Company: Tarana Wireless

Test of: AbsoluteAir 2
To: FCC CFR 47 Part 15 Subpart E 15.407

Report No.: TARA13-U3 Rev B

TEST REPORT

TEST REPORT

FROM

MiCOM Labs
opening wireless markets

Test of: Tarana Wireless AbsoluteAir 2
to

To: FCC CFR 47 Part 15 Subpart E 15.407

Test Report Serial No.: TARA13-U3 Rev B

This report supersedes: NONE

Applicant:	Tarana Wireless 2953 Bunker Hill Lane Santa Clara, California 95054 USA
Product Function:	Point to Point and Multiple Point to Point Wireless Backhaul
Issue Date:	19th May 2016

This Test Report is Issued Under the Authority of:

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

A2LA ACCREDITED
TESTING CERT #2381.01

MiCOM Labs is an ISO 17025 Accredited Testing Laboratory

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1. ACCREDITATION, LISTINGS & RECOGNITION

1.1. Test Accreditation

MiCOM Labs, Inc. is an accredited Electrical testing laboratory per the international standard ISO/IEC 17025:2005. The company is accredited by the American Association for Laboratory Accreditation (A2LA) www.a2la.org test laboratory number 2381.01. MiCOM Labs test schedule is available at the following URL; http://www.a2la.org/scopepdf/2381-01.pdf

ilac-MRA A2LA

Accredited Laboratory

A2LA has accredited

MICOM LABS

Pleasanton, CA

for technical competence in the field of

Electrical Testing

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

Presented this 4th day of February 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 2381.01
Valid to November 30, 2017

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

1.2. Recognition

MiCOM Labs, Inc. has widely recognized wireless testing capabilities. Our international recognition includes Conformity Assessment Body designation by APEC MRA countries. MiCOM Labs test reports are accepted globally.

Country	Recognition Body	Status	Phase	Identification No.
USA	Federal Communications Commission (FCC)	TCB	-	US0159 Listing #: 102167
Canada	Industry Canada (IC)	FCB	APEC MRA 2	US0159 Listing #: 4143A-2 4143A-3
Japan	MIC (Ministry of Internal Affairs and Communication)	CAB	APEC MRA 2	RCB 210
	VCCI	--	--	A-0012
Europe	European Commission	NB	EU MRA	NB 2280
Australia	Australian Communications and Media Authority (ACMA)	CAB	APEC MRA 1	US0159
Hong Kong	Office of the Telecommunication Authority (OFTA)	CAB	APEC MRA 1	
Korea	Ministry of Information and Communication Radio Research Laboratory (RRL)	CAB	APEC MRA 1	
Singapore	Infocomm Development Authority (IDA)	CAB	APEC MRA 1	
Taiwan	National Communications Commission (NCC) Bureau of Standards, Metrology and Inspection (BSMI)	CAB	APEC MRA 1	
Vietnam	Ministry of Communication (MIC)	CAB	APEC MRA 1	

EU MRA – European Union Mutual Recognition Agreement.
NB – Notified Body
APEC MRA – Asia Pacific Economic Community Mutual Recognition Agreement. 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

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1.3. Product Certification

MiCOM Labs, Inc. is an accredited Product Certification Body per the international standard ISO/IEC 17065:2012. 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

Accredited Product Certification Body

A2LA has accredited

MICOM LABS

Pleasanton, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Requirements for bodies certifying products, processes and services*. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 4th day of February 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 2381.02
Valid to November 30, 2017

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)
Industry Canada – Certification Body, CAB Identifier – US0159
Europe – Notified Body (NB), NB Identifier - 2280
Japan – Recognized Certification Body (RCB), RCB Identifier - 210

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2. DOCUMENT HISTORY

Document History		
Revision	Date	Comments
Draft	14th April 2016	
Rev A	21st April 2016	Initial Release
Rev B	19th May 2016	Client requested clarification on adjustable output power control mechanism. As a result of communication with the FCC (PBA #: 759532) maximum output power can be based on a single chain but scaled according to the number of chains, see Section 9.1 Peak Transmit Power

In the above table the latest report revision will replace all earlier versions.

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3. TEST RESULT CERTIFICATE

Manufacturer: Tarana Wireless 2953 Bunker Hill Lane Santa Clara California 95054 USA	**Tested By:** MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Model: AbsoluteAir 2 **Equipment Type:** Point to Point and Multi-Point to Point Wireless Backhaul	**Telephone:** +1 925 462 0304 **Fax:** +1 925 462 0306
S/N's: T15450234 (16th Dec 2015) T16100261 (8th April 2016)	
Test Date(s): 16th Dec 2015 – 8th April 2016	**Website:** www.micomlabs.com

STANDARD(S)	TEST RESULTS
FCC CFR 47 Part 15 Subpart E 15.407	EQUIPMENT COMPLIES

MiCOM Labs, Inc. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.

Notes:

1. This document reports conditions under which testing was conducted and the results of testing performed.

2. Details of test methods used have been recorded and kept on file by the laboratory.

3. Test results apply only to the item(s) tested.

ACCREDITED
TESTING CERT #2381.01

Approved & Released for MiCOM Labs, Inc. by:

Graeme Grieve
Quality Manager MiCOM Labs, Inc.

Gordon Hurst
President & CEO MiCOM Labs, Inc.

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4. REFERENCES AND MEASUREMENT UNCERTAINTY

4.1. Normative References

REF.	PUBLICATION	YEAR	TITLE
I	KDB 662911	Oct 31 2013	Guidance for measurement of output emission of devices that employ single transmitter with multiple outputs or systems with multiple transmitters operating simultaneously in the same frequency band
II	KDB 905462 D07 v01	10th June 2015	Test guidance to demonstrate compliance for U-NII devices subject to DFS requirements.
III	KDB 926956 DO1 v01r02	17th October 2014	U-NII Device Transition Plan
IV	KDB 662911 D02	25th Oct 2011	Measurement of Transmitters with Multiple Output, MIMO, Smart Antenna
V	KDB 789033 D02 v01	6th June 2014	General UNII Test Procedures New Rules V01
VI	A2LA	June 2015	R105 - Requirement's When Making Reference to A2LA Accreditation Status
VII	ANSI C63.10	2013	American National Standard for Testing Unlicensed Wireless Devices
VIII	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
IX	CISPR 22	2008	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
X	ETSI TR 100 028	2001-12	Parts 1 and 2 Electromagnetic compatibility and Radio Spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics
XI	FCC 06-96	Jun 3 2006	Memorandum Opinion and Order
XII	FCC 47 CFR Part 15.407	2014	Radio Frequency Devices; Subpart E –Unlicensed National Information Infrastructure Devices
XIII	ICES-003	Issue 5 2012	Spectrum Management and Telecommunications; Interference-Causing Equipment Standard. Information Technology Equipment (ITE) – Limits and methods of measurement.
XIV	M 3003	Edition 3 Nov. 2012	Expression of Uncertainty and Confidence in Measurements
XV	RSS-247 Issue 1	May 2015	Digital Transmission Systems (DTSs), Frequency Hopping System (FHSs) and Licence-Exempt Local Area Network (LE-LEN) Devices
XVI	RSS-Gen Issue 4	November 2014	General Requirements and Information for the Certification of Radiocommunication Equipment
XVII	KDB 644545 D03 v01	August 14th 2014	Guidance for IEEE 802.11ac New Rules
XVIII	FCC 47 CFR Part 2.1033	2014	FCC requirements and rules regarding photographs and test setup diagrams.

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4.2. Test and Uncertainty Procedure

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.

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5. PRODUCT DETAILS AND TEST CONFIGURATIONS

5.1. Technical Details

Details	Description
Purpose:	Test of the Tarana Wireless AbsoluteAir 2 to FCC CFR 47 Part 15 Subpart E 15.407. Radio Frequency Devices; Subpart E – Unlicensed National Information Infrastructure Devices
Applicant:	Tarana Wireless 2953 Bunker Hill Lane Santa Clara California 95054 USA
Manufacturer:	As Applicant
Laboratory performing the tests:	MiCOM Labs, Inc. 575 Boulder Court Pleasanton California 94566 USA
Test report reference number:	TARA13-U3
Date EUT received:	11th December 2015
Standard(s) applied:	FCC CFR 47 Part 15 Subpart E 15.407
Dates of test (from - to):	16th December 2015 – 8th April 2016
No of Units Tested:	1
Type of Equipment:	Point to Point and Multi-Point to Point Wireless Backhaul
Product Family Name:	AbsoluteAir 2
Model(s):	AbsoluteAir 2
Location for use:	Outdoor
Declared Frequency Range(s):	5725 - 5850 MHz; 5150 - 5250 MHz;
Type of Modulation:	Adaptive: 16 QAM, 64 QAM, 256 QAM
EUT Modes of Operation:	16 QAM;
Transmit/Receive Operation:	Transceiver - Half Duplex
Rated Input Voltage and Current:	40 – 60 Vdc, 1.6 A POE powered option (POE sold separately)
Operating Temperature Range:	Declared Range -40°C to 55°C
ITU Emission Designator:	20 MHz: 20M0W7W
Equipment Dimensions:	Concentrator Mode (CN) and End Node (EN)-HP: (WxHxD) 362 x 324 x 112 mm SP: (WxHxD) 244 x 300 x 112 mm
Weight:	CN and EN-HP: 6.0 kg SP: 5.0 kg
Hardware Rev:	30-00xx
Software Rev:	Test code: FER.E2.XXX.CXX.1.202.000.01 Release code (normal operation): 3.5.10
Primary function of equipment:	Point to Point and Multiple Point to Point Wireless Backhaul

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5.2. Scope Of Test Program

Tarana Wireless AbsoluteAir 2

The scope of the test program was to test the Tarana Wireless AbsoluteAir 2 configurations in the frequency ranges 5150 - 5250 MHz and 5725 - 5850 MHz for compliance against the following specification:

FCC CFR 47 Part 15 Subpart E 15.407
Radio Frequency Devices; Subpart E –Unlicensed National Information Infrastructure Devices

AbsoluteAir2 Device Operation

The AbsoluteAir2 has 16 antenna ports which are split into the following cross polarized offering;

8 horizontally polarized
8 vertically polarized

Test Strategy – Reference KDB 662911 D02
The AbsoluteAir2 operates on two continuous data streams and per KDB 662911 section F(2)e(i) permits the reduction of antennas used for power calculations to 4 directional antennas.
ffective Gain = Antenna Gain + 10*log (N_{ant} / N_{ss}) = Antenna Gain + 10 * Log (8/2)
= Antenna Gain + 6 dB

N_{ant}=Number of antennas
N_{ss}=number of independent data streams

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Tarana Wireless AbsoluteAir 2

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

Type (EUT/ Support)	Equipment Description (Including Brand Name)	Mfr	Model No.	Serial No.
EUT	Tarana master flat panel concentrator node**Error! Reference source not found.**	Tarana Wireless	AA2-CN12AFP	T15450234
EUT		Tarana Wireless	AA2-CN12AFP	T16100261*
Support	Laptop PC	IBM	Unknown	None

*See Section 5.7 Equipment Modifications

5.4. Antenna Details

Type	Manufacturer	Model	Family	Gain (dBi)	BF Gain	Dir BW	X-Pol	Frequency Band (MHz)
integral	Tarana Wireless	Internal	Directional Panel	13.0	-	360	Y	5150 – 5250 5725 - 5850

BF Gain - Beamforming Gain
Dir BW - Directional BeamWidth
X-Pol - Cross Polarization

5.5. Cabling and I/O Ports

Port Type	Max Cable Length	# Of Ports	Screened	Conn Type	Data Type
Ethernet	100m	2	Y	RJ-45	Packet Data
Optical	250m	1	N	SPF	Data
USB	3m	1	Y	USB	Digital
Ethernet	100m (MGMT)	1	Y	RJ-45	Digital

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5.6. Test Configurations

Results for the following configurations are provided in this report:

Operational Mode(s)	Data Rate with Highest Power MBit/s	Channel Frequency (MHz)		
		Low	Mid	High
5150 - 5250 MHz				
16 QAM (20MHz)		5,170.00	5,200.00	5,240.00
5725 - 5850 MHz				
16 QAM (20MHz)		5,735.00	5,785.00	5,835.00

5.7. Equipment Modifications

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

1. Due to the nature of the EUT antenna element selection, an internal flat panel antenna with 13 dBi gain was used to match the Manufacturer gain and use worst case scenario for emissions.

2. A second unit with the **SN#: T16100261** was used to complete testing as the first unit **SN#: T15450234** had issues with the test code.

5.8. Deviations from the Test Standard

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

1. NONE

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6. TEST SUMMARY

List of Measurements

Test Header	Result	Data Link
(a) Peak Transmit Power	Complies	View Data
(a) 26 dB & 99% Bandwidth	Complies	View Data
(a)(5) Power Spectral Density	Complies	View Data
(b)(2) Radiated	Complies	-
i).. Restricted Band Emissions	Complies	View Data
ii).. Restricted Band-Edge Emissions	Complies	View Data
iv).. Digital Emissions	Complies[1]	-
AC Wireline Emissions	Complies[2]	--

[1] See MiCOM Labs test report TARA11-U2 Section 5.1.1 Digital Emission results
[2] See MiCOM Labs test report TARA11-U2 Section 5.1.2 AC Wireline Emission results

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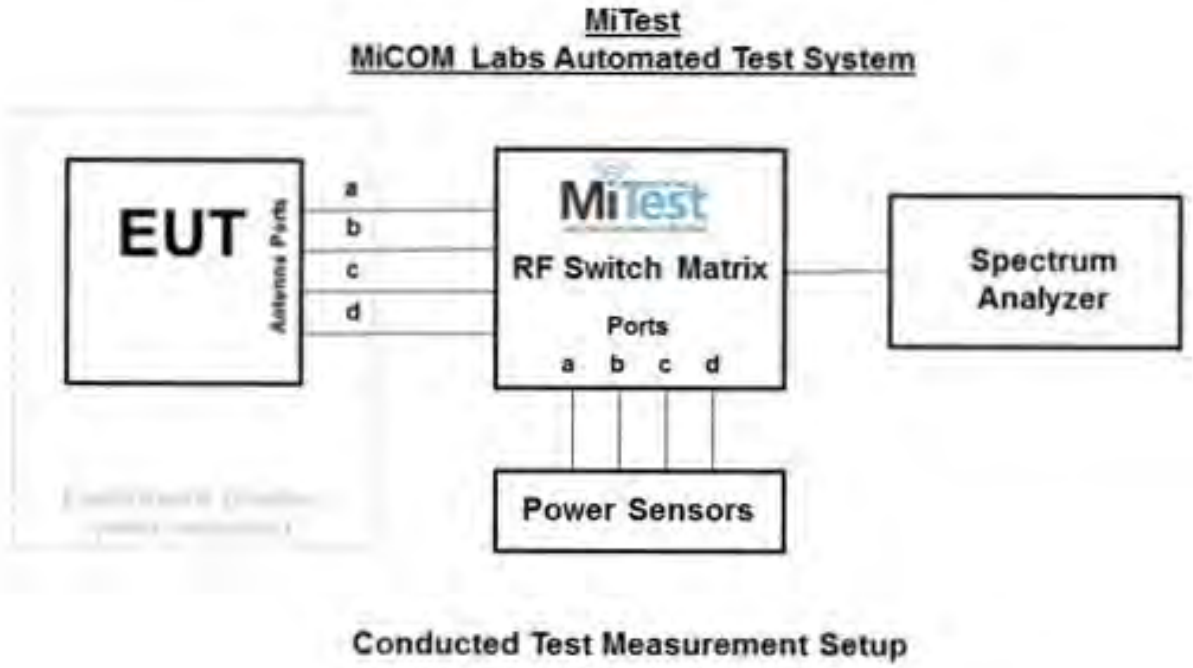
7. TEST EQUIPMENT CONFIGURATION(S)

7.1. Conducted

Conducted RF Emission Test Set-up(s)
The following tests were performed using the conducted test set-up shown in the diagram below.
1. Peak Transmit Power
2. 26 dB & 99% Bandwidth
3. Power Spectral Density



Conducted Test Measurement Setup

A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

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Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	04 Dec 2016
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	27 Aug 2016
376	USB 10MHz - 18GHz Average Power Sensor	Agilent	U2000A	MY51440005	23 Oct 2016
381	4x4 RF Switch Box	MiCOM Labs	MiTest RF Switch Box	MIC002	18 Jun 2016
419	Laptop with Labview Software	Lenova	W520	TS02	Not Required
420	USB to GPIB Interface	National Instruments	GPIB-USB HS	1346738	Not Required
435	USB Wideband Power Sensor	Boonton	55006	8730	31 Jul 2016
440	USB Wideband Power Sensor	Boonton	55006	9178	25 Sep 2016
441	USB Wideband Power Sensor	Boonton	55006	9179	25 Sep 2016
442	USB Wideband Power Sensor	Boonton	55006	9181	25 Sep 2016
460	Dell Computer	Dell	Optiplex330	BC944G1	Not Required
RF#2 GPIB#1	GPIB cable to Power Supply	HP	GPIB	None	Not Required
RF#2 SMA#1	EUT to Mitest box port 1	Flexco	SMA Cable port1	None	18 Jun 2016
RF#2 SMA#2	EUT to Mitest box port 2	Flexco	SMA Cable port2	None	18 Jun 2016
RF#2 SMA#3	EUT to Mitest box port 3	Flexco	SMA Cable port3	None	18 Jun 2016
RF#2 SMA#4	EUT to Mitest box port 4	Flexco	SMA Cable port4	None	18 Jun 2016
RF#2 SMA#SA	Mitest box to SA	Flexco	SMA Cable SA	None	18 Jun 2016
RF#2 USB#1	USB Cable to Mitest Box	Dynex	USB Cable	None	Not Required

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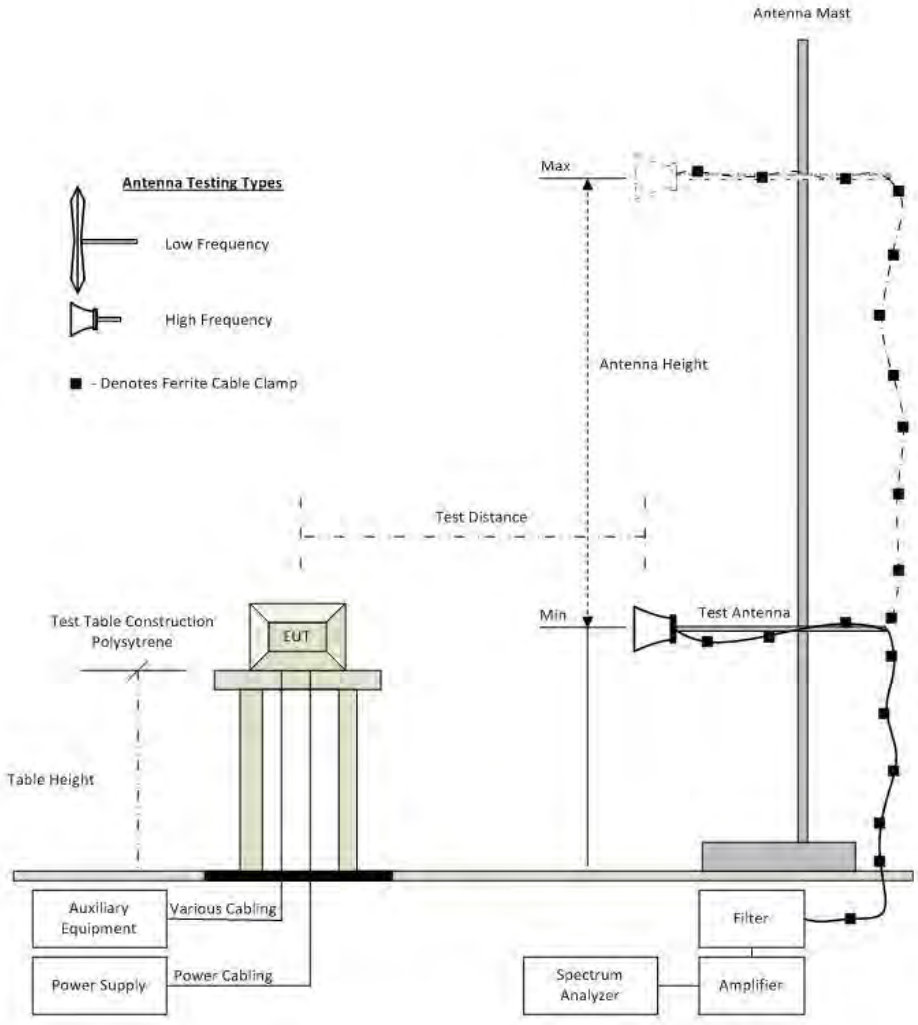
7.2. Radiated

The following tests were performed using the radiated test set-up shown in the diagram. Radiated emissions below 1GHz.Radiated Emissions above 1GHz.

1).. Restricted Band Emissions
2).. Restricted Band-Edge Emissions
3).. Digital Emissions



Radiated Emission Test Setup

A full system calibration was performed on the test station and any resulting system losses (or gains) were taken into account in the production of all final measurement data.

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Asset#	Description	Manufacturer	Model#	Serial#	Calibration Due Date
158	Barometer/Thermometer	Control Company	4196	E2846	04 Dec 2016
170	Video System Controller for Semi Anechoic Chamber	Panasonic	WV-CY101	04R08507	Not Required
287	Rohde & Schwarz 40 GHz Receiver	Rhode & Schwarz	ESIB40	100201	27 Aug 2016
338	Sunol 30 to 3000 MHz Antenna	Sunol	JB3	A052907	15 Aug 2016
396	2.4 GHz Notch Filter	Microtronics	BRM50701	001	18 Aug 2016
397	Amp 10 - 2500MHz	MiCOM Labs	Amp 10 - 2500 MHz	NA	24 Feb 2016
399	ETS 1-18 GHz Horn Antenna	ETS	3117	00154575	18th Oct 2016
406	Amplifier for Radiated Emissions	MiCOM Labs	40dB 1 to 18GHz Amp	0406	28 May 2016
410	Desktop Computer	Dell	Inspiron 620	WS38	Not Required
411	Mast/Turntable Controller	Sunol Sciences	SC98V	060199-1D	Not Required
412	USB to GPIB Interface	National Instruments	GPIB-USB HS	11B8DC2	Not Required
413	Mast Controller	Sunol Science	TWR95-4	030801-3	Not Required
415	Turntable Controller	Sunol Sciences	Turntable Controller	None	Not Required
447	Rad Emissions Test Software	MiCOM	Rad Emissions Test Software Version 1.0.73	447	Not Required
462	Schwarzbeck cable from Antenna to Amplifier.	Schwarzbeck	AK 9513	462	25 Feb 2016
463	Schwarzbeck cable from Amplifier to Bulkhead.	Schwarzbeck	AK 9513	463	25 Feb 2016
464	Schwarzbeck cable from Bulkhead to Receiver	Schwarzbeck	AK 9513	464	25 Feb 2016
465	Low Pass Filter DC-1000 MHz	Mini-Circuits	NLP-1200+	VUU01901402	18 Aug 2016
480	Cable - Bulkhead to Amp	SRC Haverhill	157-157-3050360	480	11 Aug 2016
481	Cable - Bulkhead to Receiver	SRC Haverhill	151-151-3050787	481	11 Aug 2016
482	Cable - Amp to Antenna	SRC Haverhill	157-157-3051574	482	11 Aug 2016

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8. MEASUREMENT AND PRESENTATION OF TEST DATA

The measurement and graphical data presented in this test report was generated automatically using state-of-the-art technology creating an easy to read report structure. Numerical measurement data is separated from supporting graphical data (plots) through hyperlinks. Numerical measurement data can be reviewed without scrolling through numerous graphical pages to arrive at the next data matrix.

Plots have been relegated into the Appendix 'Graphical Data'.

Test and report automation was performed by MiTest. MiTest is an automated test system developed by MiCOM Labs. MiTest is the first cloud based modular test system enabling end-to-end automation of regulatory compliance testing for conducted RF testing.

The MiCOM Labs "MiTest" Automated Test System" (Patent Pending)

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9. TEST RESULTS

9.1. Peak Transmit Power

Conducted Test Conditions for Maximum Conducted Output Power			
Standard:	FCC CFR 47:15.407	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Maximum Conducted Output Power	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.407 (a)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Maximum Conducted Output Power Measurement
Method PM (Measurement using an RF average power meter). KDB 789033 defines a methodology using an average wideband power meter. Measurements were made while the EUT was operating in a continuous transmission mode (100% duty cycle) at the appropriate center frequency. All operational modes and frequency bands were measured independently and the resultant calculated. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported separately. A summation (Σ) of each antenna port output power is provided which includes any offset due to Duty Cycle Correction Factor (DCCF). Testing was performed under ambient conditions at nominal voltage.

Test configuration and setup used for the measurement was per the Conducted Test Set-up section specified in this document.
Supporting Information
Calculated Power = A + G + Y+ 10 log (1/x) dBm

A = Total Power [10*Log10 ($10^{a/10}$ + $10^{b/10}$ + $10^{c/10}$ + $10^{d/10}$)]
G = Antenna Gain
Y = Beamforming Gain
x = Duty Cycle (average power measurements only)

Limits Maximum Conducted Output Power
Operating Frequency Band 5150-5250 MHz

15. 407 (a)(1)
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Operating Frequency Band 5250-5350 and 5470 – 5725 MHz

15. 407 (a)(2)
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Operating Frequency Band 5725 – 5850 MHz

15. 407 (a)(3)
For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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Adjustable Output Power Control Mechanism

Client requested clarification on adjustable output power control mechanism. As a result of communication with the FCC (PBA #: 759532) maximum output power can be based on a single chain but scaled according to the number of chains, see Section 9.1 Peak Transmit Power

FCC Response to PBA #: 759532 5th May 2016
Dear Mr. Aguilar,

Provided that the output power requirements apply to the total power out of all ports, please have the manufacturer clarify a few points in the two suggested options:

Option 1: Given the dynamic nature of individual power assignments to each antenna port, is it possible to make conducted measurement prior to power split into two streams and two polarizations? This way, it might be possible to artificially enforce the RF board to transmit at maximum power while conducted measurement is done and not to have to worry about individual antenna ports and their assigned power.

Option 2: Is it possible that all antenna ports transmit at the same power level at any given point in time? If so, you might be able to make one single measurement (out of one port) while that port is transmitting max power and then multiply that measured power (in power units and not in dB) by 8 which is the number of antenna ports that transmit with the same, let's say horizontal, polarization. And repeat the same process for other ports that transmit with vertical polarizations. This method, if in fact possible, will give a conservative estimate.

Best Regards,
Laboratory Division
Office of Engineering and Technology
FCC

Client Response
Client requested to implement Option #2

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Equipment Configuration for Peak Transmit Power			
Variant:	20 MHz	**Duty Cycle (%):**	100.0
Data Rate:	-	**Antenna Gain (dBi):**	13.00
Modulation:	16 QAM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power + DCCF (+0 dB) (dBm) Port(s)				Calculated Total Power	Minimum 26 dB Bandwidth	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	Σ Port(s) dBm	MHz	dBm	dB	
5170.0	17.77	17.89	16.46	16.91	23.32	--	30.00	-6.68	15.00
5200.0	20.53	20.94	20.40	20.71	26.67	--	30.00	-3.33	9.00
5240.0	20.50	20.75	20.50	20.51	26.59	--	30.00	-3.41	10.00

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

DCCF - Duty Cycle Correction Factor

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Variant:	20 MHz	**Duty Cycle (%):**	100.0
Data Rate:	-	**Antenna Gain (dBi):**	13.00
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Conducted Output Power + DCCF (+0 dB) (dBm) Port(s)				Calculated Total Power	Minimum 26 dB Bandwidth	Limit	Margin	EUT Power Setting
MHz	a	b	c	d	Σ Port(s) dBm	MHz	dBm	dB	
5735.0	20.47	21.05	20.51	21.59	26.98	--	30.00	-3.02	11.00
5785.0	20.44	20.86	20.77	21.04	26.80	--	30.00	-3.20	11.00
5835.0	20.10	20.25	19.70	20.85	26.27	--	30.00	-3.73	11.50

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-01 MEASURING RF OUTPUT POWER
Measurement Uncertainty:	±1.33 dB

DCCF - Duty Cycle Correction Factor

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9.2. 26 dB & 99% Bandwidth

Conducted Test Conditions for 26 dB and 99% Bandwidth			
Standard:	FCC CFR 47:15.407	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	26 dB and 99 % Bandwidth	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.407 (a)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for 26 dB and 99% Bandwidth Measurement
The bandwidth at 26 dB and 99 % is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency. The Resolution Bandwidth was set to approximately 1% of the emission bandwidth.
Testing was performed under ambient conditions at nominal voltage. Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured and reported.

Test configuration and setup used for the measurement was per the Conducted Test Set-up section specified in this document.

