Test of Aruba Networks APIN0204, APIN0205

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

Test Report Serial No.: ARUB170-U6 Rev A

MiCOM Labs

opening wireless markets

TEST REPORT

FROM

Test of Aruba Networks APIN0204, APIN0205

to

To FCC 47 CFR Part 15.407 & IC RSS-210

Test Report Serial No.: ARUB170-U6 Rev A

Note: this report contains data with regard to the 5,150 - 5,250 MHz (non-DFS) band for Aruba Networks APIN0204 and APIN0205 Wireless Access Point. 5,250 - 5,350 and 5470 – 5725 MHz (DFS) bands are reported in MiCOM Labs report ARUB170-U8 and 2.4 and 5.8 GHz test data are reported in MiCOM Labs test report ARUB170-U3

This report supersedes None

Applicant: Aruba Networks
1344 Crossman Avenue
Sunnyvale, California 94089
USA

Product Function: Wireless Access Point

Copy No: pdf Issue Date: 4th May 2014

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

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

American Association for Laboratory Accreditation

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence as a

Product Certification Body

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 - *Requirements for bodies certifying products, processes and services*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system.

Presented this 28th day of February 2014.

President & CEO
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2015

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

USA Telecommunication Certification Body (TCB) - TCB Identifier – US0159

Industry Canada Certification Body - CAB Identifier – US0159

European Notified Body - Notified Body Identifier - 2280

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

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	4th May 2014	Initial release

1. TEST RESULT CERTIFICATE

Applicant:	Aruba Networks 1344 Crossman Avenue Sunnyvale, California 94089 USA	Tested By:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California, 94566, USA
EUT:	Wireless LAN Access point	Tel:	+1 925 462 0304
Model:	APIN0204 & APIN0205	Fax:	+1 925 462 0306
S/N:	APIN0204: CM000392, APIN0205: CM000141		
Test Date(s):	17th February - 3rd May 2014	Website:	www.micomlabs.com

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

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

Notes:

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

ACCREDITED
TESTING CERT #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 15.407	2012	Code of Federal Regulations
(ii)	FCC 06-96	June 2006	Memorandum Opinion and Order
(iii)	FCC OET KDB 662911	4th April 2011	Emissions Testing of Transmitters with Multiple Outputs in the Same Band
(iv)	Industry Canada RSS-210	2010	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands): Category 1 Equipment
(v)	Industry Canada RSS-Gen	2010	General Requirements and Information for the Certification of Radiocommunication Equipment
(vi)	ANSI C63.4	2009	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(vii)	CISPR 22/ EN 55022	2008 2006+A1:2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(viii)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(ix)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(x)	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(xi)	A2LA	July 2012	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(xii)	FCC Public Notice – DA 02-2138	2002	Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices

2.2. Test and Uncertainty Procedures

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

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

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

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3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the Aruba Networks APIN0204, APIN0205 in the frequency range 5,150 - 5,250 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:	ARUB170-U6 Rev A
Date EUT received:	10th January 2014
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210
Dates of test (from - to):	17th February - 3rd May 2014
No of Units Tested:	Two
Type of Equipment:	802.11a/b/g/n/ac Wireless Access Point 2x2 Spatial Multiplexing MIMO configuration
Applicants Trade Name:	Wireless Access Point
Model(s):	APIN0204 & APIN0205
Location for use:	Indoor only
Declared Frequency Range(s):	5,150 – 5,250 MHz
Hardware Rev	Version P2
Software Rev	armv7nsrd_0127
Type of Modulation:	Per 802.11 – OFDM
EUT Modes of Operation:	802.11a/n/ac
Declared Nominal Output Power: (Average Power)	802.11a/n/ac: +16 dBm
Transmit/Receive Operation:	Time Division Duplex
System Beam Forming:	APIN0204 & APIN0205 has no capability for antenna beam forming
Rated Input Voltage and Current:	POE 56 Vdc 350 mA 12 Vdc 1.5 A
Operating Temperature Range:	Declared range 0o to +40ºC
ITU Emission Designator:	802.11a 16M7D1D 802.11n HT-20 17M8D1D 802.11n HT-40 36M3D1D 802.11ac-80 75M8D1D
Equipment Dimensions:	150mmx150mmx40mm
Weight:	3 lbs
Primary function of equipment:	Wireless Access Point for transmitting data and voice.

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3.2. Scope of Test Program

Aruba Networks APIN0204, APIN0205 Access Point RF Testing
The scope of the test program was to test the Aruba Networks APIN0204, APIN0205 Wireless LAN Access Point, 2x2 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.

Model Identification
APIN0204: External Antenna (Reverse SMA)
APIN0205: Integral

APIN0204 and APIN0205 Operational Modes
Client did not provide software capability for the following operational modes and claimed these were covered under 802.11n HT-20 and 802.11n HT-40.

i).. VHT-20
ii)..VHT-40

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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Aruba Networks Inc
APIN0204 External Antenna 802.11 a/b/g/n/ac Wireless Access Point

Aruba Networks Inc
APIN0205 Integral Antenna 802.11 a/b/g/n/ac Wireless Access Point

Aruba Networks Inc
802.11 a/b/g/n/ac Wireless Access Point (Rear)

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Wireless LAN Access Point	Aruba Networks	APIN0204	CM000392
EUT	Wireless LAN Access Point (Integral Antenna)	Aruba Networks	APIN0205 (Radiated only)	CM000141
Support	Laptop PC	IBM	Thinkpad	None

3.4. Antenna Details

4. APIN0204 External Antennas

Model	Type	Gain	Freq. Band	Note
		dBi	MHz	
AP-ANT-1B	Omni	3.8	2400 - 2500	
		5.8	4900 - 5875	
AP-ANT-13B	Omni	4.4	2400 - 2500	
		3.3	4900 - 5900	
AP-ANT-16	Omni	3.9	2400 - 2500	
		4.7	4900 - 5900	
AP-ANT-17	Directional 120degr.	6.0	2400 - 2500	
		5.0	4900 - 5875	
AP-ANT-18	Directional 60degr.	7.5	2400 - 2500	
		7.5	5150 - 5875	
AP-ANT-19	Omni	3.0	2400 - 2500	
		6.0	5150 - 5875	
AP-ANT-20	Omni	2.0	2400 - 2500	
		2.0	5150 - 5875	

5.

APIN0205 Integral Antennas

Model	Type	Gain	Freq. Band	Note
		dBi	MHz	
metal sheet	Omni	4.0	2400 - 2500	(3x per band, per unit)
metal sheet	Omni	4.5	5150 - 5875	(3x per band, per unit)

5.1. Cabling and I/O Ports

Number and type of I/O ports

1. 10/100/1000 Ethernet (POE)
2. Console - Serial maintenance terminal
3. 12 Vdc, jack connector

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5.2. 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	Legacy	6 MBit/s	5180/5200/5240
	HT-20, ac-20	6.5 MBit/s	
	HT-40, ac-40	13.5 MBit/s	5190, 5230
	ac-80	29.3 MBit/s	5210

Spurious Emission and Band-Edge Test Strategy, Bands 5,150 – 5250

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

KEY:-

SE – Spurious Emissions

BE – Band-Edge

5.3. Equipment Modifications

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

1. NONE

5.4. Deviations from the Test Standard

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

1. NONE

5.5. Subcontracted Testing or Third Party Data

1. NONE

6. TESTING EQUIPMENT CONFIGURATION(S)

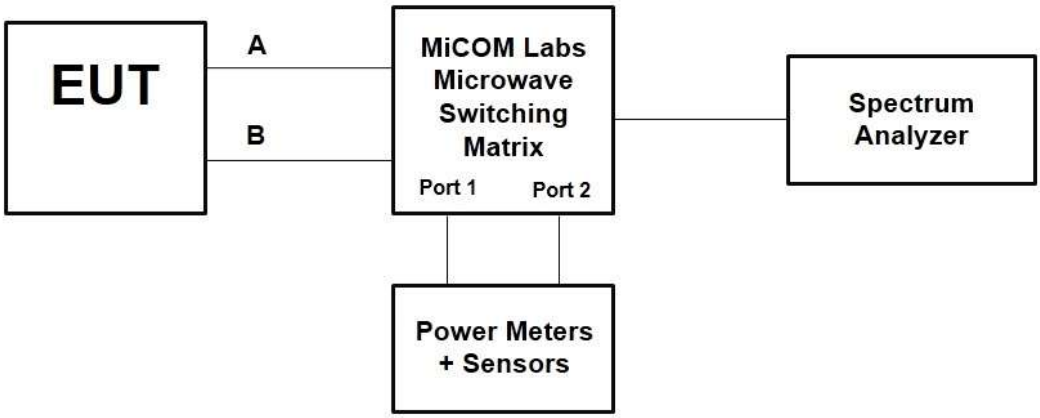
6.1. Conducted RF Emission Test Set-up

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

1. Section 6.1.1.1. 26 dB and 99% Bandwidth
2. Section 6.1.1.2. Maximum Conducted Output Power
3. Section 6.1.1.3. Peak Power Spectral Density
4. Section 6.1.1.4. Peak Excursion Ratio

Conducted Test Set-Up Pictorial Representation

Test Measurement set up



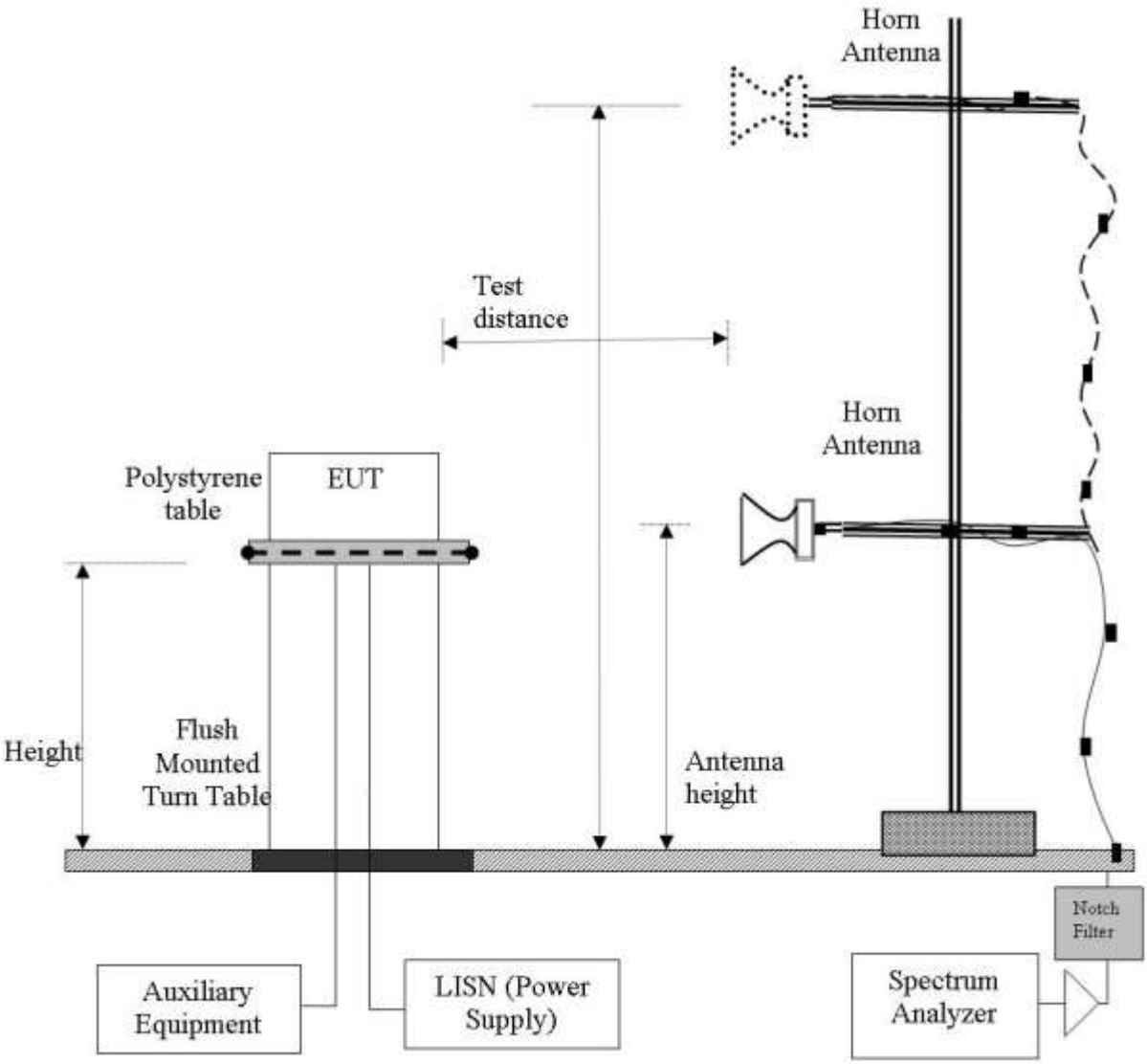
Conducted Test Measurement Setup

6.2. 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. Section 6.1.2.1 through 12

Radiated Emission Measurement Setup – Above 1 GHz

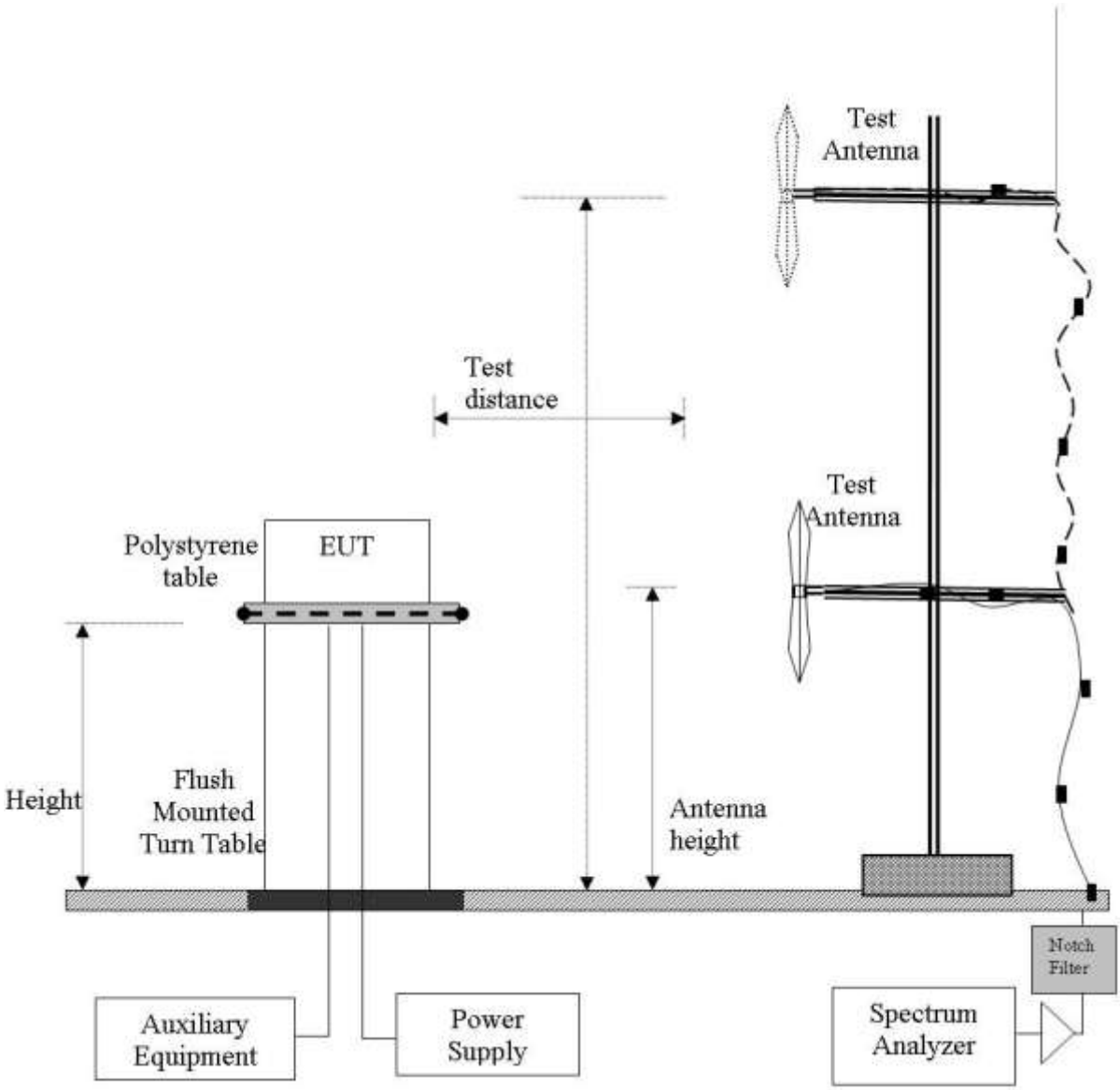


6.3. Digital Emissions Test Set-up (0.03 – 1 GHz)

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

1. Section 6.1.2.13

Digital Emission Measurement Setup – Below 1 GHz

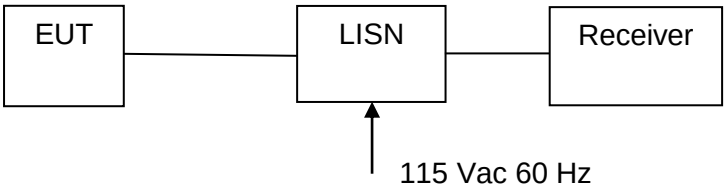


6.4. ac Wireline Emission Test Set-up

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

1. Section 6.1.3 ac Wireline Conducted Emissions

Conducted Test Set-Up Pictorial Representation



Measurement set up for ac Wireline Conducted Emissions Test

7. 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	6.1.1.1 A.1.1
15.407(a) **A9.2(2)** **4.6**	Maximum Conducted Output Power	Power Measurement	Conducted	Complies	6.1.1.2
15.407(a) **A9.2(2)**	Peak Power Spectral Density	PPSD	Conducted	Complies	6.1.1.3 A.1.2
15.407(a)(6)	Peak Excursion Ratio	<13dB in any 1MHz bandwidth	Conducted	Complies	6.1.1.4 A.1.3
15.407(g) **15.31** **2.1** **4.5**	Frequency Stability	Limits: contained within band of operation at all times.	Applicant declaration	Complies	6.1.1.5
15.407(f) **5.5**	Radio Frequency Radiation Exposure	Exposure to radio frequency energy levels, Maximum Permissible Exposure (MPE)	Conducted	See included MPE exhibit	--

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		6.1.2
	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*6.1.2.1* *6.1.2.2* *6.1.2.3*
	Radiated Band Edge	Band edge results		Complies	*6.1.2.1* *6.1.2.2* *6.1.2.3*
15.407(b)(6) **15.205(a)** **15.209(a)** **2.2**	Radiated Emissions	Emissions <1 GHz (30M-1 GHz)		Complies	*6.1.2.4*
15.407(b)(6) **15.207** **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	Complies	6.1.3

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

List of Measurements (cont'd)

Dynamic Frequency Selection (DFS)
The following table represents the list of measurements required under the **FCC CFR47 Part 15.407(h)(2)** and **FCC Memorandum Opinion and Order FCC 06-96 (Compliance Measurement procedures for Unlicensed National Information Infrastructure devices operating in the 5250-5350 MHz and 5470-5725 MHz bands incorporating dynamic frequency selection).**

Tests performed on Master Device

Section	Test Items	Description	Condition	Result	Test Report Section
	DFS	Dynamic Frequency Selection	Conducted	DFS not applicable in 5150 – 5250 MHz band	6.1.4
7.8.1	Detection Bandwidth	UNII Detection Bandwidth	Conducted		
7.8.2.1	Performance Requirements Check	Initial Channel Availability Check Time	Conducted		
7.8.2.2		Radar Burst at the Beginning of the Channel Availability Check Time	Conducted		
7.8.2.3		Radar Burst at the End of the Channel Availability Check Time	Conducted		
7.8.3	In-Service Monitoring	In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	Conducted		
7.8.4	Radar Detection	Statistical Performance Check	Conducted		

8. TEST RESULTS

8.1. Device Characteristics

8.1.1. Conducted Testing

8.1.1.1. 26 dB and 99 % Bandwidth

Conducted Test Conditions for 26 dB and 99% Bandwidth			
Standard:	FCC CFR 47:15.407	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	26 dB and 99 % Bandwidth	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.407 (a)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	KDB 789033 - D01 DTS General UNII Test Procedures v01		

Test Procedure for 26 dB and 99% Bandwidth Measurement

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. KDB 789033 Section 5.1 Emission Bandwidth was used in order to prove compliance. The Resolution Bandwidth was set to approximately 1% of the emission bandwidth.

Equipment Configuration for 26 dB & 99% Occupied Bandwidth			
Variant:	802.11a	**Duty Cycle (%):**	97
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:	No software version provided however, on boot product number 41365 was available		

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz)				26 dB Bandwidth (MHz)			
	Port(s)							
MHz	**a**	**b**	**c**	**d**	**Highest**	**Lowest**		
5180.0	20.341	20.541	--	--	20.541	20.341		
5200.0	20.240	20.441	--	--	20.441	20.240		
5240.0	20.341	20.641	--	--	20.641	20.341		

Test Frequency	Measured 99% Bandwidth (MHz)				99% Bandwidth (MHz)			
	Port(s)							
MHz	**a**	**b**	**c**	**d**	**Highest**	**Lowest**		
5180.0	16.733	16.733	--	--	16.733	16.733		
5200.0	16.733	16.733	--	--	16.733	16.733		
5240.0	16.733	16.733	--	--	16.733	16.733		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for 26 dB & 99% Occupied Bandwidth			
Variant:	802.11ac-80	**Duty Cycle (%):**	86
Data Rate:	29.3 Mbits/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz)				26 dB Bandwidth (MHz)			
	Port(s)							
MHz	**a**	**b**	**c**	**d**	**Highest**	**Lowest**		
5210.0	81.764	80.962	--	--	81.764	80.962		

Test Frequency	Measured 99% Bandwidth (MHz)				99% Bandwidth (MHz)			
	Port(s)							
MHz	**a**	**b**	**c**	**d**	**Highest**	**Lowest**		
5210.0	75.752	75.752	--	--	75.752	75.752		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for 26 dB & 99% Occupied Bandwidth

Variant:	802.11n HT-20	**Duty Cycle (%):**	94
Data Rate:	6.5 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:	No software version given however, on boot we were given product number 41365		

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz)				26 dB Bandwidth (MHz)			
	Port(s)							
MHz	a	b	c	d	Highest	Lowest		
5180.0	20.741	20.741	--	--	20.741	20.741		
5200.0	20.942	20.641	--	--	20.942	20.641		
5240.0	20.741	20.641	--	--	20.741	20.641		

Test Frequency	Measured 99% Bandwidth (MHz)				99% Bandwidth (MHz)			
	Port(s)							
MHz	a	b	c	d	Highest	Lowest		
5180.0	17.836	17.735	--	--	17.836	17.735		
5200.0	17.836	17.735	--	--	17.836	17.735		
5240.0	17.836	17.836	--	--	17.836	17.836		

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for 26 dB & 99% Occupied Bandwidth			
Variant:	802.11n HT-40	**Duty Cycle (%):**	90
Data Rate:	6.5 Mbits/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz)				26 dB Bandwidth (MHz)			
	Port(s)							
MHz	**a**	**b**	**c**	**d**	**Highest**	**Lowest**		
5190.0	39.679	39.279	--	--	39.679	39.279		
5230.0	39.679	39.279	--	--	39.679	39.279		

Test Frequency	Measured 99% Bandwidth (MHz)				99% Bandwidth (MHz)			
	Port(s)							
MHz	**a**	**b**	**c**	**d**	**Highest**	**Lowest**		
5190.0	36.273	36.273	--	--	36.273	36.273		
5230.0	36.273	36.273	--	--	36.273	36.273		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Specification

Limits

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

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

(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.

Traceability

Test Equipment Used
0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117

8.1.1.2. Maximum Conducted Output Power

Conducted Test Conditions for Maximum Conducted Output Power			
Standard:	FCC CFR 47:15.407	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Maximum Conducted Output Power	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.407 (a)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	KDB 789033 - D01 DTS General UNII Test Procedures v01		

Test Procedure for Maximum Conducted Output Power Measurement

Method PM (Measurement using an RF average power meter). Section C) 4) of KDB 789033 defines a methodology using an average wideband power meter. Measurements were made while the EUT was operating in a continuous transmission mode (100% duty cycle) at the appropriate center frequency. All cable losses and offsets were taken into consideration in the measured result. All operational modes and frequency bands were measured independently and the resultant □ calculated. For multiple outputs, the measurements were made simultaneously on each output port and summed in a linear fashion. This technique was used in order to prove compliance.

Antenna Beam and Non-Beam Forming Power Levels

15. 407 (a)(1), (a) (2) Operation with directional antenna gains greater than 6 dBi.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. Further FCC KDB 662911 D01 Multiple Transmitter Output v01 requires that the gain of antennas transmitting the same data (legacy 802.11a mode) must be increased by 10 * Log (N) when N is the number of antenna elements.

Operating Frequency Band 5150-5250 MHz

5150 – 5250 MHz Uncorrelated Operation (MIMO)

Antenna	Gain	Max. Allowable Conducted Peak Power (dBm)		Maximum EIRP
(dB)	(dBi)	Uncorrelated	Max. Power Per Chain	(dBm)
Integral	2.0	+17.00	+14.00	+19.00

5150 – 5250 MHz Correlated Operation (Non-MIMO i.e. Legacy)

Antenna	Gain dBi	Antenna Gain Increase V's No. Antenna Ports		Total Gain	Max. Allowable Conducted Peak Power	Maximum EIRP
(dB)		# of Ports	dB	dBi	∑ (dBm)	(dBm)
Integral	2.0	2	3.01	5.01	+17.00	+22.01

The APIN0205 does not implement beam-forming

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

Bands 5150 – 5250 MHz

FCC Limits

Conducted Power Limit lesser of: 50 mW or 4 dBm + 10 log (B) dBm. B is the 26 dB emission bandwidth in MHz.

Mode	Frequency Range (MHz)	Minimum 26 dB Bandwidth (MHz)	4 + 10 Log (B) (dBm)	Limit (dBm)
a	5150 – 5250	20.2	+17.05	+17.00
HT-20		20.6	+17.14	+17.00
HT-40		36.3	+19.60	+17.00
ac-80		81.0	+23.08	+17.00

Industry Canada Limits

EIRP Limit 5150 – 5250 MHz: Lesser of 200 mW (+23 dBm) or 10 + 10 Log (B) dBm. B is the 99% emission bandwidth in MHz.

Mode	Frequency Range (MHz)	Minimum 99 % Bandwidth (MHz)	4 + 10 Log (B) (dBm)	EIRP Limit (dBm)
a	5150 – 5250	16.7	+22.23	+22.23
HT-20		17.7	+22.48	+22.48
HT-40		39.3	+25.94	+23.00
ac-80		75.7	+28.79	+23.00

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Equipment Configuration for Peak Transmit Power			
Variant:	802.11a	**Duty Cycle (%):**	97
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	2.00
Modulation:	OFDM	**Beam Forming Gain (Y):**	N/A
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:	No software version provided however, on boot product number 41365 was available		

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				Calculated Total Power	Minimum 26 dB Bandwidth	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	Σ Port(s) dBm	MHz	dBm	dBm	
5180.0	11.63	11.37	--	--	14.51	20.341	17.00	-2.49	11.00
5200.0	11.65	11.28	--	--	14.48	20.240	17.00	-2.52	11.00
5240.0	11.69	11.21	--	--	14.47	20.341	17.00	-2.53	11.00

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

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Variant:	802.11ac-80	**Duty Cycle (%):**	86
Data Rate:	29.3 Mbits/s	**Antenna Gain (dBi):**	2.00
Modulation:	OFDM	**Beam Forming Gain (Y):**	N/A
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				Calculated Total Power	Minimum 26 dB Bandwidth	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	Σ Port(s) dBm	MHz	dBm	dBm	
5210.0	13.63	13.10	--	--	16.38	80.962	17.00	-0.62	13.00

Traceability to Industry Recognized Test Methodologies

Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	

Equipment Configuration for Peak Transmit Power			
Variant:	802.11n HT-20	**Duty Cycle (%):**	94
Data Rate:	6.5 MBit/s	**Antenna Gain (dBi):**	2.00
Modulation:	OFDM	**Beam Forming Gain (Y):**	N/A
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:	No software version given however, on boot we were given product number 41365		

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				Calculated Total Power	Minimum 26 dB Bandwidth	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	Σ Port(s) dBm	MHz	dBm	dBm	
5180.0	11.65	11.24	--	--	14.46	20.741	17.00	-2.54	11.00
5200.0	11.68	11.19	--	--	14.45	20.641	17.00	-2.55	11.00
5240.0	11.70	11.28	--	--	14.50	20.641	17.00	-2.50	11.00

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Equipment Configuration for Peak Transmit Power			
Variant:	802.11n HT-40	**Duty Cycle (%):**	90
Data Rate:	6.5 Mbits/s	**Antenna Gain (dBi):**	2.00
Modulation:	OFDM	**Beam Forming Gain (Y):**	N/A
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power (dBm) Port(s)				Calculated Total Power	Minimum 26 dB Bandwidth	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	Σ Port(s) dBm	MHz	dBm	dBm	
5190.0	11.80	11.28	--	--	14.56	39.279	17.00	-2.44	11.00
5230.0	12.67	12.39	--	--	15.54	39.279	17.00	-1.46	12.00

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

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Antenna Type V's Power Setting

The following **Antenna Types V's Power Setting** tables consolidates the results of all tests performed on the APIN0204 and APIN0205 to finalize the power setting for each antenna's tested;

Integral Antenna (APIN0205)

Channel	5.15-5.25 GHz			
	a	HT-20	HT-40	ac-80
Low	11	11	11	13
Mid	11	11	--	--
High	11	11	12	--

Antenna AP-ANT-1B (APIN0204)

Channel	5.15-5.25 GHz			
	a	HT-20	HT-40	ac-80
Low	11	11	11	13
Mid	11	11	--	--
High	11	11	12	--

Antenna AP-ANT-13B (APIN0204)

Channel	5.15-5.25 GHz			
	a	HT-20	HT-40	ac-80
Low	11	11	11	13
Mid	11	11	--	--
High	11	11	12	--

Antenna AP-ANT-16 (APIN0204)

Channel	5.15-5.25 GHz			
	a	HT-20	HT-40	ac-80
Low	11	11	11	13
Mid	11	11	--	--
High	11	11	12	--

Antenna AP-ANT-18 (APIN0204)

Channel	5.15-5.25 GHz			
	a	HT-20	HT-40	ac-80
Low	11	11	11	13
Mid	11	11	--	--
High	11	11	12	--

Antenna AP-ANT-19 (APIN0204)

Channel	5.15-5.25 GHz			
	a	HT-20	HT-40	ac-80
Low	11	11	11	13
Mid	11	11	--	--
High	11	11	12	--

Specification Limits

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

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

(a)(2) For the 5.25-5.35 and 5470-5725 MHz GHz band the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or +11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed +11 dBm in any 1 megahertz band.

Industry Canada RSS-210 §A9.2(2)
For the band 5150-5250 MHz, the maximum equivalent isotropically radiated power (e.i.r.p.) shall not exceed 200 mW or 10 + 10 log10 B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

For the band 5250-5350 MHz and 5470-5725 MHz, the maximum conducted output power shall not exceed 250 mW or 11 + 10 log10 B, dBm, whichever power is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band. The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10 B, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

Traceability

Test Equipment Used
0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117

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8.1.1.3. Peak Power Spectral Density

Conducted Test Conditions for Power Spectral Density			
Standard:	FCC CFR 47:15.407	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Power Spectral Density	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.247 (a)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	KDB 789033 - D01 DTS General UNII Test Procedures v01		

Test Procedure for Power Spectral Density

The In-Band power spectral density was measured using the measure and sum approach per FCC KDB 662911 (D01 Multiple Transmitter Output v01.)

Measure and sum the spectra across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The individual spectra are then summed mathematically in linear power units. Unlike in-band power measurements, in which the sum involves a single measured value (output power) from each output, measurements for compliance with PSD limits involve summing entire spectra across corresponding frequency bins on the various outputs. Consistency is maintained for any device with N transmitter outputs to be certain the individual outputs are all aligned with the same span and same number of points. In this instance, the linear power spectrum value within the first spectral bin of output 0 is summed with that in the first spectral bin of output 1, and the first spectral bin of output 2, and so on up to the Nth output to obtain the true value for the first frequency bin of the summed spectrum. The summed spectrum value for each frequency bin is computed in this fashion. These summed spectral values were calculated on a computer, and the results read back into the spectrum analyzer as a data file to produce a representative plot of total spectral power density.

NOTE:

It may be observed that spectrum in some plots break the limit line however this in itself does NOT constitute a failure. In this case a summation plot for all spectrum plots is provided to prove compliance. A failure occurs only after the summation of all spectrum plots have been summed and are found to be greater than the limit line.

