Test of Aruba AP-93H 802.11a/b/g/n Wireless AP

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

Test Report Serial No.: ARUB91-U1 Rev A





# Test of Aruba Networks, Inc AP-93H 802.11a/b/g/n Wireless AP (DFS Frequency Bands Only)

to

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

Test Report Serial No.: ARUB91-U1 Rev A

<u>Note:</u> this report contains data with regard to the 5,250 to 5,350 and 5,470 – 5,725 MHz DFS bands for the Aruba Networks, Inc AP-93H Wireless LAN Access Point. 2.4 and 5.8 GHz test data are reported in MiCOM Labs test report ARUB74-U1.

This report supersedes None

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

Product Function: Wireless LAN Access Point

Copy No: pdf Issue Date: 16th February 2012



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## **ACCREDITATION, LISTINGS & RECOGNITION**

### **ACCREDITATION - TESTING**

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) <u>www.a2la.org</u> test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; <u>http://www.a2la.org/scopepdf/2381-01.pdf</u>



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### **RECOGNITION**

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

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	ТСВ	-	Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	Listing #: 4143A
Japan	MIC	CAB	APEC MRA 2	210
• op on	VCCI			No. 2959
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	
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	Singapore Infocomm Development Authority (IDA)		APEC MRA 1	US0159
TaiwanNational Communications Commission (NCC)Bureau of Standards, Metrology and Inspection (BSMI)		CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

\*\*APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.

- Phase I recognition for product testing
- Phase II recognition for both product testing and certification
- N/A Not Applicable

\*\*EU MRA – European Union Mutual Recognition Agreement.

Is a recognition agreement under which test lab is accredited to regulatory standards of the EU member countries.

\*\*NB – Notified Body

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### PRODUCT CERTIFICATION

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard EN ISO/IEC Guide 65. The company is accredited by the American Association for Laboratory Accreditation (A2LA) <u>www.a2la.org</u> test laboratory number 2381.02. MiCOM Labs test schedule is available at the following URL; <u>http://www.a2la.org/scopepdf/2381-02.pdf</u>



<u>United States of America – Telecommunication Certification Body (TCB)</u> TCB Identifier – US0159

#### Industry Canada – Certification Body CAB Identifier – US0159

#### Europe – Notified Body Notified Body Identifier - 2280

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

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## **DOCUMENT HISTORY**

	Document History				
Revision	Date	Comments			
Draft					
Rev A	16 <sup>th</sup> February 2012	Initial Release			

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# 1. TEST RESULT CERTIFICATE

Applicant:	Aruba Networks, Inc 1344 Crossman Avenue	Tested By:	MiCOM Labs, Inc. 440 Boulder Court
	Sunnyvale		Suite 200
	CA 94089, USA		Pleasanton
			California, 94566, USA
EUT:	802.11a/b/g/n Wireless Access Point	Tel:	+1 925 462 0304
Model:	AP-93H	Fax:	+1 925 462 0306
S/N:	BN0000007 (Conducted) BN0000016 (Radiated)		
Test Date(s):	8 <sup>th</sup> Oct 2011 – 7 <sup>th</sup> Feb 2012	Website:	www.micomlabs.com

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

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

#### Notes:

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

#### Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve Quality Manager MiCOM Labs,



CERTIFICATE #2381.01

Gordon Hurst P<del>re</del>sident & CEO MiCOM Labs, Inc.

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### 2. <u>REFERENCES AND MEASUREMENT UNCERTAINTY</u>

### 2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 15.407	2009	Code of Federal Regulations
(ii)	FCC 06-96	June 2006	Memorandum Opinion and Order
(iii)	Industry Canada RSS-210	Issue 7 June 2007	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands): Category 1 Equipment
(iv)	Industry Canada RSS-Gen	Issue 2 June 2007	General Requirements and Information for the Certification of Radiocommunication Equipment
(v)	ANSI C63.4	2003	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(vi)	CISPR 22/ EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(vii)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(viii)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(ix)	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(x)	A2LA	14 <sup>th</sup> September 2005	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(xi)	FCC Public Notice – DA 02-2138	2002	Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices

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### 2.2. Test and Uncertainty Procedures

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

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

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

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## 3. PRODUCT DETAILS AND TEST CONFIGURATIONS

### 3.1. Technical Details

Details	Description	
Purpose:	Test of the Aruba AP-93H 802.11a/b/g/n Wireless AP	
	in the frequency ranges 5150 to 5250 MHz to FCC Part	
	15.407 and Industry Canada RSS-210 regulations.	
Applicant:	Aruba Networks, Inc	
	1344 Crossman Avenue	
	Sunnyvale	
	CA 94089, USA	
Manufacturer:	As applicant	
Laboratory performing the tests:	MiCOM Labs, Inc.	
	440 Boulder Court, Suite 200	
	Pleasanton, California 94566 USA	
Test report reference number:	ARUB91-U1 Rev A	
Date EUT received:	6 <sup>th</sup> October 2011	
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210	
Dates of test (from - to):	8th Oct 2011 – 7th Feb 2012	
No of Units Tested:	3 (units conducted, DFS and radiated)	
Type of Equipment:	802.11a/b/g/n Wireless Access Point, 2x2 Spatial	
	Multiplexing MIMO configuration	
Applicants Trade Name:	Aruba Networks, Inc	
Model(s):	AP-92H (integral antenna)	
Software Release	5.0.1.0 ART v0_9-b16ALL	
Location for use:	Indoor	
Declared Frequency Range(s):	5,250 to 5,350 and 5,470 – 5,725 MHz	
Type of Modulation:	Per 802.11 – CCK, BPSK, QPSK, DSSS, OFDM	
Declared Nominal Output Power:	802.11a: Legacy +17 dBm	
(Average Power)	802.11n: HT-20 +17 dBm	
	802.11n: HT-40 +17 dBm	
EUT Modes of Operation:	Legacy 802.11a/b/g, 802.11n HT-20, HT-40	
Transmit/Receive Operation:	Time Division Duplex	
Rated Input Voltage and Current:	DC: Nominal: 12V DC Current: 1.25 A	
	ENET: Nominal: 48 V DC Current: 0.350 A	
Operating Temperature Range:	Nominal: 20 °C Max: 50 °C Min: 0 °C	
ITU Emission Designator:	802.11a 18M5D1D	
-	802.11n HT-20 19M5D1D	
	802.11n HT-40 39M9D1D	
Frequency Stability:	±20 ppm	
Equipment Dimensions:		
Weight:	375 grams	
Primary function of equipment:	Wireless Access Point for transmitting data and voice	

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### 3.2. Scope of Test Program

#### Testing

Per manufactures declaration: The AP-93H contains an AP-93 Access Point with the addition of 4 Ethernet port LAN switch functionality to the main board (digital portion modification only). The RF part of the device is not modified.

The scope of the compliance program was to test the Aruba AP-93H wireless LAN access point, 2x2 Spatial Multiplexing MIMO configurations in the frequency ranges 5,250 - 5,350 and 5,470 - 5,725 MHz for compliance against FCC 47 CFR Part 15.407 and Industry Canada RSS-210 specifications.

#### Aruba AP-92, AP-93 Access Point

The AP-93 is a high-speed, affordable, and reliable 802.11n access points for indoor environments. Designed for both ceiling and wall mounting, the compact AP-92 and AP-93 deliver wire-like performance at data rates up to 300Mbps. The AP-92 and AP-93 are built to deliver years of trouble-free operation and are backed by Aruba's limited lifetime warranty program.

Working in conjunction with Aruba's line of centralized Mobility Controllers, the AP-93H delivers high-speed, secure network services that let users finally move to a "wireless where possible, wired where necessary" network access model. The network can then be right sized, with unnecessary ports eliminated to lower operating costs. The key to rightsizing is Aruba's unique Adaptive Radio Management technology, which manages channel, power, and wireless client behavior to deliver wire-like performance and reliability. By rightsizing network infrastructure, organizations significantly enhance user mobility and efficiency while lowering total cost of ownership.

The multifunction AP-93H can be configured through the controller to provide wireless LAN access, air monitoring, remote networking, secure enterprise mesh, and wireless intrusion detection and prevention over the 2.4GHz and 5GHz RF spectrum. The AP-93H feature a 100/1000Base-T Ethernet interface and operate from either standard 802.3af Power over Ethernet (PoE) sources or a 12VDC power supply.

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	802.11a/b/g/n Wireless Access Point	Aruba Networks , Inc	AP-93H	BN0000007 (Conducted) BN0000016 (Radiated)
Support	Laptop PC	IBM	Thinkpad	None

### 3.4. Antenna Details

Antenna Type	Manufacturer	Model	Gain (dBi / dBd)	Frequency Range (MHz)
Integral	Aruba Networks, Inc	Integral Antenna	5.8	4900 - 5875

### 3.5. Cabling and I/O Ports

Number and type of I/O ports

Description	Туре	Length	Additional Information
ENET	RJ-45 Ethernet Port	Greater than 10m	Ethernet connection; Only non- shielded CAT-5 cable was used during testing. Port not connected to public utility/telecommunication network.
CONSOLE	RJ-45 Serial Port	Greater than 10m	For EUT setup only, not connected during typical EUT operation; Only non-shielded CAT-5 cable was used during testing.
DC Power	DC Power Port	Less than 3m	AC adaptor with attached DC cable supplied with EUT
AC Power	AC Adaptor	Less than 3m	AC adaptor and mains cable supplied with EUT

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### 3.6. Test Configurations

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

Matrix of test configurations

Operational Mode(s) (802.11)	Variant	Data Rates with Highest Power	Frequencies (MHz)
	Legacy	6 MBit/s	5260, 5300, 5320
a,n	HT-20	6.5 MCS	5500, 5580, 5700
,	HT-40	13.5 MCS	5270, 5310 5510, 5550, 5670

#### Antenna Test Configurations for Radiated Emissions and Band-Edge

The following measurements were performed on all antenna configurations identified in Section 3.4 Antenna Details.

11a	11n HT-20	11n HT-40
SE 5260	SE 5260	SE 5270
SE 5300	SE 5300	
SE 5320	SE 5320	SE 5310
BE 5350	BE 5350	BE 5350
BE 5460	BE 5460	BE 5460
SE 5500	SE 5500	SE 5510
SE 5580	SE 5580	SE 5550
SE 5700	SE 5700	SE 5670

#### Spurious Emission and Band-Edge Test Strategy

KEY:-

SE – Spurious Emissions

BE - Band-Edge

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### 3.7. Equipment Modifications

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

1. NONE

### 3.8. Deviations from the Test Standard

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

1. NONE

### 3.9. Subcontracted Testing or Third Party Data

1. NONE



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### 4. TEST SUMMARY

#### List of Measurements

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

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

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### List of Measurements (continued)

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

Section(s)	Test Items	Description	Condition	Result	Test Report Section
15.407(b)(2) 15.205(a) 15.209(a) 2.2 2.6 A9.3(2) 4.7	Radiated Emissions		Radiated		5.1.7
4.7	Transmitter Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.1.7.1
	Radiated Band Edge	Band edge results		Complies	5.1.7.1
Industry Canada only RSS-Gen §4.10, §6	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	5.1.7.2
15.407(b)(6) 15.205(a) 15.209(a) 2.2	Radiated Emissions	Emissions <1 GHz (30M-1 GHz)		Complies	5.1.7.3
15.407(b)(6) 15.207 7.2.2	AC Wireline Conducted Emissions 150 kHz– 30 MHz	Conducted Emissions	Conducted	Complies	5.1.8

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## 5. TEST RESULTS

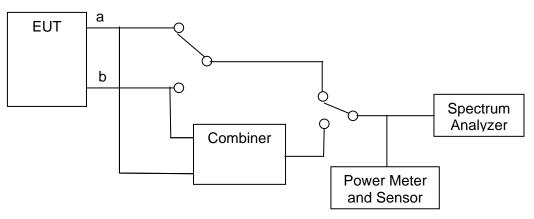
- 5.1. Device Characteristics
- 5.1.1. 26 dB and 99 % Bandwidth

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

#### **Test Procedure**

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

#### Test Measurement Set up



#### Measurement set up for 26 dB and 99 % bandwidth test

Radio Parameters Duty Cycle: 100% Output: Modulated Carrier Power: Maximum Default Power

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

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

#### TABLE OF RESULTS - 802.11a Legacy (5,250 - 5,350 MHz)

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 a	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8	dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

#### 26 dB Bandwidth

	26 dB Bandwidth				Minimu	ım 6dB		
Test Frequency		м	Hz		Bandwid	th Limit	Margin	
MHz	а	b	С	d	kHz MHz		MHz	
5260	33.367000	40.782000					-32.867000	
5300	32.164000	37.776000			500	0.5	-31.664000	
5320	31.463000	37.074000					-30.963000	

#### 99% Bandwidth

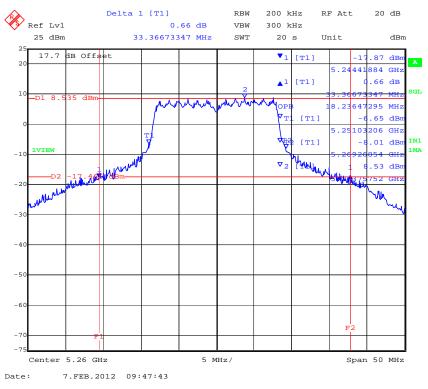
		99 % Ba	ndwidth			
Test Frequency MHz						
MHz	а	b	С	d		
5260	18.236000	22.645000				
5300	17.635000	21.343000				
5320	17.936000	20.341000				

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

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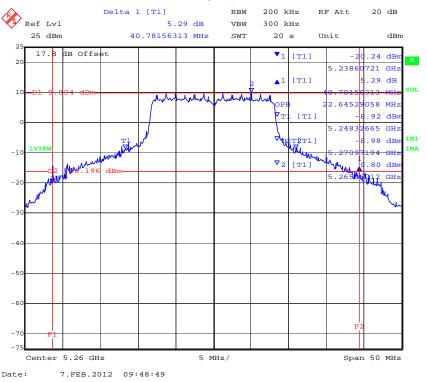


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#### CHAIN A 5,260 MHz 802.11a Legacy 26 dB and 99 % Bandwidth





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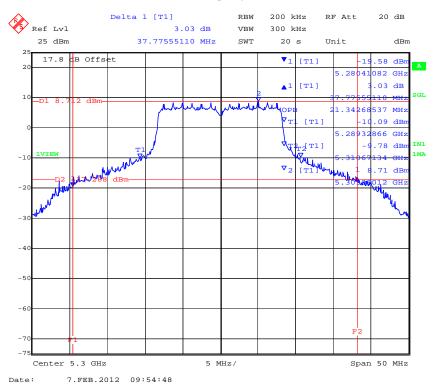


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#### Delta 1 [T1] RBW 200 kHz RF Att 20 dB Ref Lvl 2.81 dB 300 kHz VBW 32.16432866 MHz 25 dBm SWT 20 s Unit dBm 17.7 dB Offset **v**1 .52 dB [T1] -2 64 GH: 28383 [T1] .81 dB **A**1 1 ( MH dB D1 8 which MAN L.a. OF 054 MH 6352 [T1] 29 dB 246 GH [T1] .66 dB MA -1( $\nabla_2$ 10 M 01 dB W.W 17 ( <del>07 GH</del> -2 , thur 1mb Male hourse. - 3 -4 -50 -6 5 MHz/ Center 5.3 GHz Span 50 MHz Date: 7.FEB.2012 09:53:42

#### CHAIN A 5,300 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



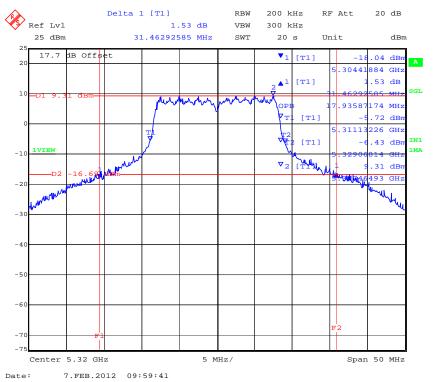


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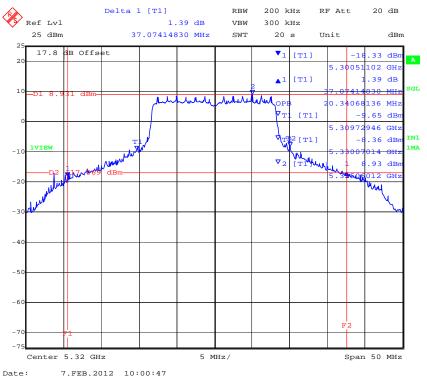


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:23 of 180

#### CHAIN A 5,320 MHz 802.11a Legacy 26 dB and 99 % Bandwidth







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### TABLE OF RESULTS - 802.11a Legacy (5,470 - 5,725 MHz)

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 a	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8	dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

#### 26 dB Bandwidth

		26 dB Ba	B Bandwidth Minimum 6dB Maggin					
Test Frequency		м	Hz		Bandwid	th Limit	Margin	
MHz	а	b	С	d	kHz MHz		MHz	
5500	29.158000	34.870000					-28.658000	
5580	31.964000	37.074000			500	0.5	-31.464000	
5700	35.070000	35.271000					-34.570000	

#### 99% Bandwidth

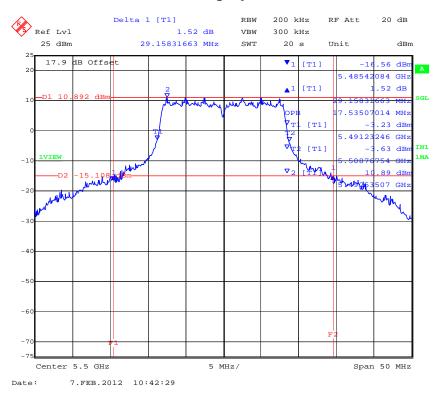
	99 % Ba	ndwidth				
MHz						
а	b	С	d			
17.535000	18.838000					
17.936000	20.040000					
18.437000	19.840000					
	17.535000 17.936000	a         b           17.535000         18.838000           17.936000         20.040000	a         b         c           17.535000         18.838000            17.936000         20.040000	MHz           a         b         c         d           17.535000         18.838000             17.936000         20.040000	MHz           a         b         c         d           17.535000         18.838000             17.936000         20.040000	MHz         d         d         1000000000000000000000000000000000000

Measurement uncertainty:	±2.81 dB
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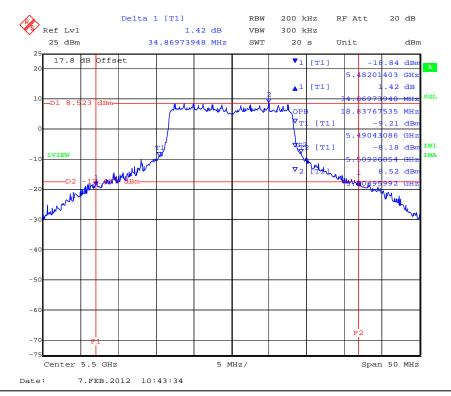


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:25 of 180



#### CHAIN A 5,500 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



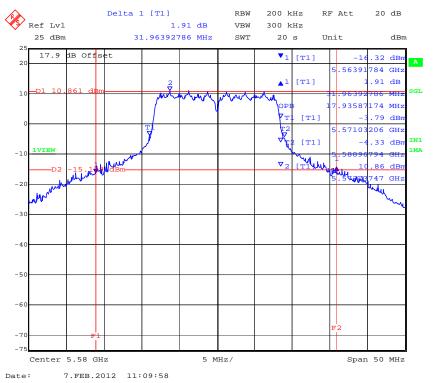


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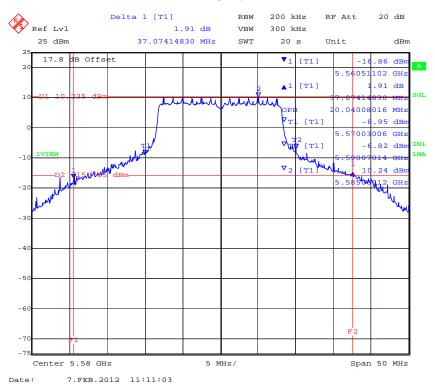


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:26 of 180

#### CHAIN A 5,580 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



#### CHAIN B 5,580 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



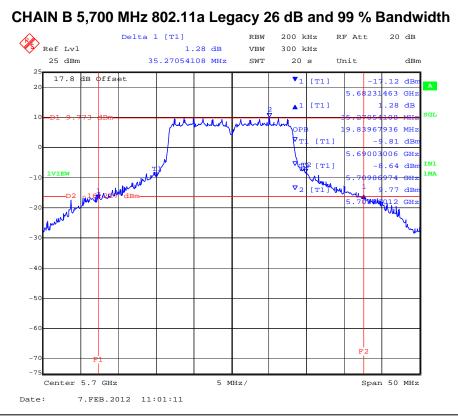
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#### Delta 1 [T1] RBW 200 kHz RF Att 20 dB Ref Lvl 2.94 dB 300 kHz VBW 35.07014028 MHz 25 dBm SWT 20 s Unit dBm 17.9 lB Offset **v**<sub>1</sub> 43 dB [T1] - 1 83 GH [T1] 94 dB **A**1 10 28 MH м. OF 375 MH 368 7-[T1] 33 dB 46 GH [T1] .61 dB MA -1( with ▼2 July . 99 dB . glab 08 GH -2 Ы - 3 -4 -50 -6 5 MHz/ Span 50 MHz Center 5.7 GHz Date: 7.FEB.2012 11:00:05

#### CHAIN A 5,700 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



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

### TABLE OF RESULTS - 802.11n HT-20 (5,250 - 5,350 MHz)

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-20	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8	dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

#### 26 dB Bandwidth

Toot Frequency		26 dB Ba	andwidth	Minimu	Minimum 6dB			
Test Frequency		М	Hz		Bandwid	dth Limit	Margin	
MHz	а	b	С	d	kHz MHz		MHz	
5260	33.667000	40.882000					-33.167000	
5300	31.764000	38.978000			500	0.5	-31.264000	
5320	33.567000	37.475000					-33.067000	

#### 99% Bandwidth

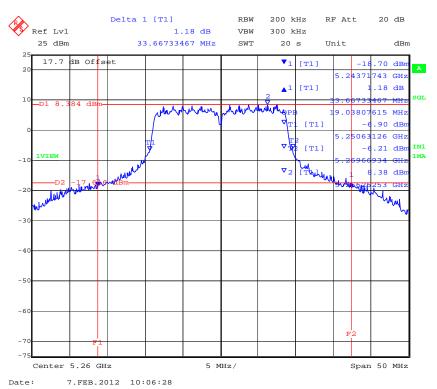
		99 % Ba	ndwidth			
Test Frequency	MHz					
MHz	а	b	С	d		
5260	19.038000	23.347000				
5300	18.838000	21.844000				
5320	18.938000	21.142000				

Measurement uncertainty:	±2.81 dB
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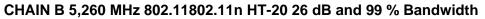
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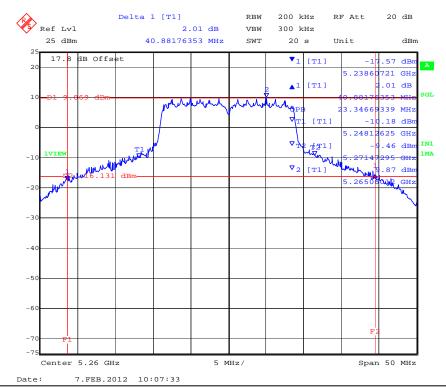


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:29 of 180



#### CHAIN A 5,260 MHz 802.11802.11n HT-20 26 dB and 99 % Bandwidth





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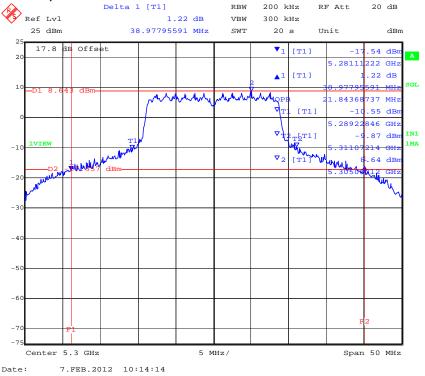


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:30 of 180

#### Delta 1 [T1] RBW 200 kHz RF Att 20 dB Ref Lvl 3.28 dB 300 kHz VBW 25 dBm 31.76352705 MHz SWT 20 s Unit dBm 17.7 dB Offset **v**<sub>1</sub> .62 dB [T1] -2 23 GH: 28363 [T1] .28 dB ▲1 1 ( م د MH Ð1 12 d man Minha ng: 535 MH [T1] 18 dB 26 GH $\nabla$ N1 [T1] .57 dB LMA -1( 21.1 $\nabla_2$ Maria 87 dB 07 CH -2 ww muy - 3 -4 -50 -60 -7 -7 Center 5.3 GHz 5 MHz/ Span 50 MHz Date: 7.FEB.2012 10:13:09

#### CHAIN A 5,300 MHz 802.11802.11n HT-20 26 dB and 99 % Bandwidth



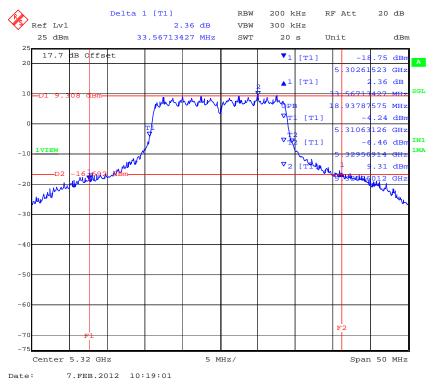


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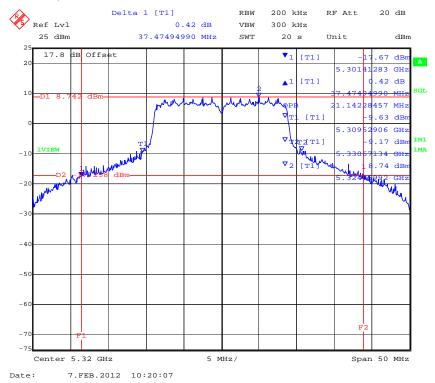


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:31 of 180

#### CHAIN A 5,320 MHz 802.11802.11n HT-20 26 dB and 99 % Bandwidth



#### CHAIN B 5,320 MHz 802.11802.11n HT-20 26 dB and 99 % Bandwidth



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### TABLE OF RESULTS - 802.11n HT-20 (5,470 - 5,725 MHz)

