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 REPORT

FROM

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

Note: 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

This Test Report is Issued Under the Authority of;

MiCOM Labs, Inc.
440 Boulder Court, Suite 200
Pleasanton, CA 94566 USA
Phone: +1 (925) 462-0304
Fax: +1 (925) 462-0306
www.micomlabs.com

ACCREDITED
CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION, LISTINGS & RECOGNITION

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

ilac-MRA

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

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

Presented this 14th day of April 2010.

President & CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to March 31, 2012
Revised January 20, 2012

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

RECOGNITION

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

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	Listing #: 4143A
Japan	MIC	CAB	APEC MRA 2	210
	VCCI	--	--	No. 2959
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

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

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

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

**NB – Notified Body

PRODUCT CERTIFICATION

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

The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence as a

Product Certification Body

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC Guide 65:1996 *General requirements for bodies operating product certification systems*. This accreditation demonstrates technical competence for a defined scope and the operation of a quality management system for a Telecommunications Certification Body (TCB) meeting FCC (U.S.), Japan (MIC), and IC (Canada) requirements.

Presented this 24th day of June 2010.

President & CEO
For the Accreditation Council
Certificate Number 2381.02
Valid to March 31, 2012
Revised January 20, 2012

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

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

Industry Canada – Certification Body
CAB Identifier – US0159

Europe – Notified Body
Notified Body Identifier - 2280

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

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	16th February 2012	Initial Release

1. TEST RESULT CERTIFICATE

Applicant:	Aruba Networks, Inc 1344 Crossman Avenue Sunnyvale CA 94089, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	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):	8th Oct 2011 – 7th 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.

ACCREDITED
CERTIFICATE #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

Ref.	Publication	Year	Title
(i)	FCC 47 CFR Part 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	14th September 2005	Reference to A2LA Accreditation Status – A2LA Advertising Policy
(xi)	FCC Public Notice – DA 02-2138	2002	Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices

2.2. Test and Uncertainty Procedures

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

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

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

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the 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:	6th 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: (Average Power)	802.11a: Legacy +17 dBm 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 ºC Max: 50 ºC Min: 0 ºC
ITU Emission Designator:	802.11a 18M5D1D 802.11n HT-20 19M5D1D 802.11n HT-40 39M9D1D
Frequency Stability:	±20 ppm
Equipment Dimensions:	12.0 cm x 12.7 cm x 3.2 cm
Weight:	375 grams
Primary function of equipment:	Wireless Access Point for transmitting data and voice

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	Type	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

3.6. Test Configurations

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

Matrix of test configurations

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

Spurious Emission and Band-Edge Test Strategy

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

KEY:-

SE – Spurious Emissions

BE – Band-Edge

3.7. Equipment Modifications

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

1. NONE

3.8. Deviations from the Test Standard

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

1. NONE

3.9. Subcontracted Testing or Third Party Data

1. NONE

4. TEST SUMMARY

List of Measurements

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

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
	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

5. TEST RESULTS

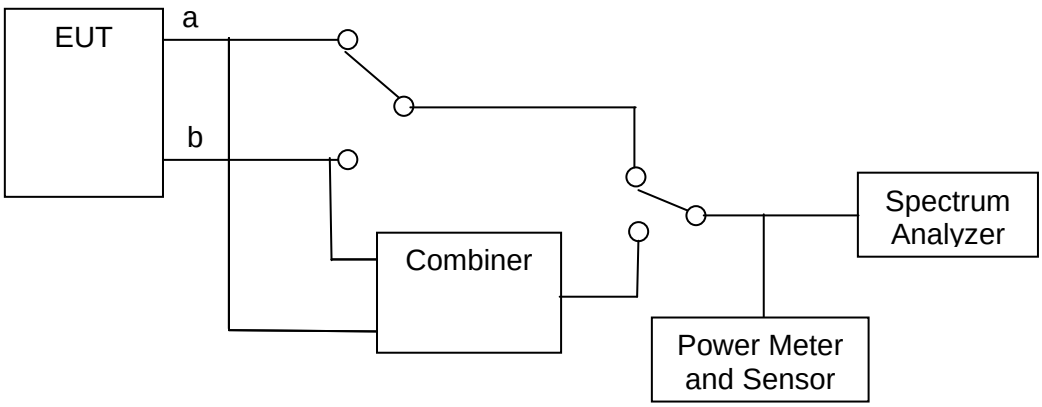
5.1. Device Characteristics

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

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

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

TABLE OF RESULTS – **802.11a Legacy (5,250 – 5,350 MHz)**

Test Conditions:	15.247 (a)(2)	**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 (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

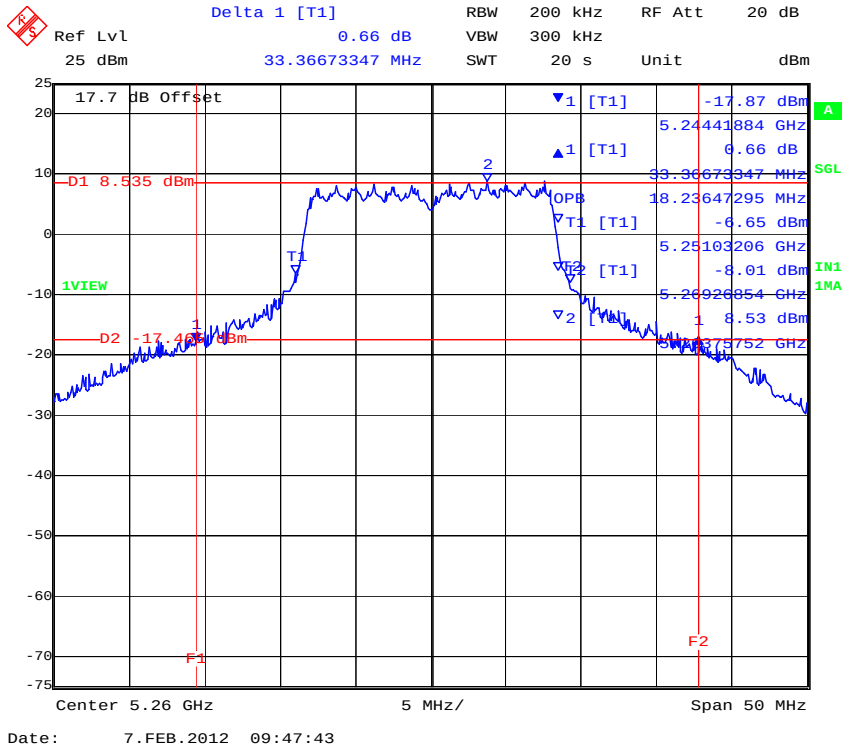
Test Frequency	26 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5260	33.367000	40.782000	--	--	500	0.5	-32.867000
5300	32.164000	37.776000	--	--			-31.664000
5320	31.463000	37.074000	--	--			-30.963000

99% Bandwidth

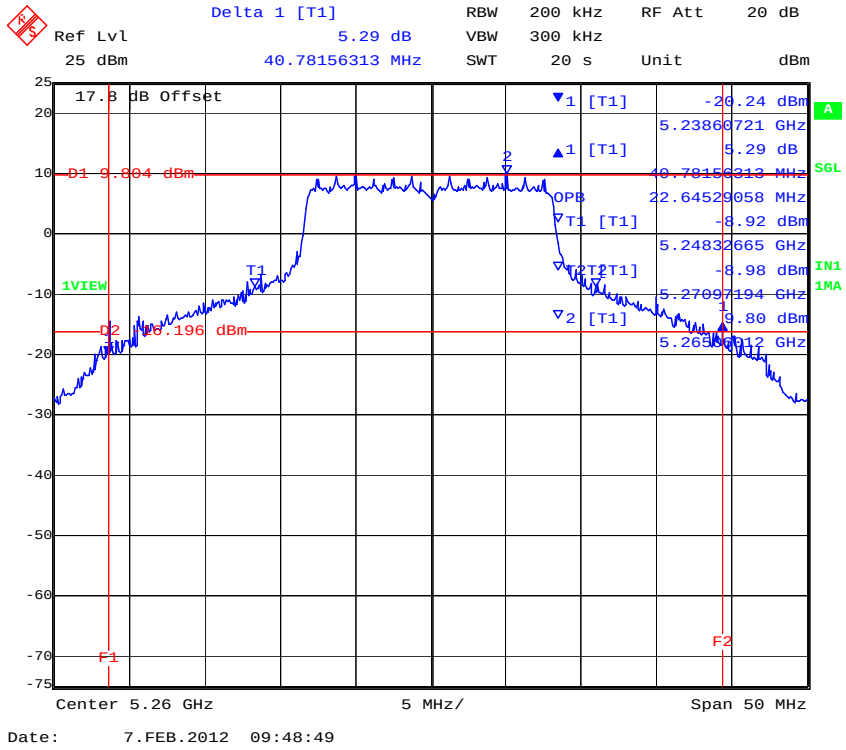
Test Frequency	99 % Bandwidth						
	MHz						
MHz	**a**	**b**	**c**	**d**			
5260	18.236000	22.645000	--	--			
5300	17.635000	21.343000	--	--			
5320	17.936000	20.341000	--	--			

Measurement uncertainty:	±2.81 dB

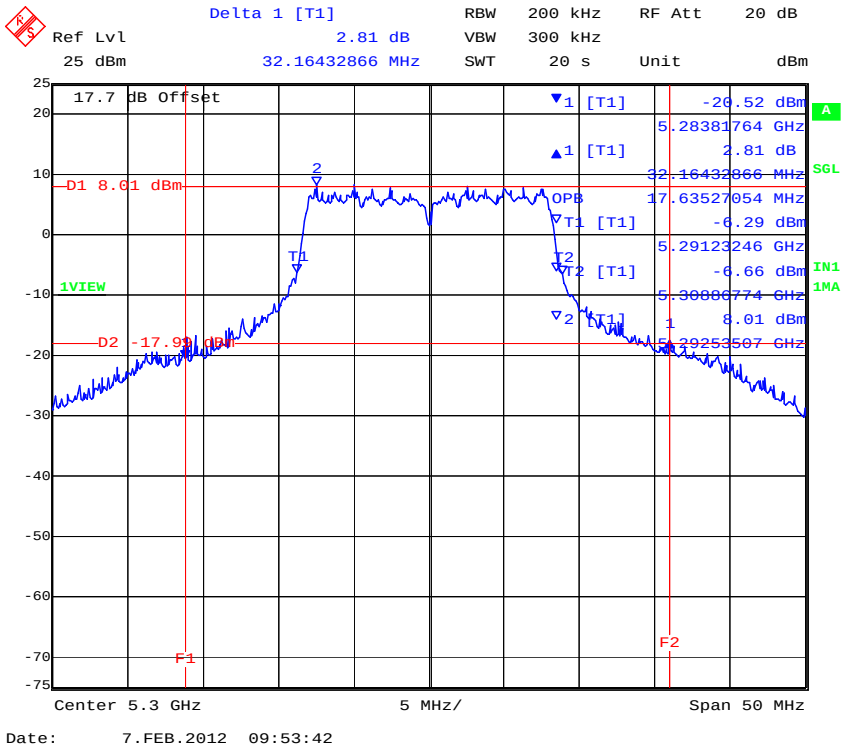
CHAIN A 5,260 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



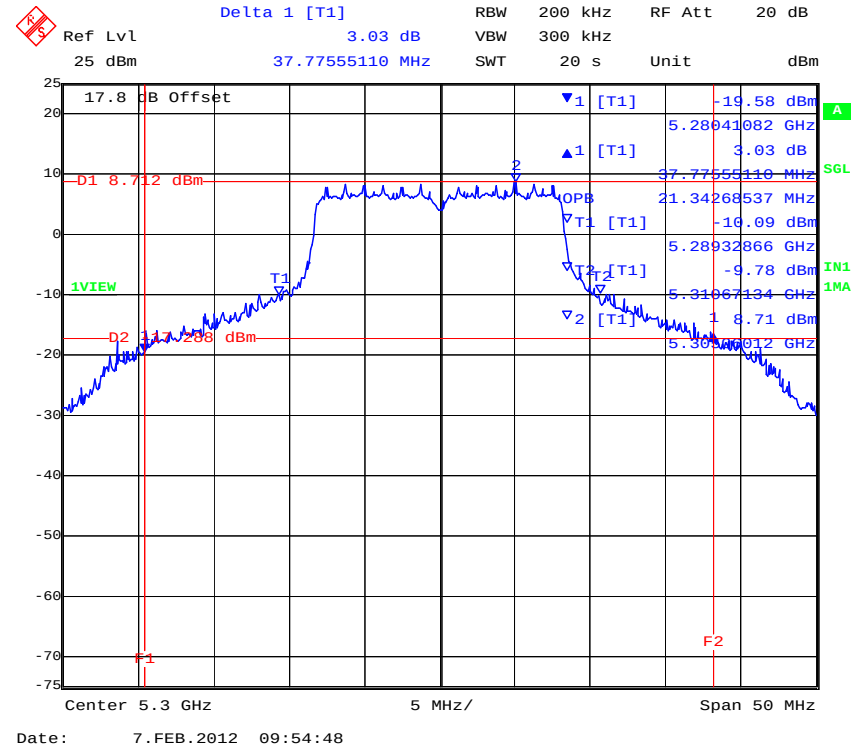
CHAIN B 5,260 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



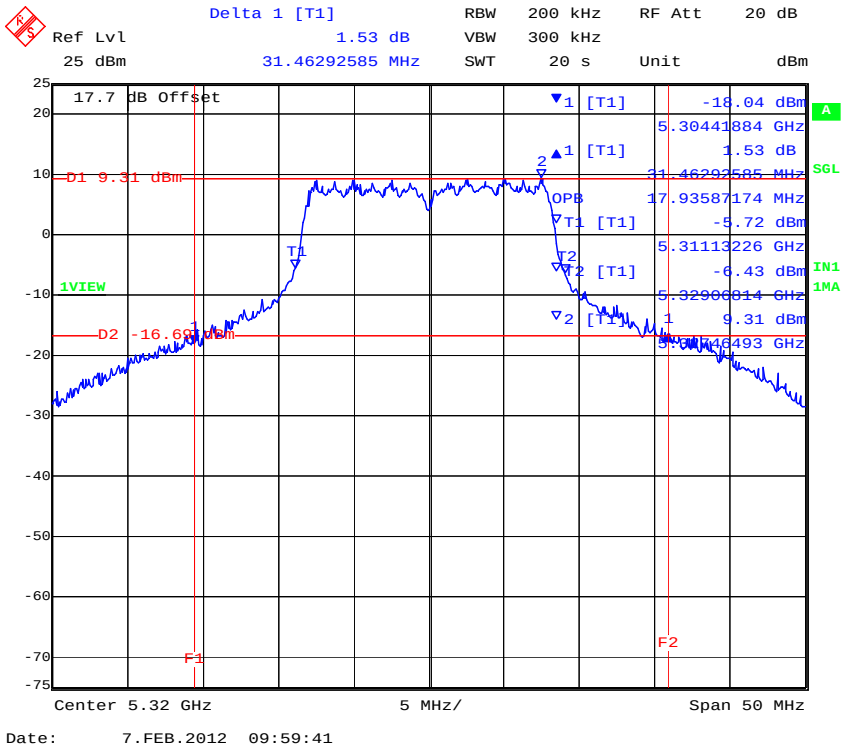
CHAIN A 5,300 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



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



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



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

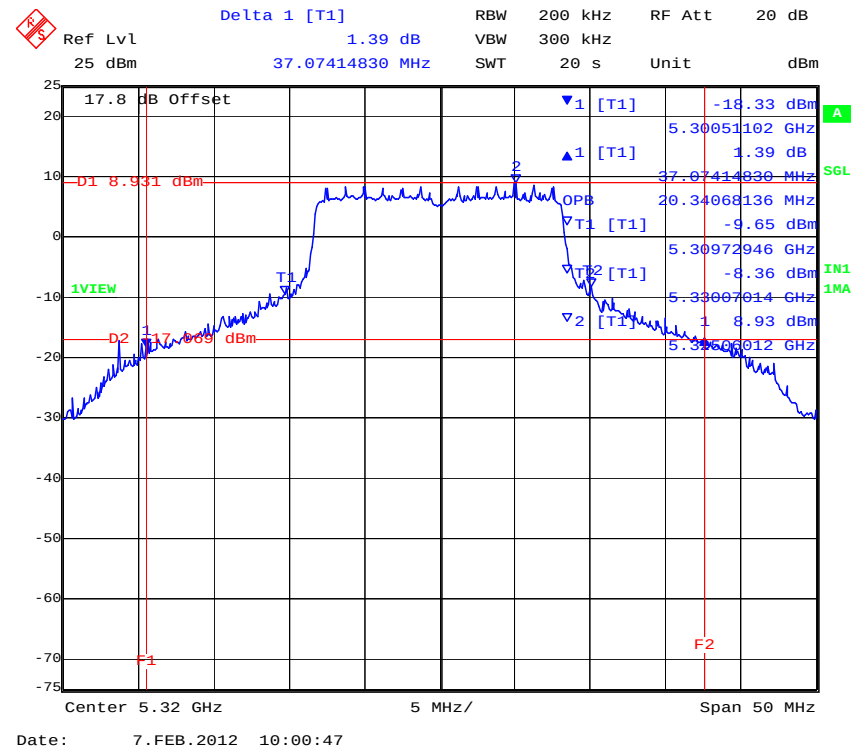


TABLE OF RESULTS – **802.11a Legacy (5,470 – 5,725 MHz)**

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 a	**Ambient Temp. (ºC):**	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

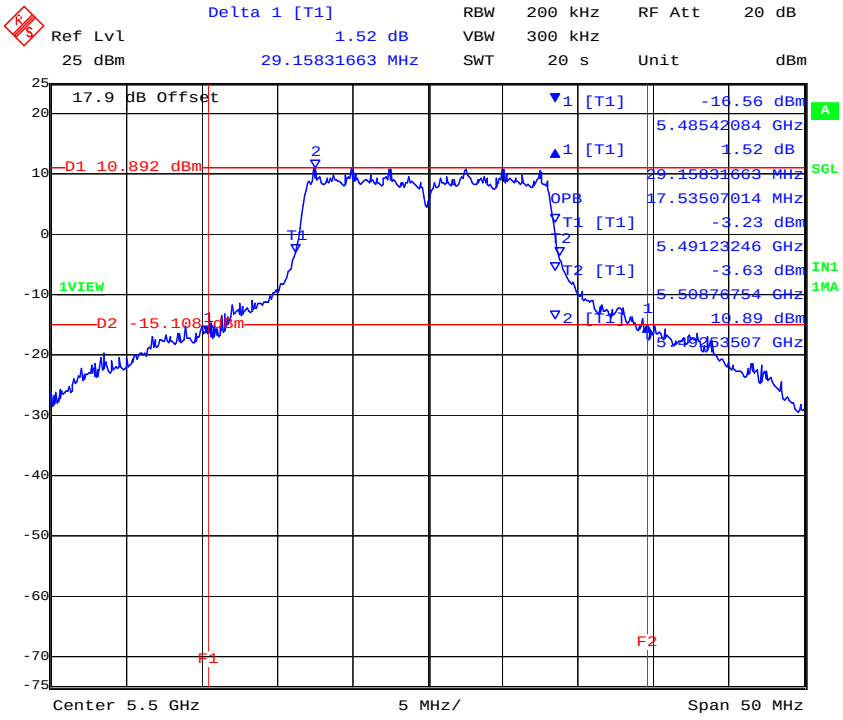
Test Frequency	26 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5500	29.158000	34.870000	--	--	500	0.5	-28.658000
5580	31.964000	37.074000	--	--			-31.464000
5700	35.070000	35.271000	--	--			-34.570000

99% Bandwidth

Test Frequency	99 % Bandwidth						
	MHz						
MHz	**a**	**b**	**c**	**d**			
5500	17.535000	18.838000	--	--			
5580	17.936000	20.040000	--	--			
5700	18.437000	19.840000	--	--			

Measurement uncertainty:	±2.81 dB

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



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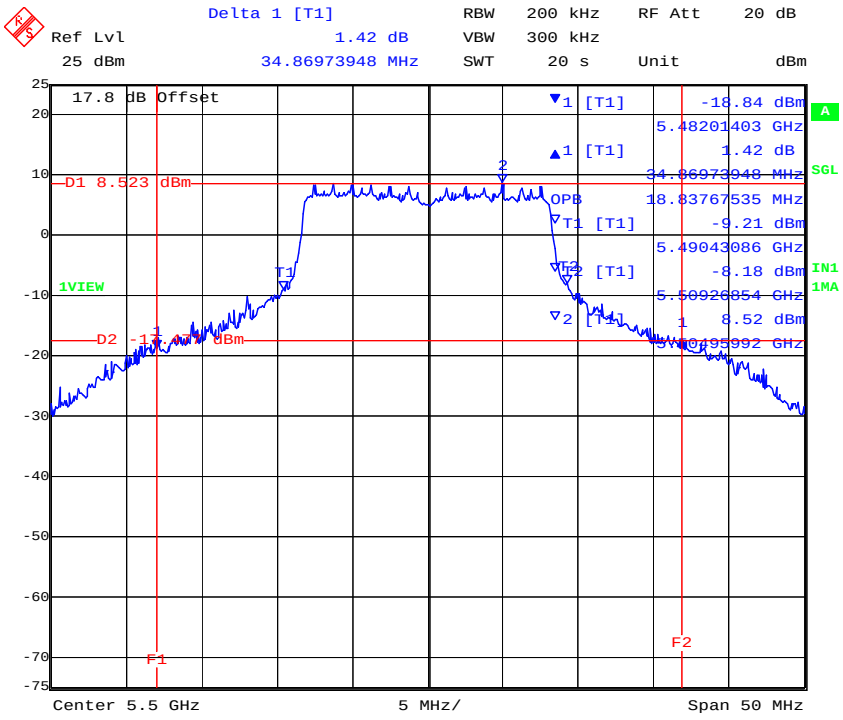
CHAIN B 5,500 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



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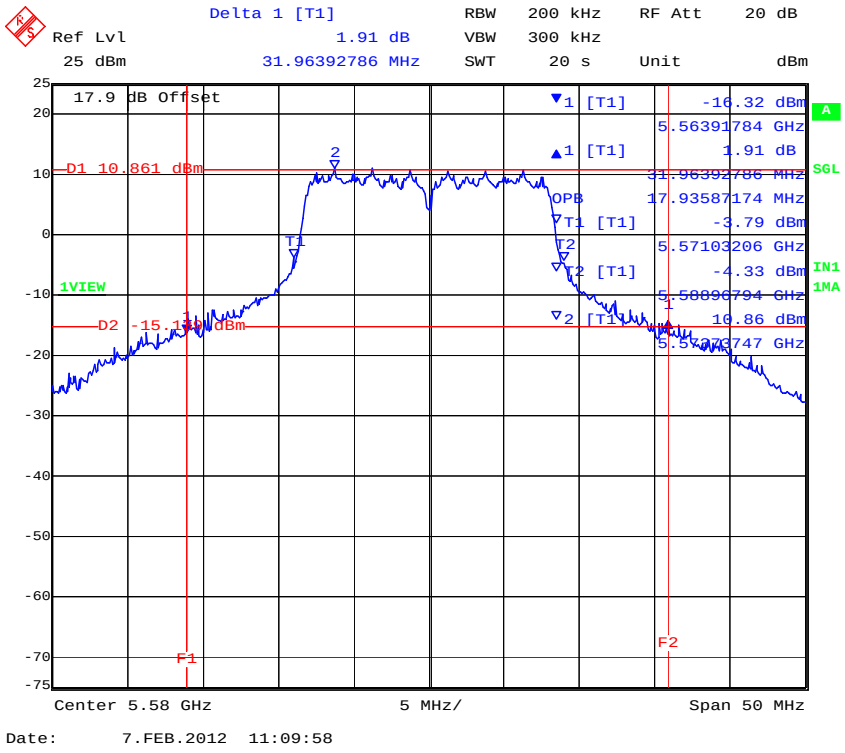
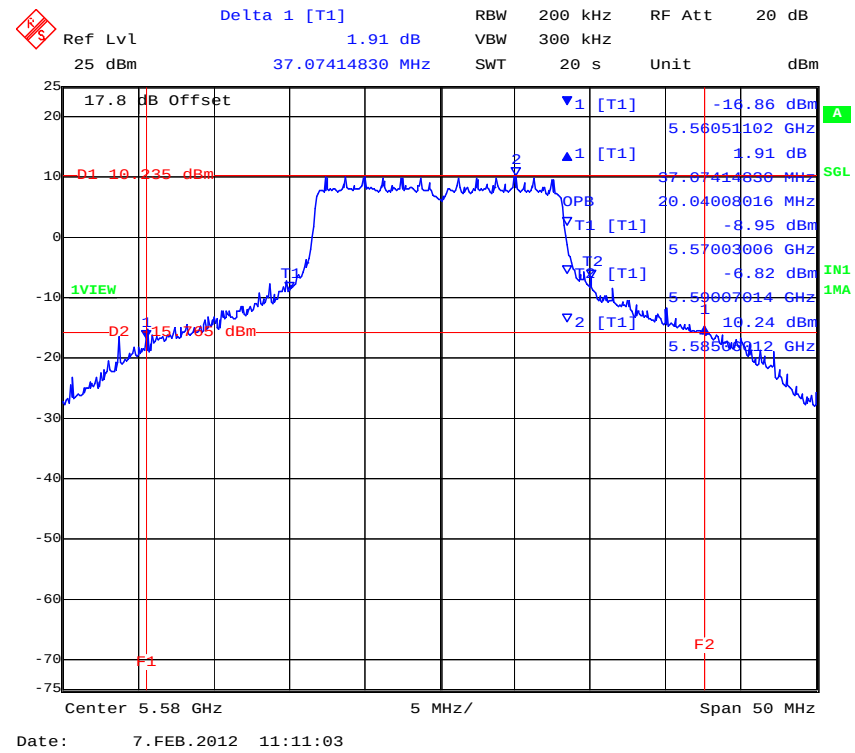
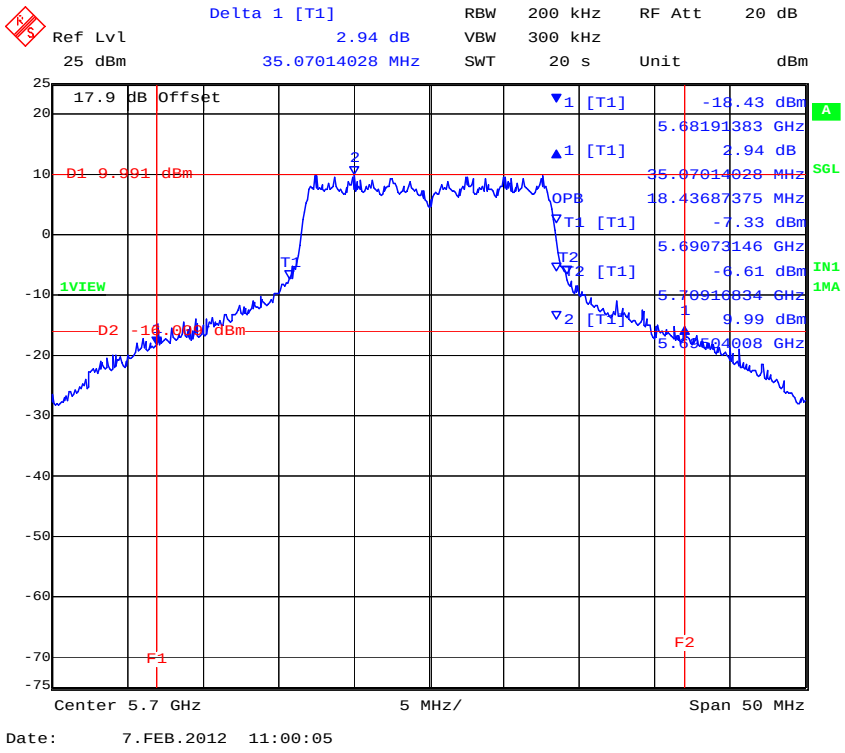
CHAIN A 5,580 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



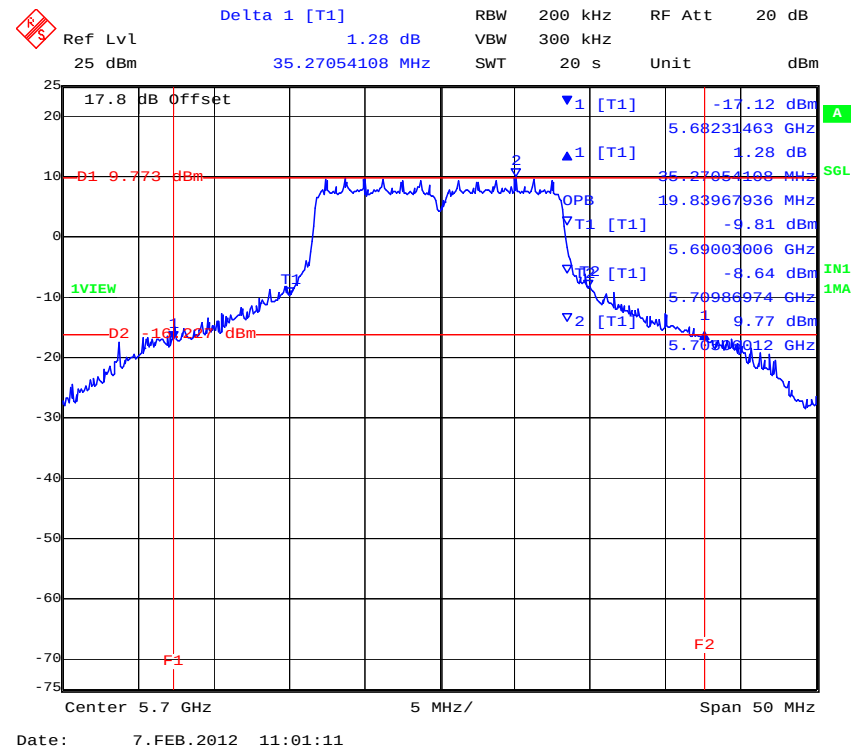
CHAIN B 5,580 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



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



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



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. (ºC):**	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

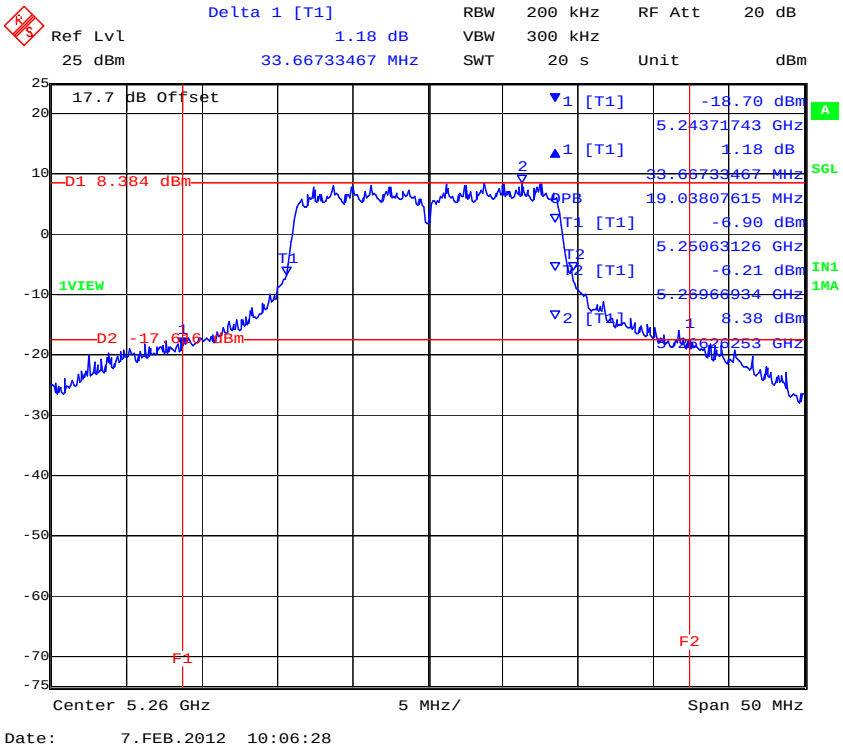
Test Frequency	26 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5260	33.667000	40.882000	--	--	500	0.5	-33.167000
5300	31.764000	38.978000	--	--			-31.264000
5320	33.567000	37.475000	--	--			-33.067000

99% Bandwidth

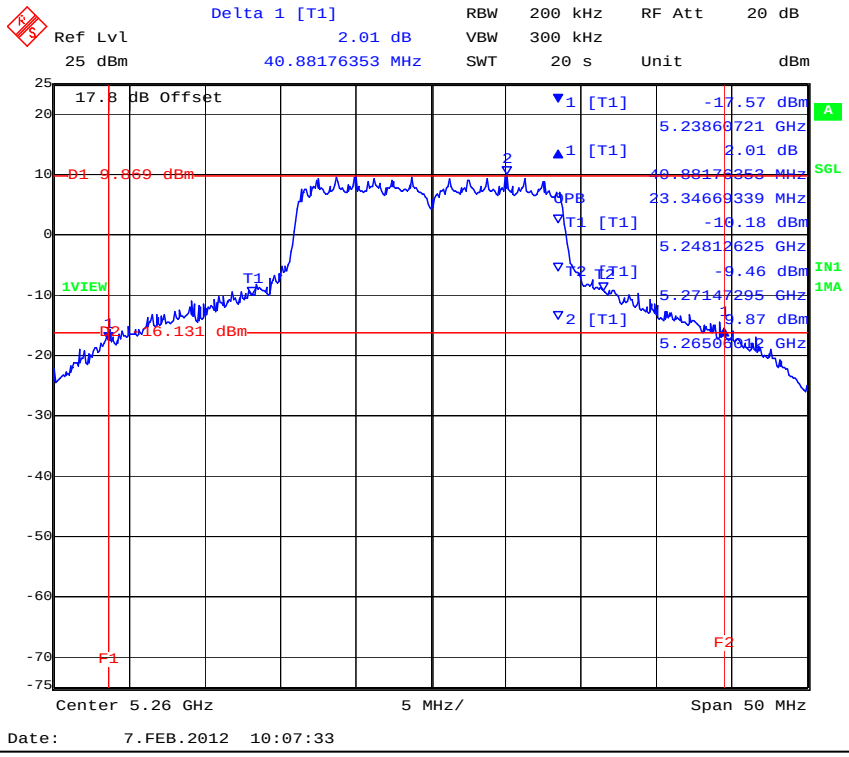
Test Frequency	99 % Bandwidth						
	MHz						
MHz	**a**	**b**	**c**	**d**			
5260	19.038000	23.347000	--	--			
5300	18.838000	21.844000	--	--			
5320	18.938000	21.142000	--	--			

Measurement uncertainty:	±2.81 dB

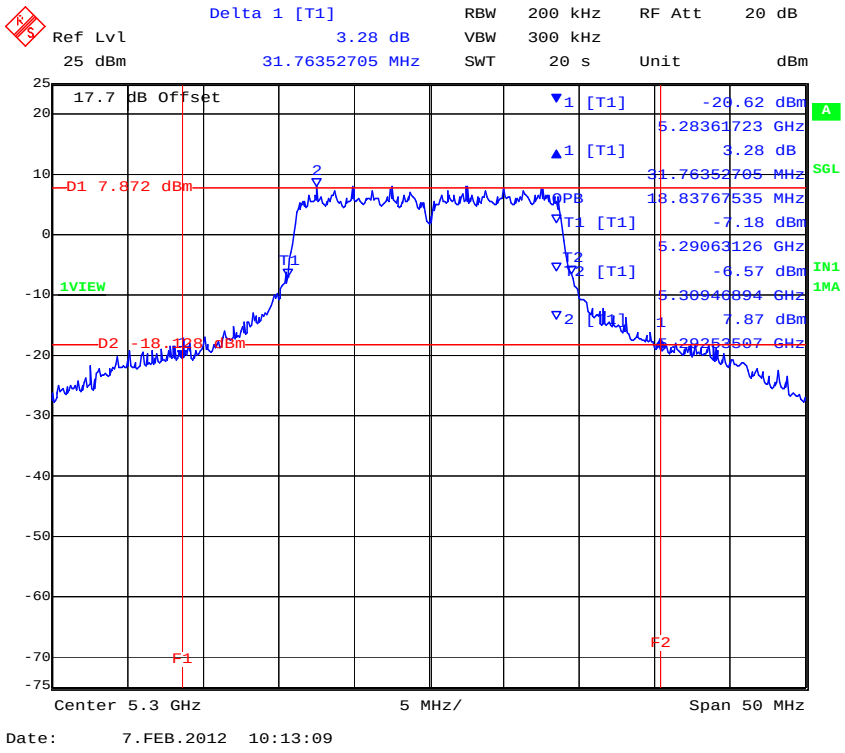
CHAIN A 5,260 MHz 802.11802.11n HT-20 26 dB and 99 % Bandwidth



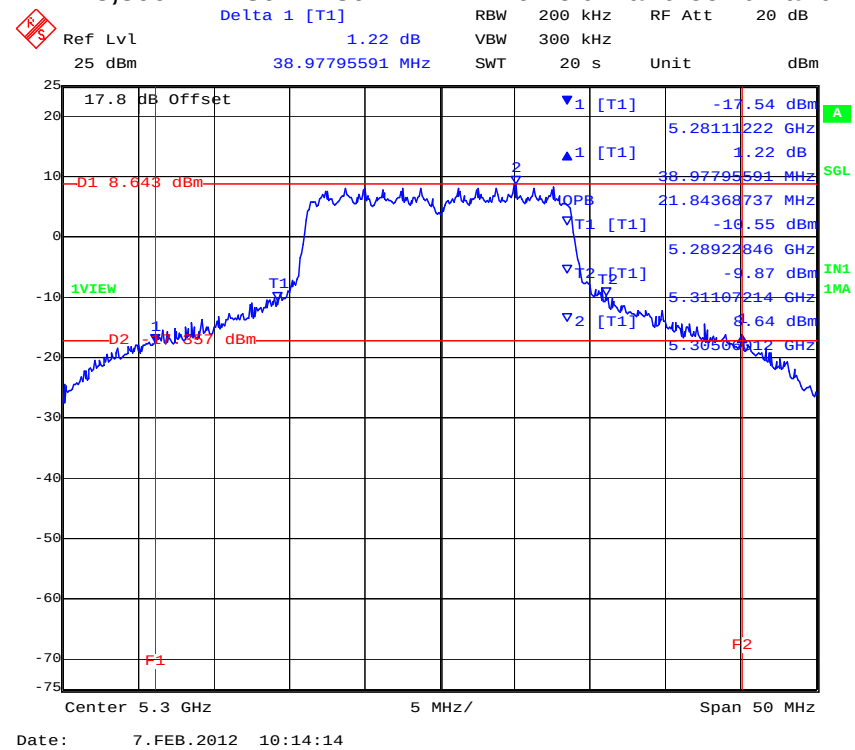
CHAIN B 5,260 MHz 802.11802.11n HT-20 26 dB and 99 % Bandwidth



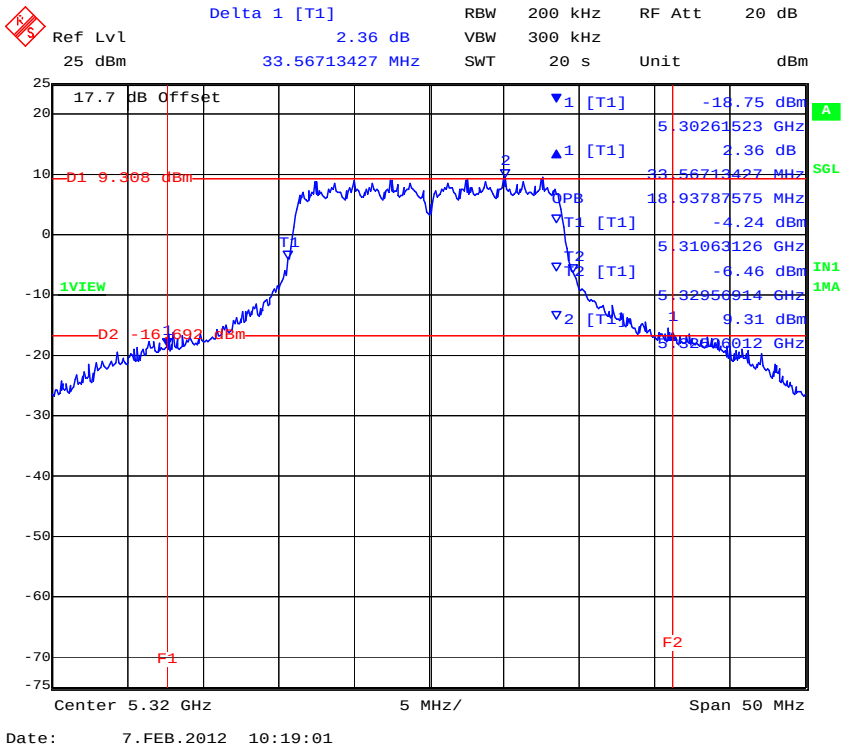
CHAIN A 5,300 MHz 802.11802.11n HT-20 26 dB and 99 % Bandwidth



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



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

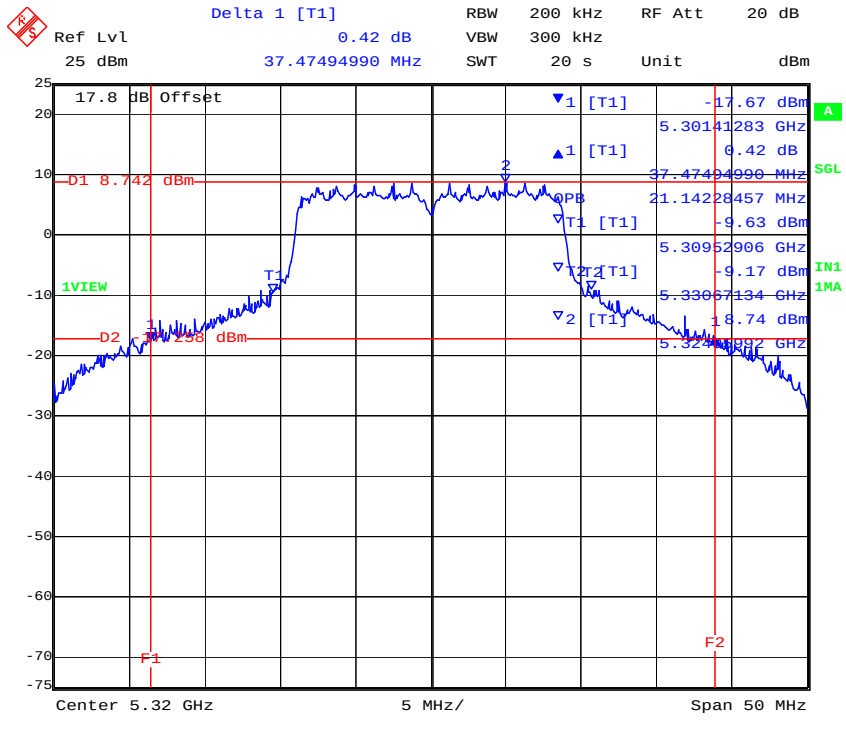


TABLE OF RESULTS – **802.11n HT-20 (5,470 – 5,725 MHz)**

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 n HT-20	**Ambient Temp. (ºC):**	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

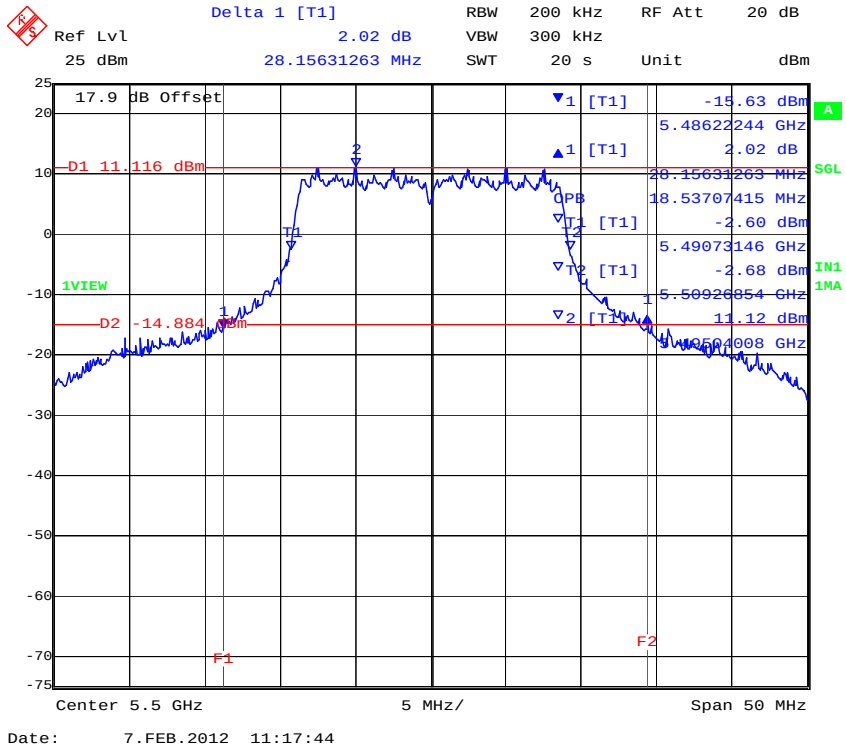
Test Frequency	26 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5500	28.156000	35.571000	--	--	500	0.5	-27.656000
5580	29.158000	37.375000	--	--			-28.658000
5700	34.369000	38.477000	--	--			-33.869000

99% Bandwidth

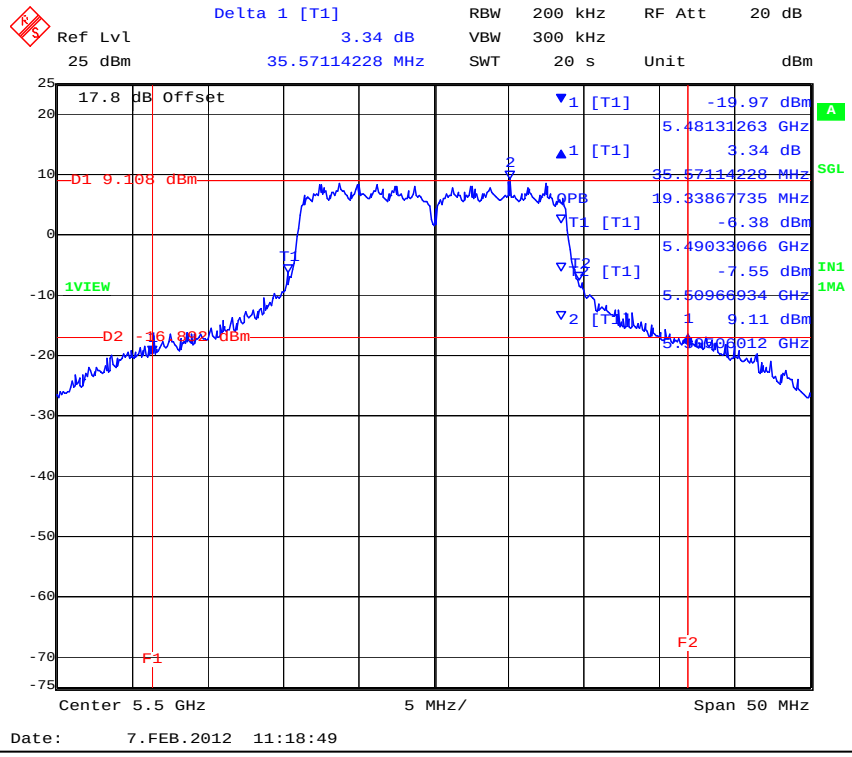
Test Frequency	99 % Bandwidth						
	MHz						
MHz	**a**	**b**	**c**	**d**			
5500	18.537000	19.339000	--	--			
5580	18.637000	20.641000	--	--			
5700	19.238000	20.341000	--	--			

Measurement uncertainty:	±2.81 dB

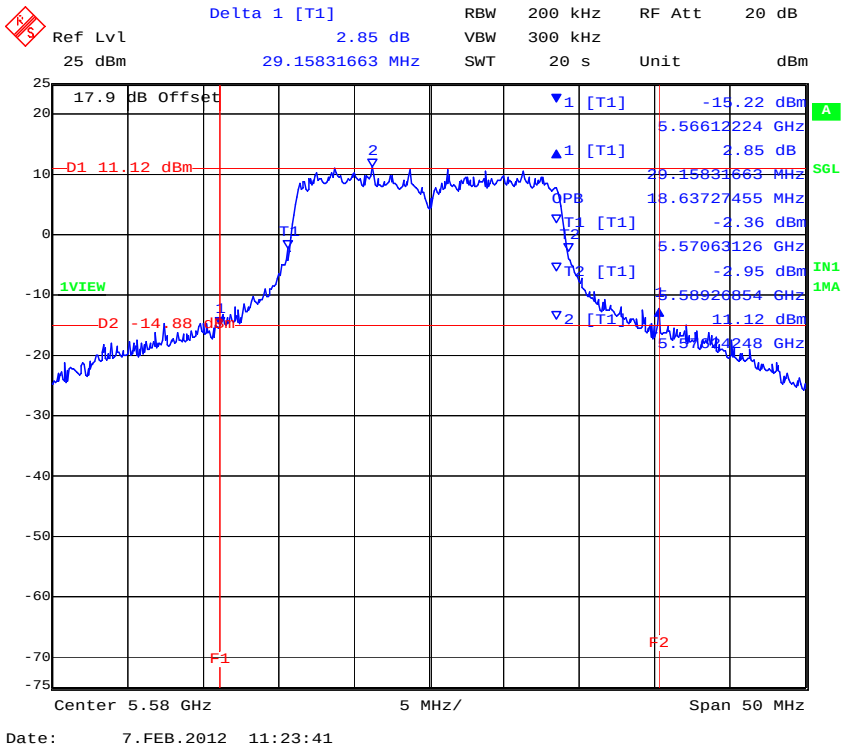
CHAIN A 5,500 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



