Test of Hewlett Packard MRLBB-1003 Wireless Module

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

Test Report Serial No.: HWPD18-U1 Rev B

TEST REPORT

FROM

Test of Hewlett Packard MRLBB-1003 Wireless Module

to

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

Test Report Serial No.: HWPD18-U1 Rev B

.

This report supersedes: HWPD18-U1 Rev A

Applicant:	Hewlett Packard 200 Forest Street MR01-2/M18 Marlborough Massachusetts 01752-3085, USA
Product Function:	Data and Voice Communication
Copy No: pdf	Issue Date: 8th December 2010

This Test Report is Issued Under the Authority of;

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

ACCREDITED
CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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ACCREDITATION, LISTINGS & RECOGNITION

TESTING ACCREDITATION

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard EN ISO/IEC 17025. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

ilac-MRA

A2LA World Class Accreditation

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 8 January 2009*).

Presented this 14th day of April 2010.

President & CEO
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2011

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

RECOGNITION

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

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

**APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement.
Is a recognition agreement under which test lab is accredited to regulatory standards of the APEC member countries.
Phase I - recognition for product testing
Phase II – recognition for both product testing and certification
N/A – Not Applicable

PRODUCT CERTIFICATION

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

United States of America – Telecommunication Certification Body

TCB Identifier – US0159

Industry Canada – Certification Body

CAB Identifier – US0159

DOCUMENT HISTORY

Document History		
Revision	**Date**	**Comments**
Draft		
Rev A	30th November 2010	Initial release.
Rev B	8th December 2010	Update to Section 5.1.2 Transmit Output Power, Section "Maximum Permissible Conducted Power V's Antenna Gain" Includes Directional Gain Computation for Smart Antenna Systems

1. TEST RESULT CERTIFICATE

Applicant:	Hewlett Packard 200 Forest Street MR01-2/M18 Marlborough Massachusetts 01752-3085, USA	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
EUT:	802.11a/b/g/n WLAN Radio Module	Tel:	+1 925 462 0304
Model:	MRLBB-1003	Fax:	+1 925 462 0306
S/N:	NC2RA270008DC01		
Test Date(s):	17th to 21st November 2010	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
TEST CERTIFICATE #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs,

Gordon Hurst
President & CEO MiCOM Labs, Inc.

2. REFERENCES AND MEASUREMENT UNCERTAINTY

2.1. Normative References

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

2.2. Test and Uncertainty Procedures

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

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

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

3. PRODUCT DETAILS AND TEST CONFIGURATIONS

3.1. Technical Details

Details	Description
Purpose:	Test of the Hewlett Packard 802.11a/b/g/n Wireless Module MRLBB-1003 in the frequency ranges 5150 to 5250 MHz to FCC Part 15.407 and Industry Canada RSS-210 regulations.
Applicant:	Hewlett Packard 200 Forest Street MR01-2/M18 Marlborough Massachusetts 01752-3085, USA
Manufacturer:	As applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	HWPD18-U1
Date EUT received:	11th November 2010
Standard(s) applied:	FCC 47 CFR Part 15.407 & IC RSS-210
Dates of test (from - to):	17th to 21st November 2010
No of Units Tested:	1
Type of Equipment:	Two 802.11a/b/g/n Wireless Access Point, 3x3 Spatial Multiplexing MIMO configuration
Applicants Trade Name:	Hewlett Packard
Model(s):	MRLBB-1003
Module Firmware Release:	V0.1
Test Software:	Atheros Radio Test (ART)
Location for use:	Indoor
Declared Frequency Range(s):	5,150 to 5,250 MHz
Type of Modulation:	Per 802.11 – OFDM
Declared Nominal Output Power: (Average Power)	802.11a: Legacy +14 dBm 802.11n: HT-20 +14 dBm 802.11n: HT-40 +14 dBm
EUT Modes of Operation:	Legacy 802.11a, 802.11n HT-20, HT-40
Transmit/Receive Operation:	Time Division Duplex
Rated Input Voltage and Current:	dc: Nominal: 48V DC (POE)
Operating Temperature Range:	-30 ºC to 50 ºC
ITU Emission Designator:	5150 – 5250 MHz 802.11a 17M1D1D 5150 – 5250 MHz 802.11n HT-20 18M2D1D 5150 – 5250 MHz 802.11n HT-40 36M7D1D
Equipment Dimensions:	30mm x 55mm
Weight:	0.3 oz
Primary function of equipment:	Wireless module for transmitting data and voice

3.2. Scope of Test Program

Program Scope

The scope of the compliance program was to test the Hewlett Packard MRLBB-1003 wireless module, 3x3 Spatial Multiplexing MIMO configurations in the frequency ranges 5150 - 5250 MHz for compliance against FCC 47 CFR Part 15.407 and Industry Canada RSS-210 specifications.

The MRLBB-1003 has U-FL connectors was tested with three antenna types detailed in Section 3.4 “Antenna Details”.

MRLBB-1003 3x3 MIMO Wireless Module

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	802.11a/b/g/n 3x3 Wireless Module	Hewlett Packard	MRLBB-1003	NC2RA270008DC01
Support	Laptop PC	Hewlett Packard		

3.4. Antenna Details

Antenna Type	Manufacturer	Model	Gain (dBi / dBd)	Frequency Range (MHz)
Integral	Hewlett Packard	RNAA-H1 6 x Element MIMO	7.02 dBi	5150 - 5350
External	Hewlett Packard	J9659A Circular 6 x Element MIMO	5.9 dBi	4900 - 5875
External	Hewlett Packard	J9171A 3 x Element MIMO	4.0 dBi	4900 - 5875

Note: initially client stated integral antenna gain was 7.4 dBi. 7.4 dBi is quote in the radiated test results for this antenna, this should now read 7.02 dBi.

3.5. Cabling and I/O Ports

Number and type of I/O ports

Description	Type	Length	Additional Information
Antenna Port	U-F/L	Less than 150mm	Antenna Connection

3.6. Test Configurations

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

Matrix of test configurations

Operational Mode(s) (802.11)	Variant	Data Rates with Highest Power	Frequencies (MHz)
a,n	Legacy	6 MBit/s	5,180 5,200 5,240
	HT-20	6.5 MBit/s (MCS 0)	
	HT-40	13.5 MBit/s (MCS 0)	5,190 5,230

Antenna Test Configurations for Radiated Emissions and Band-Edge

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

Spurious Emission and Band-Edge Test Strategy

11a	11n HT-20	11n HT-40
SE 5180	SE 5180	SE 5190
SE 5200	SE 5200	
SE 5240	SE 5240	SE 5230
BE 5150	BE 5150	BE 5150
Pk 5180	Pk 5180	Pk 5190
Pk 5200	Pk 5200	
Pk 5240	Pk 5240	Pk 5230

KEY:-

SE – Spurious Emissions

BE – Band-Edge

PK - Peak Emission

3.7. Equipment Modifications

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

1. Power Reduction

   Client delivered equipment with a specific power level (target power). Testing Peak Power Spectral Density the power level was reduced by 1 dB in order for the combined measurements (chain a + chain b + chain c) to comply. This effected only 802.11a and 802.11 HT-20 measurements. No power reduction was required for 802.11HT-40.

   Section 5.1.2 Transmit Output Power were corrected for the 1 dB power reduction.

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.	Conducted	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*
	Peak Emissions	IC only		Complies	*5.1.7.2*
	Radiated Band Edge	Band edge results		Complies	*5.1.7.3*
Industry Canada only **RSS-Gen §4.10, §6**	Receiver Radiated Spurious Emissions	Emissions above 1 GHz		Complies	*5.1.7.4*
15.407(b)(6) **15.205(a)** **15.209(a)** **2.2**	Radiated Emissions	Emissions <1 GHz (30M-1 GHz)		[1]Not Tested	*5.1.7.5*
15.407(b)(6) **15.207** **7.2.2**	AC Wireline Conducted Emissions	Conducted Emissions	Conducted	[1]Not Tested	5.1.8

[1] Additional test report *submitted in lieu of testing. Report issued by;*
Bureau Veritas Consumer Products Services (H.K.) Ltd.,
Taoyuan Branch Hsin Chu Laboratory
Report No.: FD990622C09
Date of issue: 11th October 2010

5. TEST RESULTS

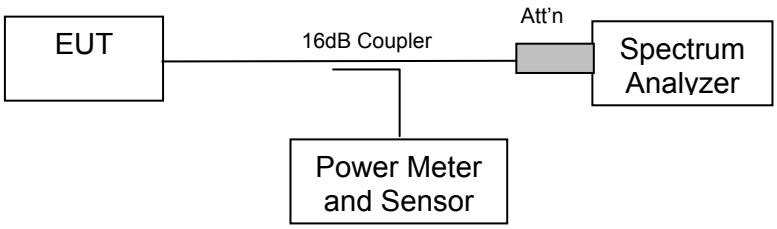
5.1. Device Characteristics

5.1.1. 26 dB and 99 % Bandwidth

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

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

Test Measurement Set up



Measurement set up for 26 dB and 99 % bandwidth test

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

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 a	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (x):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	4 dBi
Applied Voltage:	48.0 Vdc		
Notes 1:			
Notes 2:			

26 dB Bandwidth

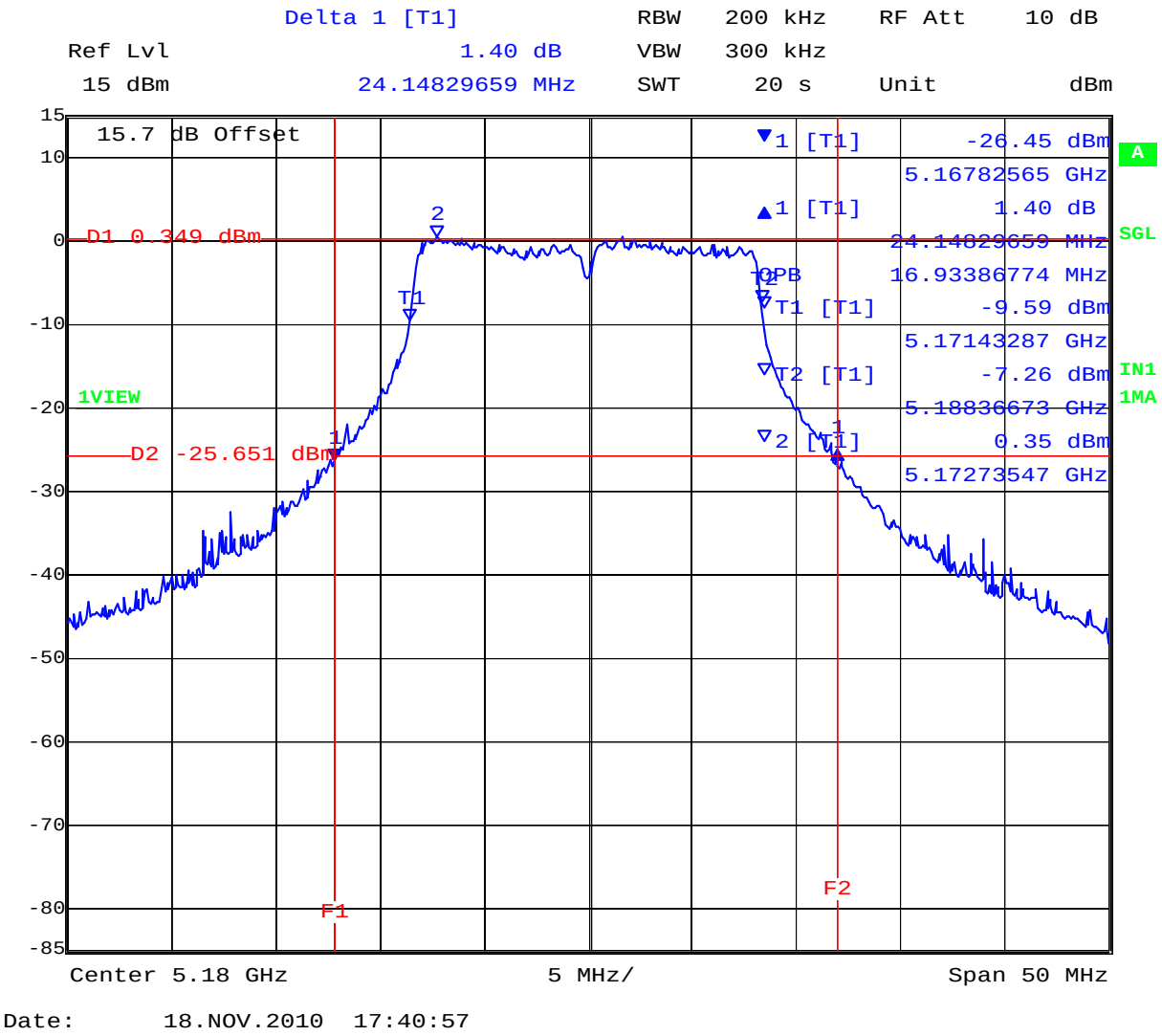
Test Frequency	26 dB Bandwidth MHz				Minimum 6dB Bandwidth Limit		Margin
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5180	24.148000	23.246000	23.647000		500	0.5	-22.746000
5200	24.850000	24.048000	24.950000				-23.548000
5240	24.148000	24.048000	24.048000				-23.548000

99% Bandwidth

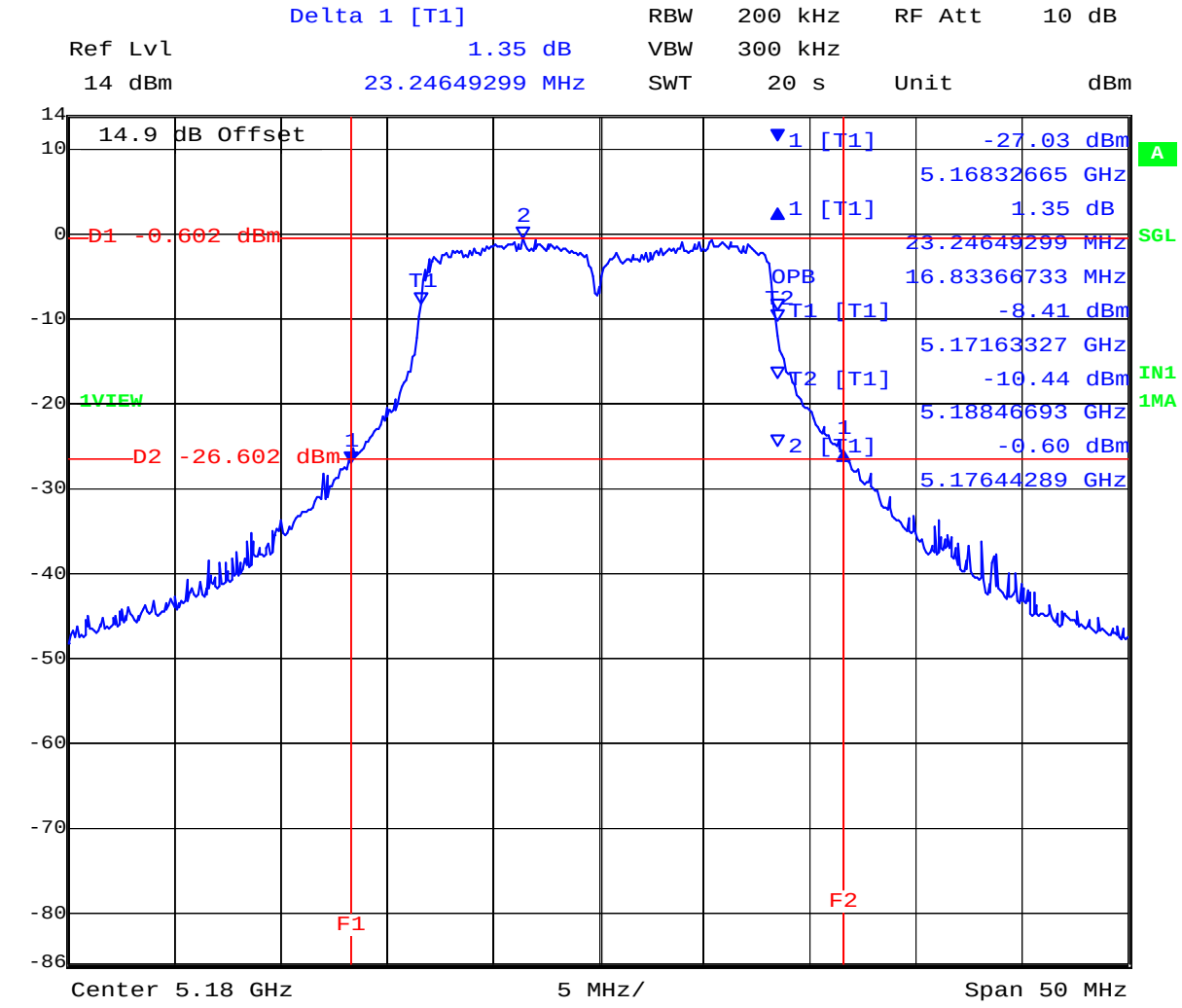
Test Frequency	99 % Bandwidth MHz						
MHz	**a**	**b**	**c**	**d**			
5180	16.934000	16.834000	17.034000				
5200	16.934000	16.934000	17.134000				
5240	16.934000	16.934000	16.934000				

Measurement uncertainty:	±2.81 dB

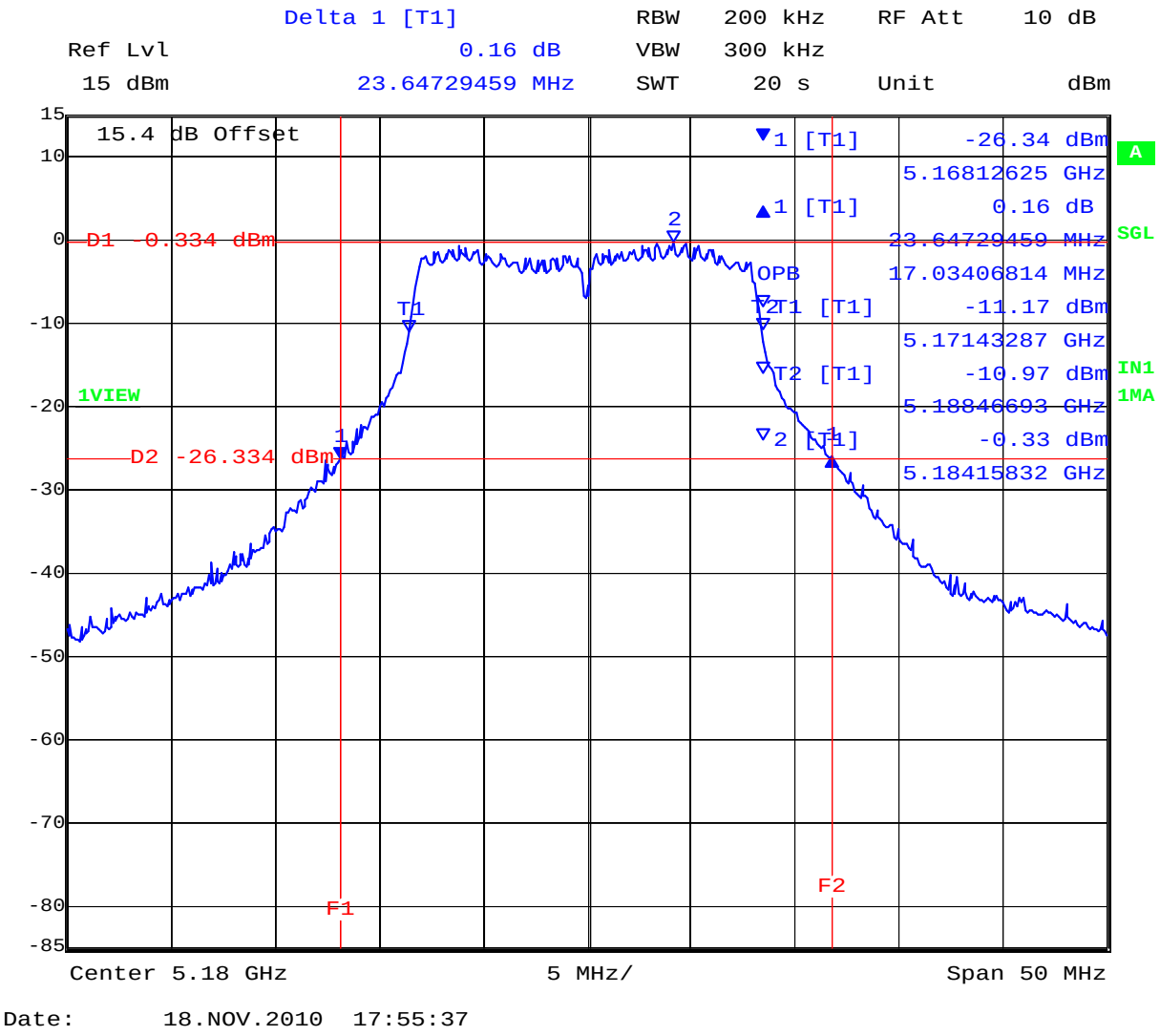
5180 MHz 802.11a Chain a, 26 dB and 99% Bandwidth



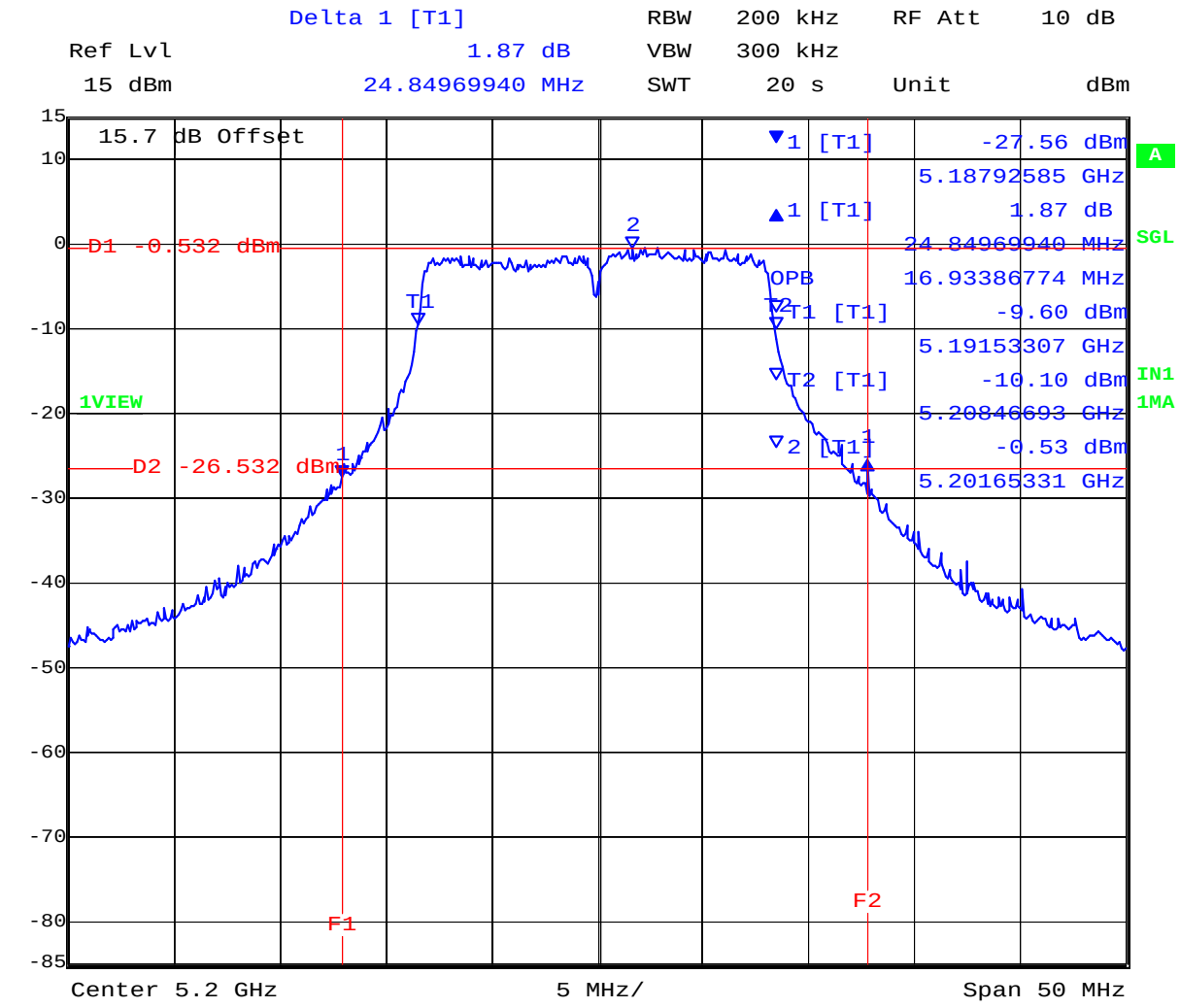
5180 MHz 802.11a Chain b, 26 dB and 99% Bandwidth



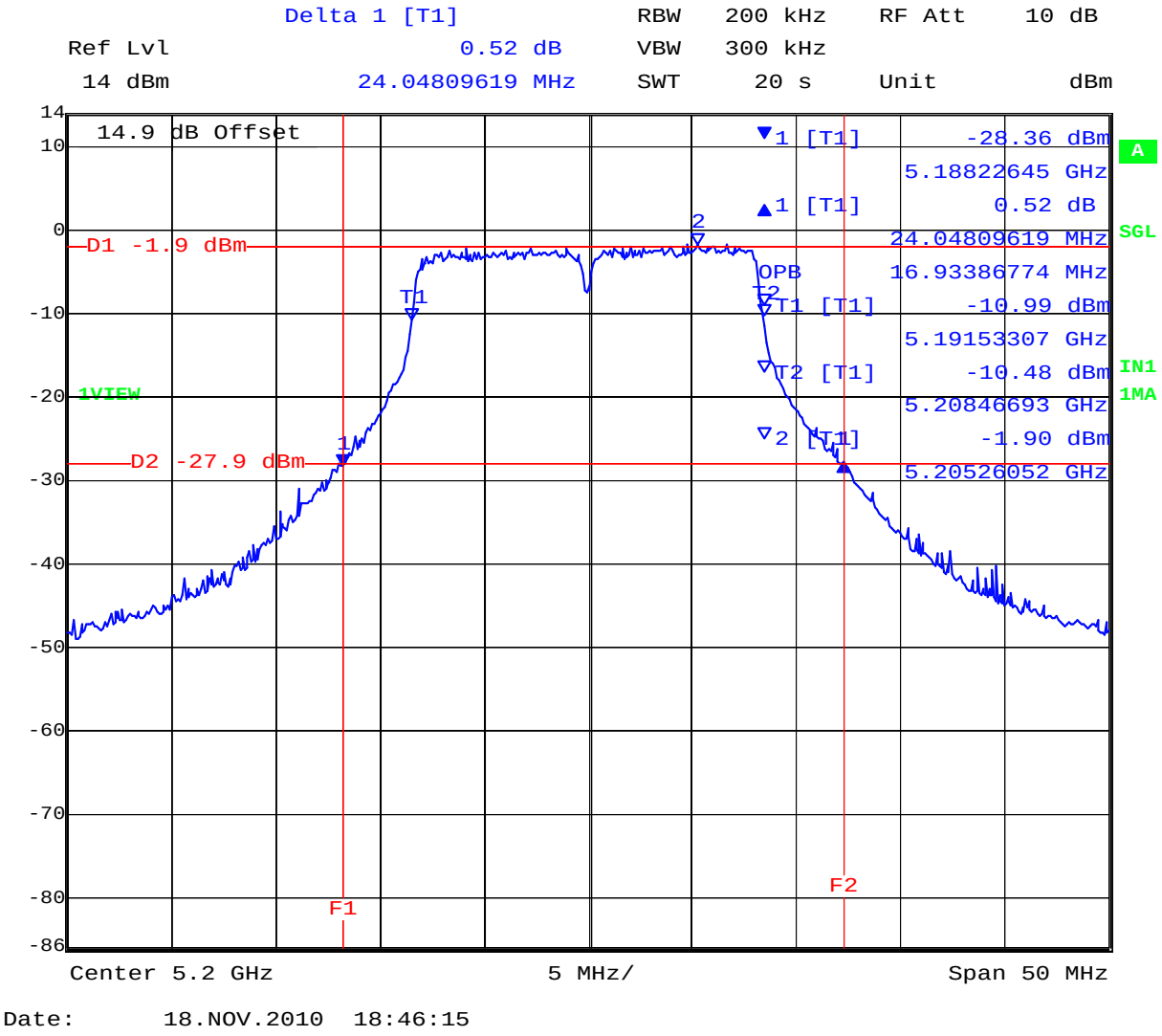
5180 MHz 802.11a Chain c, 26 dB and 99% Bandwidth



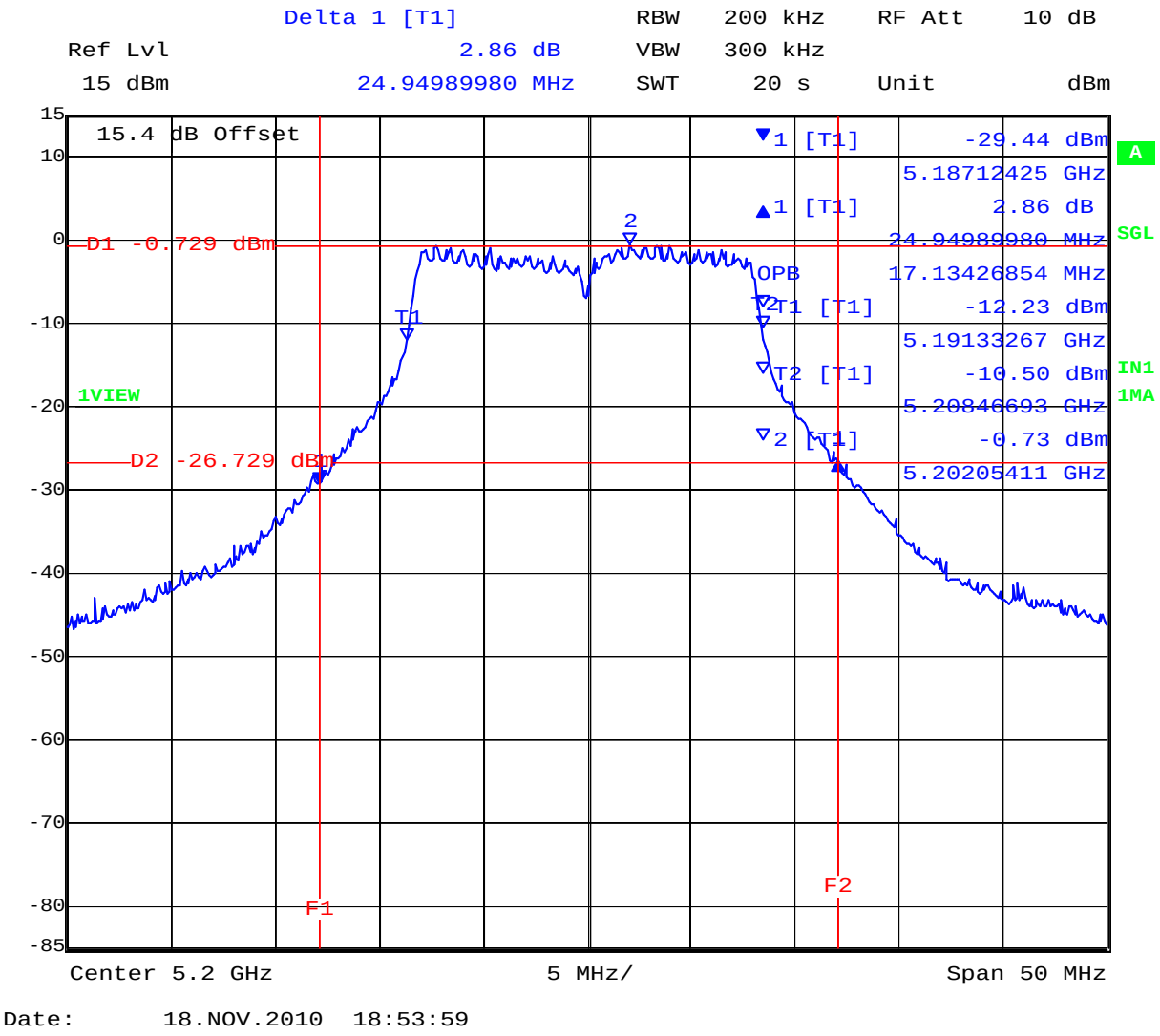
5200 MHz 802.11a Chain a, 26 dB and 99% Bandwidth



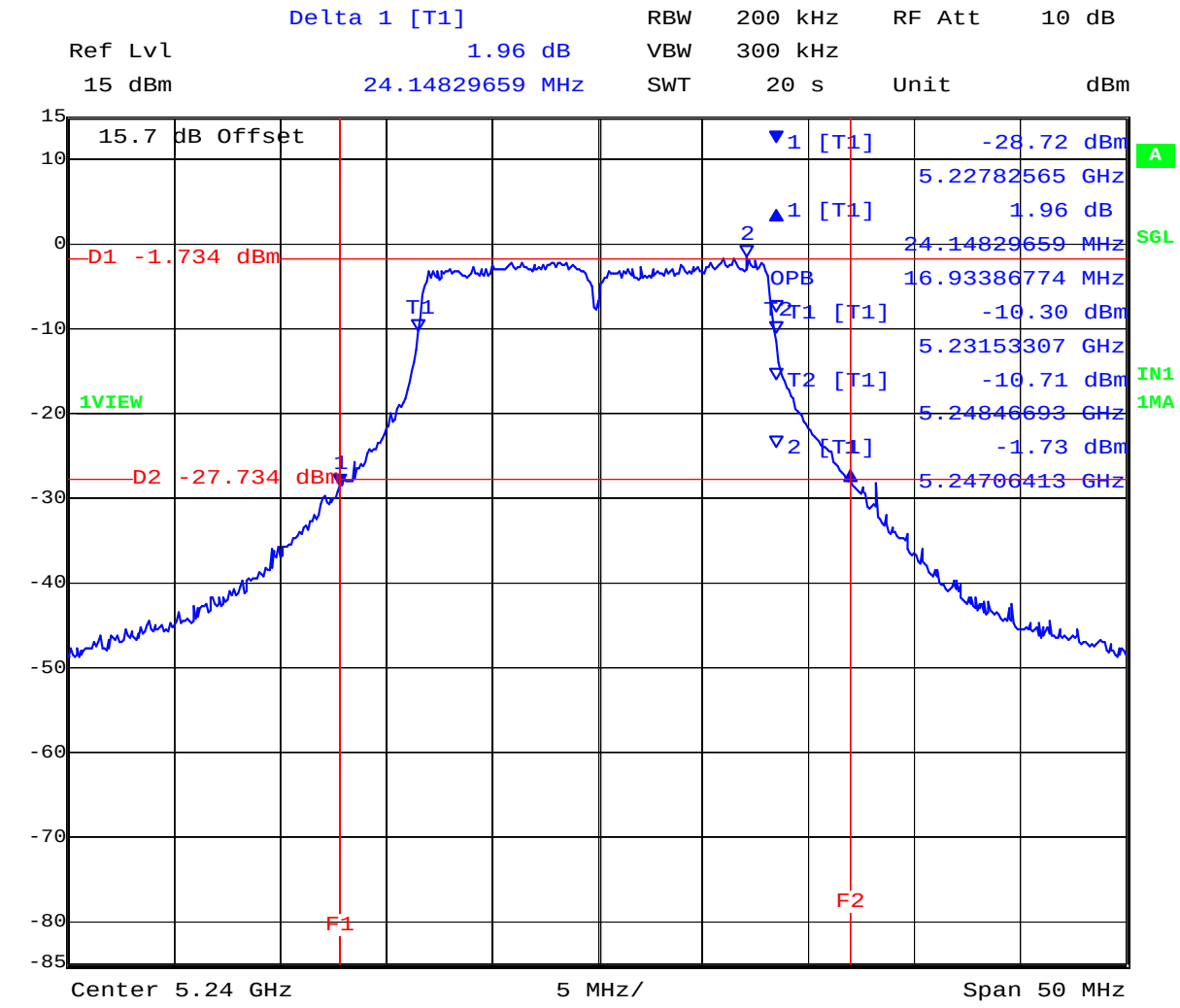
5200 MHz 802.11a Chain b, 26 dB and 99% Bandwidth



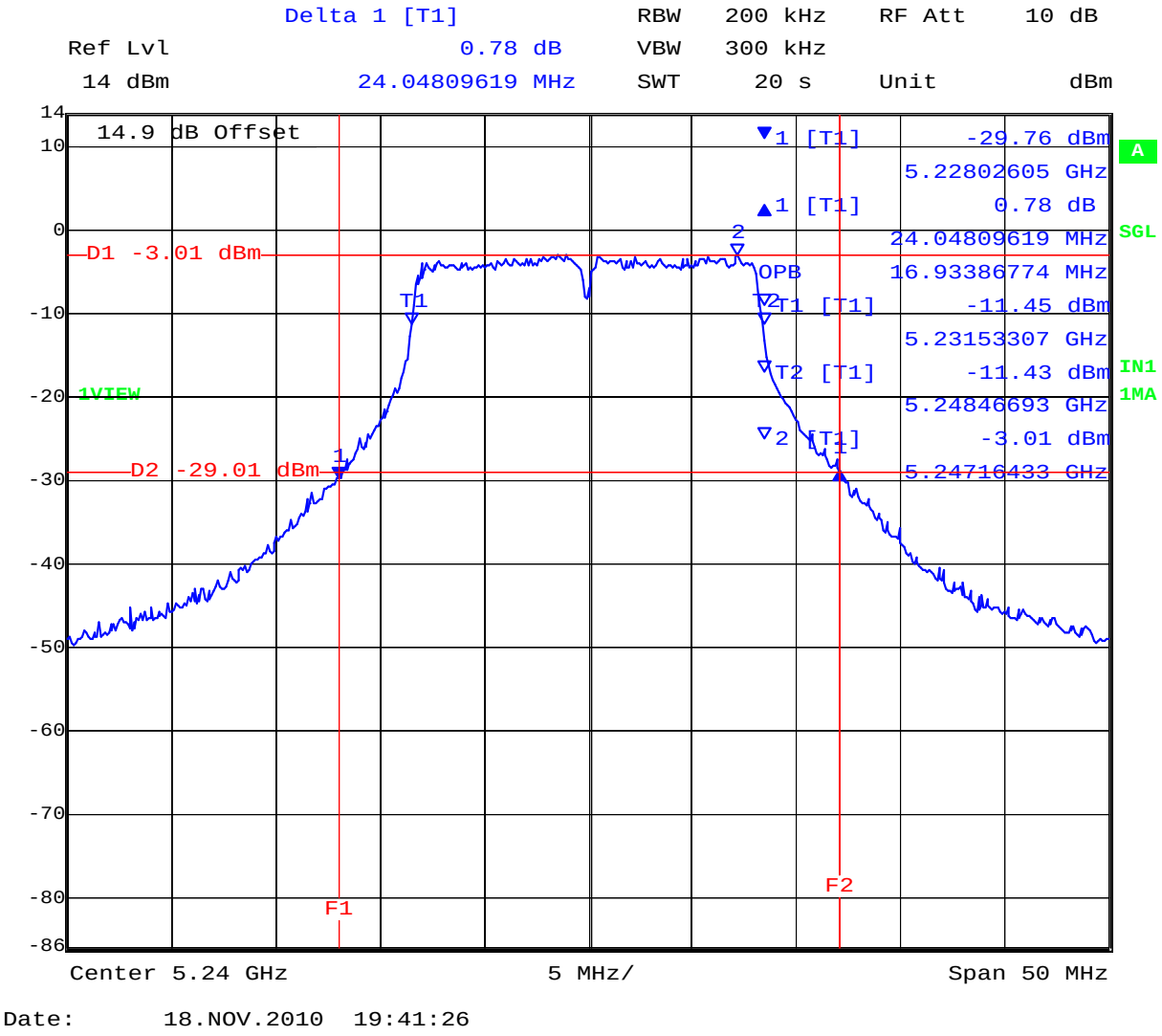
5200 MHz 802.11a Chain c, 26 dB and 99% Bandwidth



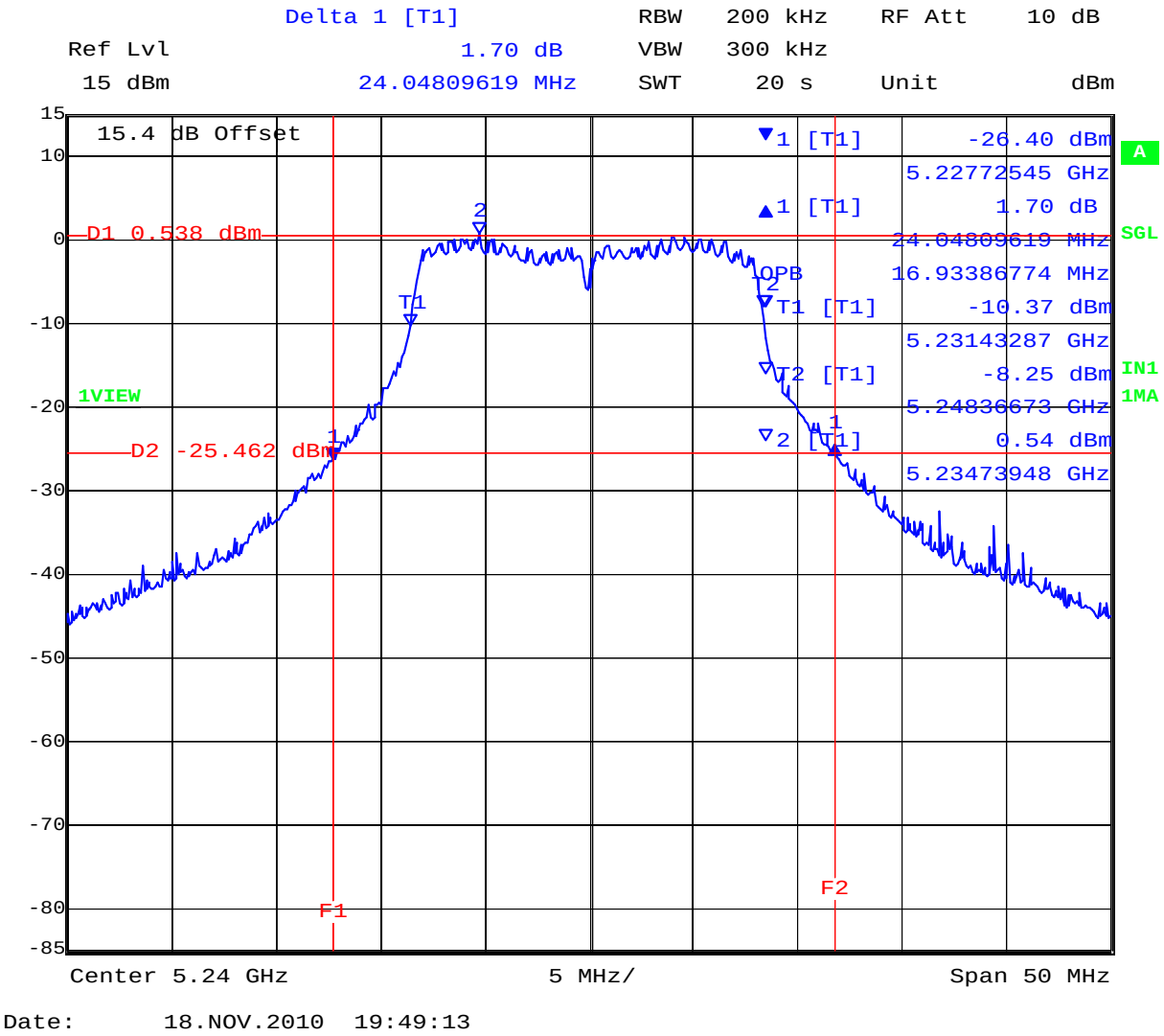
5240 MHz 802.11a Chain a, 26 dB and 99% Bandwidth



5240 MHz 802.11a Chain b, 26 dB and 99% Bandwidth



5240 MHz 802.11a Chain c, 26 dB and 99% Bandwidth



Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 n HT-20	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (x):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	4 dBi
Applied Voltage:	48.0 Vdc		
Notes 1:			
Notes 2:			

26 dB Bandwidth

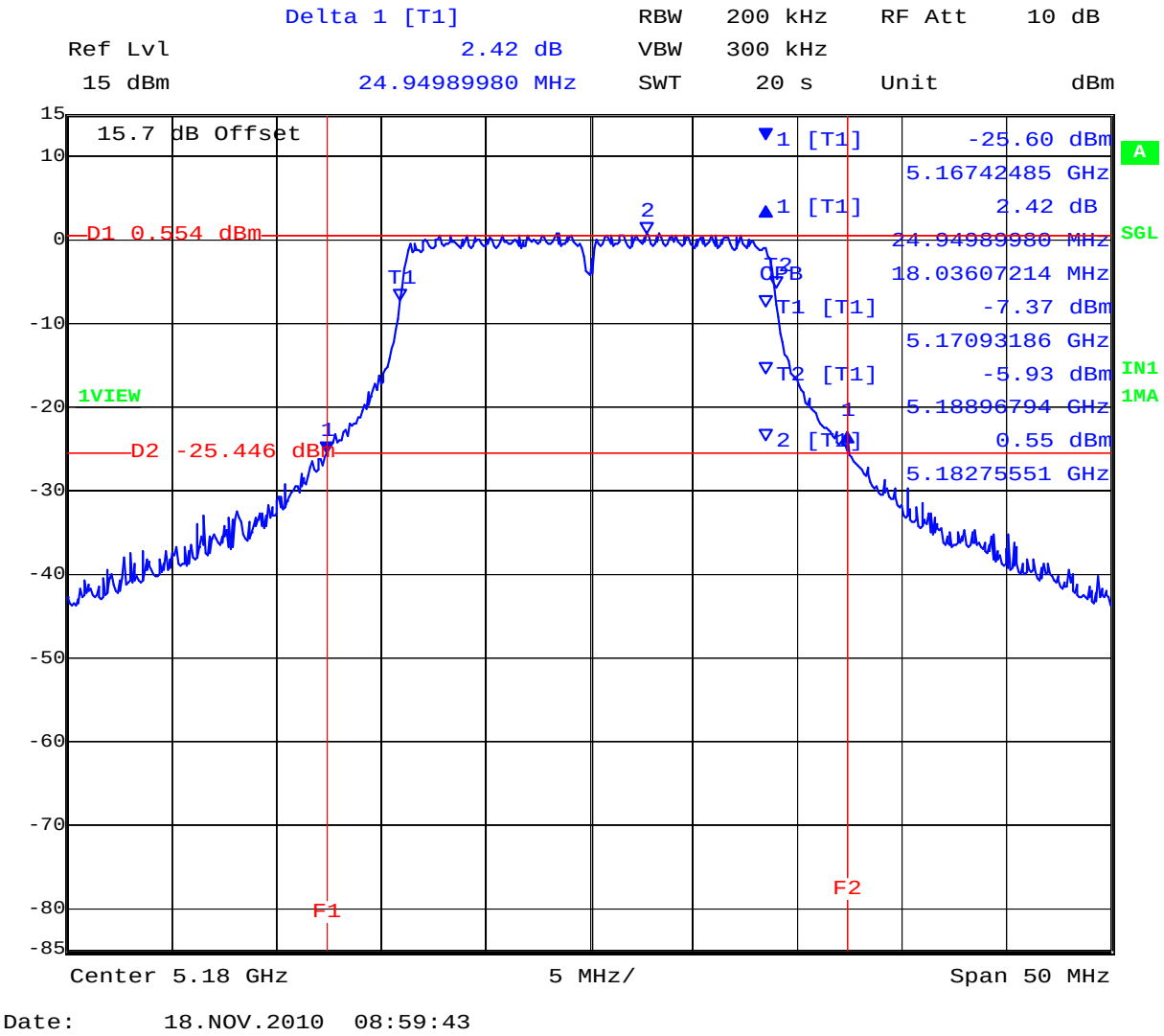
Test Frequency	26 dB Bandwidth MHz				Minimum 6dB Bandwidth Limit		Margin
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5180	24.950000	24.950000	24.850000		500	0.5	-24.350000
5200	24.850000	24.649000	25.351000				-24.149000
5240	24.549000	24.248000	24.950000				-23.748000

99% Bandwidth

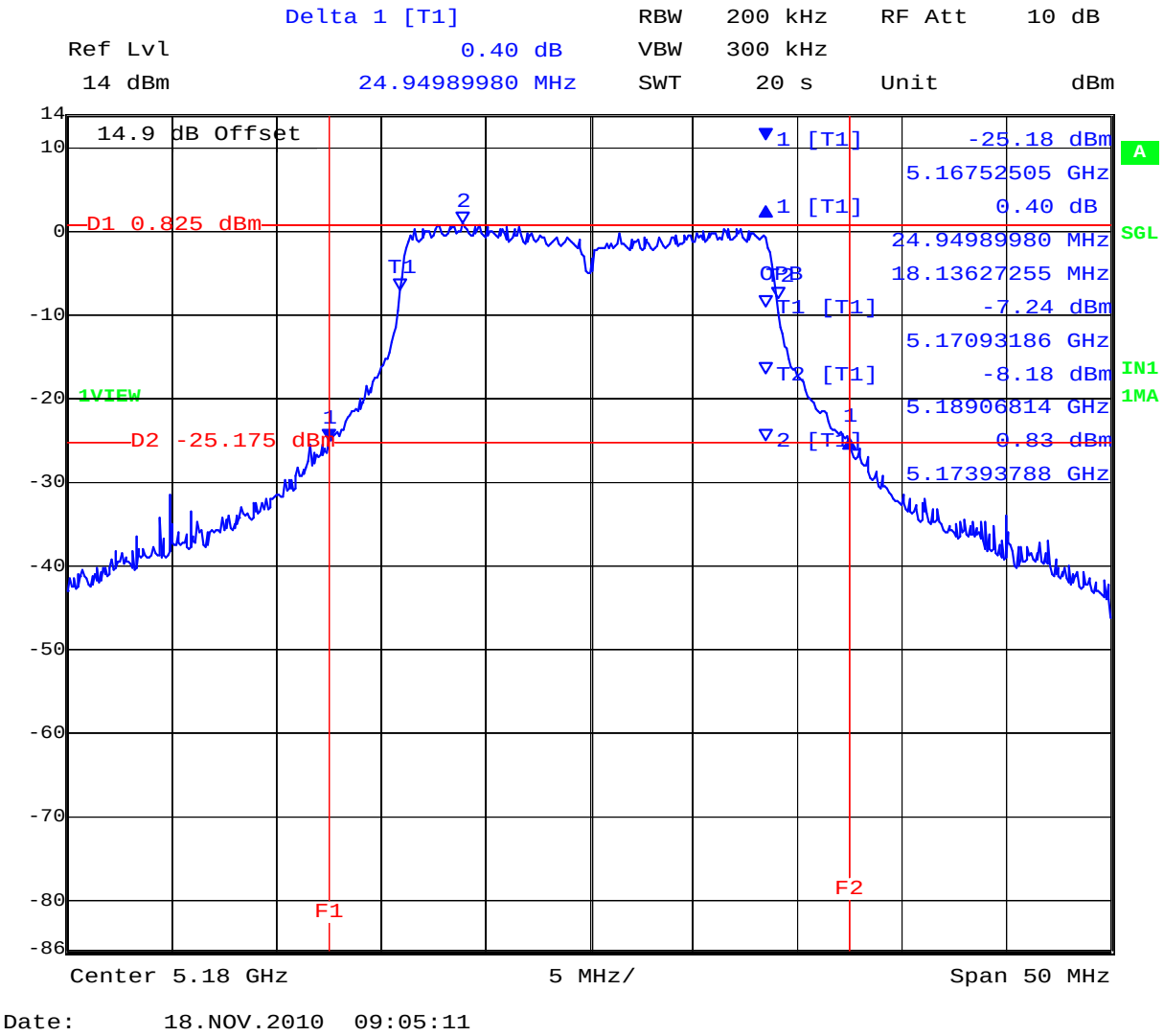
Test Frequency	99 % Bandwidth MHz						
MHz	**a**	**b**	**c**	**d**			
5180	18.036000	18.136000	18.136000				
5200	18.136000	18.136000	18.236000				
5240	18.036000	18.036000	18.236000				

Measurement uncertainty:	±2.81 dB

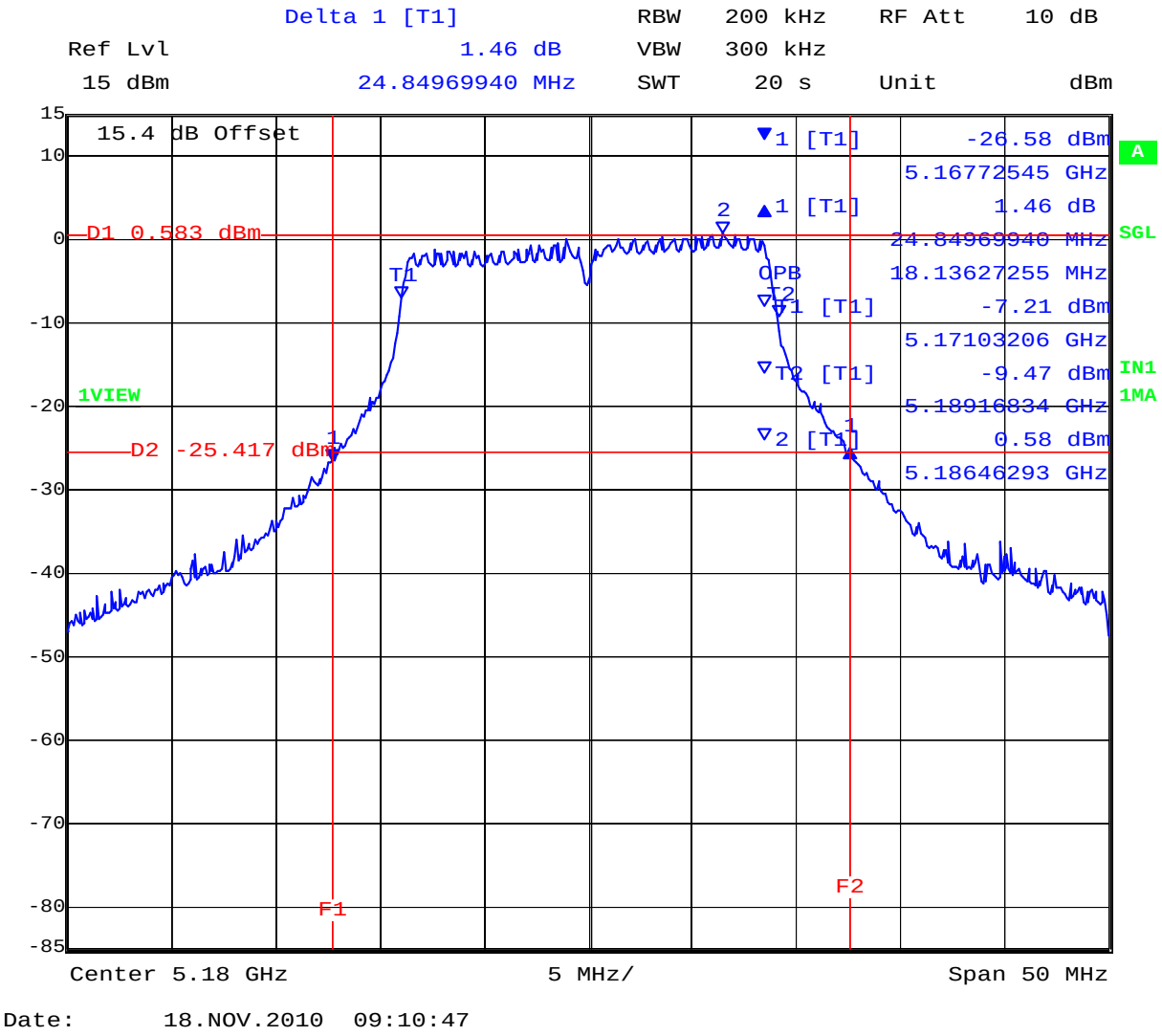
5180 MHz 802.11HT-20 Chain a, 26 dB and 99% Bandwidth



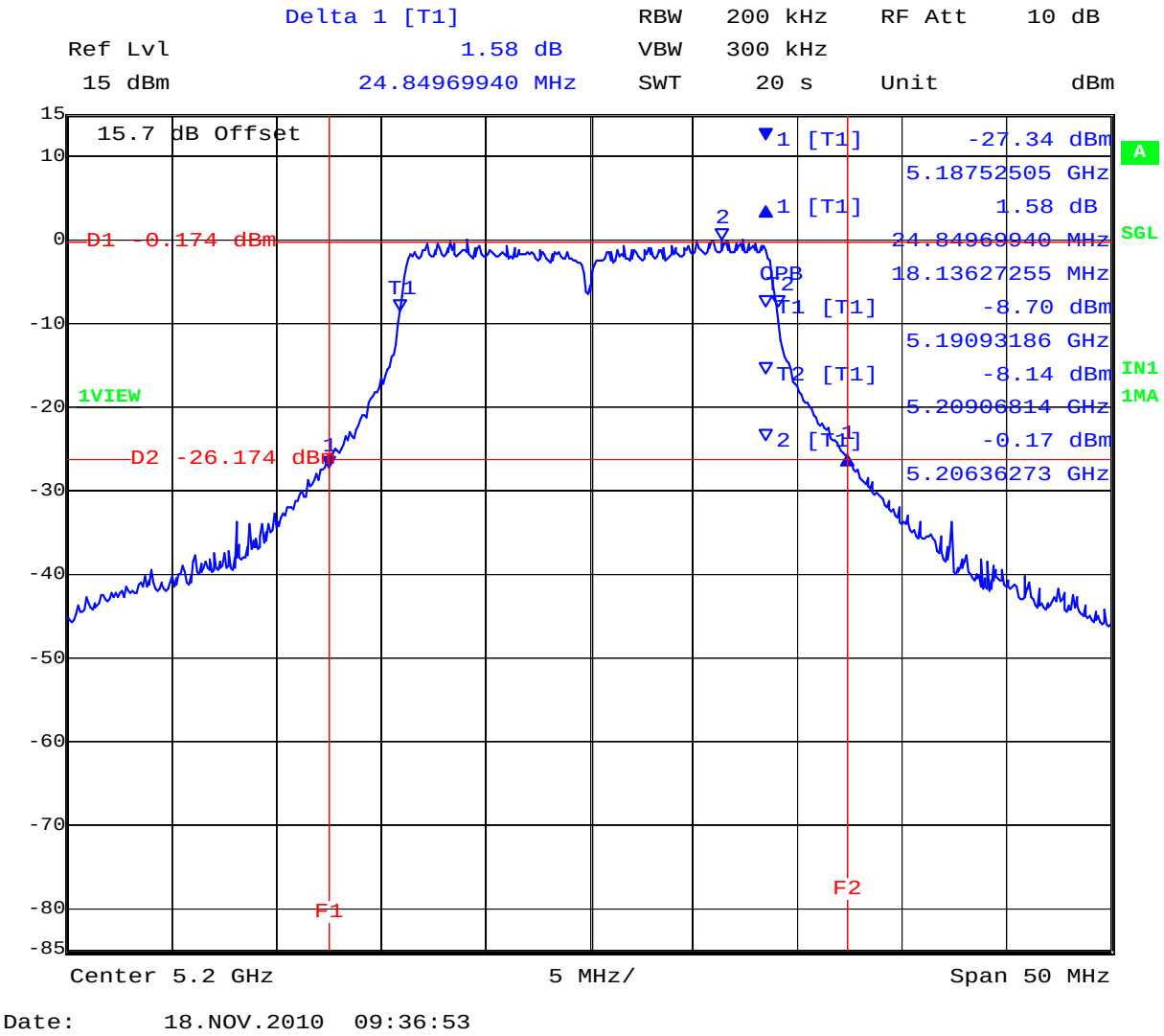
5180 MHz 802.11HT-20 Chain b, 26 dB and 99% Bandwidth



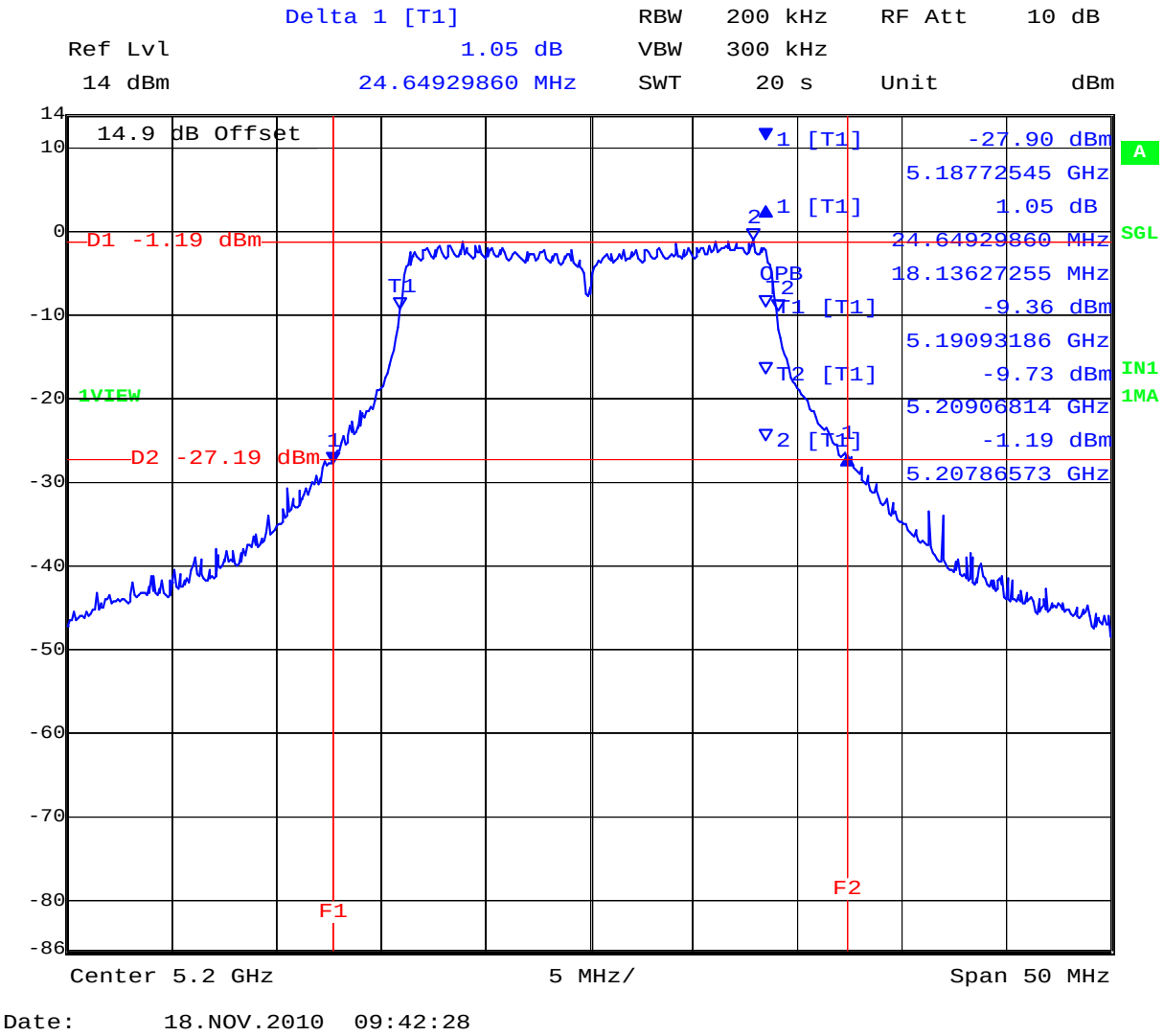
5180 MHz 802.11HT-20 Chain c, 26 dB and 99% Bandwidth



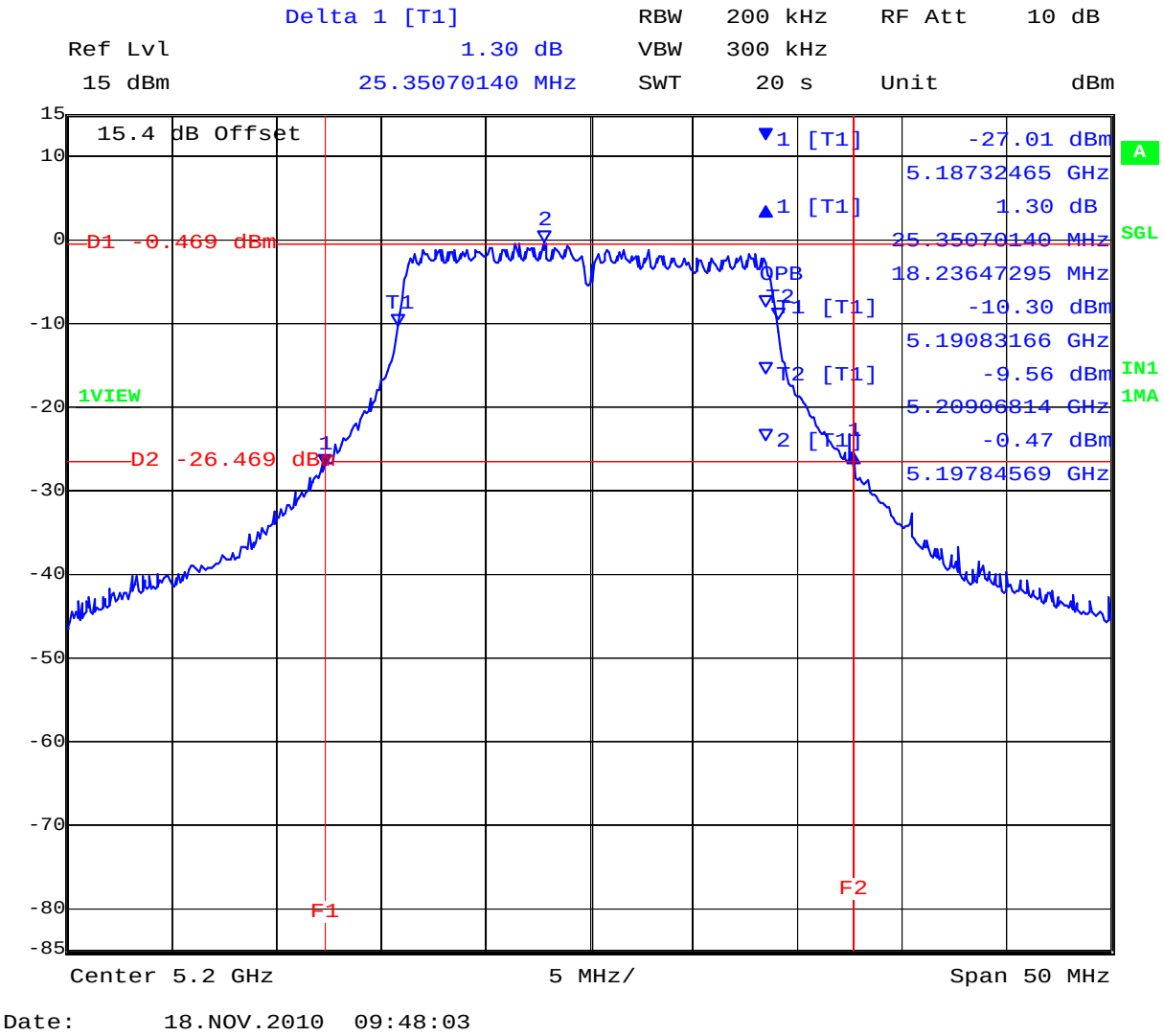
5200 MHz 802.11HT-20 Chain a, 26 dB and 99% Bandwidth



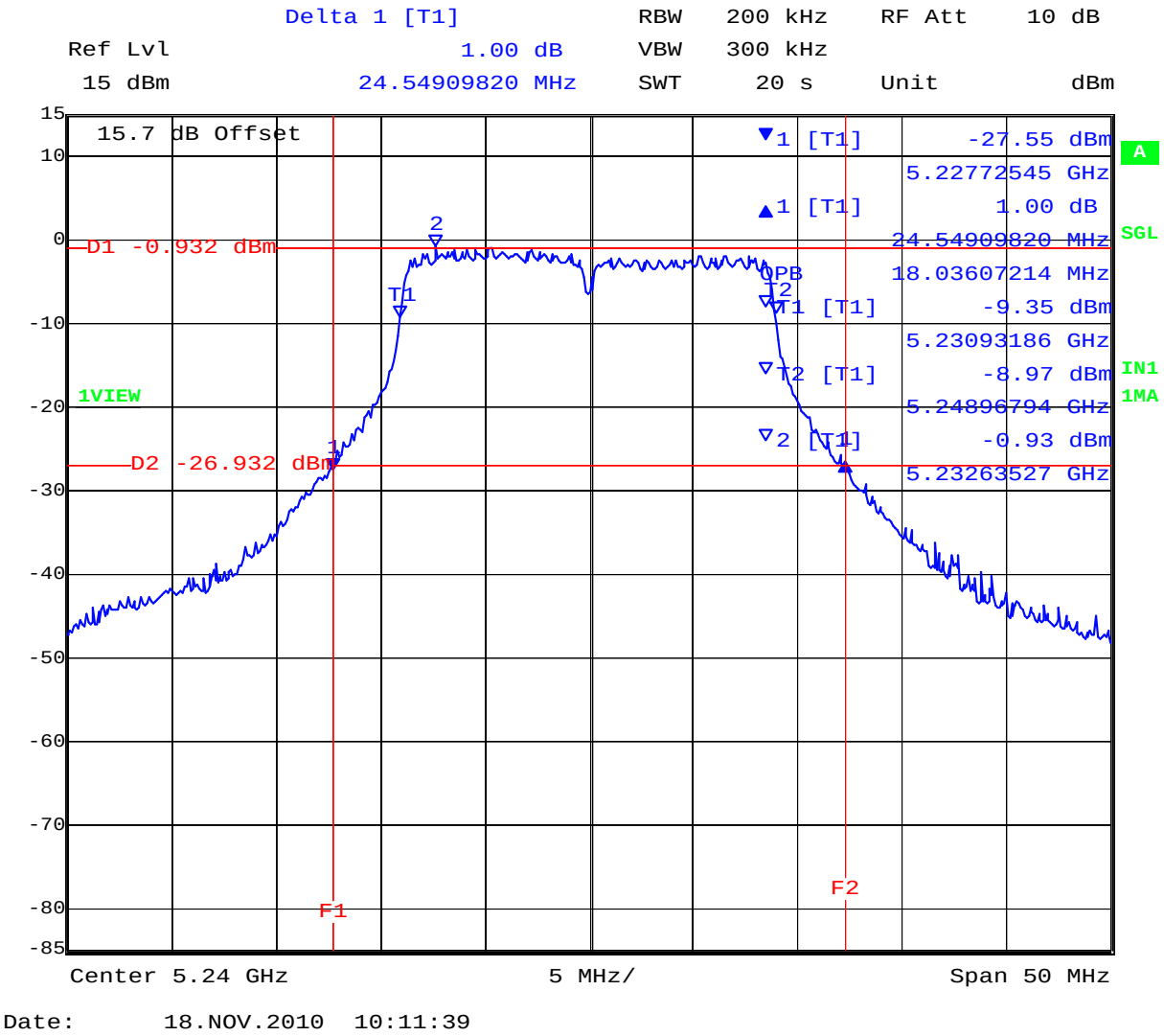
5200 MHz 802.11HT-20 Chain b, 26 dB and 99% Bandwidth