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-20	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8	dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

#### 26 dB Bandwidth

		26 dB Ba	andwidth	Minimu	ım 6dB	Morgin	
Test Frequency		м	Hz	Bandwidth Limit Margin			
MHz	а	b	С	d	kHz	MHz	MHz
5500	28.156000	35.571000					-27.656000
5580	29.158000	37.375000			500	0.5	-28.658000
5700	34.369000	38.477000					-33.869000

#### 99% Bandwidth

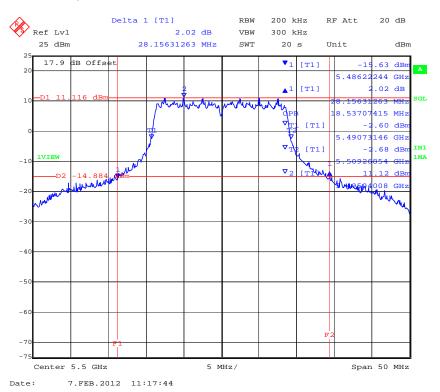
	99 % Ba	ndwidth				
MHz						
а	b	С	d			
18.537000	19.339000					
18.637000	20.641000					
19.238000	20.341000					
	18.537000 18.637000	a         b           18.537000         19.339000           18.637000         20.641000	a         b         c           18.537000         19.339000            18.637000         20.641000	MHz           a         b         c         d           18.537000         19.339000             18.637000         20.641000	MHz           a         b         c         d           18.537000         19.339000             18.637000         20.641000	MHz         d         e           a         b         c         d         e           18.537000         19.339000           18.637000         20.641000   -

Measurement uncertainty:	±2.81 dB
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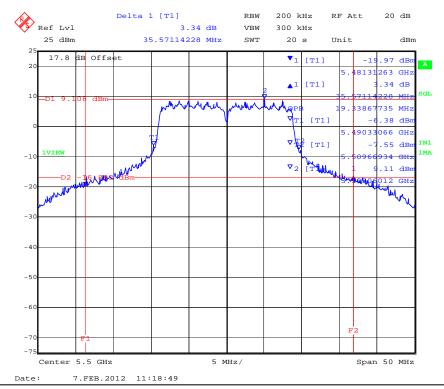


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:33 of 180



#### CHAIN A 5,500 MHz 802.11n HT-20 26 dB and 99 % Bandwidth

CHAIN B 5,500 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



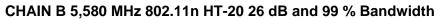
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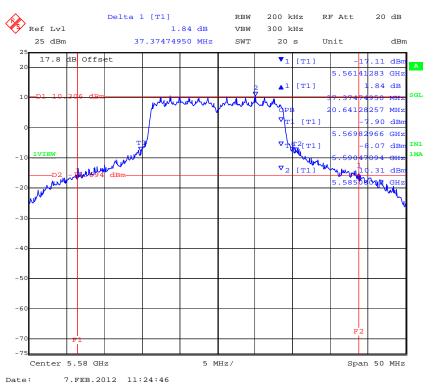


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:34 of 180

#### Delta 1 [T1] RBW 200 kHz RF Att 20 dB Ref Lvl 2.85 dB 300 kHz VBW 29.15831663 MHz 25 dBm SWT 20 s Unit dBm 17.9 B Offse **v**<sub>1</sub> 22 dB [T1] - 1 224 GH: [T1] .85 dB ▲1 10 MH A MIN Эf 455 MH 6372 4 [T1] 36 dB 26 GH $\nabla_{\tau}$ [T1] .95 dB MA -1( my ᢦ 12 dB 14,88 dit GH - 2 - 3 -4 -50 -6 5 MHz/ Center 5.58 GHz Span 50 MHz Date: 7.FEB.2012 11:23:41

#### CHAIN A 5,580 MHz 802.11n HT-20 26 dB and 99 % Bandwidth





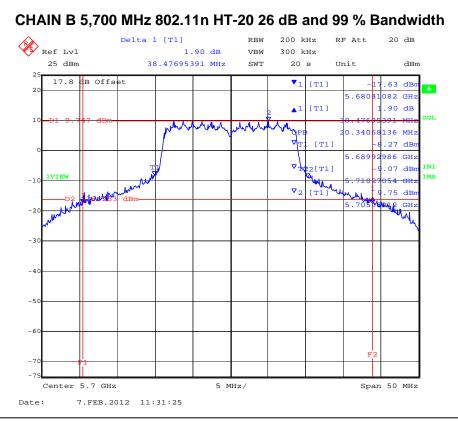
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#### Delta 1 [T1] RBW 200 kHz RF Att 20 dB Ref Lvl 0.92 dB 300 kHz VBW 34.36873747 MHz 25 dBm SWT 20 s Unit dBm 17.9 lB Offset **v**<sub>1</sub> .05 dB [T1] - 1 343 GH: [T1] .92 dB **A**1 v W Map 1 ( mound man 695 MH 2384 [T1] 17 dB 066 GH [T1] .44 dB MA -1( NW TYN $\nabla_2$ 68 dB GH -2 - 3 -4 -50 -6 -7 5 MHz/ Span 50 MHz Center 5.7 GHz Date: 7.FEB.2012 11:30:18

#### CHAIN A 5,700 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



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

### TABLE OF RESULTS - 802.11n HT-40

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-40	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8	dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

#### 26 dB Bandwidth

		26 dB Ba	andwidth	Minimu	ım 6dB		
Test Frequency	MHz				Bandwidth Limit Margin		
MHz	а	b	С	d	kHz	MHz	MHz
5270	68.737000	83.567000			500	0.5	-68.237000
5310	73.146000	83.367000			500	0.0	-72.646000

#### 99% Bandwidth

		99 % Ba	ndwidth			
Test Frequency		MHz				
MHz	а	b	С	d		
5270	36.874000	49.098000				
5310	37.475000	44.689000				

Measurement uncertainty:	±2.81 dB
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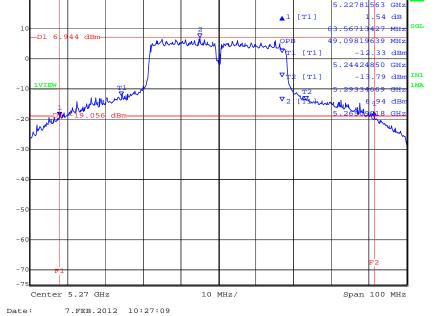
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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:37 of 180

#### RBW 200 kHz RF Att 20 dB Delta 1 [T1] Ref Lvl 2.41 dB VBW 300 kHz 25 dBm 68.73747495 MHz SWT 20 s Unit dBm 17.7 dB Offset ▼1 [T1] -21.55 dBm А 2 3482966 GH: [T1] .41 dB **^**1 1 95 MIT m the most D1 5. 39 1749 MH mmm [T1] .72 dB 5166333 GH V IN1 [T1] 91 dBr LVIEW 1MA - 1 V .64 dB 1263 GH undu hur 1.11 - 5 Center 5.27 GHz 10 MHz/ Span 100 MHz Date: 7.FEB.2012 10:26:04 Chain B 5,270 MHz 802.11n HT-40 26 dB and 99 % Bandwidth RBW 200 kHz RF Att 20 dB Delta 1 [T1] Ref Lvl VBW 1.54 dB 300 kHz 25 dBm 83.56713427 MHz SWT 20 s Unit dBm 17.8 dB Offset ▼1 [T1] -19.15 dB 20 Α 5.22781 63 GH: [T1] 54 dB ▲1 27 MH 6671 -D1 44 dBm min 9.09819 639 MH Mar [T1] .33 dB 5.24424 850 GH:

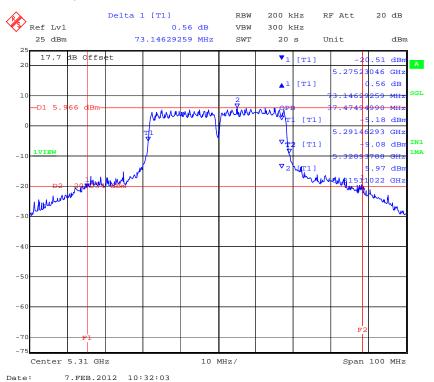
#### Chain A 5,270 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



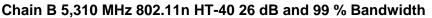
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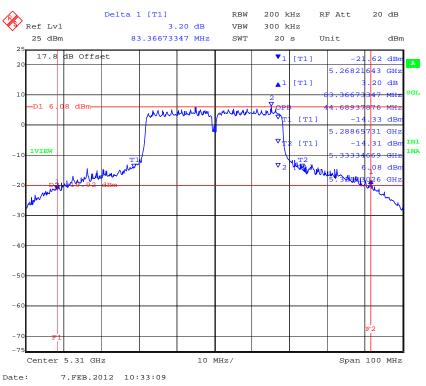


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:38 of 180



#### Chain A 5,310 MHz 802.11n HT-40 26 dB and 99 % Bandwidth





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

## TABLE OF RESULTS - 802.11n HT-40 (5470 - 5725 MHz)

Test Conditions:	15.247 (a)(2)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-40	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8	dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

#### 26 dB Bandwidth

Test Frequency		26 dB Bandwidth MHz				um 6dB dth Limit	Margin
MHz	а	b	с	d	kHz	MHz	MHz
5510	67.134000	78.758000					-66.634000
5550	65.130000	77.355000			500	0.5	-64.630000
5670	67.535000	69.339000					-67.035000

#### 99% Bandwidth

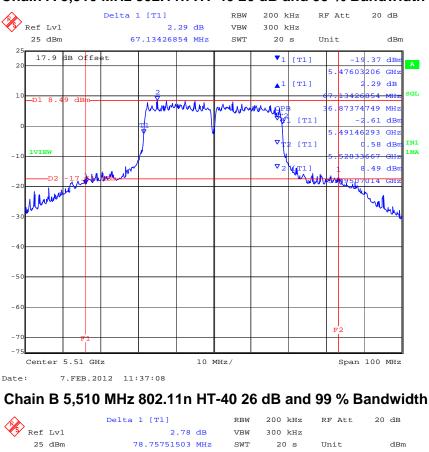
		99 % Ba	ndwidth				
Test Frequency		MHz					
MHz	а	b	С	d			
5510	36.874000	39.679000					
5550	36.874000	39.078000					
5670	36.673000	37.475000					

	Measurement uncertainty:	±2.81 dB
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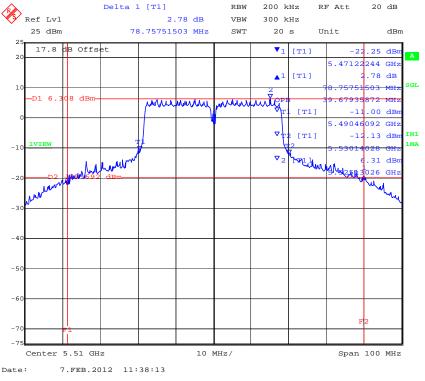
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#### Chain A 5,510 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



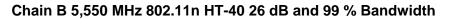
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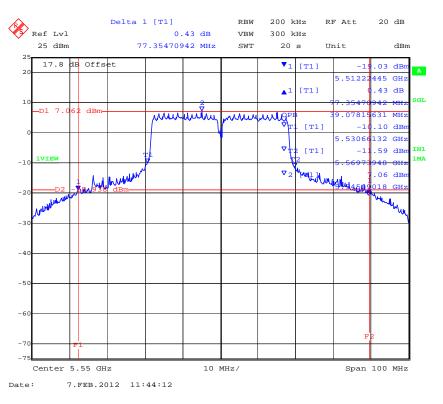


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:41 of 180

#### 200 kHz RF Att 20 dB Delta 1 [T1] RBW Ref Lvl 3.47 dB VBW 300 kHz 25 dBm 65.13026052 MHz 20 s Unit SWT dBm 17.9 dB Offset **v**1 [T1] .05 dB -20 5160 206 GH: [T1] 47 dB **^**1 7 dF muntury WMMM MMP 749 MH 873 [T1] 74 dB 293 GH $\nabla$ [T1] .01 dB IN1 1VIE -1 GH $\nabla_2$ Um Al .75 dB 57 GH -2 44 when ye MMW - 3 -40 -50 -60 -7 Center 5.55 GHz Span 100 MHz 10 MHz/ 7.FEB.2012 11:43:07 Date:

#### Chain A 5,550 MHz 802.11n HT-40 26 dB and 99 % Bandwidth





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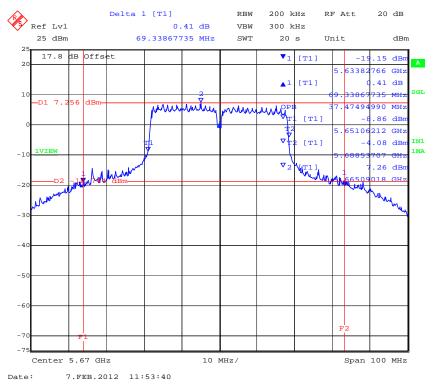


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:42 of 180

#### 200 kHz RF Att 20 dB Delta 1 [T1] RBW Ref Lvl 3.18 dB VBW 300 kHz 25 dBm 67.53507014 MHz 20 s Unit dBm SWT 17.9 dB Offset **v**1 77 dB [T1] -2 360 206 GH: [T1] .18 dB **^**1 -D1 6.2 85 dE 1 mm monthly 569 MH [T1] 63 dB 333 GH: $\nabla$ [T1] 51 dB IN1 1VIEW -1 GH $\nabla_2$ 29 dB т11 18 GH: -2 . And Unin Whathel -3 -4 -50 -60 -7 -7 Center 5.67 GHz 10 MHz/ Span 100 MHz Date: 7.FEB.2012 11:52:34

#### Chain A 5,670 MHz 802.11n HT-40 26 dB and 99 % Bandwidth

## Chain B 5,670 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



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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.

## Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement uncertainty	±2.81 dB
inououroni unoonunity	

#### Traceability

Method	Test Equipment Used
Measurements were made per work	0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117
instruction WI-03 'Measurement of RF	
Spectrum Mask'	

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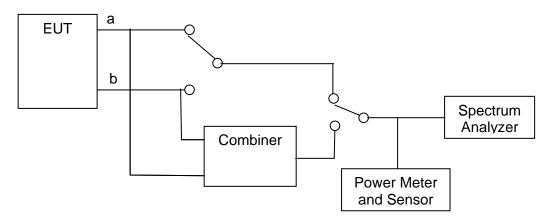
## 5.1.2. Transmit Output Power

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

## **Test Procedure**

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

## Test Measurement Set up



Measurement set up for Transmitter Output Power

Ambient conditions. Temperature: 17 to 23 °C	Relative humidity: 31 to 57 %	Pressure: 999 to 1012 mbar
EUT parameters. Power Level: Maximum Duty Cycle: 100% Temperature: Ambient		

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## Maximum Permissible Transmit Power

## FCC Limits and Industry Canada Limits

## Bands 5250 - 5350 and 5470 - 5725 MHz

Limit lesser of: 250 mW or 11 dBm + 10 log (B) dBm

Mode	Frequency Range (MHz)	Maximum 26 dB Bandwidth (MHz)	11 + 10 Log (B) (dBm)	Limit (dBm)
а		40.8	+27.1	+24.00
HT-20	5250 - 5350	40.9	+27.1	+24.00
HT-40	5470 – 5725	83.6	+30.2	+24.00

## **Output Power Reduction Required**

As a result of radiated band-edge measurements the output power was reduced from the original setting in order to bring the unit into compliance.

Operational	Band- Edge	Channel	Initial Power	Final Power
Mode	Frequency (MHz)	Frequency (MHz)	Setting	Setting
а	5,350	5,320	18	14.5
HT-20	5,350	5,320	18	14.0
	5,350	5,310	18	14.0
HT-40	5,460	5,510	18	16.5

The following power matrix takes into account the reduction in power as a result of the above findings.

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## Measurement Results for Transmit Output Power

## TABLE OF RESULTS – 802.11a Legacy

Test Conditions:	15.407 (a)(1)	Rel. Humidity (%):	35	to	42
Variant:	802.11 a	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test	Measured Peak Power				Total Pow	ver (dBm)	Limit	Margin
Frequency	RF Port (dBm)						Linin	inci gin
MHz	а	b	С	d	Combined	Calculated	dBm	dB
5260	16.68	17.93			N/A	20.36	24.00	-3.64
5300	16.53	17.03			N/A	19.80	24.00	-4.20
5320	14.21	13.60			N/A	16.93	24.00	-7.07

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

Test Conditions:	15.407 (a)(1)	Rel. Humidity (%):	35	to	42
Variant:	802.11 a	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5	.8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test	Measured Peak Power				Total Pow	ver (dBm)	Limit	Margin
Frequency	RF Port (dBm)							
MHz	а	b	c	d	Combined	Calculated	dBm	dB
5500	18.31	16.84			N/A	20.65	24.00	-3.35
5580	18.55	18.39	-		N/A	21.48	24.00	-2.52
5700	17.95	18.41			N/A	21.20	24.00	-2.80

Measurement uncertainty:	±1.33 dB

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## TABLE OF RESULTS - 802.11n HT20

Test Conditions:	15.407 (a)(1)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-20	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test	Measured Peak Power				Total Power (dBm)		Limit	Margin
Frequency	RF Port (dBm)					Linik	margin	
MHz	а	b	С	d	Combined	Calculated	dBm	dB
5260	16.61	17.82			N/A	20.27	24.00	-3.73
5300	16.59	16.98			N/A	19.80	24.00	-4.20
5320	13.89	13.10			N/A	16.52	24.00	-7.48

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

Test Conditions:	15.407 (a)(1)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-20	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5	.8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test	Measured Peak Power RF Port (dBm)				- Total Power (dBm)		Limit	Margin
Frequency							Linin	Margin
MHz	а	b	С	d	Combined	Calculated	dBm	dB
5500	18.30	16.86			N/A	20.65	24.00	-3.35
5580	18.34	18.34			N/A	21.35	24.00	-2.65
5700	17.96	18.42			N/A	21.21	24.00	-2.79

Measurement uncertainty: ±1.33 dB	
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## TABLE OF RESULTS - 802.11n HT-40

Test Conditions:	15.407 (a)(1)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-40	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test	N	leasured Po	eak Power		Total Power (dBm)		Limit	Margin
Frequency	RF Port (dBm)						j	
MHz	а	b	С	d	Combined	Calculated	dBm	dB
5270	17.17	17.88			N/A	20.55	24.00	-3.45
5310	13.26	13.58			N/A	16.43	24.00	-7.57

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

Test Conditions:	15.407 (a)(1)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-40	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (x):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8 dBi		
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test	N	leasured P	eak Power		Total Power (dBm)		Limit	Margin
Frequency		RF Port	(dBm)					
MHz	а	b	c	d	Combined	Calculated	dBm	dB
5510	17.10	16.46			N/A	19.80	24.00	-4.20
5550	18.16	18.08			N/A	21.13	24.00	-2.87
5670	17.34	18.27			N/A	20.84	24.00	-3.16

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

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## Specification

Limits

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

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

(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  $+11 \text{ dBm} + 10 \log B$ , 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.

## Industry Canada RSS-Gen 4.4

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

## Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB
measurement uncertainty	±1.33 UD

## Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117

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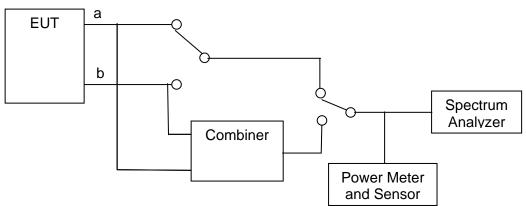
## 5.1.3. Peak Power Spectral Density

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

## **Test Procedure**

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

## Test Measurement Set up



Measurement set up for Peak Power Spectral Density

#### Measurement Results for Peak Power Spectral Density

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

Radio Parameters Duty Cycle: 100% Output: Modulated Carrier Power: Maximum Default Power

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## TABLE OF RESULTS - 802.11a Legacy (5250 - 5350 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 a	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8 dBi		
Applied Voltage:	48.0 Vdc	Antenna Ports (N):		2	
Notes 1:					
Notes 2:					

Test Frequency	N	Measured Peak Power RF Port (dBm)		Correction factor	Peak Power Spectral Density	Limit	Margin	
MHz	а	b	С	d	10Log(N)	dBm	dBm	dB
5260	4.36	5.92			3.01	8.93	11.00	-2.07
5300	4.54	4.48	-		3.01	7.55	11.00	-3.45
5320	5.39	4.46			3.01	8.40	11.00	-2.60

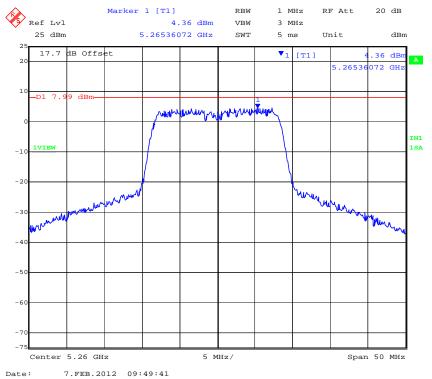
Measurement uncertainty:	±1.33 dB
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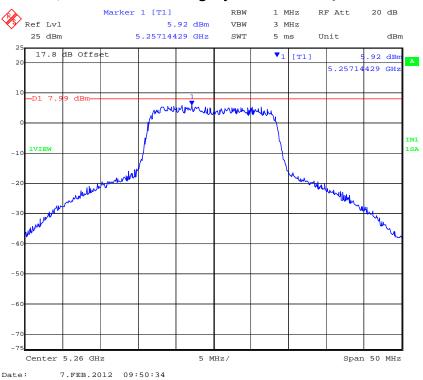


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## CHAIN A 5,260 MHz 802.11a Legacy Peak Power Spectral Density





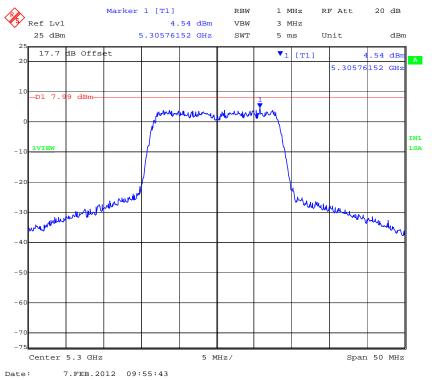


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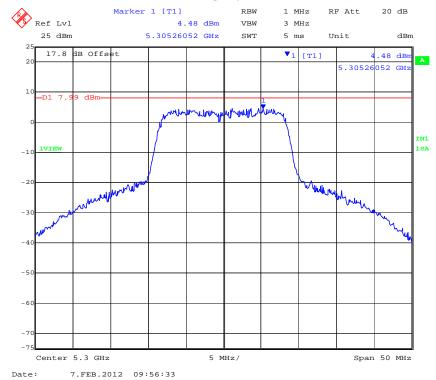


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:53 of 180

#### CHAIN A 5,300 MHz 802.11a Legacy Peak Power Spectral Density



#### CHAIN B 5,300 MHz 802.11a Legacy Peak Power Spectral Density

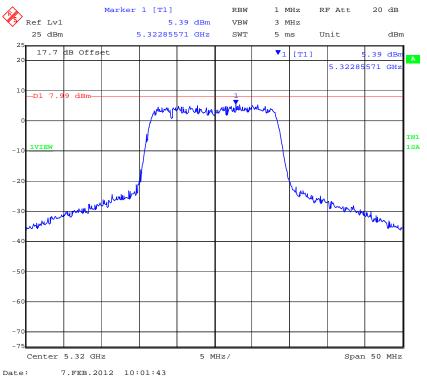


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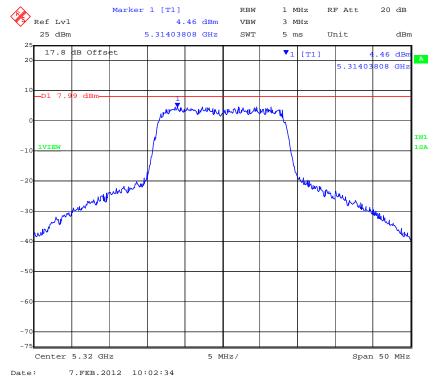


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:54 of 180









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## TABLE OF RESULTS - 802.11a Legacy (5470 - 5725 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 a	Ambient Temp. (ºC):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8 dBi		
Applied Voltage:	48.0 Vdc	Antenna Ports (N):		2	
Notes 1:					
Notes 2:					

N	leasured P	eak Power	•			Limit	Margin	
	RF Port	(dBm)		factor	Spectral Density	dBm	inc. giri	
а	b	С	d	10Log(N)	dBm	dBm	dB	
6.57	4.56			3.01	9.58	11.00	-1.42	
6.16	6.35			3.01	9.36	11.00	-1.64	
5.11	5.93			3.01	8.94	11.00	-2.06	
	<b>a</b> 6.57 6.16	a         b           6.57         4.56           6.16         6.35	RF Port (dBm)           a         b         c           6.57         4.56            6.16         6.35	RF Port (dBm)           a         b         c         d           6.57         4.56             6.16         6.35	a         b         c         d         10Log(N)           6.57         4.56           3.01           6.16         6.35           3.01	Bit Matrix         Correction factor         Power Spectral Density           a         b         c         d         10Log(N)         dBm           6.57         4.56           3.01         9.58           6.16         6.35           3.01         9.36	And Construction         Correction factor         Power Spectral Density         Limit           a         b         c         d         10Log(N)         dBm         dBm           6.57         4.56           3.01         9.58         11.00           6.16         6.35           3.01         9.36         11.00	

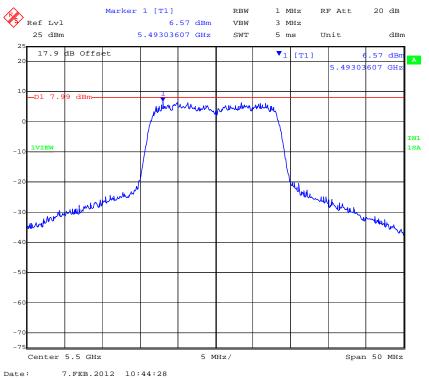
Measurement uncertainty:	±1.33 dB
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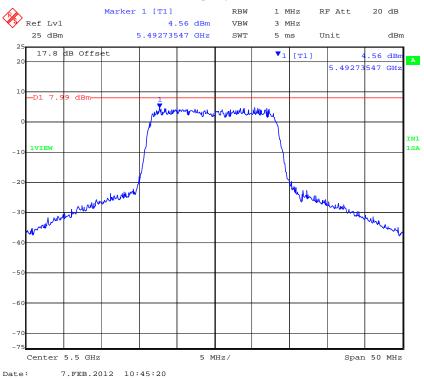