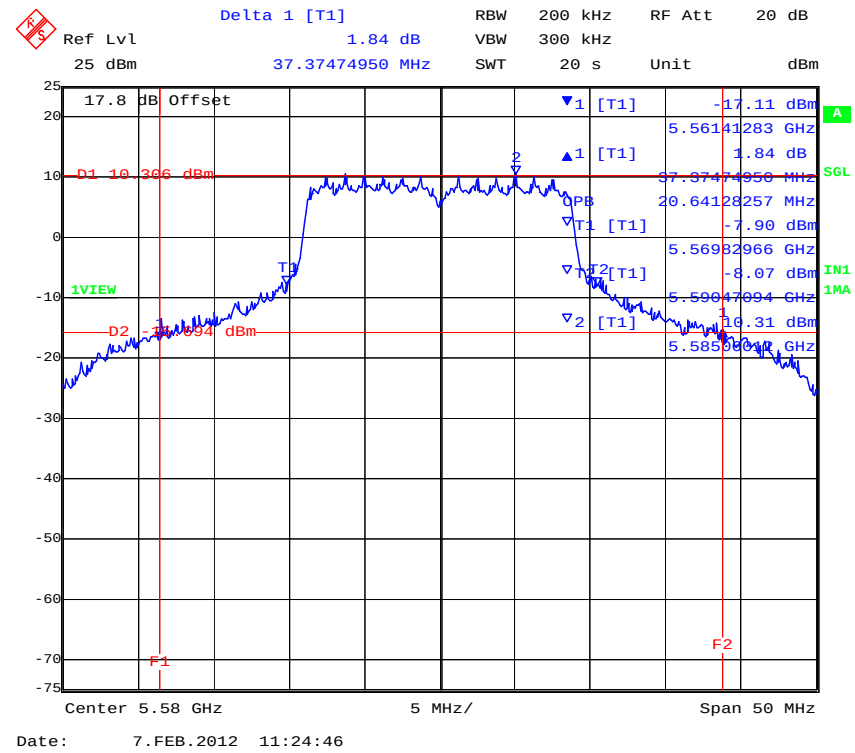
CHAIN B 5,500 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



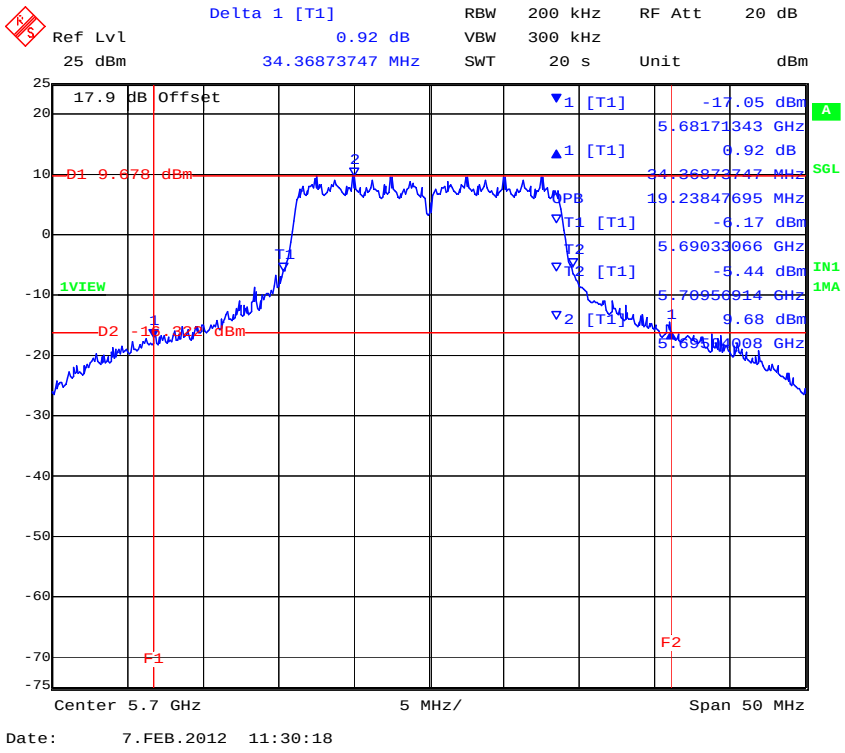
CHAIN A 5,580 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



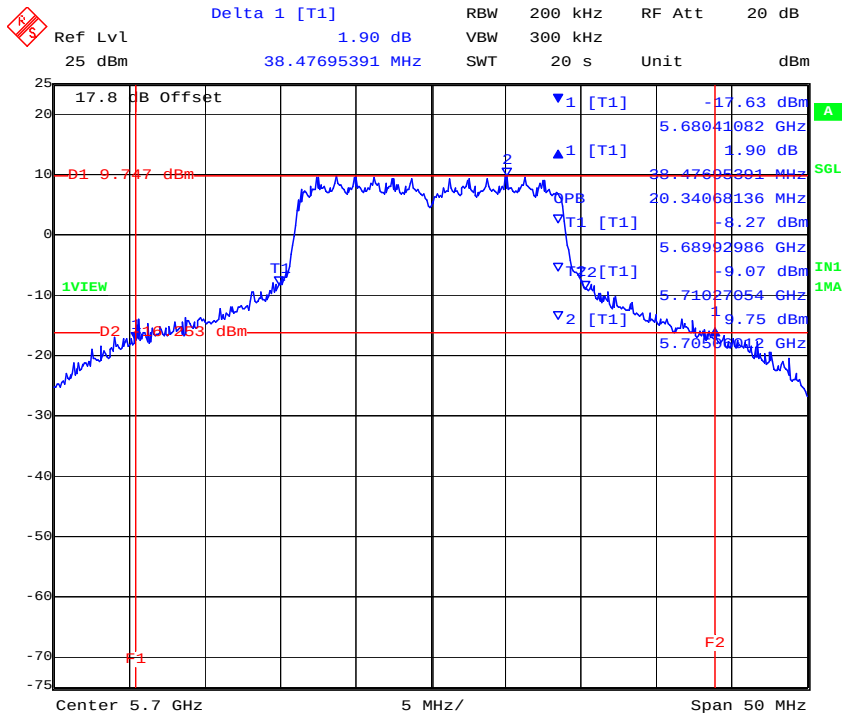
CHAIN B 5,580 MHz 802.11n HT-20 26 dB and 99 % Bandwidth



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



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



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. (ºC):**	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

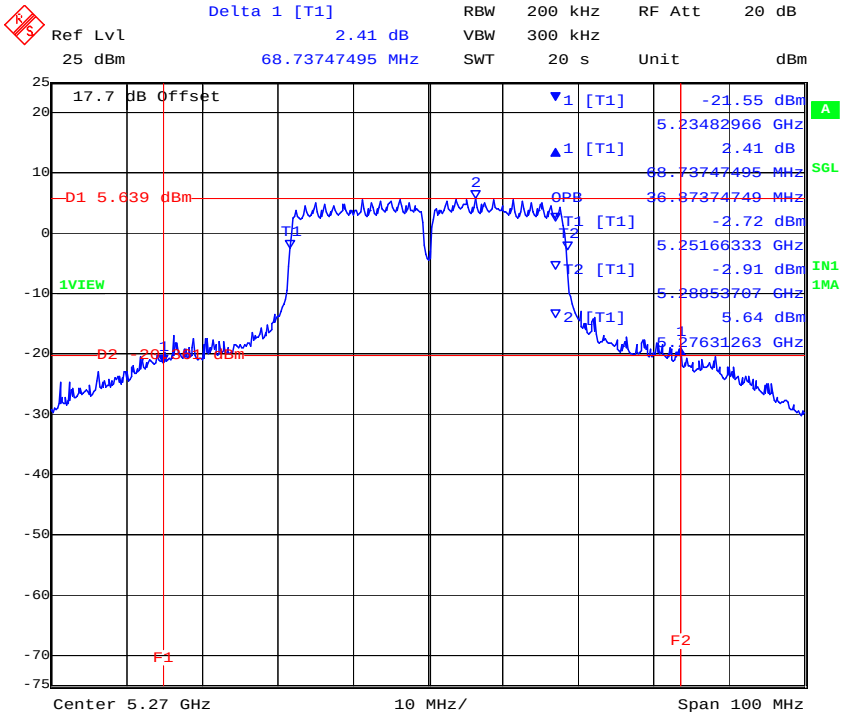
Test Frequency	26 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5270	68.737000	83.567000	--	--	500	0.5	-68.237000
5310	73.146000	83.367000	--	--			-72.646000

99% Bandwidth

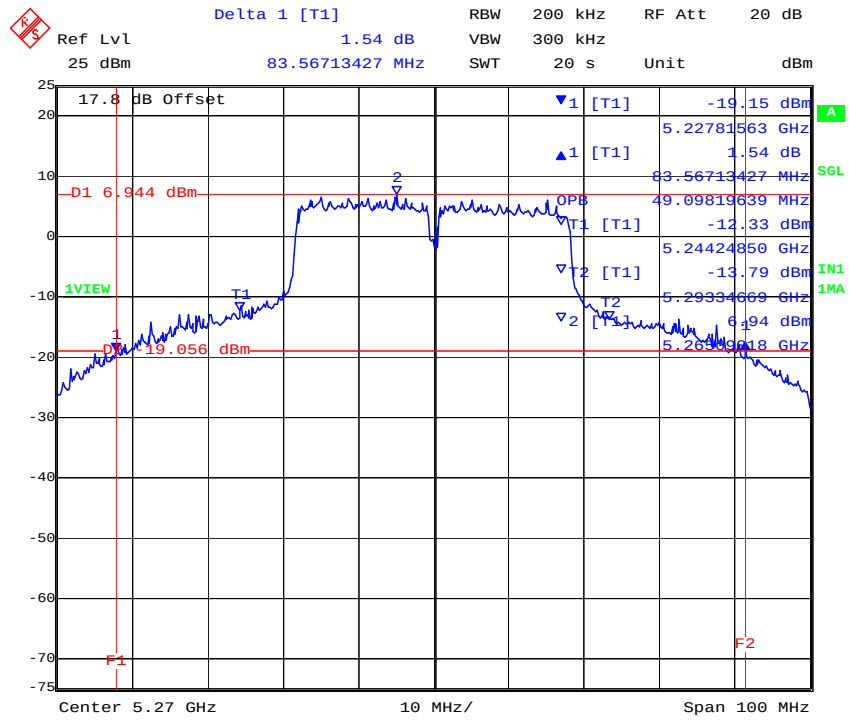
Test Frequency	99 % Bandwidth						
	MHz						
MHz	**a**	**b**	**c**	**d**			
5270	36.874000	49.098000	--	--			
5310	37.475000	44.689000	--	--			

Measurement uncertainty:	±2.81 dB

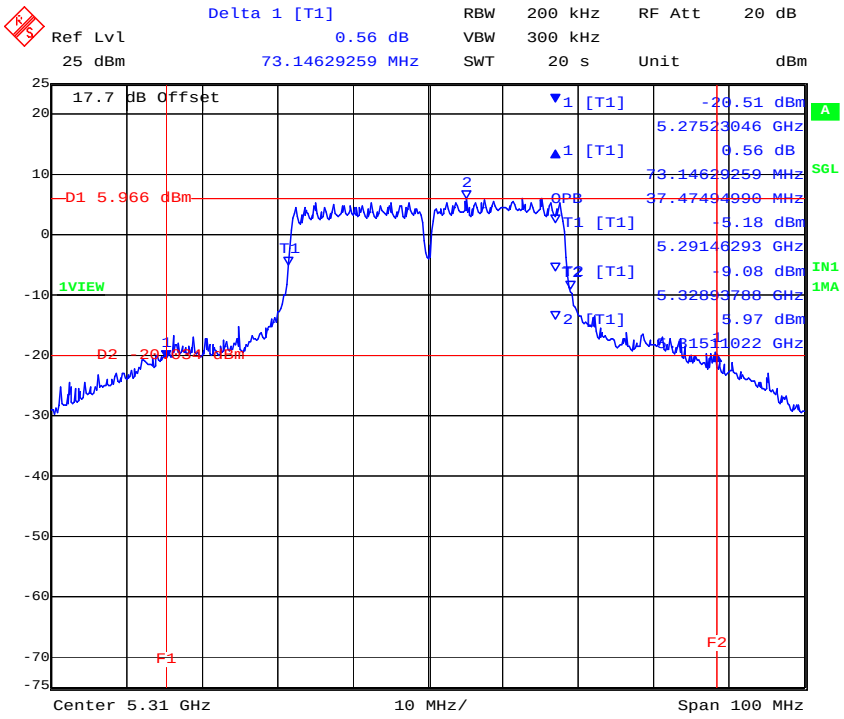
Chain A 5,270 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



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

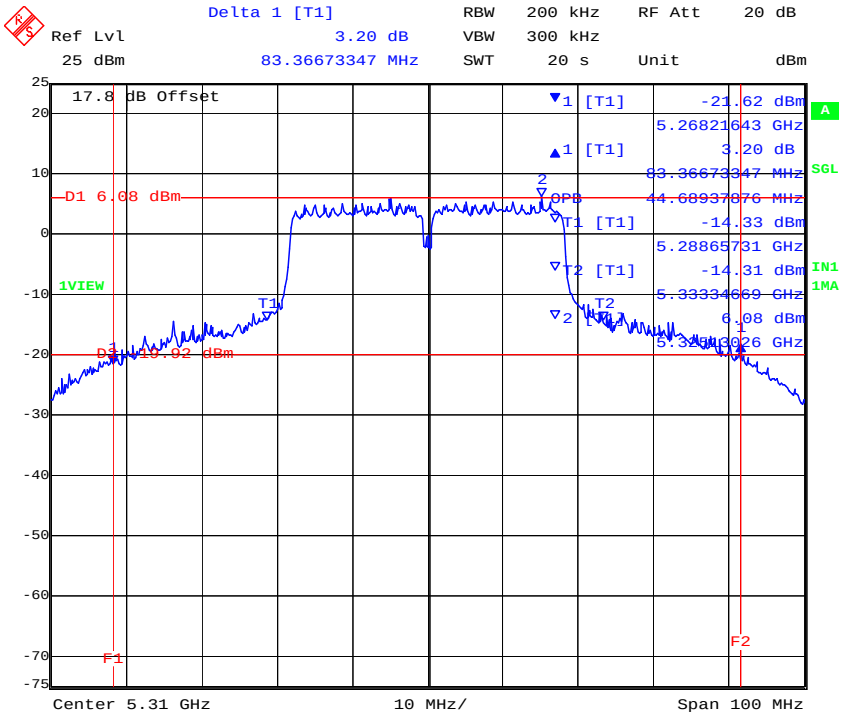


Chain A 5,310 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



Date: 7.FEB.2012 10:32:03

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



Date: 7.FEB.2012 10:33:09

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. (ºC):**	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

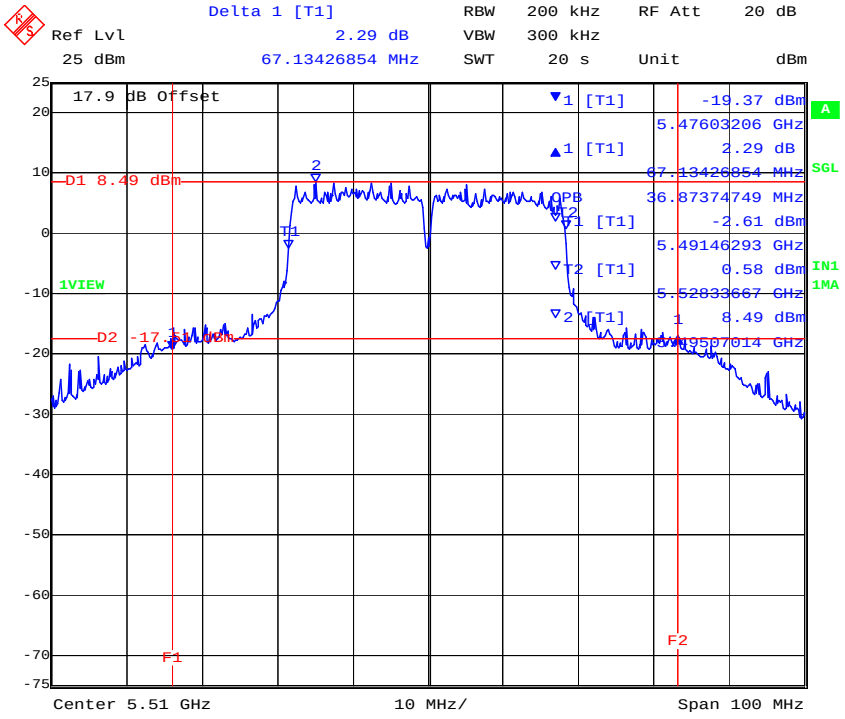
Test Frequency	26 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5510	67.134000	78.758000	--	--	500	0.5	-66.634000
5550	65.130000	77.355000	--	--			-64.630000
5670	67.535000	69.339000	--	--			-67.035000

99% Bandwidth

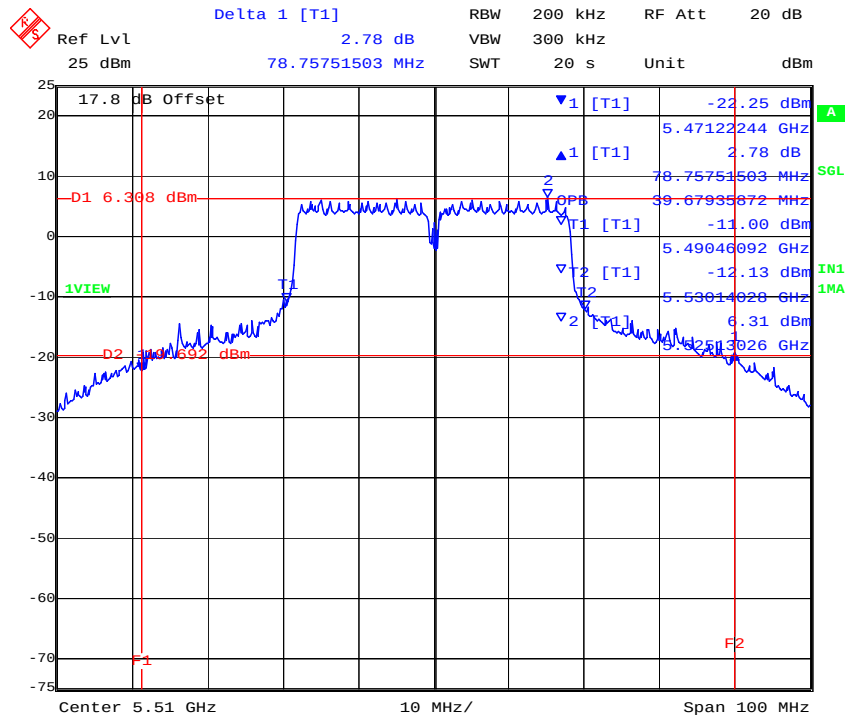
Test Frequency	99 % Bandwidth						
	MHz						
MHz	**a**	**b**	**c**	**d**			
5510	36.874000	39.679000	--	--			
5550	36.874000	39.078000	--	--			
5670	36.673000	37.475000	--	--			

Measurement uncertainty:	±2.81 dB

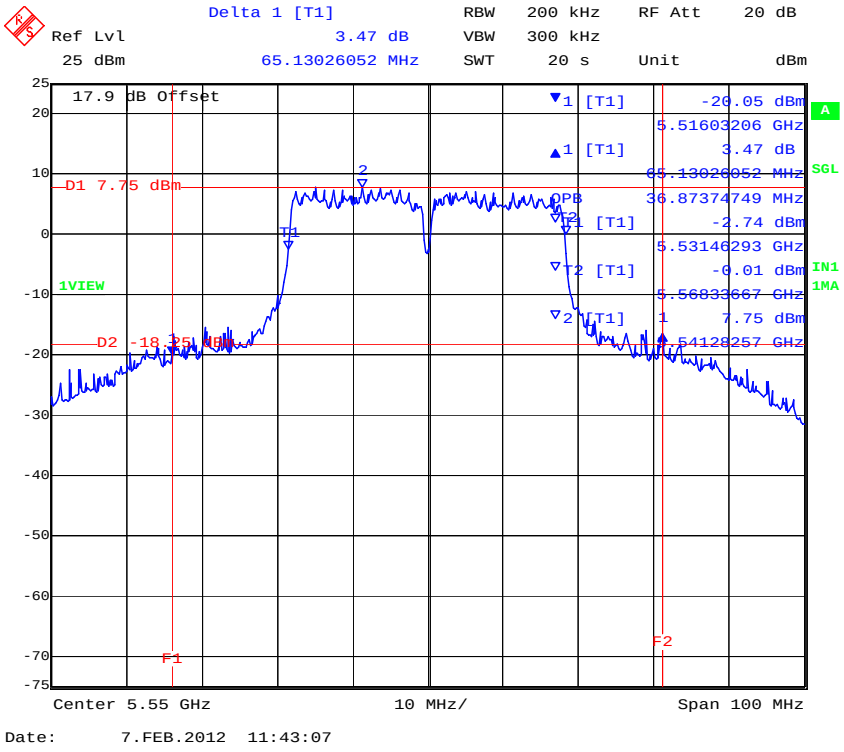
Chain A 5,510 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



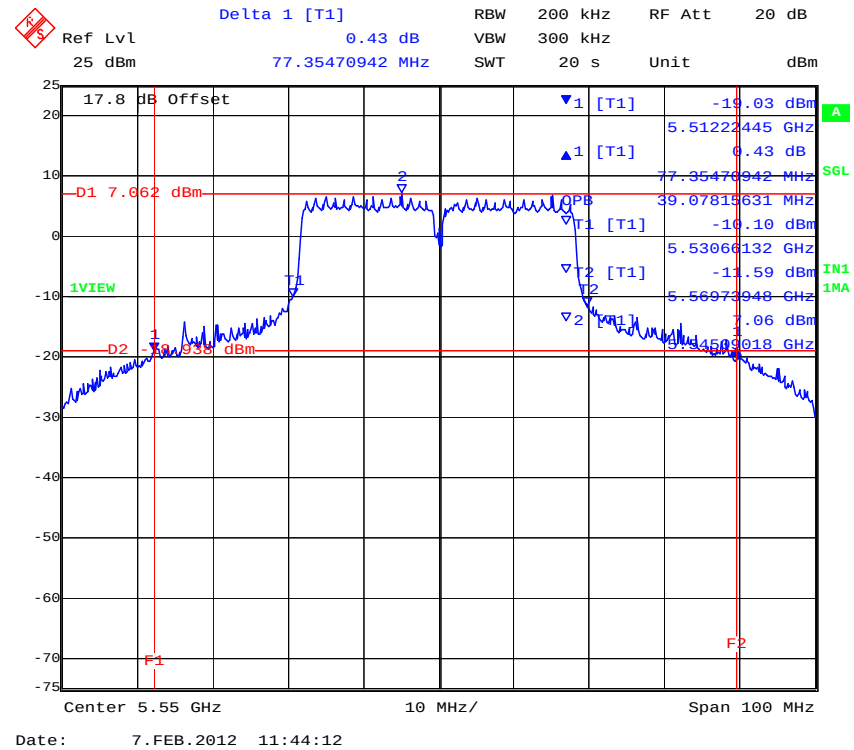
Chain B 5,510 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



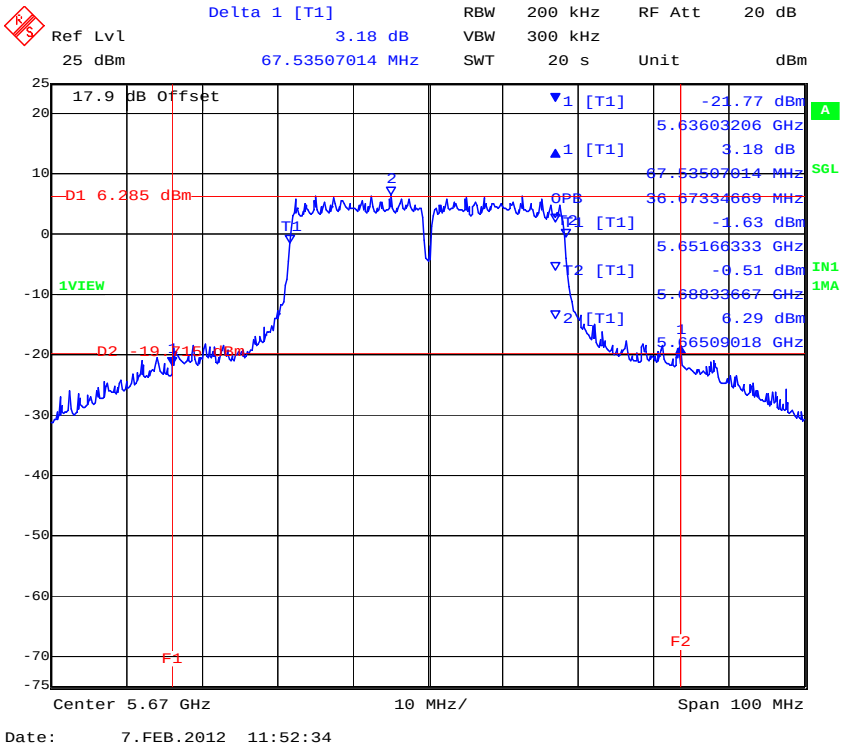
Chain A 5,550 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



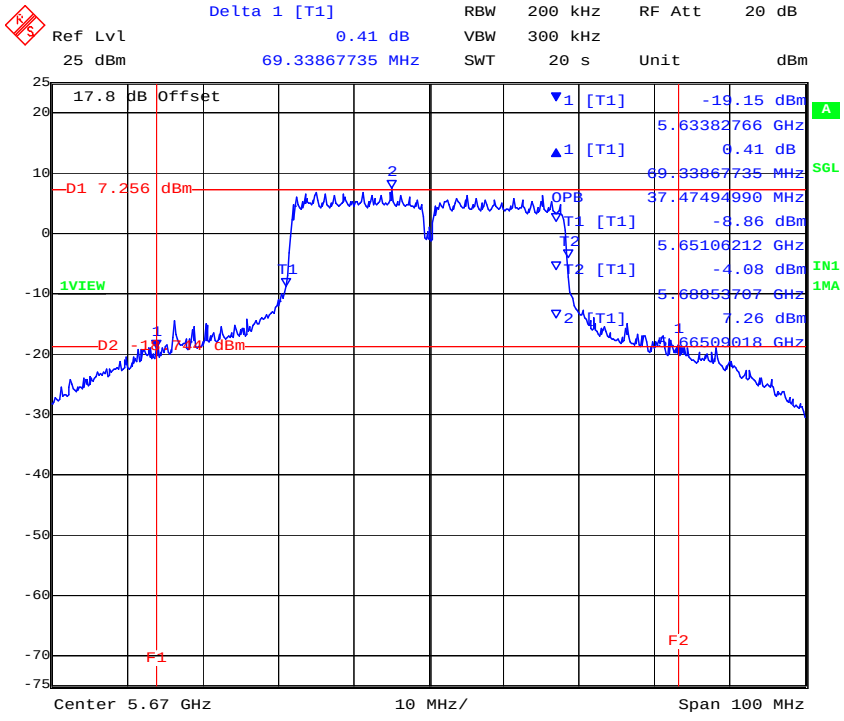
Chain B 5,550 MHz 802.11n HT-40 26 dB and 99 % Bandwidth



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



Specification

Limits

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

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

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

Industry Canada RSS-Gen 4.4

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

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement uncertainty	±2.81 dB

Traceability

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

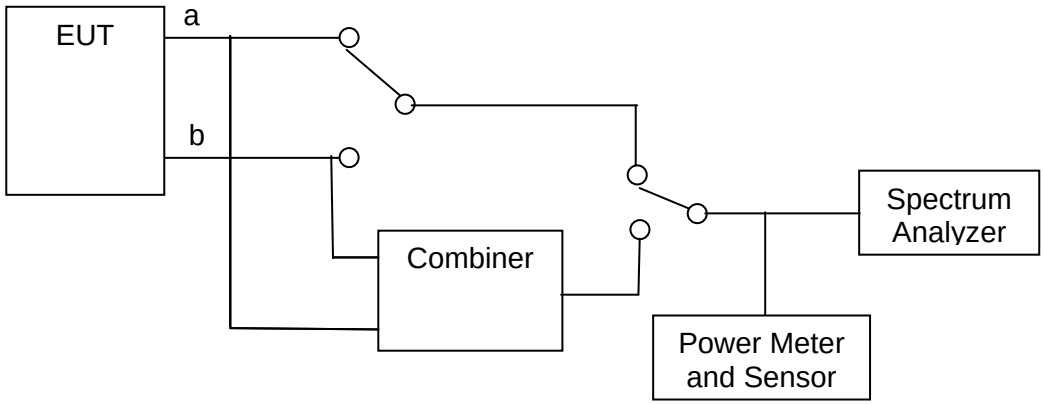
5.1.2. Transmit Output Power

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

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)
a	5250 – 5350 5470 – 5725	40.8	+27.1	+24.00
HT-20		40.9	+27.1	+24.00
HT-40		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 Mode	Band- Edge Frequency (MHz)	Channel Frequency (MHz)	Initial Power Setting	Final Power Setting
a	5,350	5,320	18	14.5
HT-20	5,350	5,320	18	14.0
HT-40	5,350	5,310	18	14.0
	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.

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. (ºC):**	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 Frequency	Measured Peak Power RF Port (dBm)				Total Power (dBm)		Limit	Margin
MHz	**a**	**b**	**c**	**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. (ºC):**	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 Frequency	Measured Peak Power RF Port (dBm)				Total Power (dBm)		Limit	Margin
MHz	**a**	**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

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. (ºC):**	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 Frequency	**Measured Peak Power RF Port (dBm)**				**Total Power (dBm)**		**Limit**	**Margin**
MHz	**a**	**b**	**c**	**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. (ºC):**	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 Frequency	**Measured Peak Power RF Port (dBm)**				**Total Power (dBm)**		**Limit**	**Margin**
MHz	**a**	**b**	**c**	**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

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. (ºC):**	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 Frequency	Measured Peak Power RF Port (dBm)				Total Power (dBm)		Limit	Margin
MHz	**a**	**b**	**c**	**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. (ºC):**	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 Frequency	Measured Peak Power RF Port (dBm)				Total Power (dBm)		Limit	Margin
MHz	**a**	**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

Specification

Limits

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

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

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

Industry Canada RSS-210 §A9.2(2)

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

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

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

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

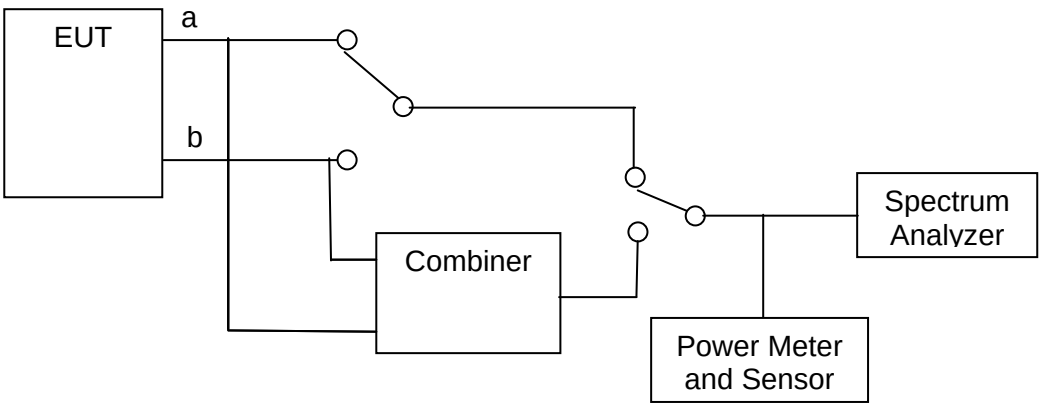
5.1.3. Peak Power Spectral Density

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

Test Procedure

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

Test Measurement Set up



Measurement set up for Peak Power Spectral Density

Measurement Results for Peak Power Spectral Density

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

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

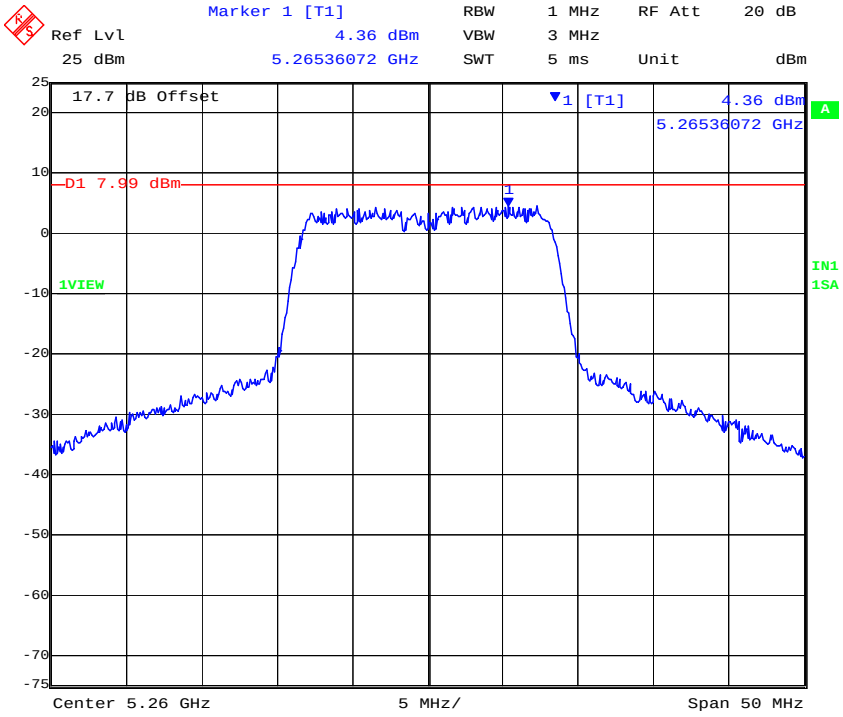
TABLE OF RESULTS – **802.11a Legacy (5250 – 5350 MHz)**

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:			

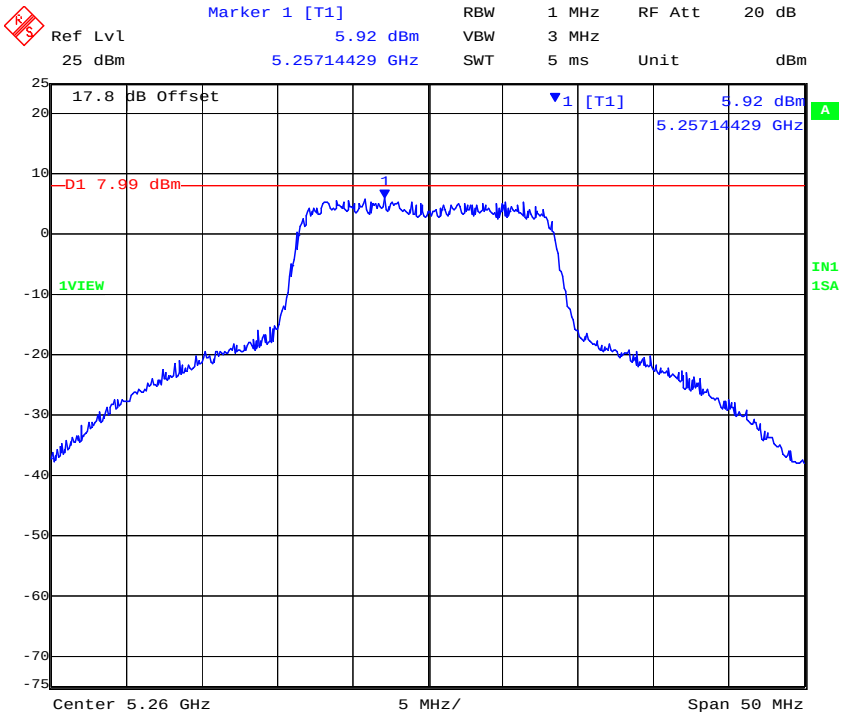
Test Frequency	Measured Peak Power RF Port (dBm)				Correction factor	Peak Power Spectral Density	Limit	Margin
MHz	**a**	**b**	**c**	**d**	**10Log(N)**	**dBm**	**dBm**	**dB**
5260	4.36	5.92	--	--	3.01	8.93	11.00	-2.07
5300	4.54	4.48	--	--	3.01	7.55	11.00	-3.45
5320	5.39	4.46	--	--	3.01	8.40	11.00	-2.60

Measurement uncertainty:	±1.33 dB

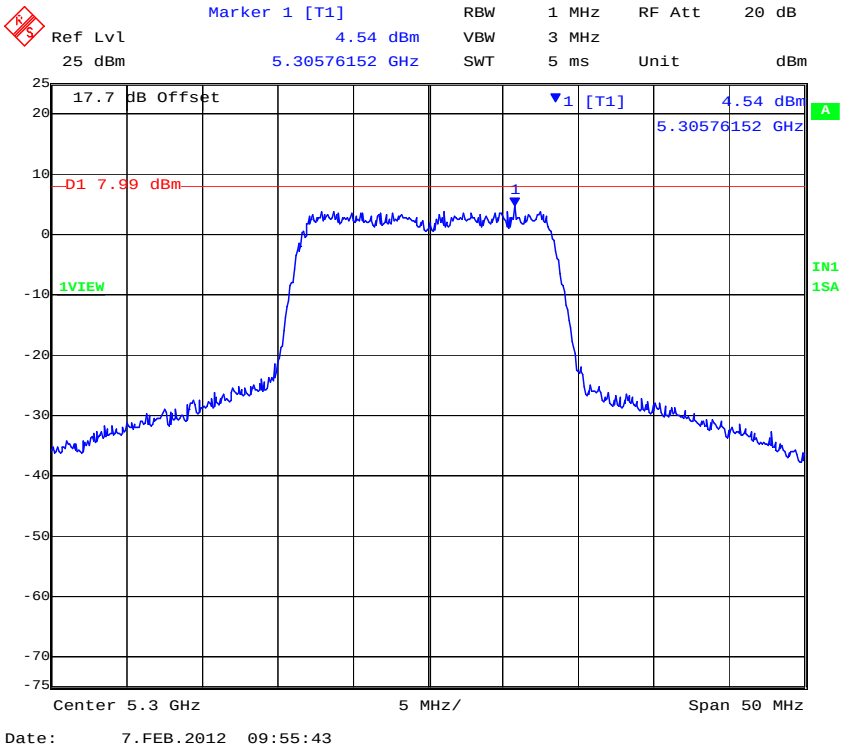
CHAIN A 5,260 MHz 802.11a Legacy Peak Power Spectral Density



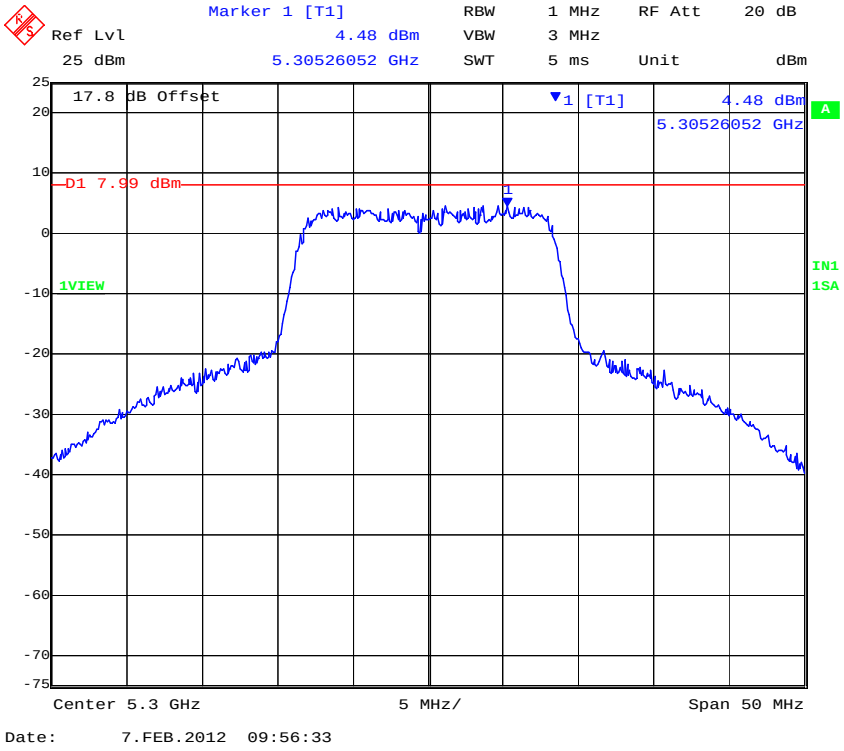
CHAIN B 5,260 MHz 802.11a Legacy Peak Power Spectral Density



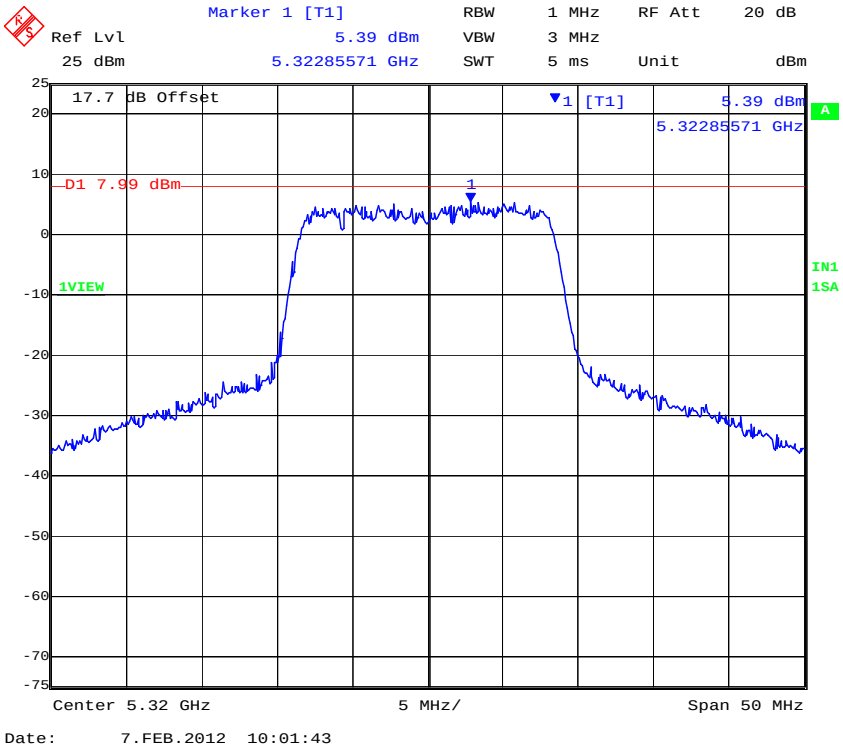
CHAIN A 5,300 MHz 802.11a Legacy Peak Power Spectral Density



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



Chain A 5,320 MHz 802.11a Legacy Peak Power Spectral Density



Chain B 5,320 MHz 802.11a Legacy Peak Power Spectral Density

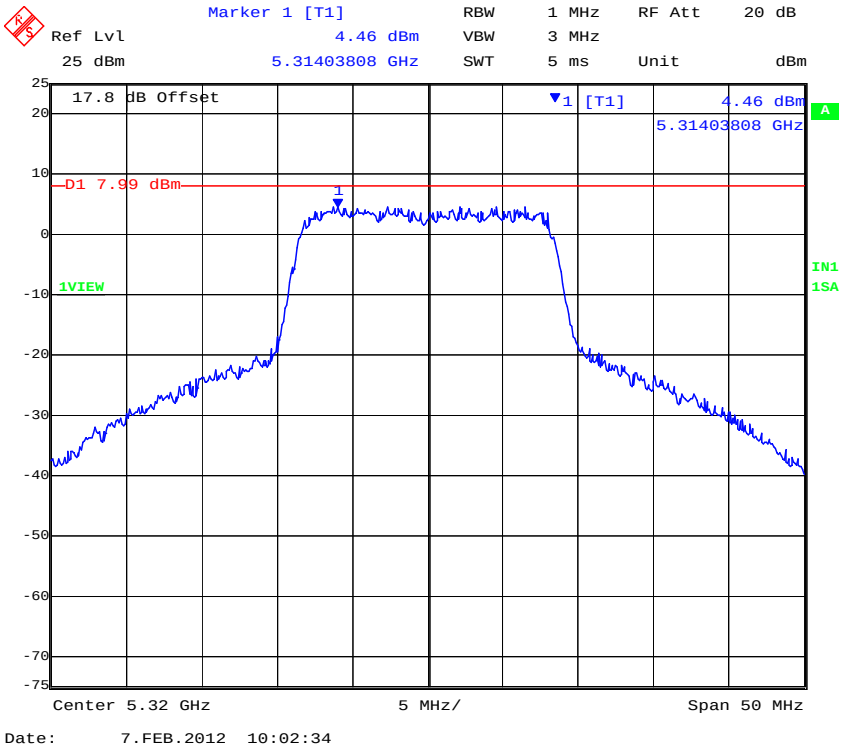


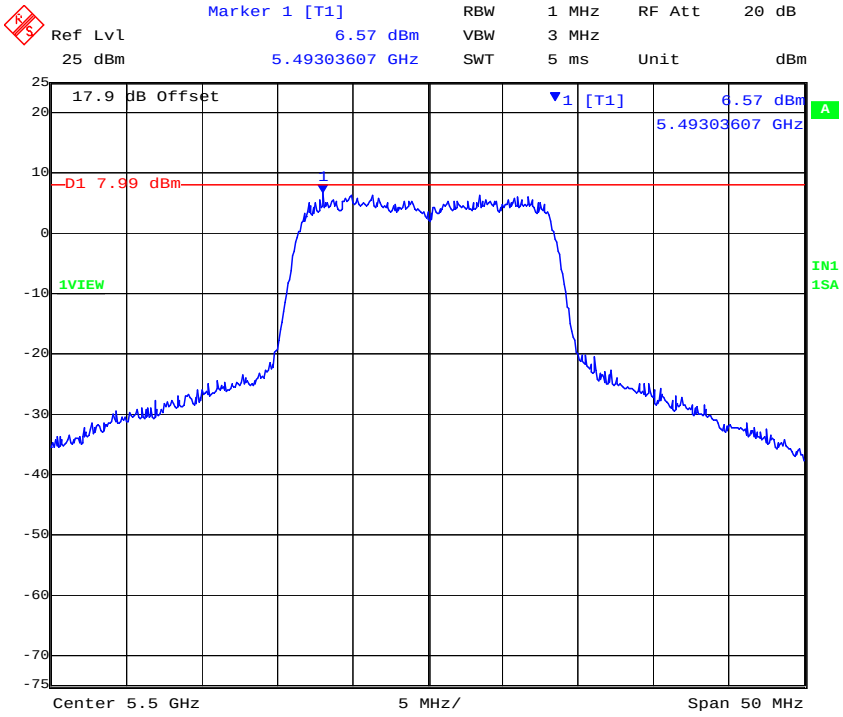
TABLE OF RESULTS – **802.11a Legacy (5470 – 5725 MHz)**

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:					

Test Frequency	**Measured Peak Power**				**Correction factor**	**Peak Power Spectral Density**	**Limit**	**Margin**
	RF Port (dBm)							
MHz	**a**	**b**	**c**	**d**	**10Log(N)**	**dBm**	**dBm**	**dB**
5500	6.57	4.56	--	--	3.01	9.58	11.00	-1.42
5580	6.16	6.35	--	--	3.01	9.36	11.00	-1.64
5700	5.11	5.93	--	--	3.01	8.94	11.00	-2.06

Measurement uncertainty:	±1.33 dB

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



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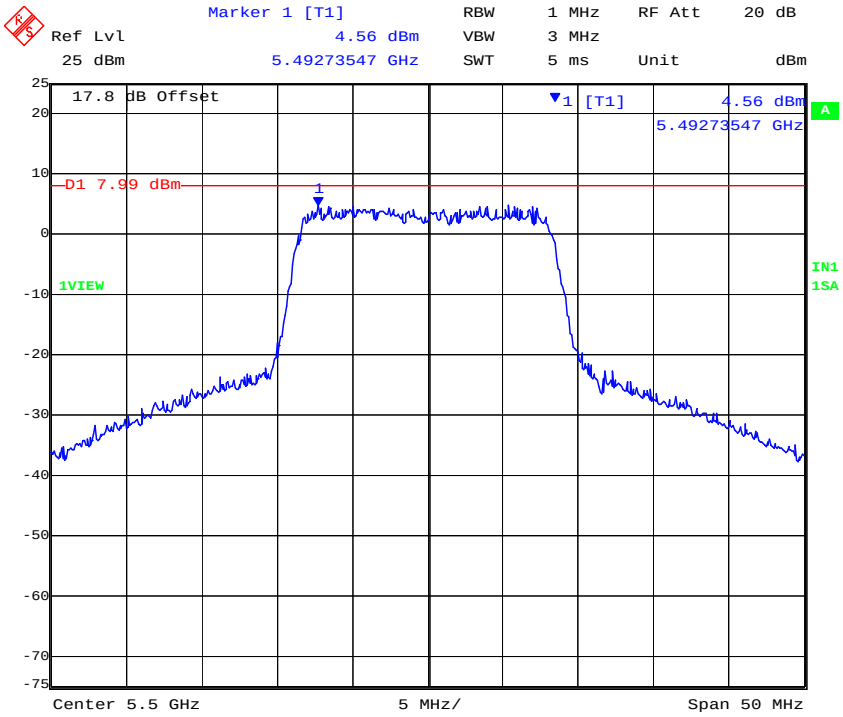
CHAIN B 5,500 MHz 802.11a Legacy Peak Power Spectral Density