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Equipment Configuration for 26 dB & 99% Occupied Bandwidth			
Variant:	20 MHz	**Duty Cycle (%):**	100.0
Data Rate:	-	**Antenna Gain (dBi):**	13.00
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz) Port(s)				26 dB Bandwidth (MHz)			
MHz	a	b	c	d	Highest	Lowest		
5170.0	18.938	18.938	18.938	18.938	18.938	18.938		
5200.0	18.938	19.038	19.038	18.938	19.038	18.938		
5240.0	18.938	19.038	19.038	18.938	19.038	18.938		

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				99% Bandwidth (MHz)			
MHz	a	b	c	d	Highest	Lowest		
5170.0	18.337	18.337	18.337	18.337	18.337	18.337		
5200.0	18.337	18.337	18.337	18.337	18.337	18.337		
5240.0	18.337	18.337	18.337	18.337	18.337	18.337		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for 26 dB & 99% Occupied Bandwidth			
Variant:	20 MHz	**Duty Cycle (%):**	100.0
Data Rate:	-	**Antenna Gain (dBi):**	13.00
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured 26 dB Bandwidth (MHz) Port(s)				26 dB Bandwidth (MHz)			
MHz	a	b	c	d	Highest	Lowest		
5735.0	18.938	18.938	18.938	18.938	18.938	18.938		
5785.0	18.938	18.938	19.038	18.938	19.038	18.938		
5835.0	18.938	18.938	18.938	18.938	18.938	18.938		

Test Frequency	Measured 99% Bandwidth (MHz) Port(s)				99% Bandwidth (MHz)			
MHz	a	b	c	d	Highest	Lowest		
5735.0	18.337	18.337	18.337	18.337	18.337	18.337		
5785.0	18.337	18.337	18.337	18.337	18.337	18.337		
5835.0	18.337	18.337	18.337	18.337	18.337	18.337		

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

Note: click the links in the above matrix to view the graphical image (plot).

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9.3. Power Spectral Density

Conducted Test Conditions for Power Spectral Density			
Standard:	FCC CFR 47:15.407	**Ambient Temp. (ºC):**	24.0 - 27.5
Test Heading:	Power Spectral Density	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.407 (a)	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Power Spectral Density
The in-band power spectral density was measured using the test technique specified in KDB 789033. A 1 MHz measurement bandwidth was implemented for the analyzer sweep. Once the sweep is complete the analyzer trace data is downloaded and used for post processing purposes.
Where the device operated with multiple antenna ports i.e. MIMO device, each port was measured separately. The Peak Power Spectral Density is the highest level found across the emission bandwidth. With multiple antenna port measurements the numerical analyzer data from each port is summed (å) and a link to this additional graphic is provided.

Test configuration and setup used for the measurement was per the Conducted Test Set-up section specified in this document.

Measure and sum the spectra across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The individual spectra are then summed mathematically in linear power units. Unlike in-band power measurements, in which the sum involves a single measured value (output power) from each output, measurements for compliance with PSD limits involve summing entire spectra across corresponding frequency bins on the various outputs. Consistency is maintained for any device with multiple transmitter outputs to be certain the individual outputs are all aligned with the same span and same number of points. In this instance, the linear power spectrum value within the first spectral bin of output 0 is summed with that in the first spectral bin of output 1, and the first spectral bin of output 2, and so on up to the Nth output to obtain the true value for the first frequency bin of the summed spectrum. The summed spectrum value for each frequency bin is computed in this fashion. These summed spectral values were post processed and the resulting numerical and graphical data presented.

NOTE: It may be observed that spectrum in some plots break the limit line however this in itself does NOT constitute a failure. In all cases a spectrum summation plot is provided in order to prove compliance. A failure occurs only after the summation of all spectrum plots have been summed and are found to be greater than the limit line.

Supporting Information
Calculated Power = A + 10 log (1/x) dBm
A = Total Power Spectral Density [10*Log10 ($10^{a/10} + 10^{b/10} + 10^{c/10} + 10^{d/10}$)]
x = Duty Cycle

Limits Power Spectral Density

Operating Frequency Band 5150-5250 MHz

15. 407 (a)(1)
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Operating Frequency Band 5250-5350 and 5470 – 5725 MHz

15. 407 (a)(2)
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Operating Frequency Band 5725 – 5850 MHz

15. 407 (a)(3)
For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

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Equipment Configuration for Power Spectral Density			
Variant:	20 MHz	**Duty Cycle (%):**	100.0
Data Rate:	-	**Antenna Gain (dBi):**	13.00
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/MHz)				Amplitude Summation + DCCF (+0 dB)	Limit	Margin
MHz	**a**	**b**	**c**	**d**	**dBm/MHz**	**dBm/MHz**	**dB**
5170.0	5.367	5.611	4.083	3.892	10.775	17.0	-6.2
5200.0	9.315	9.757	10.394	9.629	15.716	17.0	-1.3
5240.0	9.374	9.422	10.563	9.336	15.645	17.0	-1.4

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

DCCF - Duty Cycle Correction Factor

Note: click the links in the above matrix to view the graphical image (plot).

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Equipment Configuration for Power Spectral Density			
Variant:	20 MHz	**Duty Cycle (%):**	100.0
Data Rate:	-	**Antenna Gain (dBi):**	13.00
Modulation:	OFDM	**Beam Forming Gain (Y)(dB):**	Not Applicable
TPC:	Not Applicable	**Tested By:**	SB
Engineering Test Notes:			

Test Measurement Results

Test Frequency	Measured Power Spectral Density Port(s) (dBm/500 KHz)				Summation Peak Marker + DCCF (+0 dB)	Limit	Margin
MHz	**a**	**b**	**c**	**d**	**dBm/500 KHz**	**dBm/500 KHz**	**dB**
5735.0	5.809	5.801	5.765	6.236	11.900	30.0	-18.1
5785.0	6.395	6.290	8.929	6.279	13.038	30.0	-17.0
5835.0	4.873	4.732	4.652	5.186	10.849	30.0	-19.2

Traceability to Industry Recognized Test Methodologies	
Work Instruction:	WI-03 MEASURING RF SPECTRUM MASK
Measurement Uncertainty:	±2.81 dB

DCCF - Duty Cycle Correction Factor

Note: click the links in the above matrix to view the graphical image (plot).

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9.4. Radiated

Radiated Test Conditions for Radiated Spurious and Band-Edge Emissions			
Standard:	FCC CFR 47:15.407	**Ambient Temp. (ºC):**	20.0 - 24.5
Test Heading:	Radiated Spurious and Band-Edge Emissions	**Rel. Humidity (%):**	32 - 45
Standard Section(s):	15.407 (b), 15.205, 15.209	**Pressure (mBars):**	999 - 1001
Reference Document(s):	See Normative References		

Test Procedure for Radiated Spurious and Band-Edge Emissions
Radiated emissions for restricted bands above 1 GHz are measured in the anechoic chamber at a 3-meter distance on every azimuth in both horizontal and vertical polarities. The emissions are recorded and maximized as a function of azimuth by rotation through 360° with a spectrum analyzer in peak hold mode. Depending on the frequency band spanned a notch filter and waveguide filter was used to remove the fundamental frequency. The highest emissions relative to the limit are listed for each frequency spanned. Measurements on any restricted band frequency or frequencies above 1 GHz are based on the use of measurement instrumentation employing peak and average detectors. All measurements were performed using a resolution bandwidth of 1 MHz.

Test configuration and setup for Undesirable Measurement were per the Radiated Test Set-up specified in this document.

15.407 (b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

Limits for Restricted Bands (15.205, 15.209)
Peak emission: 74 dBuV/m
Average emission: 54 dBuV/m

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

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

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

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

where P is the EIRP in Watts

Therefore: -27 dBm/MHz equates to 68.23 dBuV/m

Conversion between dBmV/m (or dBmV) and mV/m (or mV) are as follows:
Level (dBmV/m) = 20 * Log (level (mV/m))

40 dBmV/m = 100 mV/m
48 dBmV/m = 250 mV/m

Restricted Bands of Operation (15.205)
(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Frequency Band			
MHz	**MHz**	**MHz**	**GHz**
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5

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12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

(b) Except as provided 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 §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

(d) The following devices are exempt from the requirements of this section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to §15.213.

(4) Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of subparts D or F of this part.

(7) Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in §15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in §15.249(a).

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of §15.245 shall not exceed the limits specified in §15.245(b).

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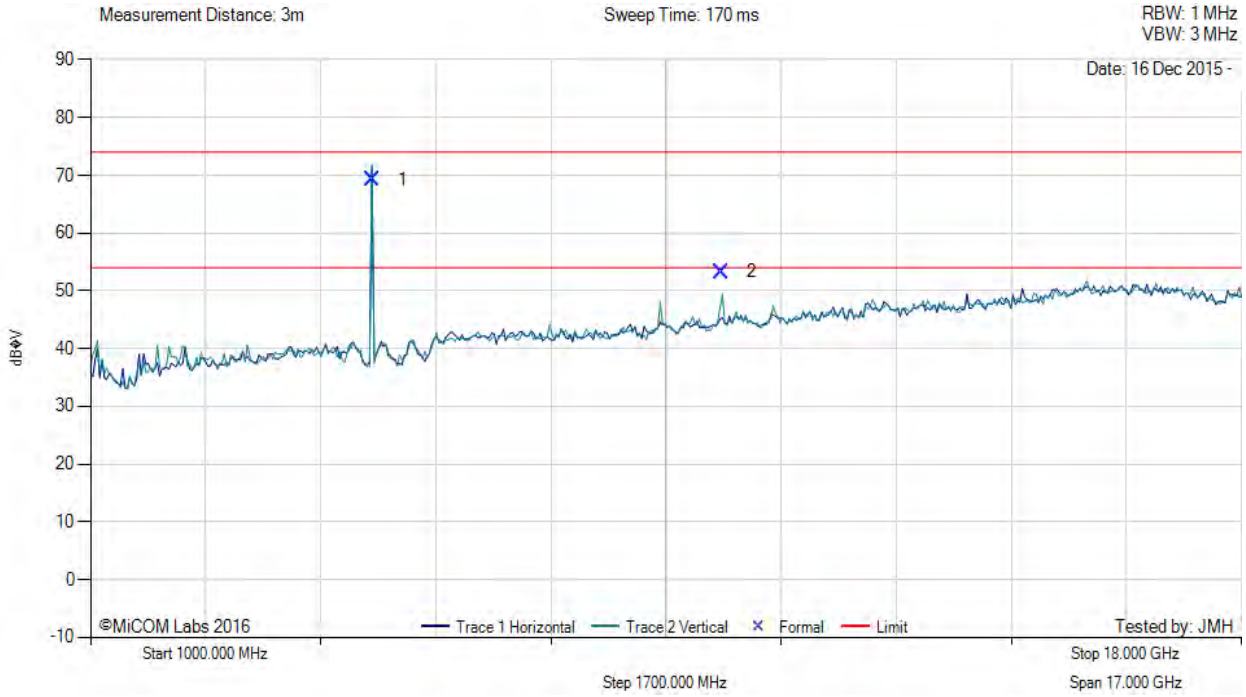
9.4.1. Restricted Band Emissions

Equipment Configuration for Radiated Spurious - Restricted Band Emissions			
Antenna:	Panel	**Variant:**	20 MHz
Antenna Gain (dBi):	13 dBi	**Modulation:**	16 QAM
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	5170.00	**Data Rate:**	-
Power Setting:	8	**Tested By:**	JMH

Test Measurement Results

Variant: , Test Freq: 5170.00 MHz, Antenna: 13 dBi panel, Power Setting: 8



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5166.61	77.03	3.72	-11.55	69.20	Fundamental	Vertical	101	1	--	--	
2	10320.00	53.11	5.58	-5.38	53.31	Peak (NRB)	Vertical	153	32	--	--	Pass

Test Notes: EUT mount on 150cm table connected to 14 dBi antenna with 2 dB cable loss

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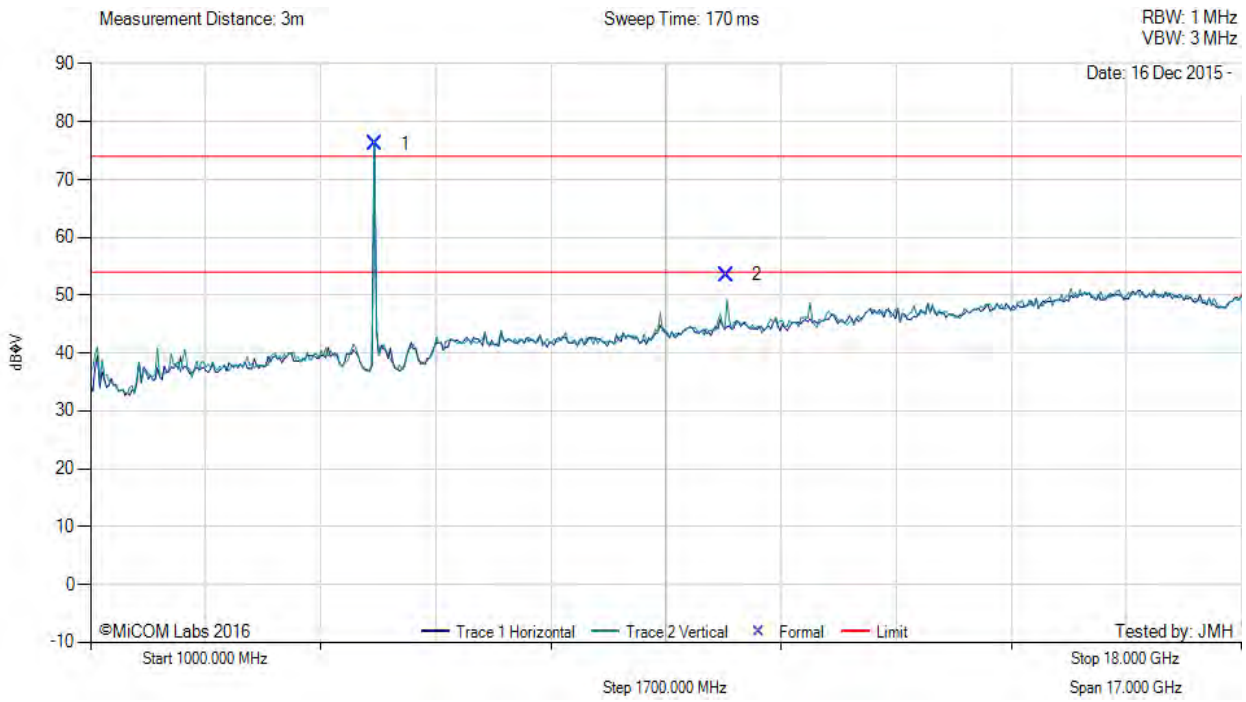
Equipment Configuration for Radiated Spurious - Restricted Band Emissions			
Antenna:	Panel	**Variant:**	20 MHz
Antenna Gain (dBi):	13 dBi	**Modulation:**	16 QAM
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	5200.00	**Data Rate:**	-
Power Setting:	8	**Tested By:**	JMH

Test Measurement Results

Variant: , Test Freq: 5200.00 MHz, Antenna: 13 dBi panel, Power Setting: 8



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5194.51	84.00	3.67	-11.47	76.20	Fundamental	Horizontal	200	1	--	--	
2	10400.20	53.13	5.40	-5.03	53.50	Peak (NRB)	Vertical	185	210	--	--	Pass

Test Notes: EUT mount on 150cm table. PS based on connected to 14 dBi antenna with 2 dB cable loss

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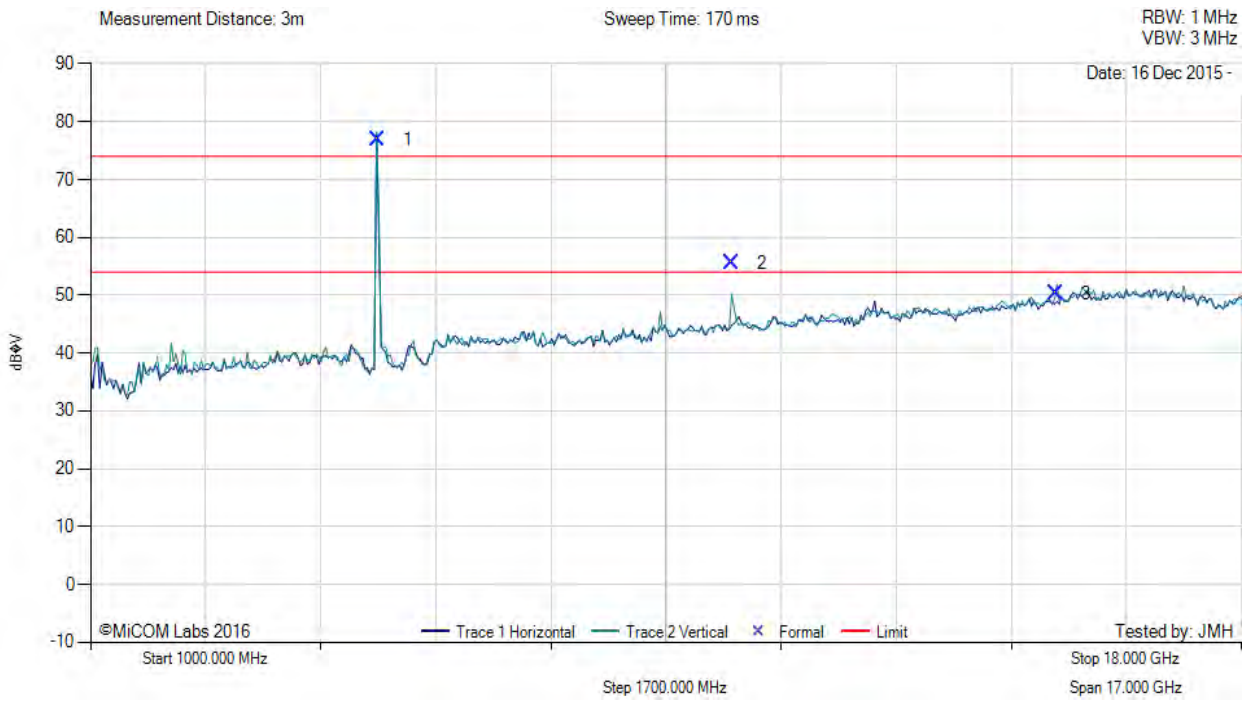
Equipment Configuration for Radiated Spurious - Restricted Band Emissions			
Antenna:	Panel	**Variant:**	20 MHz
Antenna Gain (dBi):	13 dBi	**Modulation:**	16 QAM
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	5240.00	**Data Rate:**	-
Power Setting:	9	**Tested By:**	JMH

Test Measurement Results

Variant: , Test Freq: 5240.00 MHz, Antenna: 13 dBi panel, Power Setting: 9



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5234.63	84.58	3.63	-11.37	76.84	Fundamental	Horizontal	200	1	--	--	
2	10476.03	54.57	5.45	-4.49	55.53	Peak (NRB)	Vertical	200	360	--	--	Pass
3	15257.40	46.42	5.92	-2.03	50.31	Peak (NRB)	Vertical	148	0	--	--	Pass

Test Notes: EUT mount on 150cm table. PS based on connected to 14 dBi antenna with 2 dB cable loss

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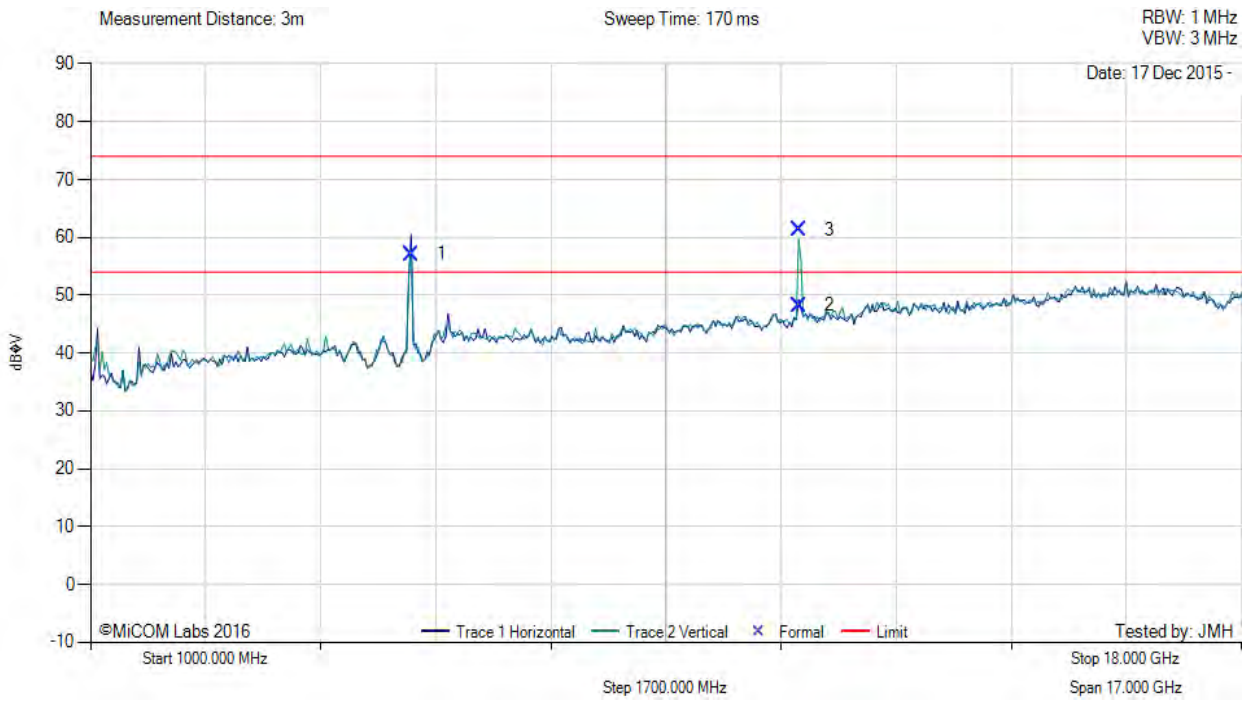
Equipment Configuration for Radiated Spurious - Restricted Band Emissions			
Antenna:	Panel	**Variant:**	20 MHz
Antenna Gain (dBi):	13 dBi	**Modulation:**	16 QAM
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	5745.00	**Data Rate:**	-
Power Setting:	8.5	**Tested By:**	JMH

Test Measurement Results

Variant: , Test Freq: 5735.00 MHz, Antenna: 13 dBi, Power Setting: 8.5, Duty Cycle (%): 100



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5734.47	63.99	3.81	-10.68	57.12	Fundamental	Horizontal	150	0	--	--	
2	11465.77	47.59	5.56	-4.89	48.26	Max Avg	Vertical	159	177	54.0	-5.7	Pass
3	11465.77	60.68	5.56	-4.89	61.35	Max Peak	Vertical	159	177	74.0	-12.7	Pass

Test Notes: EUT mount on 150cm table. PS based on connected to 14 dBi antenna with 2 dB cable loss

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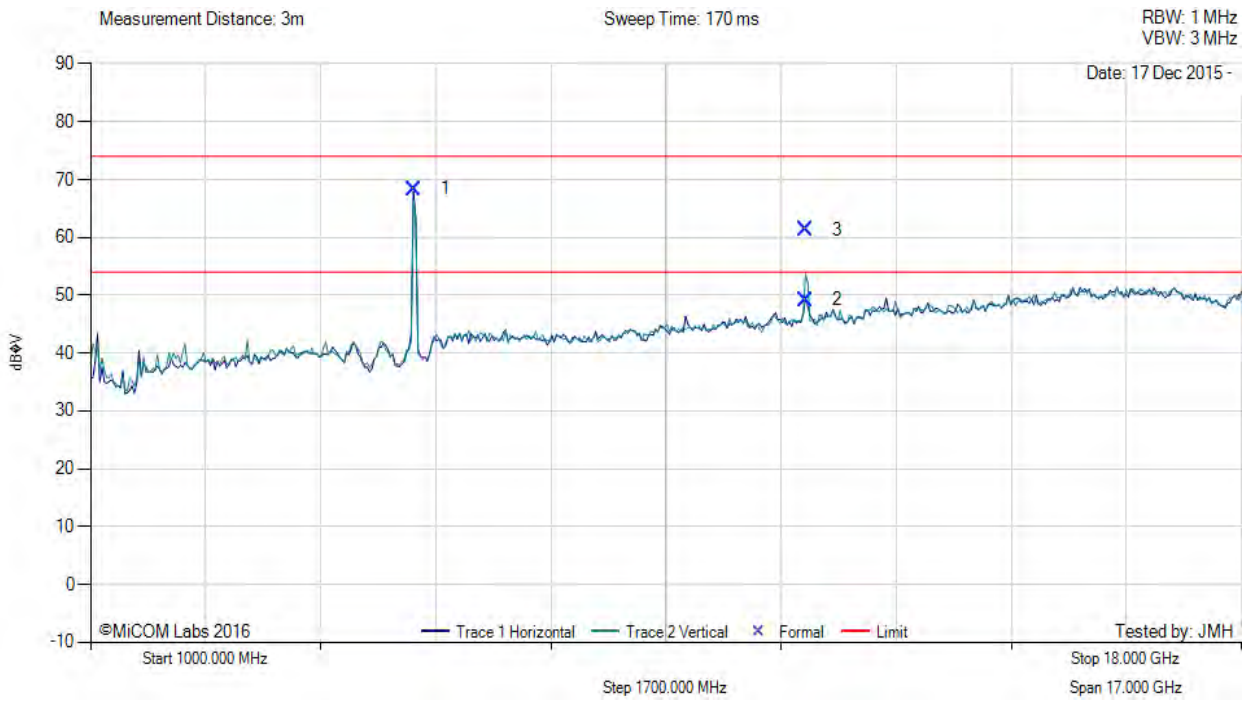
Equipment Configuration for Radiated Spurious - Restricted Band Emissions			
Antenna:	Panel	**Variant:**	20 MHz
Antenna Gain (dBi):	13 dBi	**Modulation:**	16 QAM
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	5785.00	**Data Rate:**	-
Power Setting:	8.5	**Tested By:**	JMH

Test Measurement Results

Variant: , Test Freq: 5785.00 MHz, Antenna: 13 dBi, Power Setting: 8.5, Duty Cycle (%): 100



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5786.57	74.99	3.79	-10.43	68.35	Fundamental	Horizontal	151	1	--	--	
2	11570.34	48.37	5.46	-4.64	49.19	Max Avg	Vertical	189	169	54.0	-4.8	Pass
3	11570.34	60.41	5.46	-4.64	61.23	Max Peak	Vertical	189	169	74.0	-12.8	Pass

Test Notes: EUT mount on 150cm table. PS based on connected to 14 dBi antenna with 2 dB cable loss

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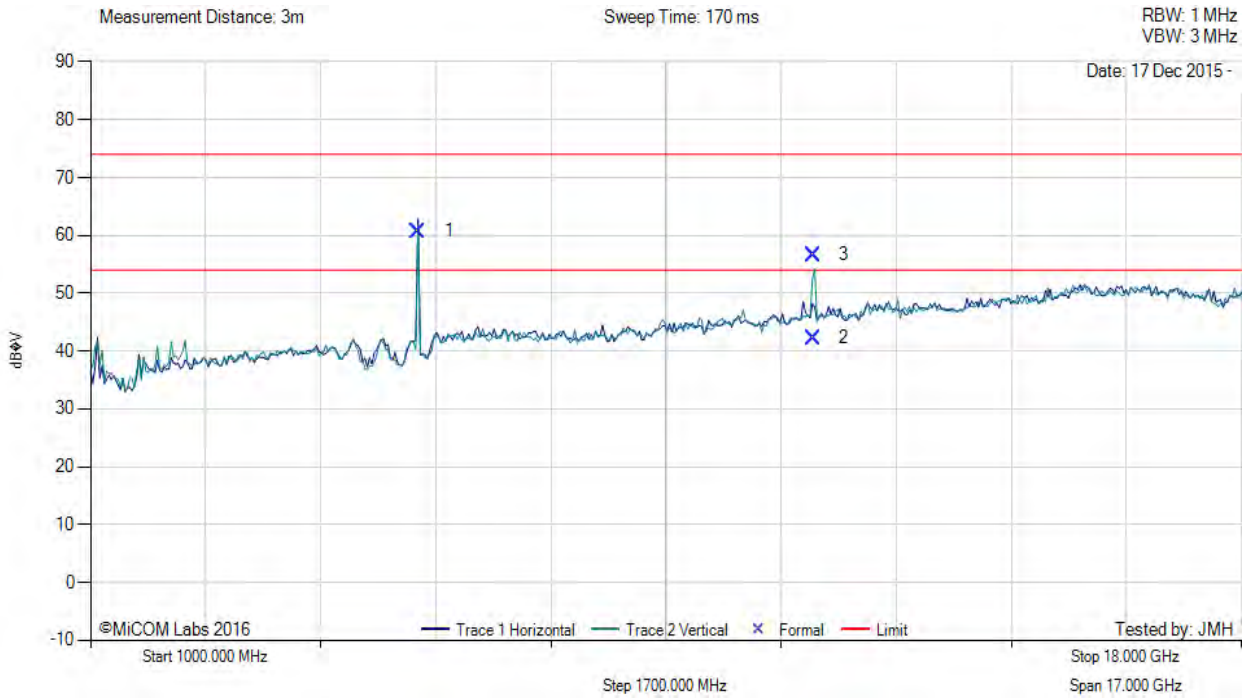
Equipment Configuration for Radiated Spurious - Restricted Band Emissions			
Antenna:	Panel	**Variant:**	20 MHz
Antenna Gain (dBi):	13 dBi	**Modulation:**	16 QAM
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	5825.00	**Data Rate:**	-
Power Setting:	10.5	**Tested By:**	JMH

Test Measurement Results

Variant: , Test Freq: 5835.00 MHz, Antenna: 13 dBi, Power Setting: 10.5, Duty Cycle (%): 100



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5841.57	67.06	3.84	-10.18	60.72	Fundamental	Horizontal	100	1	--	--	
2	11673.18	40.84	5.89	-4.45	42.28	Max Avg	Vertical	107	163	54.0	-11.7	Pass
3	11673.18	55.16	5.89	-4.45	56.60	Max Peak	Vertical	107	163	74.0	-17.4	Pass

Test Notes: EUT mount on 150cm table. PS based on connected to 14 dBi antenna with 2 dB cable loss

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9.4.2. Restricted Band-Edge Emissions

RESULTS SUMMARY FOR RADIATED BAND-EDGE EMISSIONS

5150 – 5250 MHz

Panel Antenna		Band-Edge Freq	Peak (Limit 74.0dBµV/m)	Average (Limit 54.0dBµV/m)	Power Setting
Operational Mode	Operating Frequency (MHz)	MHz	dBµV/m	dBµV/m	
20 MHz	5180.00	5460.00	64.58	52.65	13.0

5725 – 5850 MHz

Panel Antenna		Band-Edge Freq	Peak (Limit 78.2dBµV/m)	Average (Limit 68.2dBµV/m)	Power Setting
Operational Mode	Operating Frequency (MHz)	MHz	dBµV/m	dBµV/m	
20 MHz	5725.00	5460.00	74.23	55.13	9.5
20 MHz	5825.00	5460.00	74.56	62.86	7.0

Click on the links to view the data.