Supporting Information

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

A = Total Power Spectral Density [10 Log10 (10a/10 + 10 b/10 + 10c/10 + 10d/10)]

x = Duty Cycle

Equipment Configuration for Peak Power Spectral Density			
Variant:	802.11a	**Duty Cycle (%):**	97.0
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	2.00
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/MHz)				Amplitude Summation	Limit	Margin
MHz	a	b	c	d	dBm/MHz	dBm/MHz	dB
5180.0	0.943	0.778	--	--	3.585	4.0	-0.4
5200.0	0.751	0.274	--	--	3.190	4.0	-0.8
5240.0	1.084	0.867	--	--	3.978	4.0	0.0

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Peak Power Spectral Density			
Variant:	802.11ac-80	**Duty Cycle (%):**	86.0
Data Rate:	29.3 Mbits/s	**Antenna Gain (dBi):**	2.00
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/MHz)				Amplitude Summation	Limit	Margin
MHz	a	b	c	d	dBm/MHz	dBm/MHz	dB
5210.0	-4.948	-6.088	--	--	-2.672	4.0	-6.7

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Peak Power Spectral Density			
Variant:	802.11n HT-20	**Duty Cycle (%):**	94.0
Data Rate:	6.5 MBit/s	**Antenna Gain (dBi):**	2.00
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/MHz)				Amplitude Summation	Limit	Margin
MHz	a	b	c	d	dBm/MHz	dBm/MHz	dB
5180.0	0.582	-0.172	--	--	3.174	4.0	-0.8
5200.0	-0.375	-0.370	--	--	2.453	4.0	-1.5
5240.0	0.136	0.115	--	--	2.471	4.0	-1.5

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Peak Power Spectral Density			
Variant:	802.11n HT-40	**Duty Cycle (%):**	90.0
Data Rate:	6.5 Mbits/s	**Antenna Gain (dBi):**	2.00
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/MHz)				Amplitude Summation	Limit	Margin
MHz	a	b	c	d	dBm/MHz	dBm/MHz	dB
5190.0	-3.354	-4.201	--	--	-1.234	4.0	-5.2
5230.0	-2.327	-2.488	--	--	-0.384	4.0	-4.4

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Specification

FCC, Part 15 §15.407 (a)(1), (a)(2)
5150 – 5250 MHz
(a)(1) The peak power spectral density shall not exceed +4 dBm in any 1 megahertz band.

5250 – 5350 MHz & 5470 – 5725 MHz
(a)(2) The peak power spectral density shall not exceed +11 dBm in any 1 megahertz band.

Industry Canada RSS-210 § **A9.2(1), A9.2(2)**
5150 – 5250 MHz
§ **A9.2(1)** The eirp spectral density shall not exceed +10 dBm in any 1 MHz band

5250 – 5350 MHz & 5470 – 5725 MHz
§ **A9.2(2)** The power spectral density shall not exceed +11 dBm in any 1 MHz band

Traceability

Test Equipment Used
0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117

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8.1.1.4. Peak Excursion Ratio

Conducted Test Conditions for Peak Excursion Ratio			
Standard:	FCC CFR 47:15.407	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Peak Excursion Ratio	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.407 (a)(6)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	KDB 789033 - D01 DTS General UNII Test Procedures v01		

Test Procedure for Peak Excursion Ratio

Compliance with the peak excursion requirement is demonstrated by confirming the ratio of the maximum of the peak-hold spectrum to the maximum of the average spectrum during continuous transmission. Section F) of KDB 789033 was used in order to prove compliance. This is a conducted measurement using a spectrum analyzer using dual traces. Peak Excursion Ratio is the difference in amplitude (dB) between both traces; The following identifies two spectrum traces on the same plot. Trace 1 is the max hold Peak detector, and Trace 2 is the recalled trace data from Peak Power Spectral Density measurements. Each frequency and operational mode is recalled in order to prove compliance.

Equipment Configuration for Peak Excursion Ratio			
Variant:	802.11a	**Duty Cycle (%):**	97
Data Rate:	6 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:	No software version provided however, on boot product number 41365 was available		

Test Measurement Results

Test Frequency	Measured Peak Excursion (dB) Port(s)				Ratio (dB)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	dB	MHz
5180.0	8.90	--	--	--	8.90	8.90	13.0	-4.10

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Peak Excursion Ratio			
Variant:	802.11n HT-20	**Duty Cycle (%):**	94
Data Rate:	6.5 MBit/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:	No software version given however, on boot we were given product number 41365		

Test Measurement Results

Test Frequency	Measured Peak Excursion (dB) Port(s)				Ratio (dB)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	dB	MHz
5180.0	8.81	--	--	--	8.81	8.81	13.0	-4.19

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

Equipment Configuration for Peak Excursion Ratio			
Variant:	802.11n HT-40	**Duty Cycle (%):**	90
Data Rate:	6.5 Mbits/s	**Antenna Gain (dBi):**	Not Applicable
Modulation:	OFDM	**Beam Forming Gain (Y):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	AH
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Peak Excursion (dB) Port(s)				Ratio (dB)		Limit	Lowest Margin
MHz	a	b	c	d	Highest	Lowest	dB	MHz
5190.0	10.40	--	--	--	10.40	10.40	13.0	-2.60

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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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

Traceability

Test Equipment Used
0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117

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8.1.1.5. Frequency Stability

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

Test Procedure

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

Manufacturer Declaration

The frequency stability of the reference oscillator sets the frequency stability of the RF transceiver signals. Therefore all of the RF signals should have ±20ppm stability.
This stability accounts for room temp tolerance of the crystal oscillator circuit, frequency variation across temperature, and crystal ageing.

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

Specification

Limits

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

8.1.2. 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.

Field Strength Calculation

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

FS = R + AF + CORR – FO

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

CORR = Correction Factor = CL – AG + NFL

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

Field Strength Calculation Example:

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

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

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

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

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

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

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

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.

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

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Table 1: FCC 15.209 Spurious Emissions Limits

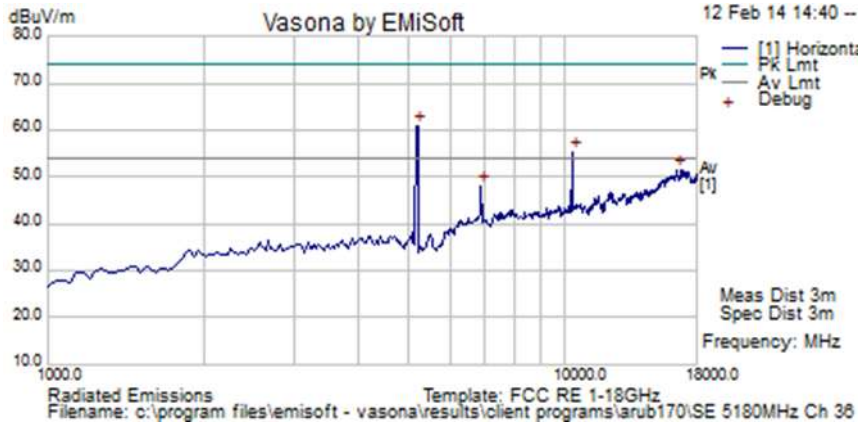
Frequency (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance (meters)
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Traceability:

Test Equipment Used
0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312

8.1.2.1. Integral Antenna – Spurious Emissions

Test Freq.	5180 MHz (ch 36)	**Engineer**	MTS
Variant	802.11a; 6 Mbit/s	**Temp (ºC)**	17
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	49
Power Setting	18	**Press. (mBars)**	1010
Antenna	Integral	**Duty Cycle (%)**	100
Test Notes 1	EUT mounted vertically on test table, all ports terminated and active. Unit is power via POE		
Test Notes 2	POE brick is on test table.		

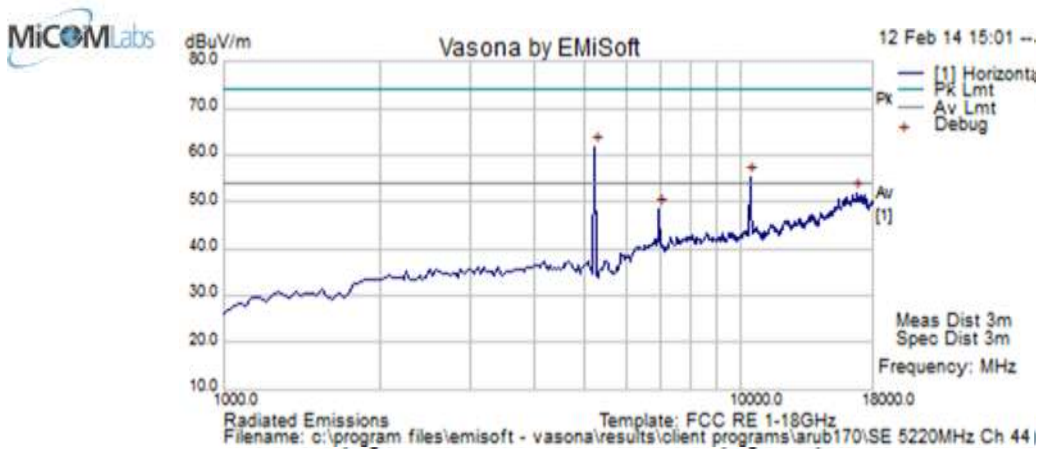


Formally measured emission peaks

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	65.0	5.9	-9.9	61.0	Peak [Scan]	H						FUND
10363.991	39.6	8.9	-2.5	46.0	Average	H						NRB
16376.355	29.7	12.0	0.2	41.9	Average	V						NRB
6893.788	47.7	7.0	-6.5	48.2	Peak [Scan]	H						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

Test Freq.	5220 MHz (ch 44)	**Engineer**	MTS
Variant	802.11a; 6 Mbit/s	**Temp (ºC)**	17
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	49
Power Setting	18	**Press. (mBars)**	1010
Antenna	Integral	**Duty Cycle (%)**	100
Test Notes 1	See notes above		
Test Notes 2			

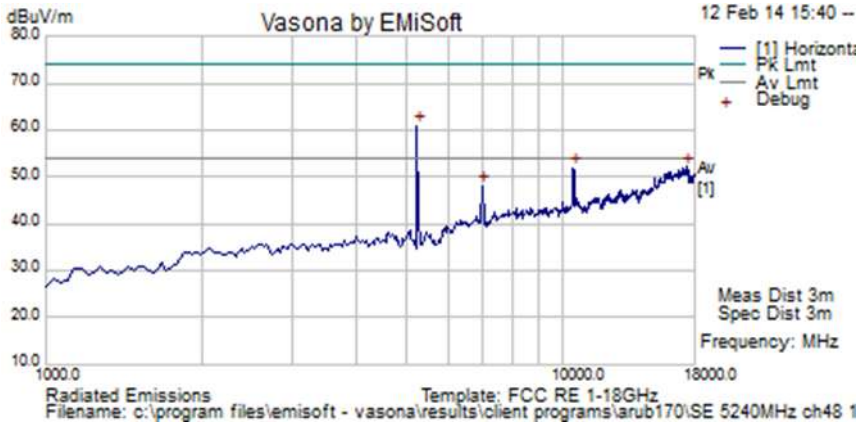


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
16717.559	28.7	12.1	0.8	41.6	Average	V	153	193	54	-12.4	Pass	
5224.449	65.8	5.9	-9.8	61.9	Peak [Scan]	H						FUND
10439.932	38.2	9.0	-2.5	44.7	Average	H	153	193	54	-9.3	Pass	
6961.924	48.0	7.0	-6.4	48.6	Peak [Scan]	H	150	0	54	-5.4	Pass	

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

Test Freq.	5240 MHz (ch 48)	**Engineer**	MTS
Variant	802.11a; 6 Mbit/s	**Temp (ºC)**	17
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	49
Power Setting	14	**Press. (mBars)**	1010
Antenna	Integral	**Duty Cycle (%)**	100
Test Notes 1	See notes above		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5224.449	65.0	5.9	-9.8	61.1	Peak [Scan]	H						FUND
17328.216	28.6	12.4	1.2	42.2	Average	V	149	139	54	-11.81	Pass	
10480.994	33.4	9.0	-2.5	40.0	Average	V	99	184	54	-14.0	Pass	
6995.992	47.5	7.0	-6.4	48.1	Peak [Scan]	H	150	0	54	-5.9	Pass	

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

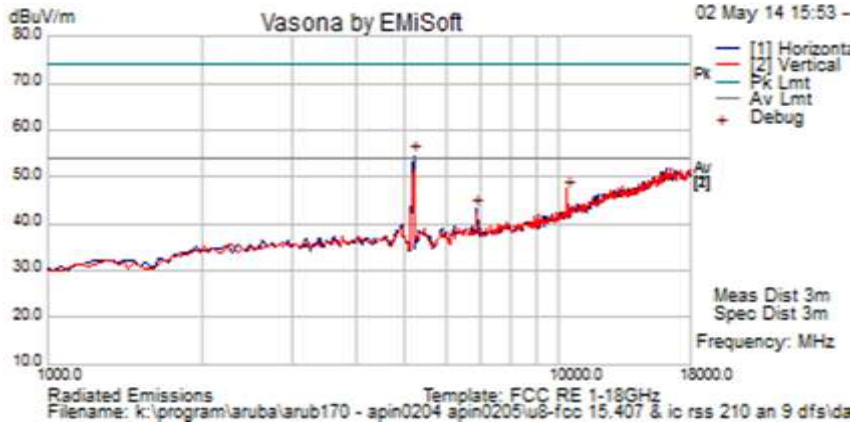
Integral Antenna - Radiated Band-Edge

Peak Limit 74.0 dBµV/m, Average Limit 54.0 dBµV/m

	5150 MHz		
	dBµV/m		Power Setting
Operational Mode	Peak	Average	
a	63.97	50.44	11
n HT-20	69.23	48.77	11
n HT-40	69.81	51.83	11
ac-80	69.90	52.83	13

8.1.2.2. AP-ANT-1B – Spurious Emissions

Test Freq.	5180 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 1B	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Vertical; Antenna Position 45 degrees; POE;		

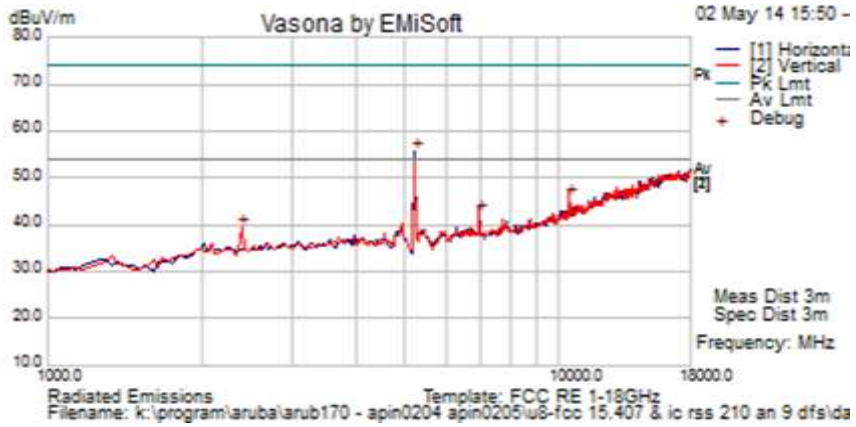


Formally measured emission peaks

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
5190.38076	51.1	5.9	-2.3	54.6	Peak [Scan]	H	100					FUND
10363.399	34.8	8.9	3.1	46.8	Peak [Scan]	V	98					NRB
6891.978	36.4	7.0	-0.3	43.0	Peak [Scan]	V	98					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

Test Freq.	5200 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 1B	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Vertical; Antenna Position 45 degrees; POE;		

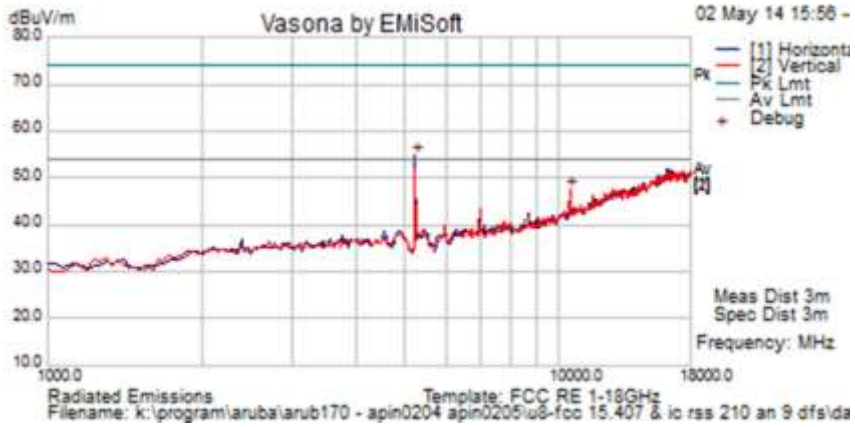


Formally measured emission peaks

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	51.9	5.9	-2.3	55.5	Peak [Scan]	H	100					FUND
10440.09	33.3	9.0	3.4	45.6	Peak [Scan]	V	98					NRB
2395.546	40.9	3.9	-5.5	39.4	Peak [Scan]	V	98					NRB
6957.310	35.8	7.0	-0.4	42.4	Peak [Scan]	H	98					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

Test Freq.	5240 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 1B	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Vertical; Antenna Position 45 degrees; POE;		



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	51.2	5.9	-2.3	54.8	Peak [Scan]	H	100					FUND
10482.989	34.8	9.0	3.6	47.5	Peak [Scan]	V	98					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

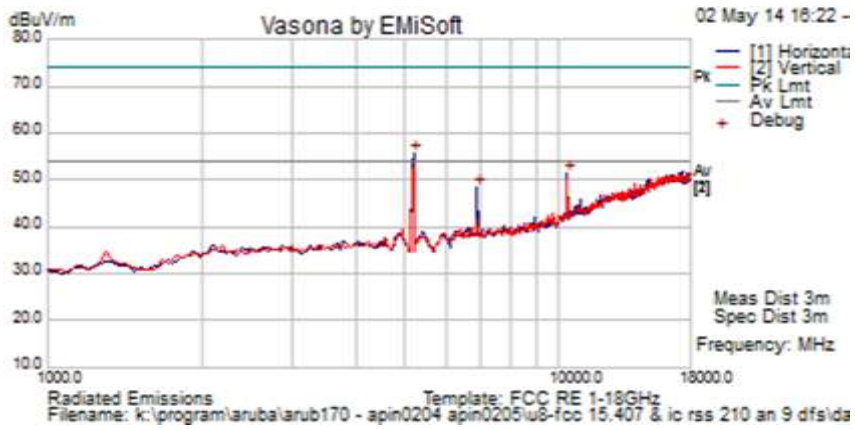
Antenna AP-ANT-1B - Radiated Band-Edge

Peak Limit 74.0 dBµV/m, Average Limit 54.0 dBµV/m

	5150 MHz		
	dBµV/m		Power Setting
Operational Mode	Peak	Average	
a	55.76	44.60	11
n HT-20	51.68	39.28	11
n HT-40	50.87	36.46	11
ac-80	54.57	39.75	13

8.1.2.3. AP-ANT-13B – Spurious Emissions

Test Freq.	5180 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 13B	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		

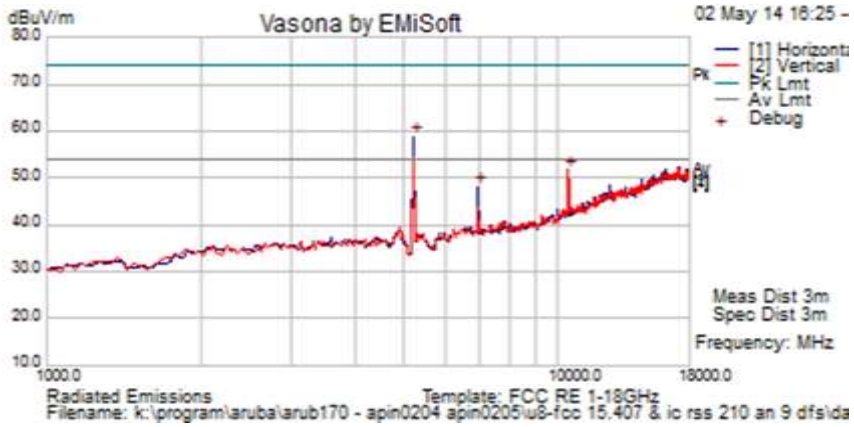


Formally measured emission peaks

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	52.0	5.9	-2.3	55.6	Peak [Scan]	H	100					FUND
10368.737	39.1	8.9	3.2	51.2	Peak [Scan]	H	100					NRB
6893.788	41.7	7.0	-0.3	48.4	Peak [Scan]	H	100					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

Test Freq.	5200 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 13B	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		

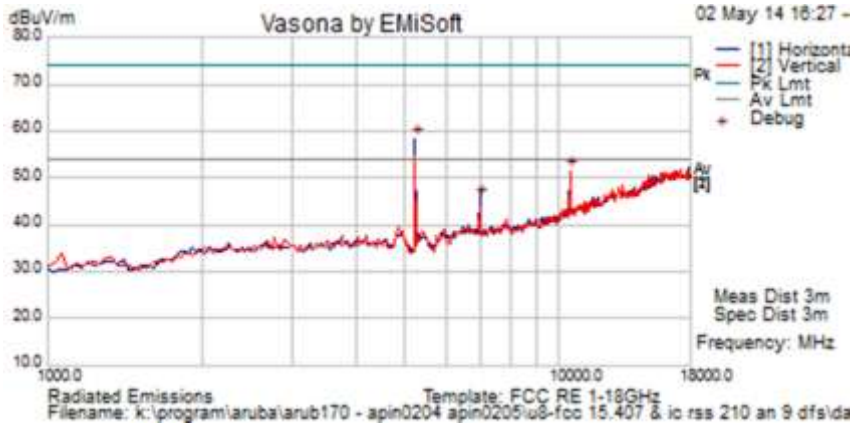


Formally measured emission peaks

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	55.3	5.9	-2.3	58.9	Peak [Scan]	H	100					FUND
10436.874	39.3	9.0	3.4	51.6	Peak [Scan]	V	100					NRB
6961.924	41.5	7.0	-0.4	48.1	Peak [Scan]	H	100					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

Test Freq.	5240 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 13B	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		



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	54.7	5.9	-2.3	58.3	Peak [Scan]	H	100					FUND
10470.942	39.0	9.0	3.6	51.5	Peak [Scan]	V	100					NRB
6991.433	39.2	7.0	-0.4	45.8	Peak [Scan]	V	98					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

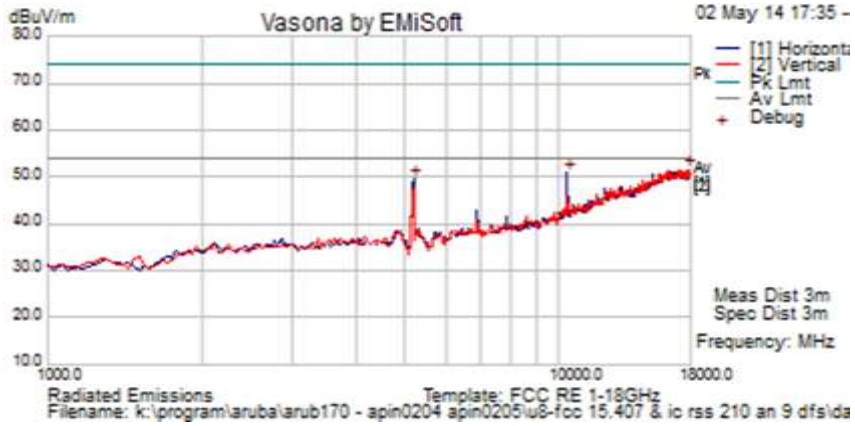
Antenna AP-ANT-13B - Radiated Band-Edge

Peak Limit 74.0 dBµV/m, Average Limit 54.0 dBµV/m

	5150 MHz		
	dBµV/m		Power Setting
Operational Mode	Peak	Average	
a	57.88	47.30	11
n HT-20	58.98	47.48	11
n HT-40	61.38	47.34	11
ac-80	69.97	53.43	13

8.1.2.4. AP-ANT-16 – Spurious Emissions

Test Freq.	5180 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 16	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		

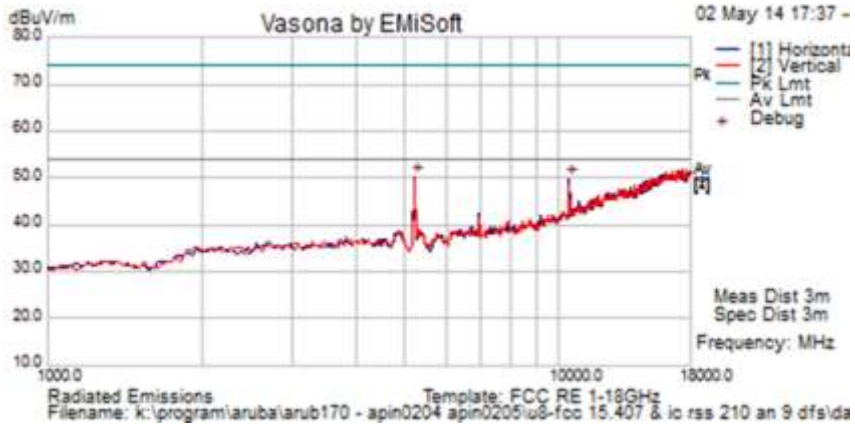


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
10368.737	38.7	8.9	3.2	50.8	Peak [Scan]	H	100					NRB
5190.38076	46.1	5.9	-2.3	49.6	Peak [Scan]	H	100					FUND

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

Test Freq.	5200 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 16	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		

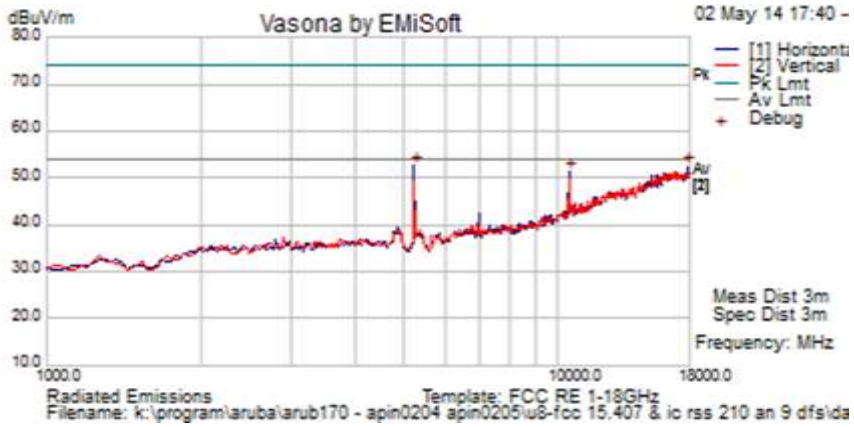


Formally measured emission peaks

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	46.7	5.9	-2.3	50.3	Peak [Scan]	H	100					FUND
10436.874	37.5	9.0	3.4	49.9	Peak [Scan]	H	100					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

Test Freq.	5240 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 16	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		



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	49.0	5.9	-2.3	52.7	Peak [Scan]	H	100					FUND
10470.942	38.8	9.0	3.6	51.3	Peak [Scan]	H	100					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

Antenna AP-ANT-16 - Radiated Band-Edge

Peak Limit 74.0 dBµV/m, Average Limit 54.0 dBµV/m

	5150 MHz		
	dBµV/m		Power Setting
Operational Mode	Peak	Average	
a	56.84	45.71	11
n HT-20	54.56	42.98	11
n HT-40	54.56	41.34	11
ac-80	66.22	49.99	13

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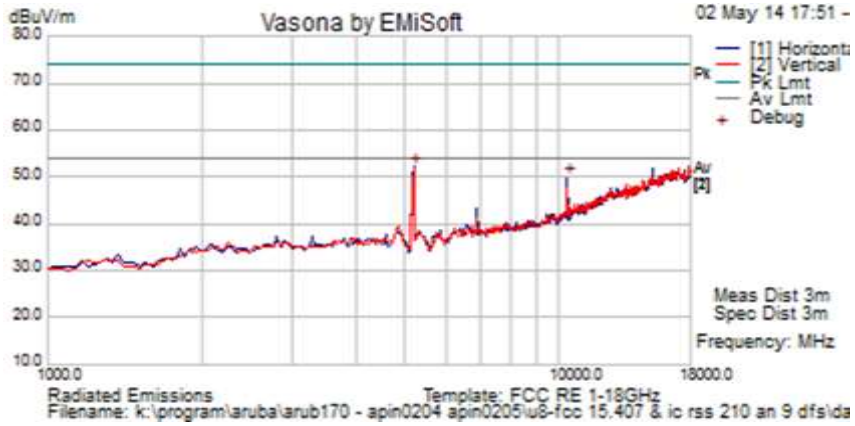
8.1.2.5. AP-ANT-18 – Spurious Emissions

Test Freq.	5180 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 18	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		

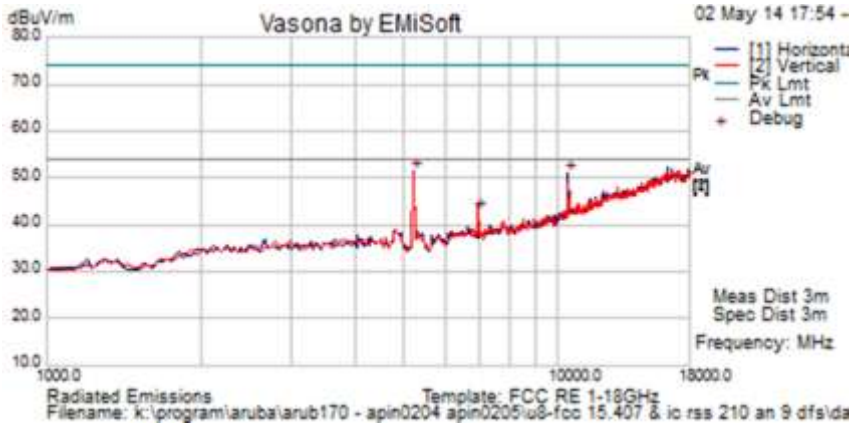


Formally measured emission peaks

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	48.6	5.9	-2.3	52.1	Peak [Scan]	H	100					FUND
10368.737	37.8	8.9	3.2	49.9	Peak [Scan]	H	100					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

Test Freq.	5200 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 18	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		

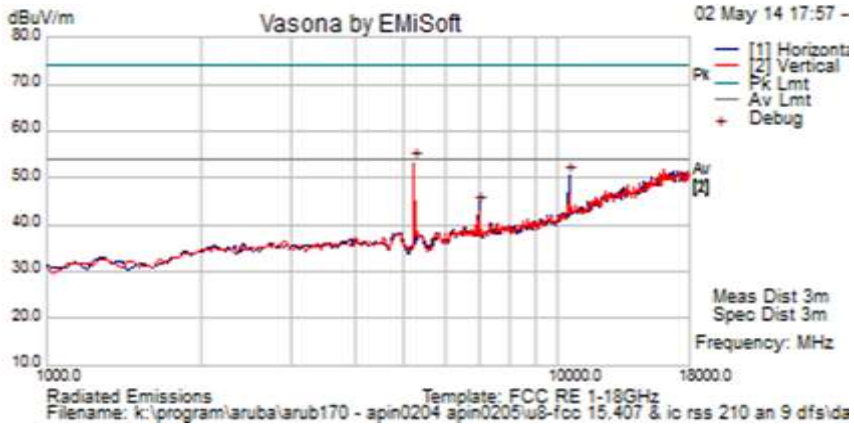


Formally measured emission peaks

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	47.7	5.9	-2.3	51.3	Peak [Scan]	H	100					FUND
10436.874	38.6	9.0	3.4	50.9	Peak [Scan]	H	100					NRB
6970.098	36.2	7.0	-0.4	42.8	Peak [Scan]	H	98					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

Test Freq.	5240 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 18	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		



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	49.7	5.9	-2.3	53.3	Peak [Scan]	V	100					FUND
10470.942	37.9	9.0	3.6	50.5	Peak [Scan]	H	100					NRB
7002.363	37.1	7.0	-0.3	43.8	Peak [Scan]	V	98					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

Antenna AP-ANT-18 - Radiated Band-Edge

Peak Limit 74.0 dBµV/m, Average Limit 54.0 dBµV/m

	5150 MHz		
	dBµV/m		Power Setting
Operational Mode	Peak	Average	
a	60.15	45.12	11
n HT-20	60.34	46.99	11
n HT-40	60.05	44.36	11
ac-80	66.58	51.35	13

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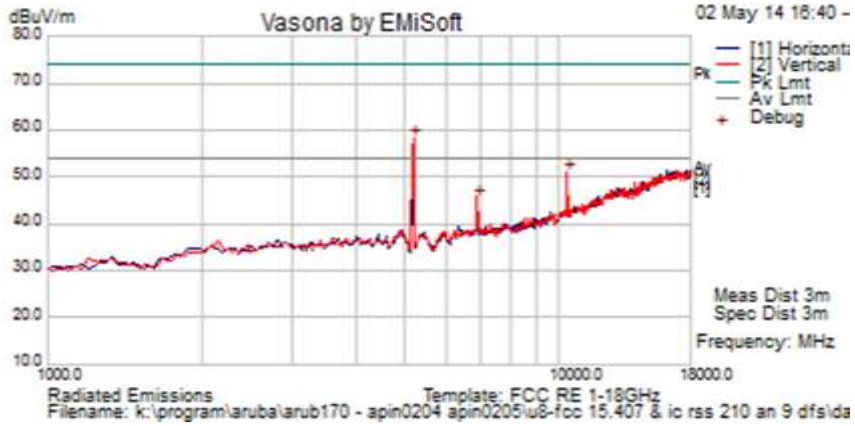
8.1.2.6. AP-ANT-19 – Spurious Emissions

Test Freq.	5180 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 19	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		

