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.: HWPD08-A2 Rev A

TEST REPORT

FROM

MiCOM Labs

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.: HWPD08-A2 Rev A

This report supersedes NONE

Applicant: Hewlett Packard
200 Forest Street
Marlborough
MA 01752, USA

Product Function: 802.11a/b/g/n Wireless Client

Copy No: pdf Issue Date: 16th September 2009

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
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www.micomlabs.com

A2LA ACCREDITED
CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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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

Japan Registration

VCCI Membership Number: 2959

- Radiation 3 meter site; Registration No. R-2881
- Line Conducted, Registration Nos. C-3181 & T-1470
- Emissions; Registration Nos. C-3180 & T-1469

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	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	I I	

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	16th September 2009	Initial release.

1. TEST RESULT CERTIFICATE

Applicant:	Hewlett Packard 200 Forest Street Marlborough MA 01752, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	Wireless Client	Telephone:	+1 925 462 0304
Model:	DNMA-83	Fax:	+1 925 462 0306
S/N:	D027814A010EC01		
Test Date(s):	17th -21st August '09	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 (Client device) in the frequency ranges 5250 to 5350 MHz, and 5470 to 5,725 MHz to FCC Part 15.407 and Industry Canada RSS-210 regulations.
Applicant:	Hewlett Packard 200 Forest Street Marlborough MA 01752, USA
Manufacturer:	As Applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	HWPD08-A2 Rev A
Date EUT received:	17th August 2009
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210
Dates of test (from - to):	17th -21st August '09
No of Units Tested:	1
Type of Equipment:	802.11a/b/g/n Client, 3x3 Spatial Multiplexing MIMO configuration
Applicants Trade Name:	WLAN a+b+g+n Client
Model(s):	DNMA-83
Software Release	V5.9
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
DFS Operational Mode:	Client without radar detection
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 client device for data communication

3.2. Scope of Test Program

RF Testing

The scope of the compliance program was to test the 802.11 a/b/g/n 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 device was setup as a client.

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

Dynamic Frequency Selection

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

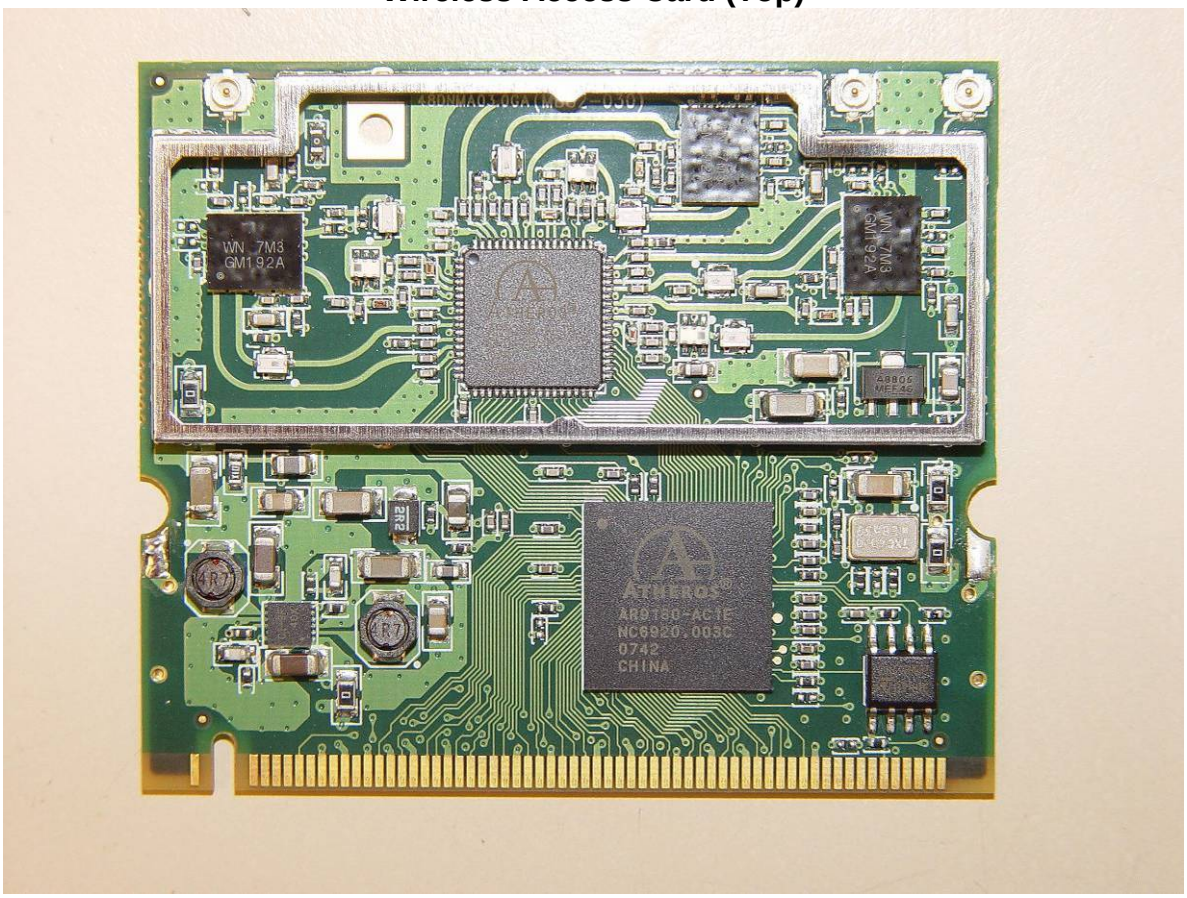
One frequency was chosen (5,500 MHz) from the operating channels of the UUT within the 5,250 – 5,350 MHz and 5,470 – 5,725 MHz bands for DFS testing per the requirements of FCC specification “Memorandum Opinion and Order FCC 06-96”, Section 7.8 “DFS Conformance Test Procedures”.

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.

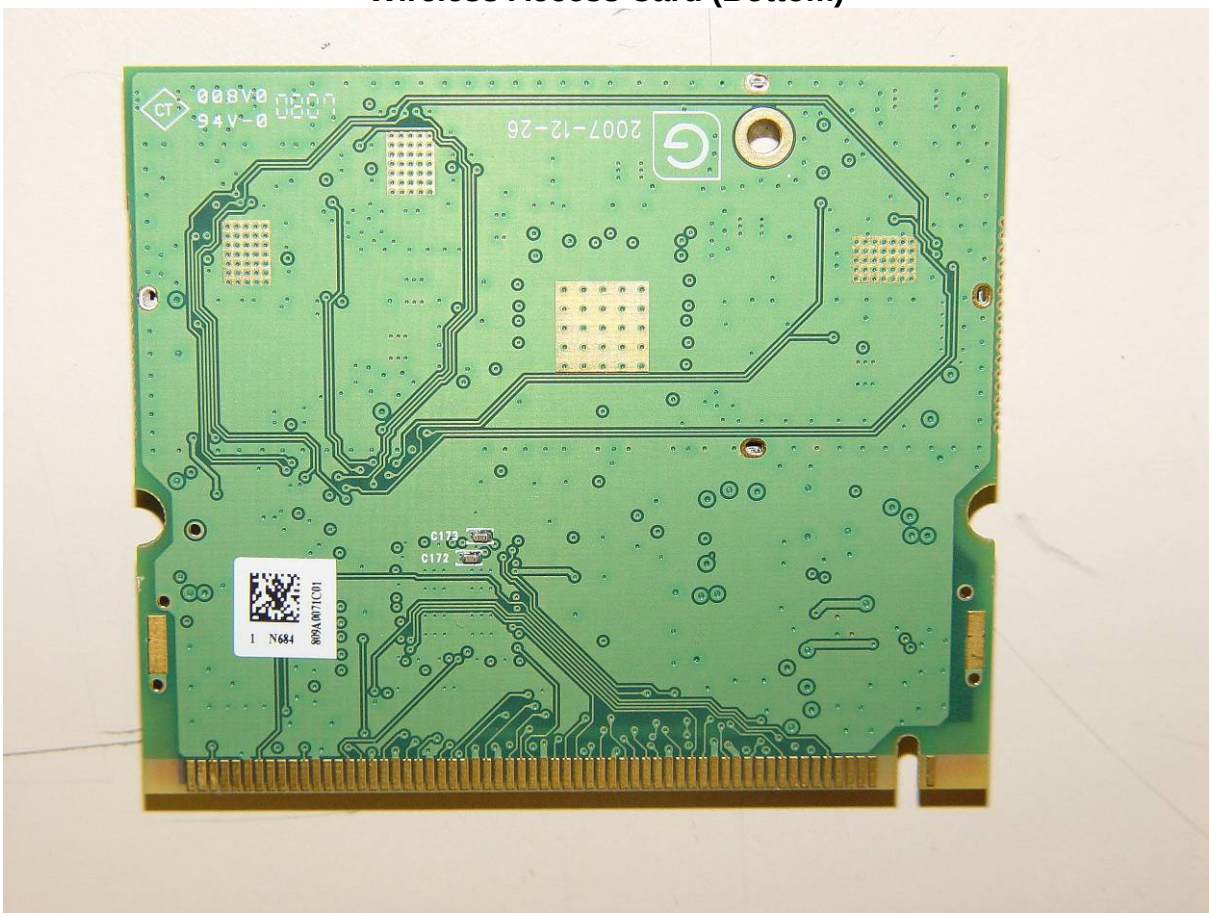
The Wistron 802.11 a/b/g/n wireless card operates as a Master device with full radar detection and Dynamic Frequency Selection (DFS) capability.

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.

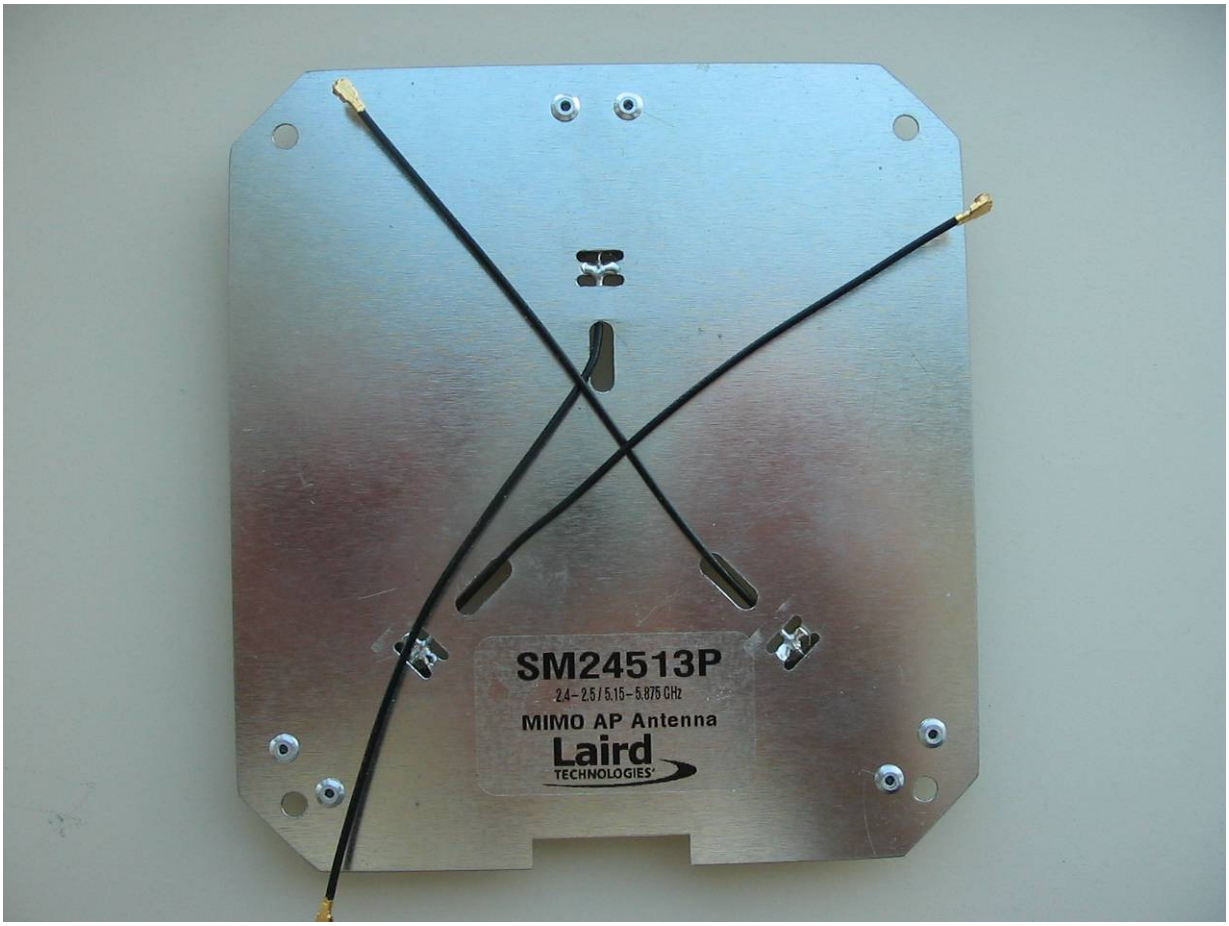
Wistron 802.11 a/b/g/n wireless card
Wireless Access Card (Top)



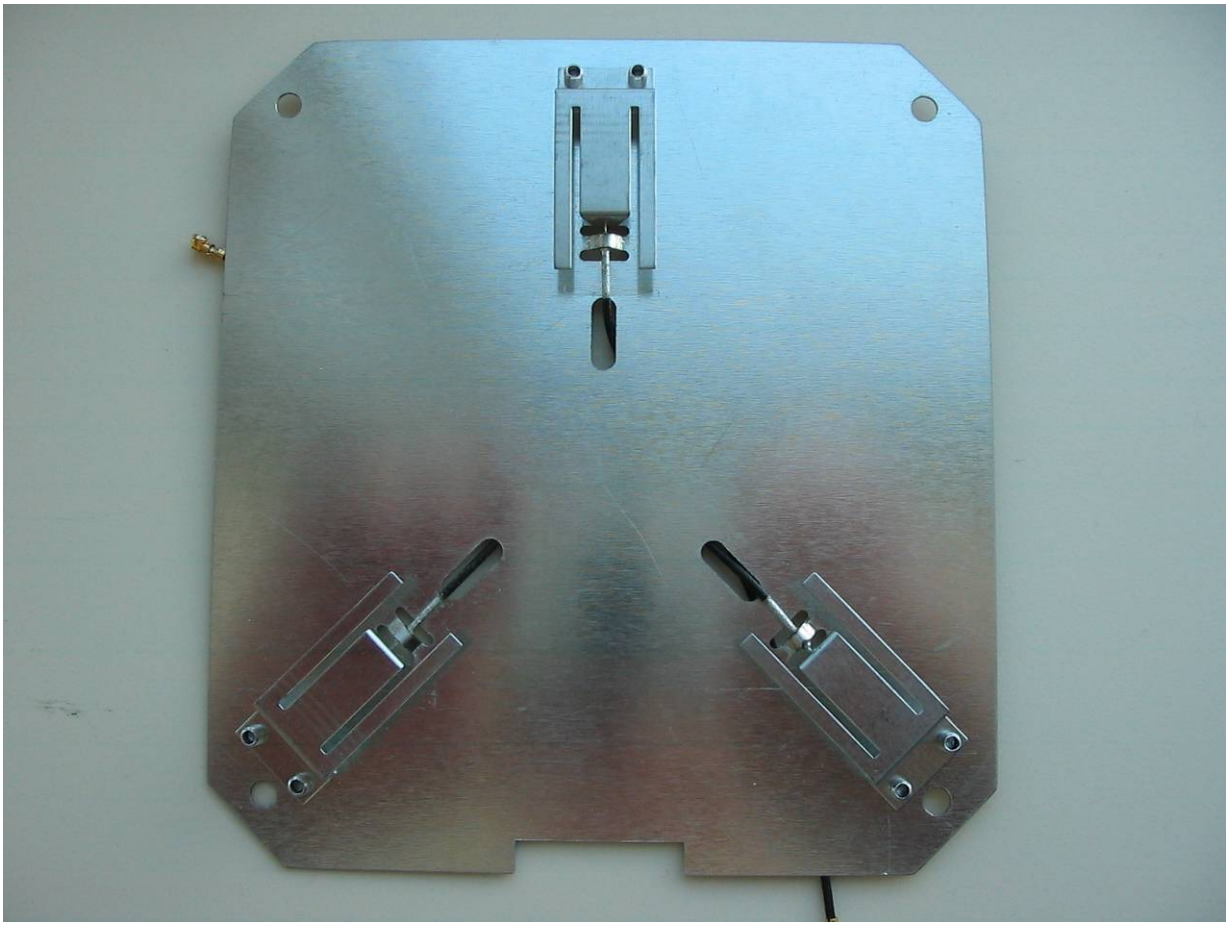
Wistron 802.11 a/b/g/n wireless card
Wireless Access Card (Bottom)



Laird Technologies SM24513P MIMO Antenna



Laird Technologies SM24513P MIMO Antenna



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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Wistron 802.11abgn wireless radio module	Hewlett Packard	MSM415 (DNMA-83 Host Device)	N/A
Support	Wireless Access Point	Hewlett Packard	MSM410	N/A
Support	RF Manager	Hewlett Packard	RF Manager	W-65-00029
Support	Laptop PC	IBM	Thinkpad	None
Support	Laptop PC	Dell	Inspiron 1100	

3.4. Antenna Details

1. Laird Technologies SM24513P MIMO AP Antenna
    - Maximum Gain 5,150 – 5,875 MHz, 6.45 dBi

3.5. Cabling and I/O Ports

Number and type of I/O ports (host device)

1. 2 X RJ-45 , 10/100/1000 BASE-T Ethernet

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

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,

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

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)		Complies	*5.1.7.3*
15.407(b)(6) **15.207** **7.2.2**	AC Wireline Conducted Emissions 150 kHz–30 MHz	Conducted Emissions	Conducted	Complies	5.1.8

* 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 Client Device

Section	Test Items	Description	Condition	Result	Test Report Section
7.8.1	In-Service Monitoring	In-Service Monitoring for Channel Move Time, Channel Closing Transmission Time and Non-Occupancy Period	Conducted	Complies	6.2.1

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

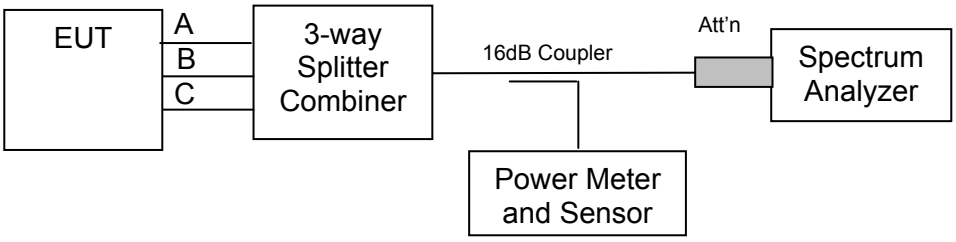
5.1. Device Characteristics

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

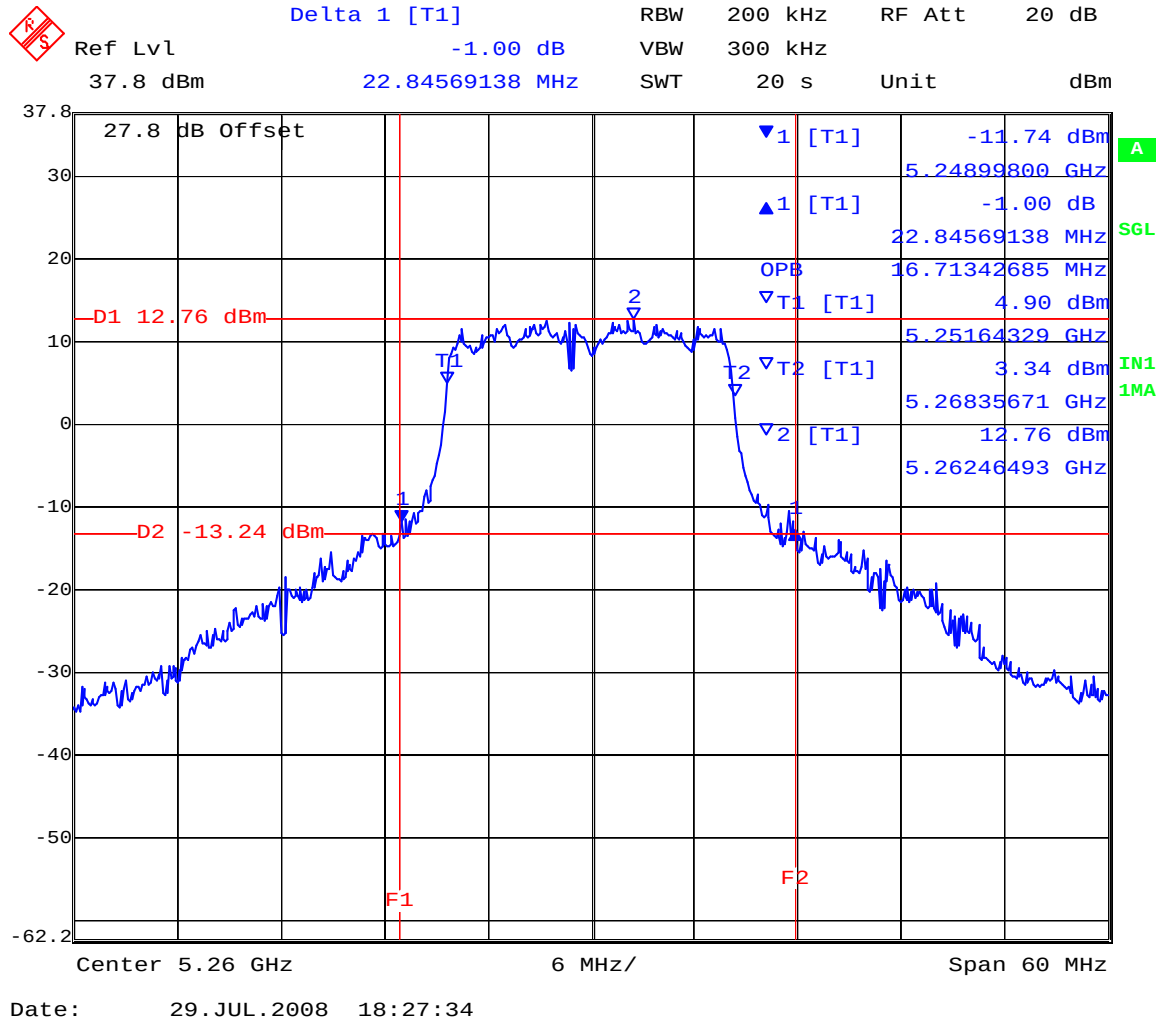
Measurement Results for 26 dB and 99 % Operational Bandwidth(s)

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

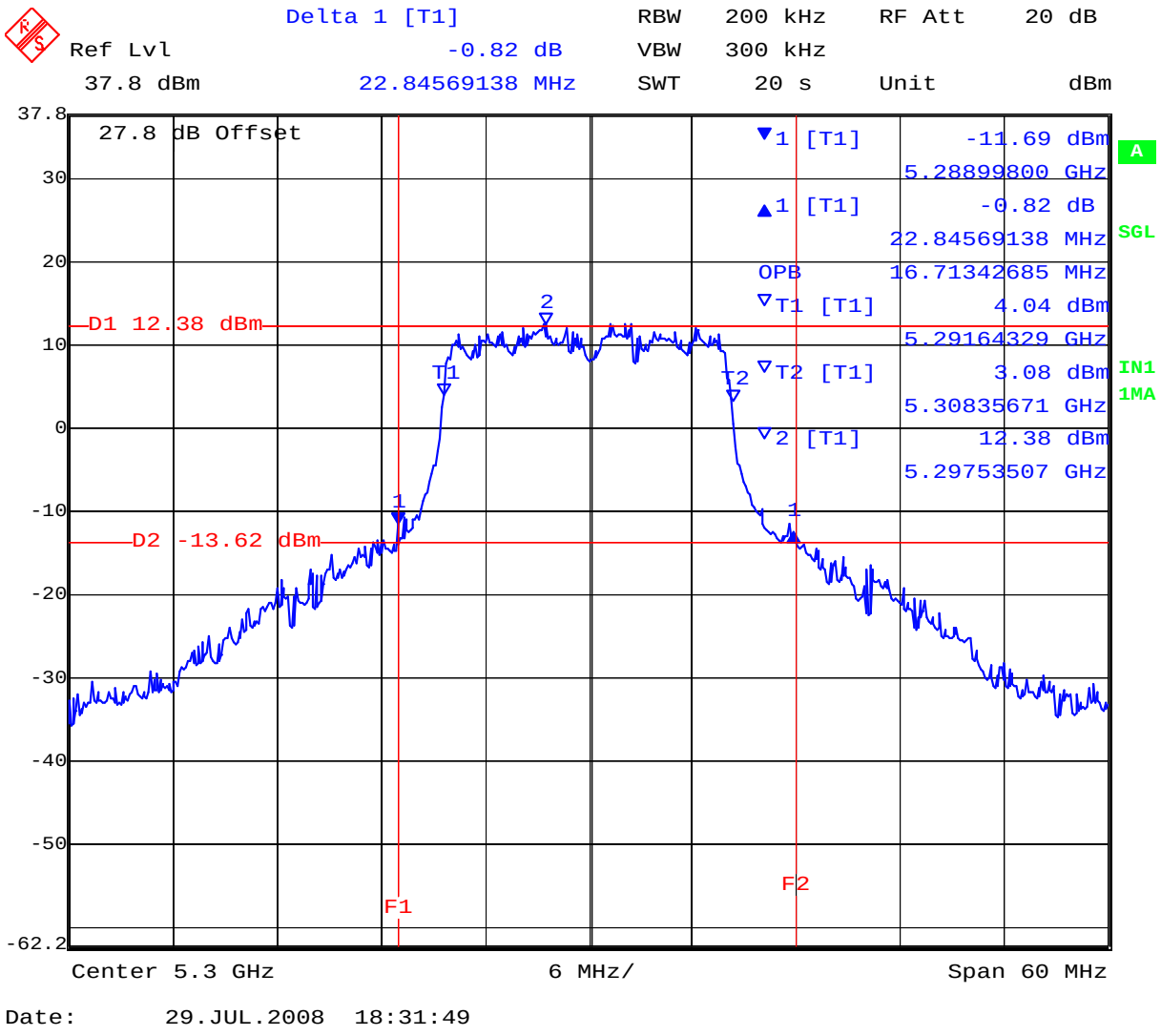
TABLE OF RESULTS – **802.11a Legacy**

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

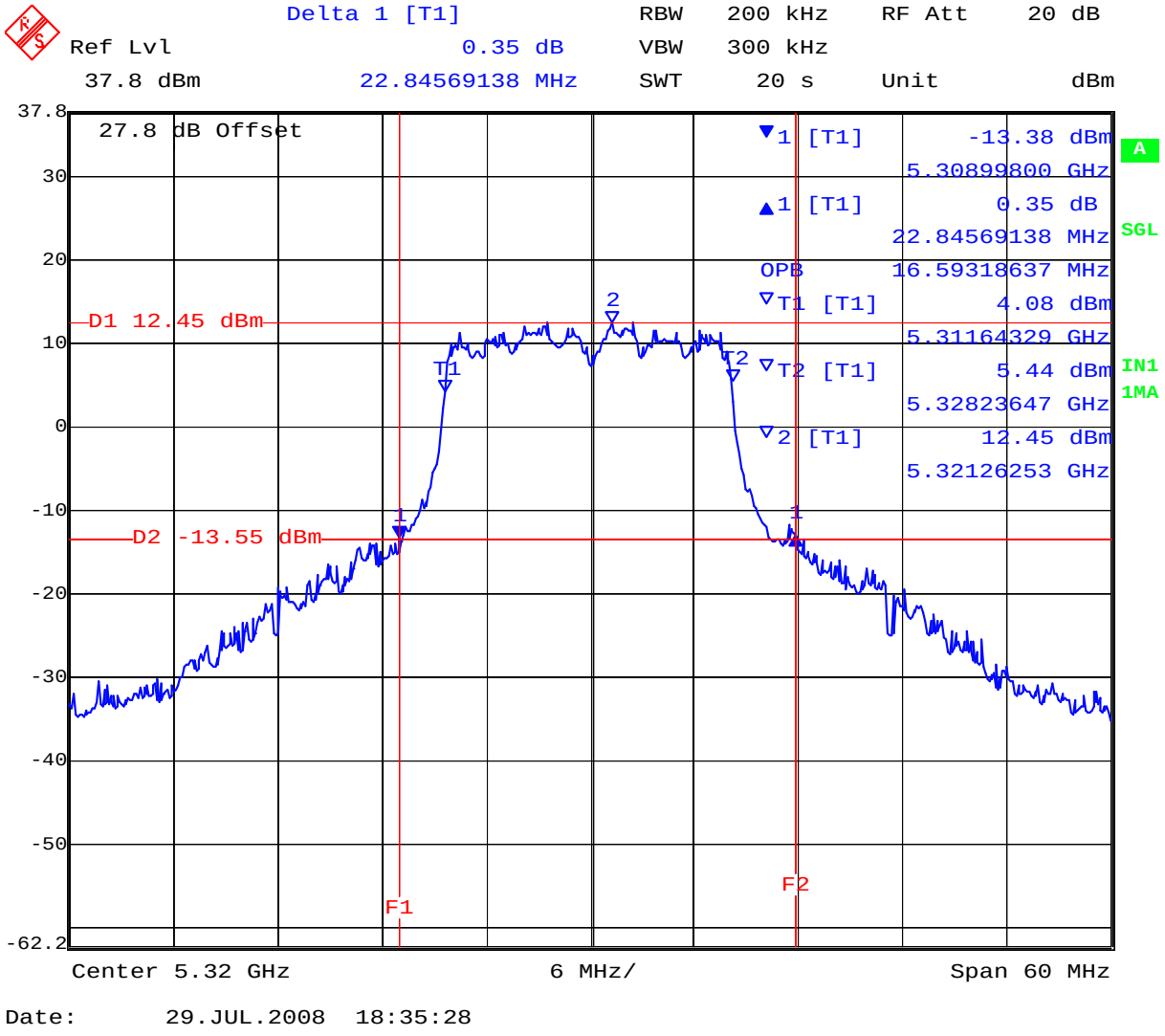
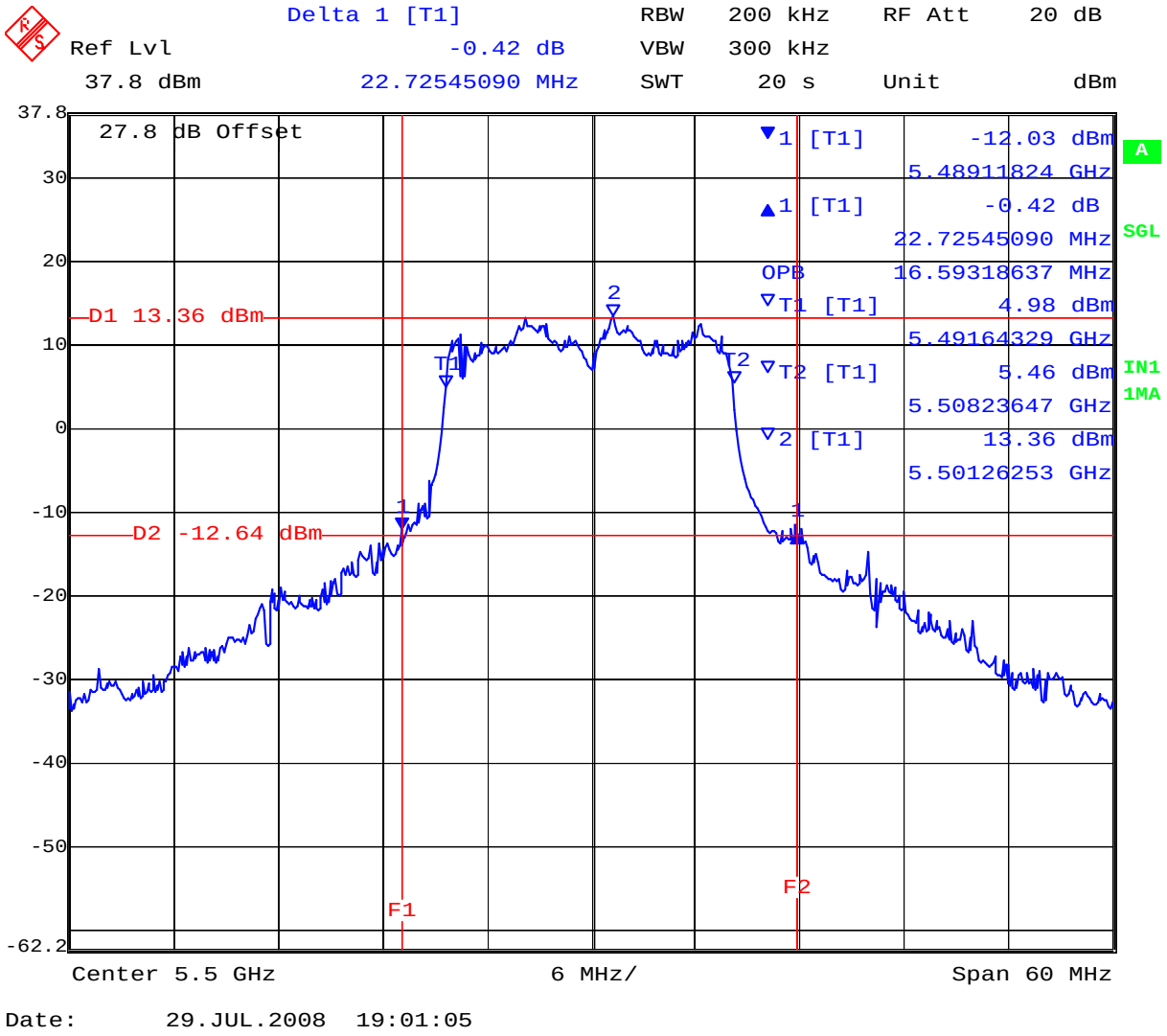


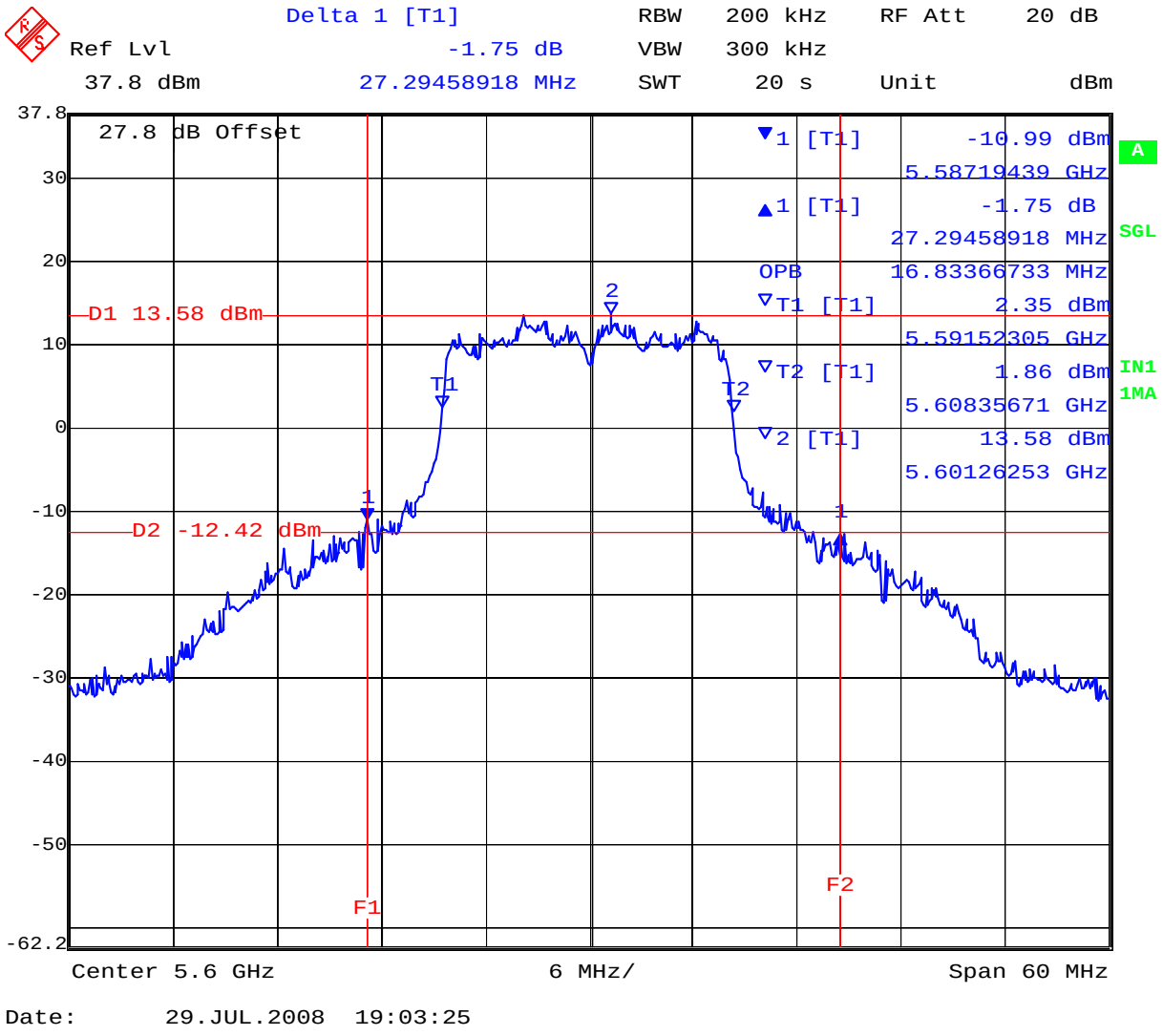
TABLE OF RESULTS – **802.11a Legacy**

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

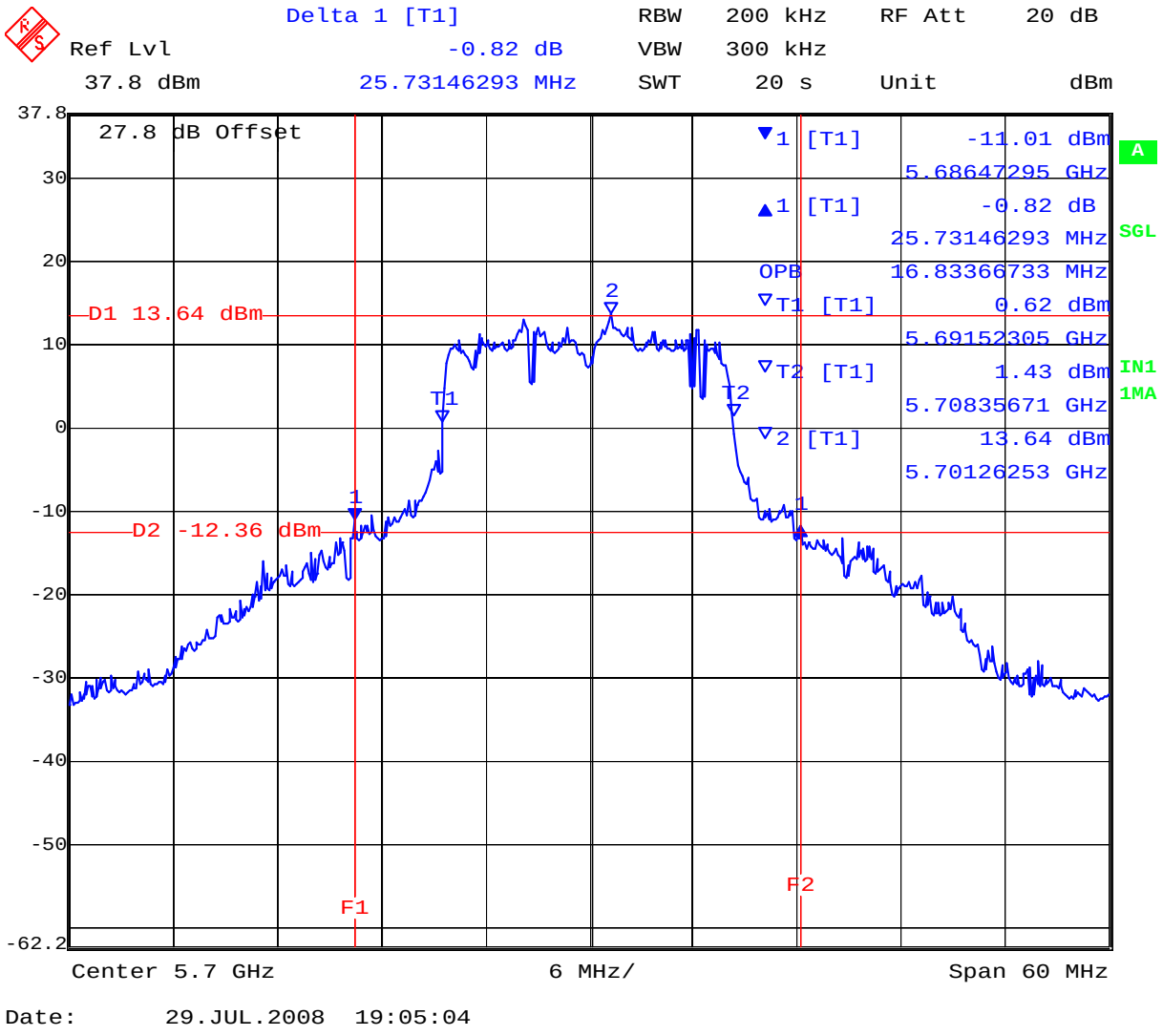
5,500 MHz 802.11a Legacy 26 dB and 99 % Bandwidth