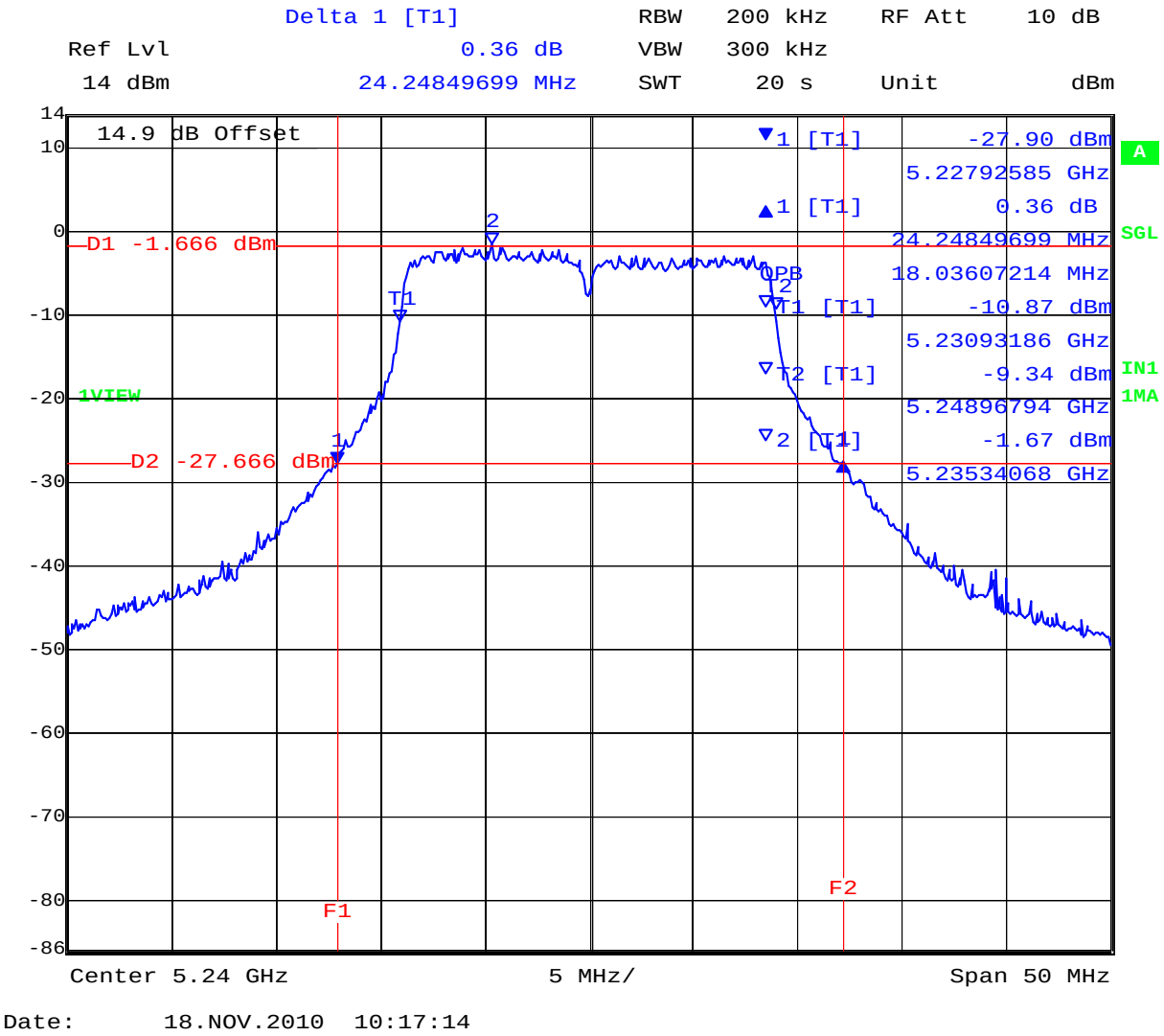
5200 MHz 802.11HT-20 Chain c, 26 dB and 99% Bandwidth



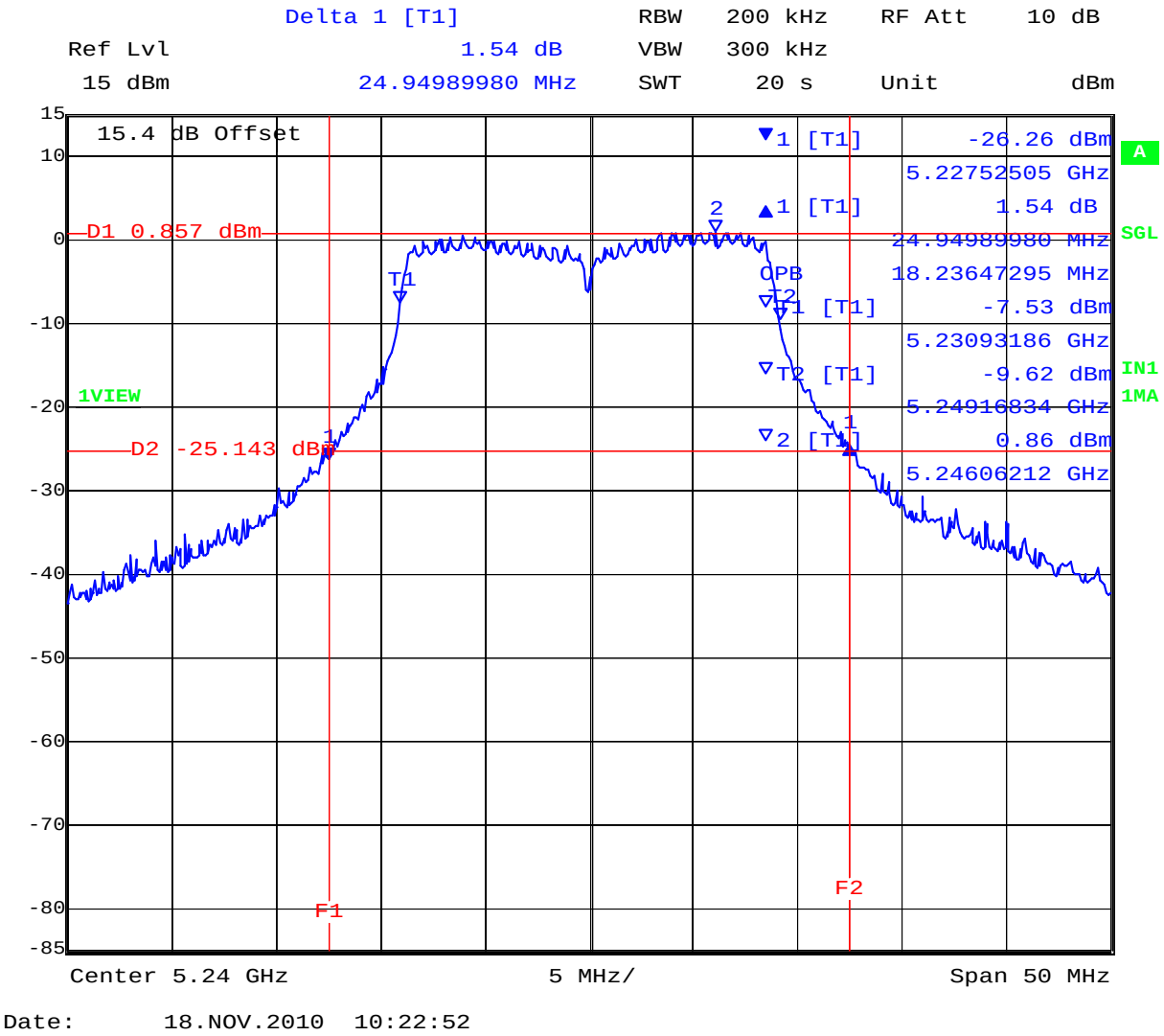
5240 MHz 802.11HT-20 Chain a, 26 dB and 99% Bandwidth



5240 MHz 802.11HT-20 Chain b, 26 dB and 99% Bandwidth



5240 MHz 802.11HT-20 Chain c, 26 dB and 99% Bandwidth



Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11 n HT-40	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (x):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	4 dBi
Applied Voltage:	48.0 Vdc		
Notes 1:			
Notes 2:			

26 dB Bandwidth

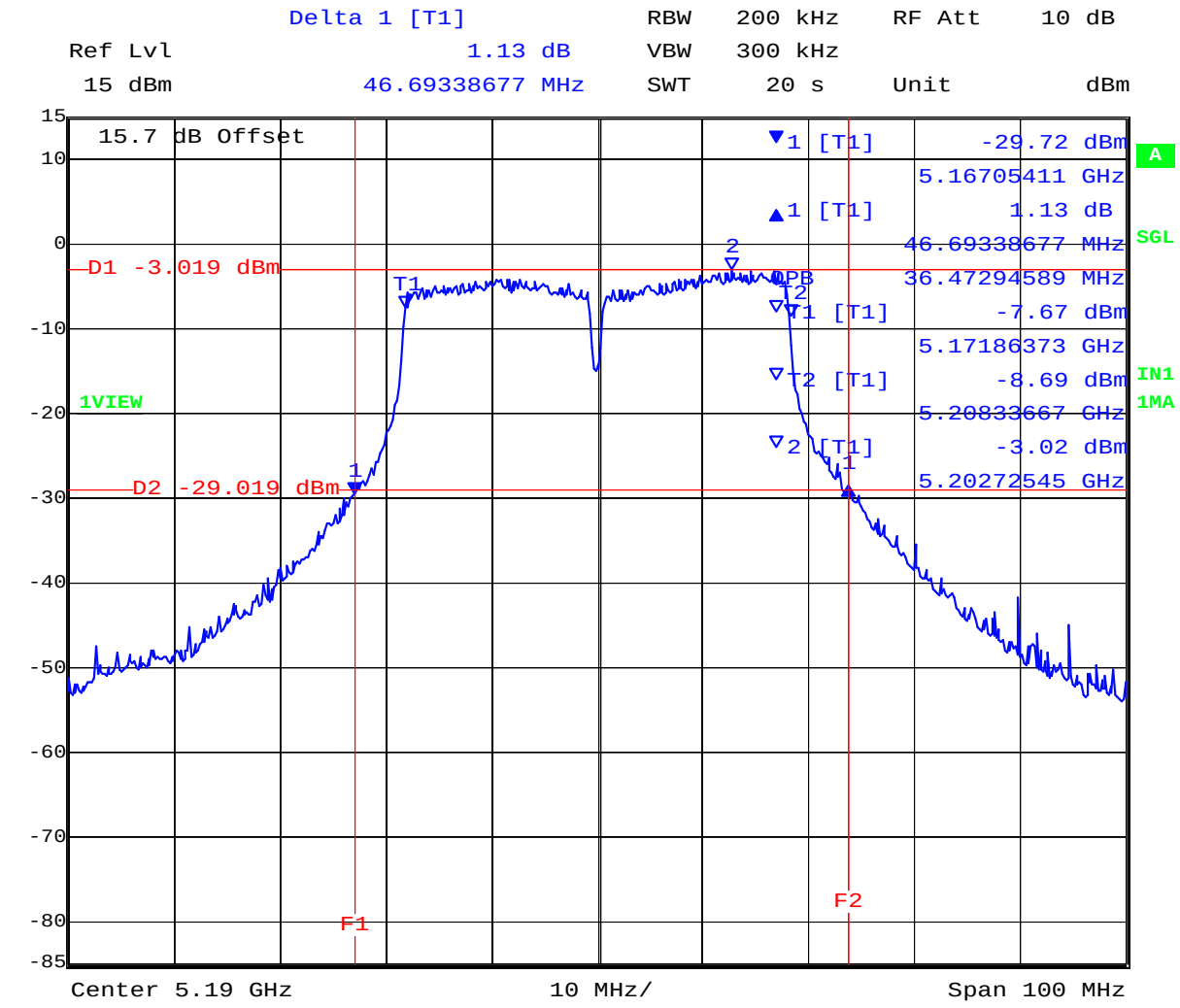
Test Frequency	26 dB Bandwidth MHz				Minimum 6dB Bandwidth Limit		Margin
MHz	**a**	**b**	**c**	**d**	**kHz**	**MHz**	**MHz**
5190	46.693000	47.295000	47.094000		500	0.5	-46.193000
5230	47.695000	46.693000	46.894000				-46.193000

99% Bandwidth

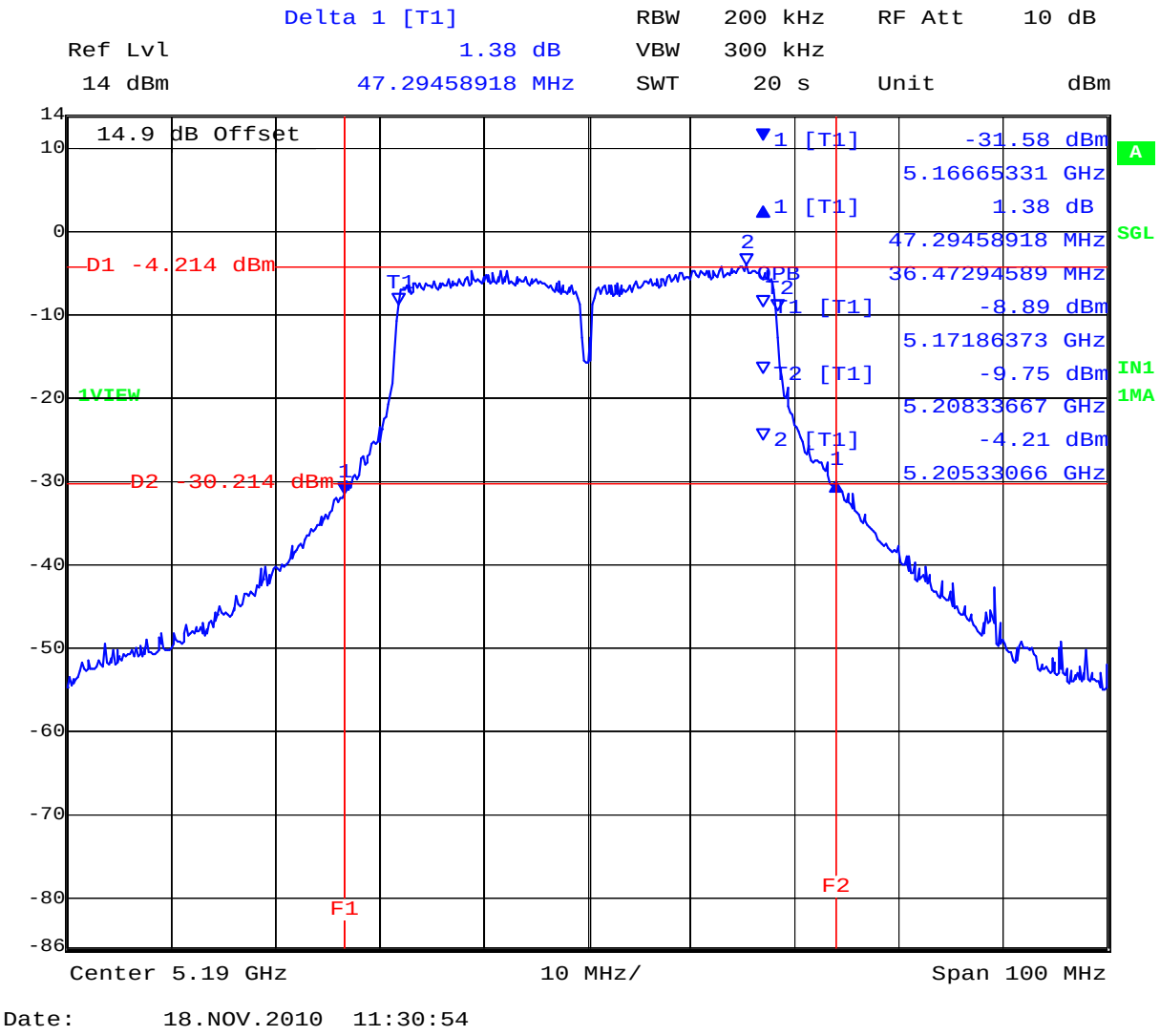
Test Frequency	99 % Bandwidth MHz						
MHz	**a**	**b**	**c**	**d**			
5190	36.473000	36.473000	36.673000				
5230	36.673000	36.473000	36.473000				

Measurement uncertainty:	±2.81 dB

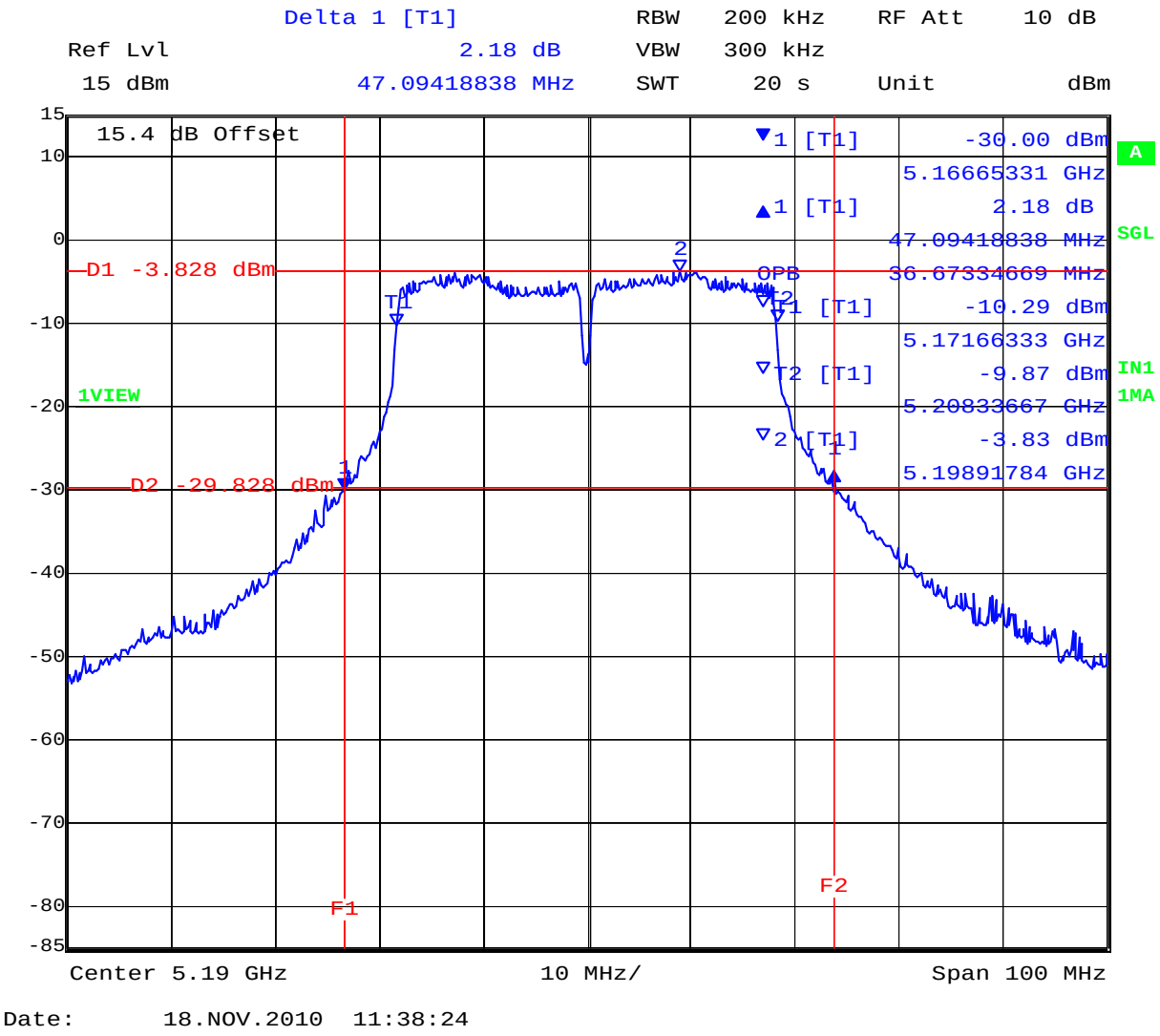
5190 MHz 802.11HT-40 Chain a, 26 dB and 99% Bandwidth



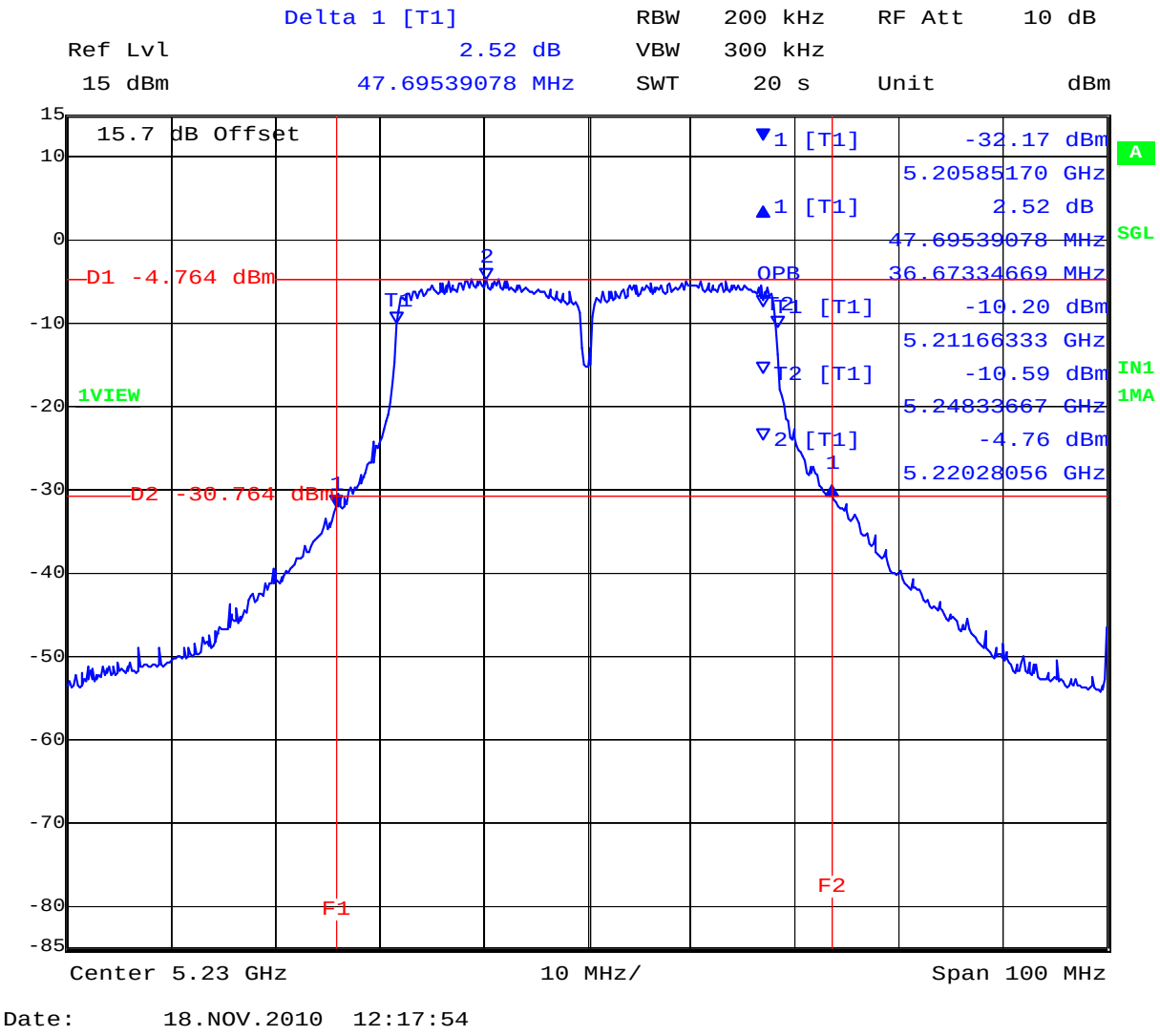
5190 MHz 802.11HT-40 Chain b, 26 dB and 99% Bandwidth



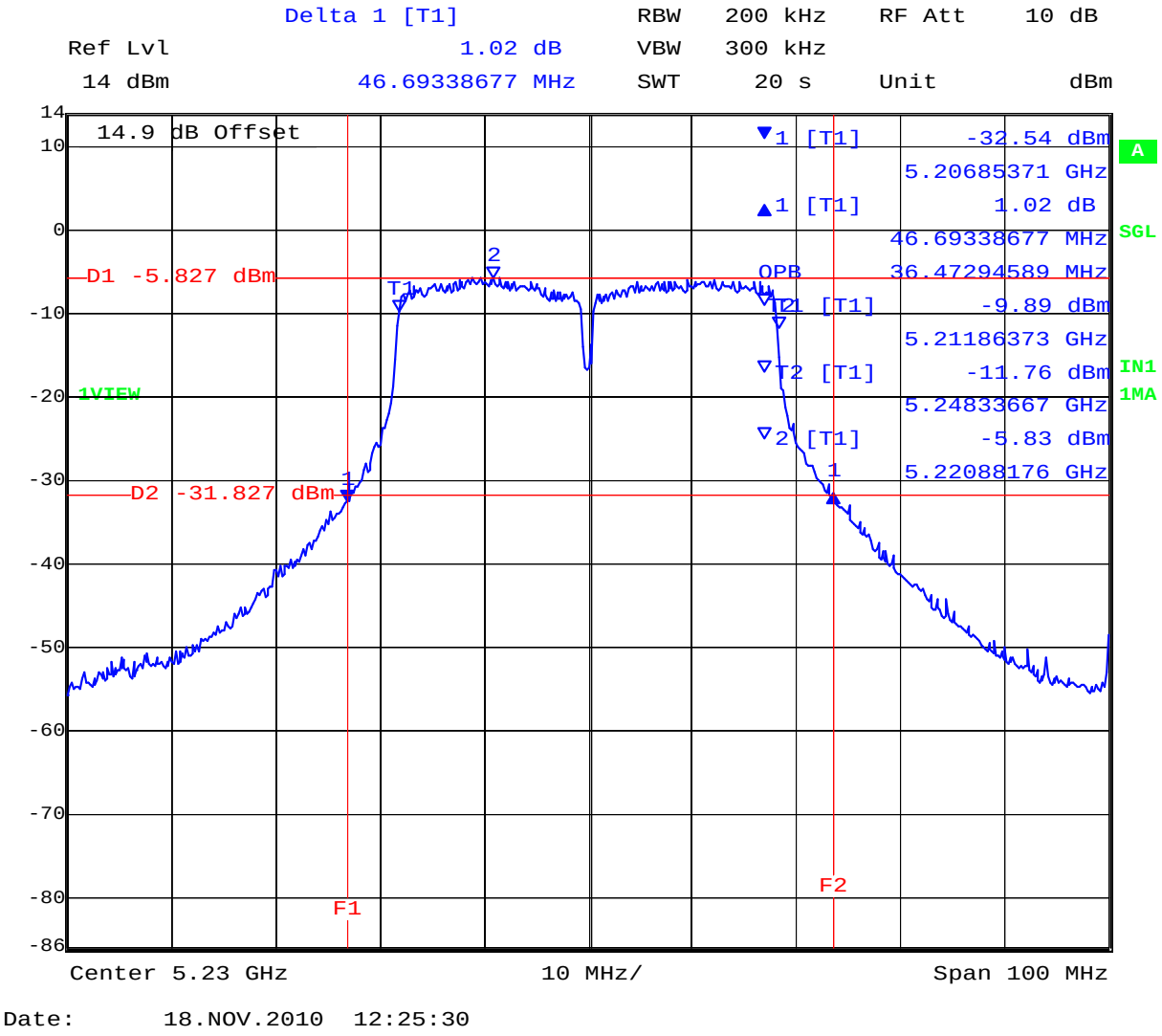
5190 MHz 802.11HT-40 Chain c, 26 dB and 99% Bandwidth



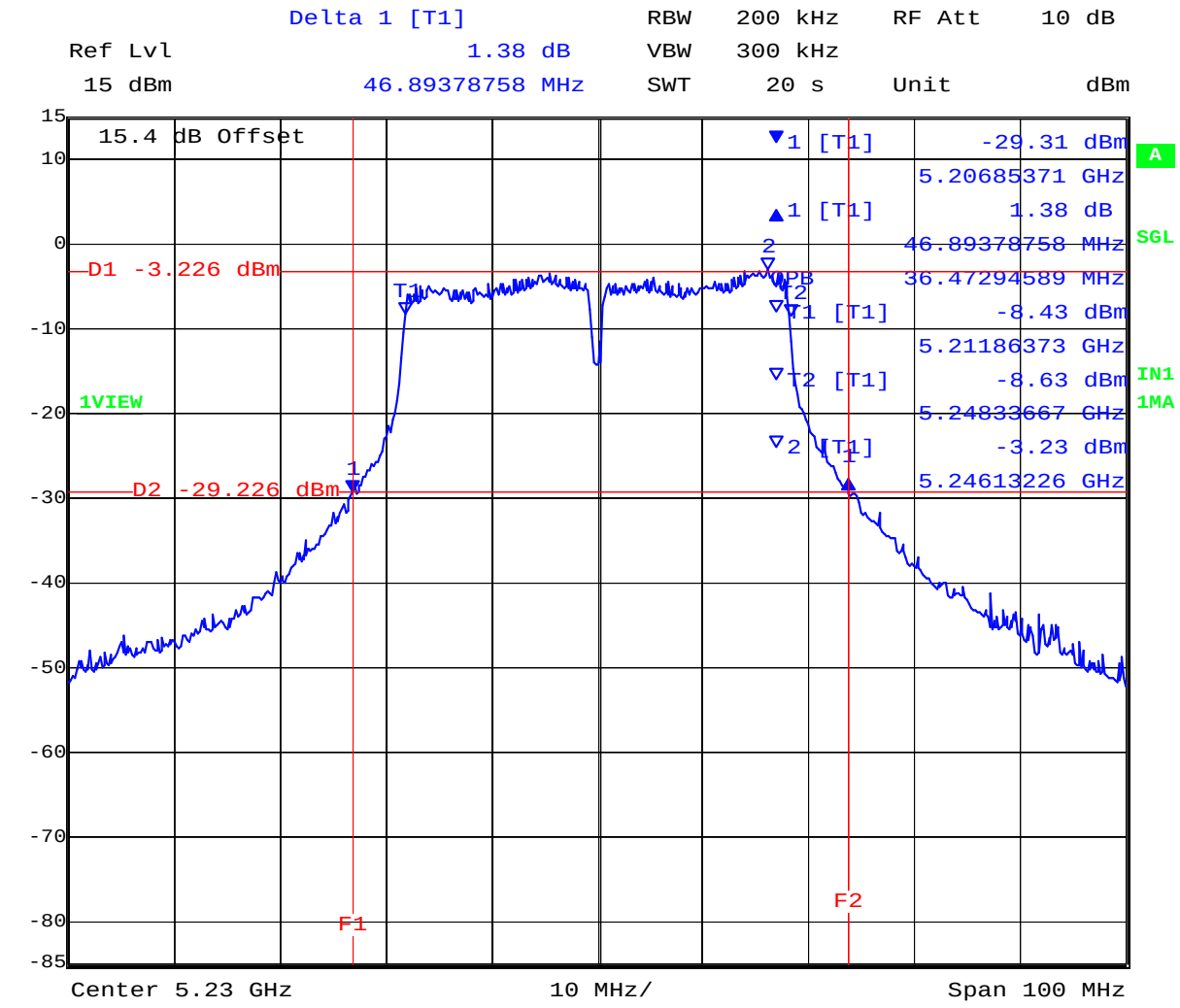
5230 MHz 802.11HT-40 Chain a, 26 dB and 99% Bandwidth



5230 MHz 802.11HT-40 Chain b, 26 dB and 99% Bandwidth



5230 MHz 802.11HT-40 Chain c, 26 dB and 99% Bandwidth



Specification

Limits

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

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

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

Industry Canada RSS-Gen 4.4

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

Laboratory Measurement Uncertainty for Spectrum Measurement

Measurement uncertainty	±2.81 dB

Traceability

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

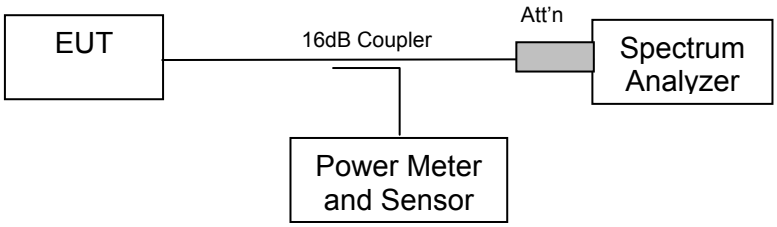
5.1.2. Transmit Output Power

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

Test Procedure

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

Test Measurement Set up



Measurement set up for Transmitter Output Power

Maximum Transmit Power, FCC Limits

Limit 5150 – 5250 MHz: Lesser of 50 mW (+17dBm) or 4 + 10 Log (B) dBm

Mode	Frequency Range (MHz)	Maximum 26 dB Bandwidth (MHz)	4 + 10 Log (B) (dBm)	Limit (dBm)
a	5150 – 5250	24.95	+17.97	+17.00
HT-20		25.35	+18.04	+17.00
HT-40		47.70	+20.78	+17.00

Maximum Conducted Power Industry Canada Limits

Limit 5150 – 5250 MHz: Lesser of 200 mW (+23 dBm) or 10 + 10 Log (B) dBm

Mode	Frequency Range (MHz)	Maximum 99% Bandwidth (MHz)	10 + 10 Log (B) (dBm)	EIRP Limit (dBm)
a	5150 – 5250	24.95	+23.97	+23.00
HT-20		25.35	+24.04	+23.00
HT-40		47.70	+26.78	+23.00

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%
Temperature: Ambient

Test Conditions:	15.407 (a)(1)	**Rel. Humidity (%):**	35	to	42
Variant:	802.11 a	**Ambient Temp. (ºC):**	19	to	22
TPC:	HIGH	**Pressure (mBars):**	998	to	1003
Modulation:	ON	**Duty Cycle (x):**	100		
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	4 dBi		
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Test Frequency	Measured Peak Power RF Port (dBm)				Total Power (dBm)		Limit	Margin
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
5180	9.64	8.94	9.05	--	13.55	--	17.00	-3.45
5200	9.09	8.32	9.00	--	13.29	--	17.00	-3.71
5240	8.13	7.47	10.09	--	13.95	--	17.00	-3.05

Measurement uncertainty:	±1.33 dB

Test Conditions:	15.407 (a)(1)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11 n HT-20		**Ambient Temp. (ºC):**	19 to 22	
TPC:	HIGH		**Pressure (mBars):**	998 to 1003	
Modulation:	ON		**Duty Cycle (x):**	100	
Beam Forming Gain (Y):	N/A	dB	**Antenna Gain:**	4 dBi	
Applied Voltage:	48.0	Vdc			
Notes 1:					
Notes 2:					

Test Frequency	Measured Peak Power RF Port (dBm)				Total Power (dBm)		Limit	Margin
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
5180	11.62	10.87	10.88		13.38		17.00	-3.62
5200	9.88	9.18	9.37		13.68		17.00	-3.32
5240	8.84	8.15	10.55		13.87		17.00	-3.13

Measurement uncertainty:	±1.33 dB

Test Conditions:	15.407 (a)(1)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11 n HT-40		**Ambient Temp. (ºC):**	19 to 22	
TPC:	HIGH		**Pressure (mBars):**	998 to 1003	
Modulation:	ON		**Duty Cycle (x):**	100	
Beam Forming Gain (Y):	N/A	dB	**Antenna Gain:**	4 dBi	
Applied Voltage:	48.0	Vdc			
Notes 1:					
Notes 2:					

Test Frequency	**Measured Peak Power RF Port (dBm)**				**Total Power (dBm)**		**Limit**	**Margin**
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
5190	10.03	9.08	9.26		13.58		30.00	-16.42
5230	8.44	7.63	9.31		13.07		30.00	-16.93

Measurement uncertainty:	±1.33 dB

Maximum Permissible Conducted Power V's Antenna Gain

Operational Mode	Antenna	Antenna Gain (dBi)		Maximum Conducted Combined Power (dBm)	Maximum EIRP (dBm)
		Nominal	Legacy/ Beam Forming		
a	J9171A	4.0	8.77	+13.95	+22.72
	J9659A	5.9	10.67	+12.33	+23.00
	Integral RNAA-H1	7.02	11.79	+11.21	+23.00
HT-20	J9171A	4.0	N/A	+13.87	+17.87
	J9659A	5.9	N/A		+19.77
	Integral RNAA-H1	7.02	N/A		+20.89
HT-40	J9171A	4.0	N/A	+13.58	+17.58
	J9659A	5.9	N/A		+19.48
	Integral RNAA-H1	7.02	N/A		+20.60

NOTE: FCC Guidelines – Directional Gain Computation (from "Smart Antenna Systems")

Antenna gain increases by 10 * Log (N) where N is the number of antenna's (in this case N = 3) to individual antenna gain except for sectorized systems and spatial multiplexing.

10 * Log (N) = 10 * Log (3) = 4.77 dB

The column Legacy / Beam Forming antenna gain takes this effect into account.

Specification

Limits

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

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

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

Industry Canada RSS-210 §A9.2(2)

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

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

Industry Canada RSS-Gen 4.4

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

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

Traceability

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

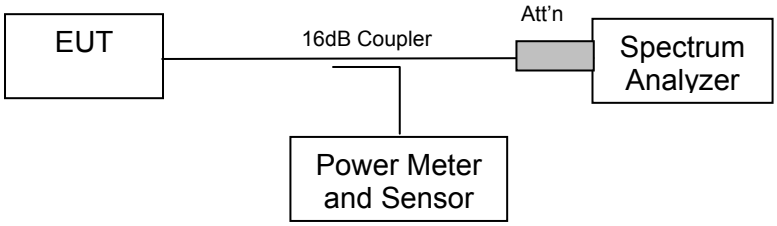
5.1.3. Peak Power Spectral Density

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

Test Procedure

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

Test Measurement Set up



Measurement set up for Peak Power Spectral Density

Measurement Results for Peak Power Spectral Density

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

Radio Parameters
Duty Cycle: 100%
Output: Modulated Carrier
Power: Reduction 1 dB from maximum (target power reduction 1 dB)

Measurement Results for Transmit Peak Power Spectral Density

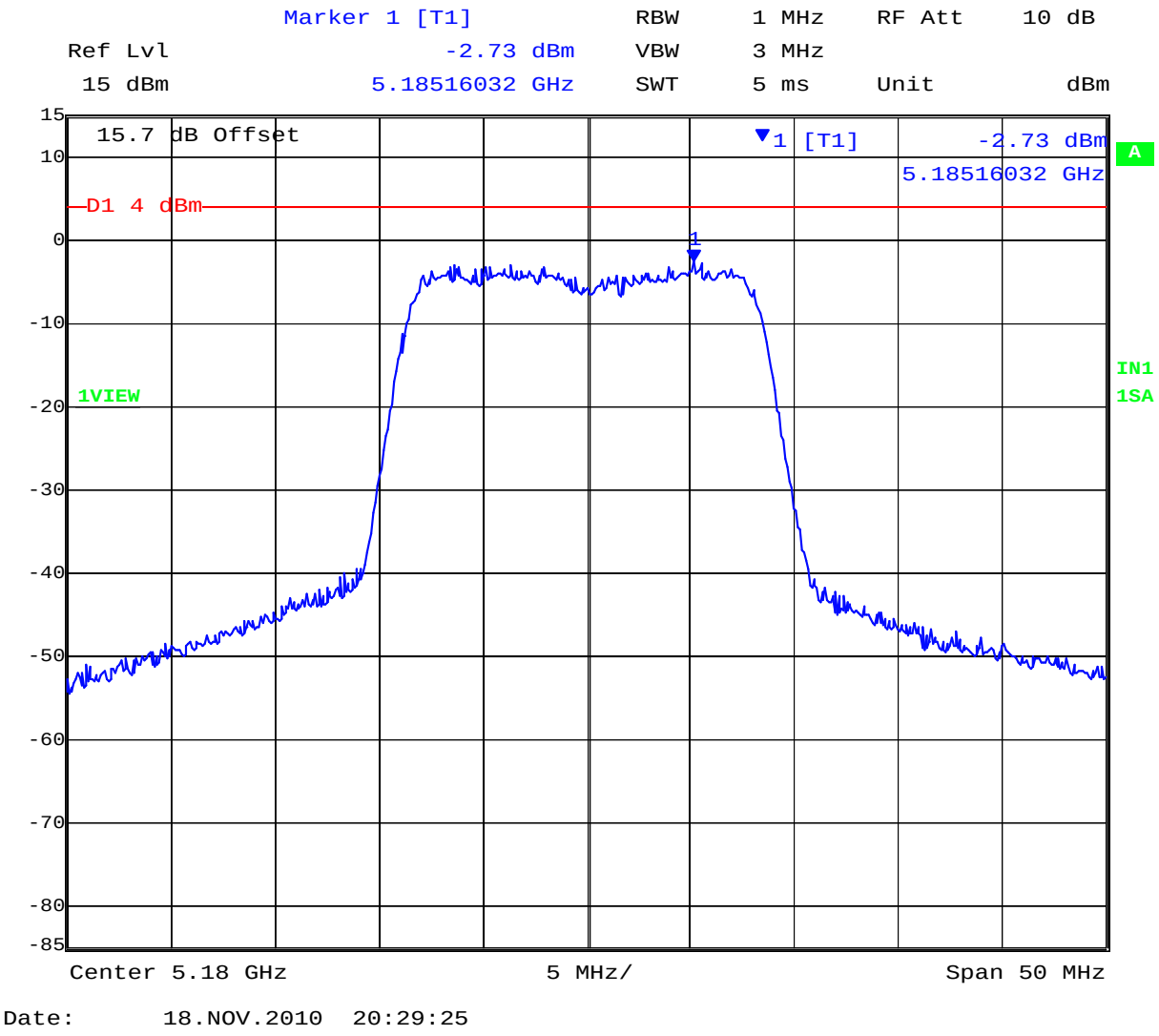
Ambient conditions.
Temperature: 17 to 23 °C Relative humidity: 31 to 57 % Pressure: 999 to 1012 mbar

Test Conditions:	15.407 (a)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11 a		**Ambient Temp. (ºC):**	19 to 22	
TPC:	HIGH		**Pressure (mBars):**	998 to 1003	
Modulation:	ON		**Duty Cycle (%):**	100	
Beam Forming Gain (Y):	N/A	dB	**Antenna Gain:**	4 dBi	
Applied Voltage:	48.0	Vdc			
Notes 1:					
Notes 2:					

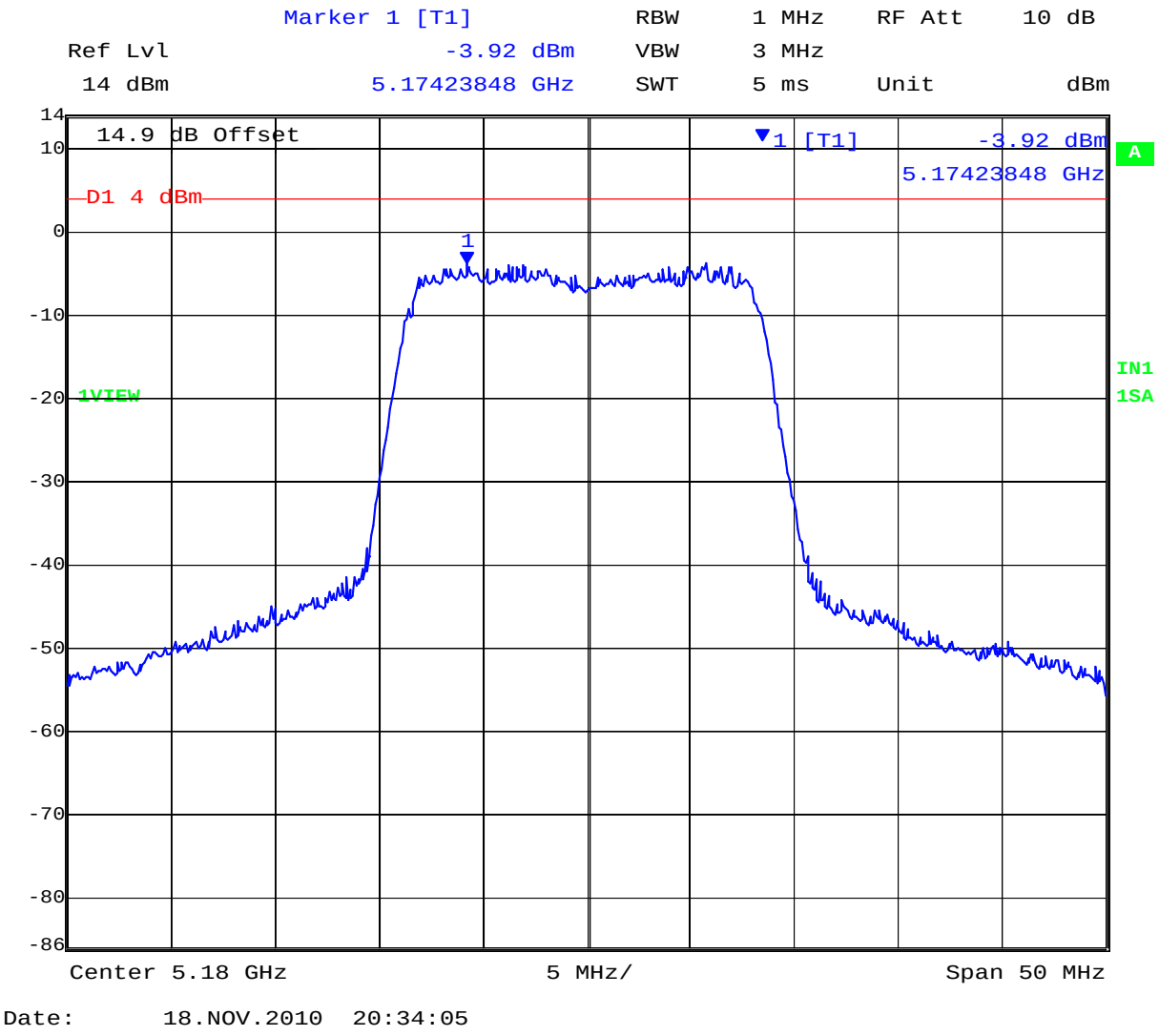
Test Frequency	**Measured Peak Power RF Port (dBm)**				**Total Power (dBm)**		**Limit**	**Margin**
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
5180	-2.73	-3.92	-3.92		3.54		4.00	-0.46
5200	-2.51	-4.07	-3.28		2.51		4.00	-1.49
5240	-4.20	-4.60	-2.15		3.02		4.00	-0.98

Measurement uncertainty:	±1.33 dB

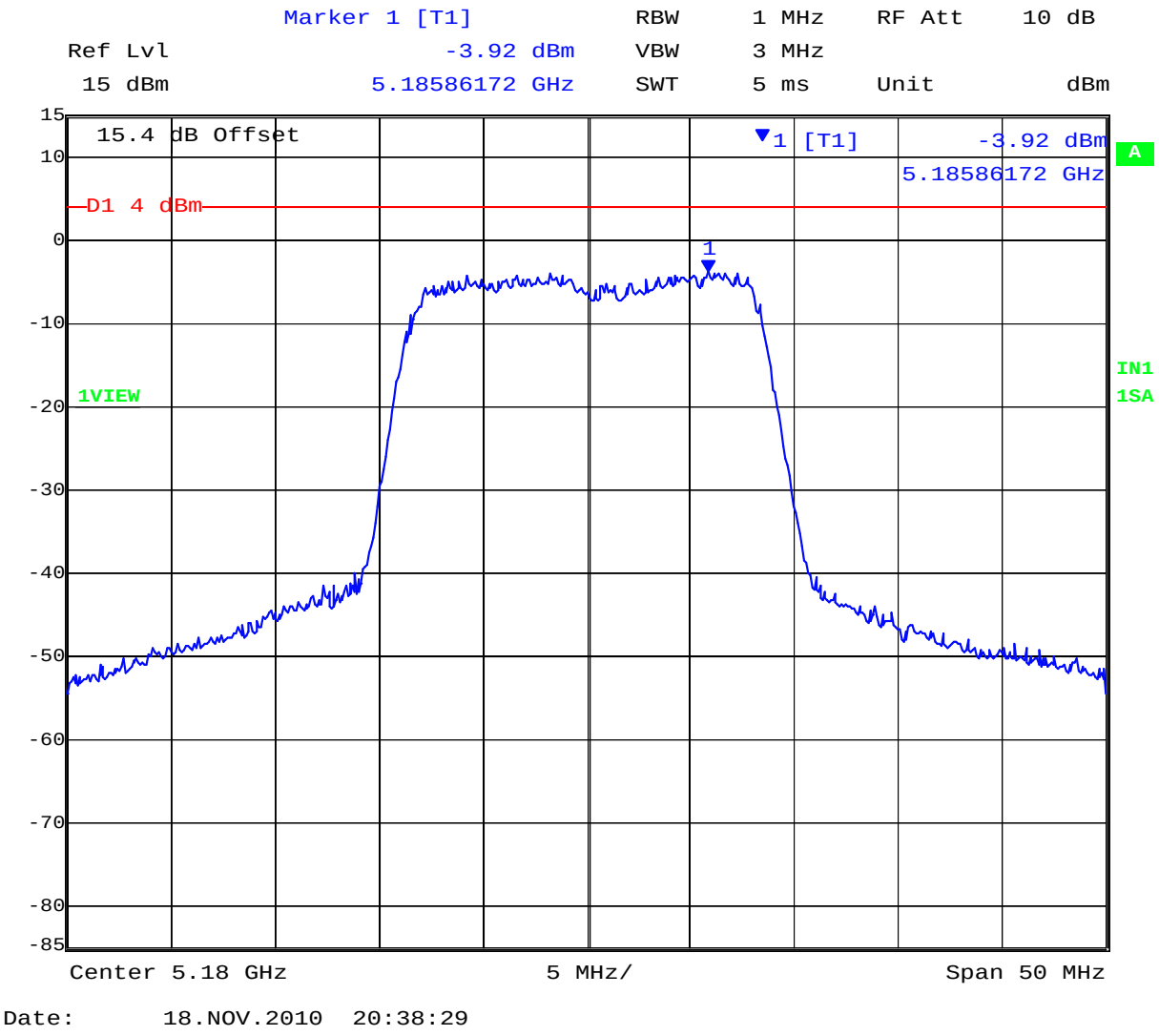
5180 MHz 802.11a Chain a, Peak Power Spectral Density



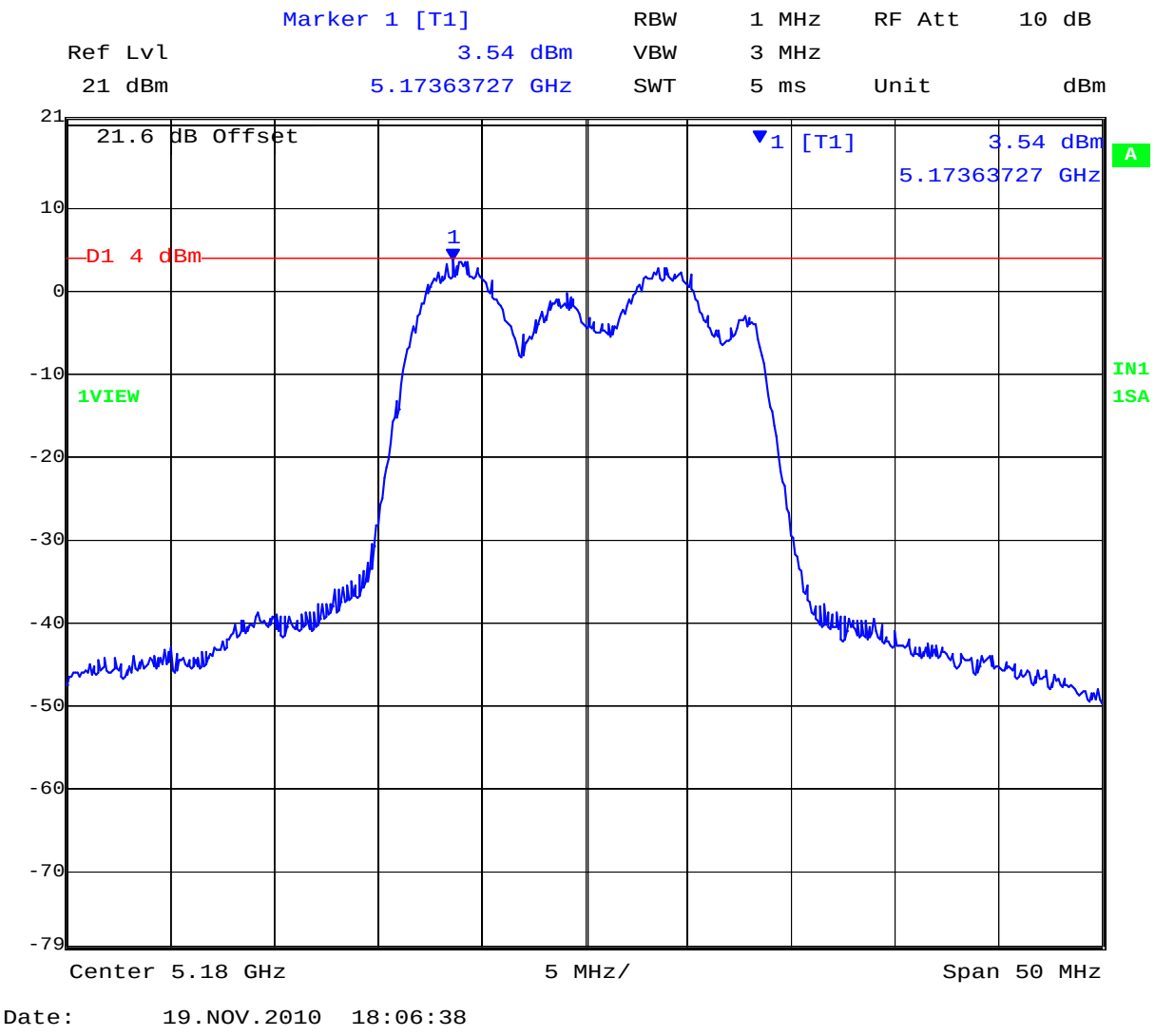
5180 MHz 802.11a Chain b, Peak Power Spectral Density



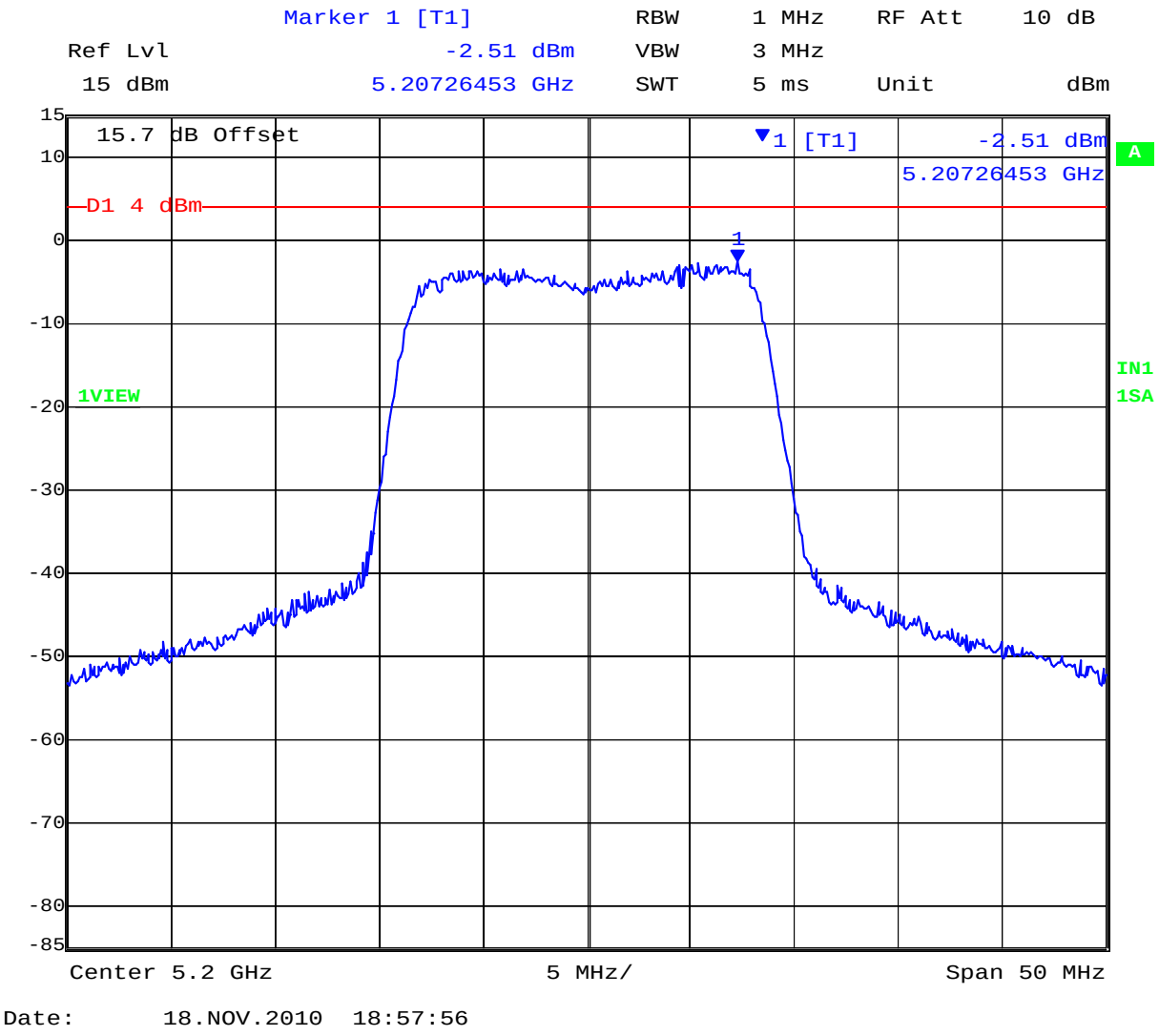
5180 MHz 802.11a Chain c, Peak Power Spectral Density



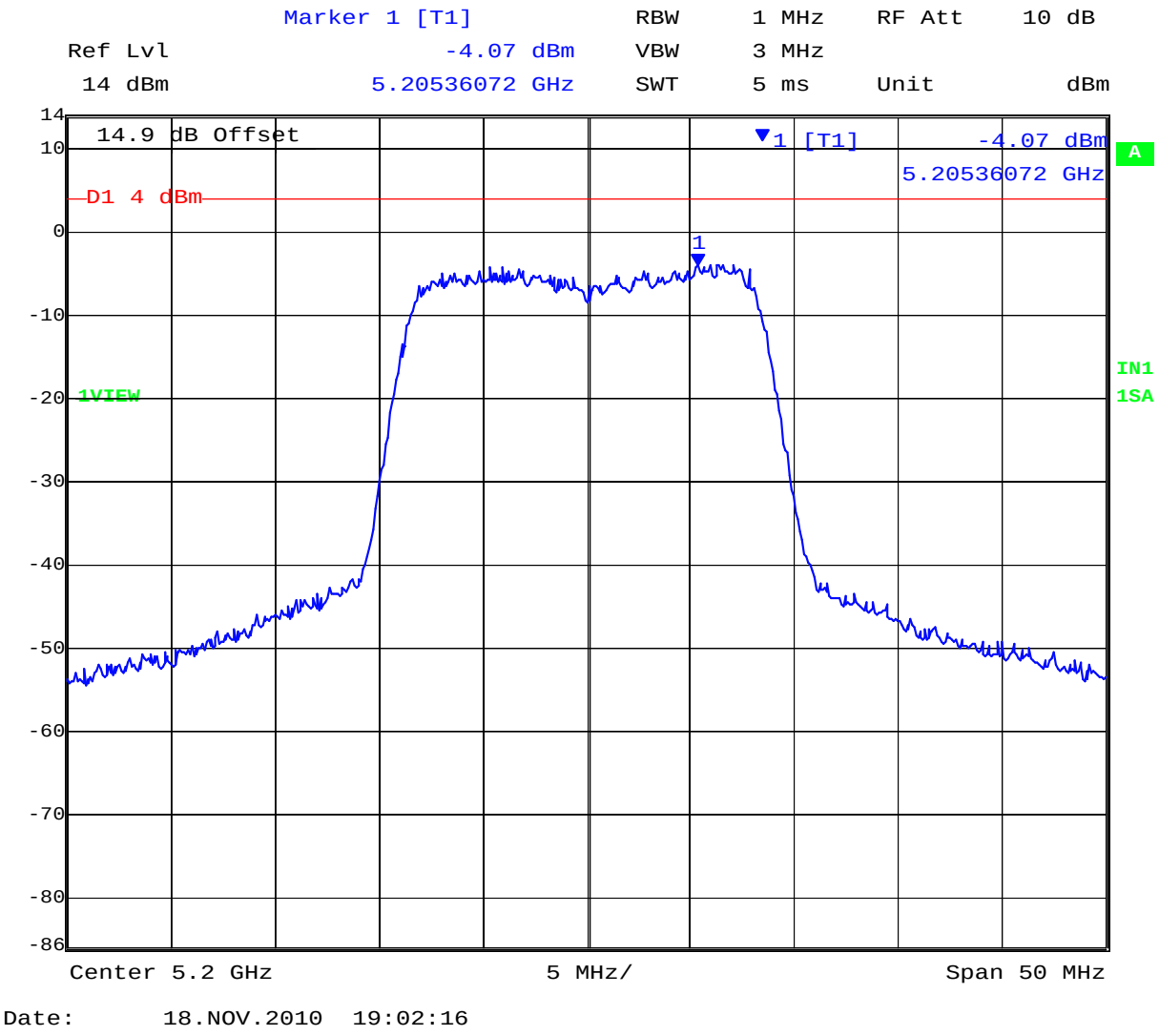
5180 MHz 802.11a Combined, Peak Power Spectral Density



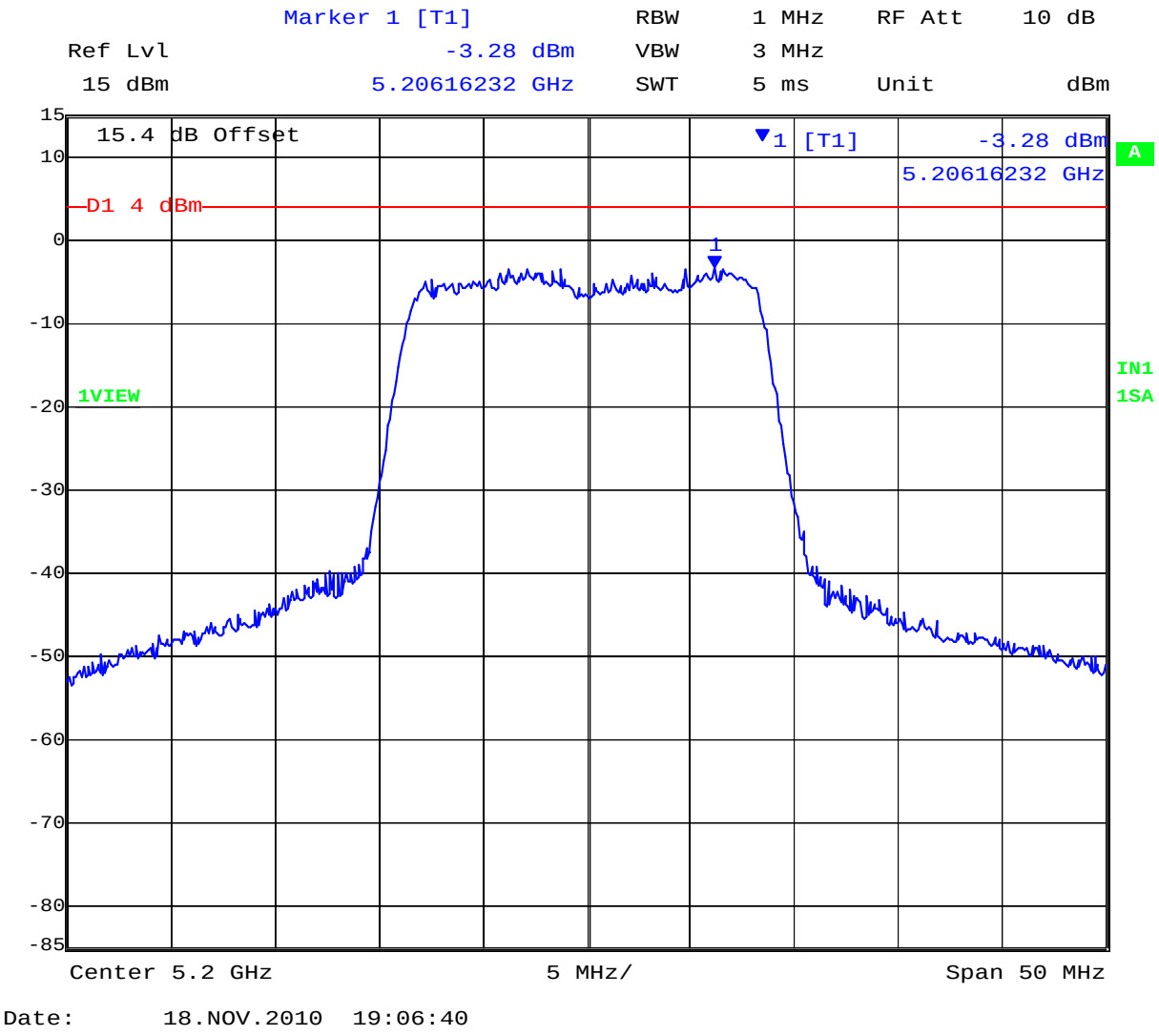
5200 MHz 802.11a Chain a, Peak Power Spectral Density



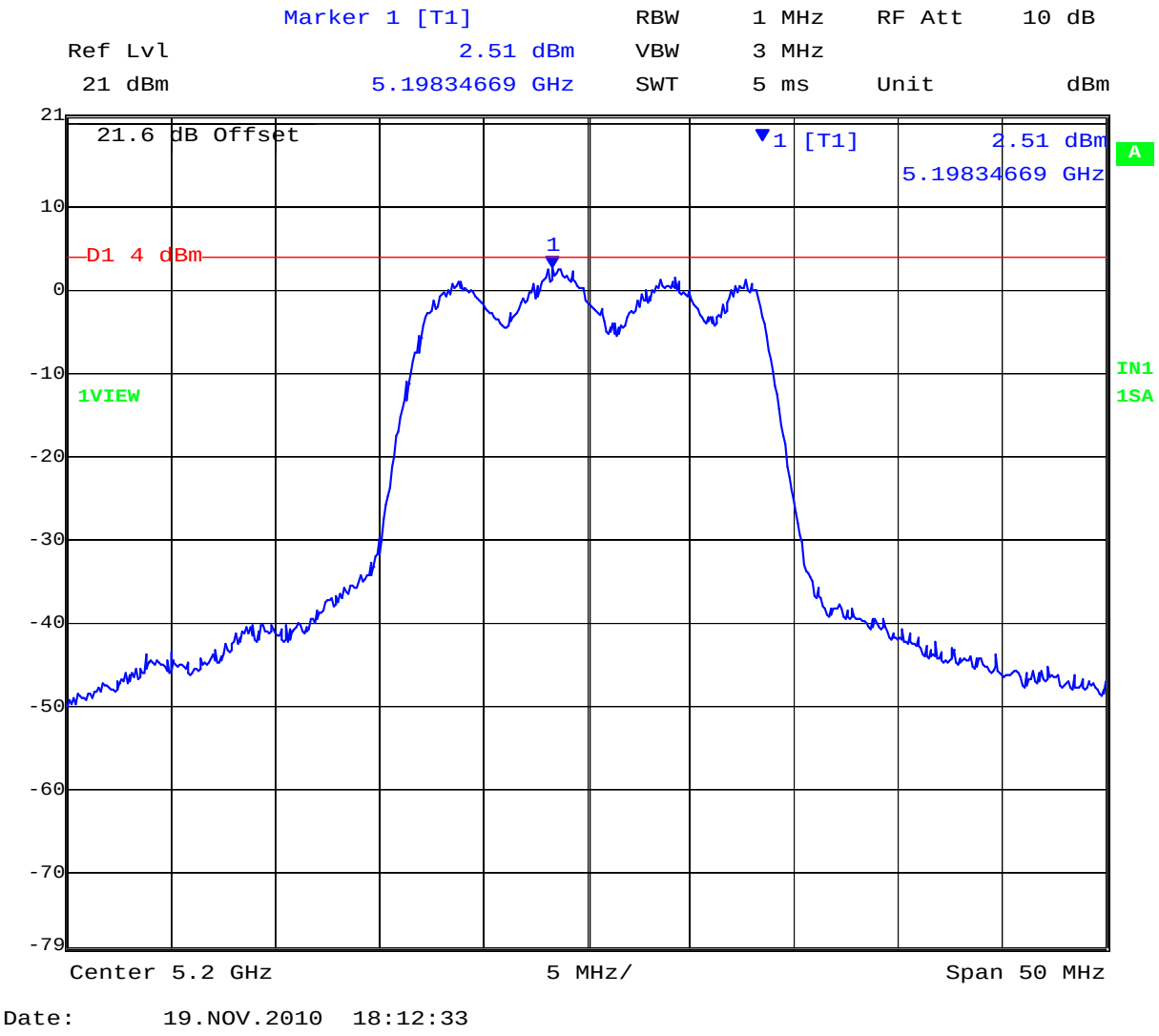
5200 MHz 802.11a Chain b, Peak Power Spectral Density