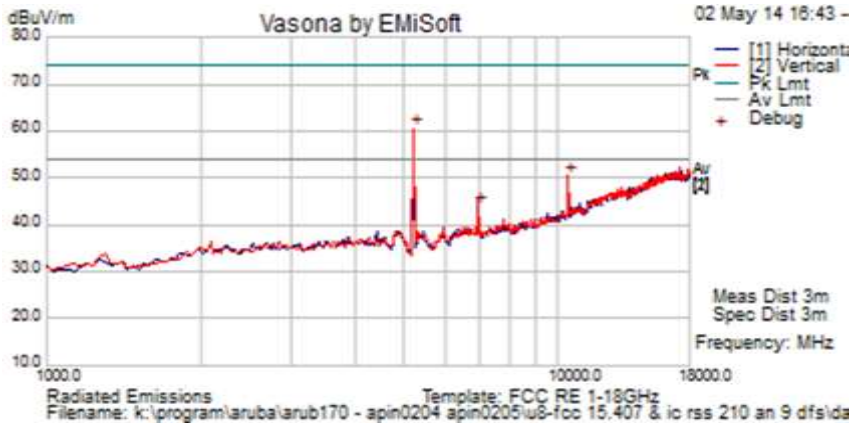


Formally measured emission peaks

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	54.6	5.9	-2.3	58.2	Peak [Scan]	V	100					FUND
10368.737	38.9	8.9	3.2	51.0	Peak [Scan]	V	100					NRB
6896.819	38.7	7.0	-0.3	45.3	Peak [Scan]	V	98					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

Test Freq.	5200 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 19	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		

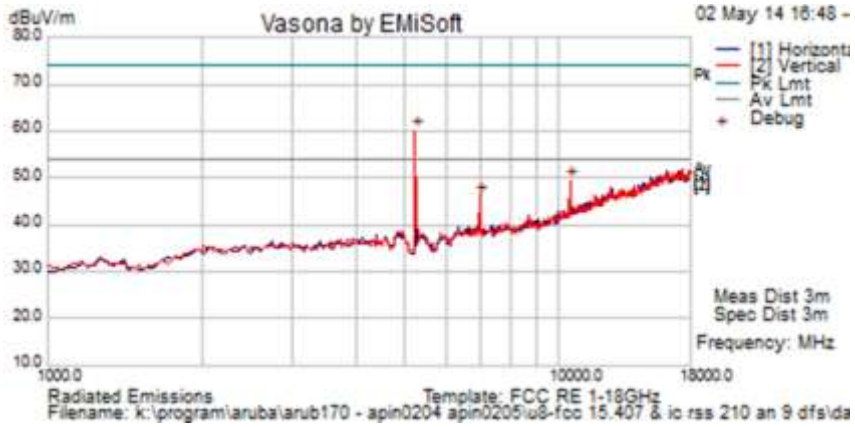


Formally measured emission peaks

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	57.0	5.9	-2.3	60.6	Peak [Scan]	V	100					FUND
10436.874	38.1	9.0	3.4	50.4	Peak [Scan]	V	100					NRB
6967.652	37.5	7.0	-0.4	44.1	Peak [Scan]	V	98					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

Test Freq.	5240 MHz	**Engineer**	SB
Variant	802.11a; 6 Mbs	**Temp (ºC)**	22
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	31
Power Setting	11	**Press. (mBars)**	1004
Antenna	AP ANT 19	**Duty Cycle (%)**	100
Test Notes 1	S/N:CM0000392; MAC:9C:1C:12:C7:DE:94;		
Test Notes 2	EUT Position Horizontal; POE;		



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	56.5	5.9	-2.3	60.1	Peak [Scan]	V	100					FUND
10470.942	36.8	9.0	3.6	49.3	Peak [Scan]	V	100					NRB
6993.166	39.4	7.0	-0.4	46.0	Peak [Scan]	V	98					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

Antenna AP-ANT-19 - Radiated Band-Edge

Peak Limit 74.0 dBµV/m, Average Limit 54.0 dBµV/m

	5150 MHz		
	dBµV/m		Power Setting
Operational Mode	Peak	Average	
a	61.31	50.82	11
n HT-20	59.97	44.70	11
n HT-40	59.97	44.70	11
ac-80	66.07	50.22	13

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8.1.2.7. 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:

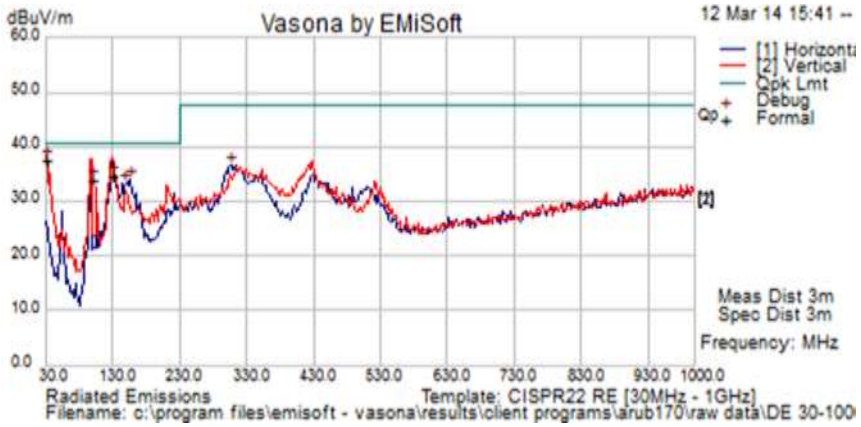
$$FS = 51.5 + 8.5 + 1.3 - 26.0 + 1 = 36.3 dB\mu V/m$$

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

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

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

Test Freq.	NA	**Engineer**	JMH
Variant	Digital Emissions	**Temp (ºC)**	18
Freq. Range	30 - 1000 MHz	**Rel. Hum.(%)**	33
Power Setting	Not Applicable	**Press. (mBars)**	1007
Antenna	External		
Test Notes 1	POE 55 Vdc		
Test Notes 2			

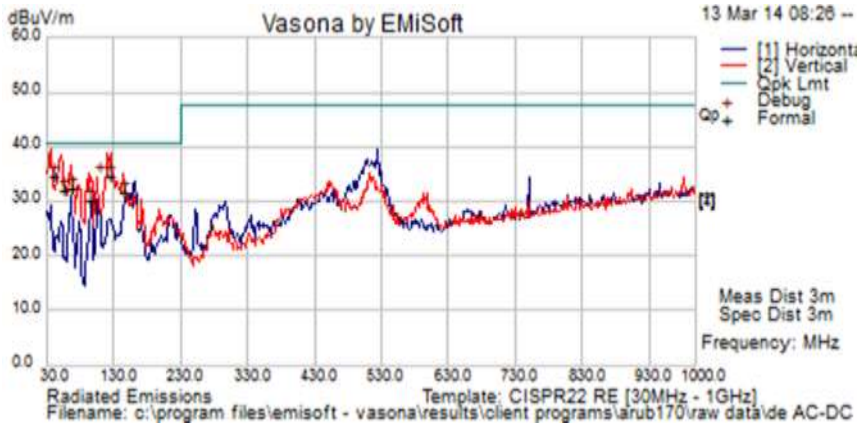


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
30.606	43.9	3.5	-10.0	37.400	Quasi Max	V	99	225	40.5	-3.1	Pass	
128.993	47.2	4.3	-16.9	34.6	Quasi Max	H	393	283	40.5	-5.9	Pass	
97.306	51.3	4.1	-21.6	33.8	Quasi Max	V	111	302	40.5	-6.7	Pass	
144.896	47.1	4.3	-18.3	33.2	Peak [Scan]	H	98	-1	40.5	-7.3	Pass	
156.413	48.1	4.4	-18.5	34.0	Peak [Scan]	H	98	-1	40.5	-6.5	Pass	
304.698	48.1	5.1	-16.8	36.4	Peak [Scan]	H	98	-1	47.5	-11.1	Pass	

Legend:	DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency
	NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

Test Freq.	NA	**Engineer**	JMH
Variant	Digital Emissions	**Temp (ºC)**	18
Freq. Range	30 - 1000 MHz	**Rel. Hum.(%)**	33
Power Setting	NA	**Press. (mBars)**	1000
Antenna	External APIN0204		
Test Notes 1	AC/DC Powered 110Vac 60 Hz / 12 Vdc		
Test Notes 2	Digital Emissions		



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
37.871	46.7	3.6	-15.6	34.670	Quasi Max	V	105	62	40.5	-5.8	Pass	
122.751	47.4	4.2	-17.0	34.6	Quasi Max	V	133	186	40.5	-5.9	Pass	
52.159	51.5	3.7	-23.2	32.0	Quasi Max	V	156	89	40.5	-8.5	Pass	
65.446	51.9	3.8	-23.2	32.5	Quasi Max	V	189	50	40.5	-8.0	Pass	
143.372	45.5	4.3	-18.2	31.7	Quasi Max	V	99	10	40.5	-8.9	Pass	
91.769	49.6	4.0	-23.3	30.3	Quasi Max	V	99	257	40.5	-10.2	Pass	
105.812	49.8	4.1	-19.3	34.4	Peak [Scan]	V	100	0	40.5	-6.0	Pass	

Legend:	DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency
	NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

Specification

Limits

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

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

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

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

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

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

Traceability

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

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

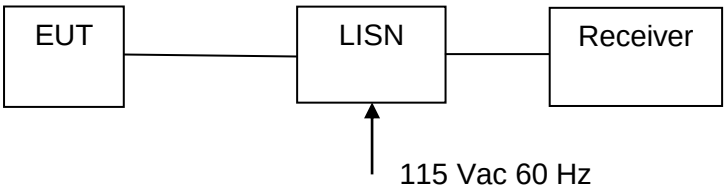
FCC, Part 15 Subpart C §15.207
Industry Canada RSS-Gen §7.2.2

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

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

Test Measurement Set up



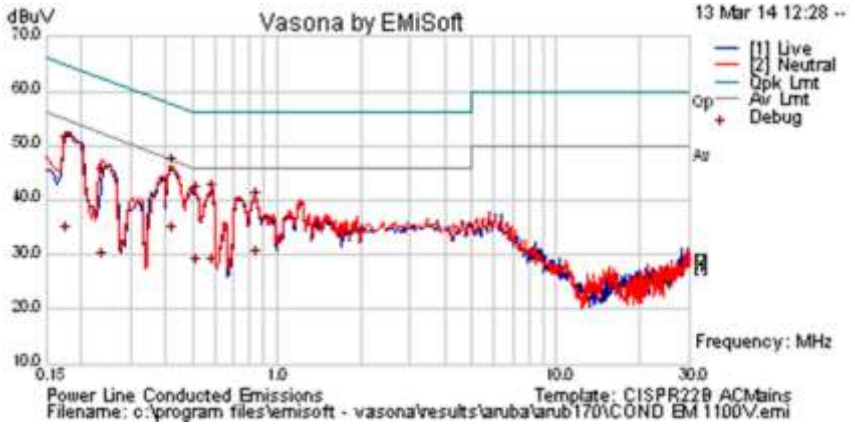
Measurement set up for AC Wireline Conducted Emissions Test

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/dc Adaptor Wireline Emissions

Test Freq.	N/A	**Engineer**	JMH
Variant	AC Line Emissions	**Temp (ºC)**	18
Freq. Range	0.150 MHz - 30 MHz	**Rel. Hum.(%)**	35
Power Setting	Not Applicable	**Press. (mBars)**	1004
Antenna	Not Applicable		
Test Notes 1	ac/dc Adaptor 110 Vac, 60 Hz		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
0.175	23.7	9.9	0.1	33.7	Average	Neutral	54.72	-21.1	Pass	
0.175	40.3	9.9	0.1	50.3	Quasi Peak	Neutral	64.72	-14.5	Pass	
0.234	18.7	9.9	0.1	28.6	Average	Neutral	52.31	-23.7	Pass	
0.234	34.2	9.9	0.1	44.1	Quasi Peak	Neutral	62.31	-18.2	Pass	
0.415	36.2	9.9	0.1	46.1	Quasi Peak	Neutral	57.56	-11.4	Pass	
0.415	23.7	9.9	0.1	33.7	Average	Neutral	47.56	-13.9	Pass	
0.506	31.1	9.9	0.1	41.1	Quasi Peak	Neutral	56	-14.9	Pass	
0.506	17.7	9.9	0.1	27.7	Average	Neutral	46	-18.3	Pass	
0.579	17.5	9.9	0.1	27.6	Average	Neutral	46	-18.4	Pass	
0.579	31.4	9.9	0.1	41.5	Quasi Peak	Neutral	56	-14.6	Pass	
0.839	29.7	9.9	0.1	39.7	Quasi Peak	Neutral	56	-16.3	Pass	
0.839	19.0	9.9	0.1	29.0	Average	Neutral	46	-17.0	Pass	

Legend:	DIG = Digital Device Emission; TX = Transmitter Emission; FUND = Fundamental Frequency
	NRB = Non-Restricted Band, Limit is 20 dB below Fundamental; RB = Restricted Band

Specification

Limit

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

RSS-Gen §7.2.2
The radio frequency voltage that is conducted back into the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in the table below. The tighter limit applies at the frequency range boundaries.

§15.207 (a) and **RSS-Gen §7.2.2** Limit Matrix
The lower limit applies at the boundary between frequency ranges

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

Measurement uncertainty	±2.64 dB

Traceability

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

8.1.4. Dynamic Frequency Selection (DFS

FCC, Part 15 Subpart C §15.407(h)
FCC 06-96 Memorandum Opinion and Order
Industry Canada RSS-210 A9.4

DFS testing is not applicable in the frequency range 5150 – 5250 MHz

Measurement Uncertainty Time/Power

Measurement uncertainty	
- Time	4%
- Power	1.33dB

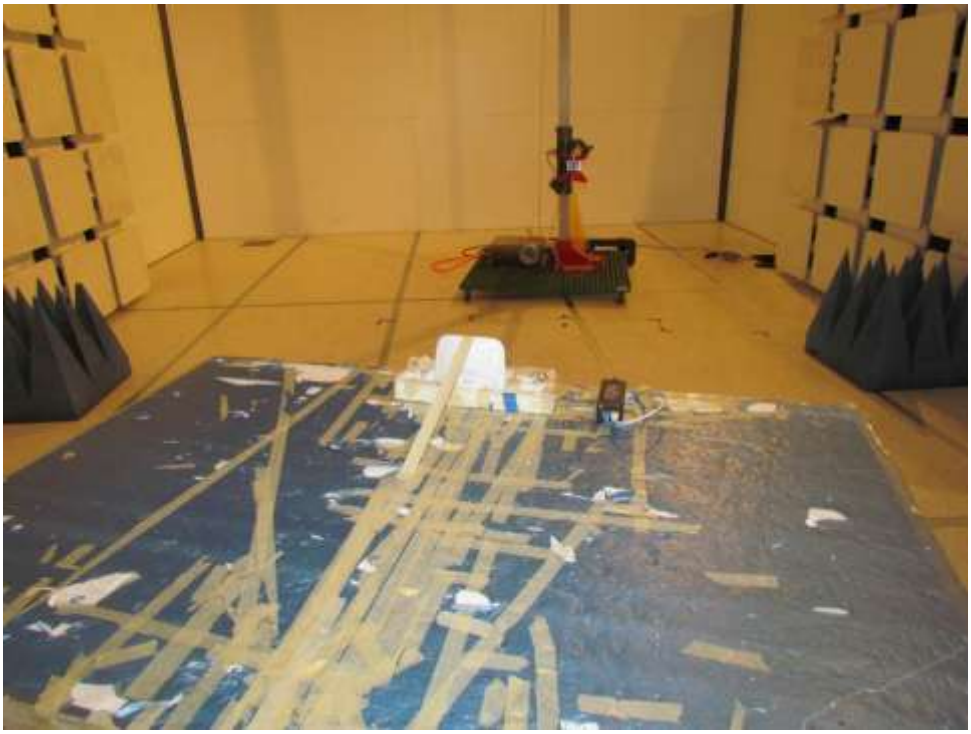
Traceability

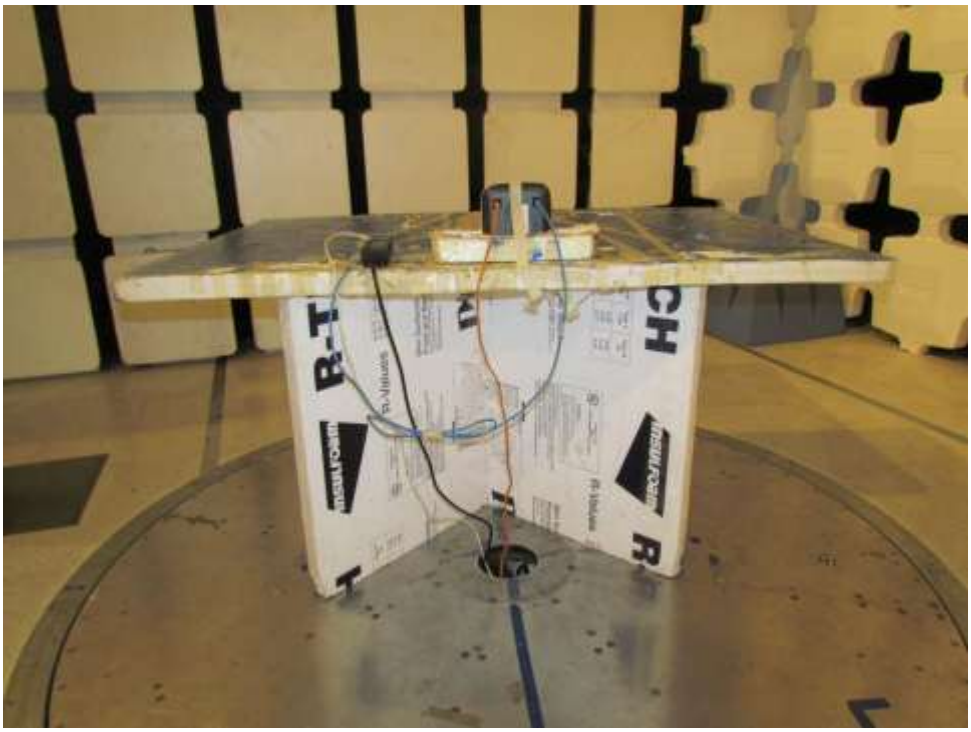
Test Equipment Used
0072, 0083, 0098, 0116, 0132, 0158, 0313, 0314, 0193, 0223, 0252, 0253, 0251, 0256, 0328, 0329

9. PHOTOGRAPHS

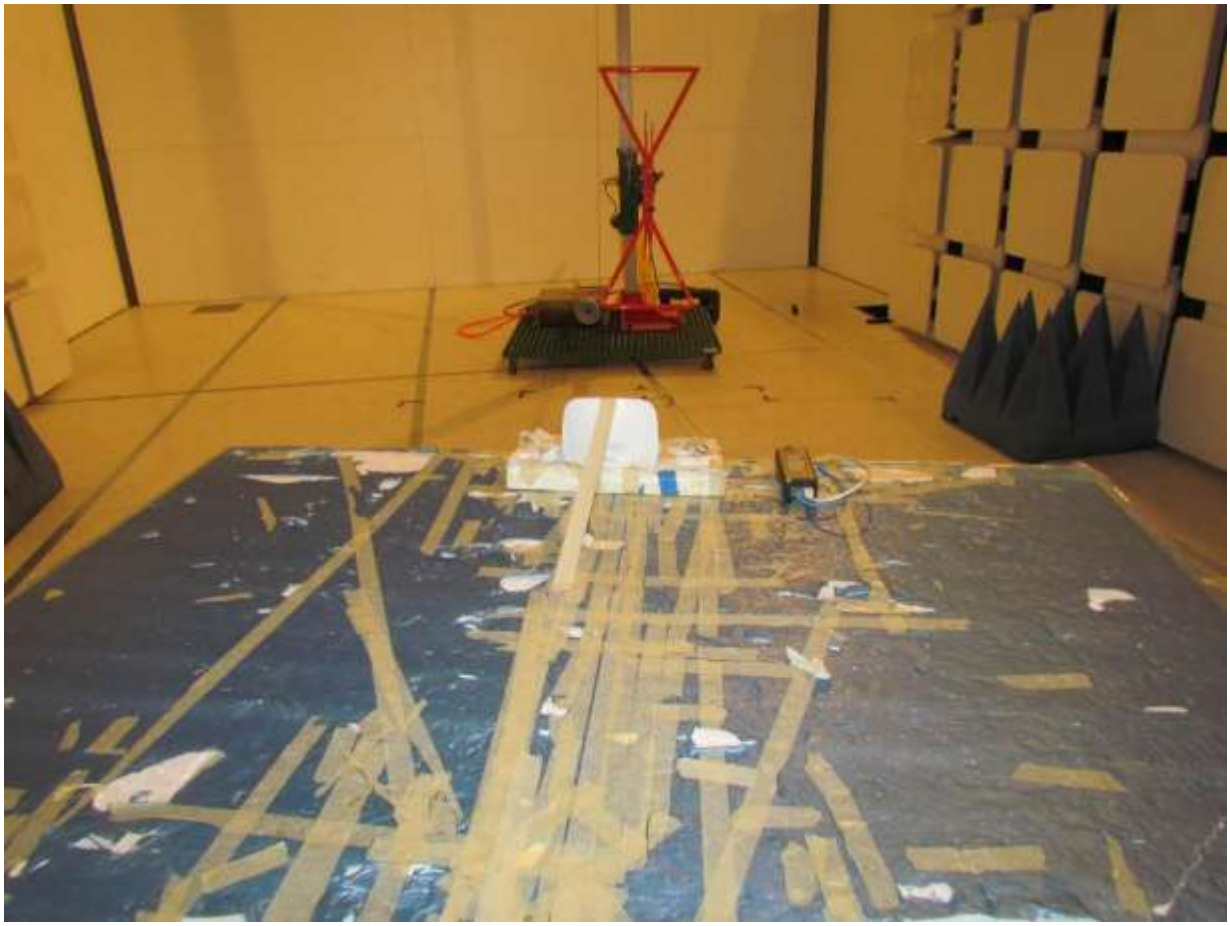
9.1. Conducted Test Setup

9.2. Test Setup - Digital Emissions > 1 GHz





9.3. Radiated Emissions Test Setup <1 GHz



9.4. ac Wireline Test Setup

10. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #	Calibration Due Date
0117	Power Sensor	Hewlett Packard	8487D	3318A00371	18th Oct 14
0223	Power Meter	Hewlett Packard	EPM-442A	US37480256	18th Oct 14
0376	Power Sensor	Agilent	U2000A	MY51440005	28th Oct 14
0390	Power Sensor	Agilent	U2002A	MY50000103	17th Oct 14
0158	Barometer /Thermometer	Control Co.	4196	E2846	6th Dec 14
0287	EMI Receiver	Rhode & Schwartz	ESIB40	100201	31st Jul 14
0378	EMI Receiver	Rhode & Schwartz	ESIB40	100107/040	17th Jul 14
0338	30 - 3000 MHz Antenna	Sunol	JB3	A052907	14th Aug 14
0399	1-18 GHz Horn Antenna	EMCO	3117	00154575	10th Oct 14
0252	SMA Cable	Megaphase	Sucoflex 104	None	N/A
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001	N/A
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001	N/A
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623	N/A
0359	DFS Test System	Aeroflex	PXI-1042	300001/004	21st Oct 14
0299	DFS Test Software	Aeroflex	PXIModule	Version 7.1.0	N/A
0502	EMC Test Software	EMISoft	Vasona	5.0051	N/A
0503	RF Conducted Test Software	National Instruments	Labview	Version 8.2	N/A
0398	RF Conducted Test Software	MiCOM Labs ATS	--	Version 1.8	N/A
0380	RF Switch	MiCOM Labs	MIC001	MIC001	20th March 14

APPENDIX

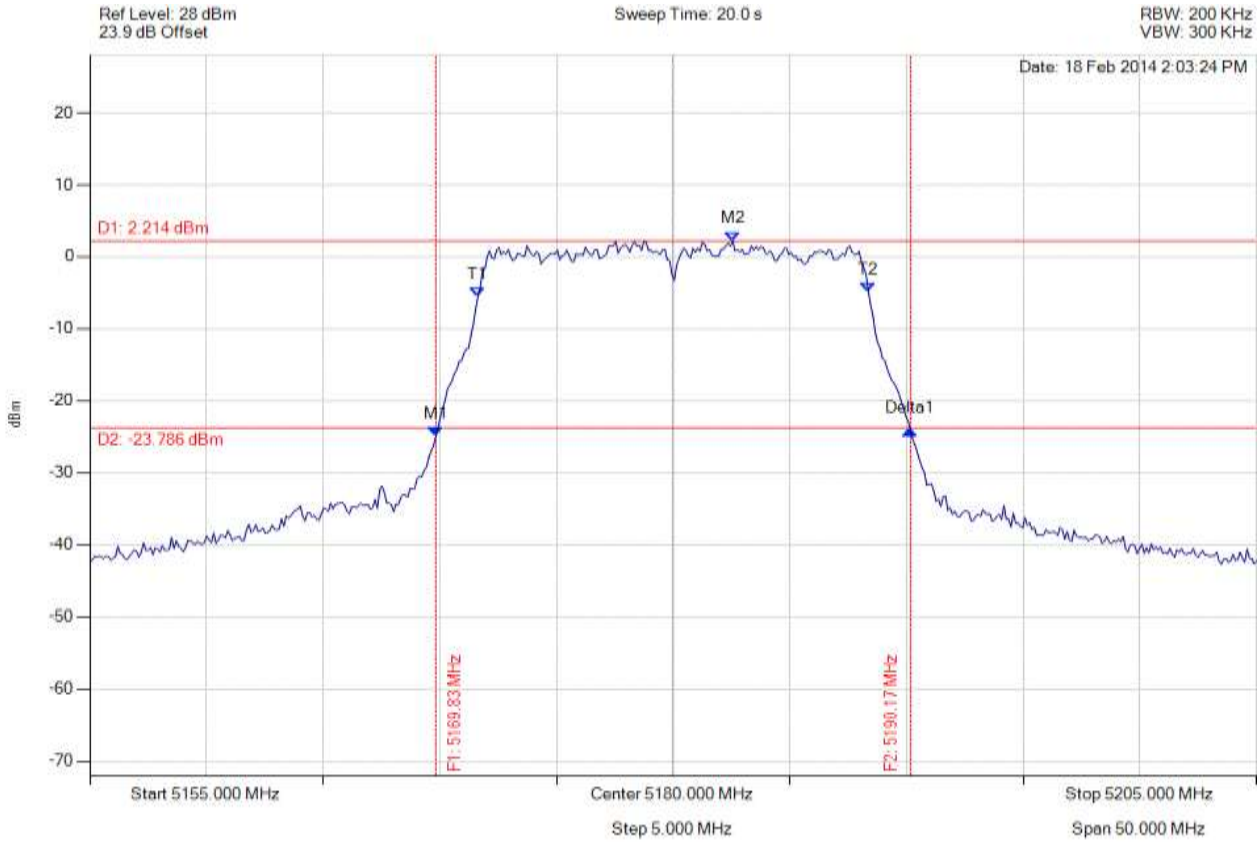
A. SUPPORTING INFORMATION

A.1. CONDUCTED TEST PLOTS

A.1.1. 26 dB & 99% Bandwidth

26 dB & 99% BANDWIDTH

Variant: 802.11a, Channel: 5180.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

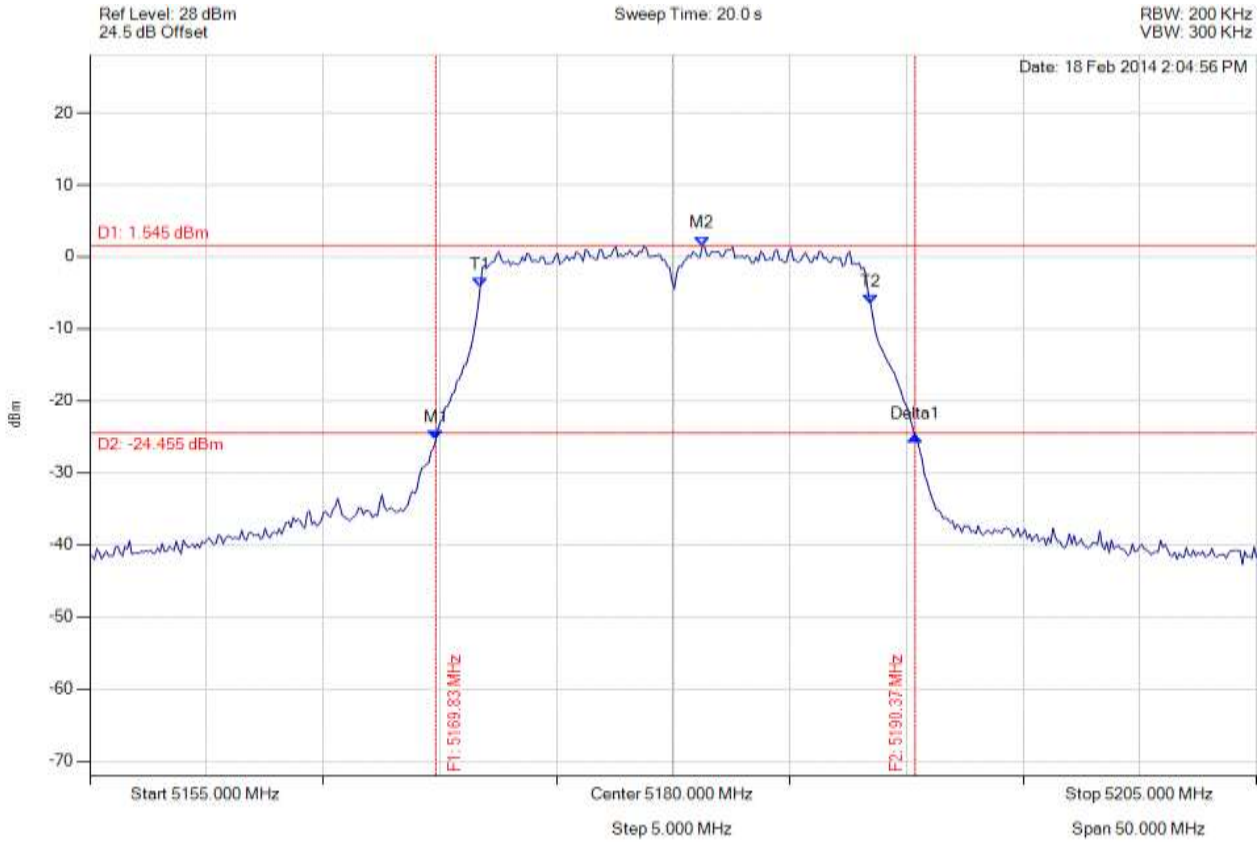


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5169.830 MHz : -24.904 dBm M2 : 5182.555 MHz : 2.214 dBm Delta1 : 20.341 MHz : 0.822 dB T1 : 5171.633 MHz : -5.573 dBm T2 : 5188.367 MHz : -4.849 dBm OBW : 16.733 MHz	Measured 26 dB Bandwidth: 20.341 MHz Measured 99% Bandwidth: 16.733 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11a, Channel: 5180.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc

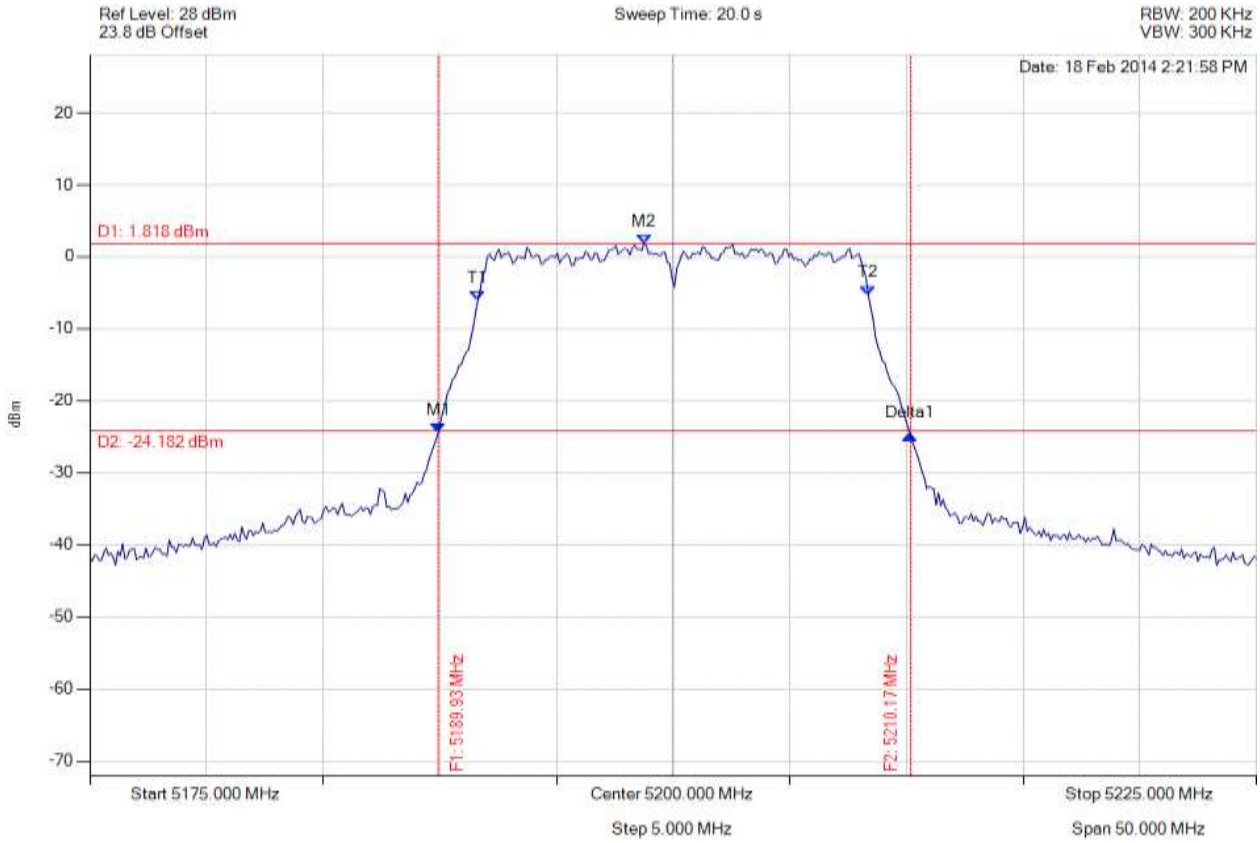


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5169.830 MHz : -25.424 dBm M2 : 5181.253 MHz : 1.545 dBm Delta1 : 20.541 MHz : 0.561 dB T1 : 5171.733 MHz : -4.210 dBm T2 : 5188.467 MHz : -6.545 dBm OBW : 16.733 MHz	Measured 26 dB Bandwidth: 20.541 MHz Measured 99% Bandwidth: 16.733 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11a, Channel: 5200.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

