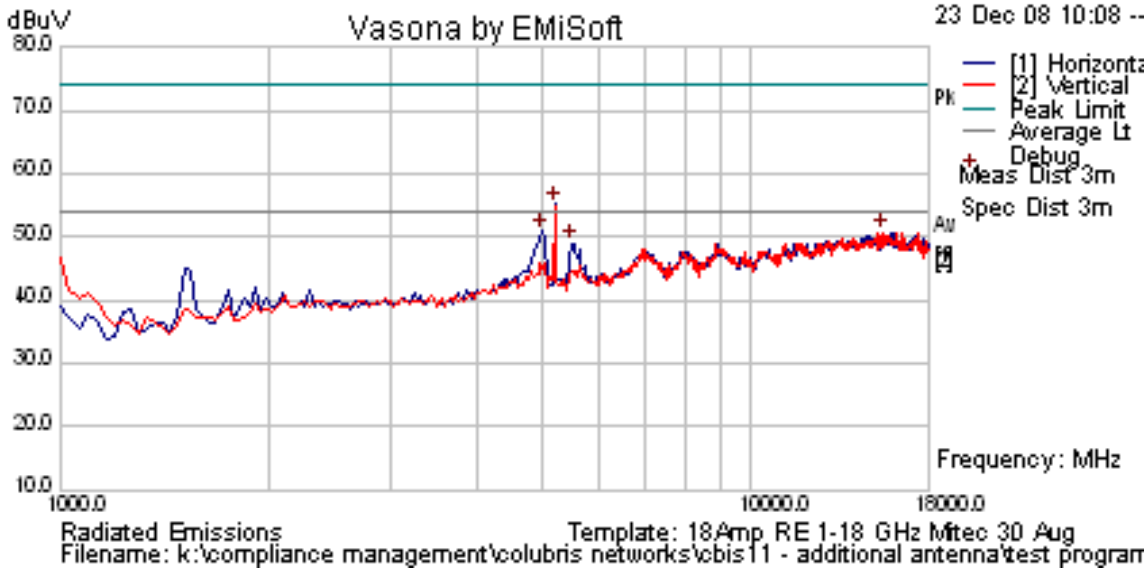
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 48 (5,240 MHz)

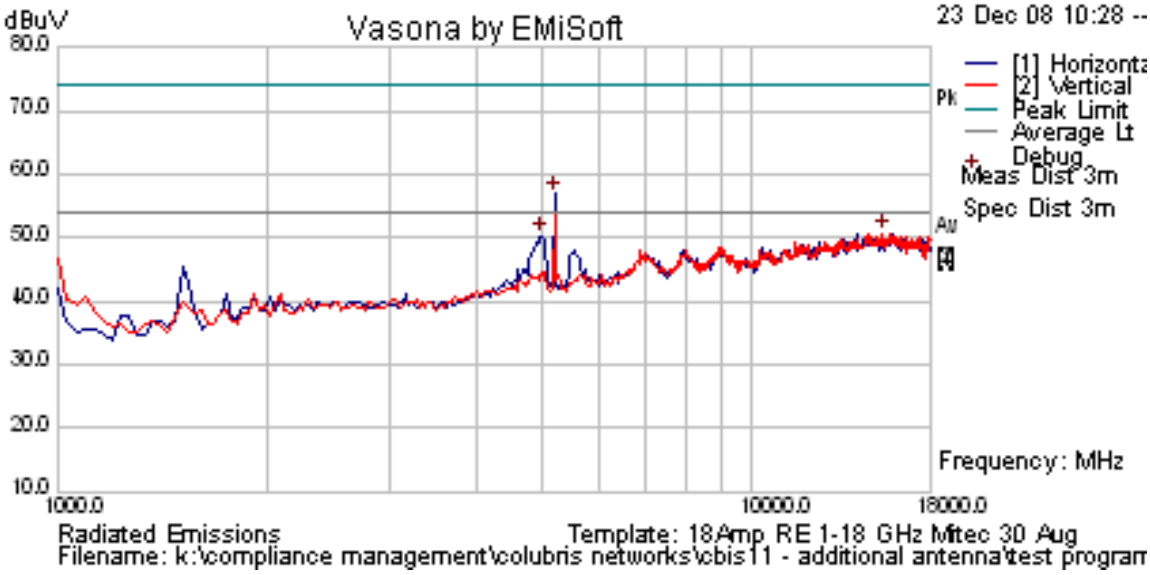
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 52 (5,260 MHz)

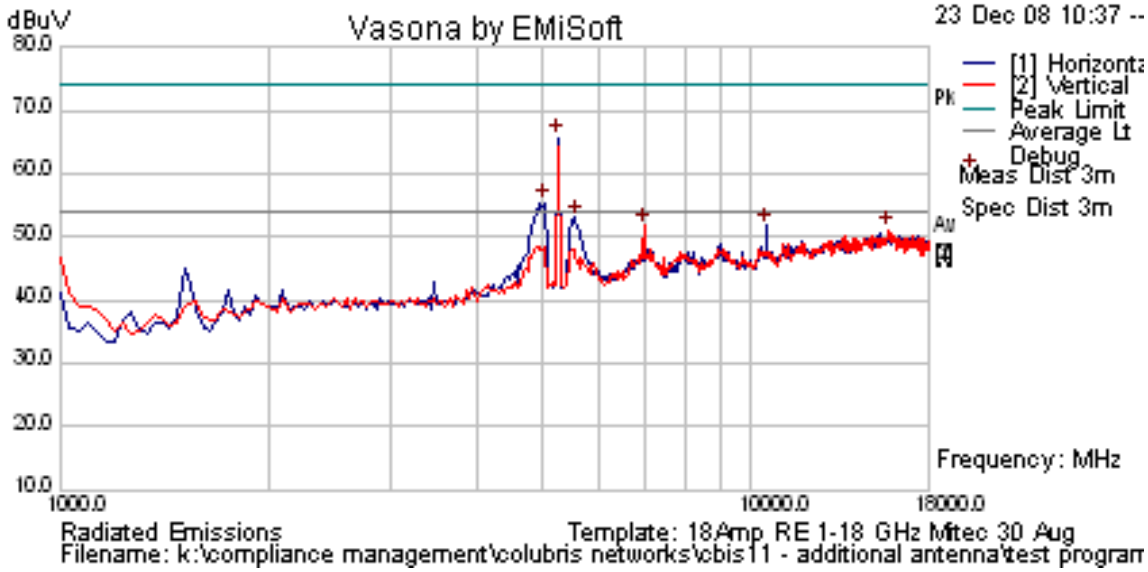
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

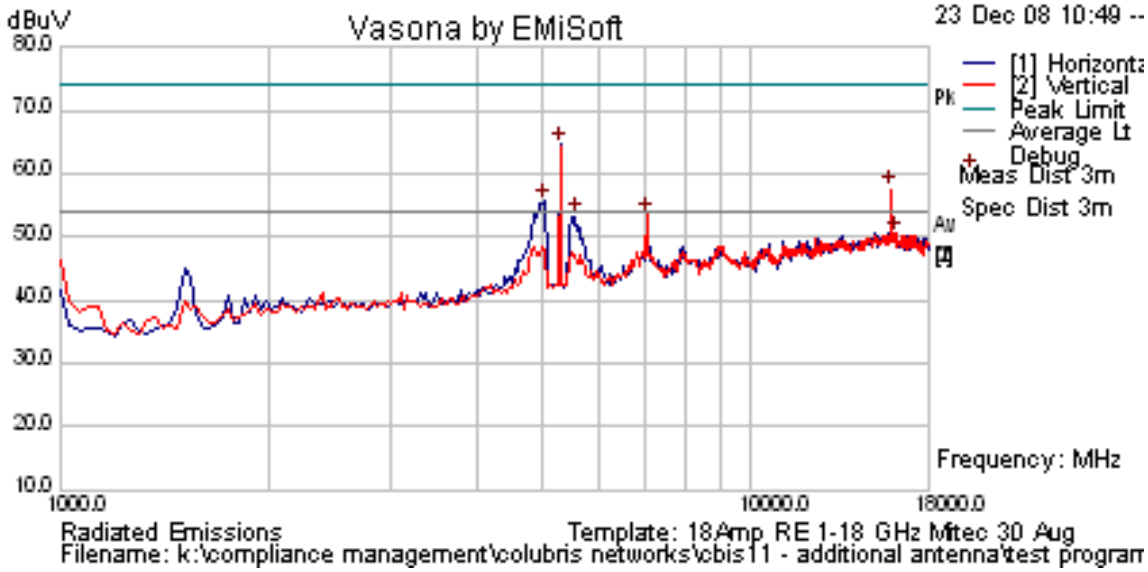
TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 60 (5,300 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
15896.471	50.49	8.85	-0.52	58.82	Peak Max	H	98	243	74	-15.18	Pass	RB
15896.471	34.13	8.85	-0.52	42.46	Average Max	H	98	243	54	-11.54	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

