



166 South Carter, Genoa City, WI 53128

Company: Cambium Networks  
Models Tested: C050900C032A & C058900P132A  
Report Number: 19222  
DLS Project: 5946

## Code of Federal Regulations 47 Part 15 – Radio Frequency Devices

Subpart E – Unlicensed National Information Infrastructure Devices

Section 15.407

General Technical Requirements.

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION  
(DFS not tested by DLS Electronic Systems Inc.)

Formal Name: Avenger Station 5.4GHz (or 5.7GHz) Radio

Kind of Equipment: Point-to-Point or Point-to-Multipoint Digital Transmission Transceiver

Frequency Range: **5495 to 5705 MHz (5.4 GHz xcvr in this report)**  
5740 to 5835 MHz (5.7 GHz xcvr reported to the FCC in CFR 47 Part 15 Subpart C Section 15.247 report # 19075)

Test Configuration: Stand-alone

Model Number(s): Integrated model: C058900P132A  
Connectorized model: C050900C032A

Model(s) Tested: Integrated model: C058900P132A  
Connectorized model: C050900C032A

Serial Number(s): Integrated: 000456C00042  
Connectorized: 000456C0000C

Date of Tests: June, July, & August 2013

Test Conducted For: Cambium Networks  
3800 Golf Road, Suite 360  
Rolling Meadows, IL 60008, USA

**NOTICE:** “This test report relates only to the items tested and must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government”. Please see the "Description of Test Sample" page listed inside of this report.

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Cambium Networks  
C050900C032A & C058900P132A  
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5946

SIGNATURE PAGE

Tested By:

A handwritten signature in black ink that reads "Craig Brandt". The signature is written in a cursive style with a long horizontal stroke at the end.

Craig Brandt  
Senior Test Engineer

Reviewed By:

A handwritten signature in black ink that reads "William Stumpf". The signature is written in a cursive style with a long horizontal stroke at the end.

William Stumpf  
OATS Manager

Approved By:

A handwritten signature in black ink that reads "Brian J. Mattson". The signature is written in a cursive style with a long horizontal stroke at the end.

Brian Mattson  
General Manager



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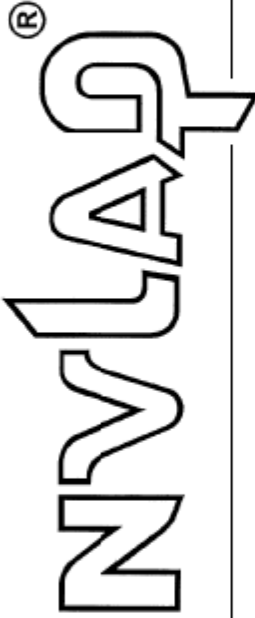


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United States Department of Commerce  
National Institute of Standards and Technology



**Certificate of Accreditation to ISO/IEC 17025:2005**

NVLAP LAB CODE: 100276-0

**D.L.S. Electronic Systems, Inc.**  
Wheeling, IL

*is accredited by the National Voluntary Laboratory Accreditation Program for specific services,  
listed on the Scope of Accreditation, for:*

**ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS**

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

2012-10-01 through 2013-09-30

Effective dates



For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)



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## 1.0 Summary of Test Report

### Subpart E Section 15.407 Applicable Technical Requirements Tested:

Section	Description	Procedure	Note	Compliant?
Informative	Duty Cycle	FCC KDB 789033 D01 General UNII Test Procedures v01r03 Section B(2)(b)	1	NA
Informative	Emission Bandwidth – 26 dB bandwidth	FCC KDB 789033 D01 General UNII Test Procedures v01r03 Section C	1	NA
Informative	99 Percent Occupied Bandwidth	FCC KDB 789033 D01 General UNII Test Procedures v01r03 Section D	1	NA
15.407(a)(2)	Maximum Conducted Output Power	FCC KDB 789033 D01 General UNII Test Procedures v01r03 Section E(3)(a)	1	Yes
15.407(a)(2)	Peak Power Spectral Density - Conducted	FCC KDB 789033 D01 General UNII Test Procedures v01r03 Sections F & E(2)(b)	1	Yes
15.407(a)(6)	Peak Excursion - Conducted	FCC KDB 789033 D01 General UNII Test Procedures v01r03 Section G	1	Yes
15.407(b)(3)	Unwanted Emission Levels – Radiated Band-Edge with integral antenna	FCC KDB 789033 D01 General UNII Test Procedures v01r03 Sections H(1), H(2), H(3), H(5), & H(6)	2	Yes
15.407(b)(3) & 15.407(b)(6)	Unwanted Emission Levels – Radiated with integral antenna	FCC KDB 789033 D01 General UNII Test Procedures v01r03 Sections H(1), H(2), H(3), H(4), H(5), & H(6)	2	Yes
15.407(b)(6) & 15.207(a)	AC Line Conducted Emissions	ANSI C63.10:2009		Yes
15.407(h)(2)	Dynamic Frequency Selection (DFS)	Not tested by DLS		NA

Note 1: RF Conducted emission measurement.

Note 2: Radiated emission measurement.



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## 1.0 Summary of Test Report - continued

It was determined that the Cambium Networks Avenger Station 5.4GHz Radio, Integrated model: C058900C00P132A, and Connectorized model: C050900C032A, complies with the requirements of CFR 47 Part 15 Subpart E Section 15.407. The data demonstrating FCC compliance of the 5.7GHz radio is found in D.L.S. Electronics, Inc. Reports #19075, where model number was C050900P032A. (See note in section 9.0 below.)

## 2.0 Introduction

In June, July, & August 2013 the Avenger Station 5.4GHz Radio, Models C058900C00P132A & C050900C032A, as provided from Cambium Networks, was tested to the requirements of CFR 47 Part 15 Subpart E Section 15.407. To meet these requirements, the procedures contained within this report were performed by personnel of D.L.S Electronic Systems, Inc.

## 3.0 Test Facilities

D.L.S. Electronic Systems, Inc. is a full service EMC/Safety Testing Laboratory accredited to ISO 17025. NVLAP Certificate and Scope can be viewed at <http://www.dlsemc.com/certificate>. Our facilities are registered with the FCC, Industry Canada, and VCCI.

### Wisconsin Test Facility:

D.L.S. Electronic Systems, Inc.  
166 S. Carter Street  
Genoa City, Wisconsin 53128

### Wheeling Test Facility:

D.L.S. Electronic Systems, Inc.  
1250 Peterson Drive  
Wheeling, IL 60090

## 4.0 Description of Test Sample

### Description:

Point-to-Point or Point-to-Multipoint 5.4 GHz (or 5.7GHz) 802.11 fixed outdoor transceiver with either 20 MHz or 40 MHz channel bandwidth. OFDM modulation. This is a software defined radio.

### Type of Equipment / Frequency Range:

Stand-Alone / **5495 to 5705 MHz (20 MHz bandwidth) (in this report)**  
**5510 to 5695 MHz (40 MHz bandwidth) (in this report)**

5740 to 5835 MHz (5.7 GHz xcvr reported to the FCC in report # 19075)



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**Physical Dimensions of Equipment Under Test:**

Length: 4 in. Width: 2 in. Height: 10 in.

**Power Source:**

29 VDC (Power Over Ethernet to Radio)  
120 Vac, 60 Hz using Phihong power supply model: 15R (for AC Line Conducted)

**Internal Frequencies:**

940 - 1000 kHz (Switching Power Supply Frequency)  
40 MHz, 25 MHz, 4 MHz

**Transmit / Receive Frequencies Used For Test Purpose:**

20 MHz Channel Bandwidth: Low channel: 5495 MHz, Middle channel: 5575 MHz,  
High channel: 5705 MHz

40 MHz Channel Bandwidth: Low channel: 5510 MHz, Middle channel: 5575 MHz,  
High channel: 5695 MHz

**Type of Modulation(s):**

OFDM: 802.11n: MCS15

**Description of Circuit Board(s) / Part Number:**

SM PC Board	84009653001
Antenna PC Board	P005135





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### 5.0 Test Equipment

A list of the equipment used can be found in the table below. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.

### D.L.S. Wisconsin

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Dates	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	7-23-13	7-23-14
LISN	Solar	9252-50-R-24-BNC	961019	9 kHz – 30 MHz	5-24-13	5-24-14
Filter- High-Pass	SOLAR	7930-120	090702	120 kHz – 30 MHz	1-7-13	1-7-14
Limiter	Electro-Metrics	EM-7600	706	9 kHz – 30 MHz	1-7-13	1-7-14
Preamp	Miteq	AMF-7D-01001800-22-10P	1809602	1GHz-18GHz	5-29-13	5-29-14
Horn Antenna	EMCO	3115	9502-4451	1-18GHz	3-18-13	3-18-15
High Pass Filter	Planar	HP8G-7G8-CD-SFF	PF1226/0728	7.5-18 GHz	8-14-13	8-14-14
Preamp	Miteq	AMF-8B-180265-40-10P-H/S	438727	18GHz-26GHz	8-12-13	8-12-14
Horn Antenna	ETS Lindgren	3116	00062917	18 – 40GHz	10-4-11	9-23-13
High Pass Filter	Planar	CL22500-9000-CD-SS	PF1229/0728	15-40 GHz	8-14-13	8-14-14
20 dB attenuator	Aeroflex/weinschel	75A-20-12	1071	DC – 40 GHz	8-14-13	8-14-14
10 dB attenuator	narda	4768-10	0702	DC – 40 GHz	8-13-13	8-13-14
Receiver	Rohde & Schwarz	ESI 26	837491/010	20 Hz – 26 GHz	1-3-13	1-3-14
Preamplifier	Rohde & Schwarz	TS-PR10	032001/005	9 kHz – 1 GHz	1-10-13	1-10-14
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	8-22-12	8-22-14
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	9-6-12	9-6-14
Power Meter	Anritsu	ML2487A	6K00002069	N/A	3-8-13	3-8-14
Thermal Power Sensor	Anritsu	MA24002A	1204359	10MHz-18GHz	3-3-13	3-3-14



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## 6.0 Test Arrangements

### RF Conducted Emissions Measurement Arrangement:

All RF conducted emission measurements were performed at D.L.S. Electronic Systems, Inc. and set up according to FCC Publication KDB 789033 D01 General UNII test Procedures v01r03 and ANSI C63.10-2009, unless otherwise noted. Description of procedures and measurements can be found in Appendix B – Measurement Data. See Appendix A for photos of the test set up.

### Radiated Emissions Measurement Arrangement:

All radiated emission measurements were performed at D.L.S. Electronic Systems, Inc. and set up according to ANSI C63.10-2009, unless otherwise noted. Description of procedures and measurements can be found in Appendix B – Measurement Data. See Appendix A for photos of the test set up.

Unless otherwise noted, the bandwidth of the measuring receiver / analyzer used during testing is shown below.

Frequency Range	Bandwidth (-6 dB)
10 to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz

## 7.0 Test Conditions

### Normal Test Conditions:

#### Temperature and Humidity:

67°F at 56% RH (or noted on the test data)

#### Supply Voltage:

29 VDC (Power Over Ethernet to Radio)

120 Vac, 60 Hz using Phihong power supply for AC Line Conducted



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## **8.0 Modifications Made To EUT For Compliance**

No modifications were made to the EUT at the time of test.

## **9.0 Additional Descriptions**

Testing was performed at low, mid, and high channels over 2 modulation bandwidths (20MHz & 40MHz). The antenna ports were tested (Channel 0 & 1). Worst case emissions were recorded. AC line conducted tested in transmit mode.

Emission Designators: 20M0x1D, 40M0x1D

Power Settings noted on the test data.

Please note that Cambium Networks requested a new model # for the Avenger Station 5.4GHz (or 5.7GHz) Radio on August 22, 2013. The model number for the 5.7GHz integrated radio was reported as C050900P032A in DLS Report # 19075. This number has been updated to C058900P132A. The same physical units were used to test the radio at all frequencies reported to the FCC.

## **10.0 Results**

Measurements were performed in accordance with FCC Publication KDB 789033 D01 General UNII test Procedures v01r03 and ANSI C63.10-2009. Graphical and tabular data can be found in Appendix B at the end of this report.

## **11.0 Conclusion**

Dynamic Frequency Selection (DFS) testing was not performed by DLS Electronic Systems, Inc. Otherwise, the Avenger Station 5.4GHz Radio, Models C058900P132A & C050900C032A, as provided from Cambium Networks tested in June, July, & August 2013 **meets** the requirements of CFR 47 Part 15 Subpart E Section 15.407.



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Models Tested:  
Report Number:  
DLS Project:

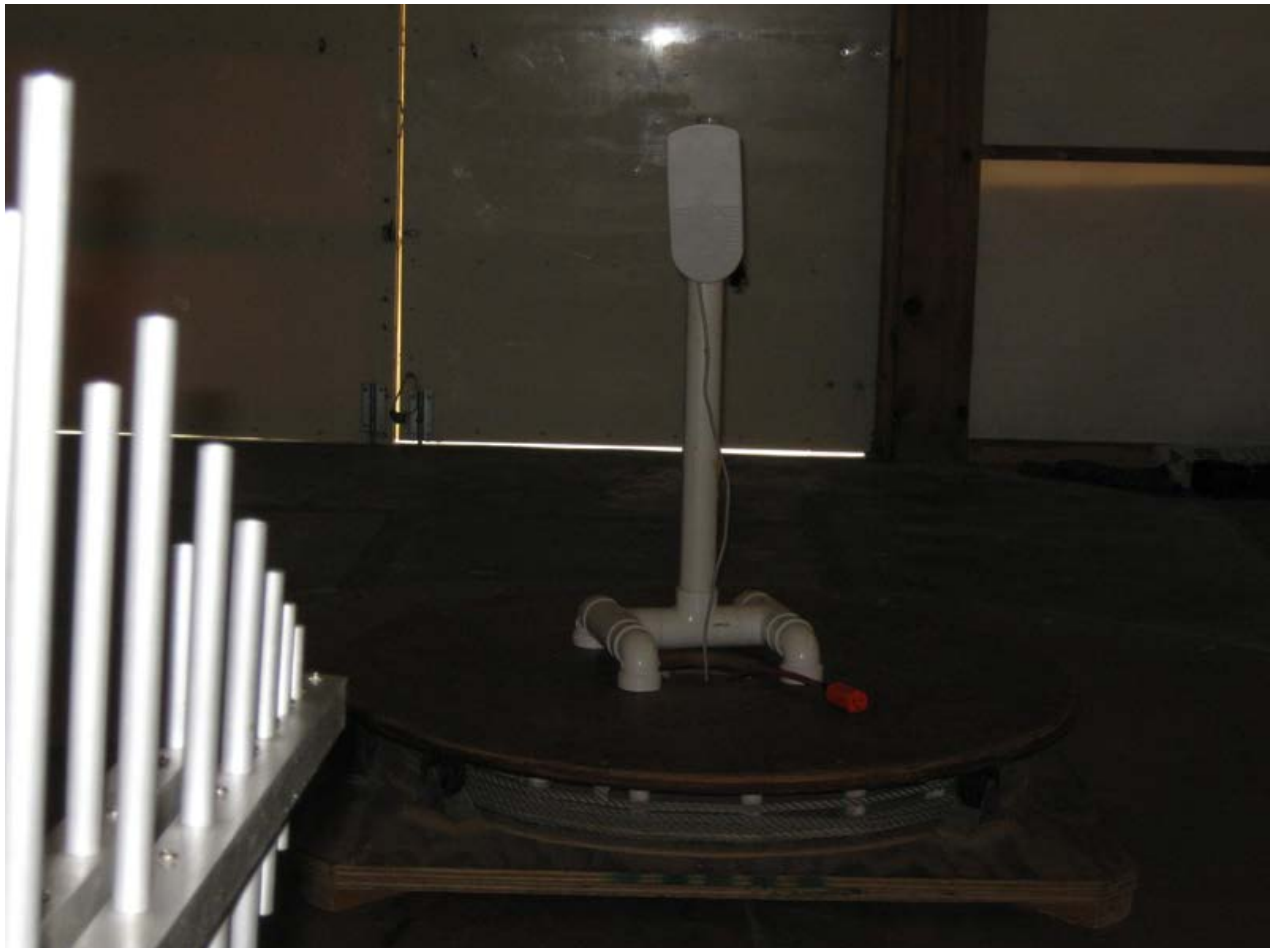
Cambium Networks  
C050900C032A & C058900P132A  
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## Appendix A – Test Photos

### Photo Information and Test Setup:

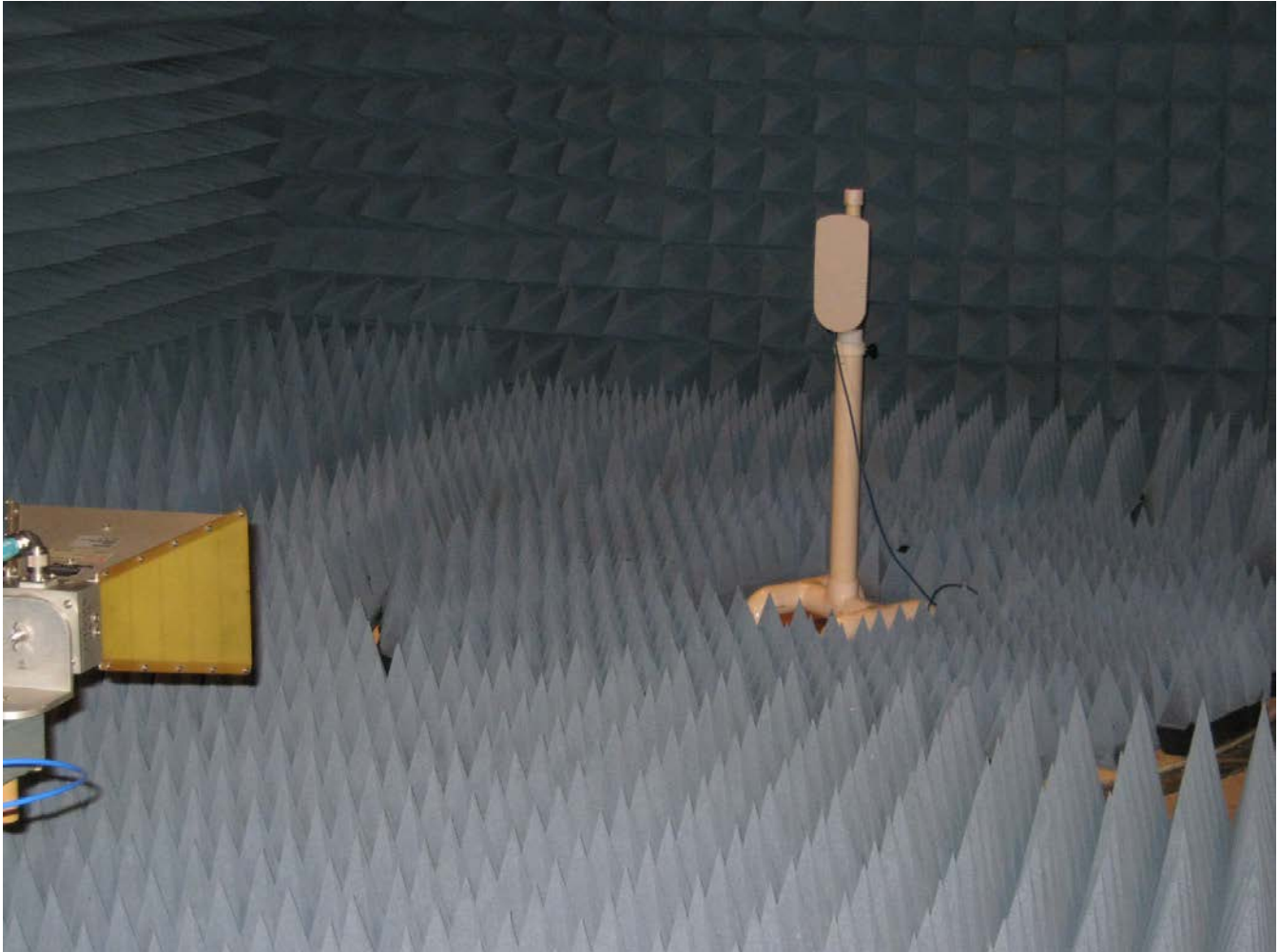
Avenger Station 5.4GHz Radio, Model C058900P132A or C050900C032A  
Unshielded Ethernet Cable - 20 meters long

### Radiated - Below 1 GHz



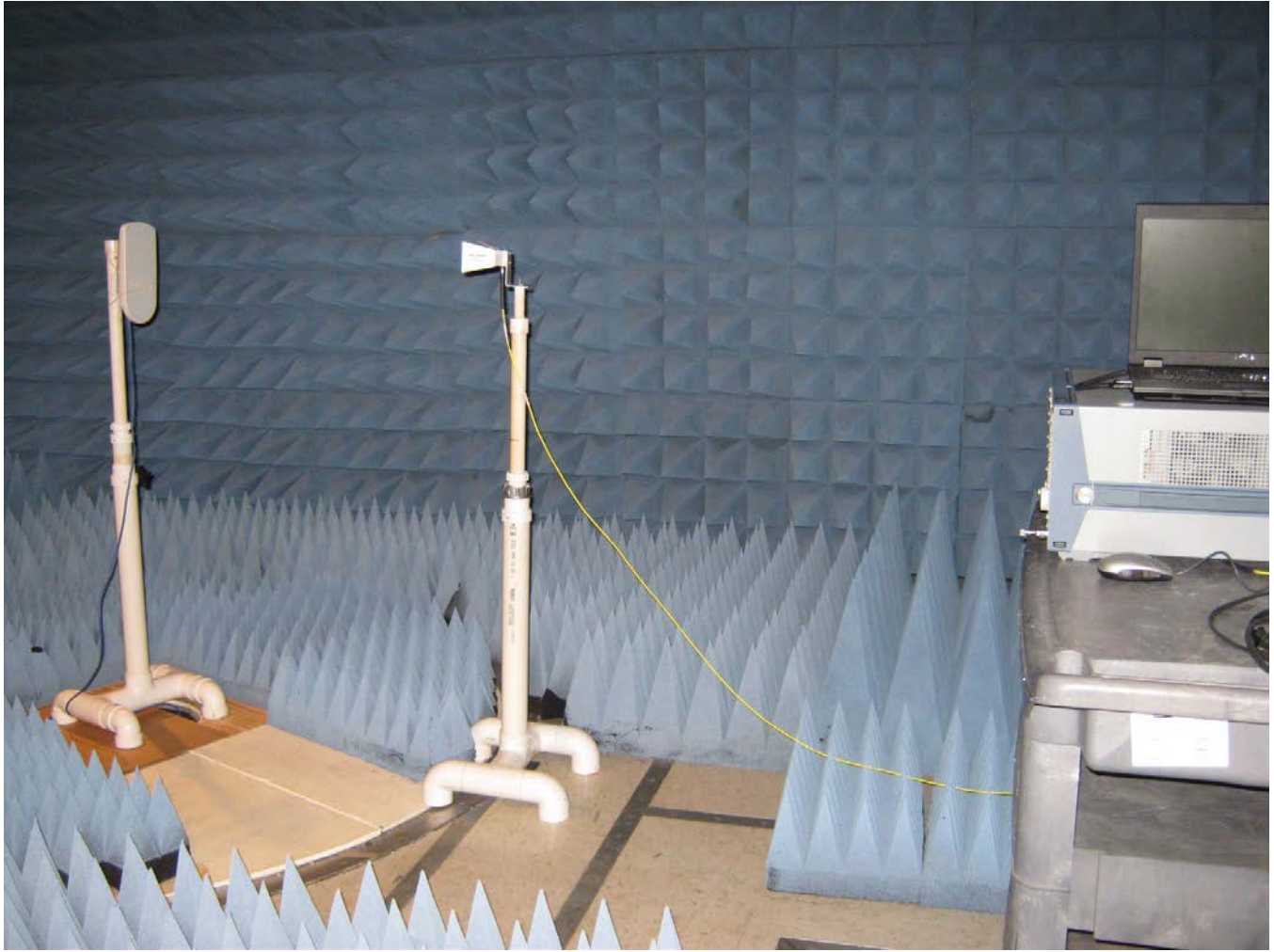
**Appendix A – Test Photos**

**Radiated - 1 to 18 GHz**



**Appendix A – Test Photos**

**Radiated - Above 18 GHz**





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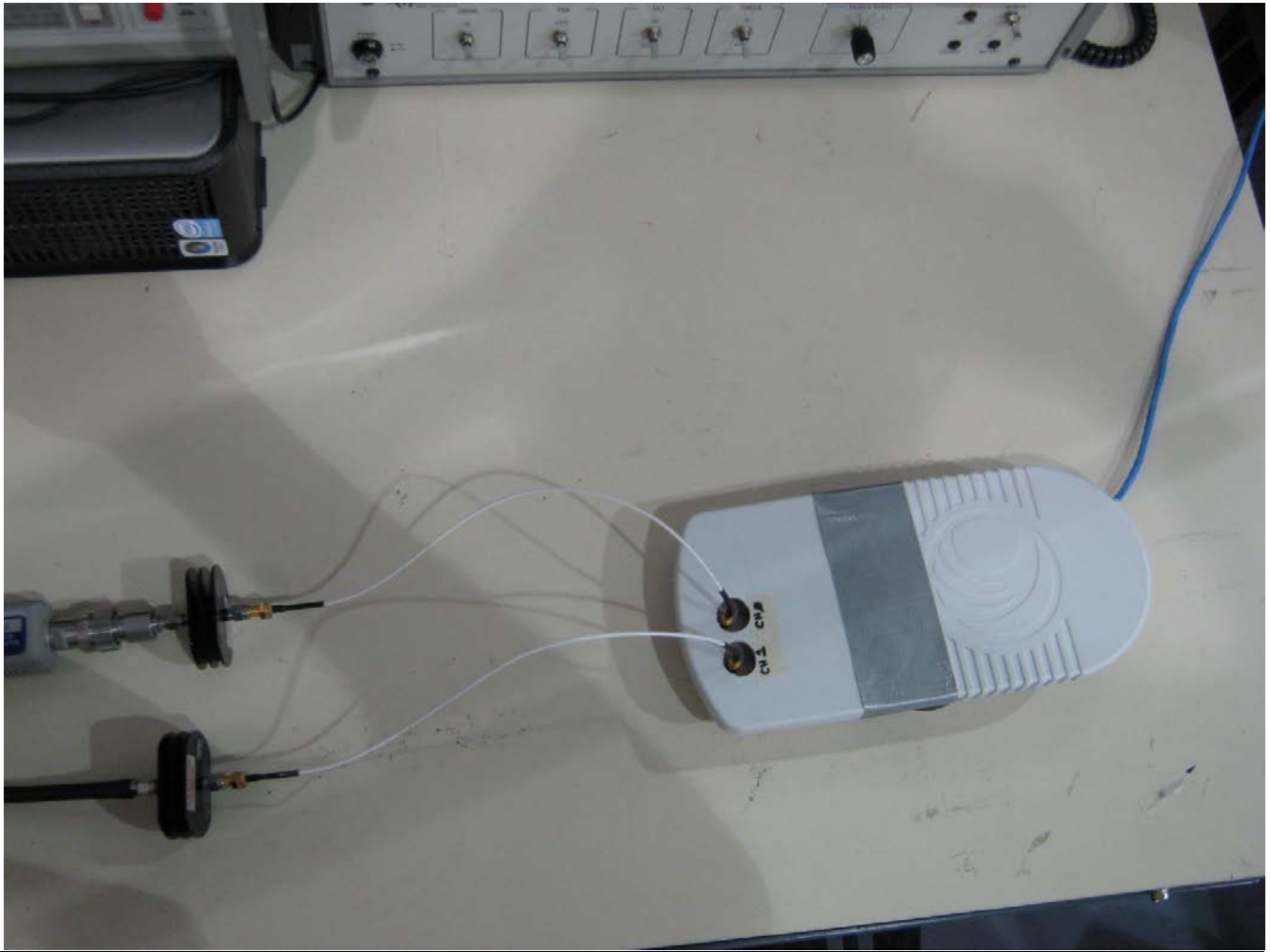
## Appendix A – Test Photos

### RF Conducted



**Appendix A – Test Photos**

**RF Conducted - output power**





**Appendix A – Test Photos**

**AC Line Conducted**





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## Appendix B – Measurement Data

### B1.0 Duty Cycle of Test Unit

**Rule Part:** FCC Section 15.35(c)

**Test Procedure:** FCC KDB 789033 D01 General UNII Test Procedures v01r03  
Section B(2)(b)

**Limits:** Informative

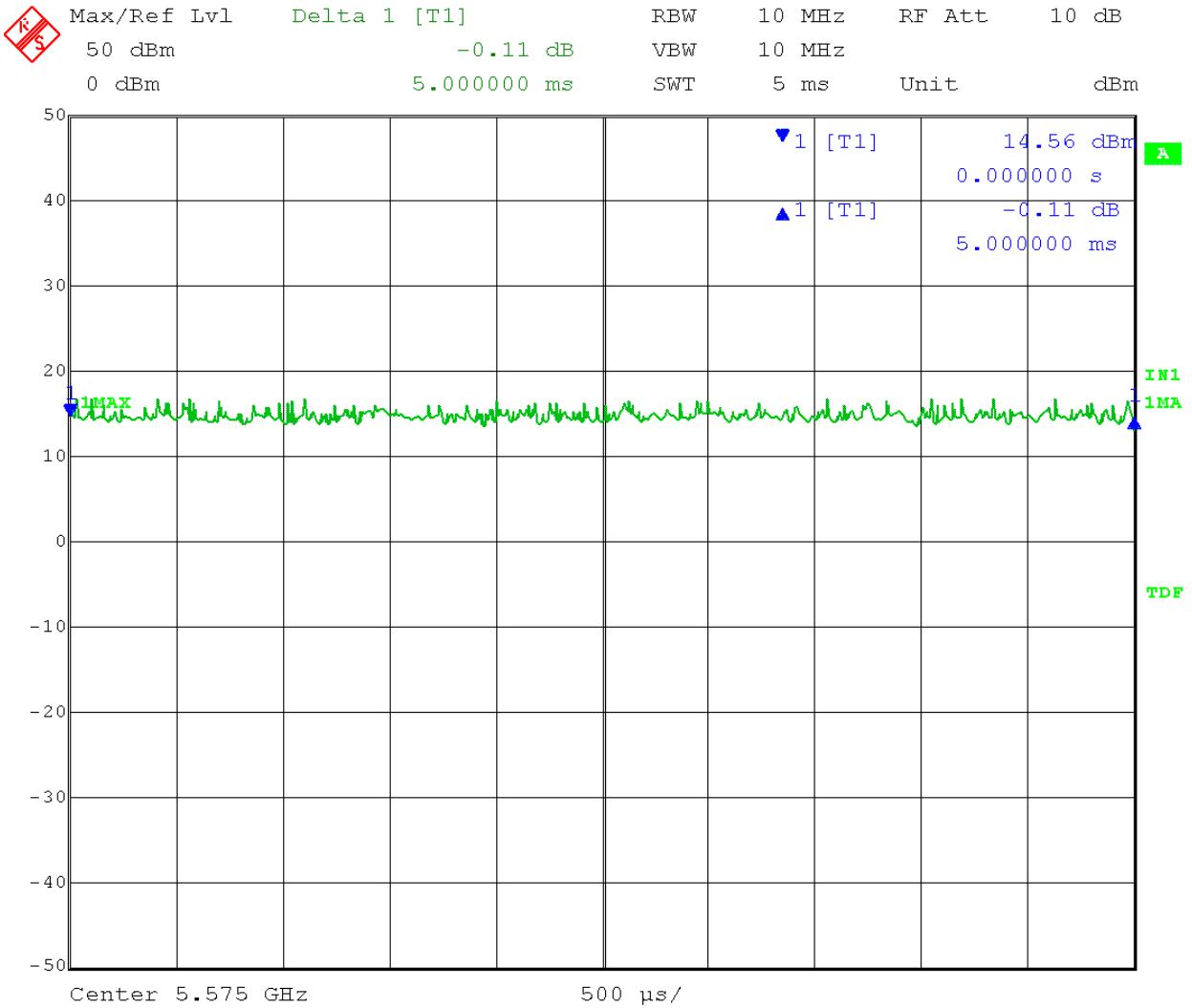
**Results:** EUT is continuously transmitting (duty cycle = 100%).

**Sample Equations:** None

**Notes:** No Duty cycle correction factor was applied to measurements for this device.

Test Date: 8-27-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: Duty Cycle during testing  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 B)2)b) Duty Cycle measurement: zero-span method - Page 3  
 EBW = 21.22 MHz    Detector = PK  
 RBW = 10 MHz      VBW = 10 MHz  
 Span = 0 Hz        SWT = 5 ms  
 Mid Channel: Transmit = 5.575GHz      20MHz BW  
 Total on Time = Duration of one pulse = 5.000000 ms

**Duty cycle factor  $x = 5.0/5.0 = 1.00$**



Date: 27.AUG.2013 09:26:34



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Company: Cambium Networks  
Models Tested: C050900C032A & C058900P132A  
Report Number: 19222  
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## Appendix B – Measurement Data

### B2.0 Emission Bandwidth – 26 dB bandwidth – conducted

**Rule Section:** Informative

**Test Procedure:** FCC KDB 789033 D01 General UNII Test Procedures v01r03 – *Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E*

Section C – Emission bandwidth

**Description:** RBW = approximately 1% of EBW  
VBW > RBW  
Detector = Peak  
Trace mode = max hold

Measure the maximum width of the emission between the lower and upper frequencies that measure 26 dB below the maximum level of the in-band emission.

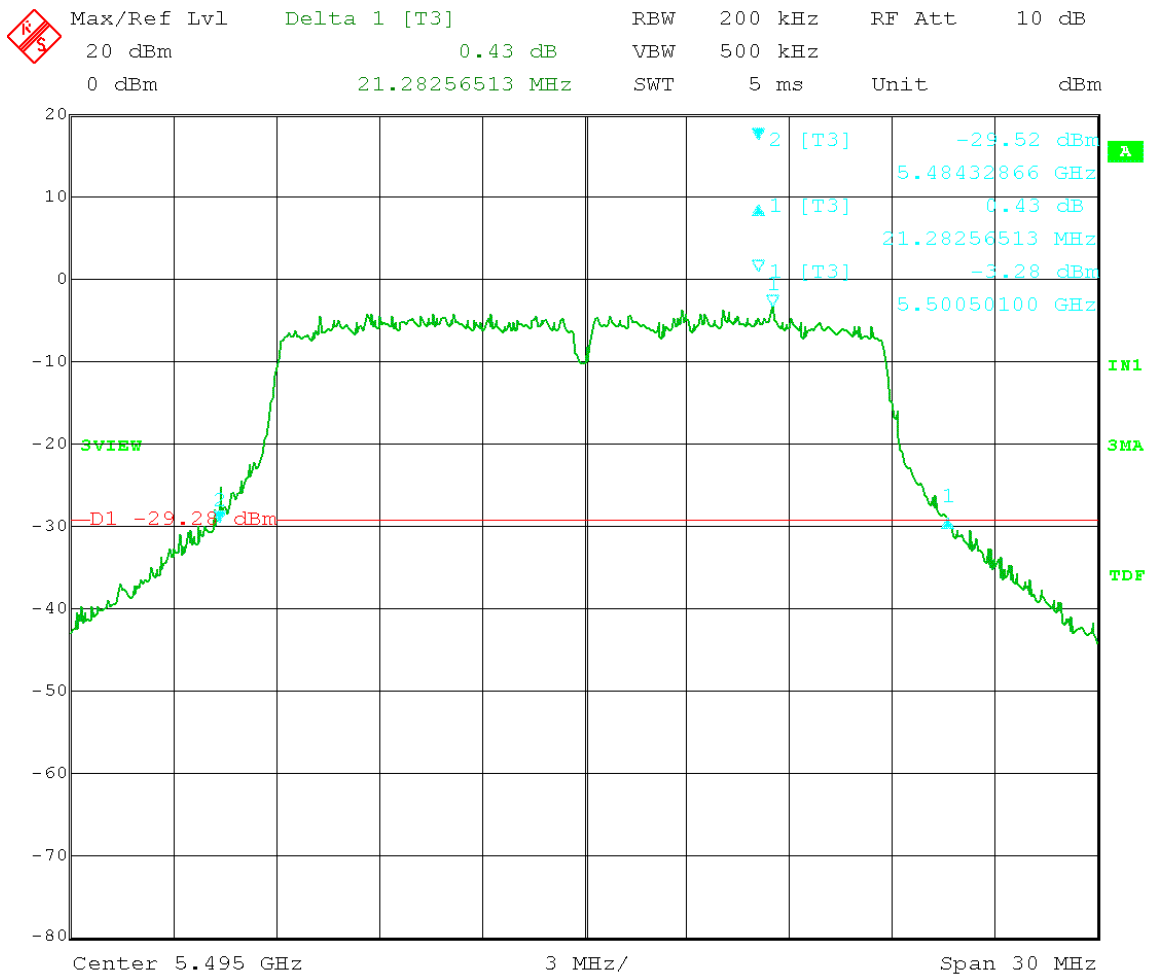
**Limit:** Informative

**Notes:** Measurements were taken for MCS15 OFDM modulation at the lowest, middle, and highest channels of operation. EUT was set to transmit continuously with 100% duty cycle.

Test Date: 7-26-2013  
 Company: Cambium Networks  
 EUT: Avenger Station 5.4GHz OFDM  
 Test: Emission Bandwidth (26 dB) - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 C) Emission bandwidth: Page 3  
 RBW = 200 kHz  
 Low Channel: Transmit = 5.495 GHz  
 Output power setting: 7

VBW = 500 kHz  
 20MHz BW  
 Channel 0

26 dB (D1) Emission Bandwidth = 21.28MHz

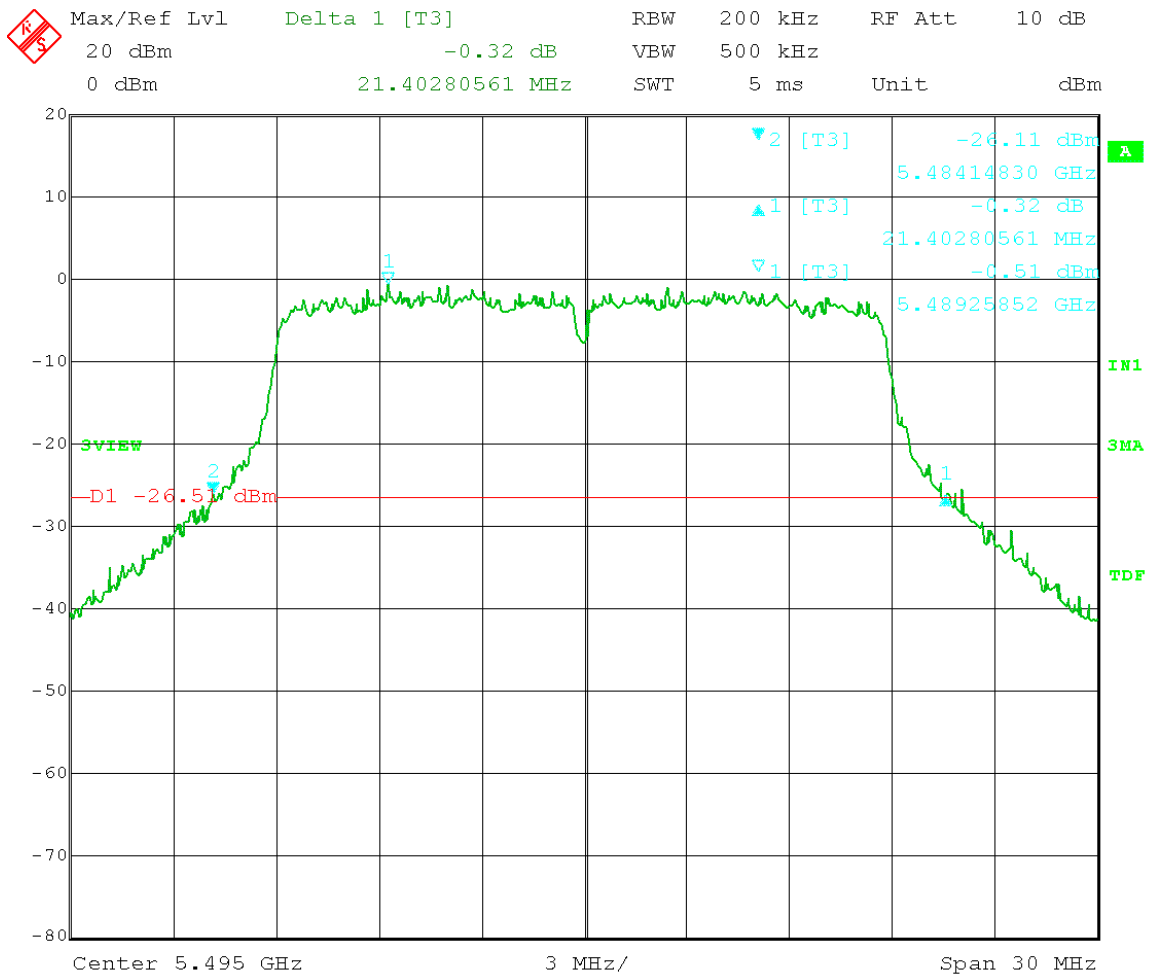


Date: 26.JUL.2013 15:41:46

Test Date: 7-26-2013  
 Company: Cambium Networks  
 EUT: Avenger Station 5.4GHz OFDM  
 Test: Emission Bandwidth (26 dB) - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 C) Emission bandwidth: Page 3  
 RBW = 200 kHz  
 Low Channel: Transmit = 5.495 GHz  
 Output power setting: 7

VBW = 500 kHz  
 20MHz BW  
 Channel 1

26 dB (D1) Emission Bandwidth = 21.40MHz

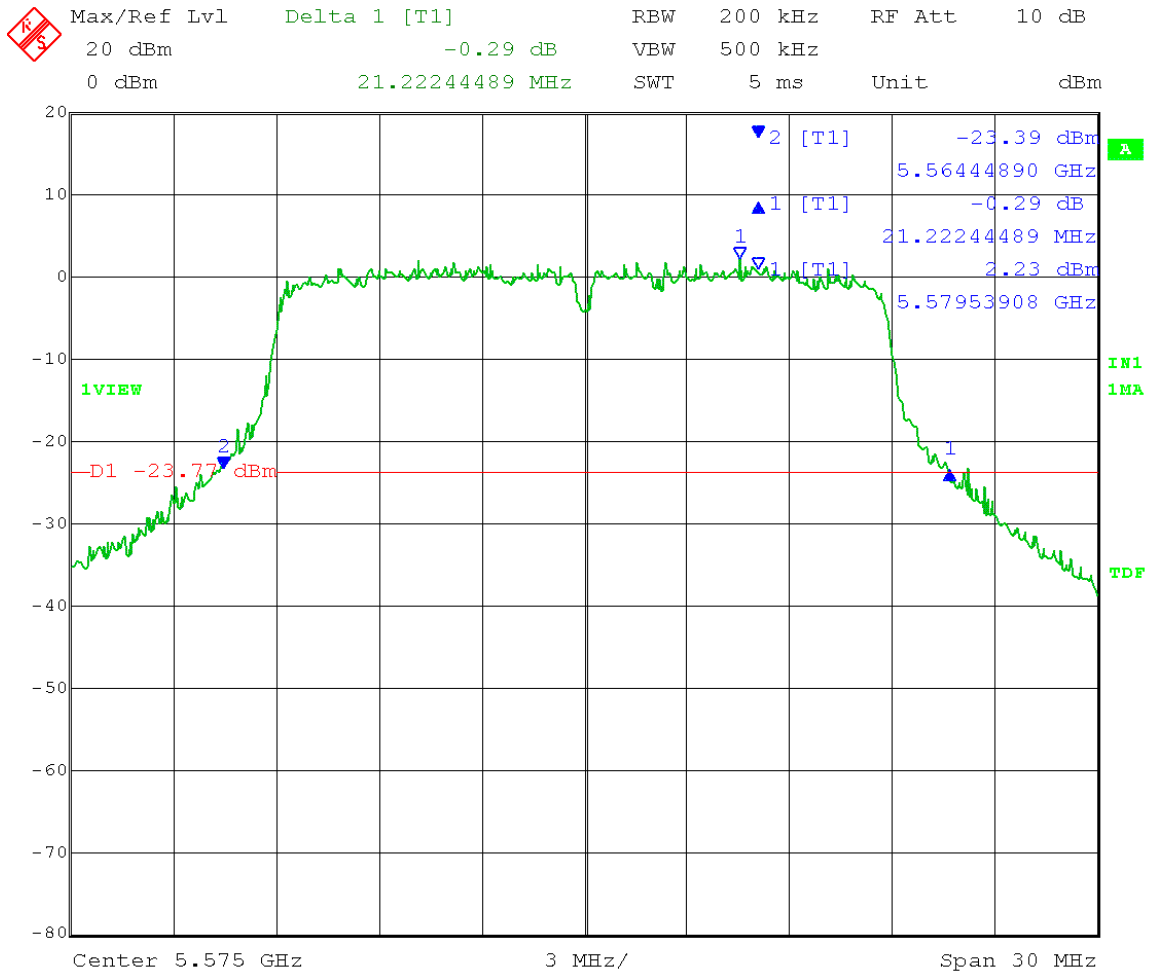


Date: 26.JUL.2013 15:11:23

Test Date: 8-23-2013  
 Company: Cambium Networks  
 EUT: Avenger Station 5.4GHz OFDM  
 Test: Emission Bandwidth (26 dB) - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 C) Emission bandwidth: Page 3  
 RBW = 200 kHz VBW = 500 kHz  
 Mid Channel: Transmit = 5.575 GHz 20MHz BW  
 Output power setting: 14

Channel 0:

