Test of Aruba Networks, WAP3212

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

Test Report Serial No.: ARUB189-U4 Rev A

TEST REPORT

FROM

Test of Aruba Networks, WAP3212

to

To FCC 47 CFR Part 15.407 & IC RSS-210

Test Report Serial No.: ARUB189-U4 Rev A

Note: this report contains data with regard to the 5,150 - 5,350 and 5,470 – 5725 MHz bands for Aruba Networks, WAP3212 Wireless Access Point. 2.4 and 5.8 GHz test data are reported in MiCOM Labs test report ARUB189-U2

This report supersedes None

Applicant:	Aruba Networks 1344 Crossman Avenue Sunnyvale, California 94089 USA
Product Function:	Wireless Access Point for use in aircraft

Copy No: pdf Issue Date: 4th February 2015

This Test Report is Issued Under the Authority of;

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TESTING CERT #2381.01

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ACCREDITATION, LISTINGS & RECOGNITION

TESTING ACCREDITATION

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

American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

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

Presented this 28th day of February 2014.

President & CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2015

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

RECOGNITION

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

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.
Phase I - recognition for product testing
Phase II – recognition for both product testing and certification
N/A – Not Applicable

**EU MRA – European Union Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

**NB – Notified Body

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PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC 17065. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-02.pdf

United States of America – Telecommunication Certification Body (TCB)
TCB Identifier – US0159

Industry Canada – Certification Body
CAB Identifier – US0159

Europe – Notified Body
Notified Body Identifier - 2280

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

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	4th February 2015	Initial release

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1. TEST RESULT CERTIFICATE

Applicant:	Aruba Networks 1344 Crossman Avenue Sunnyvale, California 94089 USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	Wireless LAN Access point	Tel:	+1 925 462 0304
Model:	WAP3212	Fax:	+1 925 462 0306
S/N:	P000013		
Test Date(s):	15th - 24th December 2014	Website:	www.micomlabs.com

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

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

Notes:

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

ACCREDITED
TESTING CERT #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

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2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 15.407	2012	Code of Federal Regulations
(ii)	FCC 06-96	June 2006	Memorandum Opinion and Order
(iii)	FCC OET KDB 662911	31st October 2013	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
(iv)	Industry Canada RSS-210 Annex 9	2010	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands): Category 1 Equipment
(v)	ICES-003	31st August 2013	Spectrum Management and Telecommunications Policy Interference-Causing Equipment Standard Digital Apparatus; Issue 5
(vi)	Industry Canada RSS-Gen	2010	General Requirements and Information for the Certification of Radiocommunication Equipment
(vii)	ANSI C63.4	2009	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(viii)	CISPR 22/ EN 55022	2010	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(ix)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(x)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(xi)	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
(xii)	A2LA	July 2012	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(xiii)	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 Aruba Networks, WAP3212 in the frequency range 5,150 - 5,350 and 5470 – 5725 MHz to FCC Part 15.407 and Industry Canada RSS-210 regulations.
Applicant:	Aruba Networks 1344 Crossman Avenue Sunnyvale, California 94089,USA
Manufacturer:	As applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton, California 94566 USA
Test report reference number:	ARUB189-U4 Rev A
Date EUT received:	15th December 2014
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210
Dates of test (from - to):	15th - 24th December 2014
No of Units Tested:	One
Type of Equipment:	802.11a/b/g/n/ac Wireless Access Point 3x3 Spatial Multiplexing MIMO configuration
Applicants Trade Name:	Cabin Wireless Access Point (CWAP)
Model(s):	WAP3212-001001 / RD-FA2066-01
Location for use:	Indoor only
Declared Frequency Range(s):	5,150 – 5,250, 5,250 – 5,350 and 5,470 – 5,725 MHz
Hardware Rev	Mod 0
Firmware Rev	e500rd_ap225.ari (radio-board)
Software Rev	SWWAP-002-001
Type of Modulation:	Per 802.11 – OFDM
EUT Modes of Operation:	Legacy 802.11a, 802.11n HT-20, HT-40, ac-40, ac-80
Declared Nominal Output Power: (Average Power)	802.11a: Legacy +15 dBm 802.11n: HT-20 +15 dBm 802.11n: HT-40 +15 dBm 802.11ac-40 +15 dBm 802.11ac-80 +15 dBm
Transmit/Receive Operation:	Time Division Duplex
Rated Input Voltage and Current:	115 Vac (360-800 Hz)
Operating Temperature Range:	Declared range 0º to +40ºC
ITU Emission Designator:	802.11a 17M7D1D 802.11n HT-20 17M7D1D 802.11n HT-40 36M4D1D 802.11ac-40 36M9D1D 802.11ac-80 75M9D1D
Equipment Dimensions:	279.4mmx 230mm x 59mm / 11.0”x8.0”x9.06” (WxDxH)
Weight:	2.0 kg
Primary function of equipment:	Wireless Access Point for transmitting data and voice within aircraft

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3.2. Scope of Test Program

Aruba Networks WAP3212 Wireless Access Point
The scope of the test program was to test the Aruba Networks WAP3212 Wireless Access Point, 3X3 Spatial Multiplexing MIMO configurations in the frequency range 5,150 - 5,250 MHz for compliance against FCC 47 CFR Part 15.407 and Industry Canada RSS-210 specifications.

FCC Correspondence – Tracking Number 906981
Aruba Networks sent an official inquiry (Tracking Number 906981) dated 21st October 2014 to the FCC requesting clarification on the reuse of test data. Received the following response from the FCC;

FCC response 12/04/2014:

You may reuse the conducted data but must do new radiated measurements. If the new application is under a different applicant's name, the applicant will need permission to reuse the data. This letter must be uploaded to the new application.

Conducted test data can be found in MiCOM Labs test report number:
ARUB145-U2 Aruba Networks APIN0224, APIN0225 FCC Pt 15.407 & IC RSS 210

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

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

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

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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/ac WLAN	Aruba Networks	WAP3212-001001 / RD-FA2066-01	P000013
Support	Laptop PC	IBM	Thinkpad	None

3.4. Antenna Details

Model	Type	Gain	Freq. Band	Note
		dBi	MHz	
metal sheet	Omni	4.0	2400 - 2500	3x per band, per unit
		4.5	4900 - 5875	

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 2 x 10/100/1000 Ethernet (Daisy-Chainable)
2. 115 Vac (360-800 Hz), supply connector
3. 4 x Strapping pins for discrete input/outputs

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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)
5150-5250 MHz	Legacy	6 MBit/s	5180/5200/5240
	HT-20	6.5 MBit/s	
	HT-40	13.5 MBit/s	5190, 5230
	ac-40		
	ac-80	29.3 MBit/s	5210

Bands (MHz)	Operational Mode(s) (802.11)	Data Rates with Highest Power	Frequencies (MHz)
5250 - 5350 5470 - 5725	Legacy	6 MBit/s	5260, 5300, 5320 5500, 5580, 5700
	HT-20, ac-20	6.5 MBit/s	
	HT-40, ac-40	13.5 MBit/s	5270, 5310 5510, 5550, 5670
	ac-80	29.3 MBit/s	5290, 5530, 5690

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Spurious Emission and Band-Edge Test Strategy

Bands 5,150 – 5250

11a	11n HT-20	11n HT-40	11ac-40	11ac-80
SE 5180				
SE 5200				
SE 5240				
BE 5150	BE 5150	BE 5150	BE 5150	BE 5150

Band 5,250 – 5,350

11a	11n HT-20	11n HT-40	11n ac-80
SE 5260			
SE 5300			
SE 5320			
BE 5350	BE 5350	BE 5350	BE 5350

Band 5,470 – 5725

11a	11n HT-20	11n HT-40	11n ac-80
SE 5500			
SE 5580			
SE 5700			
BE 5470	BE 5470	BE 5470	BE 5470

KEY:-

SE – Spurious Emissions

BE – Band-Edge

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3.7. Equipment Modifications

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

1. NONE

3.8. Deviations from the Test Standard

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

1. NONE

3.9. Subcontracted Testing or Third Party Data

1. NONE

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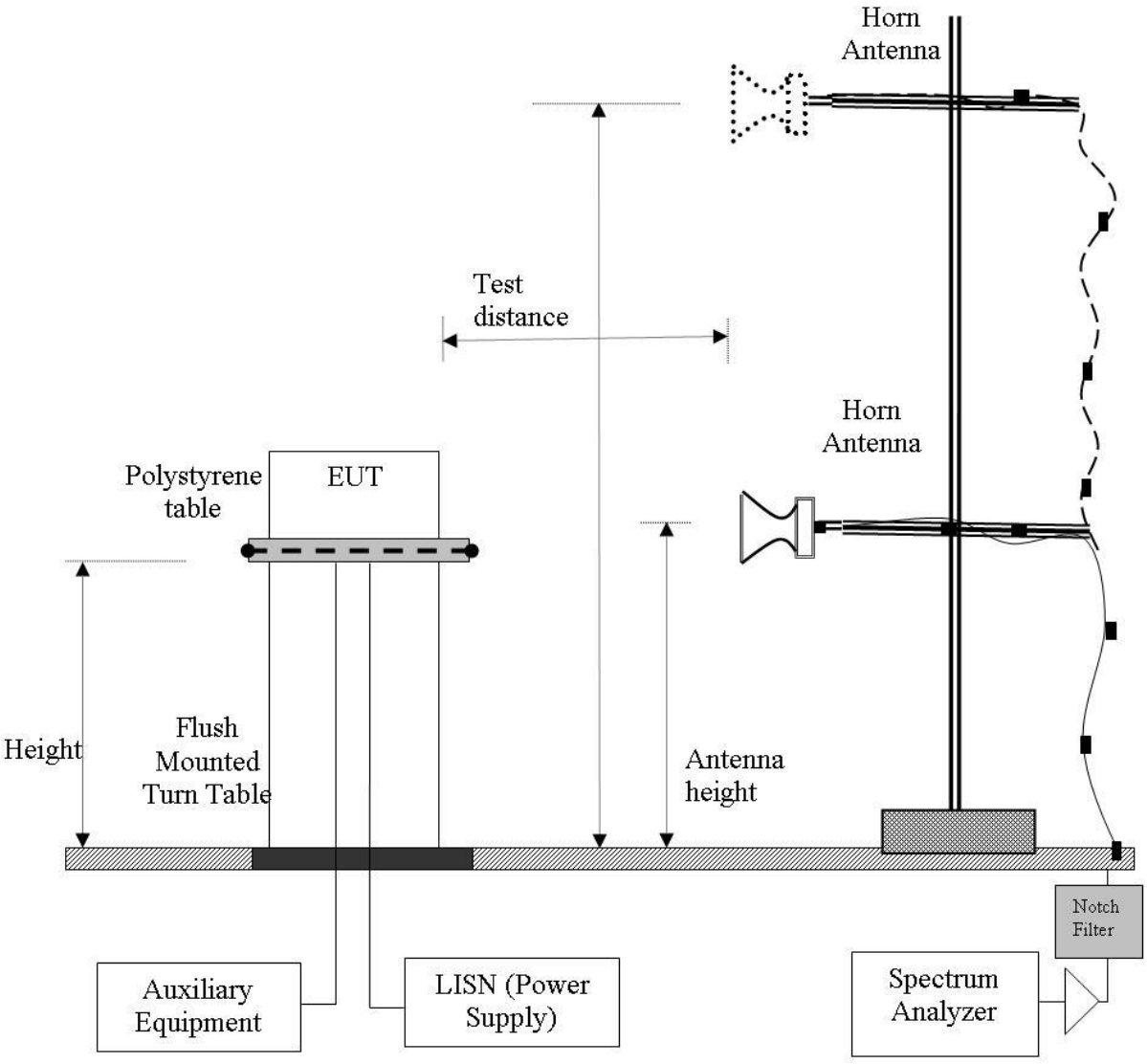
4. TESTING EQUIPMENT CONFIGURATION(S)

4.1. Radiated Spurious Emission Test Set-up > 1 GHz

The following tests were performed using the conducted test set-up shown in the diagram below.

