Test of Netronics Technologies Inc. NetStream 5x100
5.8 GHz Outdoor Unit

To: FCC 47 CFR Part 15, SubPart C 15.247

Test Report Serial No.: NTCS01-U3 Rev A

TEST REPORT

From

Test of: Netronics Technologies Inc. NetStream 5x100 5.8 GHz ODU

To: FCC 47 CFR Part 15, SubPart C 15.247

Test Report Serial No.: NTCS01-U3 Rev A

This report supersedes: None

Applicant:	Netronics Technologies Inc. 15 Allstate Avenue, Markham, Ontario L3R 5BN Canada
Product Function:	Point to Point Transceiver Communicating Data & Voice
Copy No: pdf	Issue Date: 20th January 2011

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

TESTING CERTIFICATE #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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1 ACCREDITATION, LISTINGS & RECOGNITION

1.1 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

1.2 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
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

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

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

1.3 PRODUCT CERTIFICATION

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


The American Association for Laboratory Accreditation
World Class Accreditation

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence as a

Product Certification Body

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

Presented this 24th day of June 2010.

President & CEO
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2011

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

United States of America – Telecommunication Certification Body

TCB Identifier – US0159

Industry Canada – Certification Body

CAB Identifier – US0159

2 DOCUMENT HISTORY

Revision	Date	Comments
Draft		
Rev A	20th January 2011	Initial Release

3 TEST RESULT CERTIFICATE

Applicant:	Netronics Technologies Inc. 15 Allstate Avenue, Markham, Ontario L3R 5BN Canada	Tested By:	MiCOM Labs, Inc. 440 Boulder Court Suite 200 Pleasanton California, 94566, USA
Product:	Outdoor Unit operating in the 5.8 GHz Band.	Telephone:	+1 925 462 0304
Model No.:	NetStream 5x100	Fax:	+1 925 462 0306
S/No's:	PFC5801000900001		
Date(s) Tested:	13th – 15th December 2010	Website:	www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC 47 CFR Part 15, SubPart C 15.247	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:

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

Approved & Released for MiCOM Labs, Inc. by:

A2LA ACCREDITED
TESTING CERTIFICATE #2381.01

Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.

4 REFERENCES AND MEASUREMENT UNCERTAINTY

4.1 Normative References

Ref.	Publication	Year	Title
i.	FCC 47 CFR Part 15, SubPart C 15.247	2010	Title 47: Telecommunication PART 15—RADIO FREQUENCY DEVICES Subpart C—Intentional Radiators
ii.	47 CFR Part 15, SubPart B	2010	47 CFR Part 15, SubPart B; Unintentional Radiators
iii.	ANSI C63.4	2009	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
iv.	CISPR 22/ EN 55022	2008 2006+A1:2007	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
v.	M 3003	Edition 1 Dec. 1997	Expression of Uncertainty and Confidence in Measurements
vi.	LAB34	Edition 1 Aug 2002	The expression of uncertainty in EMC Testing
vii.	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
viii.	A2LA	9th June 2010	Reference to A2LA Accreditation Status – A2LA Advertising Policy

4.2 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.

5 TEST SUMMARY

List of Measurements: The following table represents the list of measurements required under FCC 47 CFR Part 15, SubPart C 15.247.

Standard Section(s)	Test Description	Condition	Result	Notes	Test Report Section
15.247 (a)(2)	6 dB Occupied Bandwidth	Conducted	PASS	Note 1,2,3	7.1.
15.247 (i)	Maximum Permissible Exposure	Calculation	PASS	Note 1,2,3	7.2
15.247 (b)(3), 15.247 (b)(4)	Peak Output Power	Conducted	PASS	Note 1,2,3	7.3
15.247 (e)	Peak Power Spectral Density	Conducted	PASS	Note 1,2,3	7.4
15.247 (d)	Spurious Emissions	Conducted	PASS	Note 1,2,3	7.5
15.247 (d), 15.205, 15.209	Transmitter Radiated Spurious Emissions	Radiated	PASS	Note 1,2,3	7.6.1
15.247 (d), 15.205, 15.209	Radiated Band-Edge	Radiated	PASS	Note 1,2,3	7.6.2
15.207	AC Wireline Emissions 0.15 – 30 MHz	Conducted	PASS	Note 1,2,3	7.7

Note 1: Test results reported in this document relate only to the items tested

Note 2: The required tests demonstrated compliance as per client declaration of test configuration, monitoring methodology and associated pass/fail criteria

Note 3: Section 6.11 Equipment Modifications highlights the equipment modifications that were required to bring the product into compliance with the above test matrix

6 PRODUCT DETAILS AND TEST CONFIGURATIONS

6.1 Test Program Scope

The scope of the test program was to test the Netronics Technologies Inc. NetStream 5x100 5.8 GHz Outdoor Unit for compliance against FCC 47 CFR Part 15, SubPart C 15.247.

Netronics Technologies Inc.
Product: NetStream 5x100 5.8 GHz Outdoor Unit connectorized

Netronics Technologies Inc.
Product: NetStream 5x100 5.8 GHz Outdoor Unit with Integral Antenna

6.2 EUT Details

Detail	Description
Purpose:	Test of the Netronics Technologies Inc. NetStream 5x100 5.8 GHz Outdoor Unit for compliance against FCC 47 CFR Part 15, SubPart C 15.247.
Applicant:	Netronics Technologies Inc. 15 Allstate Avenue, Markham, Ontario L3R 5BN, Canada
Manufacturer:	Same as Applicant
Test Laboratory:	MiCOM Labs, Inc. 440 Boulder Court, Suite 200 Pleasanton, California 94566 USA
Test report reference number:	NTCS01-U3
Date EUT received:	13th December 2010
Dates of test (from - to):	13th – 15th December 2010
No of Units Tested:	One (1) – S/N: PFC5801000900001
Product Name:	Outdoor Unit operating in the 5.8 GHz band.
Manufacturers Trade Name:	Netronics Technologies Inc.
Model No.:	NetStream 5x100
Equipment Primary Function:	5.8 GHz Outdoor Unit for transmitting and receiving data
Equipment Secondary Function(s):	N/A
Type of Technology:	Wireless
Installation type:	Fixed
Construction/Location for Use:	Outdoor
Software/Firmware Release:	Prototype
Hardware Release:	Prototype
Test Software Release:	Atheros Radio Test
Rated Input Voltage and Current DC:	Nominal: 48V DC; Min: 22V DC; Max: 59V DC 1 Amp
Operating Temperature Range ºC:	Nom: 25 C; Min: -35 C; Max: 60 C
Equipment Dimensions:	7.1" x 2.2" x 10.6"
Weight:	3 lbs
Long Term Frequency Stability:	20 p.p.m.
Transmit/Receive Operation:	TDD (Time Div Duplex)
Output Power Type	Stepped 1dB
AutomaticTransmit Power Control Available:	No

6.3 External A.C. / D.C. Power Adaptor

Model	Description
0334B5555 Black	AC Power Adaptor ET0061040 Rev. 0 Input: 100 – 240 V AC, 50-60 Hz; 1.5A S/N: L21032009463

6.4 Operational Power Range

Modulation / Mode	Power (dBm)
BPSK (802.11n)	30
QPSK (802.11n)	30
16QAM (802.11n)	30
64QAM (802.11n)	30

6.5 Types of Modulation Supported

Modulation / Mode	BW 1	BW 2	BW 3	BW 4
BPSK (802.11n)	5MHz	10MHz	20MHz	40MHz
QPSK (802.11n)				
16QAM (802.11n)				
64QAM (802.11n)				

ITU Emissions Designators

Modulation / Mode	BW 1	BW 2	BW 3	BW 4
BPSK (802.11n)	5M00W7W	10M00W7W	20M00W7W	40M00W7W
QPSK (802.11n)				
16QAM (802.11n)				
64QAM (802.11n)				

6.6 Antenna Details

The following is a description of the EUT antennas.

Antenna Type	Manufacturer	Model	Gain (dBi)	Frequency Range (MHz)
DISH	GENERAL DYNAMICS	QFD2-56-N	30	5725 - 6000
*EXTERNAL FLAT PANEL	NETRONICS	NA 5824 FP	24	5725 - 6060
INTEGRATED FLAT PANEL	NETRONICS	NA 5824 FPI	24	5725 - 6060

Note: Antenna's are for fixed point to point communications. Antenna's NA 5824 FP and NA 5824 FPI share the same antenna construction, with only the mounting configurations varying. Therefore, only the NA 5824 FPI was tested.

6.7 Cabling and I/O Ports

The following is a description of the cable and input, output ports available on the EUT.

Type of I/O Ports	Description	Screened (y/n)	Length	Qty	Tested
RJ45	Power and ETH	N	< 10m	1	Y
RJ45	SYNC	Y	> 10m	1	N

6.8 EUT Configurations

Band (GHz)	802.11n Mode	Freq Band (MHz)	Freq Range (MHz)	Low ch	Mid ch	High ch
5.8	5MHz Chain a BPSK	5725 - 5850	5730 - 5845	5730	5780	5845
	5MHz Chain b BPSK	5725 - 5850	5730 - 5845	5730	5780	5845
	5MHz Chain a 64QAM	5725 - 5850	5730 - 5845	5730	5780	5845
	5MHz Chain b 64QAM	5725 - 5850	5730 - 5845	5730	5780	5845
	10 MHz Chain a BPSK	5725 - 5850	5730 - 5845	5730	5780	5845
	10 MHz Chain b BPSK	5725 - 5850	5730 - 5845	5730	5780	5845
	20 MHz Chain a BPSK	5725 - 5850	5735 - 5840	5735	5780	5840
	20 MHz Chain b BPSK	5725 - 5850	5735 - 5840	5735	5780	5840
	40 MHz Chain a BPSK	5725 - 5850	5745 - 5830	5745	5780	5830
	40 MHz Chain b BPSK	5725 - 5850	5745 - 5830	5745	5780	5830

6.9 Support Equipment Details

The following is the supporting equipment used during the test program.

6.10 Test Configurations

Operational Mode(s)	Data Rate Tested	Duty Cycle
BPSK (802.11n)	3.25 Mbps (MCS 8)	100
64QAM (802.11n)	32.5 Mbps (MCS 15)	100

BPSK mode was chosen because it represented the highest power spectral density mode of operation available from the EUT. 64QAM mode represents the highest data rate available from the EUT.

6.11 Equipment Modifications

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

1. **Problem:** Emission Bandwidth of 802.11n BPSK 10MHz channel bandwidth failed the band-edge test at 5,725 MHz. Spectrum spilled into the 5470 – 5725 MHz band <20 dB down at 5,725 MHz.

   Solution: Client modified the system calibration file to reduce the overall bandwidth of the 10 MHz channel spectrum.

6.12 Deviations from the Test Standard

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

1. NONE

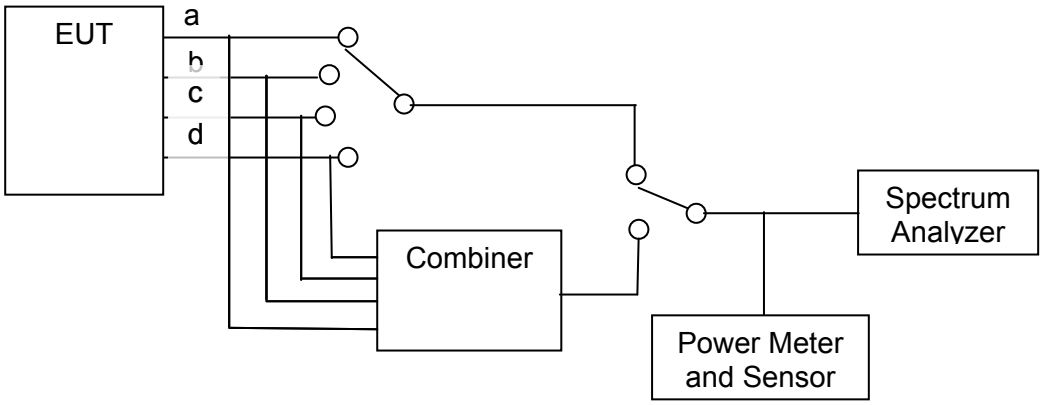
7 TEST RESULTS

7.1 6 dB and 99% Bandwidth

Test Procedure

The test methodology and conditions utilized for each measurement is referenced in the following test results matrix. 6 dB and 99% bandwidth were measured per the Test Configuration identified below.

Test Configuration



Test configuration for 6 dB & 99% Bandwidth

Specification

Limits

§15.247 (a)(2) The minimum 6 dB bandwidth shall be at least 500 kHz.

Traceability

Method	Test Equipment Used
Measurements were made per work instruction WI-03 'Measurement of RF Spectrum Mask'	0158, 0252, 0313, 0314, 0116, 0117, 0287, 0363

7.1.1 6 dB and 99% Bandwidth Results: 802.11n 5MHz BPSK

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 5MHz BPSK	**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:**	0 dBi
Applied Voltage:	48V Vdc		
Notes 1:			
Notes 2:			

6 dB Bandwidth

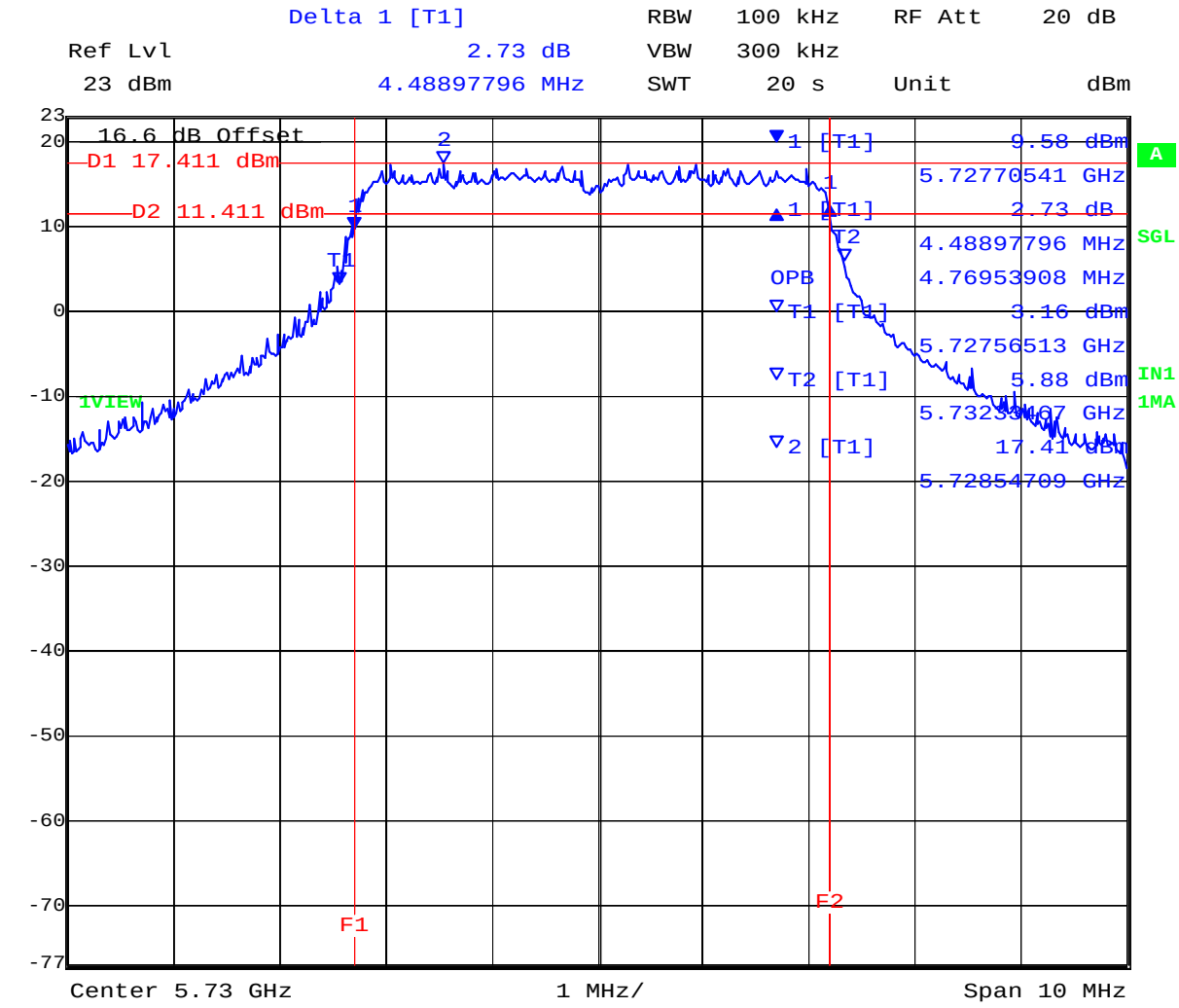
Test Frequency	6 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	a	b	c	d	kHz	MHz	MHz
5730.000	4.489000	4.469000	--	--	500	0.5	-3.969000
5780.000	4.489000	4.489000	--	--			-3.989000
5845.000	4.509000	4.509000	--	--			-4.009000

99% Bandwidth

Test Frequency	99 % Bandwidth						
	MHz						
MHz	a	b	c	d			
5730.000	4.770000	4.729000	--	--			
5780.000	4.770000	4.749000	--	--			
5845.000	4.790000	4.729000	--	--			

Measurement uncertainty:	±2.81 dB

Chain a: 6 dB 99% OBW Ambient 5730MHz 48.00V 21.86dBm



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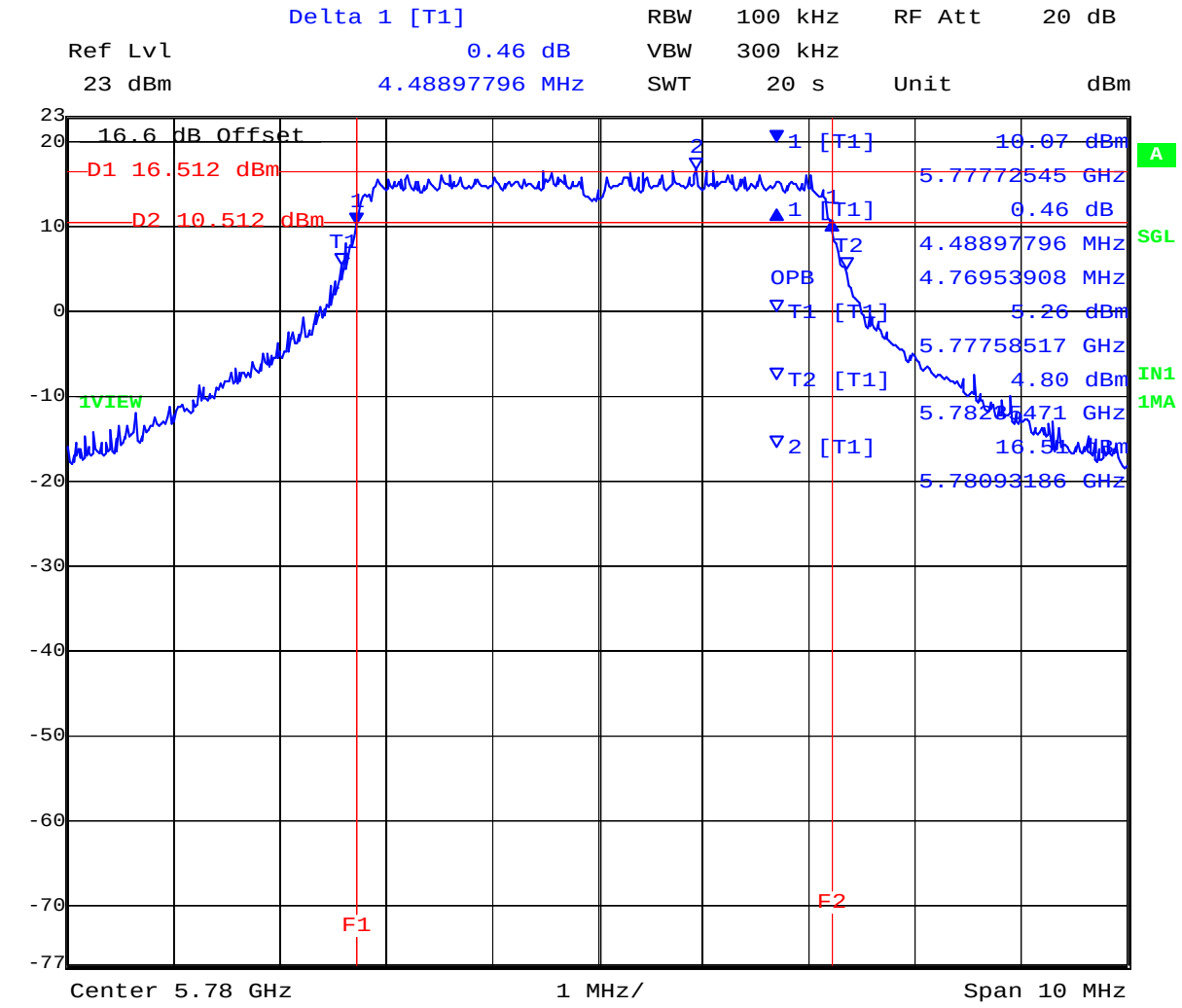
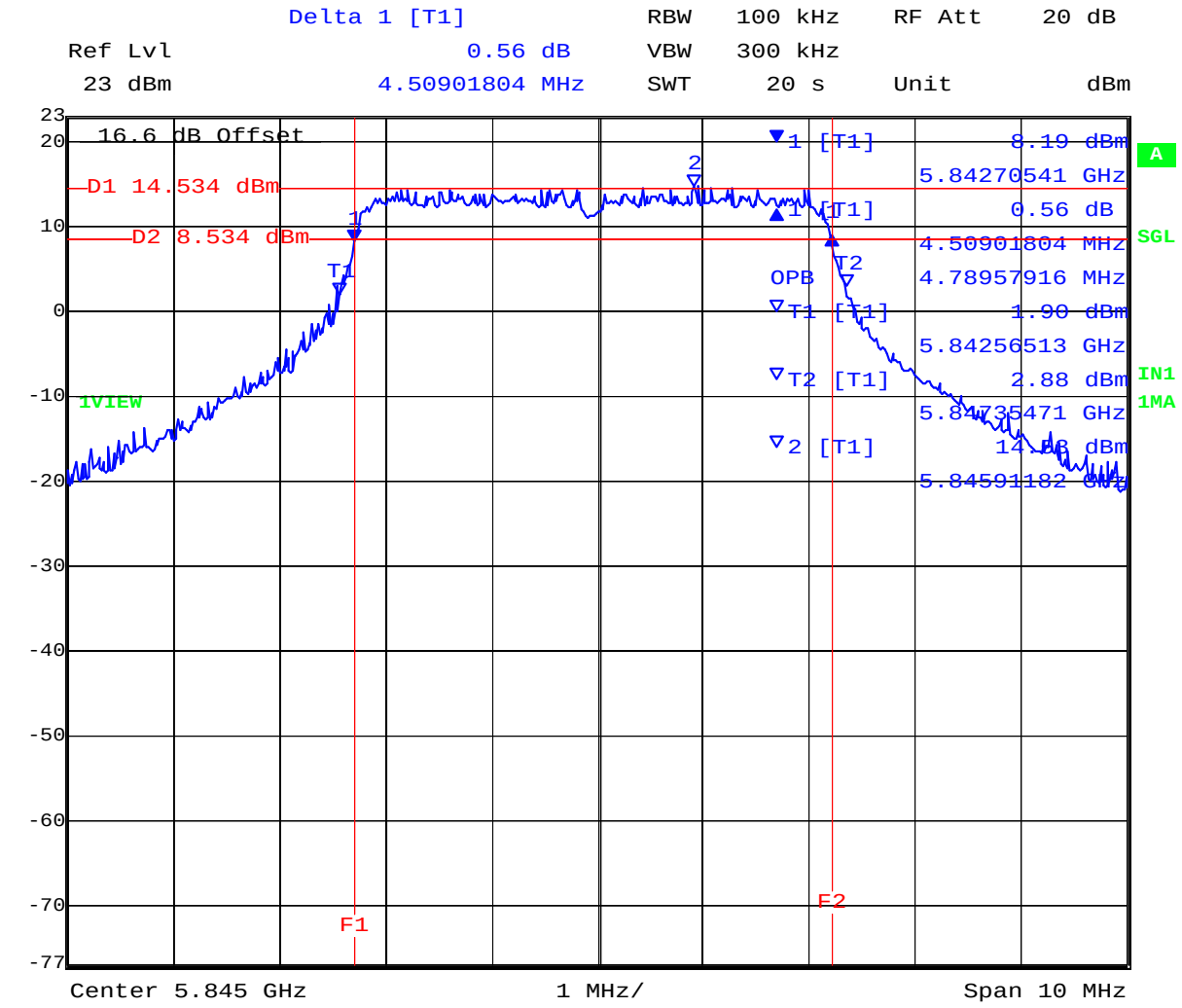
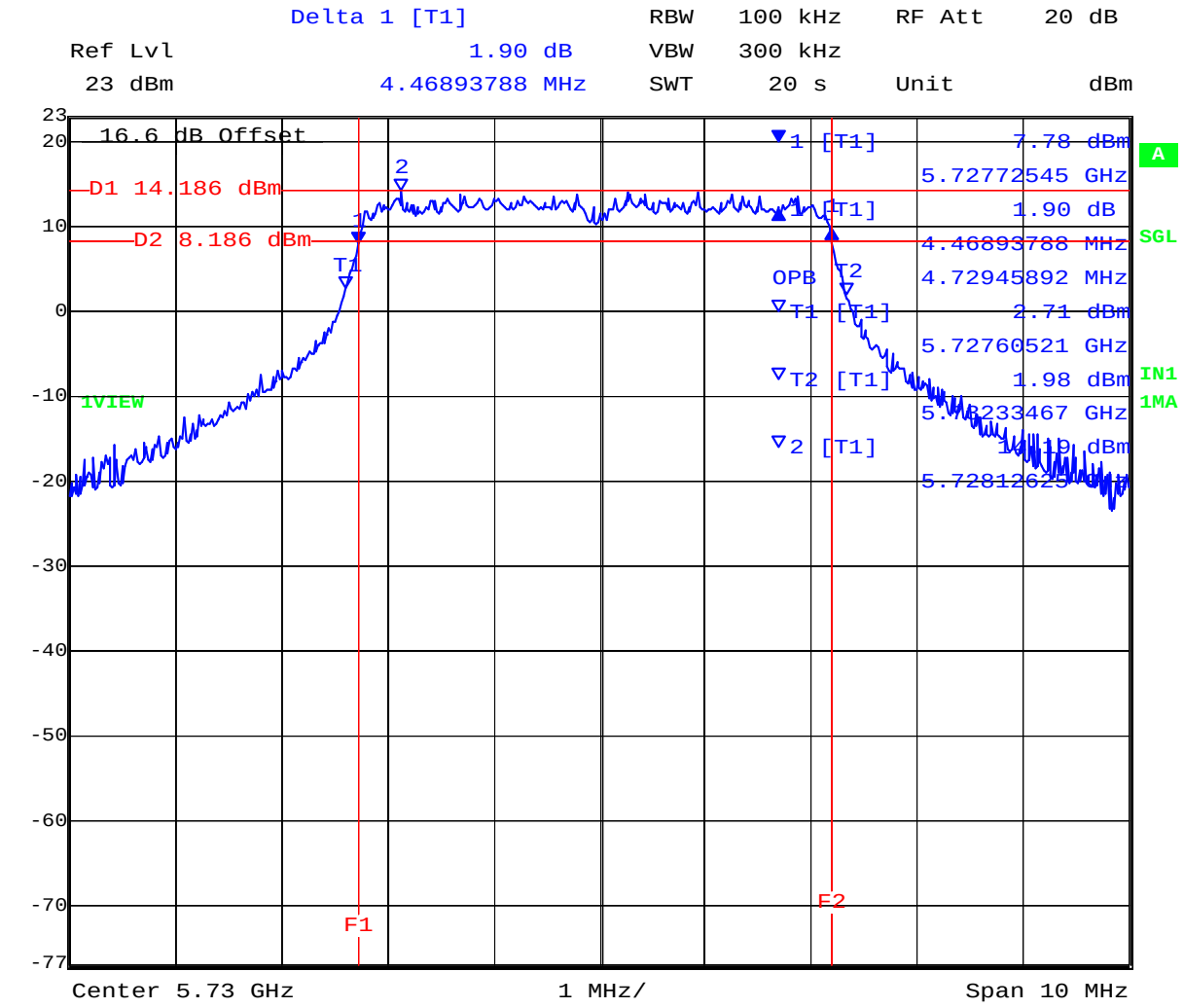
Chain a: 6 dB 99% OBW Ambient 5780MHz 48.00V 21.16dBm



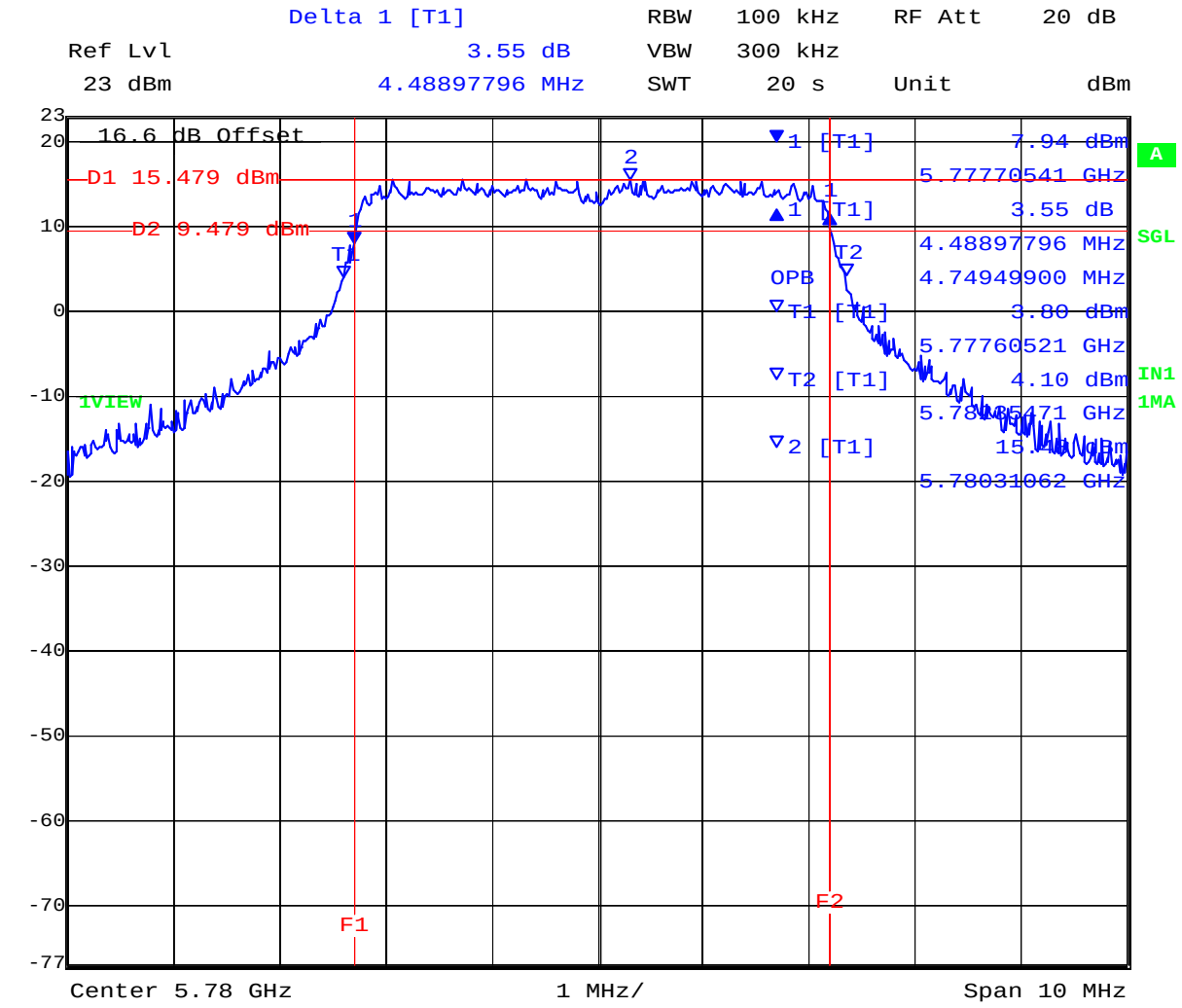
Chain a: 6 dB 99% OBW Ambient 5845MHz 48.00V 19.24dBm



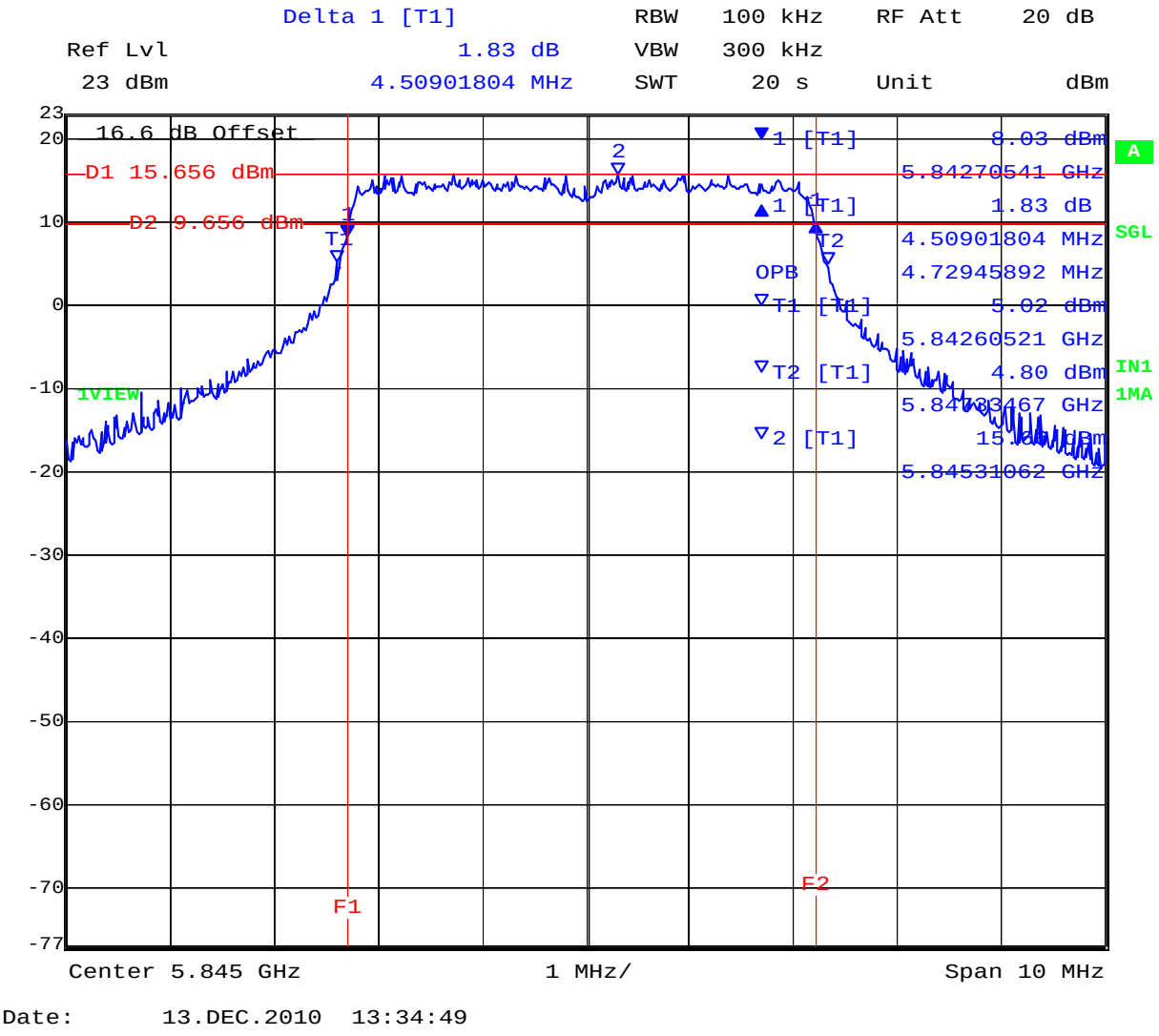
Chain b: 6 dB 99% OBW Ambient 5730MHz 48.00V 18.62dBm



Chain b: 6 dB 99% OBW Ambient 5780MHz 48.00V 20.41dBm



Chain b: 6 dB 99% OBW Ambient 5845MHz 48.00V 20.49dBm



7.1.2 6 dB and 99% Bandwidth Results: 802.11n 5MHz 64QAM

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 5MHz 64QAM	**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:**	0 dBi
Applied Voltage:	48V Vdc		
Notes 1:			
Notes 2:			

6 dB Bandwidth

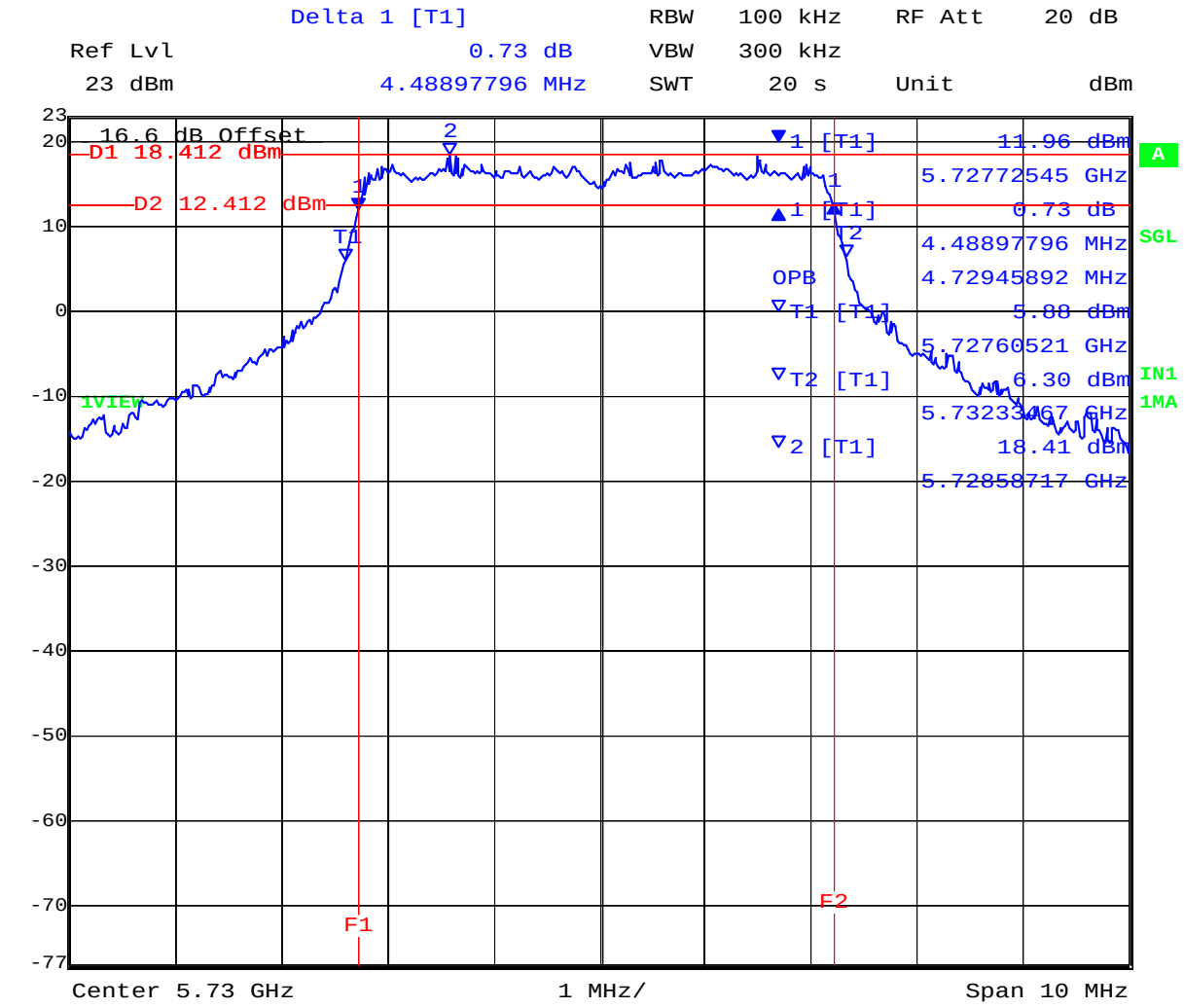
Test Frequency	6 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	a	b	c	d	kHz	MHz	MHz
5730.000	4.489000	4.529000	--	--	500	0.5	-3.989000
5780.000	4.509000	4.509000	--	--			-4.009000
5845.000	4.469000	4.509000	--	--			-3.969000

99% Bandwidth

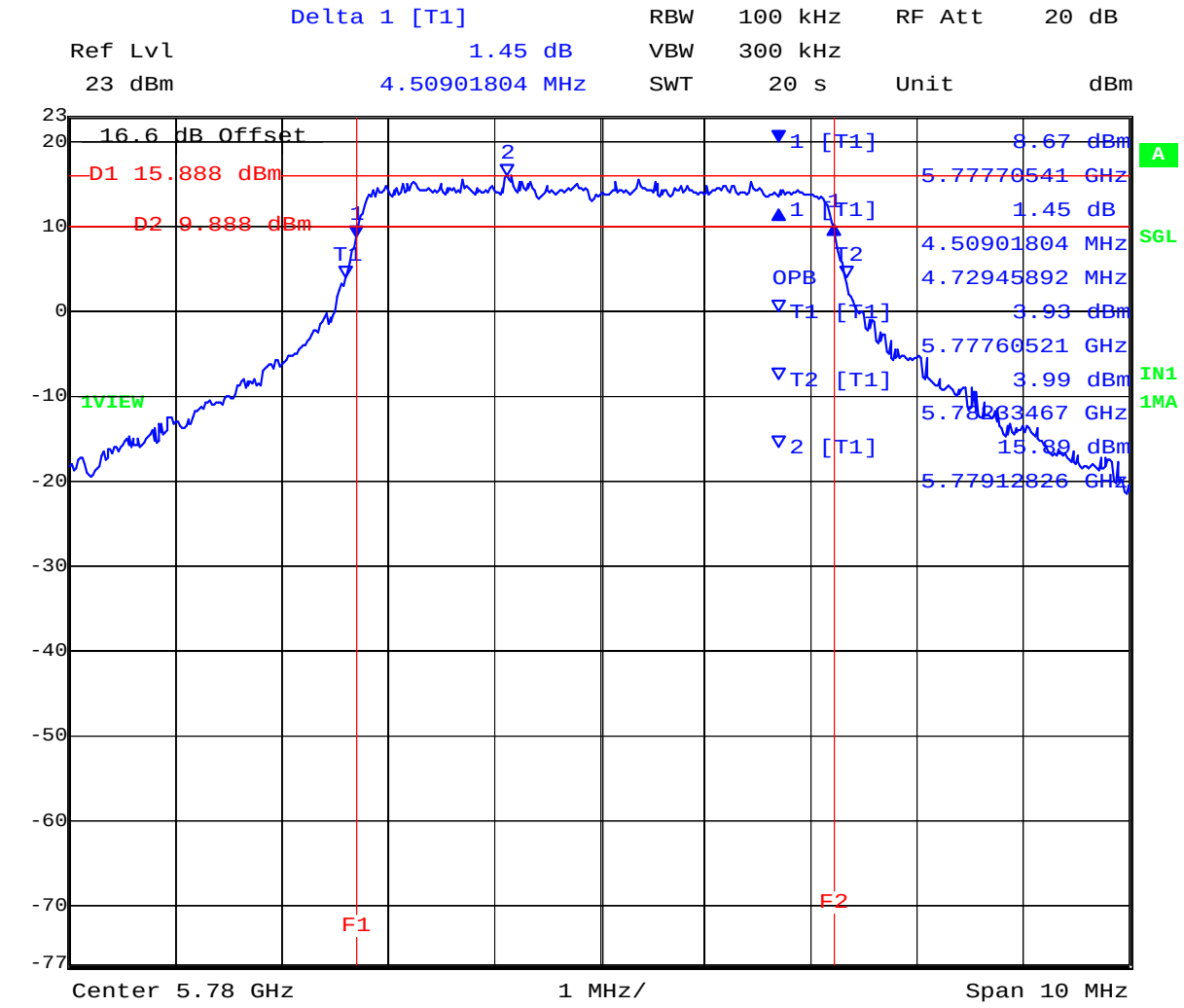
Test Frequency	99 % Bandwidth						
	MHz						
MHz	a	b	c	d			
5730.000	4.729000	4.709000	--	--			
5780.000	4.729000	4.709000	--	--			
5845.000	4.729000	4.709000	--	--			

Measurement uncertainty:	±2.81 dB

Chain a: 6 dB 99% OBW Ambient 5730MHz 48.00V 22.37dBm



Chain a: 6 dB 99% OBW Ambient 5780MHz 48.00V 20.32dBm



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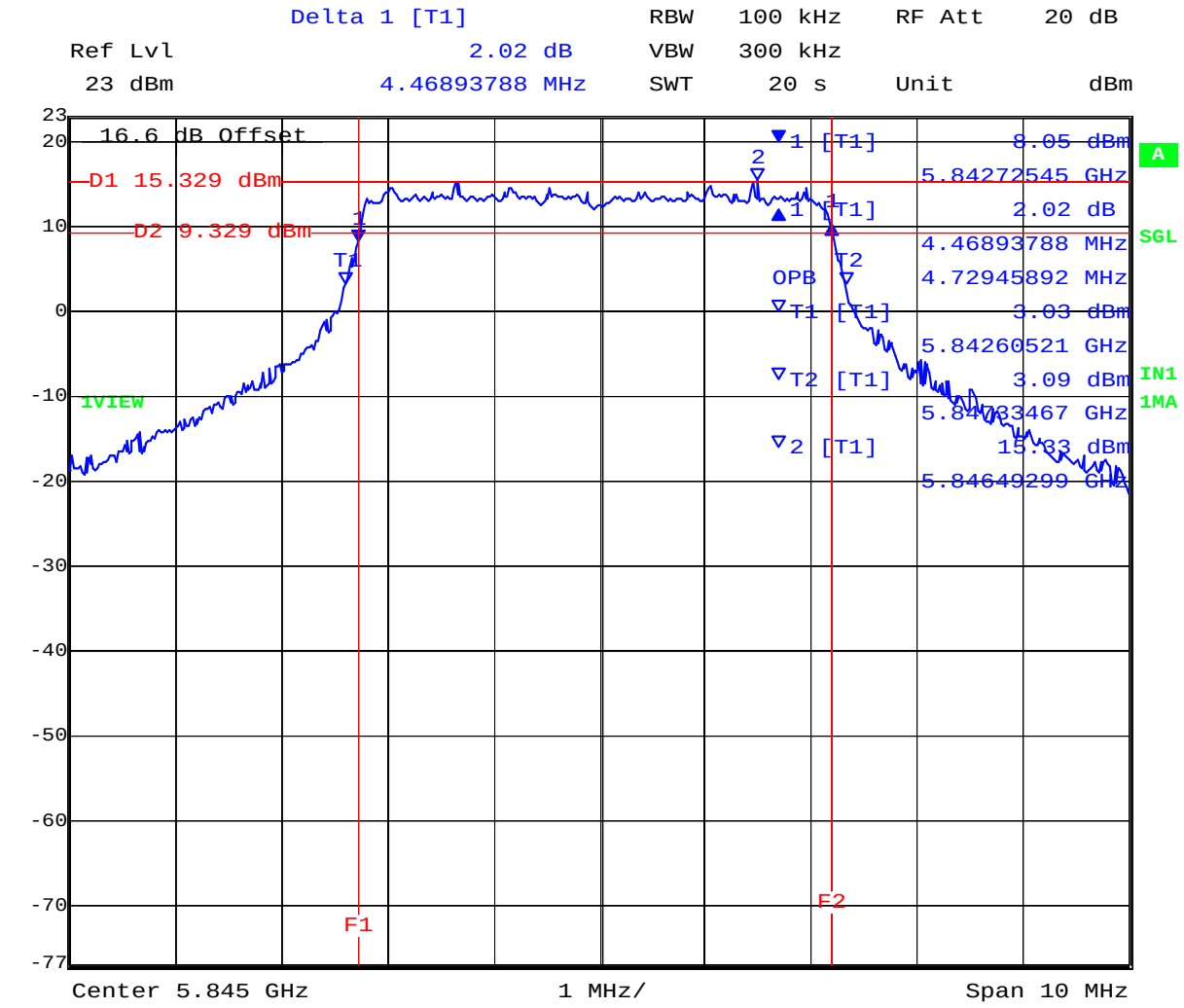
Chain a: 6 dB 99% OBW Ambient 5845MHz 48.00V 19.44dBm



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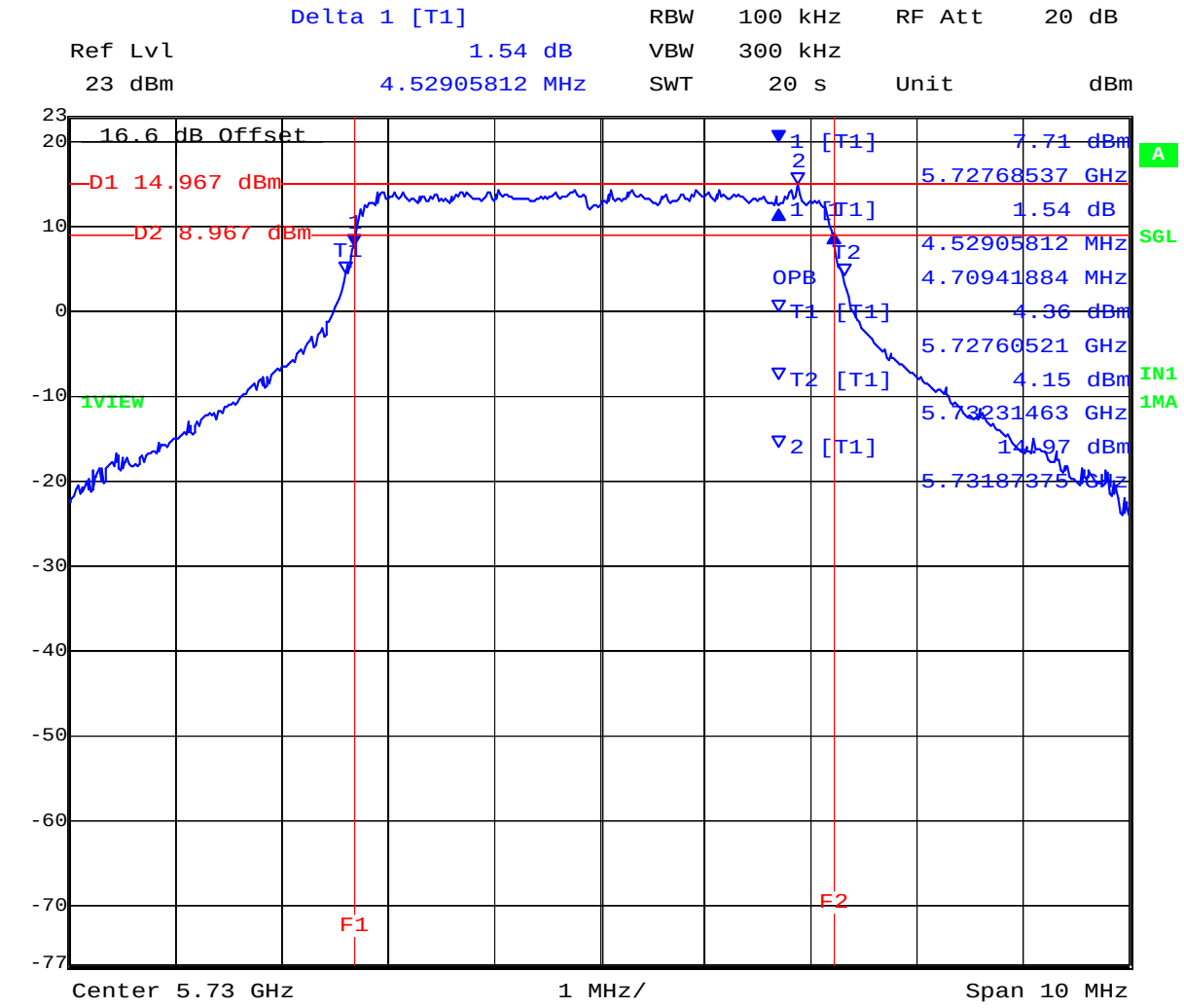
Chain b: 6 dB 99% OBW Ambient 5730MHz 48.00V 19.31dBm



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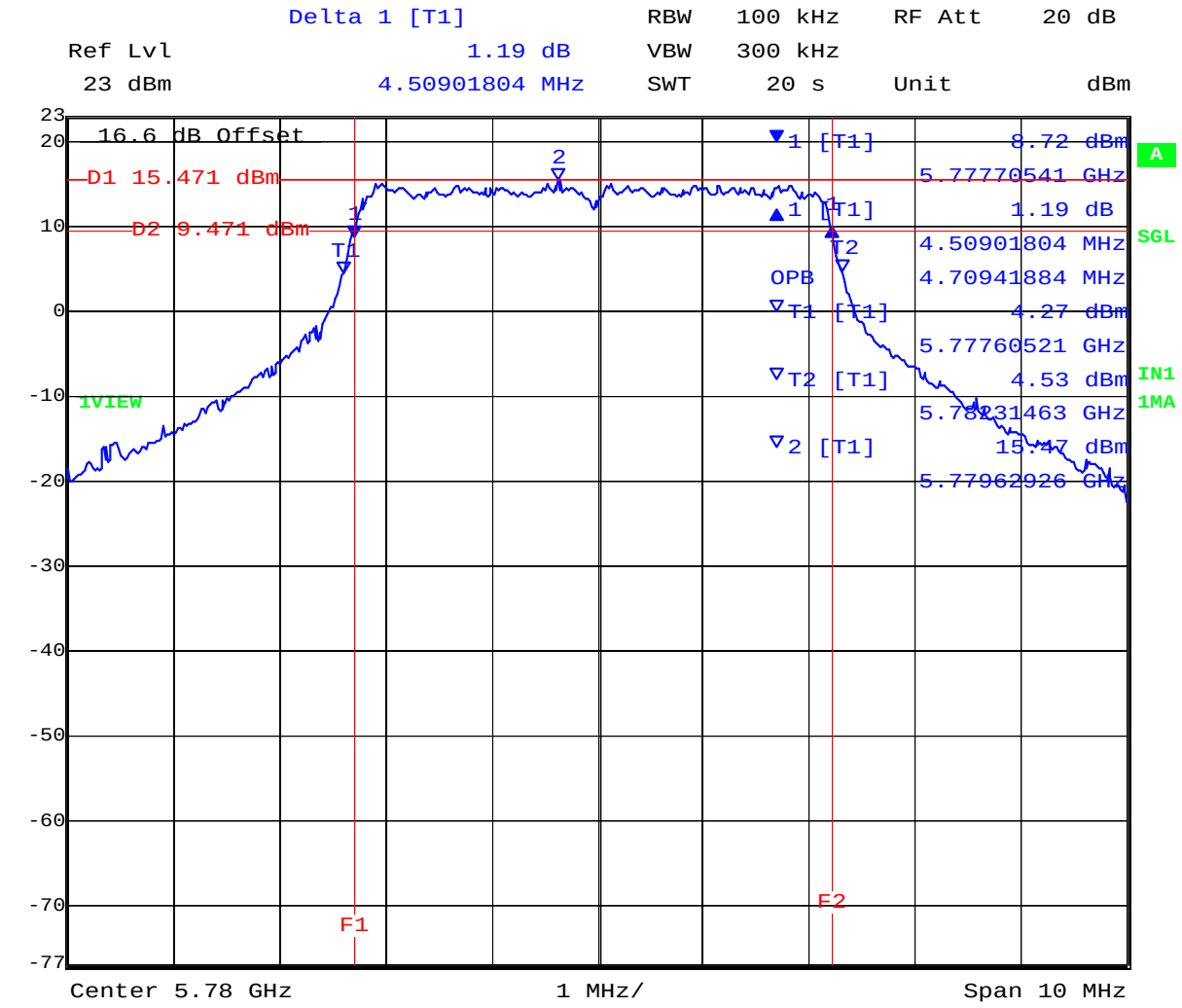
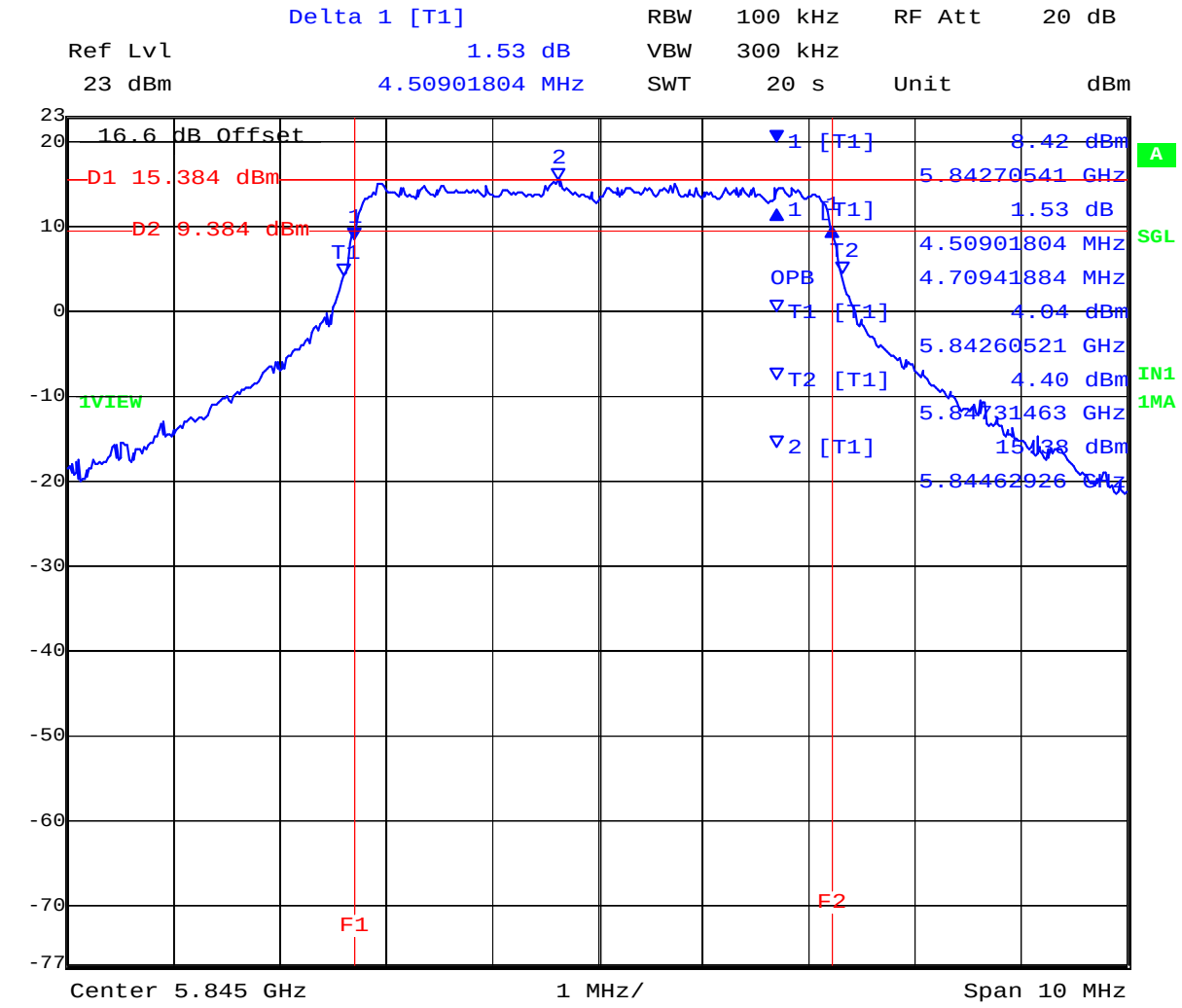
Chain b: 6 dB 99% OBW Ambient 5780MHz 48.00V 20.06dBm



Chain b: 6 dB 99% OBW Ambient 5845MHz 48.00V 19.99dBm



7.1.3 6 dB and 99% Bandwidth Results: 802.11n 10 MHz BPSK

Test Conditions:	15.247 (a)(2)		**Rel. Humidity (%):**	35 to 42	
Variant:	802.11n 10 MHz BPSK		**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:**	0 dBi	
Applied Voltage:	48V	Vdc			
Notes 1:					
Notes 2:					

6 dB Bandwidth

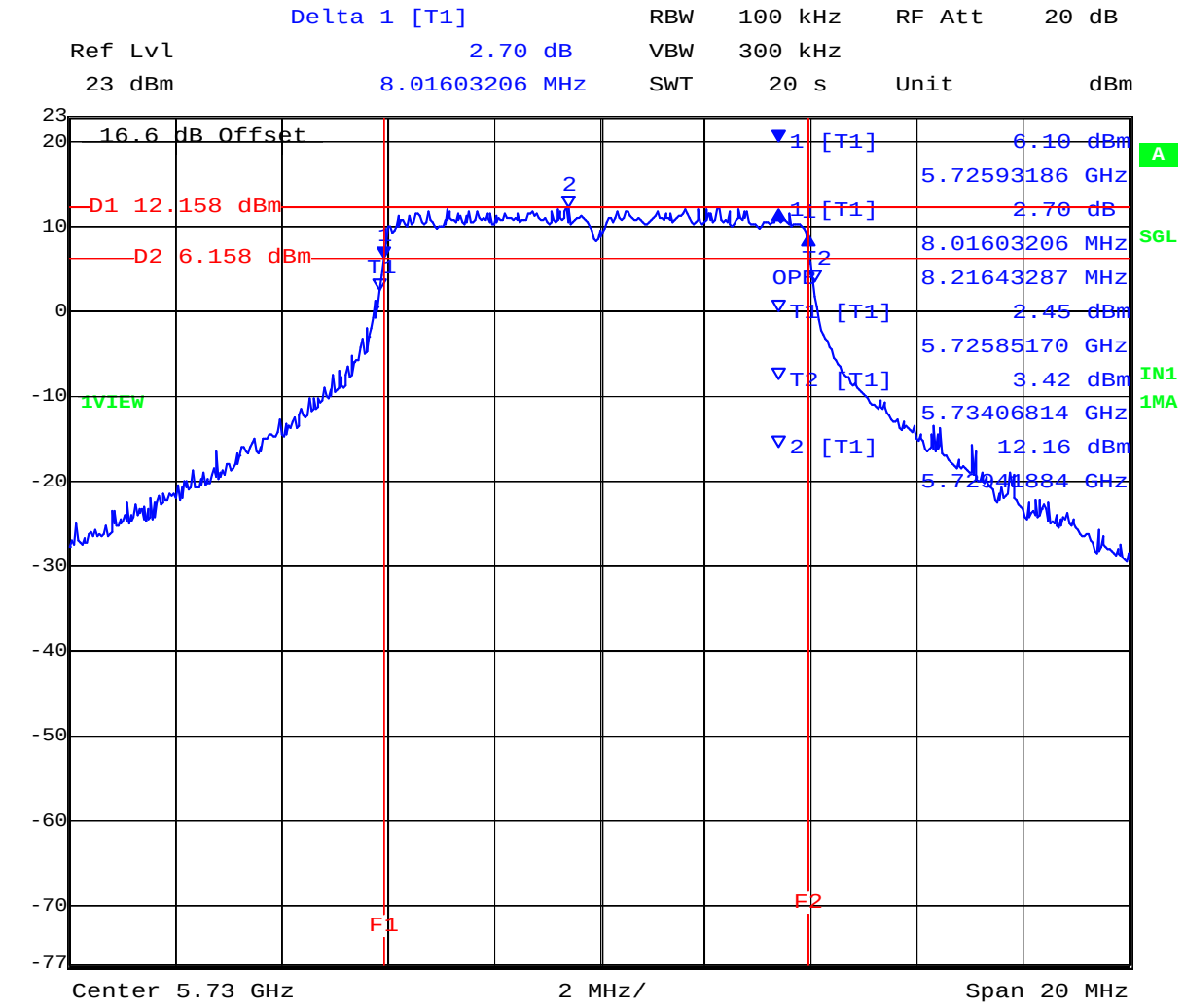
Test Frequency	6 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	a	b	c	d	kHz	MHz	MHz
5730.000	8.016000	8.056000	--	--	500	0.5	-7.516000
5780.000	8.056000	8.056000	--	--			-7.556000
5845.000	8.056000	8.056000	--	--			-7.556000