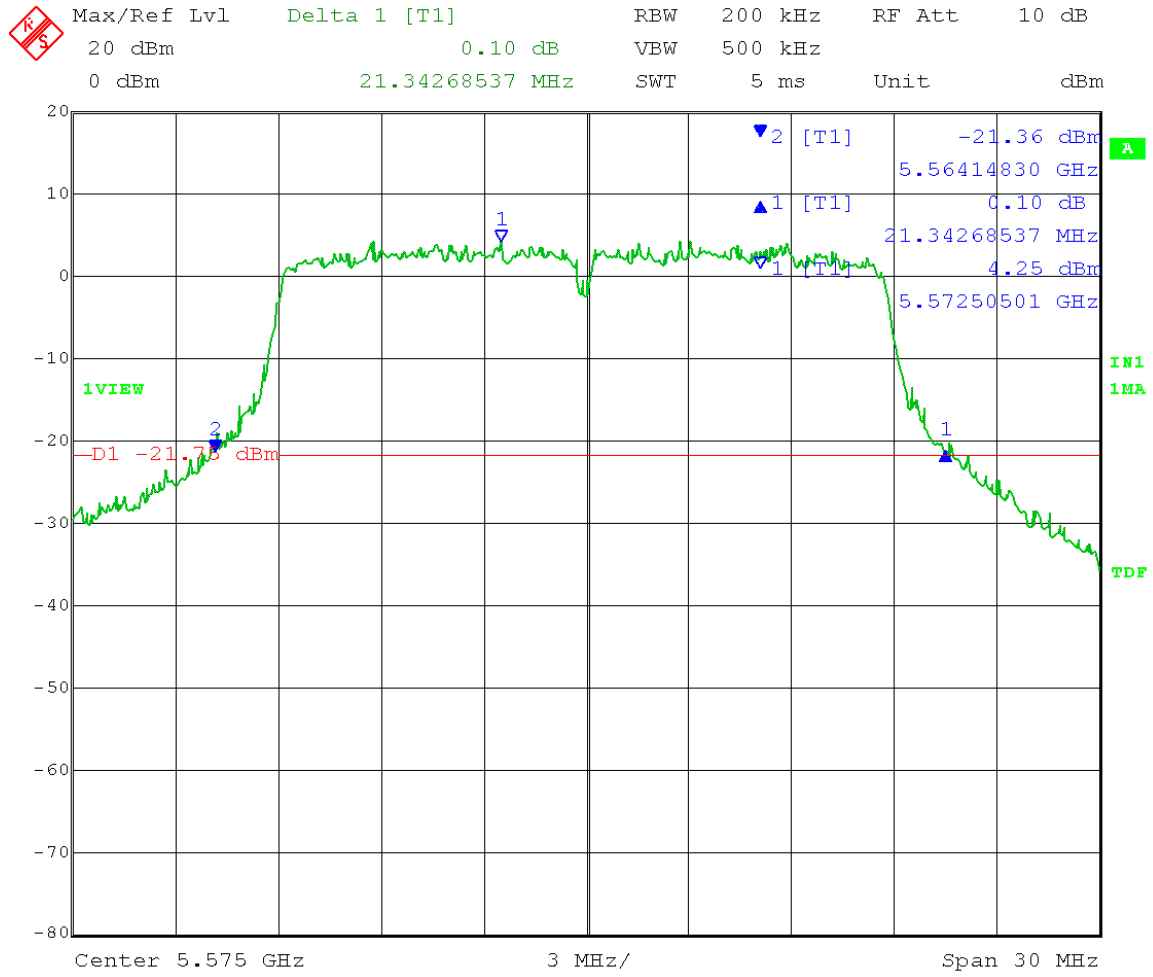
26 dB (D1) Emission Bandwidth = 21.22MHz



Date: 23.AUG.2013 14:27:23

Channel 1:

26 dB (D1) Emission Bandwidth = 21.34MHz



Date: 23.AUG.2013 14:54:42



Test Date: 7-26-2013  
 Company: Cambium Networks  
 EUT: Avenger Station 5.4GHz OFDM  
 Test: Emission Bandwidth (26 dB) - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013

C) Emission bandwidth: Page 3

RBW = 200 kHz

VBW = 500 kHz

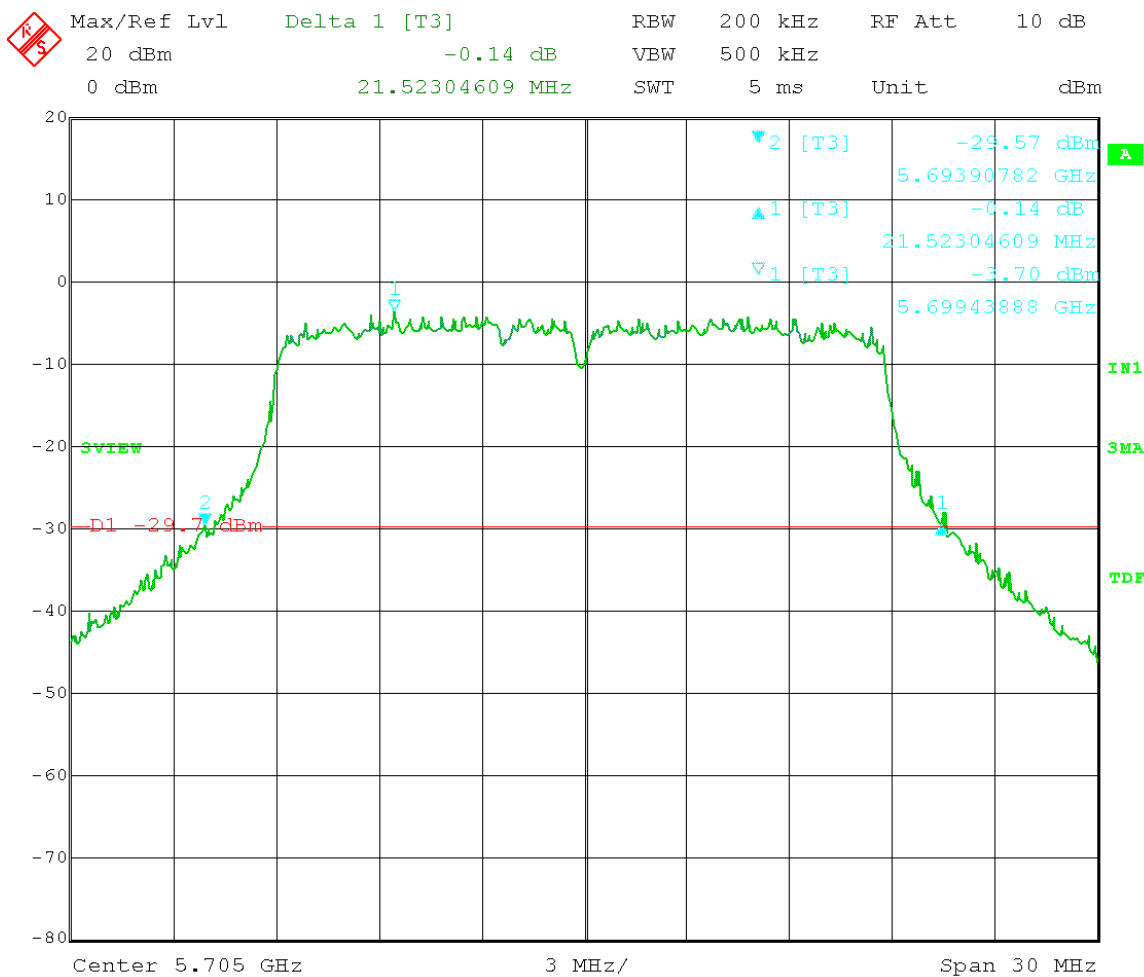
High Channel: Transmit = 5.705 GHz

20MHz BW

Output power setting: 7

Channel 0

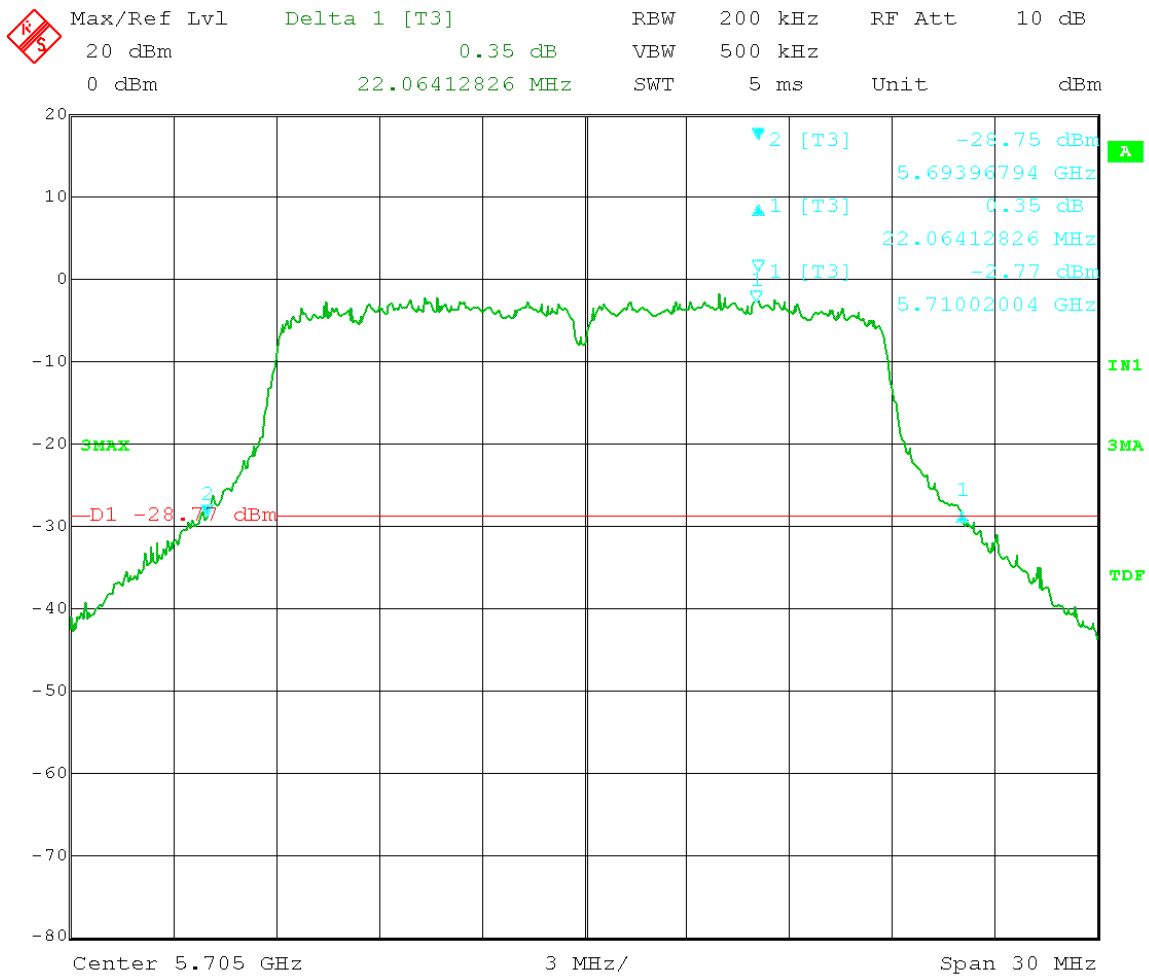
26 dB (D1) Emission Bandwidth = 21.52MHz



Date: 26.JUL.2013 15:29:36

Test Date: 7-26-2013  
 Company: Cambium Networks  
 EUT: Avenger Station 5.4GHz OFDM  
 Test: Emission Bandwidth (26 dB) - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 C) Emission bandwidth: Page 3  
 RBW = 200 kHz  
 High Channel: Transmit = 5.705 GHz  
 Output power setting: 7  
 VBW = 500 kHz  
 20MHz BW  
 Channel 1

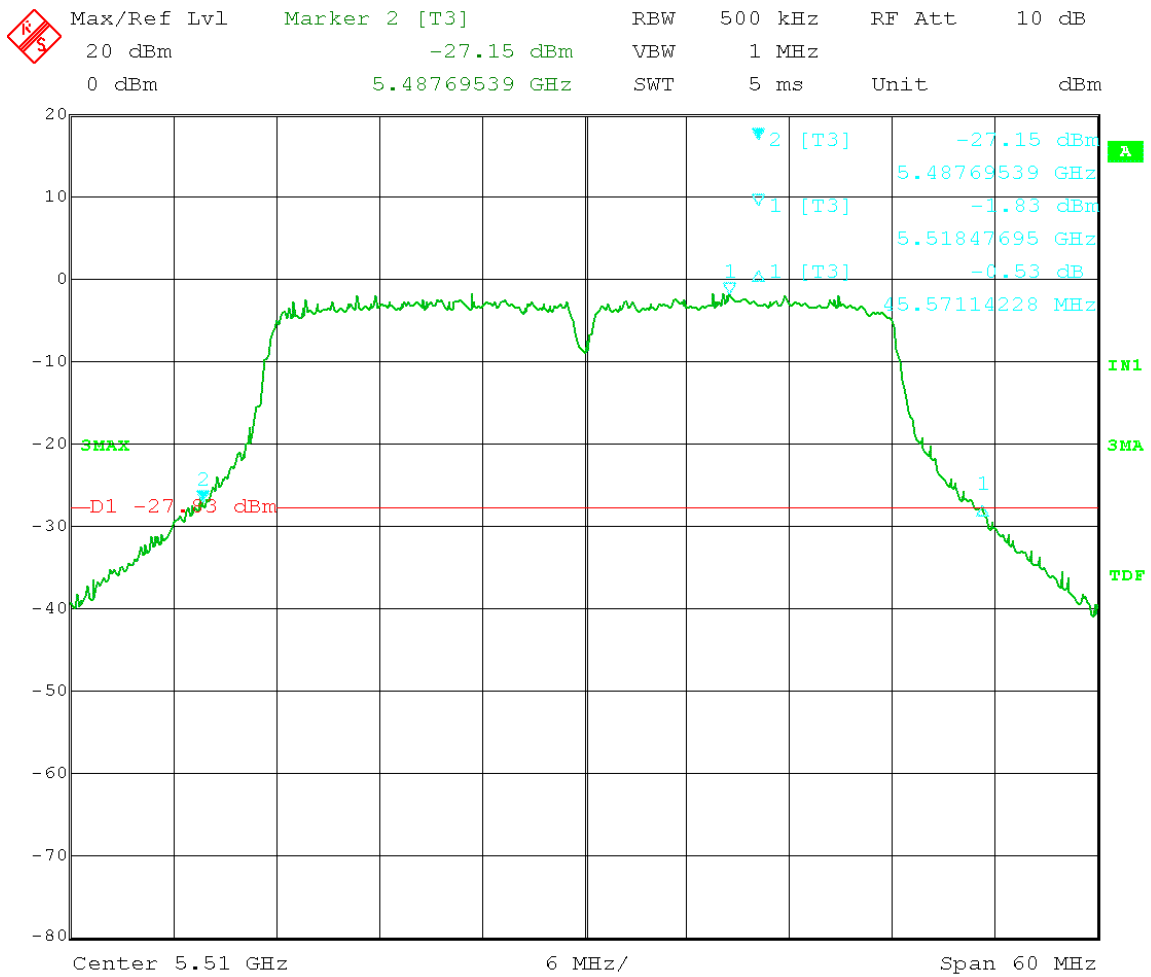
26 dB (D1) Emission Bandwidth = 22.06MHz



Date: 26.JUL.2013 15:23:43

Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger Station 5.4GHz OFDM  
 Test: Emission Bandwidth (26 dB) - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 C) Emission bandwidth: Page 3  
 RBW = 500 kHz  
 VBW = 1 MHz  
 Low Channel: Transmit = 5.510 GHz  
 40MHz BW  
 Output power setting: 6.5  
 Channel 0

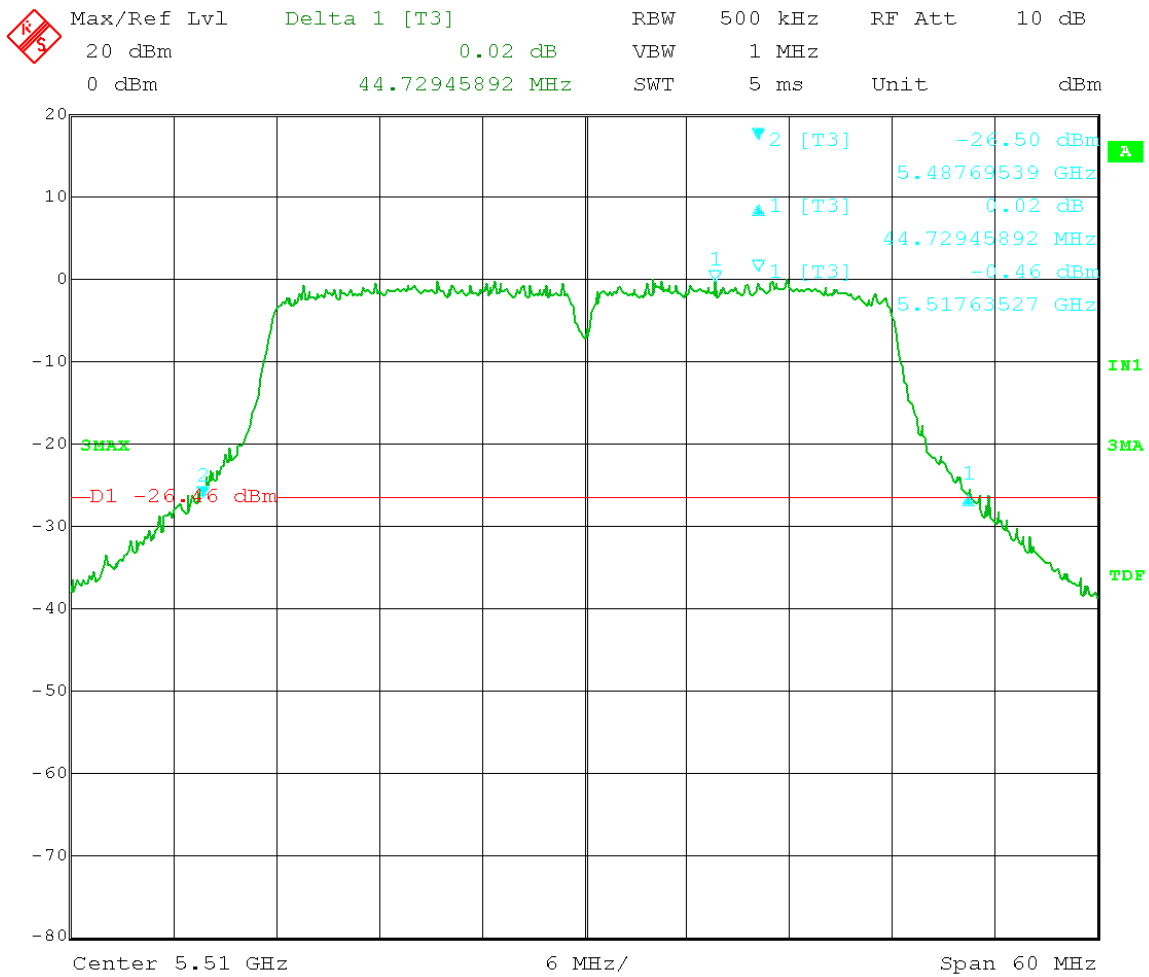
26 dB (D1) Emission Bandwidth = 45.57MHz



Date: 29.JUL.2013 09:02:25

Test Date: 7-26-2013  
 Company: Cambium Networks  
 EUT: Avenger Station 5.4GHz OFDM  
 Test: Emission Bandwidth (26 dB) - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 C) Emission bandwidth: Page 3  
 RBW = 500 kHz  
 Low Channel: Transmit = 5.510 GHz  
 Output power setting: 6.5  
 VBW = 1 MHz  
 40MHz BW  
 Channel 1

26 dB (D1) Emission Bandwidth = 44.73MHz

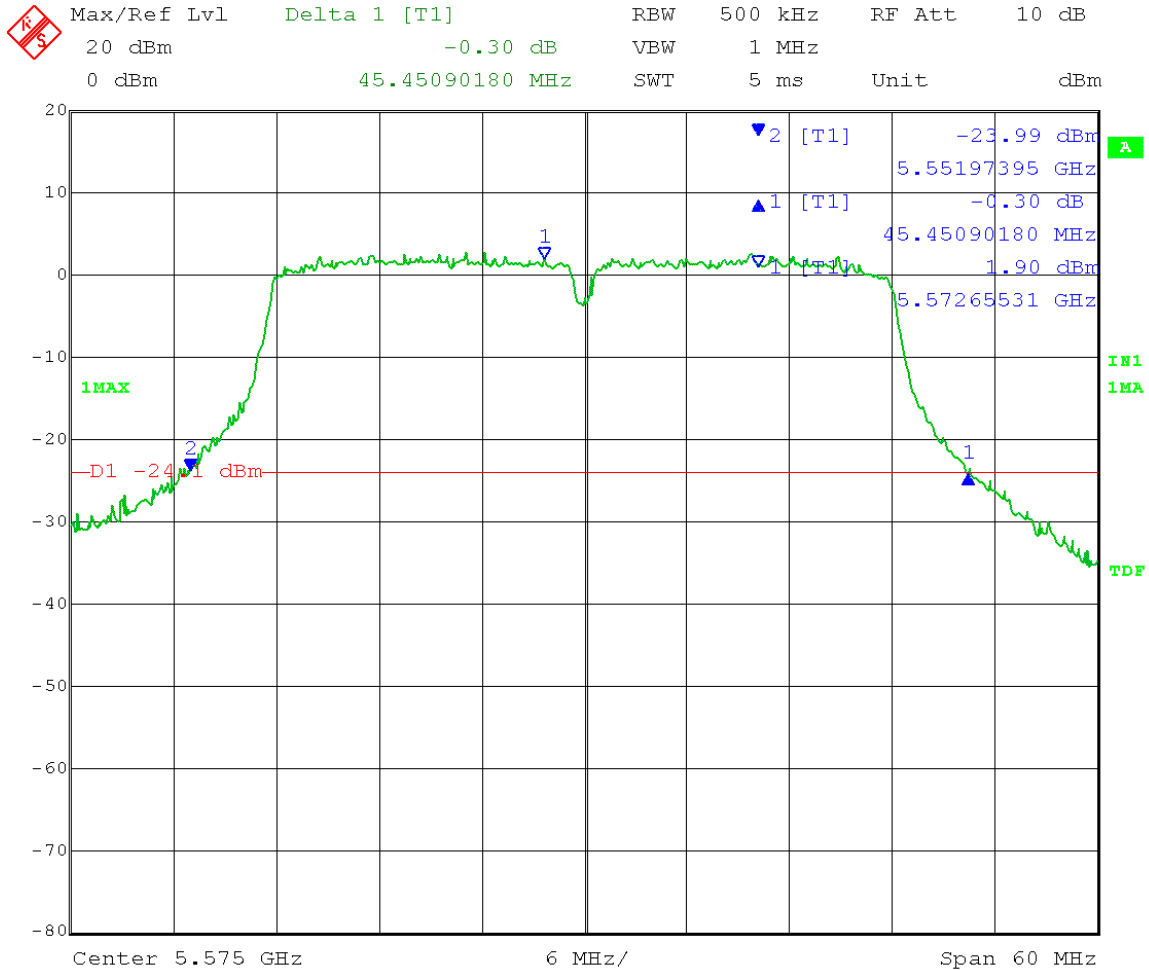


Date: 26.JUL.2013 15:05:48

Test Date: 8-23-2013  
Company: Cambium Networks  
EUT: Avenger Station 5.4GHz OFDM  
Test: Emission Bandwidth (26 dB) - Conducted  
Operator: Lillian Li  
Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
C) Emission bandwidth: Page 3  
RBW = 500 kHz VBW = 1 MHz  
Mid Channel: Transmit = 5.575 GHz 40MHz BW  
Output power setting: 14

Channel 0:

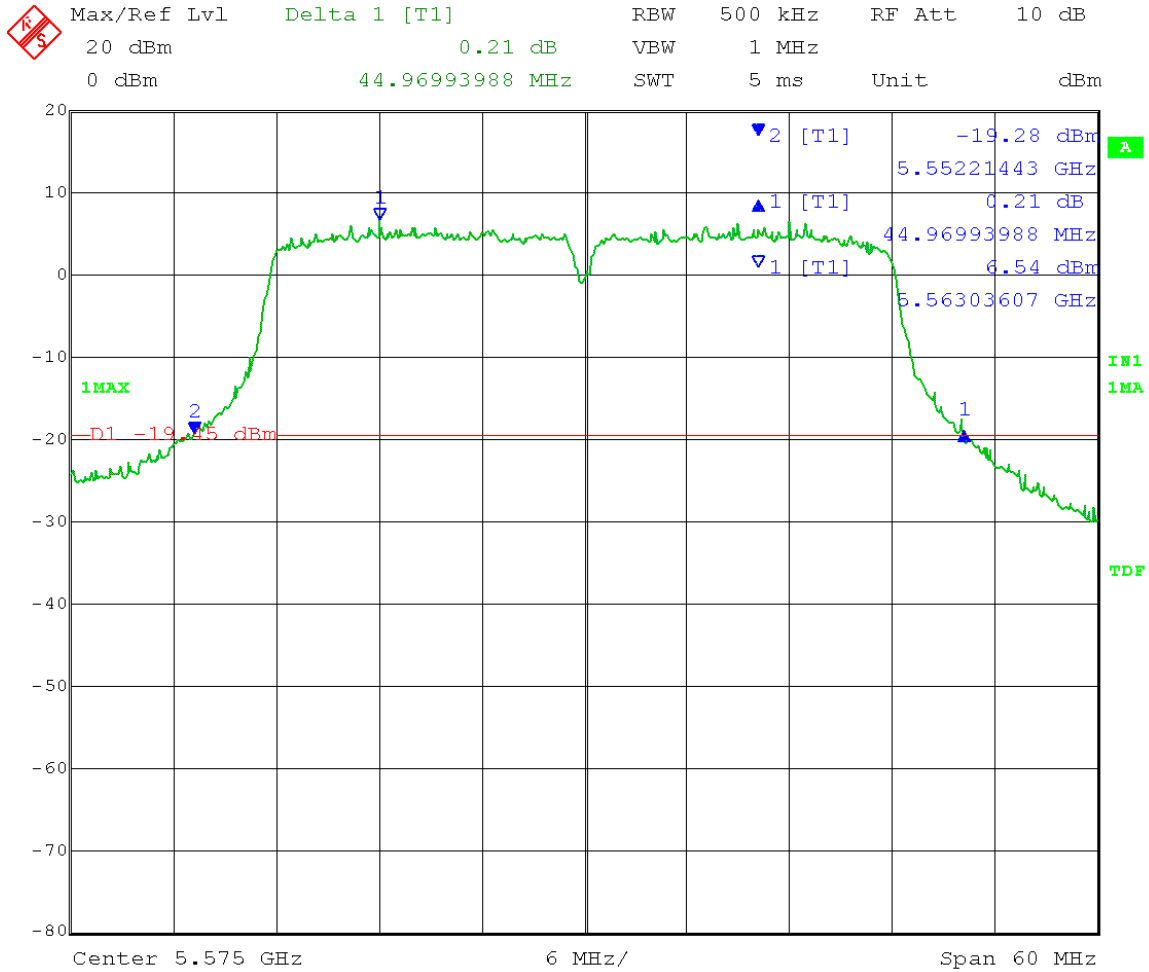
26 dB (D1) Emission Bandwidth = 45.45MHz



Date: 23.AUG.2013 14:39:31

Channel 1:

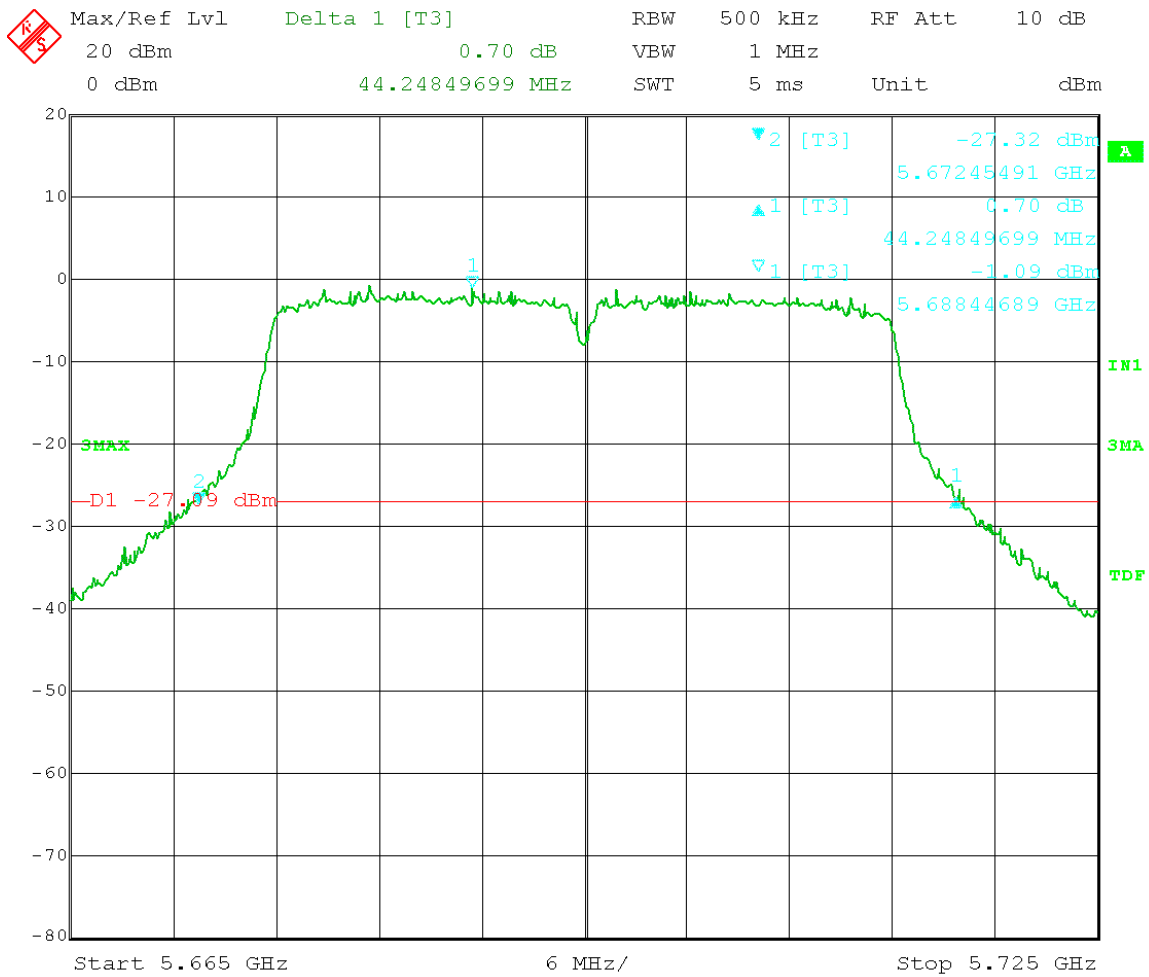
26 dB (D1) Emission Bandwidth = 44.97MHz



Date: 23.AUG.2013 14:47:03

Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger Station 5.4GHz OFDM  
 Test: Emission Bandwidth (26 dB) - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 C) Emission bandwidth: Page 3  
 RBW = 500 kHz  
 High Channel: Transmit = 5.695 GHz  
 Output power setting: 6.5  
 VBW = 1 MHz  
 40MHz BW  
 Channel 0

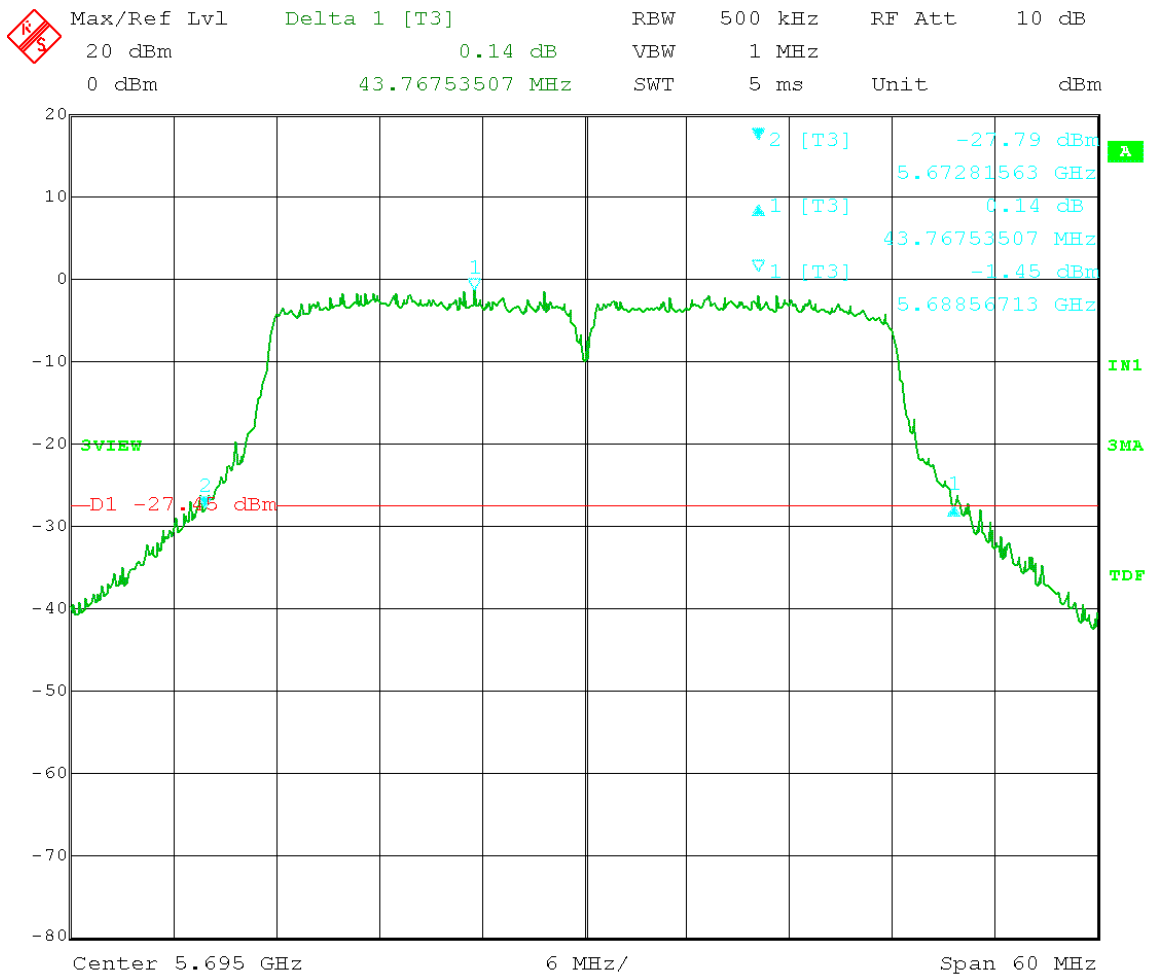
26 dB (D1) Emission Bandwidth = 44.25MHz



Date: 29.JUL.2013 09:14:18

Test Date: 7-26-2013  
 Company: Cambium Networks  
 EUT: Avenger Station 5.4GHz OFDM  
 Test: Emission Bandwidth (26 dB) - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 C) Emission bandwidth: Page 3  
 RBW = 500 kHz  
 High Channel: Transmit = 5.695 GHz  
 Output power setting: 6.5  
 VBW = 1 MHz  
 40MHz BW  
 Channel 1

26 dB (D1) Emission Bandwidth = 43.77MHz



Date: 26.JUL.2013 14:55:18





166 South Carter, Genoa City, WI 53128

Company: Cambium Networks  
Models Tested: C050900C032A & C058900P132A  
Report Number: 19222  
DLS Project: 5946

## Appendix B – Measurement Data

### B3.0 99 Percent Occupied Bandwidth

**Rule Section:** Informative

**Test Procedure:** FCC KDB 789033 D01 General UNII Test Procedures v01r03 – *Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E*

Section D – 99 Percent Occupied Bandwidth

**Description:** SPAN = 1.5 to 5 times the OBW  
RBW = 1% to 5% of OBW  
VBW  $\geq$  RBW  
Detector = Peak  
Trace mode = max hold

Measure the width of the emission using the 99% power bandwidth function of the spectrum analyzer

**Limit:** Informative

**Notes:** Measurements were taken for MCS15 OFDM modulation at the lowest, middle, and highest channels of operation. EUT was set to transmit continuously with 100% duty cycle.

Test Date: 08-9-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013

D) 99% Occupied Bandwidth - Page 4

RBW = 300 kHz

Detector = Peak

Low Channel: Transmit = 5.495 GHz

Output power setting: 7

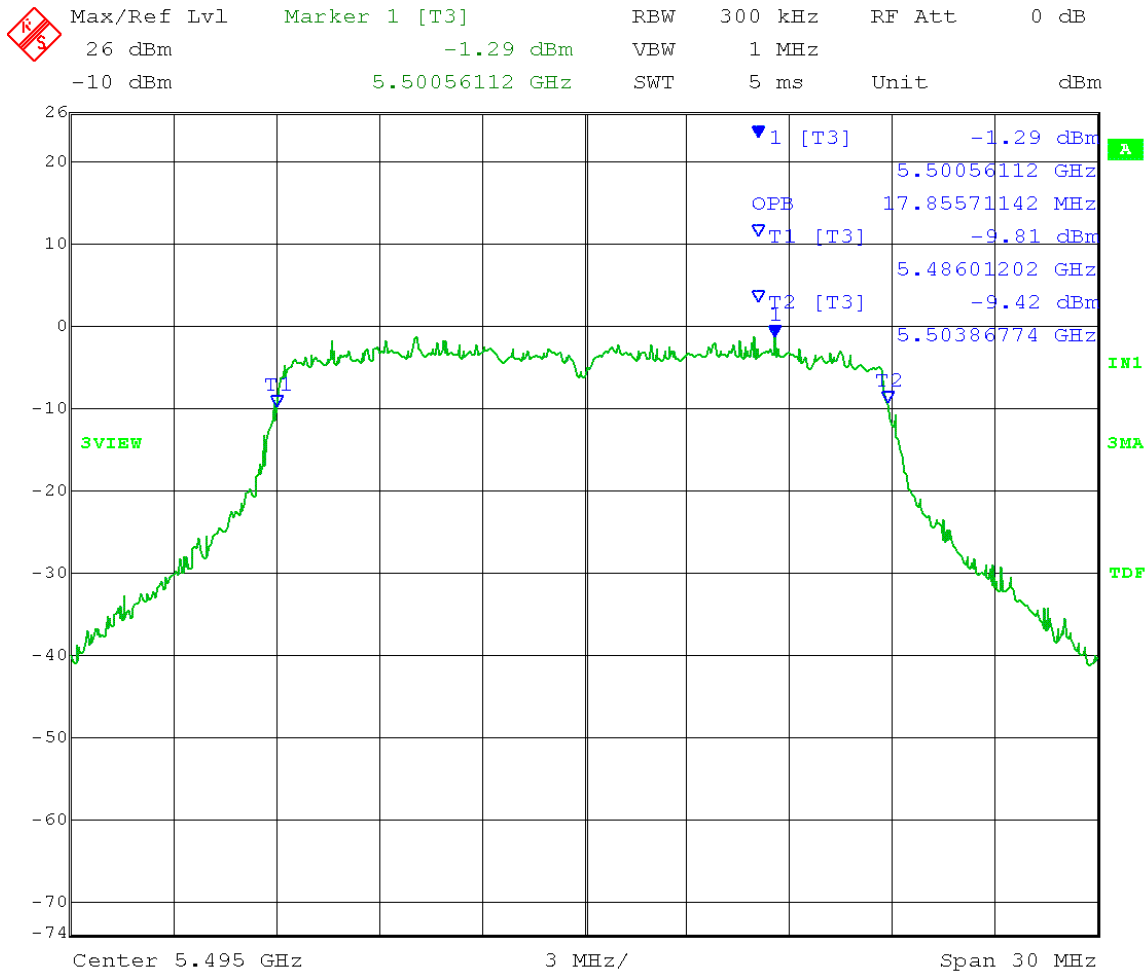
VBW = 1 MHz

Trace = Max Hold

20MHz BW

Channel 0

**99% OBW = 17.86MHz**

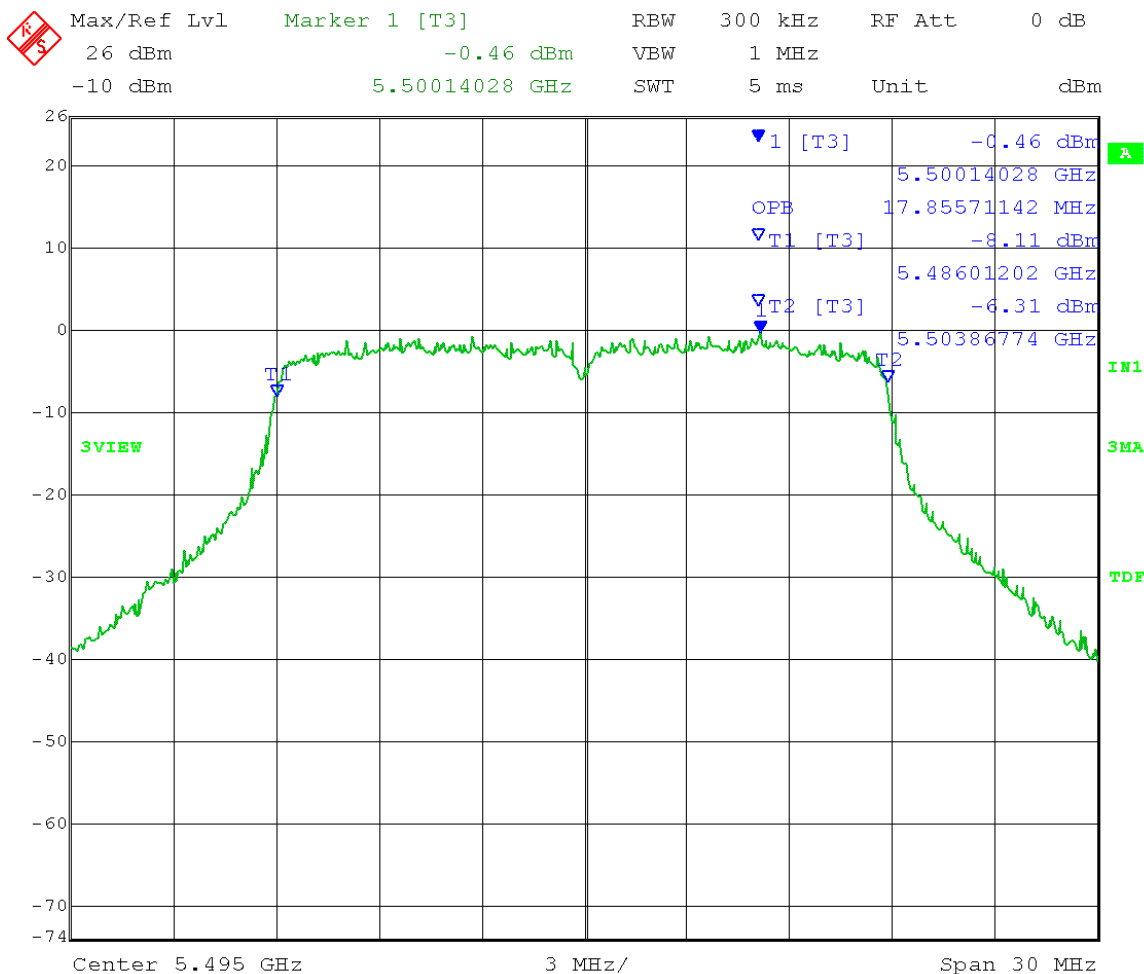


Date: 9.AUG.2013 08:30:11

Test Date: 08-9-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 D) 99% Occupied Bandwidth - Page 4  
 RBW = 300 kHz  
 Detector = Peak  
 Low Channel: Transmit = 5.495 GHz  
 Output power setting: 7