1. Spurious Emissions Section(s) 6.1.1.1
2. Band-Edge Spurious Emissions Section(s) 6.1.1.2

Radiated Emission Measurement Setup – Above 1 GHz



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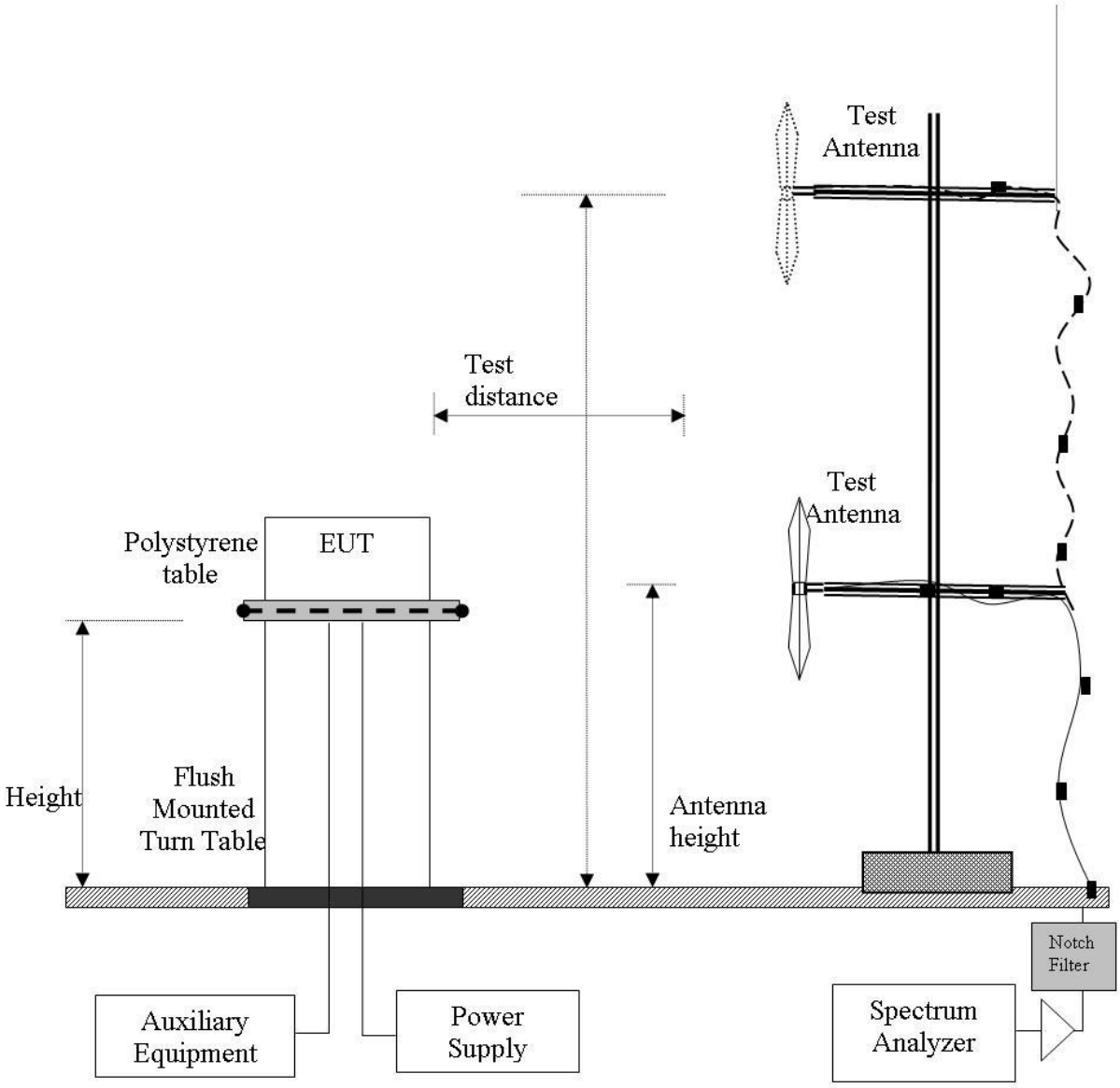
4.2. Digital Emissions Test Set-up (0.03 – 1 GHz)

The following tests were performed using the conducted test set-up shown in the diagram below.

1. Digital Emissions Section 6.1.1.3

Digital Emission Measurement Setup – Below 1 GHz



Traceability of Test Equipment Utilized for Radiated Emission Testing

Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	04 Dec 2015
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CY101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	31 Jul 2015
301	5470 to 5725 MHz Notch Filter	Microtronics	RBC50704	001	08 Oct 2015
302	5150 to 5350 MHz Notch Filter	Microtronics	BRC50703	002	08 Oct 2015
303	5725 to 5875 MHz Notch filter	Microtronics	BRC50705	003	08 Oct 2015
310	SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001	30 Oct 2015
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	14 Aug 2015
342	2.4 GHz Notch Filter	EWT	EWT-14-0203	H1	08 Oct 2015
343	5.15 GHz Notch Filter	EWT	EWT-14-0200	H1	08 Oct 2015
344	5.35 GHz Notch Filter	EWT	EWT-14-0201	H1	08 Oct 2015
345	5.46 GHz Notch Filter	EWT	EWT-14-0202	H1	08 Oct 2015
377	Band Rejection Filter 5150 to 5880MHz	Microtronics	BRM50716	034	08 Oct 2015
396	2.4 GHz Notch Filter	Microtronics	BRM50701	001	07 Oct 2015
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	23 Oct 2015
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	10 Oct 2015
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	30 May 2015
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
414	DC Power Supply 0-60V	HP	6274	1029A01285	Cal when used
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
416	Gigabit ethernet filter	ETS-Lingren	Gigafoil 260366	None	Not Required
502	Test Software for Radiated Emissions	EMISoft	Vasona	Version 5 Build 59	Not Required
87	Uninterruptible Power Supply	Falcon Electric	ED2000-1/2LC	F3471 02/01	Cal when used

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5. 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*	NT
15.407(a) **A9.2(2)** **4.6**	Maximum Conducted Output Power	Power Measurement	Conducted	*Complies*	NT
15.407(a) **A9.2(2)**	Peak Power Spectral Density	PPSD	Conducted	Complies*	NT
15.407(a)(6)	Peak Excursion Ratio	<13dB in any 1MHz bandwidth	Conducted	Complies*	NT
15.407(g) **15.31** **2.1** **4.5**	Frequency Stability	Limits: contained within band of operation at all times.	Applicant declaration	Complies*	NT
15.407(f) **5.5**	Radio Frequency Radiation Exposure	Exposure to radio frequency energy levels, Maximum Permissible Exposure (MPE)	Conducted	*See included MPE exhibit	

NT – Not tested

* Not tested as part of this program, see Section 3.2 'Scope of Test Program'

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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		6.1.1
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*6.1.1.1*
	Radiated Band Edge	Band edge results		Complies	*6.1.1.2*
15.407(b)(6) **15.205(a)** **15.209(a)** **2.2**	Radiated Emissions	Emissions <1 GHz (30M-1 GHz)		Complies	*6.1.1.3*
15.407(b)(6) **15.207** **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	N/A EUT is for use in aircraft	NT

NT – Not tested

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

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

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

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6. TEST RESULTS

6.1. Device Characteristics

6.1.1. Radiated Emission Testing

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

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

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

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Field Strength Calculation

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

FS = R + AF + CORR – FO

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

Field Strength Calculation Example:

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

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

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

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

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

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

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

where P is the EIRP in Watts

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

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

Operational Modes

Operational mode(s) tested for spurious emissions were the mode(s) which delivered maximum spectral density which was 802.11a.

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Specification

Radiated Spurious Emissions

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

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

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

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

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

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

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

Table 1: FCC 15.209 Spurious Emissions Limits

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

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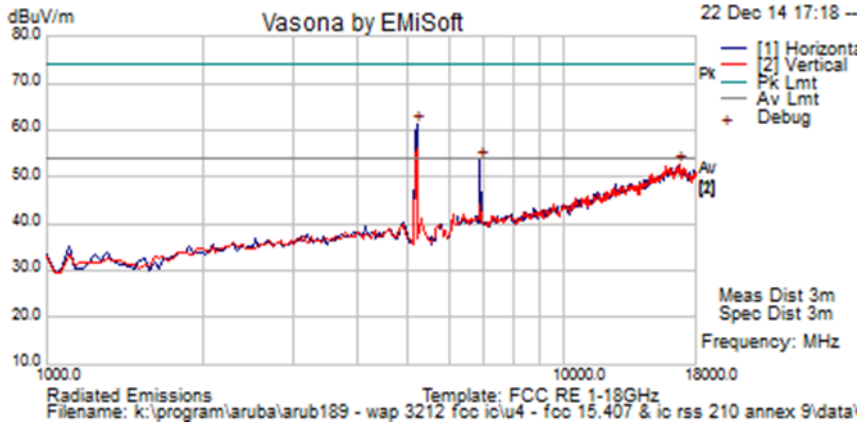
6.1.1.1. Spurious Emissions

Test Freq.	5180 MHz	**Engineer**	JMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	55
Power Setting	54	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 54-4=50 50/4=12.5 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5190.381	66.8	5.9	-11.5	61.2	Peak [Scan]							FUND
6893.78758	54.0	7.0	-7.6	53.4	Peak [Scan]	H						NRB
16705.411	39.0	12.1	1.6	52.7	Peak [Scan]	V	100	0	54	-1.3	Pass	Noise

