Test of Wistron 802.11 a/b/g/n Wireless Module

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

Test Report Serial No.: CBIS10-A4 Rev A

TEST REPORT

FROM

Test of Wistron 802.11 a/b/g/n Wireless Module
to
To: FCC 47 CFR Part 15.407 & IC RSS-210

Test Report Serial No.: CBIS10-A4 Rev A

This report supersedes NONE

Applicant: Colubris Networks Inc
200 West Street, Suite 300
Waltham
MA 02451, USA

Product Function: 802.11a/b/g/n Wireless Access Card

Copy No: pdf Issue Date: 1st October 2008

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

CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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TABLE OF CONTENTS

ACCREDITATION, LISTINGS & RECOGNITION

MiCOM Labs, Inc. an accredited laboratory complies with the international standard BS EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org 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

ACCREDITED LABORATORY

A2LA has accredited

MICOM LABS
Pleasanton, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 18 June 2005*).

Presented this 26th day of February 2008.

President
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2009

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

LISTINGS

MiCOM Labs test facilities are listed by the following organizations;

North America

United States of America
Federal Communications Commission (FCC) Listing #: 102167

Canada

Industry Canada (IC) Listing #:4143A-2

RECOGNITION

APEC MRA (Asia-Pacific Economic Community Mutual Recognition Agreement)

Conformity Assessment Body (CAB) – MiCOM Labs

Test data generated by MiCOM Labs is accepted in the following countries under the APEC MRA.

Country	Recognition Body	Phase	CAB Identification No.
Australia	Australian Communications and Media Authority (ACMA)	I	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	I	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	I	
Singapore	Infocomm Development Authority (IDA)	I	
Taiwan	Directorate General of Telecommunications (DGT) Bureau of Standards, Metrology and Inspection (BSMI)	I I	

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	1st October 2008	Initial release.

1. TEST RESULT CERTIFICATE

Applicant:	Colubris Networks Inc 200 West Street, Suite 300 Waltham MA 02451, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	Wireless Access Card	Telephone:	+1 925 462 0304
Model:	Wistron DNMA-83	Fax:	+1 925 462 0306
S/N:	D027814A010EC01		
Test Date(s):	12th August '08 to 16th September 2008	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	2007	Code of Federal Regulations
(ii)	FCC 06-96	June 2006	Memorandum Opinion and Order
(iii)	Industry Canada RSS-210	Issue 7 June 2007	Low Power License-Exempt Radiocommunication Devices (All Frequency Bands): Category 1 Equipment
(iv)	Industry Canada RSS-Gen	Issue 2 June 2007	General Requirements and Information for the Certification of Radiocommunication Equipment
(v)	ANSI C63.4	2003	American National Standards for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
(vi)	CISPR 22/ EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
(vii)	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
(viii)	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
(ix)	ETSI TR 100 028	2001	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
(x)	A2LA	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 Wistron 802.11 a/b/g/n Wireless Module in the frequency ranges 5150 to 5350 MHz, and 5470 to 5,725 MHz to FCC Part 15.407 and Industry Canada RSS-210 regulations.
Applicant:	Colubris Networks Inc 200 West Street, Suite 300 Waltham MA 02451, USA
Manufacturer:	Winstron NEWEB Corp
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	CBIS10-A4 Rev A
Date EUT received:	12th August 2008
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210
Dates of test (from - to):	12th August to 16th September 2008
No of Units Tested:	1
Type of Equipment:	802.11a/b/g/n Wireless Access Card, 3x3 Spatial Multiplexing MIMO configuration
Applicants Trade Name:	WLAN a+b+g+n mini-PCI Module
Model(s):	DNMA-83
Software Release	5.3
Hardware Release:	-030
Declared Frequency Range(s):	5,250 to 5,350 MHz 5,470 to 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 +19 dBm 802.11n: HT-40 +19 dBm
EUT Modes of Operation:	Legacy 802.11a/b/g, 802.11n HT-20, HT-40
Transmit/Receive Operation:	Time Division Duplex
Rated Input Voltage and Current:	Power Supply 3.3 Vdc @ 1 A
Operating Temperature Range:	Declared range 0 to +40ºC
ITU Emission Designator:	802.11a Legacy 16M9W7D 802.11n HT-20 18M1W7D 802.11n HT-40 37M3W7D
Frequency Stability:	±20 ppm max
Equipment Dimensions:	2.5” x 2.5”
Weight:	2oz
Primary function of equipment:	Wireless Access Card for transmitting data and voice

3.2. Scope of Test Program

RF Testing

The scope of the compliance program was to test the Wistron 802.11 a/b/g/n wireless module, 3x3 Spatial Multiplexing MIMO configurations in the frequency range 5250 - 5350 and 5470 – 5725 MHz for compliance against FCC 47 CFR Part 15.407 and Industry Canada RSS-210 specifications including Dynamic Frequency Selection (DFS) requirements.

The antennas used with the Wistron 802.11 a/b/g/n card are detailed in section 3.4 “Antenna Details”.

Although this is for a Limited Modular Approval (LMA) the module was tested in a host device (Colubris MAP-625). EMC Test Report NKR-DNMA83 FEE.pdf will be used for module emissions below 1 GHz and AC Wireline emissions.

Dynamic Frequency Selection

The scope of the test program was to test the Wistron 802.11 a/b/g/n wireless card in the frequency ranges 5,250 – 5,350 or 5,470 to 5,725 MHz as a Master device for compliance against DFS requirements of FCC 47 CFR Part 15.407 and the FCC specification Memorandum Opinion and Order FCC 06-96.

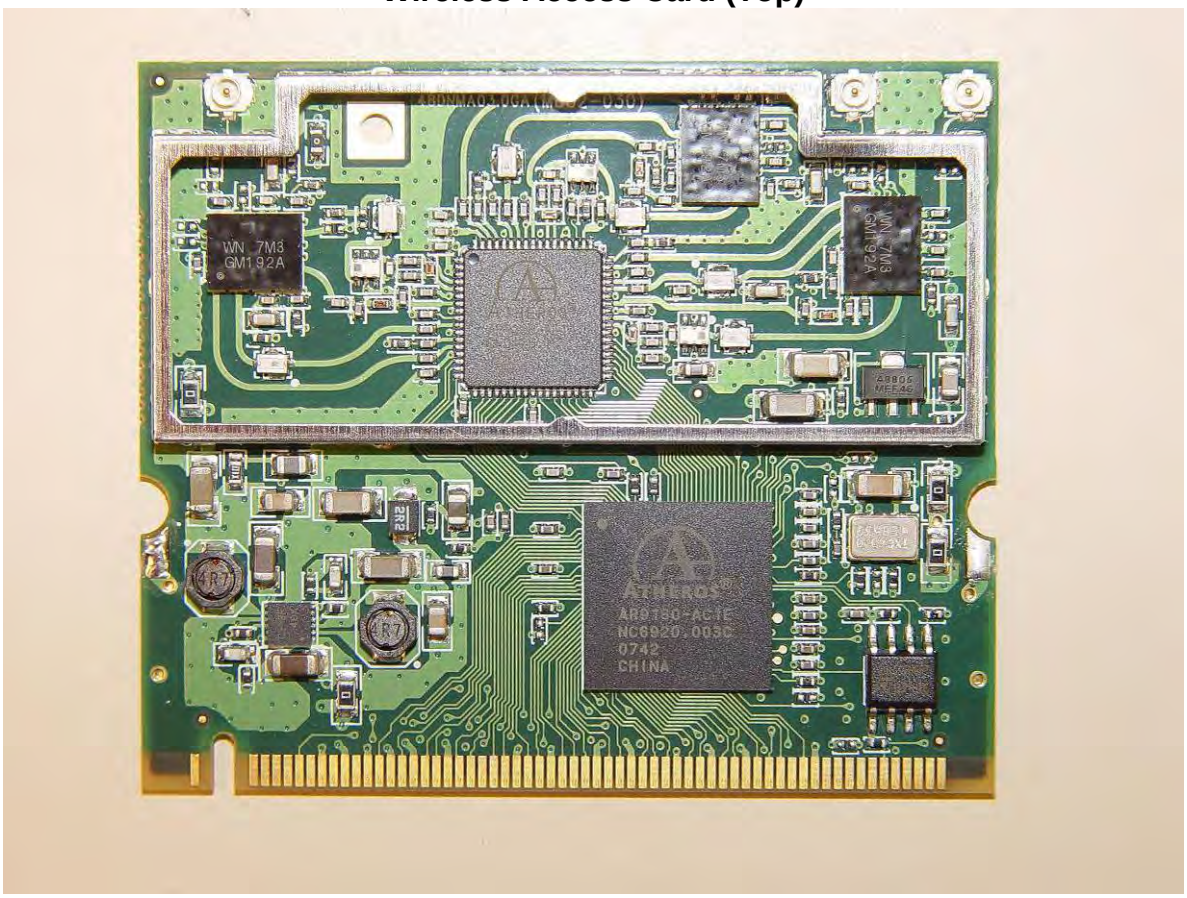
One frequency was chosen (5,500 MHz) from the operating channels of the UUT within the 5,250 – 5,350 MHz and 5,470 – 5,725 MHz bands for DFS testing per the requirements of FCC specification “Memorandum Opinion and Order FCC 06-96”, Section 7.8 “DFS Conformance Test Procedures”.

U-NII devices operating in the 5,250 – 5,350 MHz and 5,470 - 5,725 MHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems.

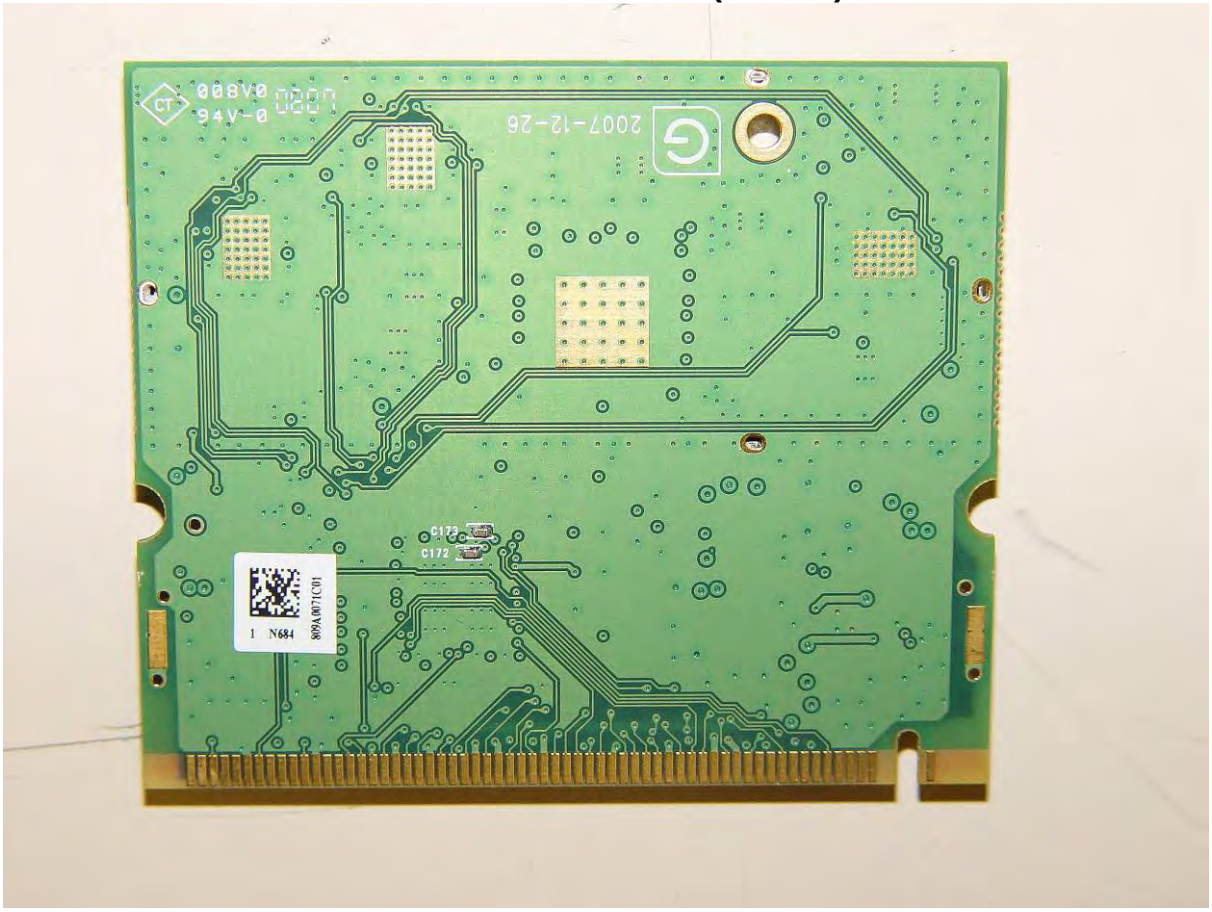
The Wistron 802.11 a/b/g/n wireless card operates as a Master device with full radar detection and Dynamic Frequency Selection (DFS) capability.

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.

Wistron 802.11 a/b/g/n wireless card
Wireless Access Card (Top)



Wistron 802.11 a/b/g/n wireless card
Wireless Access Card (Bottom)



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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Access Card	Wistron	DNMA-83	D027814A010EC01
Support	Wireless Access Point	Colubris Networks	MAP-625	KO64-00052
Support	Power Supply	Wall Industries	PSU30A-8	EJ721305-731R
Support	Laptop PC	IBM	Thinkpad	None
Support	Laptop PC	Dell	Inspiron 1100	
Support	Dual Band Wireless N-Adapter	LinkSys	WPC600N	

3.4. Antenna Details

1. 5150 – 5725 MHz
    a. Integral Centurion NanoBlade 5.1 dBi
    b. External Centurion WTS2450-RPSMA, 2.6 dBi Omni-Directional

3.5. Cabling and I/O Ports

Number and type of I/O ports

1. 1 X RJ-45 , 10/100/1000 BASE-T Ethernet, Auto MDX
2. 1 x Female DB-9 connector (DCE)
3. 3 pin 48V DC female

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[1] MBit/s	5,260 5,300 5,320
	HT-20	6.5 MCS	
	HT-40	13.5 MCS	5,270 5.310
a,n	Legacy	6[1] MBit/s	5,500 5,600 5,700
	HT-20	6.5 MCS	
	HT-40	13.5 MCS	5,510 5,620 5,690

[1] – Except for DFS these data rates were used to test and exercise the EUT at all times

Antenna Test Configurations for Radiated Emissions

Spurious Emission and Band-Edge Test Strategy

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

Legacy

NanoBlade 5.1 dBi Integral Antenna	WTS2450-RPSMA 2.6 dBi External Antenna
a 5260	a 5260
a 5300	a 5300
a 5320	a 5320
a 5500	a 5500
a 5600	a 5600
a 5700	a 5700
Pk a 5260	Pk a 5260
Pk a 5300	Pk a 5300
Pk a 5320	Pk a 5320
BE a 5350	BE a 5350
BE a 5460	BE a 5460
Pk a 5500	Pk a 5500
Pk a 5600	Pk a 5600
Pk a 5700	Pk a 5700

HT-20

NanoBlade 5.1 dBi Integral Antenna	WTS2450-RPSMA 2.6 dBi External Antenna
a 5260	a 5260
a 5300	a 5300
a 5320	a 5320
a 5500	a 5500
a 5600	a 5600
a 5700	a 5700
Pk a 5260	Pk a 5260
Pk a 5300	Pk a 5300
Pk a 5320	Pk a 5320
BE a 5350	BE a 5350
BE a 5460	BE a 5460
Pk a 5500	Pk a 5500
Pk a 5600	Pk a 5600
Pk a 5700	Pk a 5700

HT-40

NanoBlade 5.1 dBi Integral Antenna	WTS2450-RPSMA 2.6 dBi External Antenna
a 5270	a 5270
a 5310	a 5310
Pk a 5270	Pk a 5270
Pk a 5310	Pk a 5310
BE a 5350	BE a 5350
a 5510	a 5510
a 5620	a 5620
a 5690	a 5690
BE a 5460	BE a 5460
PK a 5510	PK a 5510
PK a 5620	PK a 5620
PK a 5690	PK a 5690

3.7. Equipment Modifications

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

EUT Software Power Settings - Radiated Testing

1. Reduction in output power to meet band-edge requirements was required in certain circumstances per the following tables,

Integral Antenna

Band Edge Freq (MHz)	Tx Frequency (MHz)	Mode	ART Power Setting
5350	5320	Legacy a	15
	5320	HT-20	15
	5310	HT-40	11
5460	5500	Legacy a	17 (No reduction required)
	5500	HT-20	17 (No reduction required)
	5510	HT-40	16

External Antenna

Band Edge Freq (MHz)	Tx Frequency (MHz)	Mode	ART Power Setting
5350	5320	Legacy a	18 (No reduction required)
	5320	HT-20	18 (No reduction required)
	5310	HT-40	18 (No reduction required)
5460	5500	Legacy a	18 (No reduction required)
	5500	HT-20	16
	5510	HT-40	17

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*
RSS-GEN **6**	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.7.2*
15.407(b)(6) **15.205(a)** **15.209(a)** **2.2**	Radiated Emissions	Emissions <1 GHz (30M-1 GHz)		*See EMC Test Report NKR-DNMA83 FEE.pdf	*5.1.7.3*
15.407(b)(6) **15.207** **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	*See EMC Test Report NKR-DNMA83 FEE.pdf	5.1.8

* As a result of testing the wireless module in a host device an EMC Test Report for the module is submitted in lieu of testing Radiated Emissions below 1 GHz and AC Wireline Emissions.

List of Measurements (cont'd)

Dynamic Frequency Selection (DFS)

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

Tests performed on 802.11 A/B/G/N Master Device

Section	Test Items	Description	Condition	Result	Test Report Section
7.8.1	Detection Bandwidth	UNII Detection Bandwidth	Conducted	Complies	6.2.1
7.8.2.1	Performance Requirements Check	Initial Channel Availability Check Time	Conducted	Complies	6.2.2
7.8.2.2		Radar Burst at the Beginning of the Channel Availability Check Time	Conducted	Complies	6.2.3
7.8.2.3		Radar Burst at the End of the Channel Availability Check Time	Conducted	Complies	6.2.4
7.8.3	In-Service Monitoring	In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	Conducted	Complies	6.2.5
7.8.4	Radar Detection	Statistical Performance Check	Conducted	Complies	6.2.6

Note 1: *Test results reported in this document relate only to the items tested*
Note 2: *The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria*
Note 3:Section 3.7 *Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix*

5. TEST RESULTS

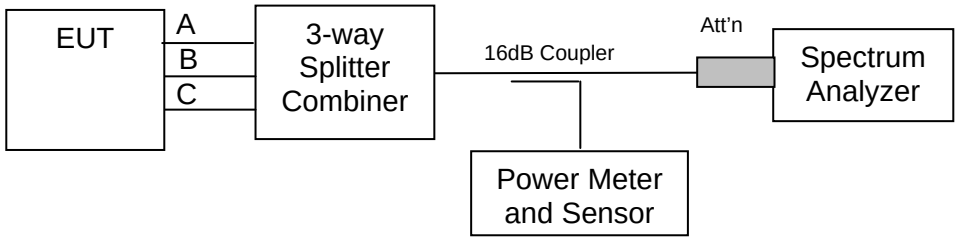
5.1. Device Characteristics

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(s), while EUT is operating in transmission mode at the appropriate center frequency.

Test Measurement Set up



Measurement set up for 26 dB and 99 % bandwidth test

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

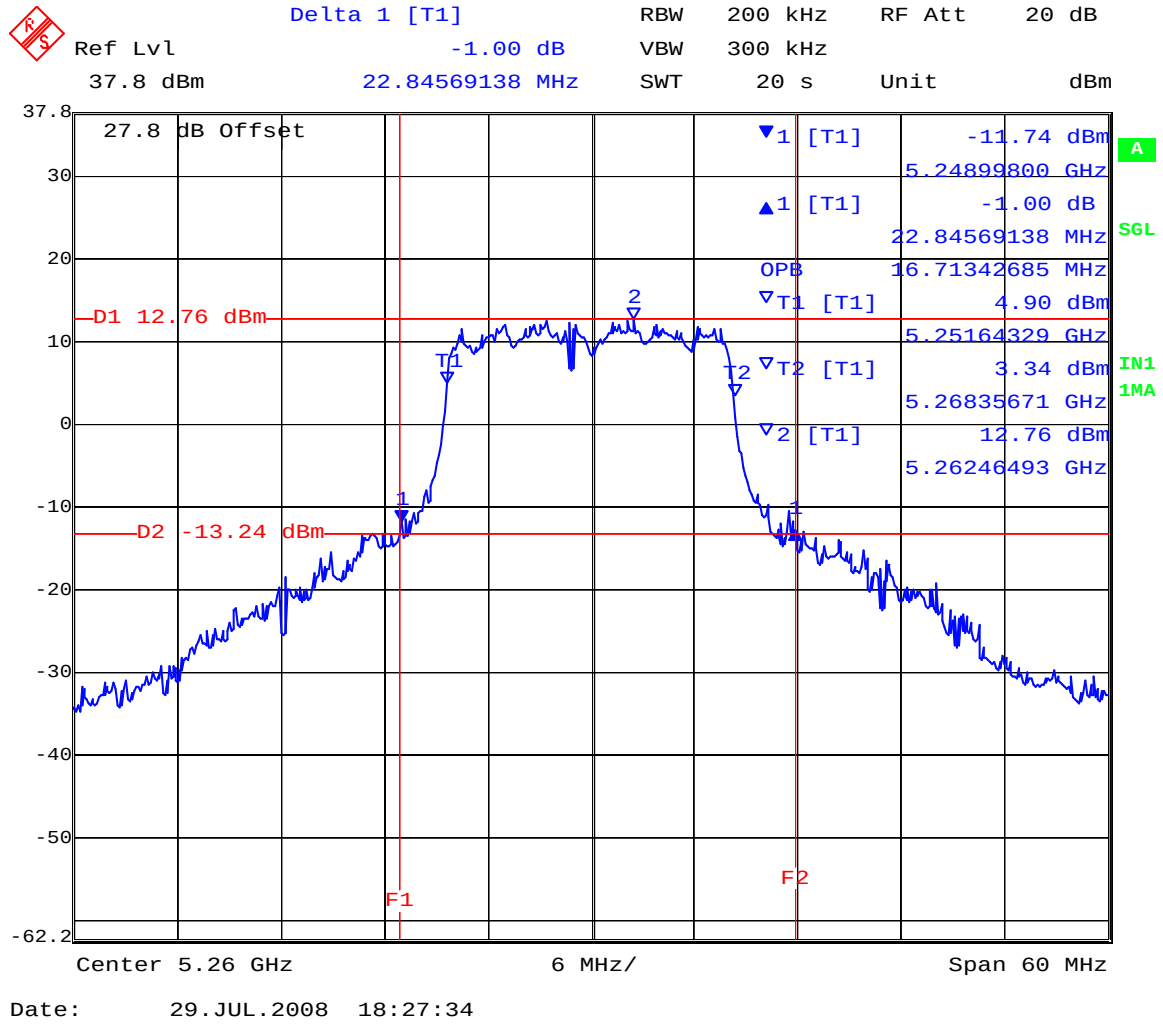
Measurement Results for 26 dB and 99 % Operational Bandwidth(s)

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

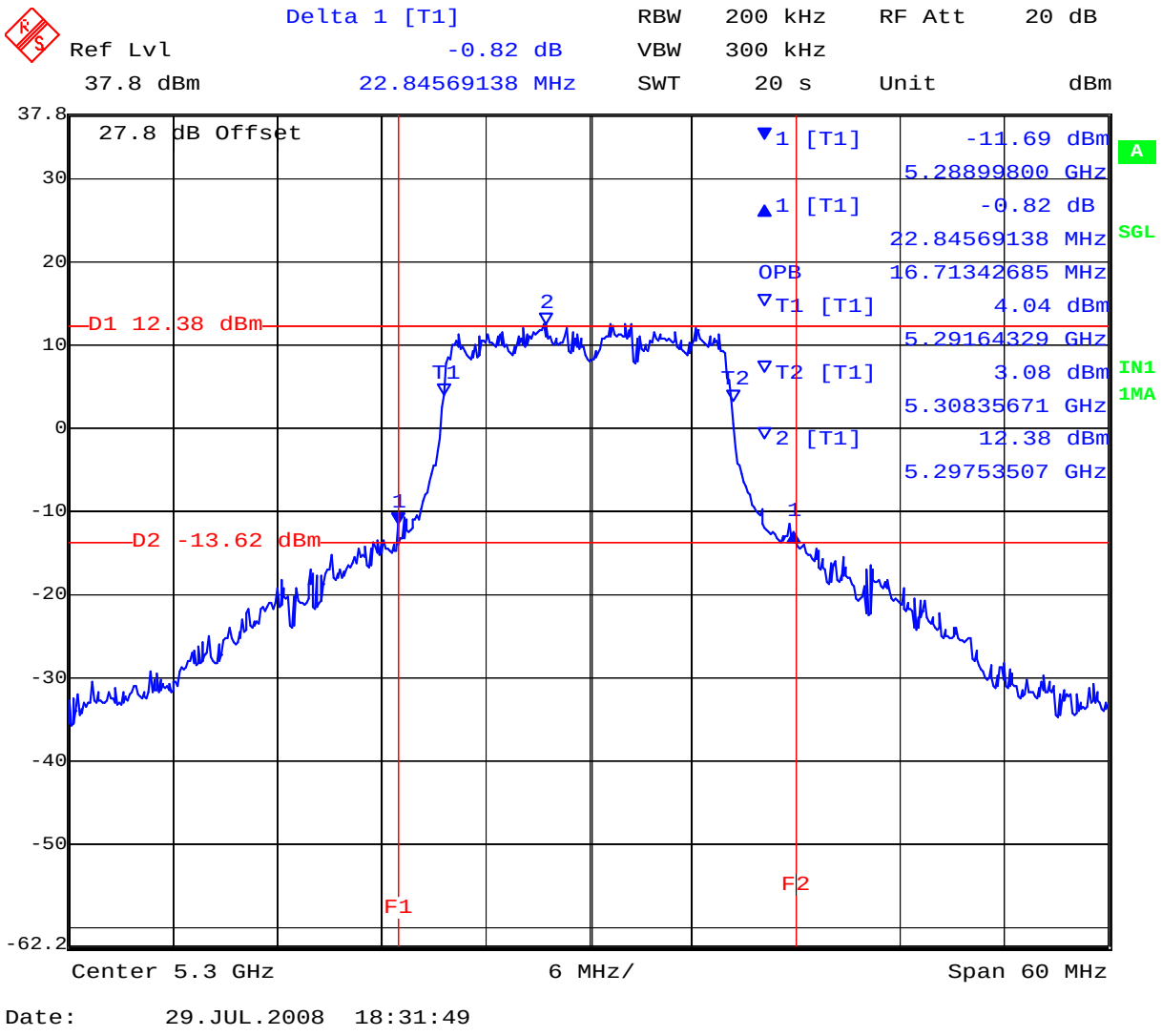
TABLE OF RESULTS – **802.11a Legacy**

Center Frequency (MHz)	26 dB Bandwidth (MHz)	99 % BW (MHz)
5,260	22.846	16.713
5,300	22.846	16.713
5,320	22.846	16.593

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



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



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

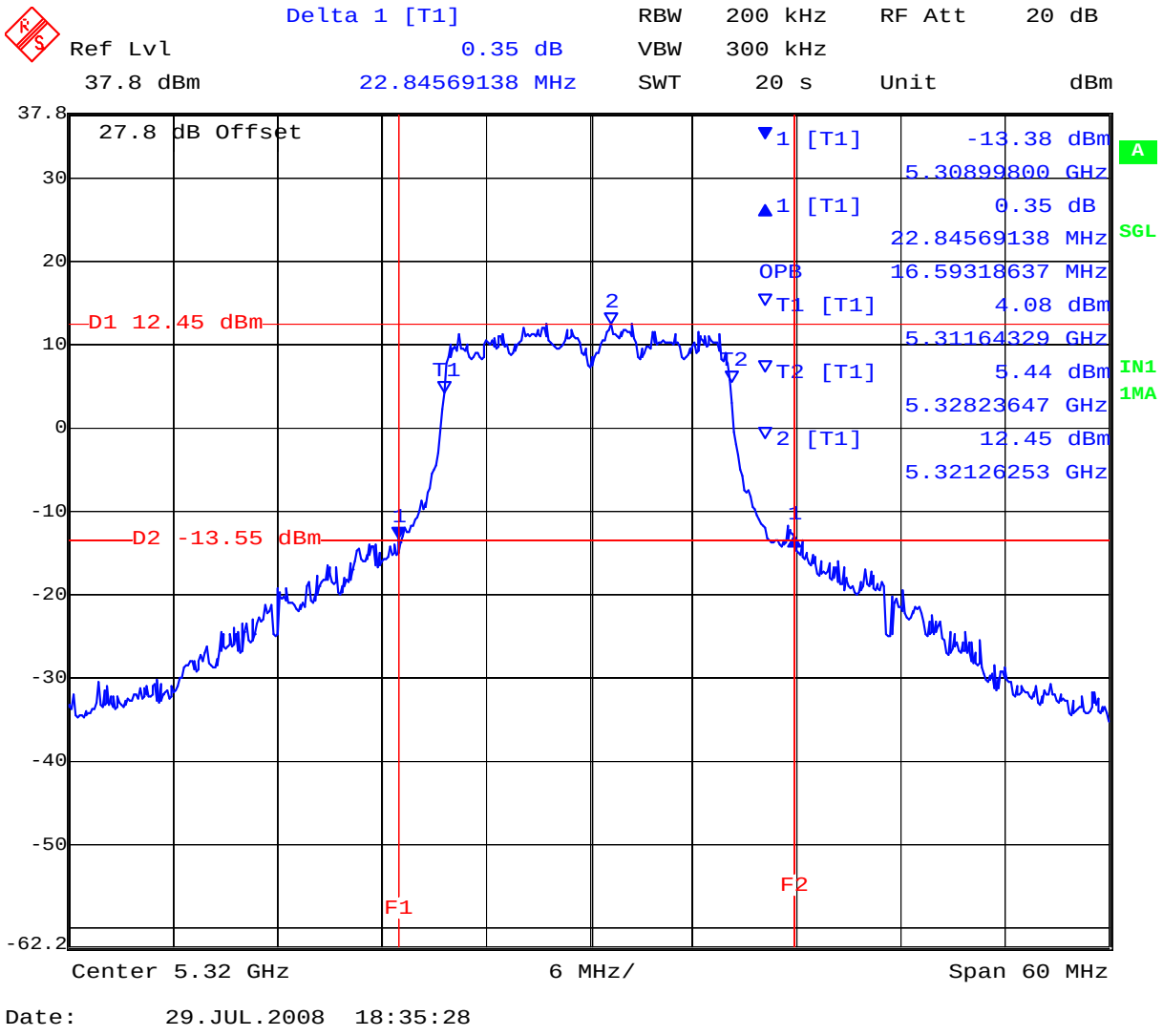
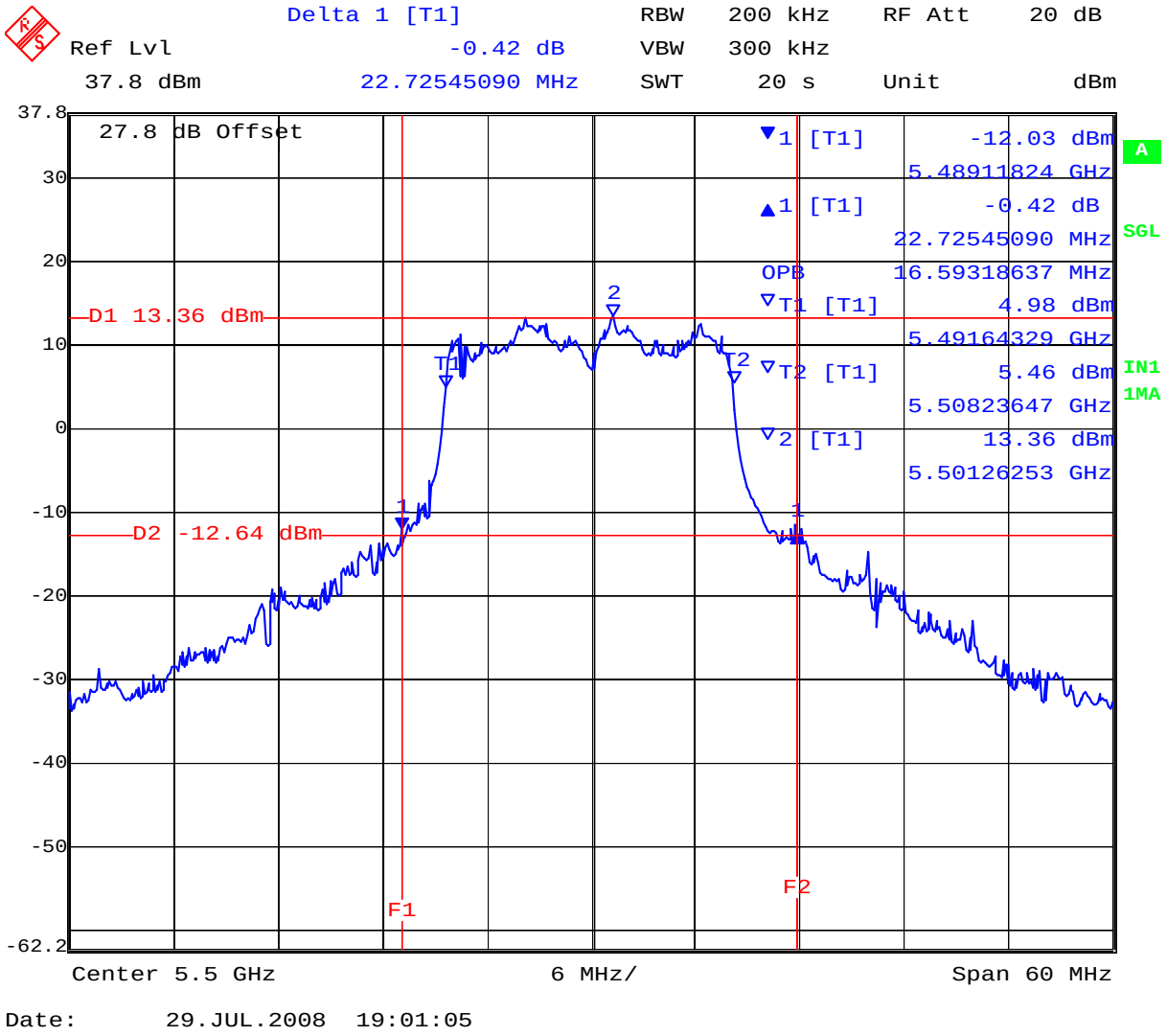


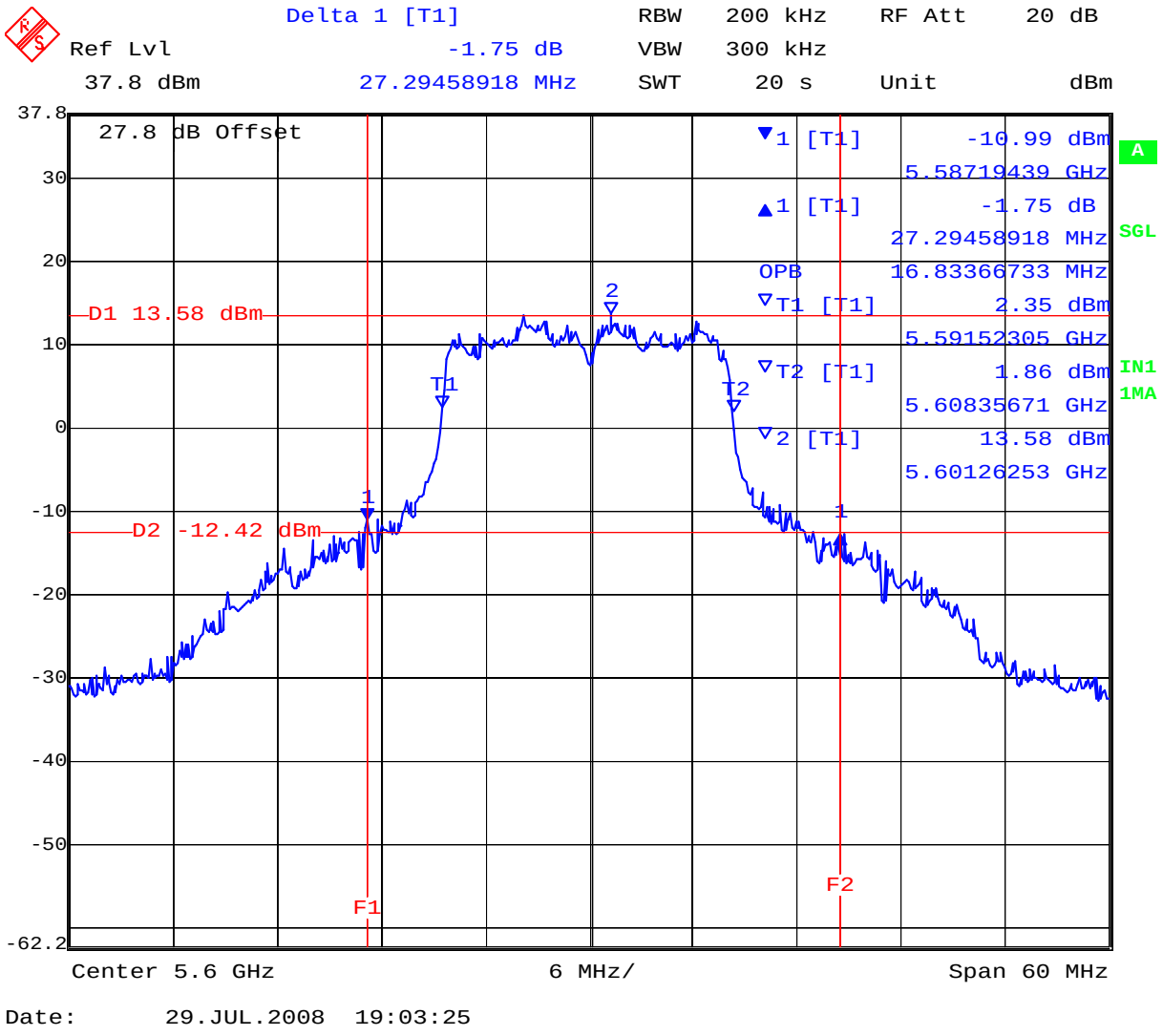
TABLE OF RESULTS – **802.11a Legacy**

Center Frequency (MHz)	26 dB Bandwidth (MHz)	99 % BW (MHz)
5,500	22.725	16.593
5,600	27.295	16.833
5,700	25.731	16.834

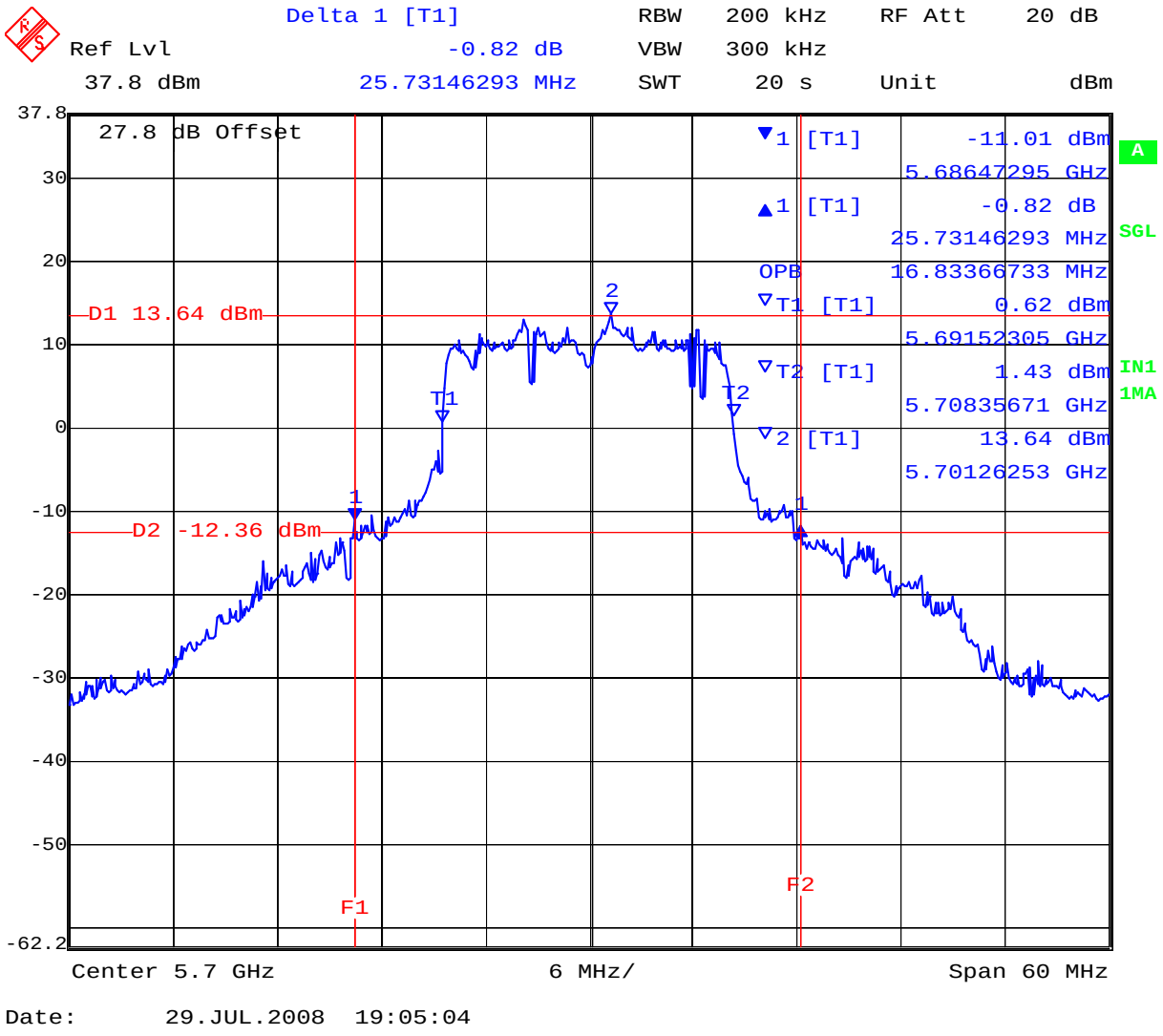
5,500 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



5,600 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



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

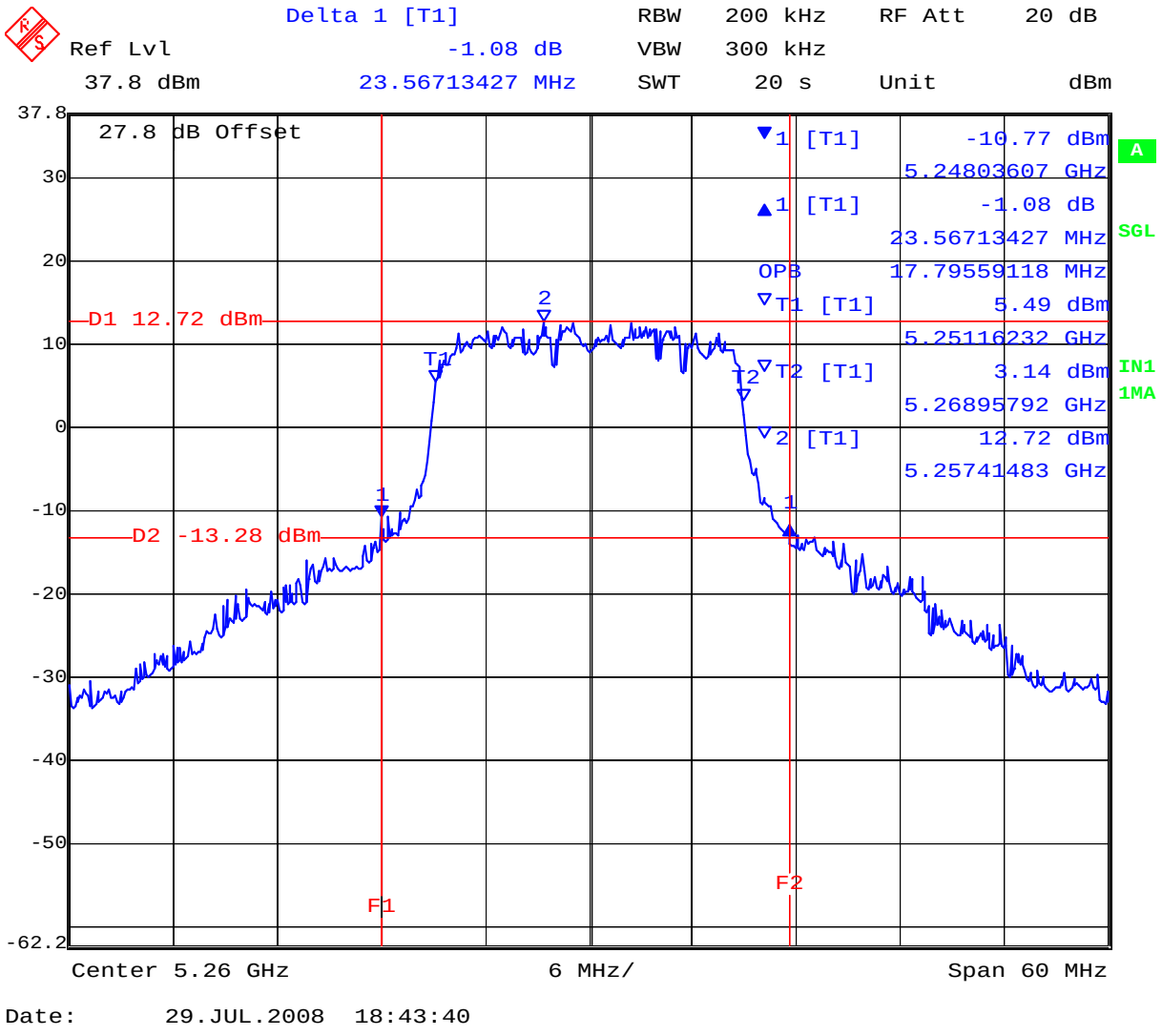


Measurement Results for 26 dB and 99 % Operational Bandwidth(s) -Continued

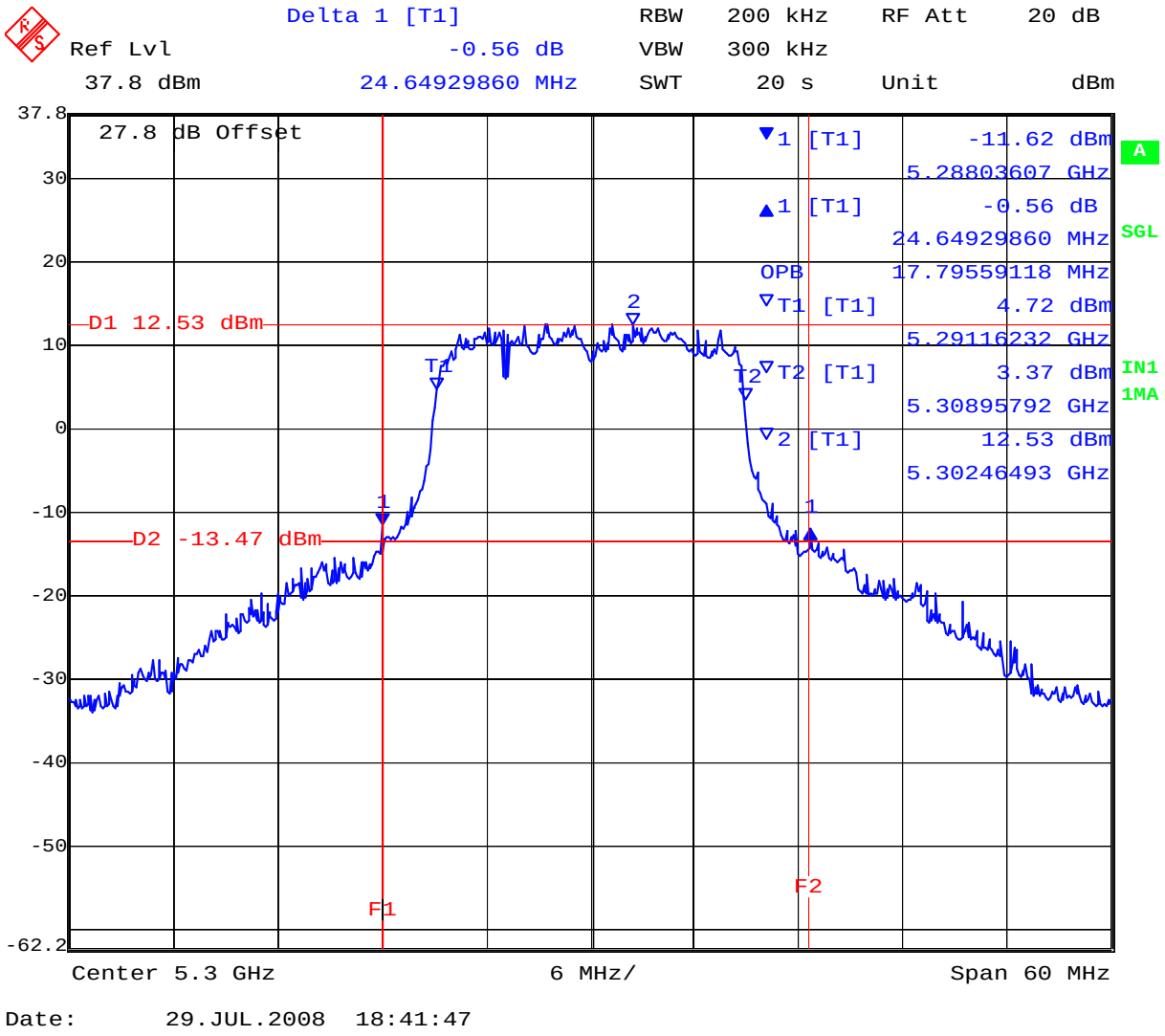
TABLE OF RESULTS – **802.11n HT20**

Center Frequency (MHz)	26 dB Bandwidth (MHz)	99 % BW (MHz)
5,260	23.567	17.796
5,300	24.649	17.796
5,320	23.567	17.796

5,260 MHz 802.11n HT20 26 dB and 99 % Bandwidth



5,300 MHz 802.11n HT20 26 dB and 99 % Bandwidth



5,320 MHz 802.11n HT20 26 dB and 99 % Bandwidth

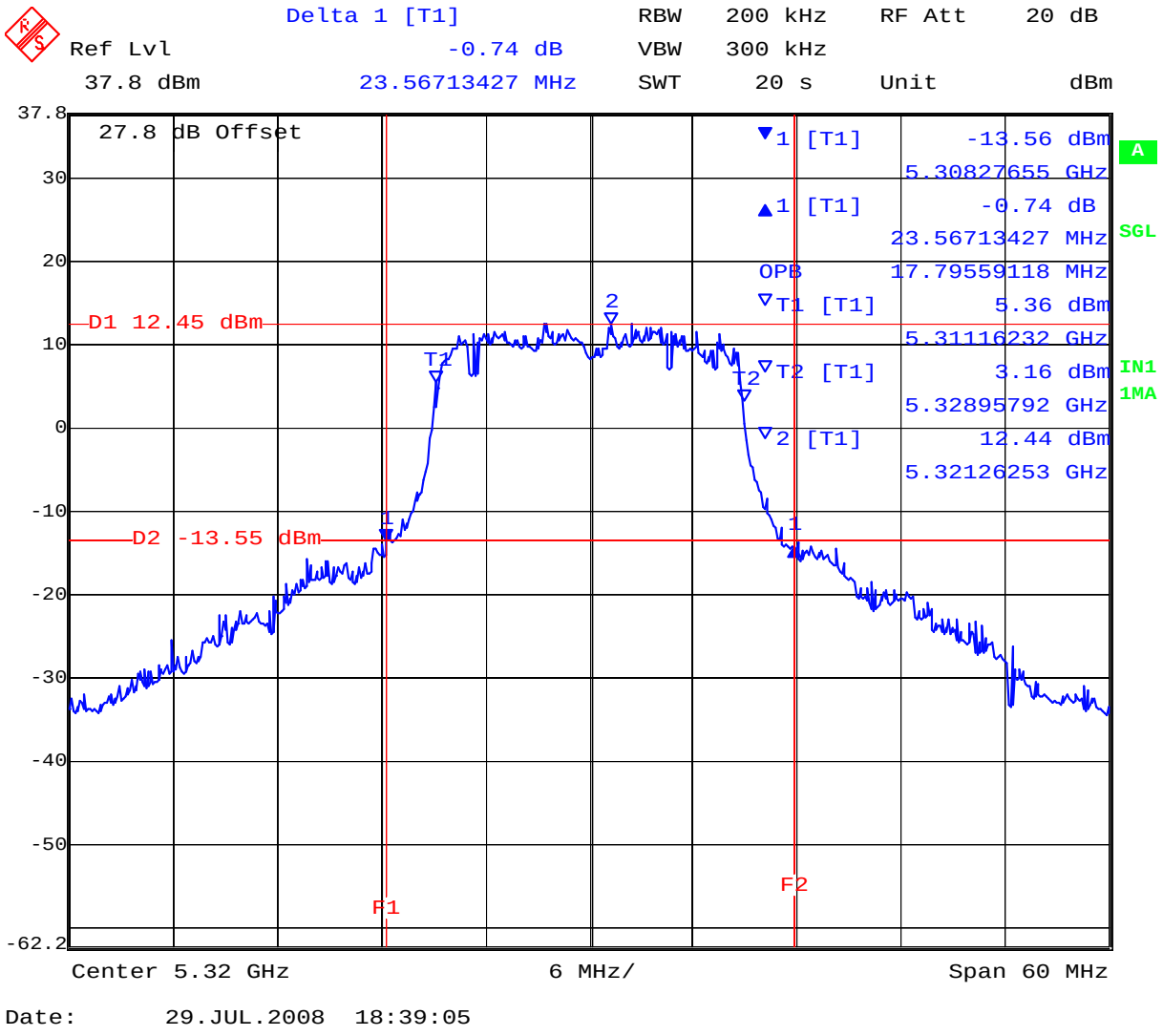
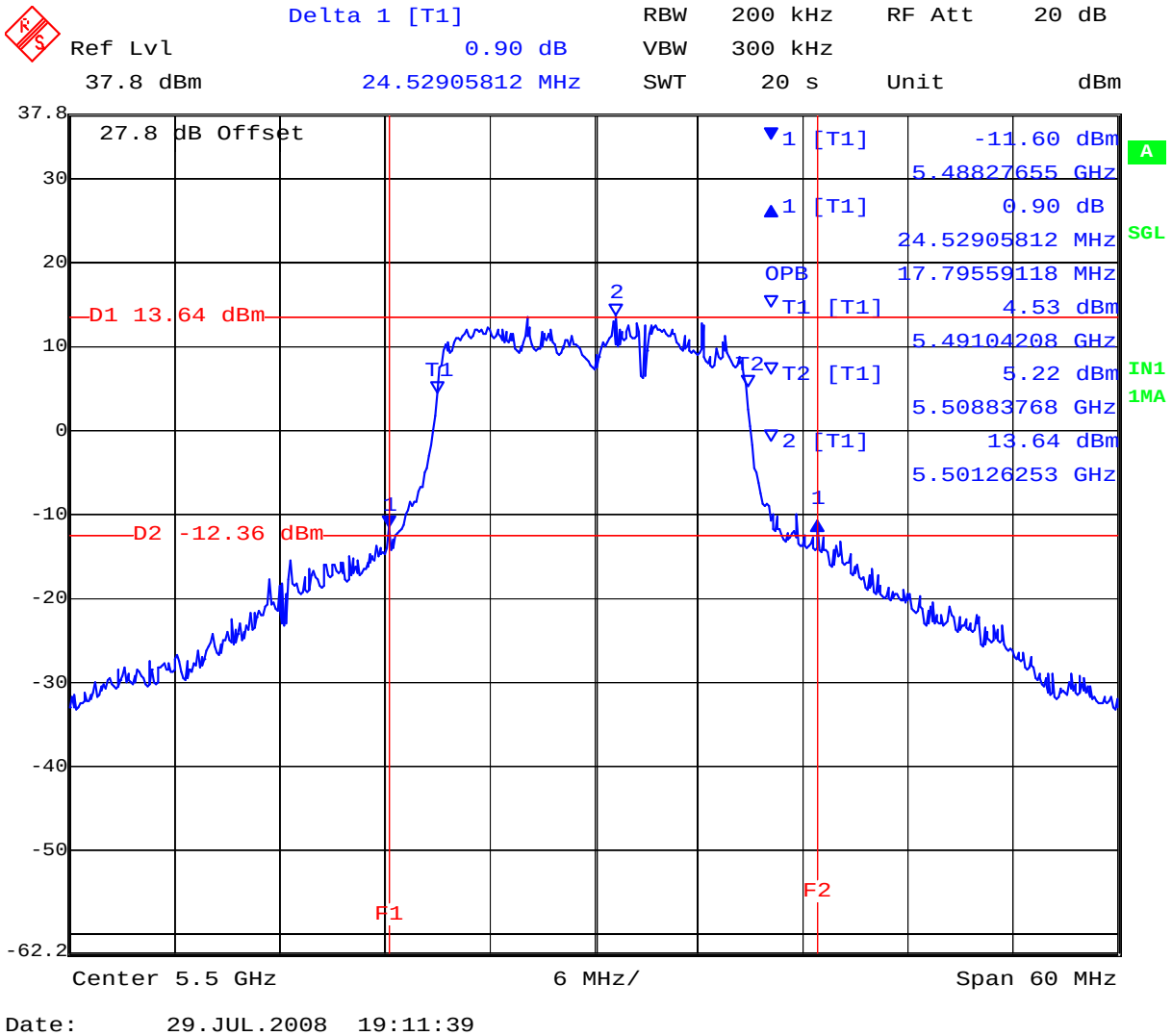