VBW = 1 MHz  
 Trace = Max Hold  
 20MHz BW  
 Channel 1

**99% OBW = 17.86MHz**



Date: 9.AUG.2013 08:42:48

Test Date: 08-23-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013

D) 99% Occupied Bandwidth - Page 4

RBW = 300 kHz

Detector = Peak

Mid Channel: Transmit = 5.575 GHz

Output power setting: 14

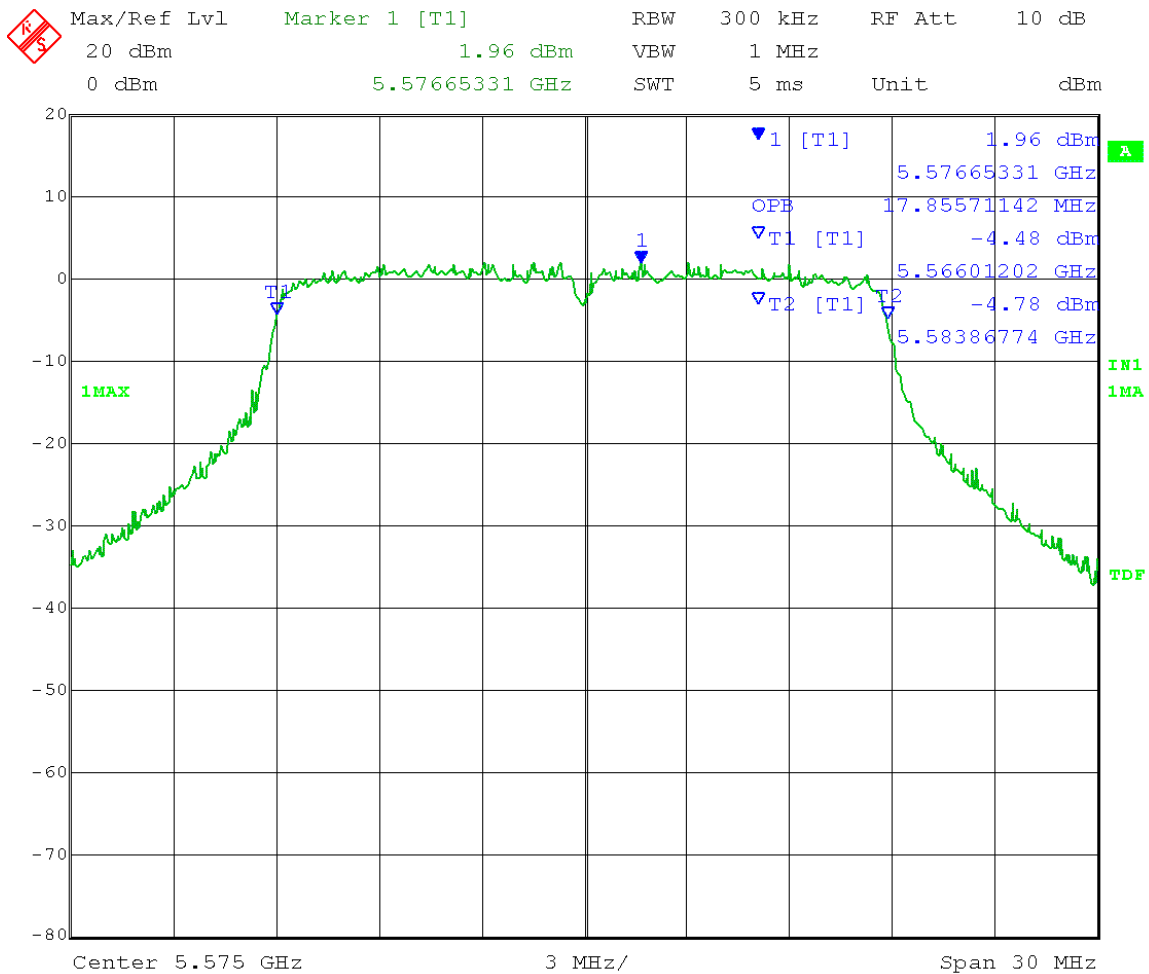
VBW = 1 MHz

Trace = Max Hold

20MHz BW

Channel 0


**99% OBW = 17.86MHz**

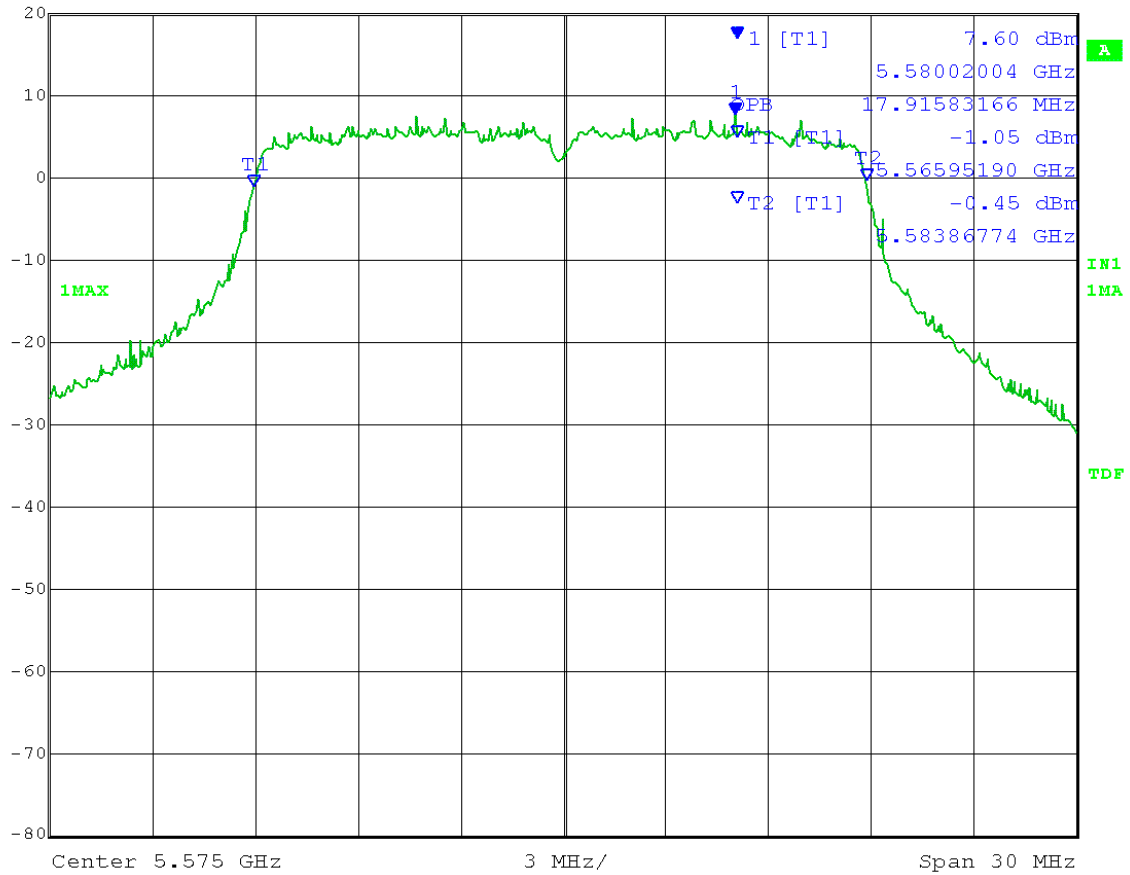


Date: 23.AUG.2013 14:29:55

Channel 1:

**99% OBW = 17.92MHz**

	Max/Ref Lvl	Marker 1 [T1]	RBW	300 kHz	RF Att	10 dB
	20 dBm	7.60 dBm	VBW	1 MHz		
	0 dBm	5.58002004 GHz	SWT	5 ms	Unit	dBm



Date: 23.AUG.2013 14:51:58

Test Date: 08-9-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013

D) 99% Occupied Bandwidth - Page 4

RBW = 300 kHz

Detector = Peak

High Channel: Transmit = 5.705 GHz

Output power setting: 7

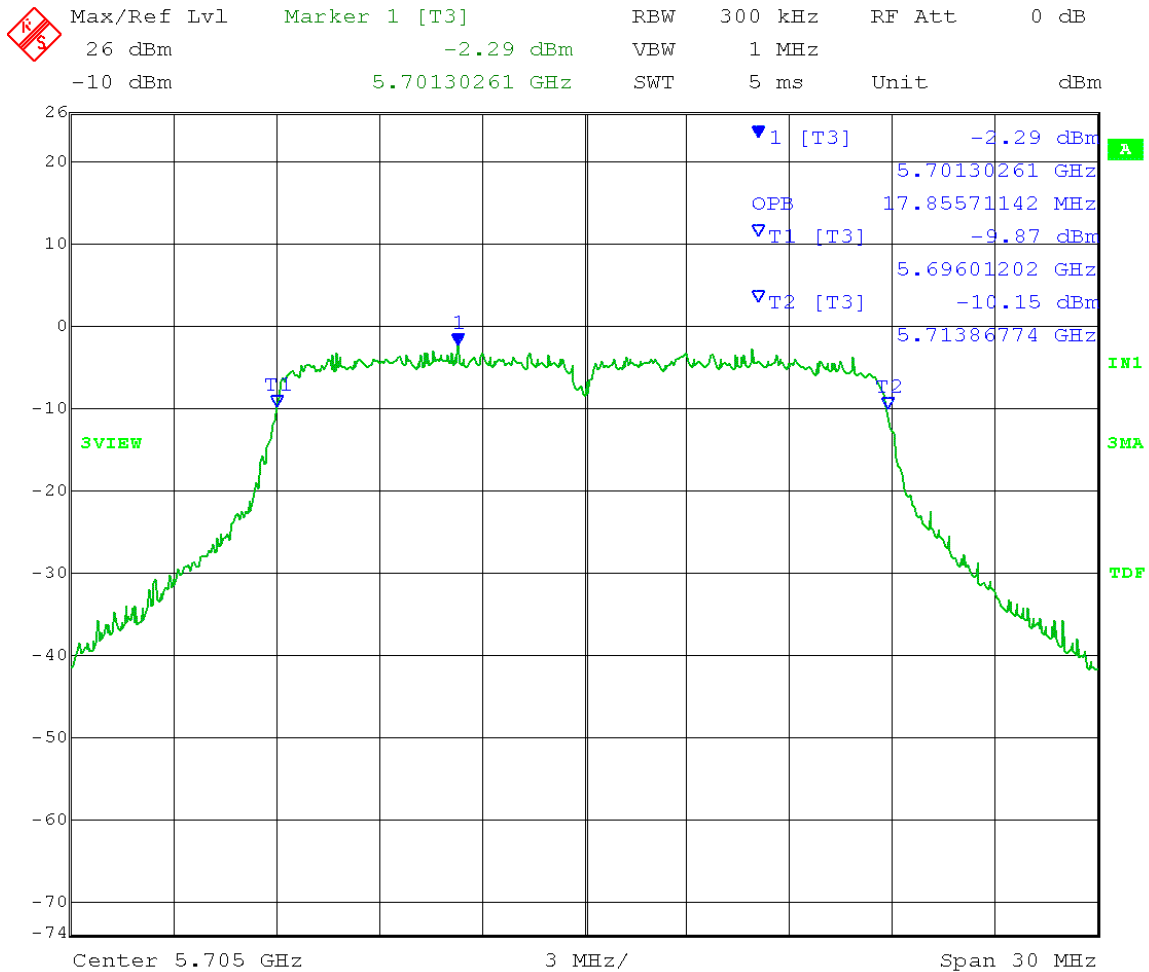
VBW = 1 MHz

Trace = Max Hold

20MHz BW

Channel 0

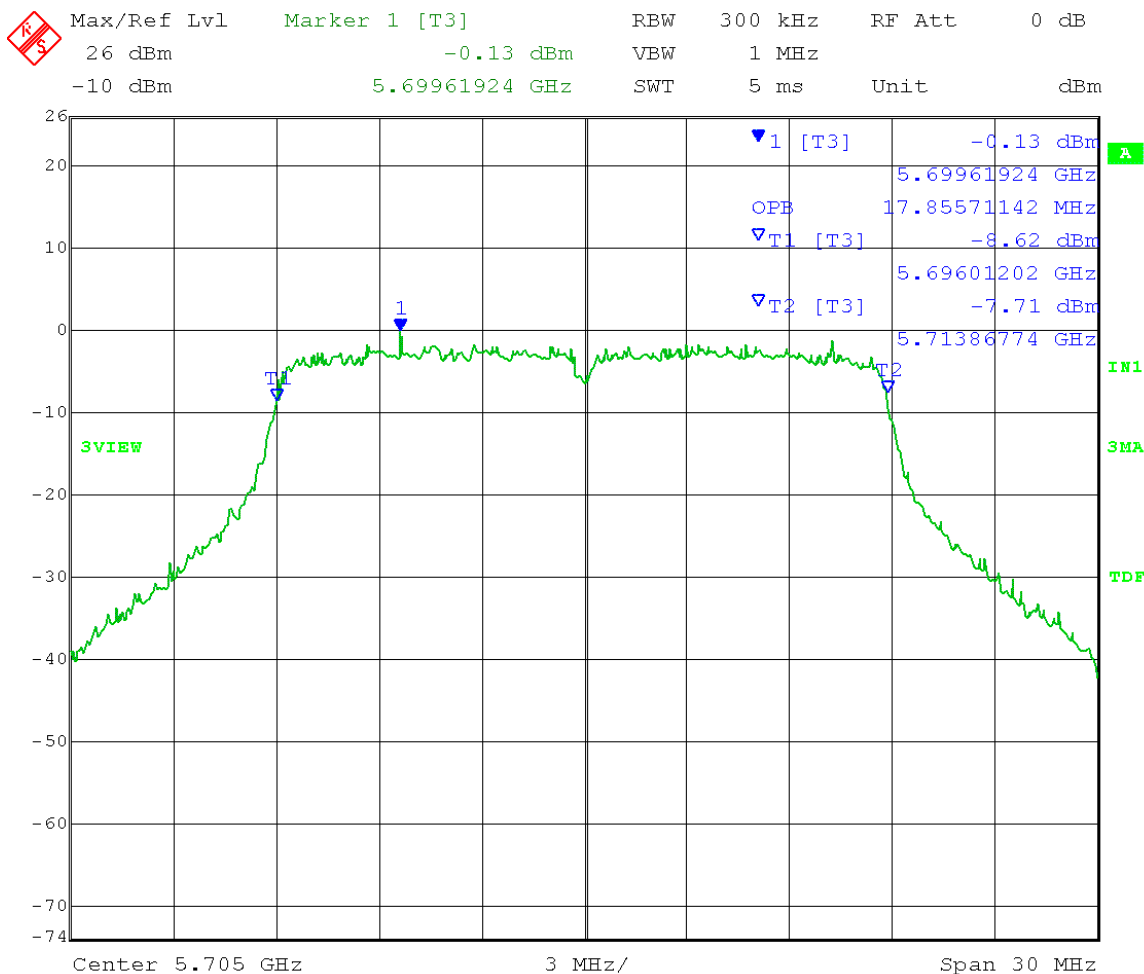
**99% OBW = 17.86MHz**



Date: 9.AUG.2013 08:34:16

Test Date: 08-9-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 D) 99% Occupied Bandwidth - Page 4  
 RBW = 300 kHz  
 Detector = Peak  
 High Channel: Transmit = 5.705 GHz  
 Output power setting: 7  
 VBW = 1 MHz  
 Trace = Max Hold  
 20MHz BW  
 Channel 1

**99% OBW = 17.86MHz**



Date: 9.AUG.2013 08:38:01

Test Date: 07-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013

D) 99% Occupied Bandwidth - Page 4

RBW = 1 MHz

VBW = 3 MHz

Detector = Peak

Trace = Max Hold

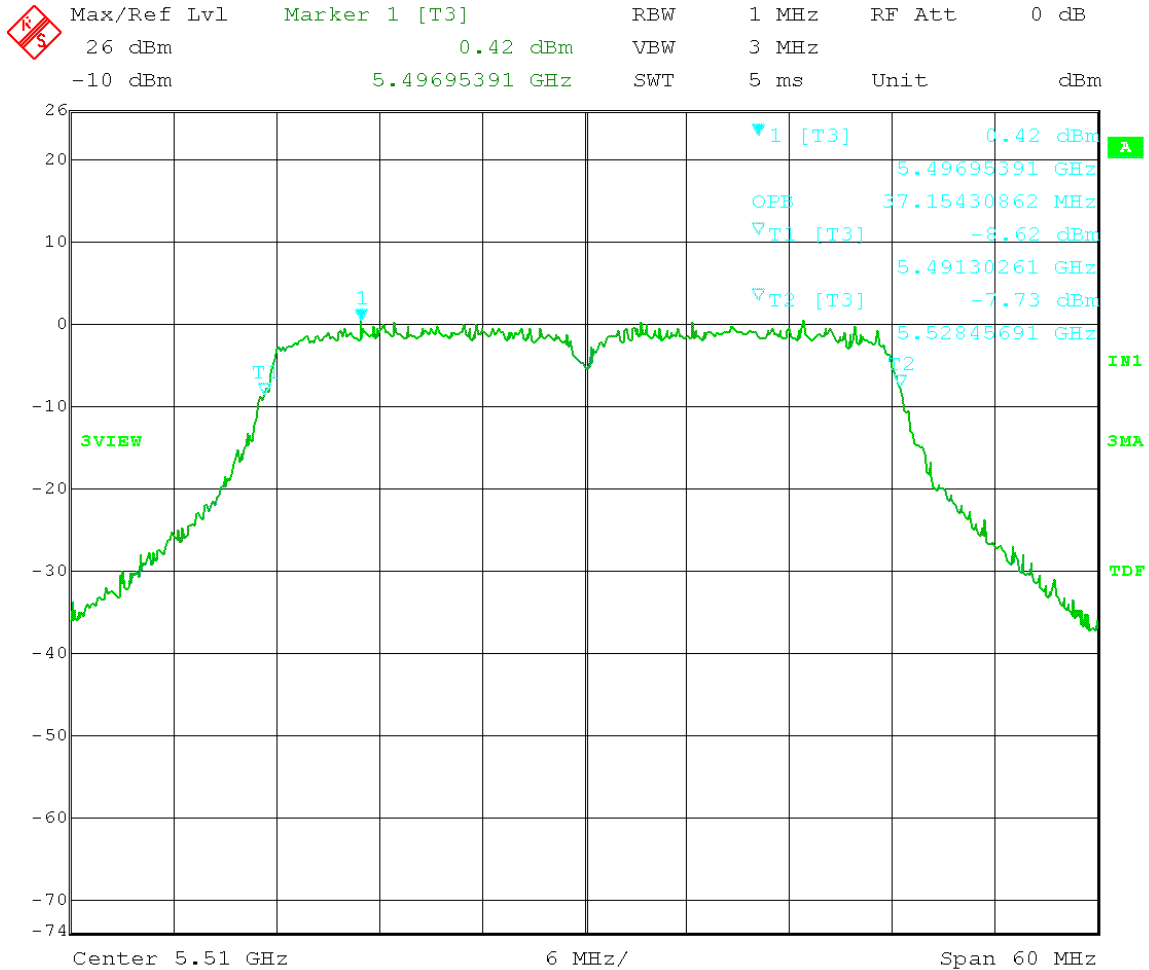
Low Channel: Transmit = 5.510 GHz

40MHz BW

Output power setting: 6.5

Channel 0

**99% OBW = 37.15MHz**

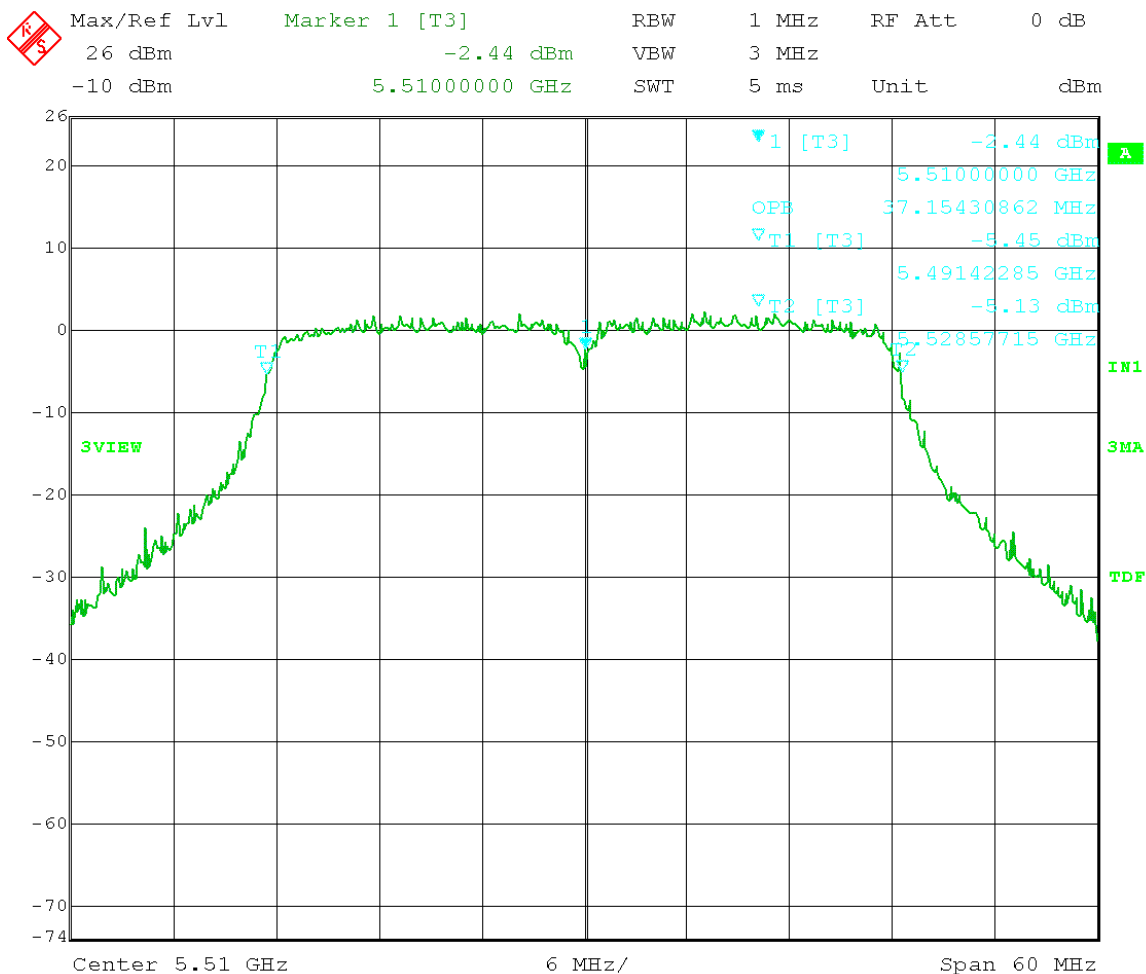


Date: 29.JUL.2013 10:05:17



Test Date: 07-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 D) 99% Occupied Bandwidth - Page 4  
 RBW = 1 MHz  
 Detector = Peak  
 Low Channel: Transmit = 5.510 GHz  
 Output power setting: 6.5  
 VBW = 3 MHz  
 Trace = Max Hold  
 40MHz BW  
 Channel 1

**99% OBW = 37.15MHz**

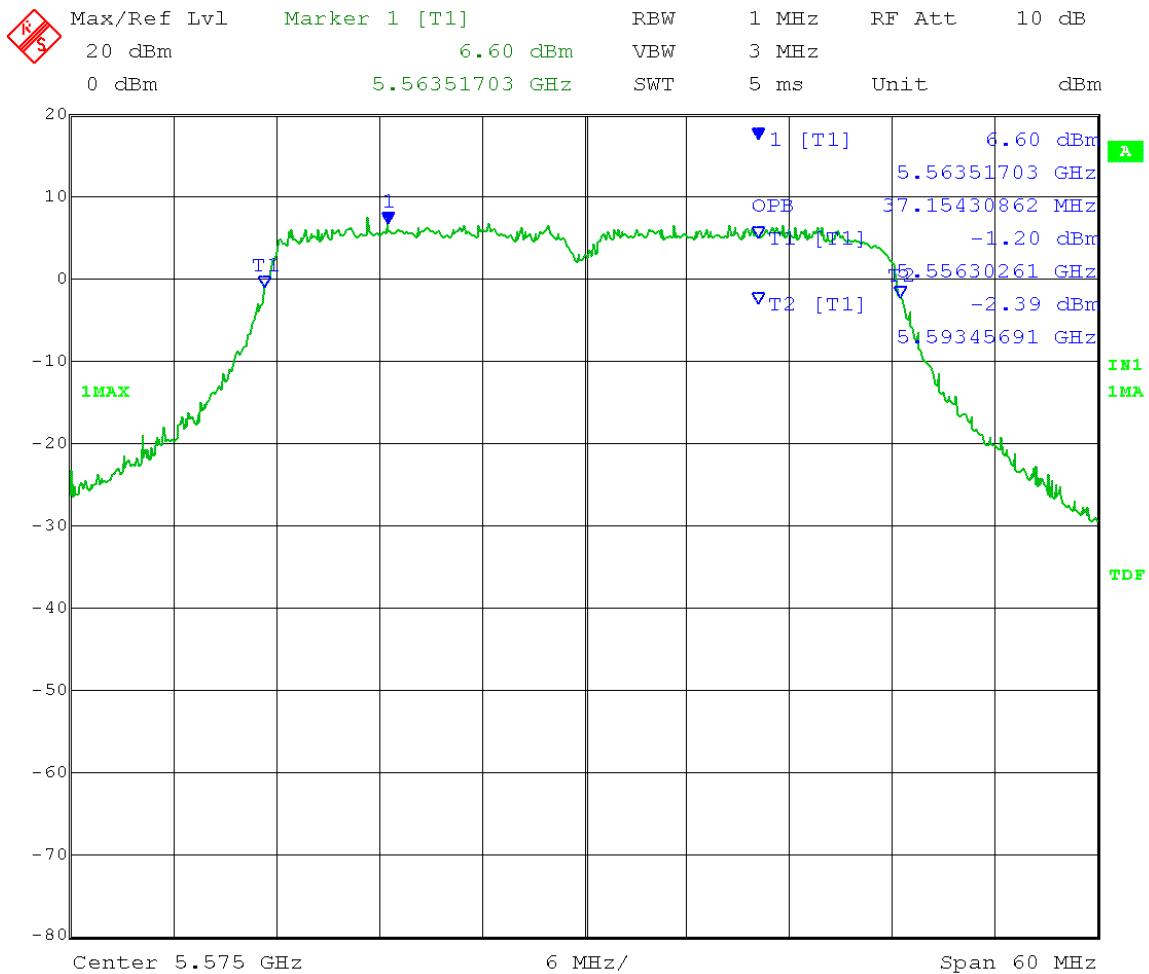


Date: 29.JUL.2013 10:36:30

Test Date: 08-23-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 D) 99% Occupied Bandwidth - Page 4  
 RBW = 1 MHz  
 Detector = Peak  
 Mid Channel: Transmit = 5.575 GHz  
 Output power setting: 14  
 VBW = 3 MHz  
 Trace = Max Hold  
 40MHz BW

Channel 0:


**99% OBW = 37.15MHz**

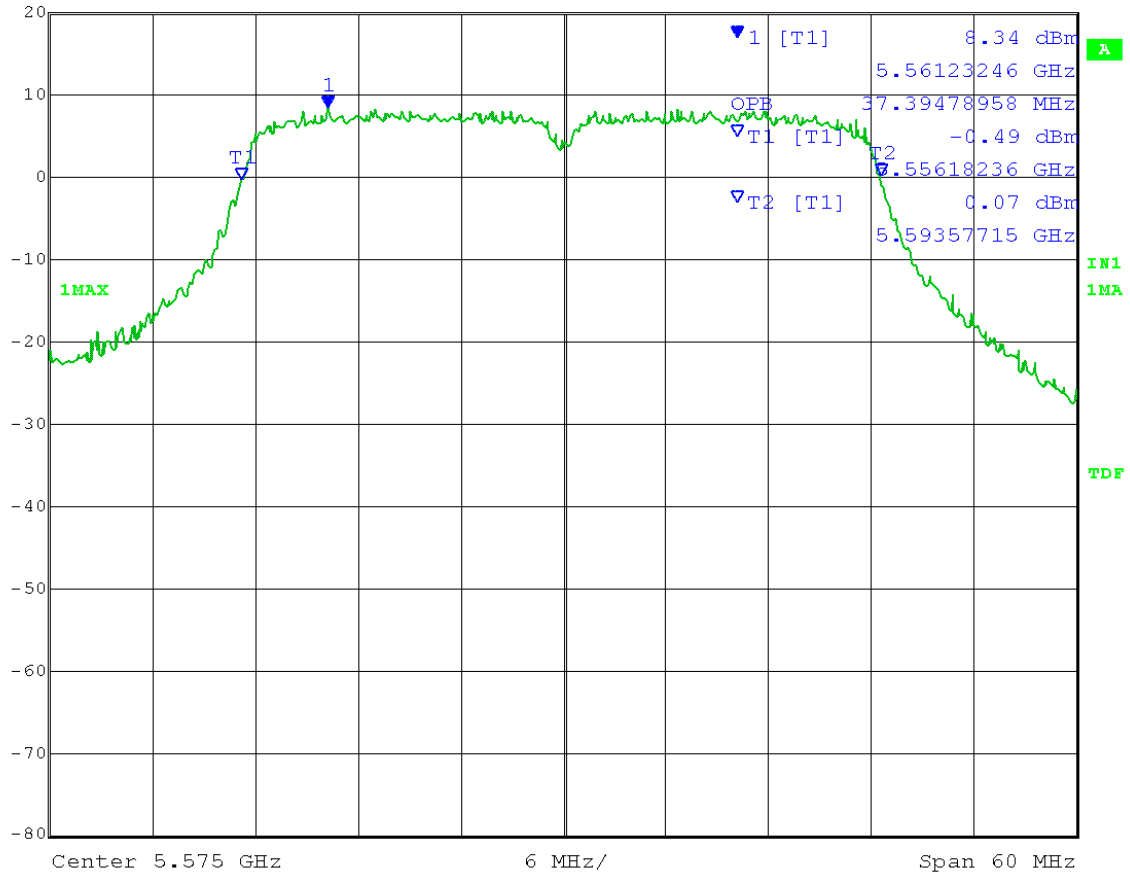


Date: 23.AUG.2013 14:33:19

Channel 1:

**99% OBW = 37.39MHz**

	Max/Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	10 dB
	20 dBm	8.34 dBm	VBW	3 MHz		
	0 dBm	5.56123246 GHz	SWT	5 ms	Unit	dBm



Date: 23.AUG.2013 14:49:16

Test Date: 07-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013

D) 99% Occupied Bandwidth - Page 4

RBW = 1 MHz

VBW = 3 MHz

Detector = Peak

Trace = Max Hold

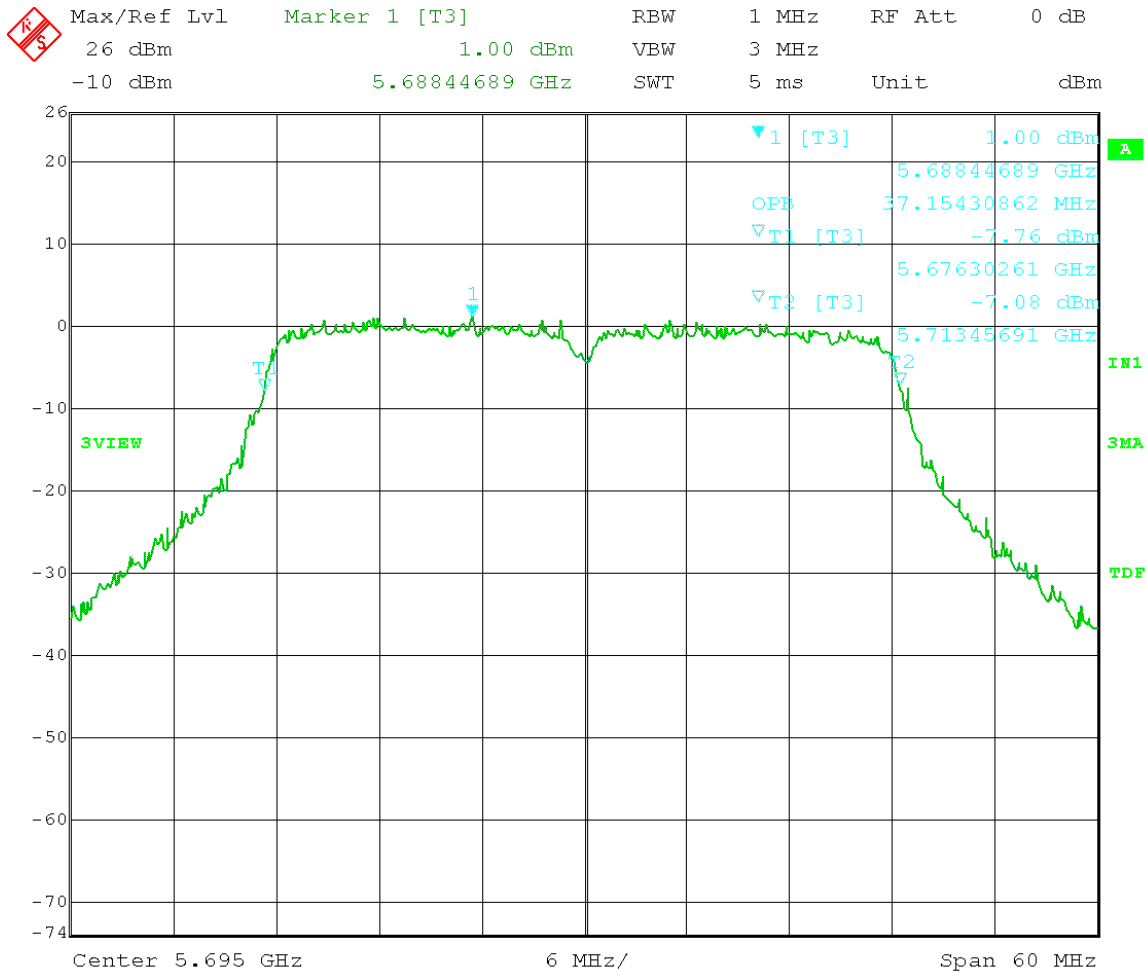
High Channel: Transmit = 5.695 GHz

40MHz BW

Output power setting: 6.5

Channel 0

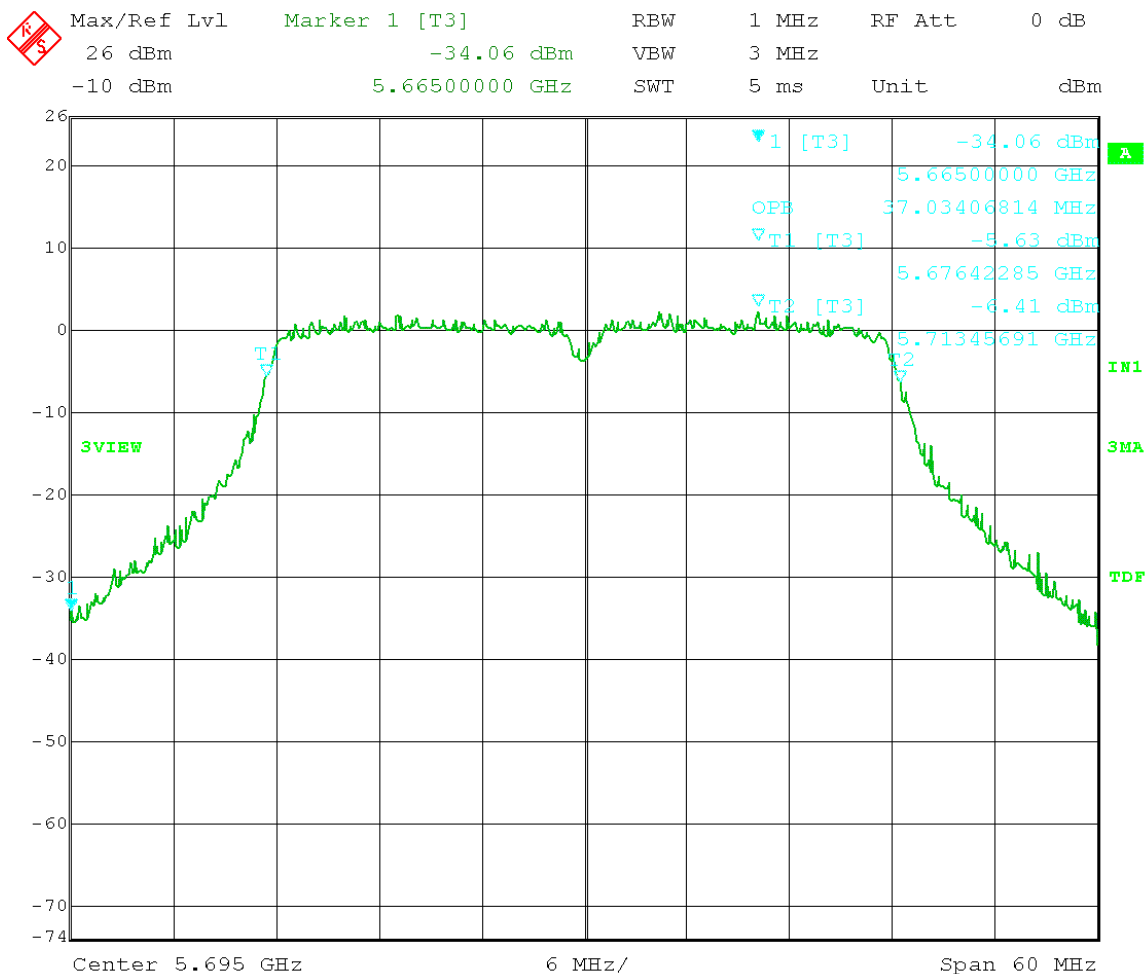
**99% OBW = 37.15MHz**



Date: 29.JUL.2013 10:02:17

Test Date: 07-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz OFDM  
 Test: 99% Occupied Bandwidth - Conducted  
 Operator: Lillian Li  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 D) 99% Occupied Bandwidth - Page 4  
 RBW = 1 MHz  
 Detector = Peak  
 High Channel: Transmit = 5.695 GHz  
 Output power setting: 6.5  
 VBW = 3 MHz  
 Trace = Max Hold  
 40MHz BW  
 Channel 1

**99% OBW = 37.03MHz**



Date: 29.JUL.2013 10:40:01



166 South Carter, Genoa City, WI 53128

Company: Cambium Networks  
Models Tested: C050900C032A & C058900P132A  
Report Number: 19222  
DLS Project: 5946

## Appendix B – Measurement Data

### B4.0 Maximum Conducted Output Power

**Rule Section:** Section 15.407(a)(2)

**Test Procedure:** FCC KDB 789033 D01 General UNII Test Procedures v01r03 – *Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E*

Section E(3)(a) Method PM (Measurement using an RF average power meter):  
Measurements performed using a wideband RF power meter with a thermocouple detector

**Description:** Measure the average power of the transmitter  
Add  $10 \log(1/x)$ , where  $x$  is the duty cycle, to the measured power  
Add  $10 \log(N)$ , where  $N$  is the number of outputs, for MIMO operation  
(according to FCC KDB 662911)

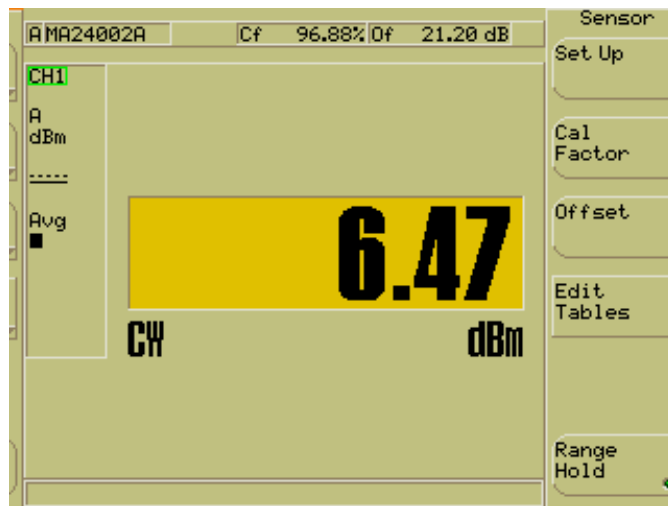
**Limit:** Lesser of: 250 mW (24 dBm) or  $11 \text{ dBm} + 10 \log B$ , where  $B$  is the 26 dB emission bandwidth in MHz.  
Limit shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi

**Results:** Passed

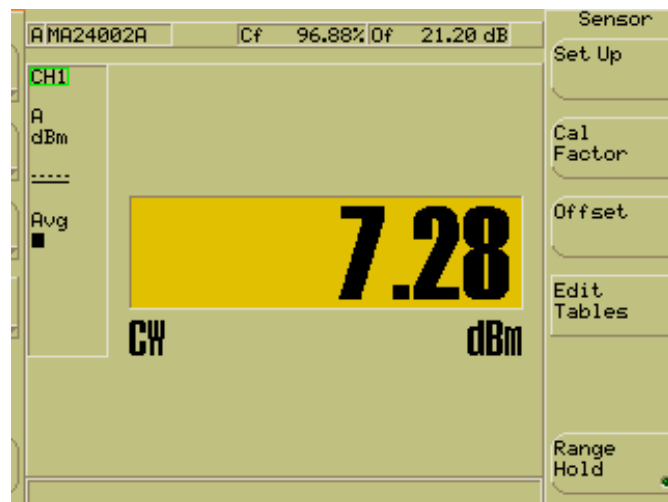
**Notes:** Measurements were taken for MCS15 OFDM modulation at the lowest, middle, and highest channels of operation. EUT was set to transmit continuously with 100% duty cycle.

Test Date: 7-29-2013  
Company: Cambium Networks  
EUT: Avenger SM 5.4 GHz OFDM  
Test: Maximum conducted output power – Conducted  
Operator: Lillian L  
Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
E)3) Measurement using a power meter(PM) - Page 8  
Limit: [15.407(a)(2)]: 24.0 dBm conducted.  
Operating Mode: Point-to-Multipoint; Antenna Gain = 15 dBi  
EUT Limit:  $24 - (15 - 6) = 15$  dBm  
Low Channel: Transmit = 5.495 GHz 20MHz BW  
Output power setting: 7

Ch 0:  
Maximum conducted output power =  $6.47\text{dBm} + 3$  dB (MIMO)  
=  $9.47\text{dBm} < 15\text{dBm} = \text{Pass}$

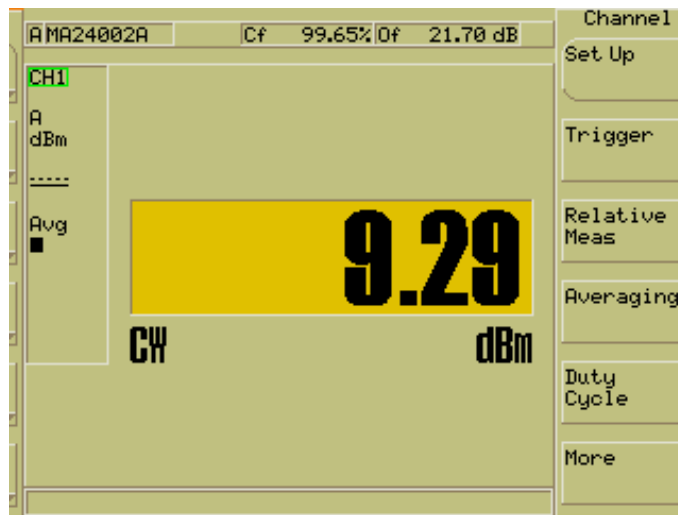


Ch 1:  
Maximum conducted output power =  $7.28\text{dBm} + 3$  dB (MIMO)  
=  $10.28\text{dBm} < 15\text{dBm} = \text{Pass}$

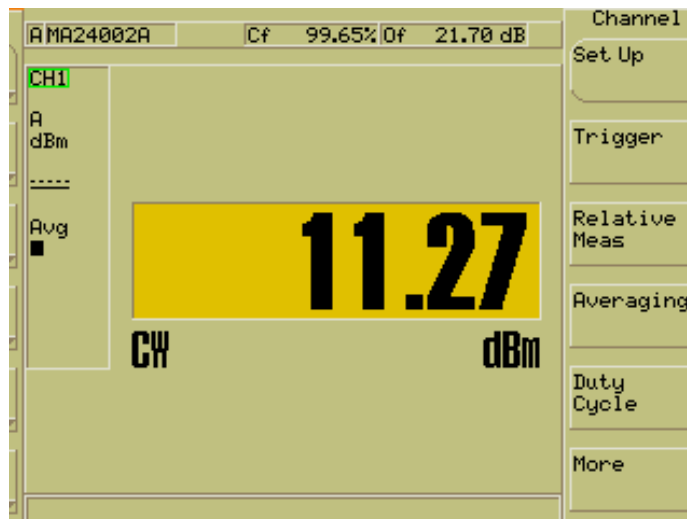


Test Date: 8-26-2013  
Company: Cambium Networks  
EUT: Avenger SM 5.4 GHz OFDM  
Test: Maximum conducted output power – Conducted  
Operator: Lillian L  
Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
E)3) Measurement using a power meter(PM) - Page 8  
Limit: [15.407(a)(2)]: 24.0 dBm conducted.  
Operating Mode: Point-to-Multipoint; Antenna Gain = 15 dBi  
EUT Limit:  $24 - (15 - 6) = 15$  dBm  
Mid Channel: Transmit = 5.575 GHz 20MHz BW  
Output power setting: 10

Ch 0:  
Maximum conducted output power =  $9.29\text{dBm} + 3$  dB (MIMO)  
=  $12.29\text{dBm} < 15\text{dBm} = \text{Pass}$



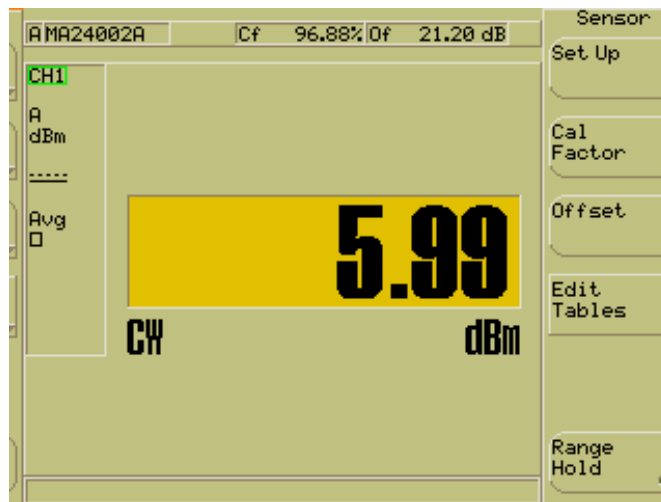
Ch 1:  
Maximum conducted output power =  $11.27\text{dBm} + 3$  dB (MIMO)  
=  $14.27\text{dBm} < 15\text{dBm} = \text{Pass}$



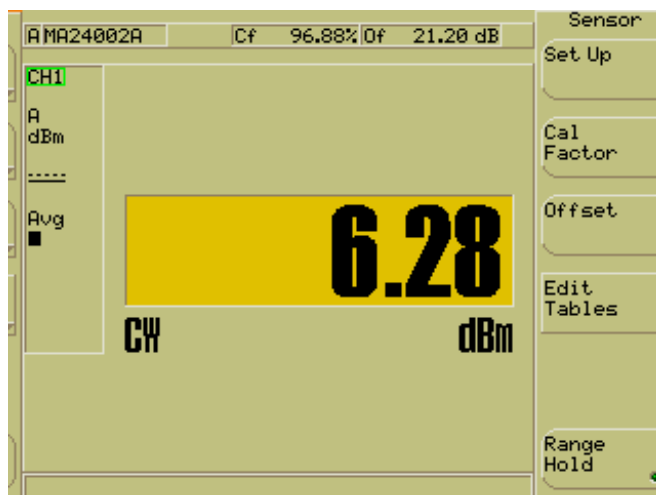


Test Date: 7-29-2013  
Company: Cambium Networks  
EUT: Avenger SM 5.4 GHz OFDM  
Test: Maximum conducted output power – Conducted  
Operator: Lillian L  
Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
E)3) Measurement using a power meter(PM) - Page 8  
Limit: [15.407(a)(2)]: 24.0 dBm conducted.  
Operating Mode: Point-to-Multipoint; Antenna Gain = 15 dBi  
EUT Limit:  $24 - (15 - 6) = 15$  dBm  
High Channel: Transmit = 5.705 GHz 20MHz BW  
Output power setting: 7

Ch 0:  
Maximum conducted output power =  $5.99\text{dBm} + 3$  dB (MIMO)  
 $= 8.99\text{dBm} < 15\text{dBm} = \text{Pass}$