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



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

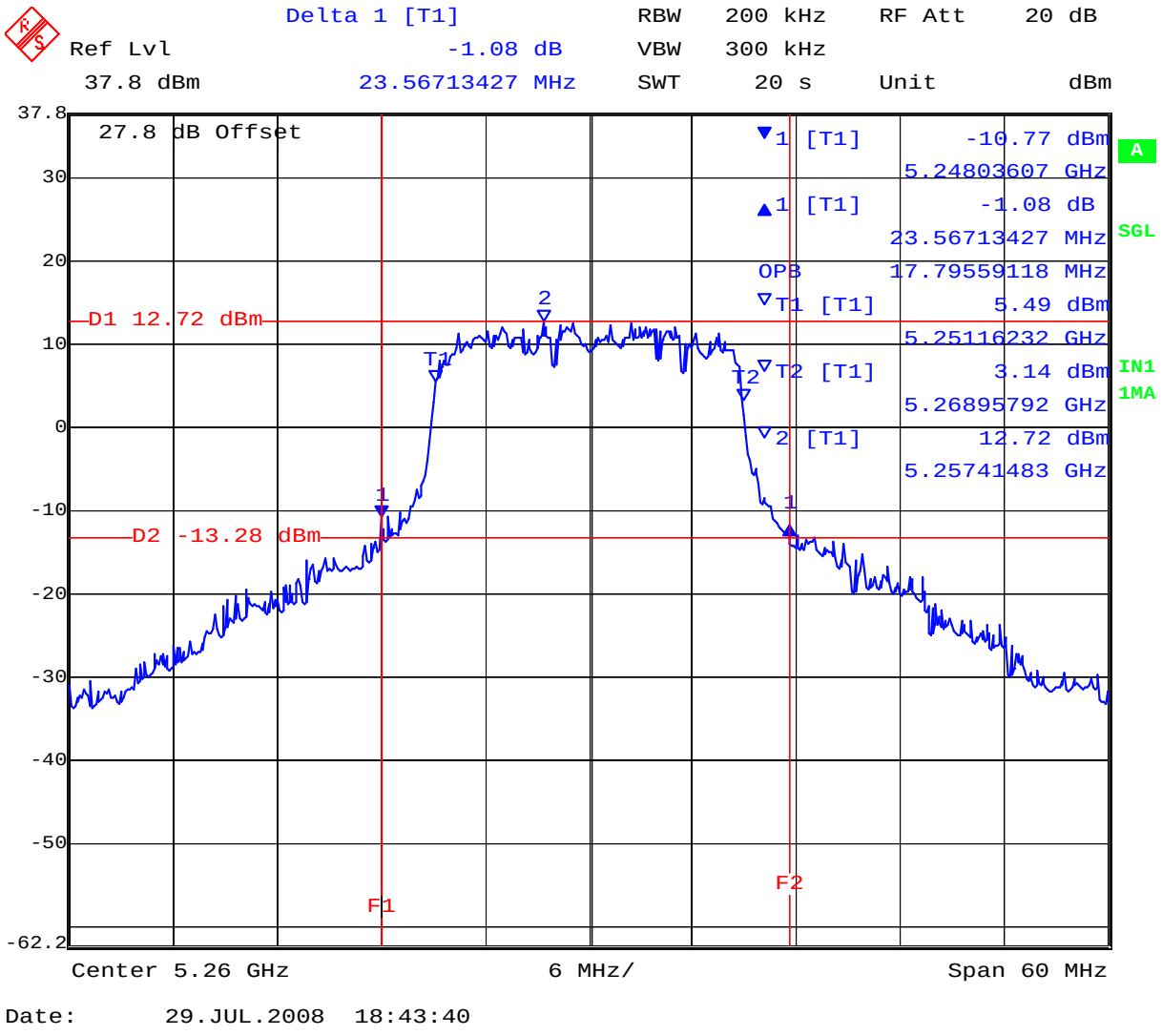


Measurement Results for 26 dB and 99 % Operational Bandwidth(s) -Continued

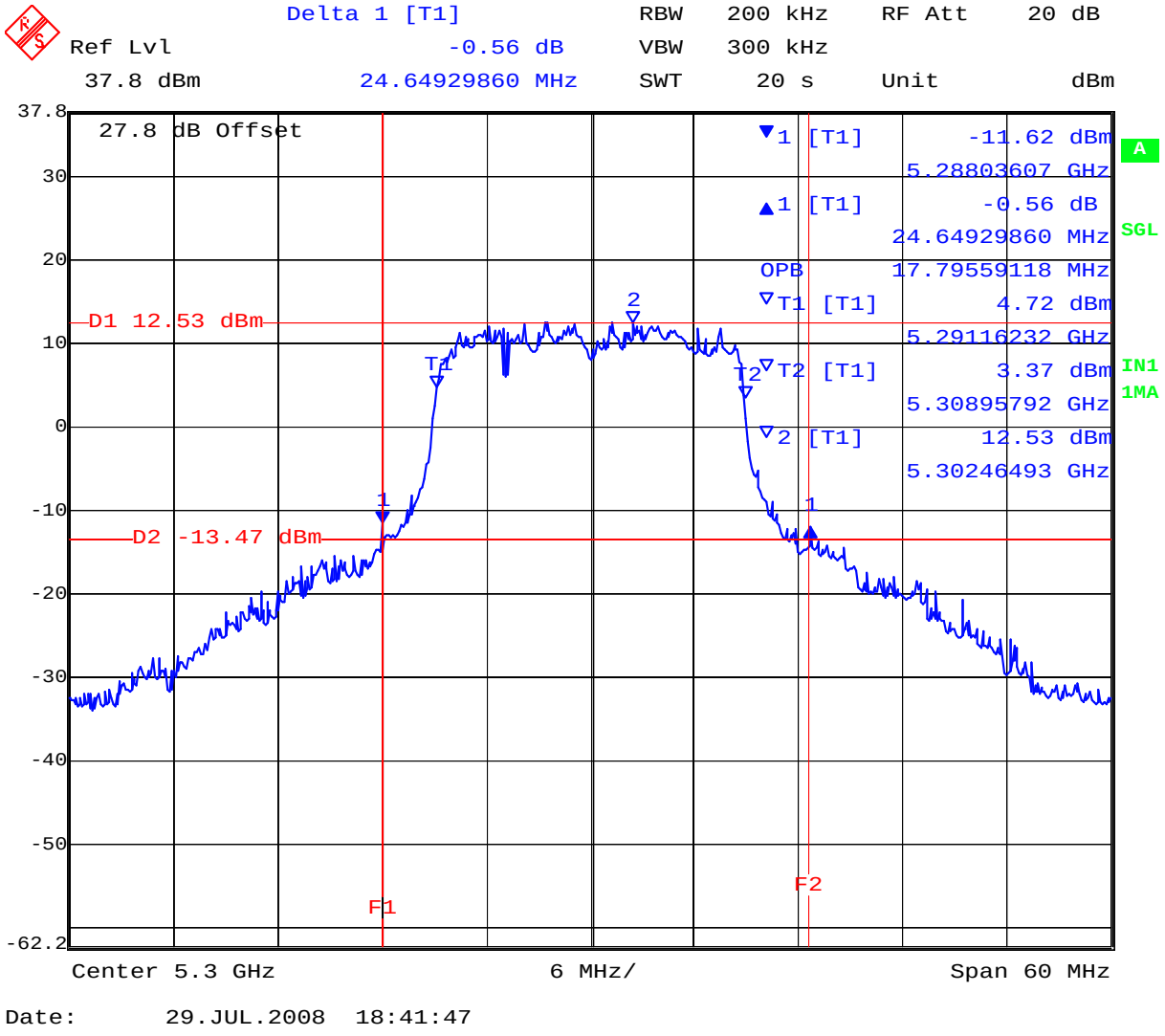
TABLE OF RESULTS – **802.11n HT20**

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

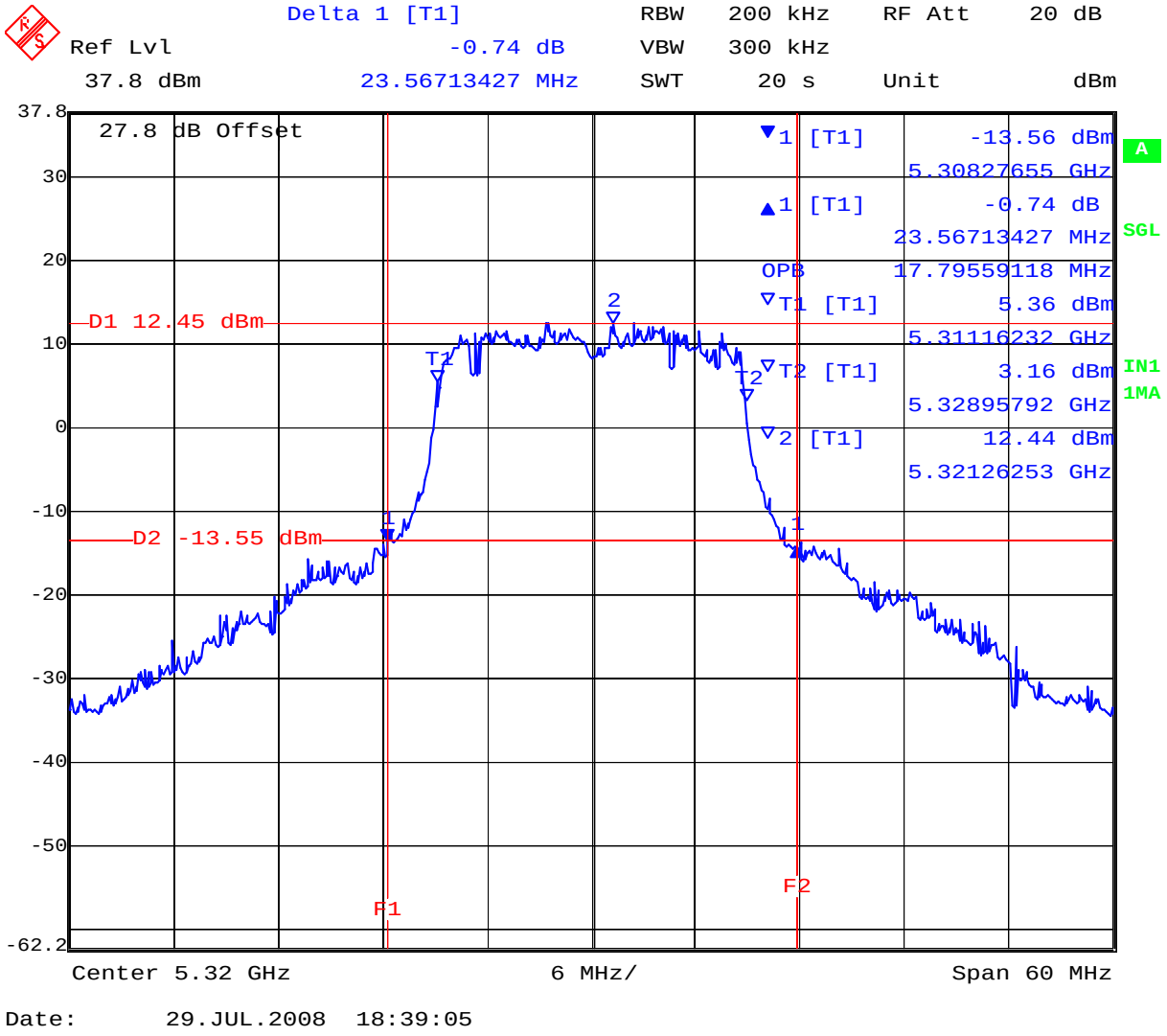
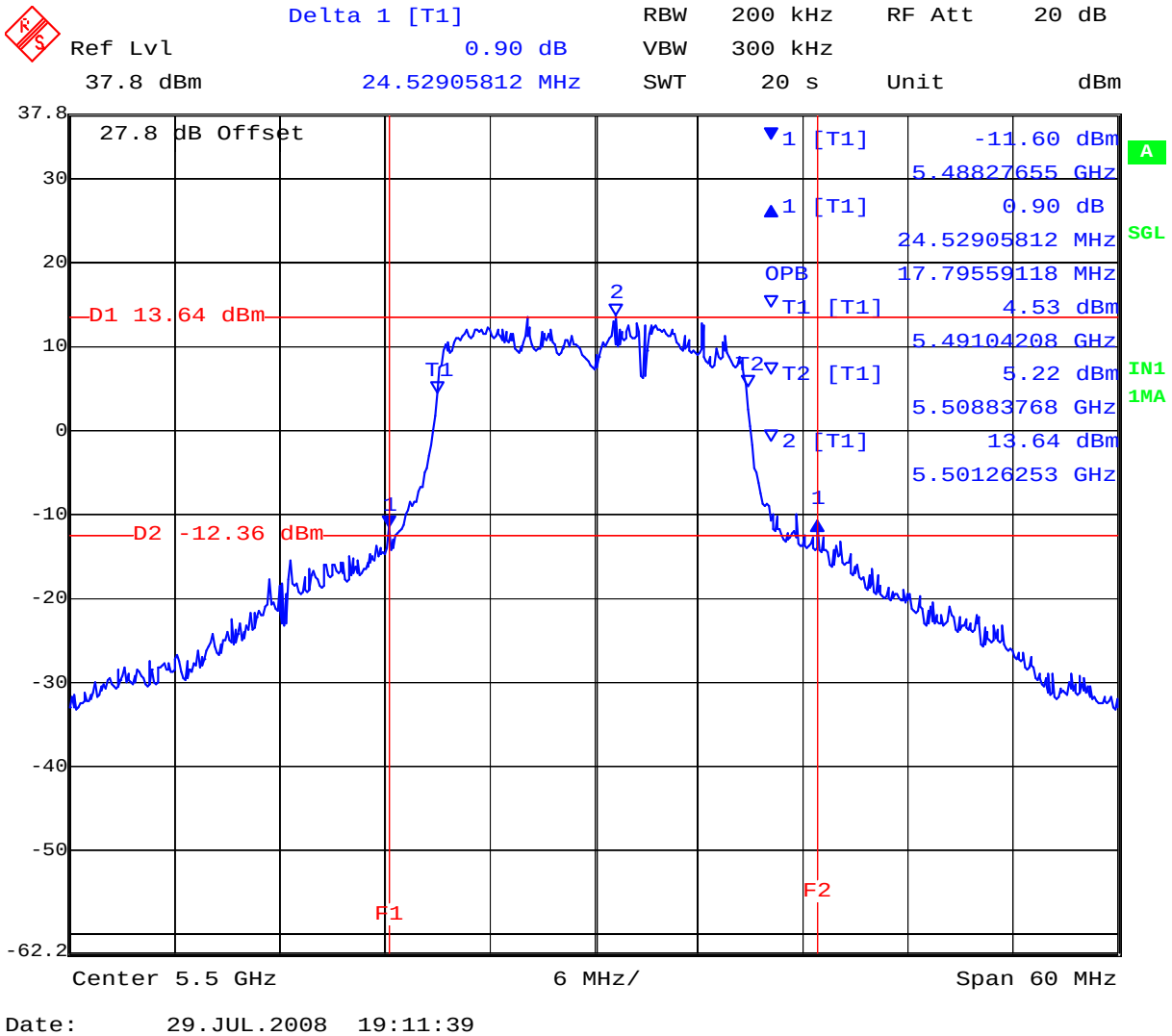


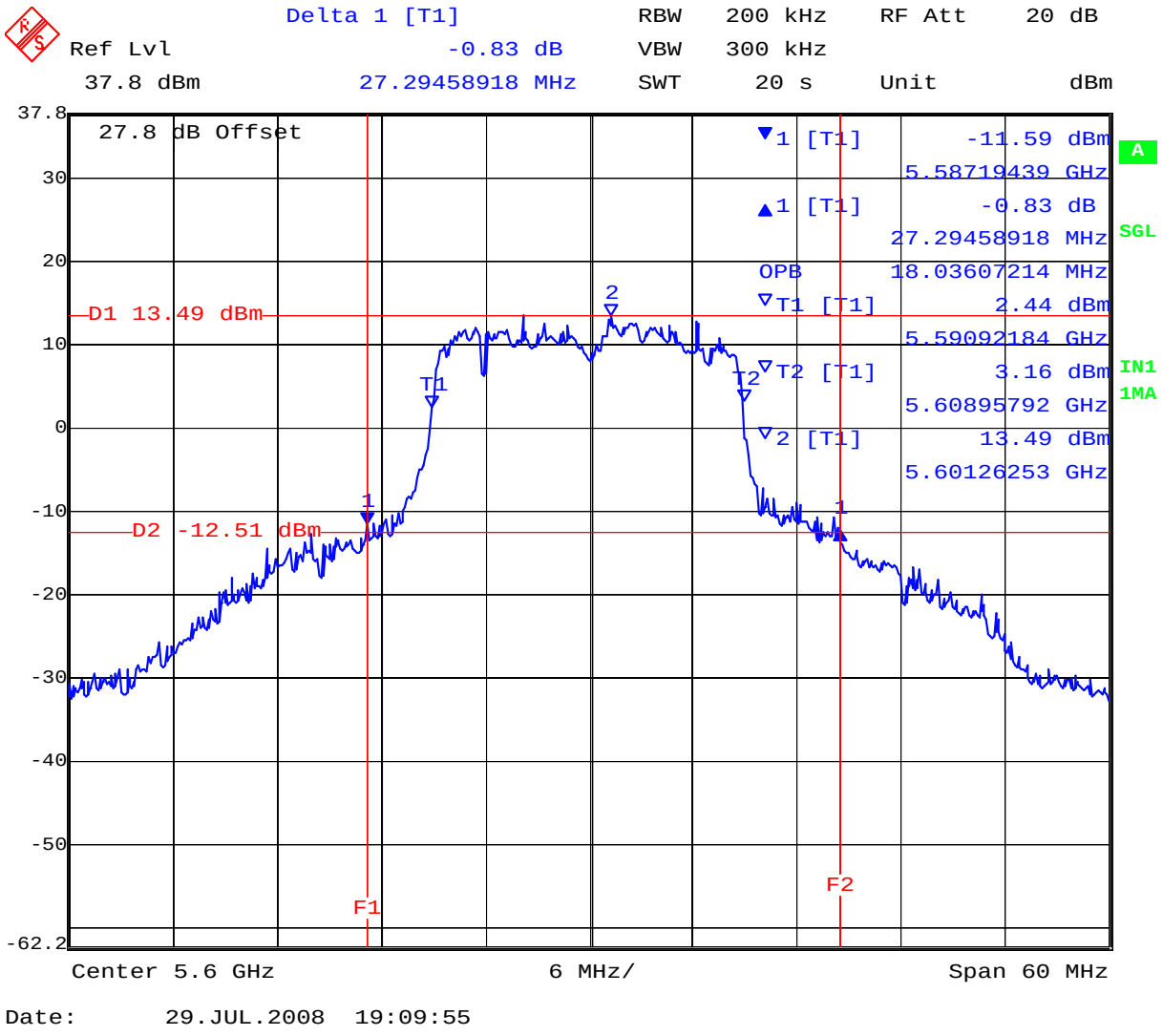
TABLE OF RESULTS – **802.11n HT20**

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

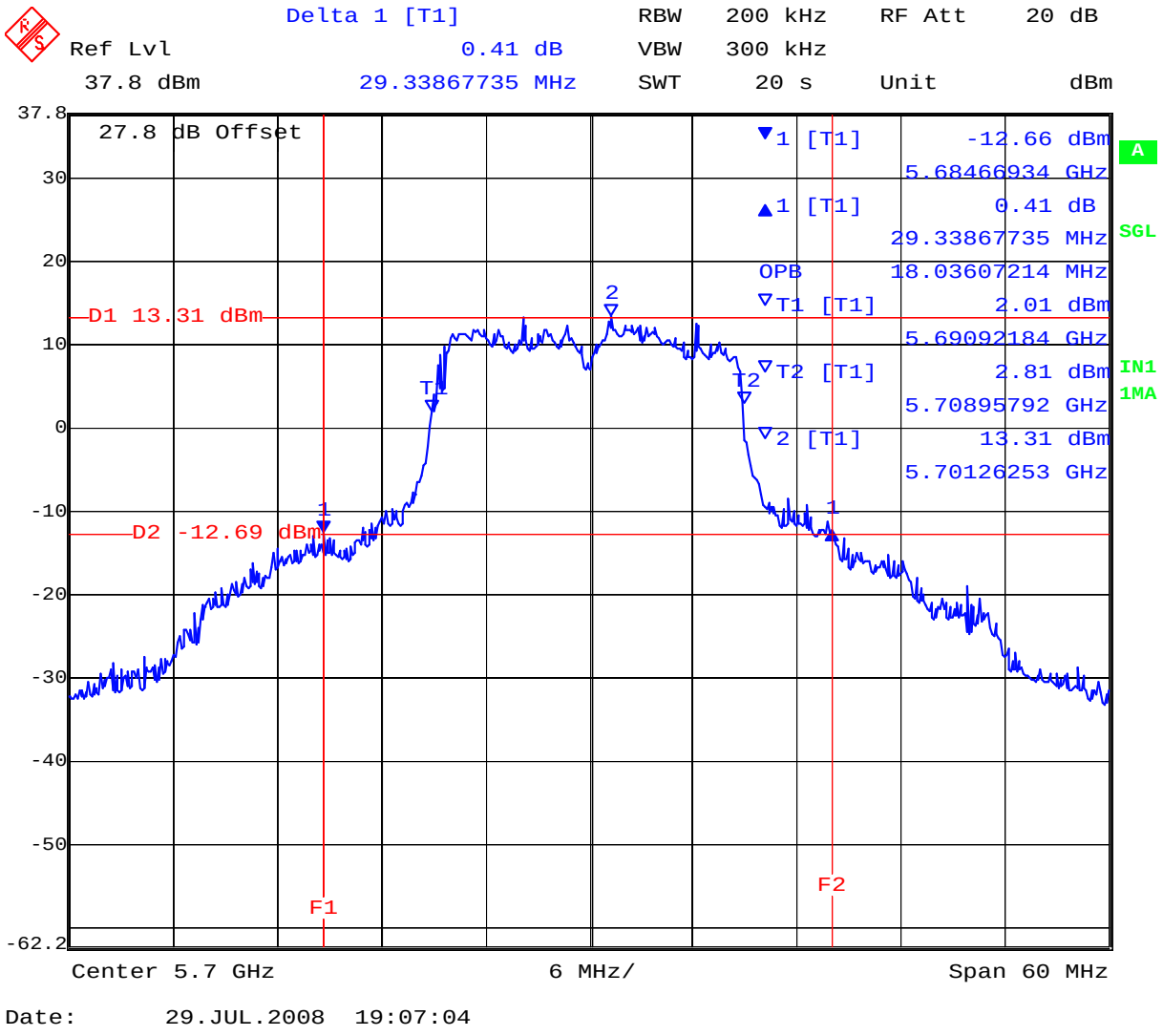
5,500 MHz 802.11n HT20 26 dB and 99 % Bandwidth



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



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

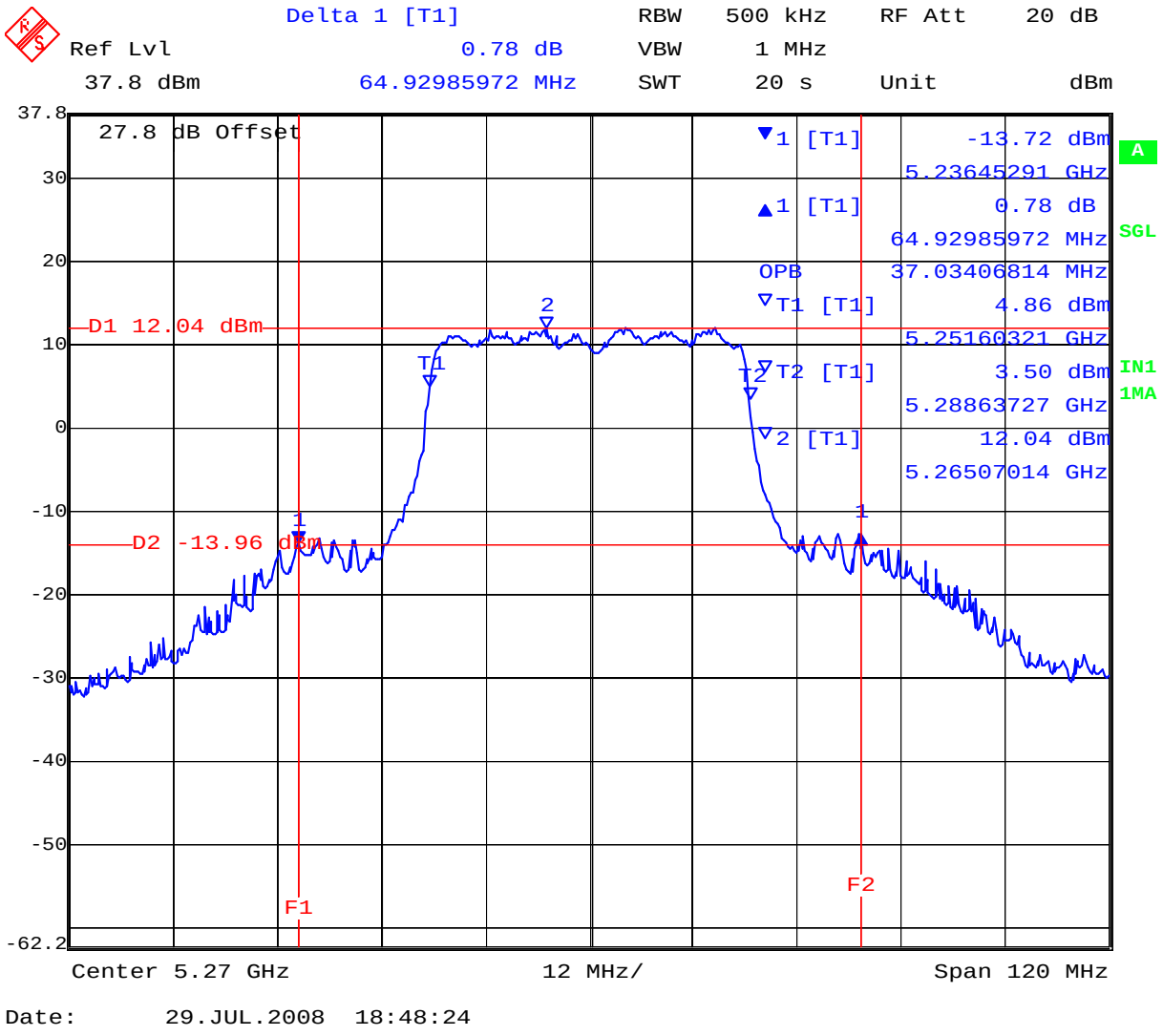


Measurement Results for 26 dB and 99 % Operational Bandwidth(s) -Continued

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

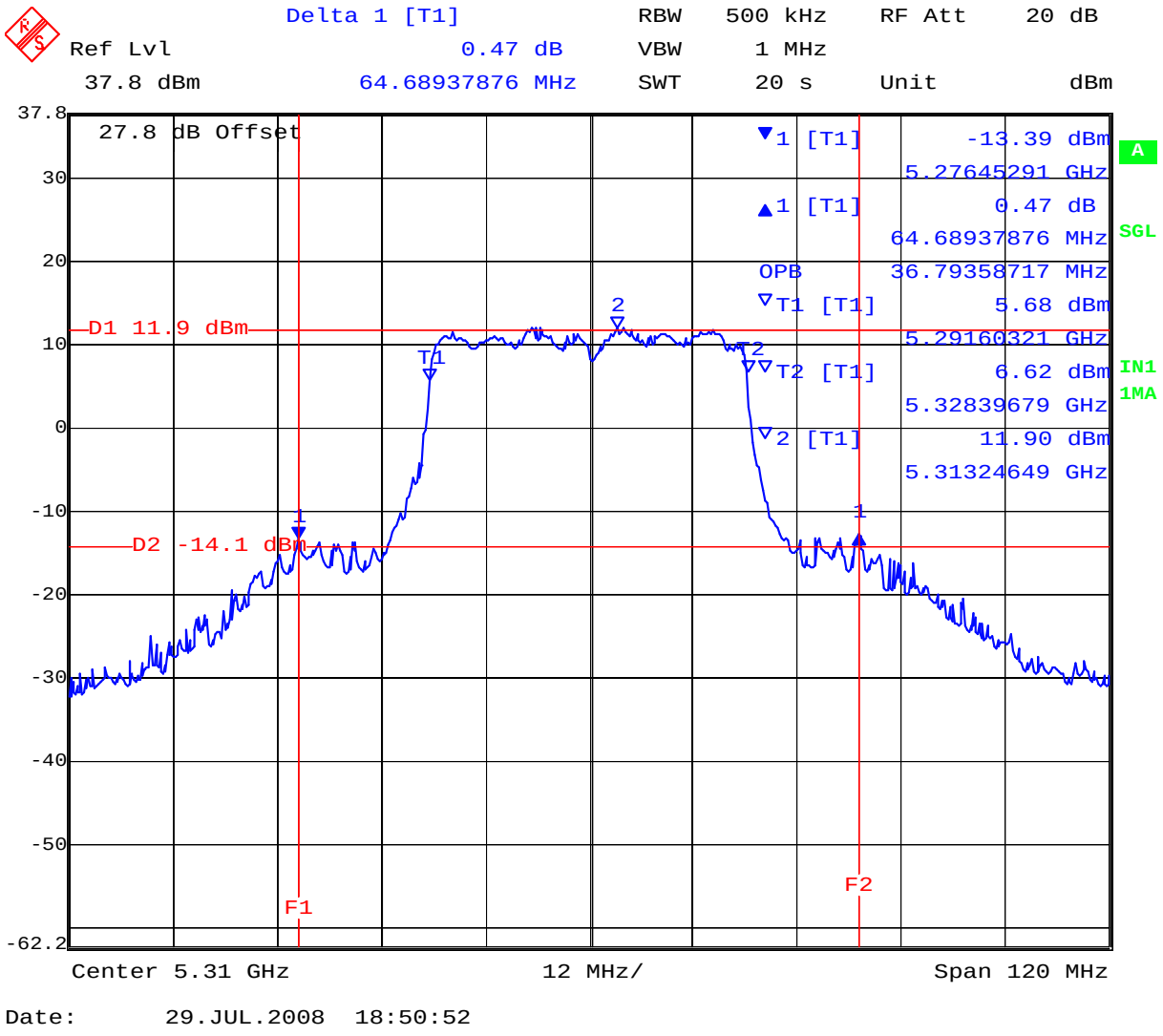
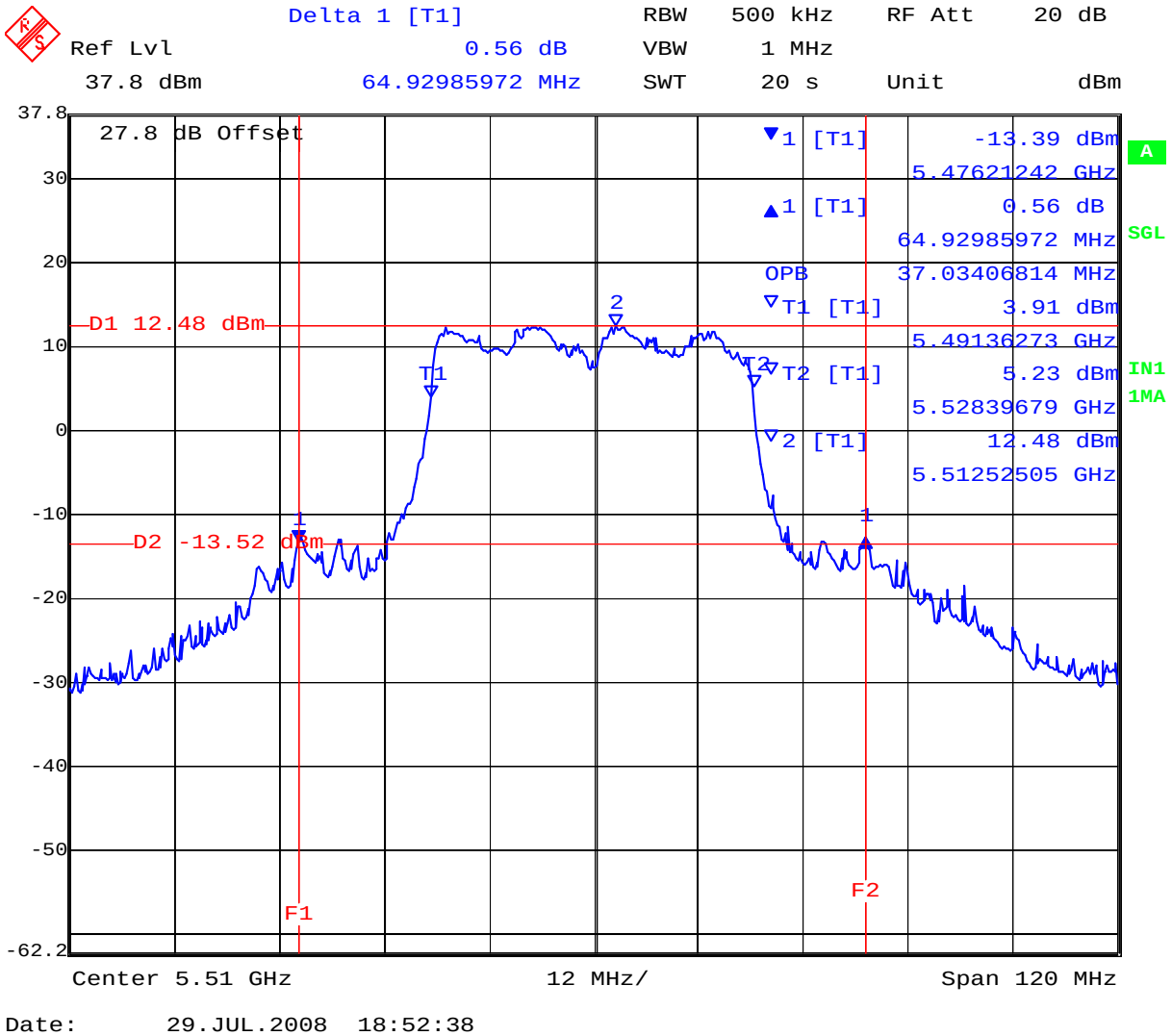


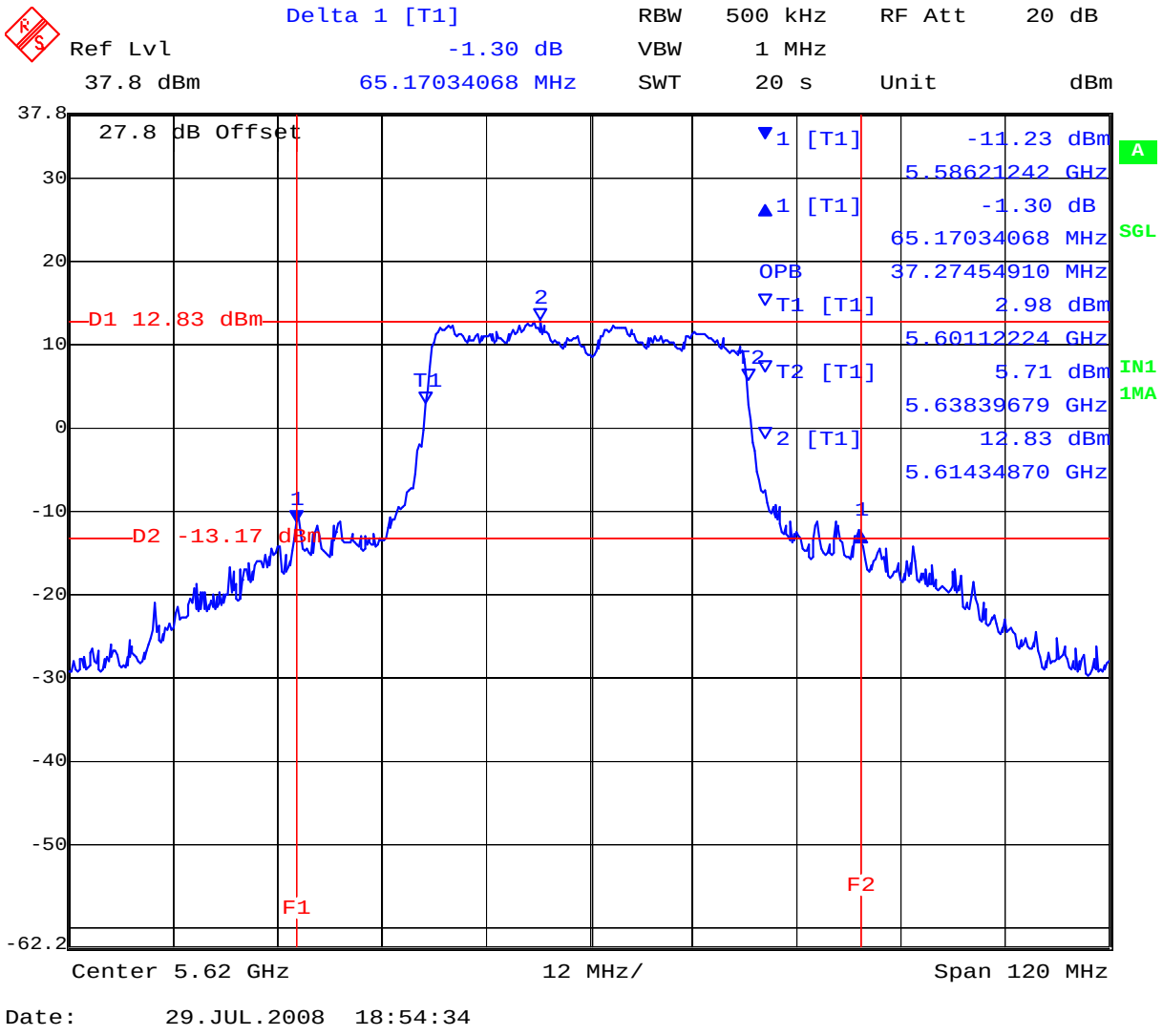
TABLE OF RESULTS – **802.11n HT40**

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

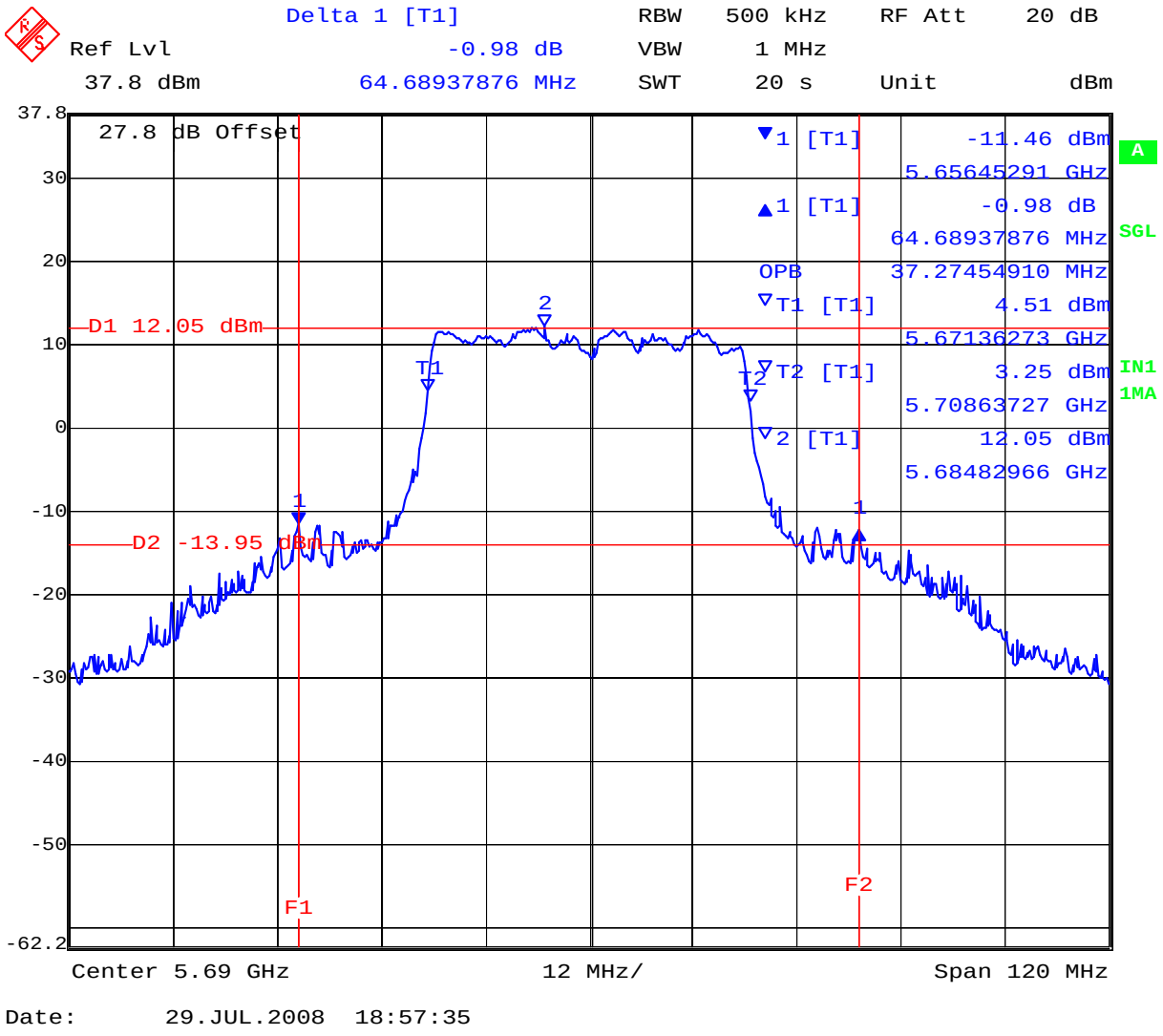
5,510 MHz 802.11n HT40 26 dB and 99 % Bandwidth