99% Bandwidth

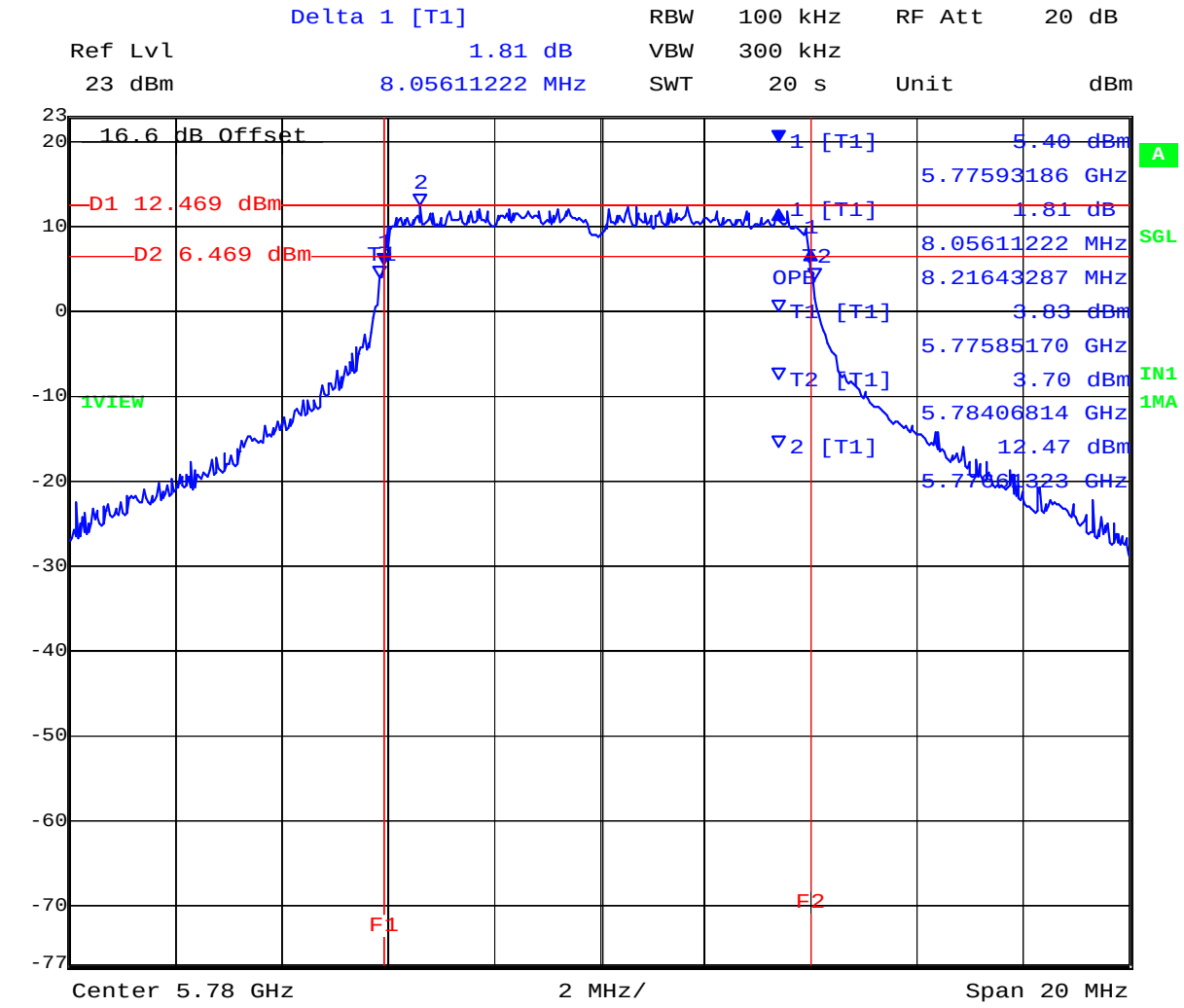
Test Frequency	99 % Bandwidth						
	MHz						
MHz	a	b	c	d			
5730.000	8.216000	8.176000	--	--			
5780.000	8.216000	8.176000	--	--			
5845.000	8.257000	8.176000	--	--			

Measurement uncertainty:	±2.81 dB

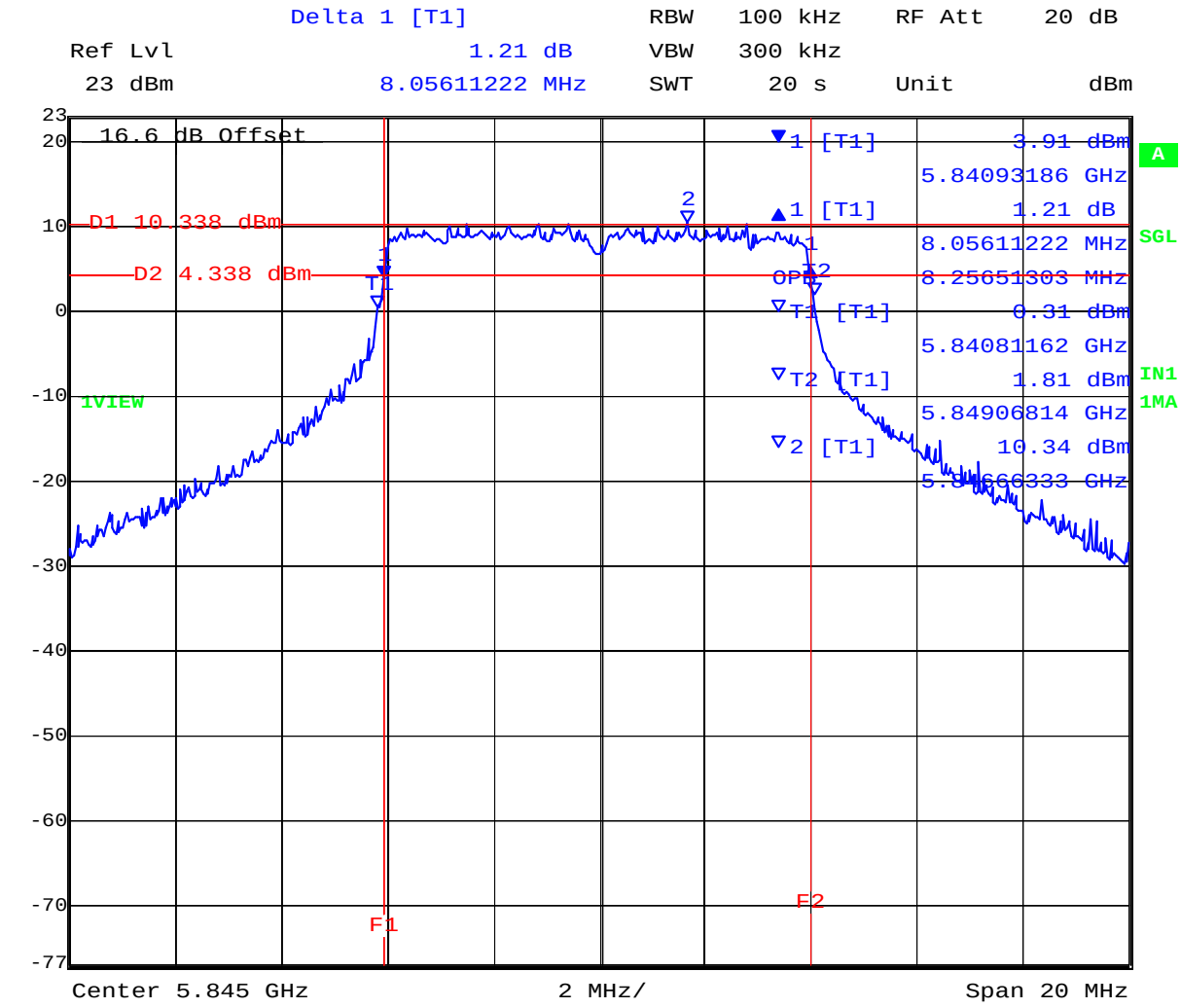
Chain a: 6 dB 99% OBW Ambient 5730MHz 48.00V 19.78dBm



Chain a: 6 dB 99% OBW Ambient 5780MHz 48.00V 20.01dBm

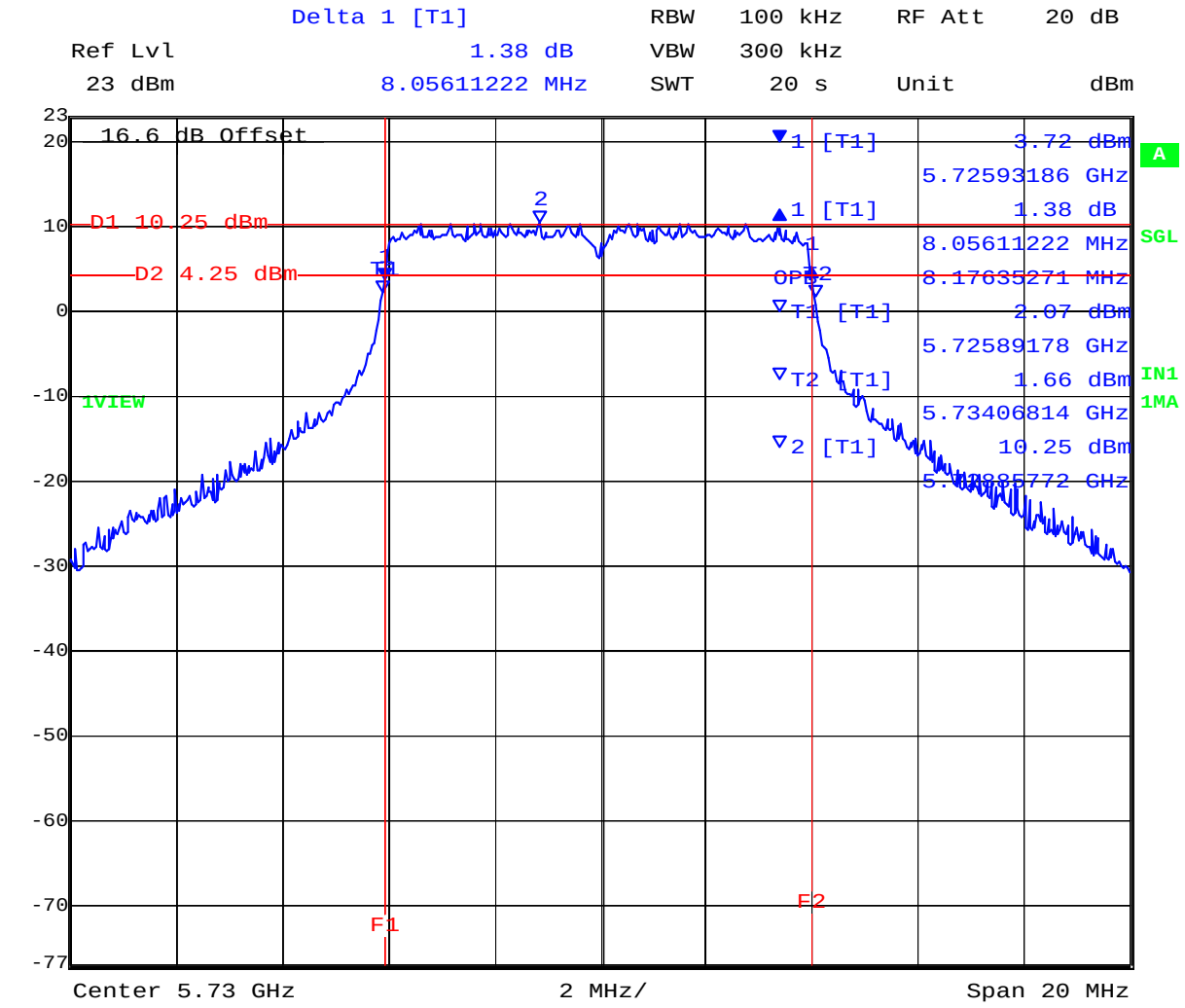


Chain a: 6 dB 99% OBW Ambient 5845MHz 48.00V 18.22dBm

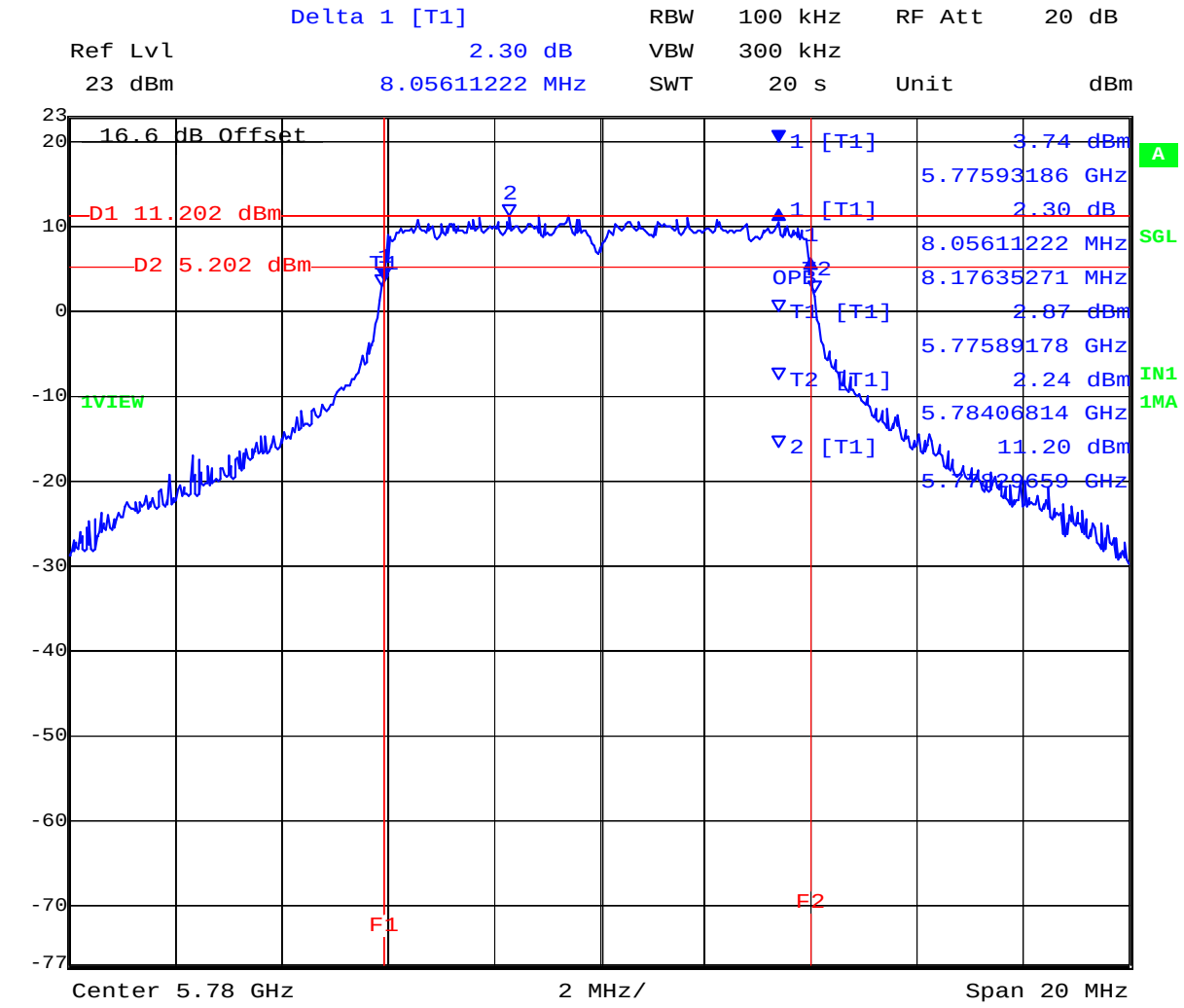


Date: 14.DEC.2010 12:32:32

Chain b 6 dB 99% OBW Ambient 5730MHz 48.00V 18.17dBm

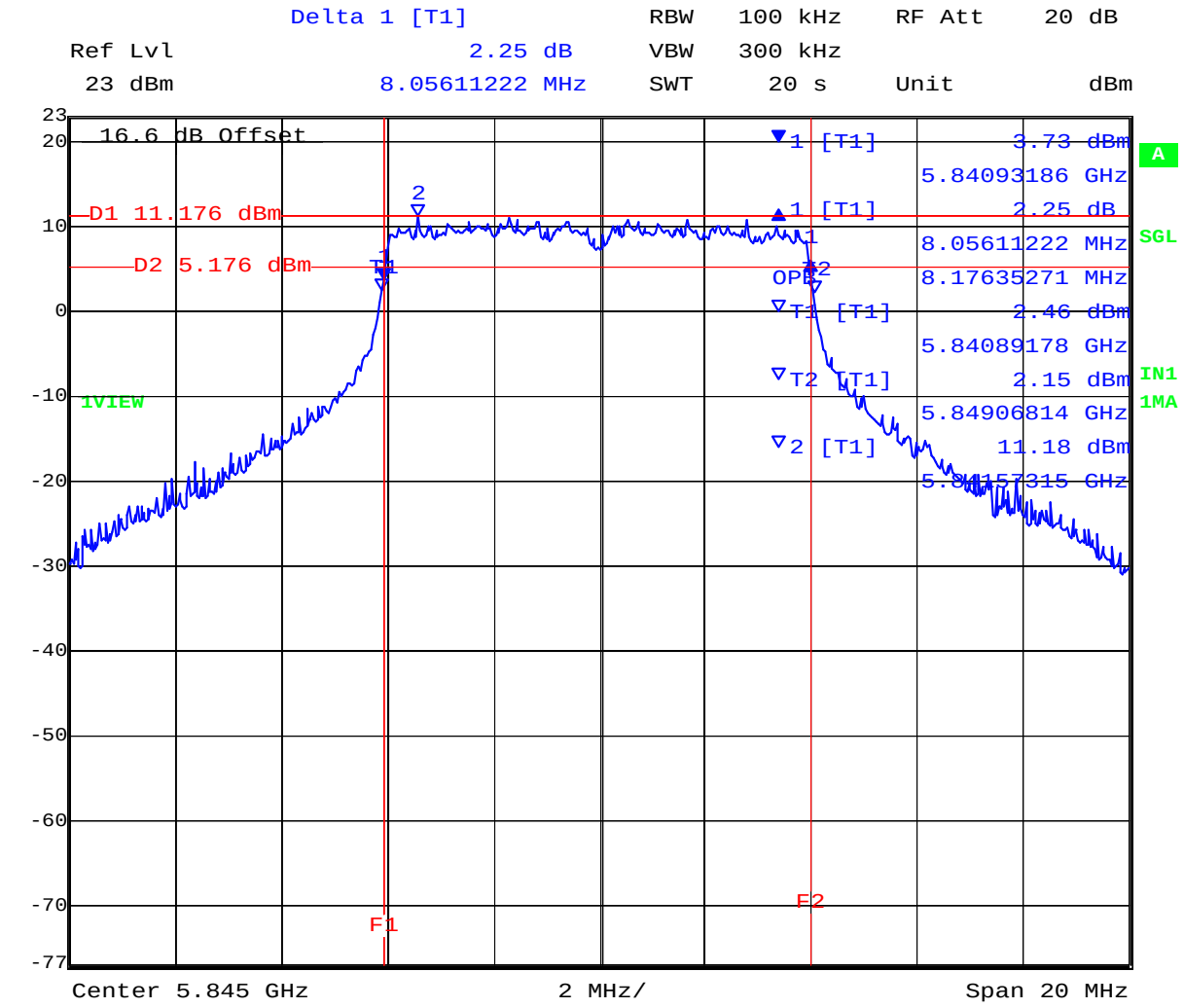


Chain b 6 dB 99% OBW Ambient 5780MHz 48.00V 18.91dBm



Date: 14.DEC.2010 13:11:17

Chain b 6 dB 99% OBW Ambient 5845MHz 48.00V 18.73dBm



Date: 14.DEC.2010 13:27:20

7.1.4 6 dB and 99% Bandwidth Results: 802.11n 20 MHz BPSK

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 20 MHz BPSK	**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:**	0 dBi
Applied Voltage:	48V Vdc		
Notes 1:			
Notes 2:			

6 dB Bandwidth

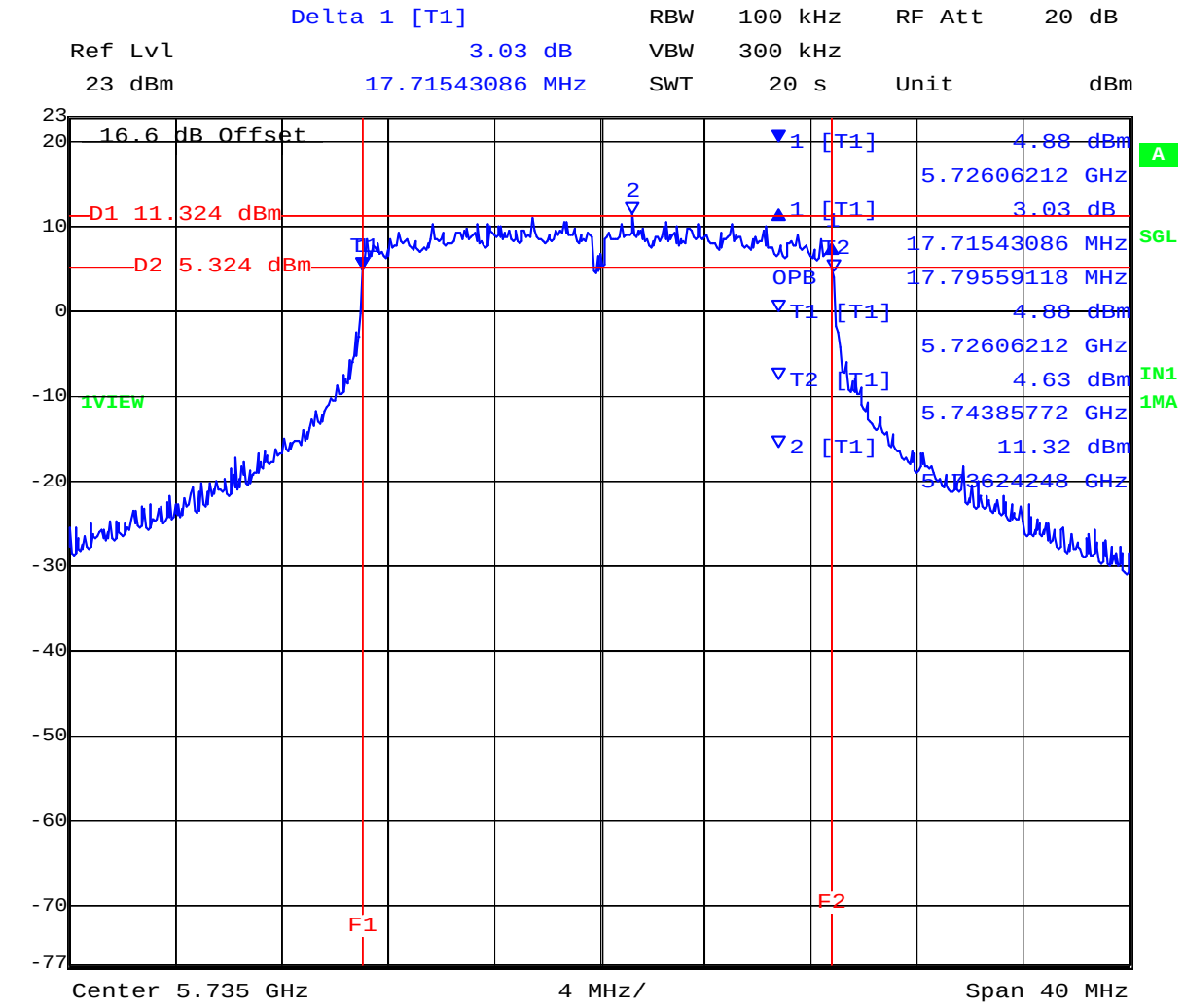
Test Frequency	6 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	a	b	c	d	kHz	MHz	MHz
5735.000	17.715000	17.796000	--	--	500	0.5	-17.215000
5780.000	17.796000	17.796000	--	--			-17.296000
5840.000	17.796000	17.876000	--	--			-17.296000

99% Bandwidth

Test Frequency	99 % Bandwidth						
	MHz						
MHz	a	b	c	d			
5735.000	17.796000	17.796000	--	--			
5780.000	17.796000	17.796000	--	--			
5840.000	17.796000	17.796000	--	--			

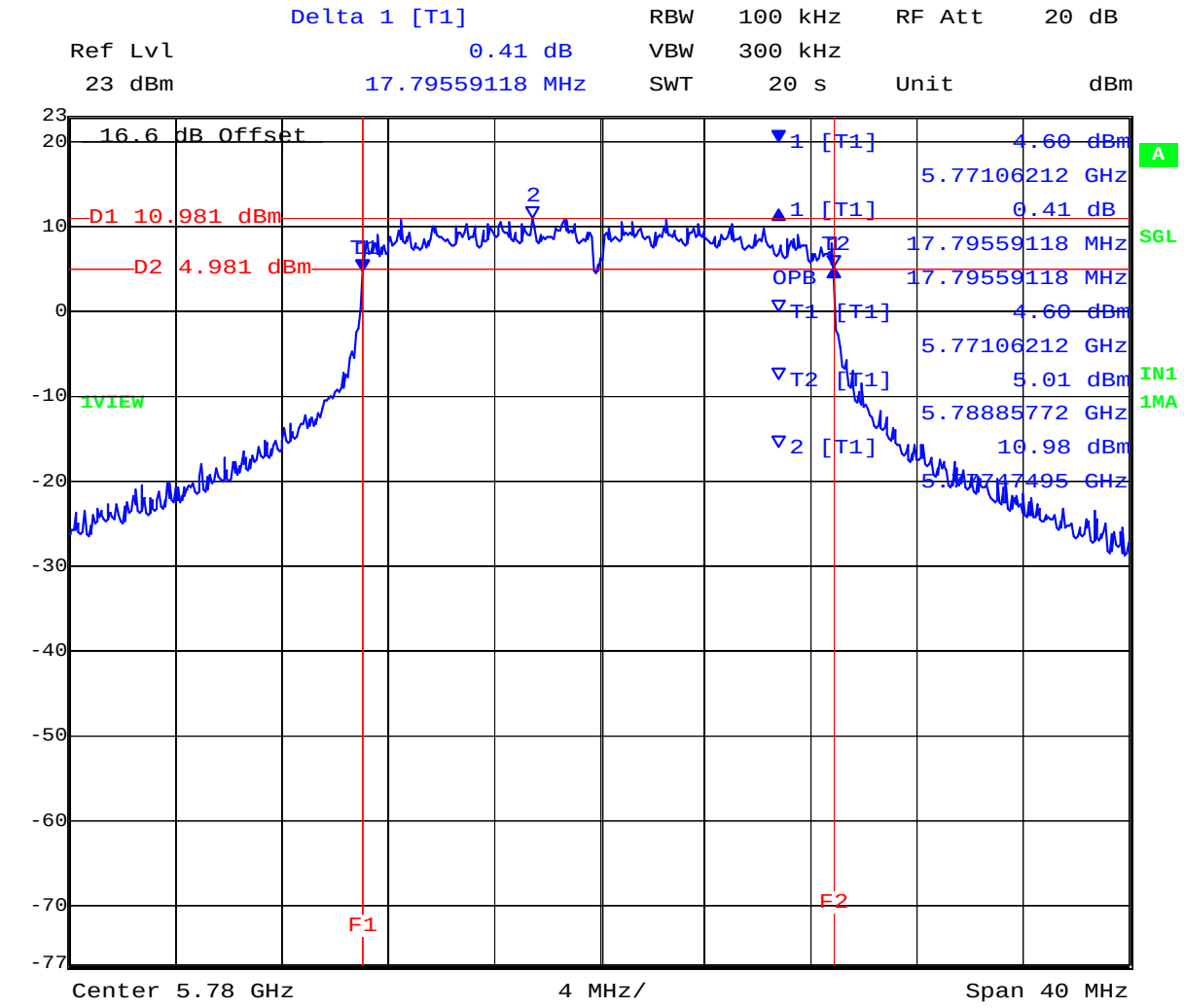
Measurement uncertainty:	±2.81 dB

Chain a 6 dB 99% OBW Ambient 5735MHz 48.00V 21.61dBm

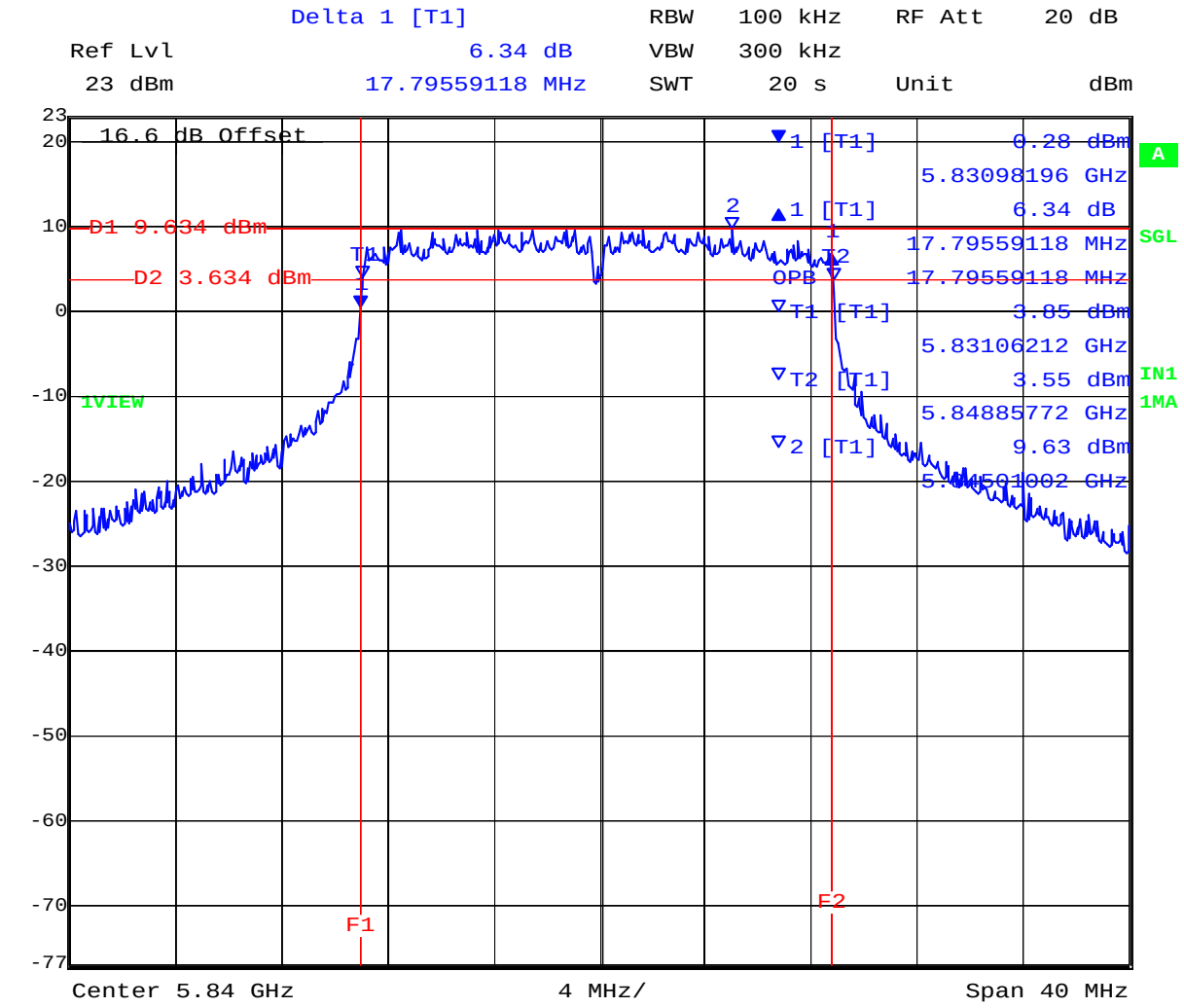


Date: 13.DEC.2010 16:43:09

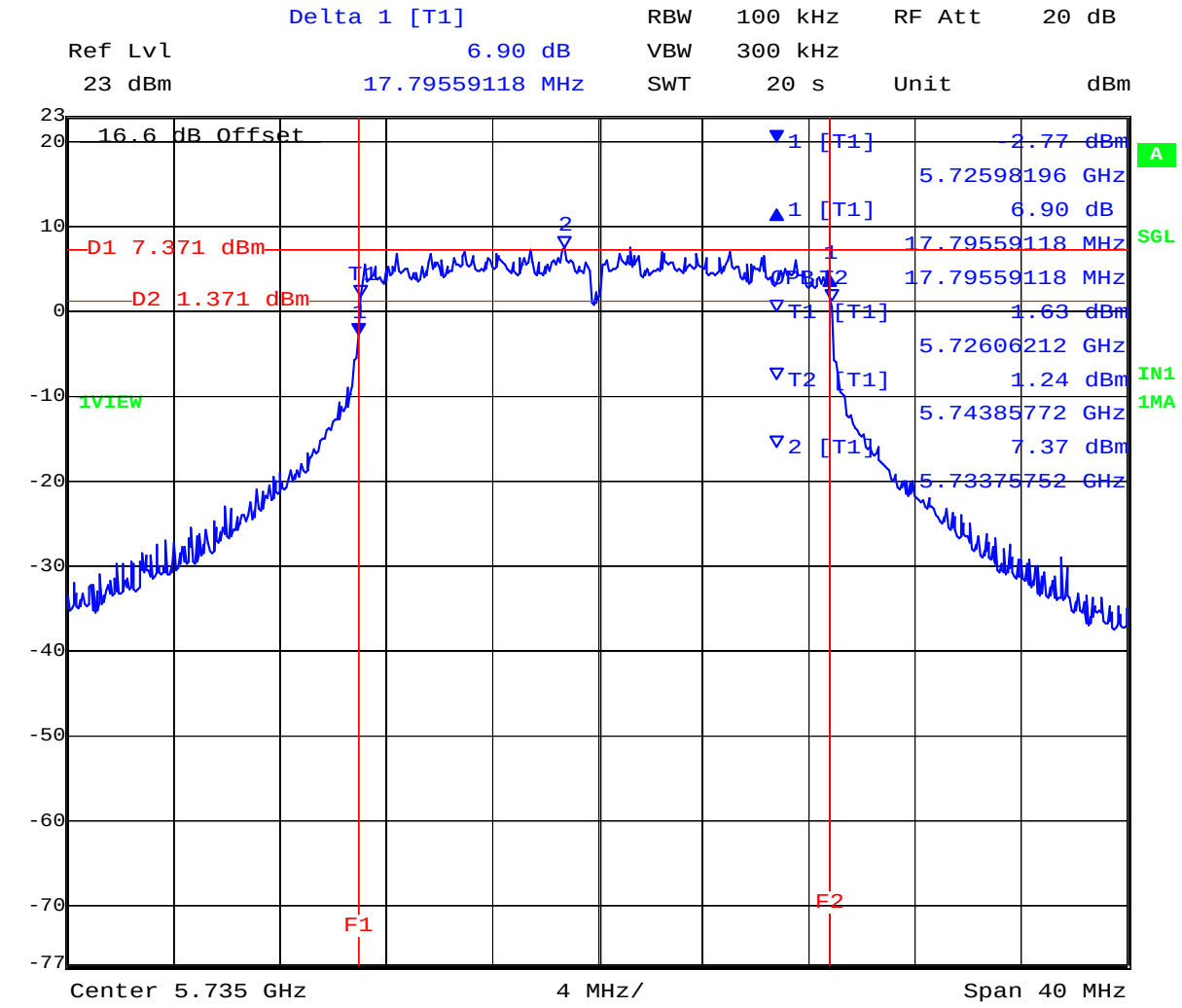
Chain a 6 dB 99% OBW Ambient 5780MHz 48.00V 21.68dBm



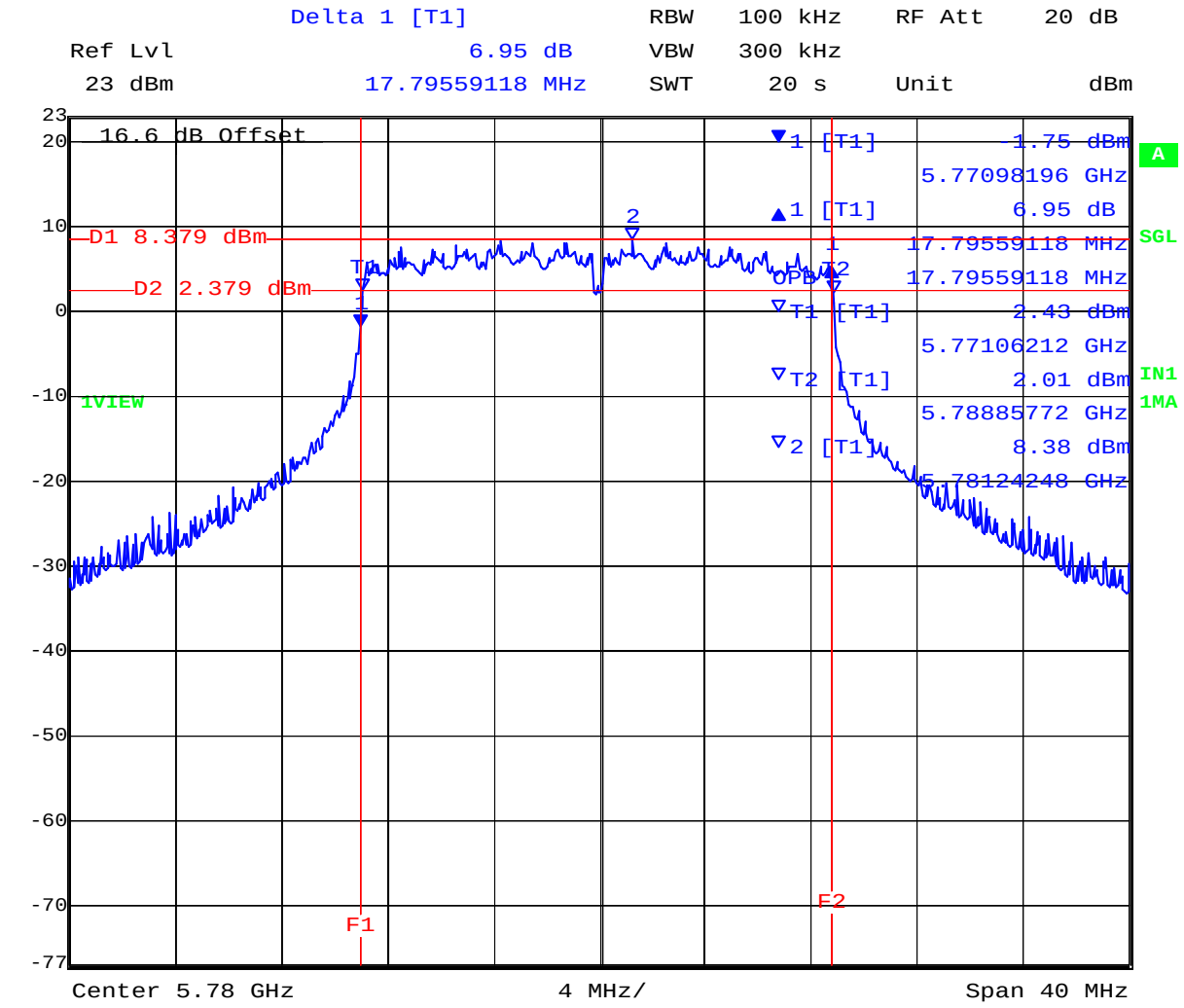
Chain a 6 dB 99% OBW Ambient 5840MHz 48.00V 20.61dBm



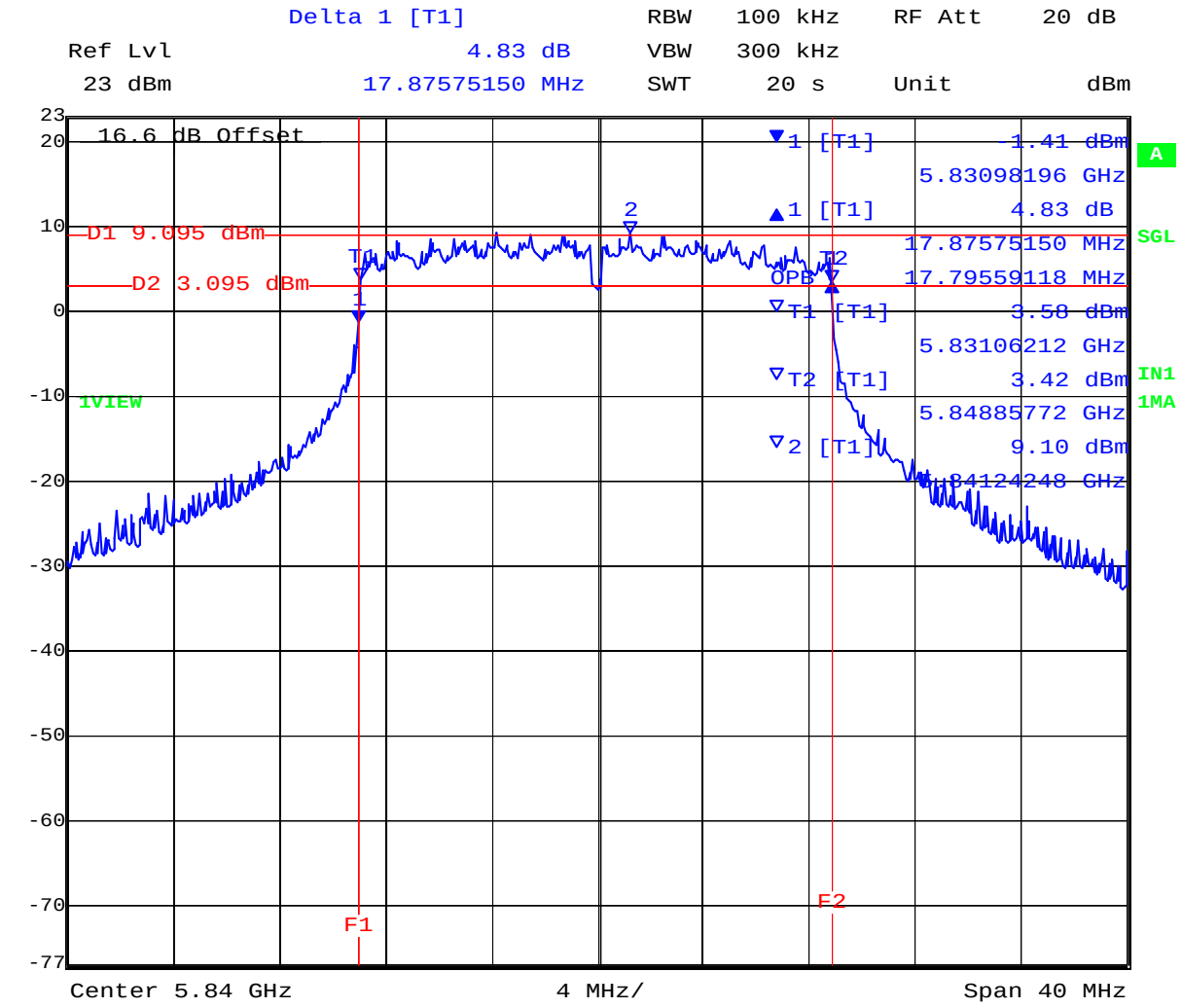
Chain b 6 dB 99% OBW Ambient 5735MHz 48.00V 18.14dBm



Chain b 6 dB 99% OBW Ambient 5780MHz 48.00V 19.10dBm



Chain b 6 dB 99% OBW Ambient 5840MHz 48.00V 19.86dBm



7.1.5 6 dB and 99% Bandwidth Results: 802.11n 40 MHz BPSK

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 40 MHz BPSK	**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:**	0 dBi
Applied Voltage:	48V Vdc		
Notes 1:			
Notes 2:			

6 dB Bandwidth

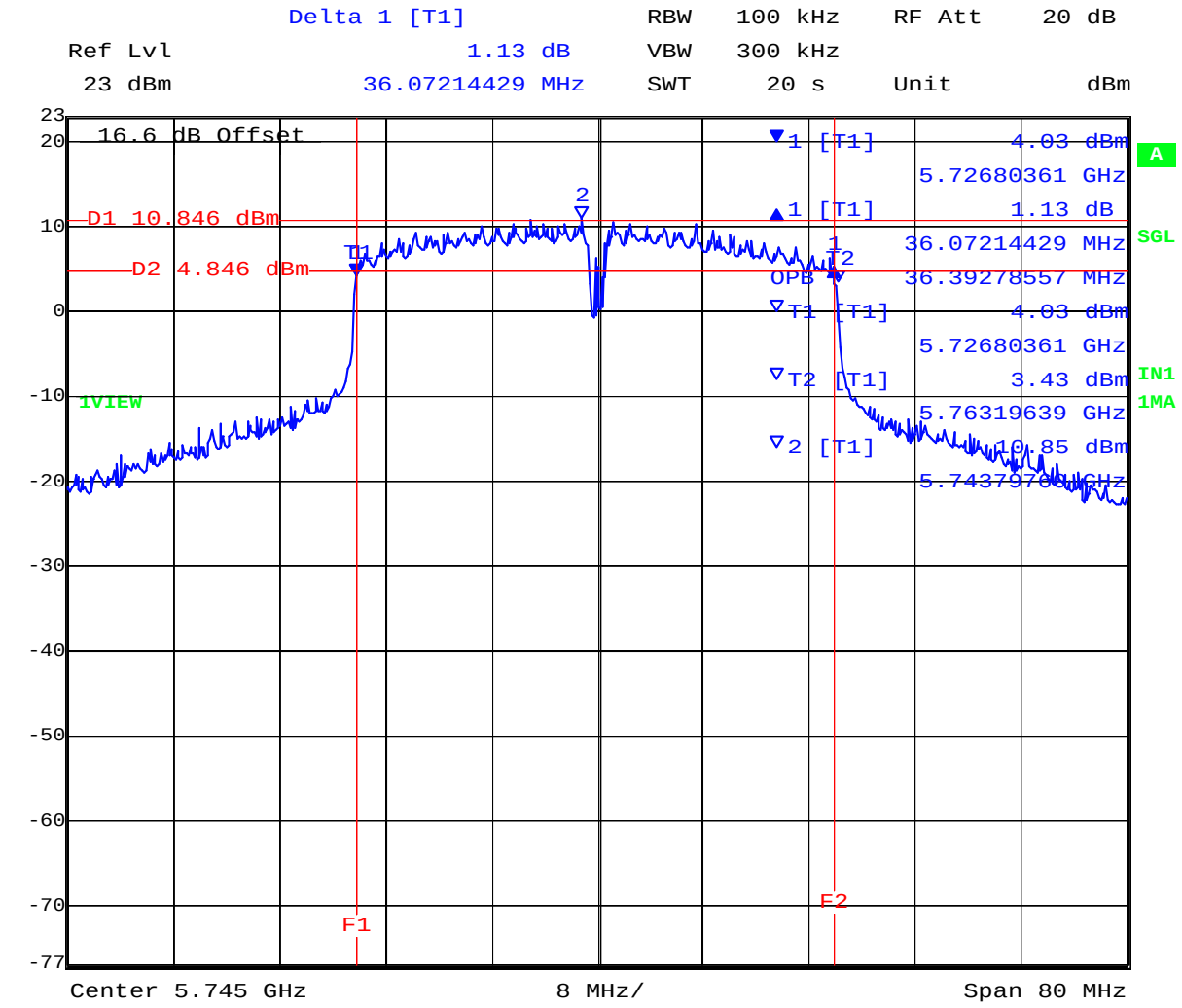
Test Frequency	6 dB Bandwidth				Minimum 6dB Bandwidth Limit		Margin
	MHz						
MHz	a	b	c	d	kHz	MHz	MHz
5745.000	36.072000	36.072000	--	--	500	0.5	-35.572000
5780.000	35.752000	36.072000	--	--			-35.252000
5830.000	36.232000	36.232000	--	--			-35.732000

99% Bandwidth

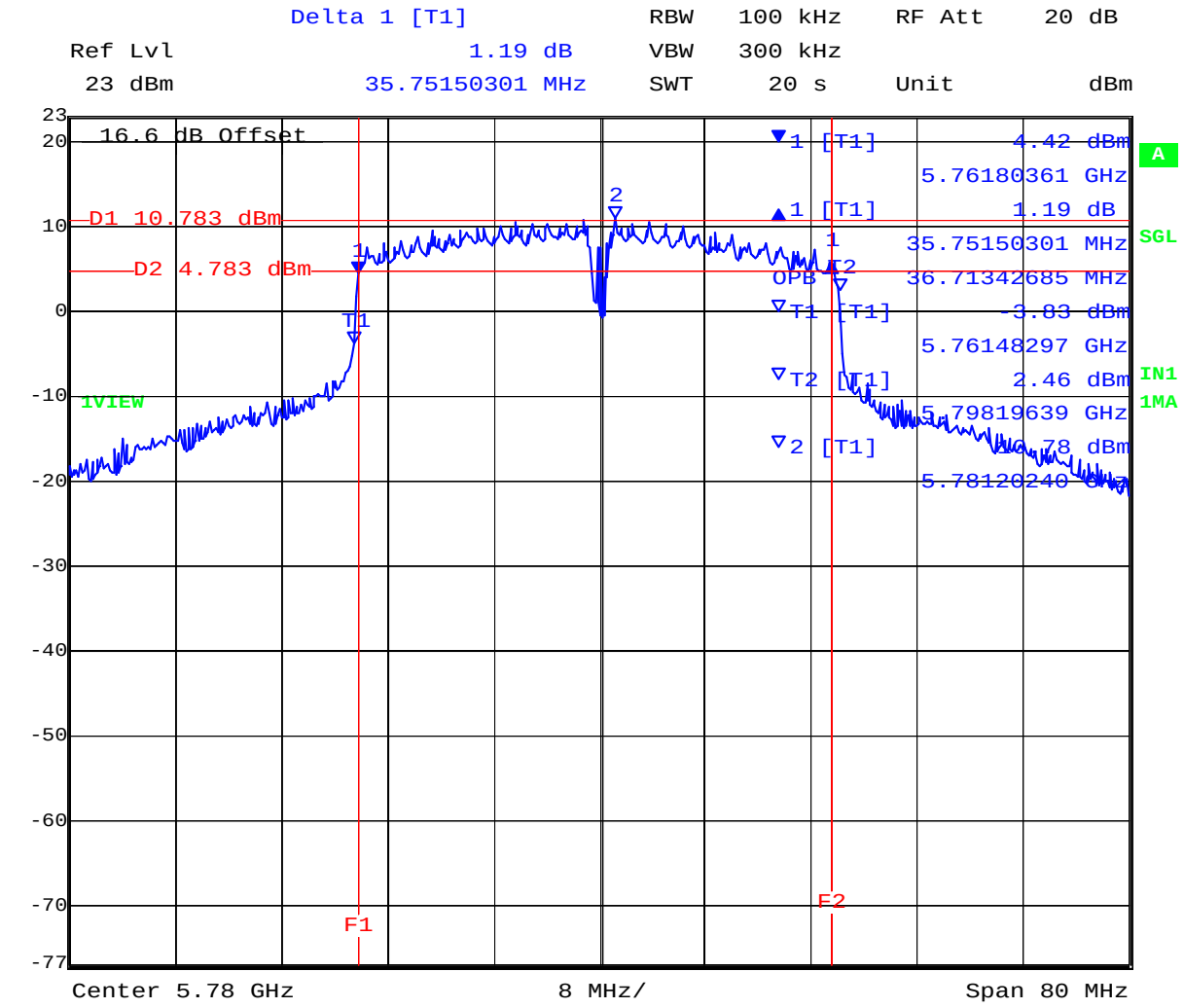
Test Frequency	99 % Bandwidth						
	MHz						
MHz	a	b	c	d			
5745.000	36.393000	36.393000	--	--			
5780.000	36.713000	36.393000	--	--			
5830.000	36.713000	36.232000	--	--			

Measurement uncertainty:	±2.81 dB

Chain a 6 dB 99% OBW Ambient 5745MHz 48.00V 23.83dBm

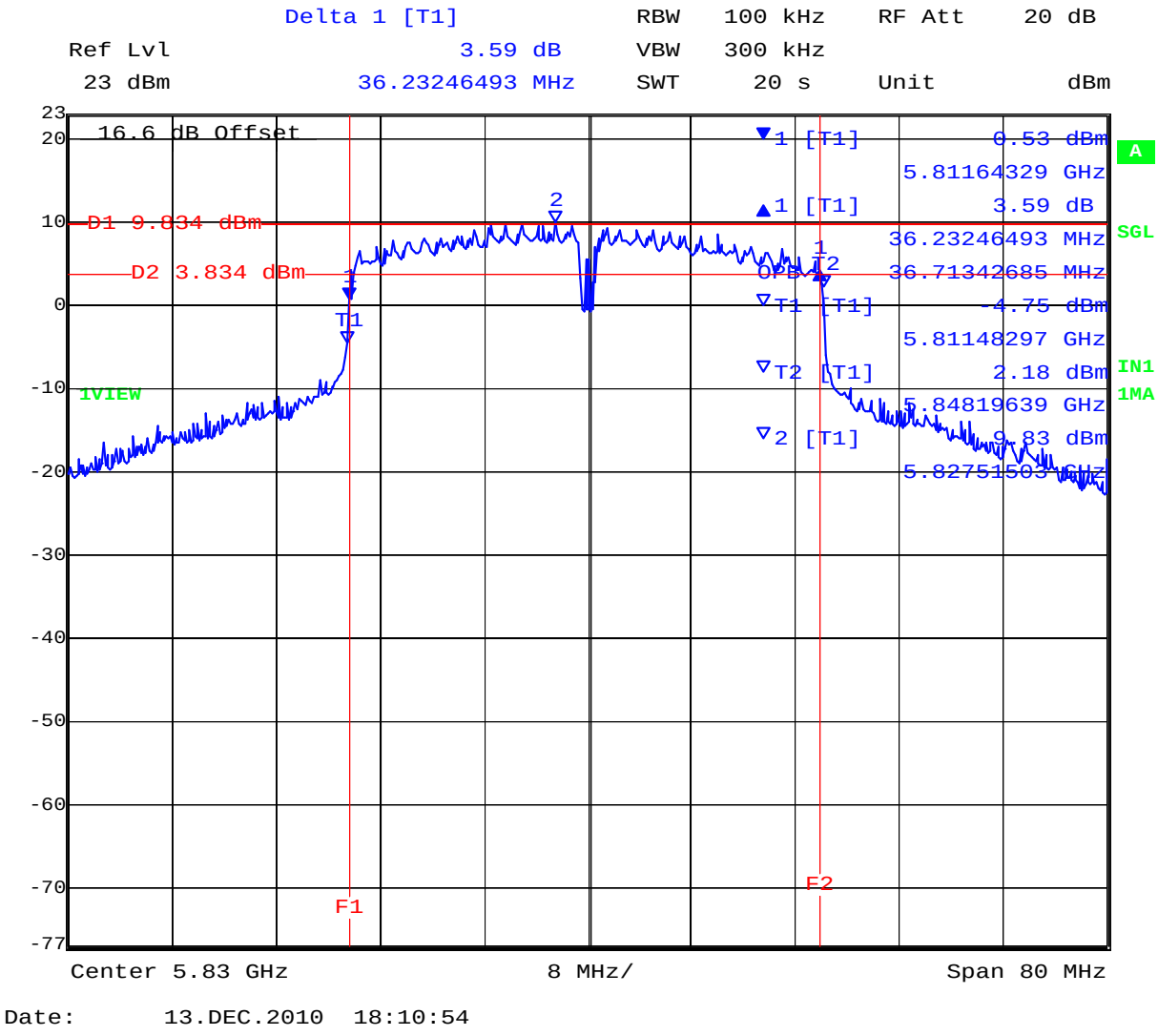


Chain a 6 dB 99% OBW Ambient 5780MHz 48.00V 23.88dBm

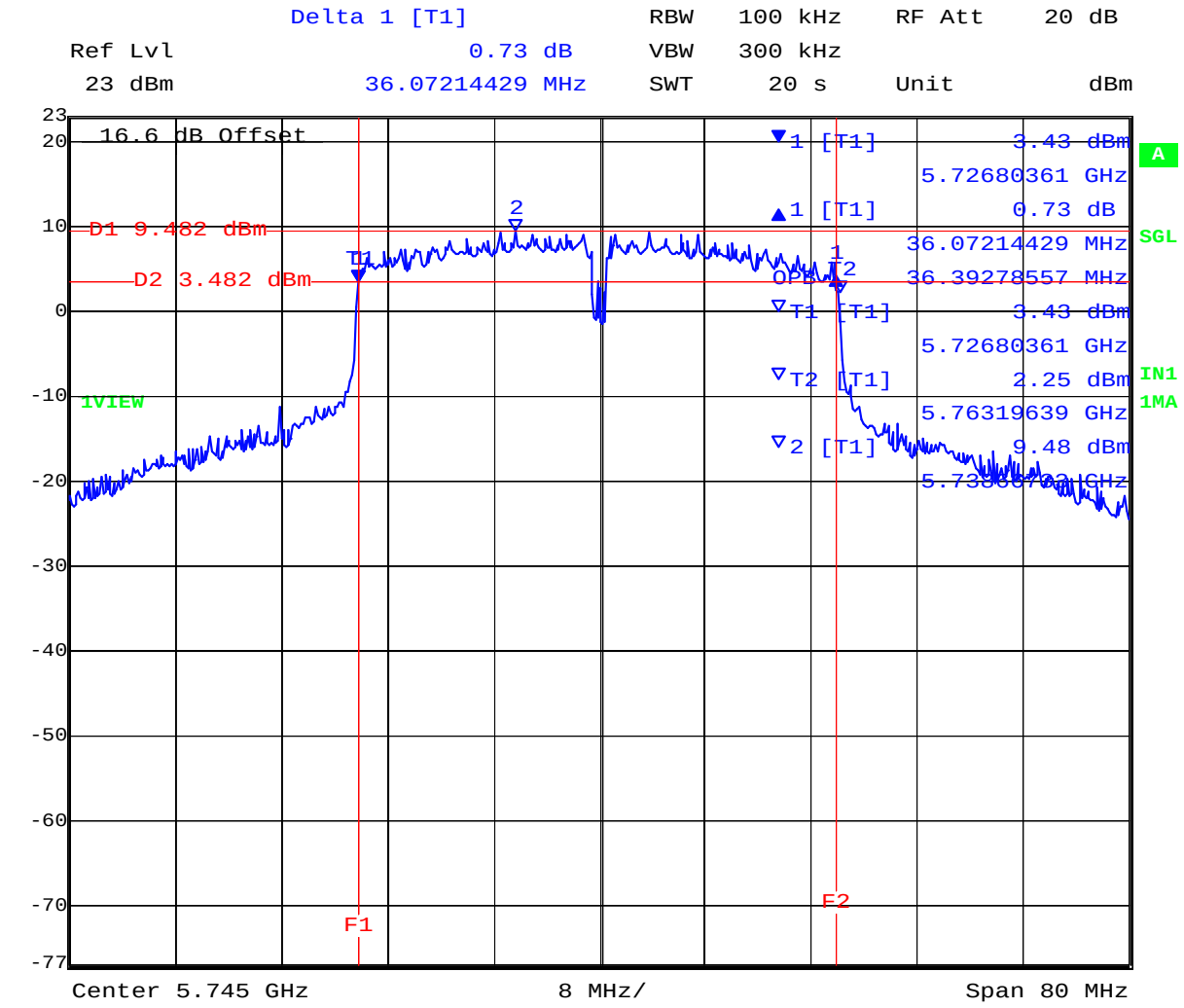


Date: 13.DEC.2010 18:06:16

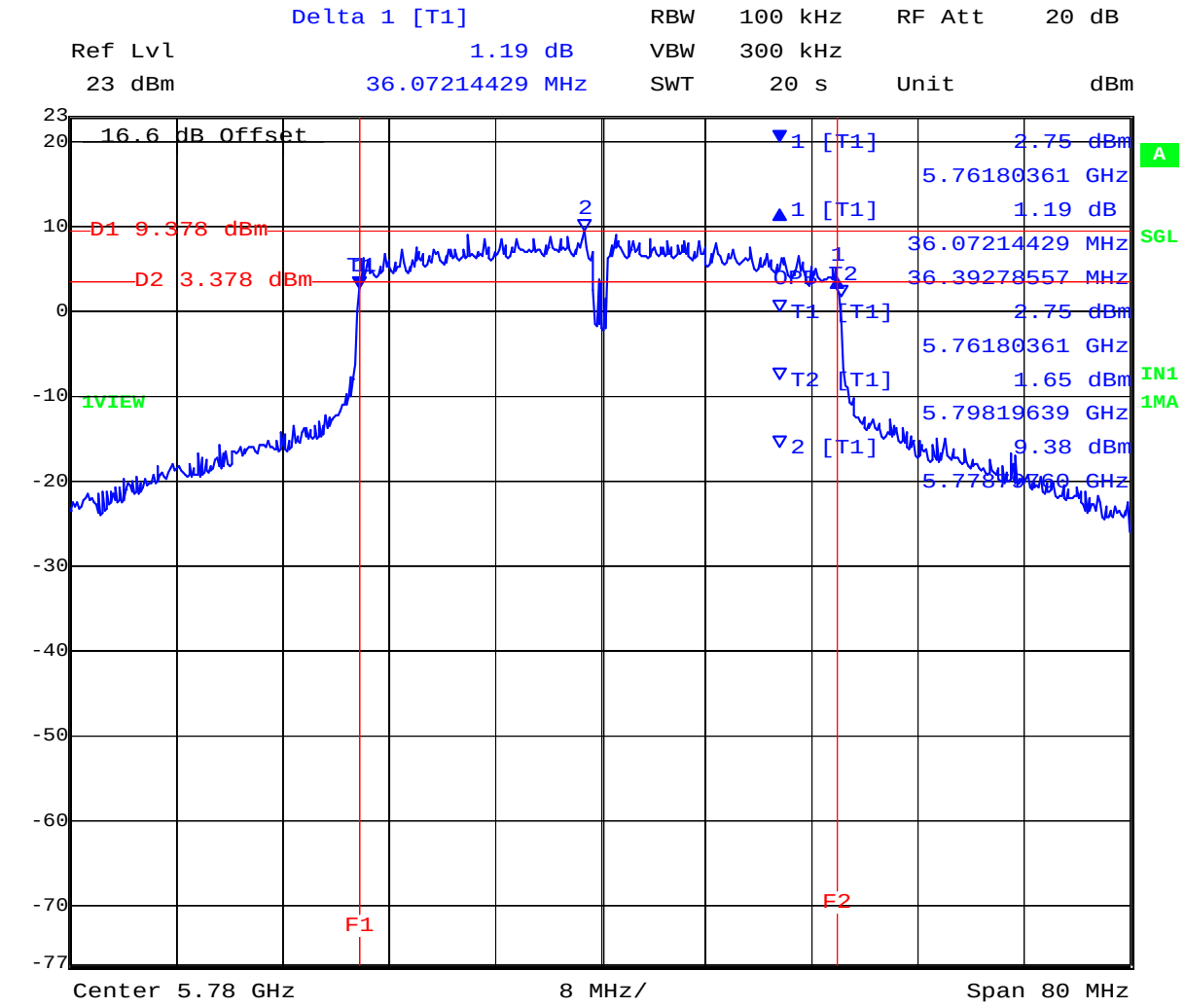
Chain a 6 dB 99% OBW Ambient 5830MHz 48.00V 22.93dBm



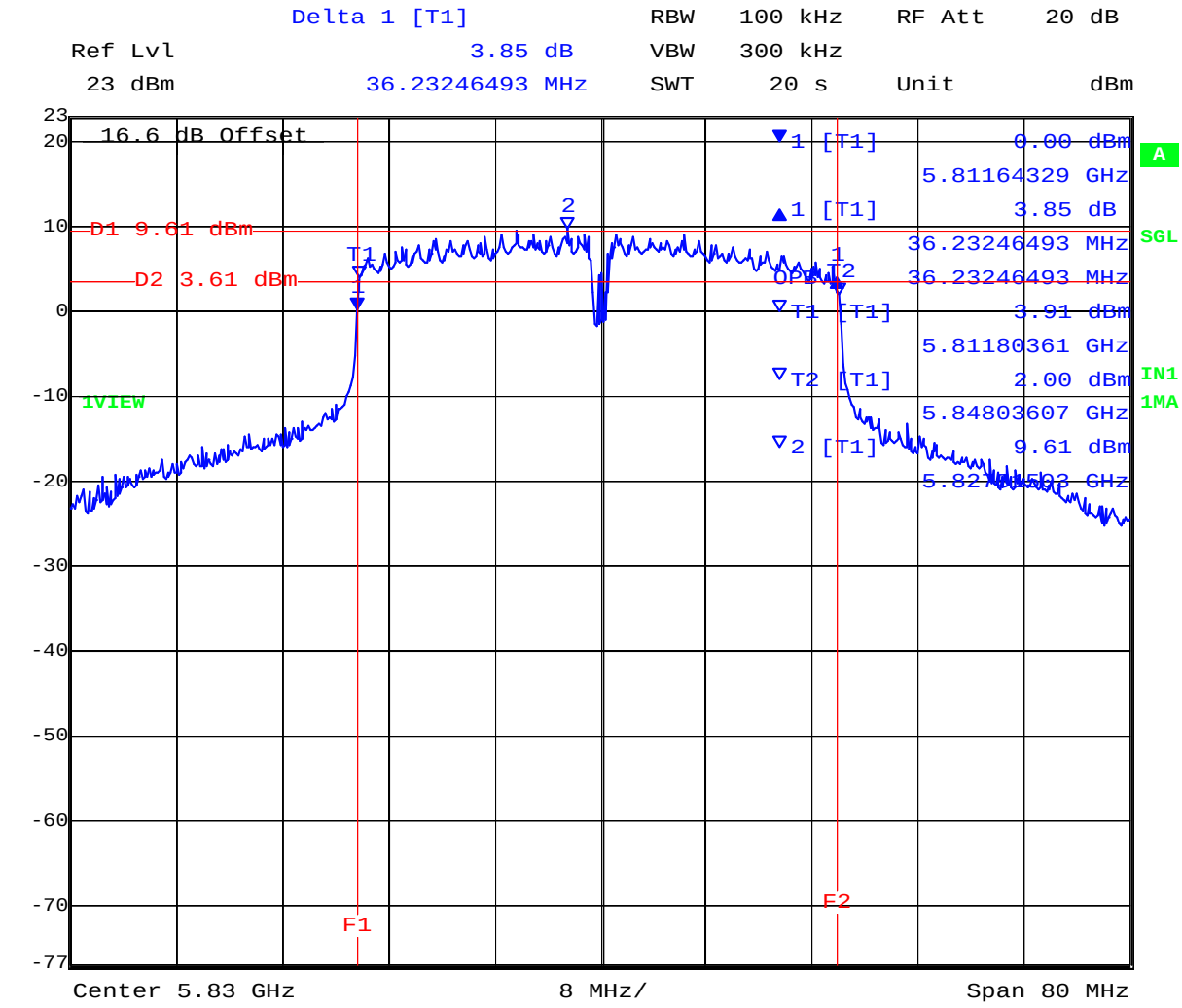
Chain b 6 dB 99% OBW Ambient 5745MHz 48.00V 22.69dBm



Chain b 6 dB 99% OBW Ambient 5780MHz 48.00V 22.40dBm



Chain b 6 dB 99% OBW Ambient 5830MHz 48.00V 22.66dBm



7.2 Maximum Permissible Exposure

Calculations for Maximum Permissible Exposure Levels

Power Density = Pd (mW/cm2) = EIRP/(4πd2)
EIRP = P * G
P = Peak output power (mW)
G = Antenna numeric gain (numeric)
d = Separation distance (cm)
Numeric Gain = 10 ^ (G (dBi)/10)

The peak power in the table below is calculated by assuming a worst case scenario where all of the EUT transmitters are operating simultaneously in the same band. The Peak Power in mW is the highest transmitter power measured and summed across all transmitters.