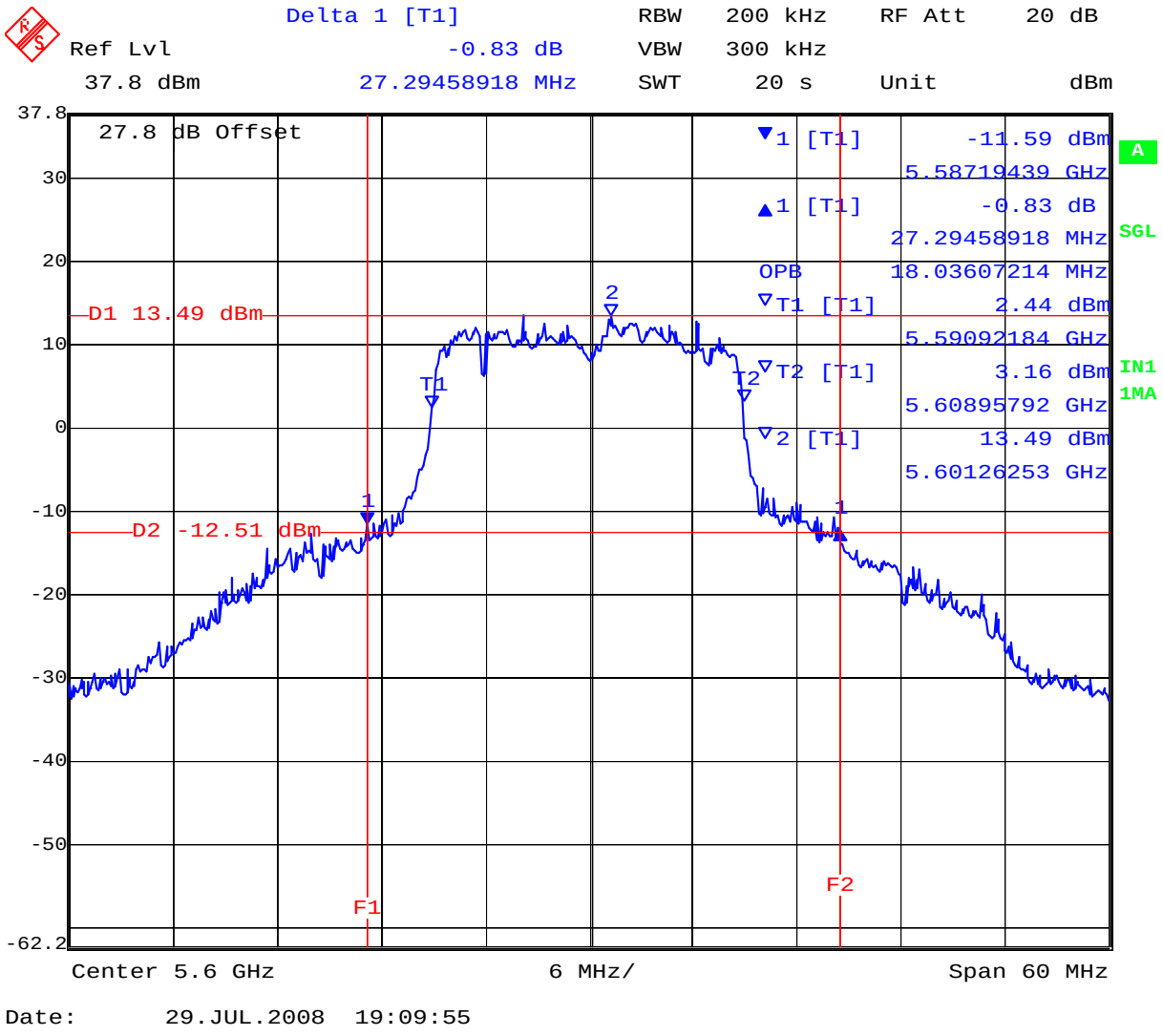
TABLE OF RESULTS – **802.11n HT20**

Center Frequency (MHz)	26 dB Bandwidth (MHz)	99 % BW (MHz)
5,500	24.529	17.796
5,600	27.295	18.036
5,700	29.339	18.036

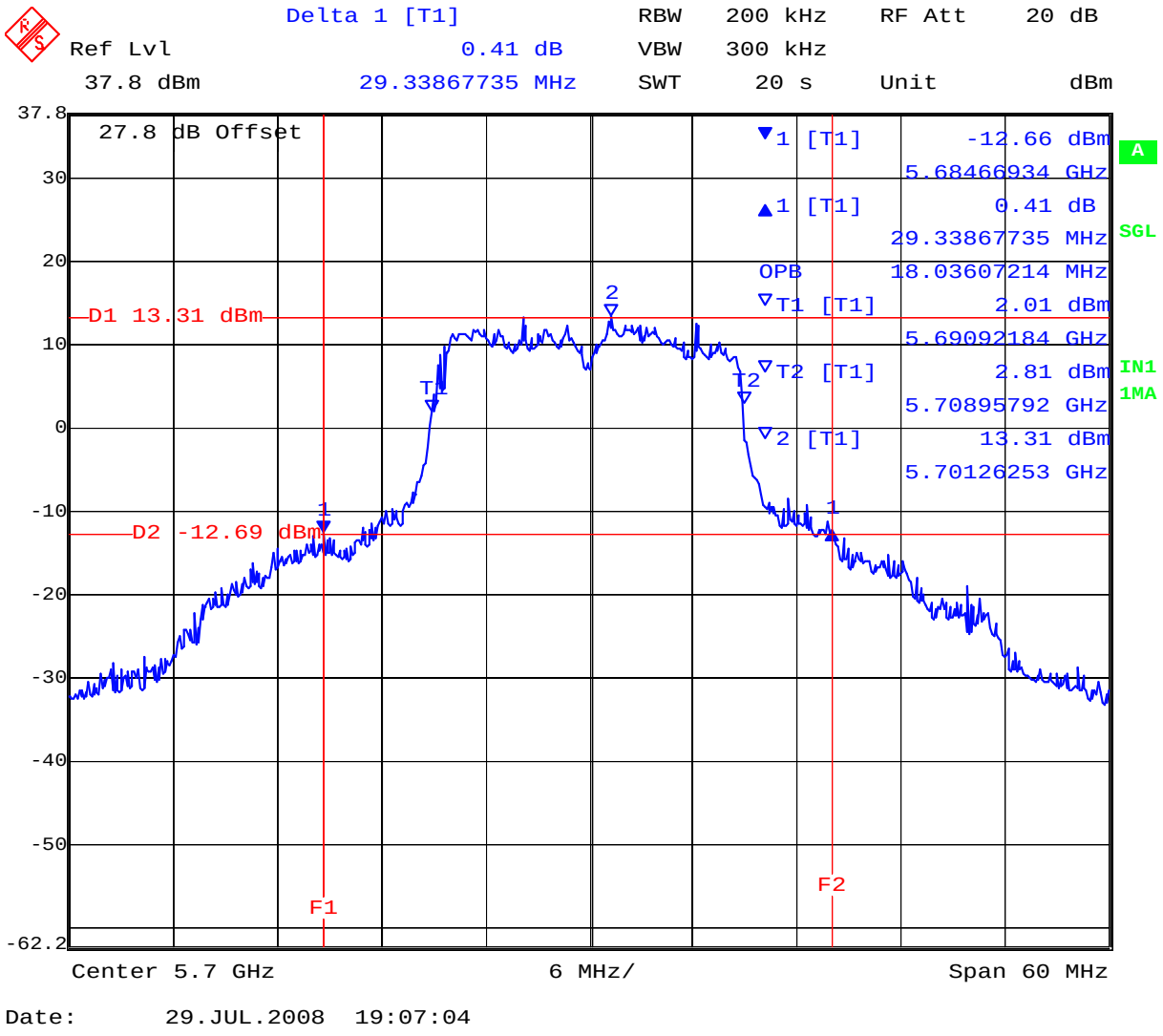
5,500 MHz 802.11n HT20 26 dB and 99 % Bandwidth



5,600 MHz 802.11n HT20 26 dB and 99 % Bandwidth



5,700 MHz 802.11n HT20 26 dB and 99 % Bandwidth

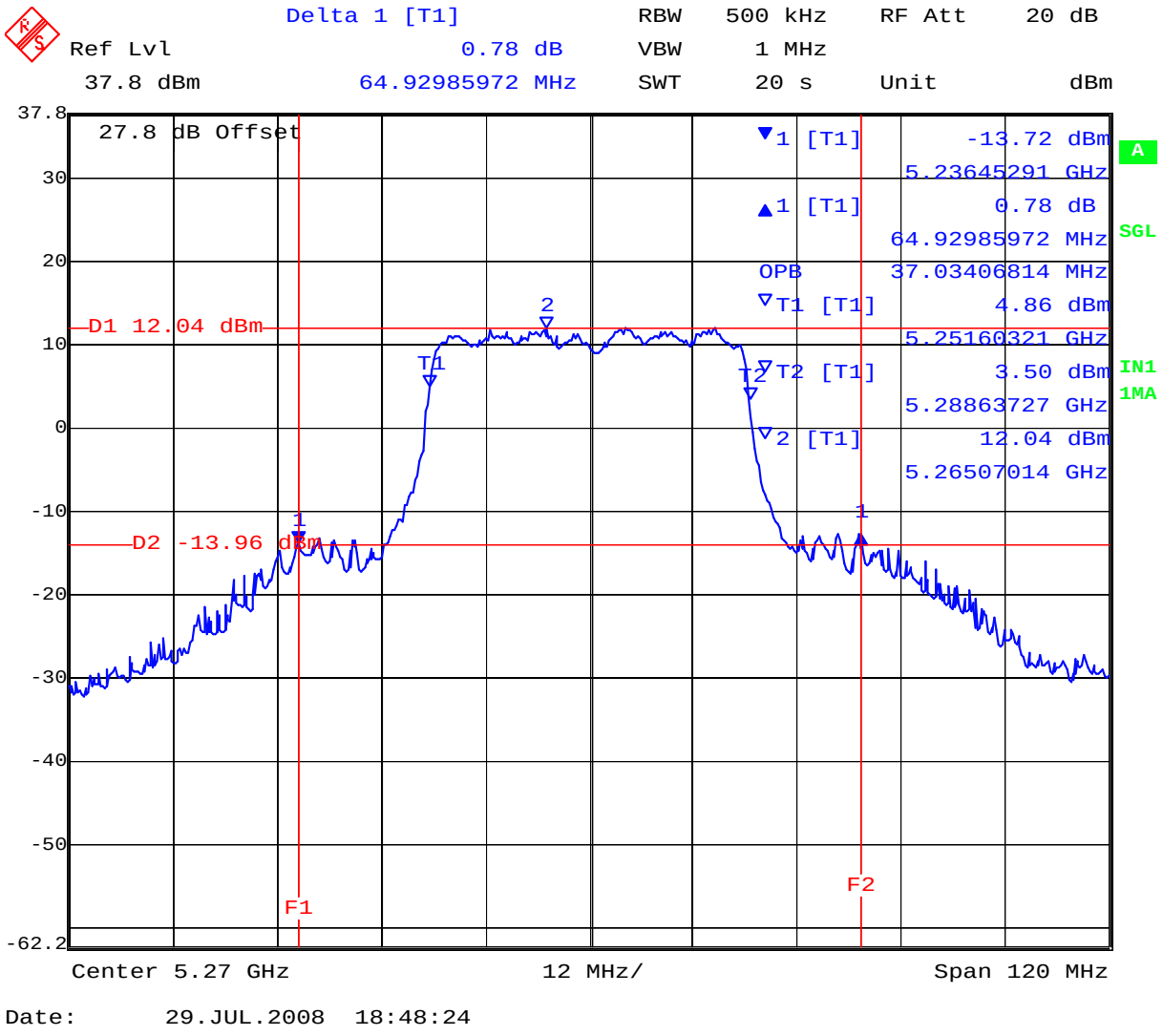


Measurement Results for 26 dB and 99 % Operational Bandwidth(s) -Continued

TABLE OF RESULTS – **802.11n HT40**

Center Frequency (MHz)	26 dB Bandwidth (MHz)	99 % BW (MHz)
5,270	64.930	37.034
5,310	64.689	36.794

5,270 MHz 802.11n HT40 26 dB and 99 % Bandwidth



5,310 MHz 802.11n HT40 26 dB and 99 % Bandwidth

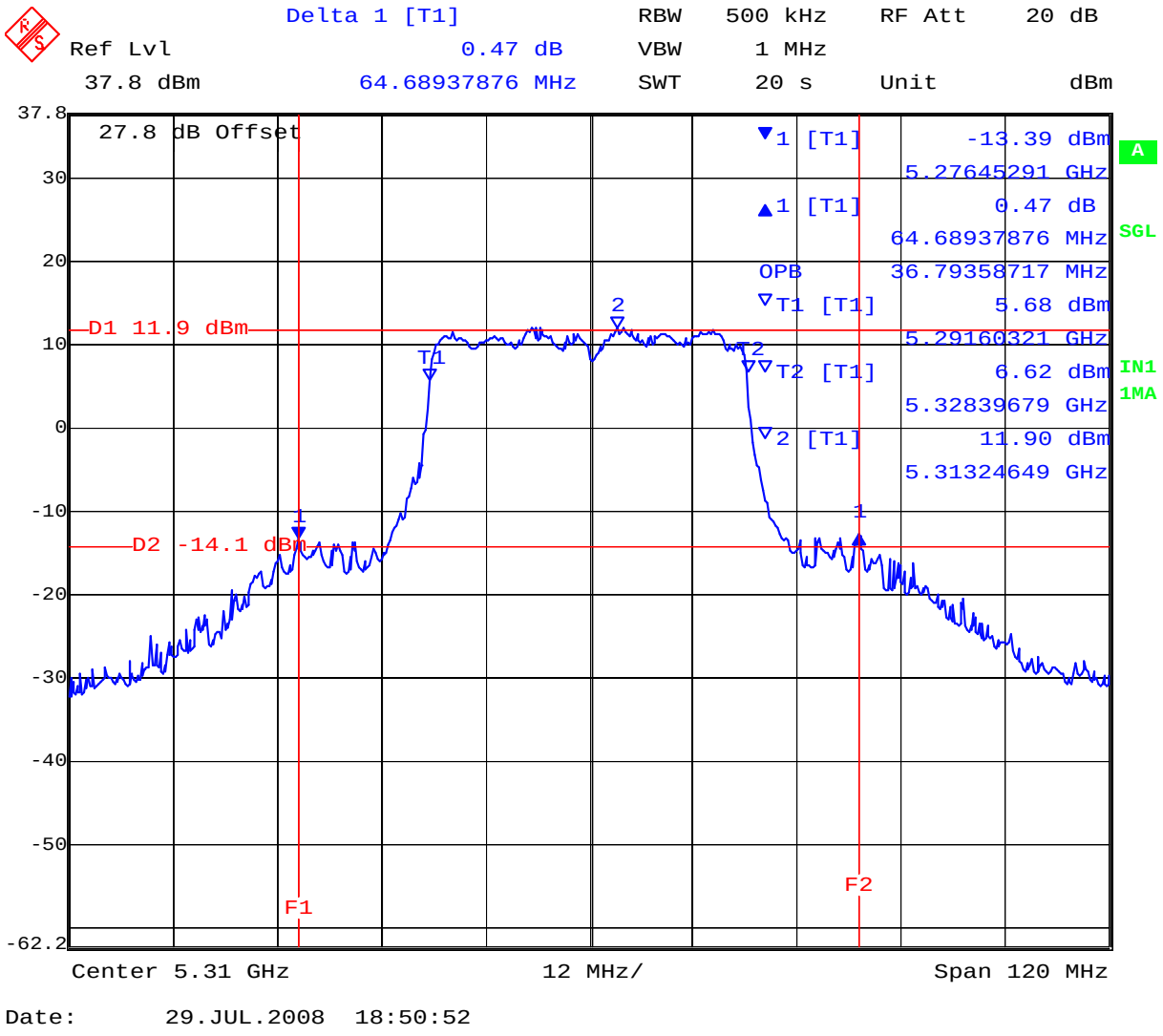
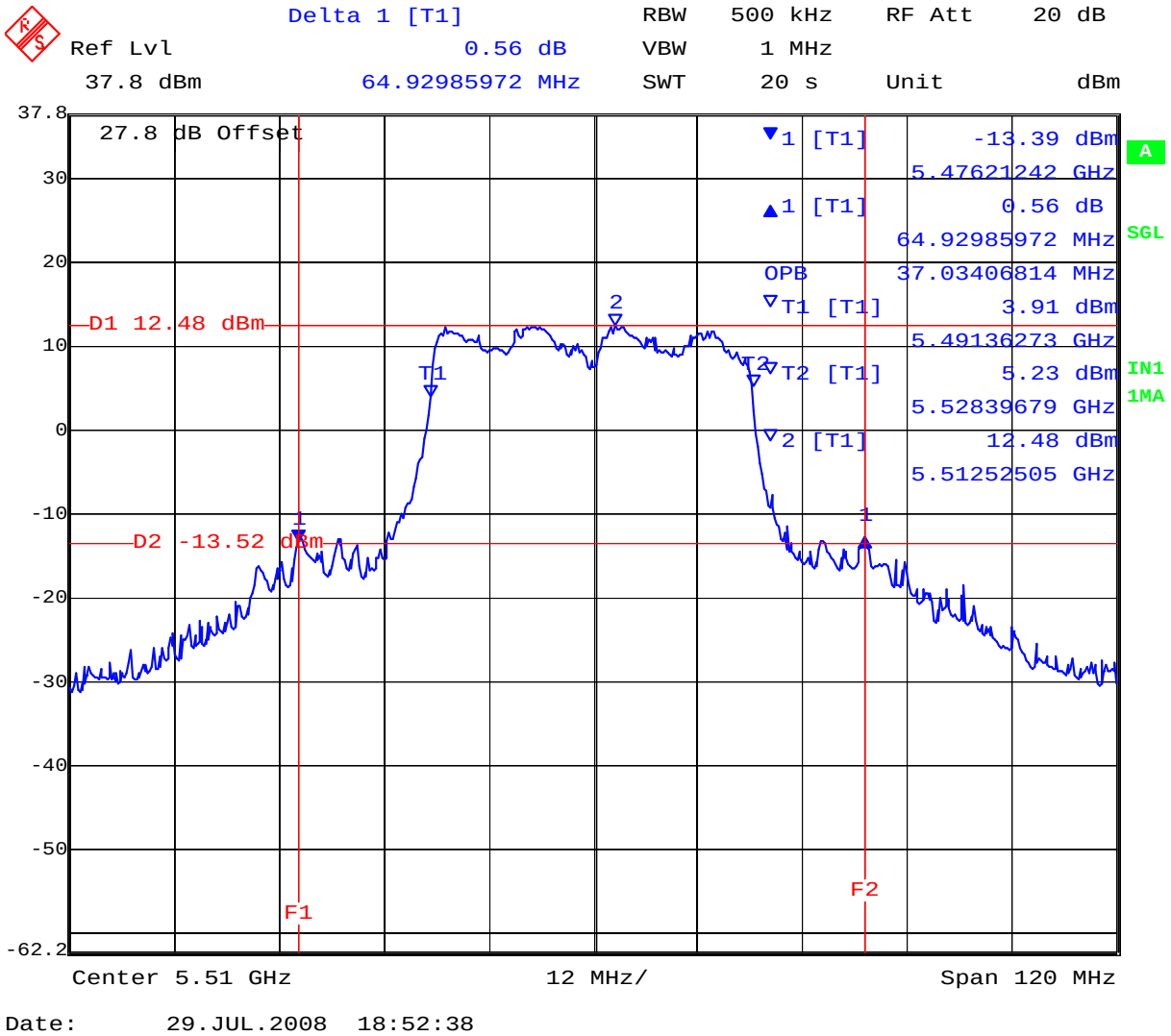


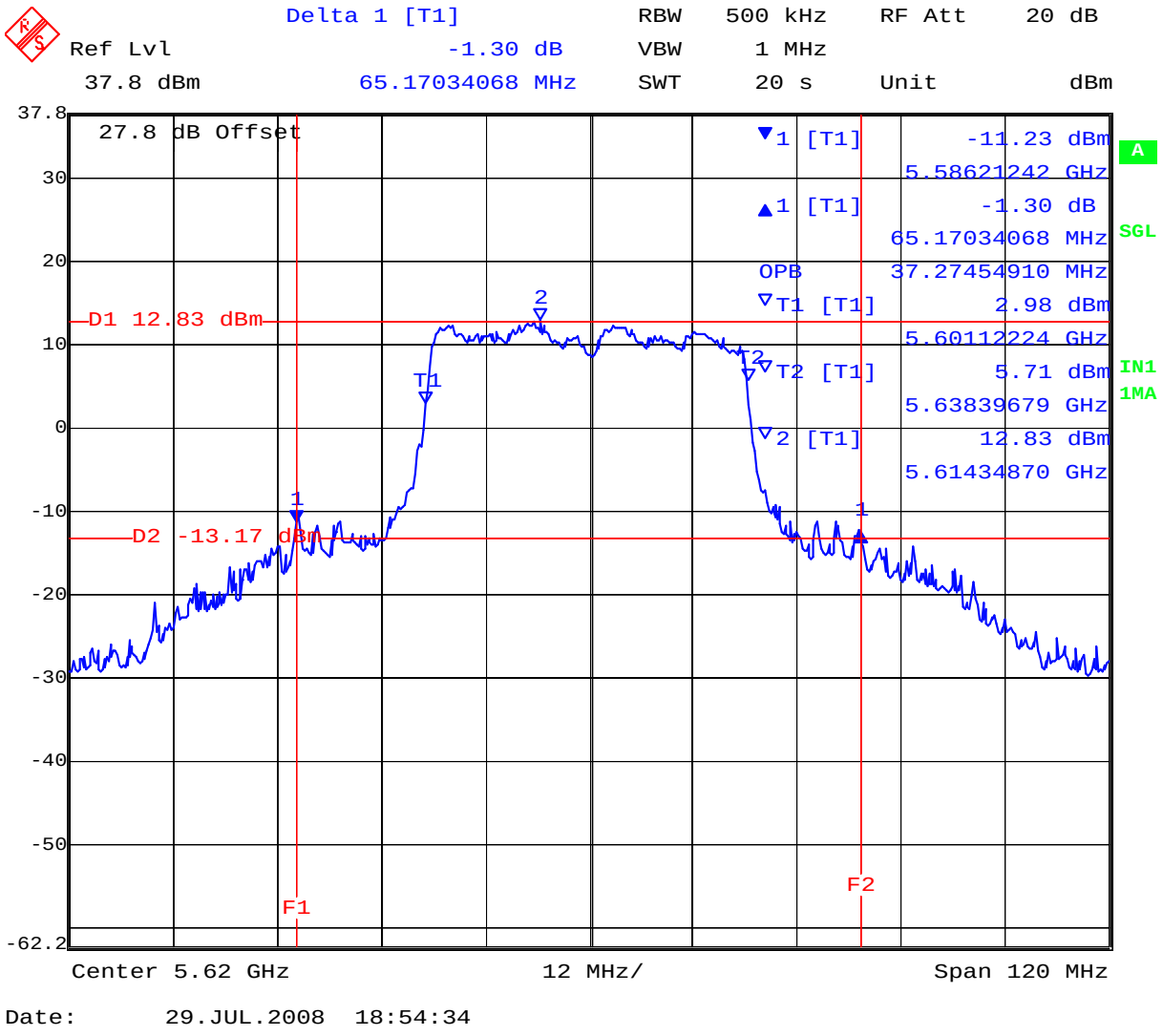
TABLE OF RESULTS – **802.11n HT40**

Center Frequency (MHz)	26 dB Bandwidth (MHz)	99 % BW (MHz)
5,510	64.930	37.034
5,620	65.170	37.275
5,690	64.689	37.275

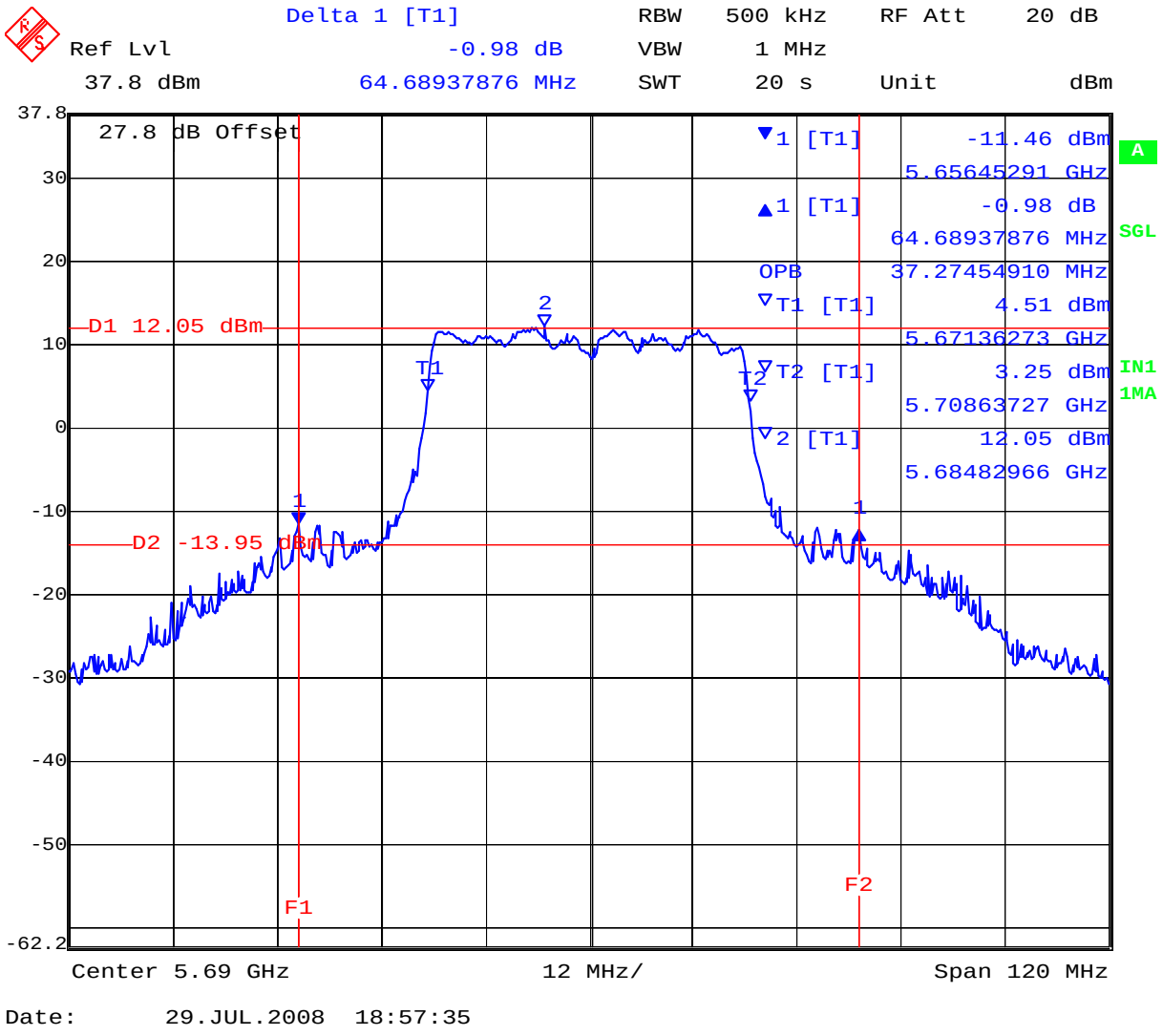
5,510 MHz 802.11n HT40 26 dB and 99 % Bandwidth



5,620 MHz 802.11n HT40 26 dB and 99 % Bandwidth



5,690 MHz 802.11n HT40 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, 0193, 0252, 0313, 0314, 0070, 0116, 0117

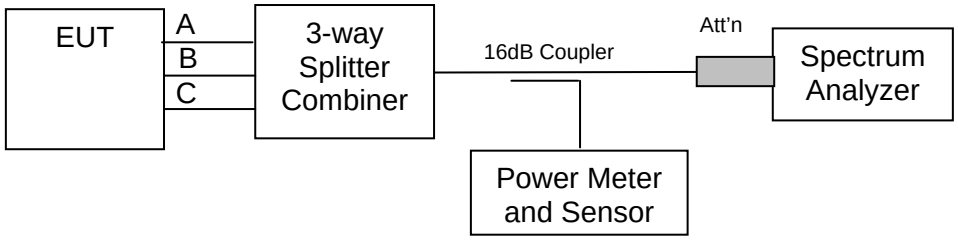
5.1.2. Transmit Output Power

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

Measurement Results for Transmit Output Power
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

EUT parameters.
Power Level: Maximum
Duty Cycle: 100%

TABLE OF RESULTS – **802.11a Legacy**

Center Frequency (MHz)	Maximum Conducted Power (dBm)
5,260	+18.8
5,300	+18.7
5,320	+18.7

TABLE OF RESULTS – **802.11a Legacy**

Center Frequency (MHz)	Maximum Conducted Power (dBm)
5,500	+19.2
5,600	+19.3
5,700	+19.1

TABLE OF RESULTS – **802.11n HT20**

Center Frequency (MHz)	Maximum Conducted Power (dBm)
5,260	+18.8
5,300	+18.7
5,320	+18.5

TABLE OF RESULTS – **802.11n HT20**

Center Frequency (MHz)	Maximum Conducted Power (dBm)
5,500	+19.2
5,600	+19.2
5,700	+19.1

TABLE OF RESULTS – **802.11n HT40**

Center Frequency (MHz)	Maximum Conducted Power (dBm)
5,270	+17.6
5,310	+17.5

TABLE OF RESULTS – **802.11n HT40**

Center Frequency (MHz)	Maximum Conducted Power (dBm)
5,510	+17.9
5,620	+18.1
5,690	+18.1

Specification

Limits

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

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

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

Industry Canada RSS-210 §A9.2(2)

For the band 5150-5250 MHz, the maximum equivalent isotropically radiated power (e.i.r.p.) shall not exceed 200 mW or 10 + 10 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

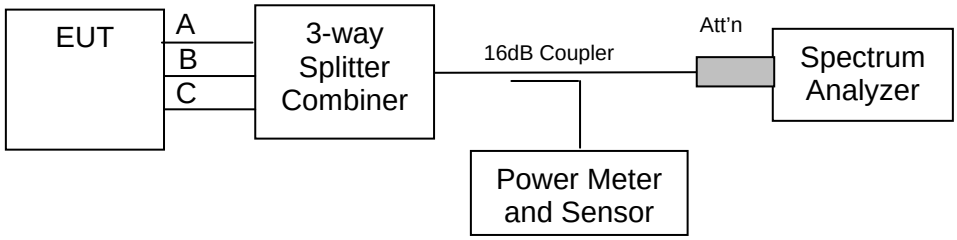
Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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

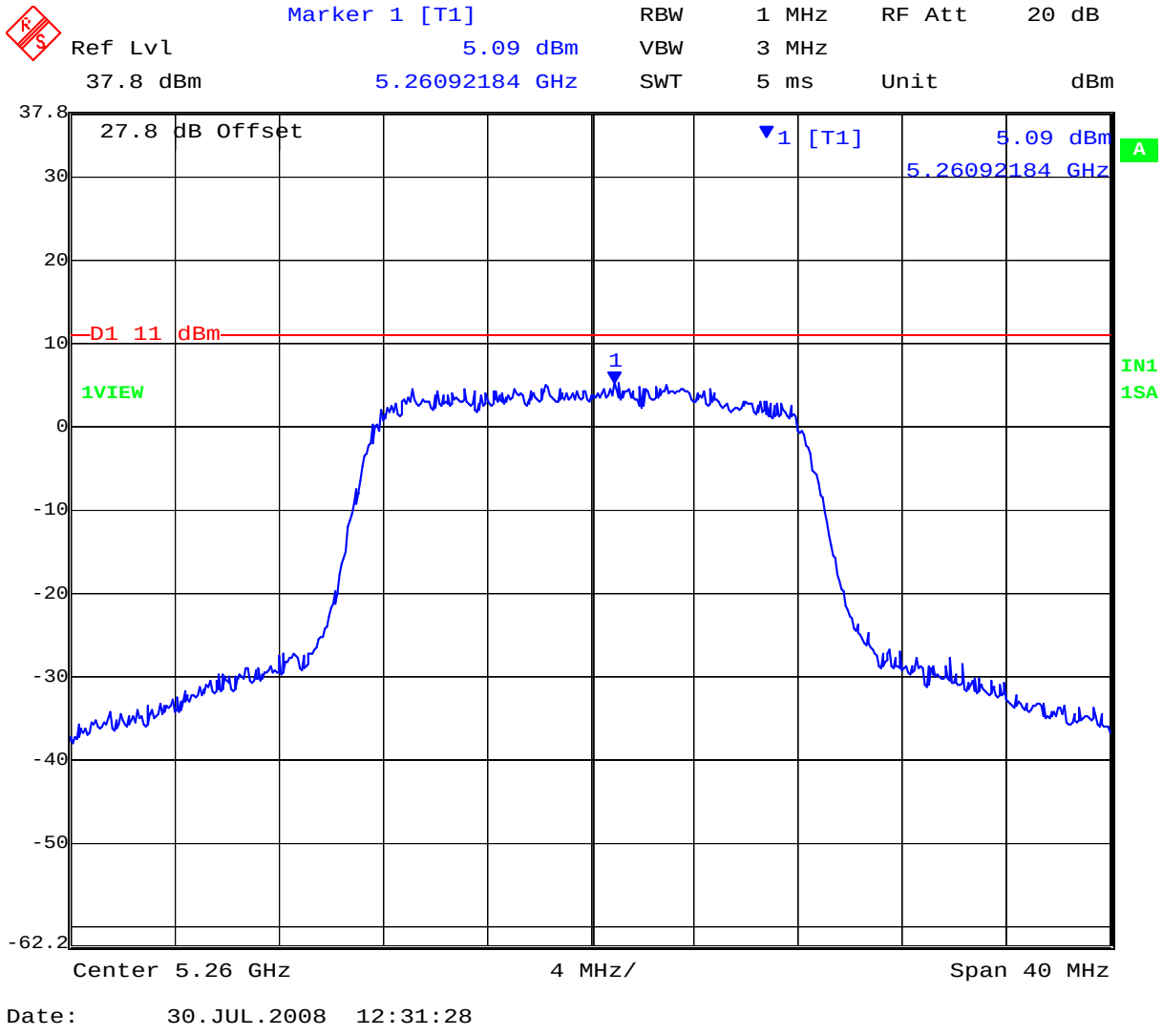
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

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

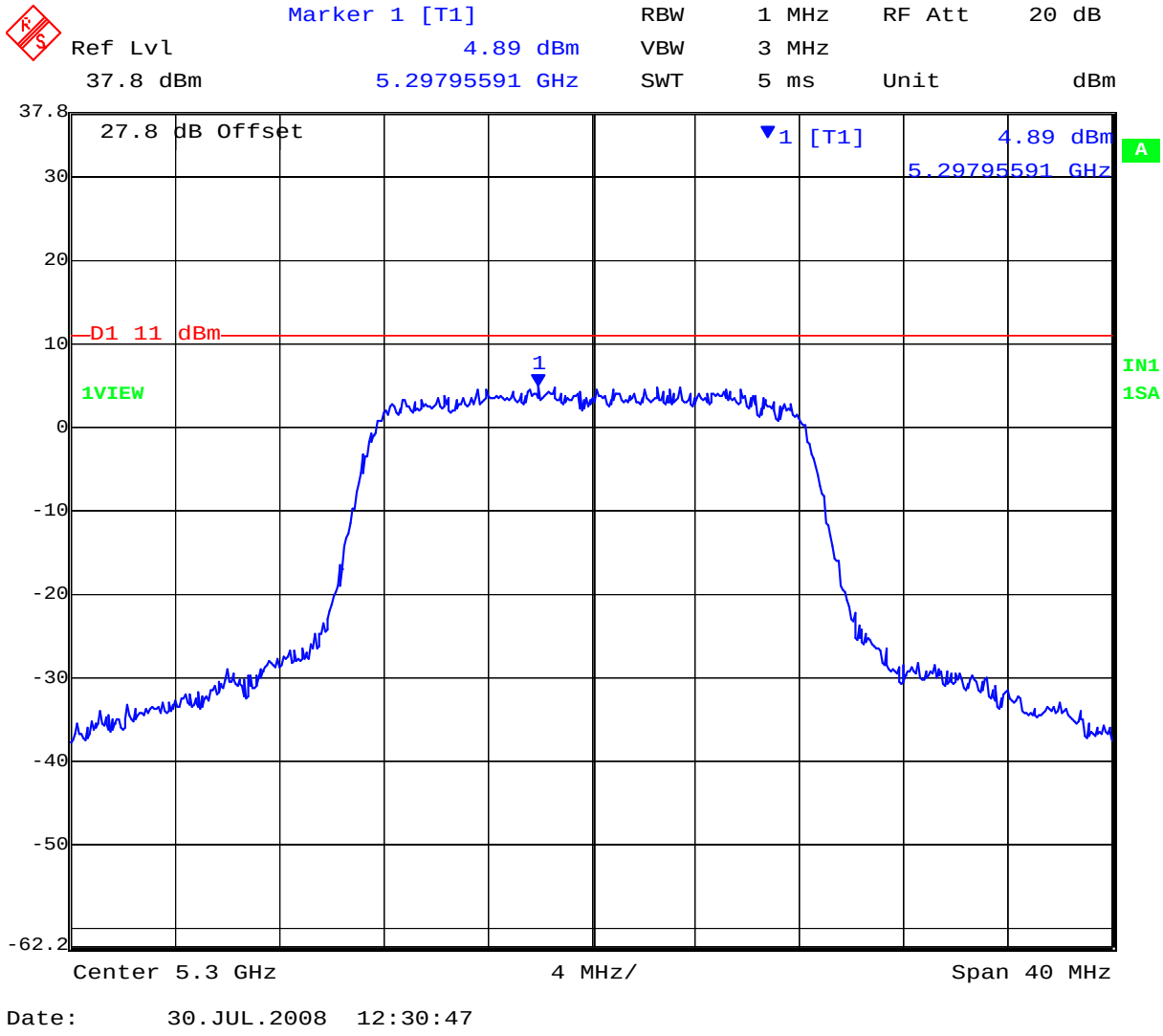
TABLE OF RESULTS – **802.11a Legacy**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)
5,260	5260.92184	+5.09
5,300	5297.95591	+4.89
5,320	5320.52104	+4.55

5,260 MHz 802.11a Legacy Peak Power Spectral Density



5,300 MHz 802.11a Legacy Peak Power Spectral Density



5,320 MHz 802.11a Legacy Peak Power Spectral Density

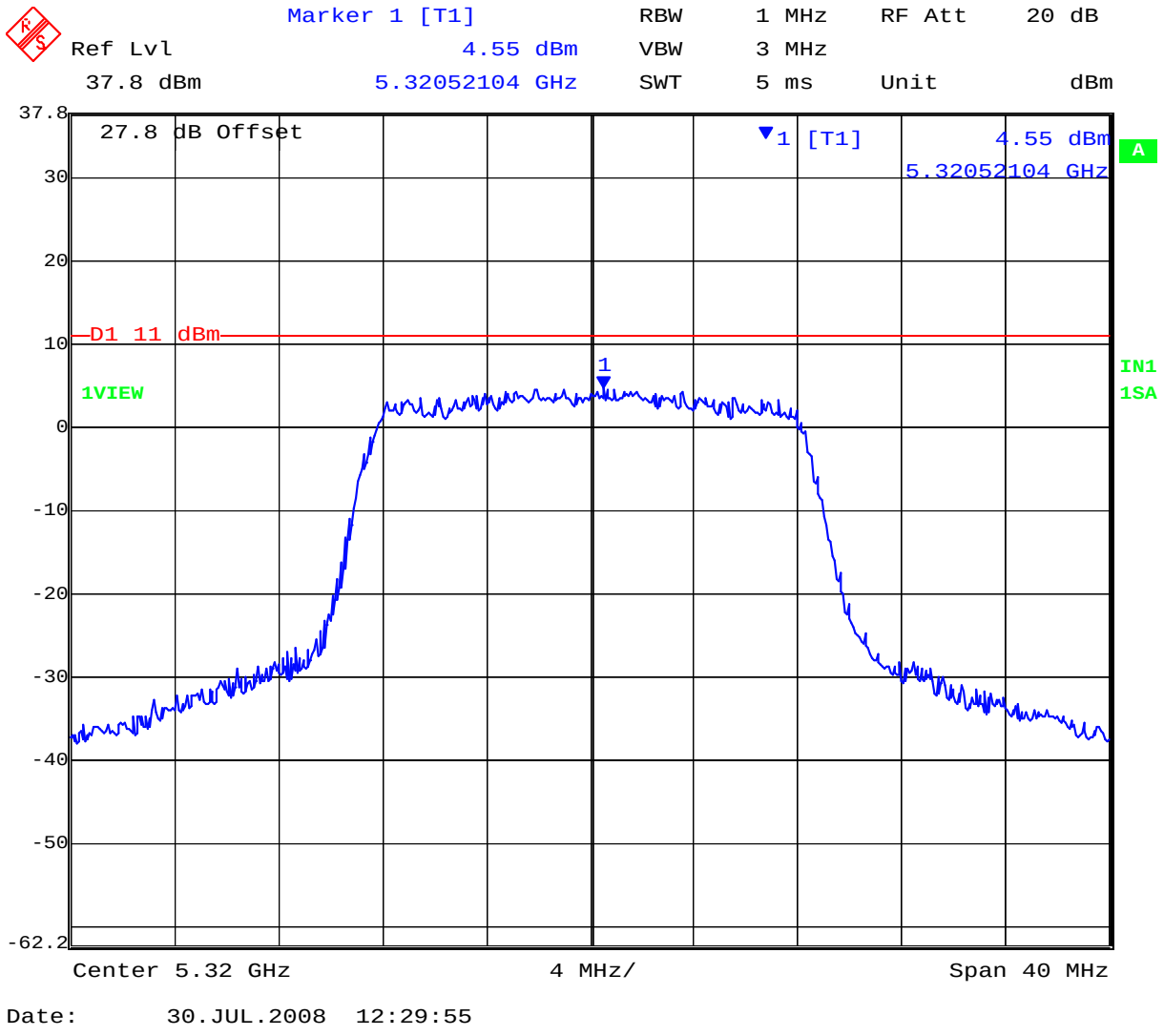
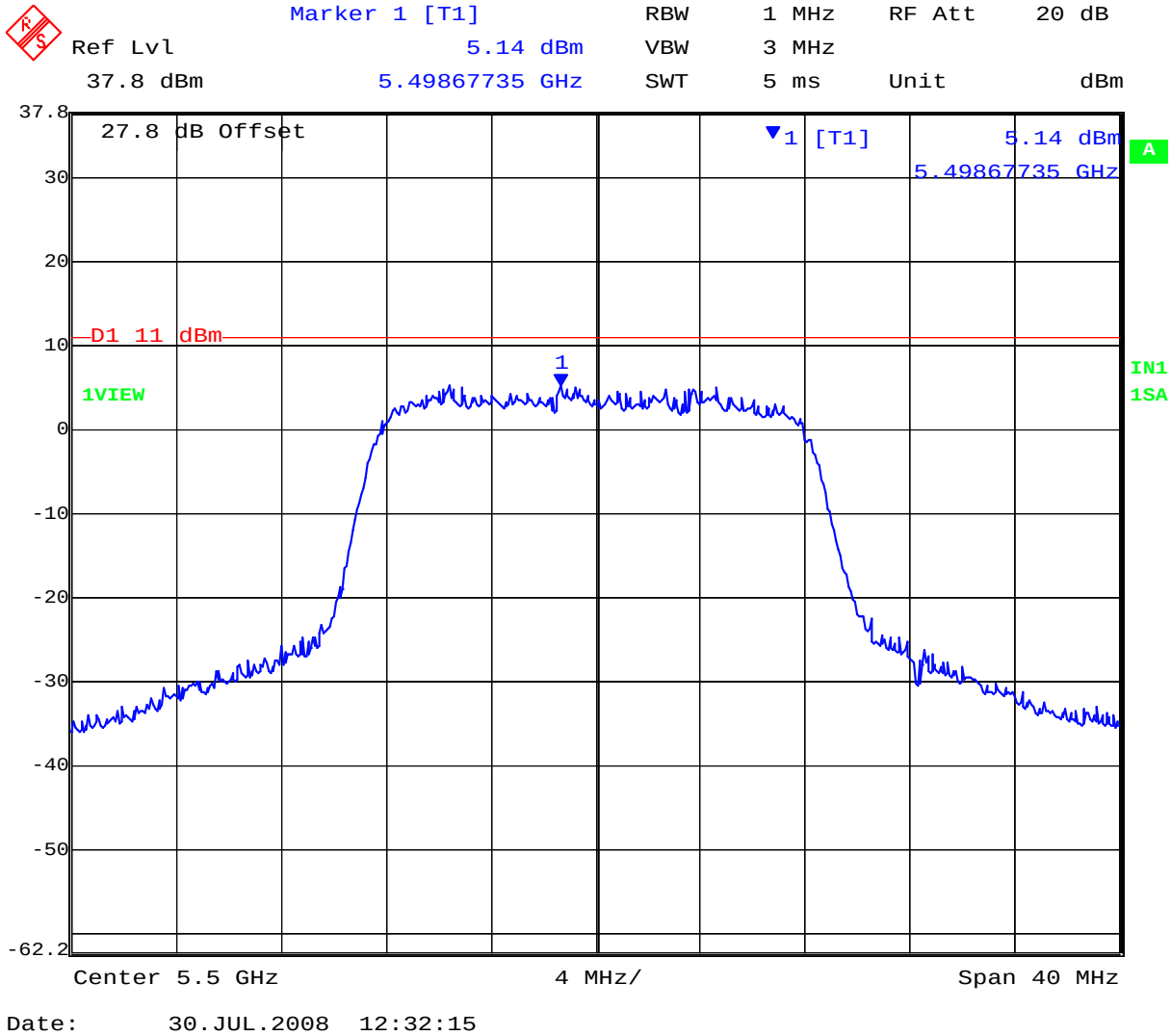


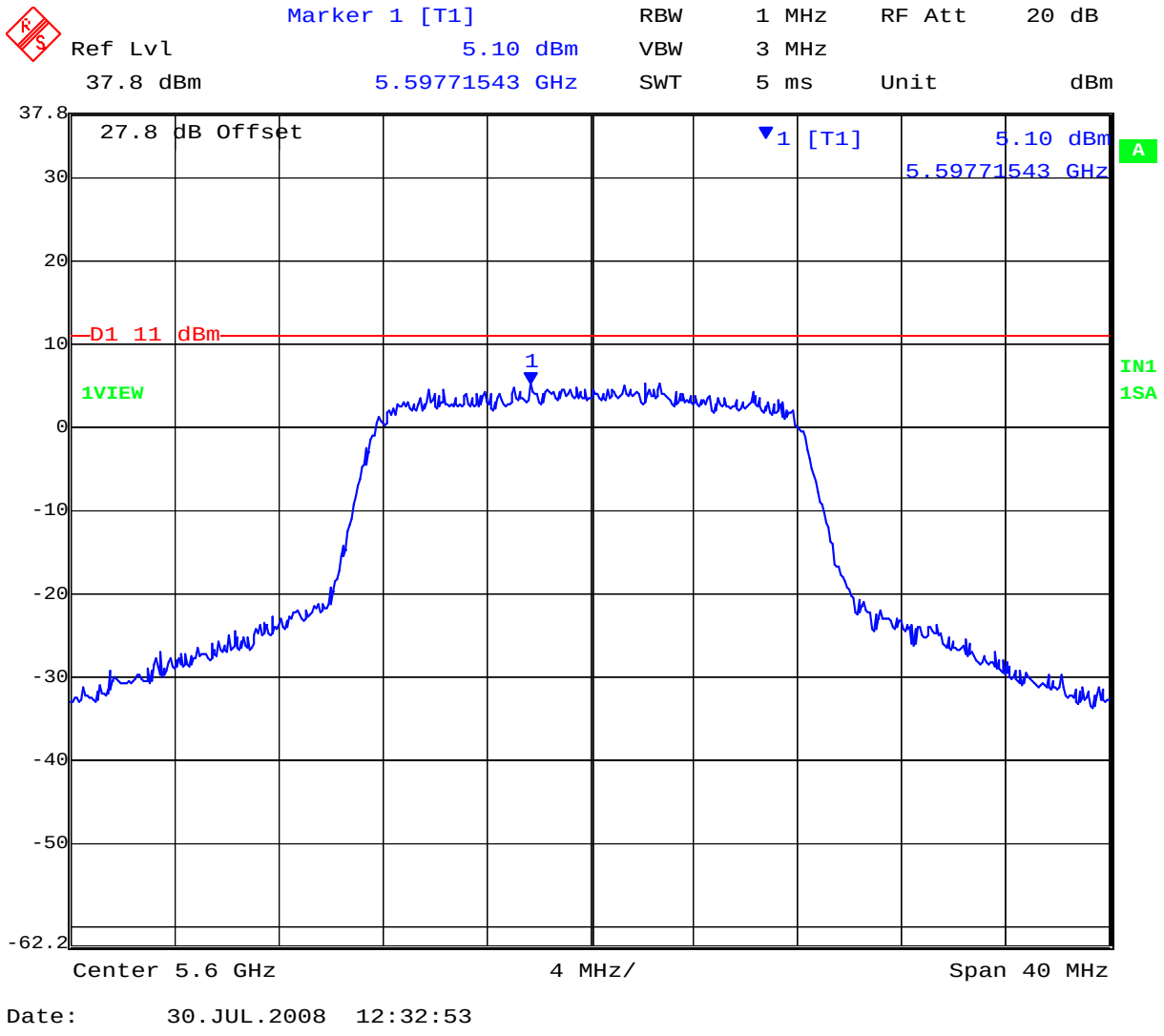
TABLE OF RESULTS – **802.11a Legacy**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)
5,500	5498.67735	+5.14
5,600	5597.71543	+5.10
5,700	5702.76553	+4.61