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:56 of 180

## CHAIN A 5,500 MHz 802.11a Legacy Peak Power Spectral Density





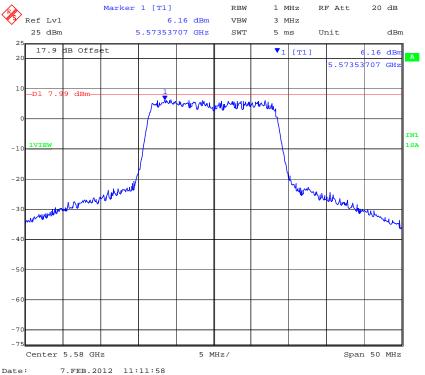


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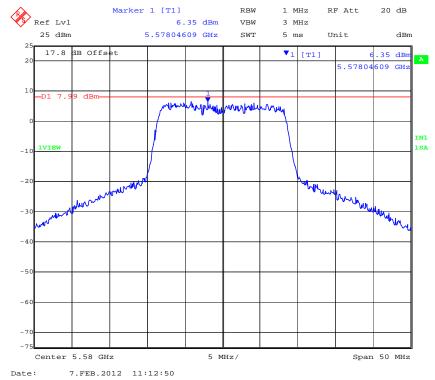


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:57 of 180

# CHAIN A 5,580 MHz 802.11a Legacy Peak Power Spectral Density





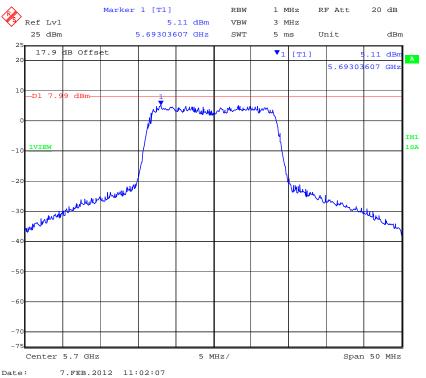


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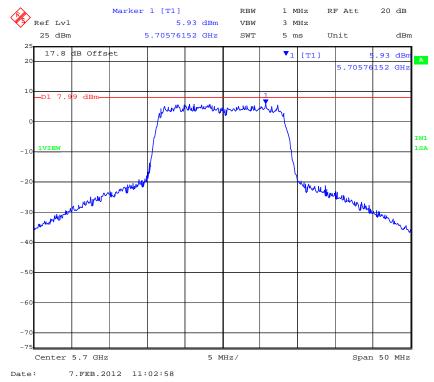


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:58 of 180





Chain B 5,700 MHz 802.11a Legacy Peak Power Spectral Density



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TABLE OF RESULTS - 802. 11n HT-20 (5250 - 5350 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-20	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	100		
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.8 dBi		
Applied Voltage:	48.0 Vdc	Antenna Ports (N):		2	
Notes 1:					
Notes 2:					

Test	Measured Peak Power				Correction factor		Limit	Margin
Frequency	RF Port (dBm)			Tactor	Spectral Density			
MHz	а	b	С	d	10Log(N)	dBm	dBm	dB
5260	4.42	5.47			3.01	8.48	11.00	-2.52
5300	3.39	4.47			3.01	7.48	11.00	-3.52
5320	4.70	4.29			3.01	7.71	11.00	-3.29

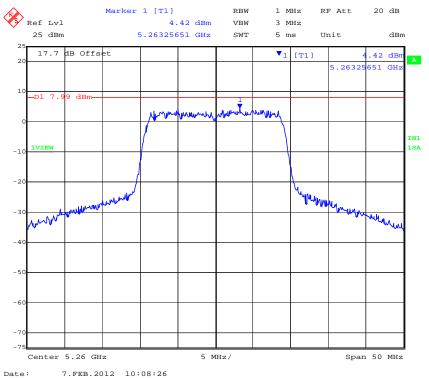
Measurement uncertainty:	±1.33 dB

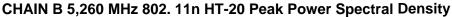
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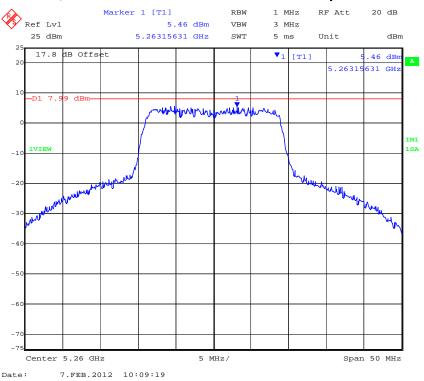


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:60 of 180

## CHAIN A 5,260 MHz 802. 11n HT-20 Peak Power Spectral Density





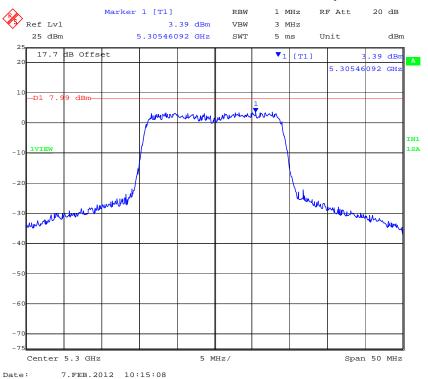


This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.

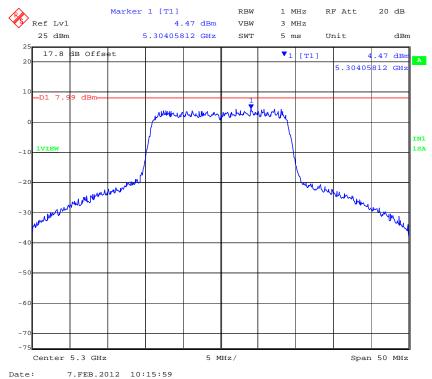


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:61 of 180

#### CHAIN A 5,300 MHz 802. 11n HT-20 Peak Power Spectral Density



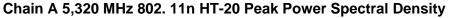
#### CHAIN B 5,300 MHz 802. 11n HT-20 Peak Power Spectral Density

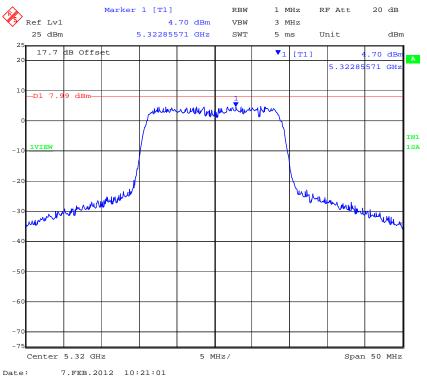


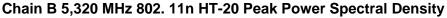
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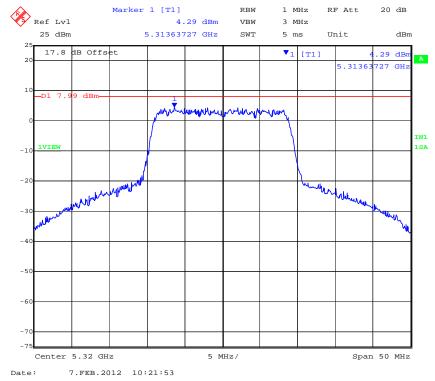


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:62 of 180









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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:63 of 180

## TABLE OF RESULTS - 802. 11n HT-20 (5470 - 5725 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-20	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	10	0	
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc	Antenna Ports (N):		2	
Notes 1:					
Notes 2:					

Test	Measured Peak Power				Correction		Limit	Margin
Frequency	RF Port (dBm)			factor	Spectral Density		margin	
MHz	а	b	С	d	10Log(N)	dBm	dBm	dB
5500	5.93	4.34			3.01	8.94	11.00	-2.06
5580	6.29	5.66			3.01	9.30	11.00	-1.70
5700	4.75	5.50			3.01	8.51	11.00	-2.49

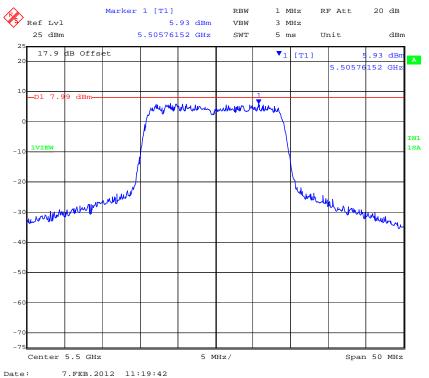
Measurement uncertainty:	±1.33 dB
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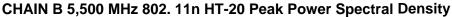
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.

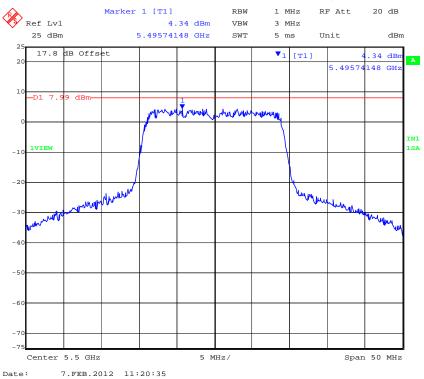


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:64 of 180

#### CHAIN A 5,500 MHz 802. 11n HT-20 Peak Power Spectral Density





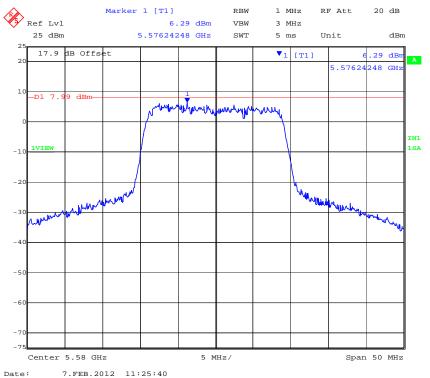


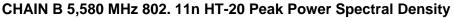
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.

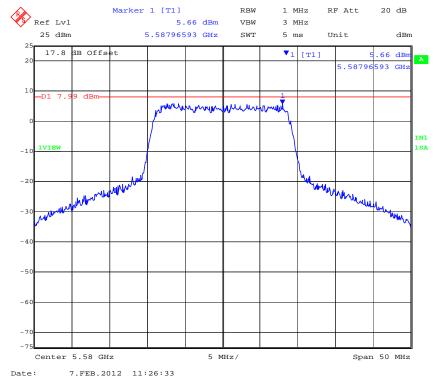


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:65 of 180

#### CHAIN A 5,580 MHz 802. 11n HT-20 Peak Power Spectral Density





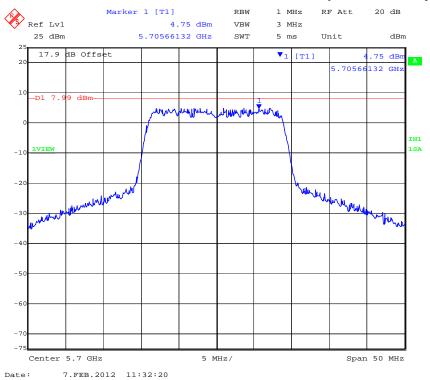


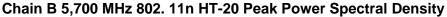
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.

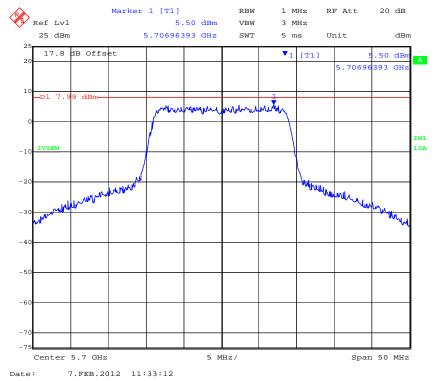


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:66 of 180

#### Chain A 5,700 MHz 802.11n HT-20 Peak Power Spectral Density







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TABLE OF RESULTS - 802. 11n HT-40 (5250 - 5350 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-40	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	10	0	
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc	Antenna Ports (N):		2	
Notes 1:					
Notes 2:					

Test	Measured Peak Power				Correction		Limit	Margin
Frequency	RF Port (dBm)				Spectral Density		ina gin	
MHz	а	b	С	d	10Log(N)	dBm	dBm	dB
5270	1.94	2.55			3.01	5.56	11.00	-5.44
5310	1.61	2.11			3.01	5.12	11.00	-5.88

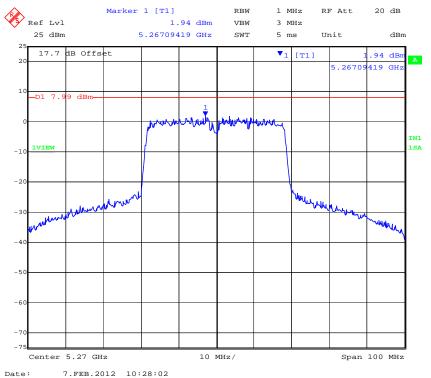
Measurement uncertainty:	±1.33 dB
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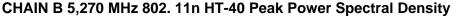
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. Any changes will be noted in the Document History section of the report.

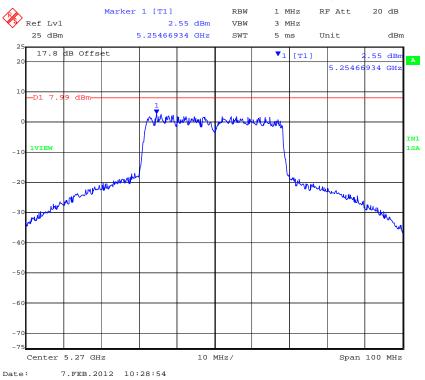


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:68 of 180

#### CHAIN A 5,270 MHz 802. 11n HT-40 Peak Power Spectral Density



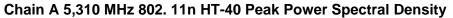


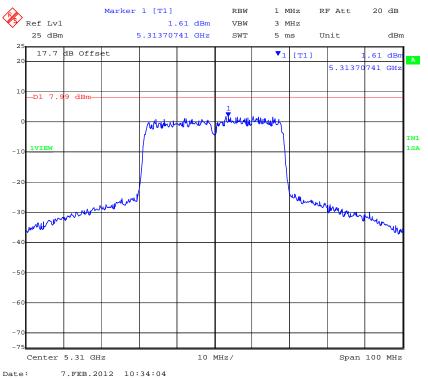


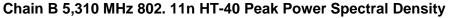
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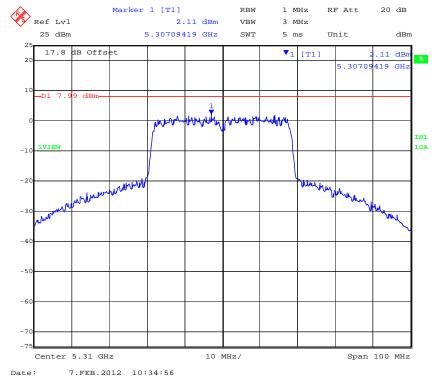


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:69 of 180









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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:70 of 180

TABLE OF RESULTS - 802. 11n HT-40 (5470 - 5725 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-40	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	10	0	
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc	Antenna Ports (N):		2	
Notes 1:					
Notes 2:					

Test Frequency	Measured Peak Power RF Port (dBm)				Peak Power Spectral Density	Limit	Margin	
MHz	а	b	С	d	10Log(N)	dBm	dBm	dB
5510	3.23	1.98			3.01	6.24	11.00	-4.76
5550	2.51	2.27			3.01	5.52	11.00	-5.48
5670	2.01	2.66			3.01	5.67	11.00	-5.33

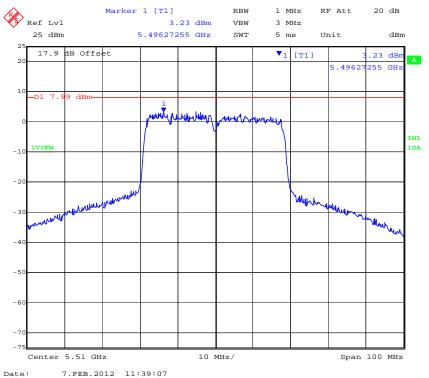
Measurement uncertainty:	±1.33 dB
-	

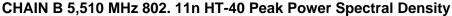
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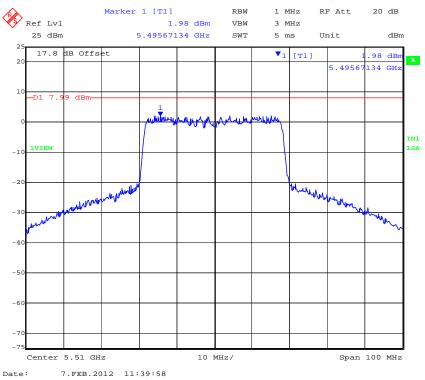


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:71 of 180

#### CHAIN A 5,510 MHz 802. 11n HT-40 Peak Power Spectral Density





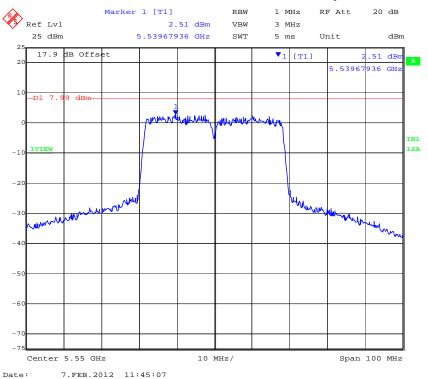


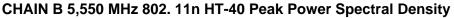
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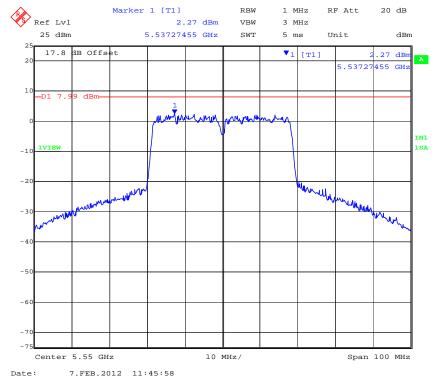


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:72 of 180

#### CHAIN A 5,550 MHz 802. 11n HT-40 Peak Power Spectral Density





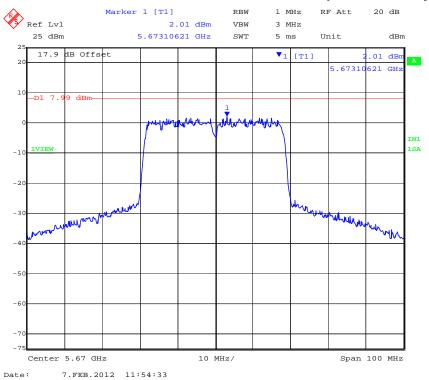


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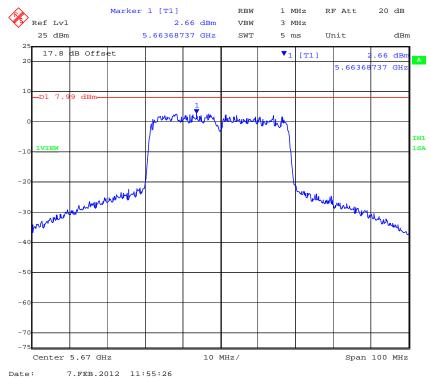


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:73 of 180

#### Chain A 5,670 MHz 802.11n HT-40 Peak Power Spectral Density



#### Chain B 5,670 MHz 802. 11n HT-40 Peak Power Spectral Density



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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

## Laboratory Measurement Uncertainty for Spectral Density

Measurement uncertainty	±1.33 dB
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## Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117

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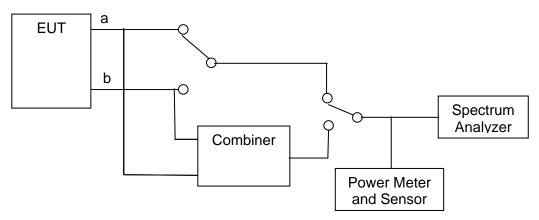
# 5.1.4. Peak Excursion Ratio

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

#### **Test Procedure**

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

## **Test Measurement Set up**



Measurement set up for Peak Excursion Ratio

## **Measurement Results for Peak Excursion Ratio**

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

Radio Parameters Duty Cycle: 100% Output: Modulated Carrier Power: Maximum Default Power

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TABLE OF RESULTS - 802.11a Legacy (5250 - 5350 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 a	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	10	0	
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

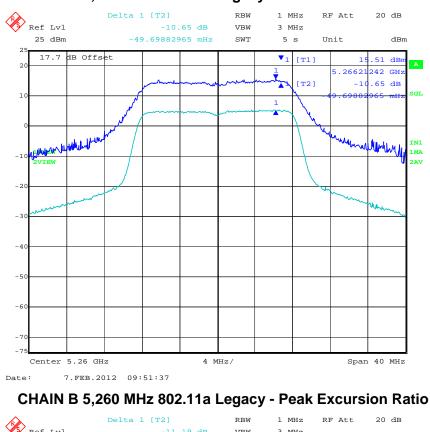
Test	Test Trace Δ Marker					Margin	
Frequency	Port A	Port B	Port C	Port D	Limit	nt Margin	
MHz	dB	dB	dB	dB	dB	dB	
5260	-10.65	-11.19				-1.81	
5300	-10.10	-11.72			-13.00	-1.28	
5320	-10.18	-11.63				-1.38	

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

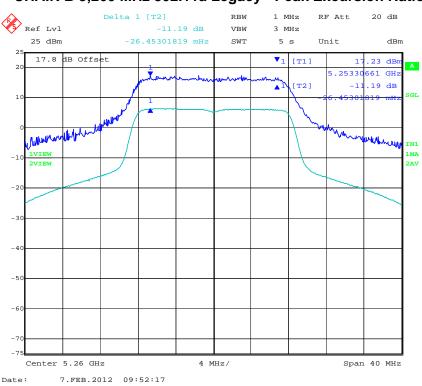
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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:77 of 180



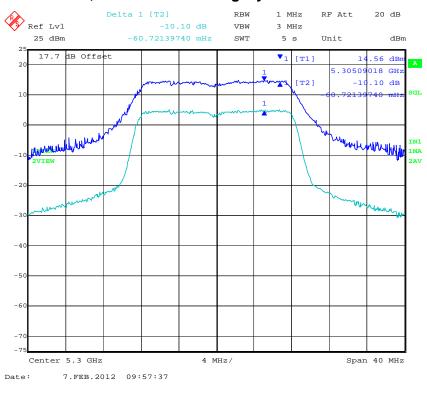
#### CHAIN A 5,260 MHz 802.11a Legacy - Peak Excursion Ratio



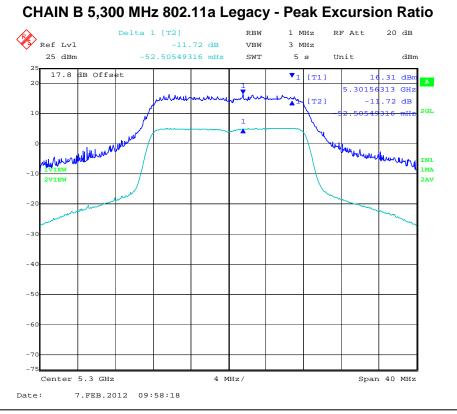
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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:78 of 180



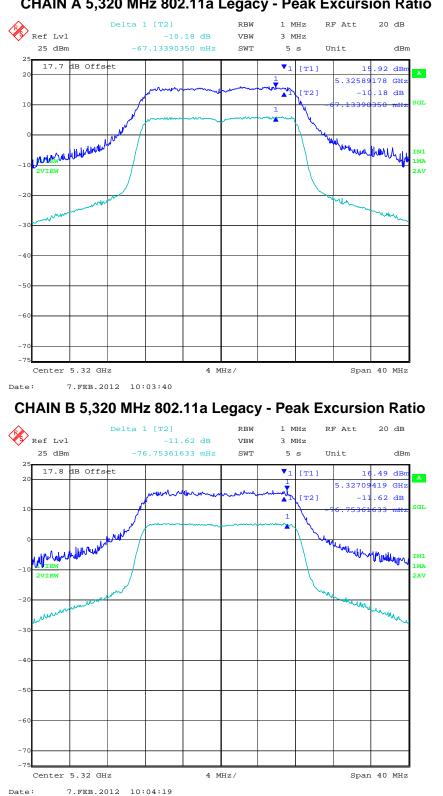
#### CHAIN A 5,300 MHz 802.11a Legacy - Peak Excursion Ratio



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Title: Aruba AP-93H 802.11a/b/g/n Wireless AP To: FCC 47 CFR Part 15.407 & IC RSS-210 Serial #: ARUB91-U1 Rev A **Issue Date:** 16<sup>th</sup> February 2012 Page: 79 of 180



CHAIN A 5,320 MHz 802.11a Legacy - Peak Excursion Ratio

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### TABLE OF RESULTS - 802.11a Legacy (5470 - 5725 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 a	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	10	0	
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

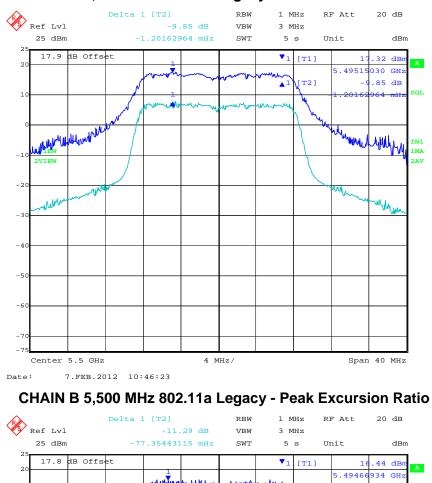
Test	st Trace Δ Marker					Margin	
Frequency	Port A	Port B	Port C	Port D	Limit	Margin	
MHz	dB	dB	dB	dB	dB	dB	
5500	-9.85	-11.29				-1.71	
5580	-10.87	-11.60			-13.00	-1.40	
5700	-10.80	-11.80				-1.20	