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

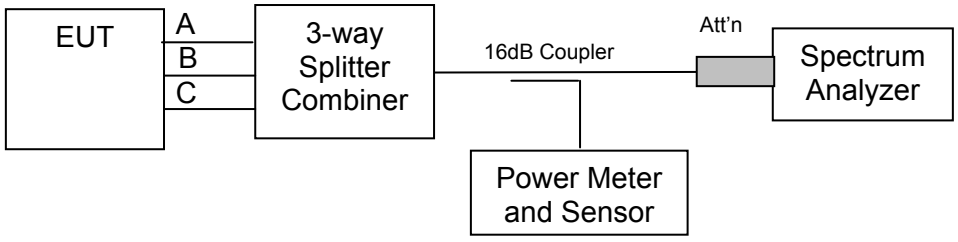
5.1.2. Transmit Output Power

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

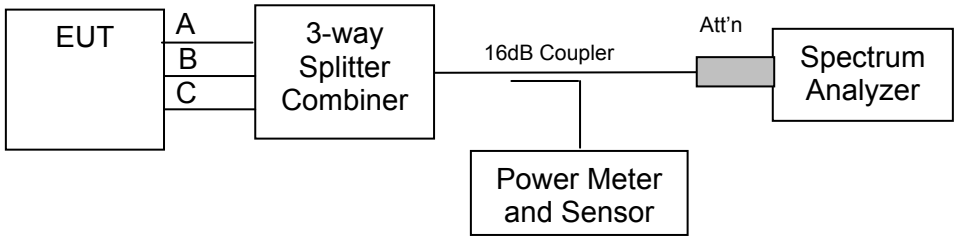
Method	Test Equipment Used
Measurements were made per work instruction WI-01 'Measuring RF Output Power'	0158, 0193, 0252, 0313, 0314, 0070, 0116, 0117

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

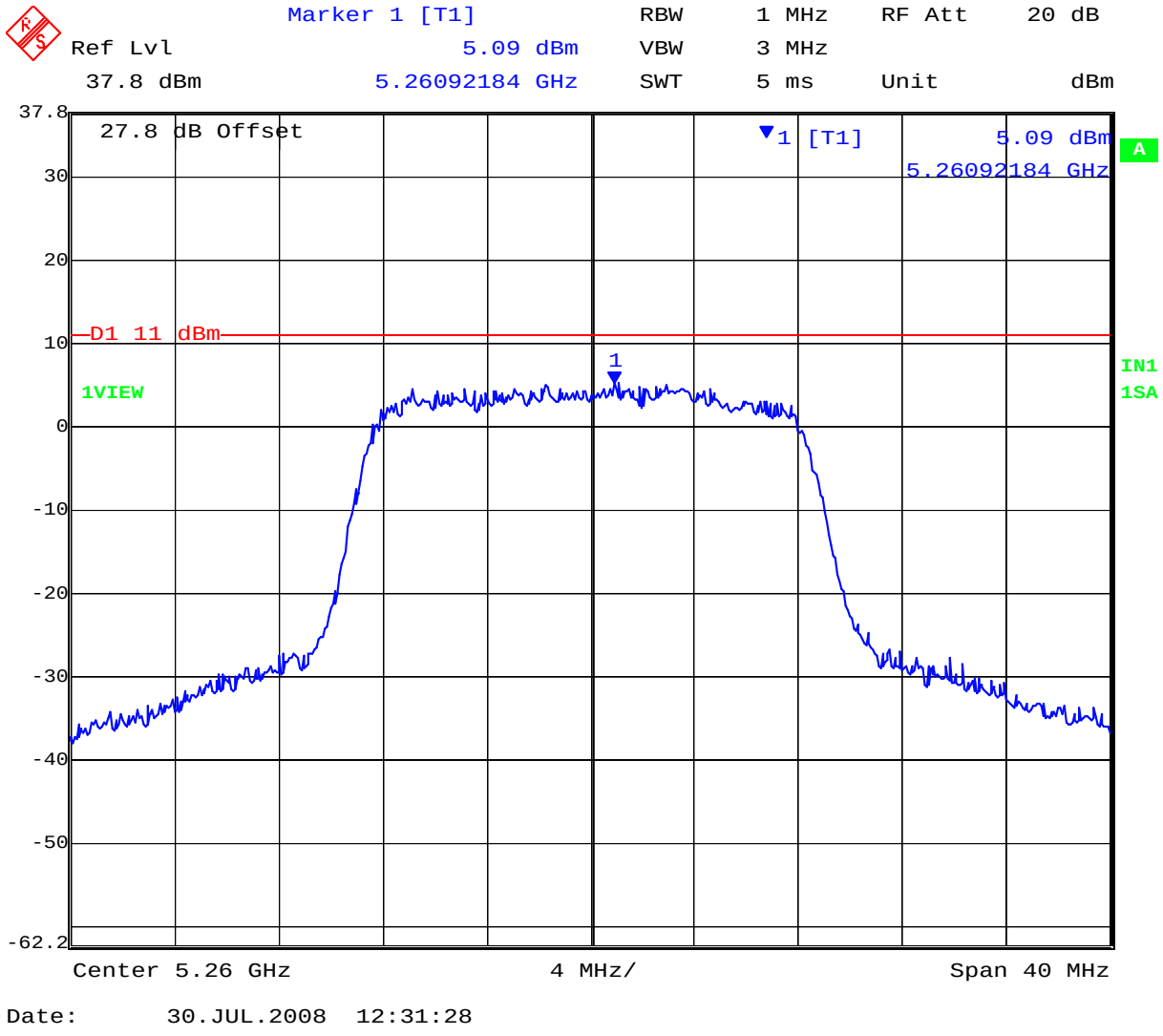
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

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

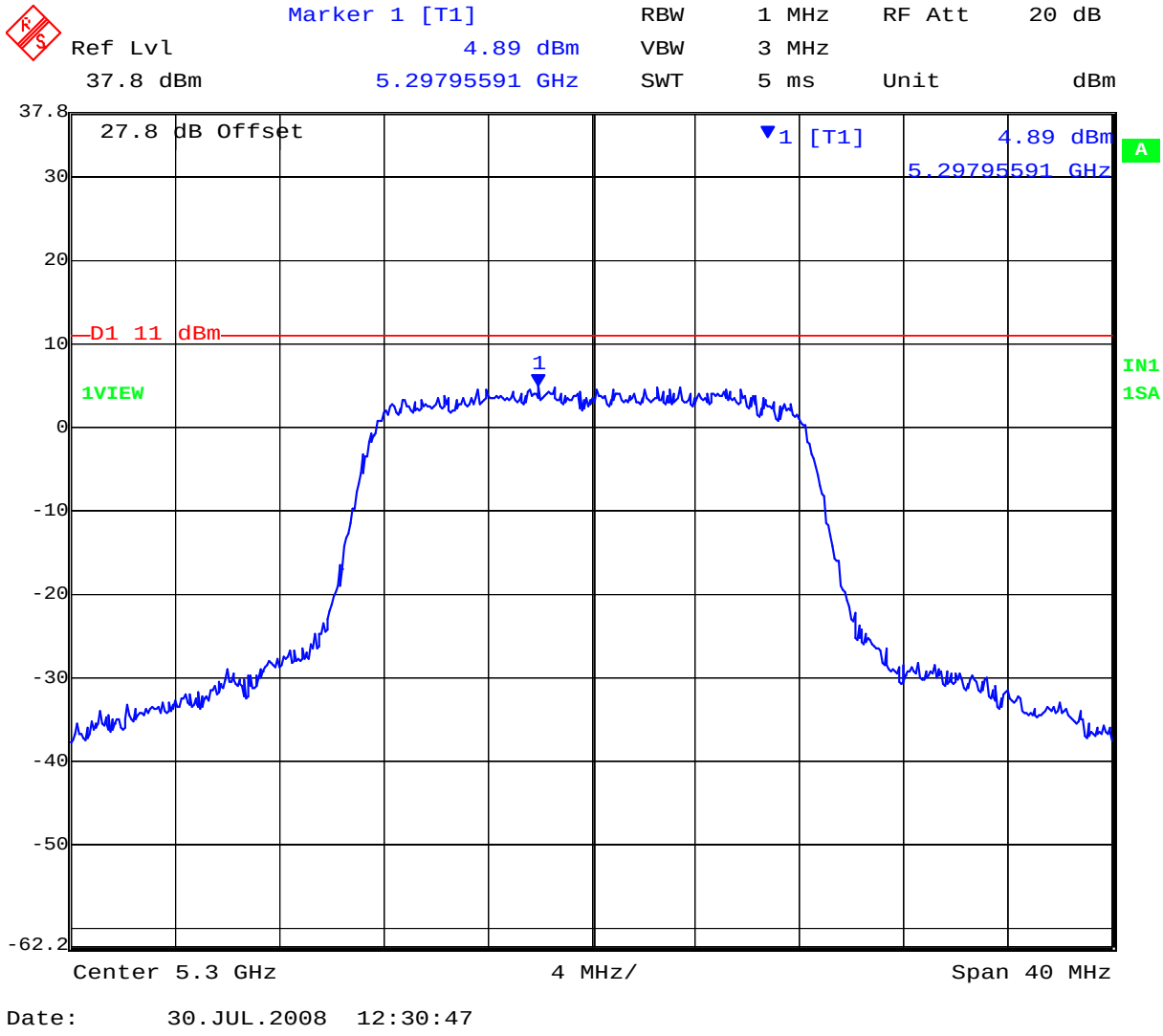
TABLE OF RESULTS – **802.11a Legacy**

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

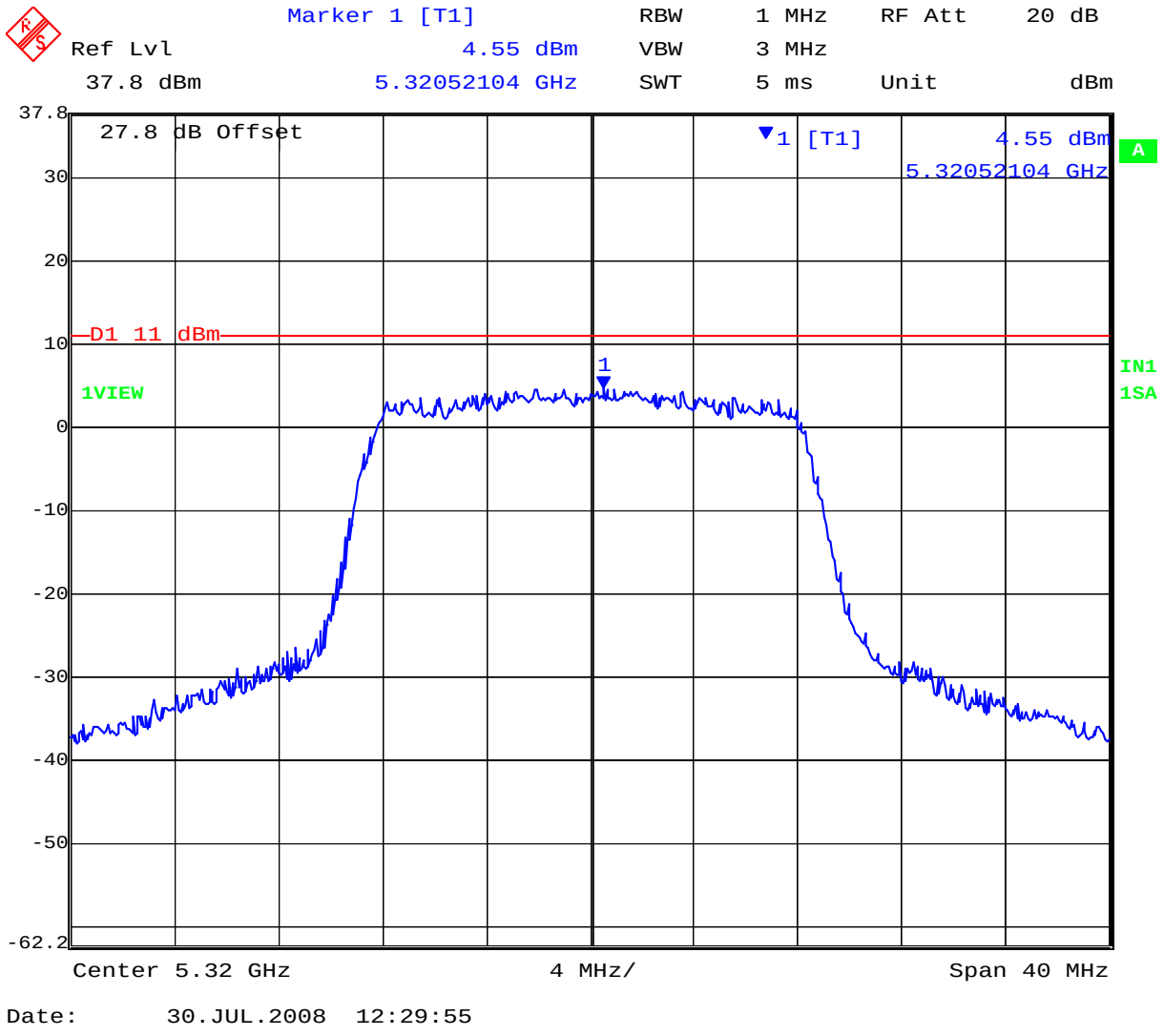
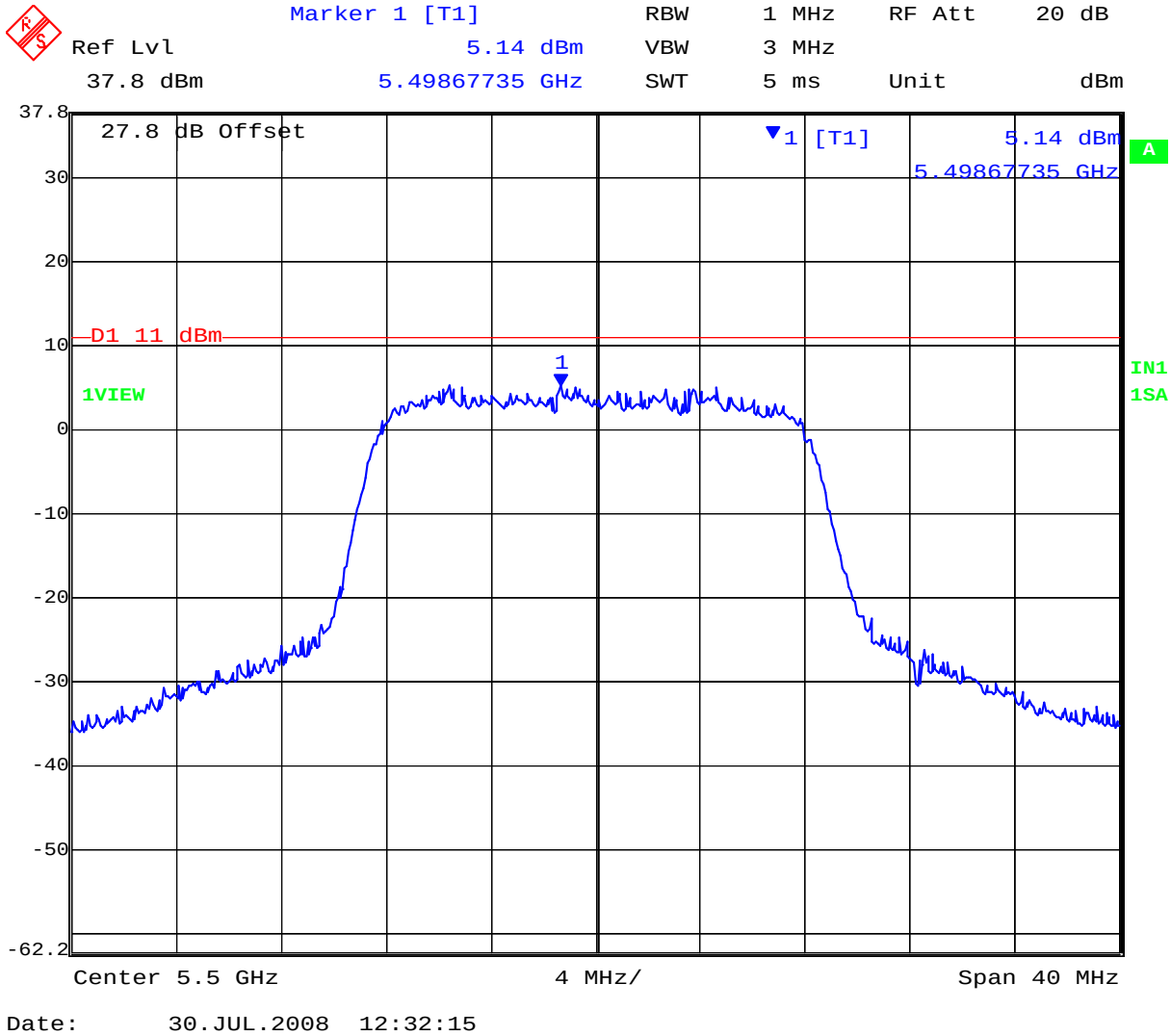


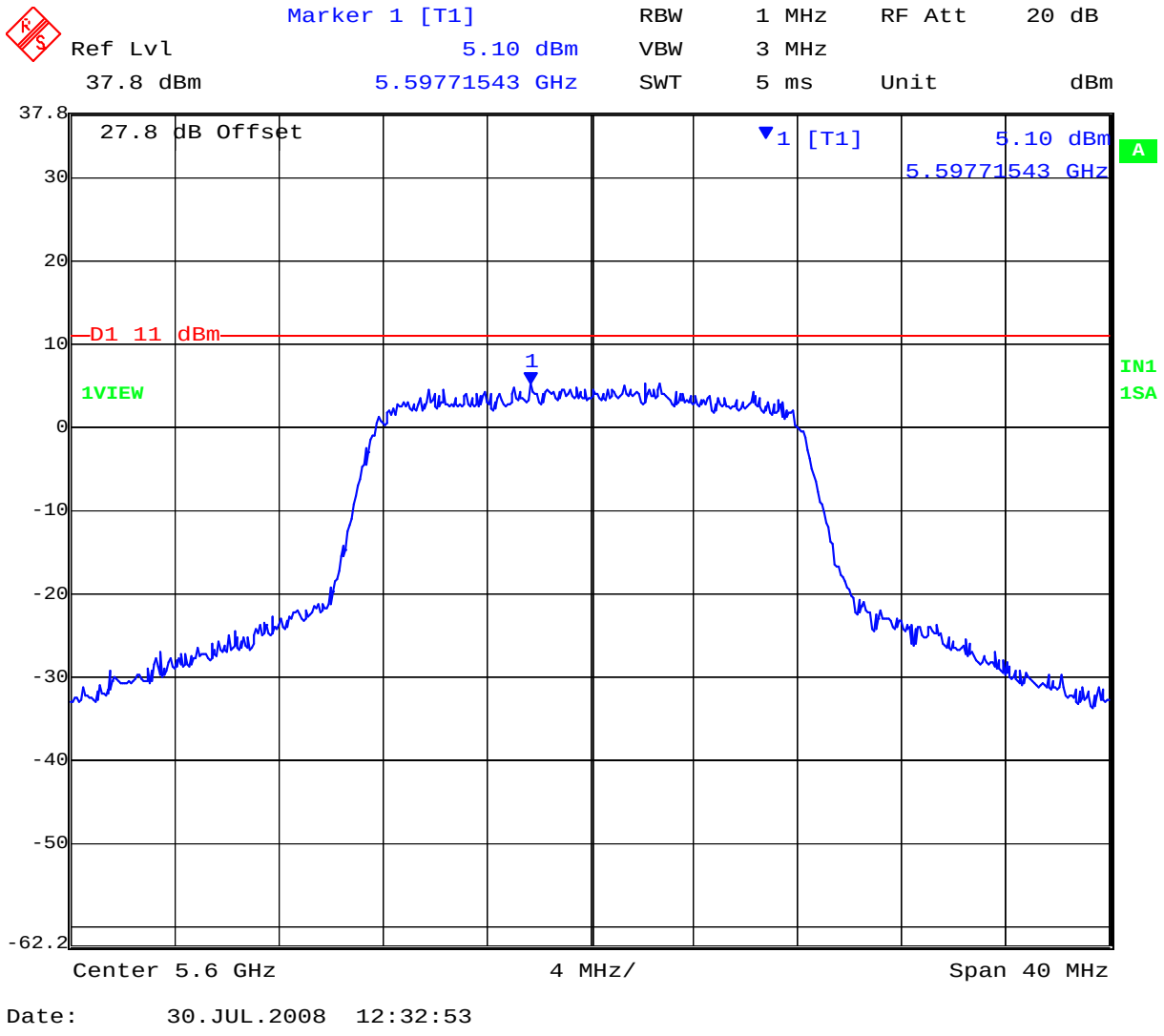
TABLE OF RESULTS – **802.11a Legacy**

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

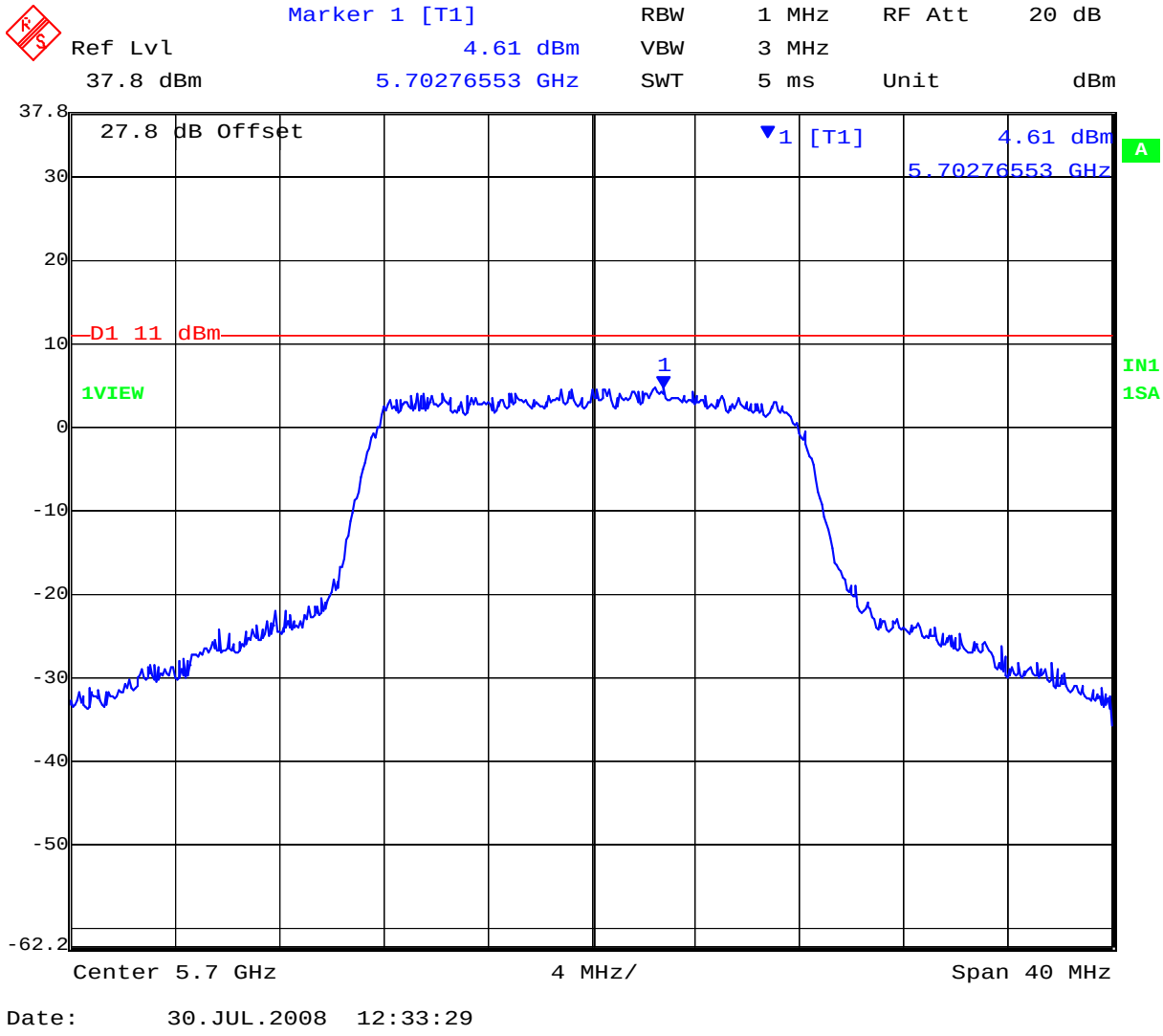


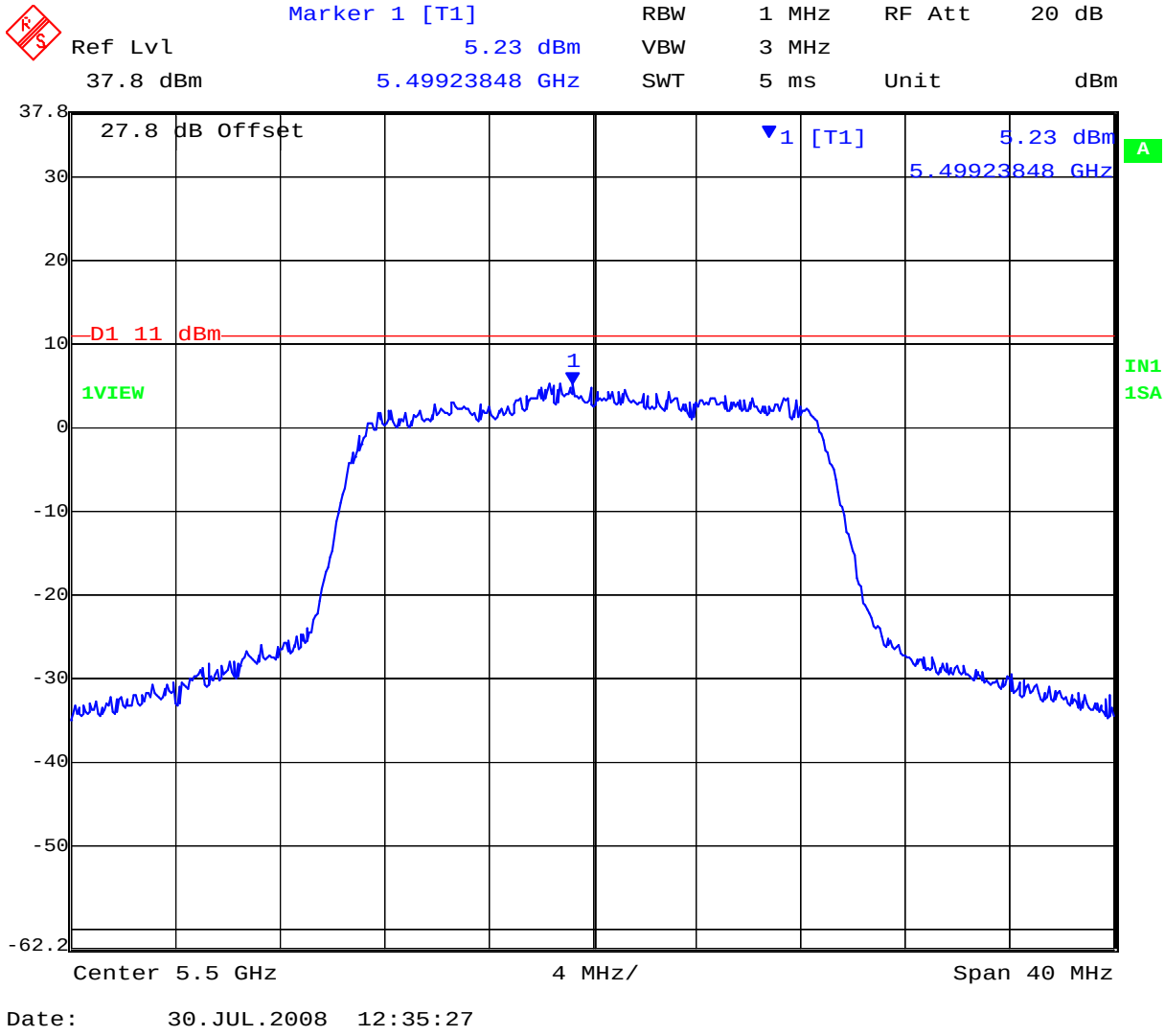
TABLE OF RESULTS – **802.11N HT20**

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

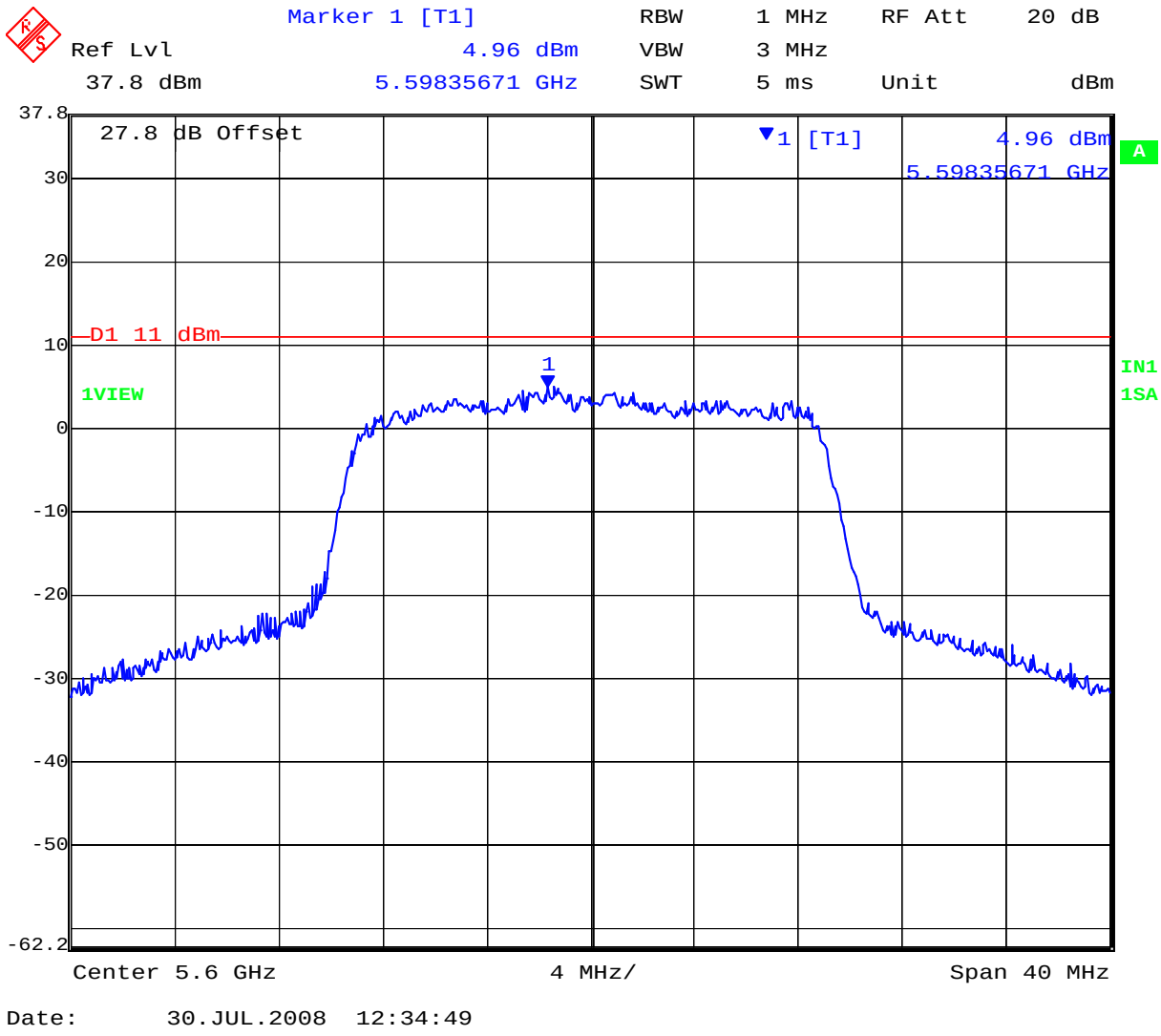
TABLE OF RESULTS – **802.11n HT20**

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

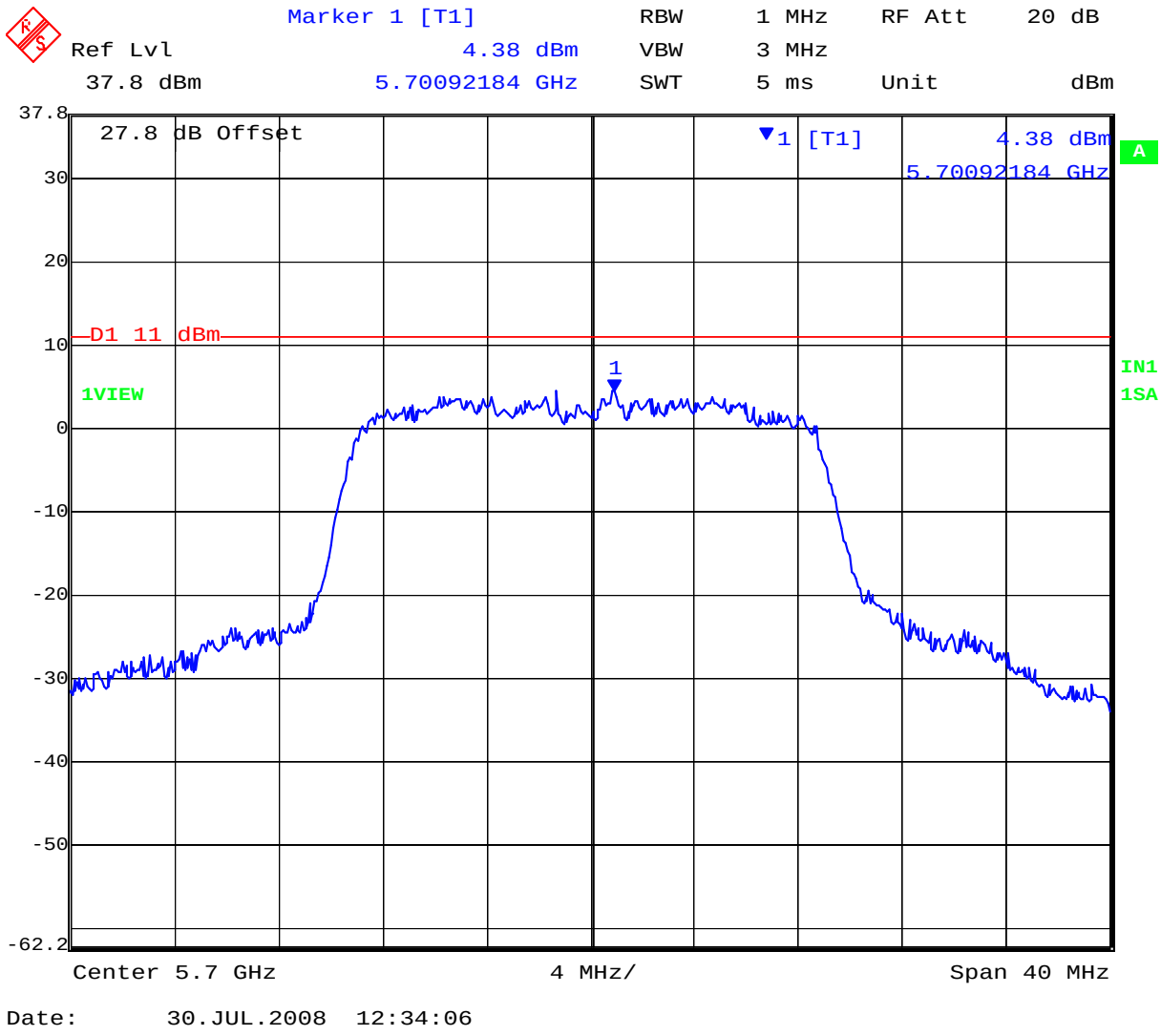
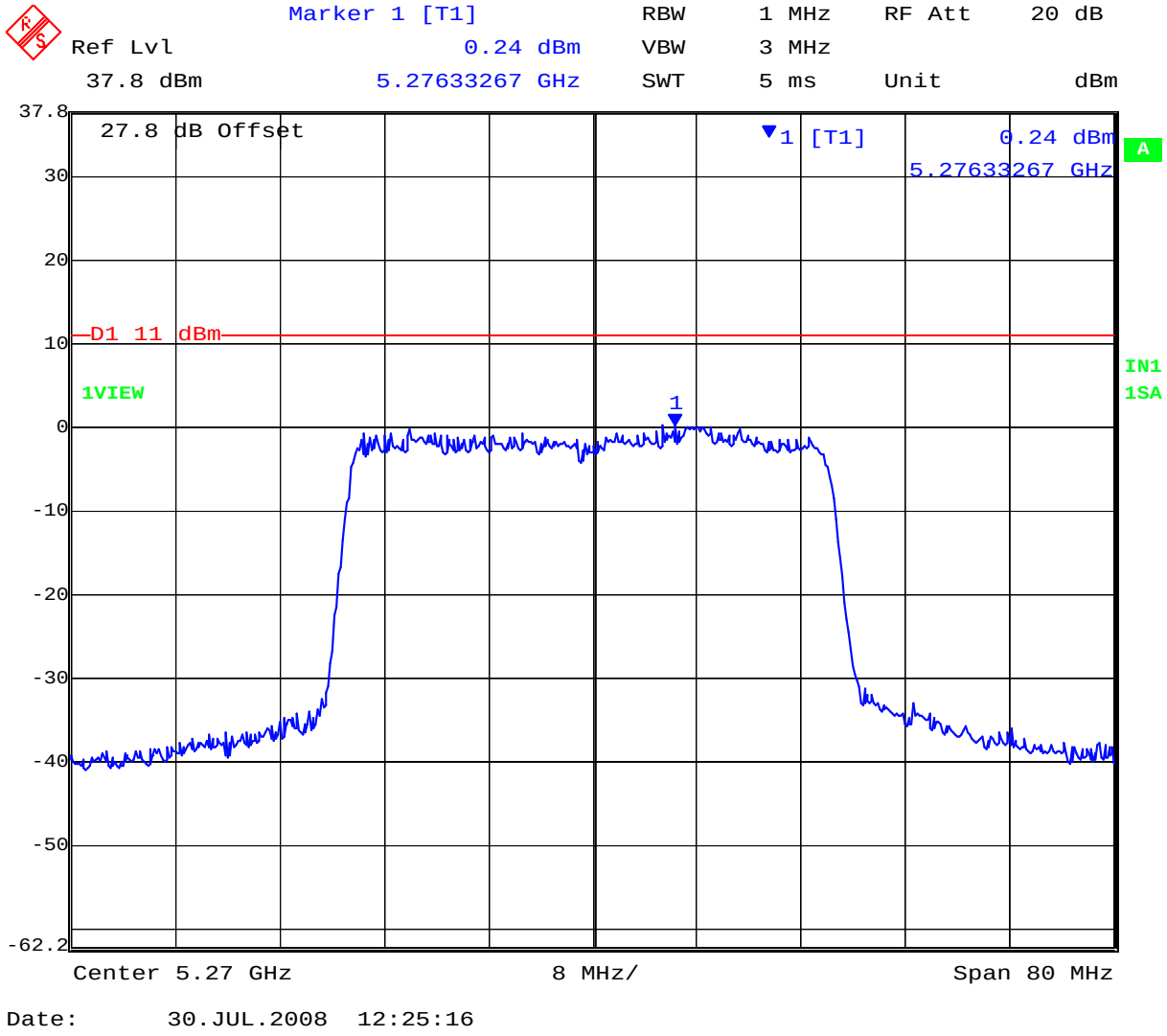