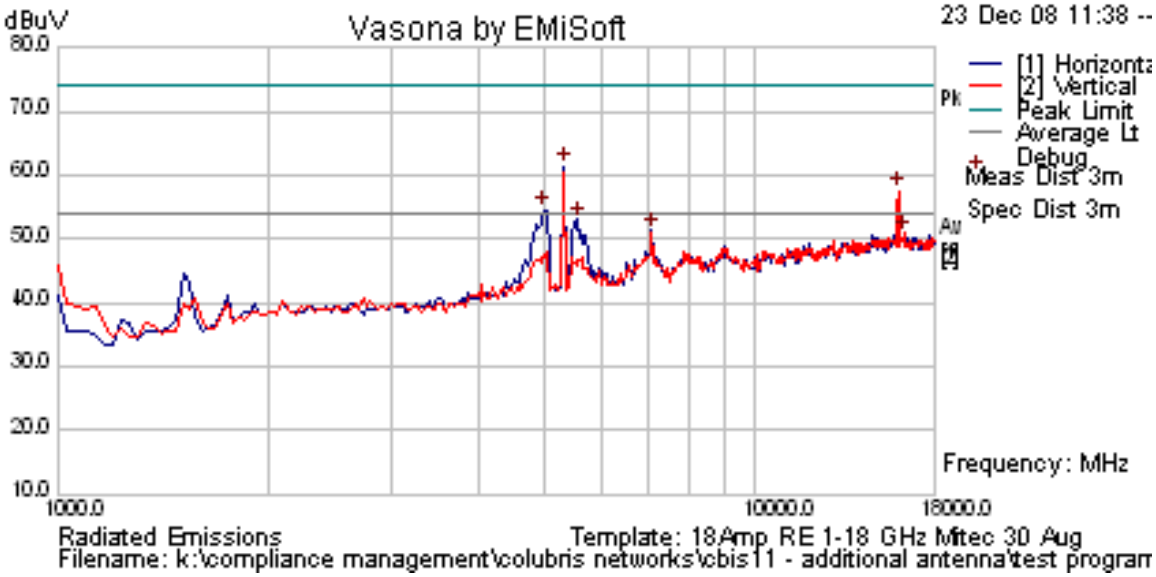
TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 64 (5,320 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
15967.134	51.25	8.97	-0.49	59.72	Peak Max	V	98	361	74	-14.28	Pass	RB
15967.134	33.69	8.97	-0.49	42.16	Average Max	V	98	361	54	-11.84	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 36 (5,180 MHz)

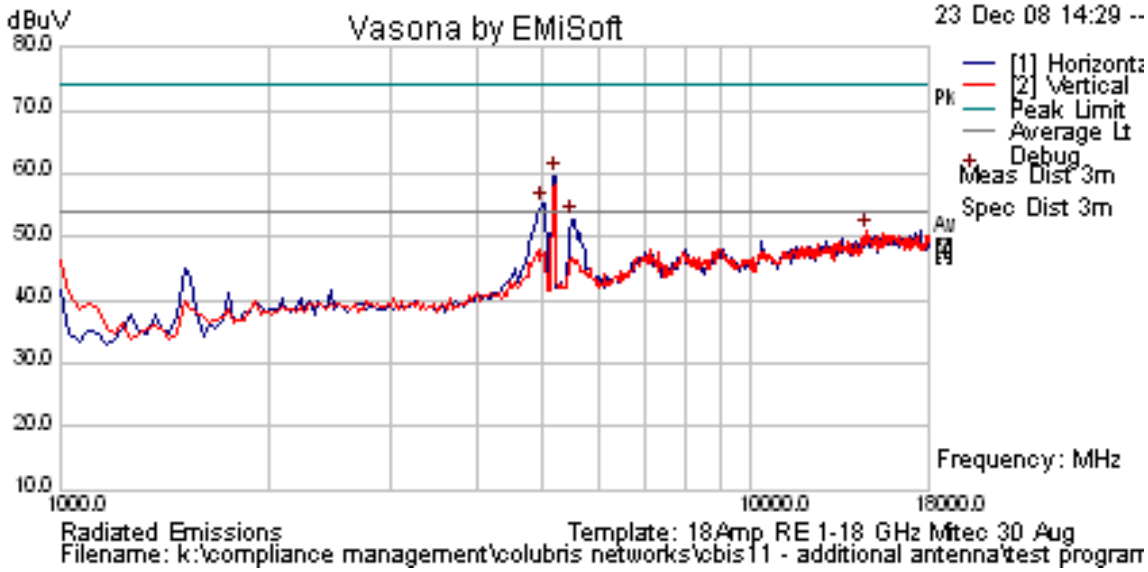
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 40 (5,200 MHz)

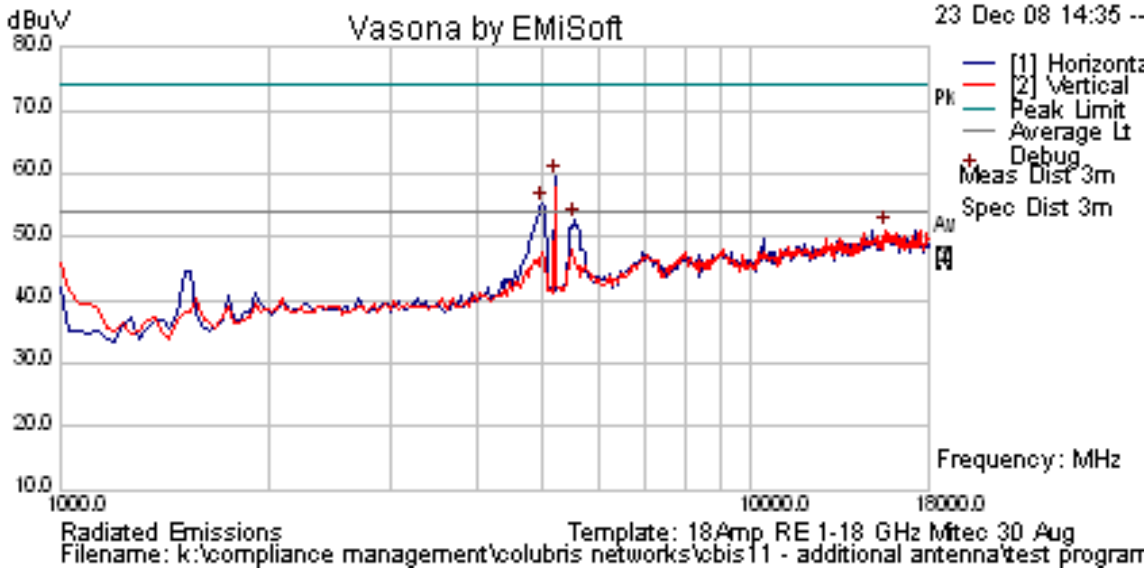
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 48 (5,240 MHz)

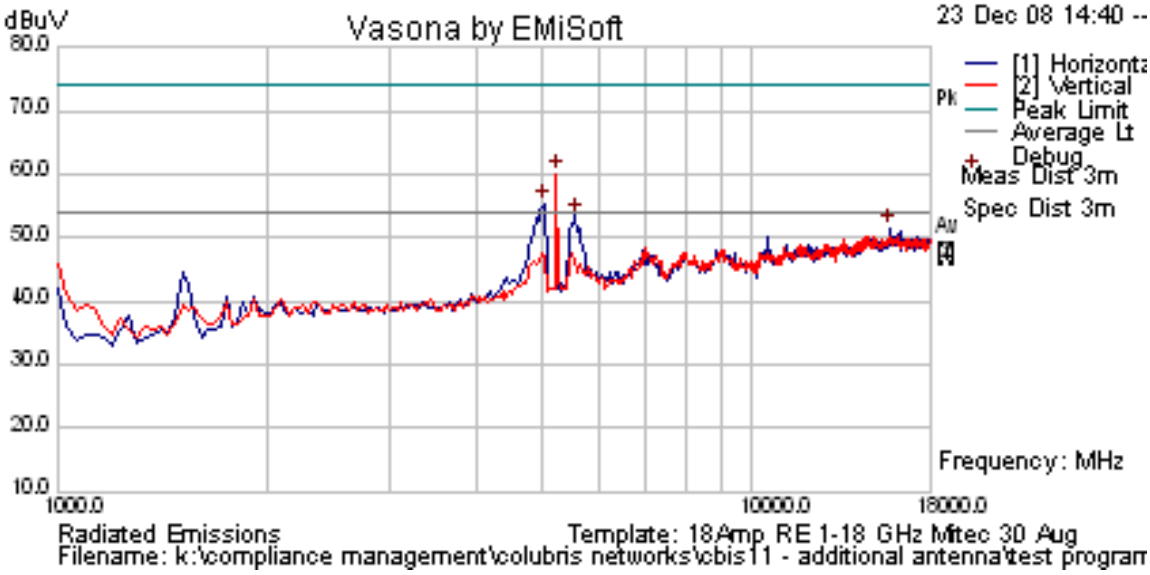
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 52 (5,260 MHz)