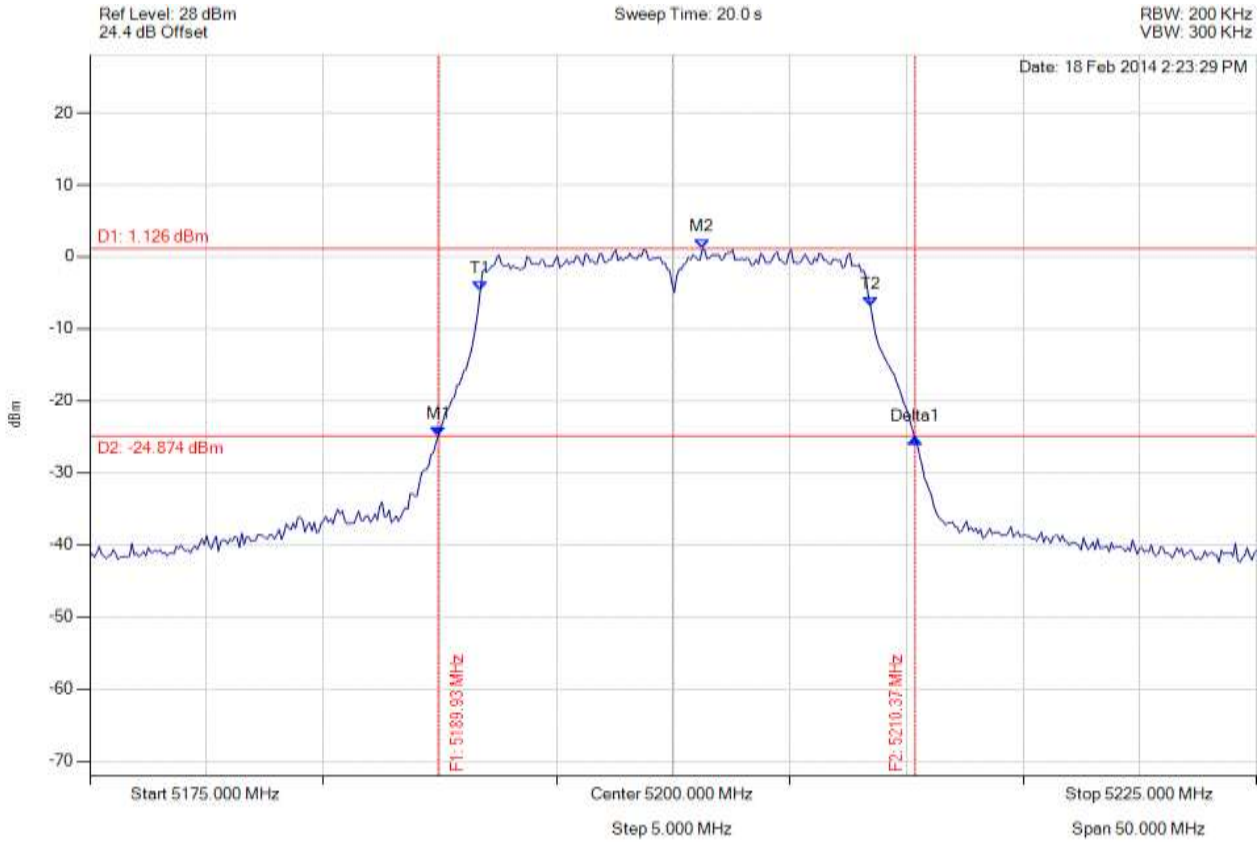


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5189.930 MHz : -24.442 dBm M2 : 5198.747 MHz : 1.818 dBm Delta1 : 20.240 MHz : -0.273 dB T1 : 5191.633 MHz : -6.000 dBm T2 : 5208.367 MHz : -5.290 dBm OBW : 16.733 MHz	Measured 26 dB Bandwidth: 20.240 MHz Measured 99% Bandwidth: 16.733 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11a, Channel: 5200.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc

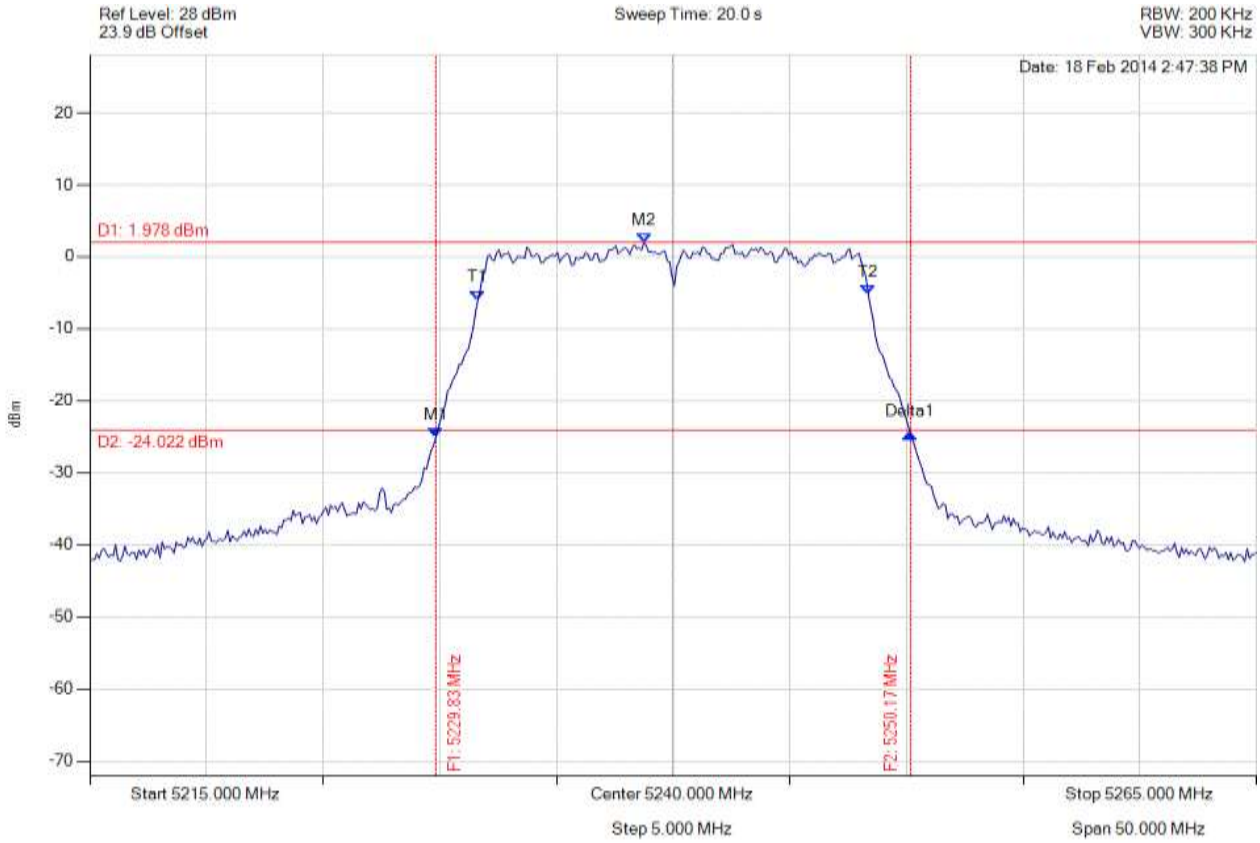


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5189.930 MHz : -24.879 dBm M2 : 5201.253 MHz : 1.126 dBm Delta1 : 20.441 MHz : -0.362 dB T1 : 5191.733 MHz : -4.743 dBm T2 : 5208.467 MHz : -6.934 dBm OBW : 16.733 MHz	Measured 26 dB Bandwidth: 20.441 MHz Measured 99% Bandwidth: 16.733 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11a, Channel: 5240.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

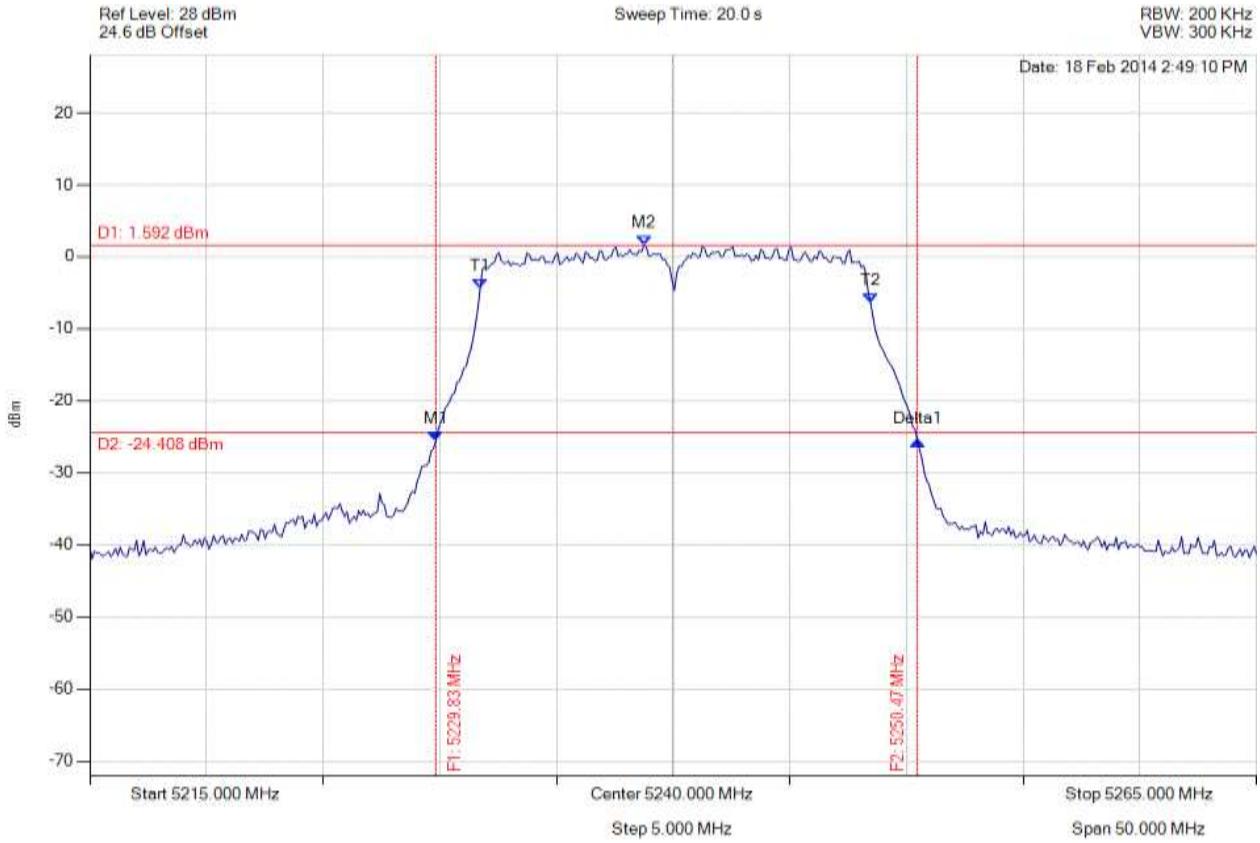


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5229.830 MHz : -25.060 dBm M2 : 5238.747 MHz : 1.978 dBm Delta1 : 20.341 MHz : 0.433 dB T1 : 5231.633 MHz : -5.957 dBm T2 : 5248.367 MHz : -5.252 dBm OBW : 16.733 MHz	Measured 26 dB Bandwidth: 20.341 MHz Measured 99% Bandwidth: 16.733 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11a, Channel: 5240.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc

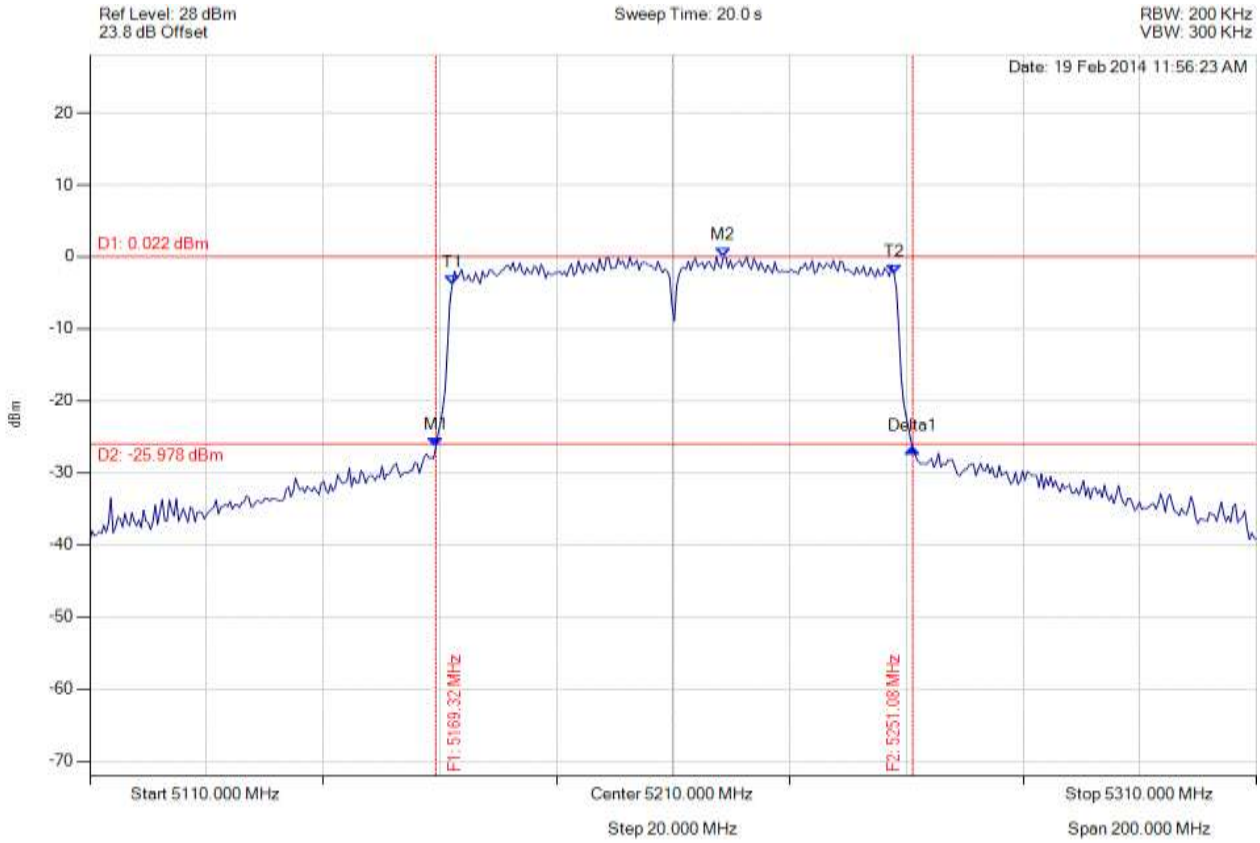


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5229.830 MHz : -25.536 dBm M2 : 5238.747 MHz : 1.592 dBm Delta1 : 20.641 MHz : -0.094 dB T1 : 5231.733 MHz : -4.324 dBm T2 : 5248.467 MHz : -6.421 dBm OBW : 16.733 MHz	Measured 26 dB Bandwidth: 20.641 MHz Measured 99% Bandwidth: 16.733 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11ac-80, Channel: 5210.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

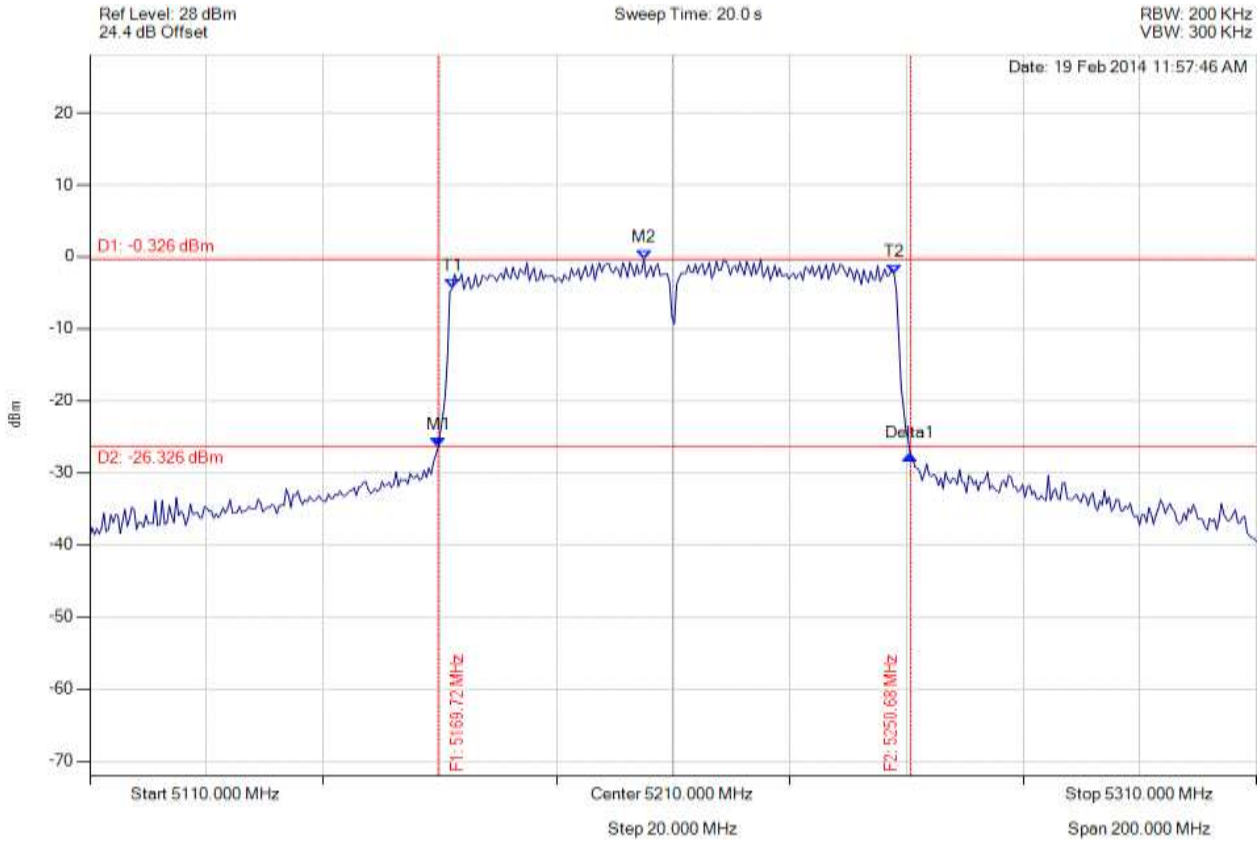


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5169.319 MHz : -26.421 dBm M2 : 5218.617 MHz : 0.022 dBm Delta1 : 81.764 MHz : -0.205 dB T1 : 5172.124 MHz : -3.903 dBm T2 : 5247.876 MHz : -2.392 dBm OBW : 75.752 MHz	Measured 26 dB Bandwidth: 81.764 MHz Measured 99% Bandwidth: 75.752 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11ac-80, Channel: 5210.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc

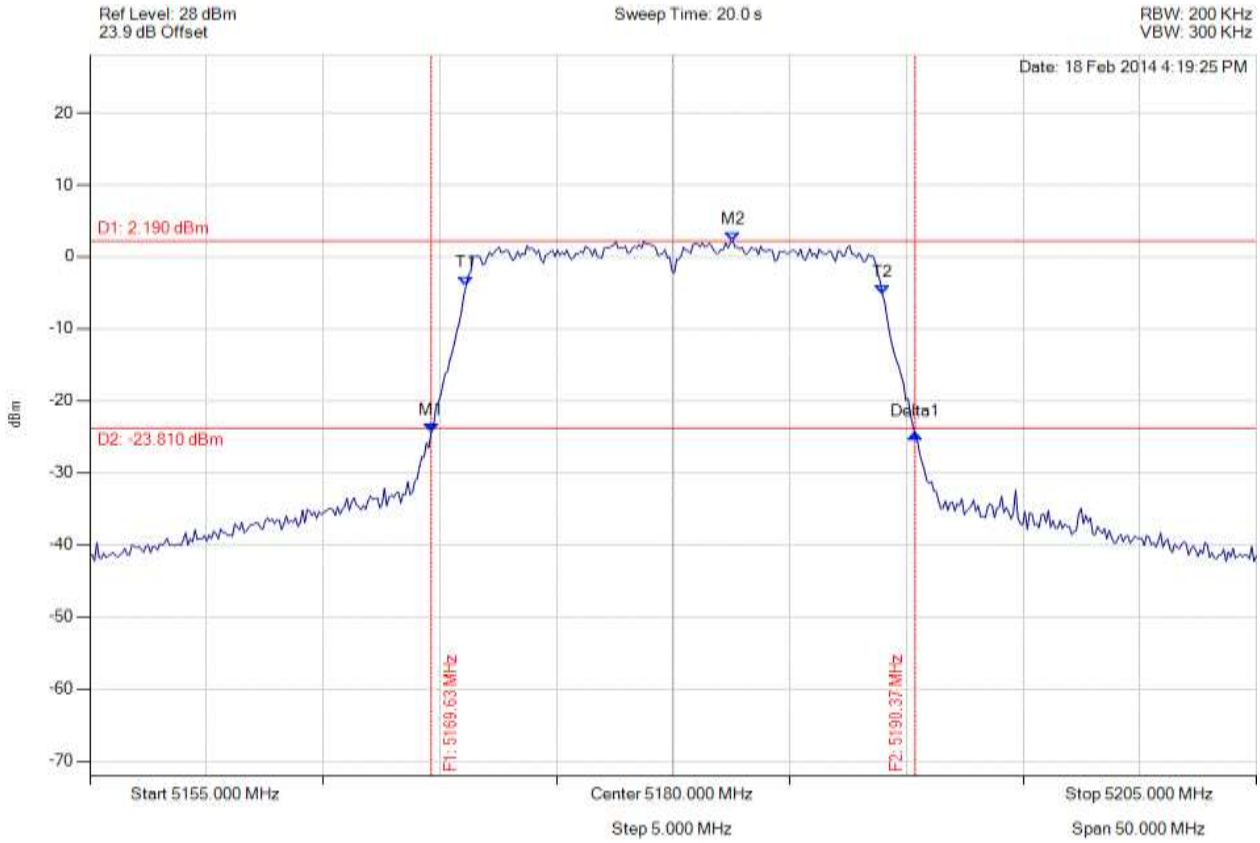


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5169.719 MHz : -26.454 dBm M2 : 5204.990 MHz : -0.326 dBm Delta1 : 80.962 MHz : -1.155 dB T1 : 5172.124 MHz : -4.394 dBm T2 : 5247.876 MHz : -2.376 dBm OBW : 75.752 MHz	Measured 26 dB Bandwidth: 80.962 MHz Measured 99% Bandwidth: 75.752 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11n HT-20, Channel: 5180.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5169.629 MHz : -24.365 dBm M2 : 5182.555 MHz : 2.190 dBm Delta1 : 20.741 MHz : -0.252 dB T1 : 5171.132 MHz : -3.952 dBm T2 : 5188.968 MHz : -5.211 dBm OBW : 17.836 MHz	Measured 26 dB Bandwidth: 20.741 MHz Measured 99% Bandwidth: 17.836 MHz

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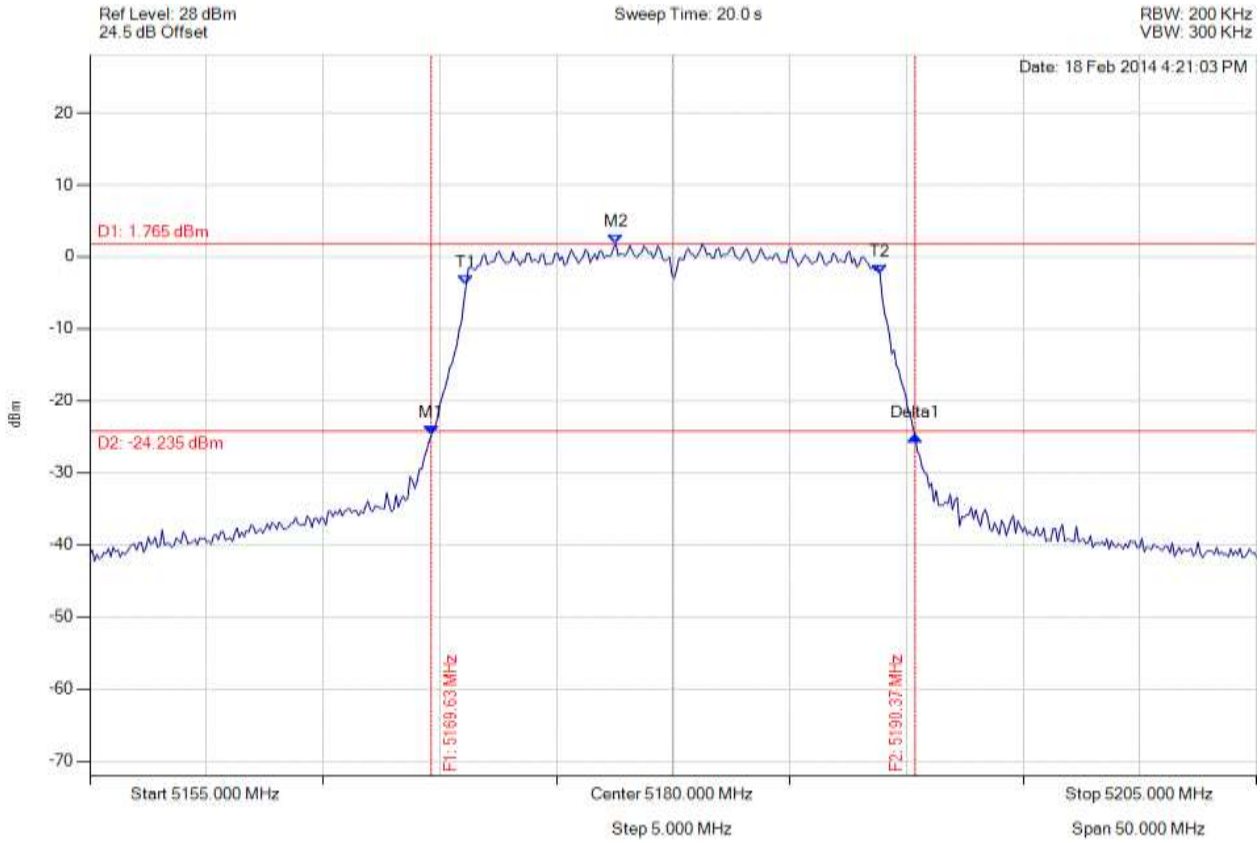
26 dB & 99% BANDWIDTH

Variant: 802.11n HT-20, Channel: 5180.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5169.629 MHz : -24.776 dBm M2 : 5177.545 MHz : 1.765 dBm Delta1 : 20.741 MHz : -0.024 dB T1 : 5171.132 MHz : -3.853 dBm T2 : 5188.868 MHz : -2.417 dBm OBW : 17.735 MHz	Measured 26 dB Bandwidth: 20.741 MHz Measured 99% Bandwidth: 17.735 MHz

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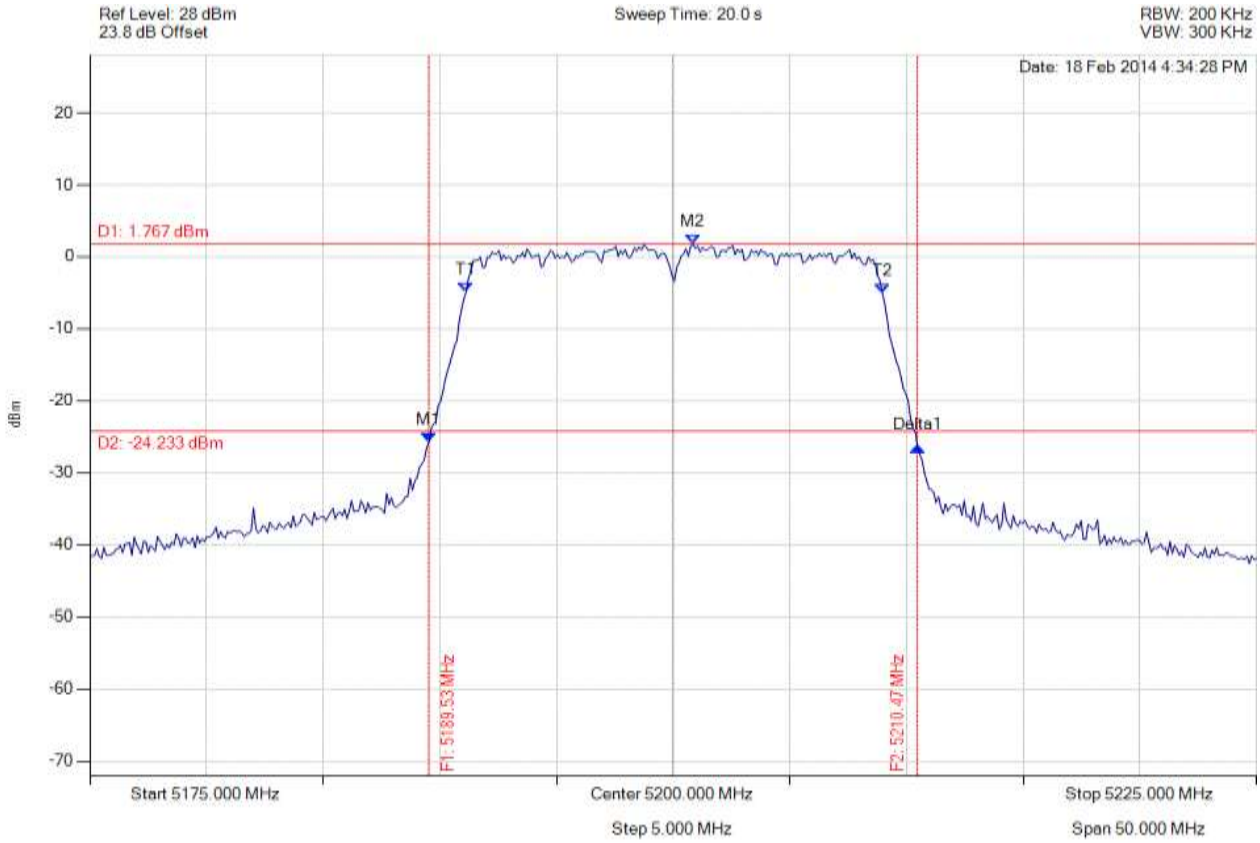
26 dB & 99% BANDWIDTH

Variant: 802.11n HT-20, Channel: 5200.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5189.529 MHz : -25.721 dBm M2 : 5200.852 MHz : 1.767 dBm Delta1 : 20.942 MHz : -0.610 dB T1 : 5191.132 MHz : -4.843 dBm T2 : 5208.968 MHz : -5.028 dBm OBW : 17.836 MHz	Measured 26 dB Bandwidth: 20.942 MHz Measured 99% Bandwidth: 17.836 MHz