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A. APPENDIX - GRAPHICAL IMAGES

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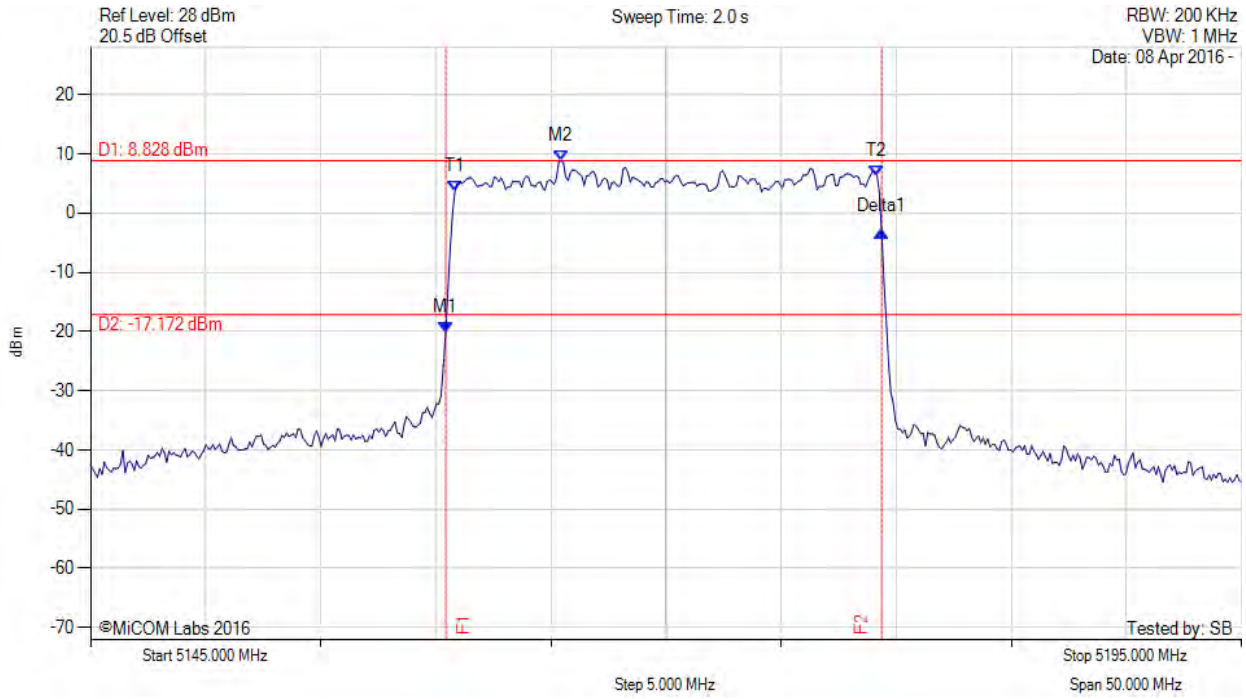
A.1. 26 dB & 99% Bandwidth

26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5170.00 MHz, Chain a, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5160.431 MHz : -20.090 dBm M2 : 5165.441 MHz : 8.828 dBm Delta1 : 18.938 MHz : 16.943 dB T1 : 5160.832 MHz : 3.739 dBm T2 : 5179.168 MHz : 6.316 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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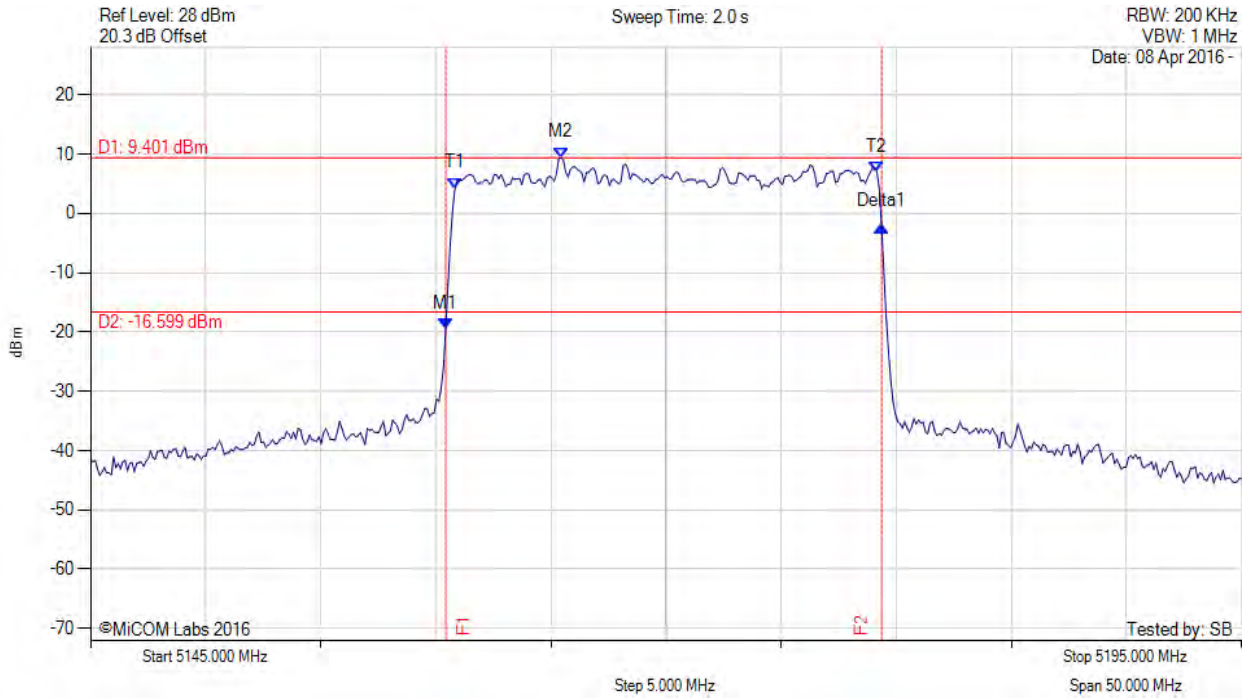
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5170.00 MHz, Chain b, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5160.431 MHz : -19.470 dBm M2 : 5165.441 MHz : 9.401 dBm Delta1 : 18.938 MHz : 17.197 dB T1 : 5160.832 MHz : 4.242 dBm T2 : 5179.168 MHz : 6.930 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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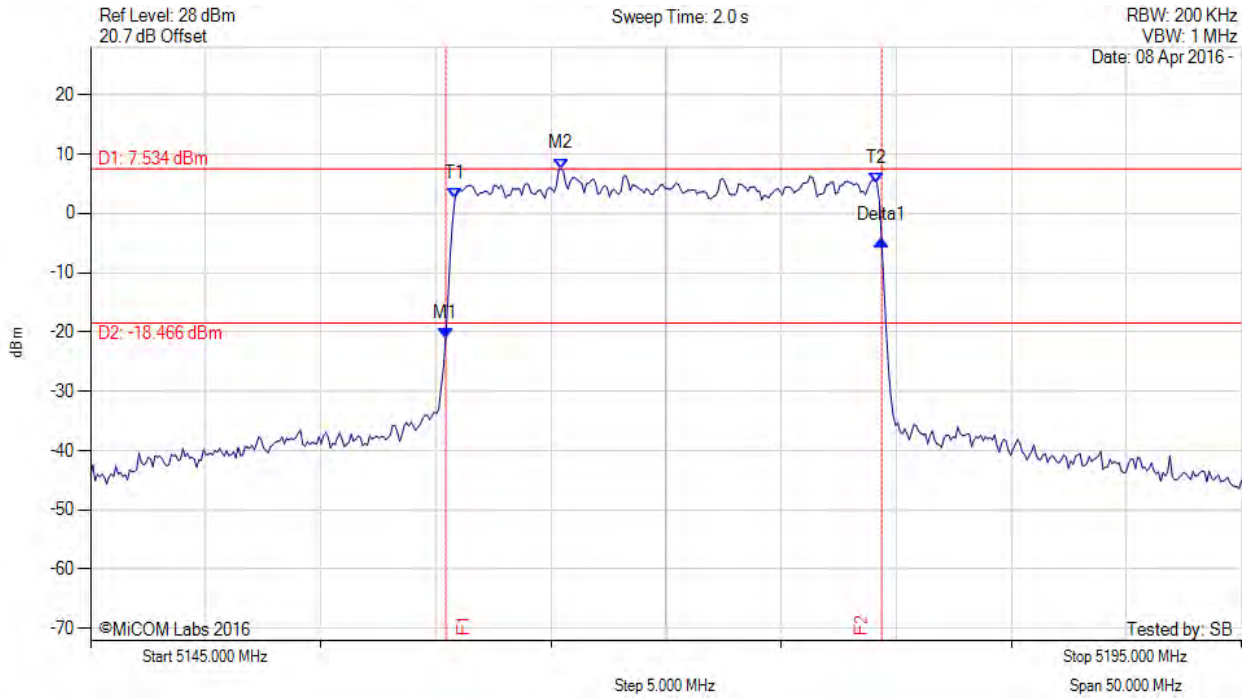
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5170.00 MHz, Chain c, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5160.431 MHz : -21.074 dBm M2 : 5165.441 MHz : 7.534 dBm Delta1 : 18.938 MHz : 16.481 dB T1 : 5160.832 MHz : 2.464 dBm T2 : 5179.168 MHz : 5.019 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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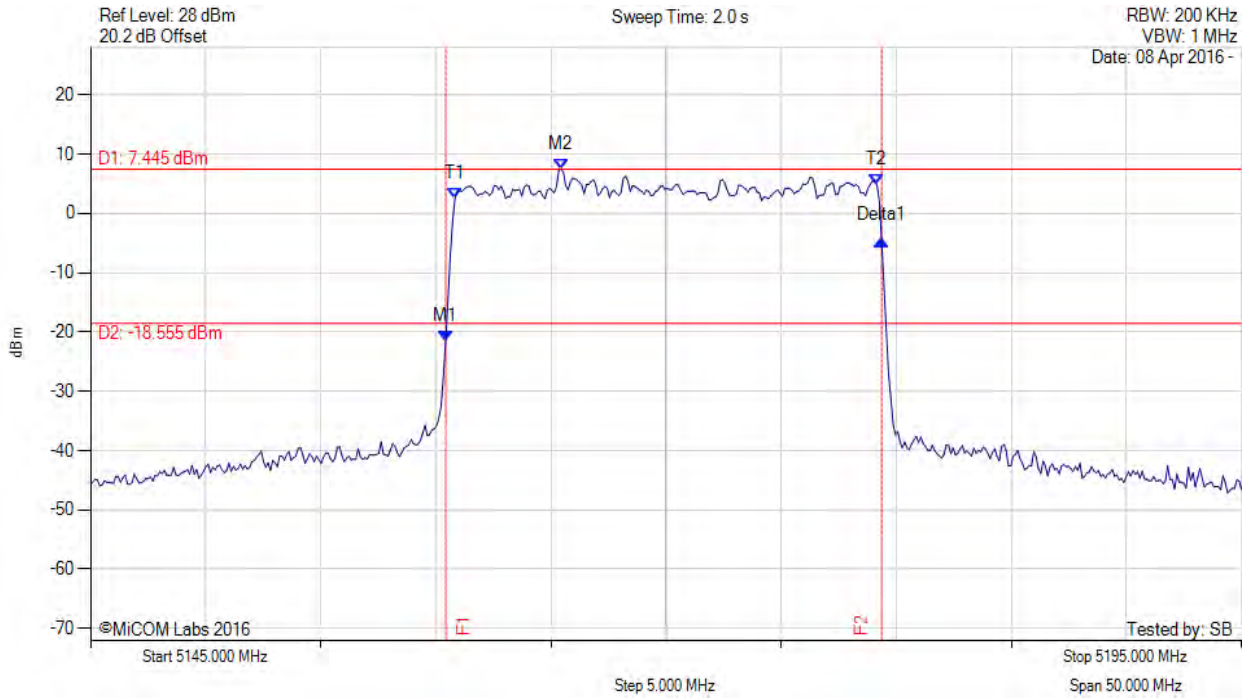
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5170.00 MHz, Chain d, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5160.431 MHz : -21.475 dBm M2 : 5165.441 MHz : 7.445 dBm Delta1 : 18.938 MHz : 16.888 dB T1 : 5160.832 MHz : 2.487 dBm T2 : 5179.168 MHz : 4.769 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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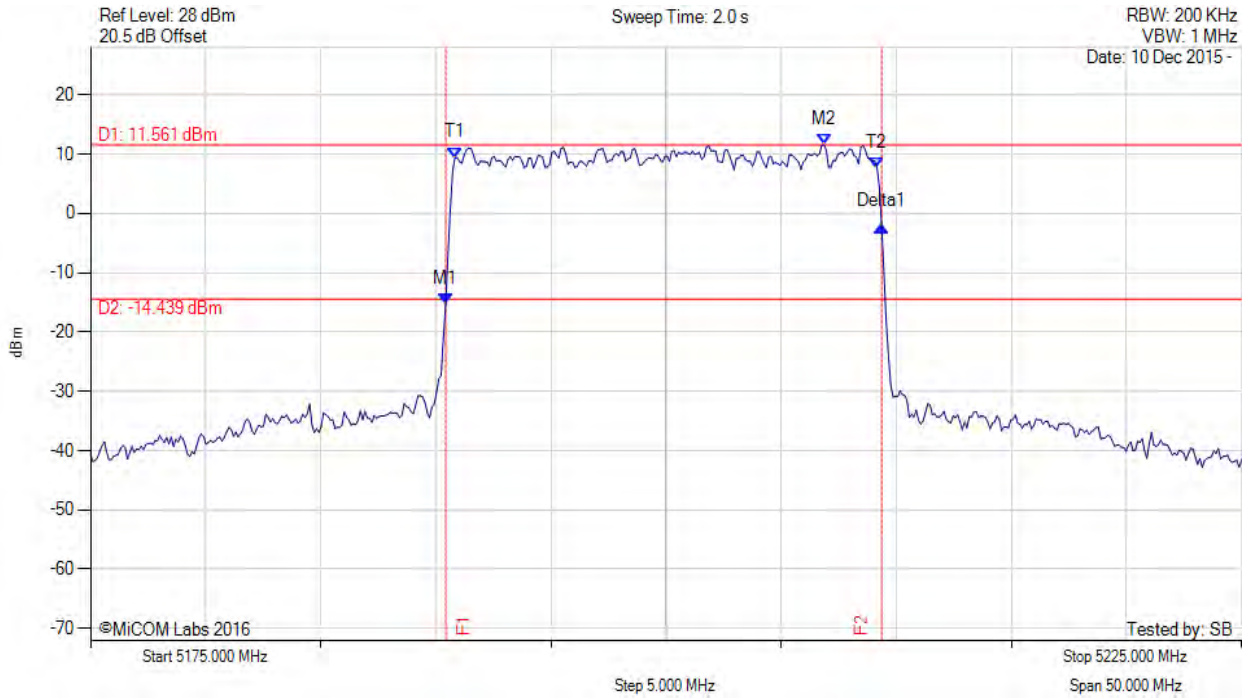
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5200.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5190.431 MHz : -15.311 dBm M2 : 5206.864 MHz : 11.561 dBm Delta1 : 18.938 MHz : 13.215 dB T1 : 5190.832 MHz : 9.381 dBm T2 : 5209.168 MHz : 7.675 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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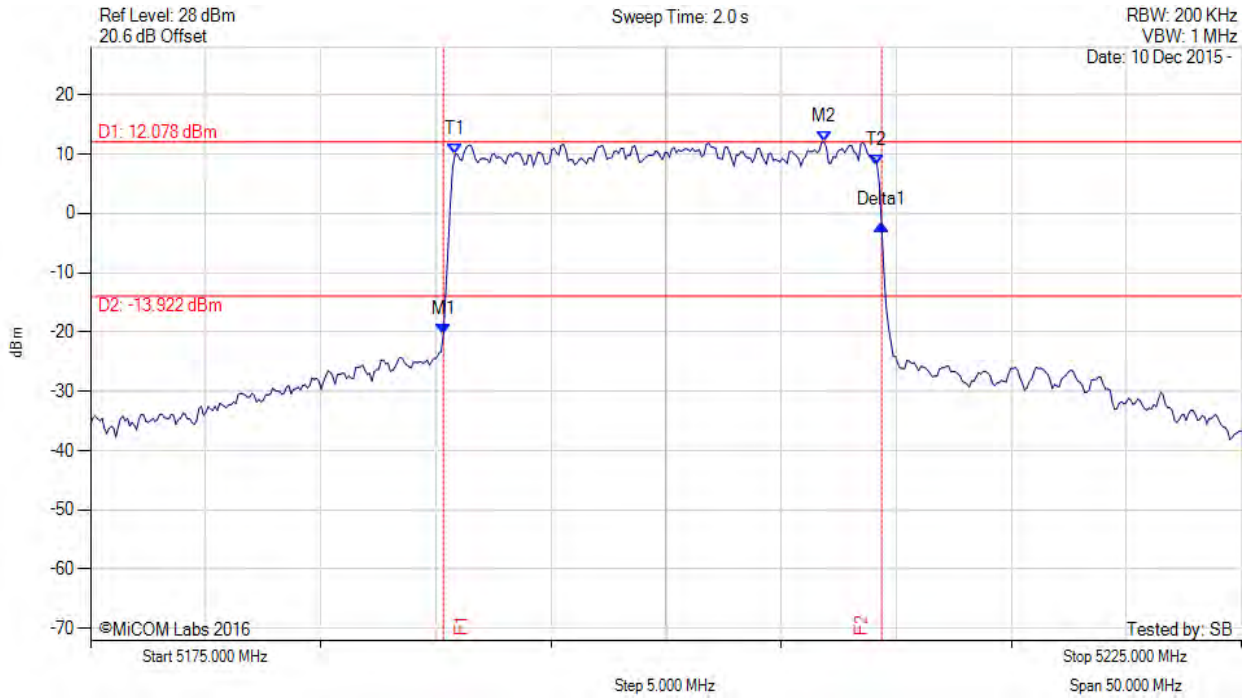
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5200.00 MHz, Chain b, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5190.331 MHz : -20.487 dBm M2 : 5206.864 MHz : 12.078 dBm Delta1 : 19.038 MHz : 18.468 dB T1 : 5190.832 MHz : 9.906 dBm T2 : 5209.168 MHz : 8.140 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 19.038 MHz Measured 99% Bandwidth: 18.337 MHz

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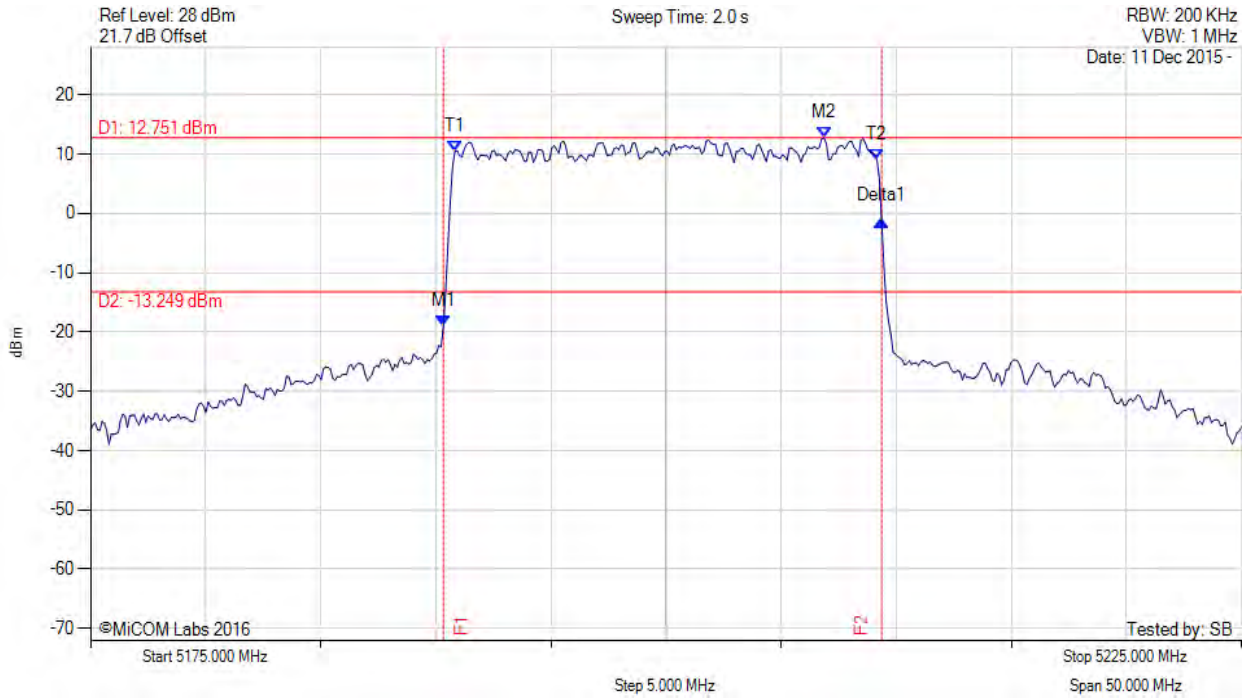
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5200.00 MHz, Chain c, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5190.331 MHz : -19.020 dBm M2 : 5206.864 MHz : 12.751 dBm Delta1 : 19.038 MHz : 17.860 dB T1 : 5190.832 MHz : 10.439 dBm T2 : 5209.168 MHz : 8.960 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 19.038 MHz Measured 99% Bandwidth: 18.337 MHz

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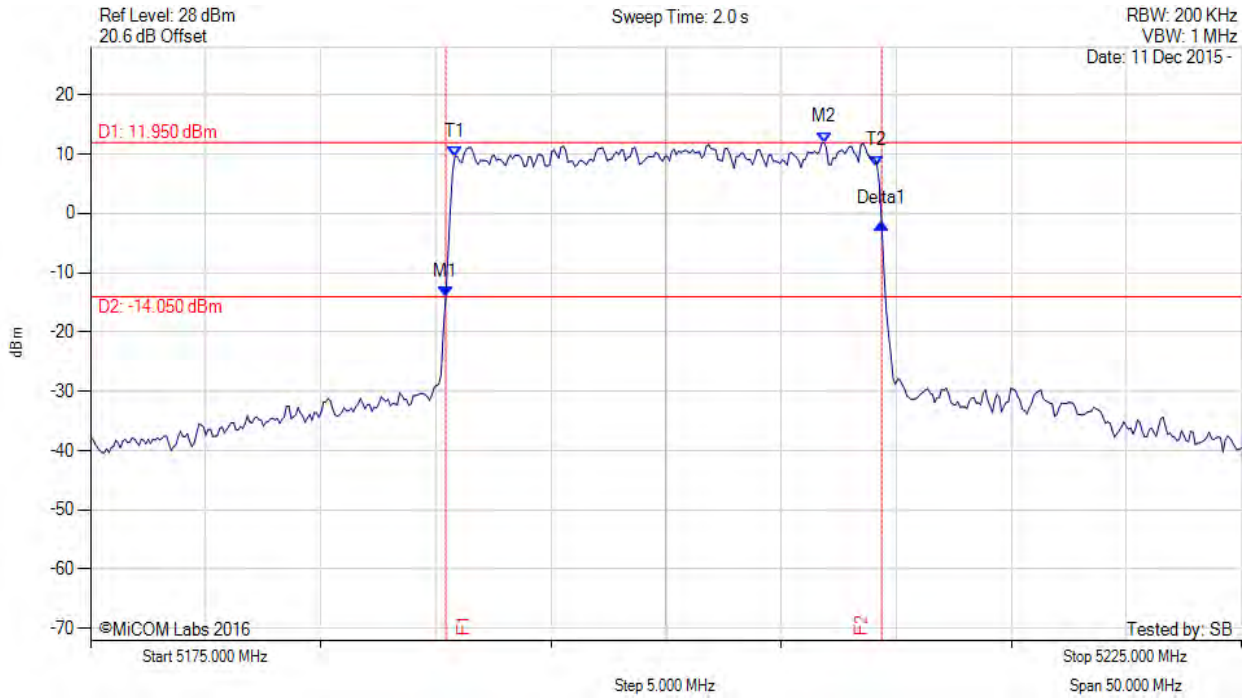
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5200.00 MHz, Chain d, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5190.431 MHz : -14.105 dBm M2 : 5206.864 MHz : 11.950 dBm Delta1 : 18.938 MHz : 12.481 dB T1 : 5190.832 MHz : 9.593 dBm T2 : 5209.168 MHz : 7.994 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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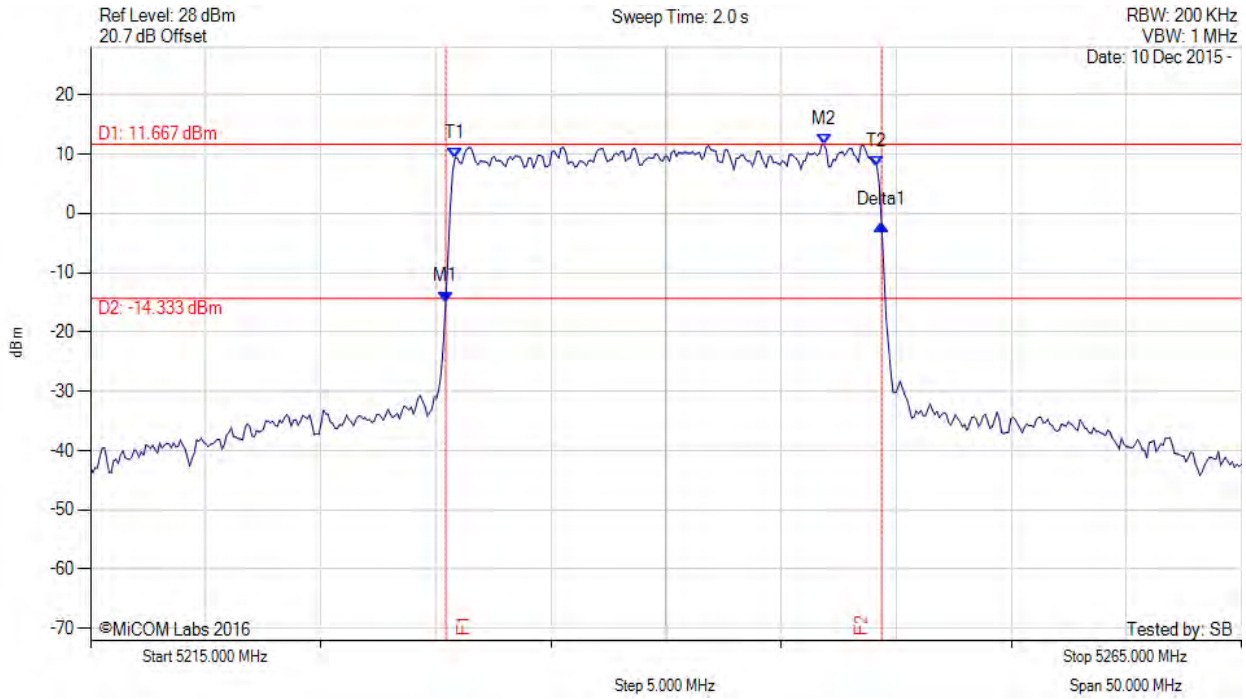
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5240.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5230.431 MHz : -14.922 dBm M2 : 5246.864 MHz : 11.667 dBm Delta1 : 18.938 MHz : 12.973 dB T1 : 5230.832 MHz : 9.290 dBm T2 : 5249.168 MHz : 7.778 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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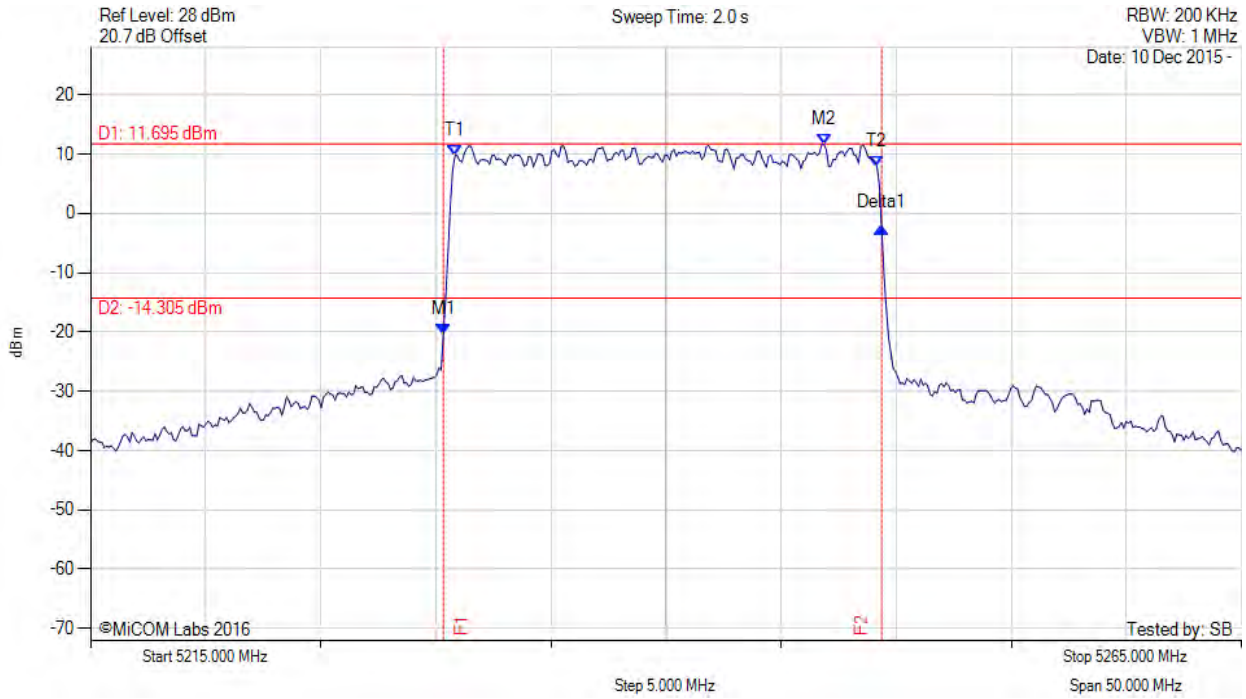
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5240.00 MHz, Chain b, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5230.331 MHz : -20.320 dBm M2 : 5246.864 MHz : 11.695 dBm Delta1 : 19.038 MHz : 17.919 dB T1 : 5230.832 MHz : 9.721 dBm T2 : 5249.168 MHz : 7.772 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 19.038 MHz Measured 99% Bandwidth: 18.337 MHz

