

## **Certification Test Report**

**FCC ID: VPYLB1CK982  
IC: 772C-LB1CK982**

**FCC Rule Part: 15.407  
ISED Canada Radio Standards Specification: RSS-247**

**ACS Report Number: 16-2033.W06.4A**

**Applicant: Murata Manufacturing Co., Ltd.  
Model(s): LBEE5ZZ1CK-982**

**Test Begin Date: June 02, 2016  
Test End Date: June 15, 2016**

**Report Issue Date: September 16, 2016**



FOR THE SCOPE OF ACCREDITATION UNDER CERTIFICATE NUMBER AT-1533

This report must not be used by the client to claim product certification, approval, or endorsement by ANAB, ANSI, or any agency of the Federal Government.

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**This report contains 125 pages**

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## 1 GENERAL

### 1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15 Subpart E of the FCC's Code of Federal Regulations and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-247.

### 1.2 Applicant Information

Murata Electronics, N.A. Inc.  
2200 Lake Park Drive  
Smyrna, GA. 30080

### 1.3 Product Description

The Murata Electronics, N.A. Inc. model LBEE5ZZ1CK-982 is an IEEE 802.11a/b/g/n/ac WLAN + Bluetooth 4.0 wireless transceiver module. The test report documents the compliance of the 5 GHz WLAN mode of operation.

#### Technical Details

Mode of Operation: WLAN IEEE 802.11a/n/ac  
Modulations: OFDM  
Antenna Type/Gain: PCB Trace Antenna, 0.7 dBi  
Input Power: 3.6 VDC  
Equipment Type: Mobile/Portable

Band of Operation* [MHz]	Mode of Operation 802.11	Ch. Range [MHz]	Number of Available Channels	Channel Spacing	Data Rate or MCS Index
5150 - 5250	a	5180 - 5240	4	20	6 Mbps – 54 Mbps
5250 - 5350		5260 - 5320	4		
5470 - 5725		5500 - 5720	12		
5725 - 5850		5745 - 5825	5		
5150 - 5250	n (HT20)	5180 - 5240	4	20	6.5 Mbps – 65 Mbps
5250 - 5350		5260 - 5320	4		
5470 - 5725		5500 - 5720	12		
5725 - 5850		5745 - 5825	5		
5150 - 5250	n (HT40) ac (VHT40)	5190 - 5230	2	40	13.5 Mbps – 135 Mbps (n HT40) 13.5 Mbps – 180 Mbps (ac VHT40)
5250 - 5350		5270 - 5310	2		
5470 - 5725		5510 - 5710	6		
5725 - 5850		5755 - 5795	2		
5150 - 5250	ac (VHT80)	5210	1	80	29.3 Mbps – 390 Mbps
5250 - 5350		5290	1		
5470 - 5725		5530 - 5690	3		
5725 - 5850		5775	1		

\* Operation in the 5600 – 5660 MHz band is not applicable to Innovation Science Economic Development Canada.

Model Number: LBEE5ZZ1CK-982

Test Sample Serial Number(s): 433900071FAC

Test Sample Condition: The samples were in good conditions with no observable physical damages.

#### **1.4 Test Methodology and Considerations**

The EUT was evaluated for RF conducted emissions for the 5 GHz 802.11a/n/ac WLAN mode of operation. The EUT provides a proprietary switched connector that adapts to an SMA connector for the RF conducted measurements.

Preliminary power measurements were performed at one channel for all the available data rates offered by the EUT. The data rates leading to the highest output power were used for all the remaining measurements and are documented in this test report.

Compliance to the radiated and power line conducted emissions requirements are documented in a separate test report.

Table 1.4-1: IEEE 802.11a/n/ac Test Configuration

Band of Operation	Mode of Operation	Frequency [MHz]	Channel	Power Setting	Data Rate (Modulation Index)
U-NII-1 (5.15 - 5.25 GHz)	802.11a	5180	36	12 dBm	48 Mbps
		5200	40		
		5240	48		
	802.11n 20 MHz	5180	36	12 dBm	52 Mbps (MCS5)
		5200	40		
		5240	48		
	802.11n 40 MHz	5190	38	11.5 dBm	108 Mbps (MCS5)
		5230	46		
	802.11ac 80 MHz	5210	42	11 dBm	351 Mbps (MCS8)
U-NII-2A (5.25 - 5.35 GHz)	802.11a	5260	52	12 dBm	48 Mbps
		5280	56		
		5320	64		
	802.11n 20 MHz	5260	52	12 dBm	52 Mbps (MCS5)
		5280	56		
		5320	64		
	802.11n 40 MHz	5270	54	11.5 dBm	108 Mbps (MCS5)
		5310	62		
	802.11ac 80 MHz	5290	58	11 dBm	351 Mbps (MCS8)
U-NII-2C (5.47 - 5.725 GHz)	802.11a	5500	100	12 dBm	48 Mbps
		5600	120		
		5720	144		
	802.11n 20 MHz	5500	100	12 dBm	52 Mbps (MCS5)
		5600	120		
		5720	144		
	802.11n 40 MHz	5510	102	11.5 dBm	108 Mbps (MCS5)
		5590	118		
		5710	142		
	802.11ac 80 MHz	5530	106	11 dBm	351 Mbps (MCS8)
		5610	122		
		5690	138		
U-NII-3 (5.725 - 5.85 GHz)	802.11a	5745	149	12 dBm	48 Mbps
		5785	157		
		5825	165		
	802.11n 20 MHz	5745	149	12 dBm	52 Mbps (MCS5)
		5785	157		
		5825	165		
	802.11n 40 MHz	5755	151	11.5 dBm	108 Mbps (MCS5)
		5795	159		
	802.11ac 80 MHz	5775	155	11 dBm	351 Mbps (MCS8)

\* Operation in the 5600 – 5660 MHz band is not applicable to Innovation Science Economic Development Canada.

## **2 TEST FACILITIES**

### **2.1 Location**

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions, Inc.  
3998 FAU Blvd, Suite 310  
Boca Raton, Florida 33431  
Phone: (561) 961-5585  
Fax: (561) 961-5587  
[www.acstestlab.com](http://www.acstestlab.com)

FCC Test Firm Registration #: 475089

Innovation, Science and Economic Development Canada Lab Code: 4175C

### **2.2 Laboratory Accreditations/Recognitions/Certifications**

ACS is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ANAB program and has been issued certificate number AT-1533 in recognition of this accreditation. Unless otherwise specified, all test methods described within this report are covered under the ISO/IEC 17025 scope of accreditation.

## 2.3 Radiated & Conducted Emissions Test Site Description

### 2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl flooring.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flush with the chamber floor which it is connected to, around its circumference, with a continuous metallic loaded spring. An EMCO Model 1060 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

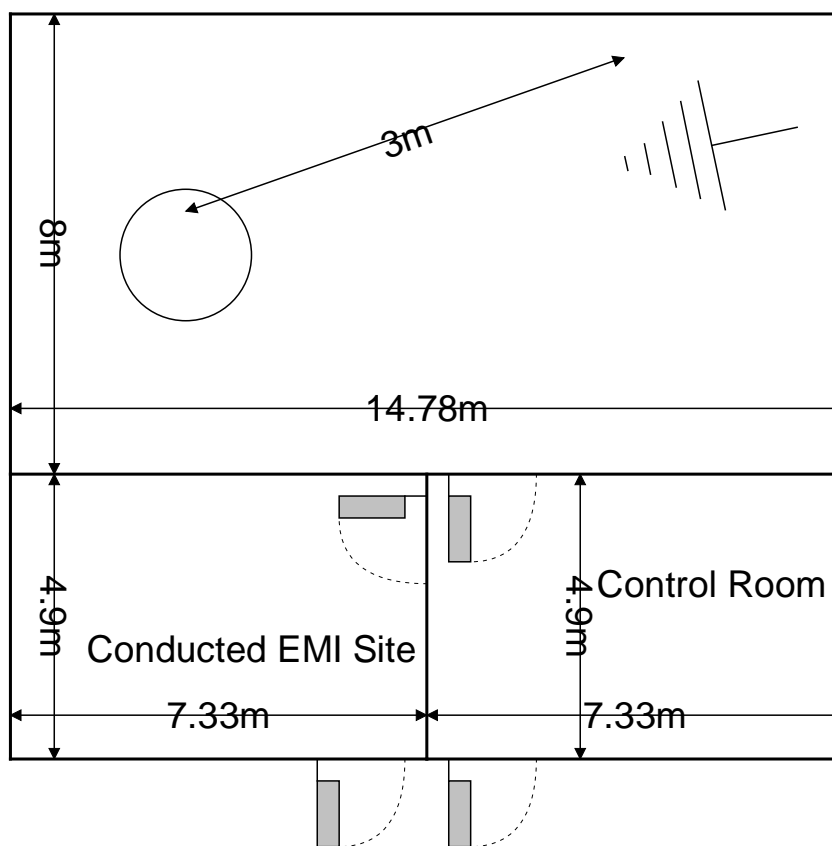


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

### 2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are  $7.3 \times 4.9 \times 3 \text{ m}^3$ . The power line conducted emission site includes two LISNs: a Solar Model 8028-50  $50 \Omega/50 \mu\text{H}$  and an EMCO Model 3825/2R, which are installed as shown in the figure below. For evaluations requiring 230 V, 50 Hz AC input, a Polarad LISN (S/N 879341/048) is used in conjunction with a California Instruments signal generator Model 2001RP-OP1.

A diagram of the room is shown below in figure 2.3.2-1:

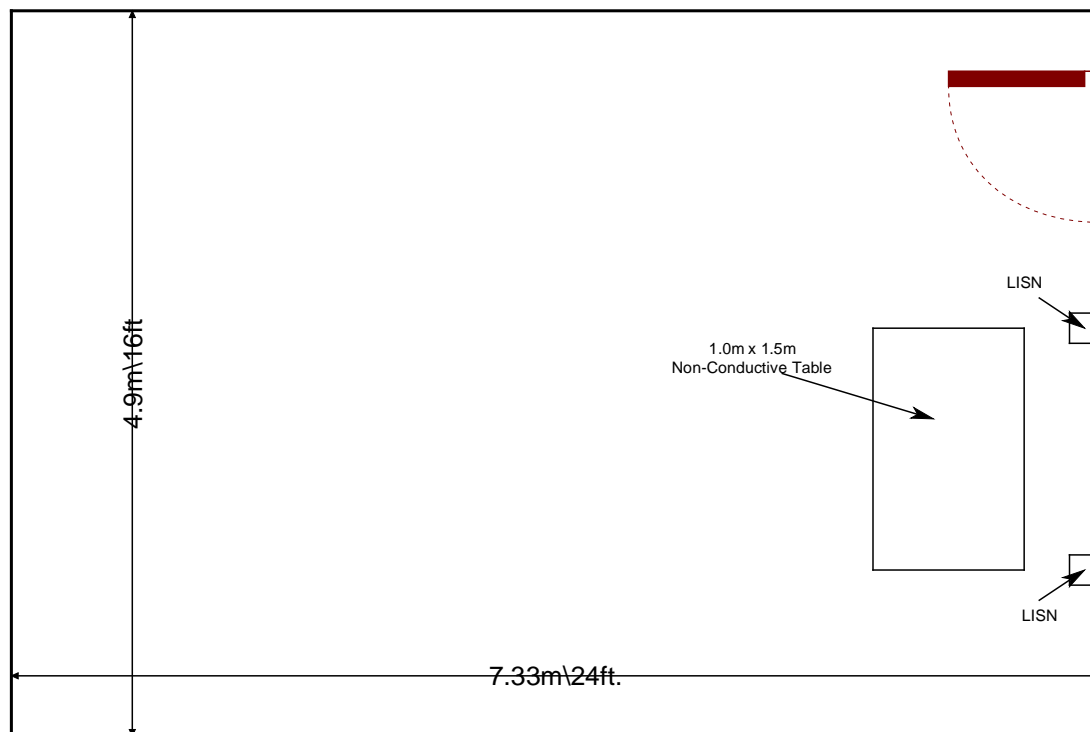


Figure 2.3.2-1: AC Mains Conducted EMI Site



### 3 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ❖ ANSI C63.4-2014: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 kHz to 40 GHz.
- ❖ ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures, 2016.
- ❖ US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart E: Unlicensed National Information Infrastructure Devices, 2016
- ❖ Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-247 — Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices, Issue 1, May 2015.
- ❖ Innovation, Science and Economic Development Canada Radio Standards Specification: RSS-GEN – General Requirements for Compliance of Radio Apparatus, Issue 4, November 2014.
- ❖ FCC OET KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01r02: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E, April, 2016.
- ❖ FCC OET KDB Publication No. 905462 D06 802.11 Channel Plans New Rules v02: Operation in U-NII Bands – 802.11 Channel Plan, 15.407 (Part 15E), April 2016
- ❖ FCC OET KDB Publication No. 644545 D03 Guidance for IEEE 802.11ac New Rules v01: Guidance for IEEE Standard 802.11ac<sup>TM</sup> Devices Emission Testing, August 2014

#### 4 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

**Table 4-1: Test Equipment**

AssetID	Manufacturer	Model #	Equipment Type	Serial #	Last Calibration Date	Calibration Due Date
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	7/1/2015	7/1/2016
2102	Test Equity	115	Environmental Chamber	150892	3/9/2016	3/9/2017
2108	Fluke	115	Digital MultiMeter	99211160	4/8/2016	4/8/2017
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/22/2015	7/22/2016
2112	Teledyne Storm Products	921-0101-036	Cables	12-06-698	11/13/2015	11/13/2016
2124	Fluke	51II	Digital Thermometer	97060019	5/31/2016	5/31/2017
RE578	MPJA	HY5003	Power Supplies	3700278	NCR	NCR
RE619	Rhode & Schwarz	ESU26	Spectrum Analyzers	1302.6005K26 Ser. 100190	11/5/2014	11/5/2016

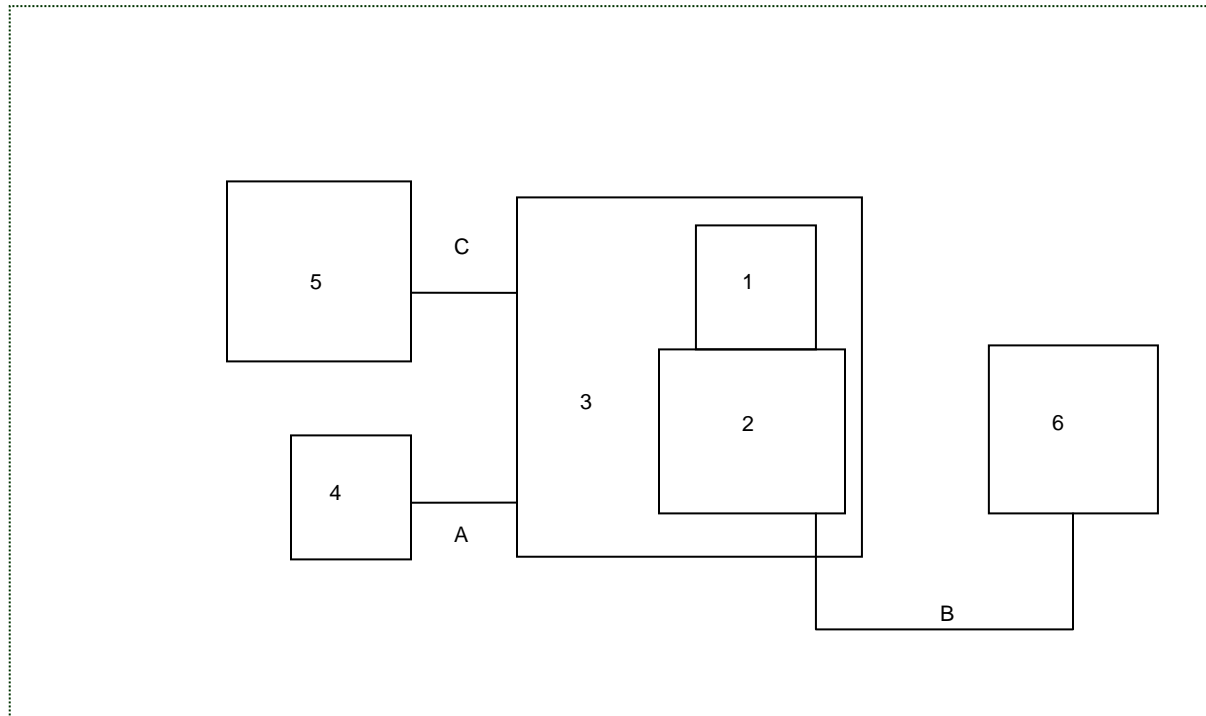
**No Calibration Required**

**5 SUPPORT EQUIPMENT****Table 5-1: EUT and Support Equipment Description**

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Murata Electronics North America, Inc..	LBEE5ZZ1CK-982	433900071FAC
2	SDIO Interface Board	Murata Electronics North America, Inc..	N/A	ACS#8
3	Evaluation Board	NXP	MCIMX6UL-BB	TR15360422
4	5 VDC Power Supply	Spectre Power	XA012AM0500240	ACS#9
5	Laptop Computer	Dell	Latitude E6430s	N/A
6	Power Supply	MPJA	HY5003	003700278

**Table 5-2: Cable Description**

Cable #	Cable Type	Length	Shield	Termination
A	Power Cord	1.83 m	No	Power Supply to Evaluation Board
B	Twisted Pair	1.22 m	No	SDIO Interface Board to Power Supply
C	USB	0.84 m	No	Evaluation Board to Laptop

**6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM**

## **7 SUMMARY OF TESTS**

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

### **7.1 Antenna Requirement – FCC: Section 15.203**

The EUT uses a printed trace antenna etched on the transceiver module PCB. The antenna is not detachable, thus meeting the requirements of FCC Section 15.203.

### **7.2 Emission/Occupied Bandwidth - FCC: Section 15.407(a), 15.407(e); ISED Canada: RSS-247 6.2, RSS-GEN 6.6**

#### **7.2.1 Measurement Procedure**

The 6dB bandwidth was measured in accordance with the FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01r02 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" Minimum Emission Bandwidth for the band 5.725-5.85 GHz. The RBW of the spectrum analyzer was set to 100 kHz and VBW 300 kHz. Span was set large enough to capture the entire emissions and >> RBW.

The 26 dB Emission Bandwidth (EBW) was measured in accordance with the FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01r02 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" Emission Bandwidth (EBW). The RBW was set to approximately 1% of the emission bandwidth. The bandwidth was measured as the maximum width of the emission that is 26 dB down from the maximum of the emission.

The 99% occupied bandwidth was measured with the spectrum analyzer span set to fully display the emission, including the emissions skirts. The RBW was to 1% to 5% of the occupied bandwidth. The occupied 99% bandwidth was measured using the occupied bandwidth function of the analyzer.

## 7.2.2 Measurement Results

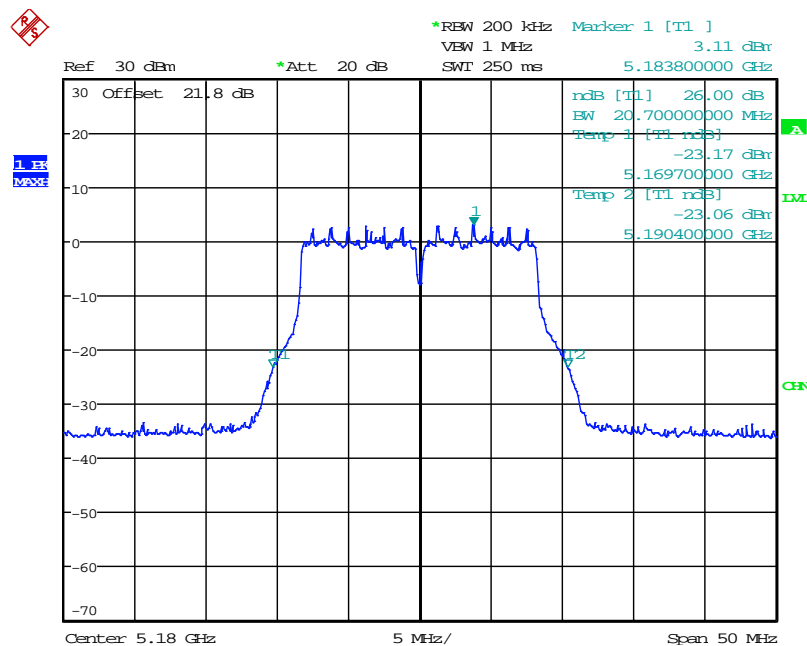
Results are shown below.

### Band 5150 – 5250 MHz

802.11a

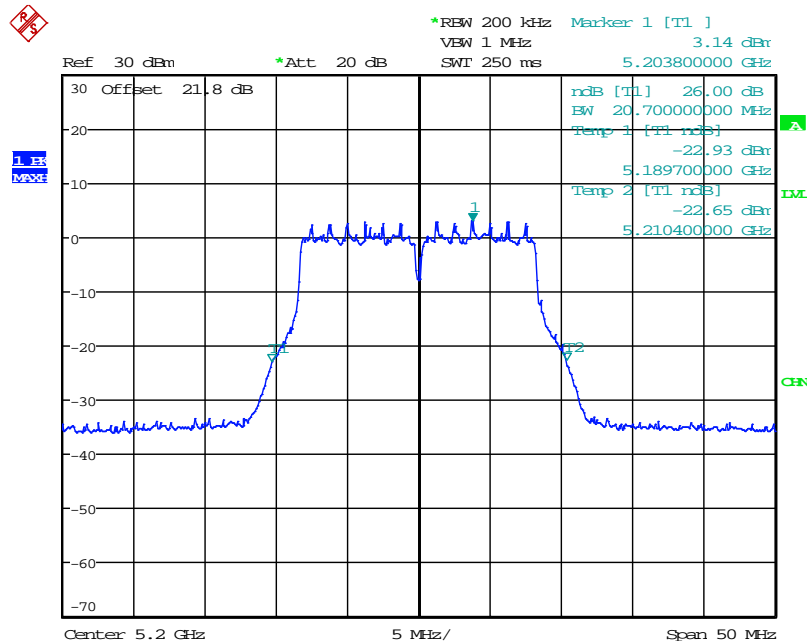
Table 7.2.2-1: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5180	20.70	17.10
5200	20.70	17.10
5240	20.60	17.10



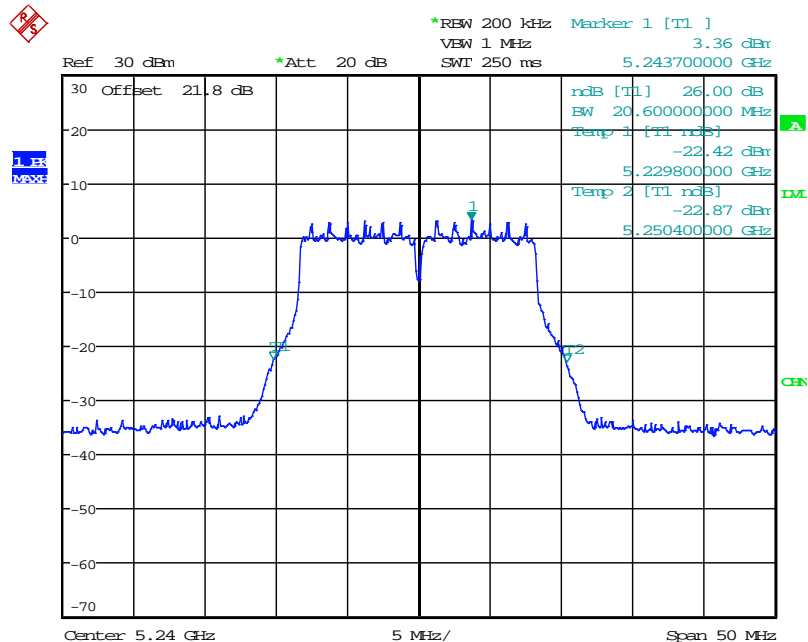
Date: 13.JUN.2016 18:32:26

Figure 7.2.2-1: 26 dB EBW - Low Channel



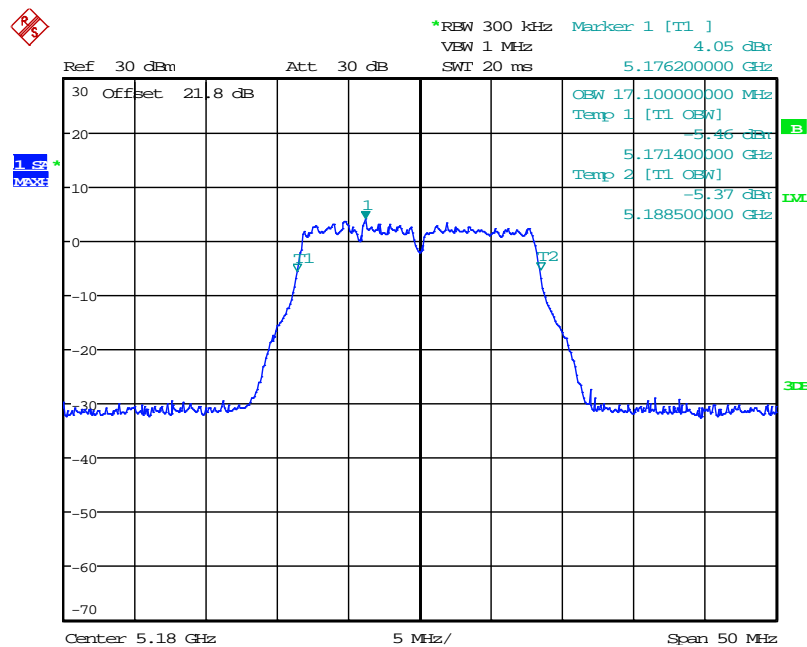
Date: 13.JUN.2016 18:45:41

Figure 7.2.2-2: 26 dB EBW - Middle Channel



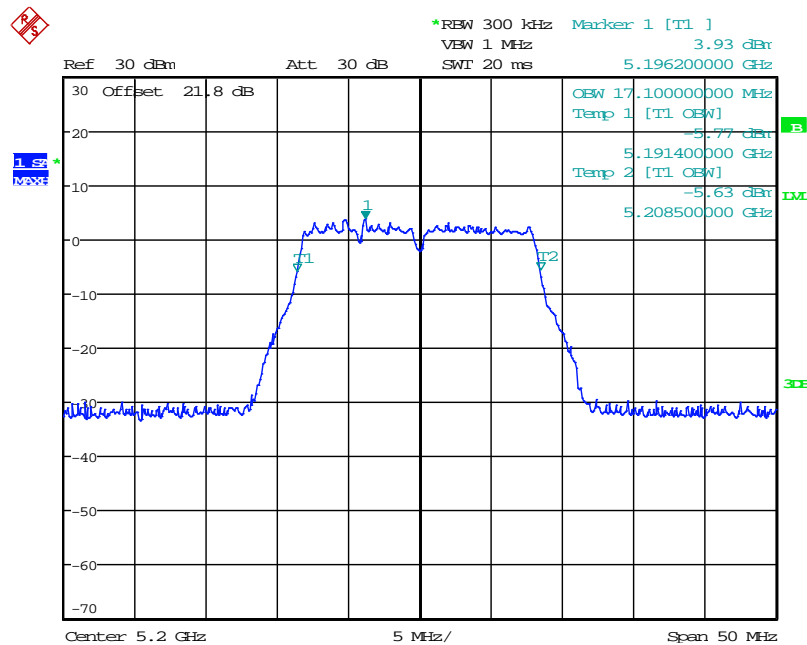
Date: 13.JUN.2016 19:03:22

Figure 7.2.2-3: 26 dB EBW - High Channel



Date: 13.JUN.2016 18:31:17

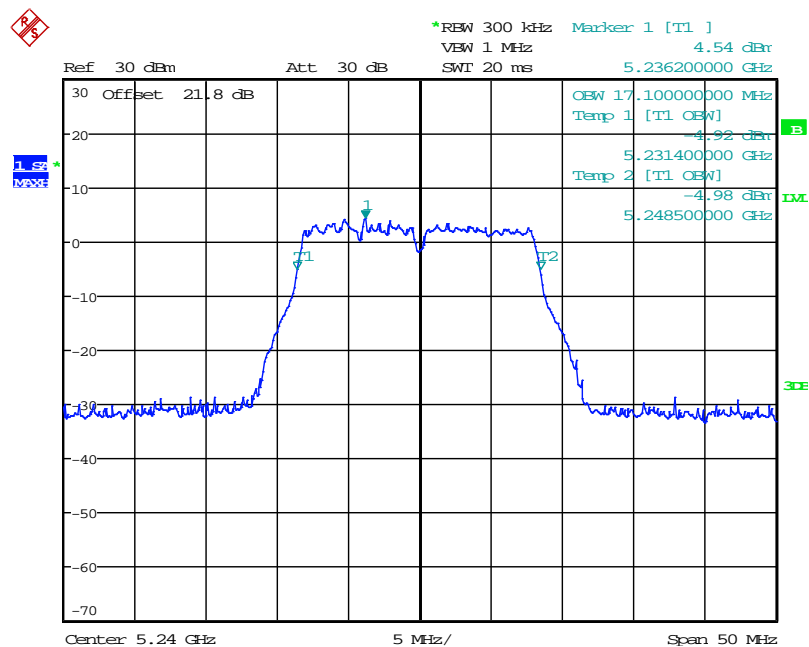
Figure 7.2.2-4: 99% OBW - Low Channel



Date: 13.JUN.2016 19:07:36

Figure 7.2.2-5: 99% OBW - Middle Channel





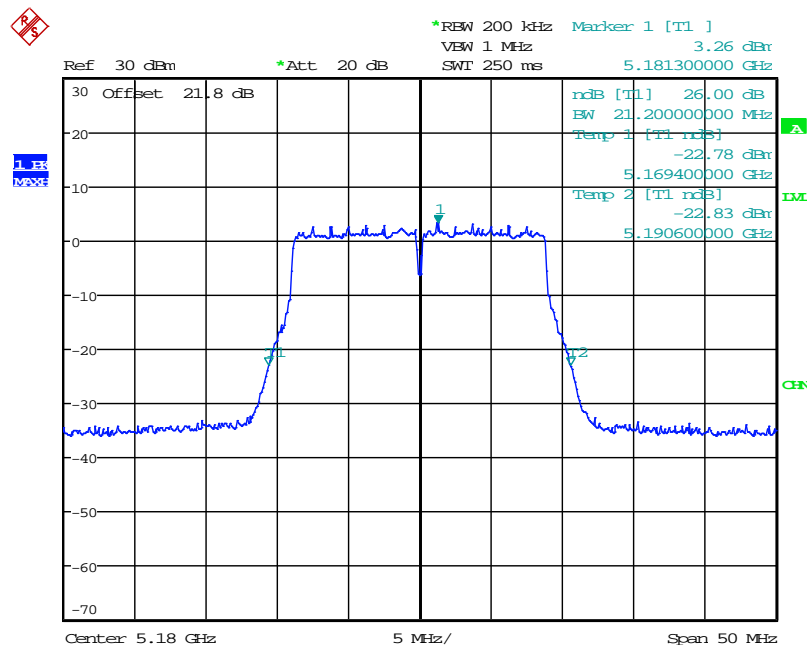
Date: 13.JUN.2016 19:05:23

Figure 7.2.2-6: 99% OBW - High Channel

802.11n 20 MHz

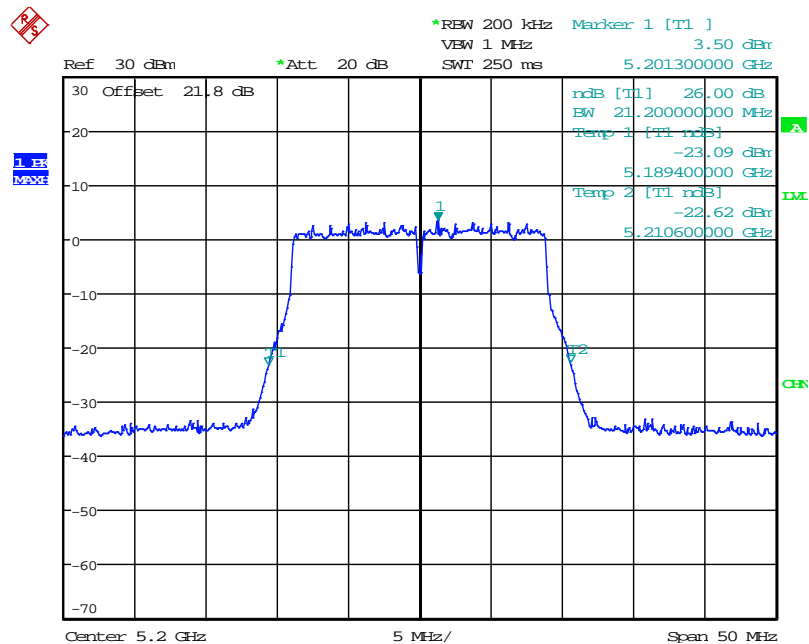
Table 7.2.2-2: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5180	21.20	18.10
5200	21.20	18.10
5240	21.20	18.10



