

Test of 651-XX 802.11a/b/g/n Wireless Controller

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

Test Report Serial No.: ARUB28-A4 Rev A



# TEST REPORT

FROM



Test of 651-XX 802.11a/b/g/n Wireless Controller  
to

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

Test Report Serial No.: ARUB28-A4 Rev A

Note: this report contains data with regard to the 5,150 to 5,250 MHz band for the Aruba 651-XX Wireless Controller. 2.4 and 5.8 GHz test data are reported in MiCOM Labs test report ARUB28-A2.

This report supersedes None

Applicant: Aruba Networks, Inc  
1344 Crossman Avenue  
Sunnyvale  
CA 94089, USA

Product Function: Wireless Controller

Copy No: pdf Issue Date: 15th May 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](http://www.micomlabs.com)



CERTIFICATE #2381.01

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



**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
**To:** FCC 47 CFR Part 15.407 & IC RSS-210  
**Serial #:** ARUB28-A4 Rev A  
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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](http://www.a2la.org) test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <http://www.a2la.org/scopepdf/2381-01.pdf>



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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).



AMERICAN ASSOCIATION FOR LABORATORY ACCREDITATION  
CORPORATE  
SEAL  
1978  
DISTRICT OF COLUMBIA  
A2LA

Presented this 26<sup>th</sup> 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.

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## 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	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	I	

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## DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft		
Rev A	15 <sup>th</sup> May 2009	Initial Release

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## 1. TEST RESULT CERTIFICATE

Applicant:	Aruba Networks, Inc 1344 Crossman Avenue Sunnyvale CA 94089, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	Wireless Controller	Tel:	+1 925 462 0304
Model:	651-XX	Fax:	+1 925 462 0306
S/N:	AF0000495 (Conducted Testing) AF0000185 (Radiated Testing)		
Test Date(s):	15th Feb to 6th March 2009	Website:	www.micomlabs.com

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

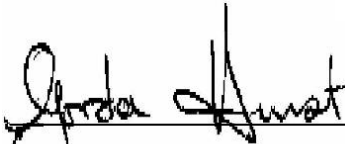
MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

### Notes:

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

Approved & Released for MiCOM Labs, Inc. by:

  
 Graeme Grieve  
 Quality Manager MiCOM Labs,

  
 Gordon Hurst  
 President & CEO MiCOM Labs, Inc.



CERTIFICATE #2381.01

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## 2. REFERENCES AND MEASUREMENT UNCERTAINTY

### 2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 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	14 <sup>th</sup> 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

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## 2.2. Test and Uncertainty Procedures

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

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

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

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### 3. PRODUCT DETAILS AND TEST CONFIGURATIONS

#### 3.1. Technical Details

Details	Description
Purpose:	Test of the 651-XX 802.11a/b/g/n Wireless Controller in the frequency ranges 5150 to 5250 MHz to FCC Part 15.407 and Industry Canada RSS-210 regulations.
Applicant:	Aruba Networks, Inc 1344 Crossman Avenue Sunnyvale CA 94089, USA
Manufacturer:	As applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	ARUB28-A4 Rev A
Date EUT received:	15 <sup>th</sup> February 2009
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210
Dates of test (from - to):	15 <sup>th</sup> February to 6 <sup>th</sup> March 2009
No of Units Tested:	Two (separate units for conducted and radiated)
Type of Equipment:	802.11a/b/g/n Wireless Controller, 3x3 Spatial Multiplexing MIMO configuration
Applicants Trade Name:	Wireless Controller
Model(s):	651-XX
Software Release	3.4.0.0
Location for use:	Indoor
Declared Frequency Range(s):	5,150 to 5,250 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:	100-240VAC, 50-60Hz, 2.5A max.
Operating Temperature Range:	Declared range 0 to +40°C
ITU Emission Designator:	11a 17M0D1D HT-20 18M1D1D HT-40 37M9D1D
Frequency Stability:	±20 ppm max
Equipment Dimensions:	13" x 8.5" x 1.5"
Weight:	4.6 lbs
Primary function of equipment:	Wireless Controller

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### 3.2. Scope of Test Program

#### RF Testing

The scope of the compliance program was to test the Aruba 651-XX wireless Access Point, 3x3 Spatial Multiplexing MIMO configurations in the frequency ranges 5150 - 5250 MHz or compliance against FCC 47 CFR Part 15.407 and Industry Canada RSS-210 specifications.

The Aruba Networks Inc 651-XX has external antennas with reverse SMA connectors. The device has two radios with three antennae (3x3). The antennas used with the 651-XX are detailed in section 3.4 "Antenna Details".

#### Original Equipment Manufacturers (OEM) Labeling of product

The 651-XX (where x=a to z, or "blank") is the original equipment manufacturer's model number. The equipment is also sold for distribution as model number OAW-4306GW-XX (where x=a to z, or "blank").

#### Aruba Networks 651-XX Wireless Controller (Front)



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**Aruba Networks  
651-XX Wireless Controller (Rear)**





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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	802.11a/b/g/n Wireless Controller	Aruba Networks	651-XX	AF0000495 Conducted AF0000185 Radiated
Support	Laptop PC	IBM	Thinkpad	None

### 3.4. Antenna Details

1. 5150 – 5725 MHz
  - a. AP-ANT-1B, 5.8 dBi Omni-Directional

### 3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 4 GIGE Ethernet with POE
2. 2 GIGE Ethernet without POE
3. 2 SFP uplink ports
4. 4 USB ports
5. 1 Console serial port (RJ-45)
6. 1 PCI Express card slot
7. 3 Antenna ports (reverse SMA)
8. IEC 320 AC input connector

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### 3.6. Test Configurations

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

Matrix of test configurations

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

#### Conducted Testing

Conducted test parameters were performed on a single antenna connector. The performance testing was carried out on the transmitter port exhibiting the highest output power. A table of output power V's antenna port for each operational mode is provided below. The power from each transmitter is provided together with the aggregate power for all three transmitters. Complete characterization for each chain has been provided only for the power settings utilized in the generation of this report. Aggregate power measurements are provided for all power settings.

#### Channel 5,200 MHz

Configuration	ART Power Setting	Tx 1 Measured Pwr (dBm)	Tx 2 Measured Pwr (dBm)	Tx 3 Measured Pwr (dBm)	Aggregate Measured Pwr (dBm)
Legacy a 6 MBit/sec	19	18.95	19.1	19.72	23.54
	18	17.85	18.12	18.66	22.71
	17	16.81	16.95	17.66	21.49
	16	15.85	16.25	17.01	20.67
	15	14.9	14.88	15.76	19.51
	14	13.94	13.81	14.73	18.51
	13	13.01	12.86	13.87	17.47
	12	12.03	11.95	12.63	16.5
	11	10.91	10.77	11.65	15.33
	10	10.01	9.99	10.59	14.35
	9	8.82	9.49	10.53	14.07
	8	7.78	8.55	9.54	13.02
	7	6.78	7.47	8.67	12.03
	6	5.64	6.41	7.56	10.85
	5	4.66	5.49	6.71	9.98
	4	3.47	4.22	5.63	8.87
	3	2.36	2.71	4.55	7.48
2	1.13	1.81	3.48	6.35	
1	-0.25	0.71	2.55	5.3	

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**Channel 5,200 MHz**

Configuration	ART Power Setting	Tx 1 Measured Pwr (dBm)	Tx 2 Measured Pwr (dBm)	Tx 3 Measured Pwr (dBm)	Aggregate Measured Pwr (dBm)
<b>HT-20, 6.5 MCS</b>	19	18.9	19.11	19.56	23.71
	18	18.01	18.03	18.63	22.65
	17	16.81	16.96	17.73	21.55
	16	15.78	16.01	16.82	20.52
	15	14.96	14.84	15.81	19.56
	14	13.79	13.81	14.85	18.49
	13	13.02	12.75	13.78	17.44
	12	11.92	11.74	12.72	16.43
	11	10.95	10.77	11.76	15.37
	10	9.96	9.81	10.58	14.34
	9	8.81	9.52	10.78	13.97
	8	7.75	8.42	9.51	12.94
	7	6.8	7.47	8.52	11.91
	6	5.64	6.33	7.49	10.85
	5	4.61	5.32	6.55	9.85
	4	3.56	4.25	5.63	8.71
	3	2.34	2.86	4.46	7.51
	2	1.15	1.74	3.45	6.37
	1	0	0.61	2.54	5.17

**Channel 5,200 MHz**

Configuration	ART Power Setting	Tx 1 Measured Pwr (dBm)	Tx 2 Measured Pwr (dBm)	Tx 3 Measured Pwr (dBm)	Aggregate Measured Pwr (dBm)
<b>HT-40, 13.5 MCS</b>	19	18.52	19.01	19.6	23.59
	18	17.65	18.01	18.37	22.43
	17	16.64	17.01	17.4	21.44
	16	15.51	15.77	16.48	20.27
	15	14.52	14.92	15.59	19.37
	14	13.65	13.73	14.44	18.24
	13	12.61	12.71	13.52	17.31
	12	11.85	11.78	12.67	16.39
	11	10.92	10.82	11.56	15.35
	10	9.81	9.84	10.51	14.35
	9	9.05	8.96	9.54	13.35
	8	7.95	8.61	9.51	12.99
	7	7.11	7.71	8.57	12.15
	6	6.1	6.71	7.78	11.21
	5	5	5.62	6.83	10.14
	4	4.07	4.71	5.87	9.21
	3	3.02	3.71	4.91	8.14
	2	1.85	2.44	3.87	7
	1	0.72	1.15	2.82	5.91

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## Antenna Test Configurations for Radiated Emissions

### Spurious Emission and Band-Edge Test Strategy

When testing radiated spurious emissions and band-edge three identical antennae were connected to the EUT at all times. Transmission during this test process simulated a typical installation. Results for the following configurations are provided in this report.

#### Legacy

AP-ANT-1B
a 5180
a 5200
a 5240
BE a 5150
Pk a 5180
Pk a 5200
Pk a 5240

KEY;-

BE – Band-Edge

PK - Peak Emission

#### HT-20

AP-ANT-1B
a 5180
a 5200
a 5240
BE a 5150
Pk a 5180
Pk a 5200
Pk a 5240

#### HT-40

AP-ANT-1B
a 5190
a 5230
BE a 5150
Pk a 5190
Pk a 5230



### 3.7. Equipment Modifications

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

#### EUT Software Power Settings - Radiated Testing

1. Reduction in output power to meet band-edge requirements was required in certain circumstances. When testing radiated spurious emissions the following matrix was generated identifying the amended power settings. The matrix identifies whether the reduction in power required bringing the EUT into compliance.

The last column amends the peak power measurements identified in Section 5.1.2 'Transmit Output Power' as a result of the band-edge power reduction.

5150 – 5250 MHz				
Channel	ART Power	Passing ART Power	Data Rate	Amended Power(s) (dBm)
36 5180 MHz 11a	19	14	6 Mb/S	18.51
36 5180 MHz HT-20	19	14	6.5 MCS	18.49
38 5190 MHz HT-40	19	12.5	13.5 MCS	16.80

### 3.8. Deviations from the Test Standard

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

1. None

### 3.9. Subcontracted Testing or Third Party Data

1. NONE



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#### 4. TEST SUMMARY

##### List of Measurements

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

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

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**List of Measurements (continued)**

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

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.407(b)(2) 15.205(a) 15.209(a) 2.2 2.6 A9.3(2) 4.7	Radiated Emissions		Radiated	Complies	5.1.7
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.1.7.1
	Radiated Band Edge	Band edge results		Complies	5.1.7.1
RSS-GEN 6	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.1.7.2
15.407(b)(6) 15.205(a) 15.209(a) 2.2	Radiated Emissions	Emissions <1 GHz (30M-1 GHz)		Complies	5.1.7.3
15.407(b)(6) 15.207 7.2.2	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	Complies	5.1.8

**List of Measurements (cont'd)**

**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

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## 5. TEST RESULTS

### 5.1. Device Characteristics

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

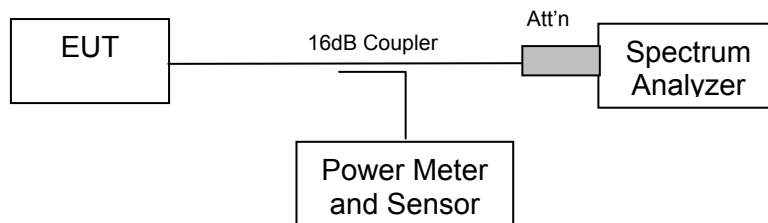
**FCC, Part 15 Subpart C §15.407(a)**

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

#### Test Procedure

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

#### Test Measurement Set up



Measurement set up for 26 dB and 99 % bandwidth test

#### Radio Parameters

Duty Cycle: 100%

Output: Modulated Carrier

Power: Maximum Default Power



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

Ambient conditions.

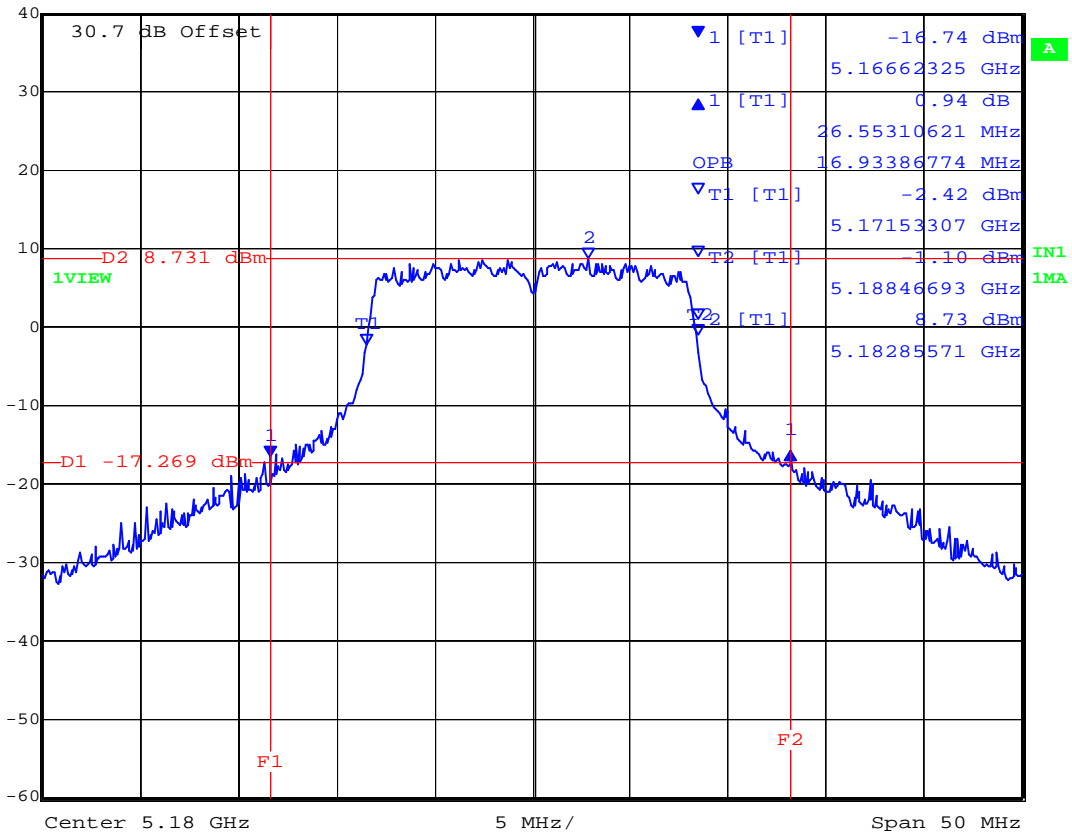
Temperature: 17 to 23 °C    Relative humidity: 31 to 57 %    Pressure: 999 to 1012 mbar

**TABLE OF RESULTS – 802.11a Legacy**

Center Frequency (MHz)	26 dB Bandwidth (MHz)	99 % BW (MHz)
5,180	26.553	16.934
5,200	25.451	16.934
5,240	27.455	17.034

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

Max/Ref Lvl    Delta 1 [T1]    RBW    200 kHz    RF Att    20 dB  
 40 dBm    0.94 dB    VBW    300 kHz  
 10.7 dBm    26.55310621 MHz    SWT    5 s    Unit    dBm

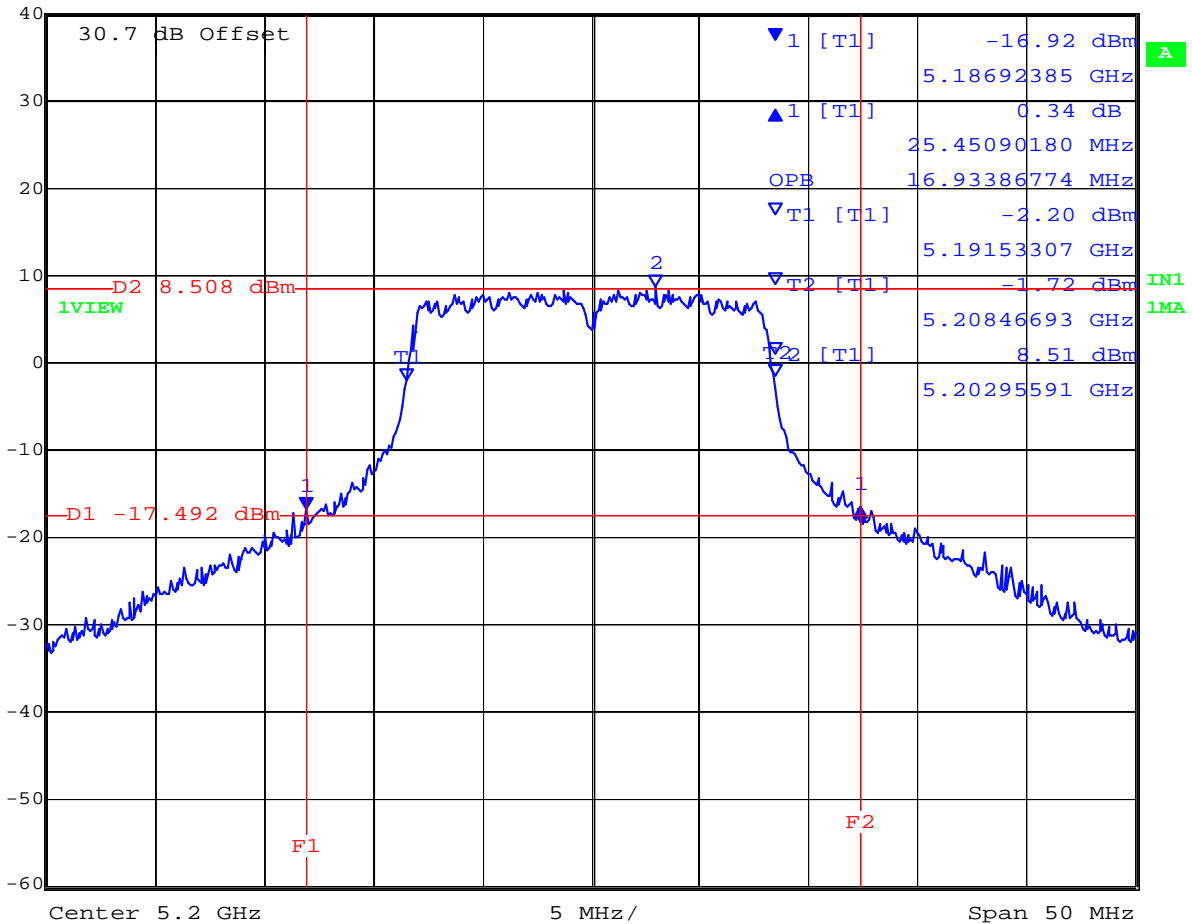


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**5,200 MHz 802.11a Legacy 26 dB and 99 % Bandwidth**

Max/Ref Lvl    Delta 1 [T1]                      RBW    200 kHz    RF Att    20 dB  
 40 dBm    0.34 dB                      VBW    300 kHz  
 10.7 dBm    25.45090180 MHz                      SWT    5 s                      Unit                      dBm



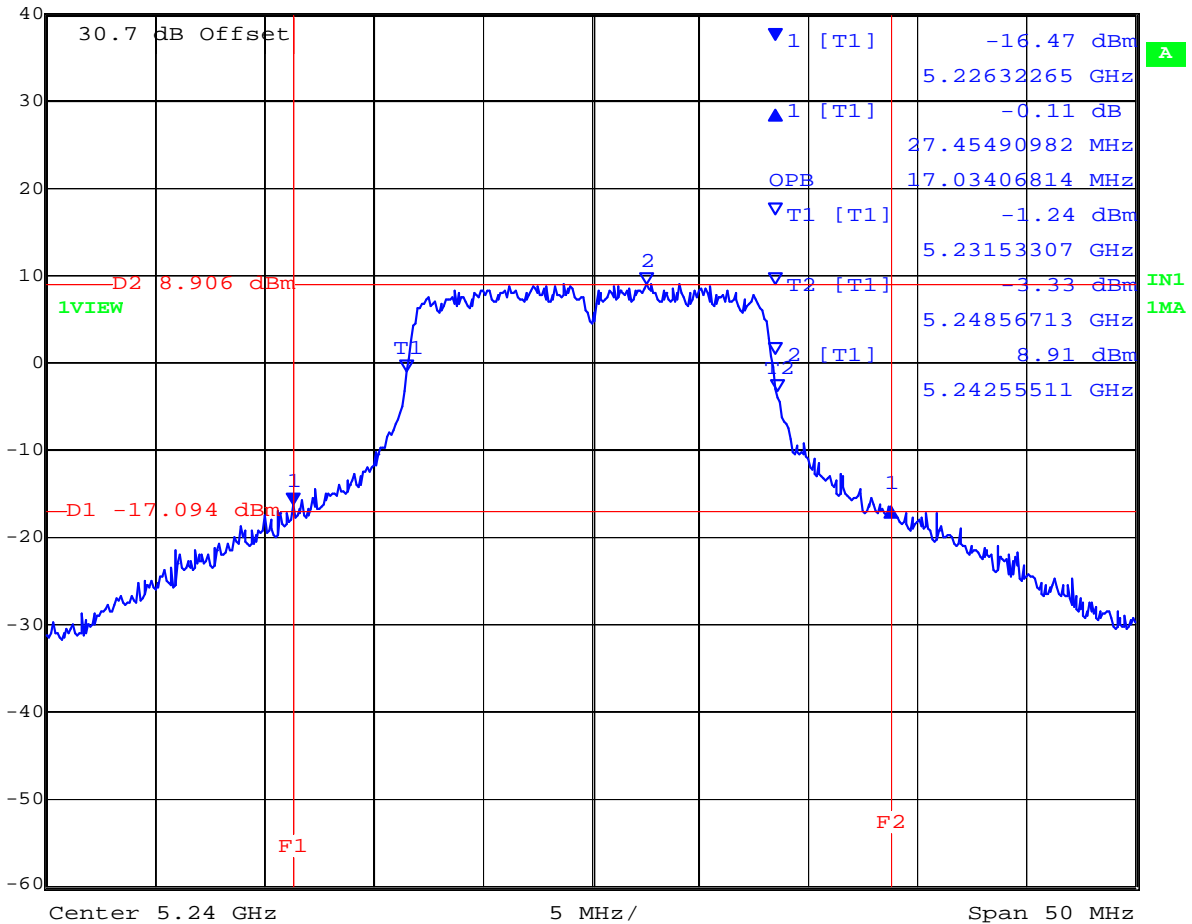
Date: 4.MAR.2009 12:43:45

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**5,240 MHz 802.11a Legacy 26 dB and 99 % Bandwidth**