TABLE OF RESULTS – **802.11n HT40**

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

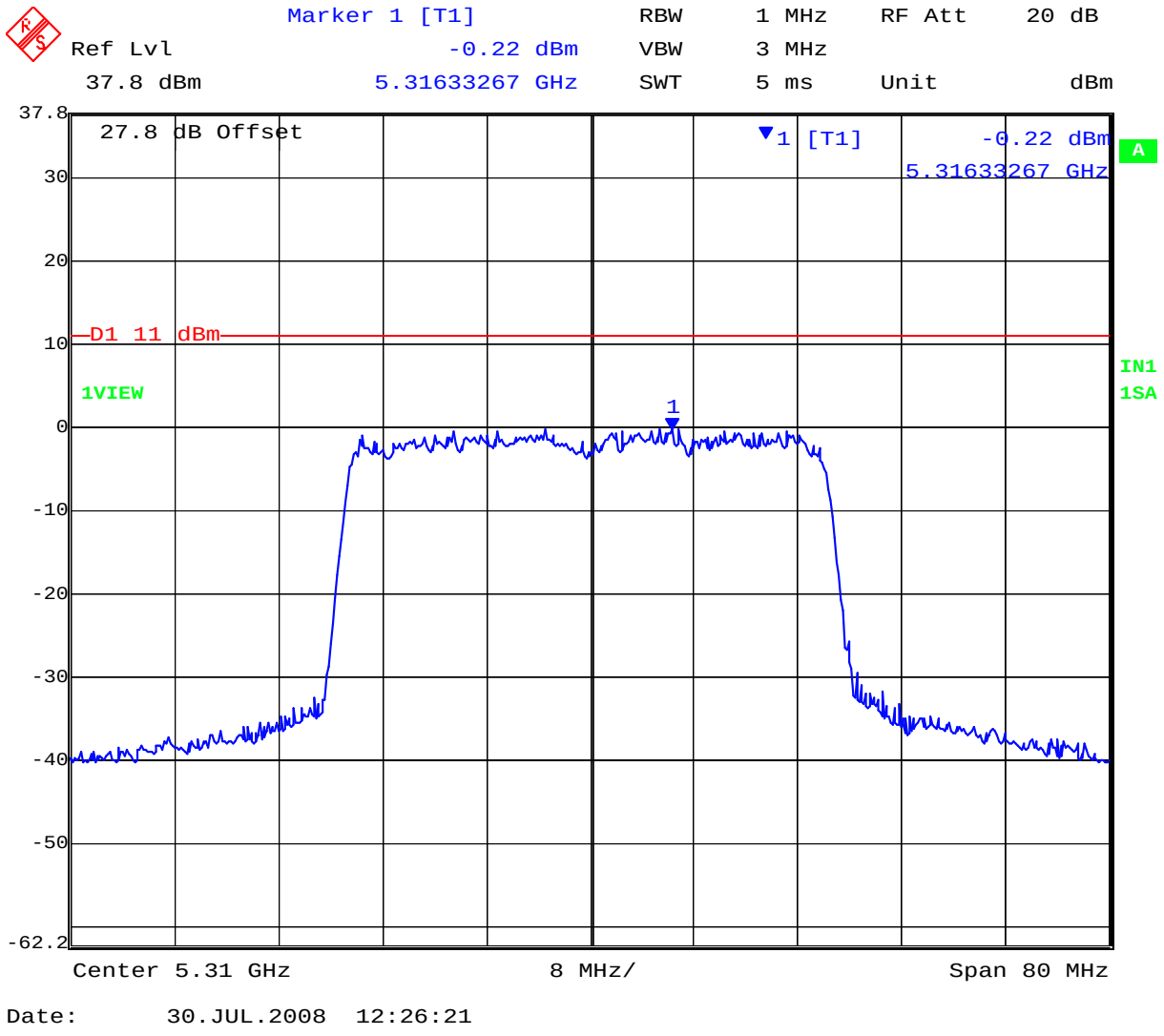
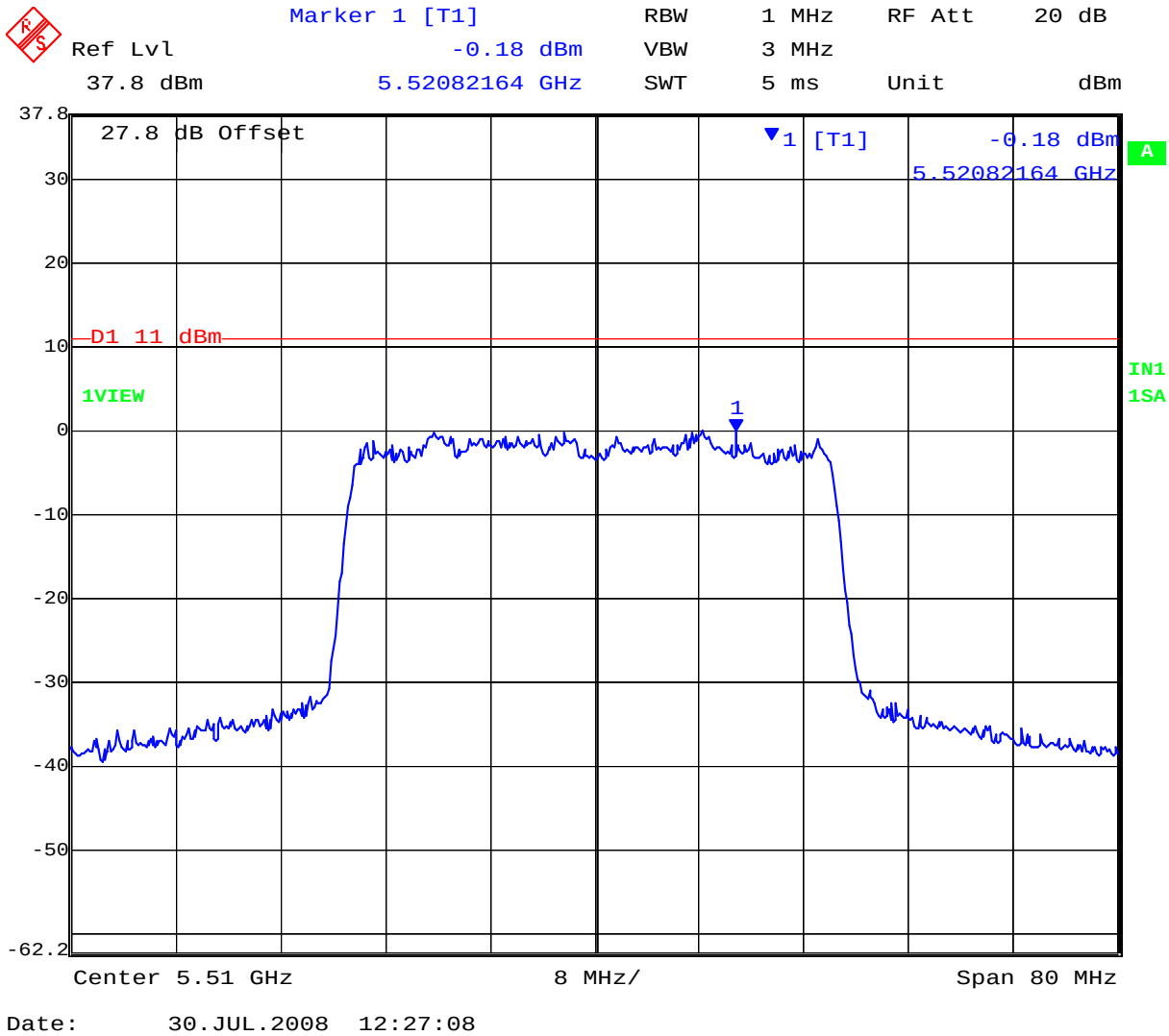


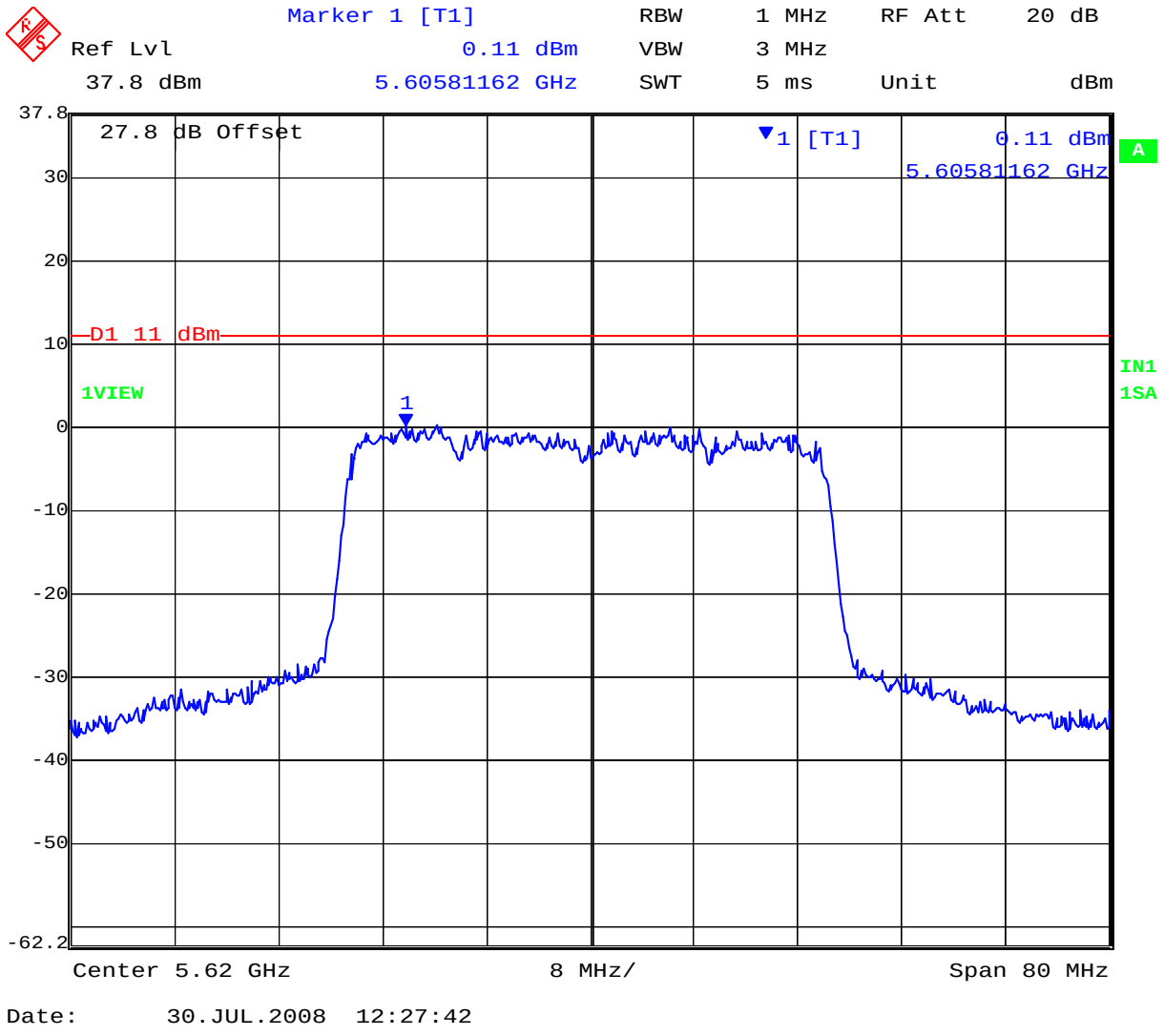
TABLE OF RESULTS – **802.11n HT40**

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

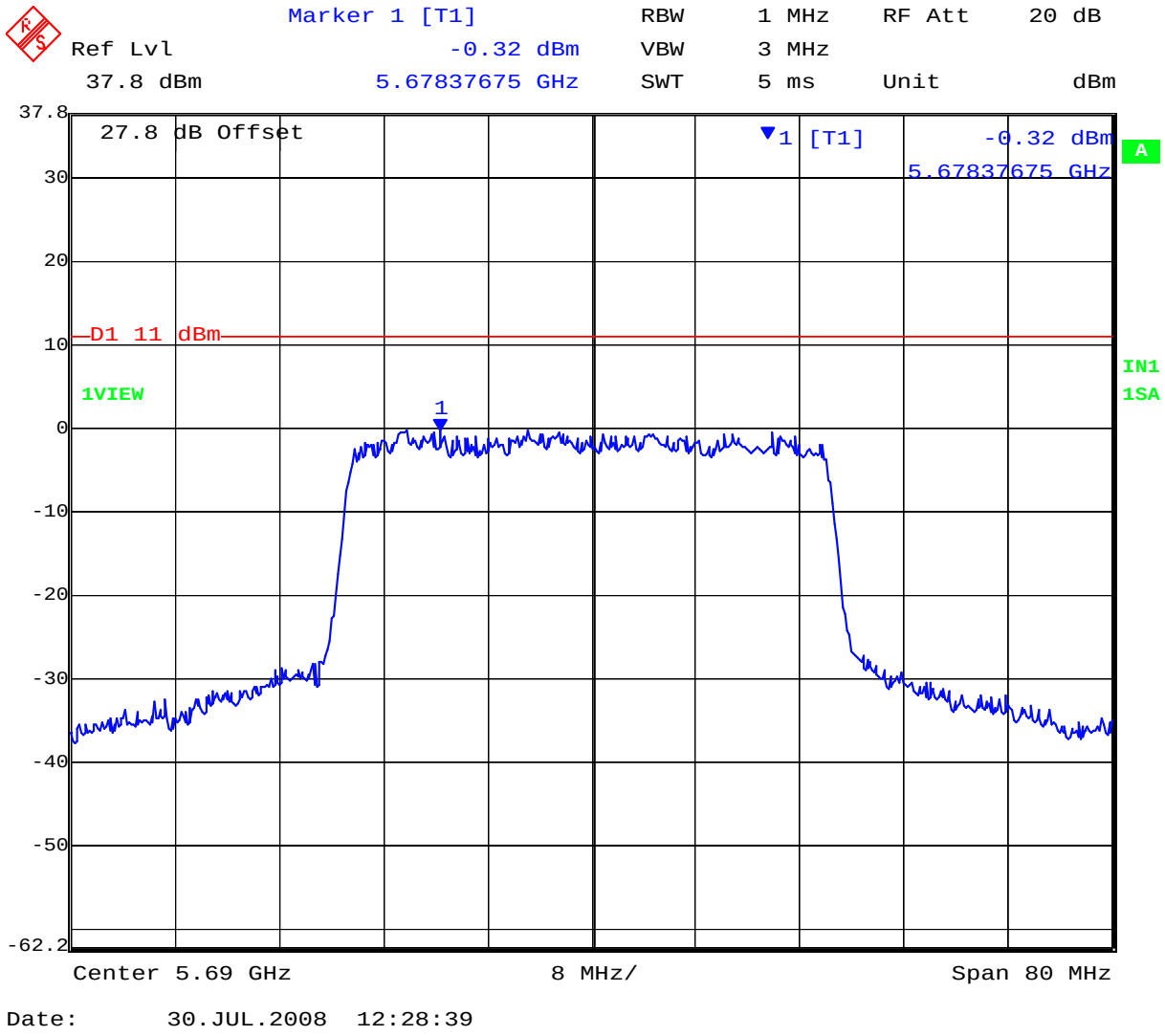
5,510 MHz 802.11n HT40 Peak Power Spectral Density



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

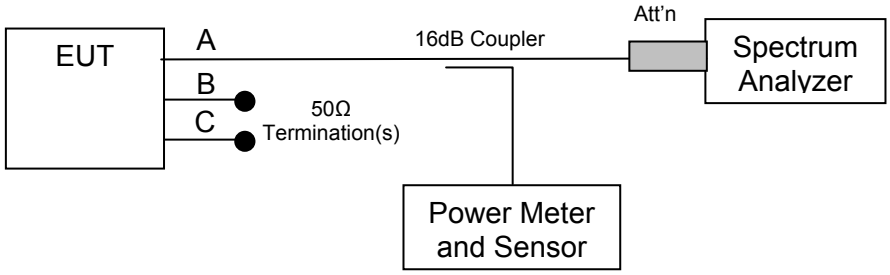
5.1.4. Peak Excursion Ratio

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

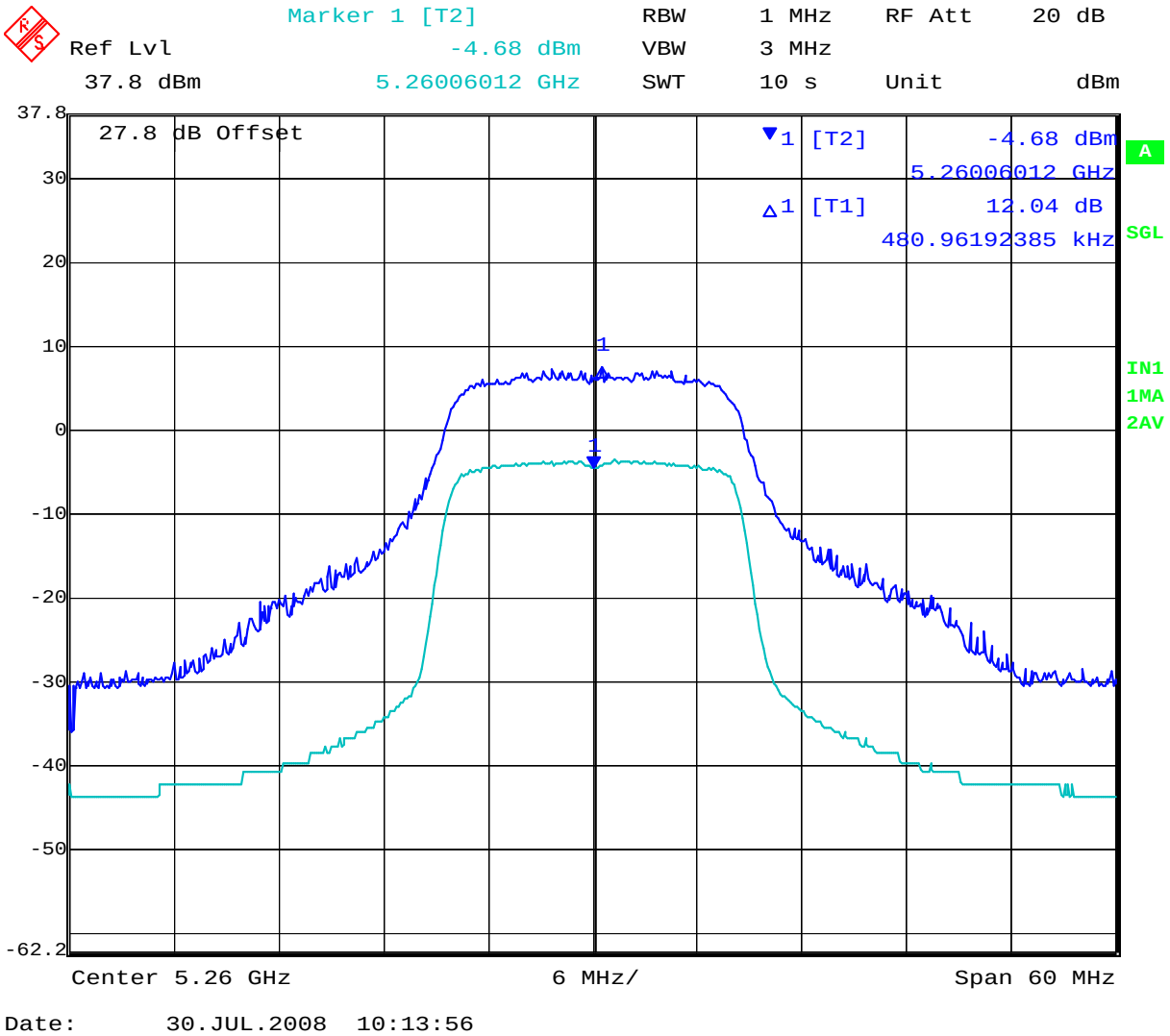
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57% Pressure: 999 to 1012 mbar

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

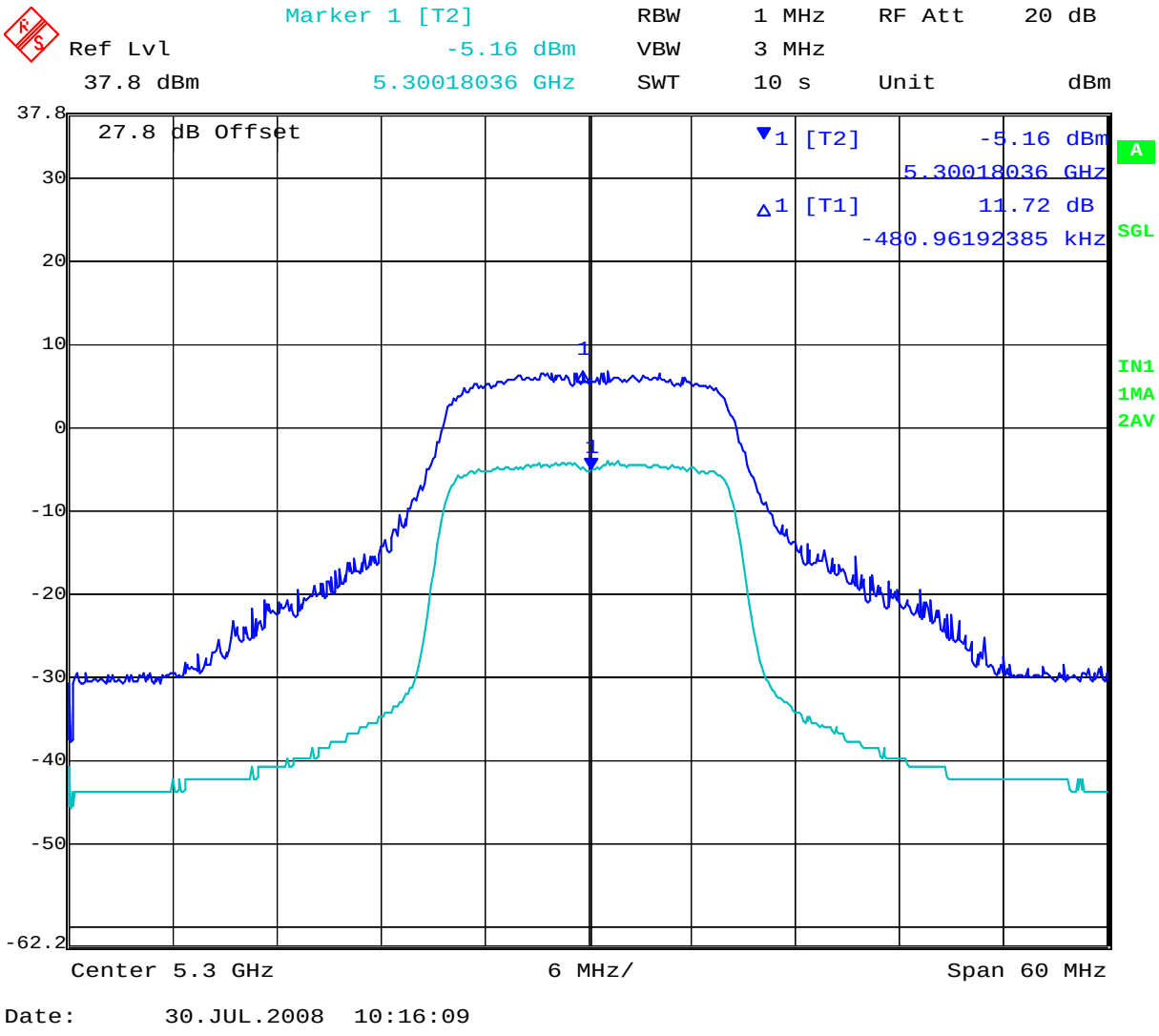
TABLE OF RESULTS – **802.11a Legacy**

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

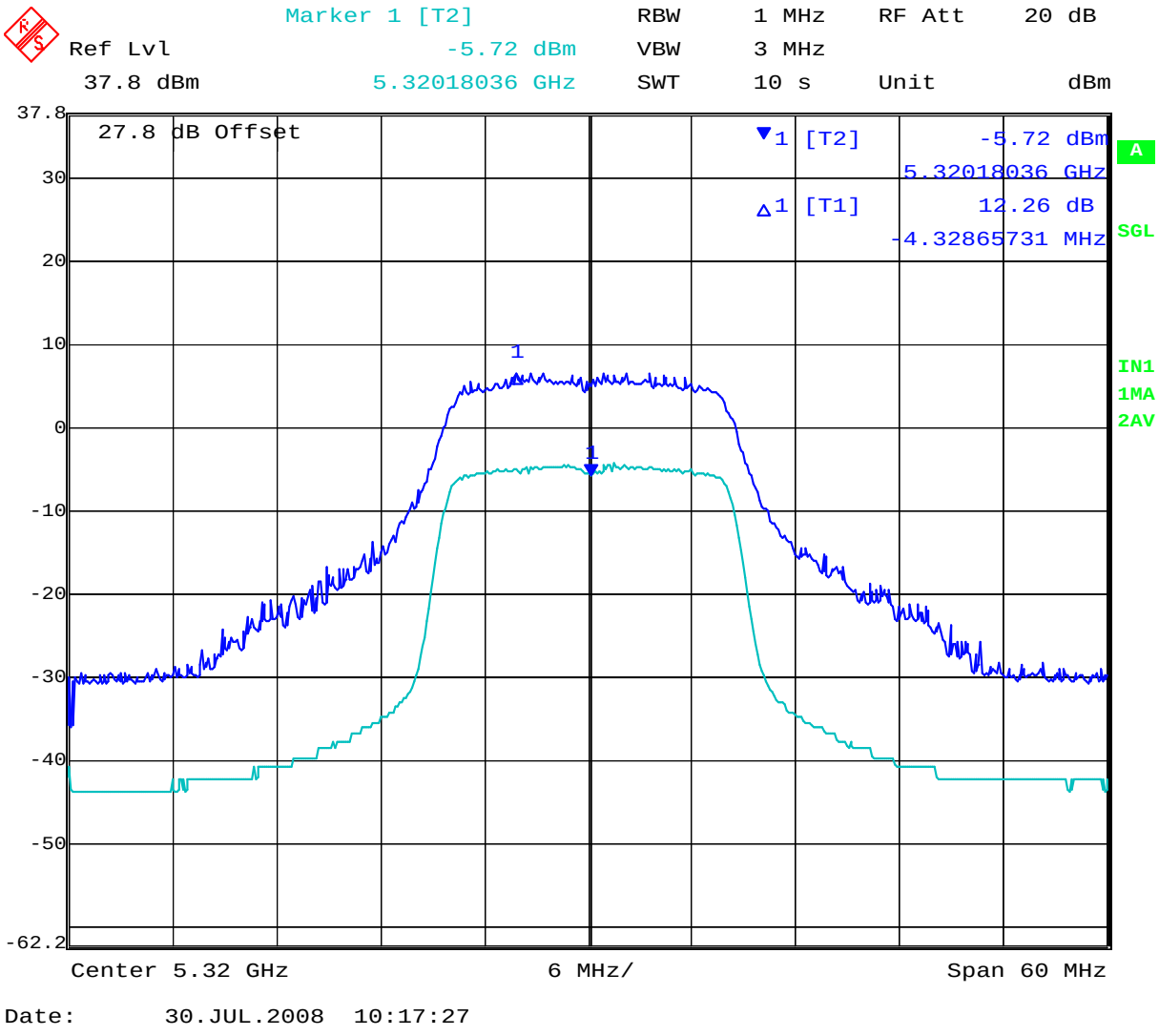
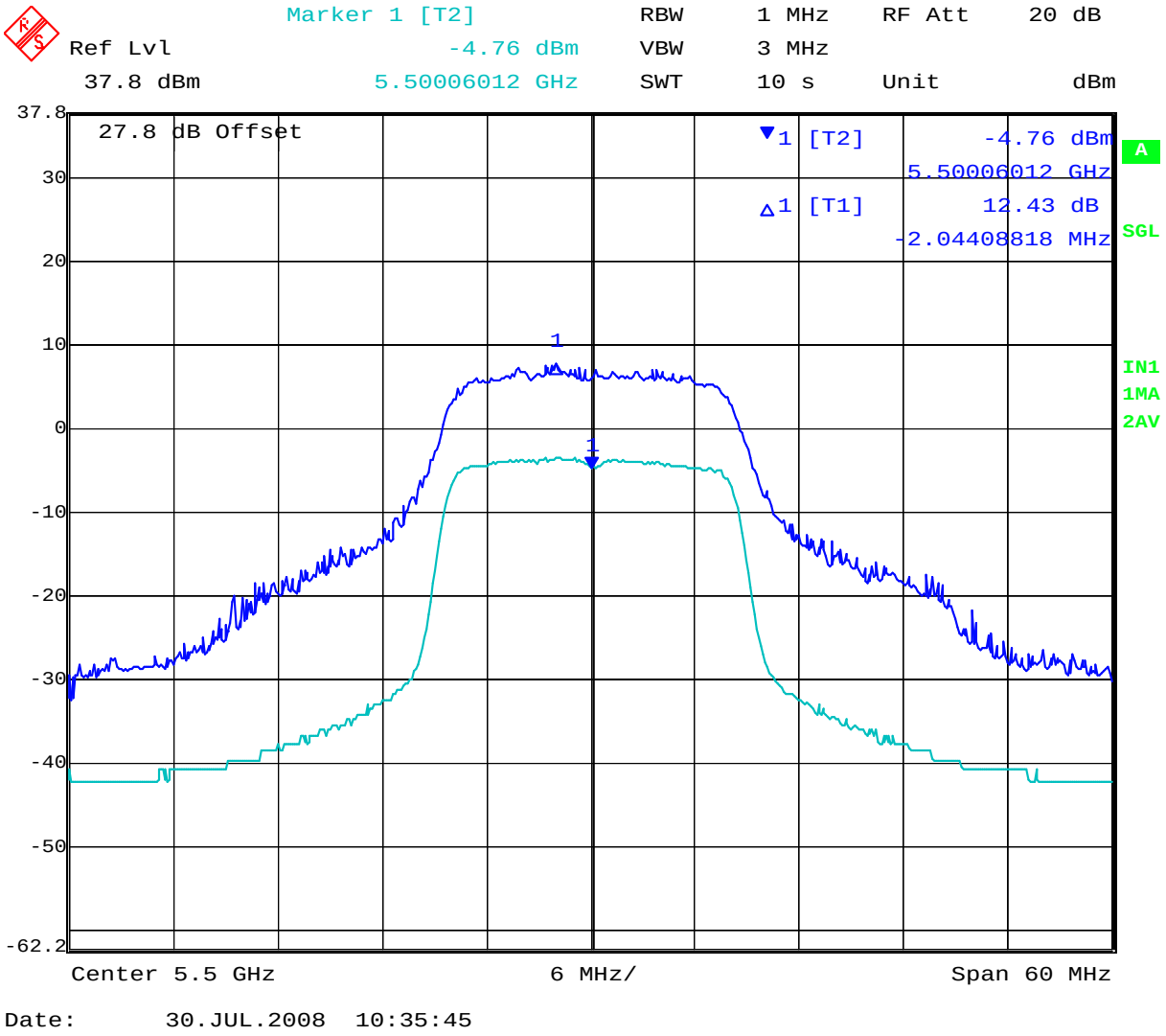


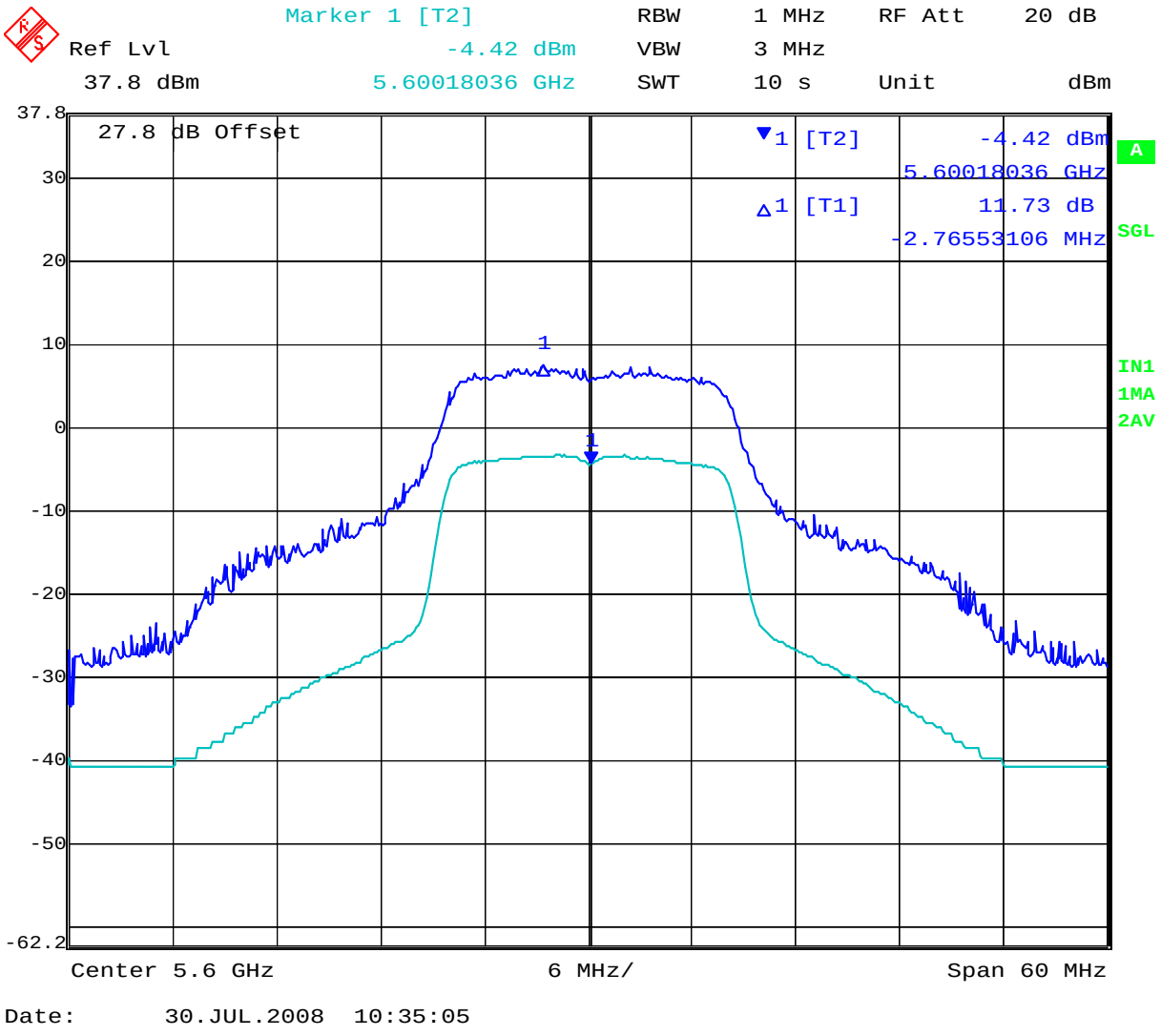
TABLE OF RESULTS – **802.11a Legacy**

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

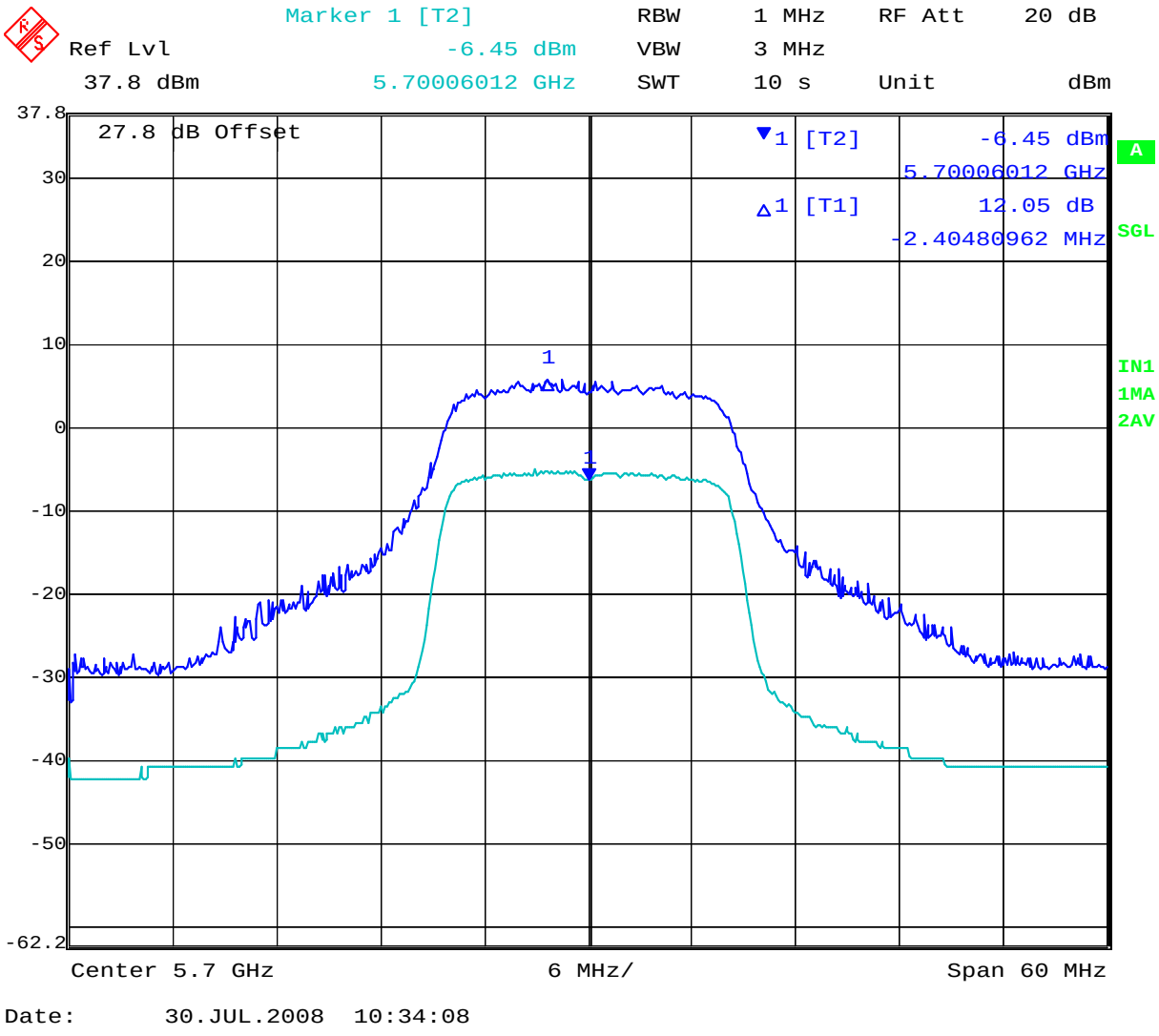
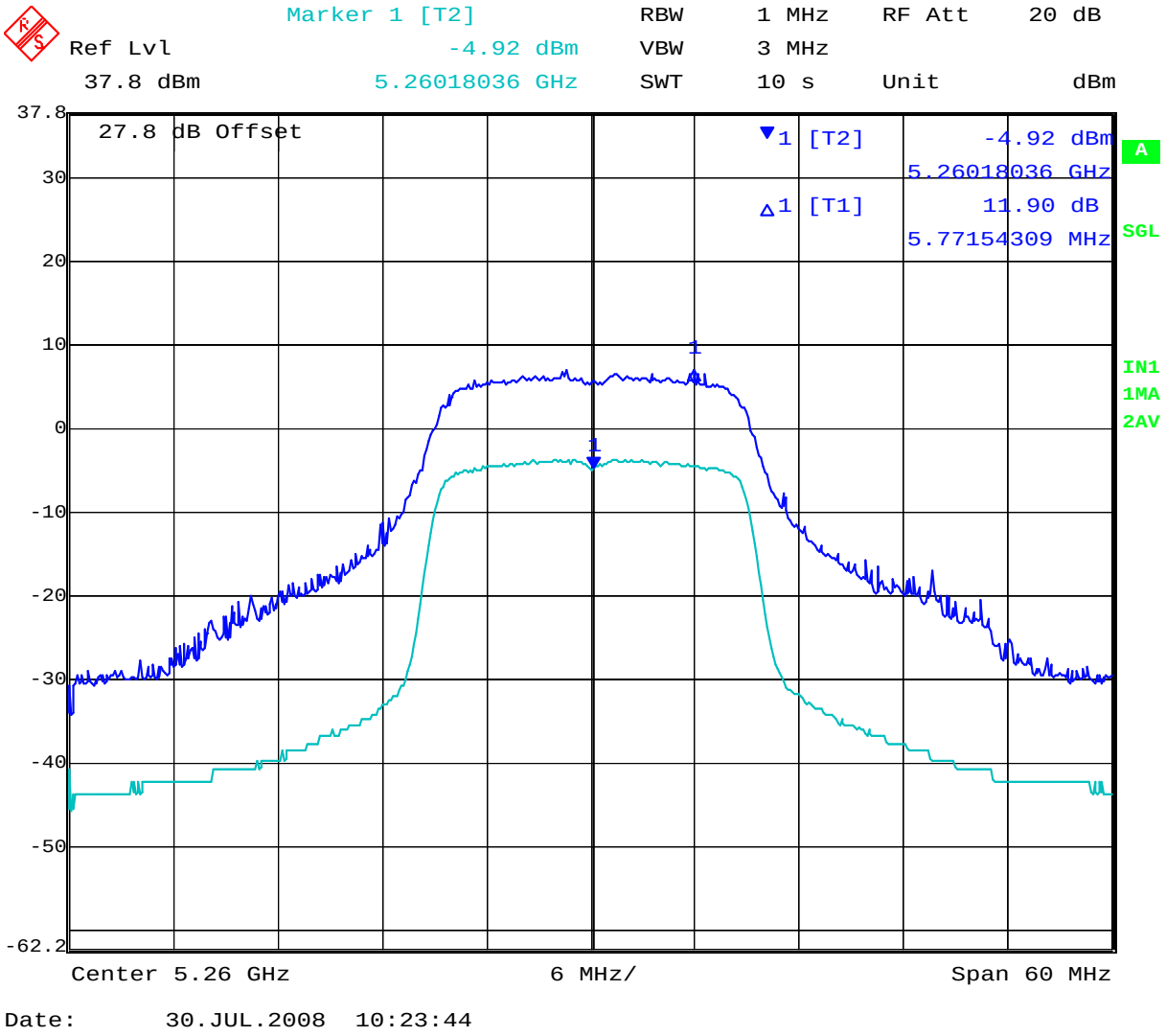