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

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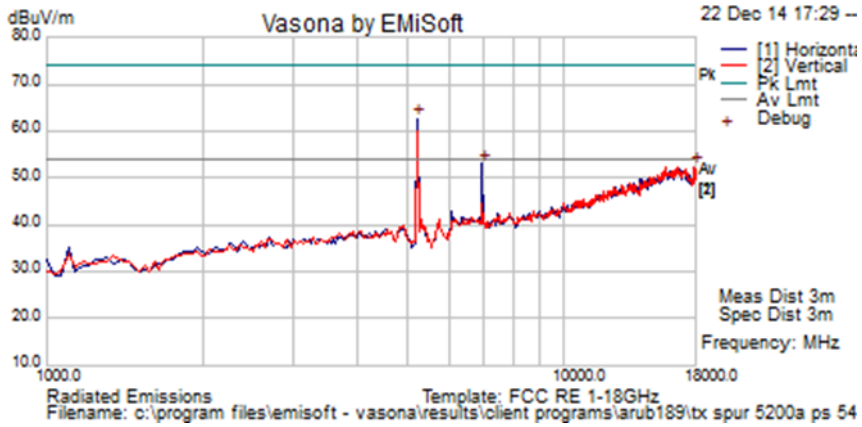
Test Freq.	5200 MHz	**Engineer**	JMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	55
Power Setting	54	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 54-4=50 50/4=12.5 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5190.381	68.4	5.9	-11.5	62.8	Peak [Scan]							FUND
6961.924	53.5	7.0	-7.5	53.0	Peak [Scan]	H						NRB
17897.796	39.8	13.0	-0.4	52.5	Peak [Scan]	V	100	0	54.0	-1.5	Pass	Noise

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

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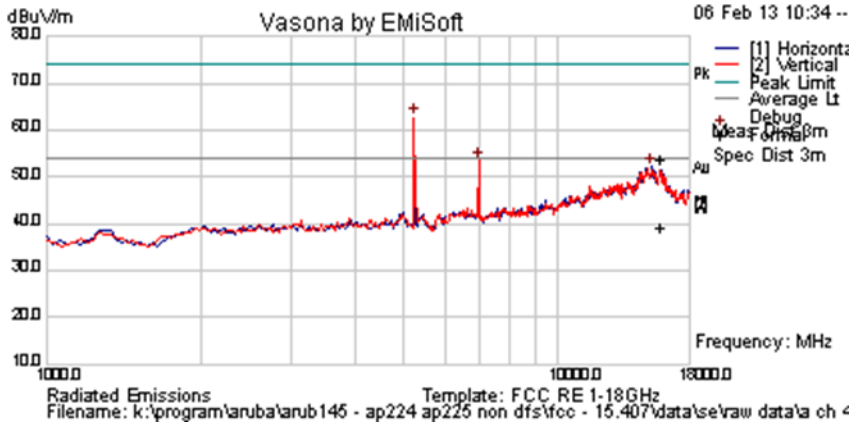
Test Freq.	5240 MHz	**Engineer**	JMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	55
Power Setting	54	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 54-4=50 50/4=12.5 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5224.449	70.9	5.9	-11.4	65.4	Peak [Scan]							FUND
6995.99198	53.7	7.0	-7.5	53.3	Peak [Scan]	H						NRB
17114.228	39.5	12.5	0.5	52.5	Peak [Scan]	H	200	0	54	-1.5	Pass	Noise

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

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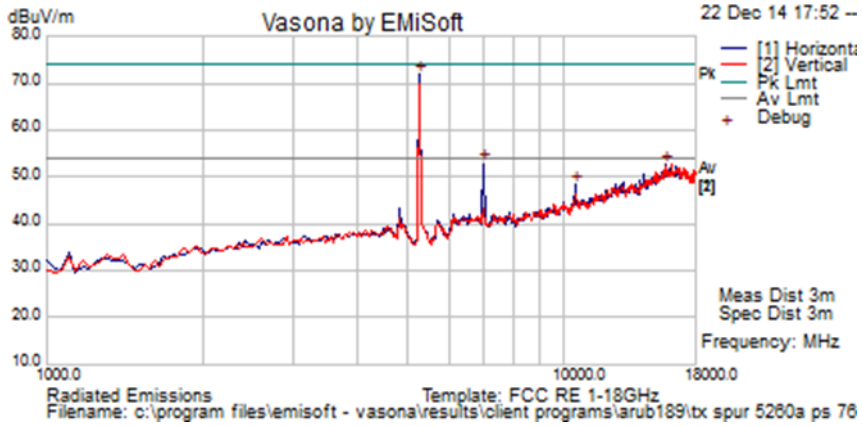
Test Freq.	5260 MHz	**Engineer**	JMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	55
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 50/4=18 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5258.517	77.3	5.9	-11.3	71.9	Peak [Scan]							FUND
6995.99198	53.3	7.0	-7.5	52.9	Peak [Scan]	H						NRB
15717.435	40.9	11.6	0.2	52.7	Peak [Scan]	H	150	0	54	-1.3	Pass	Noise
10534.008	43.3	9.0	-4.1	48.2	Peak [Scan]	V						NRB

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

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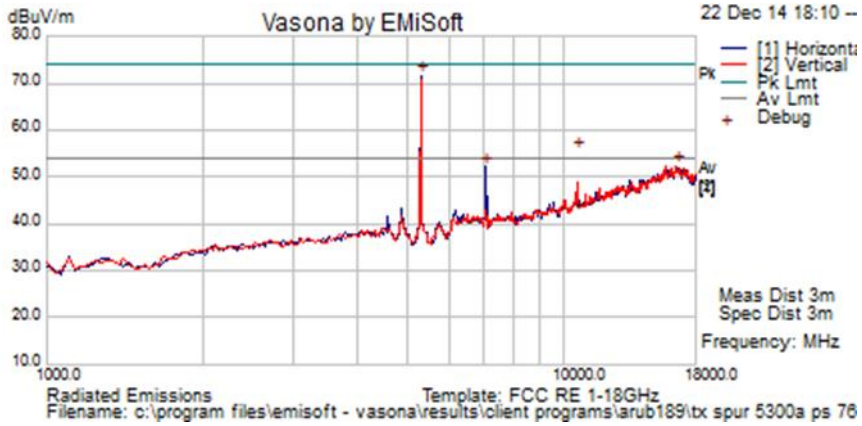
Test Freq.	5300 MHz	**Engineer**	JMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	55
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 50/4=18 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5292.585	76.9	6.0	-11.1	71.8	Peak [Scan]							FUND
16501.002	38.7	12.0	1.7	52.4	Peak [Scan]	H	100	0	54.0	-1.6	Pass	Noise
7064.128	52.5	7.0	-7.3	52.2	Peak [Scan]	H						NRB
10600.266	50.5	9.0	-3.9	55.6	Peak.	V	108	27	74	-18.4	Pass	RB
10600.266	37.0	9.0	-3.9	42.1	Average	V	108	27	54	-11.9	Pass	RB

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

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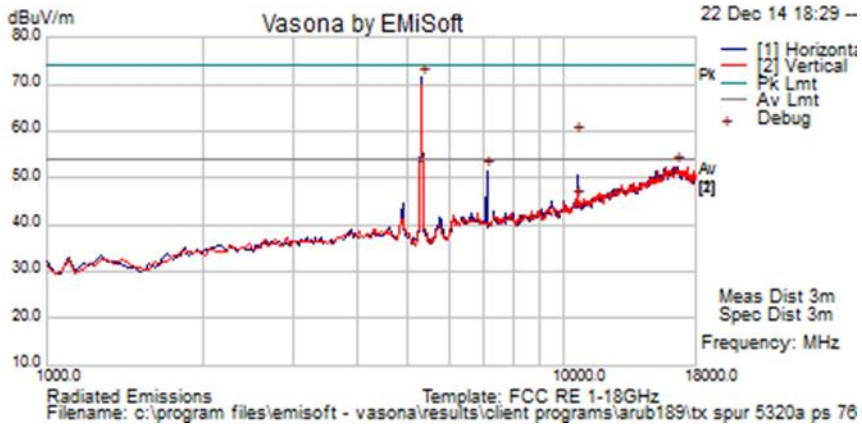
Test Freq.	5320 MHz	**Engineer**	JMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	55
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 50/4=18 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5326.653	76.5	6.0	-11.1	71.5	Peak [Scan]							FUND
16501.002	38.8	12.0	1.7	52.5	Peak [Scan]	V	200	0	54.0	-1.5	Pass	Noise
7098.196	51.8	7.1	-7.3	51.6	Peak [Scan]	H	100	0	54	-2.5	Pass	NRB
10642.393	53.9	9.0	-3.9	59.0	Peak Max	H	100	63	74	-15.0	Pass	RB
10642.393	40.0	9.0	-3.9	45.1	Average Max	H	100	63	54	-8.9	Pass	RB

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

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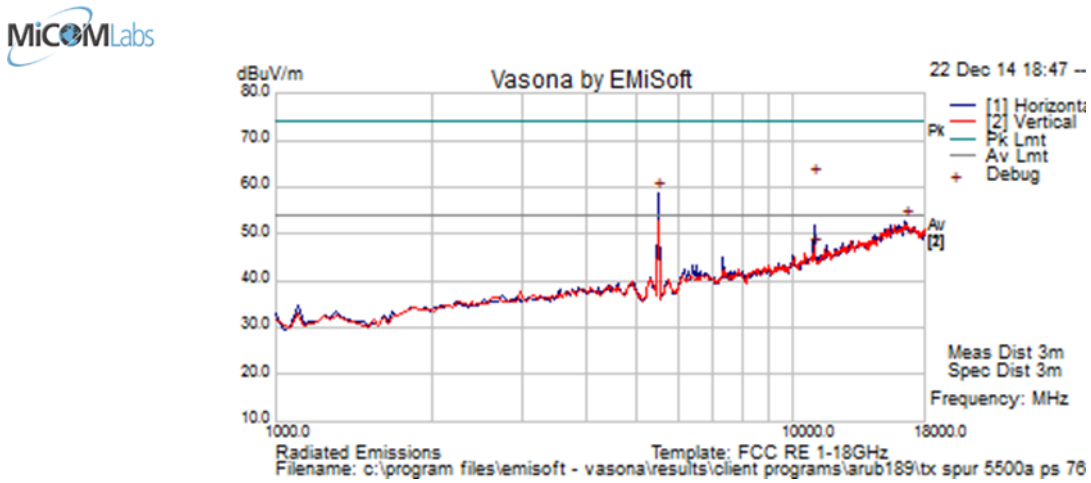
Test Freq.	5500 MHz	**Engineer**	JMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	55
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 50/4=18 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5496.994	63.9	6.1	-11.2	58.8	Peak [Scan]							FUND
16501.002	39.1	12.0	1.7	52.8	Peak [Scan]	H	150	0	54.0	-1.2	Pass	Noise
10998.115	57.0	9.1	-4.3	61.9	Peak	H	113	303	74	-12.1	Pass	RB
10998.115	42.0	9.1	-4.3	46.8	Average	H	113	303	54	-7.2	Pass	RB