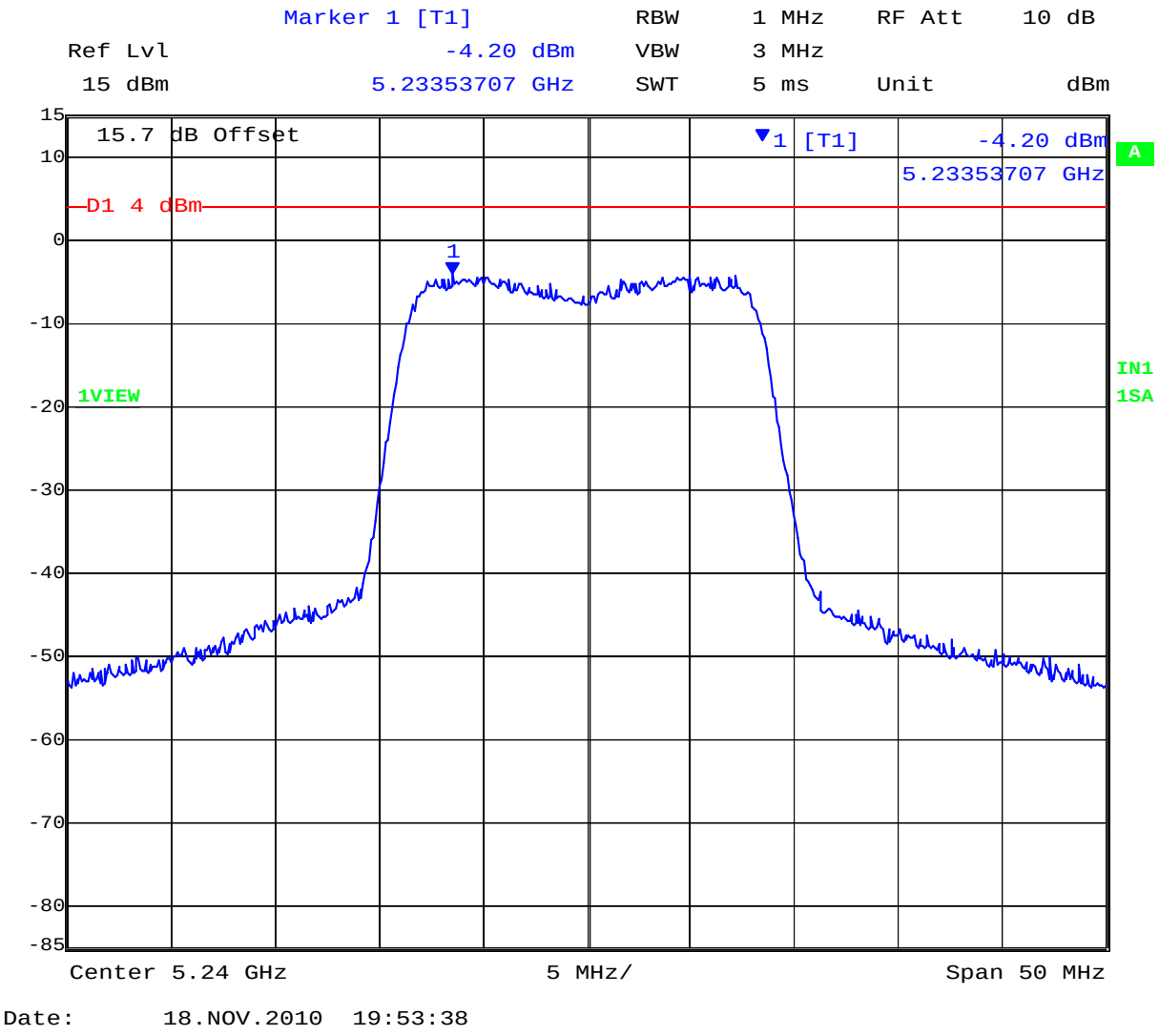
5200 MHz 802.11a Chain c, Peak Power Spectral Density



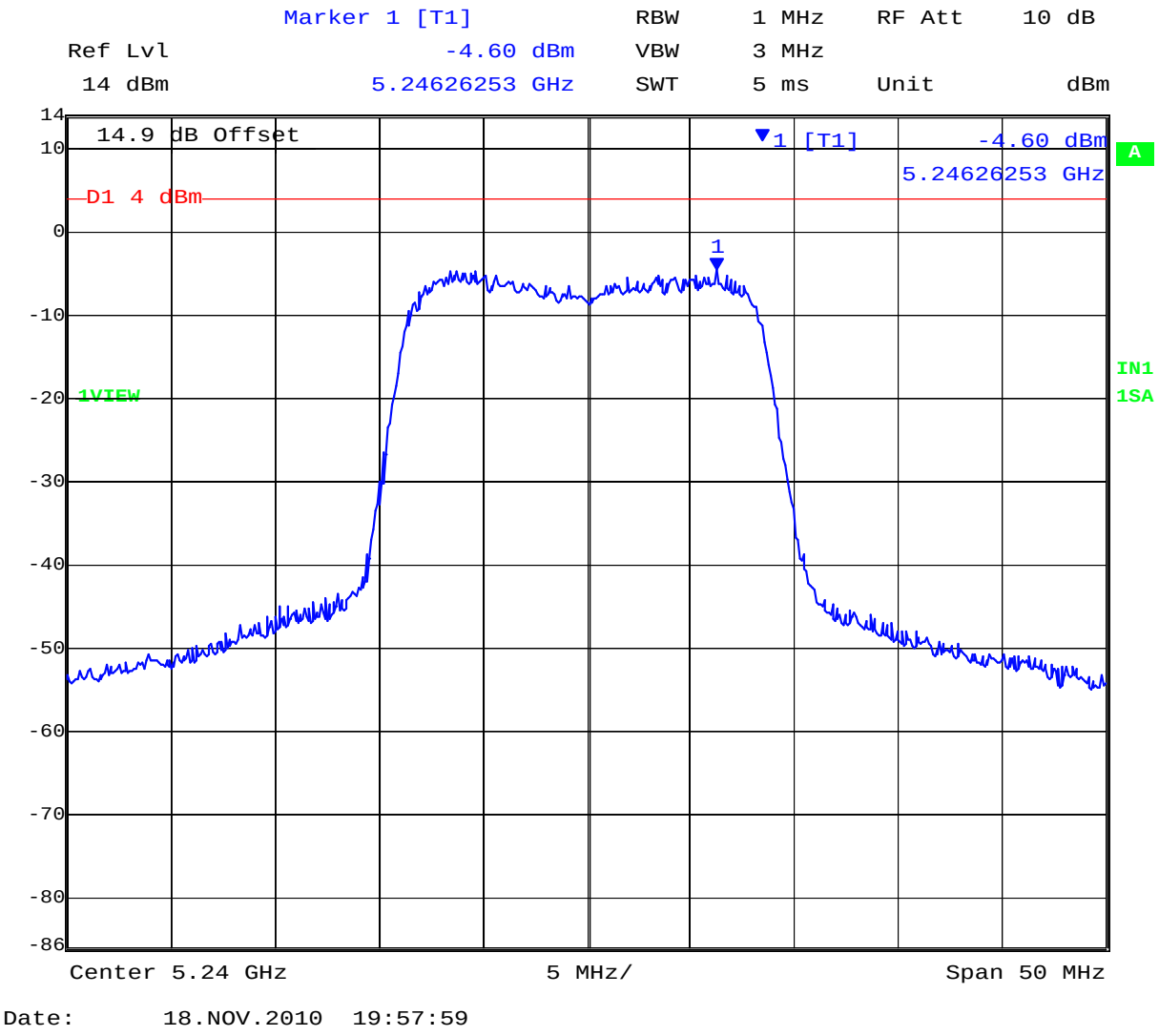
5200 MHz 802.11a Combined, Peak Power Spectral Density



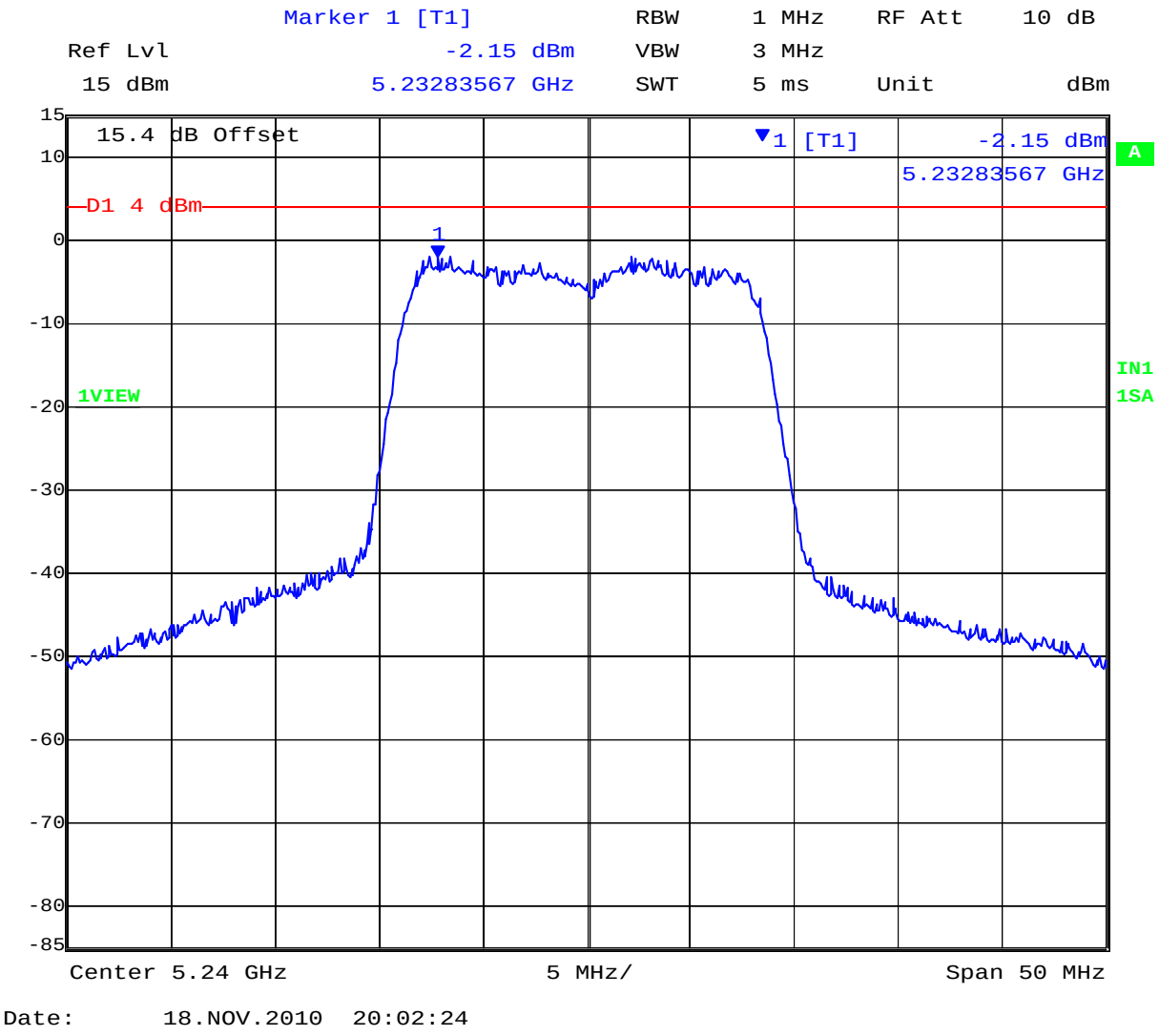
5240 MHz 802.11a Chain a, Peak Power Spectral Density



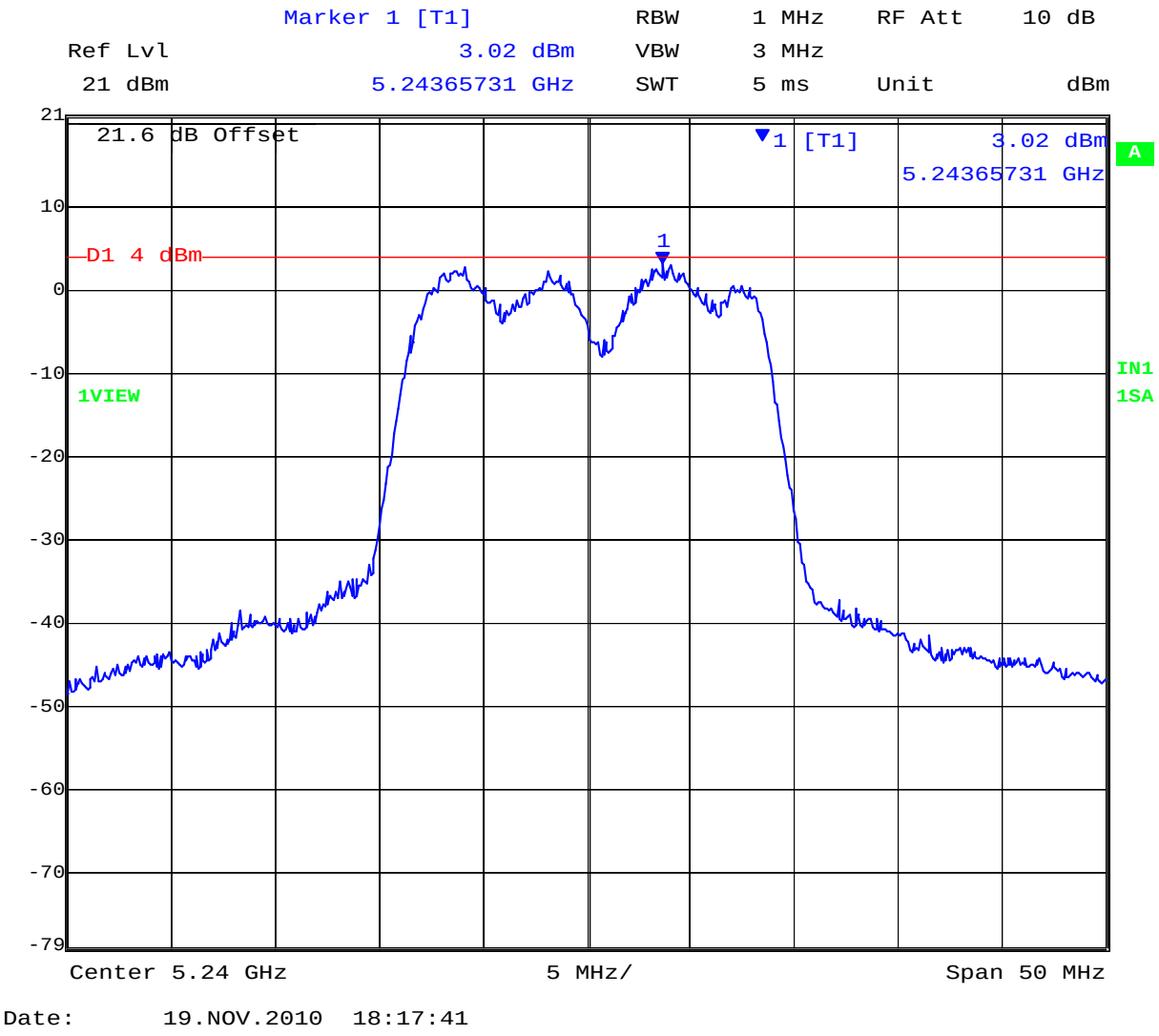
5240 MHz 802.11a Chain b, Peak Power Spectral Density



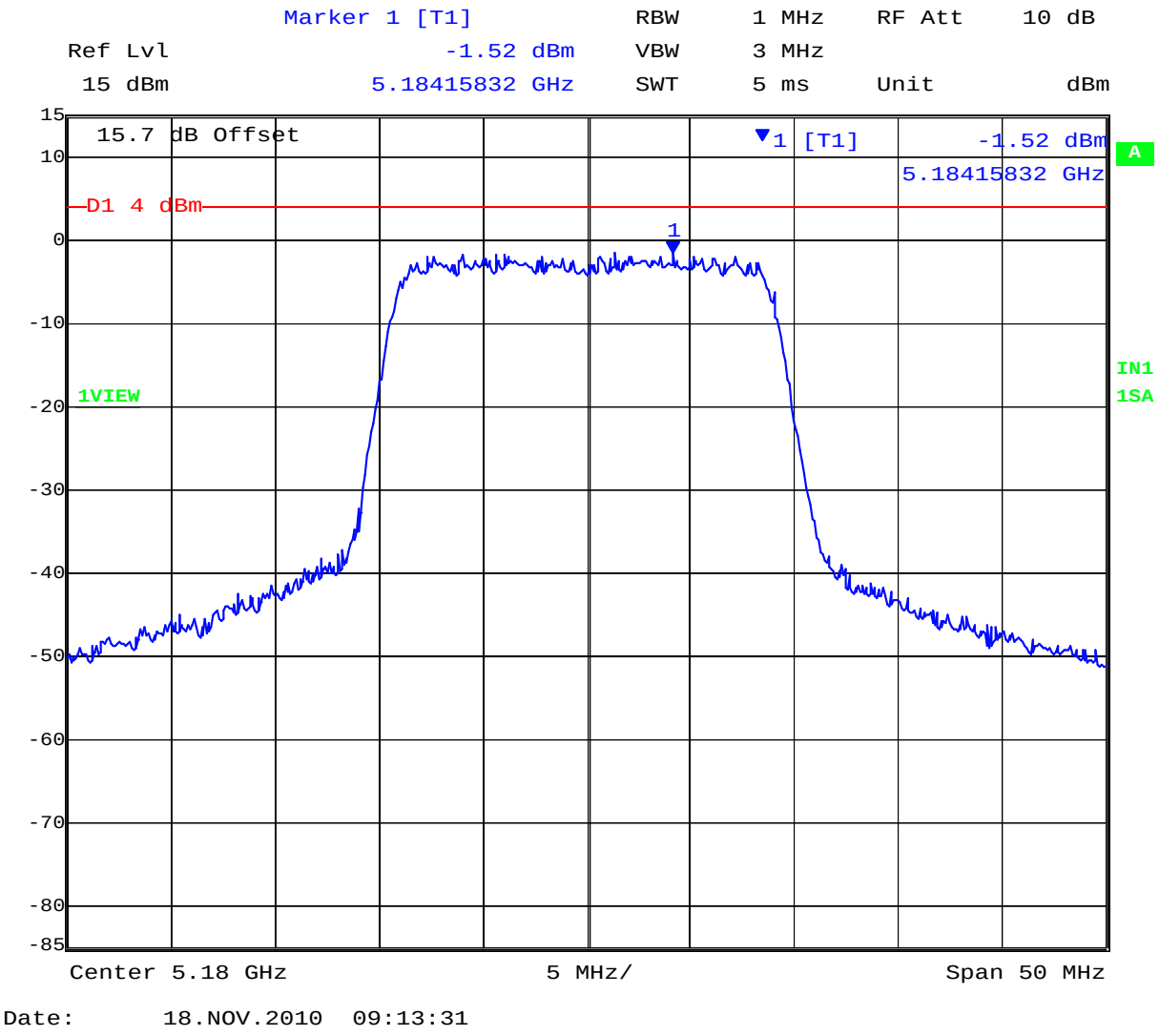
5240 MHz 802.11a Chain c, Peak Power Spectral Density



5240 MHz 802.11a Combined, Peak Power Spectral Density



5180 MHz 802.11HT-20 Chain a, Peak Power Spectral Density

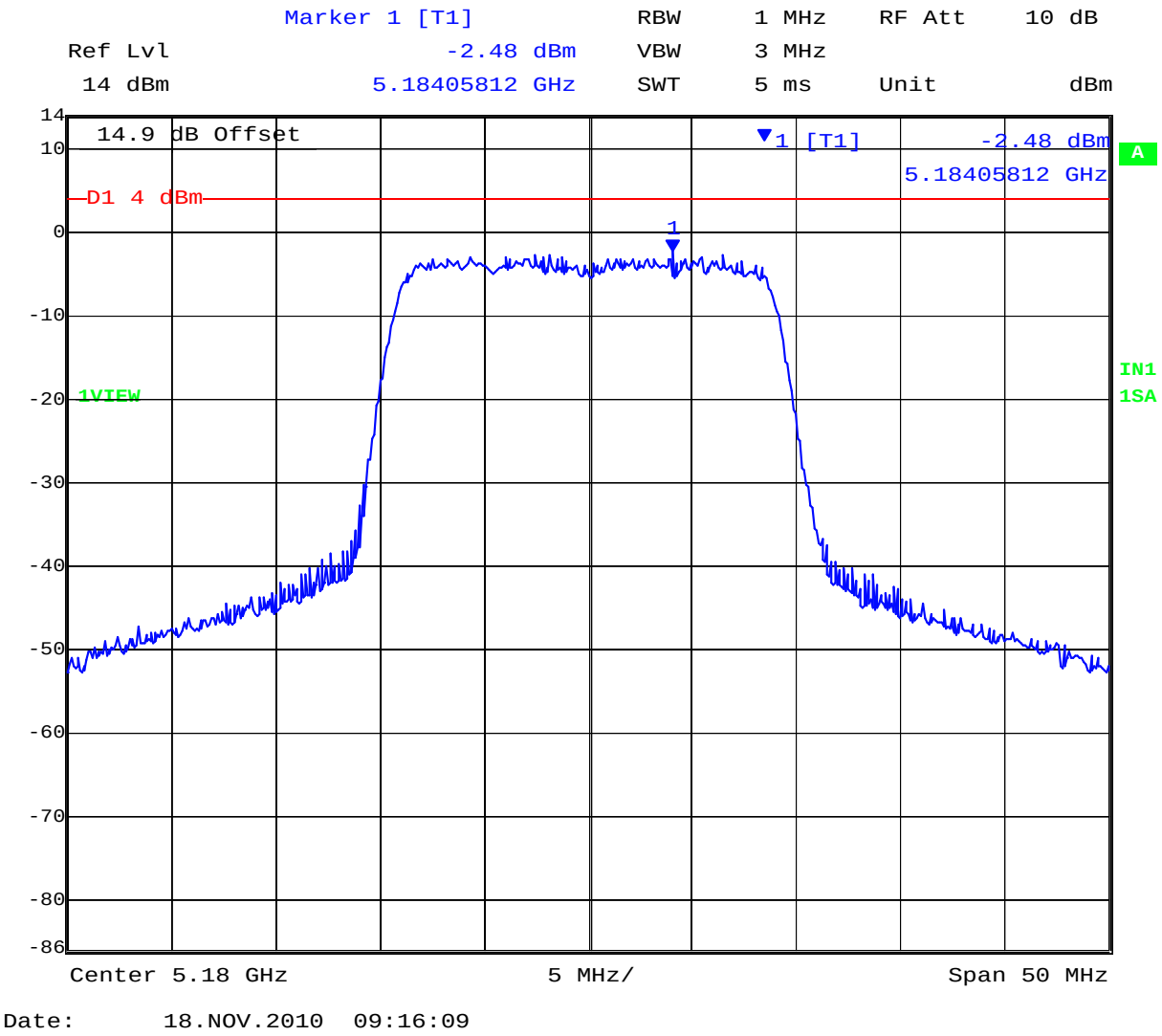


Test Conditions:	15.407 (a)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11 n HT-20		**Ambient Temp. (ºC):**	19 to 22	
TPC:	HIGH		**Pressure (mBars):**	998 to 1003	
Modulation:	ON		**Duty Cycle (%):**	100	
Beam Forming Gain (Y):	N/A	dB	**Antenna Gain:**	4 dBi	
Applied Voltage:	48.0	Vdc			
Notes 1:					
Notes 2:					

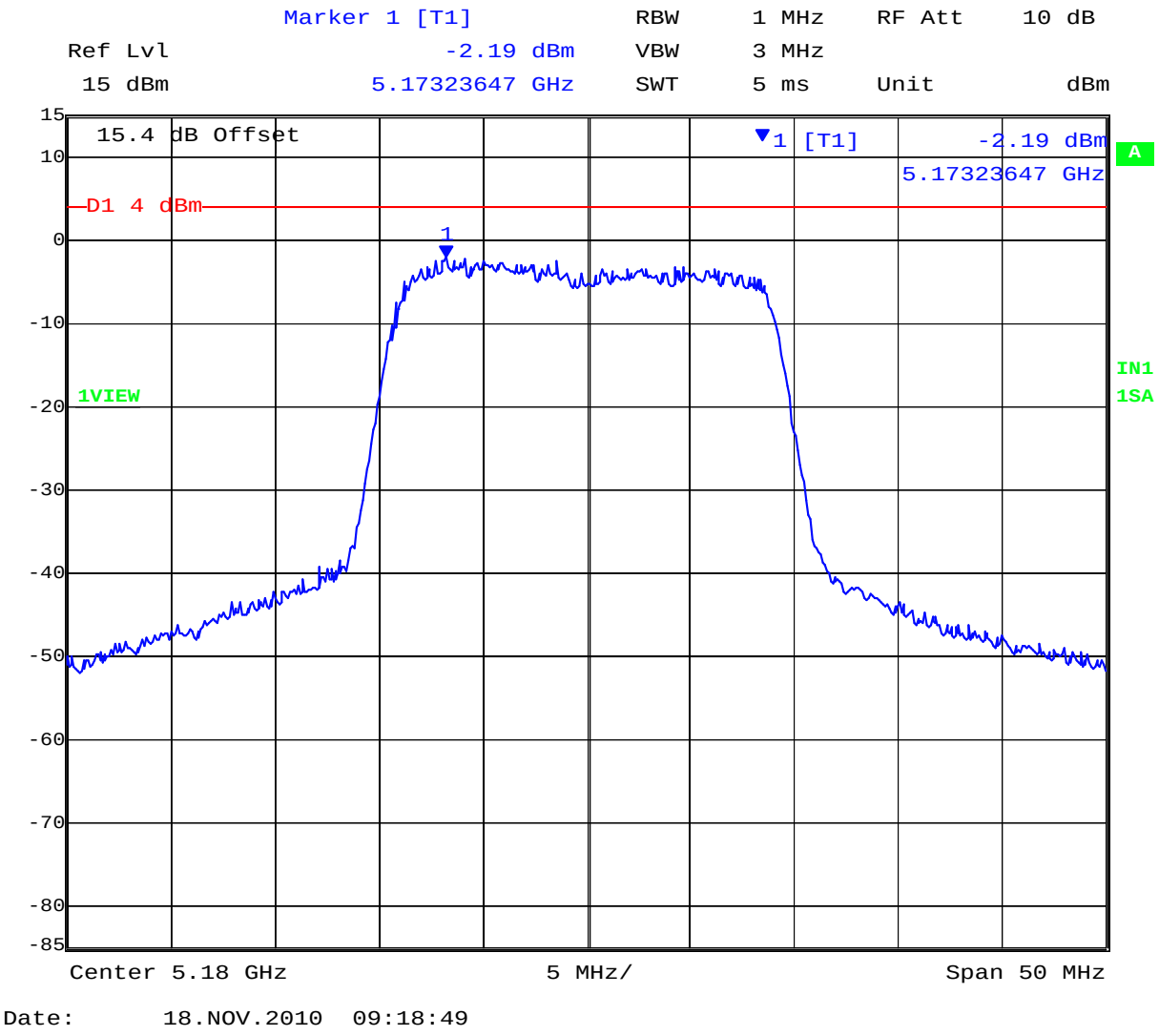
Test Frequency	Measured Peak Power RF Port (dBm)				Total Power (dBm)		Limit	Margin
MHz	a	b	c	d	Combined	Calculated	dBm	dB
5180	-1.52	-2.48	-2.19		3.33		4.00	-0.67
5200	-2.25	-3.53	-2.88		3.10		4.00	-0.91
5240	-3.35	-4.55	-1.82		3.28		4.00	-0.72

Measurement uncertainty:	±1.33 dB

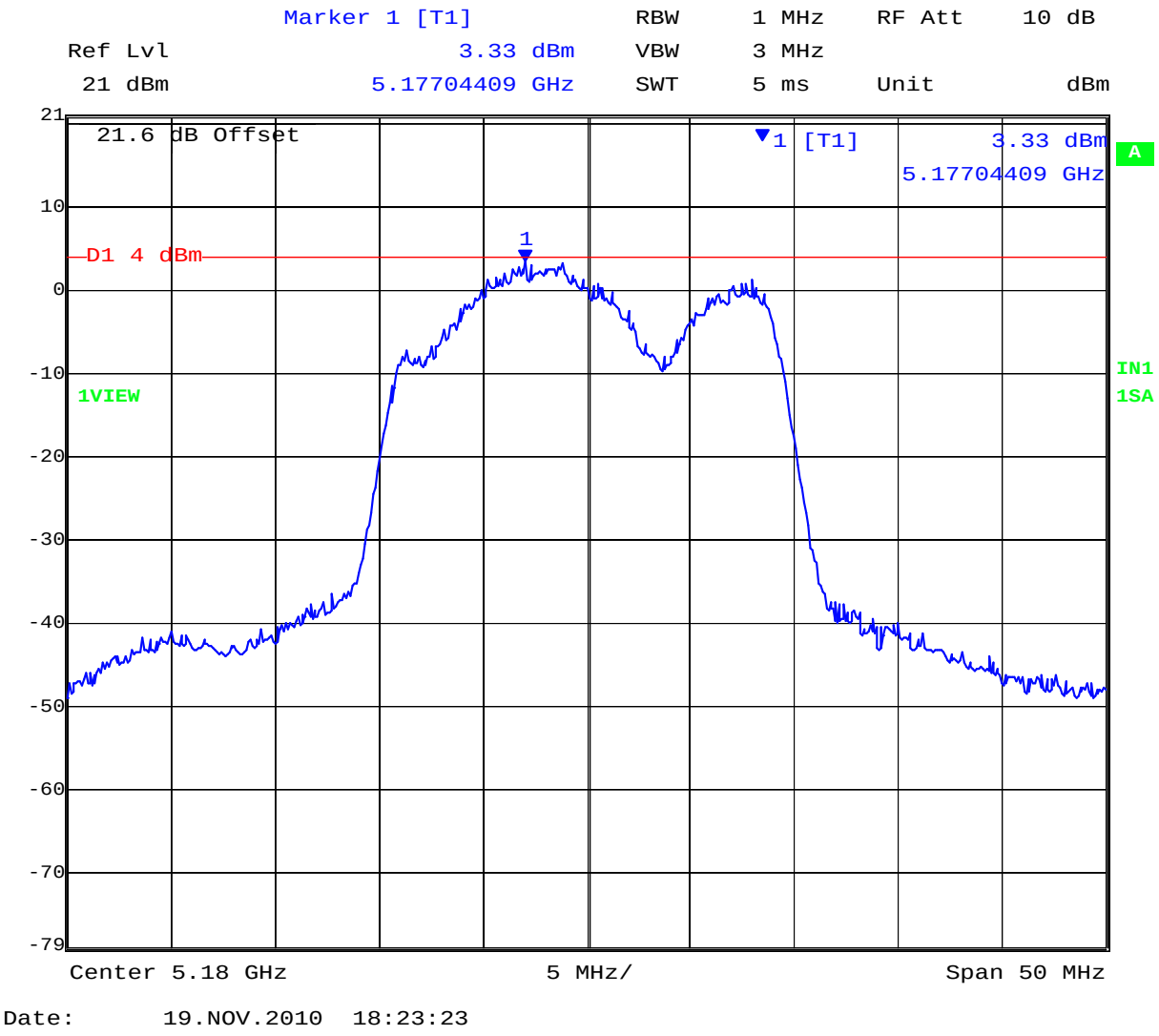
5180 MHz 802.11HT-20 Chain b, Peak Power Spectral Density



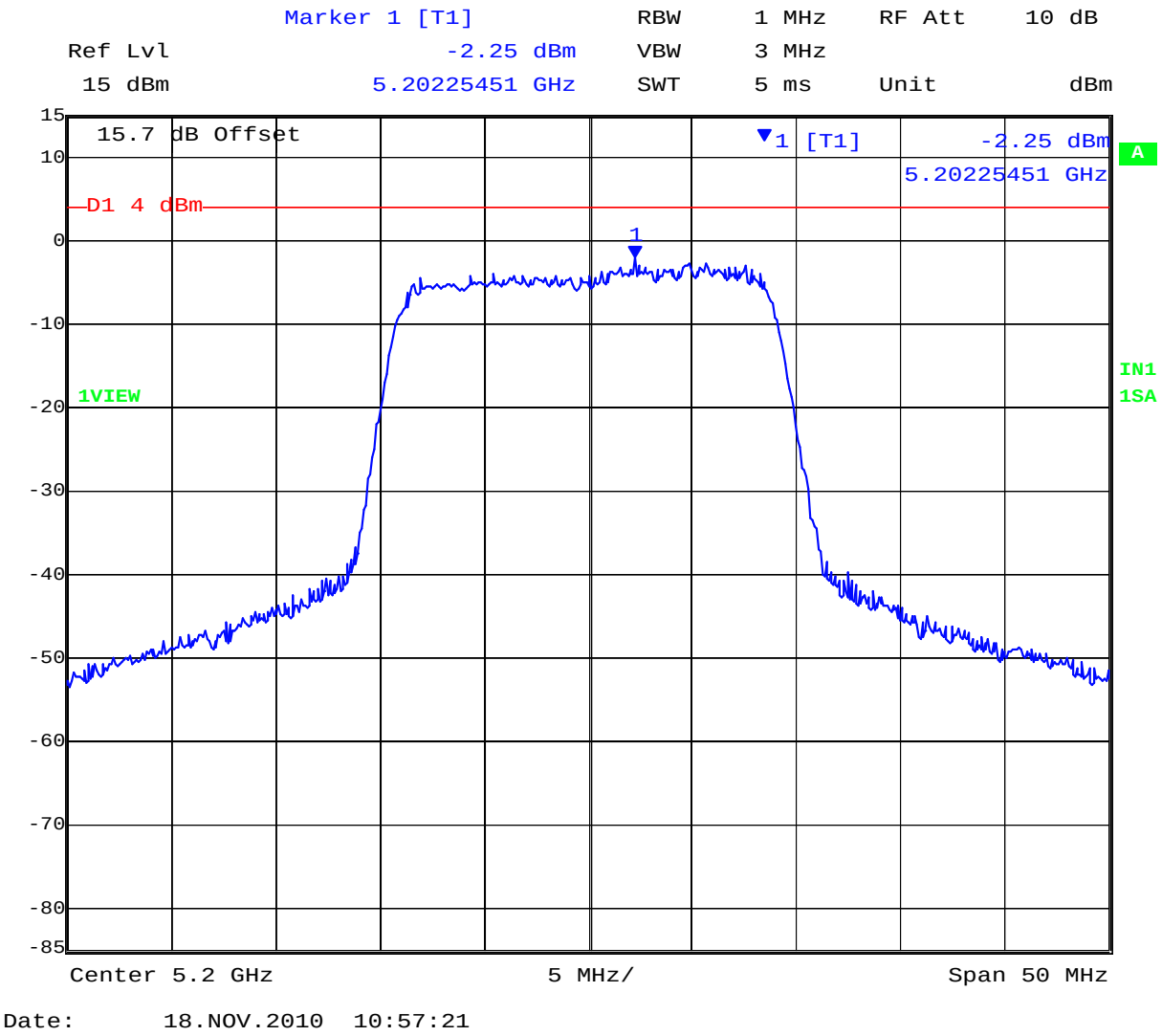
5180 MHz 802.11HT-20 Chain c, Peak Power Spectral Density



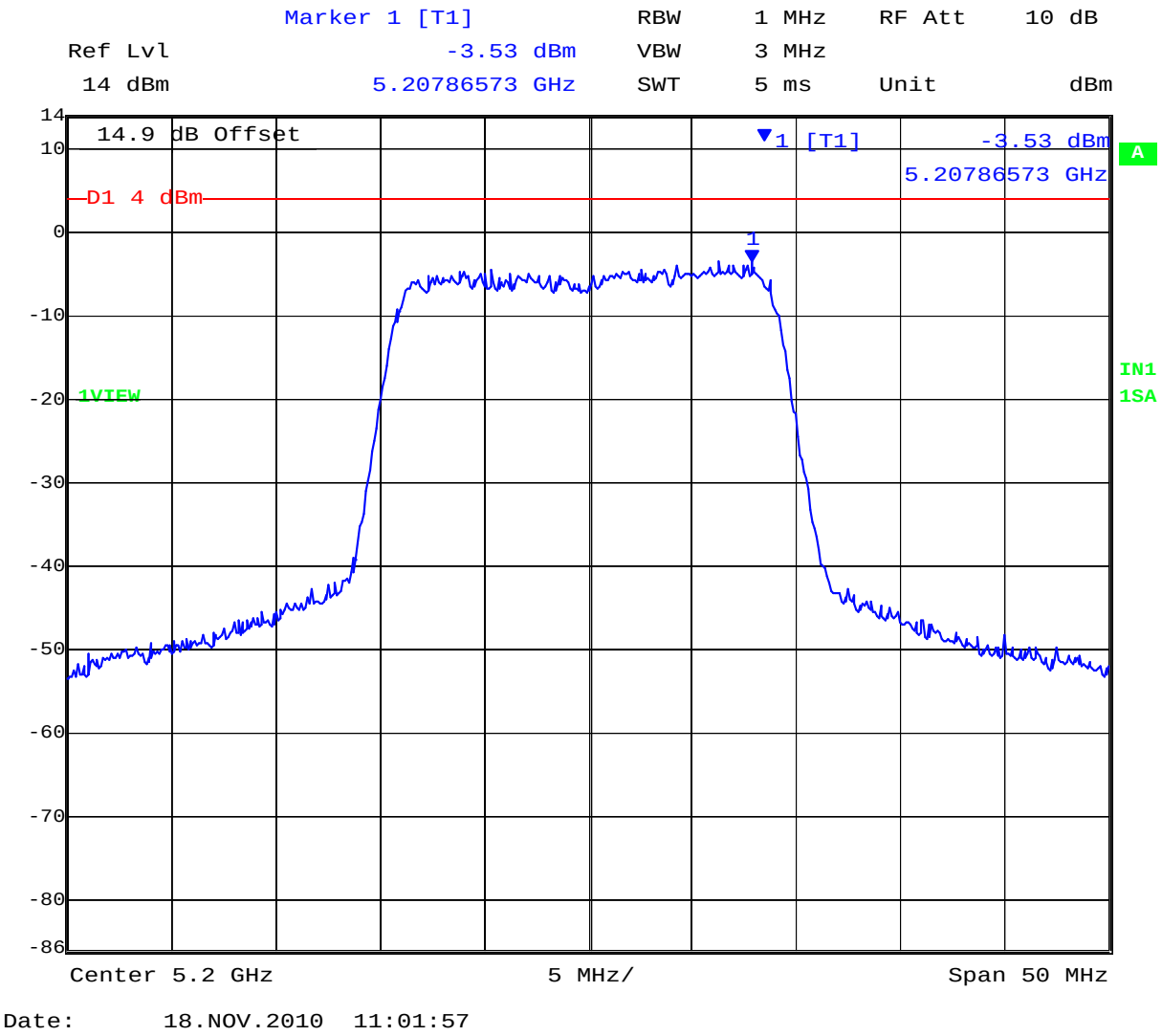
5180 MHz 802.11HT-20 Combined, Peak Power Spectral Density



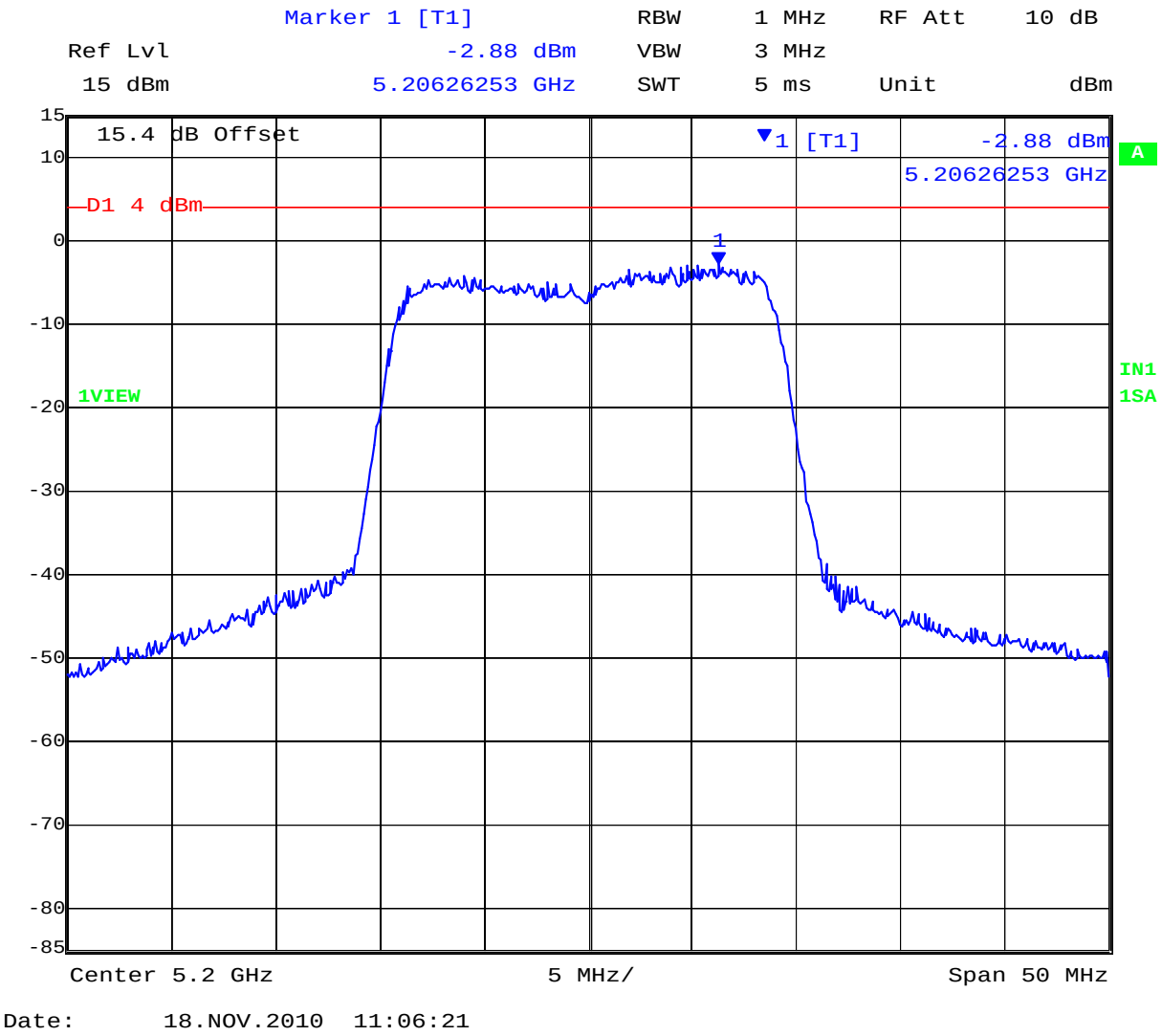
5200 MHz 802.11HT-20 Chain a, Peak Power Spectral Density



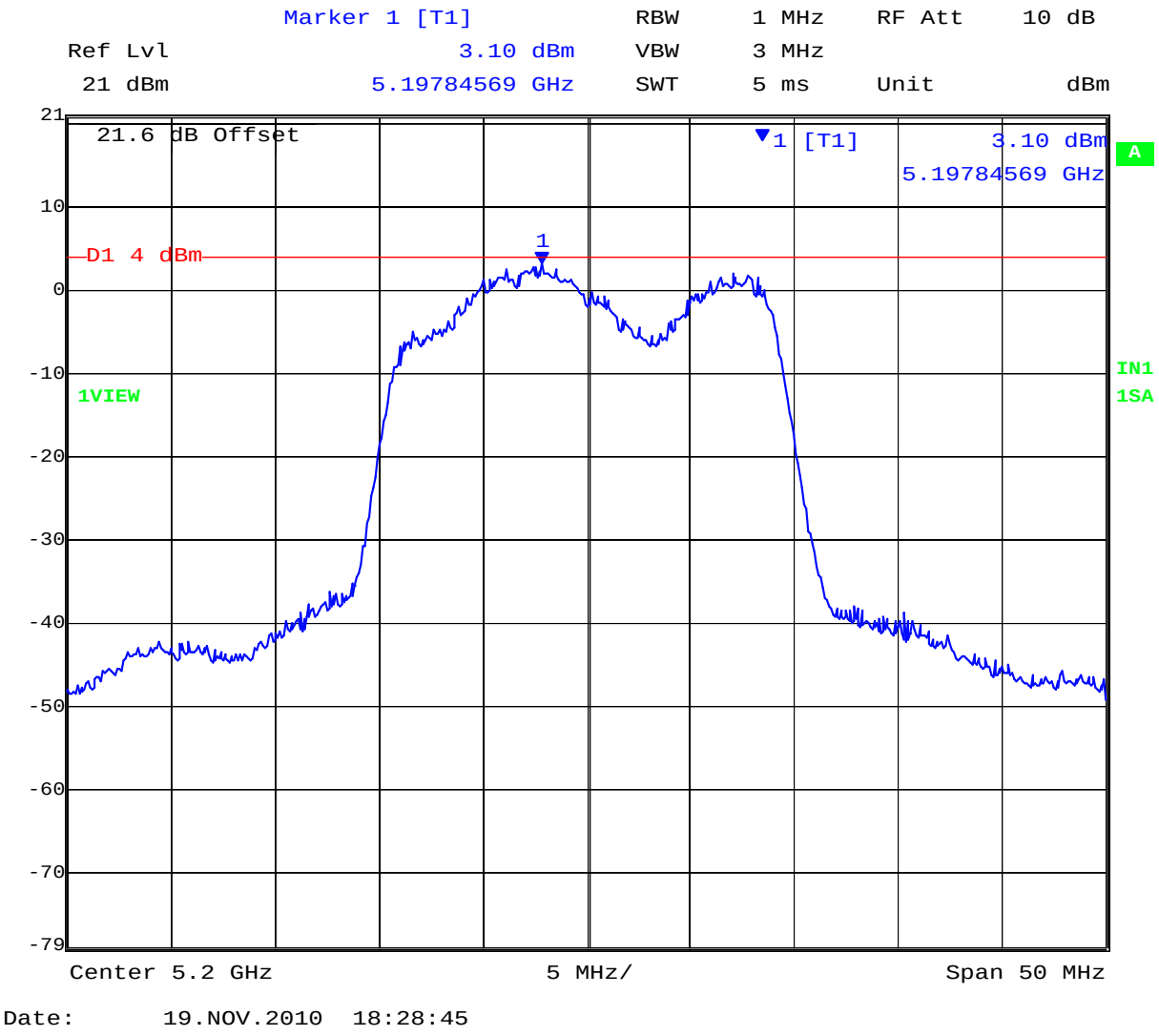
5200 MHz 802.11HT-20 Chain b, Peak Power Spectral Density



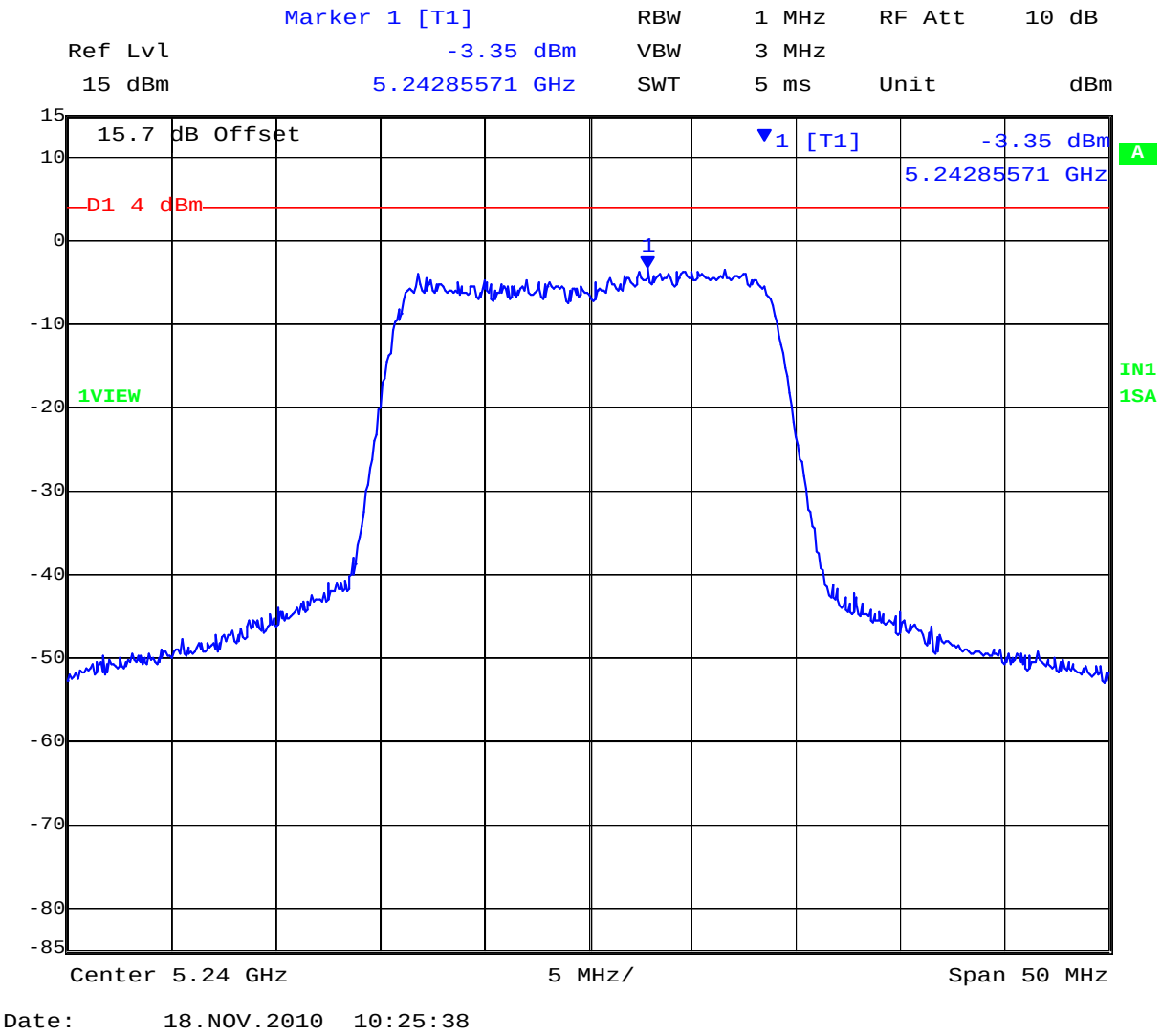
5200 MHz 802.11HT-20 Chain c, Peak Power Spectral Density



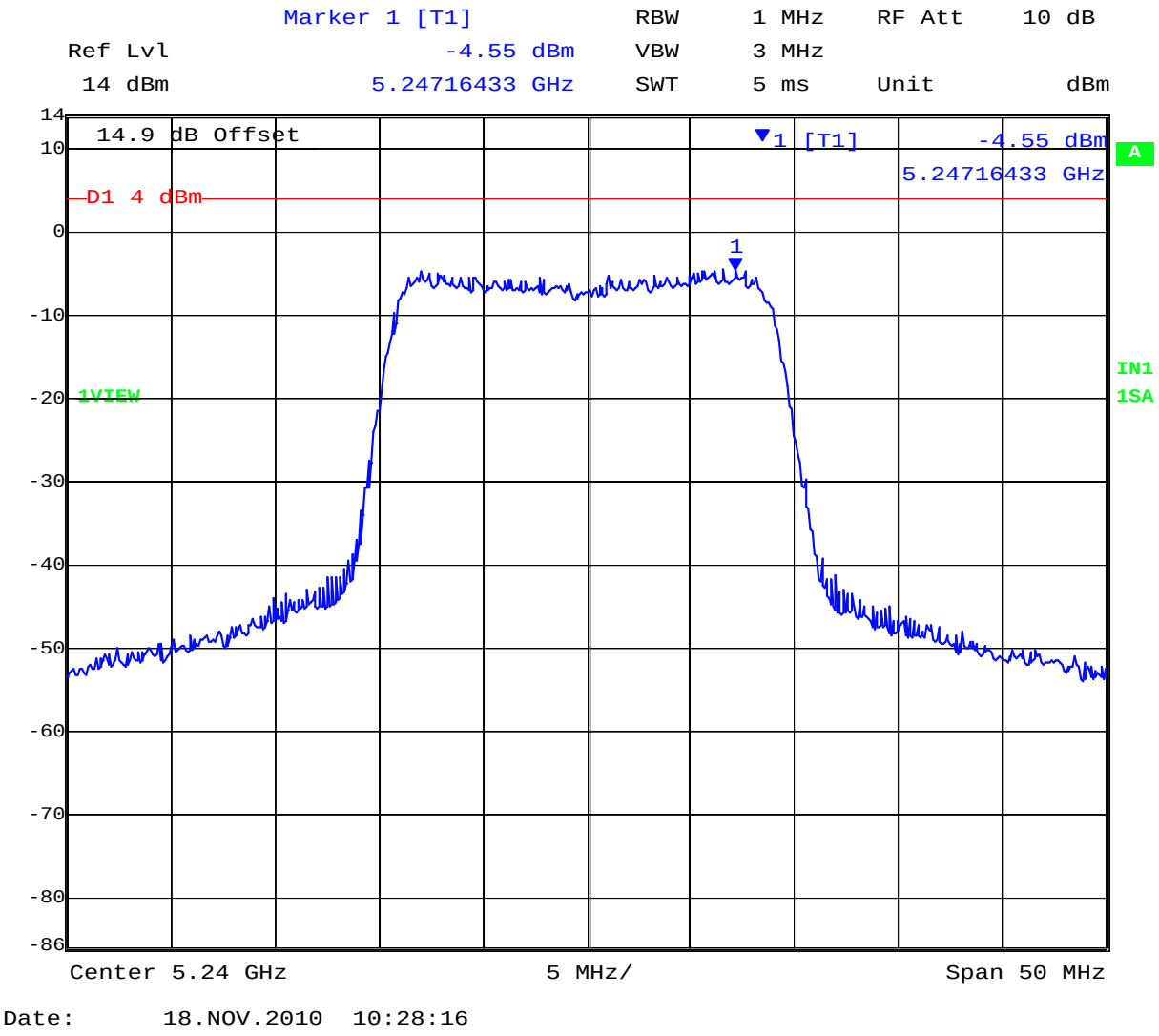
5200 MHz 802.11HT-20 Combined, Peak Power Spectral Density



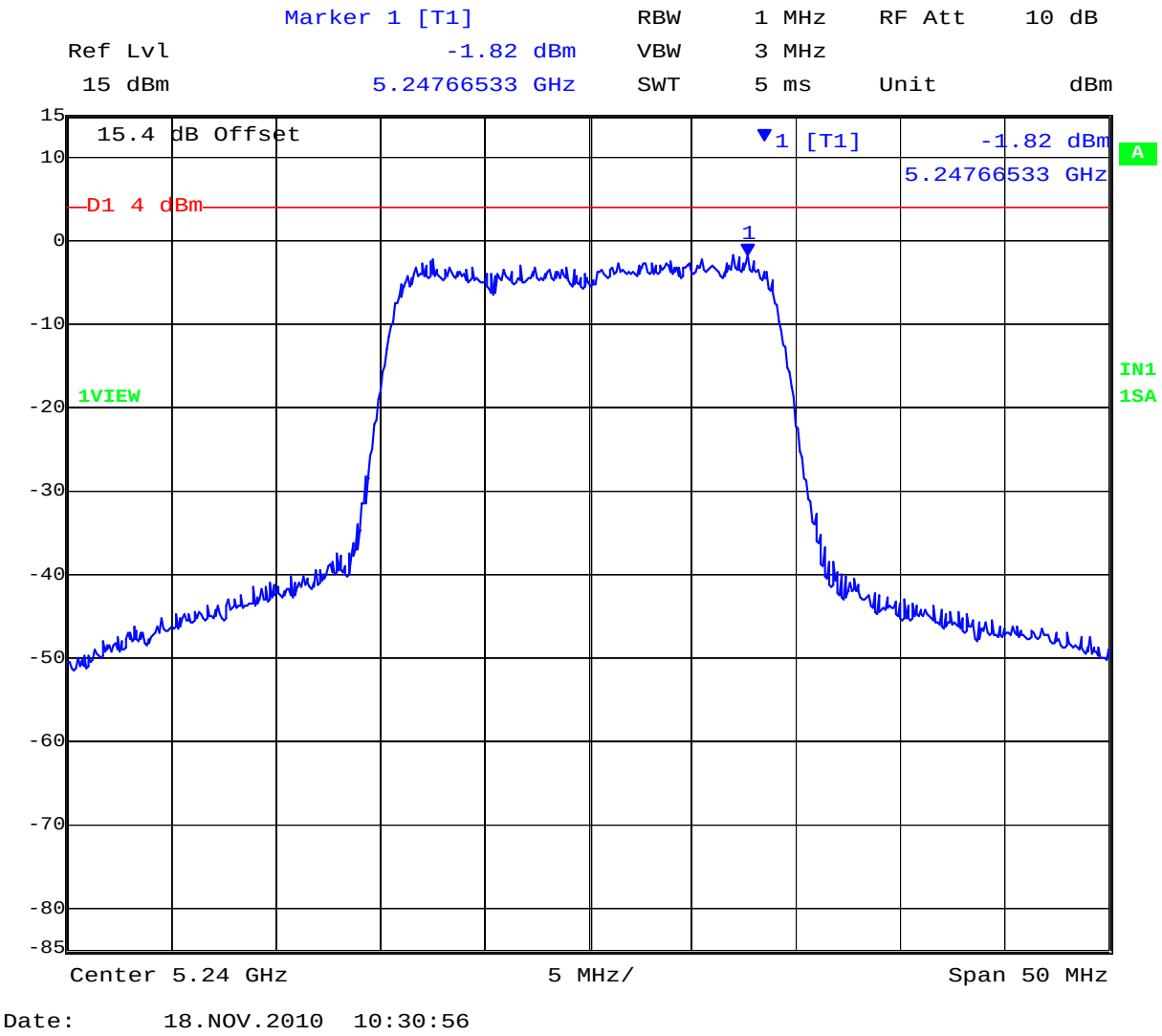
5240 MHz 802.11HT-20 Chain a, Peak Power Spectral Density



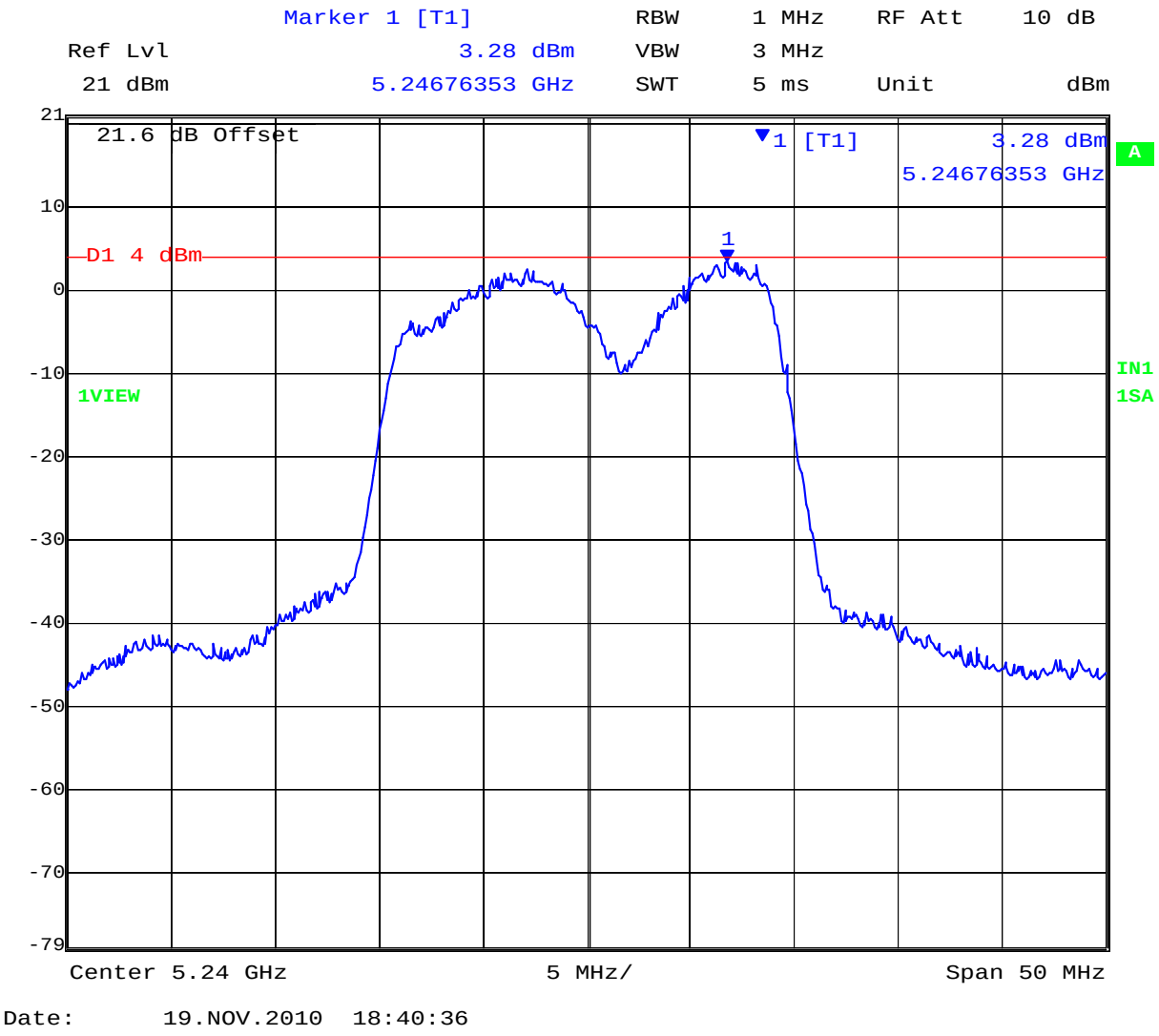
5240 MHz 802.11HT-20 Chain b, Peak Power Spectral Density



5240 MHz 802.11HT-20 Chain c, Peak Power Spectral Density



5240 MHz 802.11HT-20 Combined, Peak Power Spectral Density

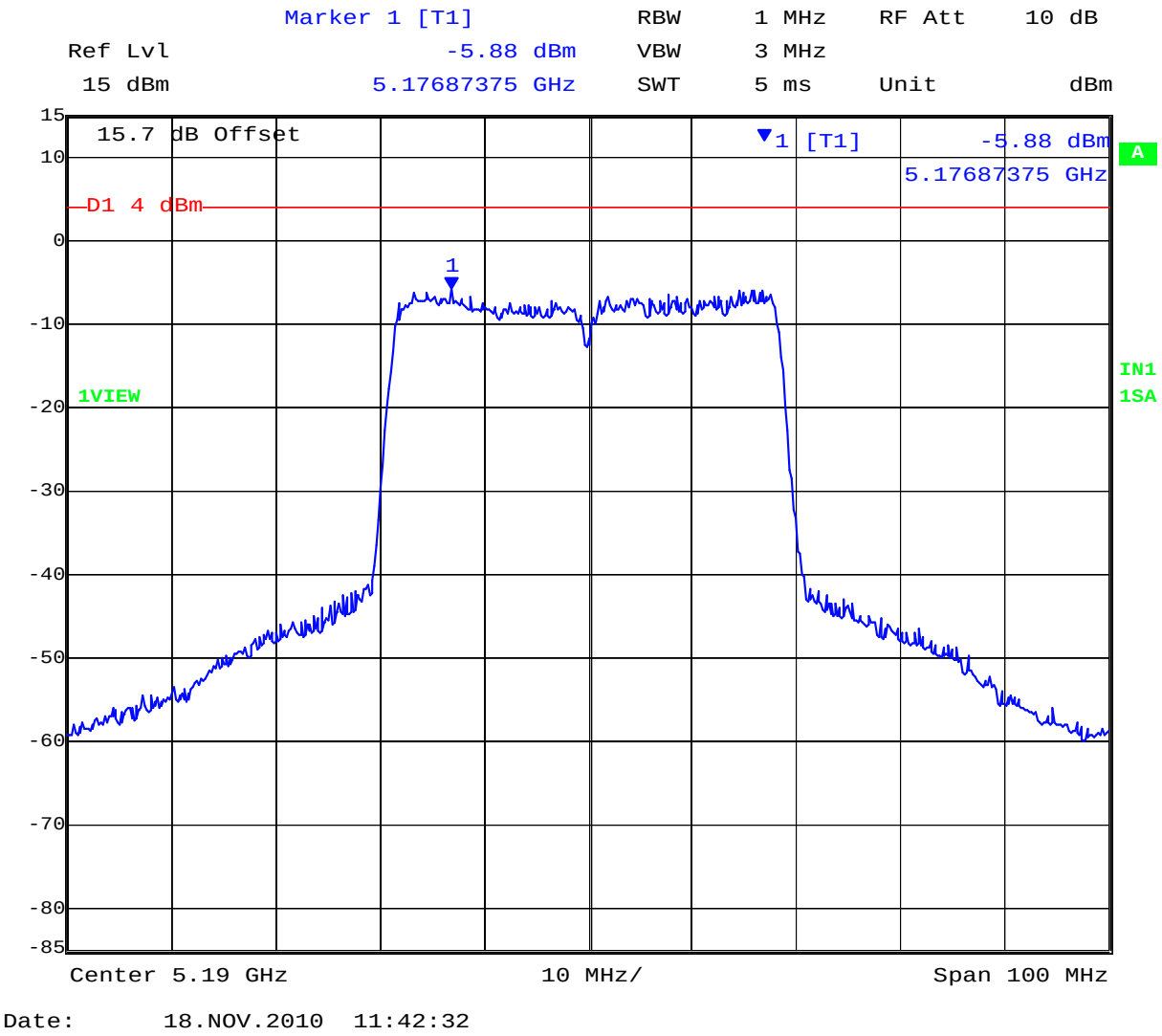


Test Conditions:	15.407 (a)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11 n HT-40		**Ambient Temp. (ºC):**	19 to 22	
TPC:	HIGH		**Pressure (mBars):**	998 to 1003	
Modulation:	ON		**Duty Cycle (%):**	100	
Beam Forming Gain (Y):	N/A	dB	**Antenna Gain:**	4 dBi	
Applied Voltage:	48.0	Vdc			
Notes 1:					
Notes 2:					

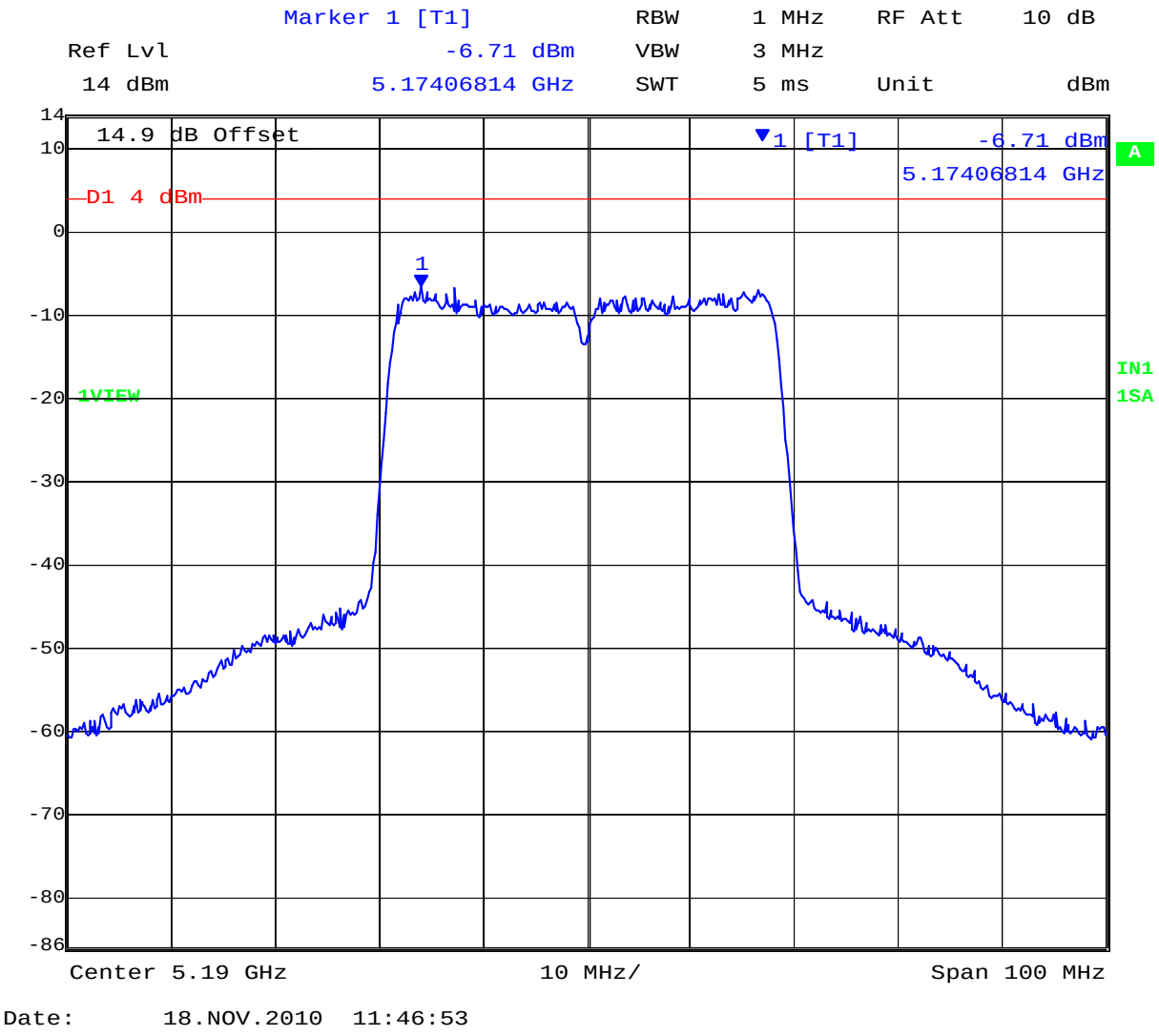
Test Frequency	**Measured Peak Power RF Port (dBm)**				**Total Power (dBm)**		**Limit**	**Margin**
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
5190	-5.88	-6.71	-5.56		2.20		4.00	-1.80
5230	-7.41	-8.32	-5.82		0.27		4.00	-3.73