Measurement uncertainty:	±1.33 dB
•	

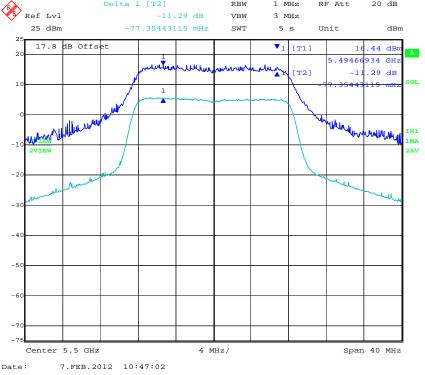
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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:81 of 180



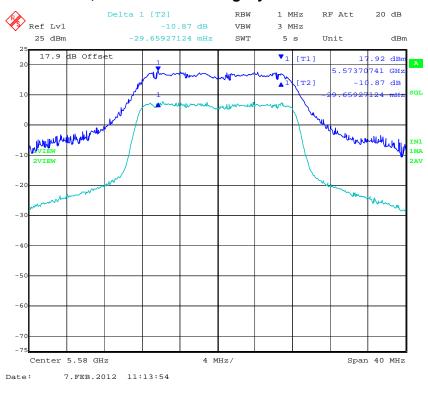
#### CHAIN A 5,500 MHz 802.11a Legacy - Peak Excursion Ratio



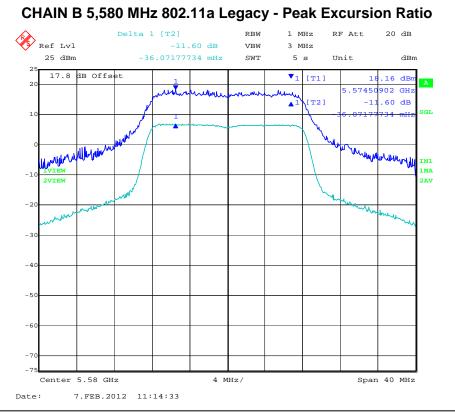
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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:82 of 180



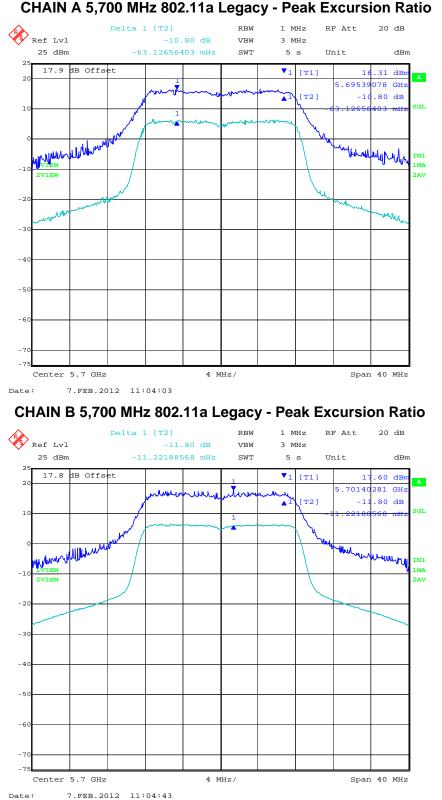
#### CHAIN A 5,580 MHz 802.11a Legacy - Peak Excursion Ratio



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CHAIN & 5 700 MHz 902 11a Lagoov Book Exourcion Potic

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#### TABLE OF RESULTS - 802. 11n HT-20 (5250 - 5350 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-20	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	10	0	
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test Trace Δ Marker					Limit	Margin
Frequency	Port A	Port B	Port C	Port D		Margin
MHz	dB	dB	dB	dB	dB	dB
5260	-10.79	-10.37				-2.22
5300	-11.11	-10.42			-13.00	-1.90
5320	-10.39	-10.43				-2.57

Measurement uncertainty:	±1.33 dB
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-4

-5

-6

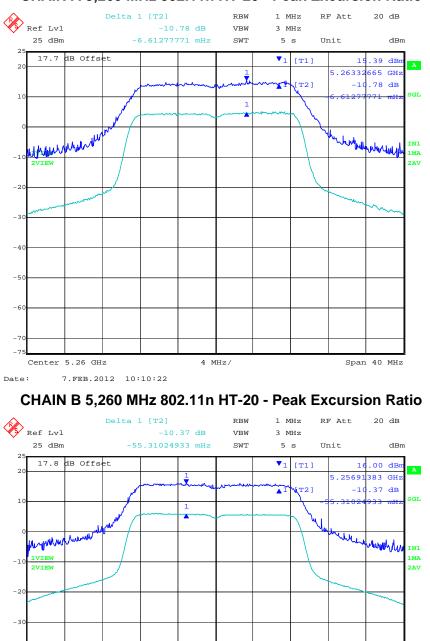
-7 -7

Date:

Center 5.26 GHz

7.FEB.2012 10:11:02

Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:85 of 180



#### CHAIN A 5,260 MHz 802.11n HT-20 - Peak Excursion Ratio

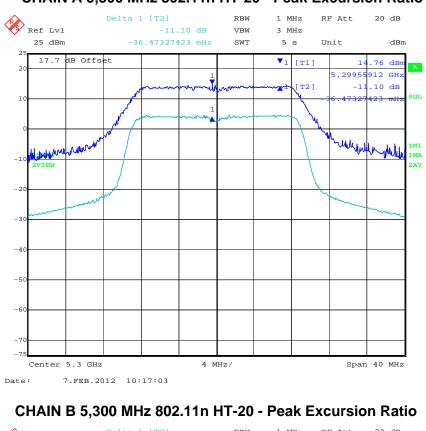
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4 MHz/

Span 40 MHz



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#### Delta 1 [T2] RBW 1 MHz RF Att 20 dB Ref Lvl -10.42 dB VBW 3 MHz 25 dBm -20.84159851 mHz SWT 5 s Unit dBm 25 17.8 dB Offset ▼1 [T1] 15.08 dB А 20 5.30260521 GH: 1 T2] -10.42 dB 1 1 the MM will m maple INJ LMA -1 2VIEW -21 - 3 -41 -51 -61 Span 40 MHz Center 5.3 GHz 4 MHz/ 7.FEB.2012 10:17:43 Date:

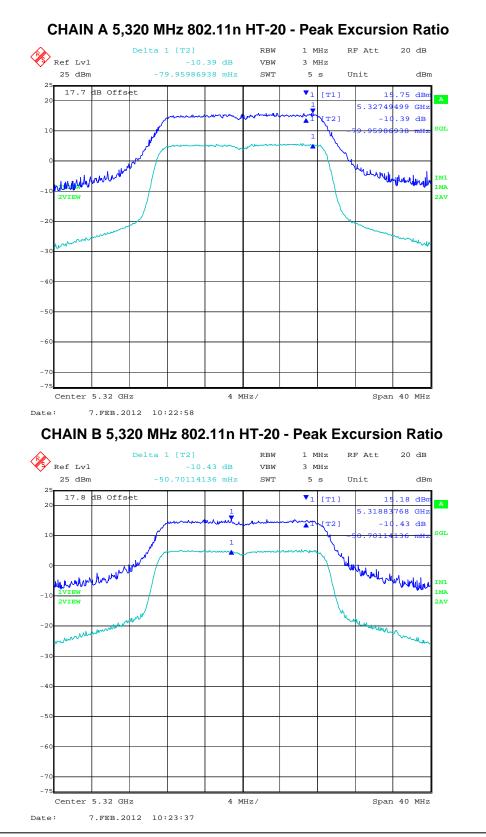
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#### CHAIN A 5,300 MHz 802.11n HT-20 - Peak Excursion Ratio



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### TABLE OF RESULTS - 802.11n HT-20 (5470 - 5725 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-20	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	10	0	
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test		Trace Δ	Marker		Limit	Margin
Frequency	Port A	Port B	Port C	Port D		Margin
MHz	dB	dB	dB	dB	dB	dB
5500	-11.65	-10.38				-1.35
5580	-10.73	-10.76			-13.00	-2.24
5700	-11.60	-11.64				-1.36

Measurement uncertainty:	±1.33 dB
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-6

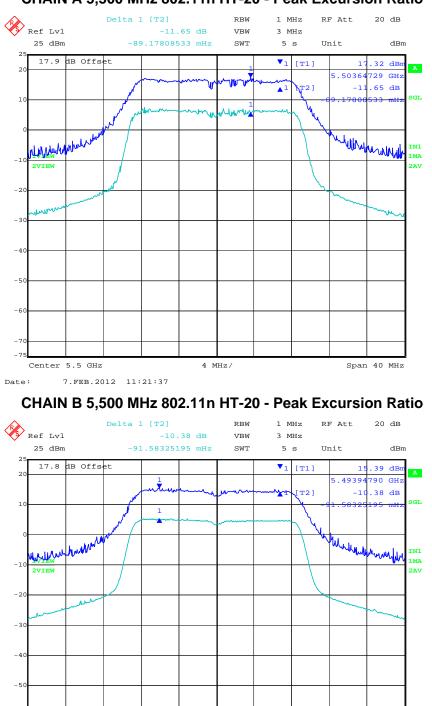
-7 -7

Date:

Center 5.5 GHz

7.FEB.2012 11:22:17

Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:89 of 180



#### CHAIN A 5,500 MHz 802.11n HT-20 - Peak Excursion Ratio

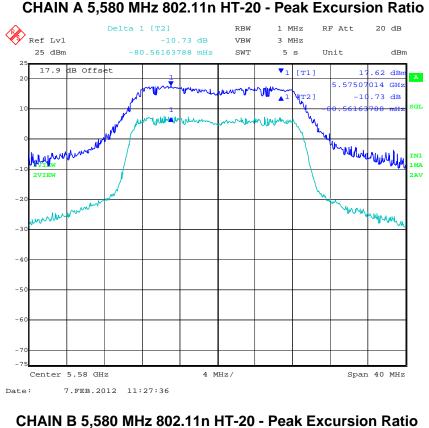
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4 MHz/

Span 40 MHz



Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:90 of 180

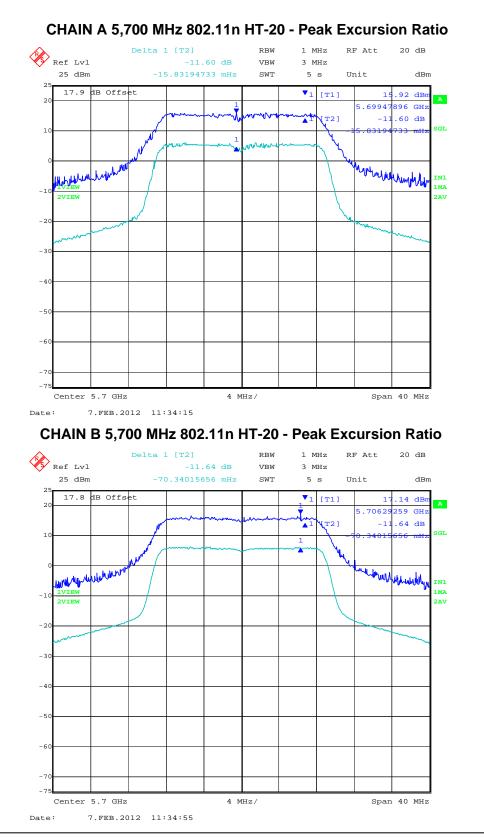


#### Delta 1 [T2] RBW 1 MHz RF Att 20 dB Ref Lvl -10.76 dB VBW 3 MHz 25 dBm -52.90603638 mHz SWT 5 s Unit dBm 25 17.8 dB Offset ▼1 [T1] 16.63 dB А 20 5.58661323 GH: Ż. -10.76 dB т2] **^**1 walken undy. hu Ma Man INJ IVIEW ιма -1 2VIEW 2AV -2 1.1 - 3 -4 -5 -61 4 MHz/ Span 40 MHz Center 5.58 GHz 7.FEB.2012 11:28:15 Date:

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TABLE OF RESULTS - 802. 11n HT-40 (5250 - 5350 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-40	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	10	0	
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test		Trace Δ	Marker		Limit	Margin
Frequency	Port A	Port B	Port C	Port D	Linit	margin
MHz	dB	dB	dB	dB	dB	dB
5270	-10.82	-10.45			-13.00	-2.18
5310	-10.40	-11.43			-13.00	-1.57

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

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-21

-31

-4

-5

-6

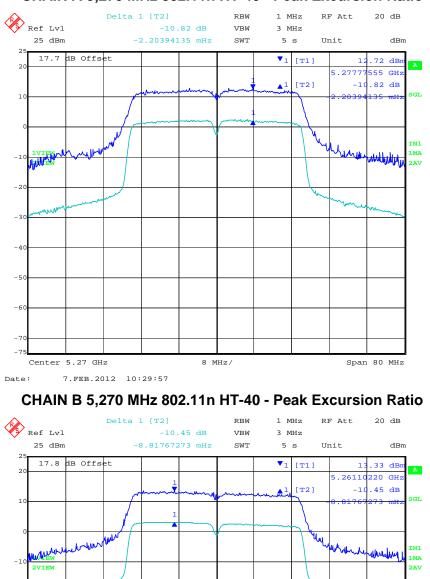
-7 -7

Date:

Center 5.27 GHz

7.FEB.2012 10:30:36

Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:93 of 180



#### CHAIN A 5,270 MHz 802.11n HT-40 - Peak Excursion Ratio

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8 MHz/

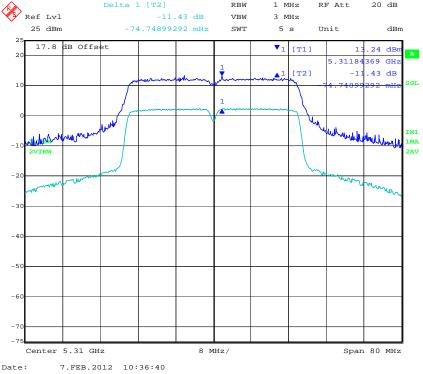
Span 80 MHz



Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:94 of 180



#### CHAIN A 5,310 MHz 802.11n HT-40 - Peak Excursion Ratio



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### TABLE OF RESULTS - 802.11n HT-40 (5470 - 5725 MHz)

Test Conditions:	15.407 (a)	Rel. Humidity (%):	35	to	42
Variant:	802.11 n HT-40	Ambient Temp. (°C):	19	to	22
TPC:	HIGH	Pressure (mBars):	998	to	1003
Modulation:	ON	Duty Cycle (%):	10	0	
Beam Forming Gain (Y):	N/A dB	Antenna Gain:	5.	8 dBi	
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test		Trace Δ	Marker		Limit	Margin	
Frequency	Port A	Port B	Port C	Port D		wargin	
MHz	dB	dB	dB	dB	dB	dB	
5510	-11.08	-11.02				-1.92	
5550	-11.99	-11.34			-13.00	-1.01	
5670	-12.54	-10.71				-0.46	

Measurement uncertainty:	±1.33 dB

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- 4

-5

-6

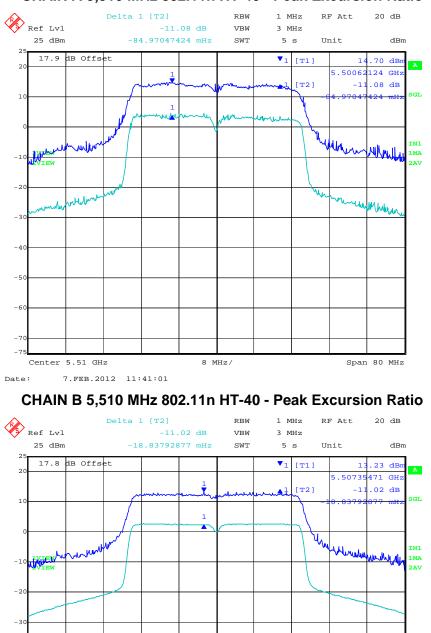
-7 -7

Date:

Center 5.51 GHz

7.FEB.2012 11:41:41

Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:96 of 180



#### CHAIN A 5,510 MHz 802.11n HT-40 - Peak Excursion Ratio

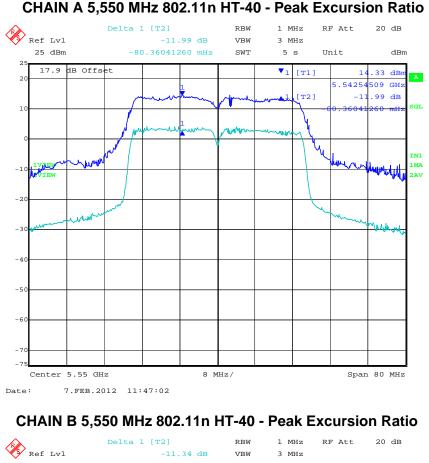
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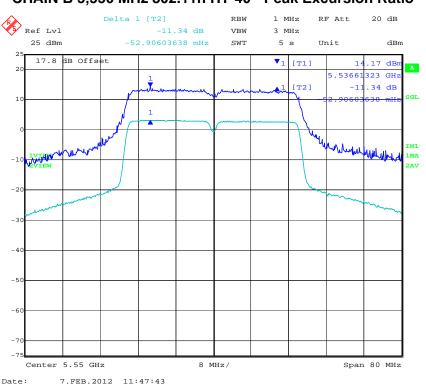
8 MHz/

Span 80 MHz



Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:97 of 180

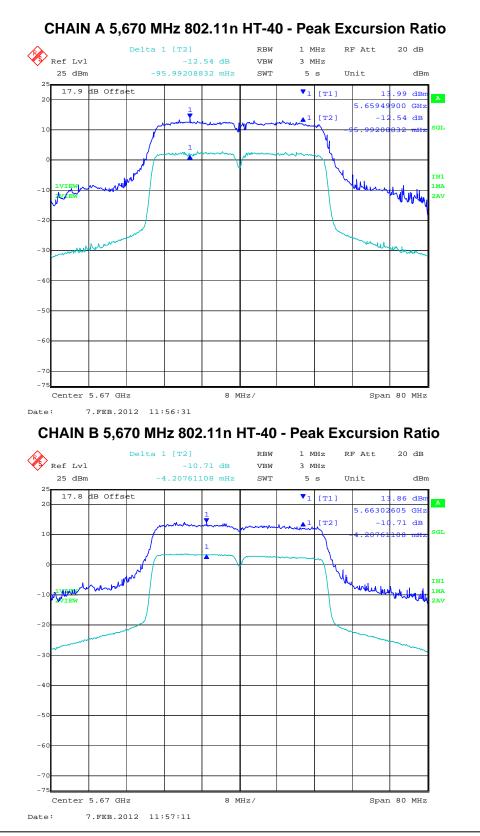




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# **Specification**

Limits

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

# Laboratory Measurement Uncertainty for Spectrum Measurement

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

## Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0158, 0287, 0252, 0313, 0314, 0070, 0116, 0117



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### 5.1.5. Frequency Stability

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

#### **Test Procedure**

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

#### **Manufacturer Declaration**

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

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

## **Specification**

#### Limits

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

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## 5.1.6. Maximum Permissible Exposure

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

# **Calculations for Maximum Permissible Exposure Levels**

Power Density = Pd (mW/cm<sup>2</sup>) = EIRP/( $4\pi d^2$ )

EIRP = P \* G \* 2

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

Numeric Gain =  $10 \wedge (G (dBi)/10)$ 

The Aruba AP93 has two transmitters. The peak power in the table below is calculated by assuming a worst case scenario where the two transmitters are operating simultaneously in the same band. The Peak Power in mW is calculated by taking the maximum conducted power measured in each band and multiplying by 2.

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0  $\rm mW/cm^2$ 

Antenna Gain (dBi)	Antenna Gain	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) @ 20cm mW/cm <sup>2</sup>
5250 - 5350	5.8	3.8	+20.55	113.5	0.086
5470 - 5725	5.8	3.8	+21.48	140.6	0.11

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

# Specification Maximum Permissible Exposure Limits

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

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

#### Laboratory Measurement Uncertainty for Power Measurements

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

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# 5.1.7. Radiated Emissions

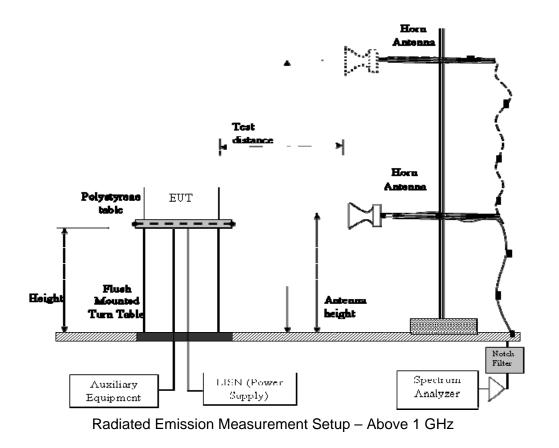
#### FCC, Part 15 Subpart C §15.407(b)(2), §15.205(a)/15.209(a) Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7

#### **Test Procedure**

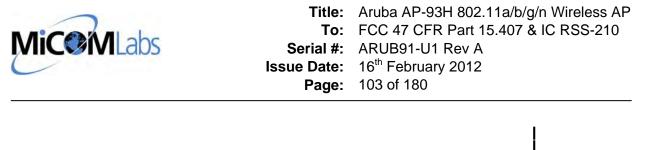
Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak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

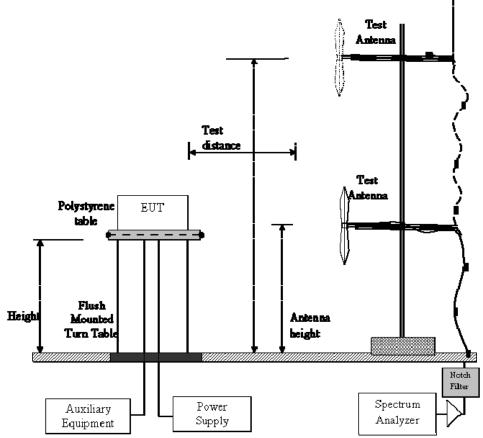
Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR compliant receiver. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Emissions from 30 MHz – 1000 MHz are measured utilizing 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.

#### **Test Measurement Set Up**



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Radiated Emission Measurement Setup – Below 1 GHz

## **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

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

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

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

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

40 dB $\mu$ V/m = 100  $\mu$ V/m 48 dB $\mu$ V/m = 250  $\mu$ V/m

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

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

where P is the EIRP in Watts

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

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

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#### Specification

### **Radiated Spurious Emissions**

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

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

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

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

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

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

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

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

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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

### Laboratory Measurement Uncertainty for Spectrum Measurement

**Measurement Uncertainty** +5.6/-4.5 dB

#### Traceability:

Method	Test Equipment Used	
Work instruction WI-03	0088, 0158, 0134, 0304, 0311, 0315, 0310, 0312	

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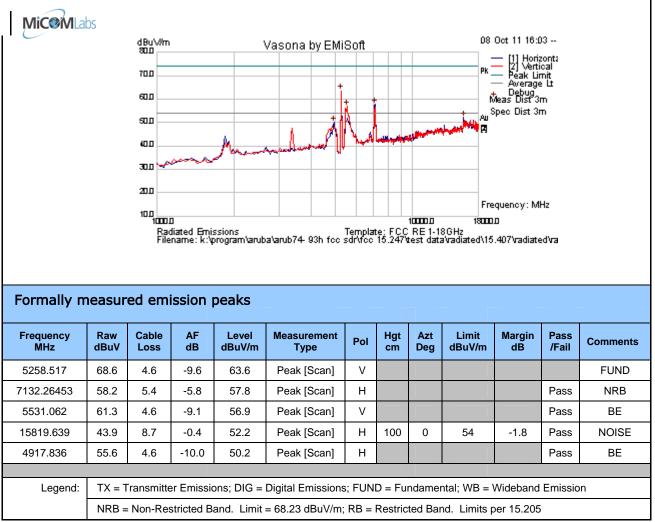


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### 5.1.7.1. Radiated Spurious Emissions – Above 1 GHz

#### 5250 - 5350 MHz, 802.11a Legacy

Test Freq.	5260 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			

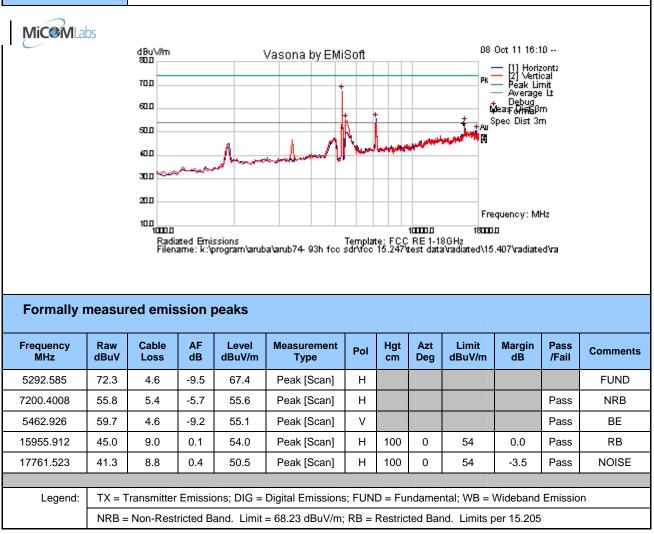


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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:108 of 180

Test Freq.	5300 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (°C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			



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Test Freq.	5320 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			