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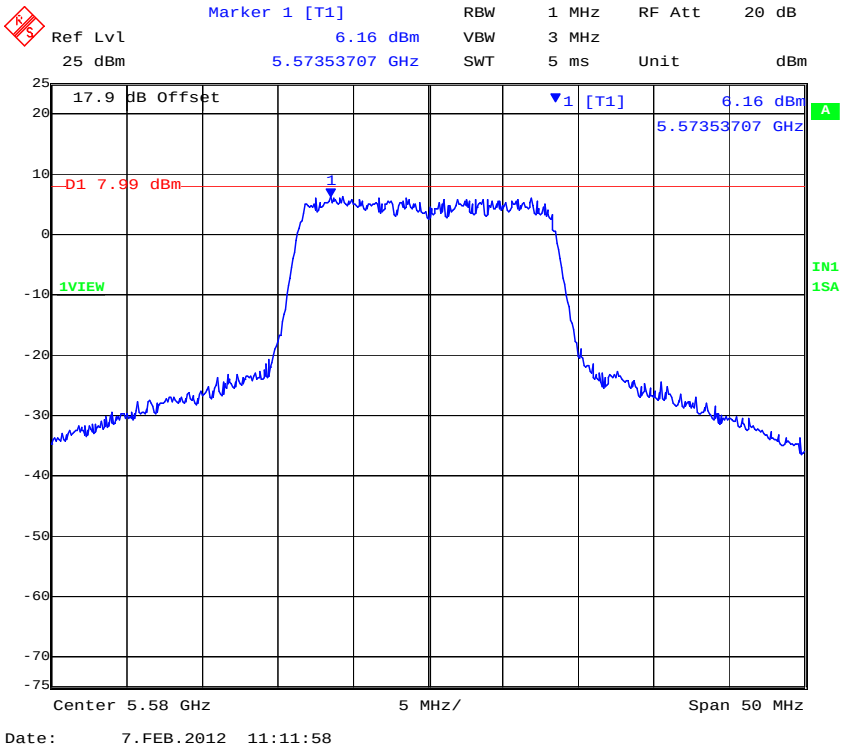
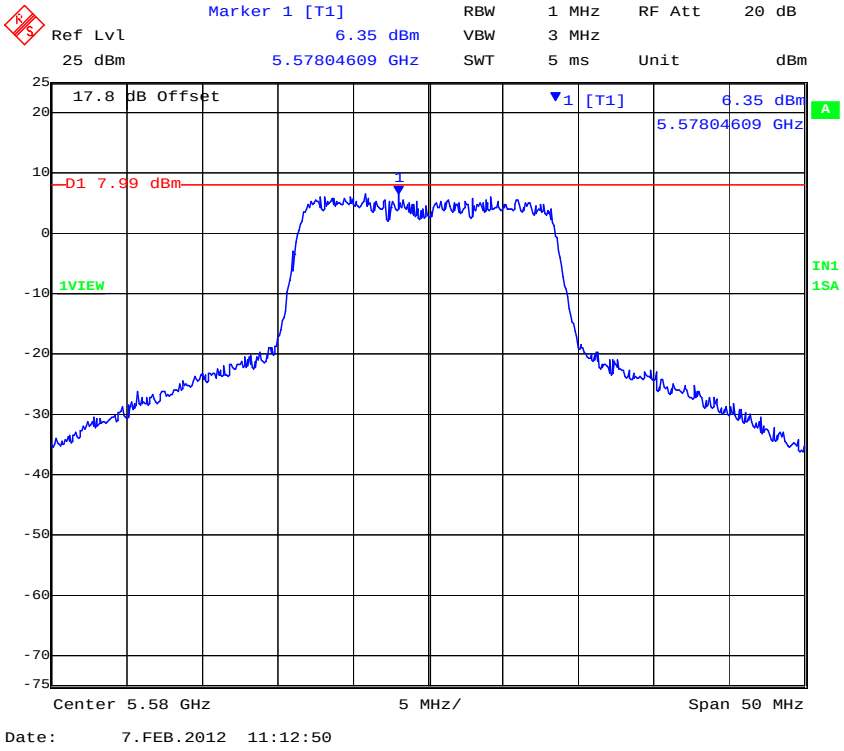
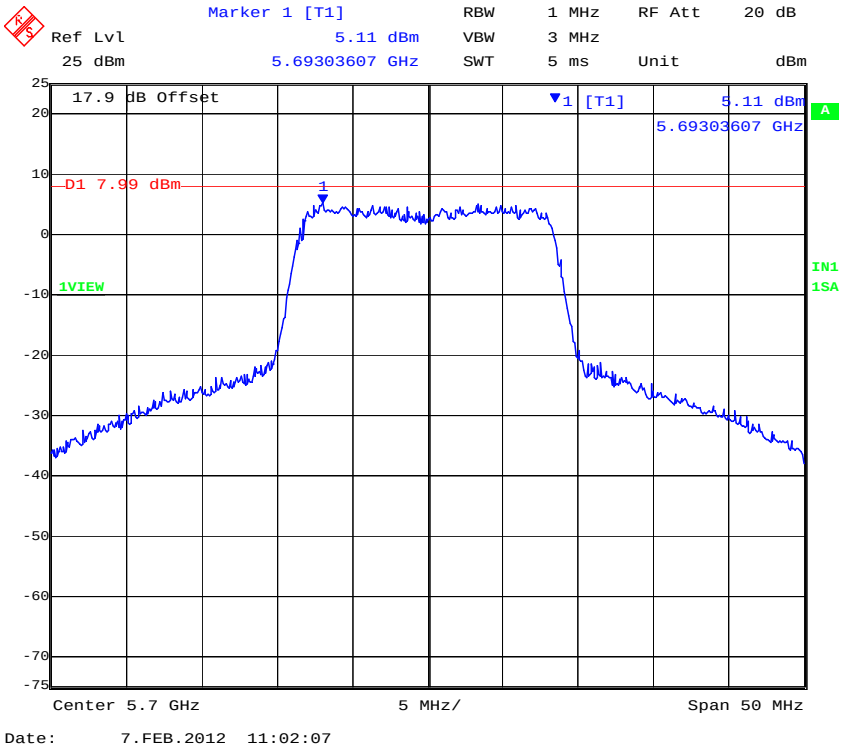
CHAIN A 5,580 MHz 802.11a Legacy Peak Power Spectral Density



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



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



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

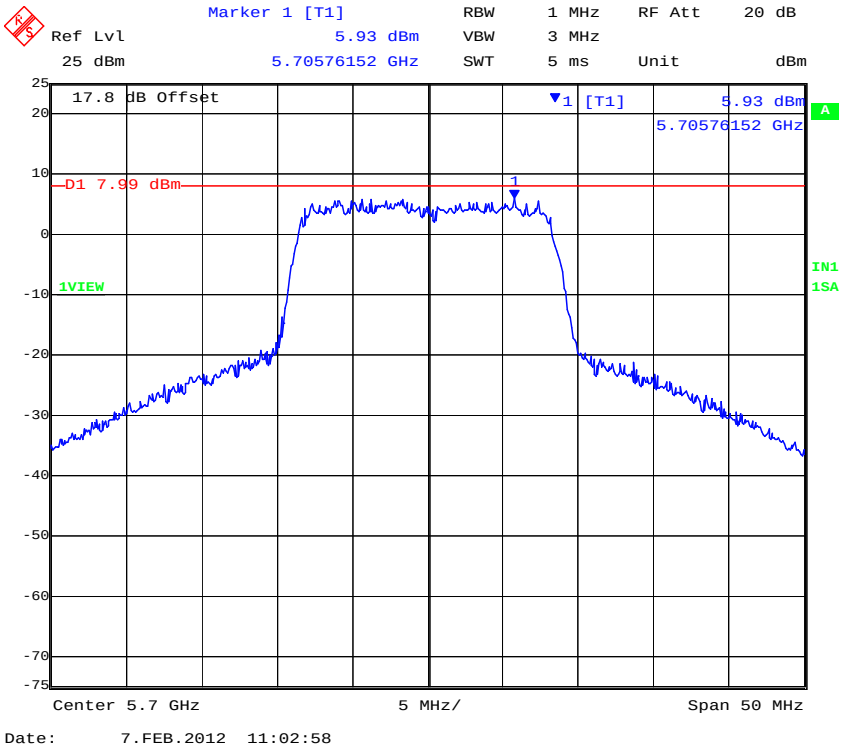


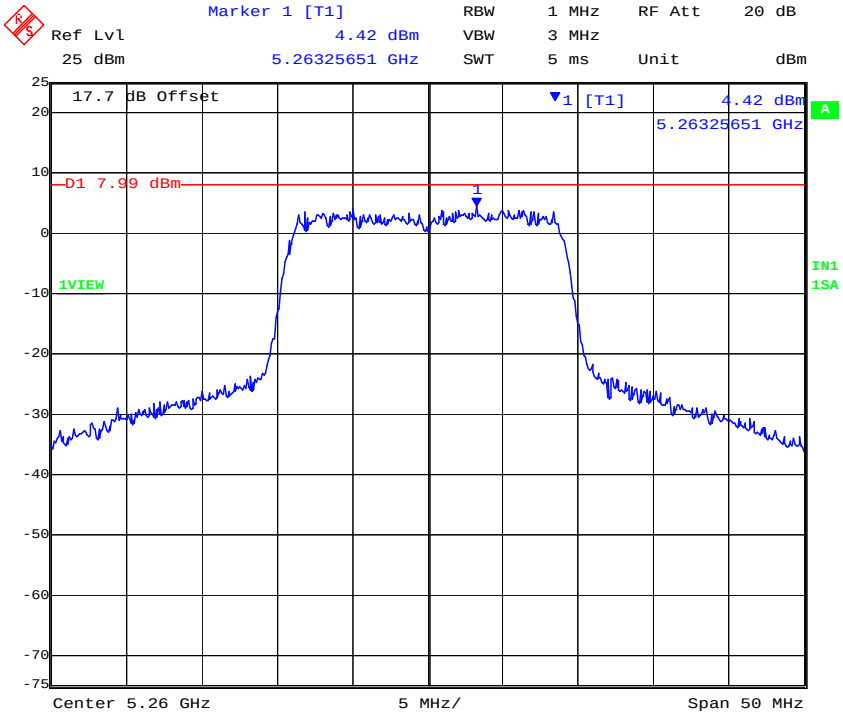
TABLE OF RESULTS – **802. 11n HT-20 (5250 – 5350 MHz)**

Test Conditions:	15.407 (a)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11 n HT-20		**Ambient Temp. (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:					

Test Frequency	**Measured Peak Power RF Port (dBm)**				**Correction factor**	**Peak Power Spectral Density**	**Limit**	**Margin**
MHz	**a**	**b**	**c**	**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

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



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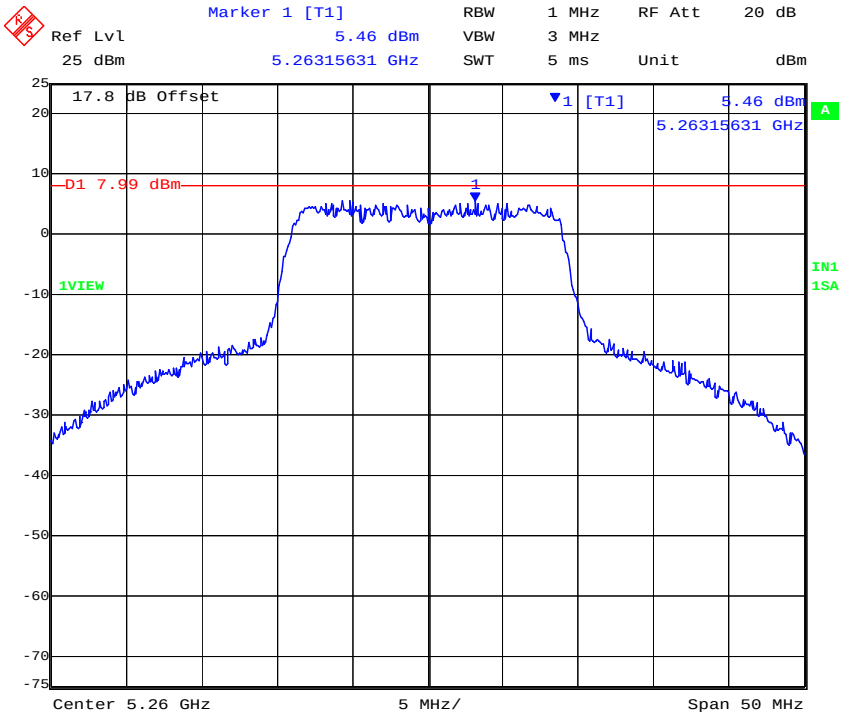
CHAIN B 5,260 MHz 802. 11n HT-20 Peak Power Spectral Density



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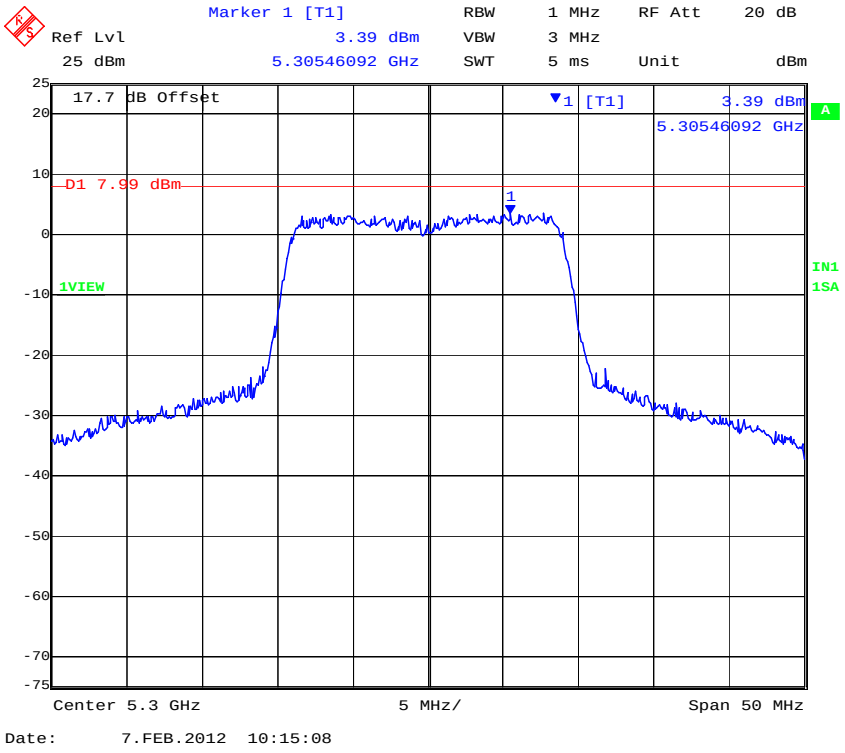
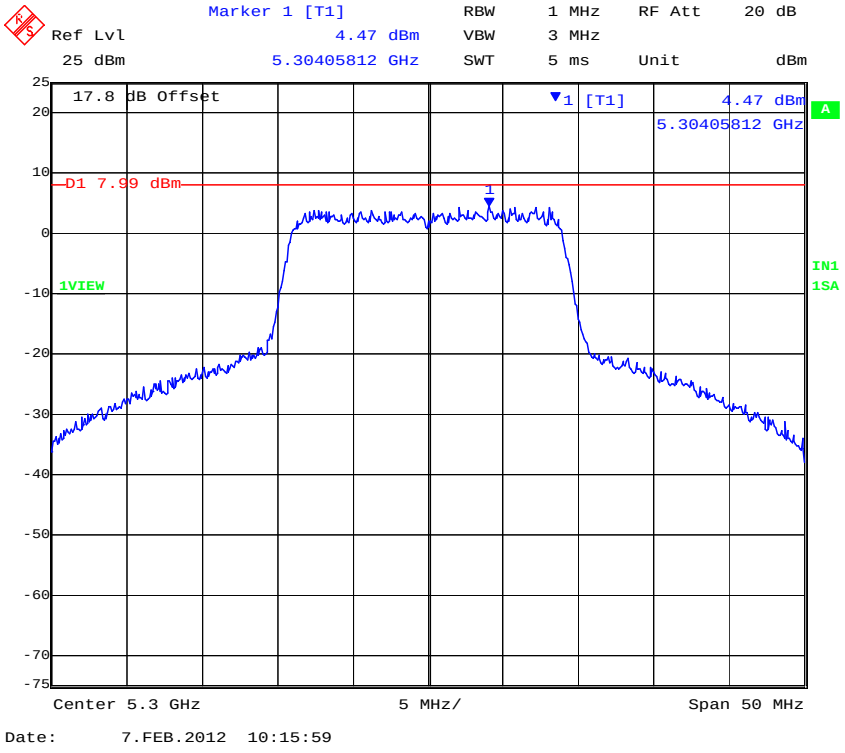
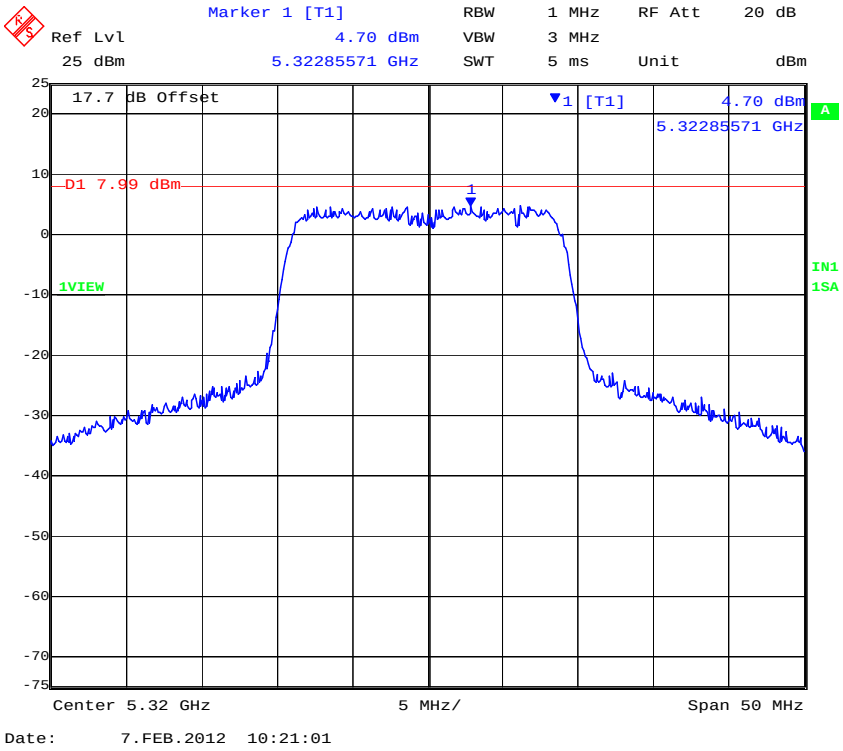
CHAIN A 5,300 MHz 802. 11n HT-20 Peak Power Spectral Density



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



Chain A 5,320 MHz 802. 11n HT-20 Peak Power Spectral Density



Chain B 5,320 MHz 802. 11n HT-20 Peak Power Spectral Density

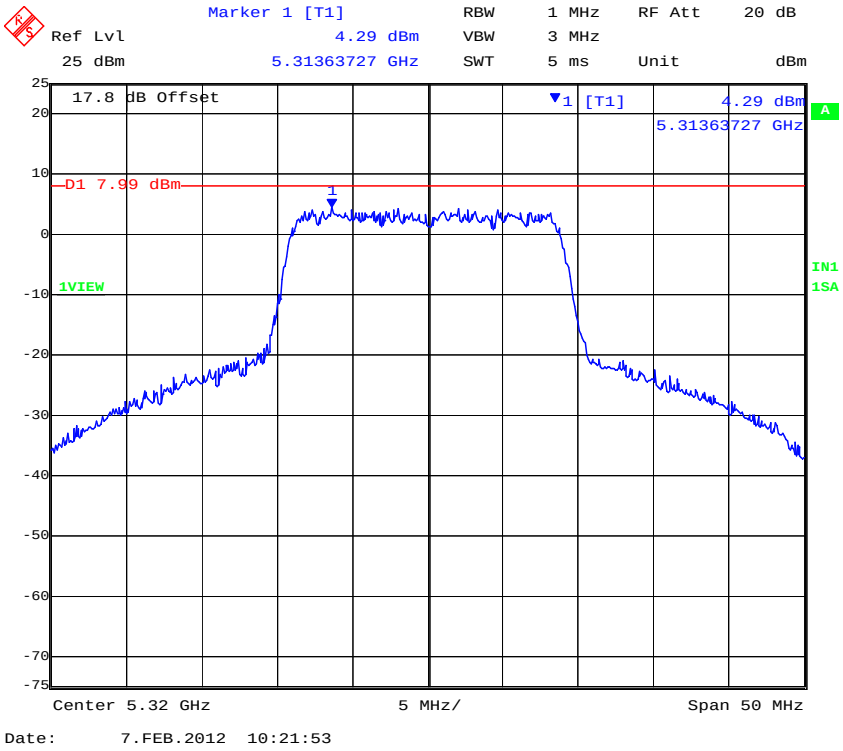


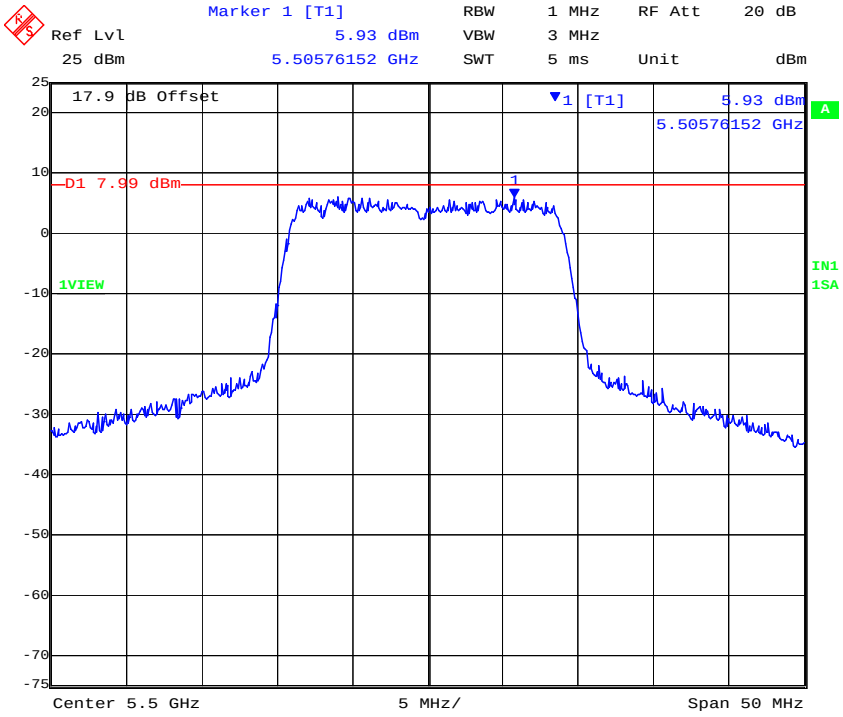
TABLE OF RESULTS – **802. 11n HT-20 (5470 – 5725 MHz)**

Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 n HT-20	**Ambient Temp. (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:			

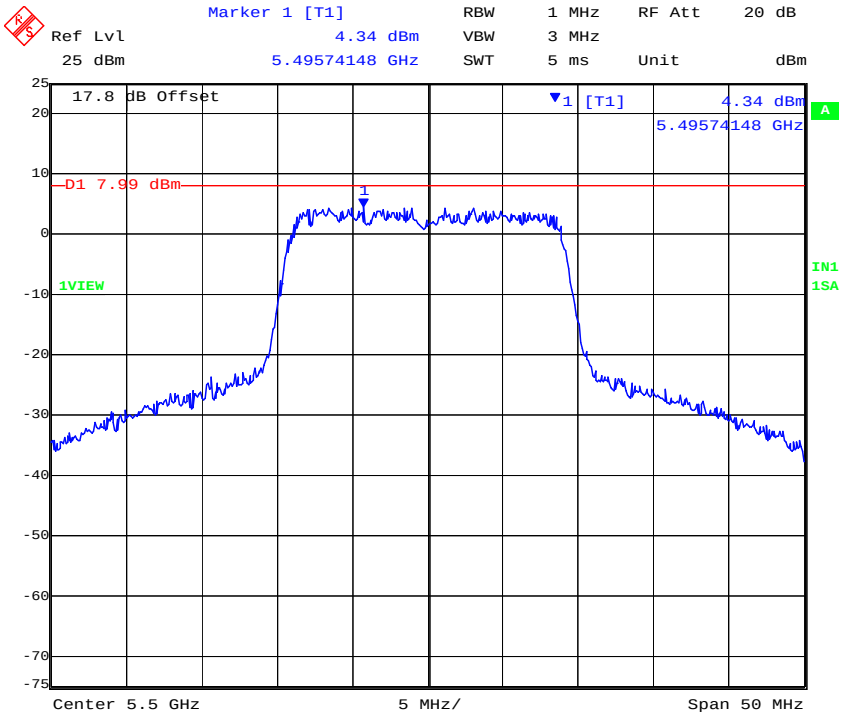
Test Frequency	Measured Peak Power RF Port (dBm)				Correction factor	Peak Power Spectral Density	Limit	Margin
MHz	a	b	c	d	10Log(N)	dBm	dBm	dB
5500	5.93	4.34	--	--	3.01	8.94	11.00	-2.06
5580	6.29	5.66	--	--	3.01	9.30	11.00	-1.70
5700	4.75	5.50	--	--	3.01	8.51	11.00	-2.49

Measurement uncertainty:	±1.33 dB

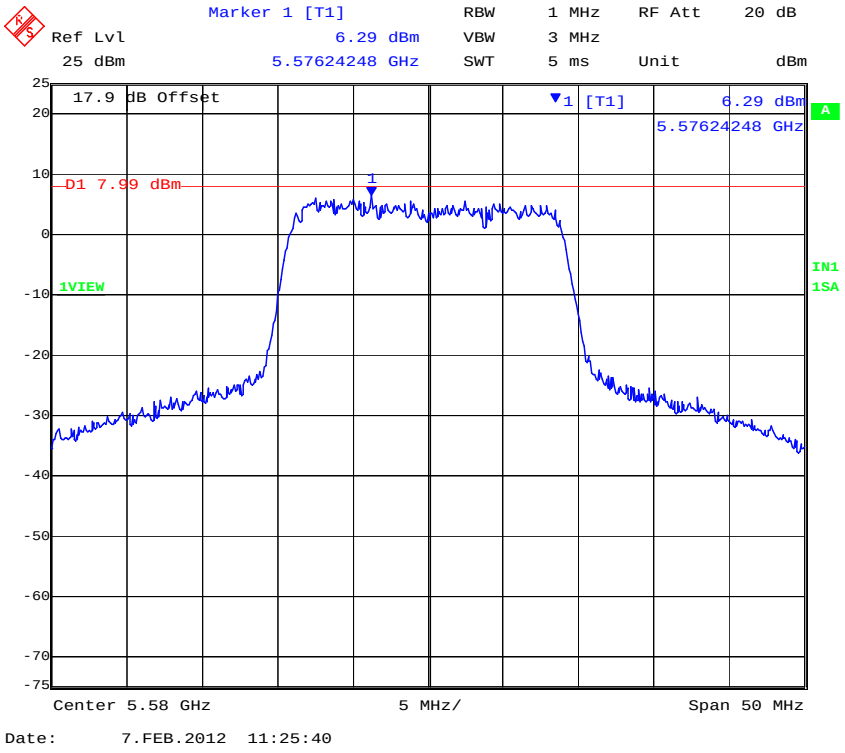
CHAIN A 5,500 MHz 802. 11n HT-20 Peak Power Spectral Density



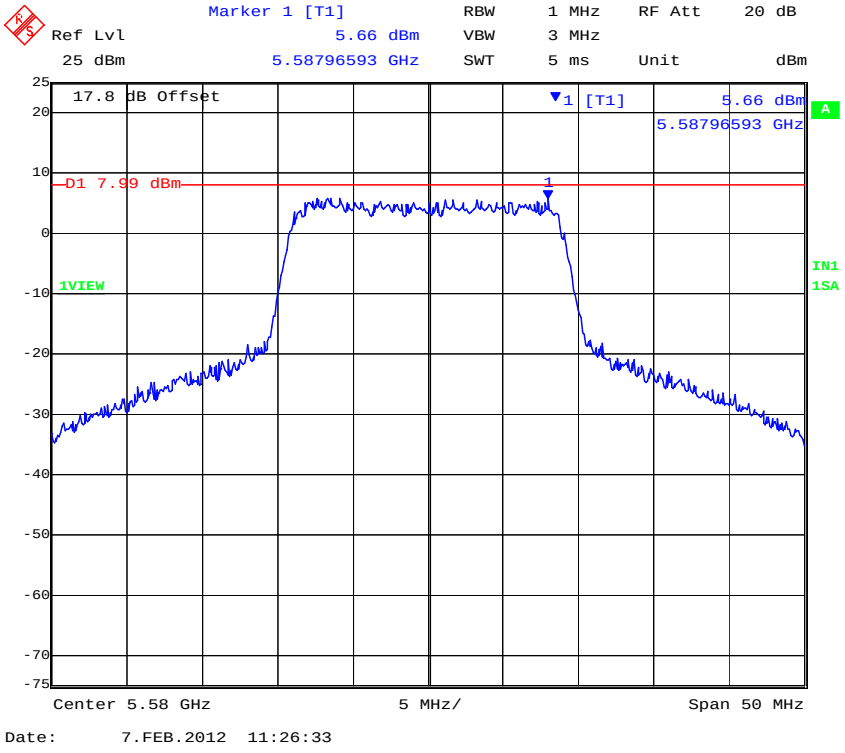
CHAIN B 5,500 MHz 802. 11n HT-20 Peak Power Spectral Density



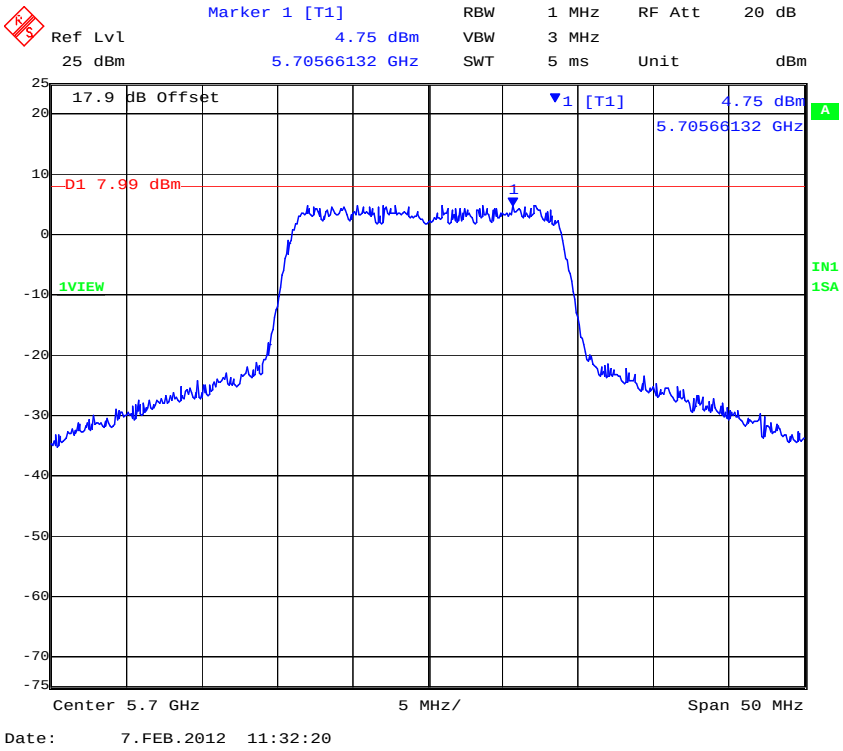
CHAIN A 5,580 MHz 802. 11n HT-20 Peak Power Spectral Density



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



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



Chain B 5,700 MHz 802. 11n HT-20 Peak Power Spectral Density

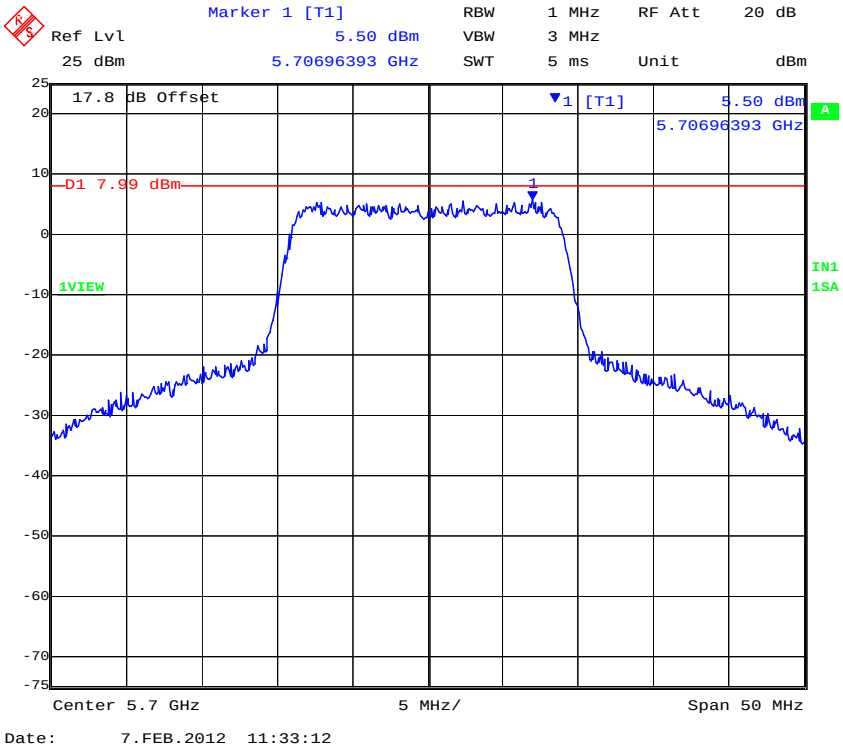


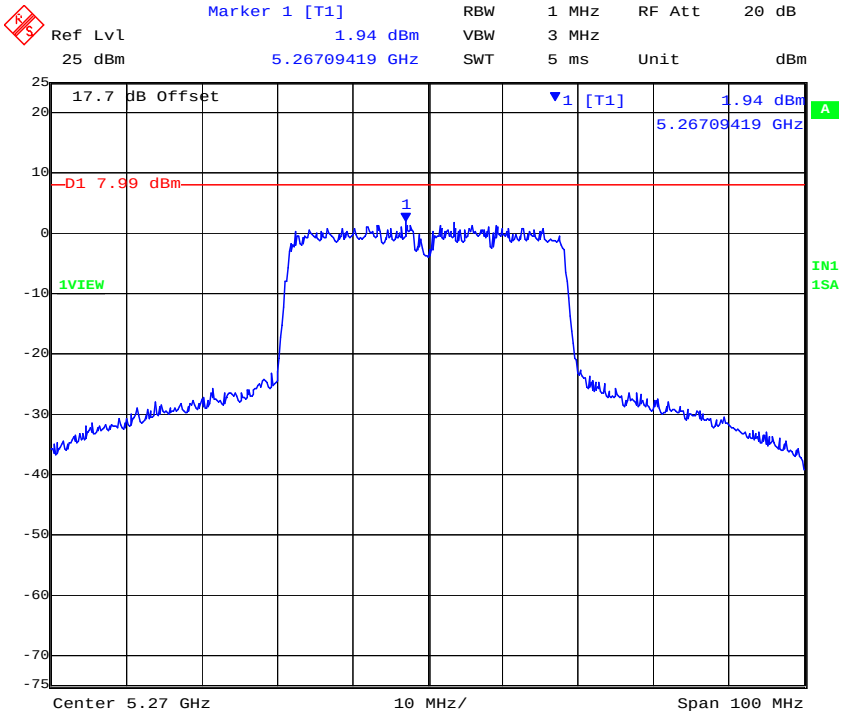
TABLE OF RESULTS – **802. 11n HT-40 (5250 – 5350 MHz)**

Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 n HT-40	**Ambient Temp. (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:			

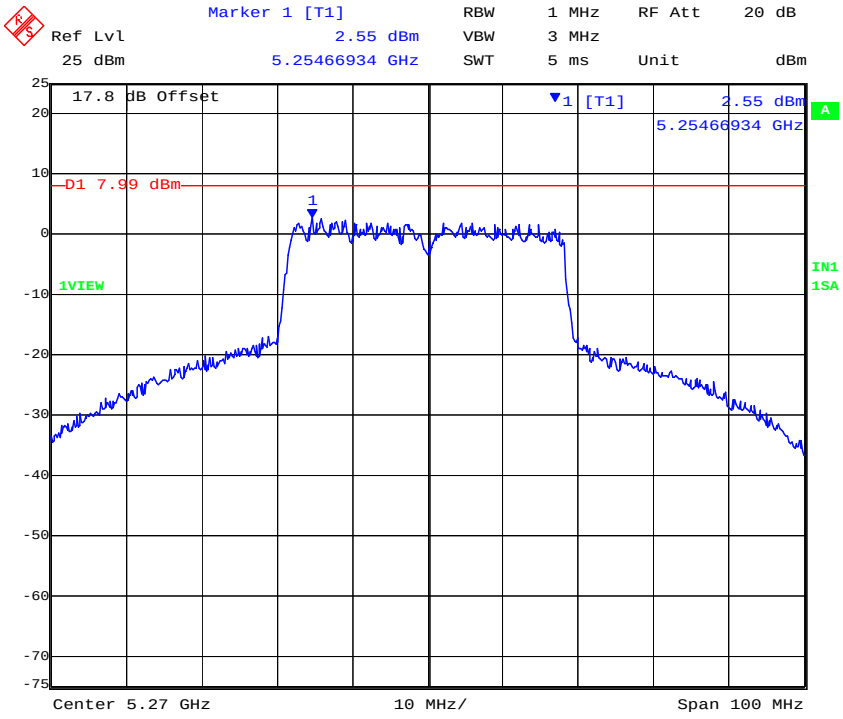
Test Frequency	**Measured Peak Power**				**Correction factor**	**Peak Power Spectral Density**	**Limit**	**Margin**
	RF Port (dBm)							
MHz	**a**	**b**	**c**	**d**	**10Log(N)**	**dBm**	**dBm**	**dB**
5270	1.94	2.55	--	--	3.01	5.56	11.00	-5.44
5310	1.61	2.11	--	--	3.01	5.12	11.00	-5.88

Measurement uncertainty:	±1.33 dB

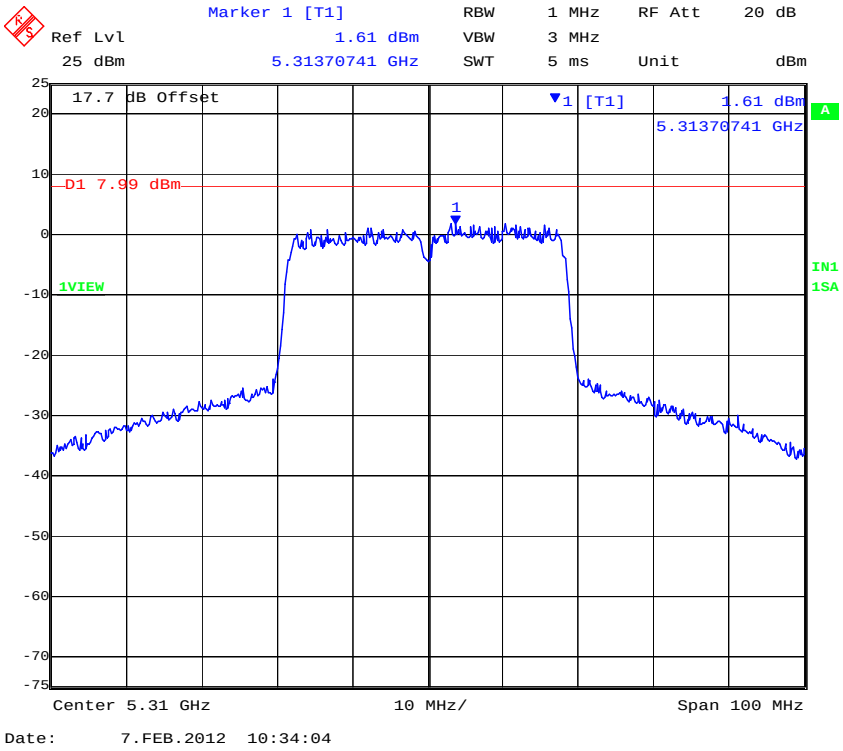
CHAIN A 5,270 MHz 802. 11n HT-40 Peak Power Spectral Density



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



Chain A 5,310 MHz 802. 11n HT-40 Peak Power Spectral Density



Chain B 5,310 MHz 802. 11n HT-40 Peak Power Spectral Density

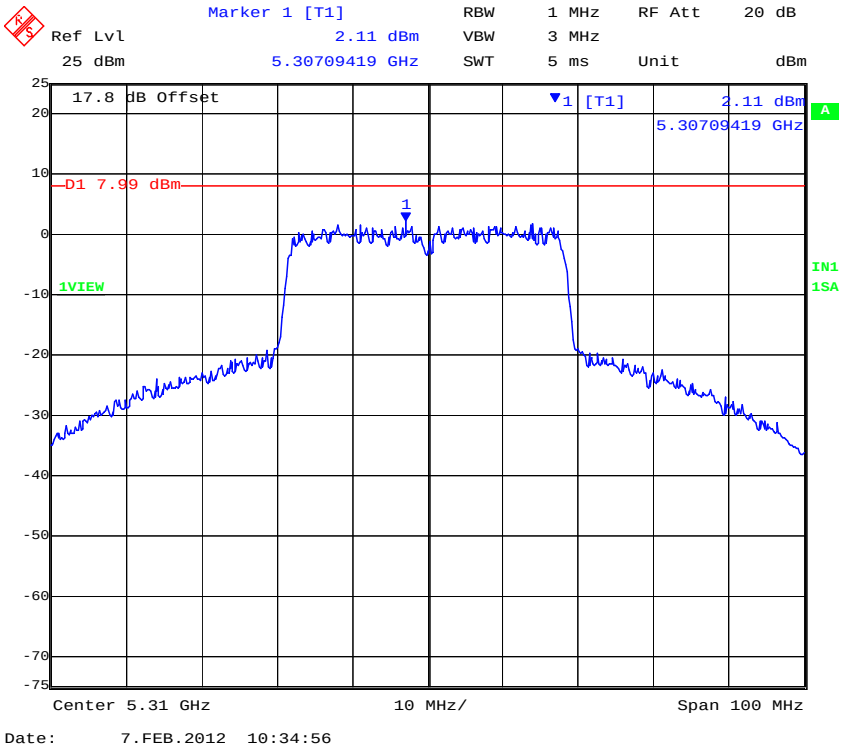


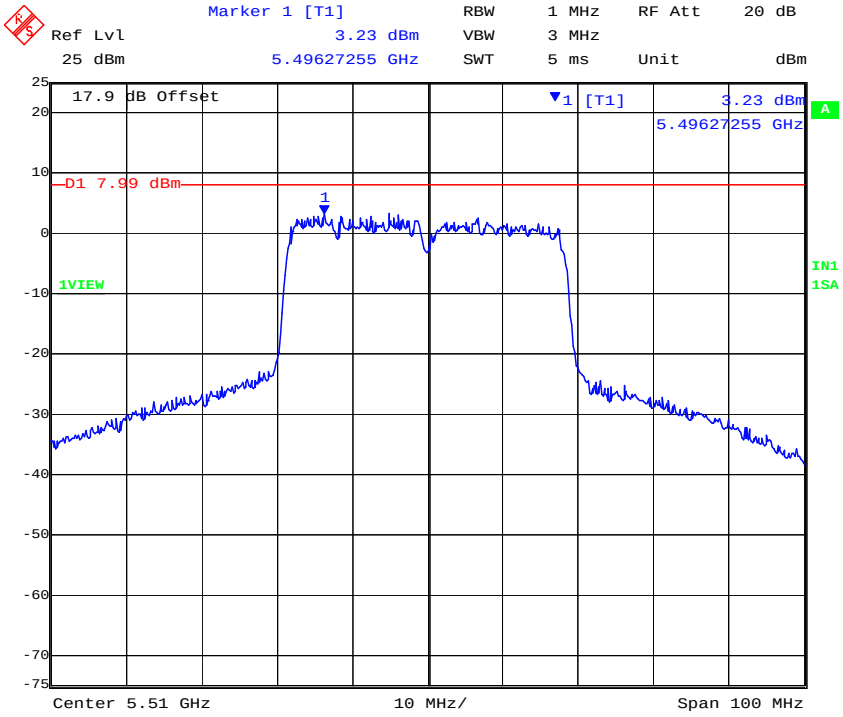
TABLE OF RESULTS – **802. 11n HT-40 (5470 – 5725 MHz)**

Test Conditions:	15.407 (a)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11 n HT-40		**Ambient Temp. (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:					

Test Frequency	**Measured Peak Power**				**Correction factor**	**Peak Power Spectral Density**	**Limit**	**Margin**
	RF Port (dBm)							
MHz	**a**	**b**	**c**	**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

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



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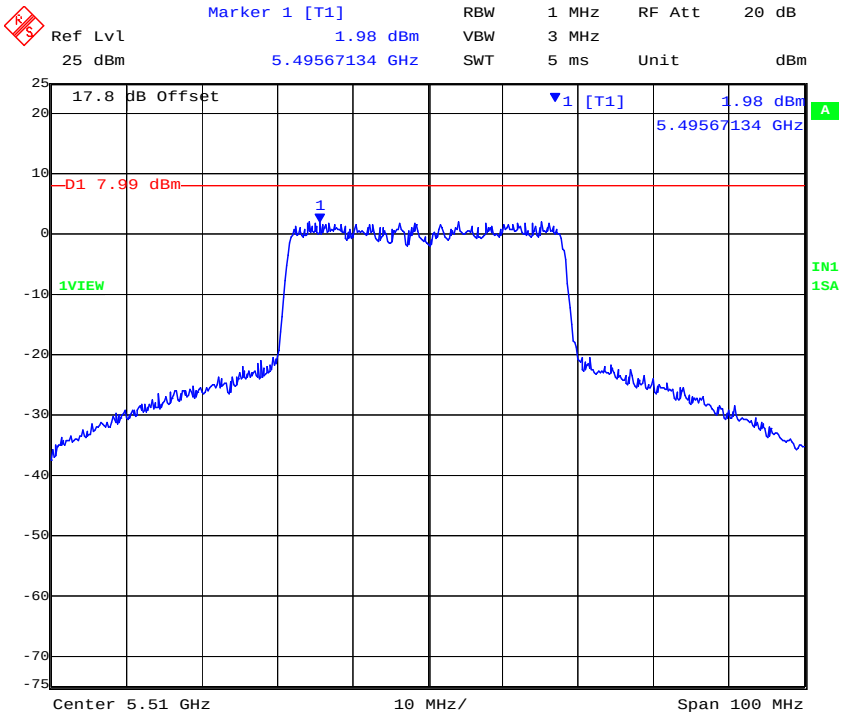
CHAIN B 5,510 MHz 802. 11n HT-40 Peak Power Spectral Density



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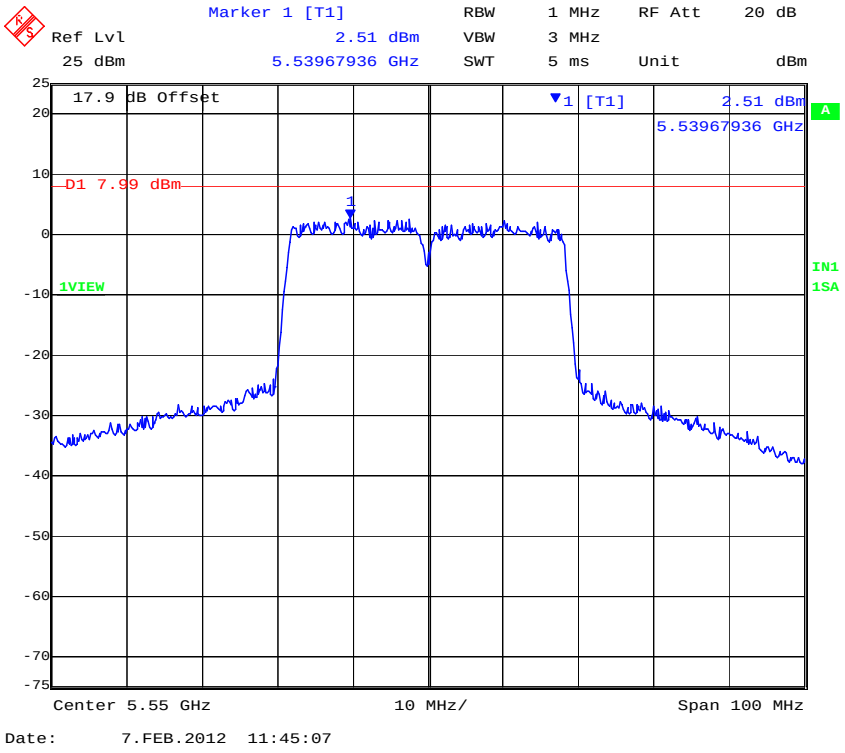
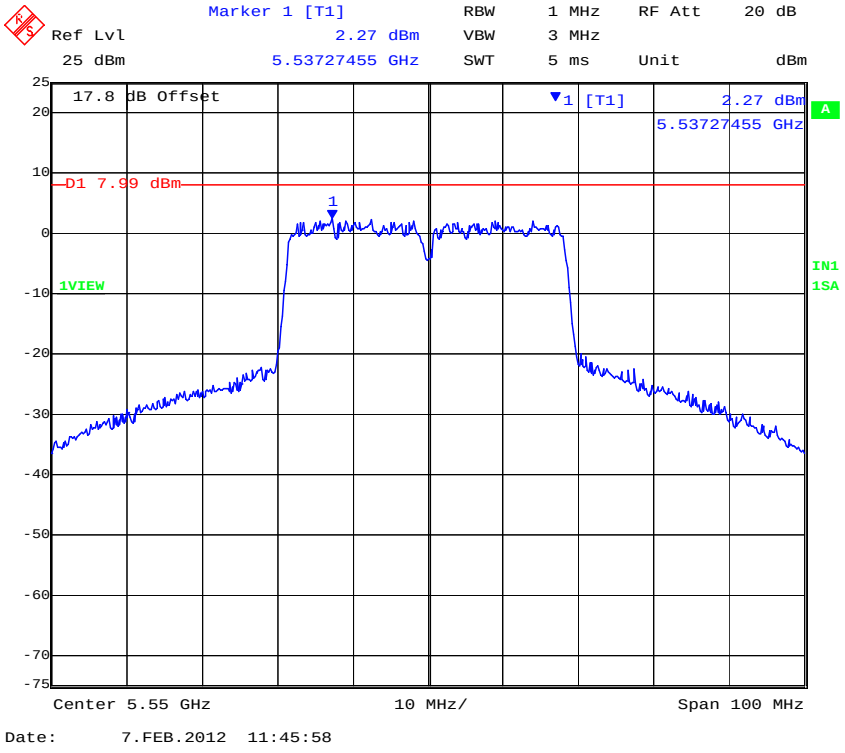
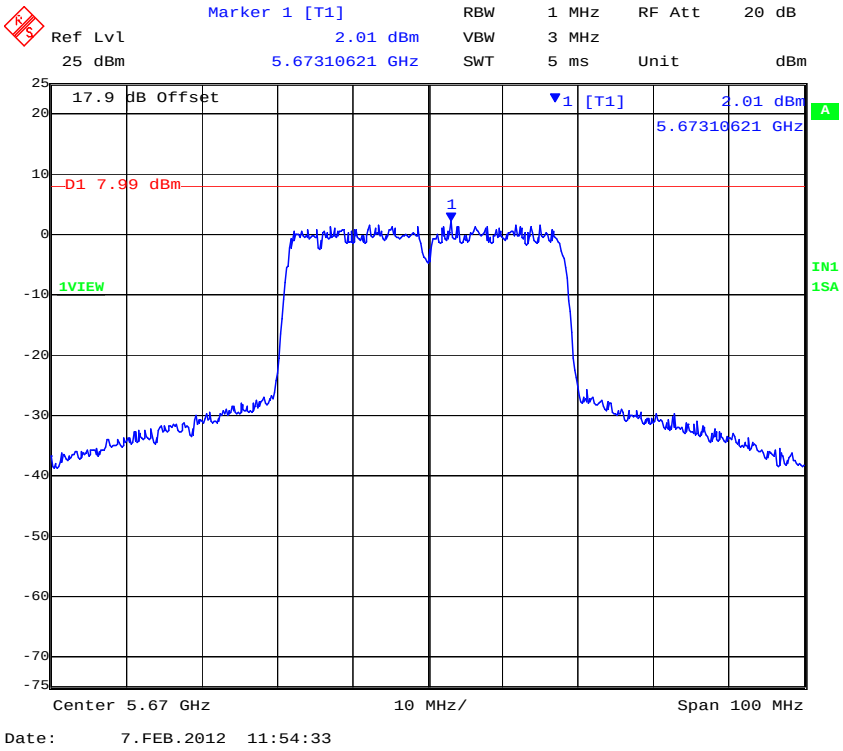
CHAIN A 5,550 MHz 802. 11n HT-40 Peak Power Spectral Density