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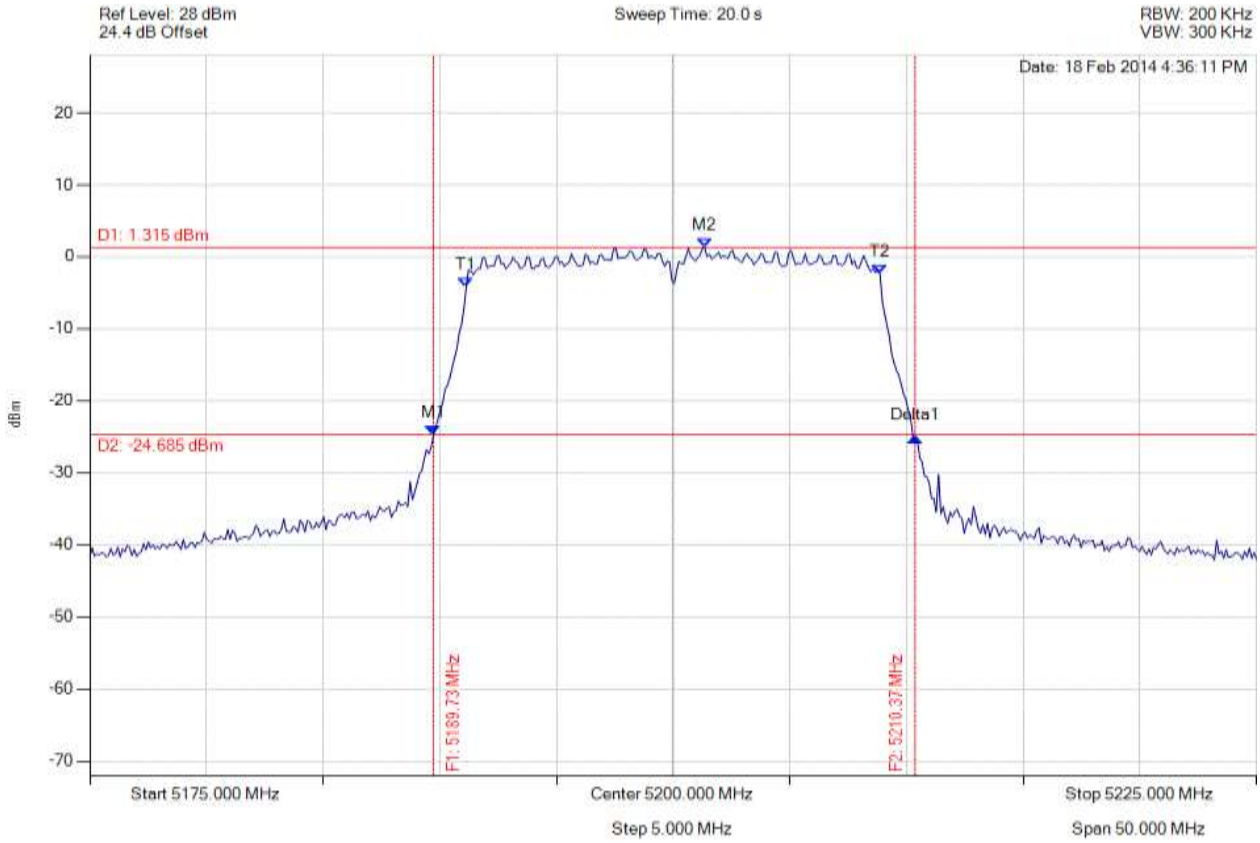
26 dB & 99% BANDWIDTH

Variant: 802.11n HT-20, Channel: 5200.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc

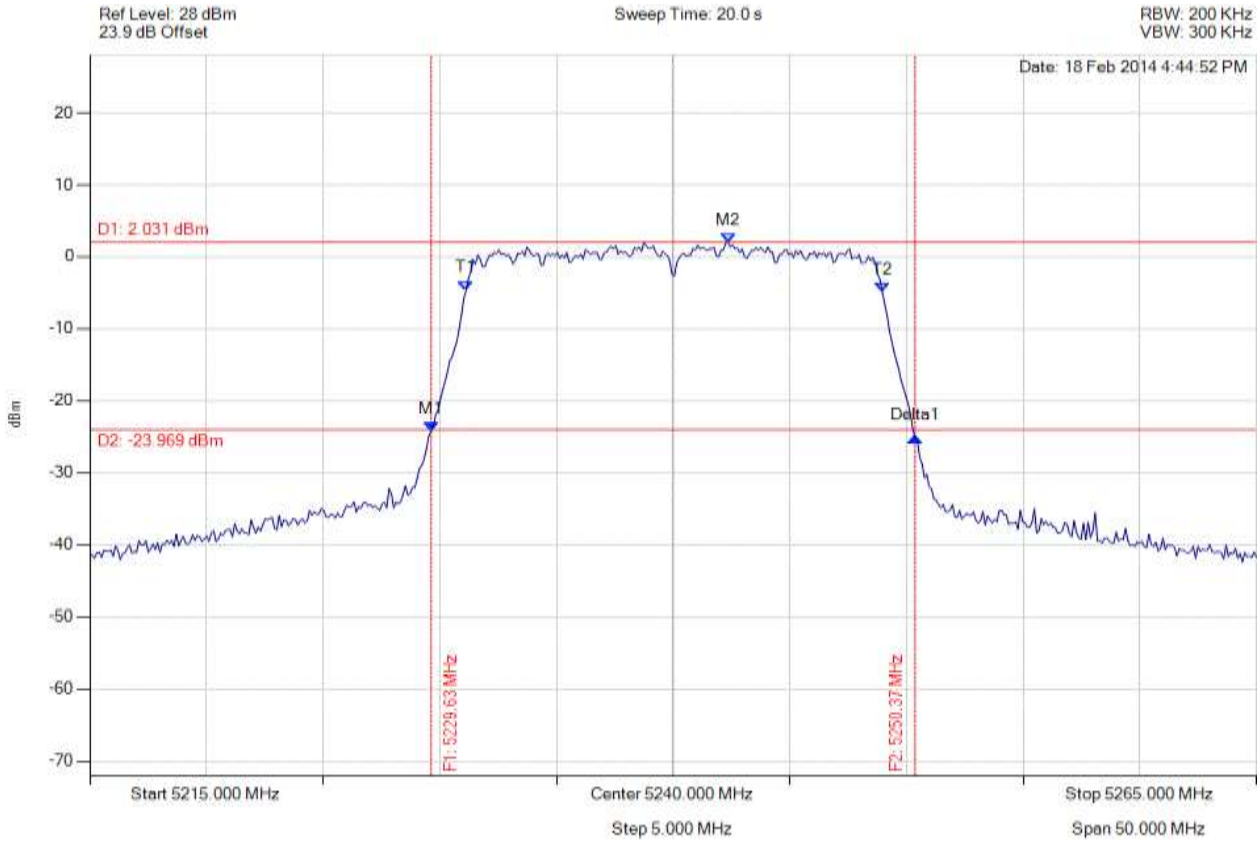


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5189.729 MHz : -24.764 dBm M2 : 5201.353 MHz : 1.315 dBm Delta1 : 20.641 MHz : -0.315 dB T1 : 5191.132 MHz : -4.239 dBm T2 : 5208.868 MHz : -2.413 dBm OBW : 17.735 MHz	Measured 26 dB Bandwidth: 20.641 MHz Measured 99% Bandwidth: 17.735 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11n HT-20, Channel: 5240.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

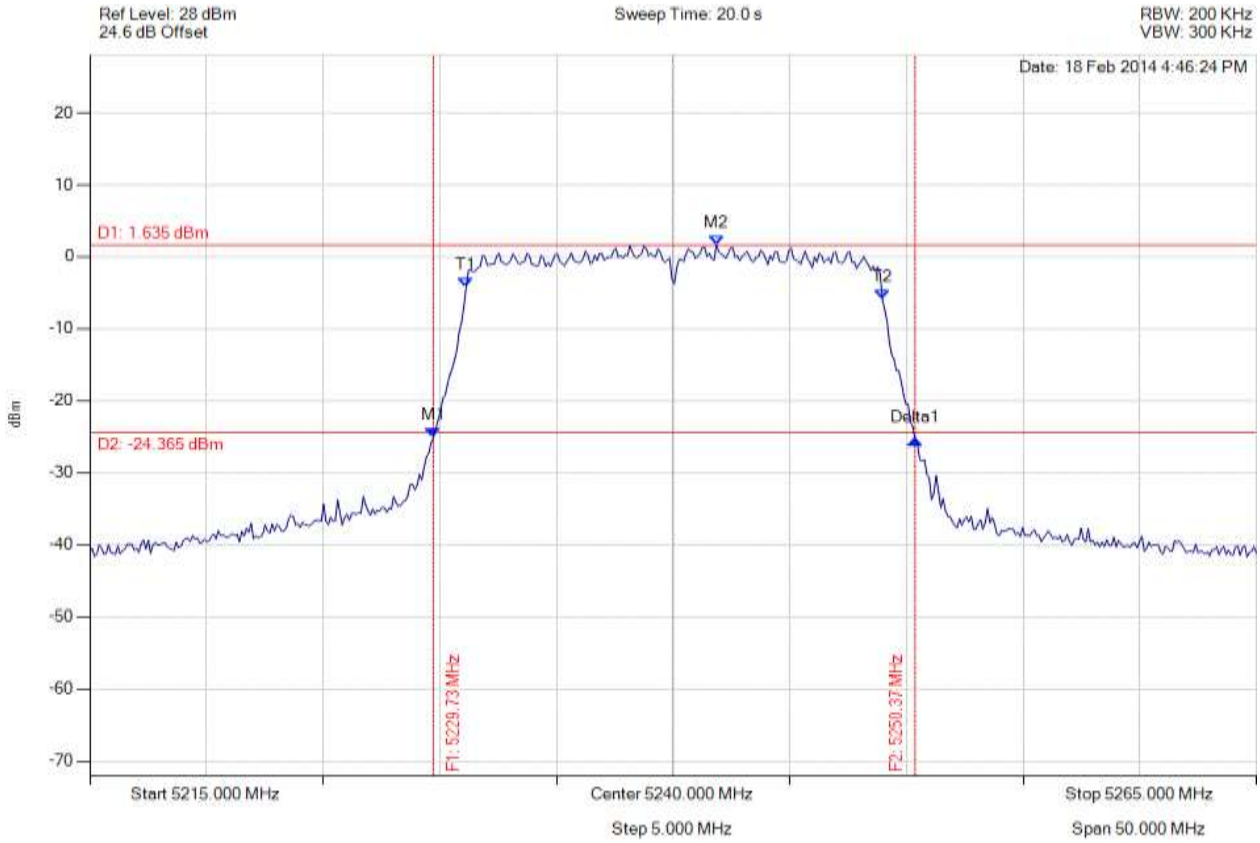


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5229.629 MHz : -24.196 dBm M2 : 5242.355 MHz : 2.031 dBm Delta1 : 20.741 MHz : -0.899 dB T1 : 5231.132 MHz : -4.619 dBm T2 : 5248.968 MHz : -4.918 dBm OBW : 17.836 MHz	Measured 26 dB Bandwidth: 20.741 MHz Measured 99% Bandwidth: 17.836 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11n HT-20, Channel: 5240.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5229.729 MHz : -25.060 dBm M2 : 5241.854 MHz : 1.635 dBm Delta1 : 20.641 MHz : -0.315 dB T1 : 5231.132 MHz : -4.168 dBm T2 : 5248.968 MHz : -5.937 dBm OBW : 17.836 MHz	Measured 26 dB Bandwidth: 20.641 MHz Measured 99% Bandwidth: 17.836 MHz

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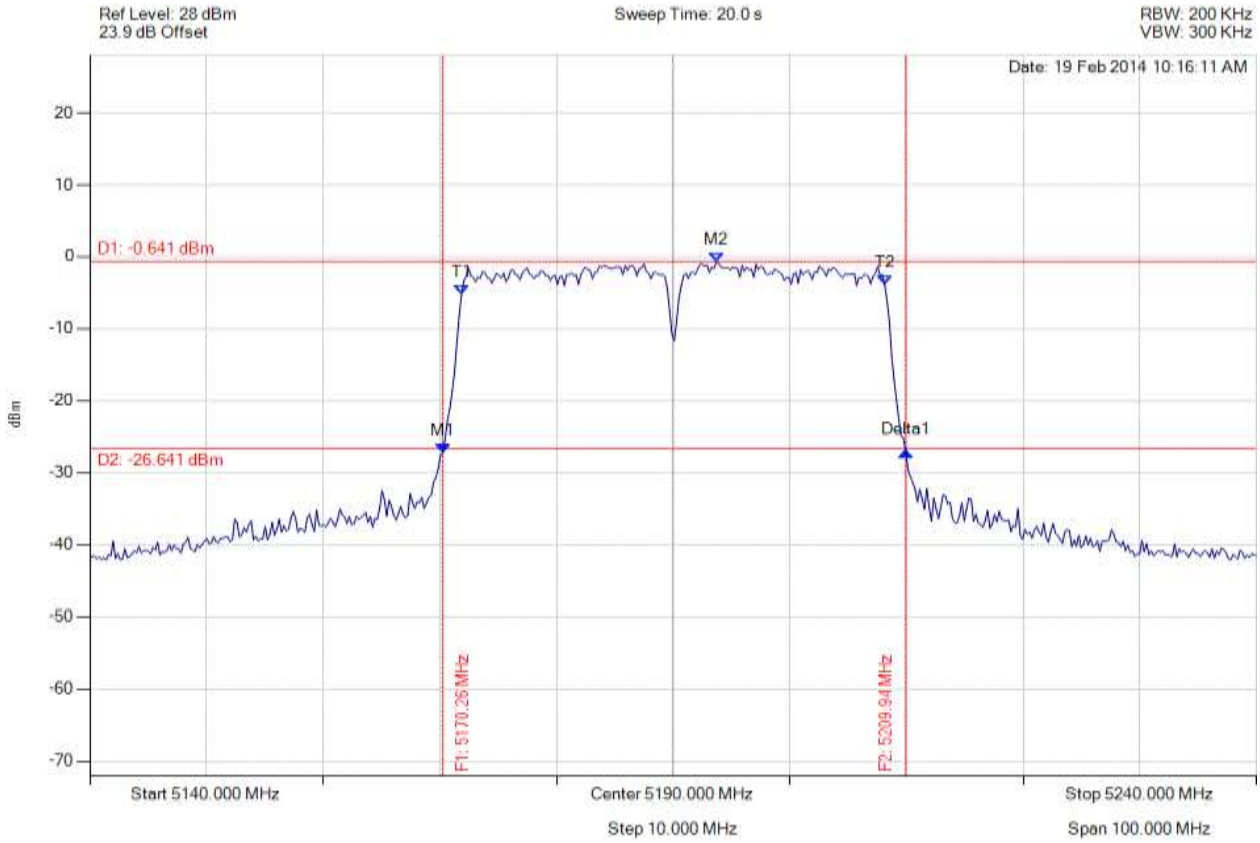
26 dB & 99% BANDWIDTH

Variant: 802.11n HT-40, Channel: 5190.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

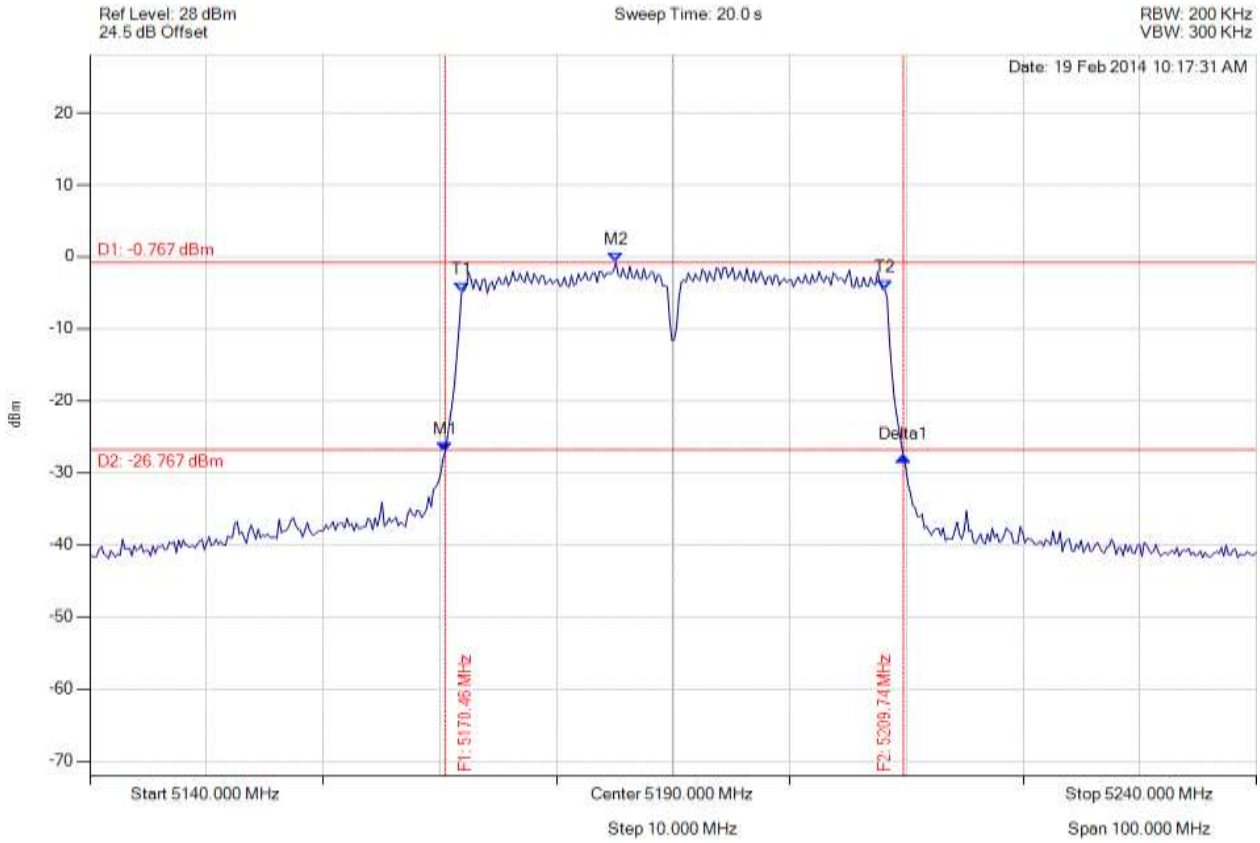


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5170.261 MHz : -27.200 dBm M2 : 5193.707 MHz : -0.641 dBm Delta1 : 39.679 MHz : 0.218 dB T1 : 5171.864 MHz : -5.242 dBm T2 : 5208.136 MHz : -3.885 dBm OBW : 36.273 MHz	Measured 26 dB Bandwidth: 39.679 MHz Measured 99% Bandwidth: 36.273 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11n HT-40, Channel: 5190.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5170.461 MHz : -27.064 dBm M2 : 5185.090 MHz : -0.767 dBm Delta1 : 39.279 MHz : -0.584 dB T1 : 5171.864 MHz : -4.930 dBm T2 : 5208.136 MHz : -4.518 dBm OBW : 36.273 MHz	Measured 26 dB Bandwidth: 39.279 MHz Measured 99% Bandwidth: 36.273 MHz

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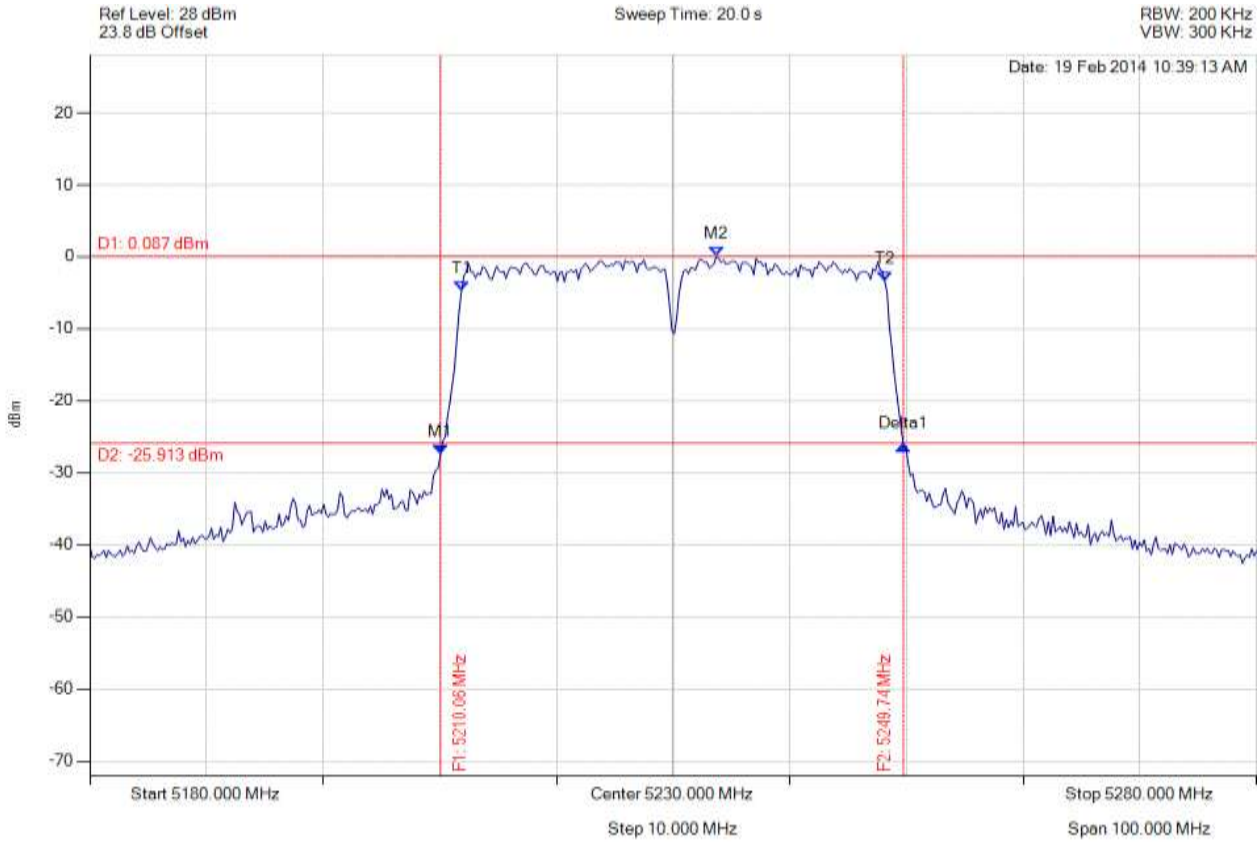
26 dB & 99% BANDWIDTH

Variant: 802.11n HT-40, Channel: 5230.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

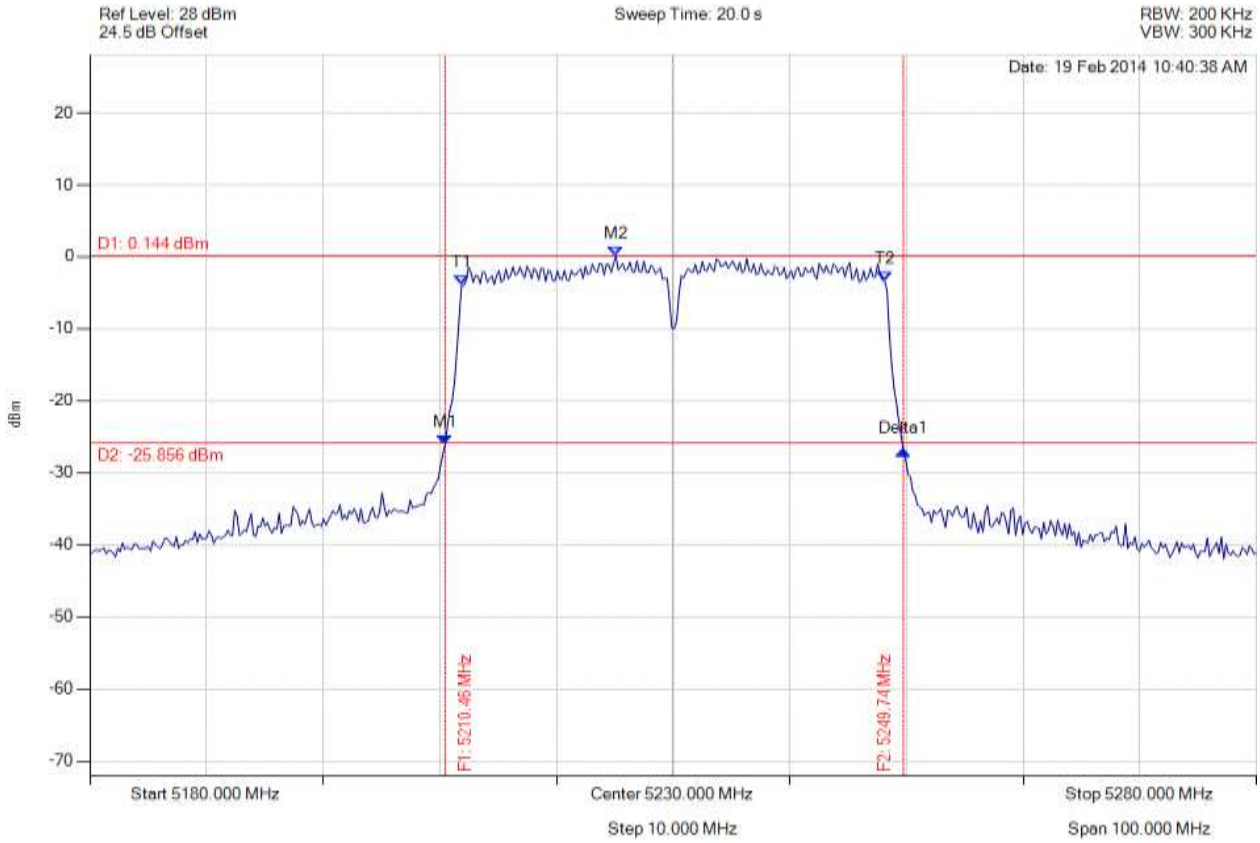


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5210.060 MHz : -27.377 dBm M2 : 5233.707 MHz : 0.087 dBm Delta1 : 39.679 MHz : 1.147 dB T1 : 5211.864 MHz : -4.660 dBm T2 : 5248.136 MHz : -3.338 dBm OBW : 36.273 MHz	Measured 26 dB Bandwidth: 39.679 MHz Measured 99% Bandwidth: 36.273 MHz

Back to the Matrix

26 dB & 99% BANDWIDTH

Variant: 802.11n HT-40, Channel: 5230.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5210.461 MHz : -25.984 dBm M2 : 5225.090 MHz : 0.144 dBm Delta1 : 39.279 MHz : -0.854 dB T1 : 5211.864 MHz : -3.853 dBm T2 : 5248.136 MHz : -3.373 dBm OBW : 36.273 MHz	Measured 26 dB Bandwidth: 39.279 MHz Measured 99% Bandwidth: 36.273 MHz

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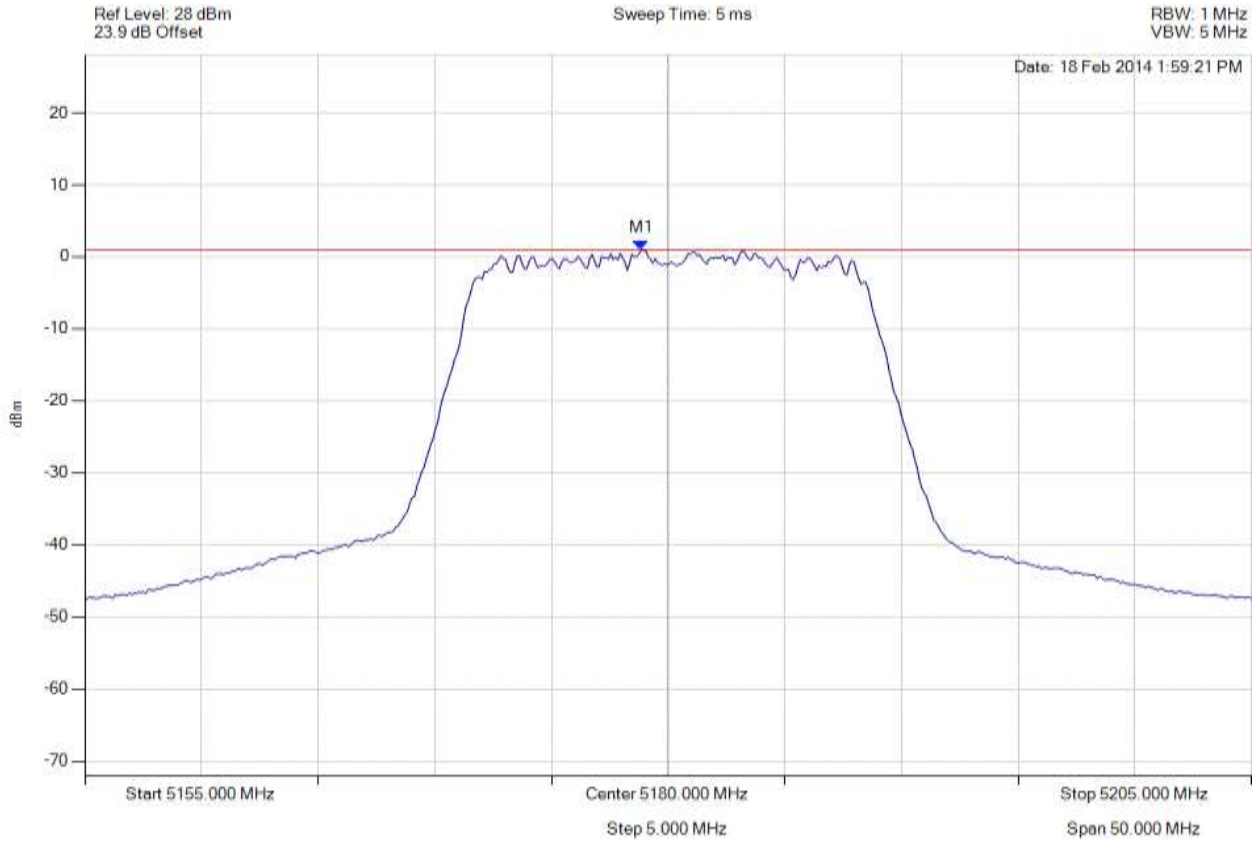
A.1.2. Peak Power Spectral Density

PEAK POWER SPECTRAL DENSITY

Variant: 802.11a, Channel: 5180.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5178.848 MHz : 0.943 dBm	Limit: ≤ 0.990 dBm Margin: -0.05 dB

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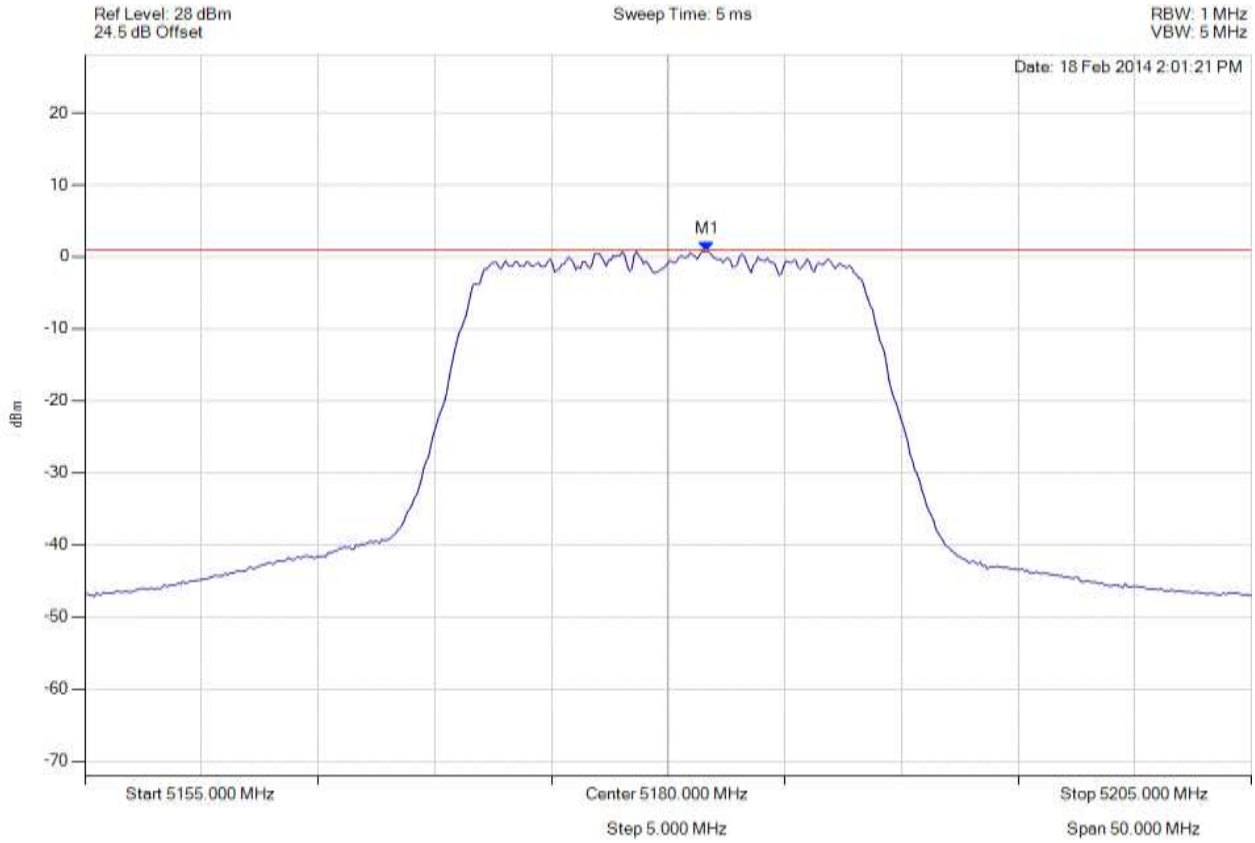
PEAK POWER SPECTRAL DENSITY

Variant: 802.11a, Channel: 5180.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5181.653 MHz : 0.778 dBm	Limit: ≤ 0.990 dBm Margin: -0.21 dB