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

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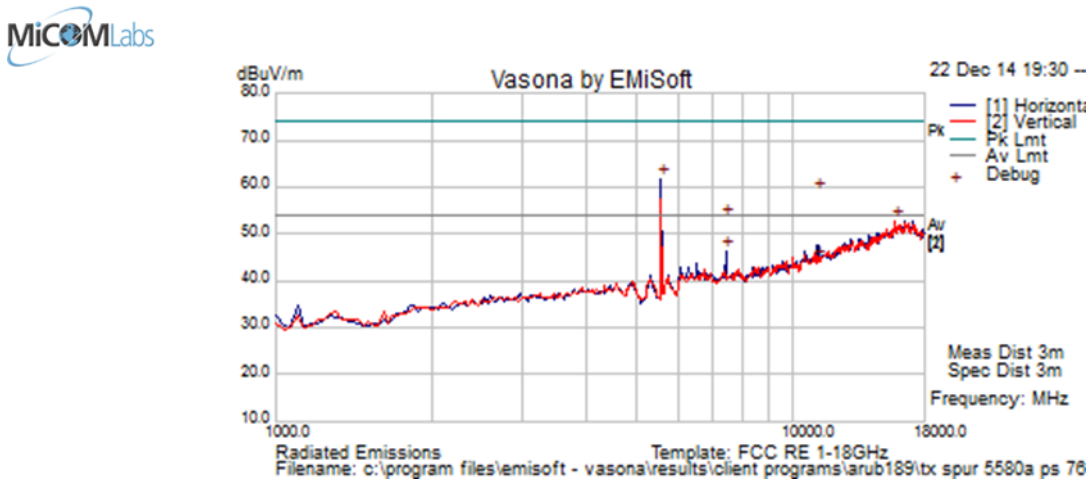
Test Freq.	5580 MHz	**Engineer**	JMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	55
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 50/4=18 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5565.130	67.0	6.1	-11.2	61.9	Peak [Scan]							FUND
15819.639	41.1	11.7	0.0	52.9	Peak [Scan]	V	150	0	54.0	-1.1	Pass	Noise
7439.993	53.1	7.3	-7.1	53.2	Peak Max	H	122	62	74	-20.8	Pass	RB
7439.993	46.5	7.3	-7.1	46.7	Average Max	H	122	62	54	-7.3	Pass	RB
11159.006	53.6	9.2	-4.1	58.7	Peak Max	H	109	311	74	-15.3	Pass	RB
11159.006	39.1	9.2	-4.1	44.2	Average Max	H	109	311	54	-9.8	Pass	RB

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

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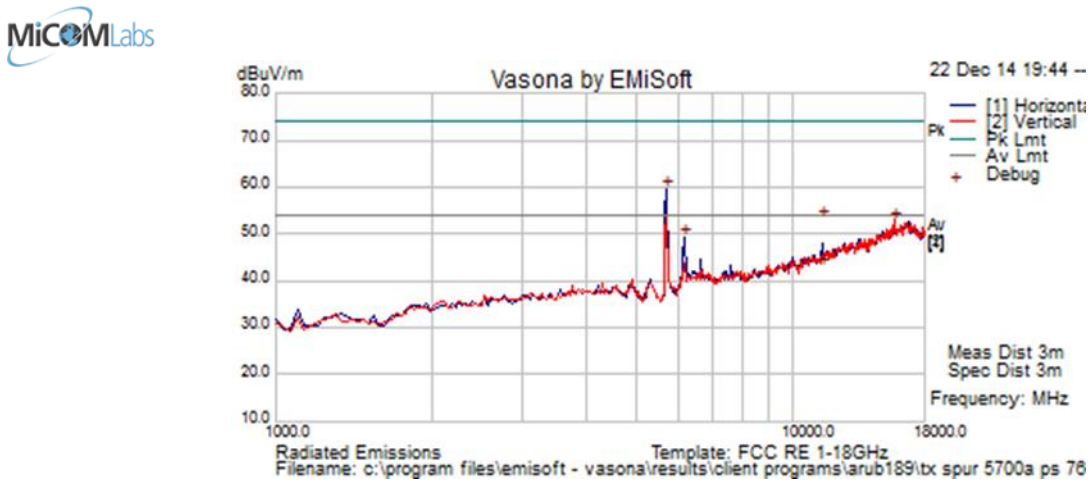
Test Freq.	5700 MHz	**Engineer**	JMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	55
Power Setting	76	**Press. (mBars)**	1009
Antenna	Integral	**Duty Cycle (%)**	99
Test Notes 1	WAP3212, SN# P000013		
Test Notes 2	Power Settings in quarter points + 4 to equal dBm settings ie: 76-4=72 50/4=18 dBm		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5701.403	64.1	6.2	-10.8	59.6	Peak [Scan]							FUND
15683.367	40.8	11.6	0.2	52.6	Peak [Scan]	V	150	0	54.0	-1.4	Pass	Noise
6178.357	51.7	6.5	-9.0	49.1	Peak [Scan]	H						NRB
11398.827	48.3	9.4	-4.9	52.8	Peak.	H	100	61	74	-21.2	Pass	RB
11398.827	38.0	9.4	-4.9	42.5	Average.	H	100	61	54	-11.5	Pass	RB

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

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6.1.1.2. Radiated Band-Edge

Peak Limit 74.0 dBµV, Peak Limit 54.0 dBµV

5,150 – 5,350 MHz Frequency Band

	5150 MHz			5350 MHz		
	dBµV/m		Power Setting	dBµV/m		Power Setting
Operational Mode	Peak	Average		Peak	Average	
a	64.14	53.90	48.0	63.54	53.71	50.0
n HT-20	68.79	53.73	62.0	65.34	53.45	58.0
n HT-40	72.57	53.47	63.0	72.60	51.23	63.0
ac-80	69.19	53.78	50.0	70.50	53.45	53.0

5,470 – 5,725 MHz Frequency Band

	5460 MHz		
	dBµV/m		Power Setting
Operational Mode	Peak	Average	
a	63.87	53.76	47.0
n HT-20	65.41	53.82	54.0
n HT-40	65.38	51.73	64.0
ac-80	71.52	53.32	52.0

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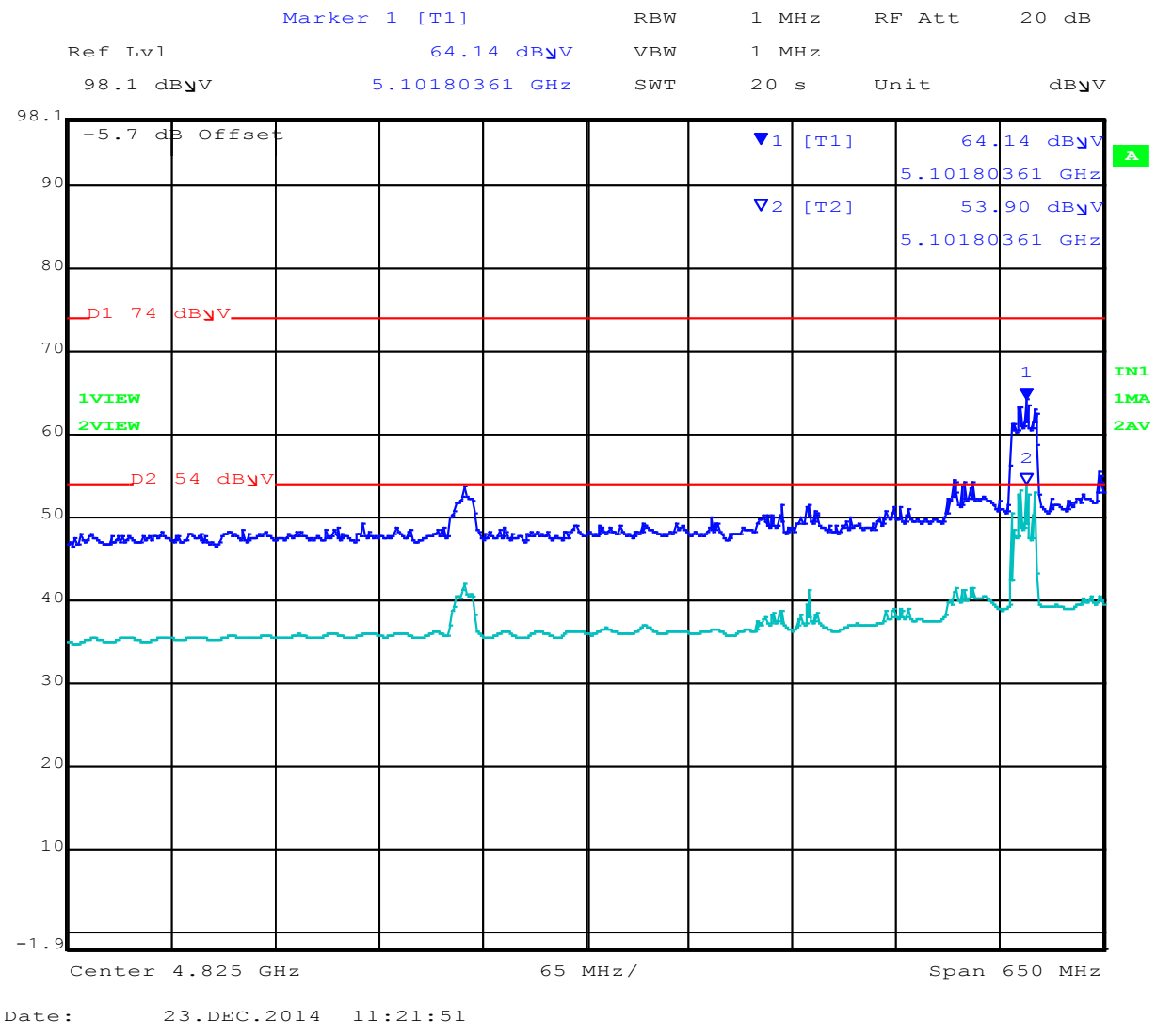
802.11a Radiated Band-Edge @ 5150 MHz