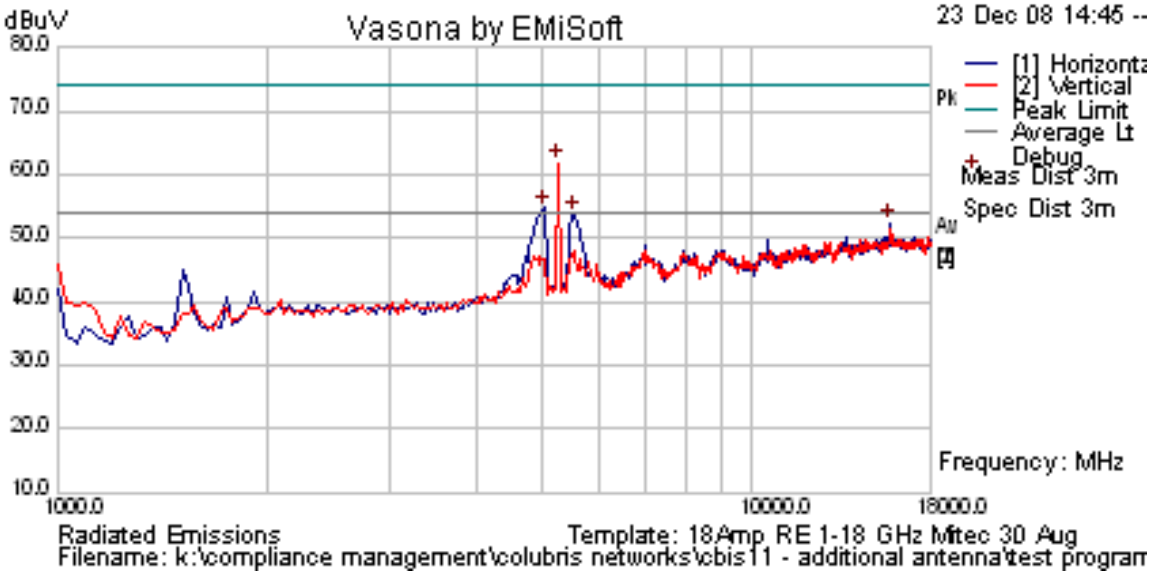
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

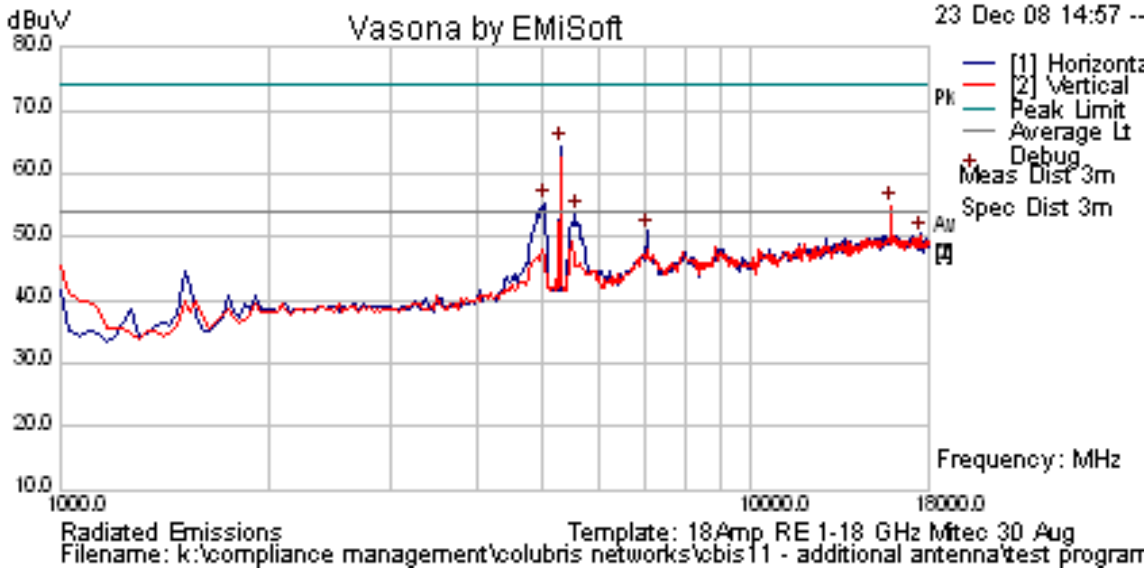
TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 60 (5,300 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
15901.724	50.24	8.86	-0.51	58.59	Peak Max	V	98	21	74	-15.41	Pass	RB
7066.633	53.27	5.39	-1.76	56.91	Peak Max	H	119	305	74	-17.09	Pass	RB
15901.724	34.49	8.86	-0.51	42.84	Average Max	V	98	21	54	-11.16	Pass	RB
7066.633	45.39	5.4	-1.88	44.91	Average Max	H	125	190	54	-5.09	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

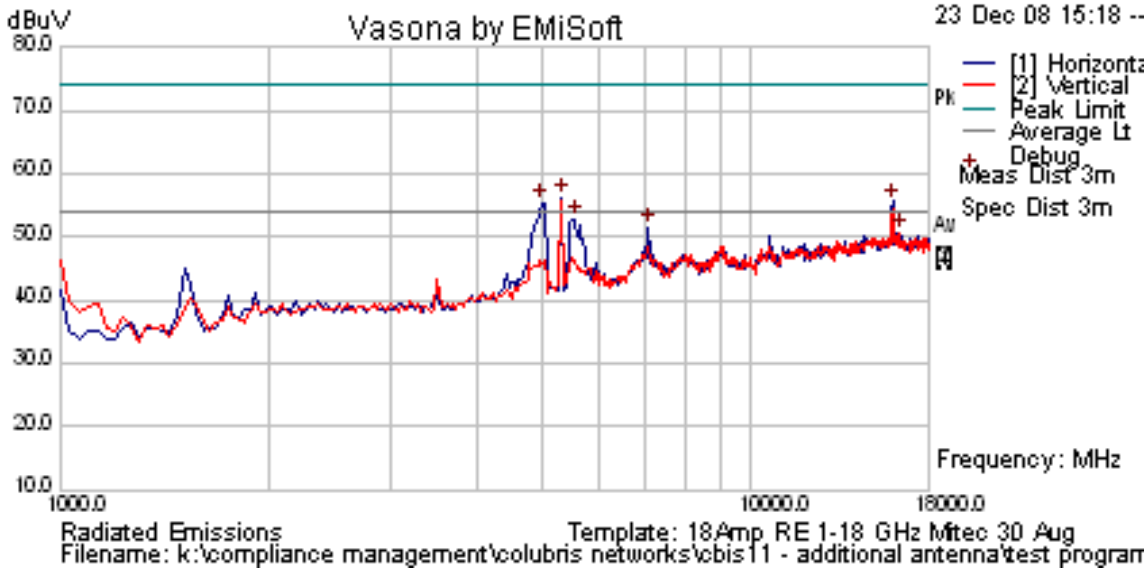
TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 64 (5,320 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
15963.619	51.38	8.96	-0.49	59.85	Peak Max	V	139	10	74	-14.15	Pass	RB
7093.106	50.73	5.4	-1.88	54.26	Peak Max	H	119	25	74	-19.74	Pass	RB
15963.619	34.42	8.96	-0.49	42.89	Average Max	V	139	10	54	-11.11	Pass	RB
7093.106	43.39	5.4	-1.88	46.91	Average Max	H	119	25	54	-7.09	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,190 MHz