Measurement uncertainty:	±1.33 dB

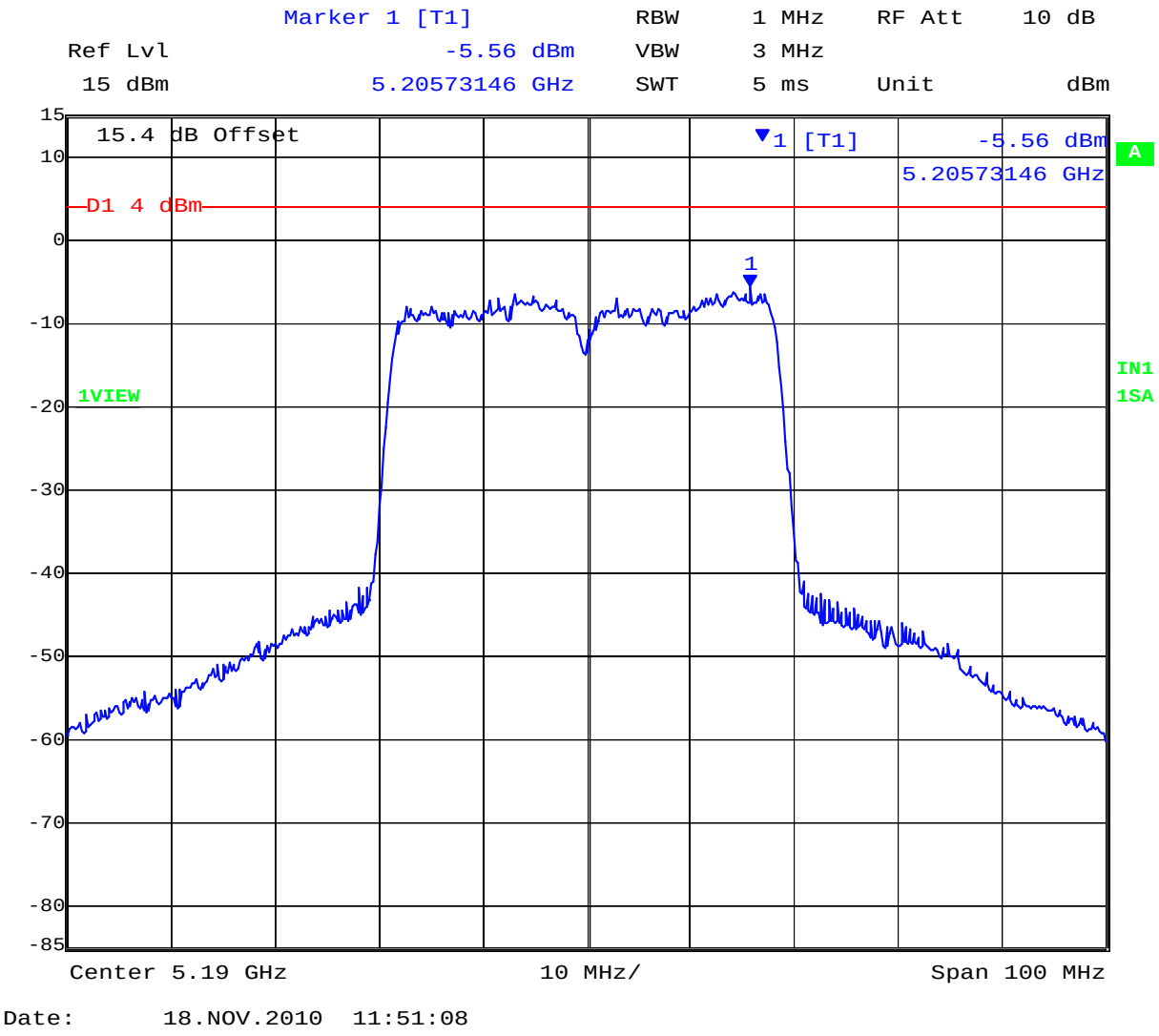
5190 MHz 802.11HT-40 Chain a, Peak Power Spectral Density



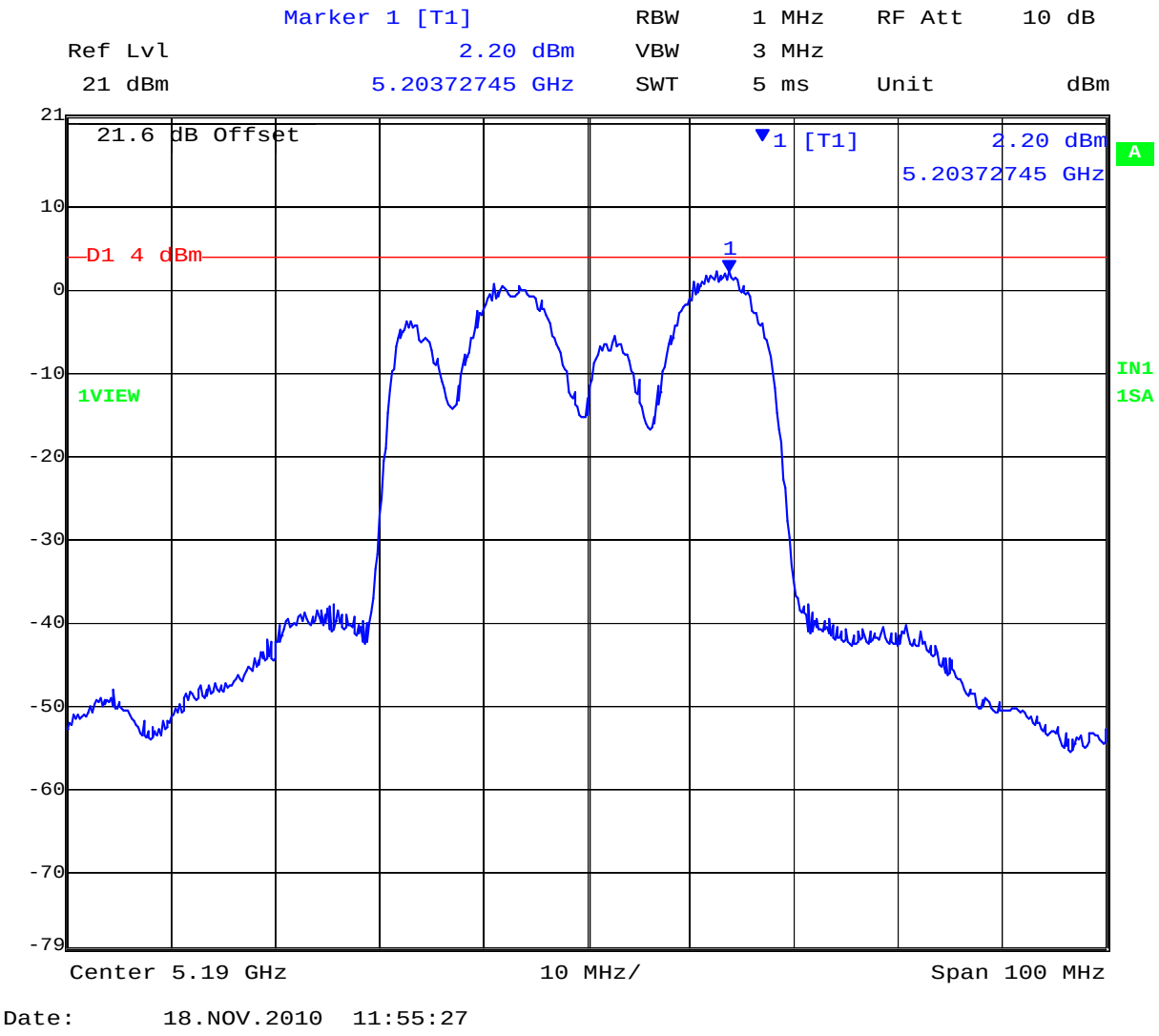
5190 MHz 802.11HT-40 Chain b, Peak Power Spectral Density



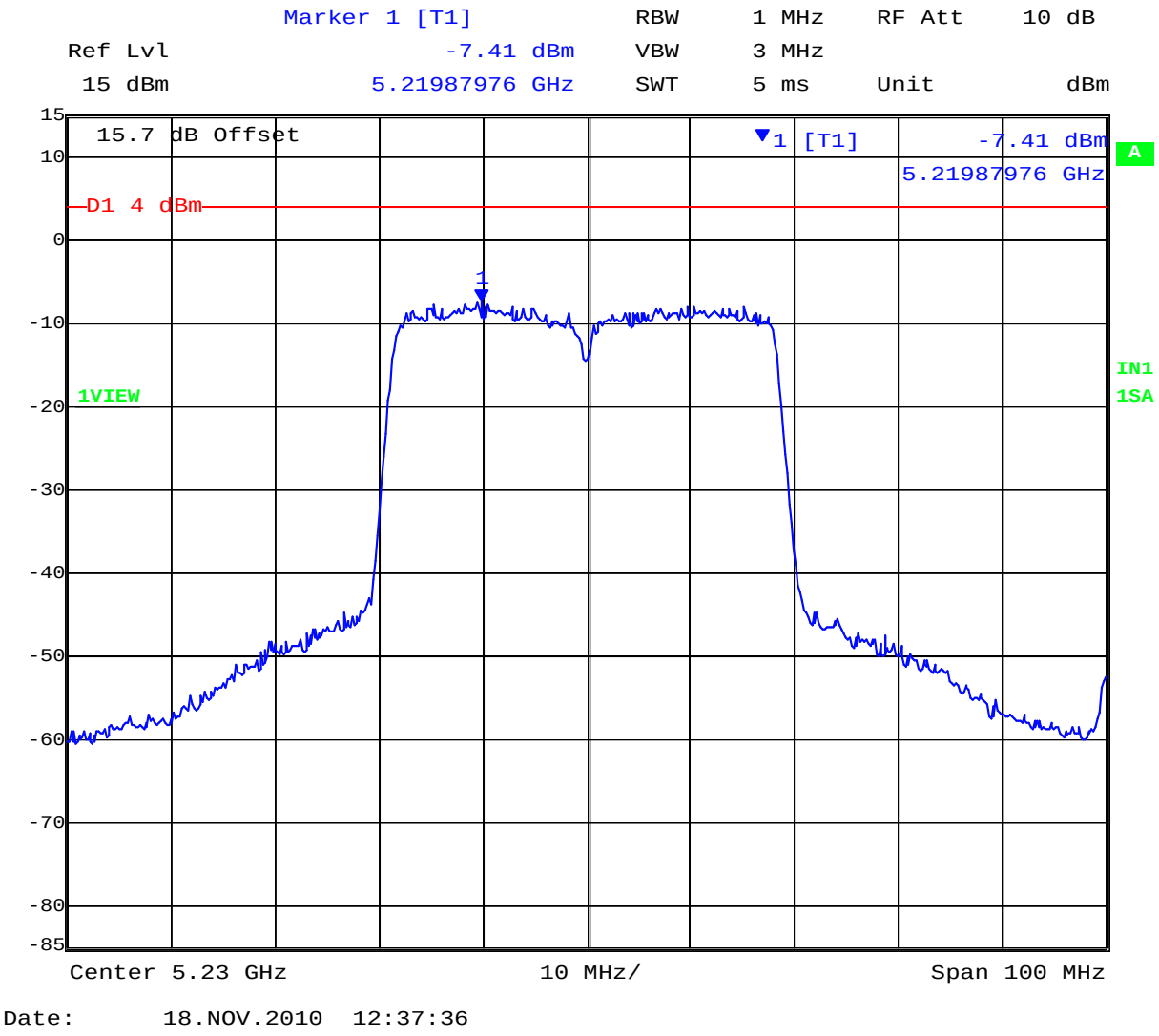
5190 MHz 802.11HT-40 Chain c, Peak Power Spectral Density



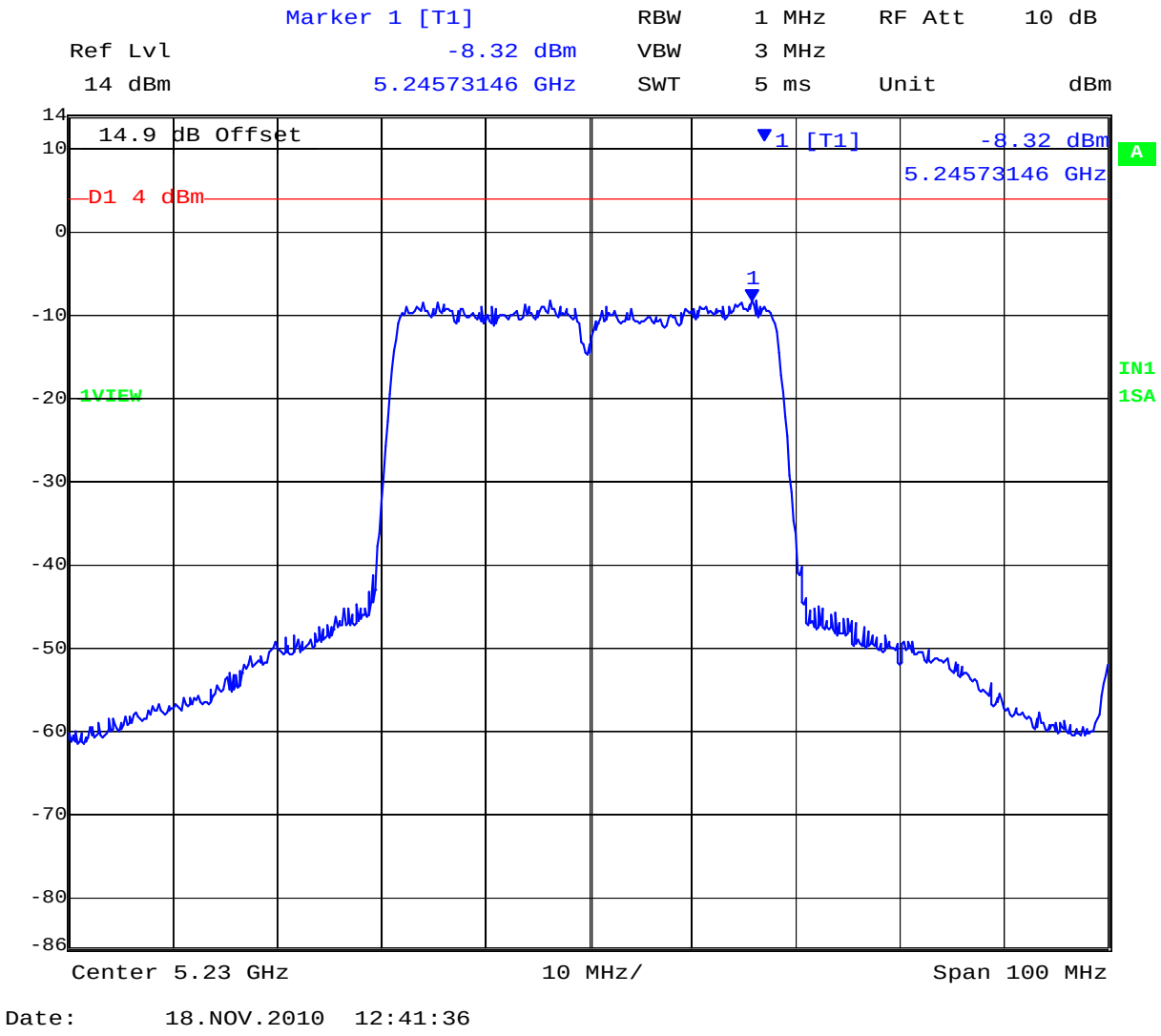
5190 MHz 802.11HT-40 Combined, Peak Power Spectral Density



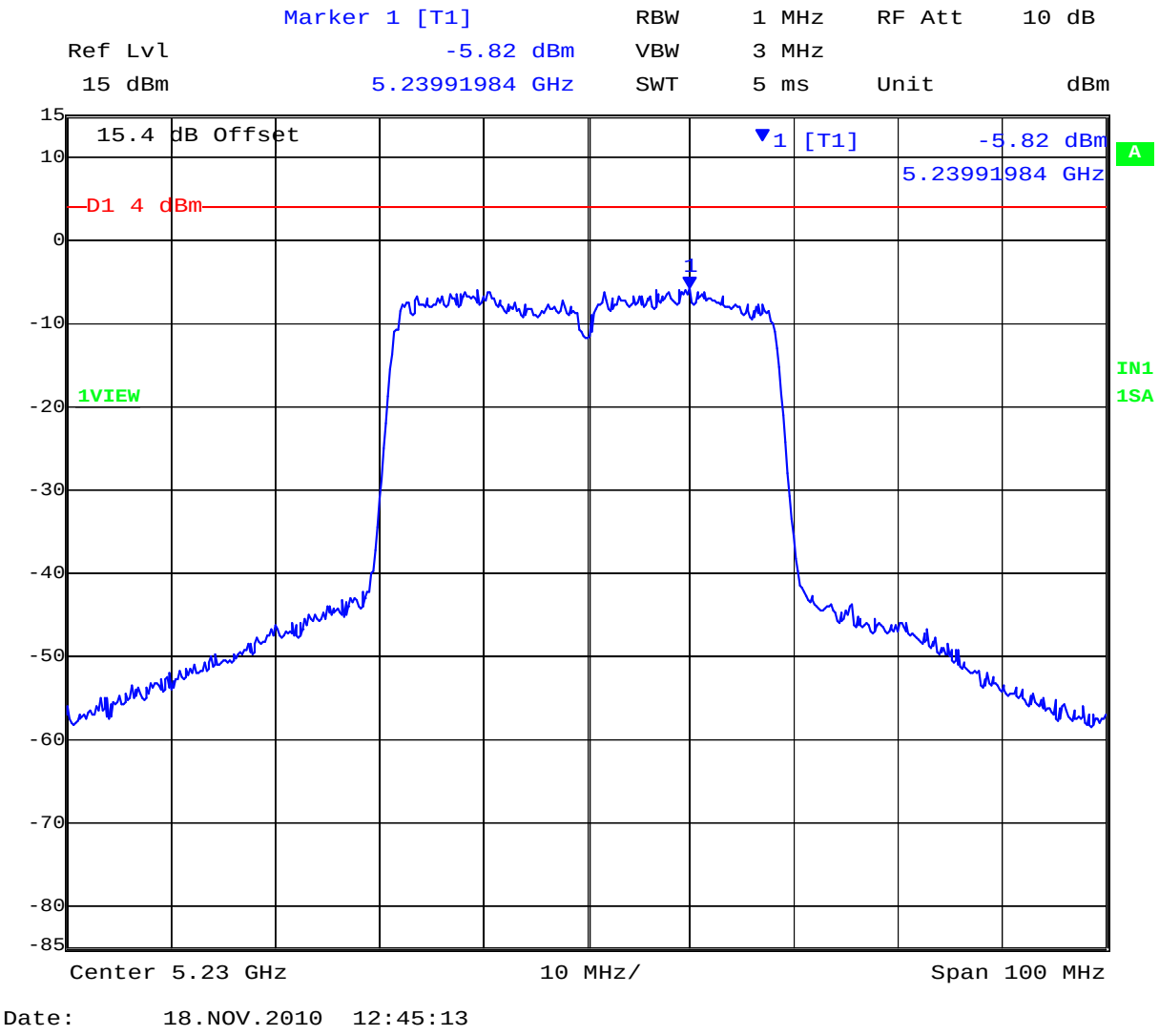
5230 MHz 802.11HT-40 Chain a, Peak Power Spectral Density



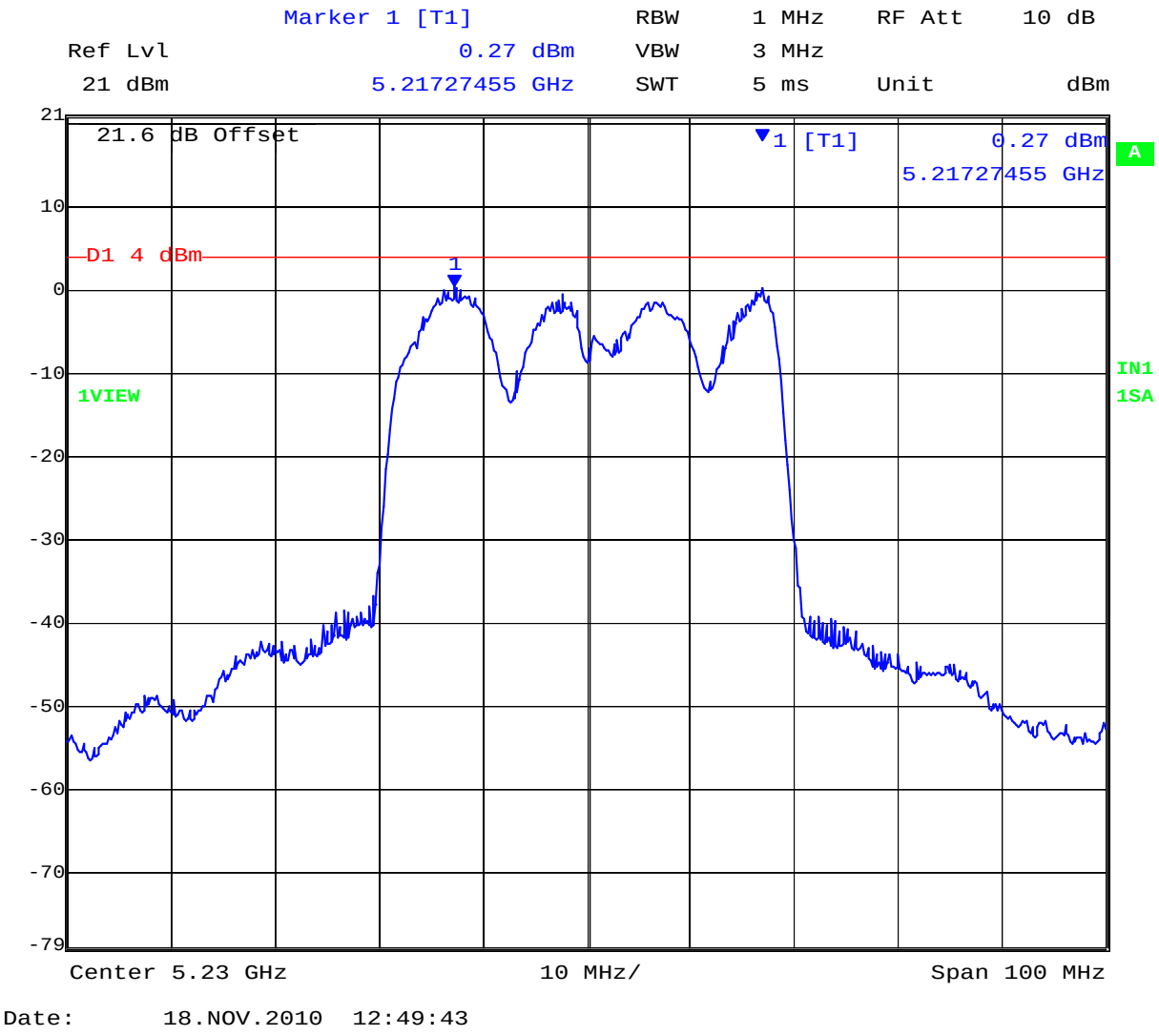
5230 MHz 802.11HT-40 Chain b, Peak Power Spectral Density



5230 MHz 802.11HT-40 Chain c, Peak Power Spectral Density



5230 MHz 802.11HT-40 Combined, Peak Power Spectral Density



Specification

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

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

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

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

Laboratory Measurement Uncertainty for Spectral Density

Measurement uncertainty	±1.33 dB

Traceability

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

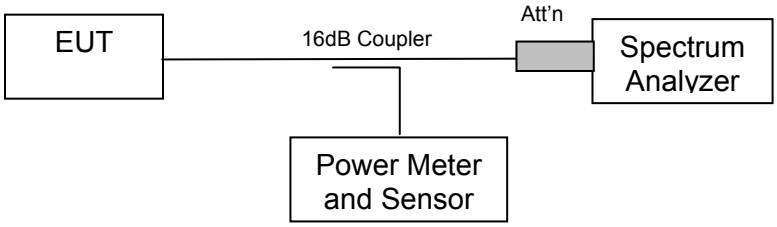
5.1.4. Peak Excursion Ratio

FCC, Part 15 Subpart C §15.407(a)(6)

Test Procedure

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

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

Test Conditions:	15.407 (a)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11a		**Ambient Temp. (ºC):**	19 to 22	
TPC:	HIGH		**Pressure (mBars):**	998 to 1003	
Modulation:	ON		**Duty Cycle (%):**	100	
Beam Forming Gain (Y):	N/A	dB	**Antenna Gain:**	4	dBi
Applied Voltage:	48.0	Vdc			

	Trace Peak Power Markers		Δ Marker (Marker 1 – 2)	Limit	Margin
	1	2			

Frequency 5180 MHz

Chain	dBm	dBm	dB	dB	dB
a	8.53	-2.67	-11.20	-13.00	-1.80
b	7.82	-4.14	-11.96		-1.04
c	7.25	-3.05	-10.30		-2.70
Combined	14.72	4.81	-9.91		-3.09

Frequency 5200 MHz

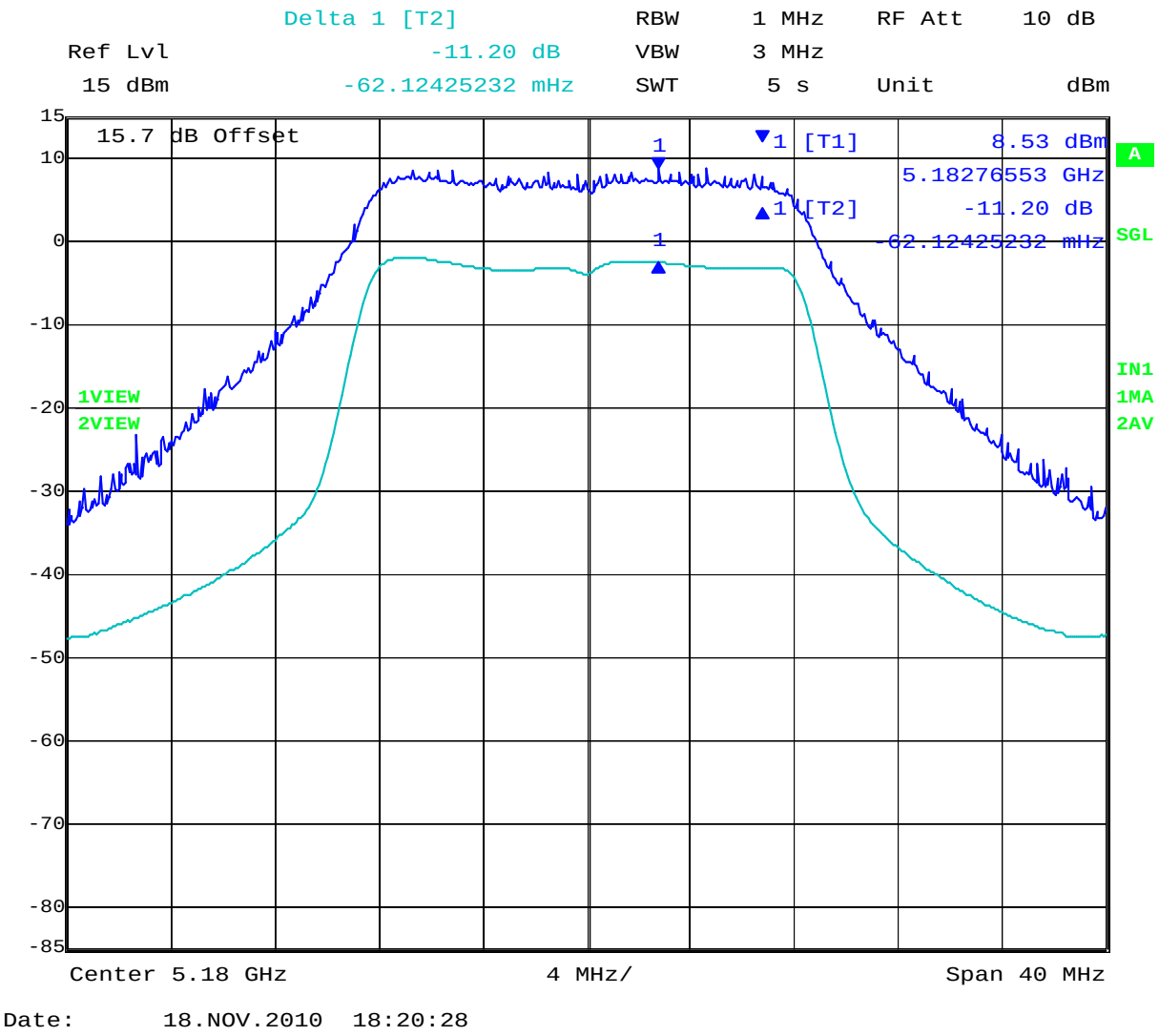
Chain	dBm	dBm	dB	dB	dB
a	7.85	-3.61	-11.46	-13.00	-1.54
b	7.79	-3.78	-11.57		-1.43
c	7.72	-2.91	-10.63		-2.37
Combined	15.29	4.57	-10.72		-2.28

Frequency 5240 MHz

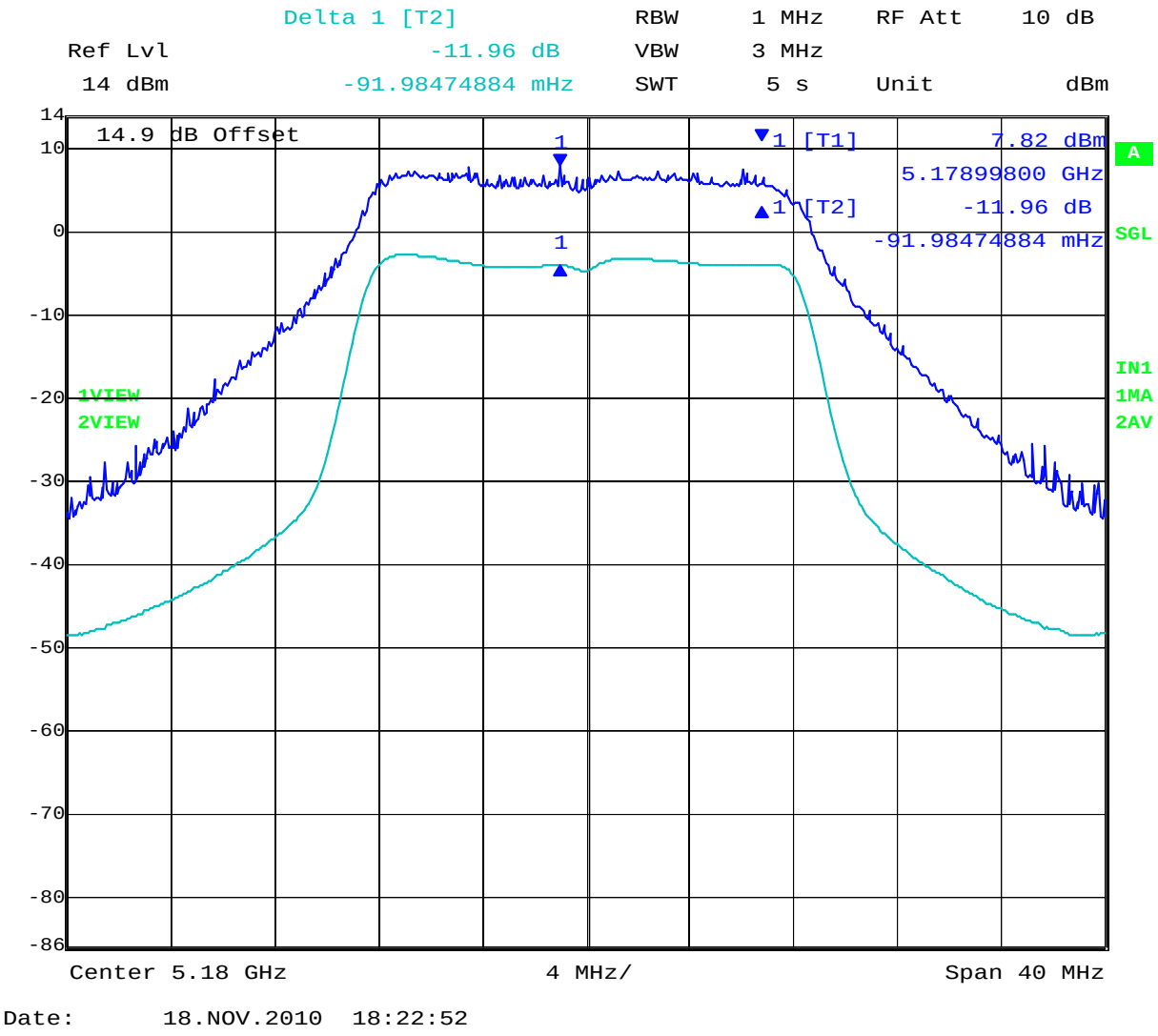
Chain	dBm	dBm	dB	dB	dB
a	7.28	-4.25	-11.53	-13.00	-1.47
b	6.42	-4.99	-11.41		-1.59
c	7.90	-2.24	-10.14		-2.86
Combined	13.61	3.40	-10.21		-2.79

Measurement uncertainty:	±1.33 dB

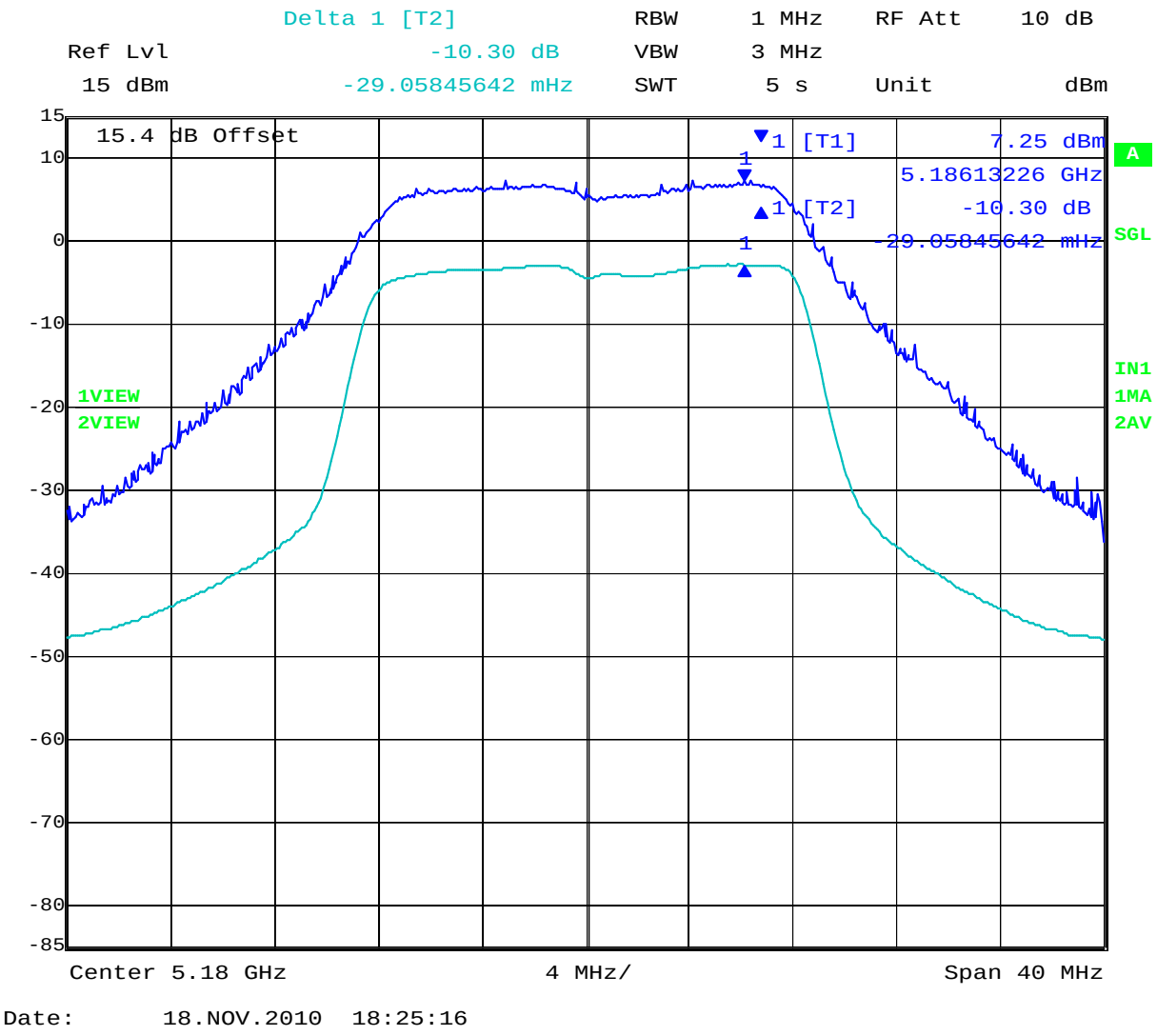
5180 MHz 802.11a Chain a, Peak Excursion Ratio



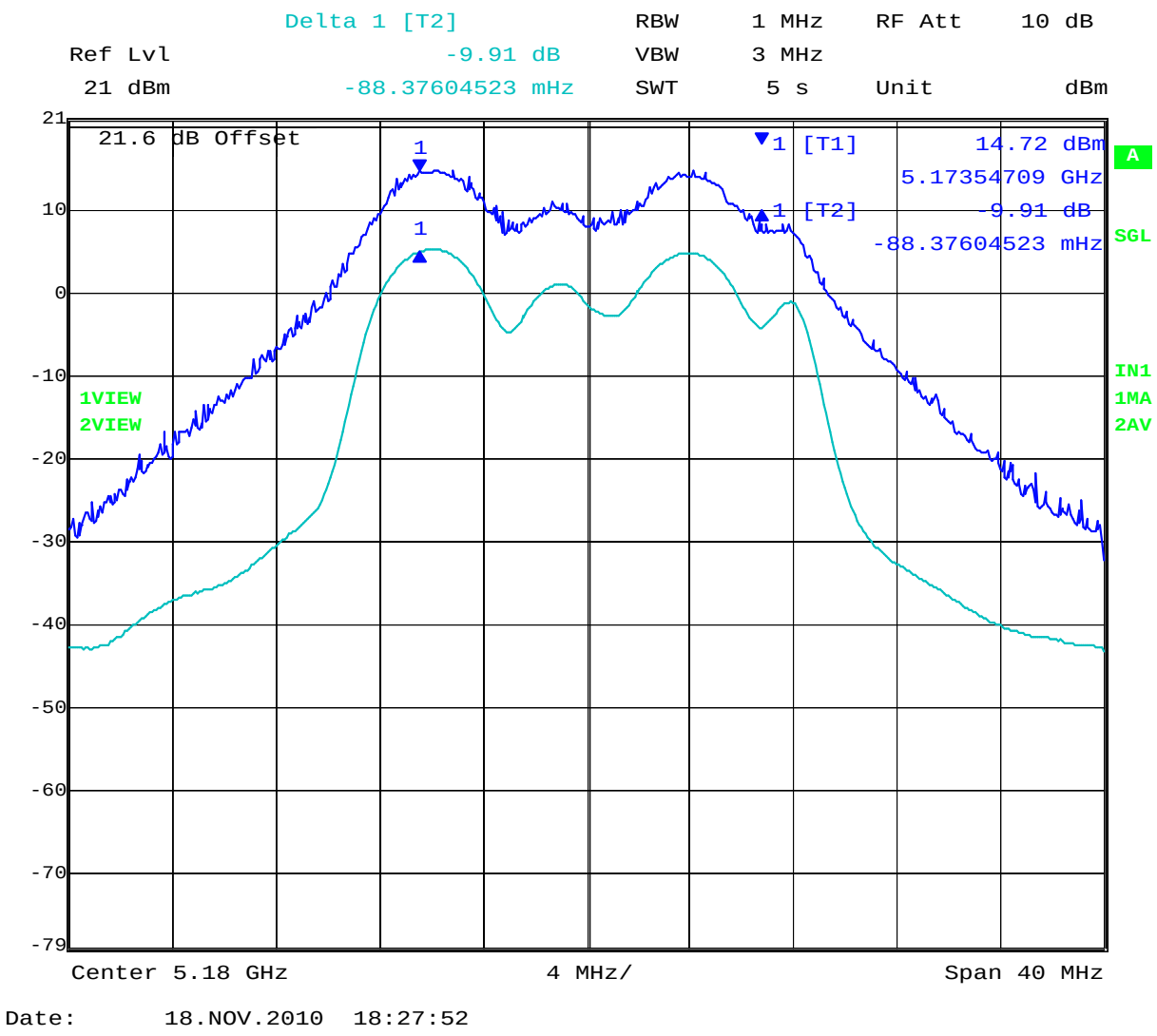
5180 MHz 802.11a Chain b, Peak Excursion Ratio



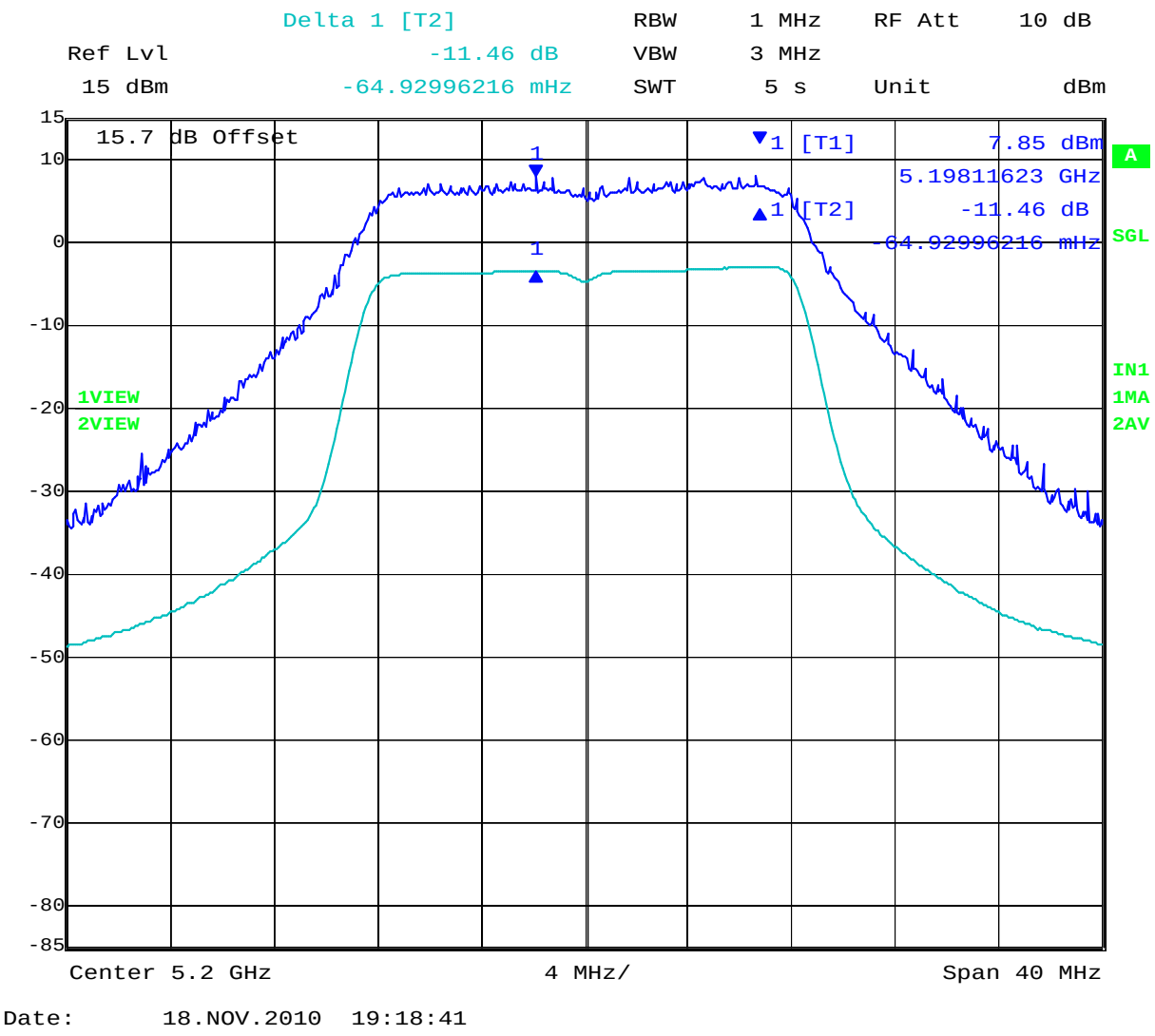
5180 MHz 802.11a Chain c, Peak Excursion Ratio



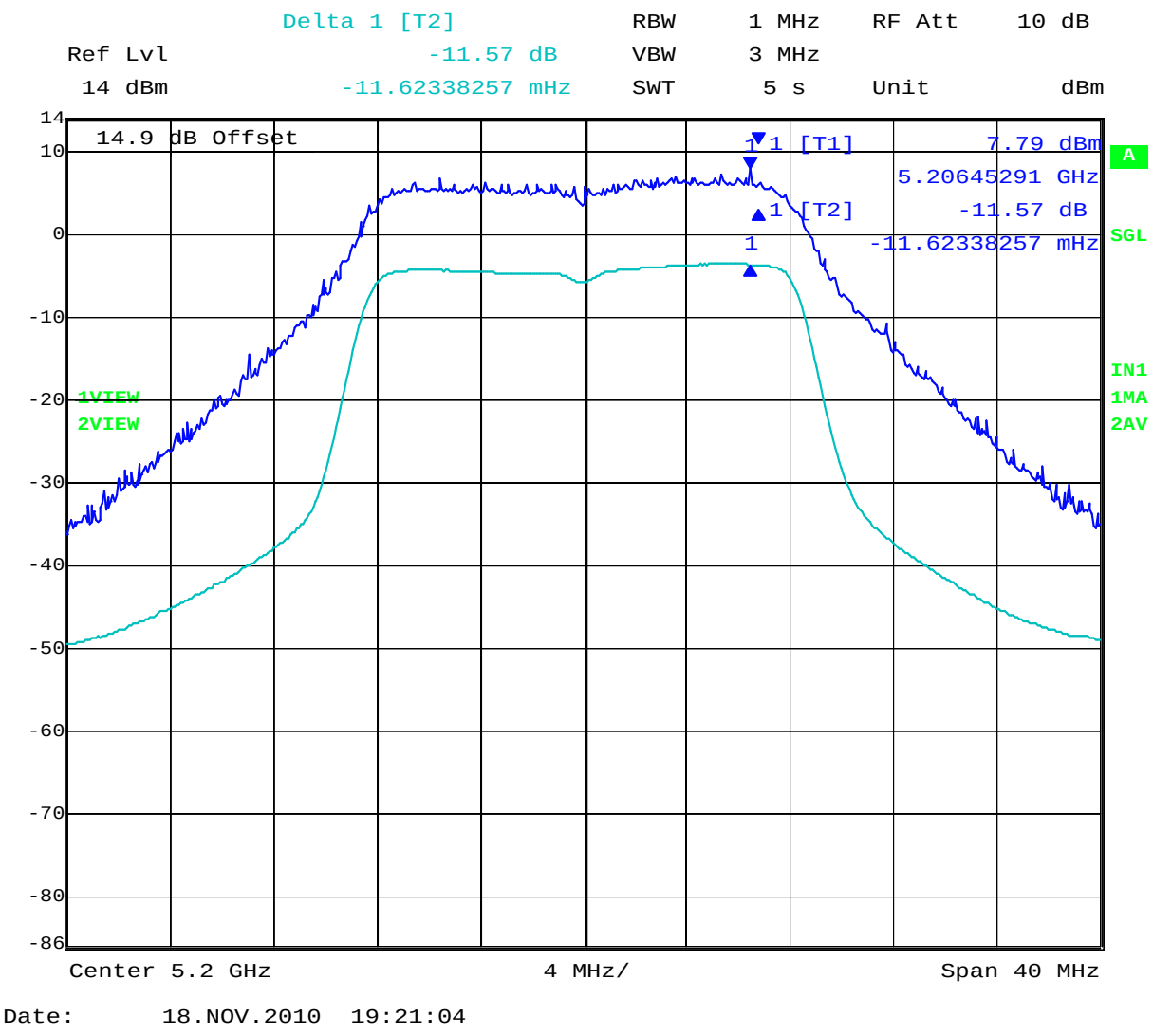
5180 MHz 802.11a Combined, Peak Excursion Ratio



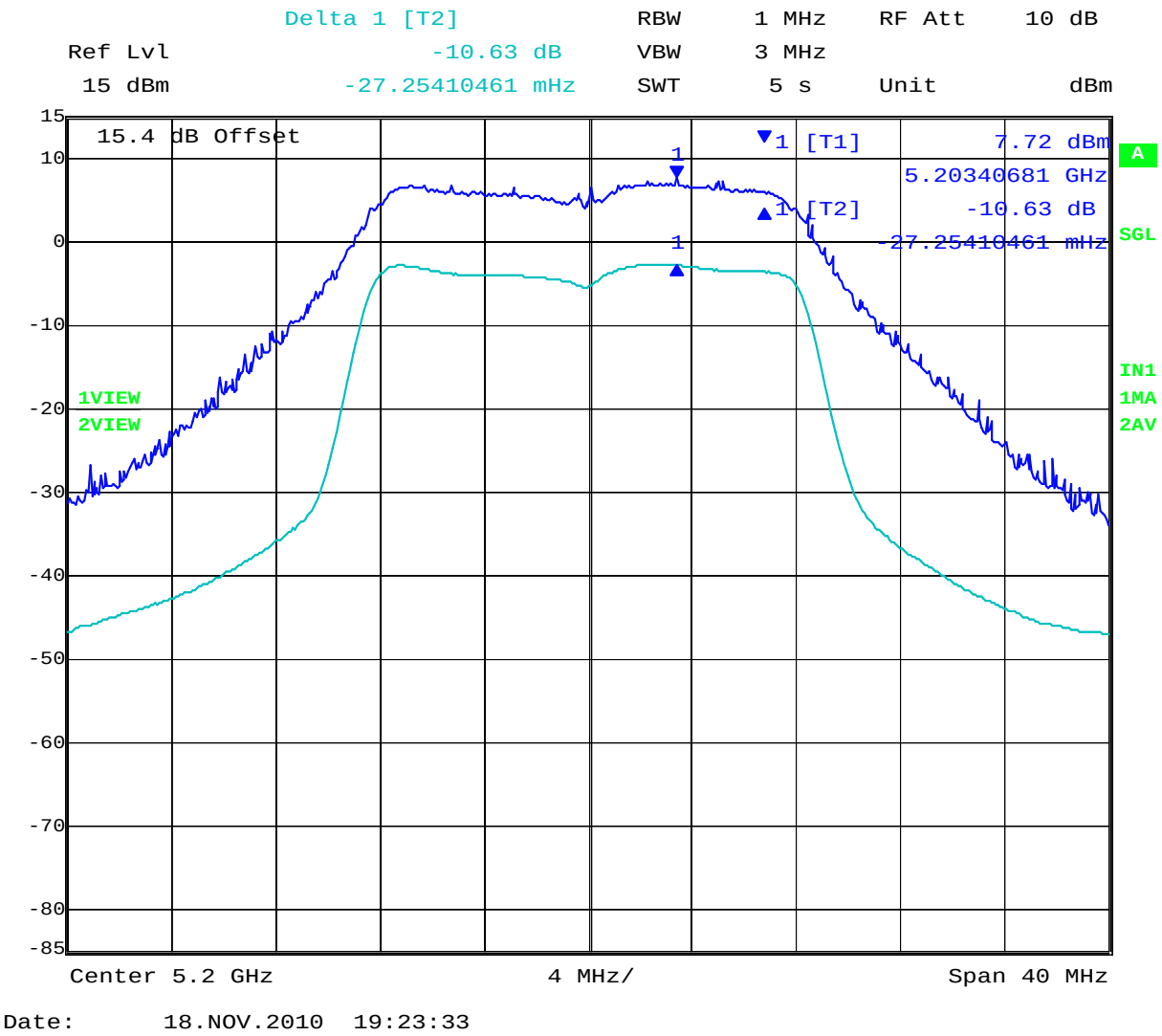
5200 MHz 802.11a Chain a, Peak Excursion Ratio



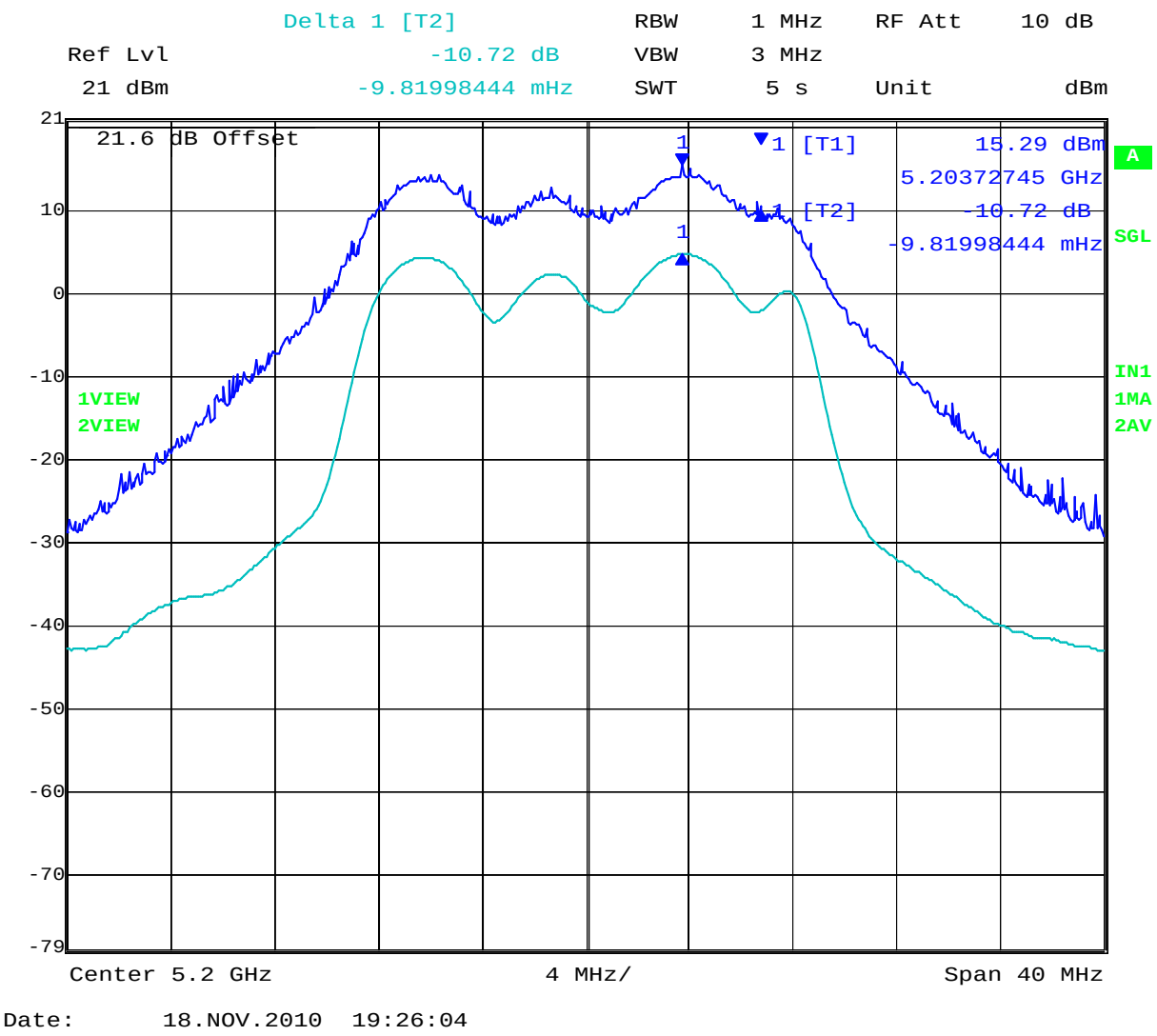
5200 MHz 802.11a Chain b, Peak Excursion Ratio



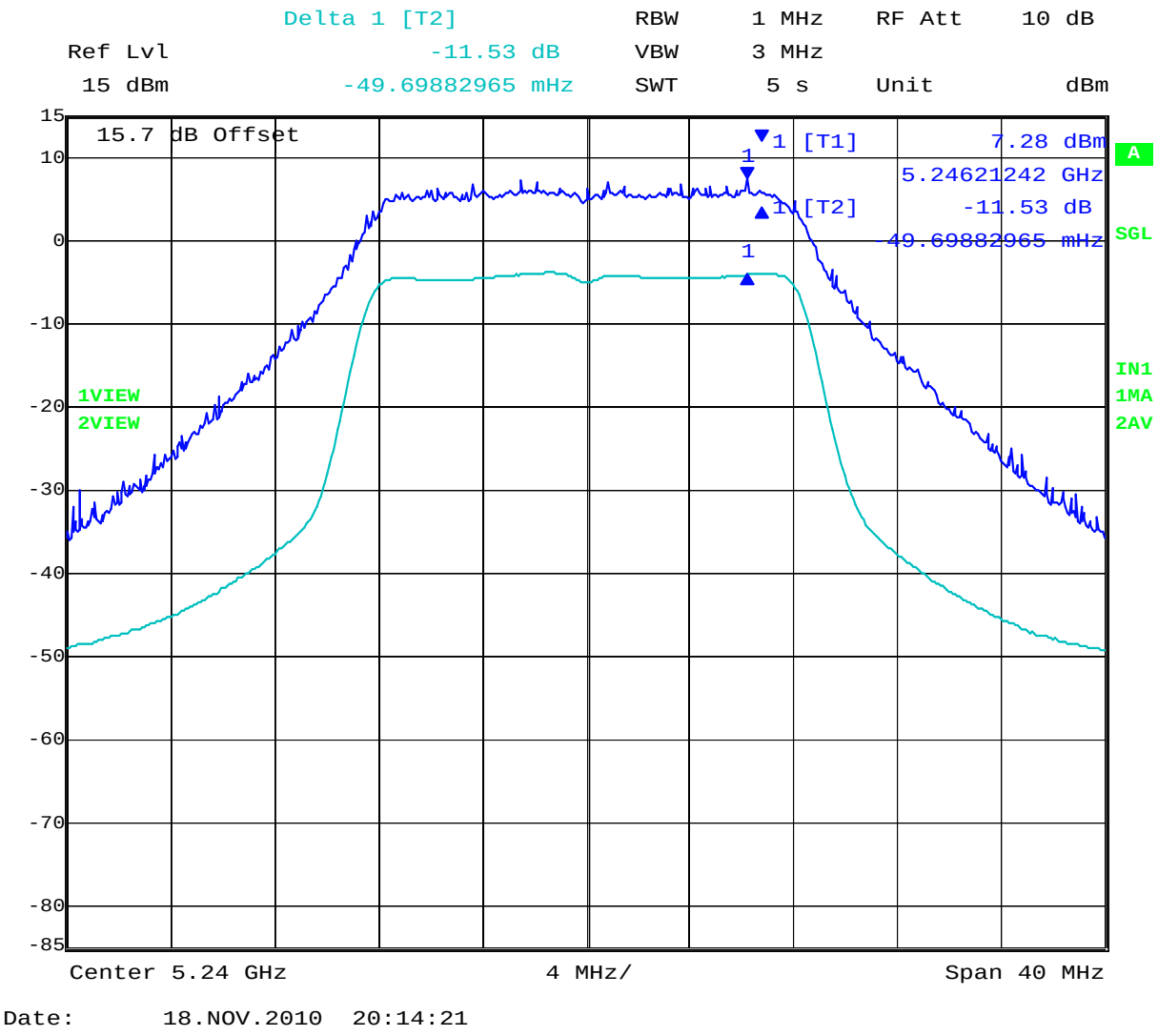
5200 MHz 802.11a Chain c, Peak Excursion Ratio



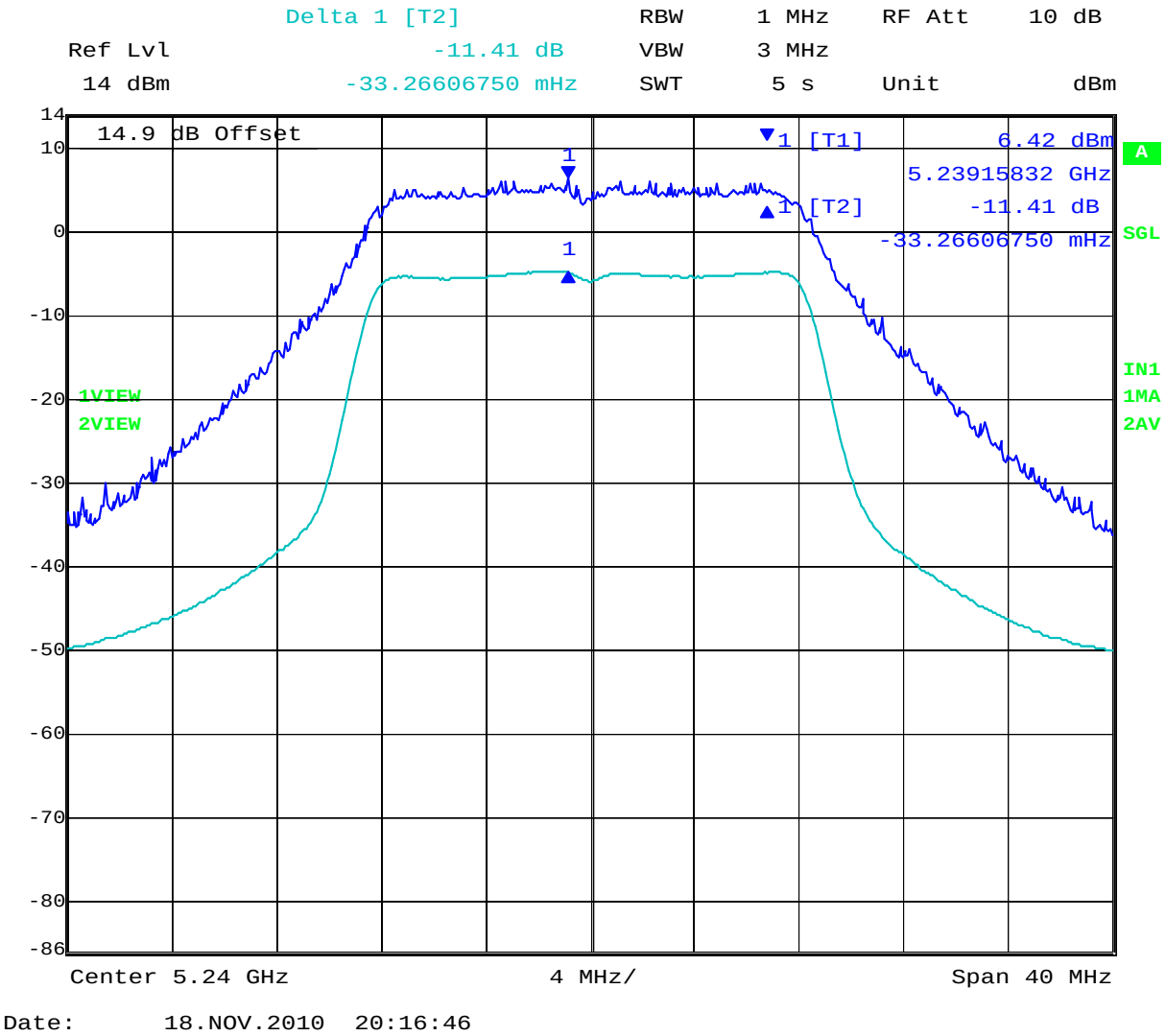
5200 MHz 802.11a Combined, Peak Excursion Ratio



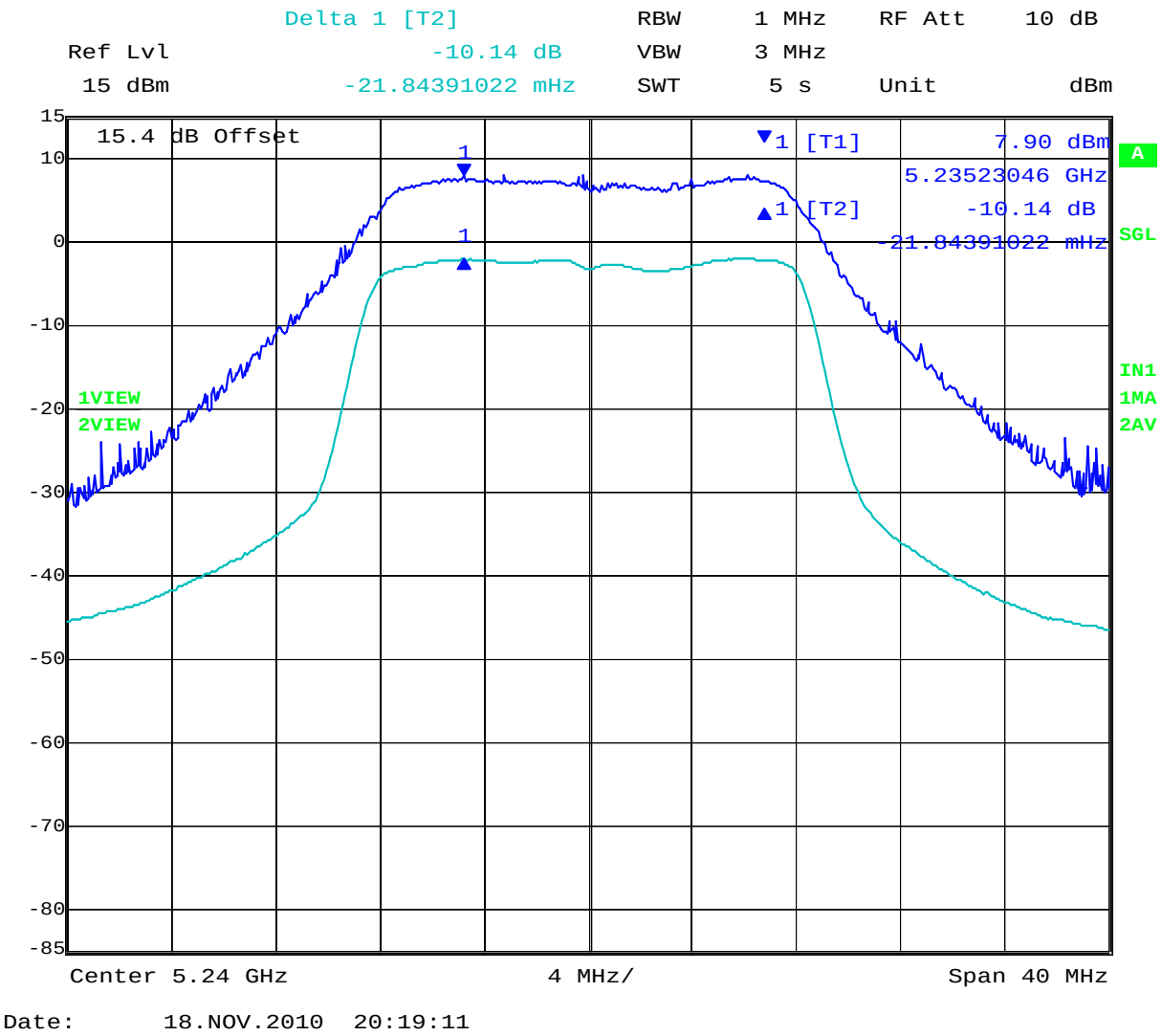
5240 MHz 802.11a Chain a, Peak Excursion Ratio