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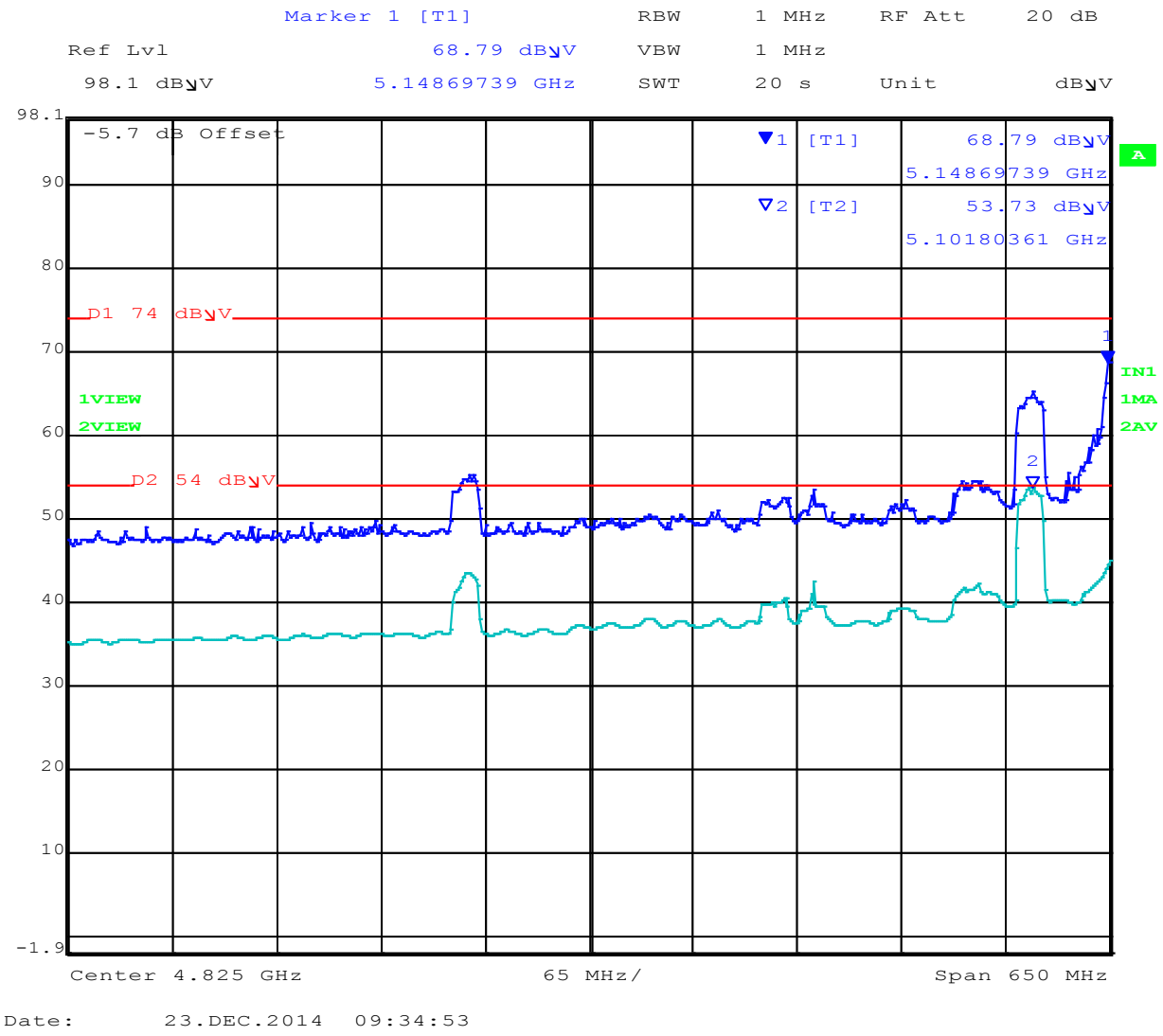
802.11n HT-20 Radiated Band-Edge @ 5150 MHz



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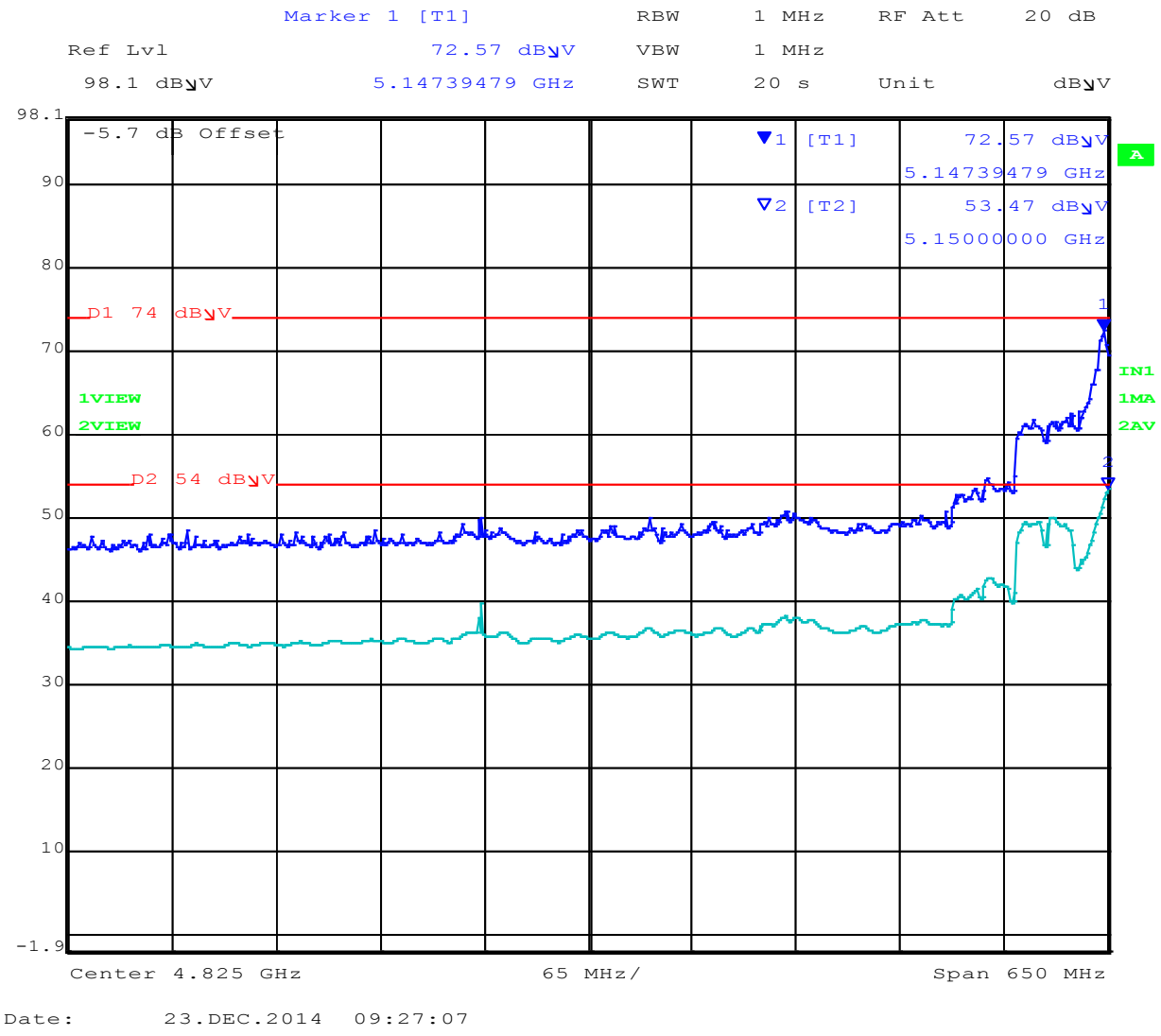
802.11n HT-40 Radiated Band-Edge @ 5150 MHz



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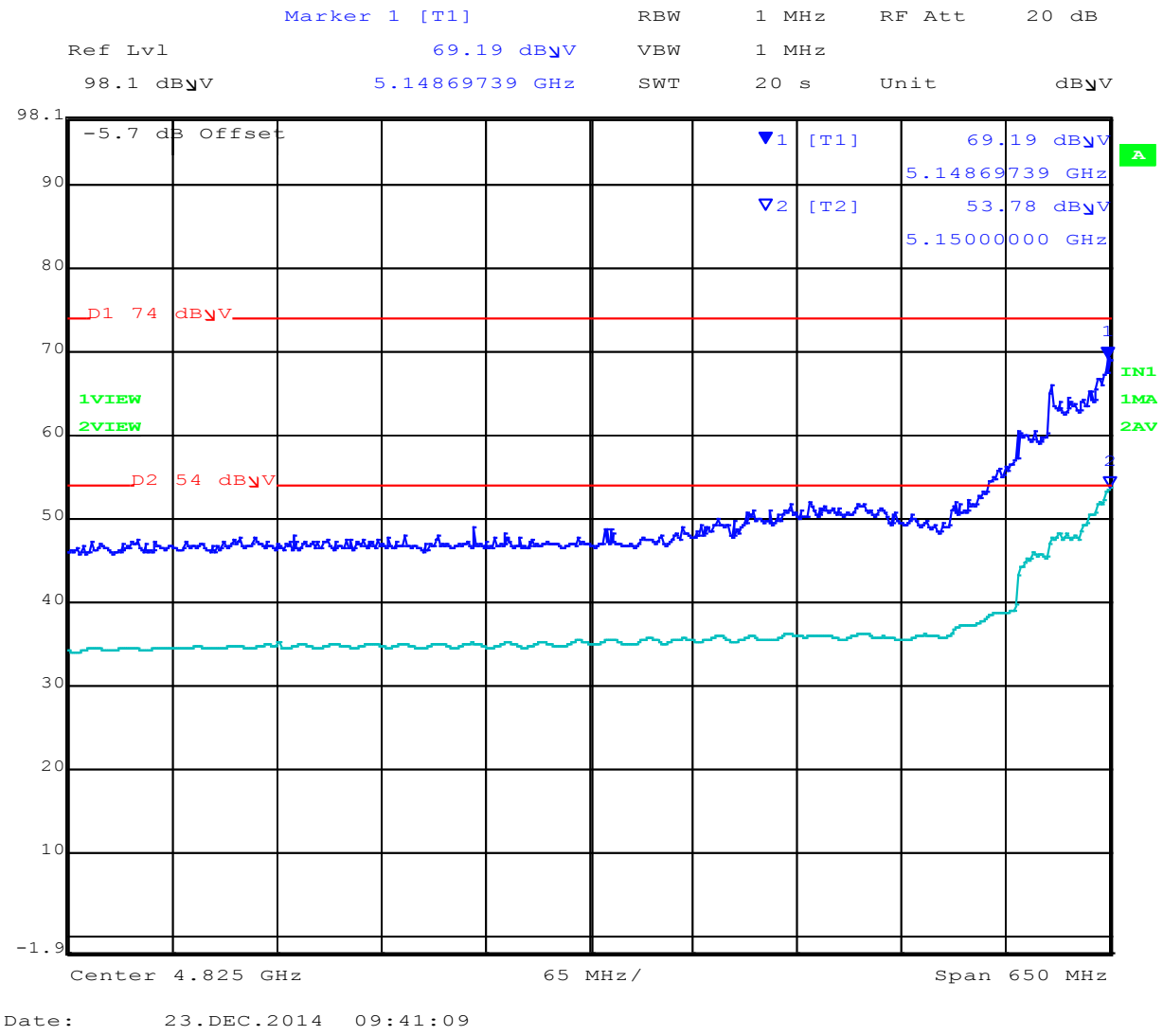
802.11ac-80 Radiated Band-Edge @ 5150 MHz