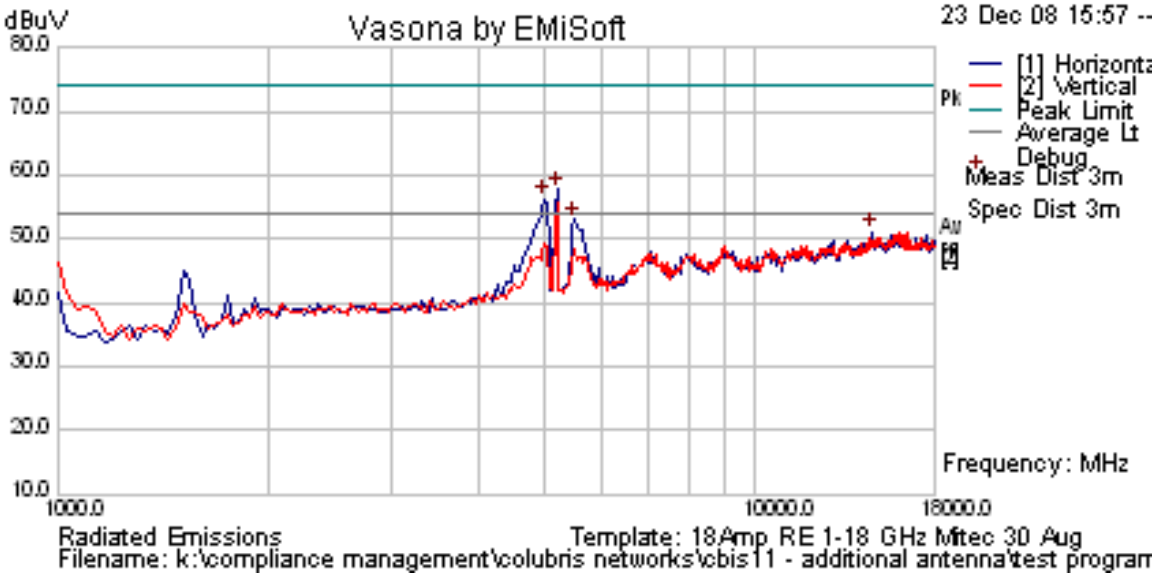
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,230 MHz

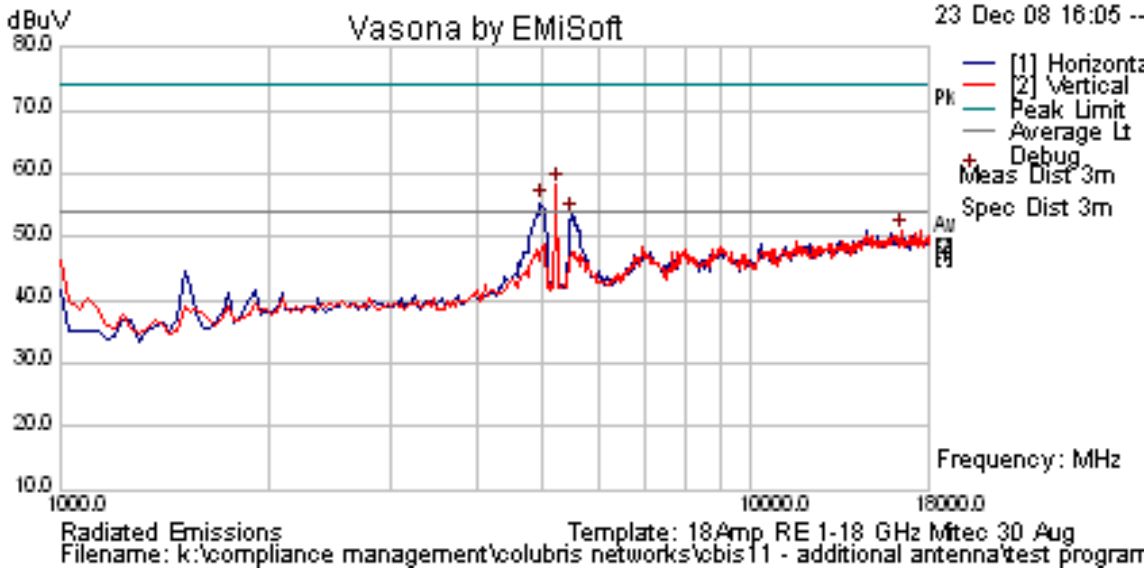
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

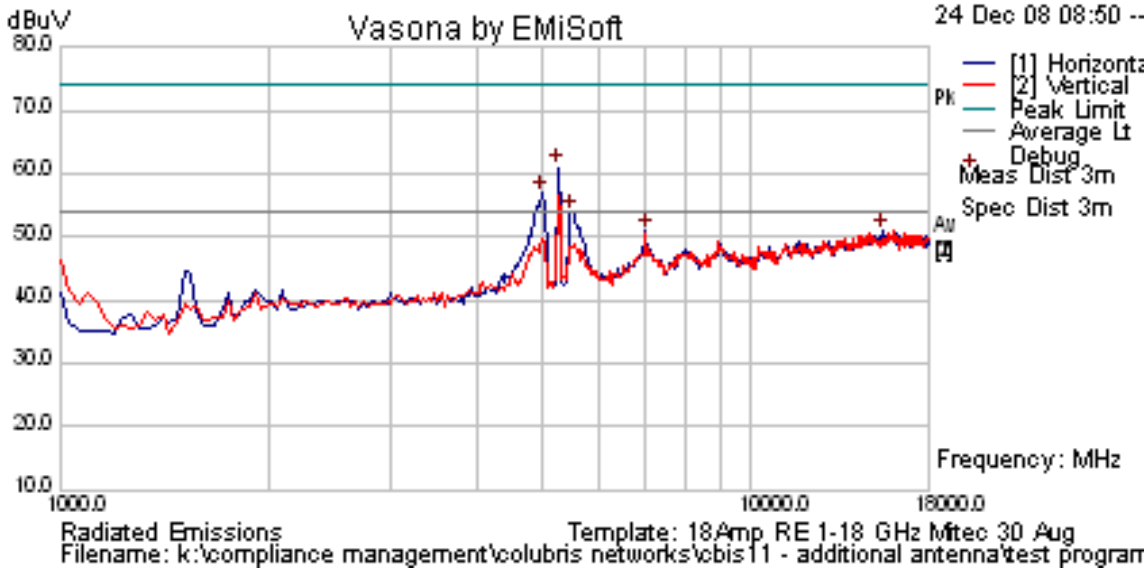
TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,270 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
7026.663	52.03	5.39	-1.61	55.81	Peak Max	H	127	311	74	-18.19	Pass	
7026.663	46.04	5.39	-1.61	49.81	Average Max	H	125	311	54	-4.19	Pass	

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

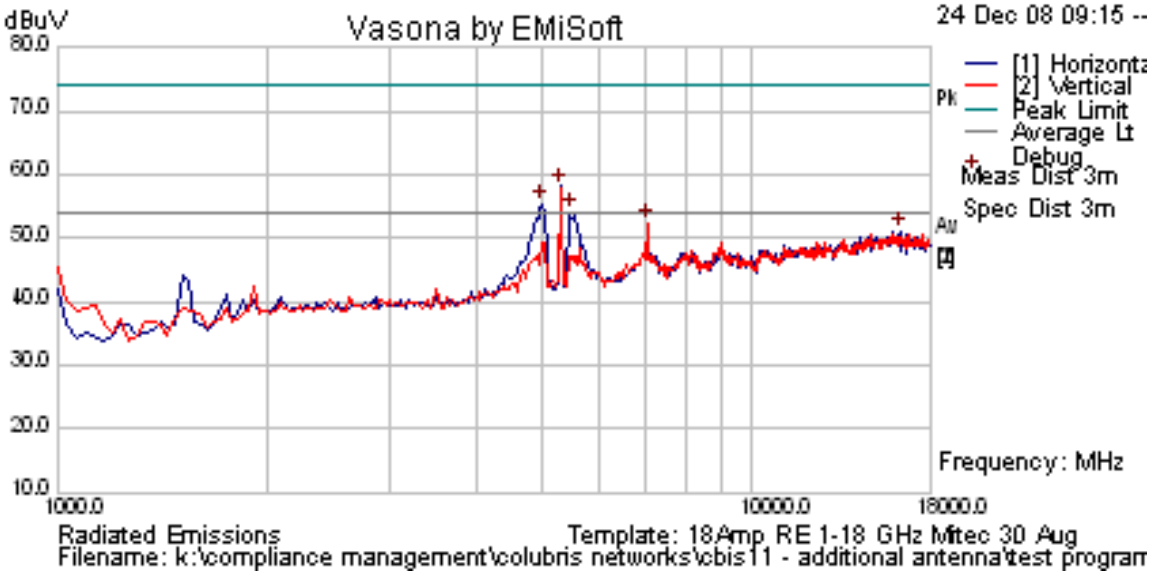
TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,310 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
7079.908	54.46	5.4	-1.82	58.04	Peak Max	V	161	360	74	-15.96	Pass	
7079.908	49.54	5.4	-1.82	53.12	Average Max	V	161	360	54	-0.88	Pass	

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 100 (5,500 MHz)