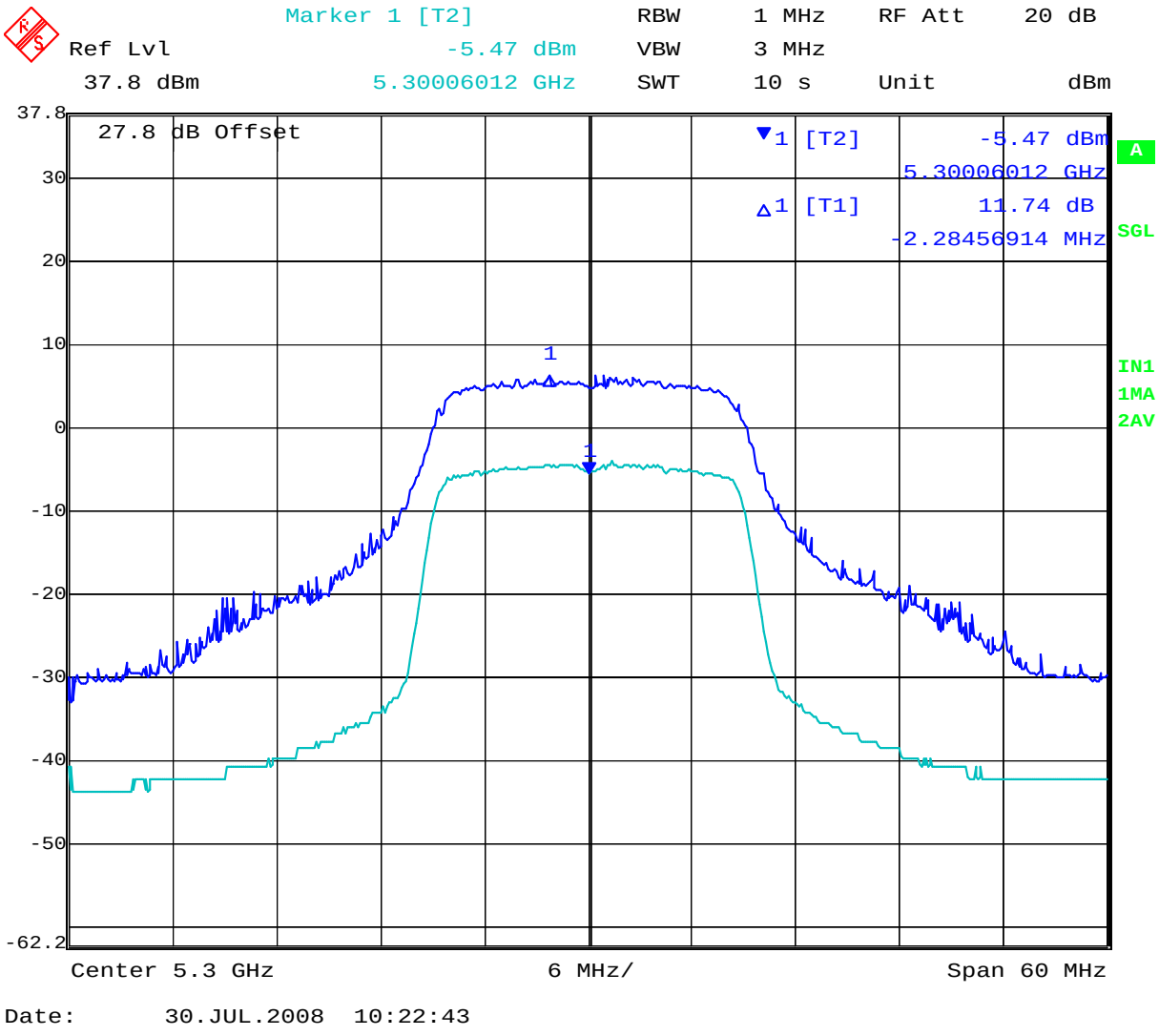
TABLE OF RESULTS – **802.11n HT20**

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

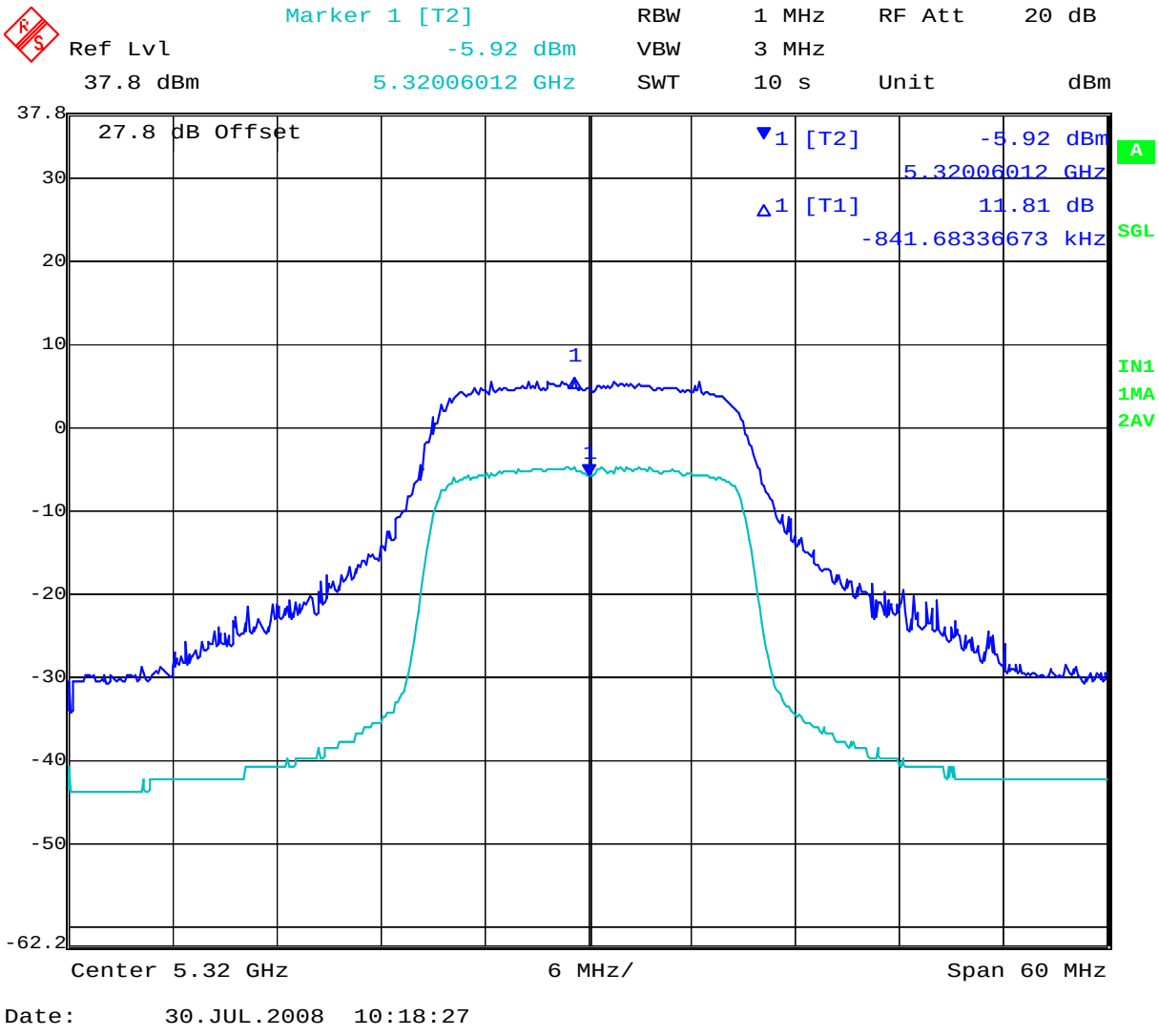
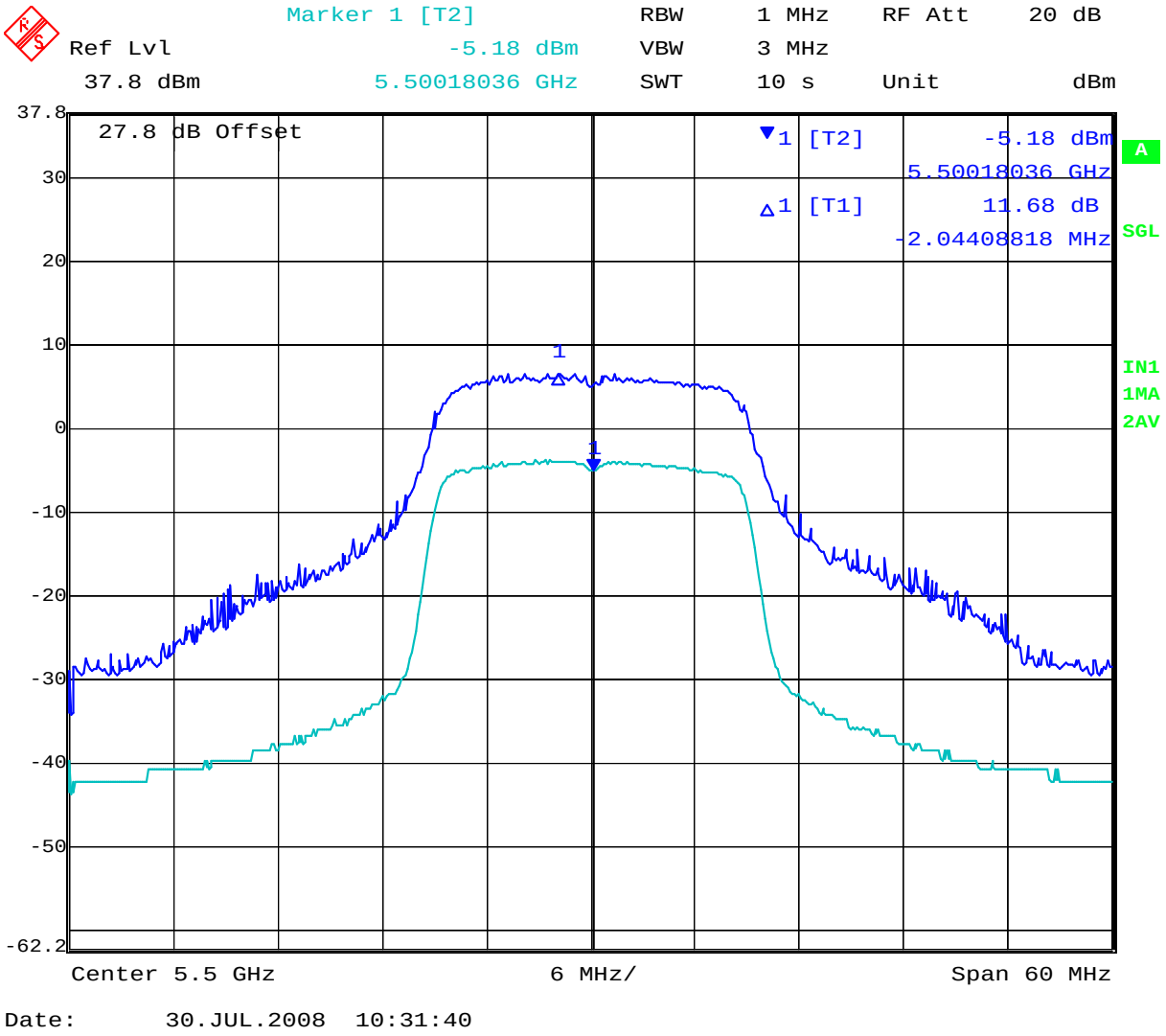


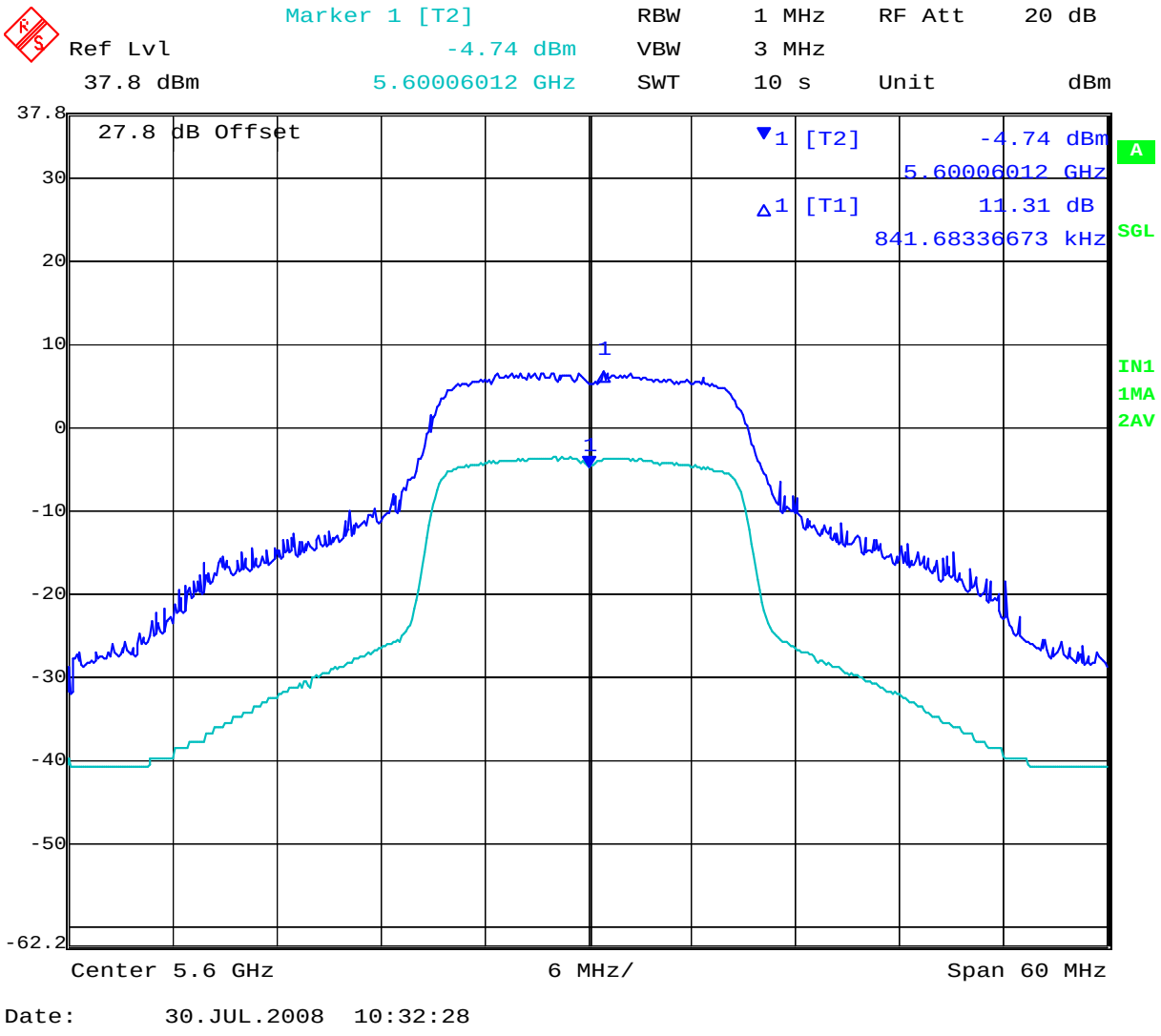
TABLE OF RESULTS – **802.11n HT20**

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

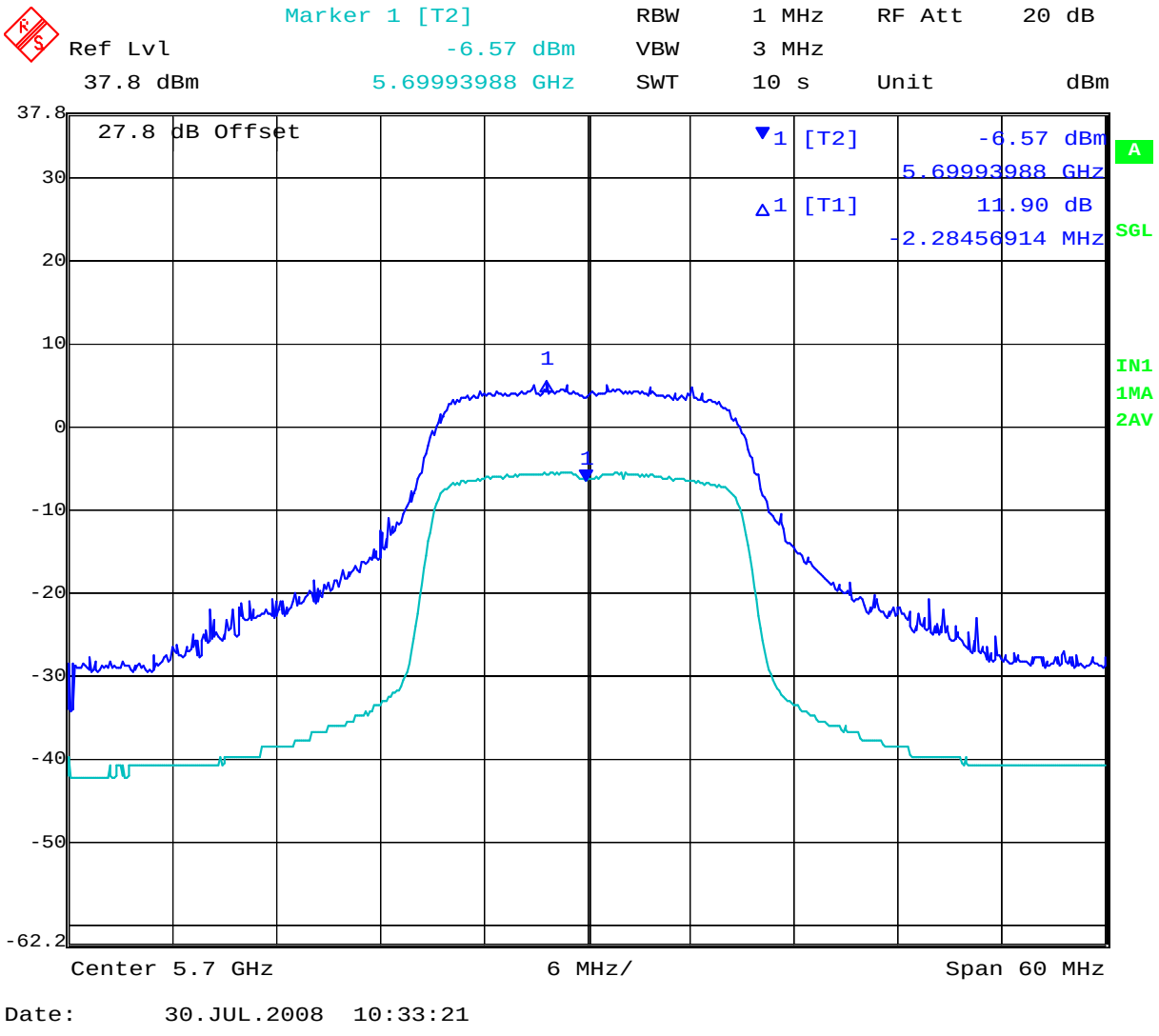
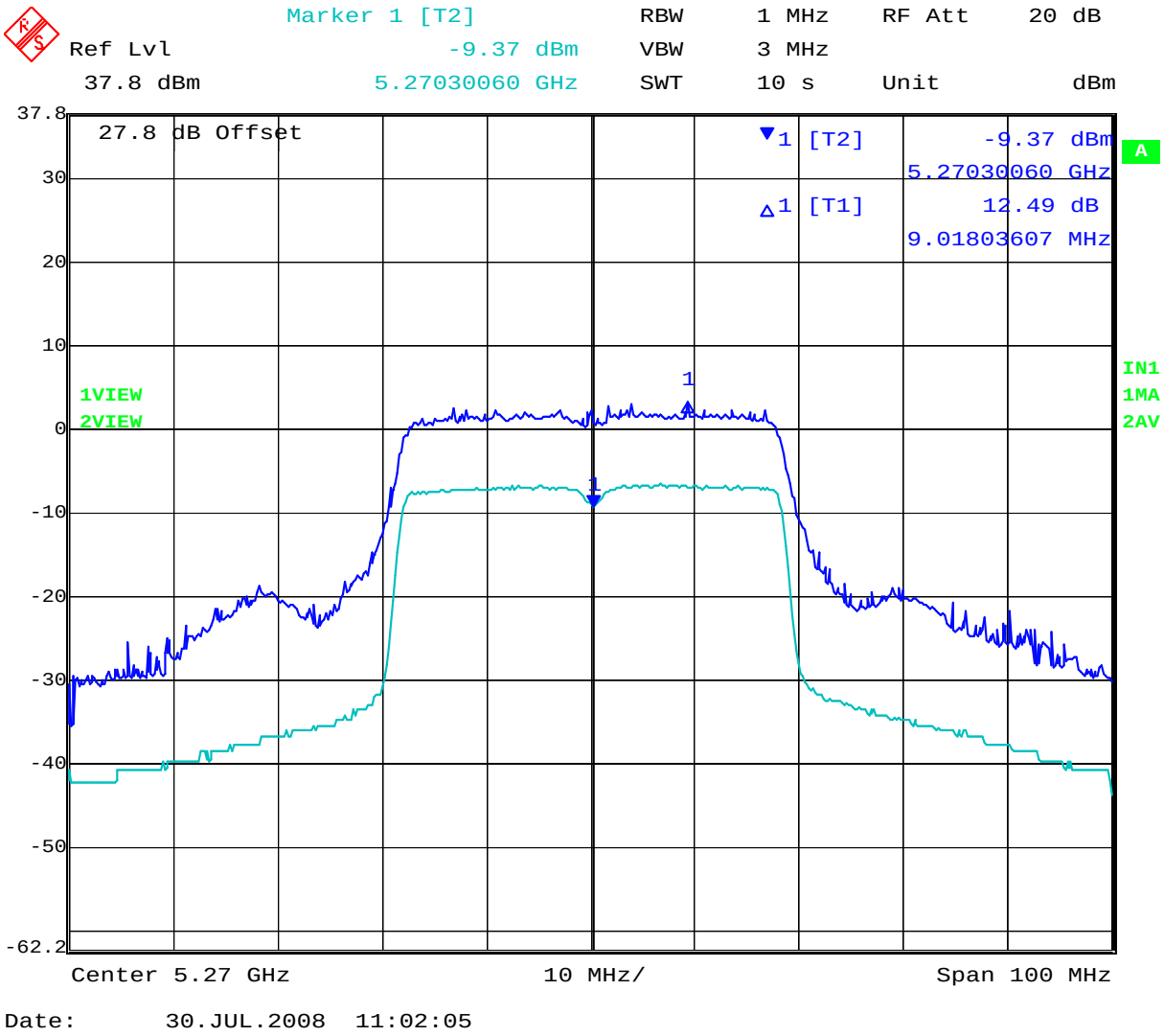


TABLE OF RESULTS – **802.11n HT40**

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

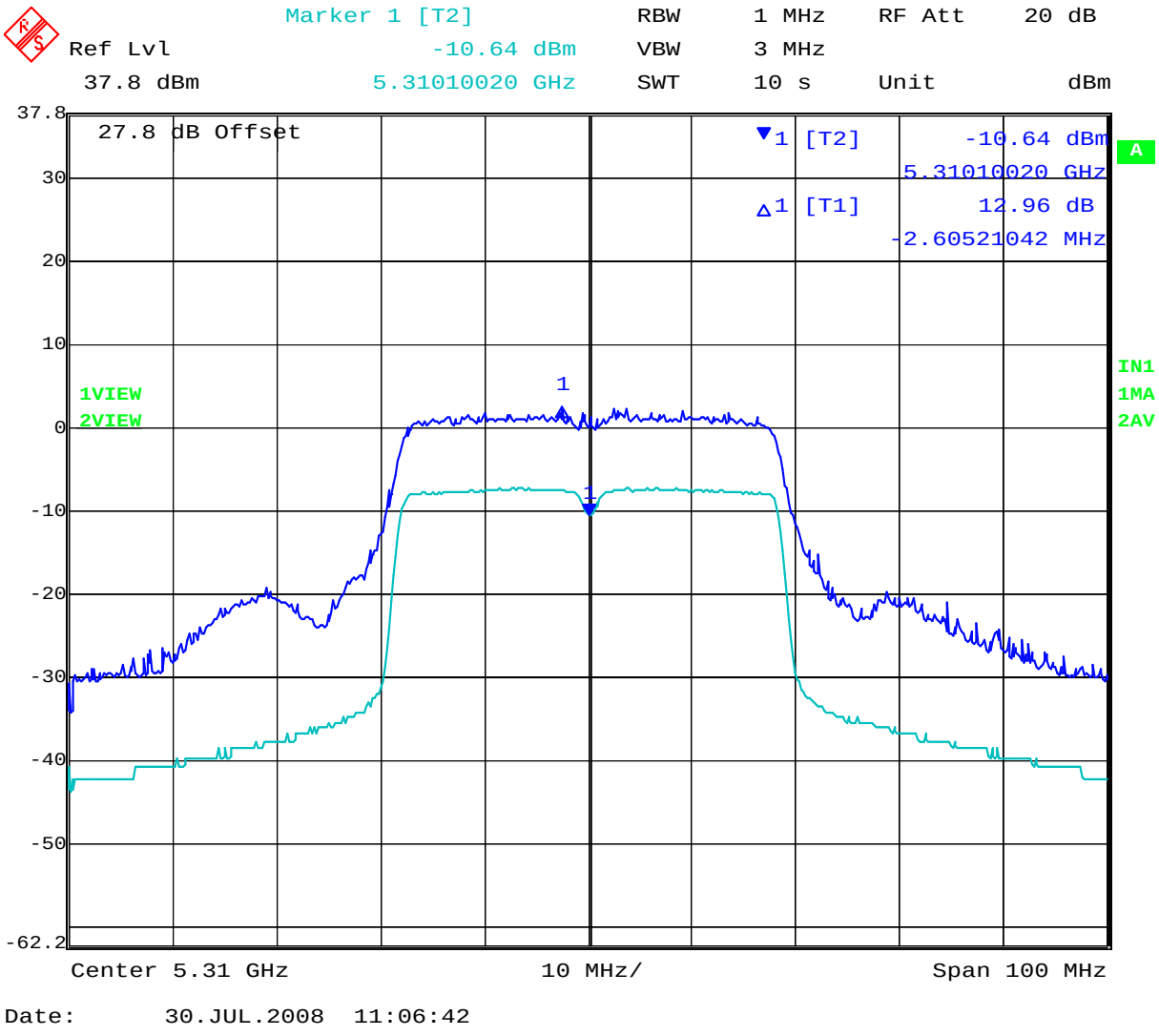
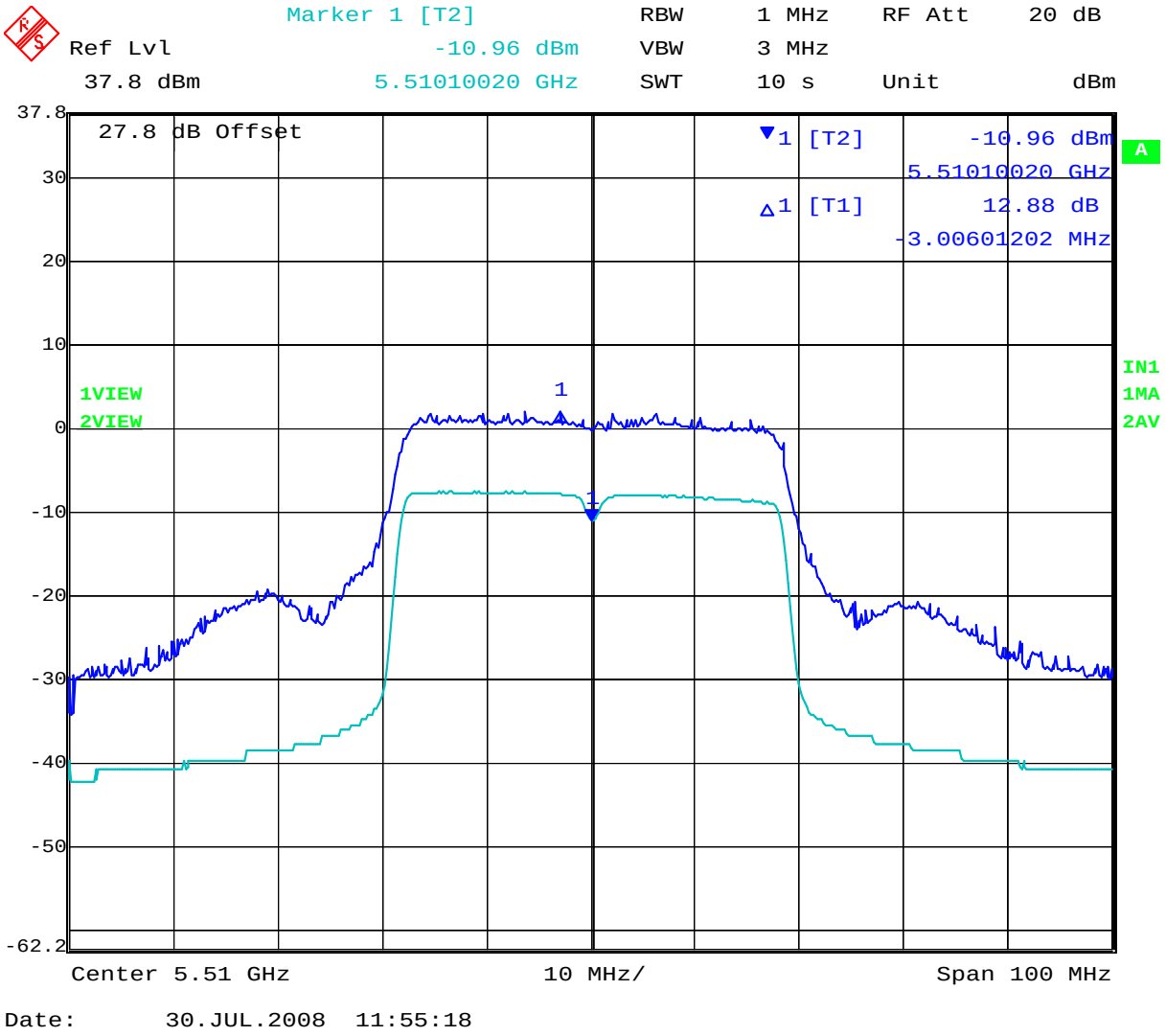


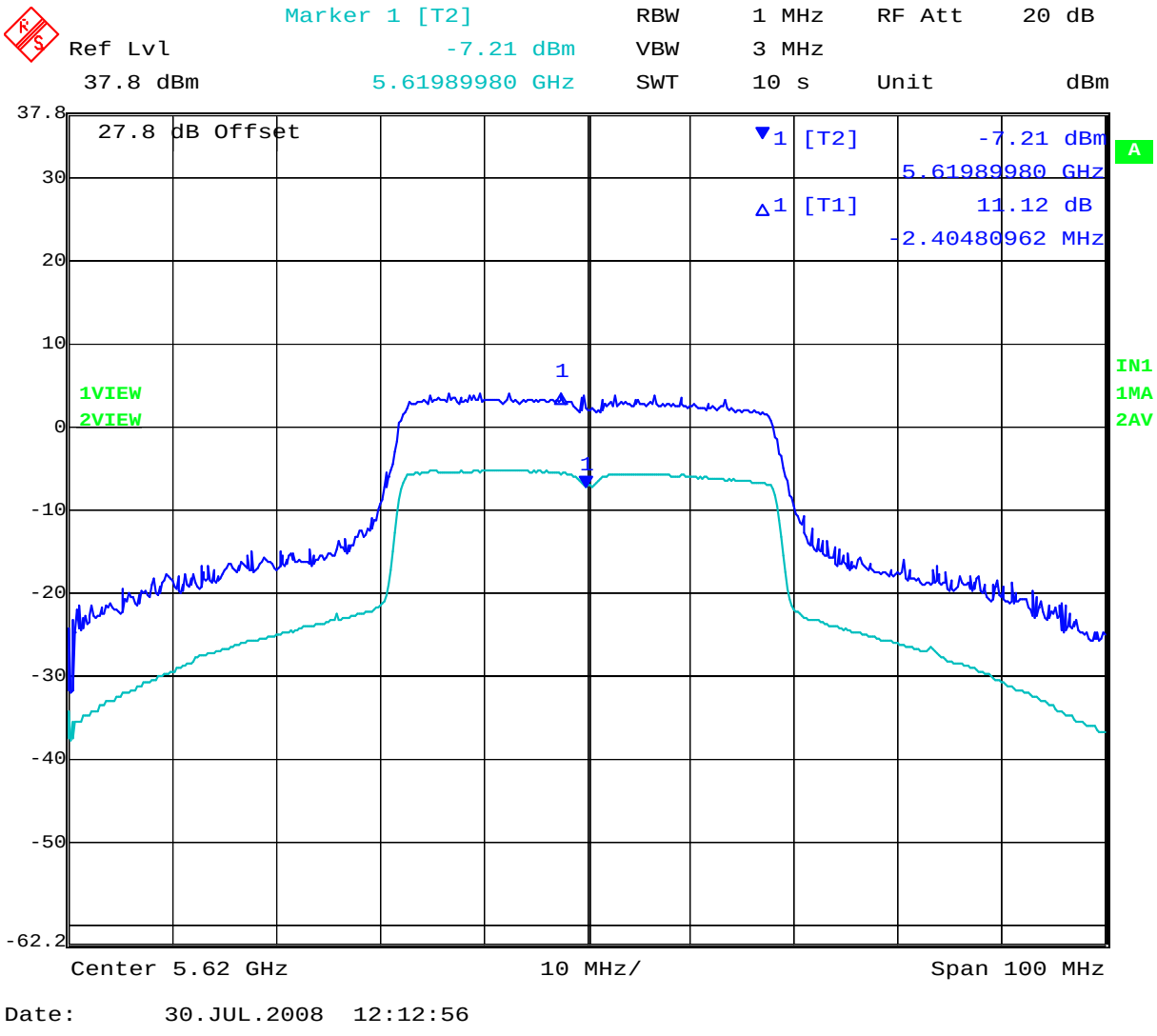
TABLE OF RESULTS – **802.11n HT40**

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

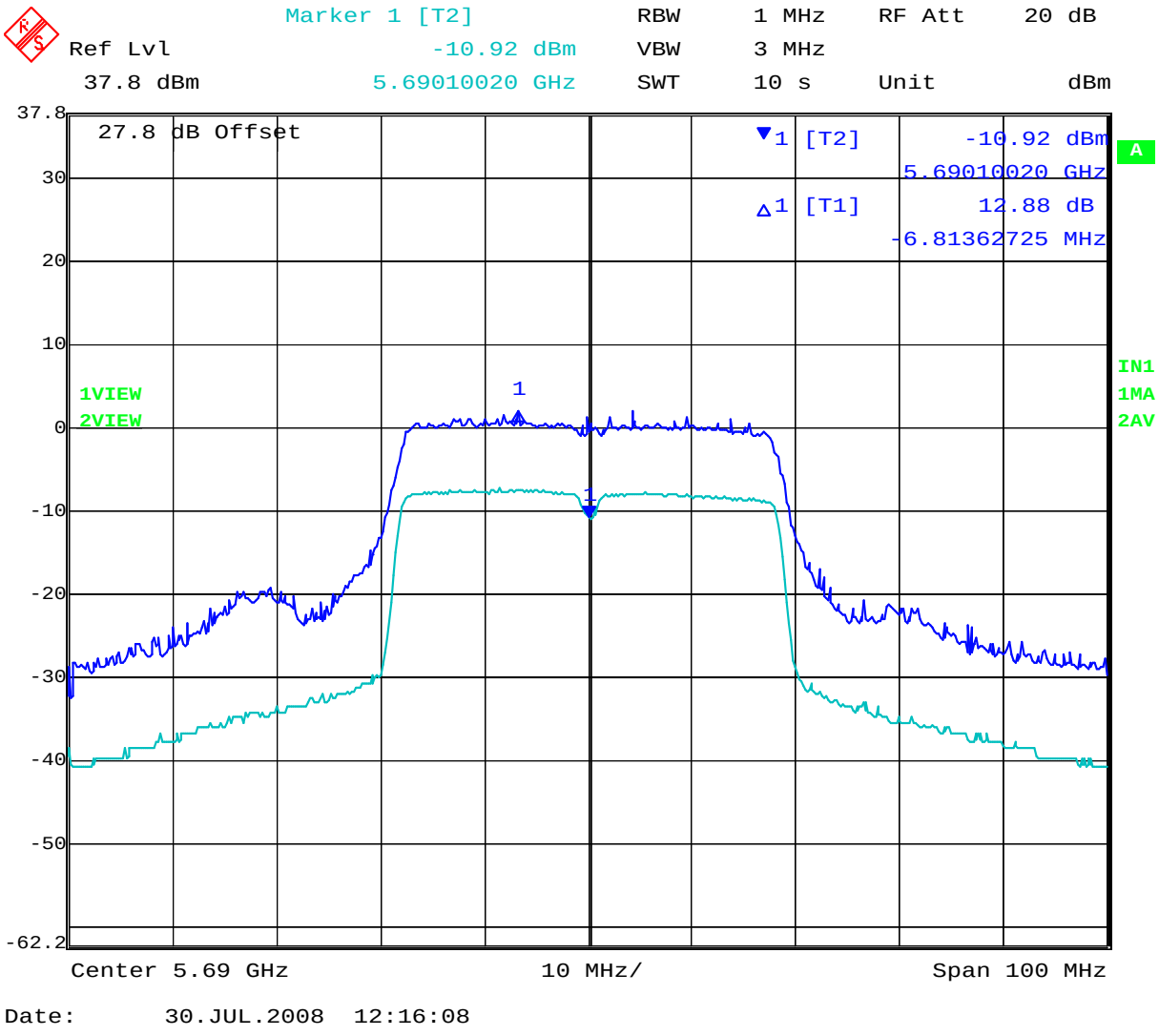
5,510 MHz 802.11n HT40 - Peak Excursion Ratio



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) = $EIRP/(4\pi d^2)$

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/cm² Limit(cm)	Minimum Separation Distance (cm)
5250 - 5350	6.45	4.42	+18.8	227.6	8.95	20
5470 - 5725	6.45	4.42	+19.3	255.3	9.48	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

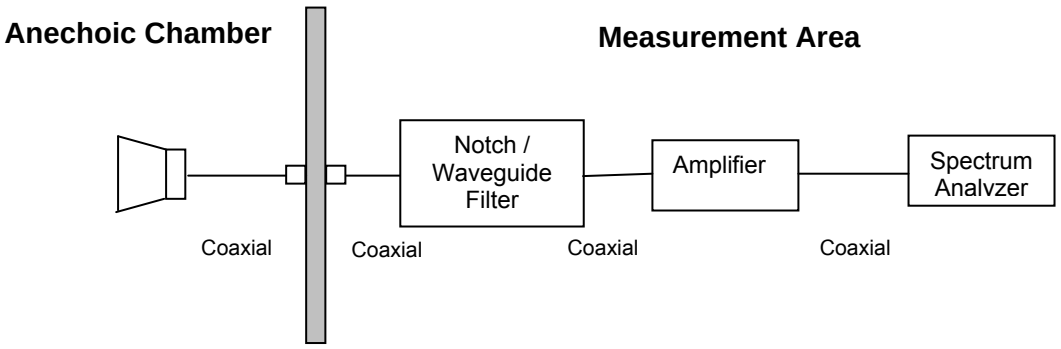
FCC, Part 15 Subpart C §15.407(b)(2), §15.205(a)/15.209(a)
Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7

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);

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

where P is the EIRP in Watts

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

Note: The data in this Section identifies that the EUT is in compliance with the -27dBm/MHz EIRP limit (68.23 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

TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 52 (5,260 MHz)

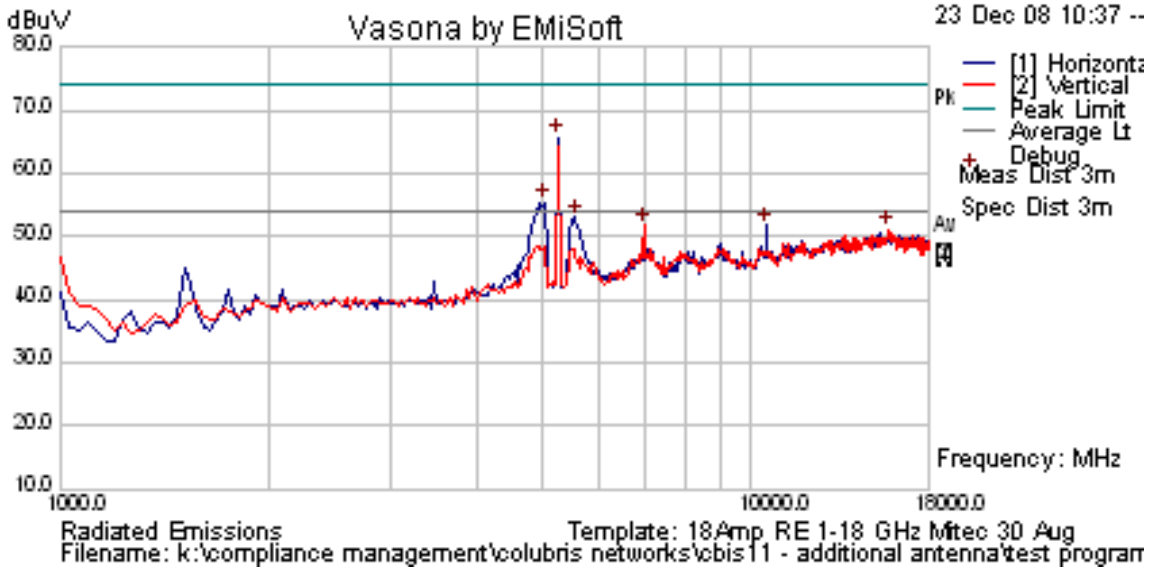
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

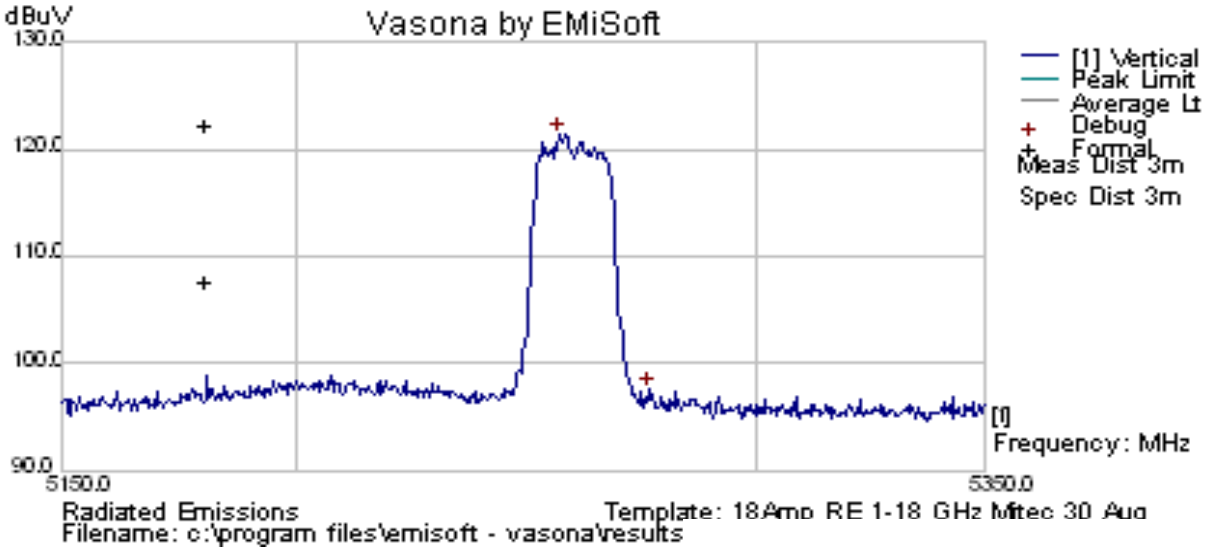
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5257.014	76.08	10.62	34.71	121.41	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