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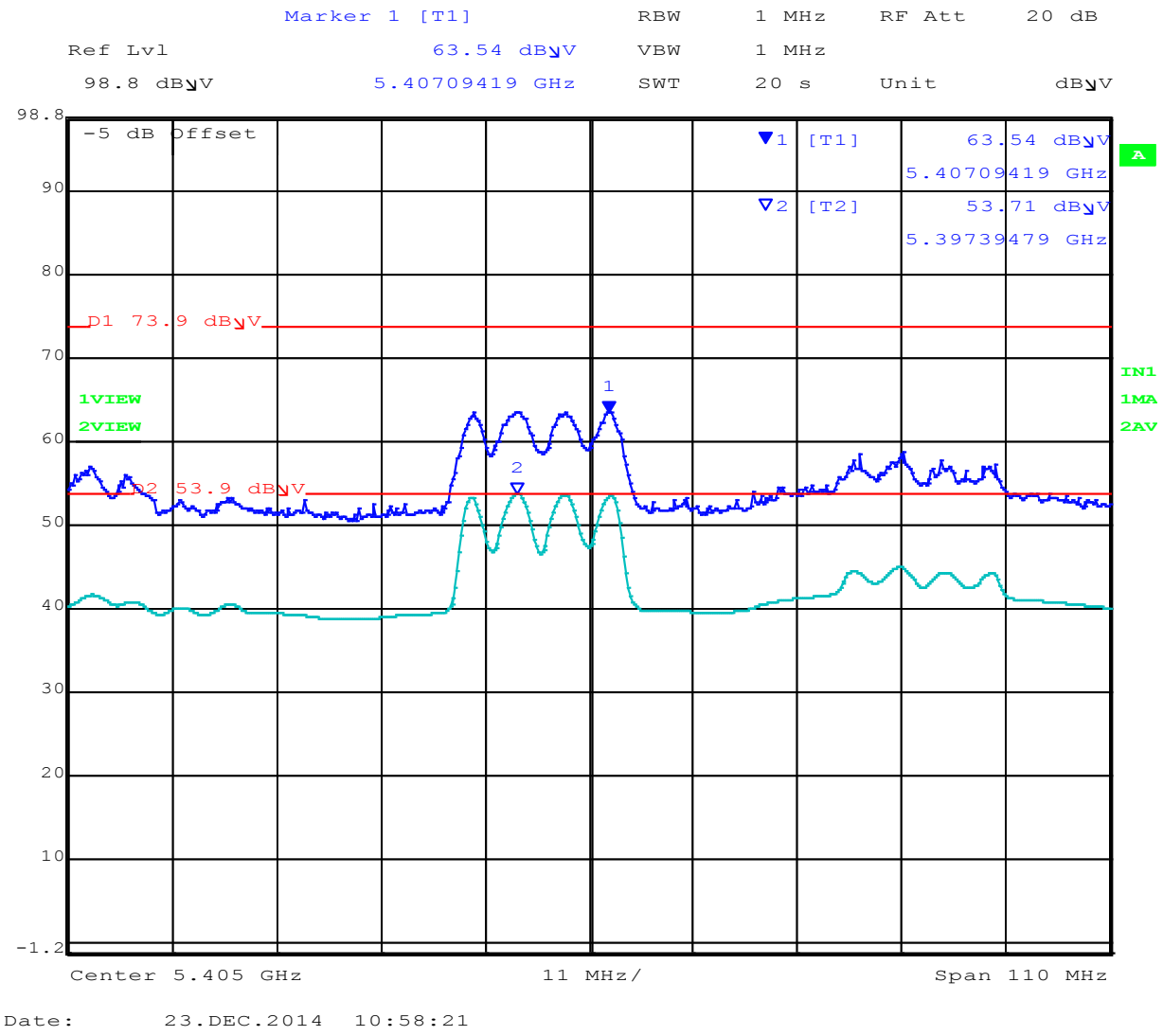
802.11a Radiated Band-Edge @ 5350 MHz



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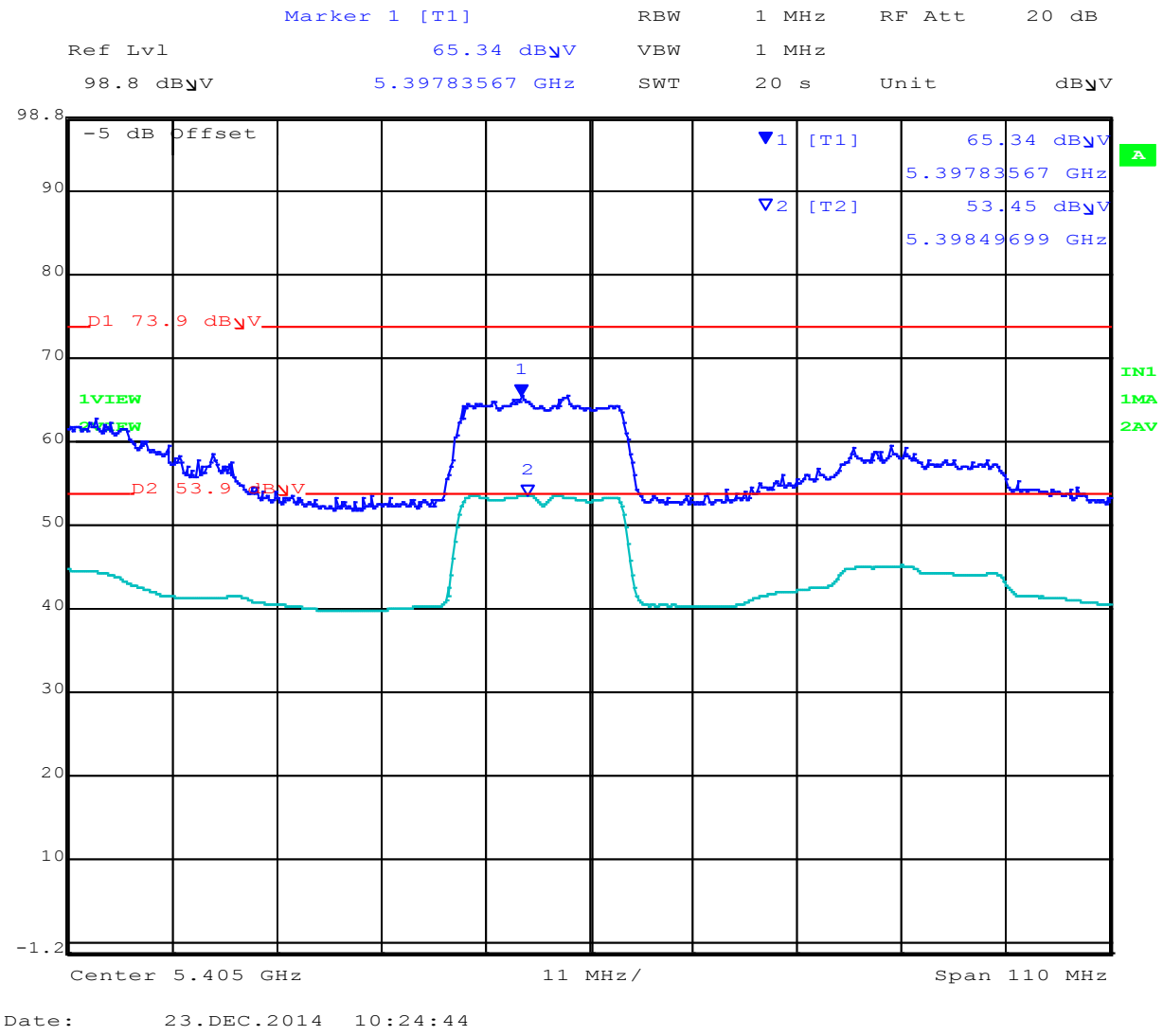
802.11n HT-20 Radiated Band-Edge @ 5350 MHz



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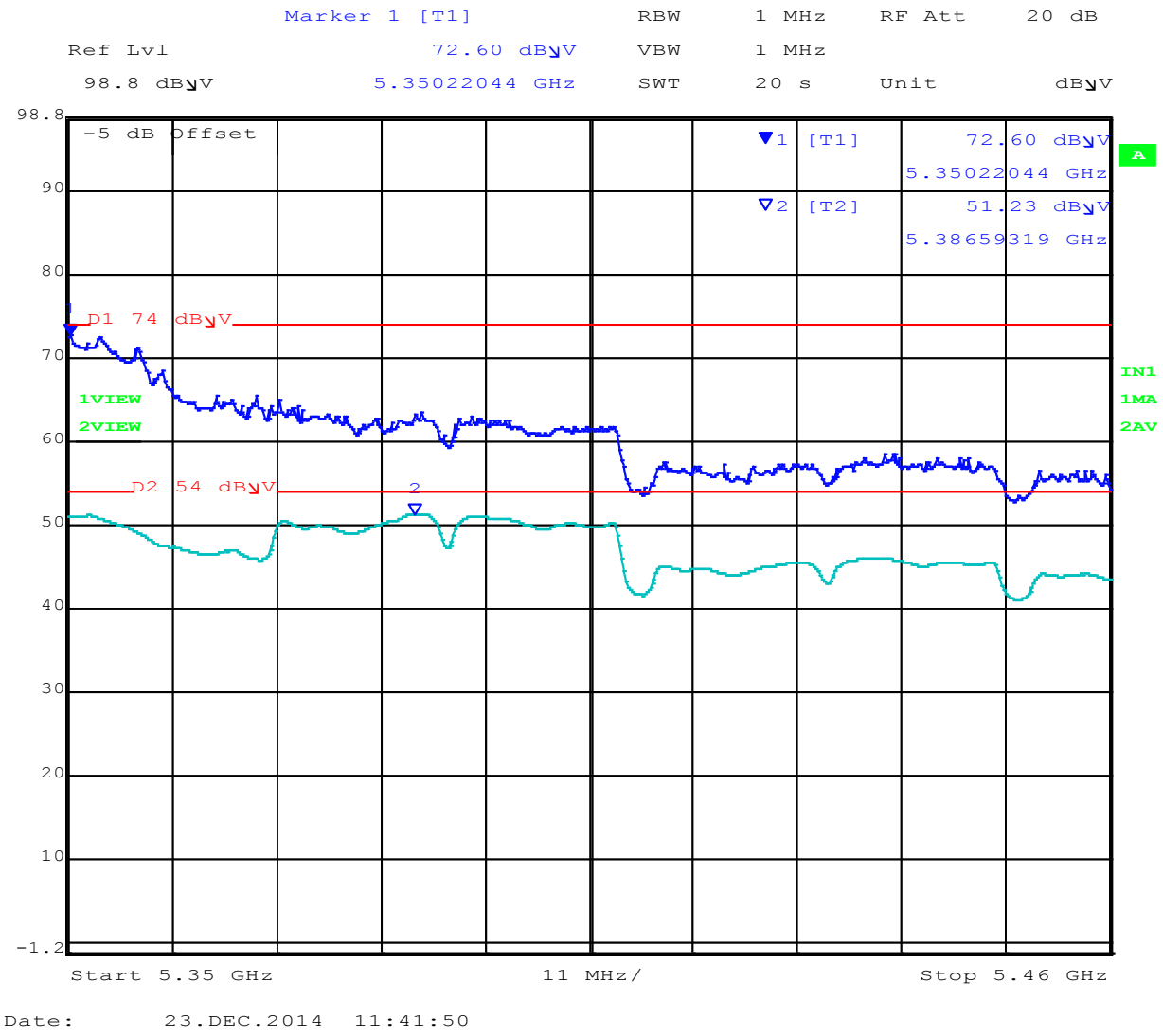
802.11n HT-40 Radiated Band-Edge @ 5350 MHz