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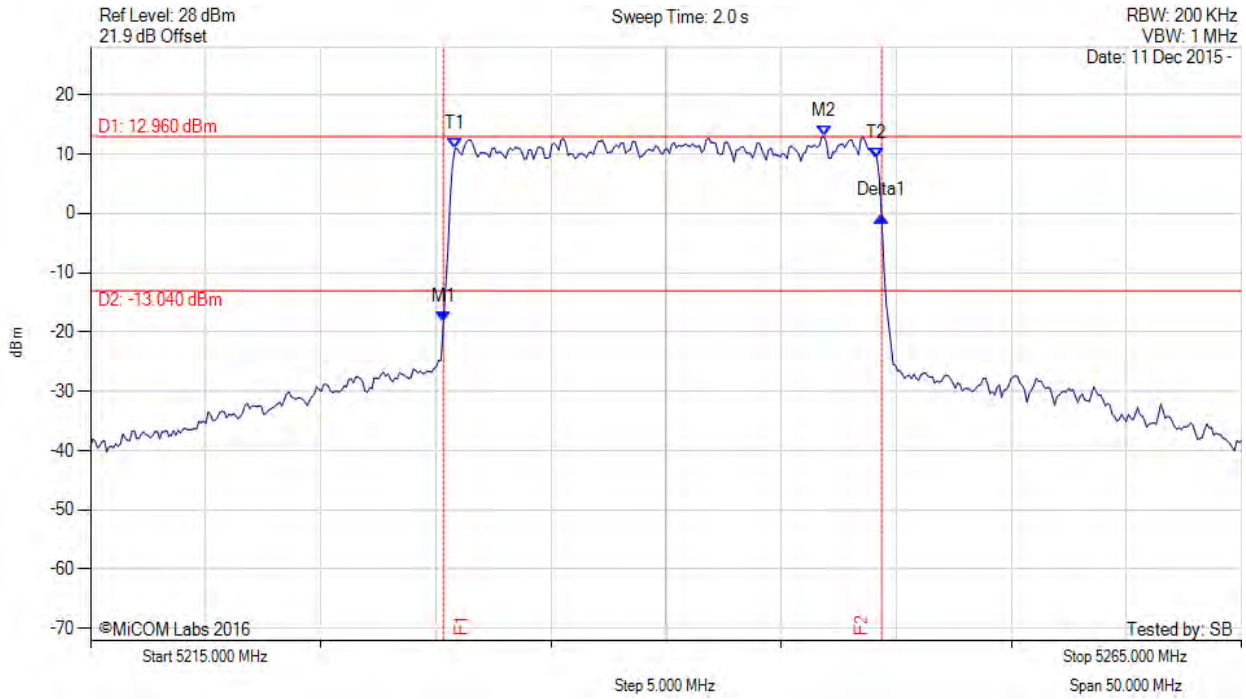
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5240.00 MHz, Chain c, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5230.331 MHz : -18.359 dBm M2 : 5246.864 MHz : 12.960 dBm Delta1 : 19.038 MHz : 17.948 dB T1 : 5230.832 MHz : 10.902 dBm T2 : 5249.168 MHz : 9.192 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 19.038 MHz Measured 99% Bandwidth: 18.337 MHz

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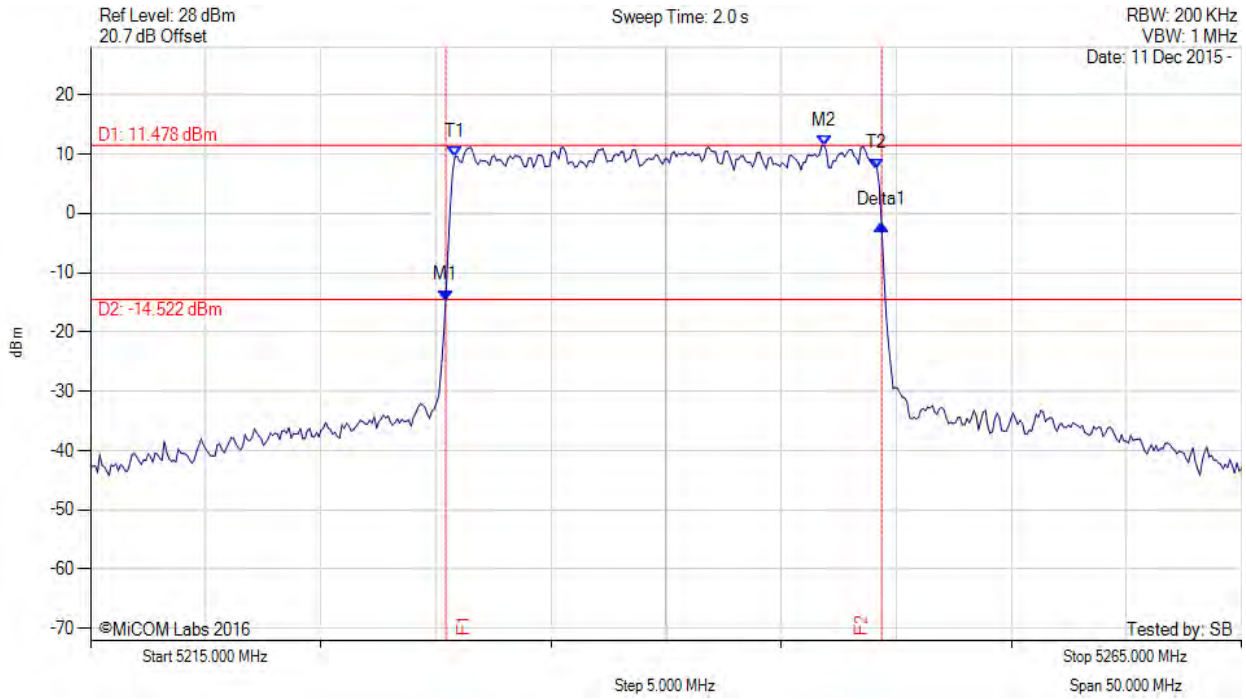
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5240.00 MHz, Chain d, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5230.431 MHz : -14.676 dBm M2 : 5246.864 MHz : 11.478 dBm Delta1 : 18.938 MHz : 12.813 dB T1 : 5230.832 MHz : 9.511 dBm T2 : 5249.168 MHz : 7.518 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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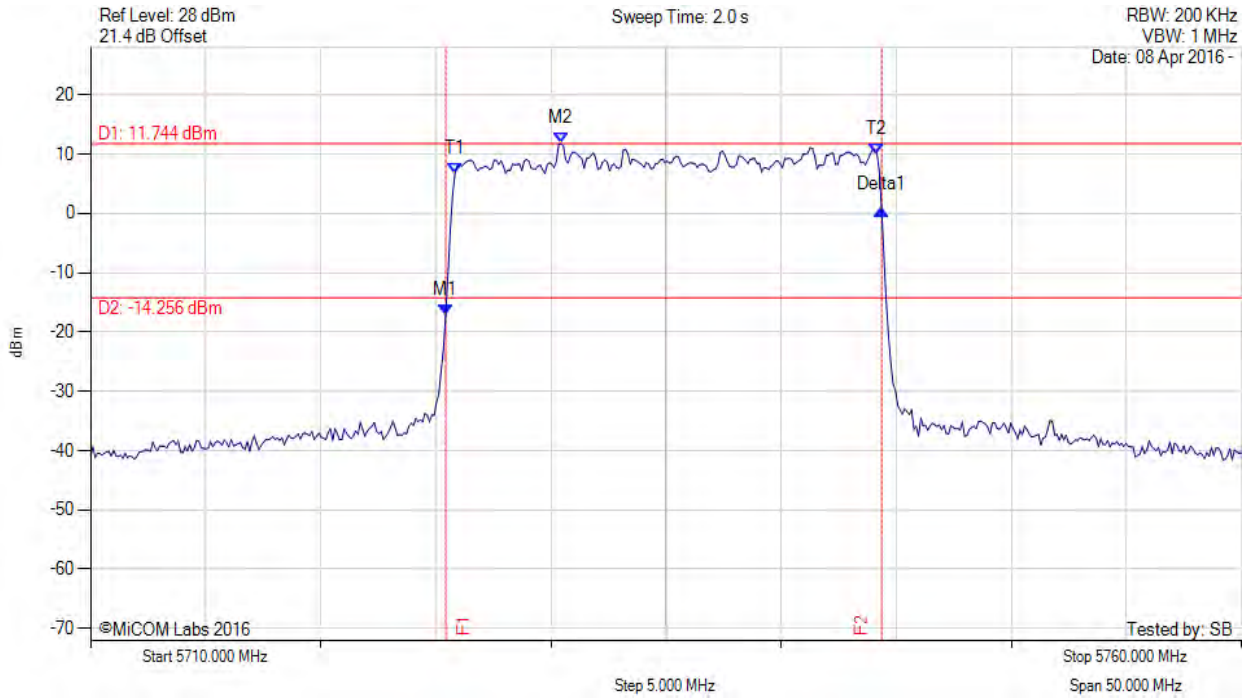
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5735.00 MHz, Chain a, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5725.431 MHz : -17.121 dBm M2 : 5730.441 MHz : 11.744 dBm Delta1 : 18.938 MHz : 17.836 dB T1 : 5725.832 MHz : 6.747 dBm T2 : 5744.168 MHz : 9.953 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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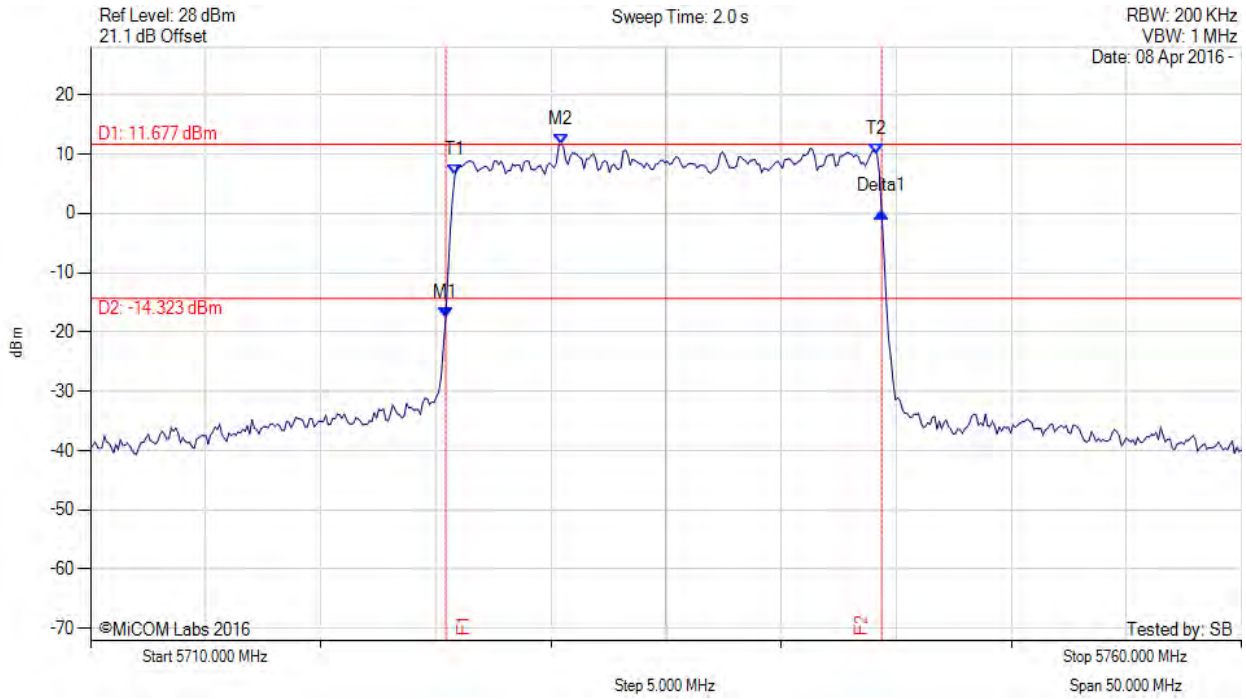
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5735.00 MHz, Chain b, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5725.431 MHz : -17.609 dBm M2 : 5730.441 MHz : 11.677 dBm Delta1 : 18.938 MHz : 17.881 dB T1 : 5725.832 MHz : 6.495 dBm T2 : 5744.168 MHz : 9.981 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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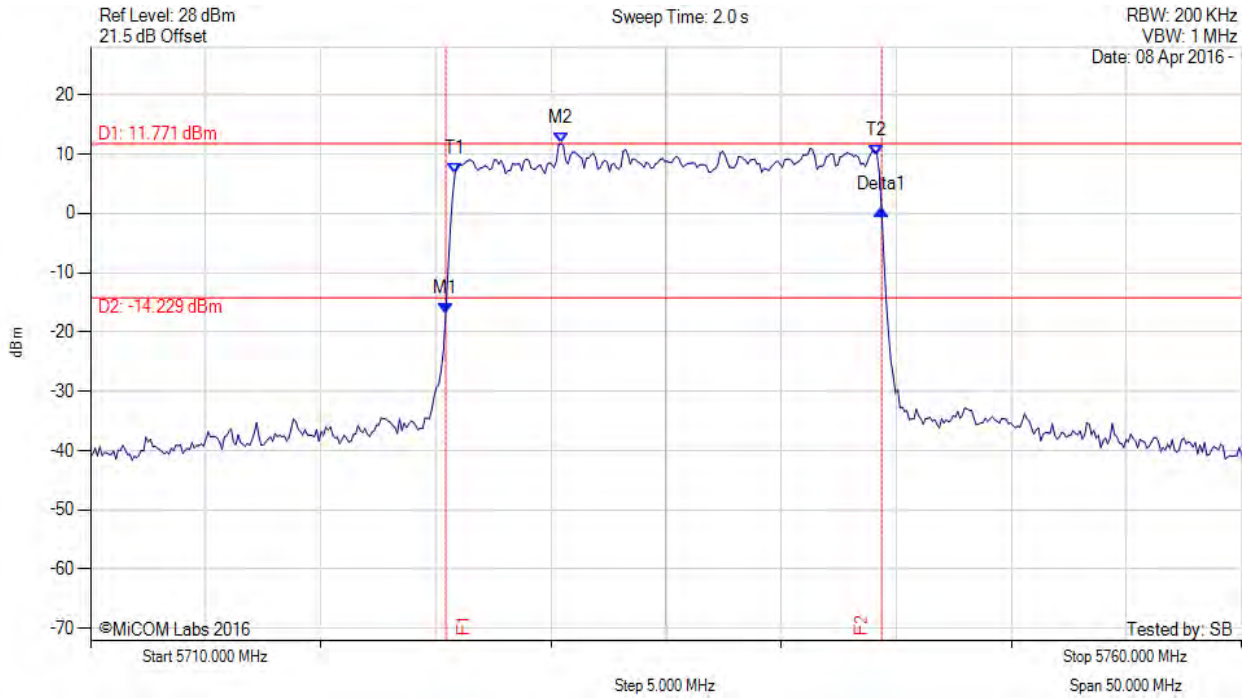
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5735.00 MHz, Chain c, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5725.431 MHz : -16.822 dBm M2 : 5730.441 MHz : 11.771 dBm Delta1 : 18.938 MHz : 17.356 dB T1 : 5725.832 MHz : 6.682 dBm T2 : 5744.168 MHz : 9.802 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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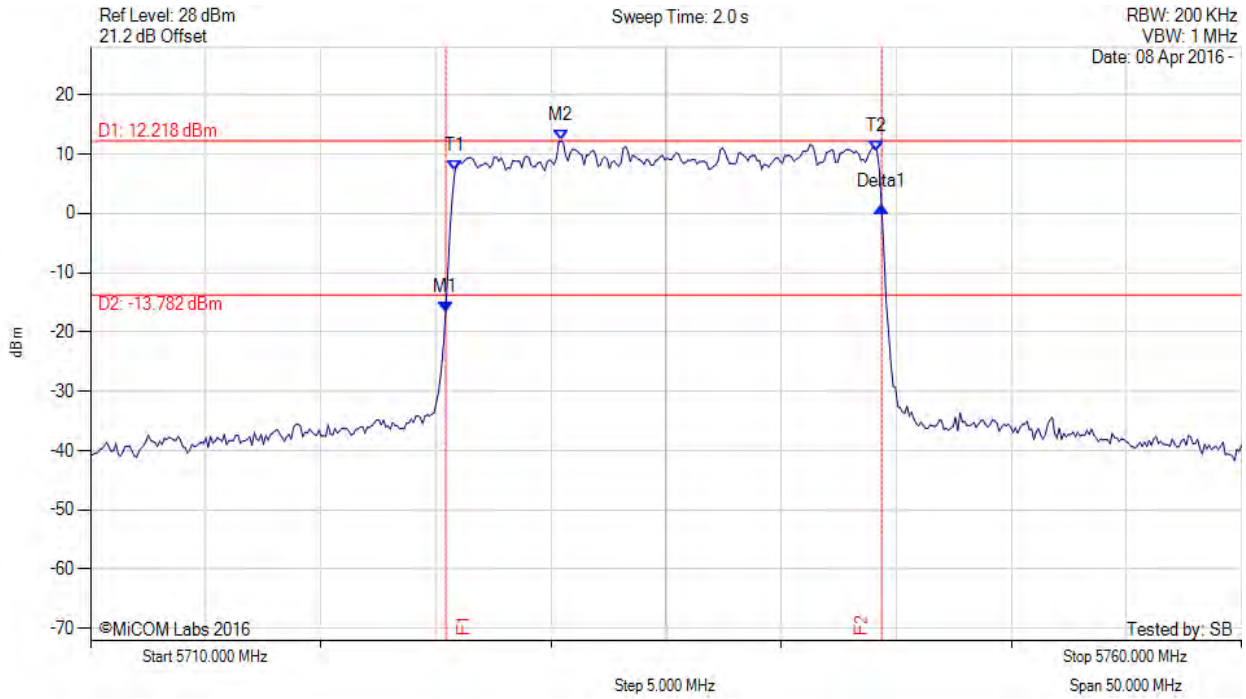
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5735.00 MHz, Chain d, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5725.431 MHz : -16.606 dBm M2 : 5730.441 MHz : 12.218 dBm Delta1 : 18.938 MHz : 17.647 dB T1 : 5725.832 MHz : 7.221 dBm T2 : 5744.168 MHz : 10.404 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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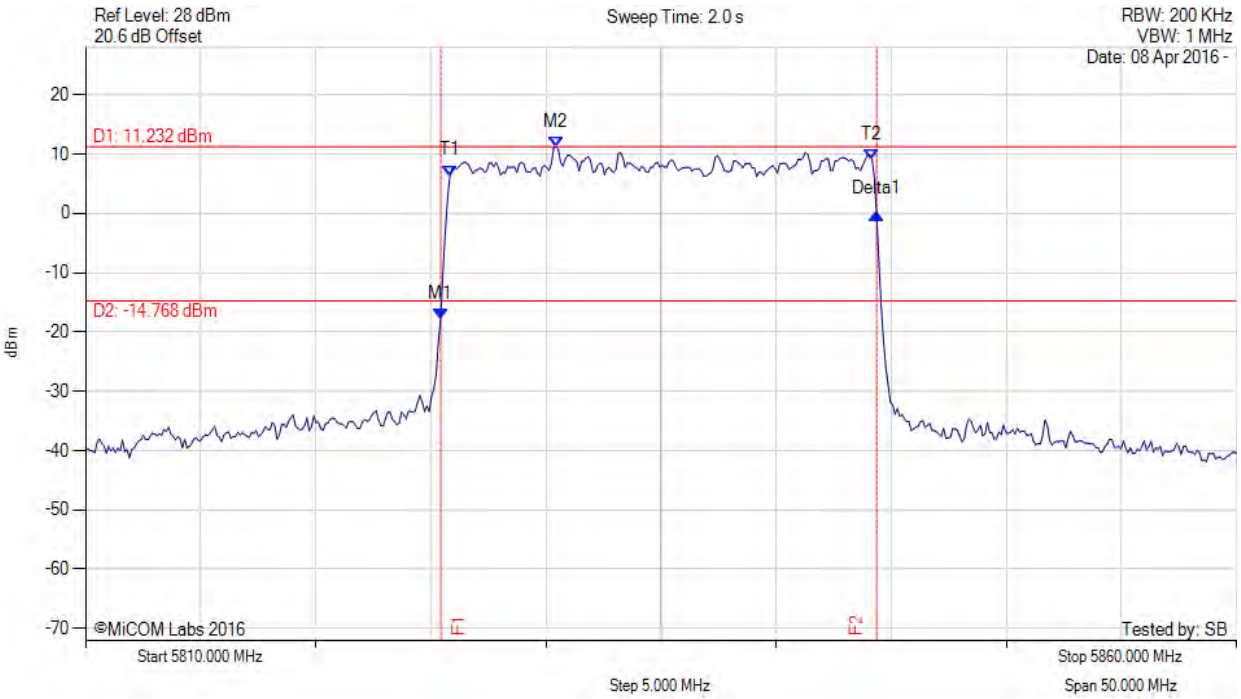
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5835.00 MHz, Chain a, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5825.431 MHz : -17.747 dBm M2 : 5830.441 MHz : 11.232 dBm Delta1 : 18.938 MHz : 17.616 dB T1 : 5825.832 MHz : 6.359 dBm T2 : 5844.168 MHz : 9.133 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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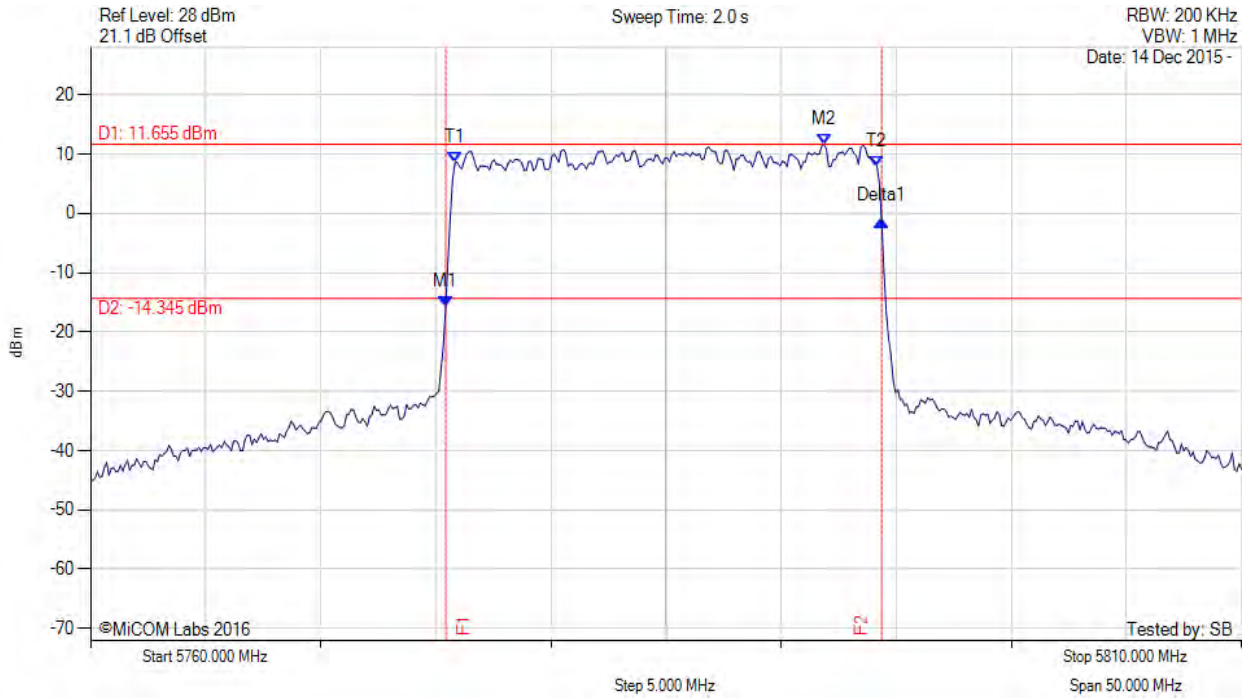
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5785.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5775.431 MHz : -15.760 dBm M2 : 5791.864 MHz : 11.655 dBm Delta1 : 18.938 MHz : 14.574 dB T1 : 5775.832 MHz : 8.537 dBm T2 : 5794.168 MHz : 7.903 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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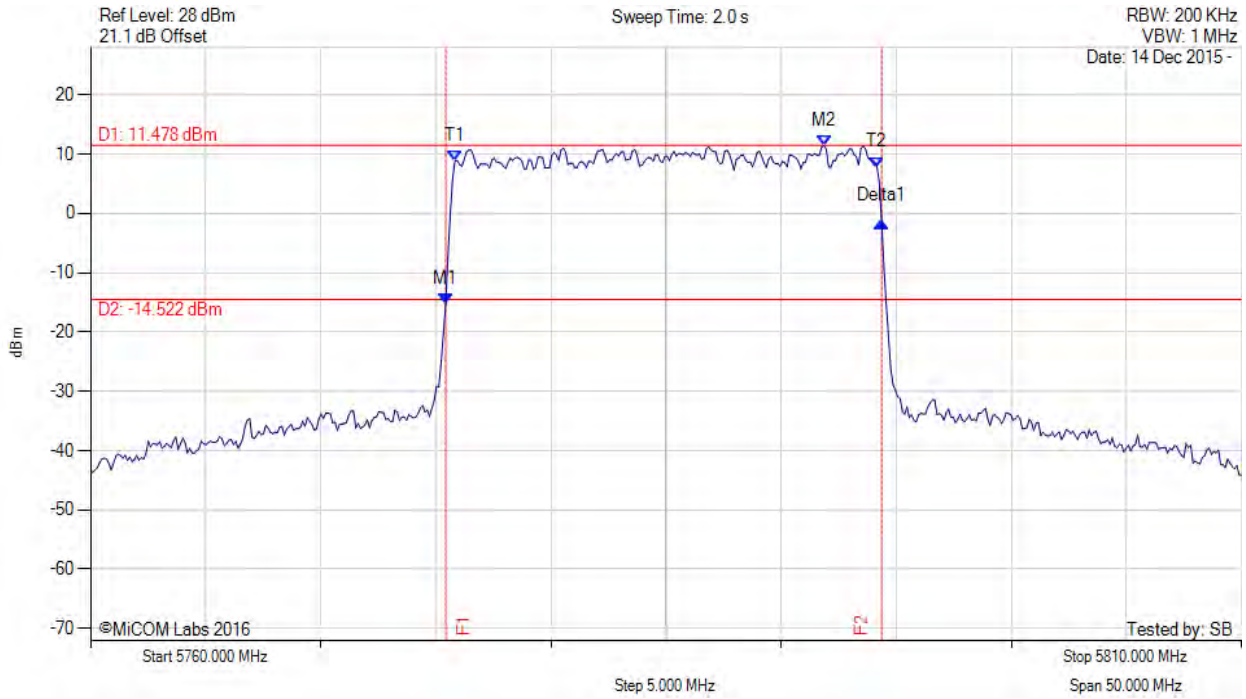
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5785.00 MHz, Chain b, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5775.431 MHz : -15.217 dBm M2 : 5791.864 MHz : 11.478 dBm Delta1 : 18.938 MHz : 13.870 dB T1 : 5775.832 MHz : 8.789 dBm T2 : 5794.168 MHz : 7.760 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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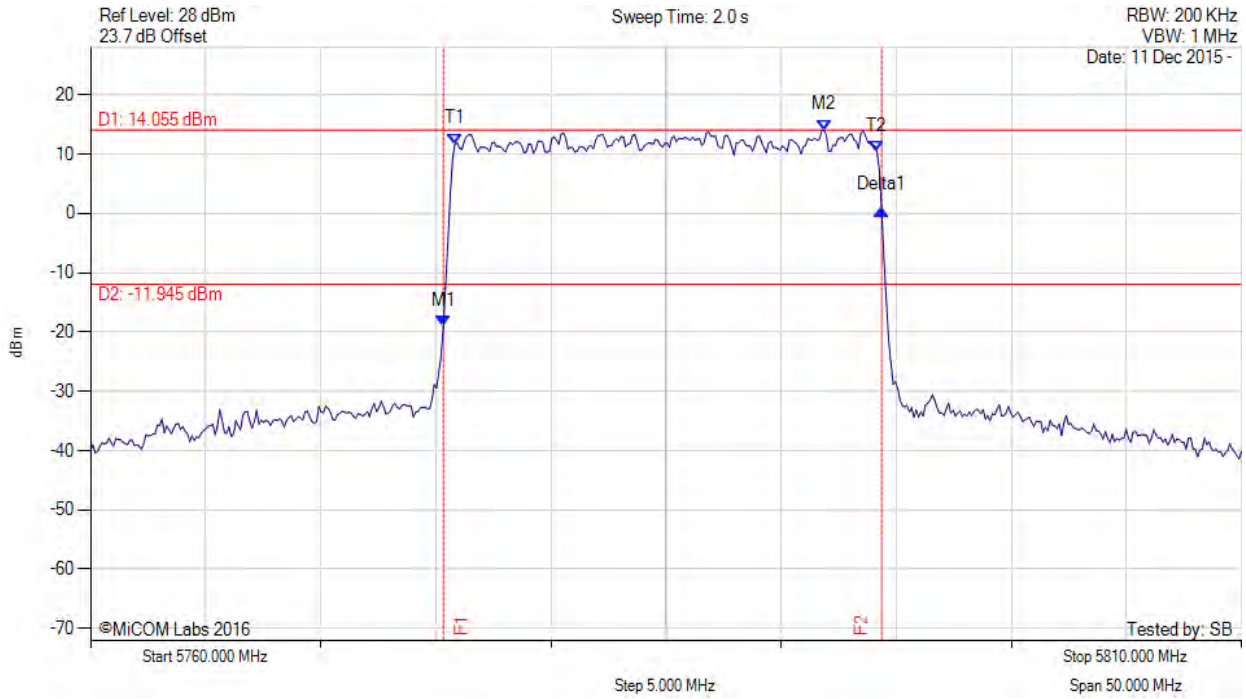
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5785.00 MHz, Chain c, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5775.331 MHz : -19.045 dBm M2 : 5791.864 MHz : 14.055 dBm Delta1 : 19.038 MHz : 19.630 dB T1 : 5775.832 MHz : 11.724 dBm T2 : 5794.168 MHz : 10.369 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 19.038 MHz Measured 99% Bandwidth: 18.337 MHz