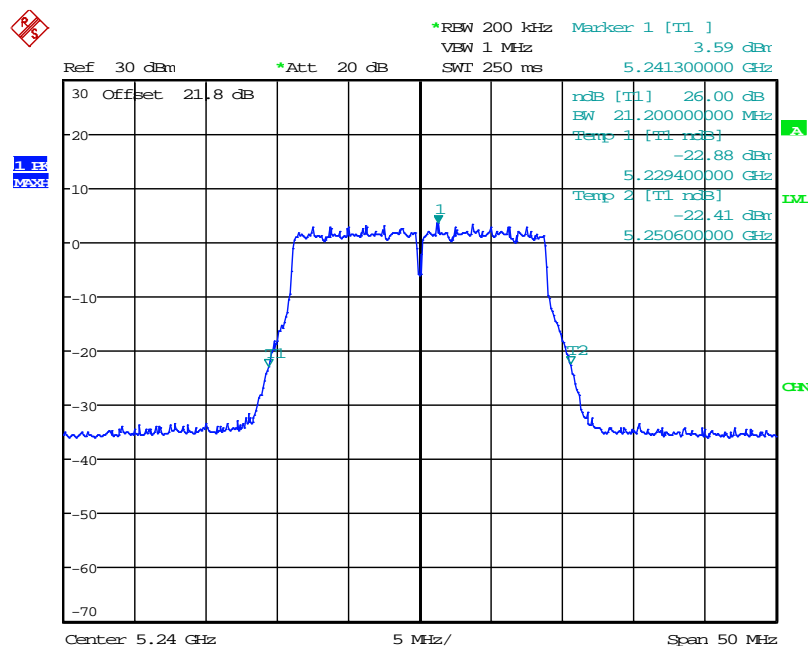
Date: 13.JUN.2016 18:34:47

Figure 7.2.2-7: 26 dB EBW - Low Channel



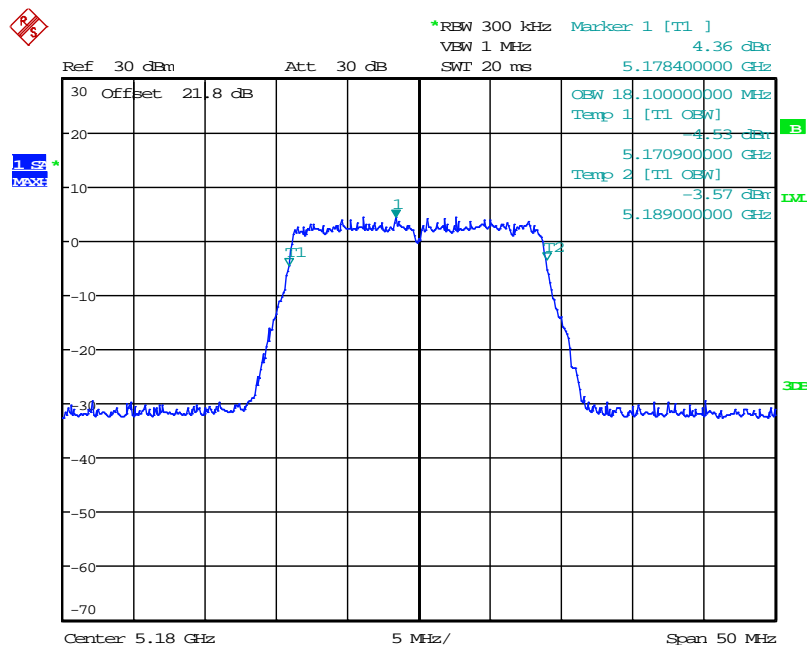
Date: 13.JUN.2016 18:38:27

Figure 7.2.2-8: 26 dB EBW - Middle Channel



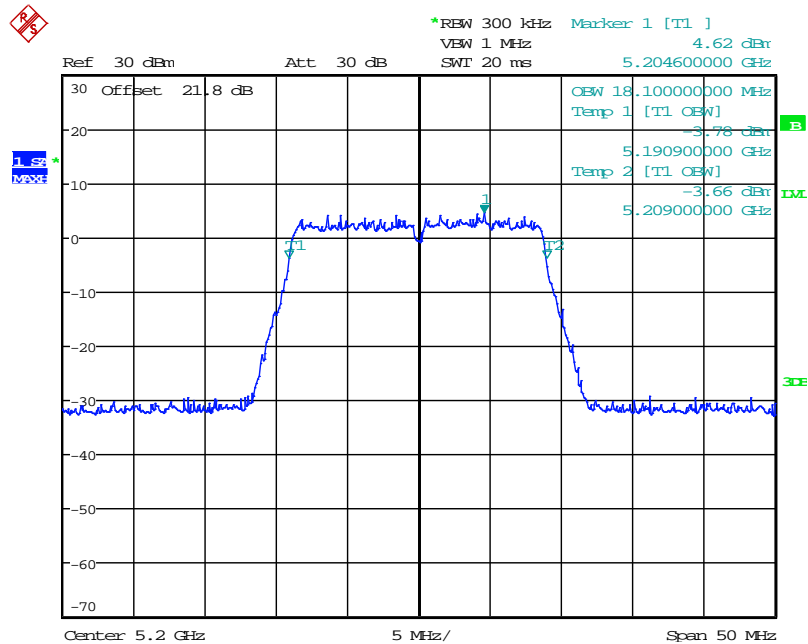
Date: 13.JUN.2016 19:01:13

Figure 7.2.2-9: 26 dB EBW - High Channel



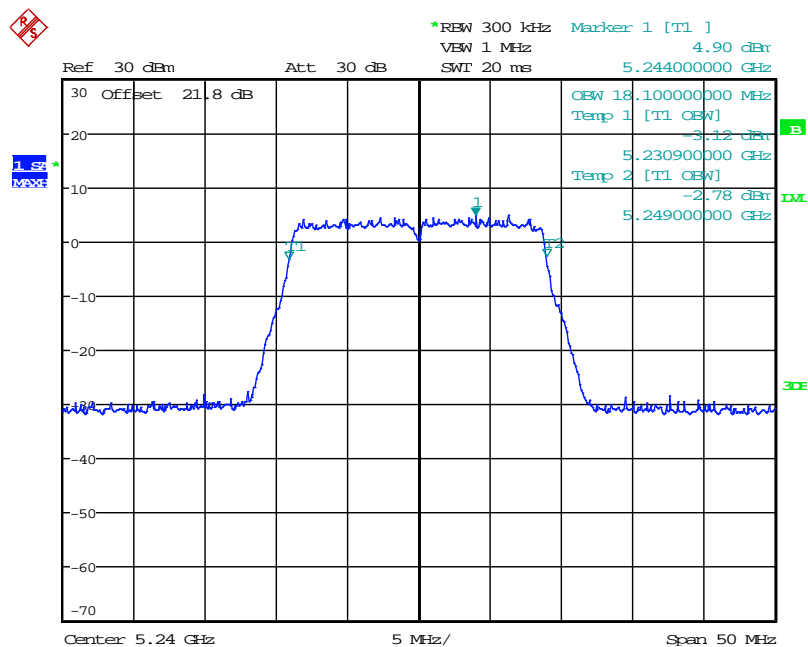
Date: 13.JUN.2016 18:49:37

Figure 7.2.2-10: 99% OBW - Low Channel



Date: 13.JUN.2016 18:41:05

Figure 7.2.2-11: 99% OBW - Middle Channel



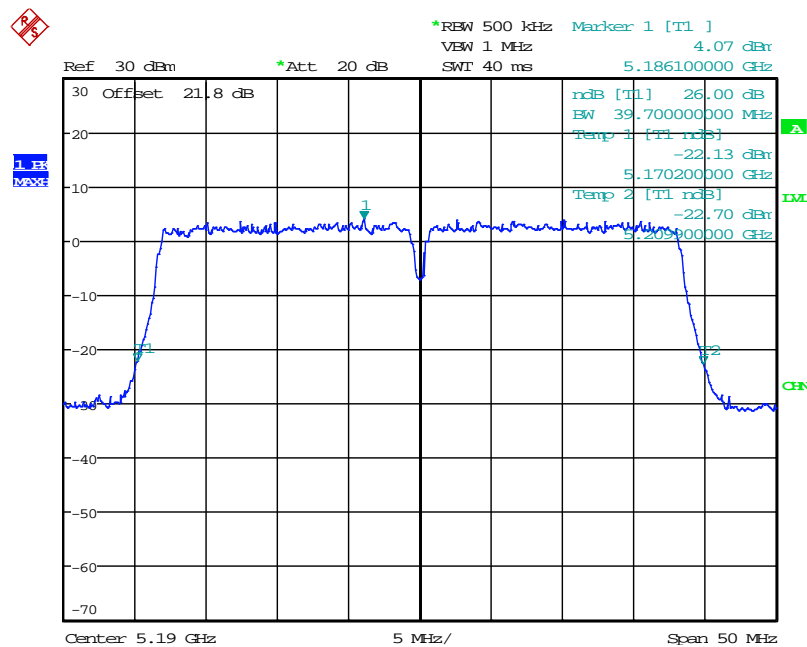
Date: 13.JUN.2016 18:58:43

Figure 7.2.2-12: 99% OBW - High Channel

802.11n 40 MHz

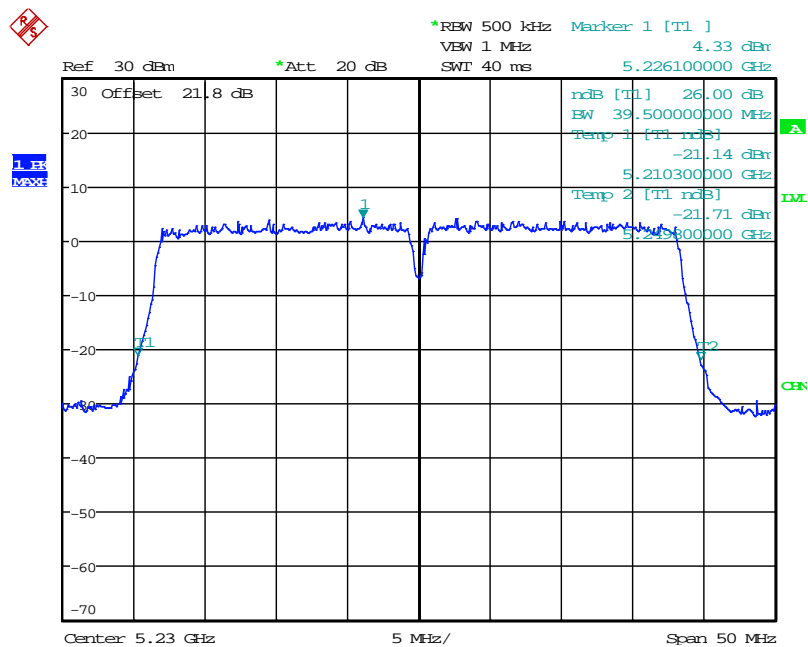
Table 7.2.2-3: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5190	39.70	36.80
5230	39.50	37.00



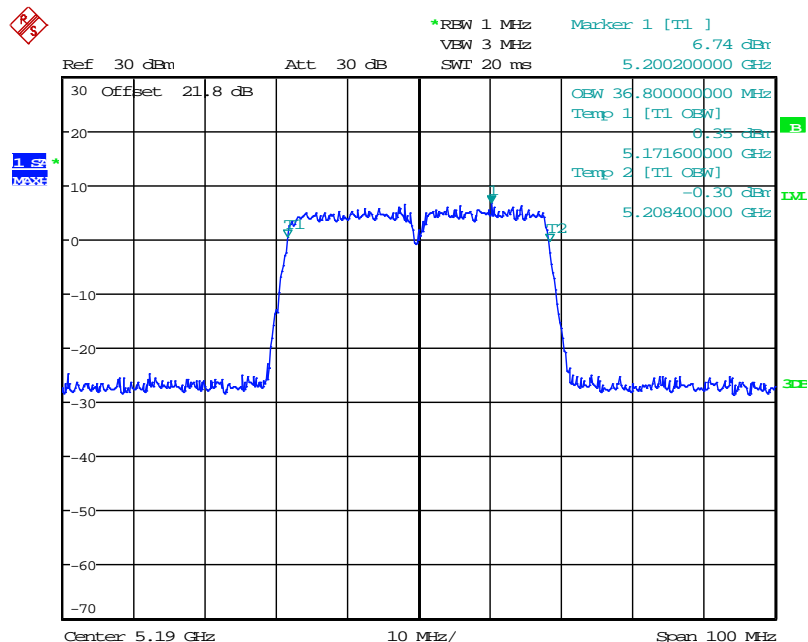
Date: 13.JUN.2016 19:44:22

Figure 7.2.2-13: 26 dB EBW - Low Channel



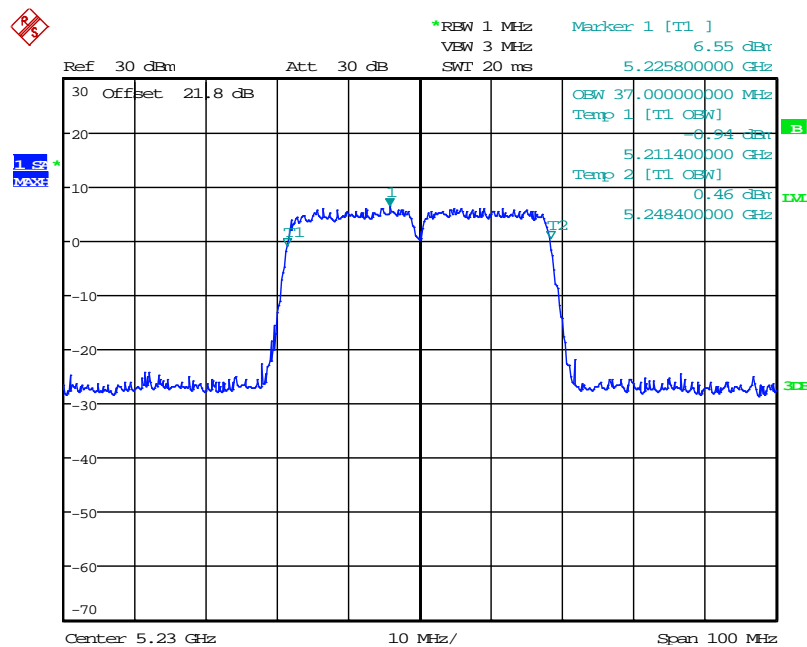
Date: 13.JUN.2016 19:46:14

Figure 7.2.2-14: 26 dB EBW - High Channel



Date: 13.JUN.2016 19:42:29

Figure 7.2.2-15: 99% OBW - Low Channel



Date: 13.JUN.2016 19:48:04

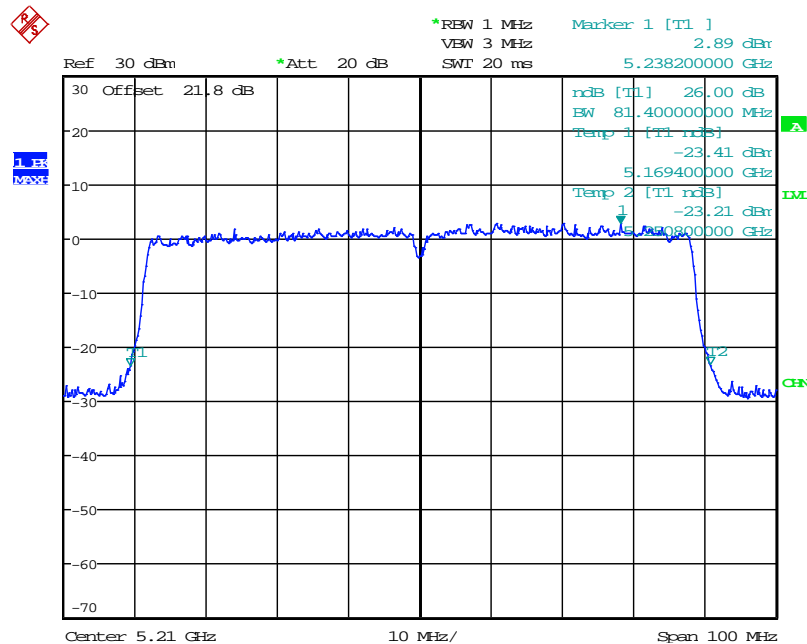
Figure 7.2.2-16: 99% OBW - High Channel



802.11ac 80 MHz

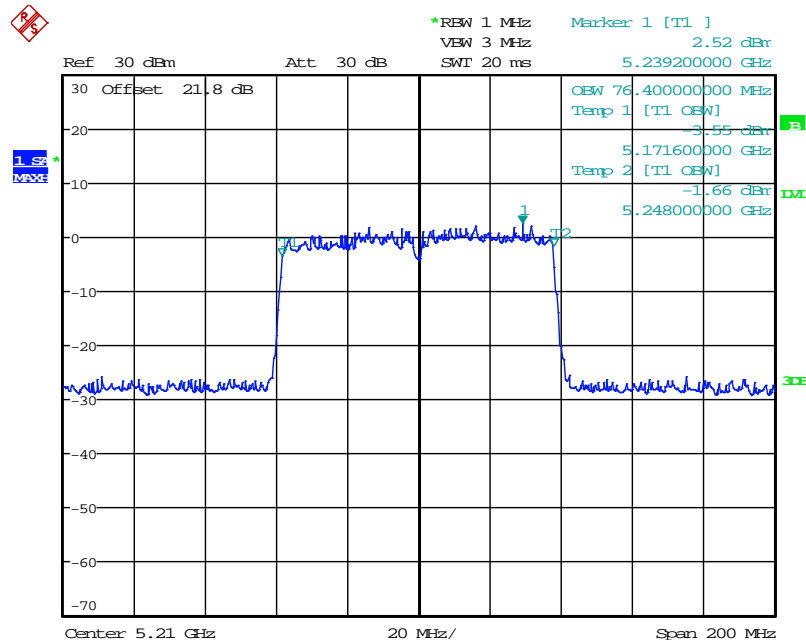
Table 7.2.2-4: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5210	81.40	76.40



Date: 13.JUN.2016 15:35:55

Figure 7.2.2-17: 26 dB EBW - Middle Channel



Date: 13.JUN.2016 15:33:18

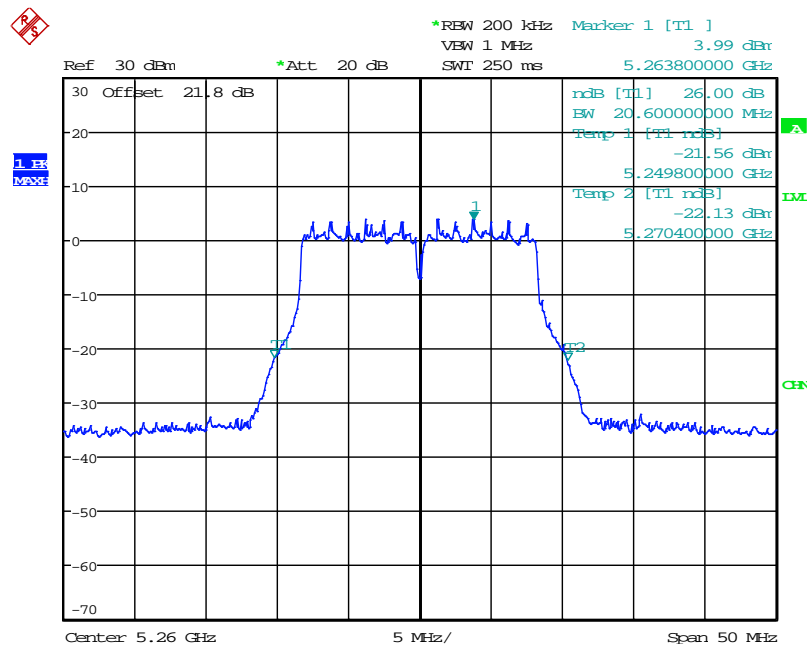
Figure 7.2.2-18: 99% OBW - Middle Channel

## Band 5250 – 5350 MHz

802.11a

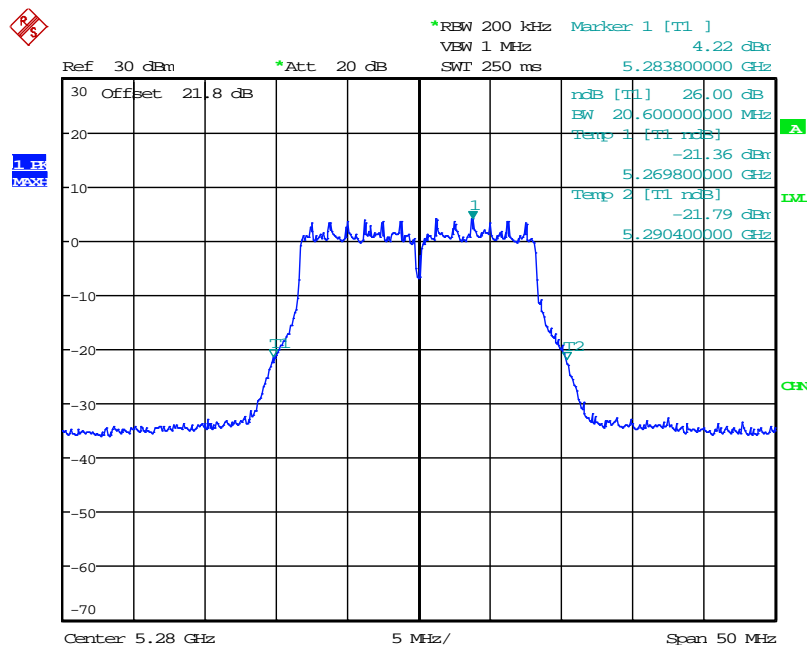
Table 7.2.2-5: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5260	20.60	17.10
5280	20.60	17.10
5320	20.70	17.10



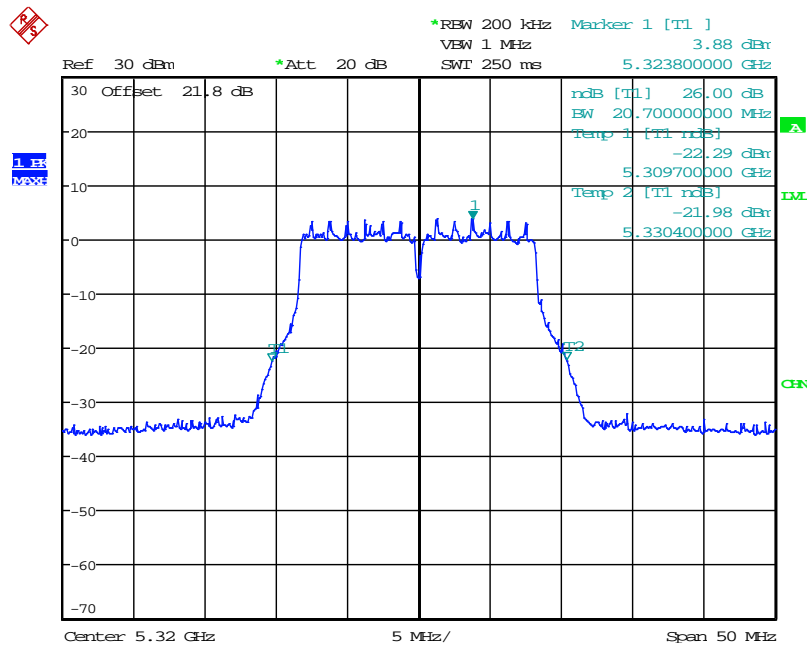
Date: 13.JUN.2016 19:13:46

Figure 7.2.2-19: 26 dB EBW - Low Channel



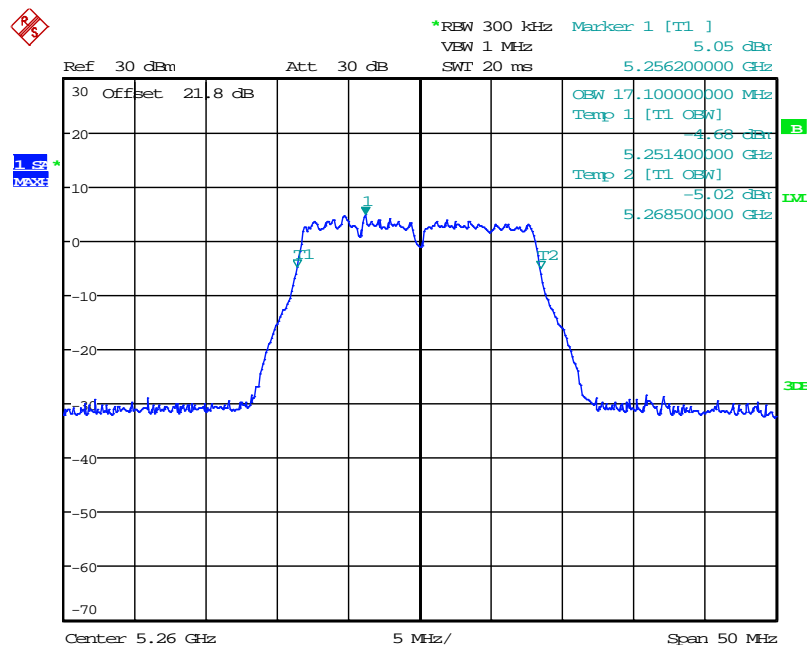
Date: 13.JUN.2016 19:25:17

Figure 7.2.2-20: 26 dB EBW - Middle Channel



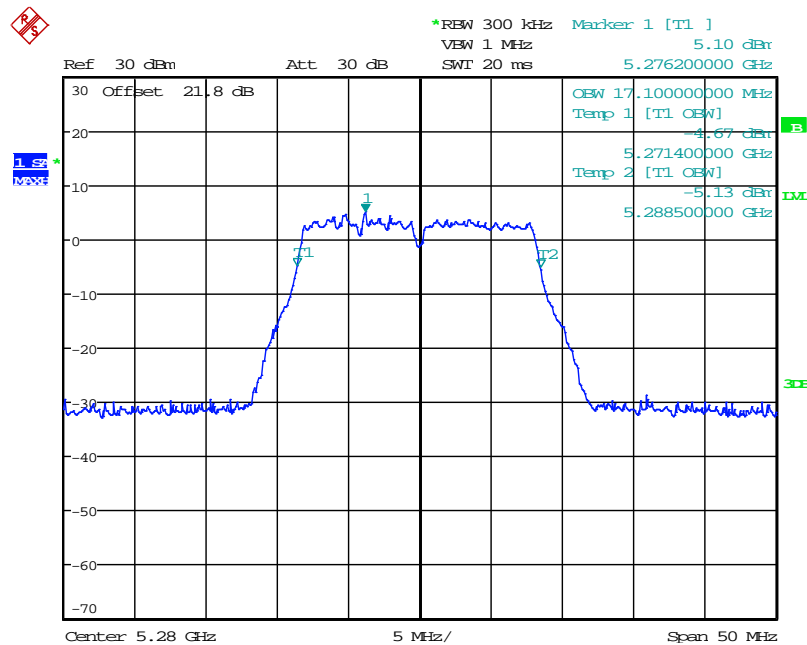
Date: 13.JUN.2016 19:32:39

Figure 7.2.2-21: 26 dB EBW - High Channel



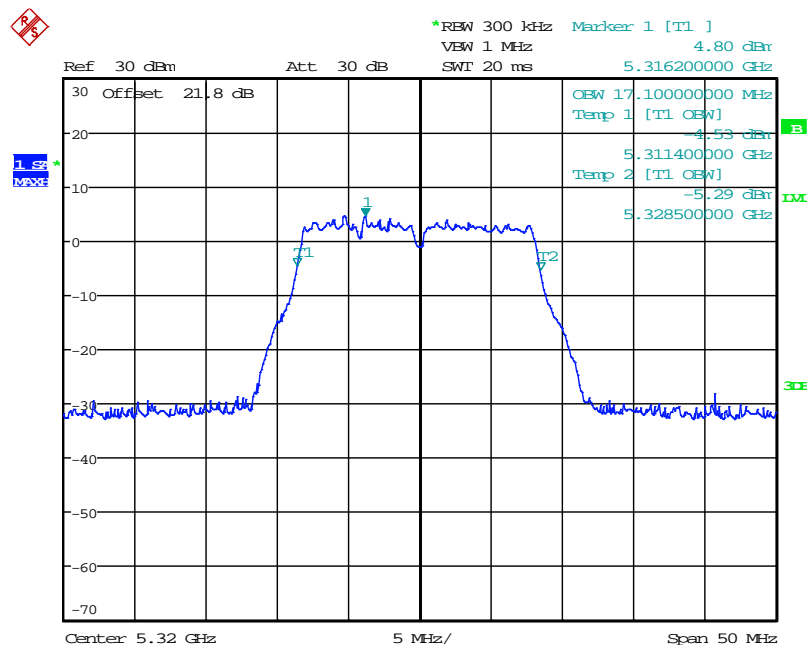
Date: 13.JUN.2016 19:12:25

Figure 7.2.2-22: 99% OBW - Low Channel



Date: 13.JUN.2016 19:27:33

Figure 7.2.2-23: 99% OBW - Middle Channel



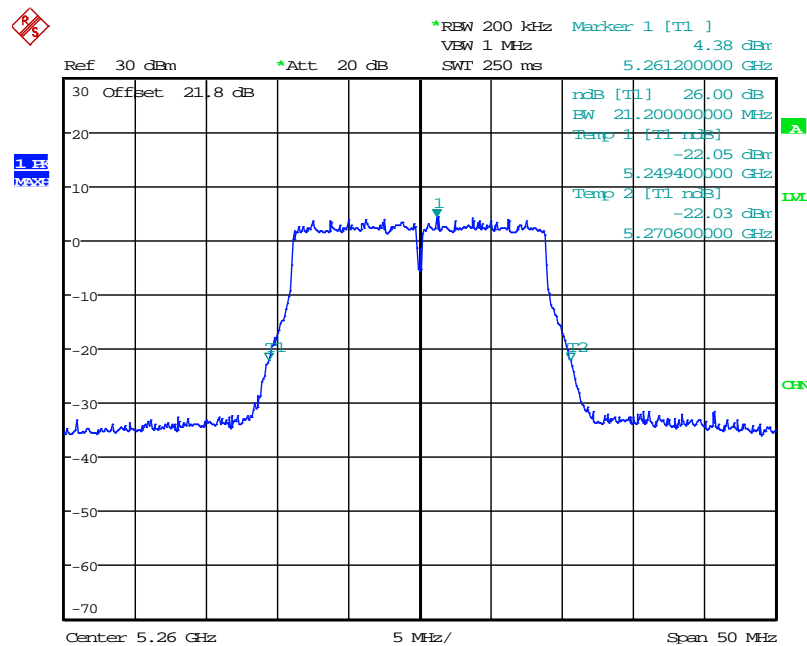
Date: 13.JUN.2016 19:30:31

**Figure 7.2.2-24: 99% OBW - High Channel**

802.11n 20 MHz

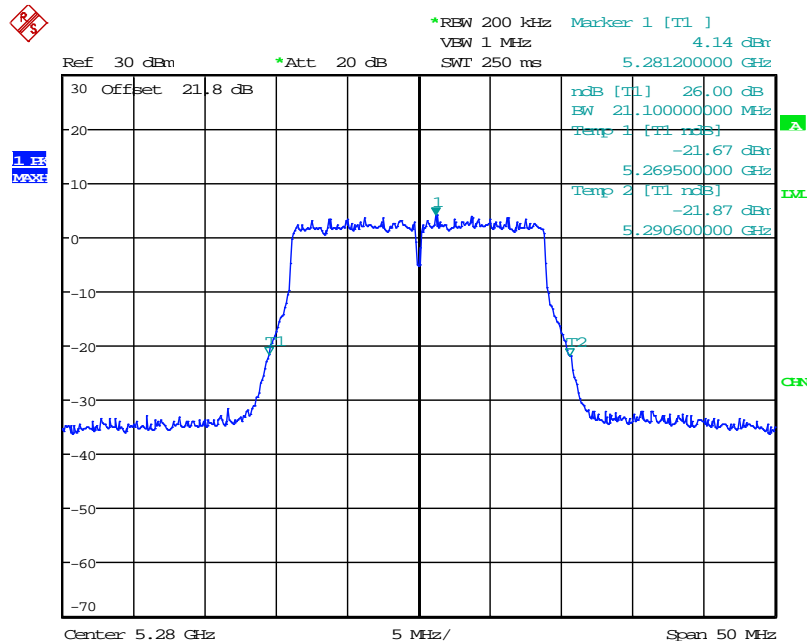
Table 7.2.2-6: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5260	21.20	18.10
5280	21.10	18.10
5320	21.20	18.10