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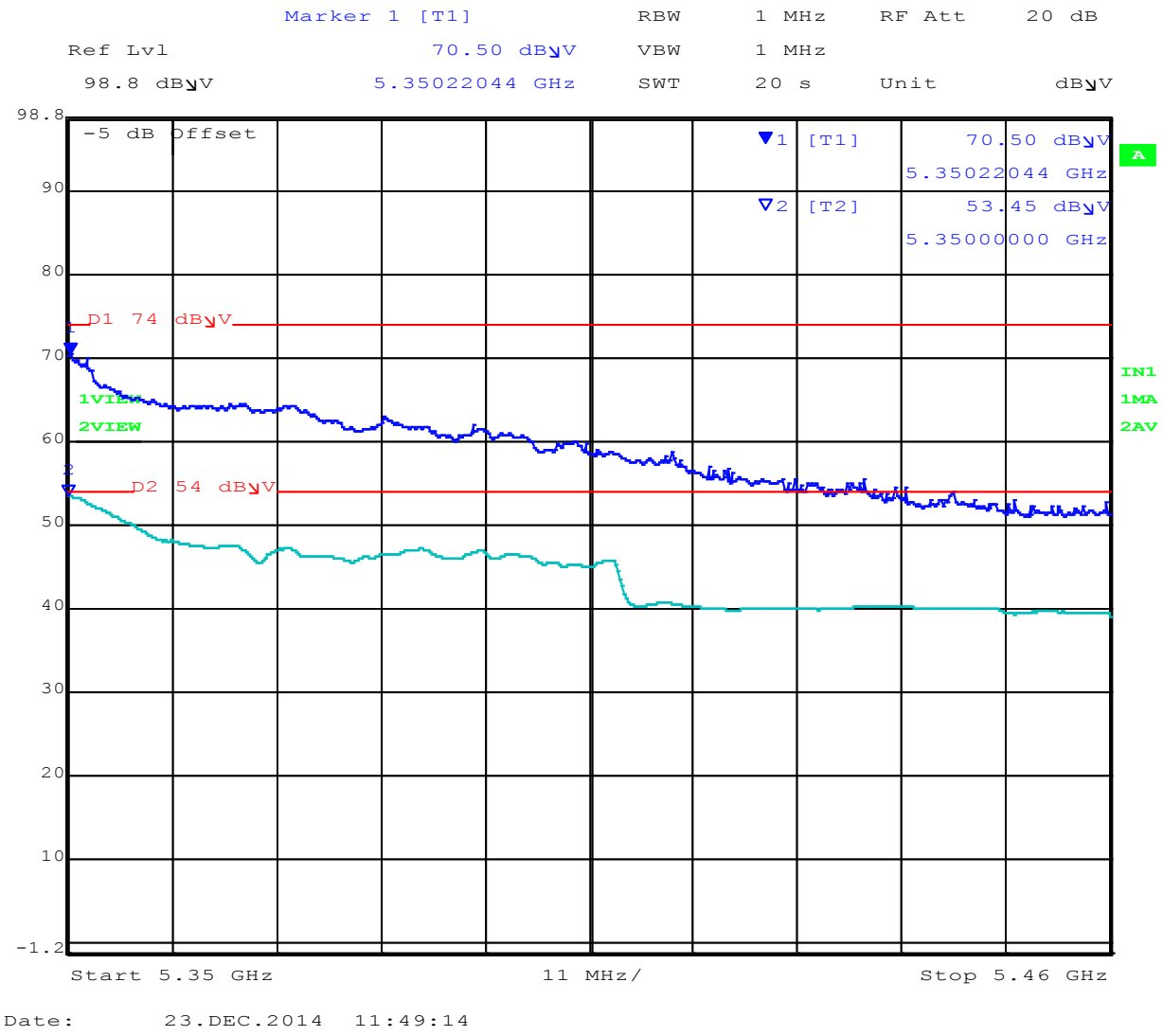
802.11ac-80 Radiated Band-Edge @ 5350 MHz



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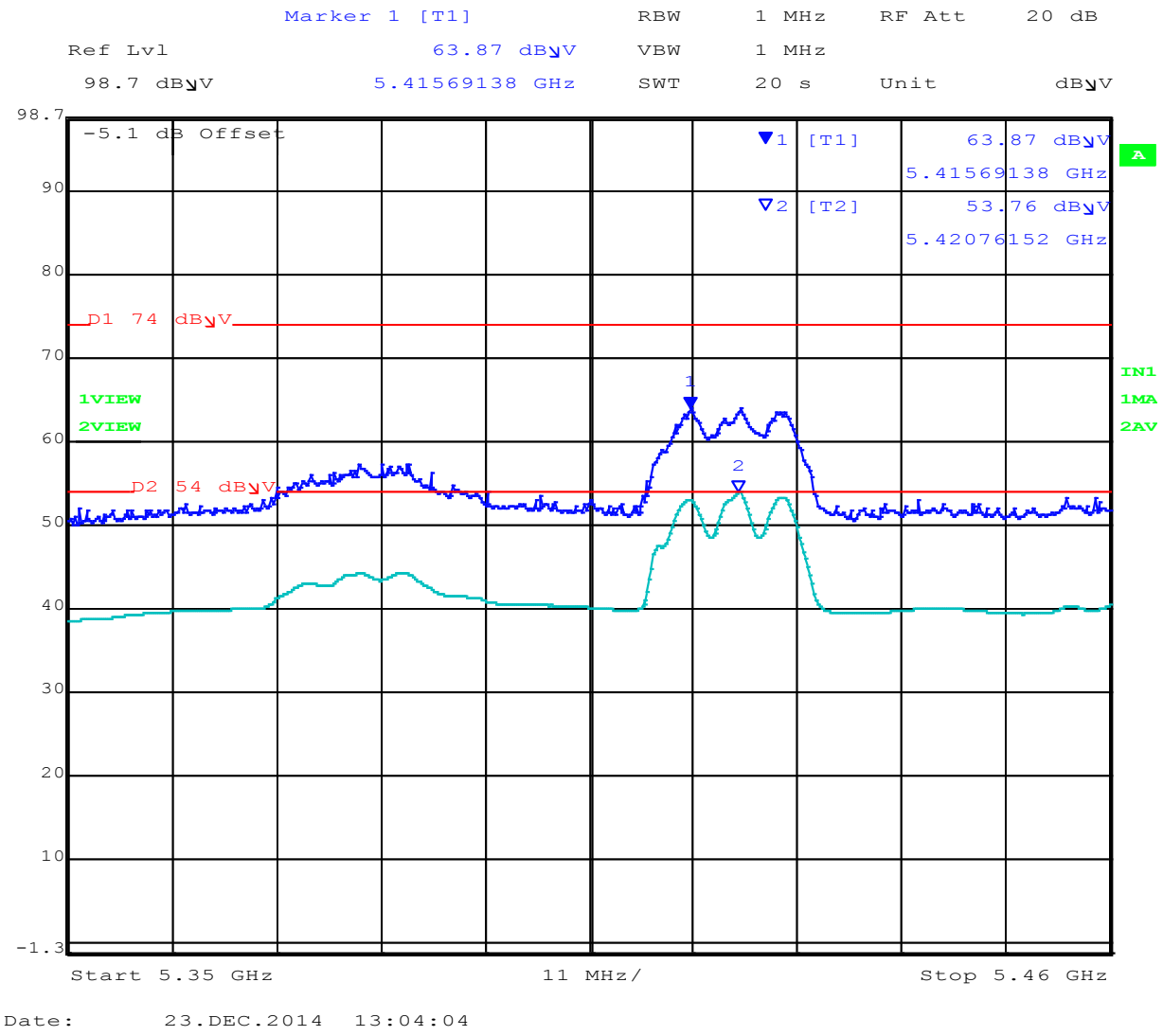
802.11a Radiated Band-Edge @ 5470 MHz



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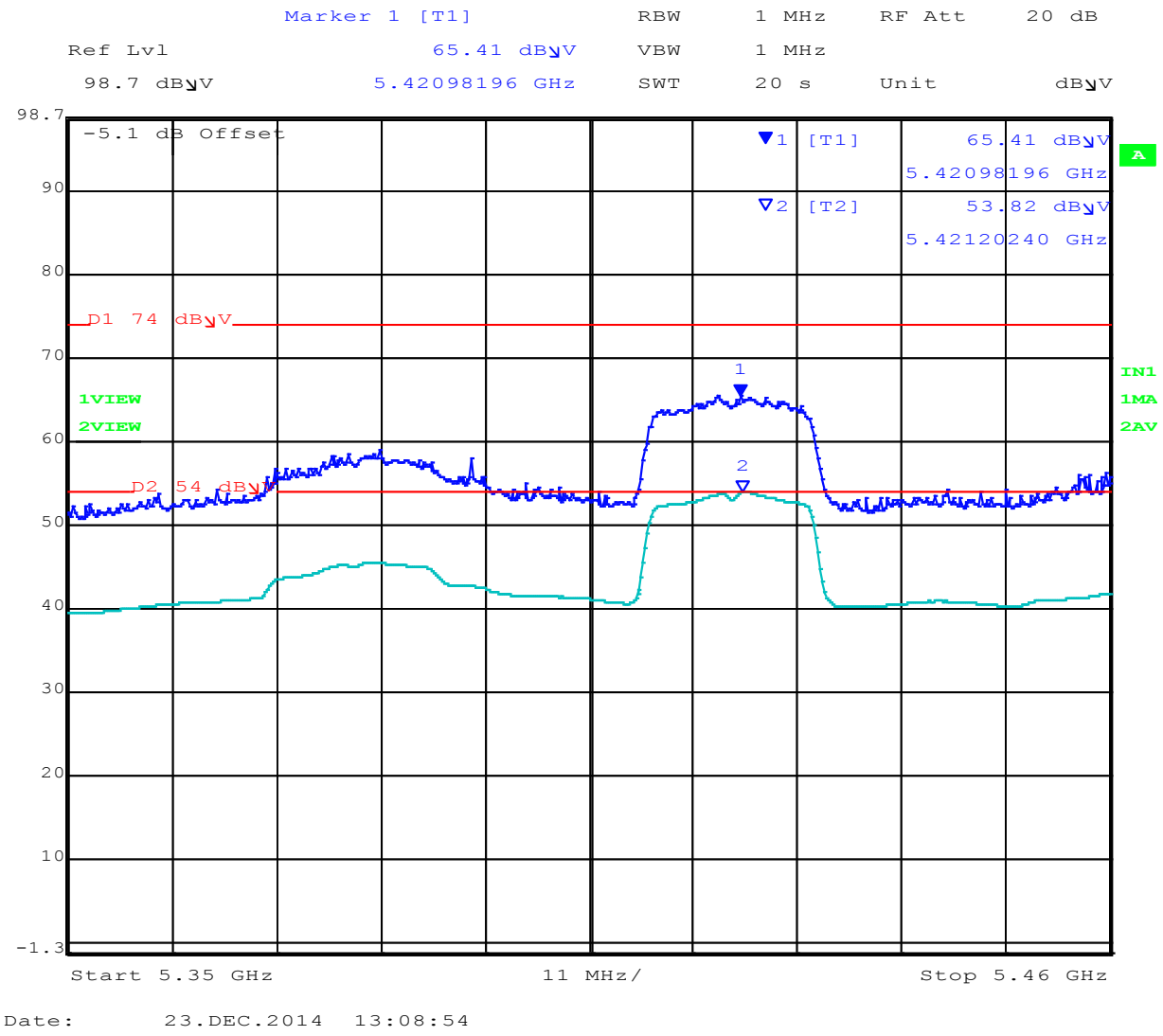
802.11n HT-20 Radiated Band-Edge @ 5470 MHz