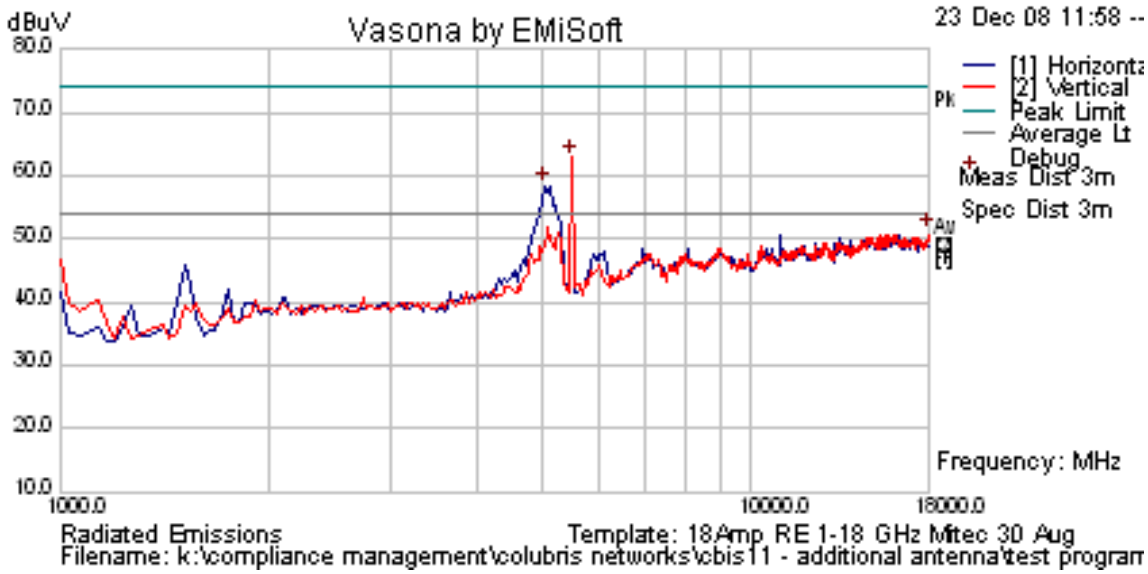
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

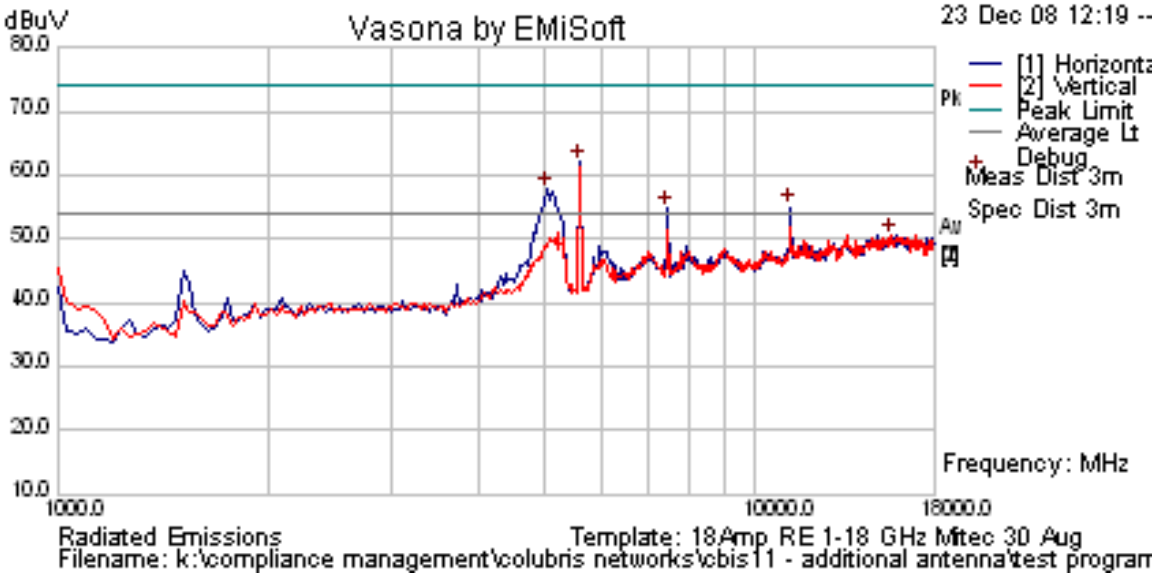
TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 120 (5,600 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
11199.92	54.6	6.9	-1.34	60.16	Peak Max	H	99	303	74	-13.84	Pass	RB
7466.781	55.11	5.47	-3.7	56.89	Peak Max	H	108	330	74	-17.11	Pass	RB
11199.92	39.71	6.9	-1.34	45.26	Average Max	H	99	303	54	-8.74	Pass	RB
7466.781	51.32	5.47	-3.7	53.09	Average Max	H	108	330	54	-0.91	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

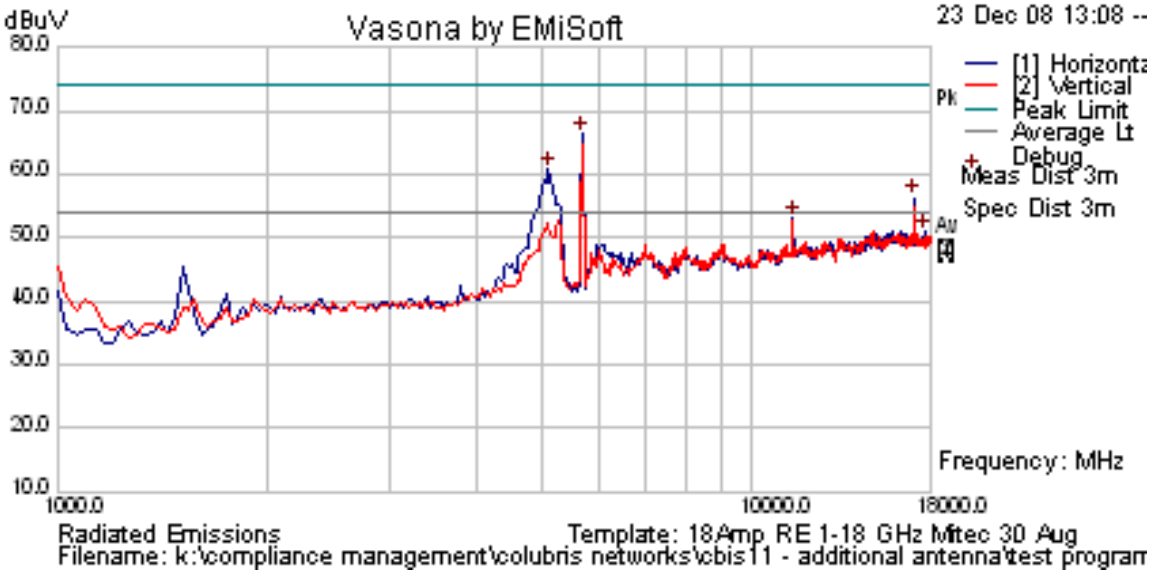
TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 140 (5,700 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
17096.56	49.99	8.53	-0.35	58.17	Peak Max	V	98	12	74	-15.83	Pass	RB
11402.068	51.12	6.82	-1.45	56.5	Peak Max	H	103	43	74	-17.5	Pass	RB
17096.56	34.59	8.53	-0.35	42.77	Average Max	V	98	12	54	-11.23	Pass	RB
11402.068	35.77	6.82	-1.45	41.15	Average Max	H	103	43	54	-12.85	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 100 (5,500 MHz)

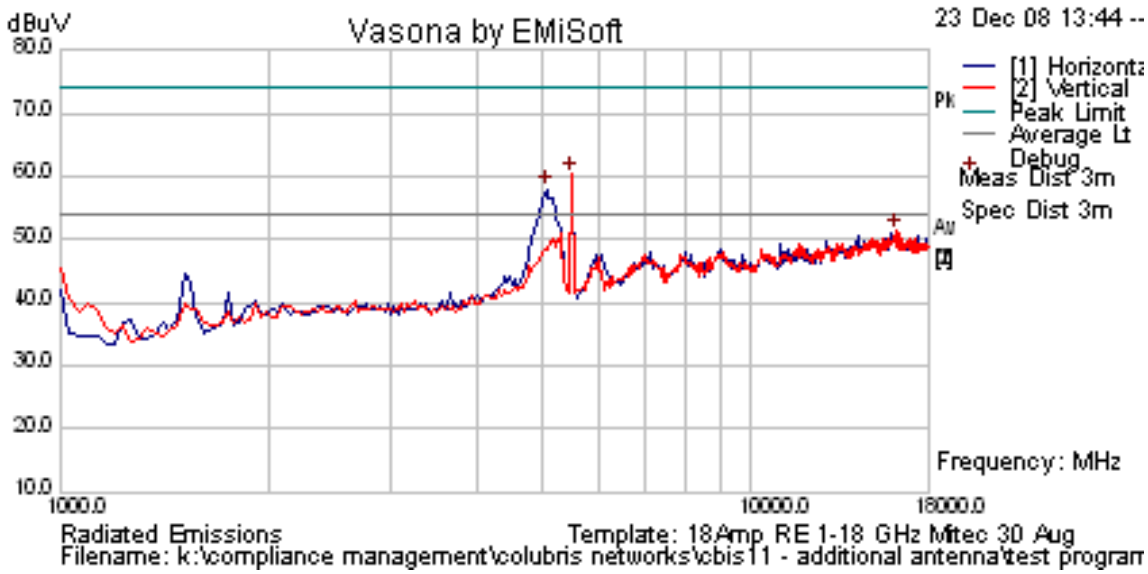
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