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Formally		red emis	ssion	peaks		Templat sdr\fcc		RE 1-1: test data	8GHz a\radiated\15	i.407\radiate		
	Raw dBuV				Measurement Type	Templat sdr\foc	te: FCC 15.2479 Hgt cm				ed'va Pass /Fail	Comment
Frequency	Raw	red emis Cable	SSION	peaks	Measurement		Hgt	RE 1-1: test data	8GHz avadiated\15	.407'vadiate	Pass	Comment
Frequency MHz	Raw dBuV	r <b>ed emis</b> Cable Loss	AF dB	peaks Level dBuV/m	Measurement Type	Pol	Hgt	RE 1-1: test data	8GHz avadiated\15	.407'vadiate	Pass	
Frequency MHz 5326.653	<b>Raw</b> <b>dBuV</b> 72.0	red emis Cable Loss 4.6	AF dB -9.5	Level dBuV/m 67.2	Measurement Type Peak [Scan]	Pol H	Hgt	RE 1-1: test data	8GHz avadiated\15	.407'vadiate	Pass /Fail	FUND
Frequency MHz 5326.653 5531.062	Raw dBuV           72.0           60.3	red emis Cable Loss 4.6 4.6	AF dB -9.5 -9.1	Level dBuV/m 67.2 55.9	Measurement Type Peak [Scan] Peak [Scan]	Pol H V	Hgt cm	Azt Deg	8GHz Vradiated\15	Margin dB	Pass /Fail Pass	FUND BE
Frequency MHz 5326.653 5531.062 16569.138 4985.972	Raw dBuV           72.0           60.3           41.8	red emis Cable Loss 4.6 4.6 8.8	<b>AF</b> <b>dB</b> -9.5 -9.1 0.4	Level dBuV/m           67.2           55.9           51.0	Measurement Type Peak [Scan] Peak [Scan] Peak [Scan]	Pol H V H	Hgt cm	Azt Deg	8GHz Vradiated\15	Margin dB	Pass /Fail Pass Pass	BE
Frequency MHz 5326.653 5531.062 16569.138 4985.972	Raw dBuV           72.0           60.3           41.8           54.2	<b>Cable</b> Loss 4.6 4.6 8.8 4.6	AF dB -9.5 -9.1 0.4 -9.9	Level dBuV/m           67.2           55.9           51.0           48.9	Measurement Type Peak [Scan] Peak [Scan] Peak [Scan] Peak [Scan]	Pol H V H	Hgt cm 100	Azt Deg	BGHz Vradiated\15	Margin dB -3.0	Pass /Fail Pass Pass	FUND BE NOISE BE
Frequency MHz 5326.653	<b>Raw</b> <b>dBuV</b> 72.0	red emis Cable Loss 4.6	AF dB -9.5	Level dBuV/m 67.2	Measurement Type Peak [Scan]	Pol H	Hgt	RE 1-1: test data	8GHz avadiated\15	.407'vadiate	Pass /Fail	FUND
Frequency MHz           5326.653           5531.062           16569.138           4985.972           15989.980	Raw dBuV           72.0           60.3           41.8           54.2           50.3	<b>Cable</b> Loss 4.6 4.6 8.8 4.6 9.0	AF dB -9.5 -9.1 0.4 -9.9 0.2	Level dBuV/m           67.2           55.9           51.0           48.9           59.6	Measurement Type         Peak [Scan]         Peak [Scan]         Peak [Scan]         Peak [Scan]         Peak [Scan]         Peak [Scan]	Pol H V H	Hgt cm 100 104	Azt Deg 0 336	BGHz Vradiated\15 Limit dBuV/m 54 74	Margin dB -3.0 -14.4	Pass /Fail Pass Pass Pass	FUND BE NOISE BE RB

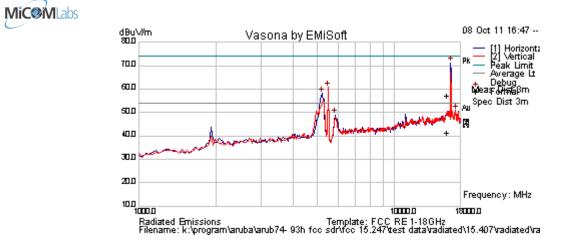
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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:110 of 180

# 5470 - 5725 MHz, 802.11a Legacy

Test Freq.	5500 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			



Formally measured emissio	n peaks
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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
16535.070	62.1	8.8	0.3	71.2	Peak [Scan]	Н					Pass	NRB
5496.99399	65.3	4.6	-9.2	60.8	Peak [Scan]	Н						FUND
5190.381	63.1	4.6	-9.6	58.1	Peak [Scan]	н					Pass	BE
17284.569	40.9	8.6	1.3	50.9	Peak [Scan]	н	100	0	54	-3.1	Pass	NOISE
5837.675	53.0	4.8	-8.8	49.0	Peak [Scan]	Н					Pass	BE
Legend:	TX = T	ransmitter	Emissi	ons; DIG =	Digital Emissions	s; FUN	D = Fu	ndame	ntal; WB =	Wideband	Emissio	n
	NRB =	Non-Rest	ricted B	and. Limit	= 68.23 dBuV/m;	RB =	Restric	ted Bar	nd. Limits p	per 15.205		

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Test Freq.	5590 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			

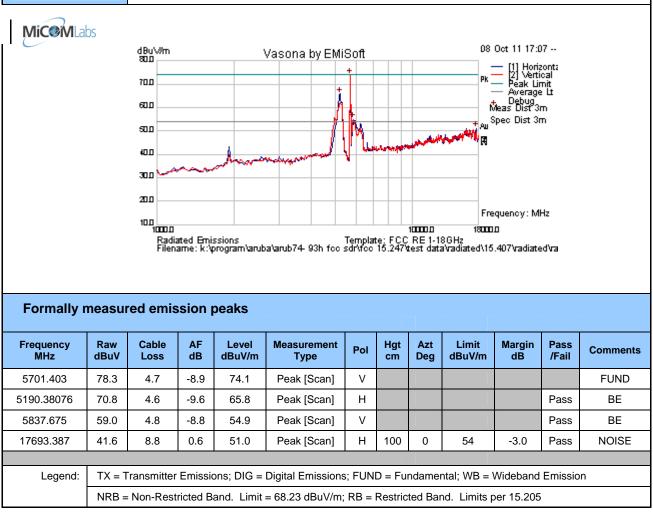
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Frequency: MHz 1000 Radiated Emissions Filename: k:\program\aruba\arub74 93h foc sdr\foc 15.247\test data\radiated\15.407\radiated\radiated\radiated\15.407\radiated\radiated\radiated\15.407\radiated\radiated\radiated\15.407\radiated\radiated\radiated\15.407\radiated\radiated\radiated\15.407\radiated\radiated\radiated\15.407\radiated\radiated\radiated\15.407\radiated\radiated\radiated\15.407\radiated\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated\15.407\radiated												
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Formally I Frequency MHz	neasur Raw dBuV				Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
Frequency	Raw	red emis Cable	sion	peaks	Measurement		Hgt	Azt	Limit	Margin	Pass	Comments
Frequency MHz	Raw dBuV	r <b>ed emis</b> Cable Loss	AF dB	peaks Level dBuV/m	Measurement Type	Pol	Hgt	Azt	Limit	Margin	Pass	
Frequency MHz 5599.198	Raw dBuV 69.7	red emis Cable Loss 4.7	AF dB -9.1	Level dBuV/m 65.3	Measurement Type Peak [Scan]	Pol H	Hgt	Azt	Limit	Margin	Pass /Fail	FUND
Frequency MHz           5599.198           16807.615	Raw dBuV 69.7 55.2	red emis Cable Loss 4.7 8.6	AF dB -9.1 1.1	Level dBuV/m 65.3 65.0	Measurement Type Peak [Scan] Peak [Scan]	Pol H H	Hgt	Azt	Limit	Margin	Pass /Fail Pass	FUND
Frequency MHz           5599.198           16807.615           5190.381	Raw dBuV           69.7           55.2           66.5	Cable Loss 4.7 8.6 4.6	AF dB -9.1 1.1 -9.6	Level dBuV/m           65.3           65.0           61.5	Measurement Type Peak [Scan] Peak [Scan] Peak [Scan]	Pol H H	Hgt	Azt	Limit	Margin	Pass /Fail Pass Pass	FUND NRB BE

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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:112 of 180

Test Freq.	5700 MHz	Engineer	GMH
Variant	802.11a; 6 Mbs	Temp (ºC)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			



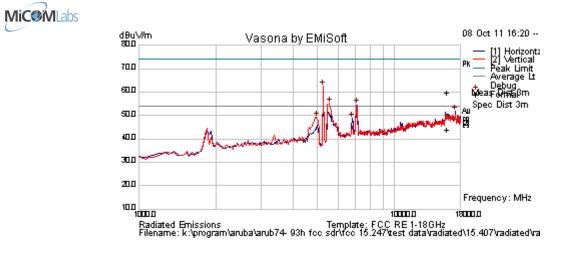
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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:113 of 180

### 5250 - 5350 MHz, 802.11n HT-20

Test Freq.	5260 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (ºC)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			



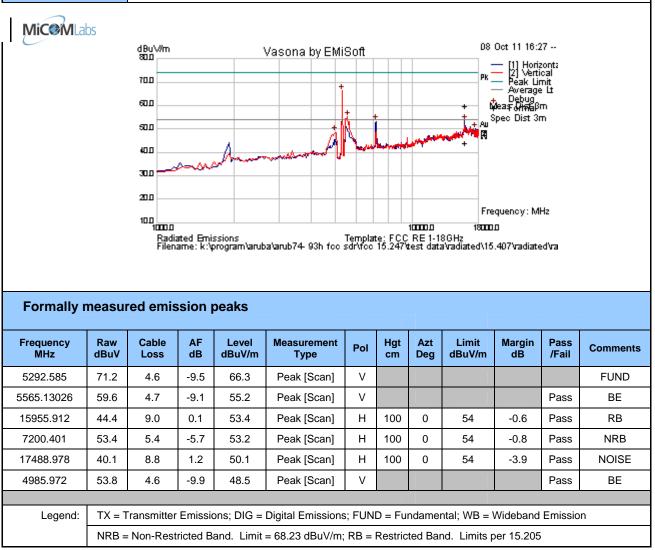
Formally m	Formally measured emission peaks											
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5258.517	67.4	4.6	-9.6	62.4	Peak [Scan]	V						FUND
5565.13026	59.5	4.7	-9.1	55.2	Peak [Scan]	V					Pass	BE
7132.265	54.9	5.4	-5.8	54.5	Peak [Scan]	н					Pass	NRB
17250.501	42.1	8.6	1.2	51.9	Peak [Scan]	н	100	0	54	-2.1	Pass	NOISE
4951.904	54.6	4.6	-9.9	49.2	Peak [Scan]	V					Pass	BE
6825.651	49.8	5.3	-6.3	48.9	Peak [Scan]	Н	100	0	54	-5.1	Pass	NRB
Legend:	TX = T	ransmitter	Emissi	ons; DIG =	Digital Emissions	s; FUN	D = Fu	ndame	ntal; WB =	Wideband	Emissio	n
	NRB =	Non-Rest	ricted B	and. Limit	= 68.23 dBuV/m;	RB =	Restric	ted Bar	nd. Limits p	per 15.205		

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Test Freq.	5300 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			

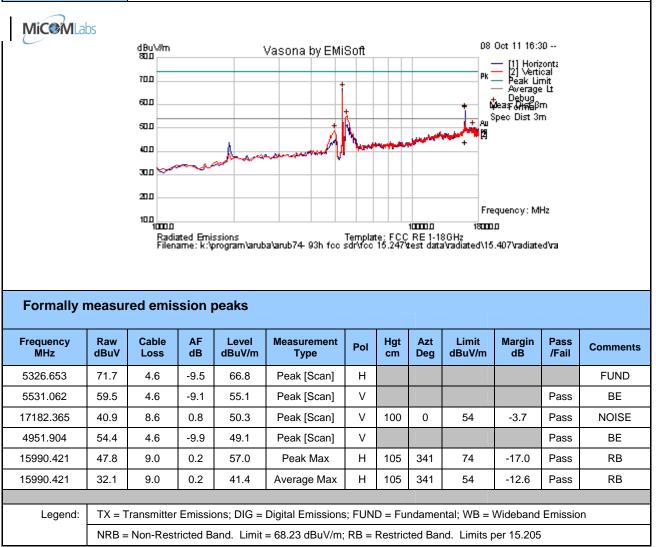


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Test Freq.	5320 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			



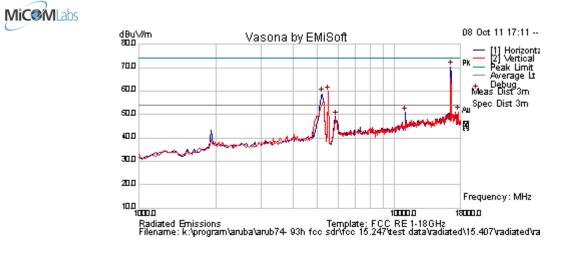
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# 5470 - 5725 MHz, 802.11n HT-20

Test Freq.	5500 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			



Formally m	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
16535.070	61.4	8.8	0.3	70.5	Peak [Scan]	н					Pass	NRB
5496.99399	64.4	4.6	-9.2	59.8	Peak [Scan]	V						FUND
5190.381	63.8	4.6	-9.6	58.8	Peak [Scan]	Н					Pass	BE
17693.387	41.6	8.8	0.6	51.0	Peak [Scan]	V	100	0	54	-3.0	Pass	NOISE
11016.032	47.1	7.0	-3.1	51.0	Peak [Scan]	Н	100	0	54	-3.1	Pass	NRB
5871.743	53.1	4.8	-8.8	49.2	Peak [Scan]	Н					Pass	BE
Legend:	TX = T	ransmitter	Emissi	ons; DIG =	Digital Emissions	s; FUN	D = Fu	ndame	ntal; WB =	Wideband	Emissio	n
	NRB =	Non-Rest	ricted B	and. Limit	= 68.23 dBuV/m;	RB =	Restric	ted Ba	nd. Limits p	per 15.205		

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Test Freq.	5580 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			

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		30.0	~~~	~					Fre	quency: M	H7	
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Frequency	Raw	red emis Cable	SSION	Deaks	Measurement		Hgt	Azt	Limit	Margin	Pass	Commen
Frequency MHz 5599.198	Raw dBuV	red emis Cable Loss	AF dB	Deaks Level dBuV/m	Measurement Type	Pol	Hgt	Azt	Limit	Margin	Pass	
Frequency MHz 5599.198	Raw dBuV 69.4	<b>Cable</b> Loss 4.7	AF dB -9.1	Level dBuV/m 65.0	Measurement Type Peak [Scan]	Pol H	Hgt	Azt	Limit	Margin	Pass /Fail	FUND
Frequency MHz 5599.198 16807.615	Raw dBuV 69.4 54.8	Cable Loss 4.7 8.6	AF dB -9.1 1.1	Level dBuV/m 65.0 64.5	Measurement Type Peak [Scan] Peak [Scan]	Pol H H	Hgt	Azt	Limit	Margin	Pass /Fail Pass	FUND NRB
Frequency MHz           5599.198           16807.615           5156.313	Raw dBuV           69.4           54.8           66.8	red emis Cable Loss 4.7 8.6 4.6	AF dB -9.1 1.1 -9.6	<b>Level</b> <b>dBuV/m</b> 65.0 64.5 61.8	Measurement Type Peak [Scan] Peak [Scan] Peak [Scan]	Pol H H	Hgt	Azt	Limit	Margin	Pass /Fail Pass Pass	FUND NRB BE BE
Frequency MHz           5599.198           16807.615           5156.313           5905.812	Raw dBuV           69.4           54.8           66.8           56.1           41.0	<b>Cable</b> Loss 4.7 8.6 4.6 4.8 8.6	AF dB -9.1 1.1 -9.6 -8.7 0.7	Level         dBuV/m           65.0         64.5           61.8         52.3           50.3         50.3	Measurement Type Peak [Scan] Peak [Scan] Peak [Scan] Peak [Scan]	<b>Роі</b> Н Н Н Н	Hgt cm 100	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail Pass Pass Pass Pass	FUND NRB BE BE NOISE

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Test Freq.	5700 MHz	Engineer	GMH
Variant	802.11n HT-20; 6.5 MCS	Temp (ºC)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			

MiC®MLa		dBu\//m 800		,	Vasona by EMi	Soft			08	Oct 11 17:1	17	
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Formally	measu	Radi: Filen		-	ba∖arub74-93h foc∶	Templat sdr\fcc					ed'va	
Formally Frequency MHz	Raw dBuV	Radi: Filen		-	a'arub74-93h foo : Measurement Type	Templat sdr\foo					ed'va Pass /Fail	Comment
Frequency	Raw	Radii Filen Cable	sion	Deaks	Measurement		te: FCC 15.2471 Hgt	RE 1-1: test data	8GHz avadiated\15	.407\radiate	Pass	Comment
Frequency MHz 5701.403	Raw dBuV	red emis Cable Loss	SSION   AF dB	Deaks Level dBuV/m	Measurement Type	Pol	te: FCC 15.2471 Hgt	RE 1-1: test data	8GHz avadiated\15	.407\radiate	Pass	
Frequency MHz	Raw dBuV 77.6	red emis Cable Loss 4.7	AF dB -8.9	Level dBuV/m 73.5	Measurement Type Peak [Scan]	Pol V	te: FCC 15.2471 Hgt	RE 1-1: test data	8GHz avadiated\15	.407\radiate	Pass /Fail	FUND
Frequency MHz           5701.403           5190.38076	Raw dBuV           77.6           69.3	red emis Cable Loss 4.7 4.6	AF dB -8.9 -9.6	Level dBuV/m 73.5 64.3	Measurement Type Peak [Scan] Peak [Scan]	Pol V H	te: FCC 15.2471 Hgt	RE 1-1: test data	8GHz avadiated\15	.407\radiate	Pass /Fail Pass	FUND BE
Frequency MHz 5701.403 5190.38076 5871.743	Raw dBuV           77.6           69.3           60.3	Radii Filen Cable Loss 4.7 4.6 4.8	AF dB -8.9 -9.6 -8.8	<b>Level</b> dBuV/m 73.5 64.3 56.3	Measurement Type Peak [Scan] Peak [Scan] Peak [Scan]	Pol V H	te: FCC 15.2471 Hgt	RE 1-1: test data	8GHz avadiated\15	.407\radiate	Pass /Fail Pass Pass	FUND BE BE

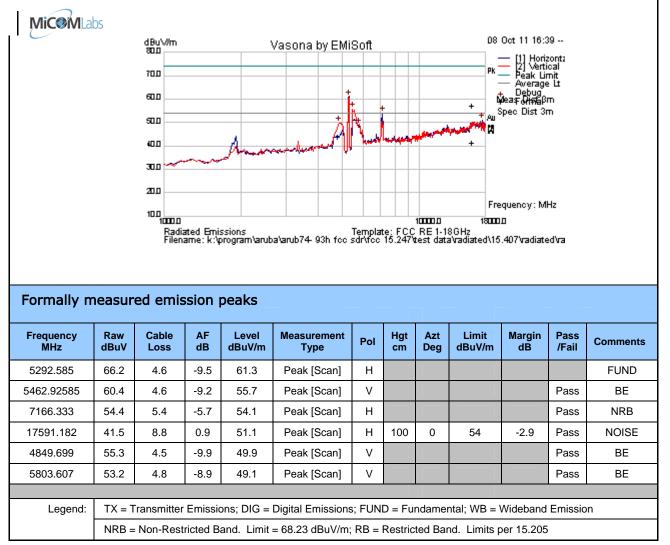
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Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:119 of 180

### 5250 - 5350 MHz, 802.11n HT-40

Test Freq.	5270 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			

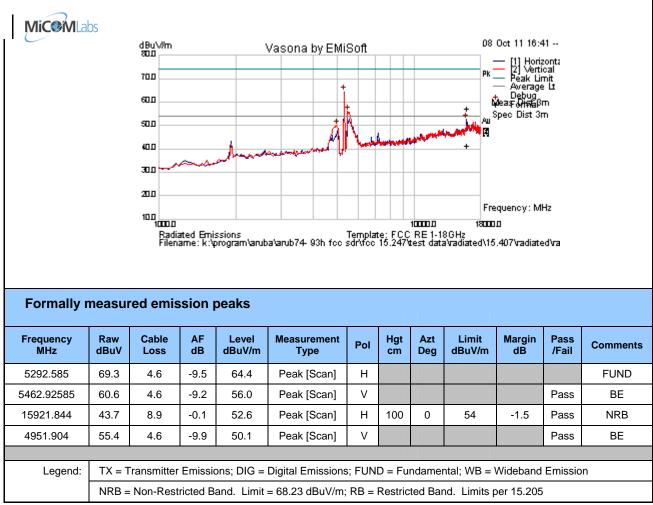


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Test Freq.	5310 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (ºC)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			



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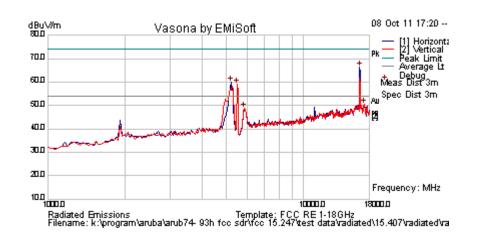


Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:121 of 180

### 5470 - 5725 MHz, 802.11n HT-40

Test Freq.	5510 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (ºC)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			

# MiC<sup>®</sup>MLabs



# Formally measured emission peaks

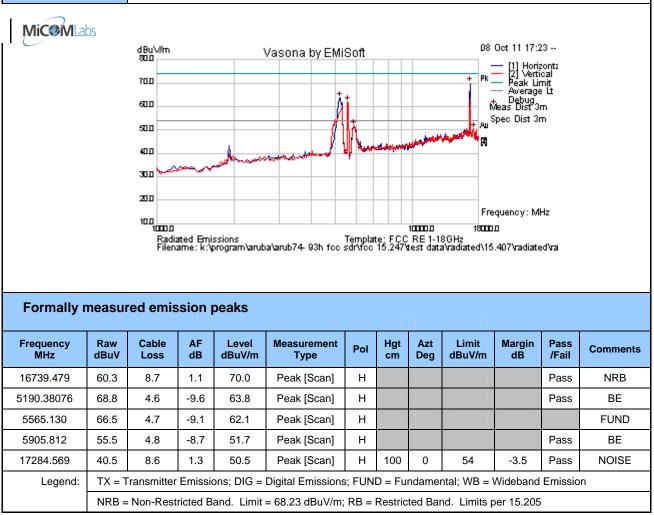
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
16535.070	57.1	8.8	0.3	66.2	Peak [Scan]	н					Pass	NRB
5190.38076	64.8	4.6	-9.6	59.8	Peak [Scan]	Н						FUND
5496.994	63.6	4.6	-9.2	59.1	Peak [Scan]	V					Pass	BE
17250.501	40.8	8.6	1.2	50.6	Peak [Scan]	V	100	0	54	-3.5	Pass	NOISE
5837.675	52.7	4.8	-8.8	48.7	Peak [Scan]	V					Pass	BE
Legend:	TX = T	ransmitter	Emissi	ons; DIG =	Digital Emissions	s; FUN	D = Fu	ndame	ntal; WB =	Wideband	Emissio	n
	NRB =	Non-Rest	ricted B	and. Limit	= 68.23 dBuV/m;	RB =	Restric	ted Bar	nd. Limits p	per 15.205		

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Test Freq.	5580 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (⁰C)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			

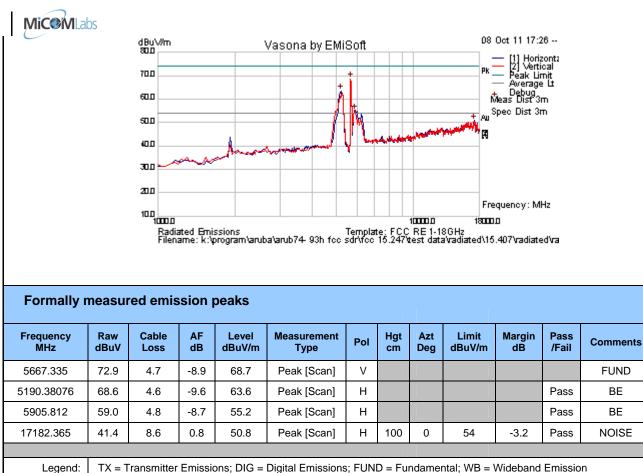


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Test Freq.	5690 MHz	Engineer	GMH
Variant	802.11n HT-40; 13.5 MCS	Temp (ºC)	29
Freq. Range	1000 MHz - 18000 MHz	Rel. Hum.(%)	999
Power Setting	18	Press. (mBars)	30.5
Antenna	Integral	Duty Cycle (%)	
Test Notes 1			
Test Notes 2			



 $\label{eq:NRB} \mathsf{NRB} = \mathsf{Non-Restricted} \ \mathsf{Band.} \ \ \mathsf{Limit} = \mathsf{68.23} \ \mathsf{dBuV/m}; \ \mathsf{RB} = \mathsf{Restricted} \ \mathsf{Band.} \ \ \mathsf{Limits} \ \mathsf{per} \ \mathsf{15.205}$ 

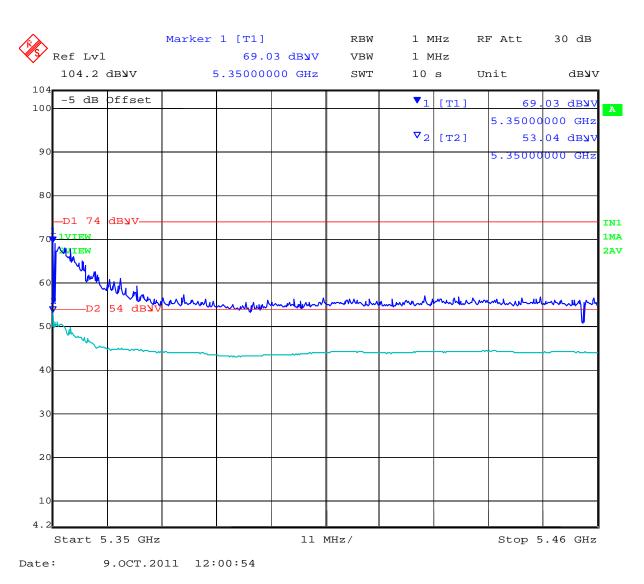
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# 5.1.7.2. Radiated Band-Edge spurious emissions





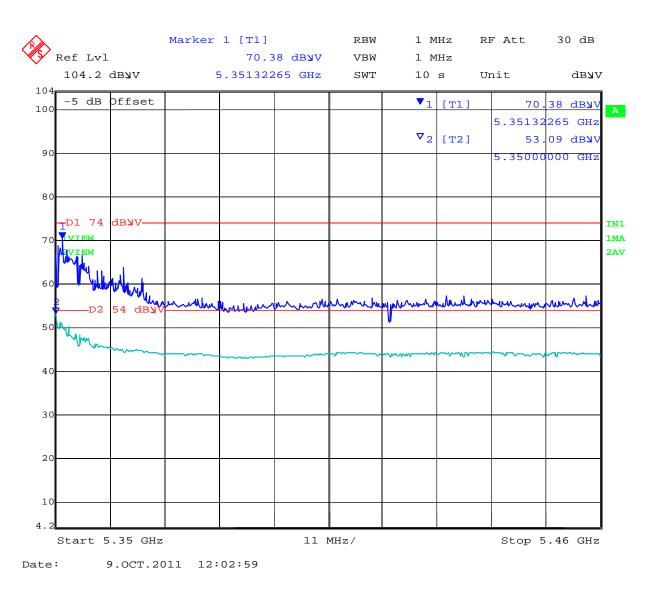
NOTE: Power Reduction Required ART = 14.5