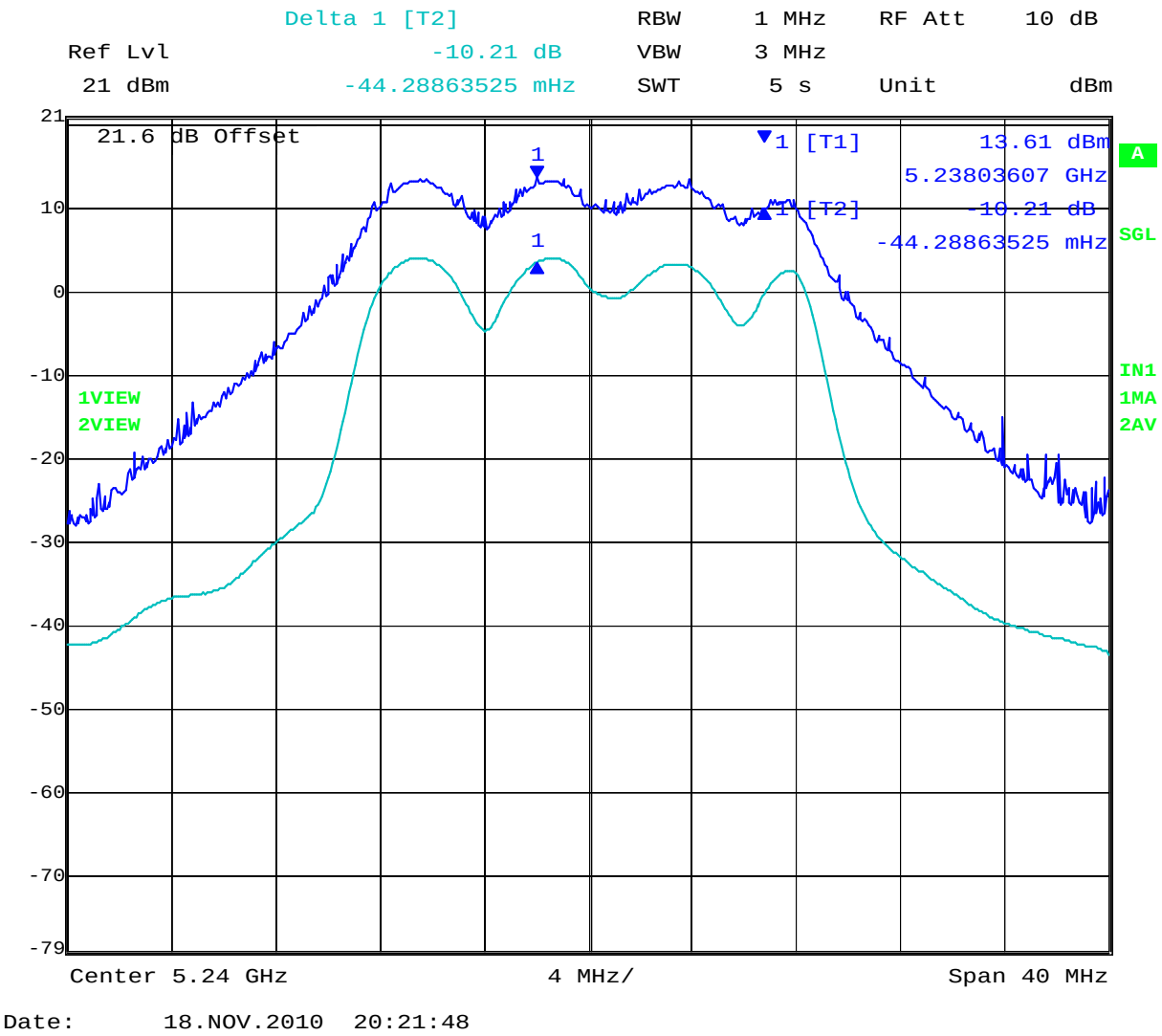
5240 MHz 802.11a Chain b, Peak Excursion Ratio



5240 MHz 802.11a Chain c, Peak Excursion Ratio



5240 MHz 802.11a Combined, Peak Excursion Ratio



Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35	to	42
Variant:	802.11HT-20	**Ambient Temp. (ºC):**	19	to	22
TPC:	HIGH	**Pressure (mBars):**	998	to	1003
Modulation:	ON	**Duty Cycle (%):**	100		
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	4 dBi		
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

Frequency 5180 MHz

	Trace Peak Power Markers		Δ Marker (Marker 1 – 2)	Limit	Margin
Chain	**1**	**2**			
	dBm	**dBm**	**dB**	**dB**	**dB**
a	10.03	-0.60	-10.63	-13.00	-2.37
b	9.50	-1.49	-10.99		-2.01
c	9.26	-0.93	-10.19		-2.81
Combined	17.59	7.62	-9.97		-3.03

Frequency 5200 MHz

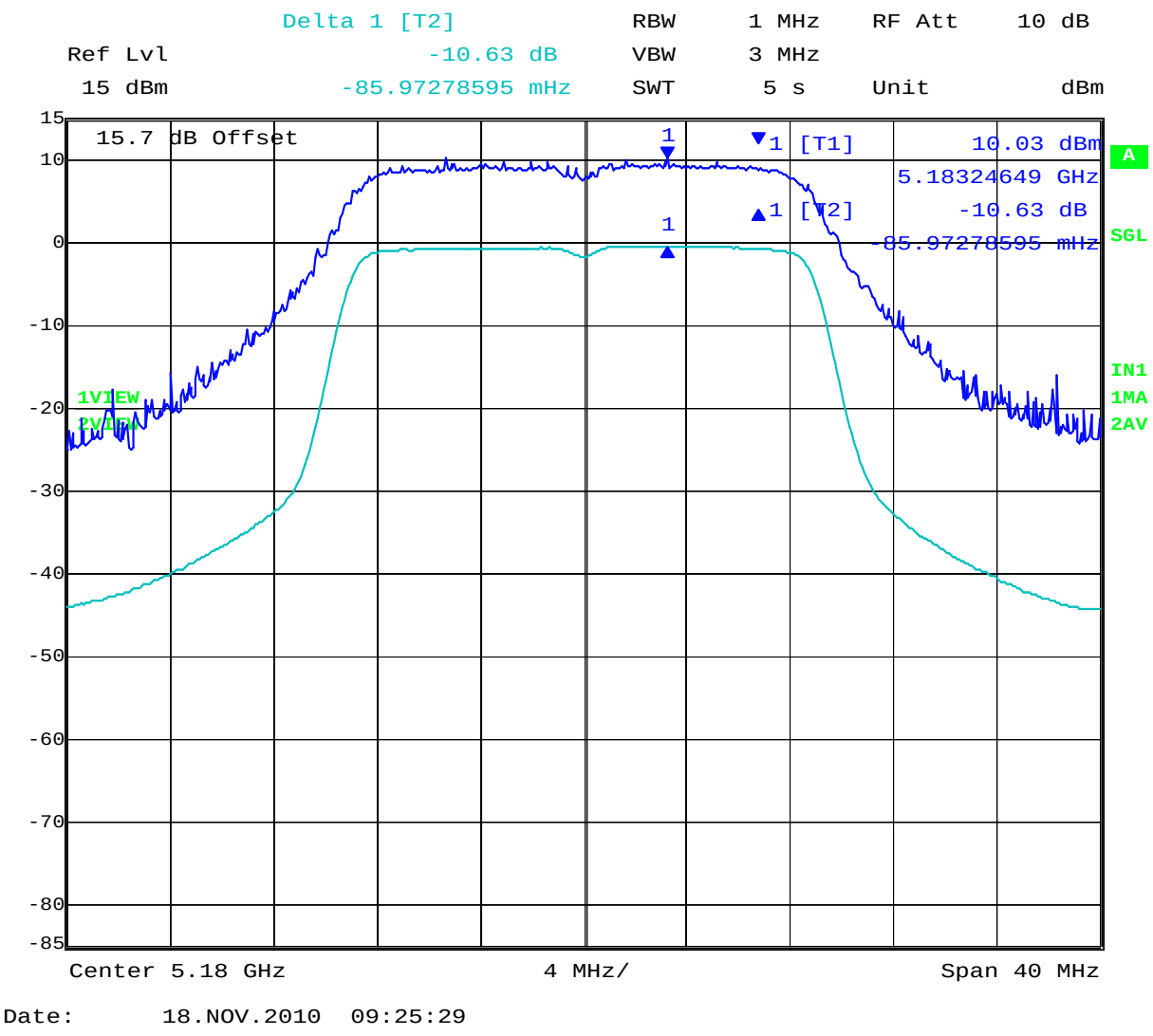
	Trace Peak Power Markers		Δ Marker (Marker 1 – 2)	Limit	Margin
Chain	**1**	**2**			
	dBm	**dBm**	**dB**	**dB**	**dB**
a	7.76	-2.68	-10.44	-13.00	-2.56
b	7.52	-3.93	-11.45		-1.55
c	7.49	-2.46	-9.95		-3.05
Combined	16.29	6.58	-9.71		-3.29

Frequency 5240 MHz

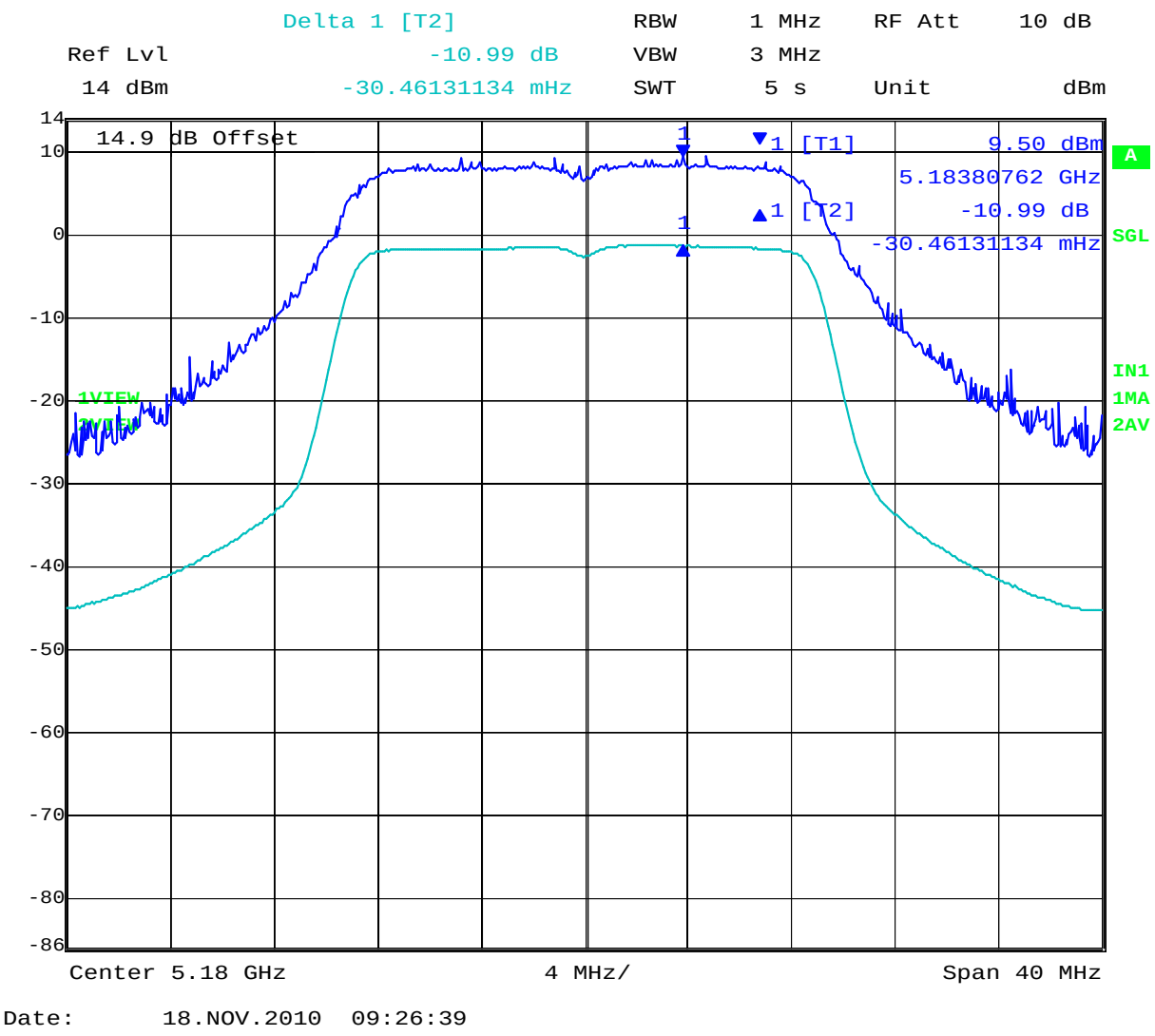
	Trace Peak Power Markers		Δ Marker (Marker 1 – 2)	Limit	Margin
Chain	**1**	**2**			
	dBm	**dBm**	**dB**	**dB**	**dB**
a	7.78	-2.63	-10.41	-13.00	-2.59
b	7.20	-3.90	-11.10		-1.90
c	9.16	-1.35	-10.51		-2.49
Combined	16.43	6.65	-9.78		-3.22

Measurement uncertainty:	±1.33 dB

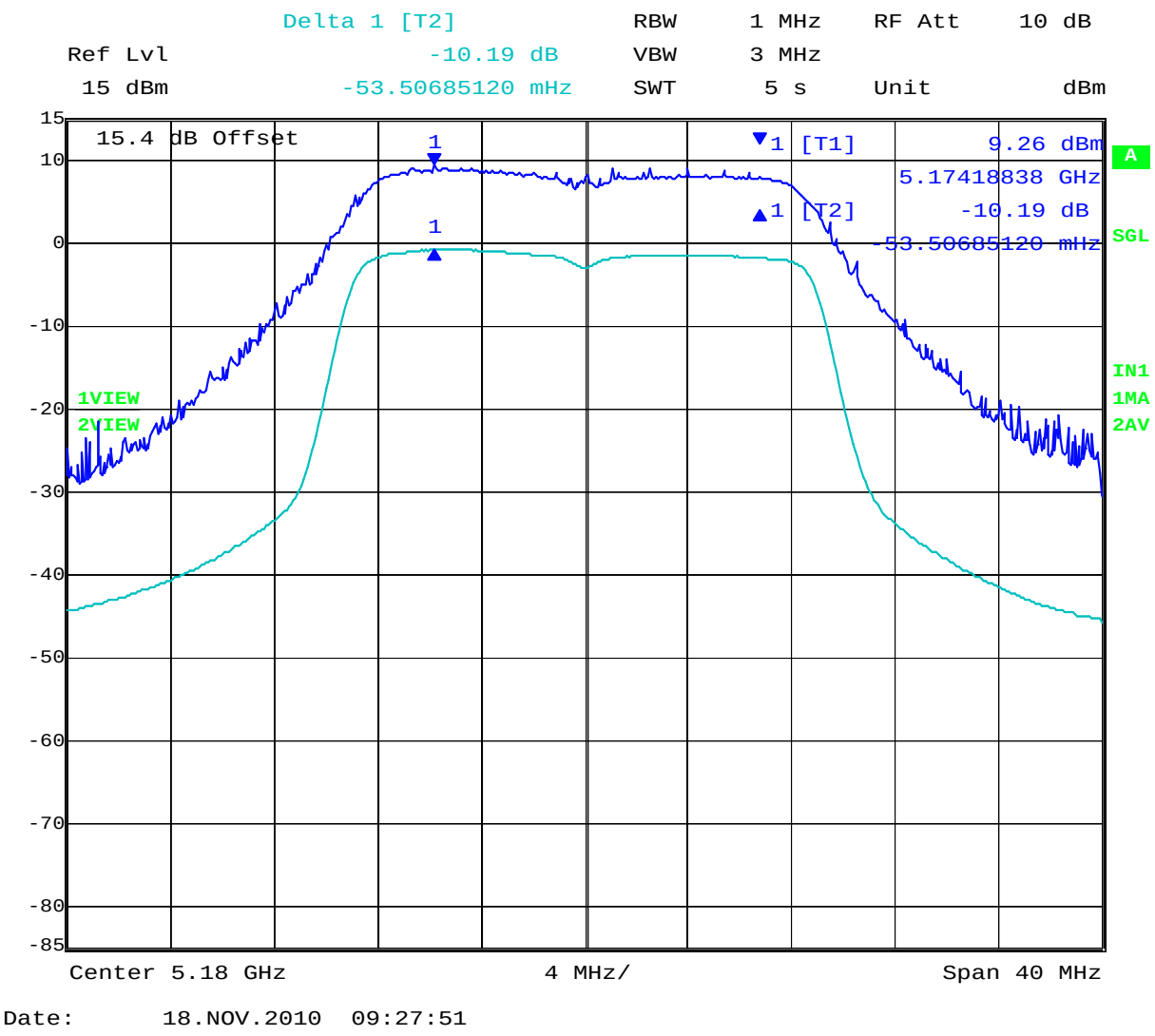
5180 MHz 802.11HT-20 Chain a, Peak Excursion Ratio



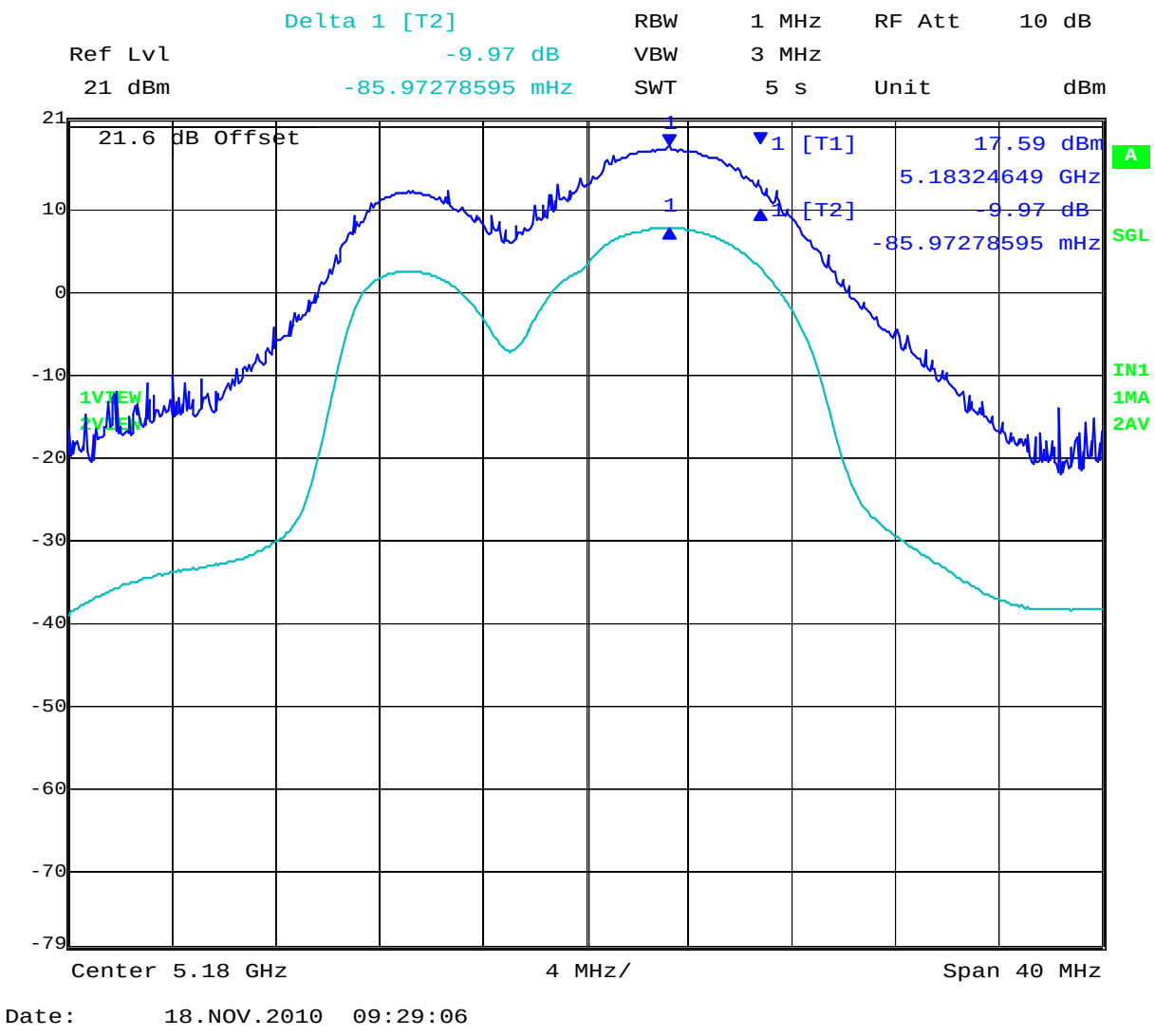
5180 MHz 802.11HT-20 Chain b, Peak Excursion Ratio



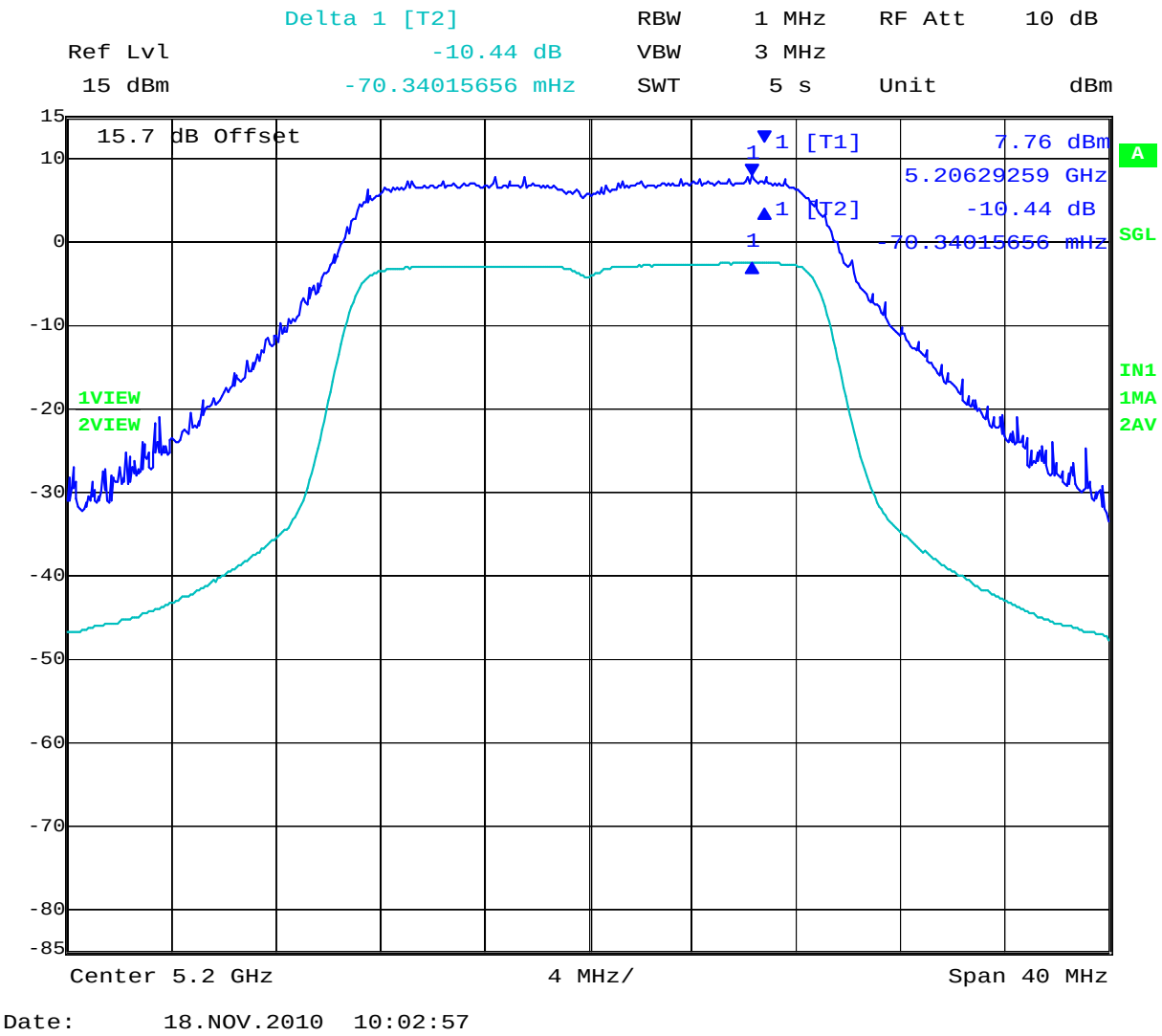
5180 MHz 802.11HT-20 Chain c, Peak Excursion Ratio



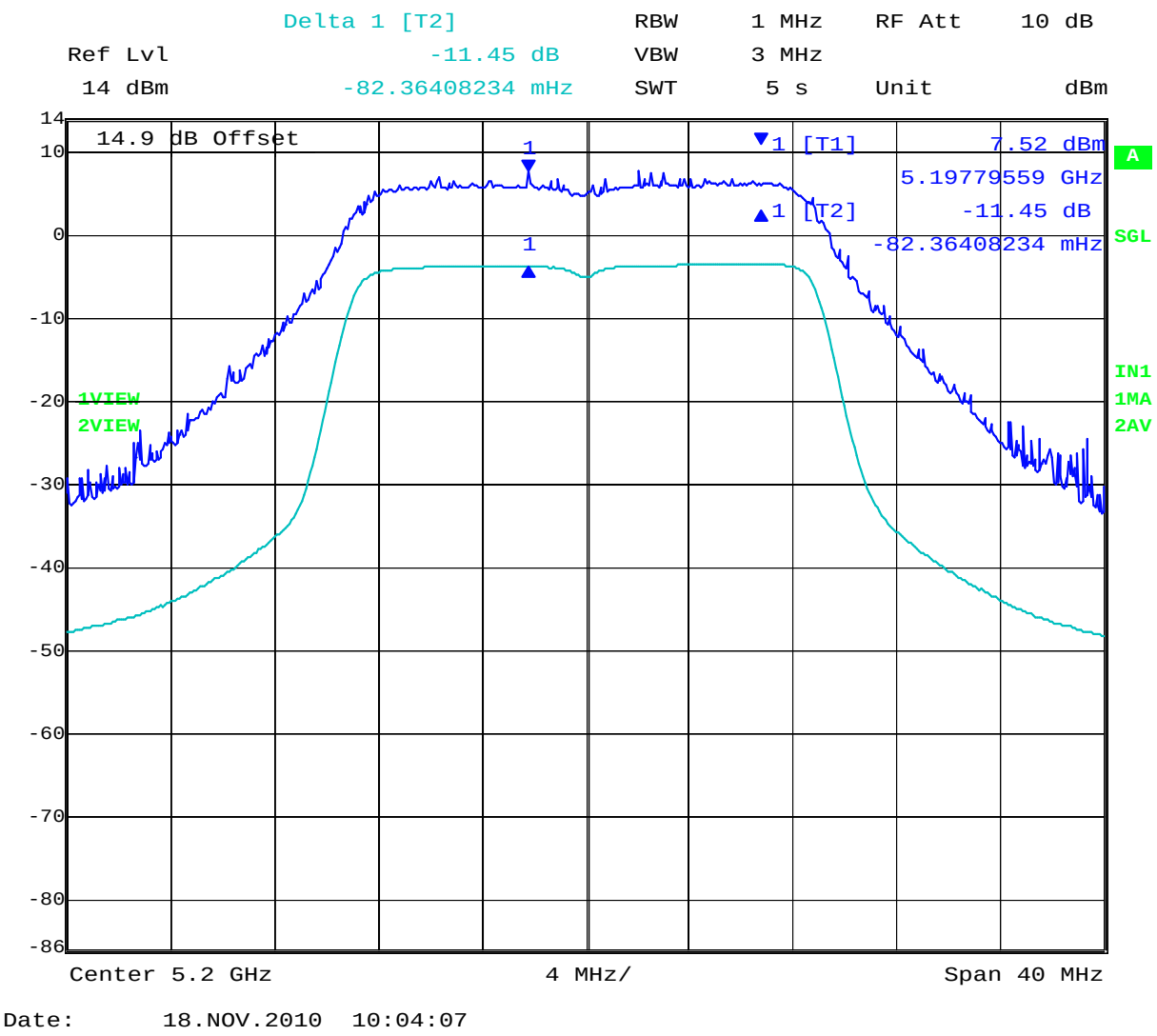
5180 MHz 802.11HT-20 Combined, Peak Excursion Ratio



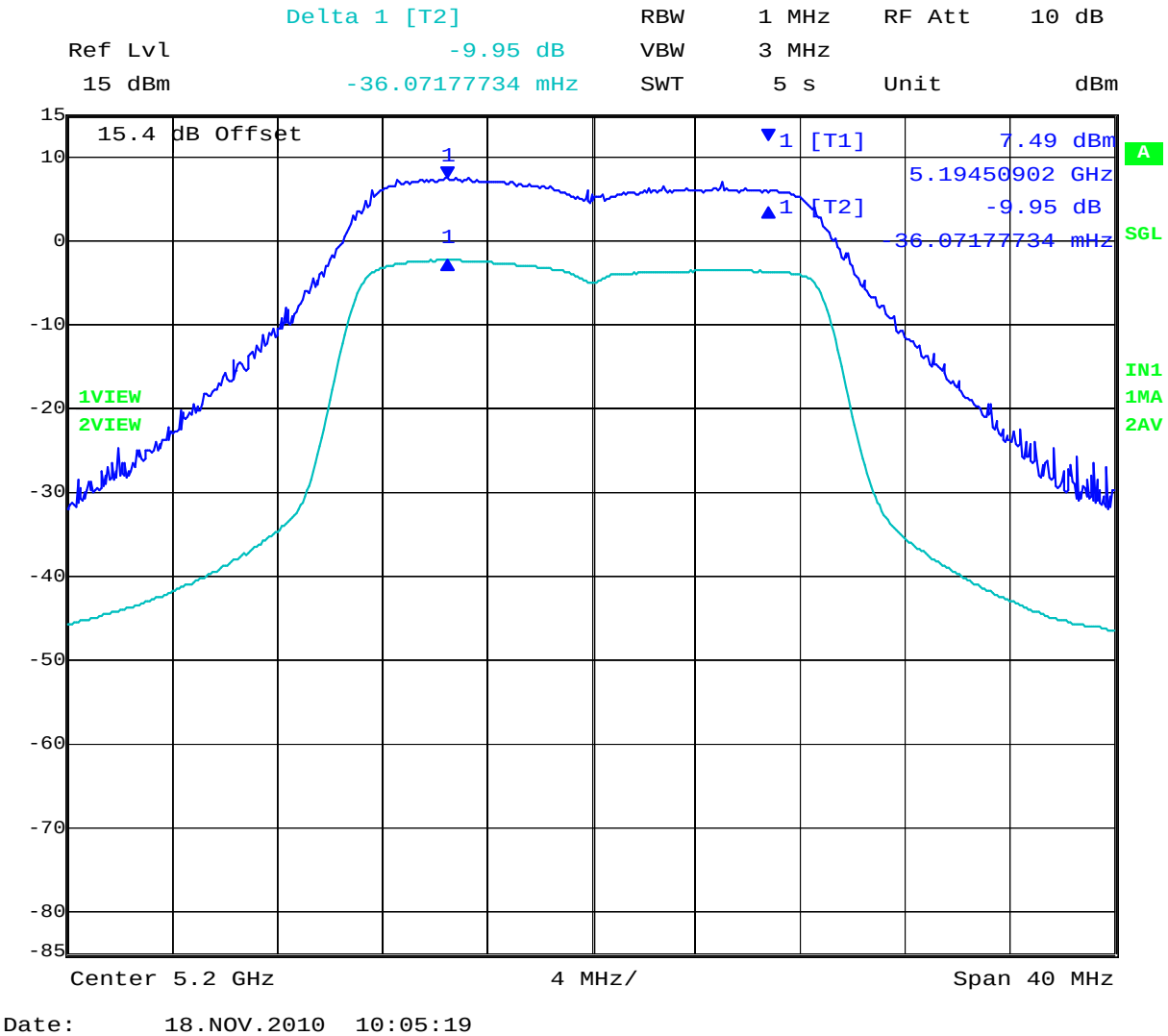
5200 MHz 802.11HT-20 Chain a, Peak Excursion Ratio



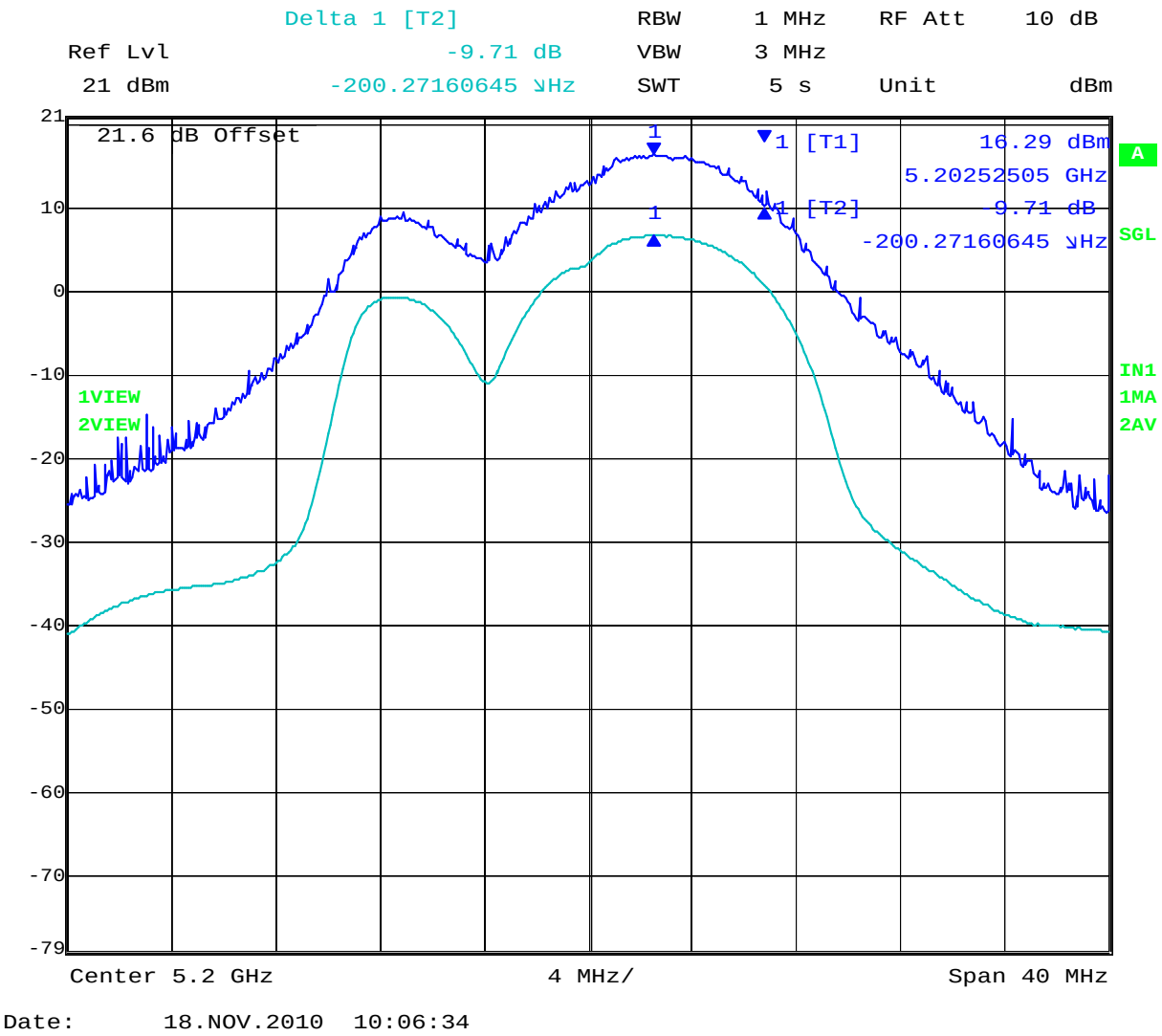
5200 MHz 802.11HT-20 Chain b, Peak Excursion Ratio



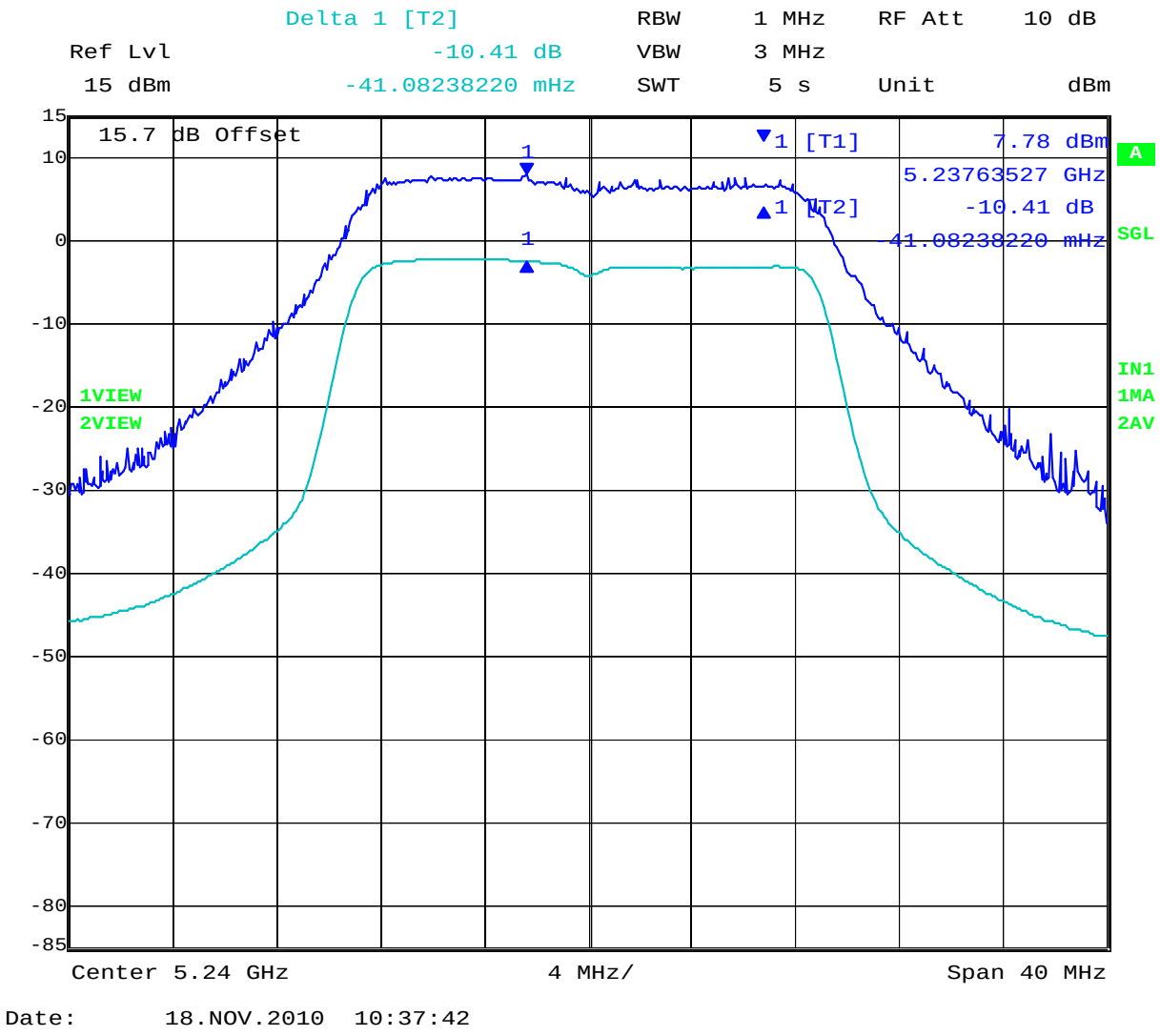
5200 MHz 802.11HT-20 Chain c, Peak Excursion Ratio



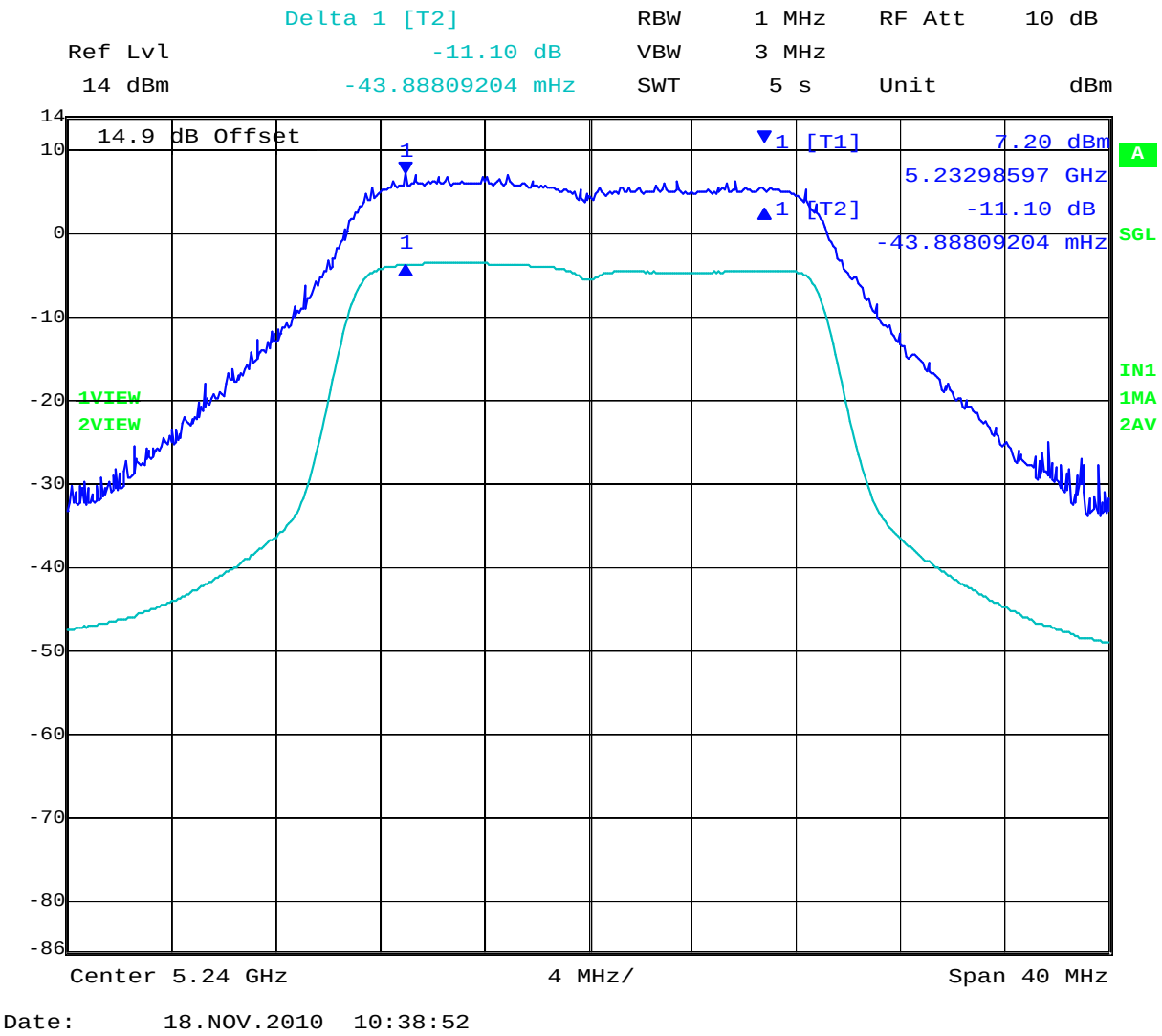
5200 MHz 802.11HT-20 Combined, Peak Excursion Ratio



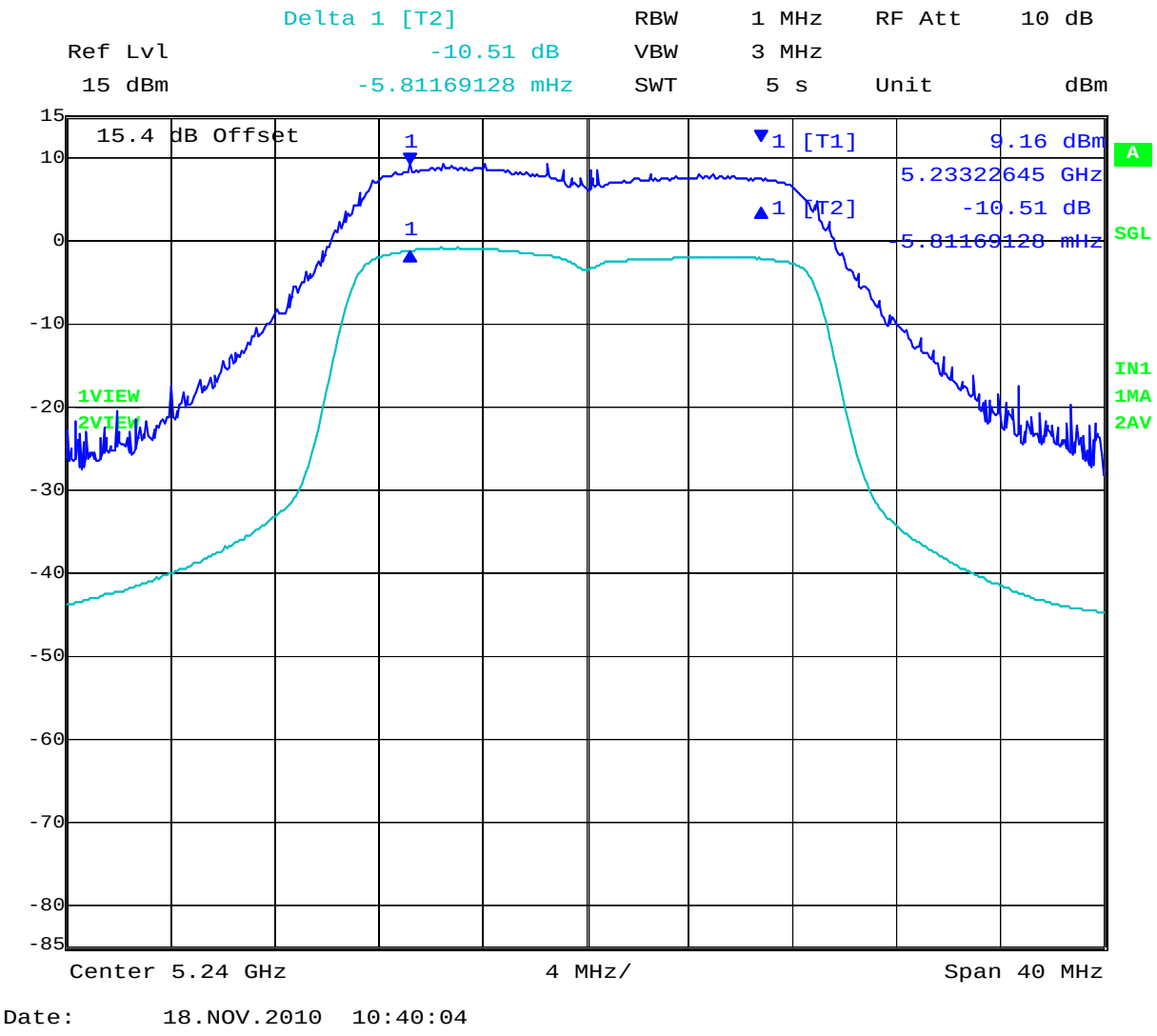
5240 MHz 802.11HT-20 Chain a, Peak Excursion Ratio



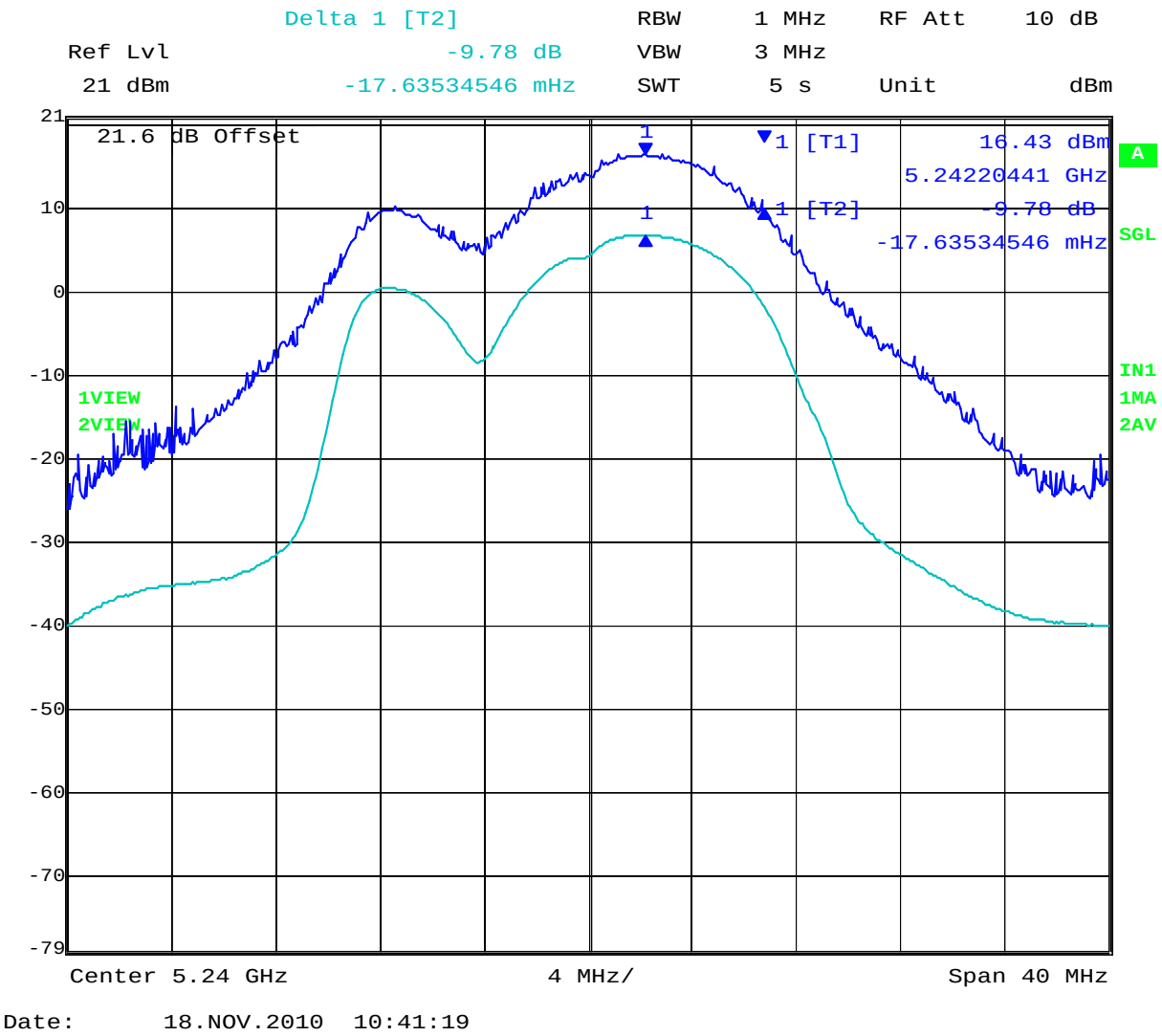
5240 MHz 802.11HT-20 Chain b, Peak Excursion Ratio



5240 MHz 802.11HT-20 Chain c, Peak Excursion Ratio



5240 MHz 802.11HT-20 Combined, Peak Excursion Ratio



Test Conditions:	15.407 (a)	**Rel. Humidity (%):**	35	to	42
Variant:	802.11HT-40	**Ambient Temp. (ºC):**	19	to	22
TPC:	HIGH	**Pressure (mBars):**	998	to	1003
Modulation:	ON	**Duty Cycle (%):**	100		
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	4 dBi		
Applied Voltage:	48.0 Vdc				
Notes 1:					
Notes 2:					

	Trace Peak Power Markers		Δ Marker (Marker 1 – 2)	Limit	Margin
	1	2			

Frequency 5190 MHz

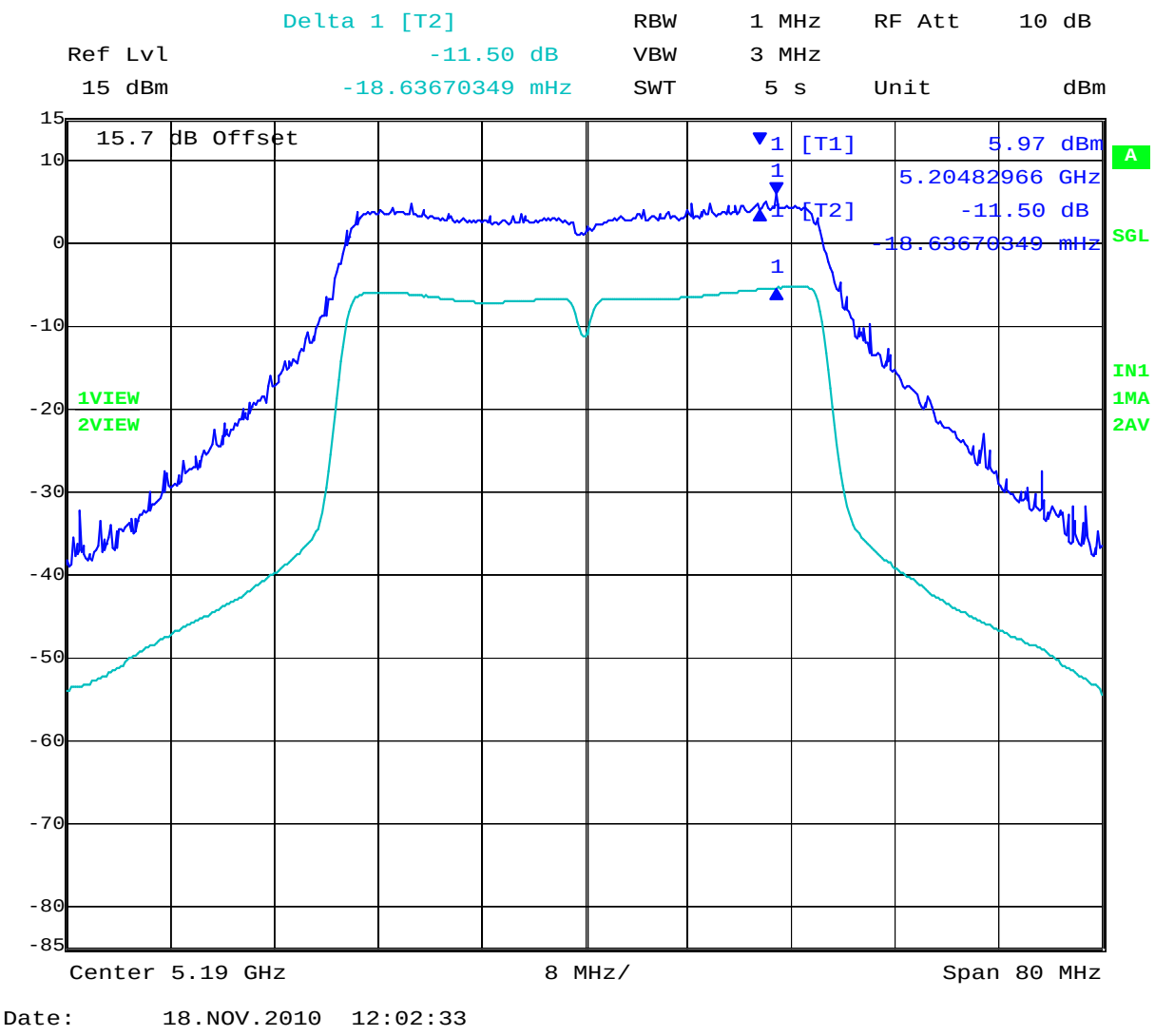
Chain	dBm	dBm	dB	dB	dB
a	5.97	-5.53	-11.50	-13.00	-1.50
b	5.24	-6.70	-11.94		-1.06
c	4.09	-6.96	-11.05		-1.95
Combined	11.31	0.81	-10.50		-2.50

Frequency 5230 MHz

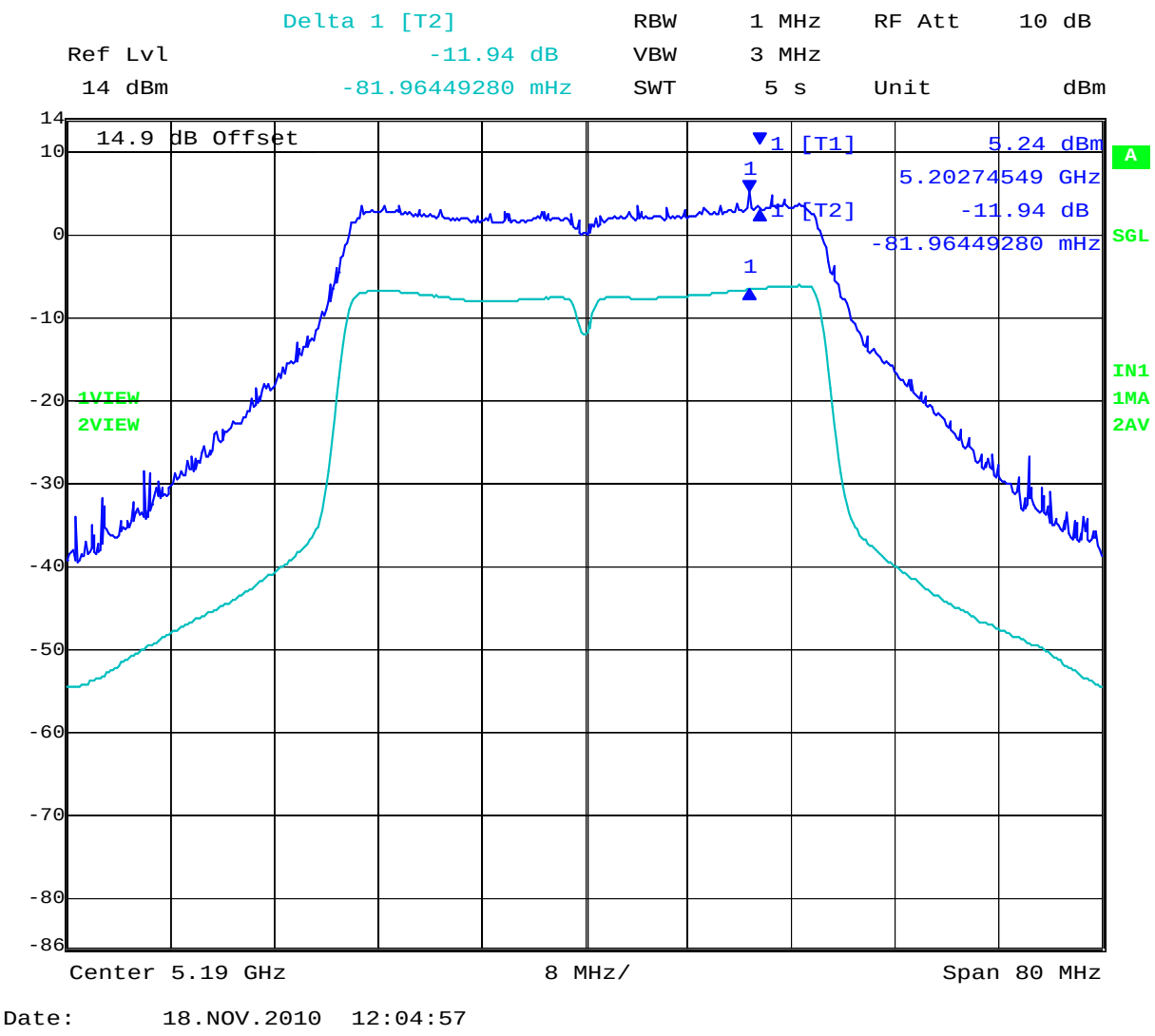
Chain	dBm	dBm	dB	dB	dB
a	3.58	-6.85	-10.43	-13.00	-2.57
b	3.17	-7.73	-10.90		-2.10
c	4.22	-6.52	-10.74		-2.26
Combined	12.34	1.63	-10.71		-2.29

Measurement uncertainty:	±1.33 dB

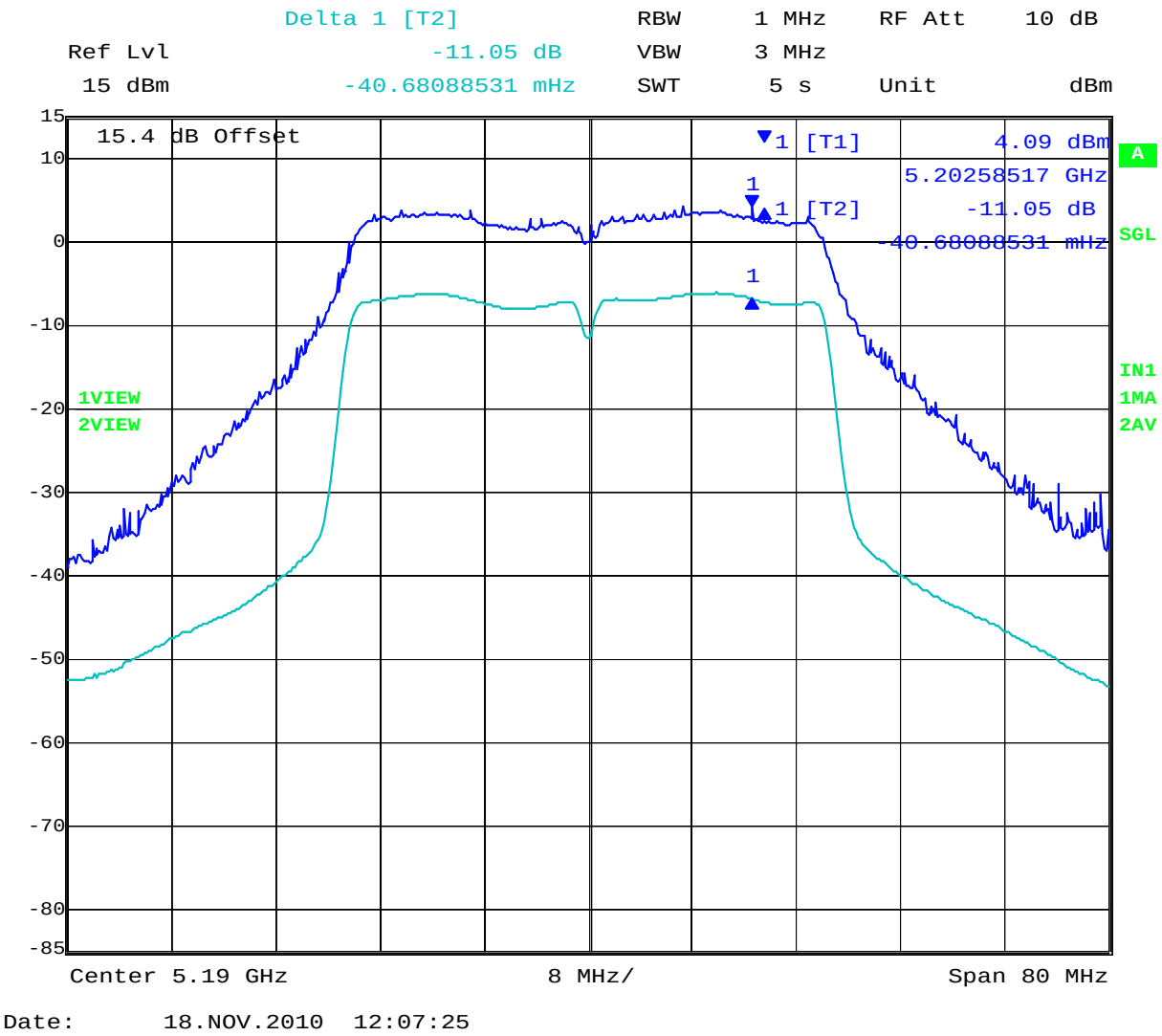
5190 MHz 802.11HT-40 Chain a, Peak Excursion Ratio



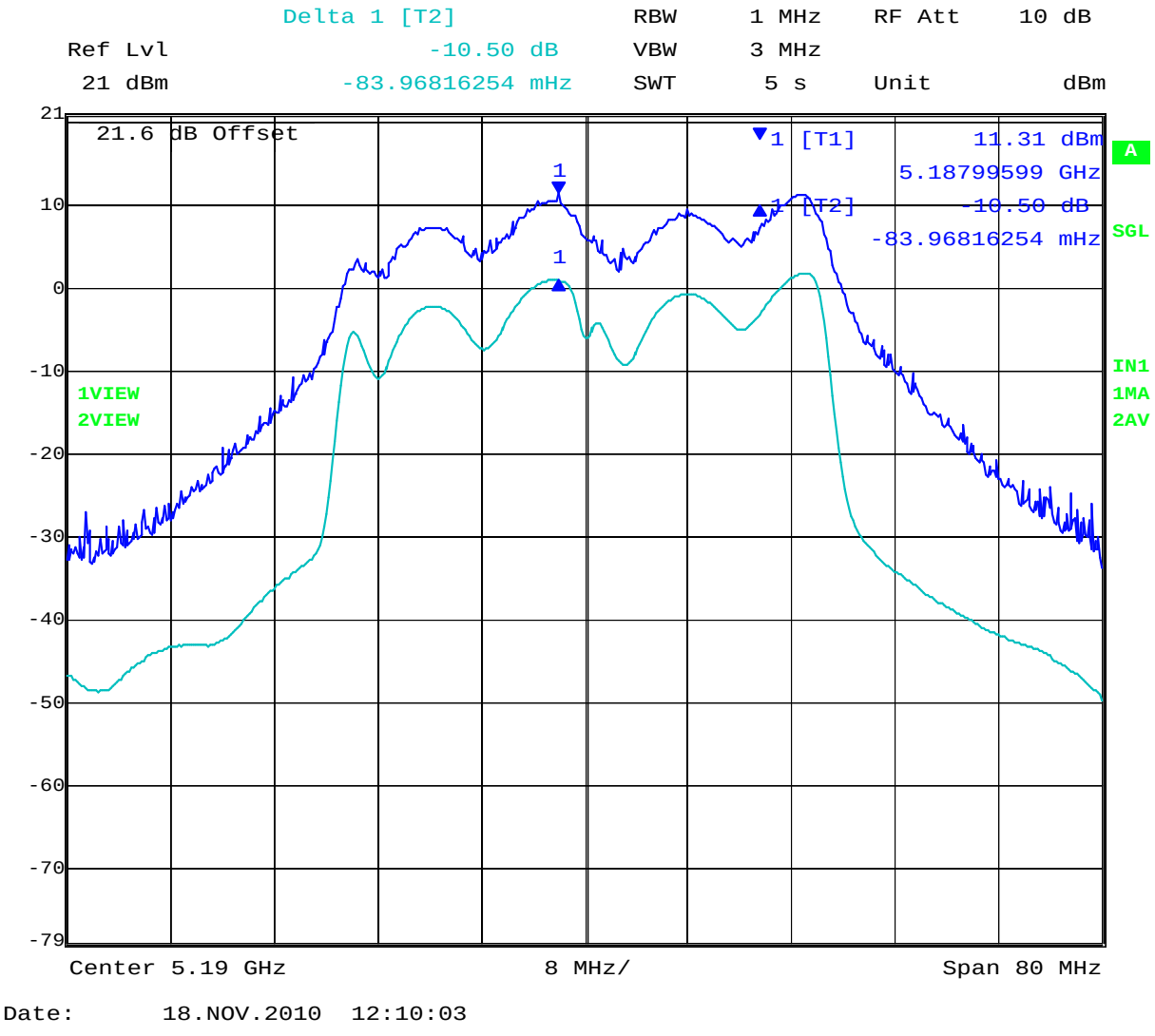
5190 MHz 802.11HT-40 Chain b, Peak Excursion Ratio



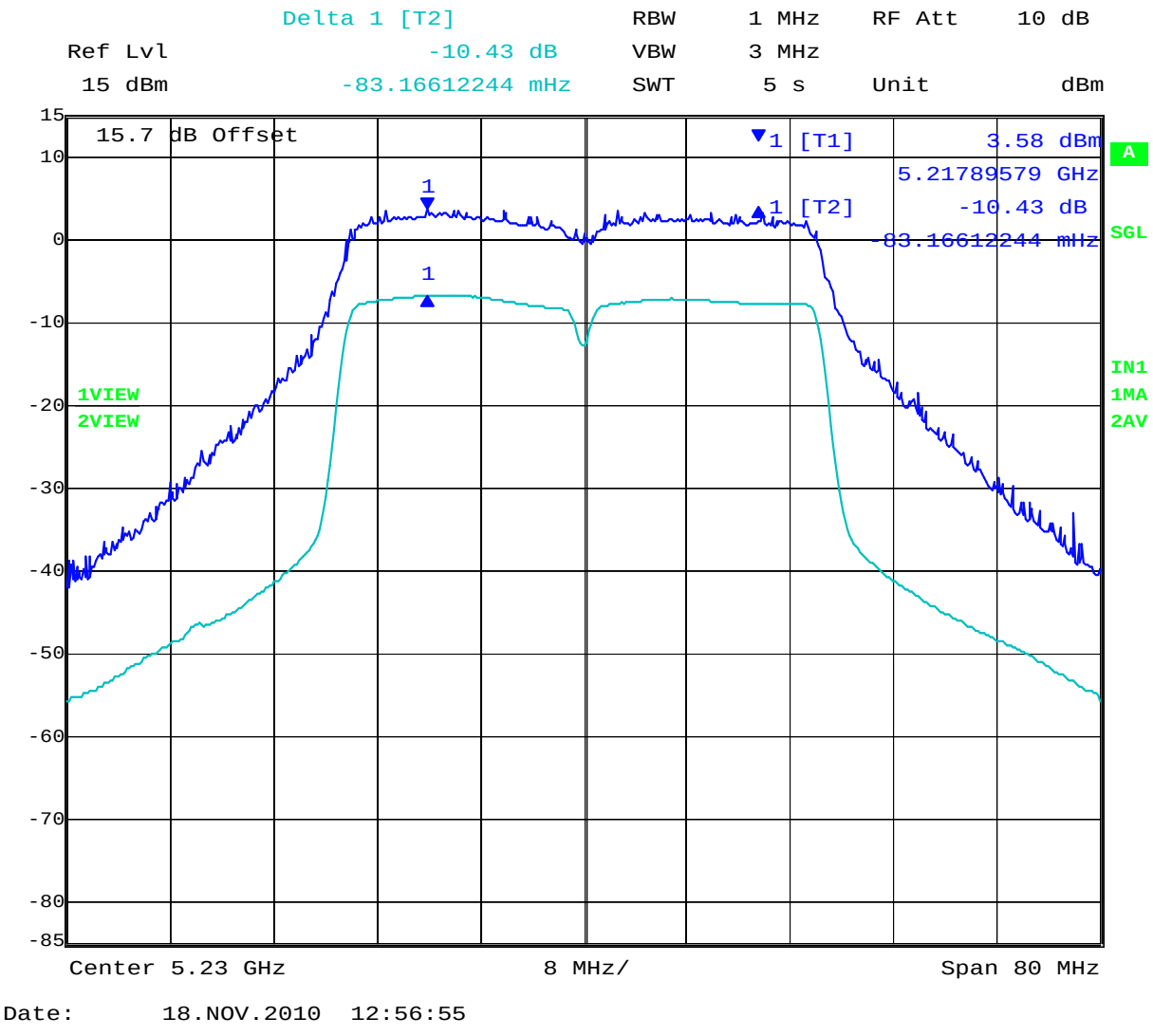
5190 MHz 802.11HT-40 Chain c, Peak Excursion Ratio