5,500 MHz 802.11a Legacy Peak Power Spectral Density



5,600 MHz 802.11a Legacy Peak Power Spectral Density



5,700 MHz 802.11a Legacy Peak Power Spectral Density

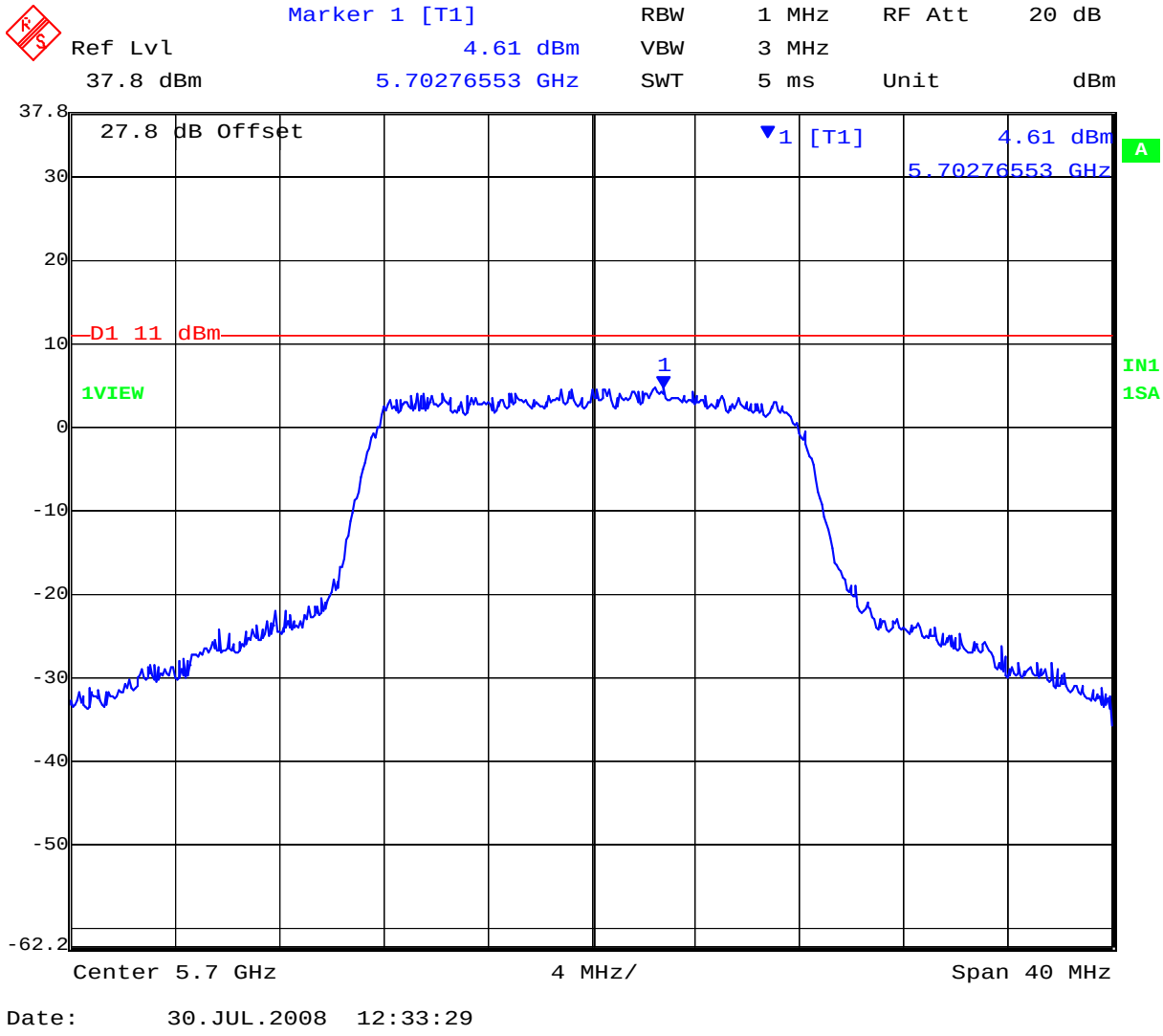


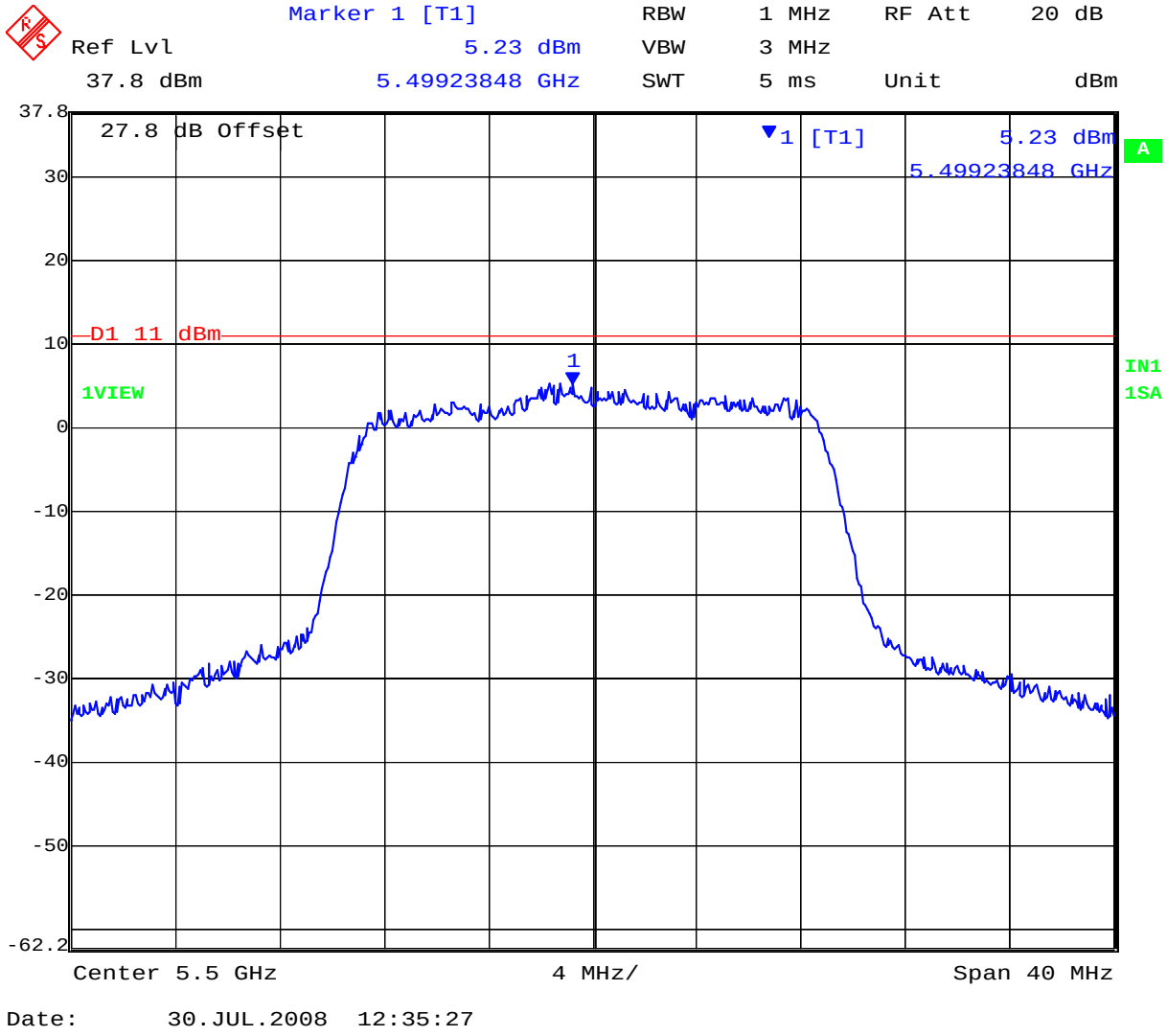
TABLE OF RESULTS – **802.11N HT20**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)
5,260	5259.29731	+4.97
5,300	5299.62109	+4.63
5,320	5321.42931	+4.71

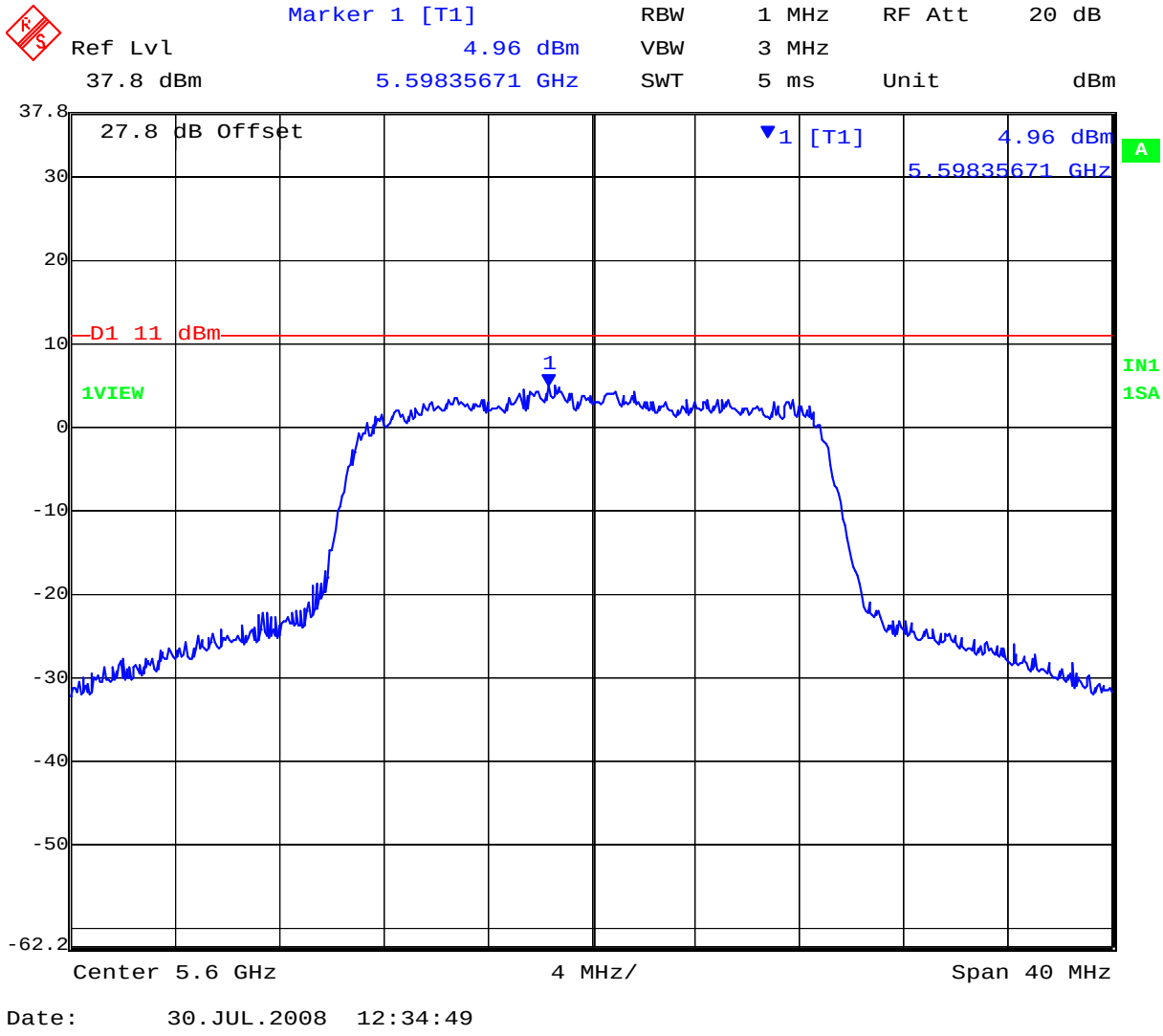
TABLE OF RESULTS – **802.11n HT20**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)
5,500	5499.23848	+5.23
5,600	5598.35671	+4.96
5,700	5700.92184	+4.38

5,500 MHz 802.11n HT20 Peak Power Spectral Density



5,600 MHz 802.11n HT20 Peak Power Spectral Density



5,700 MHz 802.11n HT20 Peak Power Spectral Density

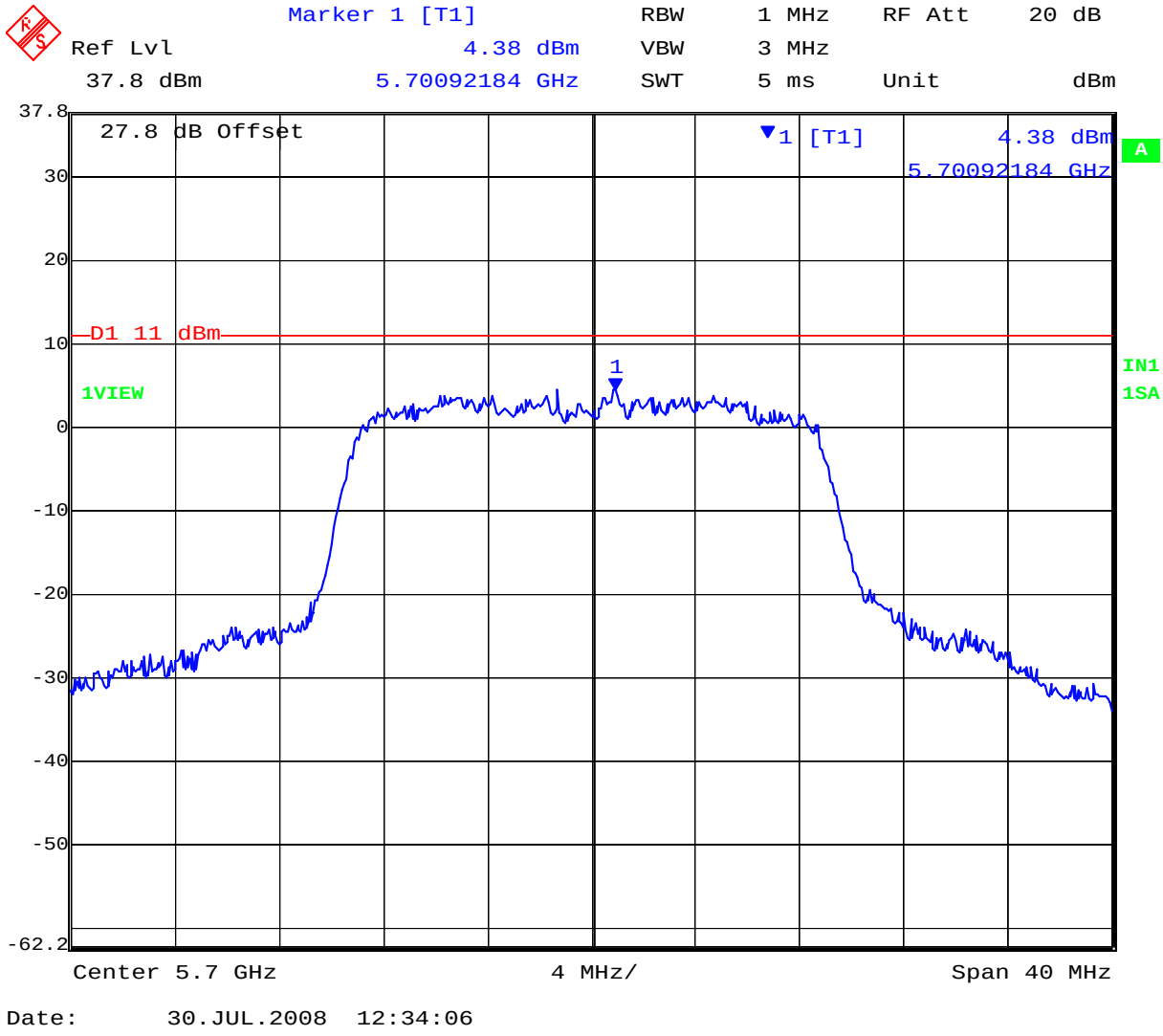
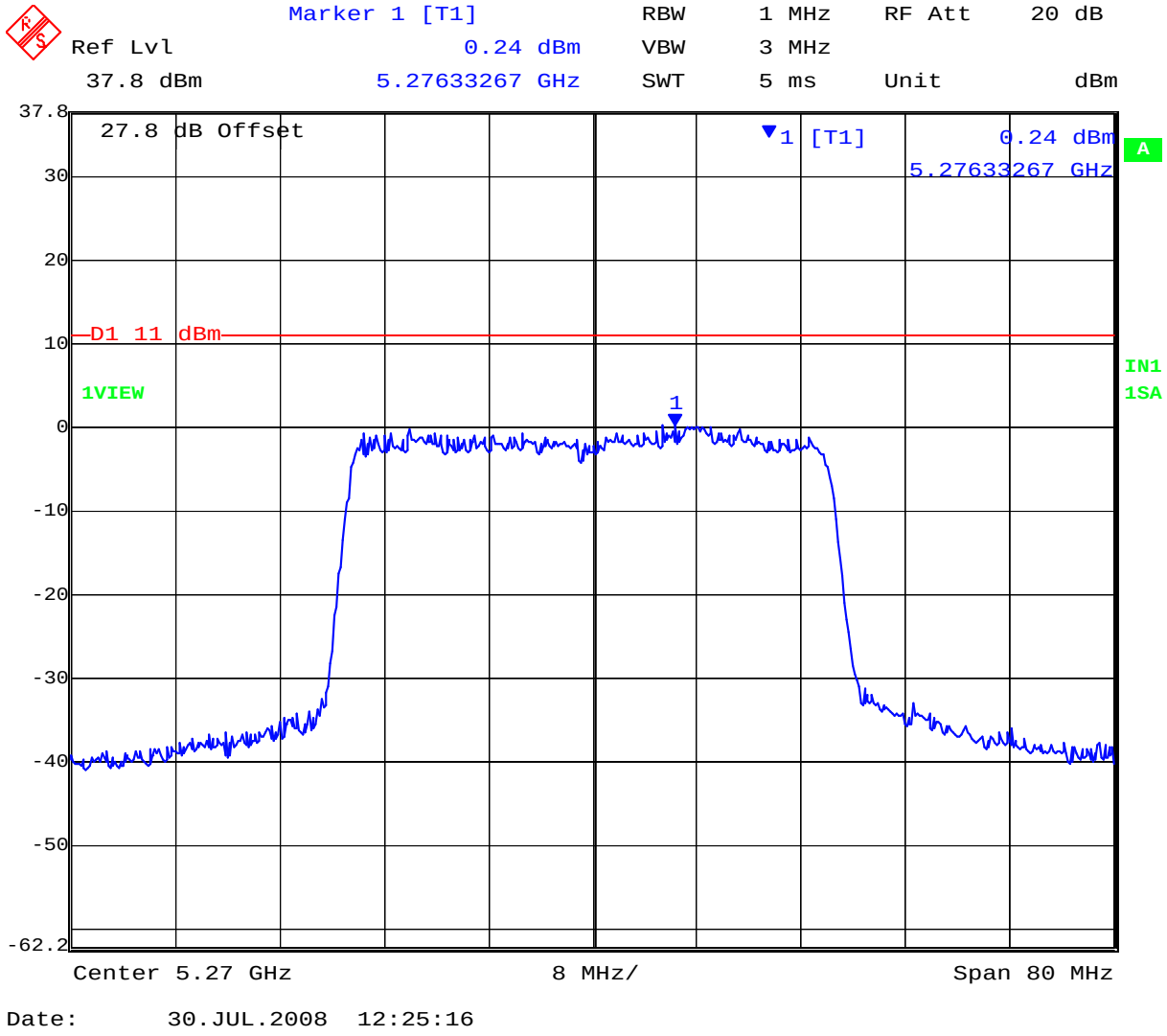


TABLE OF RESULTS – **802.11n HT40**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)
5,270	5276.33267	+0.24
5,310	5316.33267	-0.22

5,270 MHz 802.11n HT40 Peak Power Spectral Density



5,310 MHz 802.11n HT40 Peak Power Spectral Density

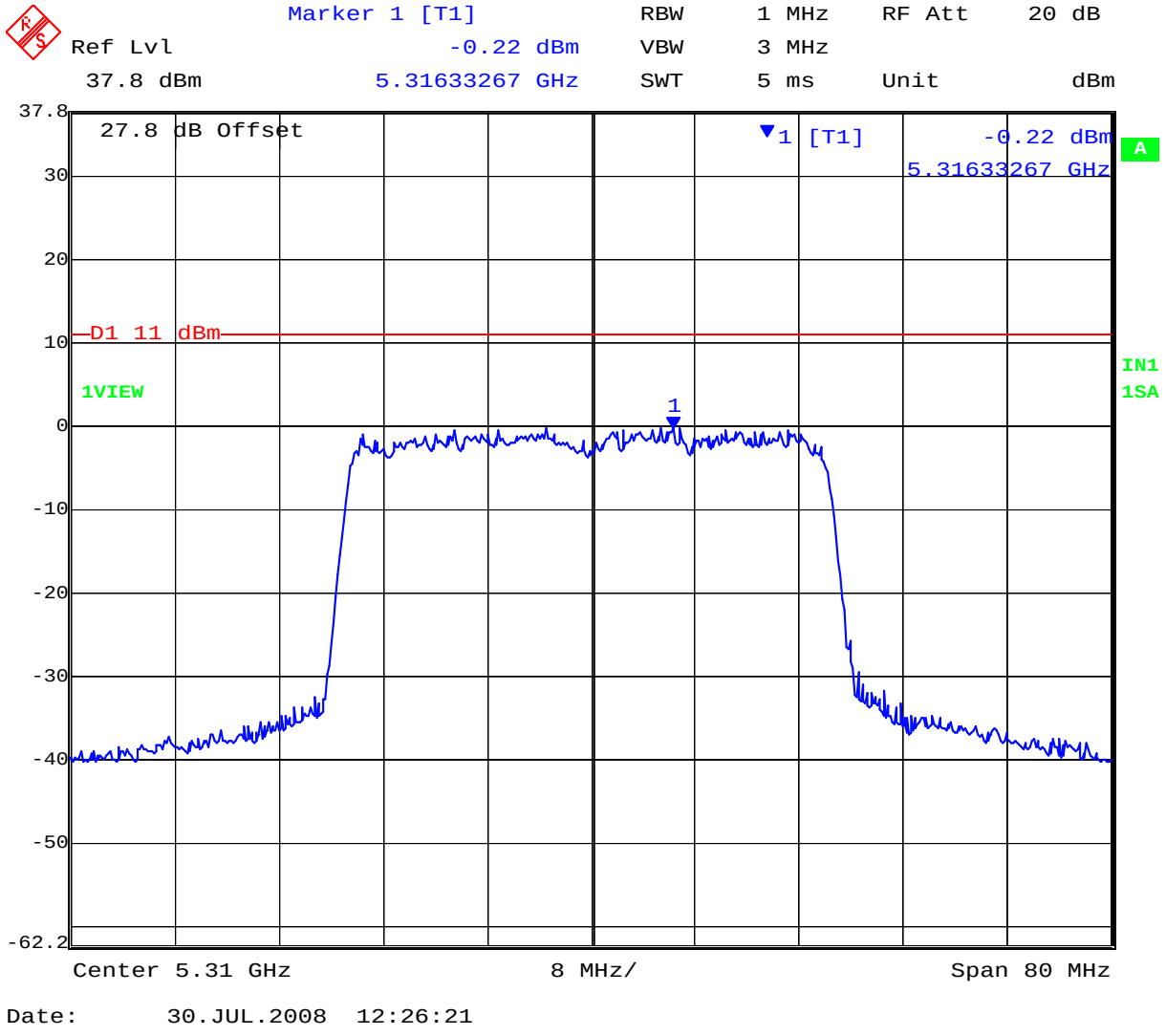
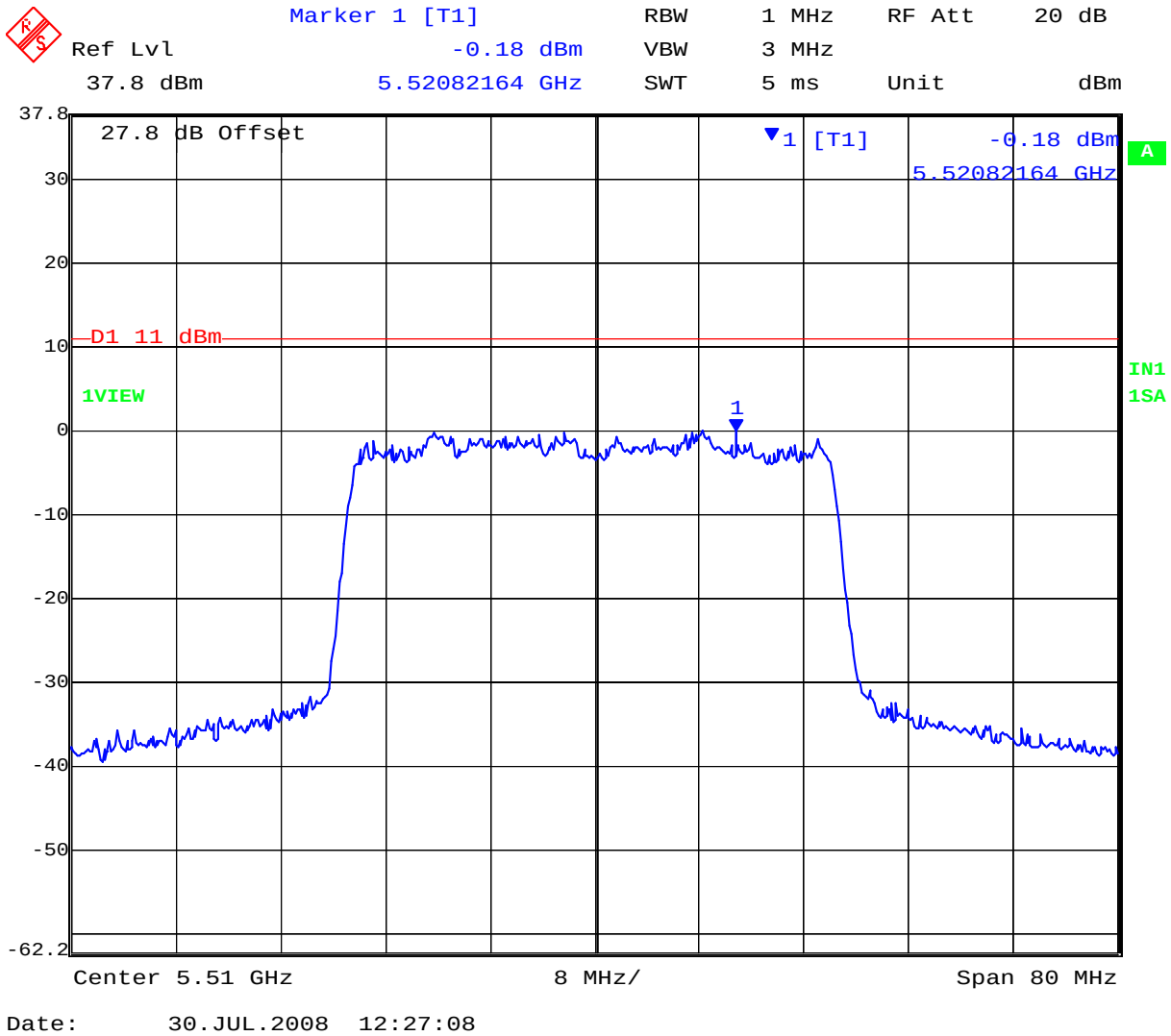


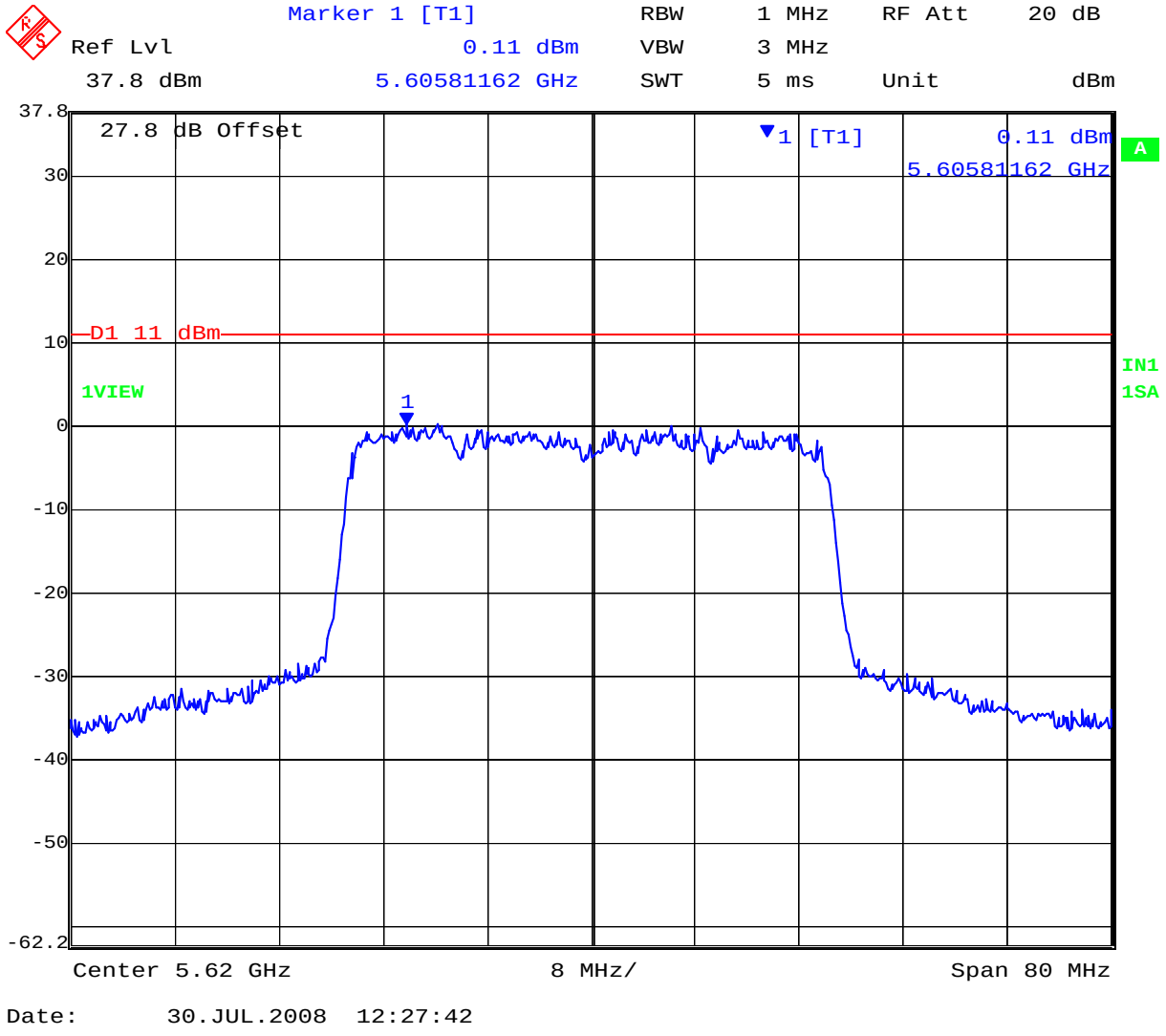
TABLE OF RESULTS – **802.11n HT40**

Center Frequency (MHz)	Peak Frequency (MHz)	PPSD (dBm)
5,510	5520.82164	-0.18
5,620	5605.81162	+0.11
5,690	5678.37675	-0.32

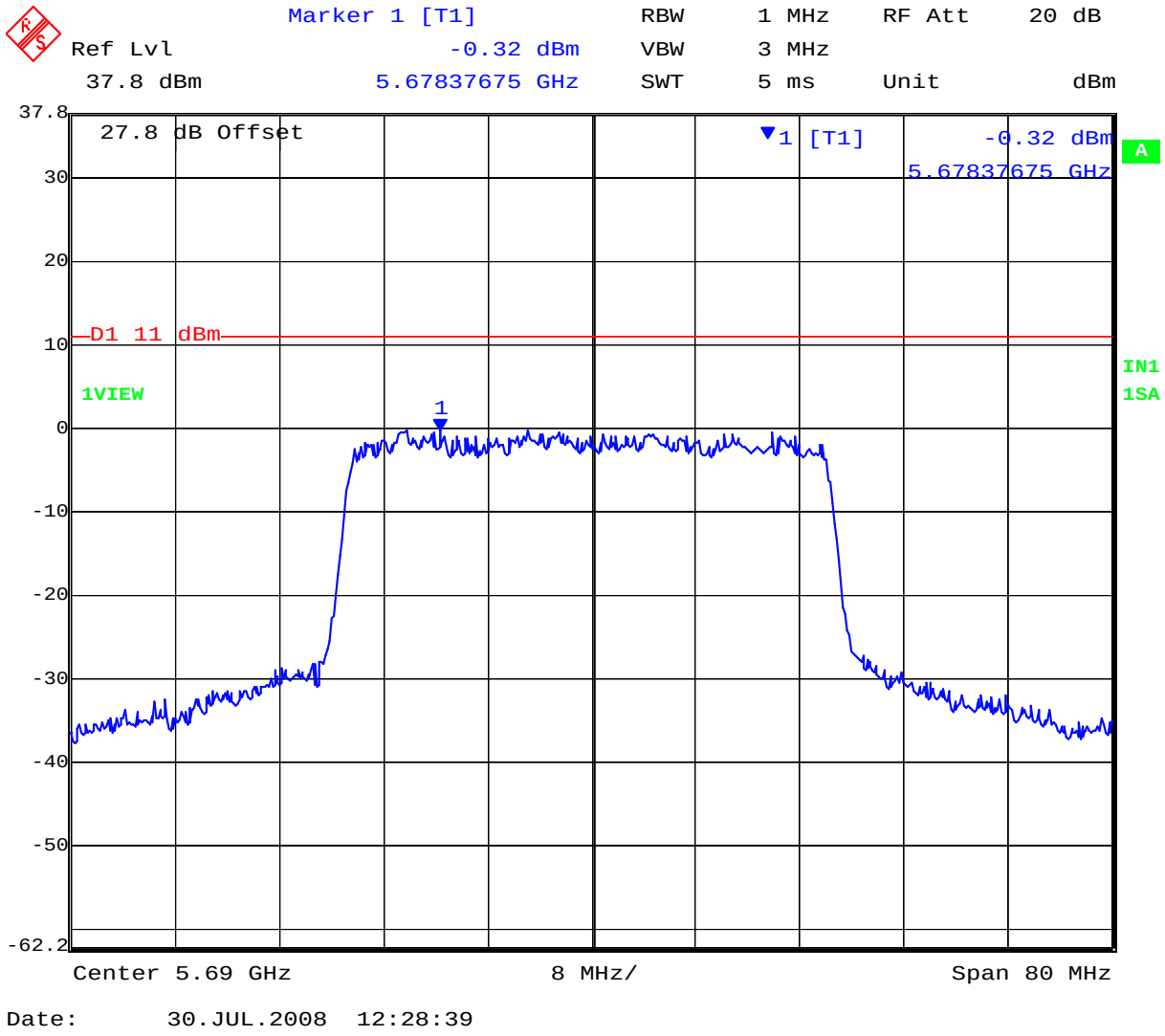
5,510 MHz 802.11n HT40 Peak Power Spectral Density



5,620 MHz 802.11n HT40 Peak Power Spectral Density



5,690 MHz 802.11n HT40 Peak Power Spectral Density



Specification

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

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

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

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

Laboratory Measurement Uncertainty for Spectral Density

Measurement uncertainty	±1.33 dB

Traceability

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

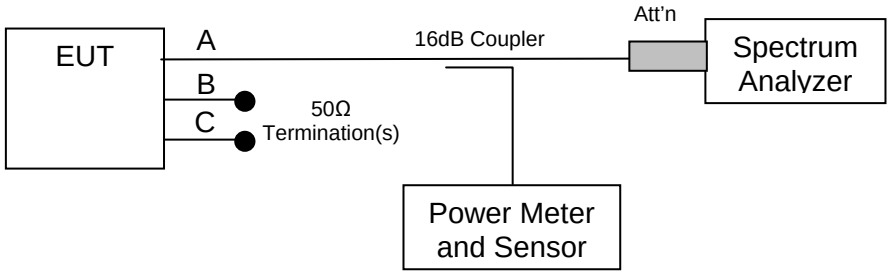
5.1.4. Peak Excursion Ratio

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

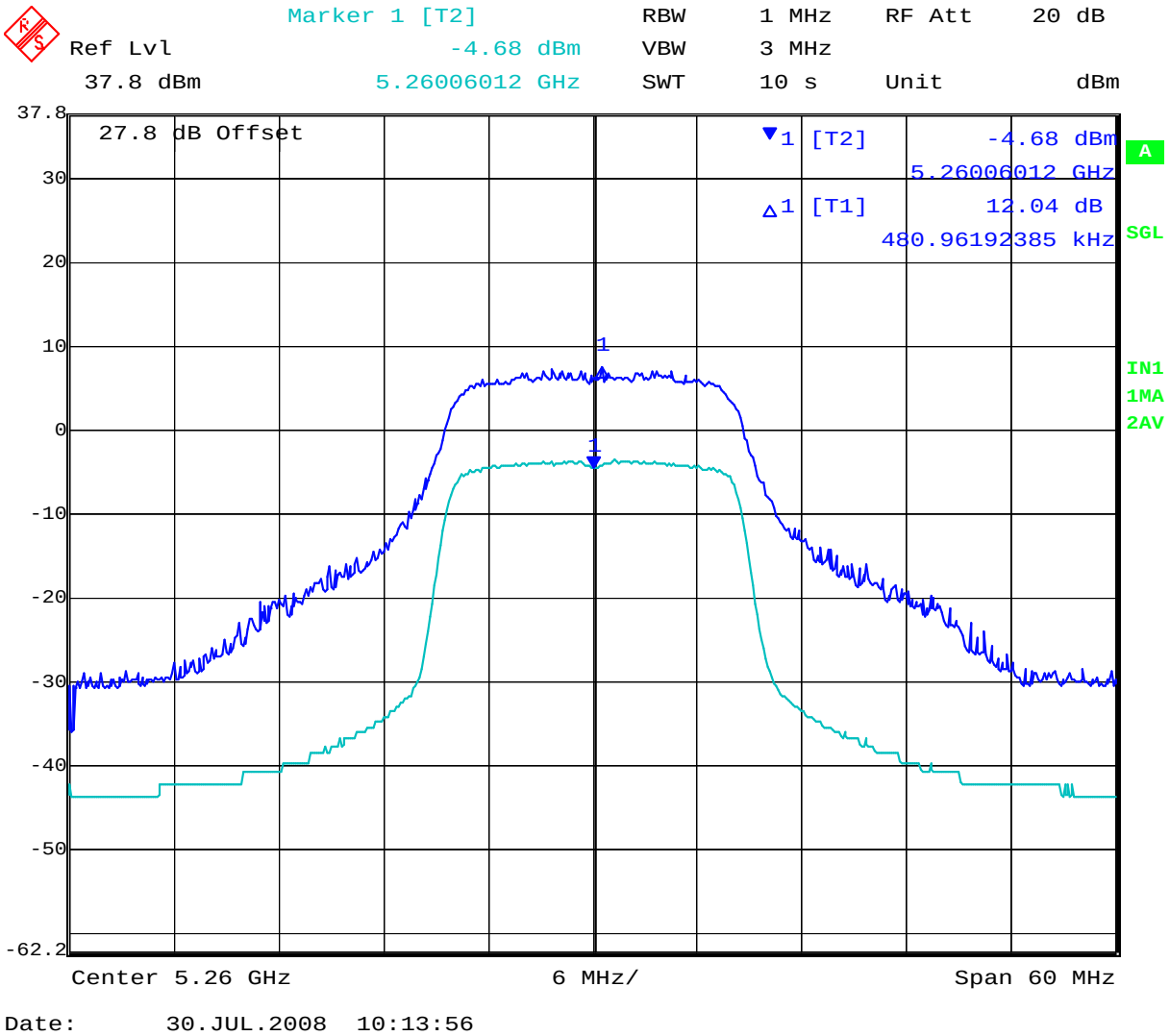
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57% Pressure: 999 to 1012 mbar

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

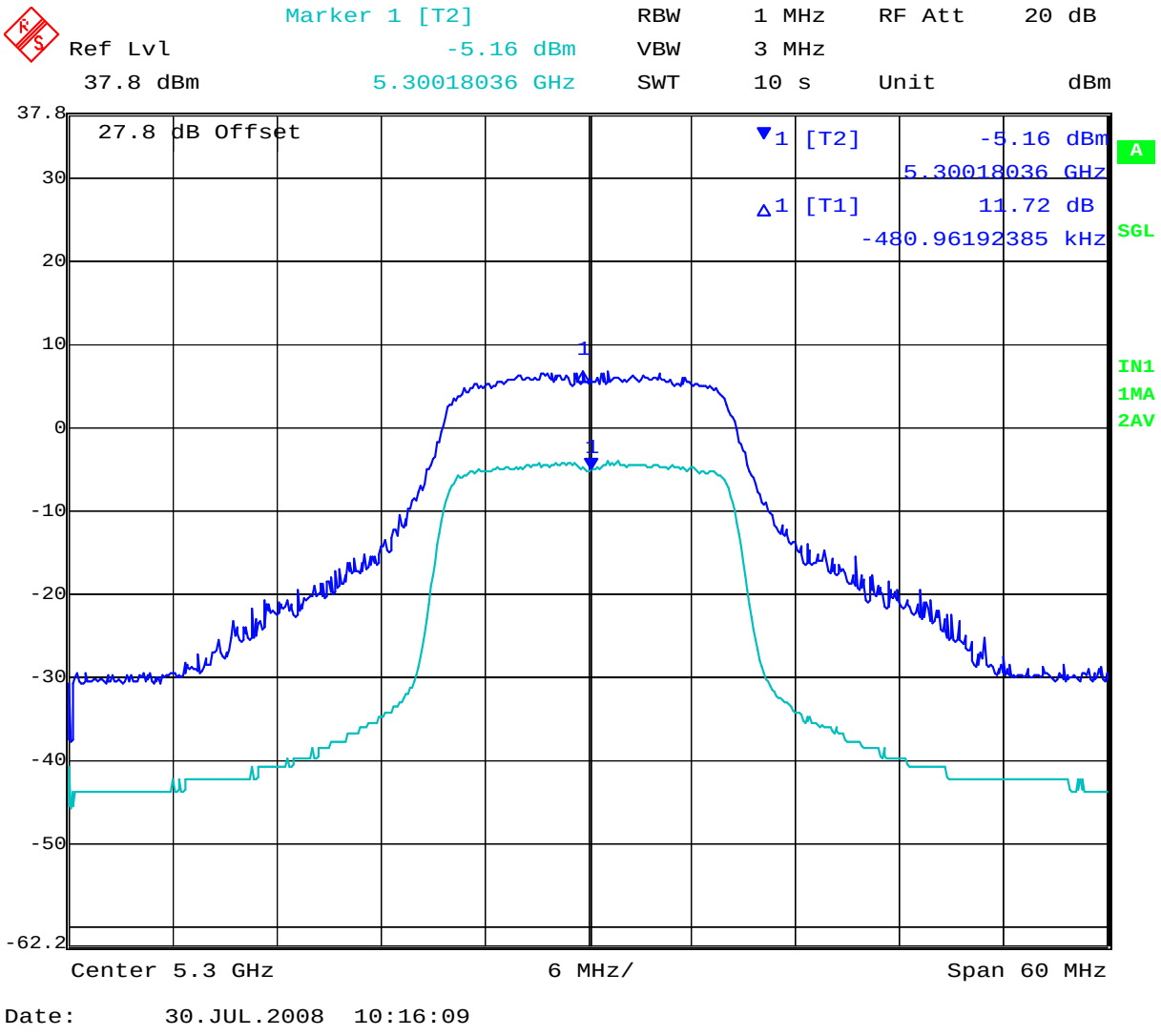
TABLE OF RESULTS – **802.11a Legacy**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)
5,260	12.04
5,300	11.72
5,320	12.26

5,260 MHz 802.11a Legacy - Peak Excursion Ratio



5,300 MHz 802.11a Legacy - Peak Excursion Ratio



5,320 MHz 802.11a Legacy - Peak Excursion Ratio

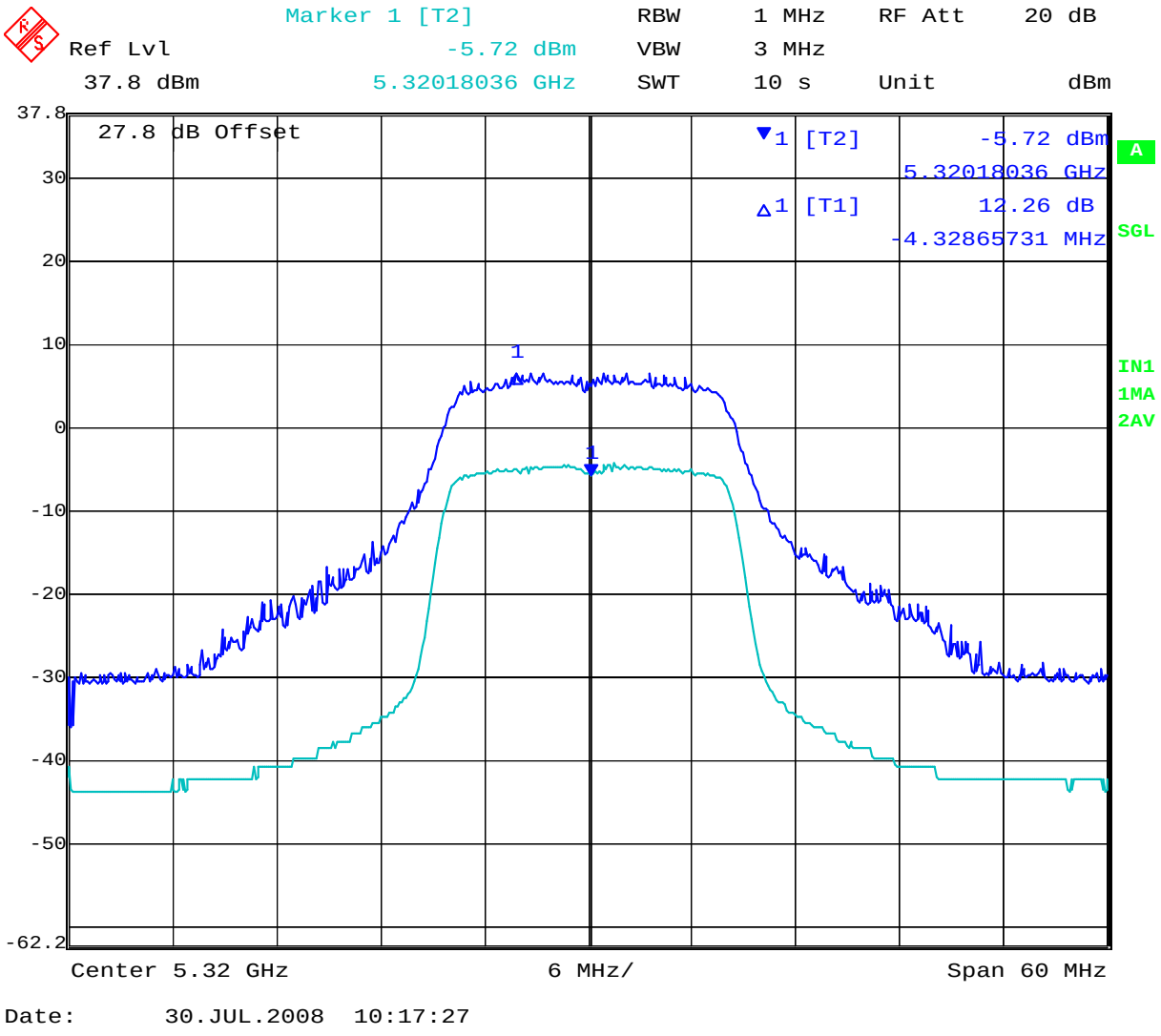
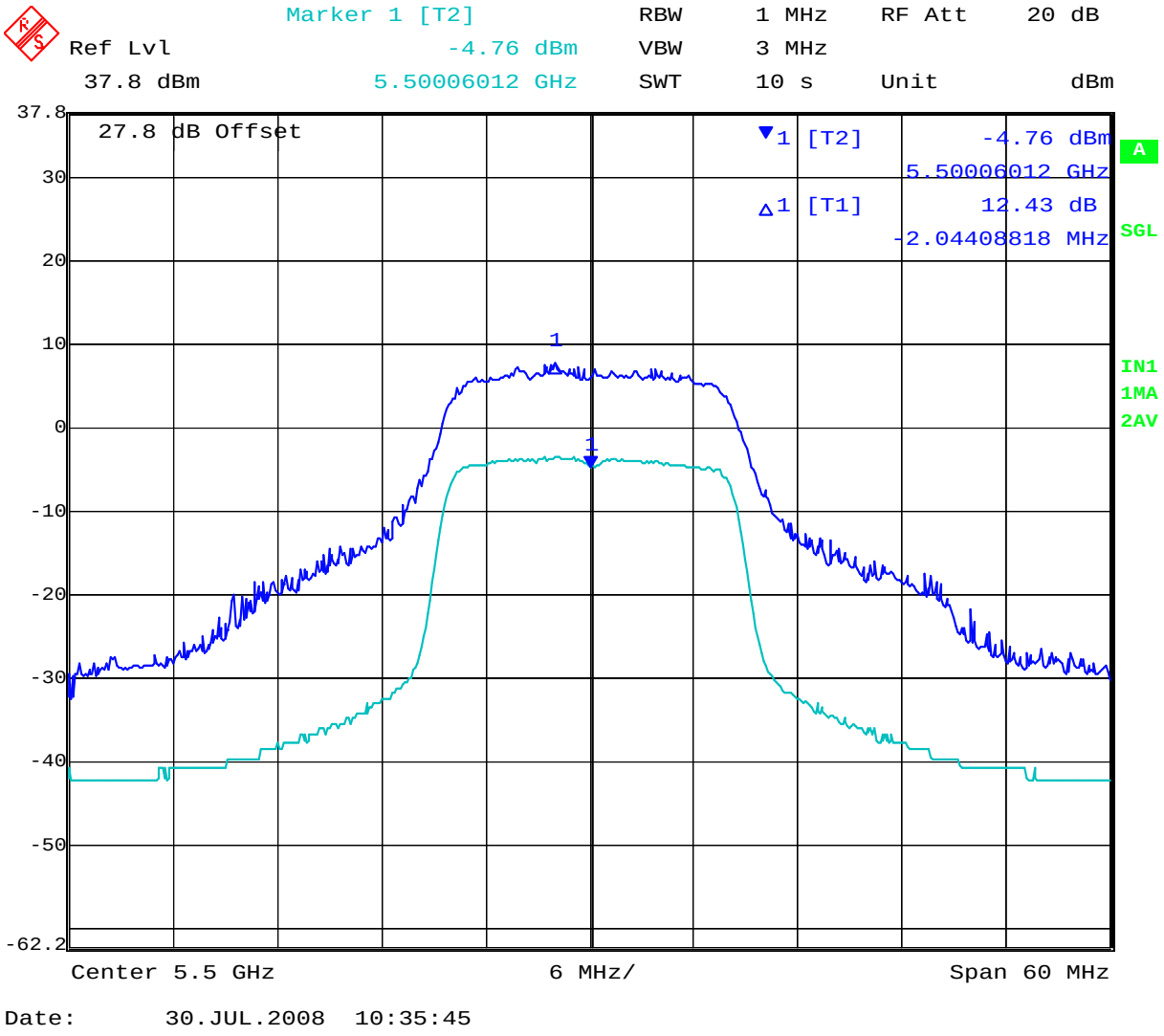


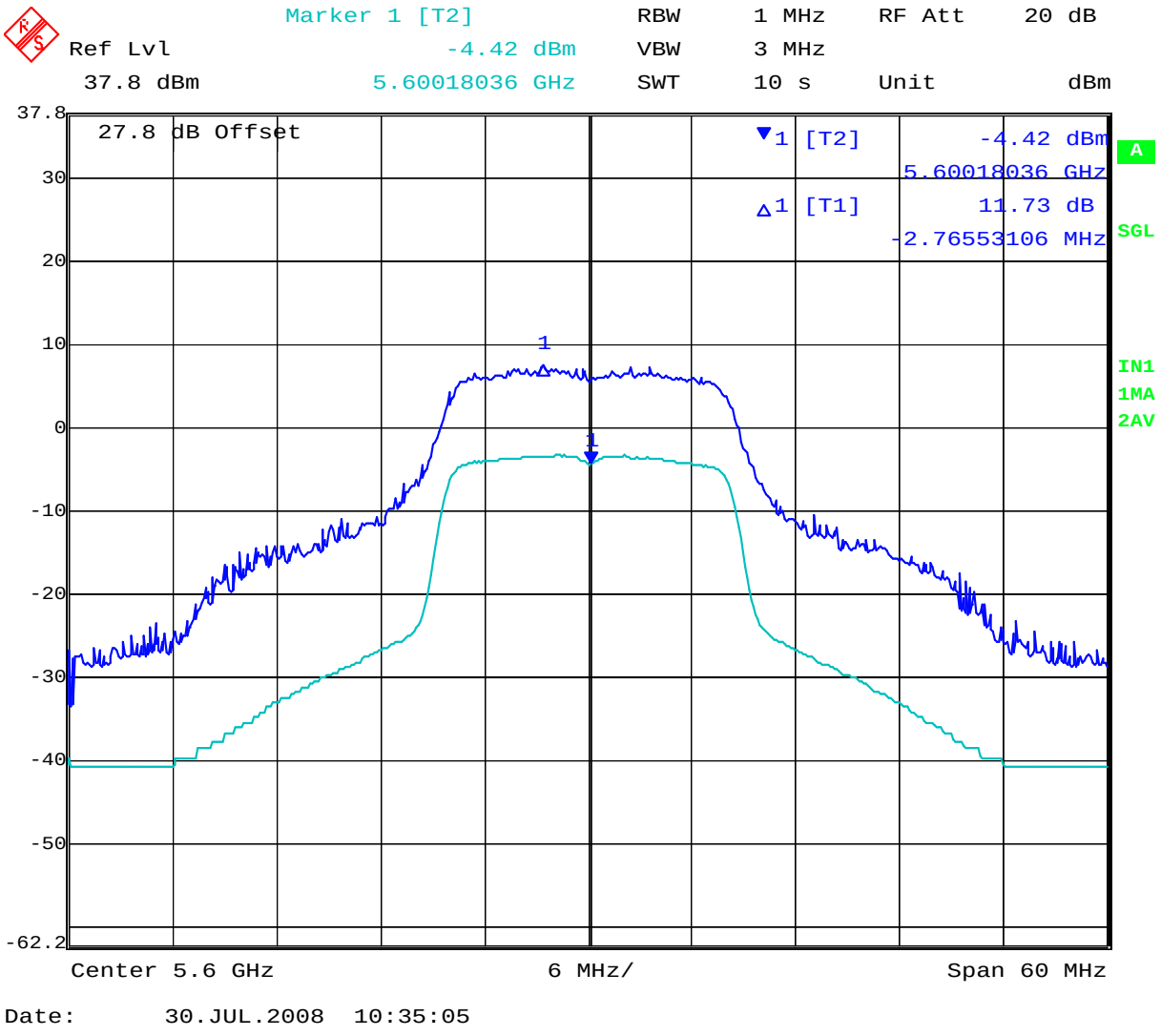
TABLE OF RESULTS – **802.11a Legacy**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)
5,500	12.43
5,600	11.73
5,700	12.05