Because the EUT belongs to the General Population/Uncontrolled Exposure the limit of power density is 1.0 mW/cm2

Freq. Band	Antenna Gain		Peak Combined Output Power		Distance @ 1mW/cm2	Minimum Separation Distance
(MHz)	dBi	Numeric	(dBm)	(mW)	Limit(cm)	(cm)
5.8	30.0	1000.00	29.99	997.7	281.8	281.8

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

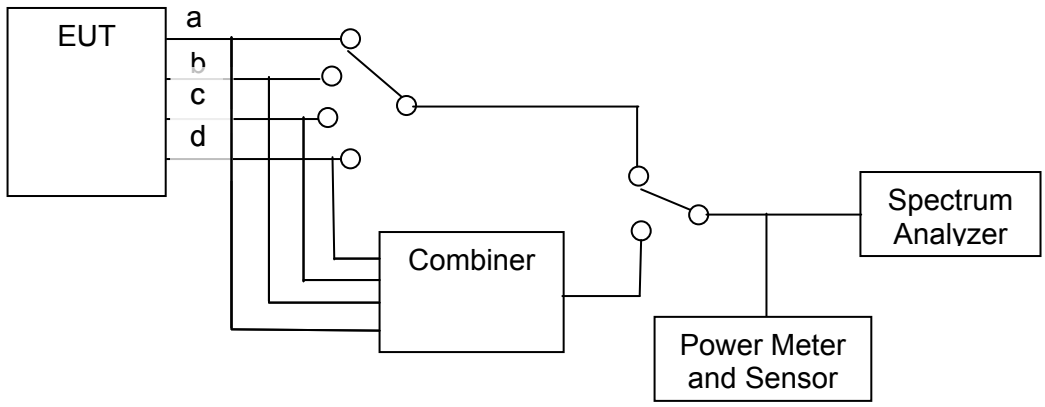
7.3 Peak Output Power

Test Procedure

The test methodology and conditions utilized for each measurement is referenced in the test results matrix. The average output power was measured per the test configuration identified below.

Per the standard measurements were taken at ambient conditions, nominal voltage.

Test Configuration



Measurement set-up for Peak Output Power

Total Power = A + G + Y + 10 log (1/x) dBm
A = Total Power [10 Log10 (10a/10 + 10b/10 +10c/10 + 10d/10)], G = Antenna Gain,
Y = Beam Forming Gain, x = Duty Cycle

Specification

§15.247 (b)
The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (3)
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz bands: 1.0 watt.

15.247 (b) (4)
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

15.247 (c)
Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:
(i) Systems operating in the 2400–2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725–5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

§15.31 (e)
For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

Traceability

Method	Test Equipment Used
WI-01	0158, 0252, 0313, 0314, 0223, 0116, 0117, 0287, 0363

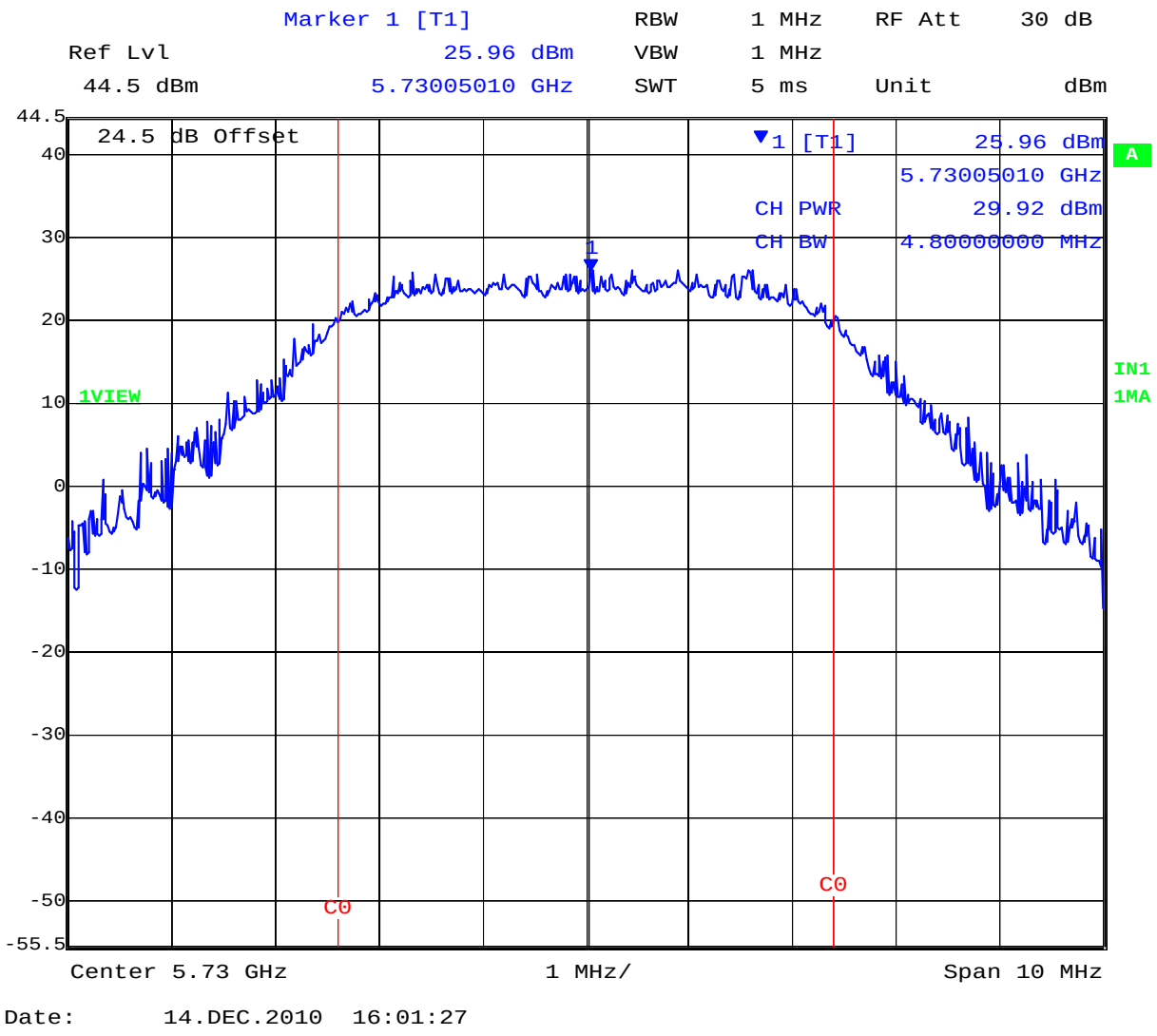
7.3.1 Measurement results for 802.11n 5MHz BPSK

Test Conditions:	15.247 (b)			**Rel. Humidity (%):**		35	to	42
Variant:	802.11n 5MHz BPSK			**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:**		0	dBi	
Applied Voltage:	48V	Vdc						

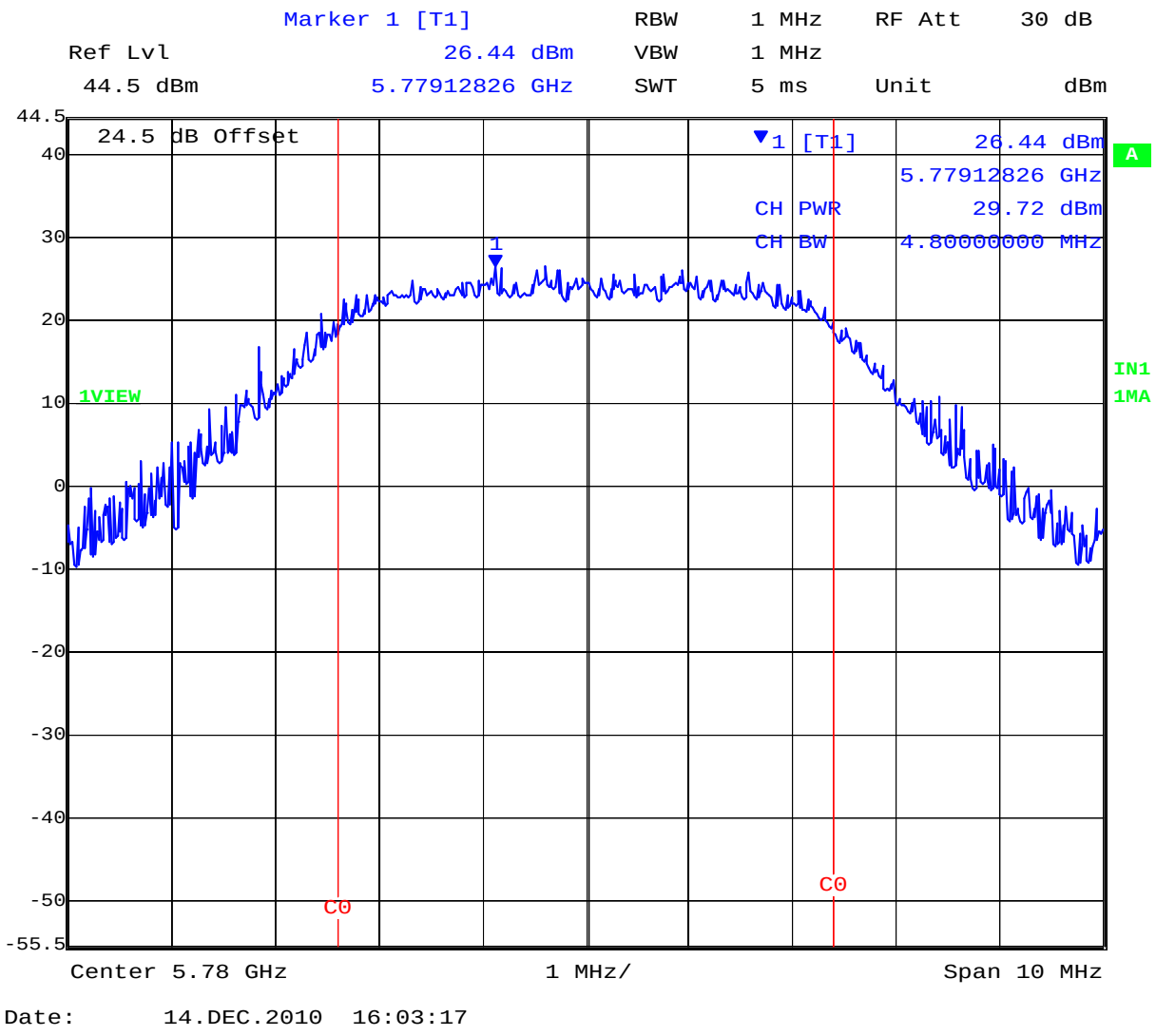
Test Frequency	Total Power Combined	Limit	Margin
MHz	**dBm**	**dBm**	**dB**
5730	29.92	30.00	-0.08
5780	29.72	30.00	-0.28
5845	28.48	30.00	-1.52

Measurement uncertainty:	±1.33 dB

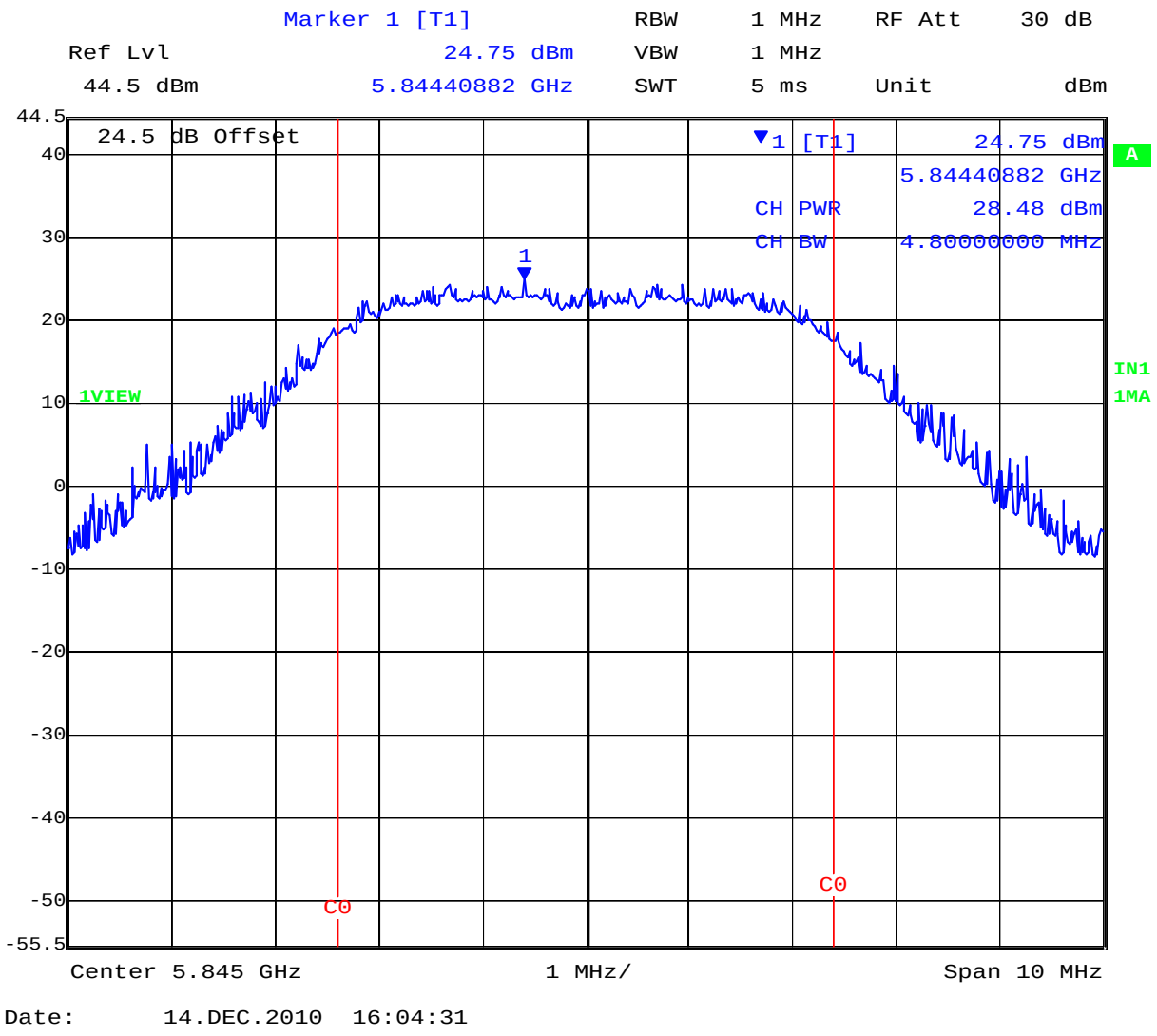
5 MHz BPSK Pk Pwr 5730 MHz combined



5 MHz BPSK Pk Pwr 5780 MHz combined



5 MHz BPSK Pk Pwr 5845 MHz combined



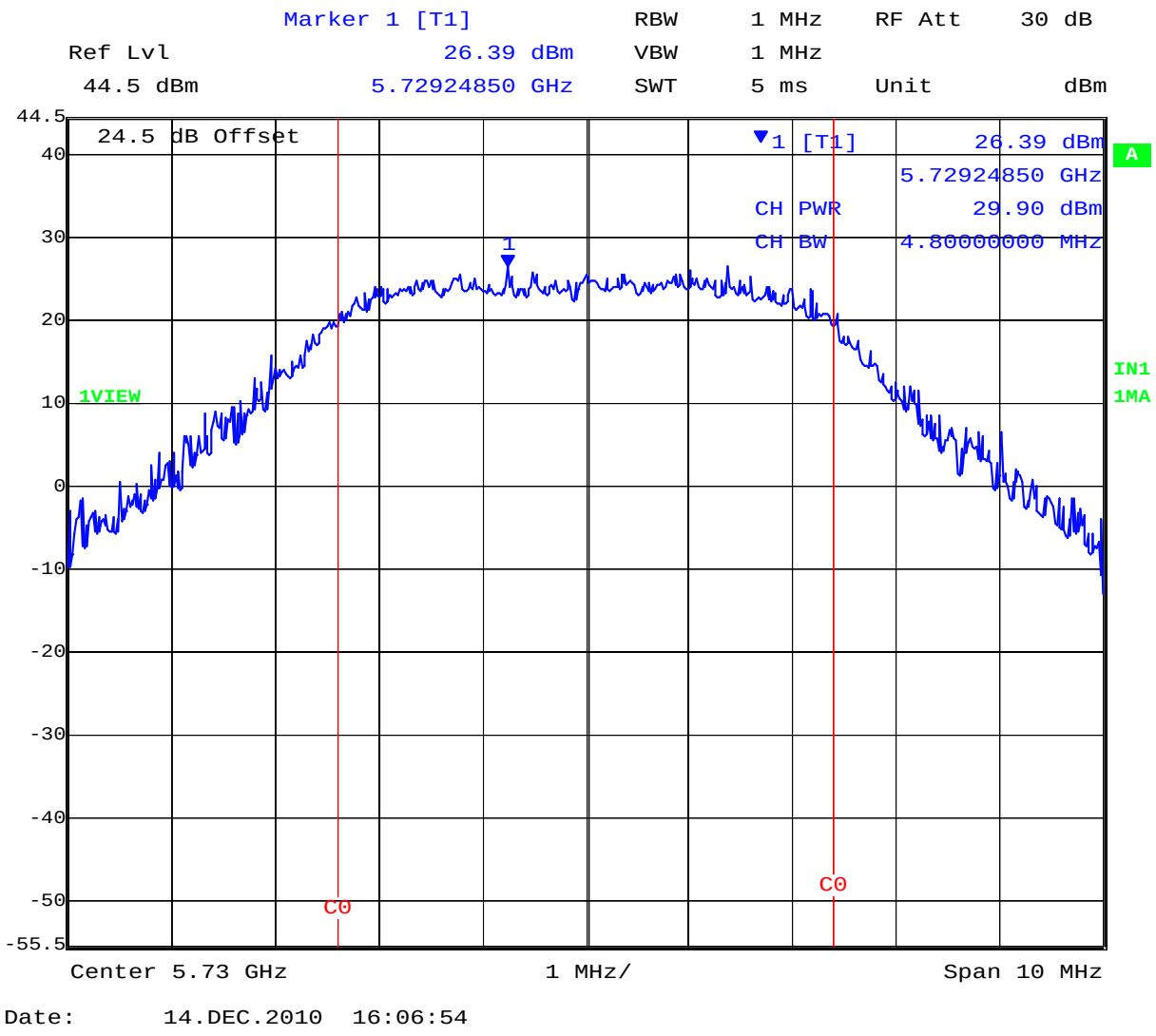
7.3.2 Measurement results for 802.11n 5MHz 64QAM

Test Conditions:	15.247 (b)			**Rel. Humidity (%):**		35	to	42
Variant:	802.11n 5MHz 64QAM			**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:**		0	dBi	
Applied Voltage:	48V	Vdc						

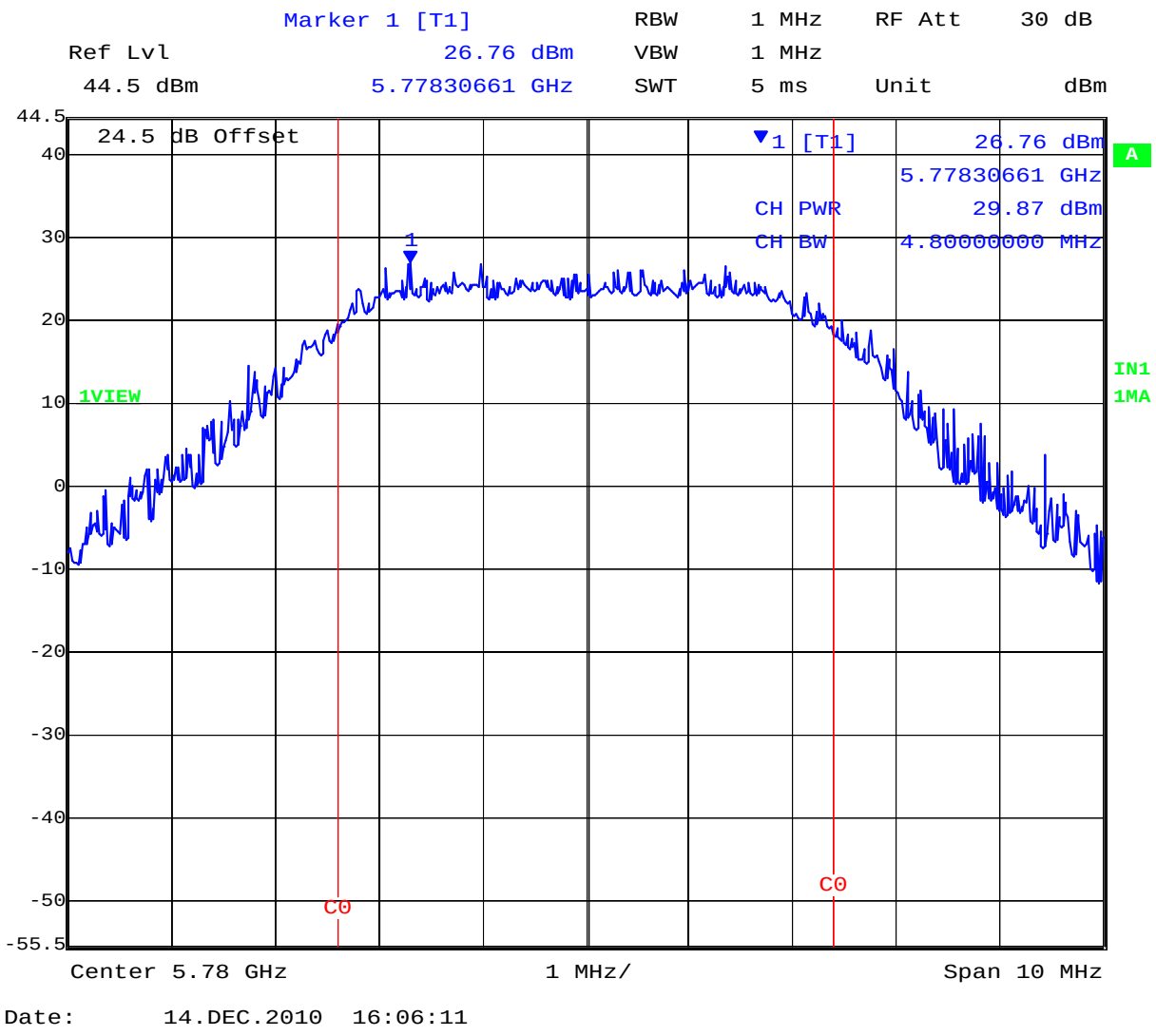
Test Frequency	Total Power Combined	Limit	Margin
MHz	**dBm**	**dBm**	**dB**
5730	29.90	30.00	-0.10
5780	29.87	30.00	-0.13
5845	29.12	30.00	-0.88

Measurement uncertainty:	±1.33 dB

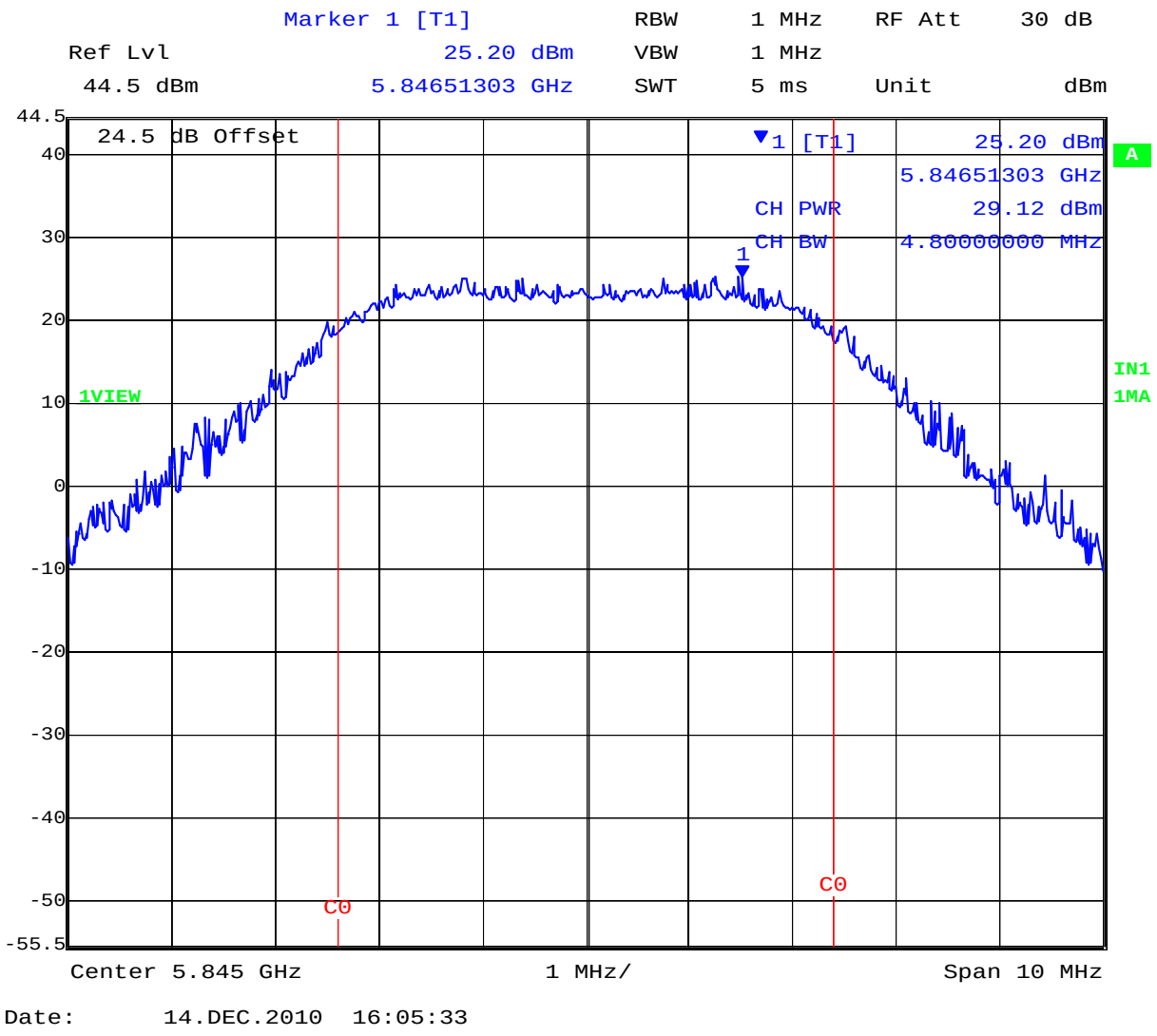
5 MHz 64QAM Pk Pwr 5730 MHz combined



5 MHz 64QAM Pk Pwr 5780 MHz combined



5 MHz 64QAM Pk Pwr 5845 MHz combined



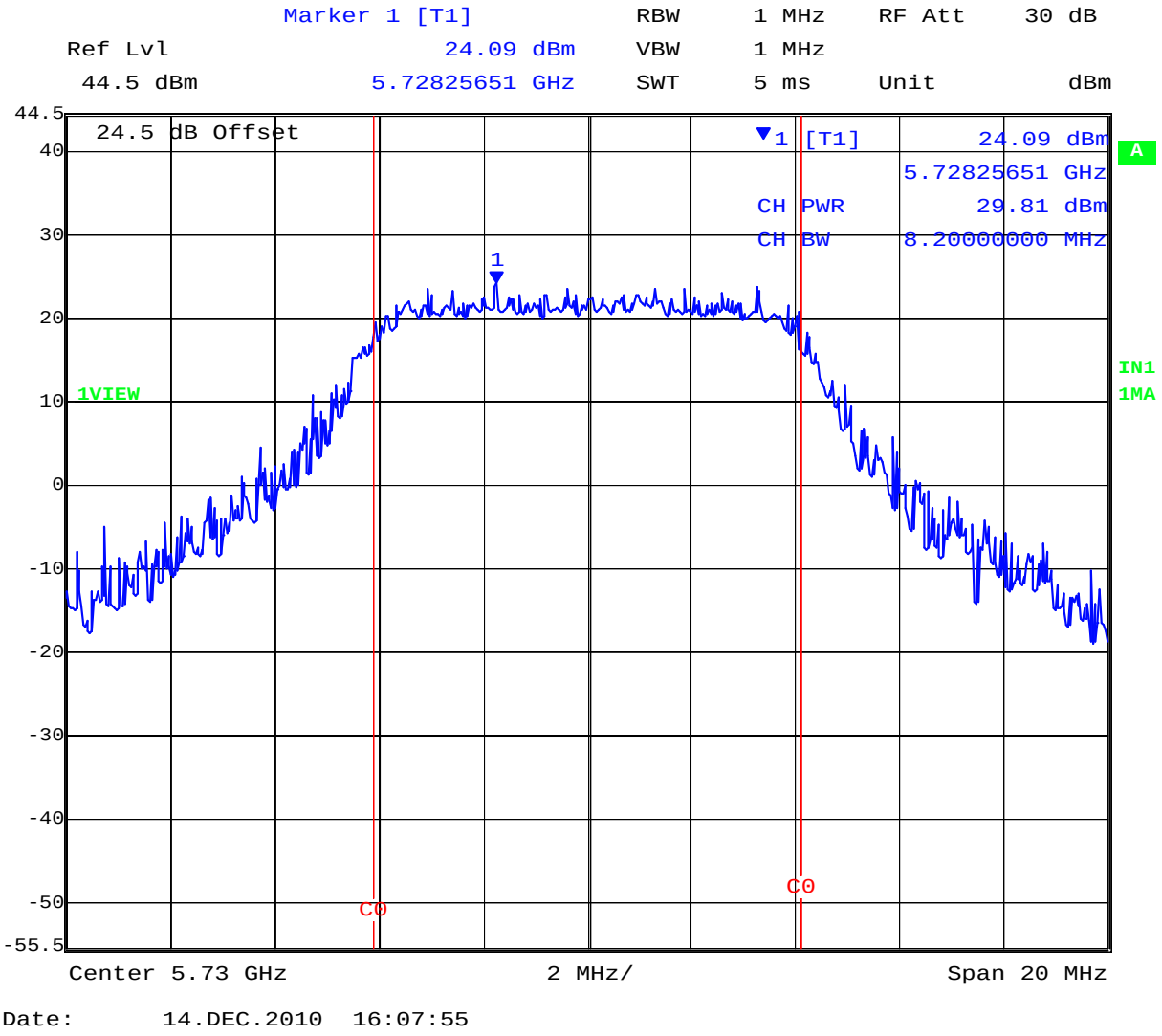
7.3.3 Measurement results for 802.11n 10MHz BPSK

Test Conditions:	15.247 (b)			**Rel. Humidity (%):**		35	to	42
Variant:	802.11n 10MHz BPSK			**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:**		0	dBi	
Applied Voltage:	48V	Vdc						

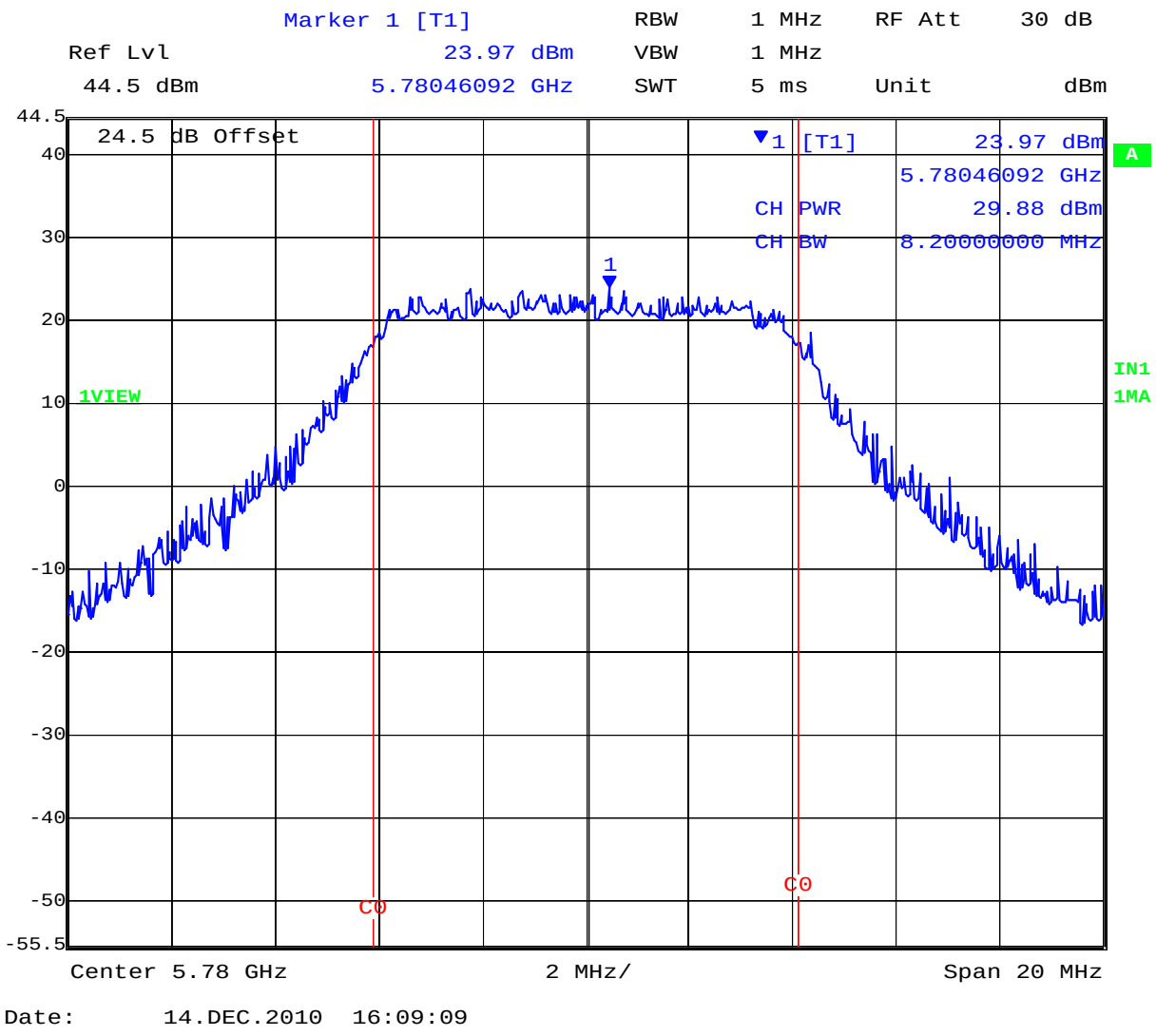
Test Frequency	Total Power Combined	Limit	Margin
MHz	**dBm**	**dBm**	**dB**
5730	29.81	30.00	-0.19
5780	29.88	30.00	-0.12
5845	28.79	30.00	-1.21

Measurement uncertainty:	±1.33 dB

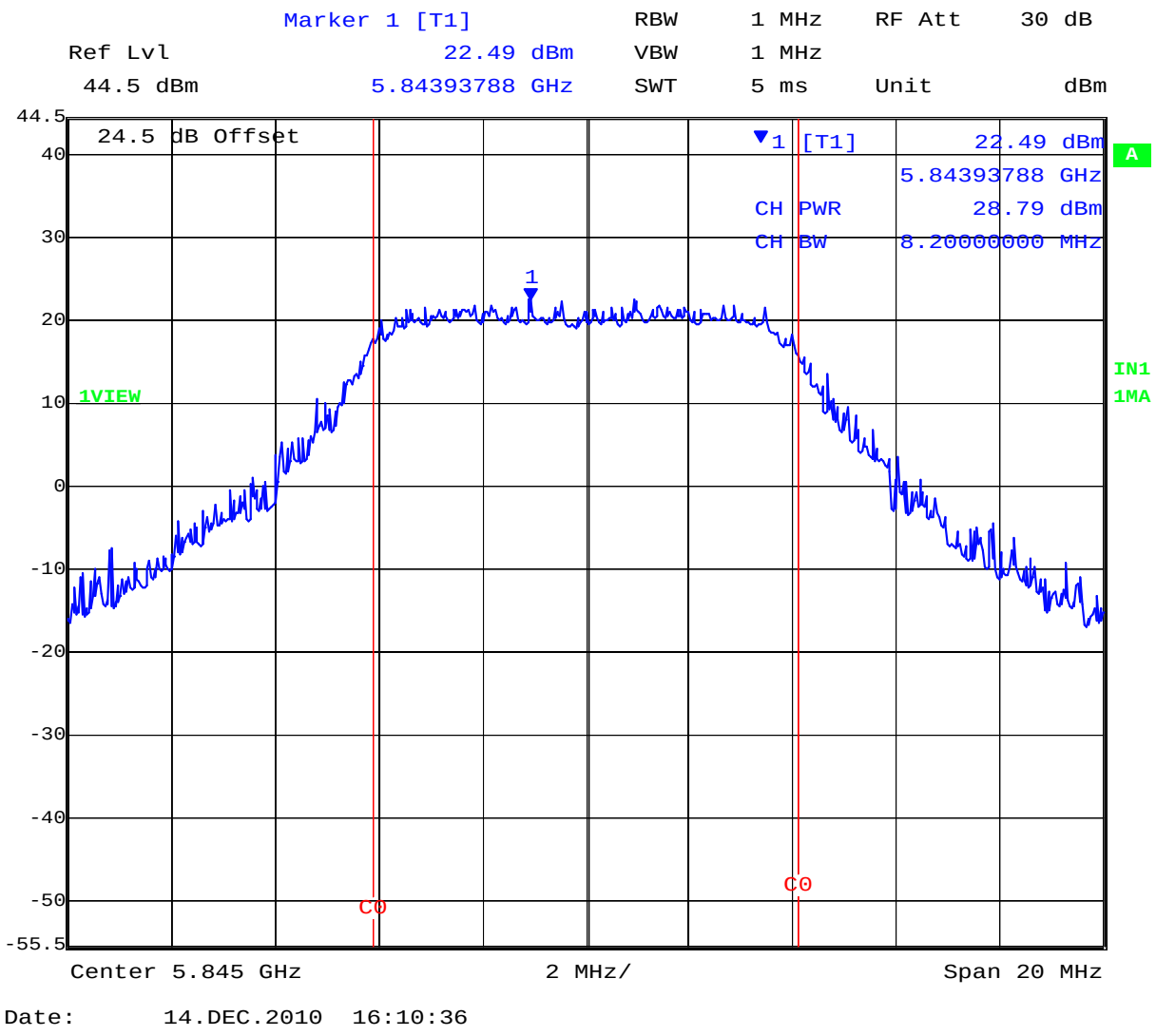
10 MHz BPSK Pk Pwr 5730 MHz combined



10 MHz BPSK Pk Pwr 5780 MHz combined



10 MHz BPSK Pk Pwr 5845 MHz combined



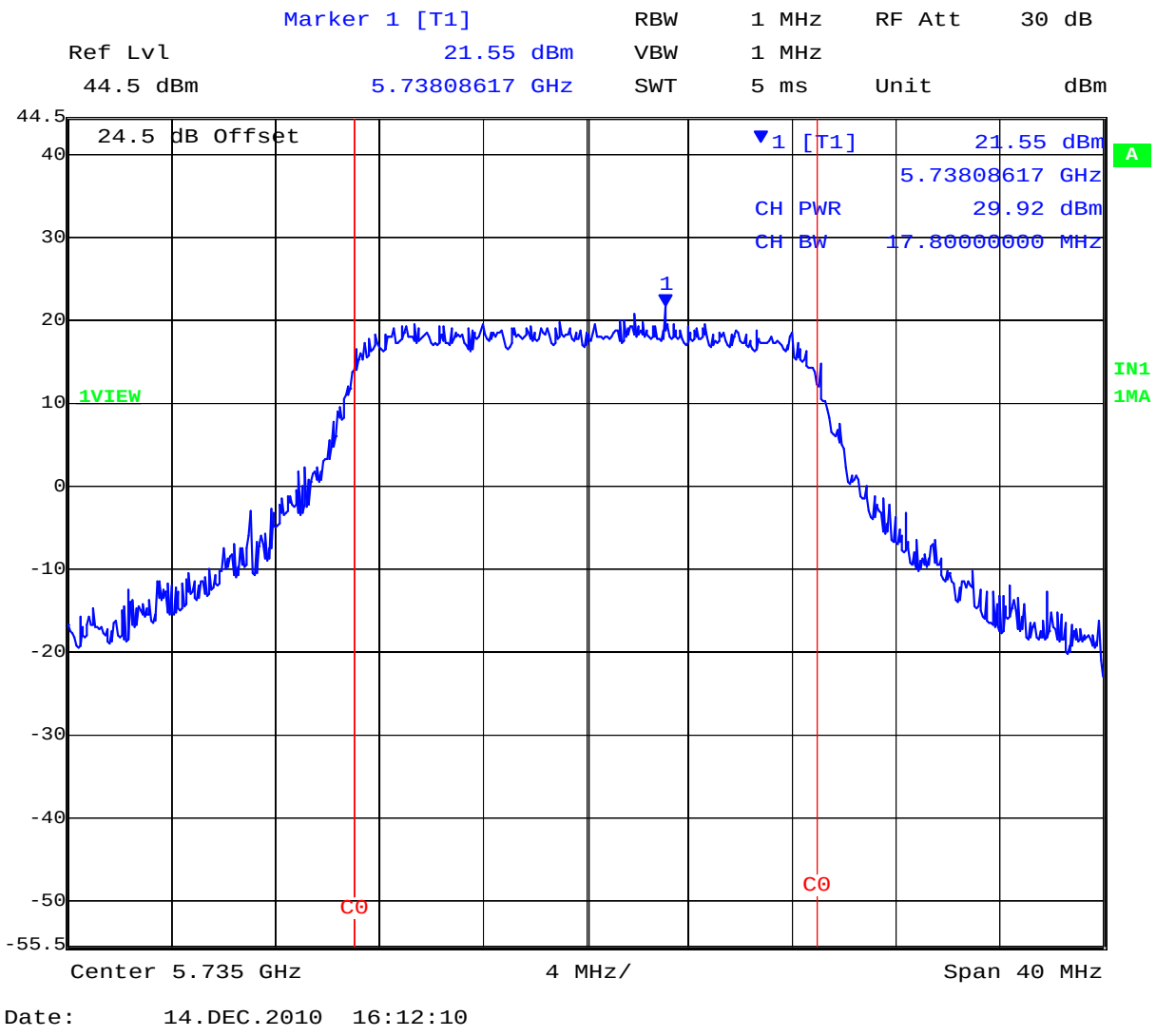
7.3.4 Measurement results for 802.11n 20MHz BPSK

Test Conditions:	15.247 (b)			**Rel. Humidity (%):**		35	to	42
Variant:	802.11n 20MHz BPSK			**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:**		0	dBi	
Applied Voltage:	48V	Vdc						

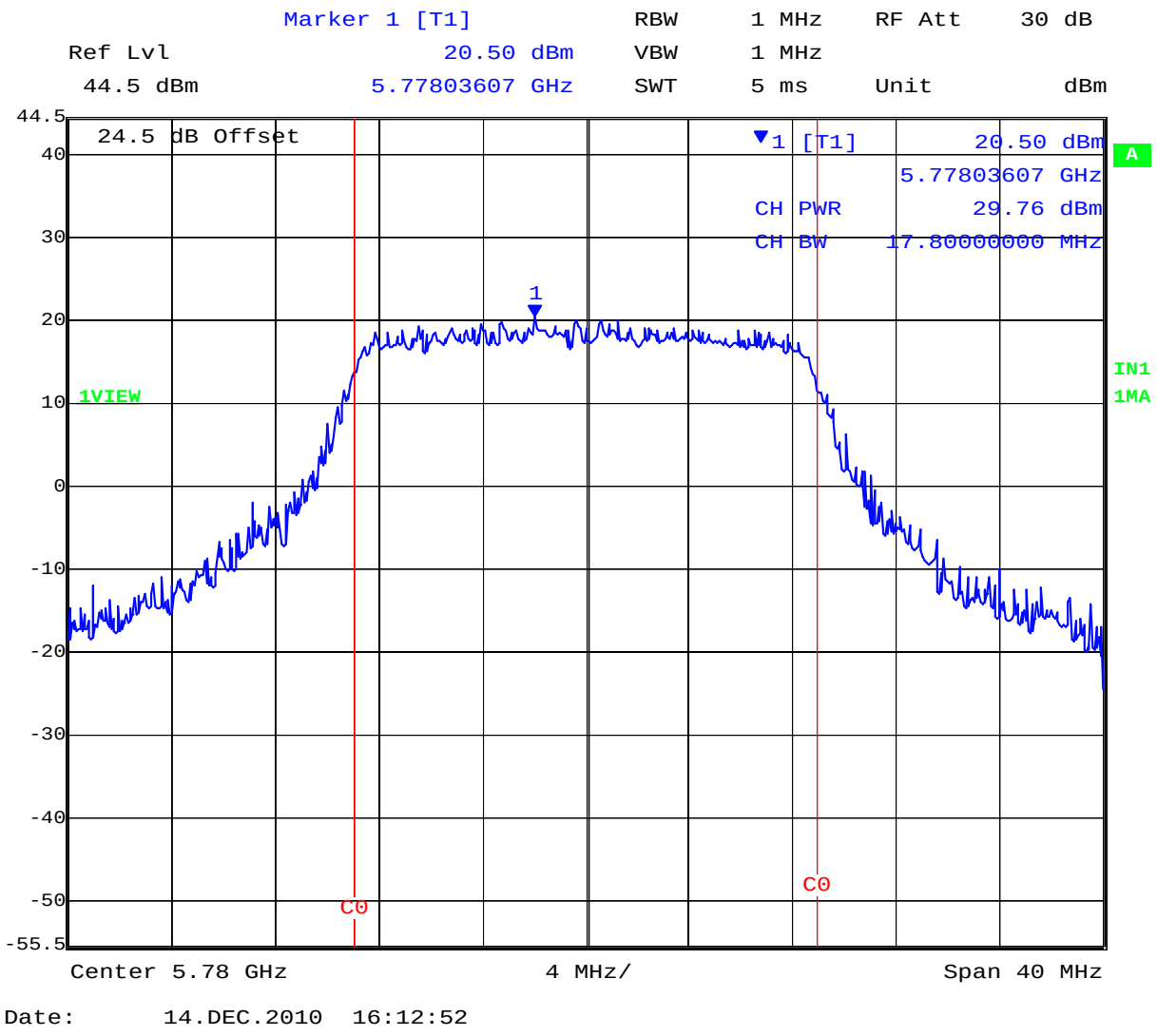
Test Frequency	Total Power Combined	Limit	Margin
MHz	**dBm**	**dBm**	**dB**
5735	29.92	30.00	-0.08
5780	29.76	30.00	-0.24
5840	28.52	30.00	-1.48

Measurement uncertainty:	±1.33 dB

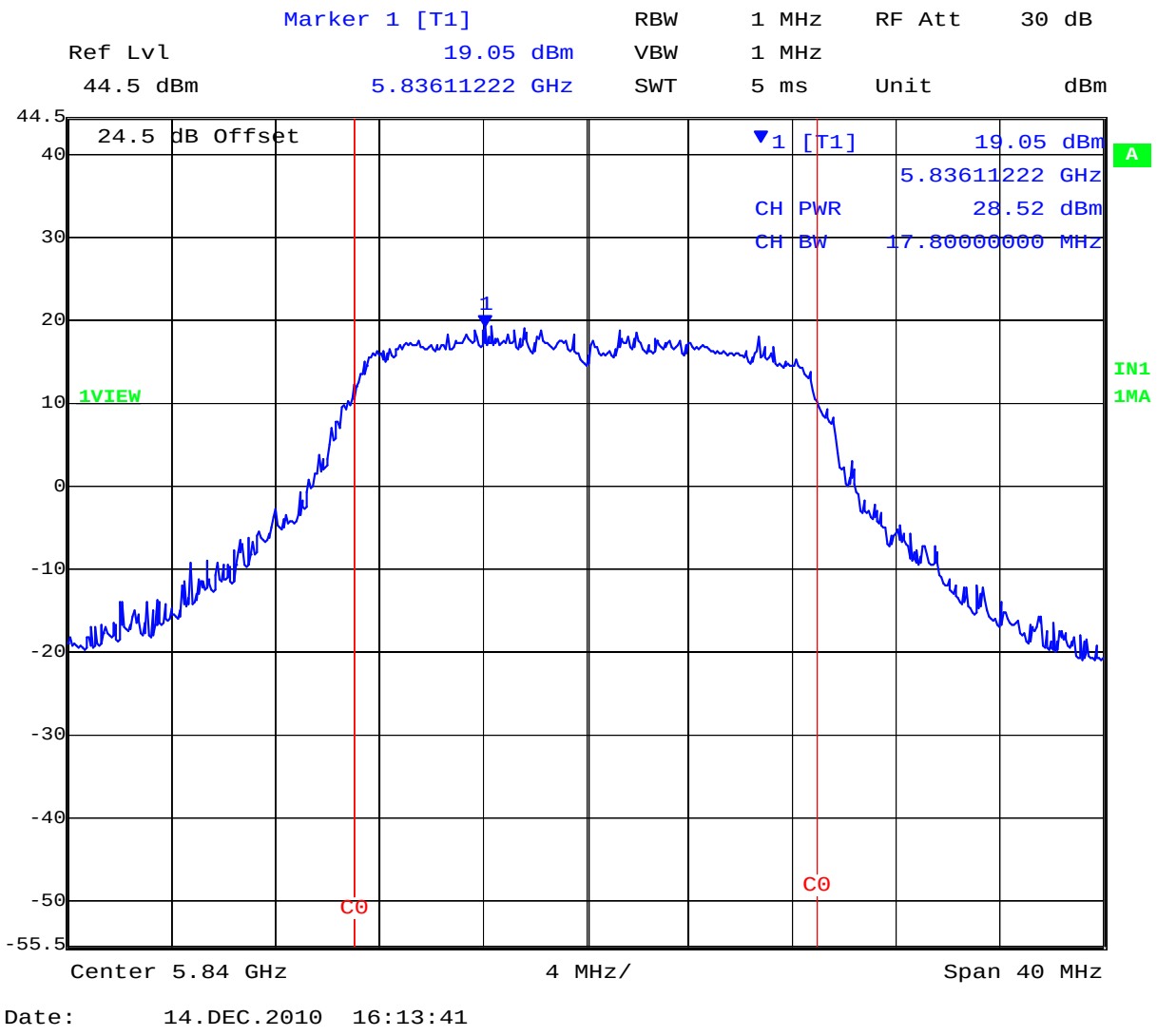
20 MHz BPSK Pk Pwr 5735 MHz combined



20 MHz BPSK Pk Pwr 5780 MHz combined



20 MHz BPSK Pk Pwr 5840 MHz combined



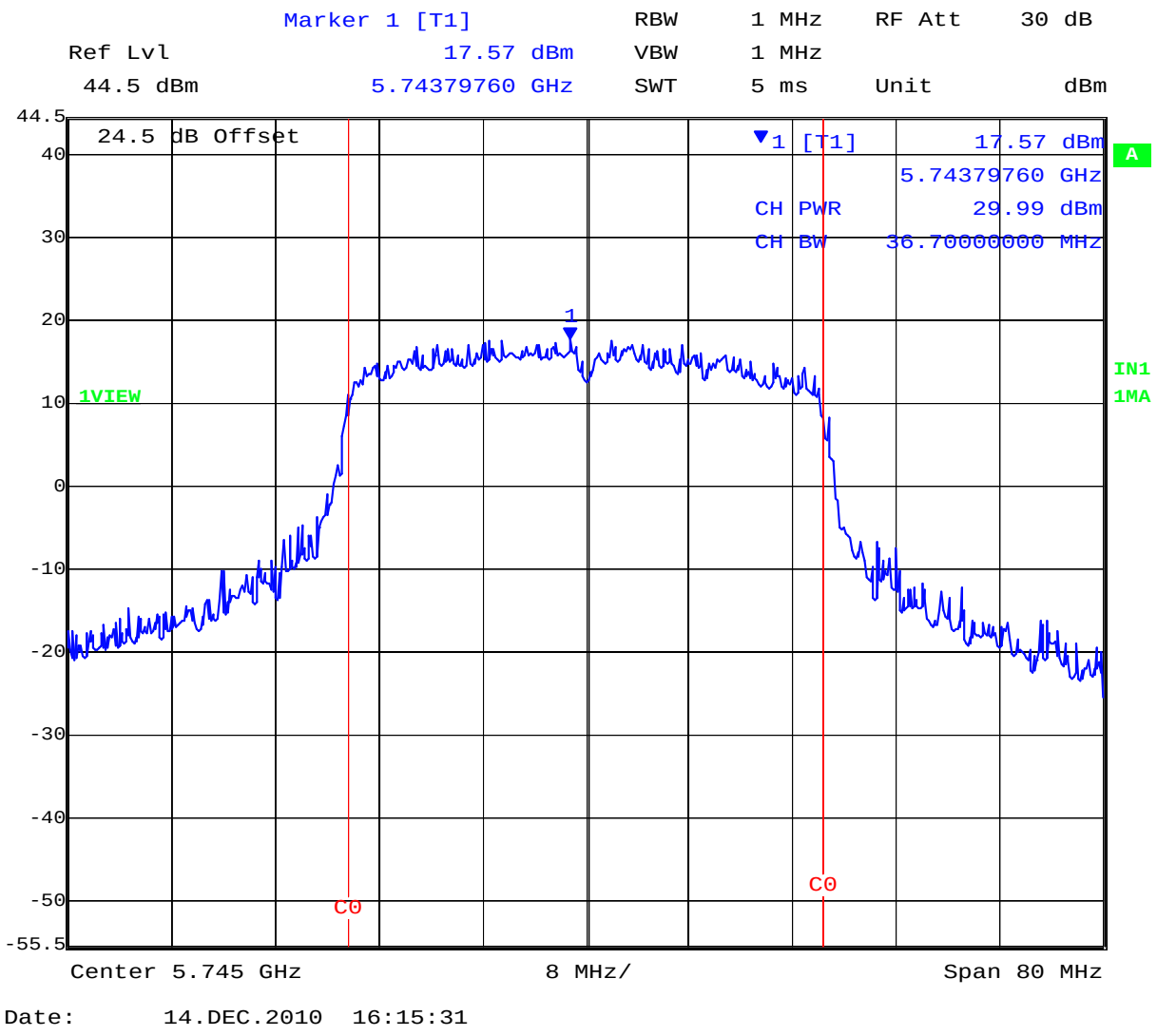
7.3.5 Measurement results for 802.11n 40MHz BPSK

Test Conditions:	15.247 (b)			**Rel. Humidity (%):**		35	to	42
Variant:	802.11n 40MHz BPSK			**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:**		0	dBi	
Applied Voltage:	48V	Vdc						

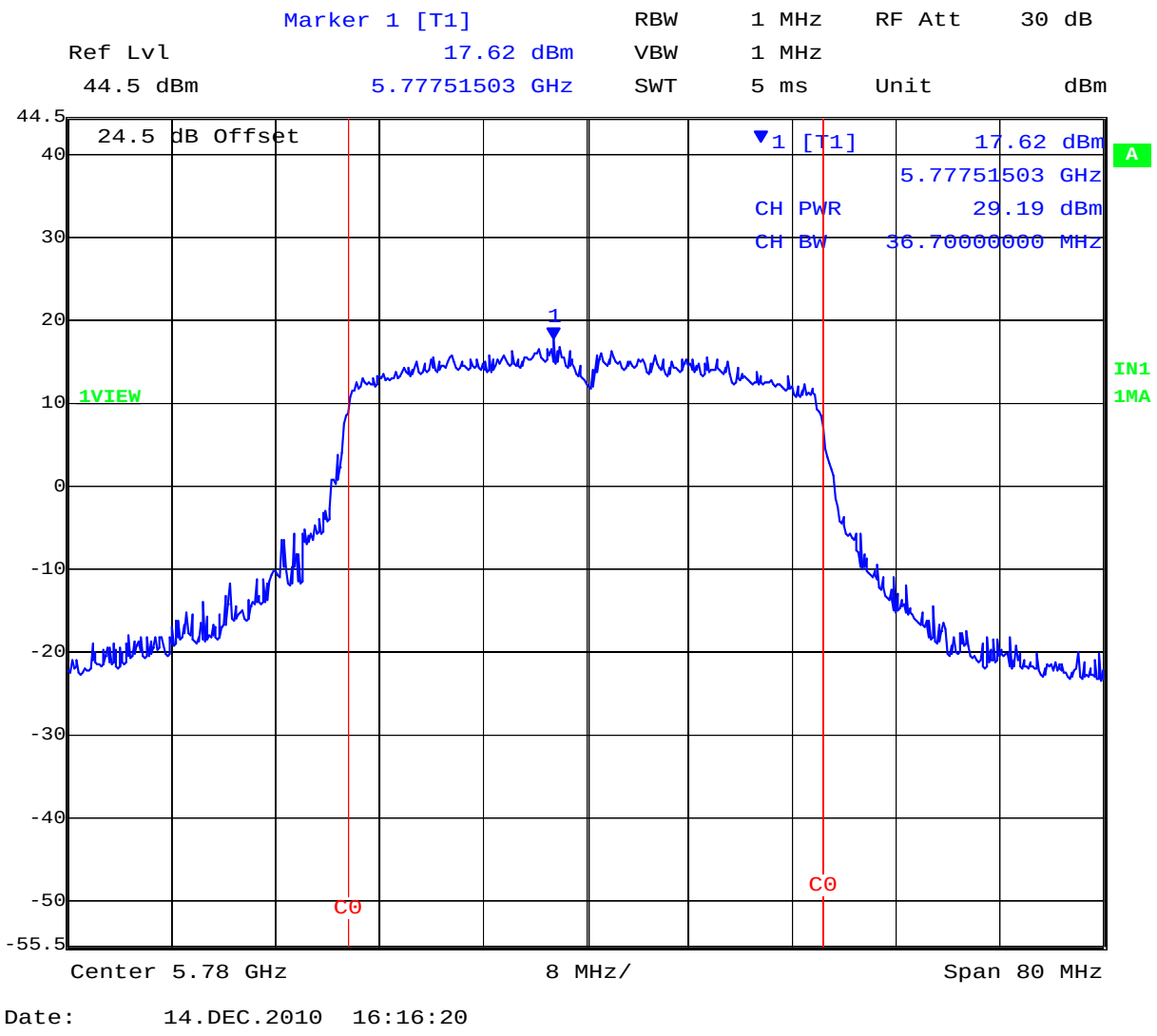
Test Frequency	Total Power Combined	Limit	Margin
MHz	**dBm**	**dBm**	**dB**
5745	29.99	30.00	-0.01
5780	29.19	30.00	-0.81
5840	28.20	30.00	-1.80

Measurement uncertainty:	±1.33 dB

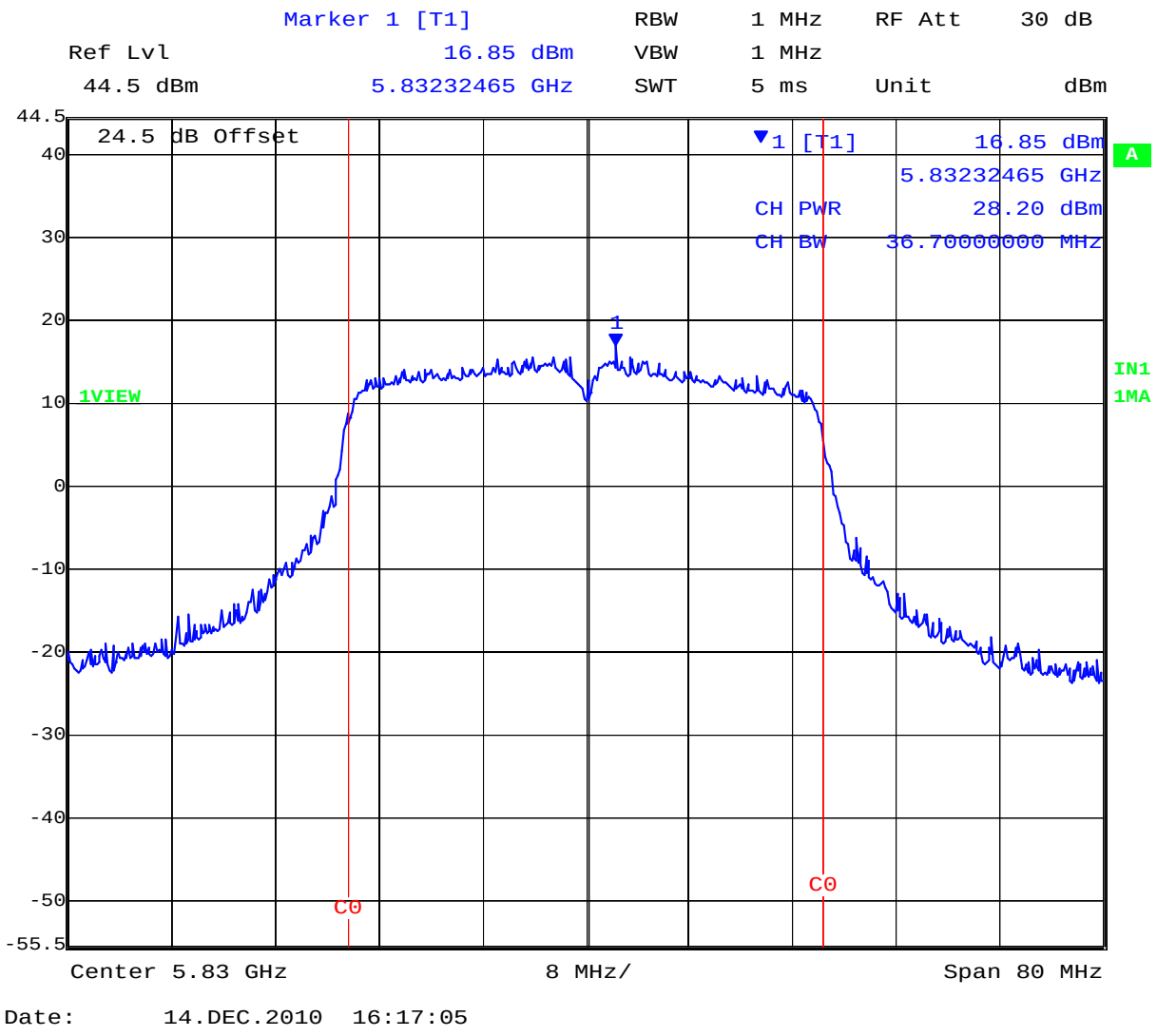
40 MHz BPSK Pk Pwr 5745 MHz combined



40 MHz BPSK Pk Pwr 5780 MHz combined



40 MHz BPSK Pk Pwr 5830 MHz combined



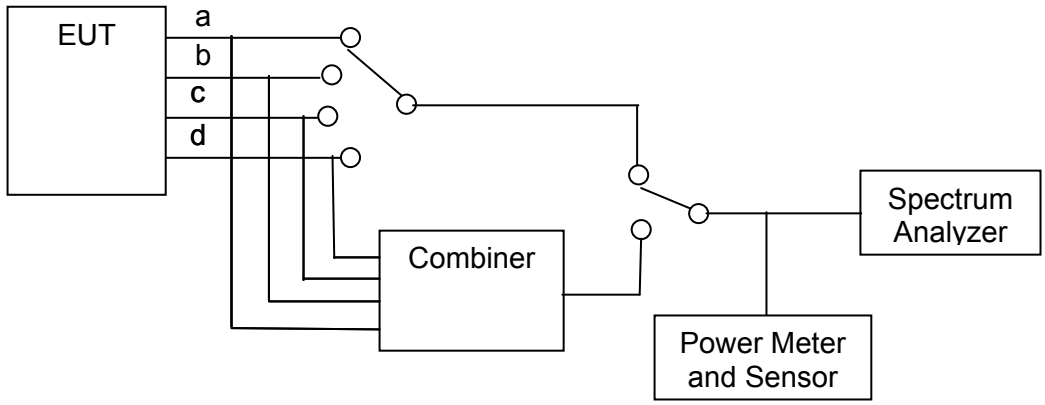
7.4 Peak Power Spectral Density

Test Procedure

The test methodology and conditions utilized for each measurement is referenced in the following test results matrix. RF output power, transmit power control and power density were measured per the Test Configuration identified below.