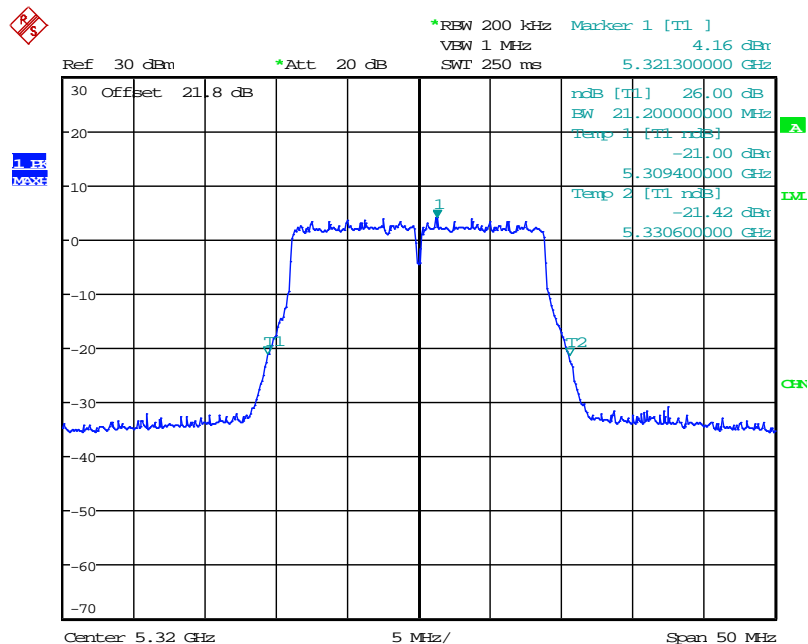
Date: 13.JUN.2016 19:16:32

Figure 7.2.2-25: 26 dB EBW - Low Channel



Date: 13.JUN.2016 19:22:14

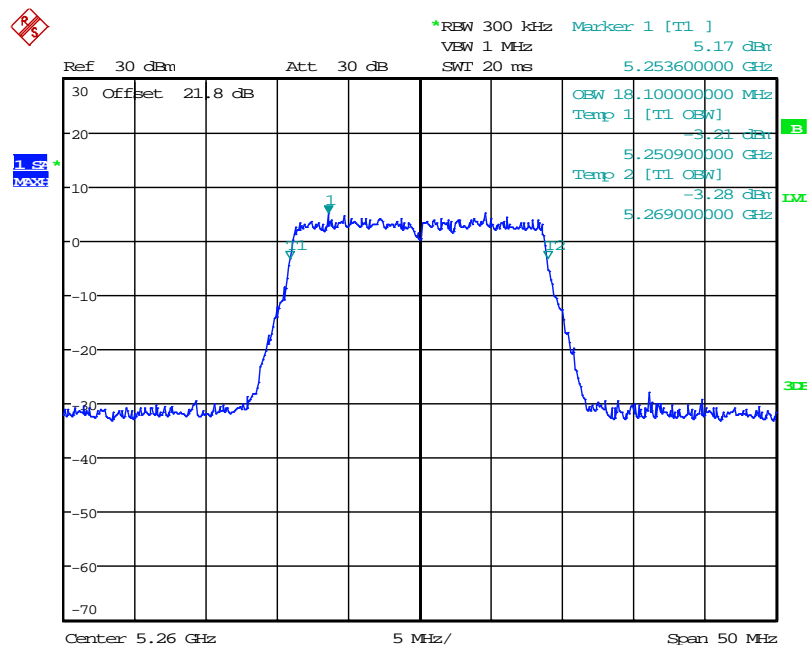
Figure 7.2.2-26: 26 dB EBW - Middle Channel



Date: 13.JUN.2016 19:37:11

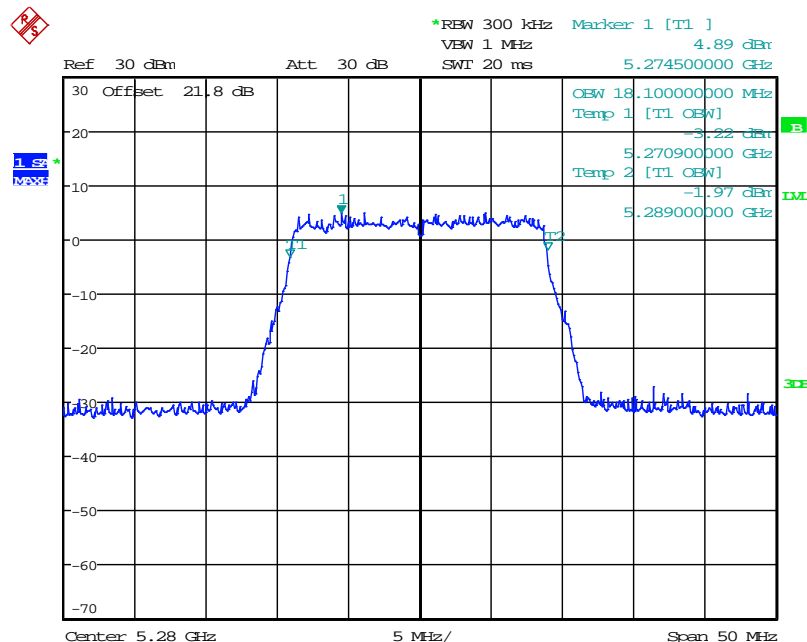
Figure 7.2.2-27: 26 dB EBW - High Channel





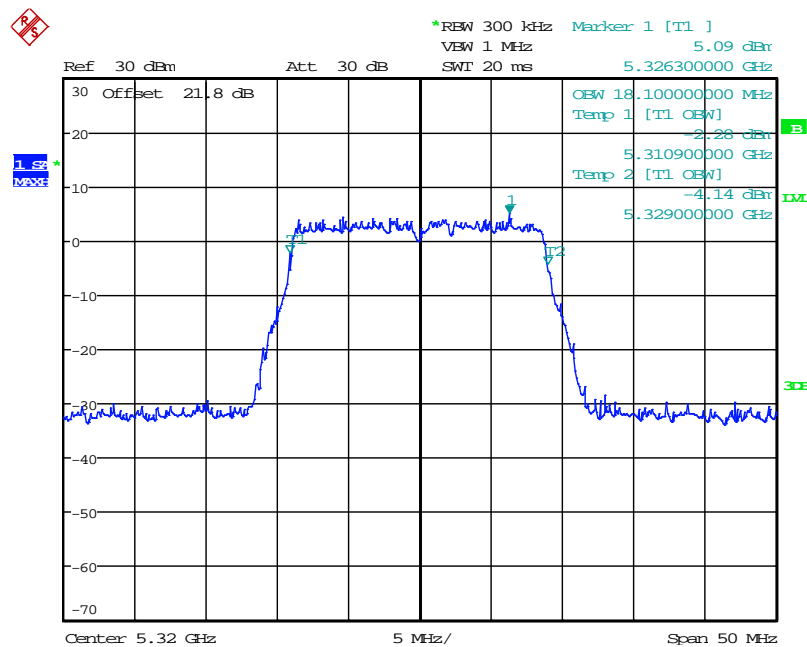
Date: 13.JUN.2016 19:17:52

Figure 7.2.2-28: 99% OBW - Low Channel



Date: 13.JUN.2016 19:21:02

Figure 7.2.2-29: 99% OBW - Middle Channel



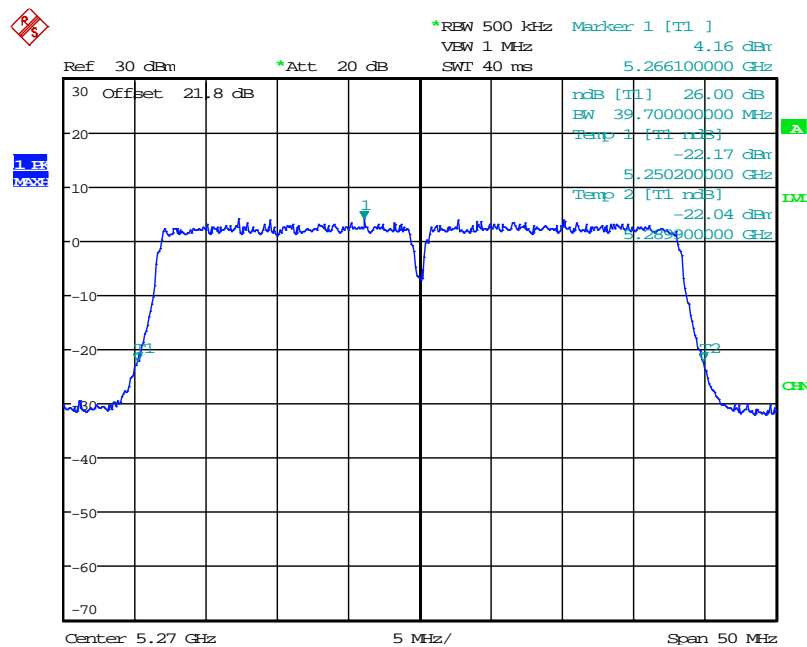
Date: 13.JUN.2016 19:38:28

Figure 7.2.2-30: 99% OBW - High Channel

802.11n 40 MHz

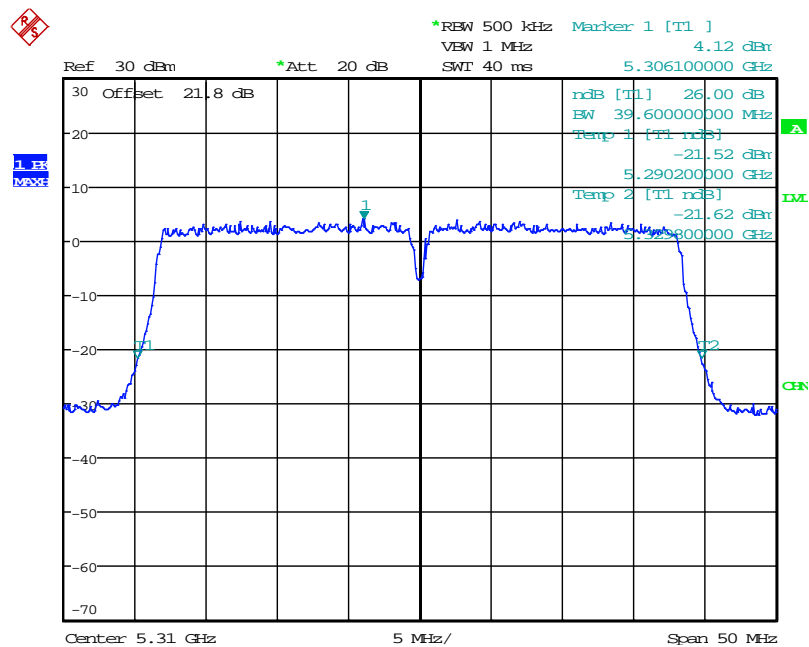
Table 7.2.2-7: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5270	39.70	37.00
5310	39.60	37.00



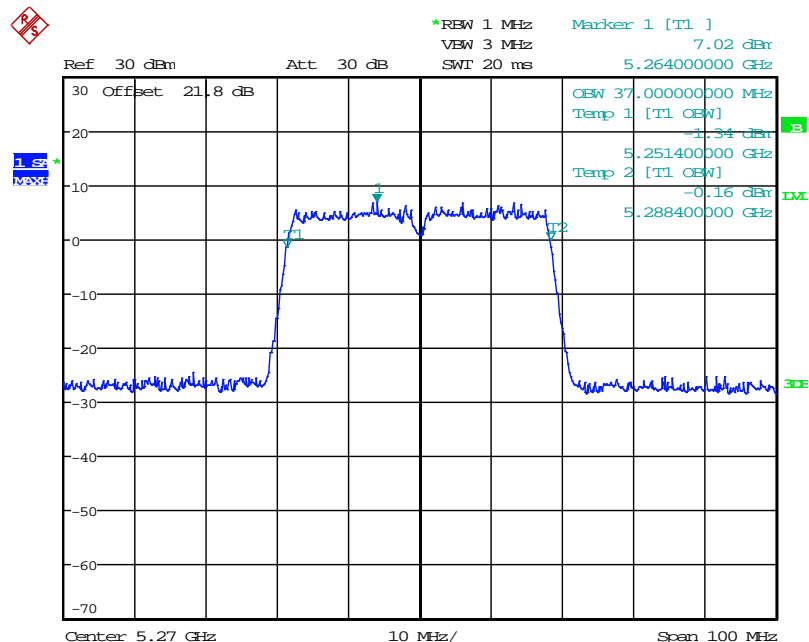
Date: 13.JUN.2016 19:51:39

Figure 7.2.2-31: 26 dB EBW - Low Channel



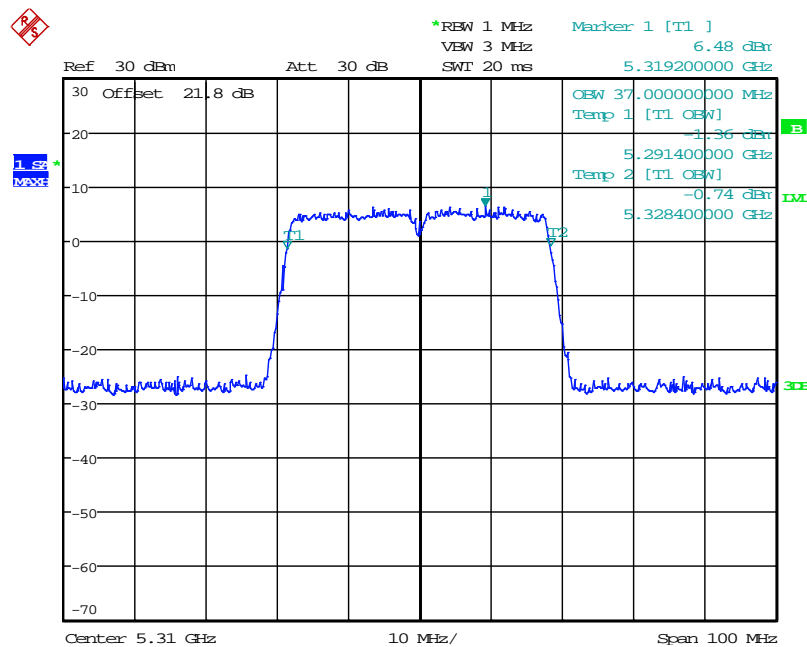
Date: 13.JUN.2016 19:53:38

Figure 7.2.2-32: 26 dB EBW - High Channel



Date: 13.JUN.2016 19:50:11

Figure 7.2.2-33: 99% OBW - Low Channel



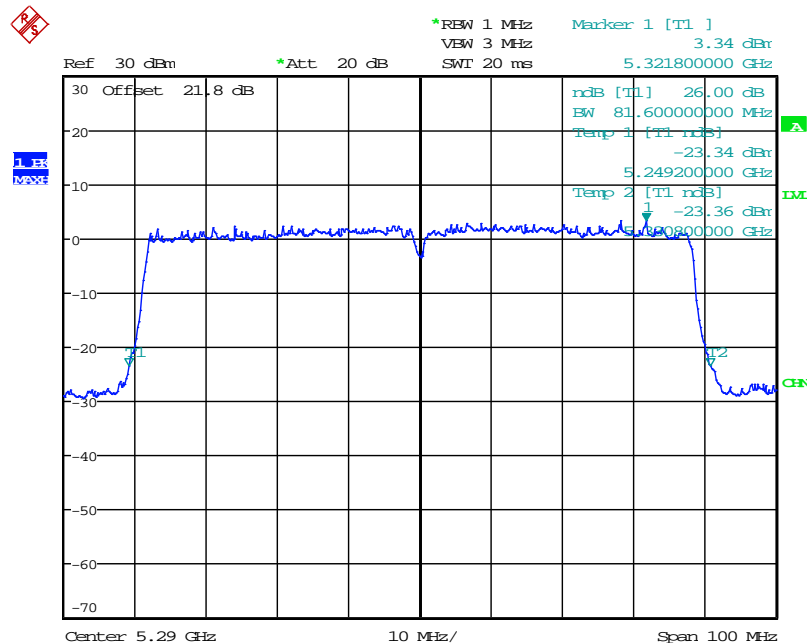
Date: 13.JUN.2016 19:56:00

Figure 7.2.2-34: 99% OBW - High Channel

802.11ac 80 MHz

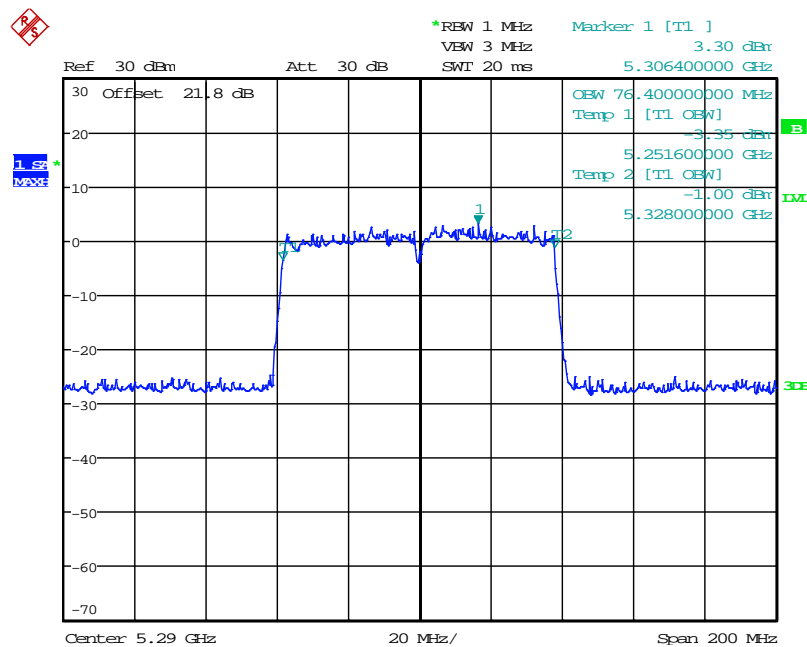
Table 7.2.2-8: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5290	81.60	76.40



Date: 13.JUN.2016 15:39:20

Figure 7.2.2-35: 26 dB EBW - Middle Channel



Date: 13.JUN.2016 15:42:58

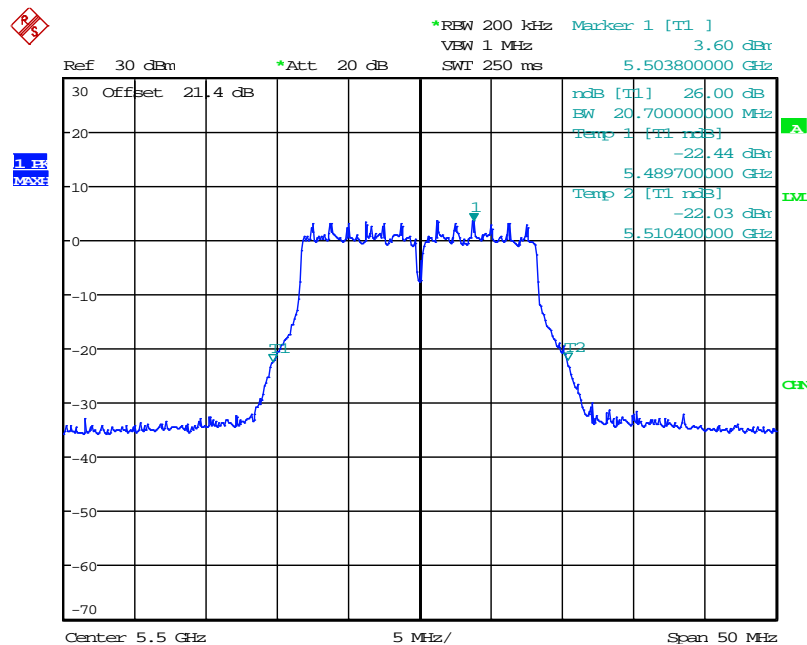
Figure 7.2.2-36: 99% OBW - Middle Channel

## Band 5470 – 5725 MHz

802.11a

Table 7.2.2-9: 26 dB EBW / 99% Bandwidth

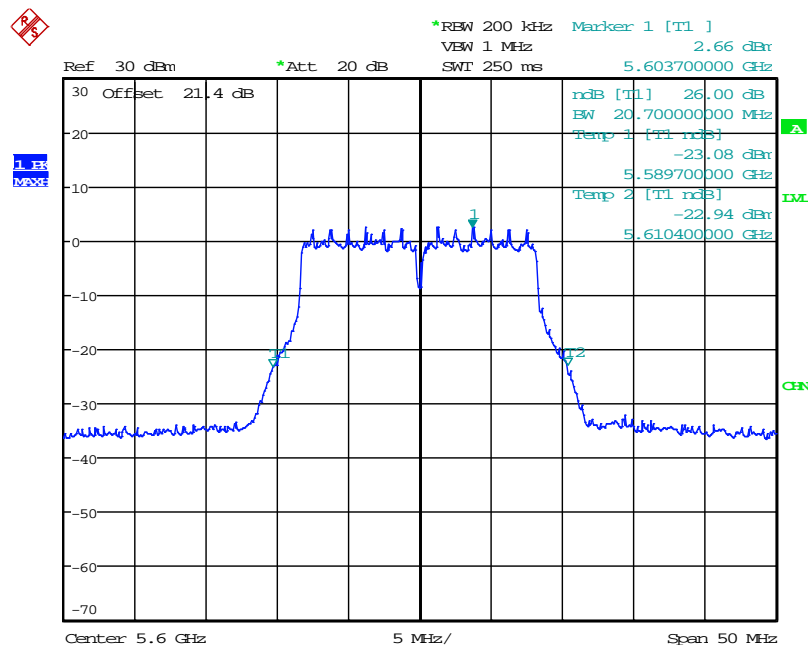
Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5500	20.70	17.20
5600	20.70	17.20
5720	20.70	17.20



Date: 13.JUN.2016 18:24:52

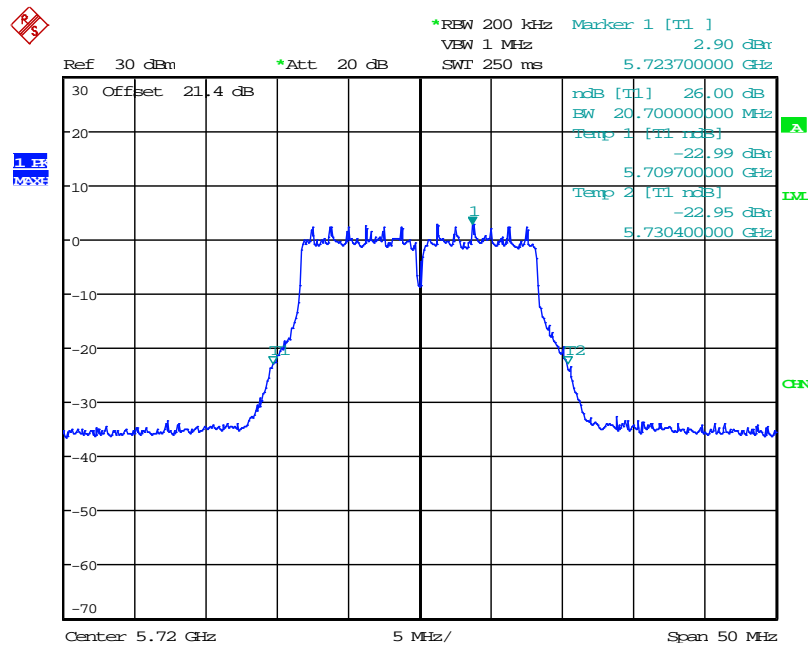
Figure 7.2.2-37: 26 dB EBW - Low Channel





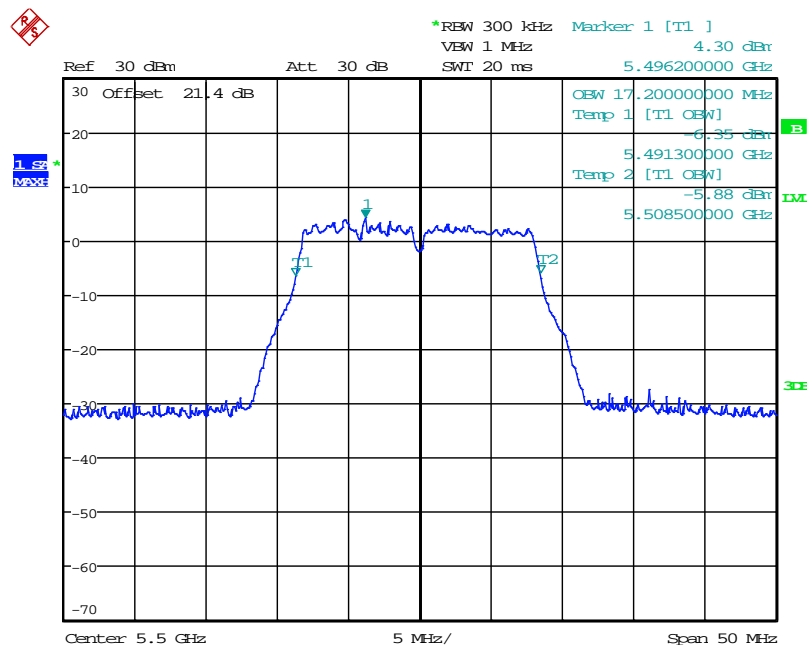
Date: 13.JUN.2016 18:04:04

Figure 7.2.2-38: 26 dB EBW - Middle Channel



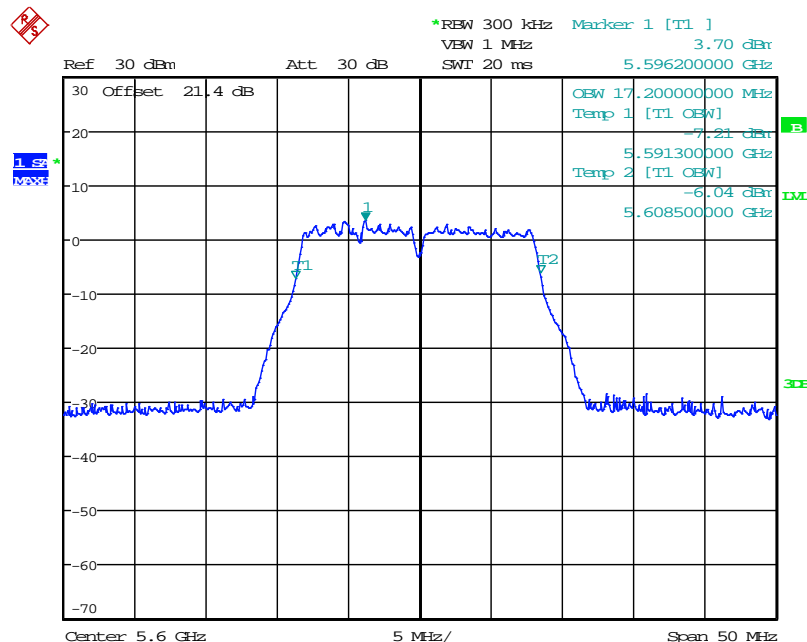
Date: 13.JUN.2016 18:02:07

Figure 7.2.2-39: 26 dB EBW - High Channel



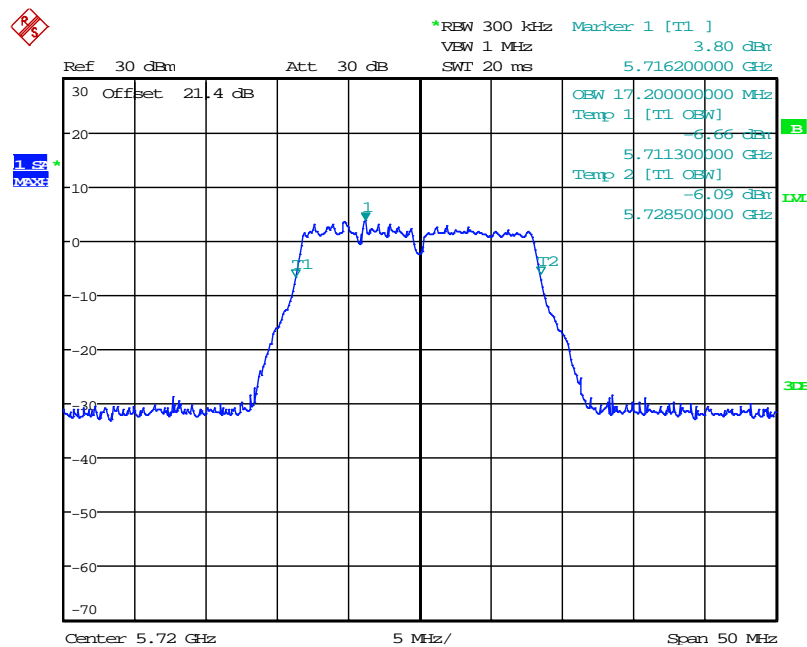
Date: 13.JUN.2016 18:22:56

Figure 7.2.2-40: 99% OBW - Low Channel



Date: 13.JUN.2016 18:06:40

Figure 7.2.2-41: 99% OBW - Middle Channel



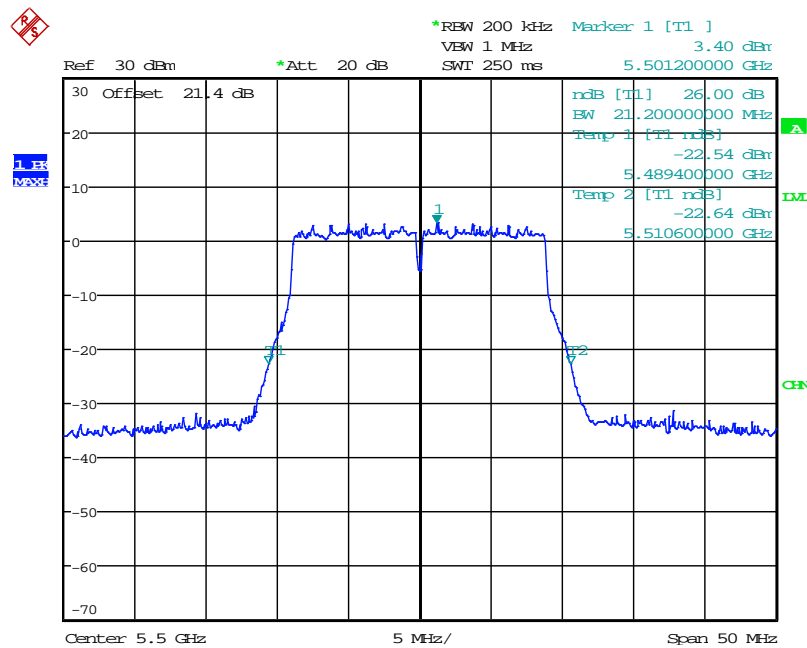
Date: 13.JUN.2016 18:00:52

Figure 7.2.2-42: 99% OBW - High Channel

802.11n 20 MHz

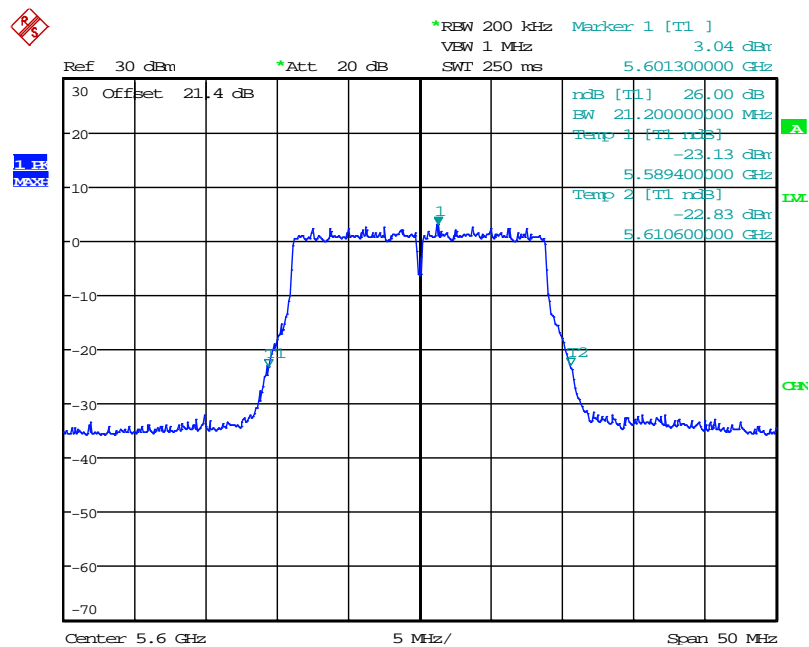
Table 7.2.2-10: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5500	21.20	18.10
5600	21.20	18.20
5720	21.20	18.10