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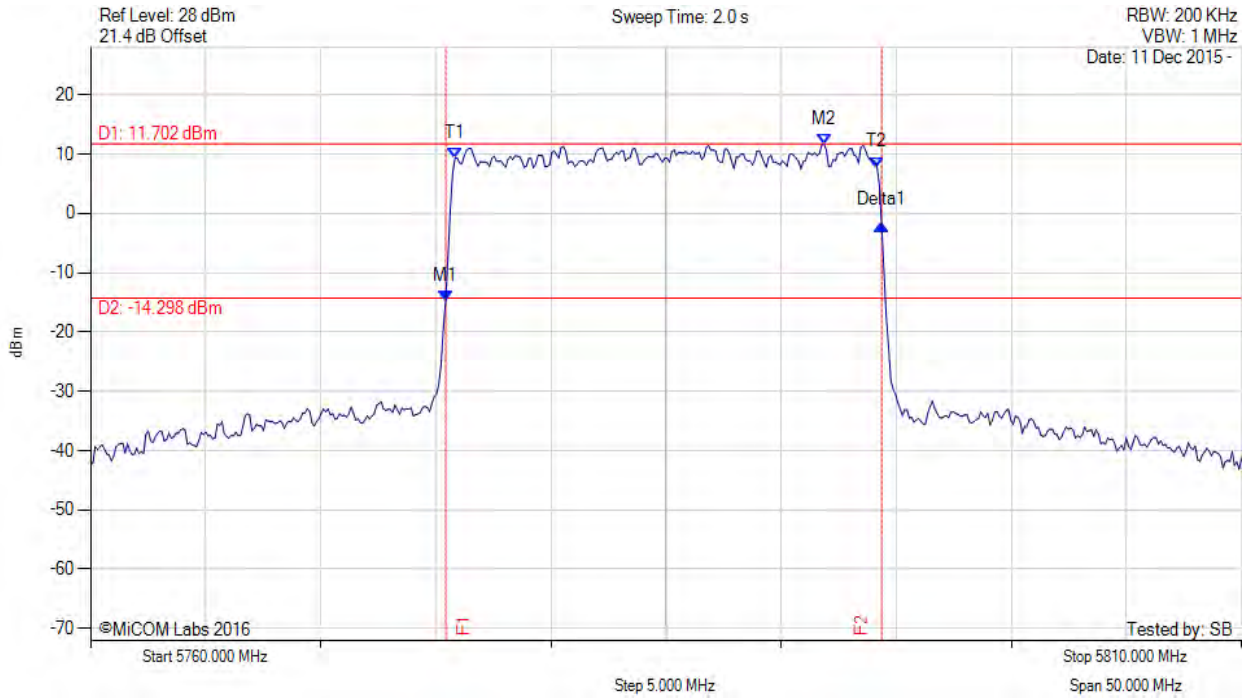
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5785.00 MHz, Chain d, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5775.431 MHz : -14.743 dBm M2 : 5791.864 MHz : 11.702 dBm Delta1 : 18.938 MHz : 12.784 dB T1 : 5775.832 MHz : 9.263 dBm T2 : 5794.168 MHz : 7.742 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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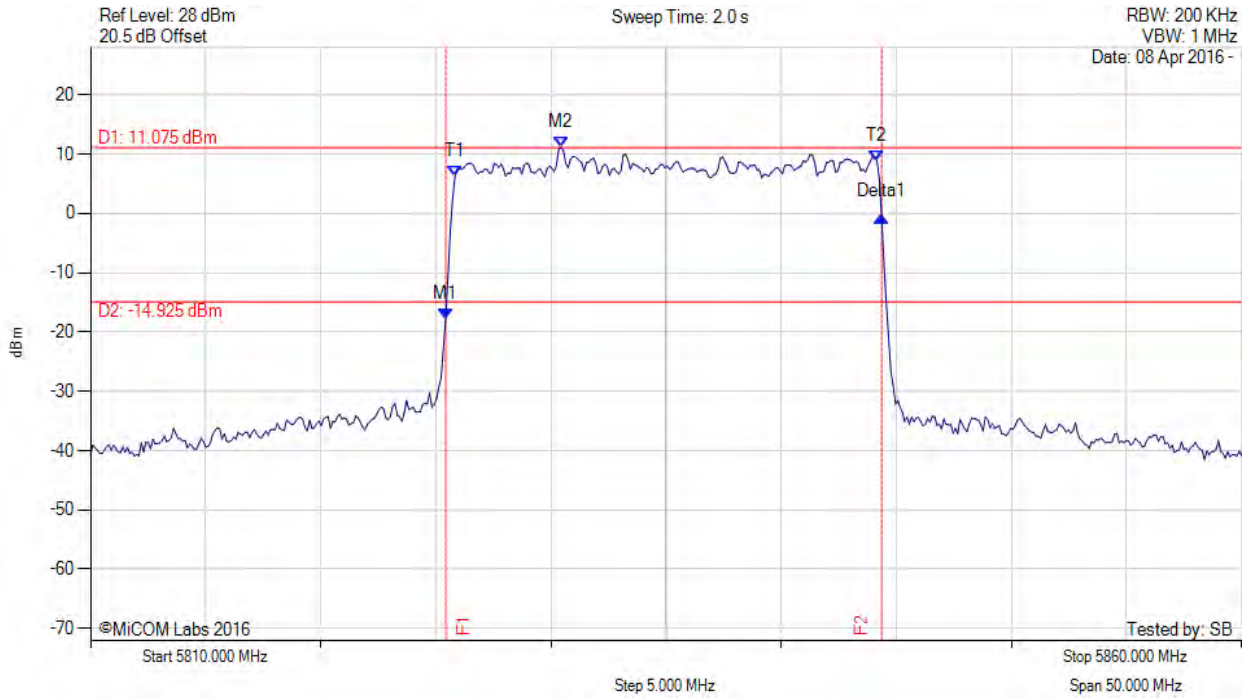
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5835.00 MHz, Chain b, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5825.431 MHz : -17.745 dBm M2 : 5830.441 MHz : 11.075 dBm Delta1 : 18.938 MHz : 17.210 dB T1 : 5825.832 MHz : 6.190 dBm T2 : 5844.168 MHz : 8.789 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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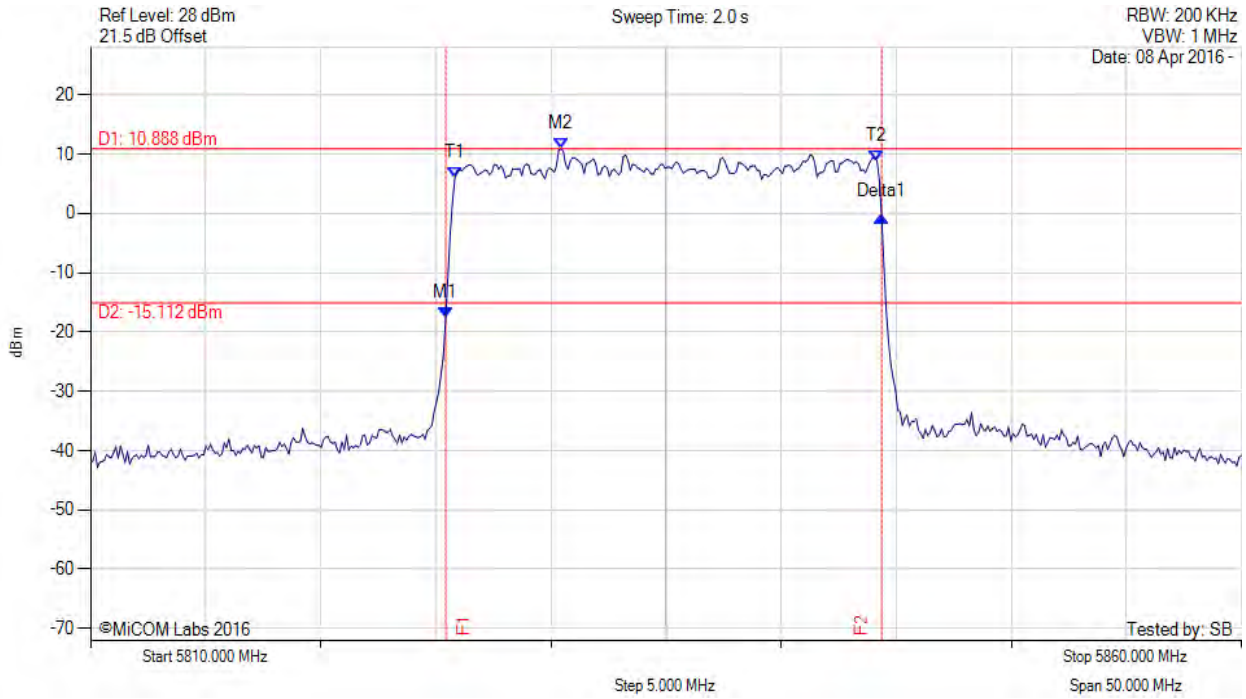
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5835.00 MHz, Chain c, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5825.431 MHz : -17.656 dBm M2 : 5830.441 MHz : 10.888 dBm Delta1 : 18.938 MHz : 17.130 dB T1 : 5825.832 MHz : 6.052 dBm T2 : 5844.168 MHz : 8.812 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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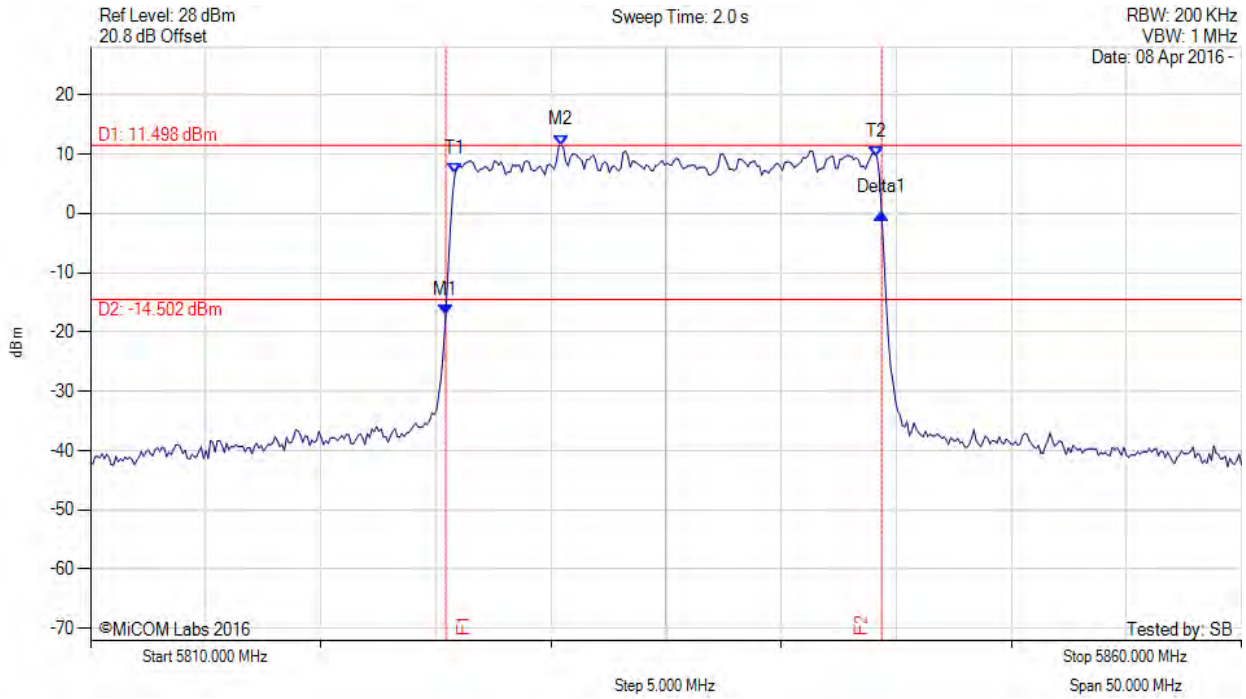
26 dB & 99% BANDWIDTH

Variant: 16 QAM, Channel: 5835.00 MHz, Chain d, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = MAX PEAK Sweep Count = 0 RF Atten (dB) = 20 Trace Mode = MAX HOLD	M1 : 5825.431 MHz : -17.052 dBm M2 : 5830.441 MHz : 11.498 dBm Delta1 : 18.938 MHz : 17.108 dB T1 : 5825.832 MHz : 6.664 dBm T2 : 5844.168 MHz : 9.527 dBm OBW : 18.337 MHz	Measured 26 dB Bandwidth: 18.938 MHz Measured 99% Bandwidth: 18.337 MHz

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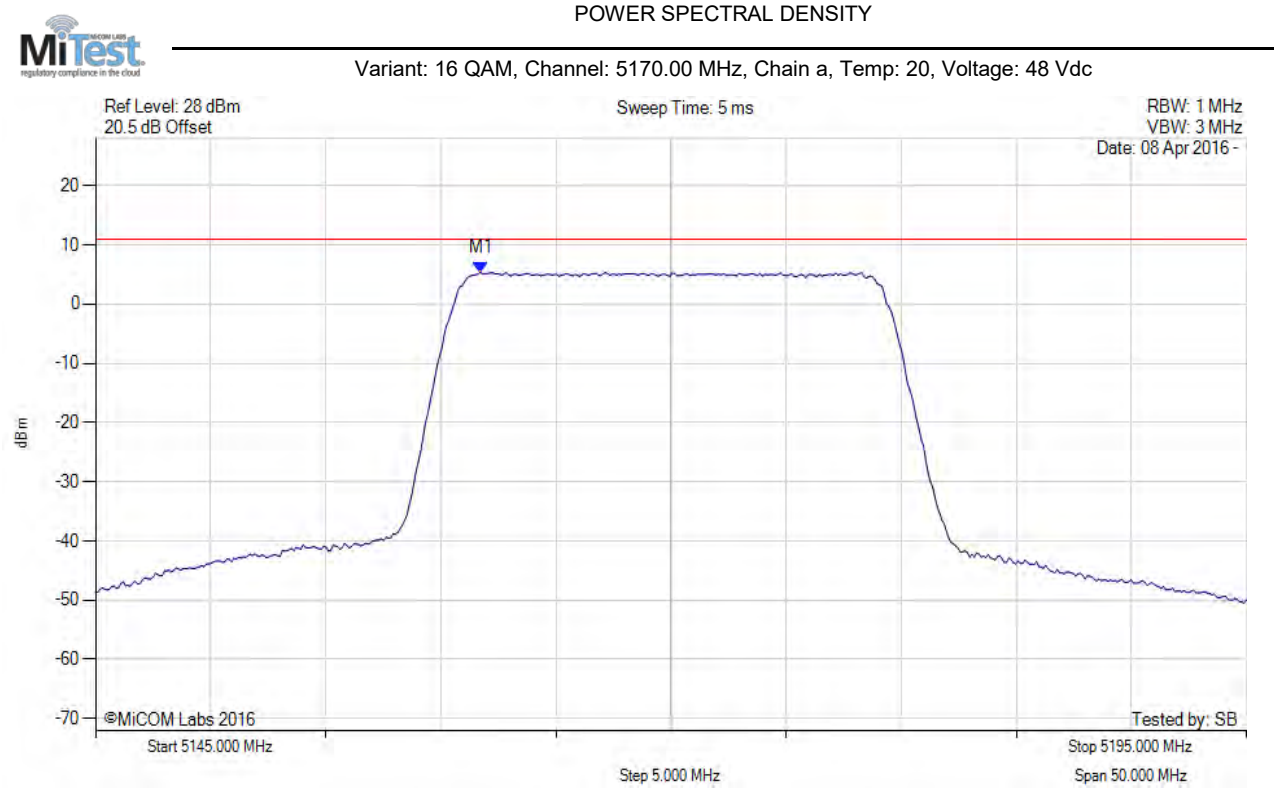
A.2. Power Spectral Density



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5161.733 MHz : 5.367 dBm	Limit: ≤ 10.980 dBm

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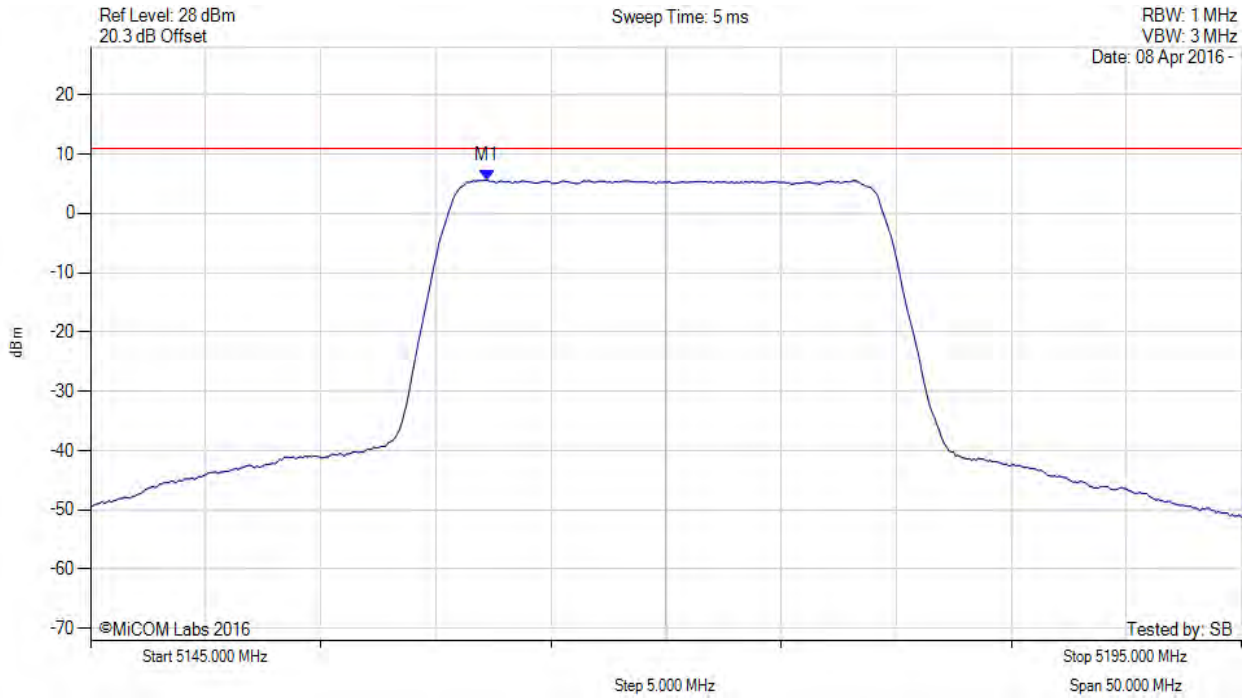
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5170.00 MHz, Chain b, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5162.234 MHz : 5.611 dBm	Limit: ≤ 10.980 dBm

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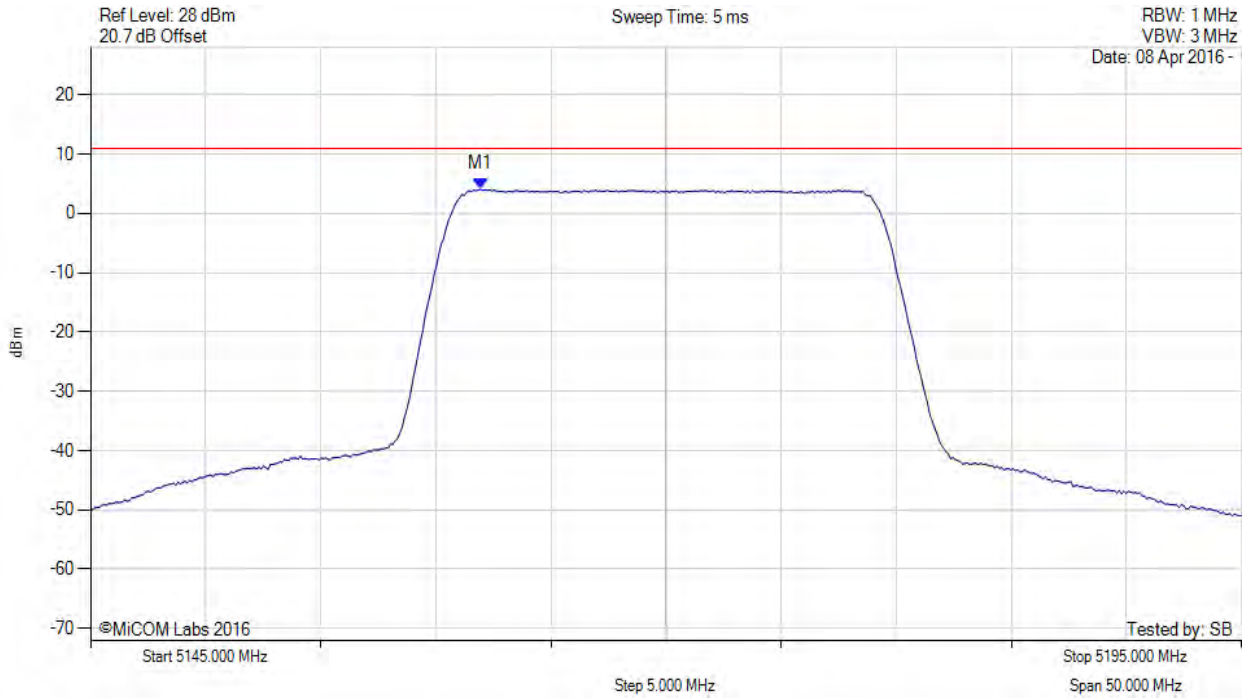
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5170.00 MHz, Chain c, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5161.934 MHz : 4.083 dBm	Limit: ≤ 10.980 dBm

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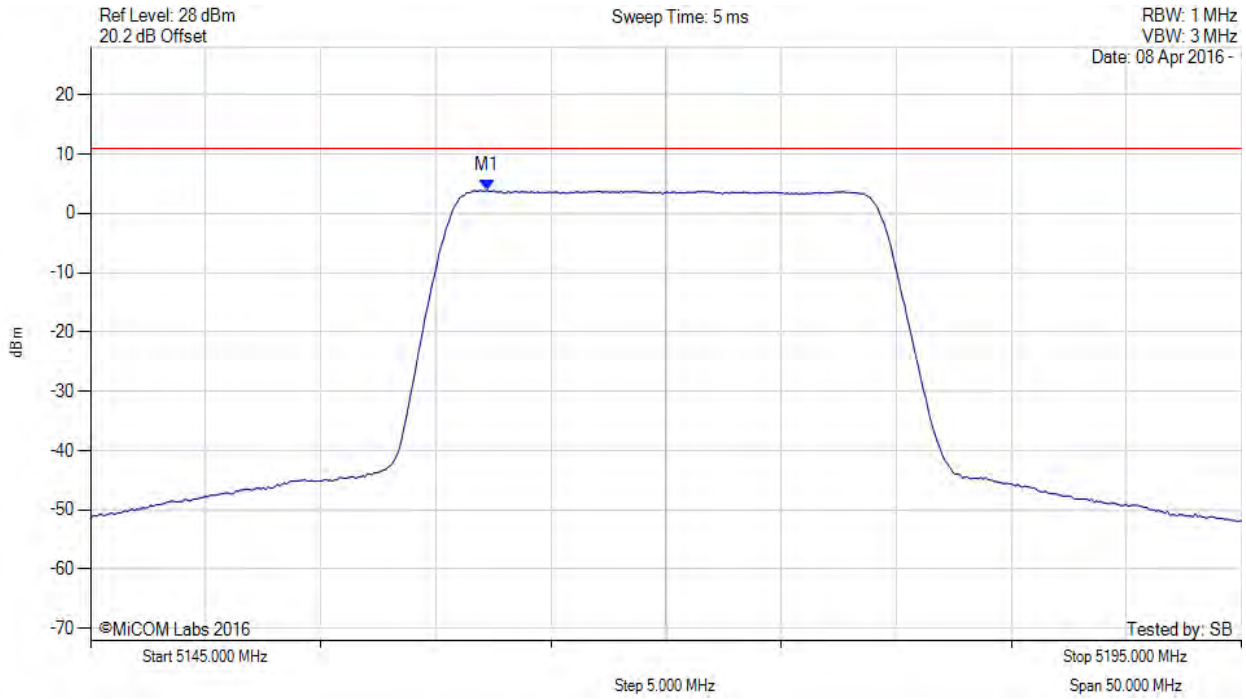
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5170.00 MHz, Chain d, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5162.234 MHz : 3.892 dBm	Limit: ≤ 10.980 dBm