Per the standard measurements were taken at ambient and extreme temperature conditions at nominal and extreme voltage levels.

Test Configuration



Measurement set-up for Peak Power Spectral Density

Specification

§15.247 (e): For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission

Traceability

Method	Test Equipment Used
WI-01	0158, 0252, 0313, 0314, 0223, 0116, 0117, 0287, 0363

Note: Peak Power Spectral Density results are only presented for the modulation types with the highest spectral density. 20 MHz and 40 MHz wide modulations which demonstrate a lower spectral density were limited in output by Peak Output Power limits.

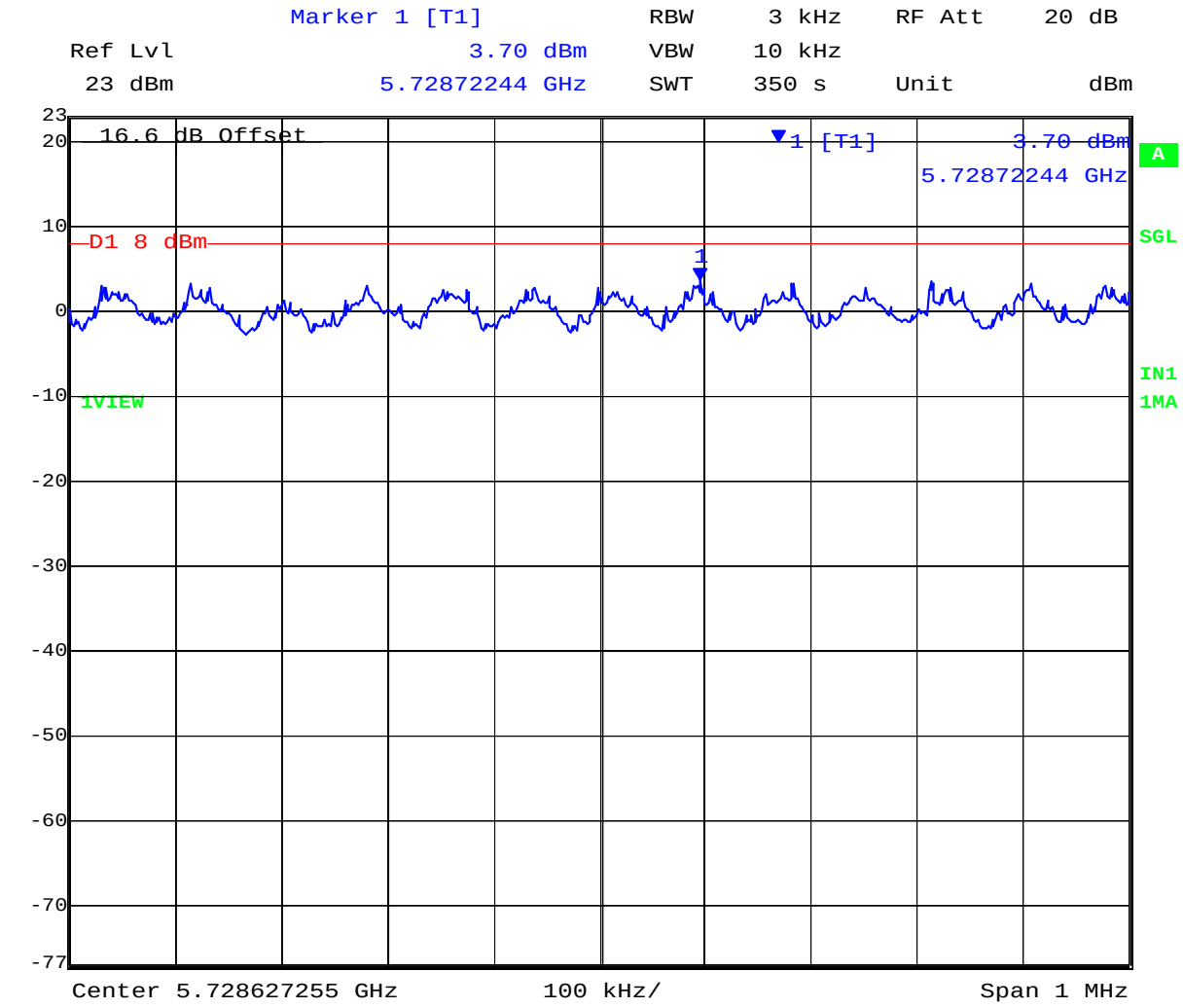
7.4.1 Measurement results for 802.11n 5MHz BPSK

Test Conditions:	15.247 (e)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 5MHz BPSK	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain	N/A dB	**Antenna Gain:**	0 dBi
Applied Voltage:	48V Vdc		
Notes 1:			
Notes 2:			

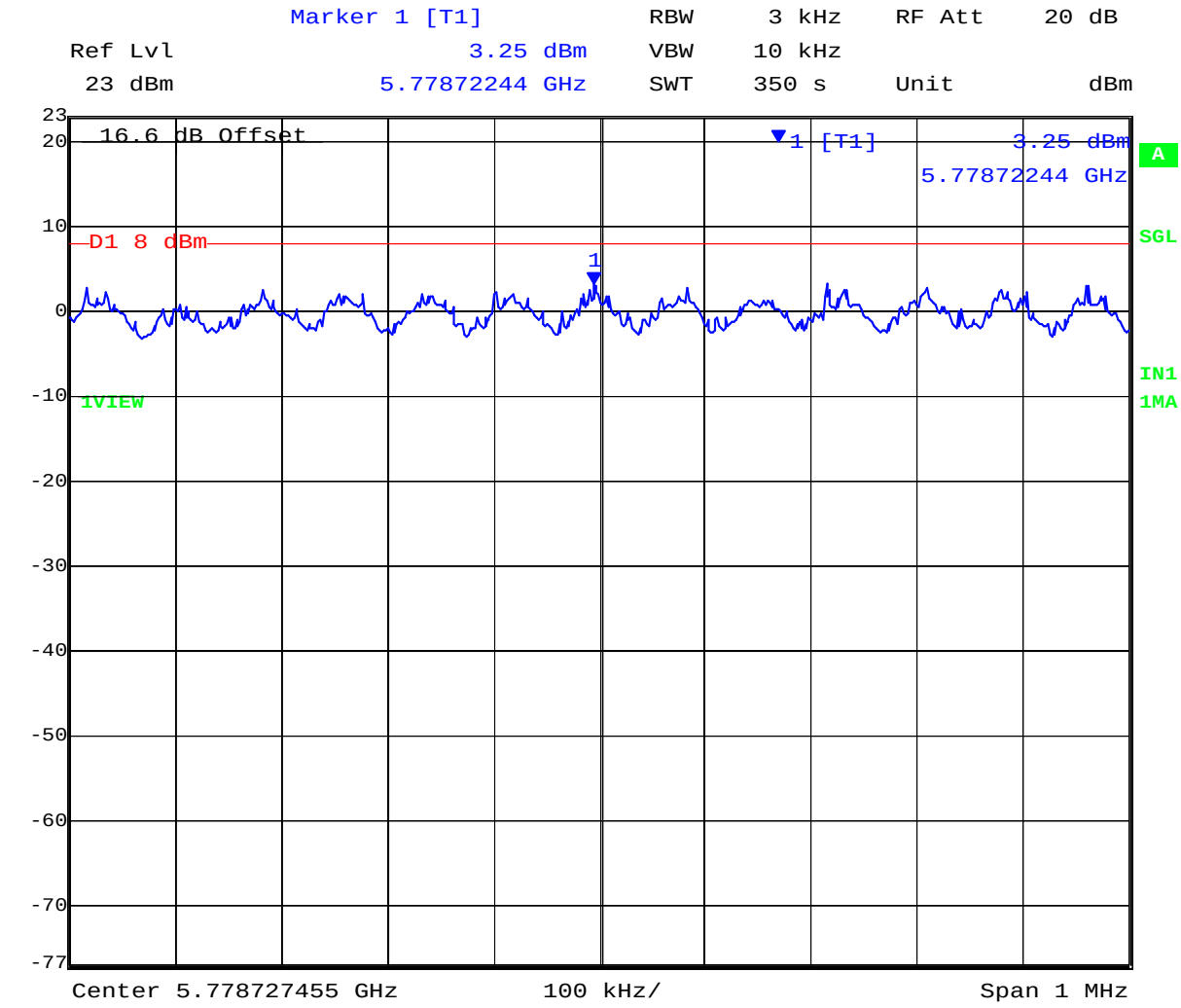
Test Frequency	Measured Power Density RF Port (dBm)				Total Peak Power Spectral Density (dBm)		Limit	Margin
MHz	a	b	c	d	Combined	Calculated	dBm	dB
5730.000	3.70	0.62	--	--		5.44	8.00	-2.56
5780.000	3.25	2.57	--	--		5.93	8.00	-2.07
5845.000	1.53	2.66	--	--		5.14	8.00	-2.86

Measurement uncertainty:	± 1.33 dB

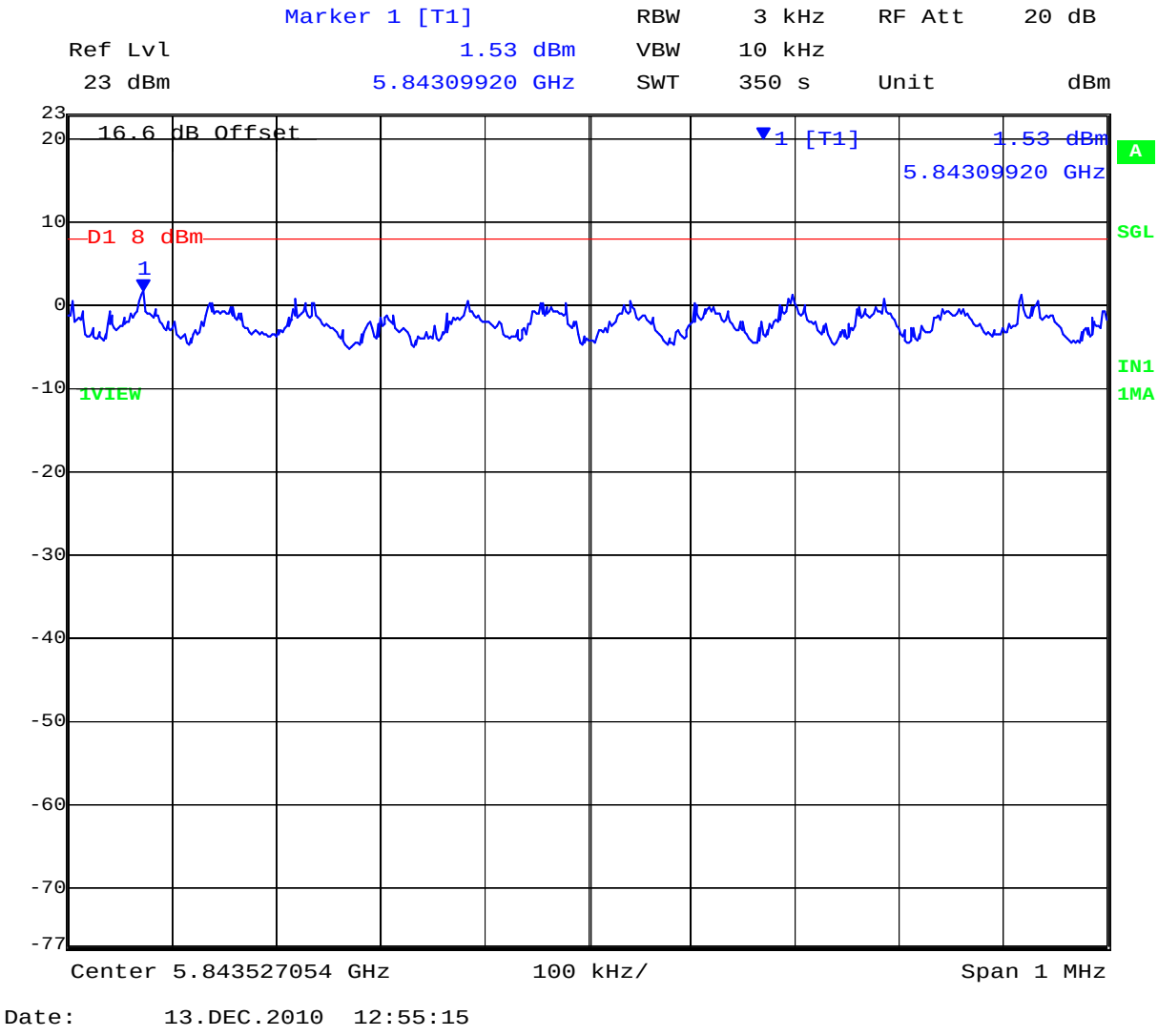
Chain a: Power Density Ambient 5730MHz 48.00V 21.55dBm



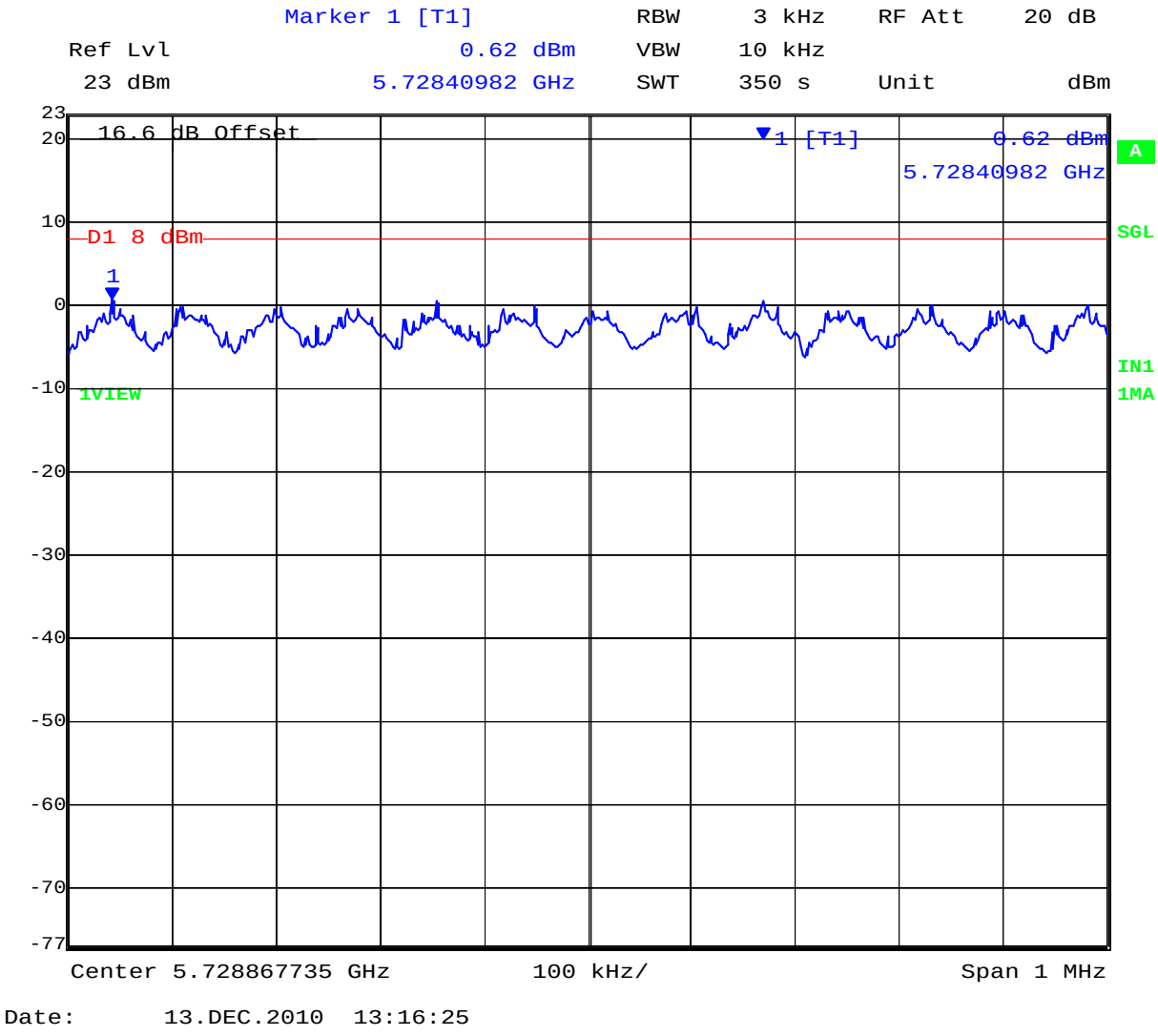
Chain a: Power Density Ambient 5780MHz 48.00V 21.07dBm



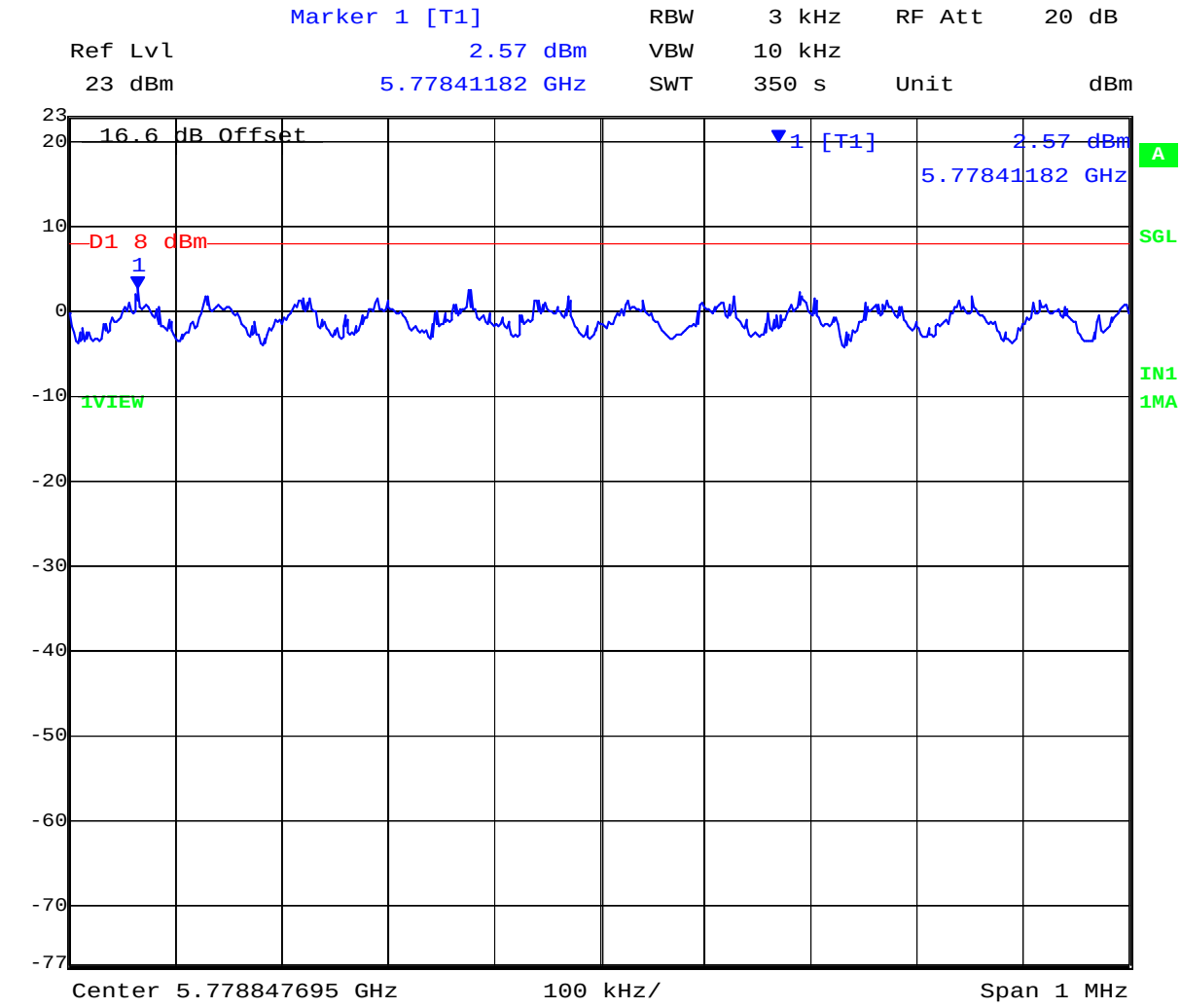
Chain a: Power Density Ambient 5845MHz 48.00V 19.08dBm



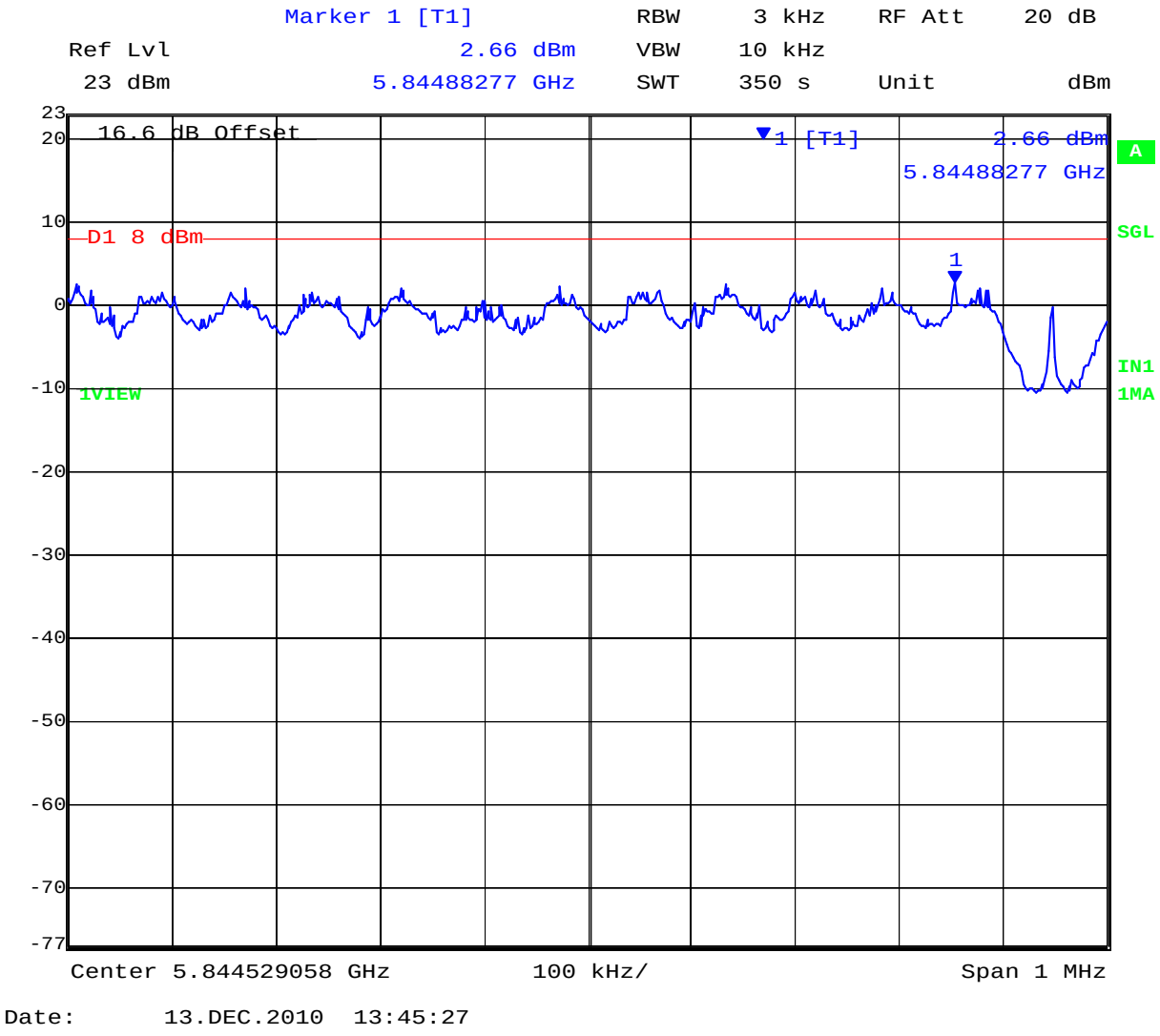
Chain b: Power Density Ambient 5730MHz 48.00V 18.37dBm



Chain b: Power Density Ambient 5780MHz 48.00V 20.27dBm



Chain b: Power Density Ambient 5845MHz 48.00V 20.36dBm



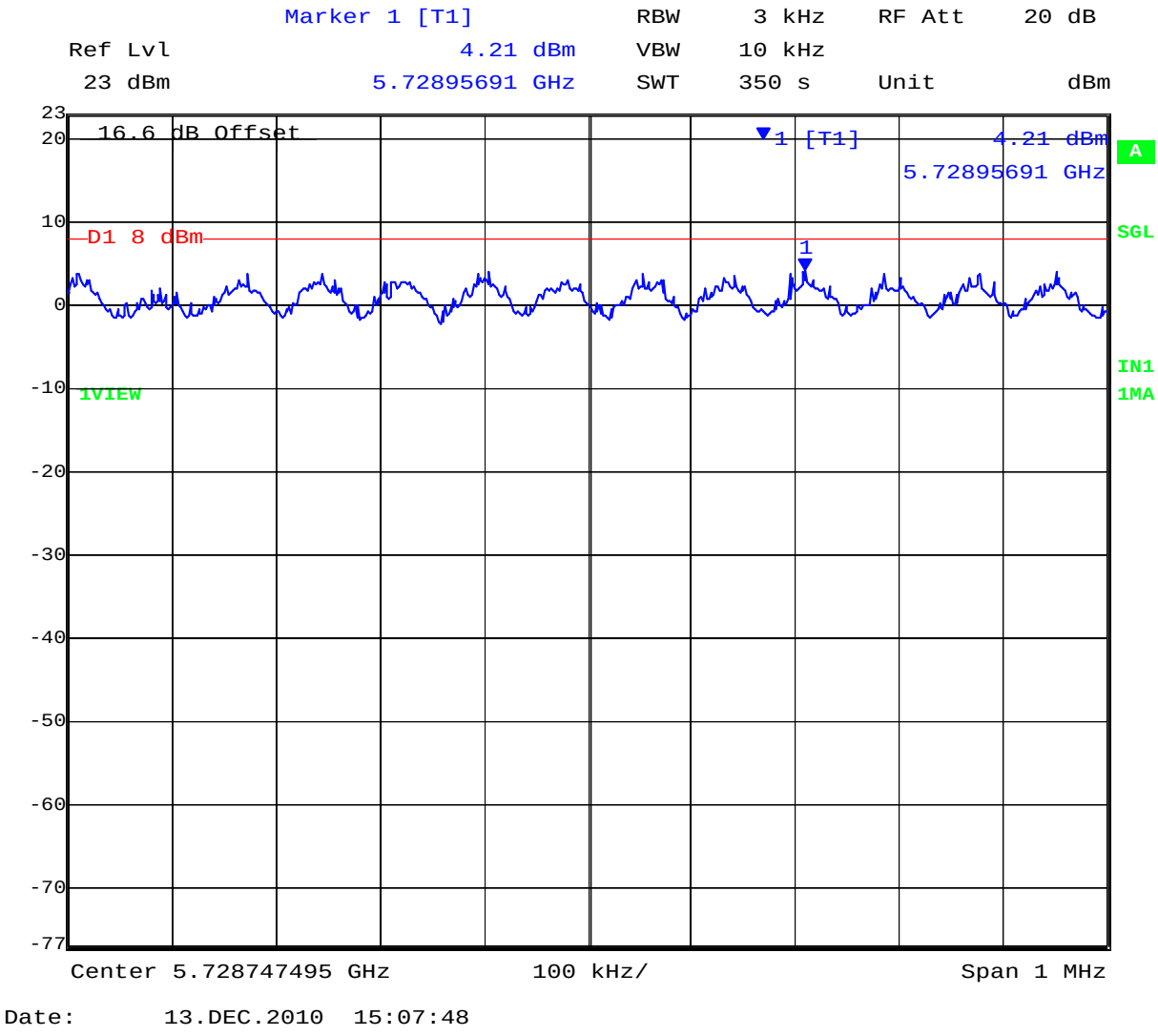
7.4.2 Measurement results for 802.11n 5MHz 64QAM

Test Conditions:	15.247 (e)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 5MHz 64QAM	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain	N/A dB	**Antenna Gain:**	0 dBi
Applied Voltage:	48V Vdc		
Notes 1:			
Notes 2:			

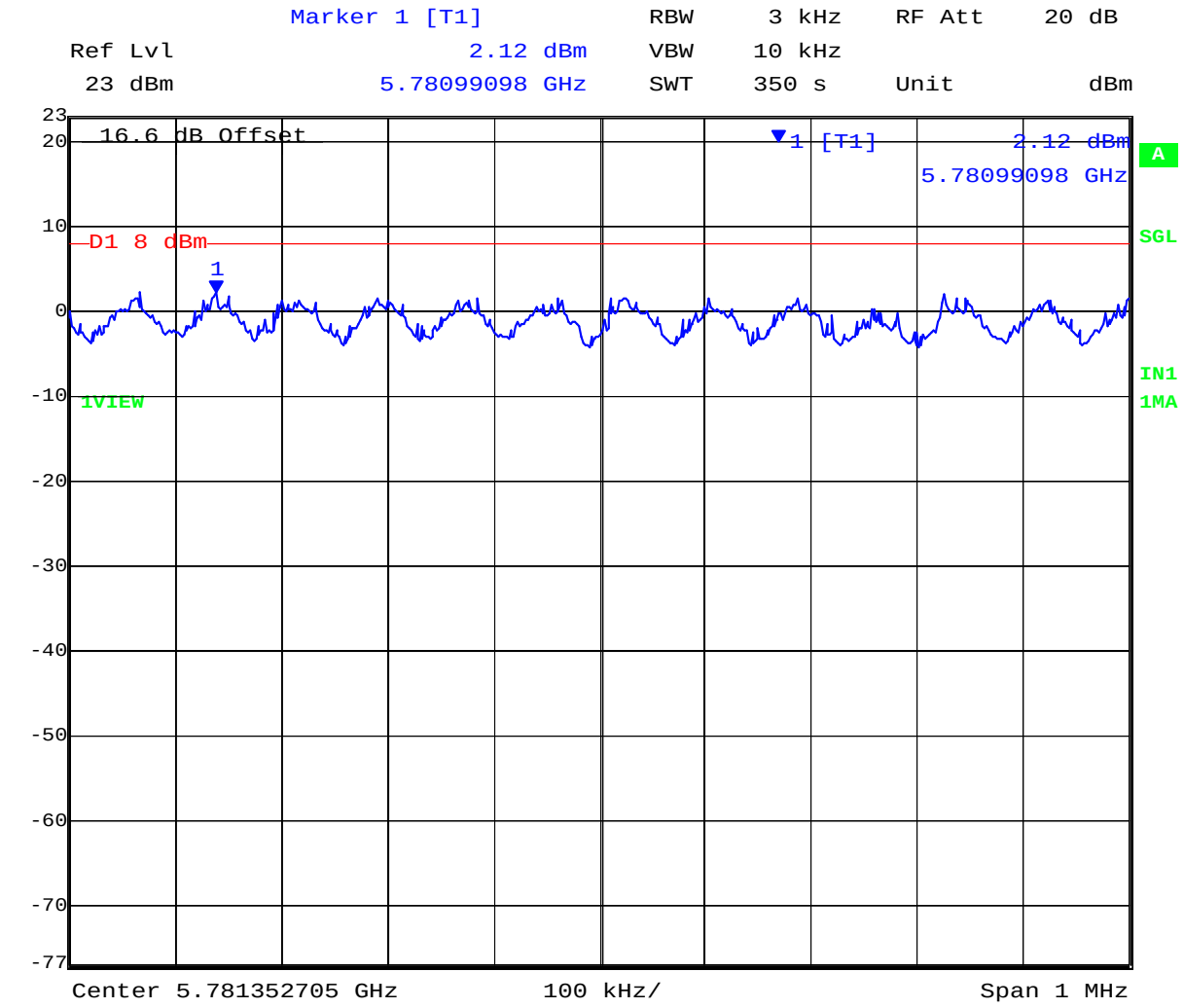
Test Frequency	Measured Power Density RF Port (dBm)				Total Peak Power Spectral Density (dBm)		Limit	Margin
MHz	**a**	**b**	**c**	**d**	**Combined**	**Calculated**	**dBm**	**dB**
5730.000	4.21	0.41	--	--		5.72	8.00	-2.28
5780.000	2.12	2.06	--	--		5.10	8.00	-2.90
5845.000	2.17	1.76	--	--		4.98	8.00	-3.02

Measurement uncertainty:	± 1.33 dB

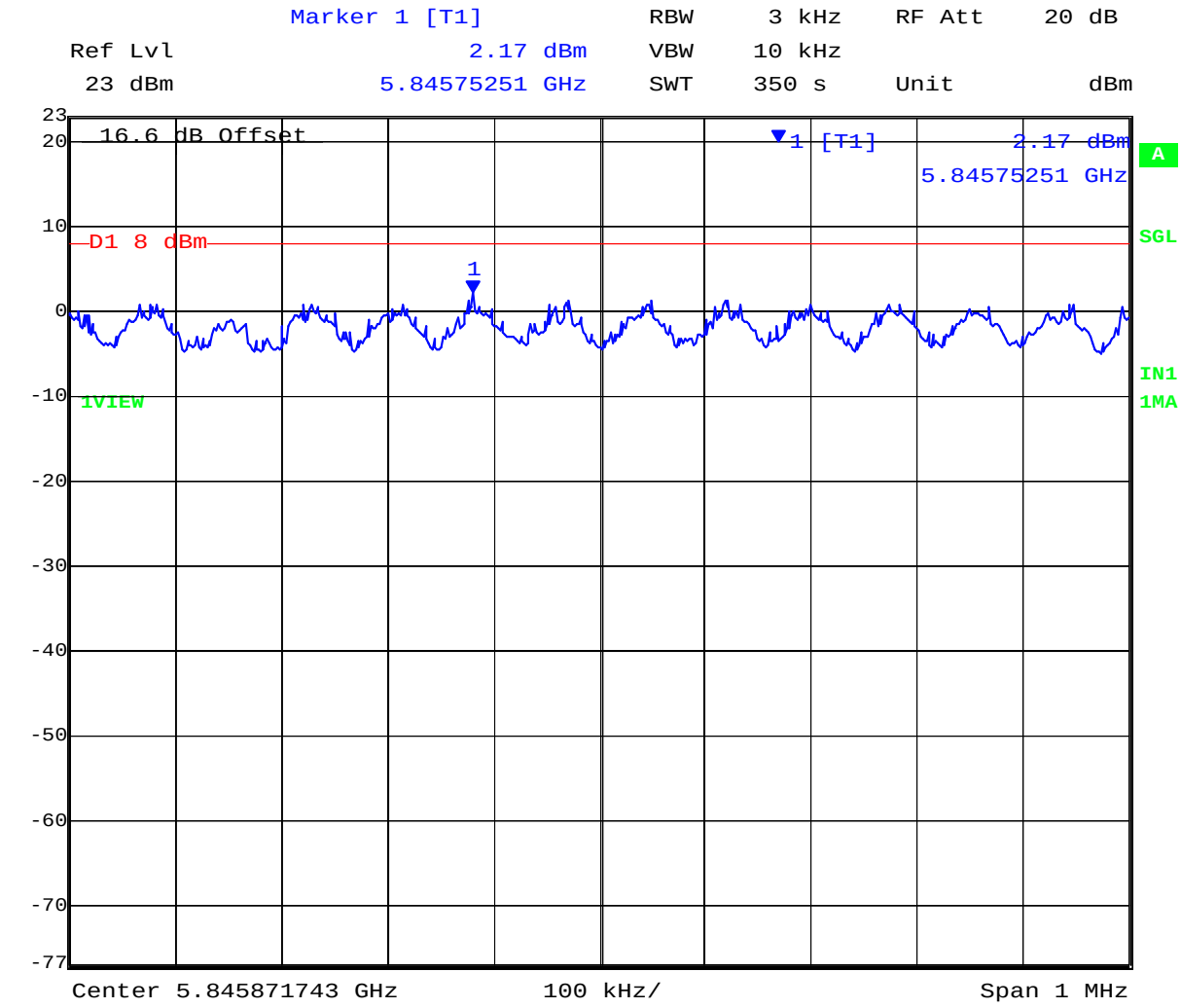
Chain a Power Density Ambient 5730MHz 48.00V 22.17dBm



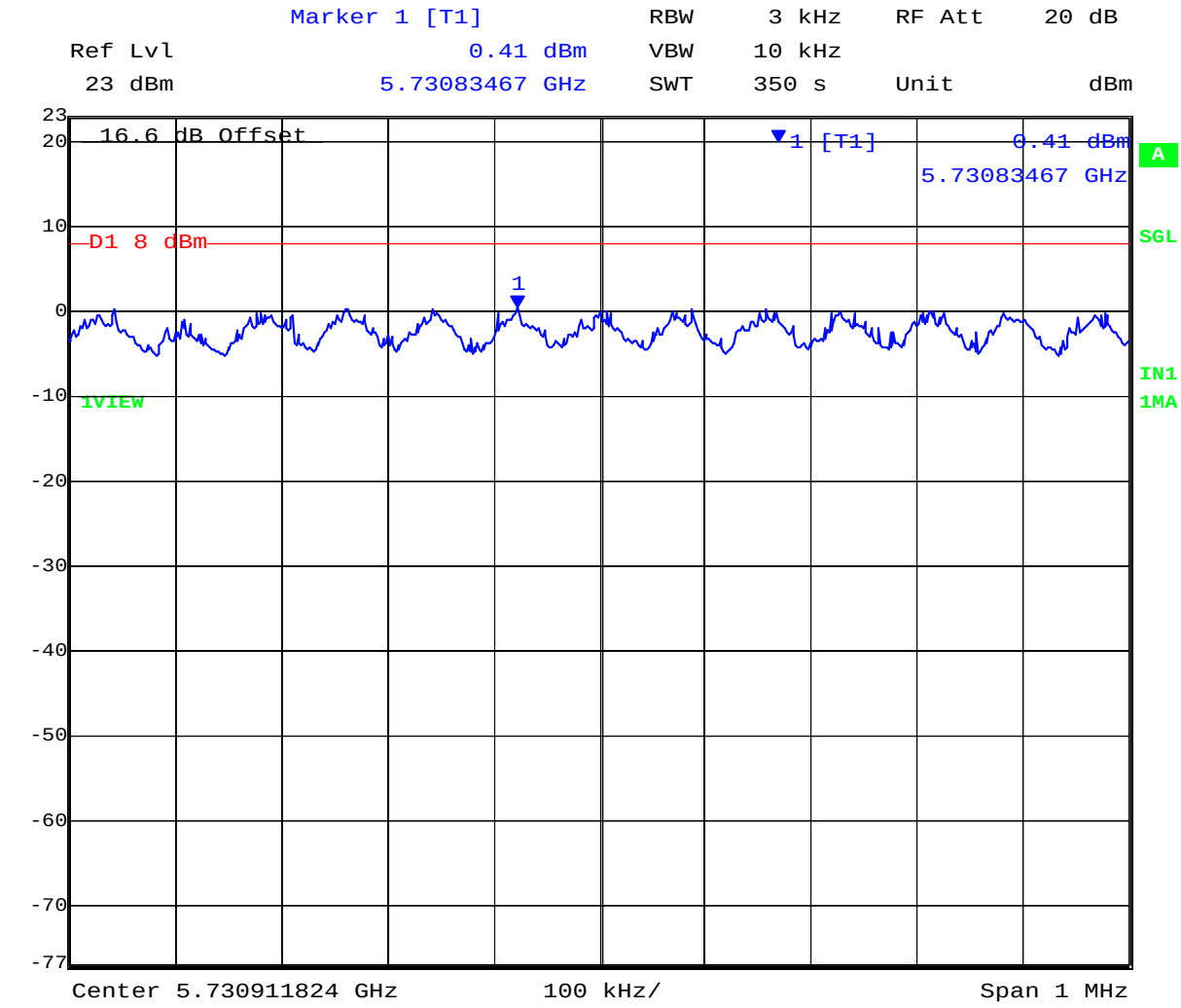
Chain a Power Density Ambient 5780MHz 48.00V 20.26dBm



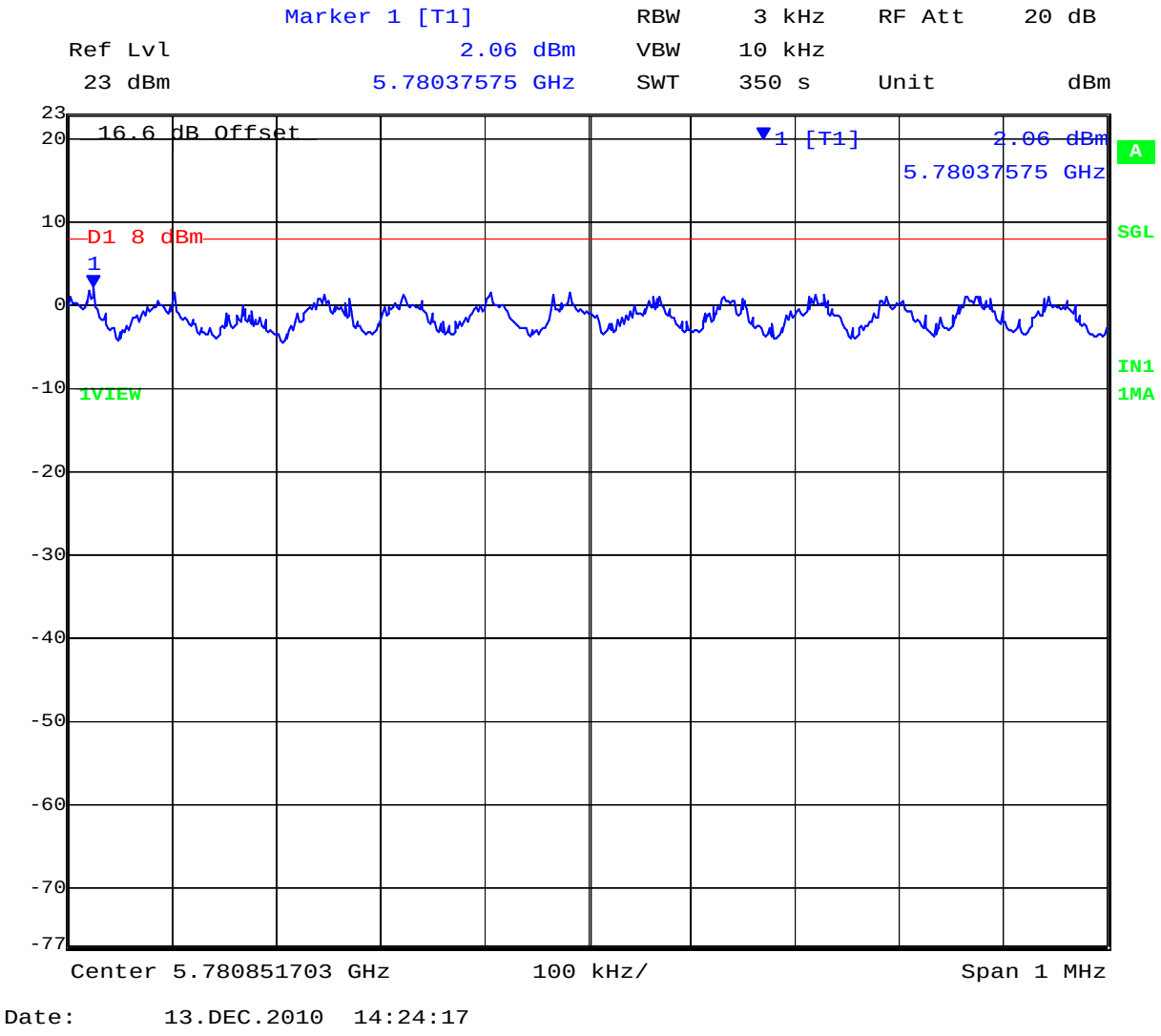
Chain a Power Density Ambient 5845MHz 48.00V 19.33dBm



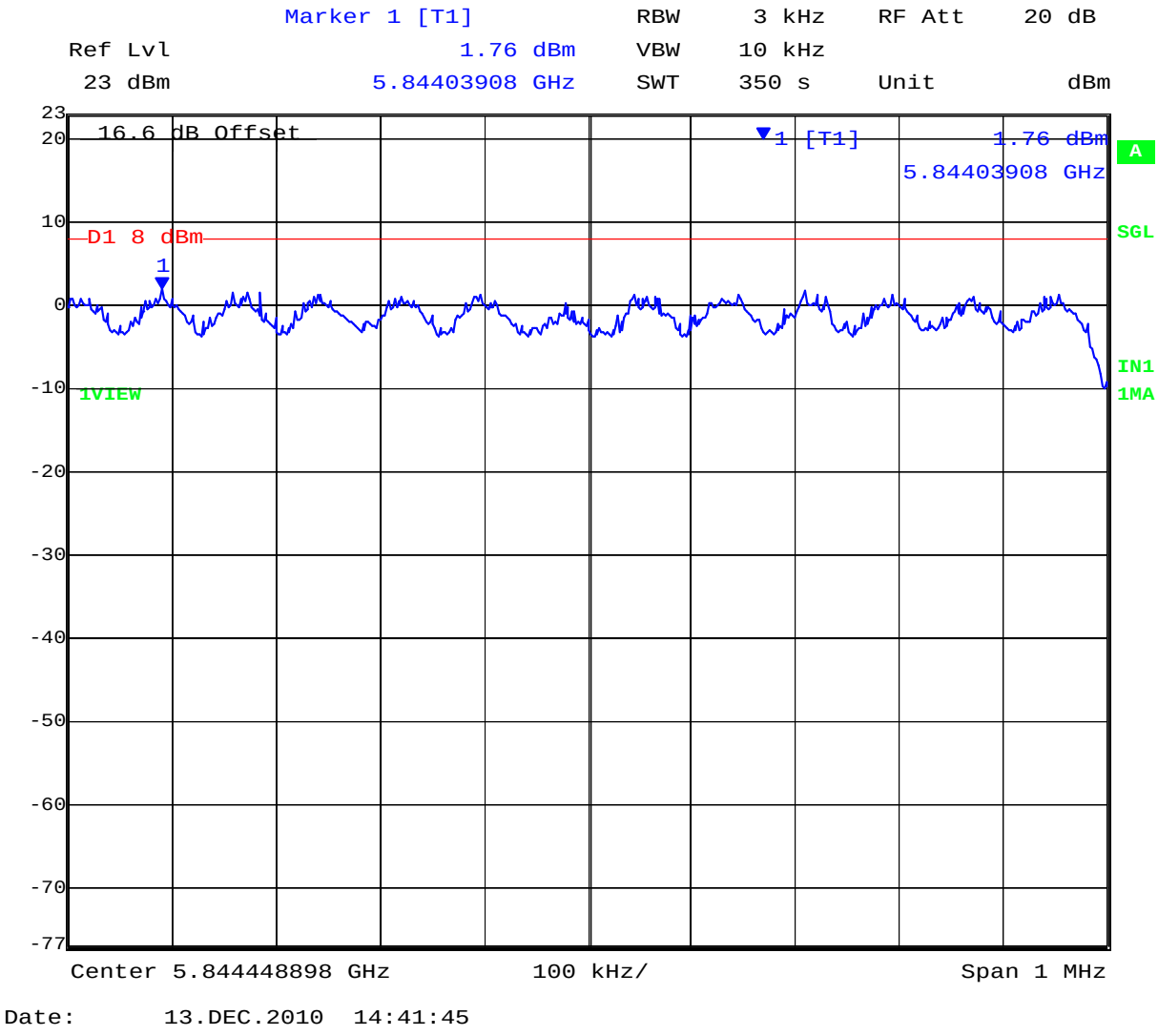
Chain b Power Density Ambient 5730MHz 48.00V 18.86dBm



Chain b Power Density Ambient 5780MHz 48.00V 19.90dBm



Chain b Power Density Ambient 5845MHz 48.00V 19.90dBm



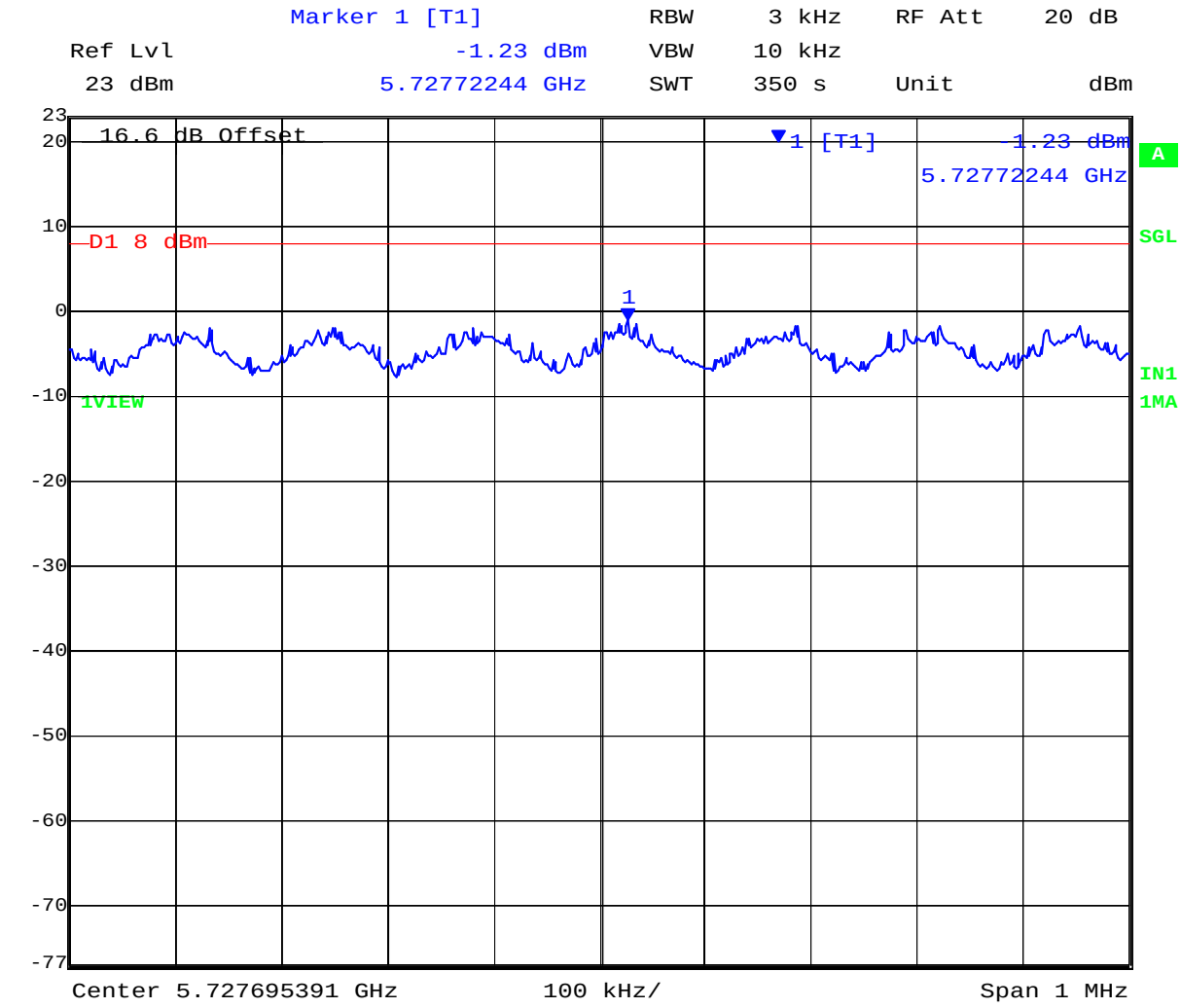
7.4.3 Measurement results for 802.11n 10MHz BPSK

Test Conditions:	15.247 (e)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 10 MHz BPSK	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain	N/A dB	**Antenna Gain:**	0 dBi
Applied Voltage:	48V Vdc		
Notes 1:			
Notes 2:			

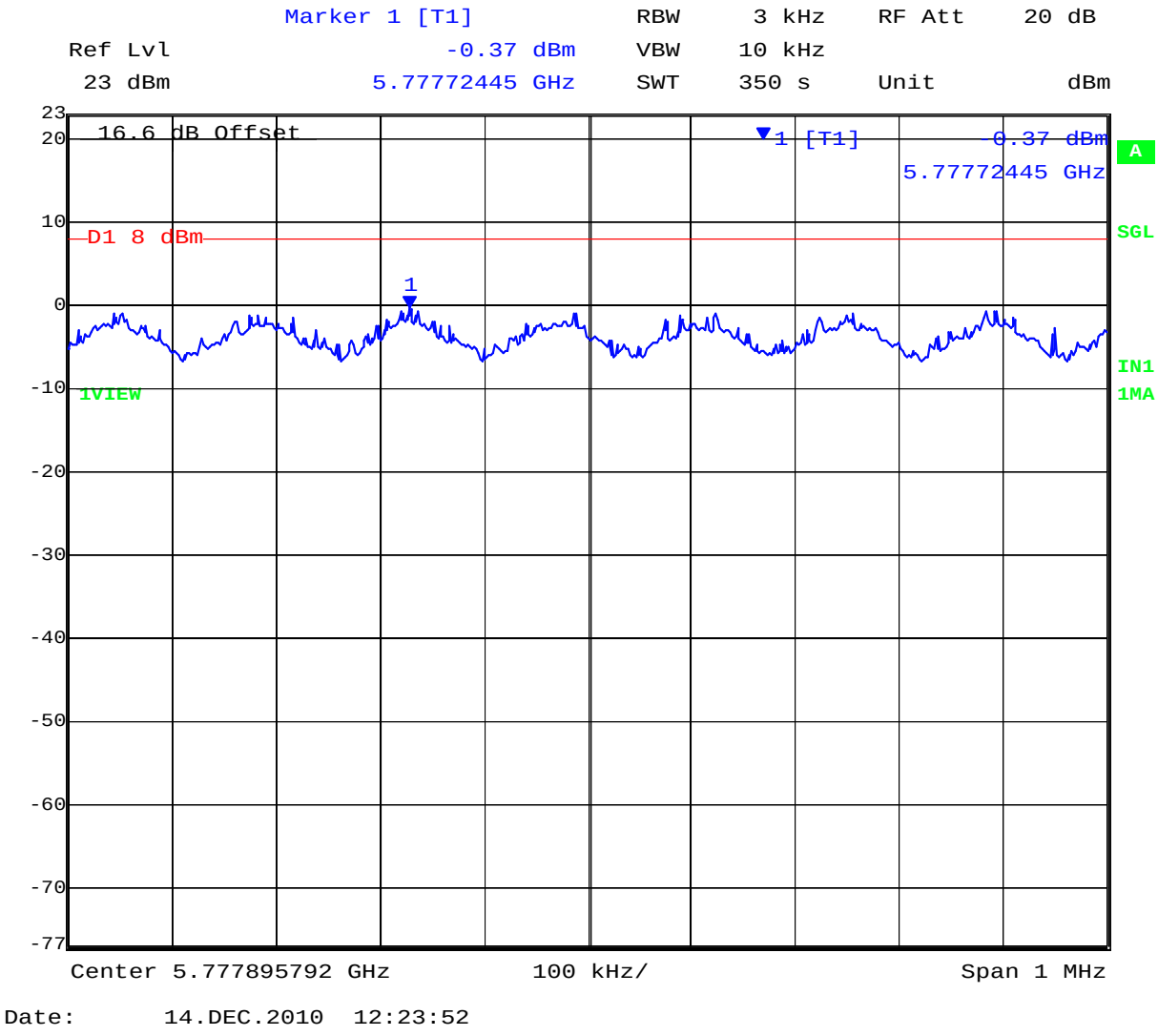
Test Frequency	Measured Power Density RF Port (dBm)				Total Peak Power Spectral Density (dBm)		Limit	Margin
MHz	a	b	c	d	Combined	Calculated	dBm	dB
5730.000	-1.23	-2.26	--	--		1.29	8.00	-6.71
5780.000	-0.37	-1.72	--	--		2.02	8.00	-5.98
5845.000	-1.79	-1.45	--	--		1.39	8.00	-6.61