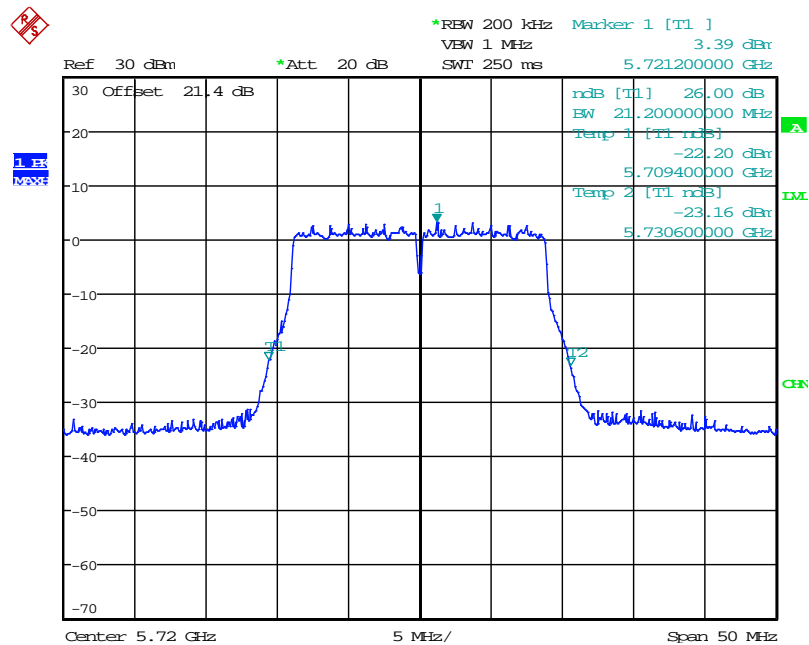
Date: 13.JUN.2016 18:15:47

Figure 7.2.2-43: 26 dB EBW - Low Channel



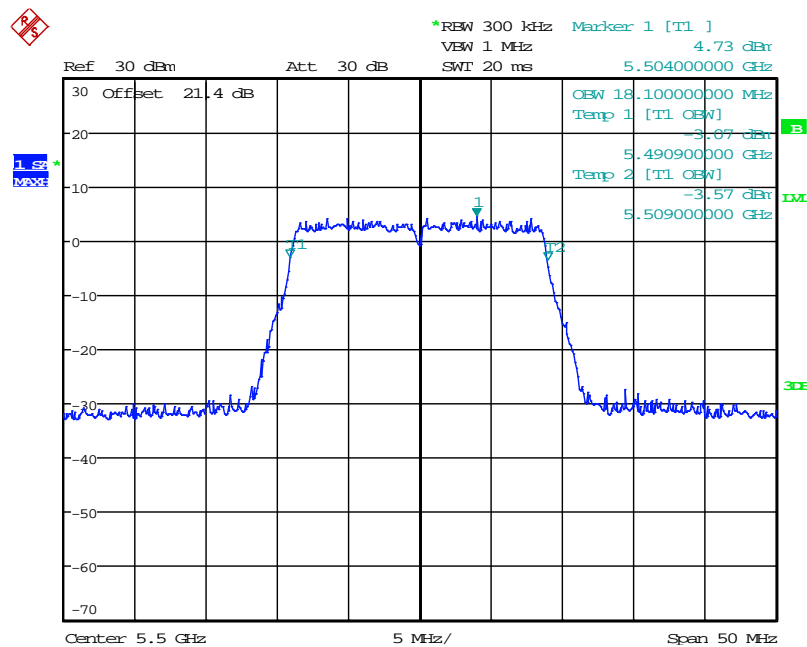
Date: 13.JUN.2016 18:13:36

Figure 7.2.2-44: 26 dB EBW - Middle Channel



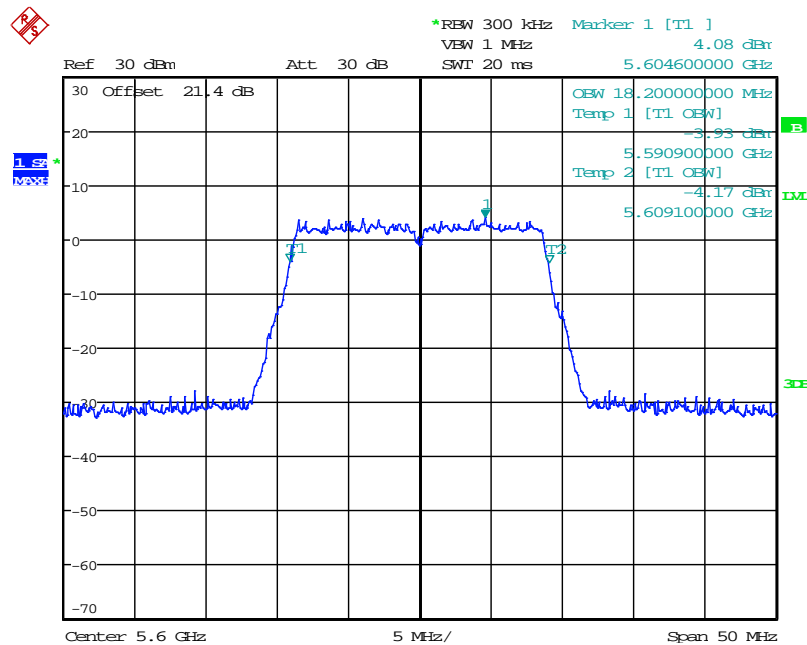
Date: 13.JUN.2016 17:53:51

Figure 7.2.2-45: 26 dB EBW - High Channel



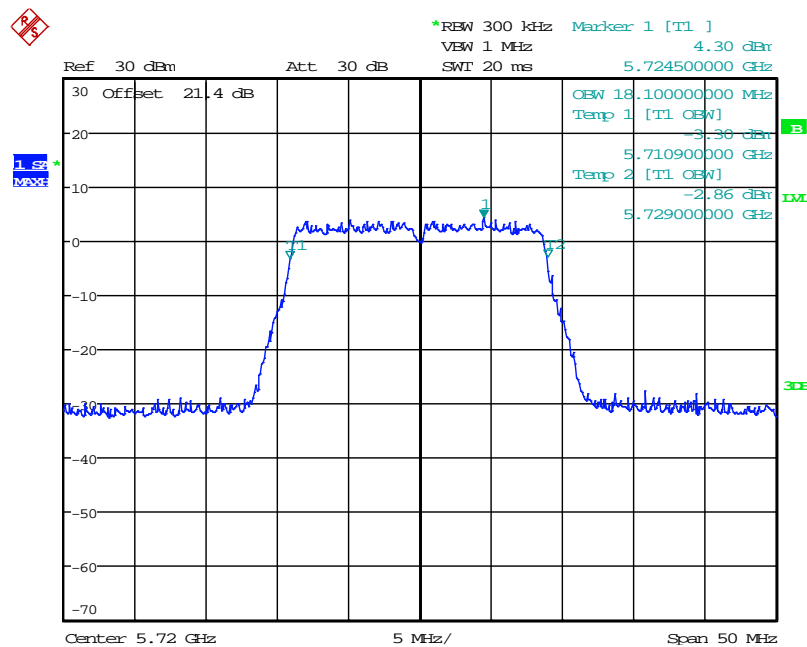
Date: 13.JUN.2016 18:18:32

Figure 7.2.2-46: 99% OBW - Low Channel



Date: 13.JUN.2016 18:11:14

Figure 7.2.2-47: 99% OBW - Middle Channel



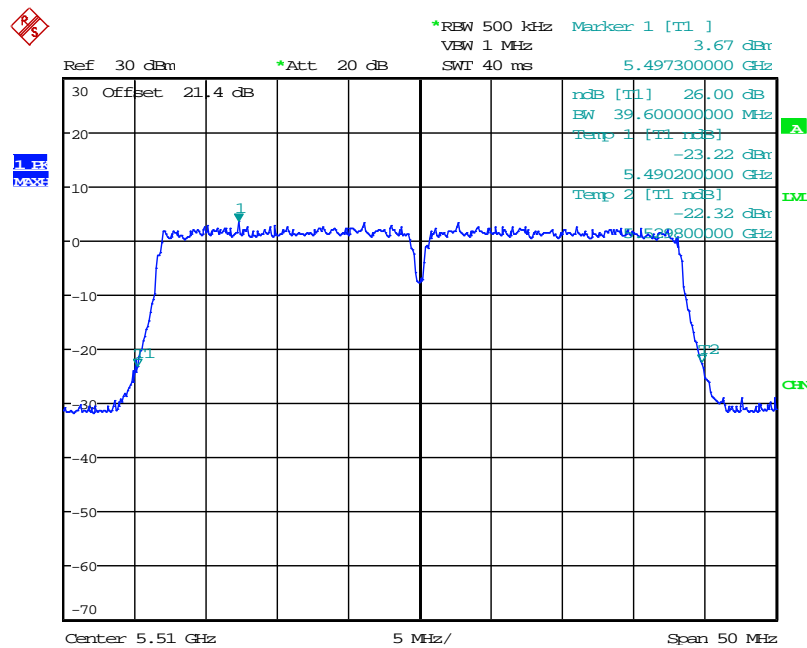
Date: 13.JUN.2016 17:57:37

Figure 7.2.2-48: 99% OBW - High Channel

802.11n 40 MHz

Table 7.2.2-11: 26 dB EBW / 99% Bandwidth

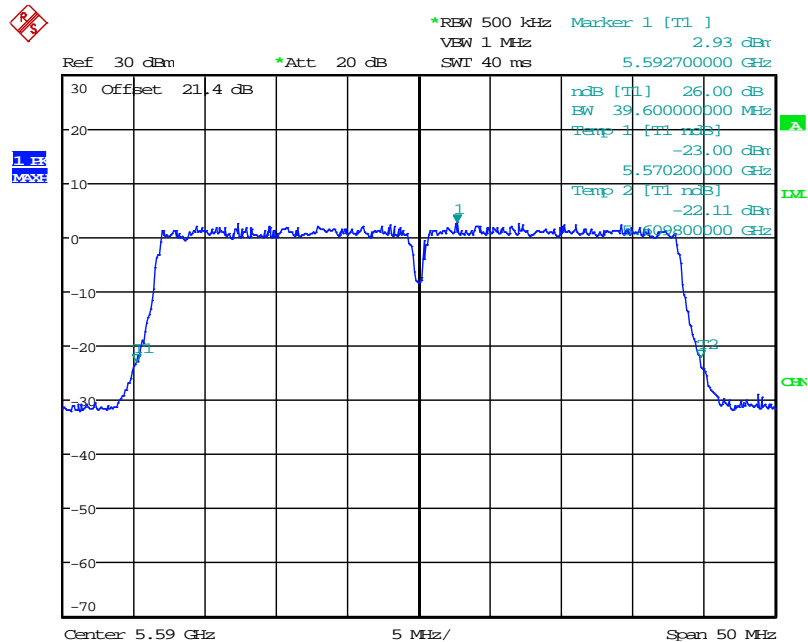
Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5510	39.60	36.80
5590	39.60	36.80
5710	39.70	37.00



Date: 13.JUN.2016 16:17:45

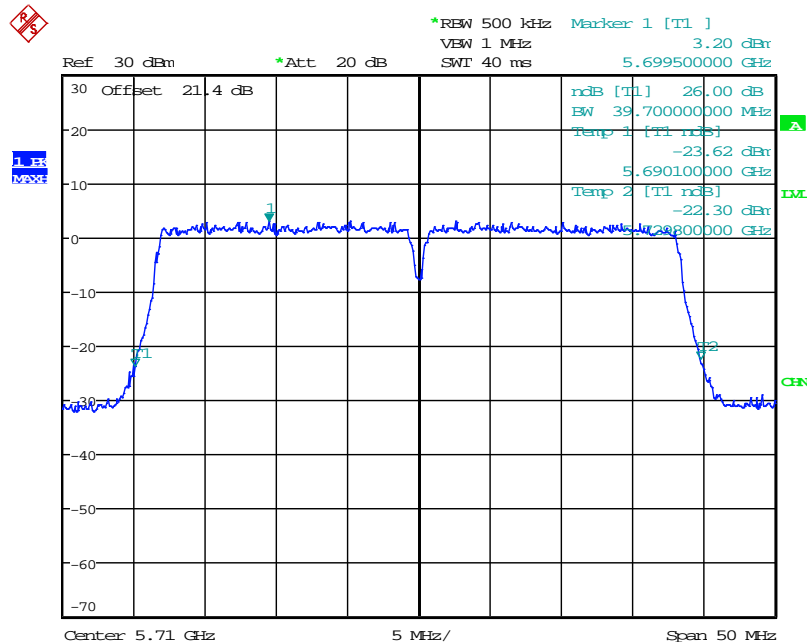
Figure 7.2.2-49: 26 dB EBW - Low Channel





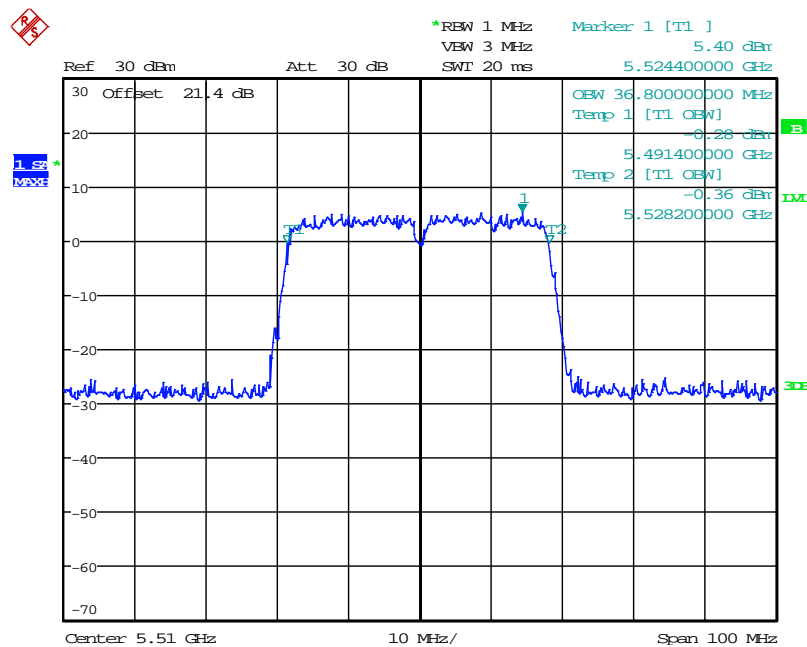
Date: 13.JUN.2016 16:20:01

Figure 7.2.2-50: 26 dB EBW - Middle Channel



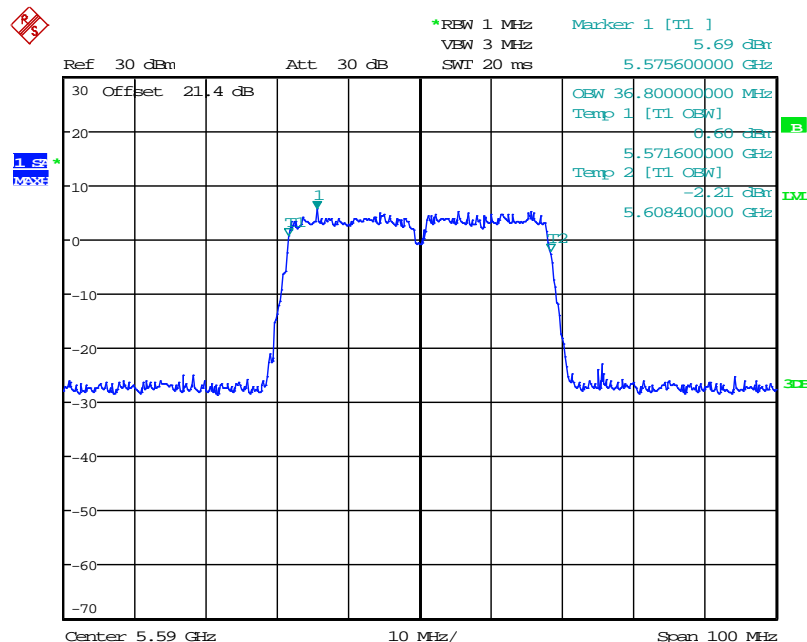
Date: 13.JUN.2016 16:26:43

Figure 7.2.2-51: 26 dB EBW - High Channel



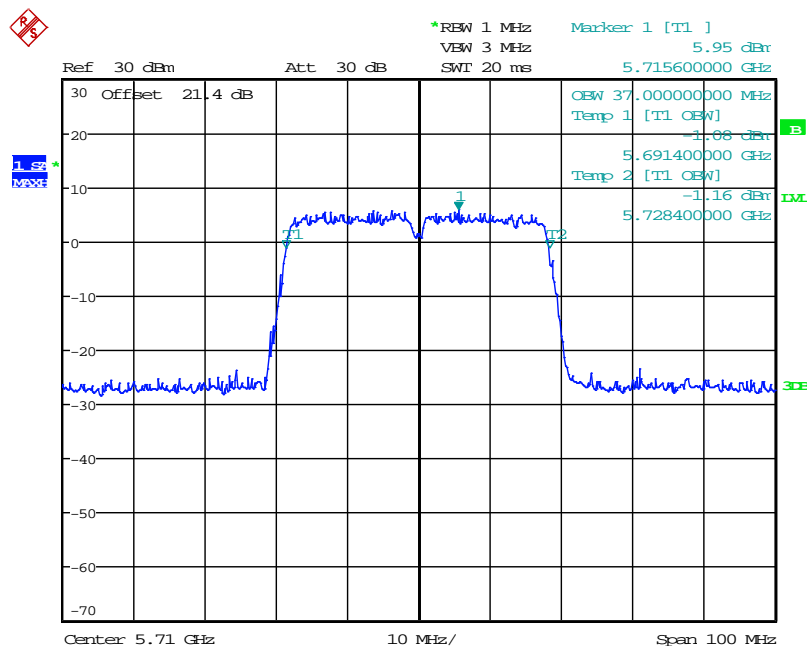
Date: 13.JUN.2016 22:22:48

Figure 7.2.2-52: 99% OBW - Low Channel



Date: 13.JUN.2016 22:25:22

Figure 7.2.2-53: 99% OBW - Middle Channel



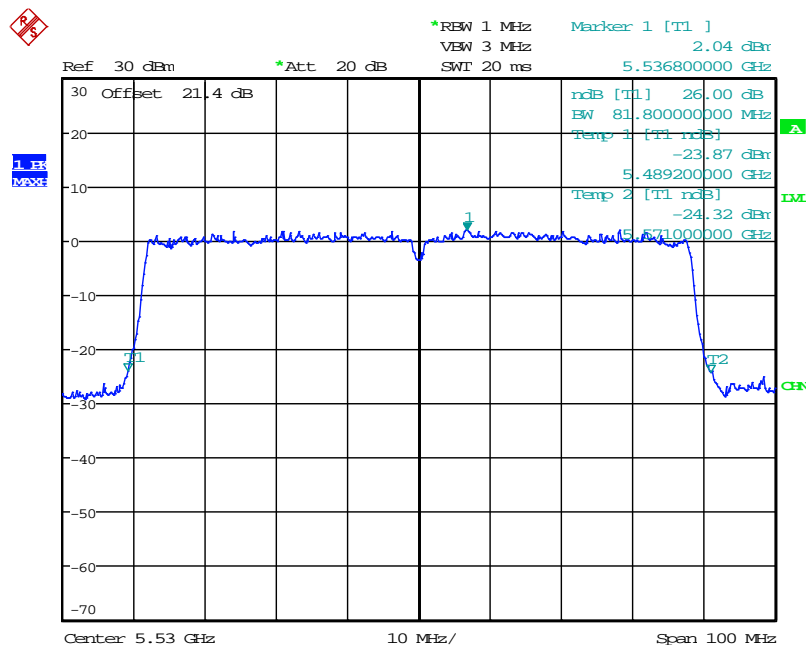
Date: 13.JUN.2016 22:29:34

Figure 7.2.2-54: 99% OBW - High Channel

802.11ac 80 MHz

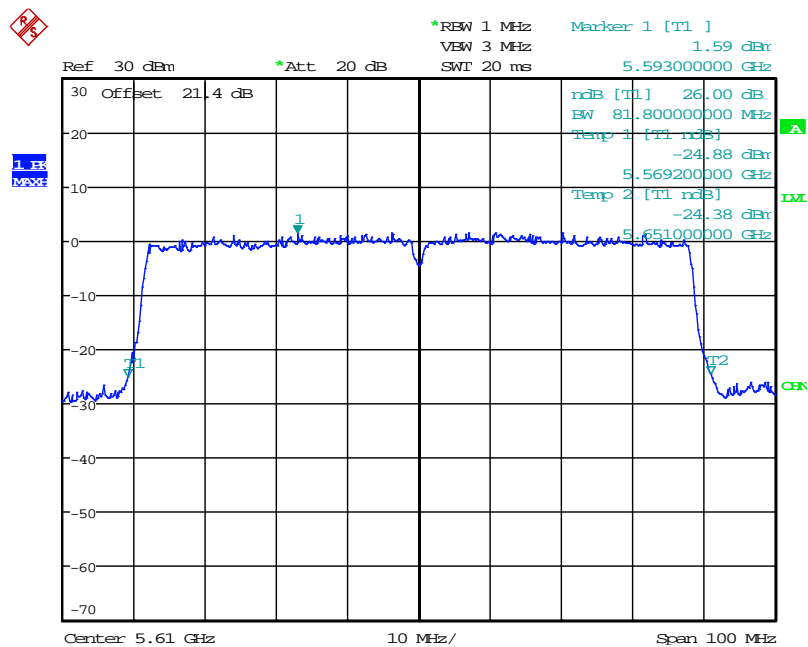
Table 7.2.2-12: 26 dB EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5530	81.80	76.40
5610	81.80	76.80
5690	81.40	76.40



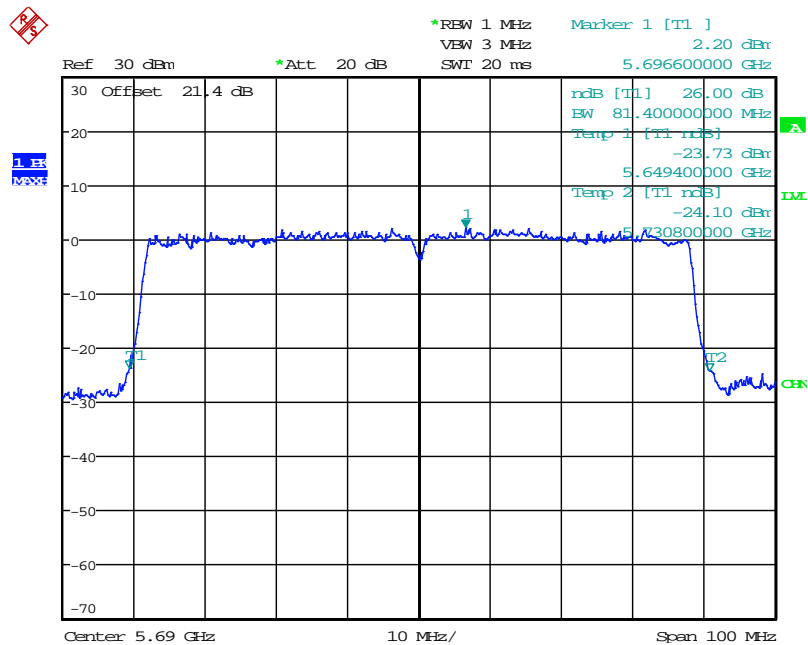
Date: 13.JUN.2016 15:48:45

Figure 7.2.2-55: 26 dB EBW - Low Channel



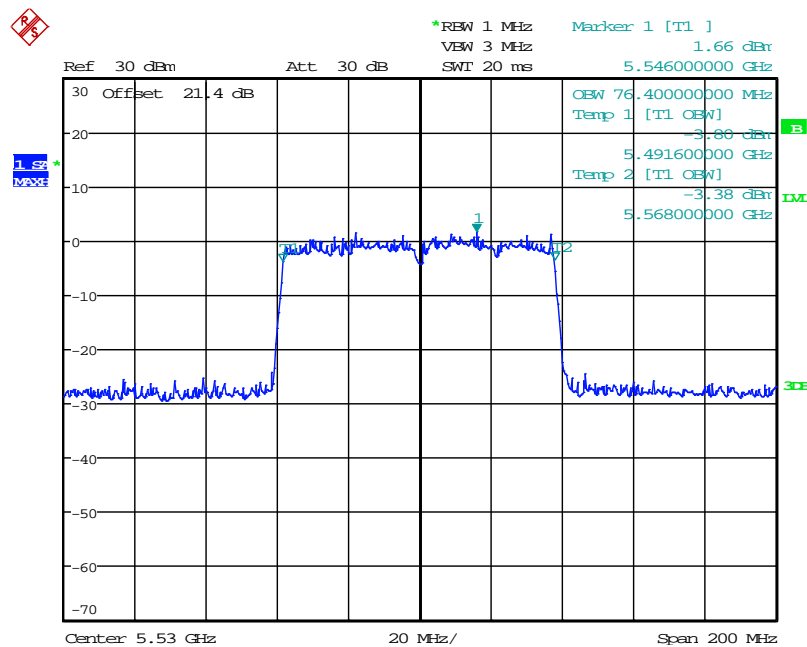
Date: 13.JUN.2016 15:59:57

Figure 7.2.2-56: 26 dB EBW - Middle Channel



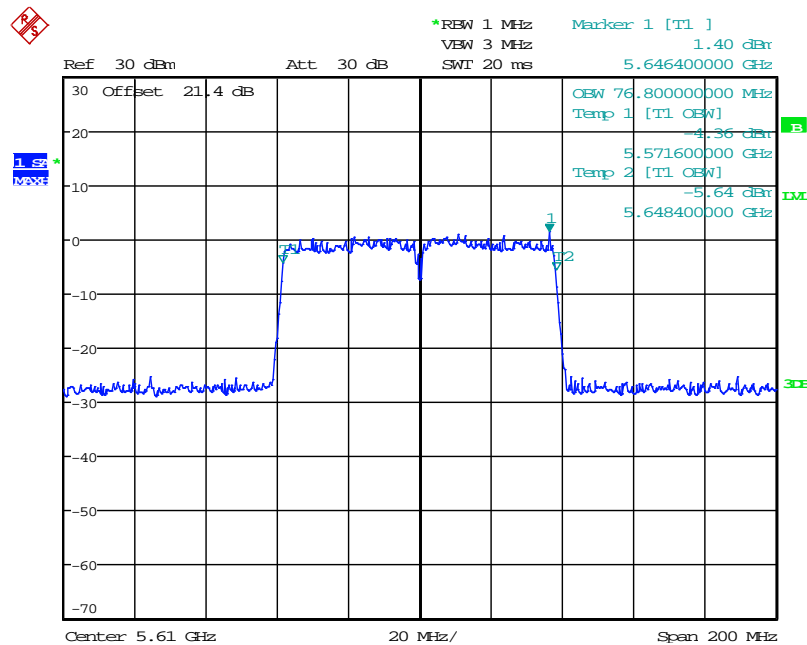
Date: 13.JUN.2016 16:03:12

Figure 7.2.2-57: 26 dB EBW - High Channel



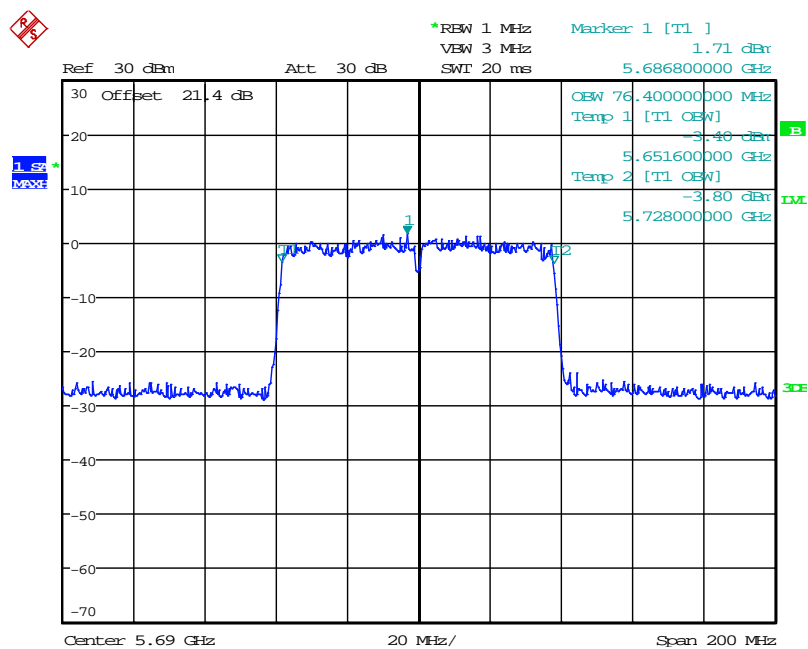
Date: 13.JUN.2016 15:50:15

Figure 7.2.2-58: 99% OBW - Low Channel



Date: 13.JUN.2016 15:58:00

Figure 7.2.2-59: 99% OBW - Middle Channel



Date: 13.JUN.2016 16:05:10

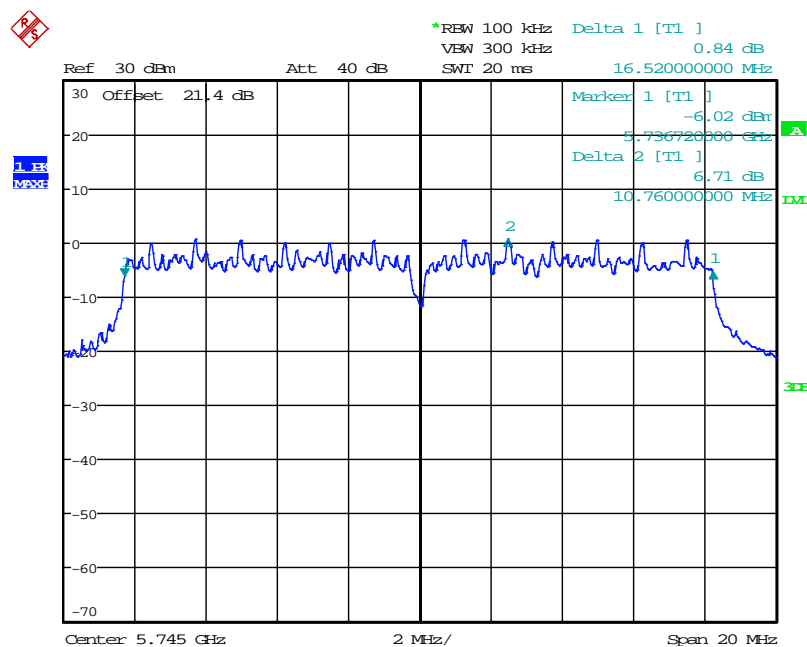
Figure 7.2.2-60: 99% OBW - High Channel

## Band 5725 – 5850 MHz

802.11a

Table 7.2.2-13: 6dB / 26 dB EBW / 99% Bandwidth

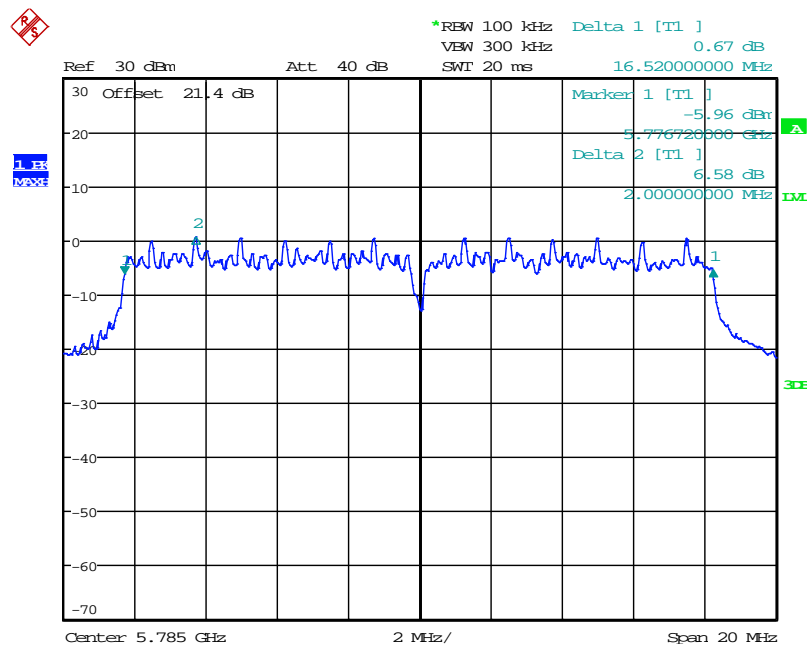
Frequency [MHz]	6dB Bandwidth [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5745	16.52	20.50	17.10
5785	16.52	20.70	17.10
5825	16.52	20.70	17.10