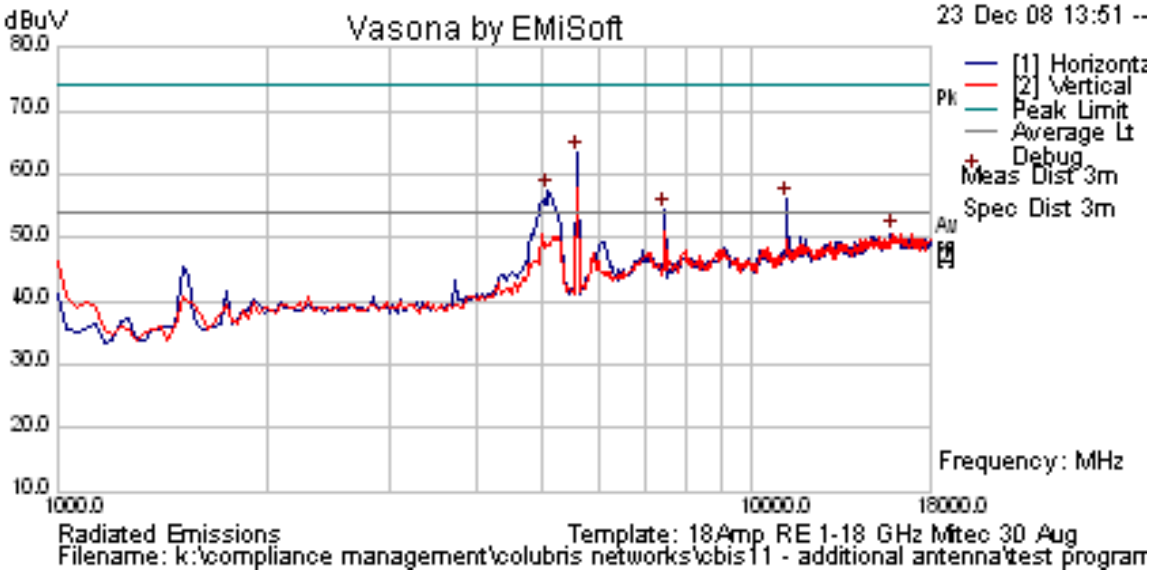
TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 120 (5,600 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
11199.439	53.01	6.9	-1.34	58.57	Peak Max	H	99	298	74	-15.43	Pass	
7466.691	57.12	5.47	-3.7	58.9	Peak Max	H	118	324	74	-15.1	Pass	
11199.439	37.94	6.9	-1.34	43.5	Average Max	H	99	298	54	-10.5	Pass	
7466.691	40.47	5.47	-3.7	42.24	Average Max	H	119	324	54	-11.76	Pass	

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

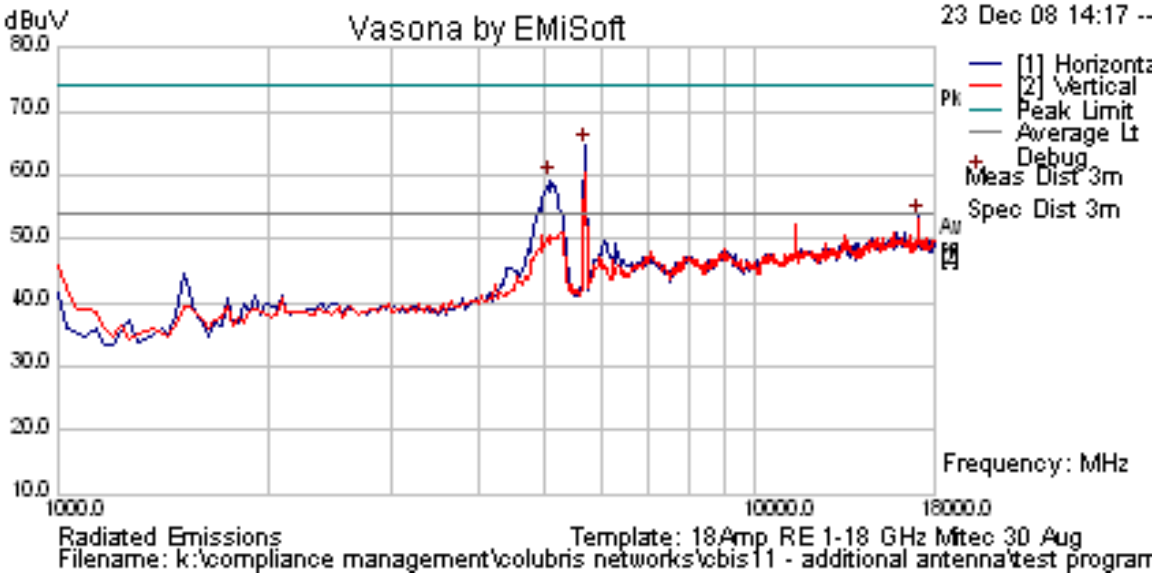
TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 140 (5,700 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
17096.56	49.99	8.53	-0.35	58.17	Peak Max	V	98	12	74	-15.83	Pass	
11402.068	51.12	6.82	-1.45	56.5	Peak Max	H	103	43	74	-17.5	Pass	
17096.56	34.59	8.53	-0.35	42.77	Average Max	V	98	12	54	-11.23	Pass	
11402.068	35.77	6.82	-1.45	41.15	Average Max	H	103	43	54	-12.85	Pass	

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

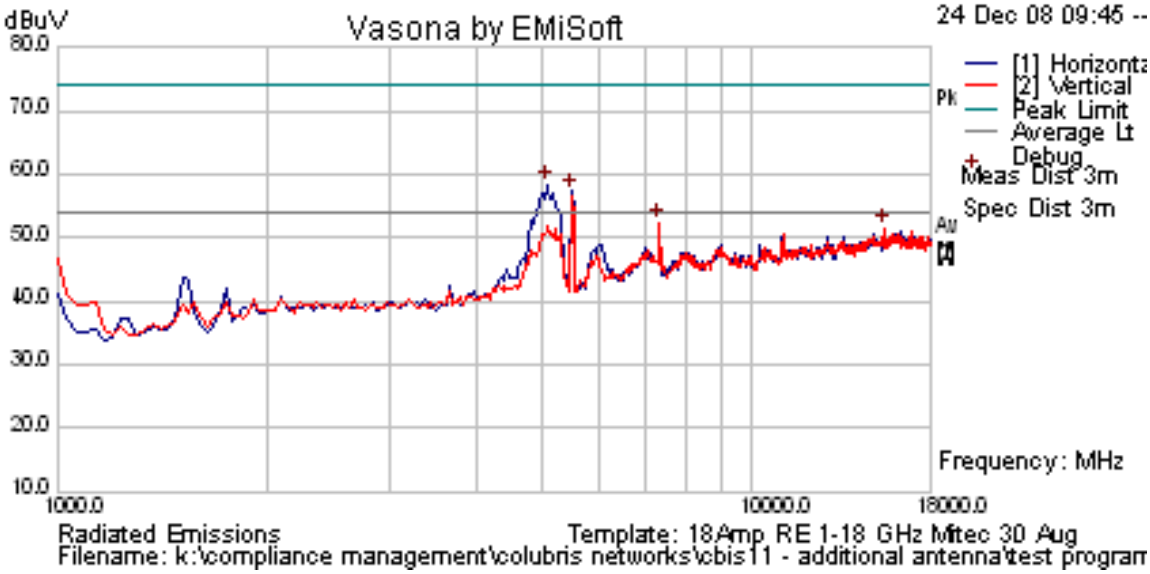
TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,510 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
7346.698	53.67	5.45	-3.02	56.1	Peak Max	H	104	38	74	-17.9	Pass	RB
7346.698	49.89	5.45	-3.02	52.32	Average Max	H	104	38	54	-1.68	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