Measurement uncertainty:	± 1.33 dB

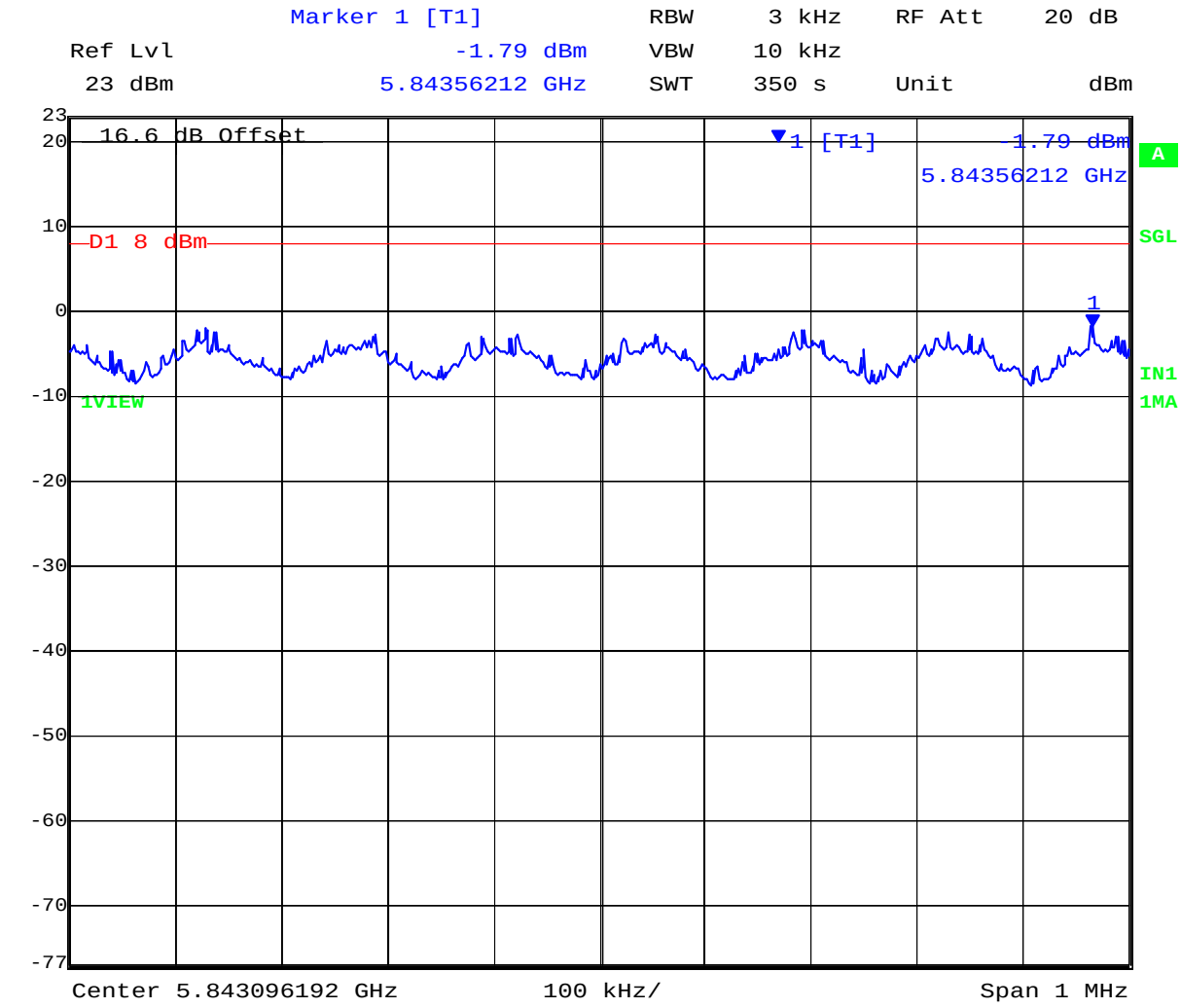
Chain a Power Density Ambient 5730MHz 48.00V 19.04dBm



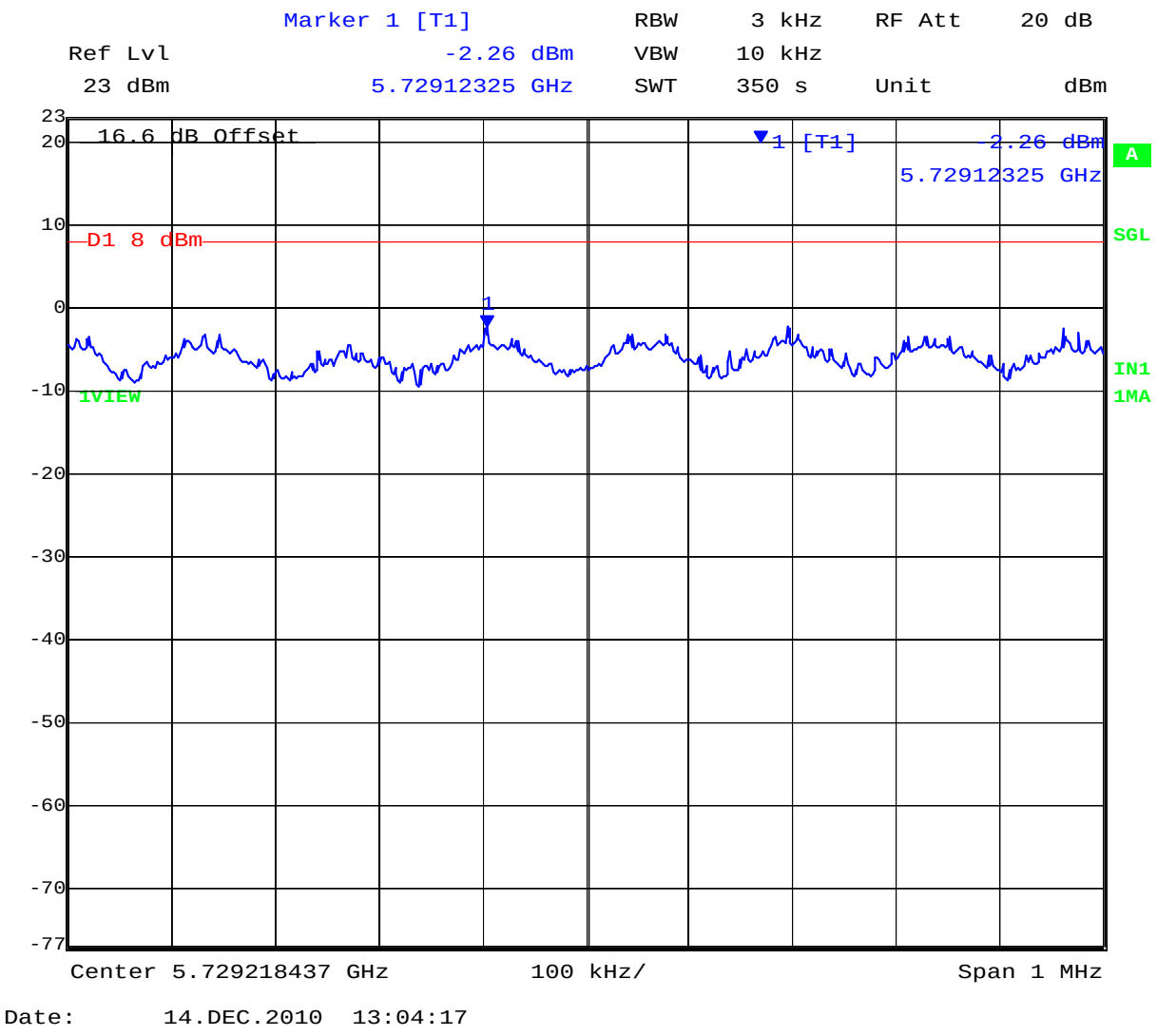
Chain a Power Density Ambient 5780MHz 48.00V 19.87dBm



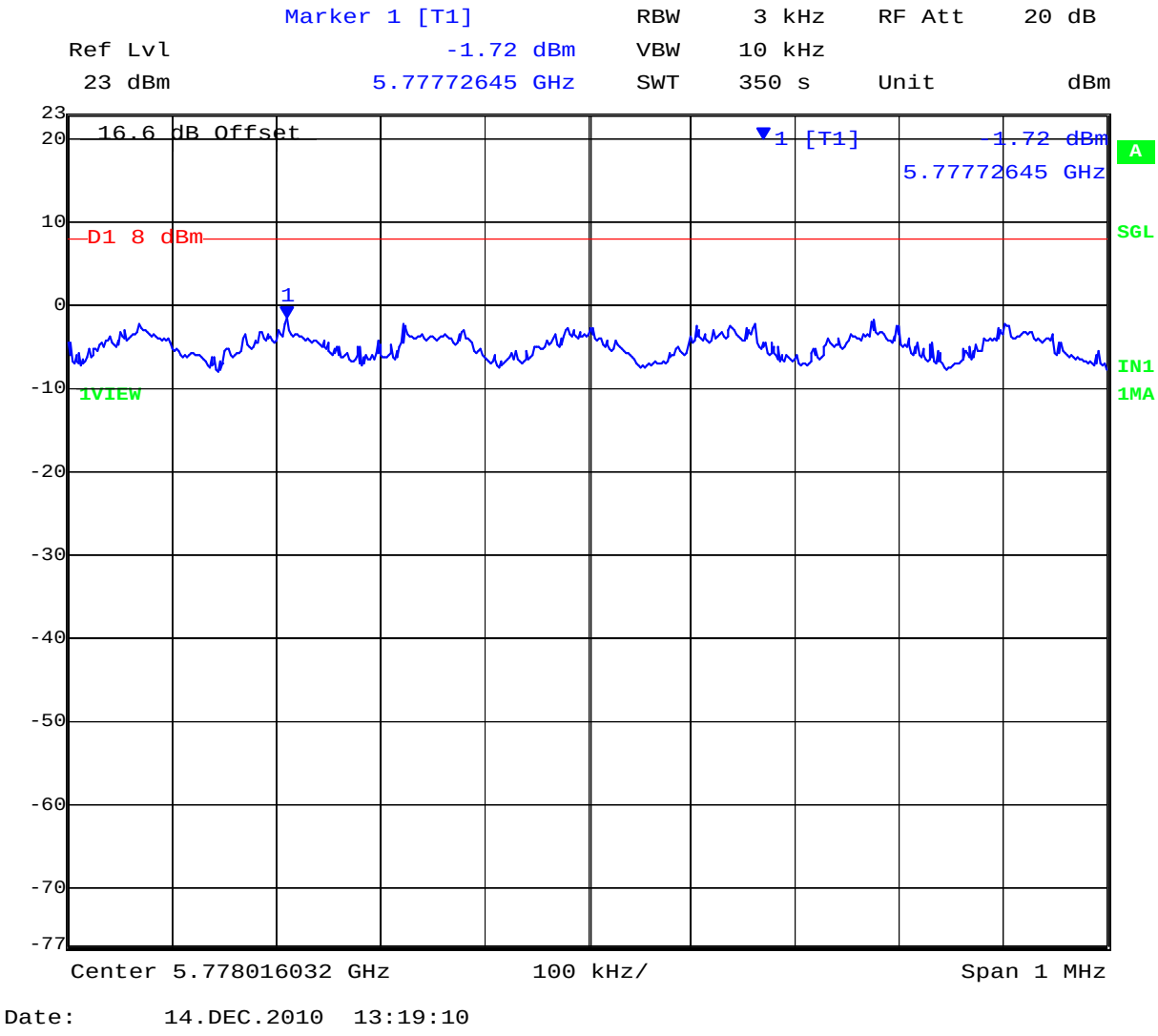
Chain a Power Density Ambient 5845MHz 48.00V 18.16dBm



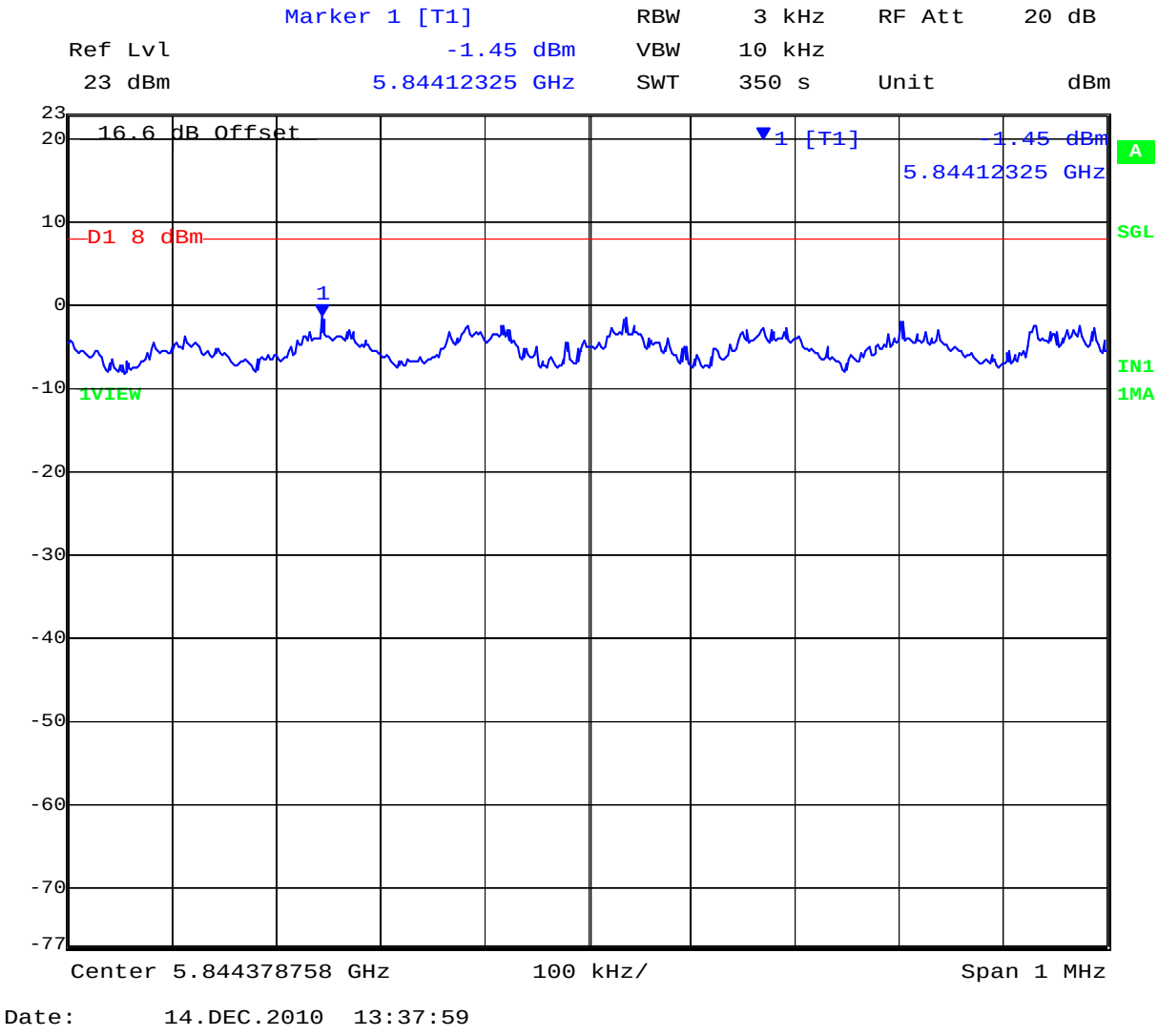
Chain b Power Density Ambient 5730MHz 48.00V 17.66dBm



Chain b Power Density Ambient 5780MHz 48.00V 18.81dBm



Chain b Power Density Ambient 5845MHz 48.00V 18.65dBm



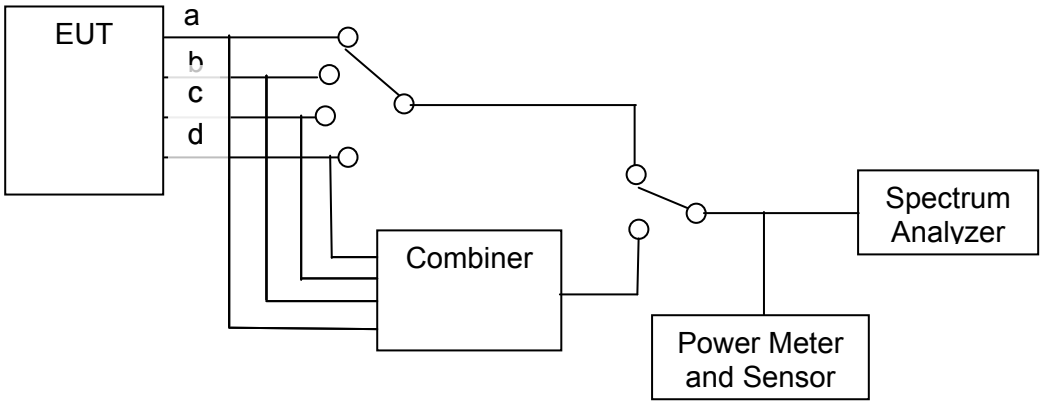
7.5 Conducted Spurious Emissions

Test Procedure

Conducted emissions were measured at a limit of 20 dB below the highest in-band spectral density measured with a spectrum analyzer connected to the antenna terminal. Emissions at the band edge were measured and recorded. Measurements were made while EUT was operating in transmit mode of operation at the appropriate center frequency.

Measurements were made using a combiner with the transmitter tuned to the channel closest to the band-edge being measured. All emissions were maximized during measurement. Limits which were derived from the peak emission.

Test Measurement Set up



Conducted Spurious Emission measurement test configuration

Specification

Conducted Spurious Emissions

§15.247(d)
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

§15.247(d)
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

Limits Band-Edge

Lower Limit Band-edge	Upper Limit Band-edge	Limit below highest level of desired power
2,400 MHz	2,483.5 MHz	≥ 20 dB
5725 MHz	5850 MHz	

Traceability

Method	Test Equipment Used
WI-05	0158, 0252, 0313, 0314, 0223, 0116, 0117, 0287, 0363.

7.5.1 Measurement Results for 802.11n 5MHz BPSK Chain a

Test Conditions:	15.247 (a)(2)		**Rel. Humidity (%):**	35 to	42
Variant:	802.11n 5MHz BPSK		**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:**	N/A dBi	
Applied Voltage:	48V	Vdc			
Notes 1:					
Notes 2:					

Conducted Spurious Measurment

Test Frequency	Start Frequency	Stop Frequency	Maximum Observed Emission	Limit (20 dB below peak of fundamental)
MHz	**MHz**	**MHz**	**dBm**	**dBm**
5730.000	30.00	40000.00	-33.70	-8.22
5780.000	30.00	40000.00	-34.21	-6.19
5845.000	30.00	40000.00	-33.99	-9.13

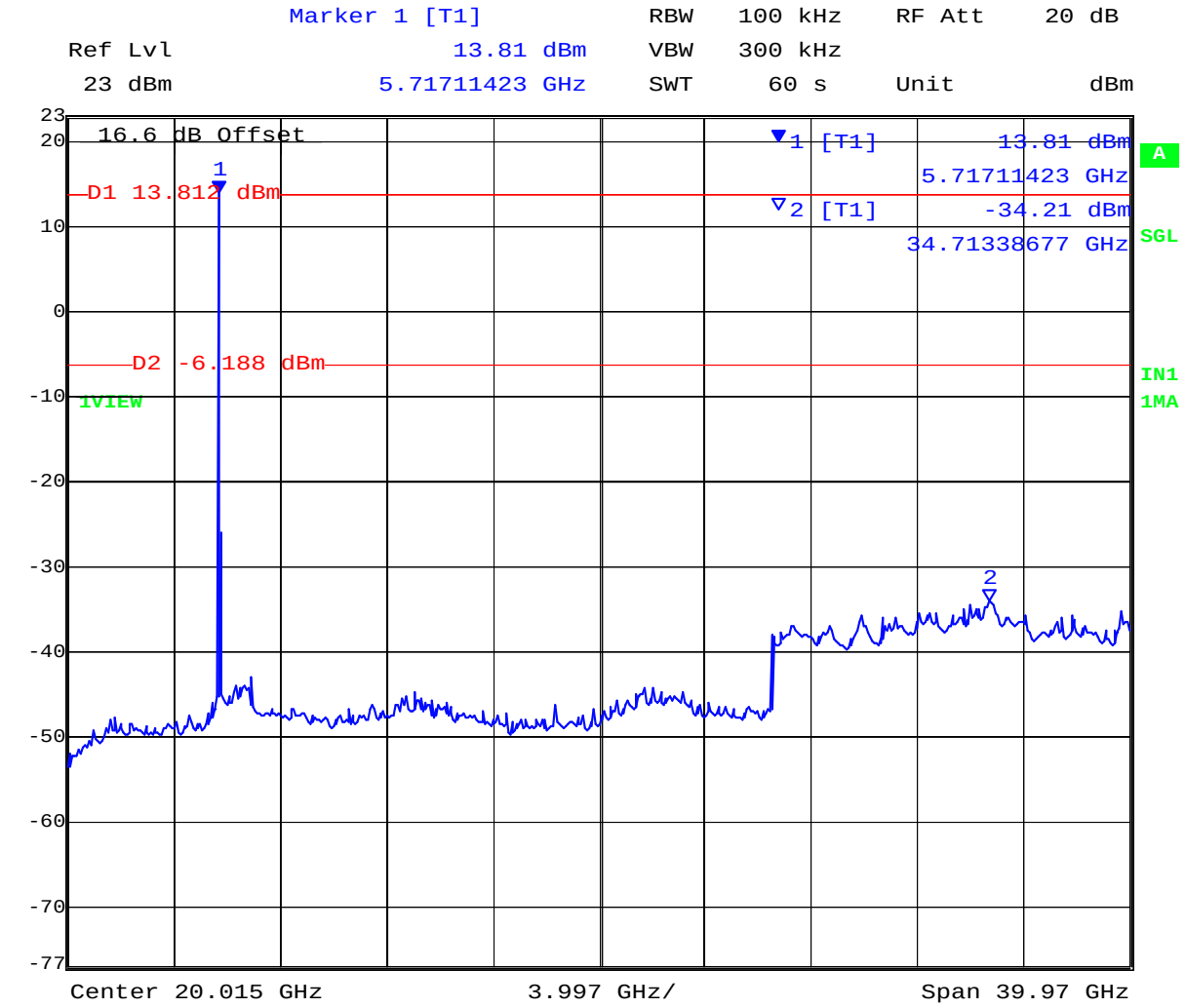
Band-edge Measurment

Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	**MHz**	**dBm**	**dBm**	**dB**
5730.000	5725.00	-17.48	-2.88	-14.60
5845.000	5850.00	-19.46	-5.50	-13.96

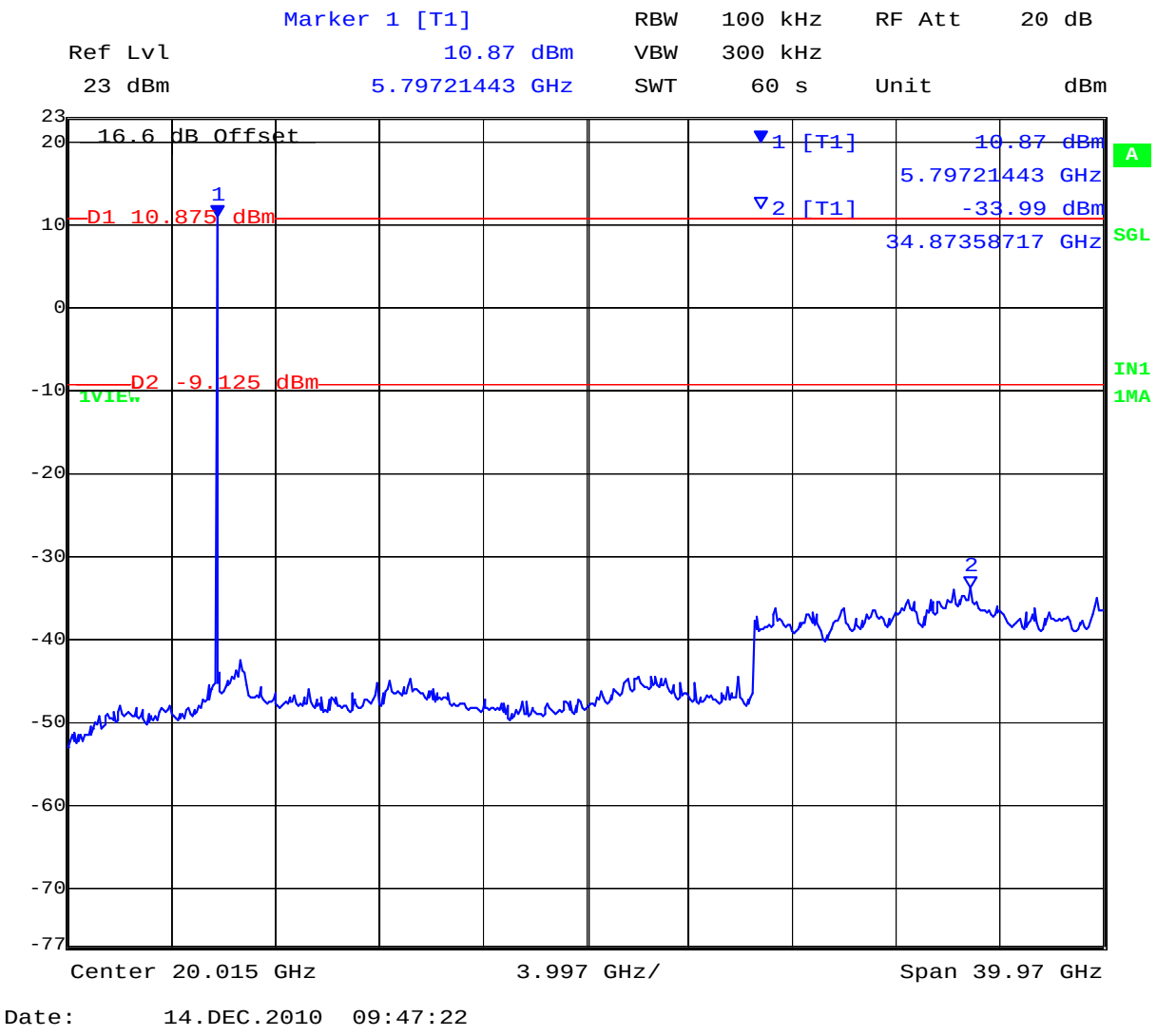
Measurement uncertainty:	±2.81 dB

Chain a TX SPR Ambient 5730MHz 48.00V 19.42dBm 0.03-40GHz

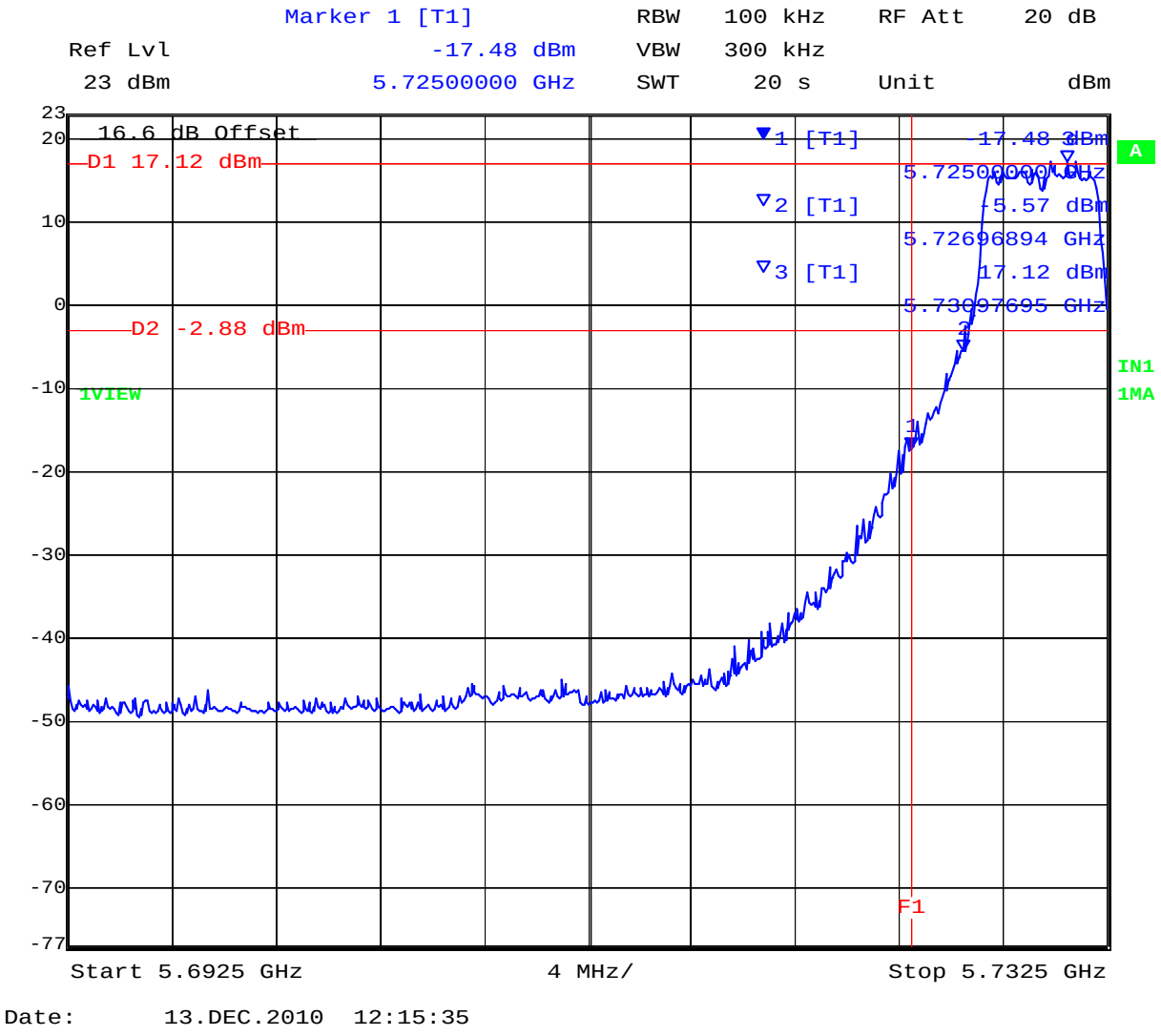
Chain a TX SPR Amb 5780 MHz 48.00V 19.87dBm 0.03-40GHz



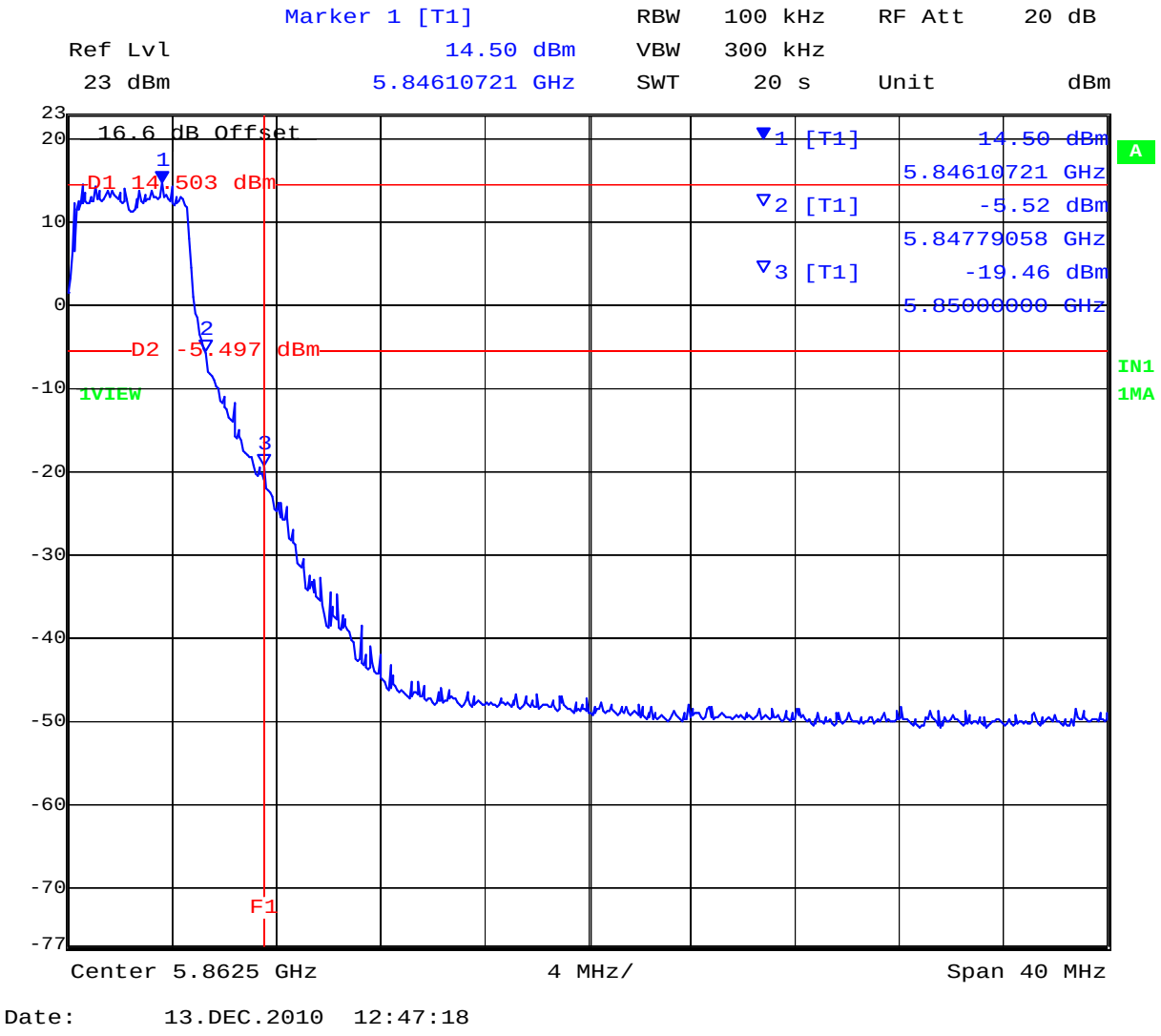
Chain a TX SPR Amb 5845 MHz 48.00V 17.87dBm 0.03-40GHz



Chain a Band Edge Ambient 5730MHz 48.00V 21.70dBm



Chain a Band Edge Ambient 5845MHz 48.00V 19.14dBm



7.5.2 Measurement Results for 802.11n 5MHz BPSK Chain b

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 5MHz BPSK	**Ambient Temp. (°C):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	N/A dBi
Applied Voltage:	48V Vdc		
Notes 1:			
Notes 2:			

Conducted Spurious Measurment

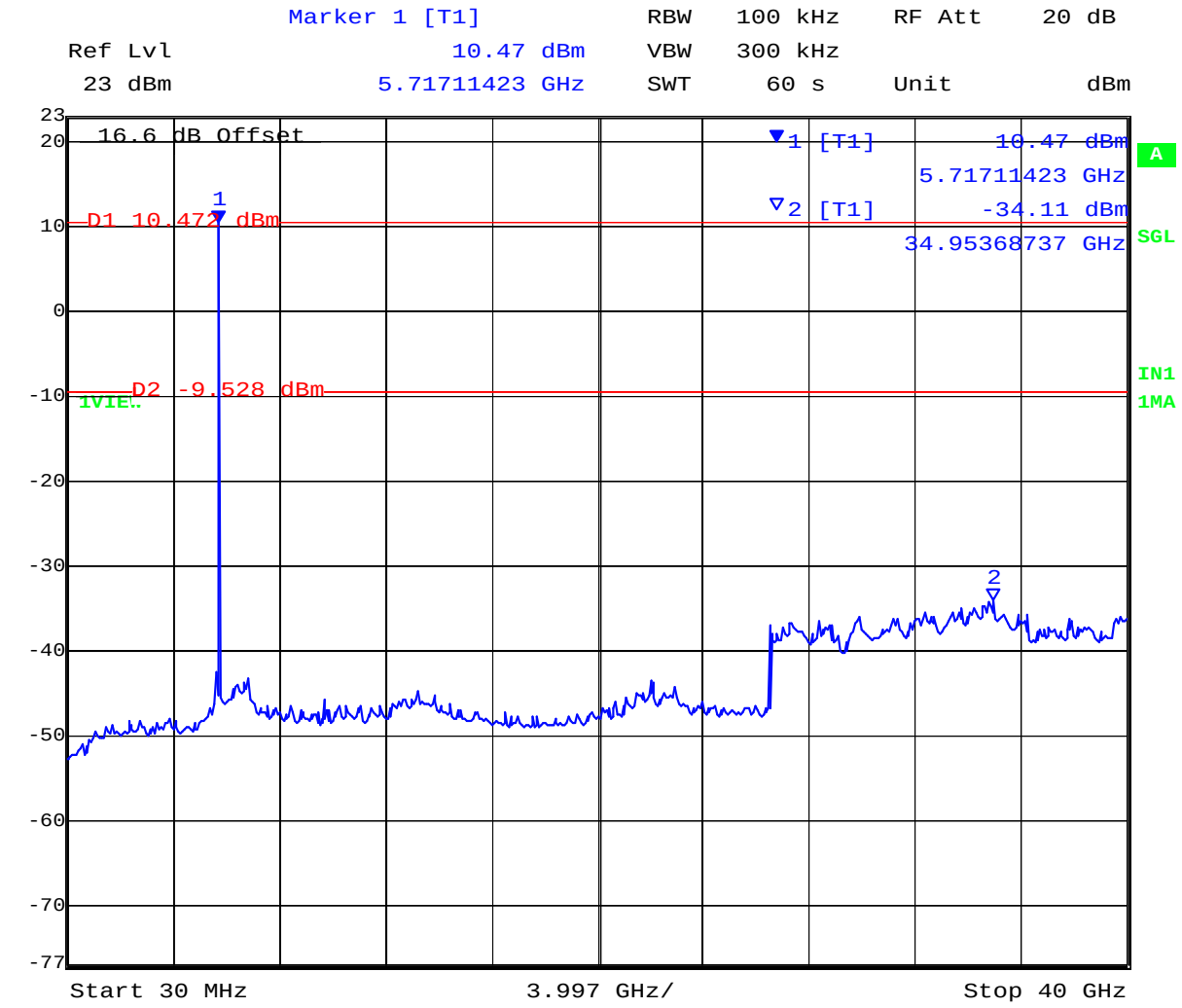
Test Frequency	Start Frequency	Stop Frequency	Maximum Observed Emission	Limit (20 dB below peak of fundamental)
MHz	MHz	MHz	dBm	dBm
5730.000	30.00	40000.00	-34.11	-9.53
5780.000	30.00	40000.00	-33.95	-8.37
5845.000	30.00	40000.00	-33.49	-8.78

Band-edge Measurment

Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	MHz	dBm	dBm	dB
5730.000	5725.00	-22.21	-6.50	-15.71
5845.000	5850.00	-19.96	-4.11	-15.85

Measurement uncertainty:	±2.81 dB

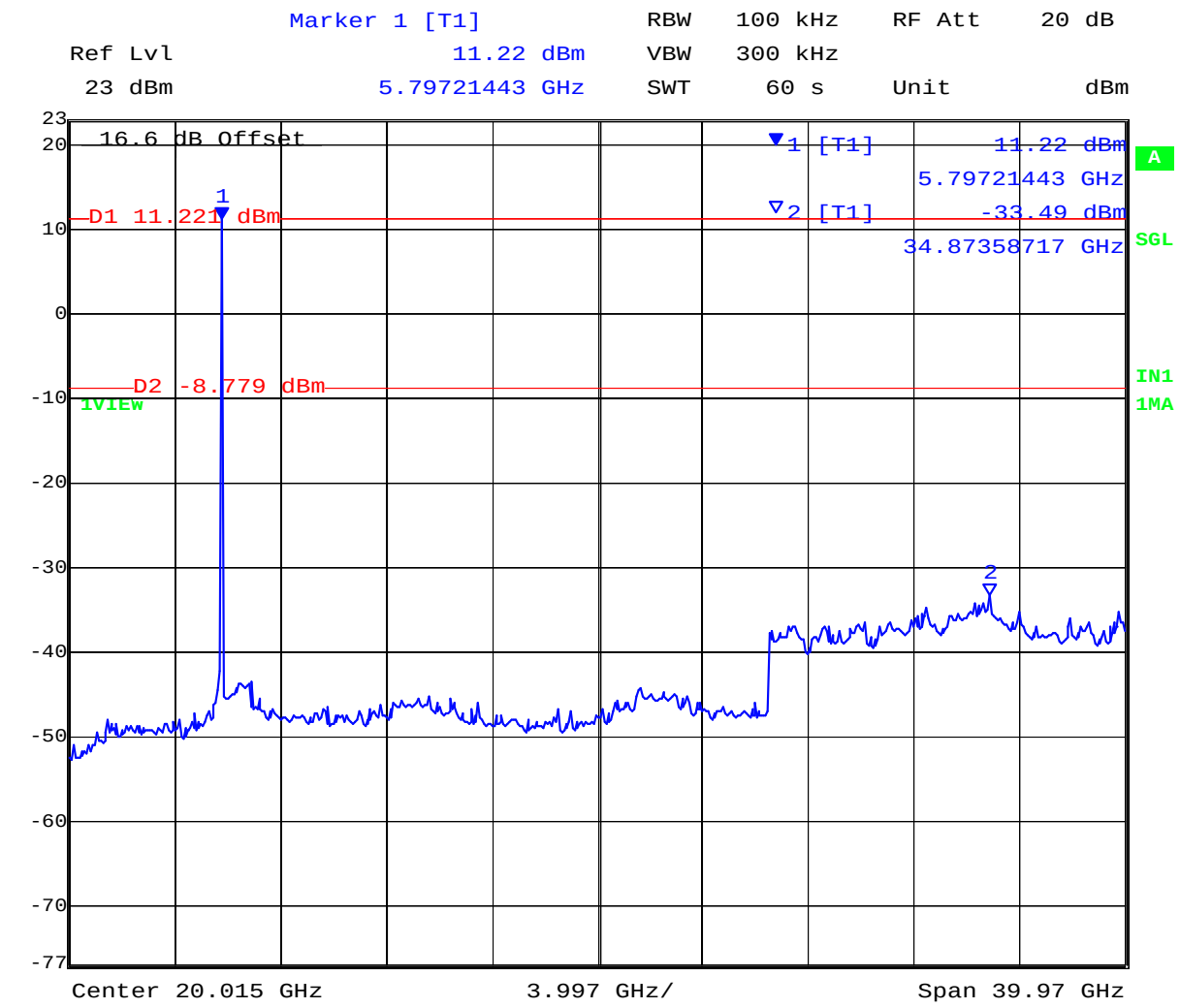
Chain b TX SPR Ambient 5730MHz 48.00V 17.00dBm 0.03-40GHz



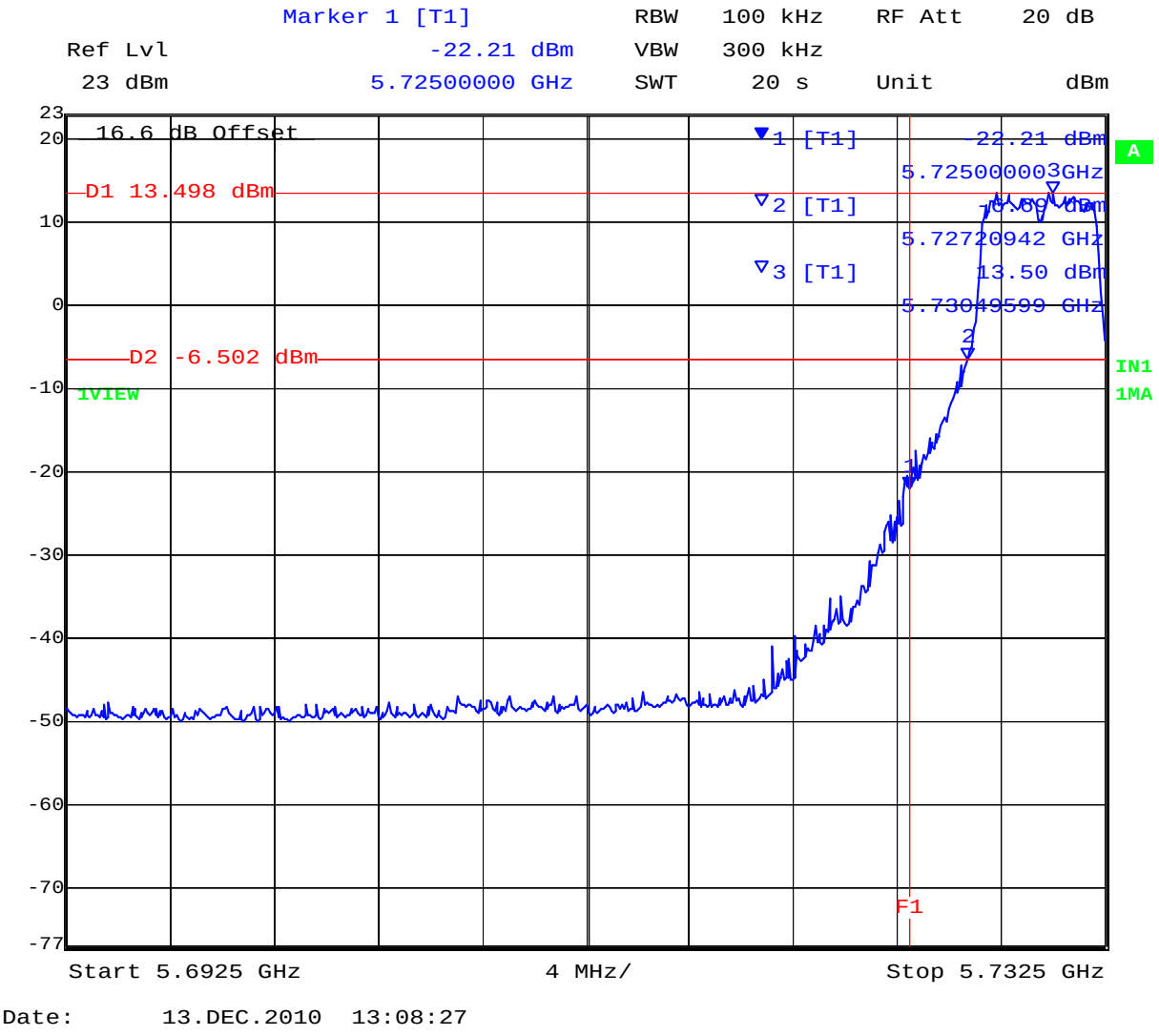
Date: 14.DEC.2010 10:04:10

Chain b TX SPR Ambient 5780MHz 48.00V 18.51dBm 0.03-40GHz

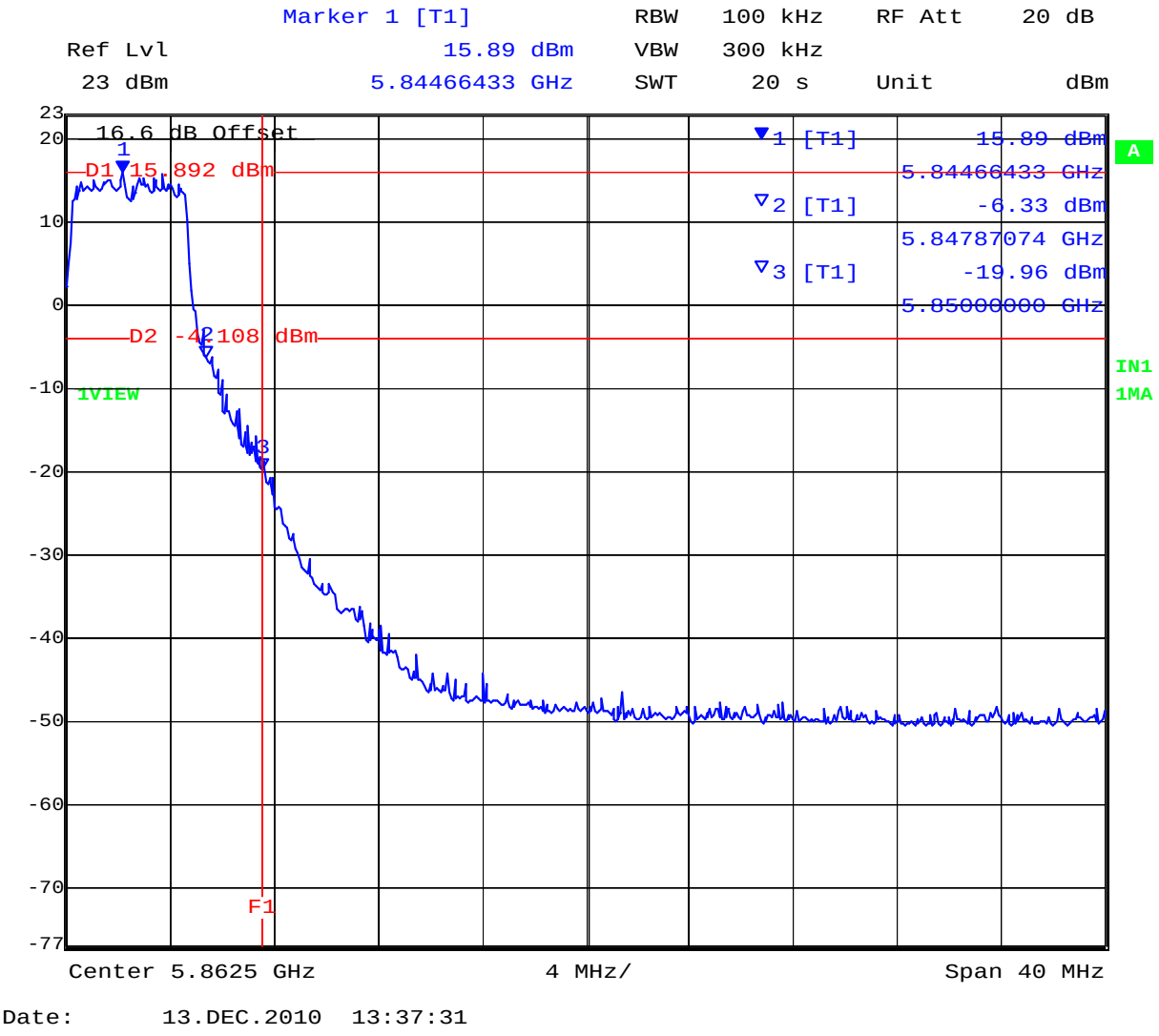
Chain b TX SPR Ambient 5845MHz 48.00V 18.55dBm 0.03-40GHz



Chain b Band Edge Ambient 5730MHz 48.00V 18.44dBm



Chain b Band Edge Ambient 5845MHz 48.00V 20.38dBm



7.5.3 Measurement Results for 802.11n 5MHz 64QAM Chain a

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 5MHz 64QAM	**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:**	N/A dBi
Applied Voltage:	48V Vdc		
Notes 1:	Chain A		
Notes 2:			

Conducted Spurious Measurment

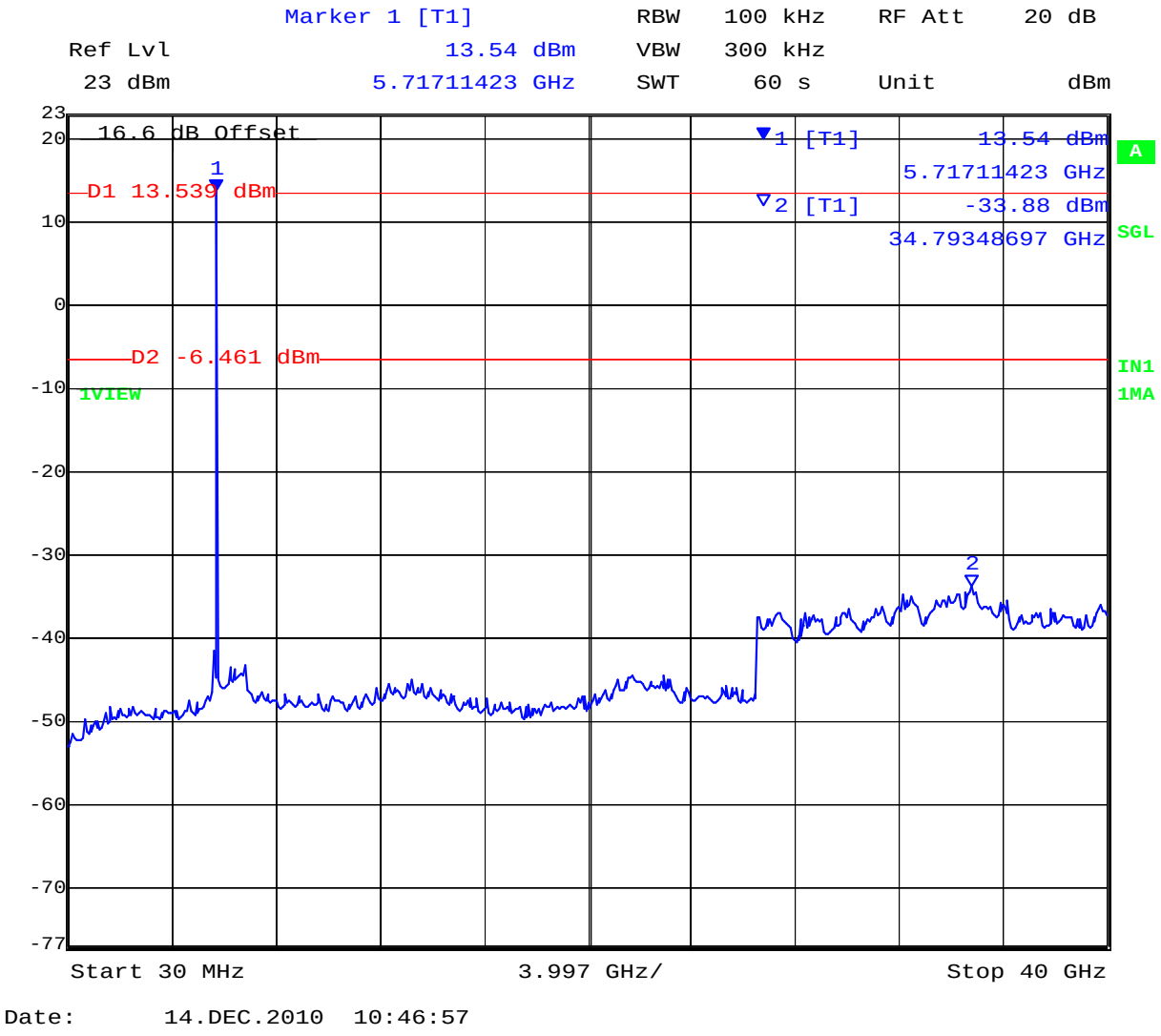
Test Frequency	Start Frequency	Stop Frequency	Maximum Observed Emission	Limit (20 dB below peak of fundamental)
MHz	**MHz**	**MHz**	**dBm**	**dBm**
5730.000	30.00	40000.00	-33.88	-6.46
5780.000	30.00	40000.00	-34.57	-7.44
5845.000	30.00	40000.00	-34.05	-8.35

Band-edge Measurment

Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	**MHz**	**dBm**	**dBm**	**dB**
5730.000	5725.00	-16.56	-2.53	-14.03
5845.000	5850.00	-21.41	-4.48	-16.93

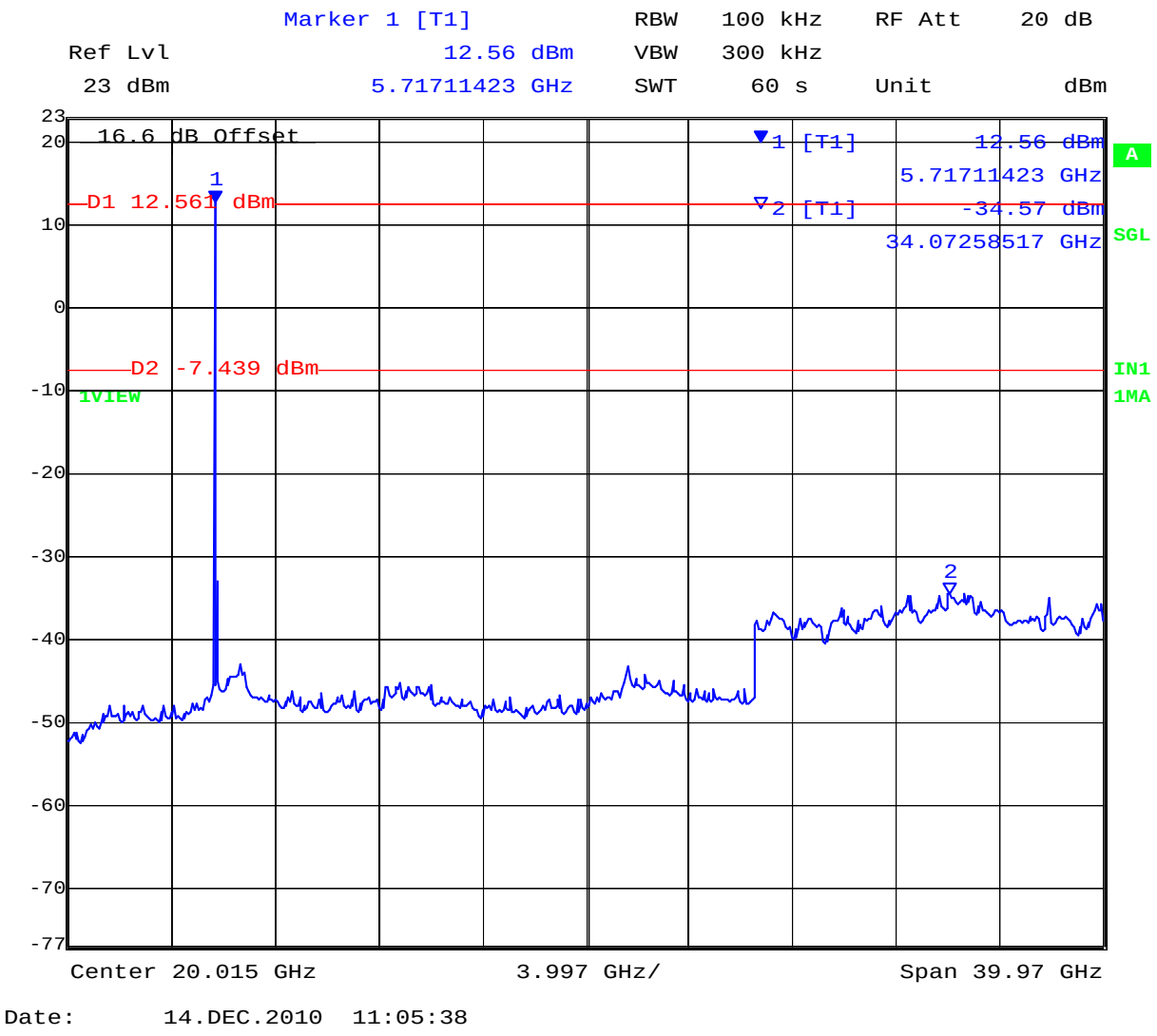
Measurement uncertainty:	±2.81 dB

Chain a TX SPR Ambient 5730MHz 48.00V 19.58dBm 0.03-40GHz

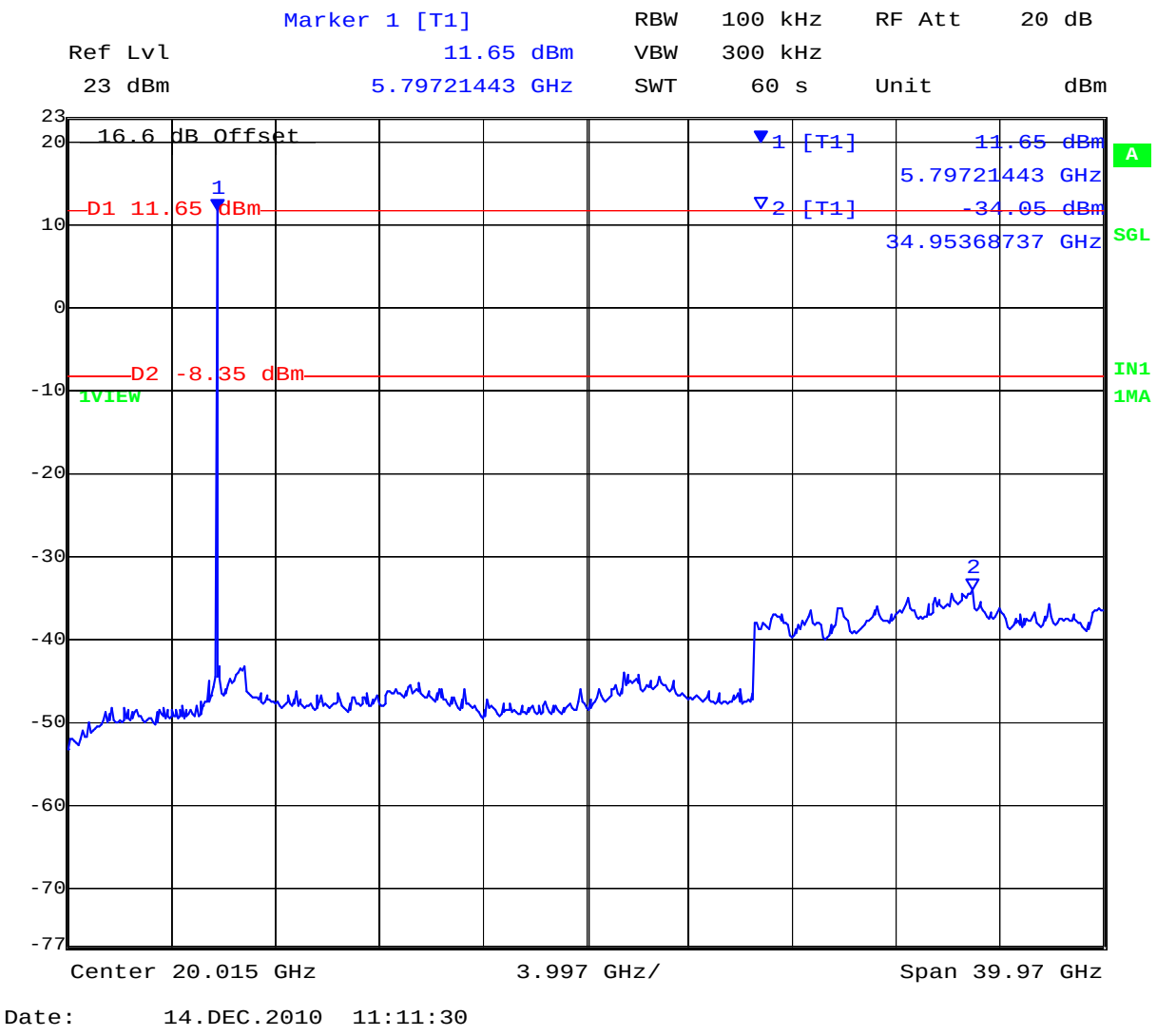


Date: 14.DEC.2010 10:46:57

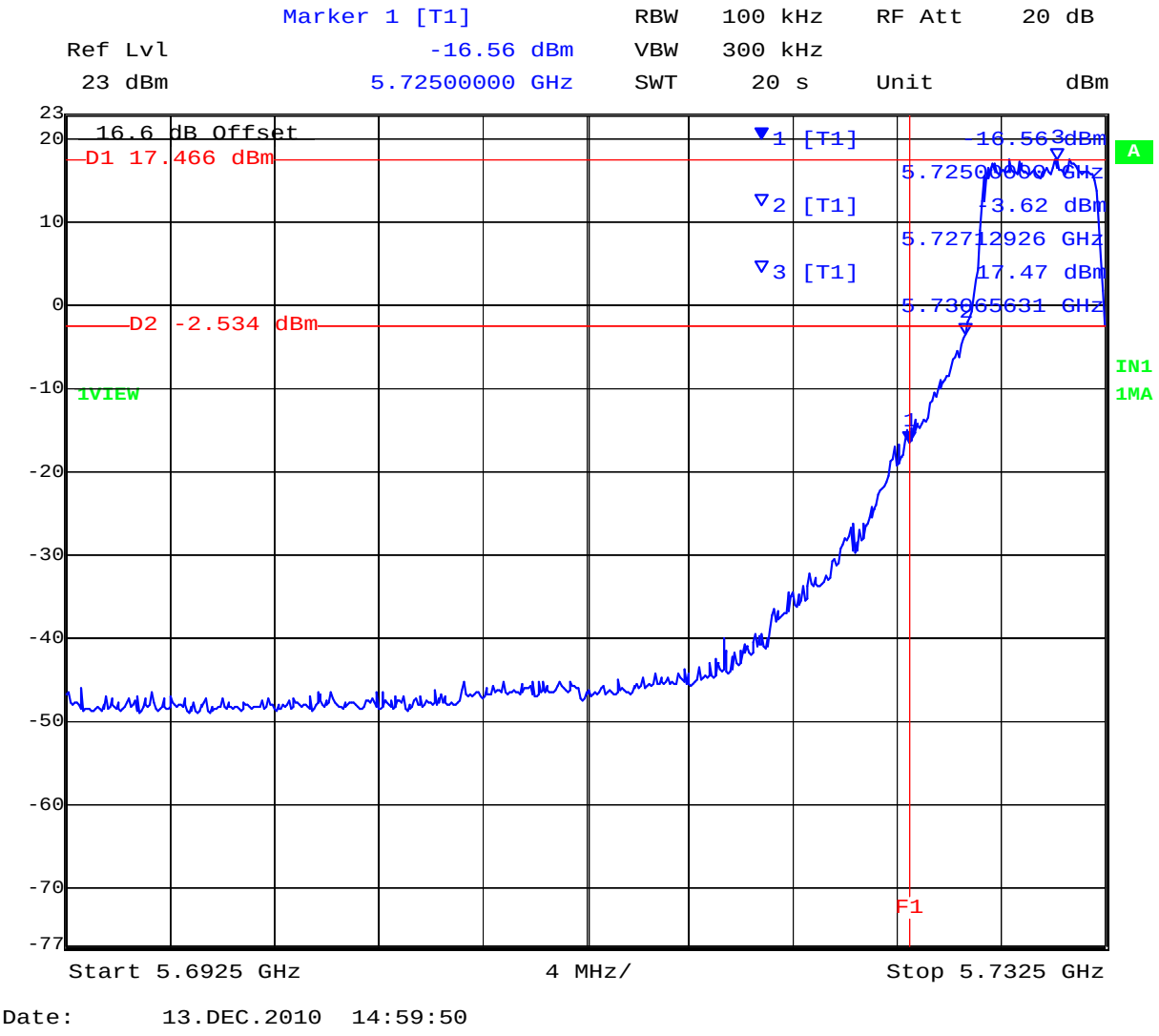
Chain a TX SPR Ambient 5780MHz 48.00V 17.86dBm 0.03-40GHz