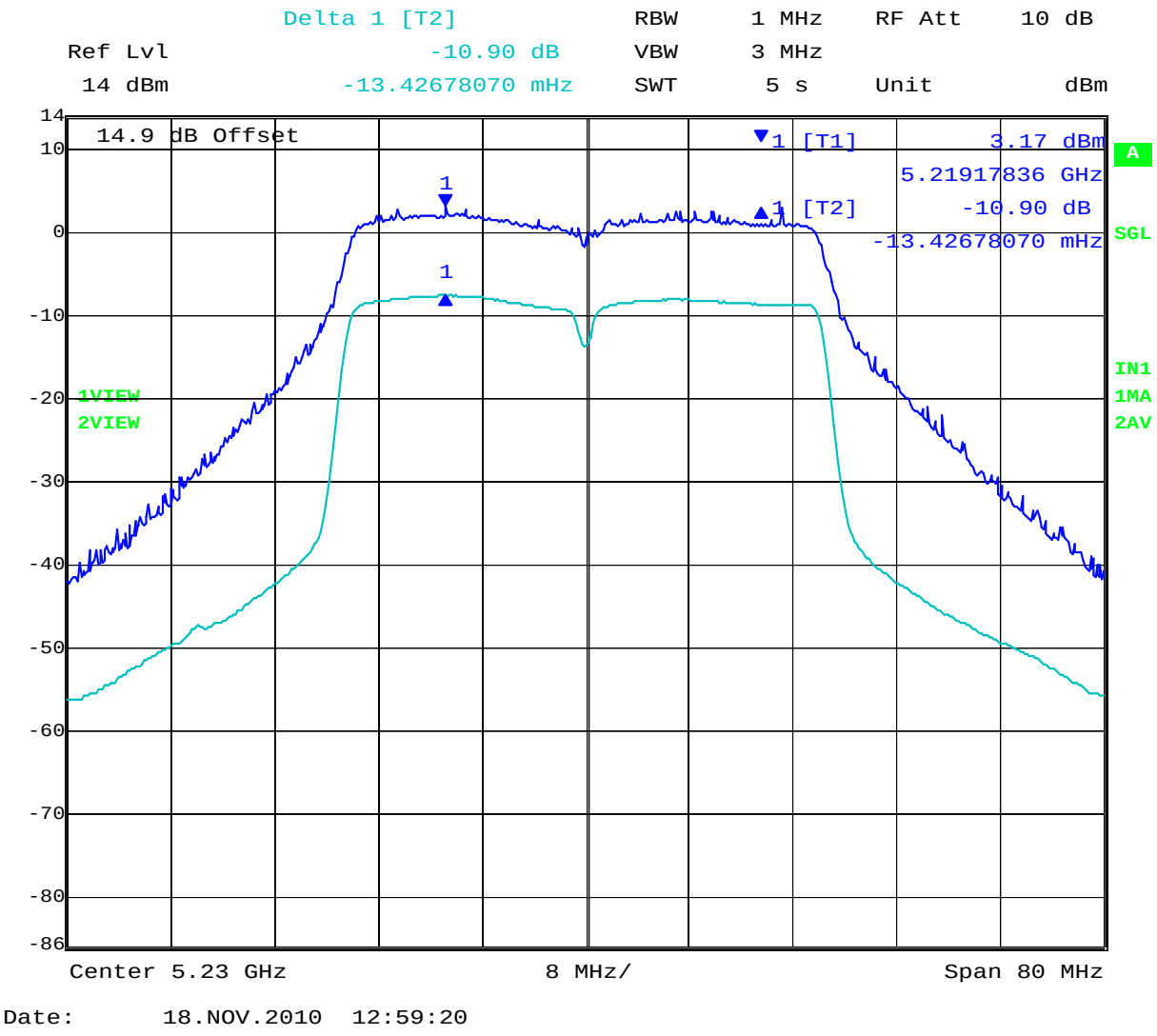
5190 MHz 802.11HT-40 Combined, Peak Excursion Ratio



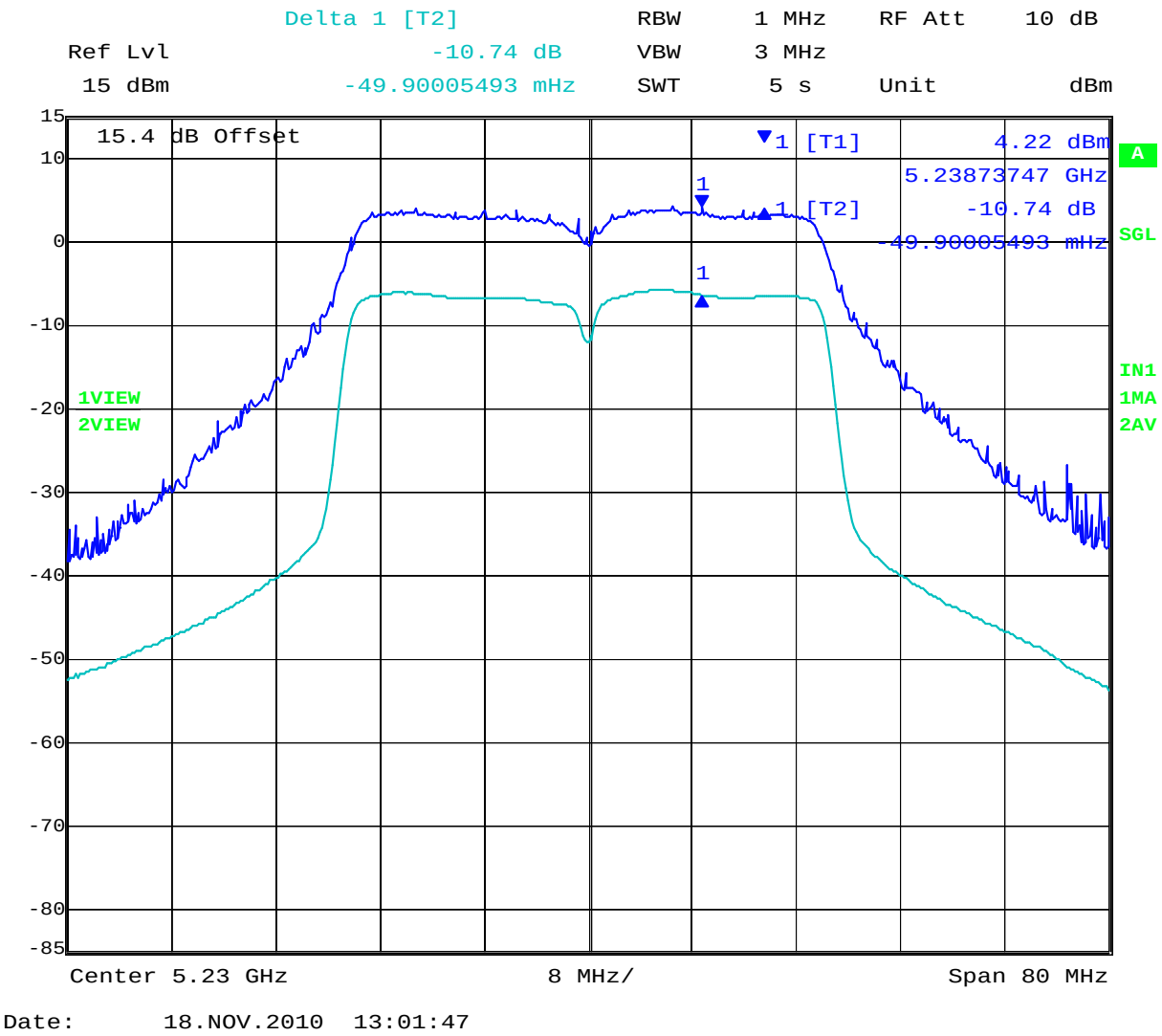
5230 MHz 802.11HT-40 Chain a, Peak Excursion Ratio



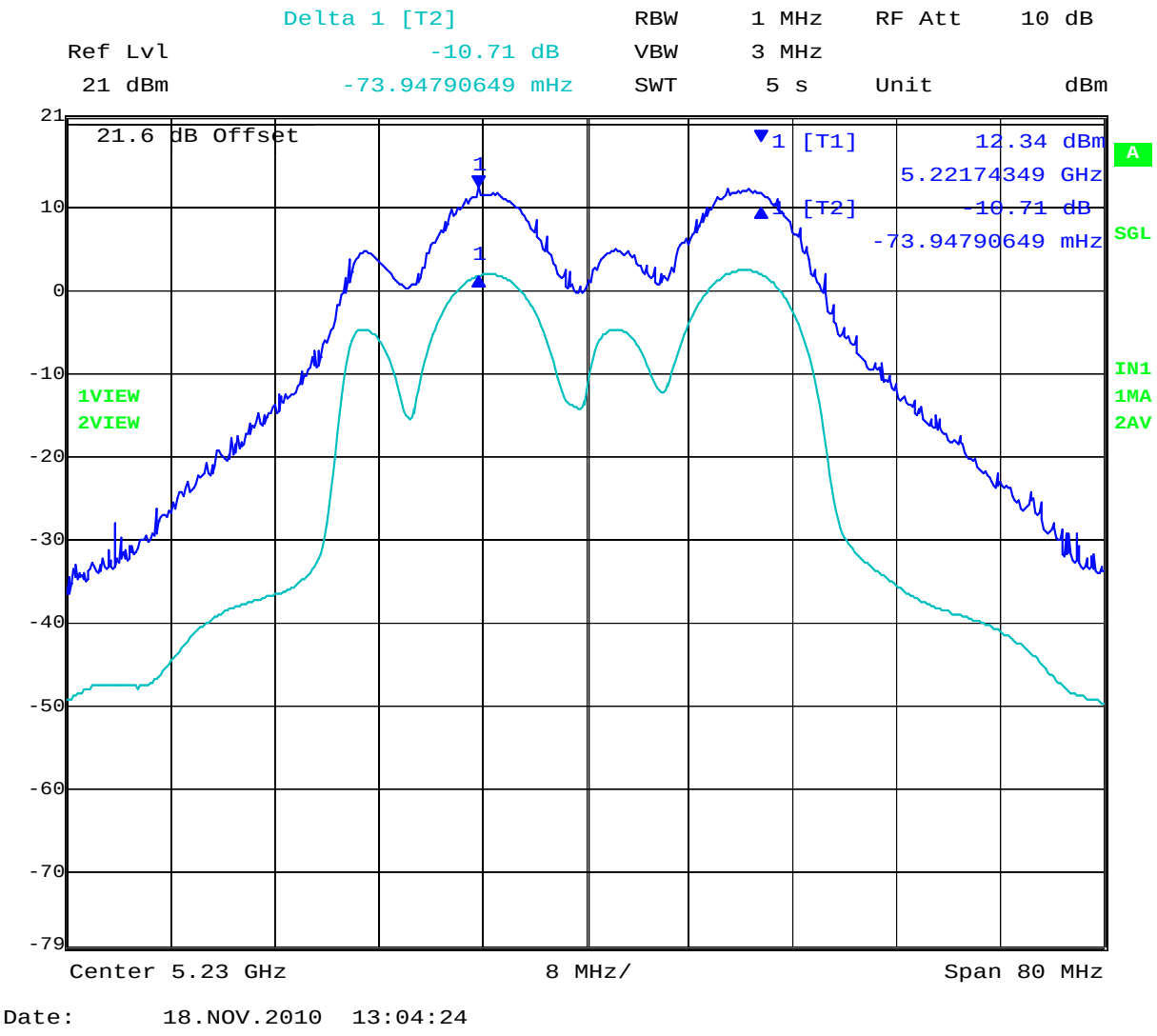
5230 MHz 802.11HT-40 Chain b, Peak Excursion Ratio



5230 MHz 802.11HT-40 Chain c, Peak Excursion Ratio



5230 MHz 802.11HT-40 Combined, 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, 0287, 0252, 0313, 0314, 0070, 0116, 0117

5.1.5. Frequency Stability

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

Test Procedure

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

Manufacturer Declaration

The frequency stability of the reference oscillator sets the frequency stability of the RF transceiver signals. Therefore all of the RF signals will be less than ±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

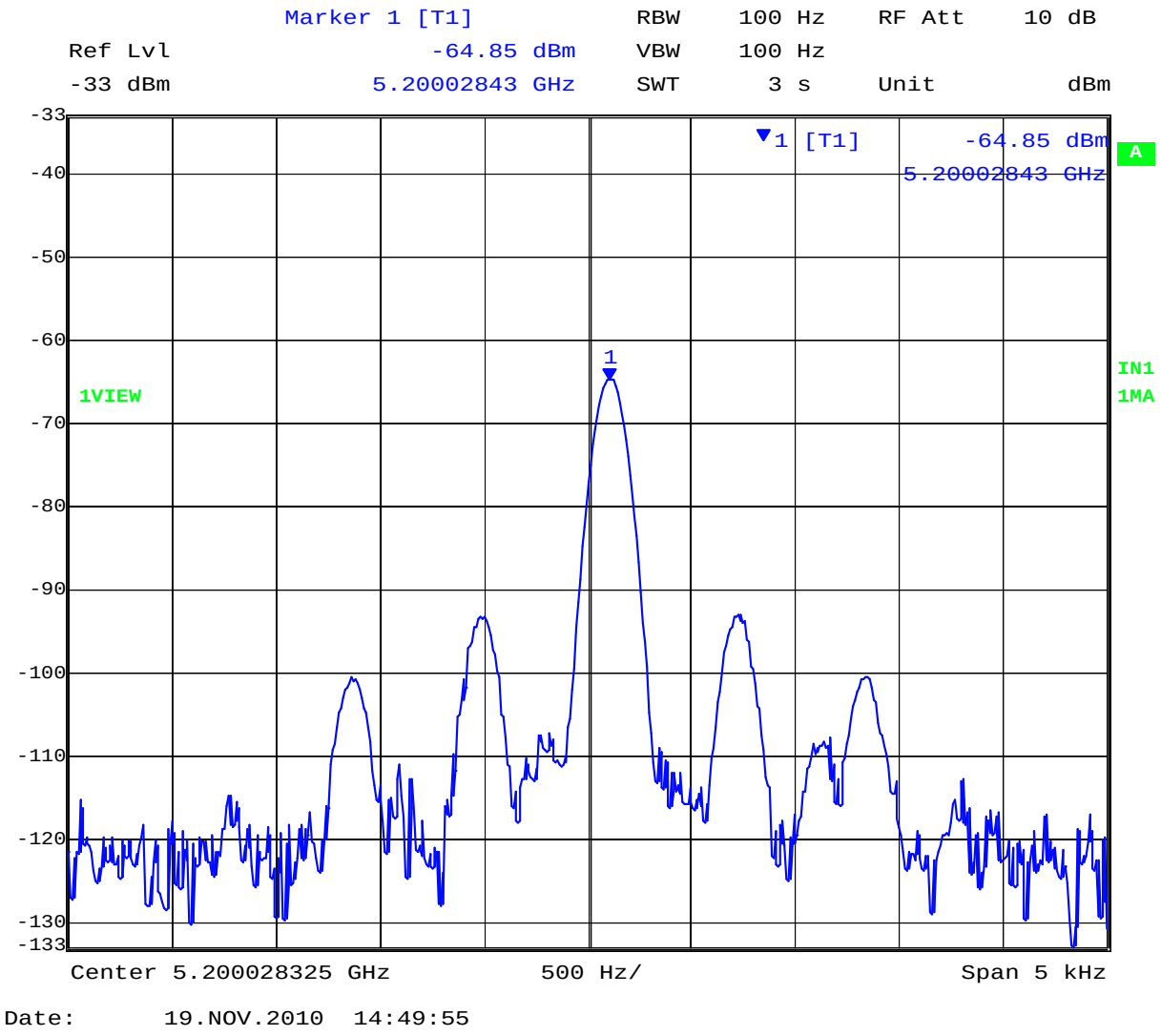
Limits

§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.

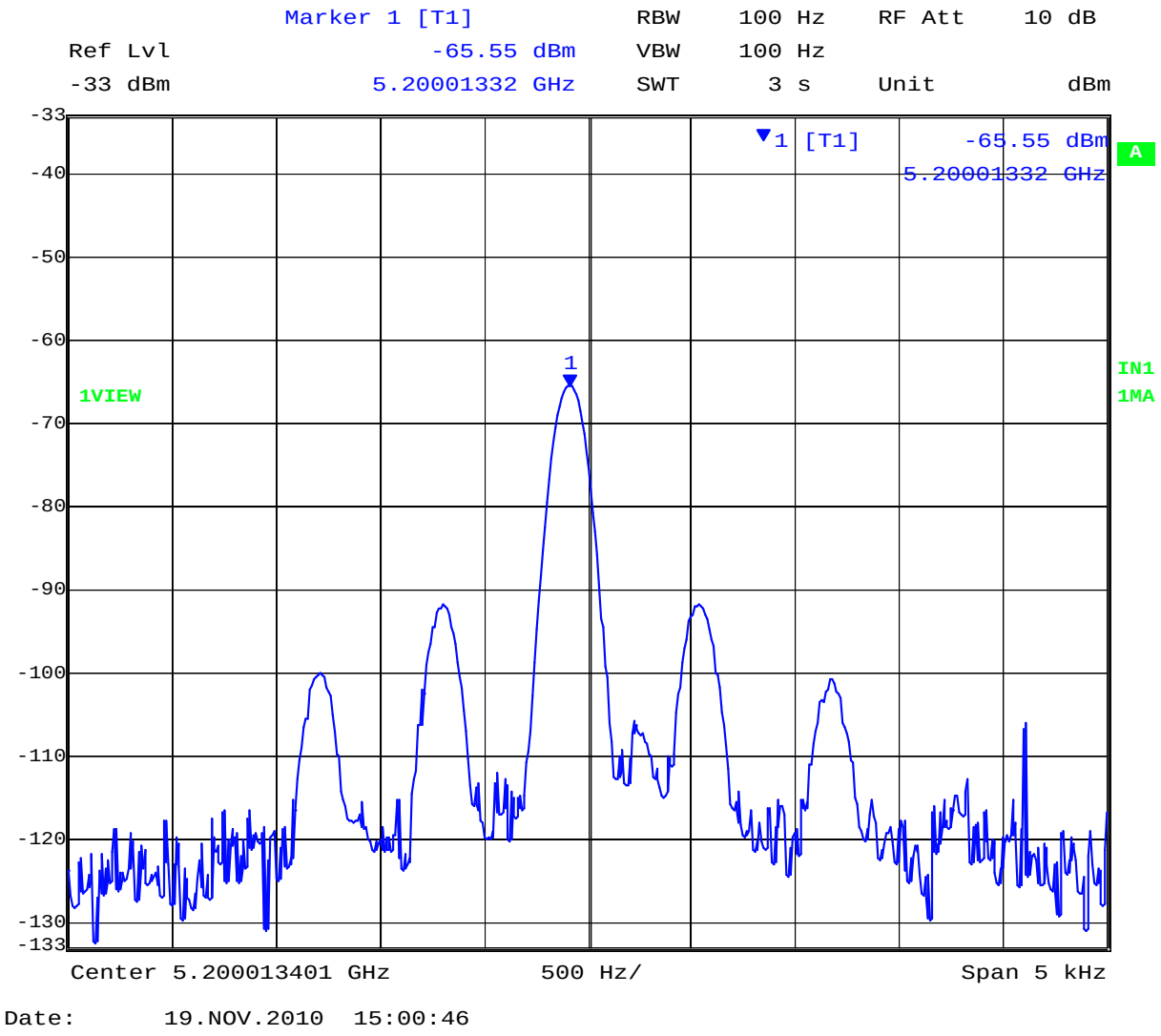
TABLE OF RESULTS Frequency Stability – Channel Measured 5,200 MHz

Voltage	Temperature (°C)	Center Frequency (MHz)	Delta (Hz)	ppm
+48.0 Vdc	-30	5200.02843	+28.43	+5.47
	-20	5200.01332	+13.32	+2.56
	-10	5199.99240	-7.60	-1.46
	+0	5199.97175	-28.25	-5.43
	+10	5199.96232	-37.68	-7.25
	+20	5199.94854	-51.46	-9.90
43.2 Vdc	+20	5199.94792	-52.08	-10.02
53.8 Vdc	+20	5199.94741	-52.59	-10.11
48.0 Vdc	+30	5199.94505	-54.95	-10.57
	+40	5199.95262	-47.38	-9.11
	+50	5199.97141	-28.59	-5.50
Maximum Frequency Drift with respect to the nominal frequency		+28.43 kHz to -54.95 Hz +5.47 ppm to -10.57 ppm		

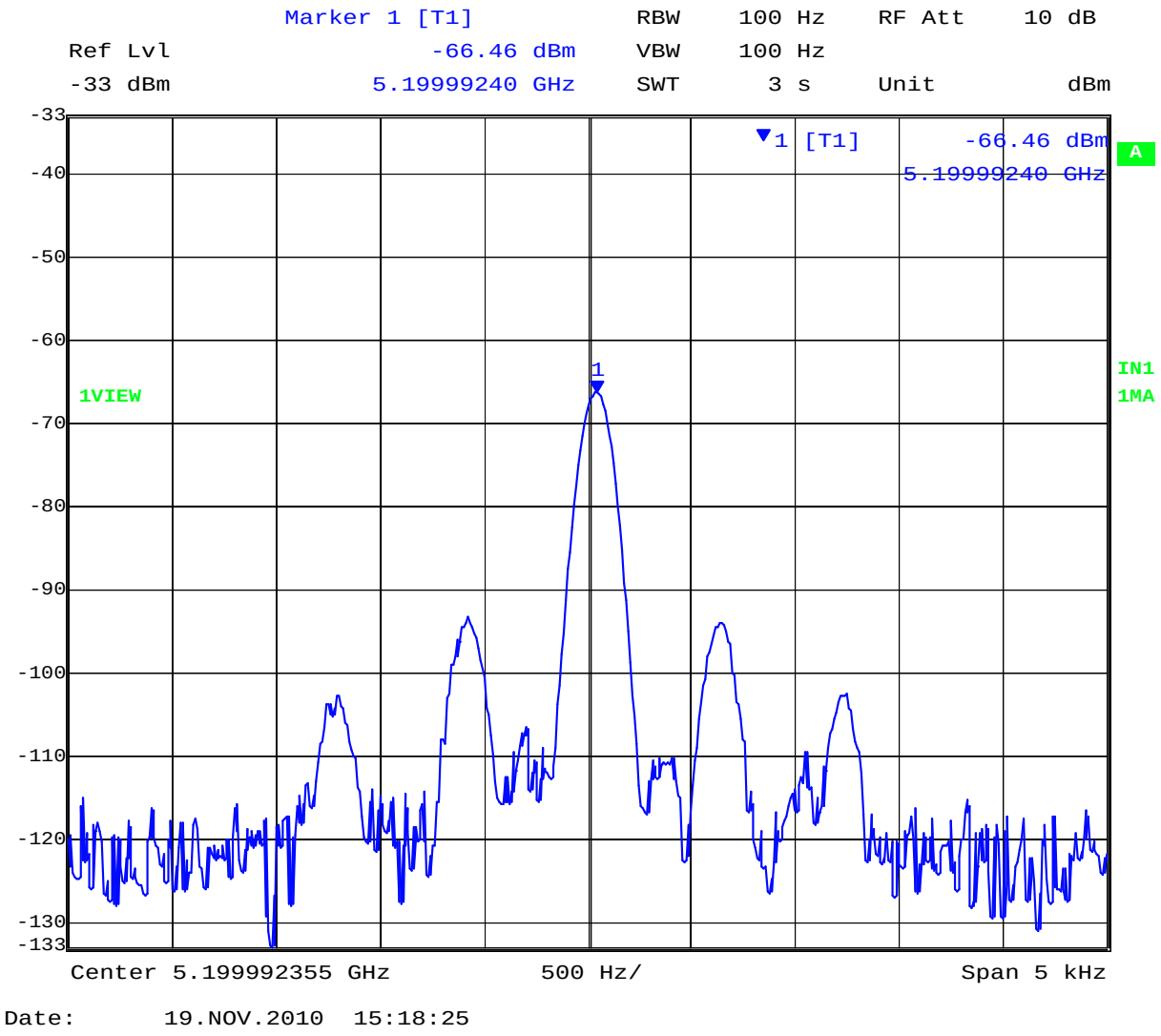
-30°C, +48 Vdc Frequency Stability



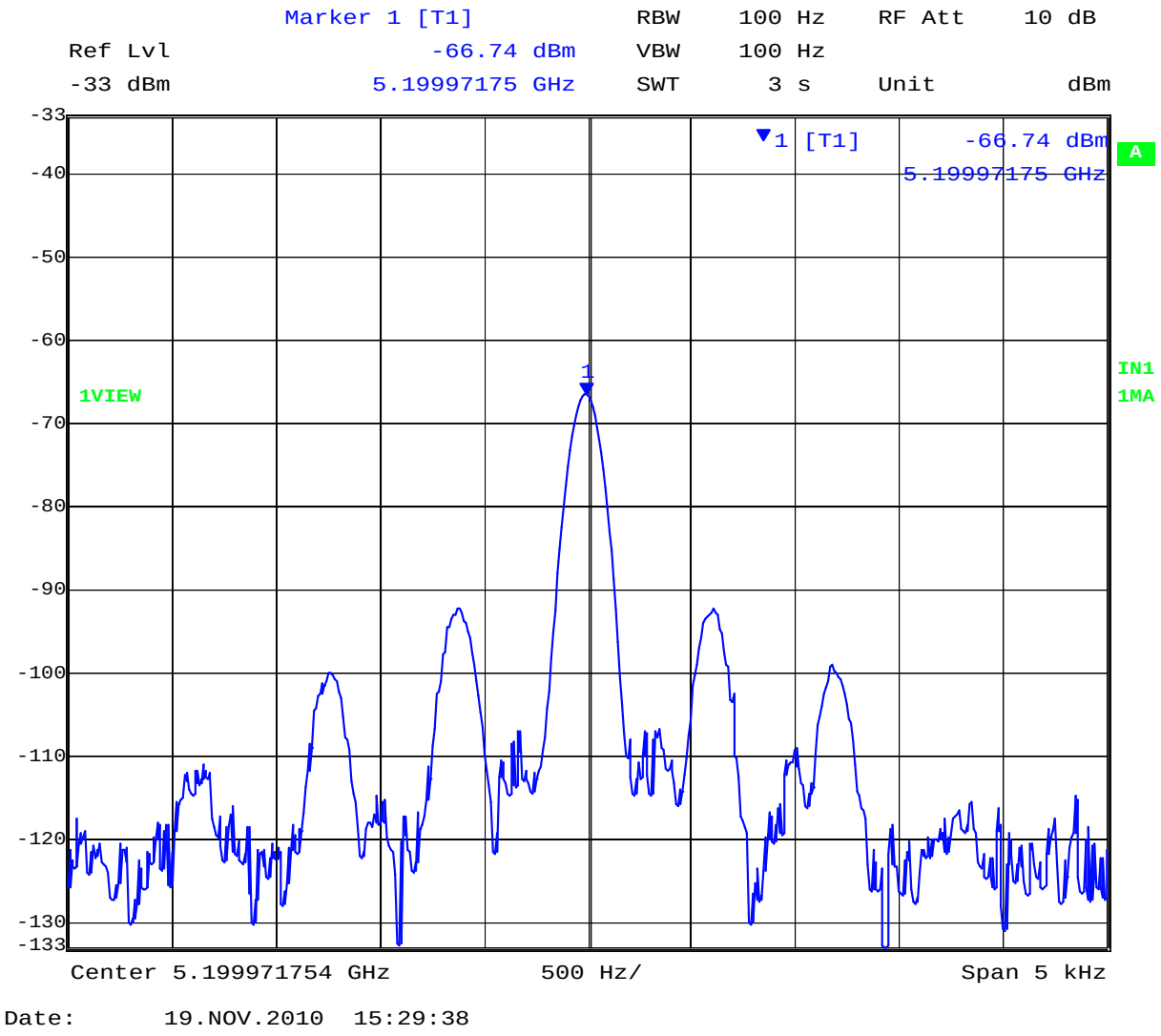
-20°C, +48 Vdc Frequency Stability



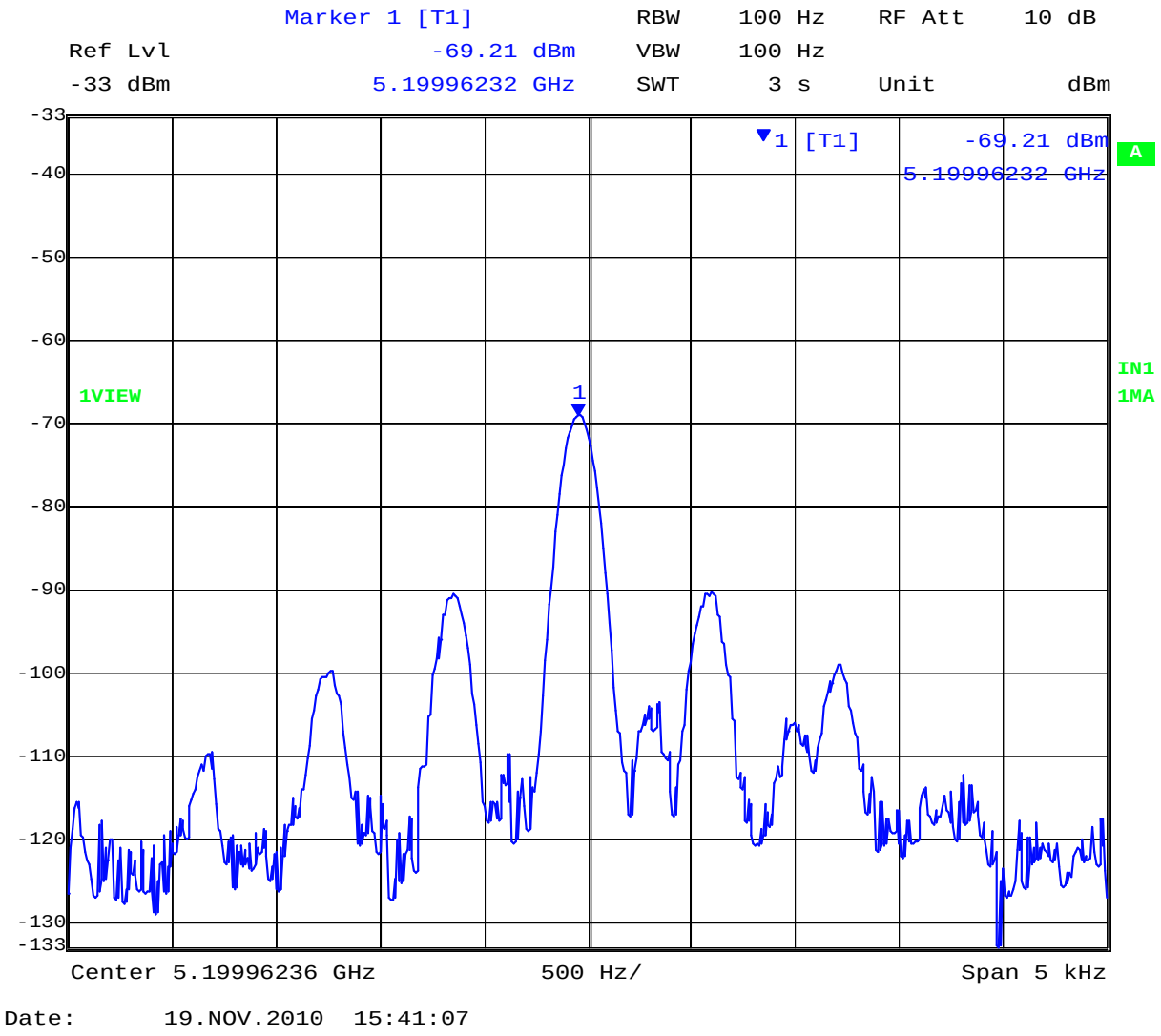
-10°C, +48 Vdc Frequency Stability



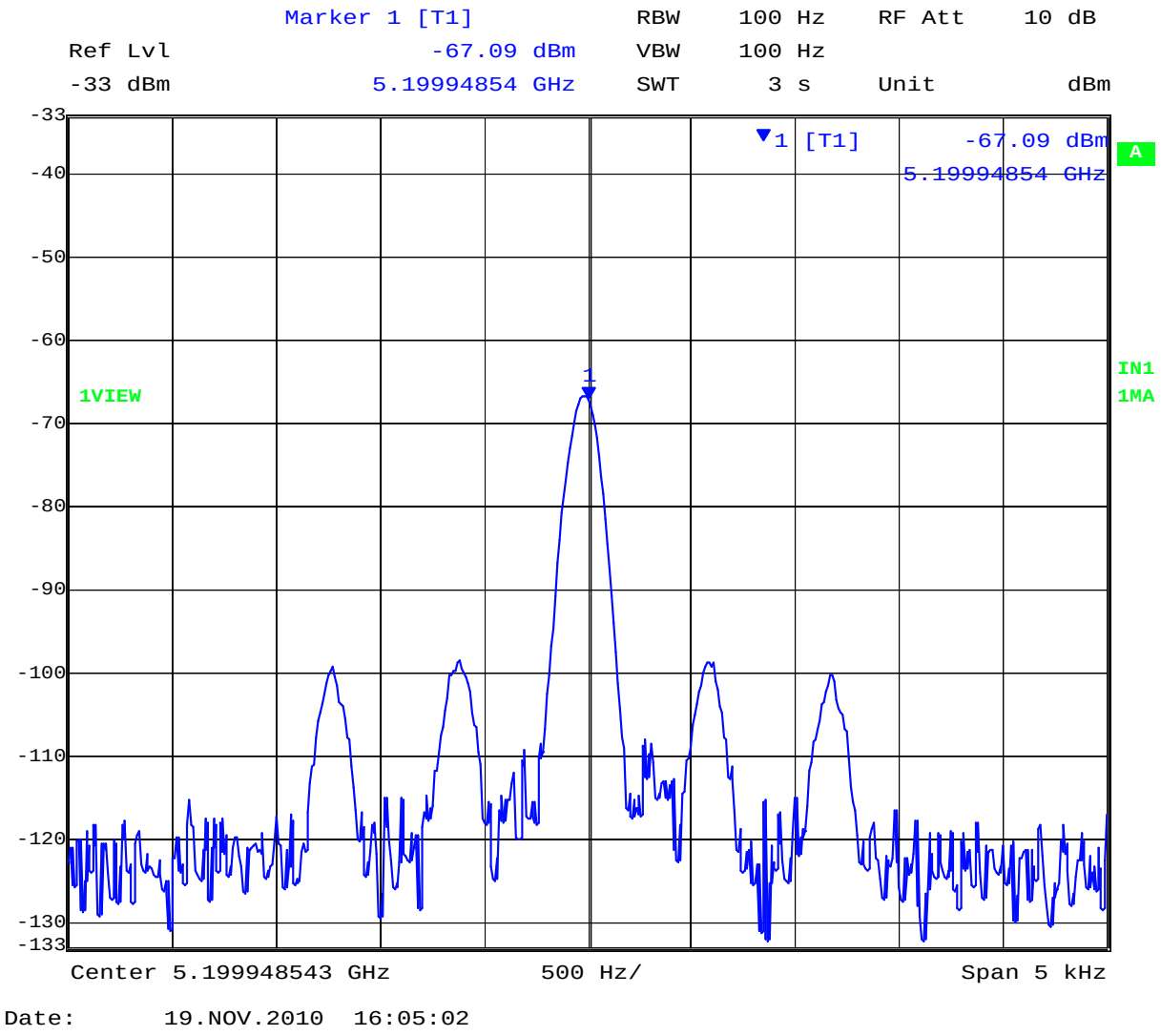
+0°C, +48 Vdc Frequency Stability



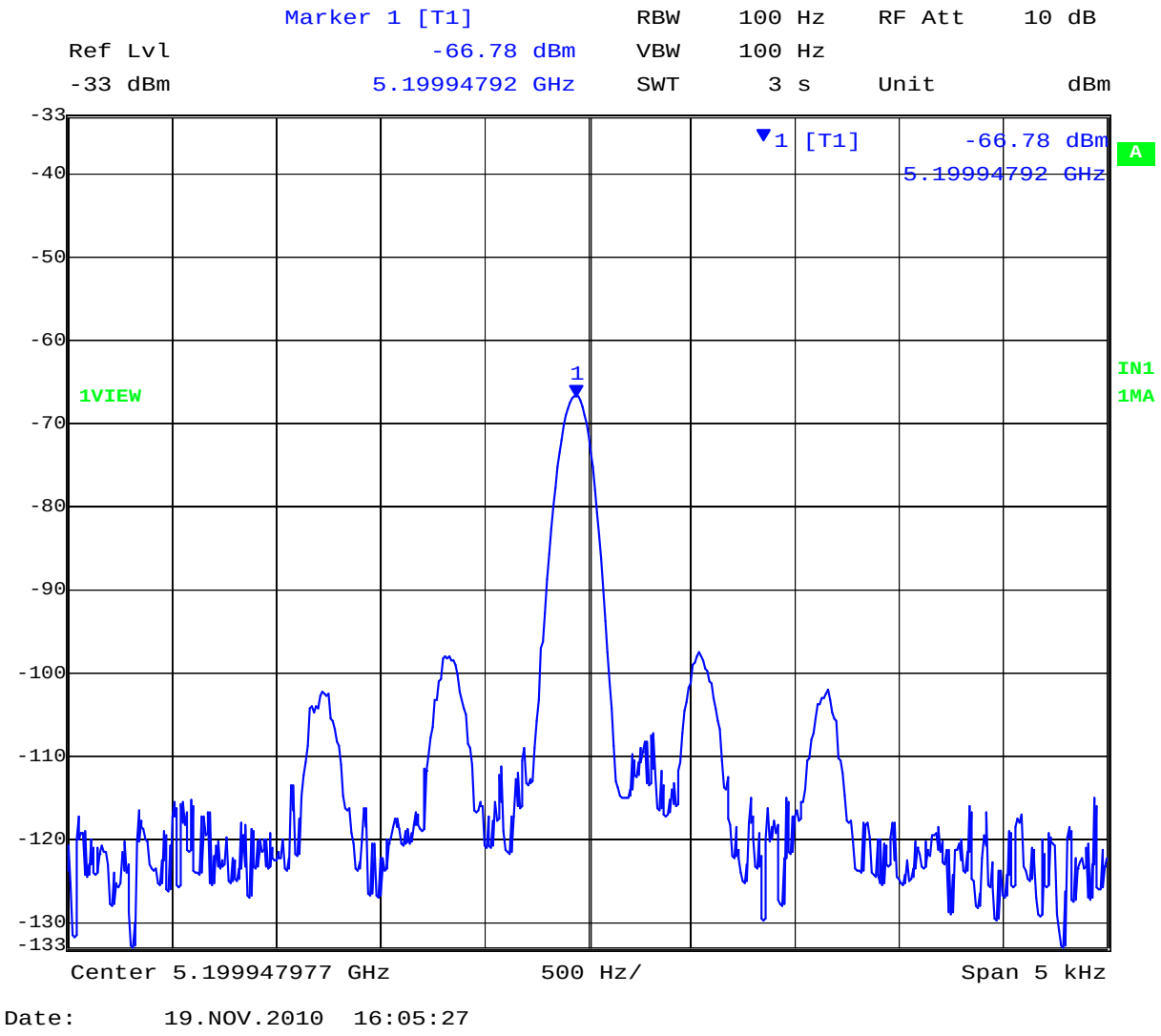
+10°C, +48 Vdc Frequency Stability



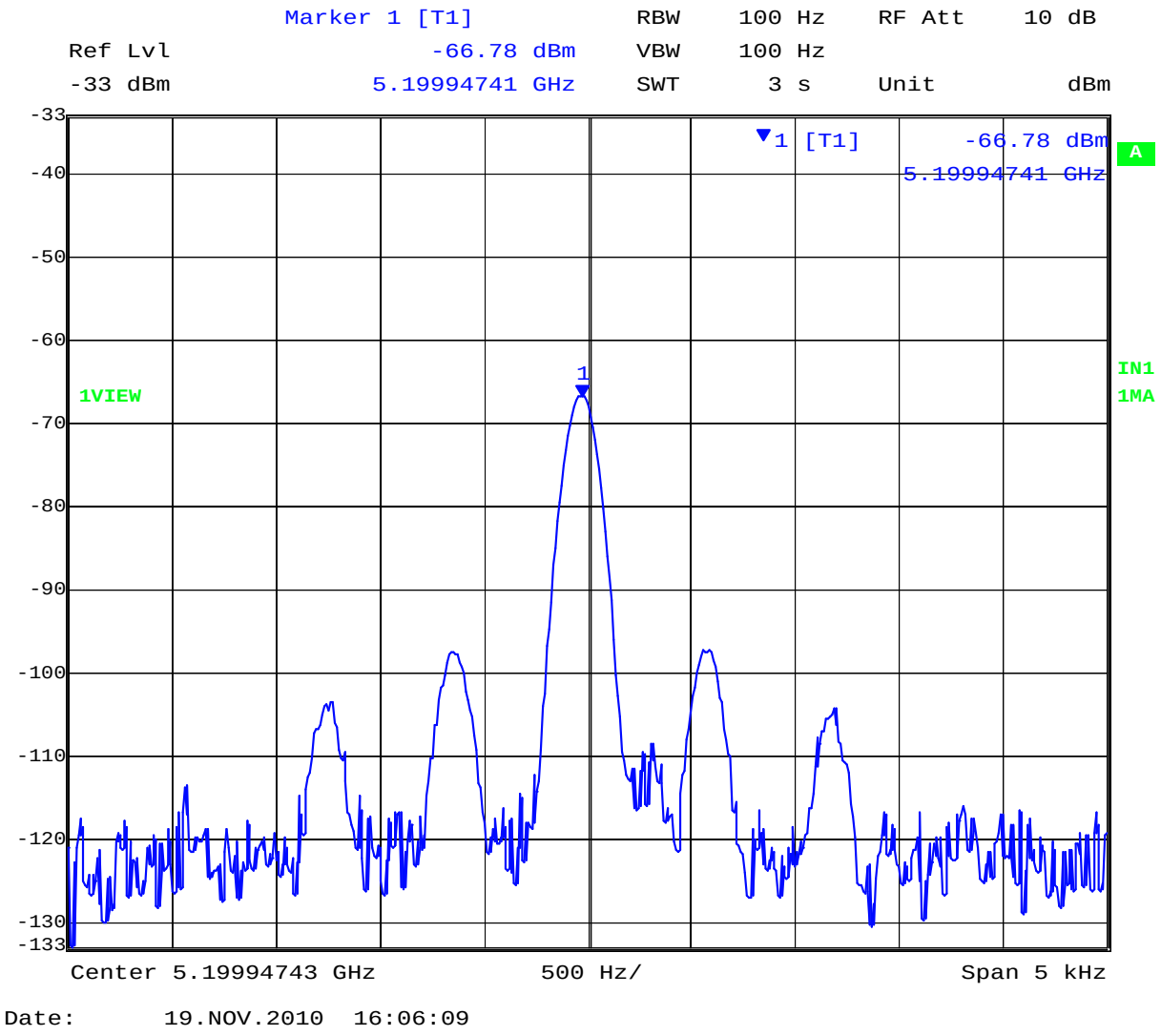
+20°C, +48 Vdc Frequency Stability



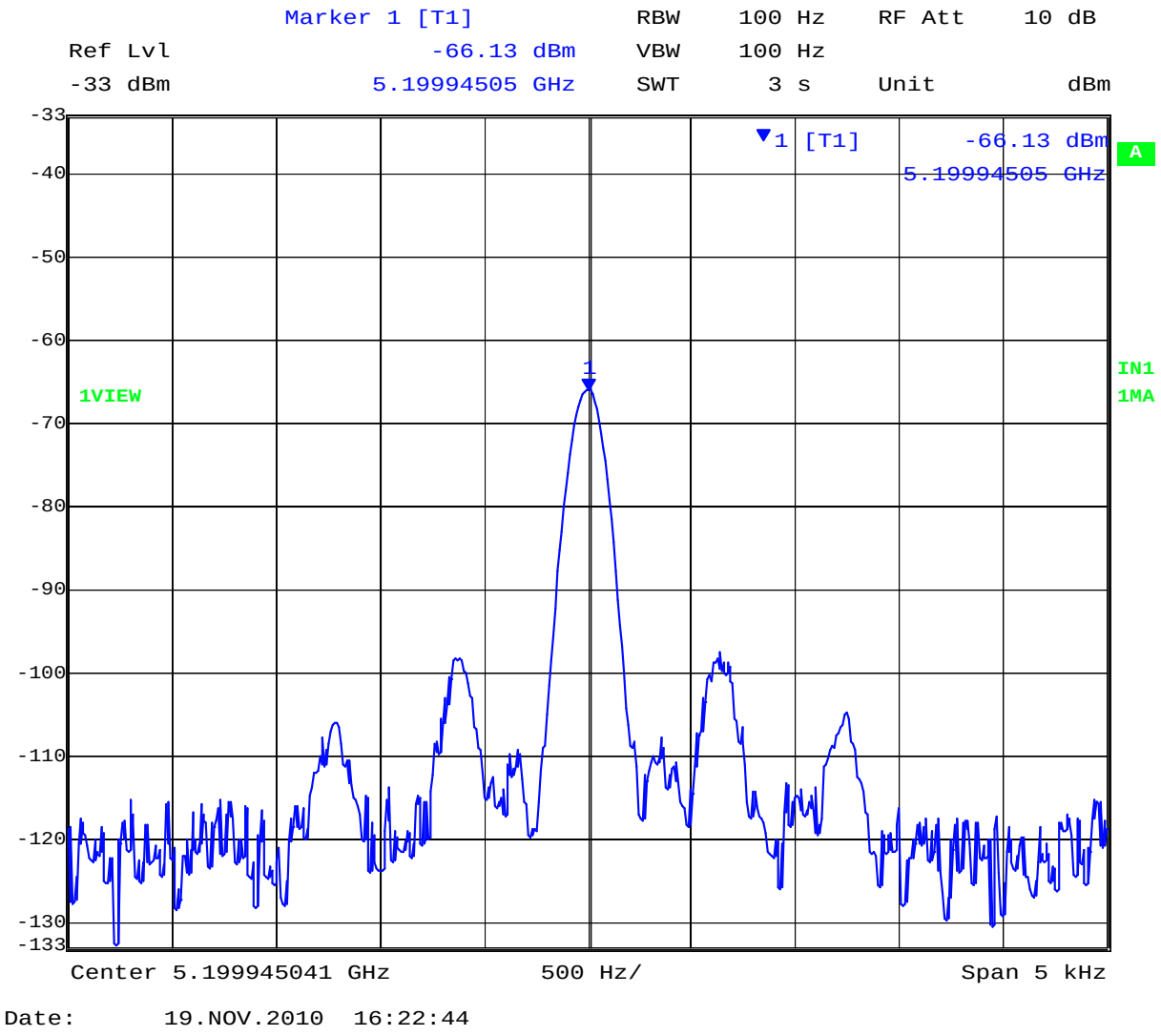
+20°C, +43.2 Vdc Frequency Stability



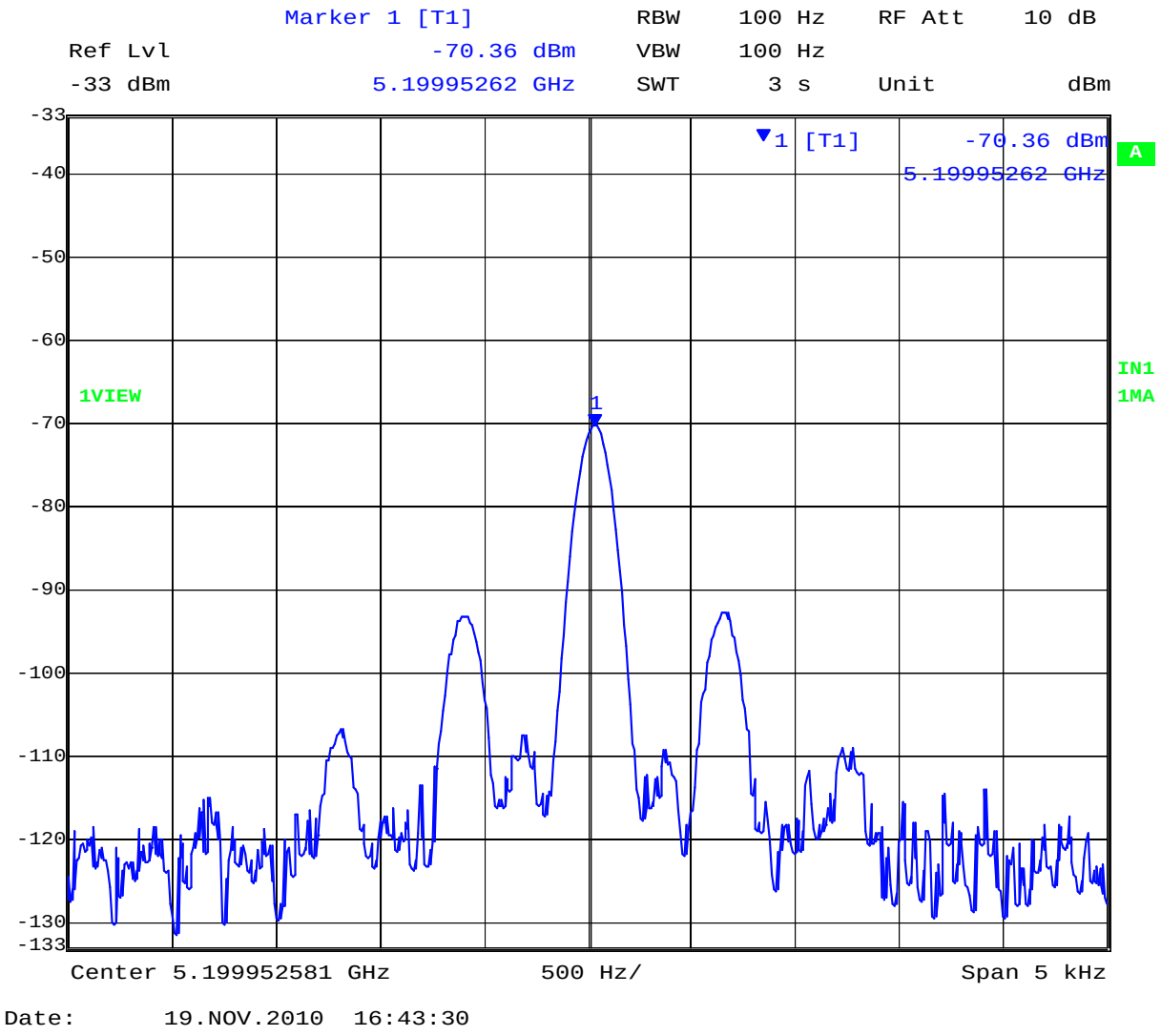
+20°C, +53.8 Vdc Frequency Stability



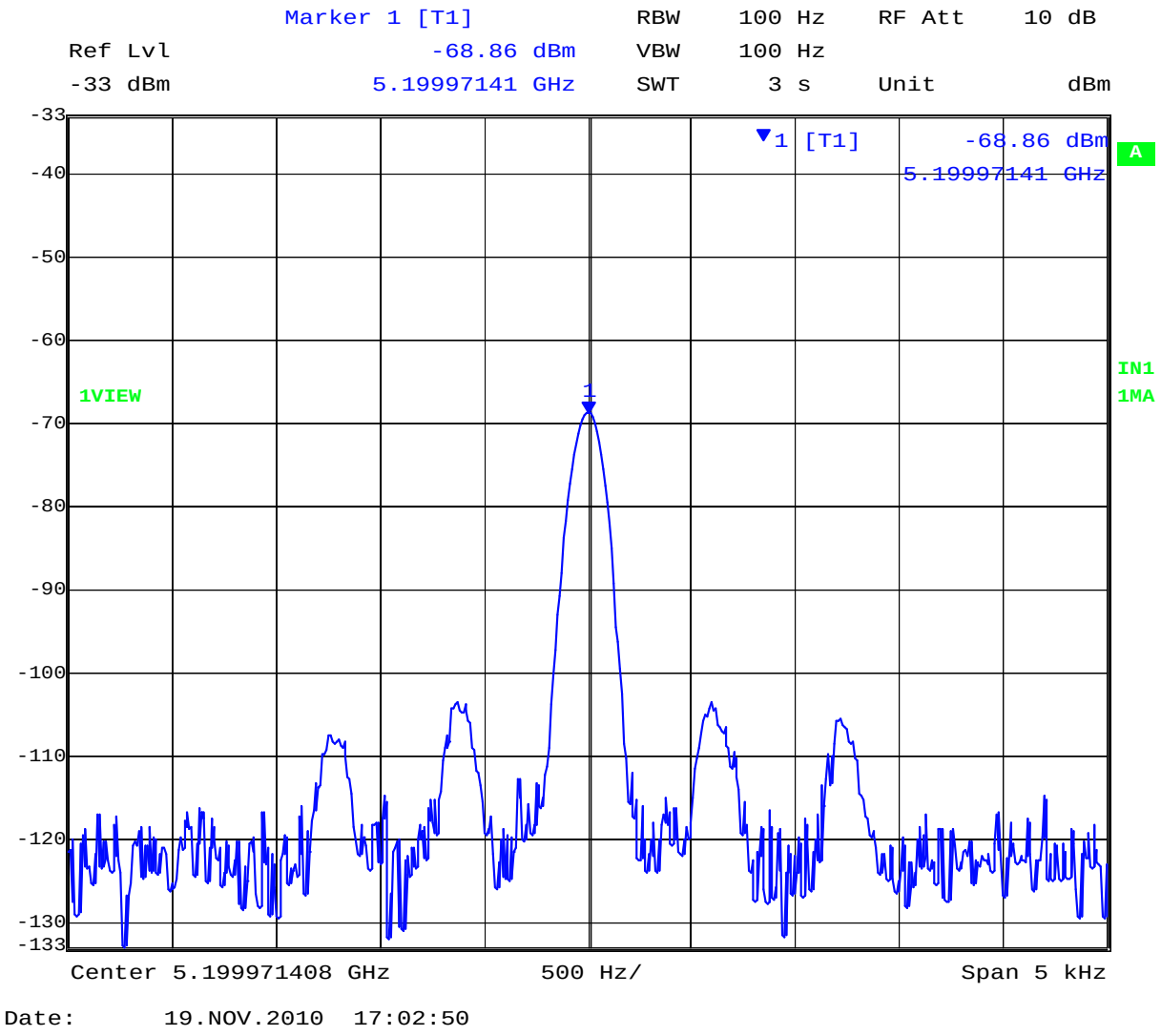
+30°C, +48 Vdc Frequency Stability



+40°C, +48 Vdc Frequency Stability



+50°C, +48 Vdc Frequency Stability



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 * 2

P = Peak output power (mW)

G = Antenna numeric gain (numeric)

d = Separation distance (cm)

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

Power level reported in the following matrix is the maximum combined power level reported in Section 5.1.3. Maximum antenna gain was used to calculate the Maximum Permissible Exposure distance.

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 x 2 (mW)	Calculated Safe Distance @ 1mW/cm² Limit(cm)	Minimum Separation Distance (cm)
5150 - 5250	7.02	5.04	+13.95	24.83	3.2	20.00

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

Specification
Maximum Permissible Exposure Limits

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

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

Laboratory Measurement Uncertainty for Power Measurements

Measurement uncertainty	±1.33 dB

5.1.7. Radiated Emissions

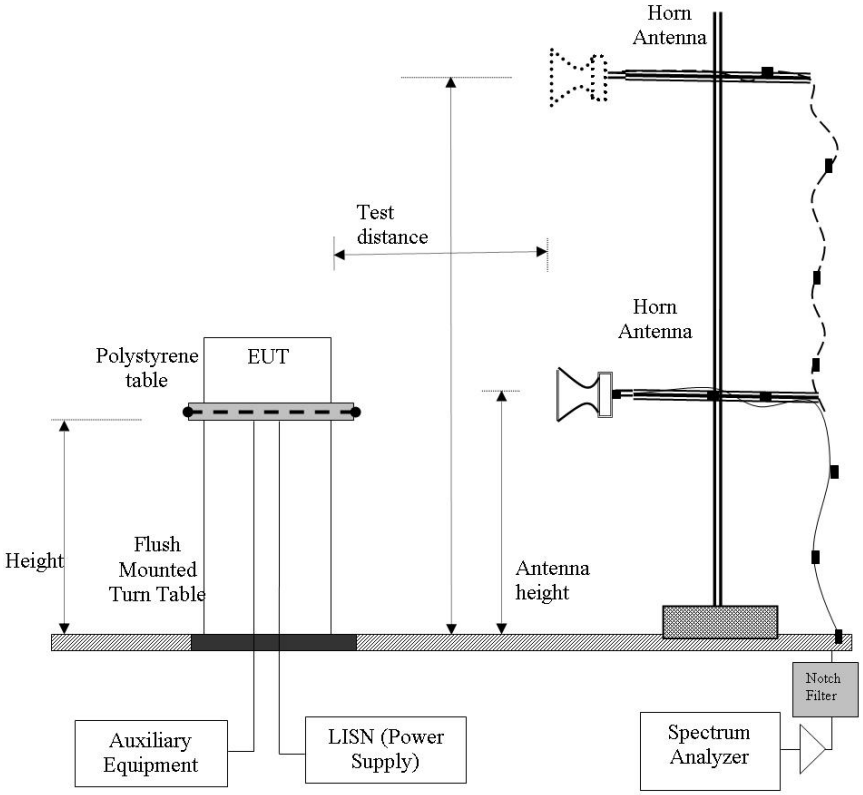
FCC, Part 15 Subpart C §15.407(b)(2), §15.205(a)/15.209(a)
Industry Canada RSS-210 §A9.3(2); §2.2; §2.6; RSS-Gen §4.7

Test Procedure

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

Emissions nearest the limits were chosen for maximization and formal measurement using a CISPR compliant receiver. Emissions above 1000 MHz are measured utilizing a CISPR compliant average detector with a tuned receiver, using a bandwidth of 1 MHz. Emissions from 30 MHz – 1000 MHz are measured utilizing a CISPR compliant quasi-peak detector with a tuned receiver, using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed.

Test Measurement Set Up



Radiated Emission Measurement Setup – Above 1 GHz

Field Strength Calculation

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

FS = R + AF + CORR – FO

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor
CORR = Correction Factor = CL – AG + NFL

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

Field Strength Calculation Example:

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

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

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

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

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

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

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

where P is the EIRP in Watts

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

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

Specification

Radiated Spurious Emissions

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

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

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

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

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

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

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

Table 1: FCC 15.209 Spurious Emissions Limits

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

Laboratory Measurement Uncertainty for Spectrum Measurement

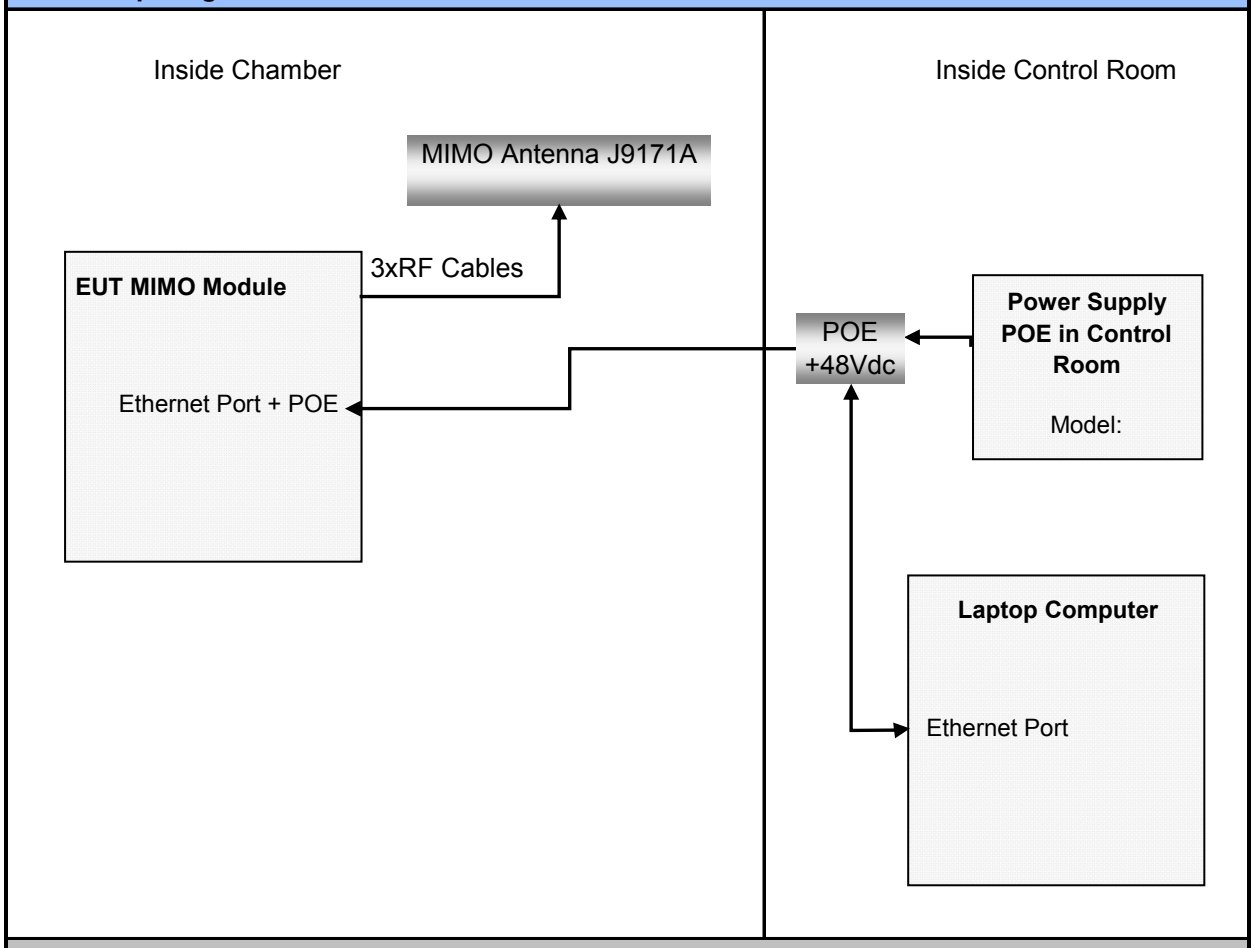
Measurement Uncertainty	+5.6/ -4.5 dB

Traceability:

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

5.1.7.1. Radiated Spurious Emissions

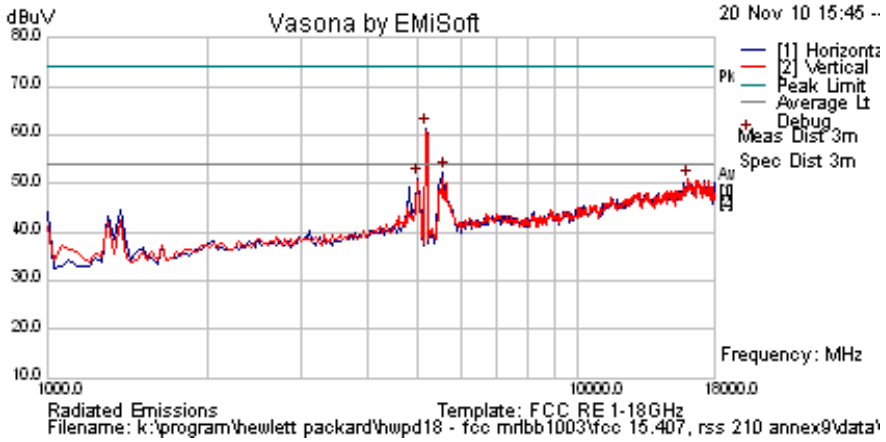
EUT Setup Diagram



Test Setup Description

Integral Antenna RNAA-H1 6 Element MIMO

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11a MIMO	**Temp (ºC)**	21.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	33
Power Setting	Antenna Maximum for band	**Press. (mBars)**	994
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

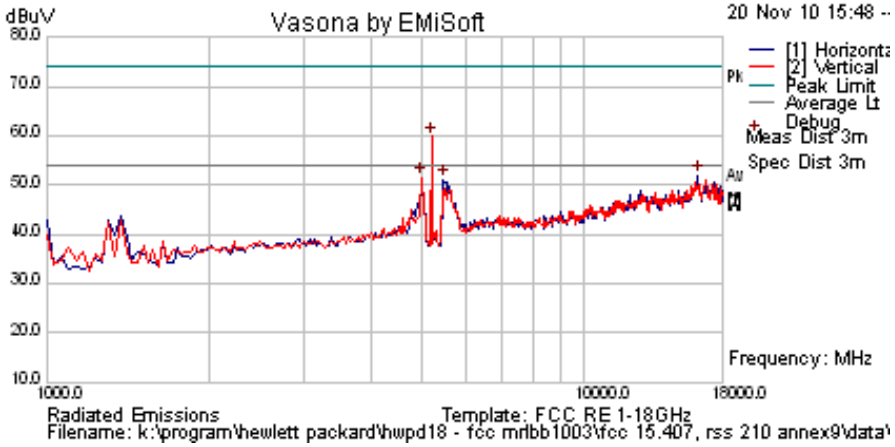


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5156.313	65.8	4.6	-9.0	61.5	Peak [Scan]	H	100	0				FUND
5565.13026	56.3	4.7	-8.5	52.4	Peak [Scan]	H	100	0	54.0	-1.6	Pass	BE
4985.972	55.7	4.6	-9.1	51.2	Peak [Scan]	H	100	0	54	-2.9	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11a MIMO	**Temp (ºC)**	21.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	33
Power Setting	Antenna Maximum for band	**Press. (mBars)**	994
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

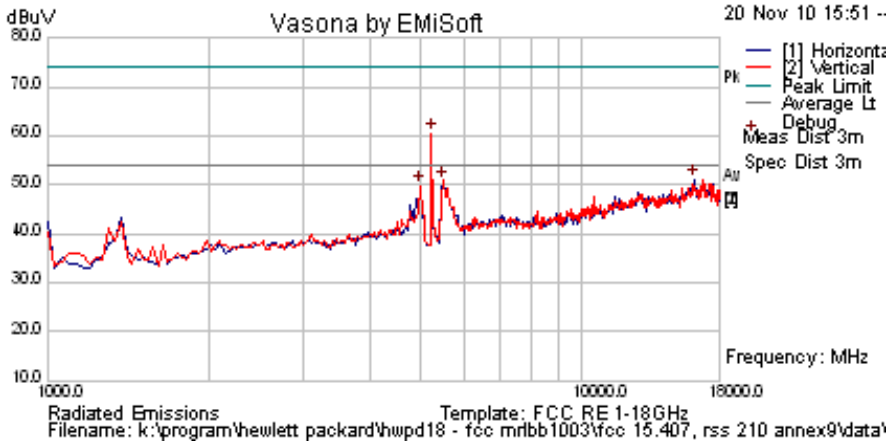


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5190.381	64.6	4.6	-9.2	60.0	Peak [Scan]	V	100	0				FUND
5462.926	55.5	4.6	-9.0	51.1	Peak [Scan]	H	100	0	54	-2.9	Pass	BE
4985.972	56.1	4.6	-9.1	51.6	Peak [Scan]	V	100	0	54	-2.4	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11 a MIMO	**Temp (ºC)**	21.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	33
Power Setting	Antenna Maximum for band	**Press. (mBars)**	994
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

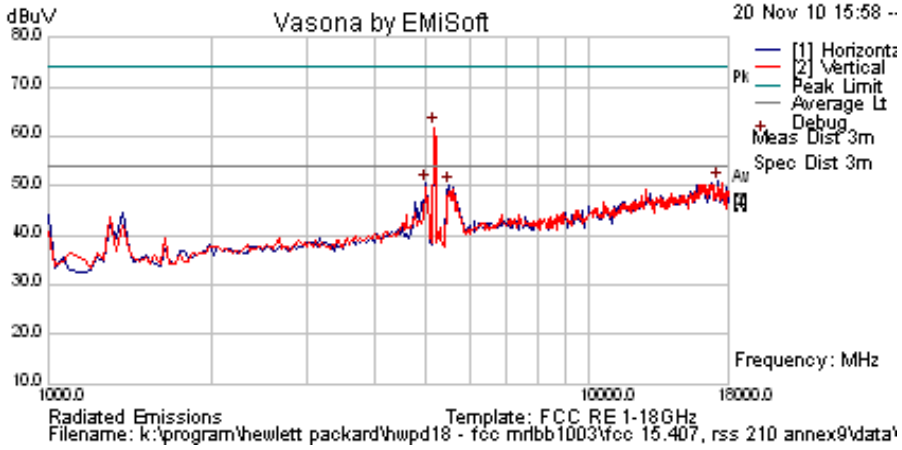


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5224.449	65.3	4.6	-9.4	60.5	Peak [Scan]	V	100	0				FUND
4985.972	54.4	4.6	-9.1	49.9	Peak [Scan]	H	100	0	54.0	-4.1	Pass	BE
5496.994	55.1	4.6	-8.7	51.0	Peak [Scan]	V	100	0	54	-3.0	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11HT-20 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