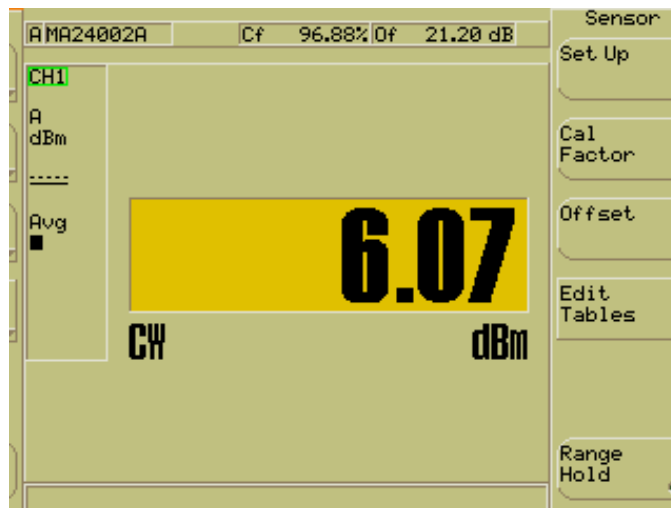


Ch 1:  
Maximum conducted output power =  $6.28\text{dBm} + 3$  dB (MIMO)  
 $= 9.28\text{dBm} < 15\text{dBm} = \text{Pass}$

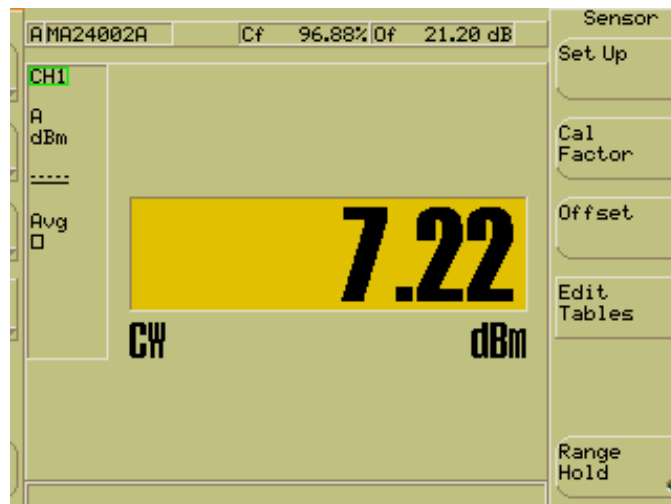


Test Date: 7-29-2013  
Company: Cambium Networks  
EUT: Avenger SM 5.4 GHz OFDM  
Test: Maximum conducted output power – Conducted  
Operator: Lillian L  
Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
E3) Measurement using a power meter(PM) - Page 8  
Limit: [15.407(a)(2)]: 24.0 dBm conducted.  
Operating Mode: Point-to-Multipoint; Antenna Gain = 15 dBi  
EUT Limit:  $24 - (15 - 6) = 15$  dBm  
Low Channel: Transmit = 5.510 GHz 40MHz BW  
Output power setting: 6.5

Ch 0:  
Maximum conducted output power =  $6.07\text{dBm} + 3$  dB (MIMO)  
=  $9.07$  dBm <  $15\text{dBm}$  = Pass

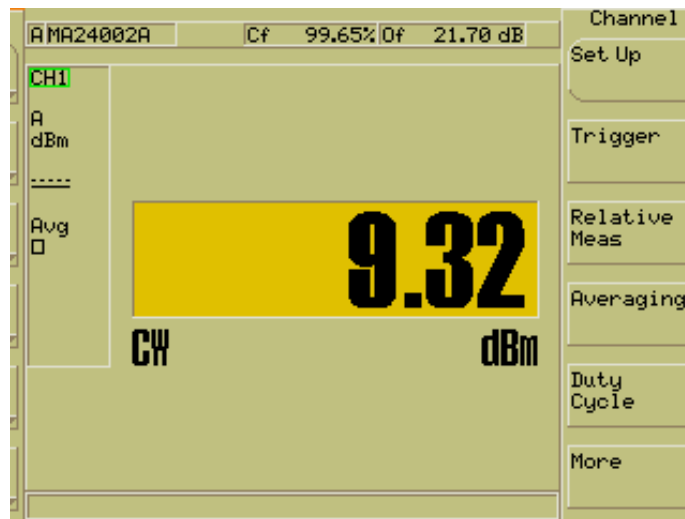


Ch 1:  
Maximum conducted output power =  $7.22\text{dBm} + 3$  dB (MIMO)  
=  $10.22\text{dBm}$  <  $15\text{dBm}$  = Pass

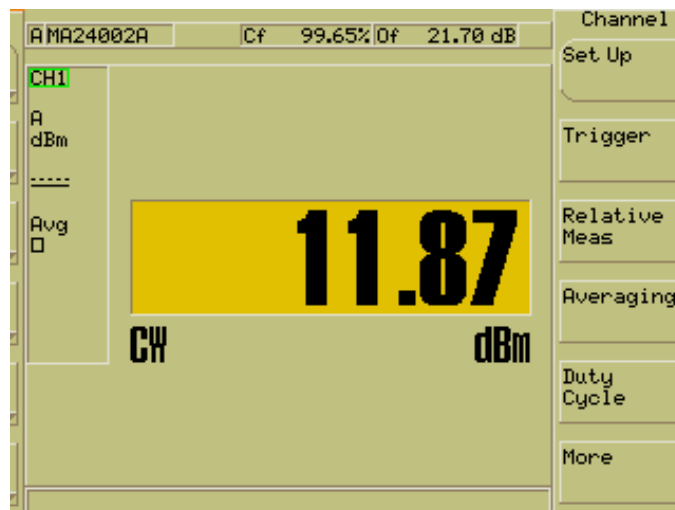


Test Date: 8-26-2013  
Company: Cambium Networks  
EUT: Avenger SM 5.4 GHz OFDM  
Test: Maximum conducted output power – Conducted  
Operator: Lillian L  
Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
E)3) Measurement using a power meter(PM) - Page 8  
Limit: [15.407(a)(2)]: 24.0 dBm conducted.  
Operating Mode: Point-to-Multipoint; Antenna Gain = 15 dBi  
EUT Limit:  $24 - (15 - 6) = 15$  dBm  
Mid Channel: Transmit = 5.575 GHz 40MHz BW  
Output power setting: 10.5

Ch 0:  
Maximum conducted output power =  $9.32\text{dBm} + 3$  dB (MIMO)  
=  $12.32$  dBm <  $15\text{dBm}$  = Pass

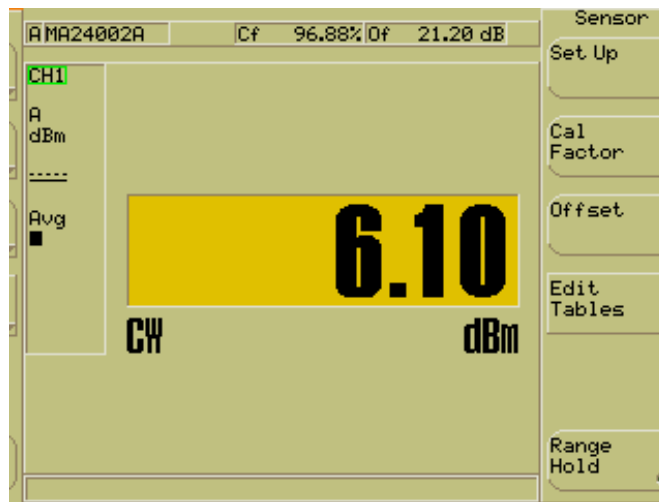


Ch 1:  
Maximum conducted output power =  $11.87\text{dBm} + 3$  dB (MIMO)  
=  $14.87\text{dBm}$  <  $15\text{dBm}$  = Pass

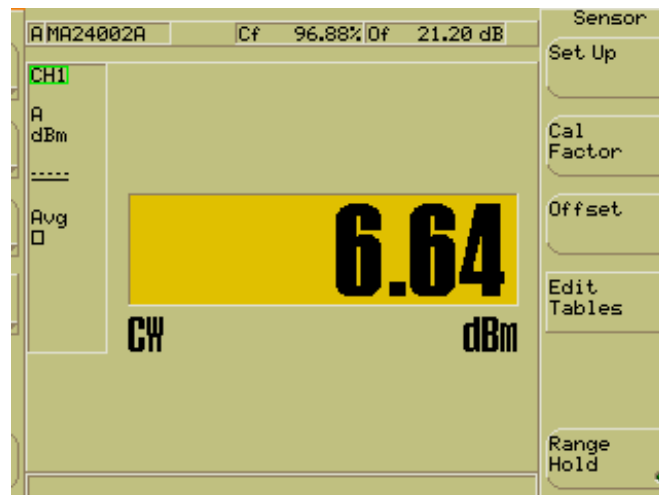


Test Date: 7-29-2013  
Company: Cambium Networks  
EUT: Avenger SM 5.4 GHz OFDM  
Test: Maximum conducted output power – Conducted  
Operator: Lillian L  
Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
E)3) Measurement using a power meter(PM) - Page 8  
Limit: [15.407(a)(2)]: 24.0 dBm conducted.  
Operating Mode: Point-to-Multipoint; Antenna Gain = 15 dBi  
EUT Limit:  $24 - (15 - 6) = 15$  dBm  
High Channel: Transmit = 5.695 GHz 40MHz BW  
Output power setting: 6.5

Ch 0:  
Maximum conducted output power =  $6.10\text{dBm} + 3$  dB (MIMO)  
=  $9.10$  dBm <  $15\text{dBm}$  = Pass



Ch 1:  
Maximum conducted output power =  $6.64\text{dBm} + 3$  dB (MIMO)  
=  $9.64\text{dBm}$  <  $15\text{dBm}$  = Pass





166 South Carter, Genoa City, WI 53128

Company: Cambium Networks  
Models Tested: C050900C032A & C058900P132A  
Report Number: 19222  
DLS Project: 5946

## Appendix B – Measurement Data

### B5.0 Peak Power Spectral Density – Conducted

**Rule Section:** Section 15.407(a)(2)

**Test Procedure:** FCC KDB 789033 D01 General UNII Test Procedures v01r03 – *Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E*

Section F – Peak power spectral density (PPSD)  
Using method E(2)(b) SA-1 for power spectrum

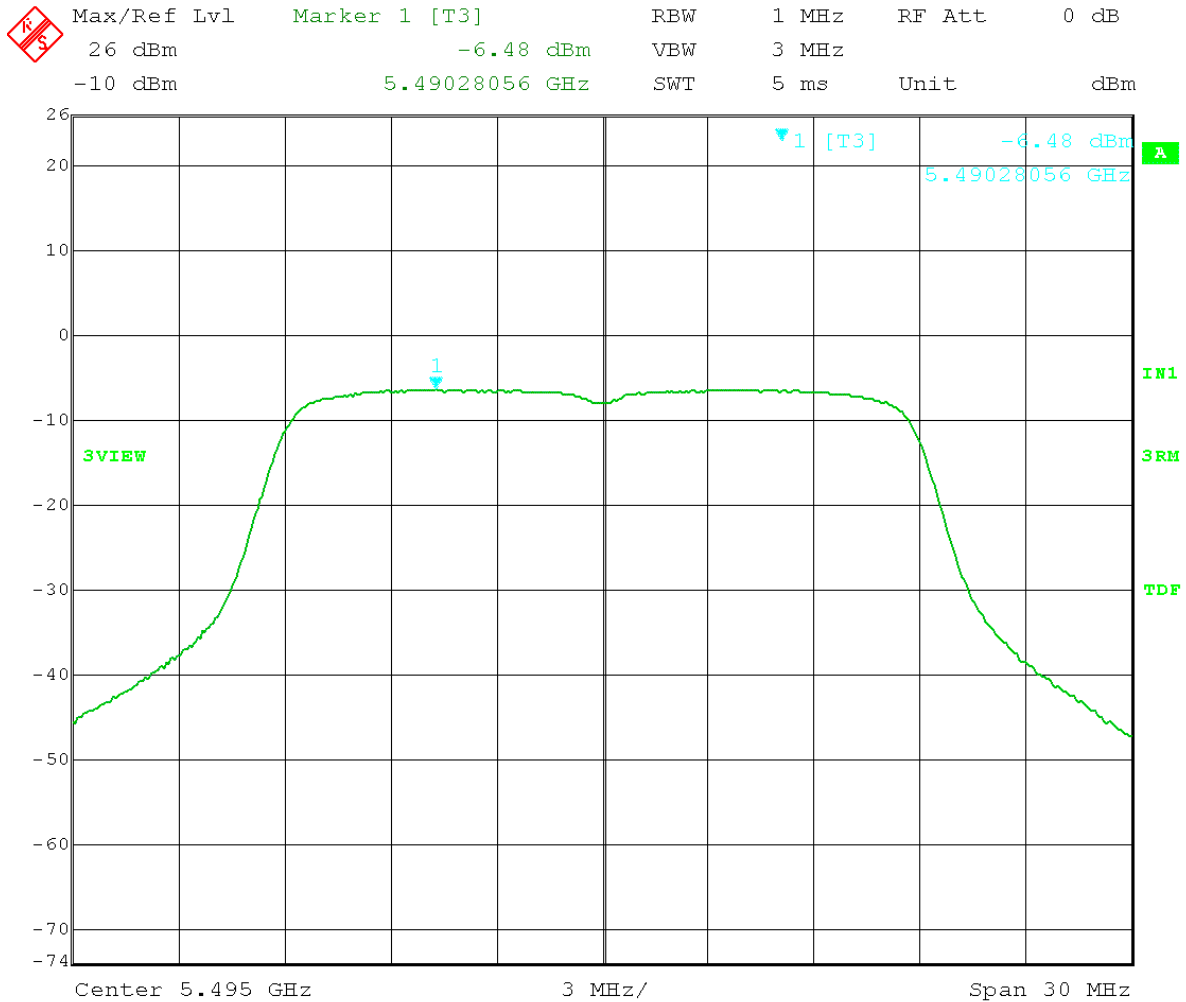
**Description:** SPAN: set to encompass entire emission bandwidth  
RBW = 1 MHz  
VBW  $\geq$  3 MHz  
Number of points  $\geq$  2 x Span/RBW  
Sweep time: auto  
Detector = RMS  
Sweep: trace average 200 sweeps in RMS mode  
Use peak search to find the peak of the spectrum

**Limit:** 11 dBm in any 1 MHz band  
Limit shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi

**Results:** Passed

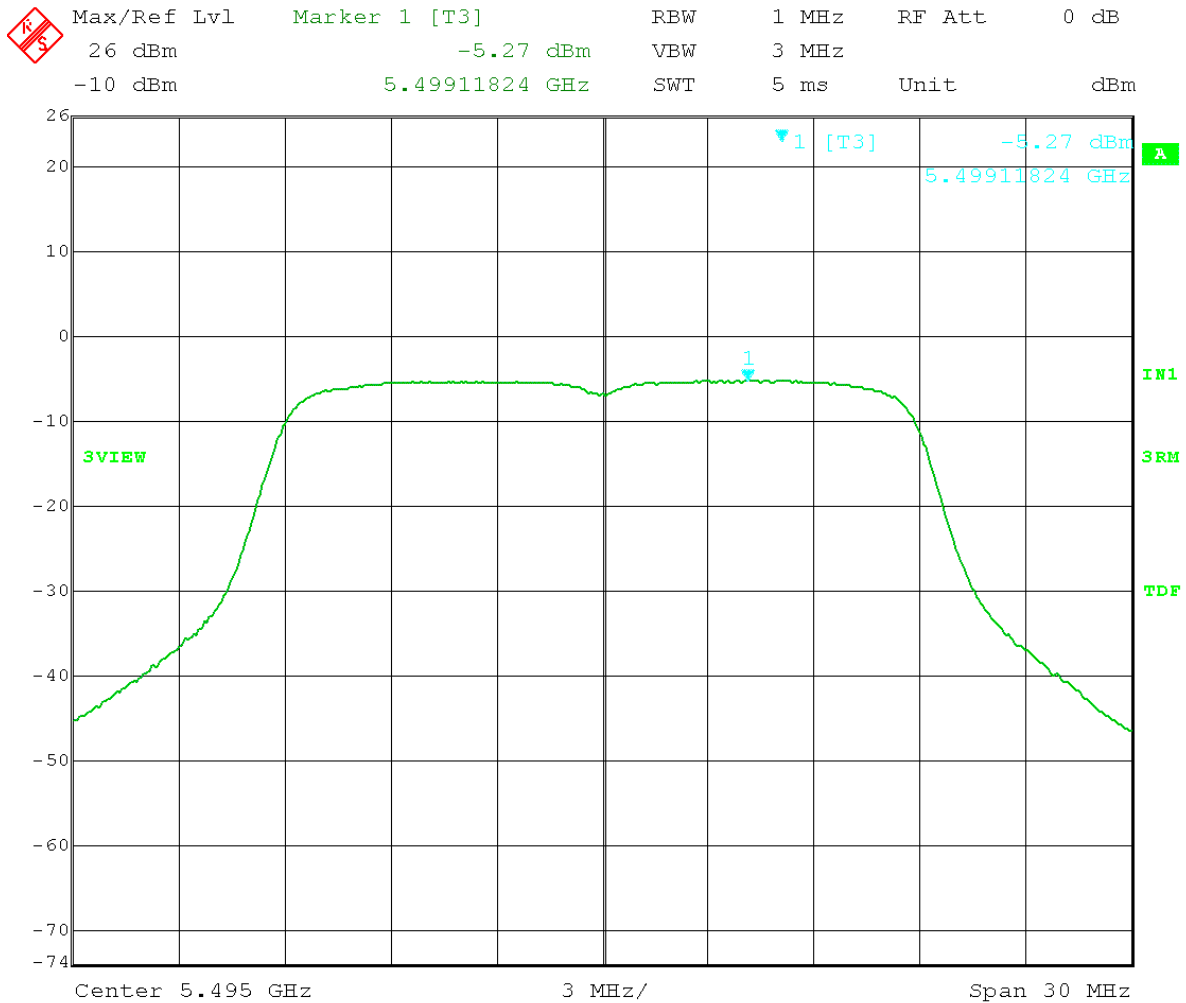
**Notes:** Measurements were taken for MCS15 OFDM modulation at the lowest, middle, and highest channels of operation. EUT was set to transmit continuously with 100% duty cycle.

Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 Low Channel: Transmit = 5.495GHz 20MHz BW  
 Output power setting: 7 Channel 0  
 26 dB Emission Bandwidth = 21.28MHz  
 PPSD = -6.48dBm < -1 dBm = Pass



Date: 29.JUL.2013 14:04:34

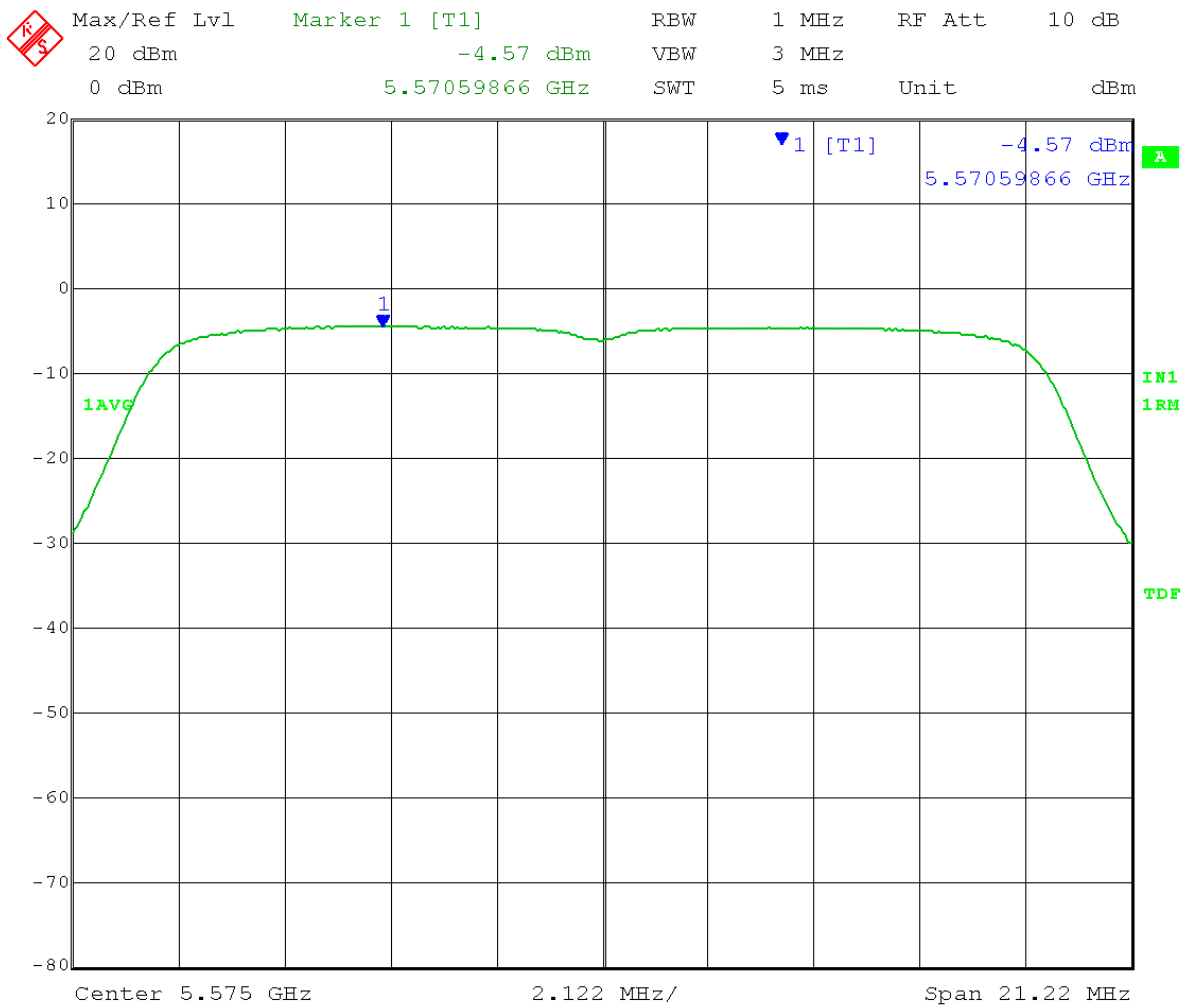
Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 Low Channel: Transmit = 5.495GHz 20MHz BW  
 Output power setting: 7 Channel 1  
 26 dB Emission Bandwidth = 21.40MHz  
 PPSD = -5.27 dBm < -1 dBm = Pass



Date: 29.JUL.2013 14:14:12

Test Date: 8-23-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 Mid Channel: Transmit = 5.575GHz 20MHz BW  
 Output power setting: 10

Channel 0:  
 26 dB Emission Bandwidth = 21.22MHz  
 PPSD = -4.7dBm < -1 dBm = Pass

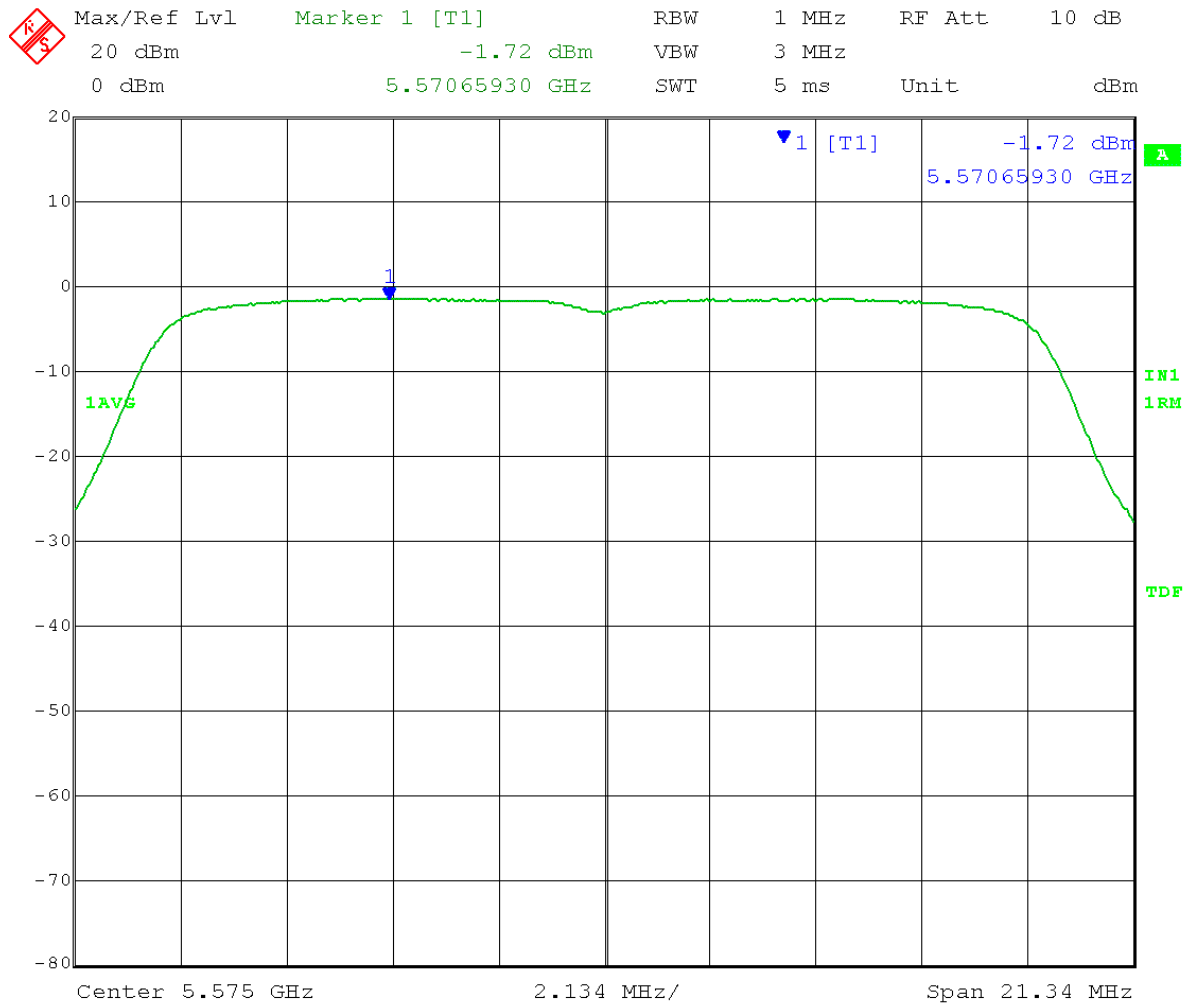


Date: 23.AUG.2013 15:18:22



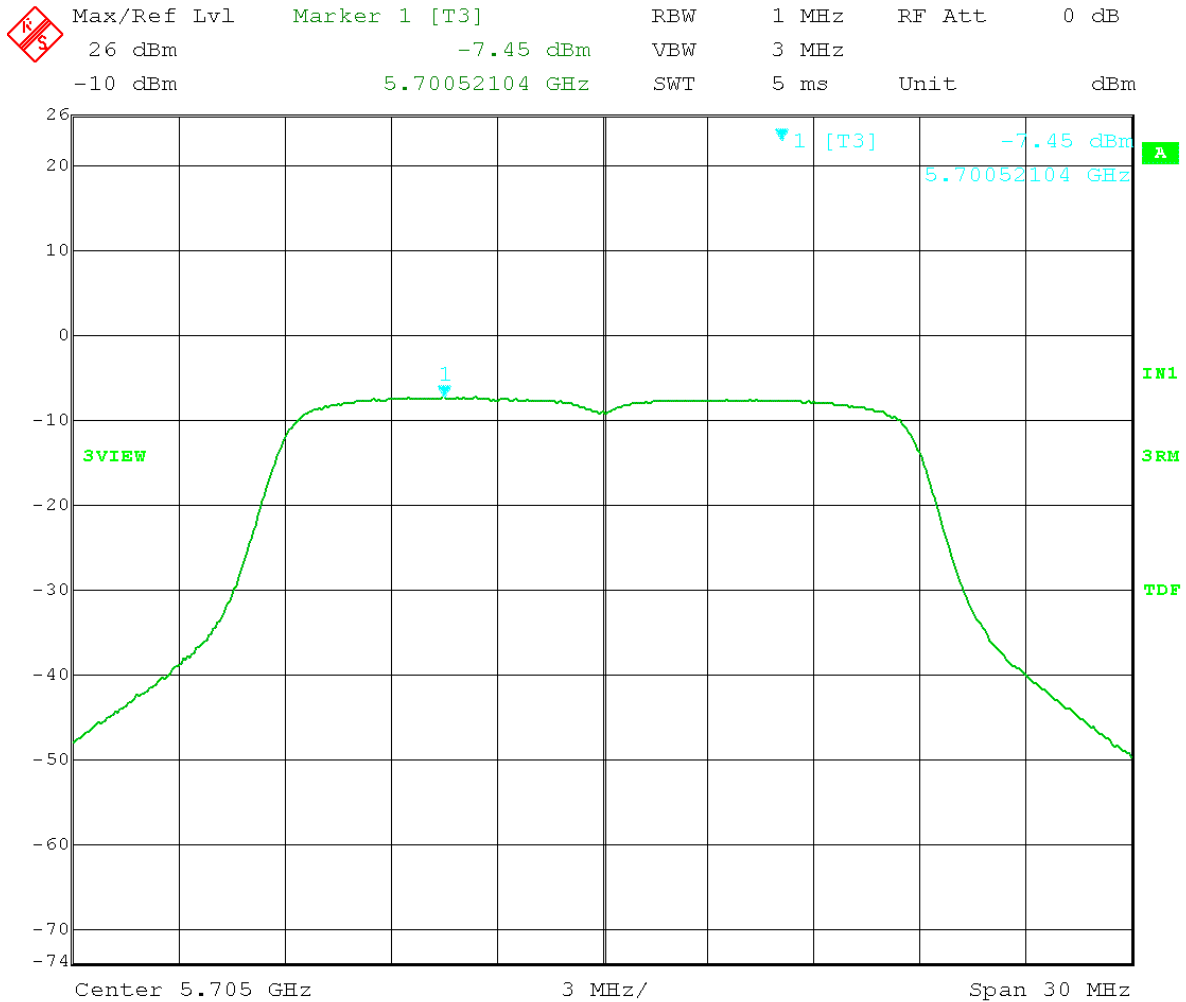
Channel 1:

26 dB Emission Bandwidth = 21.34MHz  
PPSD = -1.72 dBm < -1 dBm = Pass



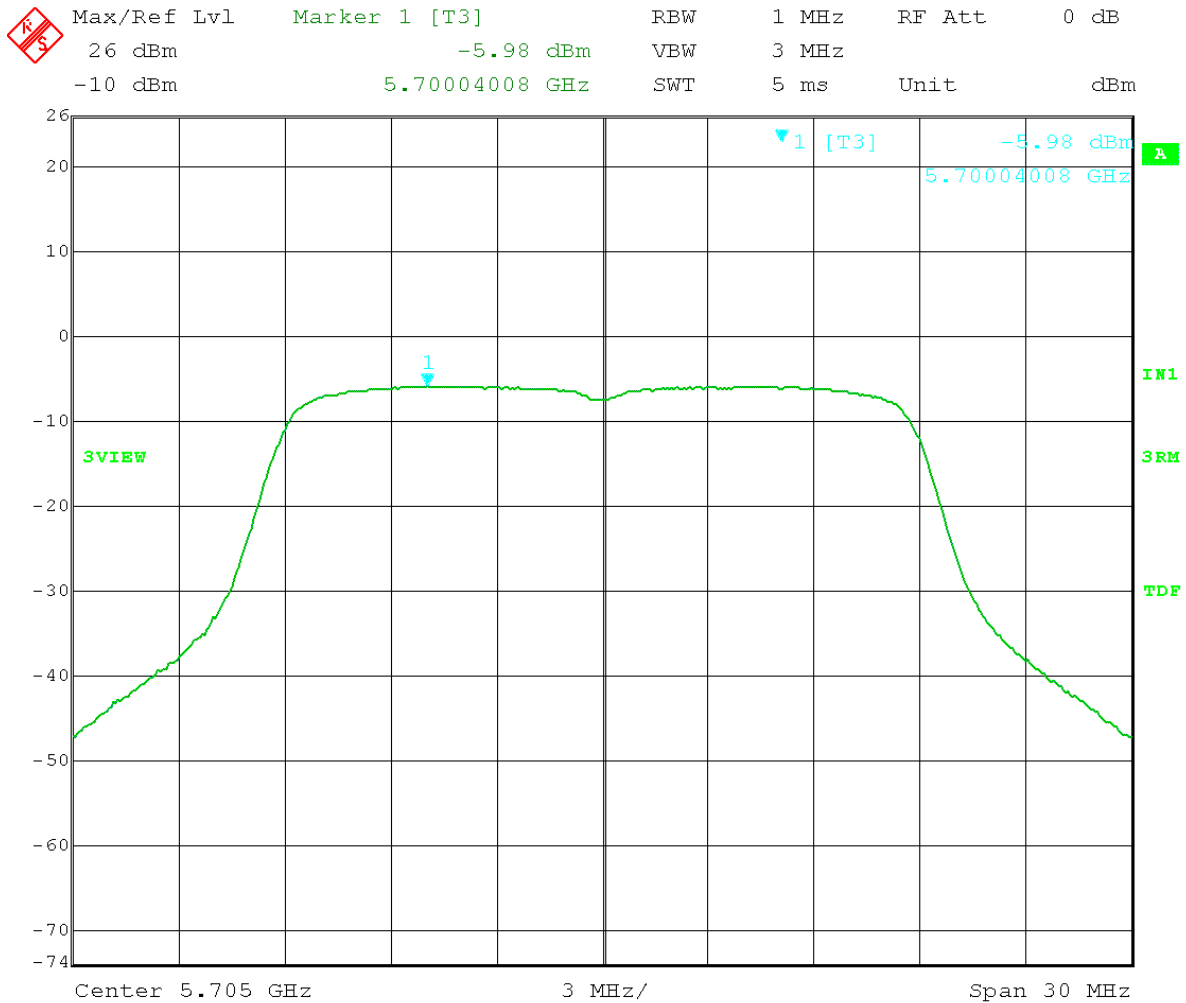
Date:            23.AUG.2013    15:01:43

Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 High Channel: Transmit = 5.705GHz 20MHz BW  
 Output power setting: 7 Channel 0  
 26 dB Emission Bandwidth = 21.52MHz  
 PPSD = -7.45dBm < -1 dBm = Pass



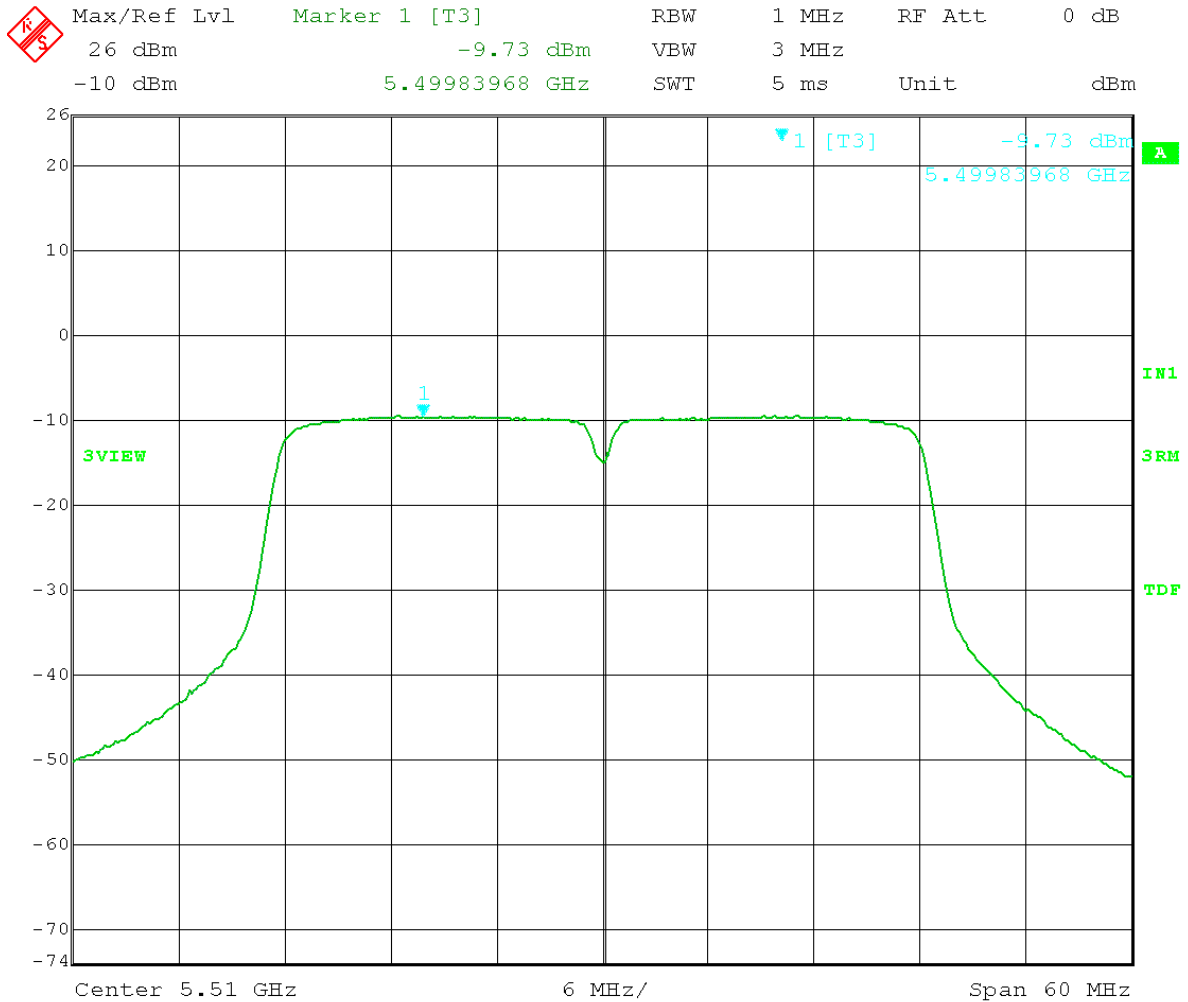
Date: 29.JUL.2013 13:58:24

Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 High Channel: Transmit = 5.705GHz 20MHz BW  
 Output power setting: 7 Channel 1  
 26 dB Emission Bandwidth = 22.06MHz  
 PPSD = -5.98 dBm < -1 dBm = Pass



Date: 29.JUL.2013 14:19:19

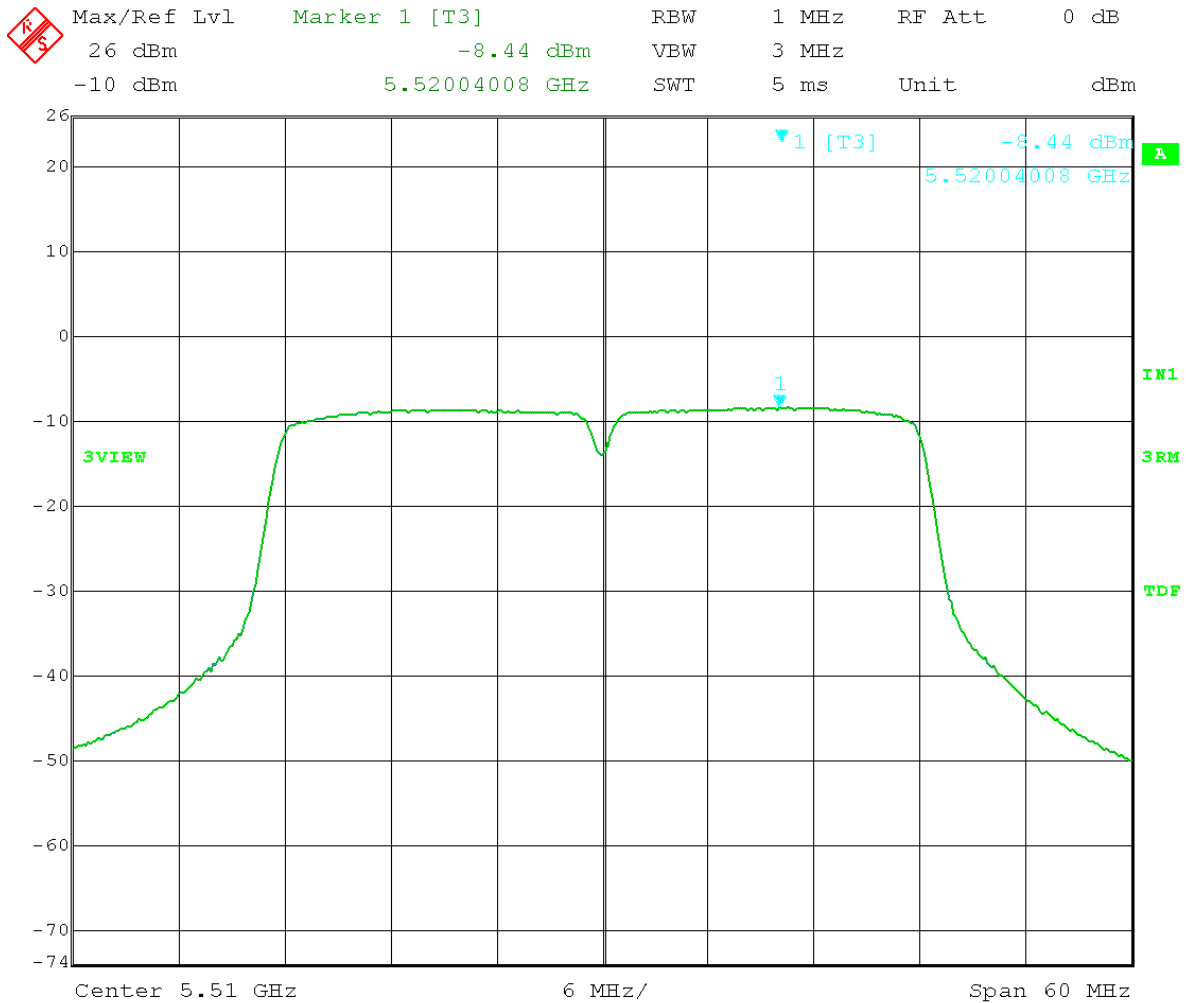
Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 Low Channel: Transmit = 5.510GHz 40MHz BW  
 Output power setting: 6.5 Channel 0  
 26 dB Emission Bandwidth = 45.57MHz  
 PPSD = -9.73dBm < -1 dBm = Pass



Date: 29.JUL.2013 13:34:26

Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013

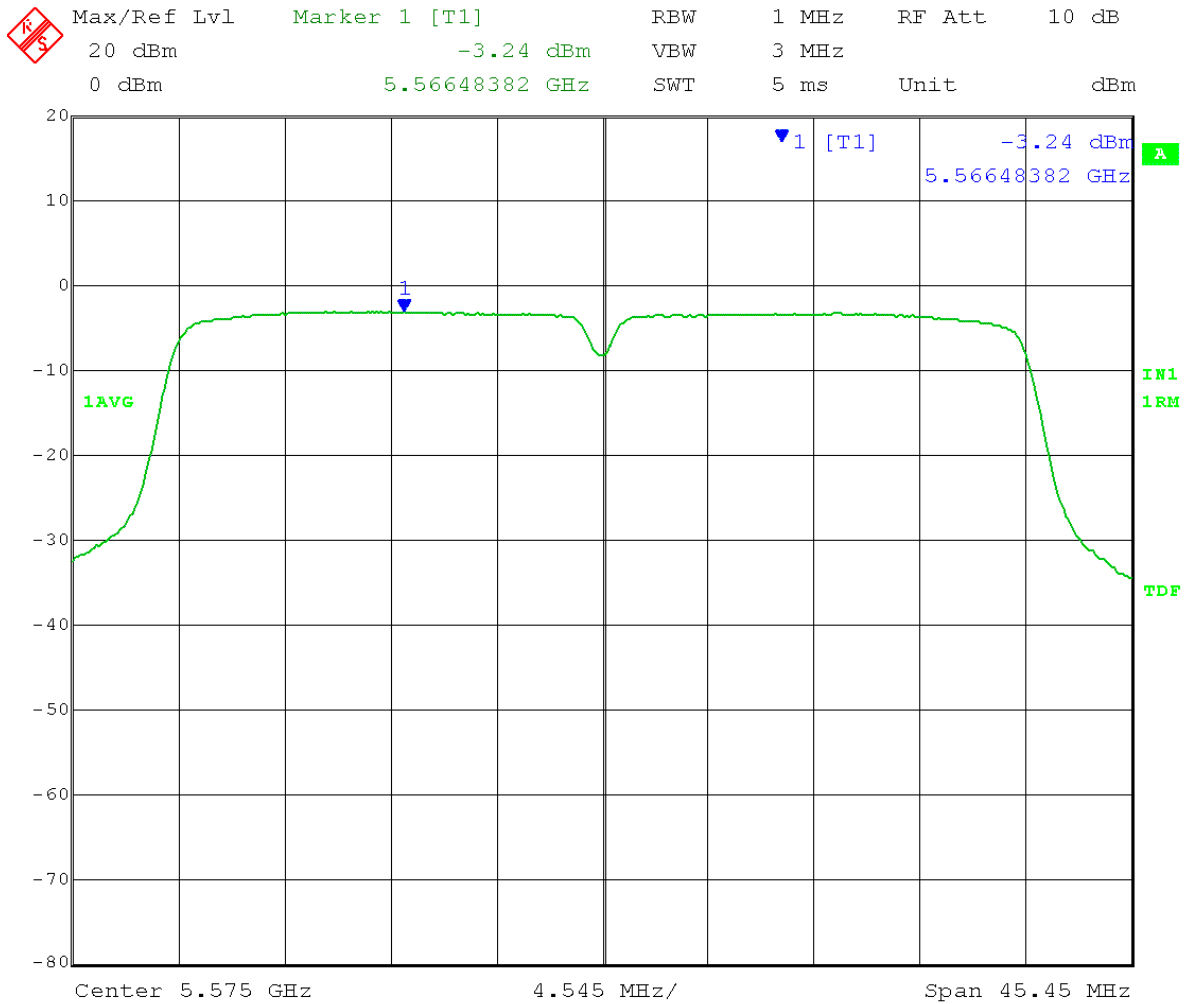
F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 Low Channel: Transmit = 5.510GHz 40MHz BW  
 Output power setting: 6.5 Channel 1  
 26 dB Emission Bandwidth = 44.73MHz  
 PPSD = -8.44 dBm < -1 dBm = Pass



Date: 29.JUL.2013 14:26:45

Test Date: 8-23-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 Mid Channel: Transmit = 5.575GHz 40MHz BW  
 Output power setting: 14