Chain a TX SPR Ambient 5845MHz 48.00V 18.34dBm 0.03-40GHz

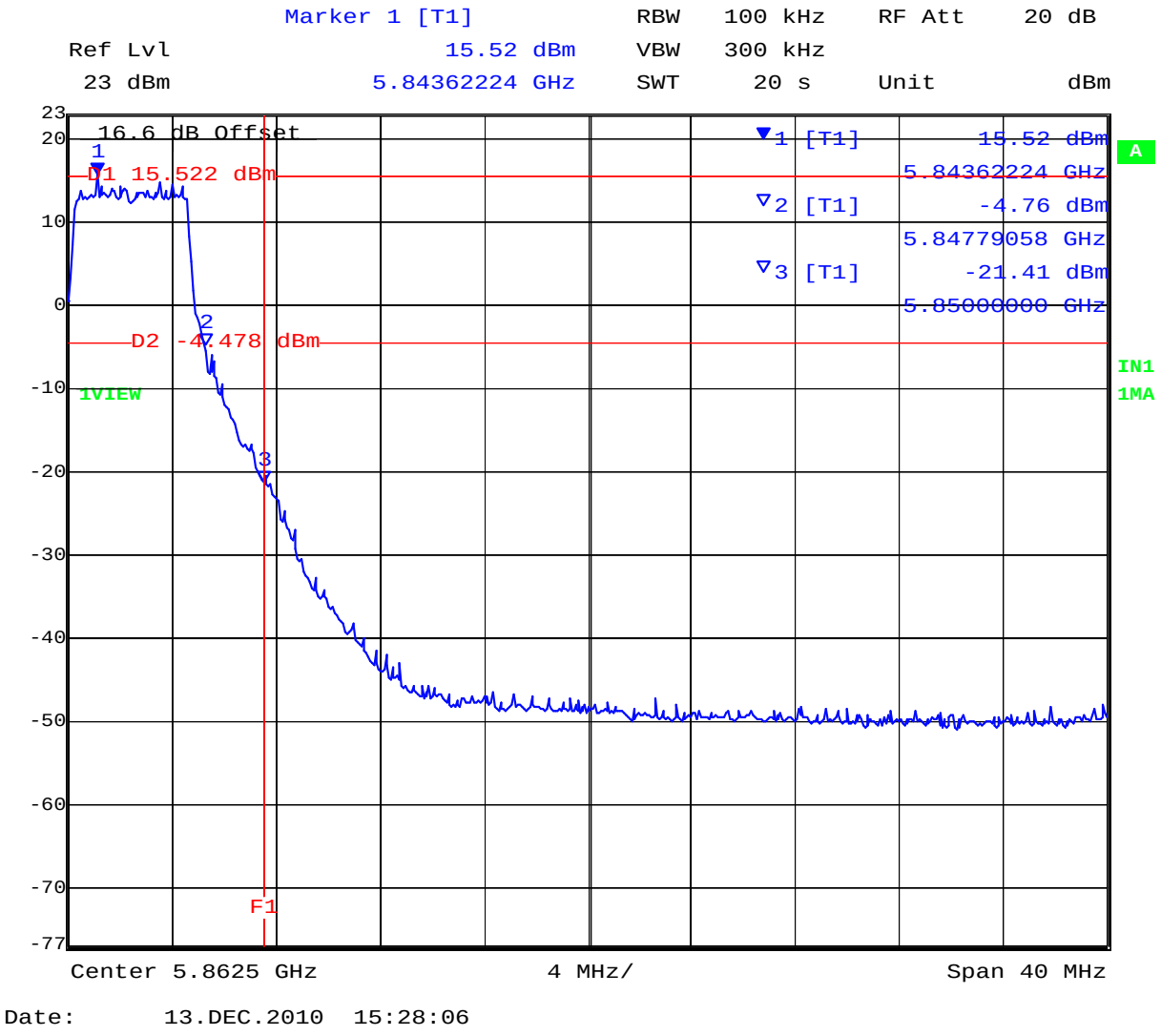


Chain a Band Edge Ambient 5730MHz 48.00V 22.24dBm



Date: 13.DEC.2010 14:59:50

Chain a Band Edge Ambient 5845MHz 48.00V 19.34dBm



7.5.4 Measurement Results for 802.11n 5MHz 64QAM Chain b

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 5MHz 64QAM	**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:**	N/A dBi
Applied Voltage:	48V Vdc		
Notes 1:	Chain B		
Notes 2:			

Conducted Spurious Measurment

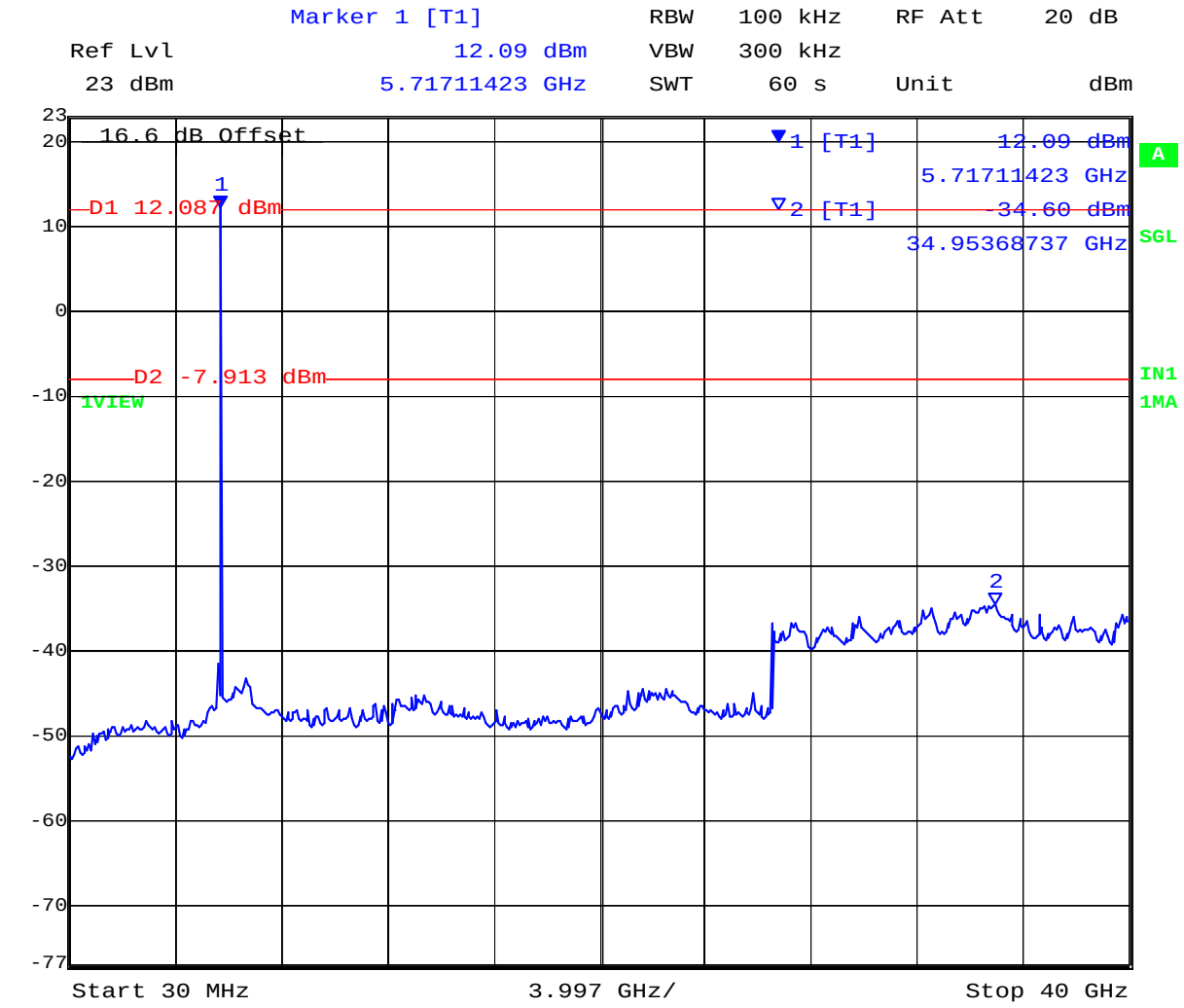
Test Frequency	Start Frequency	Stop Frequency	Maximum Observed Emission	Limit (20 dB below peak of fundamental)
MHz	MHz	MHz	dBm	dBm
5730.000	30.00	40000.00	-34.60	-7.91
5780.000	30.00	40000.00	-34.65	-8.41
5845.000	30.00	40000.00	-33.89	-7.04

Band-edge Measurment

Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	MHz	dBm	dBm	dB
5730.000	5725.00	-24.17	-5.39	-18.79
5845.000	5850.00	-22.32	-4.61	-17.71

Measurement uncertainty:	±2.81 dB

Chain b TX SPR Ambient 5730MHz 48.00V 17.91dBm 0.03-40GHz



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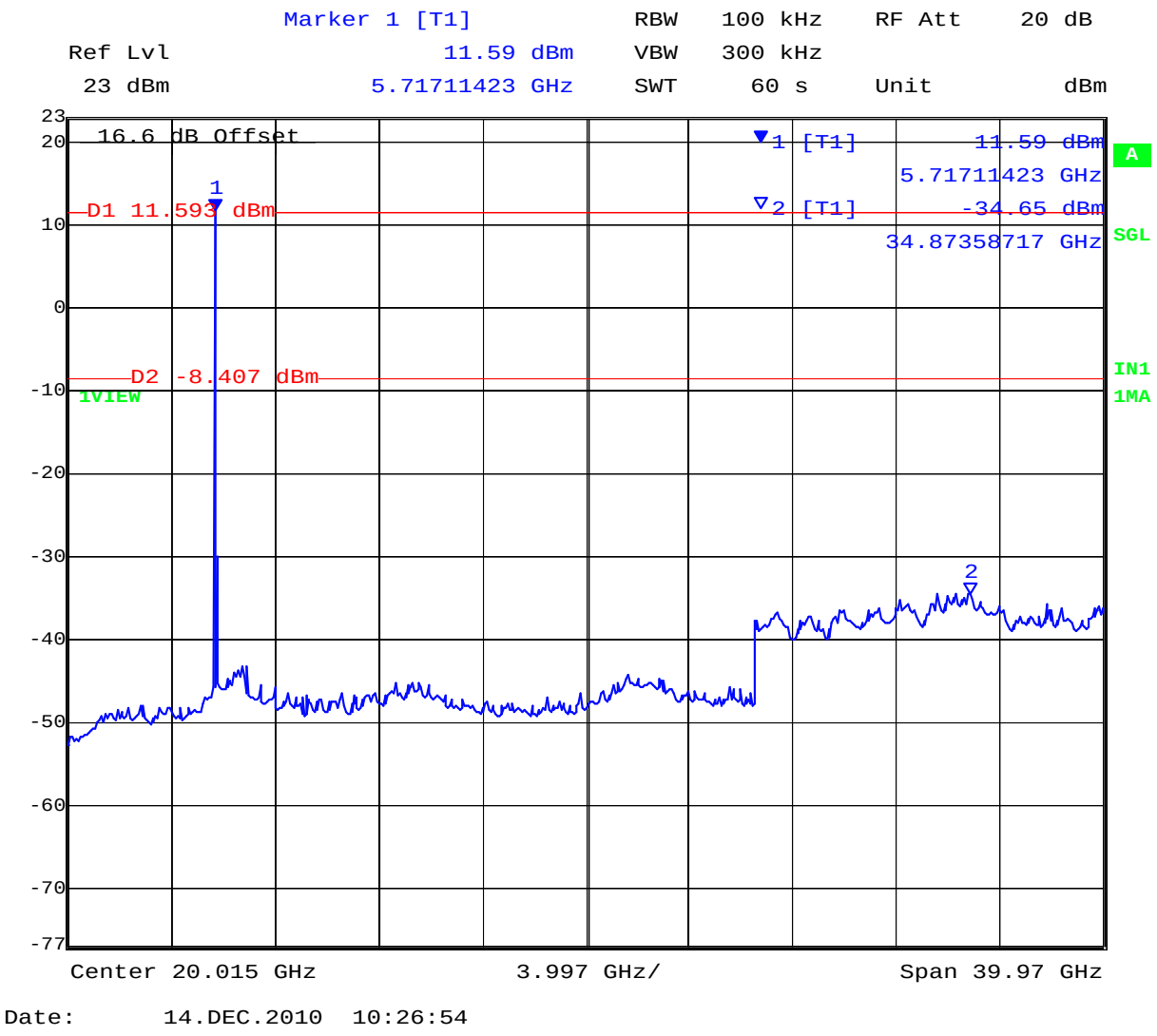
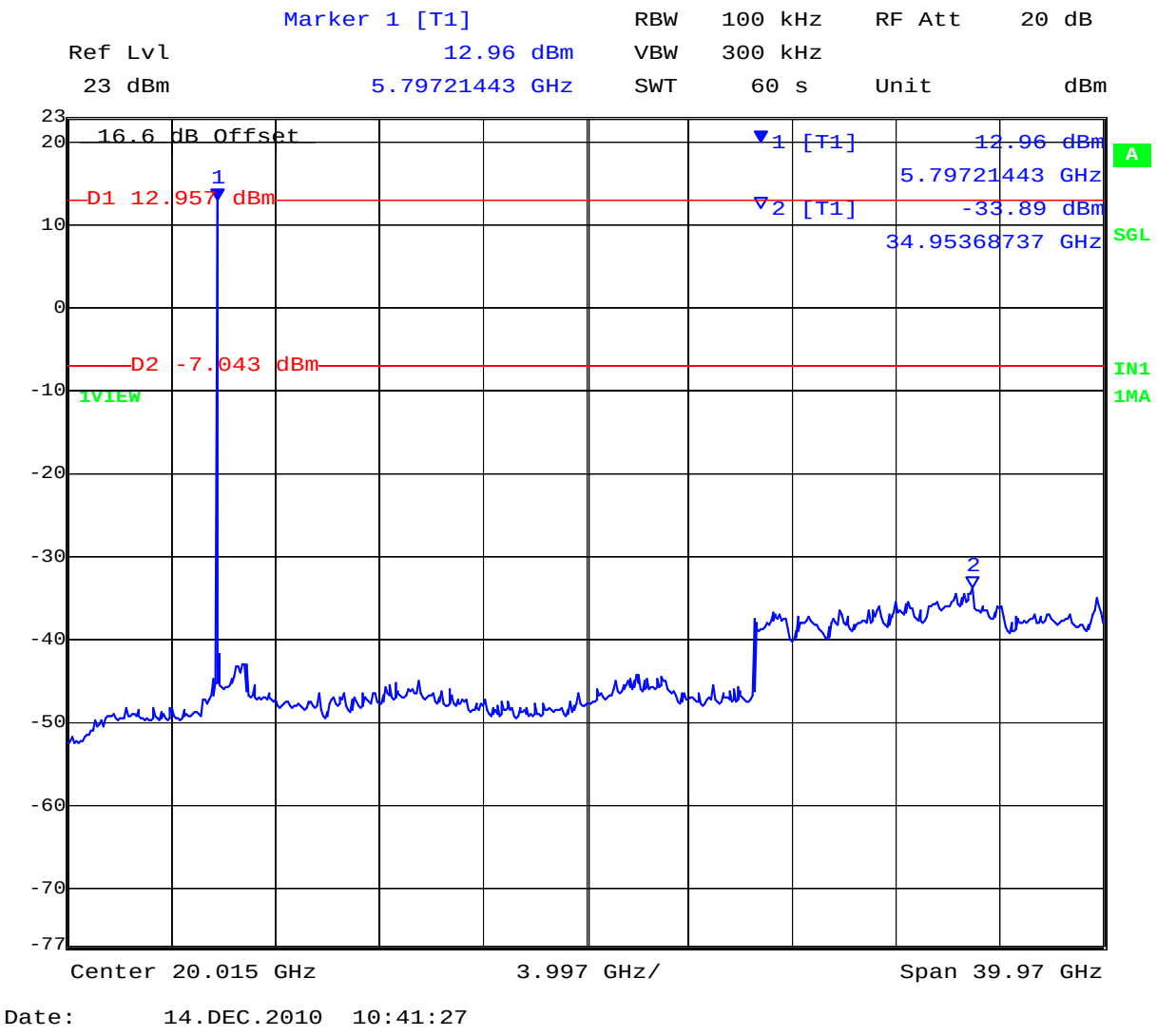
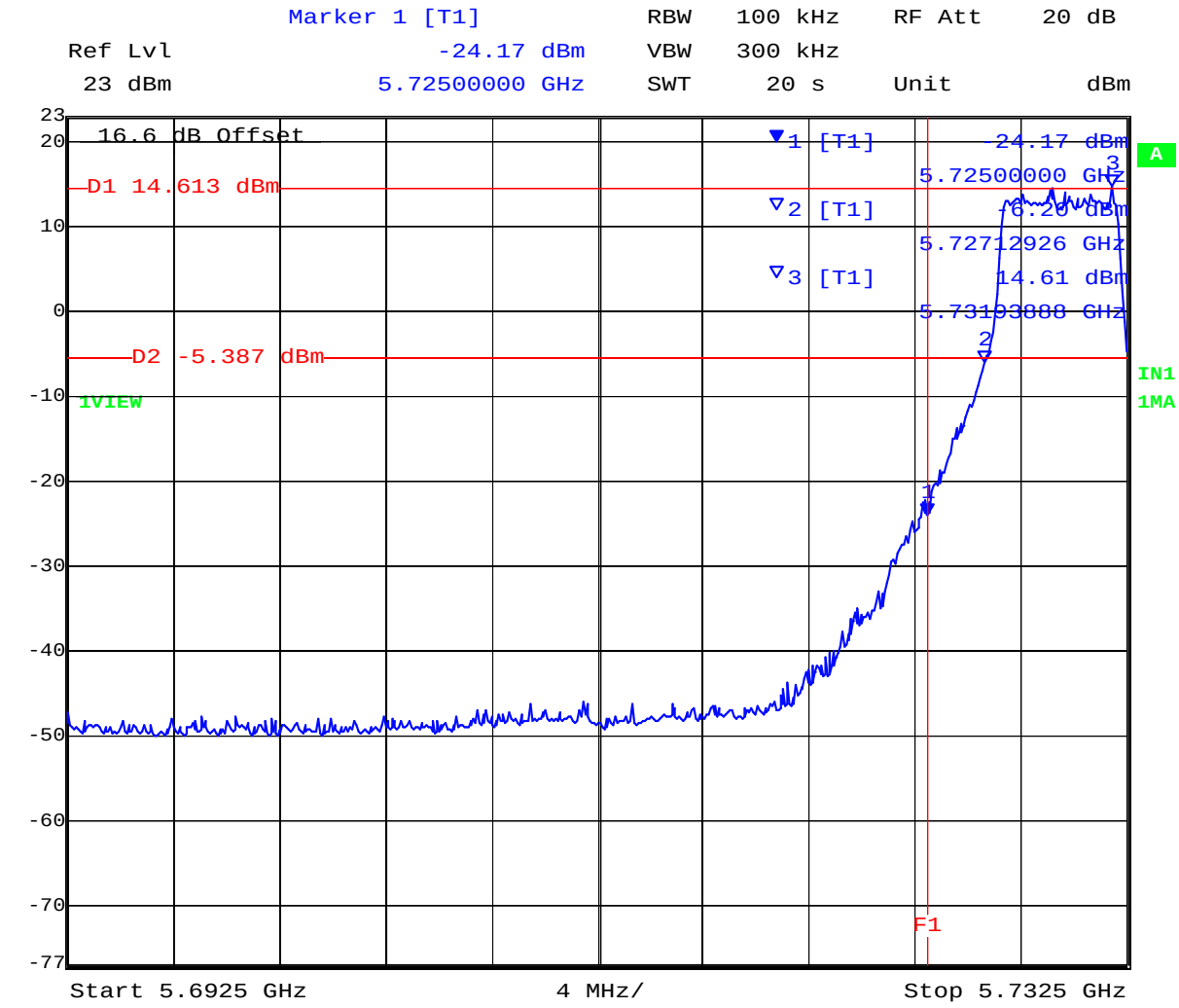
Chain b TX SPR Ambient 5780MHz 48.00V 18.46dBm 0.03-40GHz



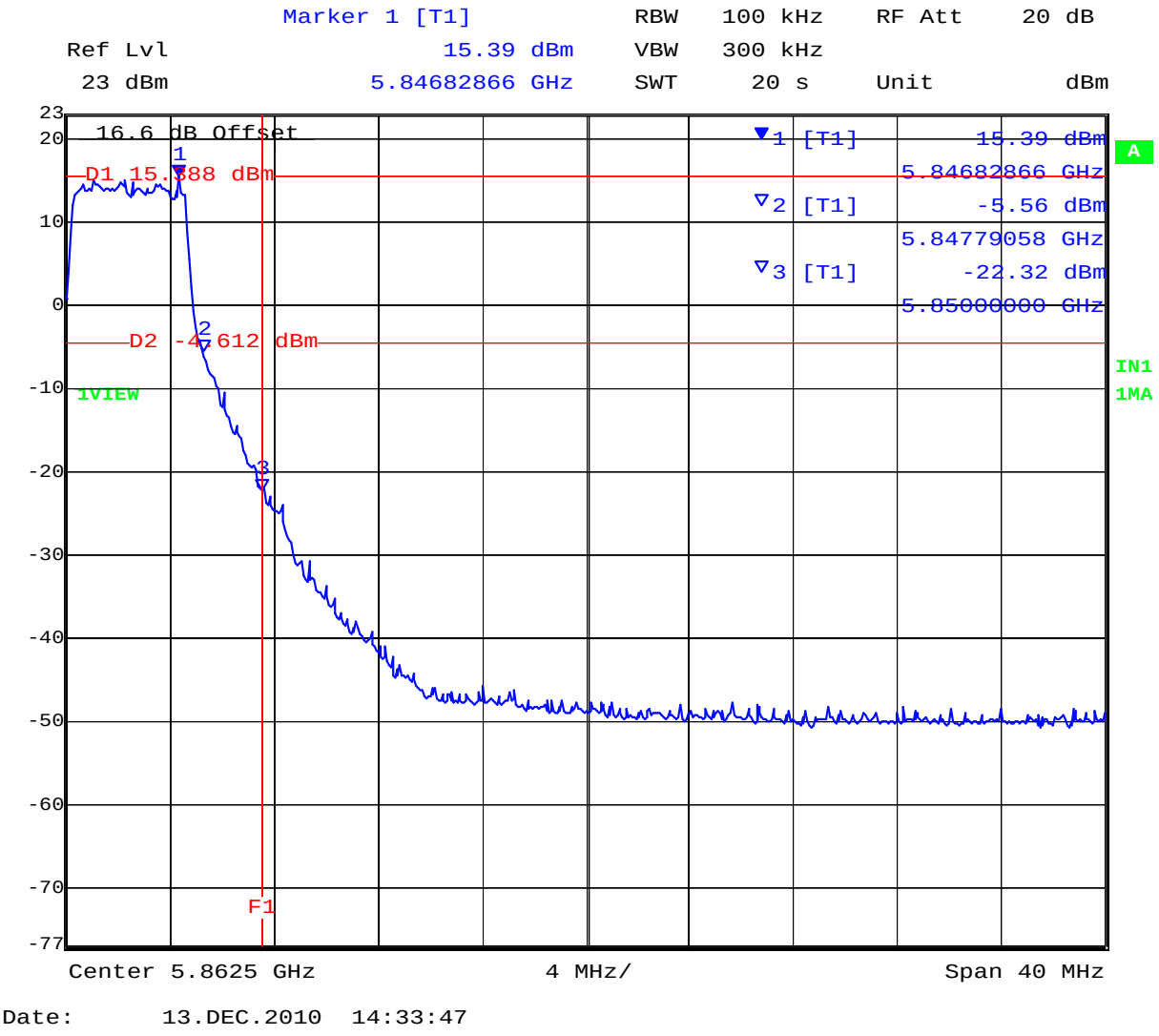
Chain b TX SPR Ambient 5845MHz 48.00V 19.68dBm 0.03-40GHz



Chain b Band Edge Ambient 5730MHz 48.00V 18.94dBm



Chain b Band Edge Ambient 5845MHz 48.00V 19.95dBm



7.5.5 Measurement Results for 802.11n 10MHz BPSK Chain a

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 10 MHz BPSK	**Ambient Temp. (°C):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	N/A dBi
Applied Voltage:	48V Vdc		
Notes 1:			
Notes 2:			

Conducted Spurious Measurment

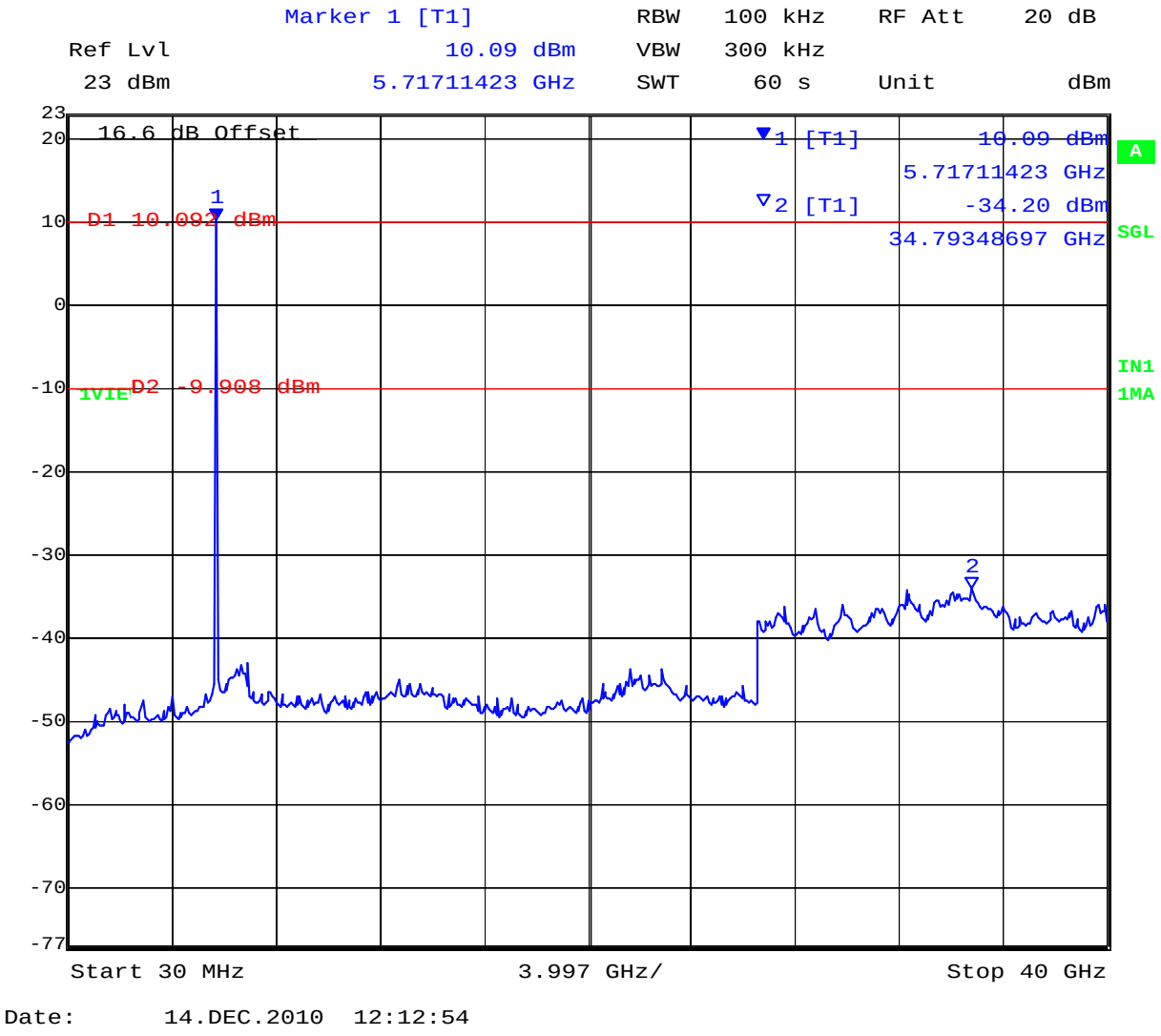
Test Frequency	Start Frequency	Stop Frequency	Maximum Observed Emission	Limit (20 dB below peak of fundamental)
MHz	MHz	MHz	dBm	dBm
5730.000	30.00	40000.00	-34.20	-9.91
5780.000	30.00	40000.00	-34.64	-9.54
5845.000	30.00	40000.00	-34.38	-11.39

Band-edge Measurment

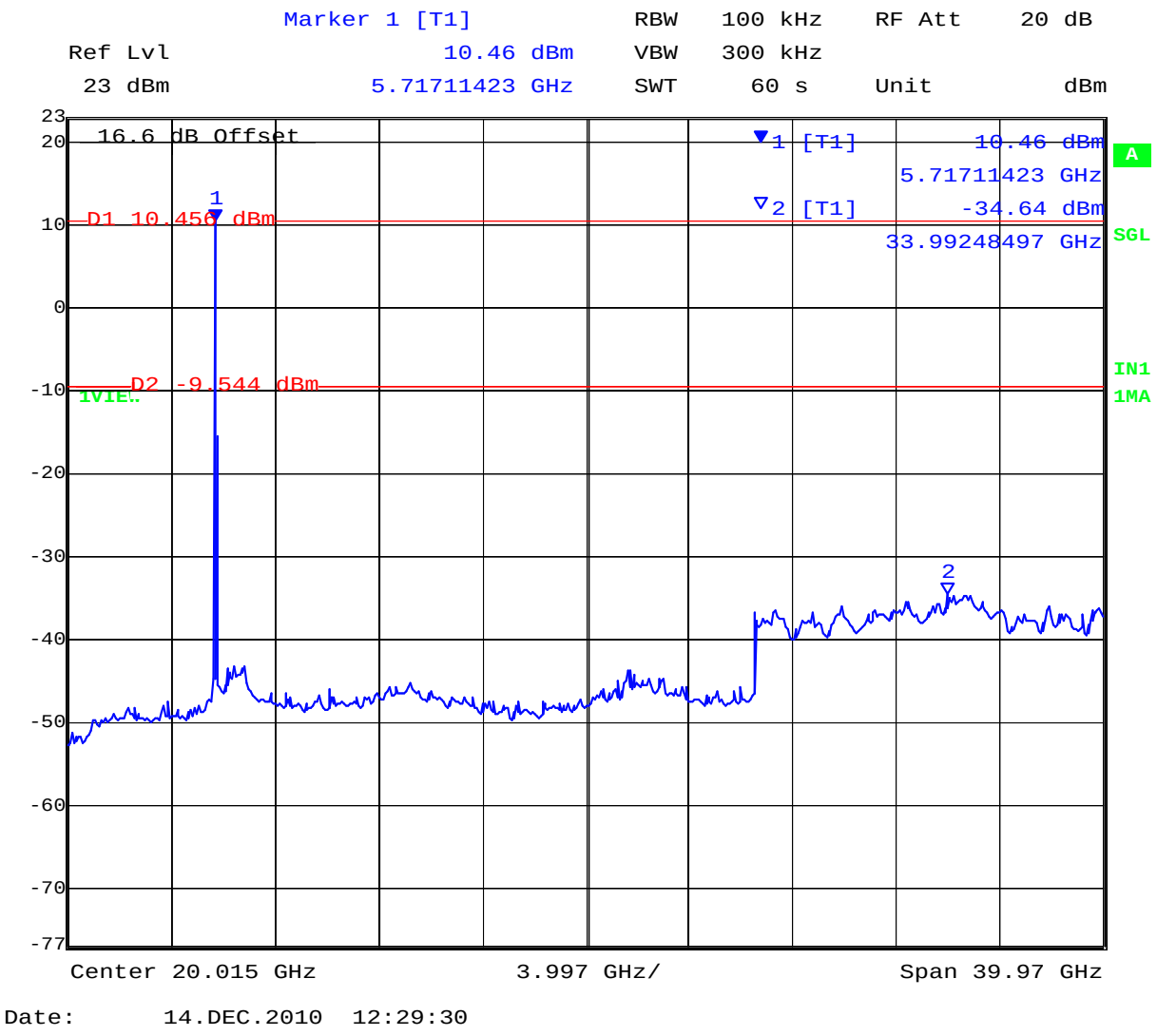
Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	MHz	dBm	dBm	dB
5730.000	5725.00	-9.53	-7.14	-2.40
5845.000	5850.00	-12.24	-10.12	-2.11

Measurement uncertainty:	±2.81 dB

Chain a TX SPR Ambient 5730MHz 48.00V 19.00dBm 0.03-40GHz

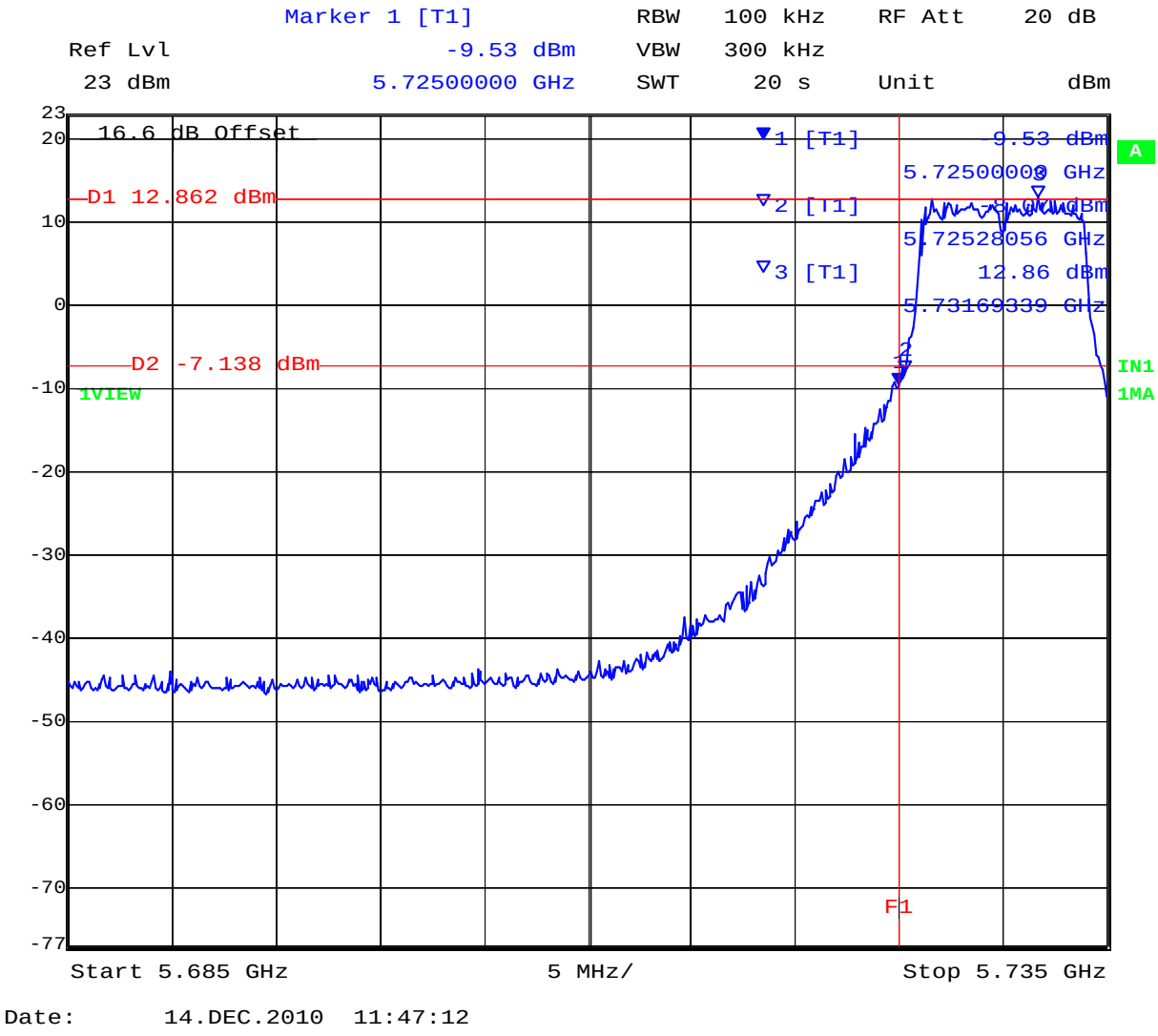


Chain a TX SPR Ambient 5780MHz 48.00V 19.84dBm 0.03-40GHz

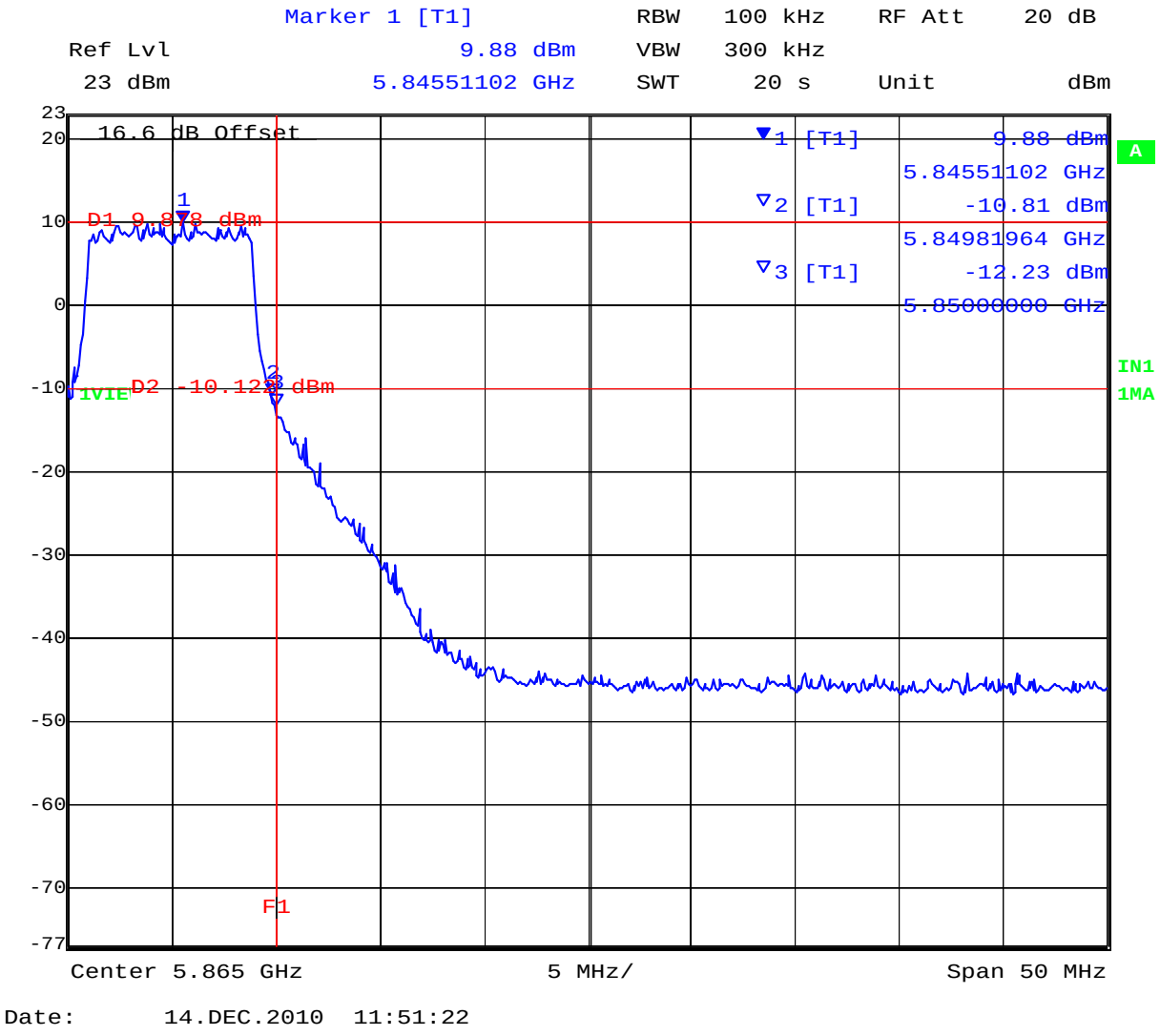


Chain a TX SPR Ambient 5845MHz 48.00V 18.14dBm 0.03-40GHz

Chain a Band Edge Ambient 5730MHz 48.00V 20.24dBm



Chain a Band Edge Ambient 5845MHz 48.00V 17.70dBm



7.5.6 Measurement Results for 802.11n 10MHz BPSK Chain b

Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 10 MHz BPSK	**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:**	N/A dBi
Applied Voltage:	48V Vdc		
Notes 1:	Chain B		
Notes 2:			

Conducted Spurious Measurment

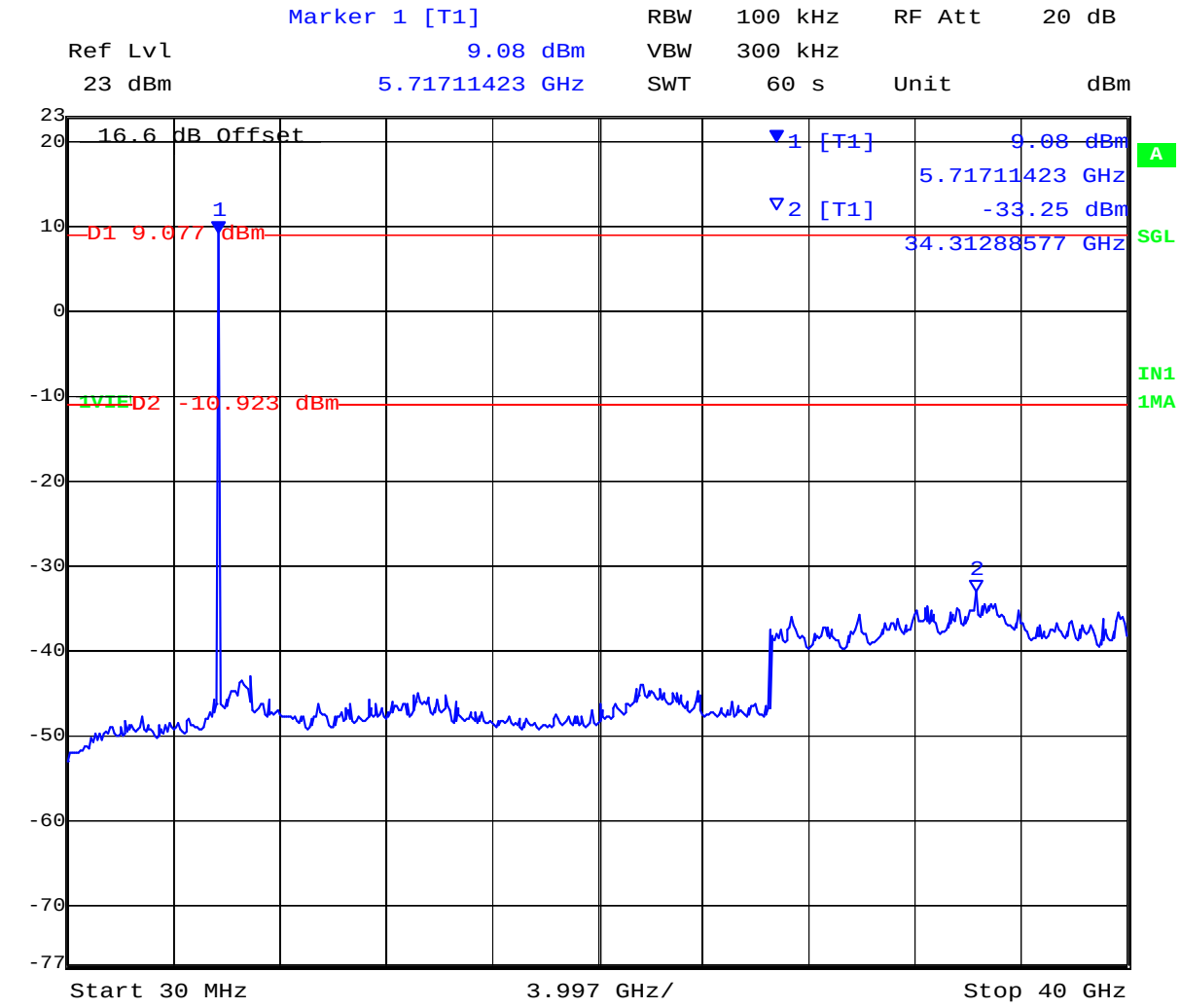
Test Frequency	Start Frequency	Stop Frequency	Maximum Observed Emission	Limit (20 dB below peak of fundamental)
MHz	**MHz**	**MHz**	**dBm**	**dBm**
5730.000	30.00	40000.00	-33.25	-10.92
5780.000	30.00	40000.00	-33.08	-11.11
5845.000	30.00	40000.00	-34.57	-10.47

Band-edge Measurment

Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	**MHz**	**dBm**	**dBm**	**dB**
5730.000	5725.00	-12.17	-9.55	-2.62
5845.000	5850.00	-10.44	-9.38	-1.05

Measurement uncertainty:	±2.81 dB

Chain b TX SPR Ambient 5730MHz 48.00V 17.65dBm 0.03-40GHz



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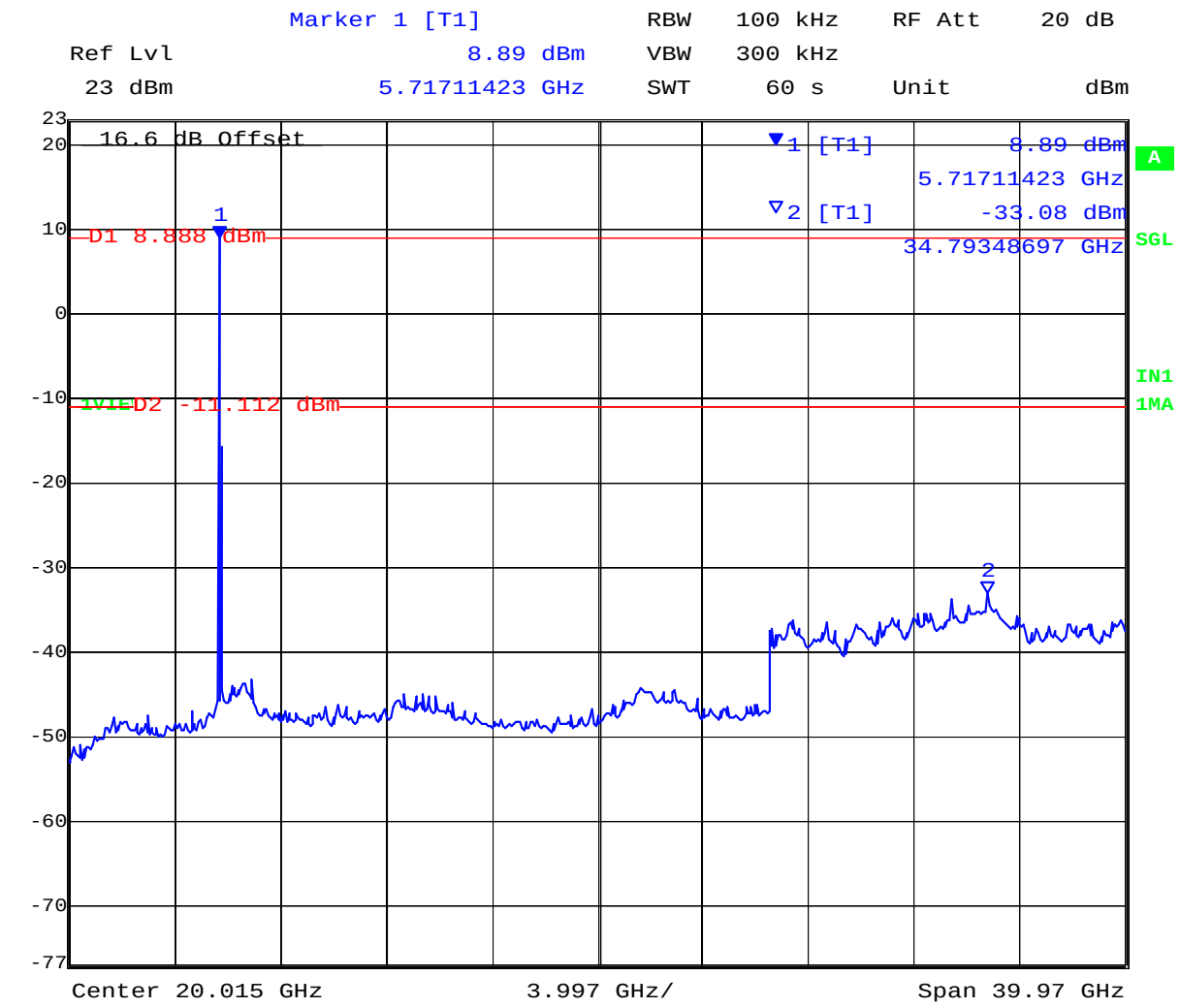
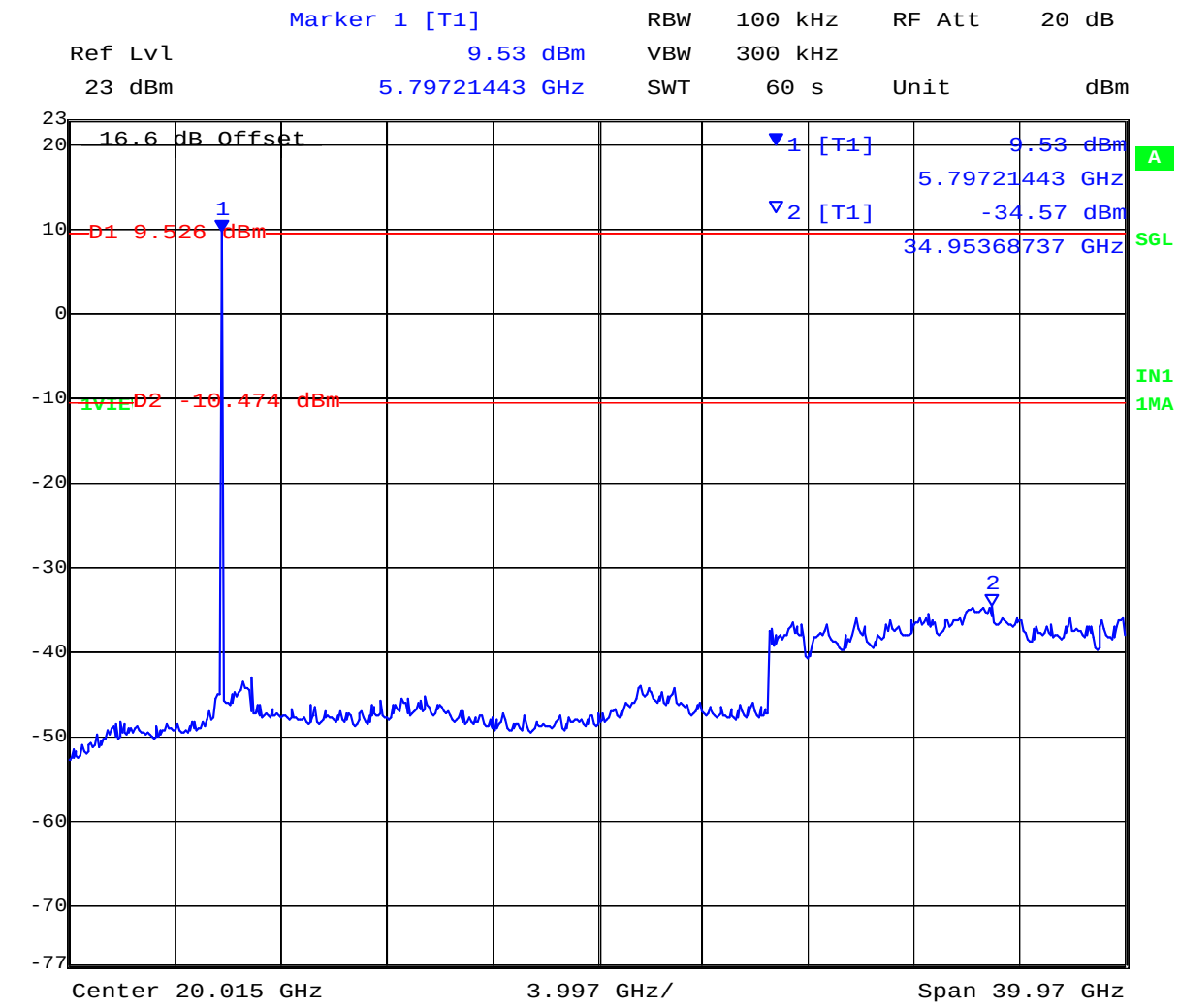
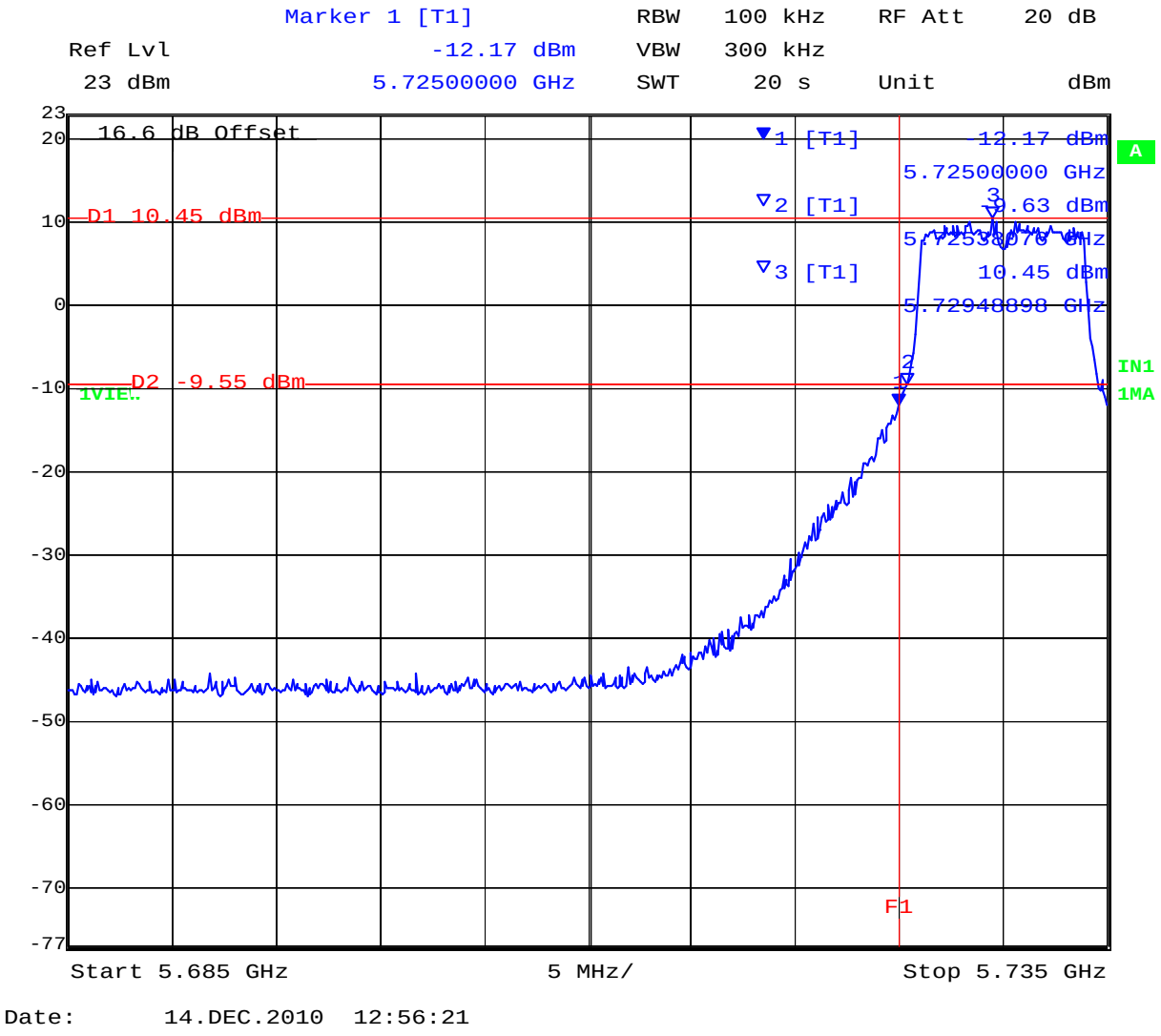
Chain b TX SPR Ambient 5780MHz 48.00V 18.79dBm 0.03-40GHz



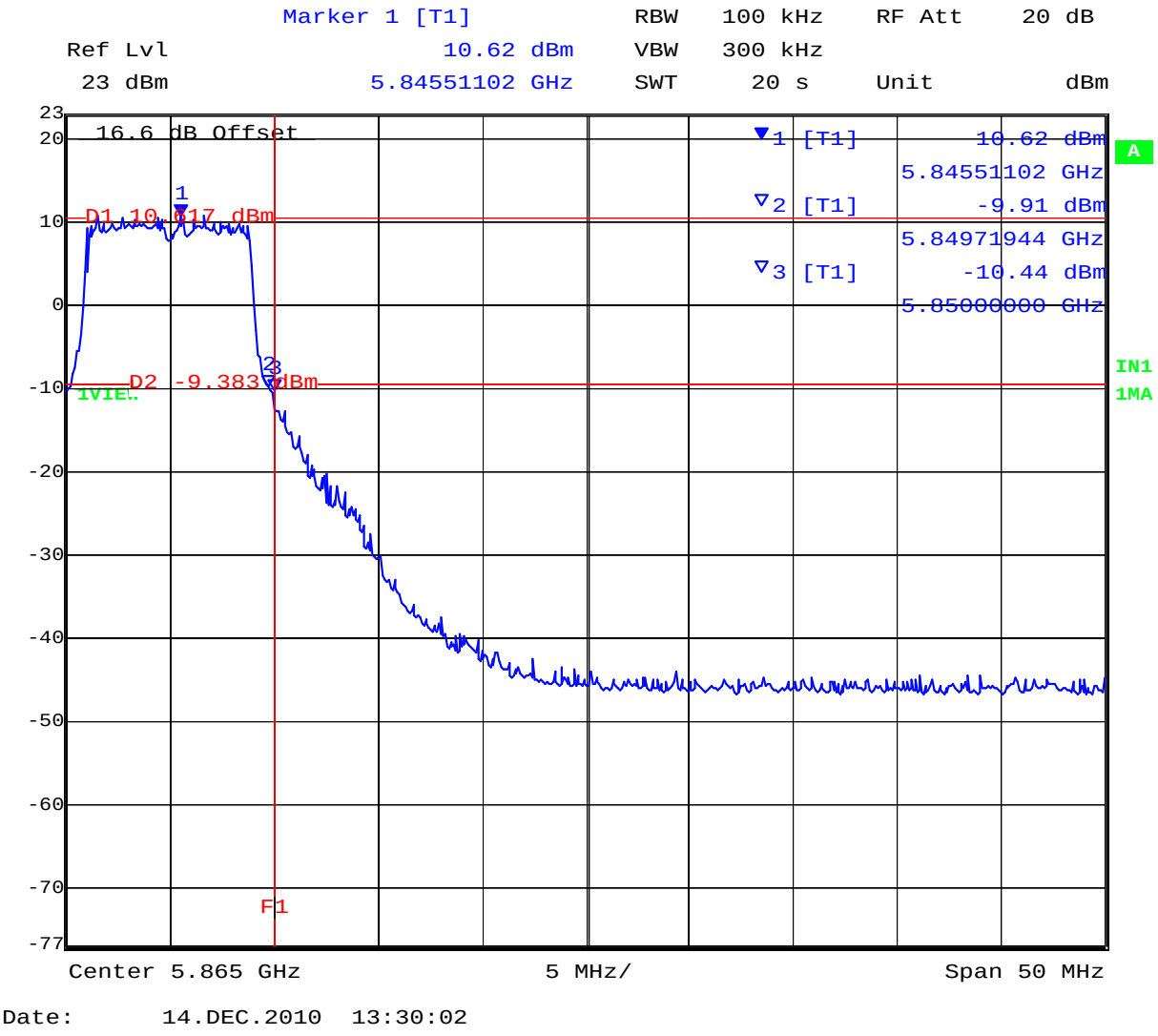
Chain b TX SPR Ambient 5845MHz 48.00V 18.64dBm 0.03-40GHz



Chain b Band Edge Ambient 5730MHz 48.00V 17.78dBm



Chain b Band Edge Ambient 5845MHz 48.00V 18.67dBm



7.5.7 Measurement Results for 802.11n 20MHz BPSK Chain a Band Edge

Note: Only band edge emissions results are presented. 802.11n 5MHz provides worst case conducted spurious emissions results.