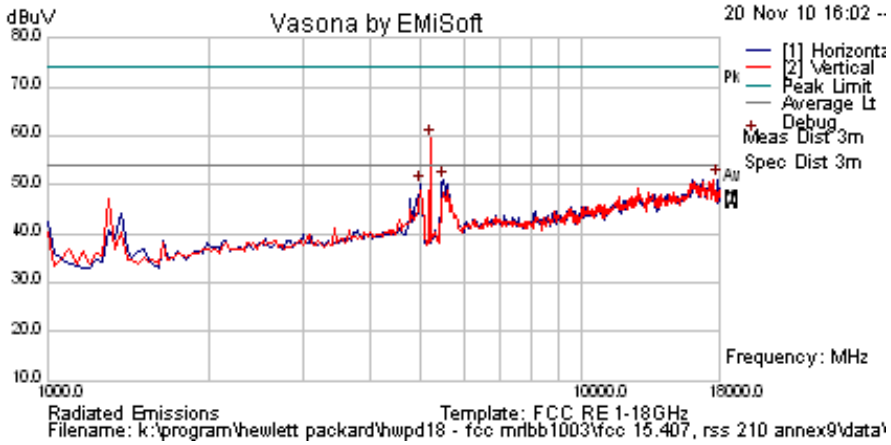


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5156.313	66.3	4.6	-9.0	61.9	Peak [Scan]	H	100	0				FUND
5496.994	54.2	4.6	-8.7	50.1	Peak [Scan]	H	100	0	54	-3.9	Pass	BE
4985.972	55.1	4.6	-9.1	50.6	Peak [Scan]	H	100	0	54	-3.4	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11HT-20 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

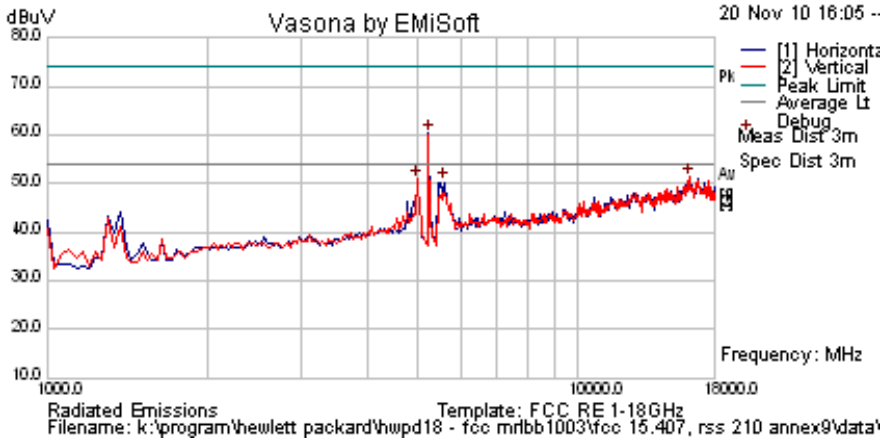


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5190.381	64.1	4.6	-9.2	59.6	Peak [Scan]	V	100	0				FUND
4985.972	54.5	4.6	-9.1	49.9	Peak [Scan]	H	100	0	54	-4.1	Pass	BE
5496.994	55.1	4.6	-8.7	51.0	Peak [Scan]	H	100	0	54	-3.0	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11 a MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

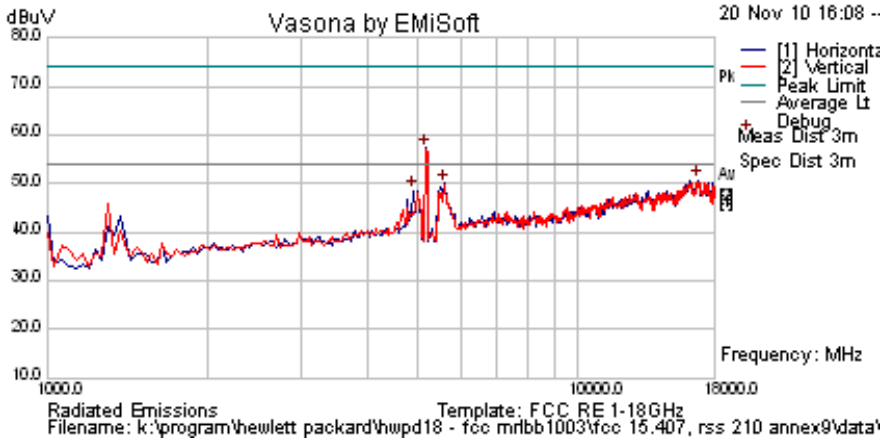


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5224.449	65.2	4.6	-9.4	60.3	Peak [Scan]	H	100	0				FUND
5599.198	54.2	4.7	-8.6	50.2	Peak [Scan]	H	100	0	54	-3.8	Pass	BE
4985.972	55.4	4.6	-9.1	50.9	Peak [Scan]	V	100	0	54	-3.1	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5190 MHz	**Engineer**	GMH
Variant	802.11HT-40 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

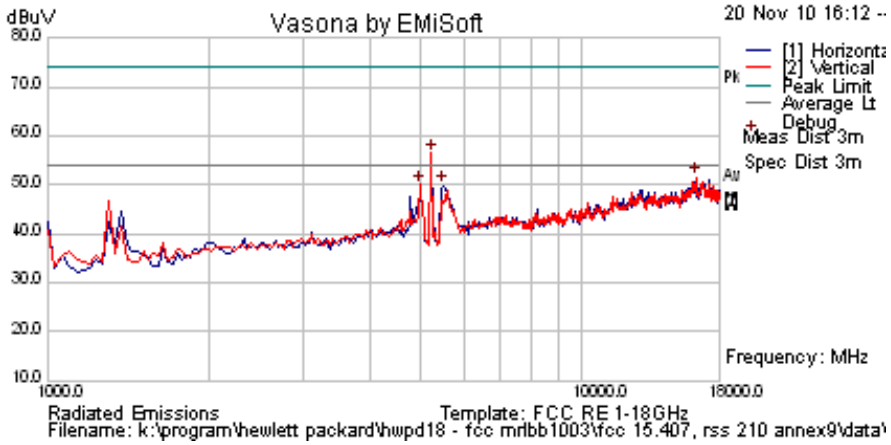


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5156.313	61.6	4.6	-9.0	57.2	Peak [Scan]	H	100	0				FUND
4883.768	53.4	4.5	-9.3	48.6	Peak [Scan]	H	100	0	54	-5.4	Pass	BE
5599.198	54.1	4.7	-8.6	50.1	Peak [Scan]	H	100	0	54	-3.9	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5230 MHz	**Engineer**	GMH
Variant	802.11HT-40 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		



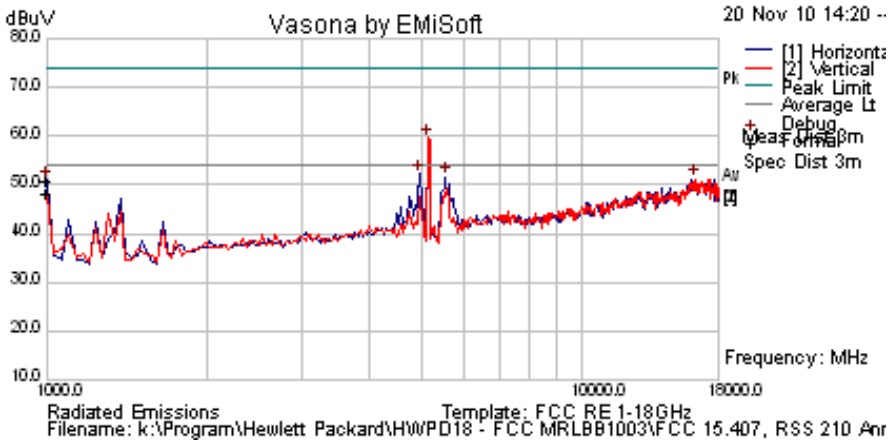
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5224.449	61.4	4.6	-9.4	56.6	Peak [Scan]	H	100	0				FUND
5496.994	53.9	4.6	-8.7	49.8	Peak [Scan]	H	100	0	54	-4.2	Pass	BE
4985.972	54.7	4.6	-9.1	50.1	Peak [Scan]	V	100	0	54	-3.9	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Antenna J9659A Circular 6 Element MIMO

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11a MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	J9659A (Gain 5.9 dBi @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

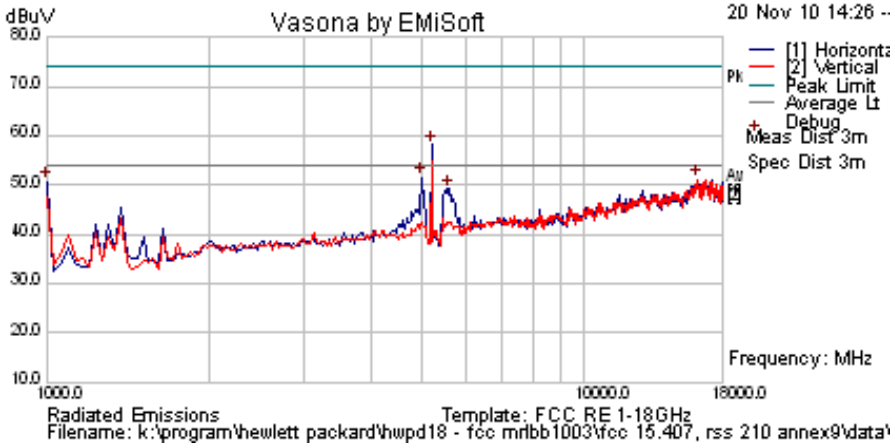


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
1000.000	65.1	2.0	-16.2	50.8	Peak Max	H	151	184	74.0	-23.2	Pass	RB
1000.000	62.3	2.0	-16.2	48.1	Average Max	H	151	184	54.0	-5.9	Pass	RB
5156.313	63.9	4.6	-9.0	59.5	Peak [Scan]	V	150	0				FUND
4985.972	56.8	4.6	-9.1	52.2	Peak [Scan]	H	100	0	54	-1.8	Pass	BE
5565.130	55.6	4.7	-8.5	51.7	Peak [Scan]	H	100	0	54	-2.3	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11a MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	J9659A (Gain 5.9 dBi @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

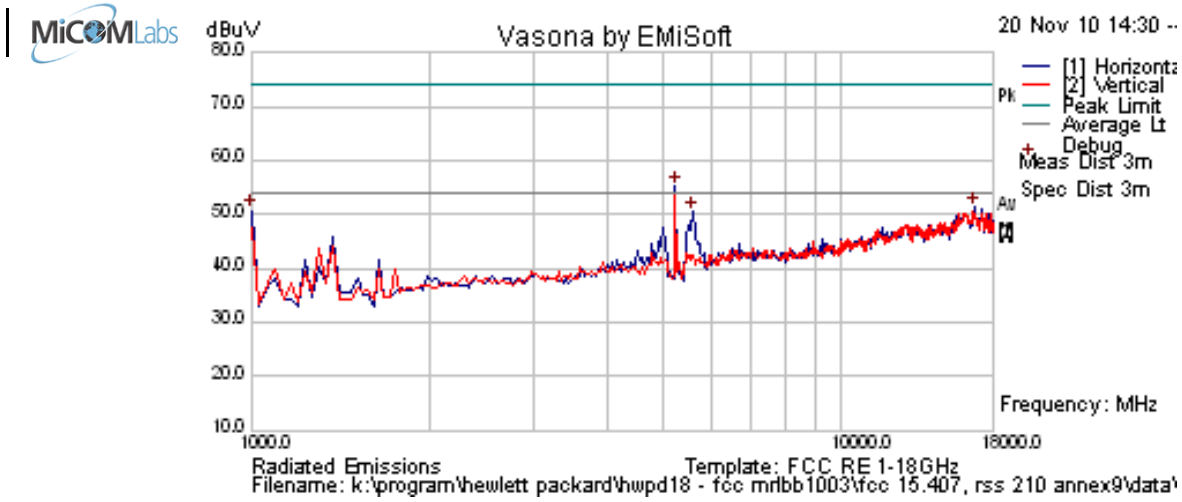


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
1000.000	65.1	2.0	-16.2	50.8	Peak Max	H	151	184	74.0	-23.2	Pass	RB
1000.000	62.3	2.0	-16.2	48.1	Average Max	H	151	184	54.0	-5.9	Pass	RB
5190.381	62.7	4.6	-9.2	58.2	Peak [Scan]	H	100					FUND
4985.97194	56.1	4.6	-9.1	51.5	Peak [Scan]	H	100	0	54.0	-2.5	Pass	BE
5599.198	53.1	4.7	-8.6	49.1	Peak [Scan]	H	100	0	54	-4.9	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11 a MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	J9659A (Gain 5.9 dBi @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

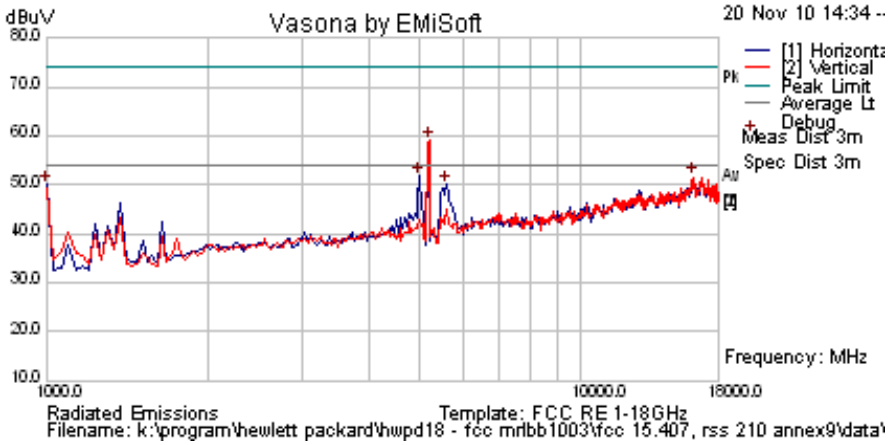


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5224.449	60.1	4.6	-9.4	55.3	Peak [Scan]	H	100	0				FUND
5599.198	54.3	4.7	-8.6	50.4	Peak [Scan]	H	100	0	54.0	-3.6	Pass	BE
1000.000	65.1	2.0	-16.2	50.8	Peak Max	H	151	184	74.0	-23.2	Pass	RB
1000.000	62.3	2.0	-16.2	48.1	Average Max	H	151	184	54.0	-5.9	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11HT-20 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	J9659A (Gain 5.9 dBi @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

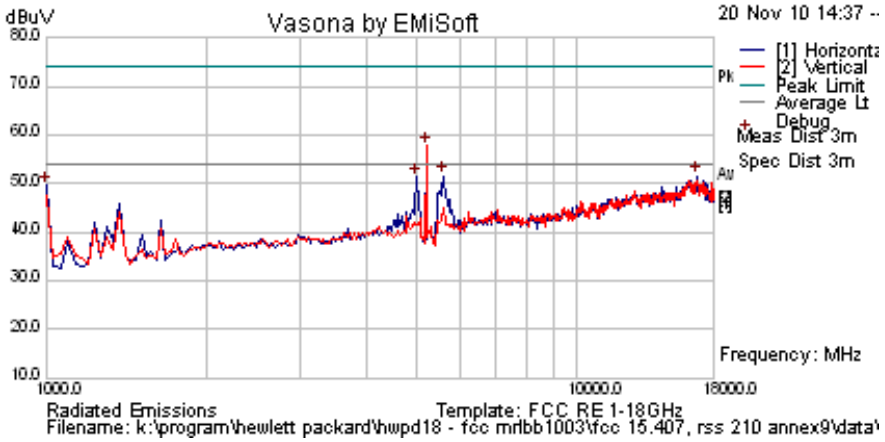


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5190.381	63.7	4.6	-9.2	59.1	Peak [Scan]	V	100	0				FUND
4985.97194	56.4	4.6	-9.1	51.9	Peak [Scan]	H	100	0	54.0	-2.2	Pass	BE
5599.198	54.1	4.7	-8.6	50.1	Peak [Scan]	H	100	0	54	-3.9	Pass	BE
1000.000	65.1	2.0	-16.2	50.8	Peak Max	H	151	184	74.0	-23.2	Pass	RB
1000.000	62.3	2.0	-16.2	48.1	Average Max	H	151	184	54.0	-5.9	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11HT-20 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	J9659A (Gain 5.9 dBi @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

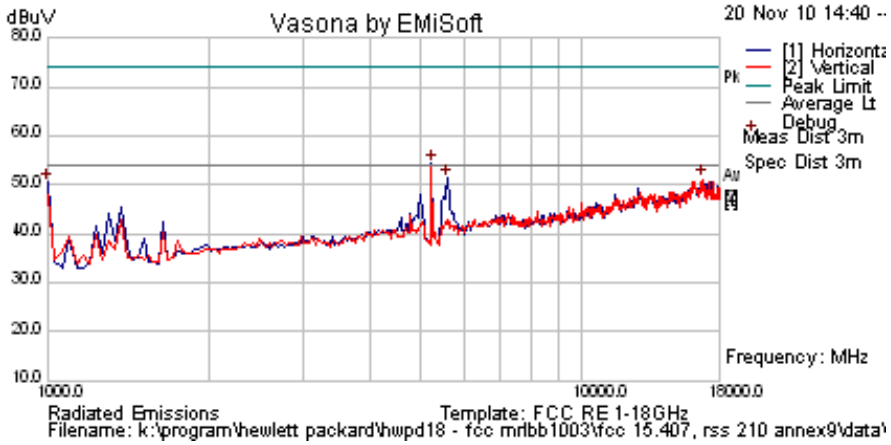


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5190.381	62.2	4.6	-9.2	57.7	Peak [Scan]	V	100	0				FUND
4985.972	55.8	4.6	-9.1	51.3	Peak [Scan]	H	100	0	54	-2.7	Pass	BE
5599.198	55.4	4.7	-8.6	51.5	Peak [Scan]	H	100	0	54	-2.5	Pass	BE
1000.000	65.1	2.0	-16.2	50.8	Peak Max	H	151	184	74.0	-23.2	Pass	RB
1000.000	62.3	2.0	-16.2	48.1	Average Max	H	151	184	54.0	-5.9	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11HT-20 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	J9659A (Gain 5.9 dBi @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

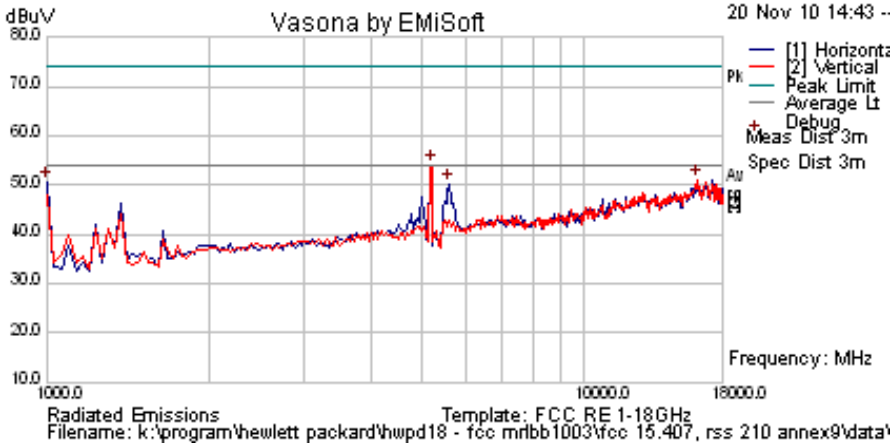


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5224.449	59.2	4.6	-9.4	54.3	Peak [Scan]	H	100	0				FUND
5599.198	55.3	4.7	-8.6	51.4	Peak [Scan]	H	100	0	54	-2.6	Pass	BE
1000.000	65.1	2.0	-16.2	50.8	Peak Max	H	151	184	74.0	-23.2	Pass	RB
1000.000	62.3	2.0	-16.2	48.1	Average Max	H	151	184	54.0	-5.9	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5190 MHz	**Engineer**	GMH
Variant	802.11HT-40 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	J9659A (Gain 5.9 dBi @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

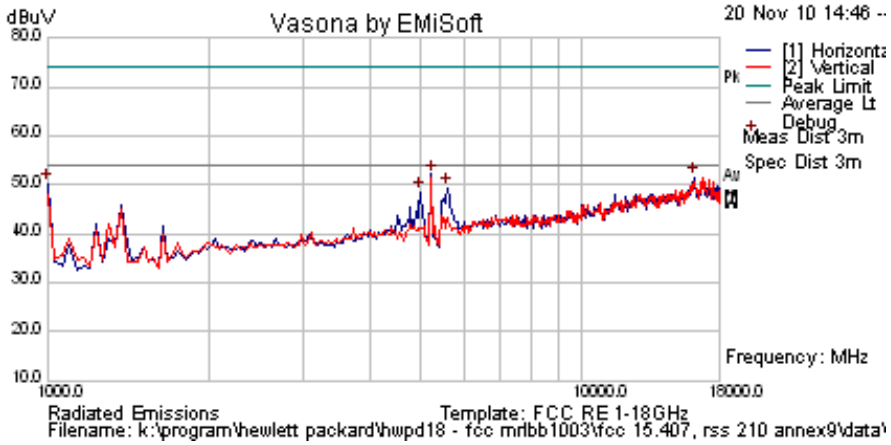


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5190.381	58.6	4.6	-9.2	54.1	Peak [Scan]	V	100	0				FUND
5599.198	54.1	4.7	-8.6	50.2	Peak [Scan]	H	100	0	54	-3.8	Pass	BE
1000.000	65.1	2.0	-16.2	50.8	Peak Max	H	151	184	74.0	-23.2	Pass	RB
1000.000	62.3	2.0	-16.2	48.1	Average Max	H	151	184	54.0	-5.9	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5230 MHz	**Engineer**	GMH
Variant	802.11HT-40 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	J9659A (Gain 5.9 dBi @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		



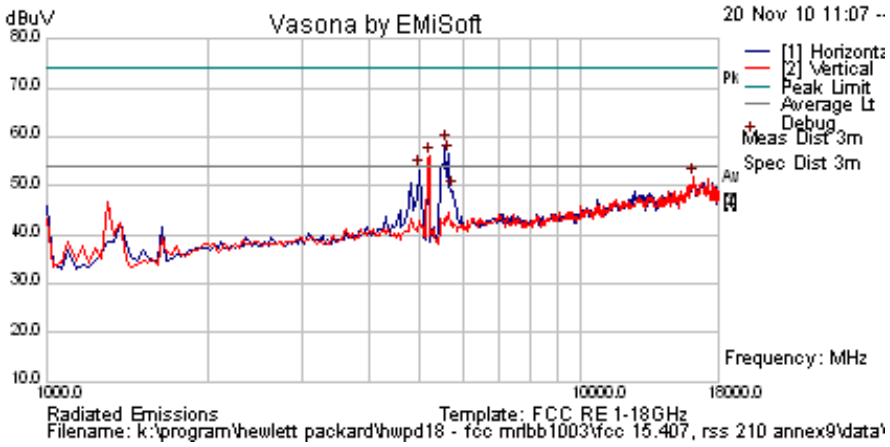
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5224.449	56.9	4.6	-9.4	52.1	Peak [Scan]	H	100	0				FUND
1000.000	65.1	2.0	-16.2	50.8	Peak Max	H	151	184	74.0	-23.2	Pass	RB
1000.000	62.3	2.0	-16.2	48.1	Average Max	H	151	184	54.0	-5.9	Pass	RB
5599.198	53.3	4.7	-8.6	49.4	Peak [Scan]	H	100	0	54	-4.7	Pass	BE
4985.972	53.1	4.6	-9.1	48.6	Peak [Scan]	H	100	0	54	-5.5	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Antenna J9171A 3 Element MIMO

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11a MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	AK-J9171A (4 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

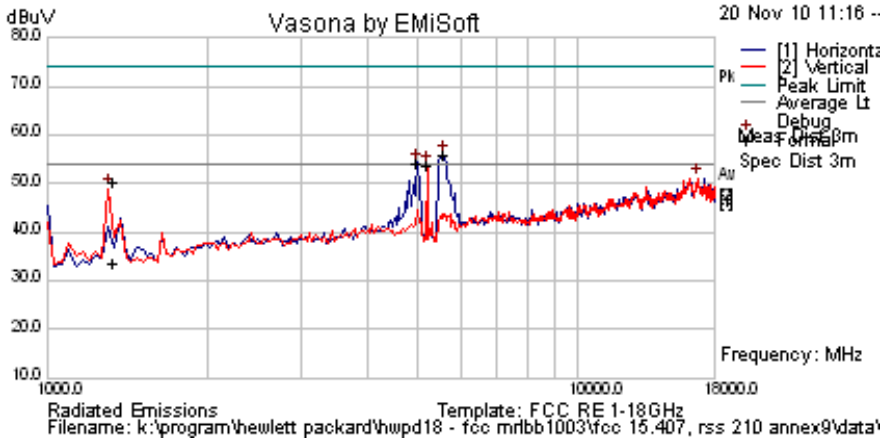


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5565.130	62.3	4.7	-8.5	58.4	Peak [Scan]	H	100	0	54.0	4.4	Fail	BE
5633.26653	60.2	4.7	-8.4	56.5	Peak [Scan]	H	100	0	54.0	2.5	Fail	BE
5190.381	60.5	4.6	-9.2	56.0	Peak [Scan]	V	100	0				FUND
4985.972	57.9	4.6	-9.1	53.3	Peak [Scan]	H	100	0	54	-0.7	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11a MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	AK-J9171A (4 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

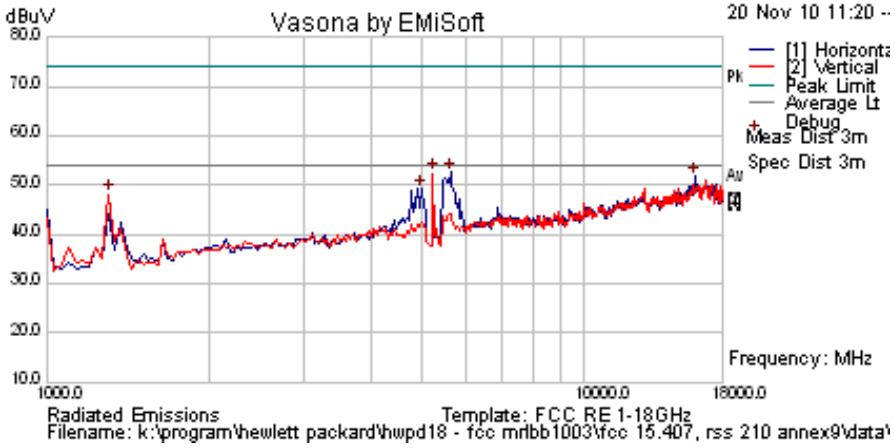


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
1333.332	62.3	2.3	-14.0	50.5	Peak Max	V	98	123	74.0	-23.5	Pass	RB
1333.332	45.3	2.3	-14.0	33.5	Average Max	V	98	123	54.0	-20.5	Pass	RB
5565.130	59.7	4.7	-8.5	55.8	Peak [Scan]	H	100	0	54	1.8	Fail	BE
4985.972	58.8	4.6	-9.1	54.3	Peak [Scan]	H	100	0	54	0.3	Fail	BE
5190.381	58.4	4.6	-9.2	53.9	Peak [Scan]	V	100	0				FUND

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11 a MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	AK-J9171A (4 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

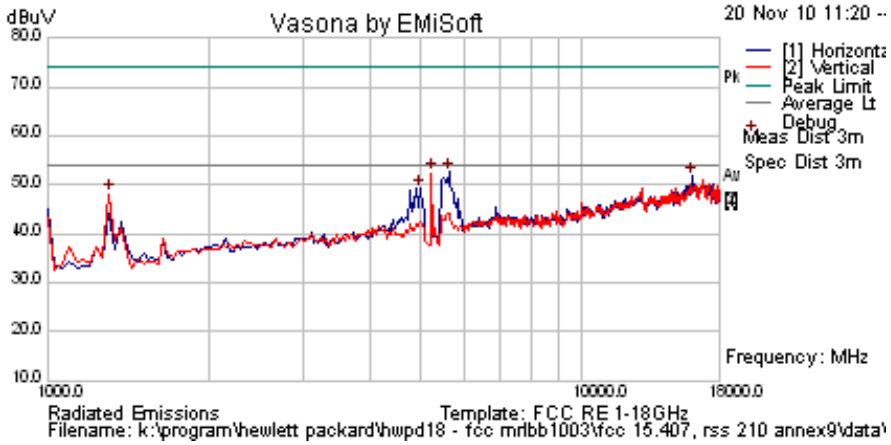


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5633.267	56.4	4.7	-8.4	52.7	Peak [Scan]	H	100	0	54.0	-1.3	Pass	BE
5224.4489	57.3	4.6	-9.4	52.5	Peak [Scan]	V	100	0				FUND
4985.972	53.8	4.6	-9.1	49.3	Peak [Scan]	H	100	0	54	-4.7	Pass	BE
1333.332	62.3	2.3	-14.0	50.5	Peak Max	V	98	123	74.0	-23.5	Pass	RB
1333.332	45.3	2.3	-14.0	33.5	Average Max	V	98	123	54.0	-20.5	Pass	RB

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11HT-20 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	AK-J9171A (4 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

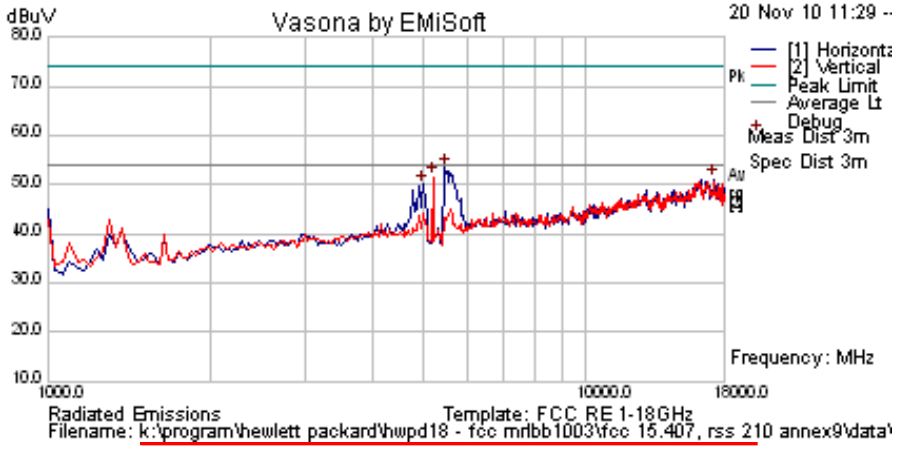


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5190.381	59.7	4.6	-9.2	55.2	Peak [Scan]	V	100	0				FUND
5599.1984	57.5	4.7	-8.6	53.6	Peak [Scan]	H	100	0	54.0	-0.4	Pass	BE
4985.972	55.7	4.6	-9.1	51.2	Peak [Scan]	H	100	0	54	-2.8	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11HT-20 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	AK-J9171A (4 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

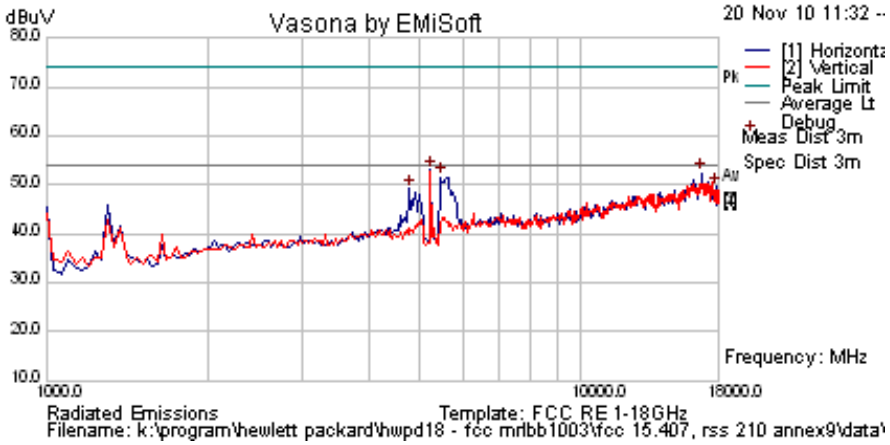


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5462.926	57.8	4.6	-9.0	53.4	Peak [Scan]	H	100	0	54.0	-0.6	Pass	BE
5190.38076	56.0	4.6	-9.2	51.5	Peak [Scan]	V	100	0				FUND
4985.972	54.6	4.6	-9.1	50.1	Peak [Scan]	H	100	0	54	-3.9	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11 a MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	AK-J9171A (4 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

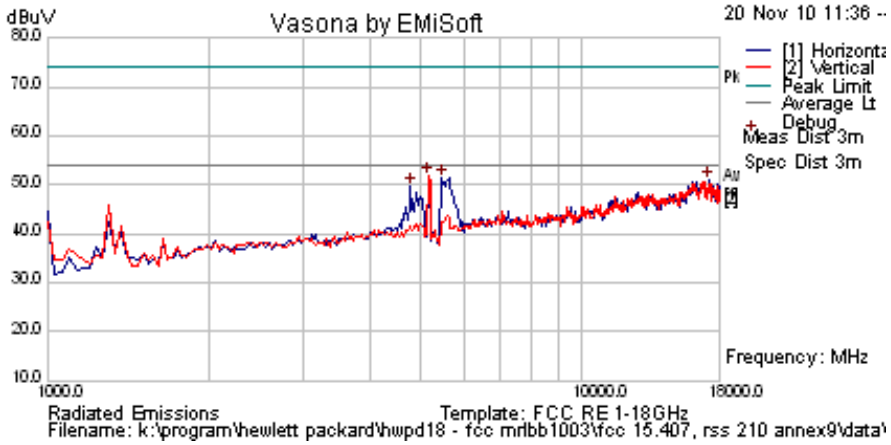


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5224.449	58.0	4.6	-9.4	53.2	Peak [Scan]	H	100	0				FUND
4781.563	54.2	4.4	-9.5	49.2	Peak [Scan]	H	100	0	54	-4.8	Pass	BE
5462.926	55.9	4.6	-9.0	51.6	Peak [Scan]	H	100	0	54	-2.5	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5190 MHz	**Engineer**	GMH
Variant	802.11HT-40 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	AK-J9171A (4 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		

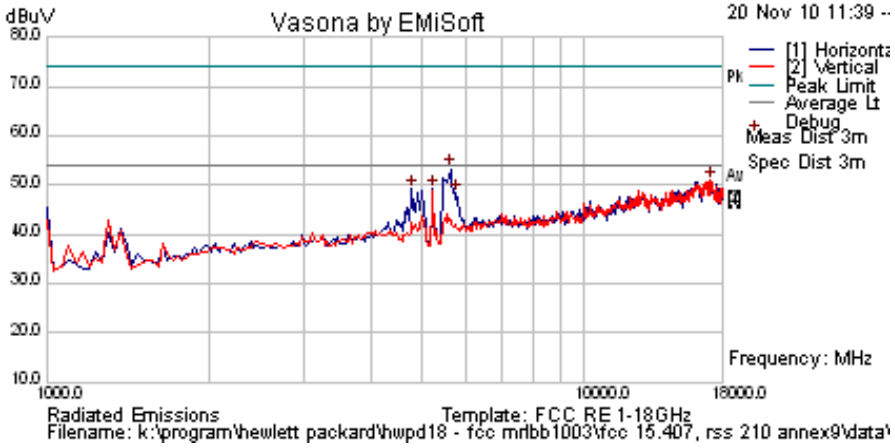


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5156.313	56.0	4.6	-9.0	51.7	Peak [Scan]	V	100	0				FUND
5462.92585	55.7	4.6	-9.0	51.3	Peak [Scan]	H	100	0	54.0	-2.7	Pass	BE
4781.563	54.8	4.4	-9.5	49.7	Peak [Scan]	H	100	0	54	-4.3	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

Test Freq.	5230 MHz	**Engineer**	GMH
Variant	802.11HT-40 MIMO	**Temp (ºC)**	20
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	35
Power Setting	Target Power	**Press. (mBars)**	997
Antenna	AK-J9171A (4 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1	Module of table-top antenna directly connected, communication via ethernet to control room		
Test Notes 2	48Vdc POE from Control Room		



Formally measured emission peaks

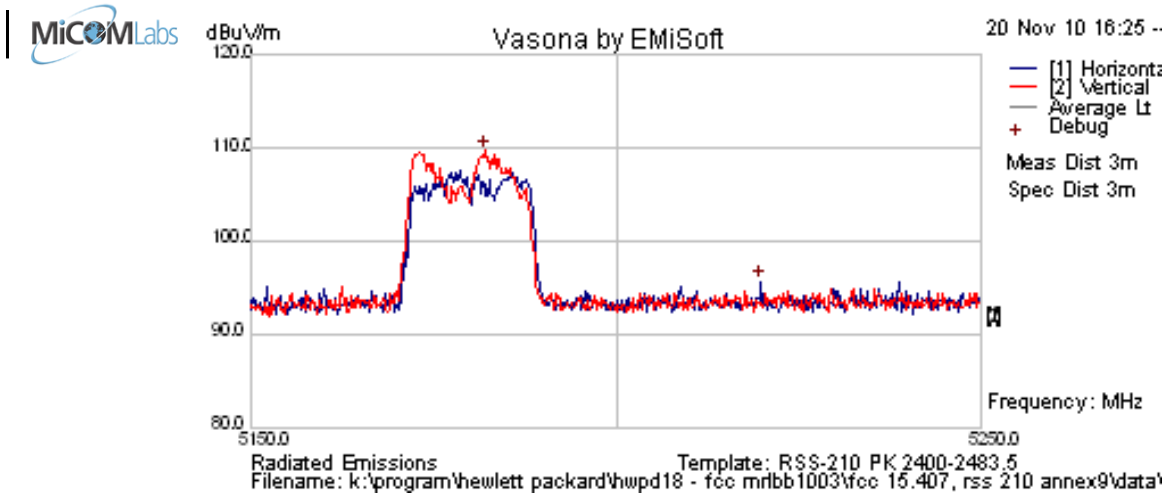
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV	Margin dB	Pass /Fail	Comments
5633.267	57.0	4.7	-8.4	53.3	Peak [Scan]	H	100	0	54.0	-0.8	Pass	BE
5224.4489	54.1	4.6	-9.4	49.3	Peak [Scan]	H	100	0				FUND
4781.563	54.2	4.4	-9.5	49.2	Peak [Scan]	H	100	0	54	-4.9	Pass	BE
5769.539	51.9	4.8	-8.3	48.4	Peak [Scan]	H	100	0	54	-5.6	Pass	BE

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

5.1.7.2. Peak Emissions

Integral Antenna RNAA-H1 6 Element MIMO

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

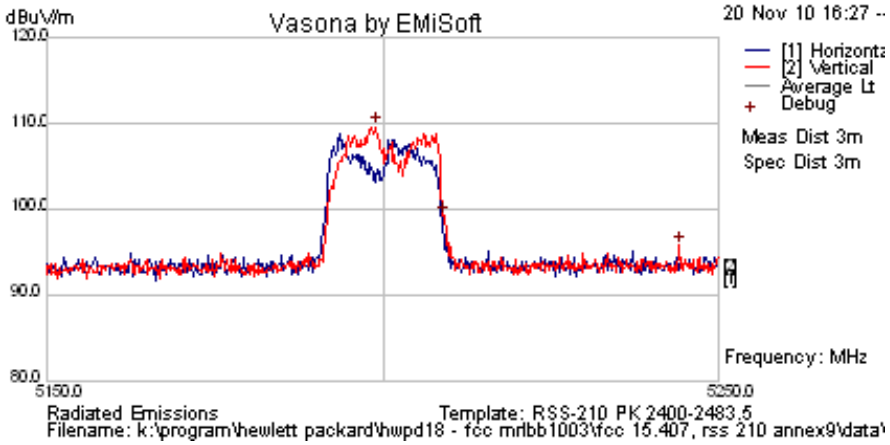


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5181.864	60.7	14.6	34.4	109.7	Peak [Scan]	V						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

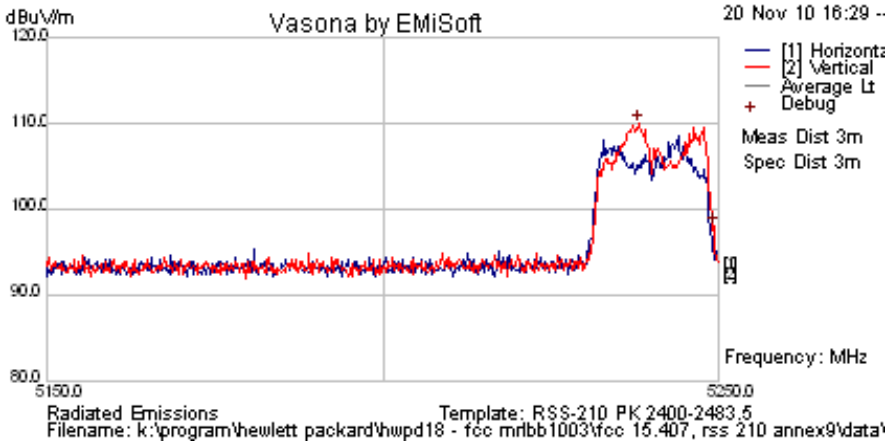


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5198.898	60.6	14.6	34.4	109.7	Peak [Scan]	V						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

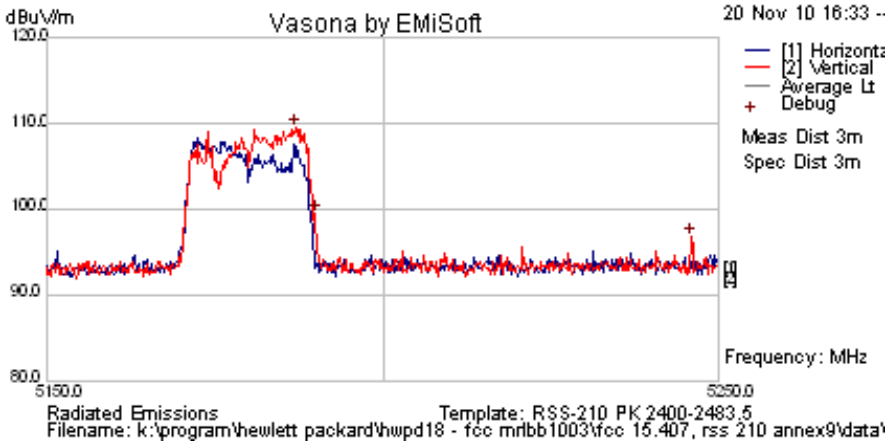


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5238.176	61.0	14.6	34.4	110.0	Peak [Scan]	V						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11HT20; 6.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

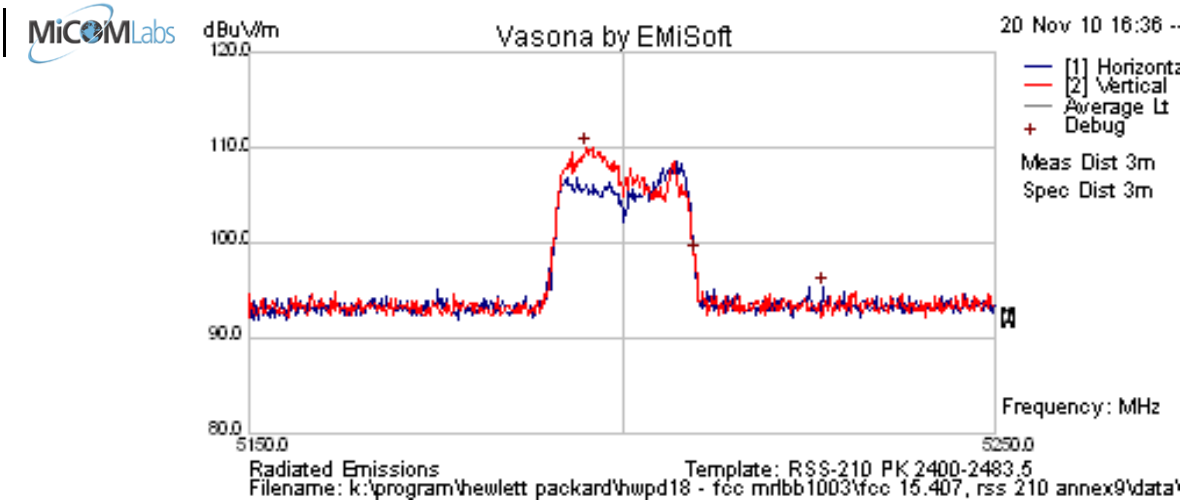


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5186.874	60.5	14.6	34.4	109.5	Peak [Scan]	V						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11HT20; 6.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

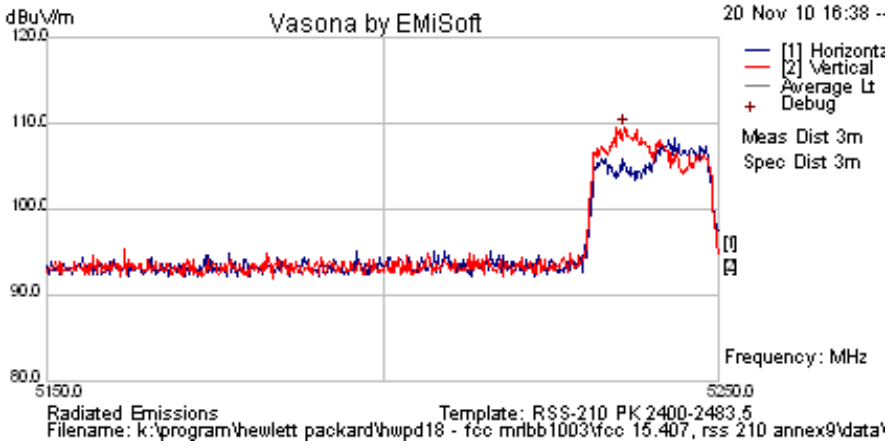


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5195.090	60.9	14.6	34.4	110.0	Peak [Scan]	V						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11HT20; 6.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

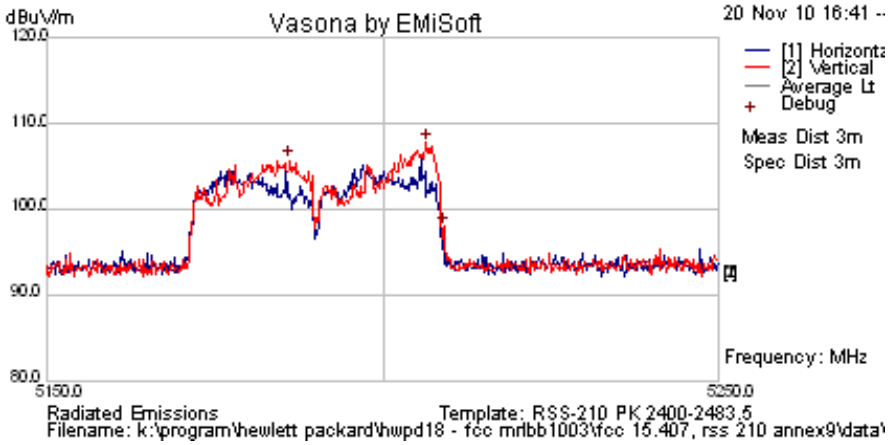


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5235.972	60.5	14.6	34.4	109.5	Peak [Scan]	V						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5190 MHz	**Engineer**	GMH
Variant	802.11HT-40; 13.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

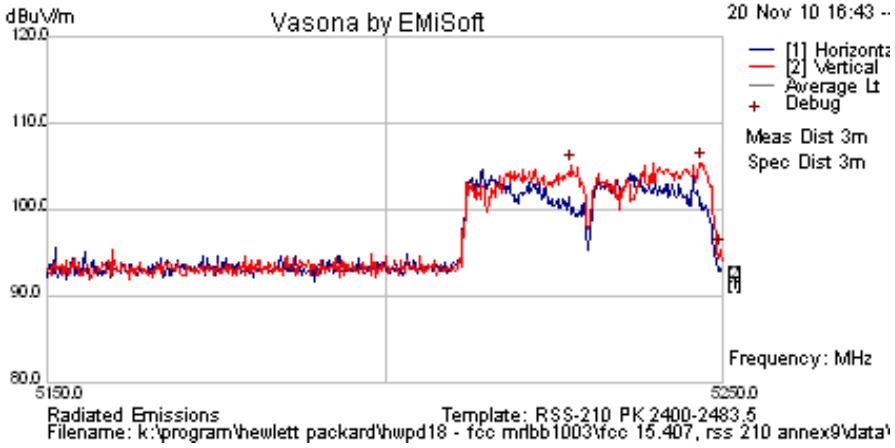


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5206.313	58.7	14.6	34.4	107.7	Peak [Scan]	V						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5230 MHz	**Engineer**	GMH
Variant	802.11HT-40; 13.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



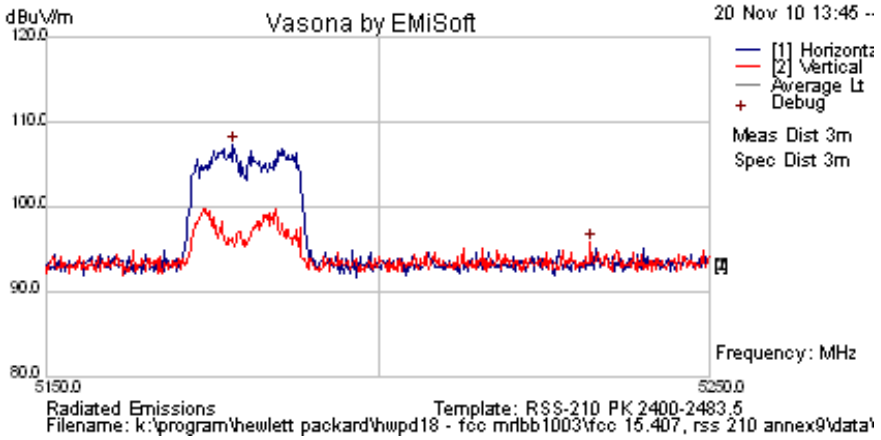
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5246.794	56.4	14.6	34.4	105.4	Peak [Scan]	V						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Antenna J9659A Circular 6 Element MIMO

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	995
Antenna	J9659A (5.9 dBi Gain @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

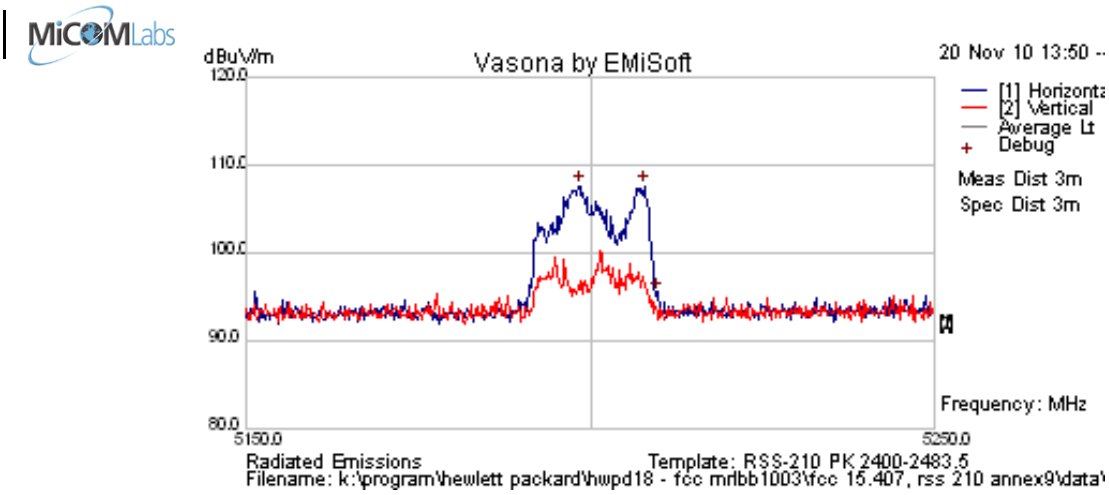


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5178.056	58.3	14.6	34.4	107.3	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	995
Antenna	J9659A (5.9 dBi Gain @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

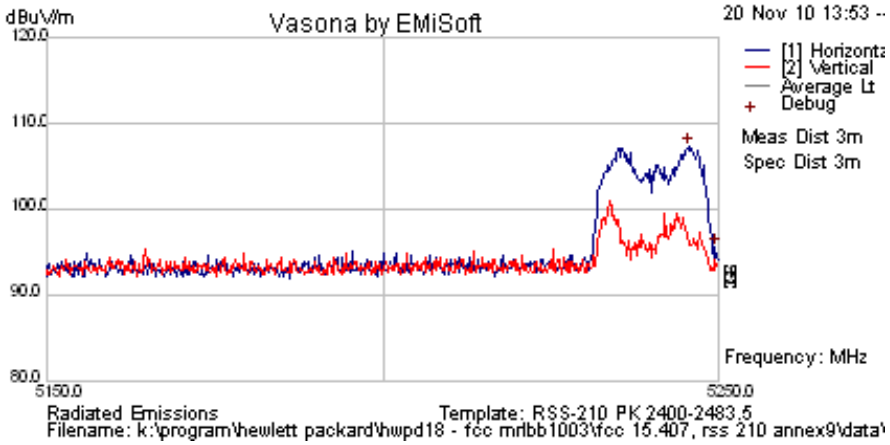


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5198.297	58.6	14.6	34.4	107.7	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	995
Antenna	J9659A (5.9 dBi Gain @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

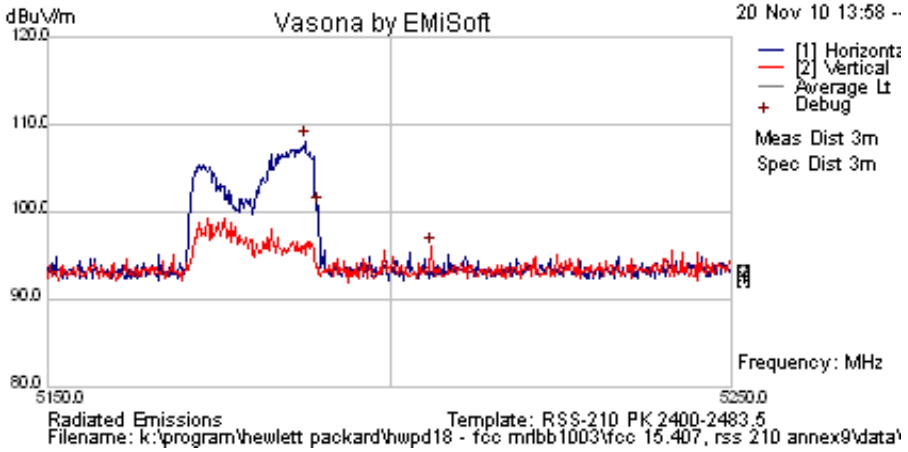


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5245.591	58.3	14.6	34.4	107.3	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11HT-20; 6.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	995
Antenna	J9659A (5.9 dBi Gain @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

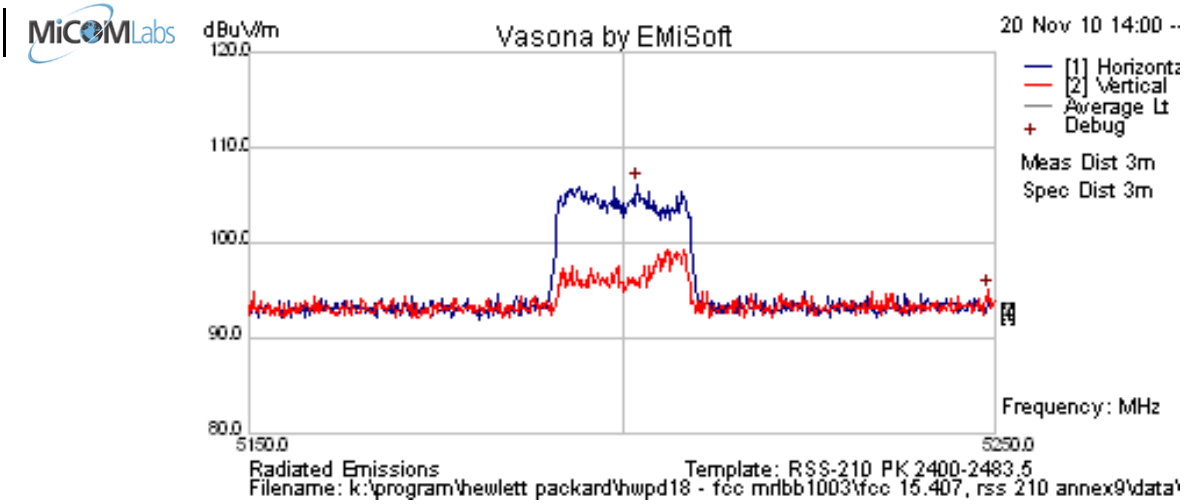


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5187.475	59.1	14.6	34.4	108.1	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11HT-20; 6.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	995
Antenna	J9659A (5.9 dBi Gain @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

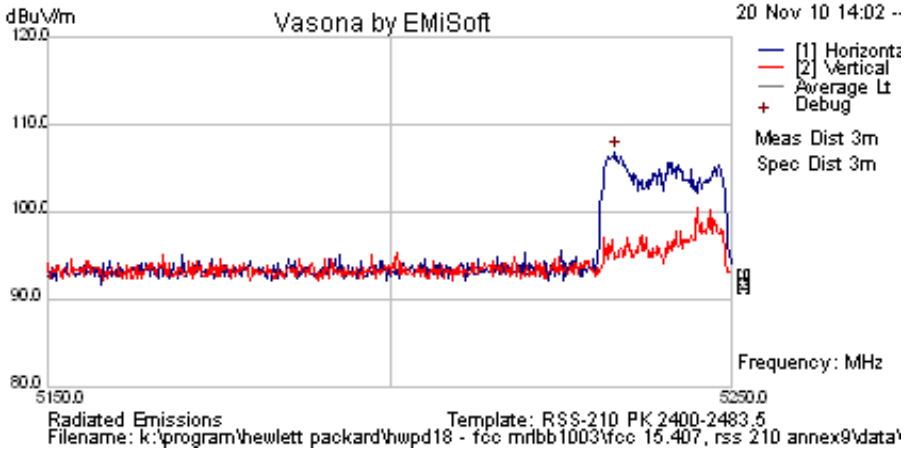


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5201.904	57.2	14.6	34.4	106.2	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11HT-20; 6.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	995
Antenna	J9659A (5.9 dBi Gain @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

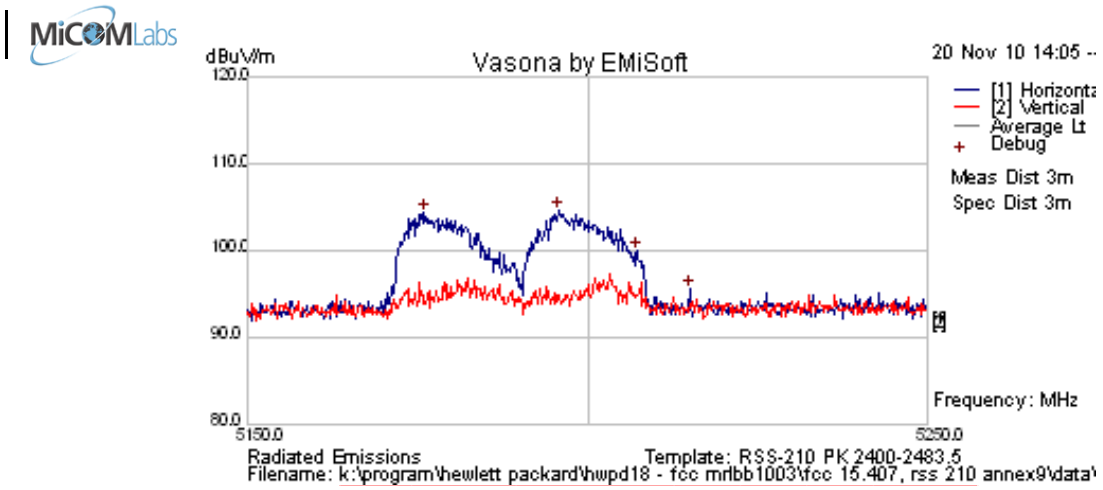


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5232.966	57.9	14.6	34.4	106.9	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5190 MHz	**Engineer**	GMH
Variant	802.11HT-40; 13.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	995
Antenna	J9659A (5.9 dBi Gain @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

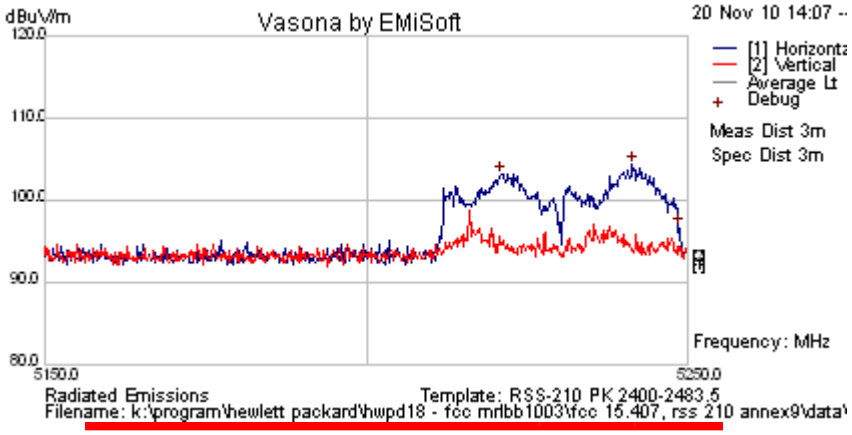


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5195.691	55.5	14.6	34.4	104.6	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5230 MHz	**Engineer**	GMH
Variant	802.11HT-40; 13.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	995
Antenna	J9659A (5.9 dBi Gain @ 5 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



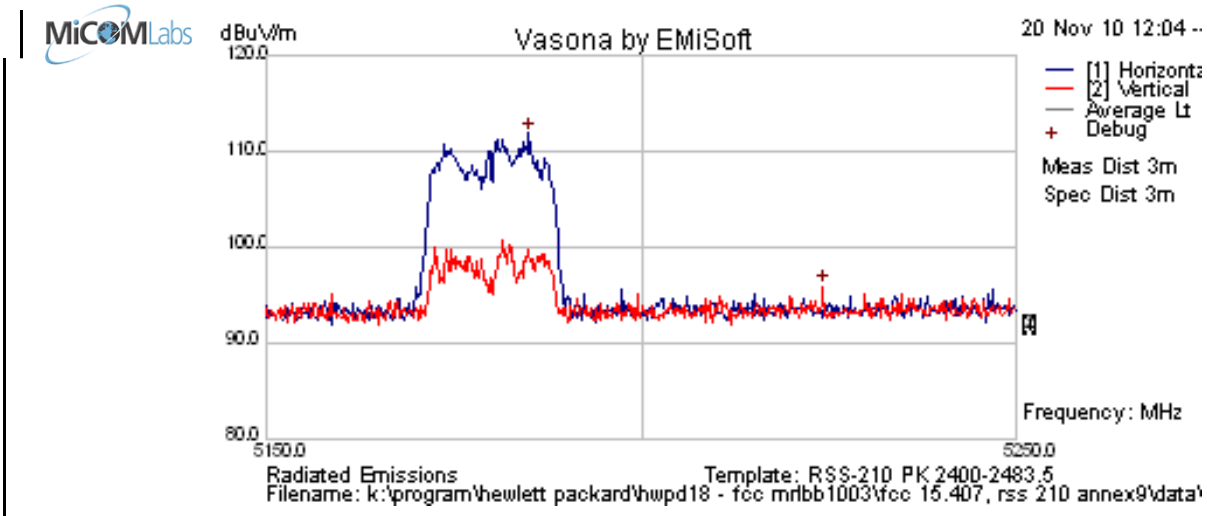
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5241.383	55.3	14.6	34.4	104.3	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Antenna J9171A 3 Element MIMO

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	J9171 (4.0 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

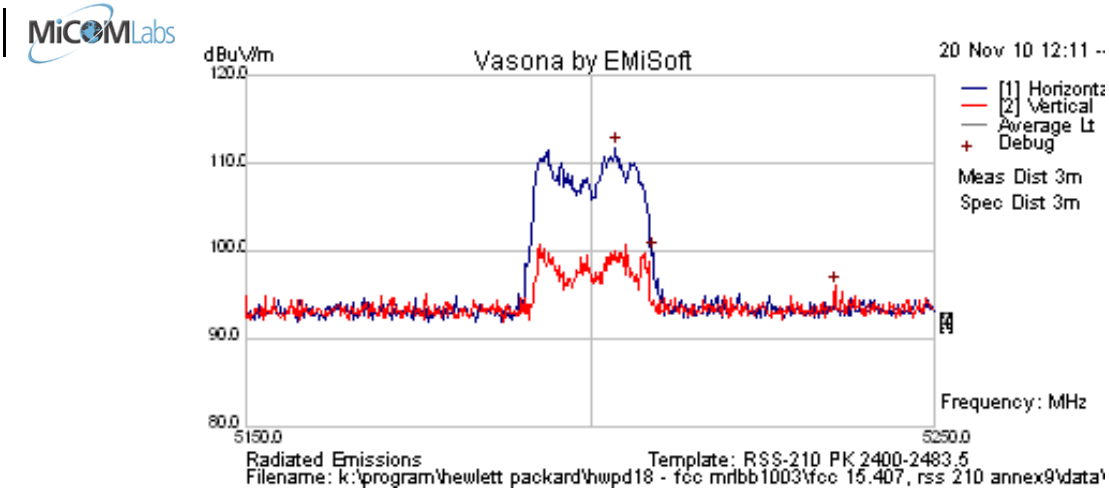


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5184.870	62.9	14.6	34.4	112.0	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	J9171 (4.0 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

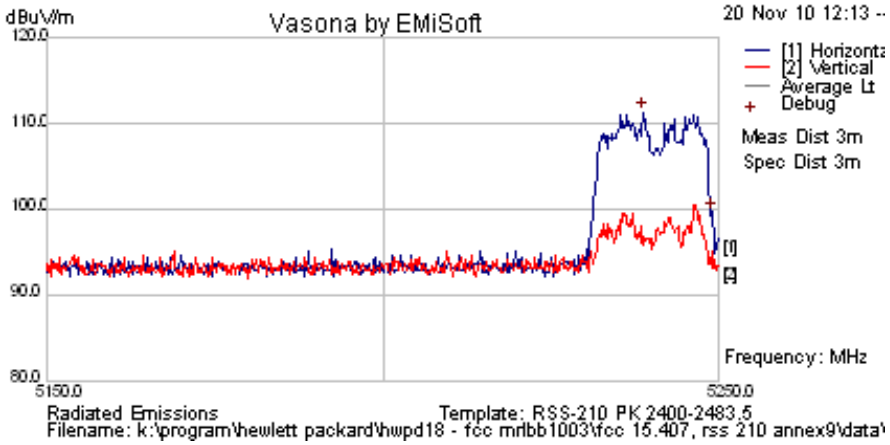


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5203.507	62.8	14.6	34.4	111.8	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11a; 6 Mbs	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	J9171 (4.0 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

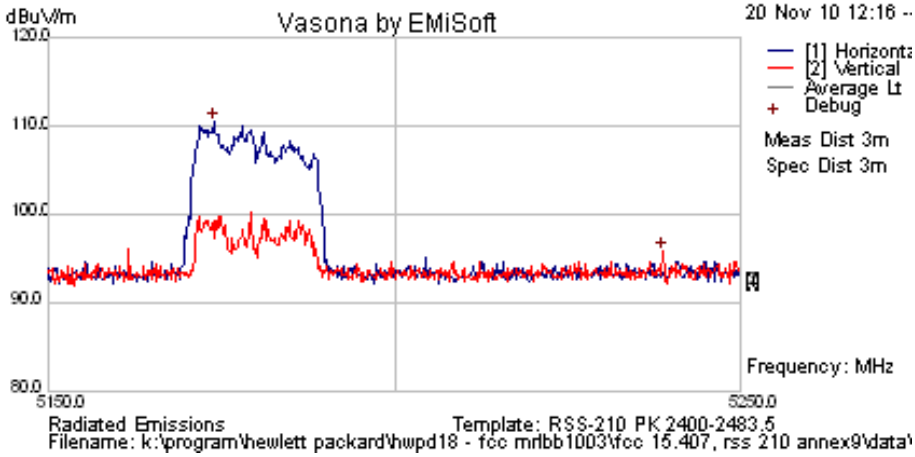


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5238.778	62.4	14.6	34.4	111.4	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5180 MHz	**Engineer**	GMH
Variant	802.11HT20; 6.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	J9171 (4.0 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

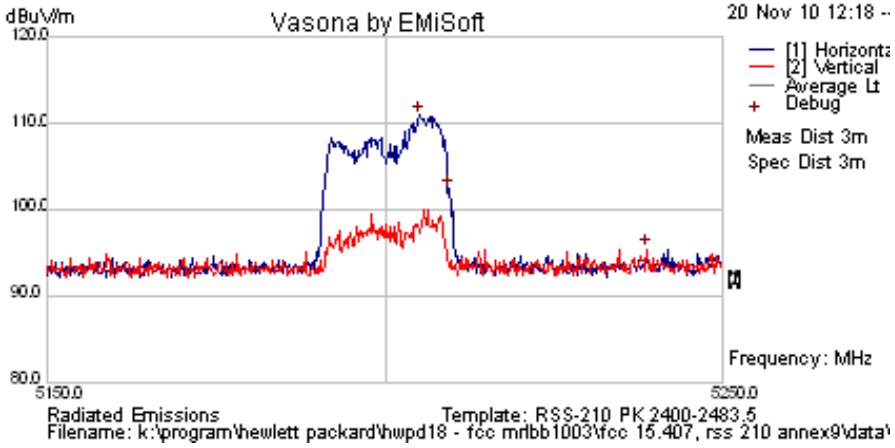


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5173.848	61.4	14.6	34.4	110.4	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	802.11HT20; 6.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	J9171 (4.0 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