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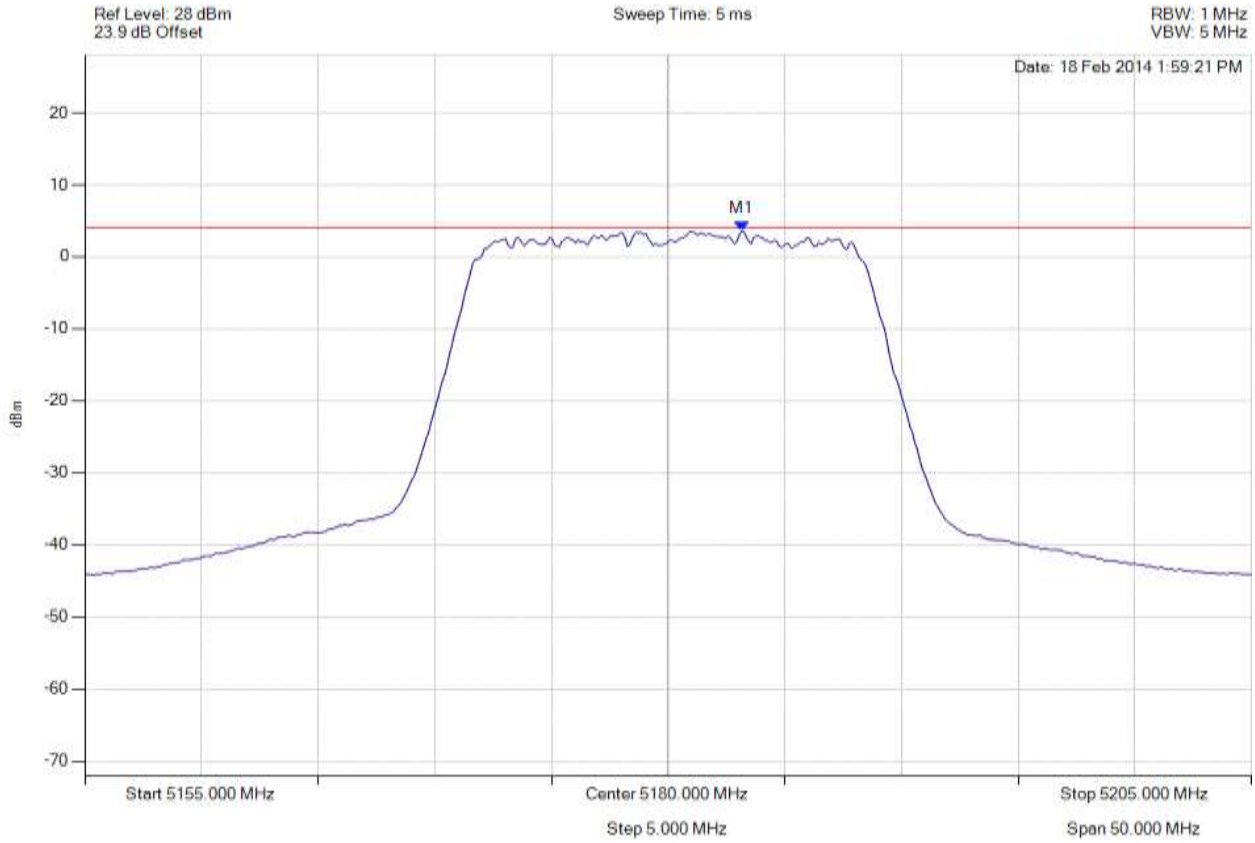
PEAK POWER SPECTRAL DENSITY

Variant: 802.11a, Channel: 5180.00 MHz, SUM, Temp: Ambient, Voltage: 12 Vdc

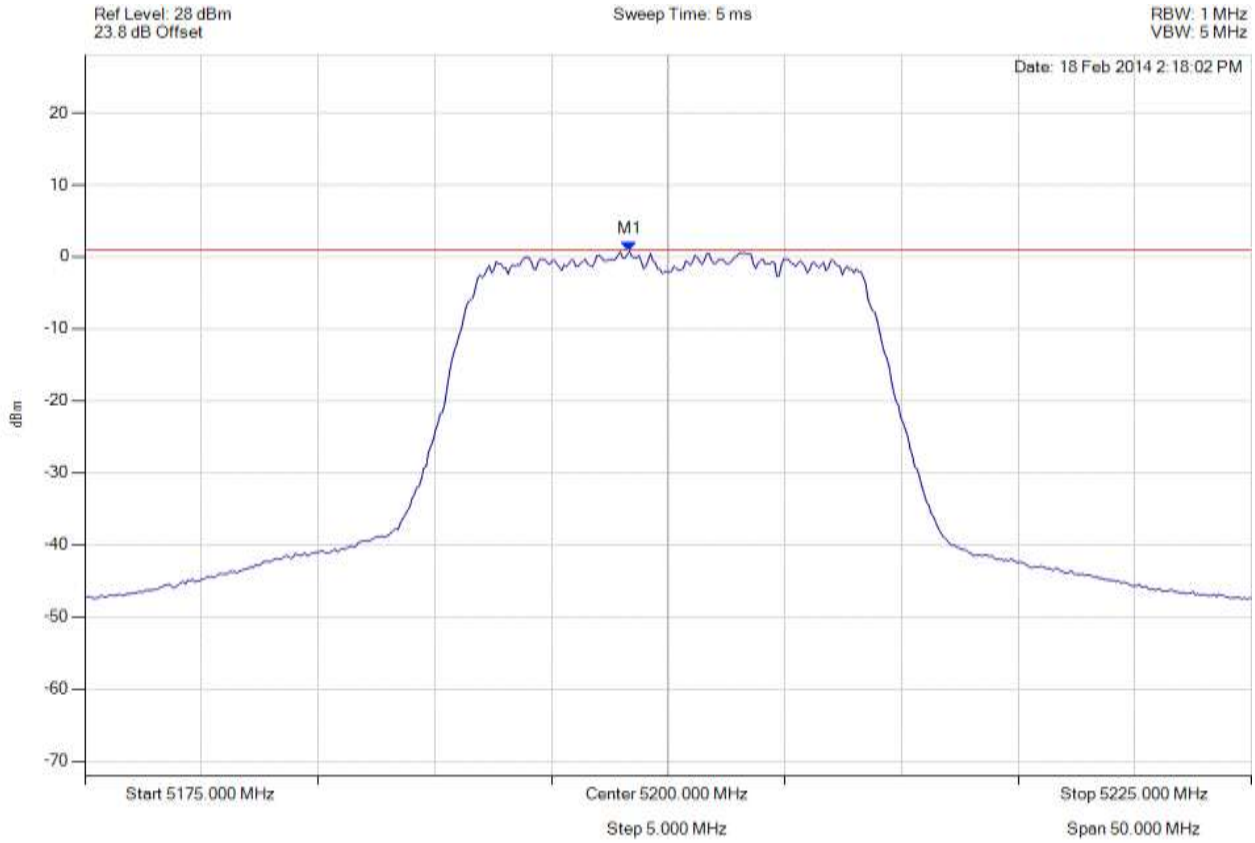


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5183.156 MHz : 3.585 dBm	Limit: ≤ 4.0 dBm Margin: -0.4 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11a, Channel: 5200.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

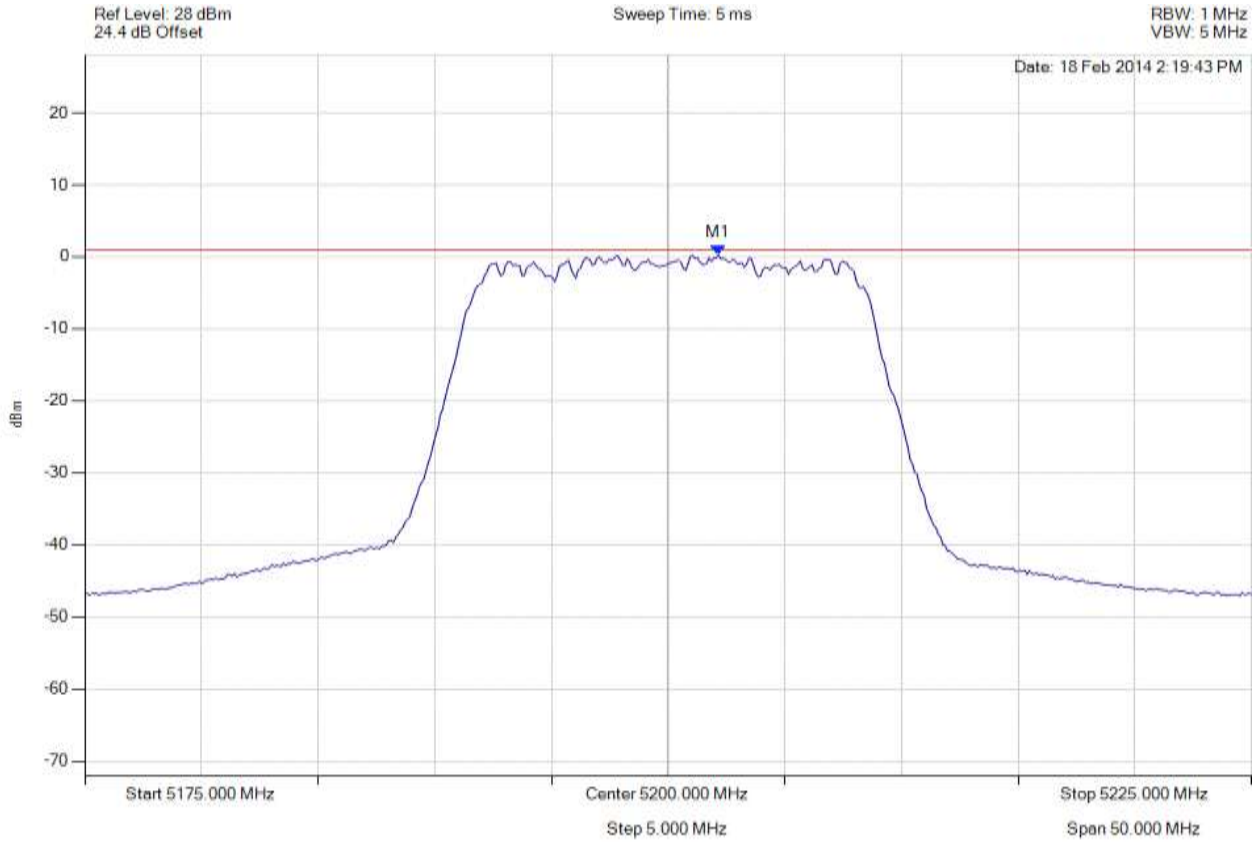


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5198.347 MHz : 0.751 dBm	Limit: ≤ 0.990 dBm Margin: -0.24 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11a, Channel: 5200.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc

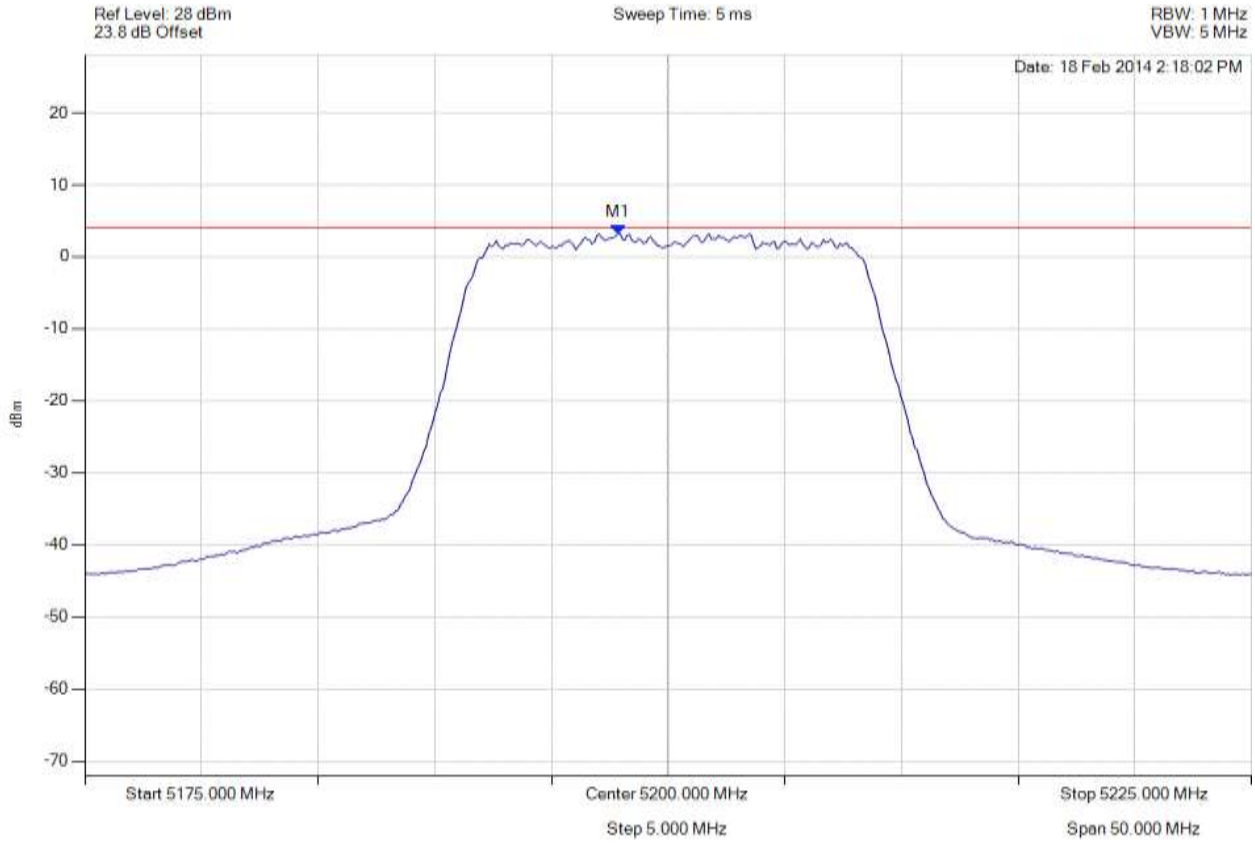


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5202.154 MHz : 0.274 dBm	Limit: ≤ 0.990 dBm Margin: -0.72 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11a, Channel: 5200.00 MHz, SUM, Temp: Ambient, Voltage: 12 Vdc

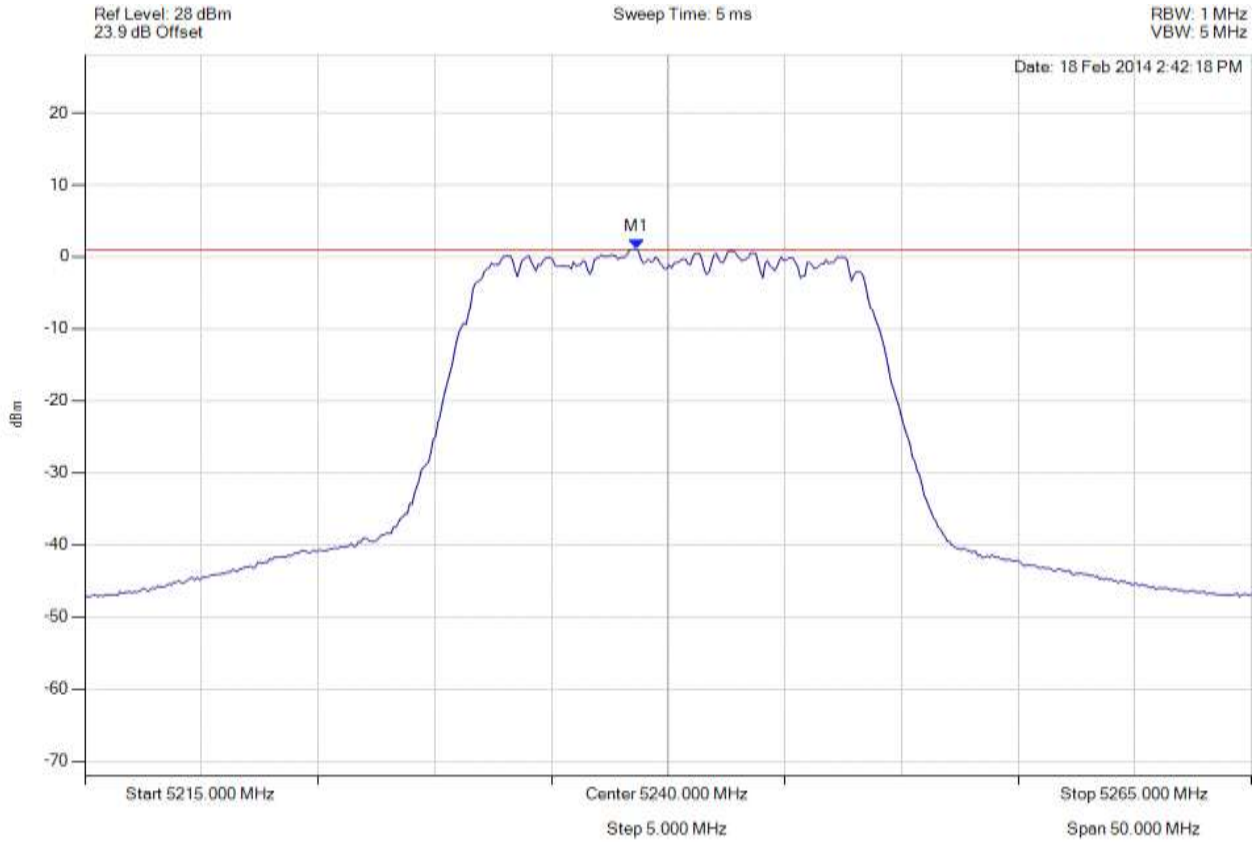


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5197.846 MHz : 3.190 dBm	Limit: ≤ 4.0 dBm Margin: -0.8 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11a, Channel: 5240.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

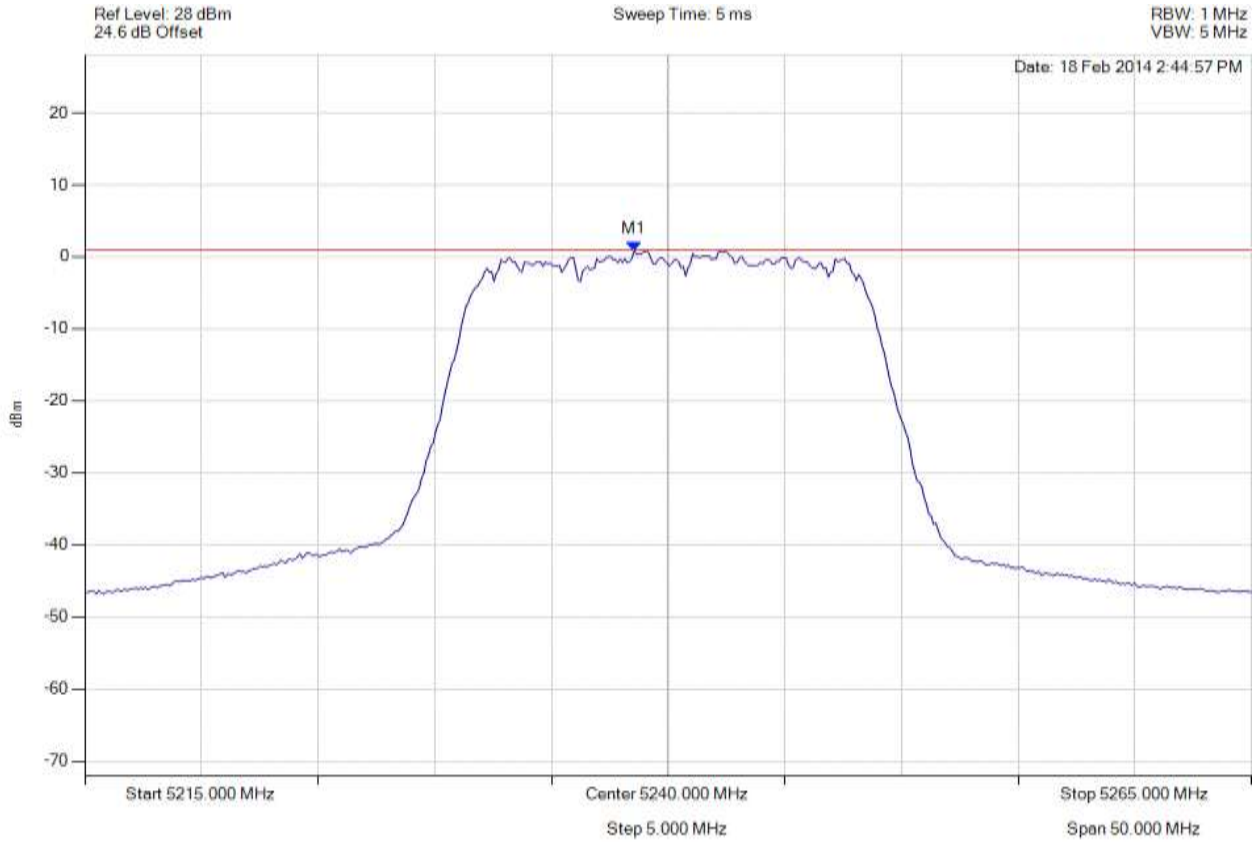


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5238.647 MHz : 1.084 dBm	Limit: ≤ 0.990 dBm Margin: 0.09 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11a, Channel: 5240.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc

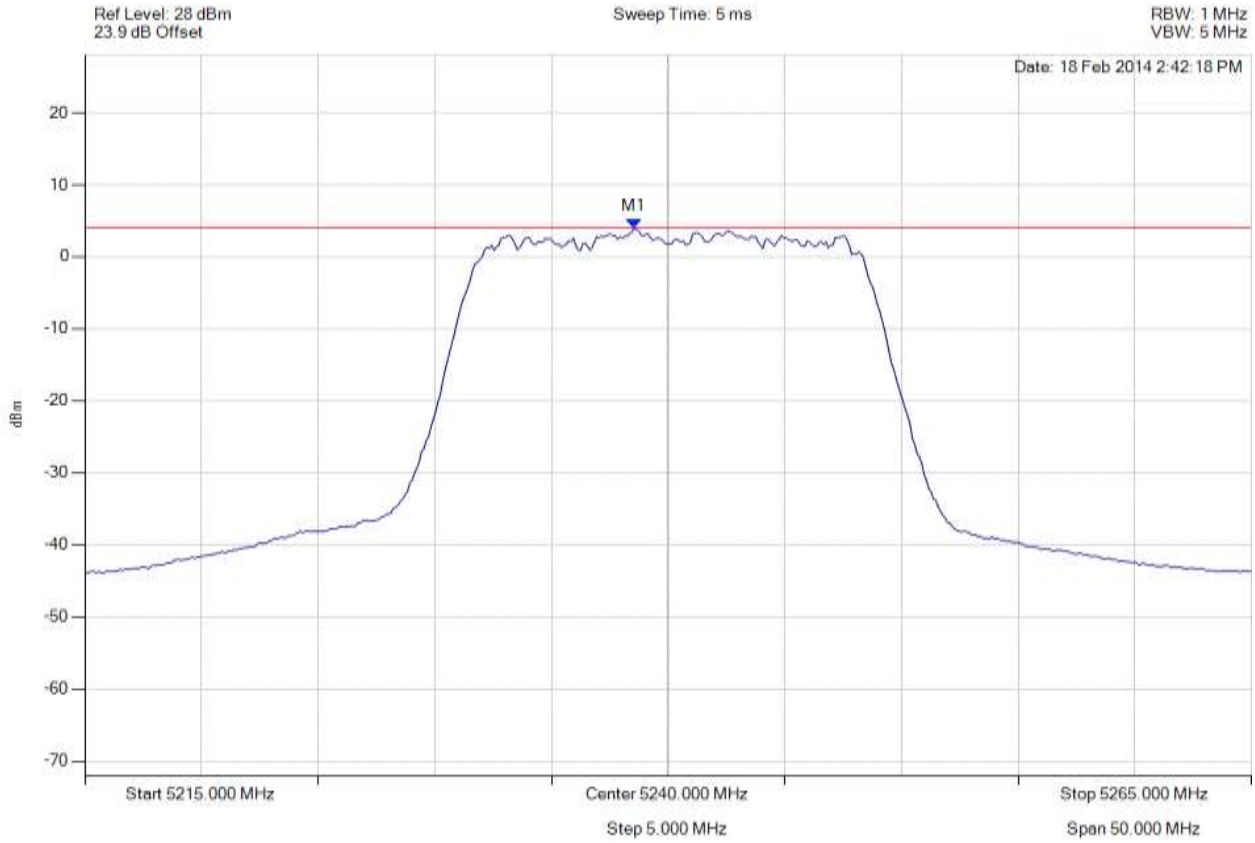


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5238.547 MHz : 0.867 dBm	Limit: ≤ 0.990 dBm Margin: -0.12 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11a, Channel: 5240.00 MHz, SUM, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5238.547 MHz : 3.978 dBm	Limit: ≤ 4.0 dBm Margin: 0.0 dB

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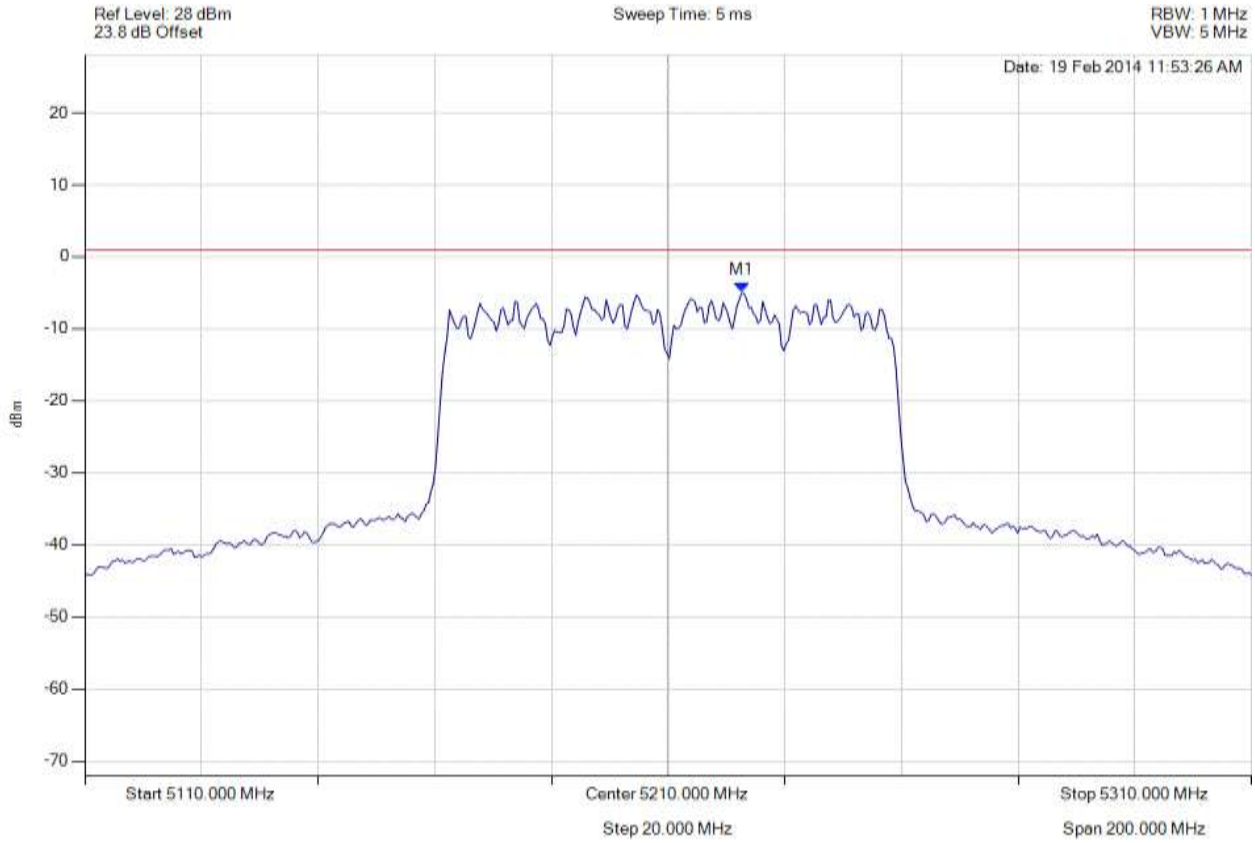
PEAK POWER SPECTRAL DENSITY

Variant: 802.11ac-80, Channel: 5210.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

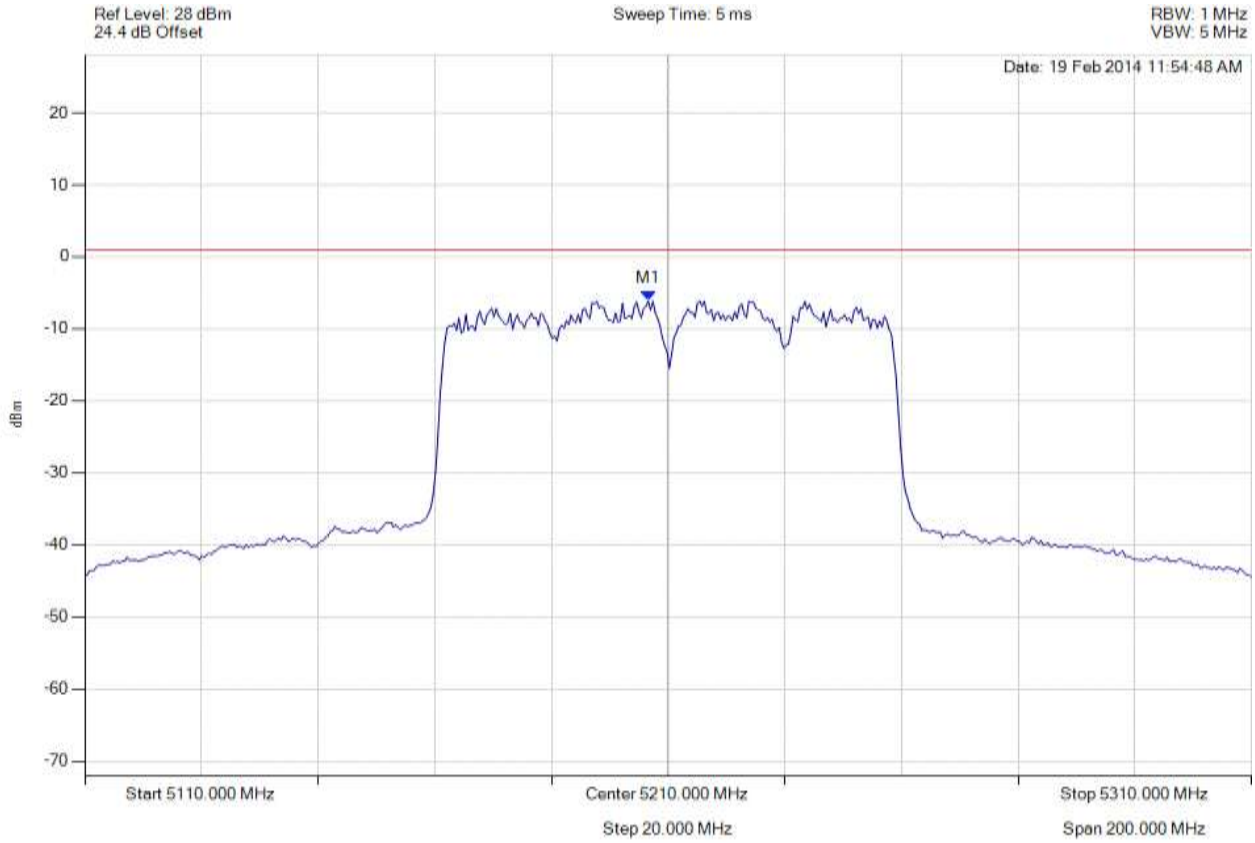


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5222.625 MHz : -4.948 dBm	Limit: ≤ 0.990 dBm Margin: 5.94 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11ac-80, Channel: 5210.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc

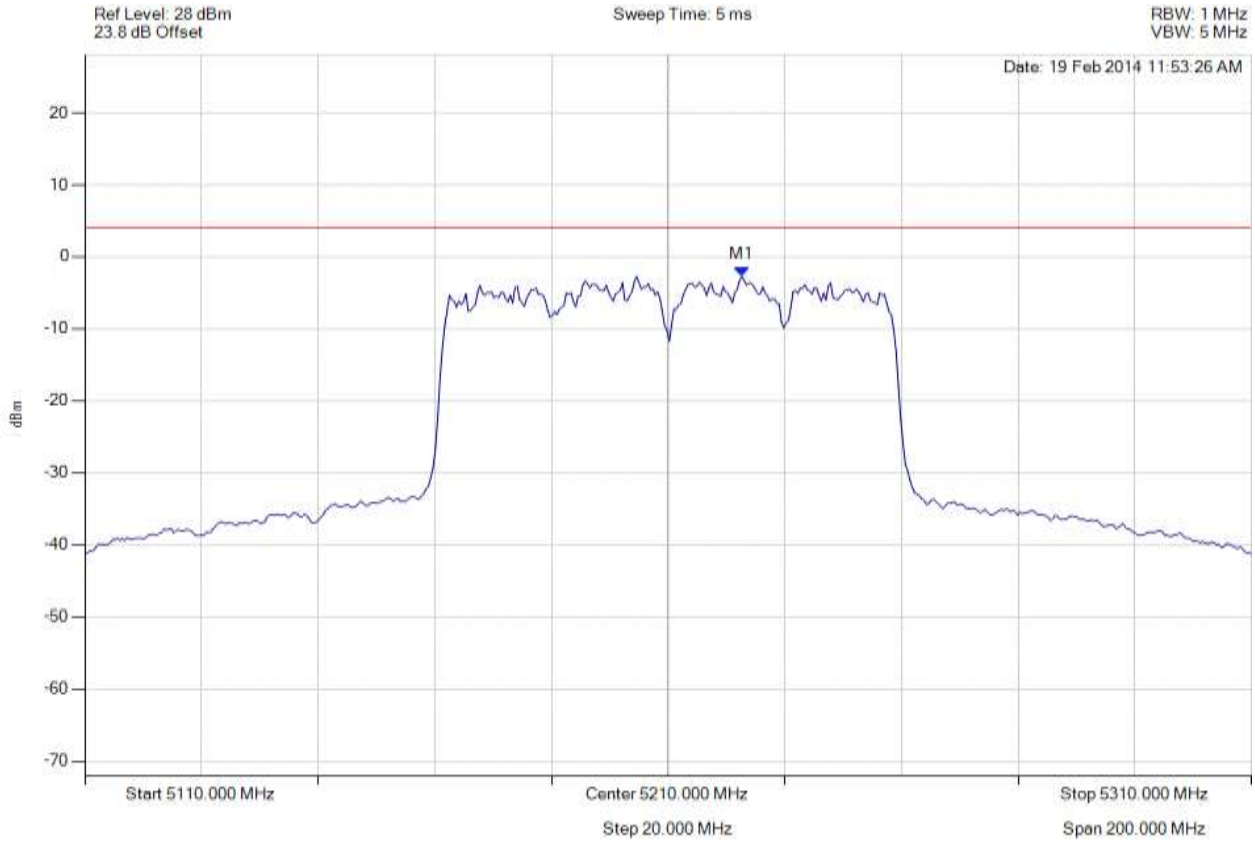


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5206.593 MHz : -6.088 dBm	Limit: ≤ 0.990 dBm Margin: 7.08 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11ac-80, Channel: 5210.00 MHz, SUM, Temp: Ambient, Voltage: 12 Vdc