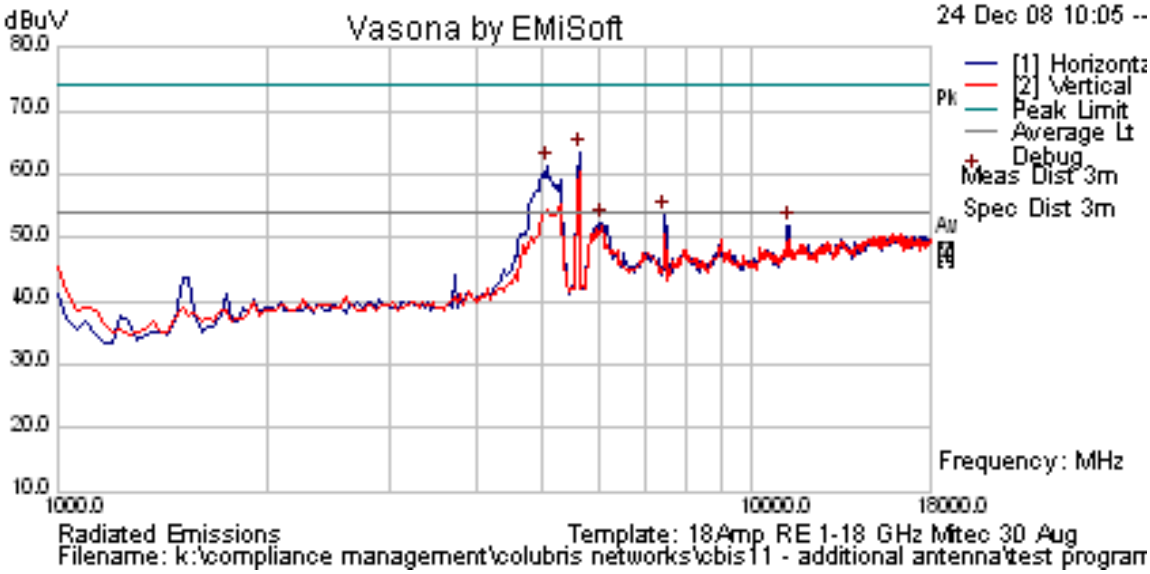
TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,620 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
7493.317	55.73	5.48	-3.79	57.41	Peak Max	H	135	321	74	-16.59	Pass	RB
11237.996	50.24	6.88	-1.43	55.69	Peak Max	H	101	311	74	-18.31	Pass	RB
7493.318	41.43	5.48	-3.79	43.11	Average Max	H	136	321	54	-10.89	Pass	RB
11237.996	36.25	6.88	-1.43	41.7	Average Max	H	101	311	54	-12.3	Pass	RB

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,690 MHz

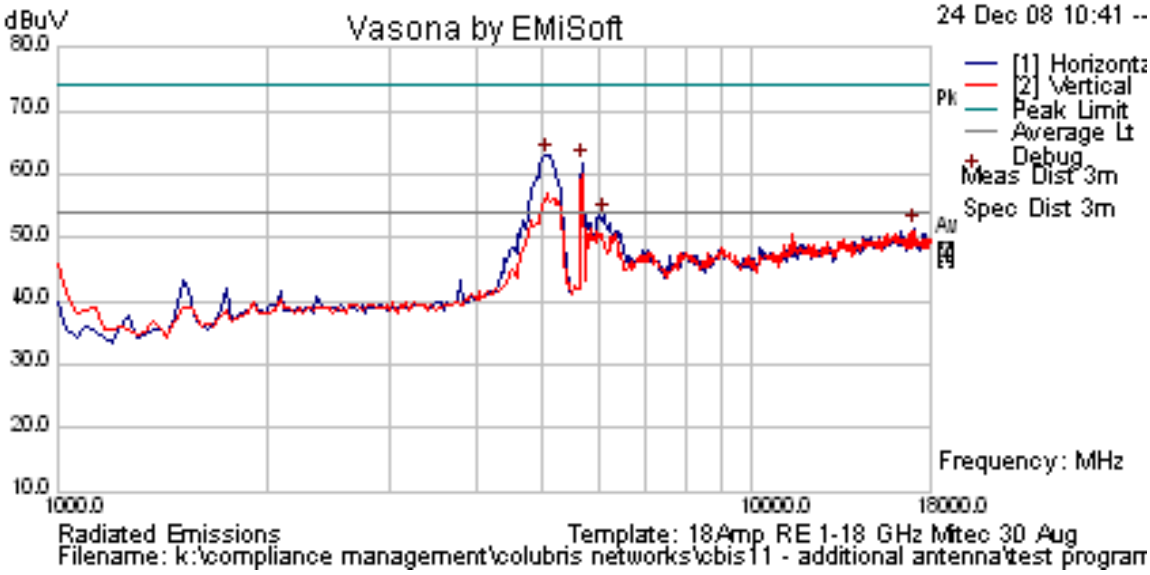
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Specification

Limits

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

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

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

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

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

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

RSS-Gen §6 Receiver Spurious Emission Standard
If a radiated measurement is made, all spurious emissions shall comply with the limits of the following Table. The resolution bandwidth of the spectrum analyzer shall be 100 kHz for spurious emission measurements below 1.0 GHz and 1.0 MHz for measurements above 1.0 GHz

§15.209 (a) Limit Matrix

Frequency(MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

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

5.1.2.2. Receiver Radiated Spurious Emissions (above 1 GHz)

Industry Canada RSS-Gen §4.8, §6

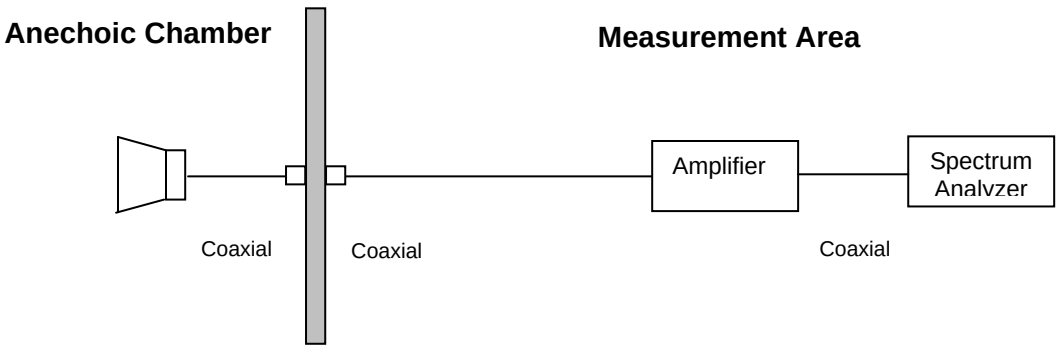
Test Procedure

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

Test Measurement Set up



Measurement set up for Radiated Emission Test

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 dBμV; Antenna Factor of 8.5 dB; Cable Loss of 1.3 dB; Falloff Factor of 0 dB, an Amplifier Gain of 26 dB and Notch Filter Loss of 1 dB. The Field Strength of the measured emission is:

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3 dBμV/m

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

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

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

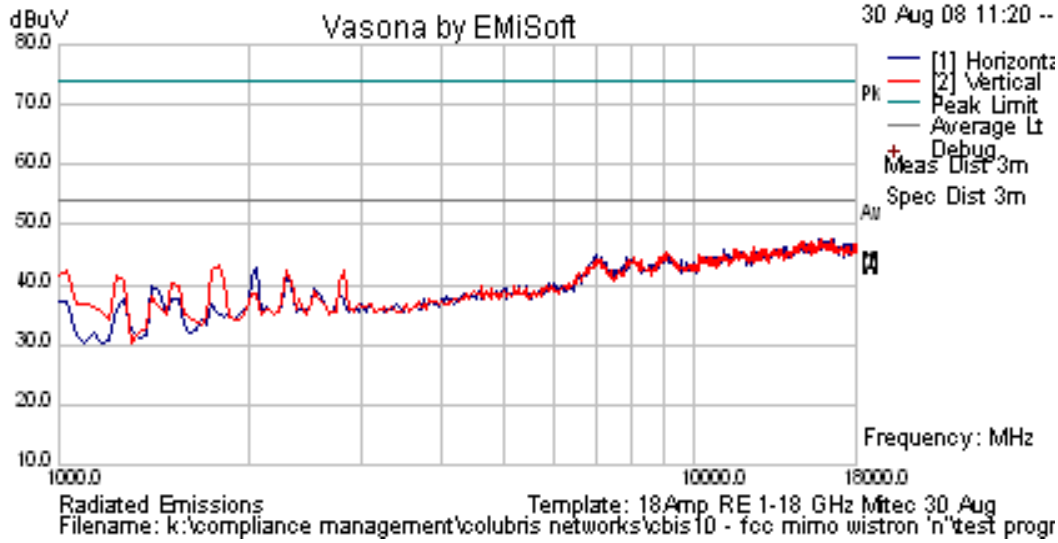
Receiver Radiated Spurious Emissions above 1 GHz

Channel 5180

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were found within 6 dB of the limit line