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# 5320 MHz - 802.11n HT-20 5350 - 5460 MHz



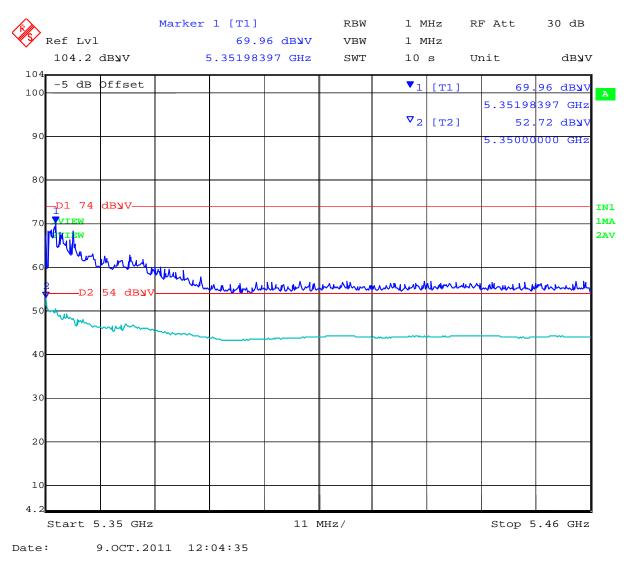
NOTE: Power Reduction Required ART = 14.0

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#### 5310 MHz - 802.11n HT-40 5350 - 5460 MHz



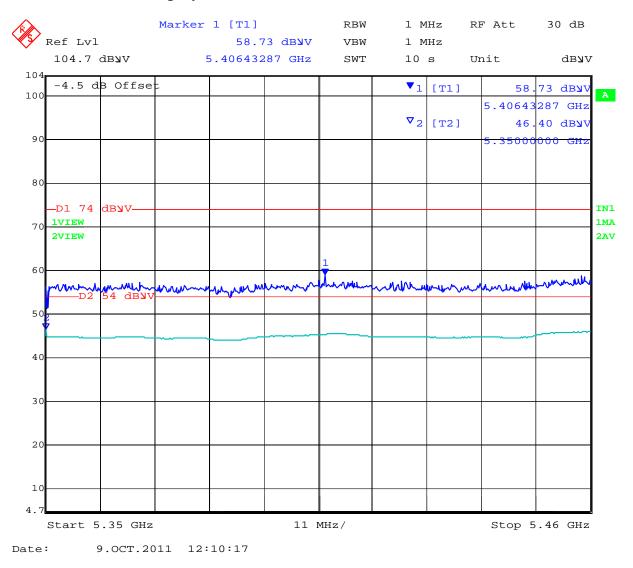
NOTE: Power Reduction Required ART = 14.0

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#### 5500 MHz - 802.11a Legacy 5350 - 5460 MHz

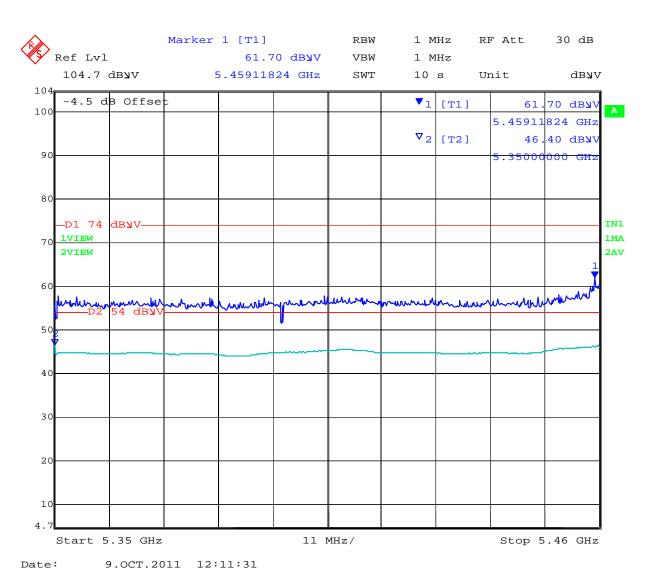


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# 5500 MHz - 802.11n HT-20 5350 - 5460 MHz

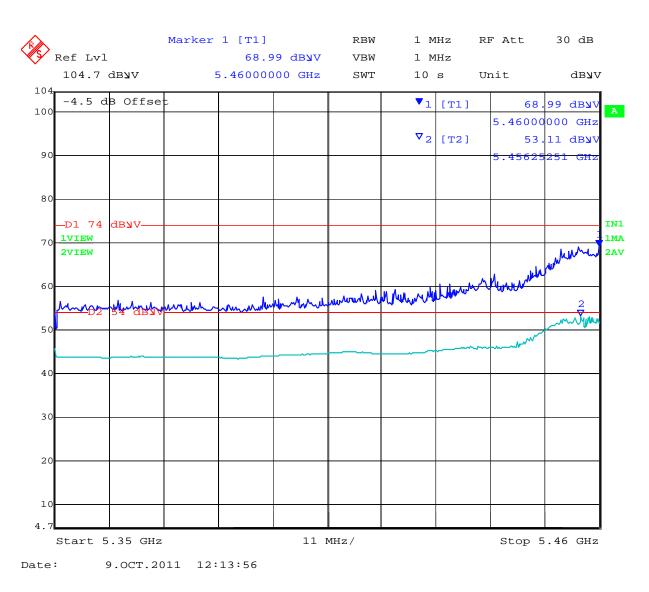


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### 5510 MHz - 802.11n HT-20 5350 - 5460 MHz



NOTE: Power Reduction Required ART = 16.5

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# Specification

Limits

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

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

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

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

RSS-210 §2.2 refers to Section 2.7 Table 2 below;-

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

#### Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty +5.6/-4.5 d
-------------------------------------

# Traceability

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

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# 5.1.7.3. Radiated Spurious Emissions – 30MHz – 1000MHz

Note: No radio emissions were present below 1 GHz. Emissions were investigated while the unit was transmitting at maximum power and in receive mode for both AC Adaptor powered and POE (Power Over Ethernet) configuration.

	st Freq.	<b>Freq.</b> 2442 MHz						Engineer			GMH	
	Variant	Digital E	missions	5		Temp (ºC)			ſemp (⁰C)	25	25	
Freq	Range	30 MHz	- 1000 N	lHz		Rel. Hum.(%)			41			
Power	Setting	Max						Press	. (mBars)	1001		
A	ntenna	integral										
Test	Notes 1											
Test	Notes 2											
MICOM	lbs	dBuV/m son son son son son 2nn 10n son Rad Files	1300 liated Emis name: k:\l	200 300	/asona by EMis	630.D	730.0 e: FCC R\FCC 1	830.0 15.209 5.209 V7	2p + % % % % % % % % % % % % % % % % % %	Det 11 20:47 – [1] Horizo – [2] Vertic – Quasi Lt – Debug Formal eas Dist 3m pec Dist 3m Juency: MH MHz al Emission	z	
Formally r	neasur	ed emi	ssion	peaks								
Formally r Frequency MHz	neasur Raw dBuV	ed emi Cable Loss	SSION   AF dB	Deaks Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comment
Frequency	Raw	Cable	AF	Level		Pol V	_					Comment
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Туре		cm	Deg	dBuV/m	dB	/Fail	Comment
Frequency MHz 30.000	Raw dBuV 41.1	Cable Loss 3.4	<b>AF</b> <b>dB</b> -9.2	Level dBuV/m 35.3	Type Quasi Max	V	<b>cm</b> 107	<b>Deg</b> 297	<b>dBuV/m</b> 40	-4.7	<b>/Fail</b> Pass	Comment

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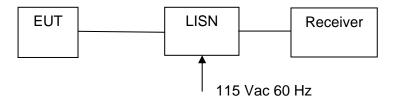
# 5.1.8. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

### FCC, Part 15 Subpart C §15.407(b)(6)/15.207 Industry Canada RSS-Gen §7.2.2

#### Test Procedure

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

### Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

# Specification

#### Limit

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

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

# **RSS-Gen §7.2.2**

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

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# §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



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

les	st Freq.	2437 - 1	37 - Rx Mode Engineer							
	Variant	AC Line	Emissions	3			Temp (ºC)	22		
Freq.	Range	0.150 N	1Hz - 30 MH	Ηz		R	Rel. Hum.(%)	38		
Power	Setting	N/A				Pre	ess. (mBars)	1006		
А	ntenna	Integral	Antennas							
Test N	Notes 1	AC Pow	/ered - 120	V AC 60Hz	Z					
Test N	Notes 2									
		484V 600 + 400 + 300 -	- Autor	rin in	/asona by EMi		~	op + **	[1] Live [2] Neut Duasi Li Average Debug Formal	ral t
		10.0 0,15 Pou File	ver Line Con name: k.\co	iducted Em impliance m	10 issions hanägement larubak	arub51 - scap	100 Template: CISI a foc ic eutest	30.0	ency: Mi Mains north am	
Formally Frequency MHz	meas Raw dBuV	File			10 Is sions nanagement tarubat Measurement Type	anub51 - scap Line		30.0		
Frequency	Raw	ured e	emission Factors	peaks	Measurement		Template: CISI a foc ic euftest	30.0 PR228 ACI program Margin	Mains north am Pass	ienc
Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Template: CISF a foc ic eutres Limit dBuV	300 PR22B AC Program Program Margin dB	Pass /Fail	Comments
Frequency MHz 0.155	Raw dBuV 38.8	Cable Loss 9.9	Factors dB 0.1	Level dBuV 48.8	Measurement Type Average	<b>Line</b> Neutral	Limit dBuV 55.73	Margin dB -7.0	Pass /Fail Pass	Comments
Frequency MHz 0.155 0.155	Raw dBuV 38.8 51.6	Cable Loss 9.9 9.9	Factors dB 0.1 0.1	<b>Deaks Level dBuV</b> 48.8 61.6	Measurement Type Average Quasi Peak	Line Neutral Neutral	Limit dBuV 55.73 65.73	00 R228 AC Program Margin dB -7.0 -4.2	Pass /Fail Pass Pass	Comments DIG DIG
Frequency MHz 0.155 0.155 0.167	Raw           dBuV           38.8           51.6           33.8	Cable Loss 9.9 9.9 9.9	Emission Factors dB 0.1 0.1 0.1	Level dBuV           48.8           61.6           43.7	Measurement Type Average Quasi Peak Average	Line Neutral Neutral Neutral	Limit dBuV 55.73 65.73 55.11	Margin dB -7.0 -4.2 -11.4	Pass /Fail Pass Pass Pass	enc Comments DIG DIG DIG
Frequency MHz 0.155 0.155 0.167 0.167	Raw dBuV           38.8           51.6           33.8           51.7	Cable           Loss           9.9           9.9           9.9           9.9           9.9           9.9	Factors dB 0.1 0.1 0.1 0.1 0.1	peaks           Level dBuV           48.8           61.6           43.7           61.7	Measurement TypeAverageQuasi PeakAverageQuasi Peak	Line Neutral Neutral Neutral Neutral	Limit dBuV 555.73 65.73 55.11 65.11	300           R228         ACI           Program         Margin           dB         -7.0           -4.2         -11.4           -3.4         -3.4	Pass /Fail Pass Pass Pass Pass Pass	Comments DIG DIG DIG DIG DIG
Frequency MHz 0.155 0.155 0.167 0.167 0.194	Raw dBuV           38.8           51.6           33.8           51.7           35.4	Cable           Loss           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9	Factors         Galary           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1	Level dBuV           48.8           61.6           43.7           61.7           45.3	Measurement Type Average Quasi Peak Average Quasi Peak Average	Line Neutral Neutral Neutral Neutral Neutral	Limit dBuV 555.73 65.73 55.11 65.11 53.86	Margin dB -7.0 -4.2 -11.4 -8.5	Pass /Fail Pass Pass Pass Pass Pass Pass	Comments DIG DIG DIG DIG DIG DIG
Frequency MHz           0.155           0.155           0.167           0.167           0.194	Raw           dBuV           38.8           51.6           33.8           51.7           35.4           47.2	Cable           Loss           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9	Emission Factors dB 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	Level dBuV           48.8           61.6           43.7           61.7           45.3           57.1	Measurement Type Average Quasi Peak Average Quasi Peak Average Quasi Peak	Line Neutral Neutral Neutral Neutral Neutral Neutral	Limit dBuV 555.73 65.73 65.11 65.11 53.86 63.86	Margin dB           -7.0           -4.2           -111.4           -3.4           -8.5           -6.7	Pass /Fail Pass Pass Pass Pass Pass Pass Pass	Comments DIG DIG DIG DIG DIG DIG DIG
Frequency MHz 0.155 0.155 0.167 0.167 0.194 0.194 0.516	Raw dBuV           38.8           51.6           33.8           51.7           35.4           47.2           28.6	Cable           Loss           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9      9.9	Factors dB           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1	Level dBuV           48.8           61.6           43.7           61.7           45.3           57.1           38.6	Measurement TypeAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakAverage	Line Neutral Neutral Neutral Neutral Neutral Neutral Neutral	Limit dBuV 555.73 65.73 55.11 65.11 53.86 63.86 46	Margin dB           -7.0           -4.2           -11.4           -3.4           -8.5           -6.7           -7.4	Pass /Fail Pass Pass Pass Pass Pass Pass Pass	Comments DIG DIG DIG DIG DIG DIG DIG DIG
Frequency MHz 0.155 0.155 0.167 0.167 0.194 0.194 0.516 0.516	Raw dBuV           38.8           51.6           33.8           51.7           35.4           47.2           28.6           37.8	Cable           Loss           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9	Factors         Galaxies           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1           0.1         0.1	Level dBuV           48.8           61.6           43.7           61.7           45.3           57.1           38.6           47.9	Measurement TypeAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakAverageQuasi Peak	Line Neutral Neutral Neutral Neutral Neutral Neutral Neutral Neutral	Limit dBuV 555.73 65.73 65.73 55.11 65.11 53.86 63.86 46 56	Margin dB -7.0 -4.2 -11.4 -3.4 -8.5 -6.7 -7.4 -8.2	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	enc Comments DIG DIG DIG DIG DIG DIG DIG DIG
Frequency MHz 0.155 0.155 0.167 0.167 0.194 0.194 0.516 0.516 0.828	Raw dBuV           38.8           51.6           33.8           51.7           35.4           47.2           28.6           37.8           38.4	Cable           Loss           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9      9.9	Factors           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1           0.1	peaks           Level dBuV           48.8           61.6           43.7           61.7           45.3           57.1           38.6           47.9           48.4	Measurement TypeAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakQuasi PeakQuasi PeakQuasi PeakQuasi PeakQuasi PeakQuasi PeakQuasi Peak	Line Neutral Neutral Neutral Neutral Neutral Neutral Neutral Neutral Neutral	Limit dBuV 555.73 65.73 55.11 65.11 53.86 63.86 46 56 56 56	Margin dB           -7.0           -4.2           -11.4           -3.4           -8.5           -6.7           -7.4           -8.2           -7.6	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments DIG DIG DIG DIG DIG DIG DIG DIG DIG DIG
Frequency MHz 0.155 0.155 0.167 0.167 0.194 0.194 0.516 0.516 0.828 0.828	Raw dBuV           38.8           51.6           33.8           51.7           35.4           47.2           28.6           37.8           38.4           29.1	Cable           Loss           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9      9.9	Factors         dB         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1	peaks           Level dBuV           48.8           61.6           43.7           61.7           45.3           57.1           38.6           47.9           48.4           39.1	Measurement TypeAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakQuasi PeakAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakAverage	Line Neutral Neutral Neutral Neutral Neutral Neutral Neutral Neutral Neutral Neutral	Limit dBuV 555.73 65.73 55.11 65.11 53.86 63.86 46 56 56 56 46	Margin dB           -7.0           -4.2           -11.4           -3.4           -8.5           -6.7           -7.4           -8.2           -7.6           -6.9	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments DIG DIG DIG DIG DIG DIG DIG DIG DIG DIG
Frequency MHz           0.155           0.155           0.167           0.167           0.194           0.516           0.516           0.828           0.828           2.661	Raw dBuV           38.8           51.6           33.8           51.7           35.4           47.2           28.6           37.8           38.4           29.1           28.2           37.3	Cable           Loss           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.9           9.10.1           10.1	Factors         dB         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1         0.1	peaks           Level dBuV           48.8           61.6           43.7           61.7           45.3           57.1           38.6           47.9           48.4           39.1           38.4           47.6	Measurement TypeAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakAverageQuasi PeakQuasi PeakQuasi PeakQuasi PeakQuasi PeakAverageAverageAverage	Line Neutral Neutral Neutral Neutral Neutral Neutral Neutral Neutral Neutral Neutral Live Live	Limit dBuV 555.73 65.73 65.73 65.11 65.11 53.86 63.86 46 56 56 46 46 46 56 46 46 56	Margin dB -7.0 -4.2 -11.4 -3.4 -8.5 -6.7 -7.4 -8.2 -7.6 -6.9 -7.6 -6.9 -7.6 -8.5	Pass /Fail Pass Pass Pass Pass Pass Pass Pass Pas	Comments DIG DIG DIG DIG DIG DIG DIG DIG DIG DIG

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# 6. Dynamic Frequency Selection (DFS)

# 6.1. Test Procedure and Setup

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

### 6.1.1. Interference Threshold values, Master or Client incorporating In-Service Monitoring

Maximum Transmit Power	Value
	(see note)
≥ 200 milliwatt	-64 dBm
< 200 milliwatt	-62 dBm
Note 1: This is the level at the input of the receiver assuming	a 0 dBi receive antenna

# 6.1.2. DFS Response requirement values

Parameter	Value
Non-occupancy period	Minimum 30 minutes
Channel Availability Check Time	60 seconds
Channel Move Time	10 seconds
	See Note 1.
Channel Closing Transmission Time	200 milliseconds + an
	aggregate of 60
	milliseconds over
	remaining 10 second
	period.
	See Notes 1 and 2.
U-NII Detection Bandwidth	Minimum 80% of the 99%
	power bandwidth See
	Note 3.

Note 1: The instant that the *Channel Move Time* and the *Channel Closing Transmission Time* begins is as follows:

- For the Short pulse radar Test Signals this instant is the end of the Burst.
- For the Frequency Hopping radar Test Signal, this instant is the end of the last radar *Burst* generated.
- For the Long Pulse radar Test Signal this instant is the end of the 12 second period defining the radar transmission.

Note 2: The *Channel Closing Transmission Time* is comprised of 200 milliseconds starting at the beginning of the *Channel Move Time* plus any additional intermittent control signals required to facilitate *Channel* changes (an aggregate of 60 milliseconds) during the remainder of the 10 second period. The aggregate duration of control signals will not count quiet periods in between transmissions.

Note 3: During the *U-NII Detection Bandwidth* detection test, radar type 1 is used and for each frequency step the minimum percentage of detection is 90%. Measurements are performed with no data traffic.



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# 6.1.3. Radar Test Waveforms

This section provides the parameters for required test waveforms, minimum percentage of successful detections, and the minimum number of trials that must be used for determining DFS conformance. Step intervals of 0.1 microsecond for Pulse Width, 1 microsecond for PRI, 1 MHz for chirp width and 1 for the number of pulses will be utilized for the random determination of specific test waveforms.

### Short Pulse Radar Test Waveforms

Radar	Pulse Width	PRI	Number	Minimum	Minimum
Туре	(µsec)	(µsec)	of	Percentage of	Trials
			Pulses	Successful	
				Detection	
1	1	1428	18	60%	30
2	1-5	150-230	23-29	60%	30
3	6-10	200-500	16-18	60%	30
4	11-20	200-500	12-16	60%	30
Aggregate (F	Radar Types 1-4)			80%	120

A minimum of 30 unique waveforms are required for each of the short pulse radar types 2 through 4. For short pulse radar type 1, the same waveform is used a minimum of 30 times. If more than 30 waveforms are used for short pulse radar types 2 through 4, then each additional waveform must also be unique and not repeated from the previous waveforms. The aggregate is the average of the percentage of successful detections of short pulse radar types 1-4.

#### Long Pulse Radar Test Waveform

Radar	Pulse	Chirp	PRI	Number	Number	Minimum	Minimum
Туре	Width	Width	(µsec)	of Pulses	of <i>Burst</i> s	Percentage	Trials
	(µsec)	(MHz)		per <i>Burst</i>		of	
						Successful	
						Detection	
5	50-100	5-20	1000-	1-3	8-20	80%	30
			2000				

The parameters for this waveform are randomly chosen. Thirty unique waveforms are required for the Long Pulse radar test signal. If more than 30 waveforms are used for the Long Pulse radar test signal, then each additional waveform must also be unique and not repeated from the previous waveforms.



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Each waveform is defined as follows:

- 1) The transmission period for the Long Pulse Radar test signal is 12 seconds.
- 2) There are a total of 8 to 20 *Bursts* in the 12 second period, with the number of *Bursts* being randomly chosen. This number is *Burst Count*.
- 3) Each *Burst* consists of 1 to 3 pulses, with the number of pulses being randomly chosen. Each *Burst* within the 12 second sequence may have a different number of pulses.
- 4) The pulse width is between 50 and 100 microseconds, with the pulse width being randomly chosen. Each pulse within a *Burst* will have the same pulse width. Pulses in different *Bursts* may have different pulse widths.
- 5) Each pulse has a linear FM chirp between 5 and 20 MHz, with the chirp width being randomly chosen. Each pulse within a *Burst* will have the same chirp width. Pulses in different *Bursts* may have different chirp widths. The chirp is centered on the pulse. For example, with a radar frequency of 5300 MHz and a 20 MHz chirped signal, the chirp starts at 5290 MHz and ends at 5310 MHz.
- 6) If more than one pulse is present in a *Burst*, the time between the pulses will be between 1000 and 2000 microseconds, with the time being randomly chosen. If three pulses are present in a *Burst*, the time between the first and second pulses is chosen independently of the time between the second and third pulses.
- 7) The 12 second transmission period is divided into even intervals. The number of intervals is equal to Burst\_Count. Each interval is of length (12,000,000 / Burst\_Count) microseconds. Each interval contains one Burst. The start time for the Burst, relative to the beginning of the interval, is between 1 and [(12,000,000 / Burst\_Count) (Total Burst Length) + (One Random PRI Interval)] microseconds, with the start time being randomly chosen. The step interval for the start time is 1 microsecond. The start time for each Burst is chosen independently.

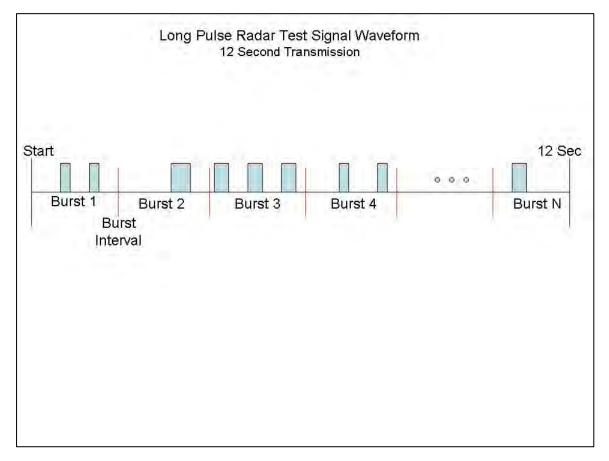


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### A representative example of a Long Pulse radar test waveform:

- 1) The total test signal length is 12 seconds.
- 2) 8 Bursts are randomly generated for the Burst\_Count.
- 3) Burst 1 has 2 randomly generated pulses.
- 4) The pulse width (for both pulses) is randomly selected to be 75 microseconds.
- 5) The PRI is randomly selected to be at 1213 microseconds.
- 6) Bursts 2 through 8 are generated using steps 3-5.
- 7) Each Burst is contained in even intervals of 1,500,000 microseconds. The starting location for Pulse 1, Burst 1 is randomly generated (1 to 1,500,000 minus the total Burst 1 length + 1 random PRI interval) at the 325,001 microsecond step. Bursts 2 through 8 randomly fall in successive 1,500,000 microsecond intervals (i.e. Burst 2 falls in the 1,500,001 3,000,000 microsecond range).

### Graphical representation of the Long Pulse radar Test Waveform.





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# 6.1.4. Frequency Hopping Radar Test Waveform

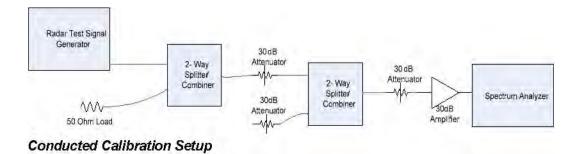
Frequency Hopping Radar Test Waveform							
Radar	Pulse	PRI	Pulses	Hopping	Hopping	Minimum	Minimum
Туре	Width	(µsec)	per	Rate	Sequence	Percentage of	Trials
	(µsec)		Нор	(kHz)	Length	Successful	
					(msec)	Detection	
6	1	333	9	.333	300	70%	30

For the Frequency Hopping Radar Type, the same *Burst* parameters are used for each waveform. The hopping sequence is different for each waveform and a 100-length segment is selected from the hopping sequence defined by the following algorithm:

# 6.1.5. Radar Waveform Calibration

The following equipment setup was used to calibrate the conducted Radar Waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero span (Time Domain) mode at the frequency of the Radar Waveform generator. Peak detection was utilized. The spectrum analyzer resolution bandwidth (RBW) and video bandwidth (VBW) were set to 3 MHz.

The signal generator amplitude was set so that the power level measured at the spectrum analyzer was -61dBm (Ref Section 5.1). The 30dB amplifier gain was entered as an amplitude offset on the spectrum analyzer.