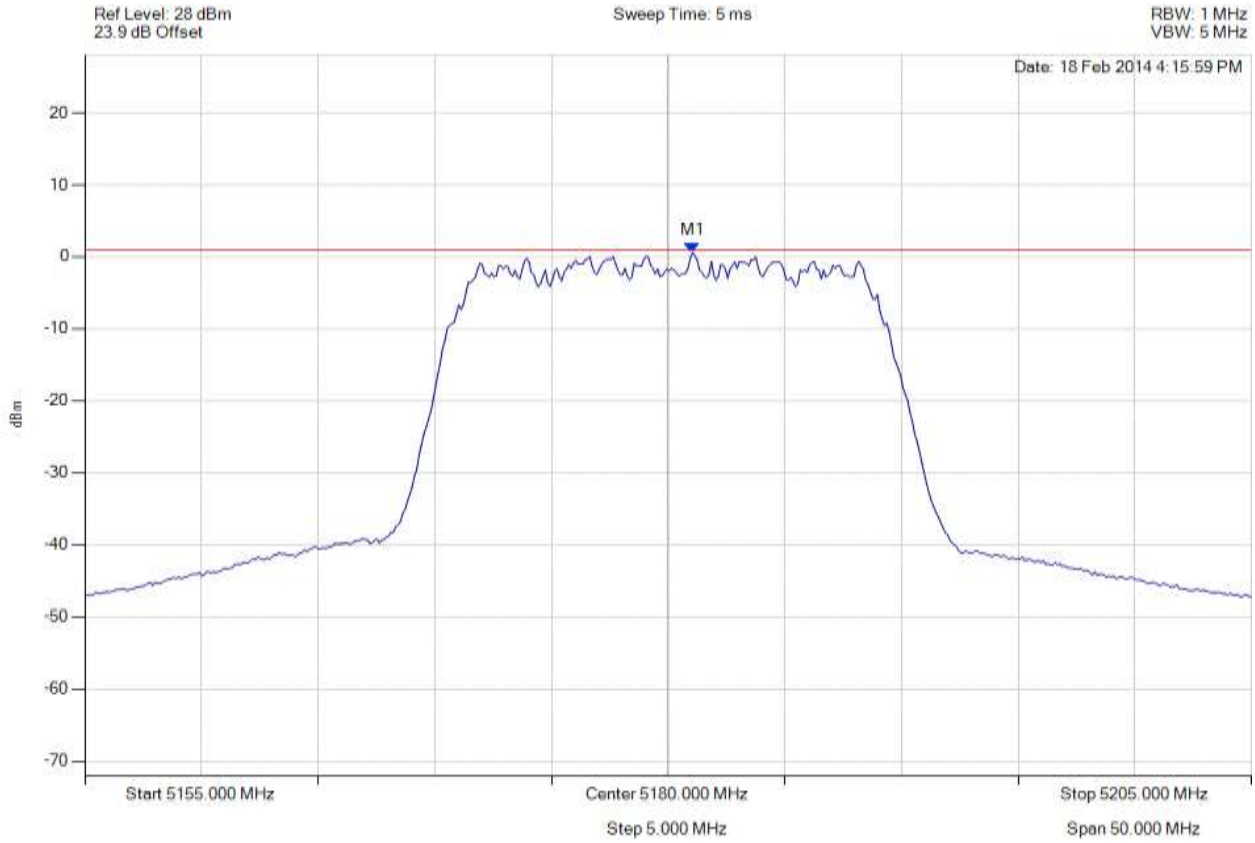


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5222.625 MHz : -2.672 dBm	Limit: ≤ 4.0 dBm Margin: -6.7 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-20, Channel: 5180.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

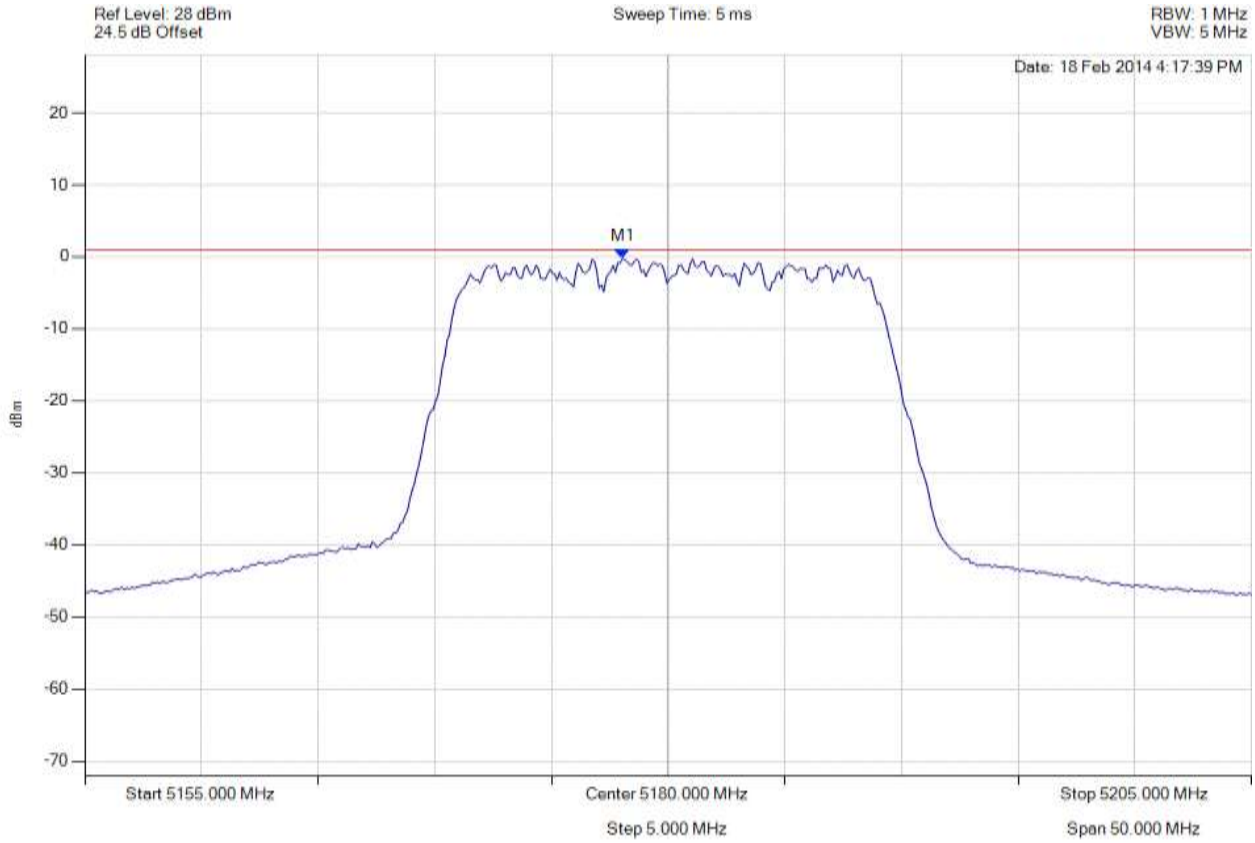


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5181.052 MHz : 0.582 dBm	Limit: ≤ 0.990 dBm Margin: -0.41 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-20, Channel: 5180.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc

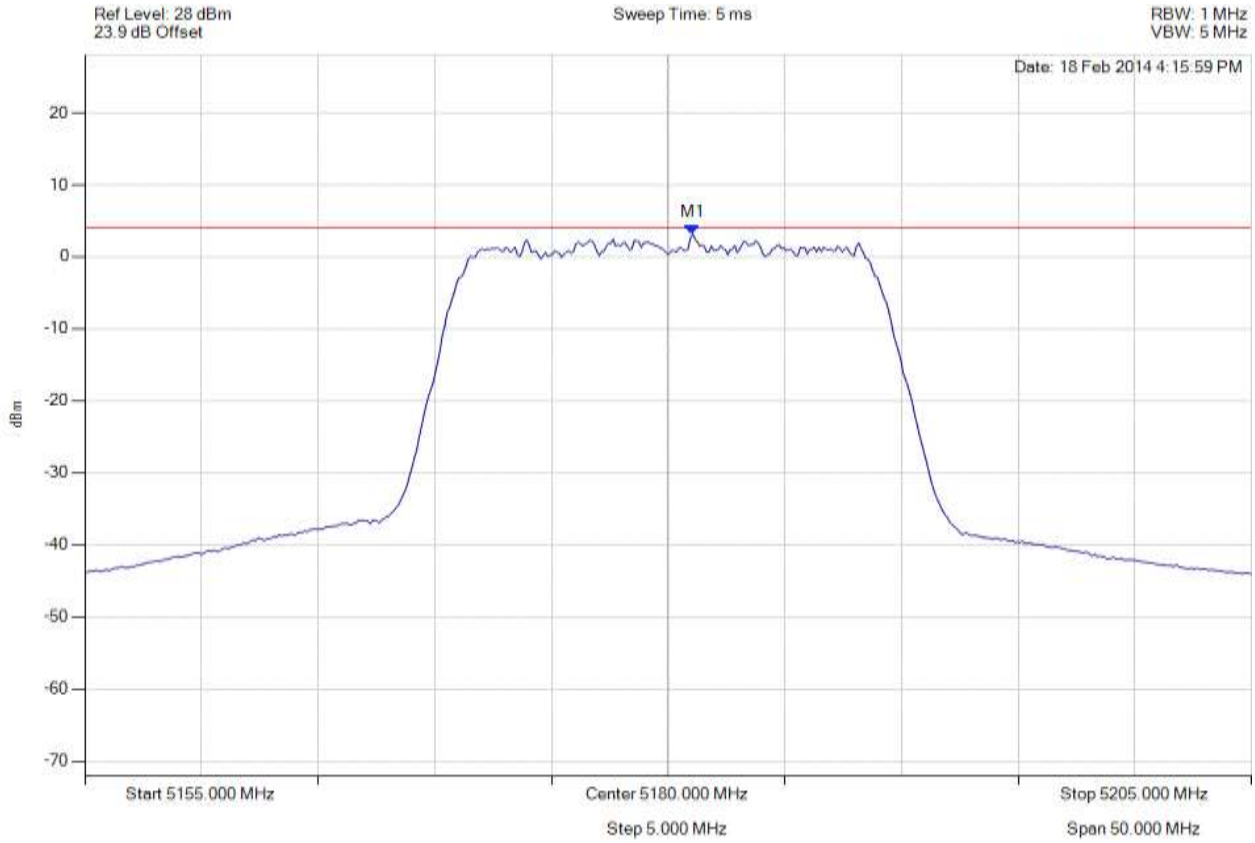


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5178.046 MHz : -0.172 dBm	Limit: ≤ 0.990 dBm Margin: 1.16 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-20, Channel: 5180.00 MHz, SUM, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5181.052 MHz : 3.174 dBm	Limit: ≤ 4.0 dBm Margin: -0.8 dB

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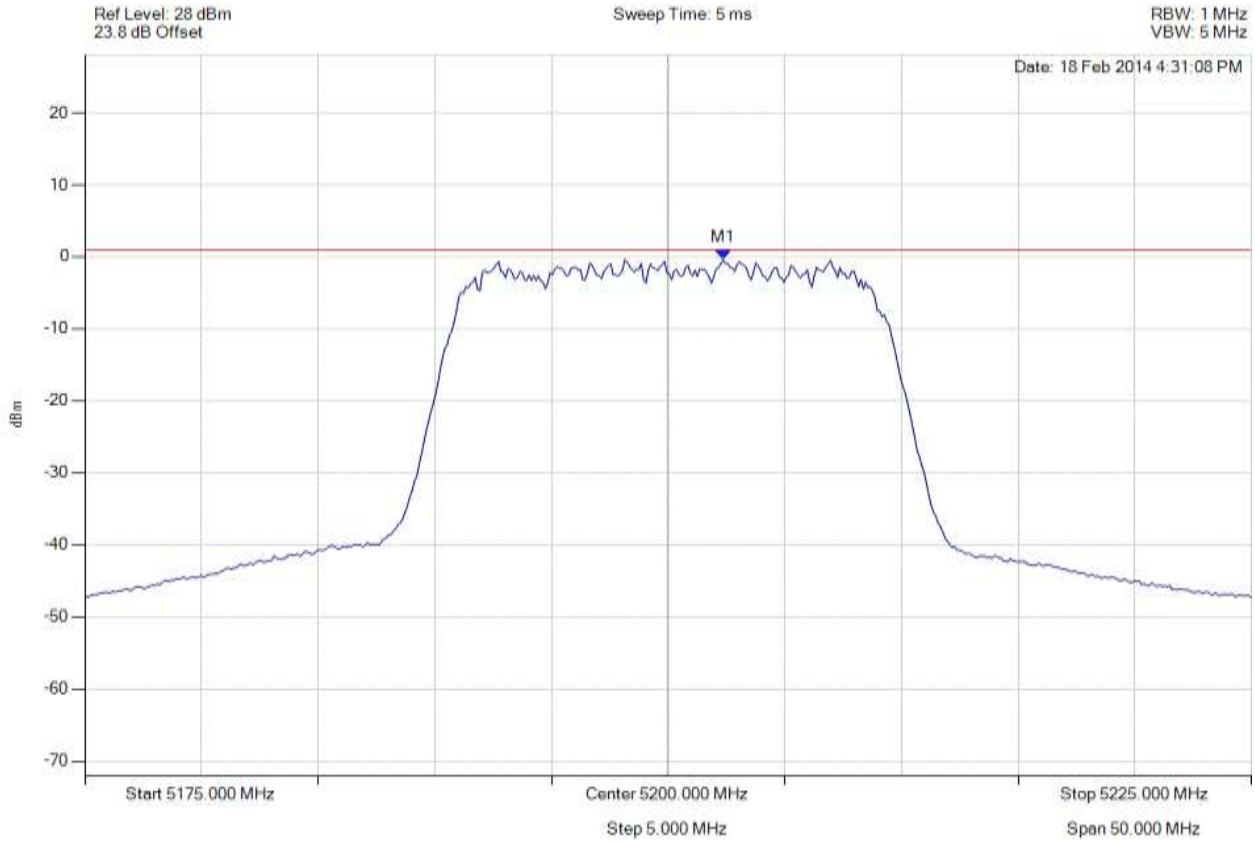
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-20, Channel: 5200.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5202.355 MHz : -0.375 dBm	Limit: ≤ 0.990 dBm Margin: 1.37 dB

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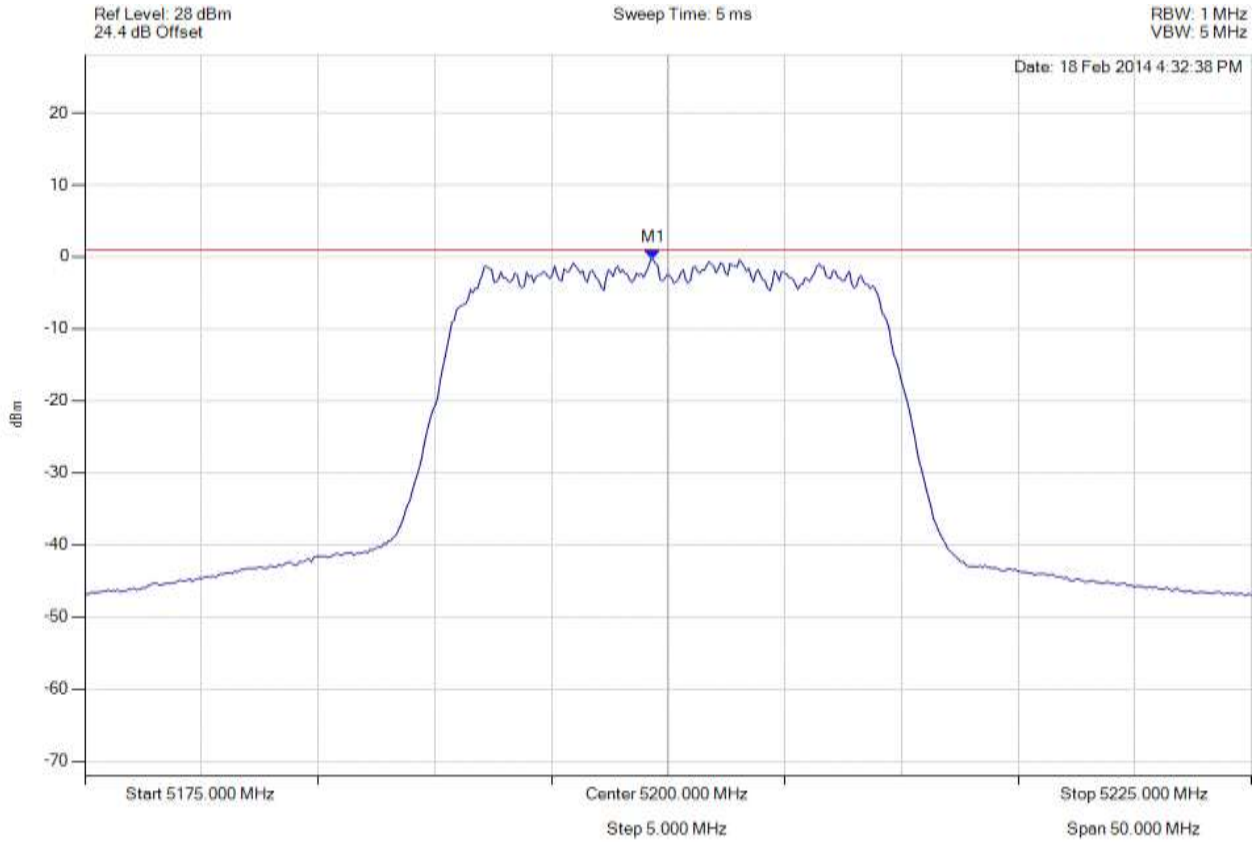
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-20, Channel: 5200.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5199.349 MHz : -0.370 dBm	Limit: ≤ 0.990 dBm Margin: 1.36 dB

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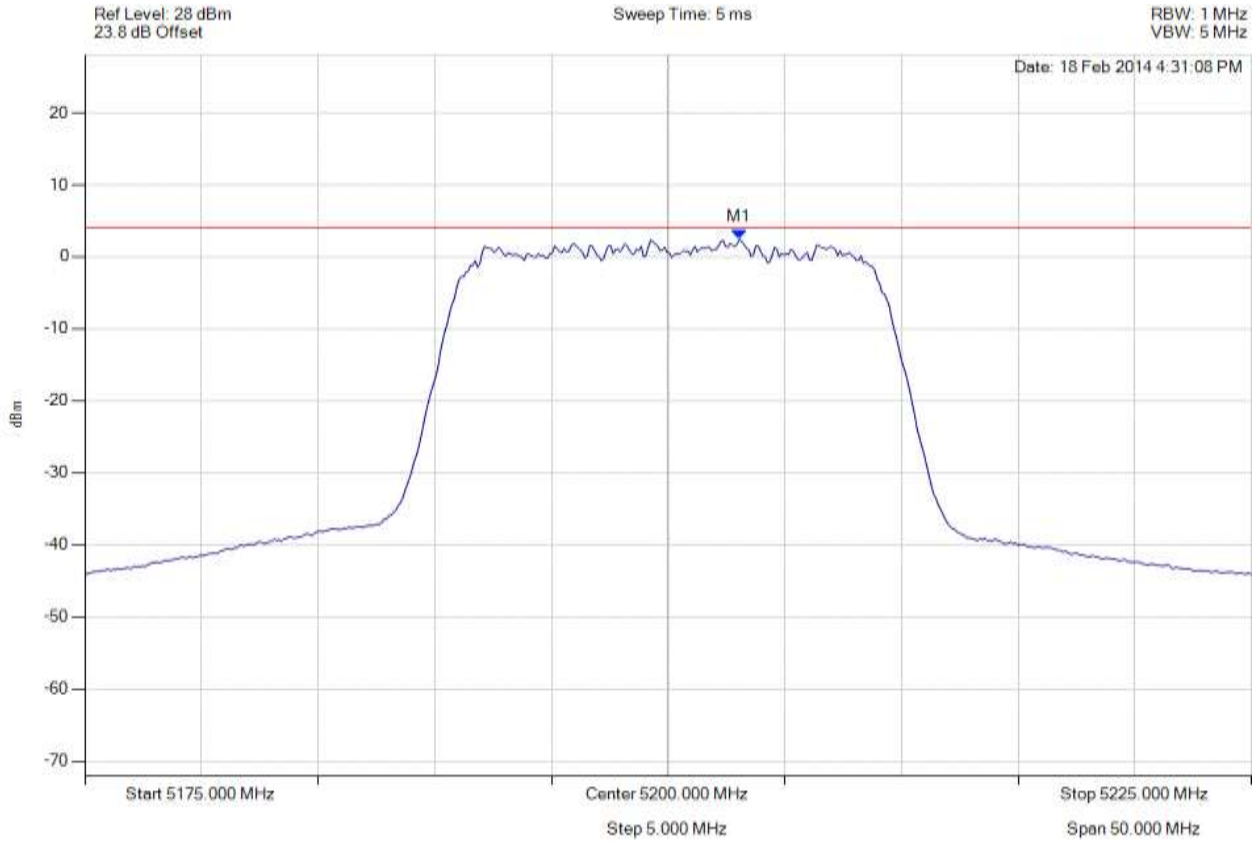
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-20, Channel: 5200.00 MHz, SUM, Temp: Ambient, Voltage: 12 Vdc

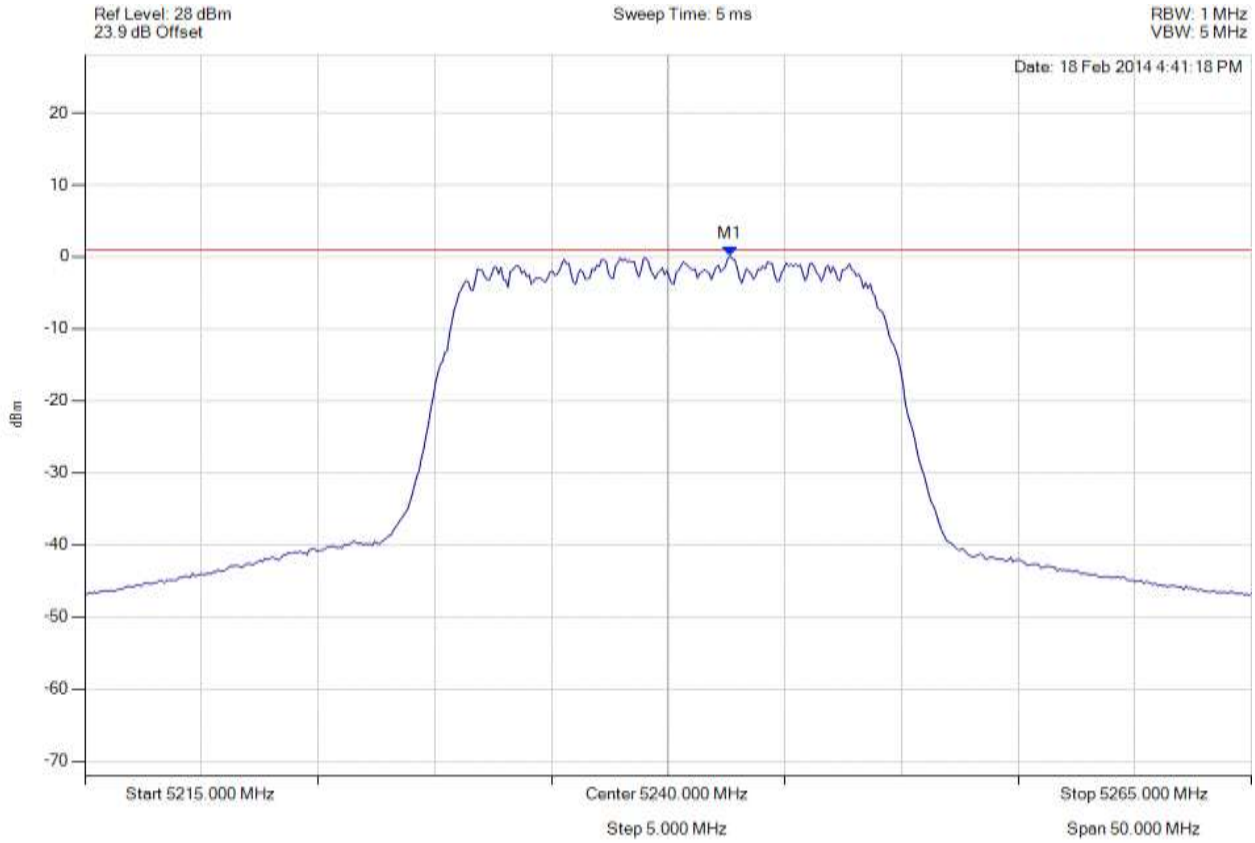


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5203.056 MHz : 2.453 dBm	Limit: ≤ 4.0 dBm Margin: -1.5 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-20, Channel: 5240.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc

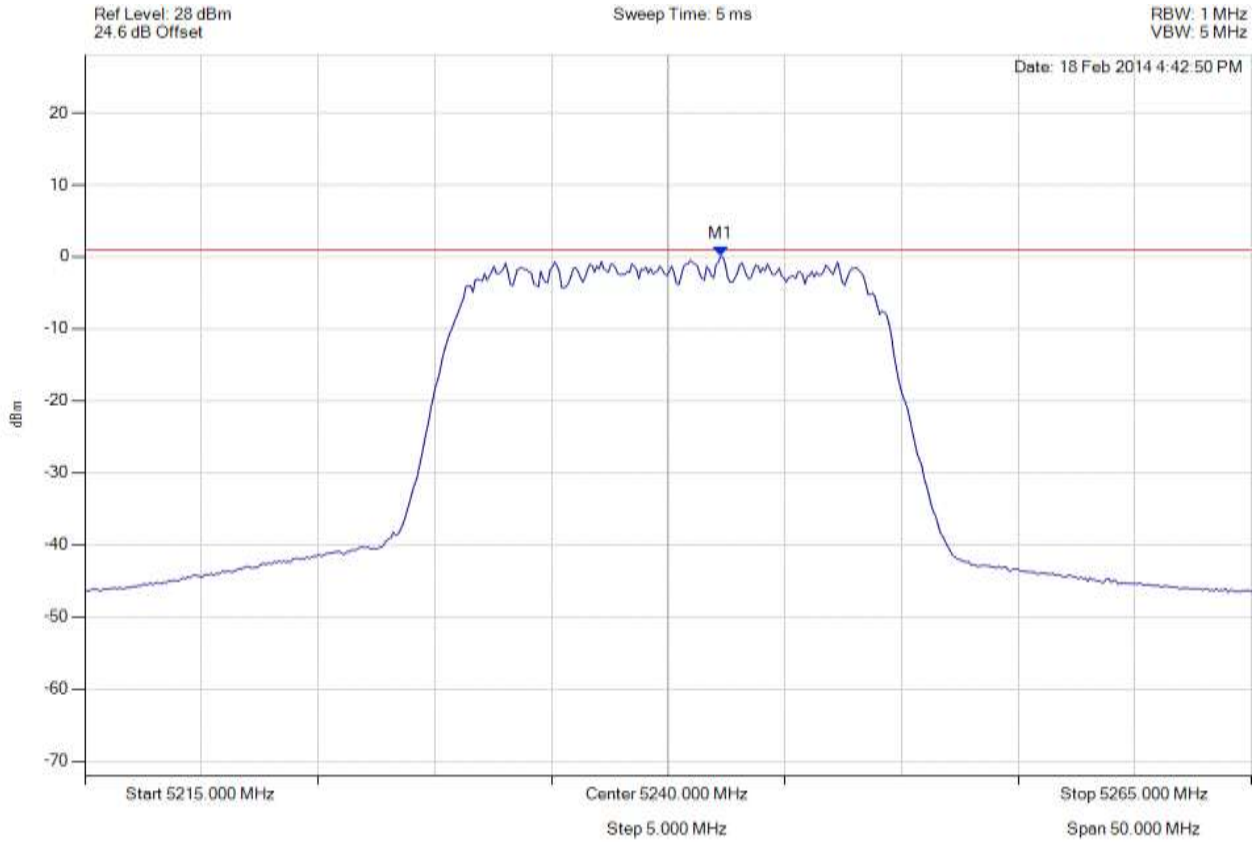


Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5242.655 MHz : 0.136 dBm	Limit: ≤ 0.990 dBm Margin: -0.85 dB

Back to the Matrix

PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-20, Channel: 5240.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5242.255 MHz : 0.115 dBm	Limit: ≤ 0.990 dBm Margin: -0.88 dB

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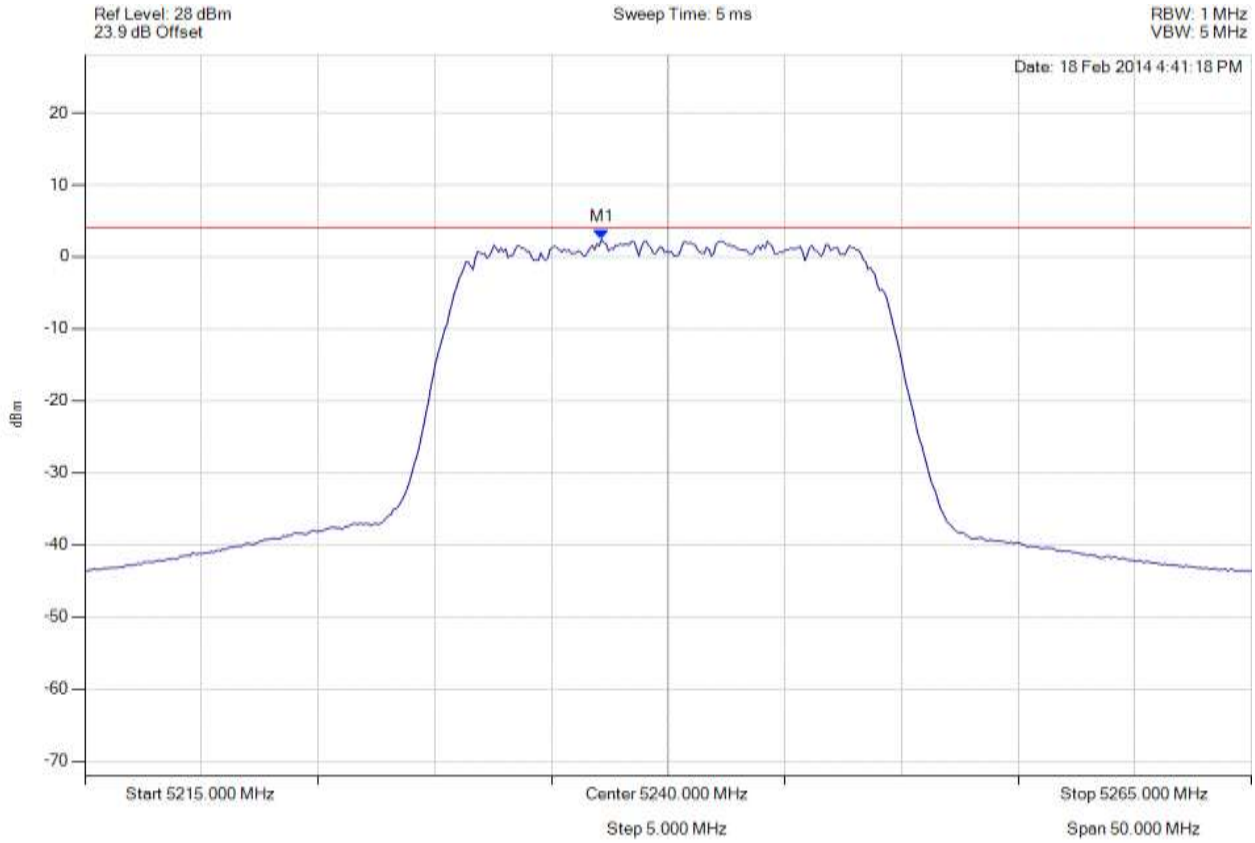
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-20, Channel: 5240.00 MHz, SUM, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5237.144 MHz : 2.471 dBm	Limit: ≤ 4.0 dBm Margin: -1.5 dB