5,500 MHz 802.11a Legacy - Peak Excursion Ratio



5,600 MHz 802.11a Legacy - Peak Excursion Ratio



5,700 MHz 802.11a Legacy - Peak Excursion Ratio

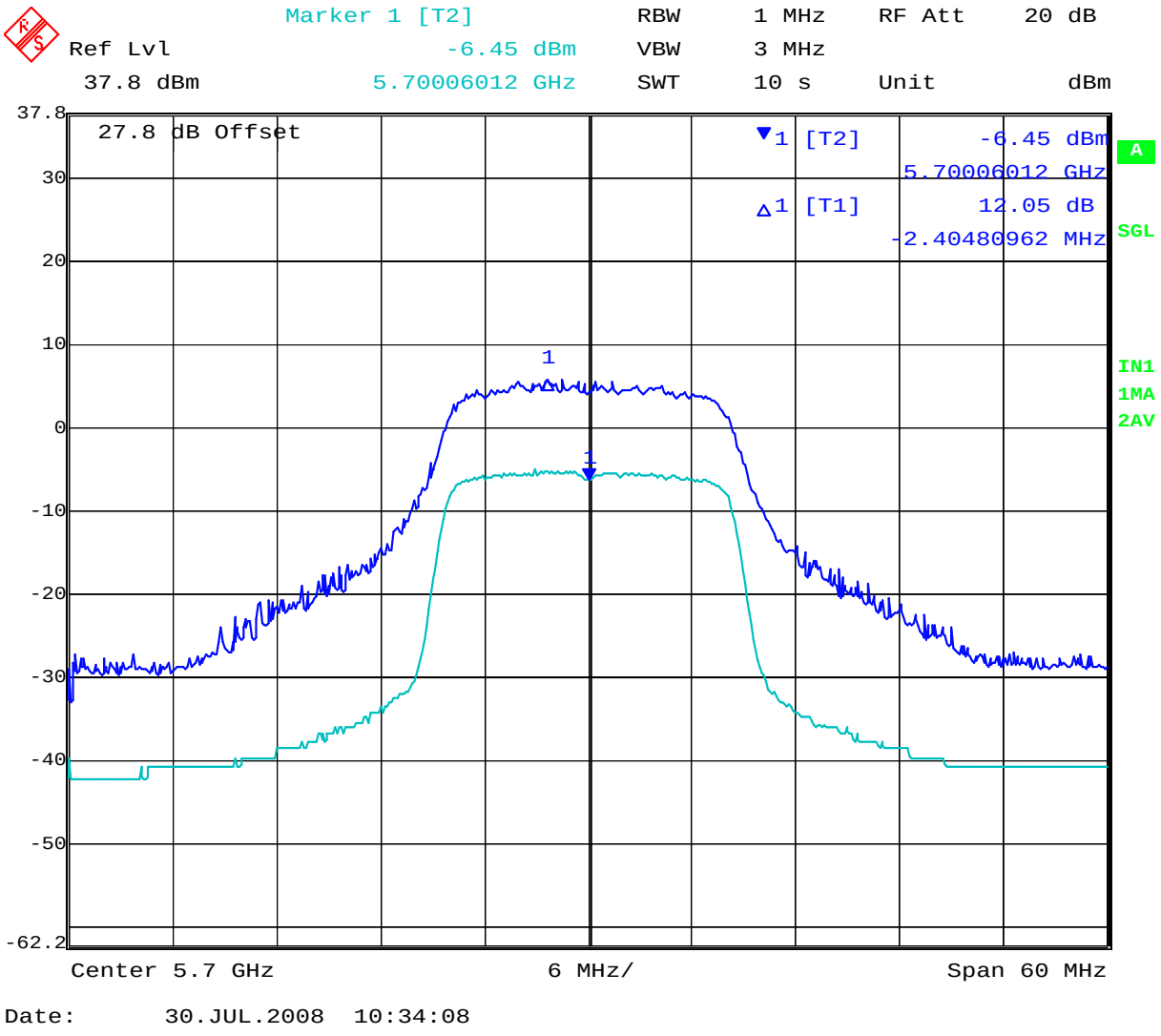
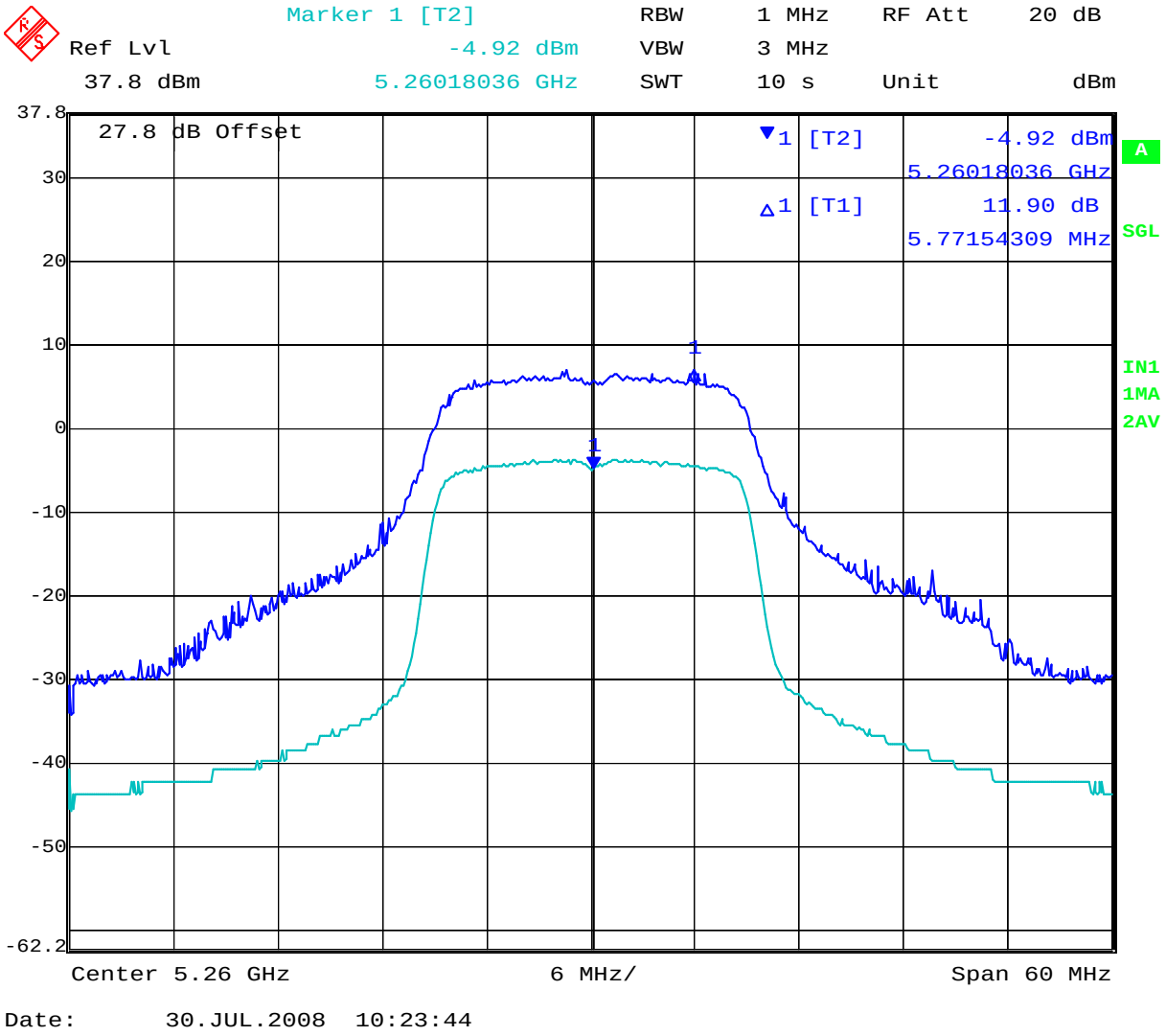


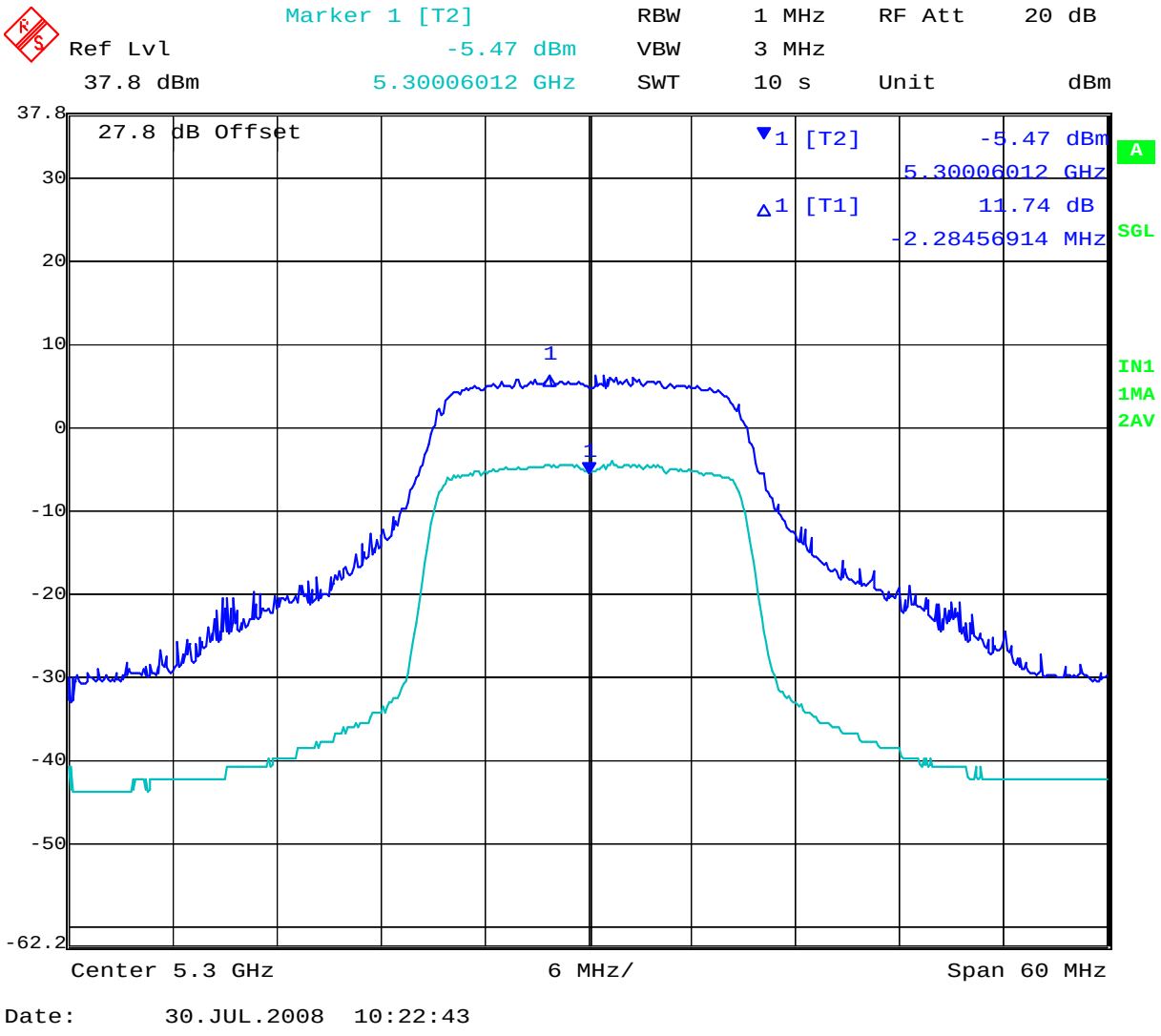
TABLE OF RESULTS – **802.11n HT20**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)
5,260	11.90
5,300	11.74
5,320	11.81

5,260 MHz 802.11n HT20 - Peak Excursion Ratio



5,300 MHz 802.11n HT20 - Peak Excursion Ratio



5,320 MHz 802.11n HT20 - Peak Excursion Ratio

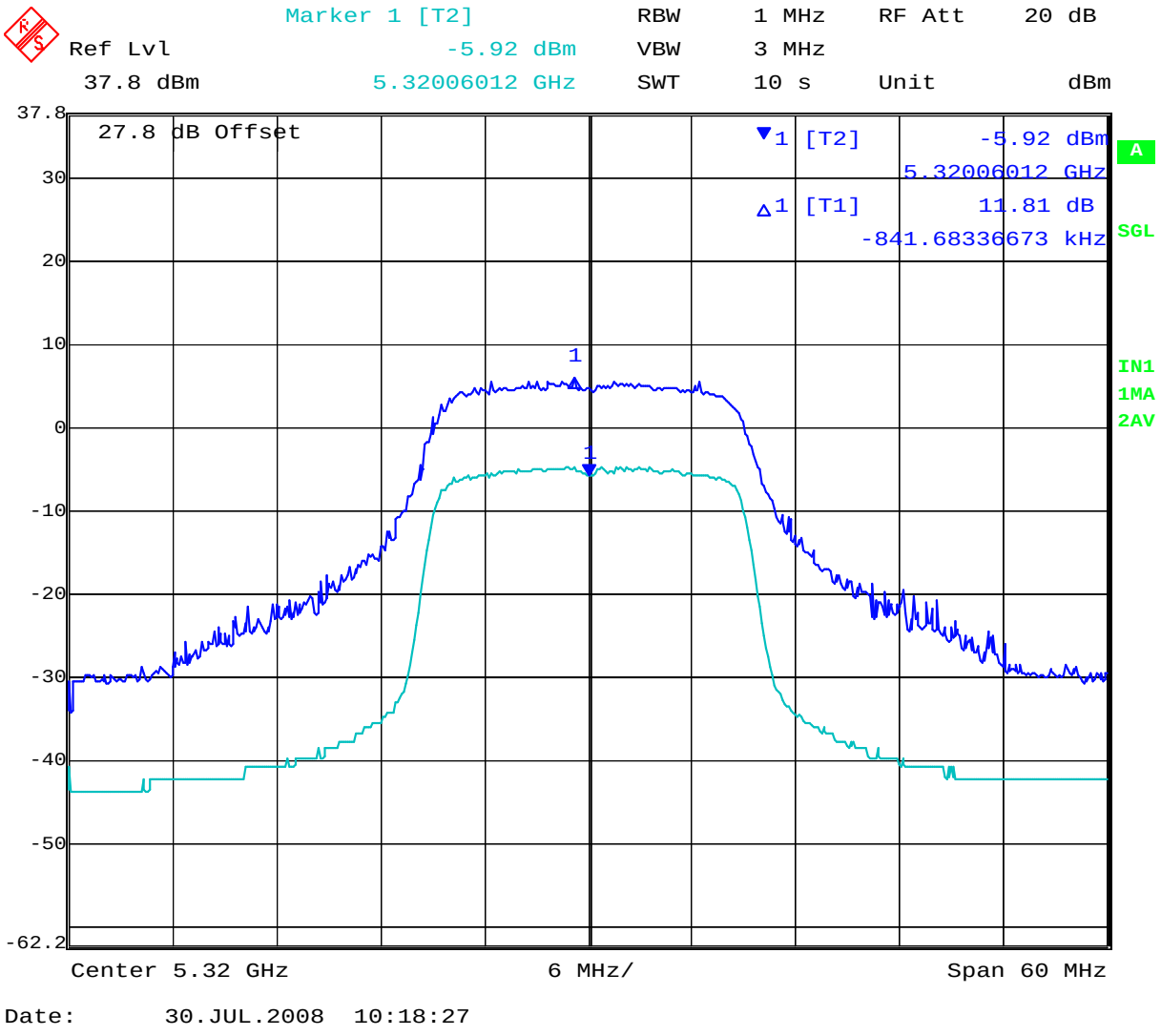
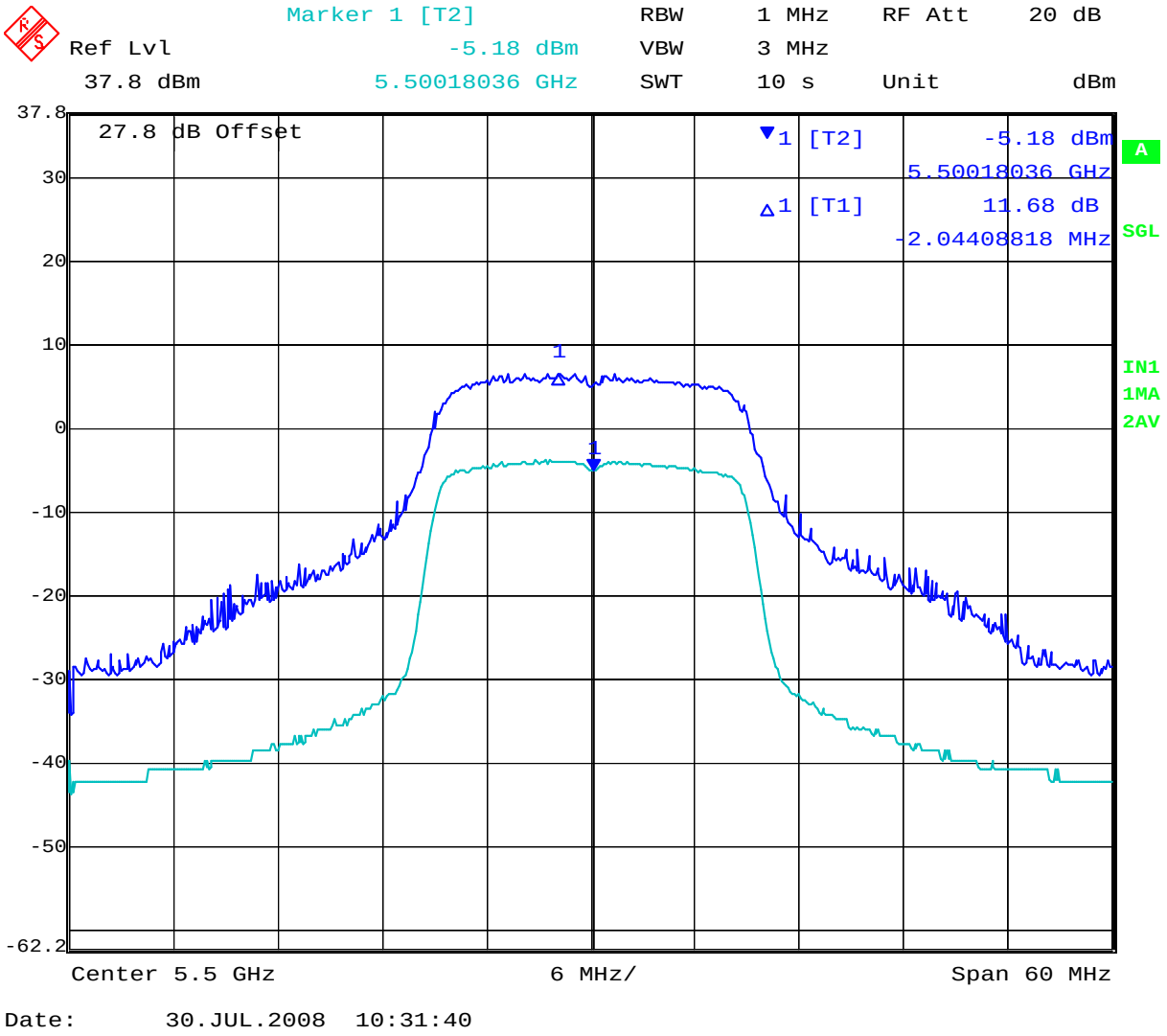


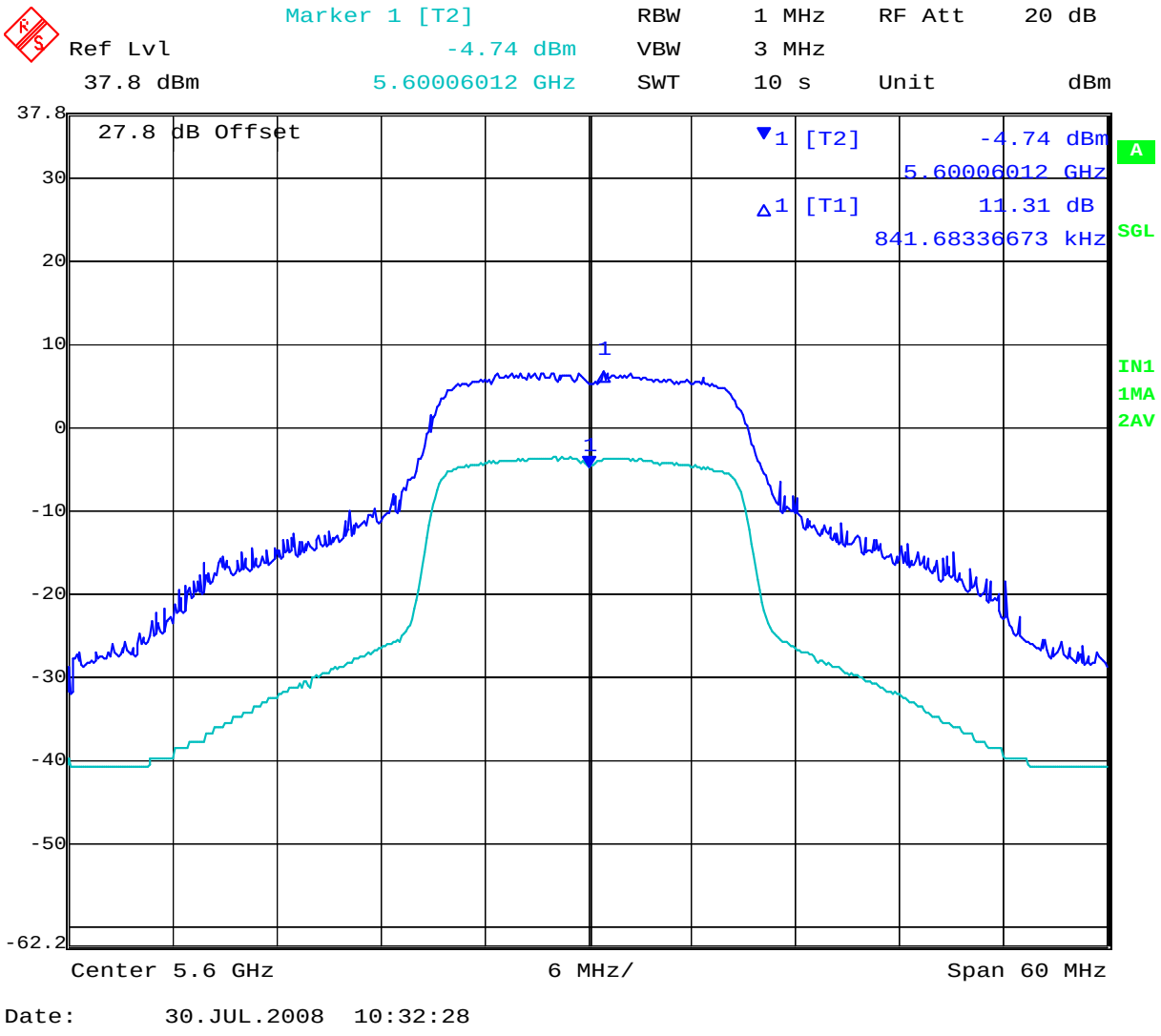
TABLE OF RESULTS – **802.11n HT20**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)
5,500	11.68
5,600	11.31
5,700	11.90

5,500 MHz 802.11n HT20 - Peak Excursion Ratio



5,600 MHz 802.11n HT20 - Peak Excursion Ratio



5,700 MHz 802.11n HT20 - Peak Excursion Ratio

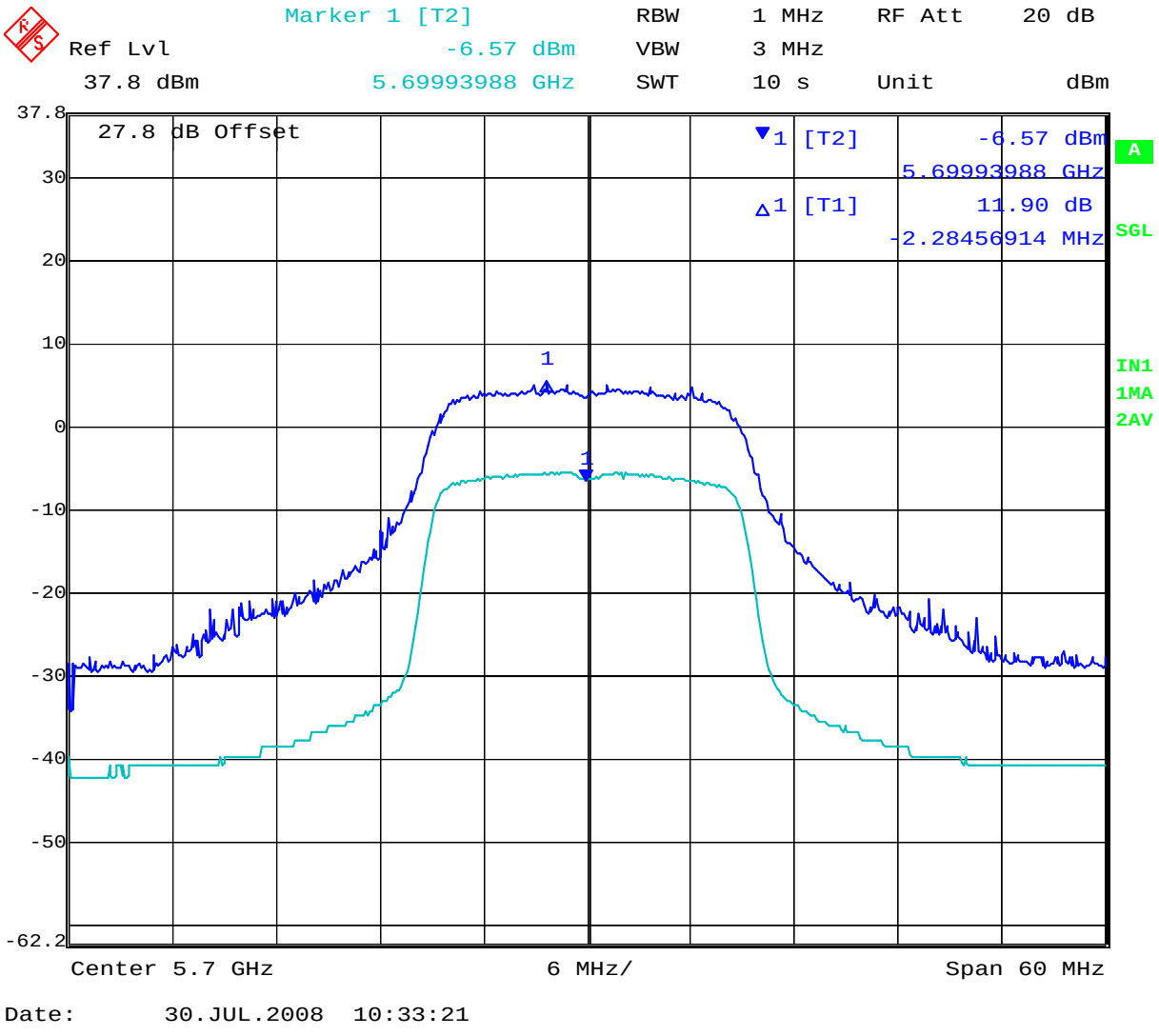
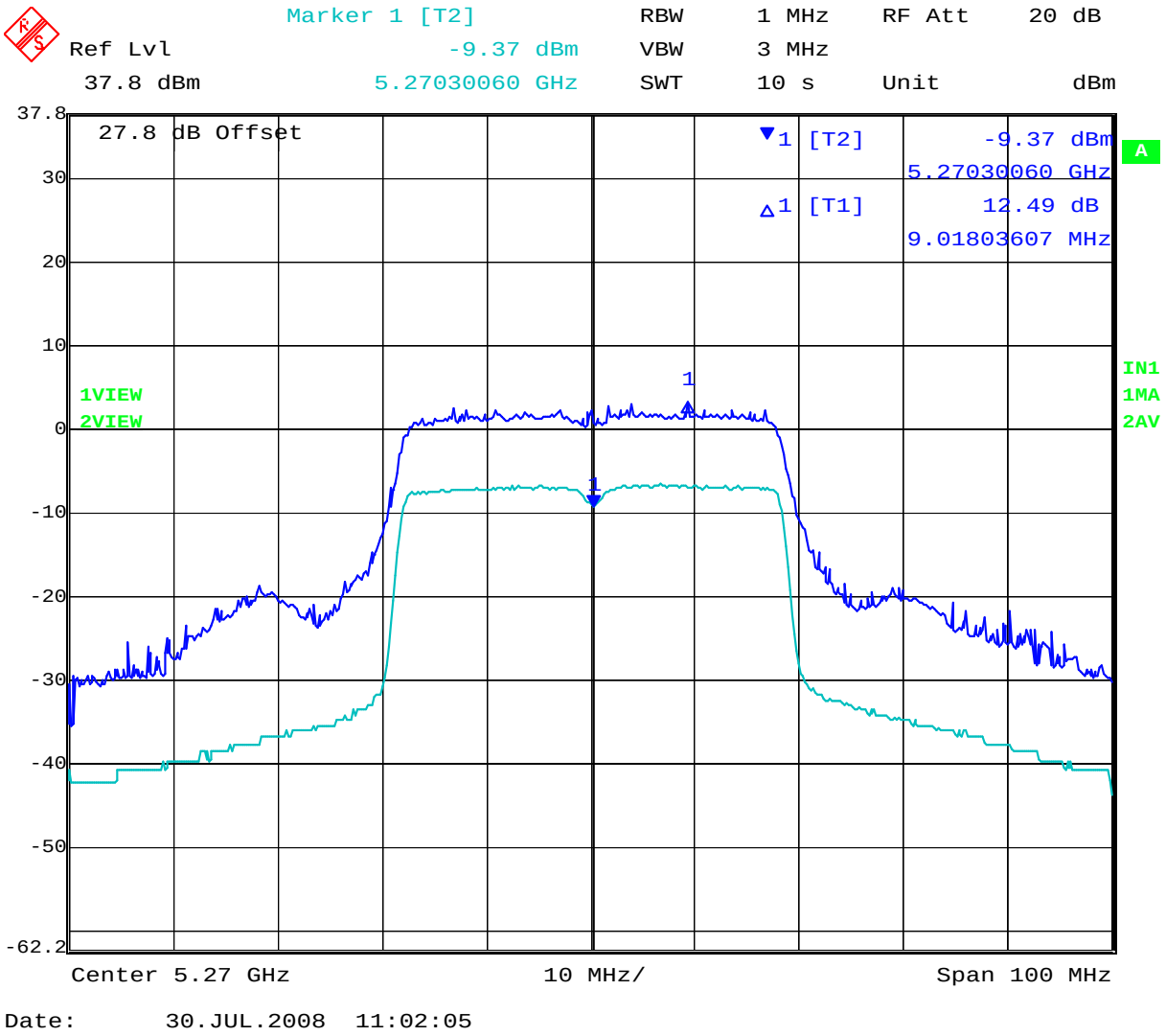


TABLE OF RESULTS – **802.11n HT40**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)
5,270	12.49
5,310	12.96

5,270 MHz 802.11n HT40 - Peak Excursion Ratio



5,310 MHz 802.11n HT40 - Peak Excursion Ratio

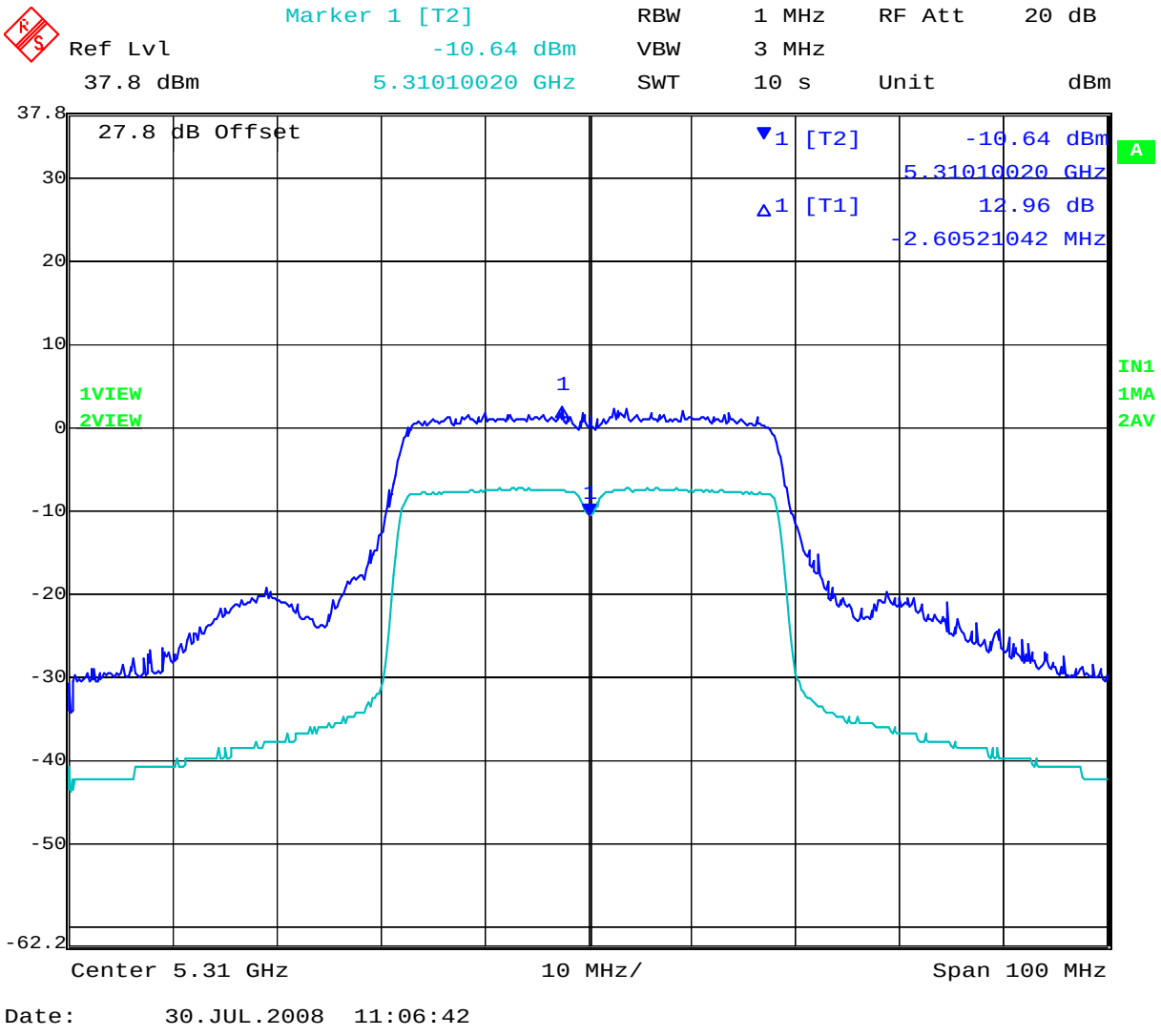
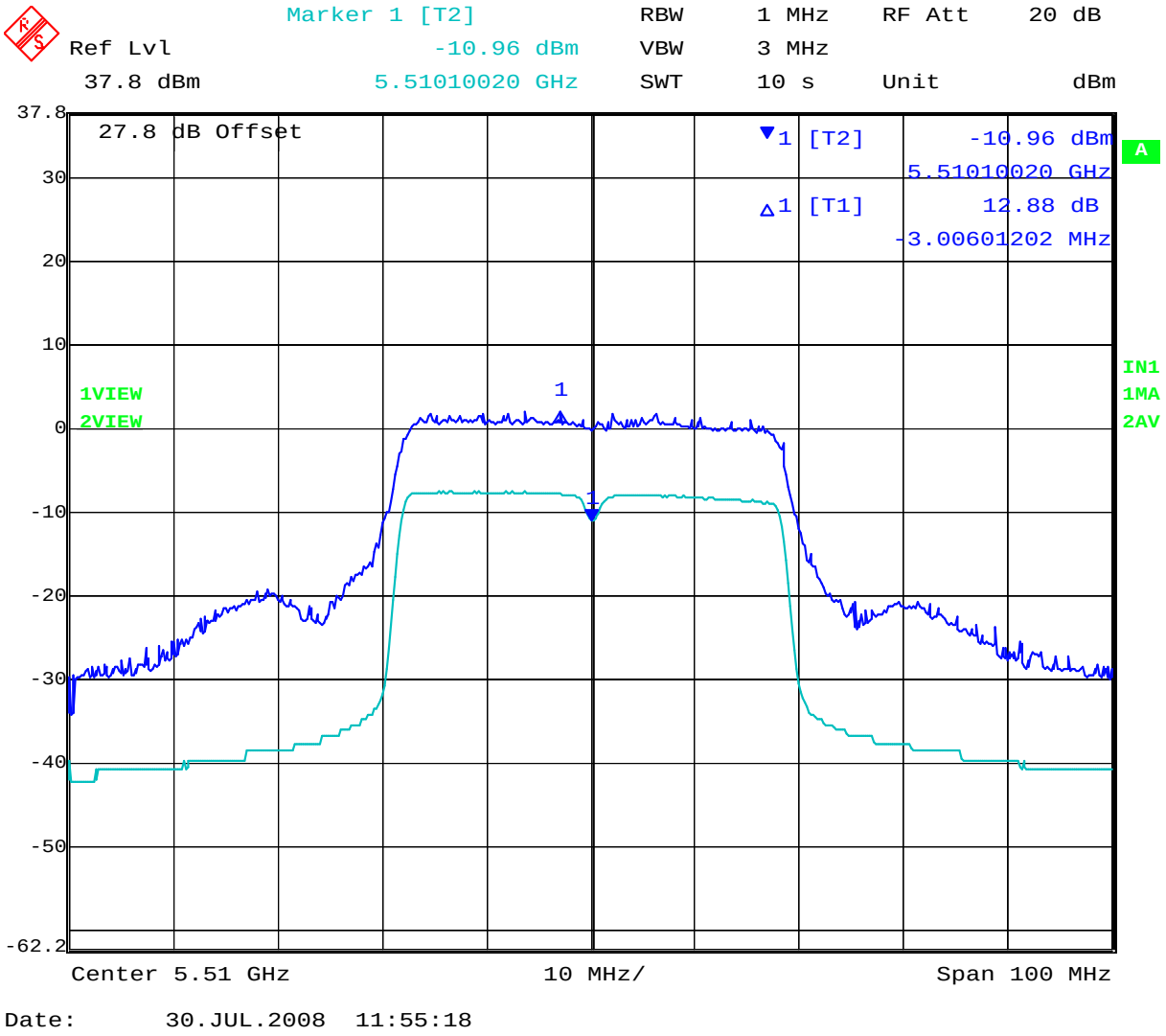


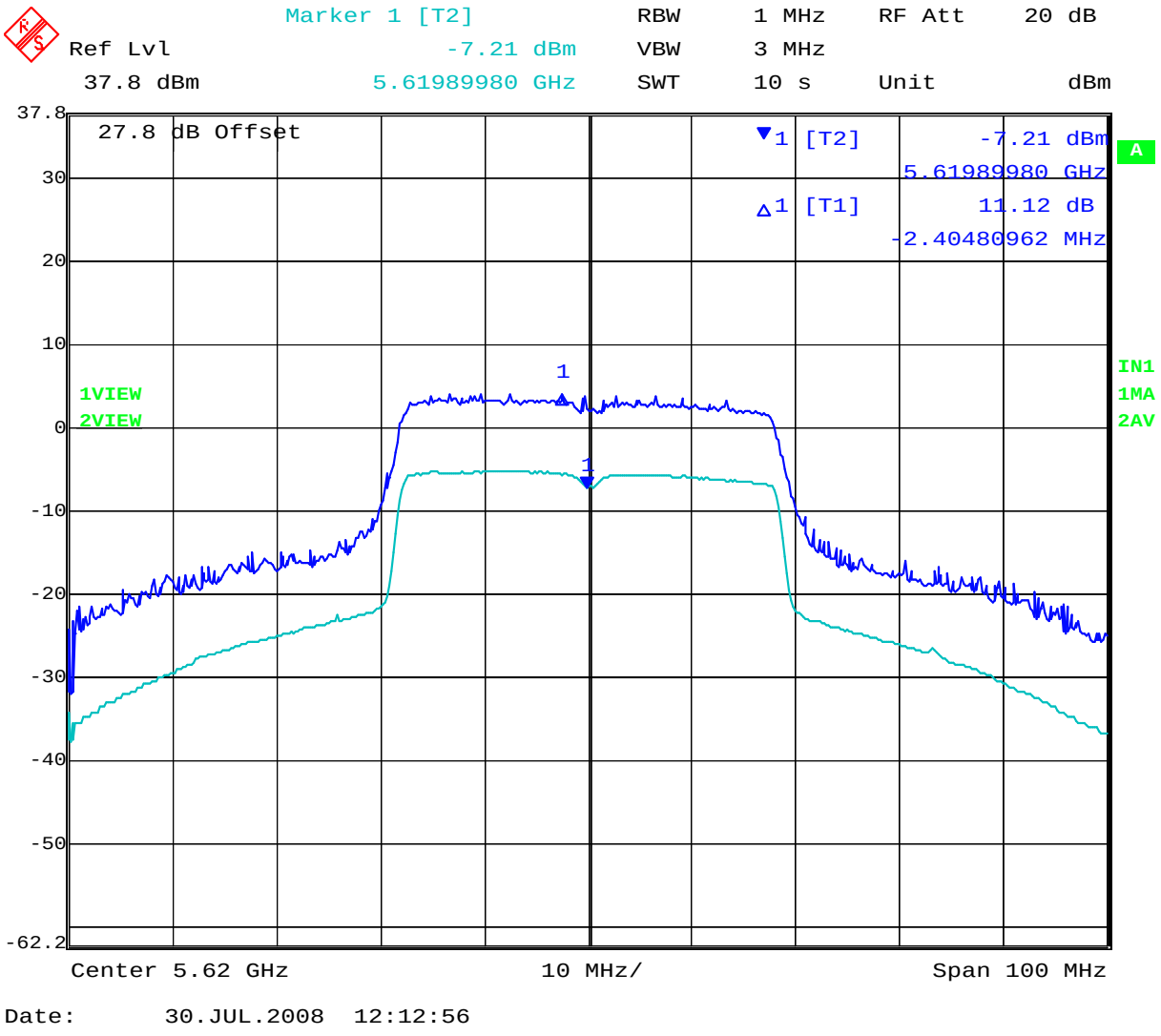
TABLE OF RESULTS – **802.11n HT40**

Centre Frequency (MHz)	Peak Excursion Ratio (dB)
5,510	12.88
5,620	11.12
5,690	12.88

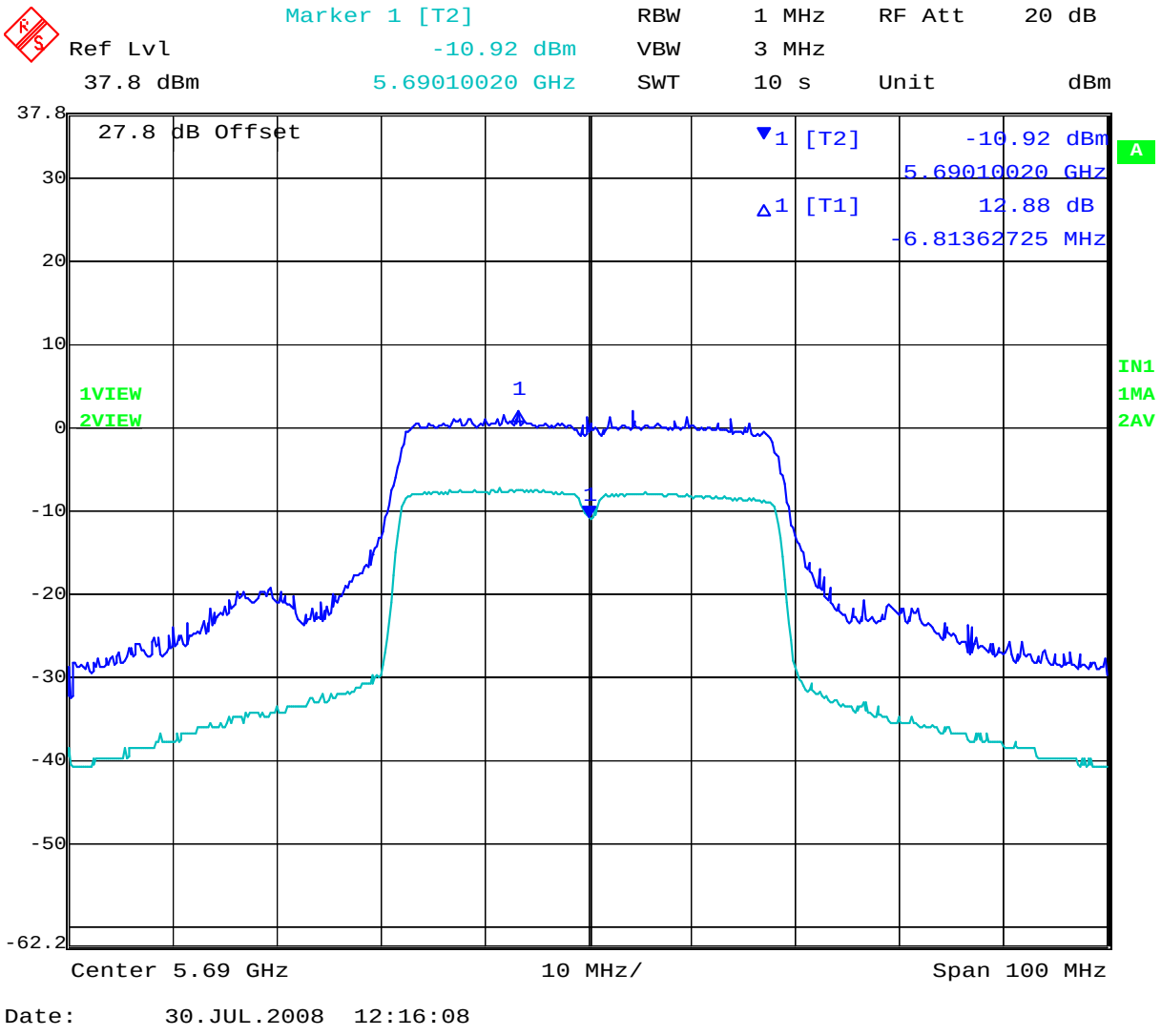
5,510 MHz 802.11n HT40 - Peak Excursion Ratio



5,620 MHz 802.11n HT40 - Peak Excursion Ratio



5,690 MHz 802.11n HT40 - Peak Excursion Ratio



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, 0193, 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 * 3

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

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

The Wistron a/b/g/n wireless module has three transmitters. The peak power in the table below is calculated by assuming a worst case scenario where the three transmitters are operating simultaneously in the same band. The Peak Power in mW is calculated by taking the maximum conducted power measured in each band and multiplying by 3.

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

Freq. Band (MHz)	Antenna Gain (dBi)	Numeric Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Calculated Safe Distance @ 1mW/cm^2 Limit(cm)	Minimum Separation Distance (cm)
5250 - 5350	5.1	3.24	+18.8	227.6	7.66	20
5470 - 5725	5.1	3.24	+19.3	255.3	8.11	20

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

Specification
Maximum Permissible Exposure Limits

FCC §1.1310 Limit = 1mW / cm^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

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

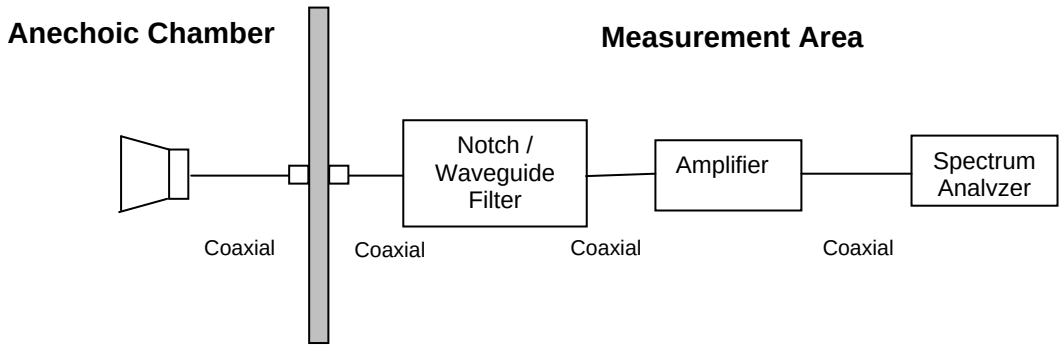
FCC, Part 15 Subpart C §15.407(b)(2), §15.205(a)/15.209(a)
Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7

Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

Test Measurement Set up



Measurement set up for Radiated Emission Test

Field Strength Calculation

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

FS = R + AF + CORR - FO
where: FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

For 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 peak emissions are less than 68.23 dB μV/m.