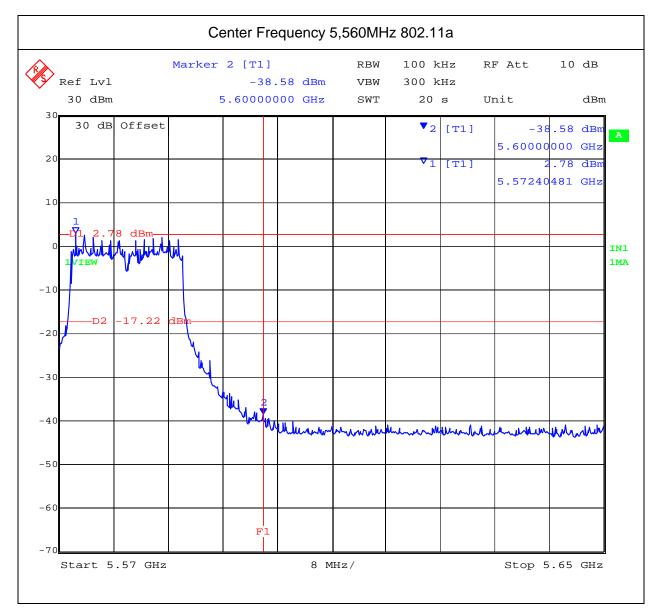


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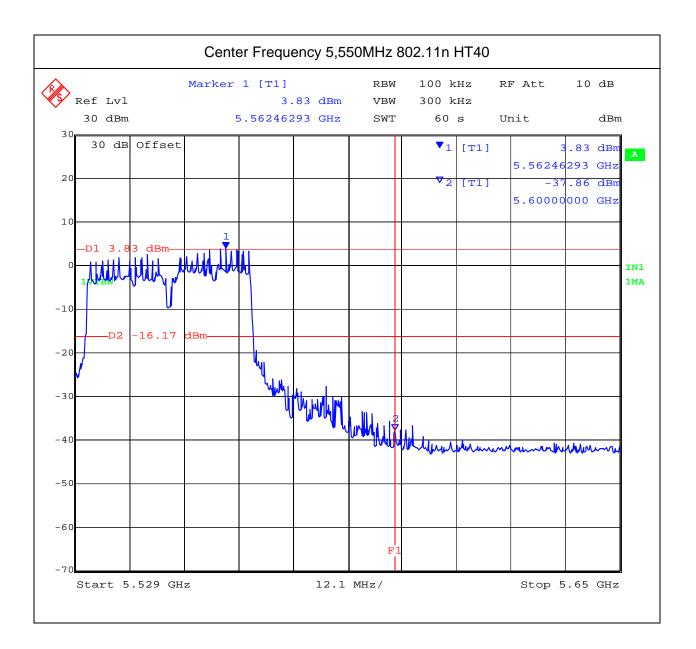
# 6.1.6. Weather Radar Band Edge Plots



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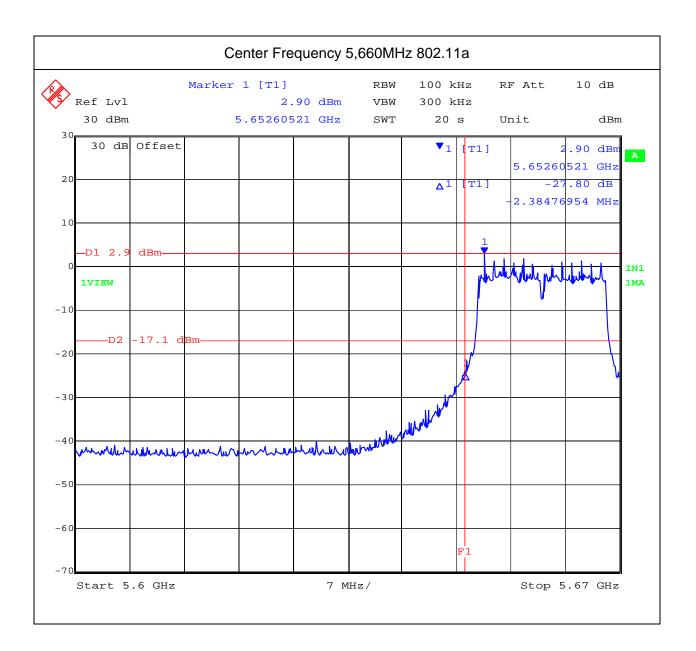
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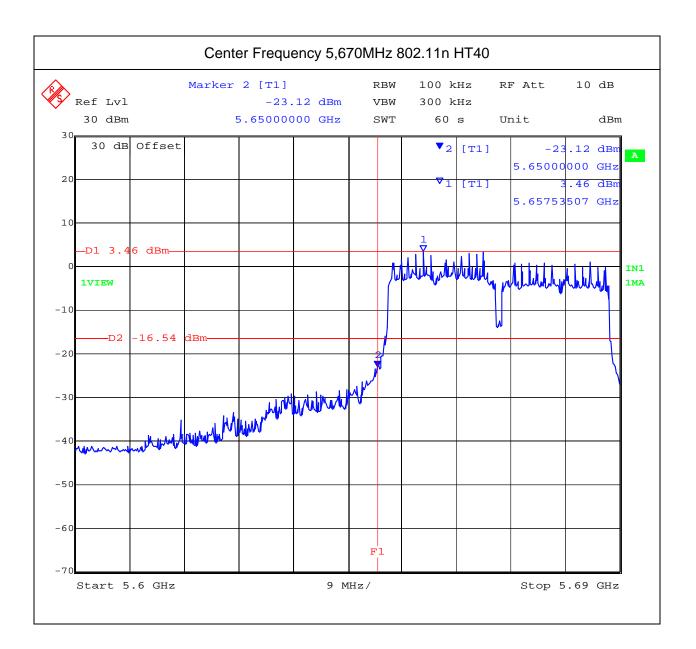
Title:Aruba AP-93H 802.11a/b/g/n Wireless APTo:FCC 47 CFR Part 15.407 & IC RSS-210Serial #:ARUB91-U1 Rev AIssue Date:16<sup>th</sup> February 2012Page:142 of 180



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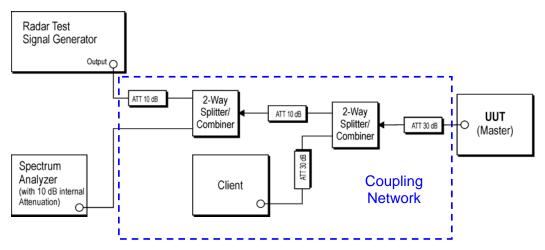
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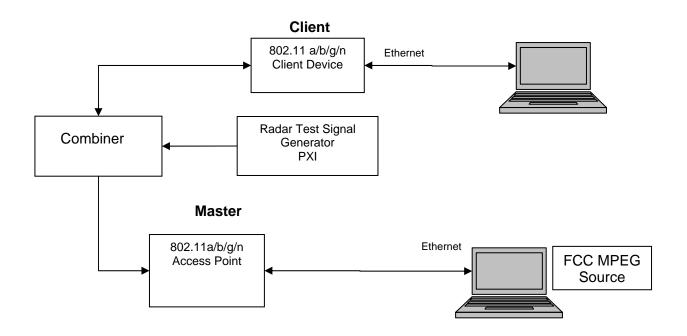
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# 6.1.7. <u>Test Set Up:</u> Block Diagram(s) of Test Setup

Setup for Conducted Measurements where the EUT is the Master with injection of Radar Test Waveforms at the Master.



**Support Equipment Configuration** 



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The EUT is a Master Device with radar detection.

## Applicability of DFS Requirements Prior to Use of a Channel

Requirement	Operati	onal Mode	
	Master	Client Without Radar Detection	Client With Radar Detection
Non-Occupancy Period	Yes	Not required	Yes
DFS Detection Threshold	Yes	Not required	Yes
Channel Availability Check Time	Yes	Not required	Not required
Uniform Spreading	Yes	Not required	Not required
U-NII Detection Bandwidth	Yes	Not required	Yes

## (Ref Table 1 of FCC 06-96)

## Applicability of DFS requirements during normal operation (Ref Table 2 of FCC 06-96)

Requirement	Operatio	nal Mode	
	Master	Client Without Radar Detection	Client With Radar Detection
DFS Detection Threshold	Yes	Not required	Yes
Channel Closing Transmission Time	Yes	Yes	Yes
Channel Move Time	Yes	Yes	Yes
U-NII Detection Bandwidth	Yes	Not required	Yes

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For the frequency band 5,470 - 5,725 MHz, the Master device provides, on aggregate, uniform loading of the spectrum across all devices by selecting an operating channel among the available channels using a random algorithm. The EUT was tested in HT-40 mode.

Declared minimum antenna gain 0 dBi. ;

Radar receive signal level = -62 dBm + minimum antenna gain + 1 dB

= -62 + 0 + 1

Radar receive signal level = -61 dBm

#### Measurement Results - Dynamic Frequency Selection (DFS)

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

Radio parameters. Test methodology: Conducted Device Type: Master Transmit Power: Maximum

#### **Operational Details - Dynamic Frequency Selection (DFS)**

Operational Modes: 802.11a & 802.11n HT40

Data Rates: 18 mpbs 802.11a/ 0MCS 802.11n

\*Note\* No video pixilation was observed during the video stream at these rates. Video frames per second were noted to be at 30fps.

#### Video Streaming Method - Dynamic Frequency Selection (DFS)

Using the VideoLan player a video stream was setup on the master laptop with the destination being the client laptop. The video profile chosen for the video stream is "MPEG-2 + MPGA (TS)". On the client laptop the VideoLan player was setup to listen to an incoming video stream from the master device.

The requisite MPEG video file ("TestFile.mpg" available on the NTIA website at the following link http://ntiacsd.ntia.doc.gov/dfs/) is used during this video stream.

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## 6.2. Dynamic Frequency Selection (DFS) Test Results

#### 6.2.1. UNII Detection Bandwidth:

All UNII channels for this device have identical channel bandwidths and DFS testing was completed on channel 5,500 MHz (802.11a) and 5510MHz (HT40).

The generating equipment is configured as shown in the Conducted Test Setup above. A single Burst of the short pulse radar Type 1 through 6 was produced at 5,500 MHz (802.11a) and 5,510 MHz (802.11n HT40) at a level of -61 dBm (Ref Section 5.1). The EUT is set up as a standalone device (no associated Client and no traffic).

A single radar Burst is generated for a minimum of 10 trials, and the response of the EUT is noted. The EUT must detect the Radar Waveform 90% or more of the time.

The radar frequency is increased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The highest frequency at which detection is greater than or equal to 90% is denoted as  $F_{H}$ .

The radar frequency is decreased in 1 MHz steps, repeating the above test sequence, until the detection rate falls below 90%. The lowest frequency at which detection is greater than or equal to 90% is denoted as  $F_L$ .

The U-NII Detection Bandwidth is calculated as follows: U-NII Detection Bandwidth =  $F_H - F_L$ 

The U-NII Detection Bandwidth must be at least 80% of the EUT transmitter 99% power bandwidth. Table of results are continued on the next page.

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	Ĩ.										$\sqrt{1}$ , No Detection = 0)
adar Frequency (MHz)	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
-20											%
-19	<u> </u>										%
-18											%
-17											%
-16											%
-15											%
-14											%
-13											%
-12											%
-11	0	0	,	,	,	,	,	,			<90%
-10											90%
-9											100%
-8											100%
-7											100%
-6		$\checkmark$		$\checkmark$				$\checkmark$			100%
-5						$\checkmark$		$\checkmark$		$\checkmark$	100%
-4	$\checkmark$	$\checkmark$		$\checkmark$		$\checkmark$		$\checkmark$	$\checkmark$		100%
-3											100%
-2		$\checkmark$		$\checkmark$					$\checkmark$		100%
-1											100%
F <sub>0</sub>		$\checkmark$		$\checkmark$			0	$\checkmark$			90%
+1											100%
+2											100%
+3						0					90%
+4											100%
+5											100%
+6											100%
+7						Ń					100%
+8											100%
+9		0		0							<90%
+10	0	0		-							<90%
+11		-									%
+12											%
+13											%
+14											%
+15											%
+15	+										%
+10											%
etection Bandwidth = $F_{H}$			500	-55	<u> </u>	_ 10	2 1 1 1	 			/0
UT 99% Bandwidth = 18									nna		
3.84  MHz *80% = 15.1			יב (ו	<u>.</u>	Jan		un	0110		1 00	

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EUT Frequency=	5,5´	10 N	ЛНz	: 80	2.1	1n H	HT4	0 (E	Dete	ectior	$n = \sqrt{1}$ , No Detection = 0)
Radar Frequency (MHz)	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
-21				0			0	$\checkmark$	$\checkmark$	$\checkmark$	<90%
-20					0			$\checkmark$	$\checkmark$	$\checkmark$	90%
-19	$\checkmark$			$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	100%
-18	$\checkmark$					$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	100%
-17	$\checkmark$				100%						
-16	$\checkmark$				100%						
-15	$\checkmark$				100%						
-14	$\checkmark$				100%						
-13	$\checkmark$				100%						
-12		$\checkmark$					$\checkmark$				100%
-11		$\checkmark$					$\checkmark$				100%
-10	$\checkmark$				100%						
-9	$\checkmark$				100%						
-8	$\checkmark$				100%						
-7	$\checkmark$				100%						
-6	$\checkmark$				100%						
-5	$\checkmark$				100%						
-4								$\checkmark$	$\checkmark$	$\checkmark$	100%
-3								$\checkmark$	$\checkmark$	$\checkmark$	100%
-2	$\checkmark$			100%							
-1	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		100%
F <sub>0</sub>	$\checkmark$										100%

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EUT Frequency=	5,5´	10 N	ЛНz	80	2.1 <sup>-</sup>	1n F	HT4	0 ([	Dete	ectior	$n = \sqrt{1}$ , No Detection = 0)
Radar Frequency (MHz)	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
F <sub>0</sub>	$\checkmark$	$\checkmark$						$\checkmark$			100%
+1											100%
+2											100%
+3		$\checkmark$									100%
+4		$\checkmark$									100%
+5		$\checkmark$									100%
+6											100%
+7			$\checkmark$	$\checkmark$			$\checkmark$	$\checkmark$			100%
+8	$\checkmark$	$\checkmark$									100%
+9											100%
+10											100%
+11											100%
+12		$\checkmark$									100%
+13											100%
+14											100%
+15											100%
+16											100%
+17											100%
+18											100%
+19											100%
+20			$\checkmark$					$\checkmark$			100%
+21			0		0						<90%
Detection Bandwidth = $F_H$											
EUT 99% Bandwidth = 44		ЛНz	: (re	f. b	and	wid	th c	har	nel	551	0 MHz)
44.7 MHz *80% = 35.8 M	Hz										

For each frequency step the minimum percentage detection is 90%

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 Aruba AP-93H 802.11a/b/g/n Wireless AP

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

 Serial #:
 ARUB91-U1 Rev A

 Issue Date:
 16<sup>th</sup> February 2012

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#### 6.2.2. Initial Channel Availability Check Time

This test verifies that the EUT does not emit pulse, control, or data signals on the test Channel until the power-up sequence has been completed and the U-NII device checks for Radar Waveforms for one minute on the test Channel. This test does not use any Radar Waveforms.

The U-NII device is powered on and be instructed to operate at 5,500MHz 802.11a and 5,510MHz 802.11n HT40. At the same time the EUT is powered on, the spectrum analyzer is set for zero span with a 1 MHz resolution bandwidth at 5,500& 5,510 MHz with a 260 second sweep time. The analyzer's sweep will be started the same time power is applied to the U-NII device.

The EUT should not transmit any pulse or data transmissions until at least 1 minute after the completion of the power-on cycle.

The first red marker line shown on the following plot denotes the instant when the EUT starts its power-up sequence i.e.  $T_0$  (as defined within the FCC's MO&O 06-96 Normative Reference 2). The power-up reference  $T_0$  is determined by the time it takes for the EUT to start "beaconing" i.e. initial beacon – 60 secs = end of power-up.

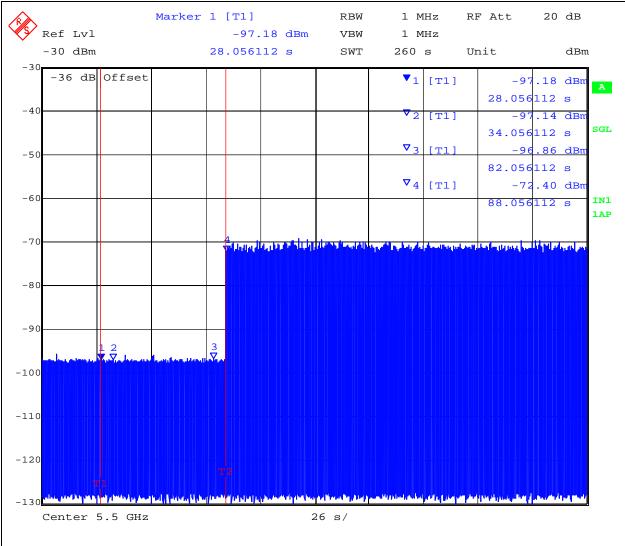
The Channel Availability Check Time commences at instant  $T_0$  and will end no sooner than  $T_0$  + 60 seconds.

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# EUT power up and Initial Channel Availability Check Time 5,500MHz 802.11a Power On = 88.05 Seconds

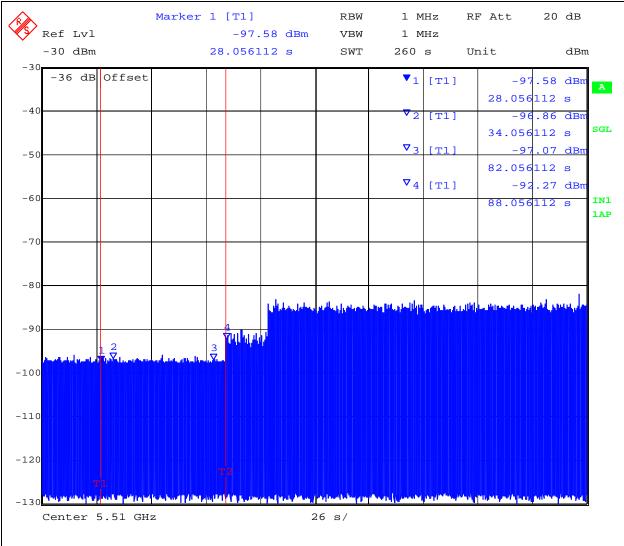


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### EUT power up and Initial Channel Availability Check Time 5,510MHz 802.11n HT40 Power On = 88.05 Seconds



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#### 6.2.3. Radar Burst at the Beginning of the Channel Availability Check Time:

The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold +6 dB (-62 dBm Ref Section 6.1.7) occurs at the beginning of the Channel Availability Check Time.

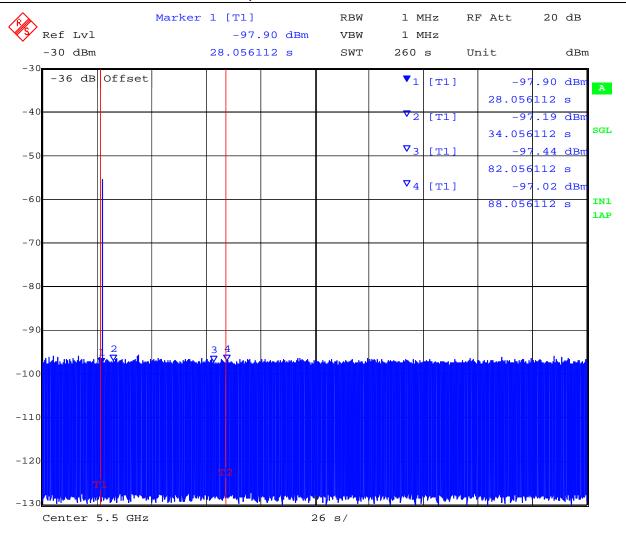
A single Burst of short pulse of radar Type 1 will commence within a 6 second window starting at  $T_0$  (first red marker line on the following plot).

Visual indication on the EUT of successful detection of the radar Burst will be recorded and reported. Observation of emissions at 5,500MHz 802.11a & 5,510MHz 802.11n HT40 will continue for 2.5 minutes after the radar burst has been generated.



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# Channel Availability Check Time at the start T0 + 6 seconds Check Time 5,500MHz 802.11a

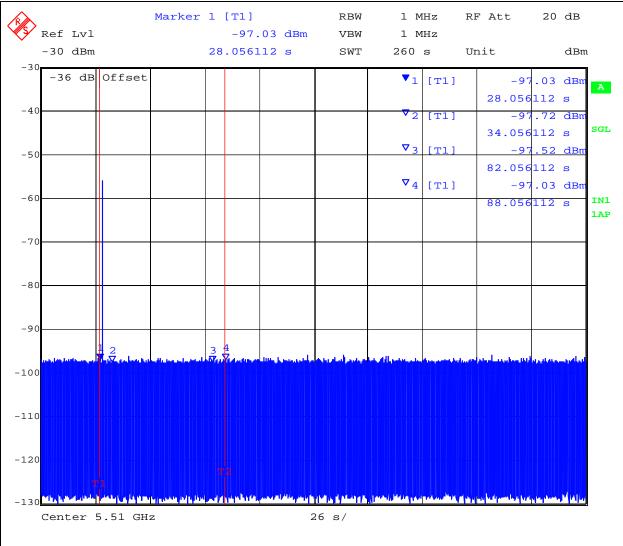


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# Channel Availability Check Time at the start T0 + 6 seconds Check Time 5,510MHz 802.11n HT40



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#### 6.2.4. Radar Burst at the End of the Channel Availability Check Time:

The steps below define the procedure to verify successful radar detection on the selected Channel during a period equal to the Channel Availability Check Time and avoidance of operation on that Channel when a radar Burst with a level equal to the DFS Detection Threshold occurs at the end of the Channel Availability Check Time.

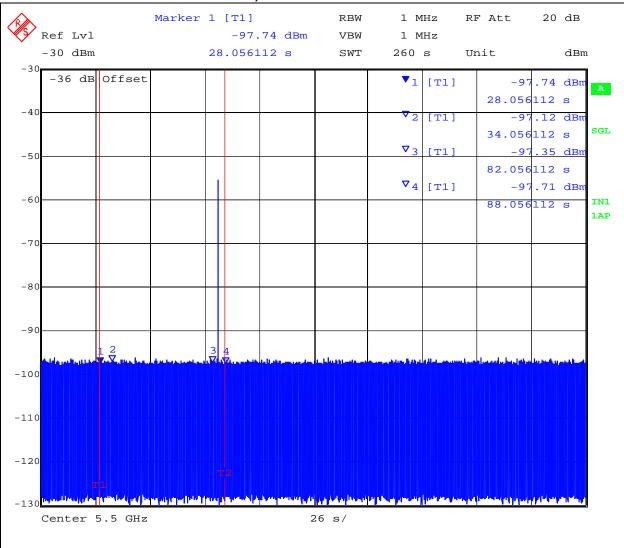
A single Burst of short pulse of radar type 1 will commence within a 6 second window starting at  $T_0$ + 54 seconds. The window will commence at marker 2 and end at the red frequency line  $T_2$ .

Visual indication on the EUT of successful detection of the radar Burst will be recorded and reported. Observation of emissions at 5,500MHz 802.11a & 5,510MHz 802.11n HT40 will continue for 2.5 minutes after the radar burst has been generated.



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## Channel Availability Check Time at T0 + 54 seconds Check Time 5,500MHz 802.11a

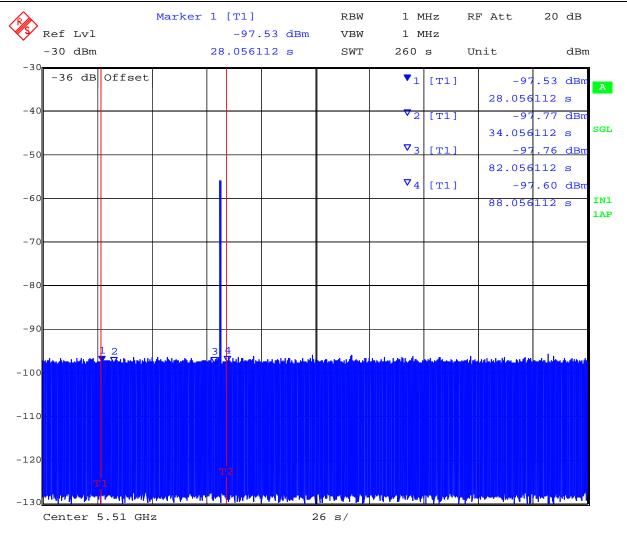


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#### Channel Availability Check Time at T0 + 54 seconds Check Time 5,510MHz 802.11n HT40



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#### 6.2.5. <u>In-Service Monitoring for Channel Move Time, Channel Closing Transmission</u> <u>Time and Non-Occupancy Period</u>

## FCC §15.407(h)(2)(iii)

The steps below define the procedure to determine the above mentioned parameters when a radar Burst with a level equal to the DFS Detection Threshold is generated on the Operating Channel of the U-NII device.

A U-NII device operating as a Client Device will associate with the EUT (Master). The requisite MPEG video file ("TestFile.mpg" available on the NTIA website at the following link http://ntiacsd.ntia.doc.gov/dfs/) is streamed from the master device (AP) to the client.

#### **Channel Closing Transmission Time - Measurement**

A Type 1 waveform was introduced to the EUT, from which a 12 second transmission record was digitally captured, collecting nearly 250M samples of data, which included in excess of 600 ms of pre-trigger data. This Type 1 waveform had an integral marker built into its construction, marking the start of the radar waveform play, which directly triggered the PXI digitizer's data capture via the PXI backplane trigger bus.

The test system was set-up to capture all transmission data for access point events above a threshold level of -50 dBm. The test equipment time stamps all captured events with respect to  $T_0$  (zero time indicating the start of the measurements sequence) starting the 612.1 ms pre-trigger period followed by the radar type 1 burst period.

Radar (Type 1) Pre-trigger period 612.1 ms

Type 1 burst period 25.70 ms

(The period of the 18 pulse burst includes [18 pulses \*1.428mS PRI] = 25.704 ms. Then add 1 µs pulse width for the final pulse.)

Channel Closing Transmission Time starts immediately after the last radar pulse is transmitted i.e. 637.8 ms after the start of the trace capture period.