Max/Ref Lvl    Delta 1 [T1]                      RBW    200 kHz    RF Att    20 dB  
 40 dBm    -0.11 dB                      VBW    300 kHz  
 10.7 dBm    27.45490982 MHz                      SWT    5 s                      Unit                      dBm



Date: 4.MAR.2009 12:44:42

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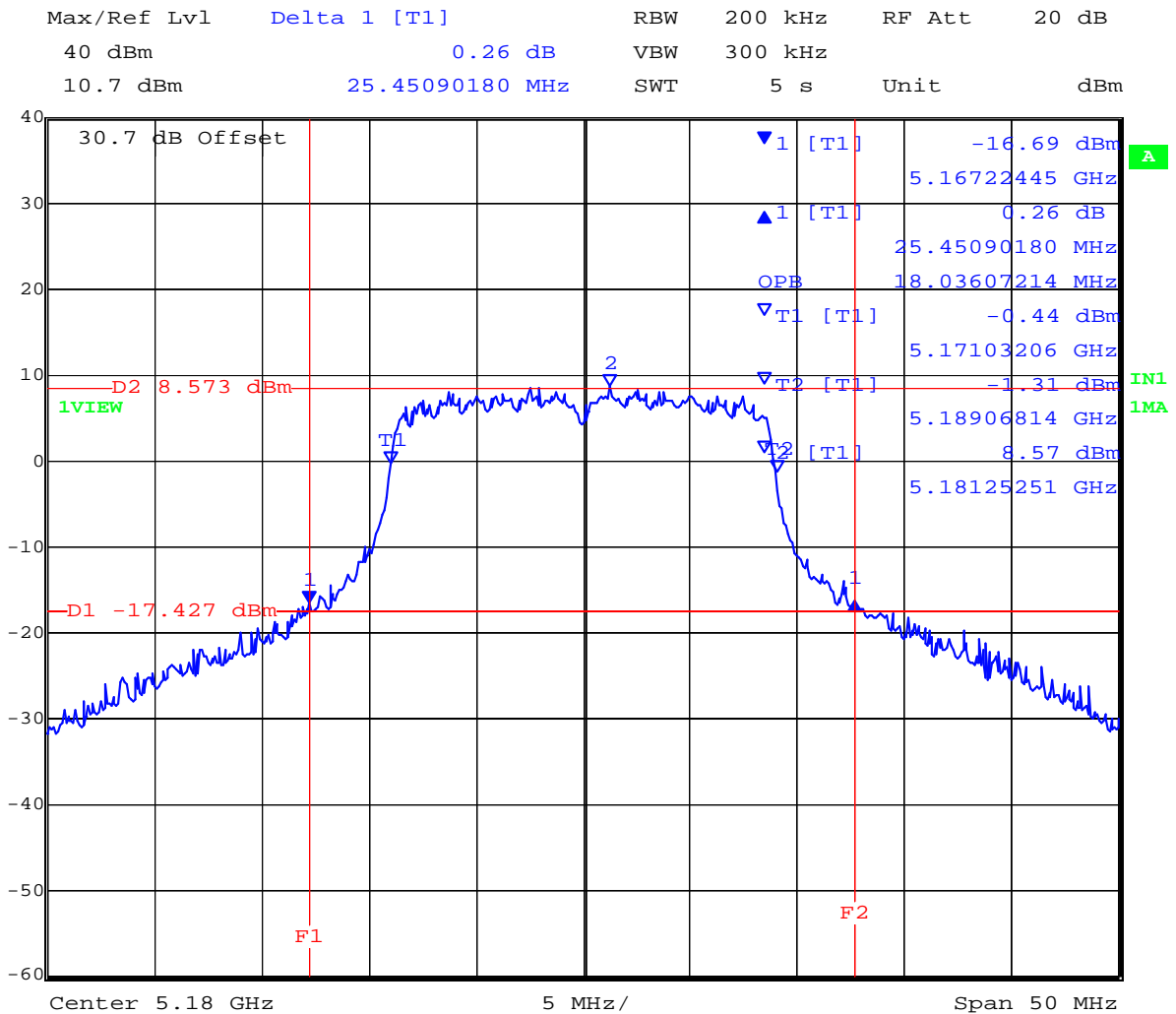


**Measurement Results for 26 dB and 99 % Operational Bandwidth(s) -Continue**

TABLE OF RESULTS – 802.11n HT20

Center Frequency (MHz)	26 dB Bandwidth (MHz)	99 % BW (MHz)
5,180	25.451	18.036
5,200	27.755	17.936
5,240	28.256	18.136

**5,180 MHz 802.11n HT20 26 dB and 99 % Bandwidth**



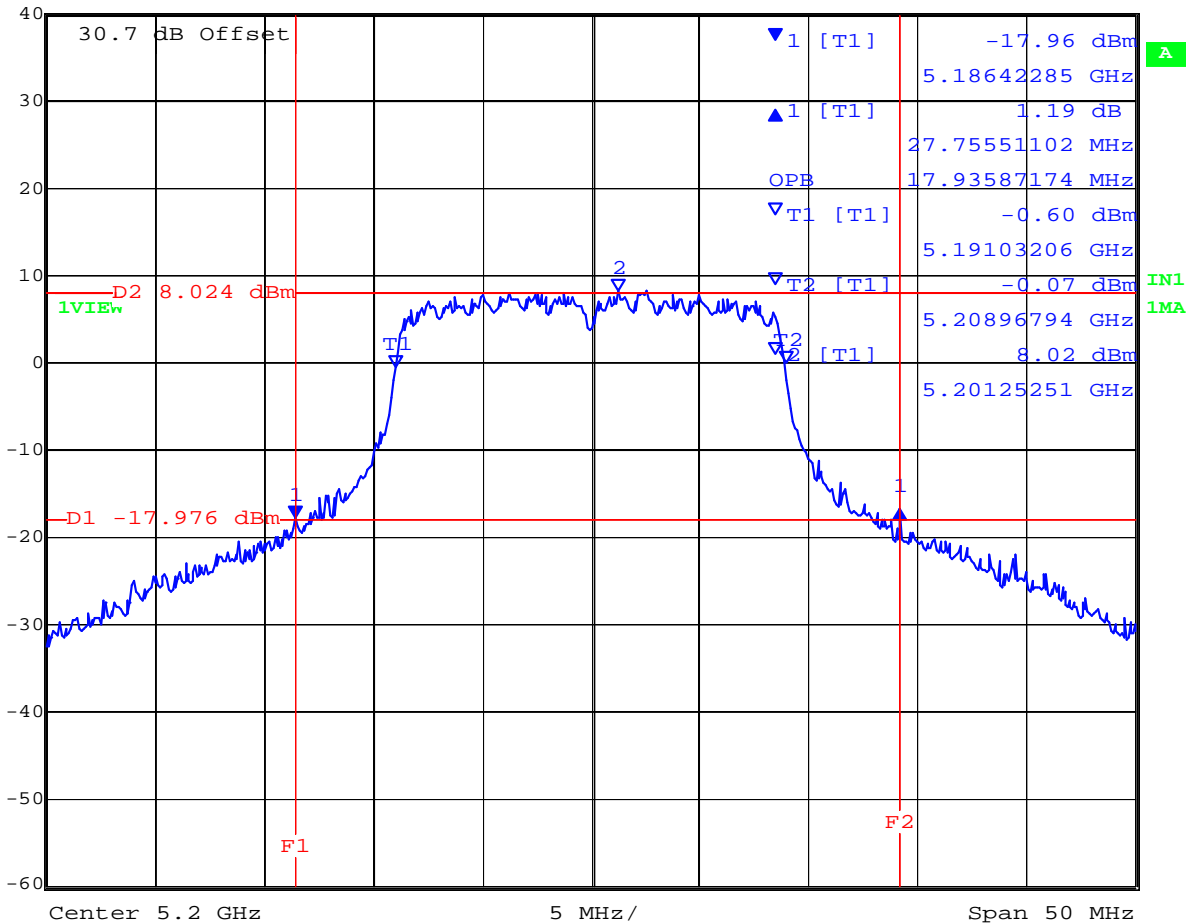
Date: 4.MAR.2009 12:48:06

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**5,200 MHz 802.11n HT20 26 dB and 99 % Bandwidth**

Max/Ref Lvl    Delta 1 [T1]                      RBW    200 kHz    RF Att    20 dB  
 40 dBm    1.19 dB                      VBW    300 kHz  
 10.7 dBm    27.75551102 MHz                      SWT    5 s                      Unit                      dBm



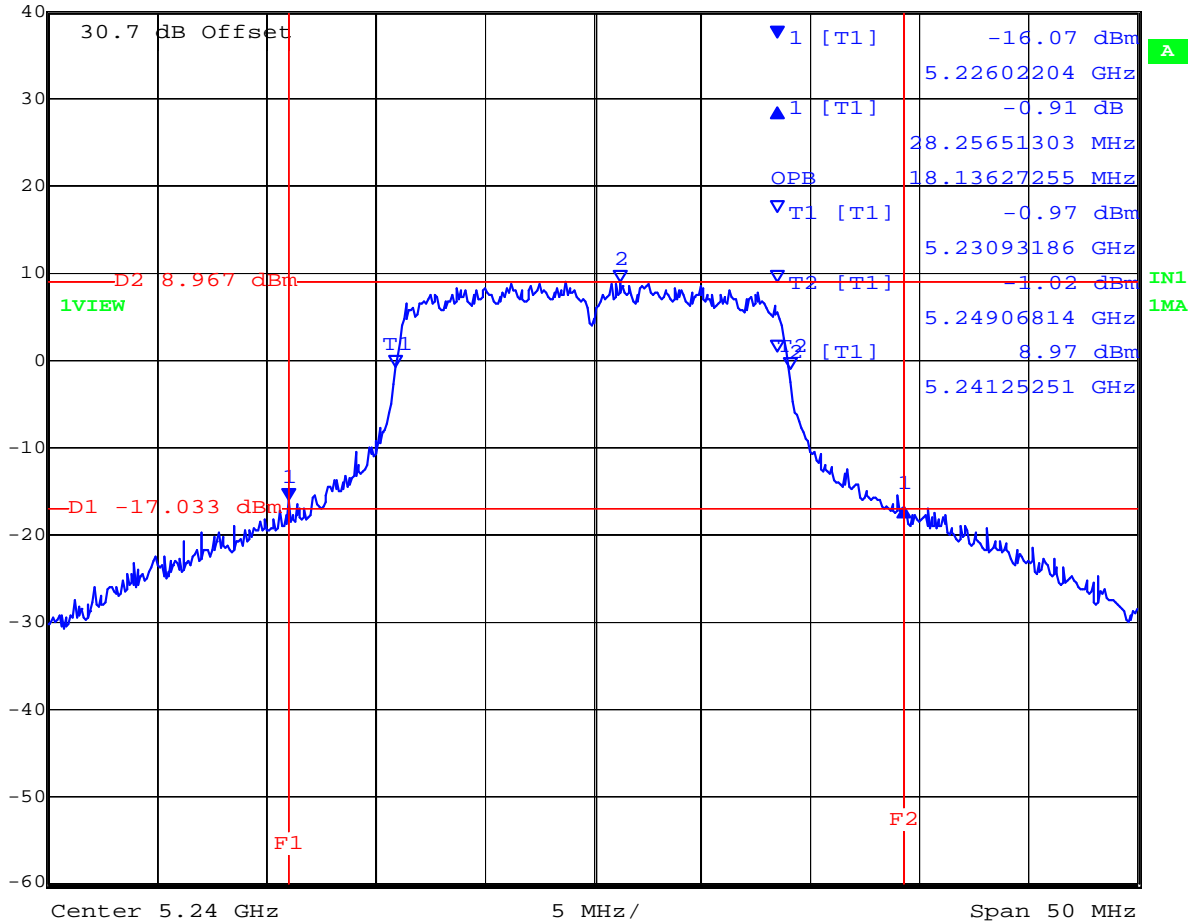
Date: 4.MAR.2009 12:46:48

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**5,240 MHz 802.11n HT20 26 dB and 99 % Bandwidth**

Max/Ref Lvl    Delta 1 [T1]                      RBW    200 kHz    RF Att    20 dB  
 40 dBm    -0.91 dB                      VBW    300 kHz  
 10.7 dBm    28.25651303 MHz                      SWT    5 s                      Unit                      dBm



Date: 4.MAR.2009 12:45:45

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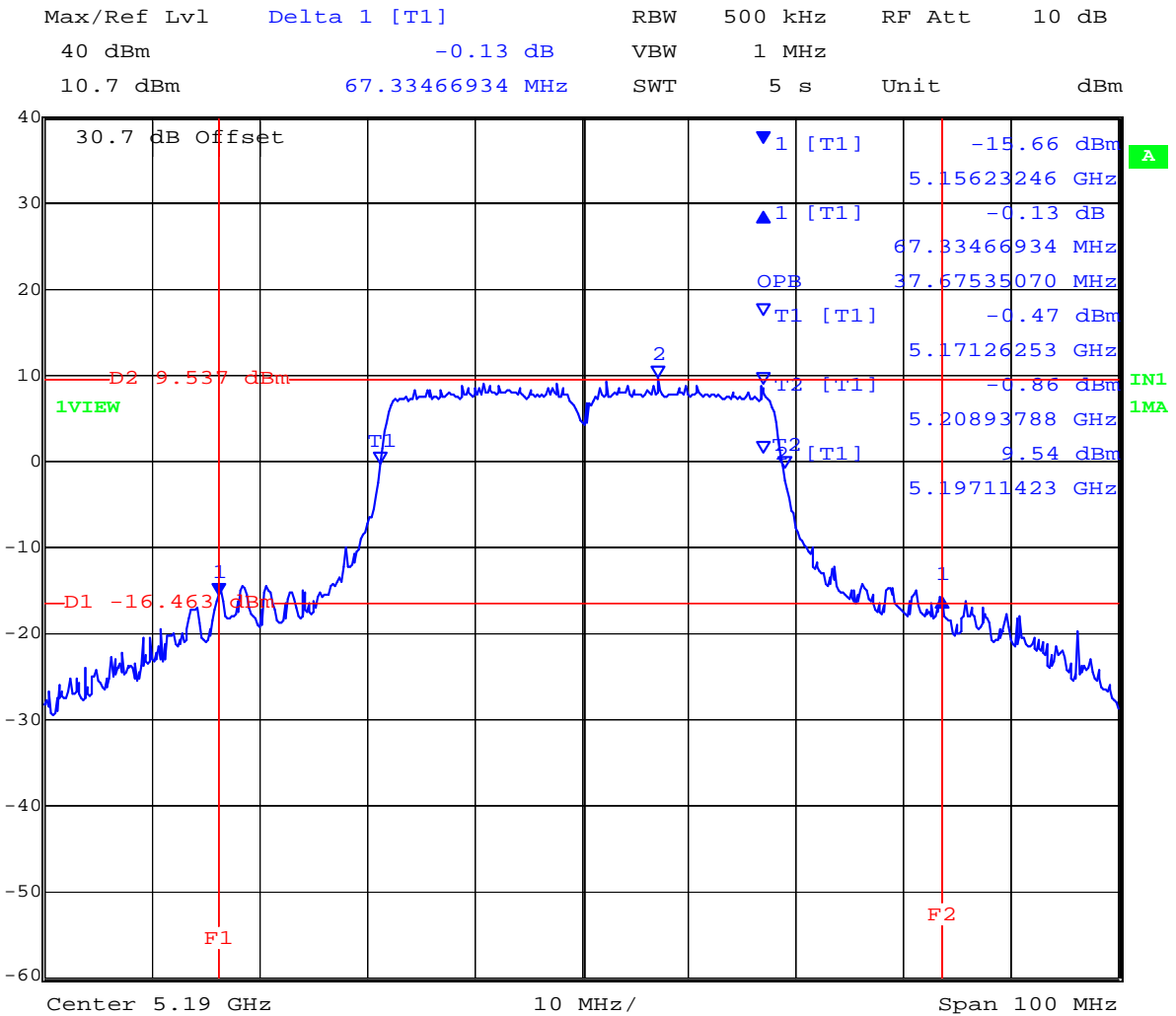


**Measurement Results for 26 dB and 99 % Operational Bandwidth(s) -Continued**

TABLE OF RESULTS – 802.11n HT40

Center Frequency (MHz)	26 dB Bandwidth (MHz)	99 % BW (MHz)
5,190	67.335	37.675
5,230	69.940	37.876

**5,190 MHz 802.11n HT40 26 dB and 99 % Bandwidth**

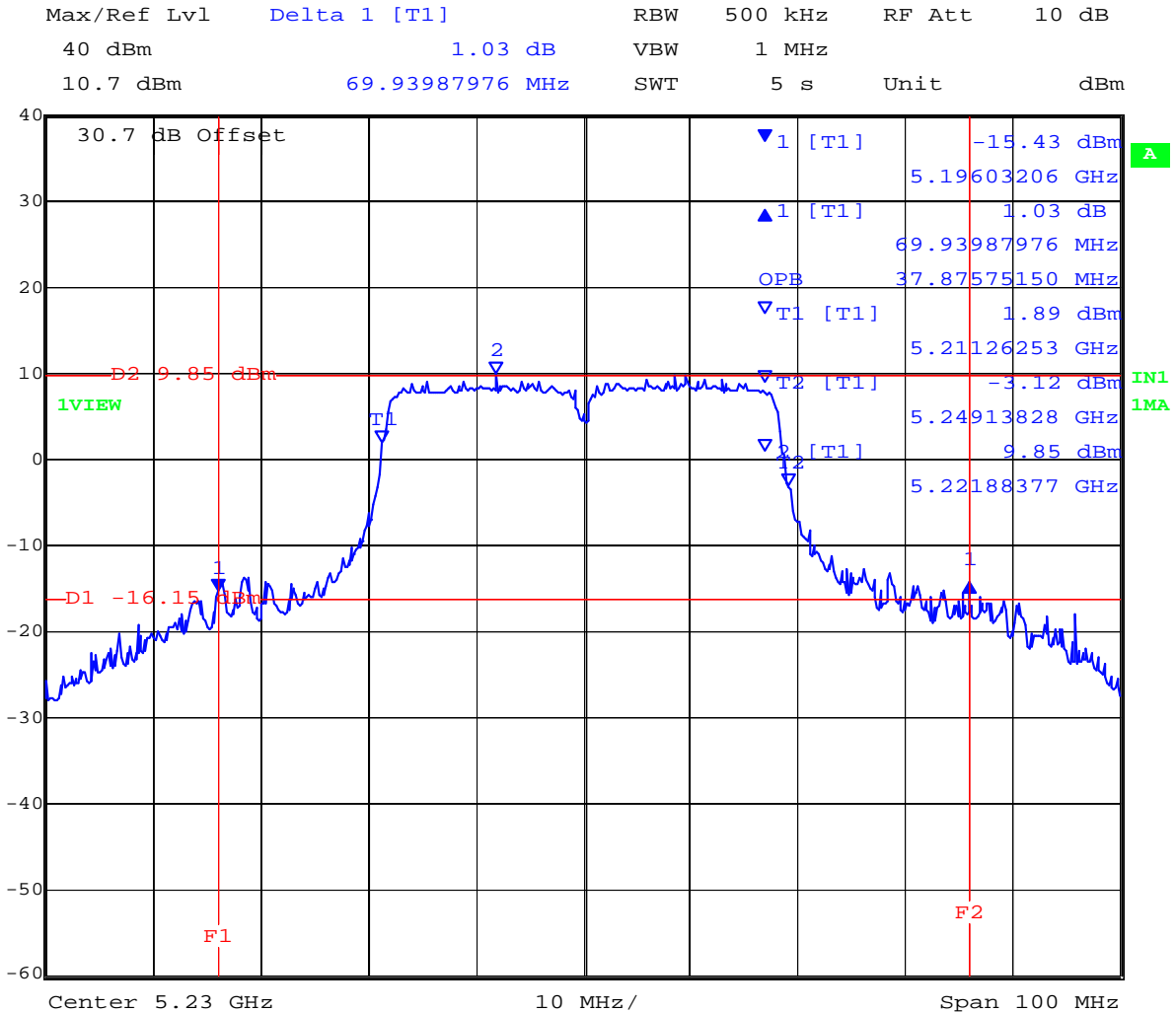


Date: 4.MAR.2009 13:13:47

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**5,230 MHz 802.11n HT40 26 dB and 99 % Bandwidth**



Date: 4.MAR.2009 13:16:16

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**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
**To:** FCC 47 CFR Part 15.407 & IC RSS-210  
**Serial #:** ARUB28-A4 Rev A  
**Issue Date:** 15th May 2009  
**Page:** 30 of 91

## Specification

### Limits

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

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

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

#### Industry Canada RSS-Gen 4.4

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

## Laboratory Measurement Uncertainty for Spectrum Measurement

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

## Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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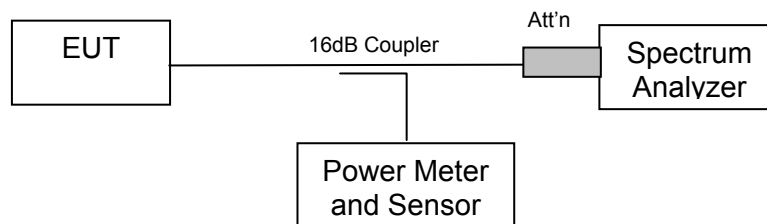
### 5.1.2. Transmit Output Power

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

#### Test Procedure

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

#### Test Measurement Set up



Measurement set up for Transmitter Output Power



**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
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### Maximum Conducted Output Power, FCC Limits

Where "B" is the 26 dB bandwidth

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

Frequency Range (MHz)	Mode	Maximum 26 dB Bandwidth (MHz)	$4 + 10 \text{ Log (B)}$ (dBm)	Limit (dBm)
5150 – 5250	11a	27.455	+18.38	+17.00
	HT-20	28.256	+18.51	+17.00
	HT-40	69.940	+22.44	+17.00

### Maximum EIRP Power Industry Canada Limits

Where "B" is the 99% bandwidth

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

Frequency Range (MHz)	Mode	Maximum 99% Bandwidth (MHz)	$10 + 10 \text{ Log (B)}$ (dBm)	Limit (dBm)
5150 – 5250	11a	17.034	22.31	+23.00
	HT-20	18.136	22.58	+23.00
	HT-40	37.876	25.78	+23.00

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**Measurement Results for Transmit Output Power**

Ambient conditions.