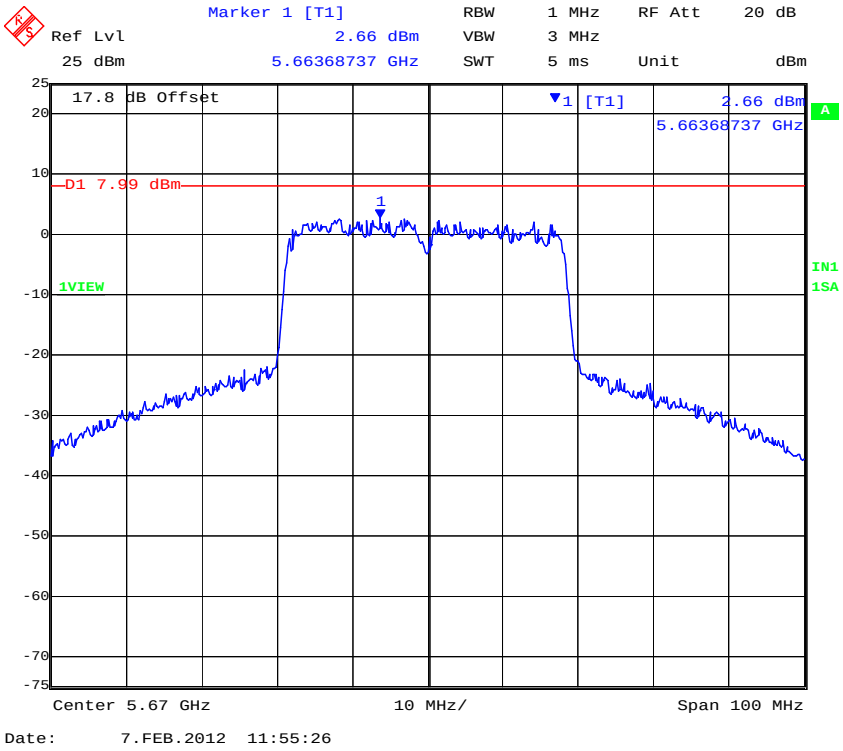
CHAIN B 5,550 MHz 802. 11n HT-40 Peak Power Spectral Density



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



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

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

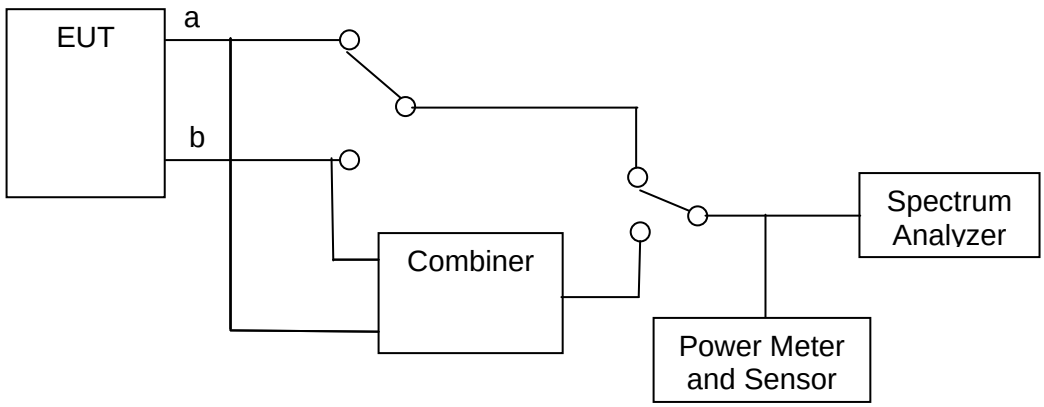
5.1.4. Peak Excursion Ratio

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

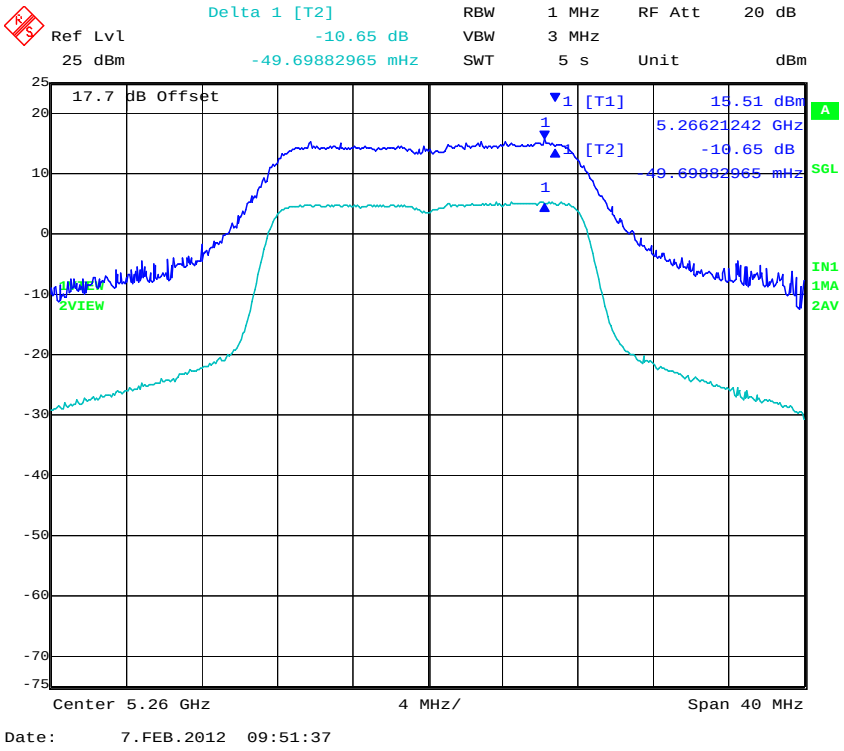
TABLE OF RESULTS – **802.11a Legacy (5250 – 5350 MHz)**

Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 a	**Ambient Temp. (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		
Notes 1:			
Notes 2:			

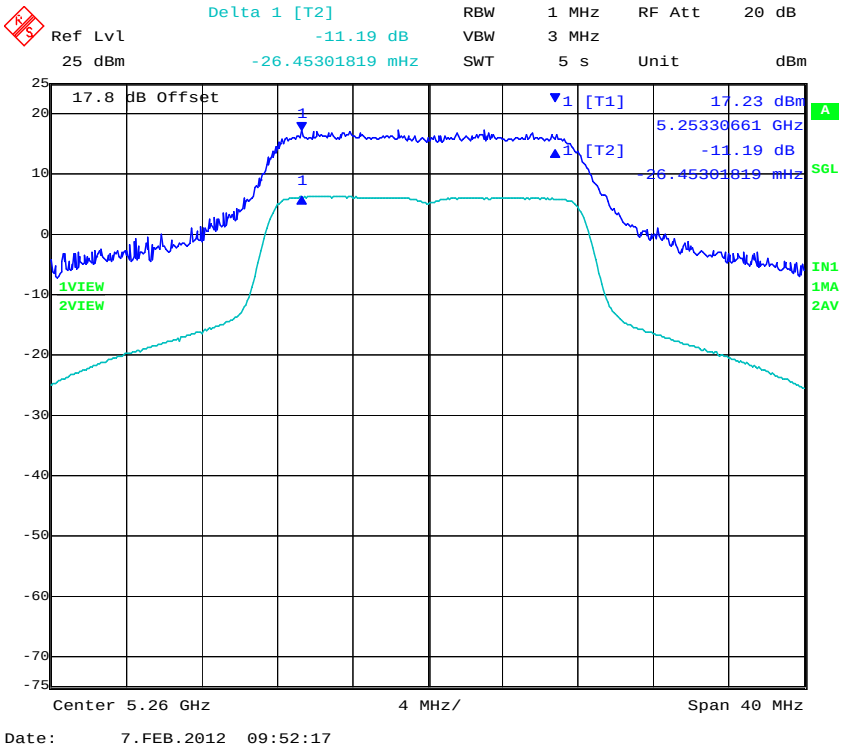
Test Frequency	Trace Δ Marker				Limit	Margin
	Port A	Port B	Port C	Port D		
MHz	dB	dB	dB	dB	dB	dB
5260	-10.65	-11.19	--	--	-13.00	-1.81
5300	-10.10	-11.72	--	--		-1.28
5320	-10.18	-11.63	--	--		-1.38

Measurement uncertainty:	±1.33 dB

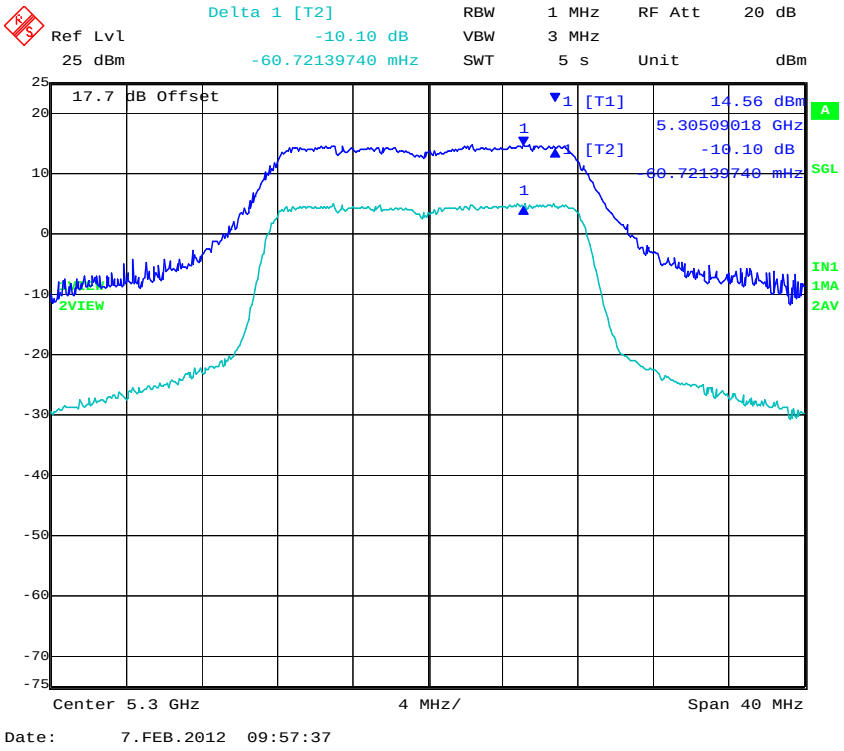
CHAIN A 5,260 MHz 802.11a Legacy - Peak Excursion Ratio



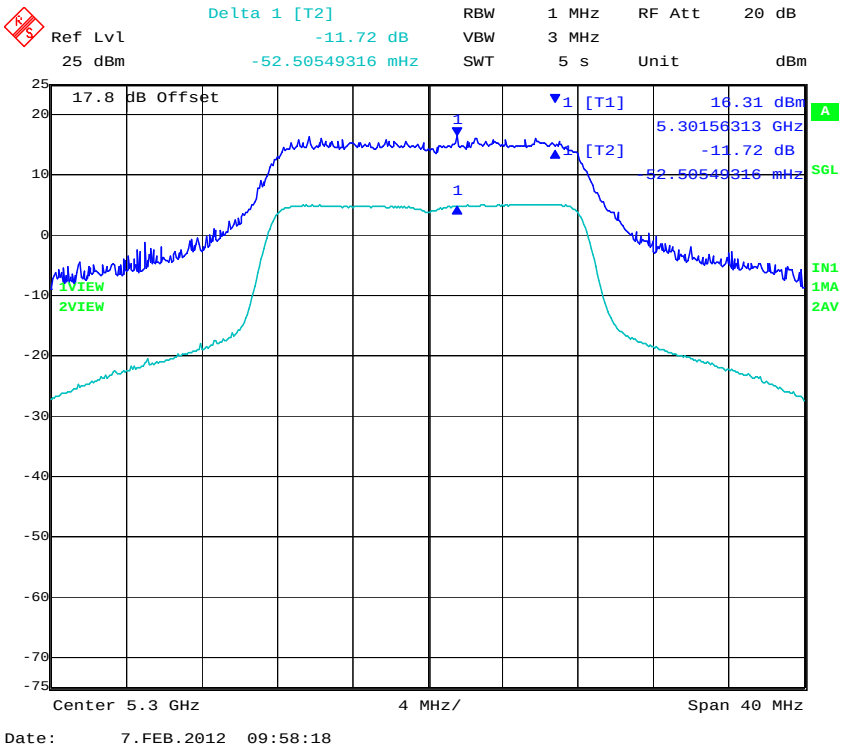
CHAIN B 5,260 MHz 802.11a Legacy - Peak Excursion Ratio



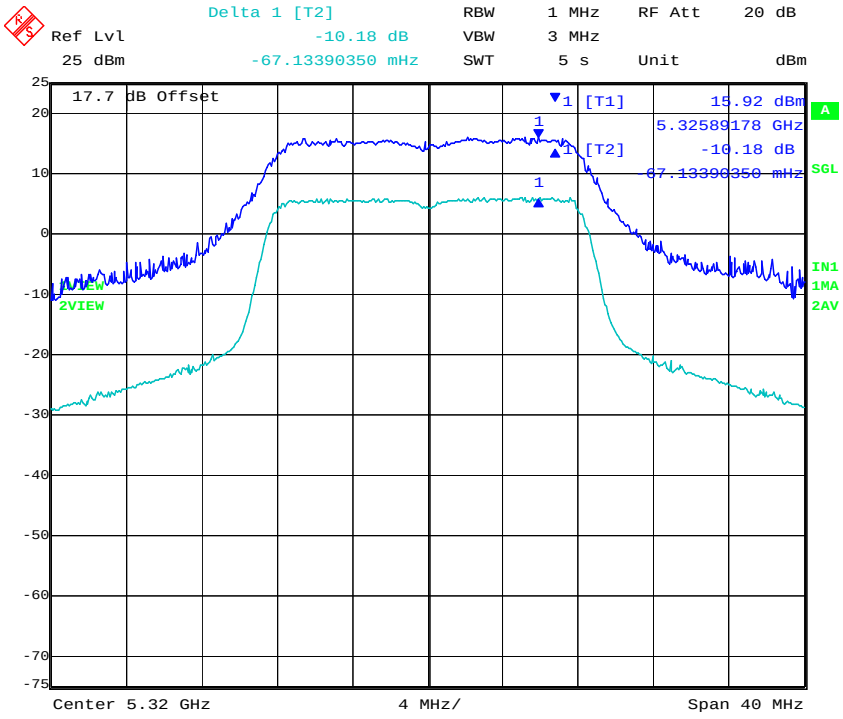
CHAIN A 5,300 MHz 802.11a Legacy - Peak Excursion Ratio



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

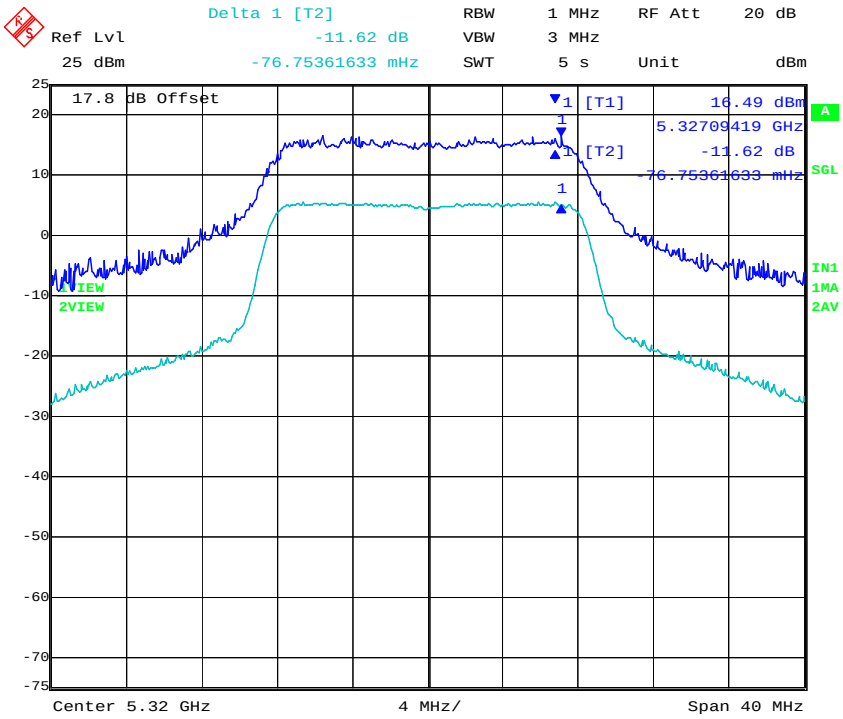


CHAIN A 5,320 MHz 802.11a Legacy - Peak Excursion Ratio



Date: 7.FEB.2012 10:03:40

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



Date: 7.FEB.2012 10:04:19

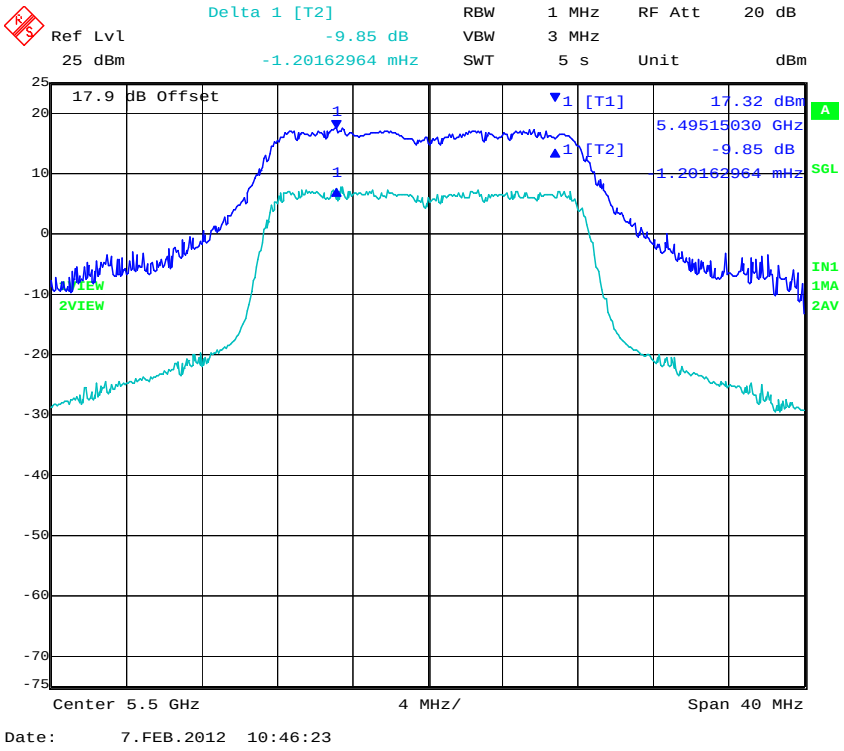
TABLE OF RESULTS – **802.11a Legacy (5470 – 5725 MHz)**

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		
Notes 1:			
Notes 2:			

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

Measurement uncertainty:	±1.33 dB

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



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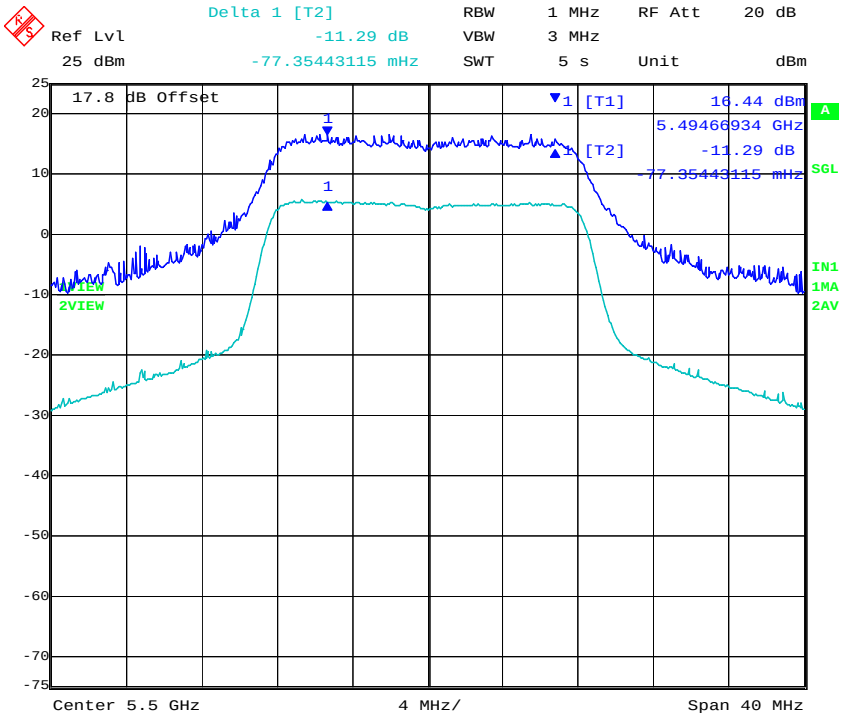
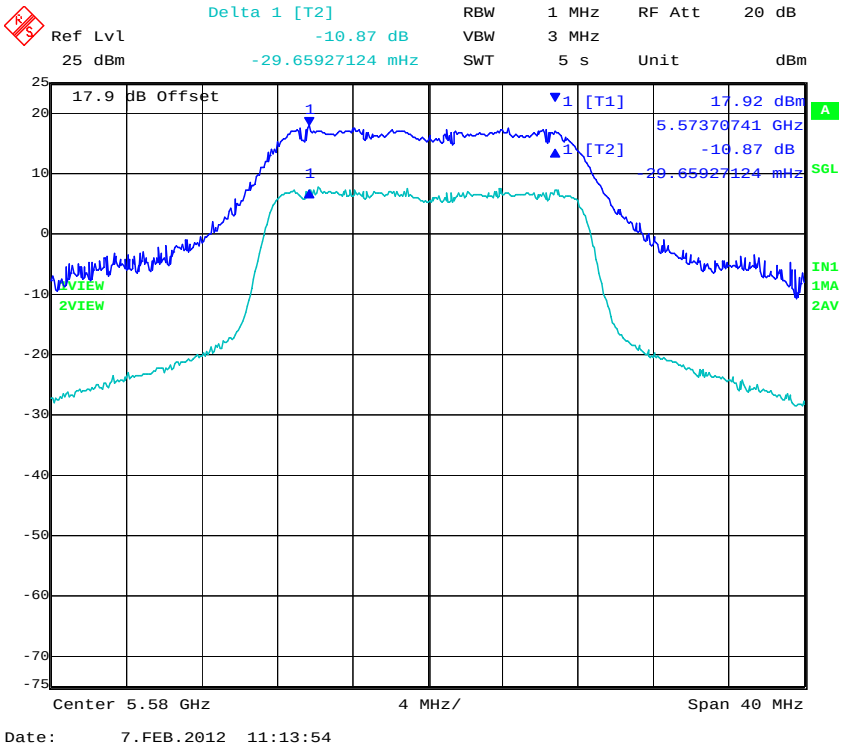
CHAIN B 5,500 MHz 802.11a Legacy - Peak Excursion Ratio



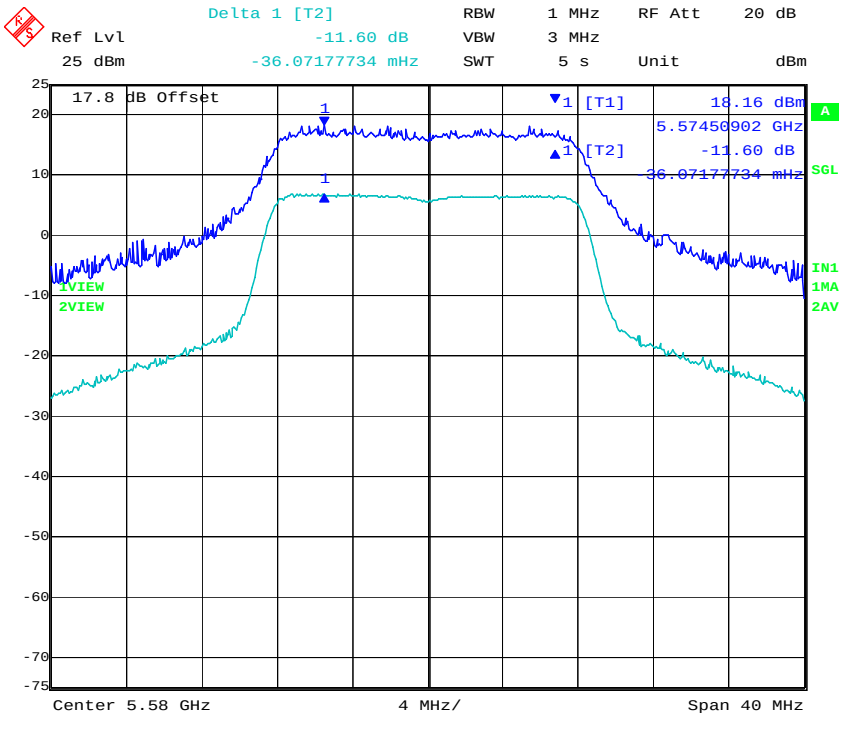
Date: 7.FEB.2012 10:47:02

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



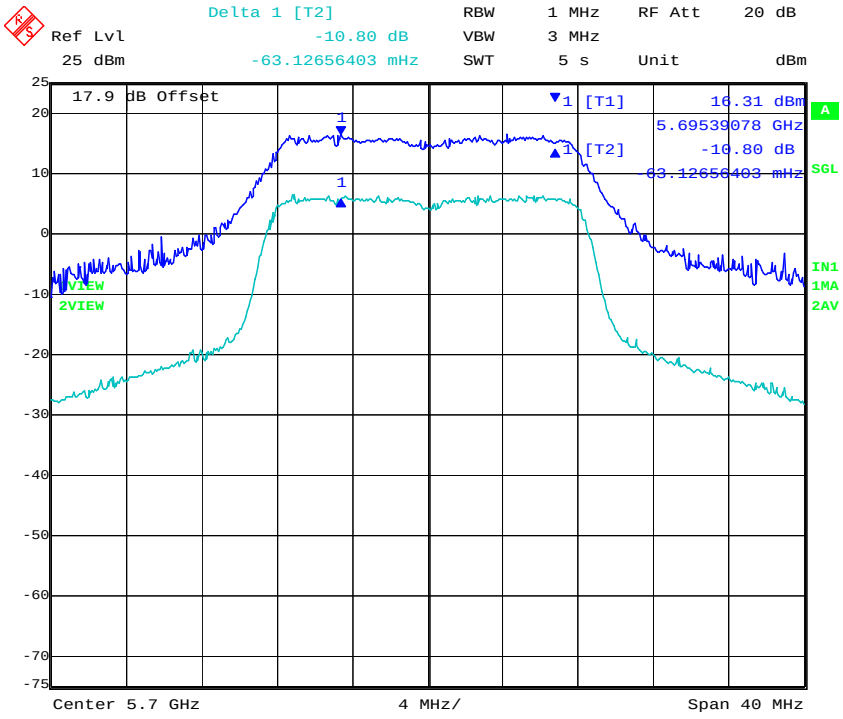
Date: 7.FEB.2012 11:13:54

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



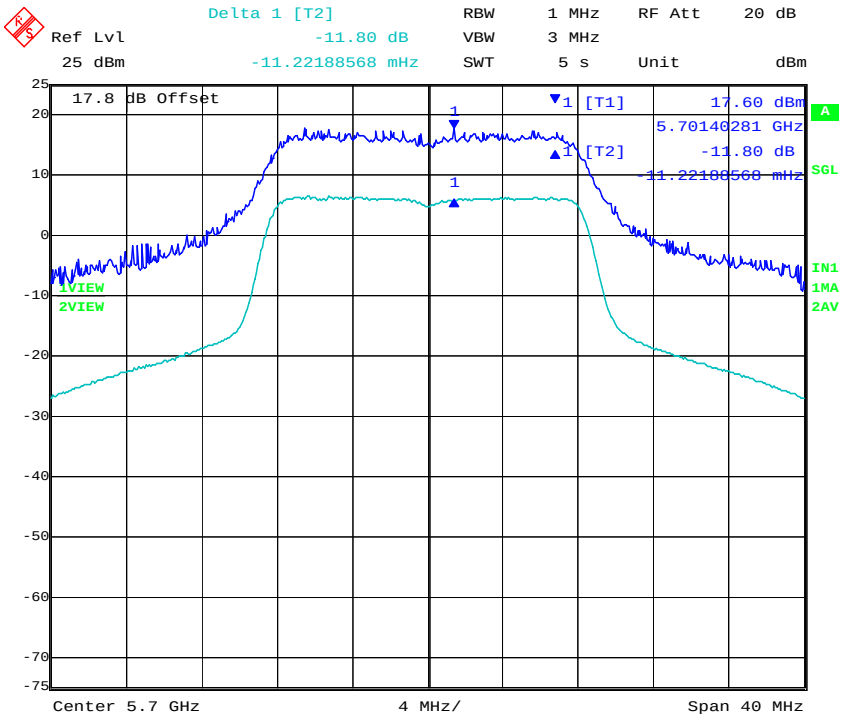
Date: 7.FEB.2012 11:14:33

CHAIN A 5,700 MHz 802.11a Legacy - Peak Excursion Ratio



Date: 7.FEB.2012 11:04:03

CHAIN B 5,700 MHz 802.11a Legacy - Peak Excursion Ratio



Date: 7.FEB.2012 11:04:43

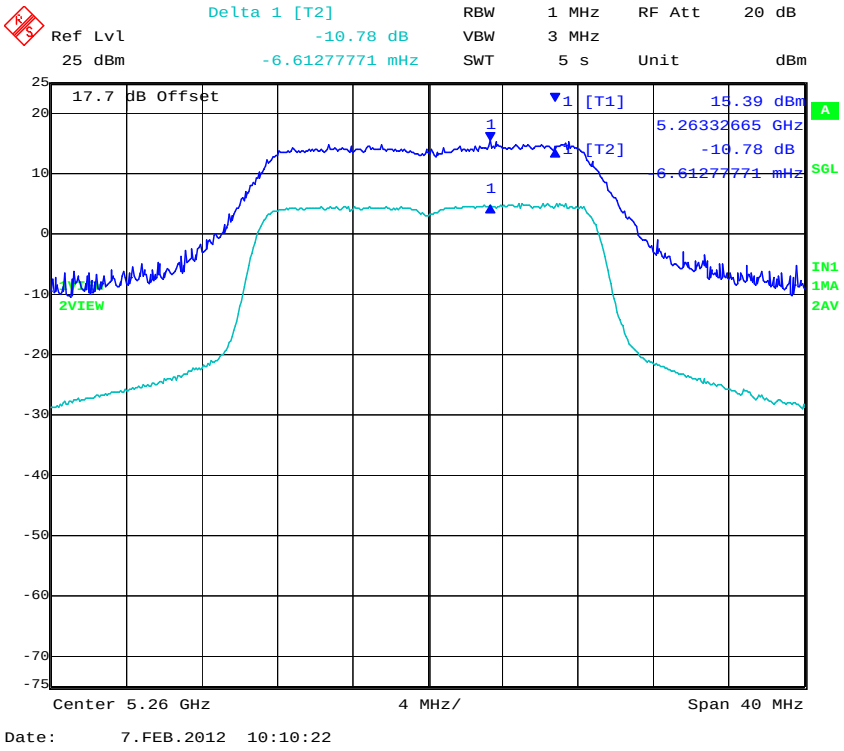
TABLE OF RESULTS – **802. 11n HT-20 (5250 – 5350 MHz)**

Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 n HT-20	**Ambient Temp. (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		
Notes 1:			
Notes 2:			

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

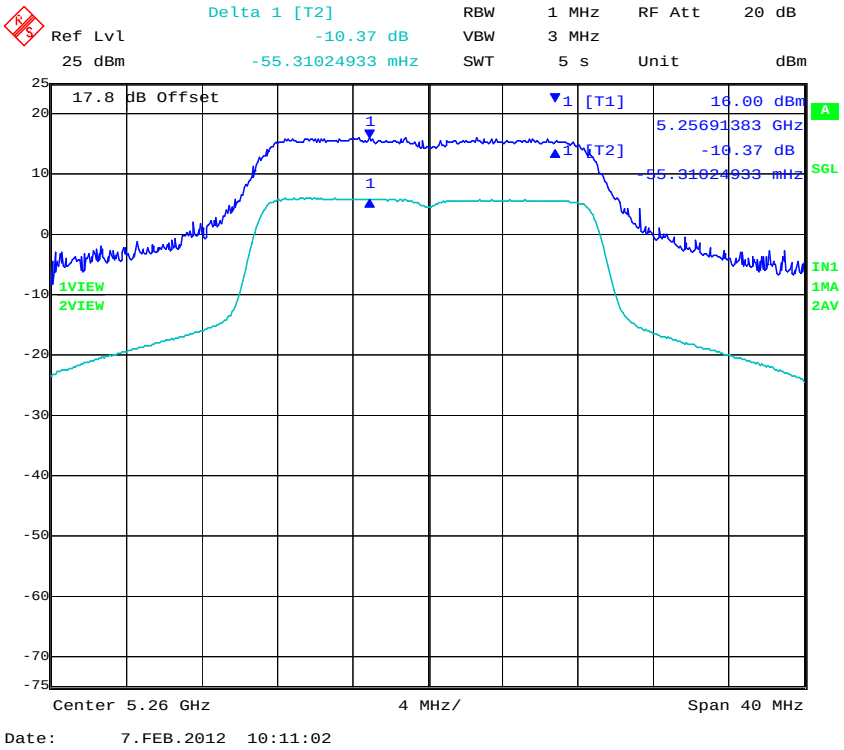
Measurement uncertainty:	±1.33 dB

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



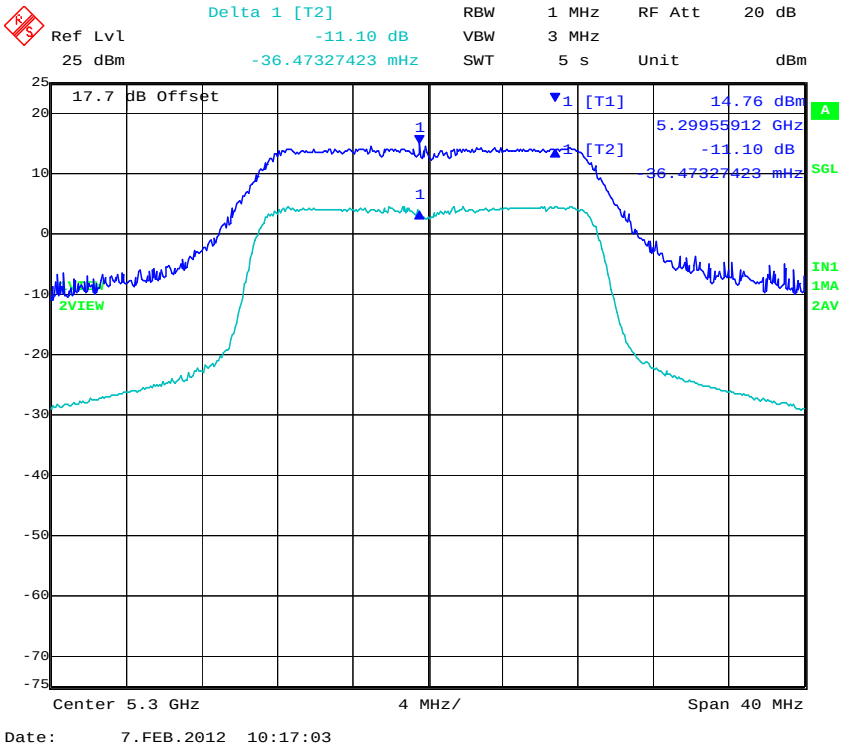
Date: 7.FEB.2012 10:10:22

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



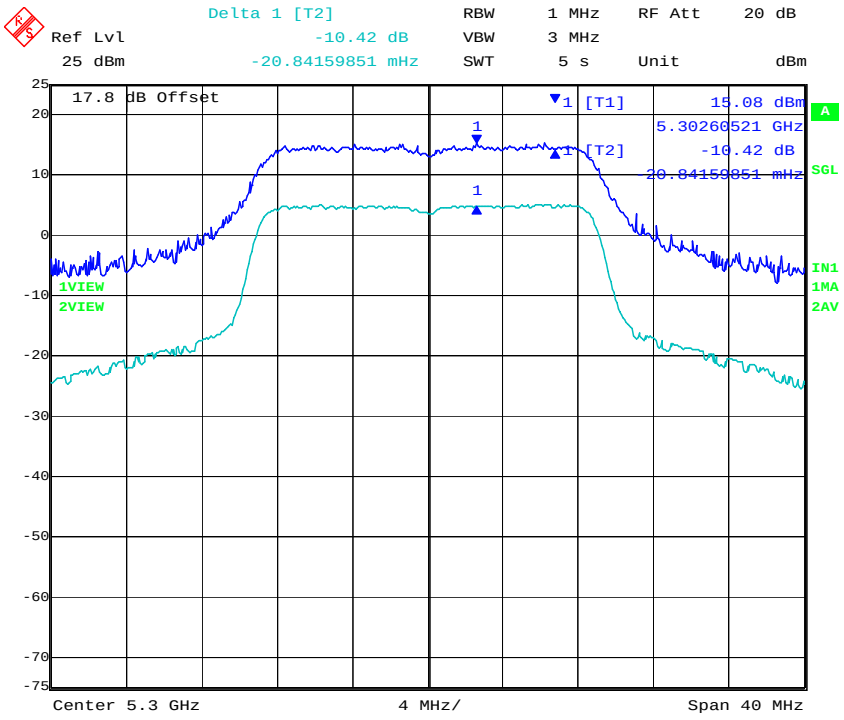
Date: 7.FEB.2012 10:11:02

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



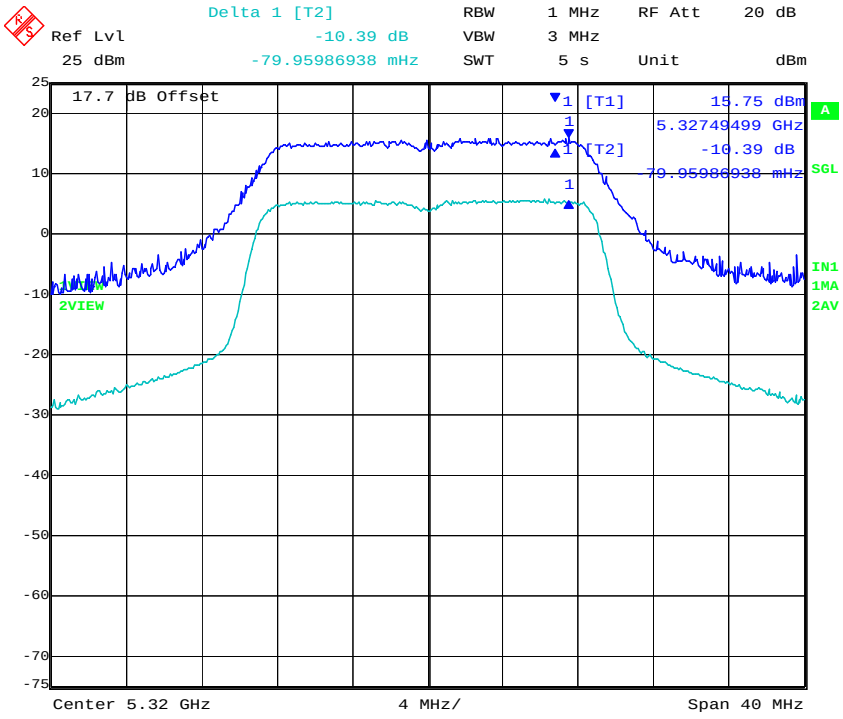
Date: 7.FEB.2012 10:17:03

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



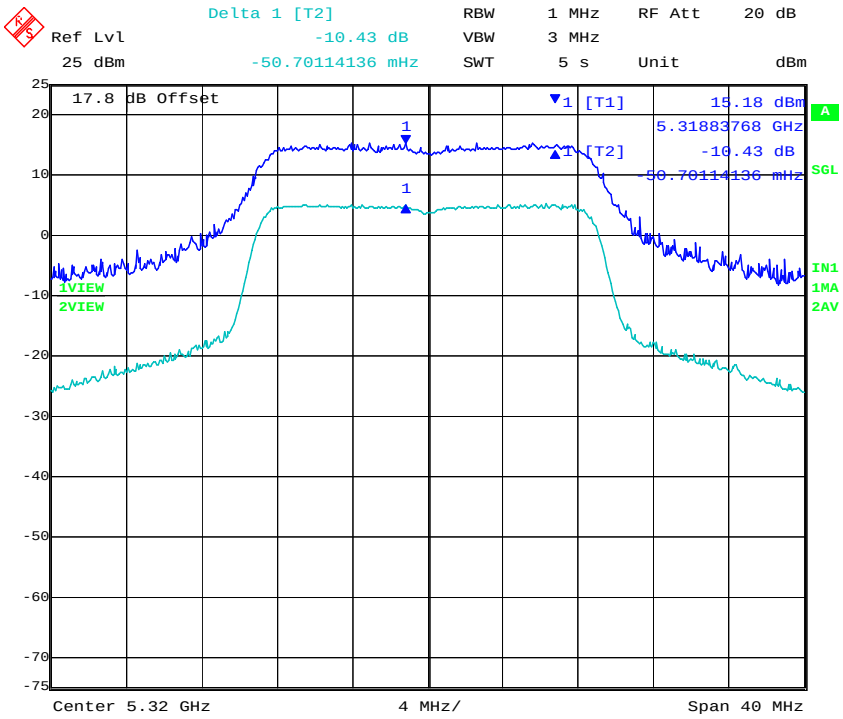
Date: 7.FEB.2012 10:17:43

CHAIN A 5,320 MHz 802.11n HT-20 - Peak Excursion Ratio



Date: 7.FEB.2012 10:22:58

CHAIN B 5,320 MHz 802.11n HT-20 - Peak Excursion Ratio



Date: 7.FEB.2012 10:23:37

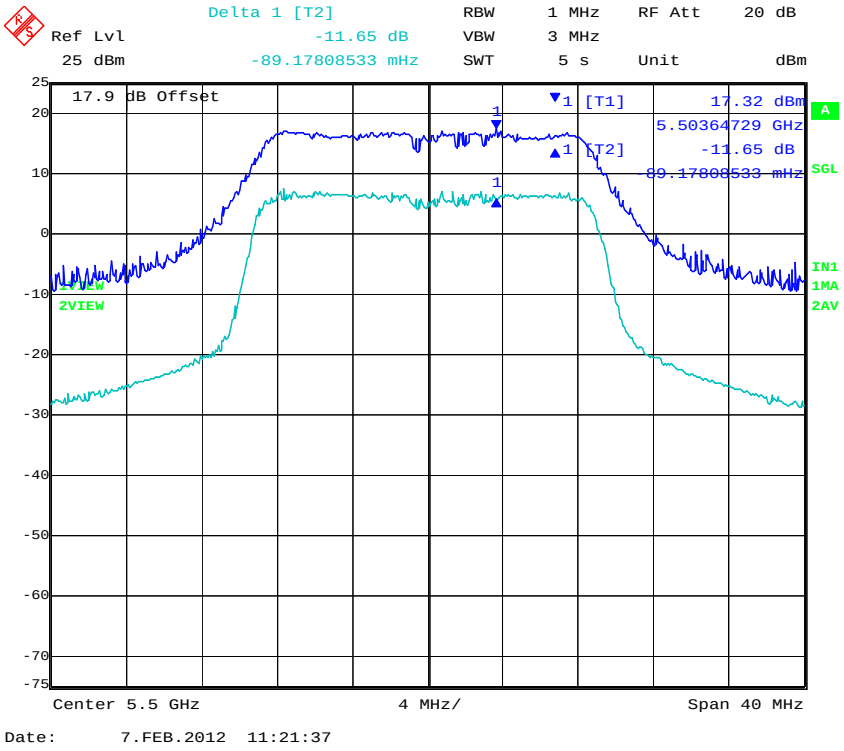
TABLE OF RESULTS – **802.11n HT-20 (5470 – 5725 MHz)**

Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 n HT-20	**Ambient Temp. (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		
Notes 1:			
Notes 2:			