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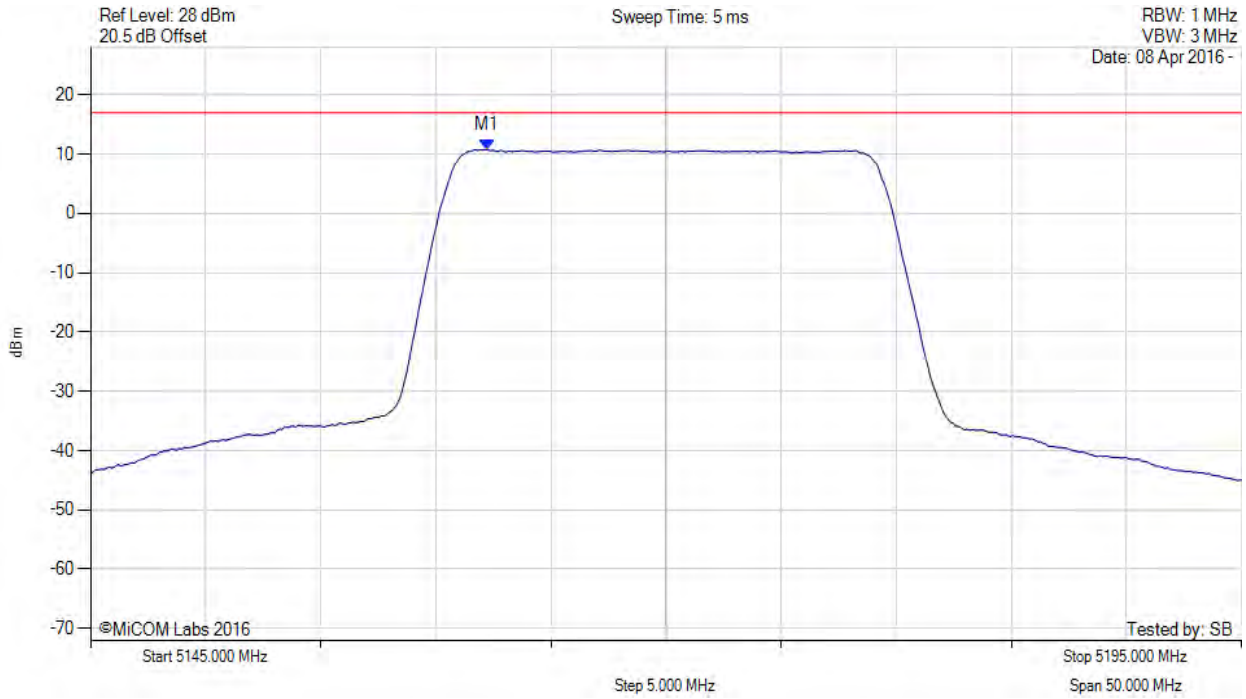
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5170.00 MHz, SUM, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5162.200 MHz : 10.775 dBm M1 + DCCF : 5162.200 MHz : 10.775 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 17.0 dBm Margin: -6.2 dB

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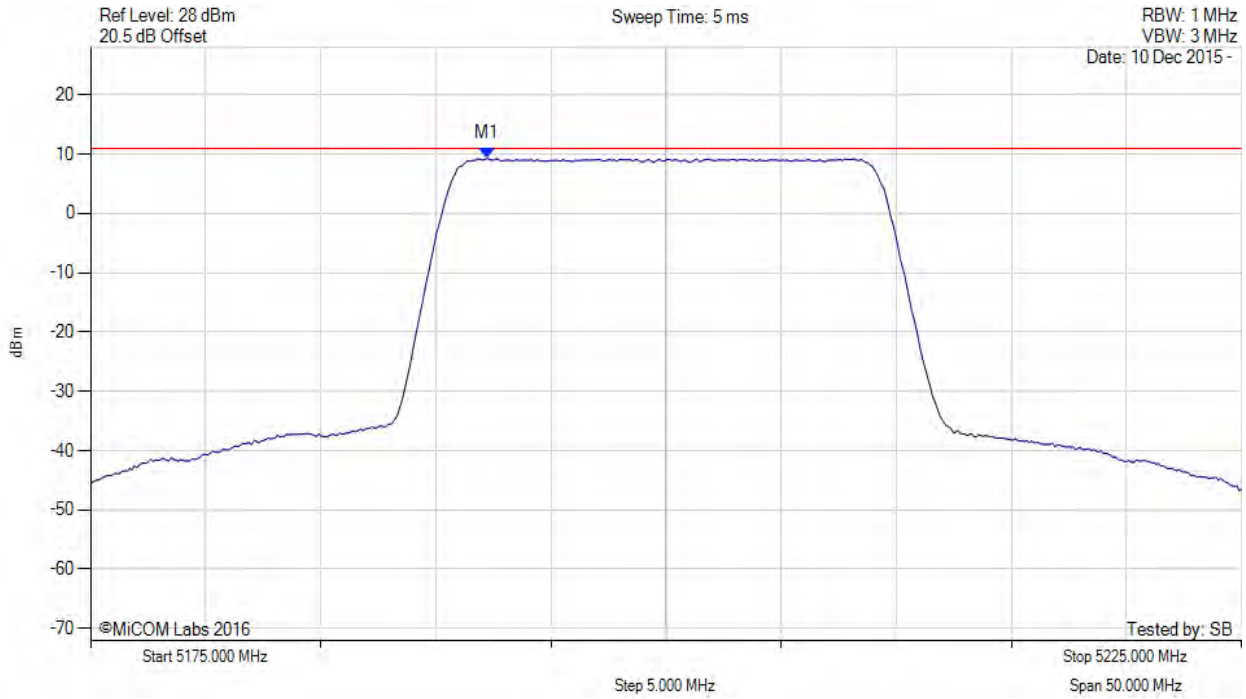
This test report may be reproduced in full only. The document may only be updated by MiCOM Labs personnel. All changes will be noted in the Document History section of the report.

POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5200.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5192.234 MHz : 9.315 dBm	Limit: ≤ 10.980 dBm

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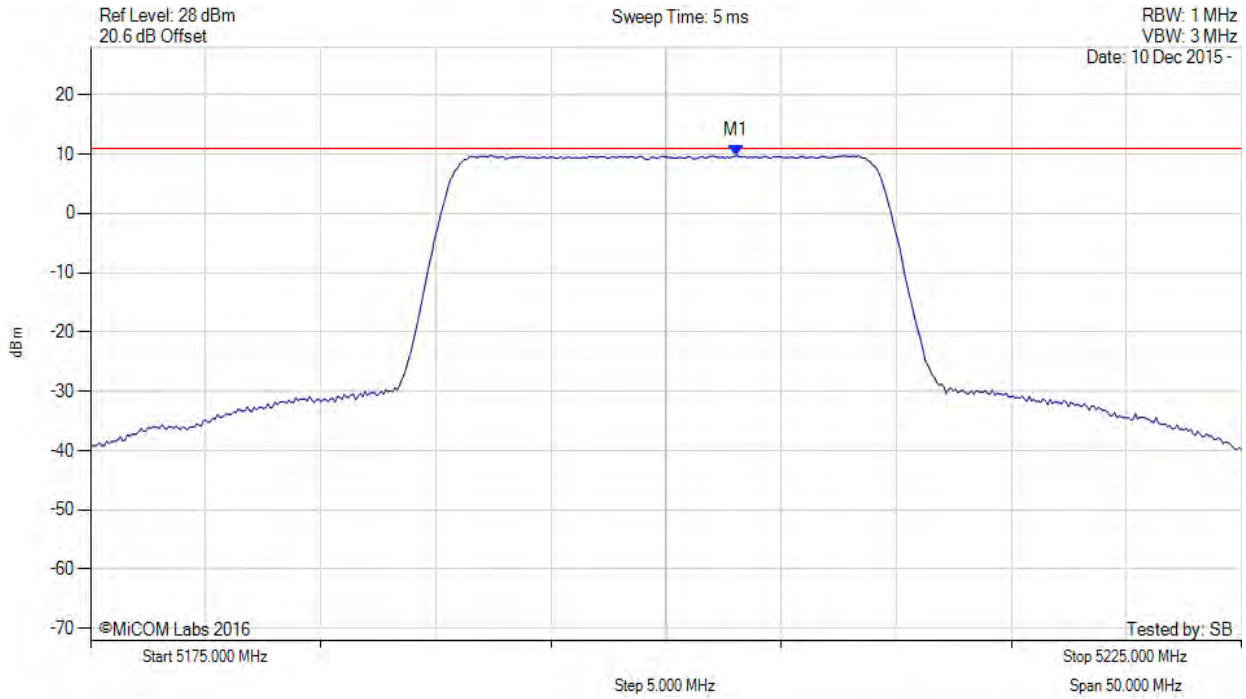
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5200.00 MHz, Chain b, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5203.056 MHz : 9.757 dBm	Channel Frequency: 5200.00 MHz

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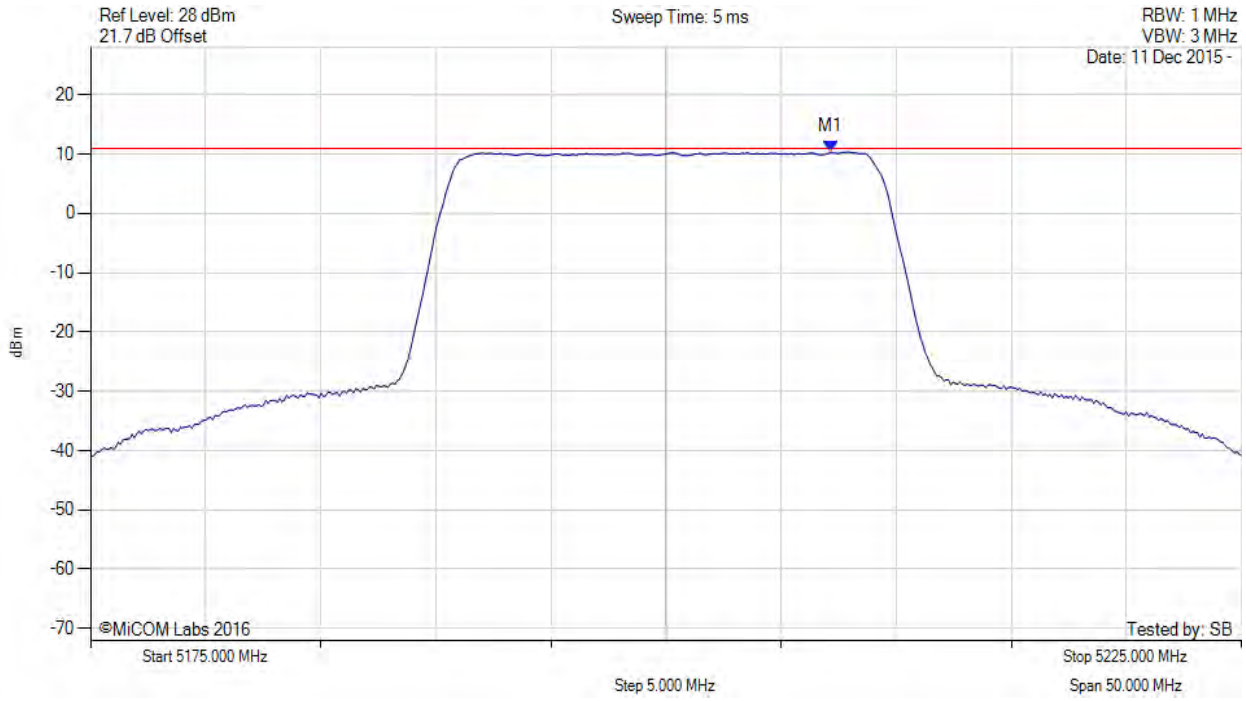
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5200.00 MHz, Chain c, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5207.164 MHz : 10.394 dBm	Limit: ≤ 10.980 dBm

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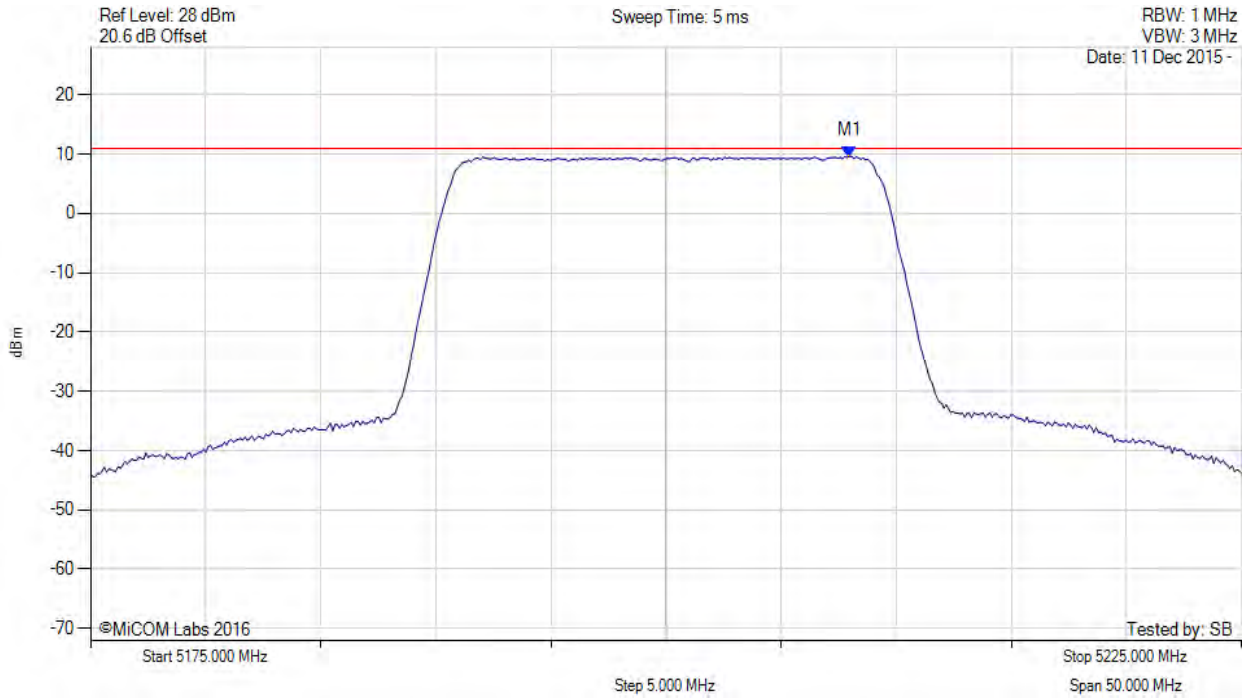
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5200.00 MHz, Chain d, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5207.966 MHz : 9.629 dBm	Limit: ≤ 10.980 dBm

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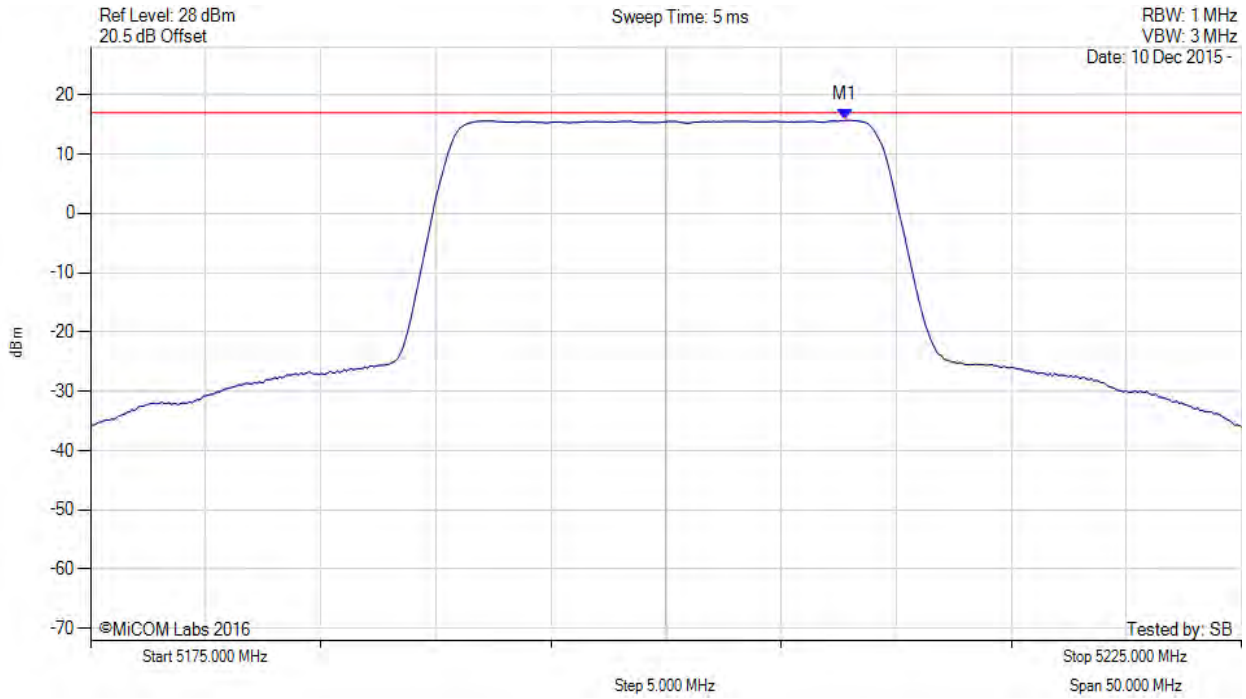
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5200.00 MHz, SUM, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5207.800 MHz : 15.716 dBm M1 + DCCF : 5207.800 MHz : 15.716 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 17.0 dBm Margin: -1.3 dB

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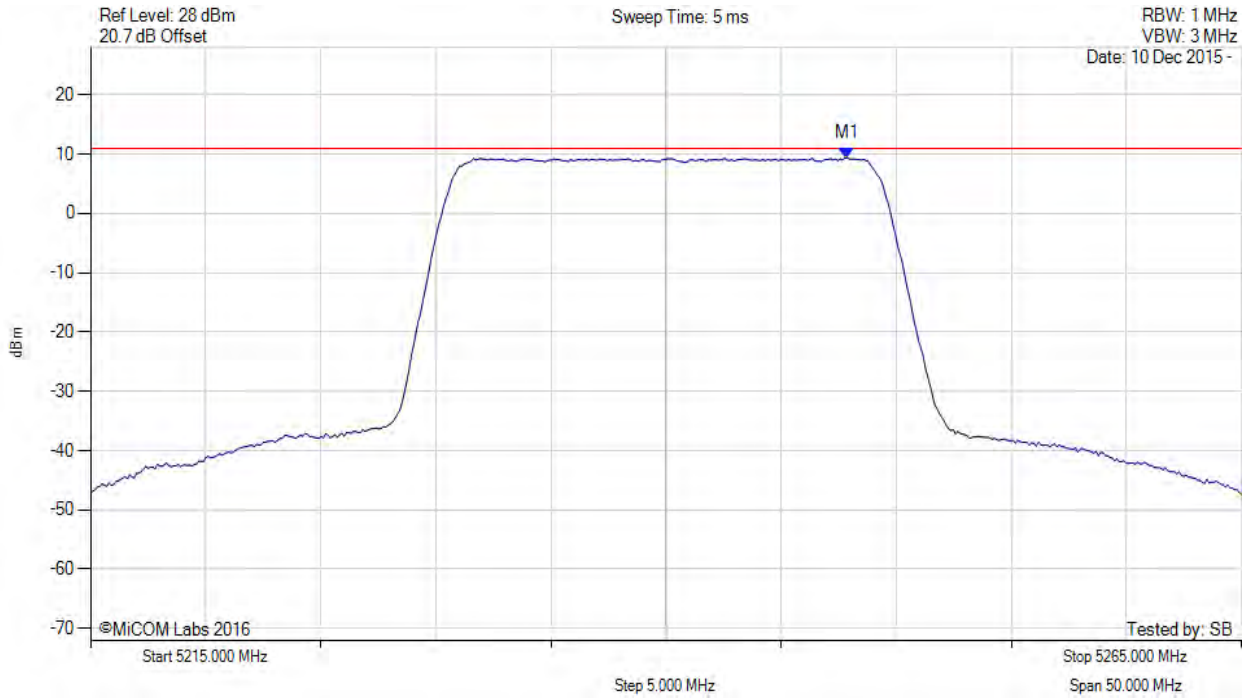
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5240.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5247.866 MHz : 9.374 dBm	Limit: ≤ 10.980 dBm

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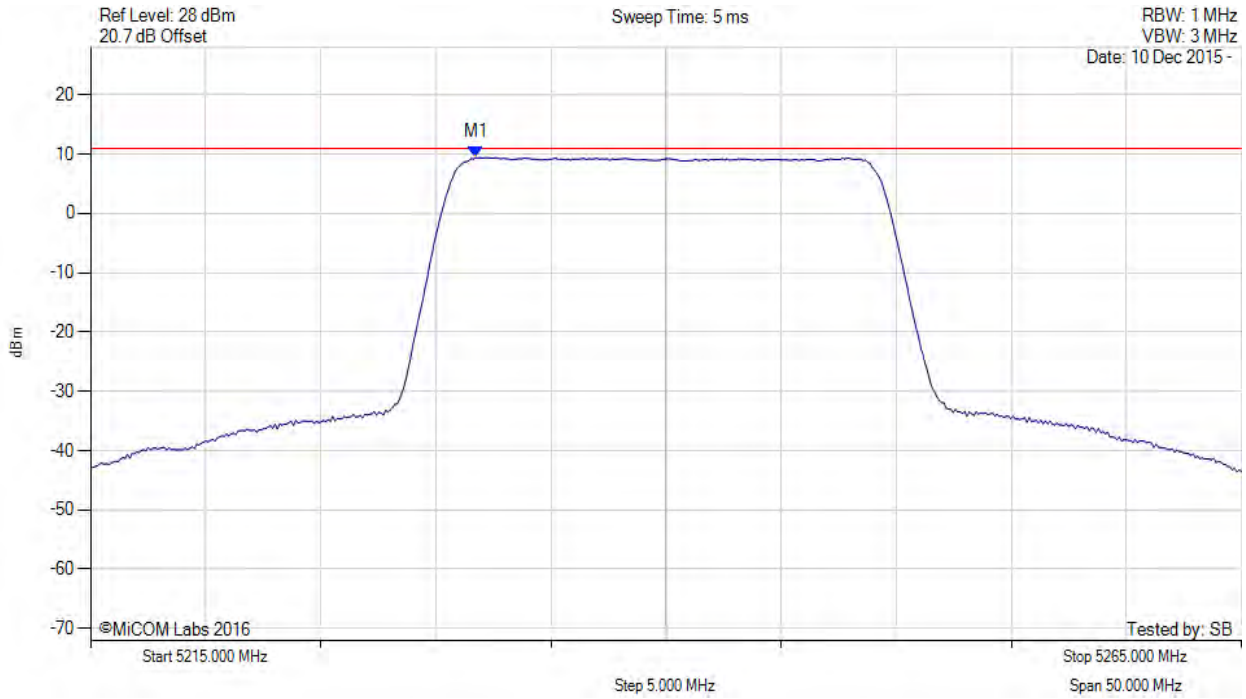
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5240.00 MHz, Chain b, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5231.733 MHz : 9.422 dBm	Limit: ≤ 10.980 dBm

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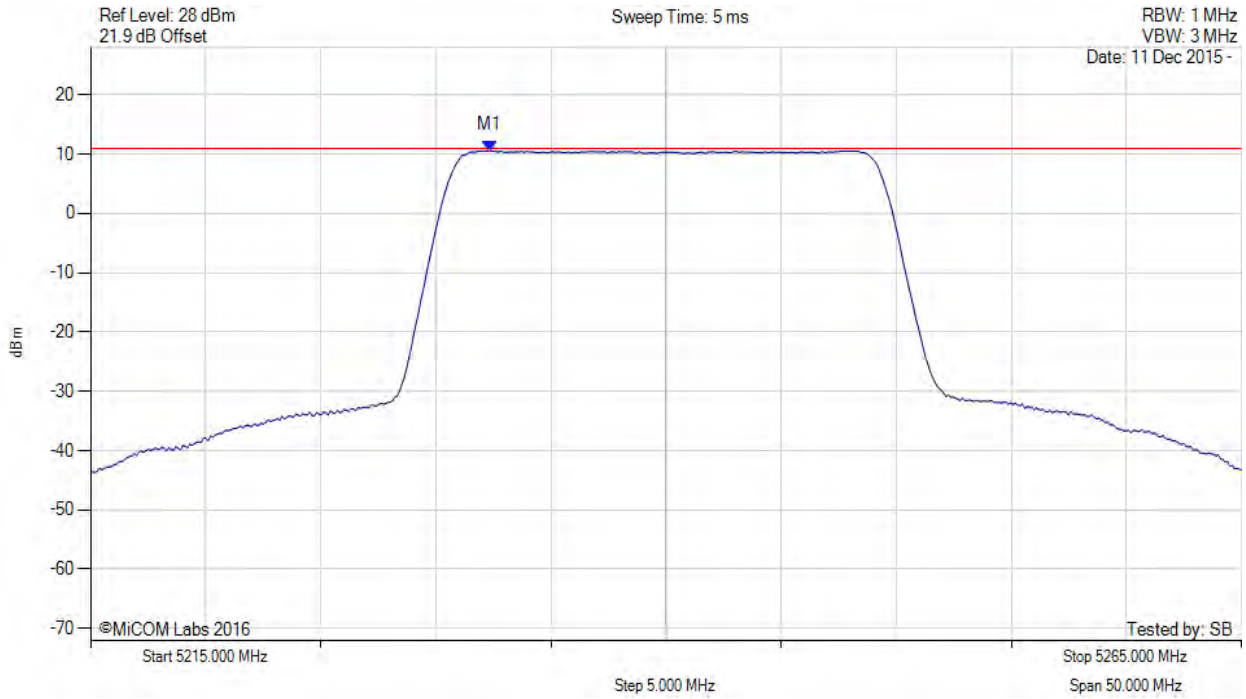
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5240.00 MHz, Chain c, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5232.335 MHz : 10.563 dBm	Limit: ≤ 10.980 dBm

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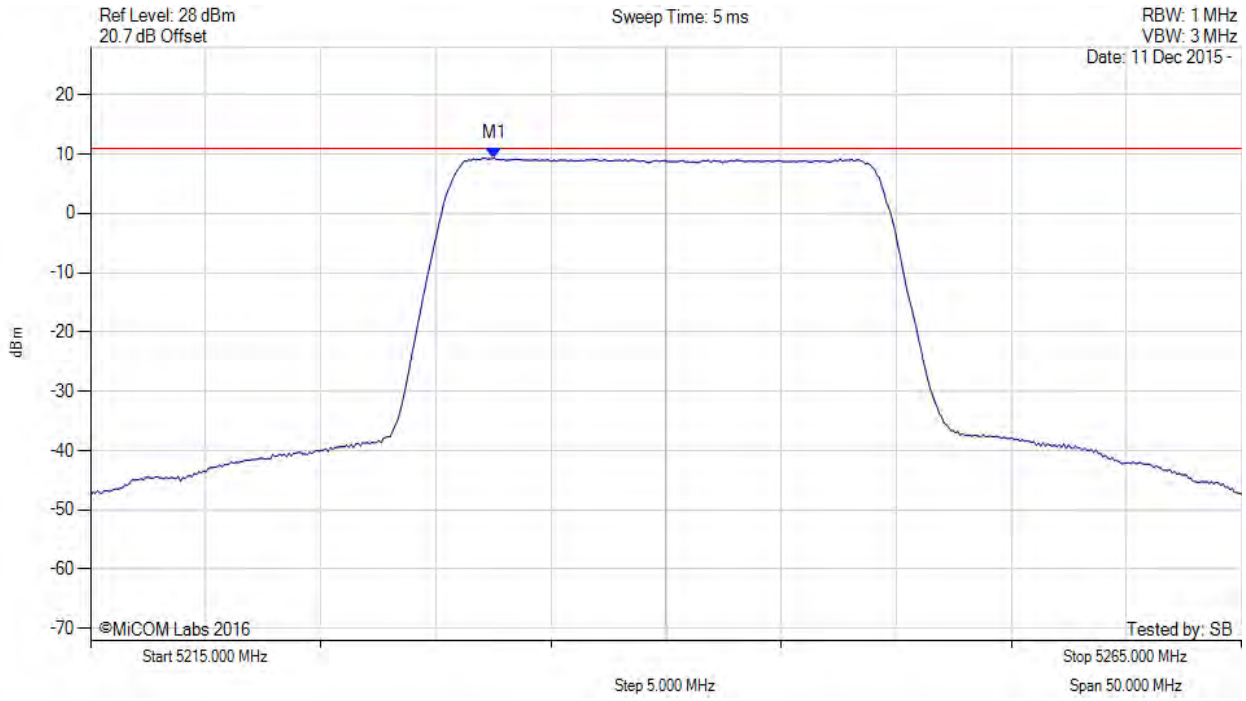
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5240.00 MHz, Chain d, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5232.535 MHz : 9.336 dBm	Limit: ≤ 10.980 dBm