Channel 0:  
 26 dB Emission Bandwidth = 45.45MHz  
 PPSD = -3.24dBm < -1 dBm = Pass

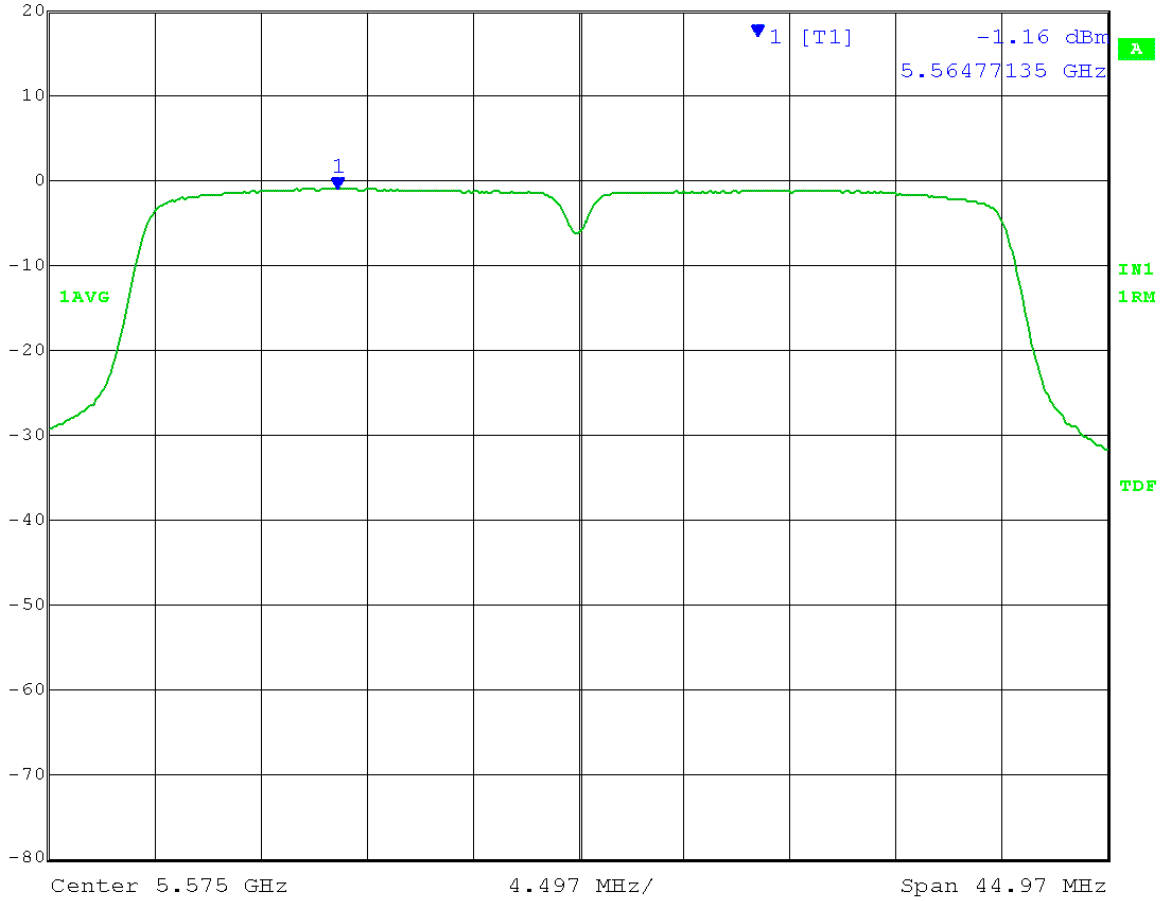


Date: 23.AUG.2013 15:12:38

Channel 1:

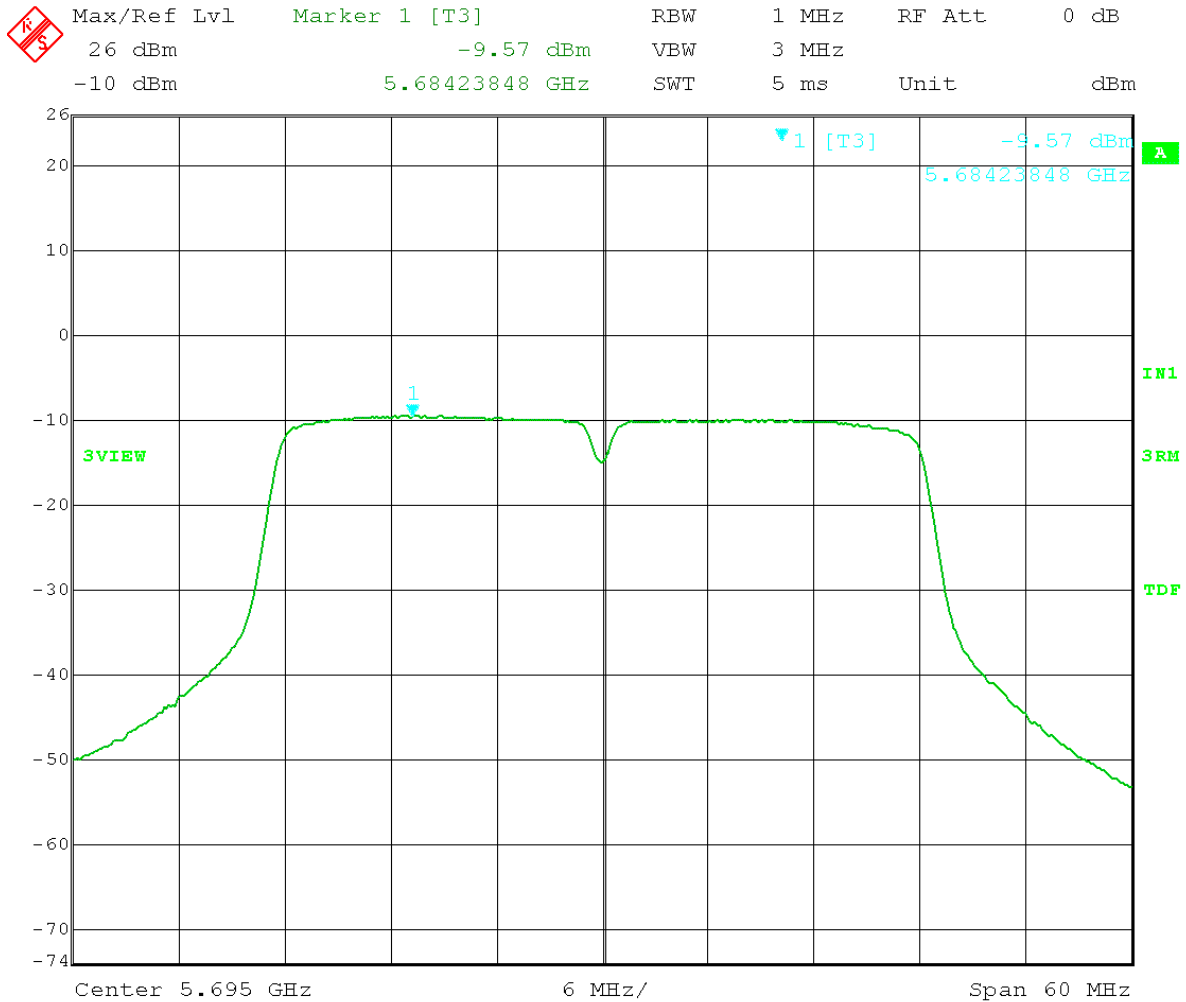
26 dB Emission Bandwidth = 44.97MHz  
PPSD = -1.16 dBm < -1 dBm = Pass

	Max/Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	10 dB
	20 dBm	-1.16 dBm	VBW	3 MHz		
	0 dBm	5.56477135 GHz	SWT	5 ms	Unit	dBm



Date: 23.AUG.2013 15:07:56

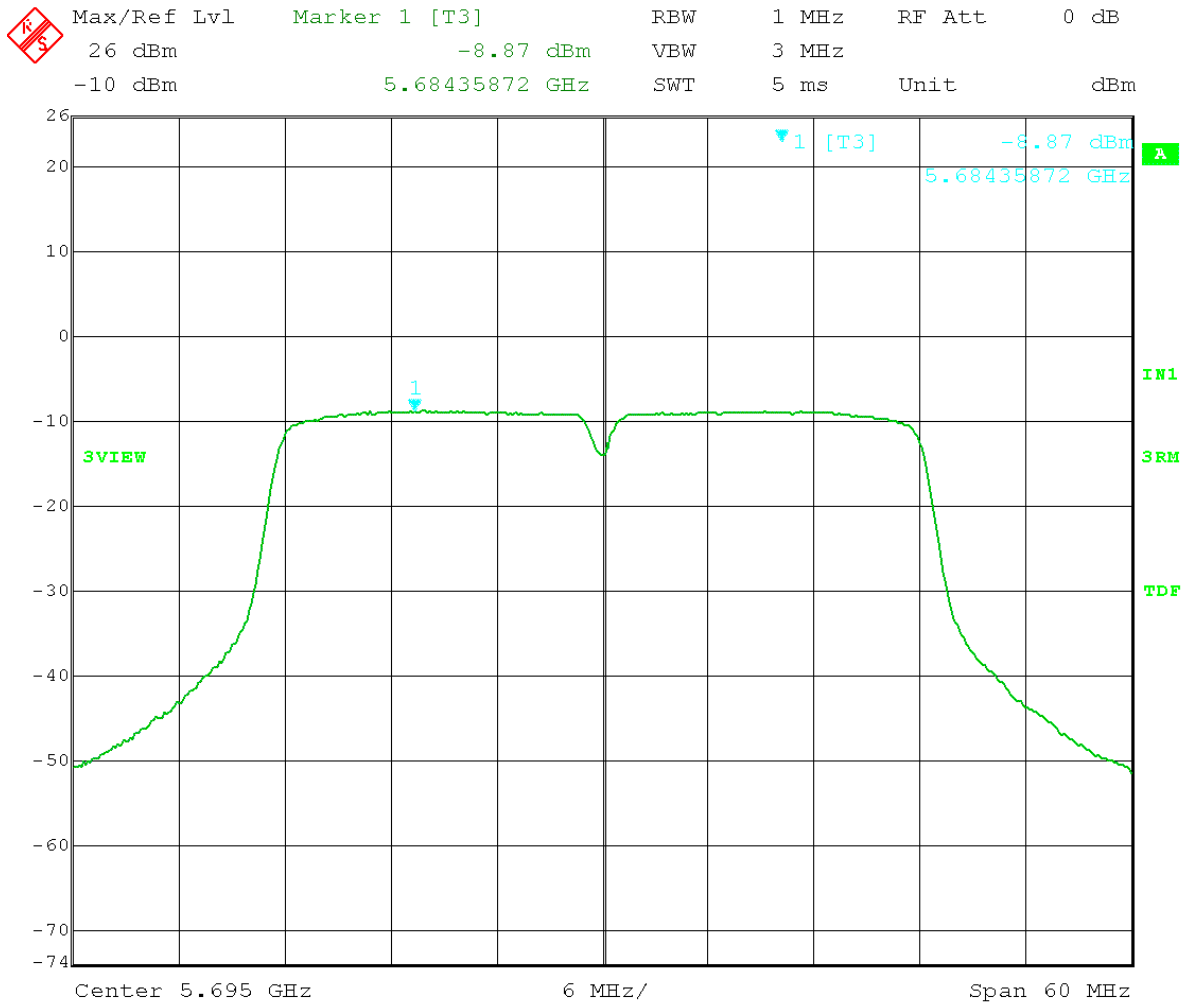
Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 High Channel: Transmit = 5.695GHz 40MHz BW  
 Output power setting: 6.5 Channel 0  
 26 dB Emission Bandwidth = 44.25MHz  
 PPSD = -9.57dBm < -1 dBm = Pass



Date: 29.JUL.2013 13:54:54



Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak Power Spectral Density - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 F) PPSD – Page 9  
 Limit:[15.407(a)(2)]:  $11 - [15(\text{antenna gain})+3(\text{MIMO})-6] = -1\text{dBm}/1\text{MHz}$   
 RBW = 1 MHz VBW = 3 MHz  
 Detector = RMS Trace = AVG  
 Sweep Time = Auto Sweep counts = 200  
 High Channel: Transmit = 5.695GHz 40MHz BW  
 Output power setting: 6.5 Channel 1  
 26 dB Emission Bandwidth = 43.77MHz  
 PPSD = -8.87 dBm < -1 dBm = Pass



Date: 29.JUL.2013 14:22:12



166 South Carter, Genoa City, WI 53128

Company: Cambium Networks  
Models Tested: C050900C032A & C058900P132A  
Report Number: 19222  
DLS Project: 5946

## Appendix B – Measurement Data

### B6.0 Peak Excursion – Conducted

**Rule Section:** Section 15.407(a)(6)

**Test Procedure:** FCC KDB 789033 D01 General UNII Test Procedures v01r03 – *Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E*

Section G – Peak excursion measurement

**Description:** SPAN: set to encompass entire emission bandwidth  
RBW = 1 MHz  
VBW  $\geq$  3 MHz  
Detector = Peak  
Trace mod = max hold  
Use peak search to find the peak of the spectrum  
Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD

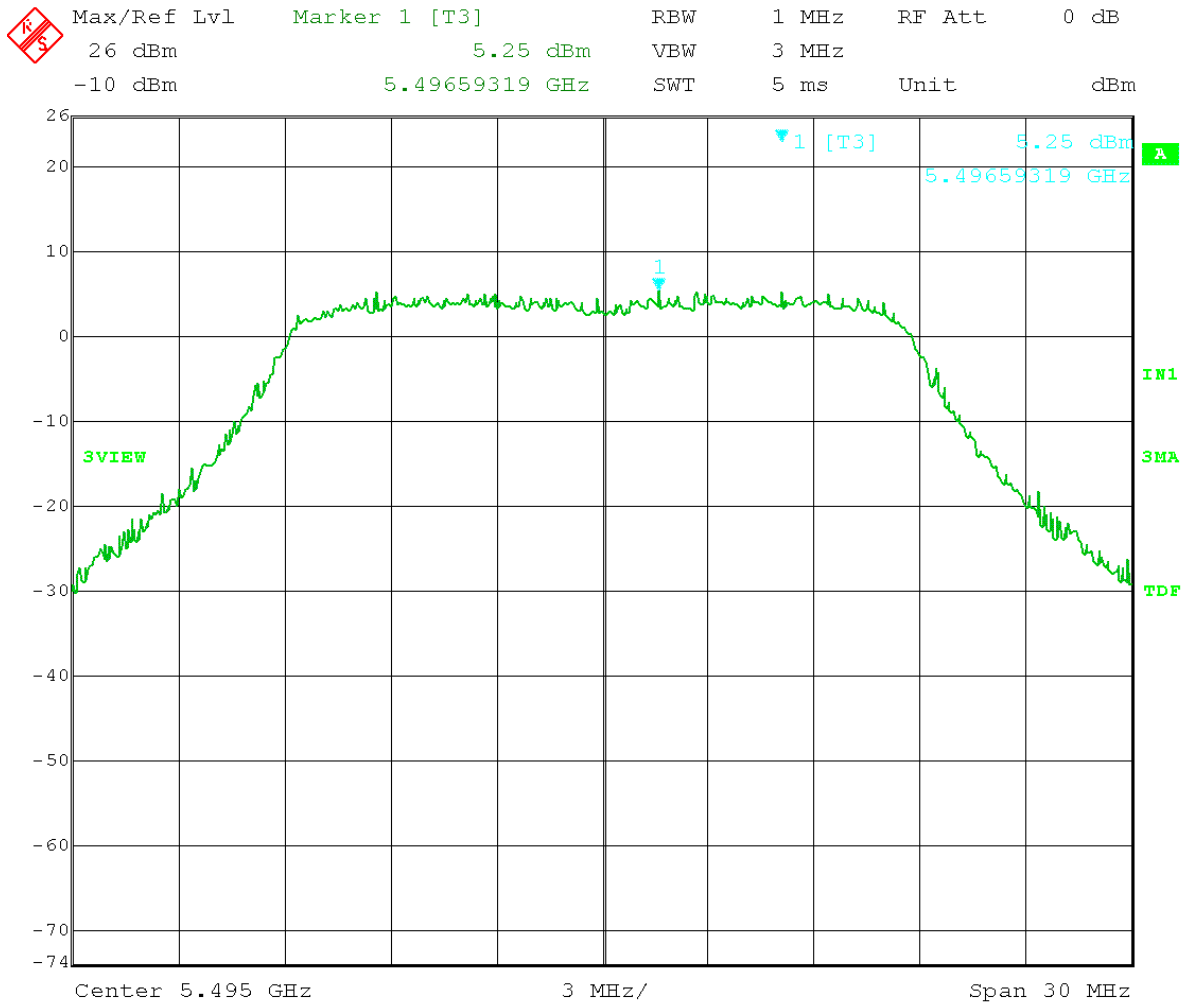
**Limit:** 13 dB peak-to-average ratio across any 1 MHz bandwidth

**Results:** Passed

**Notes:** Measurements were taken for MCS15 OFDM modulation at the lowest, middle, and highest channels of operation. EUT was set to transmit continuously with 100% duty cycle.

Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak excursion measurement - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 G) PK excursion measurement – Page 9  
 Limit:[15.407(a)(6)]: 13dBm/1MHz  
 RBW = 1 MHz  
 Detector = peak  
 Sweep Time = Auto  
 Low Channel: Transmit = 5.495GHz  
 26 dB Emission Bandwidth = 21.28MHz  
 Peak excursion = 5.25 - (-6.48) = 11.73dBm <13 dBm = Pass

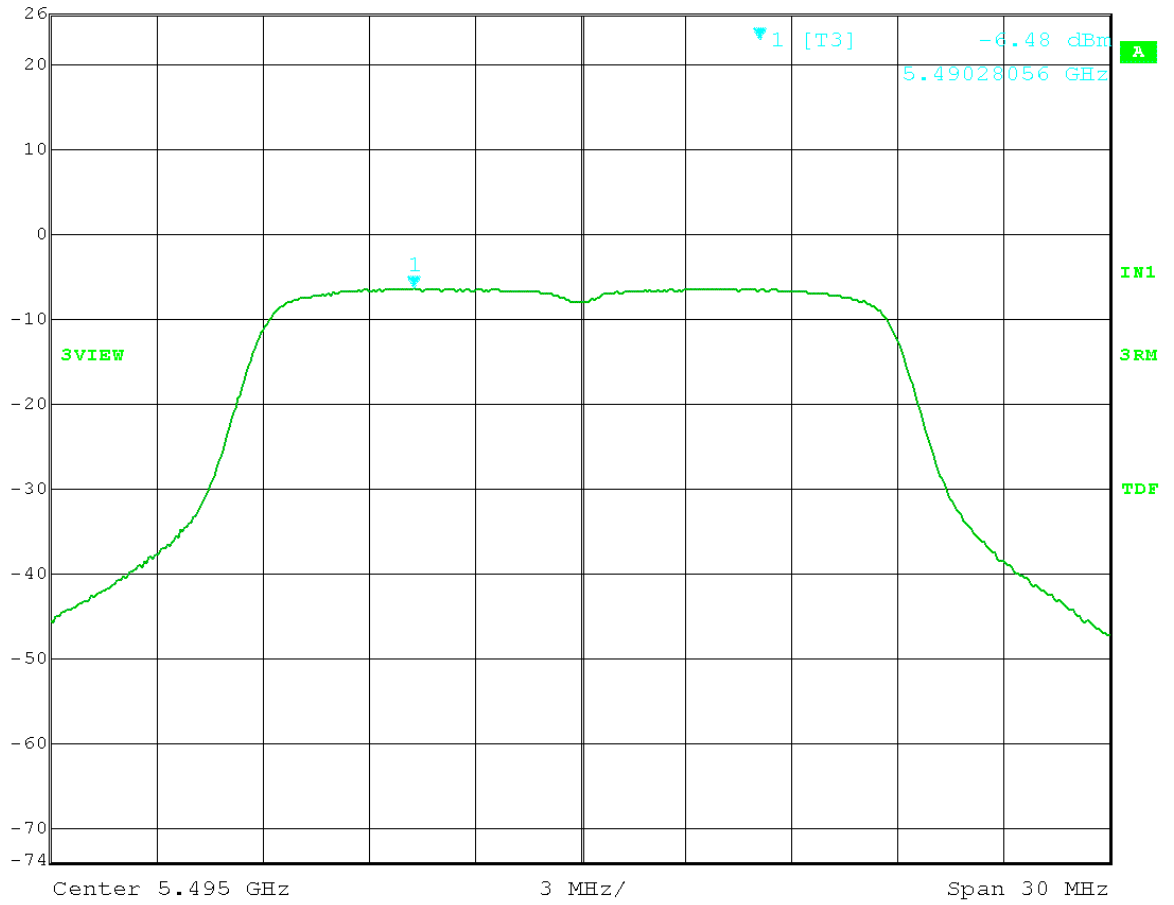
VBW = 3 MHz  
 Trace = max-hold  
 Output power setting: 7  
 20MHz BW  
 PSD = -6.48dBm



Date: 29.JUL.2013 15:16:10



Max/Ref Lvl    Marker 1 [T3]    RBW    1 MHz    RF Att    0 dB  
26 dBm                            -6.48 dBm    VBW    3 MHz  
-10 dBm                            5.49028056 GHz    SWT    5 ms    Unit    dBm



Date: 29.JUL.2013 14:04:34

Test Date: 8-26-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak excursion measurement - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013

G) PK excursion measurement – Page 9

Limit:[15.407(a)(6)]: 13dBm/1MHz

RBW = 1 MHz

VBW = 3 MHz

Detector = peak

Trace = max-hold

Sweep Time = Auto

Output power setting: 10

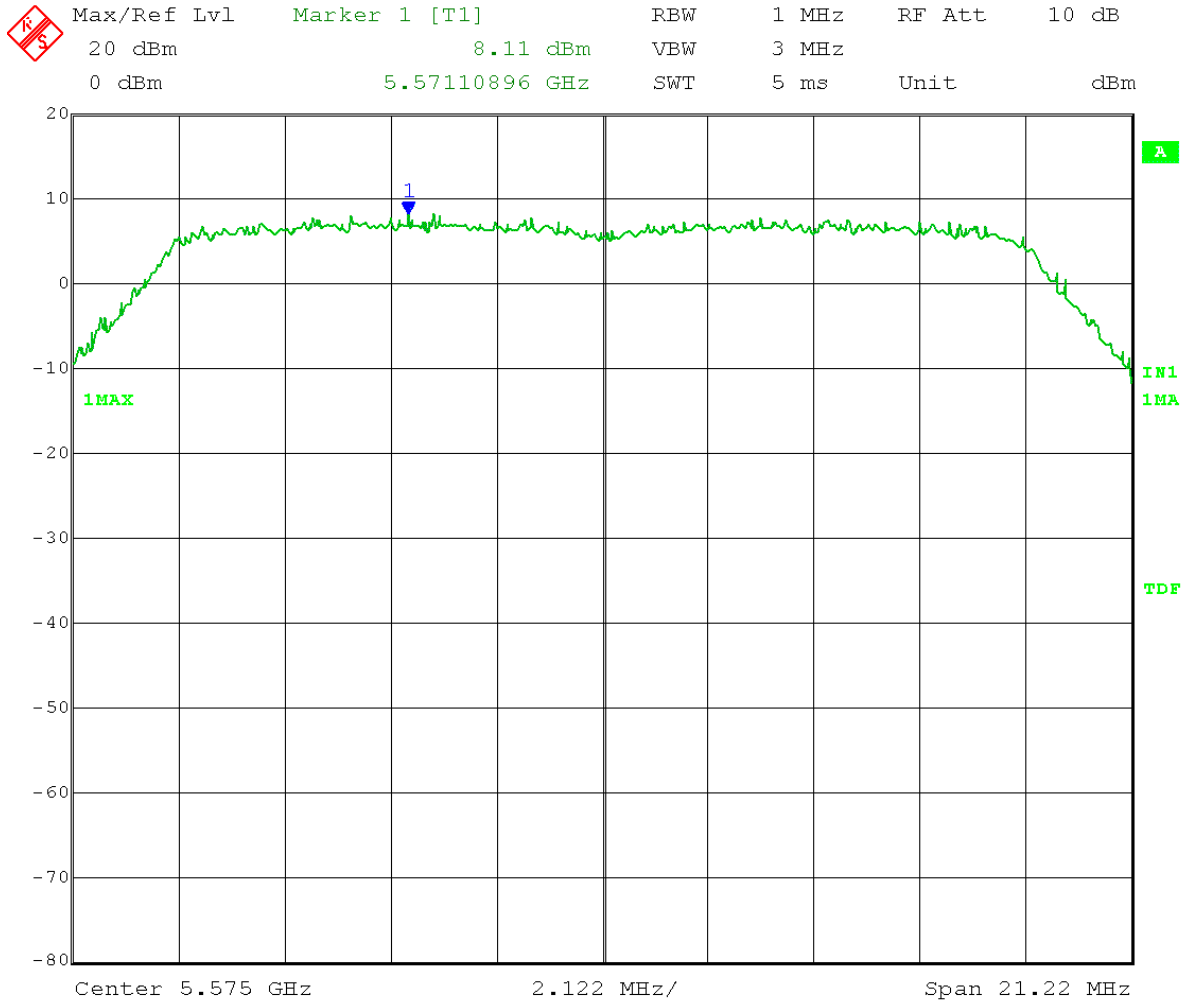
Mid Channel: Transmit = 5.575GHz

20MHz BW

26 dB Emission Bandwidth = 21.22MHz

PPSD = -4.7dBm

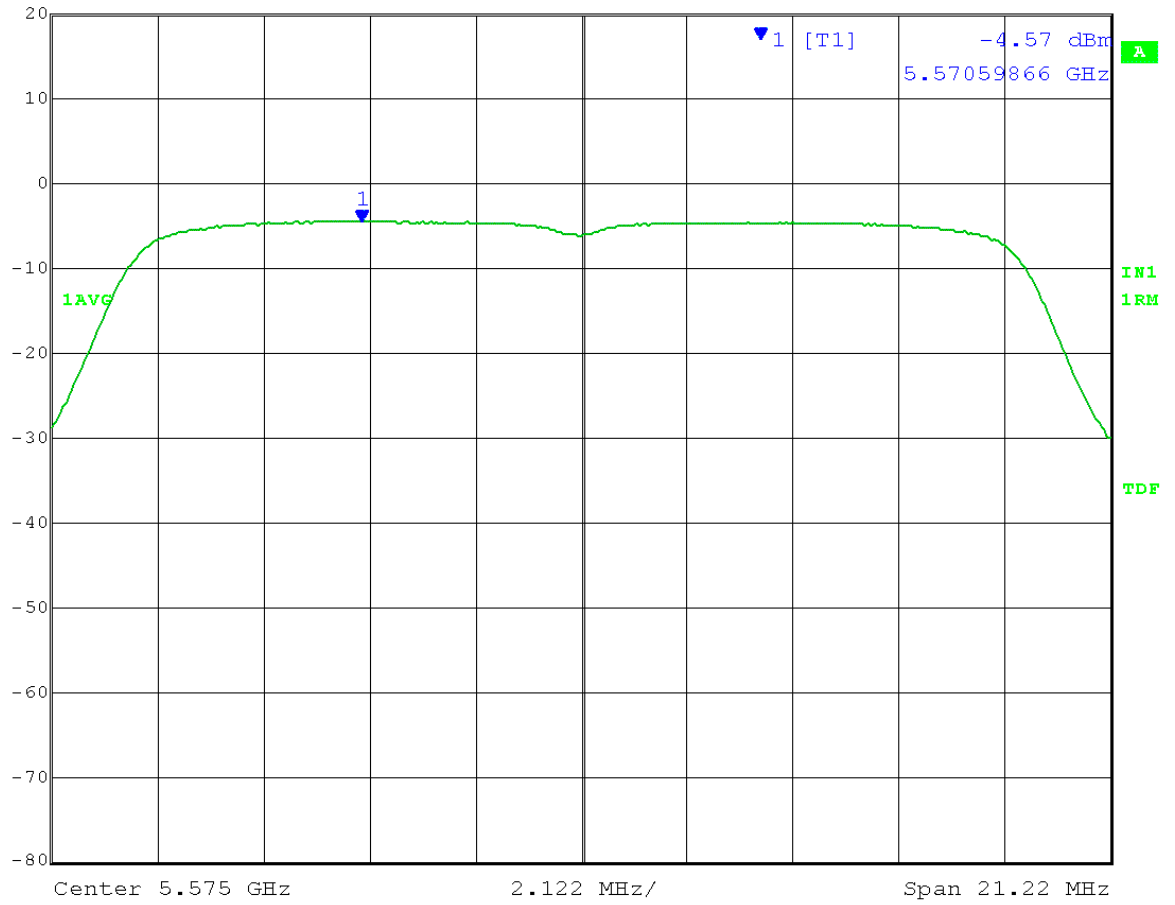
Peak excursion = 8.11 - (-4.7) = 12.81dBm < 13 dBm = Pass



Date: 26.AUG.2013 09:08:22

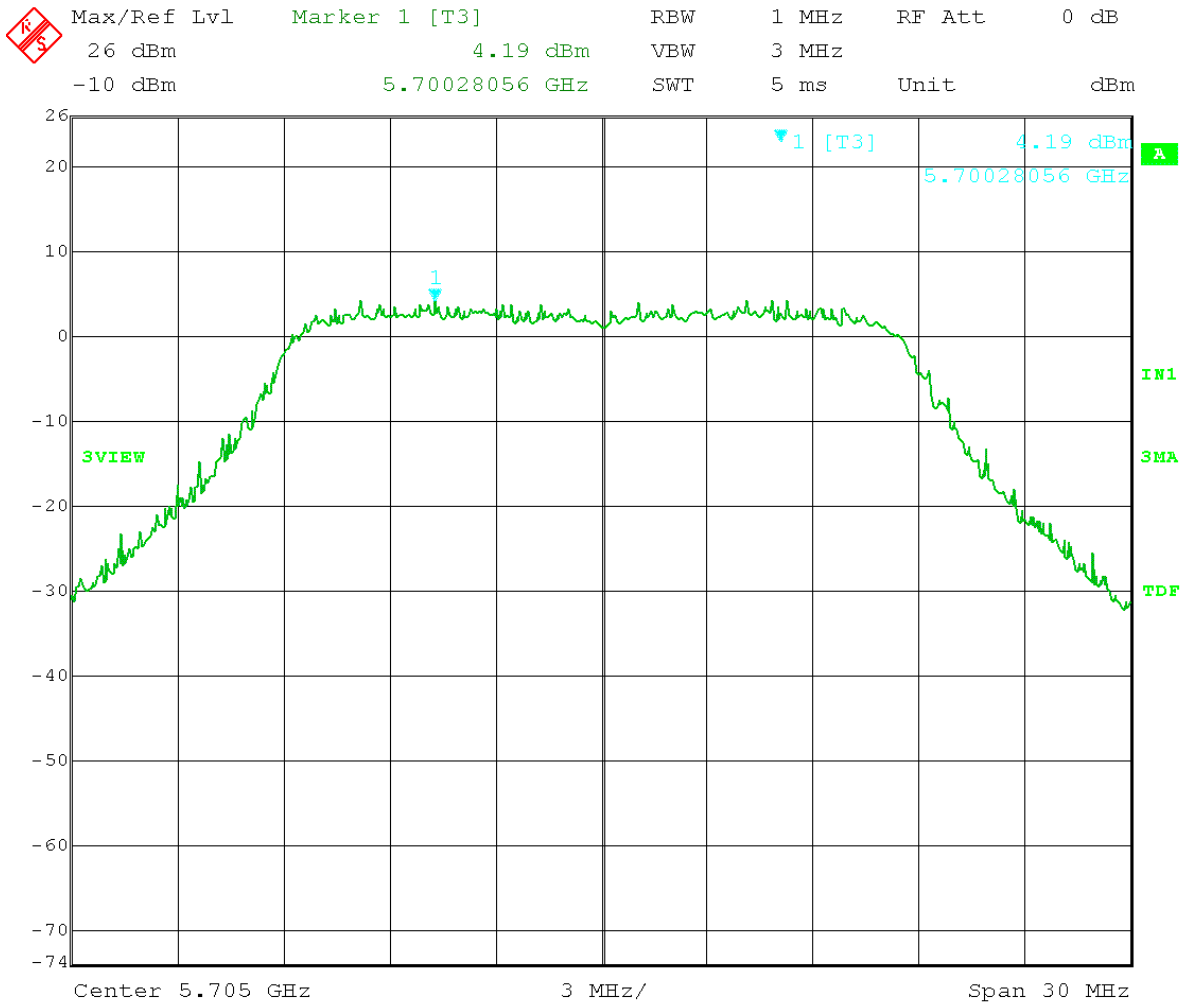


Max/Ref Lvl    Marker 1 [T1]    RBW    1 MHz    RF Att    10 dB  
20 dBm                            -4.57 dBm    VBW    3 MHz  
0 dBm                              5.57059866 GHz    SWT    5 ms    Unit    dBm



Date:    23.AUG.2013    15:18:22

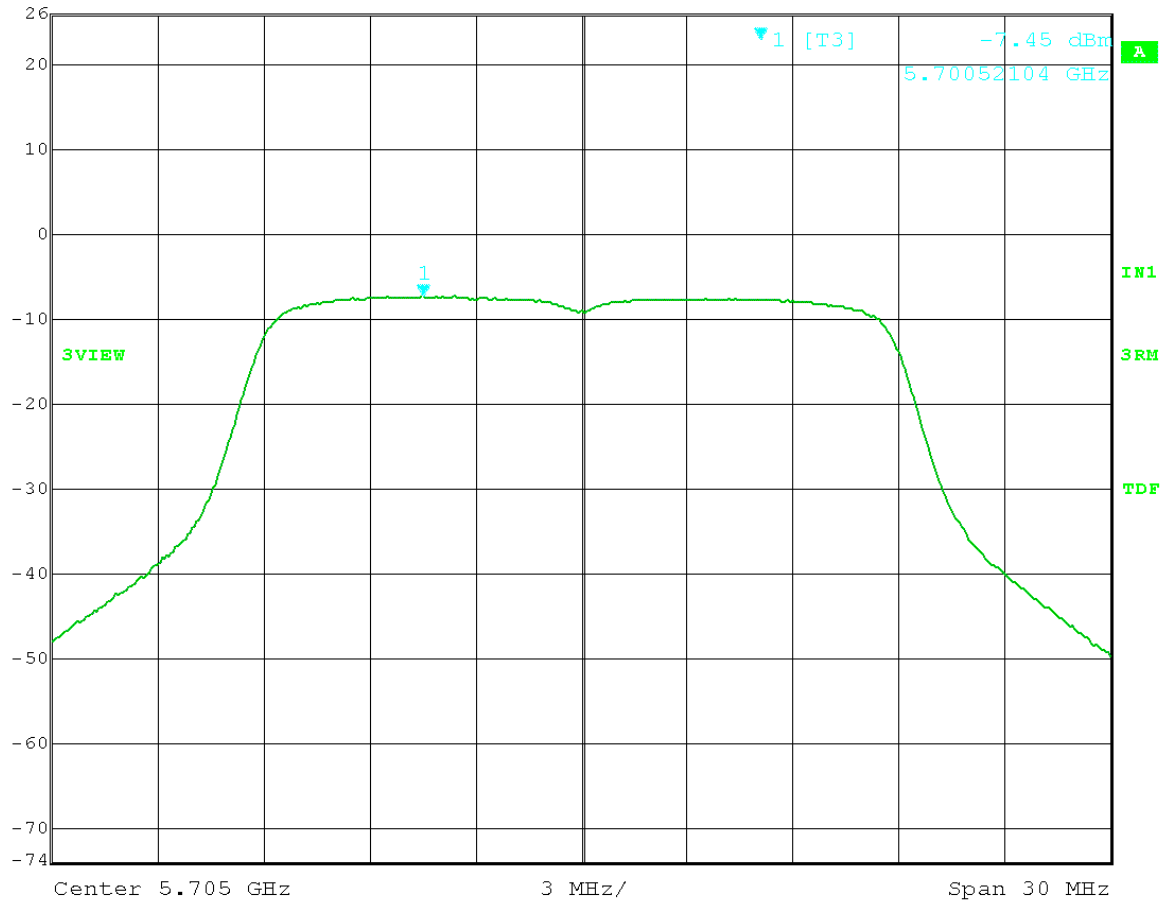
Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak excursion measurement - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 G) PK excursion measurement – Page 9  
 Limit:[15.407(a)(6)]: 13dBm/1MHz  
 RBW = 1 MHz  
 Detector = peak  
 Sweep Time = Auto  
 High Channel: Transmit = 5.705GHz  
 26 dB Emission Bandwidth = 21.52MHz  
 Peak excursion = 4.19 - (-7.45) = 11.64dBm <13 dBm = Pass



Date: 29.JUL.2013 15:01:16



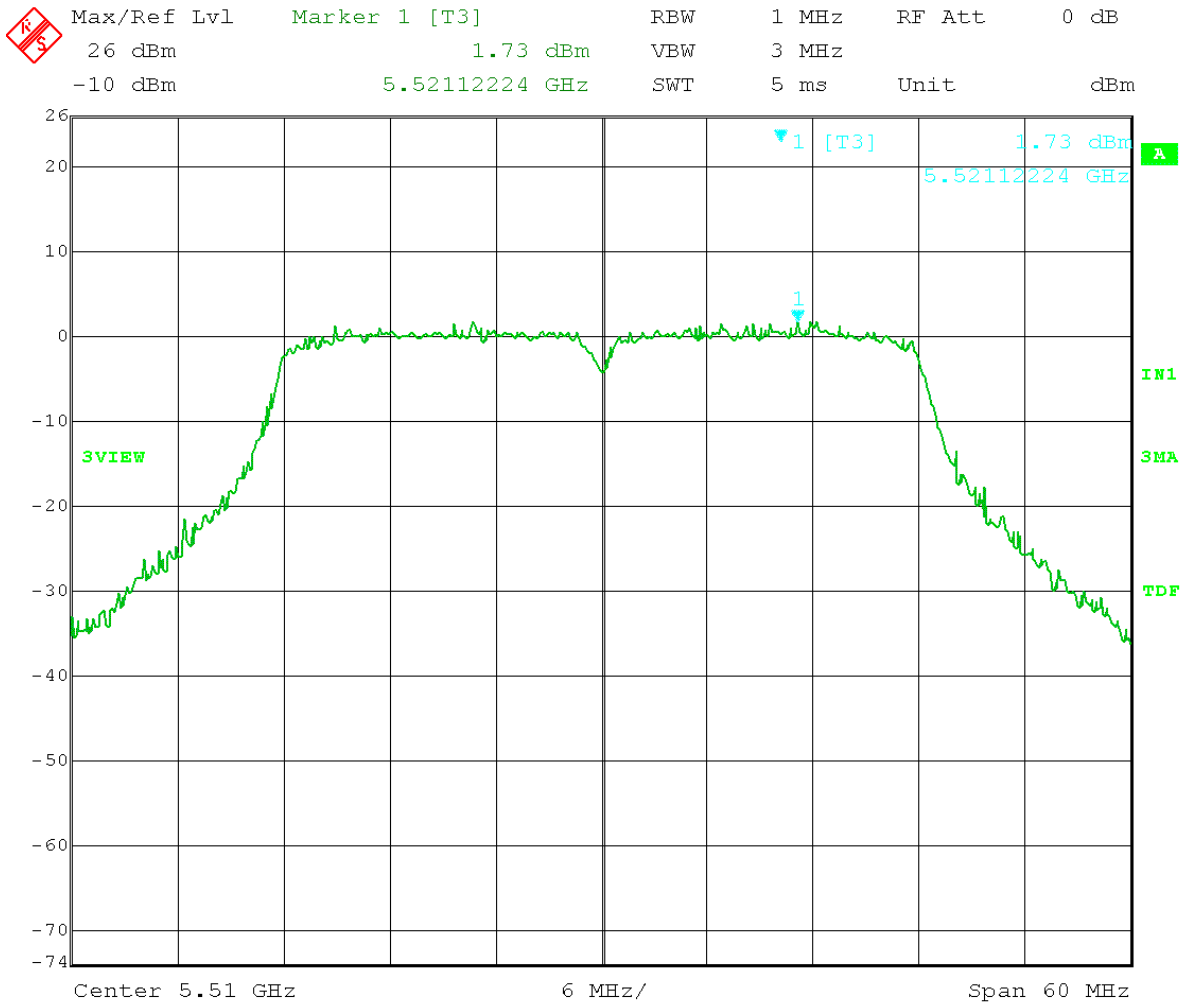
Max/Ref Lvl    Marker 1 [T3]    RBW    1 MHz    RF Att    0 dB  
26 dBm                            -7.45 dBm    VBW    3 MHz  
-10 dBm                            5.70052104 GHz    SWT    5 ms    Unit    dBm



Date:    29.JUL.2013    13:58:24



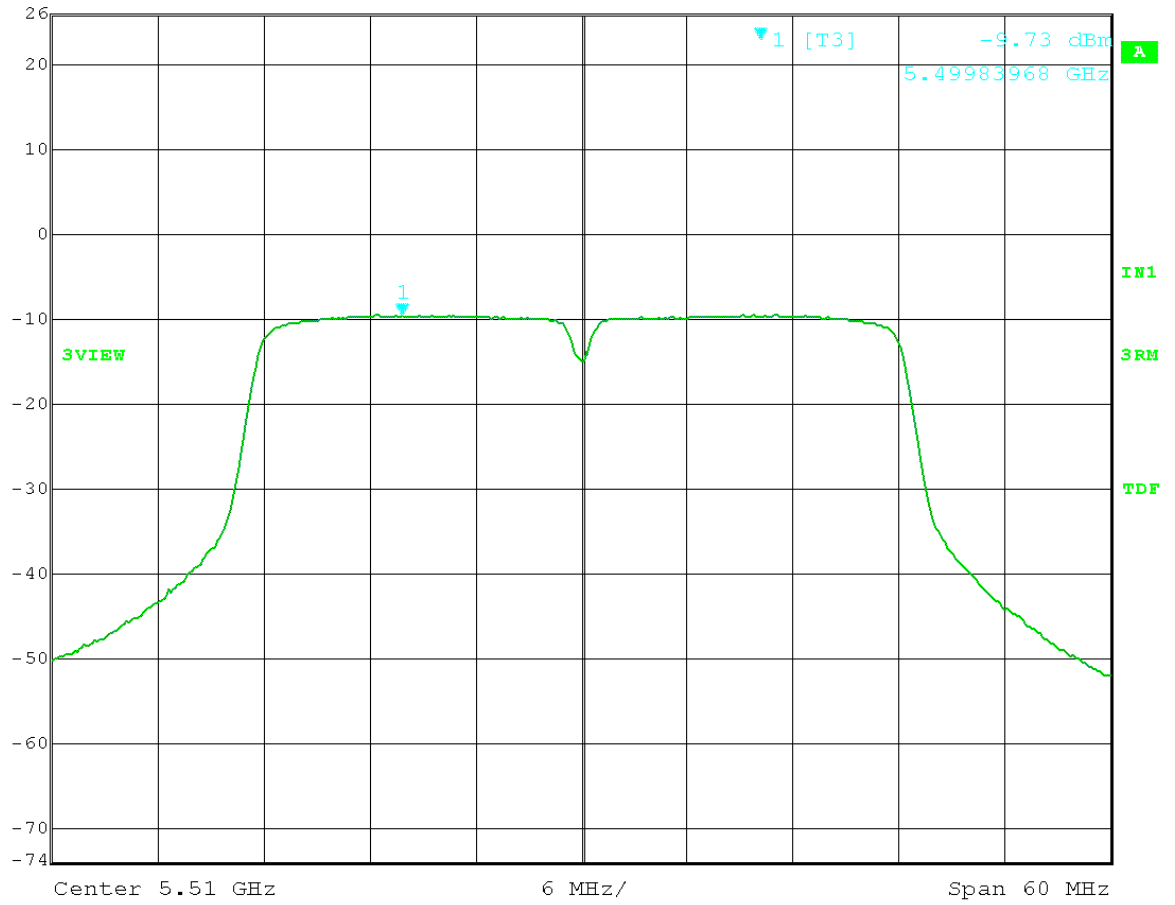
Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak excursion measurement - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 G) PK excursion measurement – Page 9  
 Limit:[15.407(a)(6)]: 13dBm/1MHz  
 RBW = 1 MHz  
 Detector = peak  
 Sweep Time = Auto  
 Low Channel: Transmit = 5.510GHz  
 Output power setting: 6.5  
 26 dB Emission Bandwidth = 45.57MHz  
 Peak excursion = 1.73 - (-9.73) = 11.46dBm <13 dBm = Pass  
 VBW = 3 MHz  
 Trace = max-hold  
 Output power setting: 6.5  
 40MHz BW  
 Channel 0  
 PPSD = -9.73dBm



Date: 29.JUL.2013 14:43:17



Max/Ref Lvl    Marker 1 [T3]    RBW    1 MHz    RF Att    0 dB  
26 dBm                            -9.73 dBm    VBW    3 MHz  
-10 dBm                            5.49983968 GHz    SWT    5 ms    Unit    dBm



Date: 29.JUL.2013 13:34:26

Test Date: 8-26-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak excursion measurement - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013