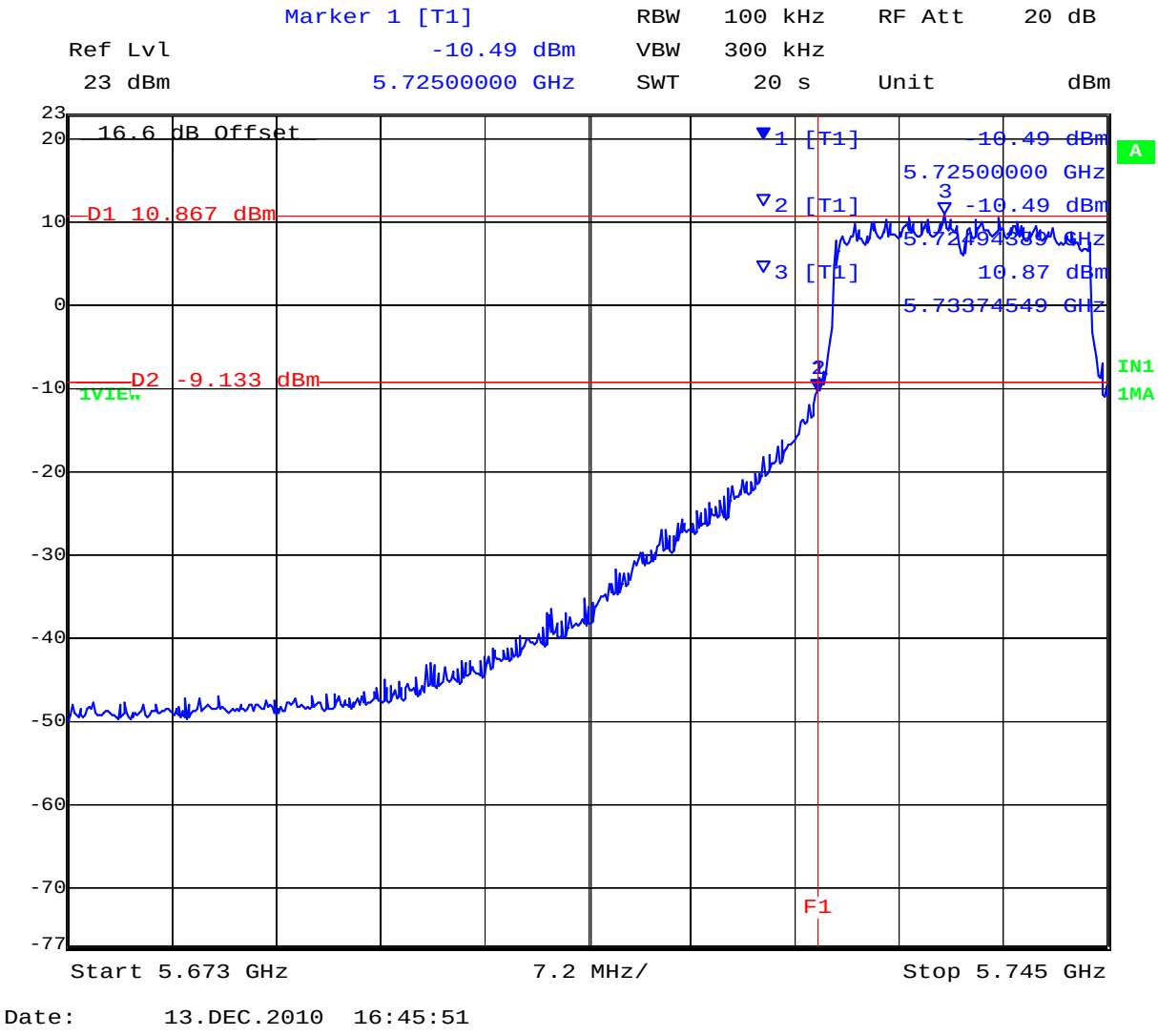
Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 20 MHz BPSK	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	N/A dBi
Applied Voltage:	48V Vdc		
Notes 1:	Chain A		
Notes 2:			

Band-edge Measurment

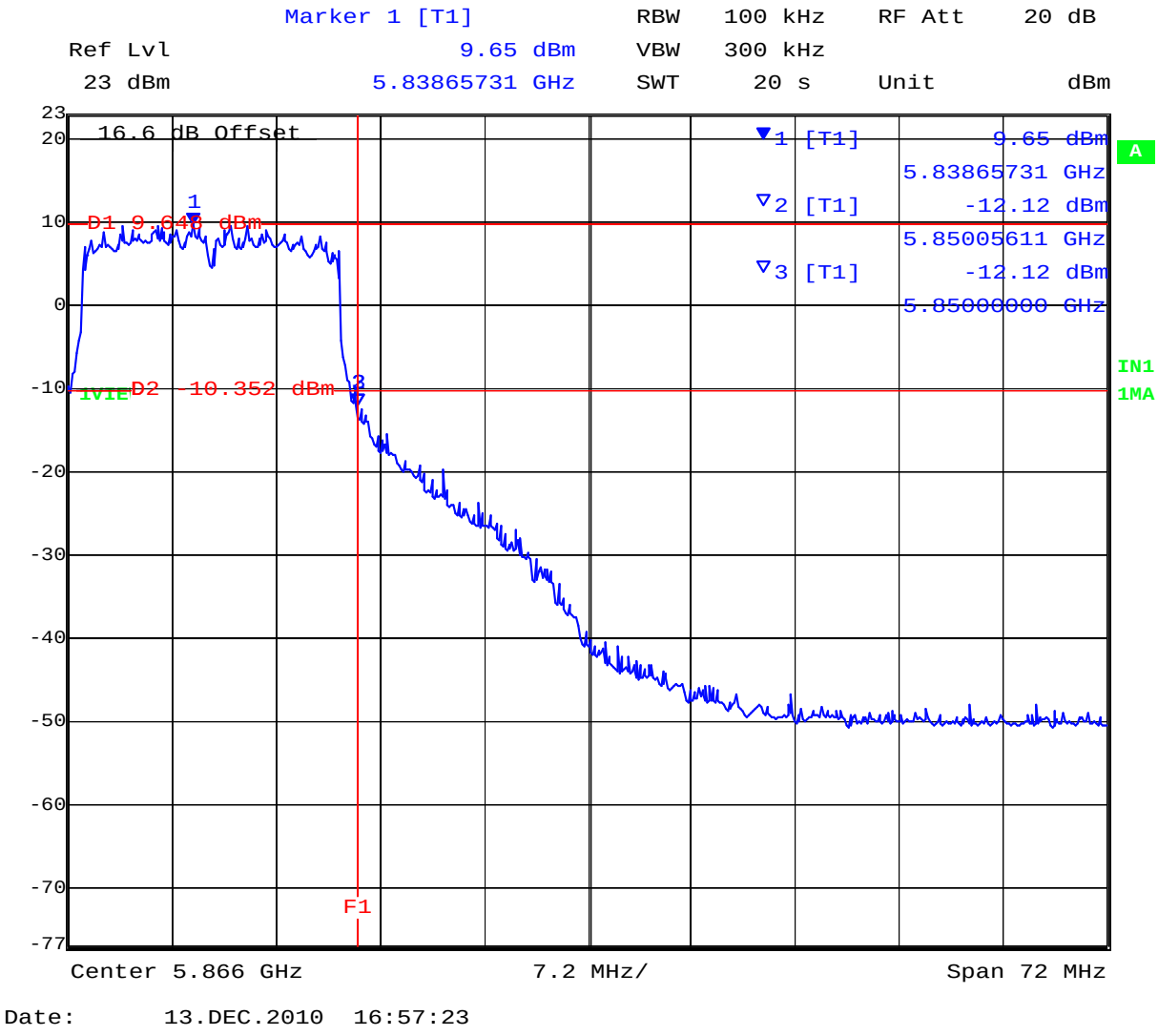
Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	**MHz**	**dBm**	**dBm**	**dB**
5735.000	5725.00	-10.49	-9.13	-1.36
5840.000	5850.00	-12.13	-10.35	-1.77

Measurement uncertainty:	±2.81 dB

Chain a Band Edge Ambient 5735MHz 48.00V 21.58dBm



Chain a Band Edge Ambient 5840MHz 48.00V 20.52dBm



7.5.8 Measurement Results for 802.11n 20MHz BPSK Chain b band Edge

Note: Only band edge emissions results are presented. 802.11n 5MHz provides worst case conducted spurious emissions results.

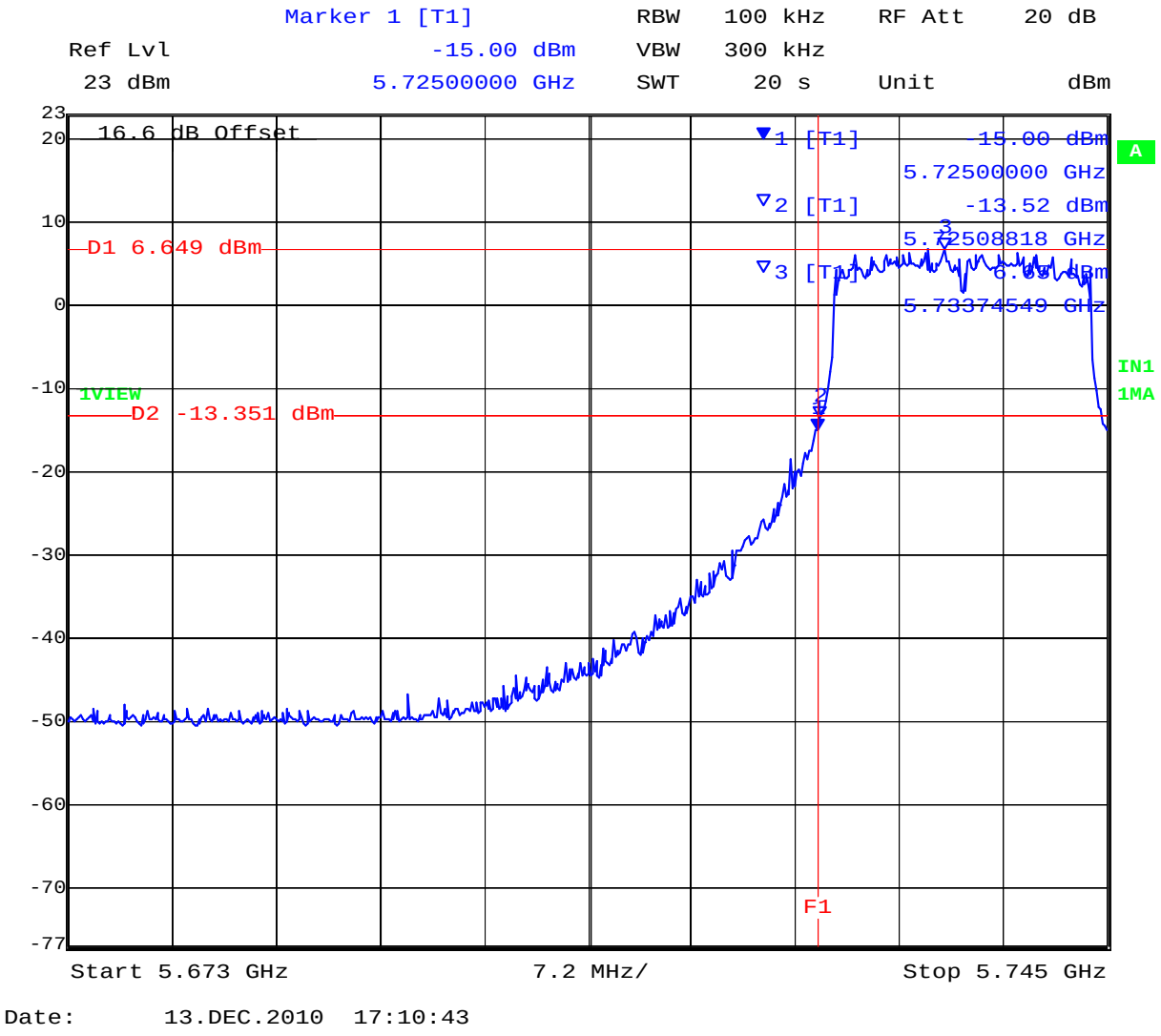
Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 20 MHz BPSK	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	N/A dBi
Applied Voltage:	48V Vdc		
Notes 1:	Chain B		
Notes 2:			

Band-edge Measurment

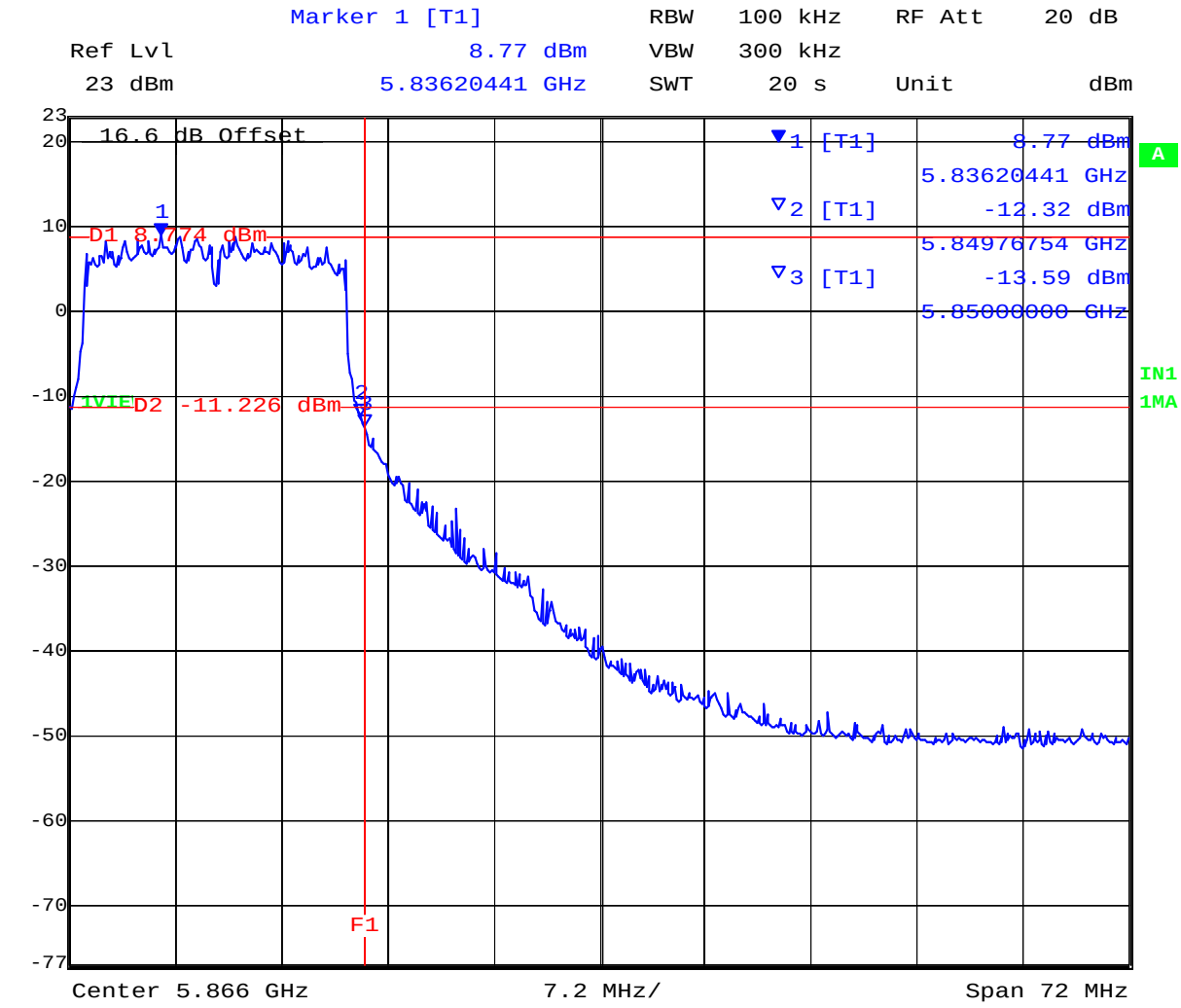
Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	**MHz**	**dBm**	**dBm**	**dB**
5735.000	5725.00	-15.01	-13.35	-1.65
5840.000	5850.00	-13.59	-11.23	-2.37

Measurement uncertainty:	±2.81 dB

Chain b Band Edge Ambient 5735MHz 48.00V 17.58dBm



Chain b Band Edge Ambient 5840MHz 48.00V 19.70dBm



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7.5.9 Measurement Results for 802.11n 40MHz BPSK Chain a Band Edge

Note: Only band edge emissions results are presented. 802.11n 5MHz provides worst case conducted spurious emissions results.

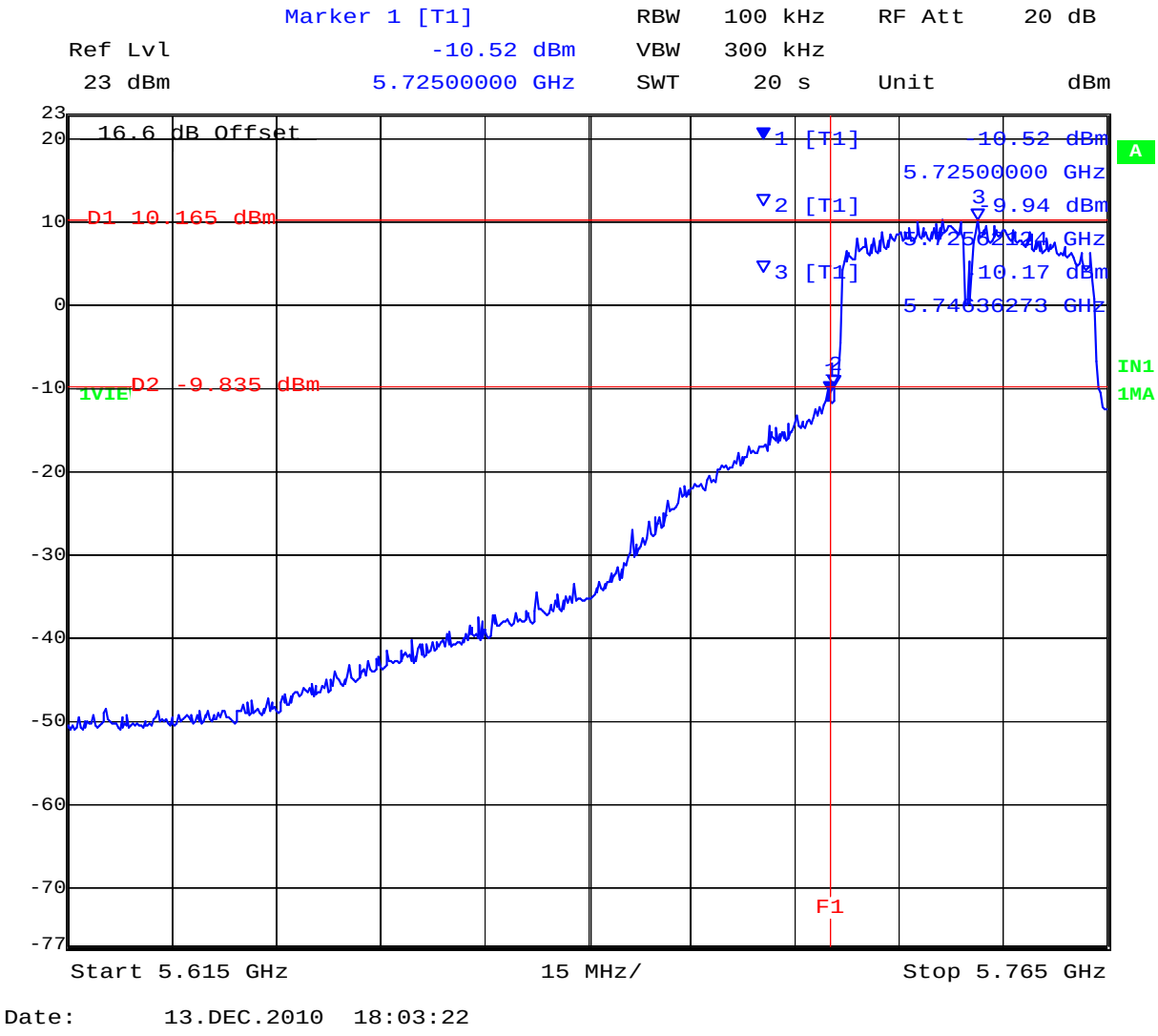
Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 40 MHz BPSK	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	N/A dBi
Applied Voltage:	48V Vdc		
Notes 1:	Chain A		
Notes 2:			

Band-edge Measurment

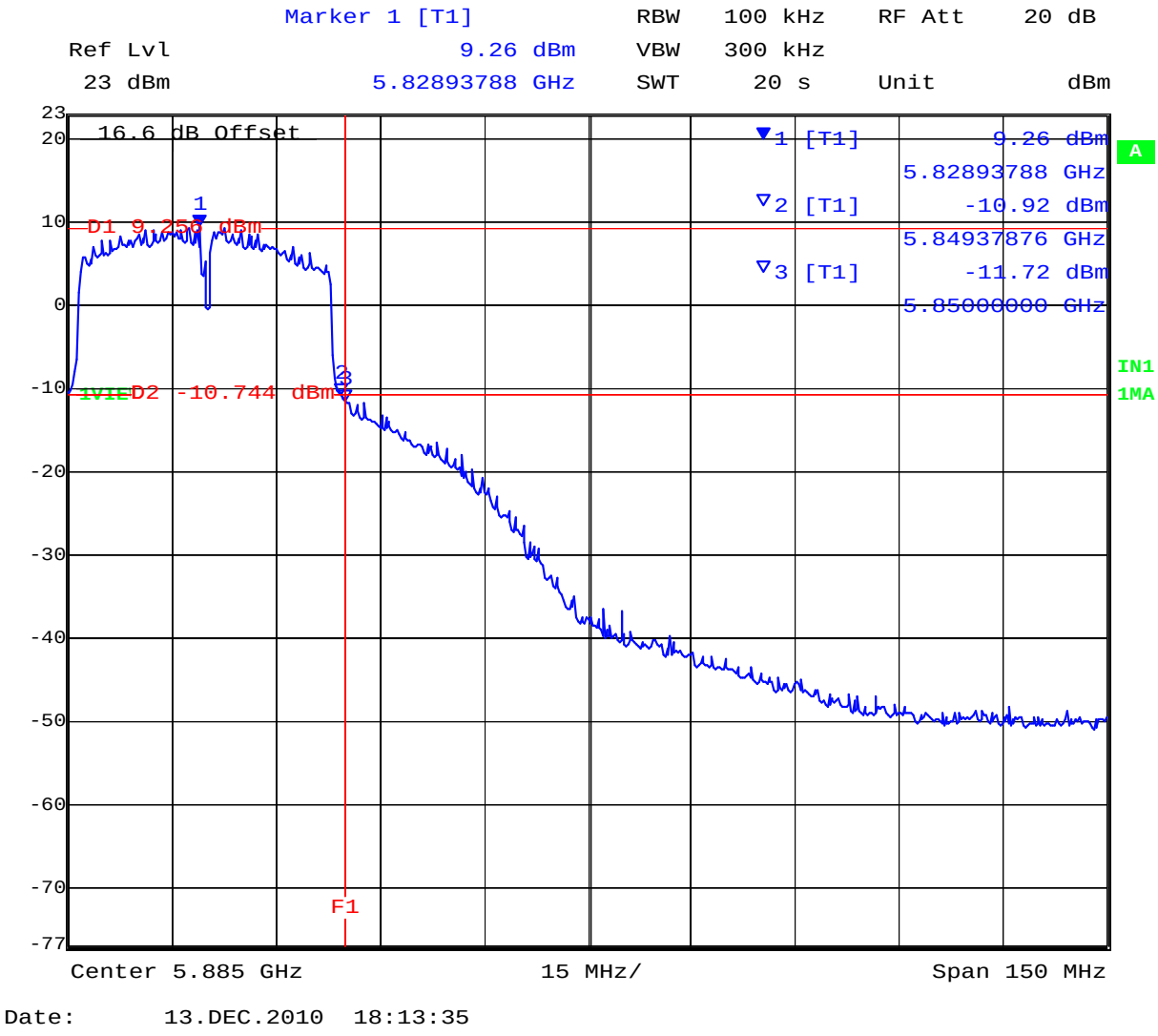
Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	**MHz**	**dBm**	**dBm**	**dB**
5745.000	5725.00	-10.52	-9.84	-0.69
5830.000	5850.00	-11.72	-10.74	-0.98

Measurement uncertainty:	±2.81 dB

Chain a Band Edge Ambient 5745MHz 48.00V 23.55dBm



Chain a Band Edge Ambient 5830MHz 48.00V 22.82dBm



7.5.10 Measurement Results for 802.11n 40MHz BPSK Chain b Band Edge

Note: Only band edge emissions results are presented. 802.11n 5MHz provides worst case conducted spurious emissions results.

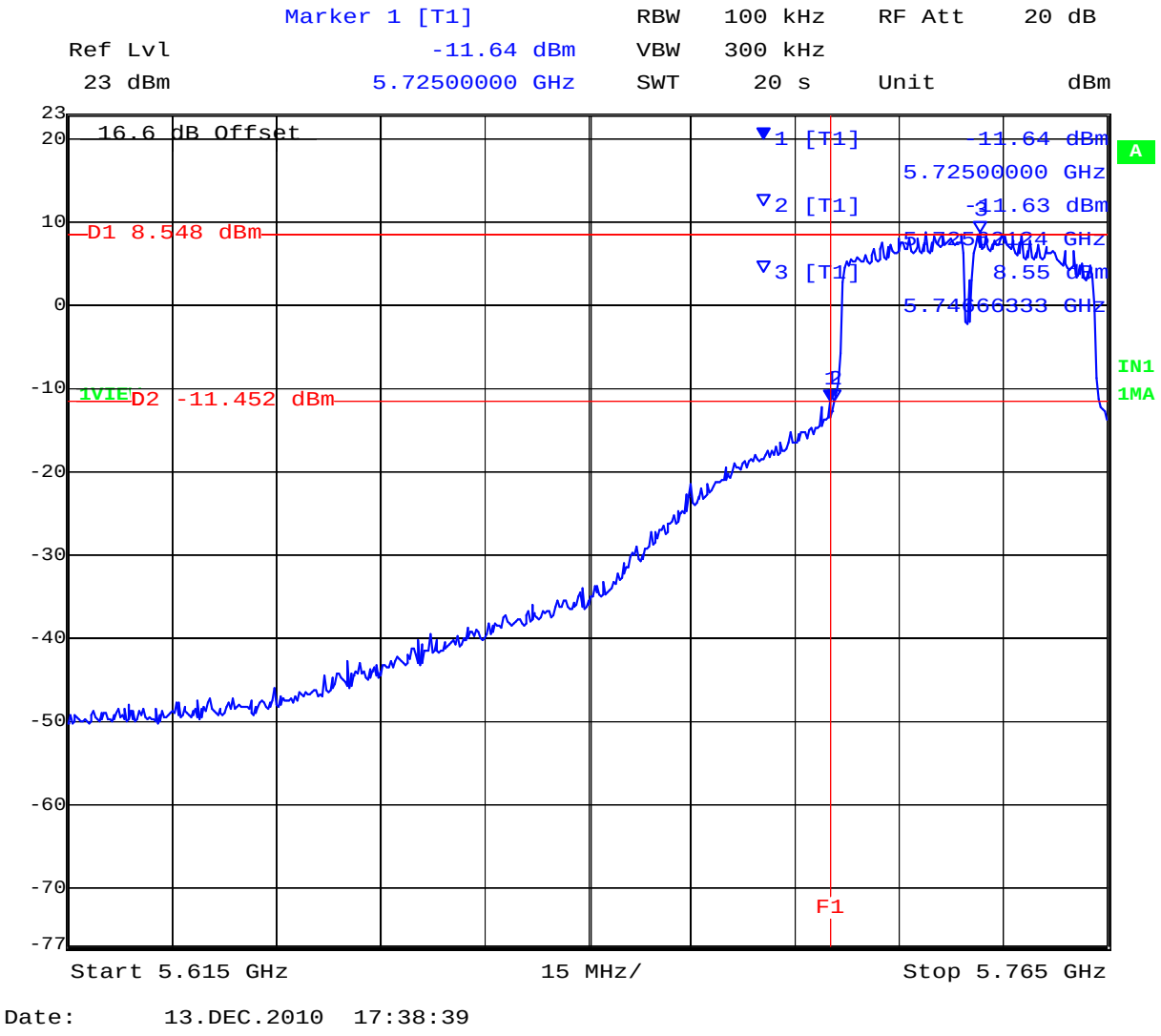
Test Conditions:	15.247 (a)(2)	**Rel. Humidity (%):**	35 to 42
Variant:	802.11n 40 MHz BPSK	**Ambient Temp. (ºC):**	19 to 22
TPC:	HIGH	**Pressure (mBars):**	998 to 1003
Modulation:	ON	**Duty Cycle (%):**	100
Beam Forming Gain (Y):	N/A dB	**Antenna Gain:**	N/A dBi
Applied Voltage:	48V Vdc		
Notes 1:	Chain B		
Notes 2:			

Band-edge Measurment

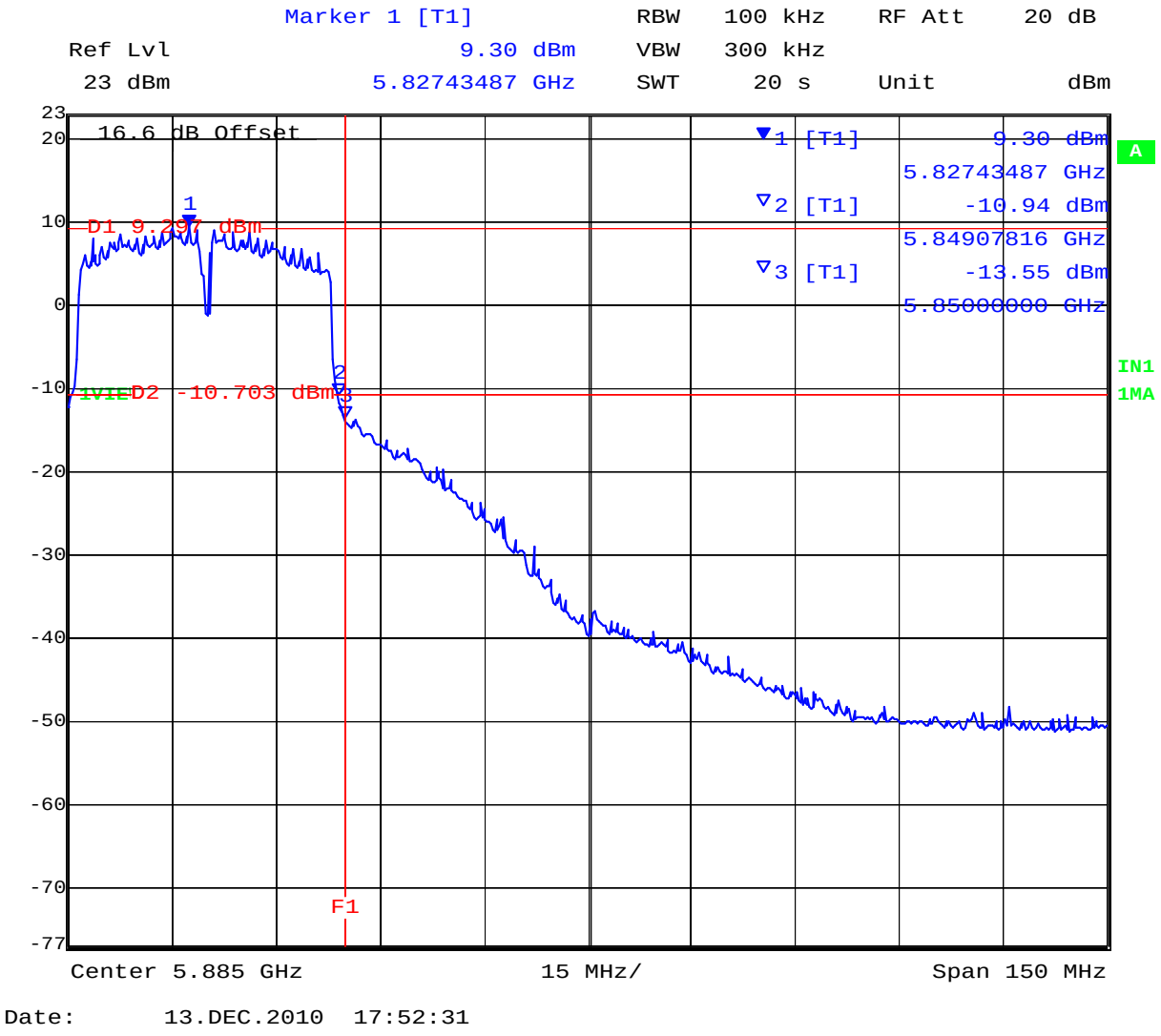
Test Frequency	Band-edge Frequency	Emission Amplitude @ Band-edge	Limit (20 dB below peak of fundamental)	Margin
MHz	**MHz**	**dBm**	**dBm**	**dB**
5745.000	5725.00	-11.64	-11.45	-0.19
5830.000	5850.00	-13.55	-10.70	-2.85

Measurement uncertainty:	±2.81 dB

Chain b Band Edge Ambient 5745MHz 48.00V 22.32dBm



Chain b Band Edge Ambient 5830MHz 48.00V 22.60dBm



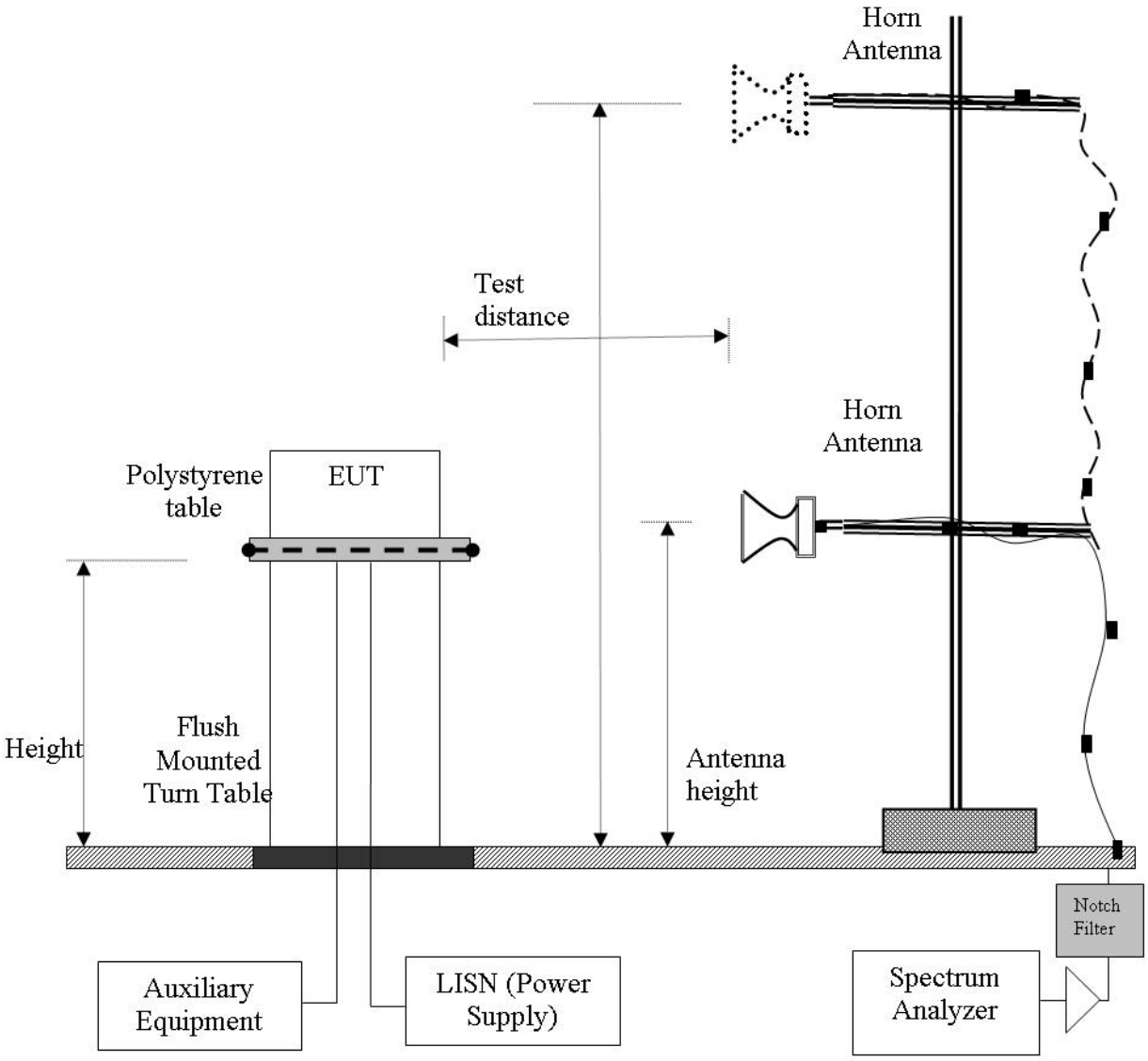
7.6 Radiated Spurious Emissions

Test Procedure

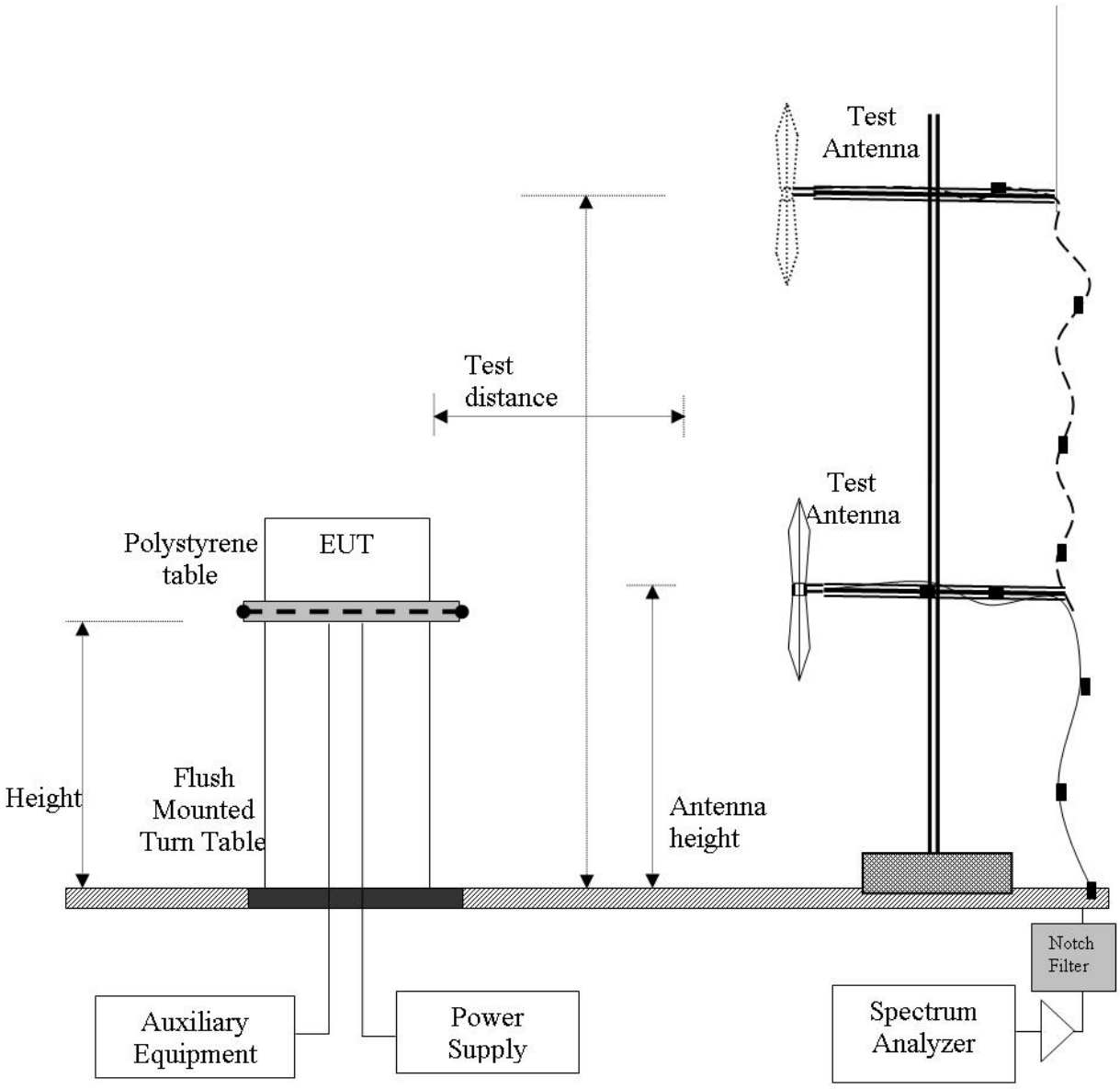
Testing was performed in a 3-meter anechoic chamber. Preliminary radiated emissions were measured on every azimuth and with the receiving antenna in both horizontal and vertical polarizations. Preliminary emissions were recorded with in Spectrum Analyzer mode, using a maximum peak detector while in peak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

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.

Radiated Emission Measurement Setup – Above 1 GHz



Radiated Emission Measurement Setup – Below 1 GHz



Field Strength Calculation

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

FS = R + AF + CORR – FO

FS = Field Strength
R = Measured Spectrum analyzer Input Amplitude
AF = Antenna Factor

CORR = Correction Factor = CL – AG + NFL

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

Field Strength Calculation Example:

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

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

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

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

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

Specification

Radiated Spurious Emissions

FCC §15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section §15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(a)).

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.

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

Specification

Radiated Spurious Emissions

Industry Canada RSS-Gen §4.10
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
If a radiated measurement is made, all spurious emissions shall comply with the limits of *Table 1: RSS-Gen §6 Spurious Emissions Limits.*

Table 1: RSS-Gen §6 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:

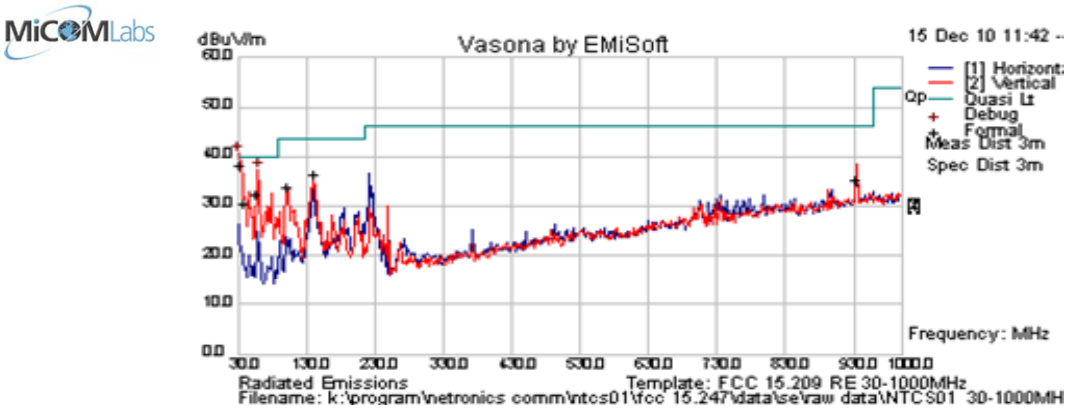
Method	Test Equipment Used
Work instruction WI-03	0287, 0193, 0342, 0158, 0303, 0304, 0134, 0310, 0312

7.6.1 Transmitter Radiated Spurious Emissions

Radiated Transmitter emissions was performed on the EUT mode with the highest Power Spectral Density and the highest gain antenna's of each type. Emissions below 1 GHz was performed using only the highest gain antenna. Emissions were investigated, and no radio emissions were witnessed. All emissions present were from non-radio sources.

7.6.1.1 15.209 Emissions Below 1 GHz

Test Freq.	5730 MHz	**Engineer**	GG
Variant	802.11n; 3.25 Mbps (MCS 8)	**Temp (ºC)**	24
Freq. Range	30 - 1000 MHz	**Rel. Hum.(%)**	32
Power Setting	Maximum	**Press. (mBars)**	1003
Antenna	QFD2-56-N	**Duty Cycle (%)**	100
Test Notes 1	EUT and POE Power Supply in Chamber; Laptop to control radio located in control room. ISN connected at computer for impedance matching.		
Test Notes 2	Performed with highest gain antenna; Emissions verified to NOT come from radio.		



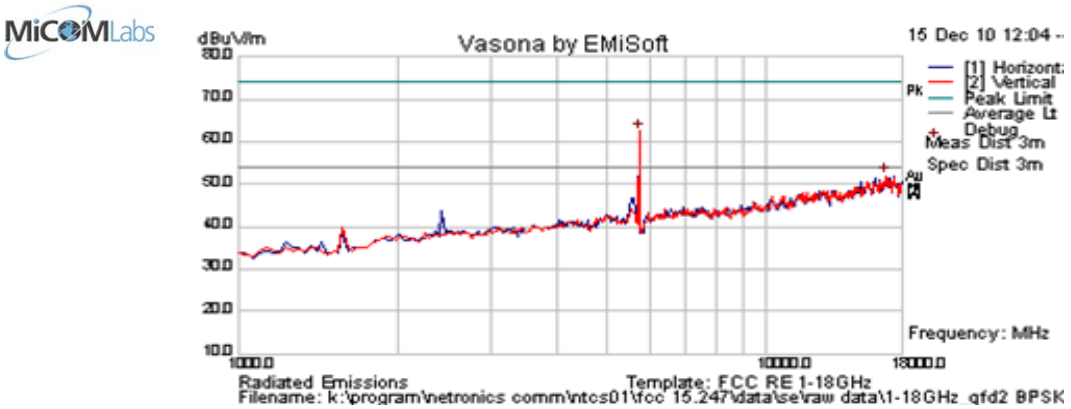
Formally measured emission peaks

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
58.741	52.3	3.8	-23.9	32.2	Quasi Max	V	160	49	40.0	-7.8	Pass	DIG
32.606	45.9	3.4	-11.1	38.3	Quasi Max	V	101	66	40.0	-1.8	Pass	DIG
40.345	43.8	3.6	-17.0	30.4	Quasi Max	V	128	325	40	-9.6	Pass	DIG
141.201	50.2	4.4	-18.1	36.5	Quasi Max	V	99	92	43.5	-7.0	Pass	DIG
101.871	50.2	4.2	-20.5	33.9	Quasi Max	V	112	62	43.5	-9.6	Pass	DIG
933.310	34.9	7.5	-7.0	35.3	Quasi Max	V	98	268	46	-10.7	Pass	DIG

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

7.6.1.2 15.209 Emissions Above 1 GHz – Antenna QFD2-56-N

Test Freq.	5730 MHz	**Engineer**	GG
Variant	802.11n; 3.25 Mbps (MCS 8)	**Temp (ºC)**	24
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	32
Power Setting	23 in ART test utility	**Press. (mBars)**	1002
Antenna	QFD2-56-N	**Duty Cycle (%)**	100
Test Notes 1	EUT and POE Power Supply in Chamber; Laptop to control radio located in control room. ISN connected at computer for impedance matching.		
Test Notes 2			

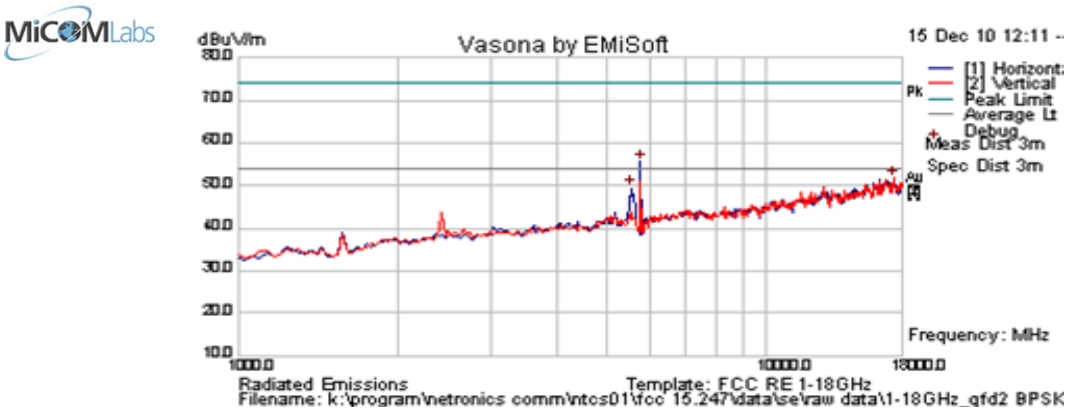


Formally measured emission peaks

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
5731.263	66.0	4.8	-8.3	62.5	Peak [Scan]	H	--	--	--	--	n/a	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.	5780 MHz	**Engineer**	GG
Variant	802.11n; 3.25 Mbps (MCS 8)	**Temp (°C)**	24
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	32
Power Setting	23 in ART test utility	**Press. (mBars)**	1002
Antenna	QFD2-56-N	**Duty Cycle (%)**	100
Test Notes 1	EUT and POE Power Supply in Chamber; Laptop to control radio located in control room. ISN connected at computer for impedance matching.		
Test Notes 2			

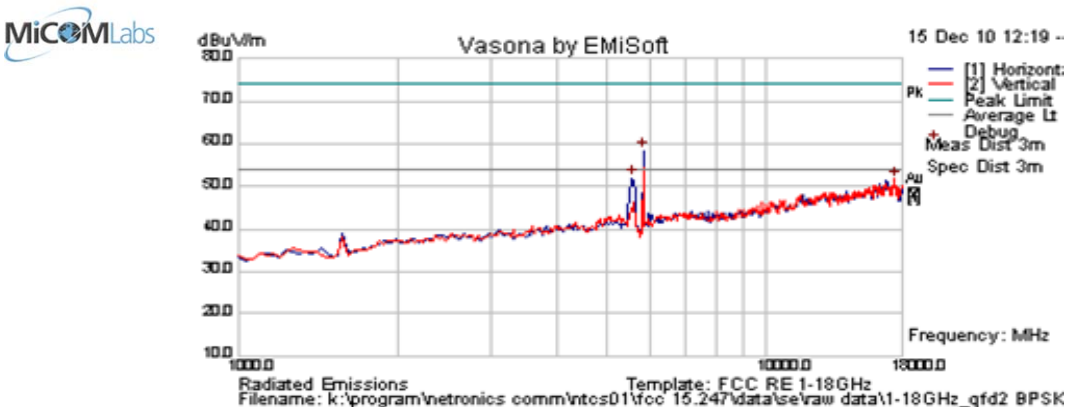


Formally measured emission peaks

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
5531.062	53.5	4.6	-8.7	49.5	Peak [Scan]	H	> 20dB below fundamental				Pass	NRB
5769.539078	59.2	4.8	-8.3	55.6	Peak [Scan]	H	100	--	--	--	n/a	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.	5845 MHz	**Engineer**	GG
Variant	802.11n; 3.25 Mbps (MCS 8)	**Temp (°C)**	24
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	32
Power Setting	23 in ART test utility	**Press. (mBars)**	1002
Antenna	QFD2-56-N	**Duty Cycle (%)**	100
Test Notes 1	EUT and POE Power Supply in Chamber; Laptop to control radio located in control room. ISN connected at computer for impedance matching.		
Test Notes 2			



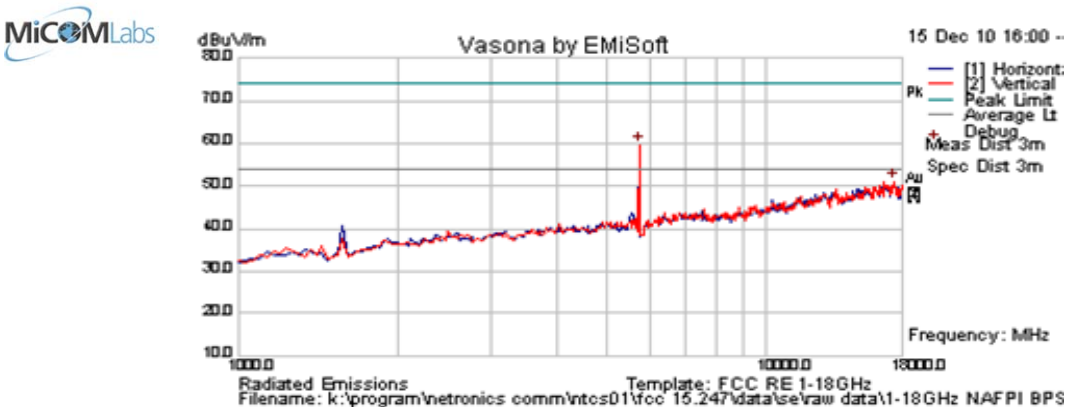
Formally measured emission peaks

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
5843.888	62.1	4.8	-8.5	58.4	Peak [Scan]	H	100	--	--	--	n/a	FUND
5565.130261	55.9	4.7	-8.5	52.1	Peak [Scan]	H	> 20dB below fundamental				Pass	NRB

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

7.6.1.3 15.209 Emissions Above 1 GHz – Antenna NA 5824 FPI

Test Freq.	5730 MHz	**Engineer**	GG
Variant	802.11n; 3.25 Mbps (MCS 8)	**Temp (ºC)**	24
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	32
Power Setting	23 in ART test utility	**Press. (mBars)**	1002
Antenna	NA 5824 FPI	**Duty Cycle (%)**	100
Test Notes 1	EUT and POE Power Supply in Chamber; Laptop to control radio located in control room. ISN connected at computer for impedance matching.		
Test Notes 2			

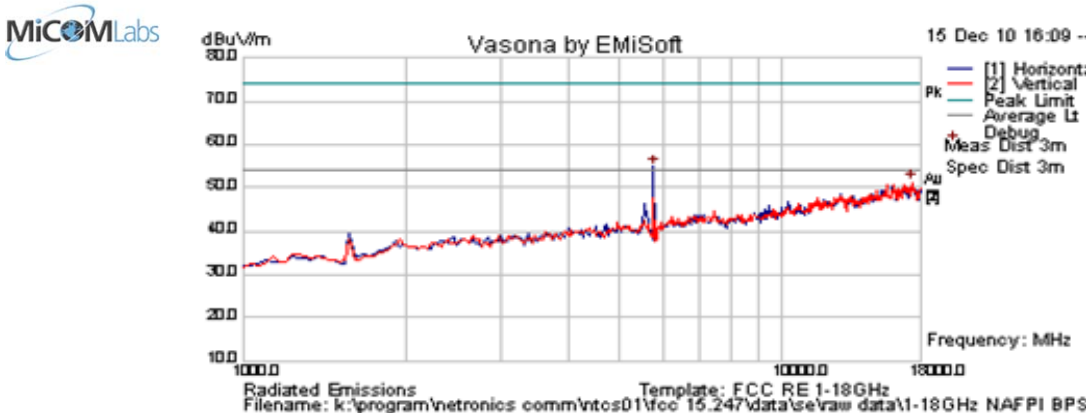


Formally measured emission peaks

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
5729.970	63.2	4.8	-8.3	59.6	Peak [Scan]	V	100	--	--	--	n/a	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.	5780 MHz	**Engineer**	GG
Variant	802.11n; 3.25 Mbps (MCS 8)	**Temp (°C)**	24
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	32
Power Setting	23 in ART test utility	**Press. (mBars)**	1002
Antenna	NA 5824 FPI	**Duty Cycle (%)**	100
Test Notes 1	EUT and POE Power Supply in Chamber; Laptop to control radio located in control room. ISN connected at computer for impedance matching.		
Test Notes 2			

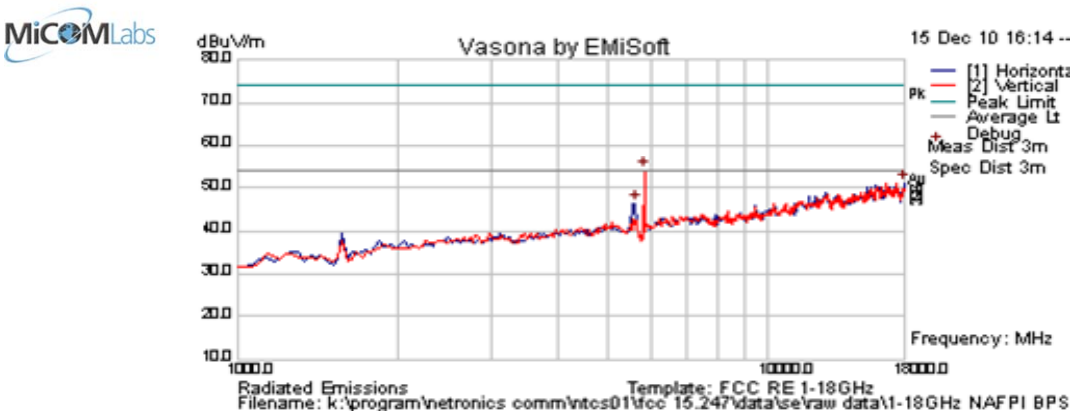


Formally measured emission peaks

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
5778.677	58.4	4.8	-8.4	54.8	Peak [Scan]	H	100	--	--	--	n/a	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.	5845 MHz	**Engineer**	GG
Variant	802.11n; 3.25 Mbps (MCS 8)	**Temp (°C)**	24
Freq. Range	1000 MHz - 18000 MHz	**Rel. Hum.(%)**	32
Power Setting	23 in ART test utility	**Press. (mBars)**	1002
Antenna	NA 5824 FPI	**Duty Cycle (%)**	100
Test Notes 1	EUT and POE Power Supply in Chamber; Laptop to control radio located in control room. ISN connected at computer for impedance matching.		
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
5633.254	50.1	4.7	-8.4	46.4	Peak [Scan]	V	> 20dB below fundamental				Pass	NRB
5837.675351	57.9	4.8	-8.6	54.1	Peak [Scan]	H	100	--	--	--	n/a	FUND

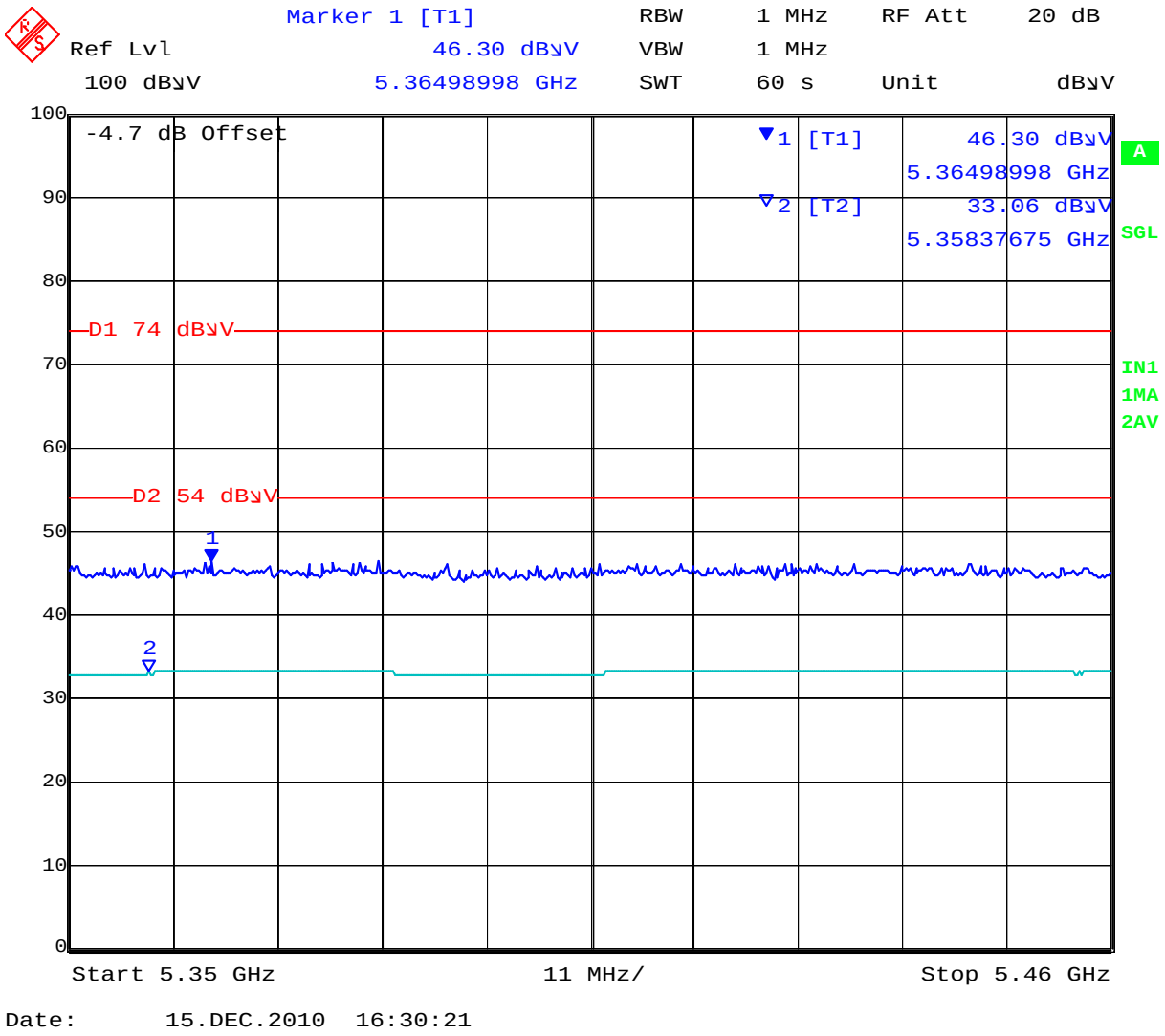
Legend:	TX = Transmitter Emissions; DIG = Digital Emissions; FUND = Fundamental; WB = Wideband Emission
	RB = Restricted Band (15.209 Limits); NRB = Non Restricted Band, Limit is 20dB below fundamental peak