Date: 13.JUN.2016 12:32:27

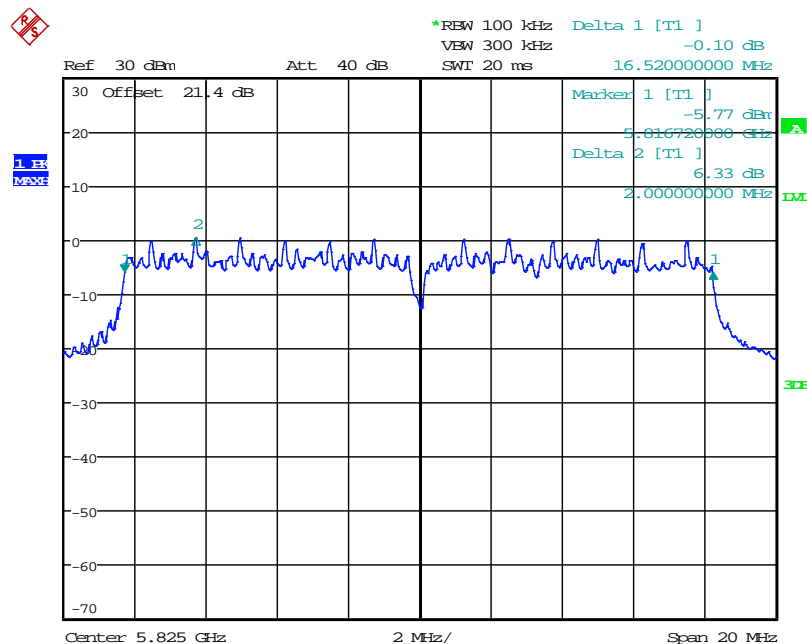
Figure 7.2.2-61: 6dB BW - Low Channel





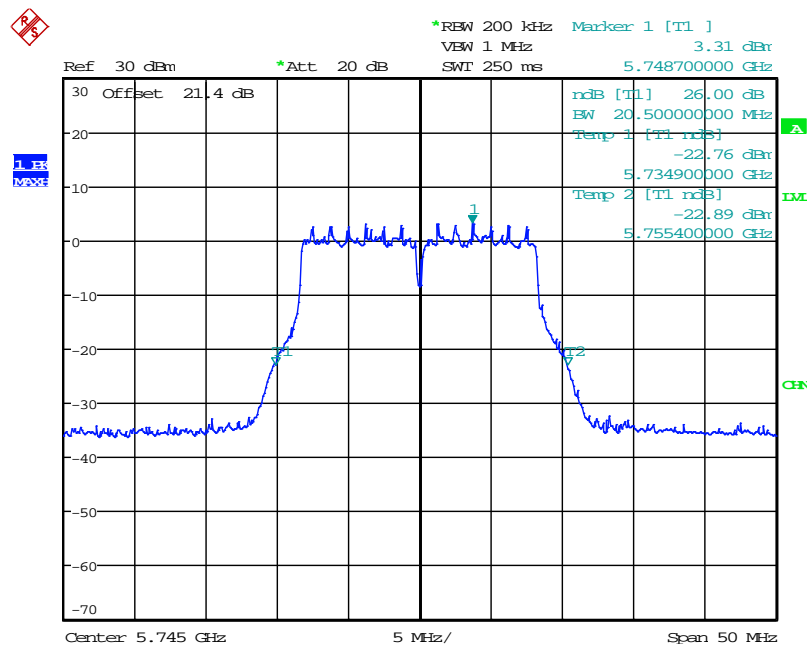
Date: 13.JUN.2016 13:52:42

Figure 7.2.2-62: 6dB BW - Middle Channel



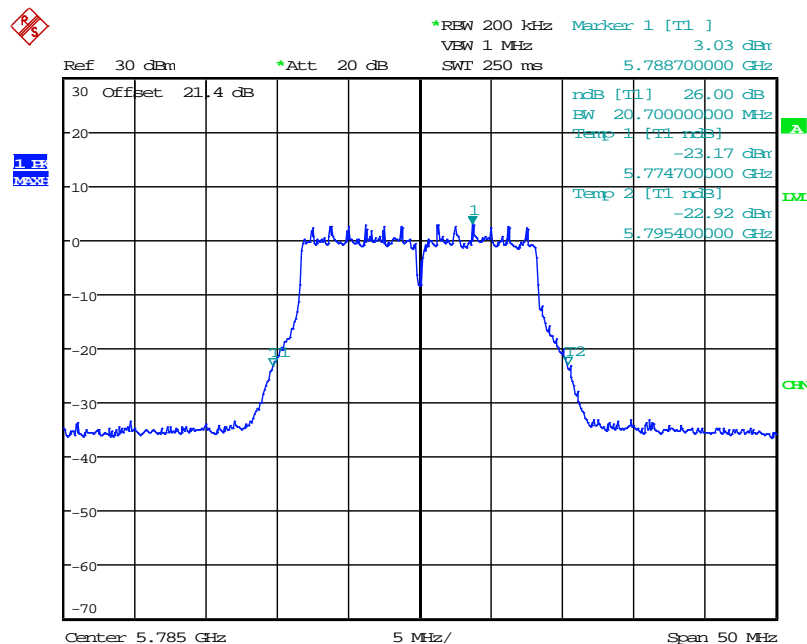
Date: 13.JUN.2016 13:56:12

Figure 7.2.2-63: 6dB BW - High Channel



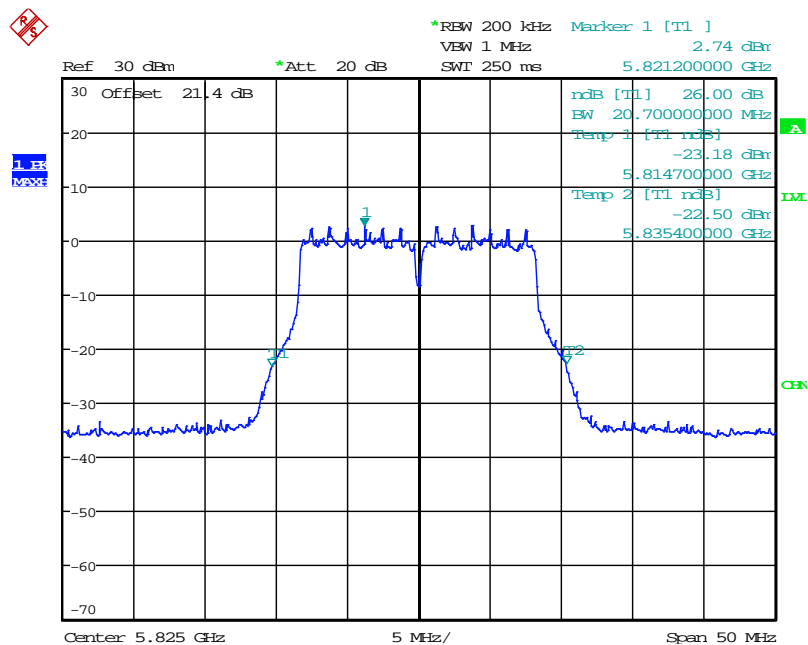
Date: 13.JUN.2016 17:44:36

Figure 7.2.2-64: 26dB EBW - Low Channel



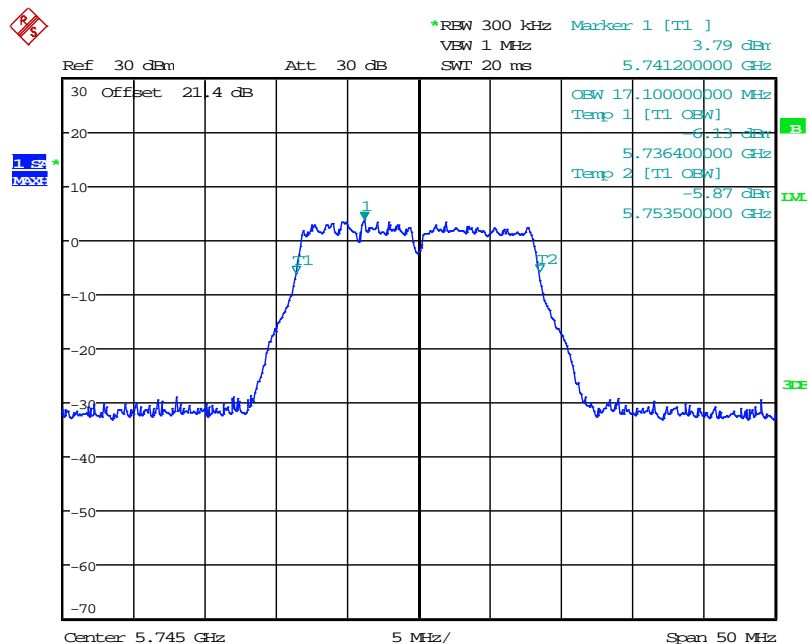
Date: 13.JUN.2016 17:41:40

Figure 7.2.2-65: 26dB EBW - Middle Channel



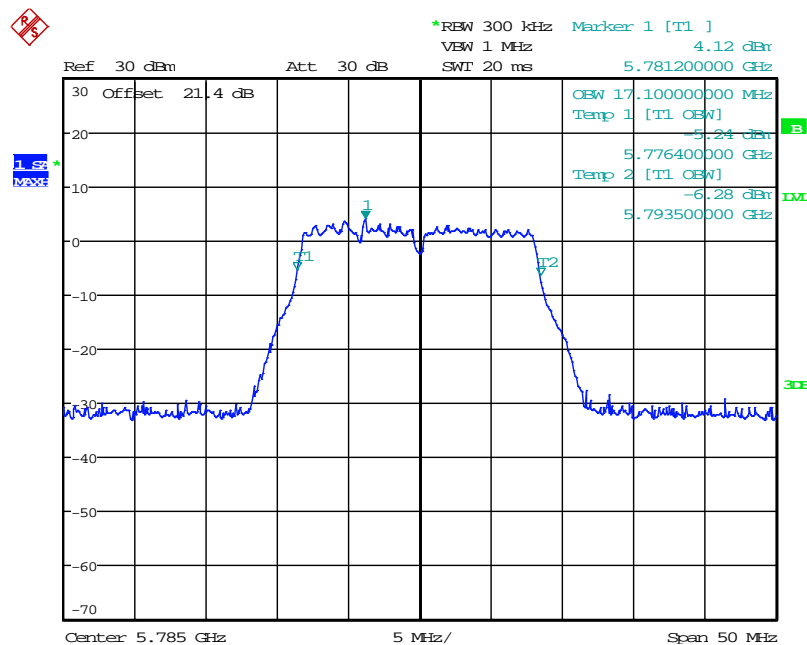
Date: 13.JUN.2016 17:23:05

Figure 7.2.2-66: 26dB EBW - High Channel



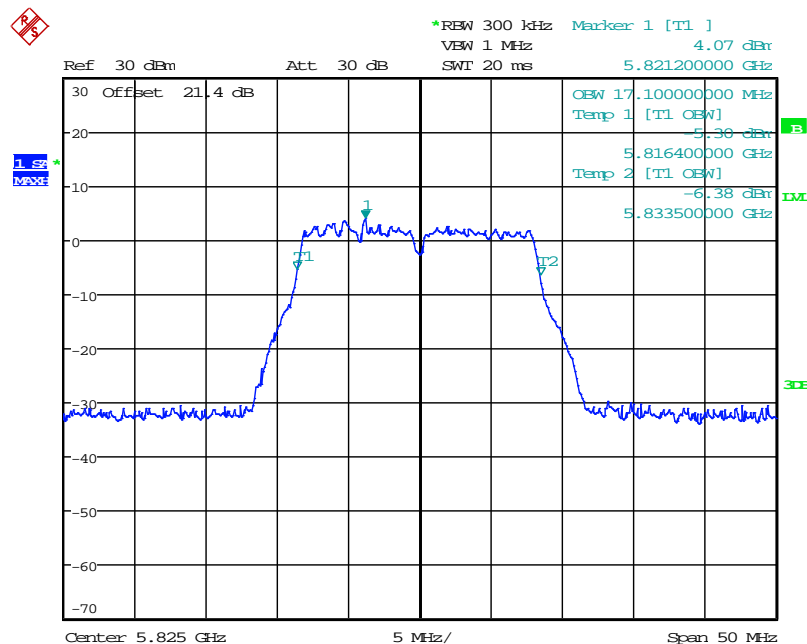
Date: 13.JUN.2016 17:46:18

Figure 7.2.2-67: 99% OBW - Low Channel



Date: 13.JUN.2016 17:39:57

Figure 7.2.2-68: 99% OBW - Middle Channel



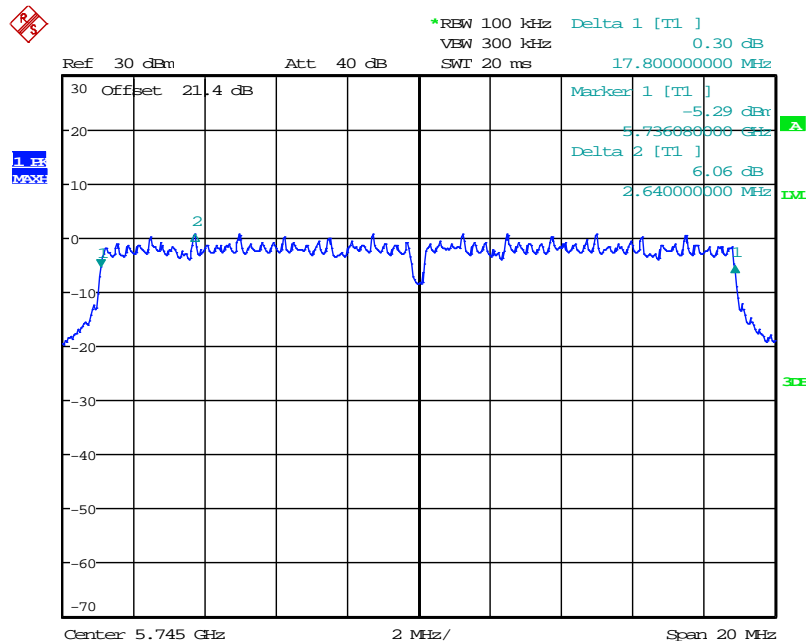
Date: 13.JUN.2016 17:25:20

Figure 7.2.2-69: 99% OBW - High Channel

802.11n 20 MHz

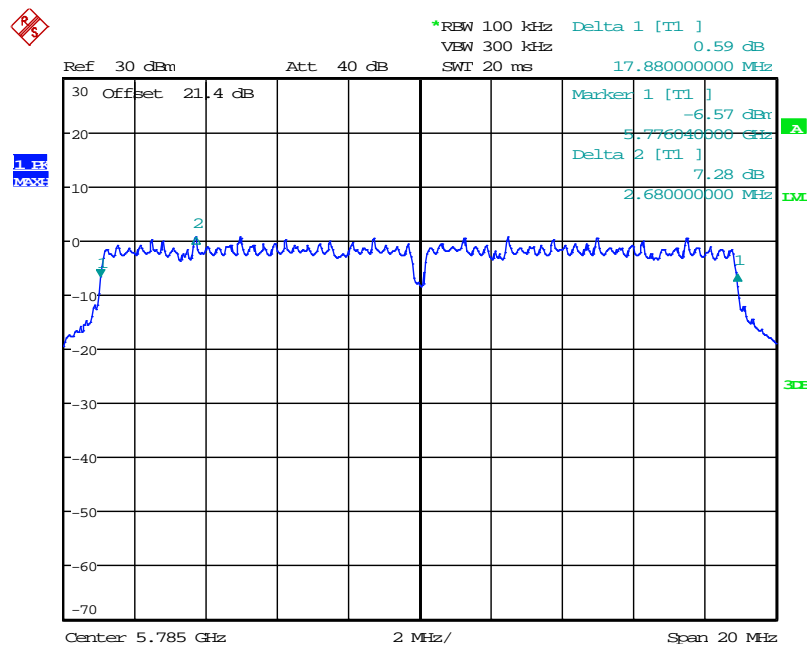
Table 7.2.2-14: 6dB / 26 dB EBW / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5745	17.80	21.20	18.10
5785	17.88	21.20	18.10
5825	17.80	21.20	18.10



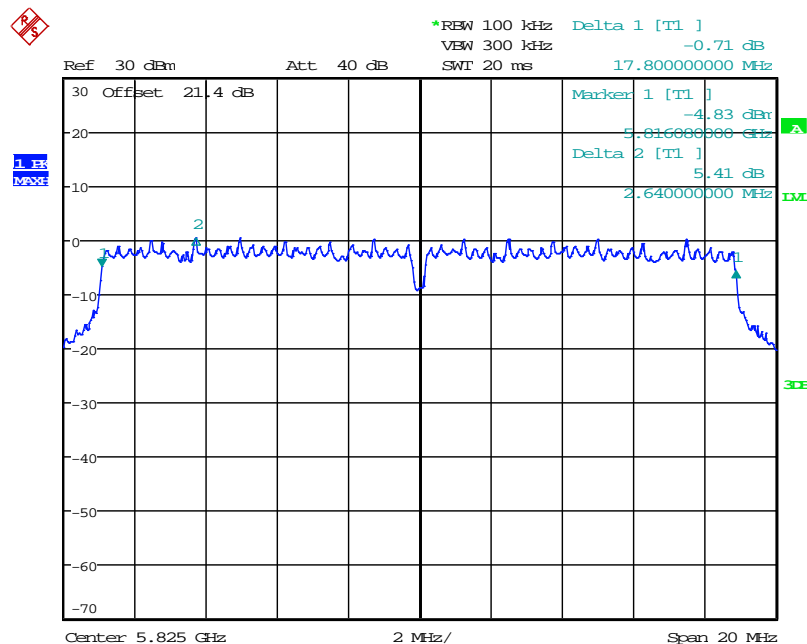
Date: 13.JUN.2016 12:37:04

Figure 7.2.2-70: 6dB BW - Low Channel



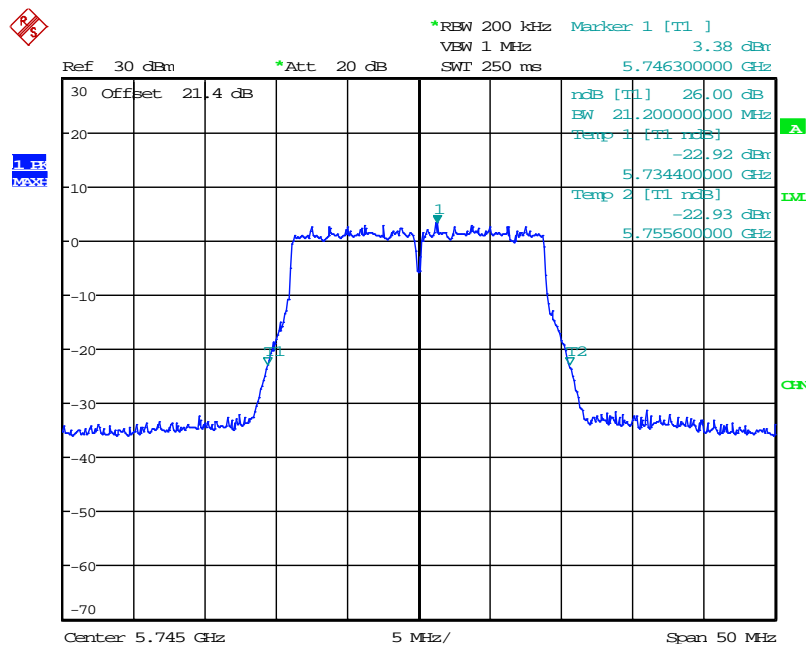
Date: 13.JUN.2016 13:08:50

Figure 7.2.2-71: 6dB BW - Middle Channel



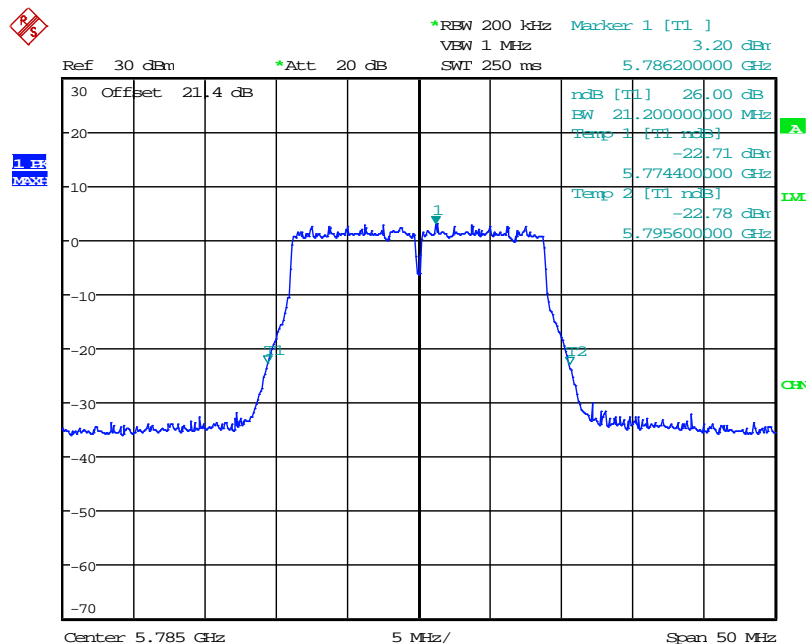
Date: 13.JUN.2016 14:00:42

Figure 7.2.2-72: 6dB BW - High Channel



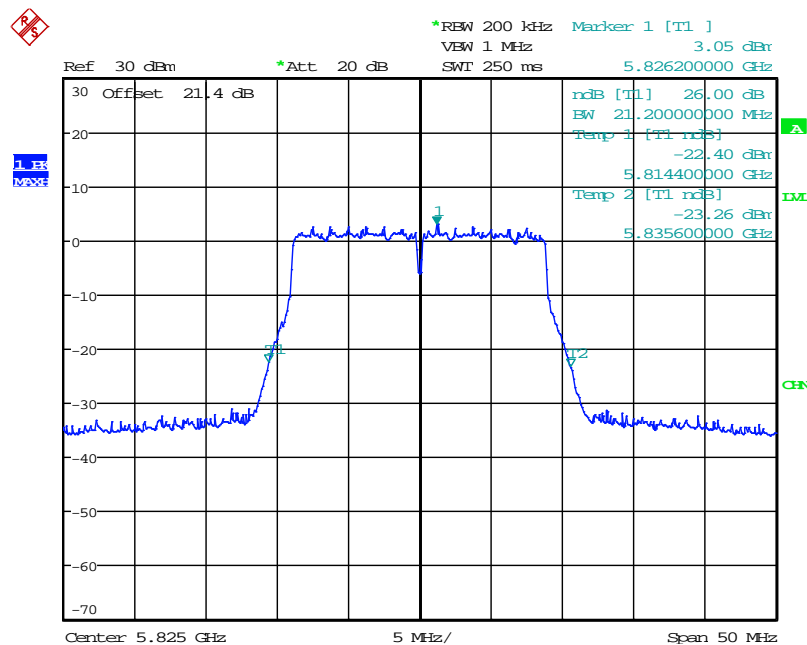
Date: 13.JUN.2016 17:51:13

Figure 7.2.2-73: 26dB EBW - Low Channel



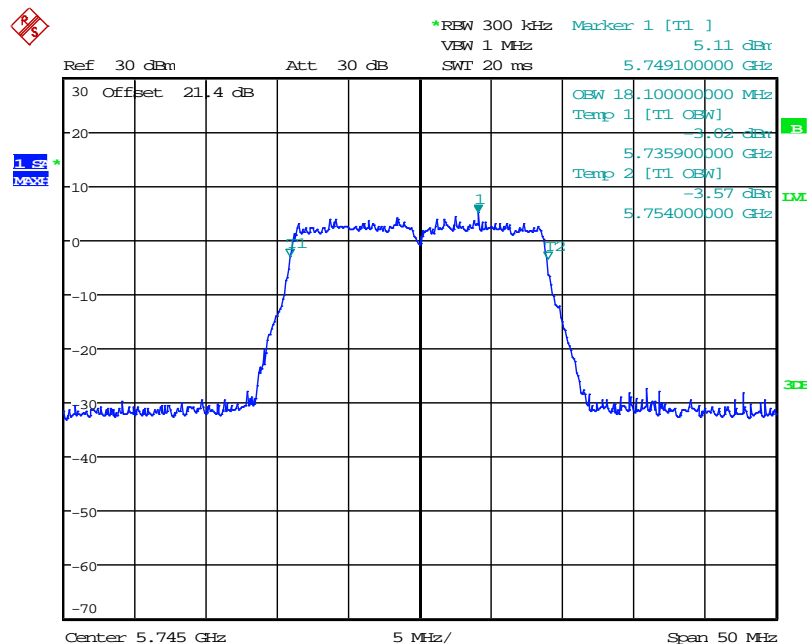
Date: 13.JUN.2016 17:33:48

Figure 7.2.2-74: 26dB EBW - Middle Channel



Date: 13.JUN.2016 17:30:44

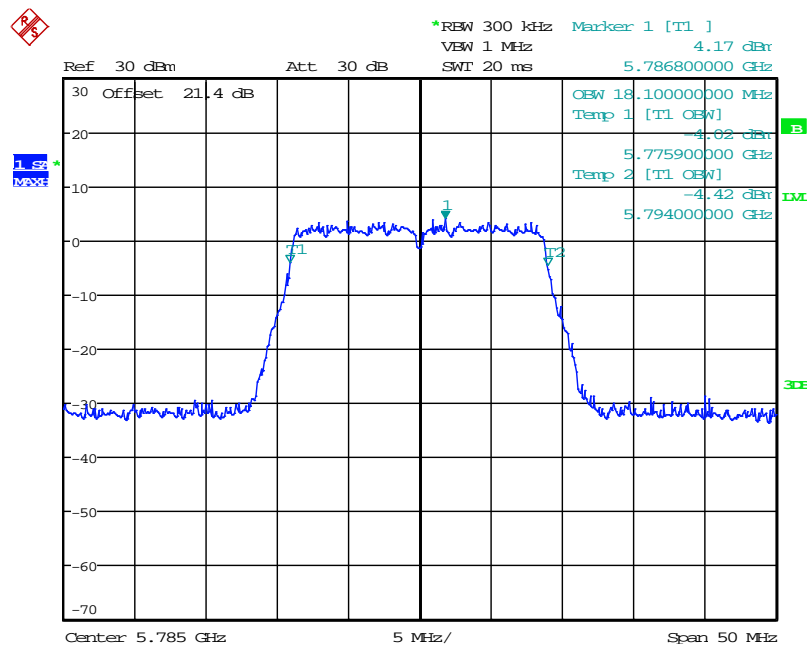
Figure 7.2.2-75: 26dB EBW - High Channel



Date: 13.JUN.2016 17:49:30

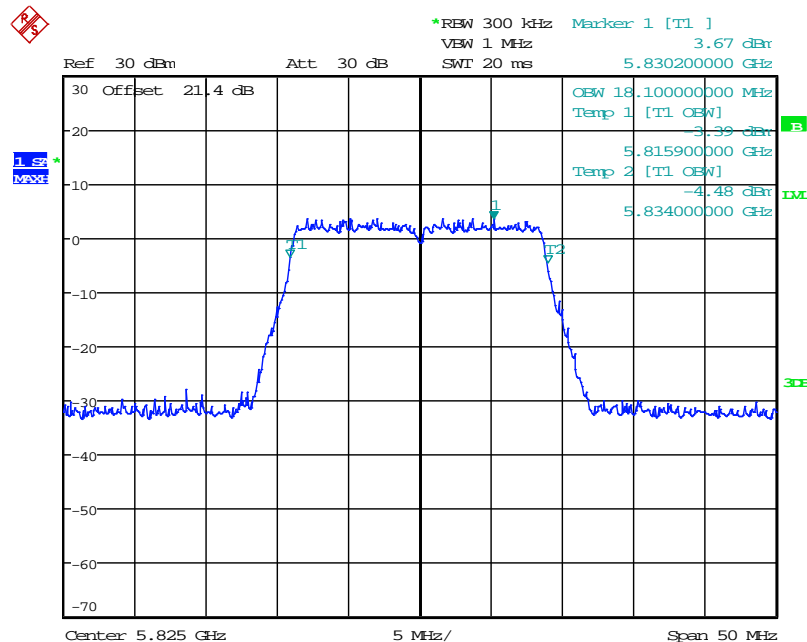
Figure 7.2.2-76: 99% OBW - Low Channel





Date: 13.JUN.2016 17:36:15

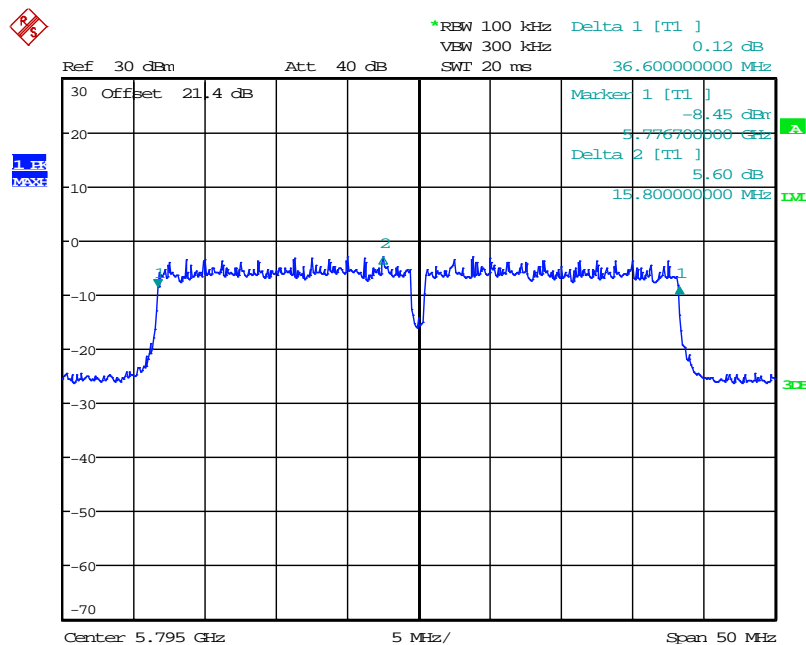
Figure 7.2.2-77: 99% OBW - Middle Channel