G) PK excursion measurement – Page 9

Limit:[15.407(a)(6)]: 13dBm/1MHz

RBW = 1 MHz

VBW = 3 MHz

Detector = peak

Trace = max-hold

Sweep Time = Auto

Output power setting: 14

Mid Channel: Transmit = 5.575GHz

40MHz BW

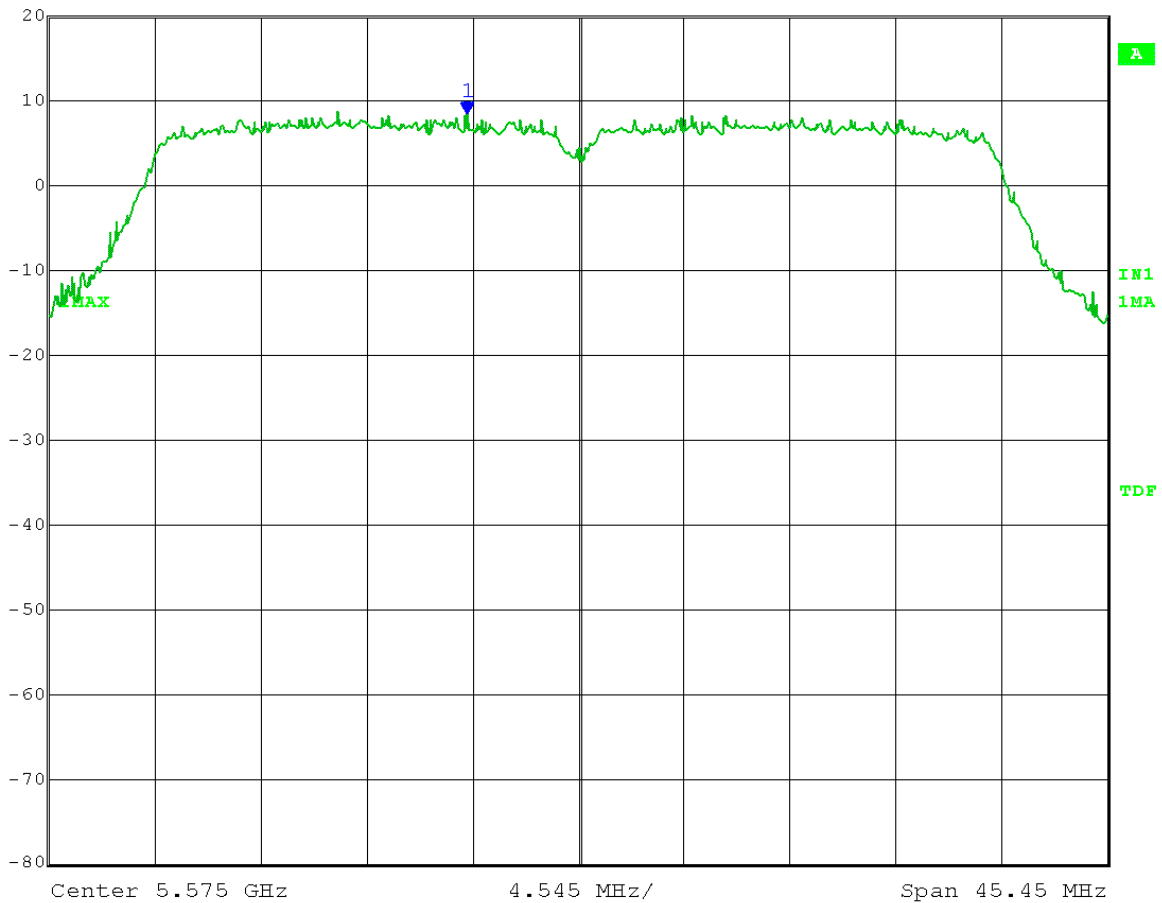
26 dB Emission Bandwidth = 45.45MHz

PPSD = -3.24dBm

Peak excursion = 8.26 - (-3.24) = 11.50dBm < 13 dBm = Pass



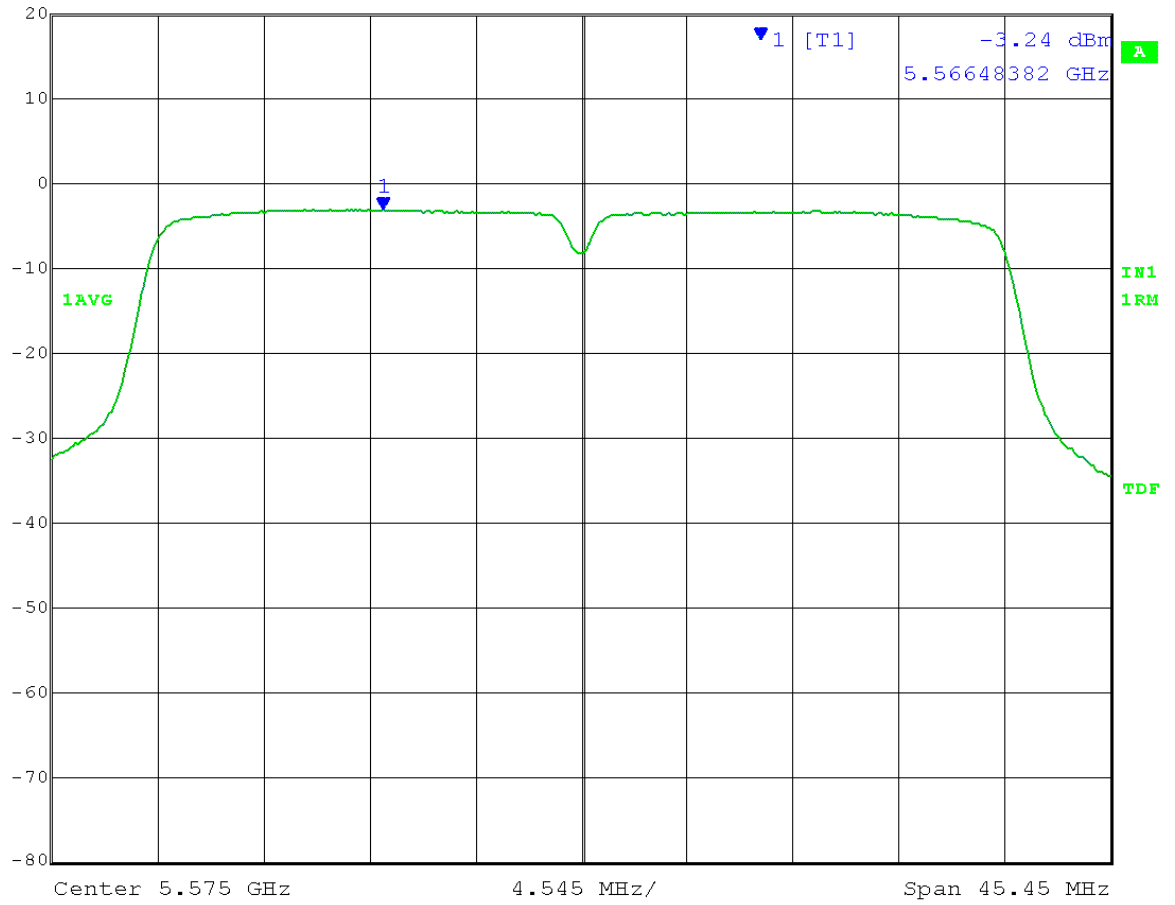
Max/Ref Lvl	Marker 1 [T1]	RBW	1 MHz	RF Att	10 dB
20 dBm	8.26 dBm	VBW	3 MHz		
0 dBm	5.57021819 GHz	SWT	5 ms	Unit	dBm



Date: 26.AUG.2013 09:15:00



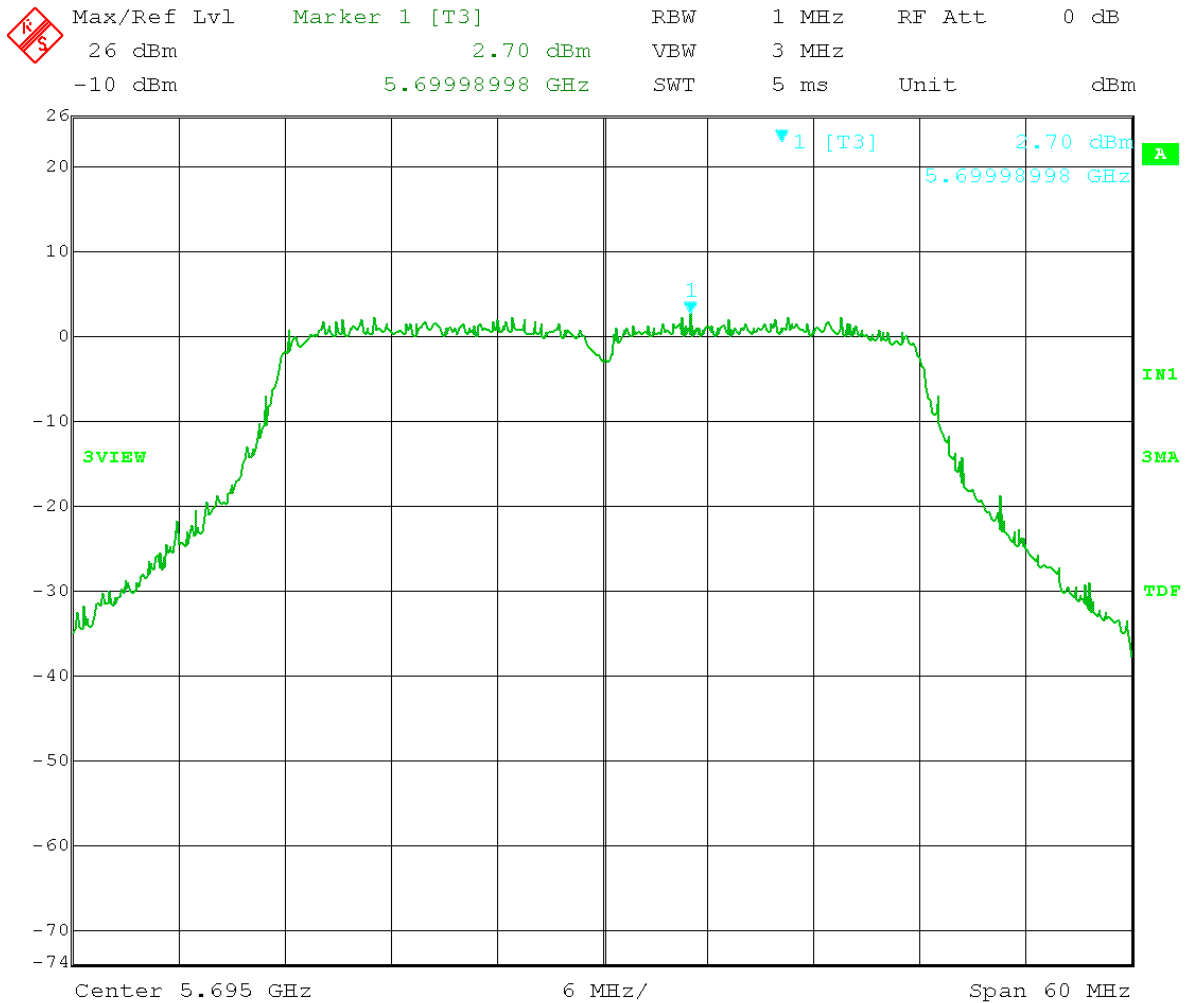
Max/Ref Lvl    Marker 1 [T1]    RBW    1 MHz    RF Att    10 dB  
20 dBm                            -3.24 dBm    VBW    3 MHz  
0 dBm                              5.56648382 GHz    SWT    5 ms    Unit    dBm



Date:    23.AUG.2013    15:12:38

Test Date: 7-29-2013  
 Company: Cambium Networks  
 EUT: Avenger SM 5.4GHz: OFDM  
 Test: Peak excursion measurement - Conducted  
 Operator: Lillian L  
 Comment: FCC UNII operating under 15.407 – OET 4/8/2013  
 G) PK excursion measurement – Page 9  
 Limit:[15.407(a)(6)]: 13dBm/1MHz  
 RBW = 1 MHz  
 Detector = peak  
 Sweep Time = Auto  
 High Channel: Transmit = 5.695GHz  
 26 dB Emission Bandwidth = 44.25MHz  
 Peak excursion = 2.07 - (-9.57) = 11.64dBm <13 dBm = Pass

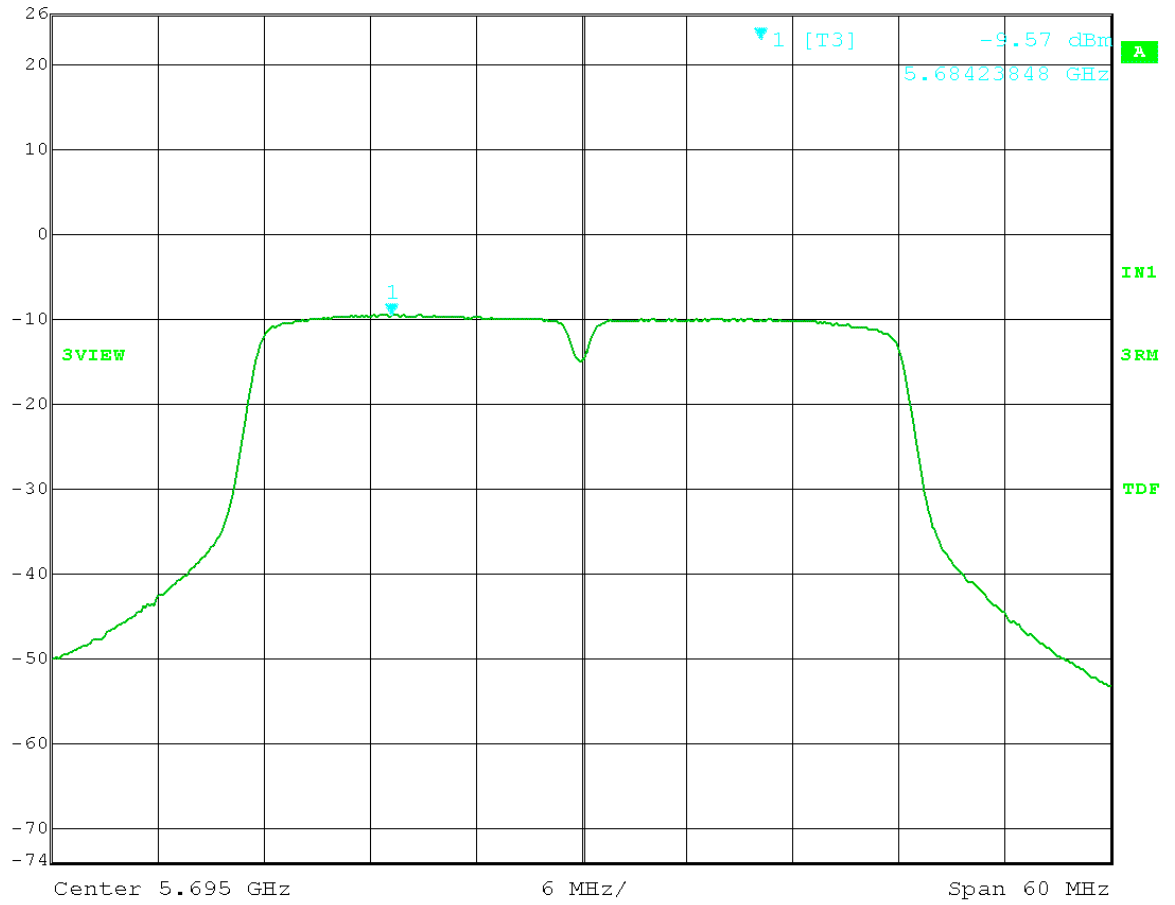
VBW = 3 MHz  
 Trace = max-hold  
 Output power setting: 6.5  
 40MHz BW  
 PSD = -9.57dBm



Date: 29.JUL.2013 14:55:18



Max/Ref Lvl    Marker 1 [T3]    RBW    1 MHz    RF Att    0 dB  
26 dBm                            -9.57 dBm    VBW    3 MHz  
-10 dBm                            5.68423848 GHz    SWT    5 ms    Unit    dBm



Date:    29.JUL.2013    13:54:54



166 South Carter, Genoa City, WI 53128

Company: Cambium Networks  
Models Tested: C050900C032A & C058900P132A  
Report Number: 19222  
DLS Project: 5946

## Appendix B – Measurement Data

### B7.0 Unwanted Emission Levels – Radiated Band-Edge Radiated with antenna connected

**Rule Section:** Sections 15.407(b)(3) and 15.407(b)(5)

**Test Procedure:** FCC KDB 789033 D01 General UNII Test Procedures v01r03 – *Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E*

Section H – Unwanted emission levels  
Section H(1) – Unwanted emissions in the restricted bands  
Section H(2) – Unwanted emissions that fall outside of the restricted bands  
Section H(3) – General Requirements for Unwanted Emissions Measurements  
Section H(5) – Procedure for Peak Unwanted Emissions Measurements Above 1 GHz  
Section H(6) – Procedure for Average Unwanted Emissions Measurements Above 1 GHz  
Section H(6)(c) – Average Detection method

**Description:** Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

Measure the band-edge emission level using the following settings

PEAK measurements:

RBW = 1 MHz  
VBW  $\geq$  3 MHz  
Detector = peak  
Sweep time = auto  
Trace mode = max hold

AVERAGE measurements:

RBW = 1 MHz  
VBW  $\geq$  3 MHz  
Detector = RMS  
Sweep time = auto  
Trace mode = trace average 200 traces

**Limit:** Peak and Average limits of 15.209 were used instead of the -27 dBm/MHz limit of FCC Part 15.407(b)(3).

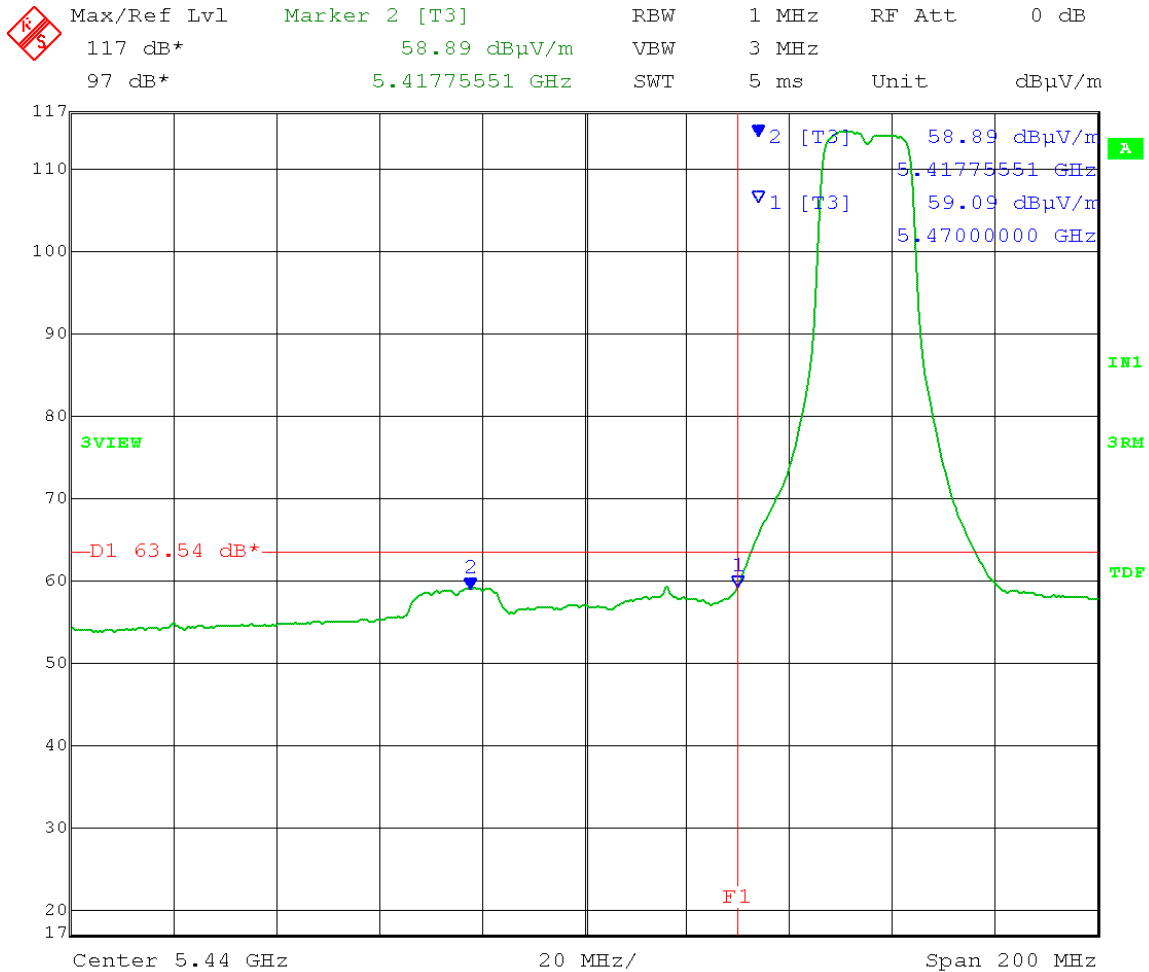
**Results:** Passed

**Notes:** Measurements were taken for MCS15 OFDM modulation at the lowest and highest channels of operation. EUT was set to transmit continuously with 100% duty cycle. Both transmit chains were active.

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated – AVG  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B  
 Comment: Low Channel: Frequency – 5495 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Band-Edge Frequency: 5.47 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

15.209 Limit: 63.54 dBμV/m AVERAGE at a test distance of 1 meter.



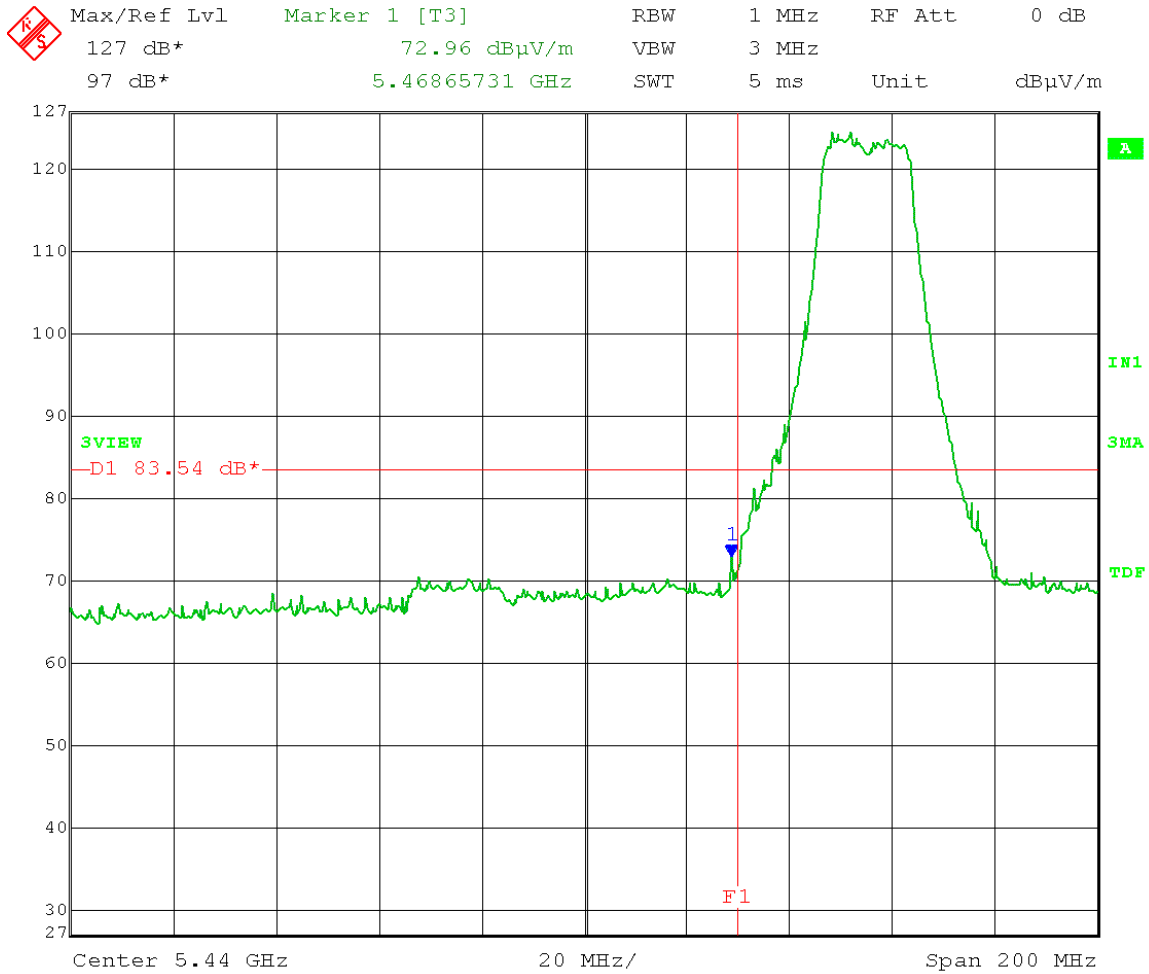
Date: 10.JUL.2013 09:05:38



Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated – PEAK  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B  
 Comment: Low Channel: Frequency – 5495 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Band-Edge Frequency: 5.47 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

Band-Edge Limit: 83.54 dBμV/m PEAK at a test distance of 1 meter.

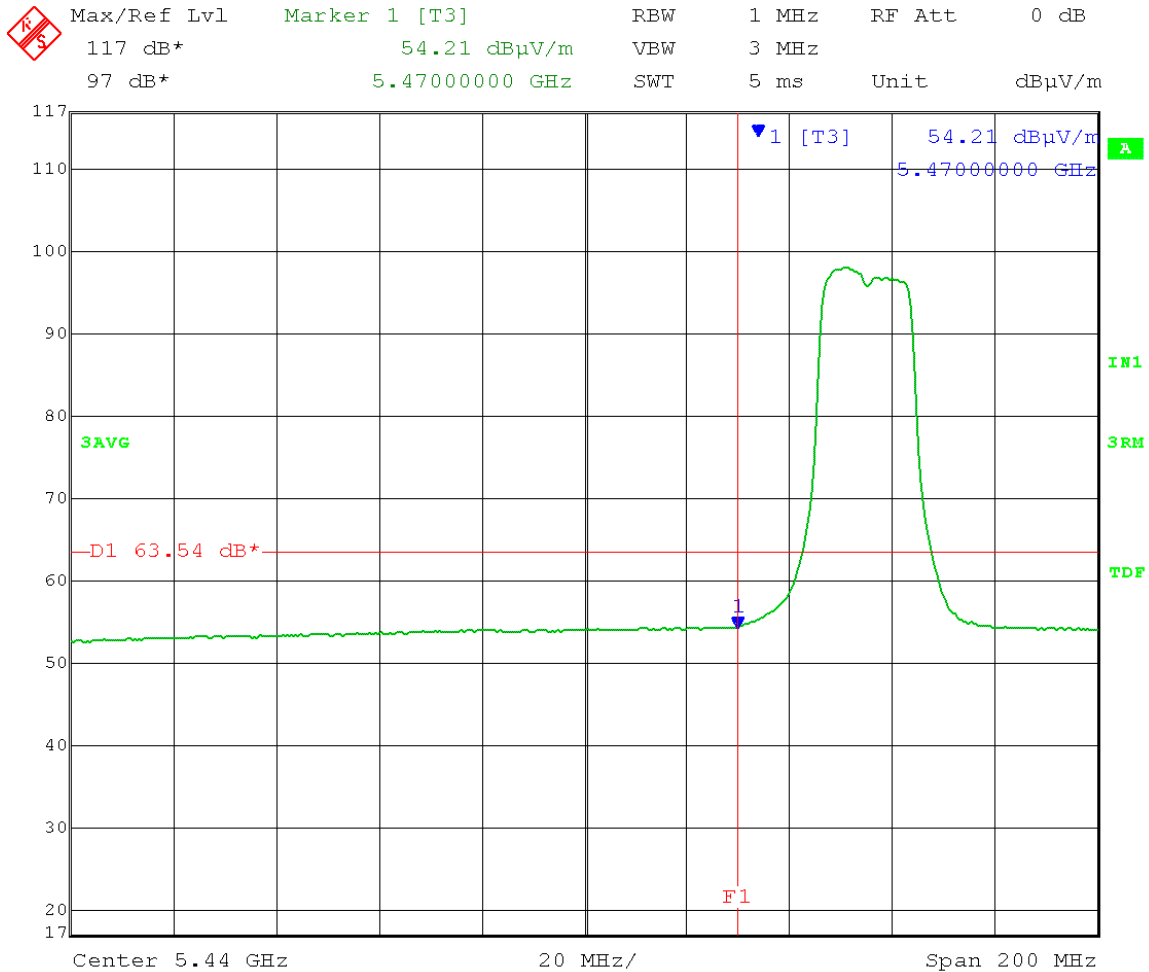


Date: 10.JUL.2013 09:12:03

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated – AVG  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5495 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Band-Edge Frequency: 5.47 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

15.209 Limit: 63.54 dB $\mu$ V/m AVERAGE at a test distance of 1 meter.

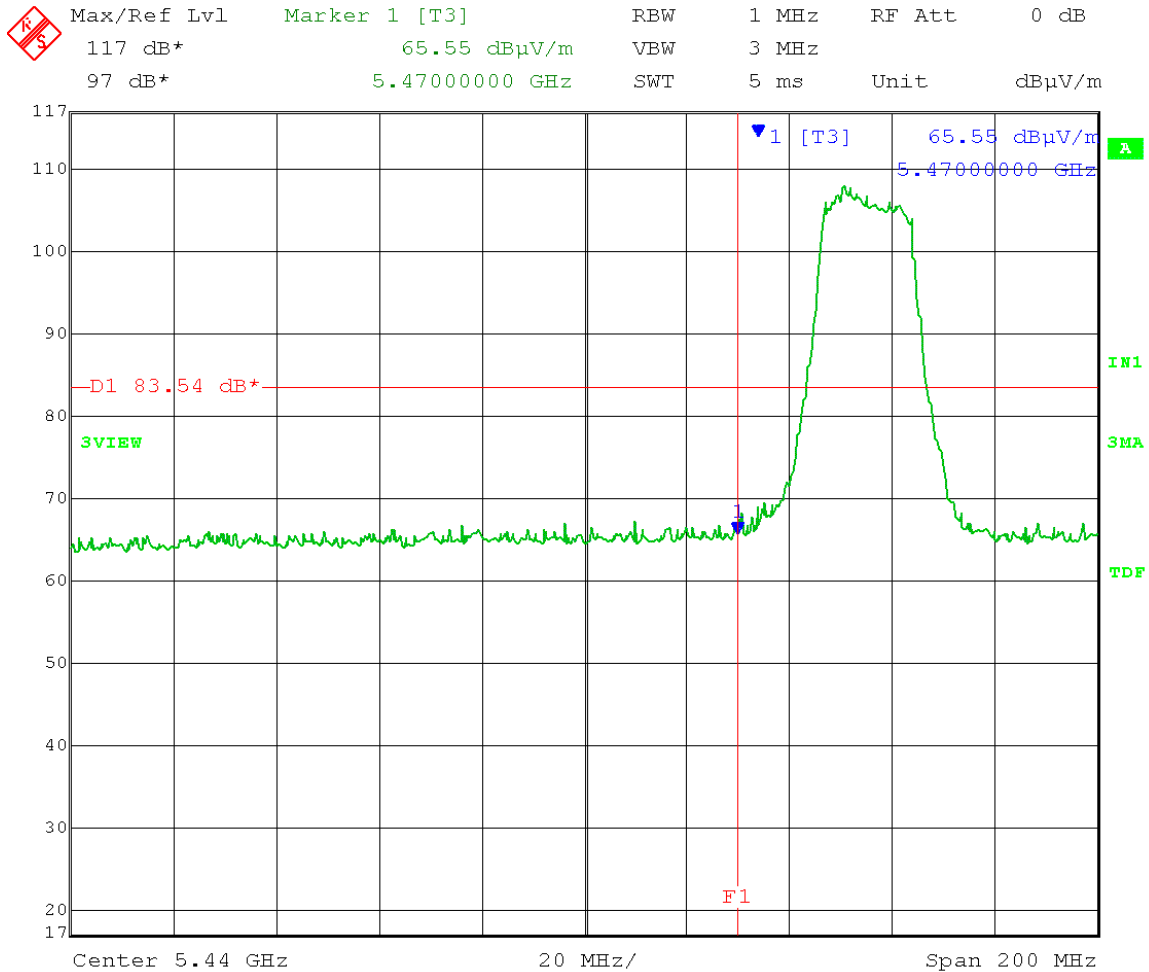


Date: 10.JUL.2013 13:44:48

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated – PEAK  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B  
 Comment: Low Channel: Frequency – 5495 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Band-Edge Frequency: 5.47 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

Band-Edge Limit: 83.54 dB $\mu$ V/m PEAK at a test distance of 1 meter.

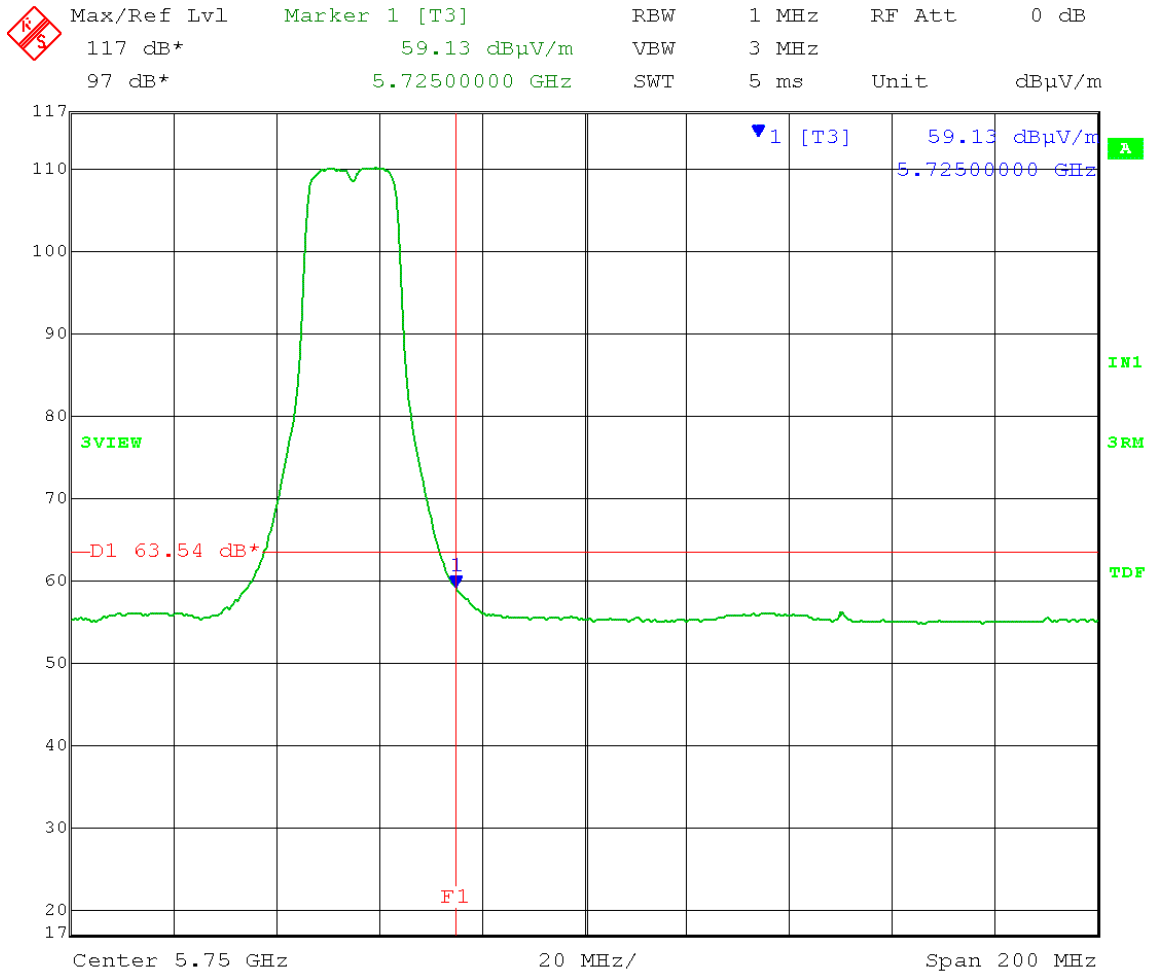


Date: 10.JUL.2013 13:52:31

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Upper Band-Edge Compliance - Radiated - AVG  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: High Channel: Frequency - 5705 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Band-Edge Frequency: 5.725 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): "an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit."

15.209 Limit: 63.54 dB $\mu$ V/m AVERAGE at a test distance of 1 meter.

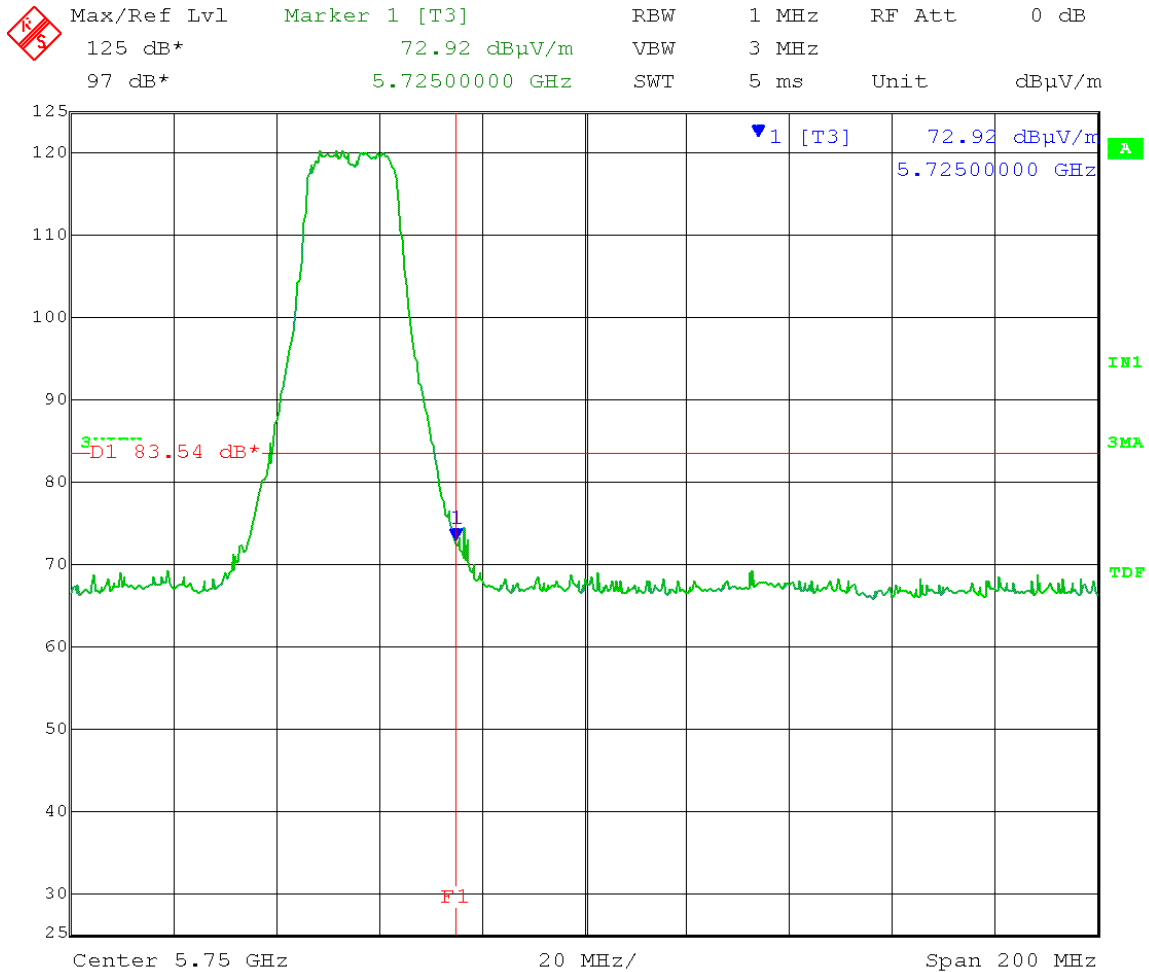


Date: 10.JUL.2013 10:24:39

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Upper Band-Edge Compliance - Radiated – PEAK  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: High Channel: Frequency – 5705 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Band-Edge Frequency: 5.725 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

Band-Edge Limit: 83.54 dBμV/m PEAK at a test distance of 1 meter.

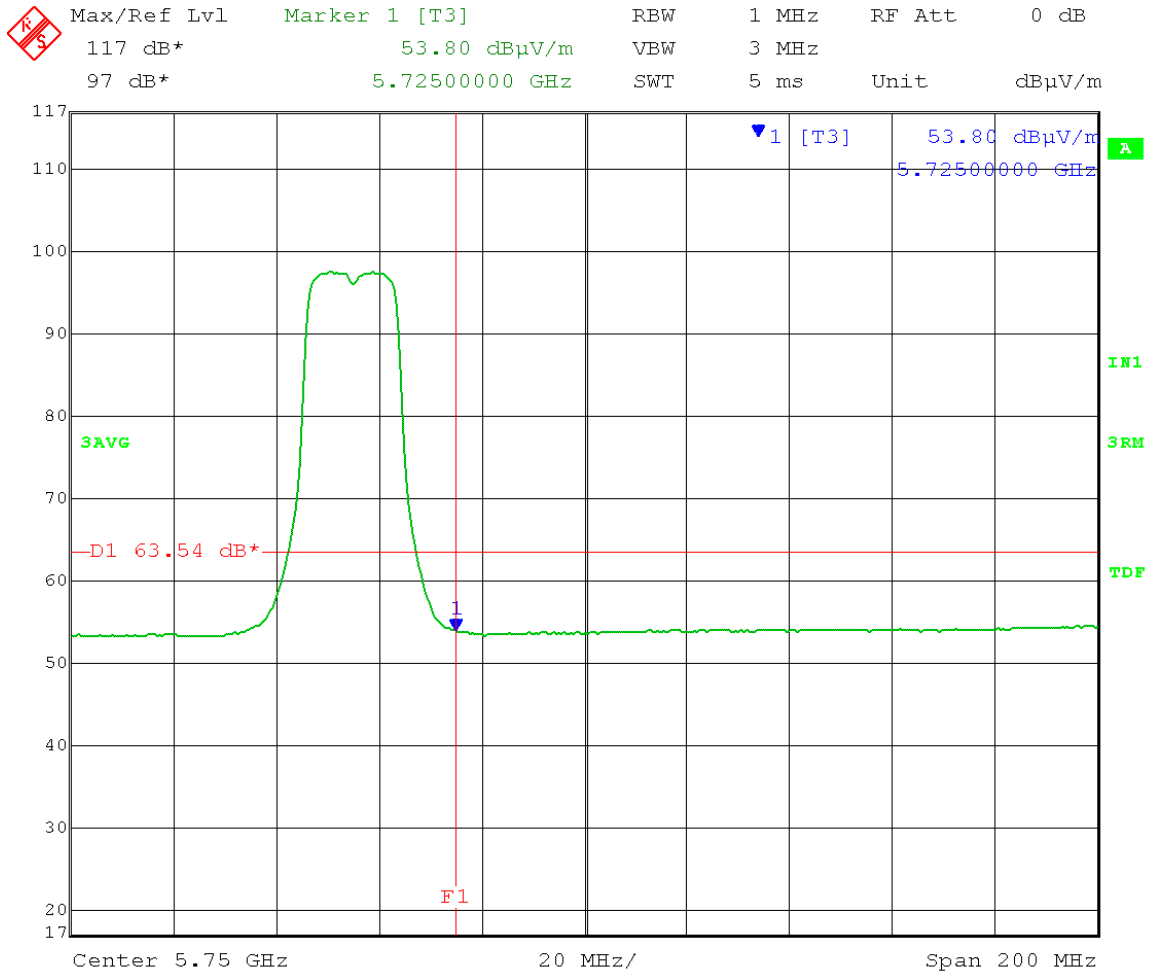


Date: 10.JUL.2013 10:32:34

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Upper Band-Edge Compliance - Radiated - AVG  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: High Channel: Frequency - 5705 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Band-Edge Frequency: 5.725 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): "an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit."