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

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

MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11a Legacy 5,260 MHz Radiated Emissions above 1 GHz**

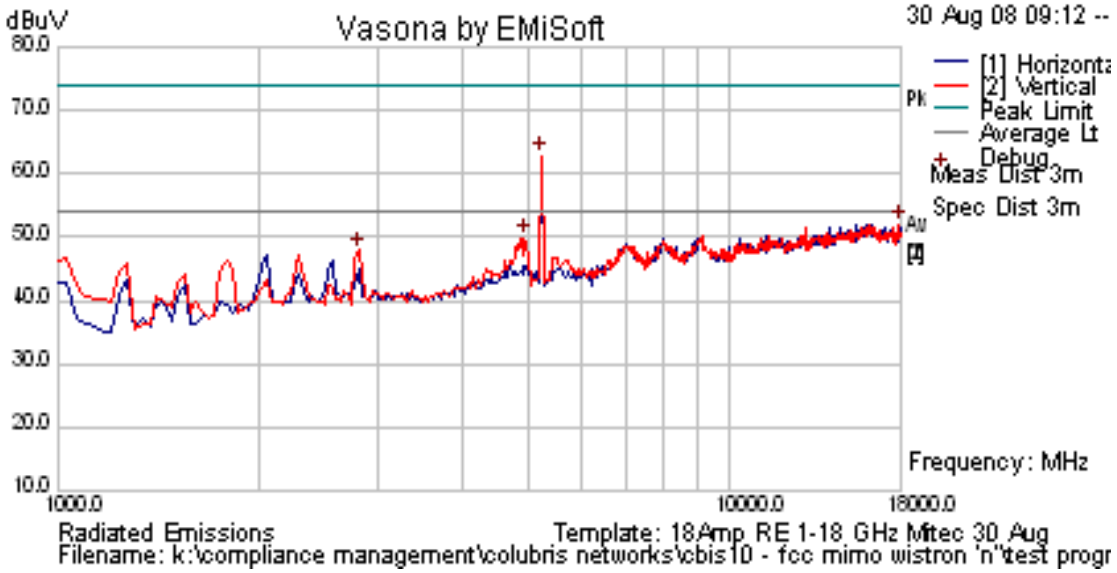
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,260 MHz Legacy



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11a Legacy 5,300 MHz Radiated Emissions above 1 GHz**

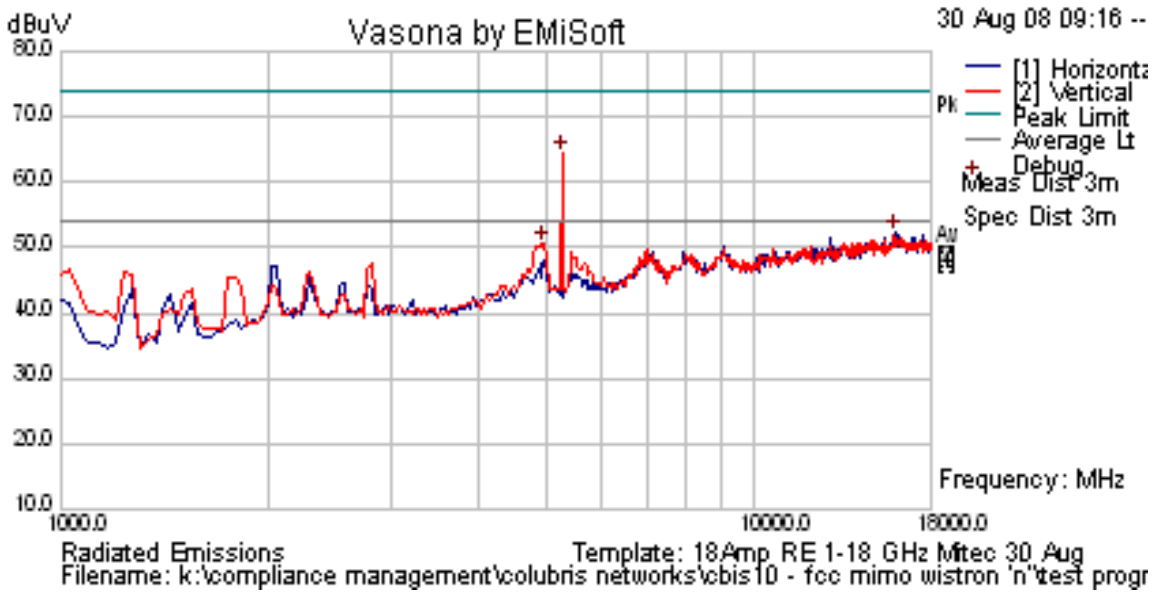
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,300 MHz Legacy



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11a Legacy 5,320 MHz Radiated Emissions above 1 GHz**

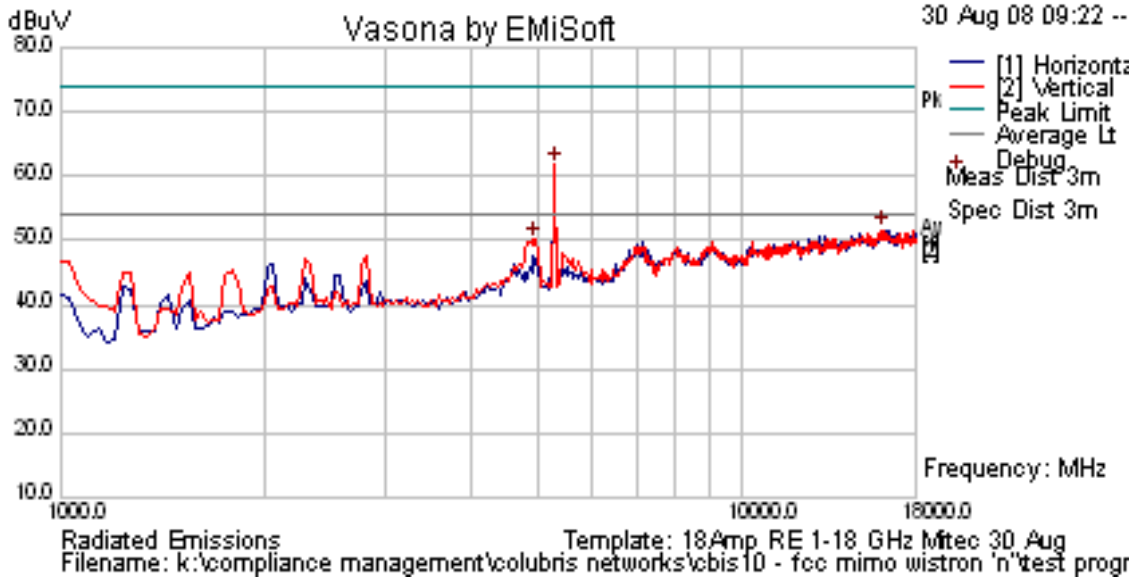
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,320 MHz Legacy



MAP-625 Integral Antenna

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **802.11n HT-20 5,260 MHz Radiated Emissions above 1 GHz**

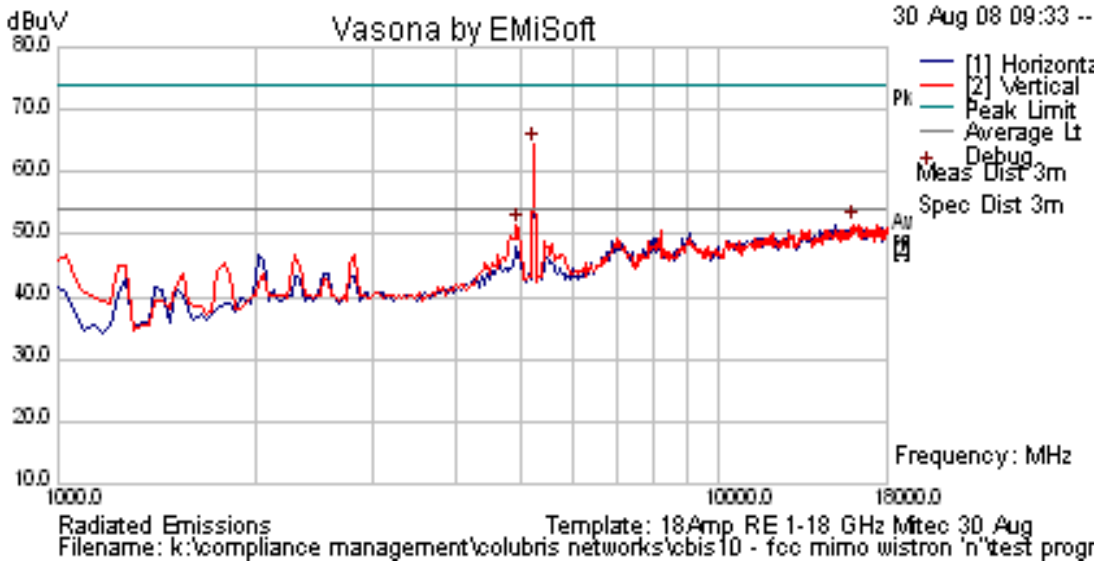
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,260 MHz HT-20



MAP-625 Integral Antenna

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **802.11n HT-20 5,300 MHz Radiated Emissions above 1 GHz**

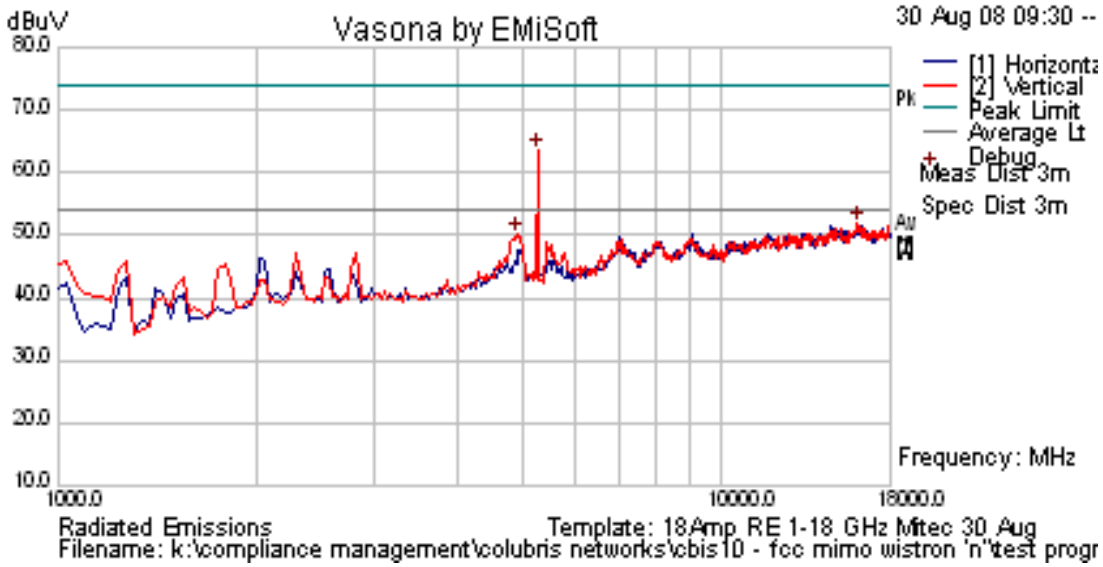
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,300 MHz HT-20



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11n HT-20 5,320 MHz Radiated Emissions above 1 GHz**

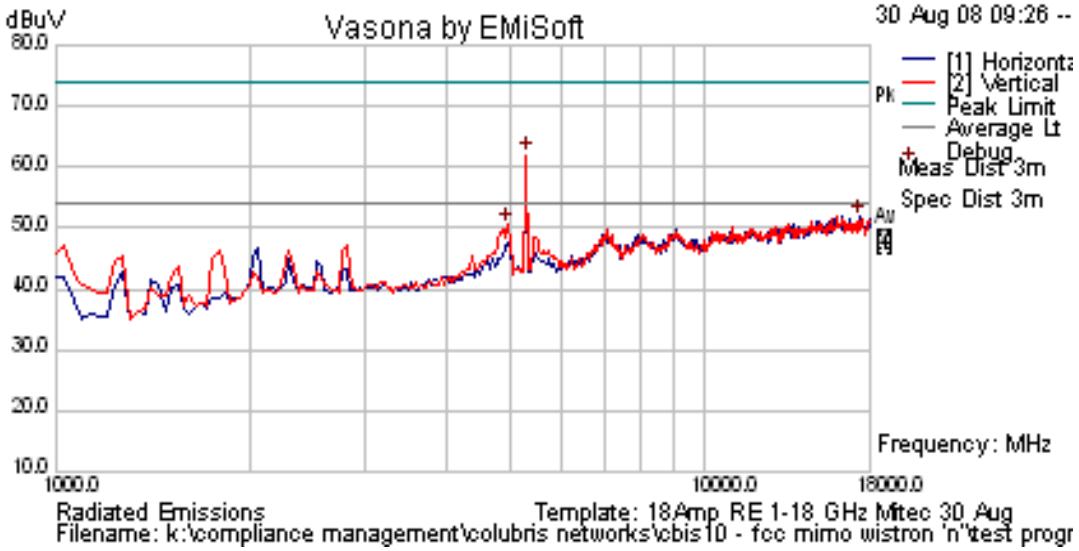
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,320 MHz HT-20



MAP-625 Integral Antenna

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **802.11n HT-40 5,270 MHz Radiated Emissions above 1 GHz**

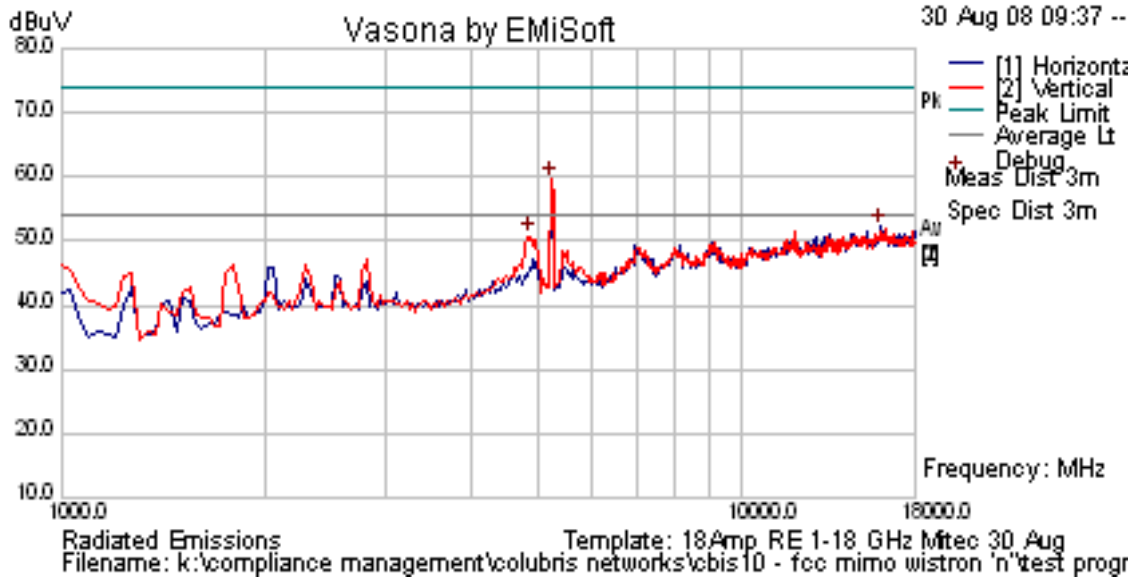
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,270 MHz HT-40



MAP-625 Integral Antenna

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **802.11n HT-40 5,310 MHz Radiated Emissions above 1 GHz**

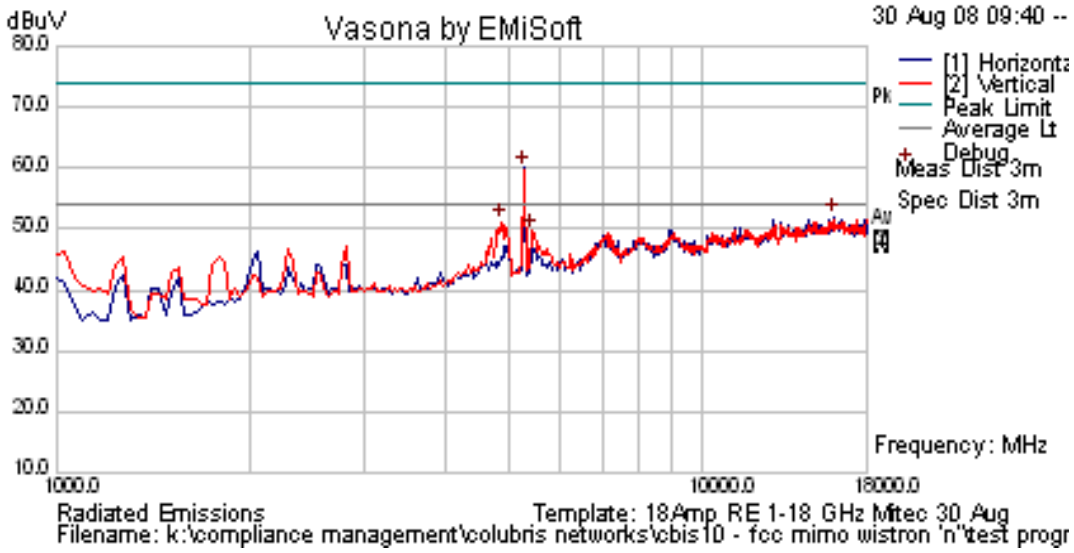
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,310 MHz HT-40



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11a Legacy 5,500 MHz Radiated Emissions above 1 GHz**

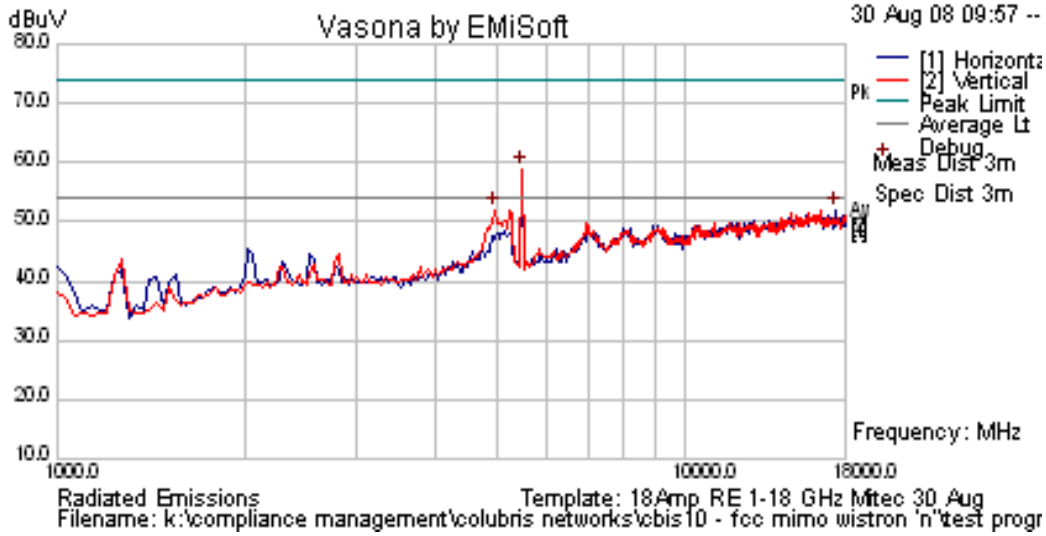
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,500 MHz Legacy



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11a Legacy 5,600 MHz Radiated Emissions above 1 GHz**

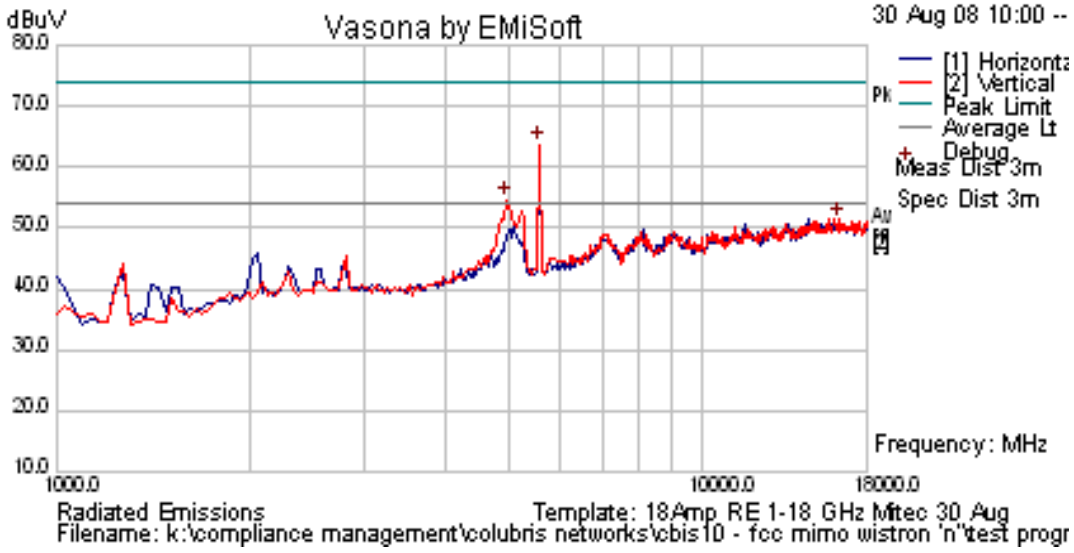
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,600 MHz Legacy



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11a Legacy 5,700 MHz Radiated Emissions above 1 GHz**

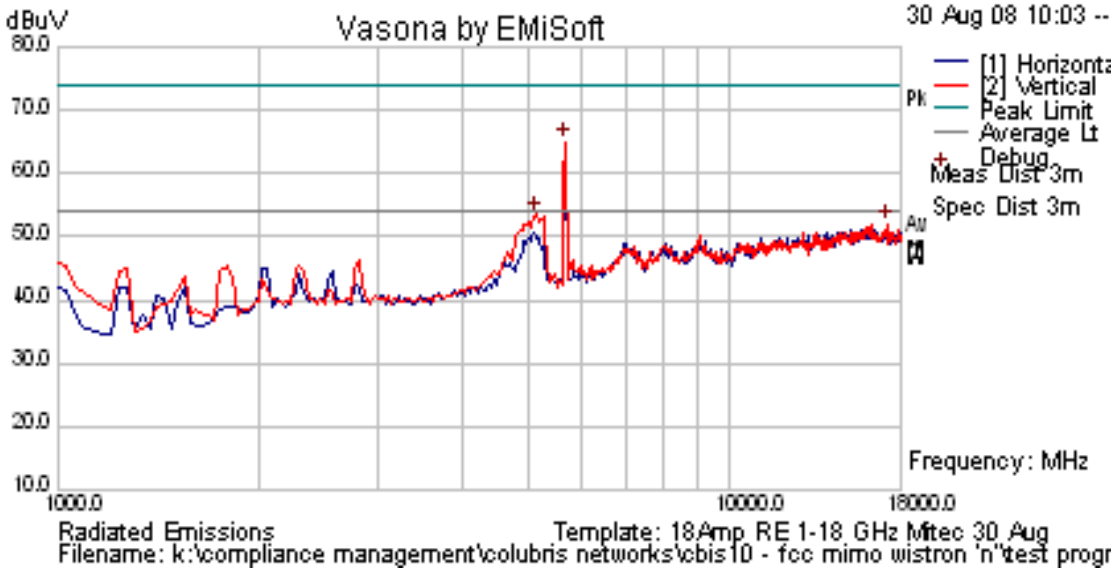
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,700 MHz Legacy



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11n HT-20 5,500 MHz Radiated Emissions above 1 GHz**

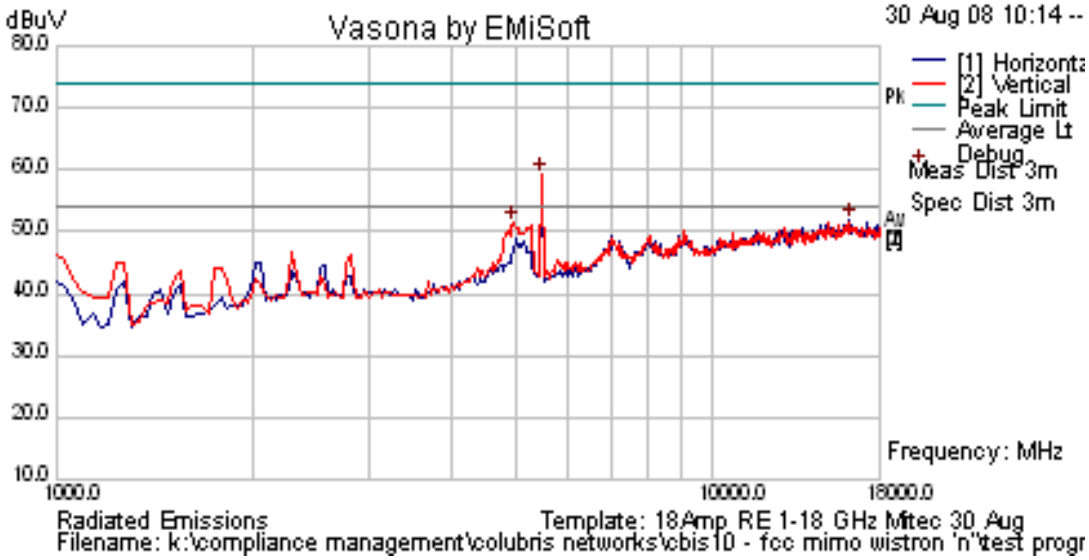
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,500 MHz HT-20



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11n HT-20 5,600 MHz Radiated Emissions above 1 GHz**

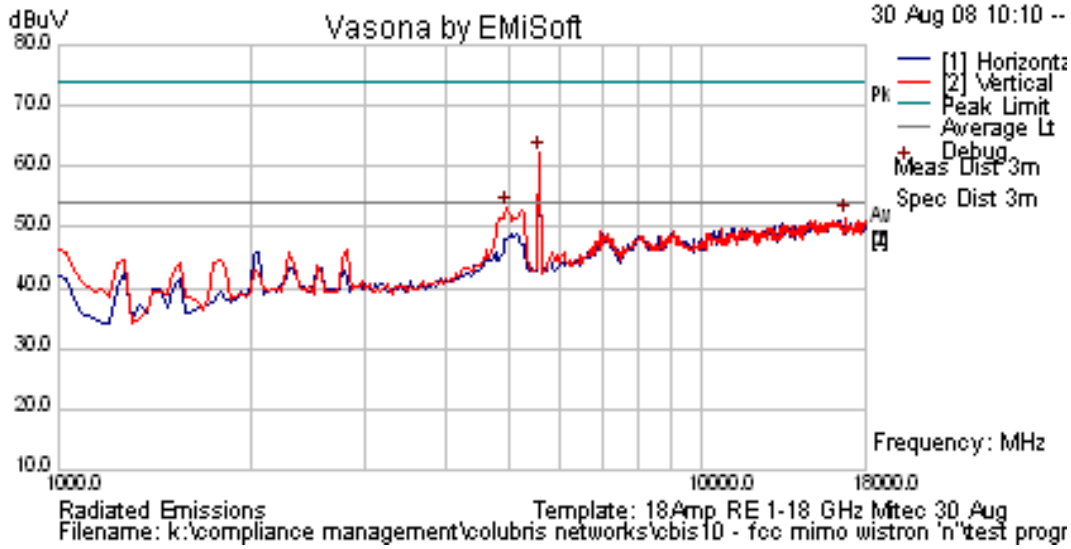
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,600 MHz HT-20



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11n HT-20 5,700 MHz Radiated Emissions above 1 GHz**

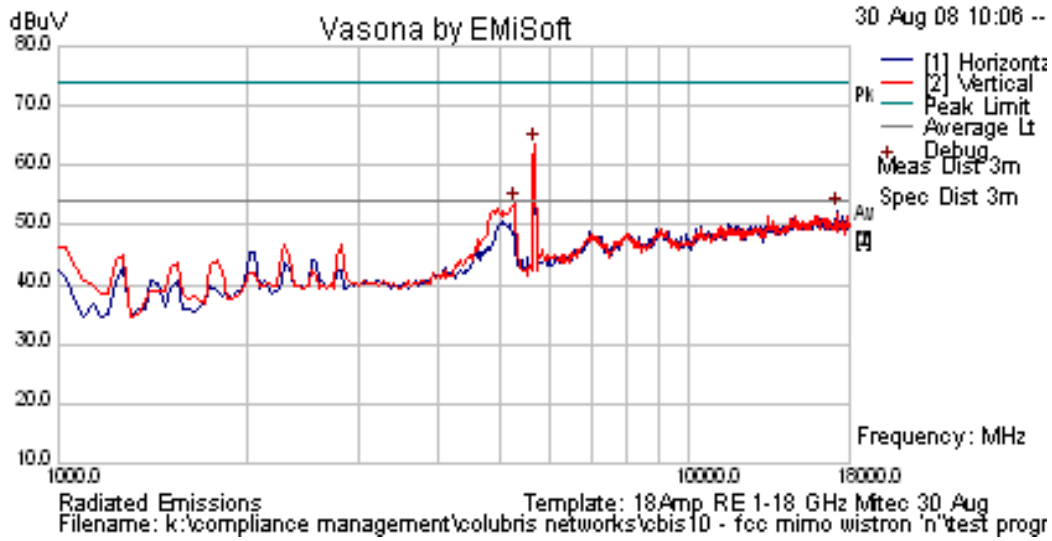
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,700 MHz HT-20



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11n HT-40 5,510 MHz Radiated Emissions above 1 GHz**

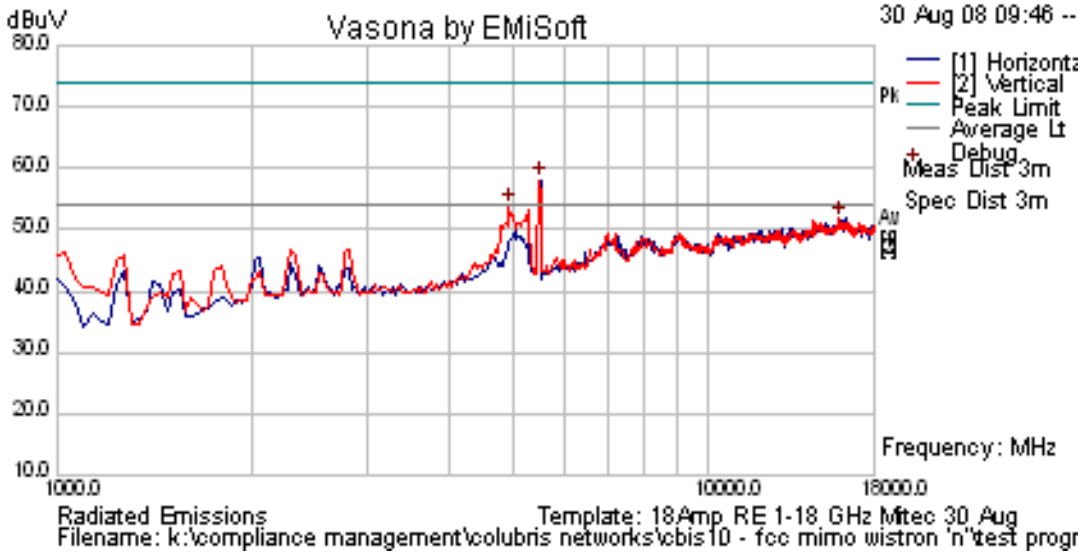
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,510 MHz HT-40



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11n HT-40 5,620 MHz Radiated Emissions above 1 GHz**

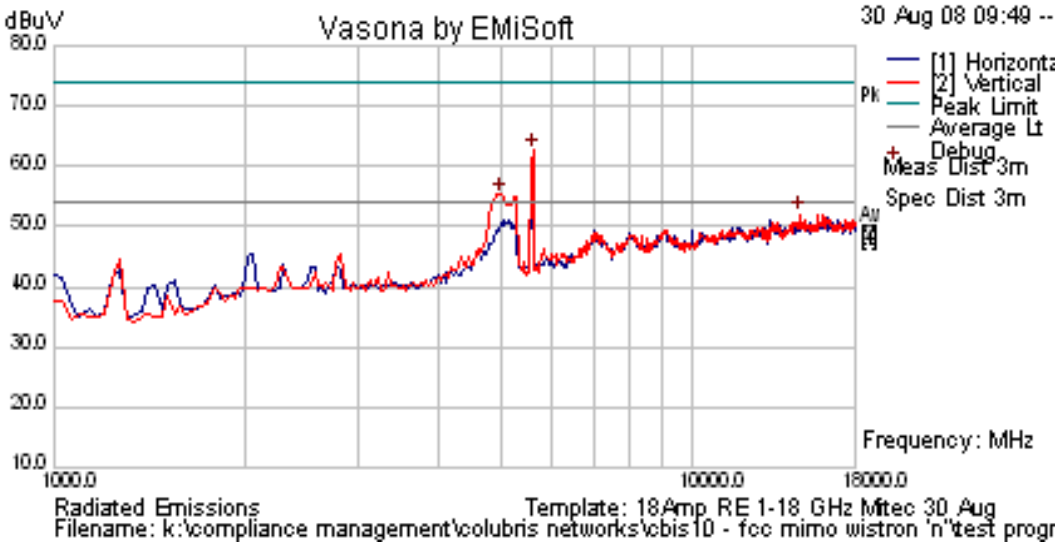
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,620 MHz HT-40



MAP-625 Integral Antenna
TABLE OF RESULTS – **802.11n HT-40 5,690 MHz Radiated Emissions above 1 GHz**

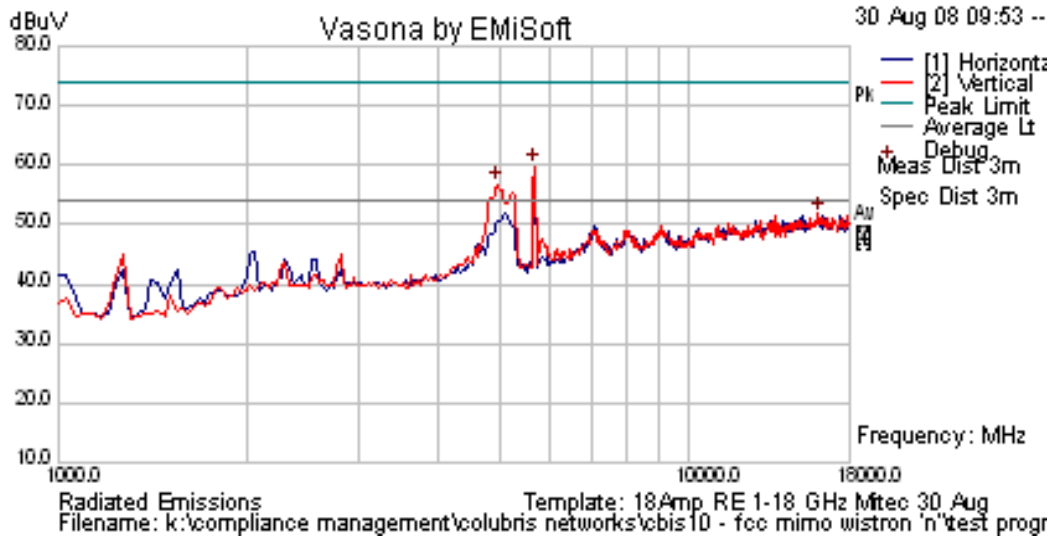
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,690 MHz HT-40



MAP-625 External Antenna
TABLE OF RESULTS – **802.11a Legacy 5,260 MHz Radiated Emissions above 1 GHz**

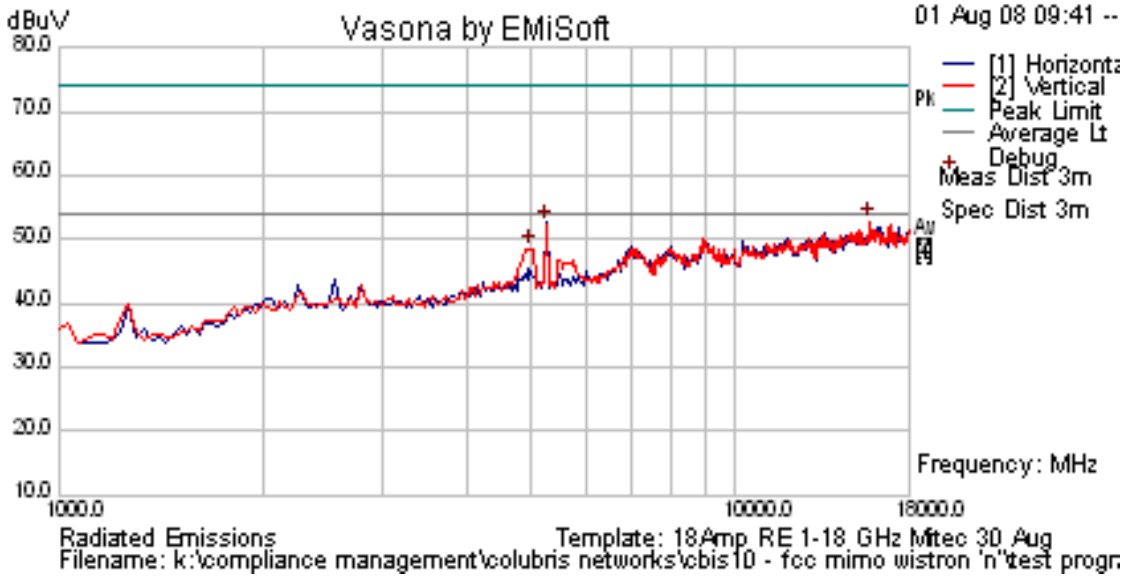
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,260 MHz Legacy



MAP-625 External Antenna
TABLE OF RESULTS – **802.11a Legacy 5,300 MHz Radiated Emissions above 1 GHz**

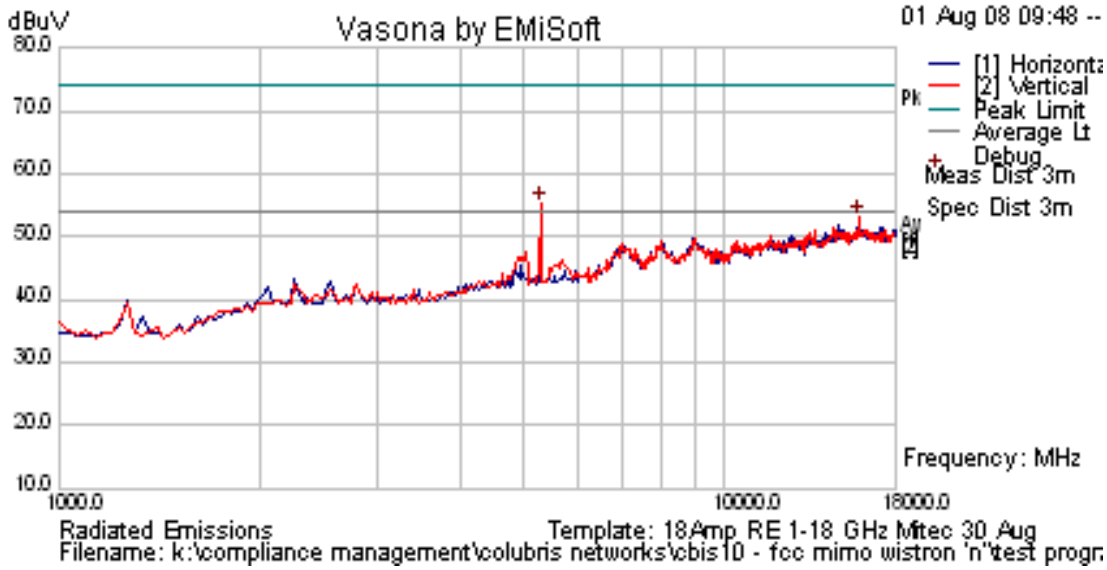
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,300 MHz Legacy



MAP-625 External Antenna
TABLE OF RESULTS – **802.11a Legacy 5,320 MHz Radiated Emissions above 1 GHz**

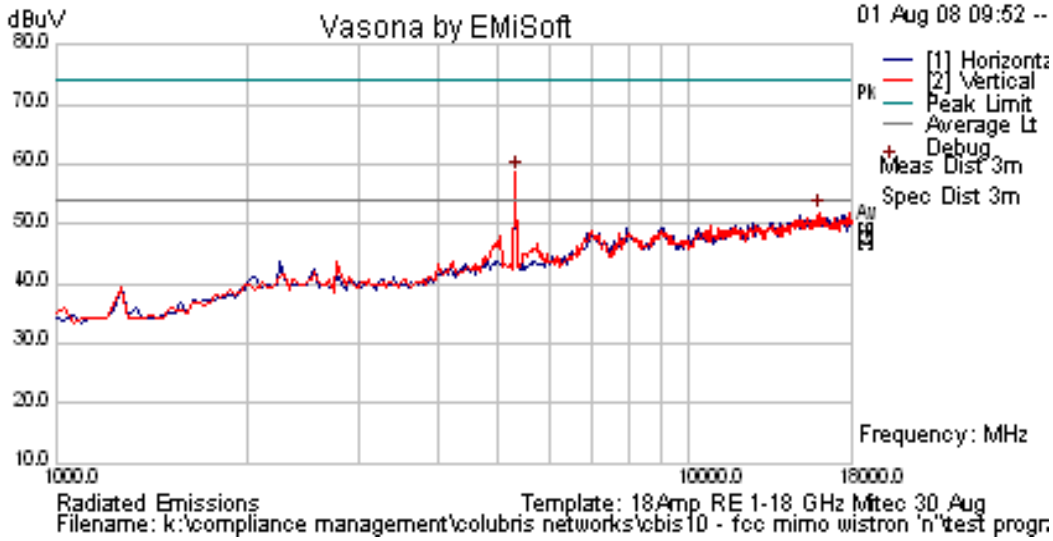
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,320 MHz Legacy



MAP-625 External Antenna

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **802.11n HT-20 5,260 MHz Radiated Emissions above 1 GHz**

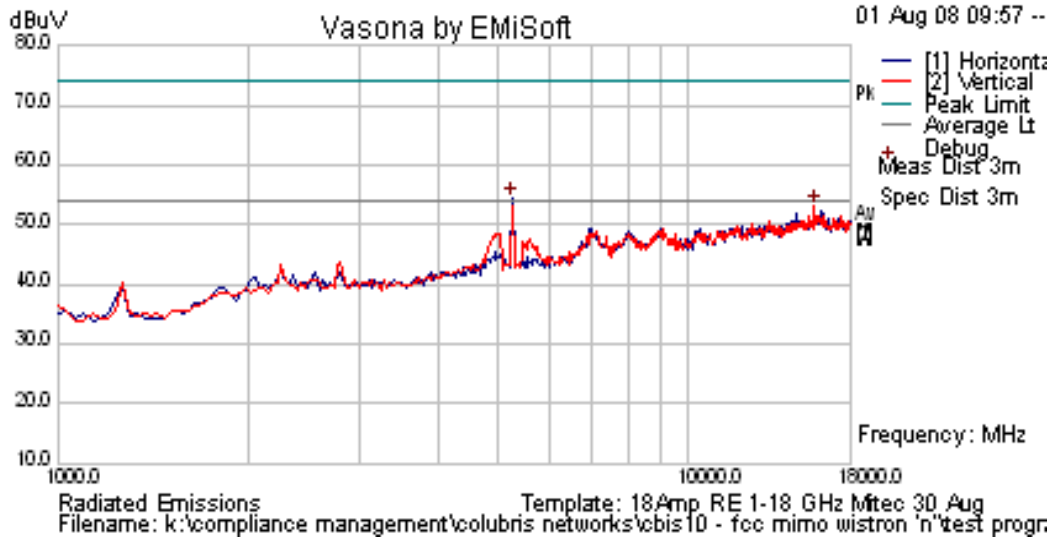
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,260 MHz HT-20



MAP-625 External Antenna

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **802.11n HT-20 5,300 MHz Radiated Emissions above 1 GHz**

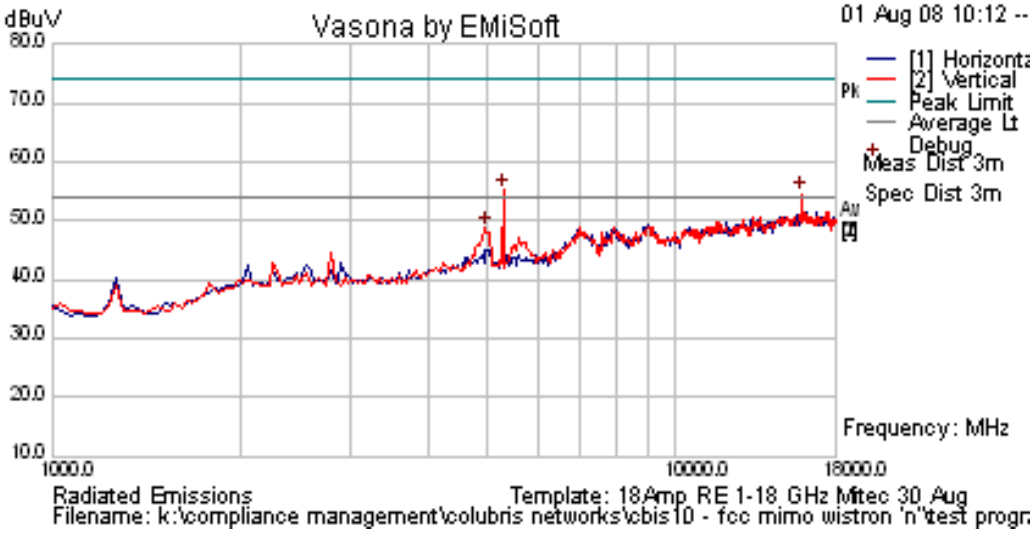
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,300 MHz HT-20



MAP-625 External Antenna
TABLE OF RESULTS – **802.11n HT-20 5,320 MHz Radiated Emissions above 1 GHz**

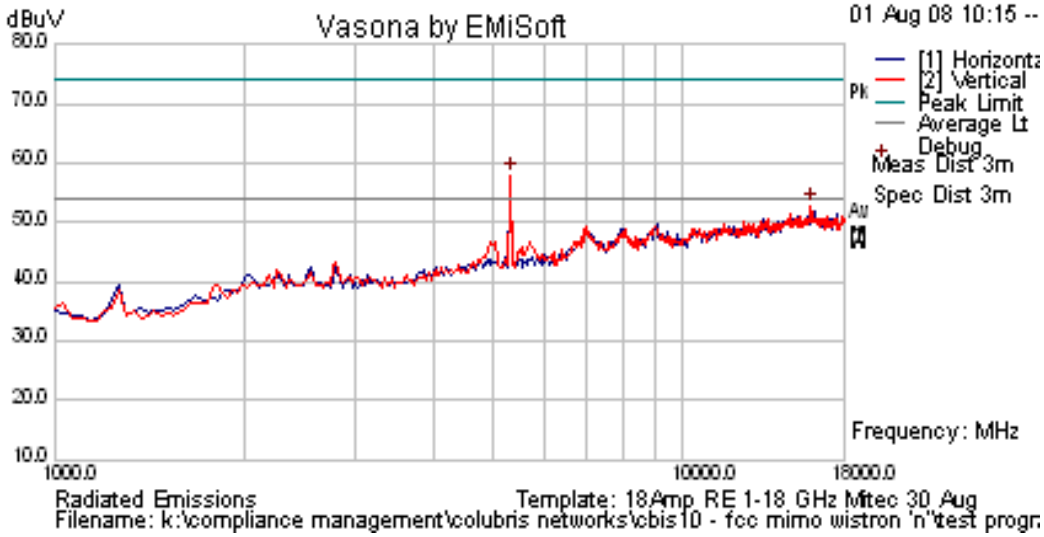
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,320 MHz HT-20



MAP-625 External Antenna

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **802.11n HT-40 5,270 MHz Radiated Emissions above 1 GHz**

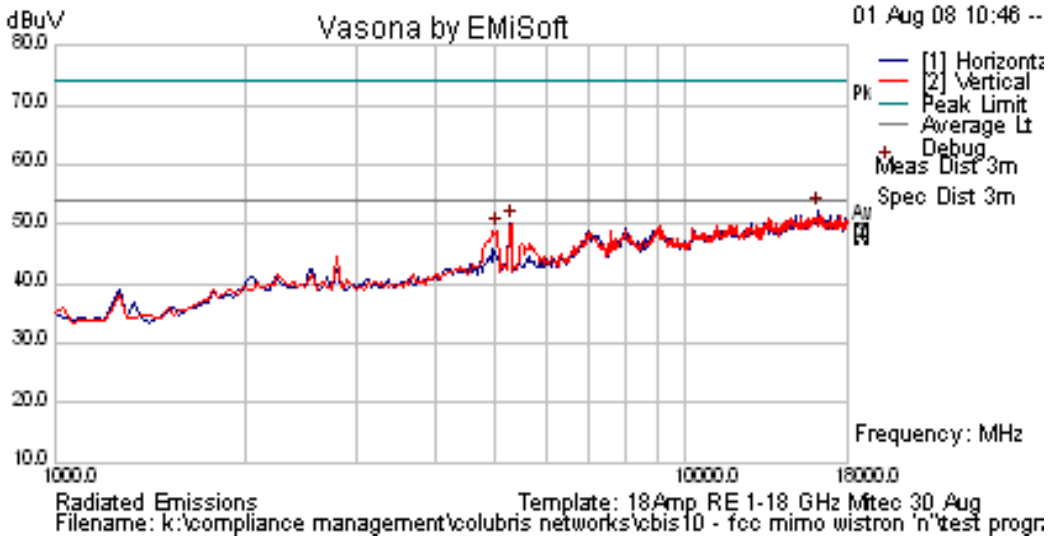
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,270 MHz HT-40



MAP-625 External Antenna

Measurement Results Transmitter Radiated Spurious Emissions above 1 GHz

TABLE OF RESULTS – **802.11n HT-40 5,310 MHz Radiated Emissions above 1 GHz**

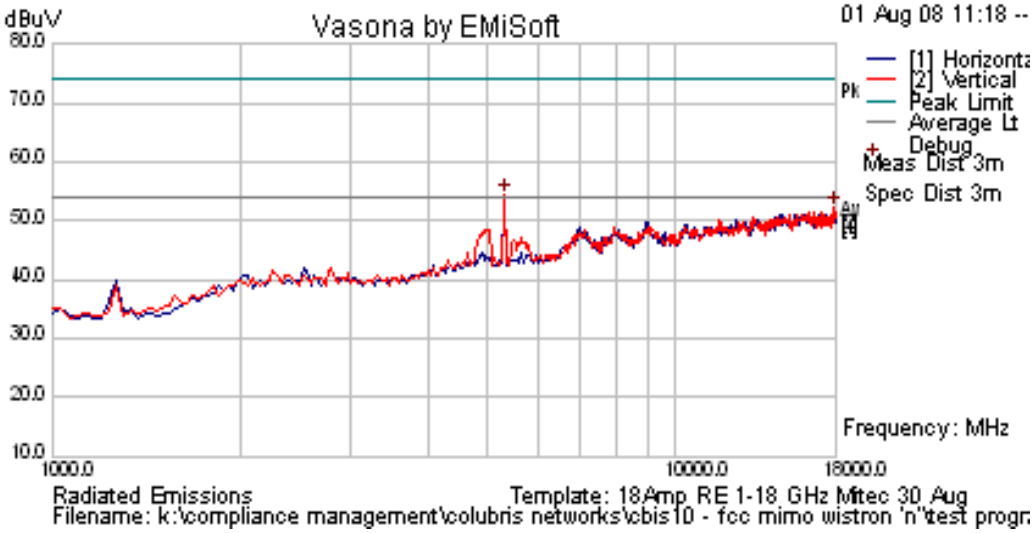
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Average Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,310 MHz HT-40



MAP-625 External Antenna
TABLE OF RESULTS – **802.11a Legacy 5,500 MHz Radiated Emissions above 1 GHz**

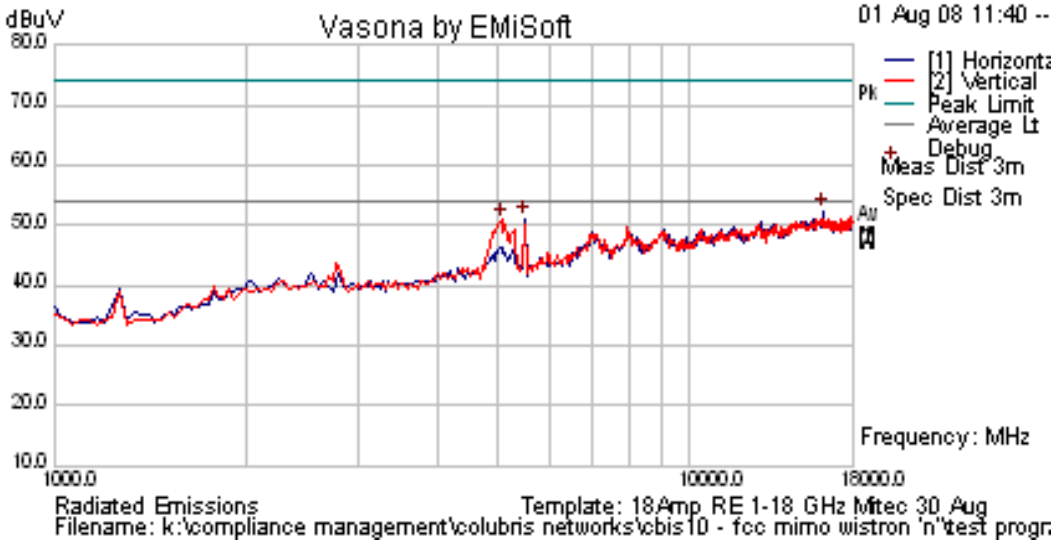
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,500 MHz Legacy



MAP-625 External Antenna
TABLE OF RESULTS – **802.11a Legacy 5,600 MHz Radiated Emissions above 1 GHz**

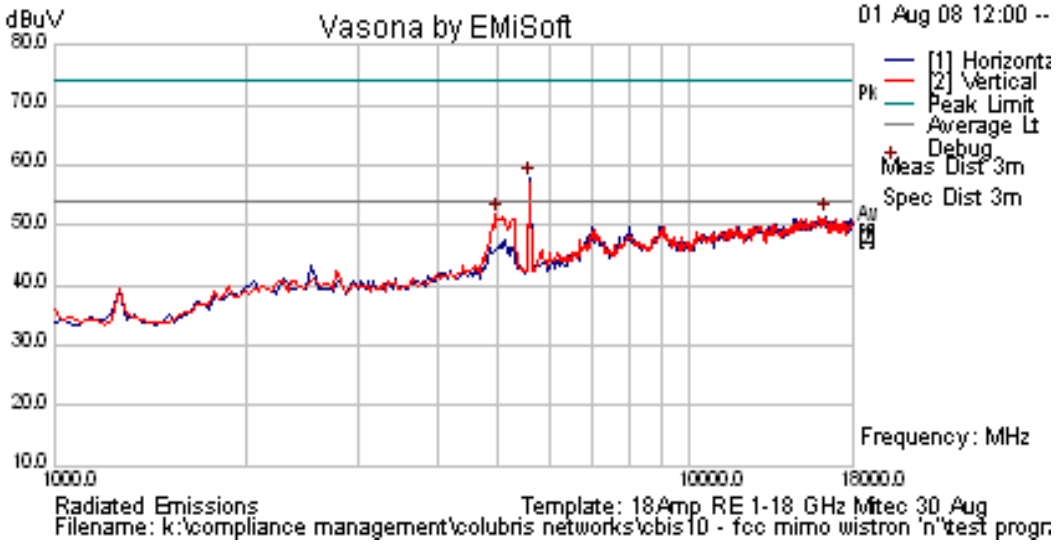
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,600 MHz Legacy



MAP-625 External Antenna
TABLE OF RESULTS – **802.11a Legacy 5,700 MHz Radiated Emissions above 1 GHz**

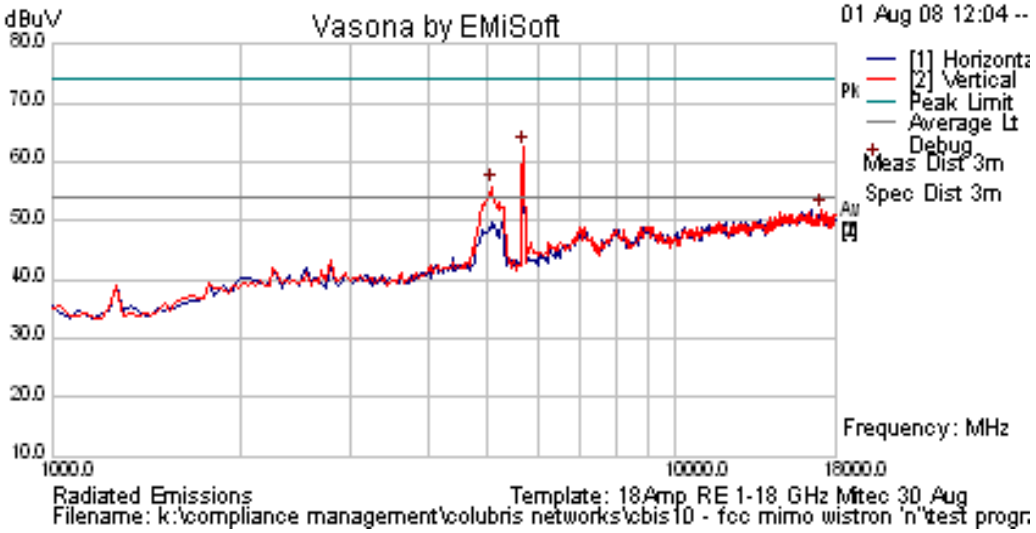
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,700 MHz Legacy



MAP-625 External Antenna
TABLE OF RESULTS – **802.11n HT-20 5,500 MHz Radiated Emissions above 1 GHz**

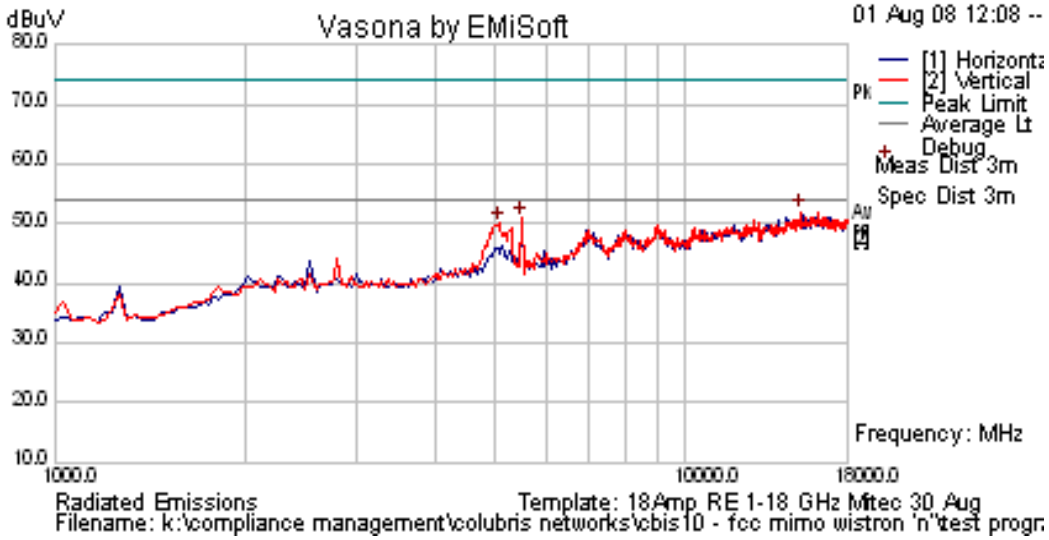
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,500 MHz HT-20



MAP-625 External Antenna
TABLE OF RESULTS – **802.11n HT-20 5,600 MHz Radiated Emissions above 1 GHz**

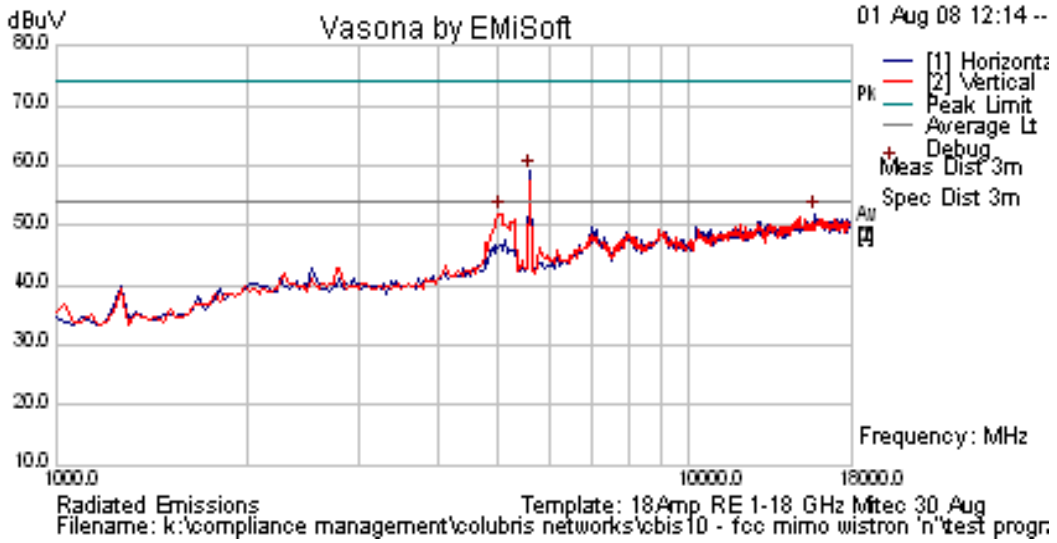
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,600 MHz HT-20