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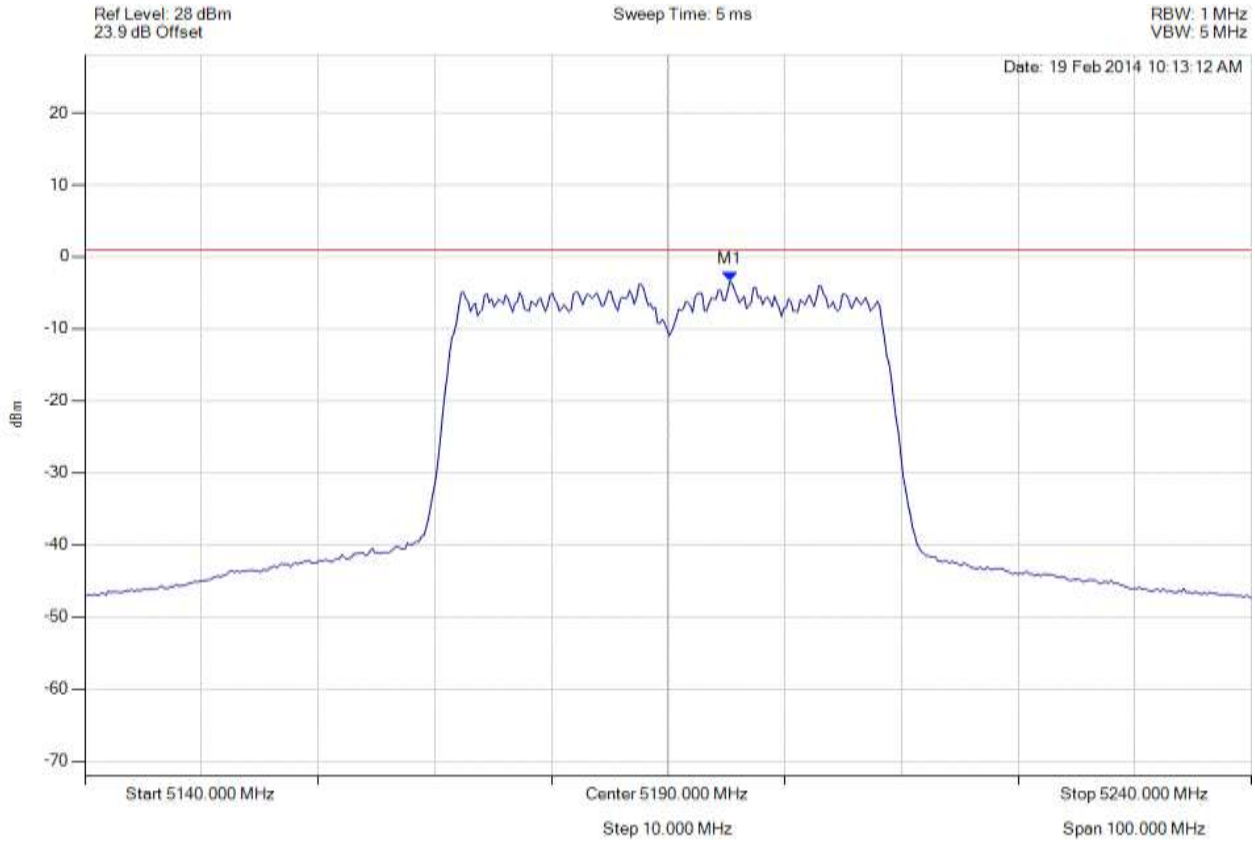
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-40, Channel: 5190.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5195.311 MHz : -3.354 dBm	Limit: ≤ 0.990 dBm Margin: 4.34 dB

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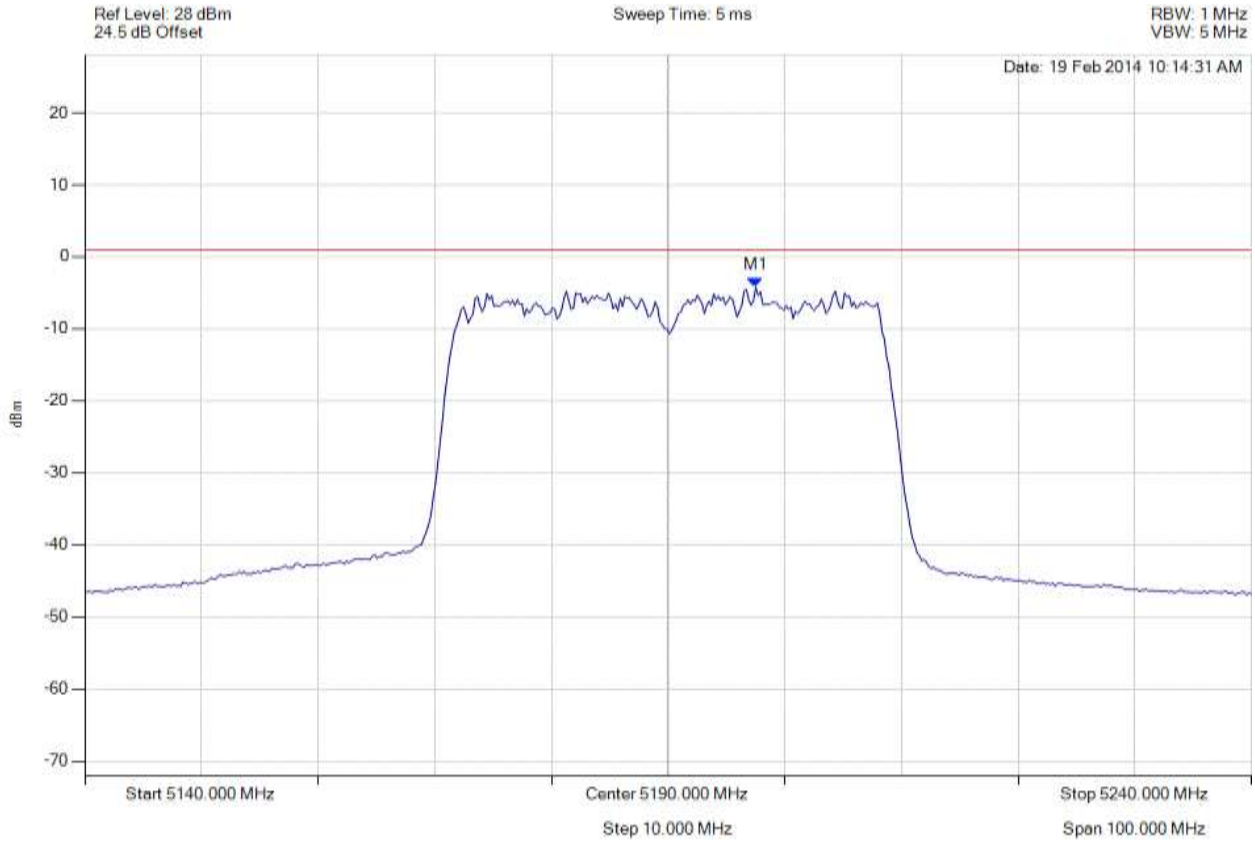
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-40, Channel: 5190.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5197.515 MHz : -4.201 dBm	Limit: ≤ 0.990 dBm Margin: 5.19 dB

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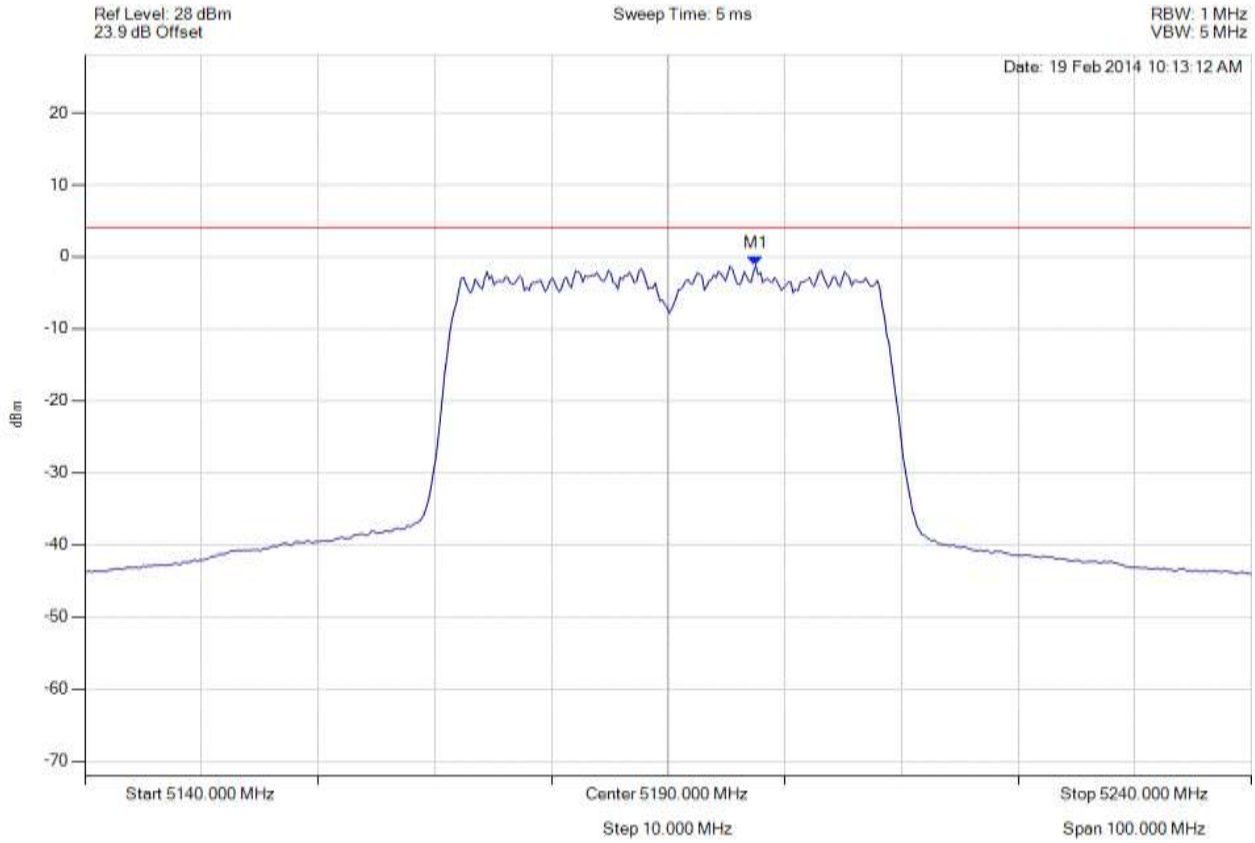
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-40, Channel: 5190.00 MHz, SUM, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5197.515 MHz : -1.234 dBm	Limit: ≤ 4.0 dBm Margin: -5.2 dB

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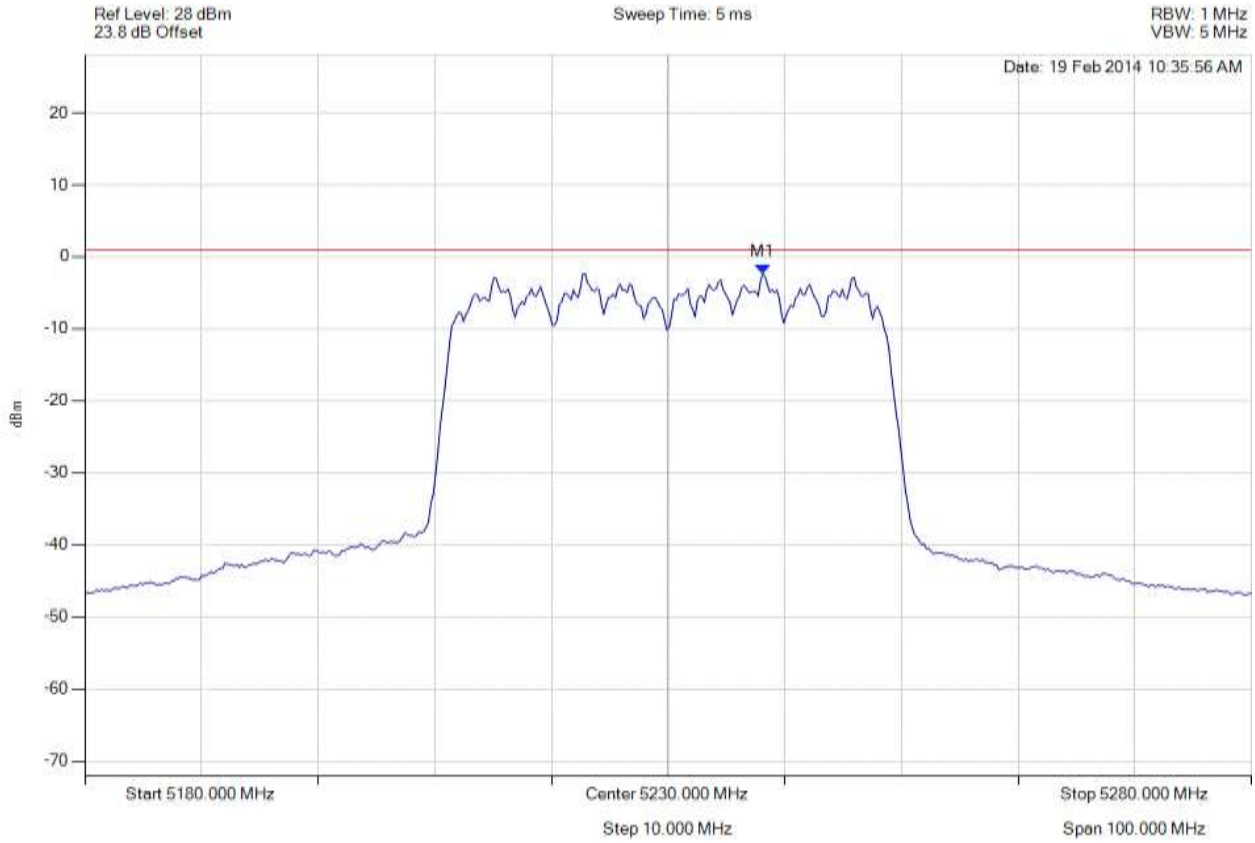
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-40, Channel: 5230.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5238.116 MHz : -2.327 dBm	Limit: ≤ 0.990 dBm Margin: 3.32 dB

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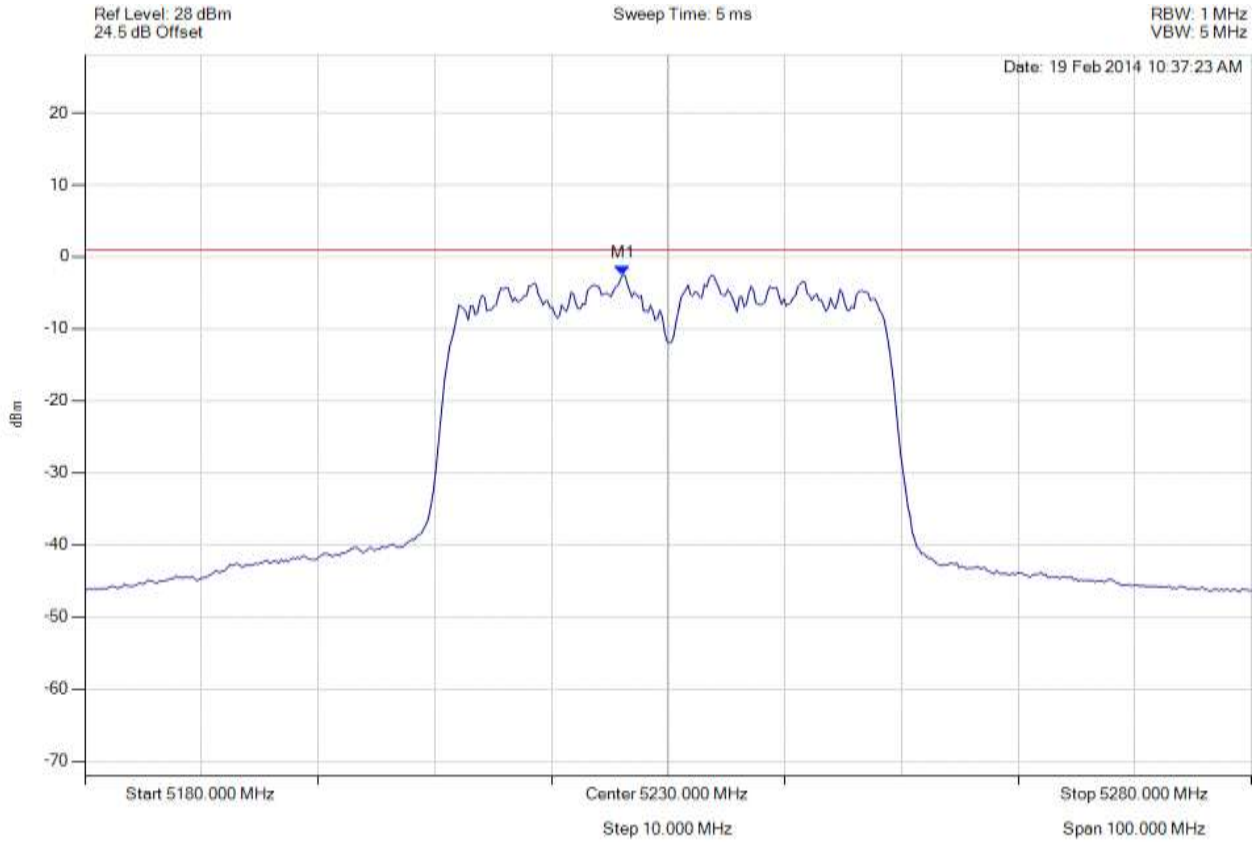
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-40, Channel: 5230.00 MHz, Chain b, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5226.092 MHz : -2.488 dBm	Limit: ≤ 0.990 dBm Margin: 3.48 dB

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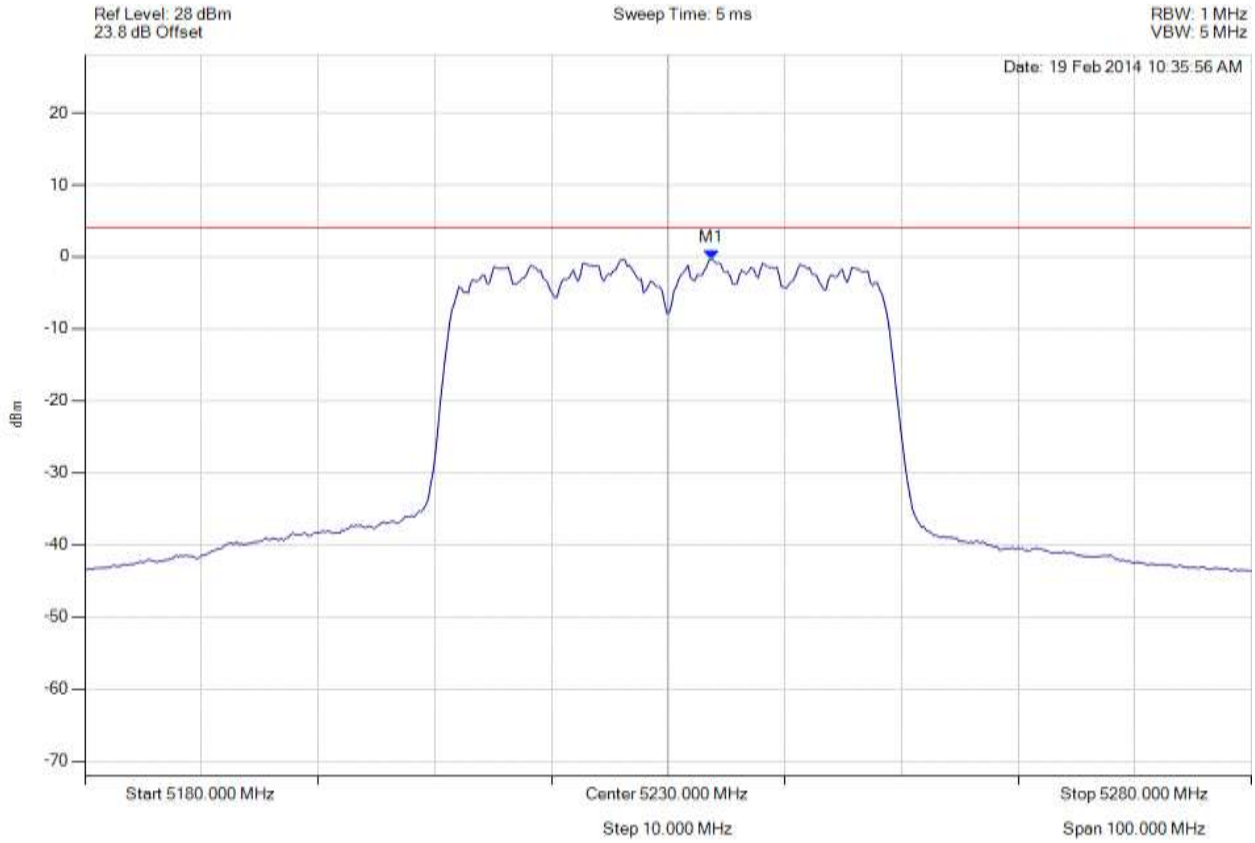
PEAK POWER SPECTRAL DENSITY

Variant: 802.11n HT-40, Channel: 5230.00 MHz, SUM, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5233.707 MHz : -0.384 dBm	Limit: ≤ 4.0 dBm Margin: -4.4 dB

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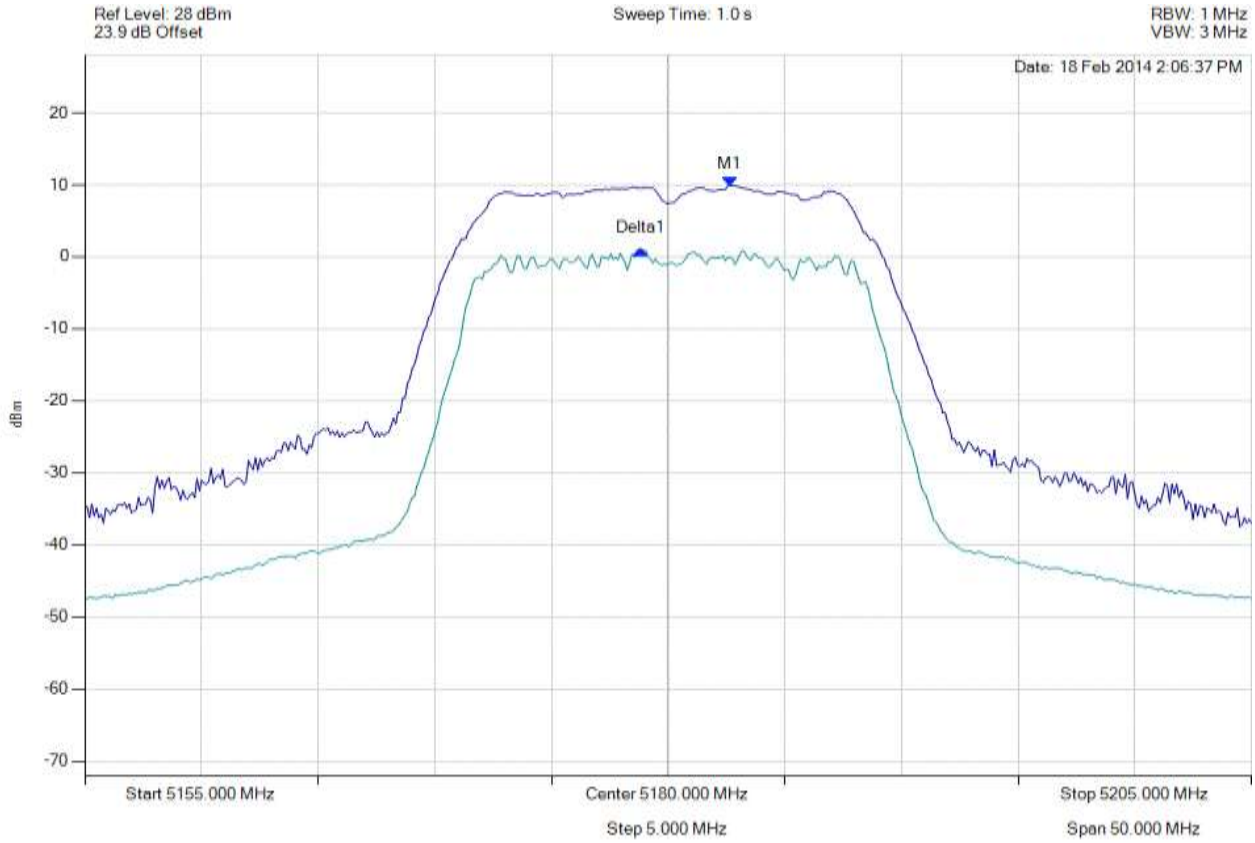
A.1.3. Peak Excursion Ratio

PEAK EXCURSION RATIO

Variant: 802.11a, Channel: 5180.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Sweep Count = 0 RF Atten (dB) = 20 TRACE 1: Detector = MAX PEAK Trace Mode = VIEW TRACE 2: Detector = RMS Trace Mode = VIEW	M1 : 5182.655 MHz : 9.846 dBm Delta1 : -3807615 Hz : -8.903 dB	Measured Excursion Ratio: 8.90 dB Limit: 13.0 dB Margin: -4.10 dB

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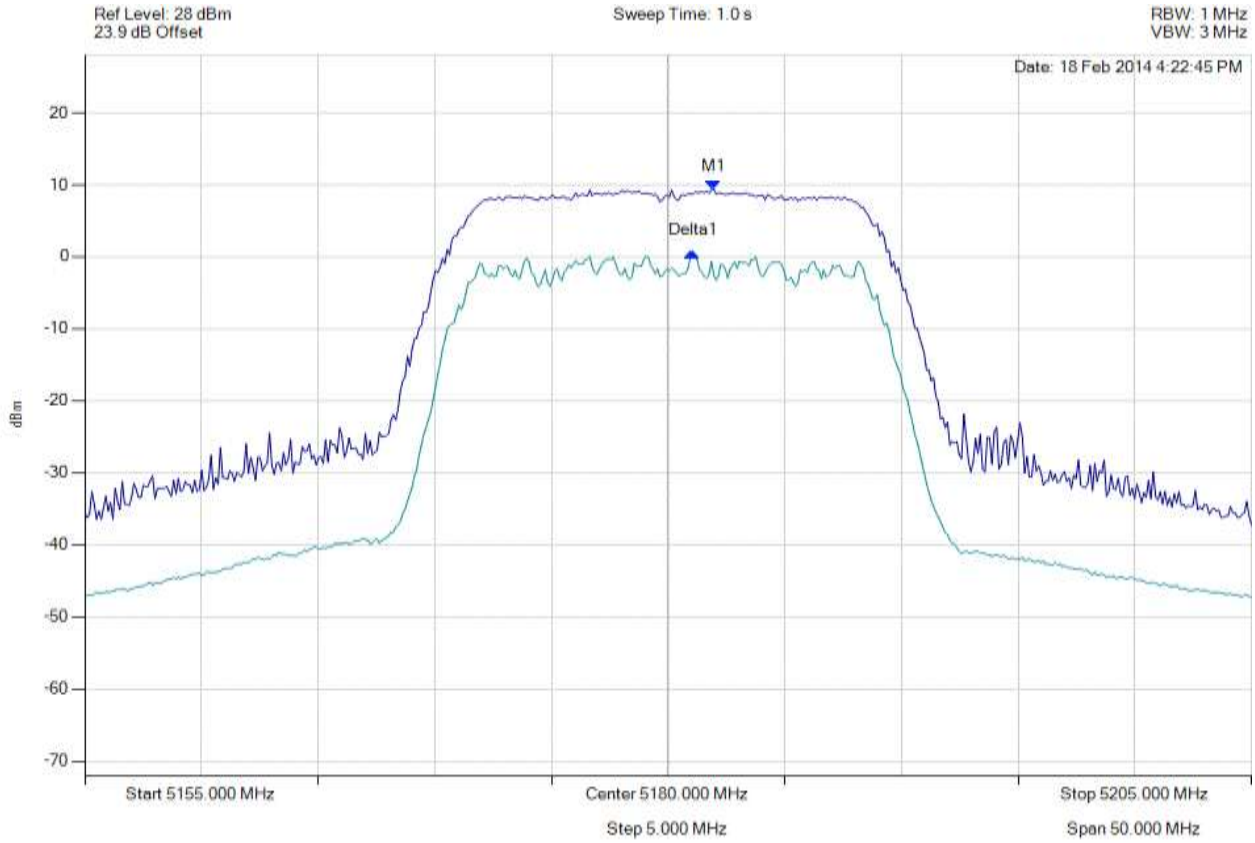
PEAK EXCURSION RATIO

Variant: 802.11n HT-20, Channel: 5180.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Sweep Count = 0 RF Atten (dB) = 20 TRACE 1: Detector = MAX PEAK Trace Mode = VIEW TRACE 2: Detector = RMS Trace Mode = VIEW	M1 : 5181.954 MHz : 9.389 dBm Delta1 : -901804 Hz : -8.807 dB	Measured Excursion Ratio: 8.81 dB Limit: 13.0 dB Margin: -4.19 dB

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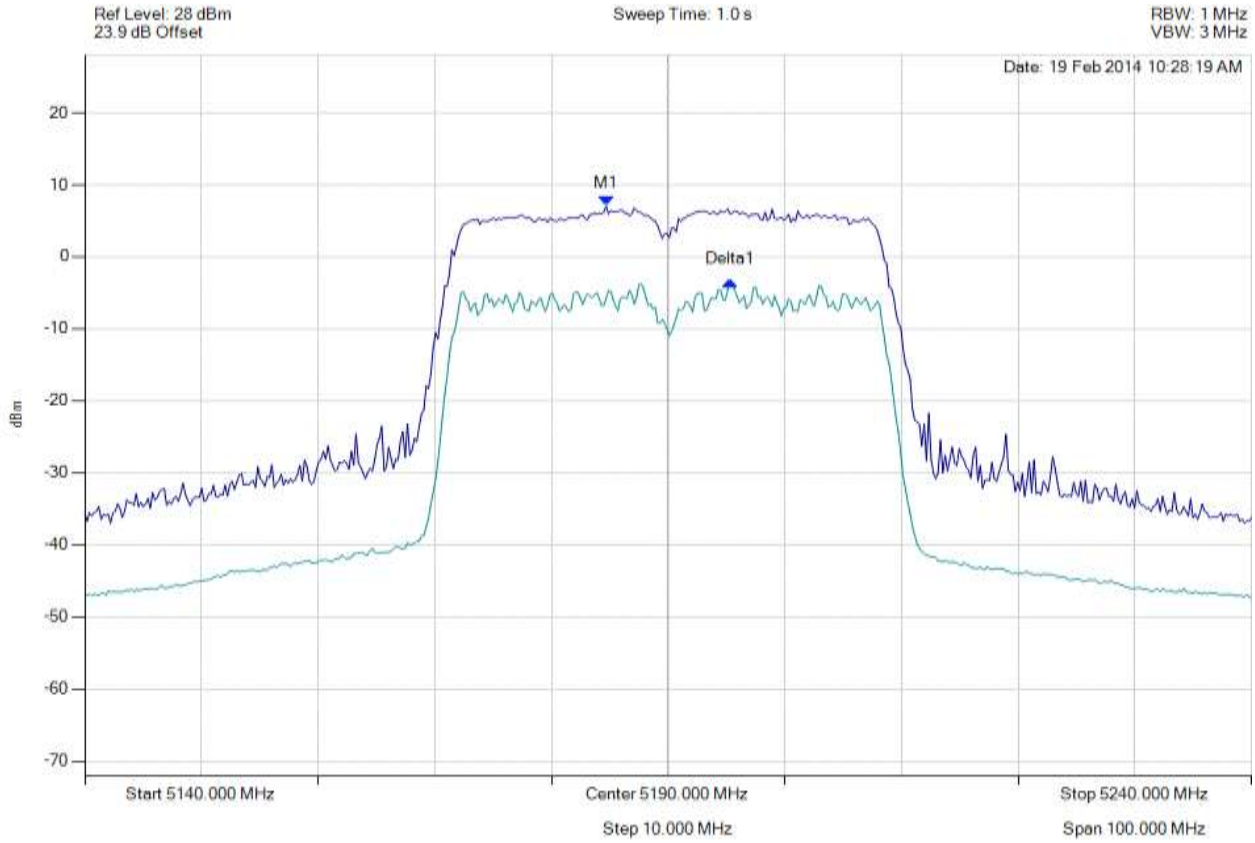
PEAK EXCURSION RATIO

Variant: 802.11n HT-40, Channel: 5190.00 MHz, Chain a, Temp: Ambient, Voltage: 12 Vdc



Analyser Setup	Marker : Frequency : Amplitude	Test Results
Sweep Count = 0 RF Atten (dB) = 20 TRACE 1: Detector = MAX PEAK Trace Mode = VIEW TRACE 2: Detector = RMS Trace Mode = VIEW	M1 : 5184.689 MHz : 7.068 dBm Delta1 : 10.621 MHz : -10.398 dB	Measured Excursion Ratio: 10.40 dB Limit: 13.0 dB Margin: -2.60 dB

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