15.209 Limit: 63.54 dBμV/m AVERAGE at a test distance of 1 meter.

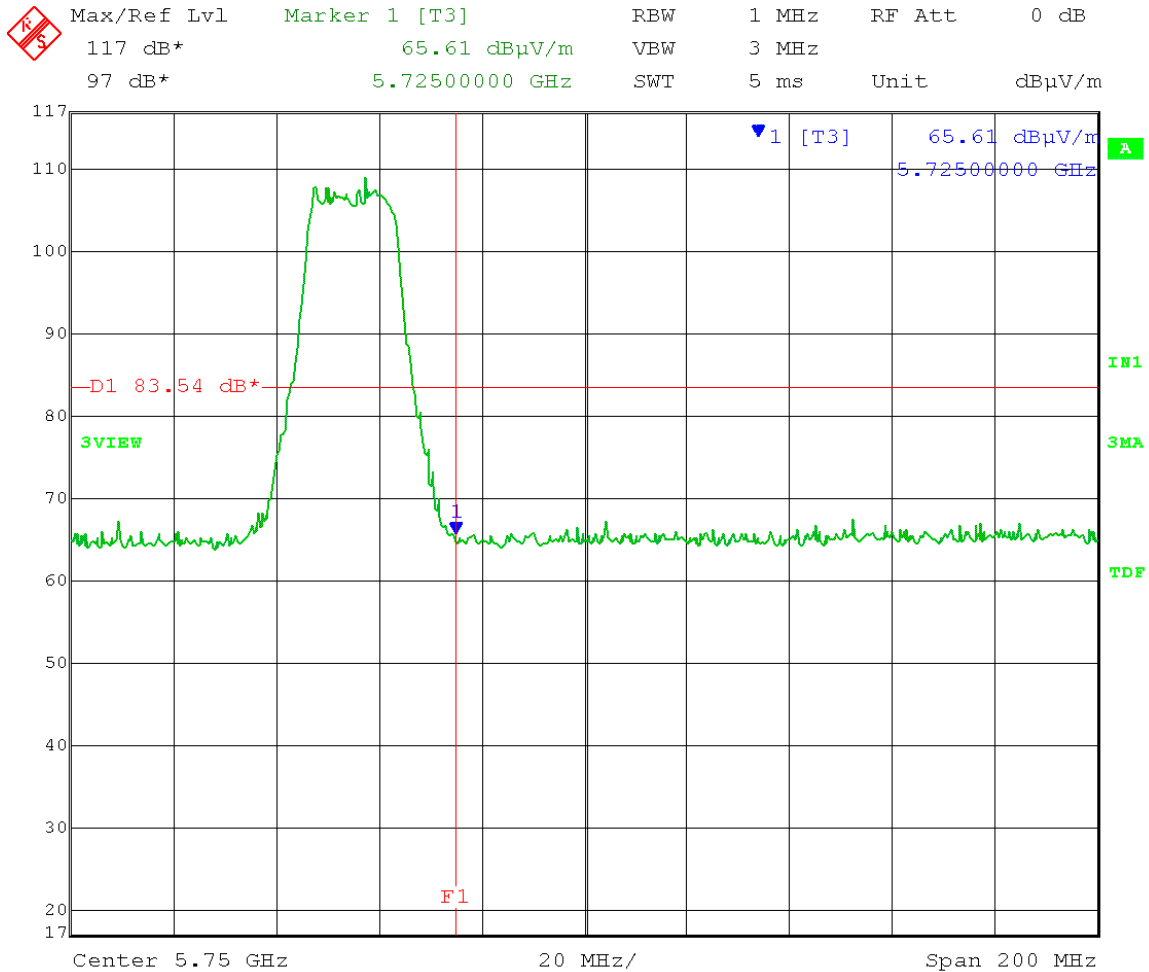


Date: 10.JUL.2013 14:00:16

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Upper Band-Edge Compliance - Radiated – PEAK  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: High Channel: Frequency – 5705 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Band-Edge Frequency: 5.725 GHz

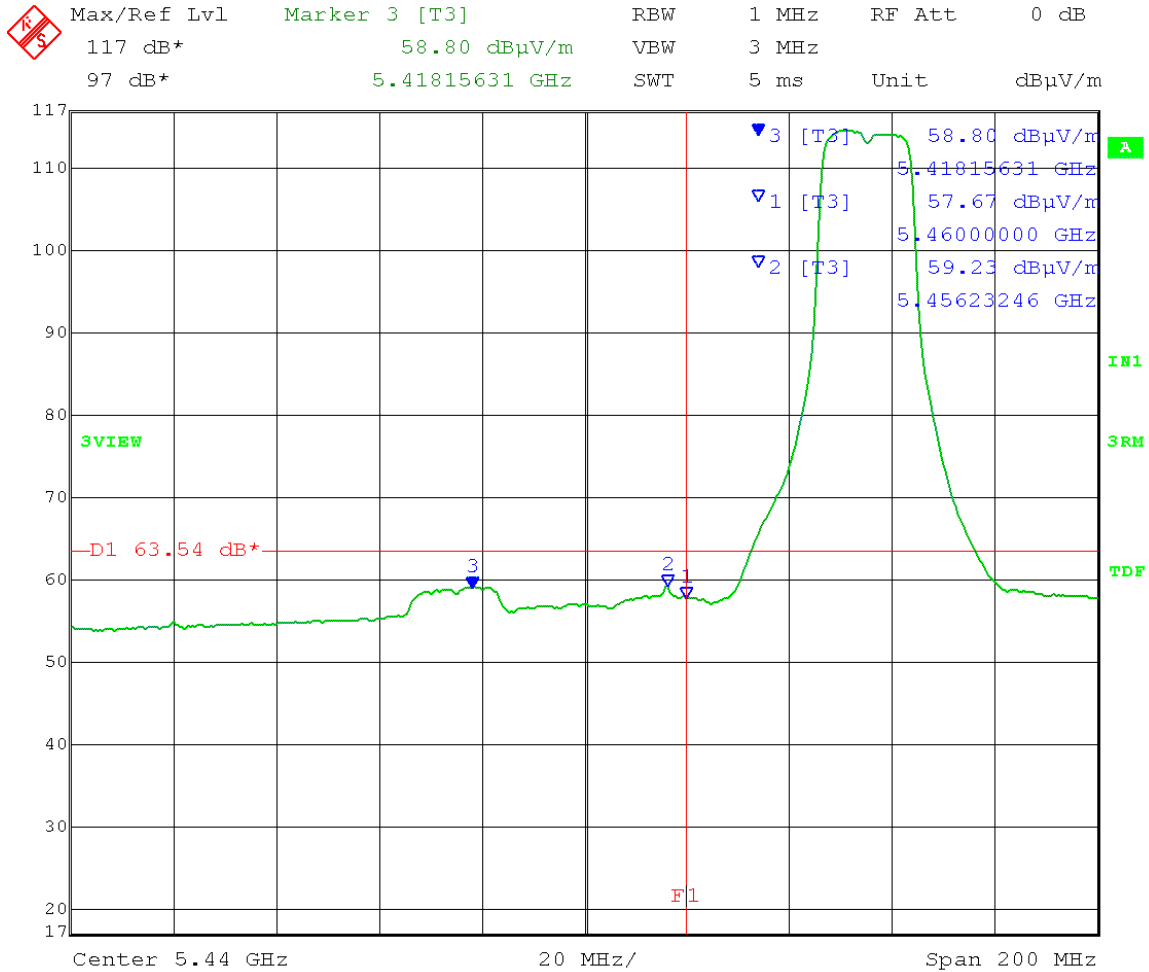
Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

Band-Edge Limit: 83.54 dBμV/m PEAK at a test distance of 1 meter.



Date: 10.JUL.2013 13:58:01

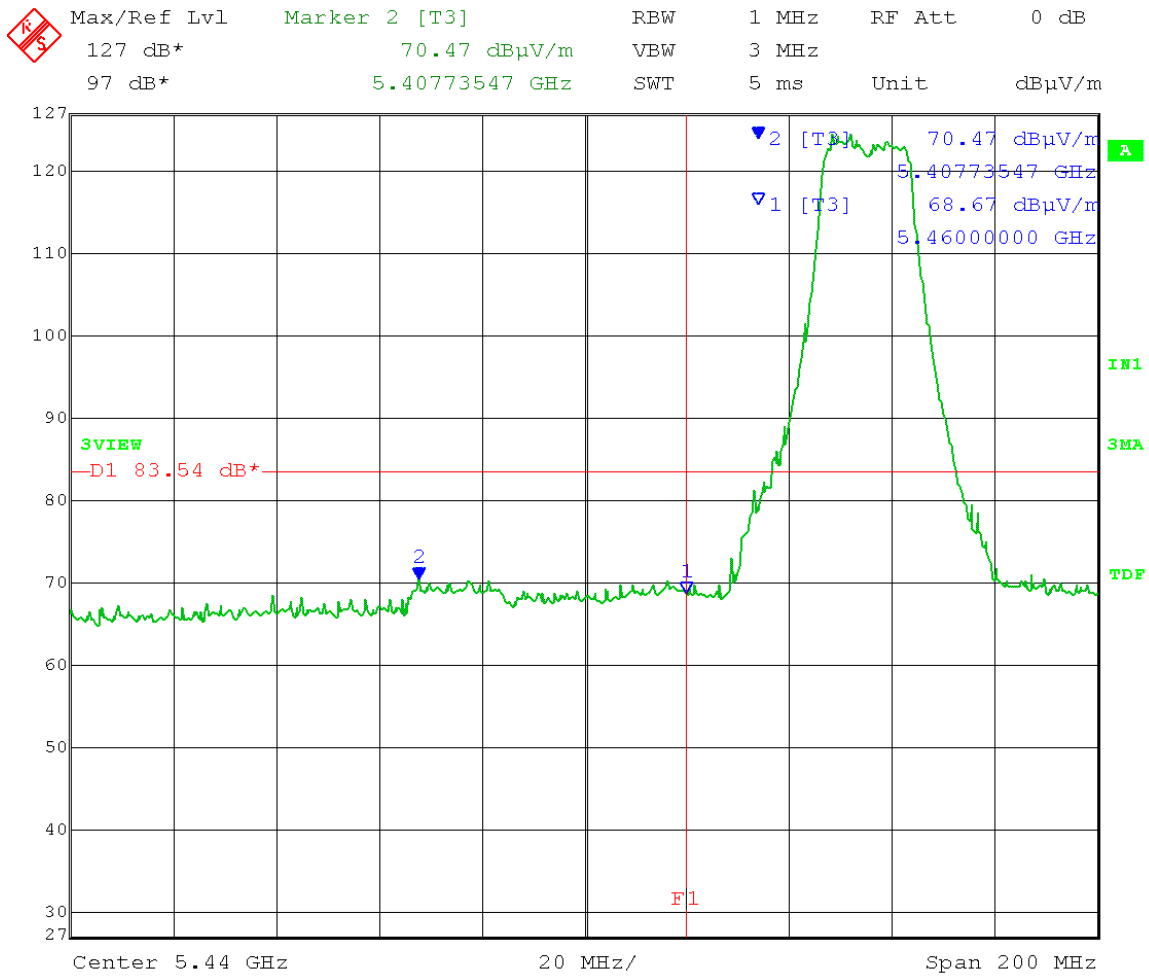
Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated (Restricted Band) – AVG  
 (FCC 15.407(b)(7)) - With integrated antenna  
 Operator: Craig B  
 Comment: Low Channel: Frequency – 5495 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Restricted Band-Edge Frequency: 5.46 GHz  
 Band-Edge Limit: 63.54 dB $\mu$ V/m AVERAGE at a test distance of 1 meter.



Date: 10.JUL.2013 09:09:22

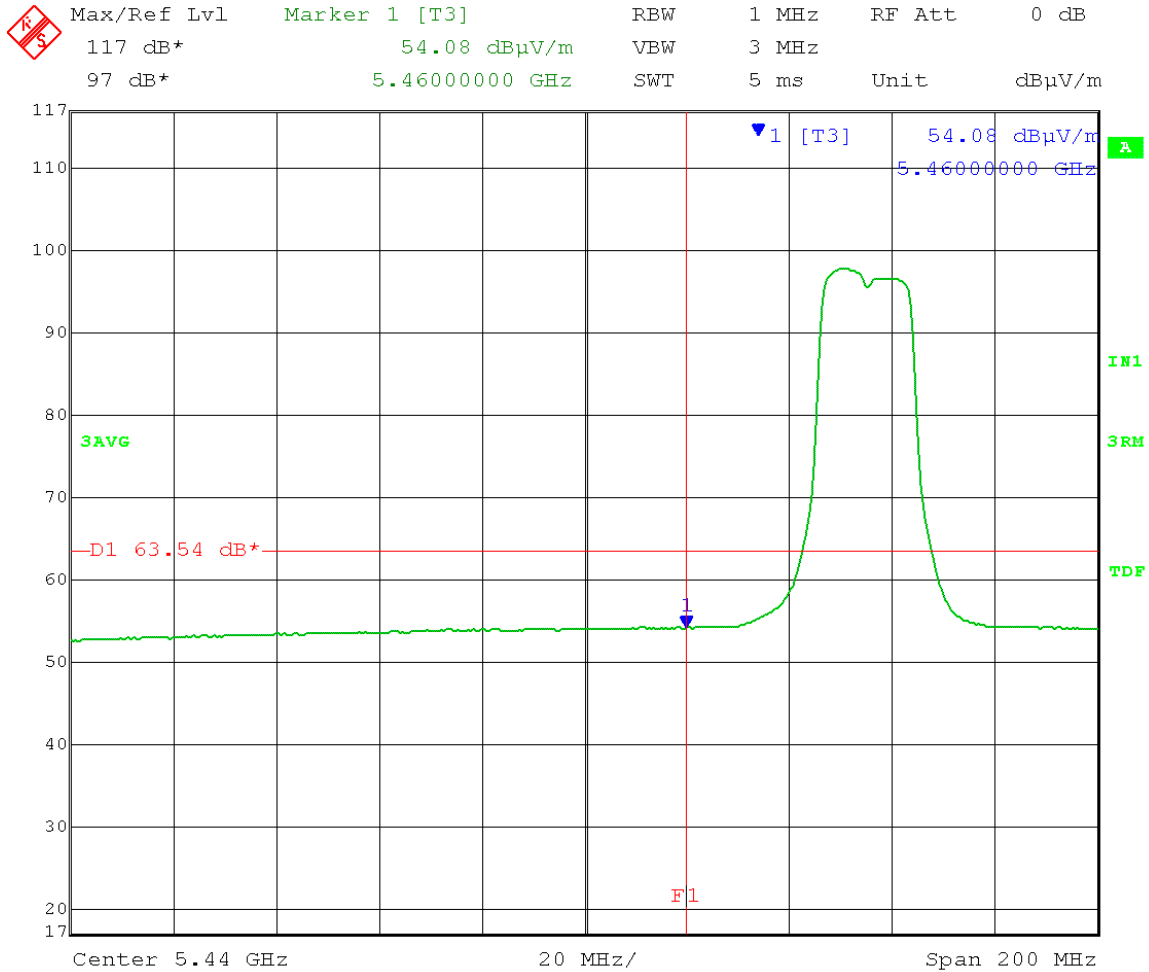


Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated (Restricted Band) – PEAK  
 (FCC 15.407(b)(7)) - With 50 Ohm terminations on antenna ports  
 Operator: Craig B  
 Comment: Low Channel: Frequency – 5495 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Restricted Band-Edge Frequency: 5.46 GHz  
 Band-Edge Limit: 83.54 dB $\mu$ V/m PEAK at a test distance of 1 meter.



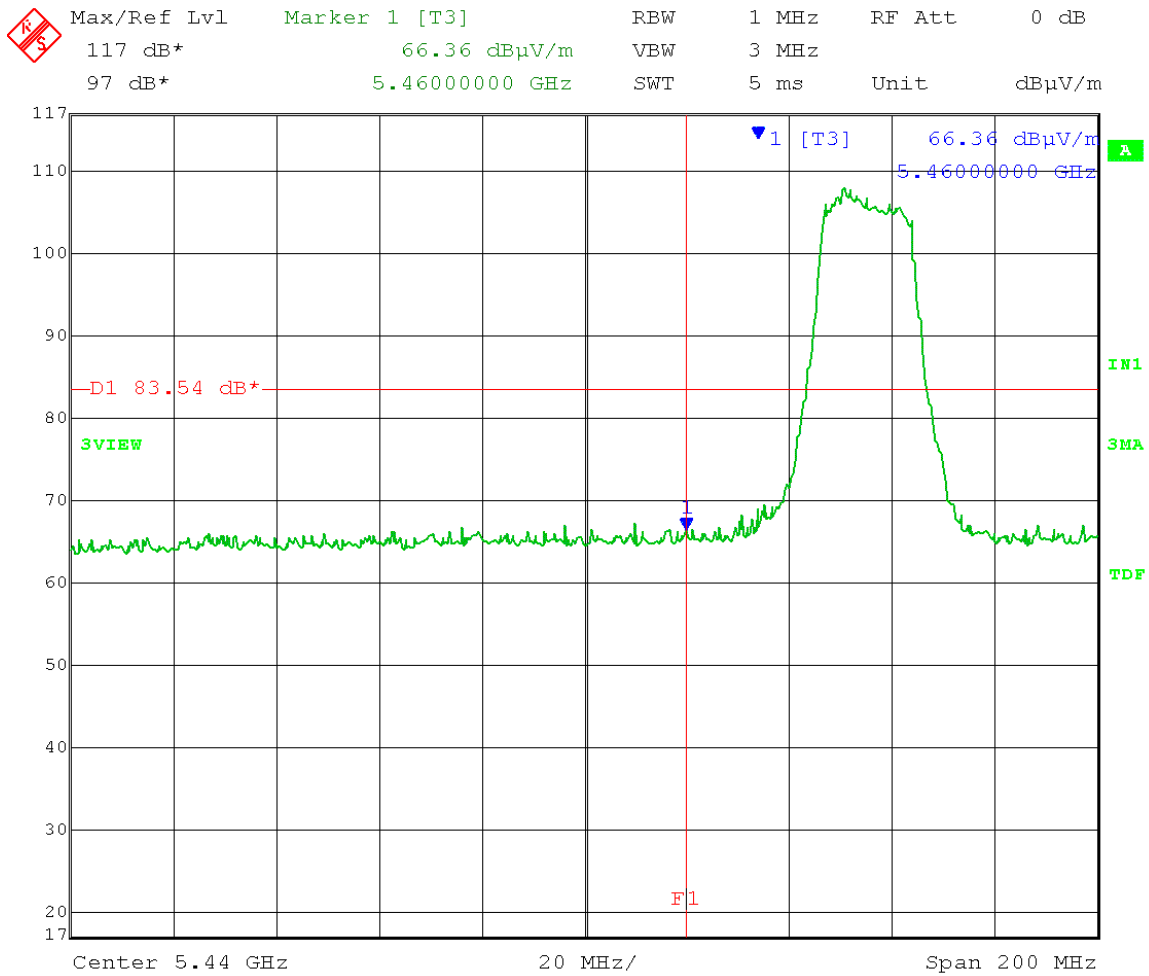
Date: 10.JUL.2013 09:13:29

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated (Restricted Band) – AVG  
 (FCC 15.407(b)(7)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5495 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Restricted Band-Edge Frequency: 5.46 GHz  
 Band-Edge Limit: 63.54 dB $\mu$ V/m AVERAGE at a test distance of 1 meter.



Date: 10.JUL.2013 13:47:49

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated (Restricted Band) – PEAK  
 (FCC 15.407(b)(7)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5495 MHz  
 Output power setting: 7.0 on both chains  
 Channel bandwidth: 20 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Restricted Band-Edge Frequency: 5.46 GHz  
 Band-Edge Limit: 83.54 dB $\mu$ V/m PEAK at a test distance of 1 meter.

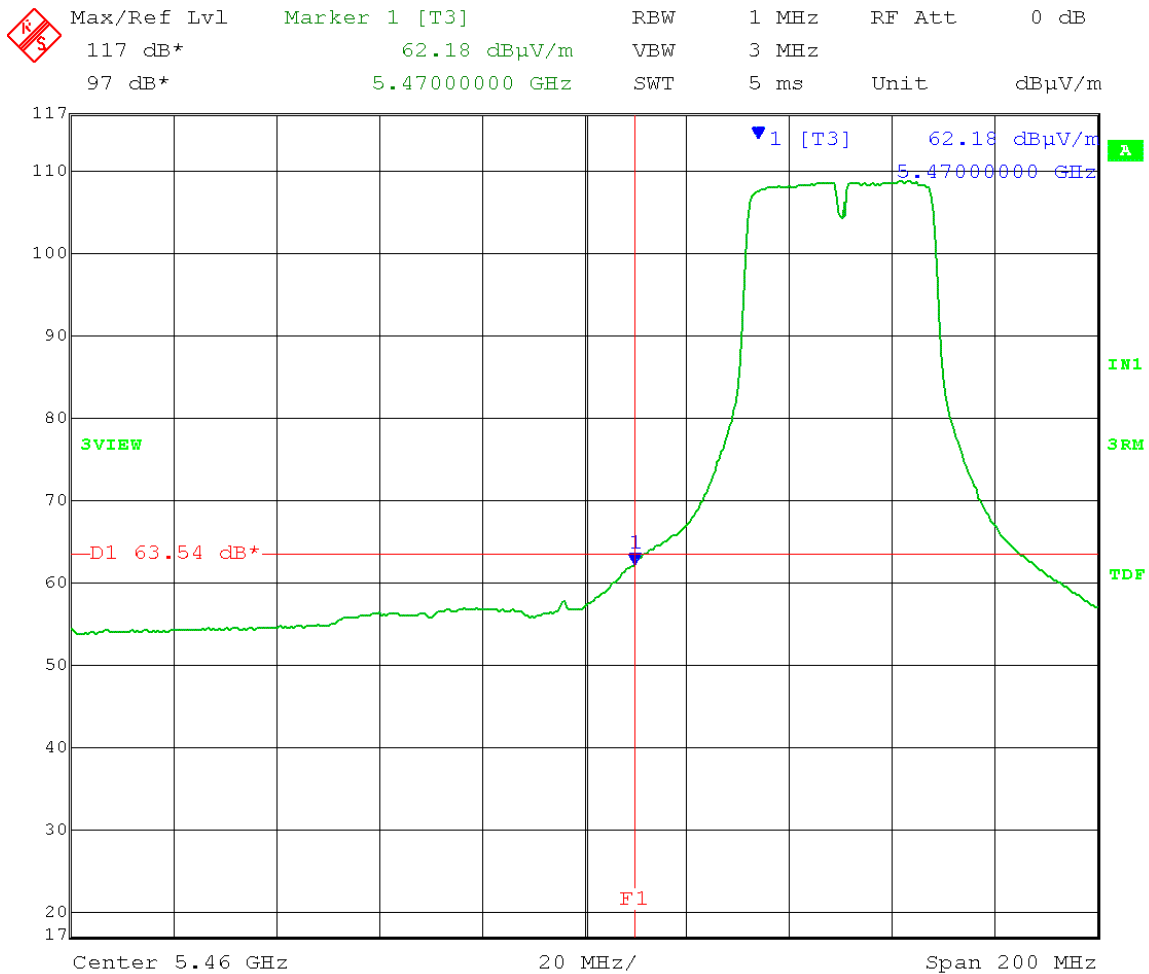


Date: 10.JUL.2013 13:49:56

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated – AVG  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5510 MHz  
 Output power setting: 6.5 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Band-Edge Frequency: 5.47 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

15.209 Limit: 63.54 dBμV/m AVERAGE at a test distance of 1 meter.

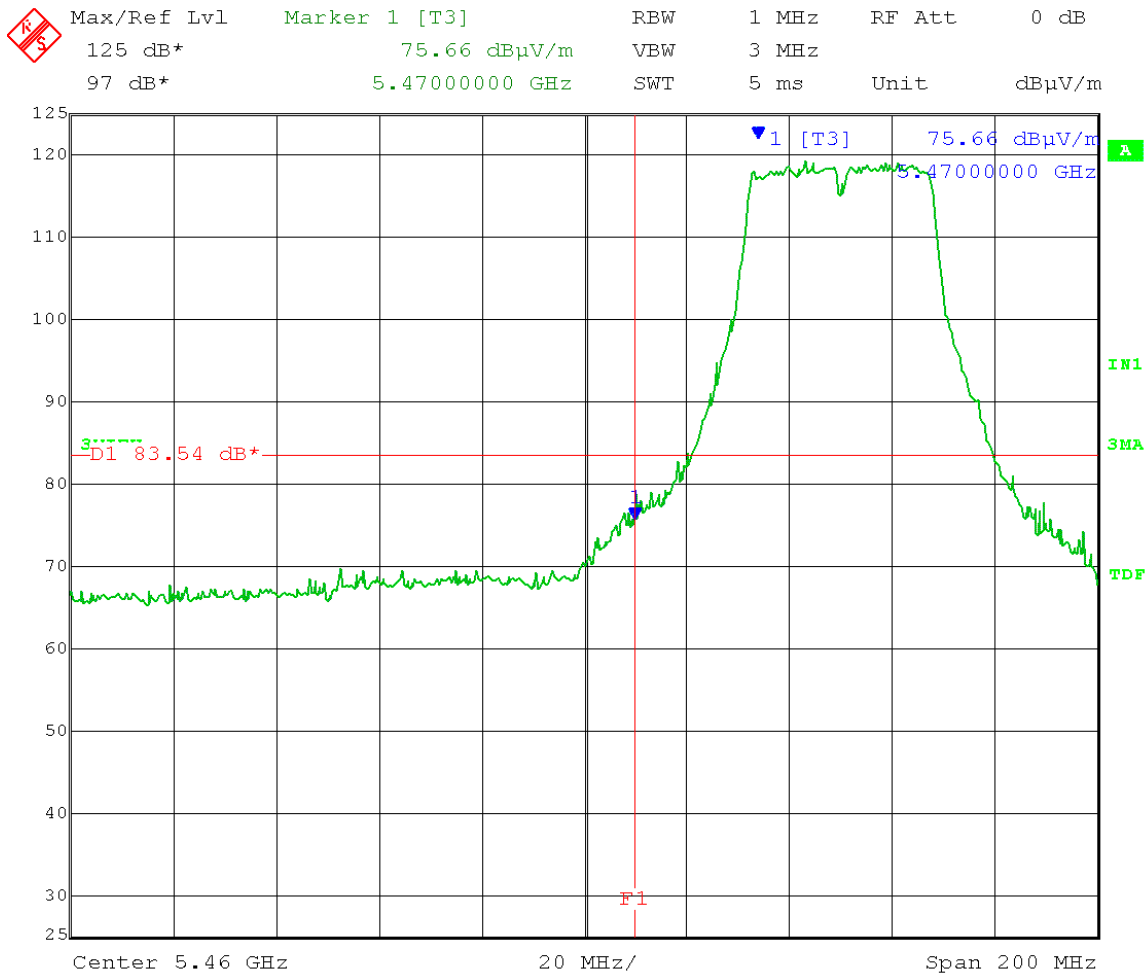


Date: 10.JUL.2013 10:47:22

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated – PEAK  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5510 MHz  
 Output power setting: 6.5 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Band-Edge Frequency: 5.47 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

Band-Edge Limit: 83.54 dB $\mu$ V/m PEAK at a test distance of 1 meter.

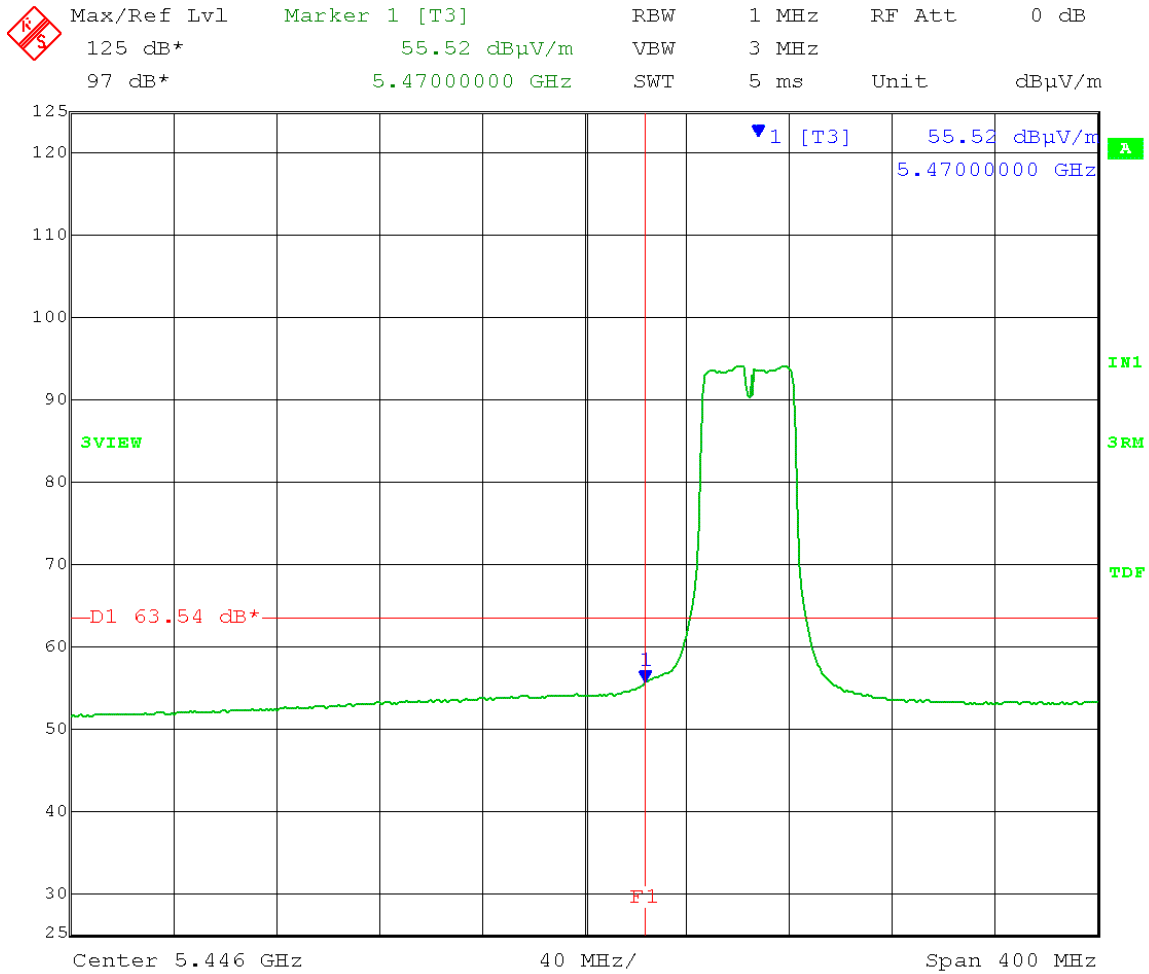


Date: 10.JUL.2013 11:04:53

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated – AVG  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5510 MHz  
 Output power setting: 6.5 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Band-Edge Frequency: 5.47 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

15.209 Limit: 63.54 dBμV/m AVERAGE at a test distance of 1 meter.

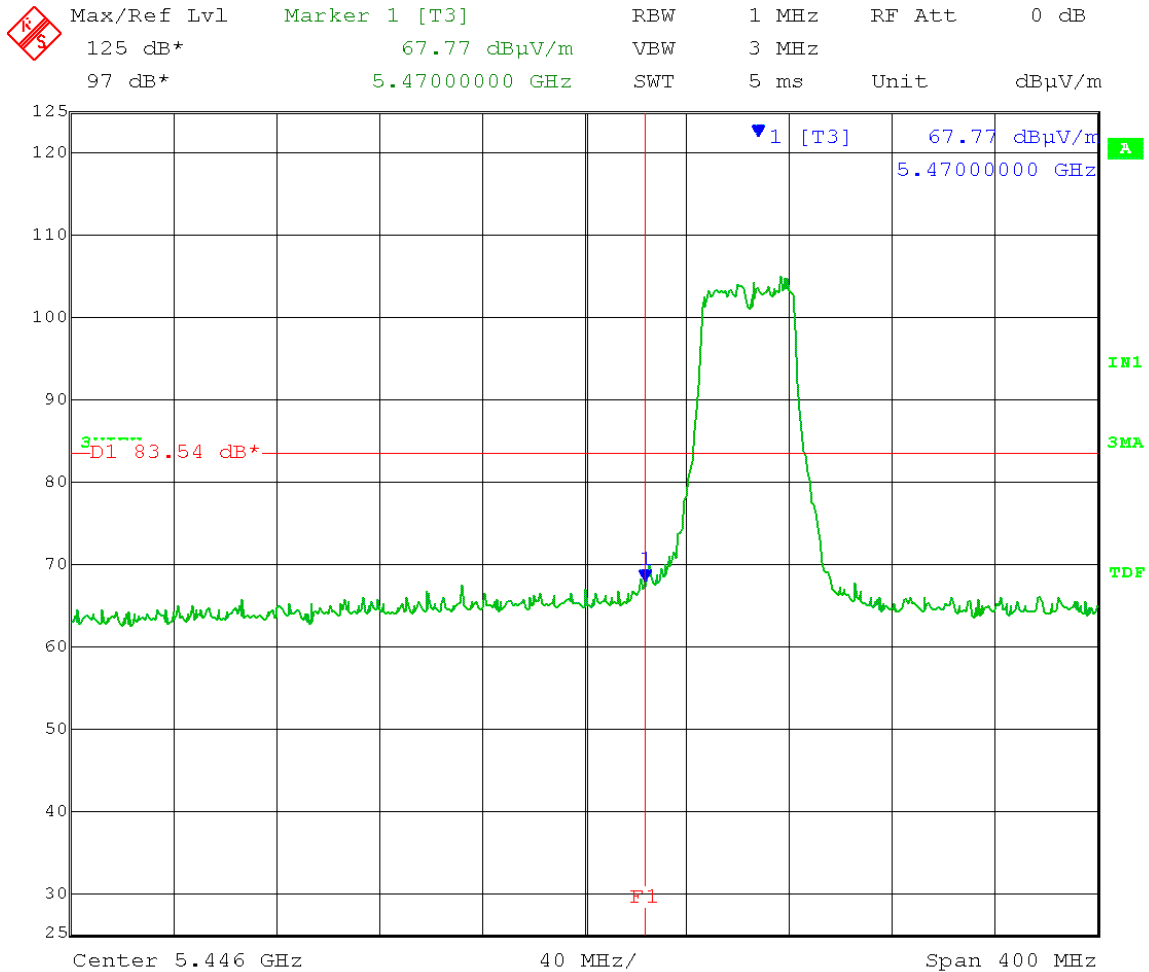


Date: 10.JUL.2013 13:37:18

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated – PEAK  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5510 MHz  
 Output power setting: 6.5 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Band-Edge Frequency: 5.47 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

Band-Edge Limit: 83.54 dB $\mu$ V/m PEAK at a test distance of 1 meter.

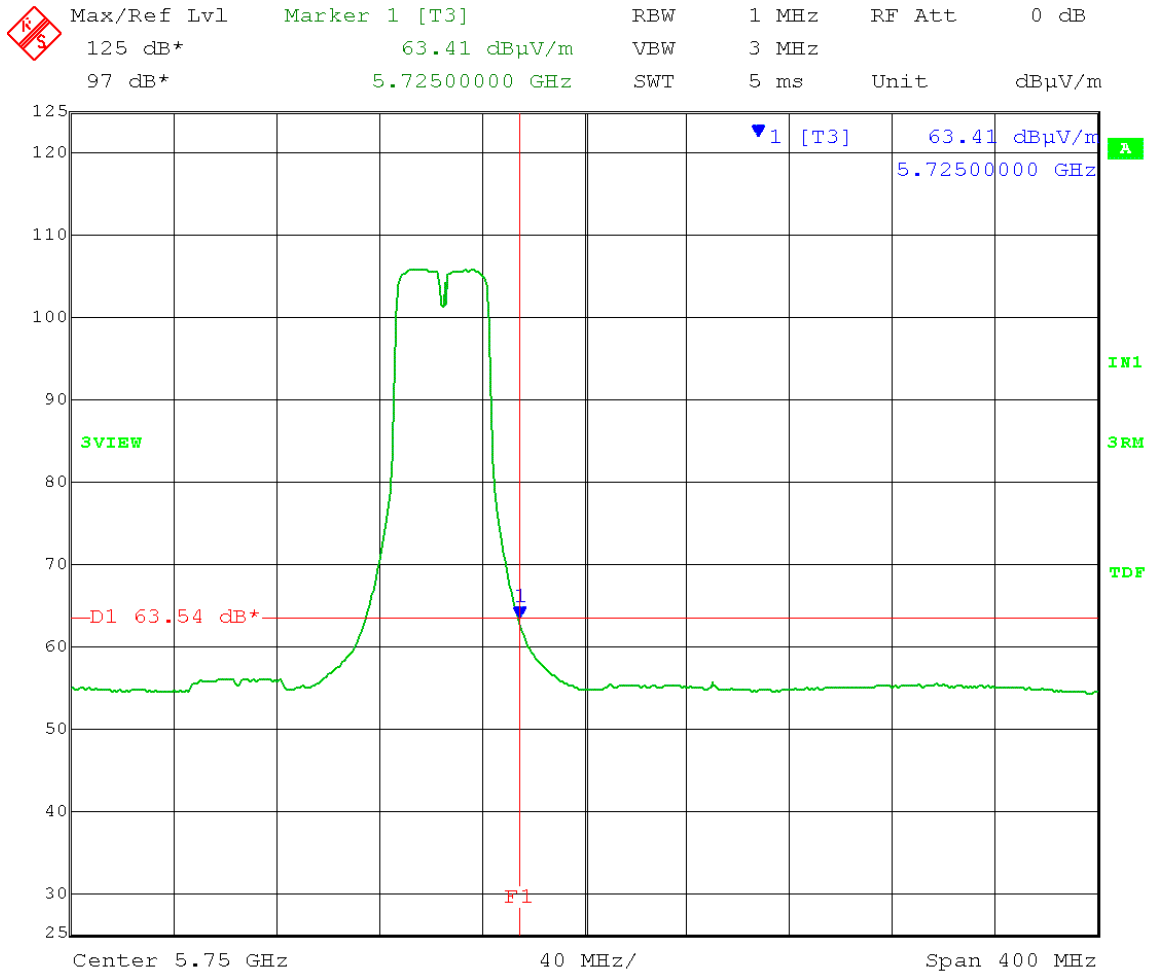


Date: 10.JUL.2013 13:28:08

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Upper Band-Edge Compliance - Radiated - AVG  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: High Channel: Frequency - 5695 MHz  
 Output power setting: 4.0 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Band-Edge Frequency: 5.725 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): "an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit."

15.209 Limit: 63.54 dB $\mu$ V/m AVERAGE at a test distance of 1 meter.



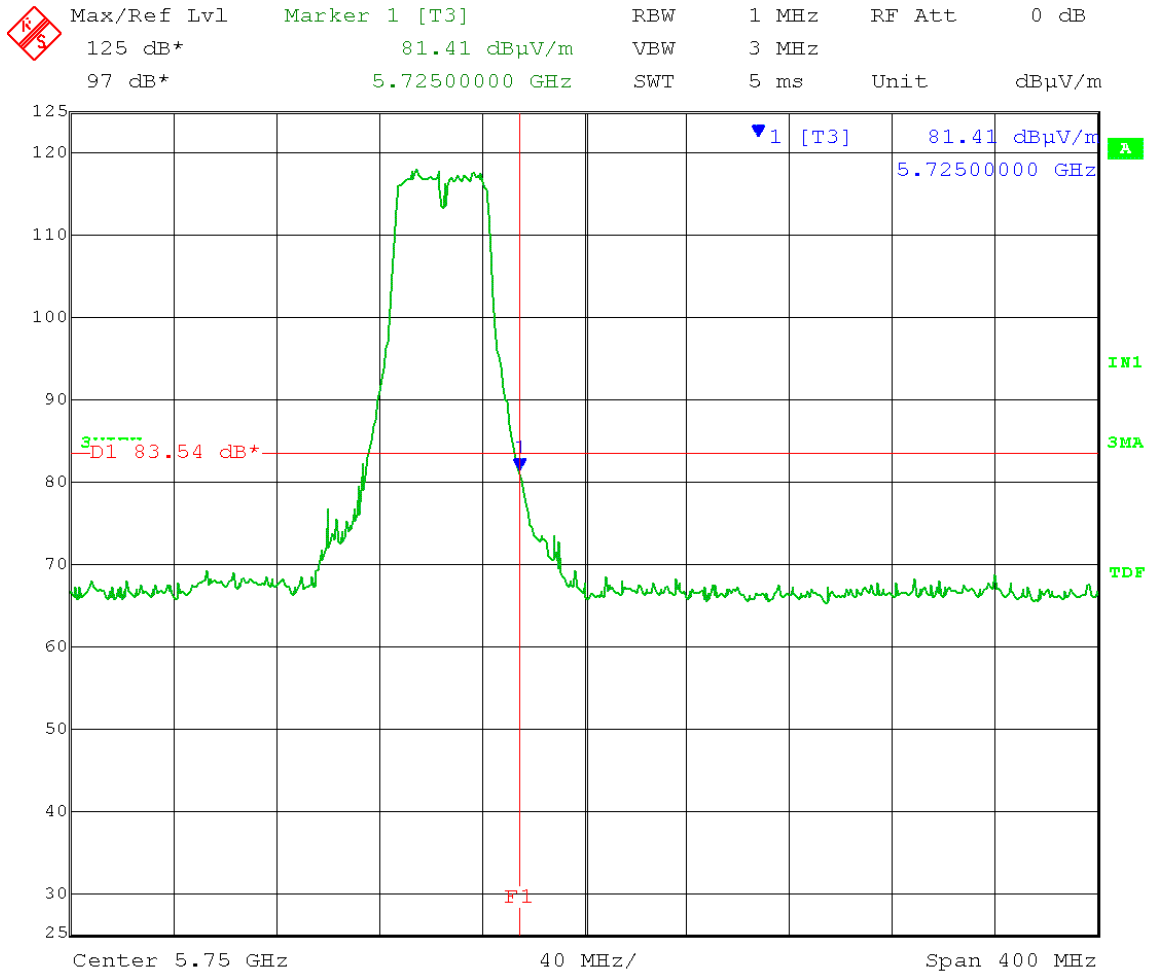
Date: 10.JUL.2013 11:25:57



Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Upper Band-Edge Compliance - Radiated – PEAK  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: High Channel: Frequency – 5695 MHz  
 Output power setting: 6.5 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Band-Edge Frequency: 5.725 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

Band-Edge Limit: 83.54 dB $\mu$ V/m PEAK at a test distance of 1 meter.

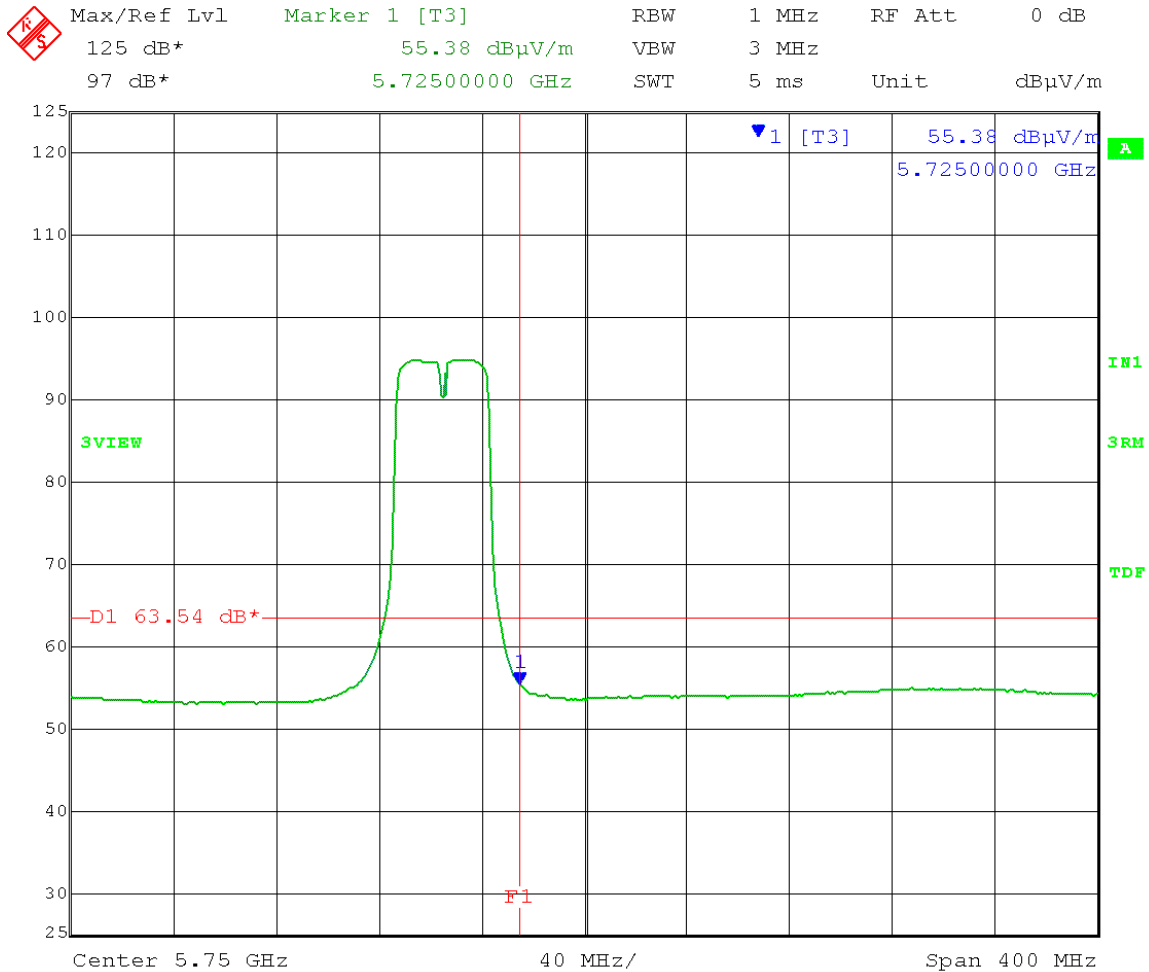


Date: 10.JUL.2013 11:18:35

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Upper Band-Edge Compliance - Radiated - AVG  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: High Channel: Frequency - 5695 MHz  
 Output power setting: 4.0 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Band-Edge Frequency: 5.725 GHz

Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): "an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit."