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

EUT parameters.

Power Level: Maximum

Duty Cycle: 100%

**TABLE OF RESULTS – 802.11a Legacy**

Center Frequency (MHz)	Maximum Conducted Power (dBm)
5,180	+16.27
5,200	+16.22
5,240	+17.04

**TABLE OF RESULTS – 802.11n HT20**

Center Frequency (MHz)	Maximum Conducted Power (dBm)
5,180	+16.22
5,200	+16.13
5,240	+16.97

**TABLE OF RESULTS – 802.11n HT40**

Center Frequency (MHz)	Maximum Conducted Power (dBm)
5,190	+18.45
5,230	+19.07



**Specification**

**Limits**

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

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

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

**Industry Canada RSS-210 §A9.2(2)**

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

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

**Industry Canada RSS-Gen 4.4**

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

**Laboratory Measurement Uncertainty for Power Measurements**

Measurement uncertainty	±1.33 dB
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**Traceability**

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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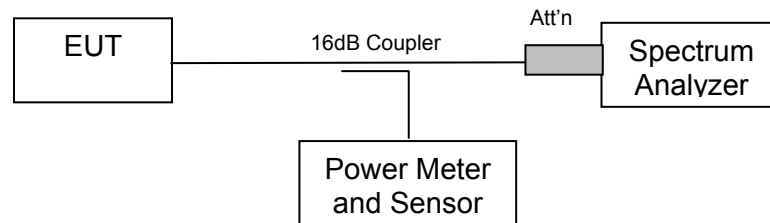
### 5.1.3. Peak Power Spectral Density

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

#### Test Procedure

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

#### Test Measurement Set up



Measurement set up for Peak Power Spectral Density

#### Measurement Results for Peak Power Spectral Density

Ambient conditions.

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

Radio Parameters

Duty Cycle: 100%

Output: Modulated Carrier

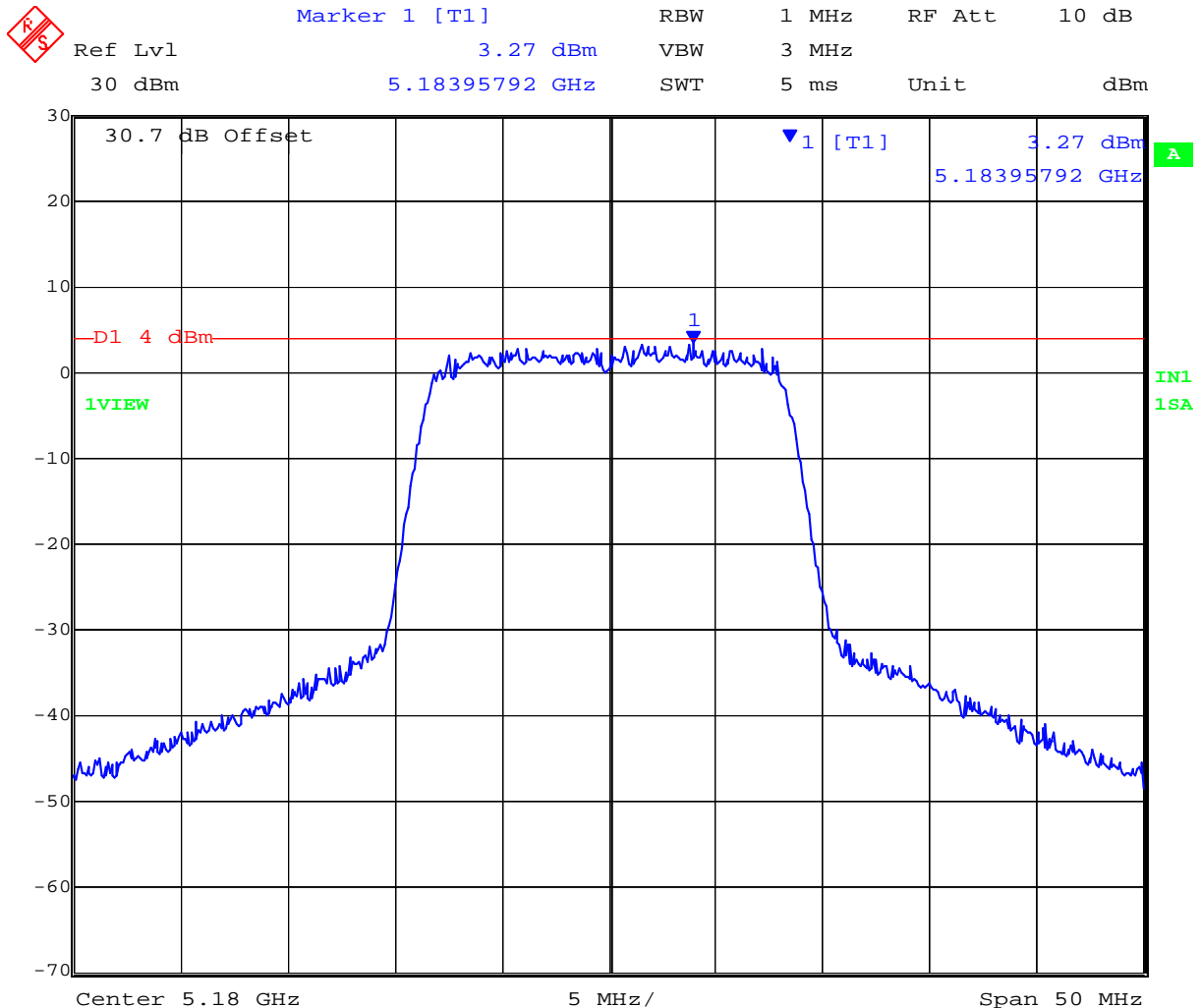
Power: Maximum Default Power



**TABLE OF RESULTS – 802.11a Legacy**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)
5,180	5183.95792	+3.27
5,200	5197.84569	+3.21
5,240	5238.44689	+3.51

**5,180 MHz 802.11a Legacy Peak Power Spectral Density**



Date: 4.MAR.2009 09:10:42

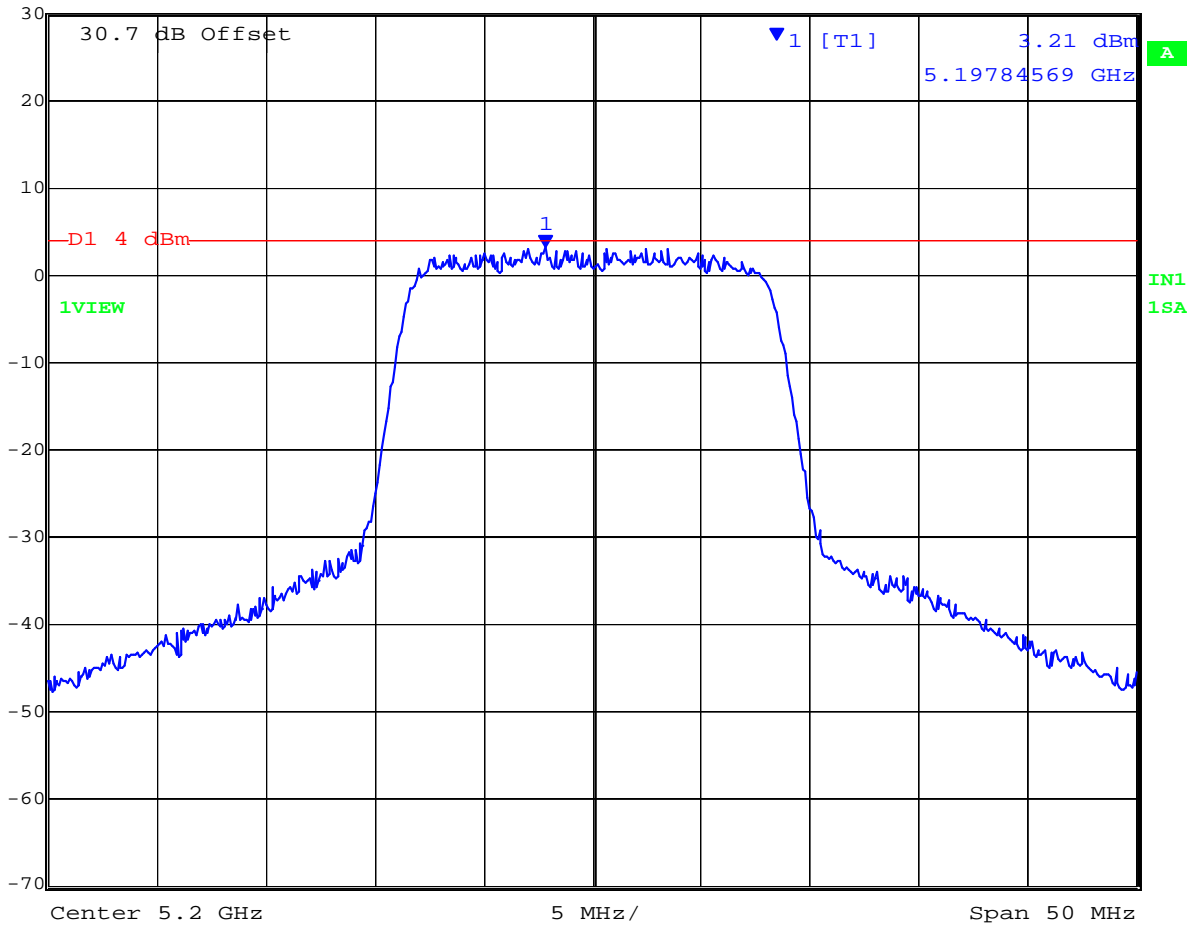
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### 5,200 MHz 802.11a Legacy Peak Power Spectral Density



Ref Lvl 30 dBm  
Marker 1 [T1] 5.19784569 GHz  
RBW 1 MHz  
RF Att 10 dB  
VBW 3 MHz  
SWT 5 ms  
Unit dBm

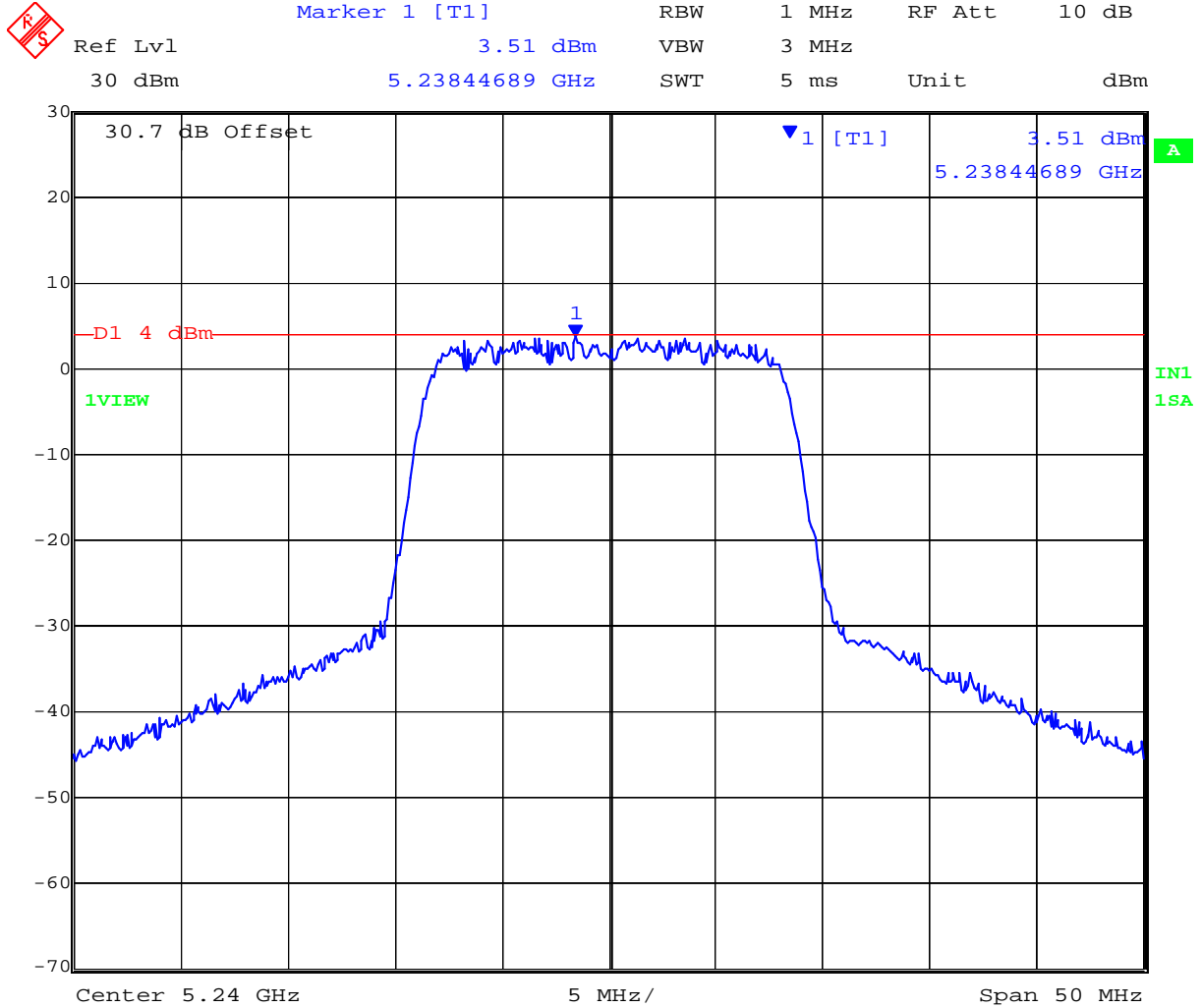


Date: 4.MAR.2009 09:12:31

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### 5,240 MHz 802.11a Legacy Peak Power Spectral Density



Date: 4.MAR.2009 09:13:17

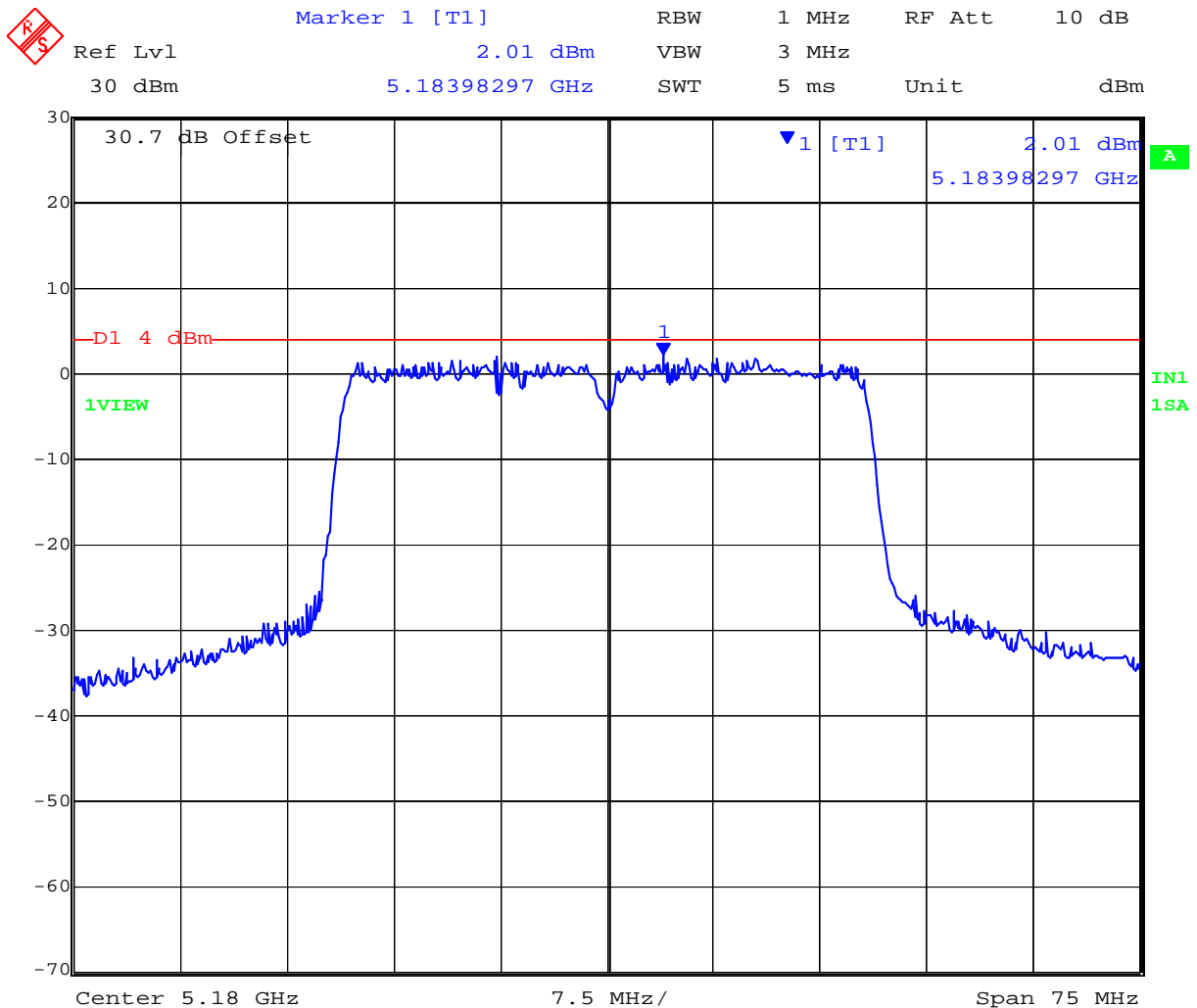
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TABLE OF RESULTS – 802.11n HT20

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)
5,180	5183.98297	+2.01
5,200	5205.26052	+2.64
5,240	5238.64729	+3.88

5,180 MHz 802.11n HT20 Peak Power Spectral Density



Date: 4.MAR.2009 09:19:23

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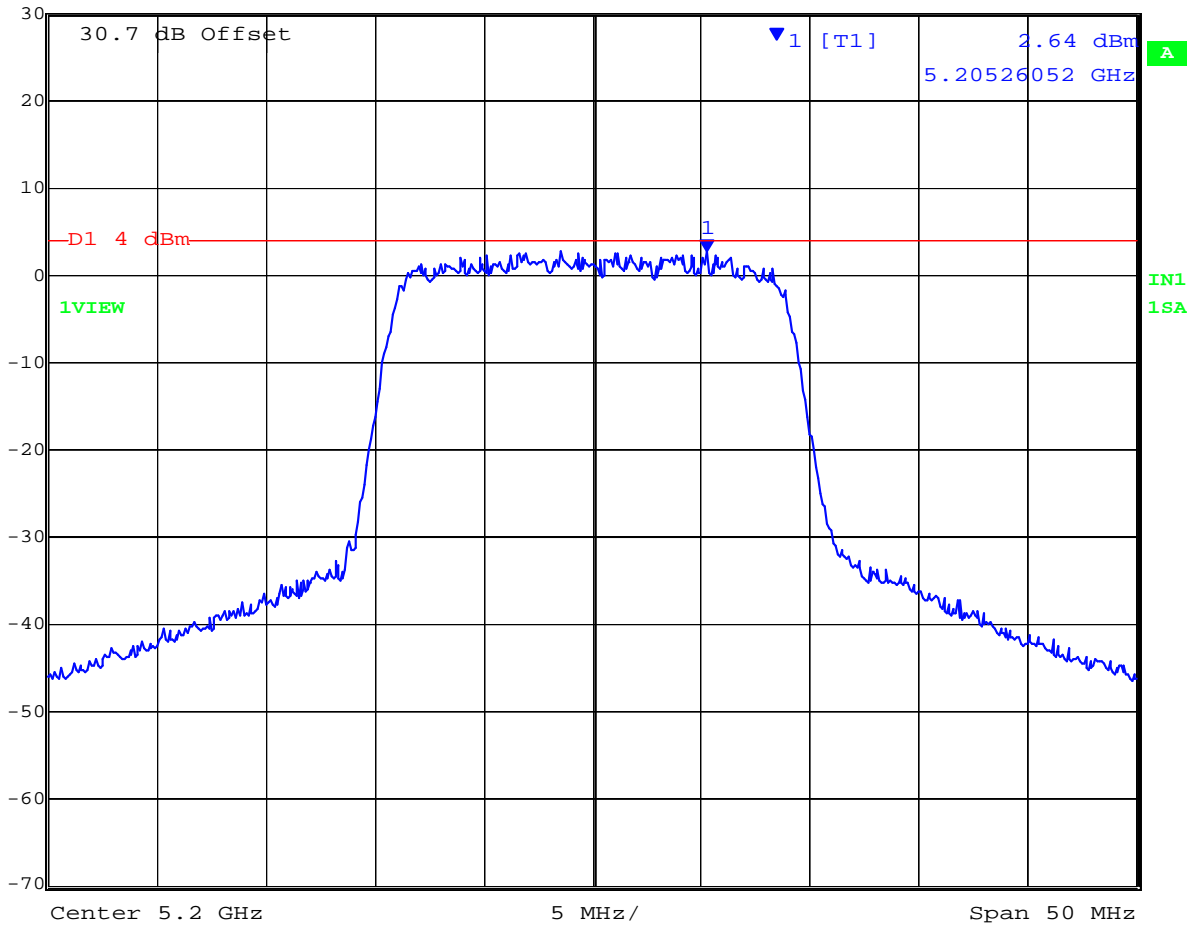


**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
**To:** FCC 47 CFR Part 15.407 & IC RSS-210  
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### 5,200 MHz 802.11n HT20 Peak Power Spectral Density



Ref Lvl	30 dBm	Marker 1 [T1]	5.20526052 GHz	RBW	1 MHz	RF Att	10 dB
			2.64 dBm	VBW	3 MHz		
				SWT	5 ms	Unit	dBm