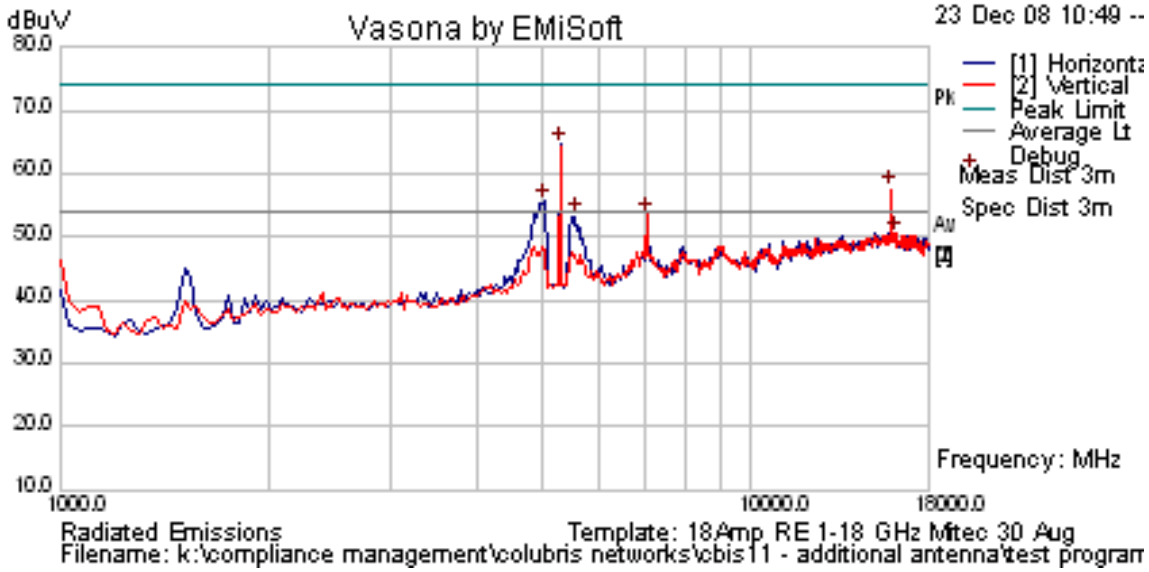
TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 60 (5,300 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
15896.471	50.49	8.85	-0.52	58.82	Peak Max	H	98	243	74	-15.18	Pass	RB
15896.471	34.13	8.85	-0.52	42.46	Average Max	H	98	243	54	-11.54	Pass	RB

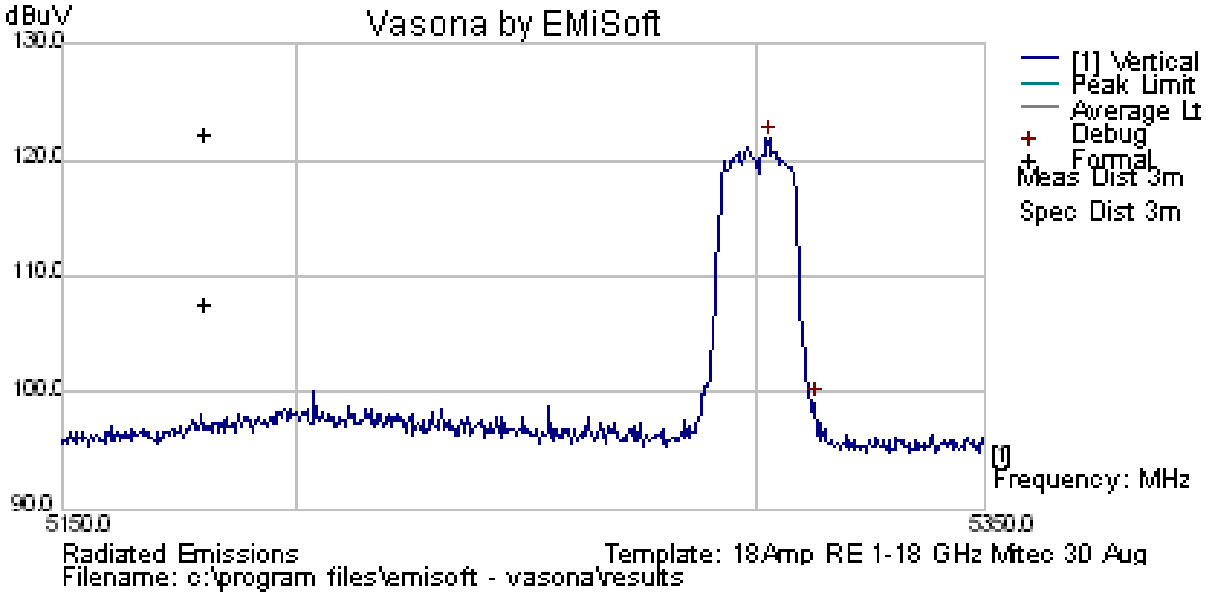
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5302.705	76.54	10.62	34.75	121.9	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

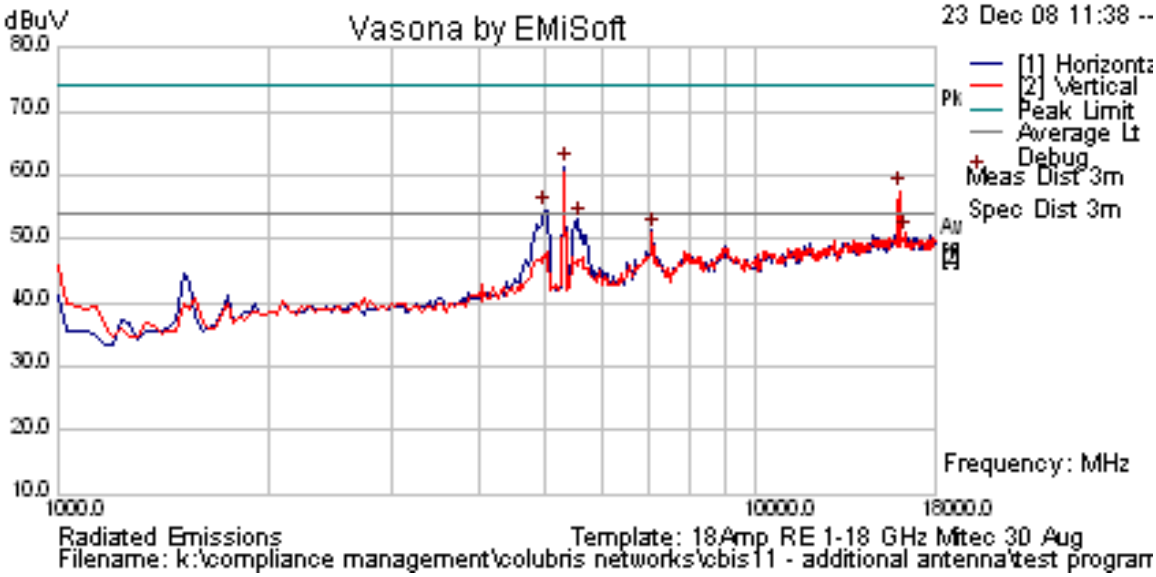
TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 64 (5,320 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
15967.134	51.25	8.97	-0.49	59.72	Peak Max	V	98	361	74	-14.28	Pass	RB
15967.134	33.69	8.97	-0.49	42.16	Average Max	V	98	361	54	-11.84	Pass	RB

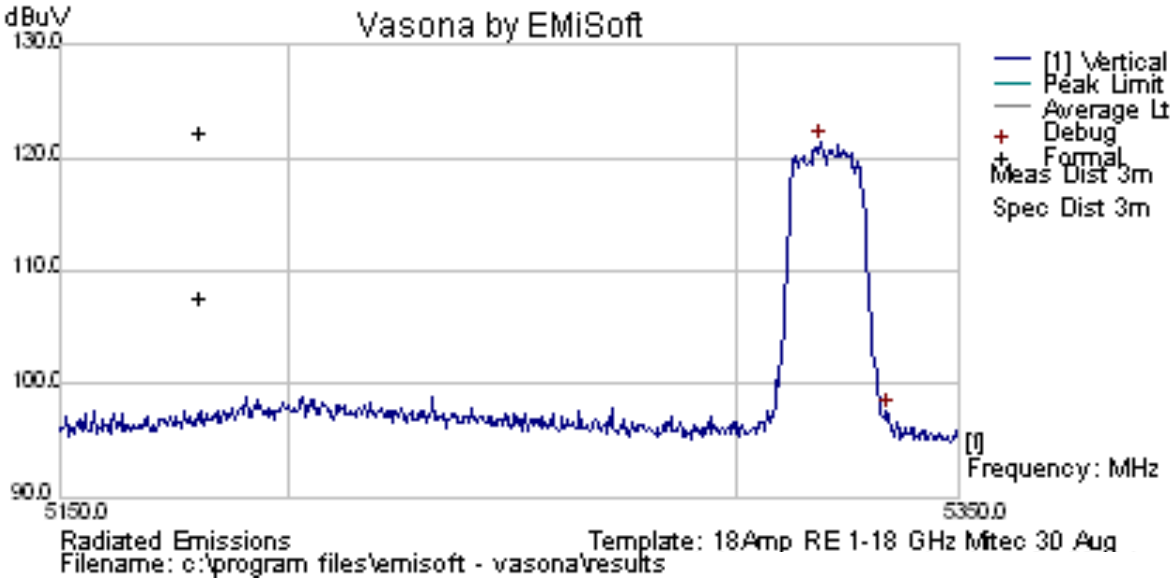
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5318.737	76.02	10.62	34.76	121.4	Peak [Scan]	V	100	0	54	67.4	N/A	Fundamental

TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 52 (5,260 MHz)

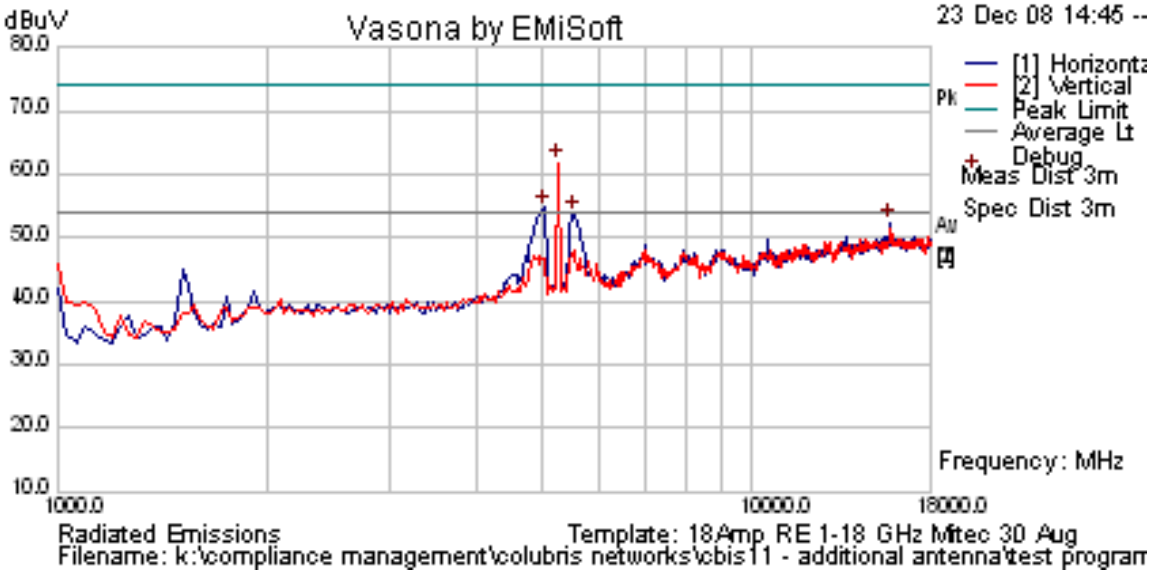
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

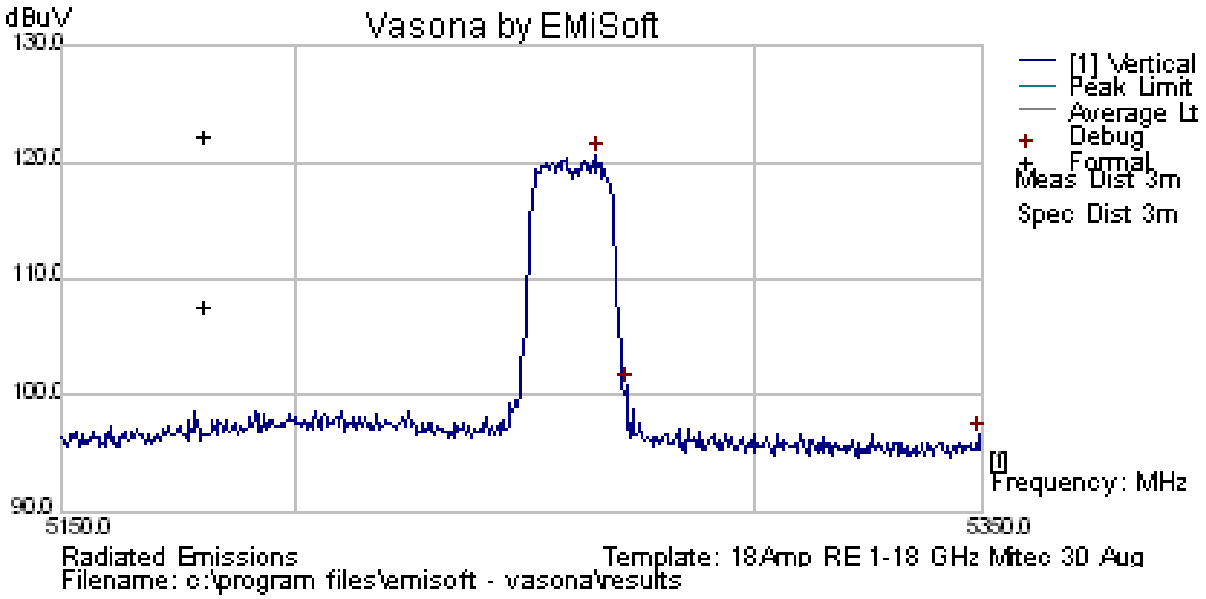
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5265.431	75.28	10.62	34.72	120.61	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

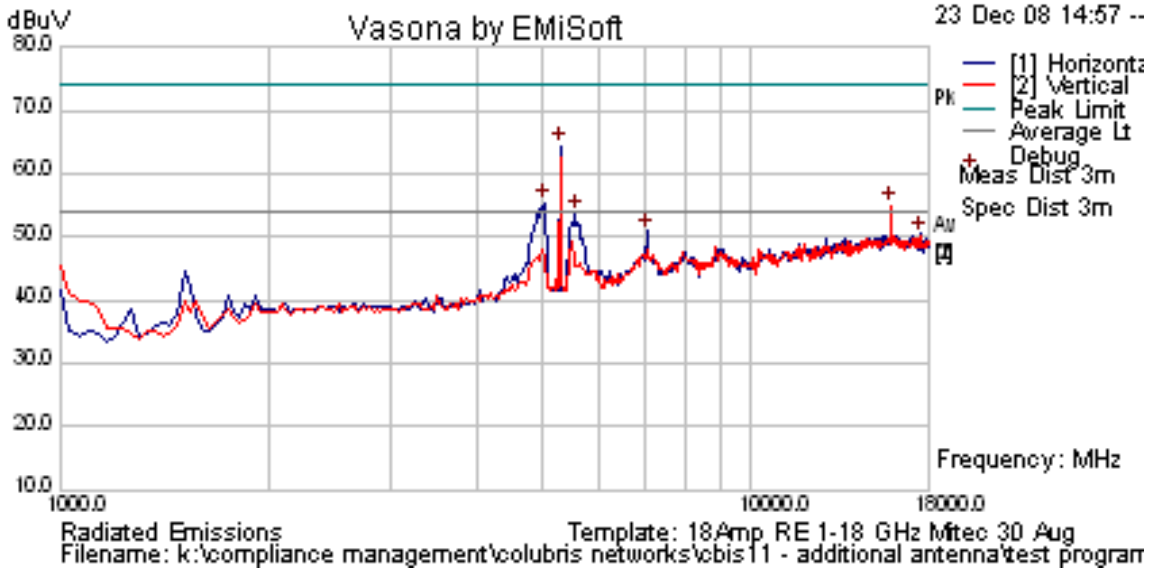
TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 60 (5,300 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
15901.724	50.24	8.86	-0.51	58.59	Peak Max	V	98	21	74	-15.41	Pass	RB
7066.633	53.27	5.39	-1.76	56.91	Peak Max	H	119	305	74	-17.09	Pass	RB
15901.724	34.49	8.86	-0.51	42.84	Average Max	V	98	21	54	-11.16	Pass	RB
7066.633	45.39	5.4	-1.88	44.91	Average Max	H	125	190	54	-5.09	Pass	RB

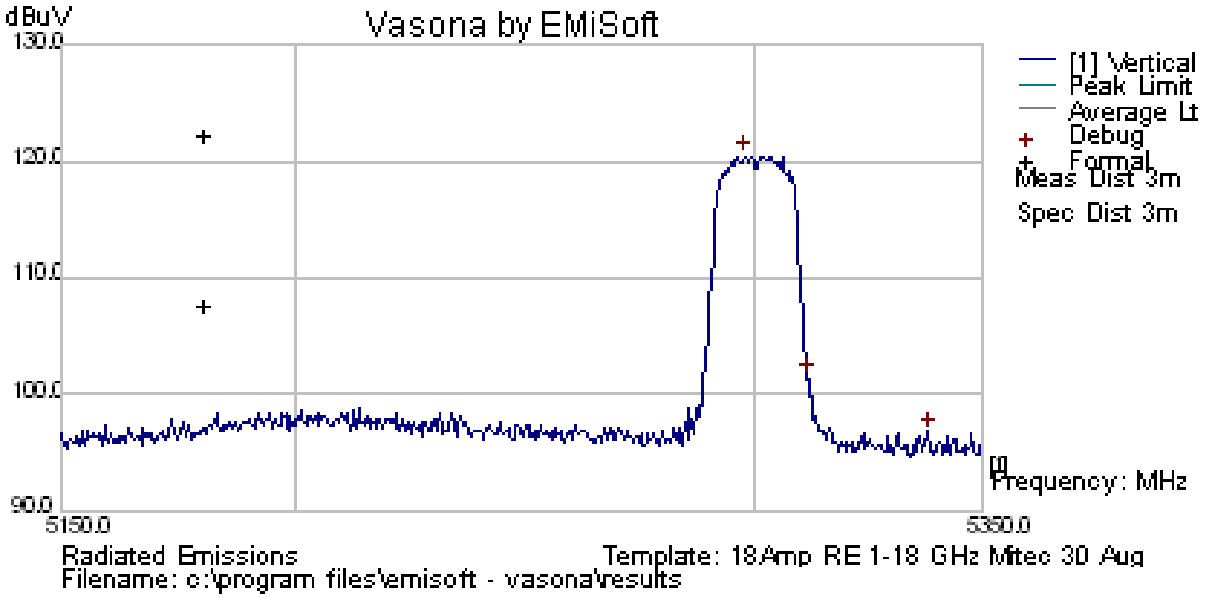
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5297.896	75.14	10.62	34.74	120.5	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

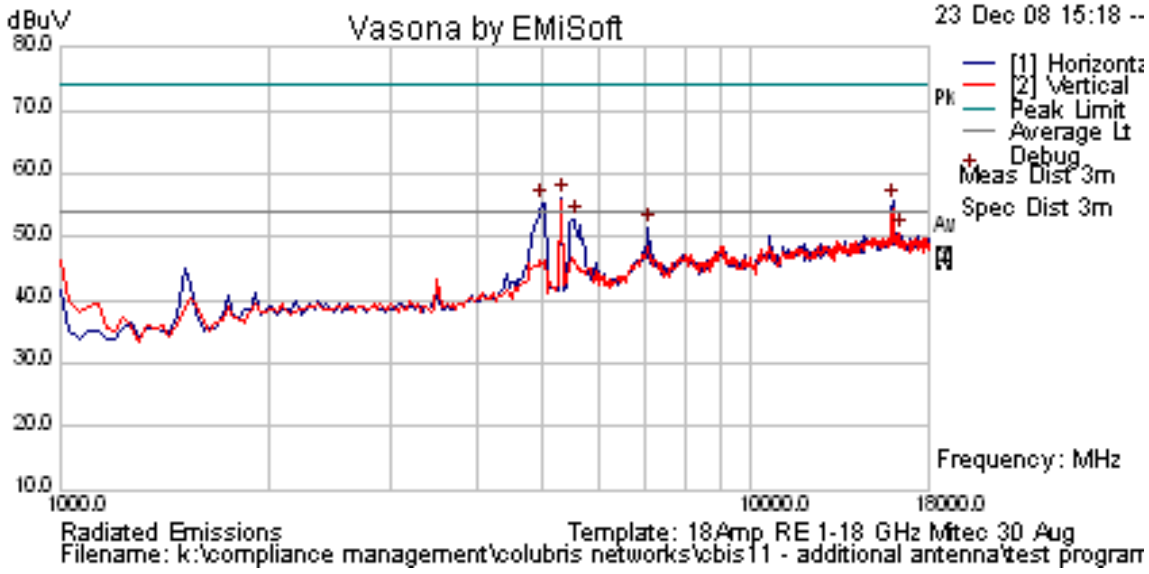
TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 64 (5,320 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
15963.619	51.38	8.96	-0.49	59.85	Peak Max	V	139	10	74	-14.15	Pass	RB
7093.106	50.73	5.4	-1.88	54.26	Peak Max	H	119	25	74	-19.74	Pass	RB
15963.619	34.42	8.96	-0.49	42.89	Average Max	V	139	10	54	-11.11	Pass	RB
7093.106	43.39	5.4	-1.88	46.91	Average Max	H	119	25	54	-7.09	Pass	RB

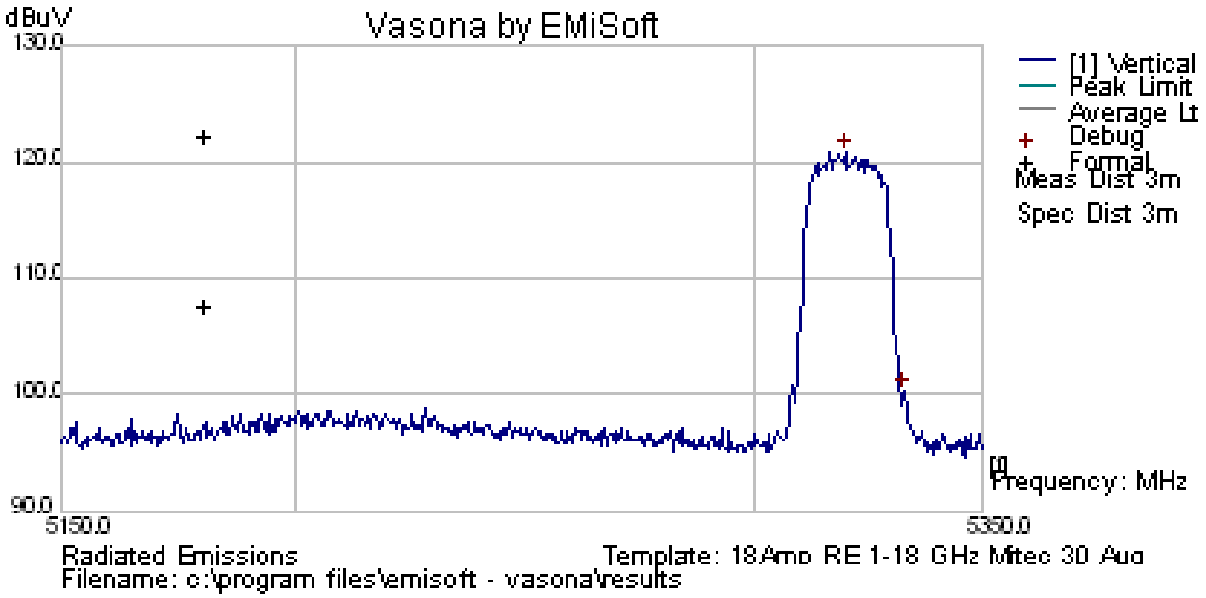
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5319.94	75.41	10.62	34.76	120.79	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

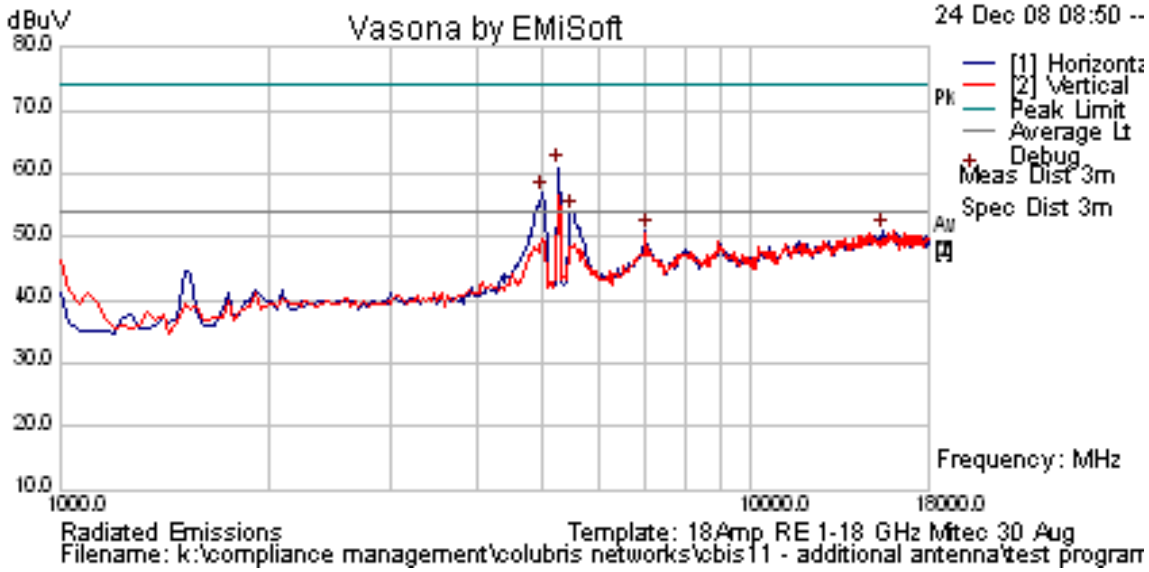
TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,270 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
7026.663	52.03	5.39	-1.61	55.81	Peak Max	H	127	311	74	-18.19	Pass	
7026.663	46.04	5.39	-1.61	49.81	Average Max	H	125	311	54	-4.19	Pass	

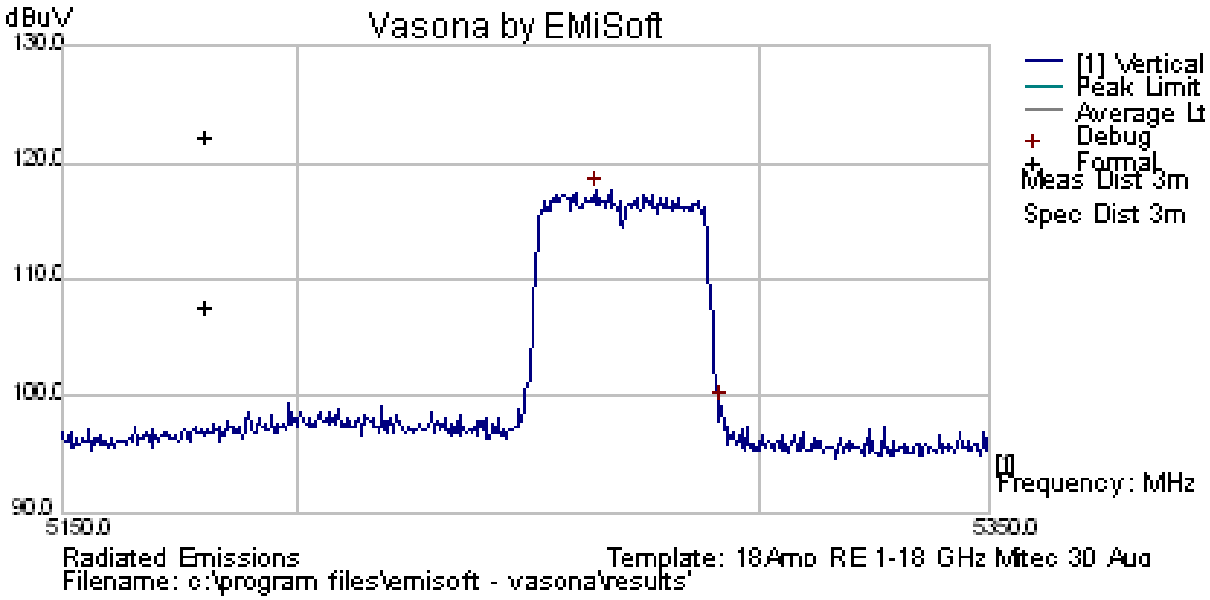
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5264.228	72.32	10.62	34.72	117.65	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

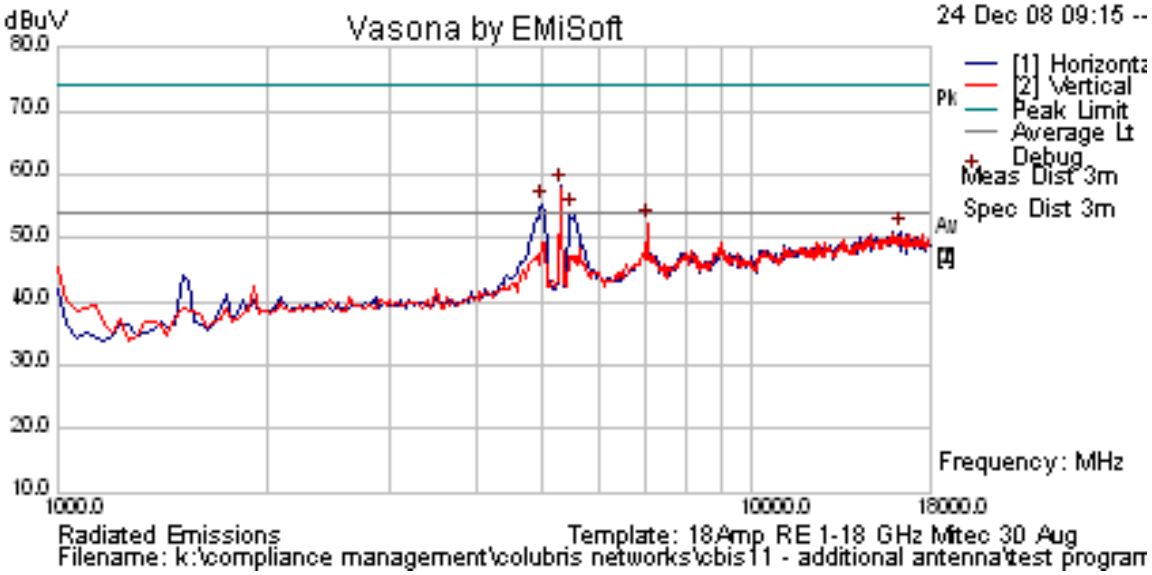
TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,310 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
7079.908	54.46	5.4	-1.82	58.04	Peak Max	V	161	360	74	-15.96	Pass	
7079.908	49.54	5.4	-1.82	53.12	Average Max	V	161	360	54	-0.88	Pass	

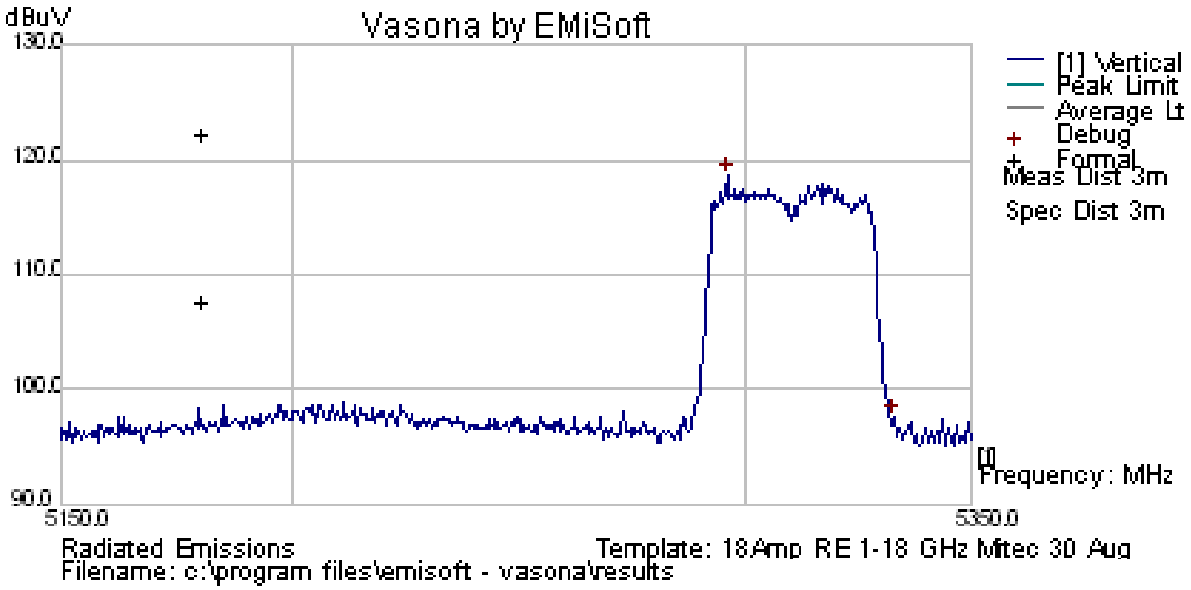
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5295.892	73.2	10.62	34.74	118.56	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 100 (5,500 MHz)

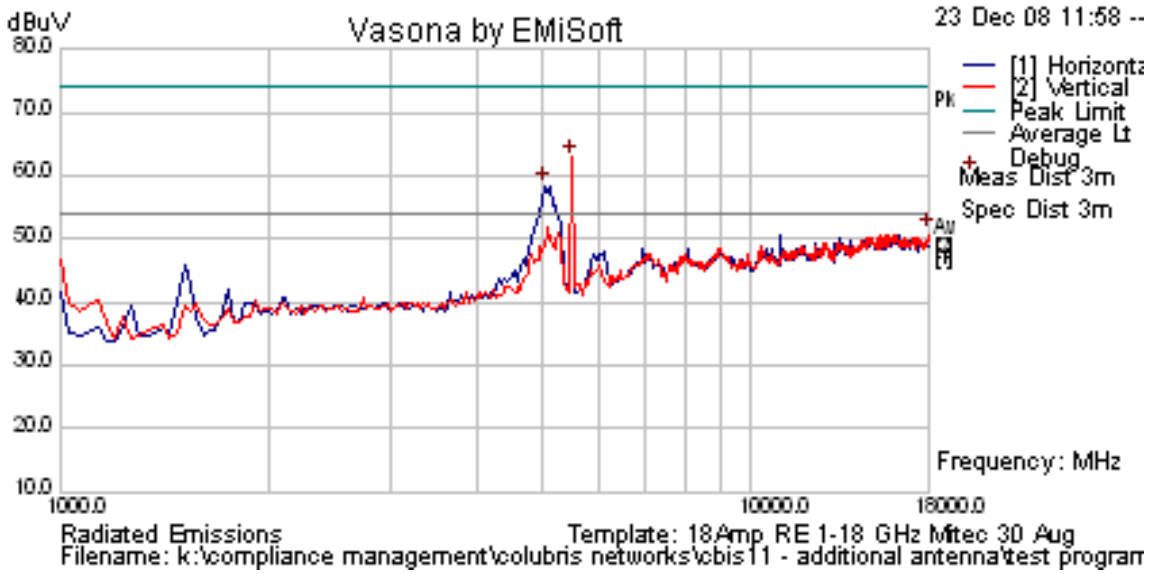
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

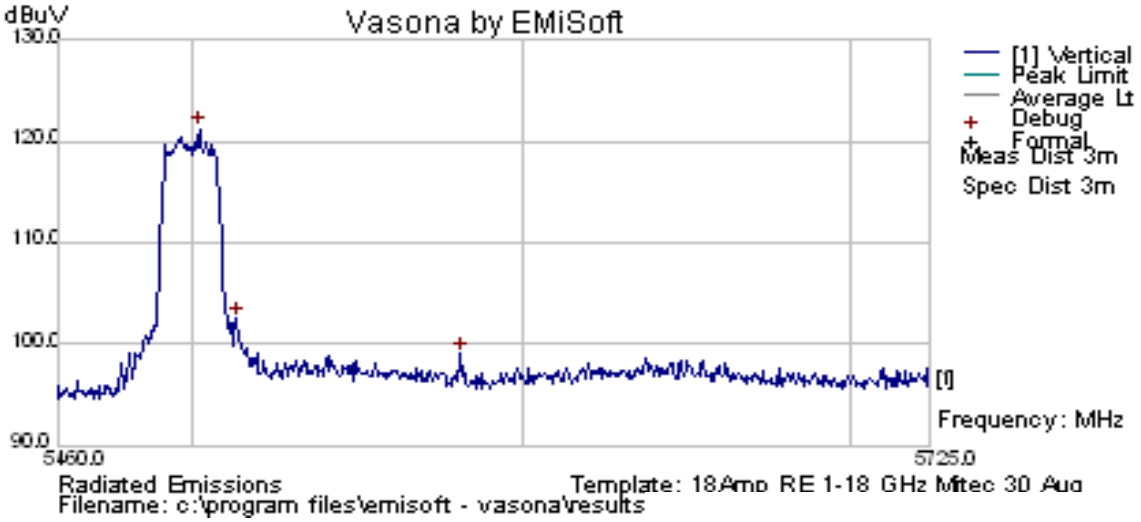
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5502.485	75.68	10.62	34.9	121.2	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

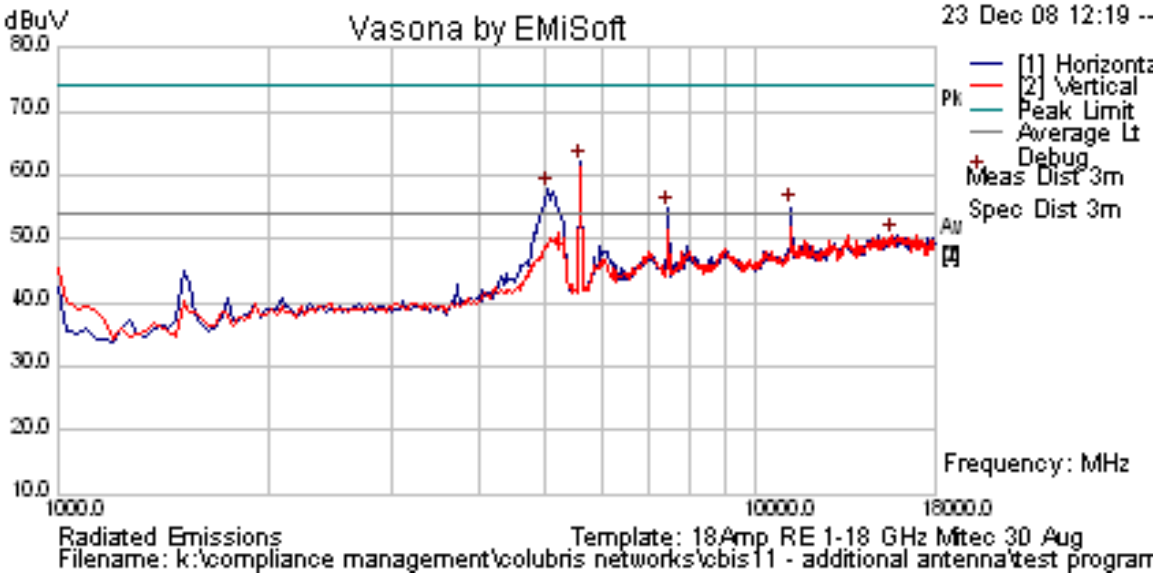
TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 120 (5,600 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
11199.92	54.6	6.9	-1.34	60.16	Peak Max	H	99	303	74	-13.84	Pass	RB
7466.781	55.11	5.47	-3.7	56.89	Peak Max	H	108	330	74	-17.11	Pass	RB
11199.92	39.71	6.9	-1.34	45.26	Average Max	H	99	303	54	-8.74	Pass	RB
7466.781	51.32	5.47	-3.7	53.09	Average Max	H	108	330	54	-0.91	Pass	RB

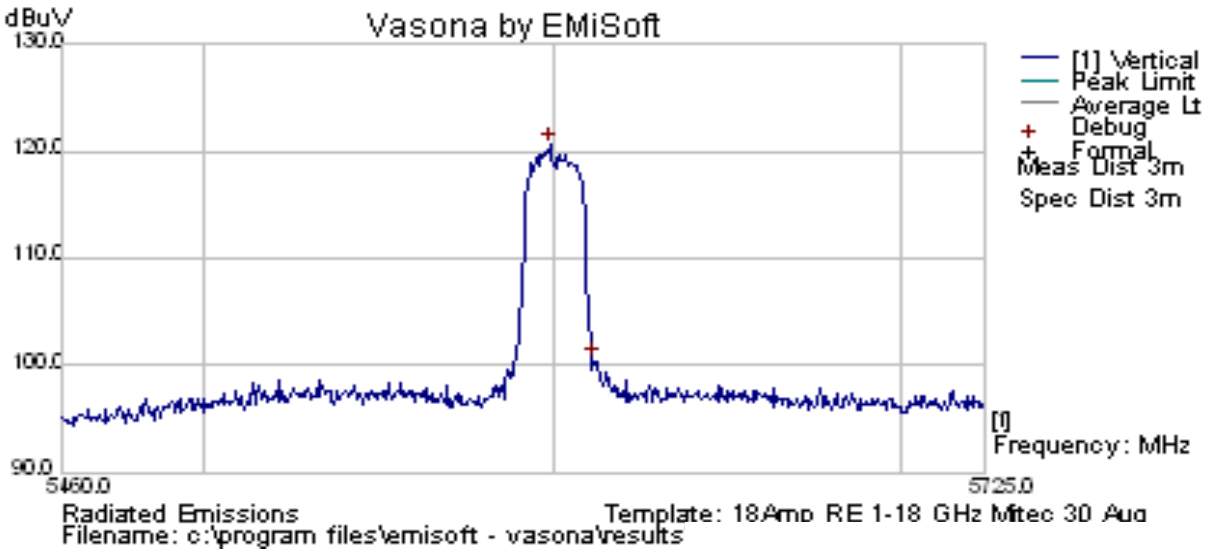
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5598.607	75.02	10.68	34.98	120.67	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