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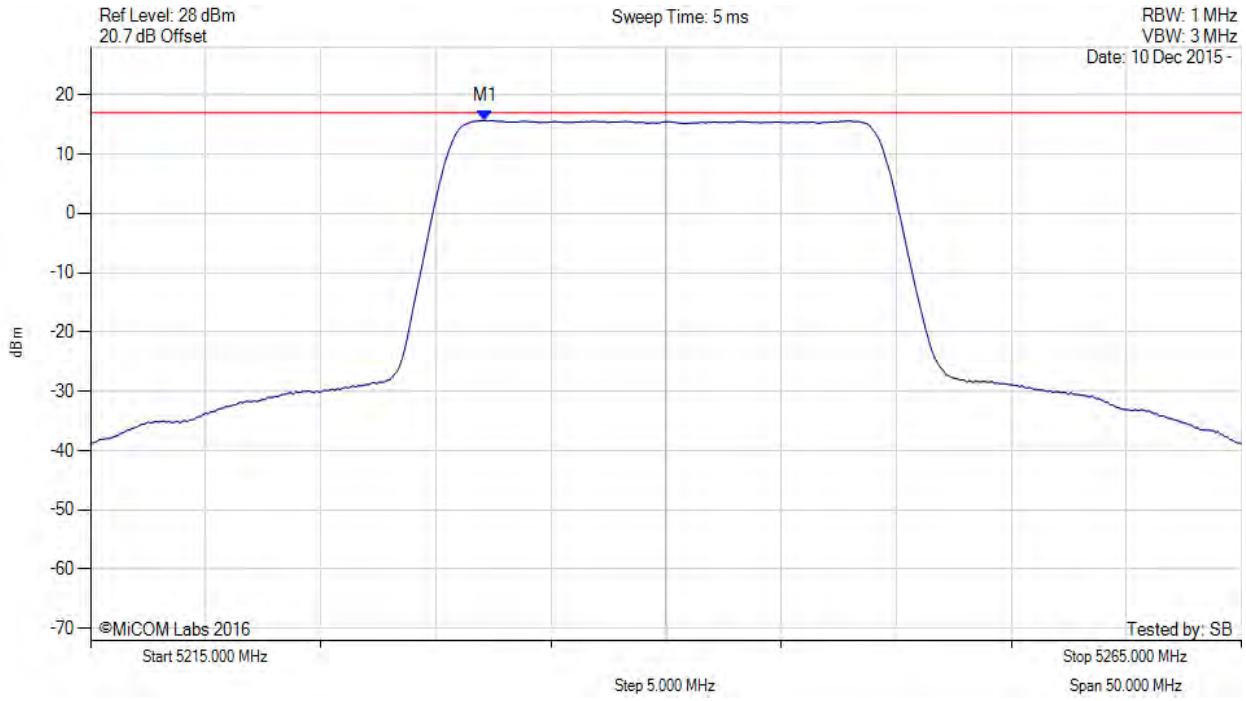
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5240.00 MHz, SUM, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5232.100 MHz : 15.645 dBm M1 + DCCF : 5232.100 MHz : 15.645 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 17.0 dBm Margin: -1.4 dB

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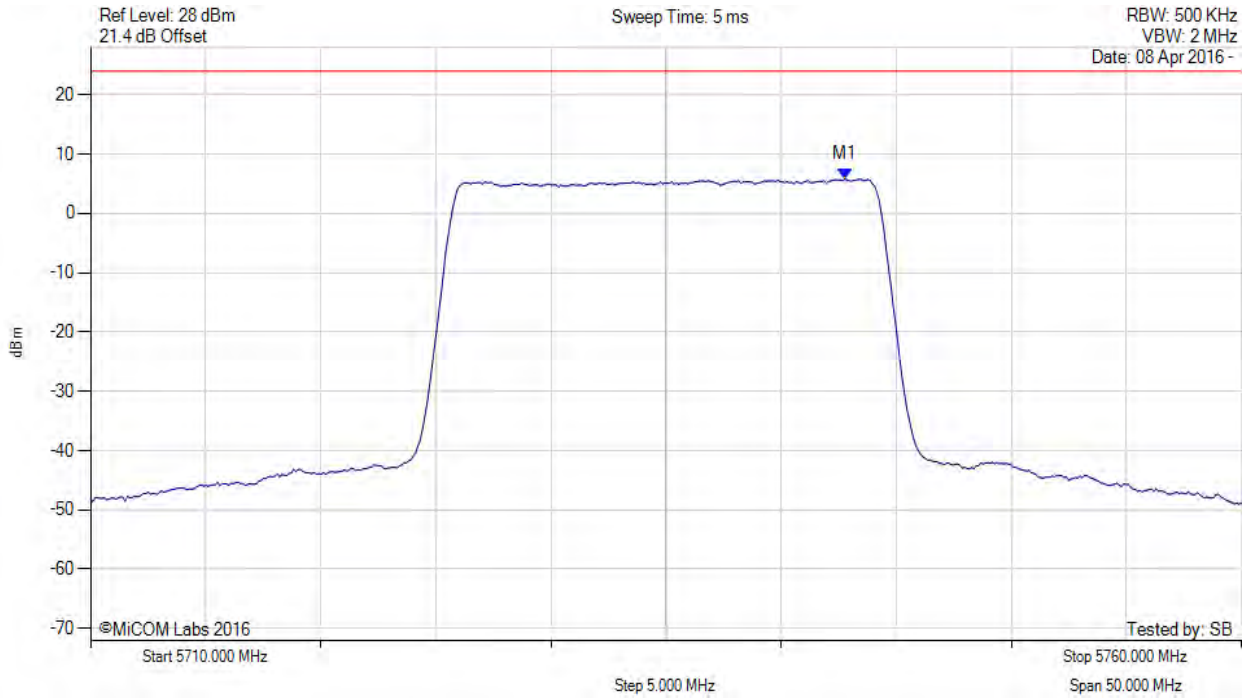
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5735.00 MHz, Chain a, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5742.766 MHz : 5.809 dBm	Limit: ≤ 23.980 dBm

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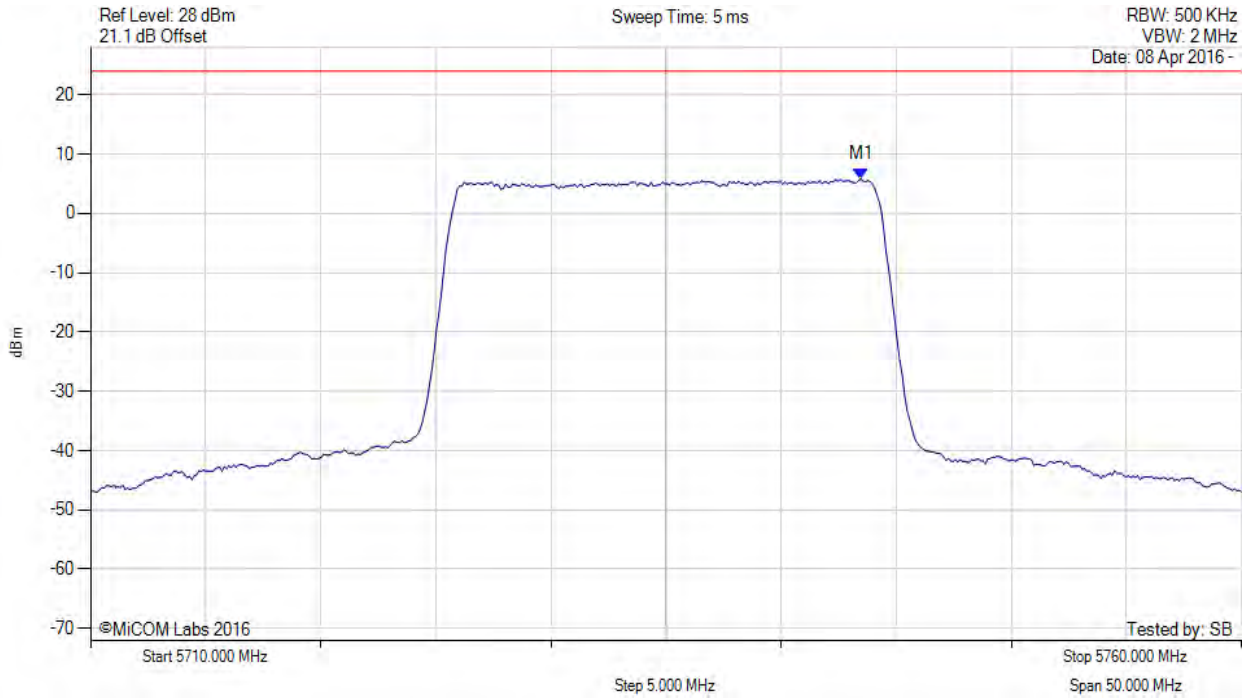
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5735.00 MHz, Chain b, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5743.467 MHz : 5.801 dBm	Limit: ≤ 23.980 dBm

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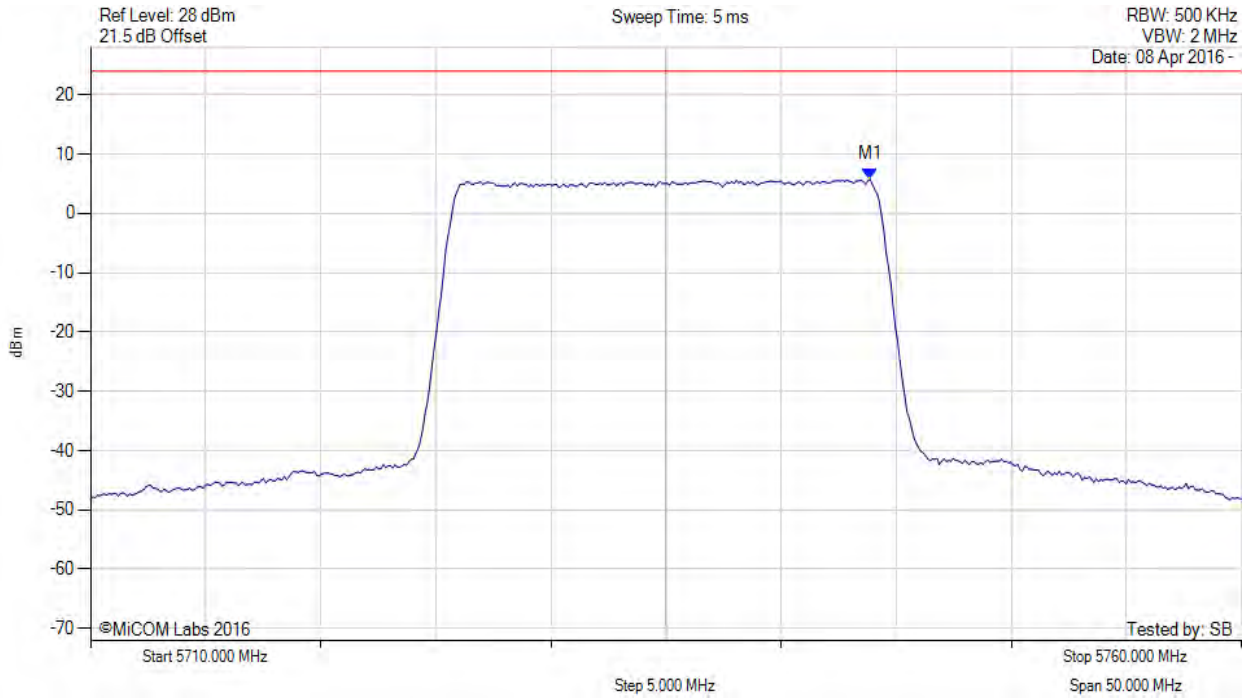
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5735.00 MHz, Chain c, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5743.868 MHz : 5.765 dBm	Limit: ≤ 23.980 dBm

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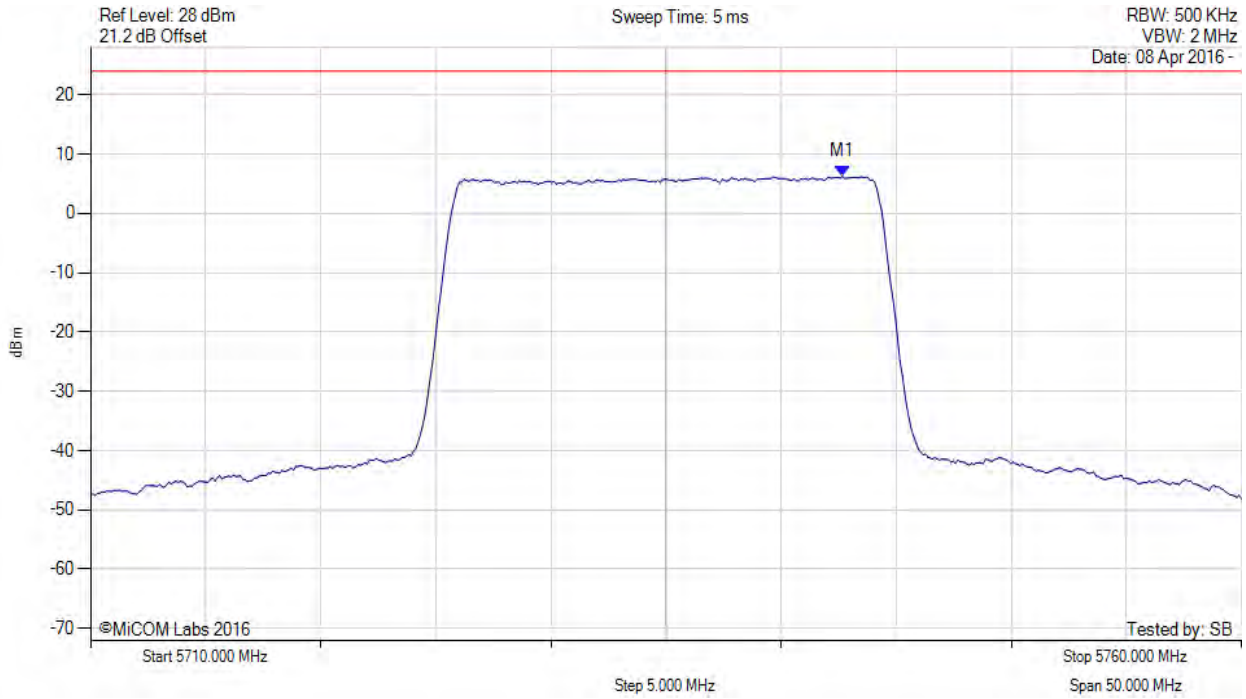
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5735.00 MHz, Chain d, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5742.665 MHz : 6.236 dBm	Limit: ≤ 23.980 dBm

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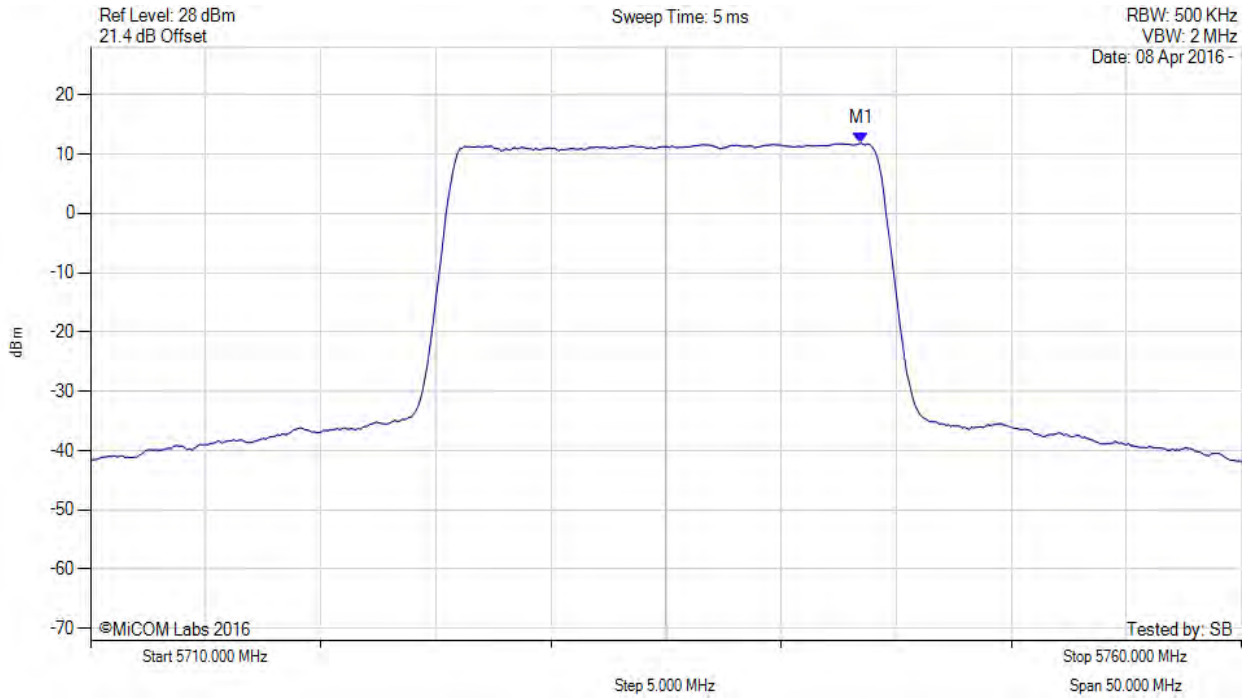
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5735.00 MHz, SUM, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5743.500 MHz : 11.856 dBm M1 + DCCF : 5743.500 MHz : 11.900 dBm Duty Cycle Correction Factor : +0.04 dB	Limit: ≤ 30.0 dBm Margin: -18.1 dB

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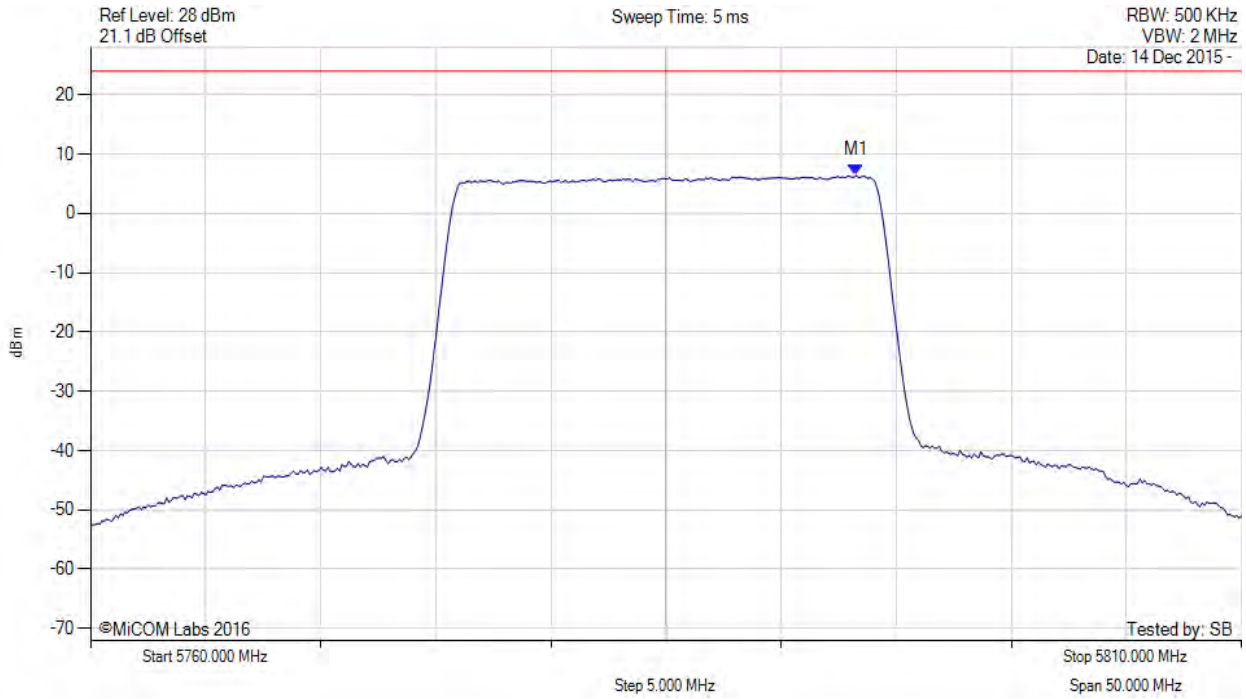
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5785.00 MHz, Chain a, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5793.267 MHz : 6.395 dBm	Limit: ≤ 23.980 dBm

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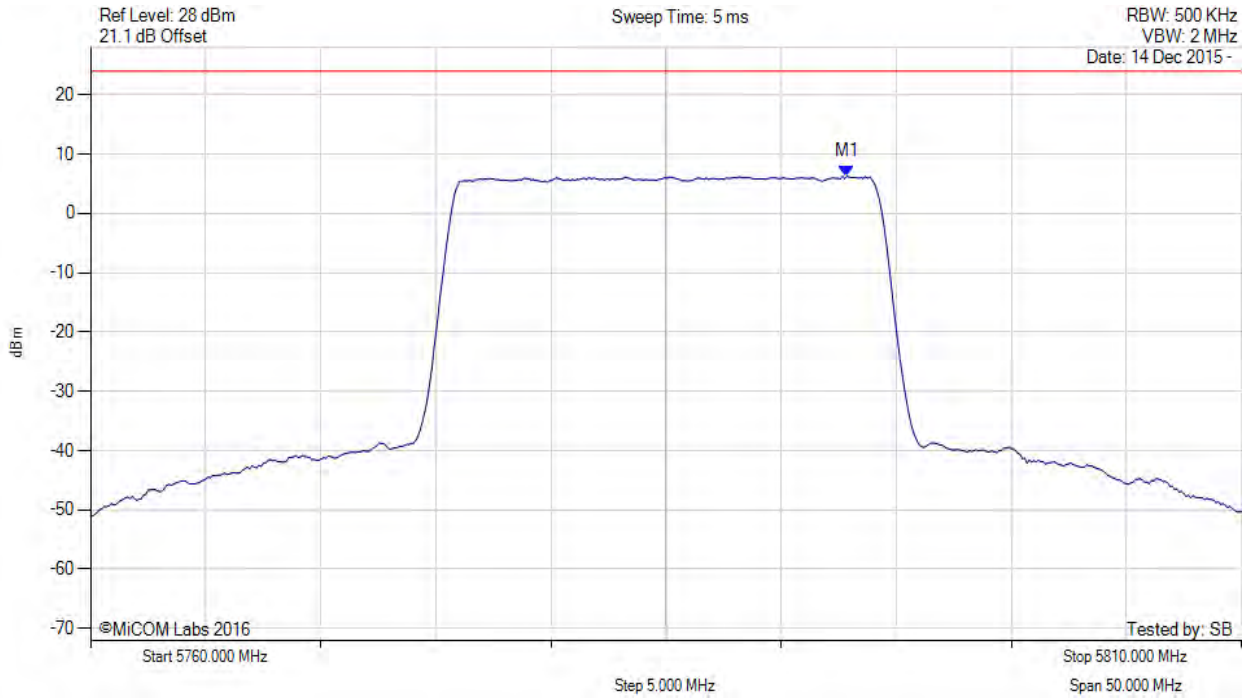
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5785.00 MHz, Chain b, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5792.866 MHz : 6.290 dBm	Channel Frequency: 5785.00 MHz

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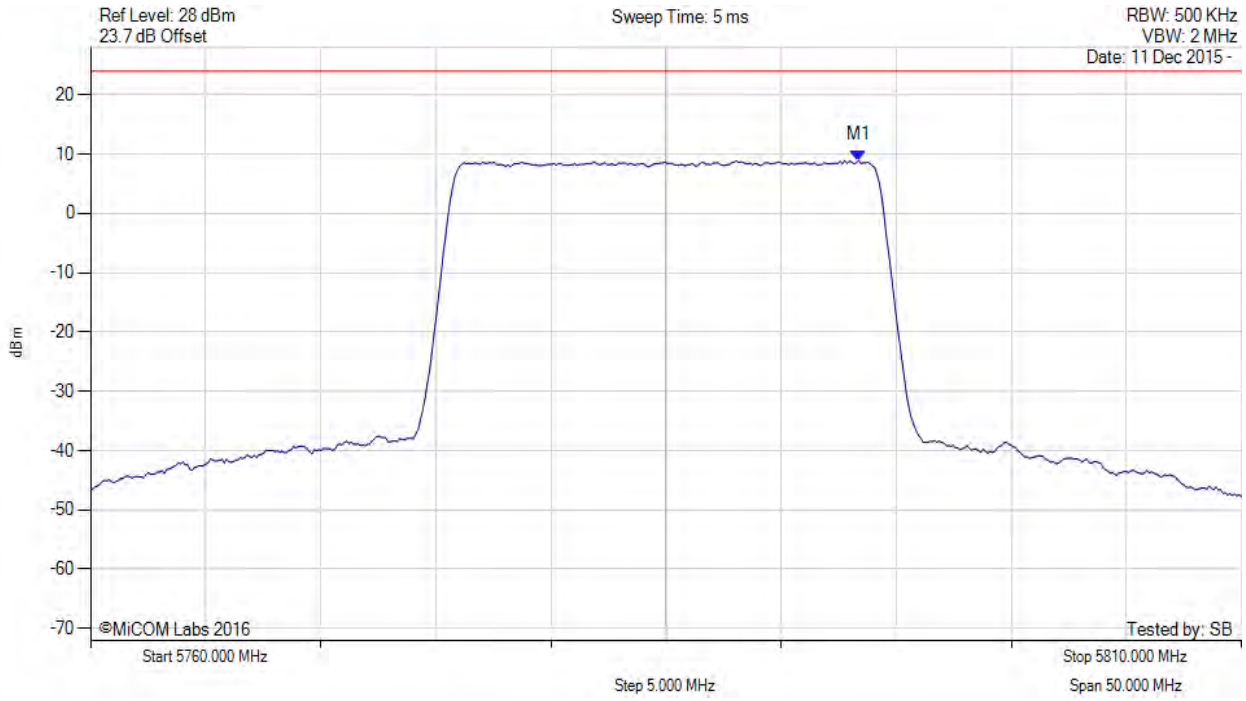
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5785.00 MHz, Chain c, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5793.367 MHz : 8.929 dBm	Limit: ≤ 23.980 dBm

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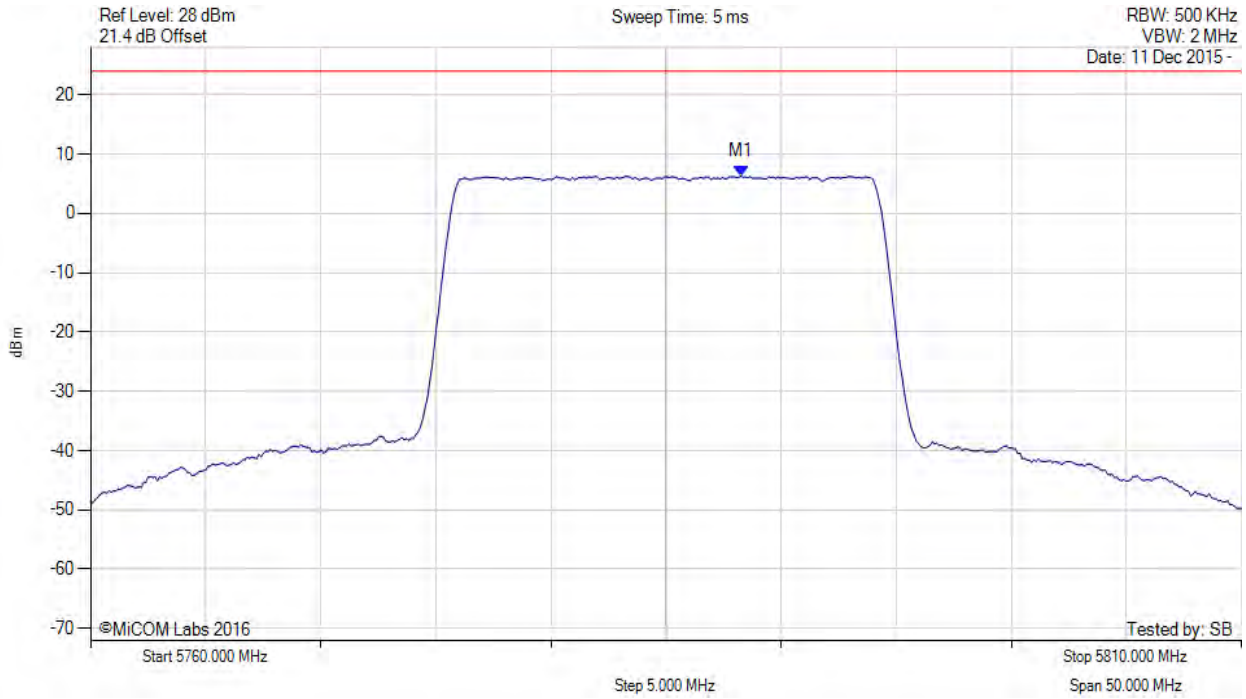
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5785.00 MHz, Chain d, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5788.257 MHz : 6.279 dBm	Limit: ≤ 23.980 dBm