Date: 13.JUN.2016 17:28:36

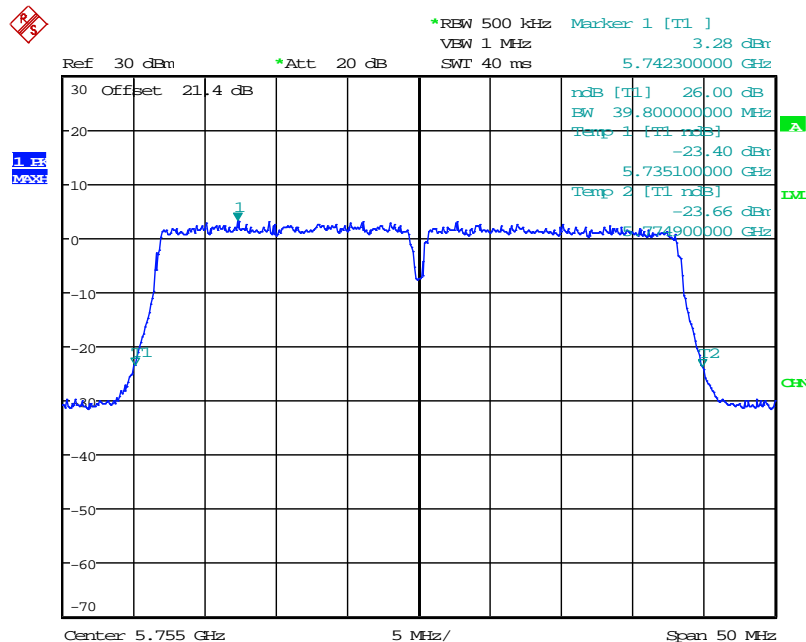
Figure 7.2.2-78: 99% OBW - High Channel





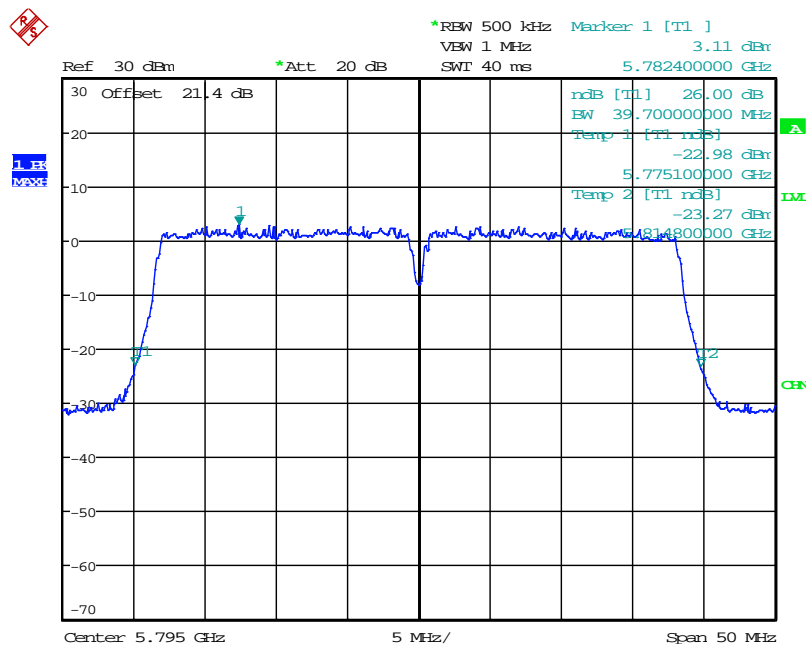
Date: 13.JUN.2016 14:14:12

Figure 7.2.2-80: 6dB BW - High Channel



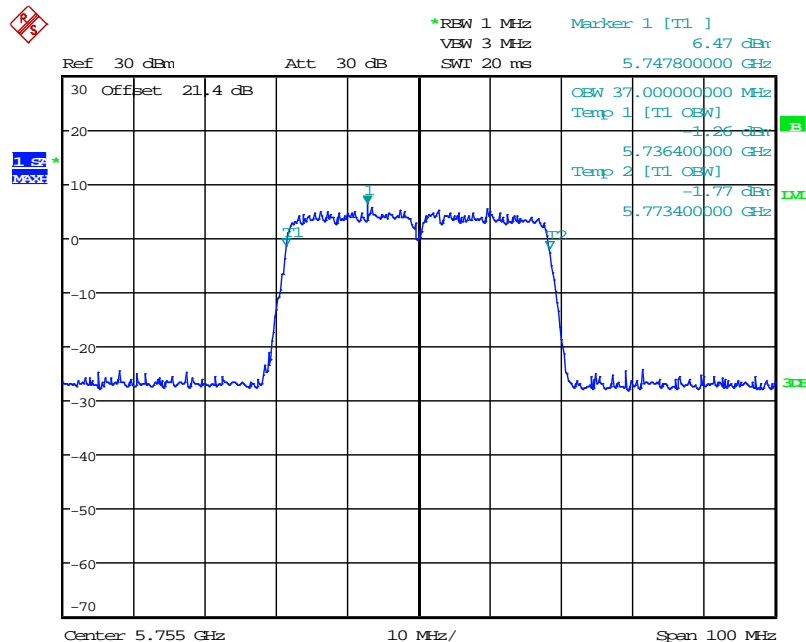
Date: 13.JUN.2016 16:37:06

Figure 7.2.2-81: 26dB EBW - Low Channel



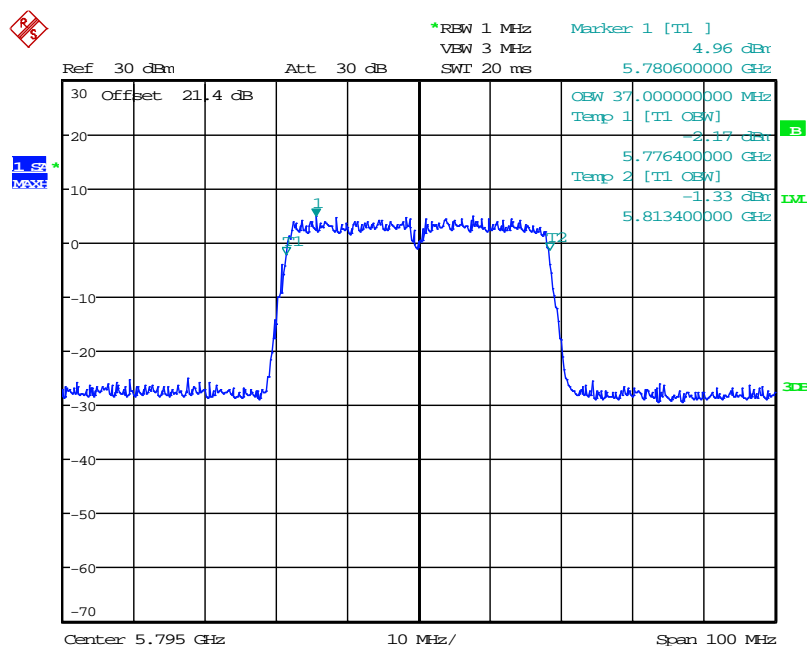
Date: 13.JUN.2016 17:18:51

Figure 7.2.2-82: 26dB EBW - High Channel



Date: 13.JUN.2016 22:34:48

Figure 7.2.2-83: 99% OBW - Low Channel



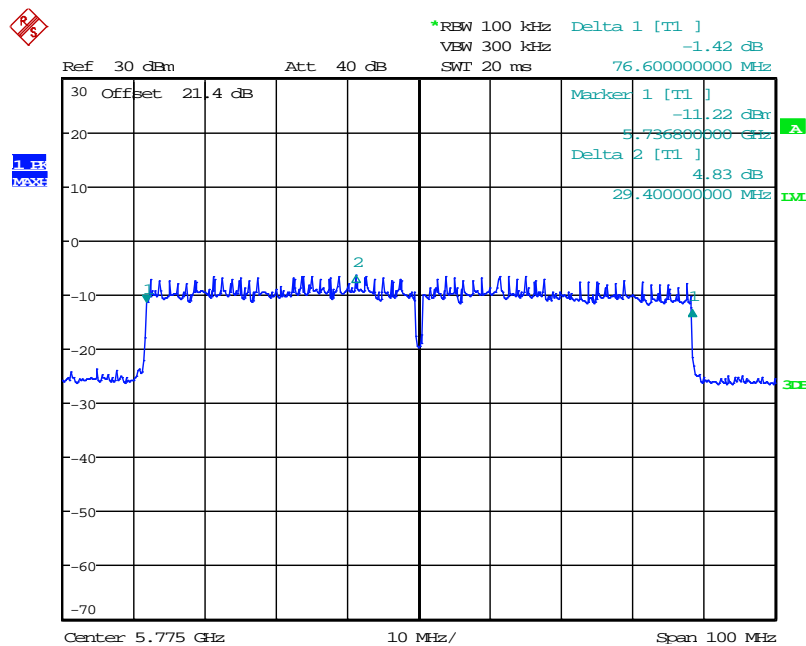
Date: 13.JUN.2016 22:37:30

Figure 7.2.2-84: 99% OBW - High Channel

802.11ac 80 MHz

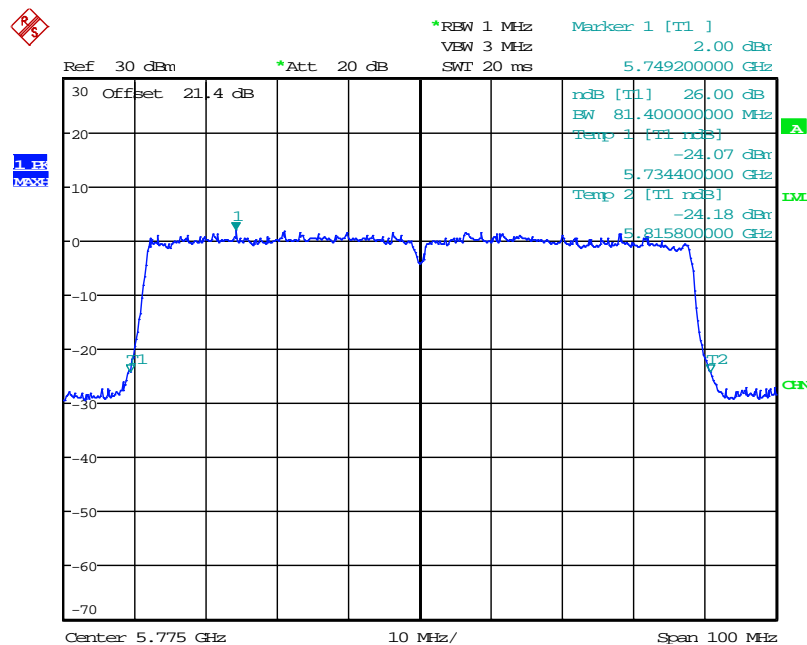
Table 7.2.2-16: 6dB / 26 dB EBW / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	26dB Bandwidth [MHz]	99% Bandwidth [MHz]
5775	76.60	81.40	76.40



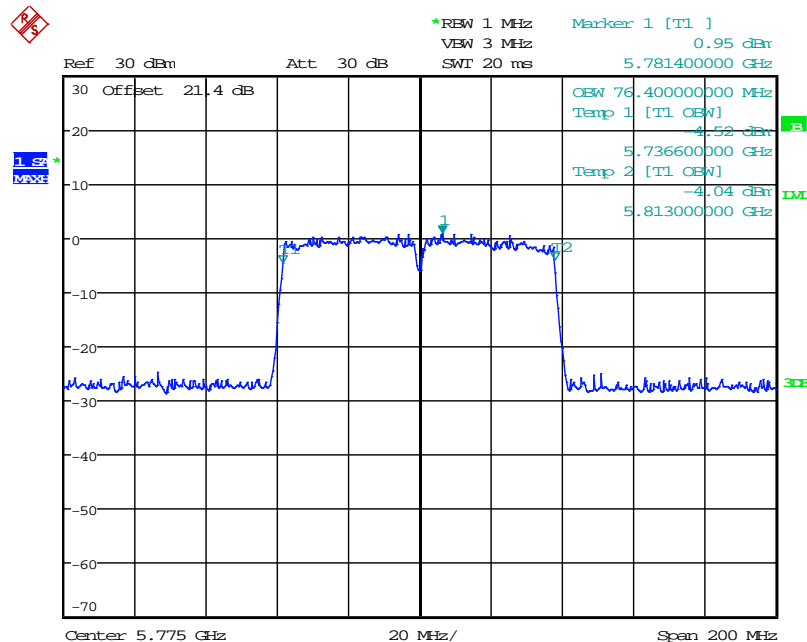
Date: 13.JUN.2016 14:19:18

Figure 7.2.2-85: 6dB BW - Middle Channel



Date: 13.JUN.2016 15:17:15

Figure 7.2.2-86: 26dB EBW - Middle Channel



Date: 13.JUN.2016 15:24:44

Figure 7.2.2-87: 99% OBW - Middle Channel

### 7.3 Maximum Conducted Output Power

#### 7.3.1 Measurement Procedure (Conducted Method)

The Peak Output Power was measured in accordance with the KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01r02 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" Method SA-2. Justification for the Duty Cycle correction factor used in provide is Section 7.6. The RF output of the equipment under test was directly connected to the input of the spectrum analyzer through suitable attenuation. The power was integrated over the 99% alternative bandwidth instead of the 26 dB bandwidth.

#### 7.3.2 Measurement Results

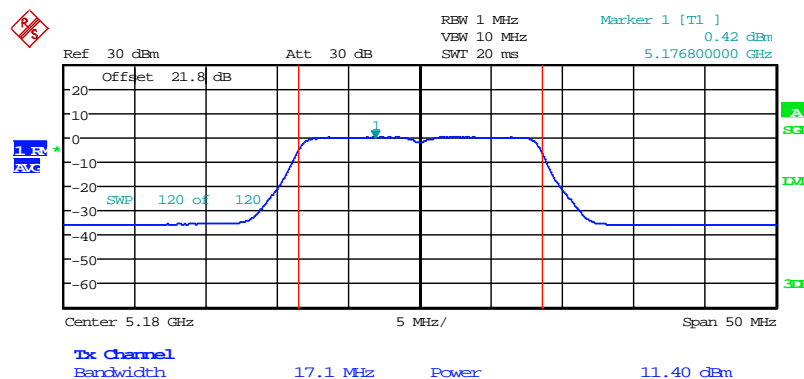
Results are shown below.

FCC Section 15.407(a)(1) ISM Canada: RSS-247 6.2.1 Band 5.15 GHz-5.25GHz

802.11a

Table 7.3.2-1: RF Output Power

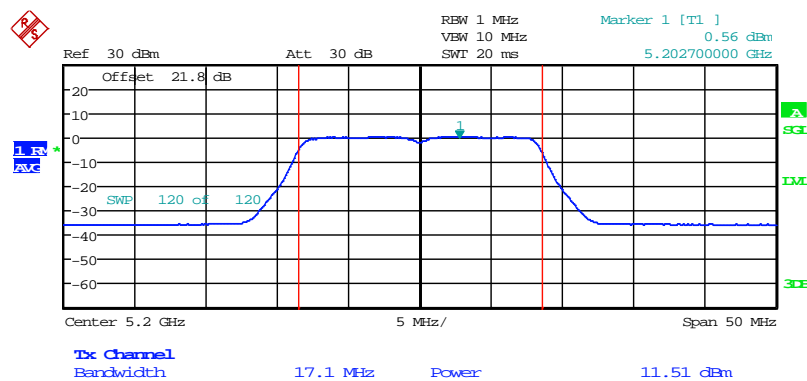
Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5180	11.40	0.42	11.82
5200	11.51	0.42	11.93
5240	11.51	0.42	11.93



Date: 14.JUN.2016 11:10:57

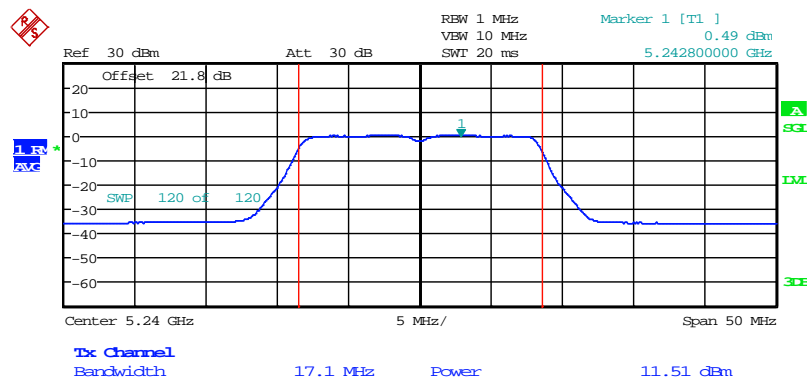
Figure 7.3.2-1: RF Output Power - Low Channel





Date: 14.JUN.2016 11:20:51

Figure 7.3.2-2: RF Output Power - Middle Channel



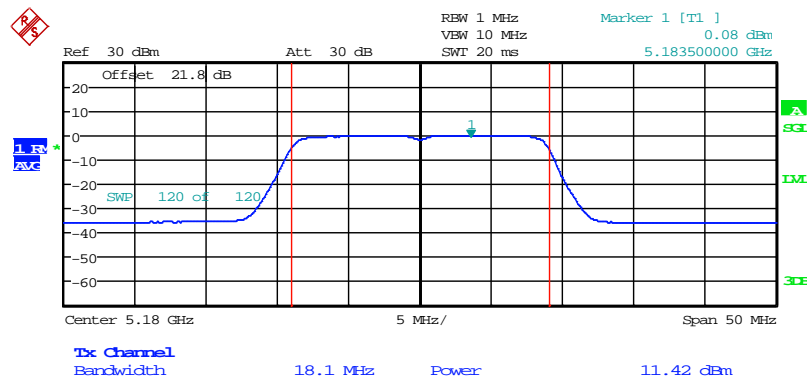
Date: 14.JUN.2016 11:22:53

Figure 7.3.2-3: RF Output Power - High Channel

802.11n 20 MHz

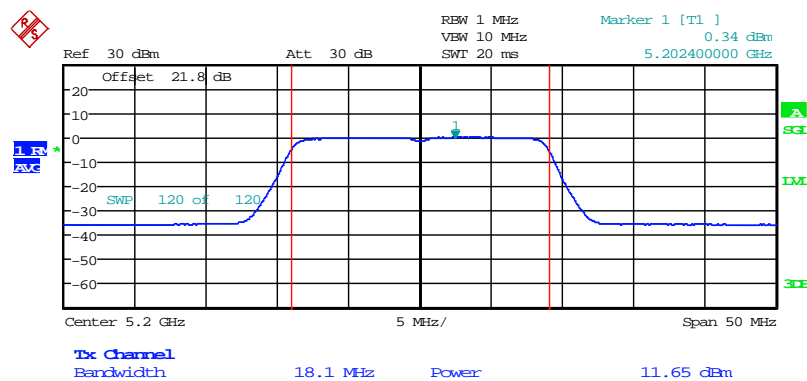
Table 7.3.2-2: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5180	11.42	0.41	11.83
5200	11.65	0.41	12.06
5240	11.57	0.41	11.98



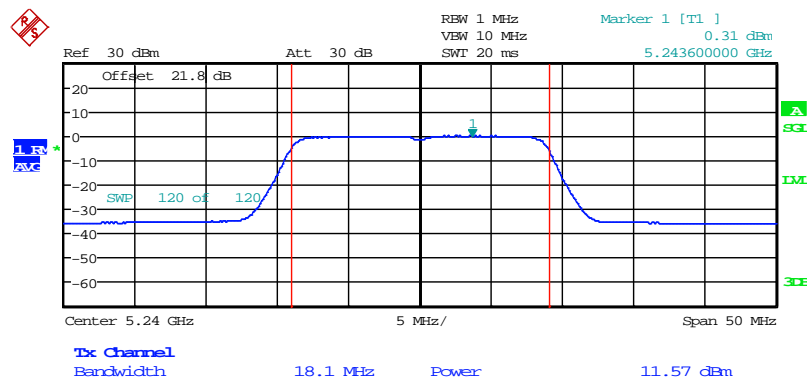
Date: 14.JUN.2016 11:15:47

Figure 7.3.2-4: RF Output Power - Low Channel



Date: 14.JUN.2016 12:48:52

Figure 7.3.2-5: RF Output Power - Middle Channel



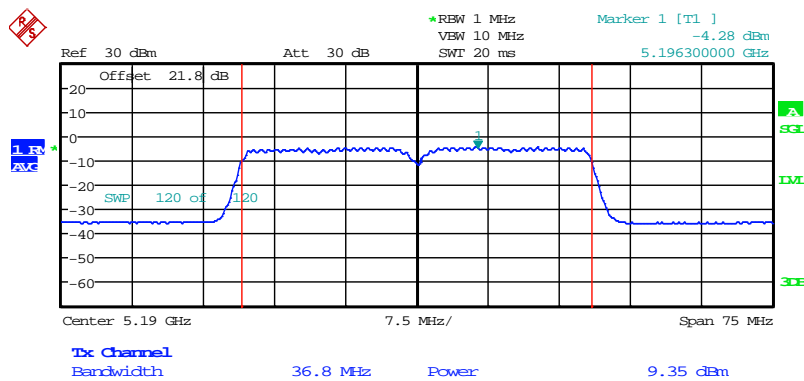
Date: 14.JUN.2016 12:50:48

Figure 7.3.2-6: RF Output Power - High Channel

802.11n 40 MHz

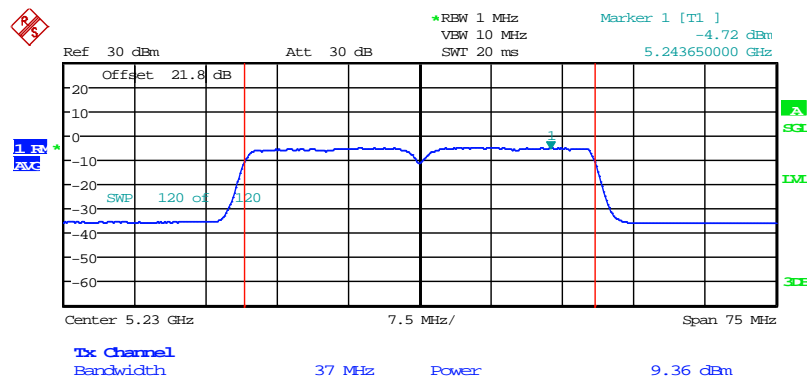
Table 7.3.2-3: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5190	9.35	2.64	11.99
5230	9.36	2.64	12.00



Date: 14.JUN.2016 13:01:31

Figure 7.3.2-7: RF Output Power - Low Channel



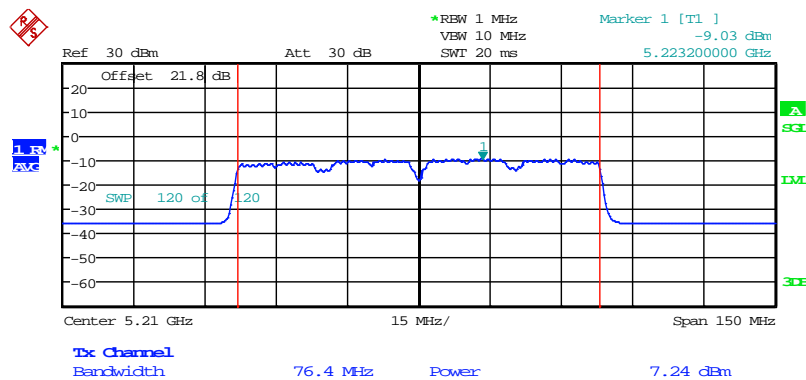
Date: 14.JUN.2016 13:03:32

Figure 7.3.2-8: RF Output Power - High Channel

## 802.11ac 80 MHz

Table 7.3.2-4: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5210	7.24	3.86	11.10



Date: 14.JUN.2016 13:15:18

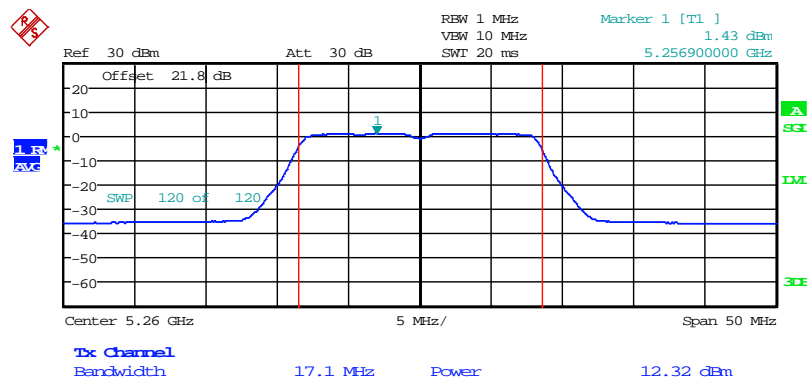
Figure 7.3.2-9: RF Output Power - Middle Channel

FCC Section 15.407(a)(2) ISCED Canada: RSS-247 6.2.2 Band 5.25 GHz-5.35GHz

802.11a

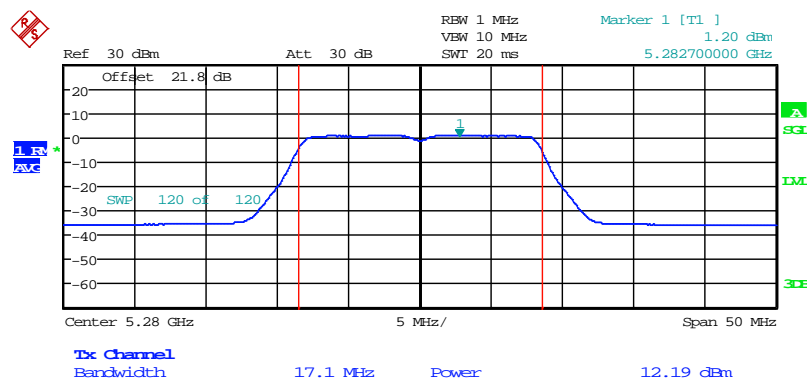
Table 7.3.2-5: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5260	12.32	0.42	12.74
5280	12.19	0.42	12.61
5320	12.18	0.42	12.60



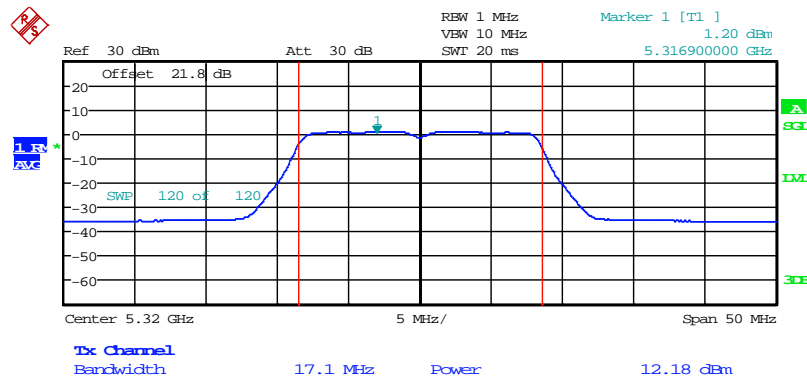
Date: 14.JUN.2016 11:25:32

Figure 7.3.2-10: RF Output Power - Low Channel



Date: 14.JUN.2016 11:28:21

Figure 7.3.2-11: RF Output Power - Middle Channel



Date: 14.JUN.2016 11:30:03

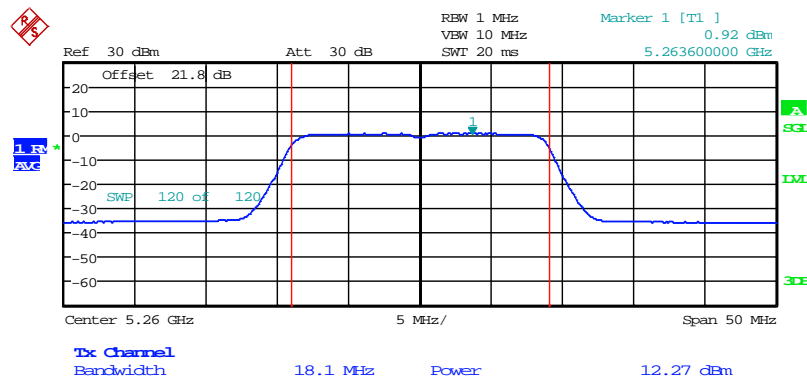
Figure 7.3.2-12: RF Output Power - High Channel



802.11n 20 MHz

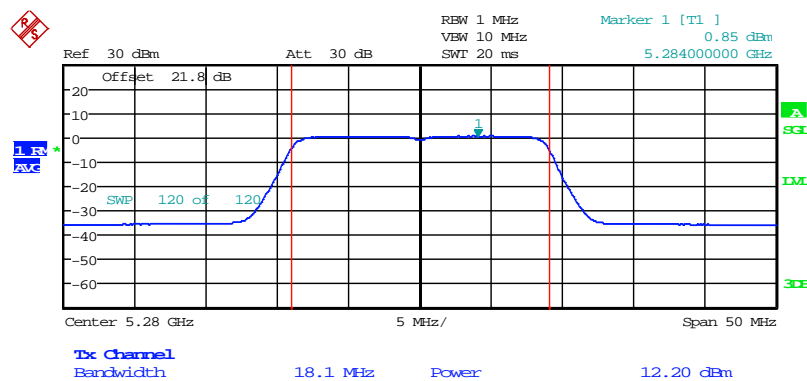
Table 7.3.2-6: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5260	12.27	0.41	12.68
5280	12.20	0.41	12.61
5320	12.15	0.41	12.56



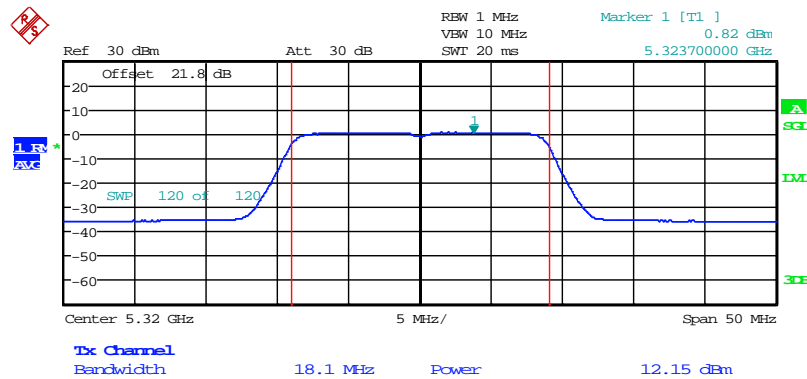
Date: 14.JUN.2016 12:52:25

Figure 7.3.2-13: RF Output Power - Low Channel



Date: 14.JUN.2016 12:53:59

Figure 7.3.2-14: RF Output Power - Middle Channel



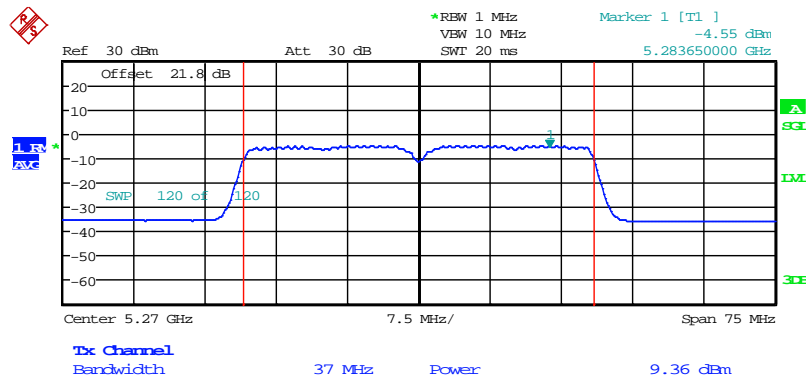
Date: 14.JUN.2016 12:55:21

Figure 7.3.2-15: RF Output Power - High Channel

## 802.11n 40 MHz

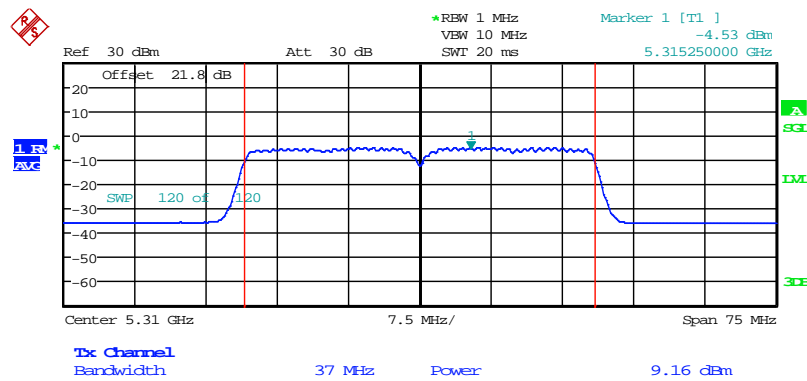
Table 7.3.2-7: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5270	9.36	2.64	12.0
5310	9.16	2.64	11.8



Date: 14.JUN.2016 13:05:09

Figure 7.3.2-16: RF Output Power - Low Channel



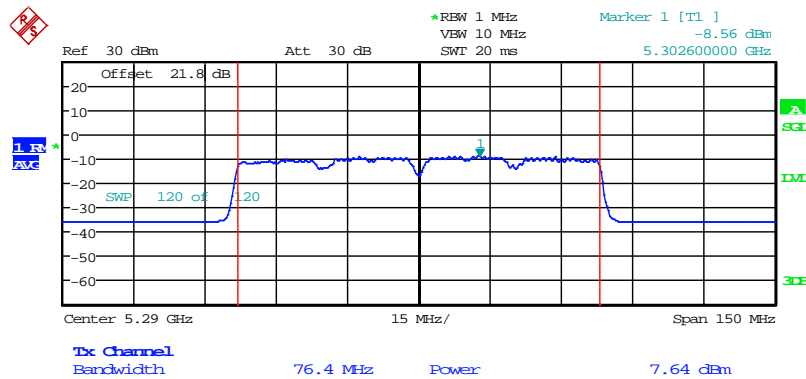
Date: 14.JUN.2016 13:09:29

Figure 7.3.2-17: RF Output Power - High Channel

802.11ac 80 MHz

Table 7.3.2-8: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5290	7.64	3.86	11.5



Date: 14.JUN.2016 13:16:28

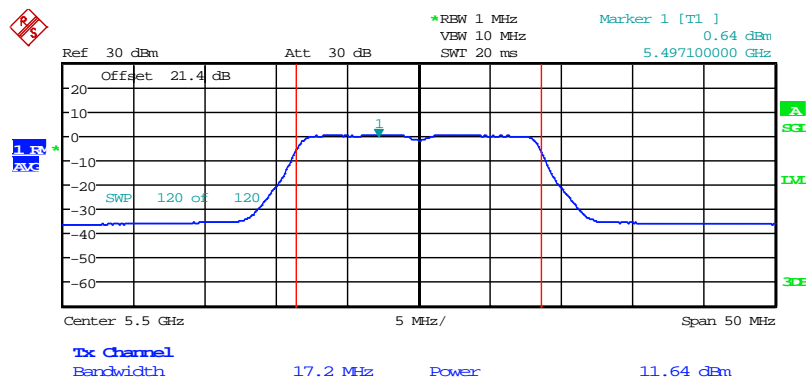
Figure 7.3.2-18: RF Output Power - Middle Channel

FCC Section 15.407(a)(2) ISCED Canada: RSS-247 6.2.3 Band 5.47 GHz-5.725 GHz

802.11a

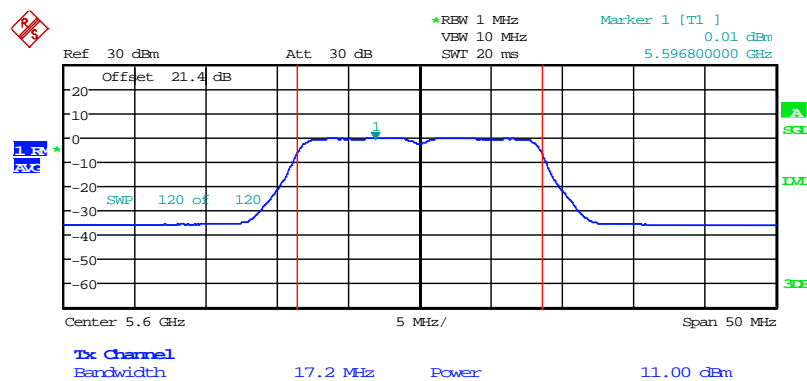
Table 7.3.2-9: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5500	11.64	0.42	12.06
5600	11.00	0.42	11.42
5720	10.35	0.42	10.77



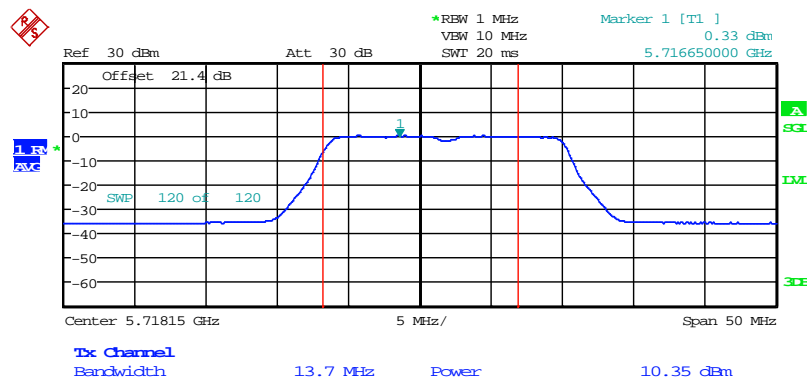
Date: 14.JUN.2016 13:23:19

Figure 7.3.2-19: RF Output Power - Low Channel



Date: 14.JUN.2016 13:25:05

Figure 7.3.2-20: RF Output Power - Middle Channel



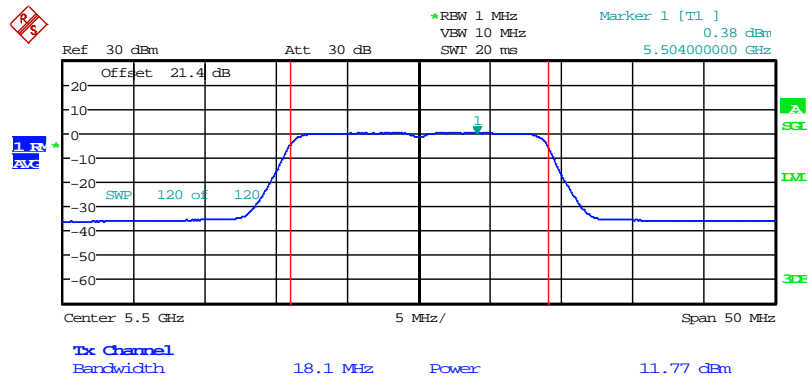
Date: 14.JUN.2016 16:17:57

Figure 7.3.2-21: RF Output Power - High Channel

802.11n 20 MHz

Table 7.3.2-10: RF Output Power

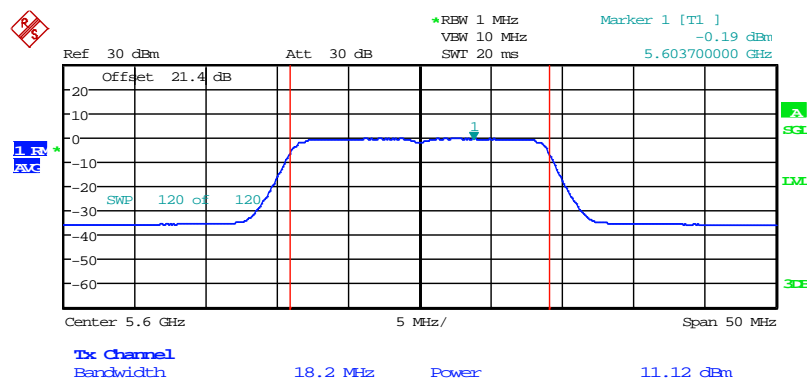
Frequency [MHz]	Level [dB]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5500	11.77	0.41	12.18
5600	11.12	0.41	11.53
5720	10.18	0.41	10.59