MAP-625 External Antenna
TABLE OF RESULTS – **802.11n HT-20 5,700 MHz Radiated Emissions above 1 GHz**

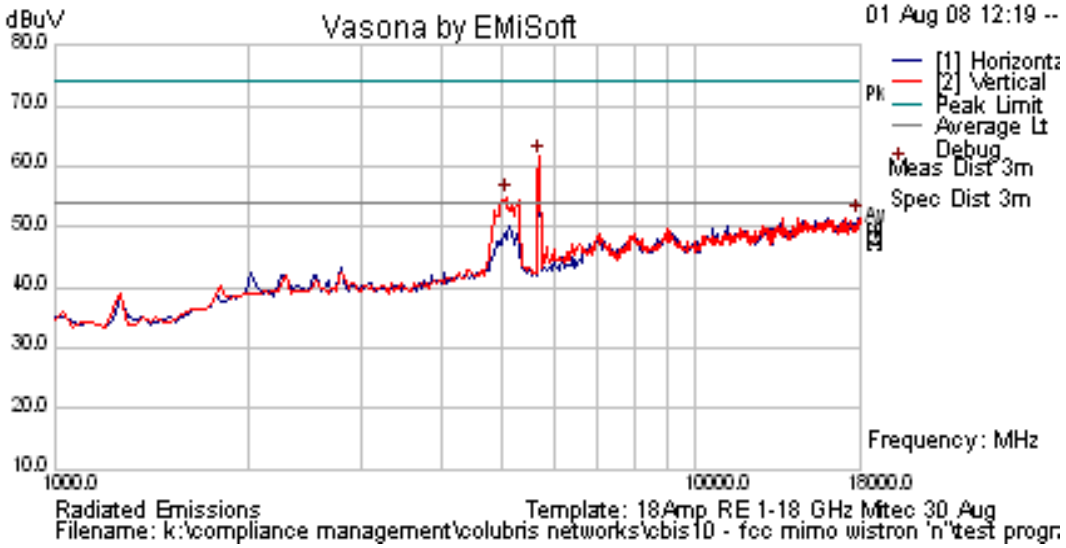
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					54	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,700 MHz HT-20



MAP-625 External Antenna
TABLE OF RESULTS – **802.11n HT-40 5,510 MHz Radiated Emissions above 1 GHz**

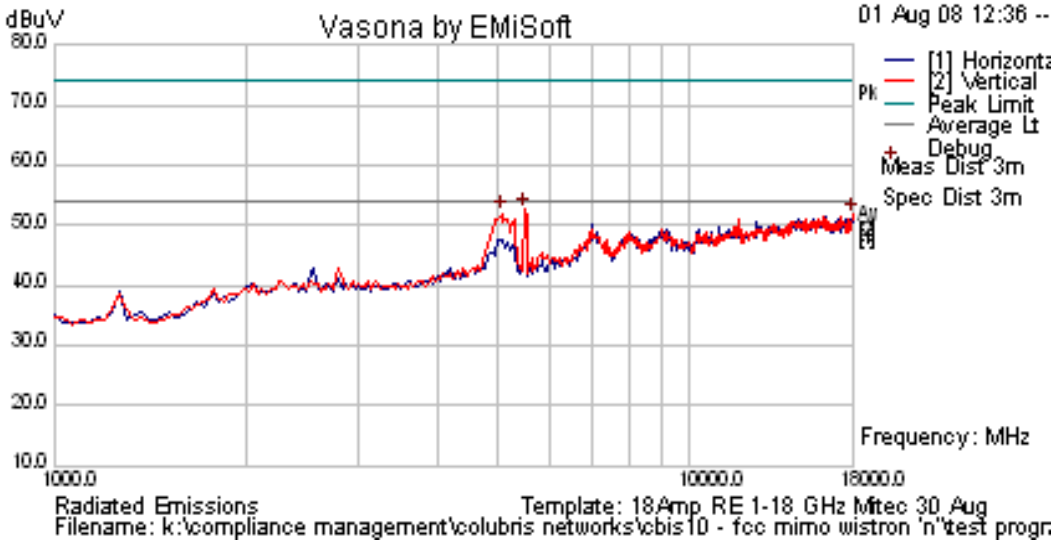
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,510 MHz HT-40



MAP-625 External Antenna
TABLE OF RESULTS – **802.11n HT-40 5,620 MHz Radiated Emissions above 1 GHz**

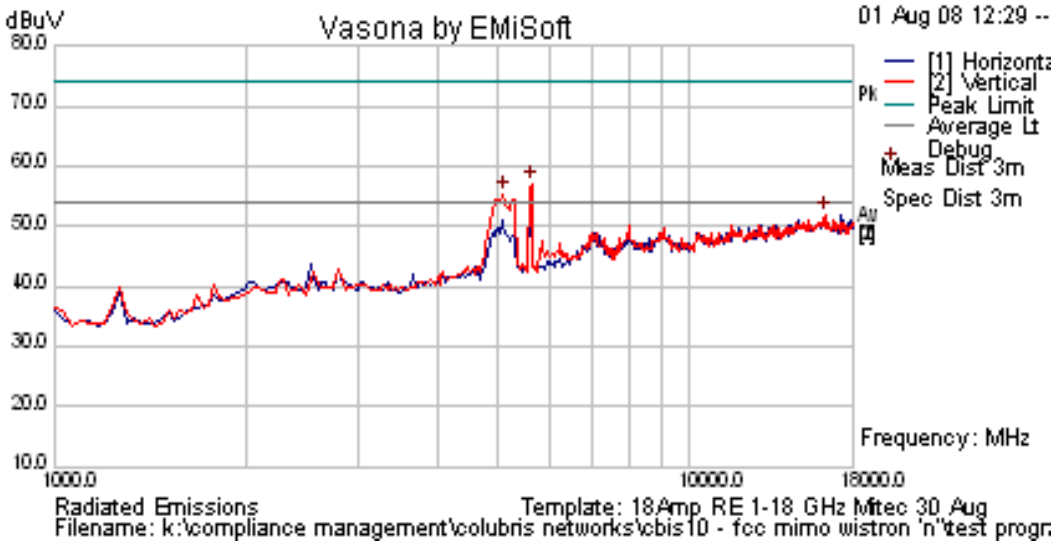
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,620 MHz HT-40



MAP-625 External Antenna
TABLE OF RESULTS – **802.11n HT-40 5,690 MHz Radiated Emissions above 1 GHz**

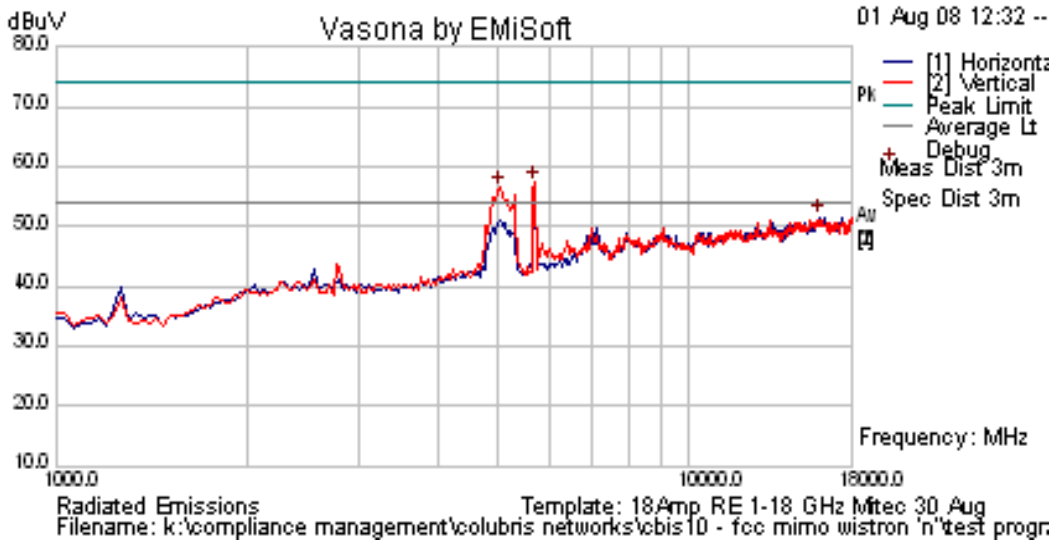
Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
					74	

Freq. (MHz)	Pol. (H/V)	Raw Reading (dBµV)	Correction Factor (dB)	Corrected Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
					54	

The peak emission seen breaking the average limit line is the fundamental. No other emissions were observed within 6dB of the peak limit.

The energy immediately to the left and/or the right of the fundamental carrier will be measured under the restricted band-edge requirement.

Radiated Emissions for 5,690 MHz HT-40



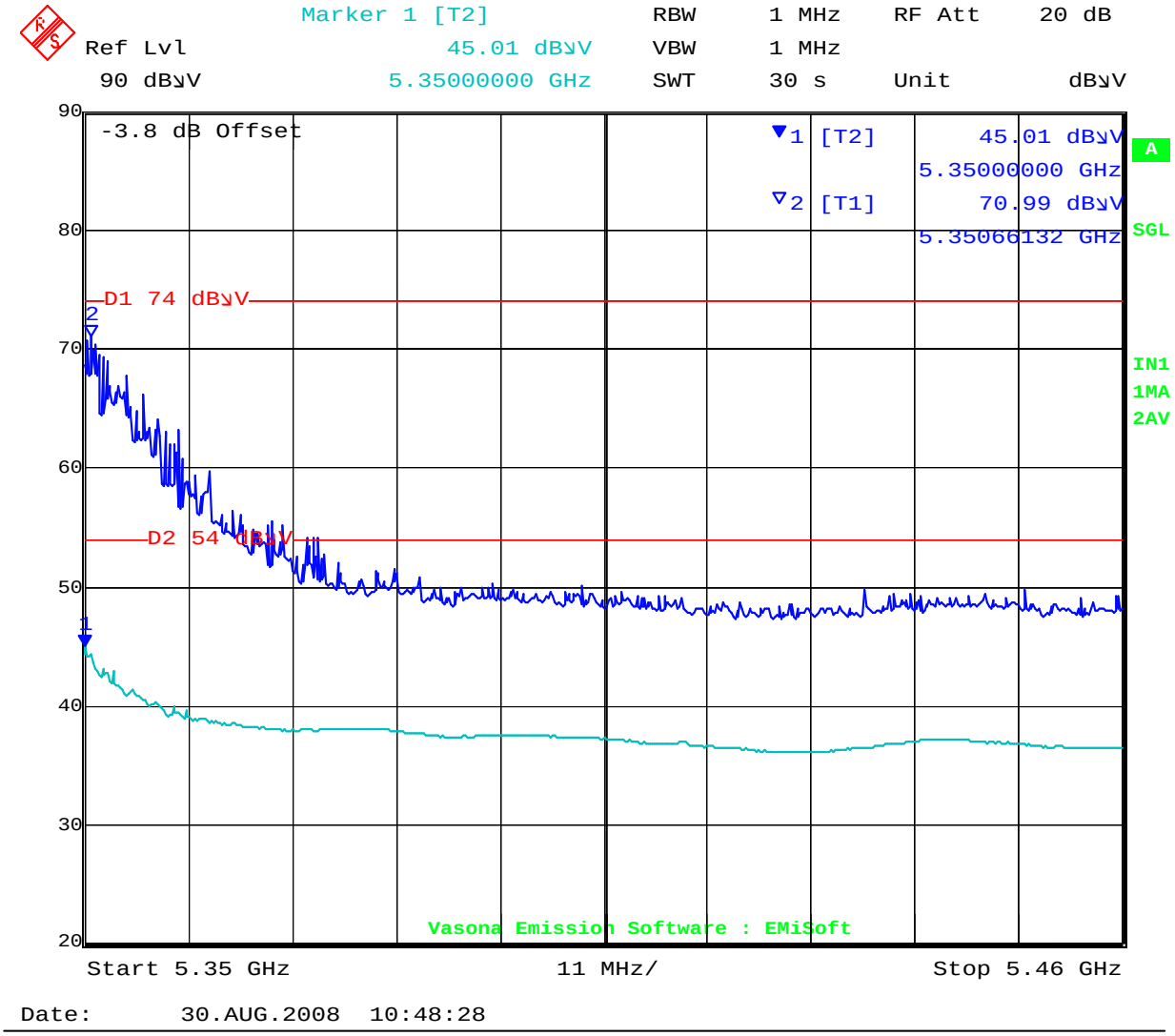
5.1.7.2. Radiated Band-Edge – Restricted Bands

Integral Antenna Lower Sub Band - 5,250 MHz to 5,350 MHz

TABLE OF RESULTS - 802.11a Legacy -

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}320_{PEAK}$	5,350	70.99	74.00	-3.01
$5{,}320_{AVE}$	5,350	45.01	54.00	-8.99

802.11a Legacy – 5,320 MHz

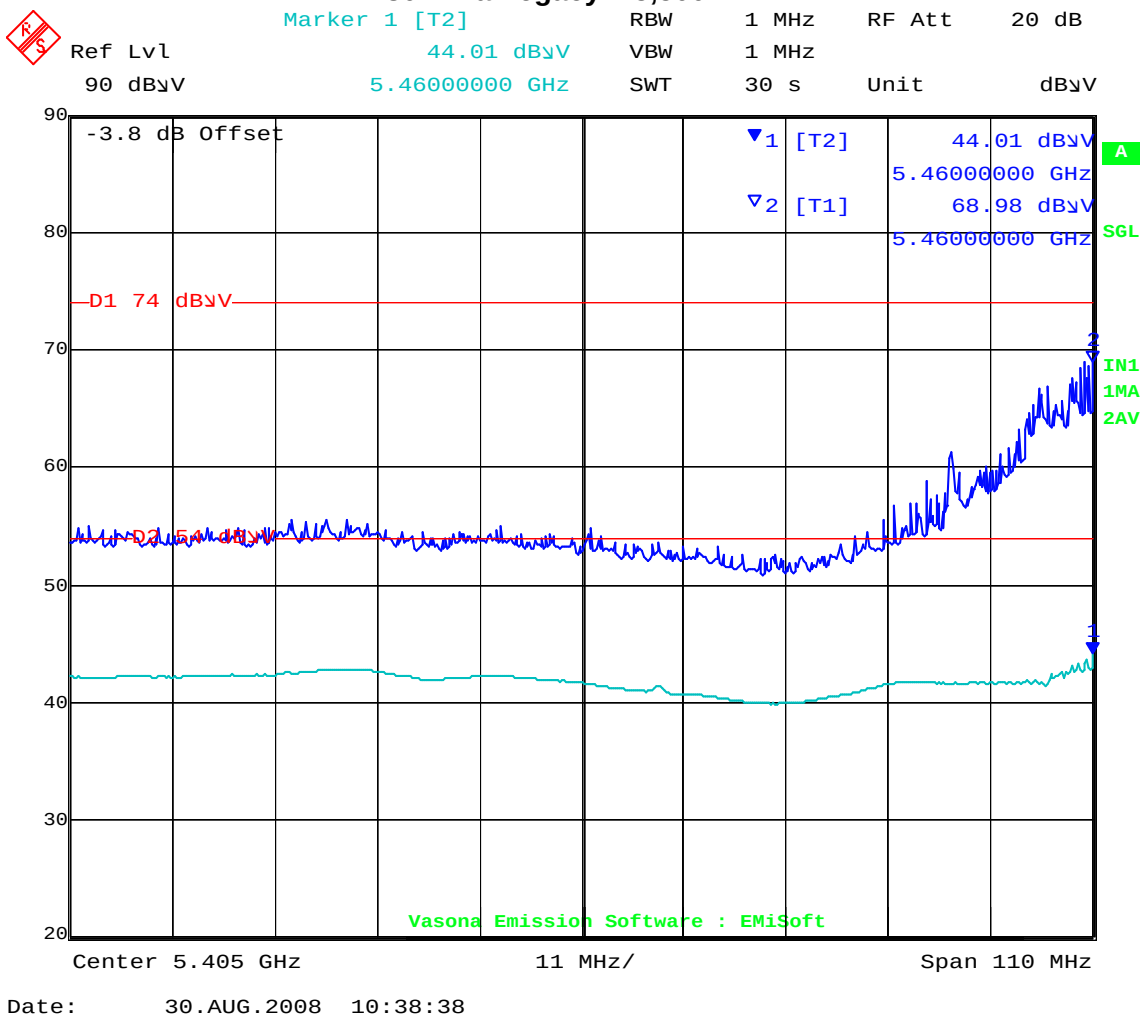


Integral antenna Upper Sub Band - 5,470 MHz to 5,725 MHz

TABLE OF RESULTS - 802.11a Legacy

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}500_{PEAK}$	5,460	68.98	74.00	-5.02
$5{,}500_{AVE}$	5,460	44.01	54.00	-9.99

802.11a Legacy – 5,500 MHz



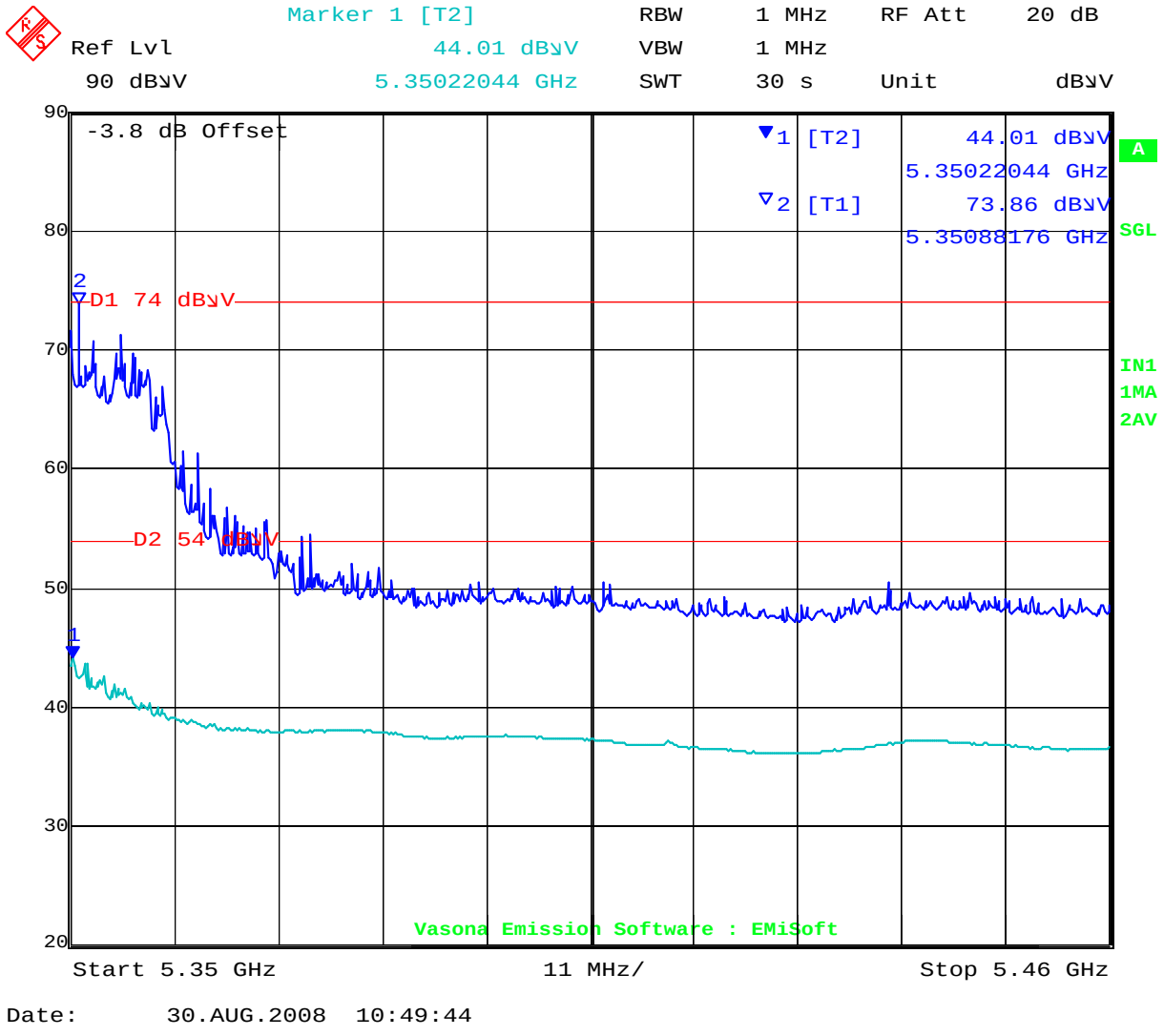
Note; No band edge measurements are required at the upper end of the 5,470 – 5,725 band.

Integral Antenna Lower Sub Band - 5,250 MHz to 5,350 MHz

TABLE OF RESULTS - 802.11n HT-20

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}320_{PEAK}$	5,350	73.86	74.00	-0.14
$5{,}320_{AVE}$	5,350	44.01	54.00	-9.99

802.11n HT-20 – 5,320 MHz

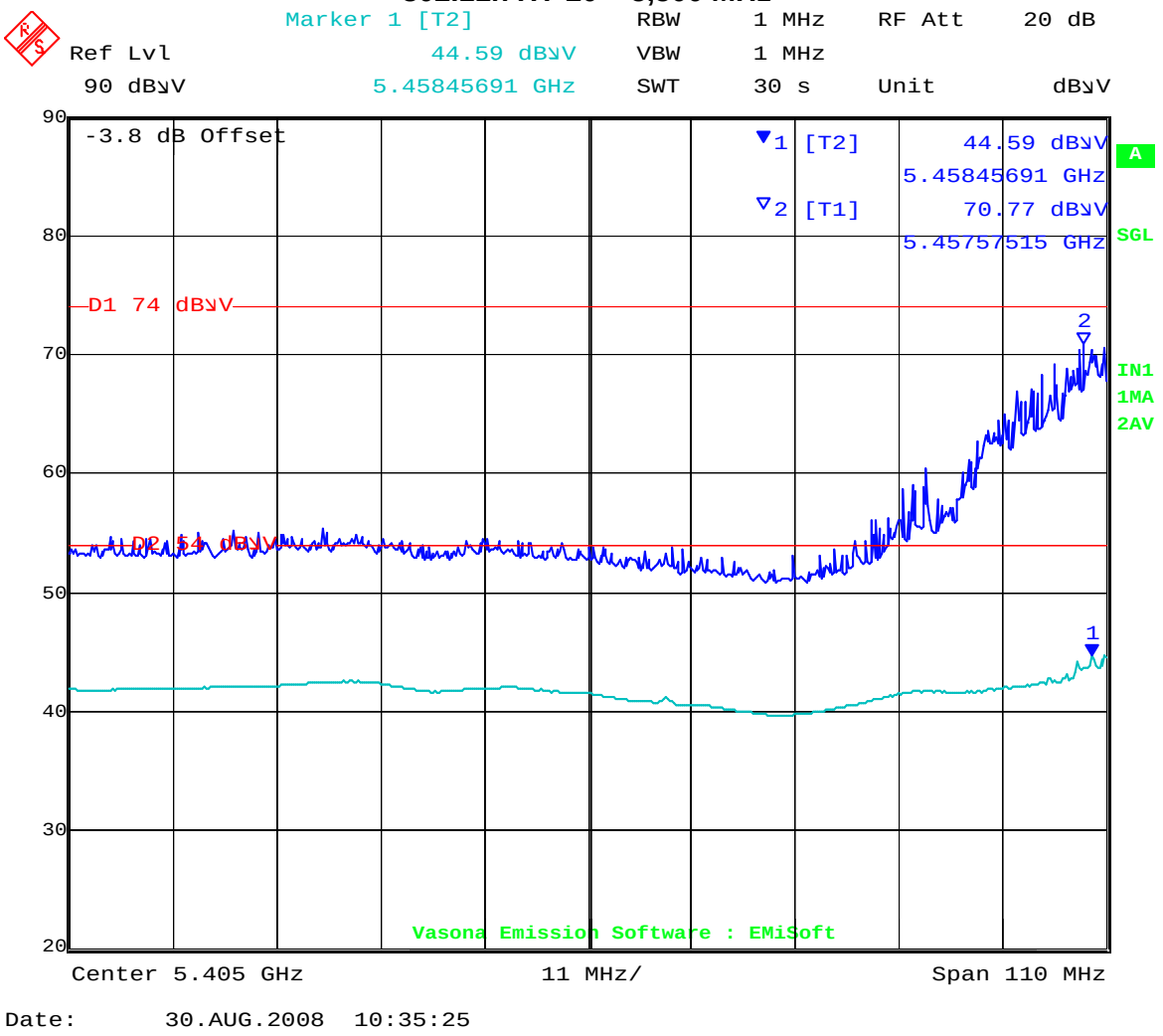


Integral antenna Upper Sub Band - 5,470 MHz to 5,725 MHz

TABLE OF RESULTS - 802.11n HT-20

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}500_{PEAK}$	5,460	70.77	74.00	-3.23
$5{,}500_{AVE}$	5,460	44.59	54.00	-9.41

802.11n HT-20 – 5,500 MHz



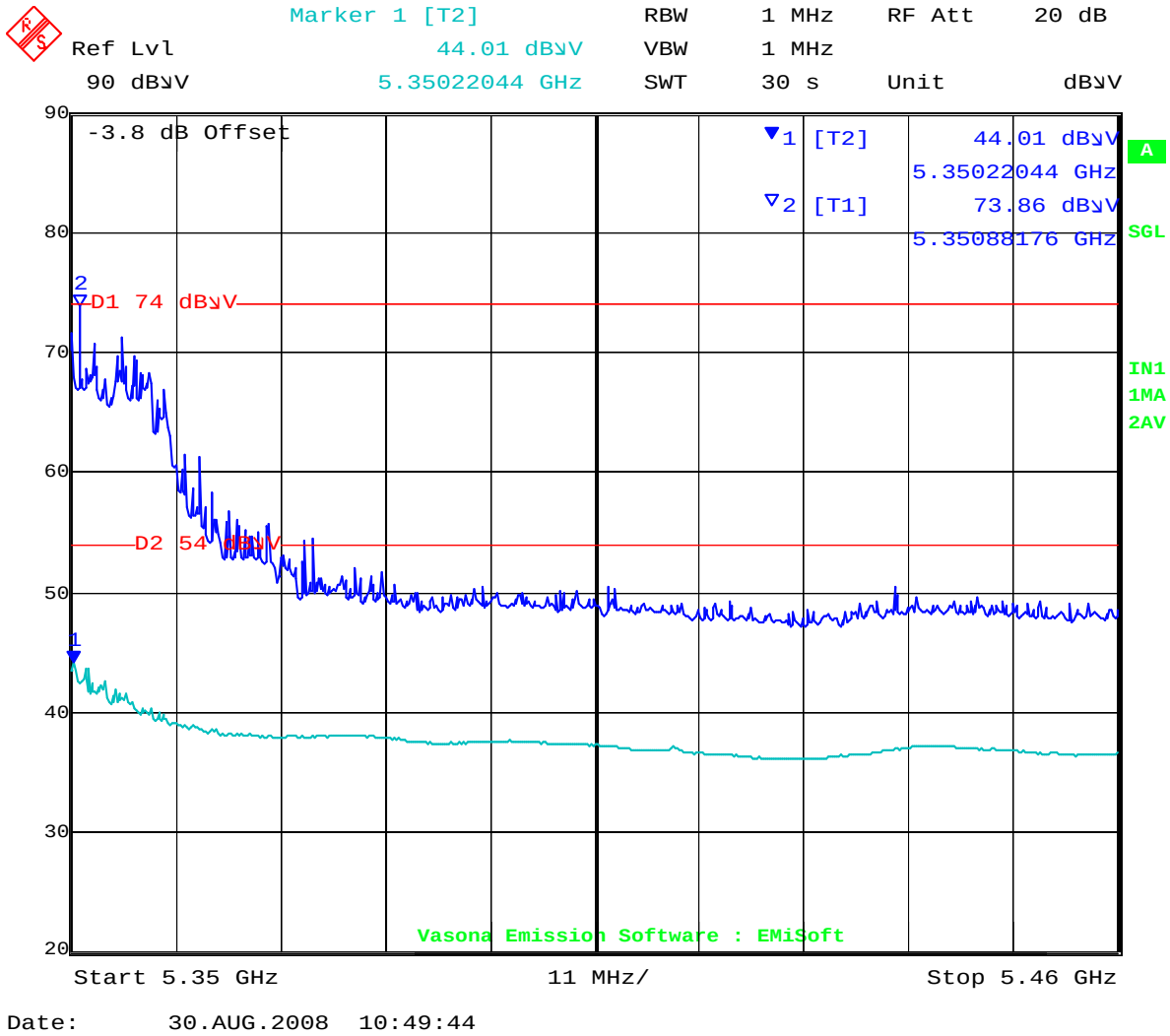
Note; No band edge measurements are required at the upper end of the 5,470 – 5,725 band.

Integral Antenna Lower Sub Band - 5,250 MHz to 5,350 MHz

TABLE OF RESULTS - 802.11n HT-40

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}310_{PEAK}$	5,350	71.11	74.00	-2.89
$5{,}310_{AVE}$	5,350	50.53	54.00	-3.47

802.11n HT-40 – 5,320 MHz

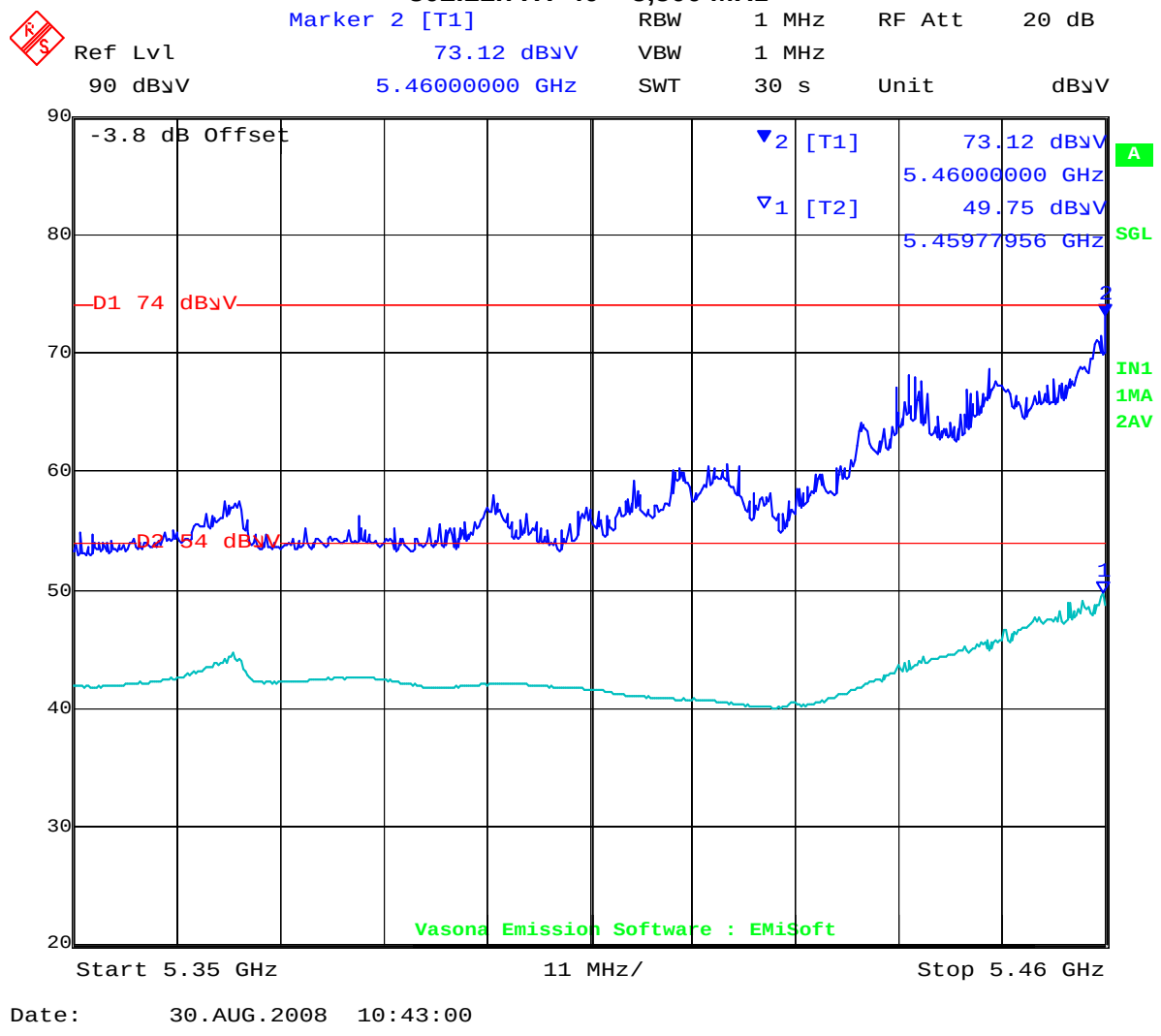


Integral antenna Upper Sub Band - 5,470 MHz to 5,725 MHz

TABLE OF RESULTS - 802.11n HT-40

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}510_{PEAK}$	5,460	73.12	74.00	-0.88
$5{,}510_{AVE}$	5,460	49.75	54.00	-4.25

802.11n HT-40 – 5,500 MHz



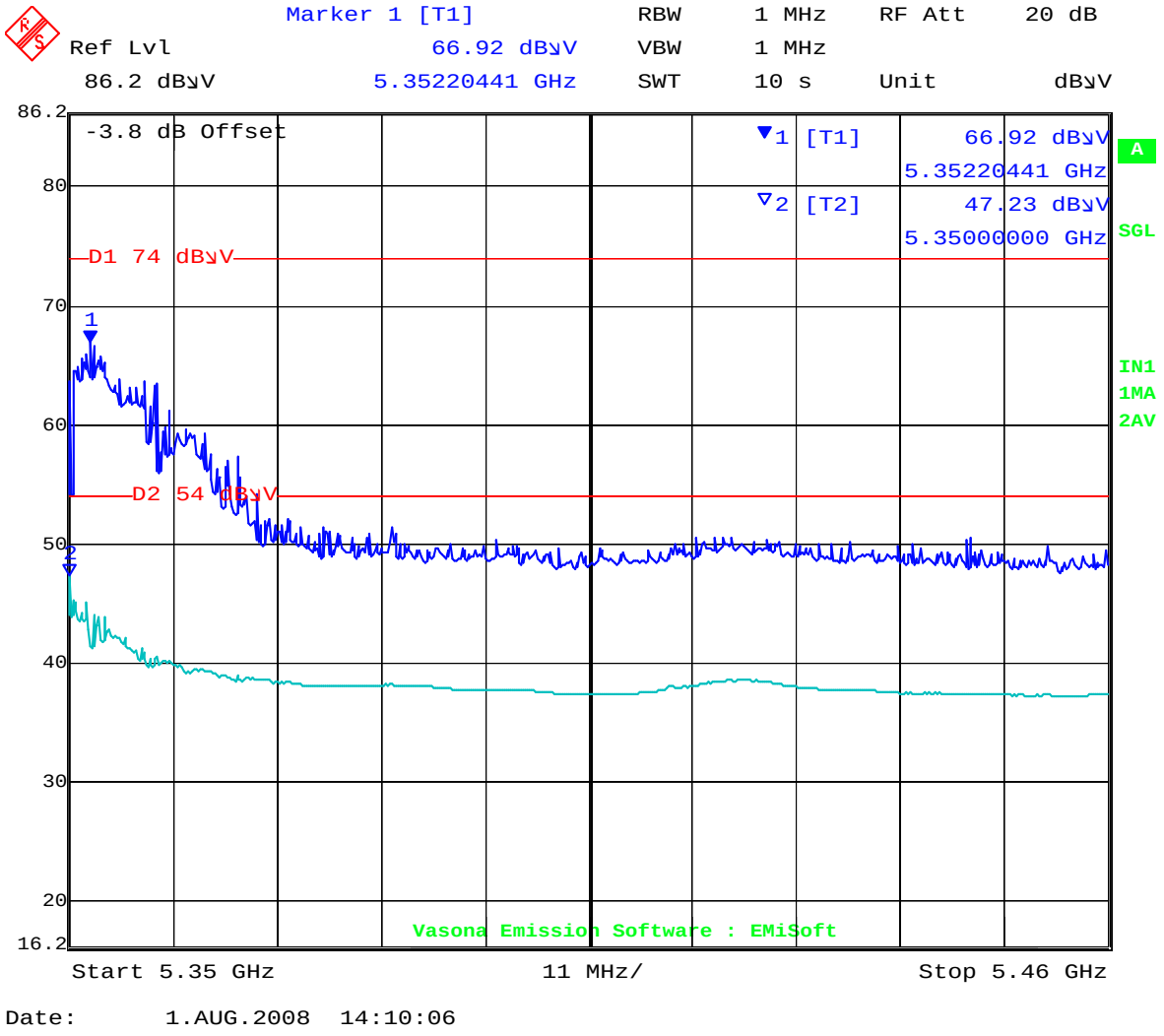
Note; No band edge measurements are required at the upper end of the 5,470 – 5,725 band.

External Antenna Lower Sub Band - 5,250 MHz to 5,350 MHz

TABLE OF RESULTS - 802.11a Legacy

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}320_{PEAK}$	5,350	66.92	74.00	-7.08
$5{,}320_{AVE}$	5,350	47.23	54.00	-6.77

802.11a Legacy – 5,320 MHz

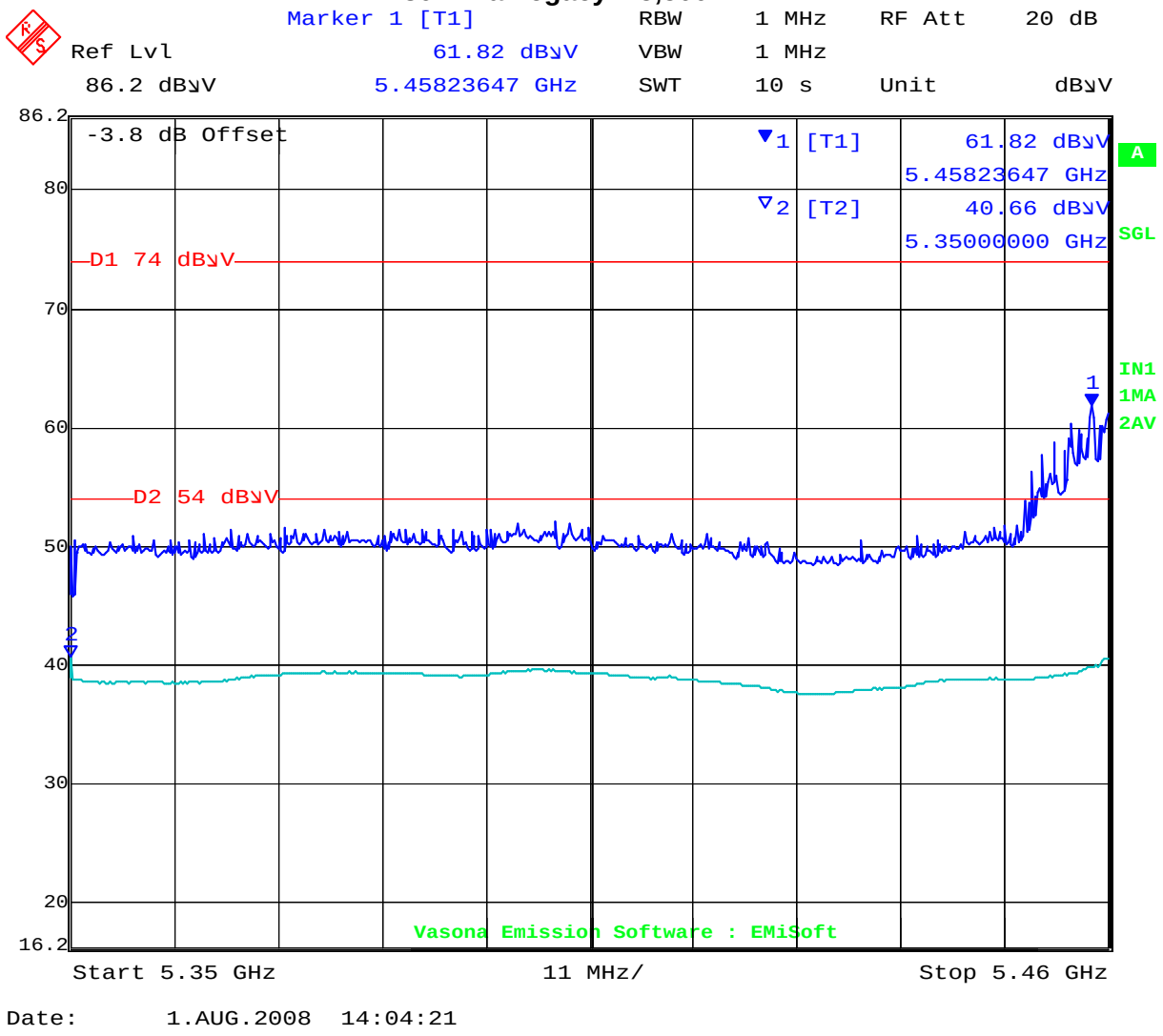


External antenna Upper Sub Band - 5,470 MHz to 5,725 MHz

TABLE OF RESULTS - 802.11a Legacy

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}500_{PEAK}$	5,460	61.82	74.00	-12.18
$5{,}500_{AVE}$	5,460	40.66	54.00	-13.34

802.11a Legacy – 5,500 MHz



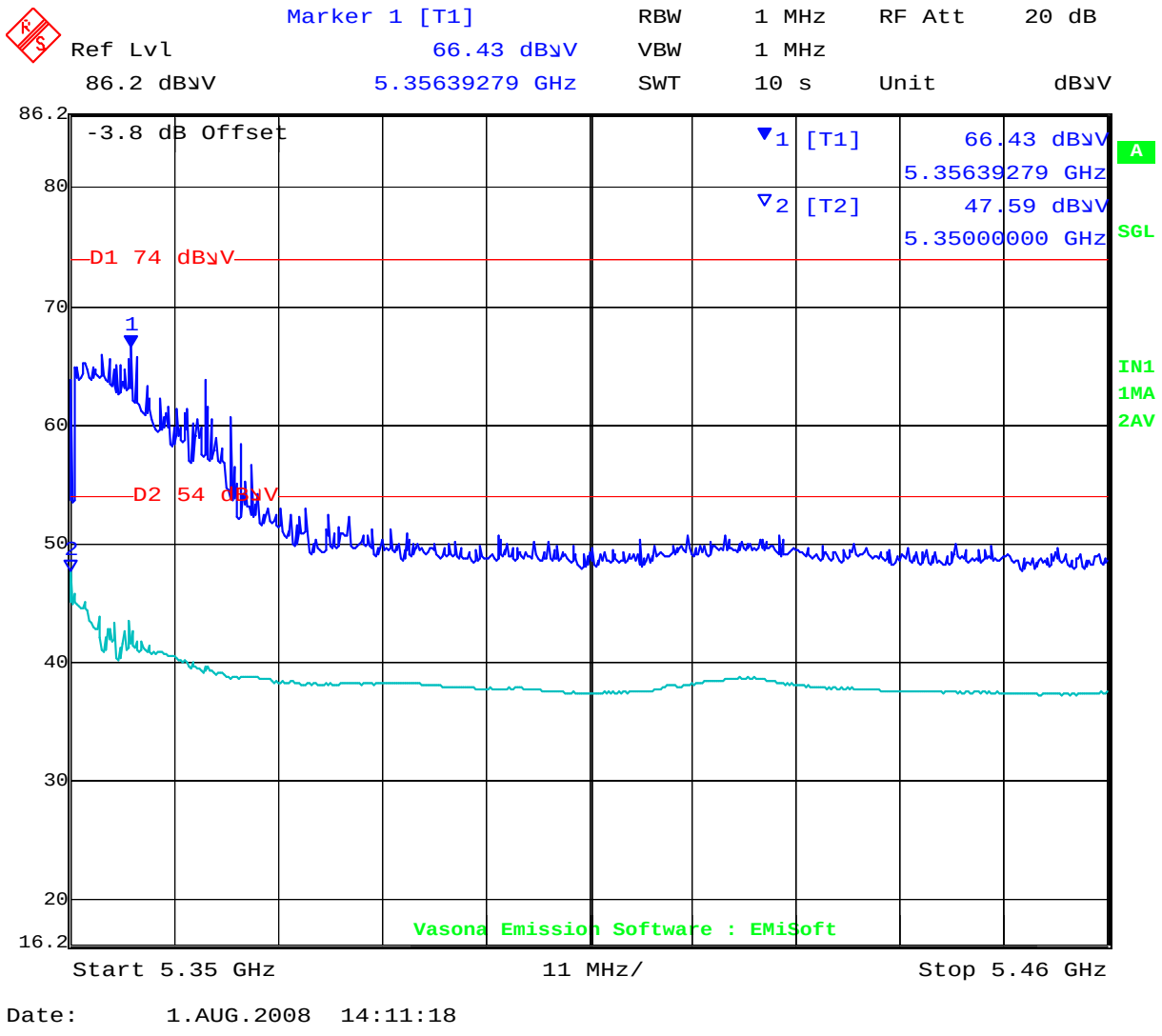
Note; No band edge measurements are required at the upper end of the 5,470 – 5,725 band.

External Antenna Lower Sub Band - 5,250 MHz to 5,350 MHz

TABLE OF RESULTS - 802.11n HT-20

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}320_{PEAK}$	5,350	66.43	74.00	-7.57
$5{,}320_{AVE}$	5,350	47.59	54.00	-6.41

802.11n HT-20 – 5,320 MHz

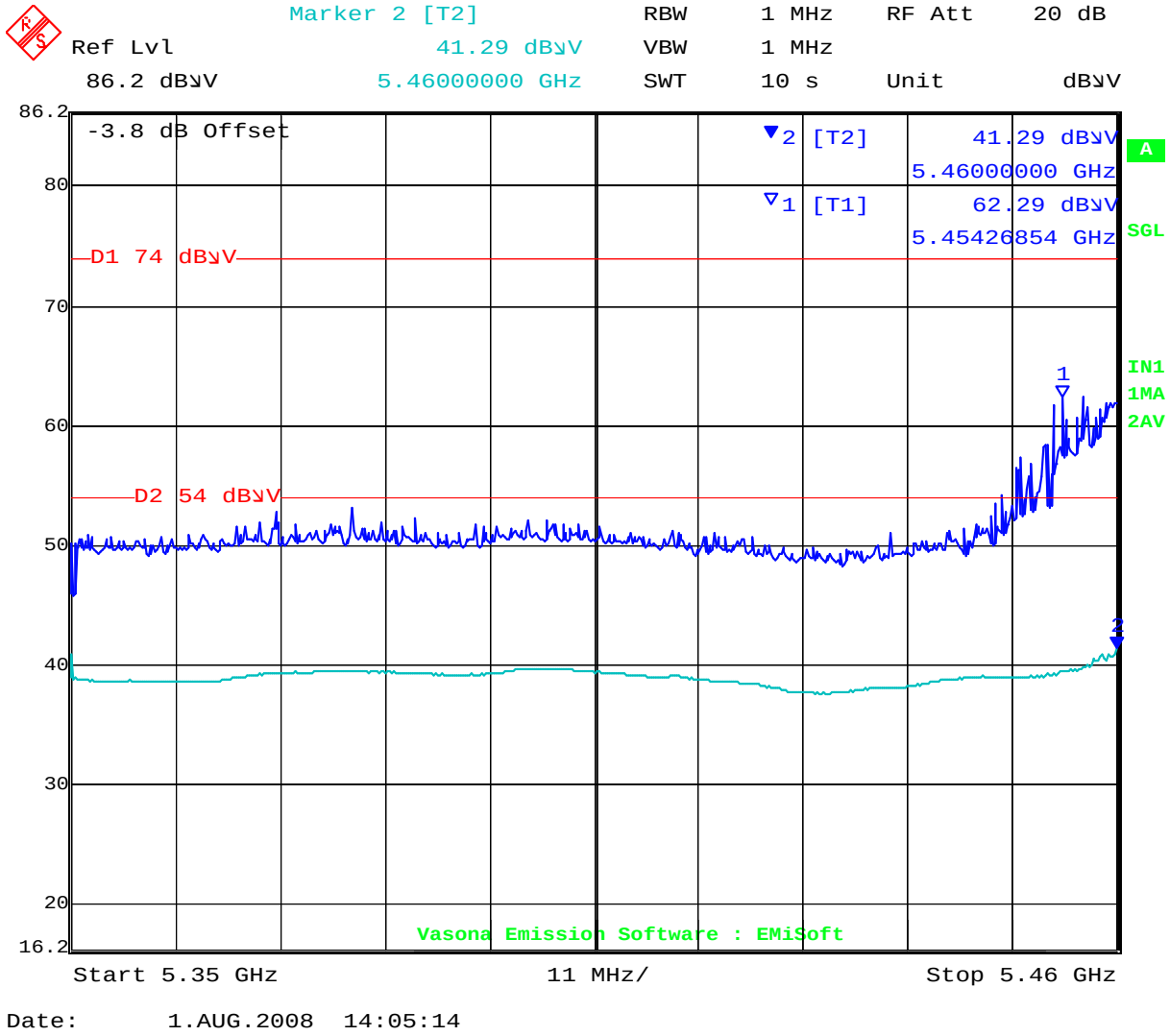


External antenna Upper Sub Band - 5,470 MHz to 5,725 MHz

TABLE OF RESULTS - 802.11n HT-20

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}500_{PEAK}$	5,460	62.29	74.00	-11.71
$5{,}500_{AVE}$	5,460	41.29	54.00	-12.71

802.11n HT-20 – 5,500 MHz



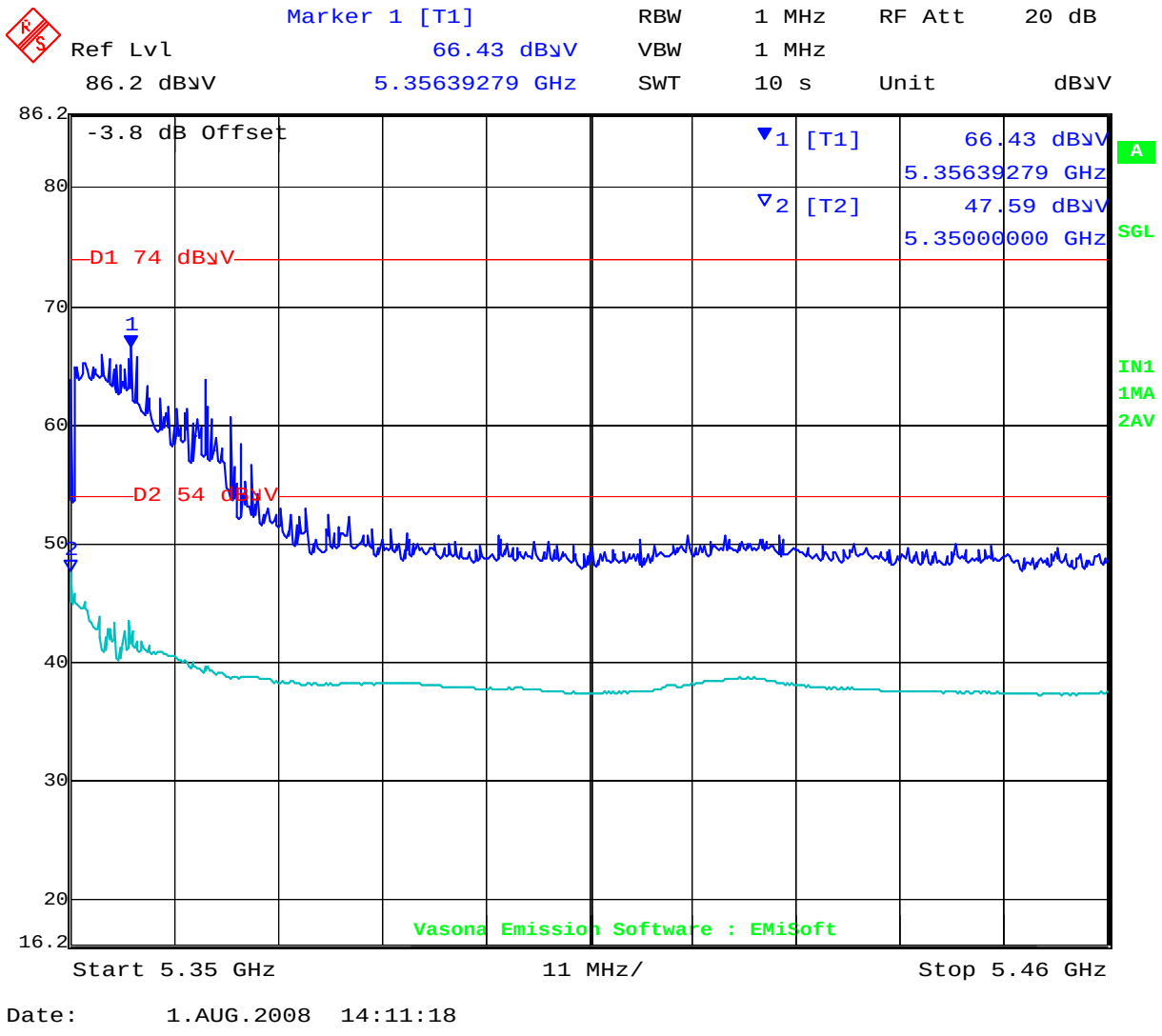
Note; No band edge measurements are required at the upper end of the 5,470 – 5,725 band.