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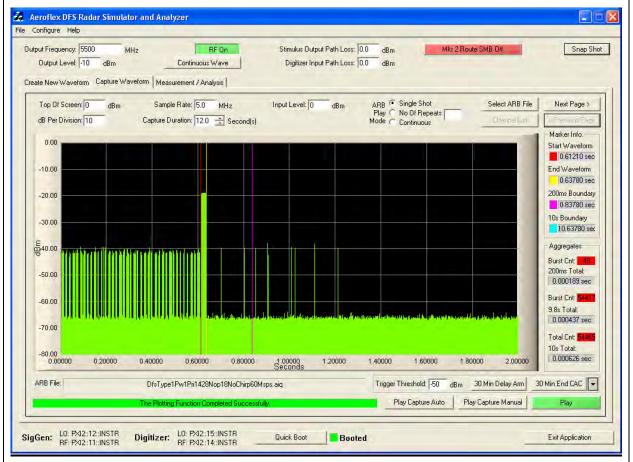
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Therefore, pulses seen after this 637.8 ms boundary are identified and totaled to provide an aggregate total of transmissions in order to determine whether the EUT is compliant with the Channel Closing Transmission Time requirements as described in MO&O FCC 06-96. In this case, it was found that an aggregate total of <u>0.00 ms</u> of transmission time accrued. This value is found at the right hand side at the foot of the following plot (10s Total).

## Channel Closing Transmission Time 5,500 MHz (802.11a) = <u>0.626 mSecs (limit</u> <u>260 mSecs)</u>

## Channel Move Time 5,500MHz (802.11a) = 0.5722Secs (limit 10 Secs)

Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 0 to 2 seconds



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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 2 to 4 seconds

tput Frequency: 550 Output Level: -10 sate New Waveform	dBm	Continuous W		Stimulus Dutpu Digitizer Inpu	it Path Loss:   it Path Loss:		Mkr 2 Route SMB D		Snap Sh
Top Of Screen: 0 dB Per Division: 11 0.00			MHz	Input Level: 0	dBm	ARB	eats		Next Page > < Previous Page Marker Info. Start Waveform
-10.00									0.61210 sec End Waveform 0.63780 sec 200ms Boundary 0.83780 sec
-30.00 -50.00									10s Boundary 10.63780 sec Aggregates Burst Cnt: 48 200ms Total:
-60.00 -60.00 -70.00	Head balling bands the other	smillplanest()cs(files(files(ling)anes))sc	Henelon) etheriot	d a the start of specification of the	gad tay (gadal)	hi dey ti bli y an hild er se det stronen de	g legenet futforios bland, second grant b	they are	0.000189 sec Burst Cnt: <b>54417</b> 9.8s Total: 0.000437 sec
-80.00 2.00000	2.20000 2	.40000 2.60000	2.80000	3.00000 Seconds	3.20000	3,40000 3.600	00 3.80000		Total Cnt: <mark>54465</mark> 10s Total: 0.000626 sec
ARB File:		DfsType1Pw1Pri1428No he Plotting Function Comp		s.aiq		Trigger Threshold:			fin End CAC

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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 4 to 6 seconds

output Level: -10	MHz dBm pture Waveform	Continuous V		Stimulus Outp Digitizer Inp	ut Path Loss: ut Path Loss:		Mkr 2 Route SMB Off	Snap Sh
Top Of Screen: 0 dB Per Division: 10 0.00	dBm Ca	Sample Rate: 5.0 opture Duration: 12.0	MHz	Input Level: 0	dBm	ARB <sup>(©</sup> Single Shot Play ⊂ No Di Repeat Mode ← Continuous	s Select ARB File	Next Page >    < Previous Page   - Marker Info.   Start Waveform
-10.00								0.61210 sec End Waveform 0.63780 sec 200ms Boundary 0.83780 sec 10s Boundary
튶40.00 -50.00								10.63780 sec Aggregates Burst Cnt: 48 200ms Total: 0.000189 sec
-60.00 -70.00 -80.00 4.00000 4.21	0000 4.41	<sup>1</sup> 43142/00034432/4944444444444444444444444444444444	4.80000	5.00000 Seconds	5.20000	5.40000 5.60000	მევაქტრია კათი თენქტრიი 5.80000 6.00000	Burst Cnt: 54417 9.8s Total: 0.000437 sec Total Cnt: 54465 10s Total: 0.000626 sec
ARB File:		)fsType1Pw1Pri1428N e Plotting Function Com		tsps.aig		Trigger Threshold: -50 Play Capture Au		30 Min End CAC

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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 6 to 8 seconds

itput Frequency: 5500 Output Level: -10 sate New Waveform	MHz dBm Capture Wavefor	Continuou Measurement / Ar			tput Path Loss: iput Path Loss:		Proute SMB Dff	Snap Sł
Top Of Screen: 0 dB Per Division: 10 0.00	dBm	Sample Rate: 5.0 Capture Duration: 12.0	MHz Second(s)	Input Level: 0	dBm	ARB  C Single Shot Play  No Di Repeats Mode  Continuous	Select ARB File	Next Page > < Previous Page Marker Info. Start Waveform
-10.00								0.61210 sec End Waveform 0.63780 sec 200ms Boundary 0.83780 sec 10s Boundary
-30.00 -50.00								Aggregates Burst Cnt: 48 200ms Total: 0.000189 sec
-60.00 -70.00	. Nels harmon to stand out on	tilleter bestanden standen at fikken at	a kenadan jila dan se	and development of the	nharaiteath athataden.	nyan dalahan talan tilya anta anta anta	elwarfsthannerfilmteres	Burst Cnt: 54417 9.8s Total: 0.000437 sec Total Cnt: 54465
-80.00 6.00000 6.	20000 6	40000 6.60000	6.80000	7.00000 Seconds	7.20000	7.40000 7.60000	7.80000 8.00000	10s Total: 0.000626 sec
ARB File:	Т	DfsType1Pw1Pri1420 he Plotting Function C				Trigger Threshold: 50 dB Play Capture Auto	m 30 Min Delay Arm 3 Play Capture Manual	80 Min End CAC

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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 8 to 10 seconds

tput Frequency: 5500 Output Level: -10 sate New Waveform	dBm	Continuou:			ut Path Loss:   ut Path Loss:		Ikr 2 Route SMB D/f	Snap Sł
Top Of Screen: 0	dBm	Sample Rate: 5.0	MHz	Input Level: 0	dBm	ARB  G Single Shot Play C No Df Repeats	Select ARB File	Next Page >
dB Per Division: 10		Capture Duration: 12.0	Second(s)			Mode C Continuous	Channel List	< Previous Page
0.00								Marker Info.
								Start Waveform 0.61210 sec
-10.00								EndWaveform
								0.63780 sec
-20.00								200ms Boundary
								0.83780 sec
-30.00								10s Boundary
								10.63780 sec
튶40.00								Aggregates
6								Burst Cnt: 48
-50.00								200ms Total:
of the second								0.000189 sec
-60.00								Burst Cnt: 54417
at the second	No to Street - A	Contract internet inter	and the Locathin of	the second data		ala cara tita dala	and him to an a state	9.8s Total:
-70.00	ad and collection and a	All the second	and have been and the		an o the Carolin Sector	an er ditter mit sint den den ber in er het beidet.	O PERSONAL CONTRACTOR OF ST	0.000437 sec
								Total Cnt: 54465
-80.00								10s Total:
8.00000	8.20000 8	3.40000 8.60000	8.80000	9.00000 Seconds	9.20000	9.40000 9.60000	9.80000 10.00000	0.000626 sec
ARB File:		DfsType1Pw1Pri1428	MaateklaChiz-CO			Trigger Threshold: -50	dBm 30 Min Delay Arm	30 Min End CAC 두
THE THE		Distyperewieff1420	IN OF LON OCURDEN	vishe girt				
	3	The Plotting Function C	ompleted Successi	fally.		Play Capture Auto	Play Capture Manual	Play

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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 10 to 12 seconds

tput Frequency: Output Level: ate New Wavef	-10 dBm	zContinuo		Stimulus Dutpu Digitizer Inpu	it Path Loss: It Path Loss:		ute SMB Off	Snap Sł
Top Of Screen	n: 0 dBm	Sample Rate: 5.1		Input Level: 0	dBm	ARB  Single Shot Play No Df Repeats	Select ARB File	NextPage -
dB Per Division	n 10	Capture Duration: 12	0 🛨 Second(s)			Mode C Continuous	Channel List	< Previous Page
0.00								Marker Info.
0.00								Start Waveform 0.61210 sec
-10.00								End Waveform
-10,00								0.63780 sec
-20.00								200ms Boundary
-20.00								0.83780 sec
-30.00								10s Boundary
-30.00								10.63780 sec
튣40.00								Aggregates
840.00								Burst Cnt: 48
-50.00								200ms Total:
-50.00								0.000189 sec
-60.00								Burst Cnt: 54417
-60.00								9.8s Total:
-70.00	all the state of the state of the			and the second secon	NING COLOR OF STR		and her are the start of the start of	0.000437 sec
-70,00								Total Cnt: 54465
-80.00								10s Total:
10.00000	10.20000	10.40000 10.600	00 10.80000	11.00000 Seconds	11.20000	11.40000 11.60000 11.8	0000 12.00000	0.000626 sec
ARB File:		DfsType1Pw1Pri14;	28Nop18NoChim60t			Trigger Threshold: -50 dBm	30 Min Delay Arm 3	0 Min End CAC
and a second								
		The Auto Test Function	Completed Succes	sfully.		Play Capture Auto Pl	ay Capture Manual	Play

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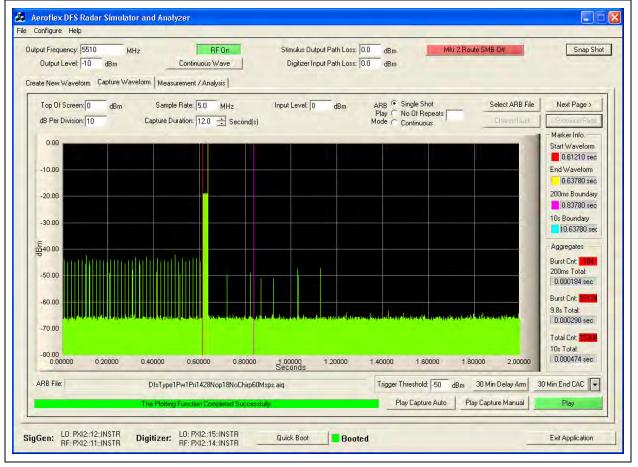


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Channel Closing Transmission Time 5,510 MHz (802.11n HT40) = 0.474 mSecs (limit 260 mSecs)

Channel Move Time 5,510 MHz (802.11n HT40) = 0.5522 Secs (limit 10 Secs)

#### Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 0 to 2 seconds



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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 2 to 4 seconds

Itput Frequency: 55 Output Level: -11 eate New Waveform	) dBm	Continuous V Continuous V prm   Measurement / Anal		Stimulus Dutp Digitizer Inp	ut Path Loss:   ut Path Loss:		Mkr 2 Rout	e SMB QIf	Snap Sh
Top Of Screen:		Sample Rate: 5.0 Capture Duration: 12.0	MHz Second(s)	Input Level: 0	dBm	ARB	neats	Select ARB File	Next Page > < Previous Page Marker Info.
-10.00									Start Waveform 0.61210 sec End Waveform 0.63780 sec 200ms Boundary 0.83780 sec
-30.00 -50.00									10s Boundary 10.63780 sec Aggregates Burst Cnt: 184 200ms Total:
-60.00 (12/03-66	a antifer a step of the stife failer	so hats as here in the endinessity	and have the laws	ājadadā at atradīta	a <mark>han Hepertugaa</mark>	a Litt souther of the state of the state	an de proton de a <sup>18</sup> a de ser de ser	Alf Sheley was directed with	0.000184 sec Burst Cnt: <b>15124</b> 9.8s Total: 0.000290 sec Total Cnt: <b>15308</b>
-80.00 2.00000	2.20000	2.40000 2.60000	2.80000	3.00000 Seconds	3.20000	3.40000 3.60	000 3.800	000 4.00000	10s Total: 0.000474 sec
ARB File:		DfsType1Pw1Pri1428N				Trigger Threshold: Play Capture	-	30 Min Delay Arm 3 Capture Manual	0 Min End CAC 두 Play

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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 4 to 6 seconds

Itput Frequency: 5 Output Level: 1 eate New Wavefor	l0 dBm	Continuous W	ave	imulus Output Path Los: Digitizer Input Path Los:		2 Route SMB D/f	Snap Sł
Top Of Screen: dB Per Division: 0.00			MHz Inpu	t Level: 0 dBm	ARB  Single Shot Play  No Df Repeats Mode  Continuous	Select ARB File	Next Page > < Previous Page Marker Info. Start Waveform
-10.00 -20.00 -30.00							0.61210 sec End Waveform 0.63780 sec 200ms Boundary 0.83780 sec 10s Boundary 10.63780 sec
.50.00 -60.00							Aggregates Burst Cnt: 184 200ms Total: 0.000184 sec Burst Cnt: 15124 9.8s Total:
-70,00 -80,00 4.00000	d padje konstructionals 4.20000 - 4	nerd anny kerrond militae 1.40000 4.60000	4.80000 \$0 Sec	10000 5.20000 conds	a <u>t han serie (1999) - Anna (1999) - Anna (1999)</u> 5,40000 - 5,60000	seetaalajaa kutapertikije k 5.80000 6.00000	0.000290 sec Total Cnt: <b>15305</b> 10s Total: 0.000474 sec
ARB File:		DfsType1Pw1Pri1428Nop			Trigger Threshold: 50 d Play Capture Auto	Bm 30 Min Delay Arm 3 Play Capture Manual	80 Min End CAC 두 Play

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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 6 to 8 seconds

itput Frequency: 5510 Output Level: -10 eate New Waveform	dBm	Continuous Continuous			out Path Loss: out Path Loss:		Mkr 2 Ro	ute SMB Dif	Snap Sł
Top Of Screen: 0 dB Per Division: 10 0.00	dBm	Sample Rate: 5.0 Capture Duration: 12.0	MHz	Input Level: 0	dBm	ARB	eneats	Select ARB File.	Next Page > < Previous Page - Marker Info.
-10.00 -20.00 -30.00									Start Waveform 0.61210 sec End Waveform 0.63780 sec 200ms Boundary 0.83780 sec 10s Boundary 10.63780 sec
50.00           -60.00						ار بر المعر العرفي بن بالقرير بر محرال			Aggregates Burst Cnt: 184 200ms Total 0.000184 sec Burst Cnt: 16124 9.8s Total:
-70.00 -80.00 6.00000	6.20000 6	.40000 6,60000	6.80000	7.00000 Seconds	7.20000			0000 8'00000 A water i with a fair, faul	0.000290 sec Total Cnt: <b>15303</b> 10s Total: 0.000474 sec
ARB File:	T	DfsType1Pw1Pri1428h he Plotting Function Col				Trigger Threshol Play Capte		30 Min Delay Arm 31 ay Capture Manual	0 Min End CAC 두 Play

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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 8 to 10 seconds

tput Frequency: 5 Output Level: - eate New Wavefo	10 dBm	zContinuo eform   Measurement / A		Stimulus Dutp Digitizer Inpr	ut Path Loss:   ut Path Loss:		oute SMB Off	Snap Sł
Top Of Screen: dB Per Division:		Sample Rate: 5.0 Capture Duration: 12		Input Level: 0	dBm	ARB C Single Shot Play C No Df Repeats Mode C Continuous	Select ARB File	Next Page >
0.00 -10.00 -20.00								Marker Info. Start Waveform 0.61210 sec End Waveform 0.63780 sec 200ms Boundary
-30.00								0.83780 sec 10s Boundary 10.63780 sec Aggregates Burst Cnt: 184
-50.00 -60.00 -70.00	aksana ana dina dina da da da	urte tryth, daeda unsernationalistation	ang public with discovery di	pine and the of protogen of	un titel and by the bit	gration that a labely tray by tray by tray by the	an <mark>material state for the state state of the state st</mark>	200ms Total: 0.000184 sec Burst Cnt: <b>15124</b> 9.8s Total: 0.000290 sec
-80.00 8.00000	8.20000	8.40000 8.6000	0 8,80000	9.00000 Seconds	9.20000	9,40000 9,60000 9,6	30000 10.00000	Total Cnt: <b>15308</b> 10s Total: 0.000474 sec
ARB File:		DfsType1Pw1Pri142				Trigger Threshold: -50 dBm Play Capture Auto F	30 Min Delay Arm 3 Play Capture Manual	80 Min End CAC 두 Play

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## Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 10 to 12 seconds

tput Frequency: 551 Output Level: -10 sate New Waveform	dBm	Continuo		Stimulus Dutp Digitizer Inpi	ut Path Loss:   ut Path Loss:		ute SMB DIf	Snap Sł
Top Of Screen: 0	dBm	Sample Rate: 5.0	) MHz	Input Level: 0	dBm	ARB  Single Shot Play No Of Repeats	Select ARB File	Next Page ×
dB Per Division: 1(	)	Capture Duration: 12	0 🕂 Second(s)			Mode C Continuous	Charmelitusi	< Previous Page
0.00								Marker Info.
0.00								Start Waveform 0.61210 sec
-10.00								End Waveform
								0.63780 sec
-20.00								200ms Boundary
								0.83780 sec
-30.00								10s Boundary
								10.63780 se
튶40.00		_			_			Aggregates
0								Burst Cnt: 184
-50.00								200ms Total: 0.000184 sec
100								FIRE FIRE FIRE STREET
-60.00								Burst Cnt: 15124 9.8s Total:
dan dan dalam	and the second state	alla anticipation in the sector	lastic aspected at the	Stanty South a state of the state	the state of the s	and the second state of the second state of the second states of the second states of the second states of the	Reladentellen over der	0.000290 sec
-70.00								Total Cnt: 15308
								10s Total:
-80.00 10.00000	10.20000 1	0.40000 10.600	00 10.80000	11.00000 Seconds	11.20000	11.40000 11.60000 11.8	0000 12.00000	0.000474 sec
ARB File:		DfsType1Pw1Pri142	28Nop18NoChirp60N	Asps.aig		Trigger Threshold: -50 dBm	30 Min Delay Arm 3	0 Min End CAC
_		ne Auto Test Function	Consisted Success			Play Capture Auto Pl	ay Capture Manual	Play
		re Auto Test Function	Completed Succes	stuny.				Fidy

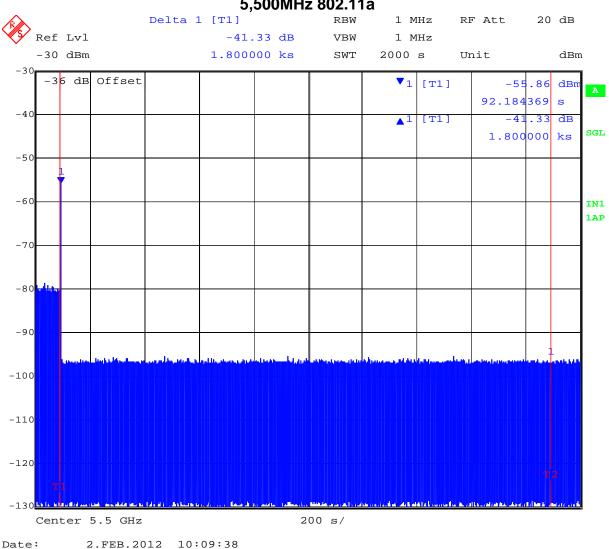
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#### 30 Minute Non-Occupancy Period

The EUT is monitored for more than 30 minutes following the channel close/move time to verify no transmissions resume on this Channel.



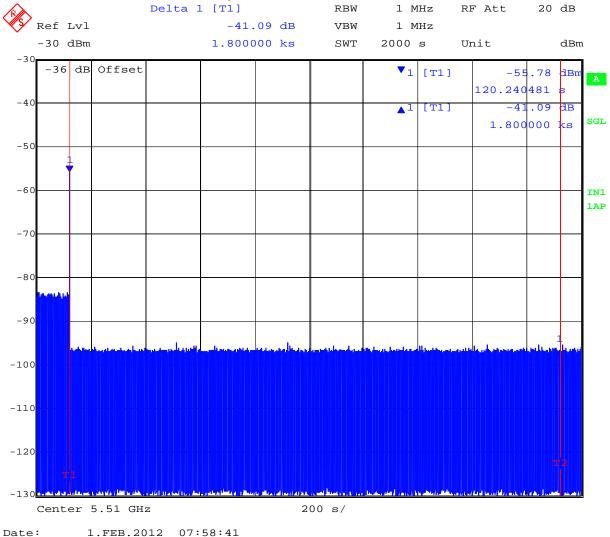
30 Minute Non-Occupancy Period Type 1 Radar 5,500MHz 802.11a

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## 30 Minute Non-Occupancy Period Type 1 Radar 5,510 MHz802.11n HT40



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#### 6.2.6. Statistical Performance Check

The steps below define the procedure to determine the minimum percentage of detection when a radar burst with a level equal to the DFS Detection Threshold is generated on the Operating Channel of the U-NII device.

A U-NII device operating as a Client Device will associate with the UUT (Master) at 5,500MHz 802.11a and 5,510MHz 802.11n HT40.

The Radar Waveform generator sends the individual waveform for each of the radar types 1-6. Statistical data will be gathered to determine the ability of the device to detect the radar test waveforms. The device can utilize a test mode to demonstrate when detection occurs to prevent the need to reset the device between trial runs. The percentage of successful detection is calculated by:

Total # of detections  $\div$  Total # of Trials  $\times$  100 = Probability of Detection

The Minimum number of trails, minimum percentage of successful detection and the average minimum percentage of successful detection are found in the Radar Test Waveforms section.



 Title:
 Aruba AP-93H 802.11a/b/g/n Wireless AP

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#### Verification of Detection 5,500MHz 802.11a

Trial #				o Detection	= 0	
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
1				$\overline{\mathbf{v}}$		
2	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
3	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
4	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
5	$\checkmark$	0		$\checkmark$	$\checkmark$	$\checkmark$
6	0	0		$\checkmark$	$\checkmark$	$\checkmark$
7	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$
8	$\checkmark$	0	$\checkmark$	0	$\checkmark$	$\checkmark$
9	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$
10	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	0
11	$\checkmark$	$\checkmark$	$\checkmark$	0	$\checkmark$	$\checkmark$
12	$\checkmark$	$\checkmark$	$\checkmark$	0	$\checkmark$	$\checkmark$
13	$\checkmark$	$\checkmark$		$\checkmark$	$\checkmark$	
14	$\checkmark$	0		$\checkmark$	0	
15		$\checkmark$		$\checkmark$	$\checkmark$	
16	$\checkmark$	$\checkmark$		$\checkmark$		
17		$\checkmark$	0	0	$\checkmark$	$\checkmark$
18		$\checkmark$		$\checkmark$	$\checkmark$	0
19		$\checkmark$		$\checkmark$	$\checkmark$	
20		0		$\checkmark$	$\checkmark$	
21		$\checkmark$	√			
22		$\checkmark$		$\checkmark$	$\checkmark$	
23		$\checkmark$	√			
24		$\checkmark$			$\checkmark$	
25		$\checkmark$	√			
26		$\checkmark$		$\checkmark$	$\checkmark$	
27		$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$
28	V	$\checkmark$		$\checkmark$	$\checkmark$	0
29		$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$
30				$\checkmark$	$\checkmark$	$\checkmark$
Detection Percentage	96.6% (>60%)	83.3% (>60%)	96.6% (>60%)	86.6% (>60%)	96.6% (>80%)	90% (>70%)

In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is required and calculated as follows;

 $\frac{(P_d 1 + P_d 2 + P_d 3 + P_d 4)}{4} / 4 = \frac{96.6\% + 83.3\% + 96.6\% + 86.6\%}{4} = 90.7\% (>80\%)$ 

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 Aruba AP-93H 802.11a/b/g/n Wireless AP

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 FCC 47 CFR Part 15.407 & IC RSS-210

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#### Verification of Detection 5,510MHz 802.11n HT40

Trial #	Detection = $$ , No Detection = 0							
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6		
1	$\sim$	$\sim$	$\sim$	$\overline{\mathbf{v}}$	$\overline{\mathbf{v}}$	$\sim$		
2	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
3	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
4	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
5	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
6	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
7	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
8	$\checkmark$	$\checkmark$	$\checkmark$	0	$\checkmark$	$\checkmark$		
9	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
10	$\checkmark$	0	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
11	$\checkmark$	0	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
12	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
13	$\checkmark$	0	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
14	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
15	$\checkmark$	0	0	$\checkmark$	$\checkmark$	$\checkmark$		
16	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
17	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
18	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
19	$\checkmark$	$\checkmark$	$\checkmark$	0	0	$\checkmark$		
20	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
21	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
22	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
23	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
24	$\checkmark$	0	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
25	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
26	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
27	$\checkmark$		$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
28	$\checkmark$	$\checkmark$	$\checkmark$		$\checkmark$			
29	$\checkmark$	$\checkmark$	$\checkmark$	0	$\checkmark$	$\checkmark$		
30	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$	$\checkmark$		
Detection Percentage	100% (>60%)	83.3% (>60%)	96.6% (>60%)	90% (>60%)	96.6% (>80%)	100% (>70%)		

In addition an average minimum percentage of successful detection across all four Short pulse radar test waveforms is required and calculated as follows;

 $\frac{(P_d 1 + P_d 2 + P_d 3 + P_d 4)}{4} / 4 = \frac{100\% + 83.3\% + 96.6\% + 90\%}{4} = 92.4\% (>80\%)$ 

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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

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## 7. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0088	Spectrum Analyzer	Hewlett Packard	8564E	3410A00141
0134	Amplifier	Com Power	PA 122	181910
0158	Barometer /Thermometer	Control Co.	4196	E2846
0287	EMI Receiver	Rhode & Schwartz	ESIB 40	100201
0252	SMA Cable	Megaphase	Sucoflex 104	None
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787- 3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181- 3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	3140A01285
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52
0190	LISN	Rhode & Schwartz	ESH3Z5	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0301	5.6 GHz Notch Filter	Micro-Tronics	RBC50704	001
0302	5.25 GHz Notch Filter	Micro-Tronics	BRC50703	002
0303	5.8 GHz Notch Filter	Micro-Tronics	BRC50705	003
0304	2.4GHzHz Notch Filter	Micro-Tronics		001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002
0335	1-18GHz Horn Antenna	ETS- Lindgren	3117	00066580
0337	Amplifier	MiCOM Labs		
0338	Antenna	Sunol Sciences	JB-3	A052907

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