Date: 14.JUN.2016 14:40:37

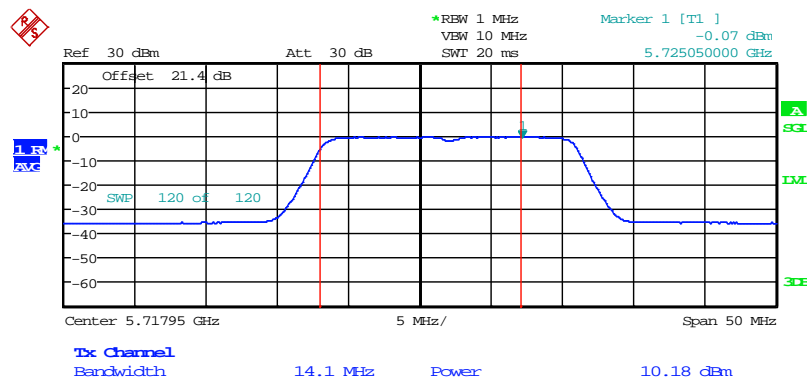
Figure 7.3.2-22: RF Output Power - Low Channel





Date: 14.JUN.2016 14:43:21

Figure 7.3.2-23: RF Output Power - Middle Channel



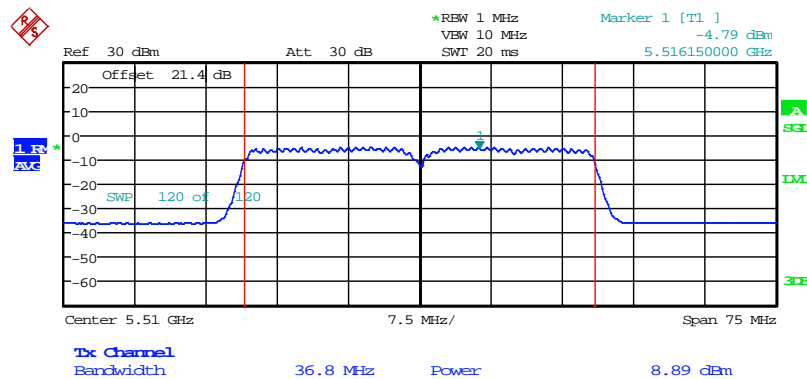
Date: 14.JUN.2016 16:26:11

Figure 7.3.2-24: RF Output Power - High Channel

802.11n 40 MHz

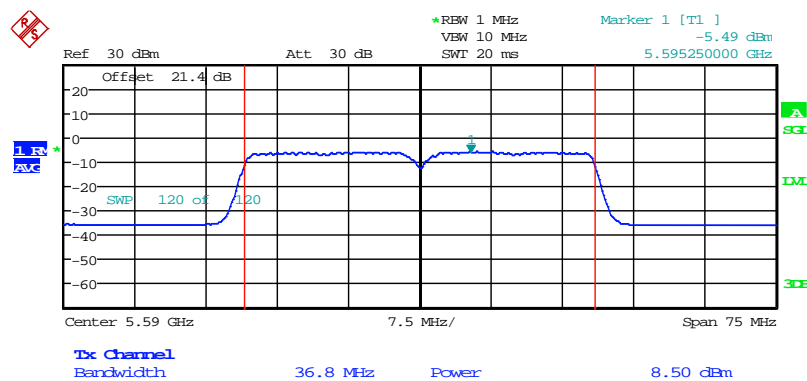
Table 7.3.2-11: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5510	8.89	2.64	11.53
5590	8.5	2.64	11.14
5710	8.12	2.64	10.76



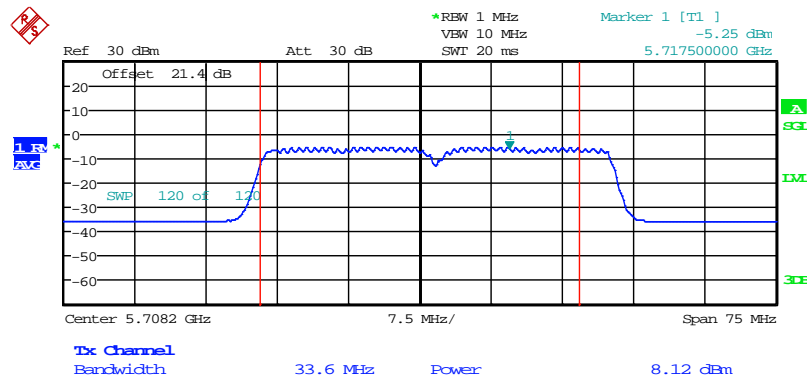
Date: 14.JUN.2016 15:05:48

Figure 7.3.2-25: RF Output Power - Low Channel



Date: 14.JUN.2016 15:08:33

Figure 7.3.2-26: RF Output Power - Middle Channel



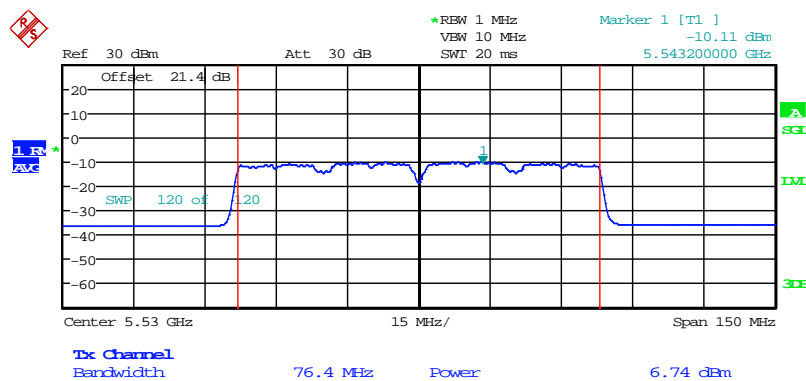
Date: 14.JUN.2016 16:36:40

Figure 7.3.2-27: RF Output Power - High Channel

802.11ac 80 MHz

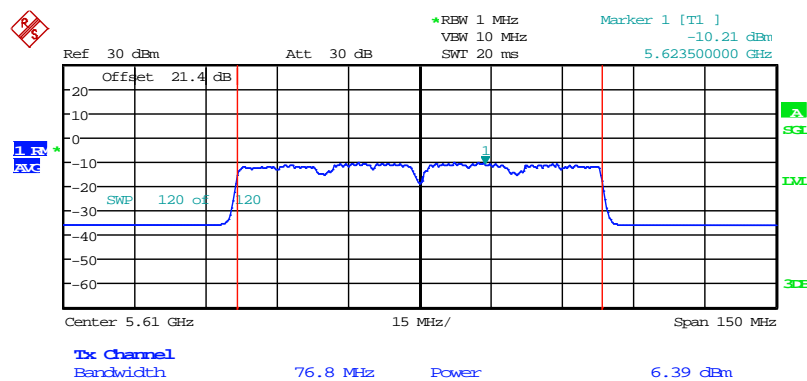
Table 7.3.2-12: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5530	6.74	3.86	10.60
5610	6.39	3.86	10.25
5690	6.39	3.86	10.25



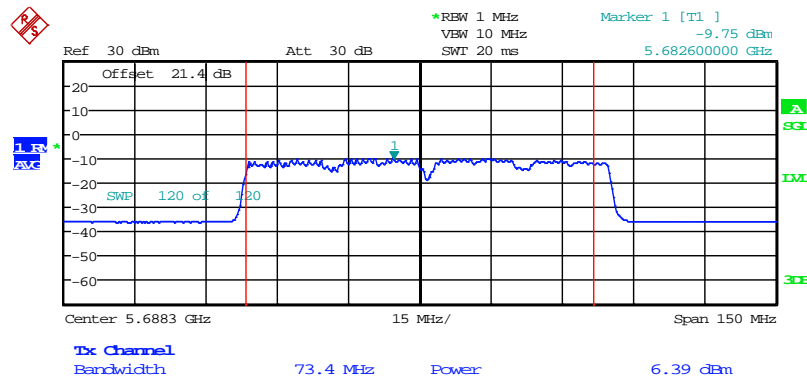
Date: 14.JUN.2016 15:34:18

Figure 7.3.2-28: RF Output Power - Low Channel



Date: 14.JUN.2016 15:39:46

Figure 7.3.2-29: RF Output Power - Middle Channel



Date: 14.JUN.2016 16:46:07

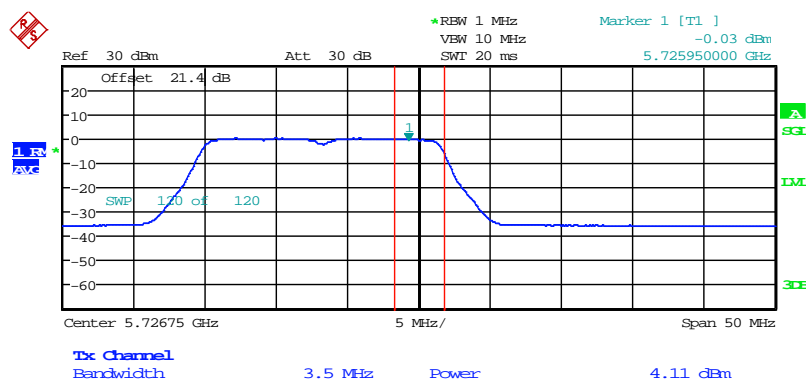
Figure 7.3.2-30: RF Output Power - High Channel

## FCC Section 15.407(a)(3) ISED Canada: RSS-247 6.2.4 Band 5.725-5.85GHz

802.11a

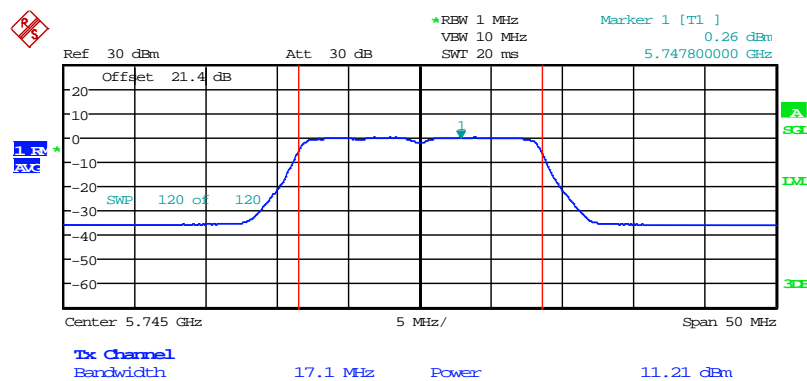
Table 7.3.2-13: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5720	4.11	0.42	4.53
5745	11.21	0.42	11.63
5785	10.82	0.42	11.24
5825	10.98	0.42	11.40



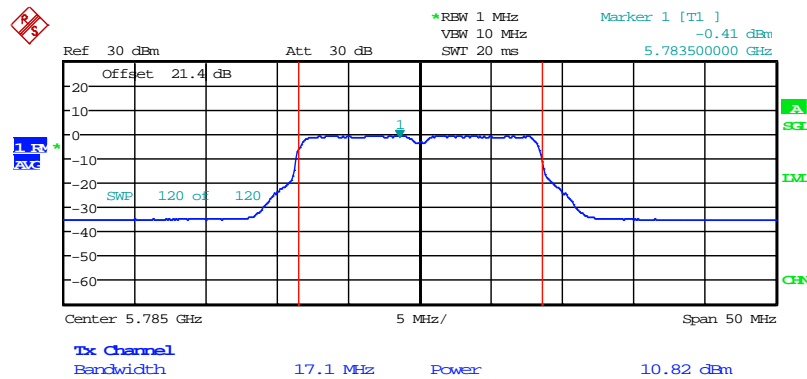
Date: 14.JUN.2016 16:21:06

Figure 7.3.2-31: RF Output Power – TX = 5720 MHz



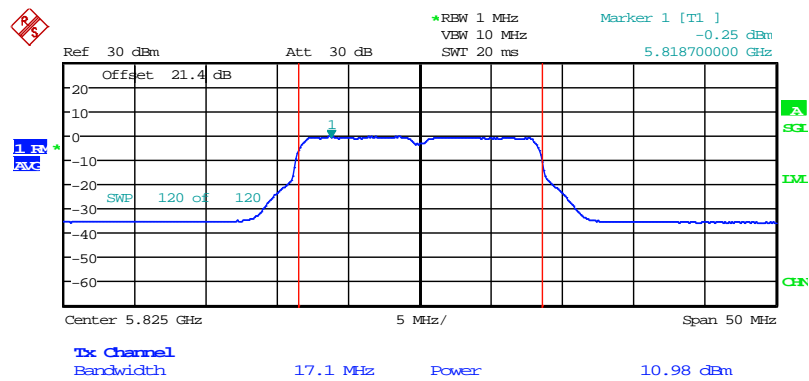
Date: 14.JUN.2016 14:11:21

Figure 7.3.2-32: RF Output Power - Low Channel



Date: 14.JUN.2016 14:36:37

Figure 7.3.2-33: RF Output Power - Middle Channel



Date: 14.JUN.2016 14:21:28

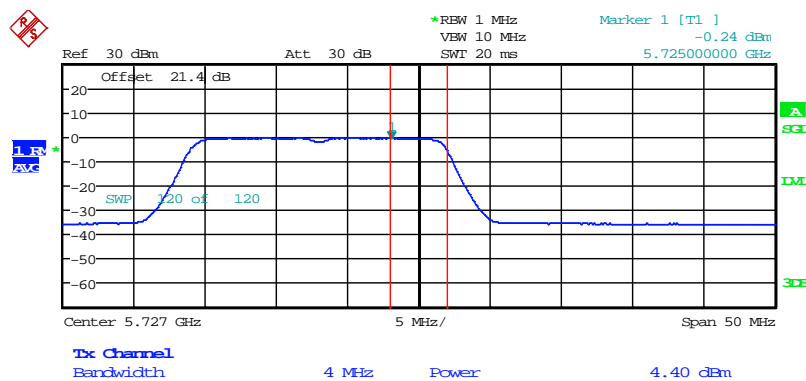
Figure 7.3.2-34: RF Output Power - High Channel



802.11n 20 MHz

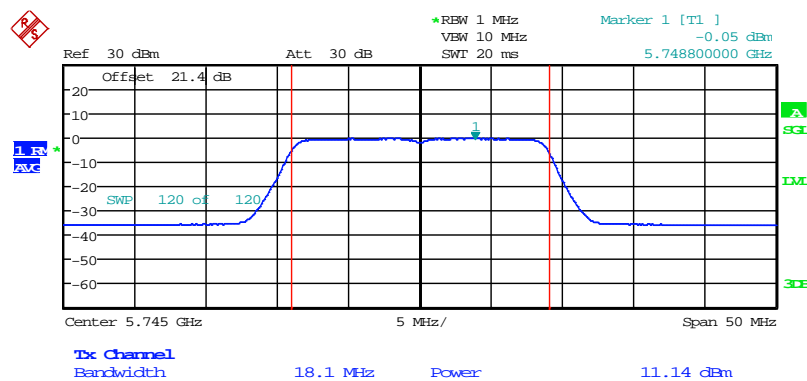
Table 7.3.2-14: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5720	4.40	0.41	4.81
5745	11.14	0.41	11.55
5785	11.15	0.41	11.56
5825	11.17	0.41	11.58



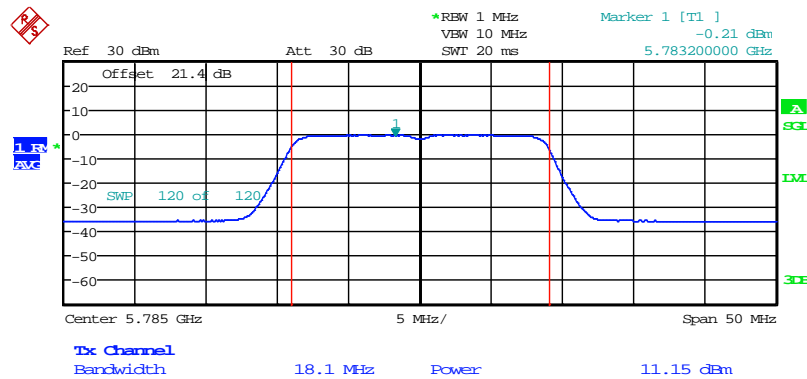
Date: 14.JUN.2016 16:24:32

Figure 7.3.2-35: RF Output Power – TX = 5720 MHz



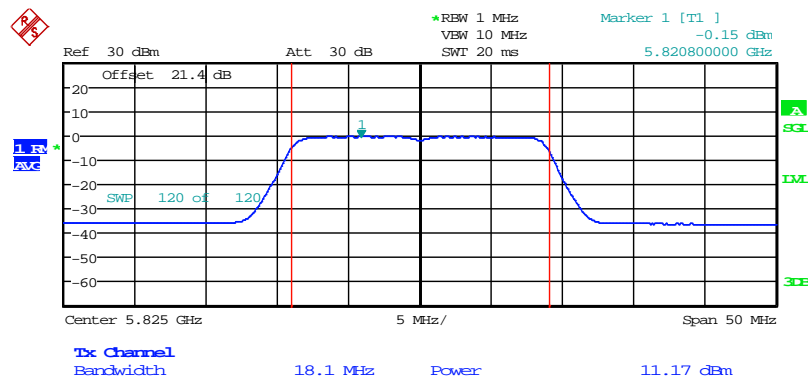
Date: 14.JUN.2016 14:46:37

Figure 7.3.2-36: RF Output Power - Low Channel



Date: 14.JUN.2016 14:49:20

Figure 7.3.2-37: RF Output Power - Middle Channel



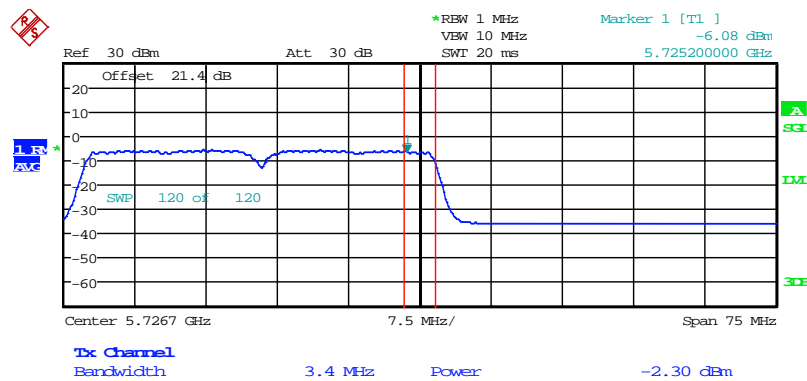
Date: 14.JUN.2016 14:51:34

Figure 7.3.2-38: RF Output Power - High Channel

802.11n 40 MHz

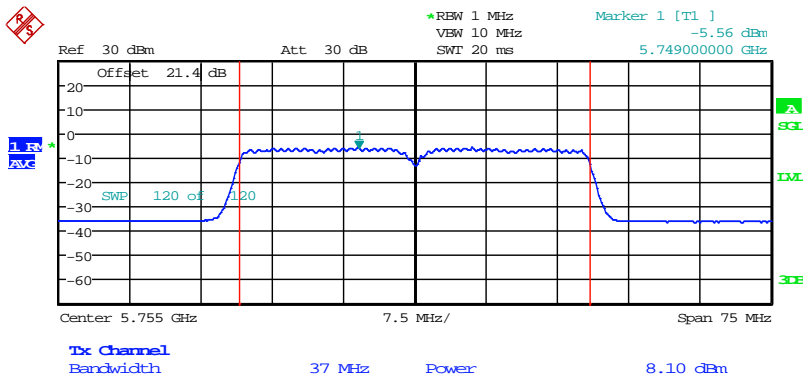
Table 7.3.2-15: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5710	-2.30	2.64	0.34
5755	8.10	2.64	10.74
5795	8.23	2.64	10.87



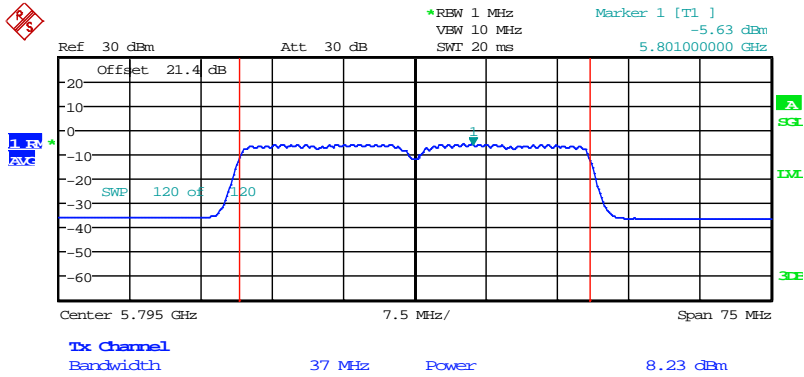
Date: 14.JUN.2016 16:38:36

Figure 7.3.2-39: RF Output Power – TX = 5710 MHz



Date: 14.JUN.2016 15:24:57

Figure 7.3.2-40: RF Output Power - Low Channel



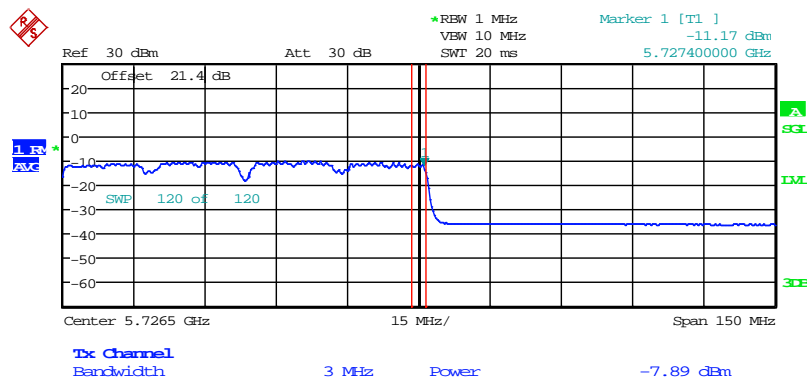
Date: 14.JUN.2016 15:28:19

Figure 7.3.2-41: RF Output Power - High Channel

802.11ac 80 MHz

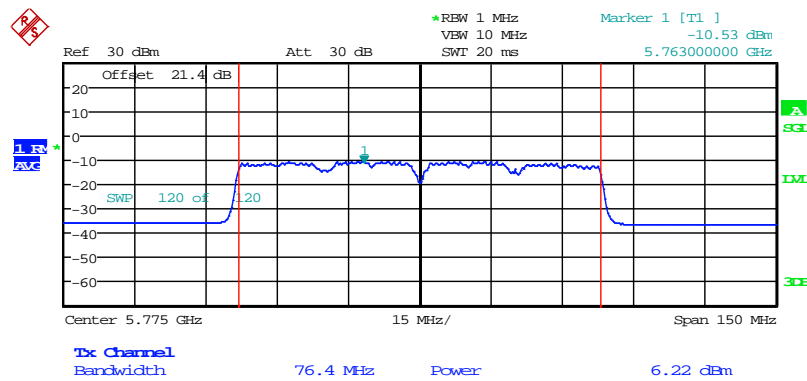
Table 7.3.2-16: RF Output Power

Frequency [MHz]	Level [dBm]	Duty Cycle Correction Factor [dB]	Corrected Level [dBm]
5690	-7.89	3.86	-4.03
5775	6.22	3.86	10.08



Date: 14.JUN.2016 16:42:43

Figure 7.3.2-42: RF Output Power – TX = 5690 MHz



Date: 14.JUN.2016 15:49:18

Figure 7.3.2-43: RF Output Power - Middle Channel

## 7.4 Maximum Power Spectral Density

### 7.4.1 PSD Measurement Procedure (Conducted Method)

The power spectral density was measured in accordance with the FCC KDB Publication No. 789033 D02 General UNII Test Procedures New Rules v01r02 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" Maximum Power Spectral Density (PSD). The RF output port of the EUT was directly connected to the input of the spectrum analyzer. Offset values were input for cable, external attenuation and transmission duty cycle.

For devices operating in the 5.15-5.25 GHz, 5.25-5.35 GHz and 5.47-5.725 GHz bands, the spectrum analyzer RBW was set to 1 MHz and VBW  $\gg 3 \times$  RBW. The power spectral density was measured from the Maximum Conducted Output Power Measurement.

For devices operating in the band 5.725 – 5.85 GHz, the spectrum analyzer RBW was set to 500 kHz and VBW  $\gg 3 \times$  RBW. The power spectral density was measured as the maximum level from the average power over 500 kHz reference bandwidth.

### 7.4.2 Measurement Results

Results are shown below.

#### FCC Section 15.407(a)(1) ISSED Canada: RSS-247 6.2.1 Band 5.15 – 5.25 GHz

##### 802.11a

Table 7.4.2-1: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5180	0.42	0.42	0.84	10.0	9.16
5200	0.56	0.42	0.98	10.0	9.02
5240	0.49	0.42	0.91	10.0	9.09

Notes:

- Graphical data for the measurement is provided in Section 7.3
- The more stringent limit from FCC 15.407 and ISSED Canada RSS-247 Is used.

##### 802.11n 20 MHz

Table 7.4.2-2: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5180	0.08	0.41	0.49	10.0	9.51
5200	0.34	0.41	0.75	10.0	9.25
5240	0.31	0.41	0.72	10.0	9.28

Notes:

- Graphical data for the measurement is provided in Section 7.3
- The more stringent limit from FCC 15.407 and ISSED Canada RSS-247 Is used.



## 802.11n 40 MHz

Table 7.4.2-3: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5190	-4.28	2.64	-1.64	10.0	11.64
5230	-4.72	2.64	-2.08	10.0	12.08

## Notes:

- Graphical data for the measurement is provided in Section 7.3
- The more stringent limit from FCC 15.407 and ISSED Canada RSS-247 Is used.

## 802.11ac 80 MHz

Table 7.4.2-4: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5210	-9.03	3.86	-5.17	10.0	15.17

## Notes:

- Graphical data for the measurement is provided in Section 7.3
- The more stringent limit from FCC 15.407 and ISSED Canada RSS-247 Is used.

## FCC Section 15.407(a)(2) ISSED Canada: RSS-247 6.2.2 Band 5.25 – 5.35 GHz

## 802.11a

Table 7.4.2-5: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5260	1.43	0.42	1.85	11.0	9.15
5280	1.20	0.42	1.62	11.0	9.38
5320	1.20	0.42	1.62	11.0	9.38

Note: Graphical data for the measurement is provided in Section 7.3

## 802.11n 20 MHz

Table 7.4.2-6: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5260	0.92	0.41	1.33	11.0	9.67
5280	0.85	0.41	1.26	11.0	9.74
5320	0.82	0.41	1.23	11.0	9.77

Note: Graphical data for the measurement is provided in Section 7.3

## 802.11n 40 MHz

Table 7.4.2-7: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5270	-4.55	2.64	-1.91	11.0	12.91
5310	-4.53	2.64	-1.89	11.0	12.89

Note: Graphical data for the measurement is provided in Section 7.3

## 802.11ac 80 MHz

Table 7.4.2-8: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5290	-8.56	3.86	-4.7	11.0	15.7

Note: Graphical data for the measurement is provided in Section 7.3

## FCC Section 15.407(a)(2) ISED Canada: RSS-247 6.2.3 Band 5.47 – 5.725 GHz

## 802.11a

Table 7.4.2-9: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5500	0.64	0.42	1.06	11.0	9.94
5600	0.01	0.42	0.43	11.0	10.57
5720	0.33	0.42	0.75	11.0	10.25

Note: Graphical data for the measurement is provided in Section 7.3

## 802.11n 20 MHz

Table 7.4.2-10: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5500	0.38	0.41	0.79	11.0	10.21
5600	-0.19	0.41	0.22	11.0	10.78
5720	-0.07	0.41	0.34	11.0	10.66

Note: Graphical data for the measurement is provided in Section 7.3

## 802.11n 40 MHz

Table 7.4.2-11: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5510	-4.79	2.64	-2.15	11.0	13.15
5590	-5.49	2.64	-2.85	11.0	13.85
5710	-5.25	2.64	-2.61	11.0	13.61

Note: Graphical data for the measurement is provided in Section 7.3

## 802.11ac 80 MHz

Table 7.4.2-12: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5530	-10.11	3.86	-6.25	11.0	17.25
5610	-10.21	3.86	-6.35	11.0	17.35
5690	-9.75	3.86	-5.89	11.0	16.89

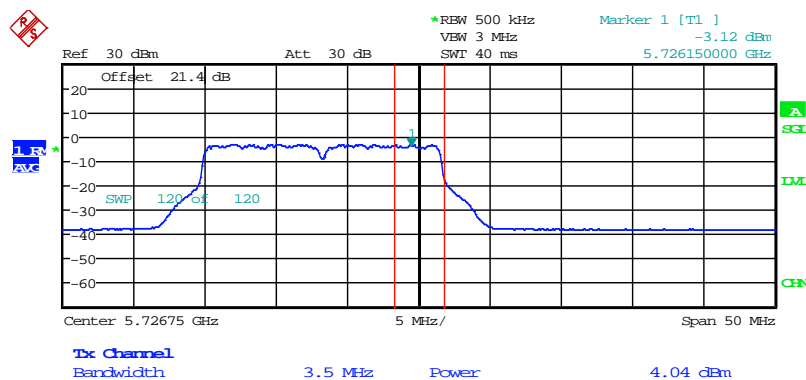
Note: Graphical data for the measurement is provided in Section 7.3

## FCC Section 15.407(a)(3) ISED Canada: RSS-247 6.2.4 Band 5.725 – 5.85 GHz

802.11a

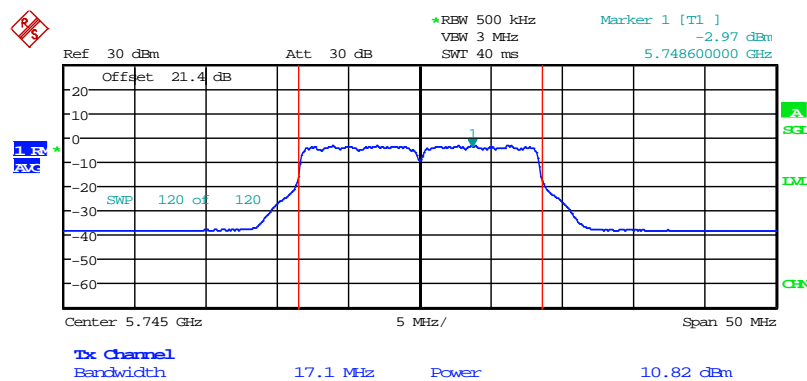
Table 7.4.2-13: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5720	-3.12	0.42	-2.7	30.0	32.7
5745	-2.97	0.42	-2.55	30.0	32.55
5785	-3.03	0.42	-2.61	30.0	32.61
5825	-2.98	0.42	-2.56	30.0	32.56



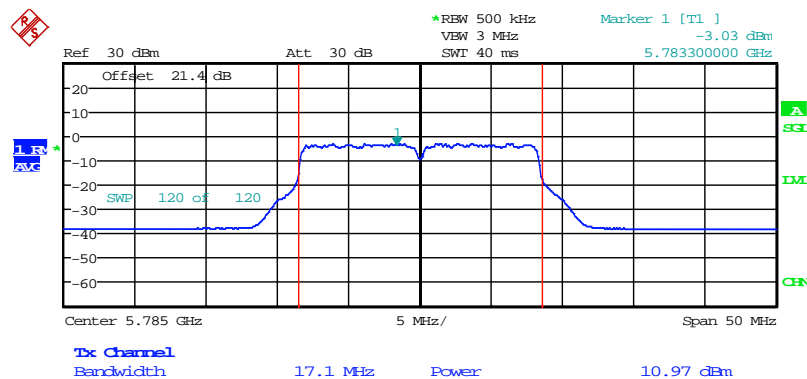
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Figure 7.4.2-1: Power Spectral Density – TX = 5720 MHz