7.6.2 Band Edge Measurements

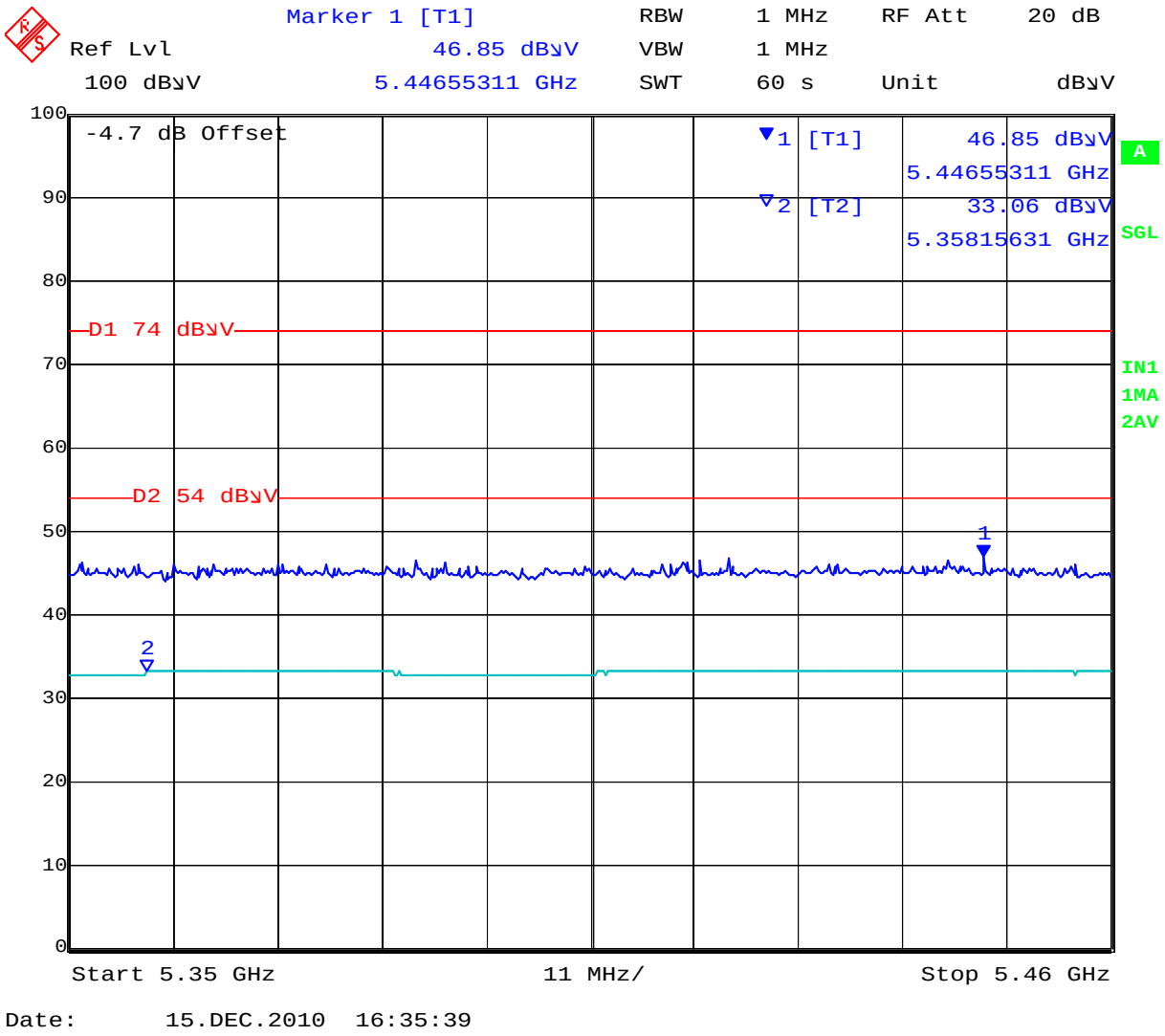
7.6.2.1 Band Edge Emissions - Antenna NA 5824 FPI

Modulation	Measurement Type	Measured Value	Limit (dBuV)	Margin (dB)
BPSK 5MHz	Peak	46.30	74	-27.70
BPSK 5MHz	Average	33.06	54	-20.94
64QAM 5MHz	Peak	46.85	74	-27.15
64QAM 5MHz	Average	33.06	54	-20.94
BPSK 10MHz	Peak	47.48	74	-26.52
BPSK 10MHz	Average	33.98	54	-20.02
BPSK 20MHz	Peak	47.04	74	-26.96
BPSK 20MHz	Average	33.98	54	-20.02
BPSK 40MHz	Peak	46.91	74	-27.09
BPSK 40MHz	Average	33.68	54	-20.32

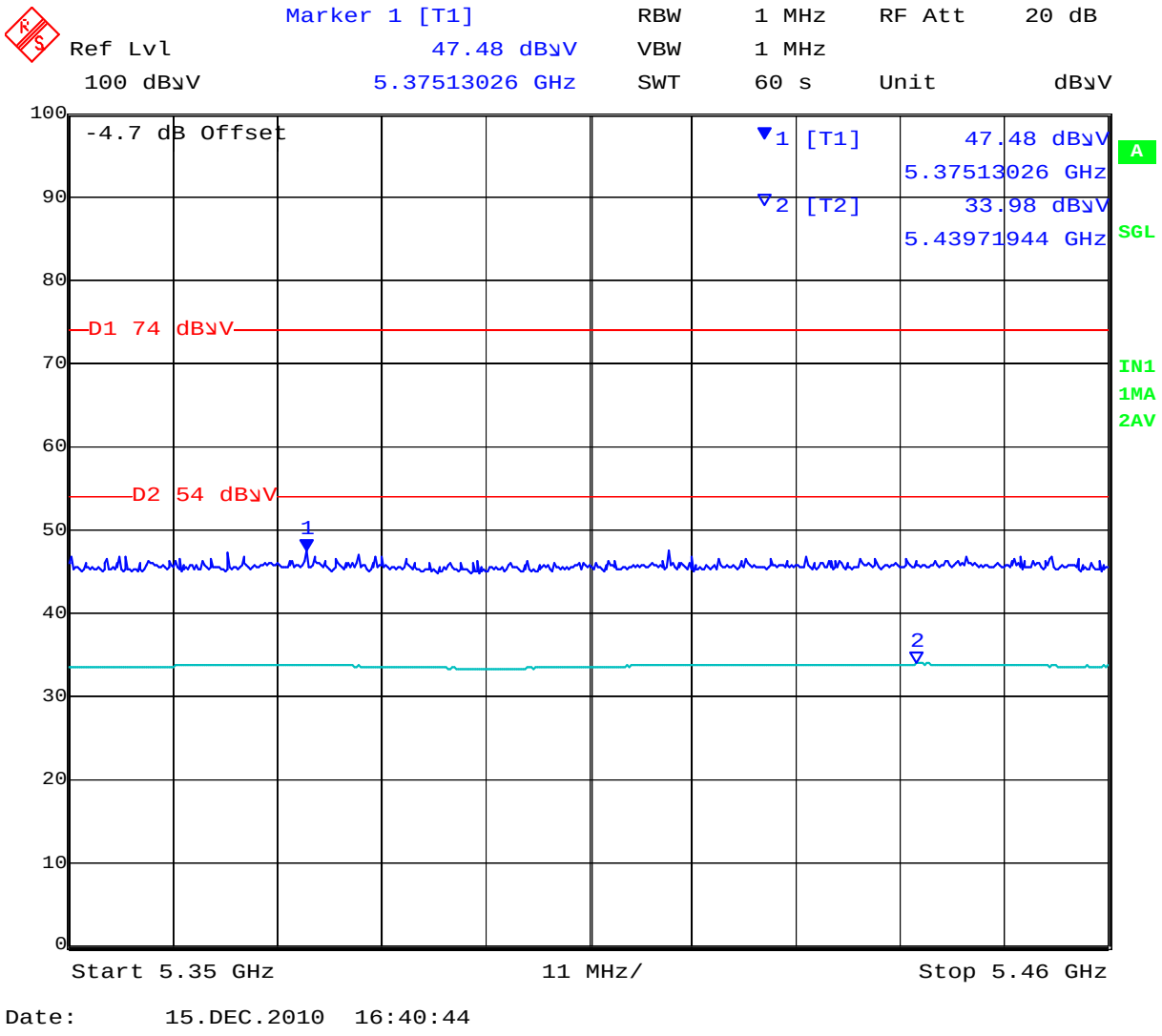
NA 5824 FPI 5350-5460MHz HOR Tx=5730MHz BPSK 5MHz 3.25 (MCS8) P23



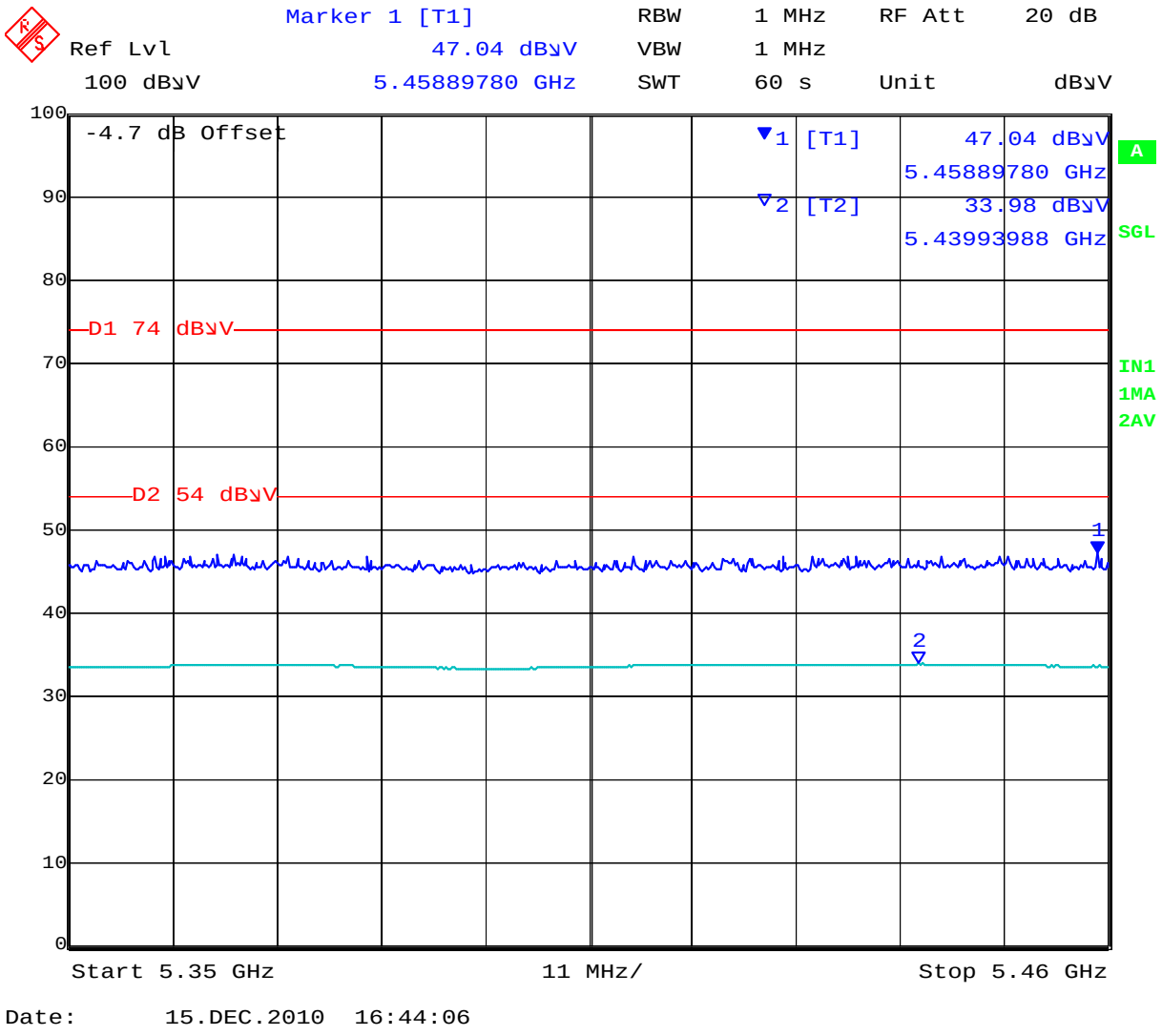
NA 5824 FPI 5350-5460MHz HOR Tx=5730MHz 64QAM 5MHz 32.5 (MCS15) P23



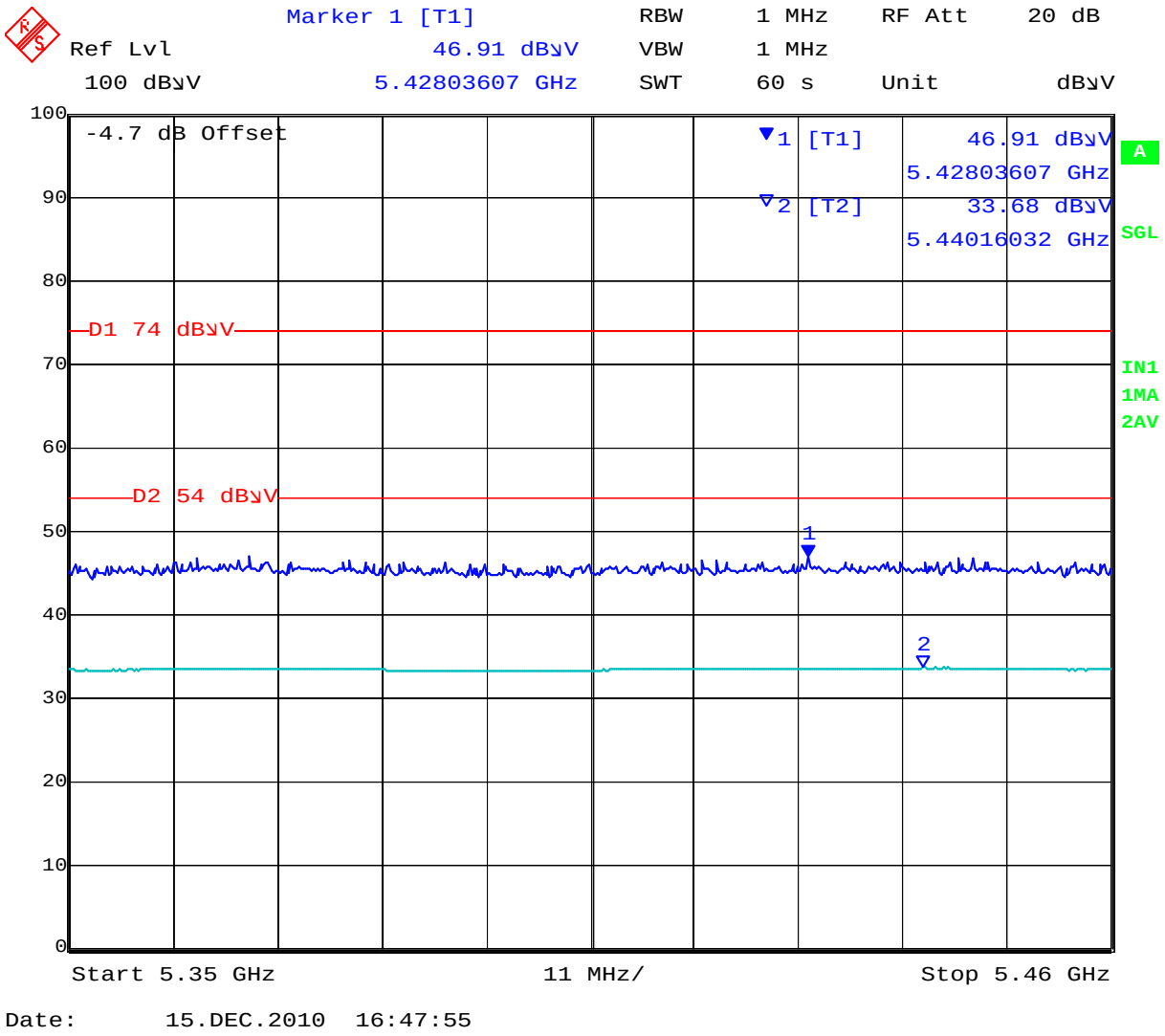
NA 5824 FPI 5350-5460MHz HOR Tx=5730MHz BPSK 10MHz 3.25 (MCS8) P23



NA 5824 FPI 5350-5460MHz HOR Tx=5735MHz BPSK 20MHz 3.25 (MCS8) P23



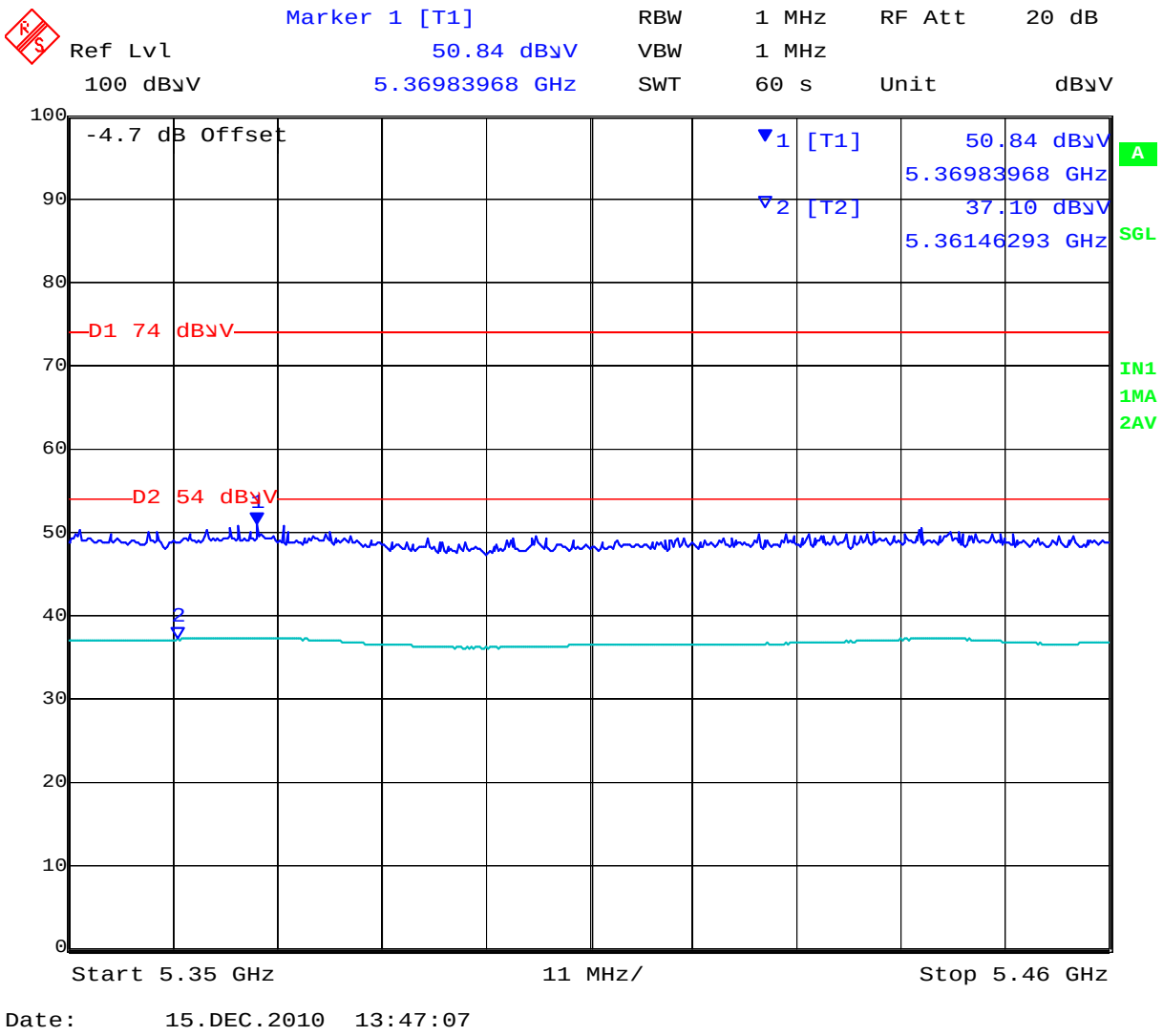
ANT NA 5824 FPI 5350-5460MHz HOR Tx=5745MHz BPSK 40MHz 3.25 (MCS8) P19



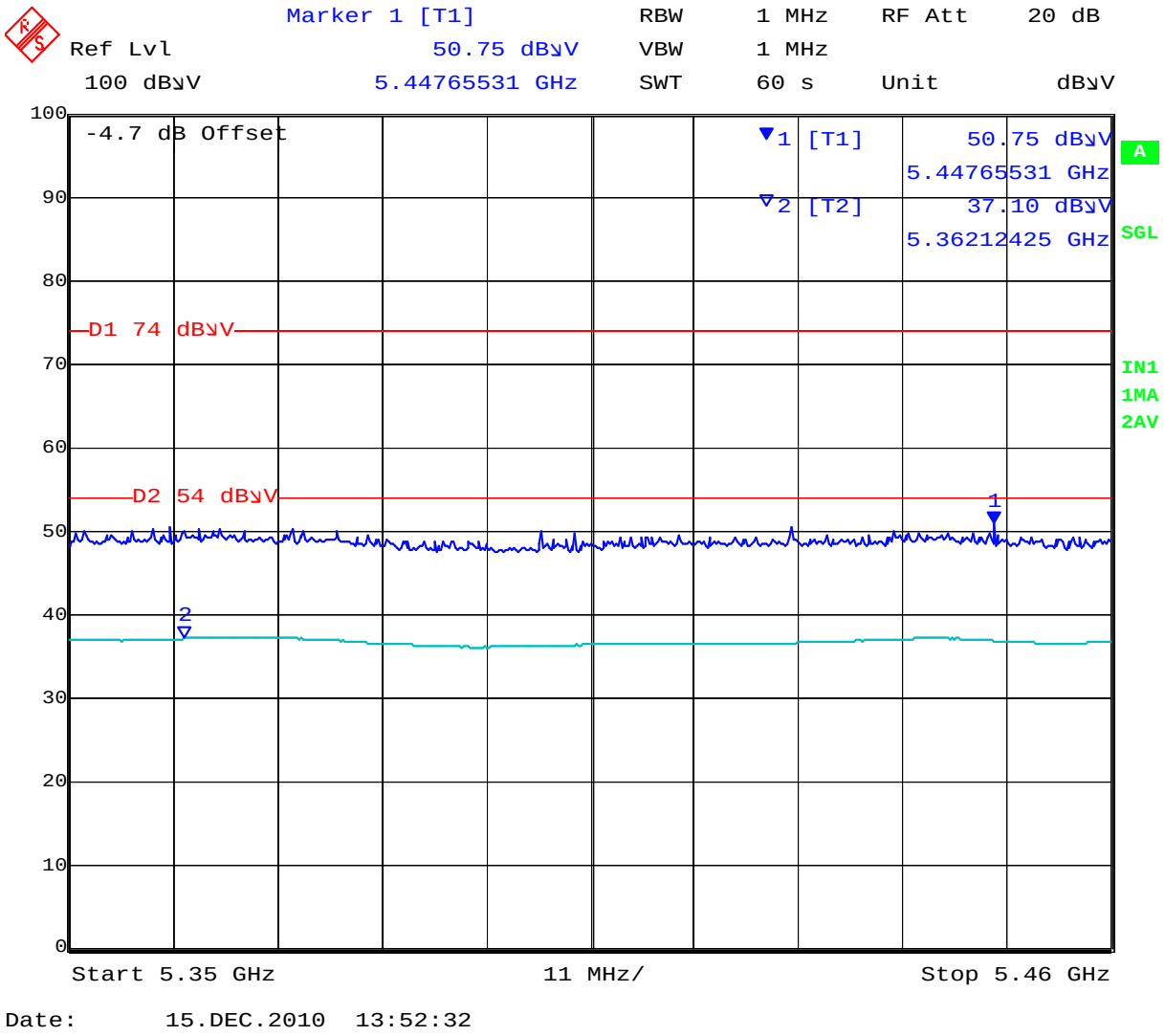
7.6.2.2 Band Edge Emissions - Antenna QFD-56-N

Modulation	Measurement Type	Measured Value	Limit (dBuV)	Margin (dB)
BPSK 5MHz	Peak	50.84	74	-23.16
BPSK 5MHz	Average	37.10	54	-16.90
64QAM 5MHz	Peak	50.75	74	-23.25
64QAM 5MHz	Average	37.10	54	-16.90
BPSK 10MHz	Peak	49.39	74	-24.61
BPSK 10MHz	Average	35.80	54	-18.20
BPSK 20MHz	Peak	48.73	74	-25.27
BPSK 20MHz	Average	35.80	54	-18.20
BPSK 40MHz	Peak	48.68	74	-25.32
BPSK 40MHz	Average	35.56	54	-18.44

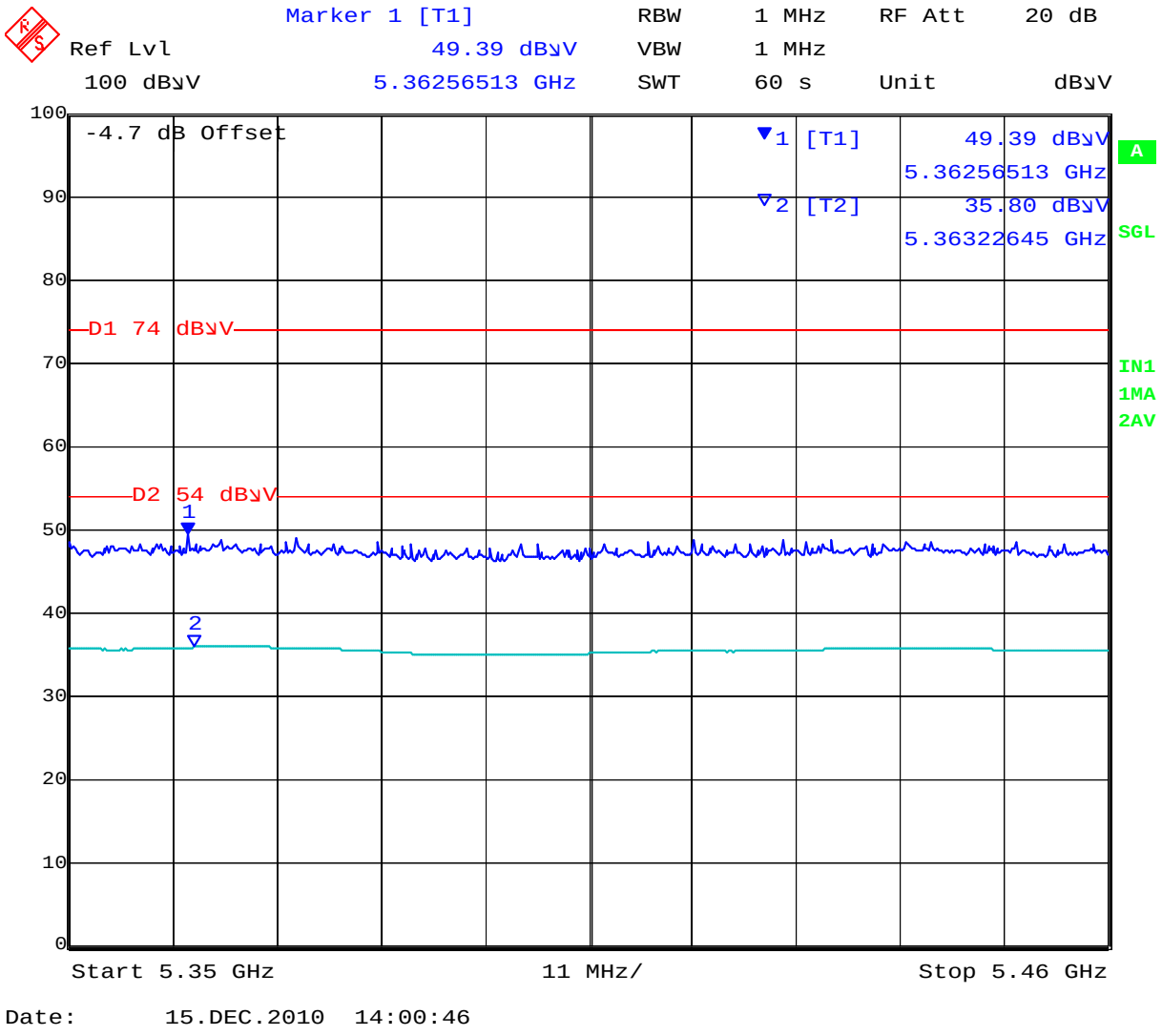
QRD2-56-N 5350-5460MHz HOR Tx=5730MHz BPSK 5MHz 3.25 (MCS8) P23



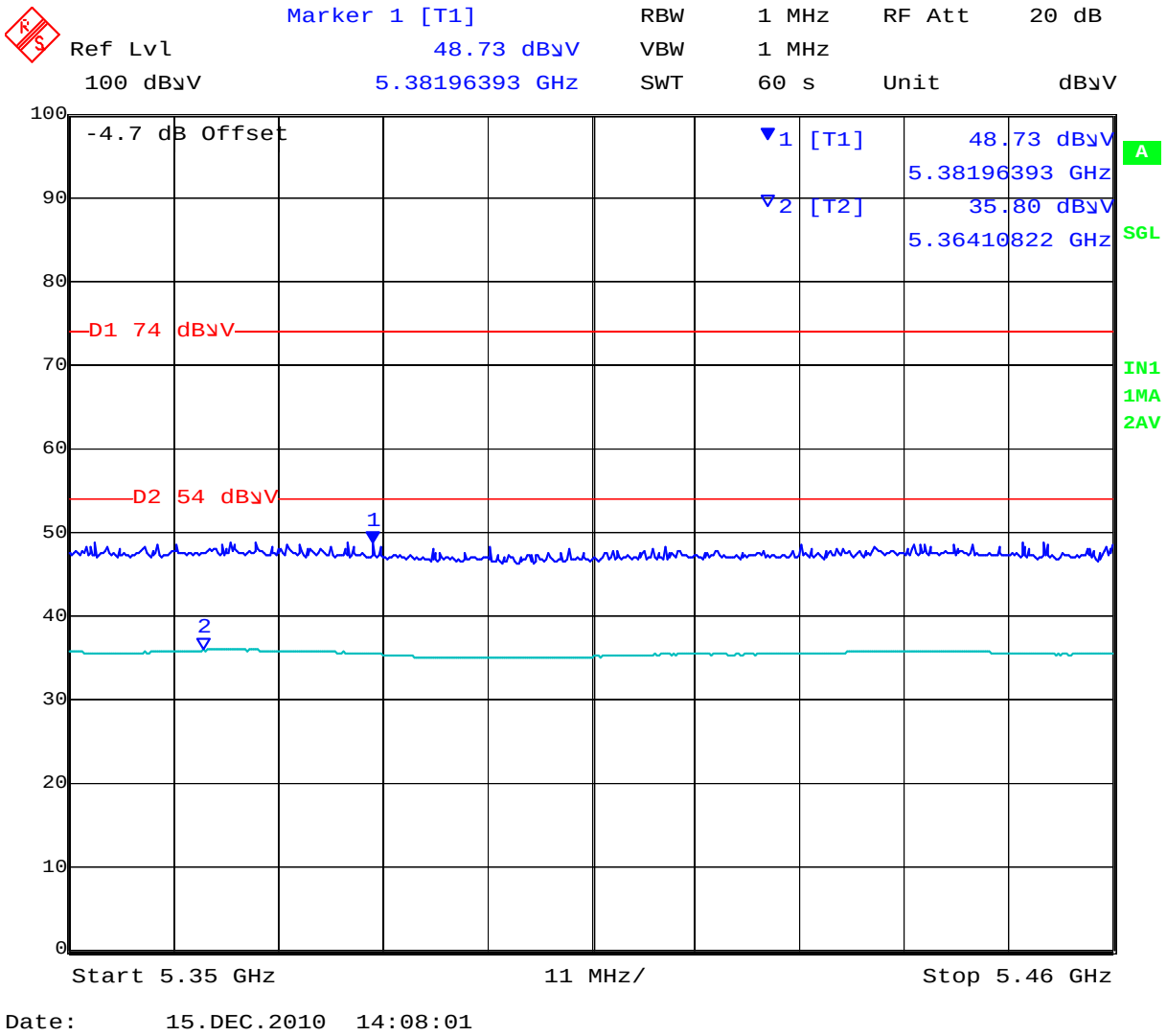
QRD2-56-N 5350-5460MHz HOR Tx=5730MHz 64QAM 5MHz 32.5 (MCS15) P23



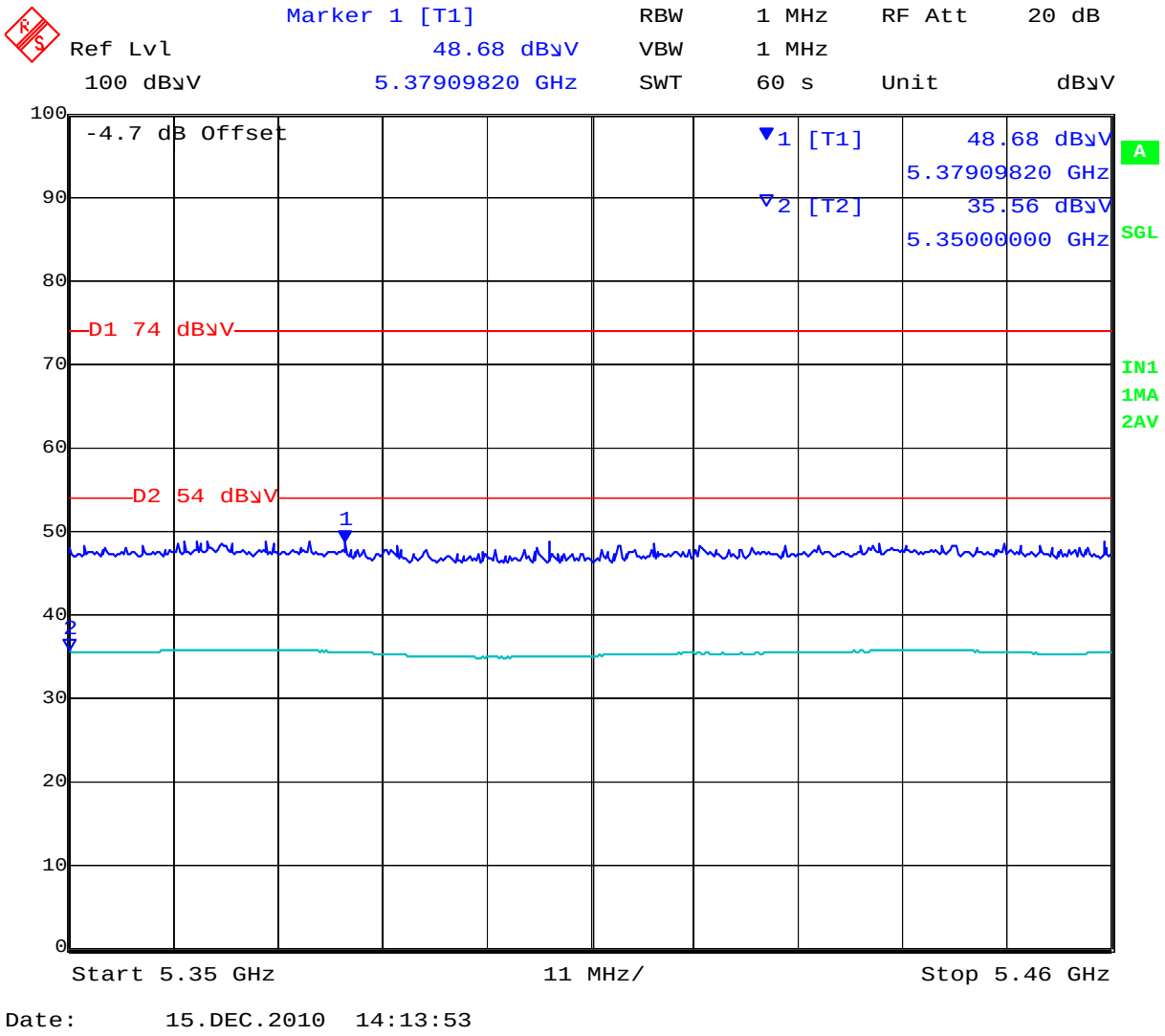
QRD2-56-N 5350-5460MHz Tx=5730MHz BPSK 10MHz 3.25 (MCS8) P23



QRD2-56-N 5350-5460MHz Tx=5735MHz BPSK 20MHz (MCS8) P23



QRD2-56-N 5350-5460MHz Tx=5745MHz BPSK 40MHz (MCS8) P19



7.7 Conducted Disturbance at Mains Terminal (150 kHz – 30 MHz)

Standard Reference

FCC, Part 15 Subpart C §15.107
Industry Canada ICES-003 §5.3

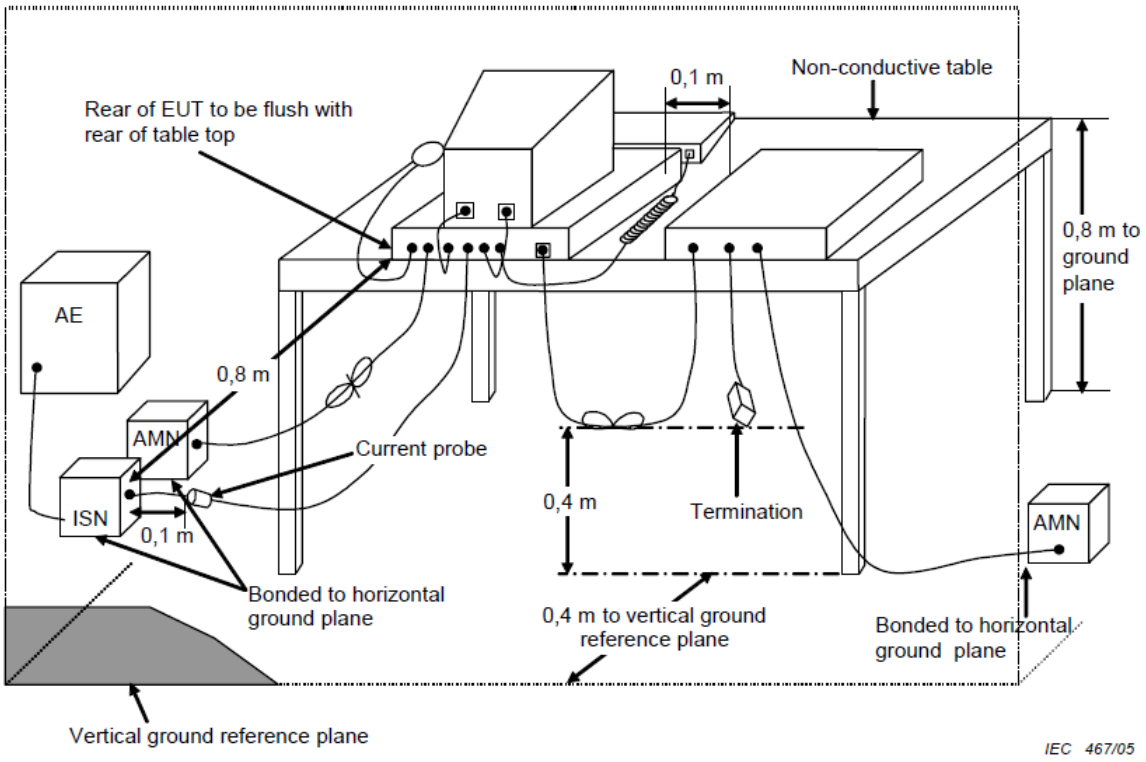
Test Procedure

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.

If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

Test Measurement Set up



Measurement set up for Conducted Disturbance at Mains Terminals

Specification

Conducted Disturbance at Mains Terminal – Digital Apparatus

FCC, Part 15 Subpart B §15.107
(a) Except for Class A digital devices, for equipment 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 μH/50 ohms line impedance stabilization network (LISN). 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. The lower limit applies at the band edges.

(b) For a Class A digital device 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 μH/50 ohms LISN. 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. The lower limit applies at the boundary between the frequency ranges.

Industry Canada ICES-003
The voltage of radio noise emissions that are conducted along the power supply lines of a Class A digital apparatus shall not exceed the limits specified in Table 1 of the publication referred to in Section 7.1 [Canadian Standards Association Standard CAN/CSA-CEI/IEC CISPR 22:02, "Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment."], within the indicated frequency range.

The voltage of radio noise emissions that are conducted along the power supply lines of a Class B digital apparatus shall not exceed the limits specified in Table 2 of the publication referred to in Section 7.1 [Canadian Standards Association Standard CAN/CSA-CEI/IEC CISPR 22:02, "Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment."], within the indicated frequency range.

FCC, Part 15 Subpart B §15.107 & Industry Canada ICES-003 Limits

Limits for conducted disturbance at the mains ports of class B ITE

Frequency of emission (MHz)	Quasi-peak dBuV	Average dBuV
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50
Note 1	* Decreases with the logarithm of the frequency	
Note 2	* The lower limit applies at the boundary between frequency ranges	

Limits for conducted disturbance at the mains ports of class A ITE

Frequency of emission (MHz)	Quasi-peak dBuV	Average dBuV
0.15–0.5	79	66
0.5–30	73	60
Note 1	* The lower limit shall apply at the transition frequency.	

Laboratory Measurement Uncertainty for Conducted Emissions

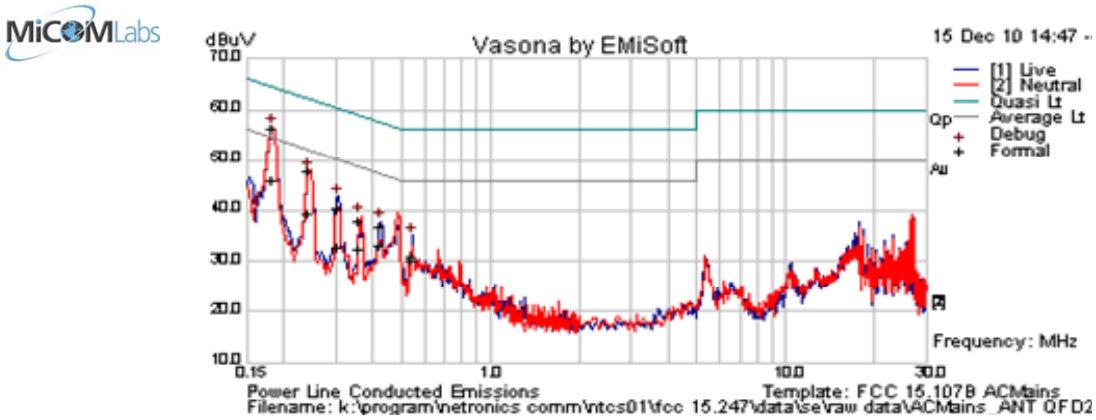
Measurement uncertainty	±2.64 dB

Traceability

Method	Test Equipment Used
Work instruction WI-EMC-01	0158, 0184, 0193, 0190, 0293, 0307

7.7.1 Conducted Disturbance at Mains Terminal (150 kHz – 30 MHz)

Test Freq.	5730 MHz BPSK 5MHz ART=23	**Engineer**	GG
Variant	AC Line Emissions	**Temp (°C)**	24
Freq. Range	0.150 MHz - 30 MHz	**Rel. Hum.(%)**	35
Power Setting	120V AC 60 Hz	**Press. (mBars)**	1001
Antenna	QFD2-56-N		
Test Notes 1			
Test Notes 2			



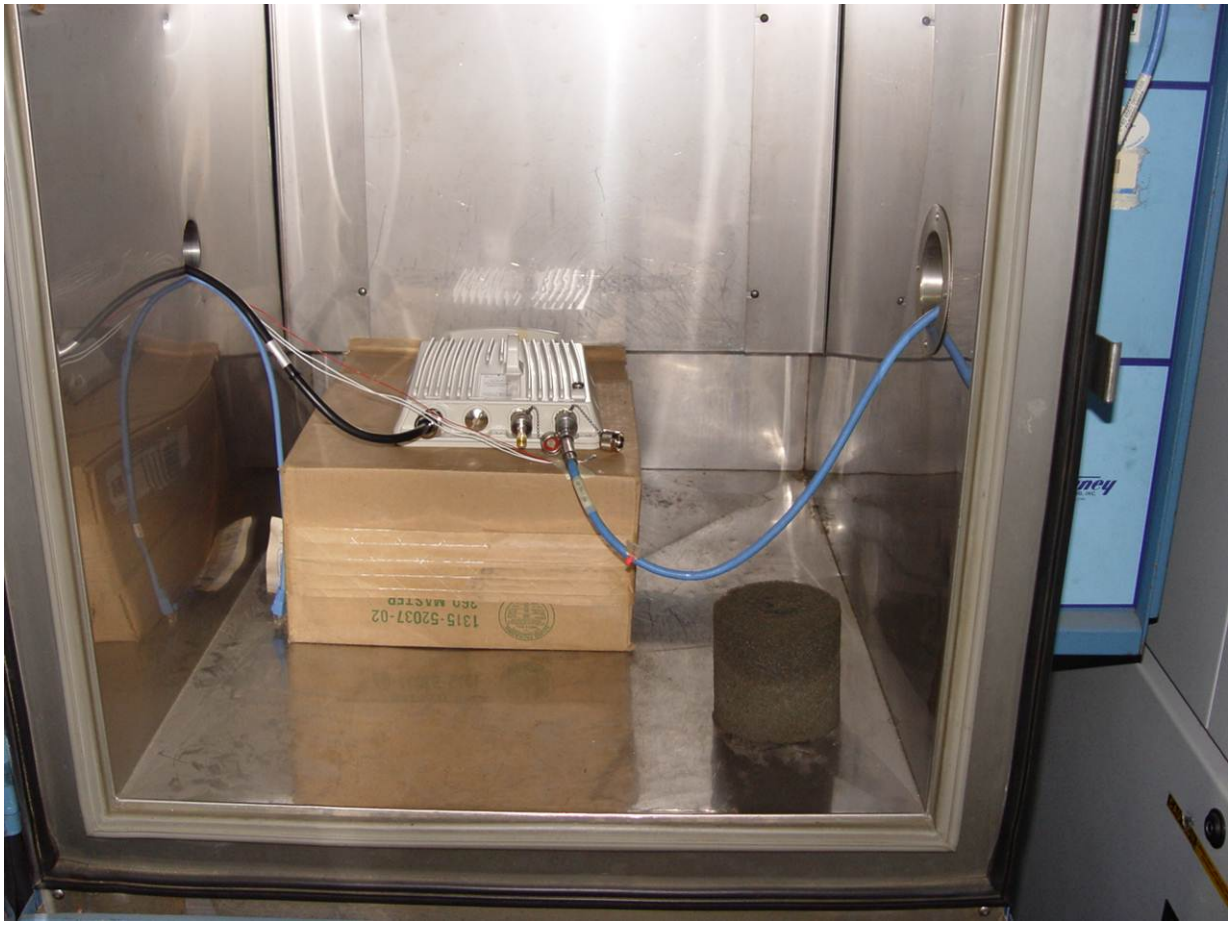
Formally measured emission peaks

Frequency MHz	Raw dBuV	Cable Loss	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail	Comments
0.182	36.1	9.9	0.1	46.1	Average	Neutral	54.39	-8.3	Pass	
0.182	46.5	9.9	0.1	56.5	Quasi Peak	Neutral	64.39	-7.9	Pass	
0.242	29.3	9.9	0.1	39.3	Average	Live	52.03	-12.7	Pass	
0.242	37.9	9.9	0.1	47.8	Quasi Peak	Live	62.03	-14.2	Pass	
0.303	30.7	9.9	0.1	40.7	Quasi Peak	Live	60.16	-19.5	Pass	
0.303	22.7	9.9	0.1	32.7	Average	Live	50.16	-17.5	Pass	
0.363	27.9	9.9	0.1	37.8	Quasi Peak	Neutral	58.66	-20.8	Pass	
0.363	22.7	9.9	0.1	32.6	Average	Neutral	48.66	-16.0	Pass	
0.424	23.1	9.9	0.1	33.1	Average	Live	47.37	-14.3	Pass	
0.424	26.8	9.9	0.1	36.8	Quasi Peak	Live	57.37	-20.6	Pass	
0.546	20.2	9.9	0.1	30.2	Average	Live	46	-15.8	Pass	
0.546	21.0	9.9	0.1	31.1	Quasi Peak	Live	56	-25.0	Pass	

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

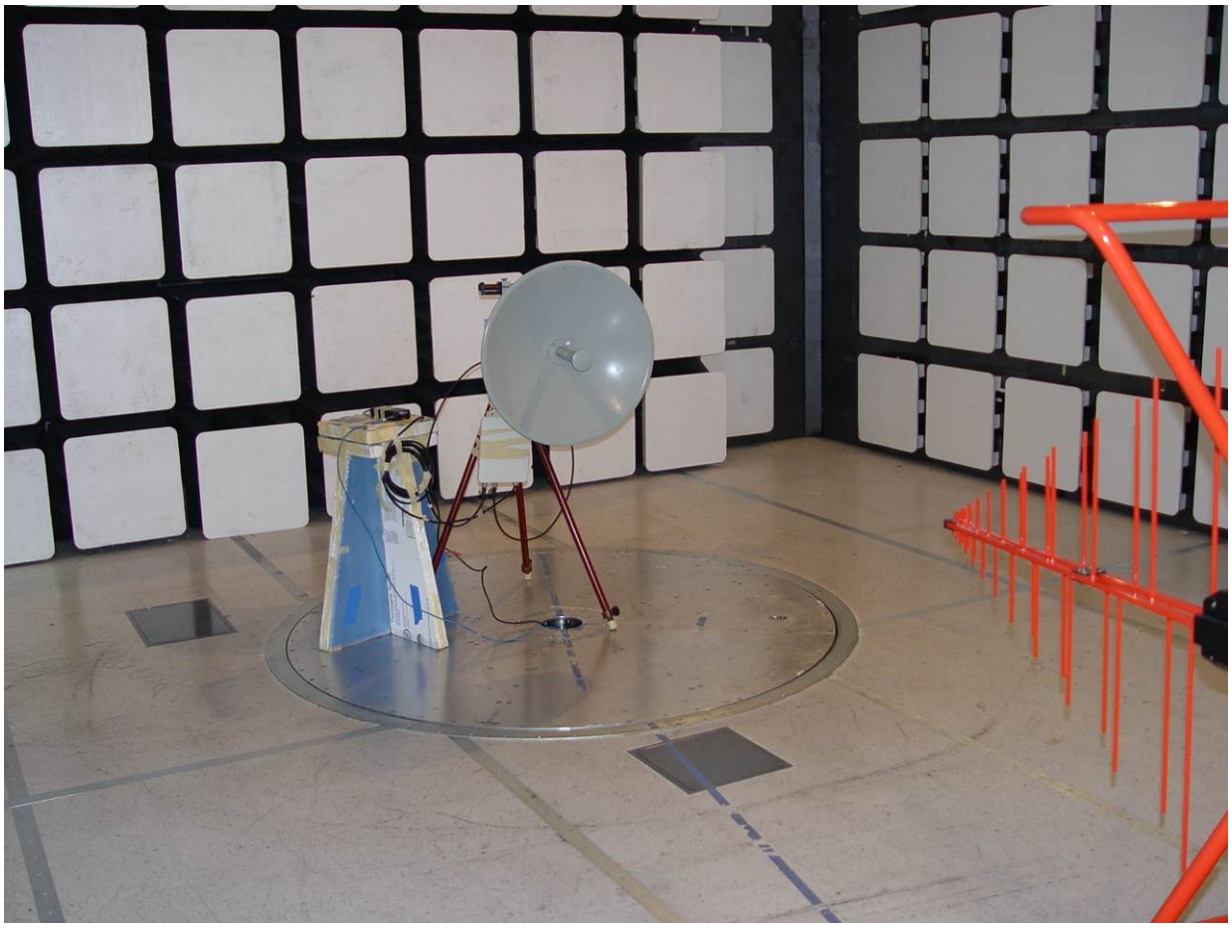
8 Photographs

8.1 Conducted RF Emissions - EUT



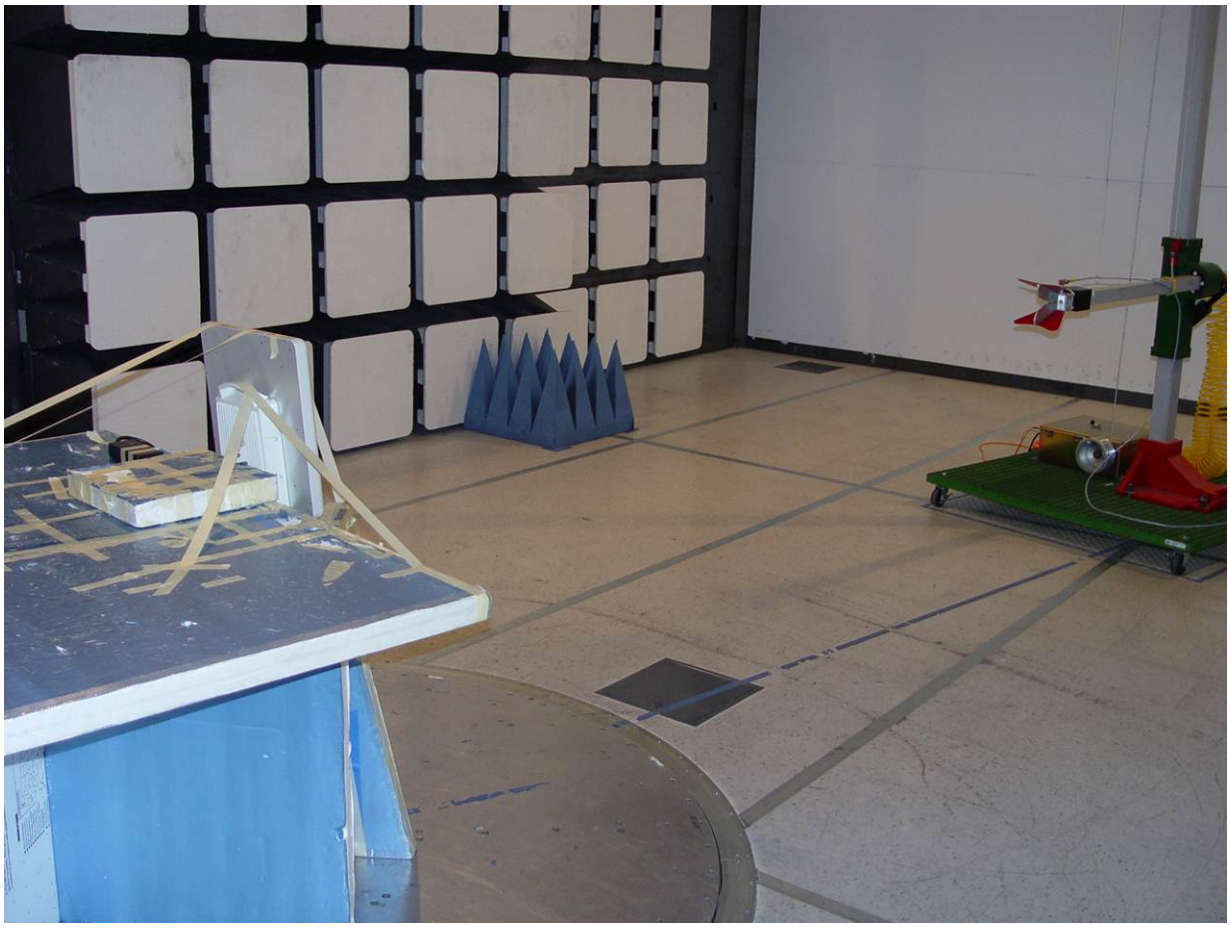
8.2 Conducted RF Emissions - Test Equipment

8.3 Transmitter Radiated Spurious Emission below 1 GHz

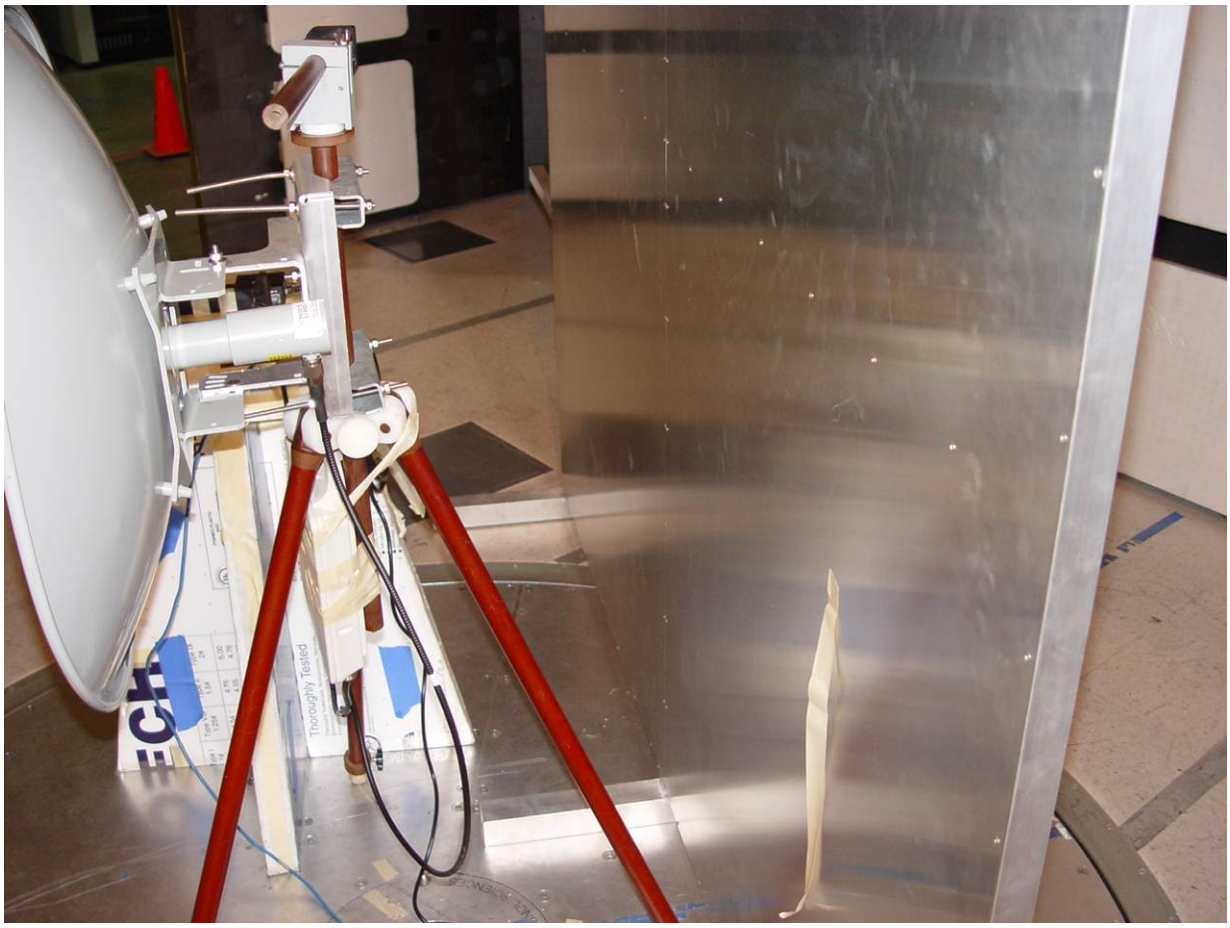


8.4 Transmitter Radiated Spurious Emissions above 1 GHz – Antenna QFD2-56-N

8.5 Transmitter Radiated Spurious Emissions above 1 GHz – Antenna NA 5824 FPI



8.6 AC Mains Conducted Emissions



9 TEST EQUIPMENT DETAILS

Asset #	Instrument	Manufacturer	Part #	Serial #
0134	Amplifier	Com Power	PA 122	181910
0158	Barometer /Thermometer	Control Co.	4196	E2846
0287	EMI Receiver	Rhode & Schwartz	ESIB 40	100201
0193	EMI Receiver	Rhode & Schwartz	ESIB 7	838496/007
0252	SMA Cable	Megaphase	Sucoflex 104	None
0310	2m SMA Cable	Micro-Coax	UFA210A-0-0787-3G03G0	209089-001
0312	3m SMA Cable	Micro-Coax	UFA210A-1-1181-3G0300	209092-001
0313	Coupler	Hewlett Packard	86205A	3140A01285
0314	30dB N-Type Attenuator	ARRA	N9444-30	1623
0070	Power Meter	Hewlett Packard	437B	3125U11552
0116	Power Sensor	Hewlett Packard	8485A	3318A19694
0117	Power Sensor	Hewlett Packard	8487D	3318A00371
0184	Pulse Limiter	Rhode & Schwartz	ESH3Z2	357.8810.52
0190	LISN	Rhode & Schwartz	ESH3Z5	836679/006
0293	BNC Cable	Megaphase	1689 1GVT4	15F50B001
0301	5.6 GHz Notch Filter	Micro-Tronics	RBC50704	001
0302	5.25 GHz Notch Filter	Micro-Tronics	BRC50703	002
0303	5.8 GHz Notch Filter	Micro-Tronics	BRC50705	003
0304	2.4GHzHz Notch Filter	Micro-Tronics	--	001
0307	BNC Cable	Megaphase	1689 1GVT4	15F50B002
0335	1-18GHz Horn Antenna	ETS- Lindgren	3117	00066580
0337	Amplifier	MiCOM Labs	--	--
0338	Antenna	Sunol Sciences	JB-3	A052907
0342	2.4 GHz Notch Filter	EWT	EWT-14-0203	H1

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