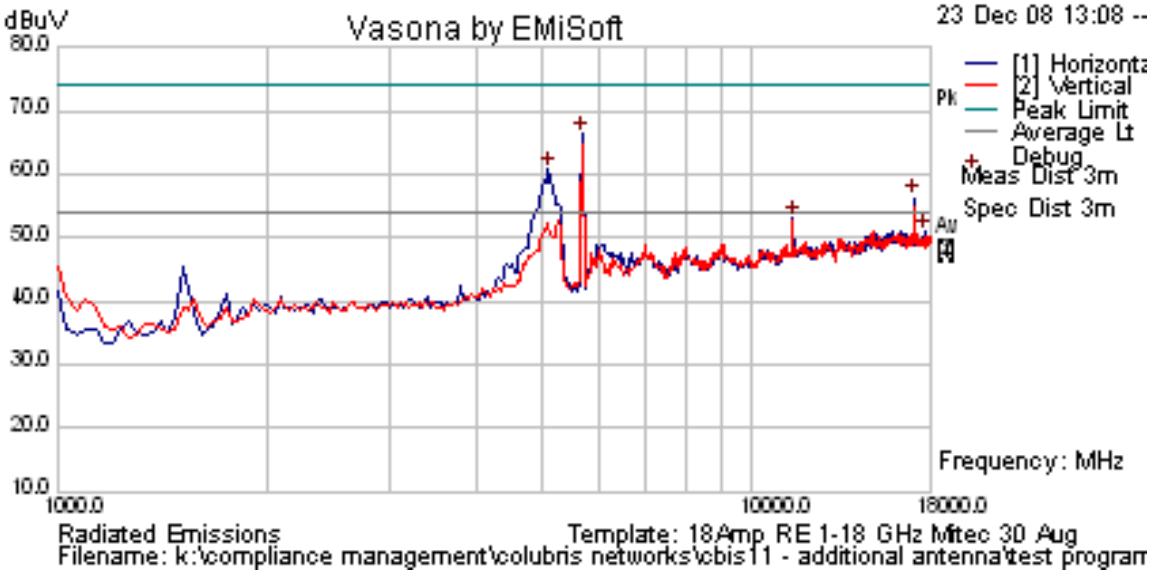
TABLE OF RESULTS – 802.11a, Legacy 6 MBit/s Channel 140 (5,700 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
17096.56	49.99	8.53	-0.35	58.17	Peak Max	V	98	12	74	-15.83	Pass	RB
11402.068	51.12	6.82	-1.45	56.5	Peak Max	H	103	43	74	-17.5	Pass	RB
17096.56	34.59	8.53	-0.35	42.77	Average Max	V	98	12	54	-11.23	Pass	RB
11402.068	35.77	6.82	-1.45	41.15	Average Max	H	103	43	54	-12.85	Pass	RB

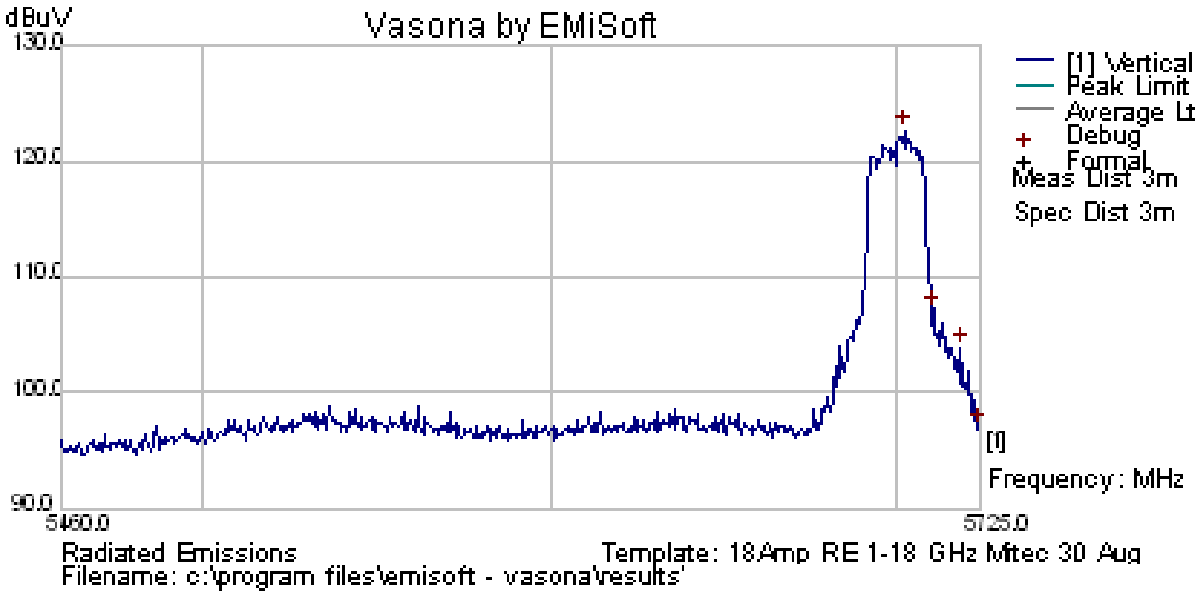
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5702.695	76.87	10.73	35.07	122.67	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 100 (5,500 MHz)

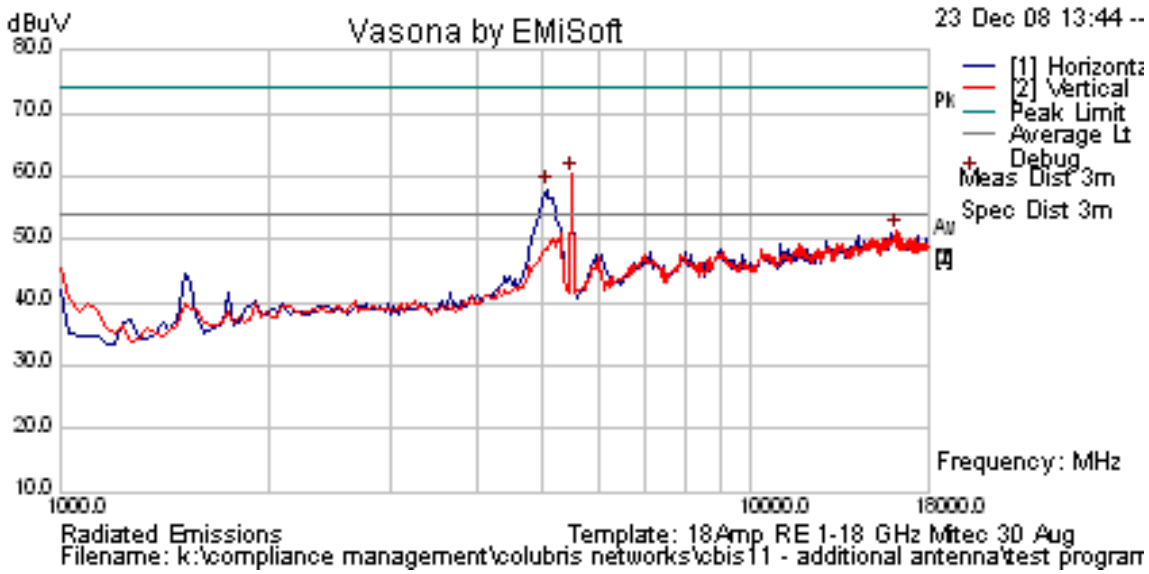
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

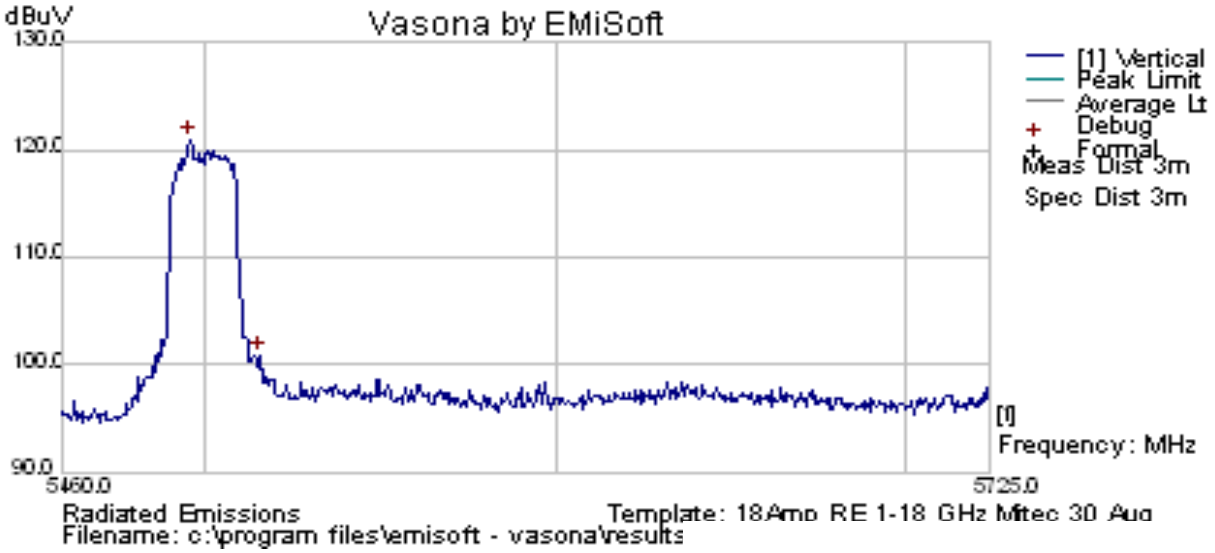
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5496.112	75.44	10.62	34.9	120.96	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

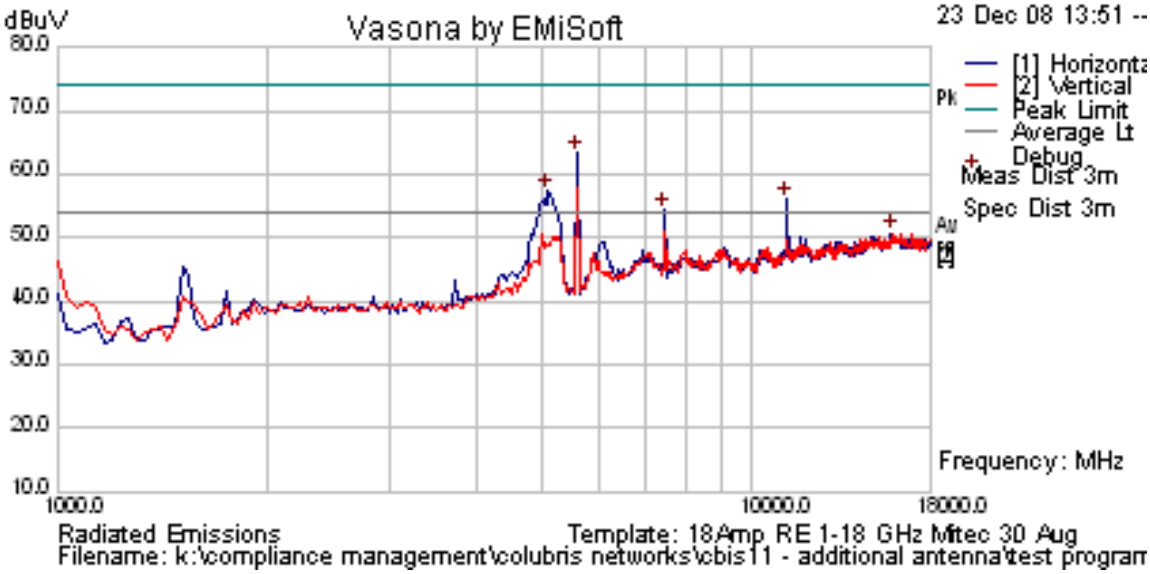
TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 120 (5,600 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
11199.439	53.01	6.9	-1.34	58.57	Peak Max	H	99	298	74	-15.43	Pass	
7466.691	57.12	5.47	-3.7	58.9	Peak Max	H	118	324	74	-15.1	Pass	
11199.439	37.94	6.9	-1.34	43.5	Average Max	H	99	298	54	-10.5	Pass	
7466.691	40.47	5.47	-3.7	42.24	Average Max	H	119	324	54	-11.76	Pass	

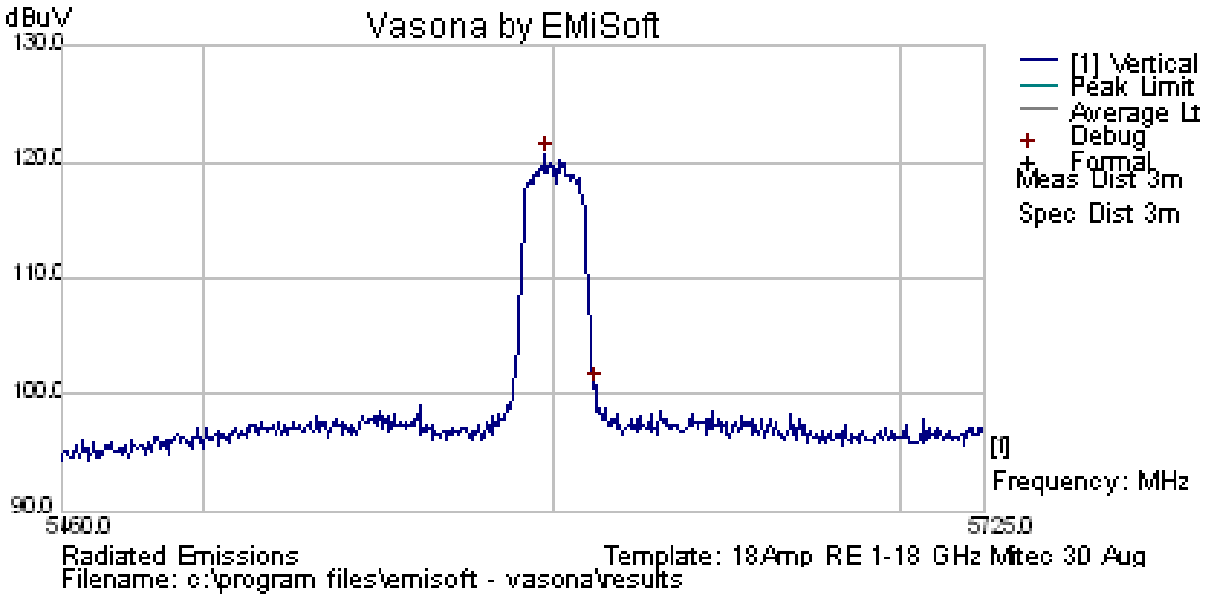
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5597.545	74.88	10.67	34.98	120.53	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

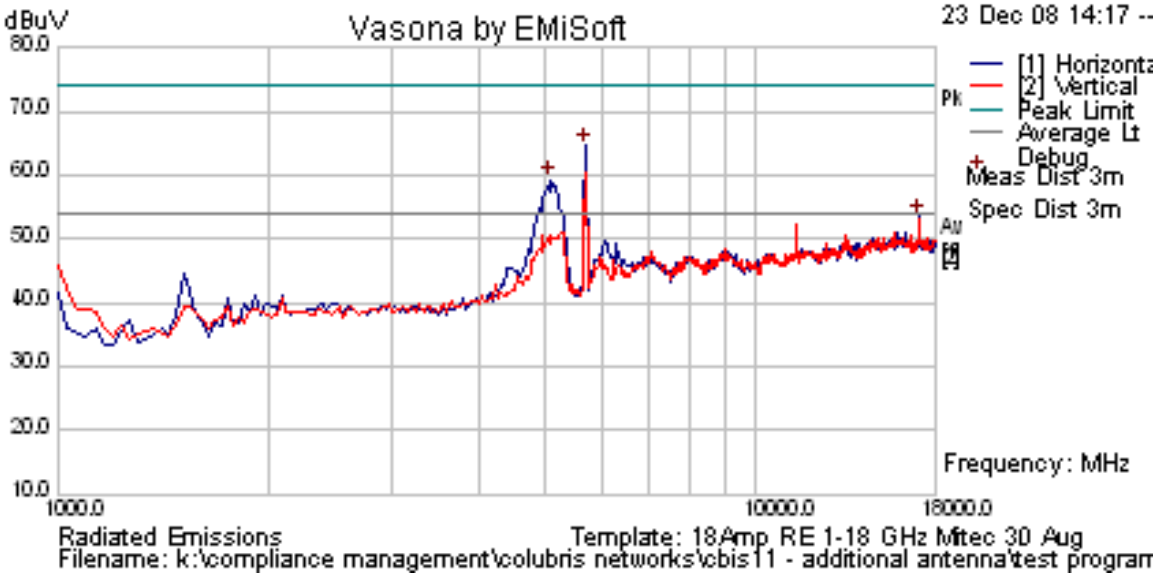
TABLE OF RESULTS – 802.11a, HT-20 6.5 MCS Channel 140 (5,700 MHz)

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
17096.56	49.99	8.53	-0.35	58.17	Peak Max	V	98	12	74	-15.83	Pass	
11402.068	51.12	6.82	-1.45	56.5	Peak Max	H	103	43	74	-17.5	Pass	
17096.56	34.59	8.53	-0.35	42.77	Average Max	V	98	12	54	-11.23	Pass	
11402.068	35.77	6.82	-1.45	41.15	Average Max	H	103	43	54	-12.85	Pass	

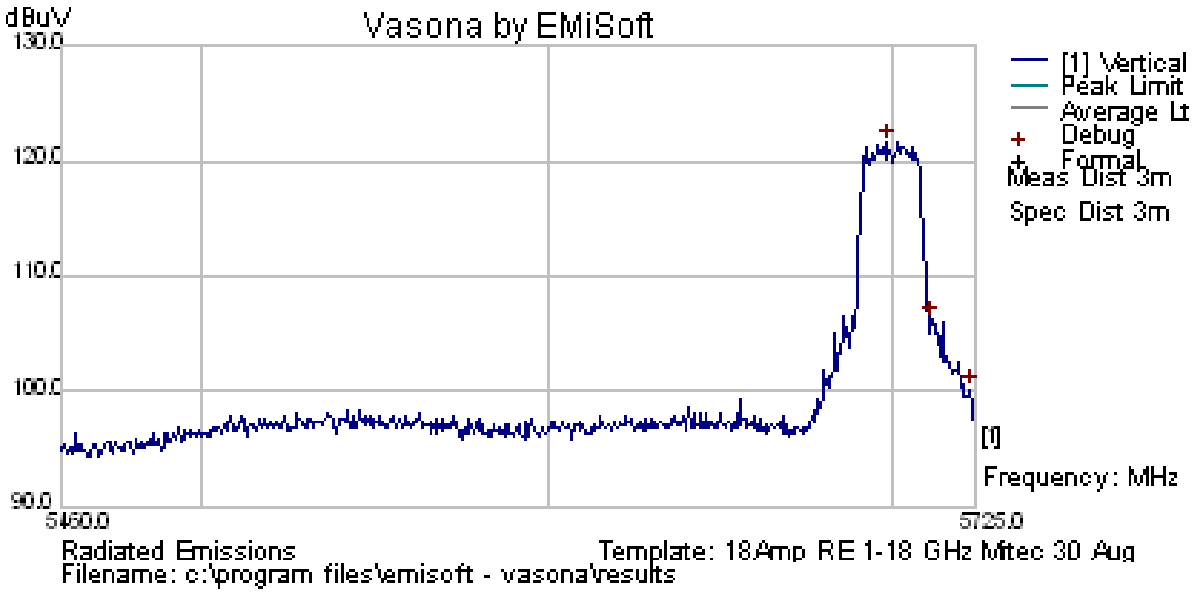
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5698.978	75.8	10.73	35.06	121.59	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

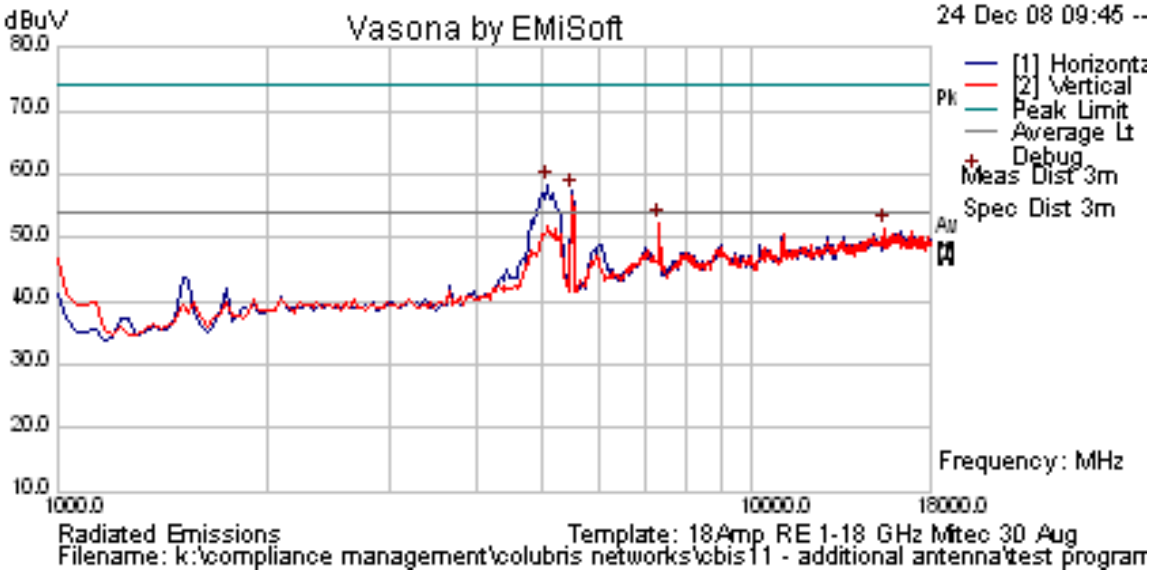
TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,510 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
7346.698	53.67	5.45	-3.02	56.1	Peak Max	H	104	38	74	-17.9	Pass	RB
7346.698	49.89	5.45	-3.02	52.32	Average Max	H	104	38	54	-1.68	Pass	RB

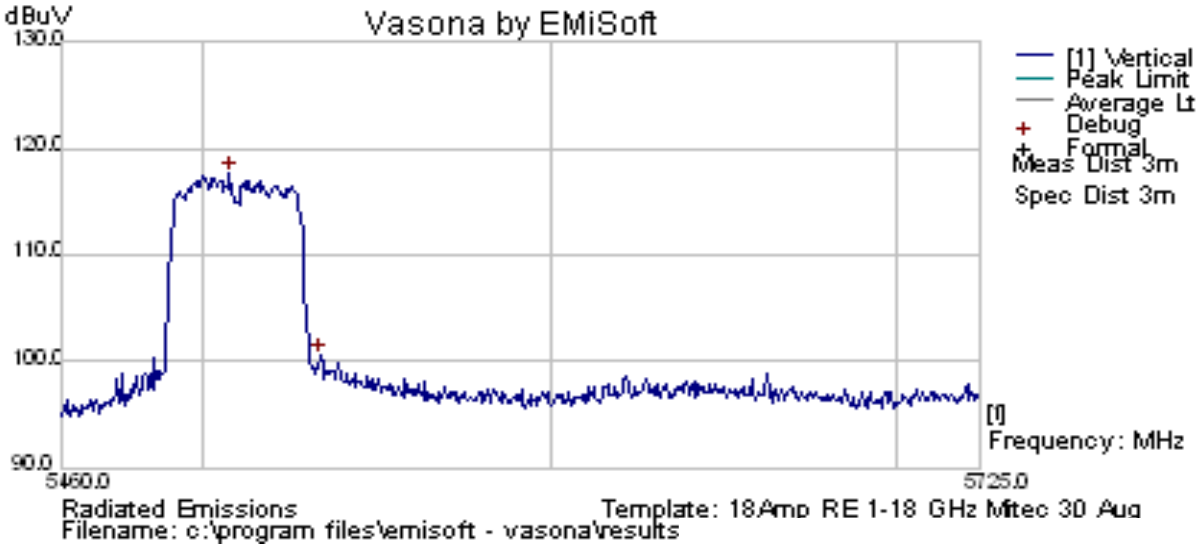
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	**Limit dBuV**	**Margin dB**	**Pass /Fail**	**Comments**
5507.796	72.05	10.62	34.91	117.58	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

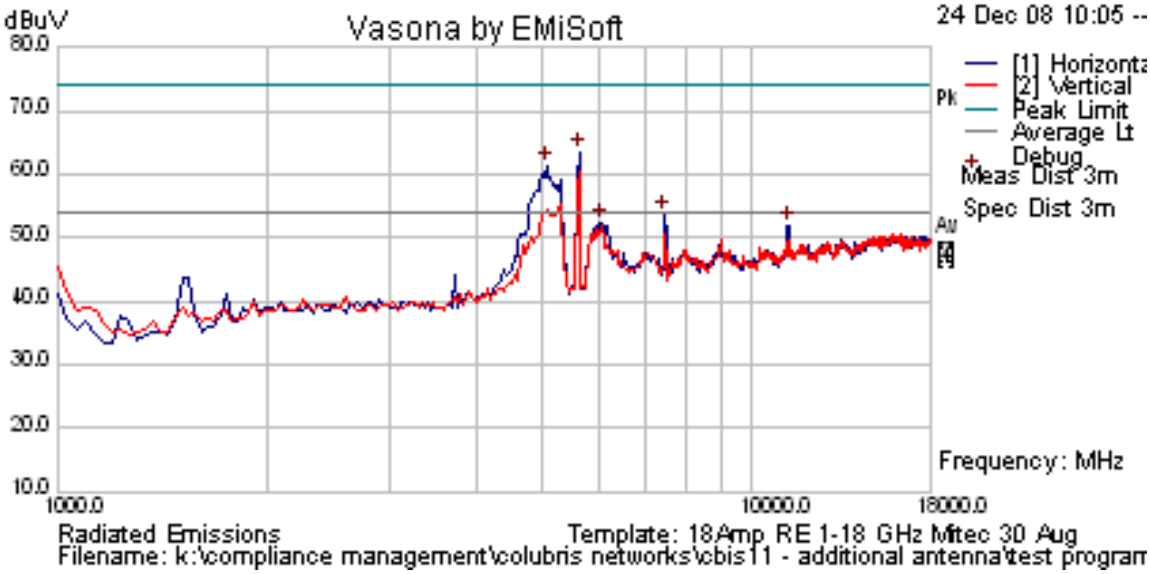
TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,620 MHz

Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
7493.317	55.73	5.48	-3.79	57.41	Peak Max	H	135	321	74	-16.59	Pass	RB
11237.996	50.24	6.88	-1.43	55.69	Peak Max	H	101	311	74	-18.31	Pass	RB
7493.318	41.43	5.48	-3.79	43.11	Average Max	H	136	321	54	-10.89	Pass	RB
11237.996	36.25	6.88	-1.43	41.7	Average Max	H	101	311	54	-12.3	Pass	RB

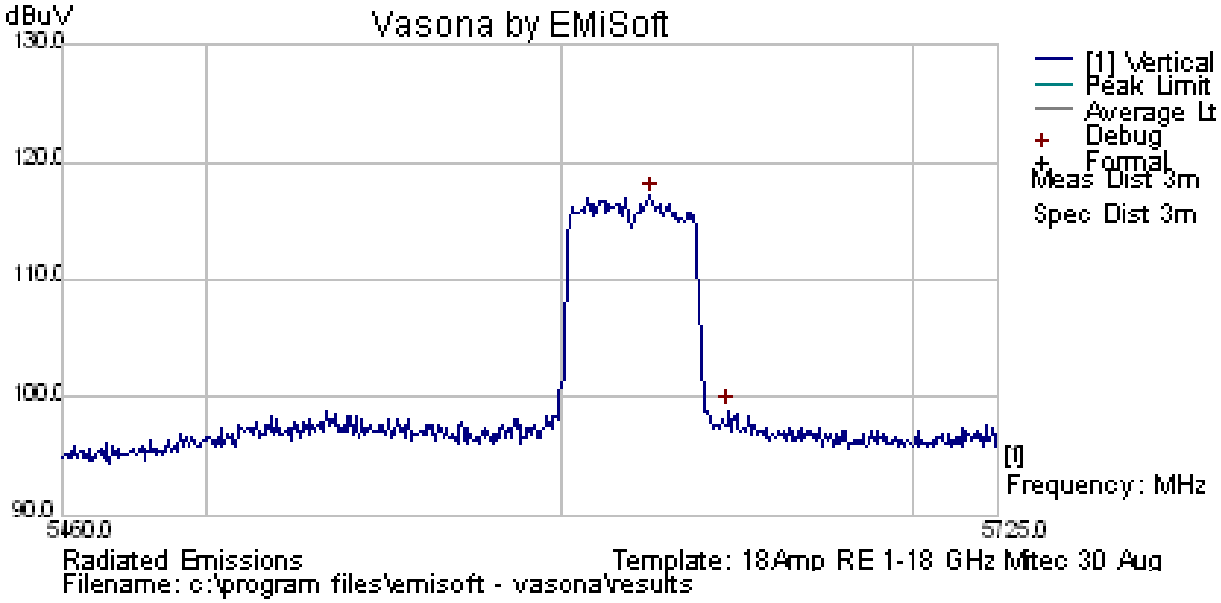
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5625.16	71.53	10.69	35	117.22	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

TABLE OF RESULTS – 802.11a, HT-40 13.5 MCS Channel 5,690 MHz

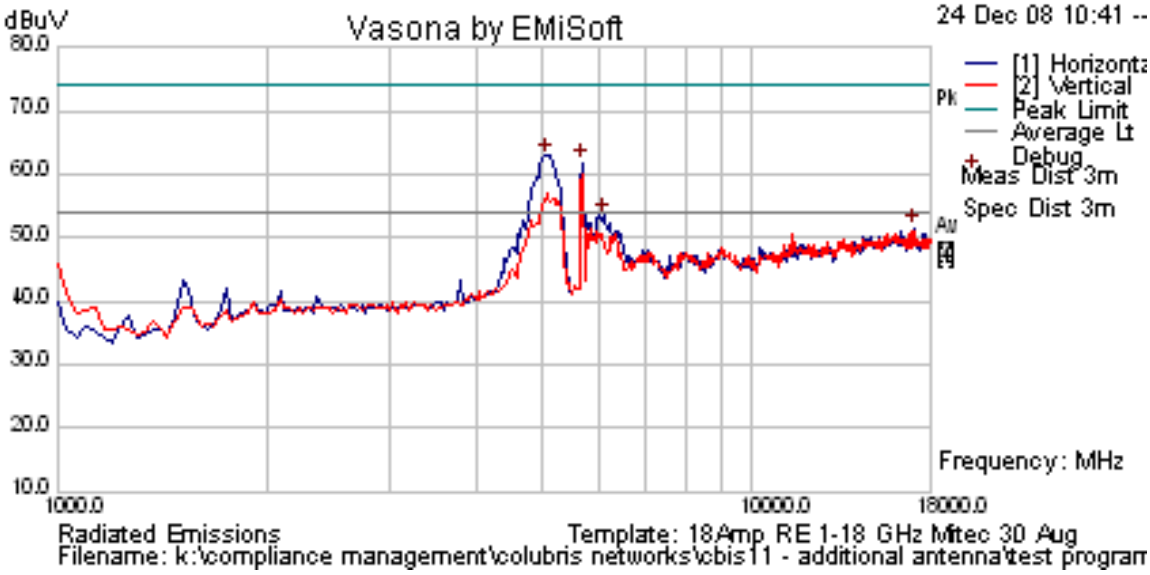
Maximum Power

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments

No emissions found within 6 dB of the limit line

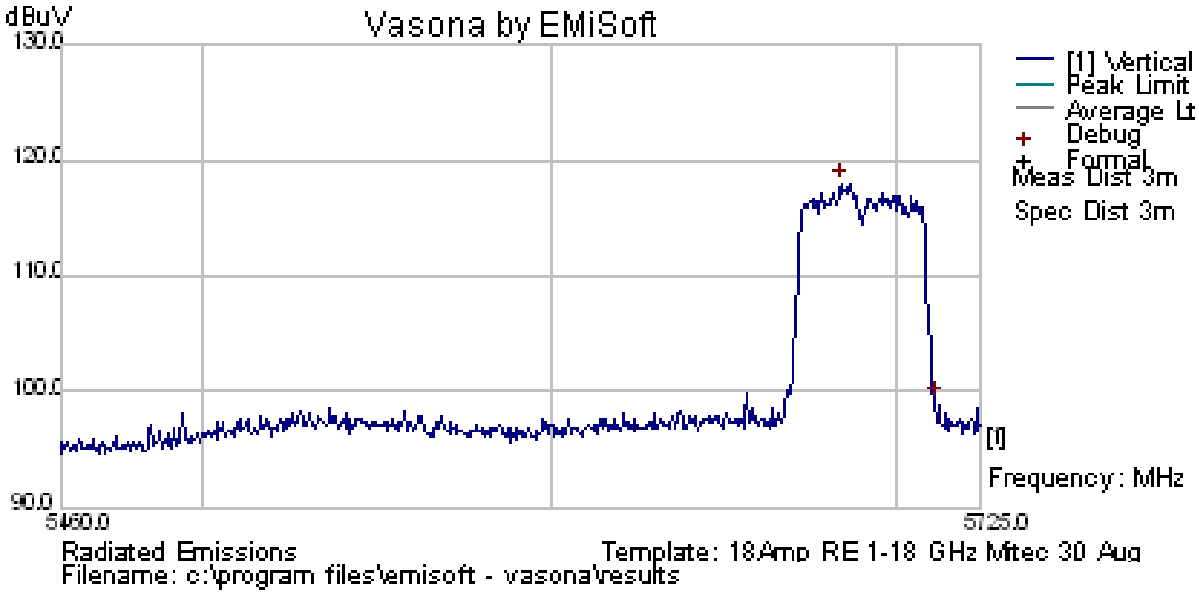
Band-edge – Restricted Bands
RB – Restricted Band
NRB – Non-Restricted Band

Radiated Emissions



The above plot is peak emissions only

Peak Emission Scan



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5684.108	72.24	10.72	35.05	118.01	Peak [Scan]	V	100	0	N/A	N/A	N/A	Fundamental

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

5.1.7.2. Receiver Radiated Spurious Emissions (above 1 GHz)

Industry Canada RSS-Gen §4.8, §6

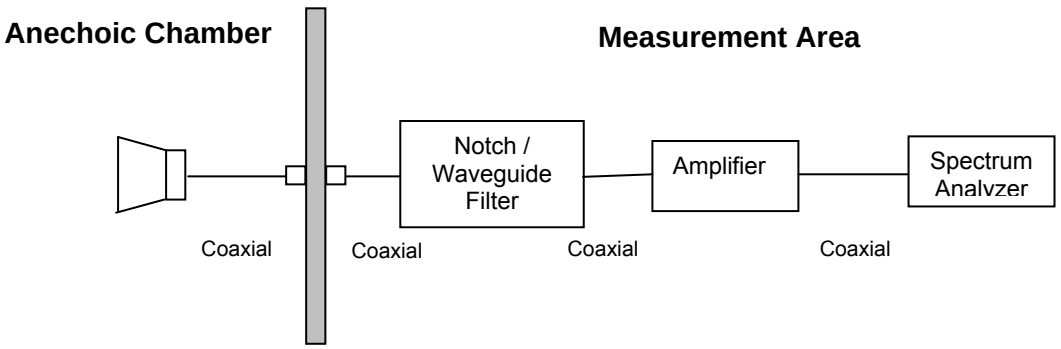
Test Procedure

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.

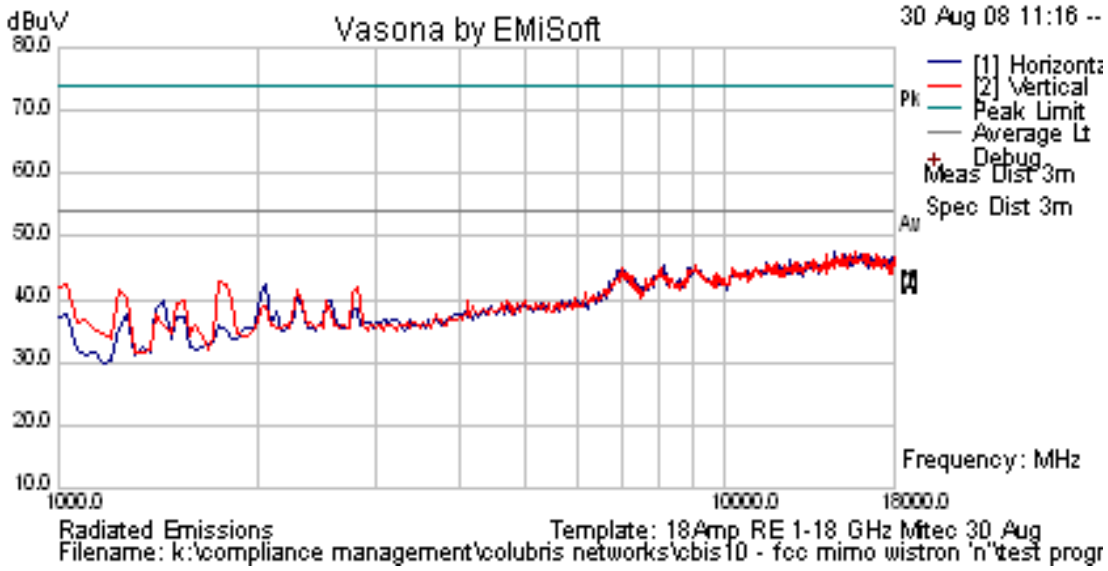
Receiver Radiated Spurious Emissions above 1 GHz

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.

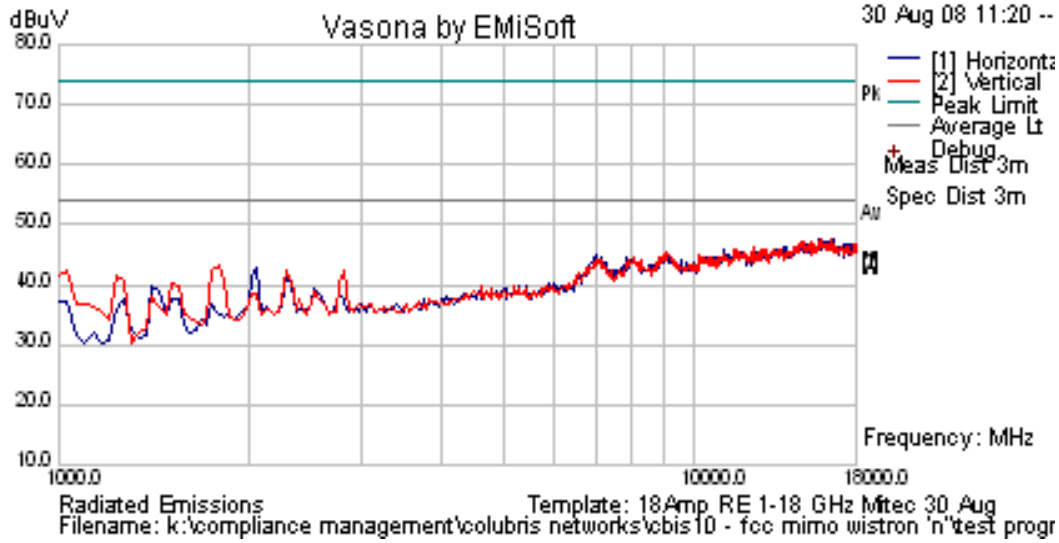
Receiver Radiated Spurious Emissions above 1 GHz

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

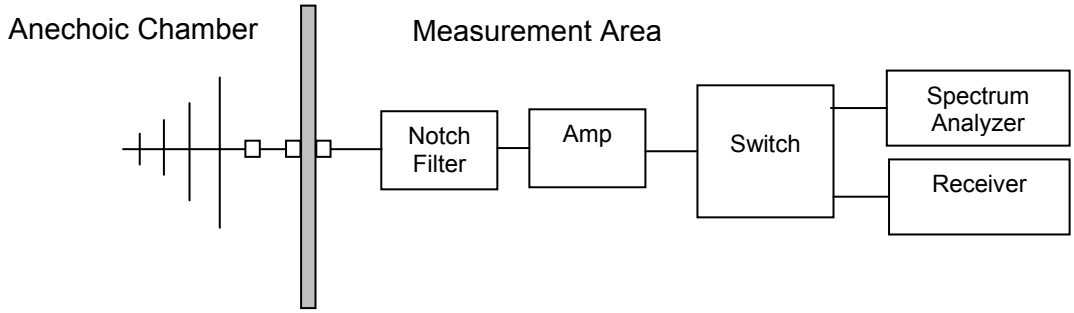
Traceability

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

5.1.7.3. 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

Test Procedure
Preliminary radiated emissions are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarity. The emissions are recorded with a spectrum analyzer in peak hold mode. Emissions closest to the limits are measured in the quasi-peak mode with a CISPR compliant receiver. Only the highest emissions relative to the limit are listed.



Test Measurement Set up

The product was initially tested to find worst case orientation for the maximization of spurious emissions. Worst case orientation was used for emission testing.