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

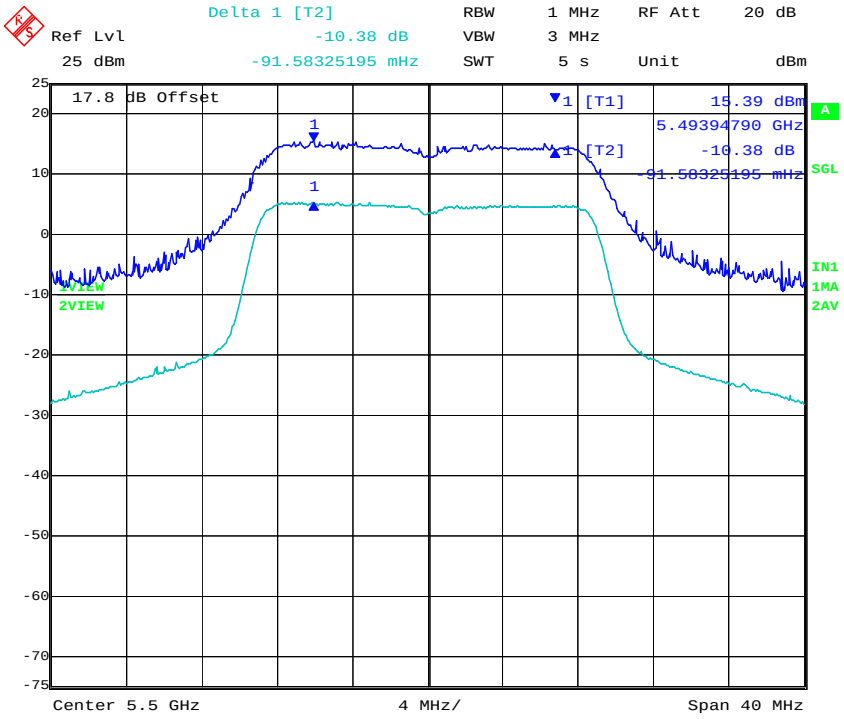
Measurement uncertainty:	±1.33 dB

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



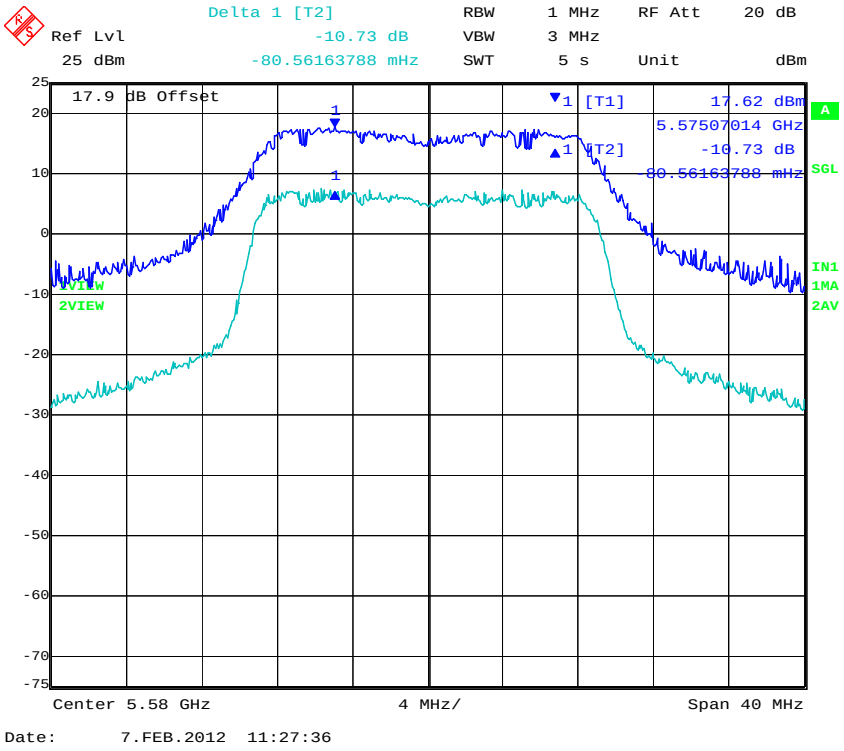
Date: 7.FEB.2012 11:21:37

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



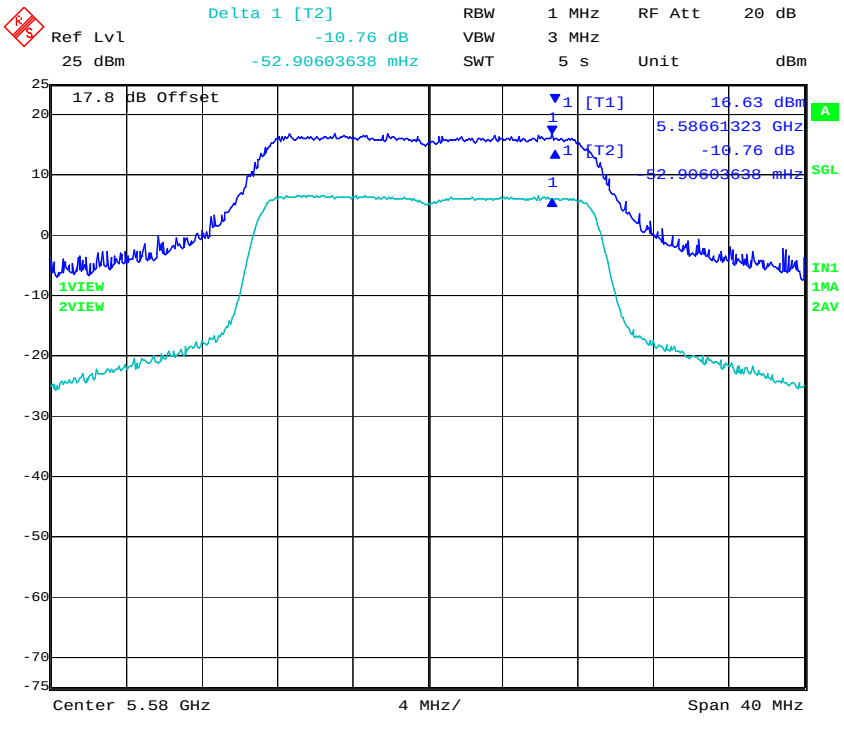
Date: 7.FEB.2012 11:22:17

CHAIN A 5,580 MHz 802.11n HT-20 - Peak Excursion Ratio



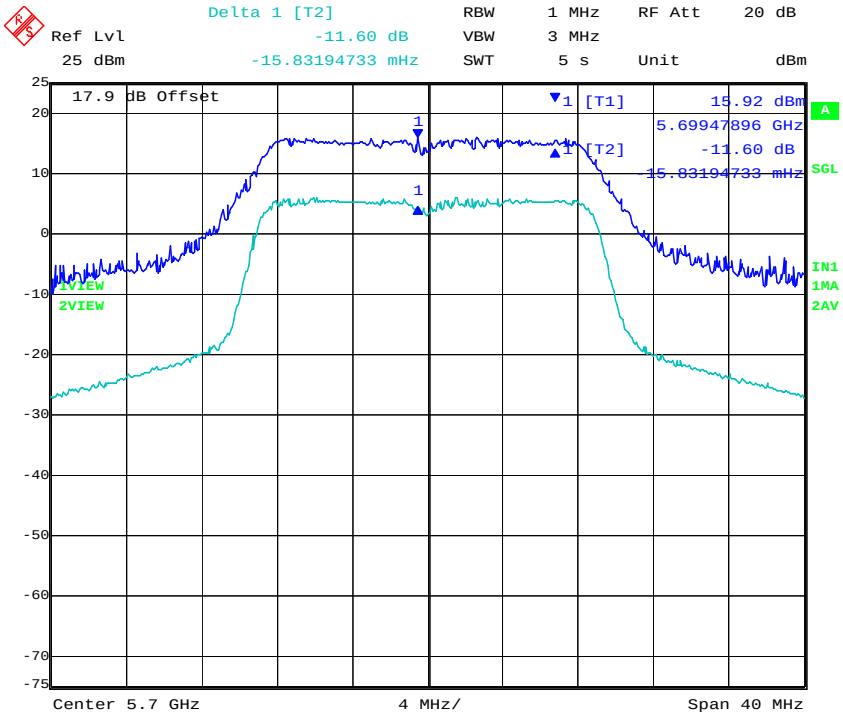
Date: 7.FEB.2012 11:27:36

CHAIN B 5,580 MHz 802.11n HT-20 - Peak Excursion Ratio



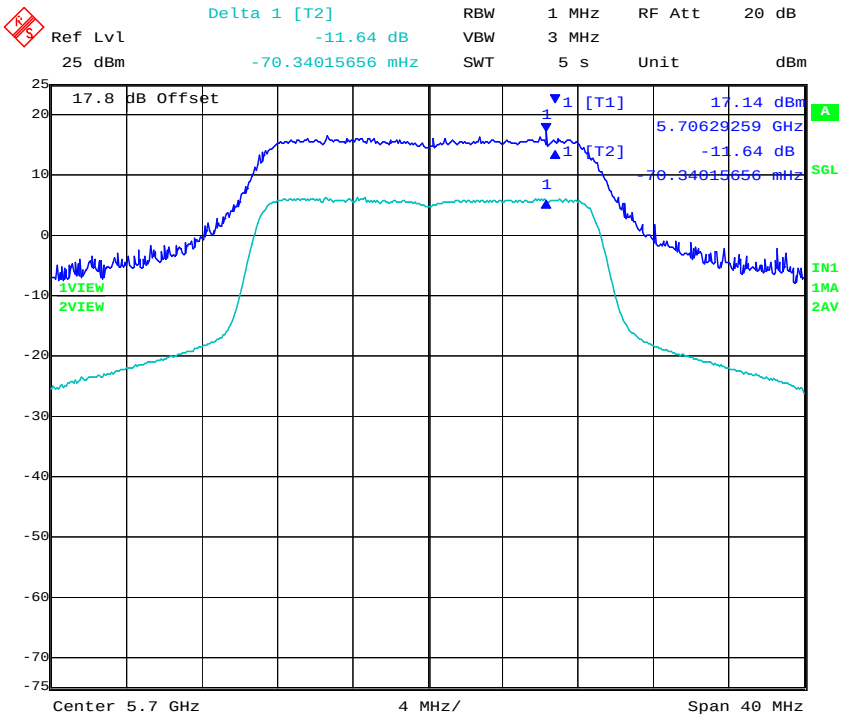
Date: 7.FEB.2012 11:28:15

CHAIN A 5,700 MHz 802.11n HT-20 - Peak Excursion Ratio



Date: 7.FEB.2012 11:34:15

CHAIN B 5,700 MHz 802.11n HT-20 - Peak Excursion Ratio



Date: 7.FEB.2012 11:34:55

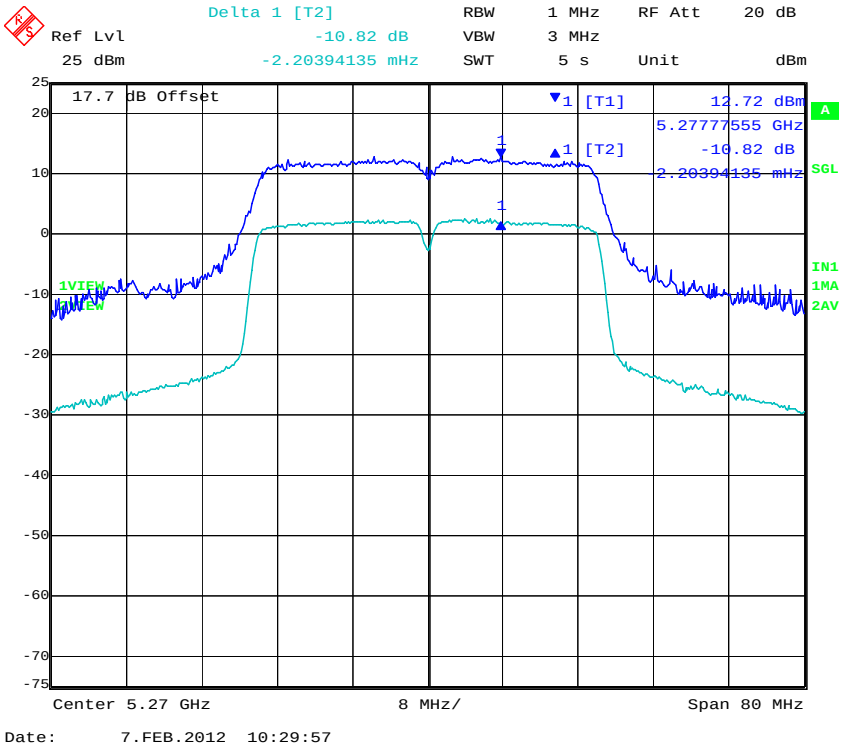
TABLE OF RESULTS – **802. 11n HT-40 (5250 – 5350 MHz)**

Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 n HT-40	**Ambient Temp. (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		
Notes 1:			
Notes 2:			

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

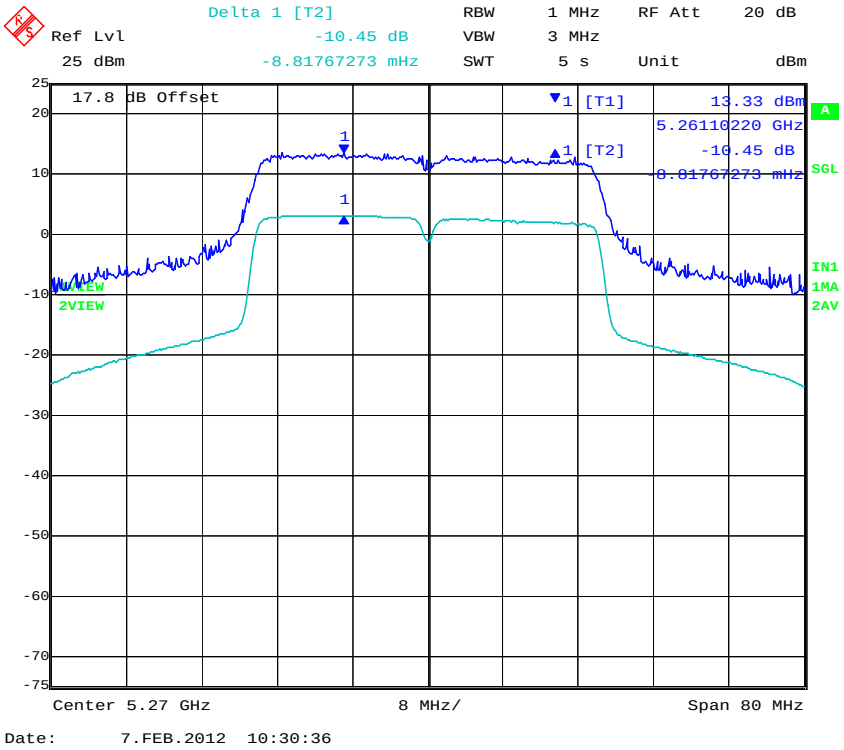
Measurement uncertainty:	±1.33 dB

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



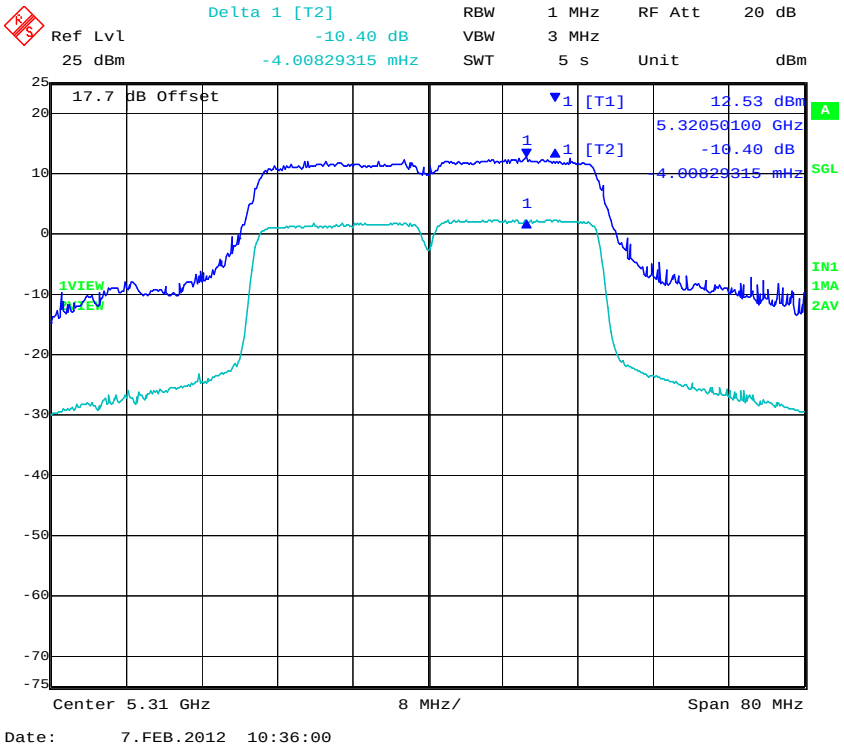
Date: 7.FEB.2012 10:29:57

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



Date: 7.FEB.2012 10:30:36

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



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

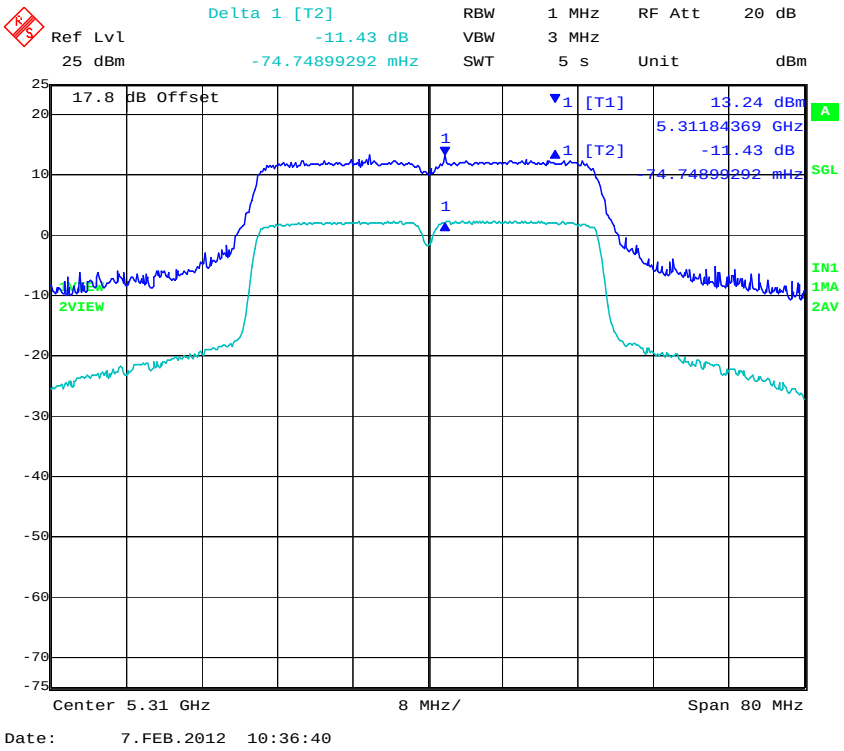


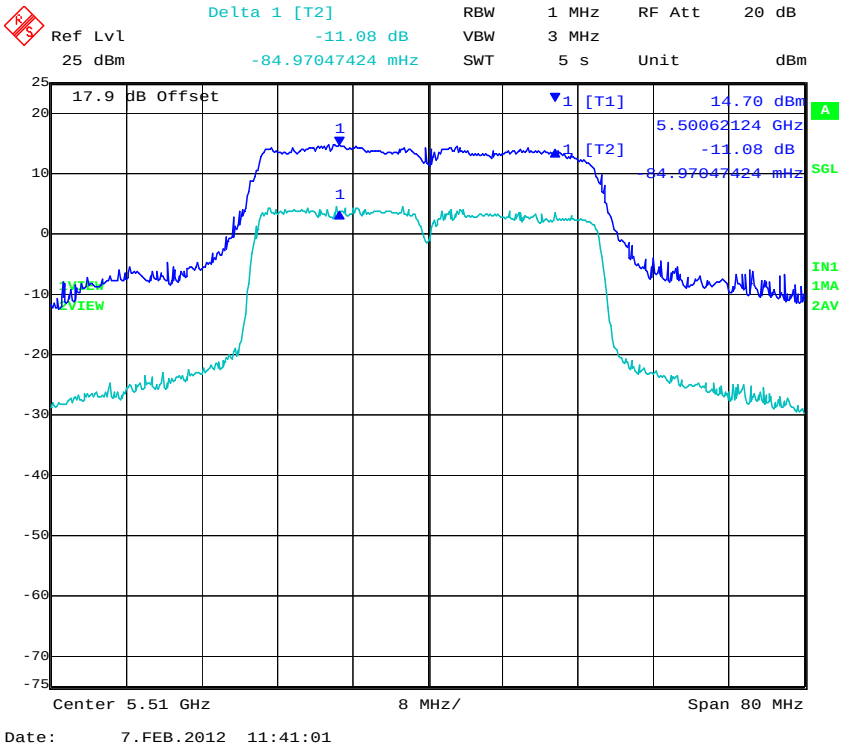
TABLE OF RESULTS – **802.11n HT-40 (5470 – 5725 MHz)**

Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 n HT-40	**Ambient Temp. (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		
Notes 1:			
Notes 2:			

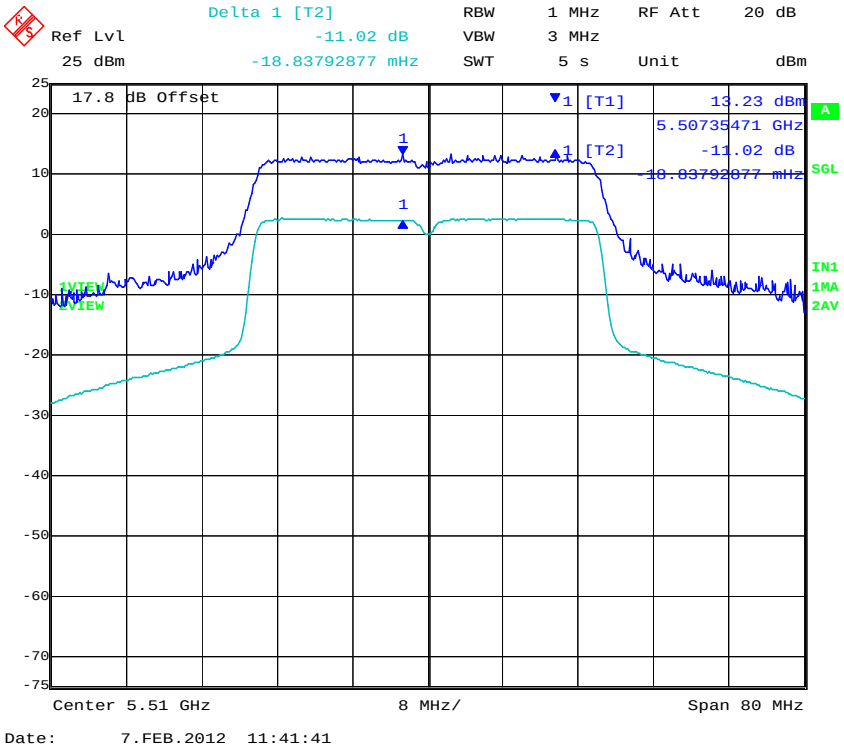
Test Frequency	Trace Δ Marker				Limit	Margin
	Port A	Port B	Port C	Port D		
MHz	dB	dB	dB	dB	dB	dB
5510	-11.08	-11.02	--	--	-13.00	-1.92
5550	-11.99	-11.34	--	--		-1.01
5670	-12.54	-10.71	--	--		-0.46

Measurement uncertainty:	±1.33 dB

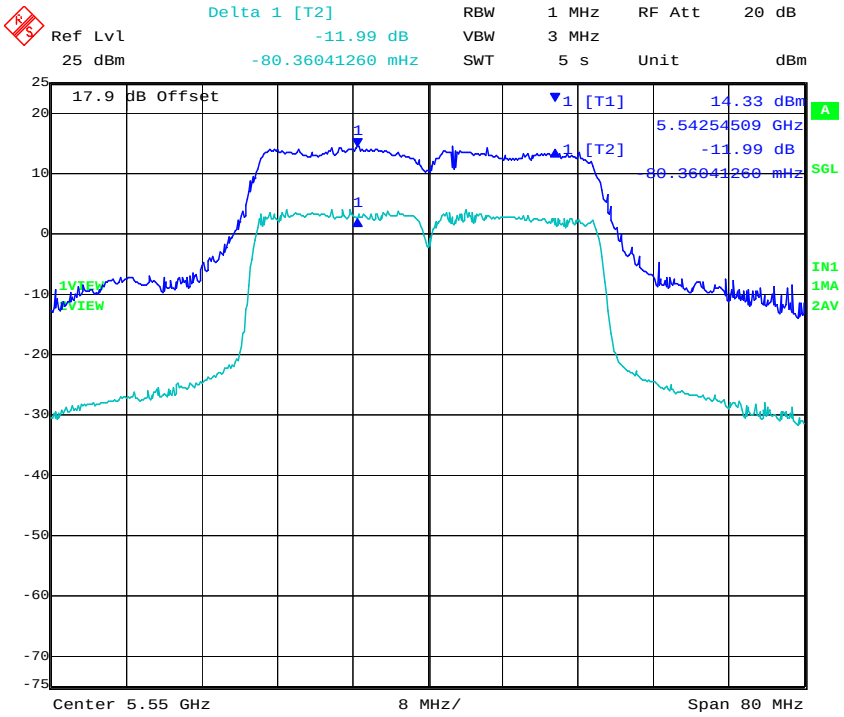
CHAIN A 5,510 MHz 802.11n HT-40 - Peak Excursion Ratio



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

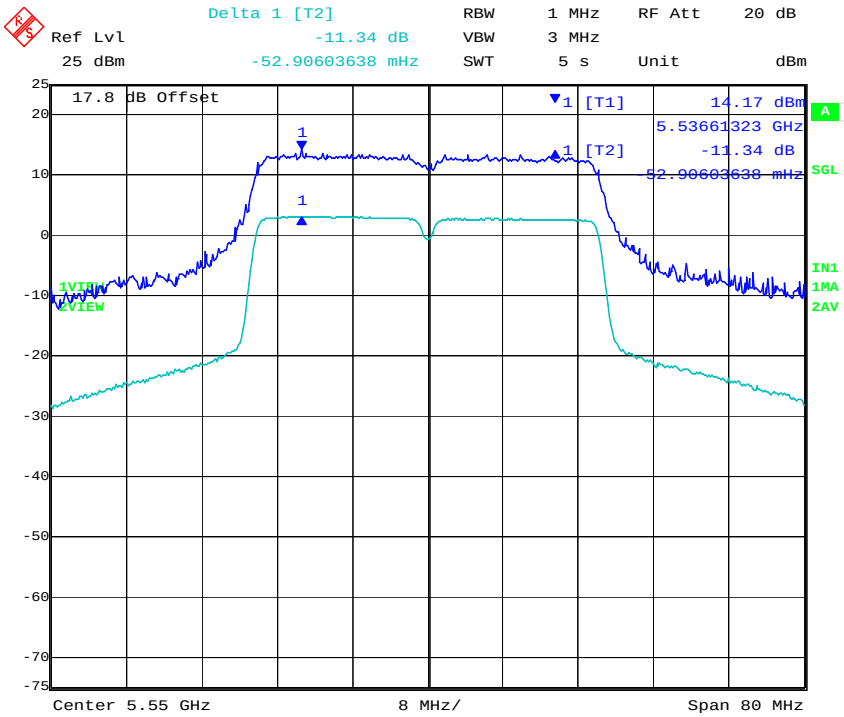


CHAIN A 5,550 MHz 802.11n HT-40 - Peak Excursion Ratio



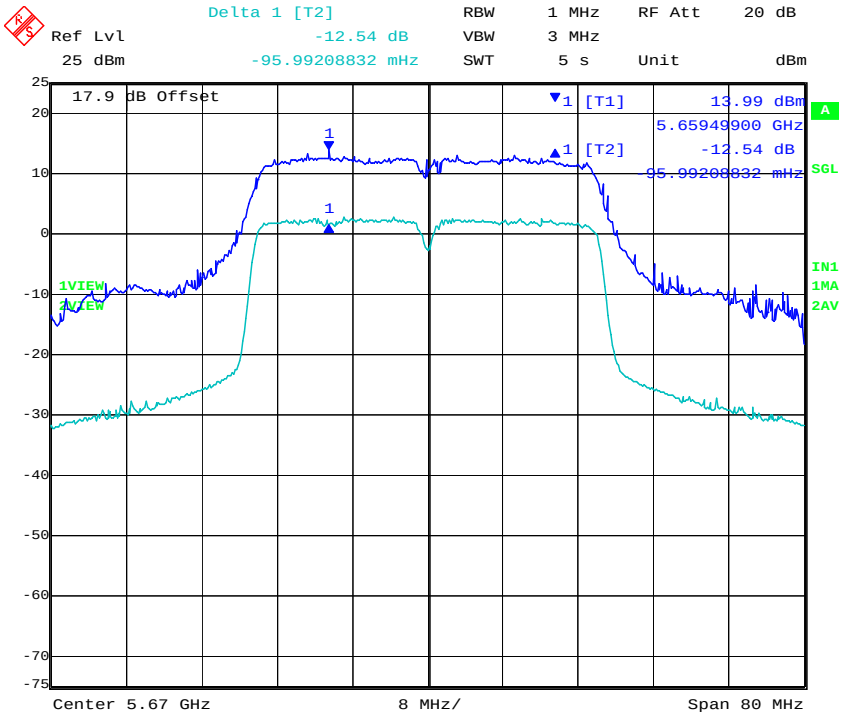
Date: 7.FEB.2012 11:47:02

CHAIN B 5,550 MHz 802.11n HT-40 - Peak Excursion Ratio



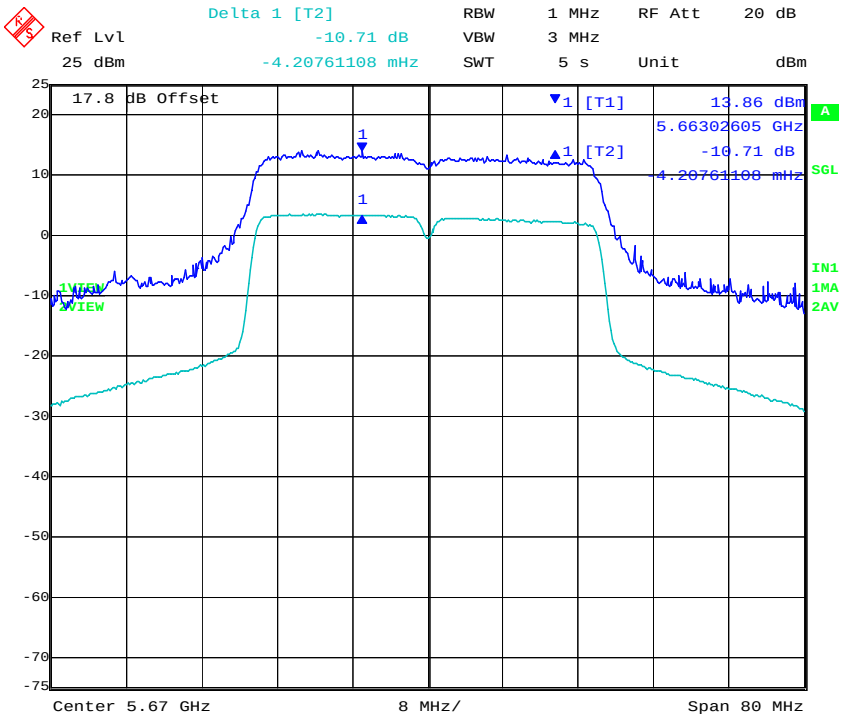
Date: 7.FEB.2012 11:47:43

CHAIN A 5,670 MHz 802.11n HT-40 - Peak Excursion Ratio



Date: 7.FEB.2012 11:56:31

CHAIN B 5,670 MHz 802.11n HT-40 - Peak Excursion Ratio



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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

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.

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

Specification

Limits

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

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^2) = EIRP/(4πd^2)

EIRP = P * G * 2

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

Numeric Gain = 10 ^ (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 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^2
5250 - 5350	5.8	3.8	+20.55	113.5	0.086
5470 - 5725	5.8	3.8	+21.48	140.6	0.11

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

Specification
Maximum Permissible Exposure Limits

FCC §1.1310 Limit = 1mW / cm^2 from 1.310 Table 1

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

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

5.1.7. Radiated Emissions

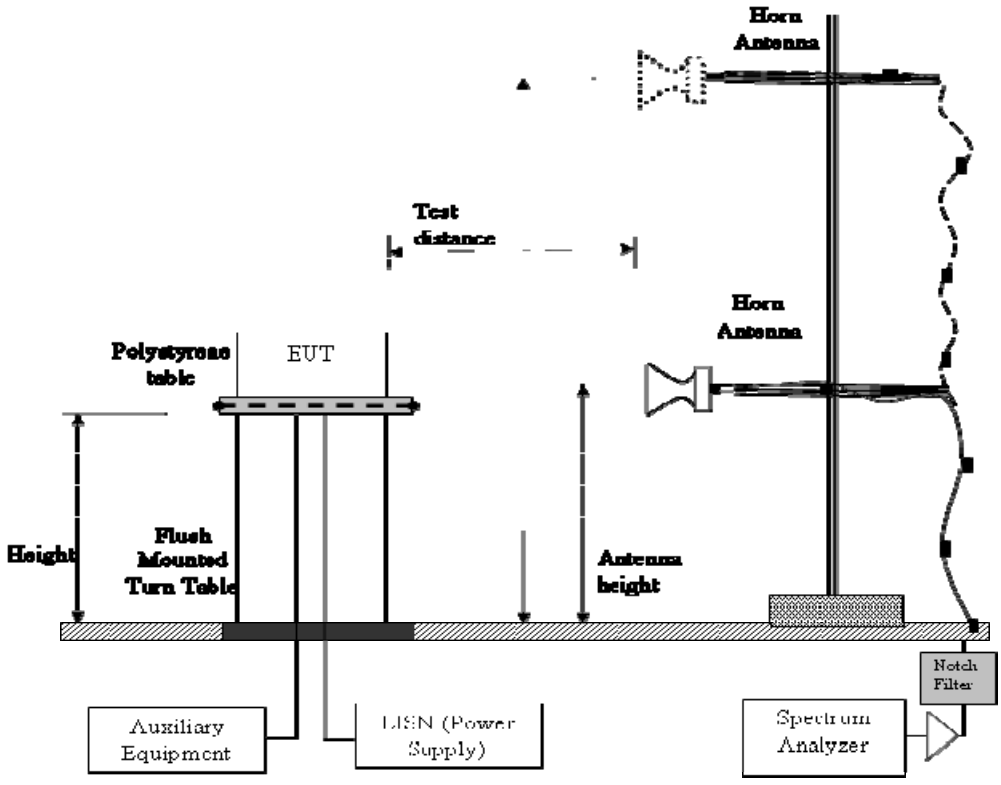
FCC, Part 15 Subpart C §15.407(b)(2), §15.205(a)/15.209(a)
Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7

Test Procedure

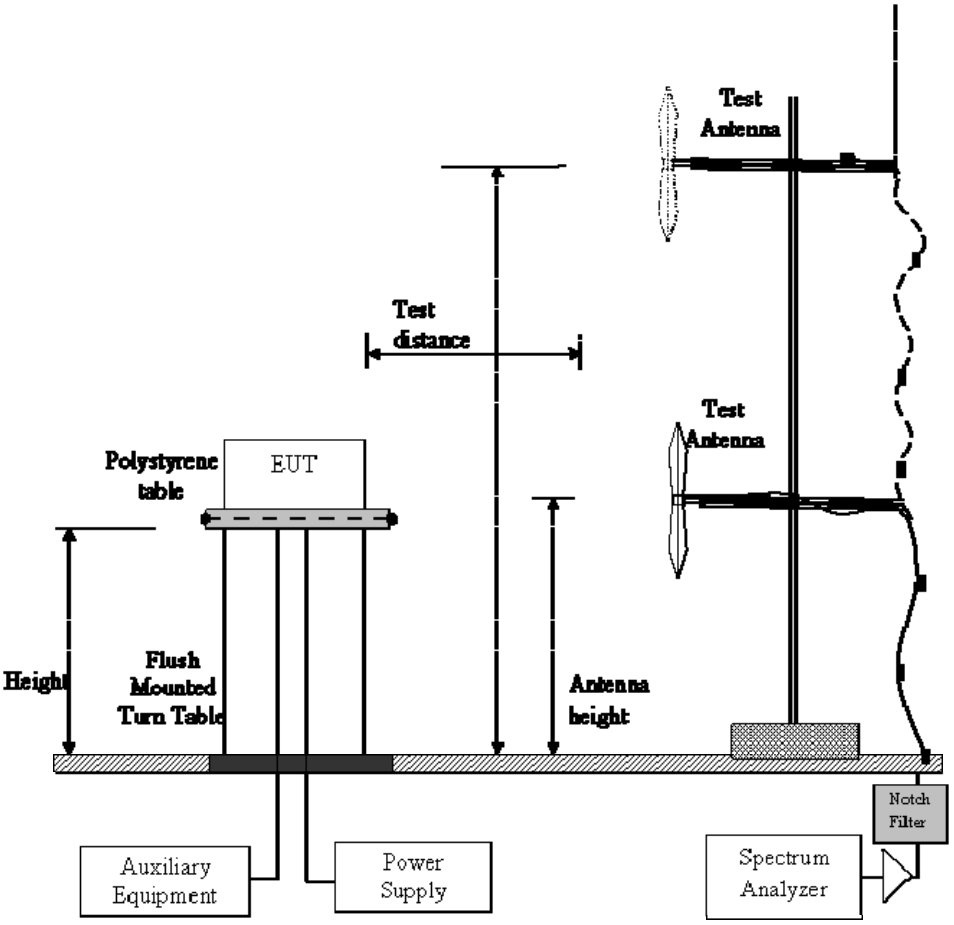
Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak 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



Radiated Emission Measurement Setup – Above 1 GHz



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

CORR = Correction Factor = CL – AG + NFL

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

Field Strength Calculation Example:

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

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

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

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

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

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

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

where P is the EIRP in Watts

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

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

Specification

Radiated Spurious Emissions

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

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

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

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

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

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

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

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

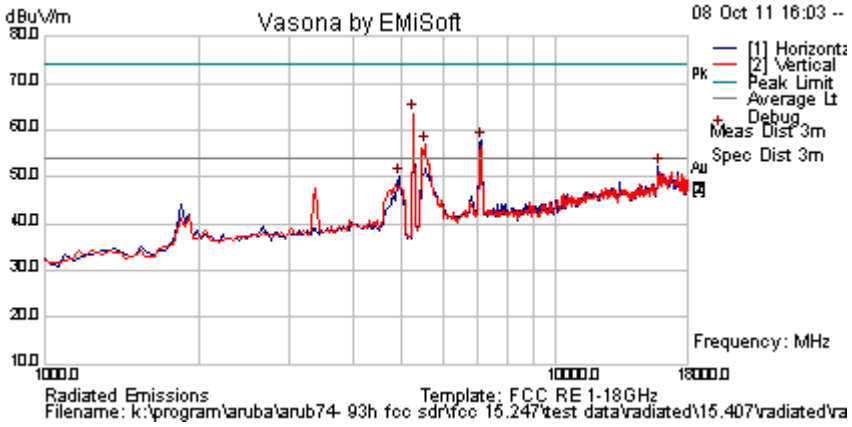
Traceability:

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

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 (°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			

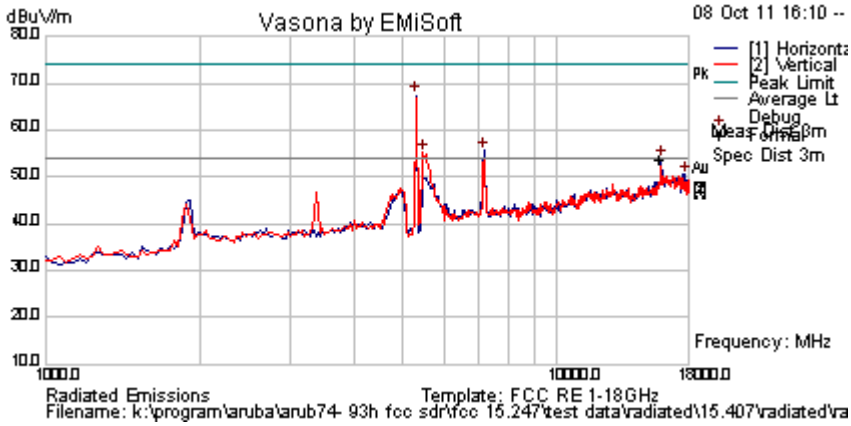


Formally measured emission peaks

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	68.6	4.6	-9.6	63.6	Peak [Scan]	V						FUND
7132.26453	58.2	5.4	-5.8	57.8	Peak [Scan]	H					Pass	NRB
5531.062	61.3	4.6	-9.1	56.9	Peak [Scan]	V					Pass	BE
15819.639	43.9	8.7	-0.4	52.2	Peak [Scan]	H	100	0	54	-1.8	Pass	NOISE
4917.836	55.6	4.6	-10.0	50.2	Peak [Scan]	H					Pass	BE

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

Test Freq.	5300 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			

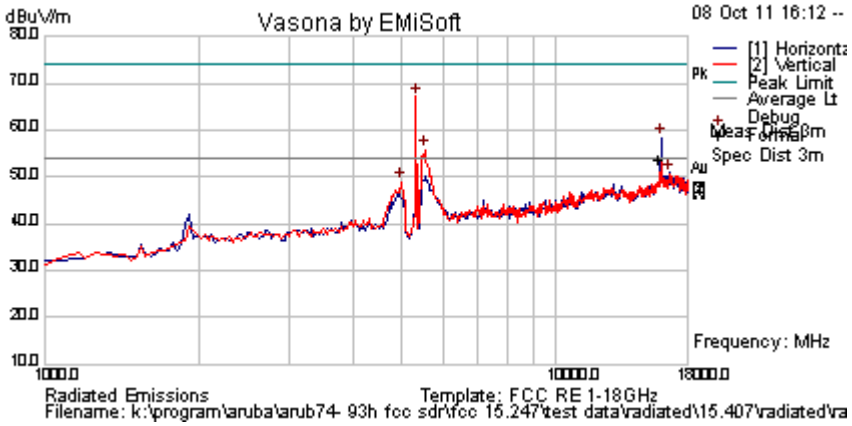


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5292.585	72.3	4.6	-9.5	67.4	Peak [Scan]	H						FUND
7200.4008	55.8	5.4	-5.7	55.6	Peak [Scan]	H					Pass	NRB
5462.926	59.7	4.6	-9.2	55.1	Peak [Scan]	V					Pass	BE
15955.912	45.0	9.0	0.1	54.0	Peak [Scan]	H	100	0	54	0.0	Pass	RB
17761.523	41.3	8.8	0.4	50.5	Peak [Scan]	H	100	0	54	-3.5	Pass	NOISE

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

Test Freq.	5320 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			



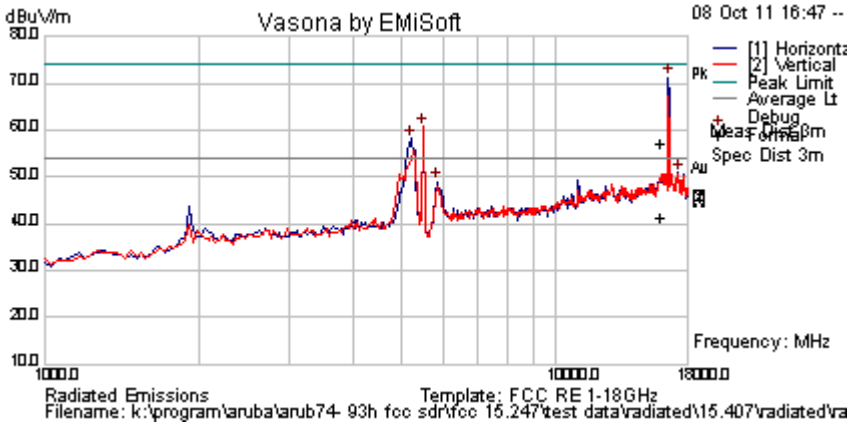
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5326.653	72.0	4.6	-9.5	67.2	Peak [Scan]	H						FUND
5531.062	60.3	4.6	-9.1	55.9	Peak [Scan]	V					Pass	BE
16569.138	41.8	8.8	0.4	51.0	Peak [Scan]	H	100	0	54	-3.0	Pass	NOISE
4985.972	54.2	4.6	-9.9	48.9	Peak [Scan]	V					Pass	BE
15989.980	50.3	9.0	0.2	59.6	Peak Max	H	104	336	74	-14.4	Pass	RB
15989.980	34.7	9.0	0.2	43.9	Average Max	H	104	336	54	-10.1	Pass	RB

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

5470 – 5725 MHz, 802.11a Legacy

Test Freq.	5500 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			

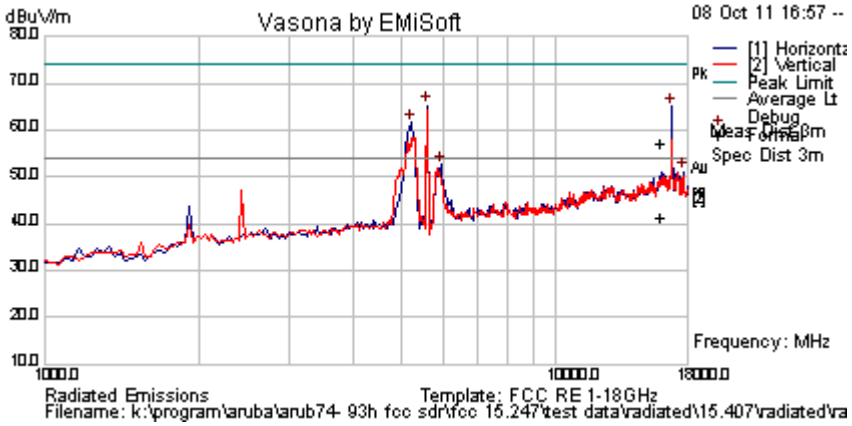


Formally measured emission peaks

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	62.1	8.8	0.3	71.2	Peak [Scan]	H					Pass	NRB
5496.99399	65.3	4.6	-9.2	60.8	Peak [Scan]	H						FUND
5190.381	63.1	4.6	-9.6	58.1	Peak [Scan]	H					Pass	BE
17284.569	40.9	8.6	1.3	50.9	Peak [Scan]	H	100	0	54	-3.1	Pass	NOISE
5837.675	53.0	4.8	-8.8	49.0	Peak [Scan]	H					Pass	BE

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

Test Freq.	5590 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			

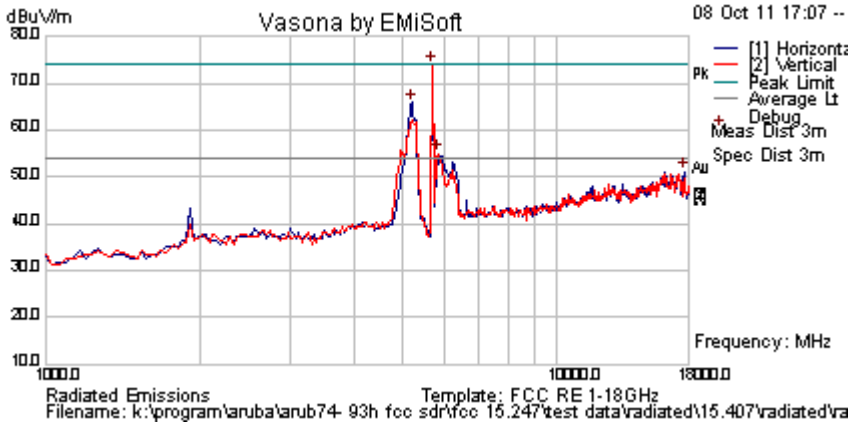


Formally measured emission peaks

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
5599.198	69.7	4.7	-9.1	65.3	Peak [Scan]	H						FUND
16807.615	55.2	8.6	1.1	65.0	Peak [Scan]	H					Pass	NRB
5190.381	66.5	4.6	-9.6	61.5	Peak [Scan]	H					Pass	BE
5939.880	56.3	4.9	-8.6	52.6	Peak [Scan]	H					Pass	BE
17693.387	41.6	8.8	0.6	51.0	Peak [Scan]	H	100	0	54	-3.0	Pass	NOISE

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

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			



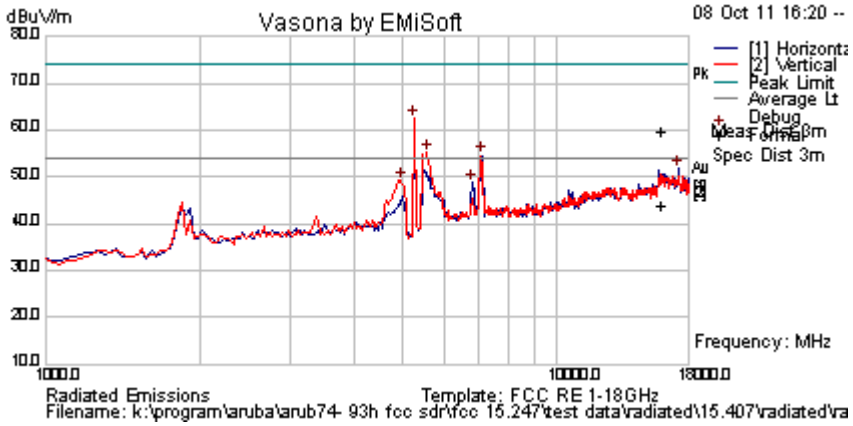
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5701.403	78.3	4.7	-8.9	74.1	Peak [Scan]	V						FUND
5190.38076	70.8	4.6	-9.6	65.8	Peak [Scan]	H					Pass	BE
5837.675	59.0	4.8	-8.8	54.9	Peak [Scan]	V					Pass	BE
17693.387	41.6	8.8	0.6	51.0	Peak [Scan]	H	100	0	54	-3.0	Pass	NOISE

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

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			

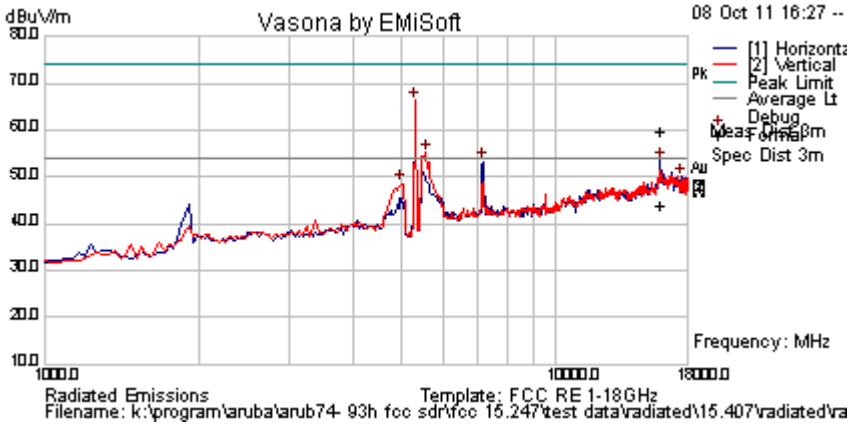


Formally measured emission peaks

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]	H					Pass	NRB
17250.501	42.1	8.6	1.2	51.9	Peak [Scan]	H	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]	H	100	0	54	-5.1	Pass	NRB

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

Test Freq.	5300 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			

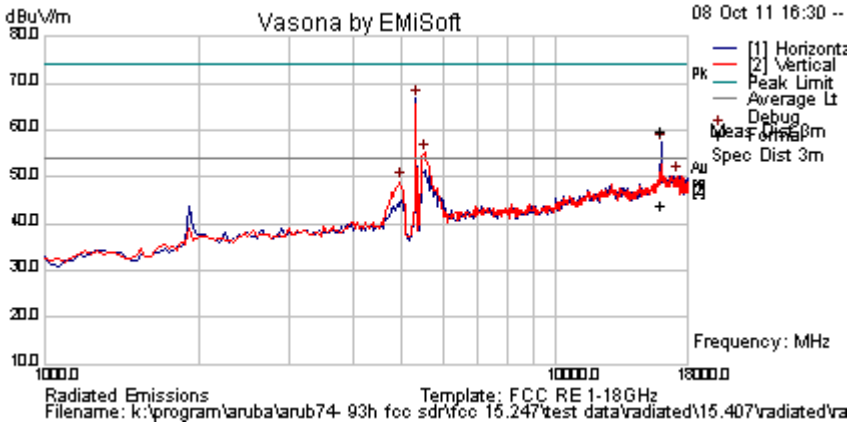


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5292.585	71.2	4.6	-9.5	66.3	Peak [Scan]	V						FUND
5565.13026	59.6	4.7	-9.1	55.2	Peak [Scan]	V					Pass	BE
15955.912	44.4	9.0	0.1	53.4	Peak [Scan]	H	100	0	54	-0.6	Pass	RB
7200.401	53.4	5.4	-5.7	53.2	Peak [Scan]	H	100	0	54	-0.8	Pass	NRB
17488.978	40.1	8.8	1.2	50.1	Peak [Scan]	H	100	0	54	-3.9	Pass	NOISE
4985.972	53.8	4.6	-9.9	48.5	Peak [Scan]	V					Pass	BE