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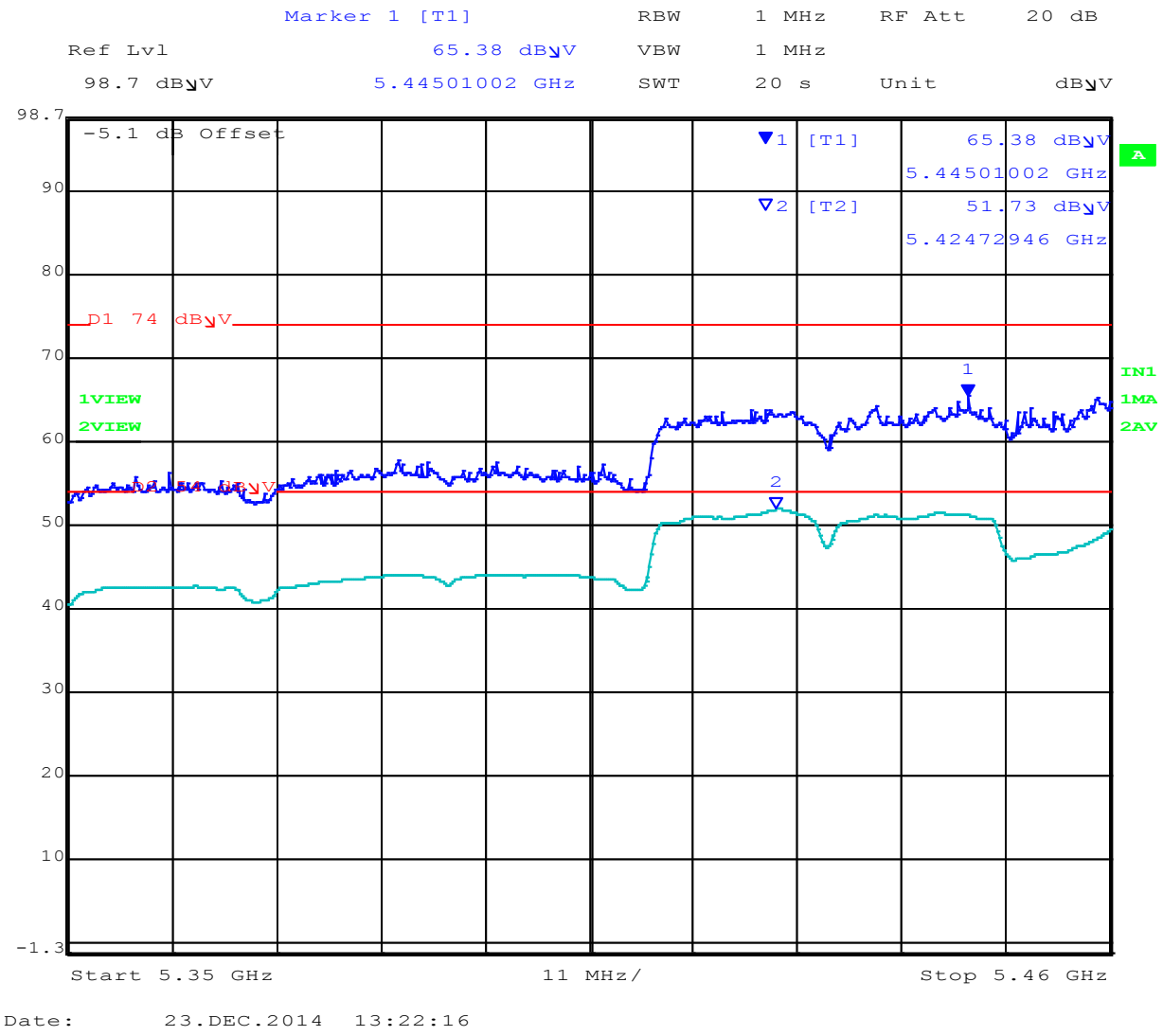
802.11n HT-40 Radiated Band-Edge @ 5470 MHz



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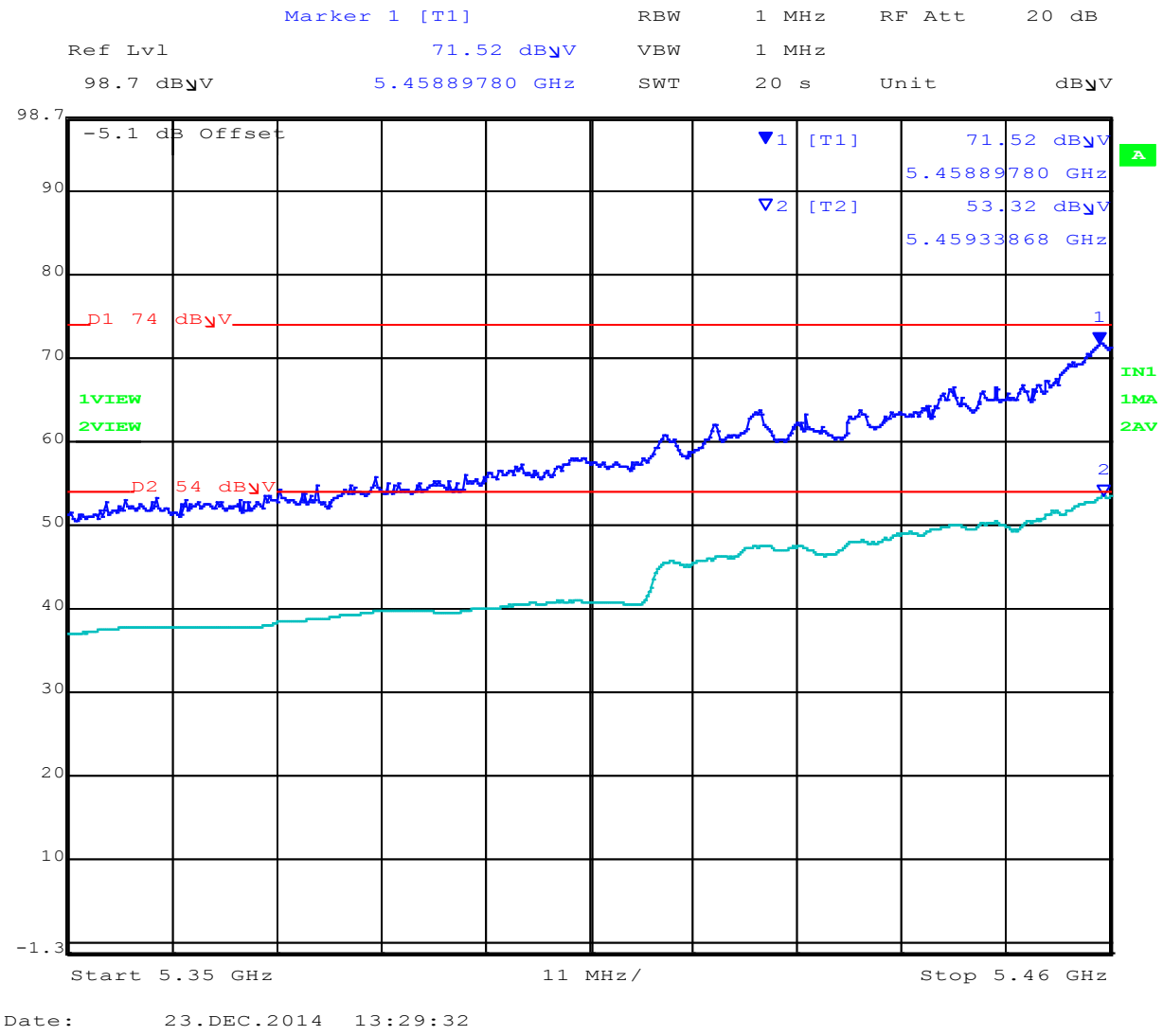
802.11ac-80 Radiated Band-Edge @ 5470 MHz



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6.1.1.3. Digital Emissions (30M-1 GHz)

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

Test Procedure

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

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

Field Strength Calculation

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

$$FS = R + AF + CORR$$

where:

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

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

FS = 51.5 + 8.5 + 1.3 - 26.0 +1 = 36.3dBμV/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 = 100μV/m
48 dBμV/m = 250μV/m

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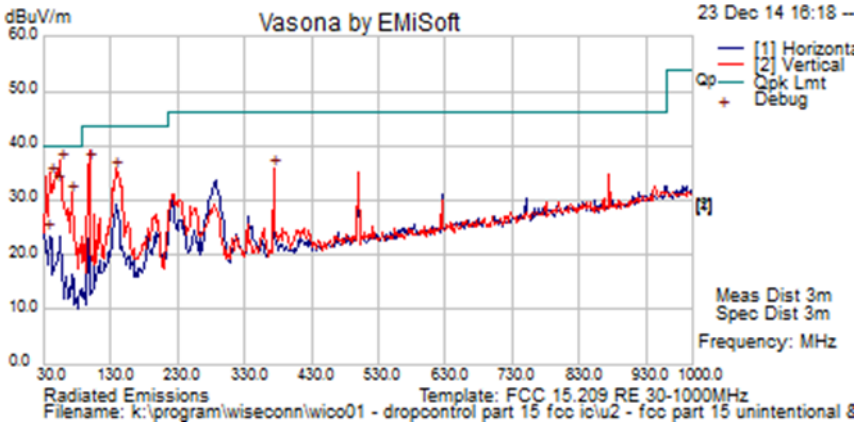
EUT	WAP3212	**Engineer**	JMH
Variant	Digital Emissions	**Temp (ºC)**	21.5
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	42
Standard Limit	FCC Class B	**Press. (mBars)**	1007
Support Equip	Laptop outside chamber		
Test Notes	SN# P000013		



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
55.356	57.2	3.7	-24.1	36.8	Quasi Max	V	99	200	40	-3.2	Pass	
98.105	54.6	4.1	-21.8	36.930	Quasi Max	V	99	325	43.5	-6.6	Pass	
49.469	52.1	3.7	-23.0	32.9	Quasi Max	V	99	345	40.0	-7.2	Pass	
34.960	33.8	3.6	-13.6	23.8	Quasi Max	V	99	242	40.0	-16.2	Pass	
40.943	48.6	3.6	-18.1	34.1	Quasi Max	V	99	236	40	-5.9	Pass	
136.632	48.9	4.3	-17.9	35.3	Peak [Scan]	V	98	361	43.5	-8.2	Pass	
71.629	50.2	3.9	-23.1	31.0	Peak [Scan]	V	98	361	40	-9.0	Pass	
374.028	45.7	5.4	-15.3	35.7	Peak [Scan]	V	98	361	46	-10.3	Pass	

Legend:	DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency
	TRNS= Transient Emission, Brbnd= Broadband emission

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Specification

Limits

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

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

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

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

Frequency(MHz)	Field Strength (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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