Date: 4.MAR.2009 09:16:31

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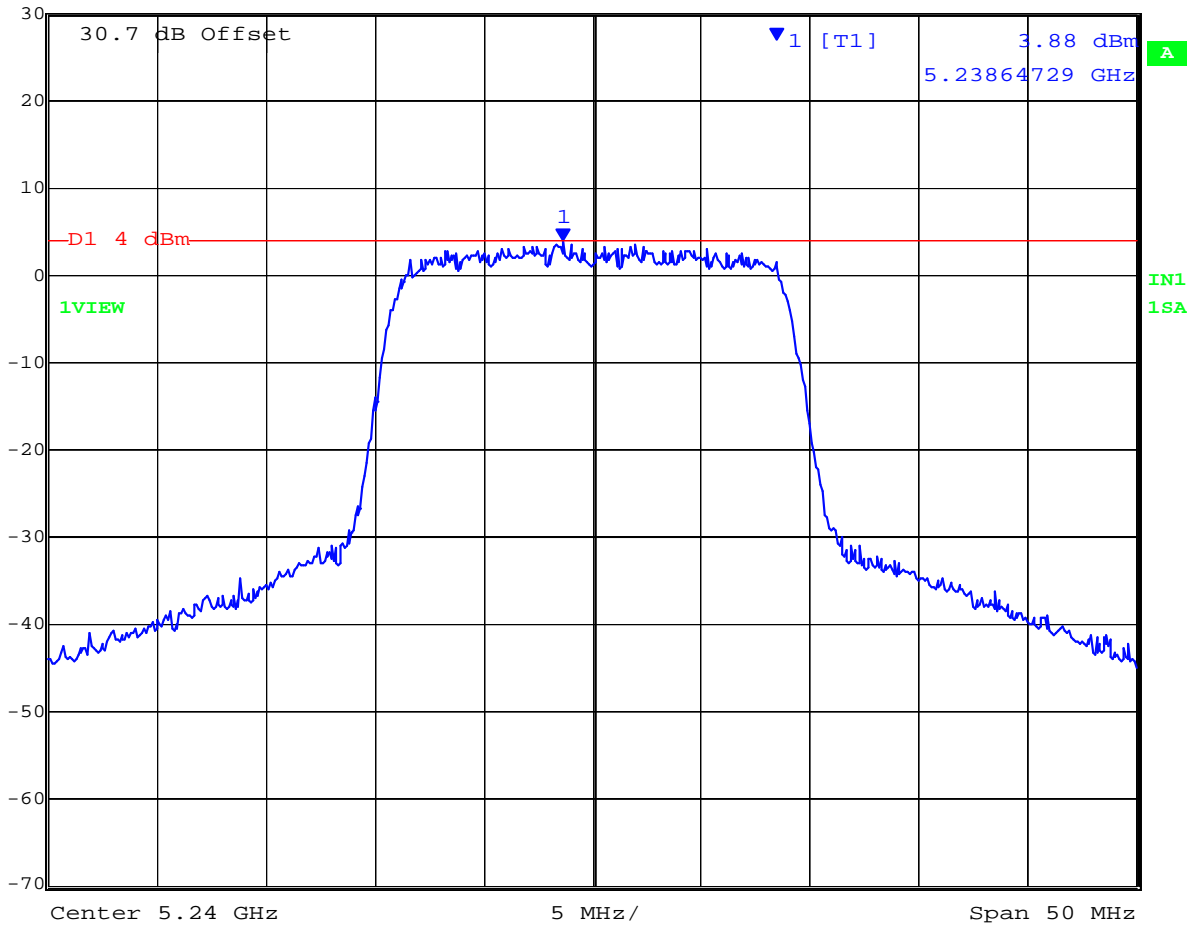




### 5,240 MHz 802.11n HT20 Peak Power Spectral Density



Ref Lvl	30 dBm	Marker 1 [T1]	5.23864729 GHz	RBW	1 MHz	RF Att	10 dB
			3.88 dBm	VBW	3 MHz		
				SWT	5 ms	Unit	dBm



Date: 4.MAR.2009 09:15:20

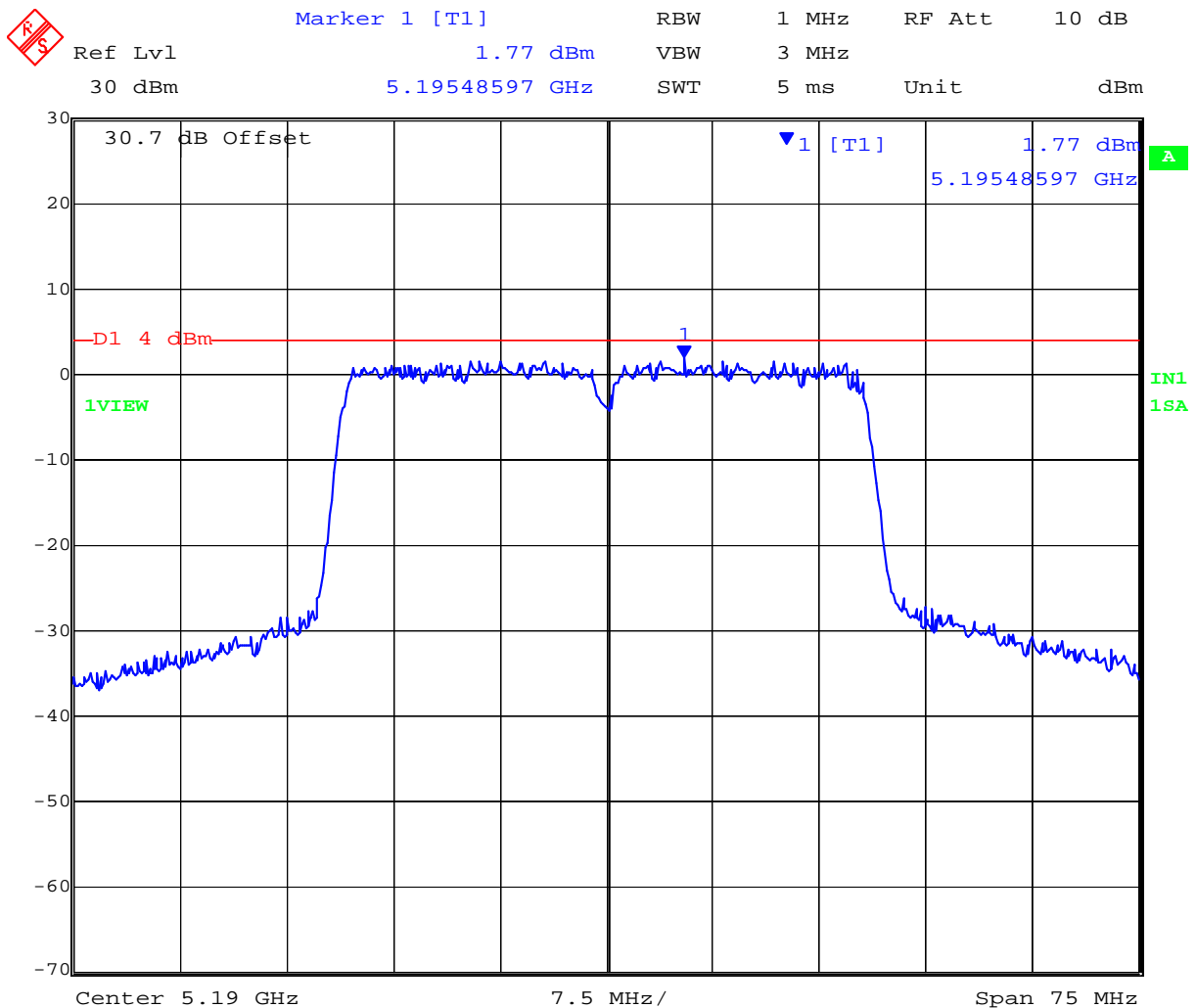
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TABLE OF RESULTS – 802.11n HT40

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)
5,190	5195.48597	+1.77
5,230	5238.04108	+2.66

5,190 MHz 802.11n HT40 Peak Power Spectral Density



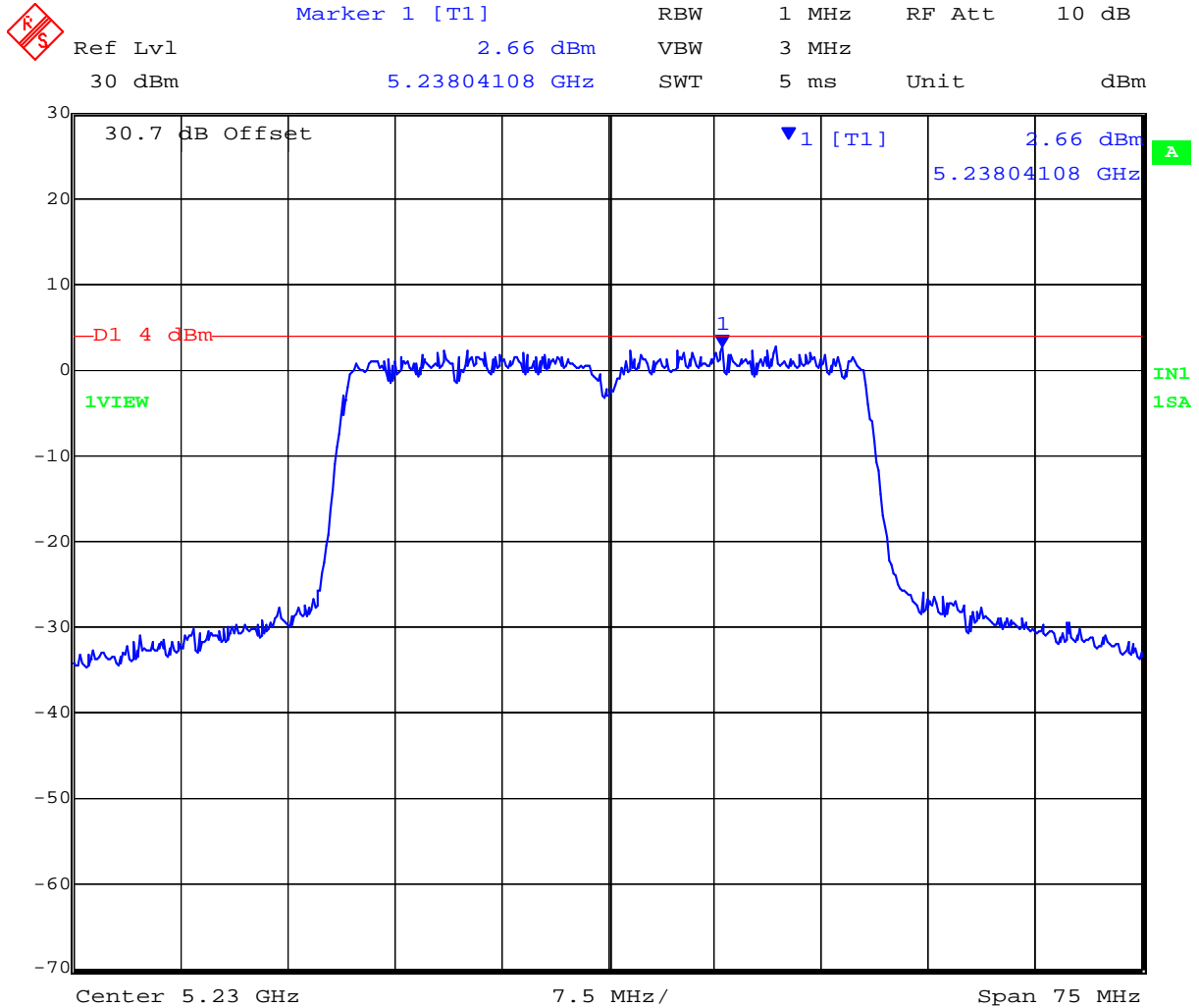
Date: 4.MAR.2009 09:19:57

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**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
**To:** FCC 47 CFR Part 15.407 & IC RSS-210  
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**Issue Date:** 15th May 2009  
**Page:** 43 of 91

### 5,230 MHz 802.11n HT40 Peak Power Spectral Density



Date: 4.MAR.2009 09:20:57

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**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
**To:** FCC 47 CFR Part 15.407 & IC RSS-210  
**Serial #:** ARUB28-A4 Rev A  
**Issue Date:** 15th May 2009  
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## Specification

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

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

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

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

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

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

## Laboratory Measurement Uncertainty for Spectral Density

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

## Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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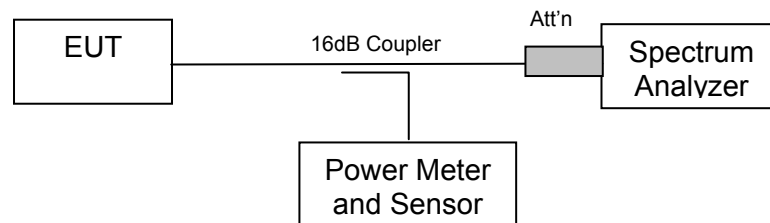
#### 5.1.4. Peak Excursion Ratio

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

##### Test Procedure

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

##### Test Measurement Set up



Measurement set up for Peak Excursion Ratio

##### Measurement Results for Peak Excursion Ratio

Ambient conditions.

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

Radio Parameters

Duty Cycle: 100%

Output: Modulated Carrier

Power: Maximum Default Power

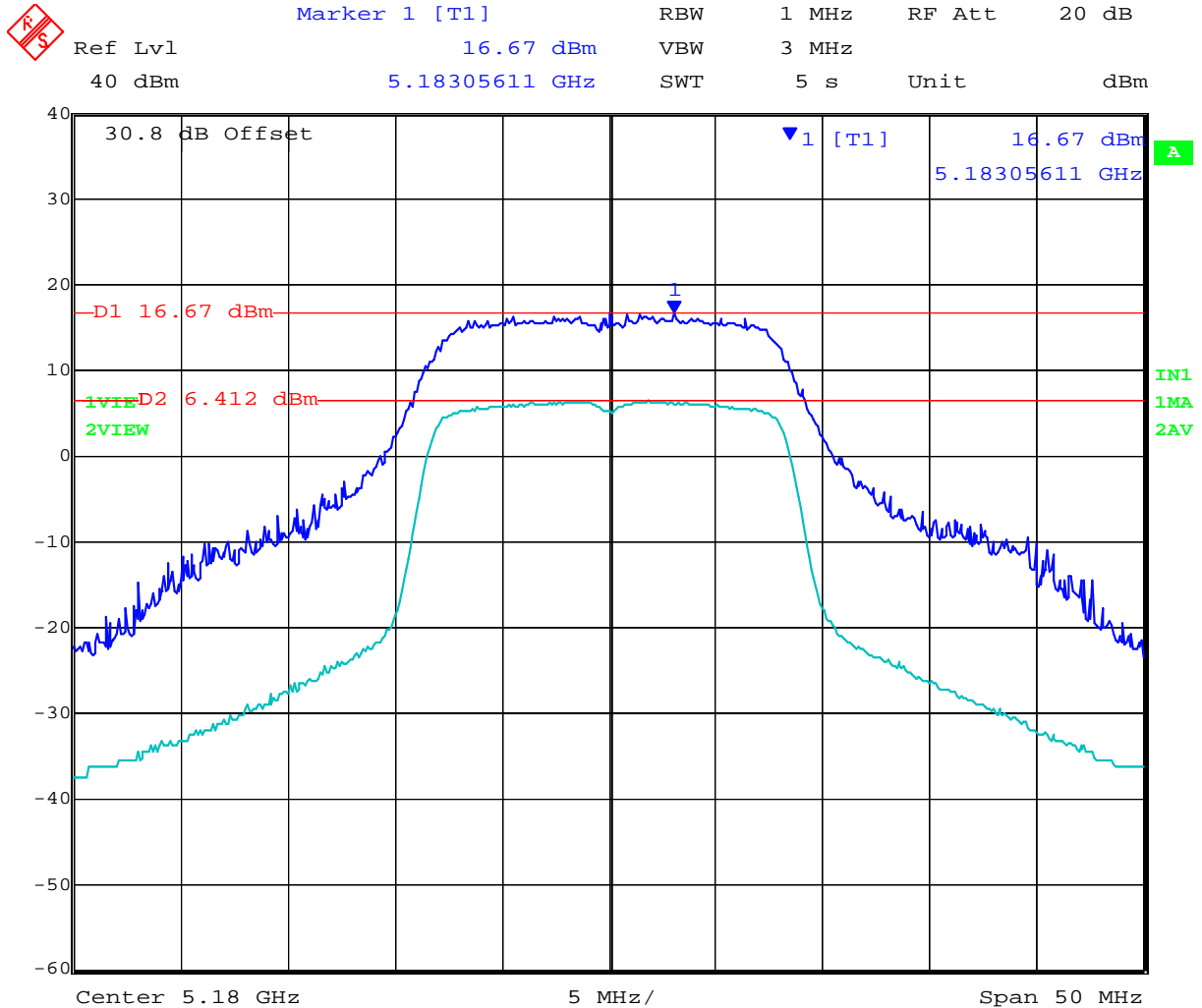


**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
**To:** FCC 47 CFR Part 15.407 & IC RSS-210  
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**TABLE OF RESULTS – 802.11a Legacy**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)
5,180	10.26
5,200	10.22
5,240	9.87

**5,180 MHz 802.11a Legacy - Peak Excursion Ratio**



Date: 4.MAR.2009 10:14:27

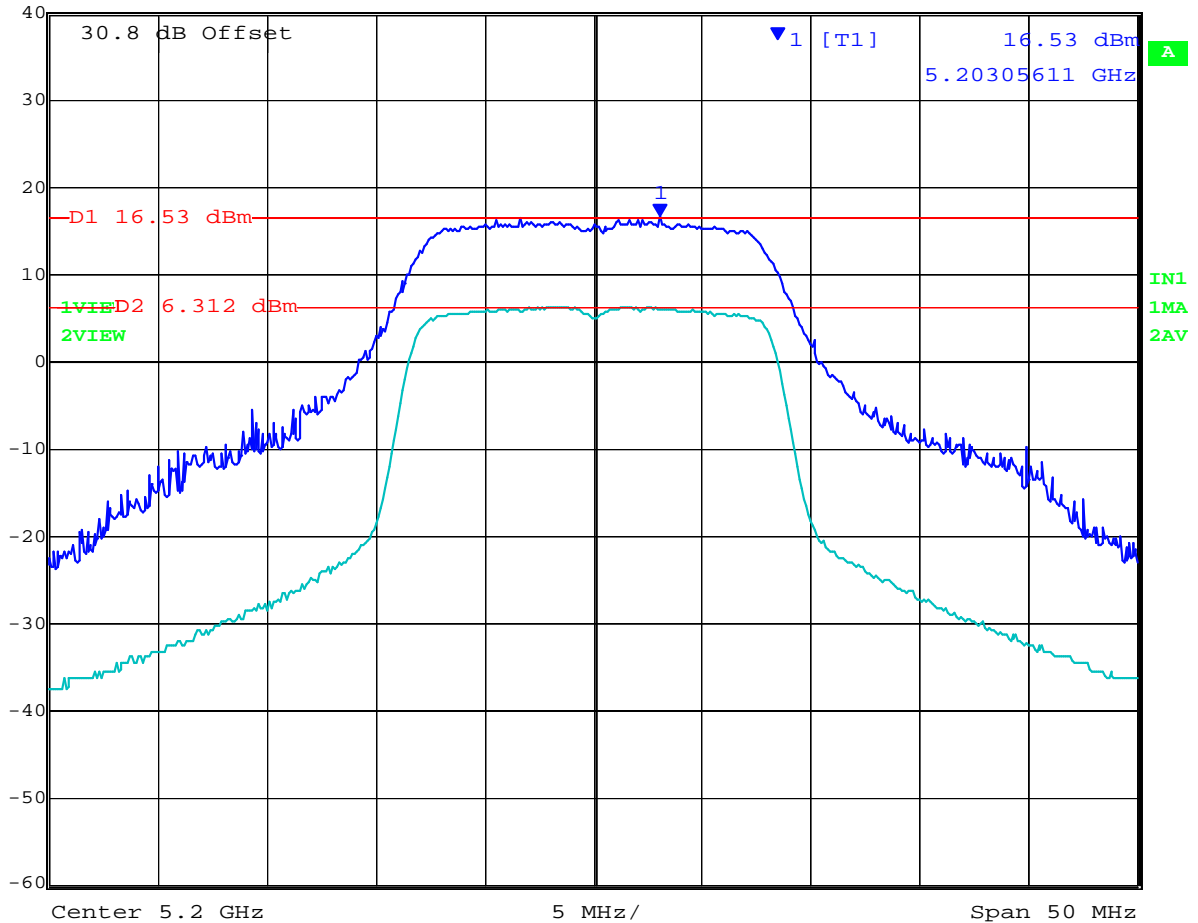
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### 5,200 MHz 802.11a Legacy - Peak Excursion Ratio



Ref Lvl 40 dBm  
Marker 1 [T1] 16.53 dBm  
5.20305611 GHz  
REW 1 MHz RF Att 20 dB  
VBW 3 MHz  
SWT 5 s Unit dBm



Date: 4.MAR.2009 10:16:23

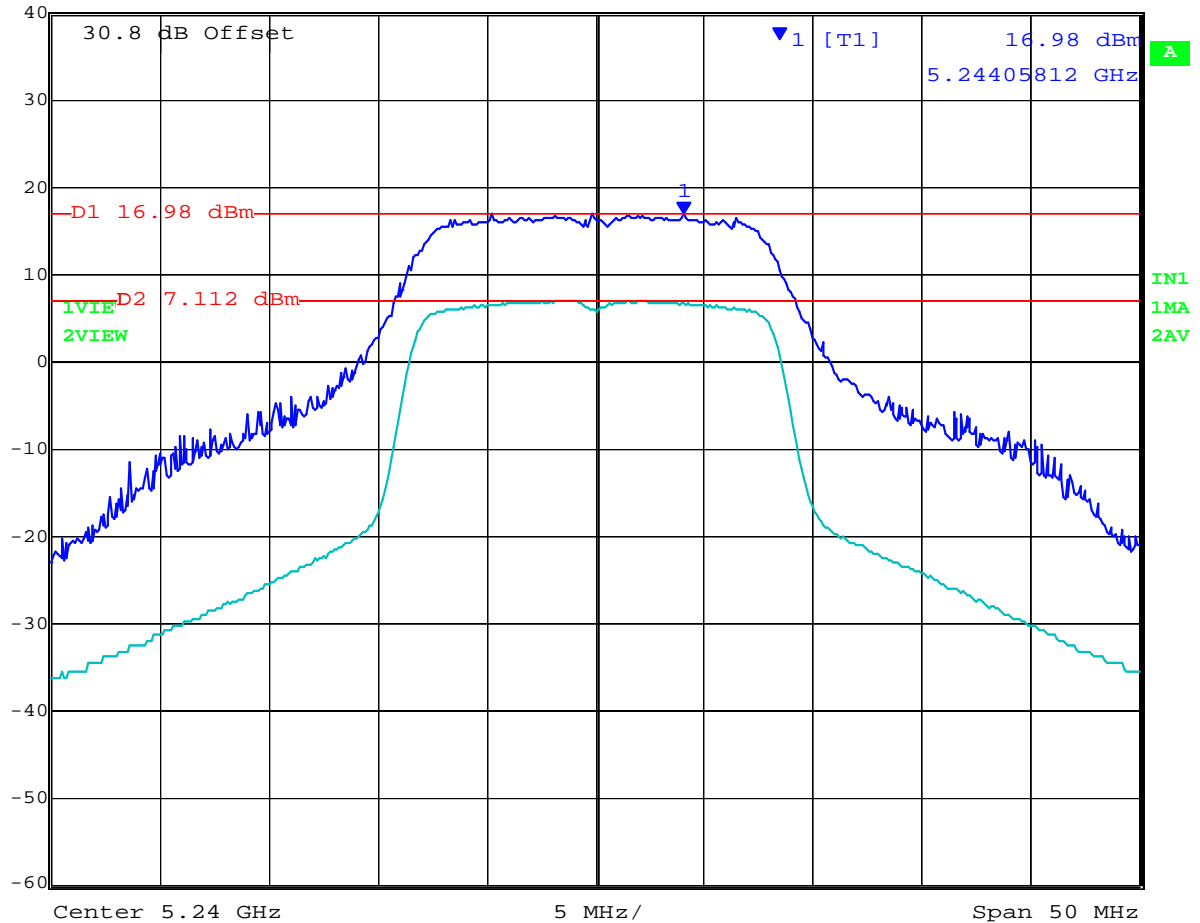
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### 5,240 MHz 802.11a Legacy - Peak Excursion Ratio