Field Strength Calculation

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

FS = R + AF + CORR

where:

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

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

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

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

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

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

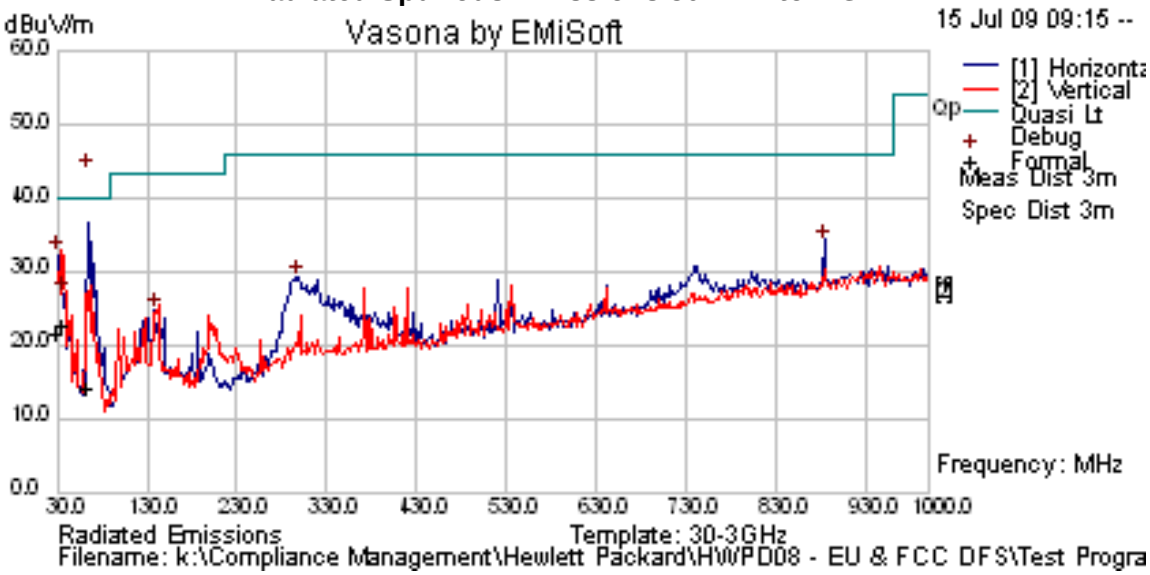
Measurement Results for Spurious Emissions (30 MHz – 1 GHz)

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

TABLE OF RESULTS

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB
63.614	42.35	3.85	-31.79	14.4	Quasi Max	H	143	178	40	-25.6
30.000	31.89	3.37	-13.7	21.56	Quasi Max	H	247	300	40	-18.44
36.468	39.46	3.51	-20.09	22.88	Quasi Max	V	107	183	40	-17.12
883.625	47.1	7.27	-20.54	33.82	Peak [Scan]	H	204	0	46	-12.18
297.255	53.19	5.21	-29.16	29.23	Peak [Scan]	H	204	0	46	-16.77
138.925	49.03	4.41	-28.8	24.64	Peak [Scan]	H	204	0	43.5	-18.86

Radiated Spurious Emissions 30 MHz to 1 GHz



The above plot identifies peak emissions only

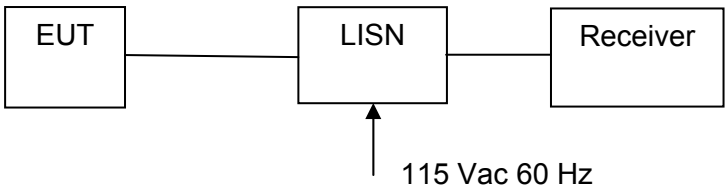
5.1.8. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

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

Test Procedure

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

Test Measurement Set up

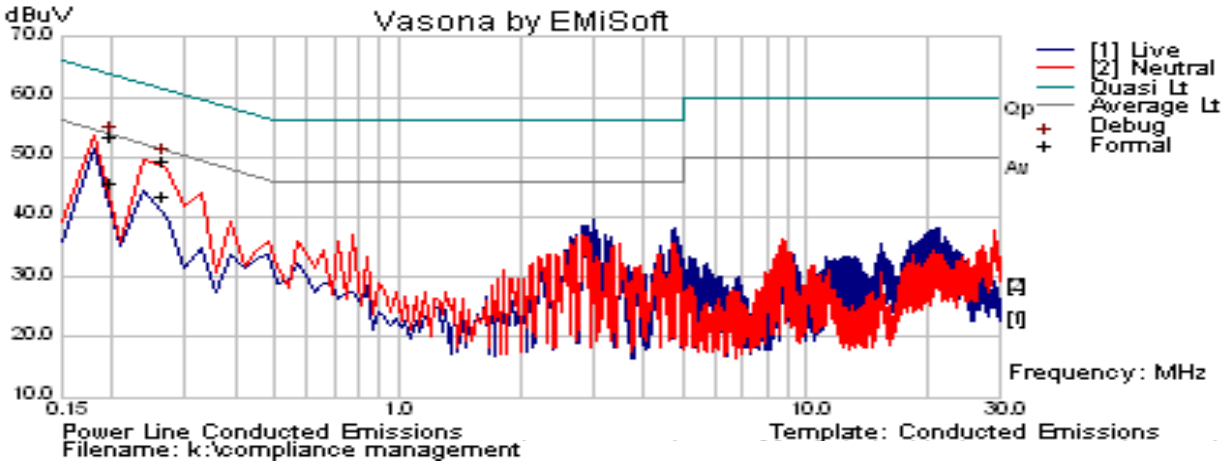


Measurement set up for AC Wireline Conducted Emissions Test

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

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

AC Wireline 0.15 - 30 MHz



Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail
0.198108	35.54	9.9	0.1	45.54	Average	Neutral	54	-8.15	Pass
0.263747	33.48	9.9	0.1	43.49	Average	Neutral	51	-7.82	Pass
2.95816	25.9	10.1	0.18	36.22	Average	Neutral	46	-9.80	Pass
0.198108	43.22	9.9	0.1	53.23	Quasi Peak	Neutral	64	-10.5	Pass
0.263747	39.51	9.9	0.1	49.51	Quasi Peak	Neutral	61	-11.8	Pass
2.95816	26.9	10.1	0.18	37.23	Quasi Peak	Neutral	56	-19.0	Pass
0.332	32.7	9.89	0.1	42.7	Peak	Neutral	49.4	-6.7	Pass
4.784	24.4	10.1	0.2	34.7	Peak	Live	46	-11.0	Pass
8.822	25.4	10.3	0.3	35.99	Peak	Neutral	50	-14.0	Pass

Specification

Limit

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

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

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

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

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

Measurement uncertainty	±2.64 dB

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'	0158, 0184, 0193, 0190, 0293, 0307

6. Dynamic Frequency Selection (DFS)

6.1. Test Procedure and Setup for Client without Radar Detection Capability

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

Measurement Results - Dynamic Frequency Selection (DFS)

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

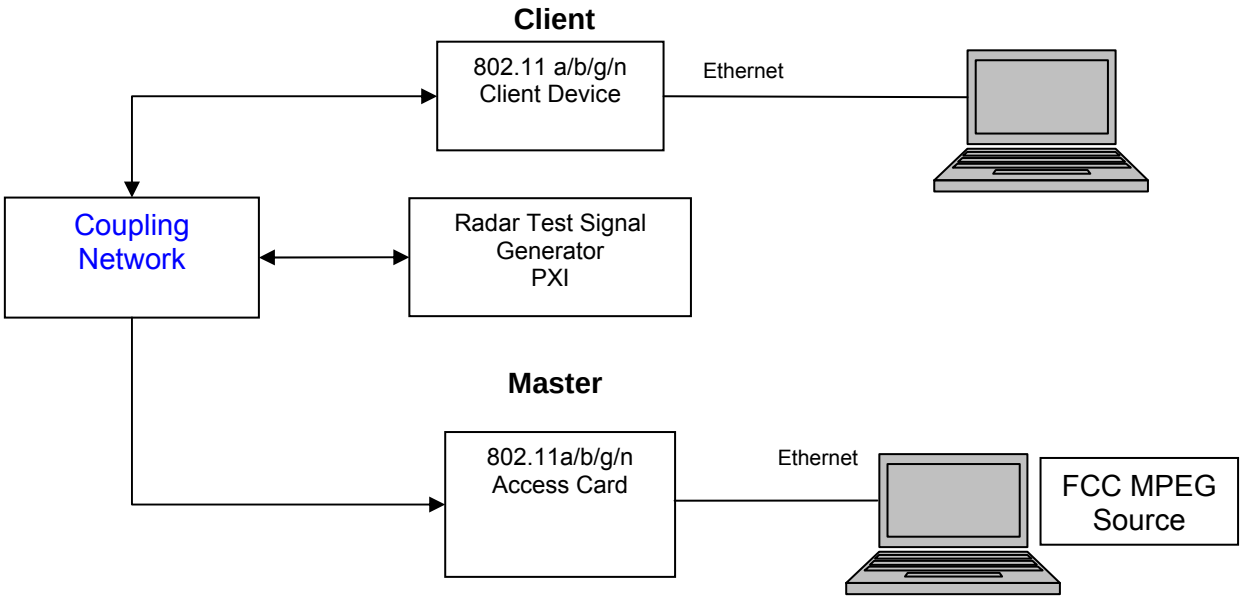
Radio parameters.
Test methodology: Conducted
Device Type: Client
Transmit Power: Maximum

Tests Performed with EUT configured as Client Device

Requirement	Operational Mode
	Client
Channel Closing Transmission Time	Yes
Channel Move Time	Yes
Non-Occupancy Period	Yes

6.1.1. Test Set Up:

Block Diagram(s) of Test Setup



6.2. Dynamic Frequency Selection (DFS) Test Results

6.2.1. 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

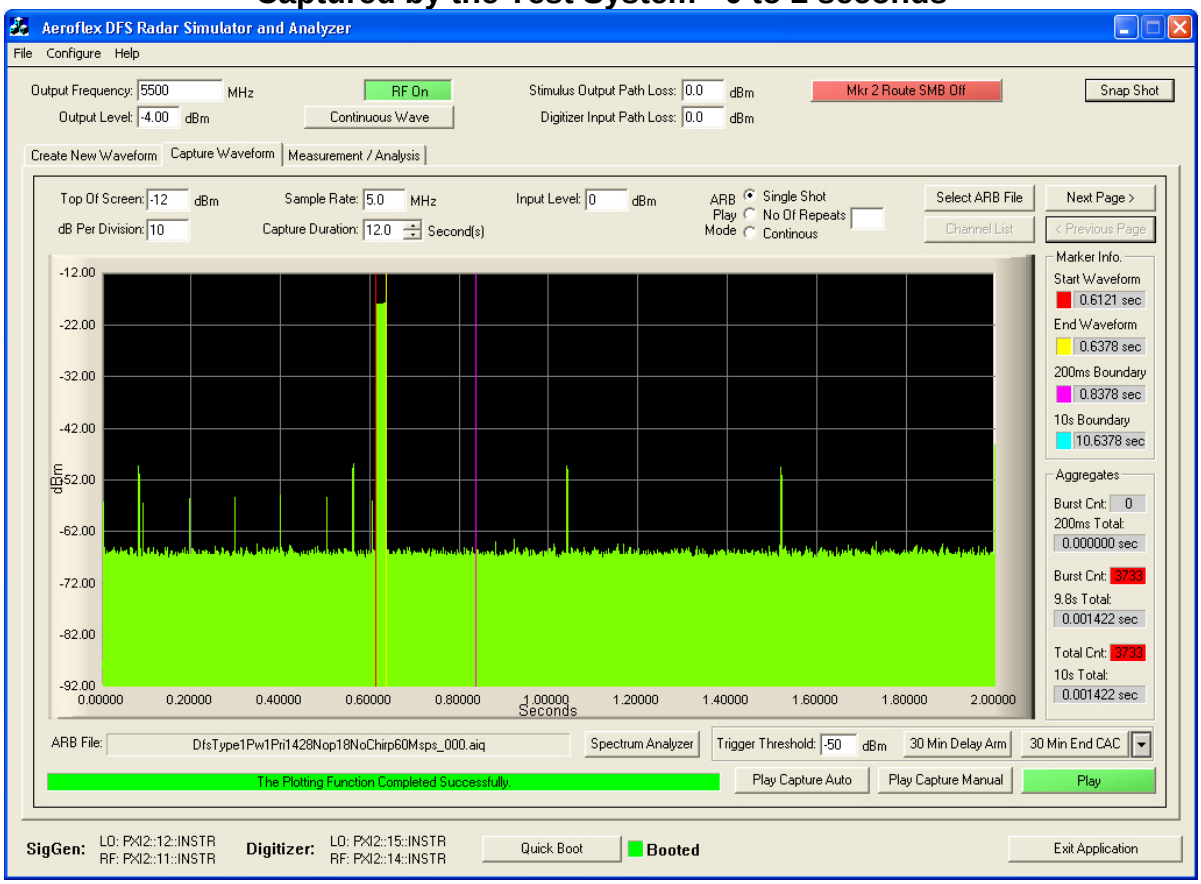
(The period of the 18 pulse burst includes [18 pulses *1.428mS PRI] = 25.704 ms. Then add 1 µs pulse width for the final pulse.)

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 1.422 ms of transmission time accrued. This value is found at the right hand side at the foot of the following plot (10s Total). Note, no transmitter activity took place within the 200mS boundary after the radar.

Channel Closing Transmission Time = 1.422 mSecs (limit 260 mSecs)

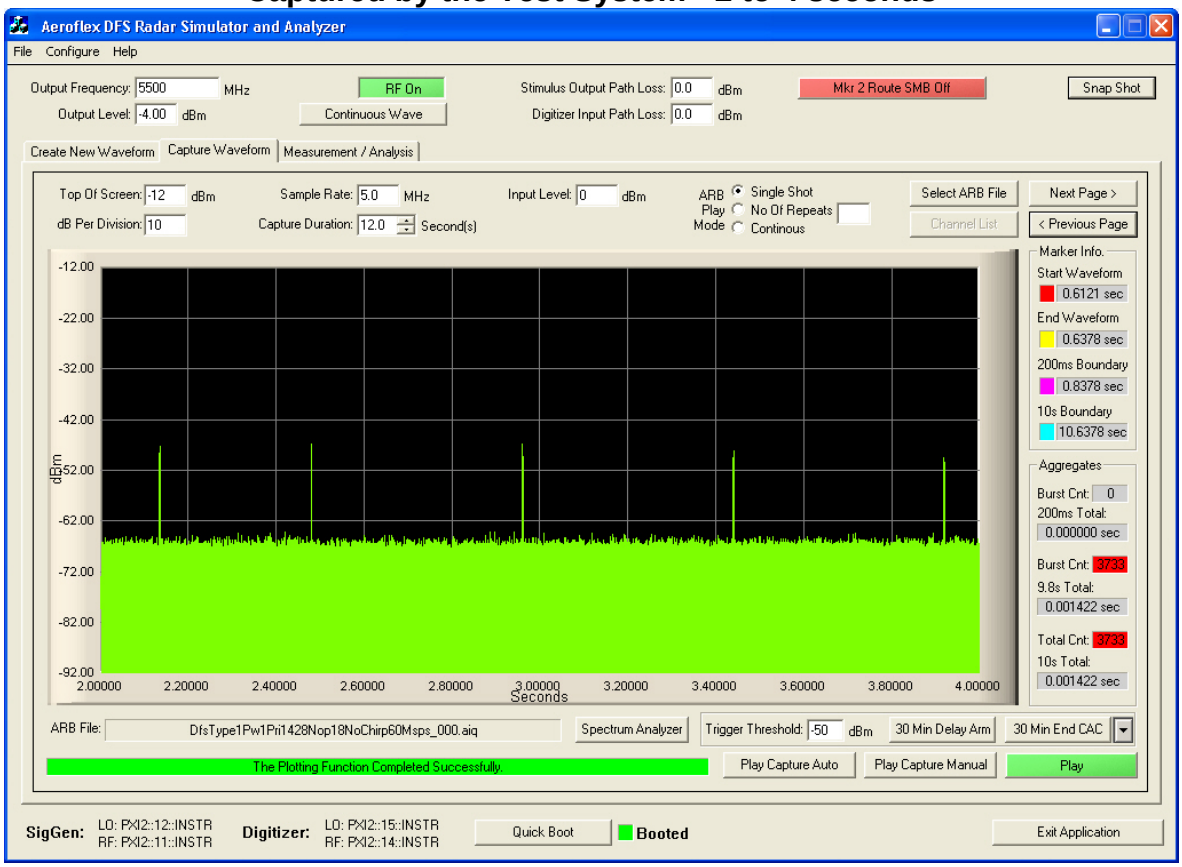
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 0 to 2 seconds



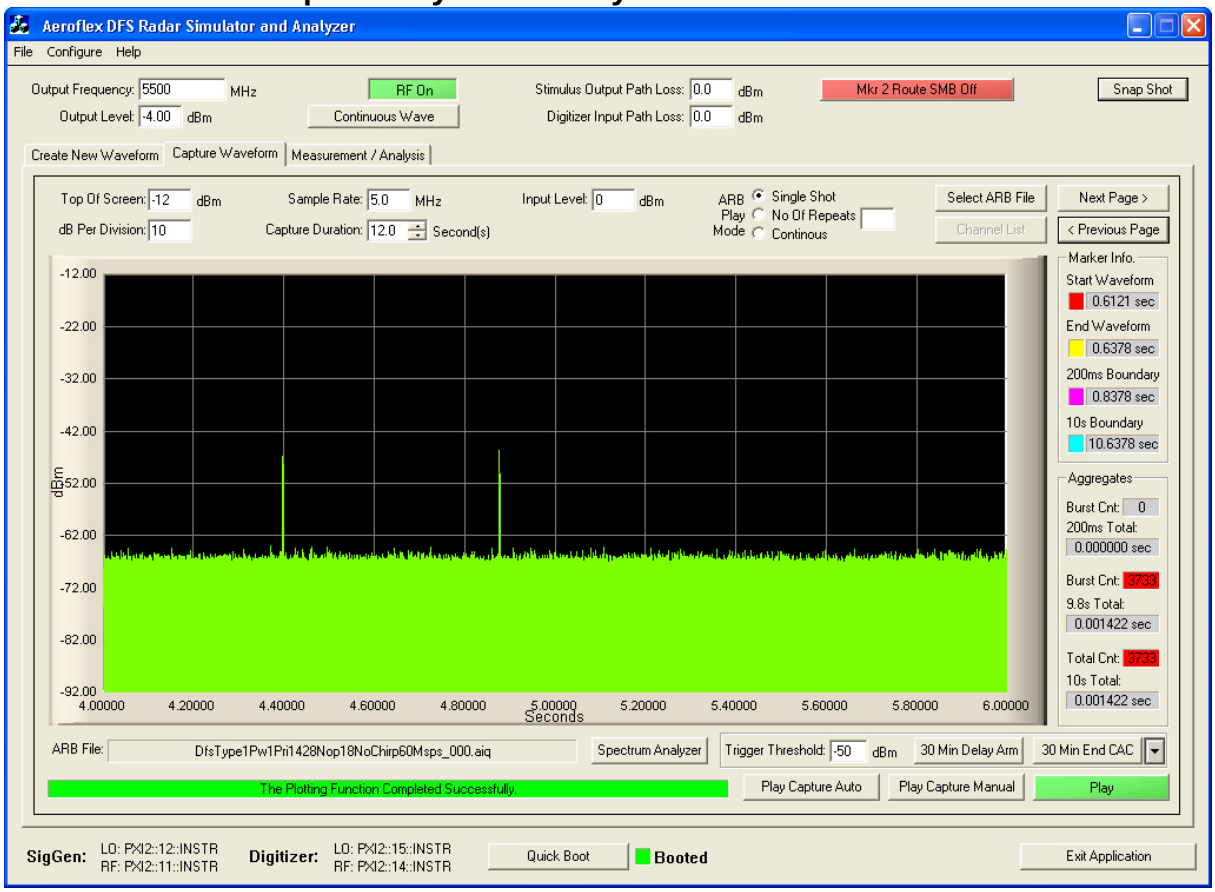
From the plot above it can be seen that the transmission activity within the 200 mS window is 0 mS (see 200 mS Total). The following plots identify all additional activity within the remainder of the 10 sec measurement window.

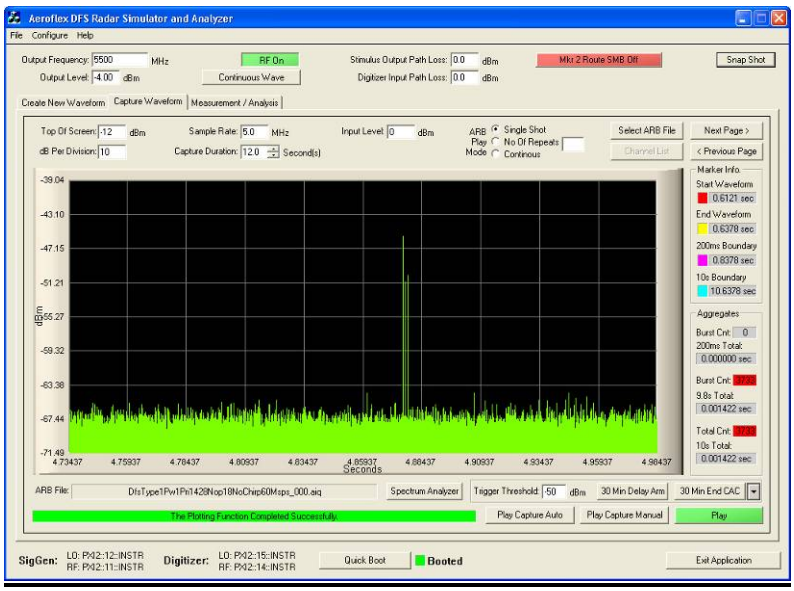
Last Transmitter Activity = 4.870 Seconds
Last Radar Activity = 0.6378 Seconds
Channel Move Time = Last Transmitter Activity – Last Radar Activity = 4.87 – 0.6378
Channel Move Time = 4.2322 secs (Limit 10 secs)

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



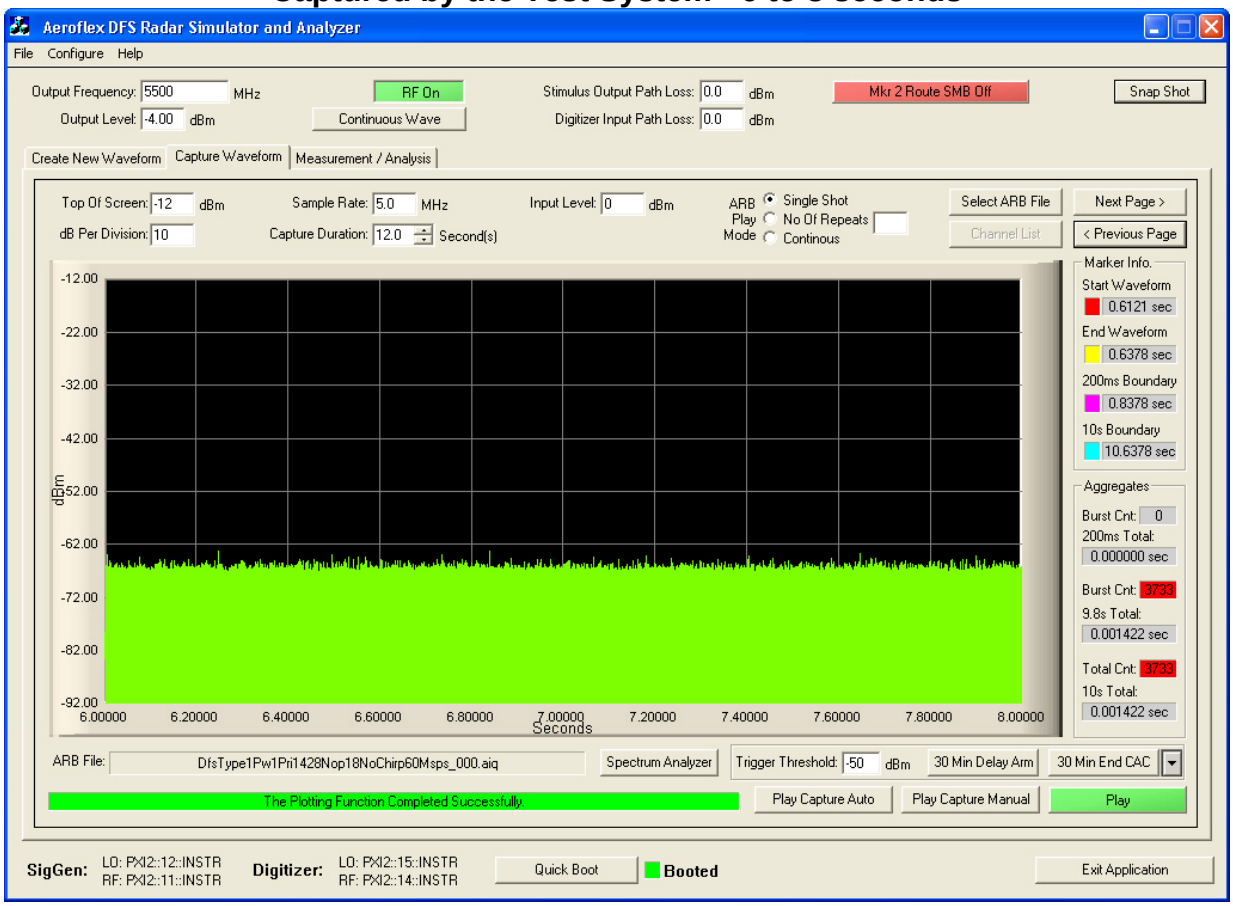
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 4 to 6 seconds



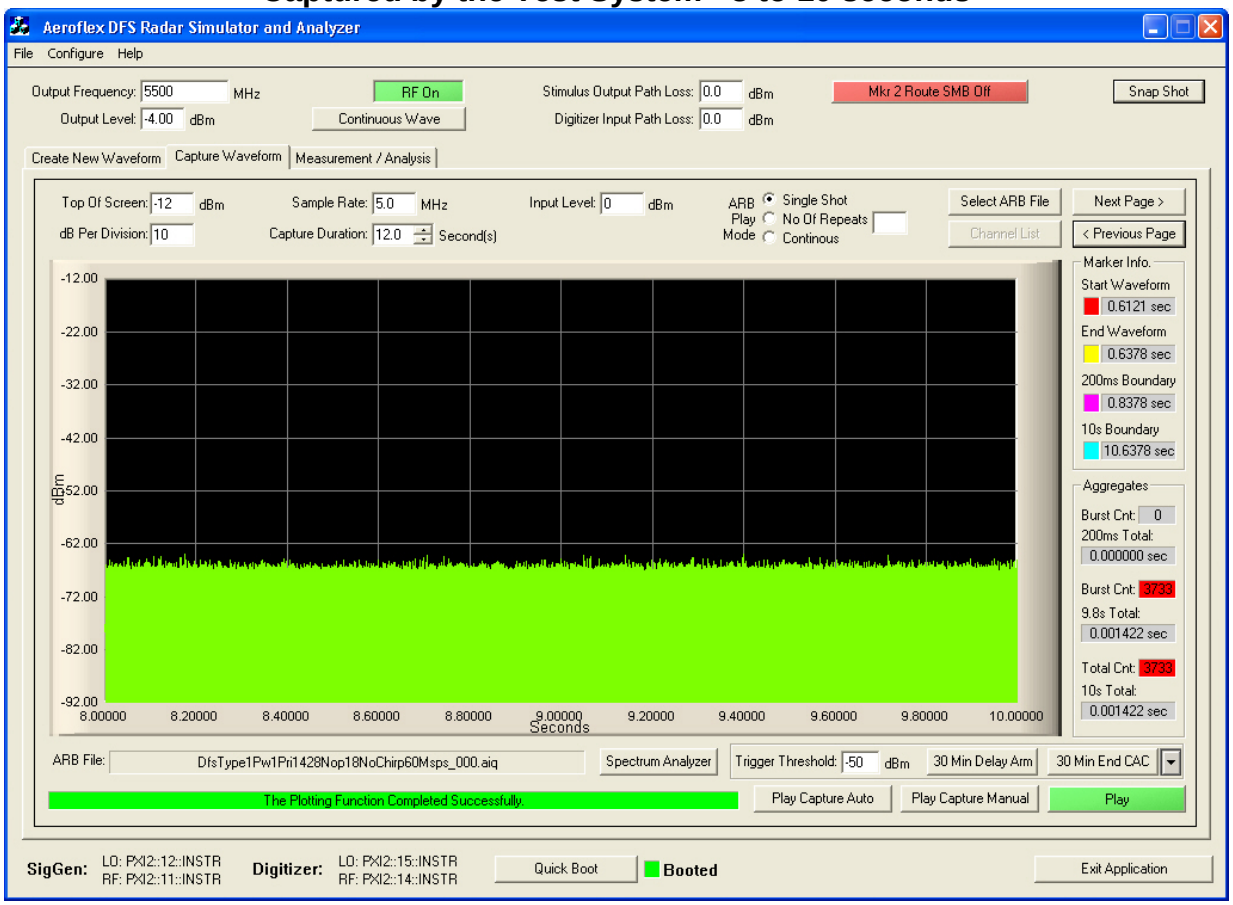


Zoomed client transmit packet

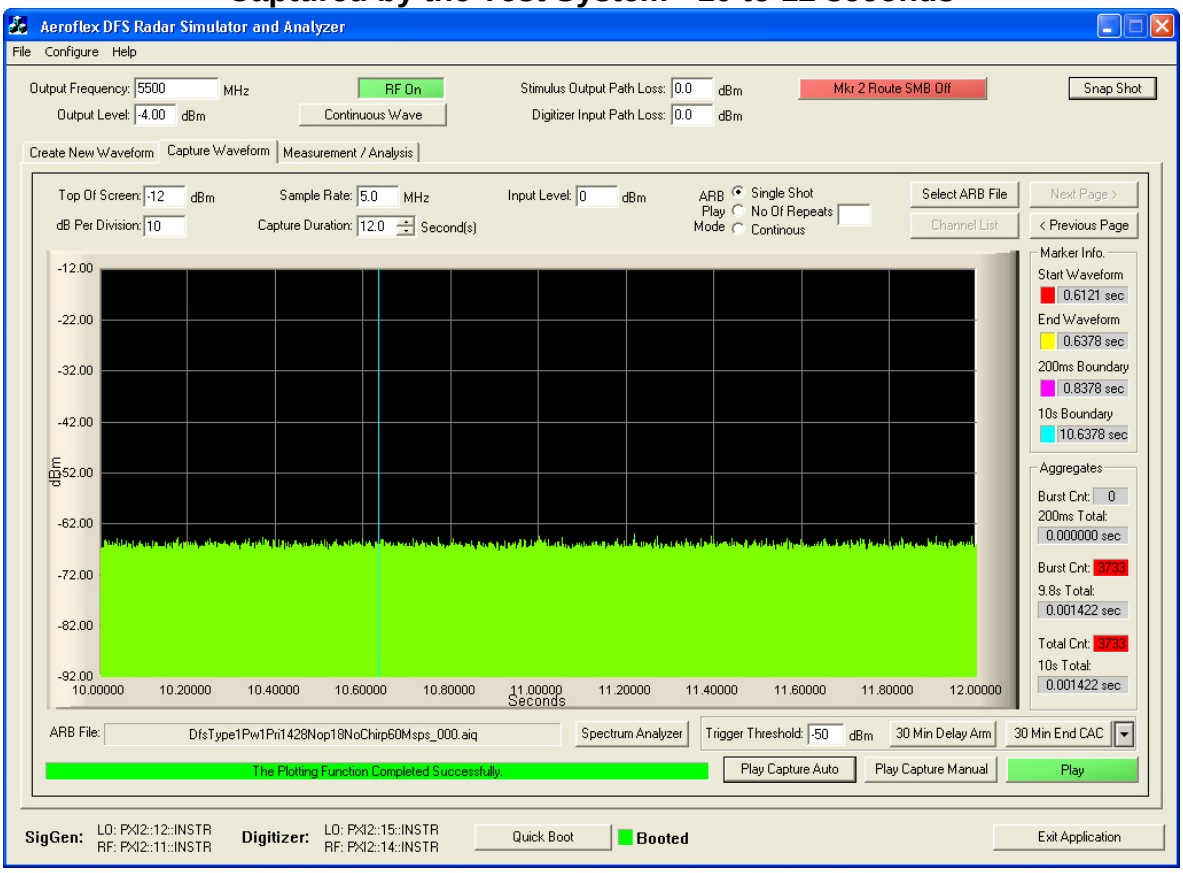
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 6 to 8 seconds



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



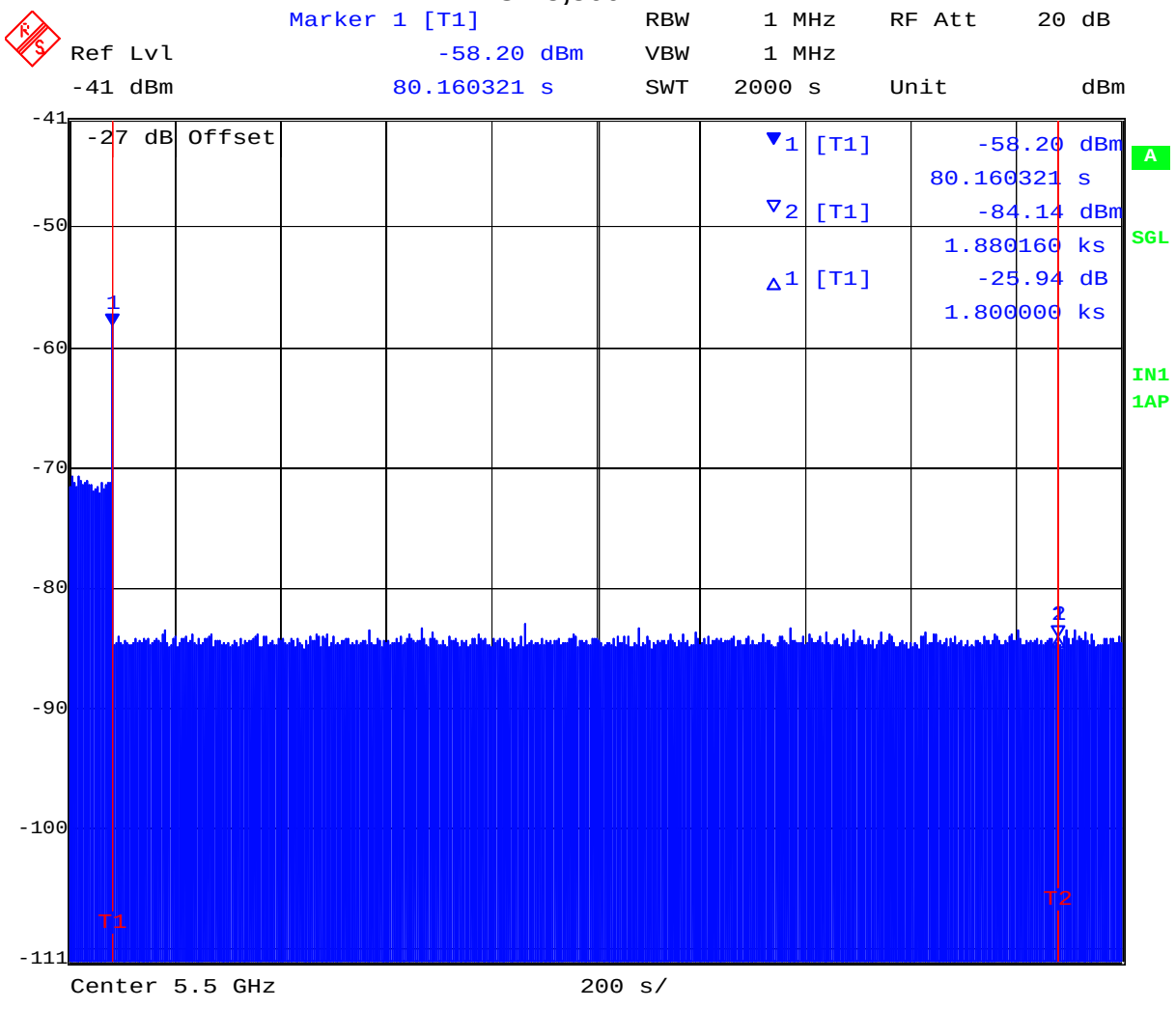
Channel Move Time, Channel Closing Transmission Time for Type 1 Radar Captured by the Test System - 10 to 12 seconds



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



Measurement Uncertainty Time/Power

Measurement uncertainty - Time - Power	 4% 1.33dB

Traceability

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

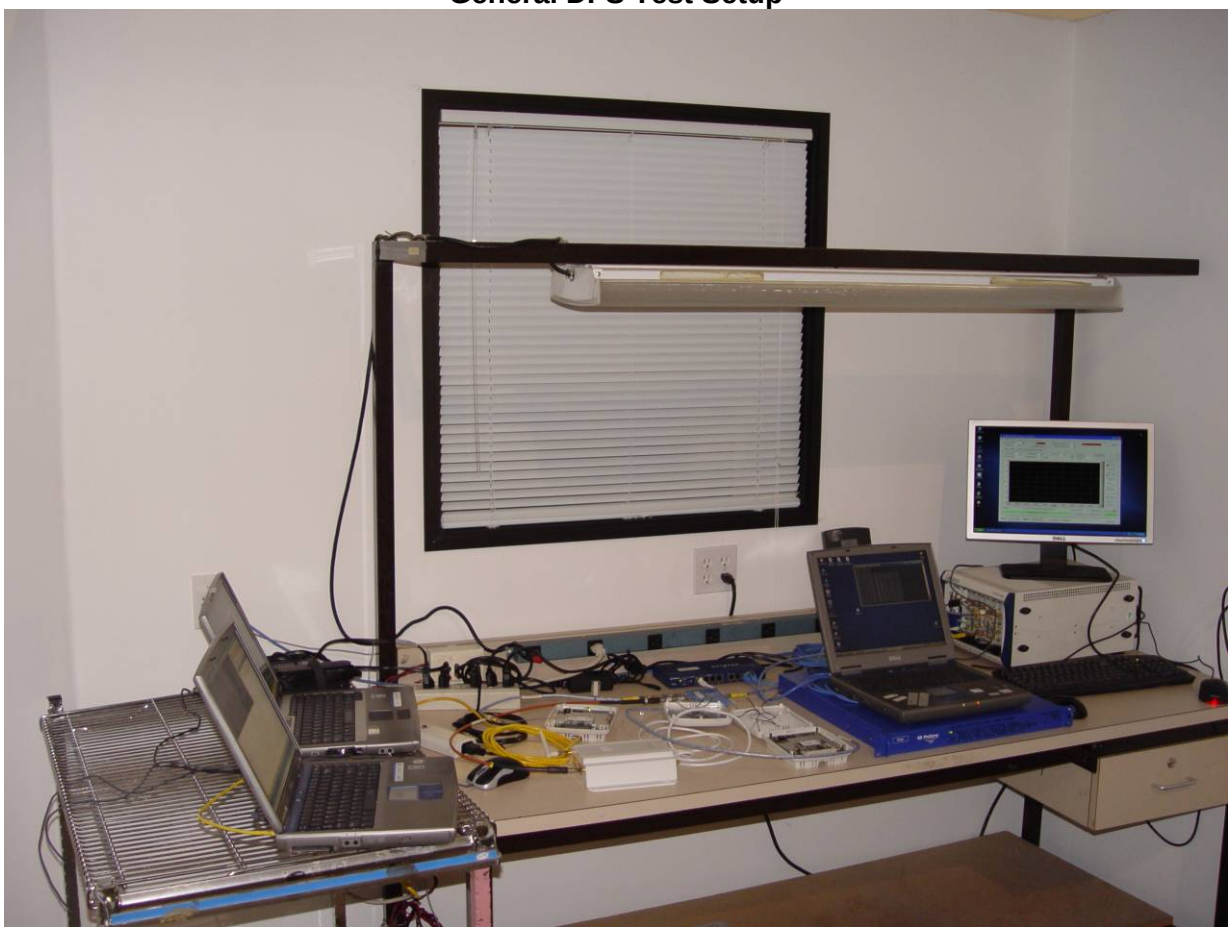
7. PHOTOGRAPHS

7.1. Radiated Emissions > 1GHz

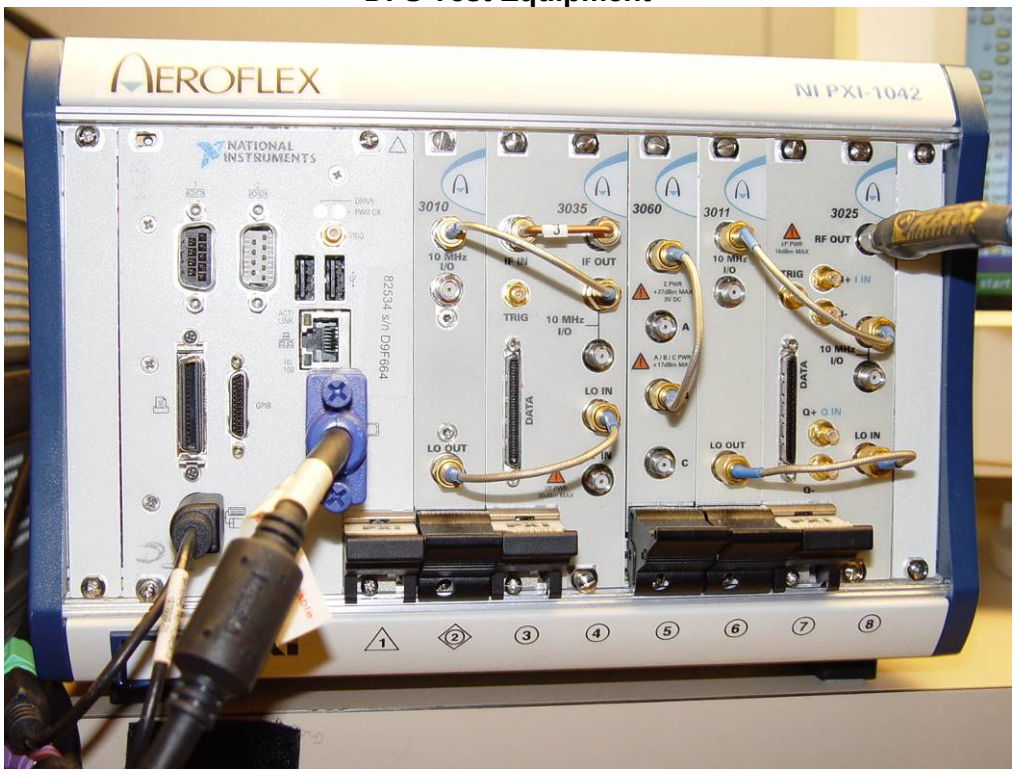
7.2. General Measurement Test Set-Up

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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