15.209 Limit: 63.54 dBμV/m AVERAGE at a test distance of 1 meter.

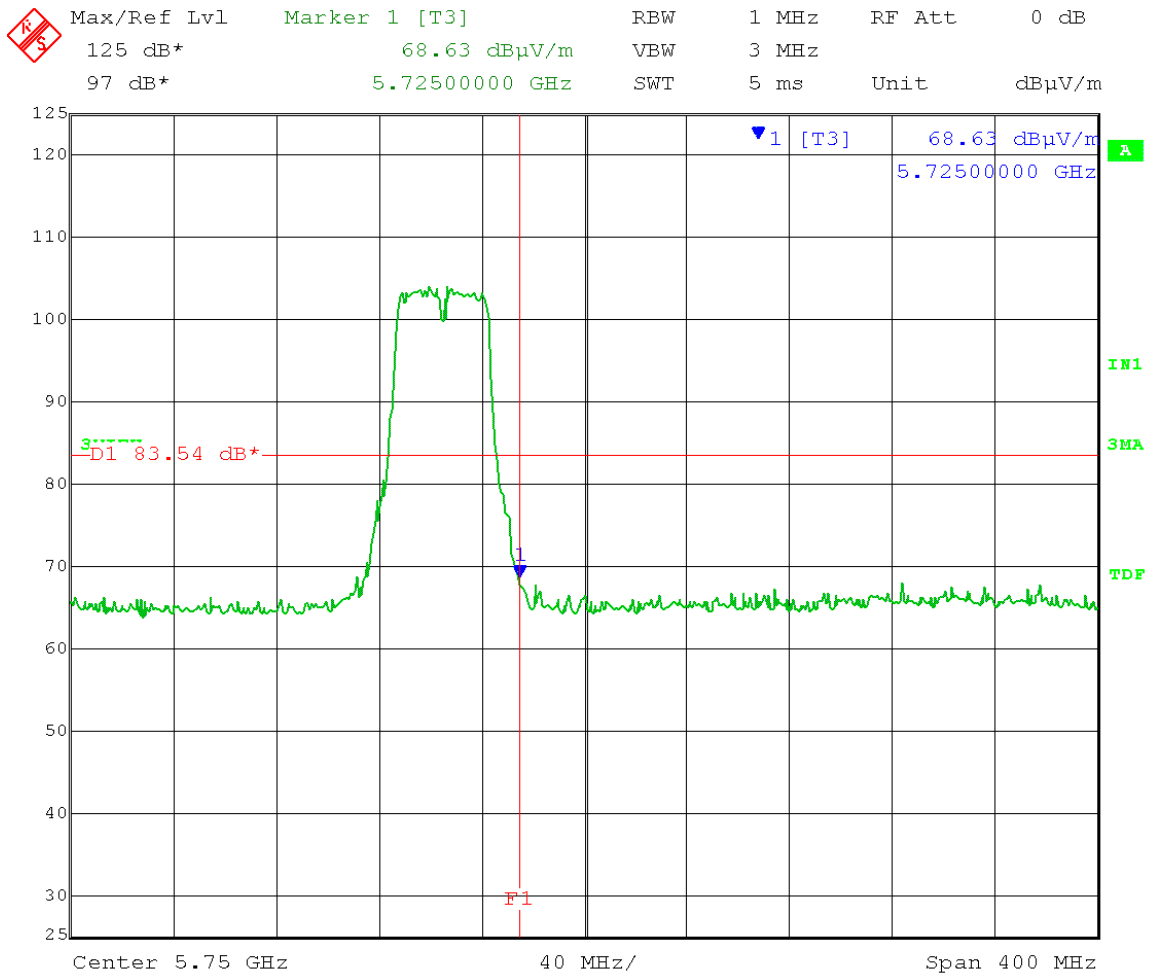


Date: 10.JUL.2013 13:15:35

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Upper Band-Edge Compliance - Radiated – PEAK  
 (FCC 15.407(b)(3)) - With integrated antenna  
 Operator: Craig B  
 Comment: High Channel: Frequency – 5695 MHz  
 Output power setting: 4.0 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Band-Edge Frequency: 5.725 GHz

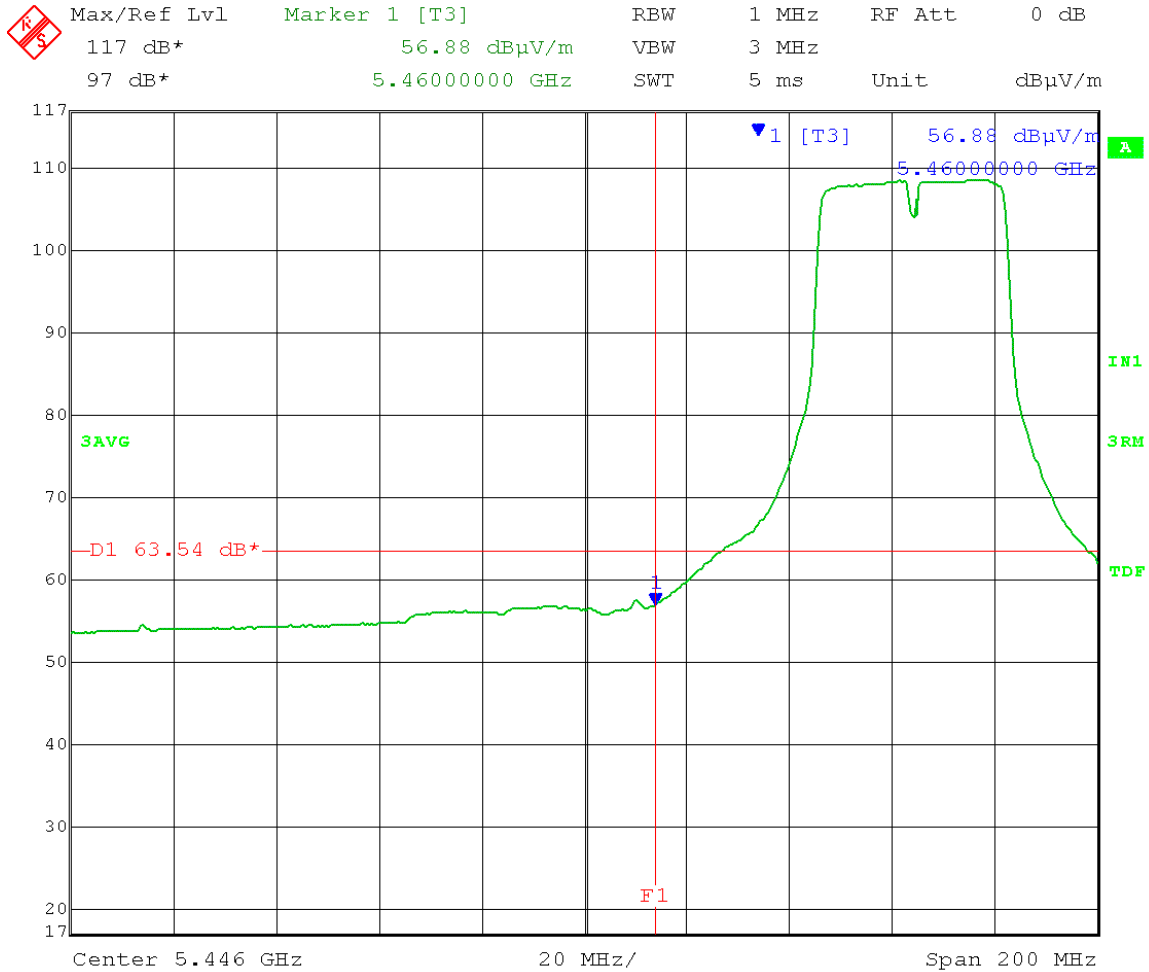
Per 789033 D01 General UNII Test Procedures v01r03, section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

Band-Edge Limit: 83.54 dBμV/m PEAK at a test distance of 1 meter.



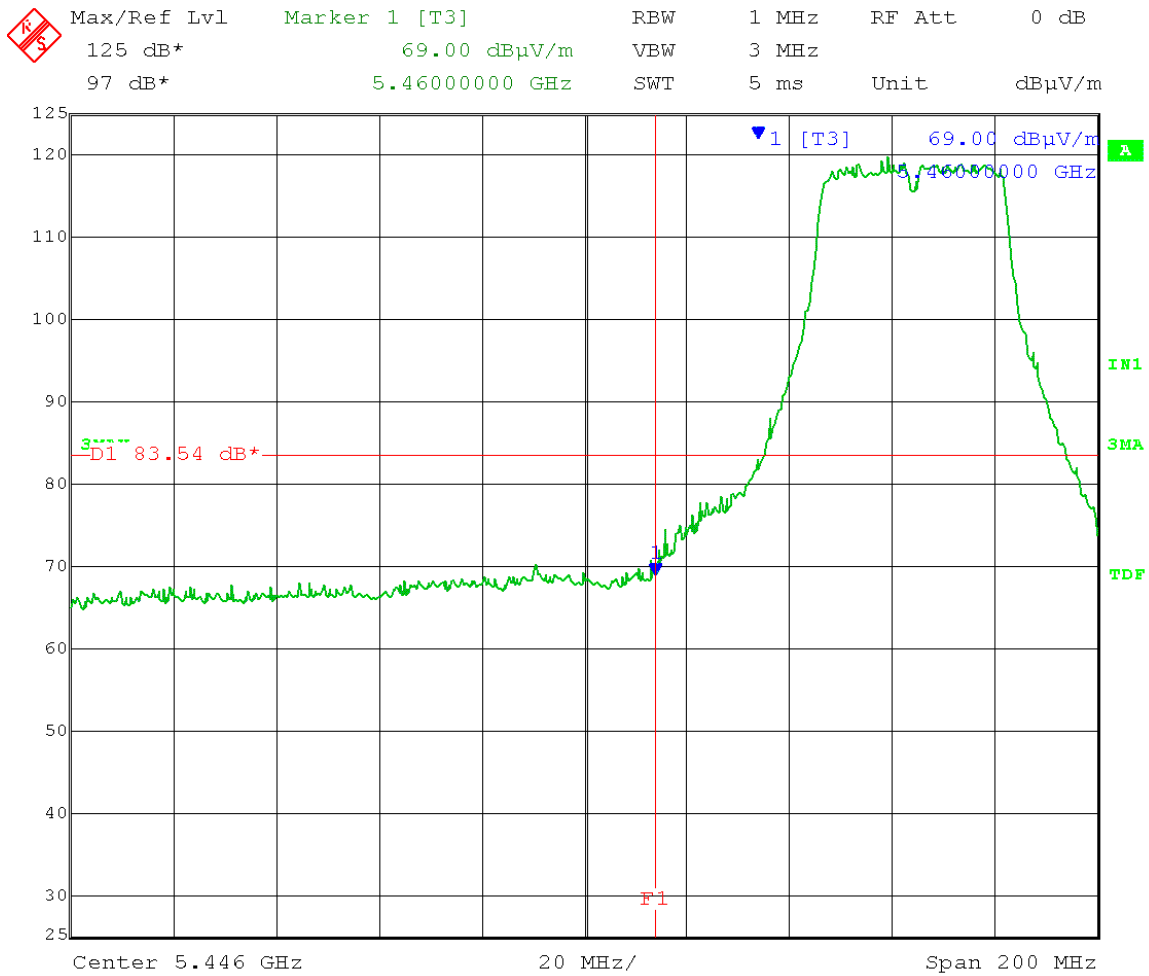
Date: 10.JUL.2013 13:20:24

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated (Restricted Band) – AVG  
 (FCC 15.407(b)(7)) - With integrated antenna  
 Operator: Craig B  
 Comment: Low Channel: Frequency – 5510 MHz  
 Output power setting: 6.5 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Restricted Band-Edge Frequency: 5.46 GHz  
 Band-Edge Limit: 63.54 dB $\mu$ V/m AVERAGE at a test distance of 1 meter.



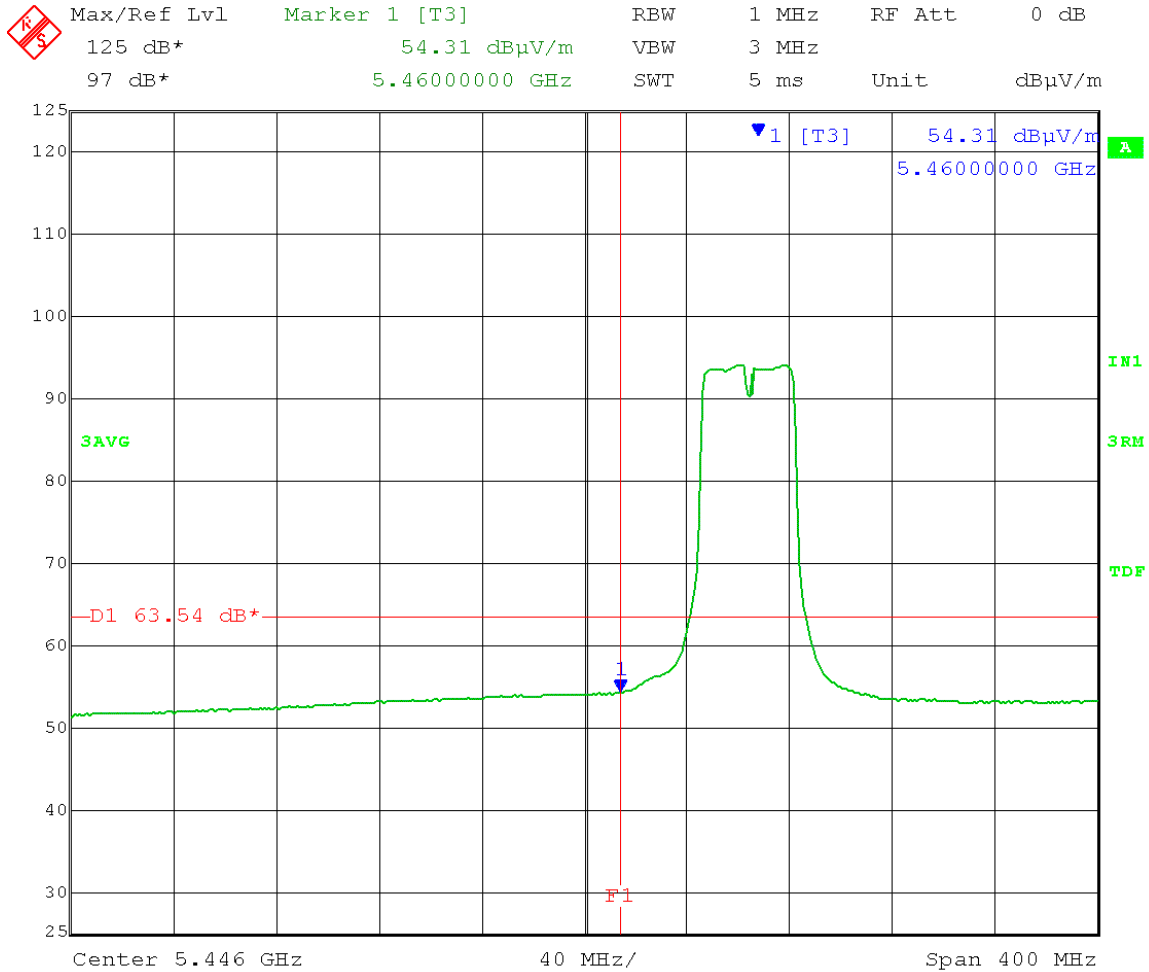
Date: 10.JUL.2013 10:58:57

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated (Restricted Band) – PEAK  
 (FCC 15.407(b)(7)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5510 MHz  
 Output power setting: 6.5 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Horizontal  
 Restricted Band-Edge Frequency: 5.46 GHz  
 Band-Edge Limit: 83.54 dB $\mu$ V/m PEAK at a test distance of 1 meter.



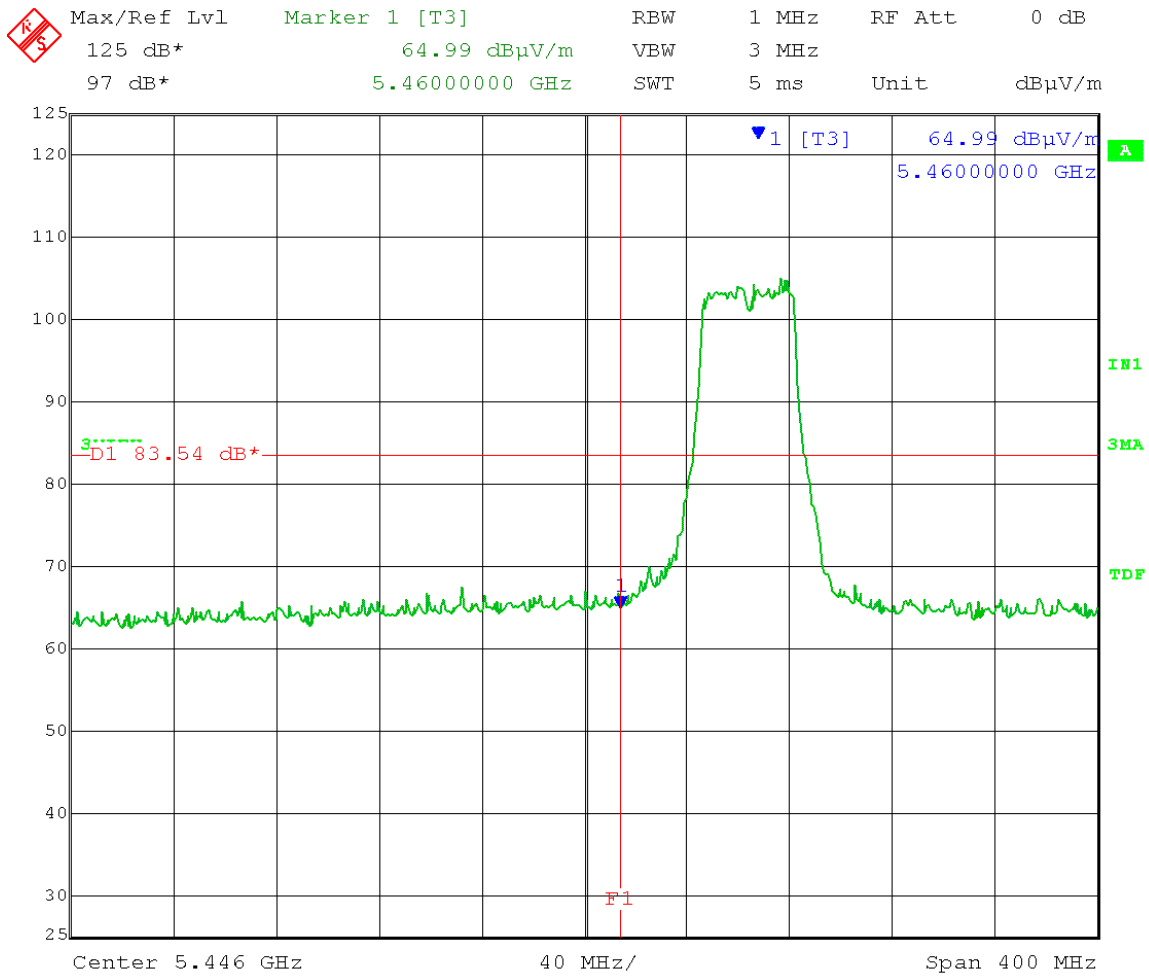
Date: 10.JUL.2013 11:08:32

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated (Restricted Band) – AVG  
 (FCC 15.407(b)(7)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5510 MHz  
 Output power setting: 6.5 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Restricted Band-Edge Frequency: 5.46 GHz  
 Band-Edge Limit: 63.54 dB $\mu$ V/m AVERAGE at a test distance of 1 meter.



Date: 10.JUL.2013 13:32:25

Test Date: 07-10-2013  
 Company: Cambium Networks  
 EUT: 5.4 GHz Avenger SM  
 Test: Lower Band-Edge Compliance - Radiated (Restricted Band) – PEAK  
 (FCC 15.407(b)(7)) - With integrated antenna  
 Operator: Craig B/Lillian L  
 Comment: Low Channel: Frequency – 5510 MHz  
 Output power setting: 6.5 on both chains  
 Channel bandwidth: 40 MHz  
 Modulation: OFDM; MCS15  
 Polarization: Vertical  
 Restricted Band-Edge Frequency: 5.46 GHz  
 Band-Edge Limit: 83.54 dB $\mu$ V/m PEAK at a test distance of 1 meter.



Date: 10.JUL.2013 13:29:34



166 South Carter, Genoa City, WI 53128

Company: Cambium Networks  
Models Tested: C050900C032A & C058900P132A  
Report Number: 19222  
DLS Project: 5946

## Appendix B – Measurement Data

### B8.0 Unwanted Emission Levels – Radiated with integral antenna

**Rule Section:** Sections 15.407(b)(3) and 15.407(b)(6)

**Test Procedure:** FCC KDB 789033 D01 General UNII Test Procedures v01r03 – *Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E*

Section H(1) – Unwanted emissions in the restricted bands  
Section H(2) – Unwanted emissions that fall outside of the restricted bands  
Section H(3) – General Requirements for Unwanted Emissions Measurements  
Section H(4) – Procedure for Unwanted Emissions Measurements Below 1 GHz  
Section H(5) – Procedure for Peak Unwanted Emissions Measurements Above 1 GHz  
Section H(6) – Procedure for Average Unwanted Emissions Measurements Above 1 GHz  
Section H(6)(c) – Average Detection method

Below 1000 MHz

Detector = quasi-peak

Alternately, peak detector is permitted

Peak measurements above 1000 MHz

RBW = 1 MHz

VBW  $\geq$  3 MHz

Detector = peak

Sweep time = auto; increased by a factor of (1 / duty cycle)

Trace mode = max hold

Average measurements above 1000 MHz (required for peak emissions that are above the average limits)

– Method AD (Average Detection)

RBW = 1 MHz

VBW  $\geq$  3 MHz

Detector = RMS (span/(# of points in sweep)  $\leq$  RBW/2)

Averaging type = power

Sweep time = auto; increased by a factor of (1 / duty cycle)

Trace mode = trace average 100 sweeps; increased by a factor of (1 / duty cycle)

For a duty cycle less than 98%, add 10 log (1/duty cycle)

**Limits:** Outside restricted bands: Peak EIRP shall not exceed -27 dBm/MHz

Inside restricted bands: Peak and Average limits of FCC Part 15.209

Per Section H(2)(c)(i): “an out-of-band emission that complies with both the average and peak limits of 15.209 is not required to satisfy the -27 dBm/MHz or -17 dBm/MHz peak emission limit.”

**Results:** Passed

**Notes:** Both transmit chains active and at maximum power during test.

Measurements were taken for MCS15 OFDM modulation at the lowest, middle, and highest channels of operation.

EUT was set to transmit continuously with 100% duty cycle.



**FCC Part 15 Class B**

**Electric Field Strength**

EUT: Avenger Station 5.4GHz  
Manufacturer: Cambium Networks  
Operating Condition: 67 deg. F; 56% R.H.  
Test Site: DLS O.F. Site 3  
Operator: Jim O  
Test Specification: 120V 60Hz POE  
Comment: Continuous TX  
Date: 06-05-2013

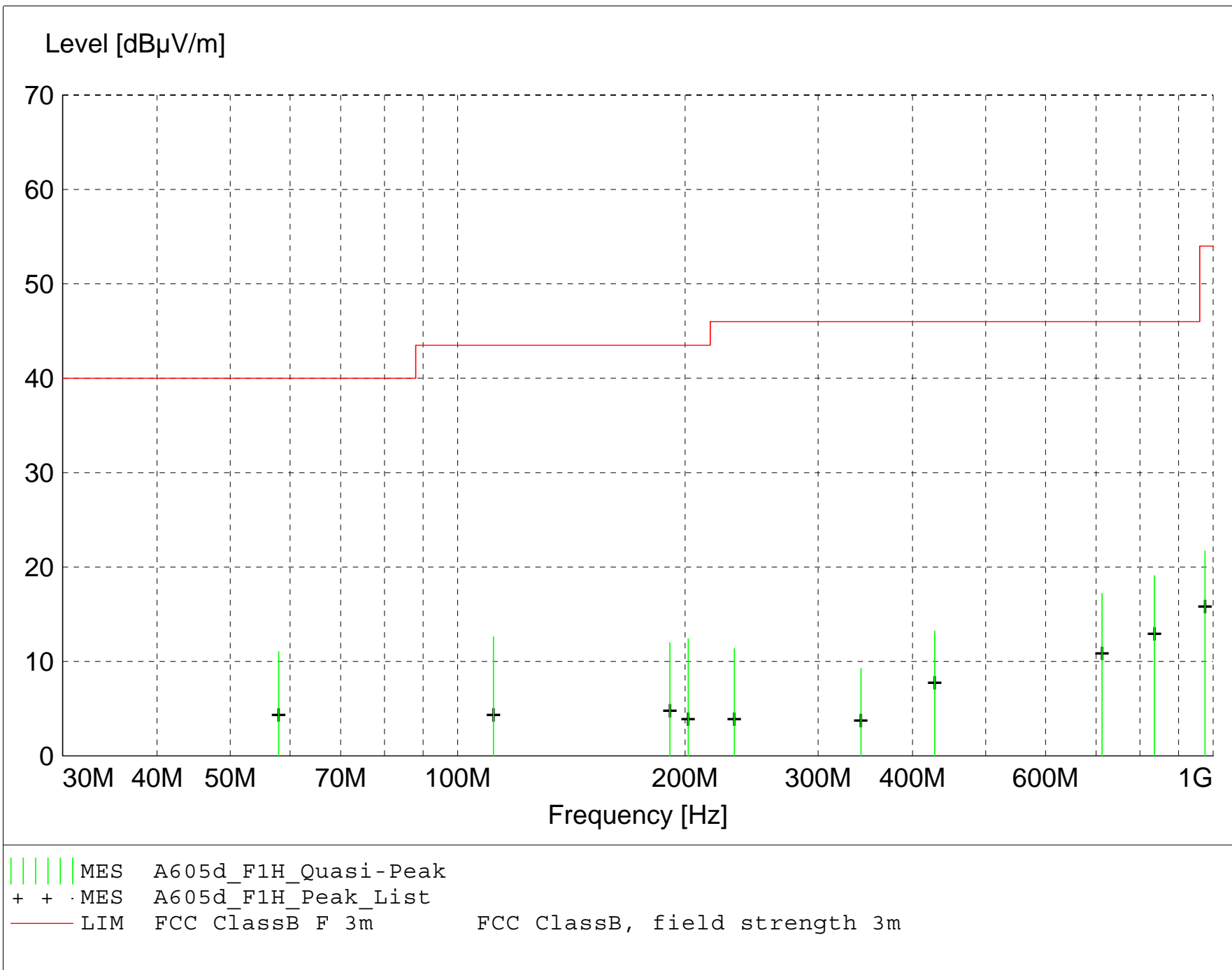
**TEXT: "Horz 3 meters"**

Short Description: Test Set-up

Test Set-up: EUT Measured at 3 Meters with HORIZONTAL Antenna Polarization

Equations:  $\text{Total Level (dB}\mu\text{V/m)} = \text{Level (dB}\mu\text{V)} + \text{System Loss (dB)} + \text{Antenna Factor (dB}\mu\text{V/m)}$   
 $\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$

Graph Markers: + Frequency marker (Level of marker not related to final level)  
| Final maximized level using Quasi-Peak detector  
X Final maximized level using Average detector  
# Final maximized level using Peak detector



**MEASUREMENT RESULT: "A605d\_F1H\_Final"**

6/5/2013 10:34AM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBµV	Factor	Loss	Level	dBµV/m	dB	Ant.	Angle	Detector	
		dBµV/m	dB	dBµV/m	dBµV/m		m	deg		
836.060000	15.49	22.42	-18.8	19.1	46.0	26.9	2.00	0	QUASI-PEAK	NF
712.940000	15.68	20.96	-19.4	17.2	46.0	28.8	2.00	0	QUASI-PEAK	NF
57.960000	24.37	10.61	-23.9	11.0	40.0	29.0	1.00	0	QUASI-PEAK	NF
111.540000	23.19	12.46	-23.0	12.6	43.5	30.9	1.00	350	QUASI-PEAK	None
201.920000	22.49	12.18	-22.2	12.4	43.5	31.1	2.00	90	QUASI-PEAK	None
190.980000	16.84	17.40	-22.3	12.0	43.5	31.5	1.00	0	QUASI-PEAK	NF
975.440000	14.80	24.11	-17.2	21.7	54.0	32.3	2.00	0	QUASI-PEAK	NF
428.000000	17.58	16.58	-20.9	13.2	46.0	32.8	2.00	200	QUASI-PEAK	None
232.340000	21.68	11.59	-21.9	11.4	46.0	34.6	2.00	170	QUASI-PEAK	None
341.840000	15.70	14.90	-21.3	9.3	46.0	36.7	2.00	0	QUASI-PEAK	NF

**FCC Part 15 Class B**

**Electric Field Strength**

EUT: Avenger Station 5.4GHz  
Manufacturer: Cambium Networks  
Operating Condition: 67 deg. F; 56% R.H.  
Test Site: DLS O.F. Site 3  
Operator: Jim O  
Test Specification: 120V 60Hz POE  
Comment: Continuous TX  
Date: 06-05-2013

**TEXT: "Vert 3 meters"**

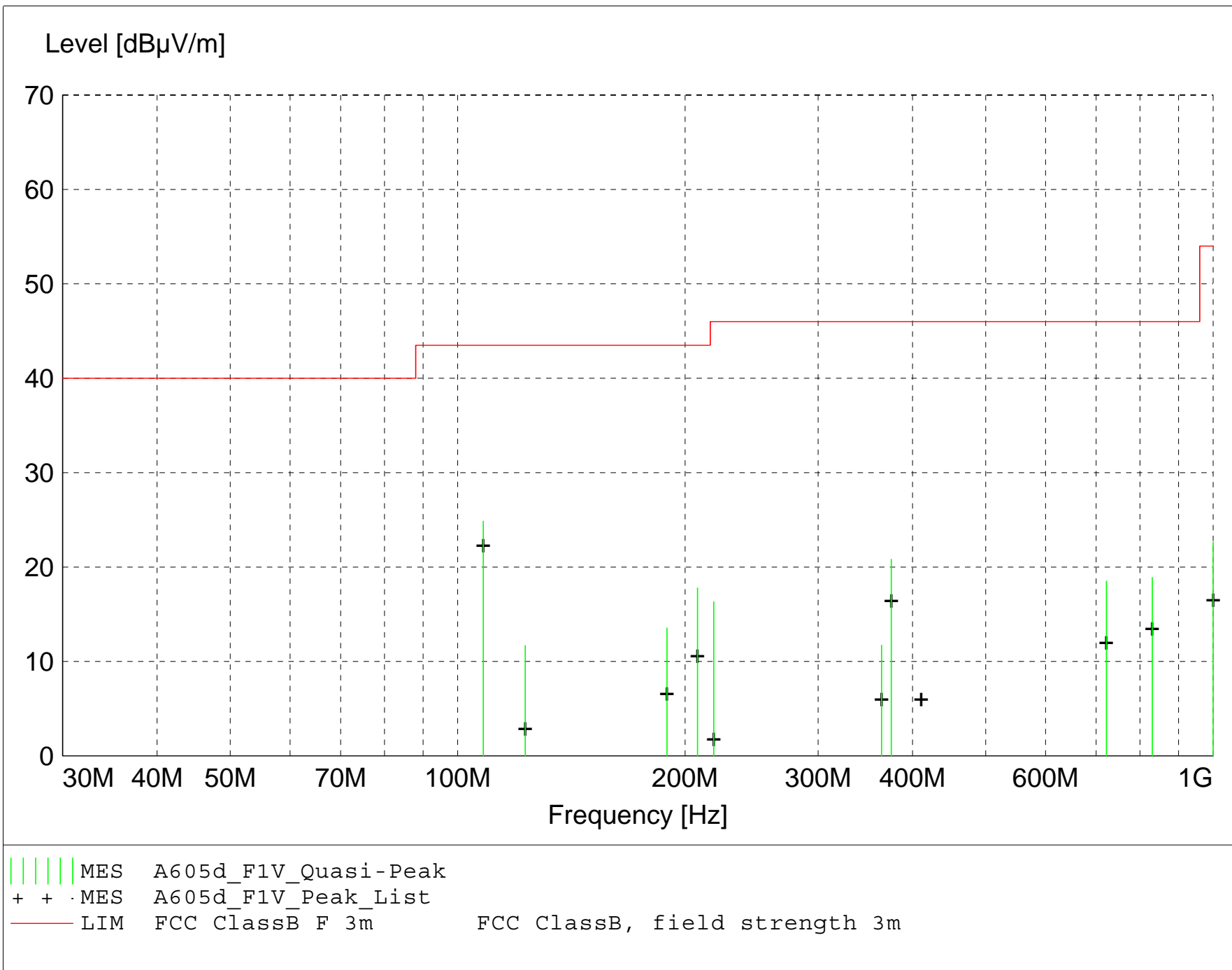
Short Description: Test Set-up

Test Set-up: EUT Measured at 3 Meters with VERTICAL Antenna Polarization

Sample Equations: Total Level (dBµV/m) = Level (dBµV) + System Loss (dB) + Antenna Factor (dBµV/m)  
24.6 = 35.51 + (-22.1) + 11.20

Margin (dB) = Limit (dBµV/m) - Total Level (dBµV/m)  
15.4 = 40 - 24.6

Graph Markers: + Frequency marker (Level of marker not related to final level)  
| Final maximized level using Quasi-Peak detector  
X Final maximized level using Average detector  
# Final maximized level using Peak detector



**MEASUREMENT RESULT: "A605d\_F1V\_Final"**

6/5/2013 10:23AM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBµV	Factor	Loss	Level	dBµV/m	dB	Ant.	Angle	Detector	
		dBµV/m	dB	dBµV/m	dBµV/m		m	deg		
108.120000	35.87	12.09	-23.1	24.9	43.5	18.6	1.00	350	QUASI-PEAK	None
374.960000	26.69	15.30	-21.2	20.8	46.0	25.2	1.00	0	QUASI-PEAK	NF
207.740000	28.10	11.89	-22.2	17.8	43.5	25.7	1.00	0	QUASI-PEAK	NF
830.780000	15.56	22.32	-19.0	18.9	46.0	27.1	1.00	0	QUASI-PEAK	NF
722.300000	16.52	21.20	-19.2	18.5	46.0	27.5	1.00	0	QUASI-PEAK	NF
218.300000	26.79	11.53	-22.0	16.3	46.0	29.7	1.00	180	QUASI-PEAK	None
189.240000	18.38	17.42	-22.3	13.5	43.5	30.0	1.00	0	QUASI-PEAK	NF
999.980000	14.96	24.70	-17.0	22.7	54.0	31.3	1.00	0	QUASI-PEAK	NF
122.880000	21.58	13.01	-22.9	11.7	43.5	31.8	1.00	0	QUASI-PEAK	NF
364.040000	17.91	15.06	-21.2	11.7	46.0	34.3	1.00	0	QUASI-PEAK	NF



166 South Carter, Genoa City, WI 53128

Company:	Cambium Networks
Models Tested:	C050900C032A & C058900P132A
Report Number:	19222
DLS Project:	5946

**No measurable emissions were detected  
from the EUT above 1GHz.**

**Radiated emissions testing was performed  
up to 40GHz.**



166 South Carter, Genoa City, WI 53128

Company: Cambium Networks  
Models Tested: C050900C032A & C058900P132A  
Report Number: 19222  
DLS Project: 5946

## Appendix B – Measurement Data

### B9.0 AC Line Conducted Emissions

**Rule Part:** FCC Part 15.207

**Test Procedure:** ANSI C63.10-2009  
Section 6.2

**Limit:** FCC Part 15.207(a)

**Results:** Compliant

**Notes:** This was an AC Conducted emissions measurement.  
The EUT was powered from a representative AC Adapter with an input of  
120 VAC 60 Hz.



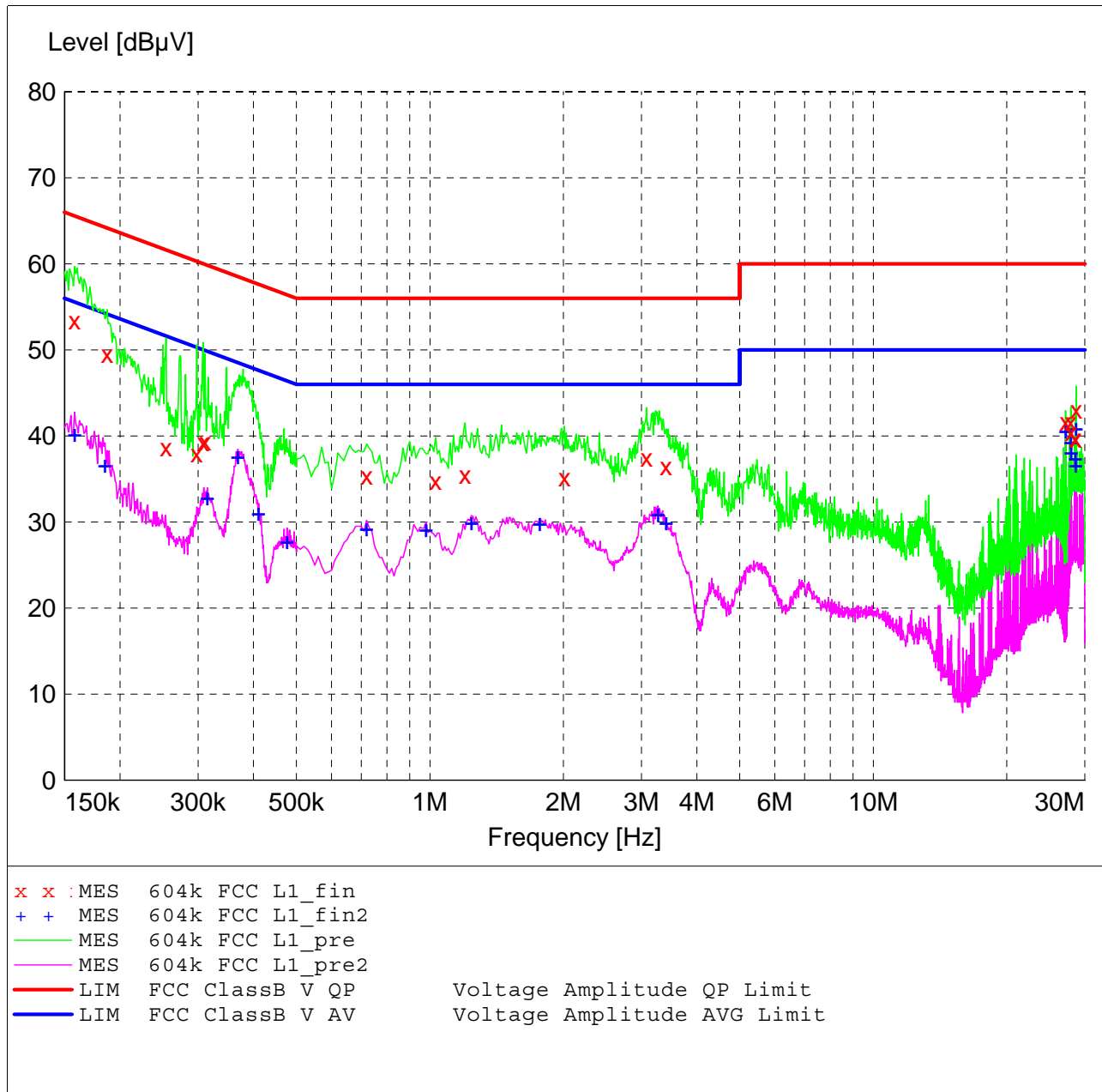
**FCC Part 15 Class B**

**Voltage Mains Test**

EUT: Avenger Station Radio 5.4 (or 5.7)GHz  
 Manufacturer: Cambium  
 Operating Condition: 70 deg. F, 34% R.H.  
 Test Site: DLS O.F. Screen Room  
 Operator: Jim O  
 Test Specification: 120V, 60Hz  
 Comment: Continious TX; Line 1  
 6-04-2013

**SCAN TABLE: "Line Cond SR Final"**

Short Description:		Line Conducted Emissions				Transducer
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak	5.0 s	9 kHz	LISN DLS#128
CISPR AV						



**MEASUREMENT RESULT: "604k FCC L1\_fin"**

6/4/2013 2:23PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.158000	53.40	13.6	66	12.2	QP
0.187000	49.50	12.9	64	14.7	QP
0.254000	38.70	12.1	62	22.9	QP
0.298000	38.00	11.9	60	22.3	QP
0.308000	39.20	11.8	60	20.8	QP
0.311000	39.40	11.8	60	20.5	QP
0.720000	35.40	10.8	56	20.6	QP
1.030000	34.80	10.7	56	21.2	QP
1.200000	35.50	10.6	56	20.5	QP
2.010000	35.20	10.6	56	20.8	QP
3.080000	37.50	10.7	56	18.5	QP
3.410000	36.50	10.7	56	19.5	QP
27.155000	41.70	11.5	60	18.3	QP
27.890000	41.70	11.6	60	18.3	QP
27.950000	40.50	11.6	60	19.5	QP
28.565000	39.80	11.7	60	20.2	QP
28.625000	39.60	11.7	60	20.4	QP
28.685000	43.00	11.7	60	17.0	QP

**MEASUREMENT RESULT: "604k FCC L1\_fin2"**

6/4/2013 2:23PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.158000	40.20	13.6	56	15.4	CAV
0.185000	36.70	12.9	54	17.6	CAV
0.315000	32.90	11.8	50	16.9	CAV
0.369000	37.70	11.5	49	10.8	CAV
0.411000	31.10	11.4	48	16.5	CAV
0.476000	27.80	11.3	46	18.6	CAV
0.720000	29.30	10.8	46	16.7	CAV
0.980000	29.20	10.7	46	16.8	CAV
1.240000	30.00	10.6	46	16.0	CAV
1.770000	29.90	10.6	46	16.1	CAV
3.270000	31.00	10.7	46	15.0	CAV
3.410000	30.00	10.7	46	16.0	CAV
27.155000	40.60	11.5	50	9.4	CAV
27.890000	39.30	11.6	50	10.7	CAV
27.950000	38.10	11.6	50	11.9	CAV
28.565000	37.50	11.7	50	12.5	CAV
28.625000	36.70	11.7	50	13.3	CAV
28.685000	41.00	11.7	50	9.0	CAV

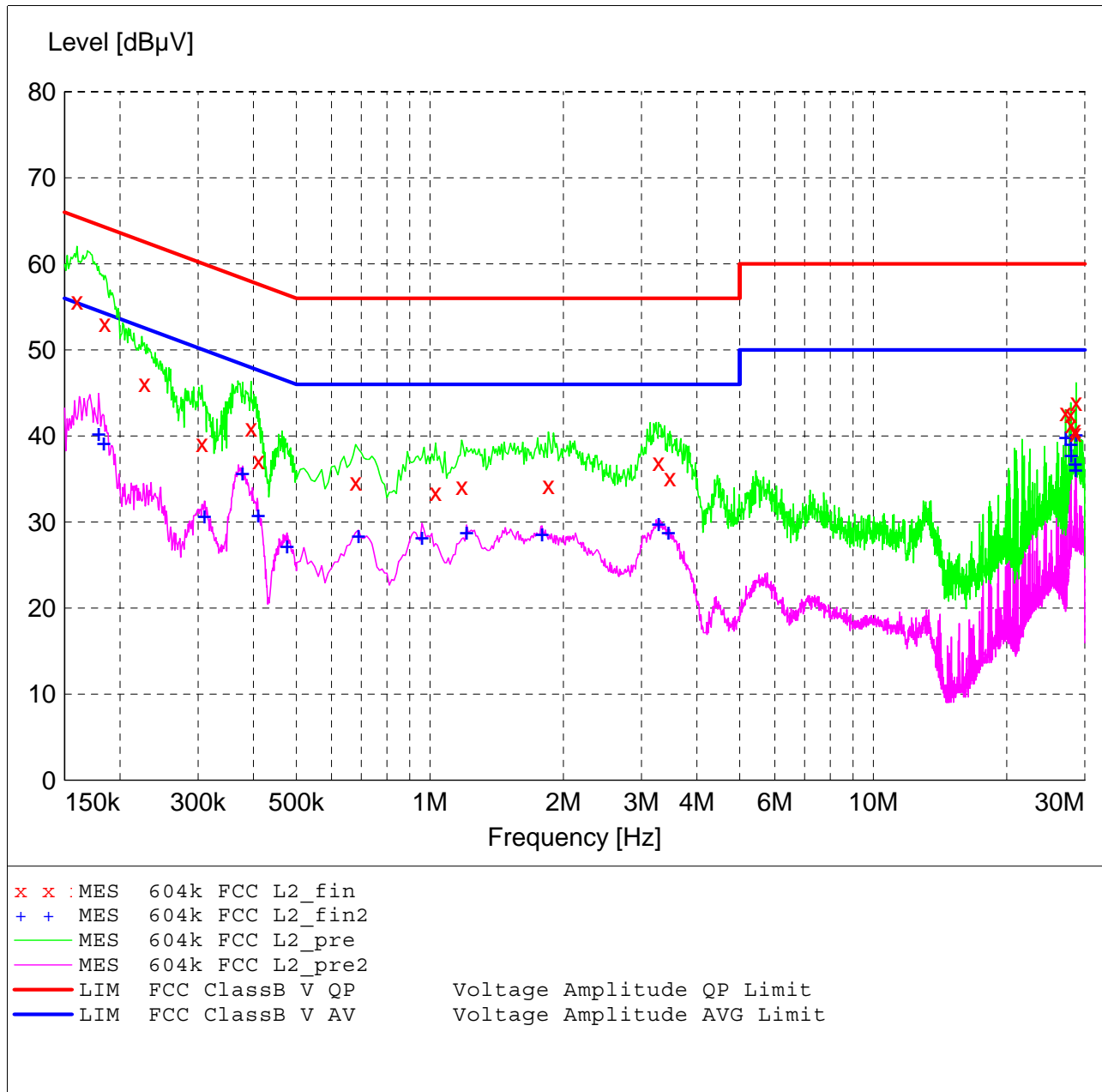
**FCC Part 15 Class B**

**Voltage Mains Test**

EUT: Avenger Station Radio 5.4 (or 5.7)GHz  
 Manufacturer: Cambium  
 Operating Condition: 70 deg. F, 34% R.H.  
 Test Site: DLS O.F. Screen Room  
 Operator: Jim O  
 Test Specification: 120V, 60Hz  
 Comment: Continious TX; Line 2  
 6-04-2013

**SCAN TABLE: "Line Cond SR Final"**

Short Description:		Line Conducted Emissions				Transducer
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak	5.0 s	9 kHz	LISN DLS#128
CISPR AV						



**MEASUREMENT RESULT: "604k FCC L2\_fin"**

6/4/2013 2:12PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.160000	55.70	13.5	66	9.8	QP
0.185000	53.10	12.9	64	11.2	QP
0.227000	46.10	12.4	63	16.5	QP
0.306000	39.20	11.8	60	20.9	QP
0.395000	41.00	11.4	58	17.0	QP
0.411000	37.20	11.4	58	20.4	QP
0.680000	34.70	10.8	56	21.3	QP
1.030000	33.50	10.7	56	22.5	QP
1.180000	34.20	10.6	56	21.8	QP
1.850000	34.30	10.6	56	21.7	QP
3.280000	37.00	10.7	56	19.0	QP
3.480000	35.20	10.7	56	20.8	QP
27.155000	42.70	11.5	60	17.3	QP
27.890000	42.50	11.6	60	17.5	QP
27.950000	41.30	11.6	60	18.7	QP
28.565000	40.80	11.7	60	19.2	QP
28.625000	40.40	11.7	60	19.6	QP
28.685000	43.90	11.7	60	16.1	QP

**MEASUREMENT RESULT: "604k FCC L2\_fin2"**

6/4/2013 2:12PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.179000	40.30	13.0	55	14.2	CAV
0.184000	39.30	12.9	54	15.0	CAV
0.310000	30.80	11.8	50	19.2	CAV
0.378000	35.80	11.5	48	12.5	CAV
0.410000	30.90	11.4	48	16.7	CAV
0.476000	27.30	11.3	46	19.1	CAV
0.690000	28.50	10.8	46	17.5	CAV
0.960000	28.30	10.7	46	17.7	CAV
1.210000	28.90	10.6	46	17.1	CAV
1.790000	28.70	10.6	46	17.3	CAV
3.280000	29.90	10.7	46	16.1	CAV
3.450000	28.90	10.7	46	17.1	CAV
27.155000	40.00	11.5	50	10.0	CAV
27.890000	39.20	11.6	50	10.8	CAV
27.950000	37.90	11.6	50	12.1	CAV
28.565000	36.90	11.7	50	13.1	CAV
28.625000	36.20	11.7	50	13.8	CAV
28.685000	40.20	11.7	50	9.8	CAV



166 South Carter, Genoa City, WI 53128

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# END OF REPORT

Revision #	Date	Comments	By
1.0	8-9-2013	Preliminary Release	JS
1.1	8-9-2013	Added missing picture (& minor edits)	JS
1.2	8-12-2013	Final data added	JS
1.3	8-27-2013	New mid channel data & updated model number	JS