External Antenna Lower Sub Band - 5,250 MHz to 5,350 MHz

TABLE OF RESULTS - 802.11n HT-40

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}320_{PEAK}$	5,350	71.61	74.00	-2.39
$5{,}320_{AVE}$	5,350	49.05	54.00	-4.95

802.11n HT-40 – 5,320 MHz

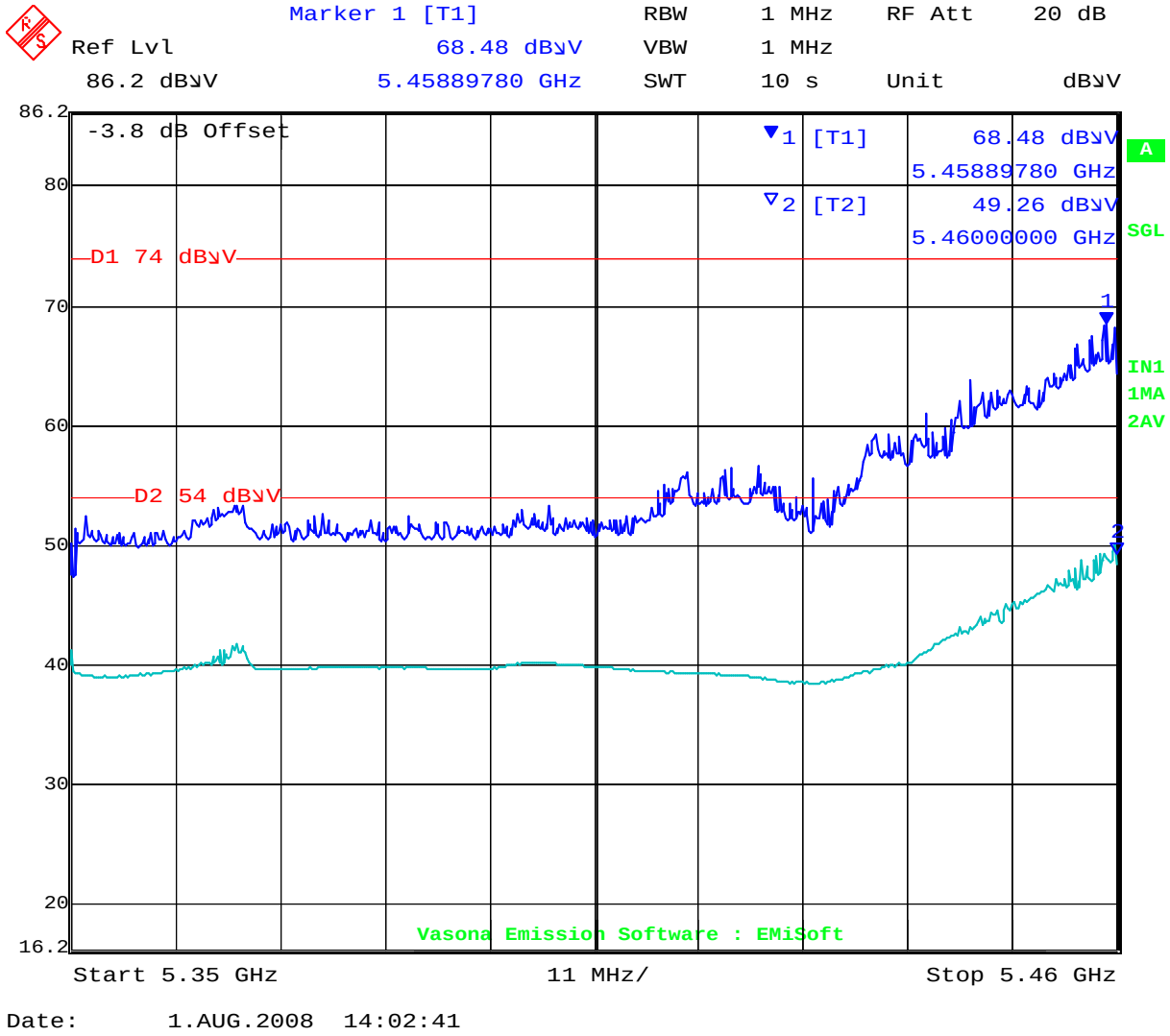


External antenna Upper Sub Band - 5,470 MHz to 5,725 MHz

TABLE OF RESULTS - 802.11n HT-40

Tx Freq. (MHz)	Restricted Band Frequency (MHz)	Measured (dBuV/m)	Limit (dBuV/m)	Margin (dB)
$5{,}500_{PEAK}$	5,460	68.48	74.00	-5.52
$5{,}500_{AVE}$	5,460	49.26	54.00	-4.74

802.11n HT-40 – 5,500 MHz



Note; No band edge measurements are required at the upper end of the 5,470 – 5,725 band.

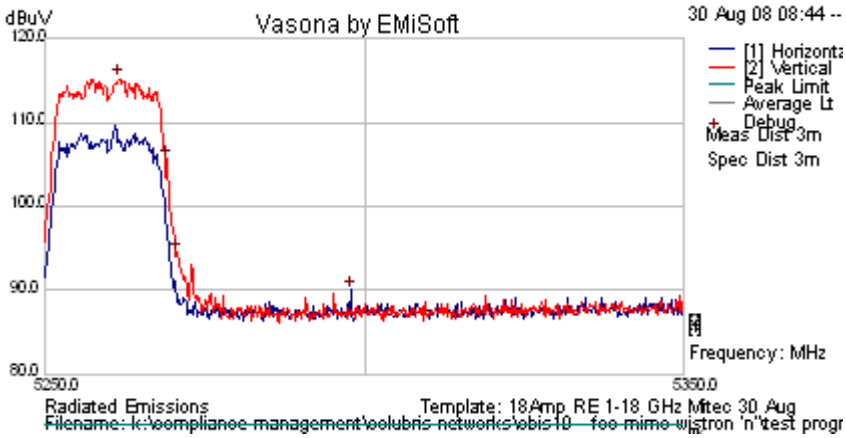
5.1.7.3. Peak Field Strength Measurements;

Lower sub-band 5,250 MHz to 5,350 MHz

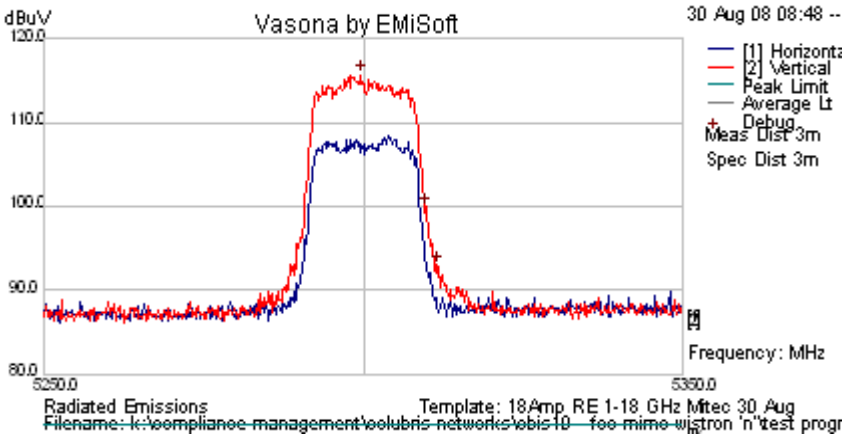
TABLE OF RESULTS - 802.11a Legacy – Integral Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,260	115.17
5,300	115.69
5,320	115.45

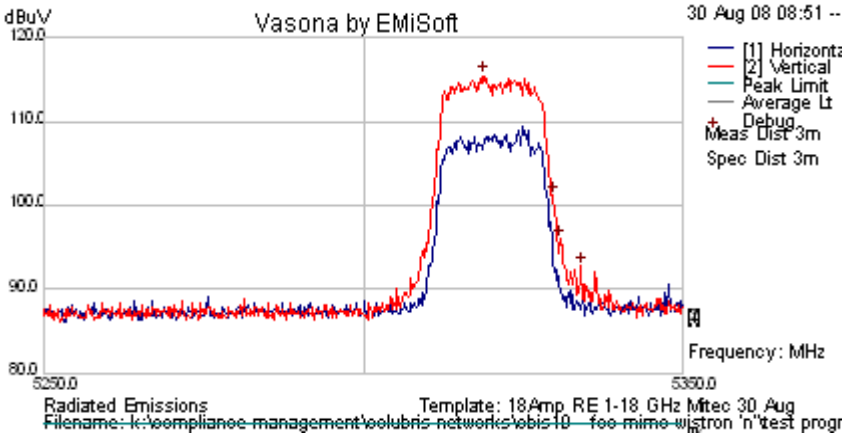
802.11a Legacy – 5,260 MHz - Integral Antenna
Lower Band Edge Peak Emission = 115.17 dBµV/m



802.11a Legacy – 5,300 MHz - Integral Antenna
Lower Band Edge Peak Emission = 115.69 dBµV/m



802.11a Legacy – 5,320 MHz - Integral Antenna
Lower Band Edge Peak Emission = 115.45 dBµV/m

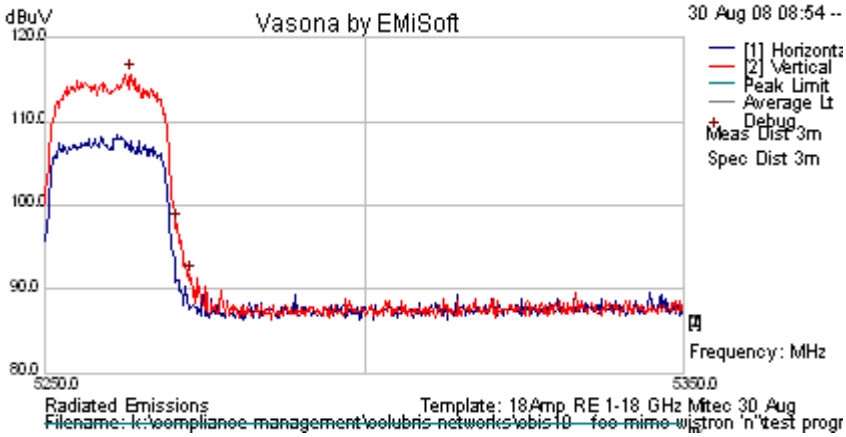


Lower sub-band 5,250 MHz to 5,350 MHz

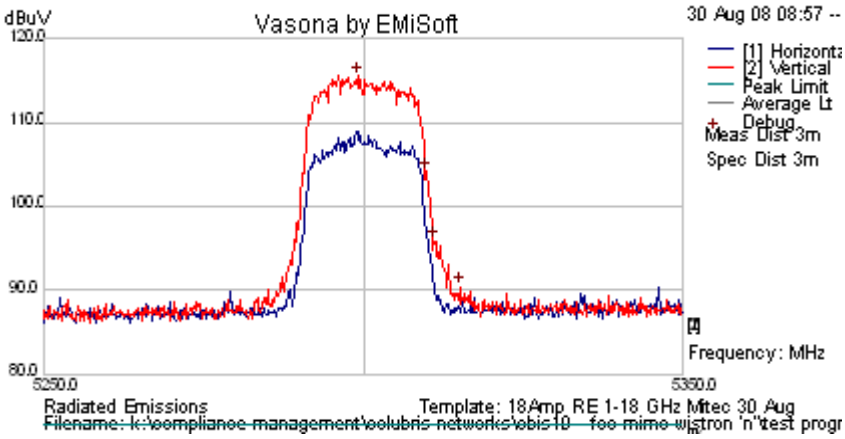
TABLE OF RESULTS - 802.11a HT-20 – Integral Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,260	115.71
5,300	115.61
5,320	115.08

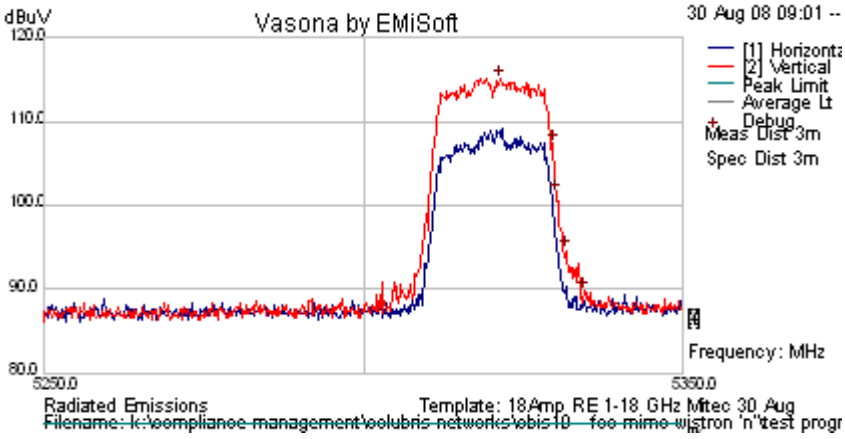
802.11a HT-20 – 5,260 MHz - Integral Antenna
Lower Band Edge Peak Emission = 115.71 dBµV/m



802.11a HT-20 – 5,300 MHz - Integral Antenna
Lower Band Edge Peak Emission = 115.61 dBµV/m



802.11a HT-20 – 5,320 MHz - Integral Antenna
Lower Band Edge Peak Emission = 115.08 dBµV/m

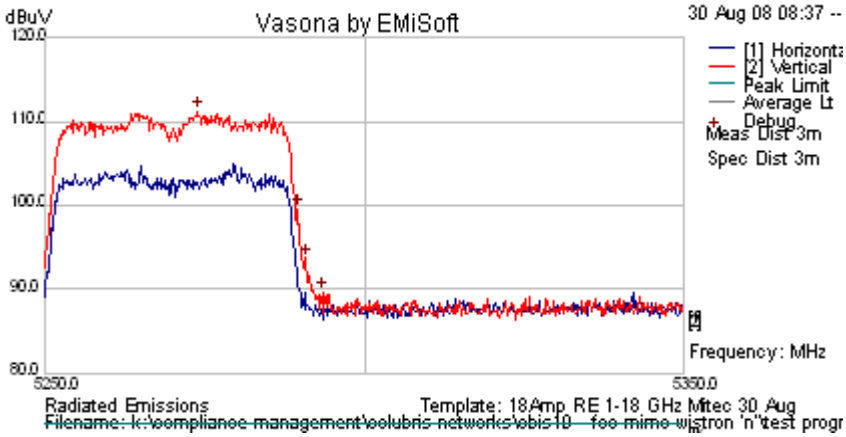


Lower sub-band 5,250 MHz to 5,350 MHz

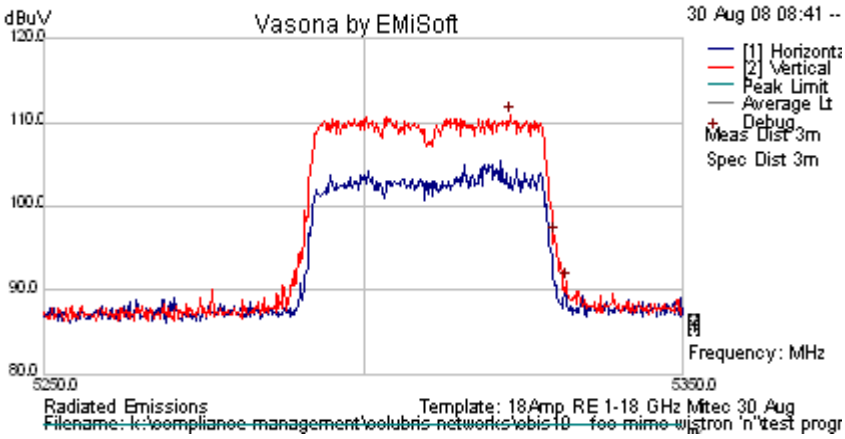
TABLE OF RESULTS - 802.11a HT-40 – Integral Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,270	111.19
5,310	110.91

802.11a HT-40 – 5,270 MHz - Integral Antenna
Lower Band Edge Peak Emission = 111.19 dBµV/m



802.11a HT-40 – 5,310 MHz - Integral Antenna
Lower Band Edge Peak Emission = 110.91 dBµV/m

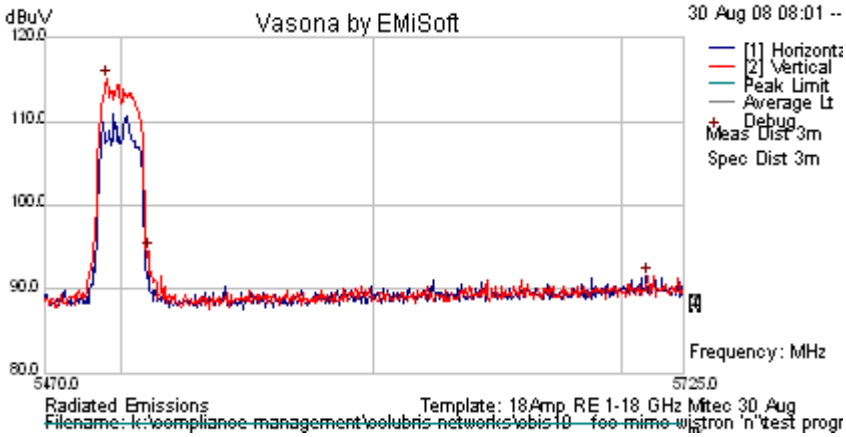


Lower sub-band 5,470 MHz to 5,725 MHz

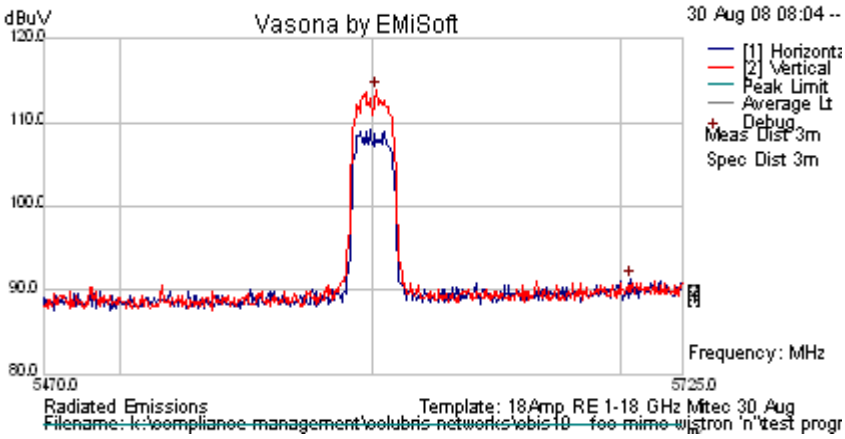
TABLE OF RESULTS - 802.11a Legacy – Integral Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,500	114.98
5,600	113.90
5,700	113.46

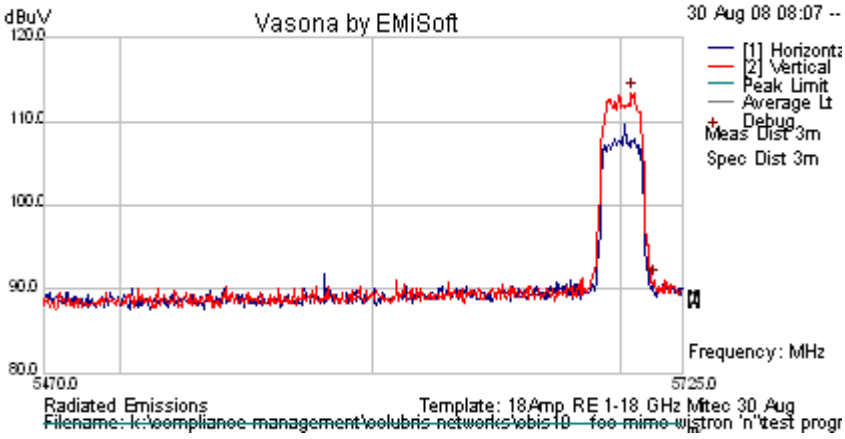
802.11a Legacy – 5,500 MHz - Integral Antenna
Lower Band Edge Peak Emission = 114.98 dBµV/m



802.11a Legacy – 5,600 MHz - Integral Antenna
Lower Band Edge Peak Emission = 113.90 dBµV/m



802.11a Legacy – 5,700 MHz - Integral Antenna
Lower Band Edge Peak Emission = 113.46 dBµV/m

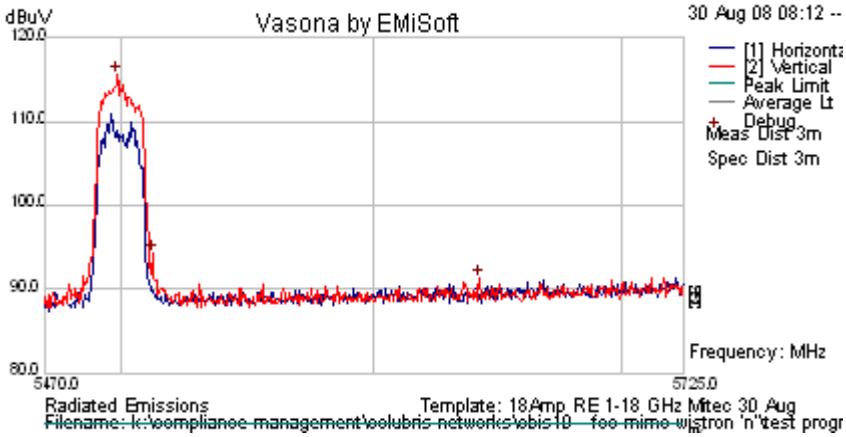


Lower sub-band 5,470 MHz to 5,725 MHz

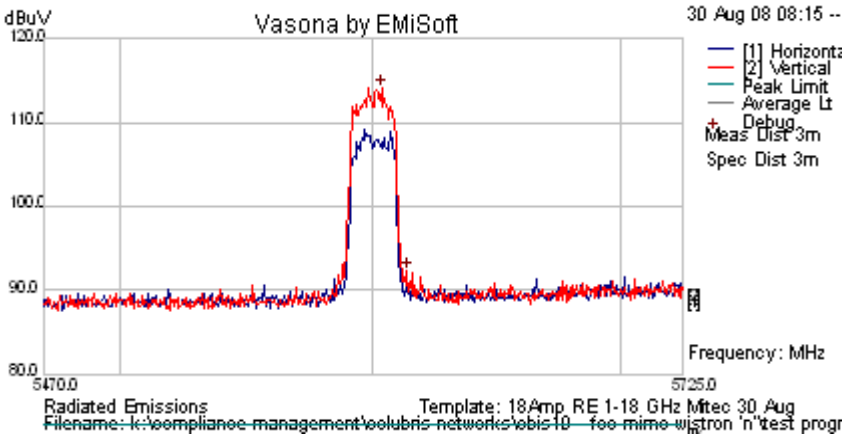
TABLE OF RESULTS - 802.11a HT-20 – Integral Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,500	115.55
5,600	114.06
5,700	112.78

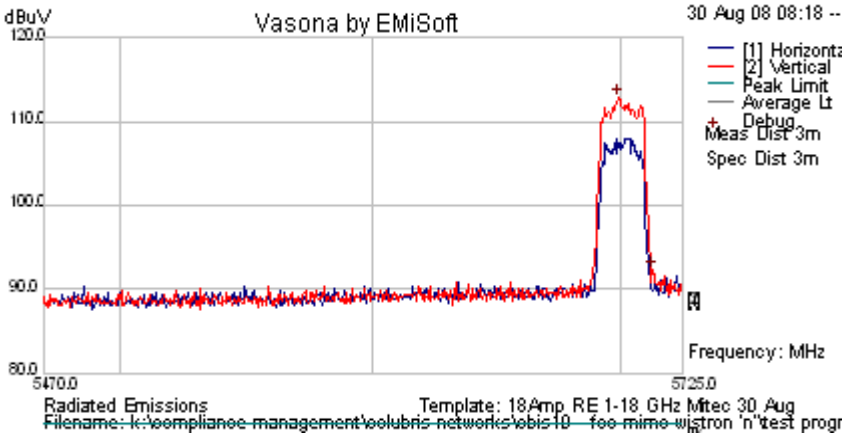
802.11a HT-20 – 5,500 MHz - Integral Antenna
Lower Band Edge Peak Emission = 115.55 dBµV/m



802.11a HT-20 – 5,600 MHz - Integral Antenna
Lower Band Edge Peak Emission = 114.06 dBµV/m



802.11a HT-20 – 5,700 MHz - Integral Antenna
Lower Band Edge Peak Emission = 112.78 dBµV/m

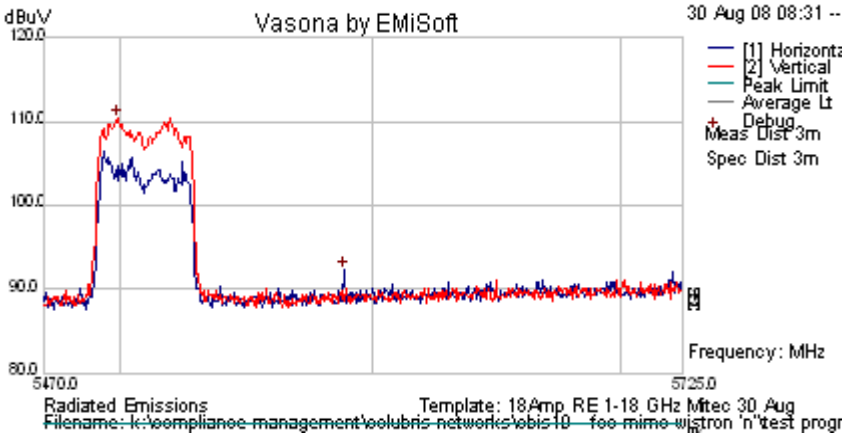


Lower sub-band 5,470 MHz to 5,725 MHz

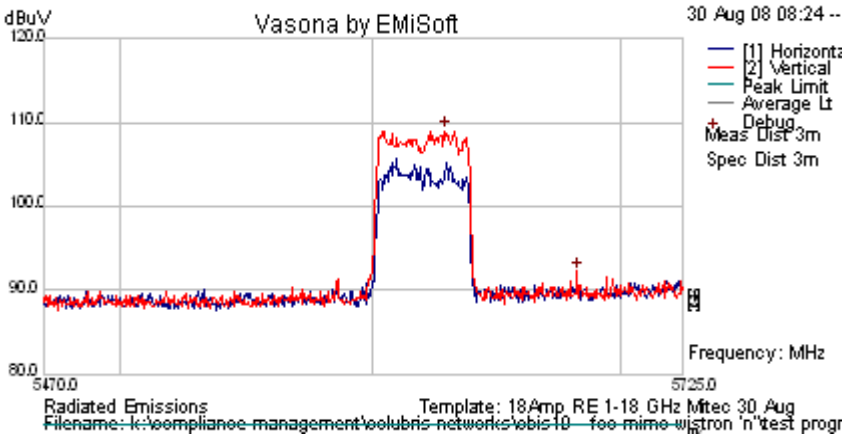
TABLE OF RESULTS - 802.11a HT-40 – Integral Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,510	110.30
5,620	109.02
5,690	108.54

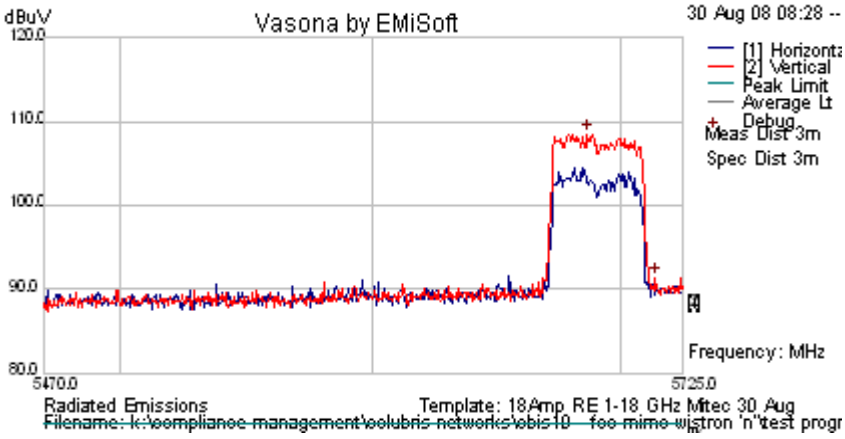
802.11a HT-40 – 5,510 MHz - Integral Antenna
Lower Band Edge Peak Emission = 110.30 dBµV/m



802.11a HT-40 – 5,620 MHz - Integral Antenna
Lower Band Edge Peak Emission = 109.02 dBµV/m



802.11a HT-40 – 5,690 MHz - Integral Antenna
Lower Band Edge Peak Emission = 108.54 dBµV/m

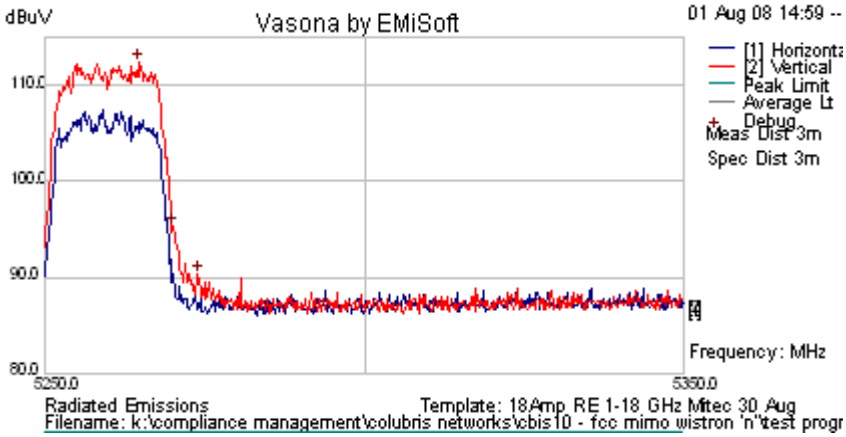


Lower sub-band 5,250 MHz to 5,350 MHz

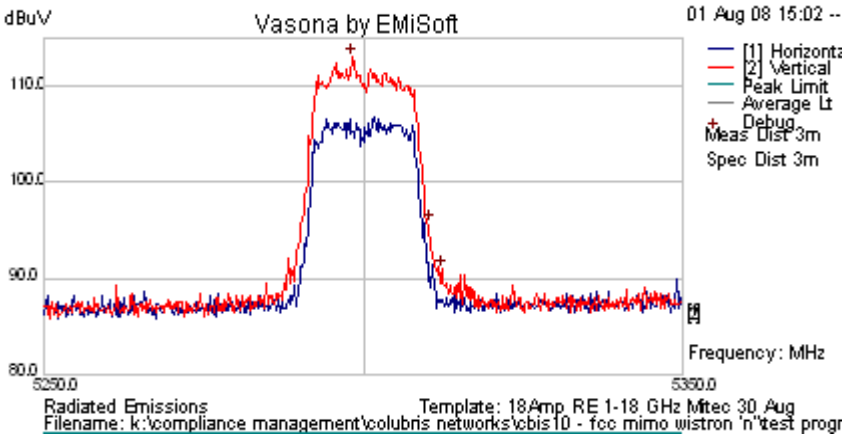
TABLE OF RESULTS - 802.11a Legacy – External Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,260	112.40
5,300	112.99
5,320	112.08

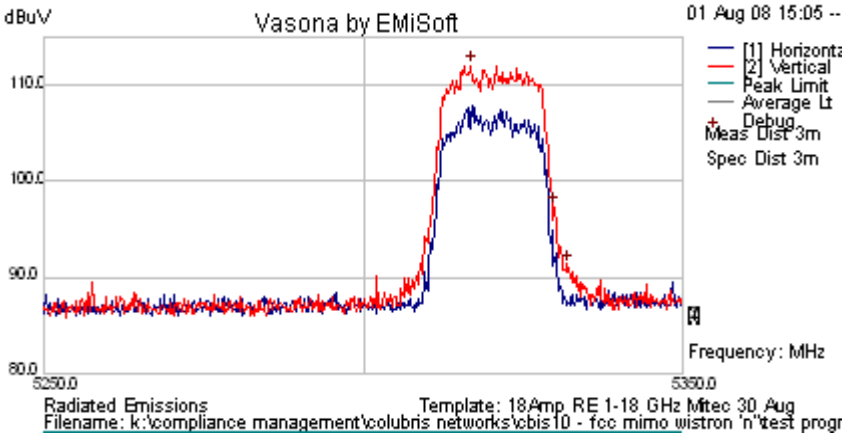
802.11a Legacy – 5,260 MHz - External Antenna
Lower Band Edge Peak Emission = 112.40 dBµV/m



802.11a Legacy – 5,300 MHz - External Antenna
Lower Band Edge Peak Emission = 112.99 dBµV/m



802.11a Legacy – 5,320 MHz - External Antenna
Lower Band Edge Peak Emission = 112.08 dBµV/m

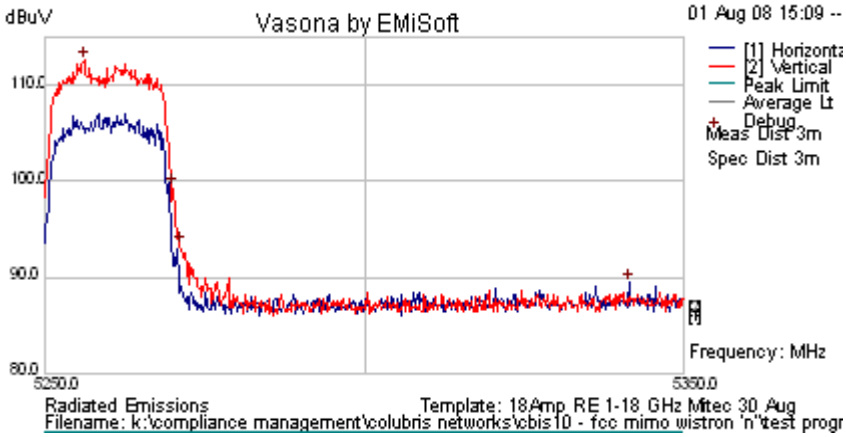


Lower sub-band 5,250 MHz to 5,350 MHz

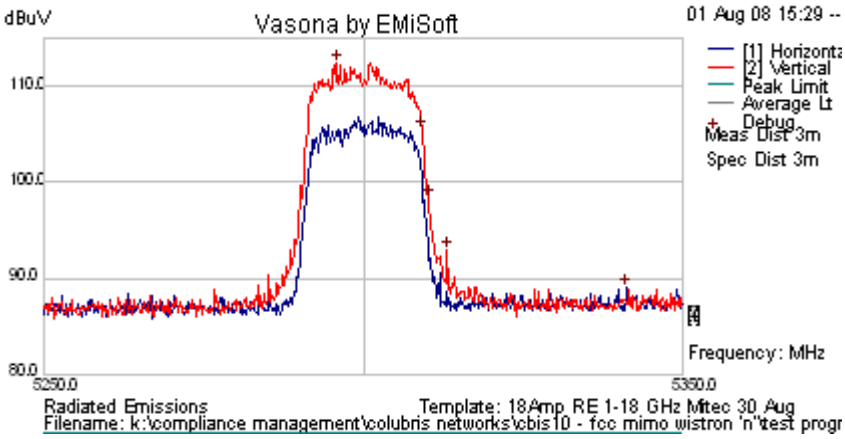
TABLE OF RESULTS - 802.11a HT-20 – External Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,260	112.61
5,300	112.39
5,320	112.22

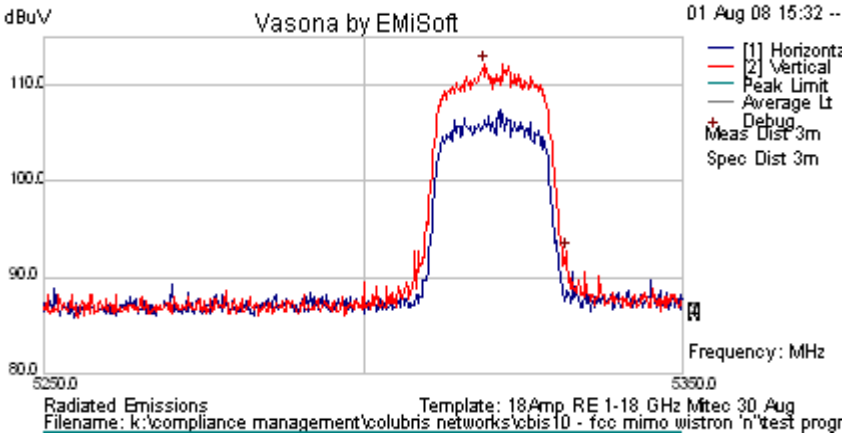
802.11a HT-20 – 5,260 MHz - External Antenna
Lower Band Edge Peak Emission = 112.61 dBµV/m



802.11a HT-20 – 5,300 MHz - External Antenna
Lower Band Edge Peak Emission = 112.39 dBµV/m



802.11a HT-20 – 5,320 MHz - External Antenna
Lower Band Edge Peak Emission = 112.22 dBµV/m

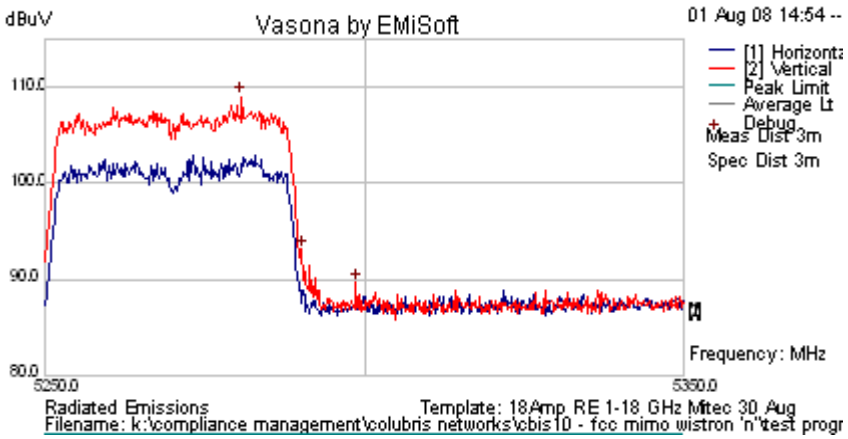


Lower sub-band 5,250 MHz to 5,350 MHz

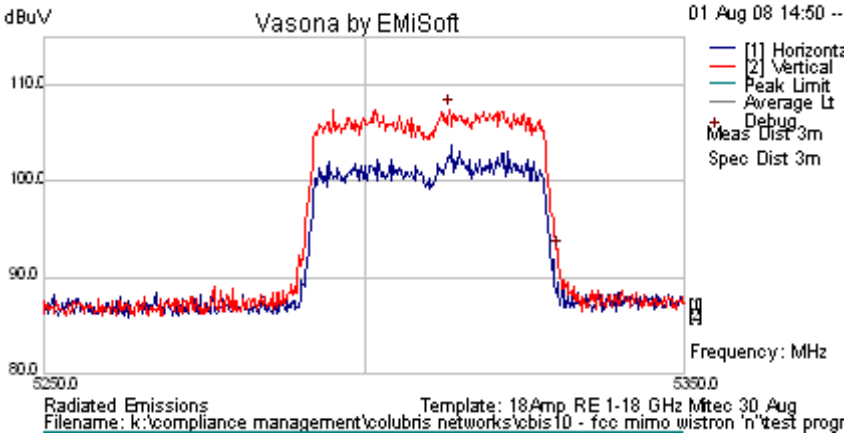
TABLE OF RESULTS - 802.11a HT-40 – External Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,270	109.06
5,310	107.56

802.11a HT-40 – 5,270 MHz - External Antenna
Lower Band Edge Peak Emission = 109.06 dBµV/m



802.11a HT-40 – 5,310 MHz - External Antenna
Lower Band Edge Peak Emission = 107.56 dBµV/m

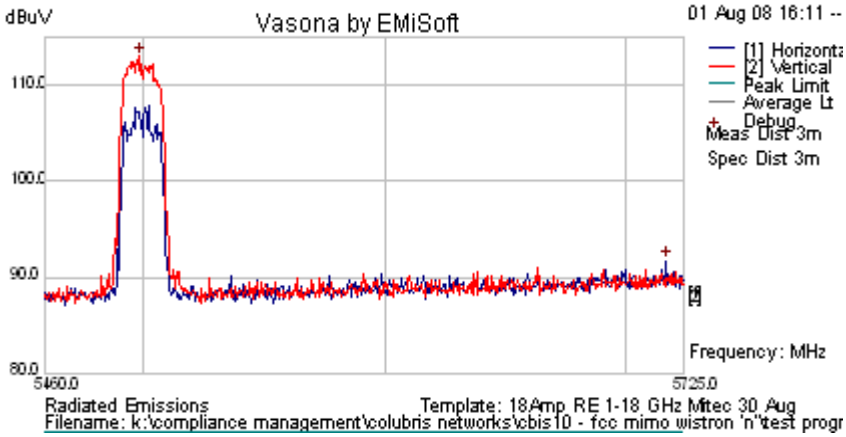


Lower sub-band 5,470 MHz to 5,725 MHz

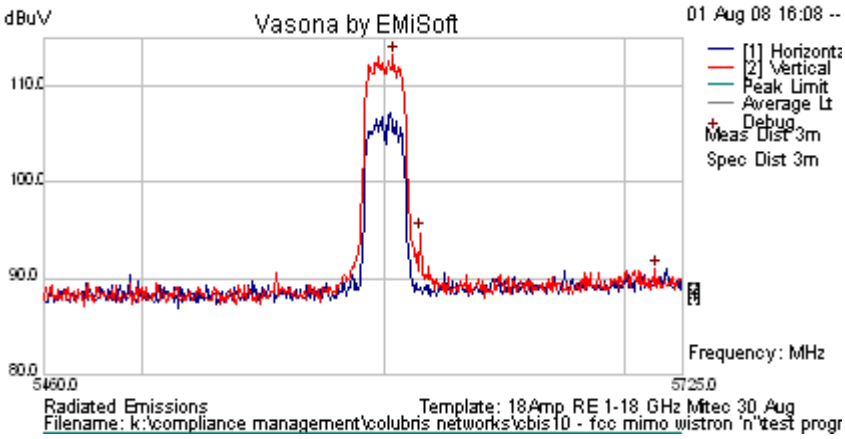
TABLE OF RESULTS - 802.11a Legacy – External Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,500	112.99
5,600	113.33
5,700	113.23

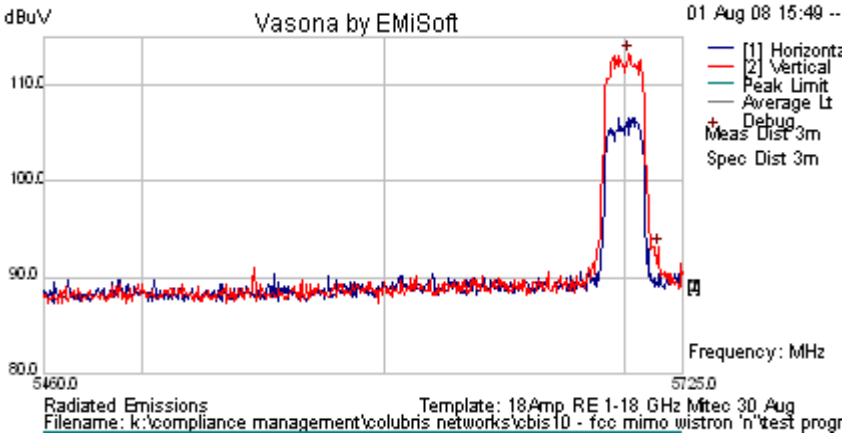
802.11a Legacy – 5,500 MHz - External Antenna
Lower Band Edge Peak Emission = 112.99 dBµV/m



802.11a Legacy – 5,600 MHz - External Antenna
Lower Band Edge Peak Emission = 113.33 dBµV/m



802.11a Legacy – 5,700 MHz - External Antenna
Lower Band Edge Peak Emission = 113.23 dBµV/m

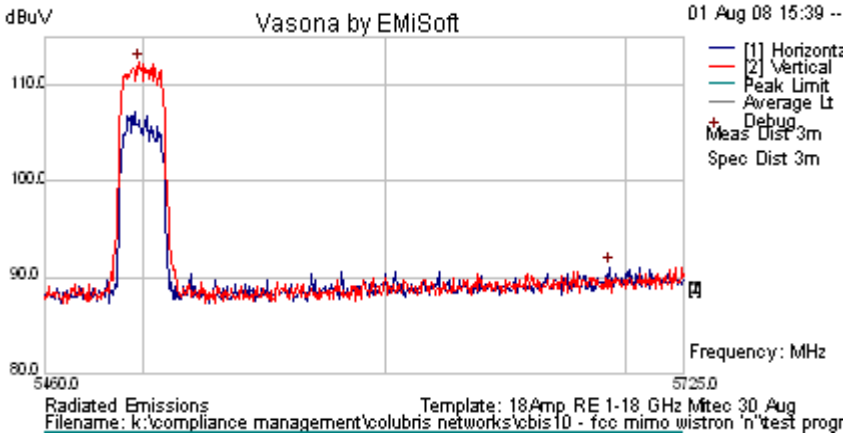


Lower sub-band 5,470 MHz to 5,725 MHz

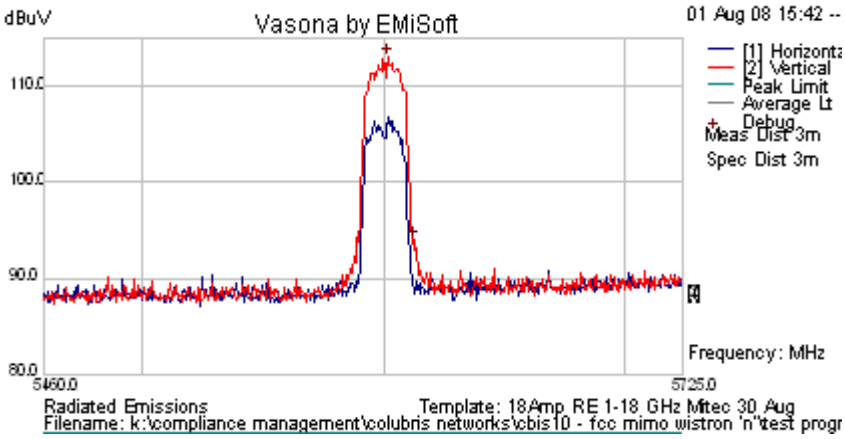
TABLE OF RESULTS - 802.11a HT-20 – External Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,500	112.34
5,600	113.05
5,700	113.34

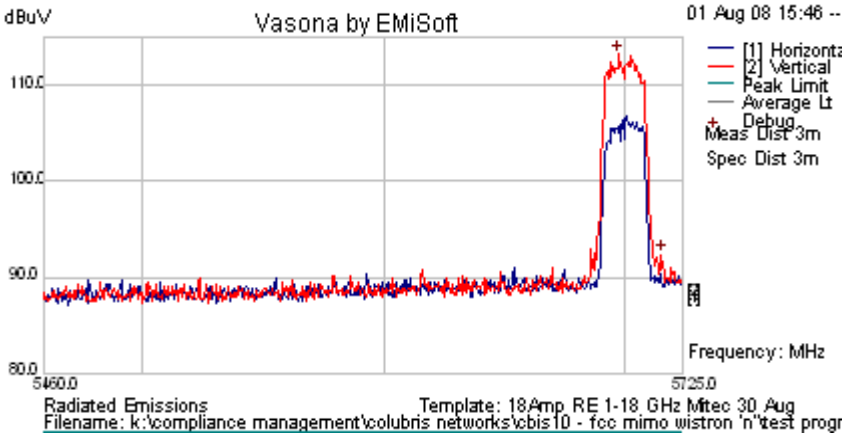
802.11a HT-20 – 5,500 MHz - External Antenna
Lower Band Edge Peak Emission = 112.34 dBµV/m



802.11a HT-20 – 5,600 MHz - External Antenna
Lower Band Edge Peak Emission = 113.05 dBµV/m



802.11a HT-20 – 5,700 MHz - External Antenna
Lower Band Edge Peak Emission = 113.34 dBµV/m

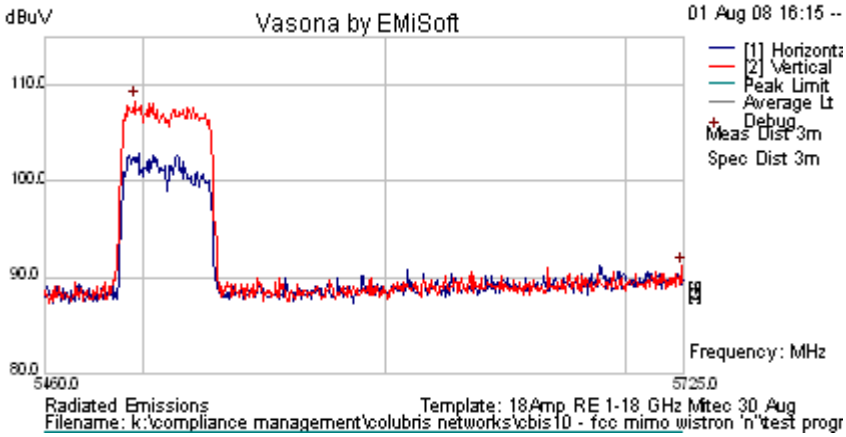


Lower sub-band 5,470 MHz to 5,725 MHz

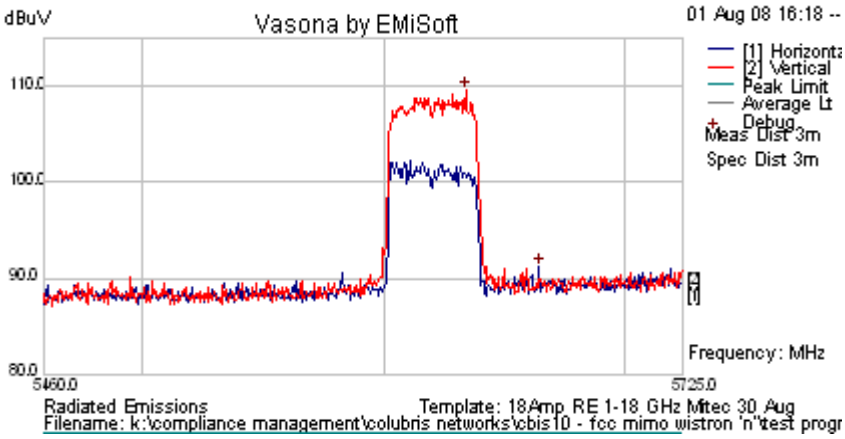
TABLE OF RESULTS - 802.11a HT-40 – External Antenna

Tx Freq. (MHz)	Peak Field Strength (dBuV/m)
5,510	108.38
5,620	109.58
5,690	109.04

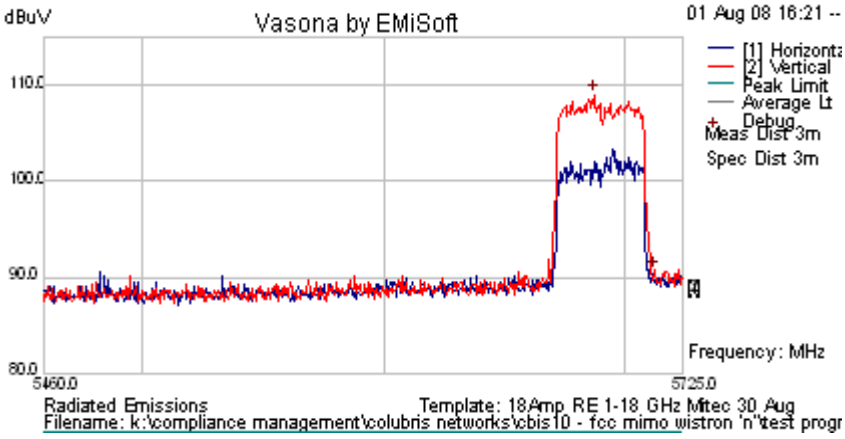
802.11a HT-40 – 5,510 MHz - External Antenna
Lower Band Edge Peak Emission = 108.38 dBµV/m



802.11a HT-40 – 5,620 MHz - External Antenna
Lower Band Edge Peak Emission = 109.58 dBµV/m



802.11a HT-40 – 5,690 MHz - External Antenna
Lower Band Edge Peak Emission = 109.54 dBµV/m



Specification

Limits

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

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

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

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

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

RSS-Gen §4.7 The search for unwanted emissions shall be from the lowest frequency internally generated or used in the device (local oscillator, intermediate of carrier frequency), or from 30 MHz , whichever is the lowest frequency, to the 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

§15.209 (a) Limit Matrix

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

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

5.1.7.4. Receiver Radiated Spurious Emissions (above 1 GHz)

Industry Canada RSS-Gen §4.8, §6

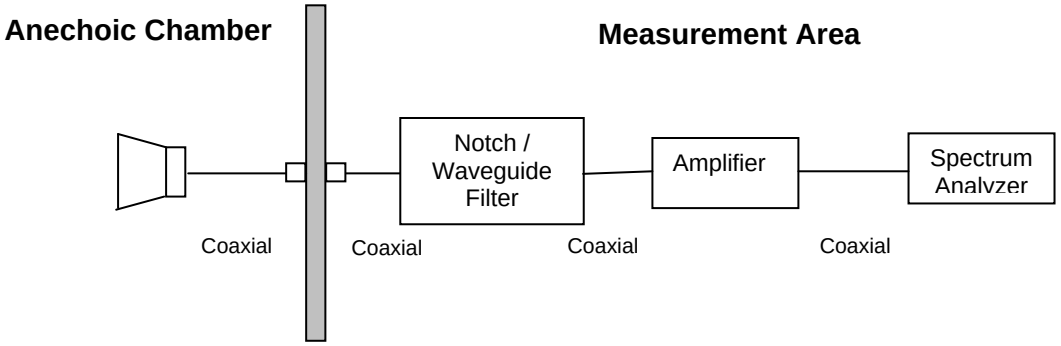
Test Procedure

Radiated emissions above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned.

All measurements on any frequency or frequencies over 1 MHz are based on the use of measurement instrumentation employing an average detector function. All measurements above 1 GHz were performed using a minimum resolution bandwidth of 1 MHz.

All Sectors of the EUT were tested simulatneously

Test Measurement Set up



Measurement set up for Radiated Emission Test

Field Strength Calculation

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

FS = R + AF + CORR - FO

where: FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL
CL = Cable Loss
AG = Amplifier Gain
FO = Distance Falloff Factor
NFL = Notch Filter Loss or Waveguide Loss

For 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

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

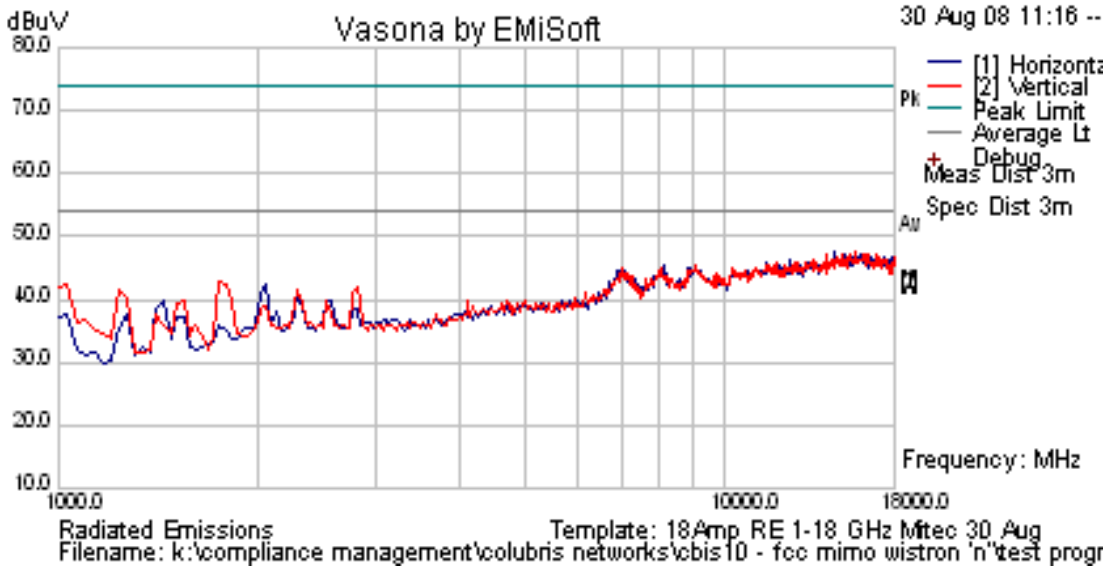
Receiver Radiated Spurious Emissions above 1 GHz

Test Setup – Integral Antenna, 5300 MHz, all modes Legacy, HT-20, HT-40.