Channel 5180 MHz Leg/HT-20/HT-40
Receiver Radiated Emissions



The above plot is peak emissions only

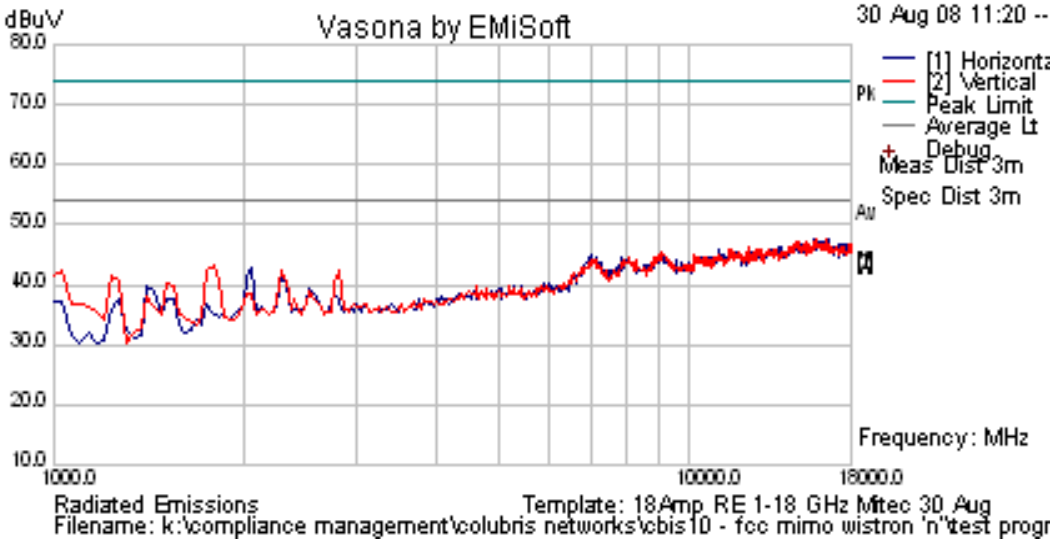
Receiver Radiated Spurious Emissions above 1 GHz

Channel 5260

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were found within 6 dB of the limit line

Channel 5260 MHz Leg/HT-20/HT-40
Receiver Radiated Emissions



The above plot is peak emissions only

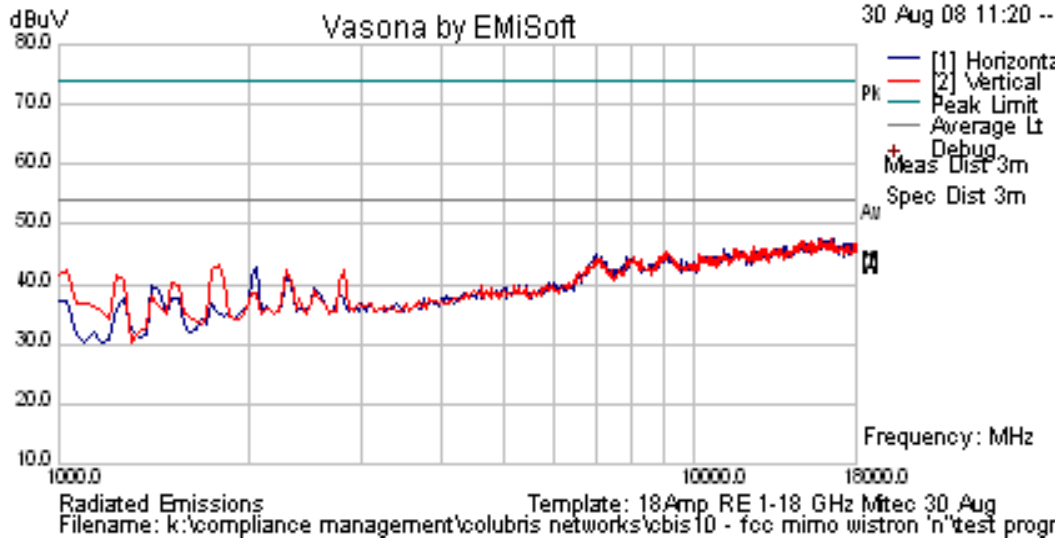
Receiver Radiated Spurious Emissions above 1 GHz

Channel 5600

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions were found within 6 dB of the limit line

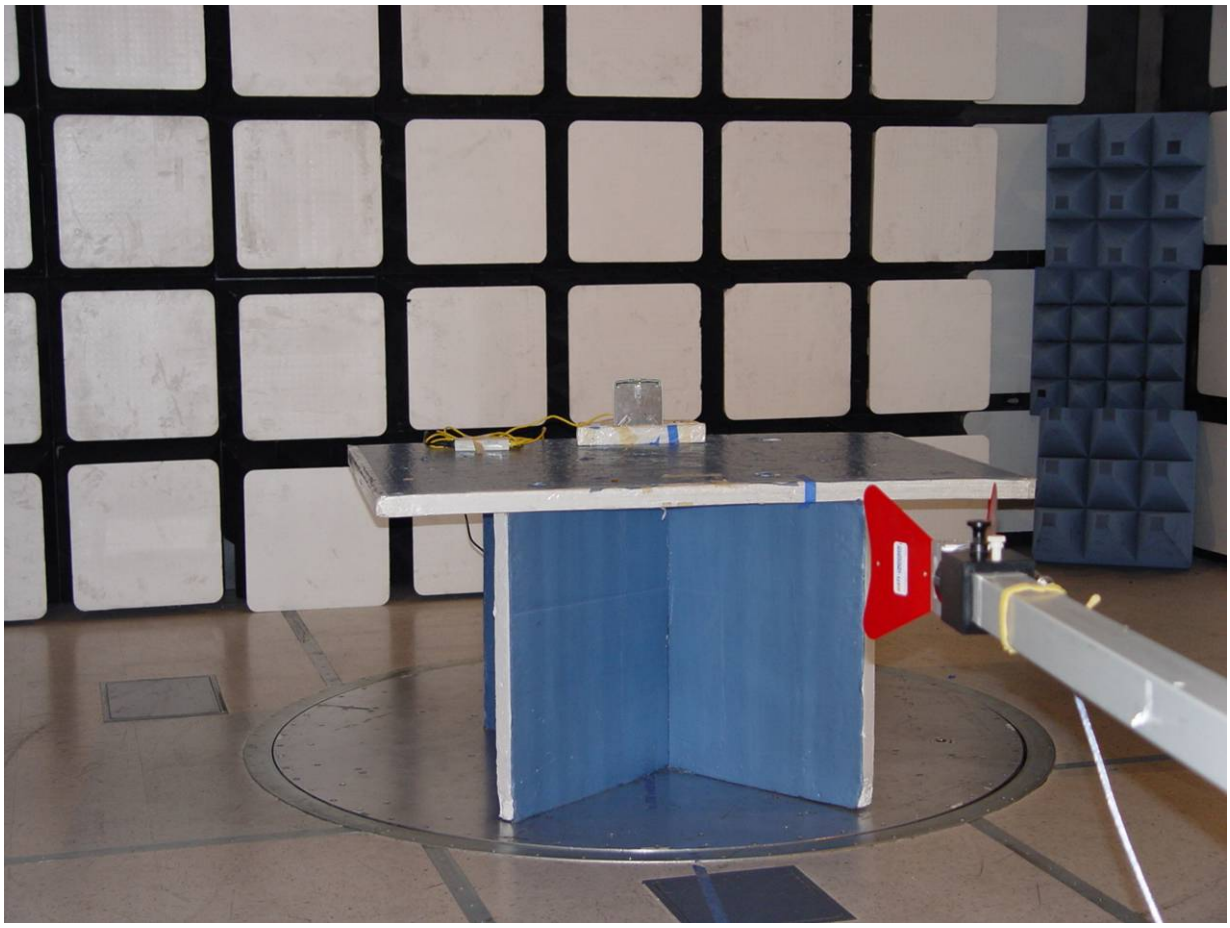
Channel 5600 MHz Leg/HT-20/HT-40
Receiver Radiated Emissions



The above plot is peak emissions only

6. PHOTOGRAPHS

6.1. Radiated Emissions > 1GHz



7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0088	Spectrum Analyzer	Hewlett Packard	8564E	3410A00141
0134	Amplifier	Com Power	PA 122	181910
0158	Barometer /Thermometer	Control Co.	4196	E2846
0193	EMI Receiver	Rhode & Schwartz	ESI 7	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	None
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	3140A01285
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52
0190	LISN	Rhode & Schwartz	ESH3Z5	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0301	5.6 GHz Notch Filter	Micro-Tronics	RBC50704	001
0302	5.25 GHz Notch Filter	Micro-Tronics	BRC50703	002
0303	5.8 GHz Notch Filter	Micro-Tronics	BRC50705	003
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002
0335	1-18GHz Horn Antenna	ETS- Lindgren	3117	00066580
0337	Amplifier	MiCOM Labs	--	--
0338	Antenna	Sunol Sciences	JB-3	A052907

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