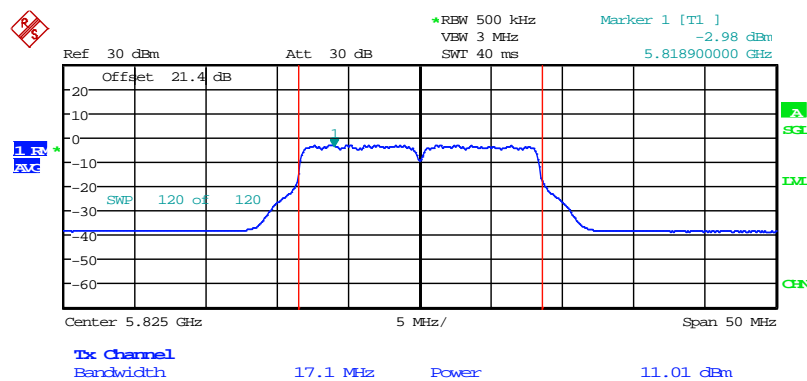
Date: 14.JUN.2016 14:16:18

Figure 7.4.2-2: Power Spectral Density - Low Channel



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Figure 7.4.2-3: Power Spectral Density - Middle Channel



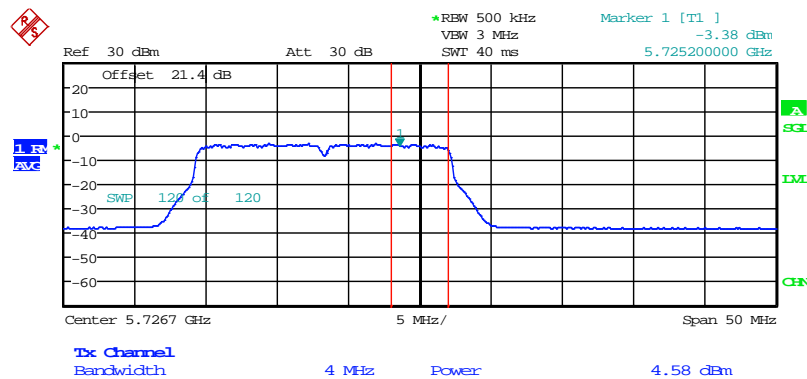
Date: 14.JUN.2016 14:18:58

Figure 7.4.2.4: Power Spectral Density – High Channel

802.11n 20 MHz

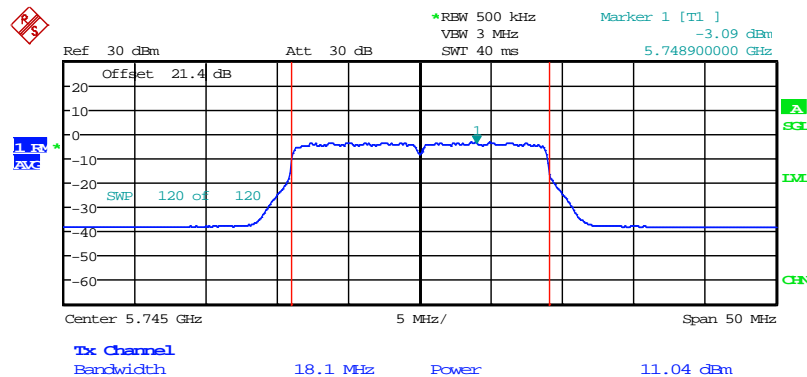
Table 7.4.2-14: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5720	-3.38	0.41	-2.97	30.0	32.97
5745	-3.09	0.41	-2.68	30.0	32.68
5785	-3.17	0.41	-2.76	30.0	32.76
5825	-3.06	0.41	-2.65	30.0	32.65



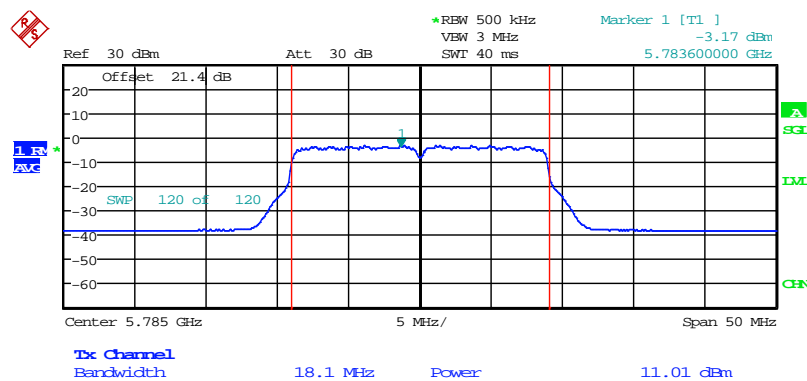
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Figure 7.4.2-5: Power Spectral Density – TX = 5720 MHz



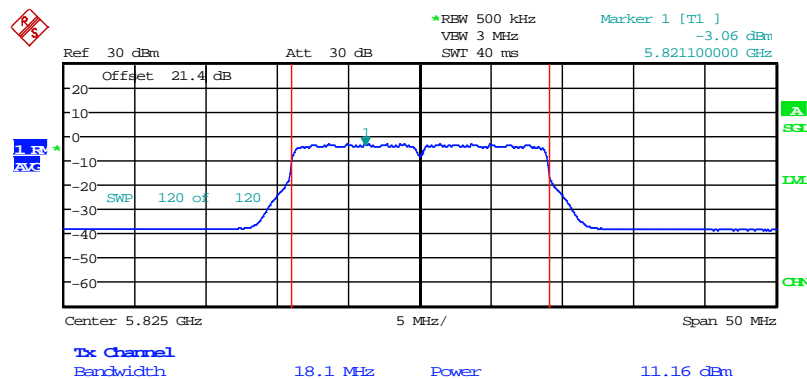
Date: 14.JUN.2016 14:58:56

Figure 7.4.2-6: Power Spectral Density - Low Channel



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Figure 7.4.2-7: Power Spectral Density - Middle Channel



Date: 14.JUN.2016 14:54:25

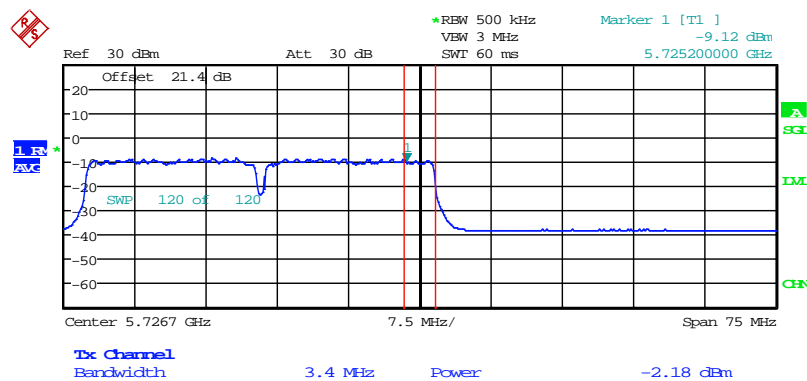
Figure 7.4.2.8: Power Spectral Density – High Channel



802.11n 40 MHz

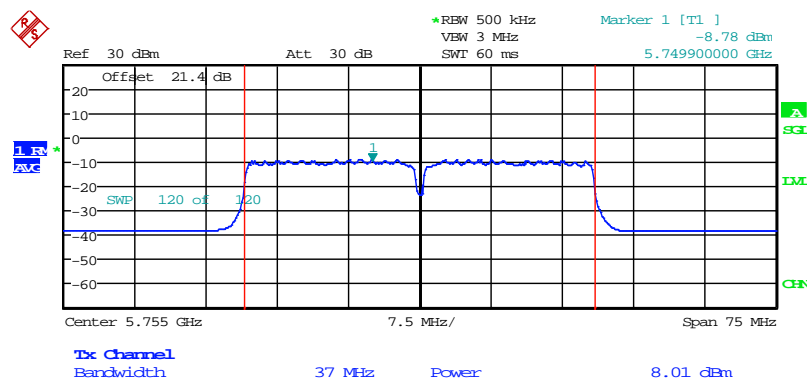
Table 7.4.2-15: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5710	-9.12	2.64	-6.48	30.0	36.48
5755	-8.78	2.64	-6.14	30.0	36.14
5795	-8.90	2.64	-6.26	30.0	36.26



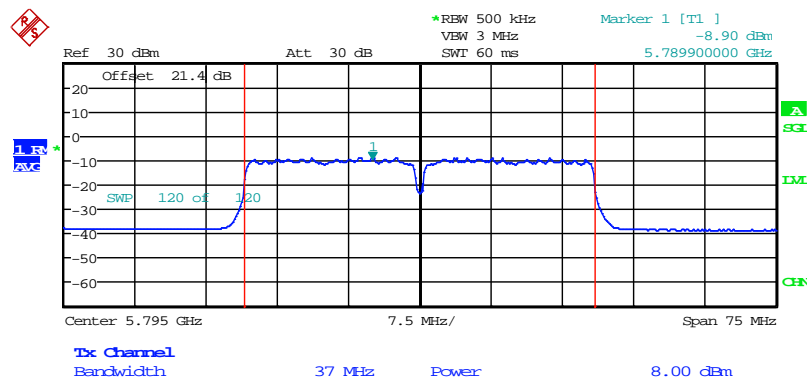
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Figure 7.4.2-9: Power Spectral Density – TX = 5710 MHz



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Figure 7.4.2-10: Power Spectral Density - Low Channel



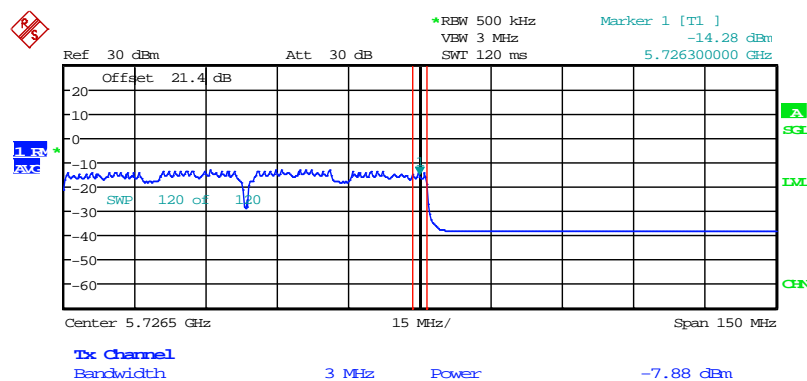
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Figure 7.4.2-11: Power Spectral Density – High Channel

802.11ac 80 MHz

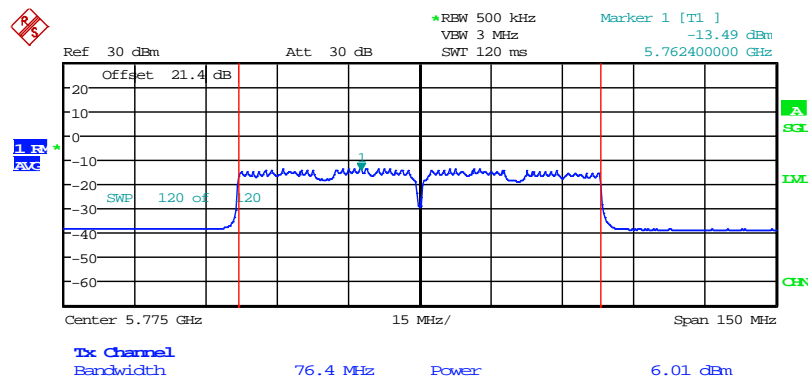
Table 7.4.2-16: Power Spectral Density

Frequency [MHz]	PSD [dBm]	Duty Cycle Correction Factor [dB]	Corrected PSD Level [dBm]	Limit [dBm]	Margin [dB]
5690	-14.28	3.86	-10.42	30.0	40.42
5775	-13.49	3.86	-9.63	30.0	39.63



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Figure 7.4.2-12: Power Spectral Density – TX = 5690 MHz



Date: 14.JUN.2016 15:51:21

Figure 7.4.2-13: Power Spectral Density - Middle Channel

**7.5 Frequency Stability – FCC Section 15.407(g), ISED Canada RSS-Gen 8.11****7.5.1 Measurement Procedure**

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment and a power supply is attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range -30° C to +50° C and at intervals of 10° C at normal supply voltage. A period of time sufficient to stabilize all components of the equipment was allowed at each frequency measurement. At a temperature 20° C the supply voltage was also reduced to the endpoint. The maximum variation of frequency was recorded.

Results of the test are shown below

## 7.5.2 Measurement Results

## Frequency Stability

Frequency (MHz): 5180

Deviation Limit (PPM): 20

Temperature C	Frequency MHz	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	5180.034671	6.693	100%	3.60
-20 C	5180.049000	9.459	100%	3.60
-10 C	5180.043662	8.429	100%	3.60
0 C	5180.035471	6.848	100%	3.60
10 C	5180.031994	6.176	100%	3.60
20 C	5180.009801	1.892	100%	3.60
30 C	5180.005955	1.150	100%	3.60
40 C	5179.986330	-2.639	100%	3.60
50 C	5179.982476	-3.383	100%	3.60
20 C	5180.008551	1.651	85%	3.06
20 C	5180.011115	2.146	115%	4.14

### Frequency Stability vs. Temperature

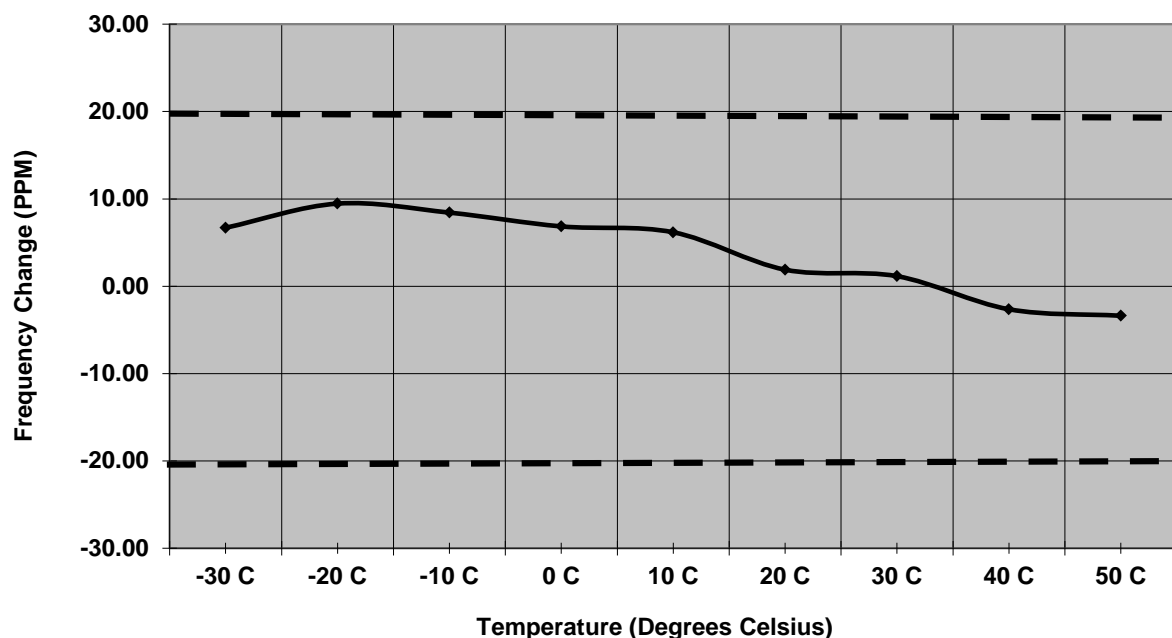


Figure 7.5.2-1: Frequency Stability 5.15 GHz – 5.25 GHz

## Frequency Stability

Frequency (MHz): 5320

Deviation Limit (PPM): 20

Temperature C	Frequency MHz	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	5320.043830	8.239	100%	3.60
-20 C	5320.060000	11.278	100%	3.60
-10 C	5320.028131	5.288	100%	3.60
0 C	5320.035220	6.620	100%	3.60
10 C	5320.021522	4.045	100%	3.60
20 C	5320.005021	0.944	100%	3.60
30 C	5319.989391	-1.994	100%	3.60
40 C	5319.985689	-2.690	100%	3.60
50 C	5319.983413	-3.118	100%	3.60
20 C	5320.002375	0.446	85%	3.06
20 C	5320.003021	0.568	115%	4.14

### Frequency Stability vs. Temperature

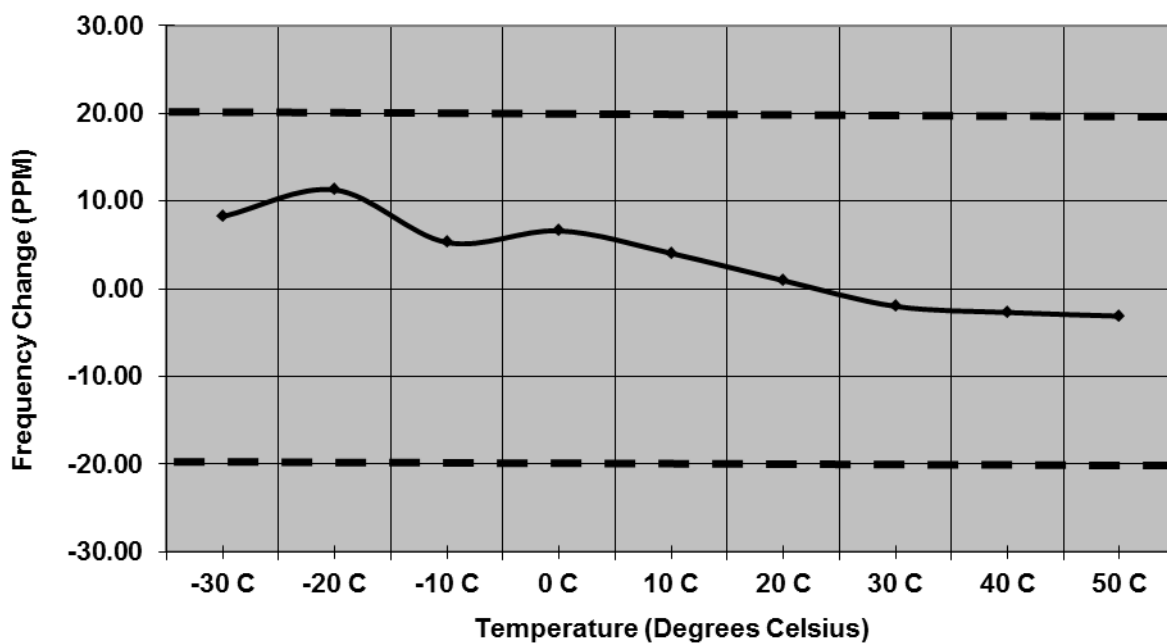


Figure 7.5.2-2: Frequency Stability 5.25 GHz – 5.35 GHz

## Frequency Stability

Frequency (MHz): 5500

Deviation Limit (PPM): 20

Temperature C	Frequency MHz	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	5500.035369	6.431	100%	3.60
-20 C	5500.051000	9.273	100%	3.60
-10 C	5500.048534	8.824	100%	3.60
0 C	5500.037889	6.889	100%	3.60
10 C	5500.021715	3.948	100%	3.60
20 C	5500.004474	0.813	100%	3.60
30 C	5499.976635	-4.248	100%	3.60
40 C	5499.984936	-2.739	100%	3.60
50 C	5499.993349	-1.209	100%	3.60
20 C	5499.995785	-0.766	85%	3.06
20 C	5500.004327	0.787	115%	4.14

Frequency Stability vs. Temperature

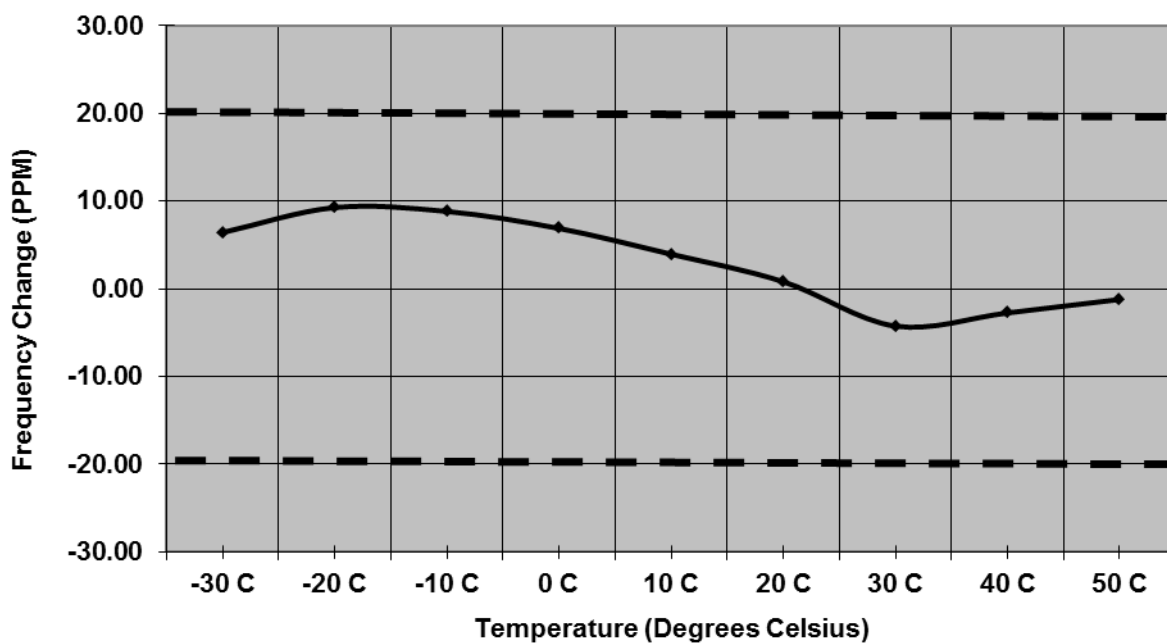


Figure 7.5.2-3: Frequency Stability 5.47 GHz – 5.725 GHz



## Frequency Stability

Frequency (MHz): 5825

Deviation Limit (PPM): 20

Temperature C	Frequency MHz	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	5825.038269	6.570	100%	3.60
-20 C	5825.037949	6.515	100%	3.60
-10 C	5825.051082	8.769	100%	3.60
0 C	5825.031066	5.333	100%	3.60
10 C	5825.016611	2.852	100%	3.60
20 C	5824.992933	-1.213	100%	3.60
30 C	5824.988413	-1.989	100%	3.60
40 C	5824.983381	-2.853	100%	3.60
50 C	5824.984519	-2.658	100%	3.60
20 C	5824.991715	-1.422	85%	3.06
20 C	5824.989583	-1.788	115%	4.14

Frequency Stability vs. Temperature

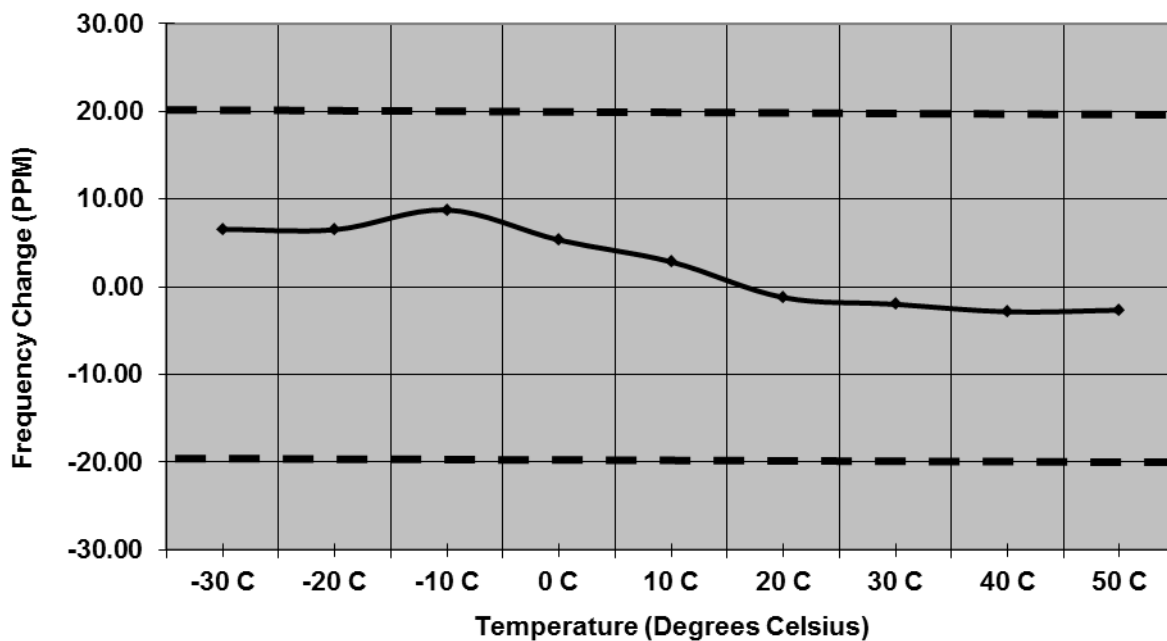


Figure 7.5.2-4: Frequency Stability 5.725 GHz – 5.85 GHz

## 7.6 Duty Cycle

### 7.6.1 Measurement Procedure

The duty cycle was measured in accordance with ANSI C63.10 Section 12.2 Duty cycle (D), transmission duration (T), and maximum power control level. The unit was connected directly to the input of the spectrum analyzer via suitable attenuation. The RBW and VBW were set to 10 MHz and the number of sweep points across duration T was set to exceed 100.

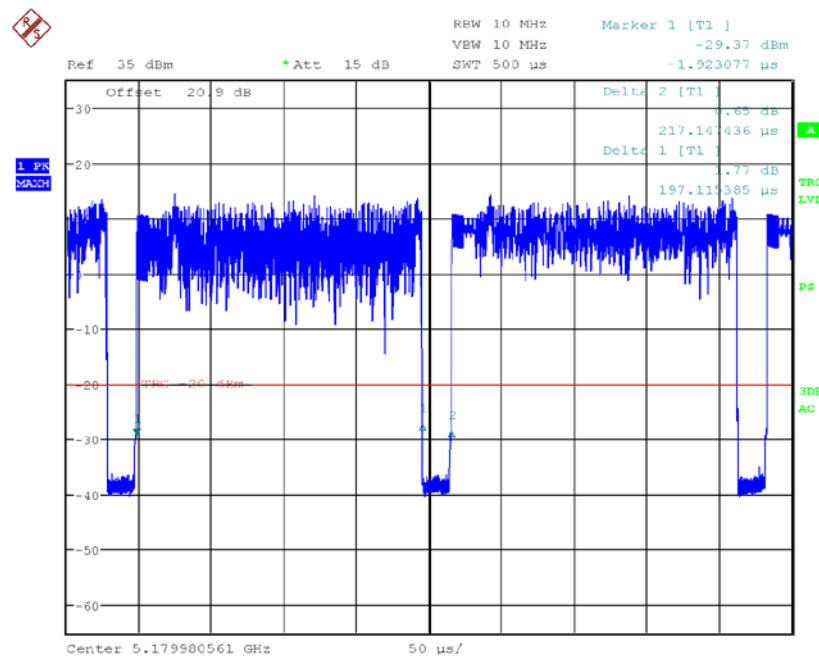
### 7.6.2 Measurement Results

The results for all the modes of operation are provided below.

**Table 7.6.2-1 Duty Cycle Correction Factor**

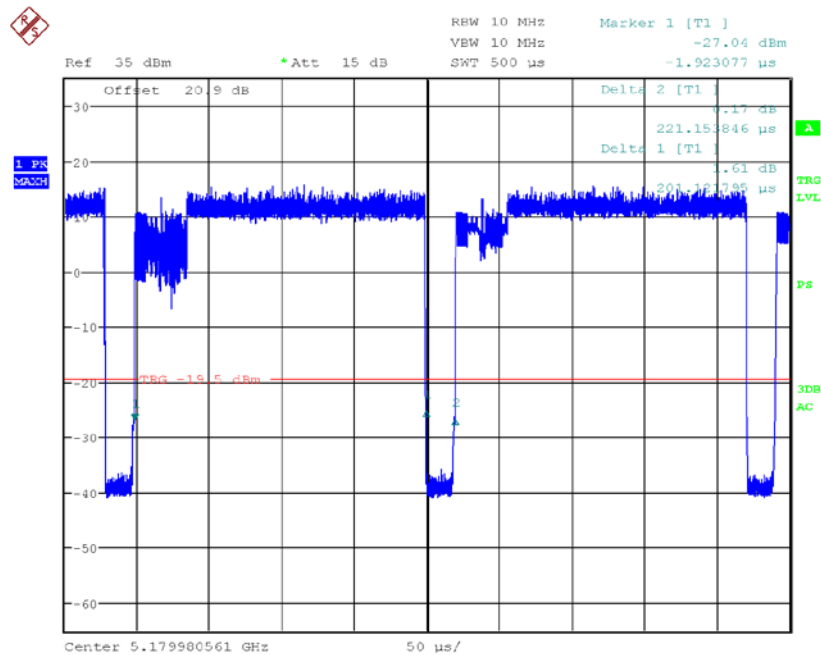
Mode	Time On (ms)	Period (ms)	Duty Cycle %	Correction Factor [dB]
802.11a	0.197115	0.217147	90.775	0.42
802.11n 20 MHz	0.201122	0.221154	90.942	0.41
802.11n 40MHz	0.117788	0.216346	54.444	2.64
802.11ac 80 MHz	0.069913	0.169872	41.156	3.86

**Note:** The correction factor was calculated as  $10 \cdot \log(1/(\text{Time on}/\text{Period}))$



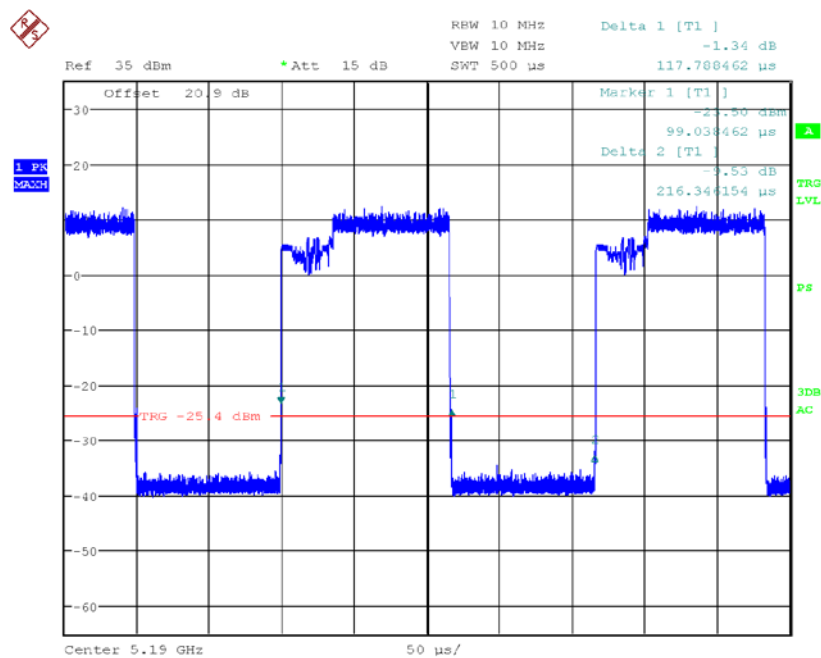
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**Figure 7.6.2-1: Duty Cycle 802.11a**



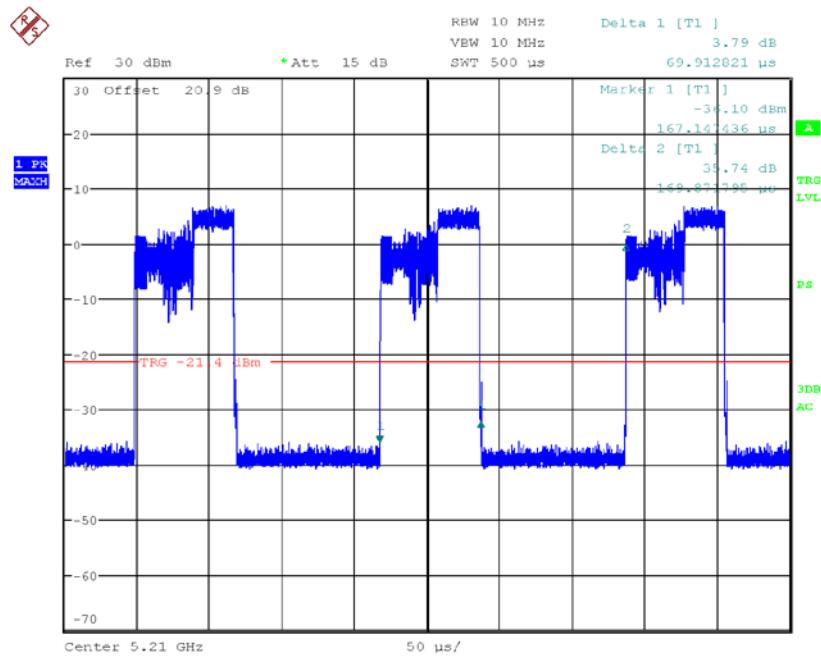
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Figure 7.6.2-2: Duty Cycle 802.11n 20 MHz



Date: 2.JUN.2016 22:17:31

Figure 7.6.2-3: Duty Cycle 802.11n 40 MHz



Date: 2.JUN.2016 23:05:24

Figure 7.6.2-4: Duty Cycle 802.11ac 80 MHz

**8 CONCLUSION**

In the opinion of ACS, Inc., the model LBEE5ZZ1CK-982 meets the requirements of FCC Part 15 subpart E and Innovation, Science and Economic Development Canada's Radio Standards Specification RSS-247 for the test procedures documented in the test report.

**END REPORT**