Marker 1 [T1] REW 1 MHz RF Att 20 dB  
Ref Lvl 16.98 dBm VBW 3 MHz  
40 dBm 5.24405812 GHz SWT 5 s Unit dBm



Date: 4.MAR.2009 10:18:31

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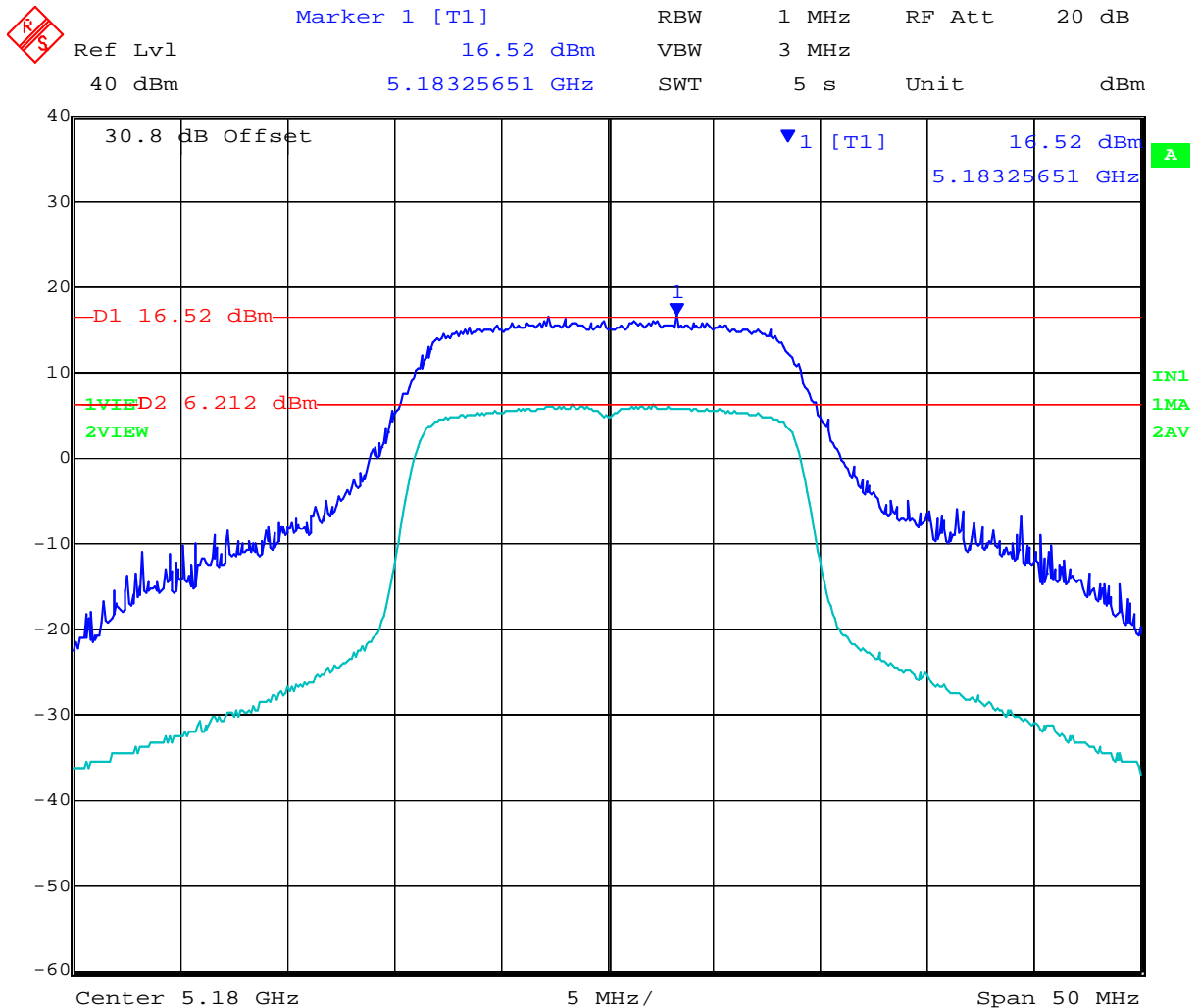




**TABLE OF RESULTS – 802.11n HT20**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)
5,180	10.31
5,200	10.17
5,240	10.10

**5,180 MHz 802.11n HT20 - Peak Excursion Ratio**



Date: 4.MAR.2009 10:22:21

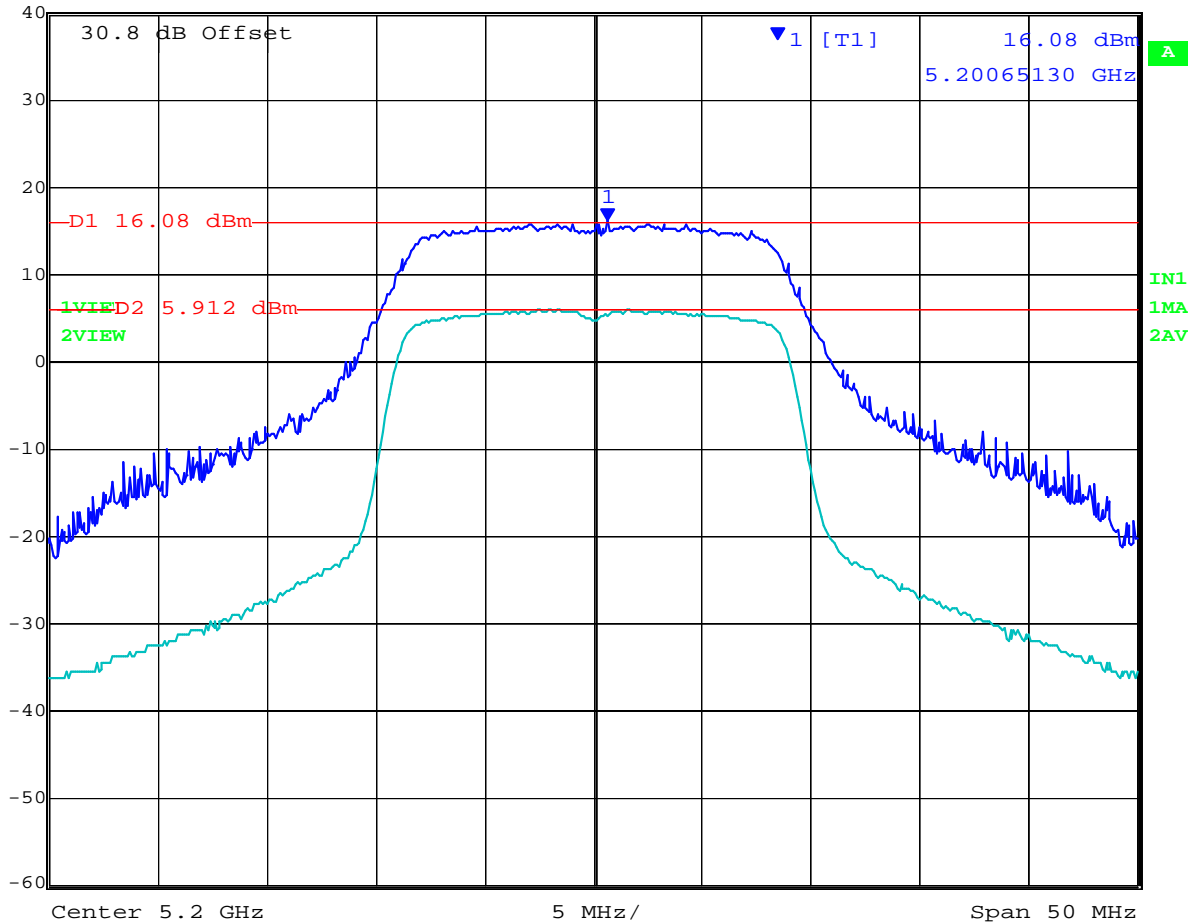
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### 5,200 MHz 802.11n HT20 - Peak Excursion Ratio



Ref Lvl 40 dBm  
Marker 1 [T1] 16.08 dBm  
5.20065130 GHz  
REW 1 MHz RF Att 20 dB  
VBW 3 MHz  
SWT 5 s Unit dBm



Date: 4.MAR.2009 10:21:13

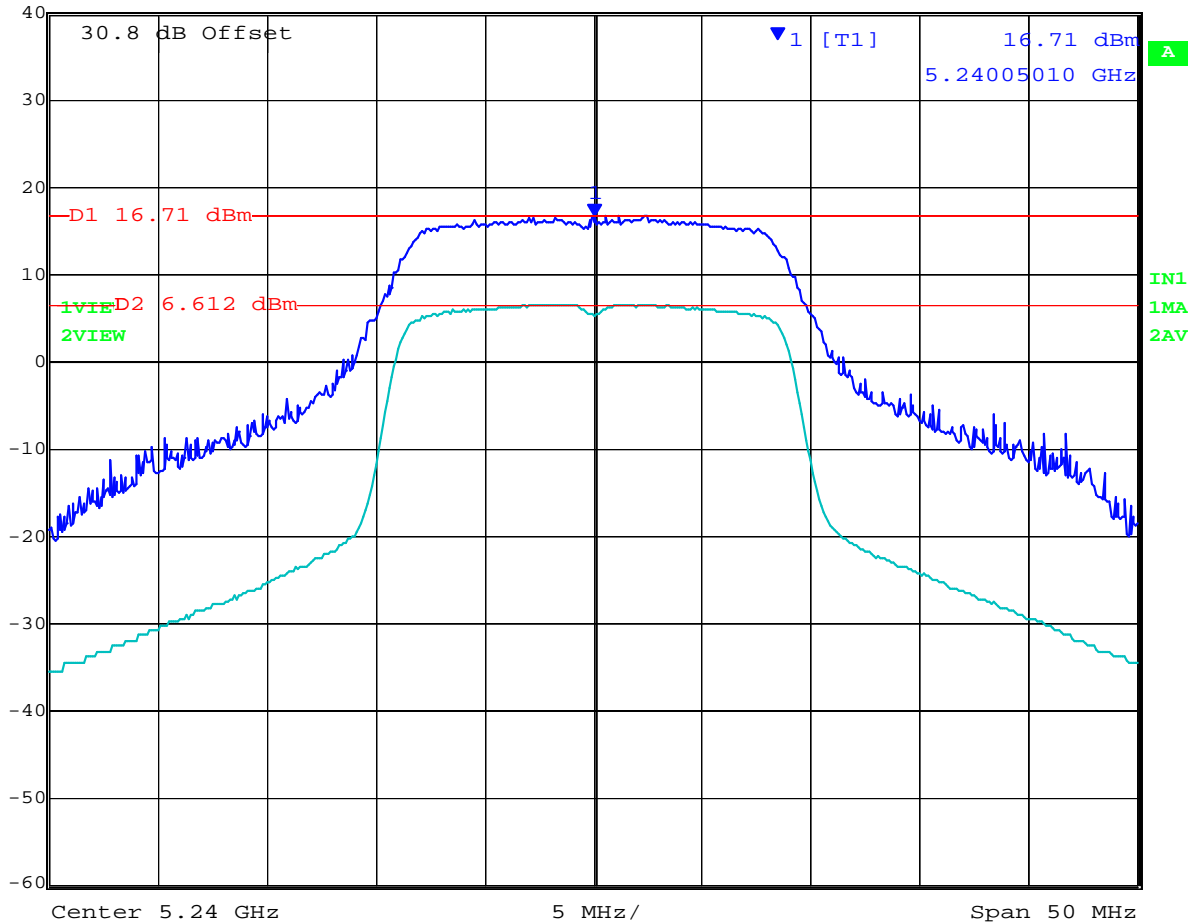
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### 5,240 MHz 802.11n HT20 - Peak Excursion Ratio



Ref Lvl 40 dBm  
Marker 1 [T1] 16.71 dBm  
5.24005010 GHz  
REW 1 MHz RF Att 20 dB  
VBW 3 MHz  
SWT 5 s Unit dBm



Date: 4.MAR.2009 10:19:51

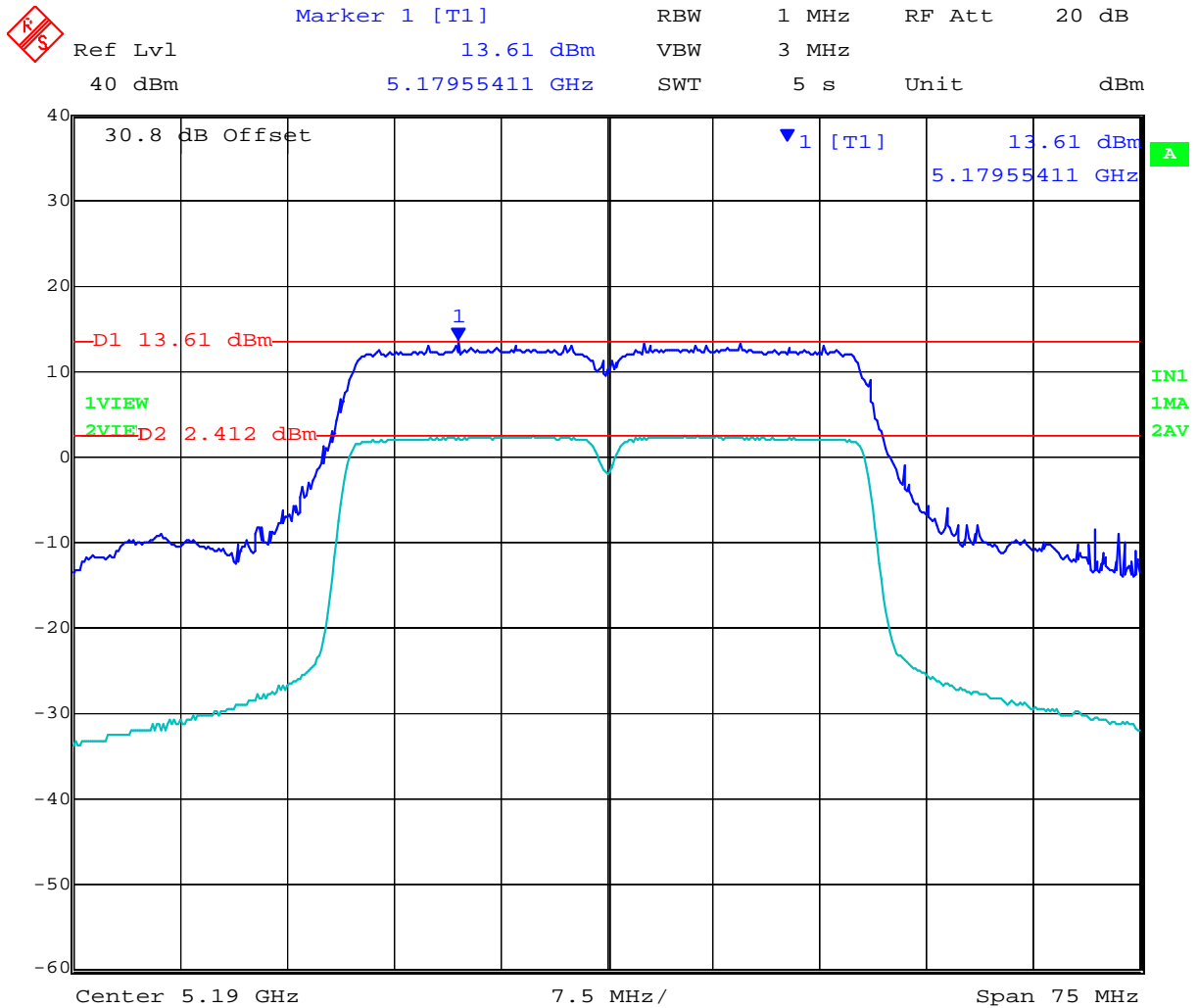
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TABLE OF RESULTS – 802.11n HT40

Centre Frequency (MHz)	Peak Excursion Ratio (dB)
5,190	11.20
5,230	10.36

5,190 MHz 802.11n HT40 - Peak Excursion Ratio



Date: 4.MAR.2009 10:25:34

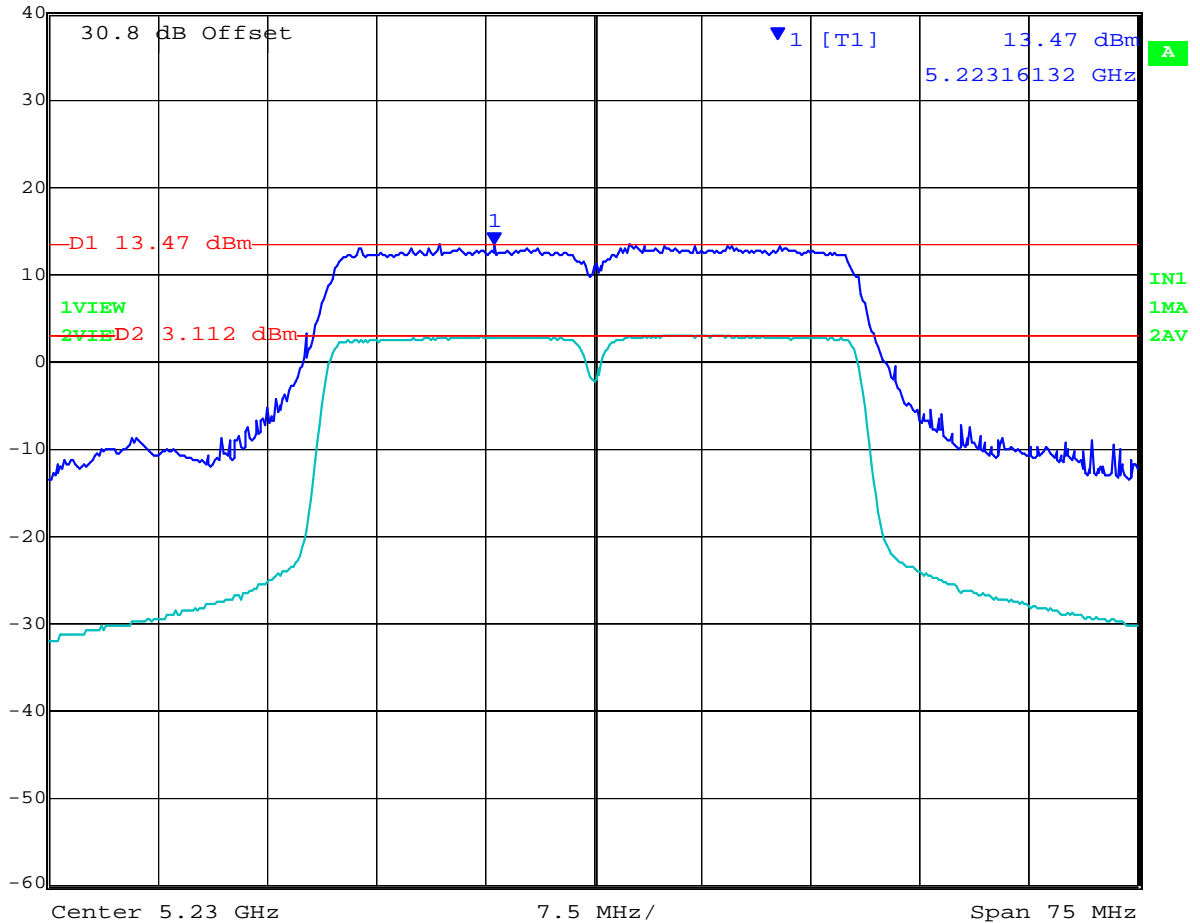
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### 5,230 MHz 802.11n HT40 - Peak Excursion Ratio



Marker 1 [T1]      RBW      1 MHz      RF Att      20 dB  
Ref Lvl                      13.47 dBm      VBW      3 MHz  
40 dBm                      5.22316132 GHz      SWT      5 s      Unit      dBm



Date: 4.MAR.2009 10:26:42

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## Specification

### Limits

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

## Laboratory Measurement Uncertainty for Spectrum Measurement

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

## Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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### 5.1.5. Frequency Stability

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

#### **Test Procedure**

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

#### **Manufacturer Declaration**

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

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

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

#### **Specification**

#### **Limits**

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

---

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**5.1.6. Maximum Permissible Exposure**

**FCC, Part 15 Subpart C §15.407(f)**  
**Industry Canada RSS-Gen §5.5**

**Calculations for Maximum Permissible Exposure Levels**

Power Density = Pd (mW/cm<sup>2</sup>) = EIRP/(4πd<sup>2</sup>)

EIRP = P \* G \* 3

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

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

The Aruba 651-XX has three transmitters. The peak power in the table below is calculated by assuming a worst case scenario where the three transmitters are operating simultaneously in the same band. The Peak Power in mW is calculated by taking the maximum conducted power measured in each band and multiplying by 3.

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

Freq. Band (MHz)	Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm <sup>2</sup> Limit(cm)	Minimum Separation Distance (cm)
5150 - 5250	5.8	3.8	+17.00	150.4	6.7	20

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

**Specification**

**Maximum Permissible Exposure Limits**

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

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

**Laboratory Measurement Uncertainty for Power Measurements**

Measurement uncertainty

±1.33 dB



### 5.1.7. Radiated Emissions

#### 5.1.7.1. Transmitter Radiated Spurious Emissions (above 1 GHz); Peak Field Strength Measurements; and Radiated Band Edge Measurements – Restricted Bands

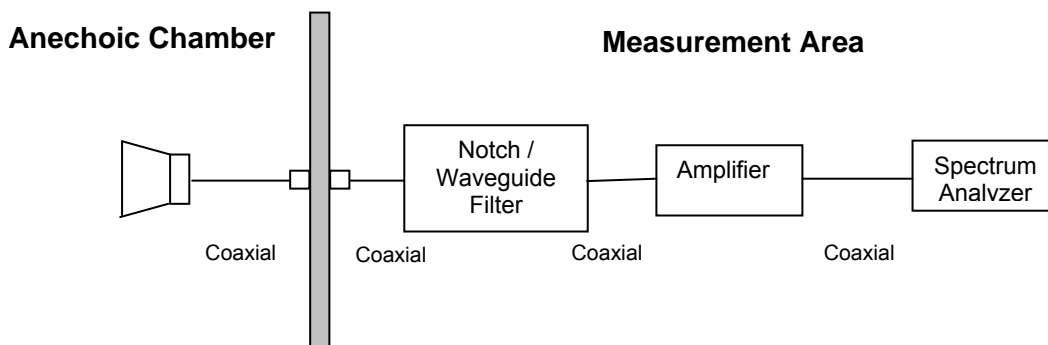
FCC, Part 15 Subpart C §15.407(b)(2), §15.205(a)/15.209(a)  
Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7

#### 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



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For example:

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

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

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

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

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

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

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

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

where P is the EIRP in Watts

$$\text{Therefore: } -27 \text{ dBm/MHz} = 68.23 \text{ dB}\mu\text{V/m}$$

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

#### Emission Characterization

During testing it was verified that there were several emissions emanating from the body of the EUT which was unrelated to the transmit channel. The emissions which were observed over the range 1 – 4 GHz were individually characterized.