TABLE OF RESULTS –

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

Channel 5300 MHz
Receiver Radiated Emissions



No receiver emissions were observed.

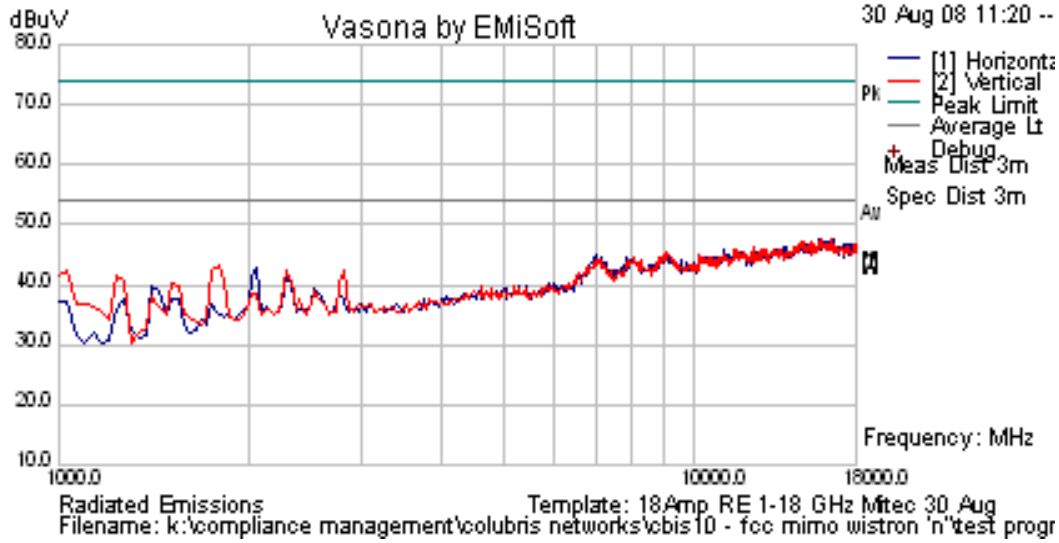
Receiver Radiated Spurious Emissions above 1 GHz

Test Setup – Integral Antenna, 5600 MHz, all modes Legacy, HT-20, HT-40.

TABLE OF RESULTS –

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

Channel 5600 MHz
Receiver Radiated Emissions



No receiver emissions were observed.

Specification

Receiver Radiated Spurious Emissions

Industry Canada RSS-Gen §4.8,
The search for spurious emissions shall be from the lowest frequency internally generated or used in the receiver (e.g. local oscillator, intermediate or carrier frequency), or 30 MHz, whichever is the higher, to at least 3 times the highest tunable or local oscillator frequency, whichever is the higher, without exceeding 40 GHz.

RSS-Gen §6
The following receiver spurious emission limits shall be complied with;
(a) If a radiated measurement is made, all spurious emissions hall comply with the limits of Table 1.

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

5.1.7.5. Radiated Spurious Emissions (30M-1 GHz)

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

The test results are reported in test report number “EMC Test Report NKR-DNMA83 FEE.pdf”

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

The test results are reported in report number “EMC Test Report NKR-DNMA83 FEE.pdf”

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.

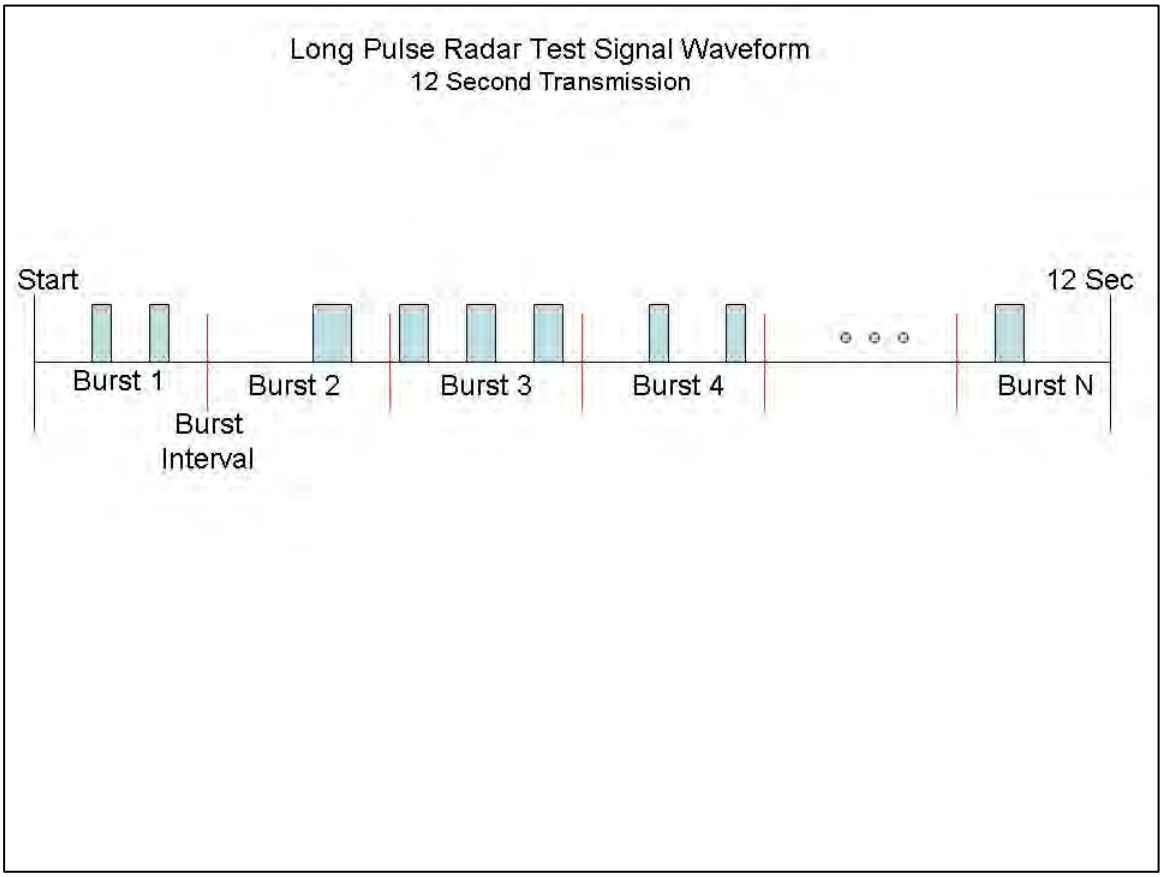
Each waveform is defined as follows:

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

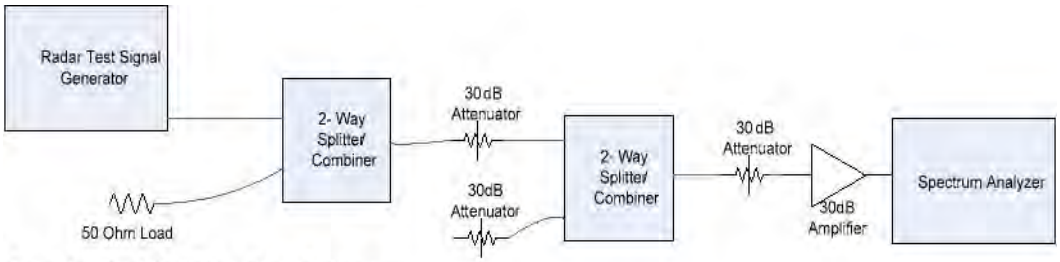
Frequency Hopping Radar Test Waveform

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

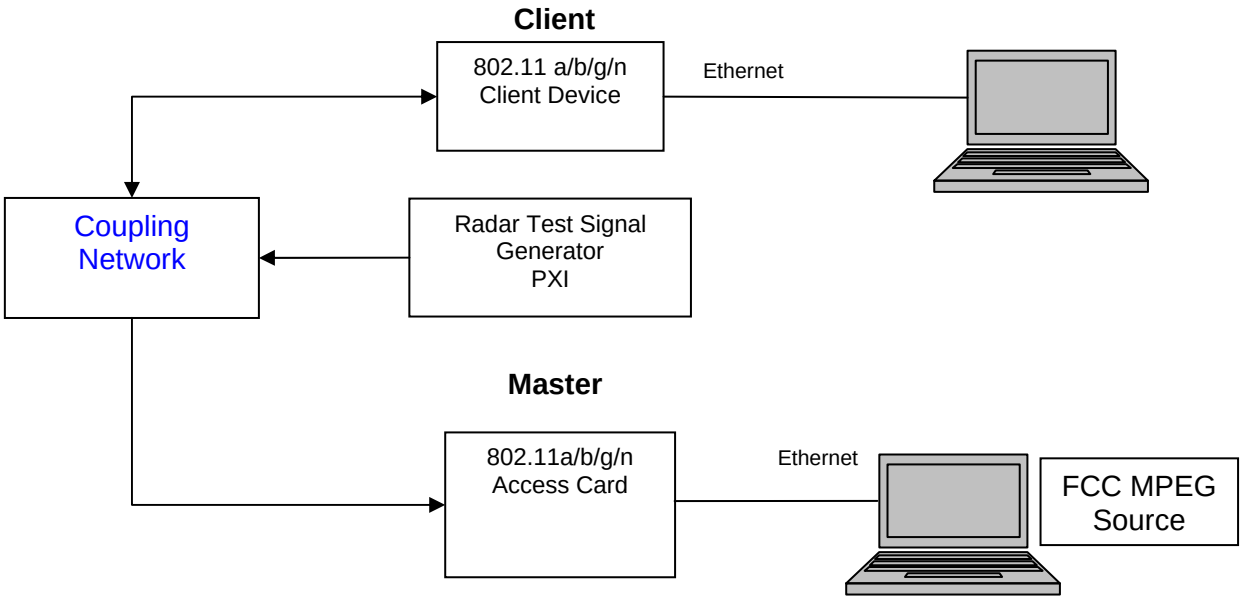
The following equipment setup was used to calibrate the conducted Radar Waveform. A spectrum analyzer was used to establish the test signal level for each radar type. During this process there were no transmissions by either the Master or Client Device. The spectrum analyzer was switched to the zero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

Block Diagram(s) of Test Setup



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.

Declared minimum antenna gain 2.6 dBi. ;

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

= -62 + 2.6 + 1

Radar receive signal level = -58.4 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

Tests Performed with EUT configured as Master Device

Requirement	Operational Mode
	Master
DFS Detection Threshold	Yes
Channel Closing Transmission Time	Yes
Channel Move Time	Yes
U-NII Detection Bandwidth	Yes

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 in HT-40 mode on channel 5,510 MHz.

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 5,510 MHz at a level of -58.4 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

EUT Frequency=5510MHz(TX) (√=Detection, 0= No Detection)											
Radar Frequency (MHz)	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
-21	0	0	0	0	0	0	0	0	0	0	0%
-20	√	√	√	√	√	√	√	√	√	√	100%
-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%
F0	√	√	√	√	√	√	√	√	√	√	100%

Table of results are continued on the next page.

EUT Frequency=5510MHz(TX) (√=Detection, 0= No Detection)											
Radar Frequency (MHz)	1	2	3	4	5	6	7	8	9	10	Detection Rate (%)
F0	√	√	√	√	√	√	√	√	√	√	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	0	0	0	0	0	0	0	0	0%
Detection Bandwidth = F_H-F_L = 5530-5490 = 40 MHz											
EUT 99% Bandwidth = 37.034 MHz (ref. bandwidth channel 5510 MHz)											
37.034 MHz *80% = 29..627 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 5,500 MHz. 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 MHz with a 250 second sweep time. The analyzer's sweep will be started the same time power is applied to the U-NII device.

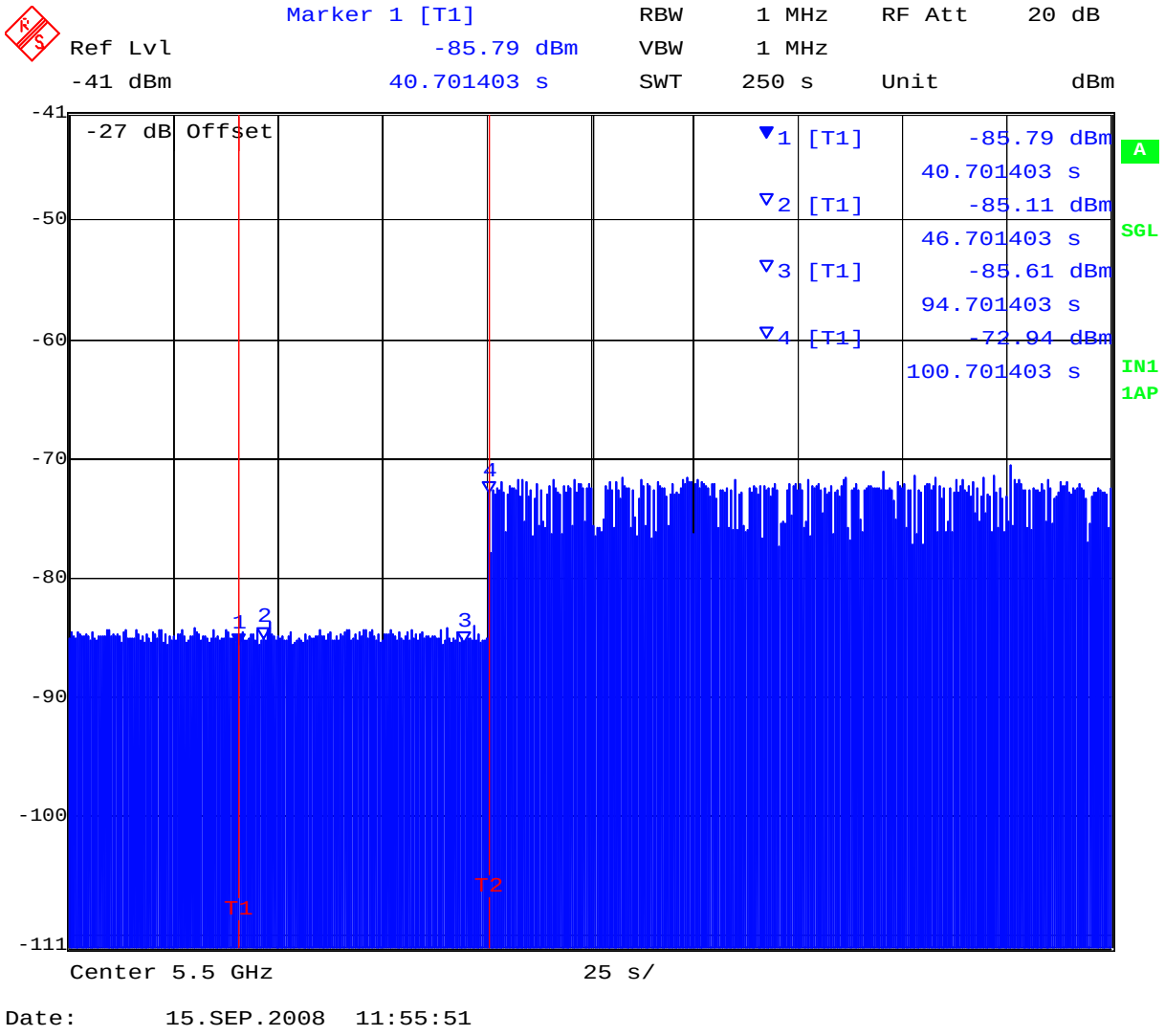
The EUT should not transmit any pulse or data transmissions until at least 1 minute after the completion of the power-on cycle.

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.

The EUT Master device requires 100.701 seconds to complete its power-on cycle.

Initial Channel Availability Check Time during power up of EUT
Ch 5,500 MHz



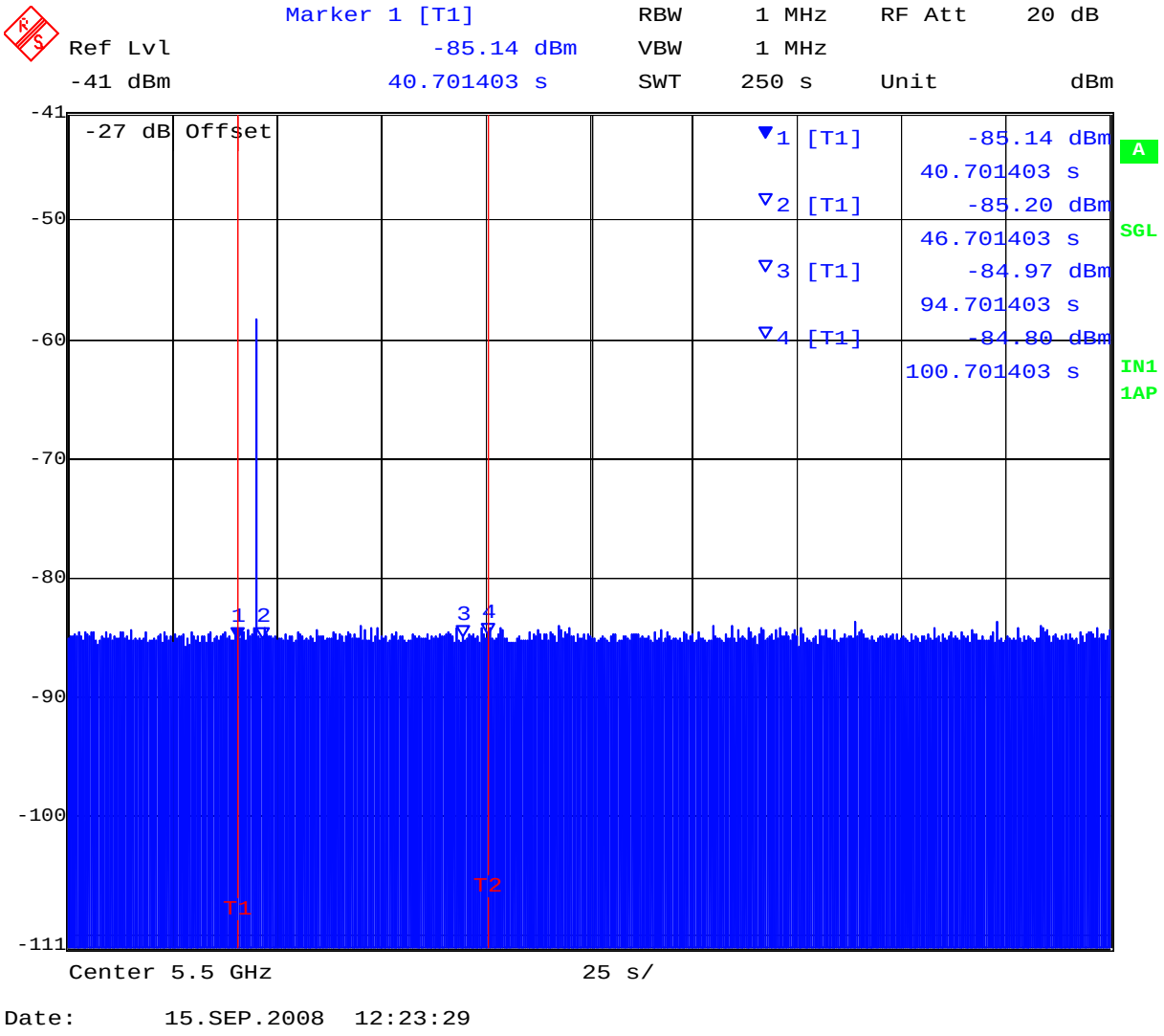
6.2.3. Radar Burst at the Beginning of the Channel Availability Check Time:

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 (-58.4 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 will continue for 2.5 minutes after the radar burst has been generated.

Channel Availability Check Time at the start of the 60 second Check Time
Ch 5,500 MHz



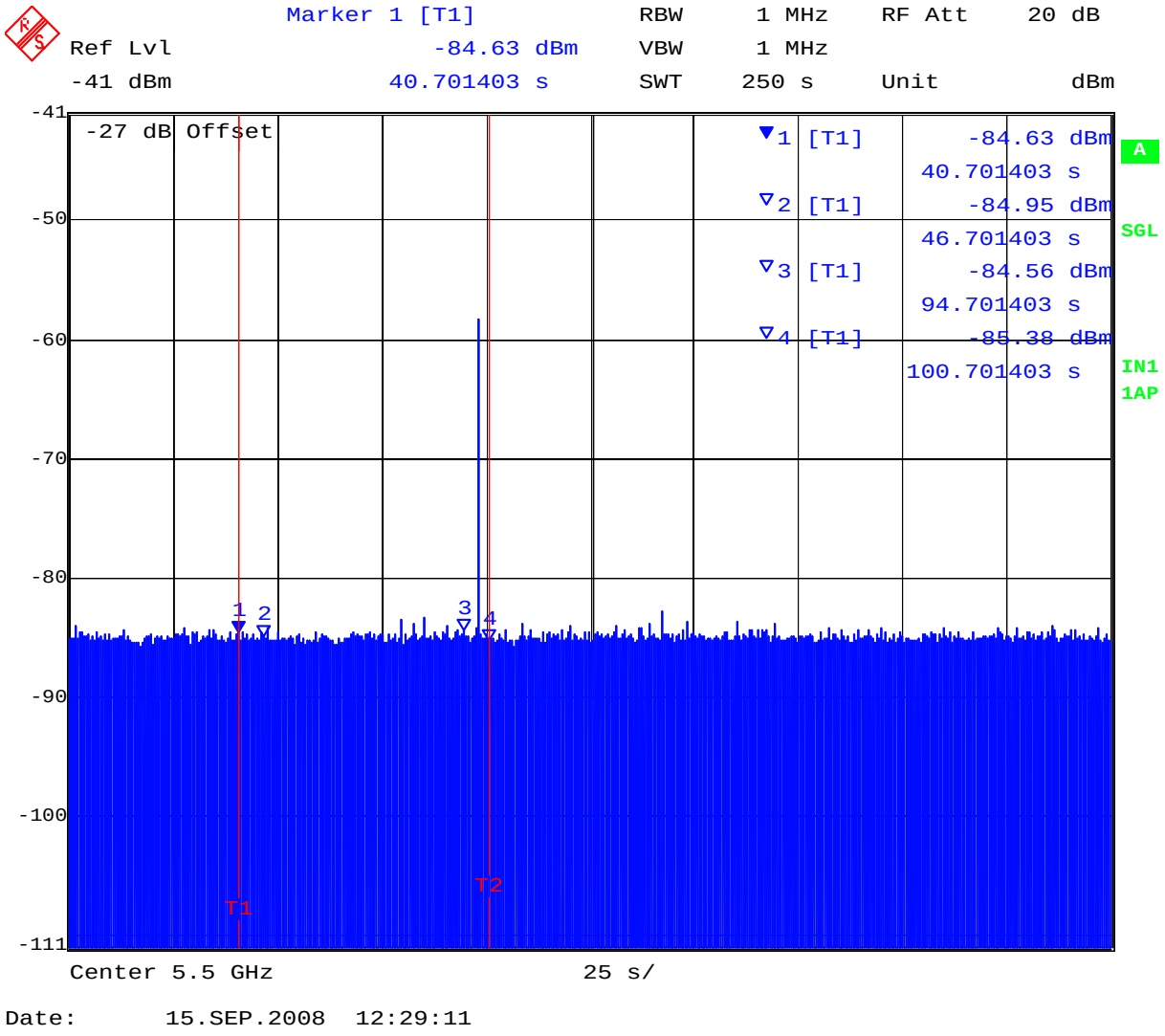
6.2.4. Radar Burst at the End of the Channel Availability Check Time:

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 will continue for 2.5 minutes after the radar burst has been generated.

Channel Availability Check Time at the end of the 60 second Check Time
Ch 5,500 MHz



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 Card 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 25.705 ms

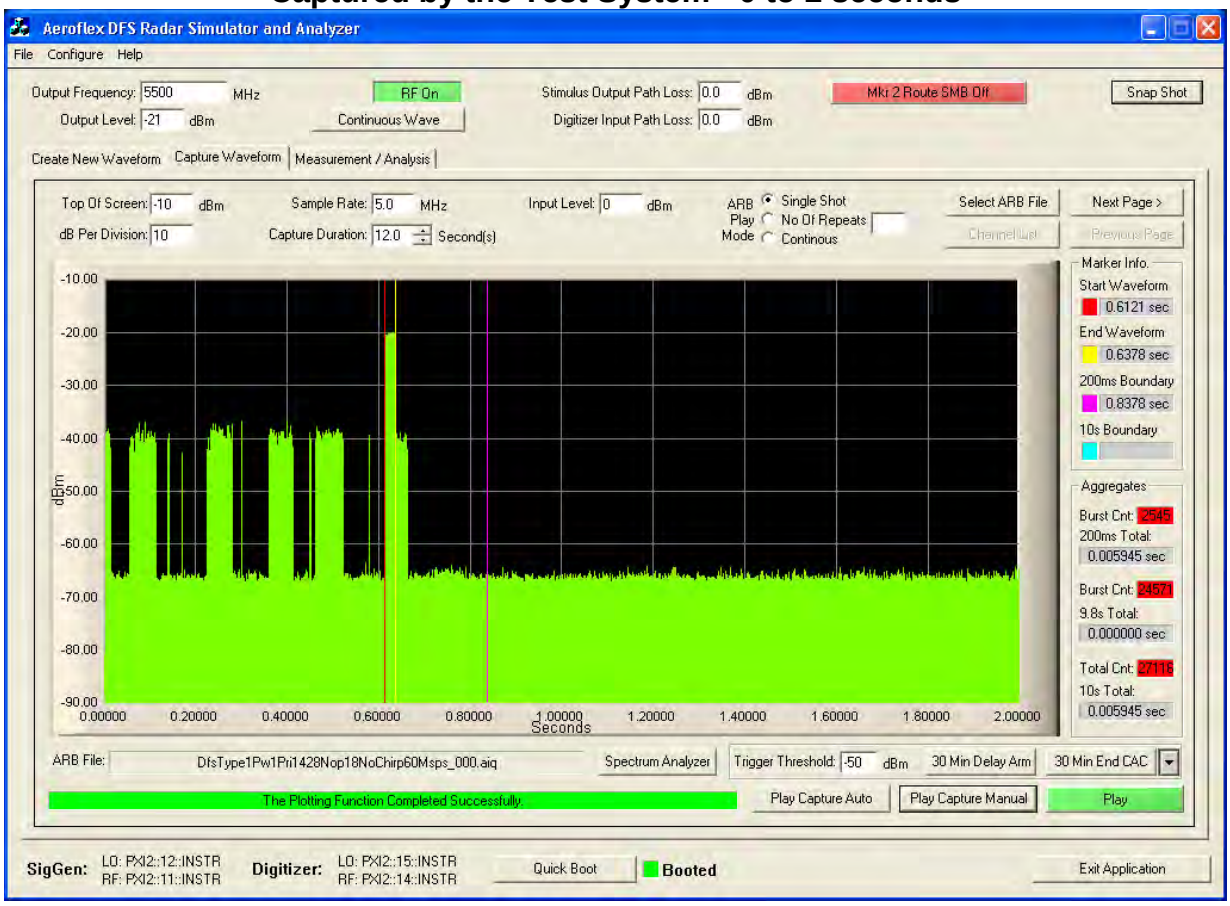
(The period of the 18 pulse burst includes [18 pulses *1.428mS PRI] = 25.704 ms. Then add 1 µs pulse width for the final pulse.)

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 5.945 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 = 5.945 mSecs (limit 260 mSecs)

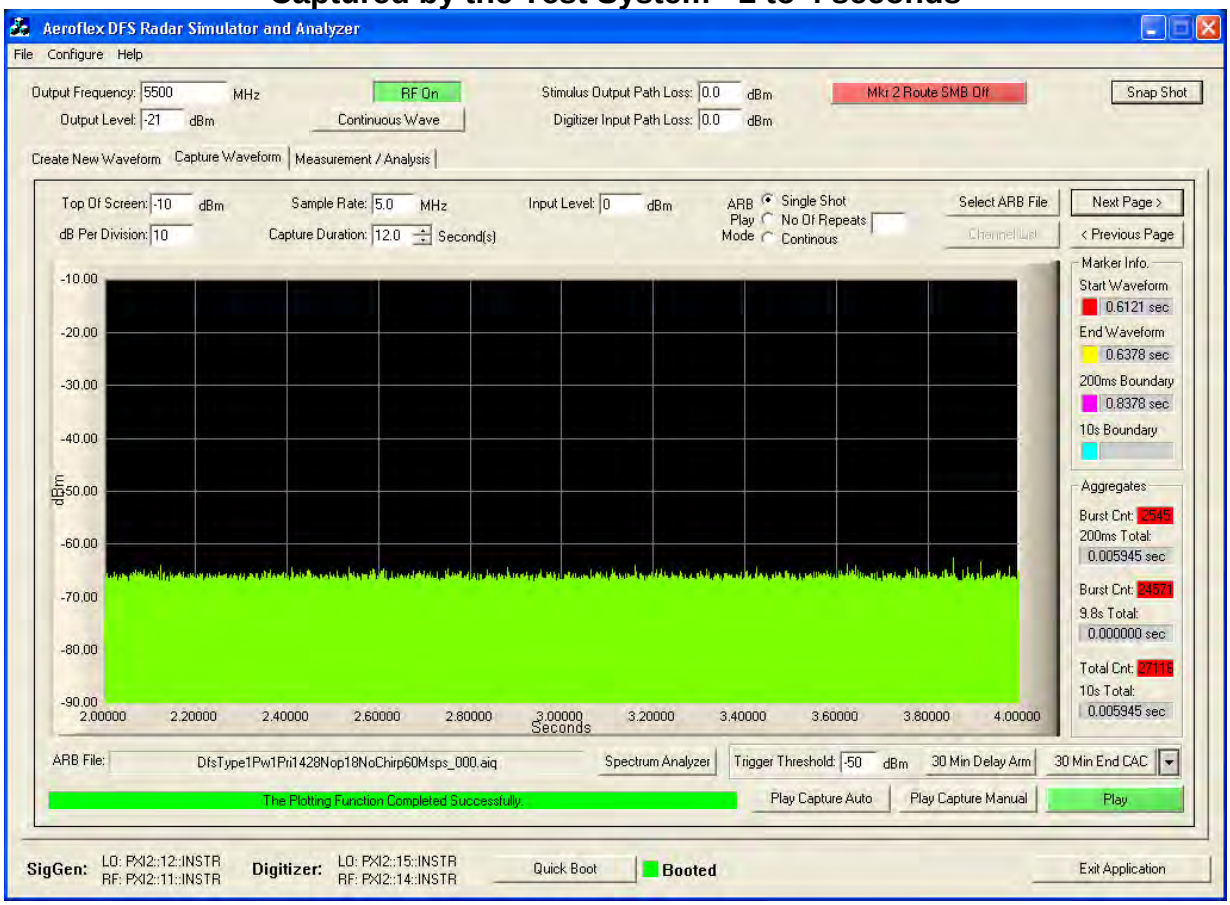
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 0 to 2 seconds



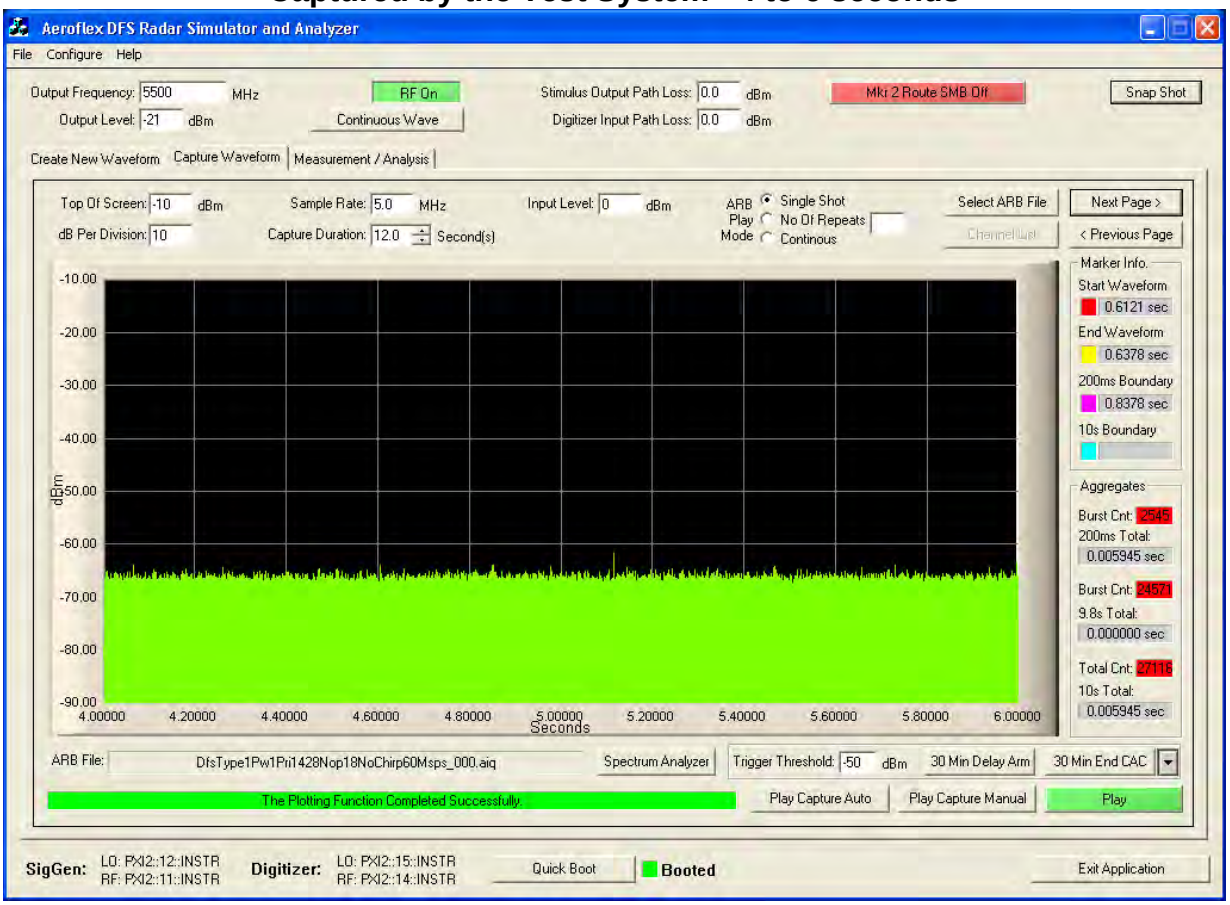
From the plot above it can be seen that the transmission activity within the 200 mS window is 5.945 mS (see 200 mS Total). From the following plots which shows all additional activity within the remainder of the 10 sec measurement window it can be determined that the aggregate transmission is 0.0 mS. This is less than the 60 mS limit.

Last Transmitter Activity = 0.670 Seconds
Last Radar Activity = 0.6378 Seconds
Channel Move Time = Last Transmitter Activity – Last Radar Activity = 0.670 – 0.6378
Channel Move Time = 32.2 msecs (Limit 10 secs)

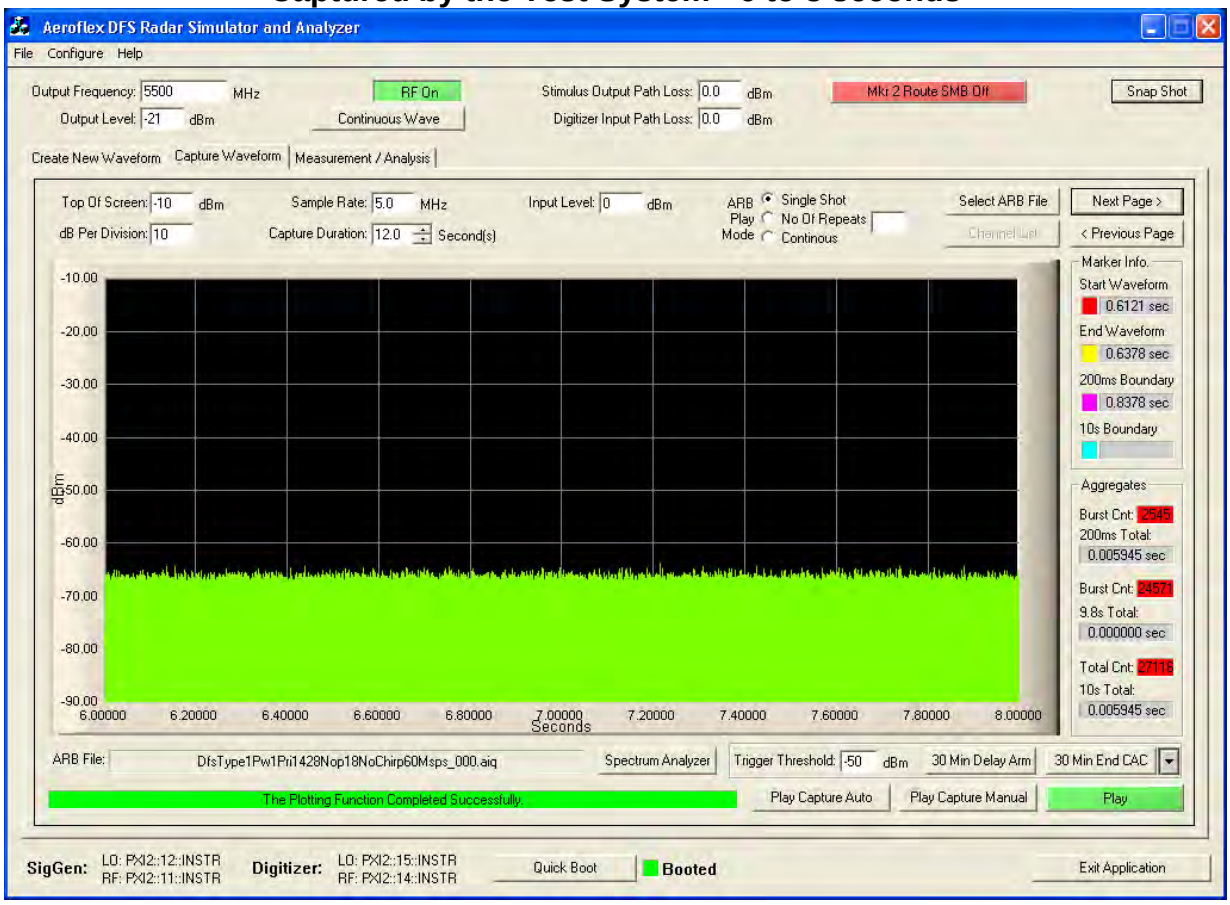
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 2 to 4 seconds



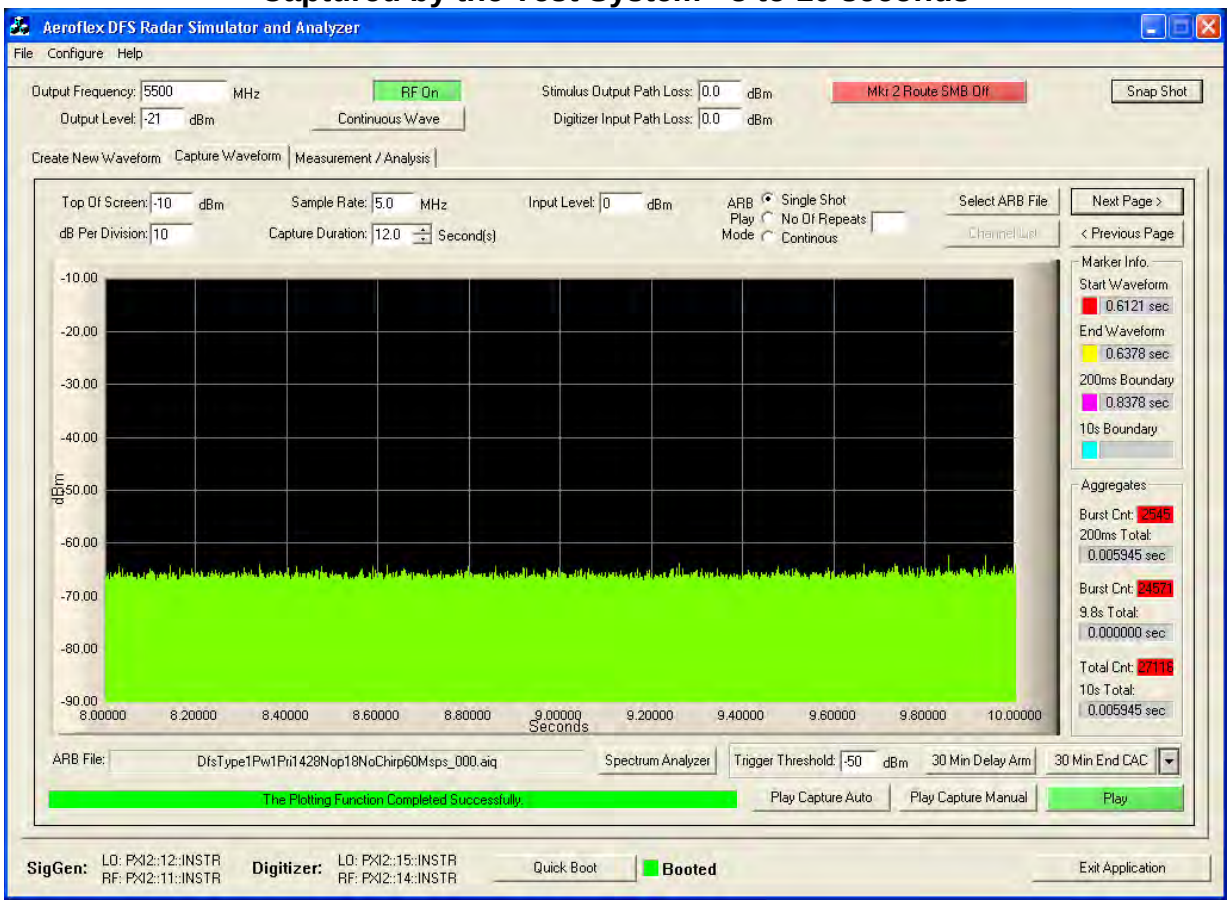
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 4 to 6 seconds



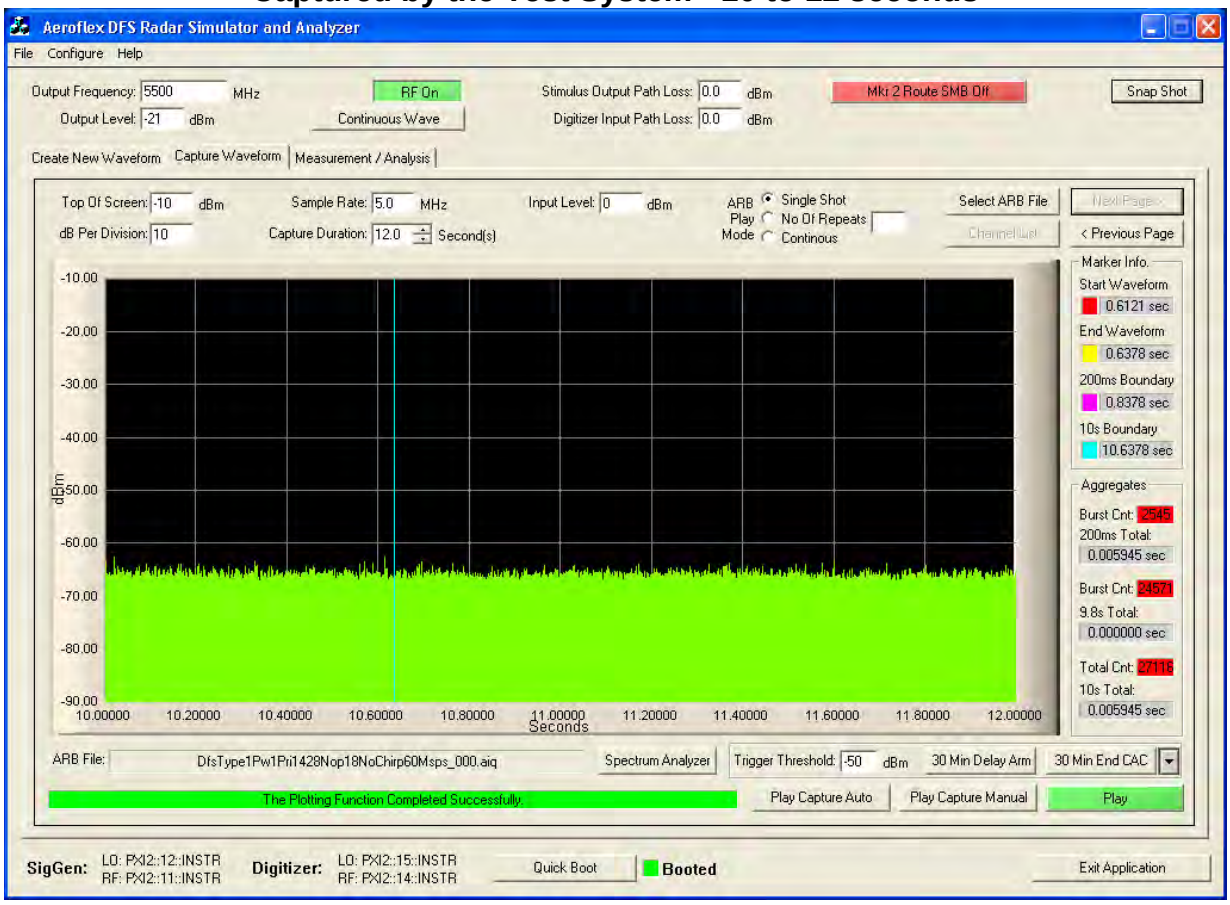
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 6 to 8 seconds



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



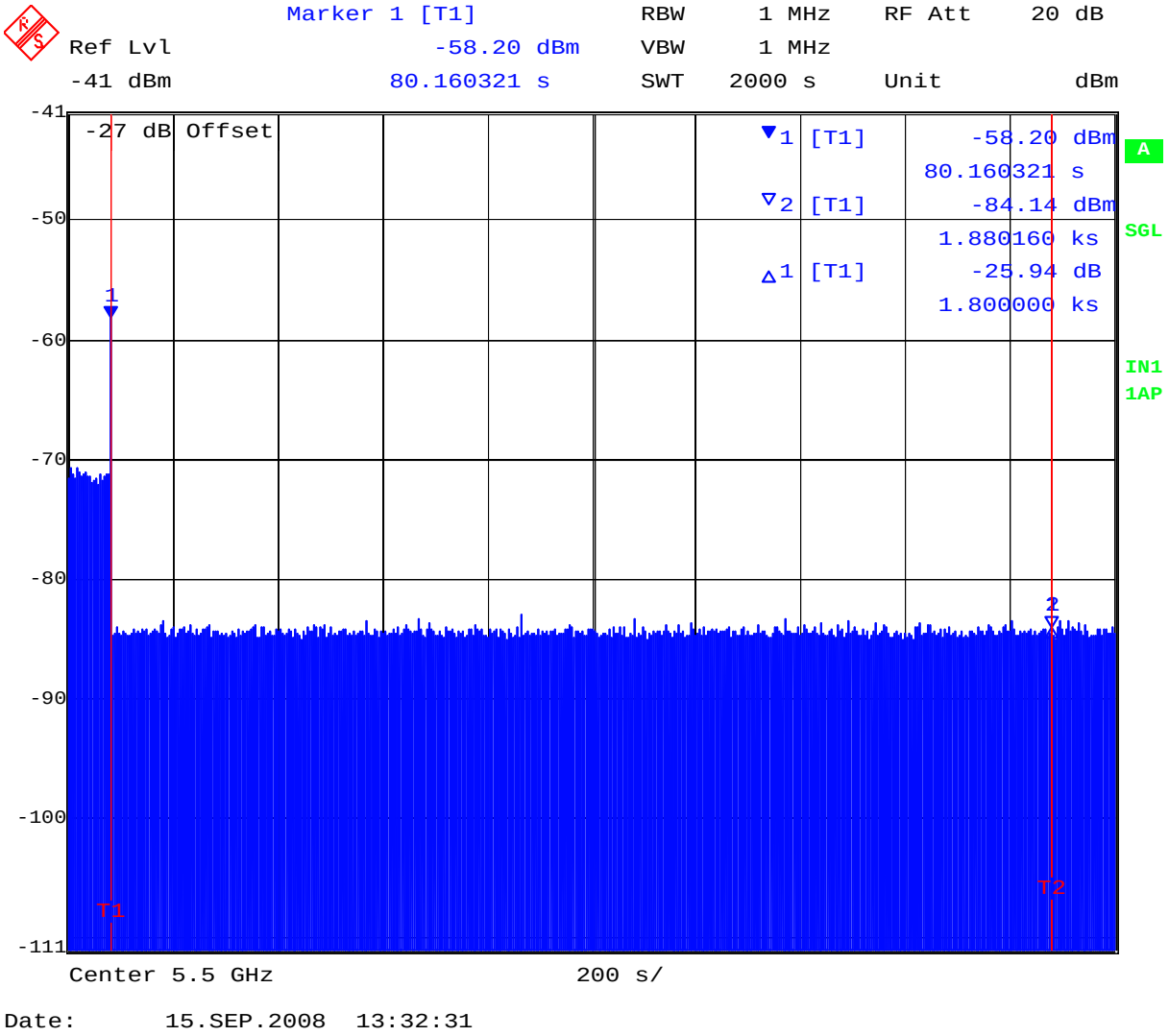
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 10 to 12 seconds



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
Ch 5,500 MHz



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 5,500 MHz. Stream the MPEG test file from the Master Device to the Client Device on the selected Channel for the entire period of the test.

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

Trial #	Detection = √, No Detection = 0					
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
1	√	√	√	√	√	√
2	√	√	√	√	0	√
3	√	0	√	√	√	√
4	√	√	√	√	√	√
5	√	√	√	√	√	√
6	√	√	√	√	√	0
7	√	√	√	√	√	√
8	√	√	√	√	√	√
9	√	0	√	√	√	0
10	0	√	√	√	√	√
11	√	√	0	√	√	√
12	√	√	√	√	√	√
13	√	√	√	√	0	√
14	√	0	√	√	√	√
15	√	√	0	√	√	√
16	√	√	√	√	√	√
17	√	√	√	√	√	√
18	0	√	√	√	√	√
19	√	√	√	√	√	√
20	√	√	√	√	√	√
21	√	√	√	√	√	√
22	√	√	√	√	√	√
23	√	√	√	0	√	√
24	√	√	√	0	0	√
25	√	0	√	0	√	√
26	√	√	√	0	√	√
27	√	√	√	√	√	√
28	√	√	√	√	√	√
29	√	0	√	√	√	√
30	√	√	√	√	√	√
Detection Percentage	90% (>60%)	80% (>60%)	93% (>60%)	86% (>60%)	80% (>80%)	93% (>80%)

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

$(P_d1 + P_d2 + P_d3 + P_d4) / 4 = (90\% + 80\% + 93\% + 86\%) / 4 = 87.25\ \%\ (> 80\%)$

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. PHOTOGRAPHS

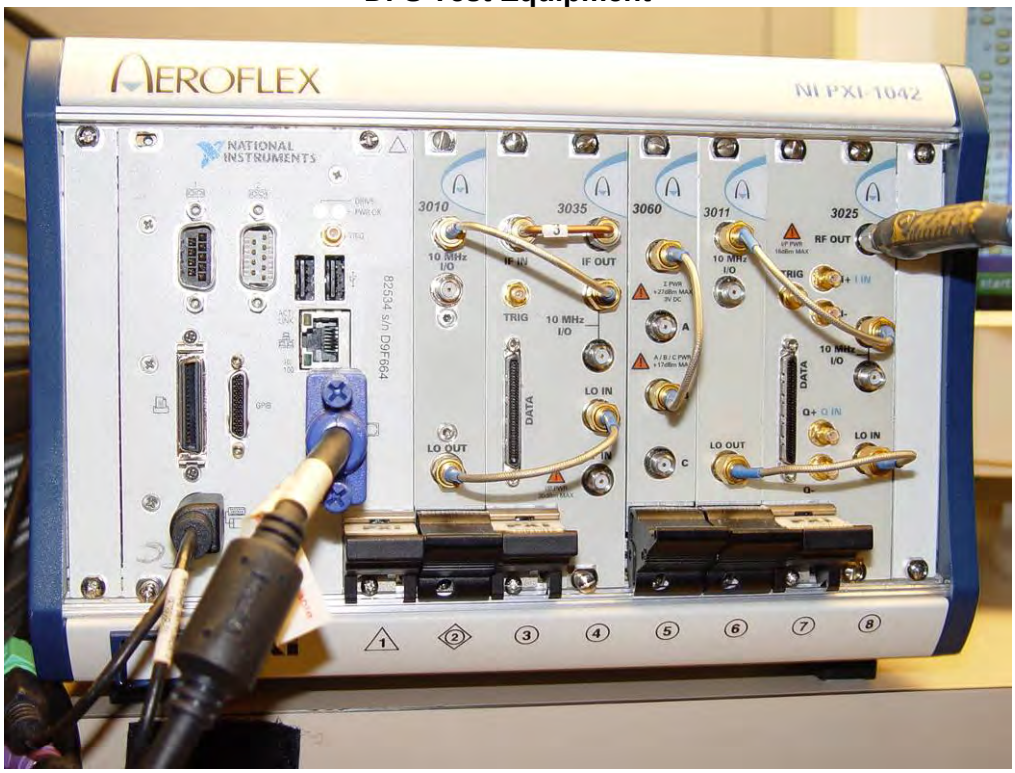
7.1. Radiated Emissions > 1GHz

7.2. General Measurement Test Set-Up

7.3. Dynamic Frequency Selection Test Set-Up

General DFS Test Setup

DFS Test Equipment



8. TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0088	Spectrum Analyzer	Hewlett Packard	8564E	3410A00141
0134	Amplifier	Com Power	PA 122	181910
0158	Barometer /Thermometer	Control Co.	4196	E2846
0193	EMI Receiver	Rhode & Schwartz	ESI 7	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	None
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	3140A01285
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52
0190	LISN	Rhode & Schwartz	ESH3Z5	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0301	5.6 GHz Notch Filter	Micro-Tronics	RBC50704	001
0302	5.25 GHz Notch Filter	Micro-Tronics	BRC50703	002
0303	5.8 GHz Notch Filter	Micro-Tronics	BRC50705	003
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002
0335	1-18GHz Horn Antenna	ETS- Lindgren	3117	00066580
0337	Amplifier	MiCOM Labs	--	--
0338	Antenna	Sunol Sciences	JB-3	A052907

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