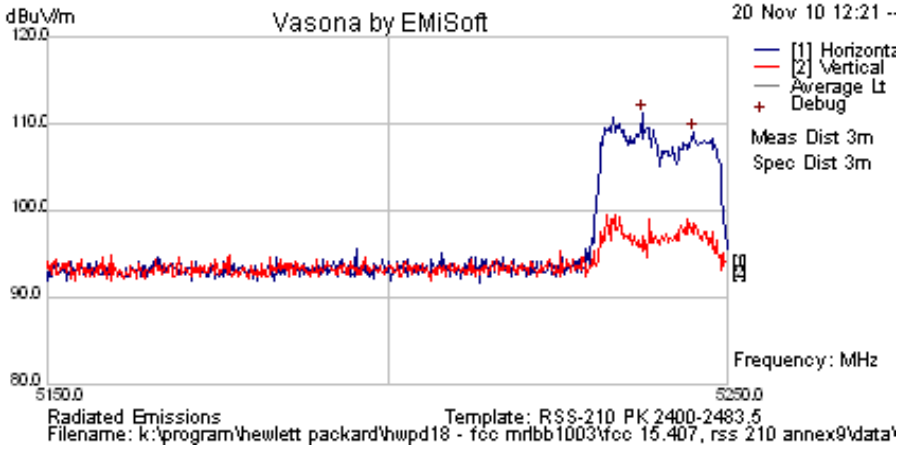


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5204.910	61.9	14.6	34.4	111.0	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5240 MHz	**Engineer**	GMH
Variant	802.11HT20; 6.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	J9171 (4.0 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

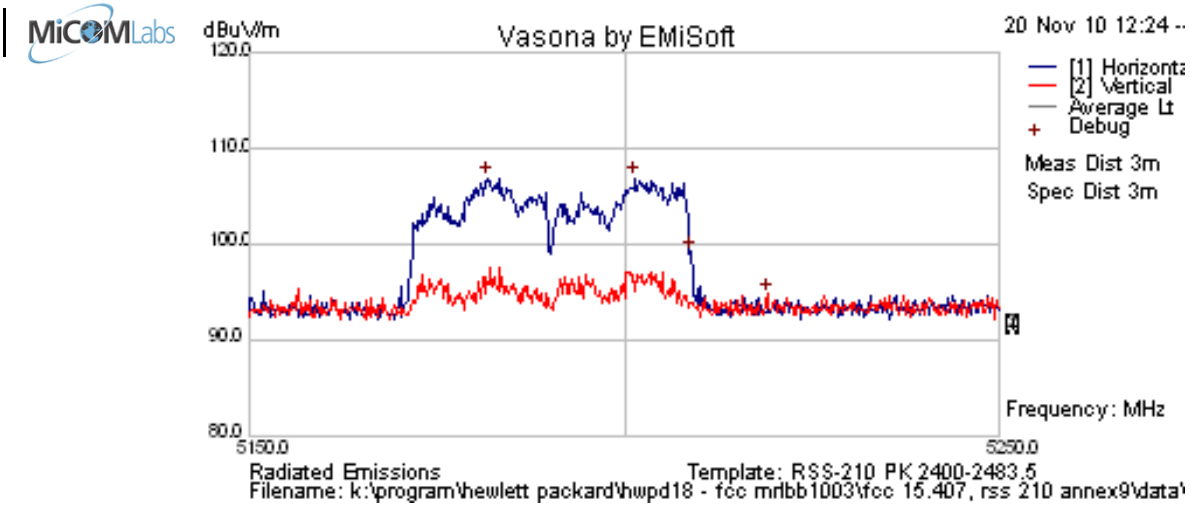


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5237.375	62.1	14.6	34.4	111.1	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5190 MHz	**Engineer**	GMH
Variant	802.11HT-40; 13.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	J9171 (4.0 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			

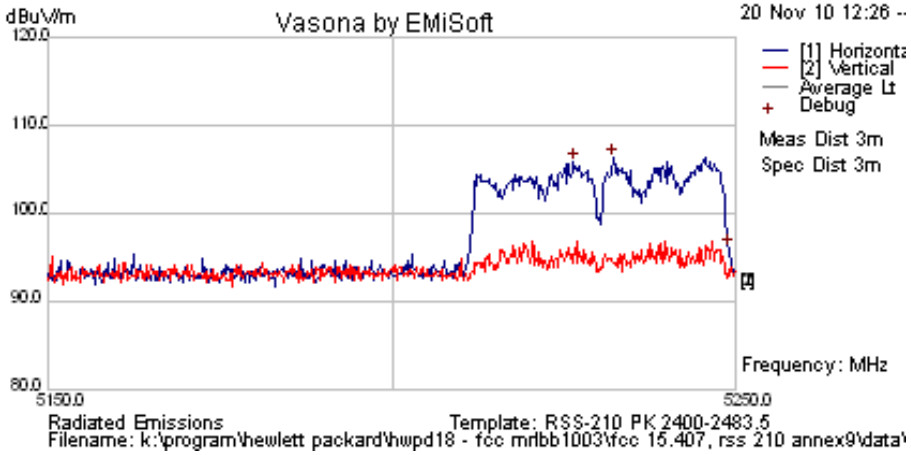


Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5181.663	57.9	14.6	34.4	107.0	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

Test Freq.	5230 MHz	**Engineer**	GMH
Variant	802.11HT-40; 13.5 MCS	**Temp (ºC)**	21.5
Freq. Range	5150 - 5250 MHz	**Rel. Hum.(%)**	33
Power Setting	Target	**Press. (mBars)**	997
Antenna	J9171 (4.0 dBi Gain 4.9 - 5.9 GHz)	**Duty Cycle (%)**	100
Test Notes 1			
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
5232.164	57.4	14.6	34.4	106.4	Peak [Scan]	H						PK

Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	PK = Peak emissions of Fundamental

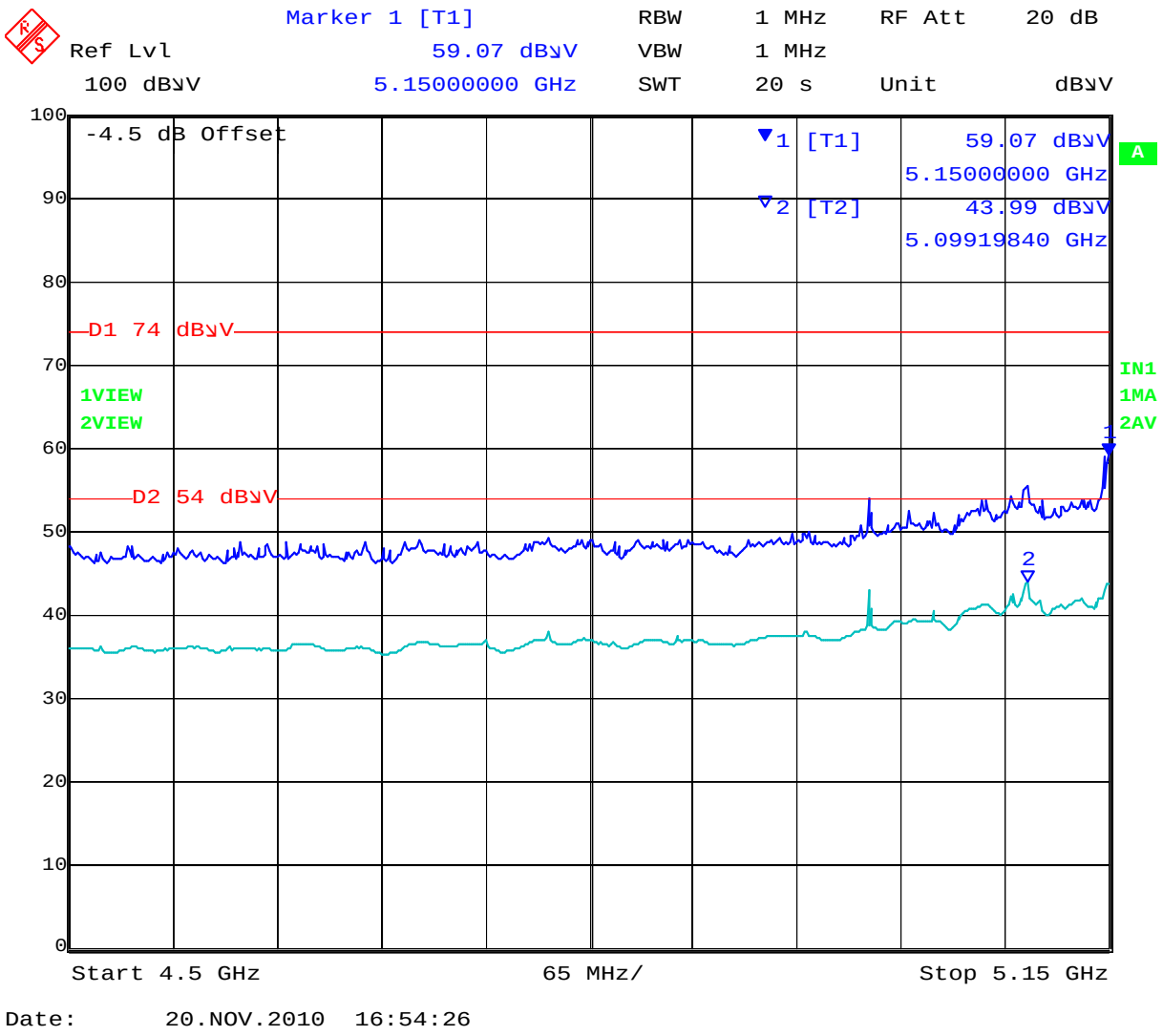
5.1.7.3. Radiated Band-Edge

Integral Antenna RNAA-H1 6 Element MIMO

802.11a Band-edge @ 5150 MHz - Integral antenna

4.5 – 5.15 GHz Span

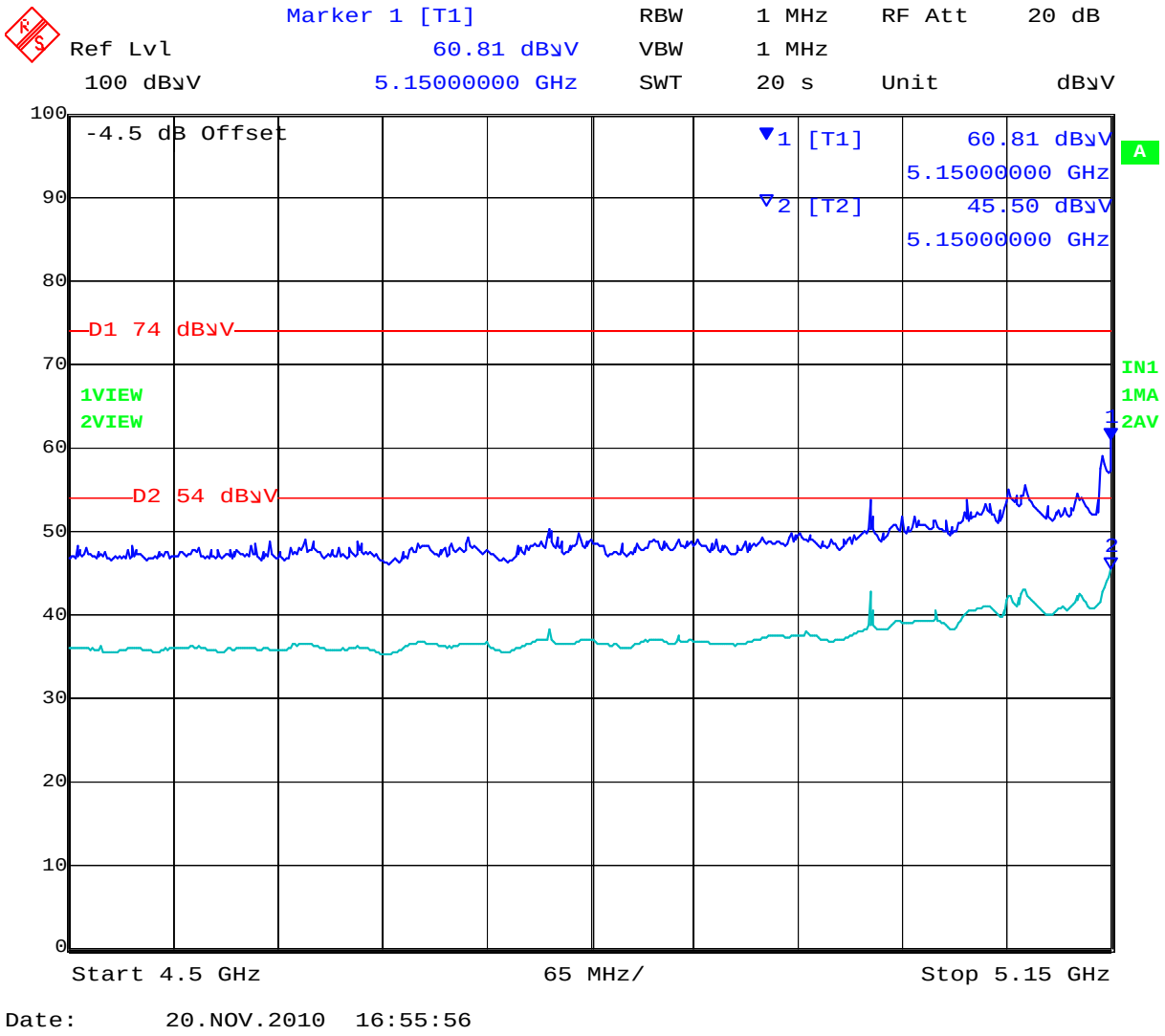
Frequency of Transmission: 5180 MHz



802.11HT-20 Band-edge @ 5150 MHz - Integral antenna

4.5 – 5.15 GHz Span

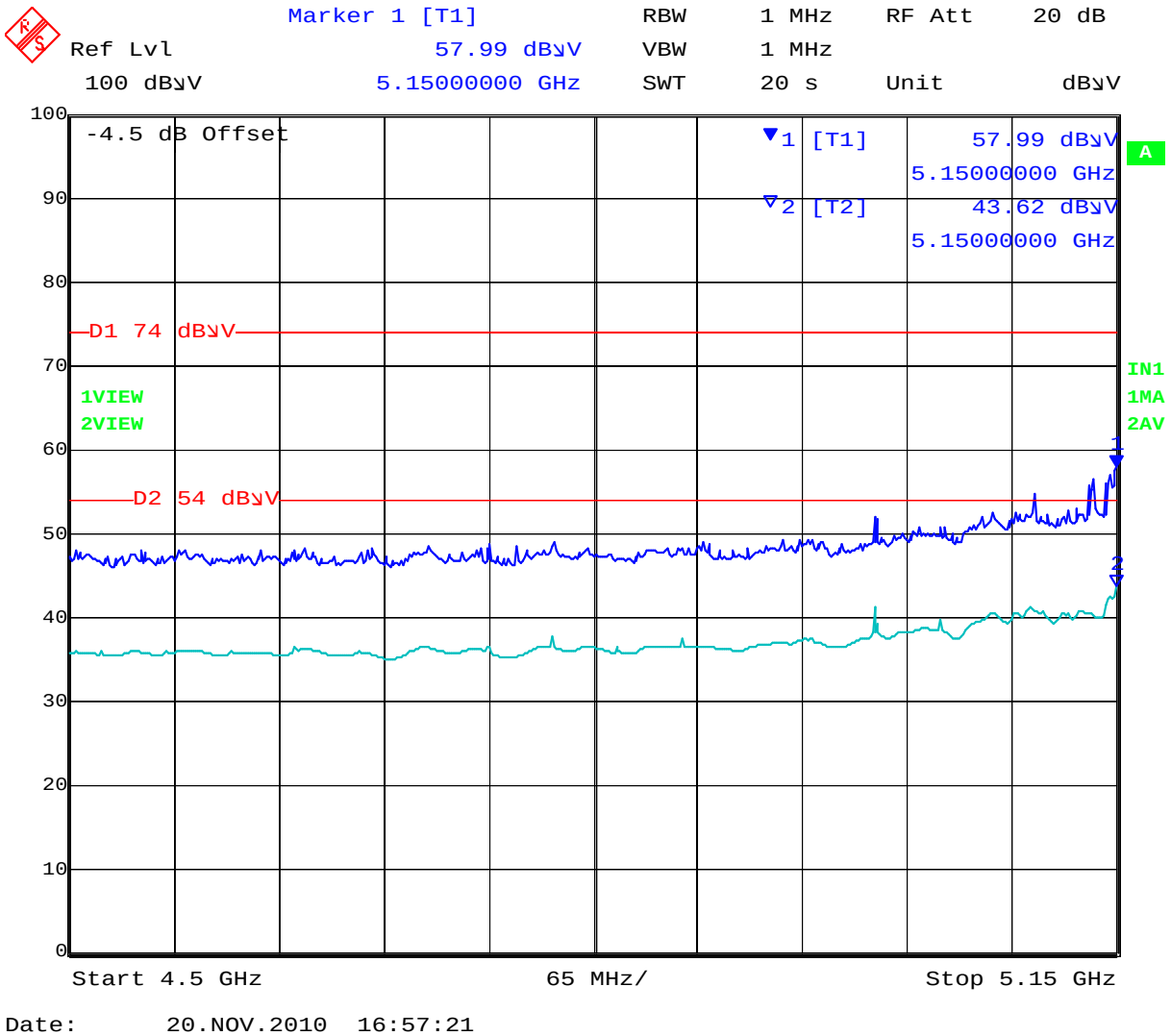
Frequency of Transmission: 5180 MHz



802.11HT-40 Band-edge @ 5150 MHz - Integral antenna

4.5 – 5.15 GHz Span

Frequency of Transmission: 5190 MHz

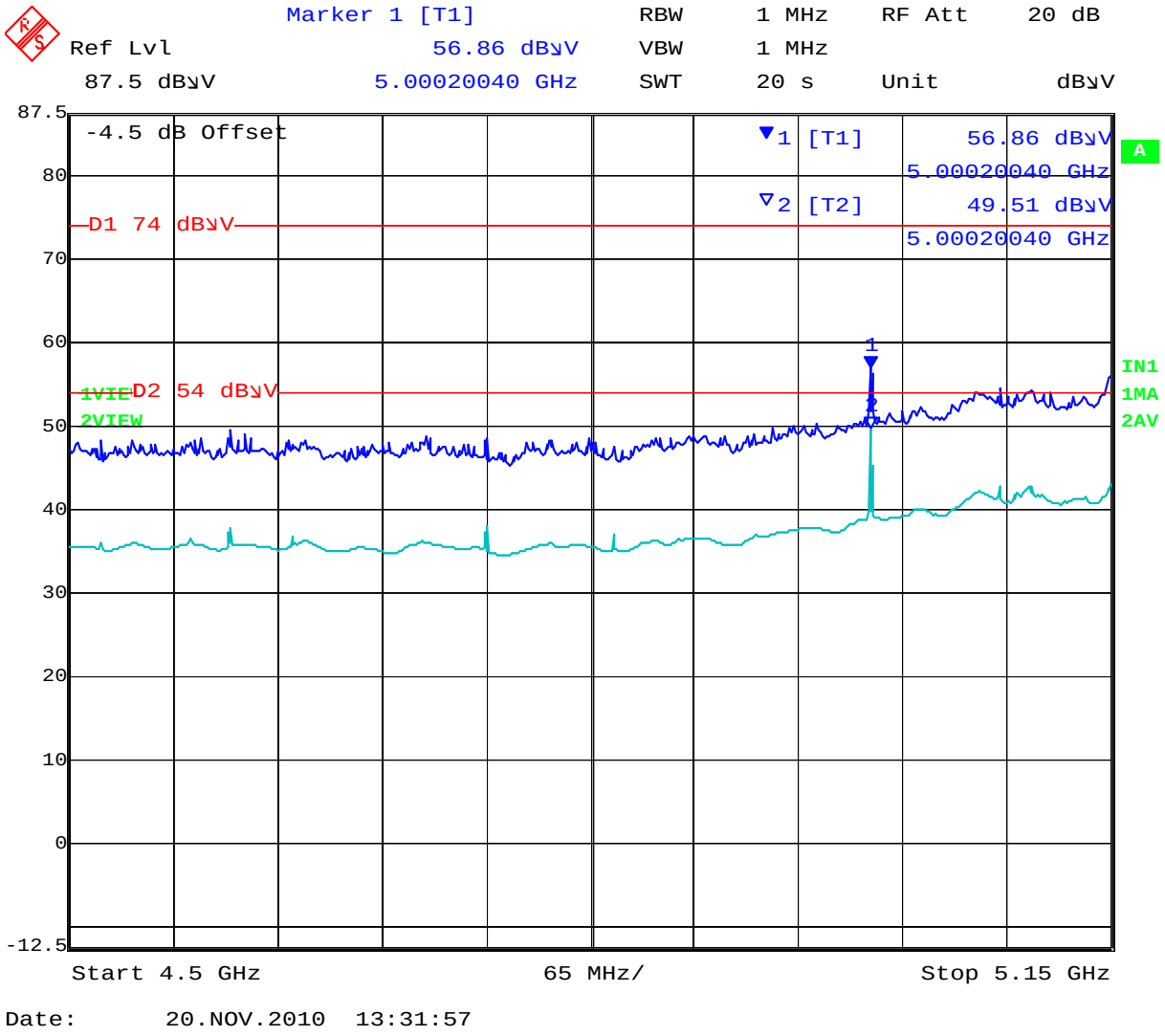


Antenna J9659A 6 Element MIMO

802.11a Band-edge @ 5150 MHz – Antenna J9659A

4.5 – 5.15 GHz Span

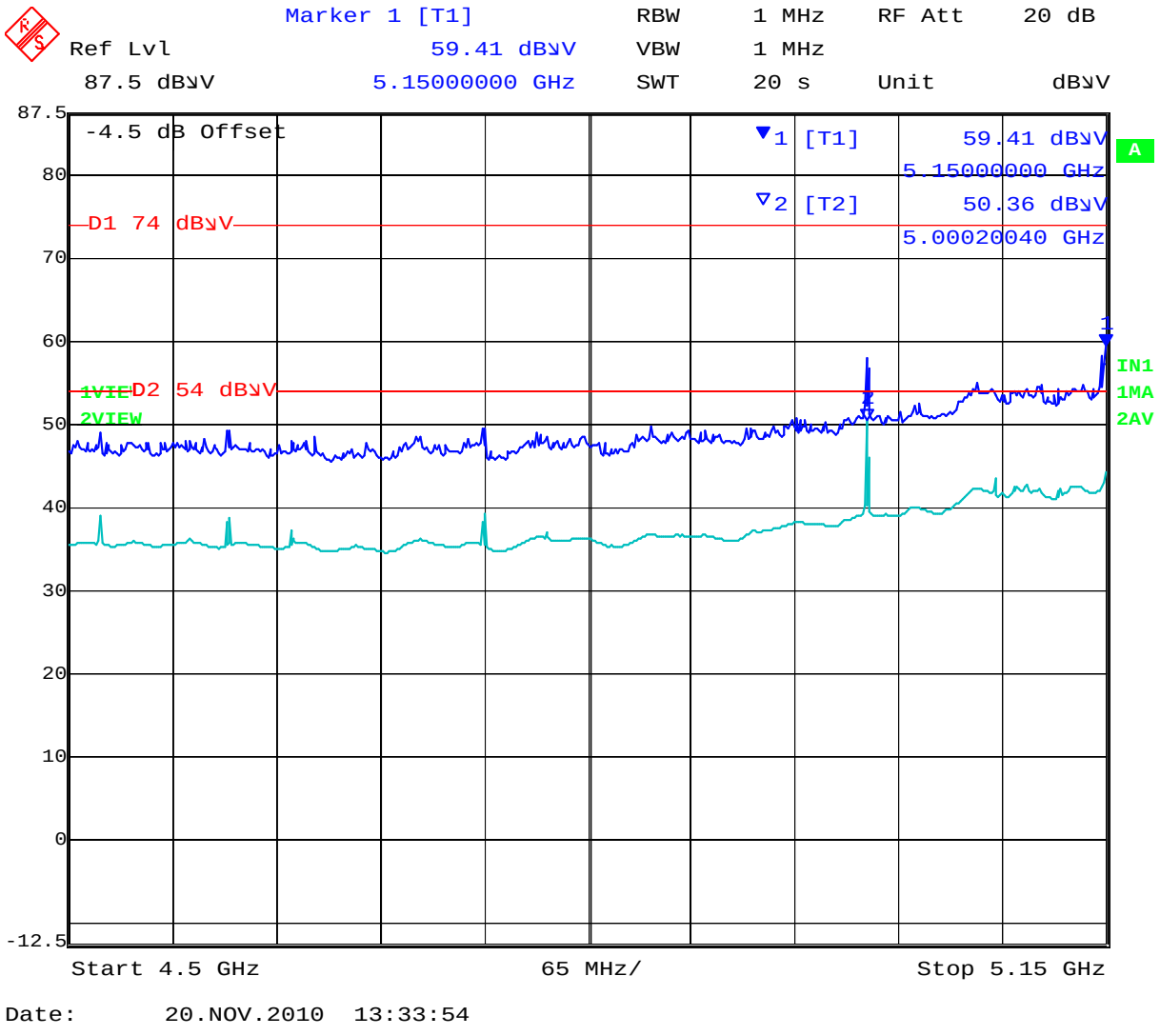
Frequency of Transmission: 5180 MHz



802.11HT-20 Band-edge @ 5150 MHz - Antenna J9659A

4.5 – 5.15 GHz Span

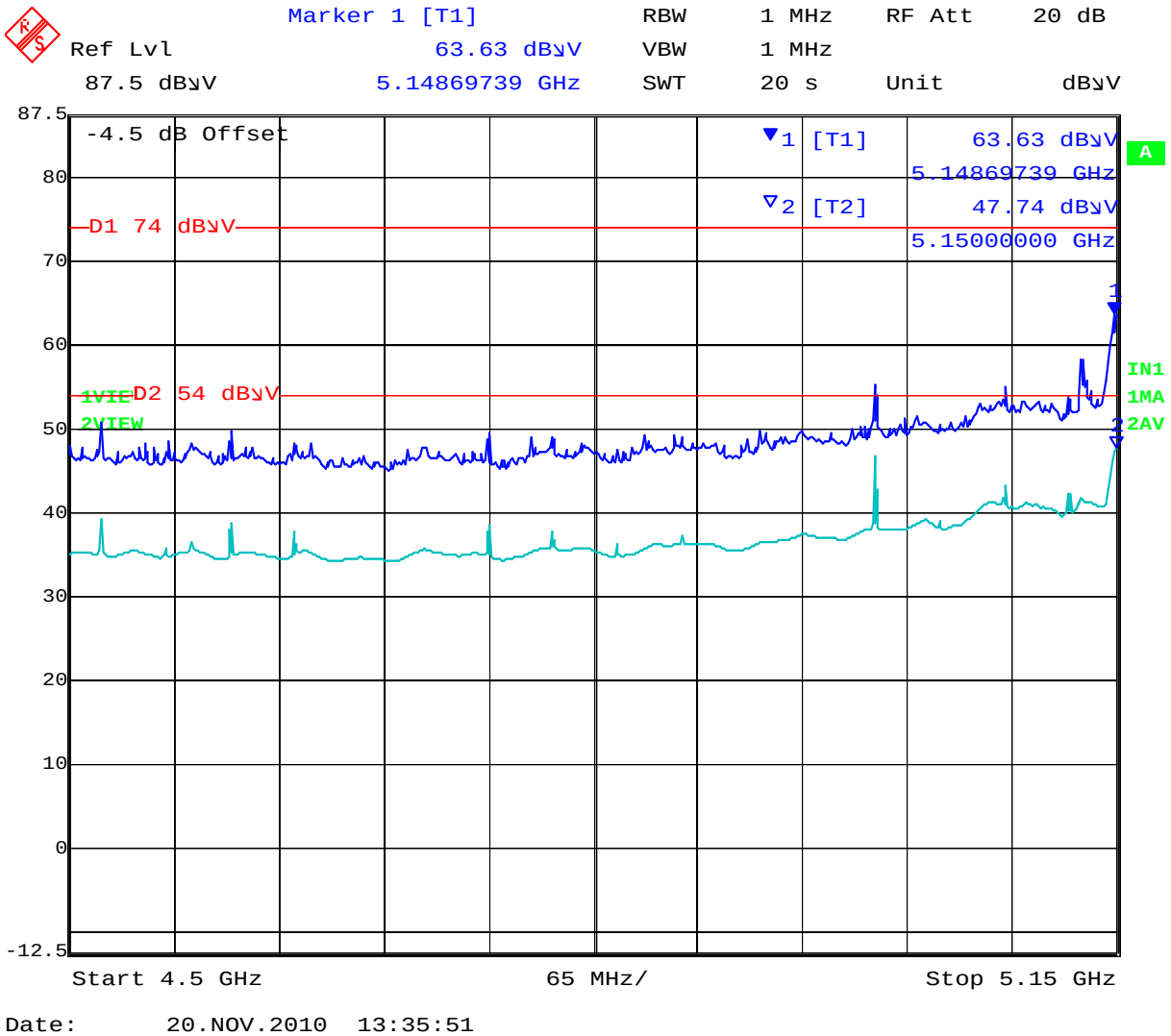
Frequency of Transmission: 5180 MHz



802.11HT-40 Band-edge @ 5150 MHz - Antenna J9659A

4.5 – 5.15 GHz Span

Frequency of Transmission: 5190 MHz

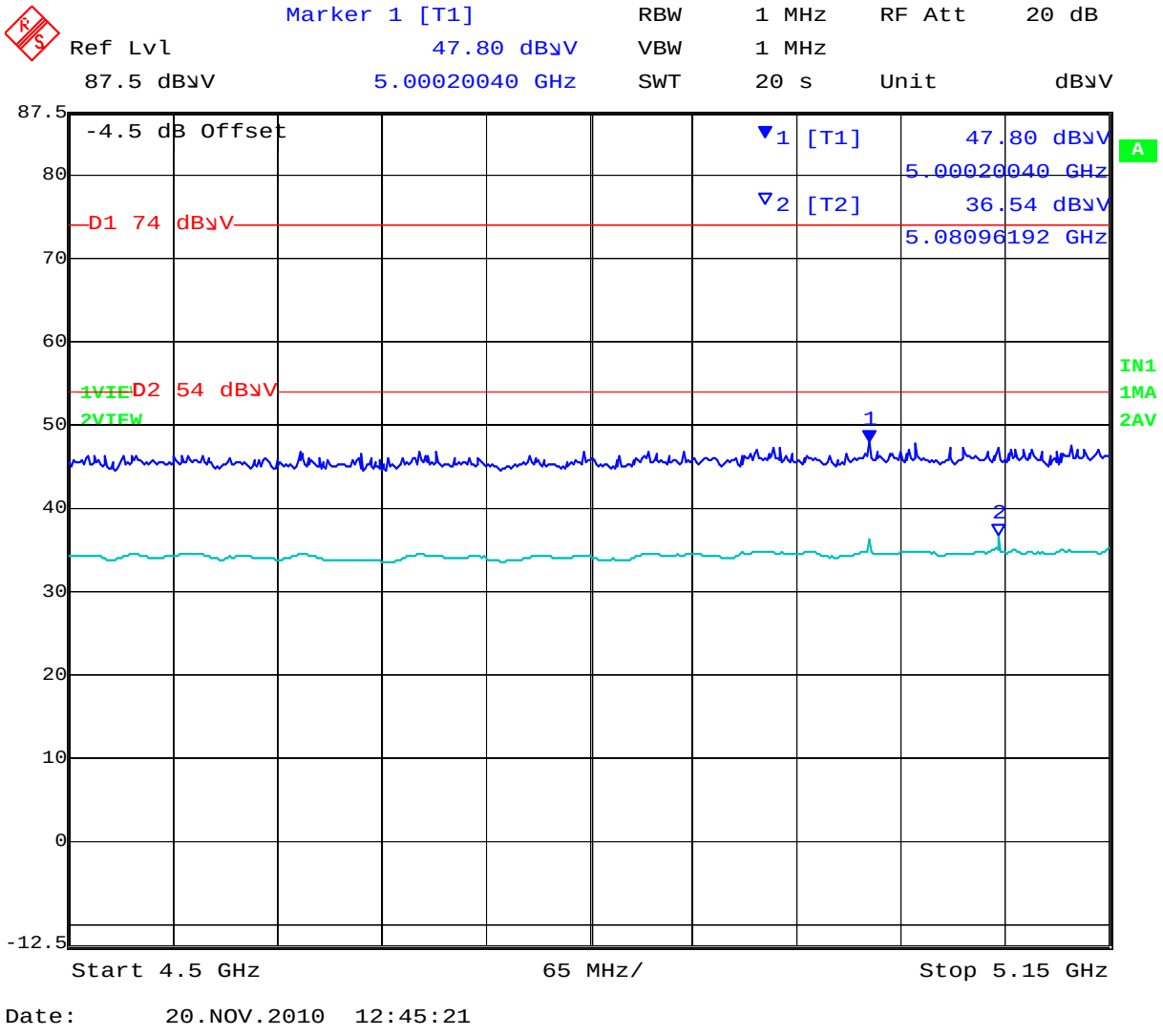


Antenna J9171A 3 Element MIMO

802.11a Band-edge @ 5150 MHz - Antenna J9171A

4.5 – 5.15 GHz Span

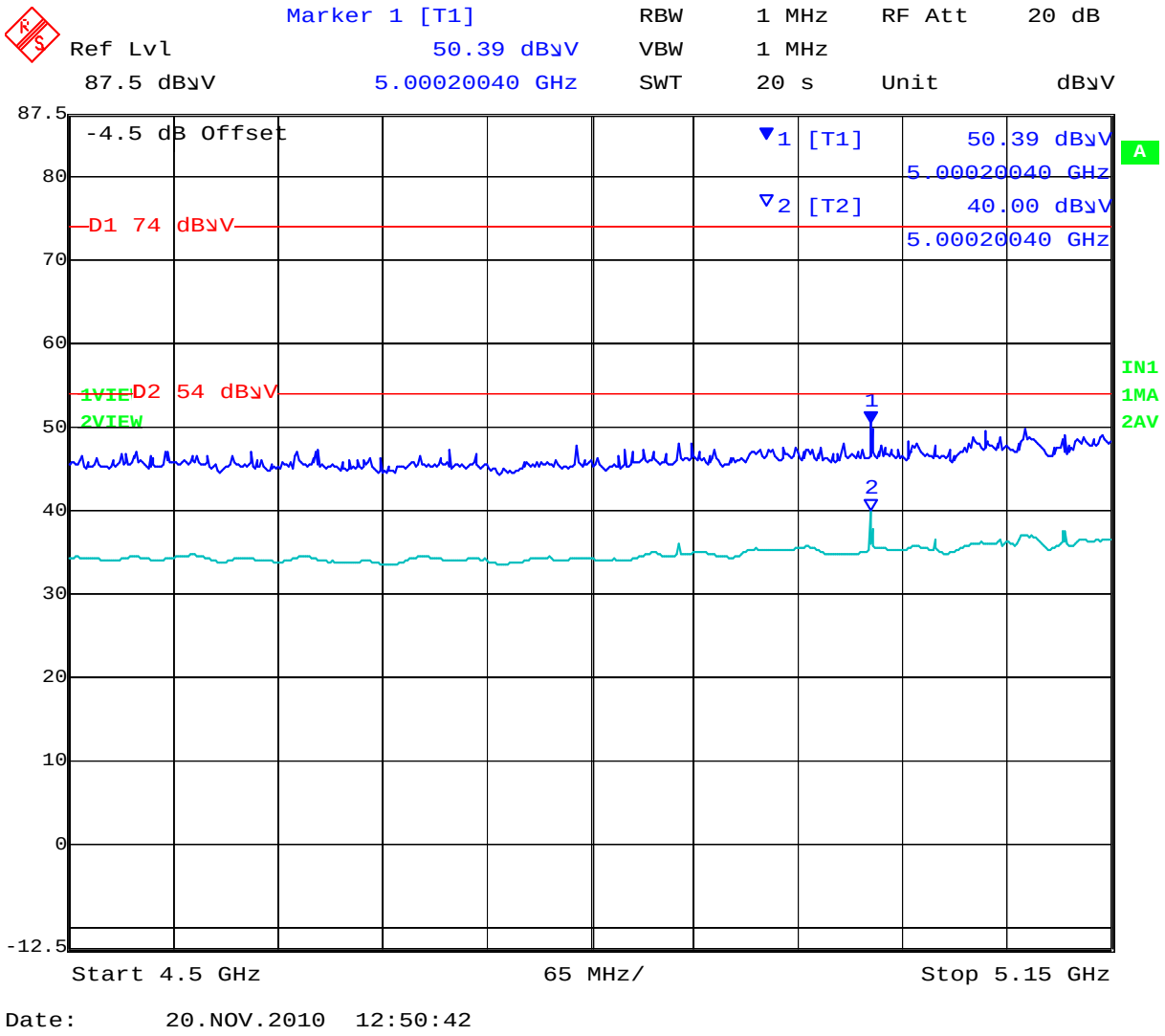
Frequency of Transmission: 5180 MHz



802.11HT-20 Band-edge @ 5150 MHz – Antenna J9171A

4.5 – 5.15 GHz Span

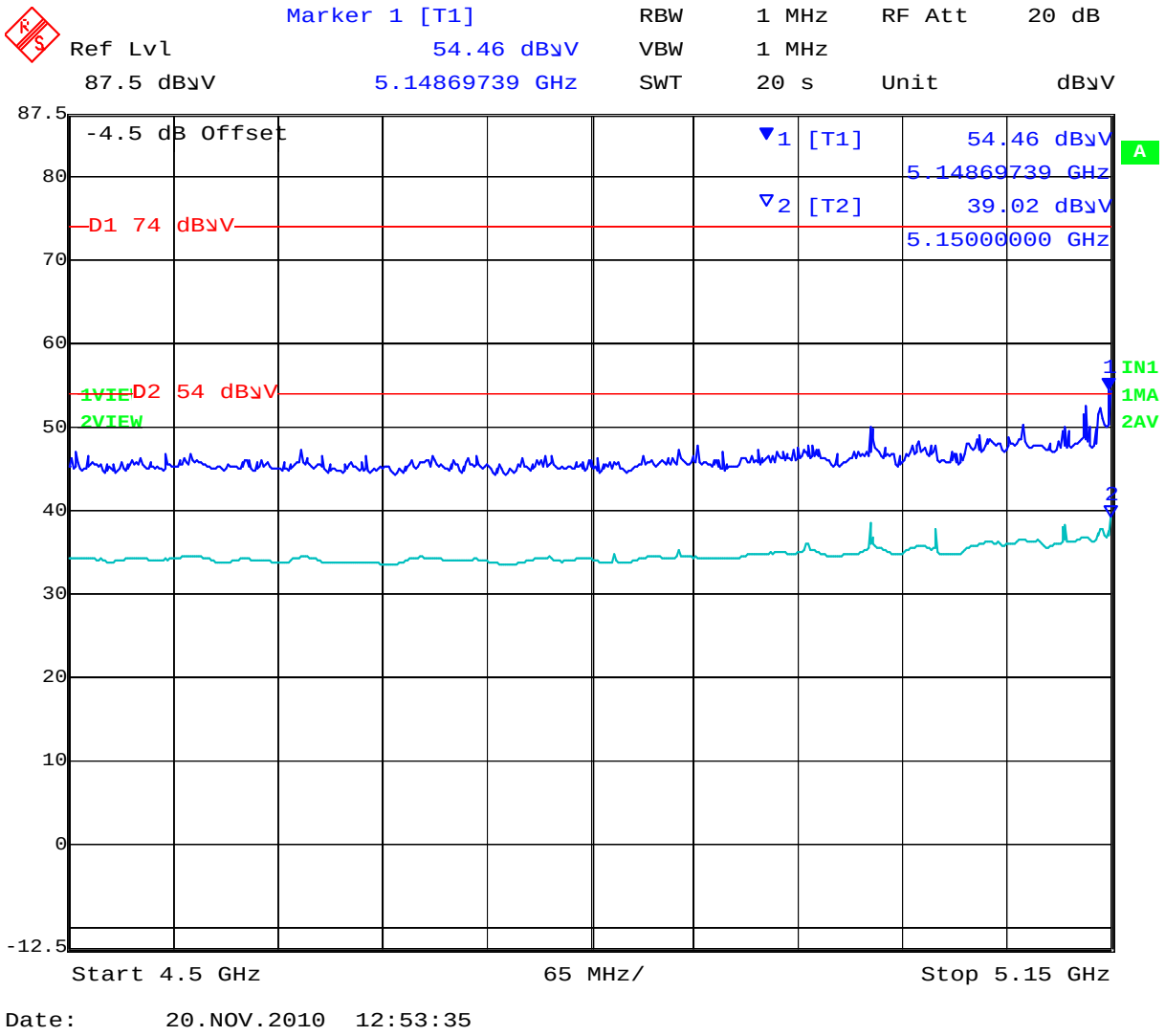
Frequency of Transmission: 5180 MHz



802.11HT-40 Band-edge @ 5150 MHz - Antenna J9171A

4.5 – 5.15 GHz Span

Frequency of Transmission: 5190 MHz



5.1.7.4. Receiver Radiated Spurious Emissions

Industry Canada RSS-Gen §4.8, §6

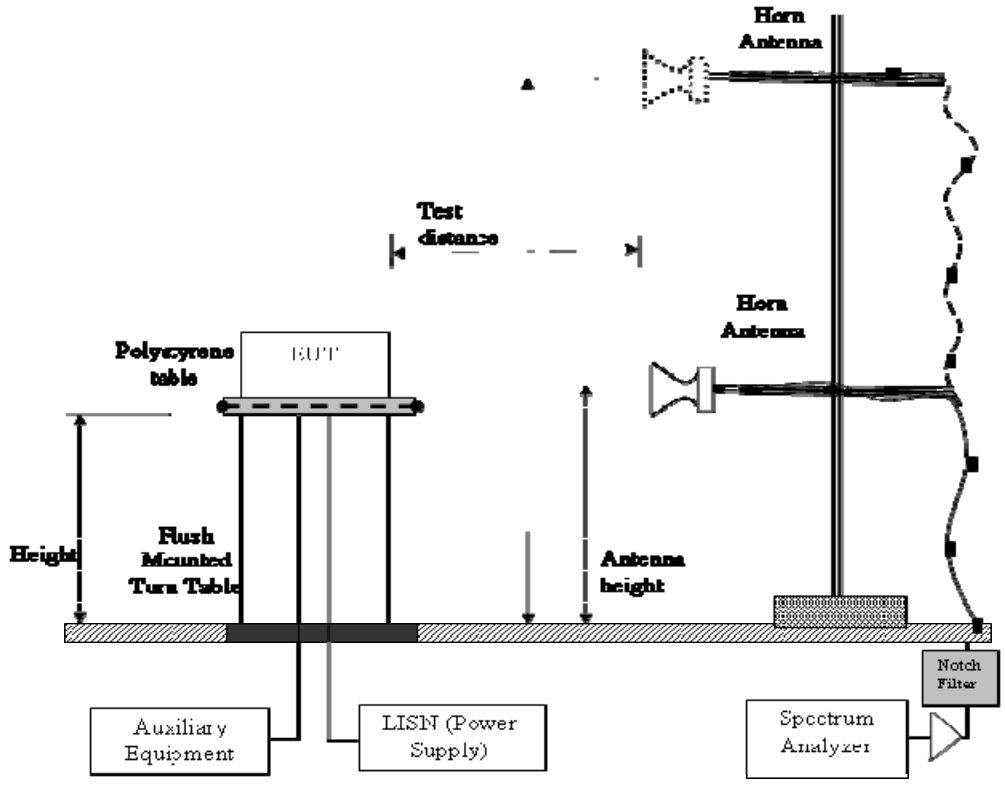
Test Procedure

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:

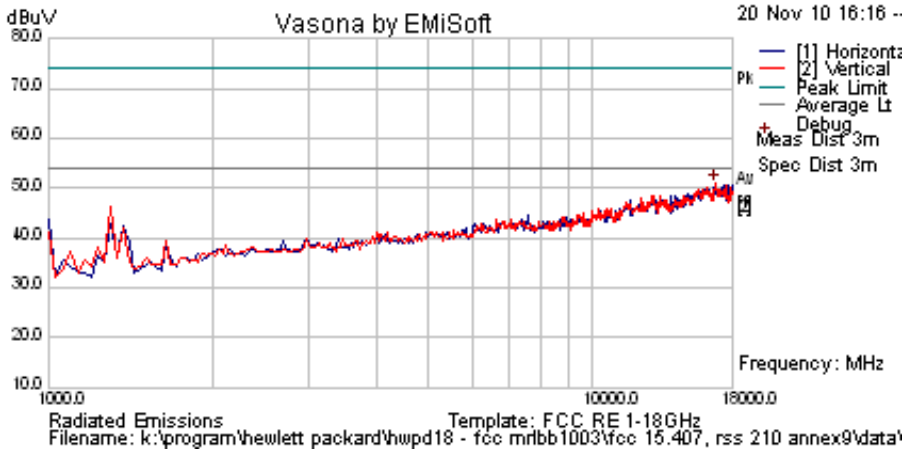
Level (dBμV/m) = 20 * Log (level (μV/m))

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

Receiver Radiated Spurious Emissions above 1 GHz

Integral Antenna RNAA-H1 6 Element MIMO

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	Receive in Test Utility	**Temp (ºC)**	21.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	33
Power Setting	Not Applicable in Receive Mode	**Press. (mBars)**	997
Antenna	RNAA-H1 (7.4dBi Gain 5.15 - 5.35 GHz)		
Test Notes 1			
Test Notes 2			



Formally measured emission peaks

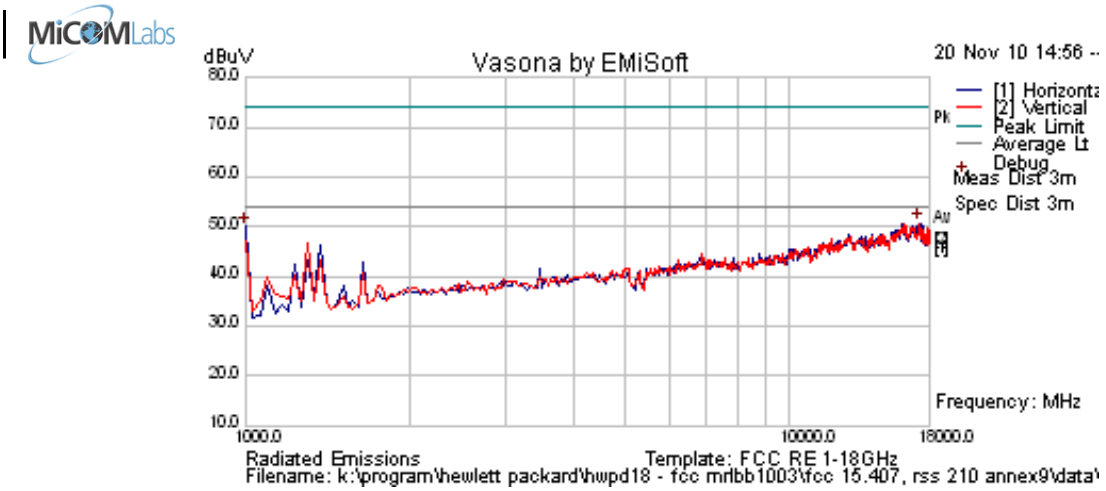
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
No Receiver Emissions within 6dB of limit.												

Legend:	TRANS = Transient Emission; RB = Restricted Band; NRB = Non-Restricted Band;
	BE = Emission in Restricted Band Nearest Transmission Band Edge; FUND = Fundamental Freq.

No receiver emissions were observed

Antenna J9659A Circular 6 Element MIMO

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	Receive in Test Utility	**Temp (ºC)**	21.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	33
Power Setting	Not Applicable in Receive Mode	**Press. (mBars)**	994
Antenna	J9659A (Gain 5.9 dBi @ 5 GHz)		
Test Notes 1			
Test Notes 2			



Formally measured emission peaks

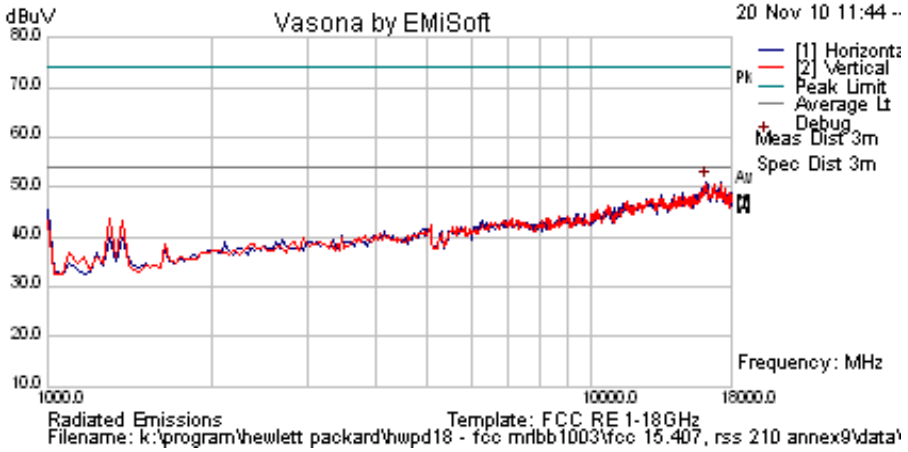
Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
1000.000	65.1	2.0	-16.2	50.8	Peak Max	H	151	184	74.0	-23.2	Pass	RB
1000.000	62.3	2.0	-16.2	48.1	Average Max	H	151	184	54.0	-5.9	Pass	RB

Legend:	TRANS = Transient Emission; RB = Restricted Band; NRB = Non-Restricted Band;
	BE = Emission in Restricted Band Nearest Transmission Band Edge; FUND = Fundamental Freq.

No receiver emissions were observed, any emissions close to the limit on the above plot are digital emissions

Antenna J9171A 3 Element MIMO

Test Freq.	5200 MHz	**Engineer**	GMH
Variant	Receive in Test Utility	**Temp (ºC)**	21.5
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	33
Power Setting	Not Applicable in Receive Mode	**Press. (mBars)**	997
Antenna	J9171A (4.0 dBi Gain 4.9 - 5.9 GHz)		
Test Notes 1			
Test Notes 2			



Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass /Fail	Comments
No Receiver Emissions within 6dB of limit.												

Legend:	TRANS = Transient Emission; RB = Restricted Band; NRB = Non-Restricted Band;
	BE = Emission in Restricted Band Nearest Transmission Band Edge; FUND = Fundamental Freq.

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

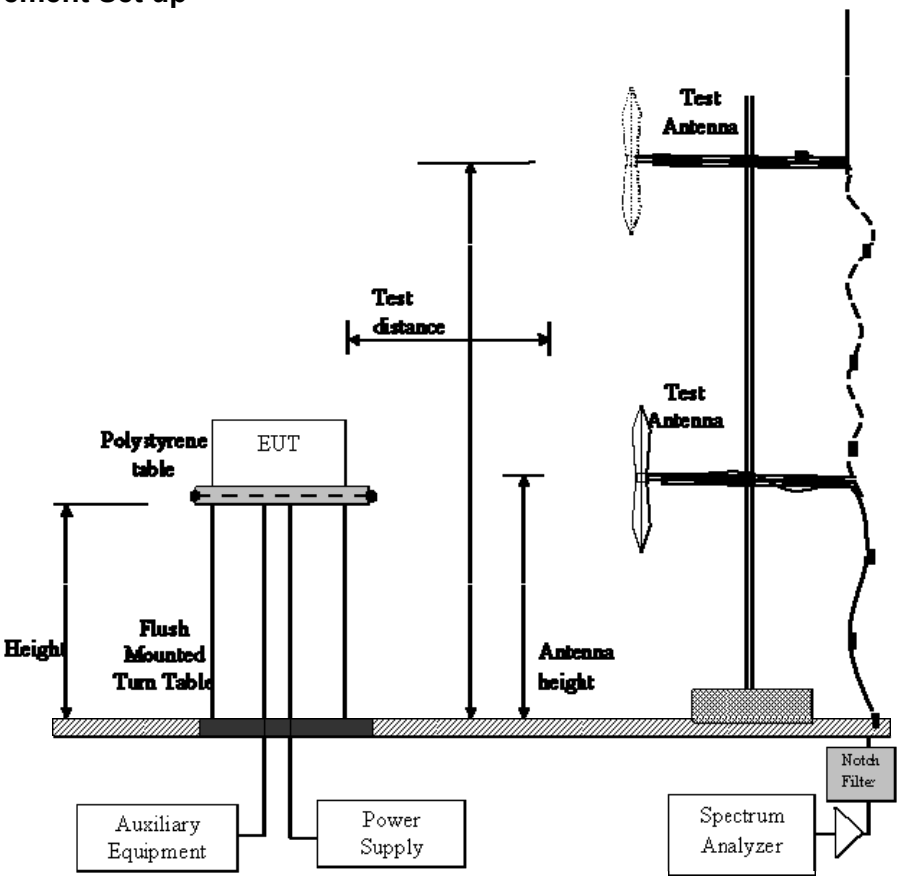
5.1.7.5. Radiated Spurious Emissions 30MHz – 1000MHz

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

Results for radiated Spurious Emission can be found in the following Test Report
Bureau Veritas Consumer Products Services (H.K.) Ltd.,
Taoyuan Branch Hsin Chu Laboratory
Report No.: FD990622C09
Date of issue: 11th October 2010

Test Procedure
Preliminary radiated emissions are measured in the anechoic chamber at a 10-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 the tuned receiver using a bandwidth of 120 kHz. Only the highest emissions relative to the limit are listed. The anechoic chamber test set-up is identified in Section 6 Test Set-Up Photographs.

Test Measurement Set up



Radiated Emission Measurement Setup – Below 1 GHz

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and subtracting Amplifier Gain from the measured reading. 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

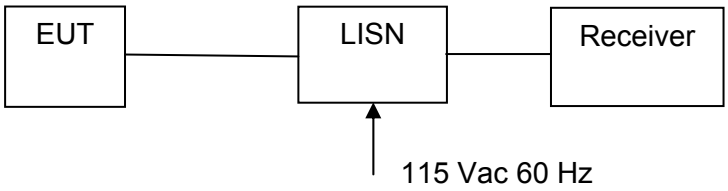
5.1.8. AC Wireline Conducted Emissions (150 kHz – 30 MHz)

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

Results for ac Wireline can be found in the following Test Report
Bureau Veritas Consumer Products Services (H.K.) Ltd.,
Taoyuan Branch Hsin Chu Laboratory
Report No.: FD990622C09
Date of issue: 11th October 2010

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

Test Measurement Set up



Measurement set up for AC Wireline Conducted Emissions Test

Specification

Limit

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

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

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

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

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

* Decreases with the logarithm of the frequency

Laboratory Measurement Uncertainty for Conducted Emissions

Measurement uncertainty	±2.64 dB

Traceability

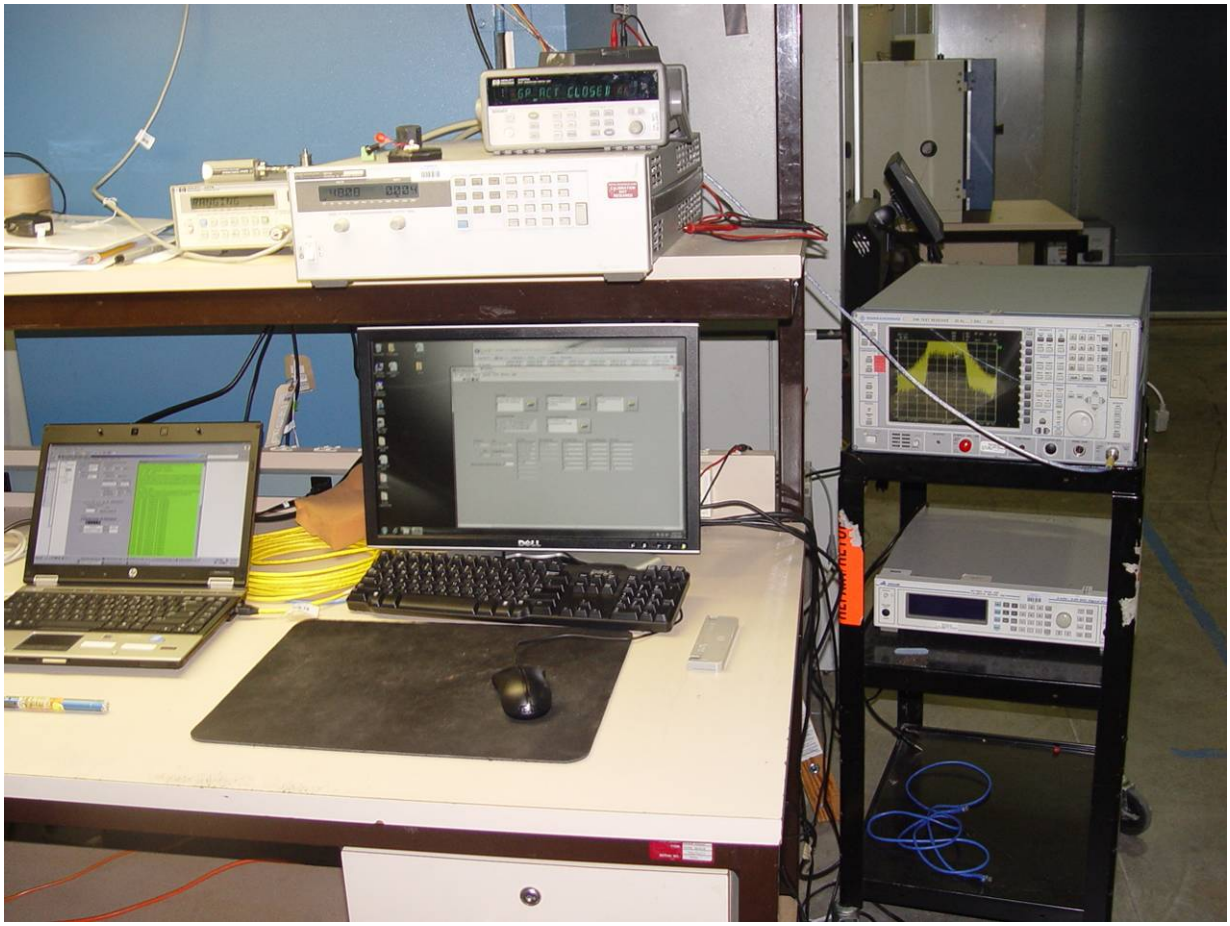
Method	Test Equipment Used
Measurements were made per work instruction WI-EMC-01 'Measurement of Conducted Emissions'	0158, 0184, 0287, 0190, 0293, 0307

6. TEST EQUIPMENT DETAILS

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

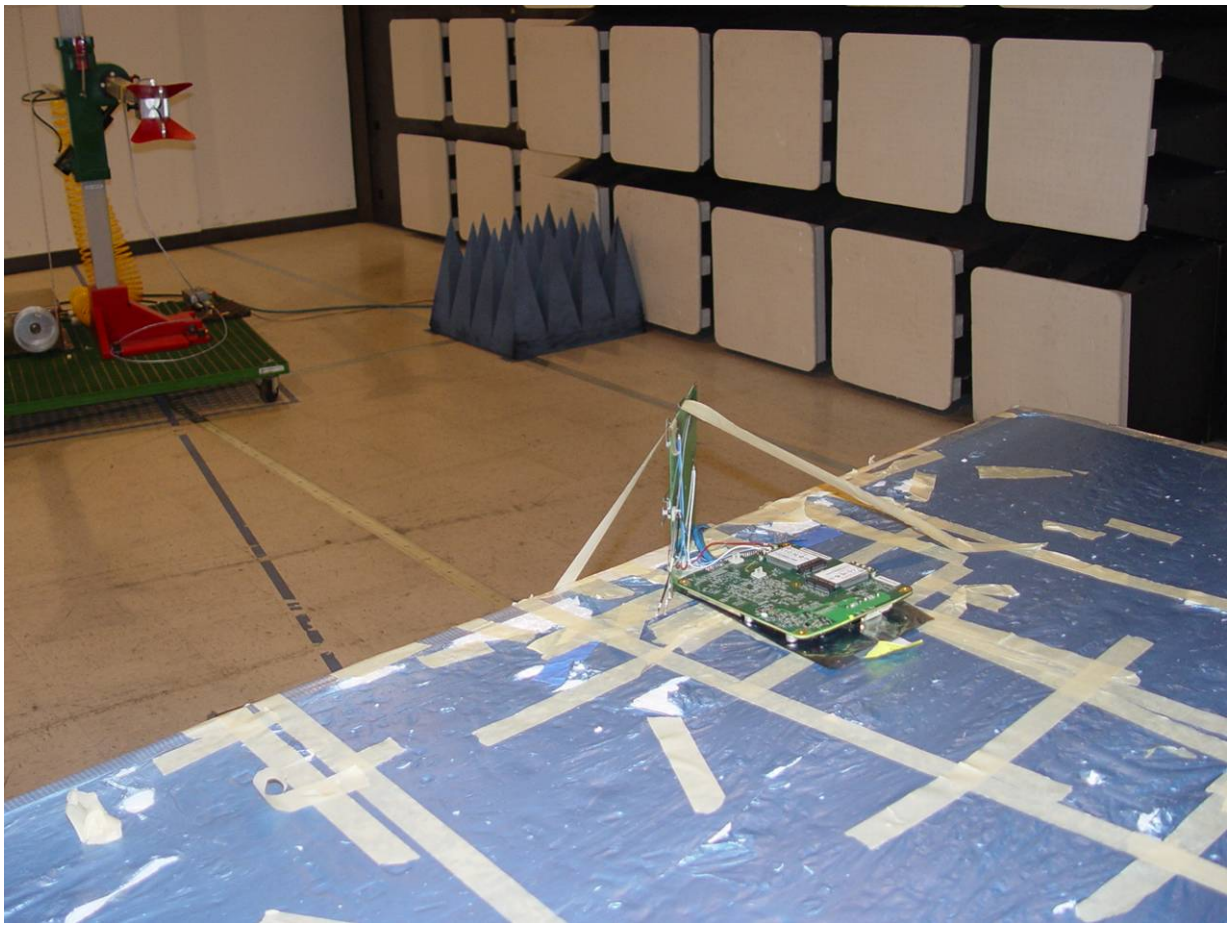
7. PHOTOGRAPHS

7.1. Conducted Testing

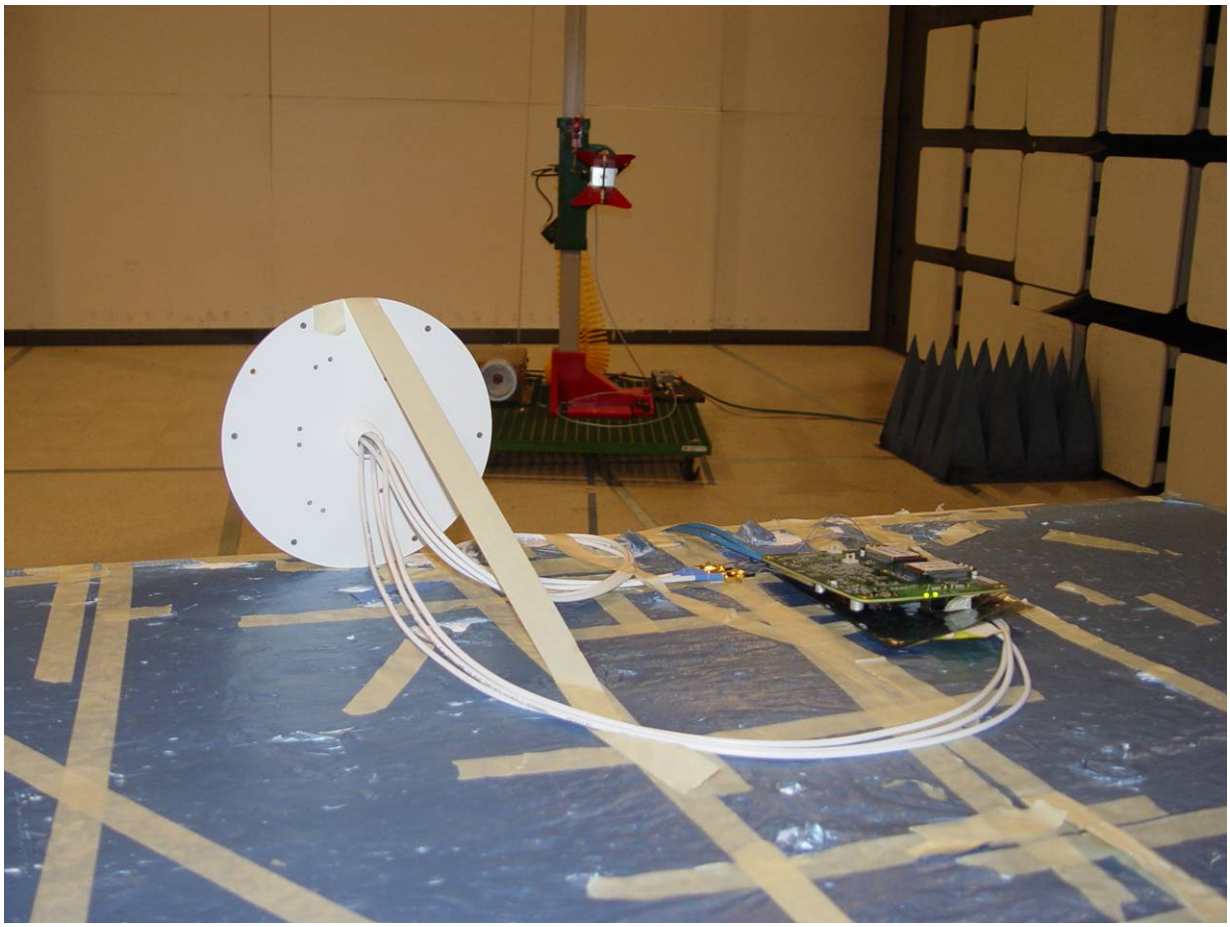


7.2. Environmental Chamber

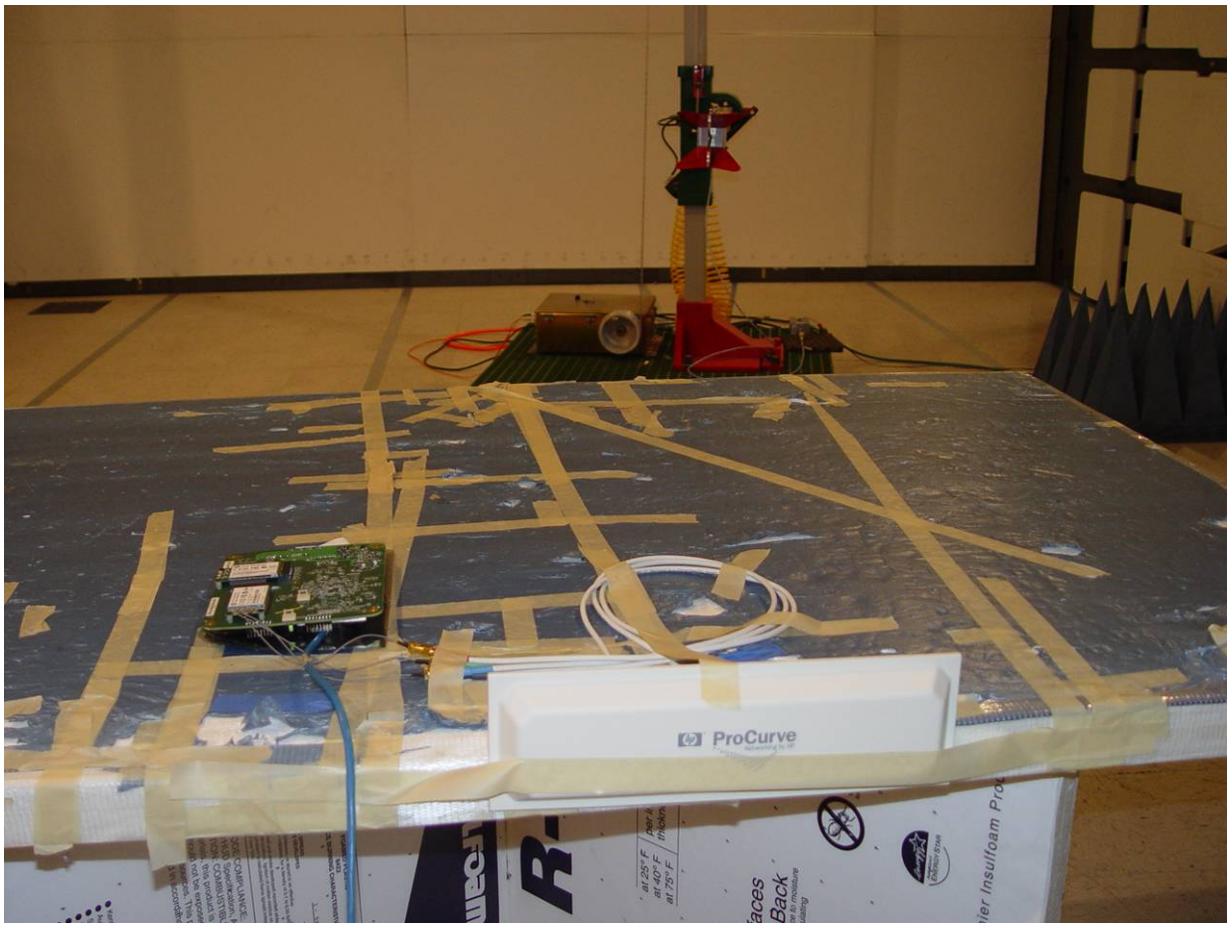
7.3. Radiated Testing – Integral Antenna RNAA-H1



7.4. Radiated Testing – Antenna J9659A



7.5. Radiated Testing – Antenna J9171A



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