Emissions 1 - 4 GHz and corresponding measurement values are identified on the following page.

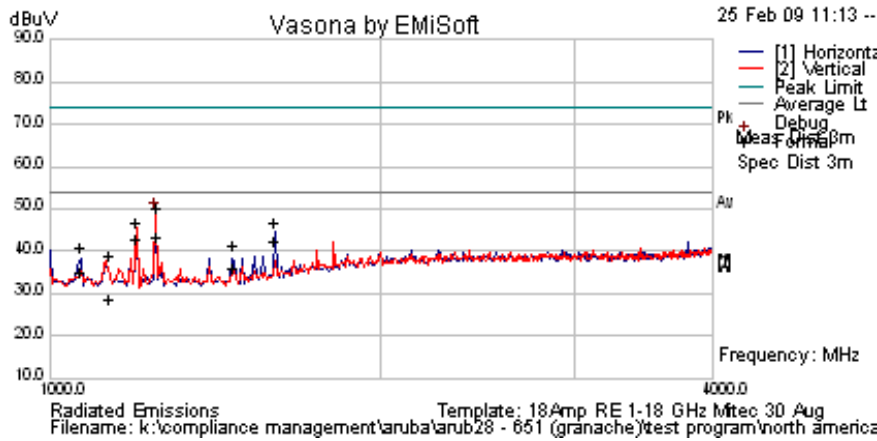
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**Emission Characterization**

Emissions emanating from body of EUT, 50 Ohm termination on all antenna ports  
 NRB = None Restrictive Band

**Spurious Emission Scan**



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
1066.727	53.88	2.02	-15.64	40.26	Peak Max	H	149	126	74	-33.74	Pass	
1133.375	52.64	2.08	-15.48	39.24	Peak Max	V	103	143	74	-34.76	Pass	
1200.005	60.1	2.14	-15.31	46.93	Peak Max	V	101	361	74	-27.07	Pass	
1249.933	63.15	2.18	-15.25	50.09	Peak Max	V	100	0	74	-23.91	Pass	NRB
1466.691	53.6	2.35	-14.96	40.99	Peak Max	H	109	140	74	-33.01	Pass	
1600.001	58.69	2.46	-13.89	47.26	Peak Max	H	98	242	74	-26.74	Pass	
1066.727	48.86	2.02	-15.64	35.23	Average Max	H	149	126	54	-18.77	Pass	
1133.375	45.37	2.08	-15.48	31.97	Average Max	V	103	143	54	-22.03	Pass	
1200.005	56.26	2.14	-15.31	43.09	Average Max	V	101	361	54	-10.91	Pass	
1249.933	56.46	2.18	-15.25	43.4	Average Max	V	100	0	54	-10.6	Pass	NRB
1466.691	48.39	2.35	-14.96	35.78	Average Max	H	109	140	54	-18.22	Pass	
1600.001	54.23	2.46	-13.89	42.79	Average Max	H	98	242	54	-11.21	Pass	

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**ARUB28 651 (ANT-INTEGRAL)  
ART Settings V Aggregate Measured Power**

The following matrix identifies the ART power setting V's each output chain. The aggregate power was also measured for all three chains.

As a result of either spurious emissions (harmonic) or band-edge issues the power was reduced to bring the unit into compliance.

Configuration	ART Power Setting	Tx 1 Measured Pwr (dBm)	Tx 2 Measured Pwr (dBm)	Tx 3 Measured Pwr (dBm)	Aggregate Measured Pwr (dBm)
Legacy a (5150   5180 MHz)BE	14	13.94	13.81	14.73	18.51
HT-20 (5150   5180 MHz)BE	14	13.79	13.81	14.85	18.49
HT-40 (5150   5190 MHz)BE	12.5	11.85	11.78	12.67	16.39

Note BE = Band-edge, SE – Spurious emissions

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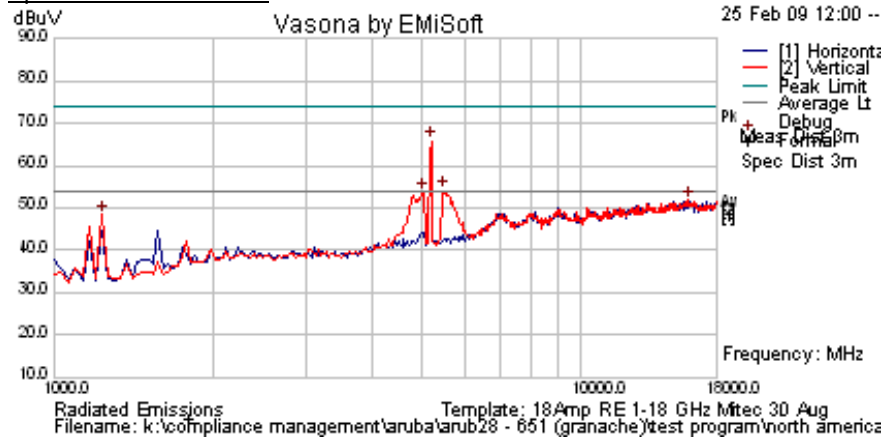
**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
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**ARUBA 651: 5150-5250GHz AP-ANT-1B 11a Data Rates**

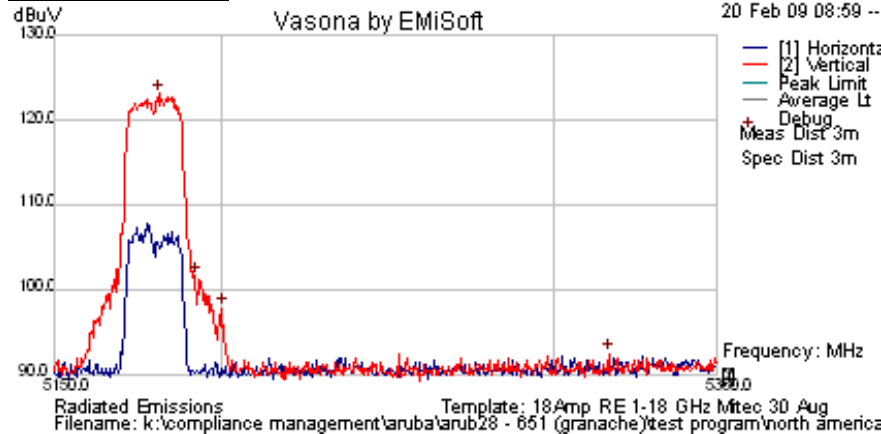
ARUB28 ARUBA 651 - AP-ANT-1B Test Configuration					
Channel	Freq (MHz)	Software Pwr Setting	Duty Cycle	Data Rate (MBit/s)	Compliant
36	5180	ART 19	99%	a 6 Legacy	Yes

Three antennas operating simultaneously  
 NRB = None Restrictive Band

**Spurious Emission Scan**

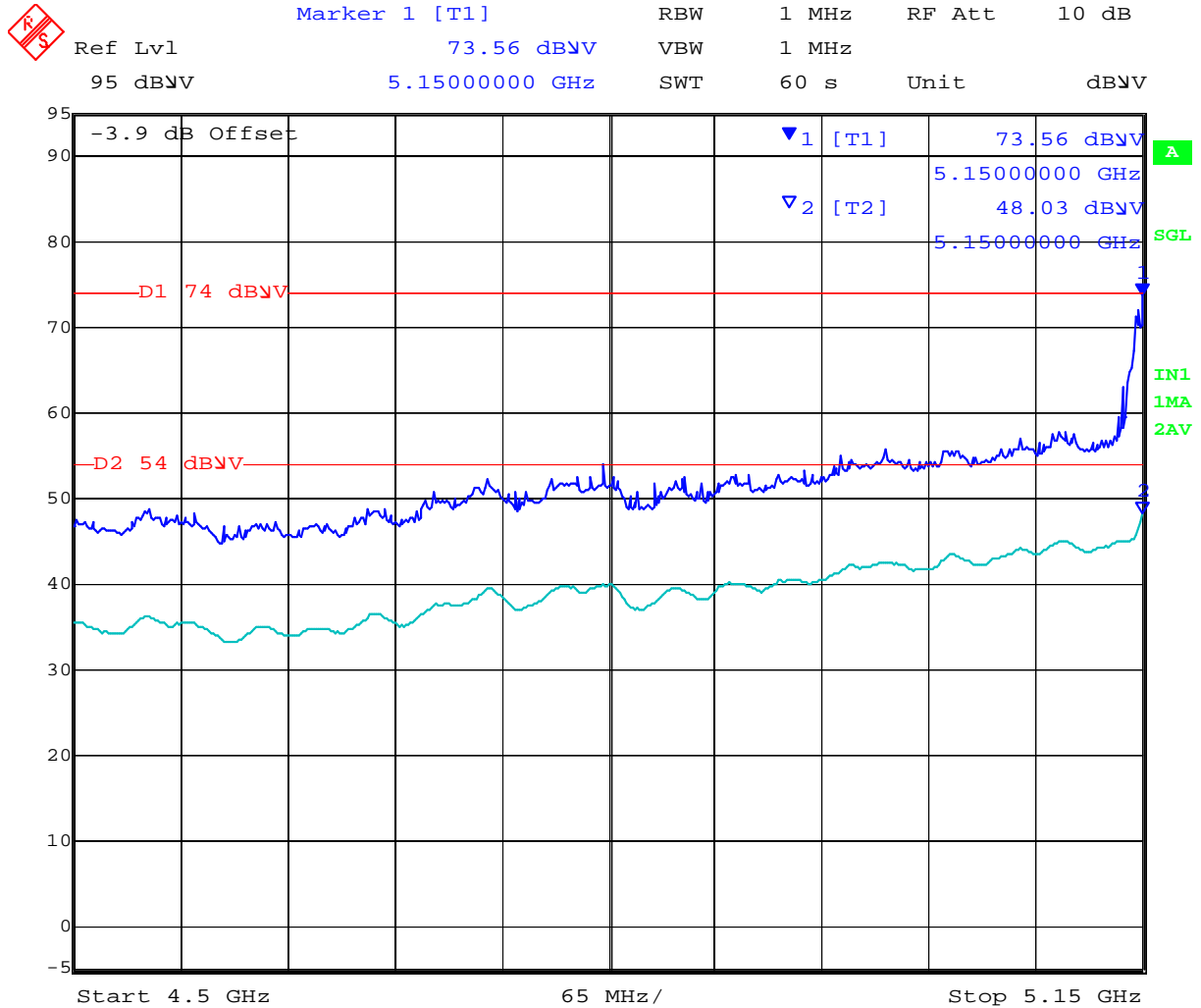


**Peak Emission Scan**



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5181.263	73.95	14.62	34.65	123.22	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental
5150.000	ART Power Setting = 14.0				Peak Max	V			74	-0.44	Pass	Band-edge
5150.000	ART Power Setting = 14.0				Average Max	V			54	-5.97	Pass	Band-edge
15954.549	43.54	8.95	-0.49	52	Peak Max	V	139	193	74	-22.00	Pass	
15954.549	30.2	8.95	-0.49	38.66	Average Max	V	139	193	54	-15.34	Pass	

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Date: 20.FEB.2009 02:15:40

802.11a Legacy Band-edge @ 5150 MHz with AP-ANT-1B antenna

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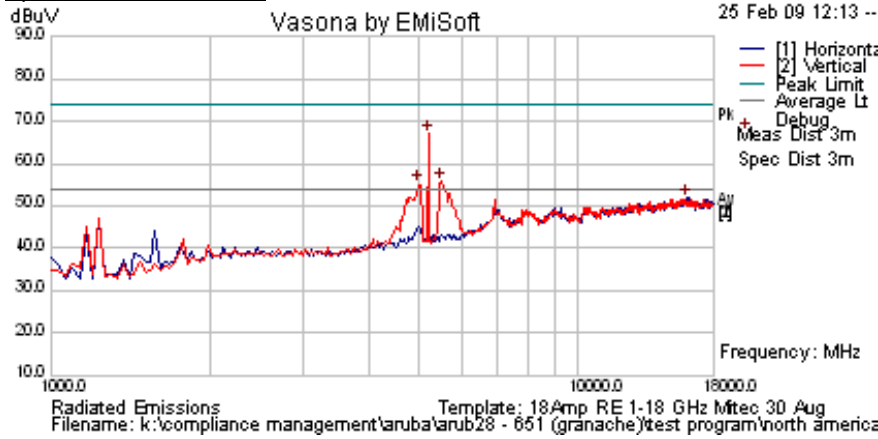


**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
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ARUB28 ARUBA 651 - AP-ANT-1B Test Configuration					
Channel	Freq (MHz)	Software Pwr Setting	Duty Cycle	Data Rate (MBit/s)	Compliant
40	5200	ART 19	99%	a 6 Legacy	Yes

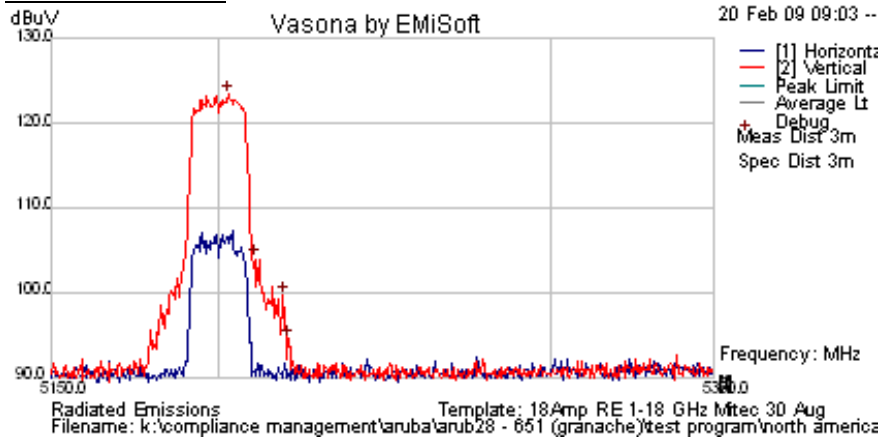
Three antennas operating simultaneously  
 NRB = None Restrictive Band

**Spurious Emission Scan**



**Spurious Emission Scan**

**Peak Emission Scan**



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5202.905812	74.1	14.62	34.67	123.39	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

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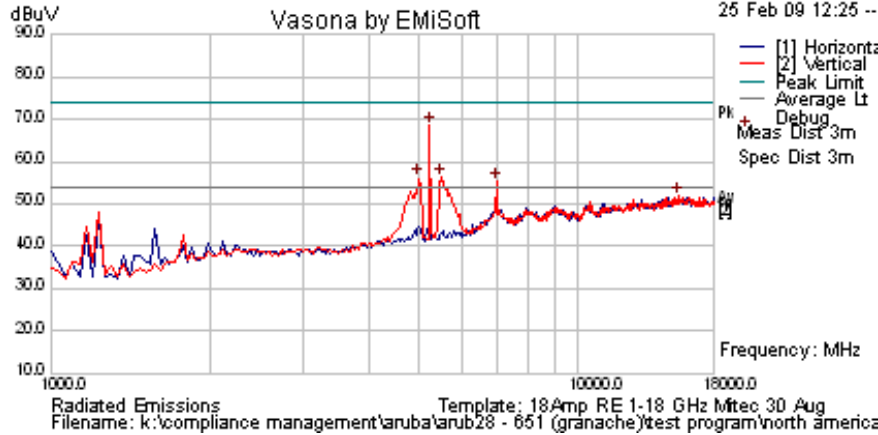


**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
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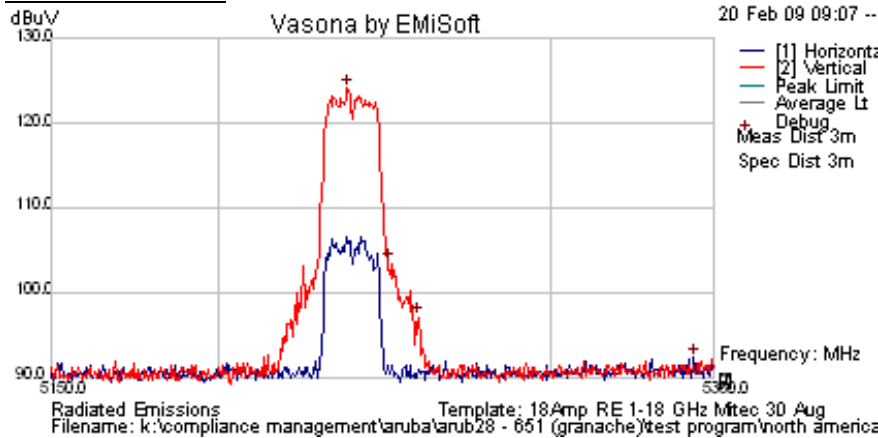
ARUB28 ARUBA 651 - AP-ANT-1B Test Configuration					
Channel	Freq (MHz)	Software Pwr Setting	Duty Cycle	Data Rate (MBit/s)	Compliant
48	5240	ART 19	99%	a 6 Legacy	Yes

Three antennas operating simultaneously  
 NRB = None Restrictive Band

**Spurious Emission Scan**



**Peak Emission Scan**



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5238.577154	74.8	14.62	34.7	124.11	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental
6995.991984	51.5	5.38	-1.56	55.31	Peak [Scan]	V	100	0	68.23	-12.92	Pass	NRB

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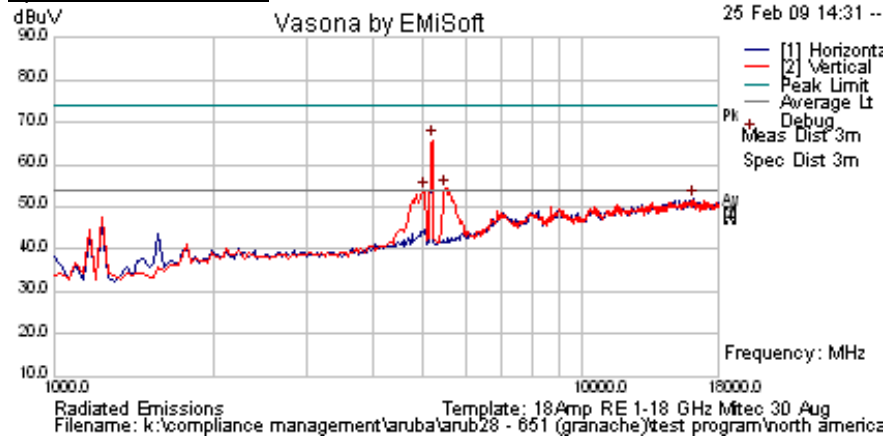
**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
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**ARUBA 651: 5150-5250GHz AP-ANT-1B HT-20 Data Rates**

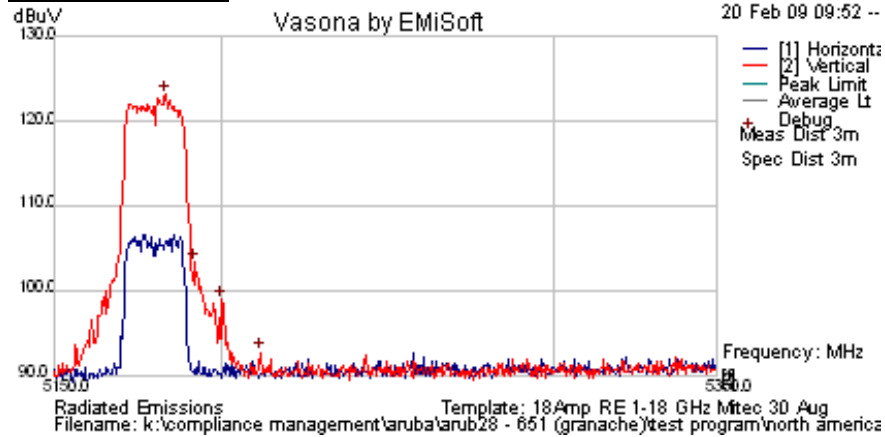
ARUB28 ARUBA 651 - AP-ANT-1B Test Configuration					
Channel	Freq (MHz)	Software Pwr Setting	Duty Cycle	Data Rate (MCS)	Compliant
36	5180	ART 19	99%	6.5 HT-20	Yes

Three antennas operating simultaneously  
 NRB = None Restrictive Band

**Spurious Emission Scan**



**Peak Emission Scan**

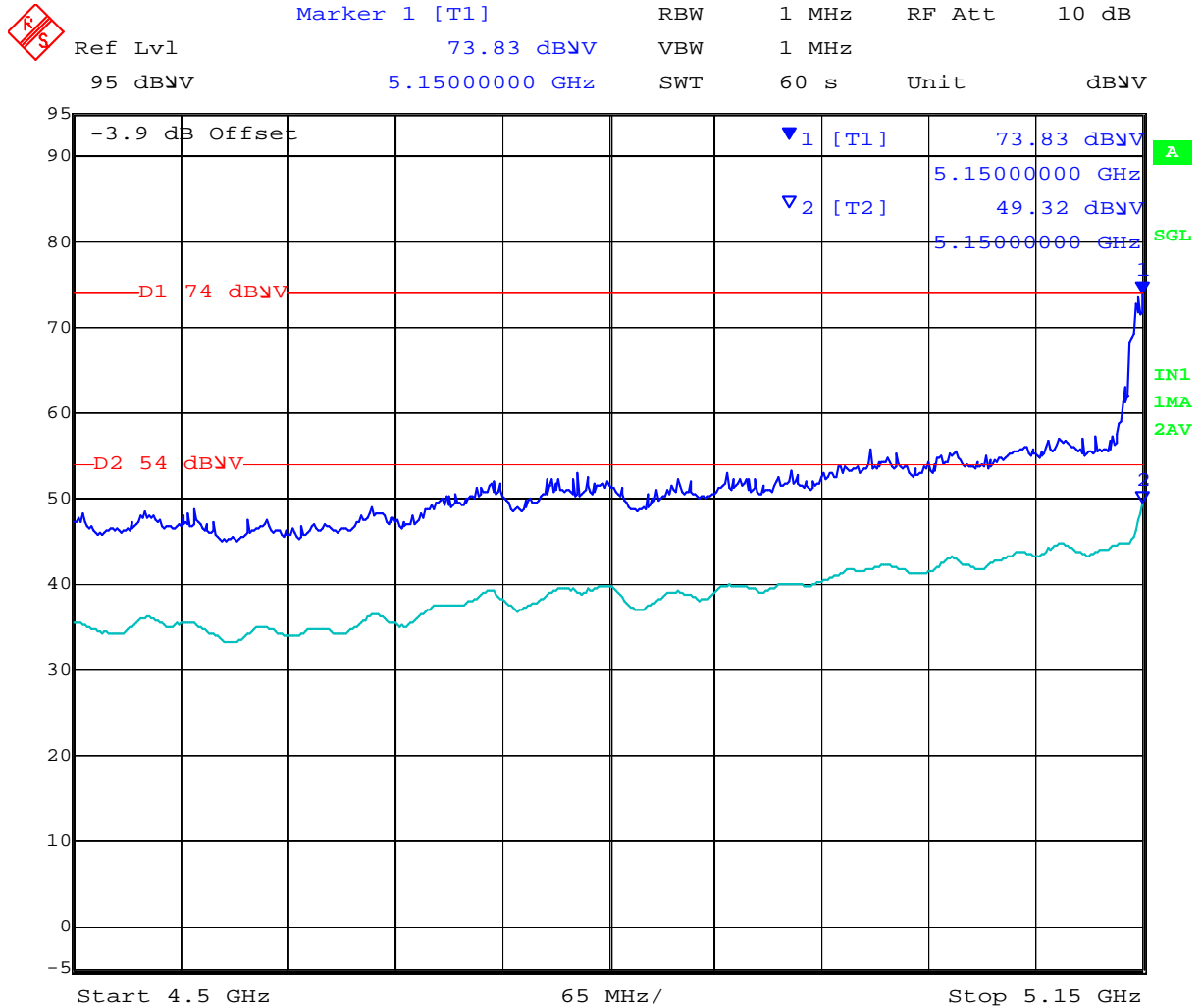


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5183.266533	73.94	14.62	34.65	123.21	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental
5150.000	ART Power Setting = 14.0				Peak Max				74	-0.17	Pass	Band-edge
5150.000	ART Power Setting = 14.0				Average Max				54	-4.68	Pass	Band-edge