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

Test Freq.	5320 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			



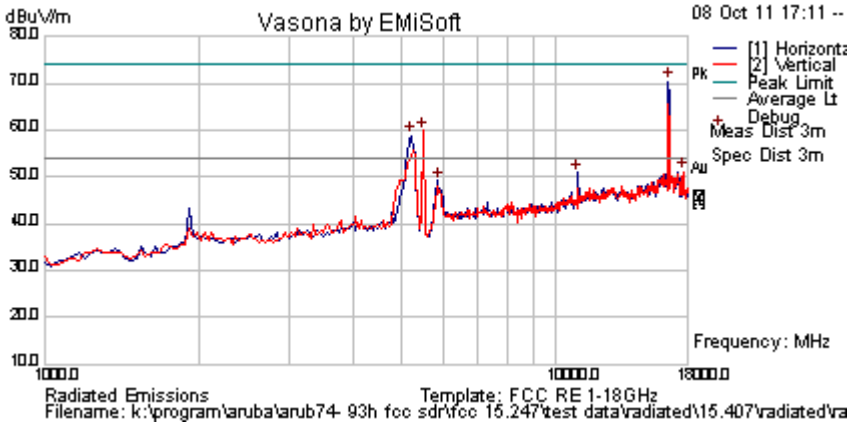
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5326.653	71.7	4.6	-9.5	66.8	Peak [Scan]	H						FUND
5531.062	59.5	4.6	-9.1	55.1	Peak [Scan]	V					Pass	BE
17182.365	40.9	8.6	0.8	50.3	Peak [Scan]	V	100	0	54	-3.7	Pass	NOISE
4951.904	54.4	4.6	-9.9	49.1	Peak [Scan]	V					Pass	BE
15990.421	47.8	9.0	0.2	57.0	Peak Max	H	105	341	74	-17.0	Pass	RB
15990.421	32.1	9.0	0.2	41.4	Average Max	H	105	341	54	-12.6	Pass	RB

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

5470 – 5725 MHz, 802.11n HT-20

Test Freq.	5500 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			

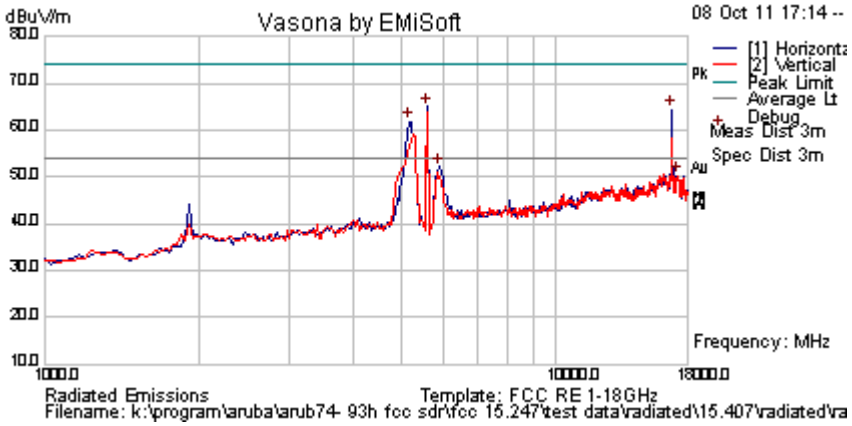


Formally measured emission peaks

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]	H					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]	H					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]	H	100	0	54	-3.1	Pass	NRB
5871.743	53.1	4.8	-8.8	49.2	Peak [Scan]	H					Pass	BE

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

Test Freq.	5580 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			

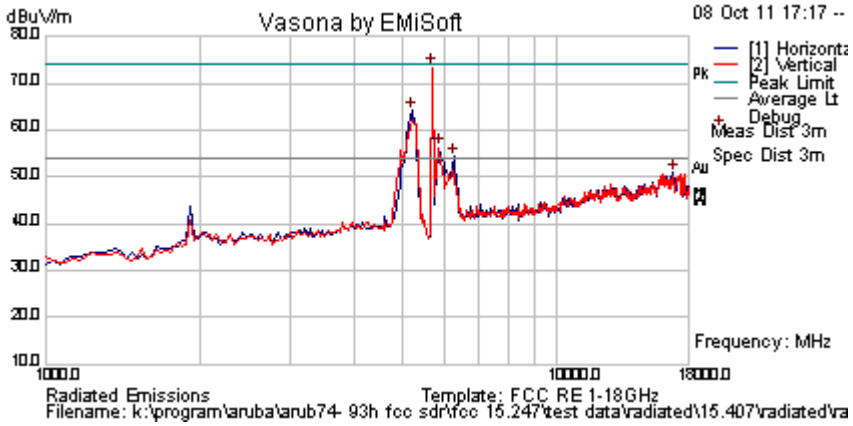


Formally measured emission peaks

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
5599.198	69.4	4.7	-9.1	65.0	Peak [Scan]	H						FUND
16807.615	54.8	8.6	1.1	64.5	Peak [Scan]	H					Pass	NRB
5156.313	66.8	4.6	-9.6	61.8	Peak [Scan]	H					Pass	BE
5905.812	56.1	4.8	-8.7	52.3	Peak [Scan]	H					Pass	BE
17148.297	41.0	8.6	0.7	50.3	Peak [Scan]	H	100	0	54	-3.7	Pass	NOISE

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

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			



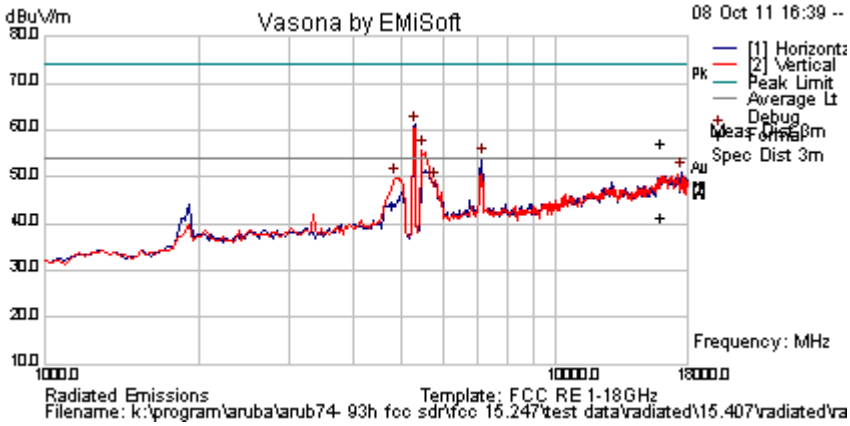
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5701.403	77.6	4.7	-8.9	73.5	Peak [Scan]	V						FUND
5190.38076	69.3	4.6	-9.6	64.3	Peak [Scan]	H					Pass	BE
5871.743	60.3	4.8	-8.8	56.3	Peak [Scan]	H					Pass	BE
6280.561	56.9	5.0	-7.5	54.4	Peak [Scan]	H					Pass	BE
16841.683	41.4	8.6	1.0	51.0	Peak [Scan]	H	100	0	54	-3.1	Pass	NOISE

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

5250 – 5350 MHz, 802.11n HT-40

Test Freq.	5270 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			

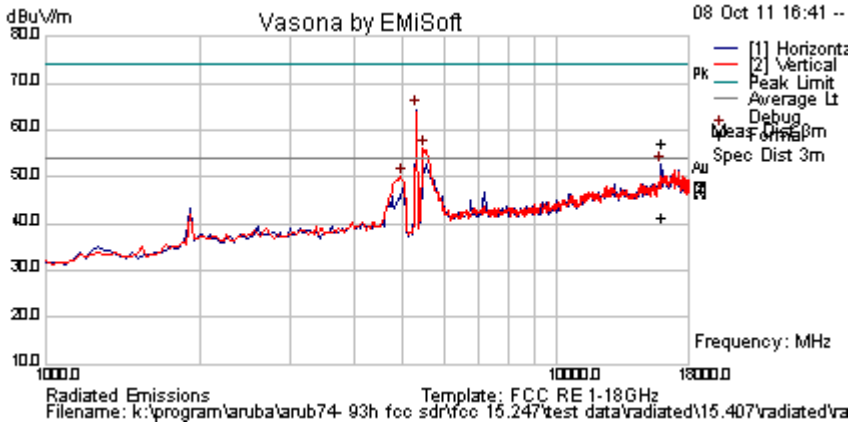


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5292.585	66.2	4.6	-9.5	61.3	Peak [Scan]	H						FUND
5462.92585	60.4	4.6	-9.2	55.7	Peak [Scan]	V					Pass	BE
7166.333	54.4	5.4	-5.7	54.1	Peak [Scan]	H					Pass	NRB
17591.182	41.5	8.8	0.9	51.1	Peak [Scan]	H	100	0	54	-2.9	Pass	NOISE
4849.699	55.3	4.5	-9.9	49.9	Peak [Scan]	V					Pass	BE
5803.607	53.2	4.8	-8.9	49.1	Peak [Scan]	V					Pass	BE

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

Test Freq.	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			



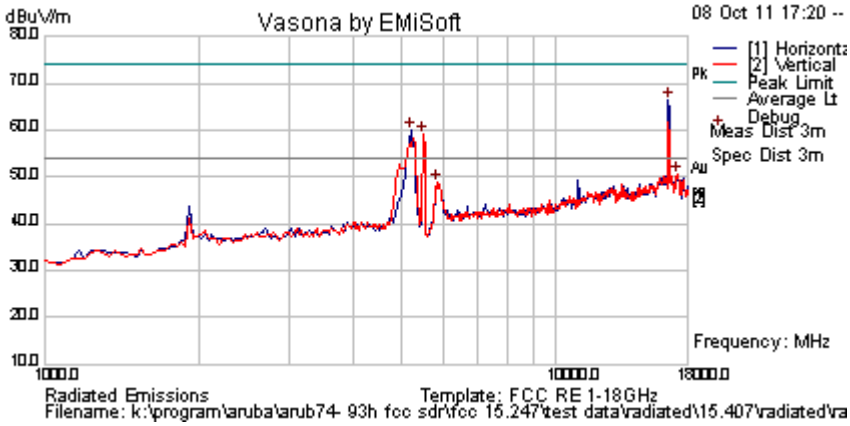
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5292.585	69.3	4.6	-9.5	64.4	Peak [Scan]	H						FUND
5462.92585	60.6	4.6	-9.2	56.0	Peak [Scan]	V					Pass	BE
15921.844	43.7	8.9	-0.1	52.6	Peak [Scan]	H	100	0	54	-1.5	Pass	NRB
4951.904	55.4	4.6	-9.9	50.1	Peak [Scan]	V					Pass	BE

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

5470 – 5725 MHz, 802.11n HT-40

Test Freq.	5510 MHz	**Engineer**	GMH
Variant	802.11n HT-40; 13.5 MCS	**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			

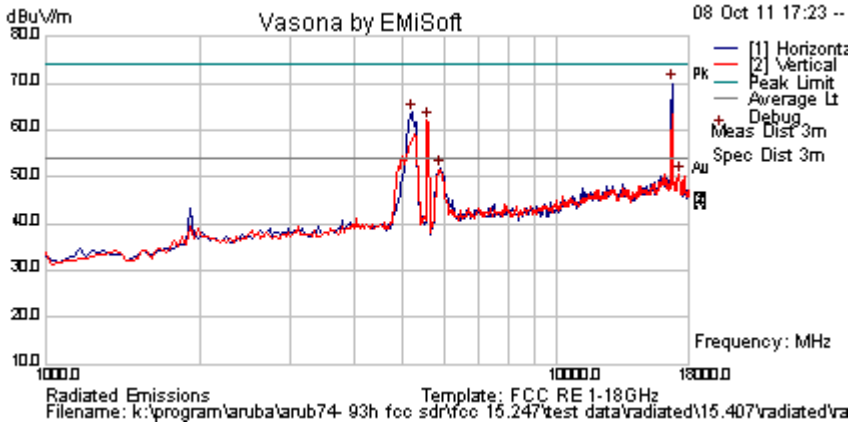


Formally measured emission peaks

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]	H					Pass	NRB
5190.38076	64.8	4.6	-9.6	59.8	Peak [Scan]	H						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 = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205

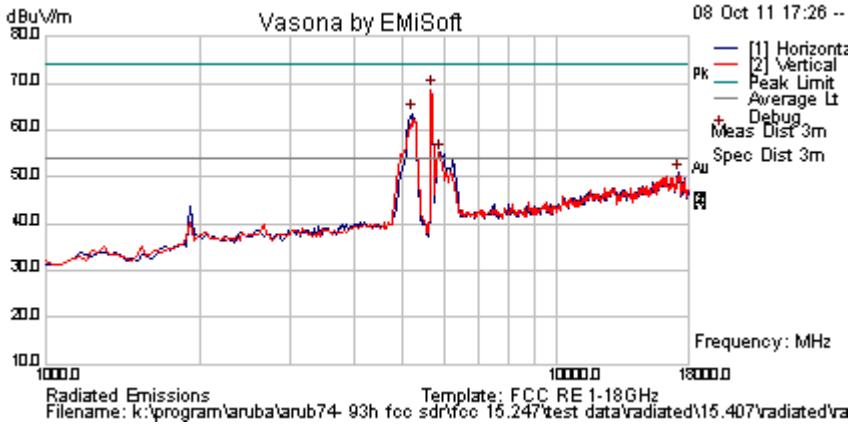
Test Freq.	5580 MHz	**Engineer**	GMH
Variant	802.11n HT-40; 13.5 MCS	**Temp (ºC)**	29
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	999
Power Setting	18	**Press. (mBars)**	30.5
Antenna	Integral	**Duty Cycle (%)**	
Test Notes 1			
Test Notes 2			



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
16739.479	60.3	8.7	1.1	70.0	Peak [Scan]	H					Pass	NRB
5190.38076	68.8	4.6	-9.6	63.8	Peak [Scan]	H					Pass	BE
5565.130	66.5	4.7	-9.1	62.1	Peak [Scan]	H						FUND
5905.812	55.5	4.8	-8.7	51.7	Peak [Scan]	H					Pass	BE
17284.569	40.5	8.6	1.3	50.5	Peak [Scan]	H	100	0	54	-3.5	Pass	NOISE
Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission											
	NRB = Non-Restricted Band. Limit = 68.23 dBuV/m; RB = Restricted Band. Limits per 15.205											

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			



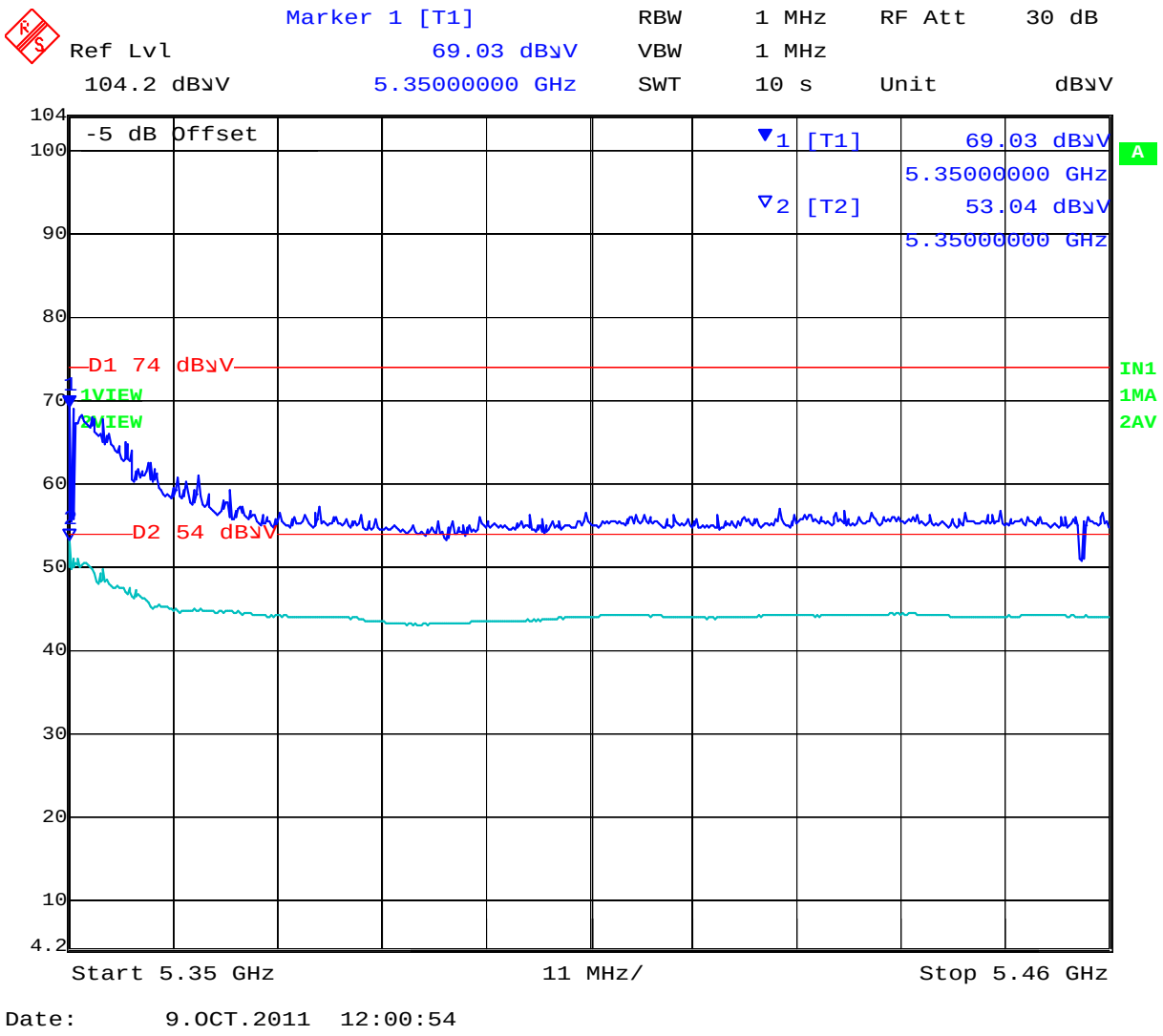
Formally measured emission peaks

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
5667.335	72.9	4.7	-8.9	68.7	Peak [Scan]	V						FUND
5190.38076	68.6	4.6	-9.6	63.6	Peak [Scan]	H					Pass	BE
5905.812	59.0	4.8	-8.7	55.2	Peak [Scan]	H					Pass	BE
17182.365	41.4	8.6	0.8	50.8	Peak [Scan]	H	100	0	54	-3.2	Pass	NOISE

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

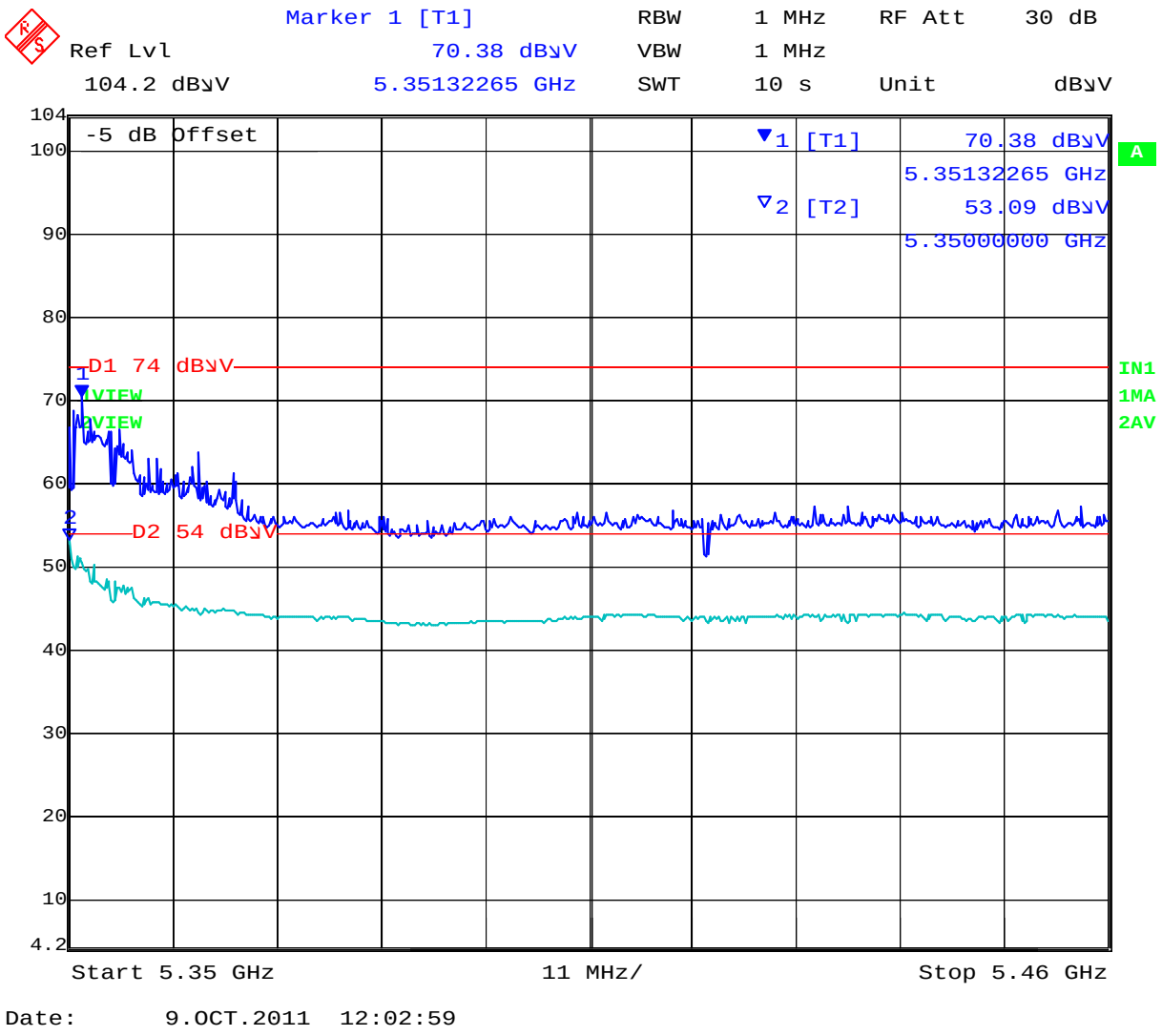
5.1.7.2. Radiated Band-Edge spurious emissions

5320 MHz - 802.11a Legacy 5350 - 5460 MHz



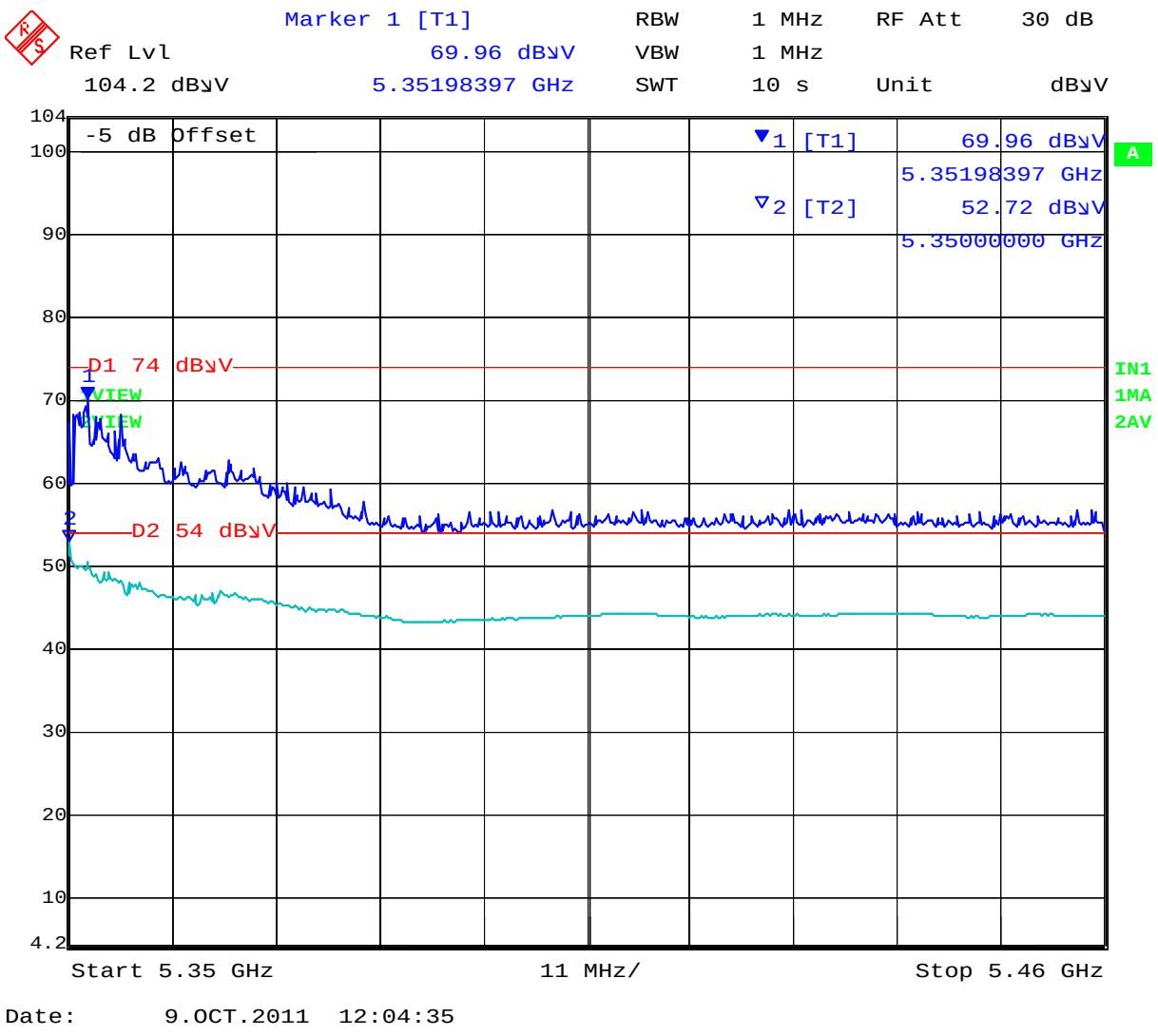
NOTE: Power Reduction Required ART = 14.5

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



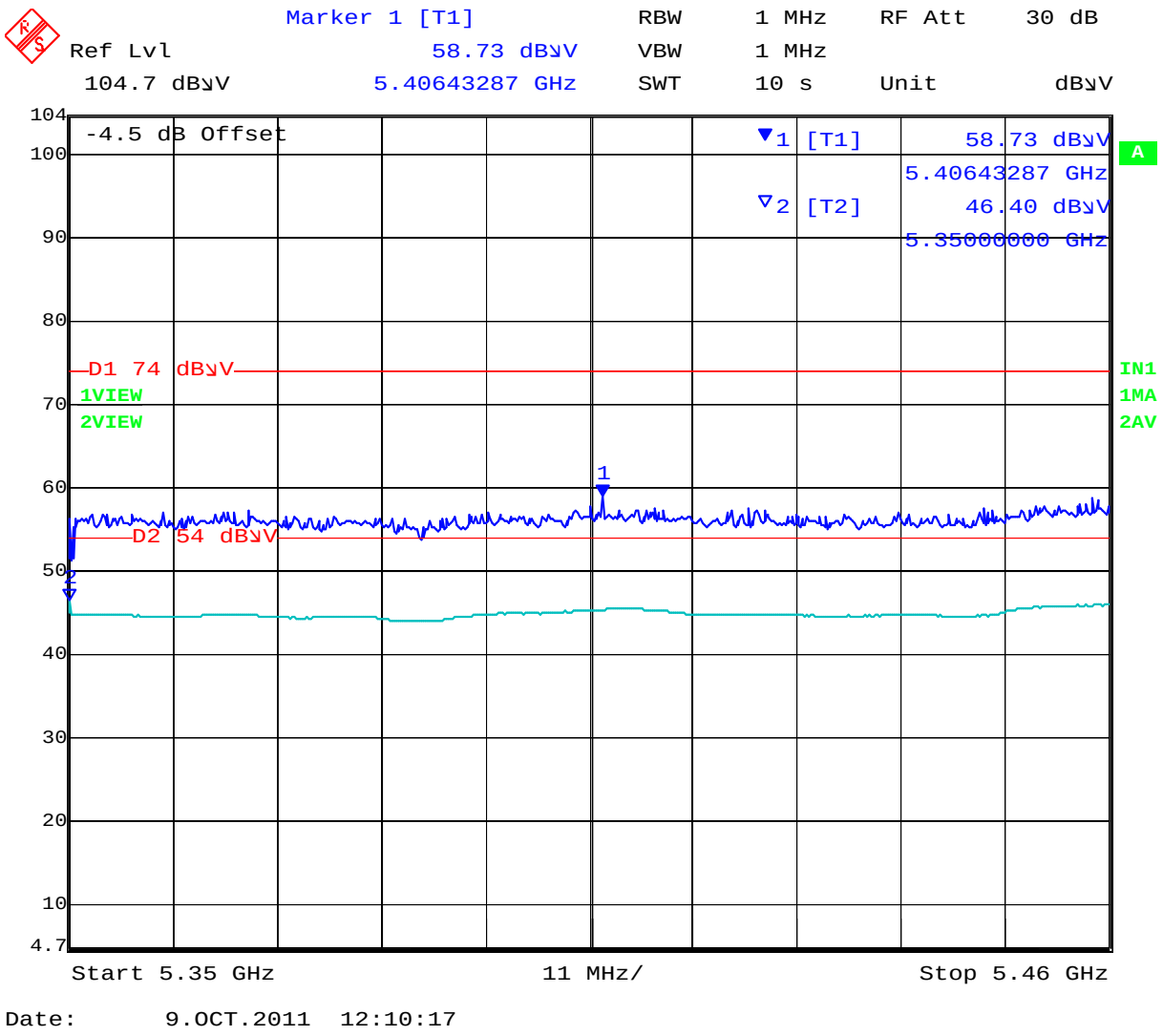
NOTE: Power Reduction Required ART = 14.0

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

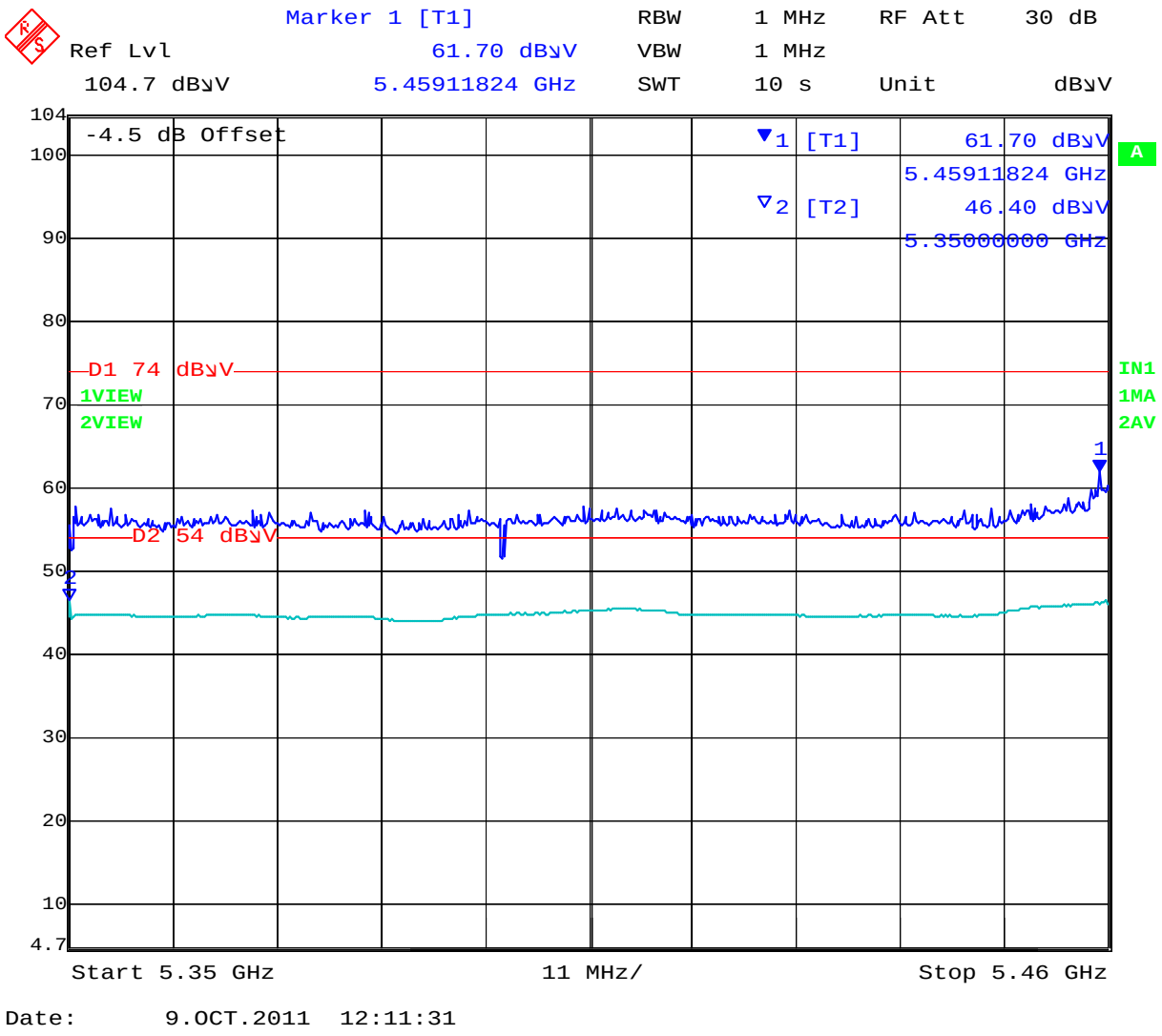


NOTE: Power Reduction Required ART = 14.0

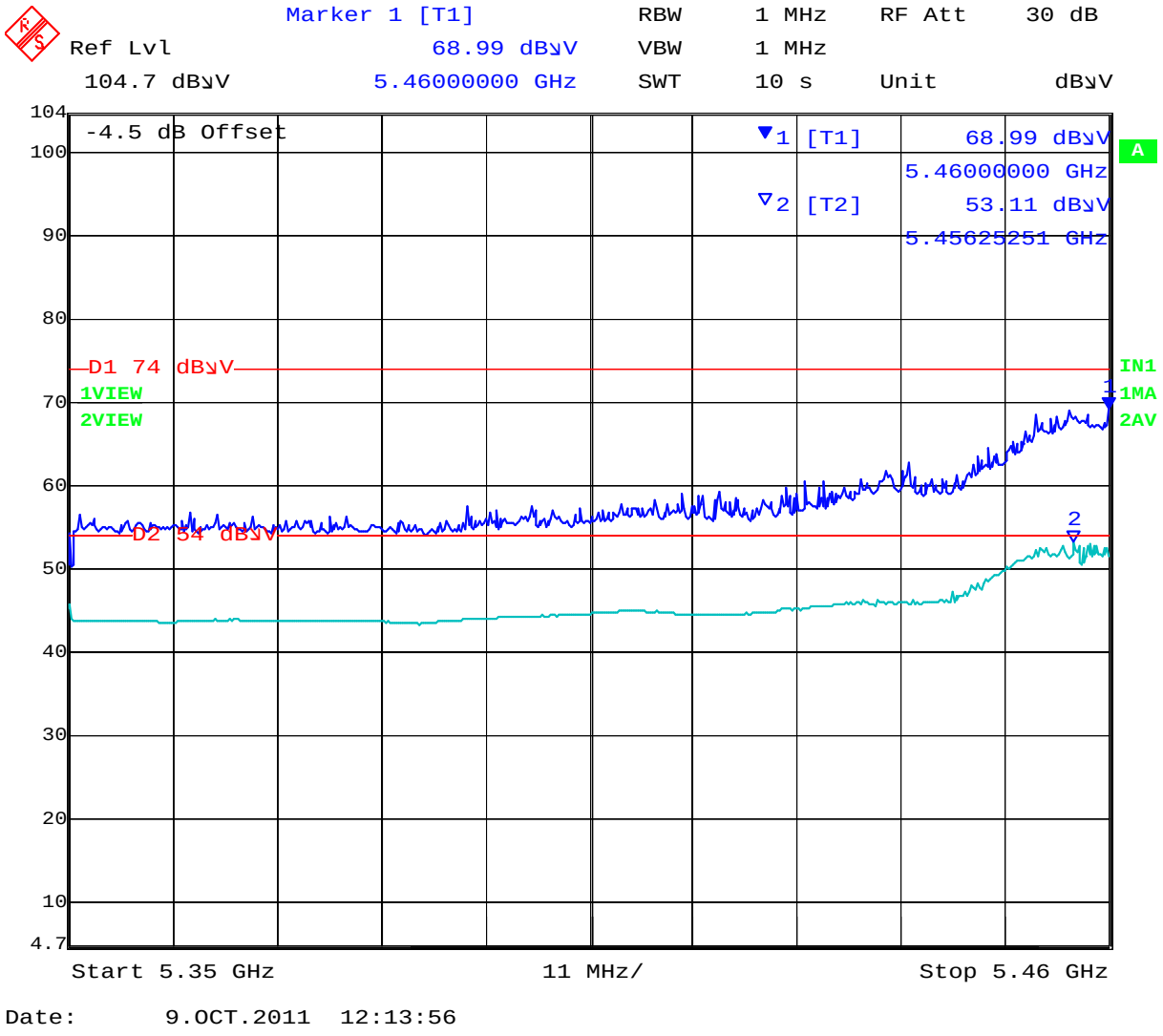
5500 MHz - 802.11a Legacy 5350 - 5460 MHz



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



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



NOTE: Power Reduction Required ART = 16.5

Specification

Limits

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

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

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

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

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

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

Laboratory Measurement Uncertainty for Radiated Emissions

Measurement uncertainty	+5.6/ -4.5 dB

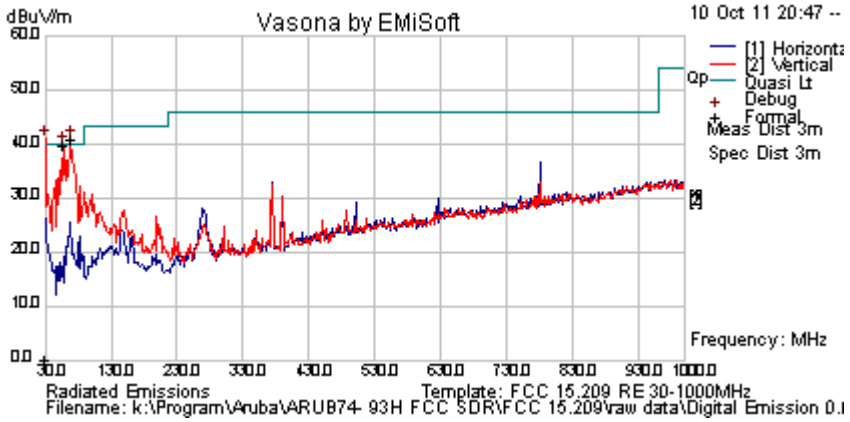
Traceability

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

5.1.7.3. Radiated Spurious Emissions – 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.

Test Freq.	2442 MHz	**Engineer**	GMH
Variant	Digital Emissions	**Temp (°C)**	25
Freq. Range	30 MHz - 1000 MHz	**Rel. Hum.(%)**	41
Power Setting	Max	**Press. (mBars)**	1001
Antenna	integral		
Test Notes 1			
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
30.000	41.1	3.4	-9.2	35.3	Quasi Max	V	107	297	40	-4.7	Pass	
57.214	56.1	3.8	-23.7	36.2	Quasi Max	V	98	176	40.0	-3.8	Pass	
69.184	58.2	3.9	-23.0	39.1	Quasi Max	V	130	201	40.0	-0.9	Pass	

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

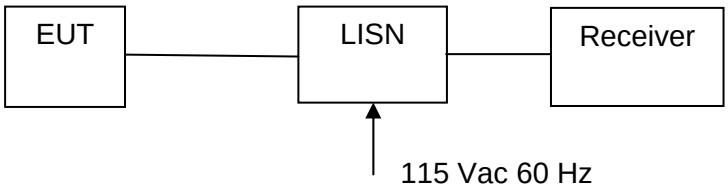
5.1.8. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

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 μΩ line impedance stabilization network (LISN), see §15.207 (a) matrix below. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

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

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

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

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

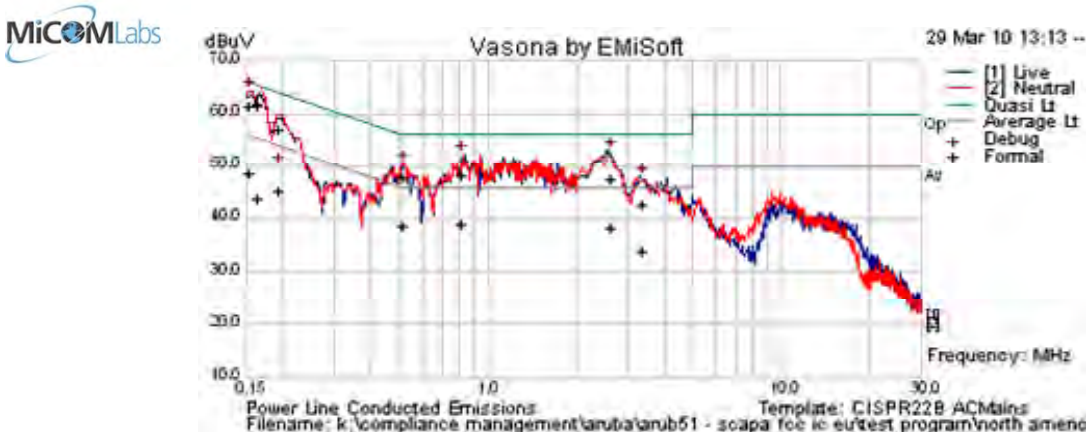
Measurement uncertainty	±2.64 dB

Traceability

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

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

Test Freq.	2437 - Rx Mode	**Engineer**	CSB
Variant	AC Line Emissions	**Temp (ºC)**	22
Freq. Range	0.150 MHz - 30 MHz	**Rel. Hum.(%)**	38
Power Setting	N/A	**Press. (mBars)**	1006
Antenna	Integral Antennas		
Test Notes 1	AC Powered - 120V AC 60Hz		
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
0.155	38.8	9.9	0.1	48.8	Average	Neutral	55.73	-7.0	Pass	DIG
0.155	51.6	9.9	0.1	61.6	Quasi Peak	Neutral	65.73	-4.2	Pass	DIG
0.167	33.8	9.9	0.1	43.7	Average	Neutral	55.11	-11.4	Pass	DIG
0.167	51.7	9.9	0.1	61.7	Quasi Peak	Neutral	65.11	-3.4	Pass	DIG
0.194	35.4	9.9	0.1	45.3	Average	Neutral	53.86	-8.5	Pass	DIG
0.194	47.2	9.9	0.1	57.1	Quasi Peak	Neutral	63.86	-6.7	Pass	DIG
0.516	28.6	9.9	0.1	38.6	Average	Neutral	46	-7.4	Pass	DIG
0.516	37.8	9.9	0.1	47.9	Quasi Peak	Neutral	56	-8.2	Pass	DIG
0.828	38.4	9.9	0.1	48.4	Quasi Peak	Neutral	56	-7.6	Pass	DIG
0.828	29.1	9.9	0.1	39.1	Average	Neutral	46	-6.9	Pass	DIG
2.661	28.2	10.1	0.1	38.4	Average	Live	46	-7.6	Pass	DIG
2.661	37.3	10.1	0.1	47.6	Quasi Peak	Live	56	-8.5	Pass	DIG

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

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.

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 Type	Pulse Width (µsec)	PRI (µsec)	Number of Pulses	Minimum Percentage of Successful Detection	Minimum Trials
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 (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 Type	Pulse Width (µsec)	Chirp Width (MHz)	PRI (µsec)	Number of Pulses per *Burst*	Number of *Bursts*	Minimum Percentage of Successful Detection	Minimum Trials
5	50-100	5-20	1000-2000	1-3	8-20	80%	30

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.

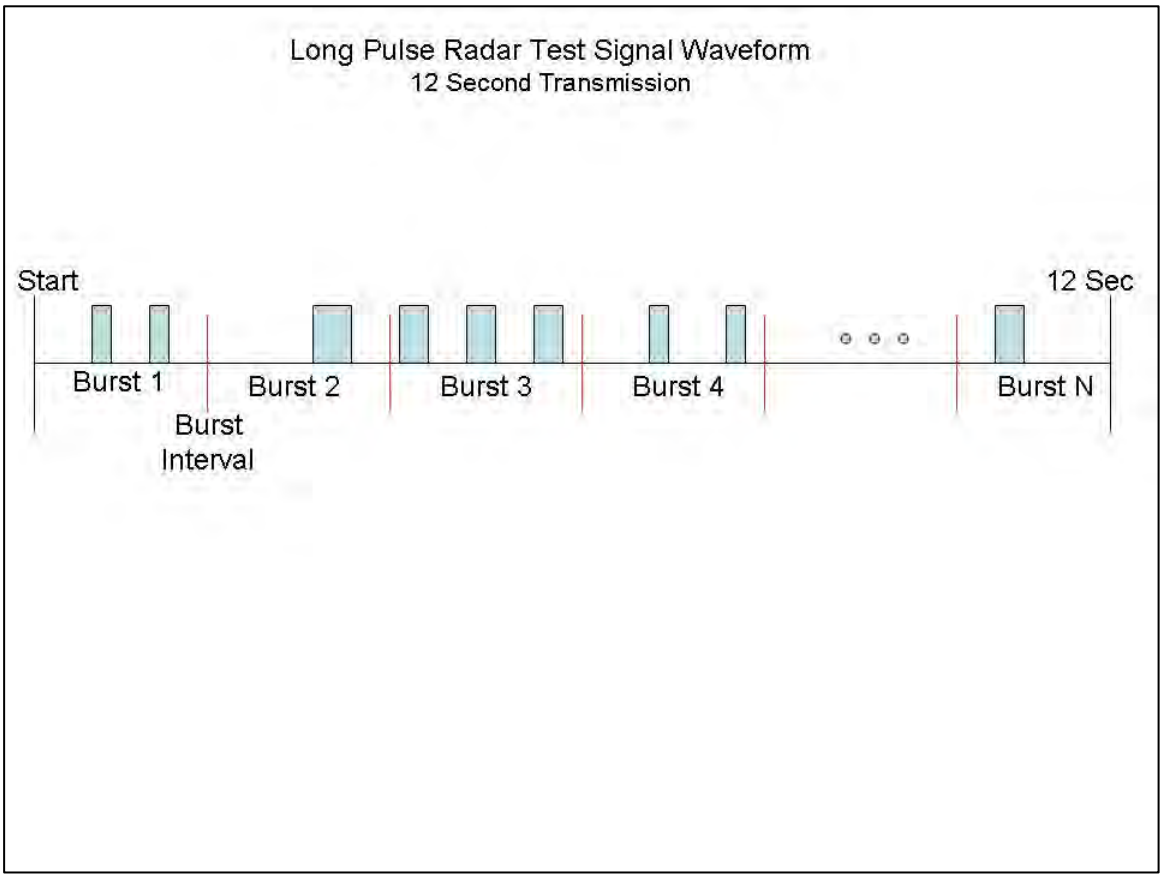
Each waveform is defined as follows:

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.

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.



6.1.4. Frequency Hopping Radar Test Waveform

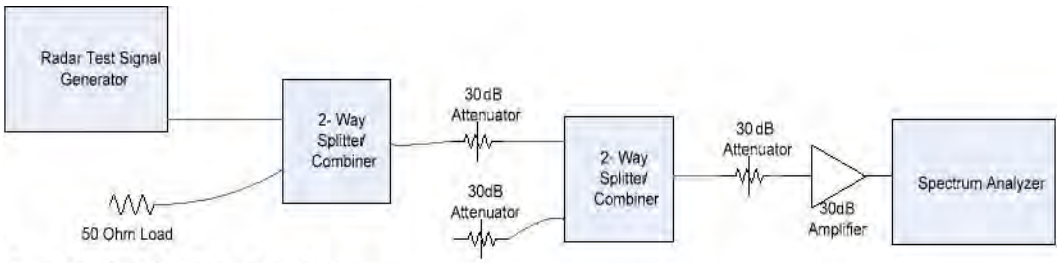
Frequency Hopping Radar Test Waveform

Radar Type	Pulse Width (µsec)	PRI (µsec)	Pulses per Hop	Hopping Rate (kHz)	Hopping Sequence Length (msec)	Minimum Percentage of Successful Detection	Minimum Trials
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

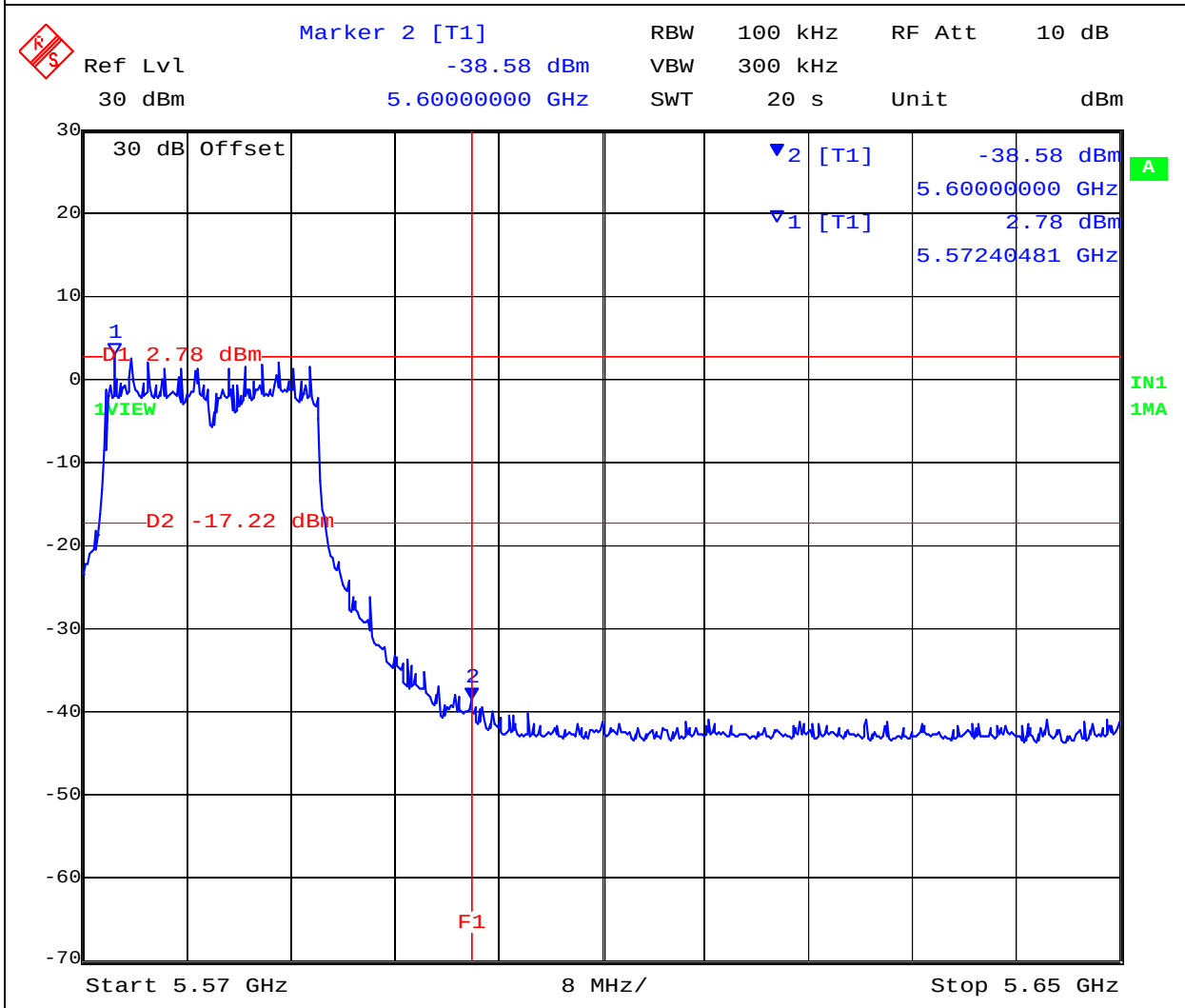
The following equipment setup was used to calibrate the conducted Radar Waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero 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.