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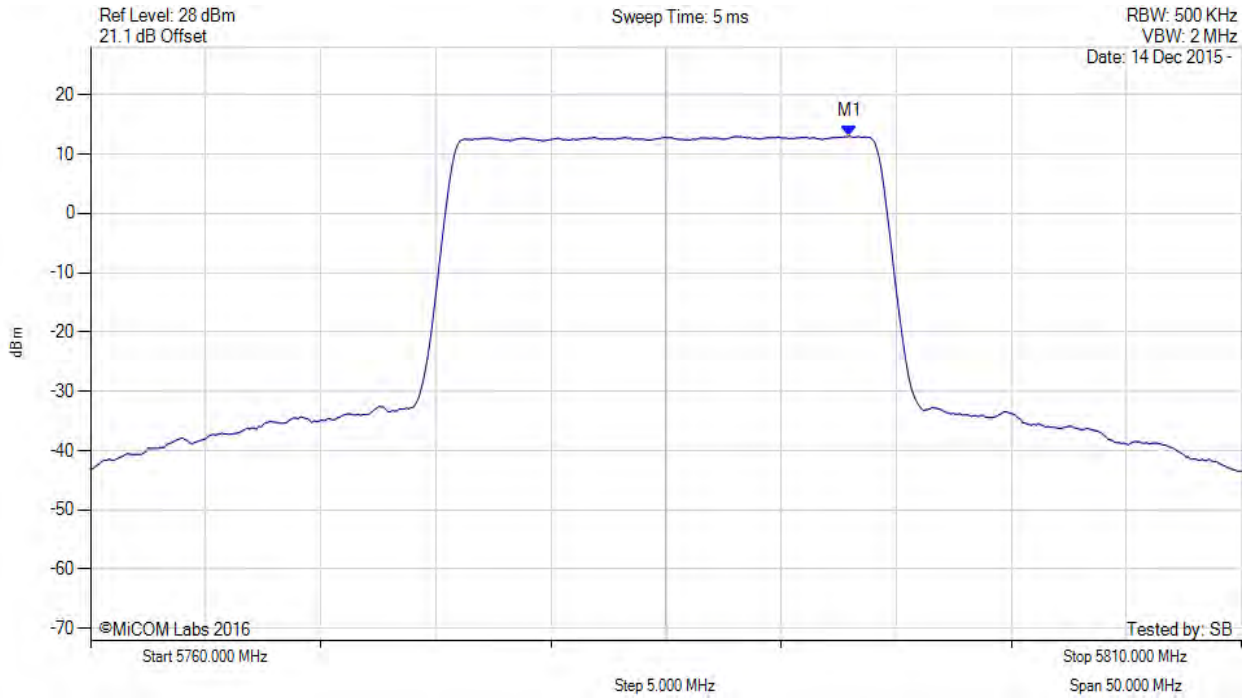
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5785.00 MHz, SUM, Temp: Ambient, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5793.000 MHz : 13.038 dBm M1 + DCCF : 5793.000 MHz : 13.038 dBm Duty Cycle Correction Factor : +0 dB	Limit: ≤ 30.0 dBm Margin: -17.0 dB

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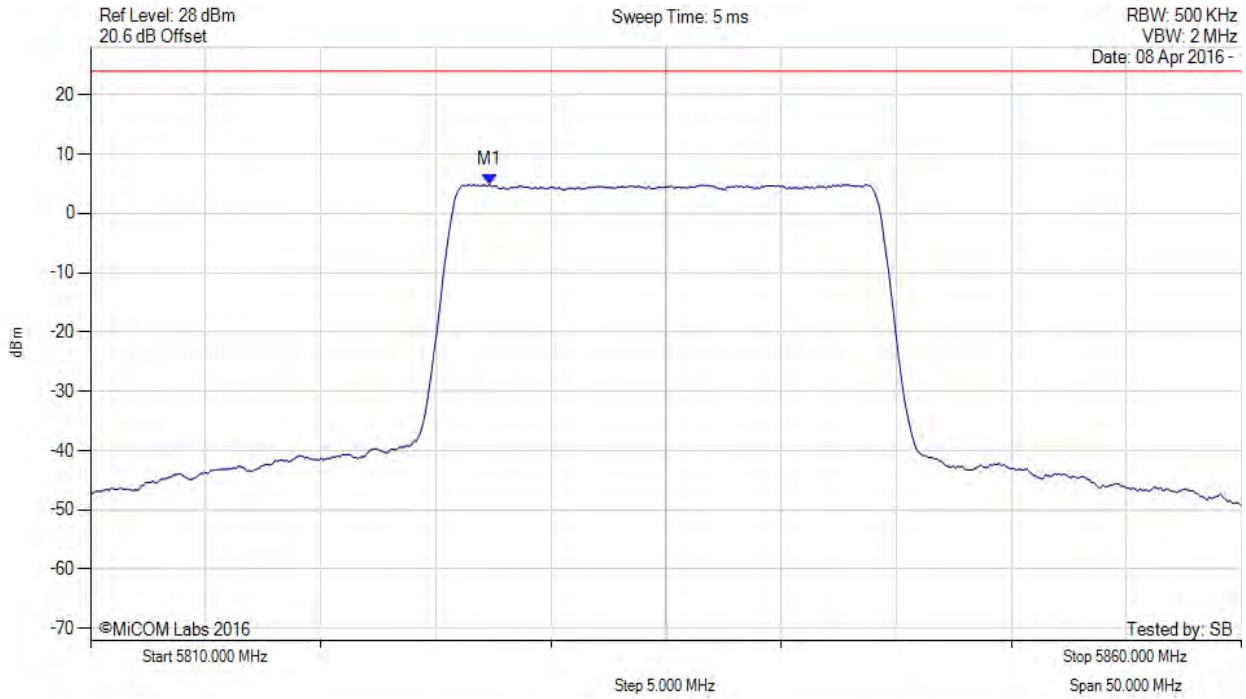
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5835.00 MHz, Chain a, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5827.335 MHz : 4.873 dBm	Limit: ≤ 23.980 dBm

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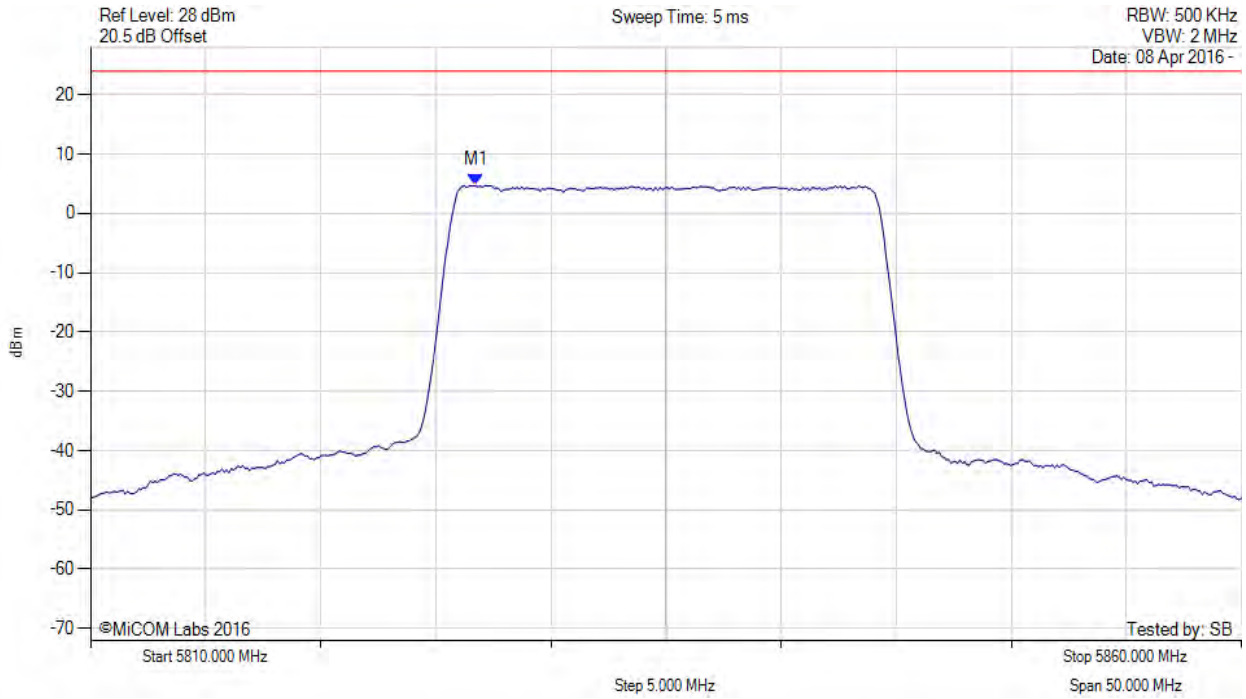
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5835.00 MHz, Chain b, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5826.733 MHz : 4.732 dBm	Limit: ≤ 23.980 dBm

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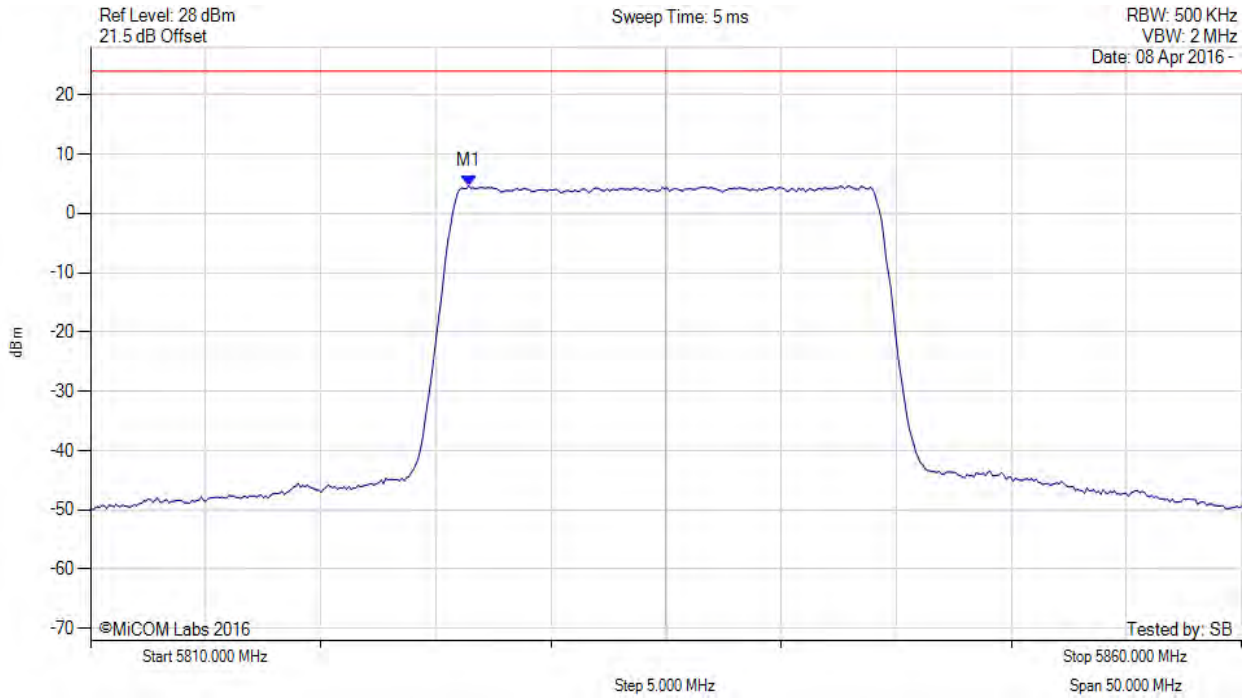
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5835.00 MHz, Chain c, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5826.433 MHz : 4.652 dBm	Limit: ≤ 23.980 dBm

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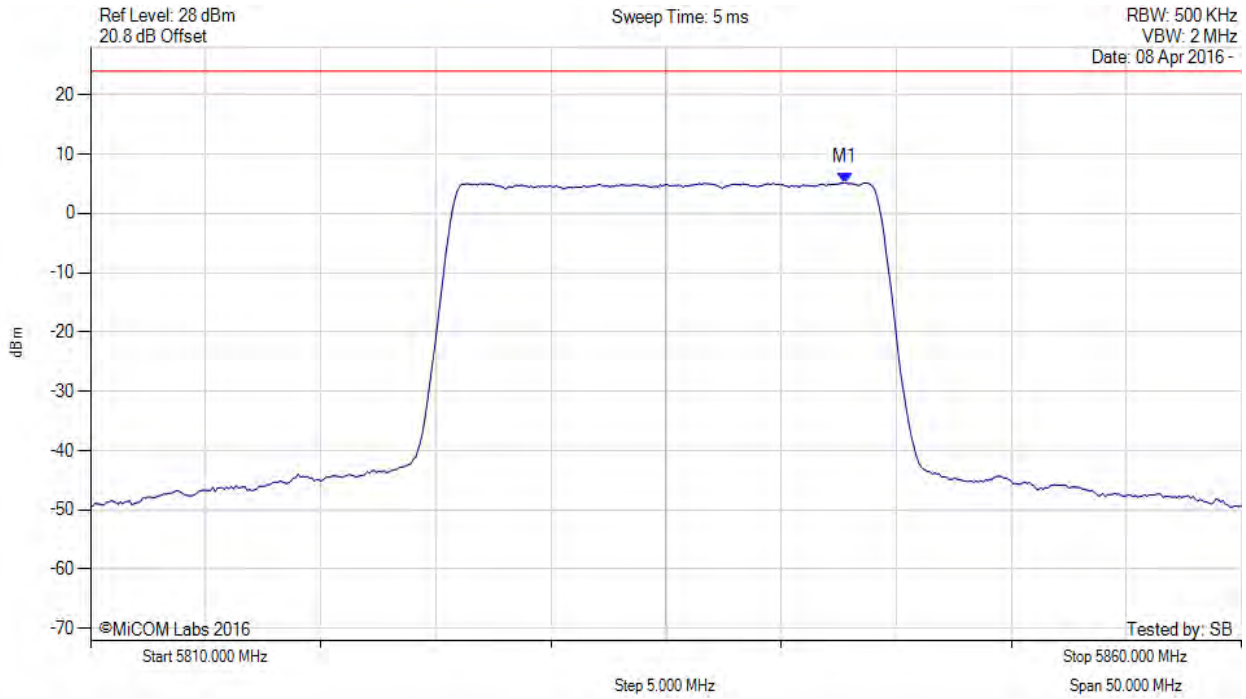
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5835.00 MHz, Chain d, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5842.766 MHz : 5.186 dBm	Limit: ≤ 23.980 dBm

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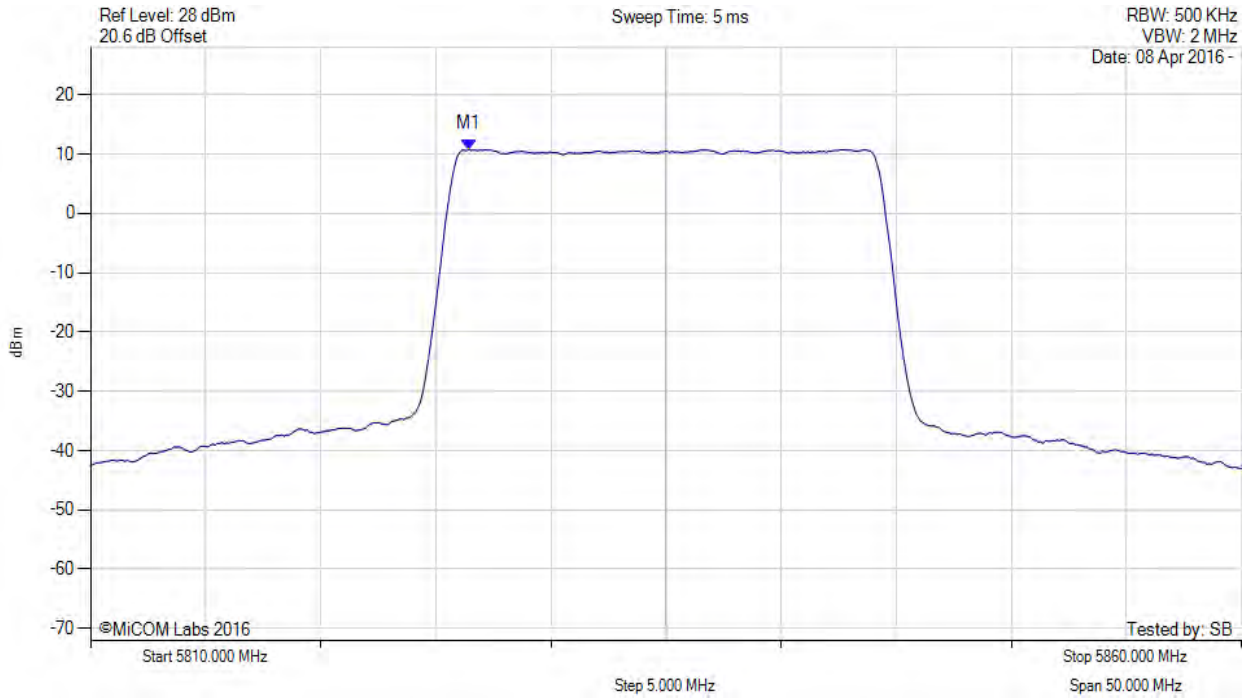
POWER SPECTRAL DENSITY

Variant: 16 QAM, Channel: 5835.00 MHz, SUM, Temp: 20, Voltage: 48 Vdc



Analyzer Setup	Marker:Frequency:Amplitude	Test Results
Detector = RMS Sweep Count = 100 RF Atten (dB) = 20 Trace Mode = VIEW	M1 : 5826.400 MHz : 10.805 dBm M1 + DCCF : 5826.400 MHz : 10.849 dBm Duty Cycle Correction Factor : +0.04 dB	Limit: ≤ 30.0 dBm Margin: -19.2 dB

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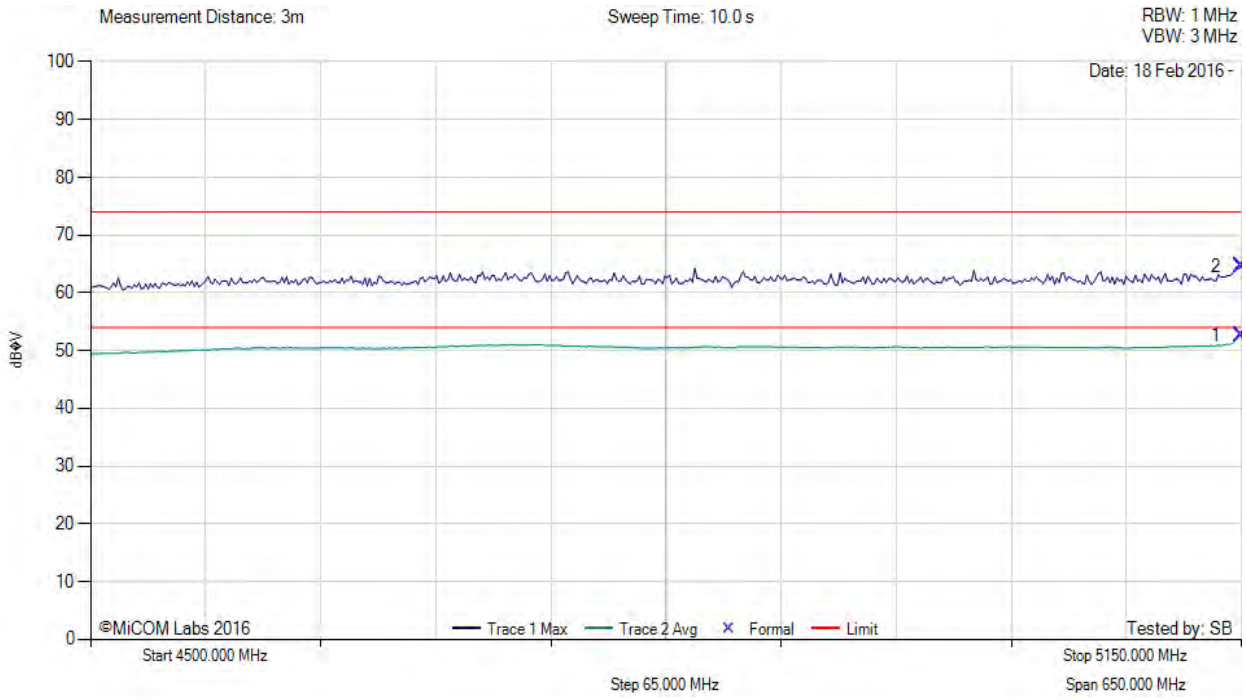
A.3. Restricted Band-Edge Emissions

Equipment Configuration for Restricted Lower Band-Edge Emissions			
Antenna:	Panel	**Variant:**	20 MHz
Antenna Gain (dBi):	13	**Modulation:**	16 QAM
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	5170.00	**Data Rate:**	-
Power Setting:	13	**Tested By:**	SB

Test Measurement Results

Variant: , Test Freq: 5170 MHz, Antenna: 13 dBi, Power Setting: 13, Duty Cycle (%): 100



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5150.00	14.87	3.67	34.11	52.65	Max Avg	Vertical	173	353	54.0	-1.4	Pass
2	5150.00	26.80	3.67	34.11	64.58	Max Peak	Vertical	173	353	74.0	-9.4	Pass

Test Notes: Ant Position = Horizontal, Active EUT Port = 0.

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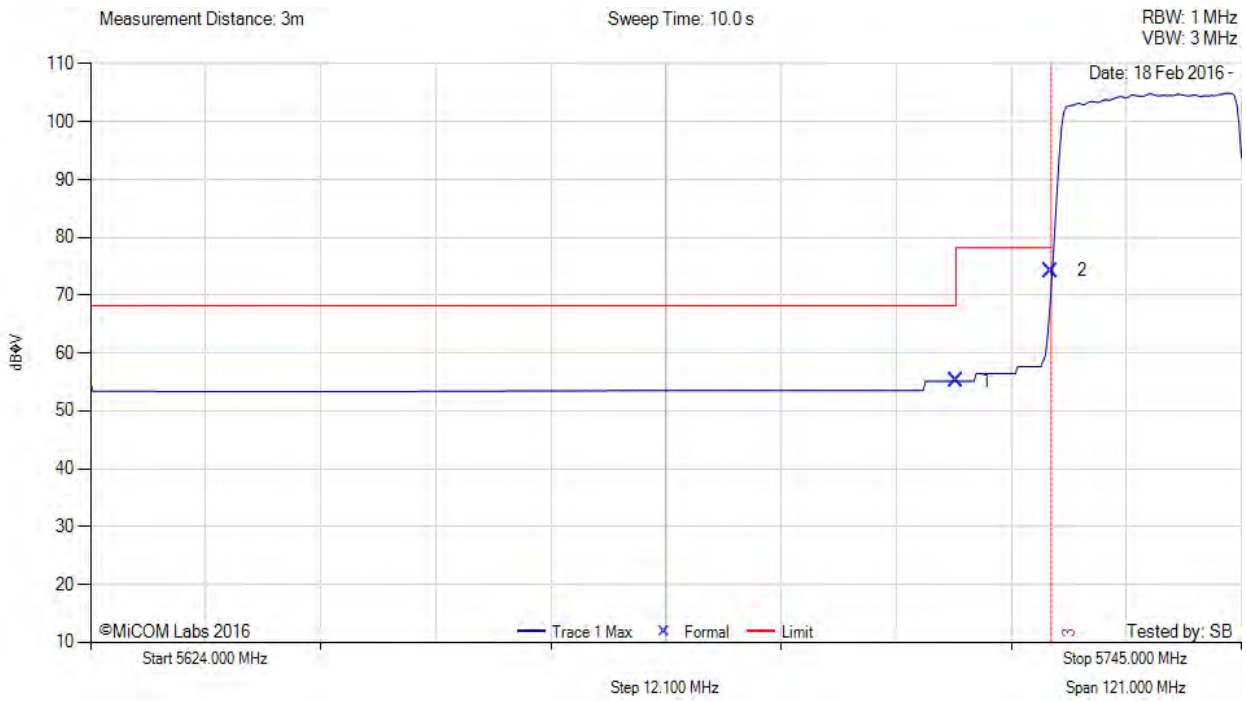
Equipment Configuration for 5725 MHz Radiated Band-Edge Emissions			
Antenna:	Panel	**Variant:**	20 MHz
Antenna Gain (dBi):	13	**Modulation:**	16 QAM
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	5735.00	**Data Rate:**	-
Power Setting:	9.5	**Tested By:**	SB

Test Measurement Results

Variant: , Test Freq: 5735.00 MHz, Antenna: 13 dBi, Power Setting: 9.5, Duty Cycle (%): 100



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5715.00	16.98	3.81	34.34	55.13	Marker	Horizontal	173	353	68.2	-13.1	Pass
2	5725.00	36.09	3.79	34.35	74.23	Marker	Horizontal	173	353	78.2	-4.0	Pass
3	5725.00	--	--	--	--	Frequency Line 1	--	--	--	--	--	--

Test Notes: Ant Position = Horizontal, Active EUT Port = 0.

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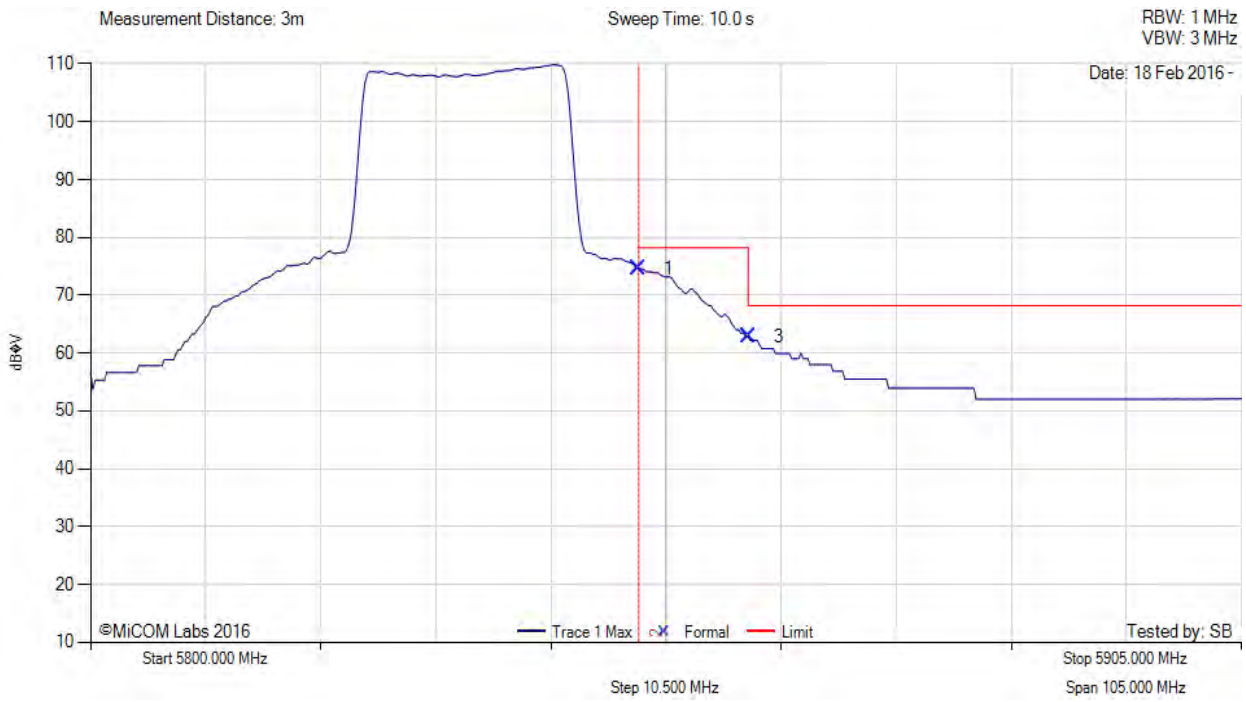
Equipment Configuration for 5850 MHz Radiated Band-Edge Emissions			
Antenna:	Panel	**Variant:**	20 MHz
Antenna Gain (dBi):	13	**Modulation:**	16 QAM
Beam Forming Gain (Y):	Not Applicable	**Duty Cycle (%):**	100
Channel Frequency (MHz):	5835.00	**Data Rate:**	-
Power Setting:	7	**Tested By:**	SB

Test Measurement Results

Variant: , Test Freq: 5835.00 MHz, Antenna: 13 dBi, Power Setting: 7, Duty Cycle (%): 100



Num	Frequency MHz	Raw dBµV	Cable Loss	AF dB	Level dBµV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBµV/m	Margin dB	Pass /Fail
1	5850.00	36.12	3.81	34.63	74.56	Marker	Horizontal	173	353	78.2	-3.7	Pass
3	5860.00	24.35	3.86	34.65	62.86	Marker	Horizontal	173	353	78.2	-15.4	Pass
2	5850.00	--	--	--	--	Frequency Line 1	--	--	--	--	--	--

Test Notes: Ant Position = Horizontal, Active EUT Port = 0.

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