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Date: 20.FEB.2009 03:10:07

HT-20 Band-edge @ 5150 MHz - AP-ANT-1B antenna

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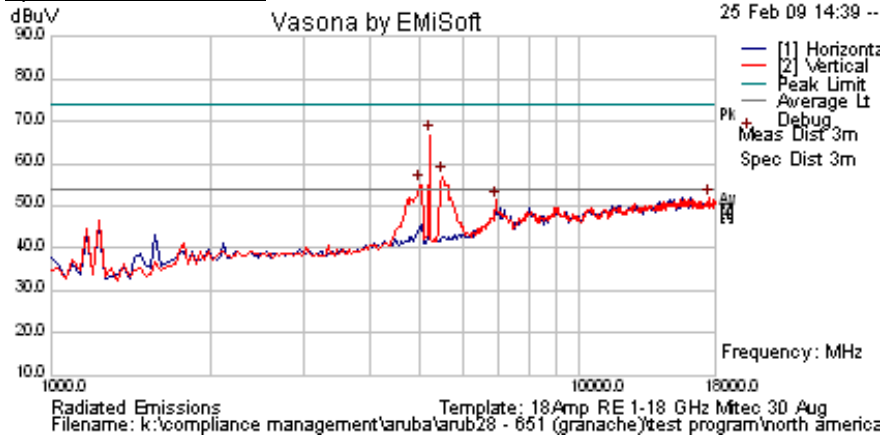


**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
**To:** FCC 47 CFR Part 15.407 & IC RSS-210  
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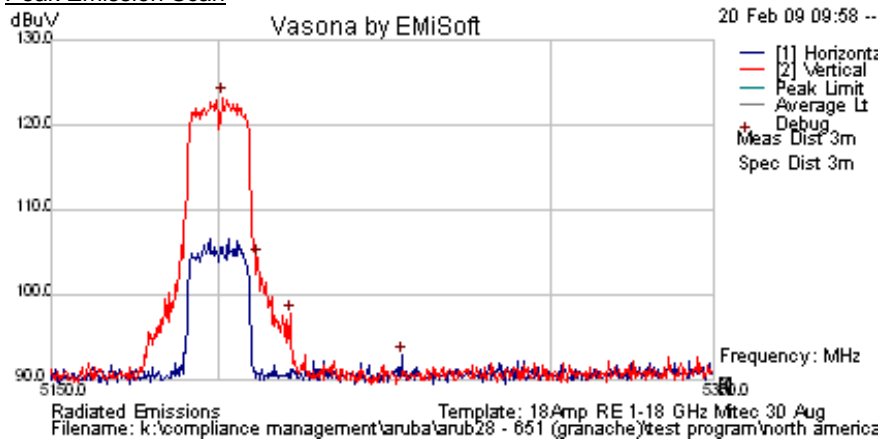
ARUB28 ARUBA 651 - AP-ANT-1B Test Configuration					
Channel	Freq (MHz)	Software Pwr Setting	Duty Cycle	Data Rate (MCS)	Compliant
40	5200	ART 19	99%	6.5 HT-20	Yes

Three antennas operating simultaneously  
 NRB = None Restrictive Band

**Spurious Emission Scan**



**Peak Emission Scan**



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5201.302605	74.02	14.62	34.67	123.31	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental
6927.855711	48.21	5.35	-2.21	51.34	Peak [Scan]	V	100	0	68.23	-16.89	Pass	NRB

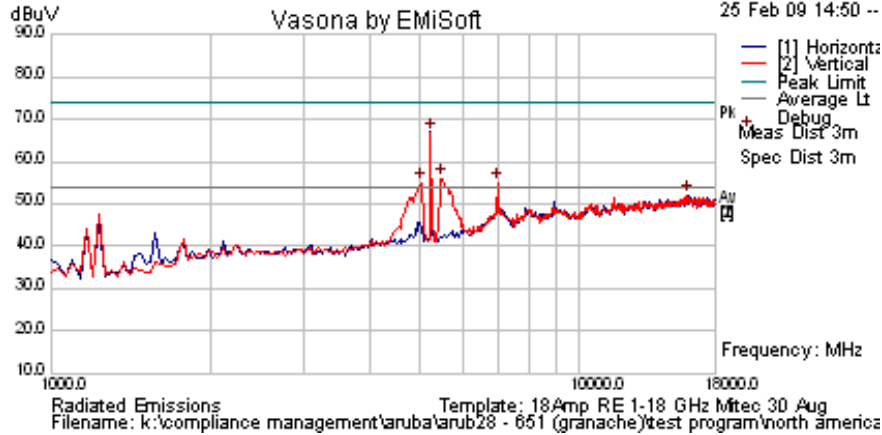
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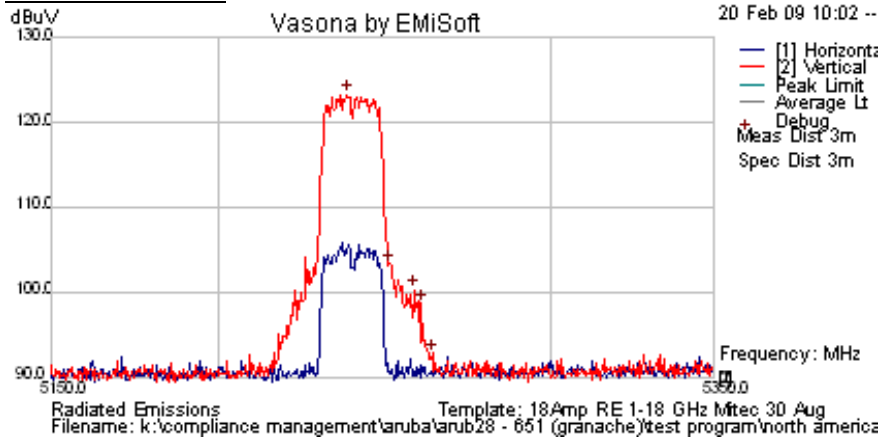
ARUB28 ARUBA 651 - AP-ANT-1B Test Configuration					
Channel	Freq (MHz)	Software Pwr Setting	Duty Cycle	Data Rate (MCS)	Compliant
48	5240	ART 19	99%	6.5 HT-20	Yes

Three antennas operating simultaneously  
 NRB = None Restrictive Band

Spurious Emission Scan



Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5238.577154	73.96	14.62	34.7	123.28	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental
6995.991984	51.5	5.38	-1.56	55.31	Peak [Scan]	V	100	0	68.23	-12.92	Pass	NRB

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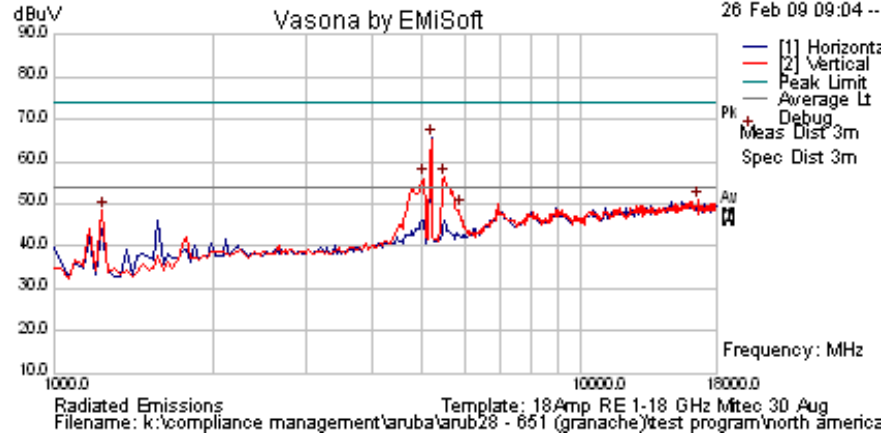
**ARUBA 651: 5150-5250GHz AP-ANT-1B HT-40 Data Rates**

ARUB28 ARUBA 651 - AP-ANT-1B Test Configuration					
Channel	Freq (MHz)	Software Pwr Setting	Duty Cycle	Data Rate (MCS)	Compliant
	5190	ART 19	99%	13.5 HT-40	Yes

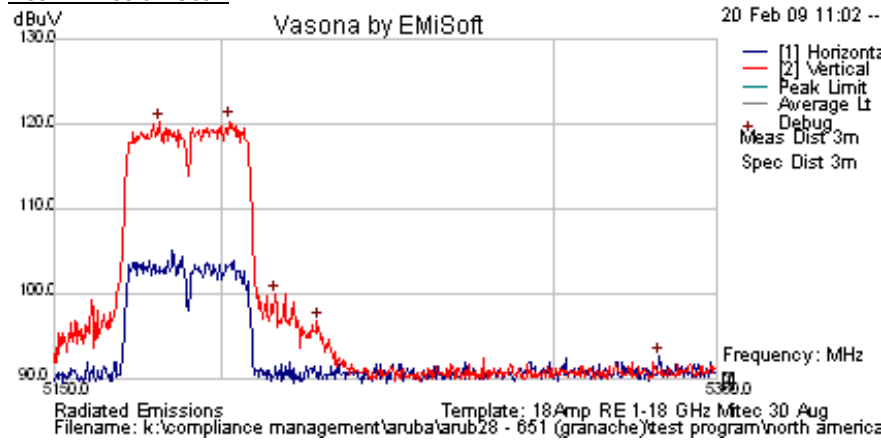
Three antennas operating simultaneously

NRB = None Restrictive Band

Spurious Emission Scan

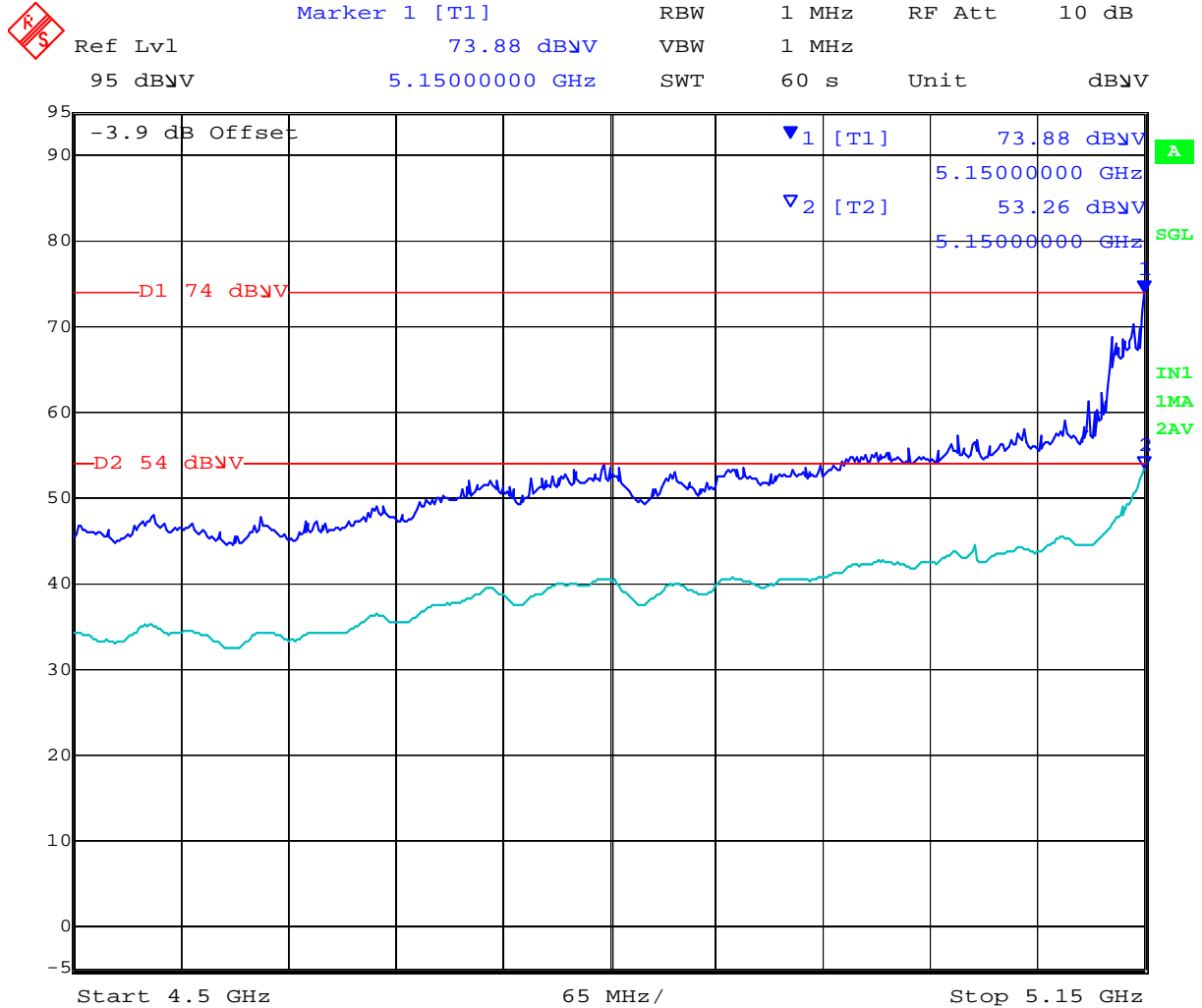


Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	PoI	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5202.104208	71.09	14.62	34.67	120.38	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental
5150.000	ART Power Setting = 12.5				Peak Max	V			74	-0.12	Pass	Band-edge
5150.000	ART Power Setting = 12.5				Average Max	V			54	-0.74	Pass	Band-edge

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Date: 20.FEB.2009 03:15:29

HT-40 Band-edge @ 5150 MHz - AP-ANT-1B antenna

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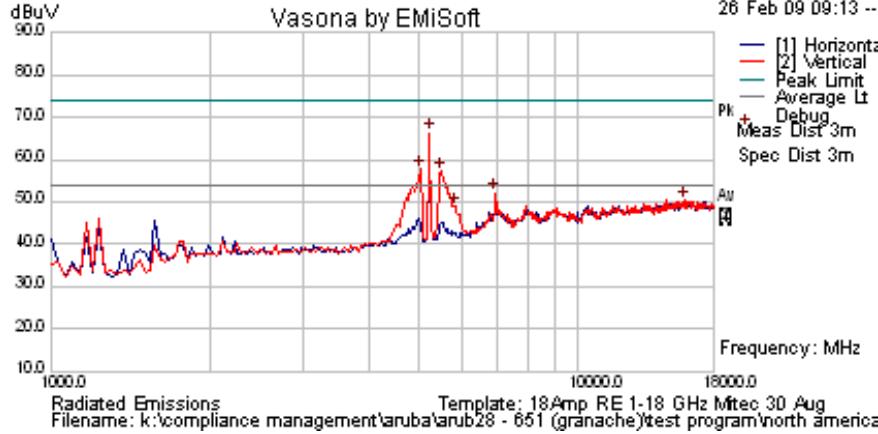
**Title:** 651-XX 802.11a/b/g/n Wireless Controller  
**To:** FCC 47 CFR Part 15.407 & IC RSS-210  
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**ARUB28 ARUBA 651 - AP-ANT-1B Test Configuration**

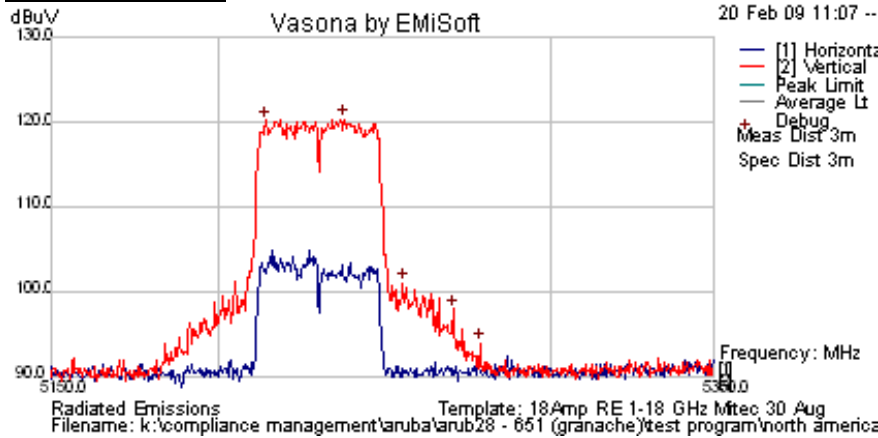
Channel	Freq (MHz)	Software Pwr Setting	Duty Cycle	Data Rate (MCS)	Compliant
	5230	ART 19	99%	13.5 HT-40	Yes

Three antennas operating simultaneously  
 NRB = None Restrictive Band

**Spurious Emission Scan**



**Peak Emission Scan**



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5237.775551	71.05	14.62	34.69	120.37	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental
6961.923848	48.64	5.36	-1.88	52.13	Peak [Scan]	V	100	0	68.23	-16.10	Pass	NRB

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## 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 5<sup>th</sup> harmonic of the highest frequency generated without exceeding 40 GHz.

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

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

#### **§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

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### Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB
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### Traceability

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

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### 5.1.7.2. Receiver Radiated Spurious Emissions (above 1 GHz)

#### Industry Canada RSS-Gen §4.8, §6

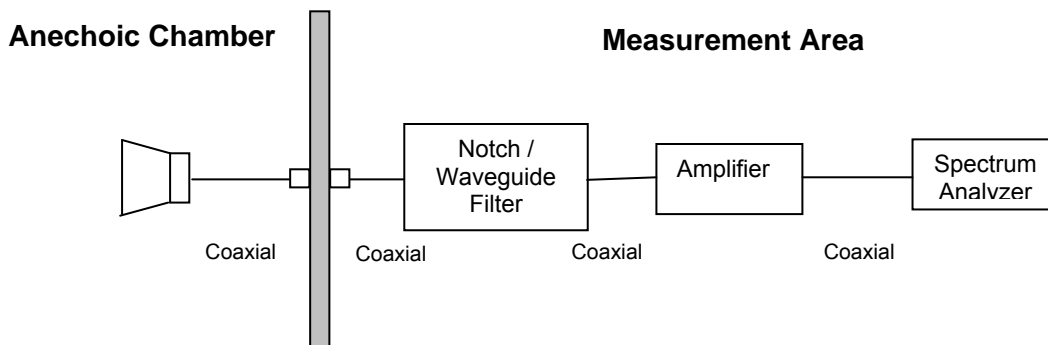
#### Test Procedure

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



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For example:

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

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

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

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

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

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

Section 5.1.6.1 Transmitter Spurious above 1 GHz identifies that emissions peaking above 54 dB $\mu$ V/m emanate from the EUT and not transmitted through the antenna port. These (1 – 3.5 GHz) emissions were formally measured and characterized and are not considered when examining Receiver Radiated Spurious above 1 GHz.

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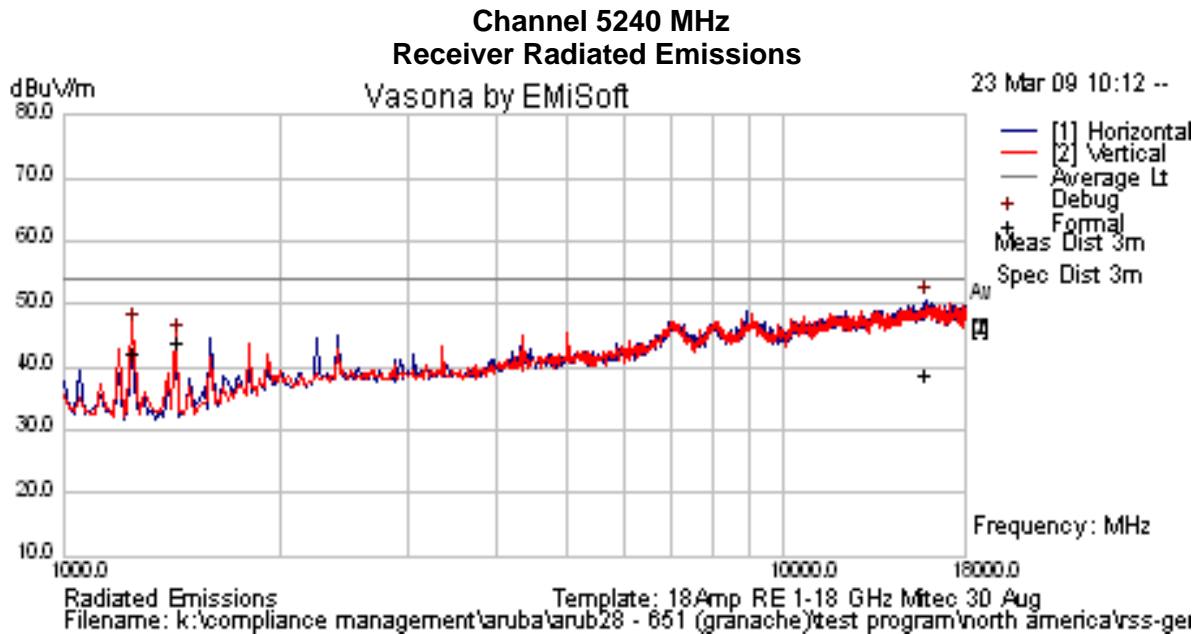


**Receiver Radiated Spurious Emissions above 1 GHz**

Test Setup – AP-ANT-1B Antenna, Channel 48, 5240 MHz, all modes Legacy, HT-20, HT-40.