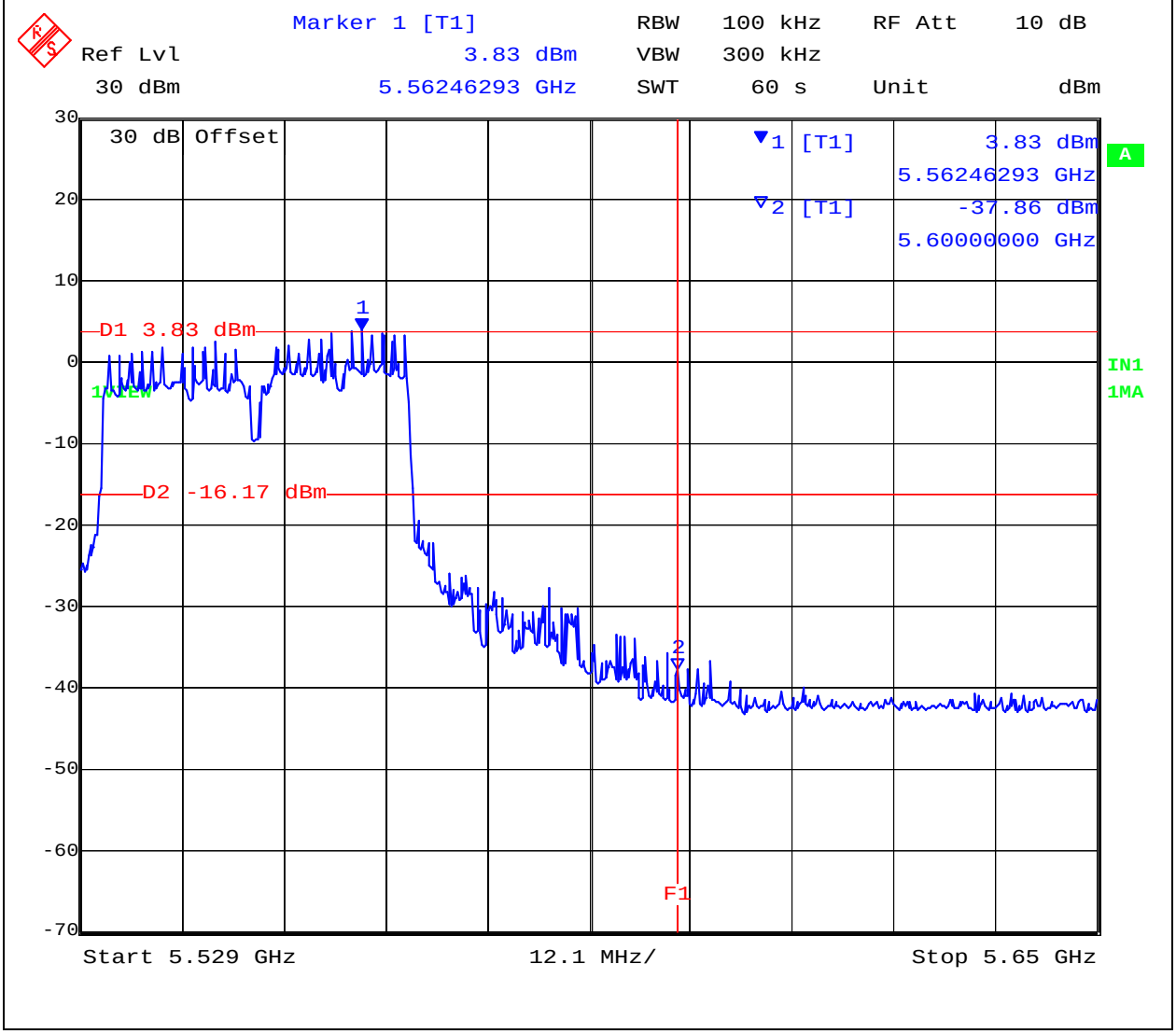
Conducted Calibration Setup

6.1.6. Weather Radar Band Edge Plots

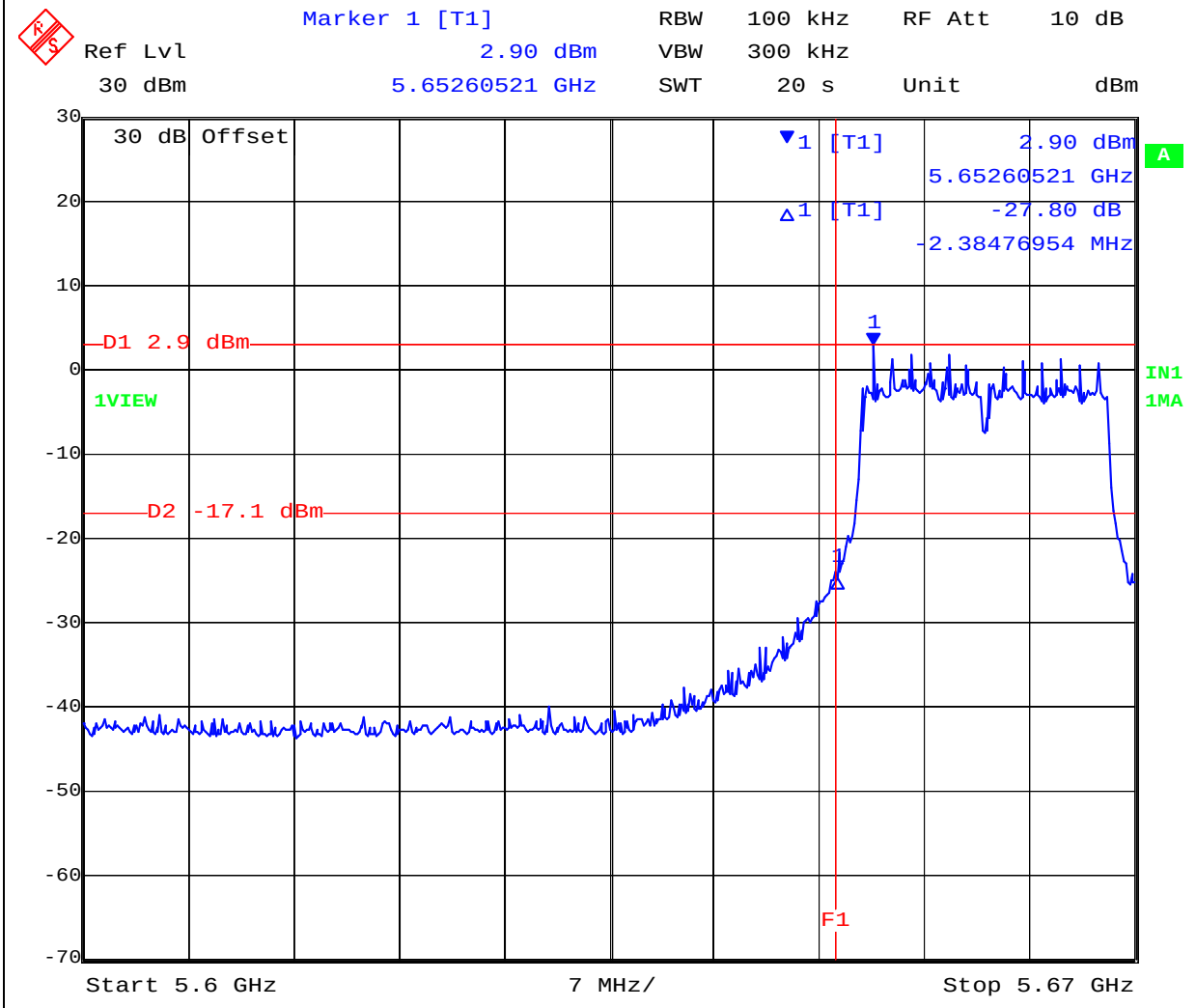
Center Frequency 5,560MHz 802.11a



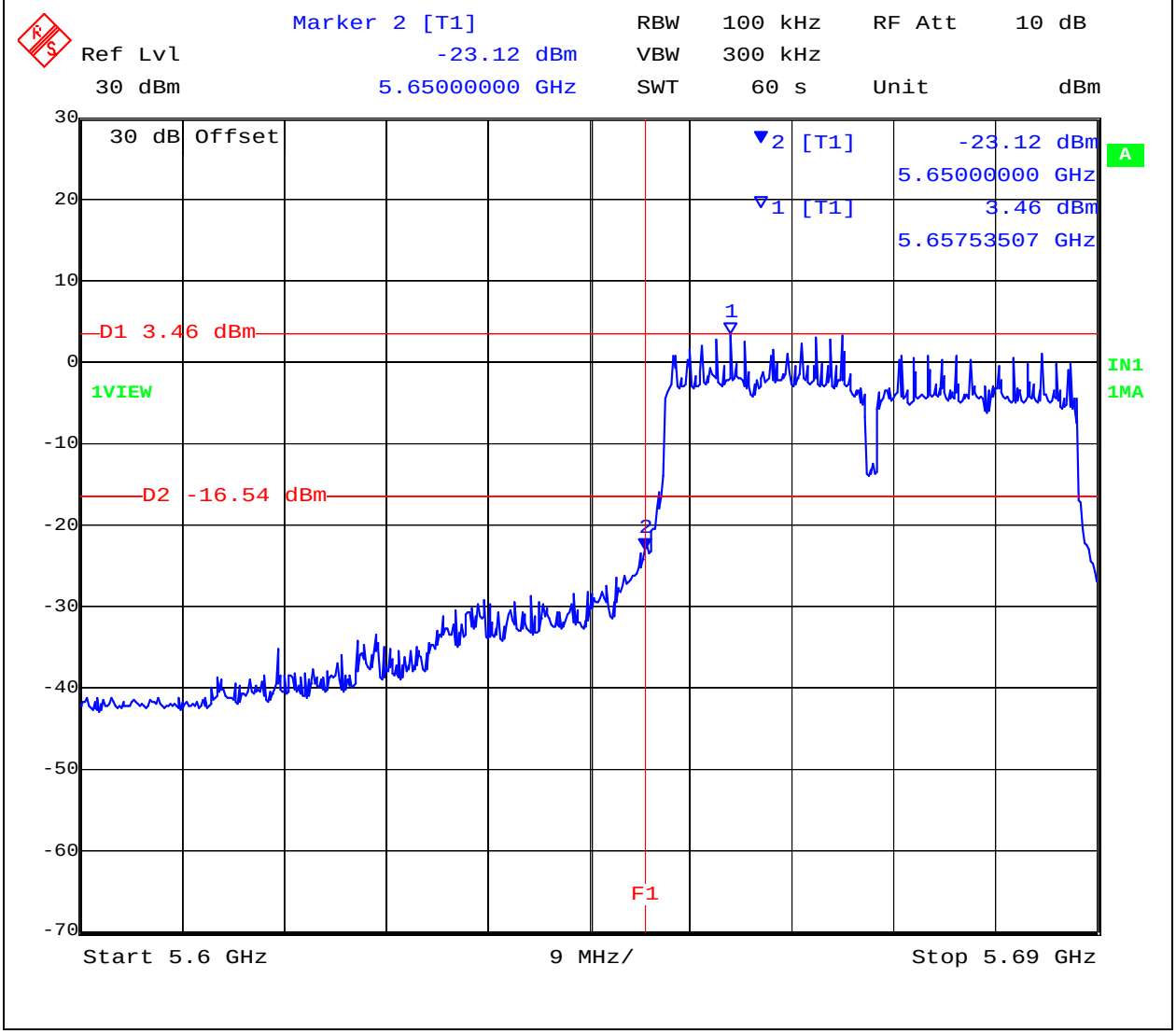
Center Frequency 5,550MHz 802.11n HT40



Center Frequency 5,660MHz 802.11a



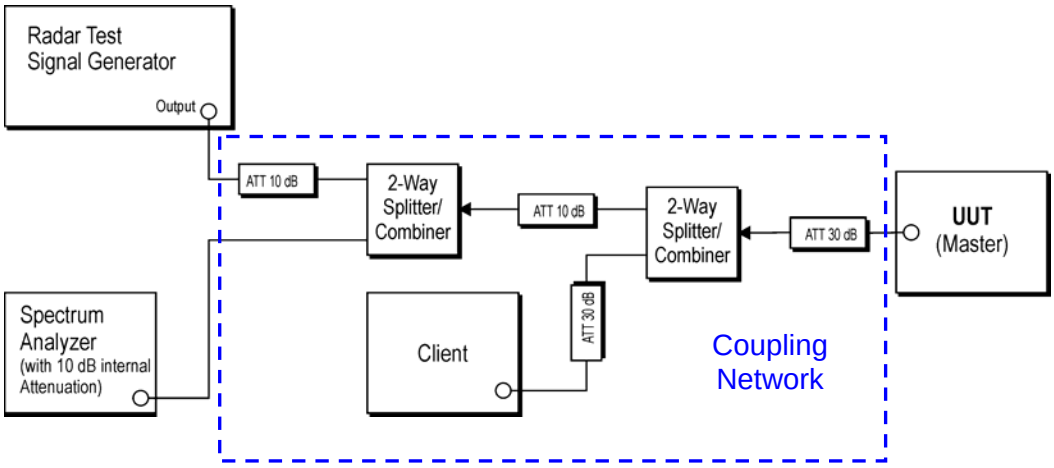
Center Frequency 5,670MHz 802.11n HT40



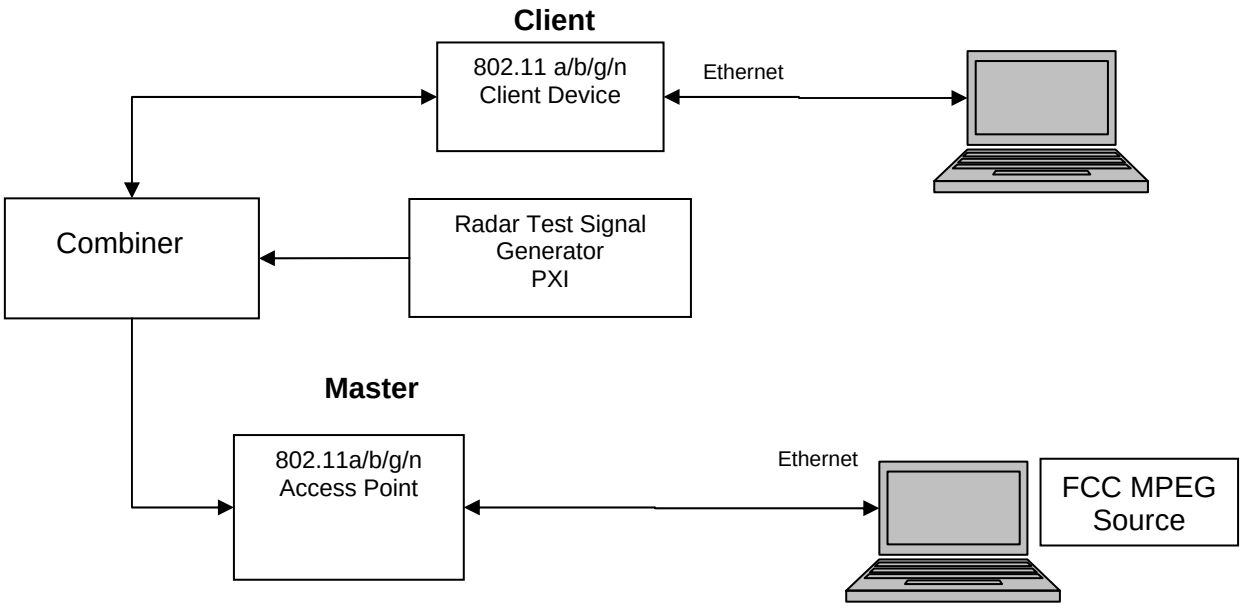
6.1.7. Test Set Up:

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



The EUT is a Master Device with radar detection.

Applicability of DFS Requirements Prior to Use of a Channel

(Ref Table 1 of FCC 06-96)

Requirement	Operational 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

Applicability of DFS requirements during normal operation

(Ref Table 2 of FCC 06-96)

Requirement	Operational 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

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.

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.

EUT Frequency= 5,500 MHz 802.11a (Detection = √, No Detection = 0)											
Radar Frequency (MHz)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Detection Rate (%)**
-20											%
-19											%
-18											%
-17											%
-16											%
-15											%
-14											%
-13											%
-12											%
-11	0	0									<90%
-10	√	√	√	√	√	√	√	√	√	√	90%
-9	√	√	√	√	√	√	√	√	√	√	100%
-8	√	√	√	√	√	√	√	√	√	√	100%
-7	√	√	√	√	√	√	√	√	√	√	100%
-6	√	√	√	√	√	√	√	√	√	√	100%
-5	√	√	√	√	√	√	√	√	√	√	100%
-4	√	√	√	√	√	√	√	√	√	√	100%
-3	√	√	√	√	√	√	√	√	√	√	100%
-2	√	√	√	√	√	√	√	√	√	√	100%
-1	√	√	√	√	√	√	√	√	√	√	100%
F_0	√	√	√	√	√	√	0	√	√	√	90%
+1	√	√	√	√	√	√	√	√	√	√	100%
+2	√	√	√	√	√	√	√	√	√	√	100%
+3	√	√	√	√	√	0	√	√	√	√	90%
+4	√	√	√	√	√	√	√	√	√	√	100%
+5	√	√	√	√	√	√	√	√	√	√	100%
+6	√	√	√	√	√	√	√	√	√	√	100%
+7	√	√	√	√	√	√	√	√	√	√	100%
+8	√	√	√	√	√	√	√	√	√	√	100%
+9	√	0	√	0							<90%
+10	0	0									<90%
+11											%
+12											%
+13											%
+14											%
+15											%
+16											%
+17											%
Detection Bandwidth = F_H-F_L = 5590-5508 = 18 MHz											
EUT 99% Bandwidth = 18.84 MHz (ref. bandwidth channel 5500 MHz)											
18.84 MHz *80% = 15.1 MHz											
For each frequency step the minimum percentage detection is 90%											

EUT Frequency= 5,510 MHz 802.11n HT40 (Detection = √, No Detection = 0)											
Radar Frequency (MHz)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Detection Rate (%)**
-21	√	√	√	0	√	√	0	√	√	√	<90%
-20	√	√	√	√	0	√	√	√	√	√	90%
-19	√	√	√	√	√	√	√	√	√	√	100%
-18	√	√	√	√	√	√	√	√	√	√	100%
-17	√	√	√	√	√	√	√	√	√	√	100%
-16	√	√	√	√	√	√	√	√	√	√	100%
-15	√	√	√	√	√	√	√	√	√	√	100%
-14	√	√	√	√	√	√	√	√	√	√	100%
-13	√	√	√	√	√	√	√	√	√	√	100%
-12	√	√	√	√	√	√	√	√	√	√	100%
-11	√	√	√	√	√	√	√	√	√	√	100%
-10	√	√	√	√	√	√	√	√	√	√	100%
-9	√	√	√	√	√	√	√	√	√	√	100%
-8	√	√	√	√	√	√	√	√	√	√	100%
-7	√	√	√	√	√	√	√	√	√	√	100%
-6	√	√	√	√	√	√	√	√	√	√	100%
-5	√	√	√	√	√	√	√	√	√	√	100%
-4	√	√	√	√	√	√	√	√	√	√	100%
-3	√	√	√	√	√	√	√	√	√	√	100%
-2	√	√	√	√	√	√	√	√	√	√	100%
-1	√	√	√	√	√	√	√	√	√	√	100%
F_0	√	√	√	√	√	√	√	√	√	√	100%

EUT Frequency= 5,510 MHz 802.11n HT40 (Detection = √, No Detection = 0)											
Radar Frequency (MHz)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Detection Rate (%)**
F_0	√	√	√	√	√	√	√	√	√	√	100%
+1	√	√	√	√	√	√	√	√	√	√	100%
+2	√	√	√	√	√	√	√	√	√	√	100%
+3	√	√	√	√	√	√	√	√	√	√	100%
+4	√	√	√	√	√	√	√	√	√	√	100%
+5	√	√	√	√	√	√	√	√	√	√	100%
+6	√	√	√	√	√	√	√	√	√	√	100%
+7	√	√	√	√	√	√	√	√	√	√	100%
+8	√	√	√	√	√	√	√	√	√	√	100%
+9	√	√	√	√	√	√	√	√	√	√	100%
+10	√	√	√	√	√	√	√	√	√	√	100%
+11	√	√	√	√	√	√	√	√	√	√	100%
+12	√	√	√	√	√	√	√	√	√	√	100%
+13	√	√	√	√	√	√	√	√	√	√	100%
+14	√	√	√	√	√	√	√	√	√	√	100%
+15	√	√	√	√	√	√	√	√	√	√	100%
+16	√	√	√	√	√	√	√	√	√	√	100%
+17	√	√	√	√	√	√	√	√	√	√	100%
+18	√	√	√	√	√	√	√	√	√	√	100%
+19	√	√	√	√	√	√	√	√	√	√	100%
+20	√	√	√	√	√	√	√	√	√	√	100%
+21	√	√	0	√	0						<90%
Detection Bandwidth = F_H-F_L = 5590-5530 = 40 MHz											
EUT 99% Bandwidth = 44.7 MHz (ref. bandwidth channel 5510 MHz)											
44.7 MHz *80% = 35.8 MHz											

For each frequency step the minimum percentage detection is 90%

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.

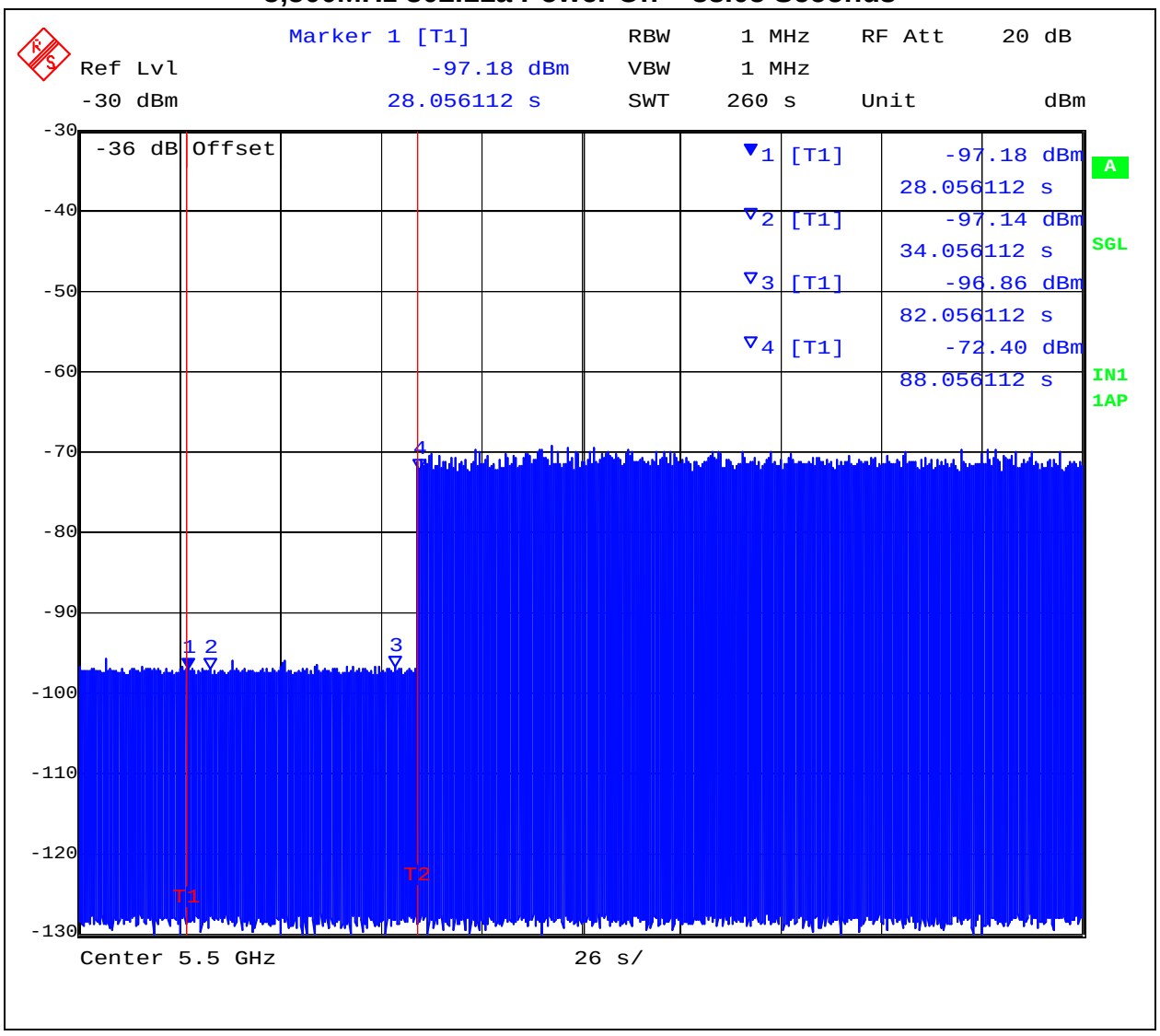
The U-NII device is powered on and be instructed to operate at 5,500MHz 802.11a and 5,510MHz 802.11n HT40. At the same time the EUT is powered on, the spectrum analyzer is set for zero span with a 1 MHz resolution bandwidth at 5,500& 5,510 MHz with a 260 second sweep time. The analyzer's sweep will be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

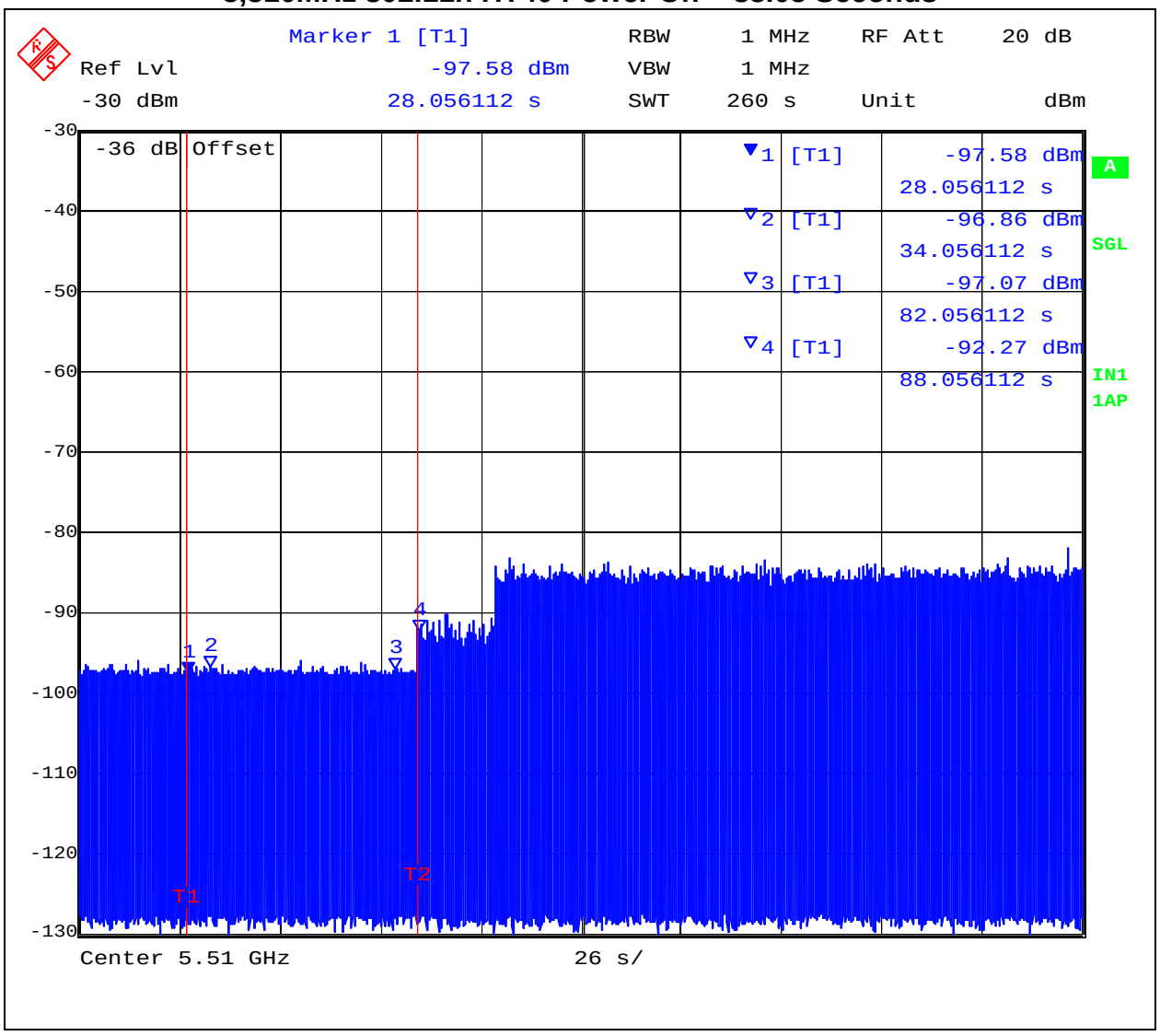
The first red marker line shown on the following plot denotes the instant when the EUT starts its power-up sequence i.e. T_0 (as defined within the FCC's MO&O 06-96 Normative Reference 2). The power-up reference T_0 is determined by the time it takes for the EUT to start "beaconing" i.e. initial beacon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

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



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



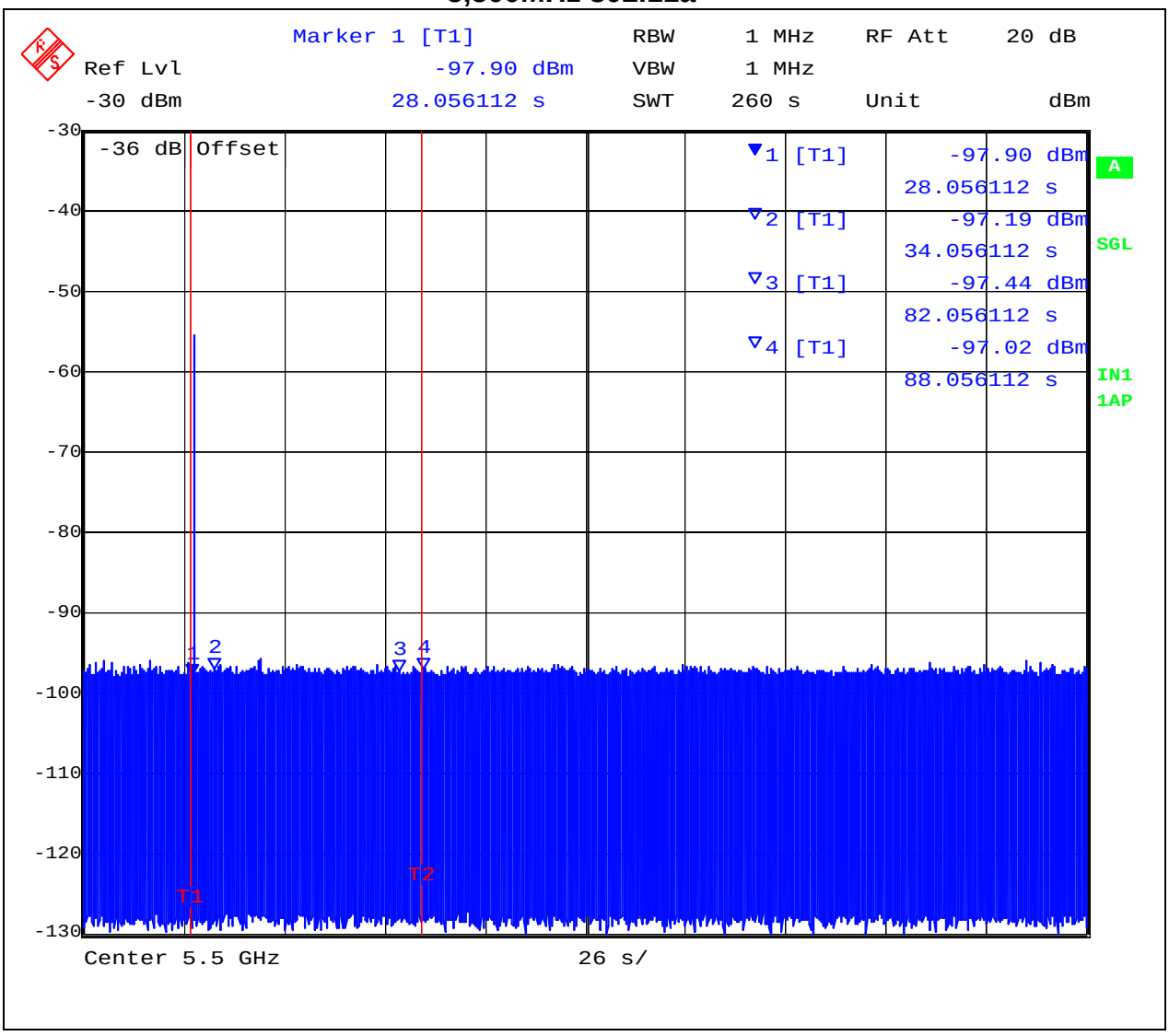
6.2.3. Radar Burst at the Beginning of the Channel Availability Check Time:

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.

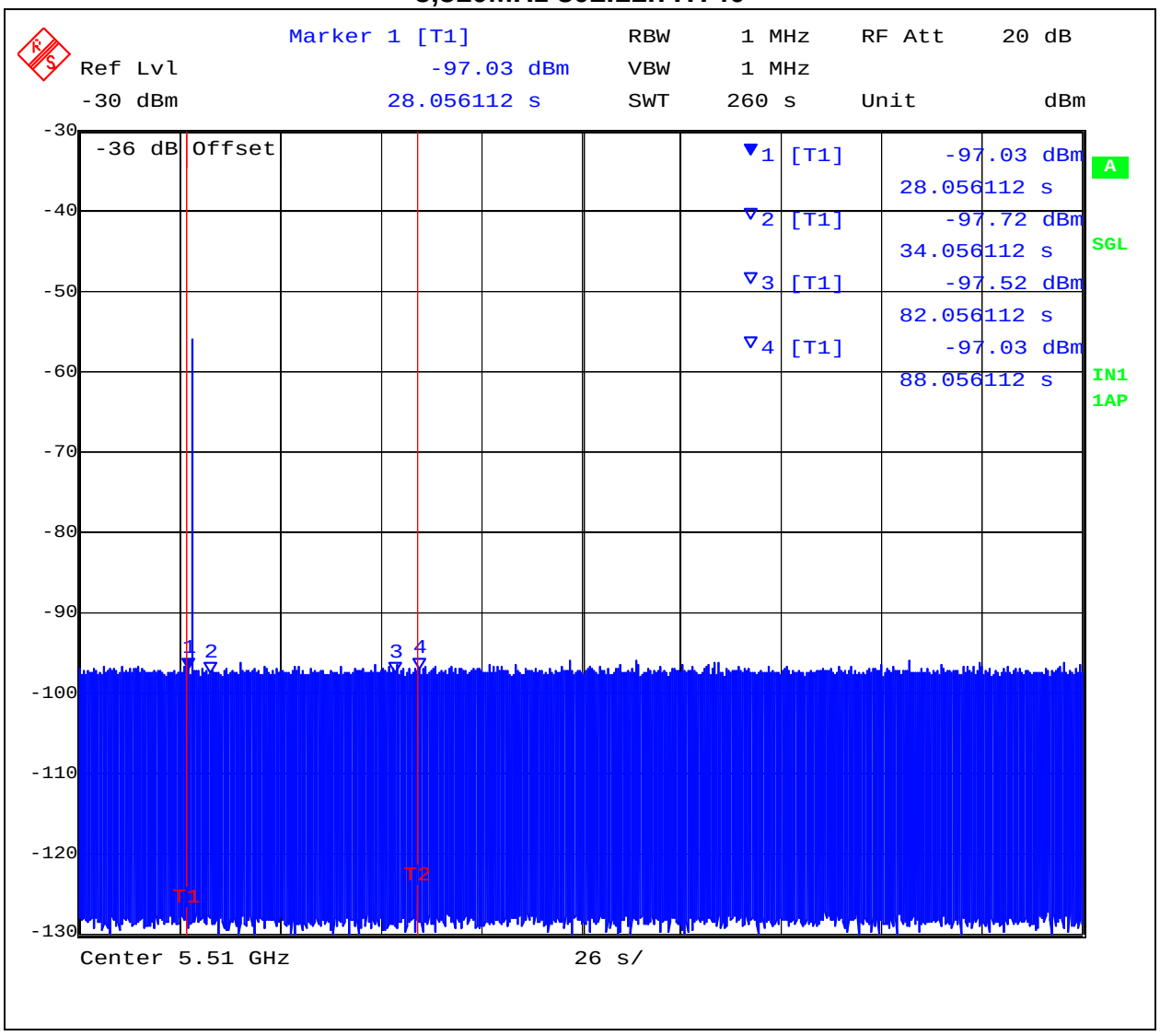
A single Burst of short pulse of radar Type 1 will commence within a 6 second window starting at T_0 (first red marker line on the following plot).

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.

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



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



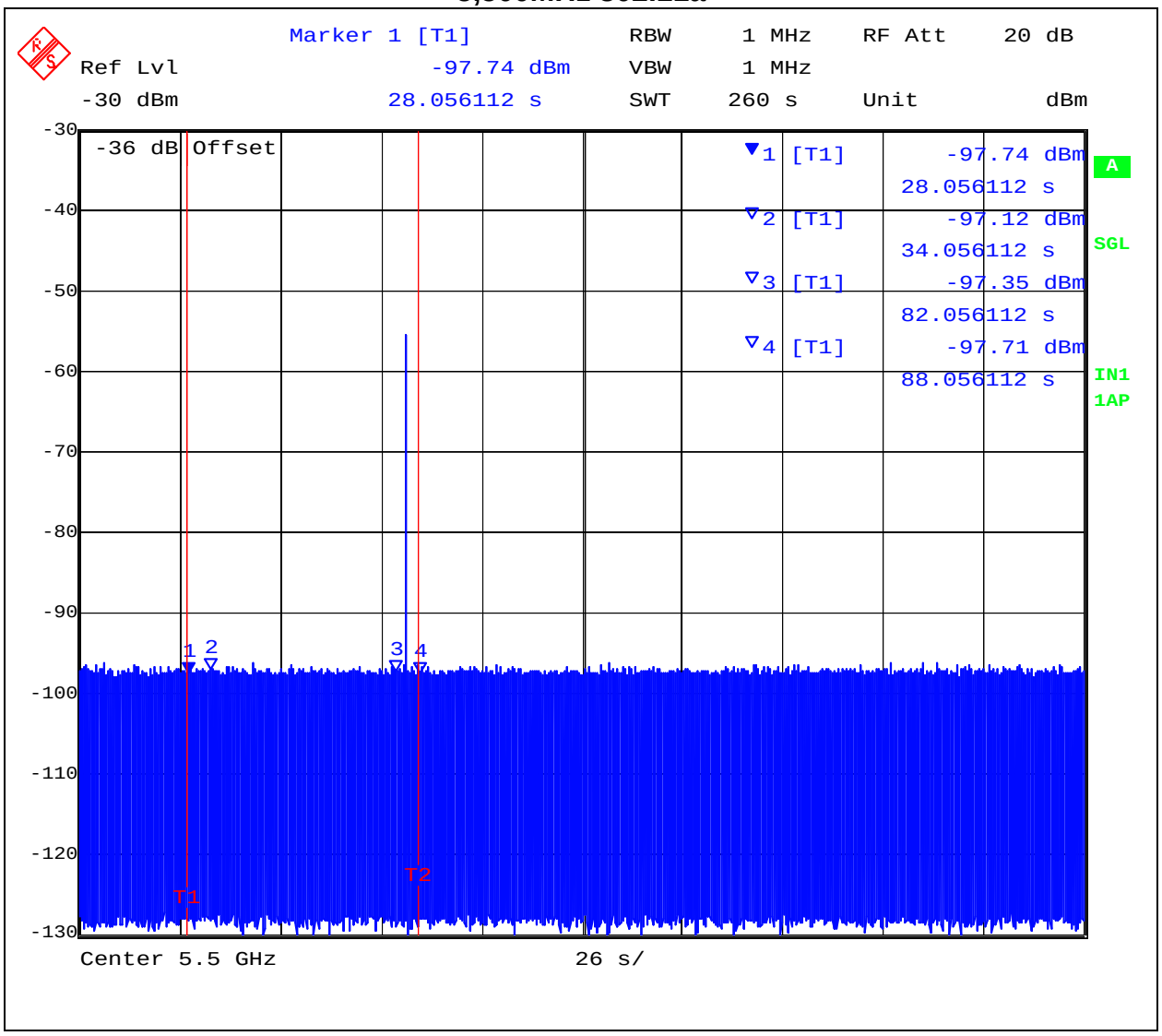
6.2.4. Radar Burst at the End of the Channel Availability Check Time:

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.

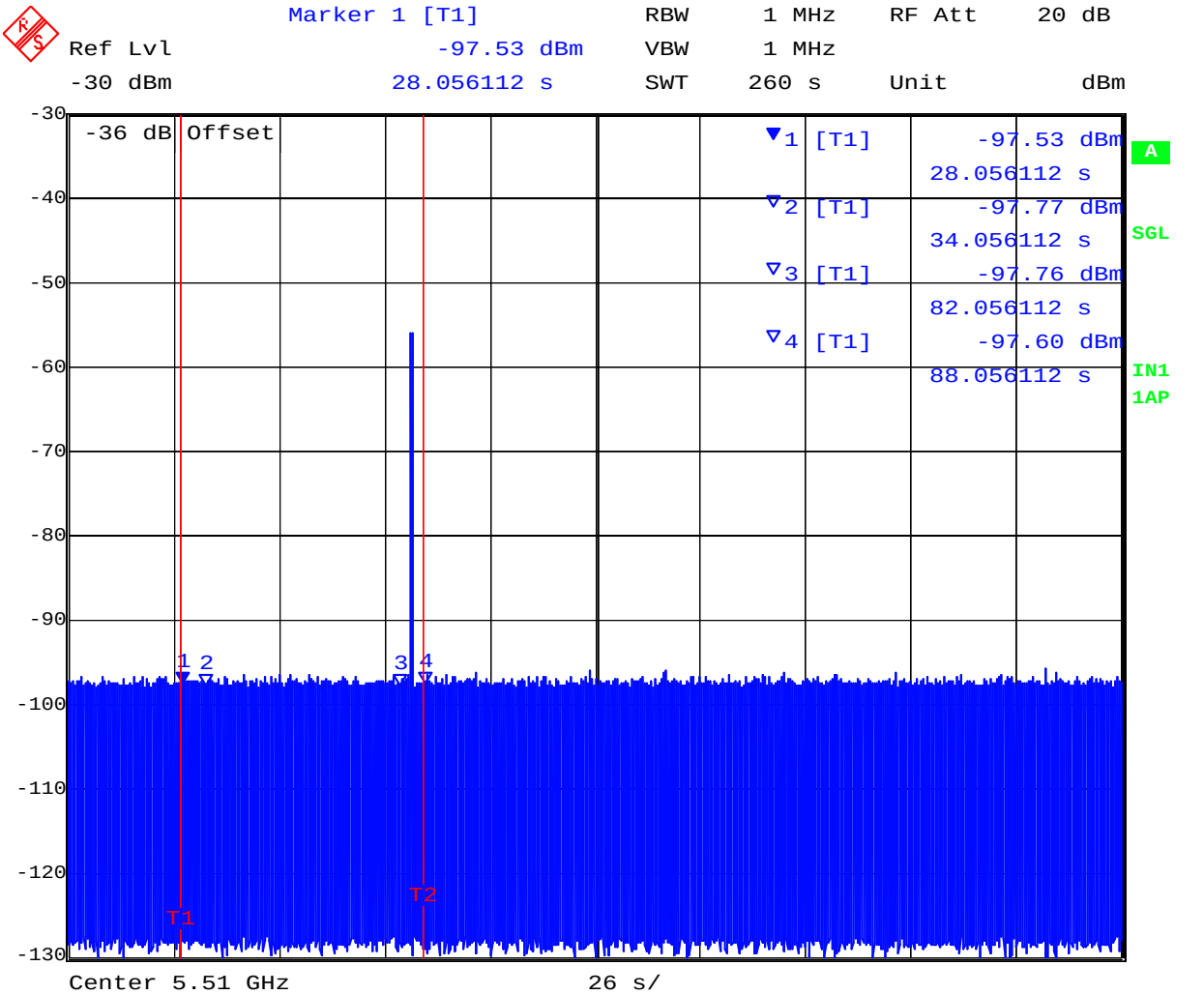
A single Burst of short pulse of radar type 1 will commence within a 6 second window starting at T_0+ 54 seconds. The window will commence at marker 2 and end at the red frequency line T_2.

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.

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



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



6.2.5. In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period

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

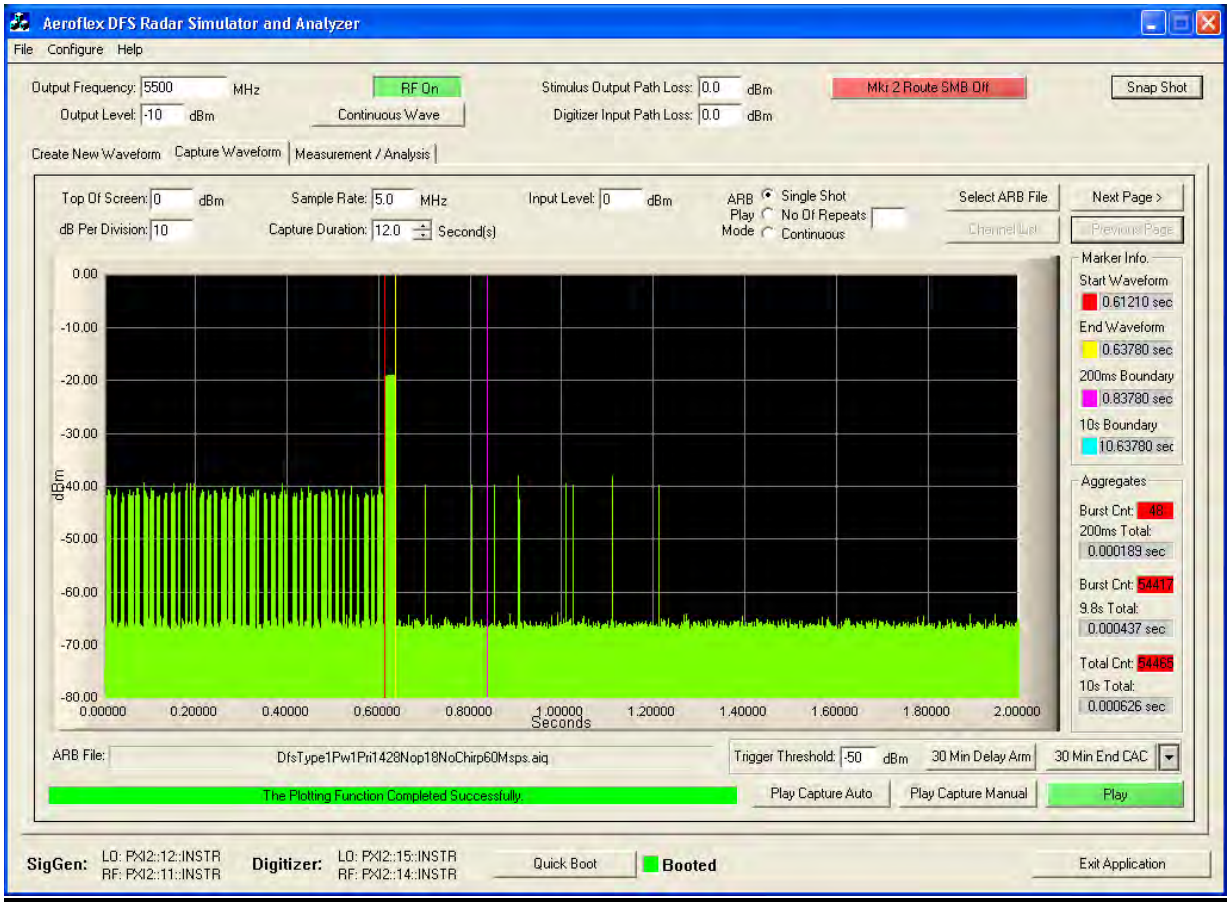
(The period of the 18 pulse burst includes [18 pulses *1.428mS PRI] = 25.704 ms. Then add 1 µs pulse width for the final pulse.)

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.

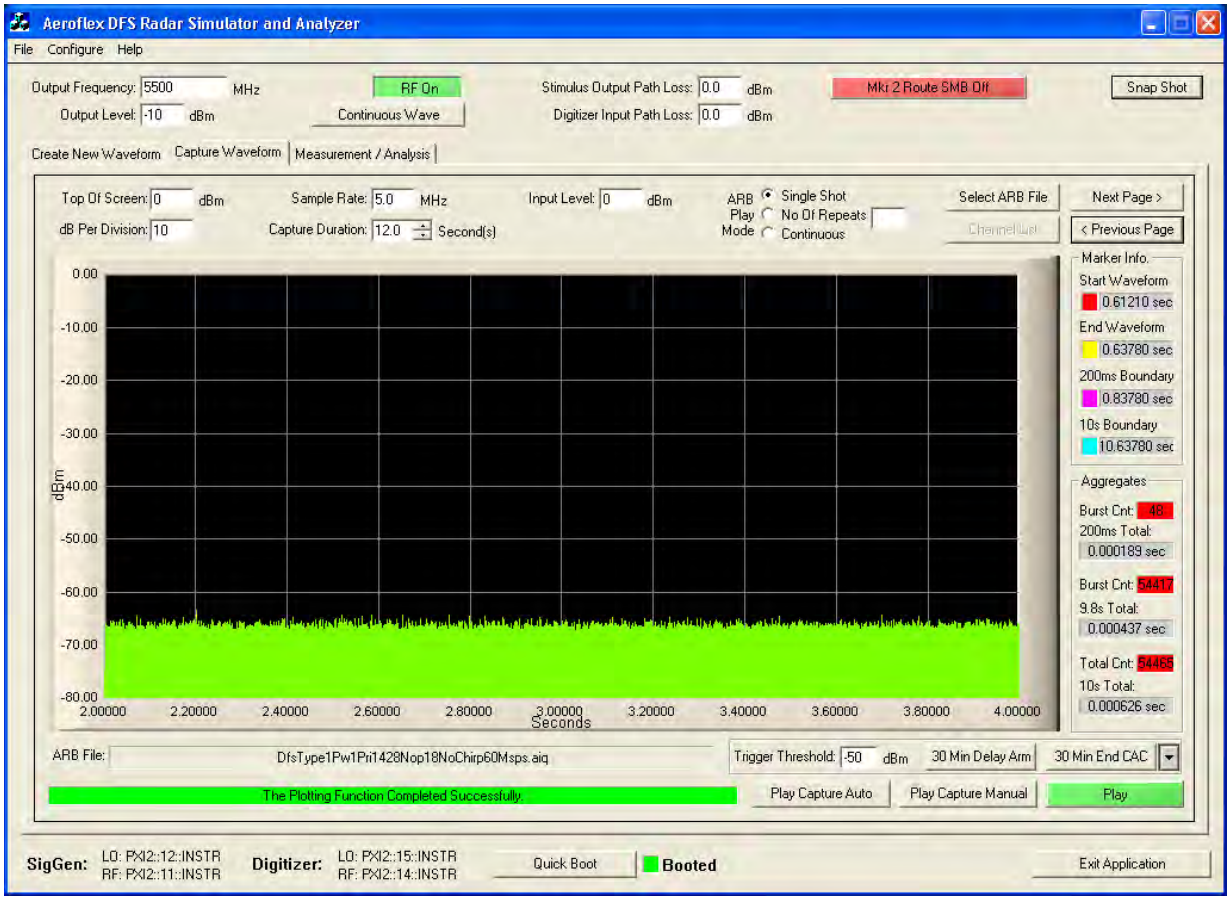
Therefore, pulses seen after this 637.8 ms boundary are identified and totaled to provide an aggregate total of transmissions in order to determine whether the EUT is compliant with the Channel Closing Transmission Time requirements as described in MO&O FCC 06-96. In this case, it was found that an aggregate total of 0.00 ms 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) = 0.626 mSecs (limit 260 mSecs)
Channel Move Time 5,500MHz (802.11a) = 0.5722Secs (limit 10 Secs)

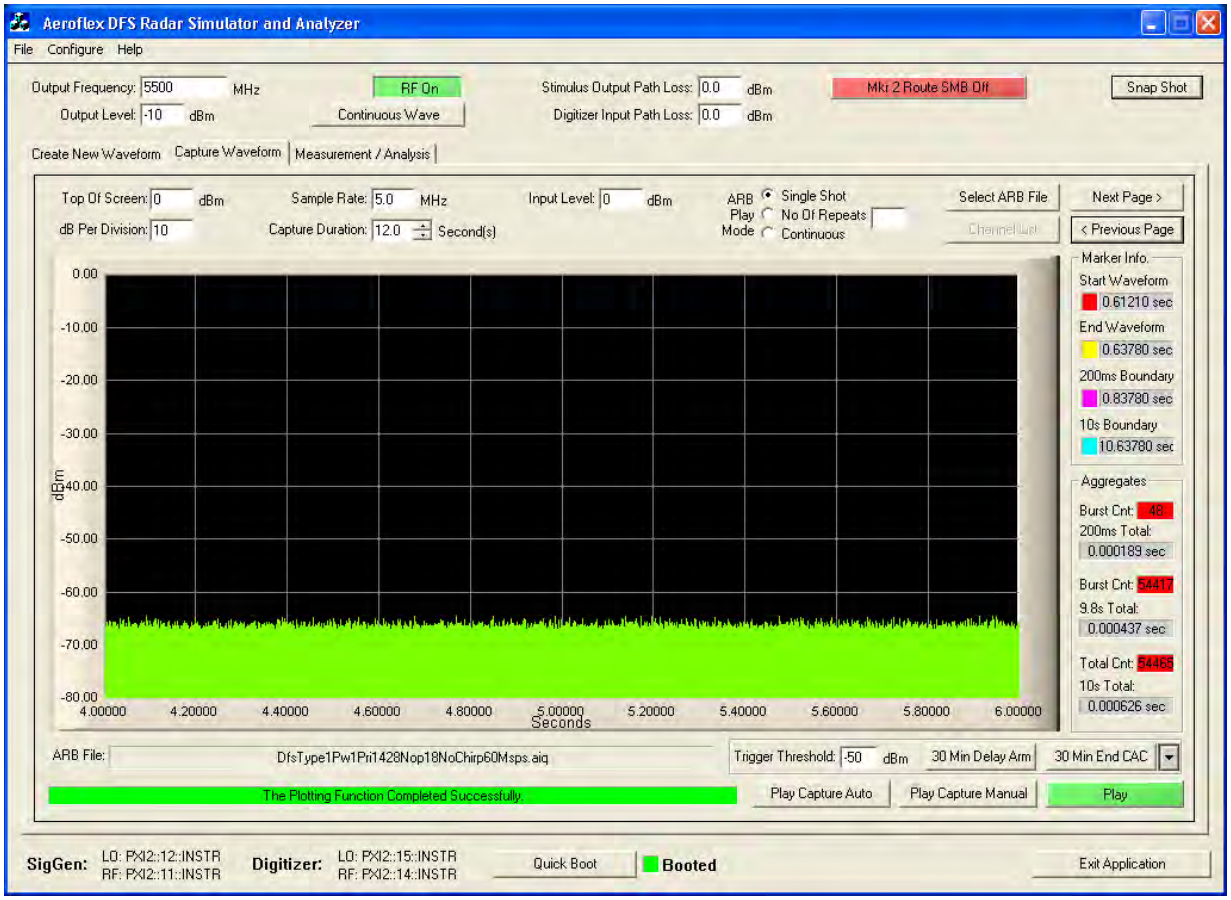
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 0 to 2 seconds



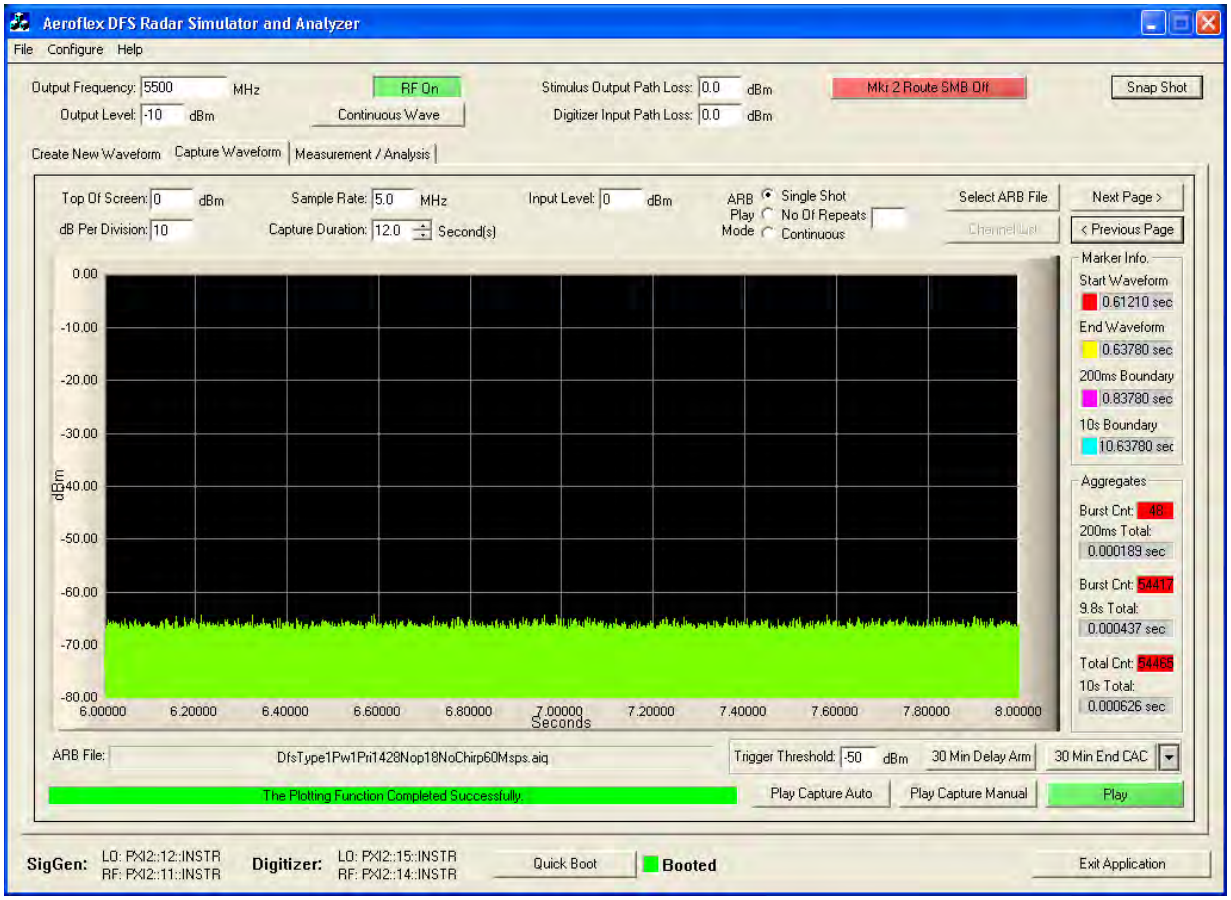
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 2 to 4 seconds



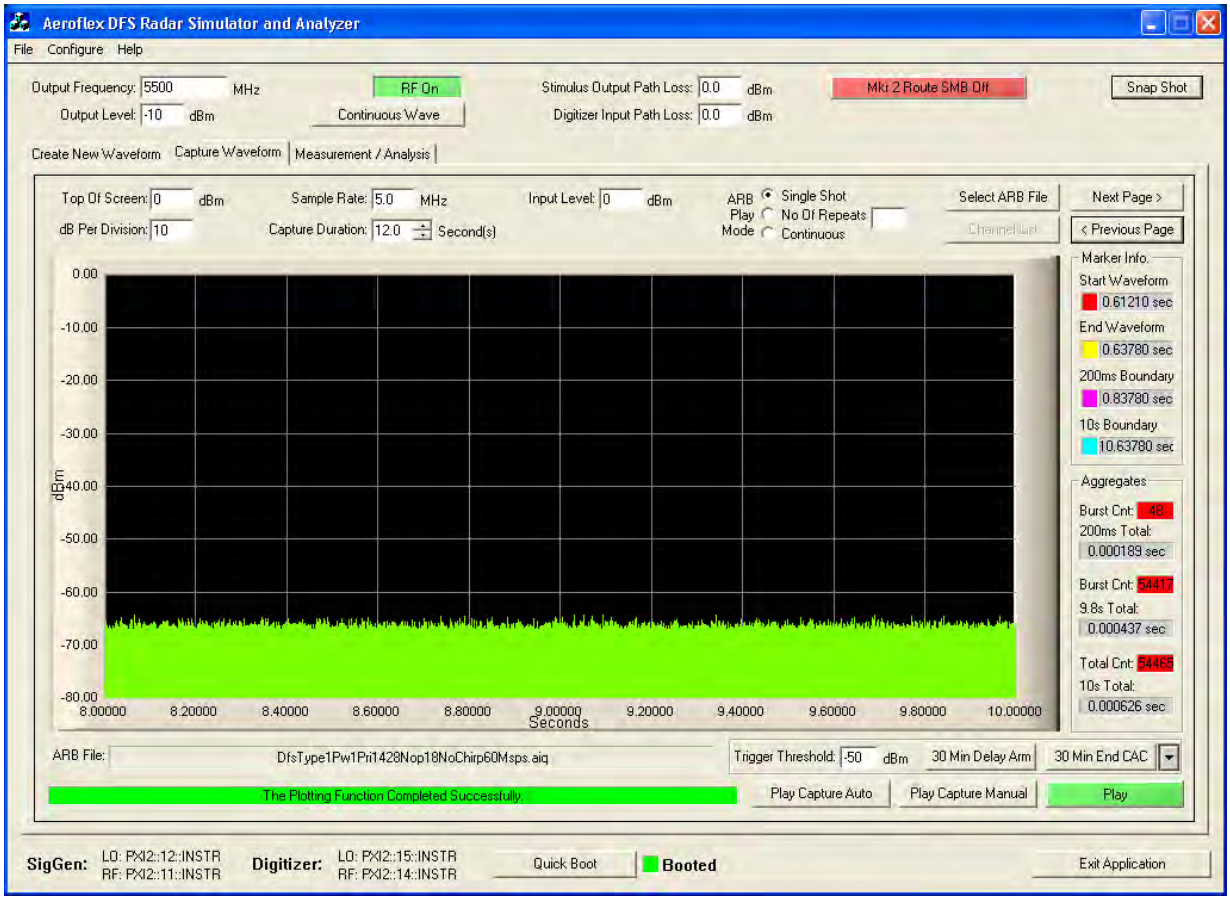
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 4 to 6 seconds



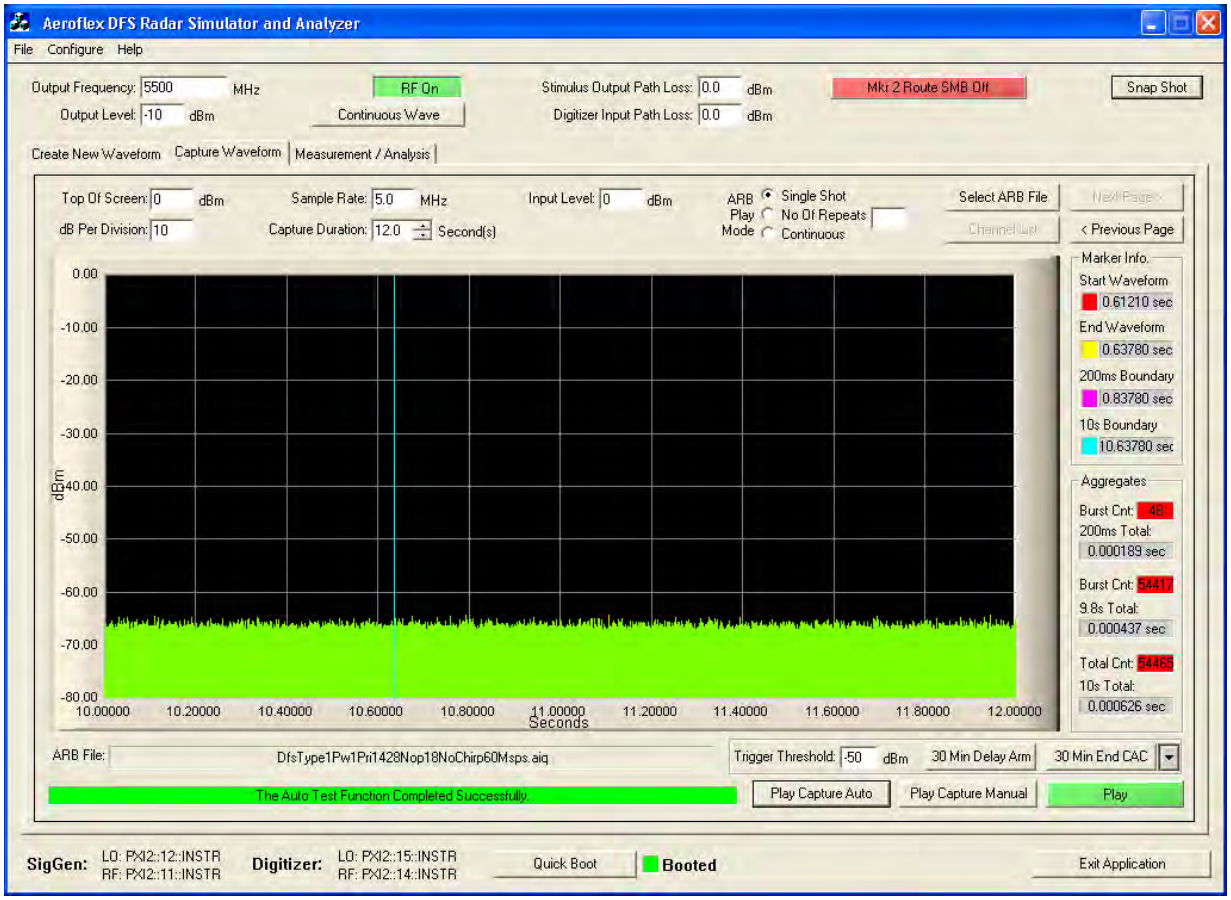
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 6 to 8 seconds



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



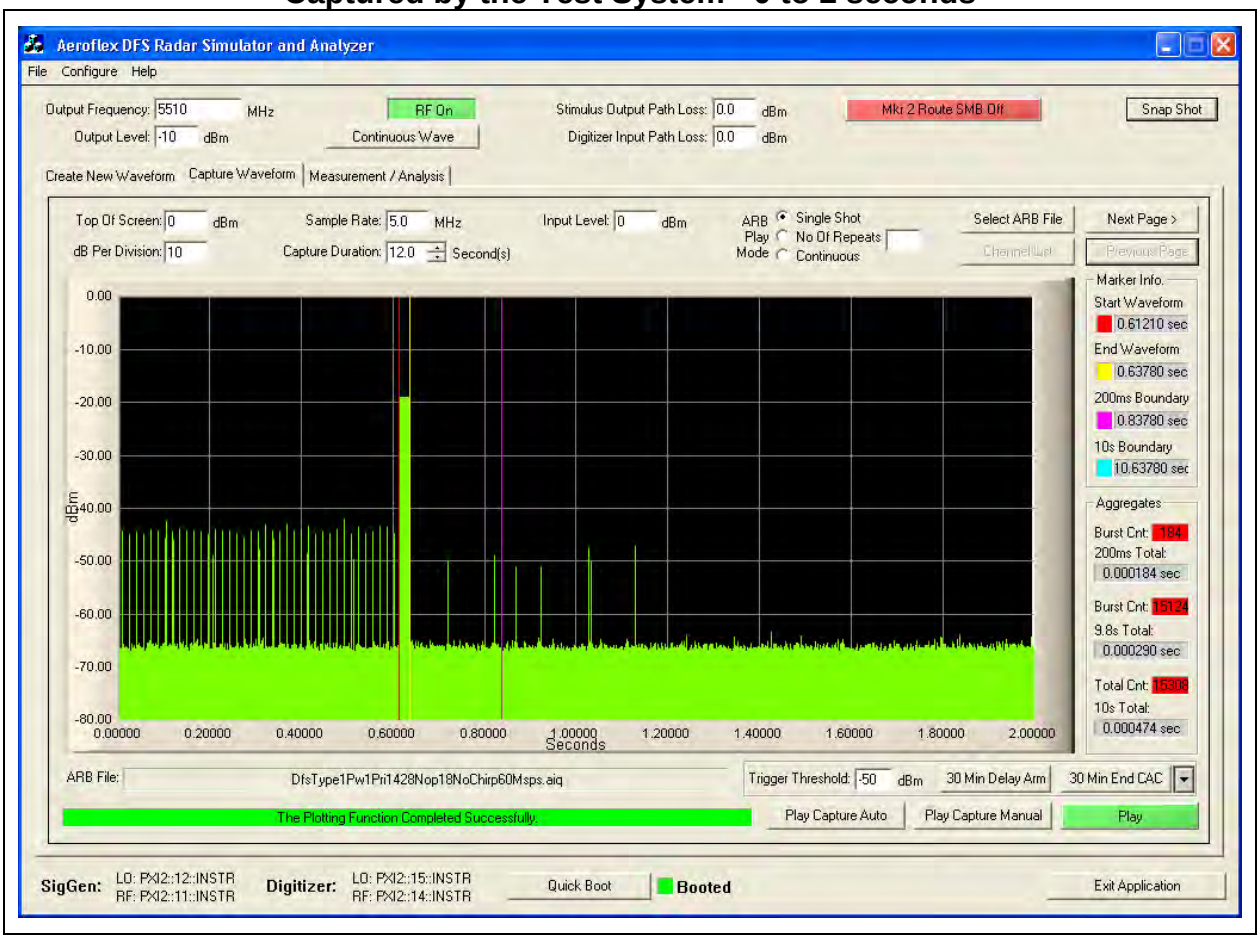
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 10 to 12 seconds



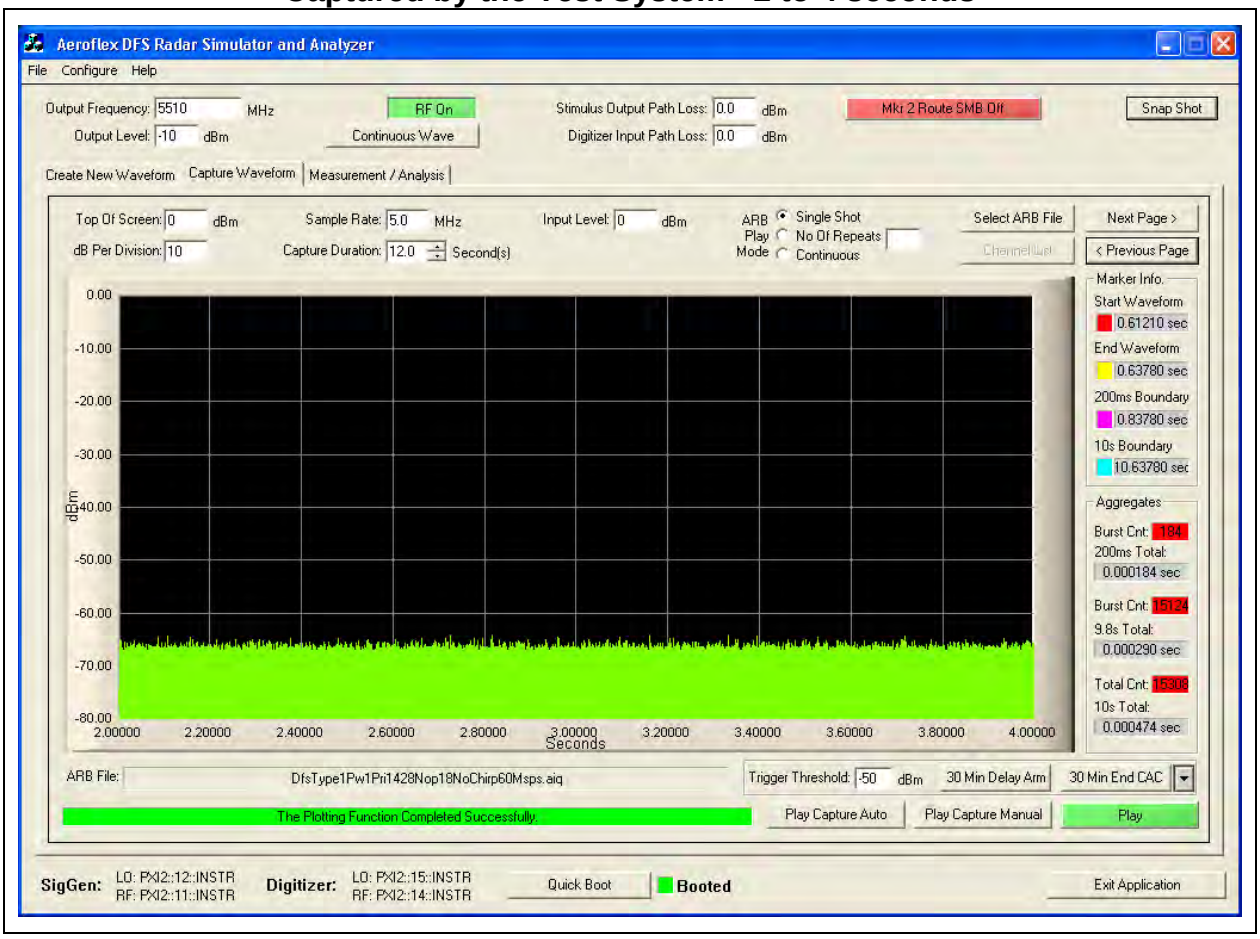
Channel Closing Transmission Time 5,510 MHz (802.11n HT40) = 0.474 mSecs (limit 260 mSecs)

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

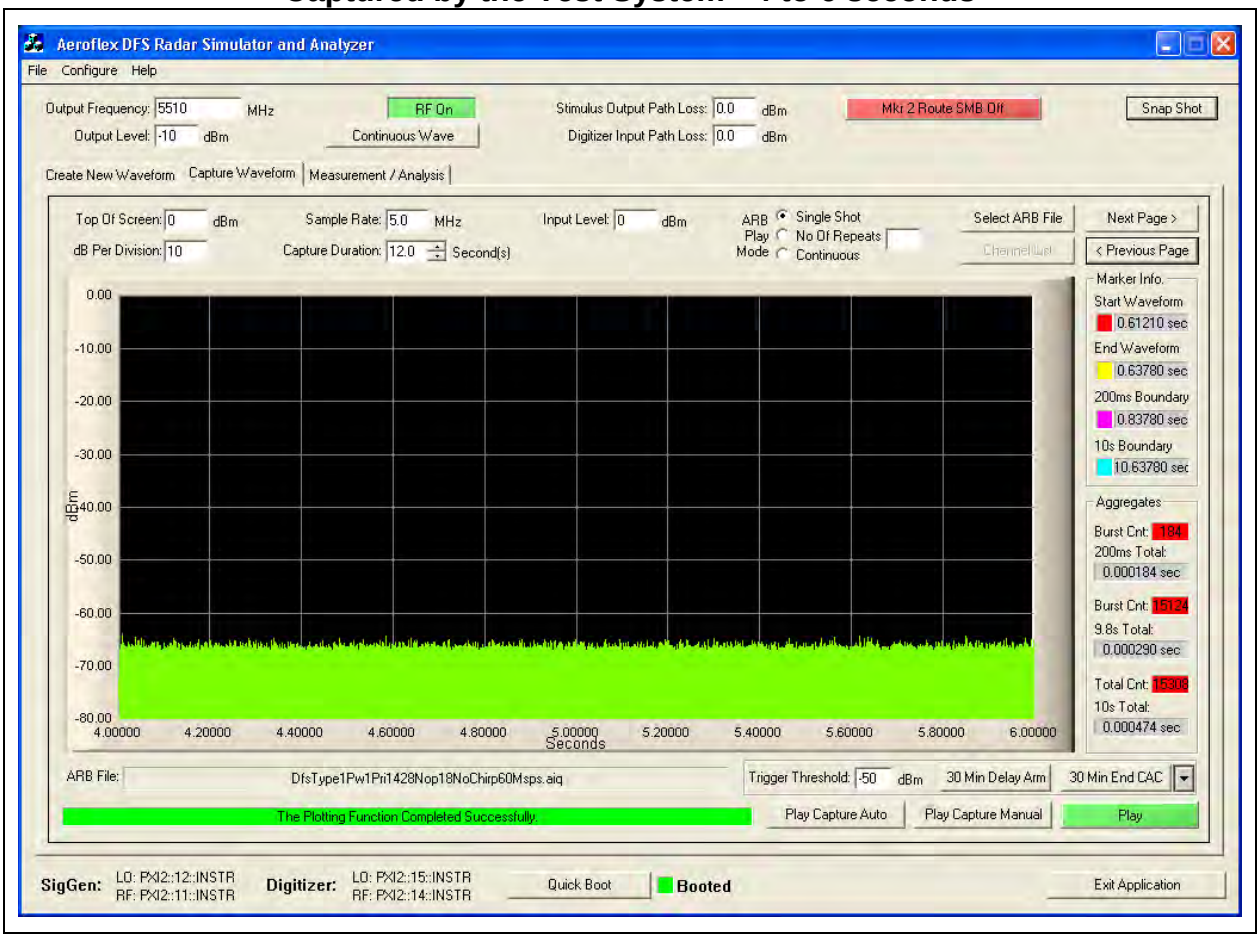
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 0 to 2 seconds



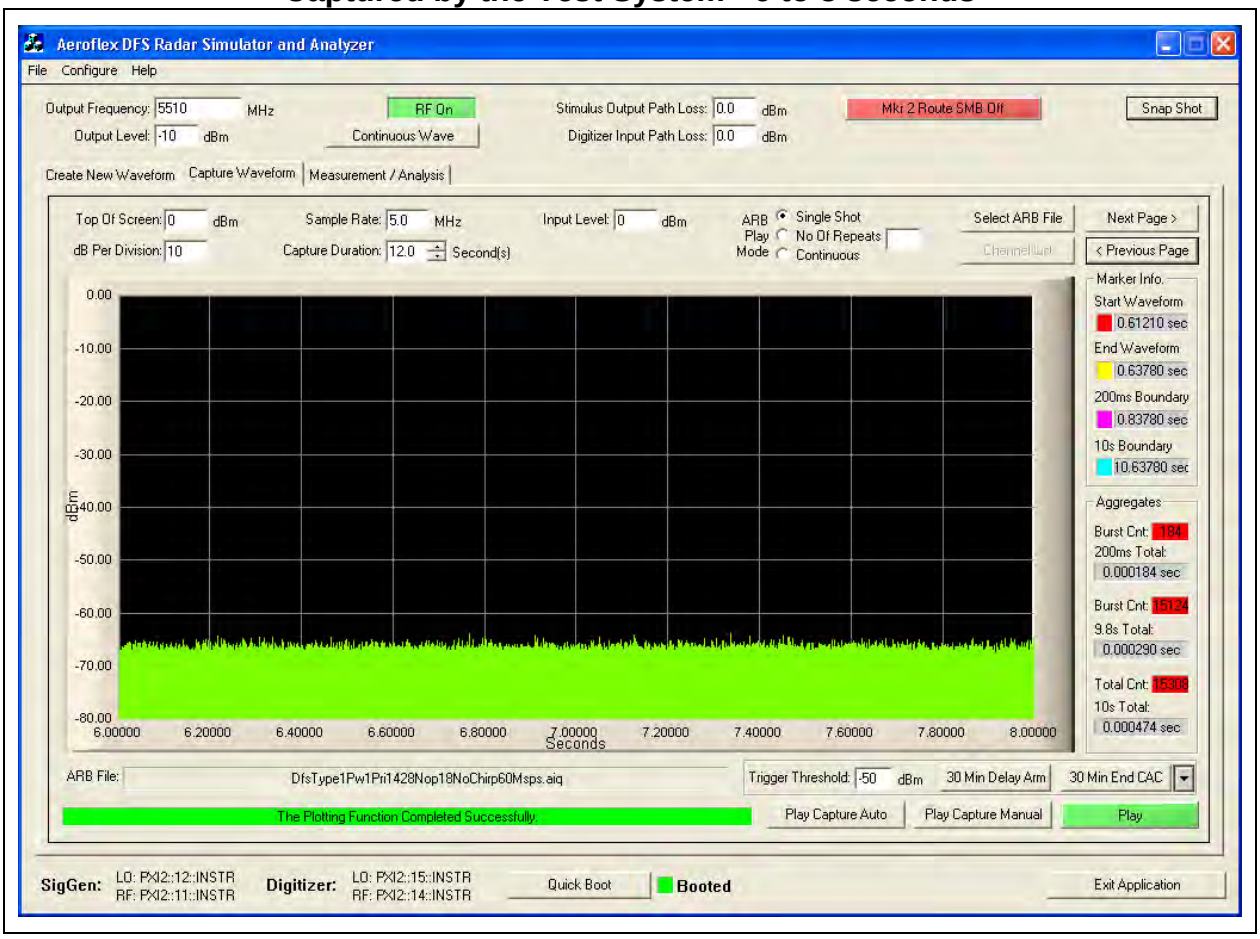
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 2 to 4 seconds



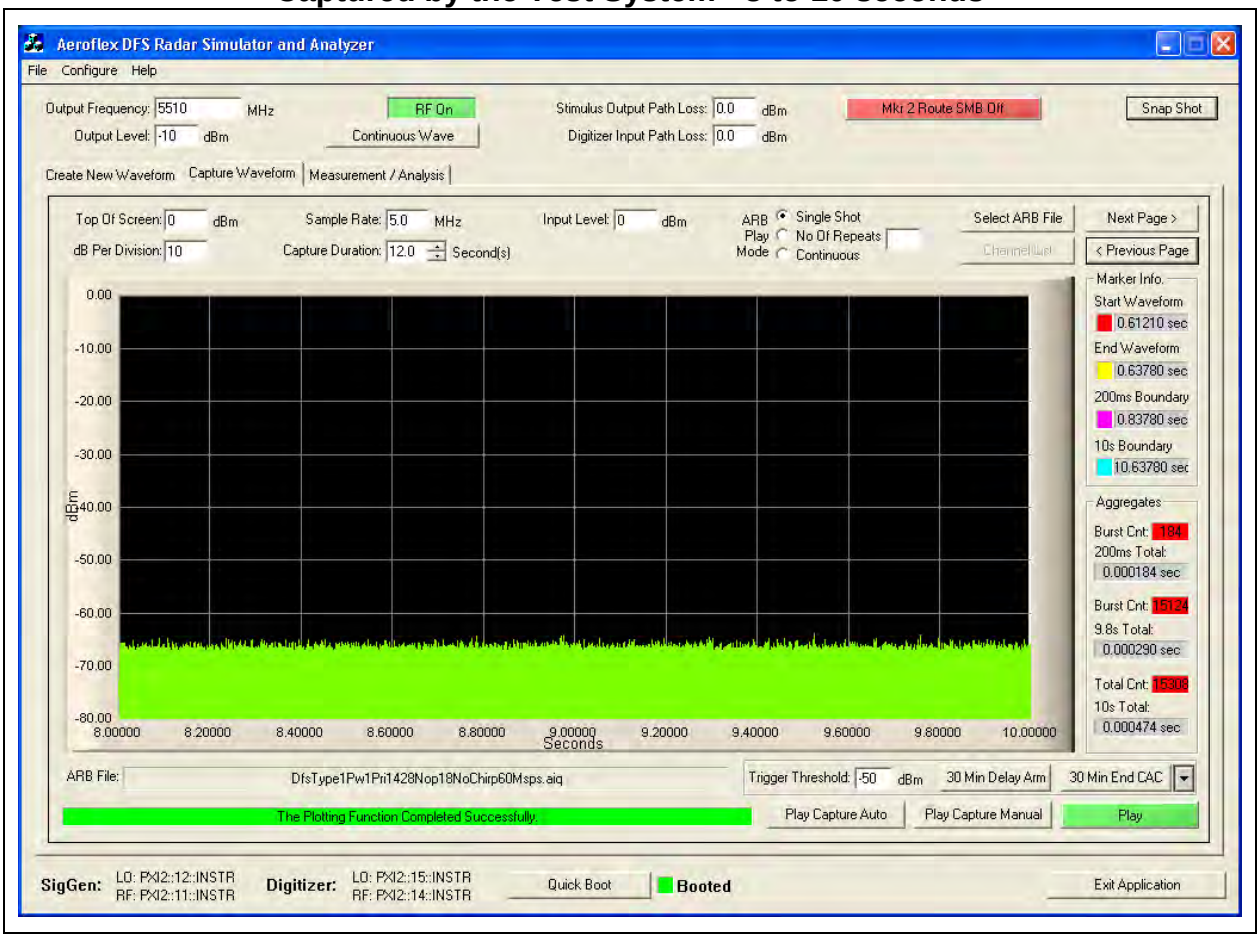
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 4 to 6 seconds



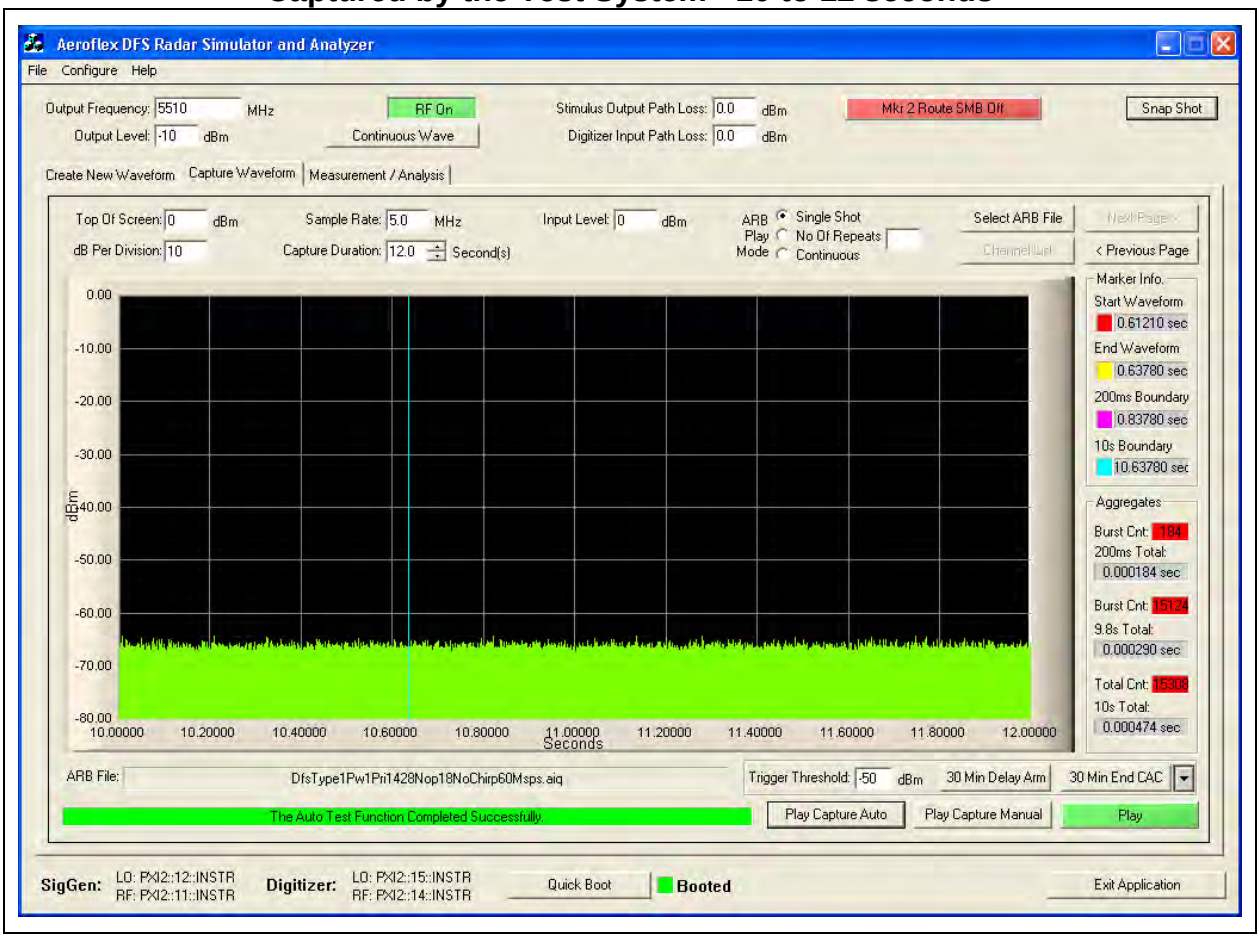
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 6 to 8 seconds



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



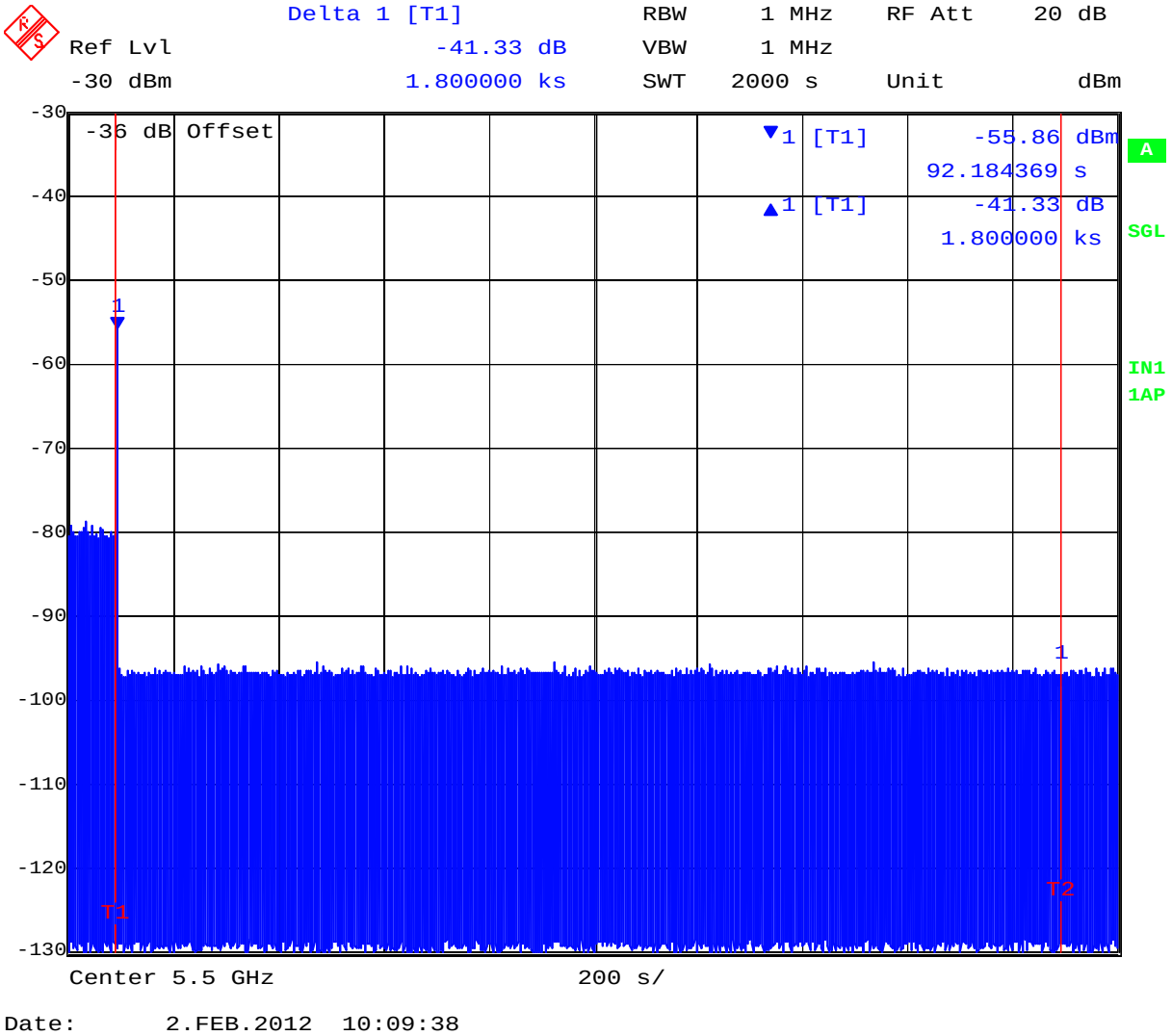
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 10 to 12 seconds



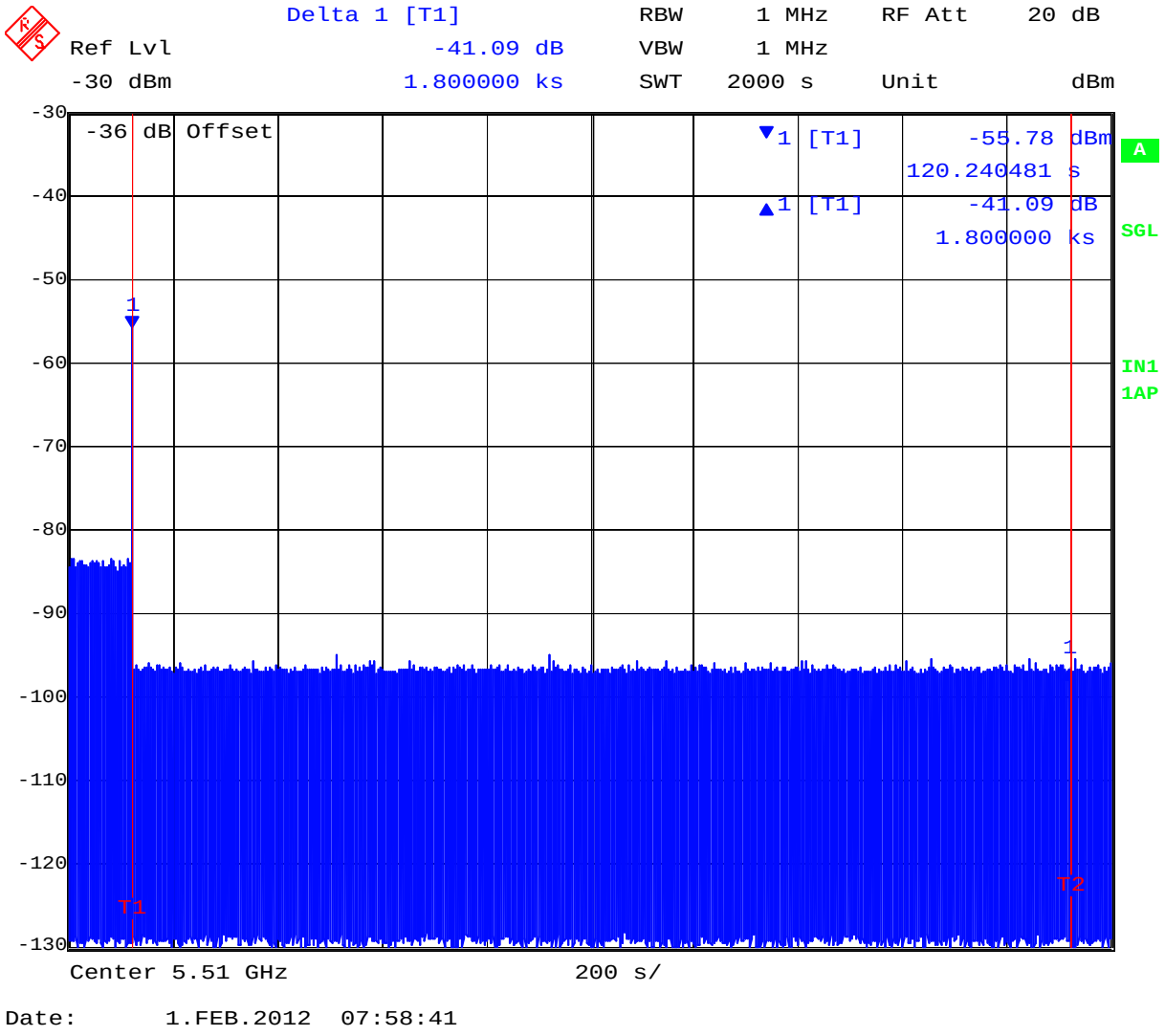
30 Minute Non-Occupancy Period

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



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



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 ÷ Total # of Trials × 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.

Verification of Detection 5,500MHz 802.11a

Trial #	Detection = √, No Detection = 0					
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
1	√	√	√	√	√	√
2	√	√	√	√	√	√
3	√	√	√	√	√	√
4	√	√	√	√	√	√
5	√	0	√	√	√	√
6	0	0	√	√	√	√
7	√	√	√	√	√	√
8	√	0	√	0	√	√
9	√	√	√	√	√	√
10	√	√	√	√	√	0
11	√	√	√	0	√	√
12	√	√	√	0	√	√
13	√	√	√	√	√	√
14	√	0	√	√	0	√
15	√	√	√	√	√	√
16	√	√	√	√	√	√
17	√	√	0	0	√	√
18	√	√	√	√	√	0
19	√	√	√	√	√	√
20	√	0	√	√	√	√
21	√	√	√	√	√	√
22	√	√	√	√	√	√
23	√	√	√	√	√	√
24	√	√	√	√	√	√
25	√	√	√	√	√	√
26	√	√	√	√	√	√
27	√	√	√	√	√	√
28	√	√	√	√	√	0
29	√	√	√	√	√	√
30	√	√	√	√	√	√
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;

$(P_d1 + P_d2 + P_d3 + P_d4) / 4 = 96.6\% + 83.3\% + 96.6\% + 86.6\%) / 4 = 90.7\ \%\ (> 80\%)$

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	√	√	√	√	√	√
2	√	√	√	√	√	√
3	√	√	√	√	√	√
4	√	√	√	√	√	√
5	√	√	√	√	√	√
6	√	√	√	√	√	√
7	√	√	√	√	√	√
8	√	√	√	0	√	√
9	√	√	√	√	√	√
10	√	0	√	√	√	√
11	√	0	√	√	√	√
12	√	√	√	√	√	√
13	√	0	√	√	√	√
14	√	√	√	√	√	√
15	√	0	0	√	√	√
16	√	√	√	√	√	√
17	√	√	√	√	√	√
18	√	√	√	√	√	√
19	√	√	√	0	0	√
20	√	√	√	√	√	√
21	√	√	√	√	√	√
22	√	√	√	√	√	√
23	√	√	√	√	√	√
24	√	0	√	√	√	√
25	√	√	√	√	√	√
26	√	√	√	√	√	√
27	√	√	√	√	√	√
28	√	√	√	√	√	√
29	√	√	√	0	√	√
30	√	√	√	√	√	√
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;

$(P_d1 + P_d2 + P_d3 + P_d4) / 4 = 100\% + 83.3\% + 96.6\% + 90\%) / 4 = 92.4\ \%\ (> 80\%)$

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

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

440 Boulder Court, Suite 200
Pleasanton, CA 94566, USA
Tel: 1.925.462.0304
Fax: 1.925.462.0306
www.micomlabs.com