TABLE OF RESULTS –

Freq. (MHz)	Pol. (H/V)	Raw Reading (dB $\mu$ V/m)	Correction Factor (dB)	Corrected Field Strength (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)



No receiver emissions were observed.



## Specification

### Receiver Radiated Spurious Emissions

#### Industry Canada RSS-Gen §4.8,

The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

#### RSS-Gen §6

The following receiver spurious emission limits shall be complied with;

(a) If a radiated measurement is made, all spurious emissions shall comply with the limits of Table 1.

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

### Laboratory Measurement Uncertainty for 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

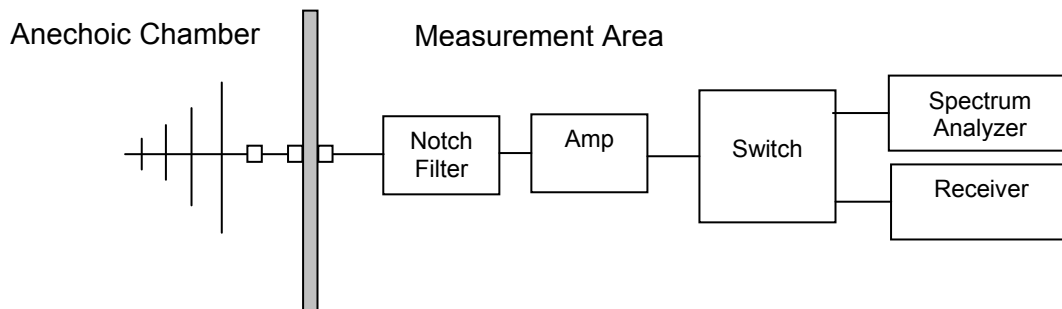
### 5.1.7.3. Radiated Spurious Emissions (30M-1 GHz)

**FCC, Part 15 Subpart C §15.407(b)(6); §15.205(a); §15.209(a)**  
**Industry Canada RSS-210 §2.2**

#### Test Procedure

Preliminary radiated emissions are measured in the anechoic chamber at a 10-meter distance on every azimuth in both horizontal and vertical polarity. The emissions are recorded with a spectrum analyzer in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

The EUT had two methods of powering on ac/dc converter and Power over Ethernet, Both modes were tested.



#### Test Measurement Set up

#### Field Strength Calculation

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

where:

$$FS = R + AF + CORR$$

FS = Field Strength  
R = Measured Receiver Input Amplitude  
AF = Antenna Factor  
CORR = Correction Factor = CL – AG + NFL  
CL = Cable Loss  
AG = Amplifier Gain



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For example:

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

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

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

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

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

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

### Measurement Results for Spurious Emissions (30 MHz – 1 GHz)

Ambient conditions.

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

For emissions below 1 GHz the 651 Wireless Controller ports were fully loaded and exercised;

1. 4 GIGE Ethernet ports with POE – loaded with active POE driving Access Points 124/125 which were installed in the support chamber
2. 2 GIGE Ethernet without POE – 2 ethernet cables connected to Access Points 124/125
3. 2 SFP uplink ports - fiberoptic cables in loop back configuration for each port; Internally exercised.
4. 4 USB ports – portable USB flash drives in each port
5. 1 Console serial port (RJ-45) – connected to Laptop PC
6. 1 PCI Express card slot – Kyocera PCI Express Card
7. 3 Antenna ports (reverse SMA) – AP-ANT-1B antennas connected
8. IEC 320 AC input connector – powered

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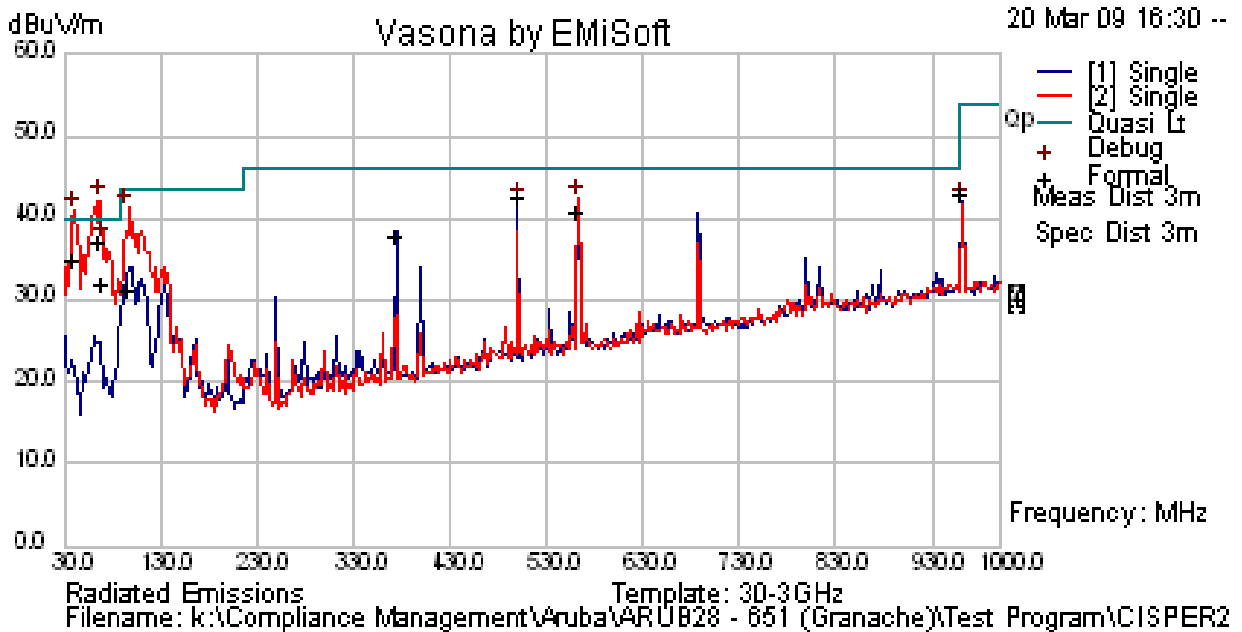


**TABLE OF RESULTS**

**115 VAC 60 Hz**

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB
66.823	56.62	3.87	-23.27	37.22	Quasi Peak	V	149	124	40	-2.78
960.022	41.89	7.56	-6.6	42.85	Quasi Max	H	98	120	54	-11.15
499.987	49.12	6	-12.62	42.51	Quasi Max	H	187	142	46	-3.49
40.345	49.07	3.57	-17.6	35.04	Quasi Max	V	110	206	40	-4.96
562.517	46.04	6.29	-11.65	40.68	Quasi Peak	H	168	133	46	-5.32
70.837	51.28	3.89	-23.14	32.03	Quasi Max	V	133	278	40	-7.97

**Radiated Spurious Emissions 0.03 to 1 GHz (115 Vac 60 Hz)**



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## Specification

### Limits

**§15.407(b)(6)** Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209.

**§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 §2.2** refers to Section 2.7 Table 2 below;-

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
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### Traceability

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

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

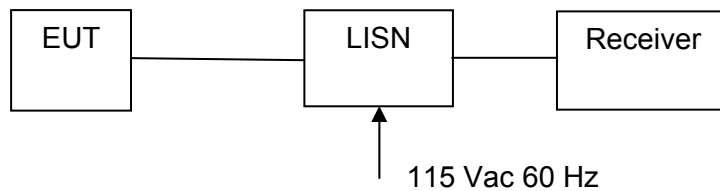
**FCC, Part 15 Subpart C §15.407(b)(6)/15.207**

**Industry Canada RSS-Gen §7.2.2**

#### **Test Procedure**

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

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



Measurement set up for AC Wireline Conducted Emissions Test

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

Ambient conditions.

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

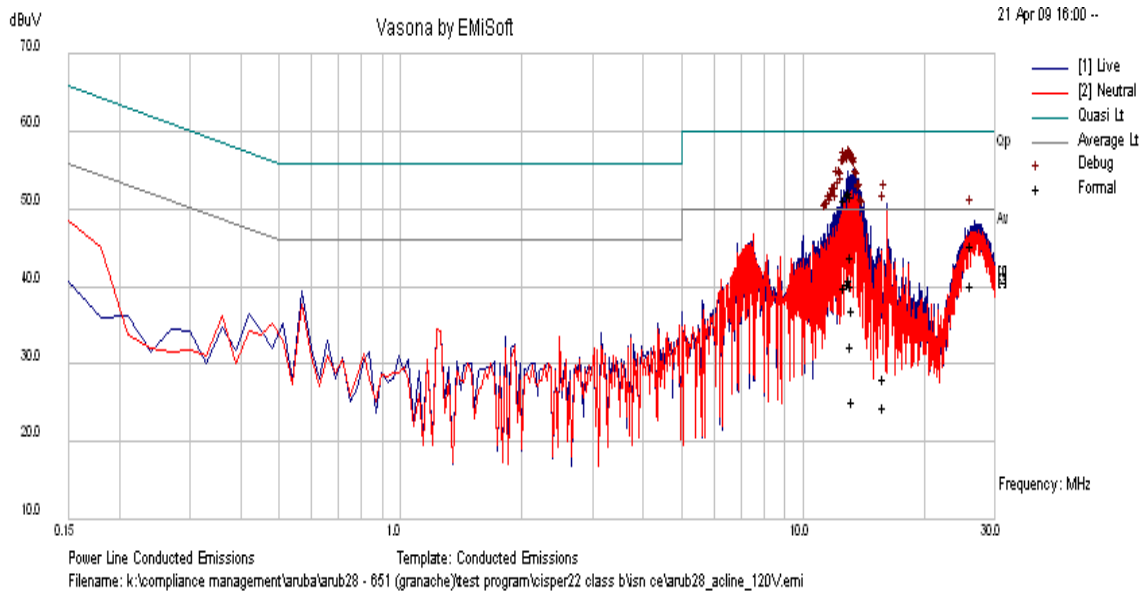
AC Wireline Emissions 115Vac 60Hz  
Transmitter Power Level: Maximum



**TABLE OF RESULTS**

Freq (MHz)	Line	Peak (dBµV)	QP (dBµV)	QP Limit (dBµV)	QP Margin (dB)	Ave. (dBµV)	Ave. Limit (dBµV)	Ave. Margin (dB)
12.939	Line	51.79	51.17	60	-8.83	39.98	50	-10.00
13.16	Line	52.17	51.94	60	-8.06	40.37	50	-9.63
13.306	Line	50.05	52.21	60	-7.79	40.9	50	-9.10
13.387	Line	49.76	43.92	60	-16.1	32.31	50	-17.70
13.454	Line	46.11	51.75	60	-8.25	40.19	50	-9.81
26.634	Line	44.86	45.39	60	-14.6	40.07	50	-9.93

**AC Wireline Conducted Emissions 0.15 – 30 MHz, 115 Vac 60 Hz**



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**Specification**

**Limit**

**§15.407 (b)(6);** Any U-NII devices using an AC power line are required to comply also with the limits set forth in Section 15.207.

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

**RSS-Gen §7.2.2**

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

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

The lower limit applies at the boundary between frequency ranges

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

\* Decreases with the logarithm of the frequency

**Laboratory Measurement Uncertainty for Conducted Emissions**

Measurement uncertainty	$\pm 2.64$ dB
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**Traceability**

Method	Test Equipment Used
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'	0158, 0184, 0193, 0190, 0293, 0307

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## 6. PHOTOGRAPHS

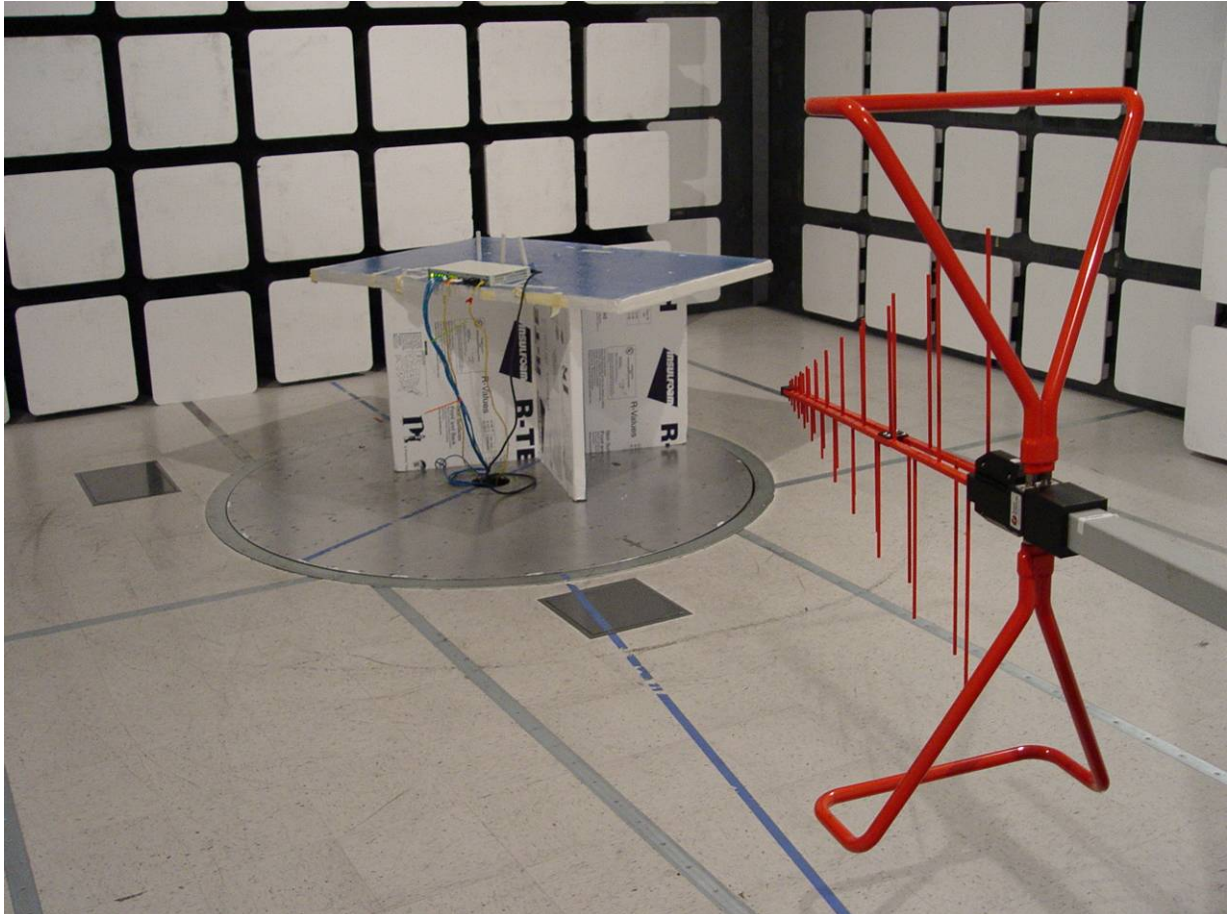
### 6.1. Radiated Emissions > 1GHz



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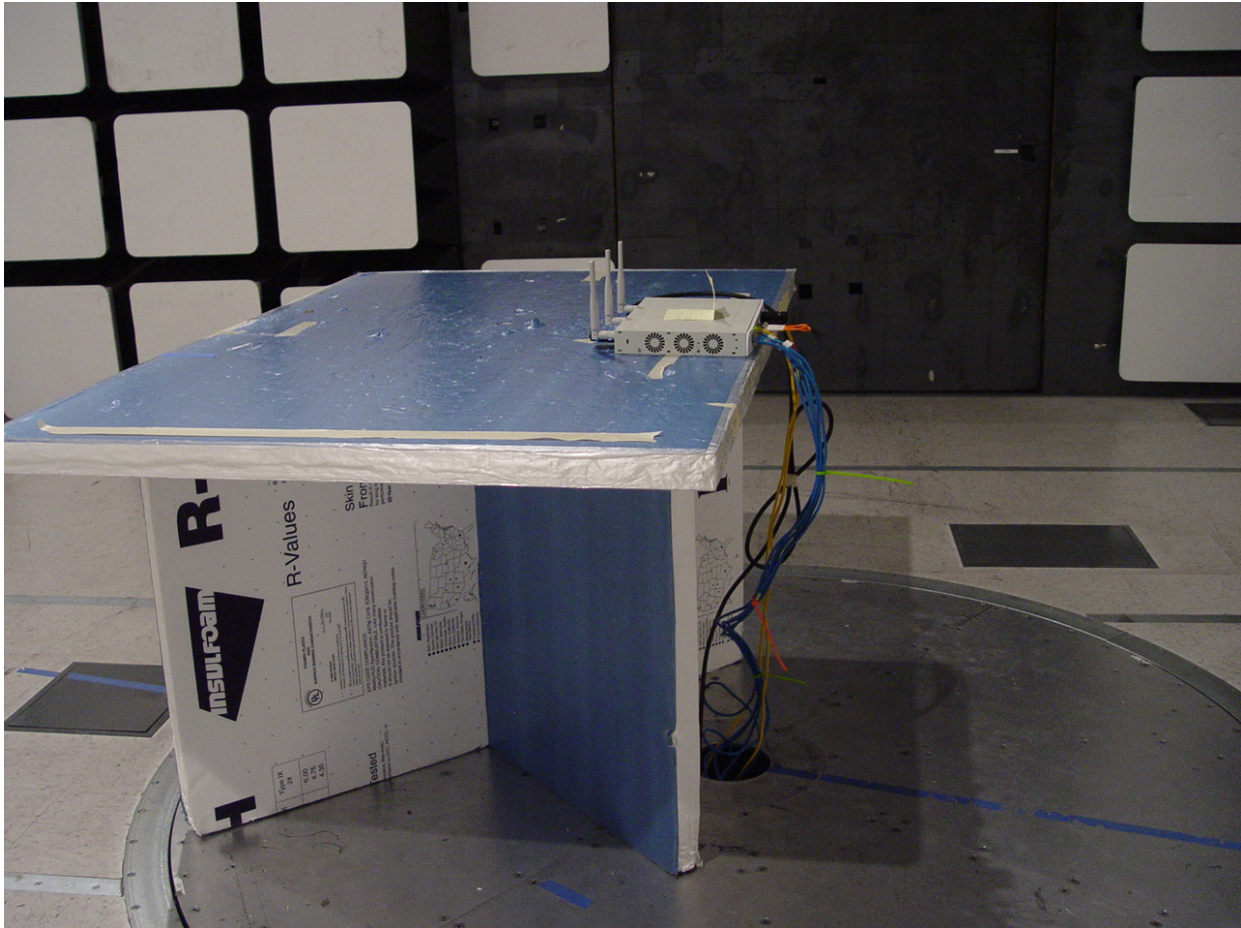
## 6.2. Radiated Emissions < 1GHz



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### 6.3. Radiated Emissions Cable & Accessory Configuration



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#### 6.4. AC Wireline Conducted Emissions

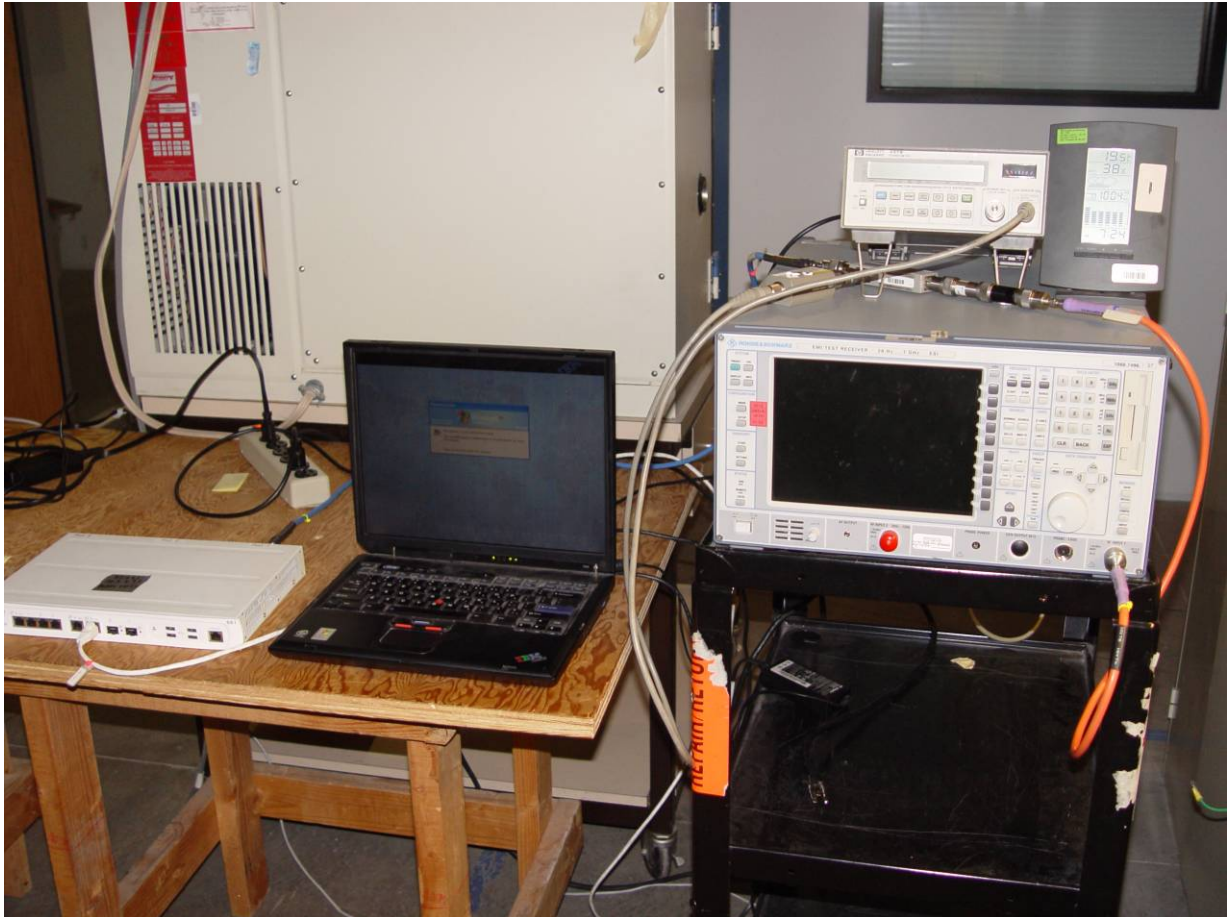


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## 6.5. Conducted RF Measurement Test Set-Up



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## 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
0302	5.25 GHz Notch Filter	Micro-Tronics	BRC50703	002
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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440 Boulder Court, Suite 200  
Pleasanton, CA 94566, USA  
Tel: 1.925.462.0304  
Fax: 1.925.462.0306  
[www.micomlabs.com](http://www.micomlabs.com)