

Certification Test Report

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IC: 109U-89FT7088

FCC Rule Part: 15.407
IC Radio Standards Specification: RSS-247

ACS Report Number: 15-2124.W06.4A

Applicant: Motorola Solutions, Inc.
Model(s): HK2062A

Test Begin Date: December 2, 2015
Test End Date: February 15, 2016

Report Issue Date: February 17, 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.

Reviewed by:

A handwritten signature in blue ink, appearing to read "Thierry Jean-Charles".

Thierry Jean-Charles
EMC Engineer
Advanced Compliance Solutions, Inc.

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This report contains 105 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 Industry Canada's Radio Standards Specification RSS-247.

1.2 Applicant Information

Motorola Solutions, Inc.
8000 West Sunrise Blvd.
Fort Lauderdale, FL 33322

1.3 Product Description

The Motorola Solutions, Inc. Si500 model HK2062A is a video speaker microphone. The unit includes a WLAN transceiver as well as a Bluetooth radio supporting both Bluetooth Legacy (2.1+EDR) and Bluetooth Low Energy (BLE). The IEEE 802.11 WLAN transceiver operates in the 2.4 GHz ISM band as well as in the 5 GHz U-NII bands. This test report is limited to the 5 GHz WLAN transceiver only.

Technical Details

Mode of Operation: WLAN IEEE 802.11n/ac
Modulations: OFDM
Antenna Type/Gain: Ceramic Chip Antenna, 4.2dBi
Input Power: 5 VDC USB, 3.7 VDC Lithium Ion Battery

Band of Operation* (MHz)	Mode of Operation (802.11)	Ch. Range (MHz)	Number of Available Channels	Channel Spacing	MCS Index
5150 - 5250	a	5180 - 5240	4	20	0 - 7
5250 - 5350		5260 - 5320	4		
5470 - 5725		5500 - 5720	12		
5725 - 5850		5745 - 5825	5		
5150 - 5250	n (HT20)/ ac (VHT20)	5180 - 5240	4	20	0 - 7 / 0 - 8*
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	0 - 7 / 0 - 8
5250 - 5350		5270 - 5310	2		
5470 - 5725		5510 - 5710	6		
5725 - 5850		5755 - 5795	2		
5150 - 5250	ac (VHT80)	5210	1	80	0 - 9
5250 - 5350		5290	1		
5470 - 5725		5530 - 5690	3		
5725 - 5850		5775	1		

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

Model Number: HK2062A

Test Sample Serial Number(s): ATP1B083 (RF Conducted Emissions), ATP1B104 (Radiated and Power Line Conducted Emissions).

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 radiated, RF conducted and power line conducted emissions for the WLAN IEEE 802.11 radio transmitting at 100% duty cycle. The EUT was evaluated using the QUALCOMM Remote Evaluation Tool (QRCT) using the self-calibrated power control (SCPC) power setting option. Preliminary power measurements were performed for all the available data rates for all the modes of operations. The final measurements were performed using the data rates to the highest output power, were applicable.

For the radiated emission investigation, preliminary evaluation was performed for the EUT standalone, set in three orthogonal orientations. Additional measurements were carried out for the EUT powered via a wall adapter, for the EUT powered using a car battery and a vehicle power adapter (VPA), for the EUT connected to a computer and a multi-charger and for the EUT connected with a computer and an APX8000 radio. The EUT with the multi-charger and the laptop was determined to be the configuration leading to the highest emissions as compared to the limits. That configuration was used for all the radiated emissions reported in this document. While the manufacturer's work instructions request the laptop to be running from battery when connected to the Fusion on the Multi-charger, the laptop was connected to the AC Mains for the sake of testing..

The RF conducted emissions were investigated with the EUT configured with a temporary SMA connector at the antenna port.

The power line conducted emission test was performed for the EUT constantly transmitting while powered via the multi-charger. The Laptop was running from the battery. The results reported correspond to the transceiver mode of operation leading to the worst case AC emissions.

The EUT was also evaluated for unintentional emissions. The results are reported separately in a Declaration of Conformity/Verification test report.

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

Band of Operation	Mode of Operation	Frequency (MHz)	Channel	Power Setting	Modulation Index (Data Rate)
U-NII-1 (5.15 - 5.25 GHz)	802.11n 20 MHz	5180	36	14	MCS0 (6.5Mbps)
		5200	40		
		5240	48		
	802.11n 40 MHz	5190	38	11	MCS0 (13.5 Mbps)
		5230	46		
	802.11ac 80 MHz	5210	42	11	MCS0 (29.3 Mbps)
U-NII-2A (5.25 - 5.35 GHz)	802.11n 20 MHz	5260	52	14	MCS0 (6.5Mbps)
		5280	56		
		5320	64		
	802.11n 40 MHz	5270	54	11	MCS0 (13.5 Mbps)
		5310	62		
	802.11ac 80 MHz	5290	58	11	MCS0 (29.3 Mbps)
U-NII-2C (5.47 - 5.725 GHz)	802.11n 20 MHz	5500	100	14	MCS0 (6.5Mbps)
		5600	120		
		5720	144		
	802.11n 40 MHz	5510	102	11	MCS0 (13.5 Mbps)
		5590	118		
		5710	142		
	802.11ac 80 MHz	5530	106	11	MCS0 (29.3 Mbps)
		5610	122		
		5690	138		
U-NII-3 (5.725 - 5.85 GHz)	802.11n 20 MHz	5745	149	14	MCS0 (6.5Mbps)
		5785	157		
		5825	165		
	802.11n 40 MHz	5755	151	11	MCS0 (13.5 Mbps)
		5795	159		
	802.11ac 80 MHz	5775	155	11	MCS0 (29.3 Mbps)

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

FCC Test Firm Registration #: 475089
Industry 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 1050 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:

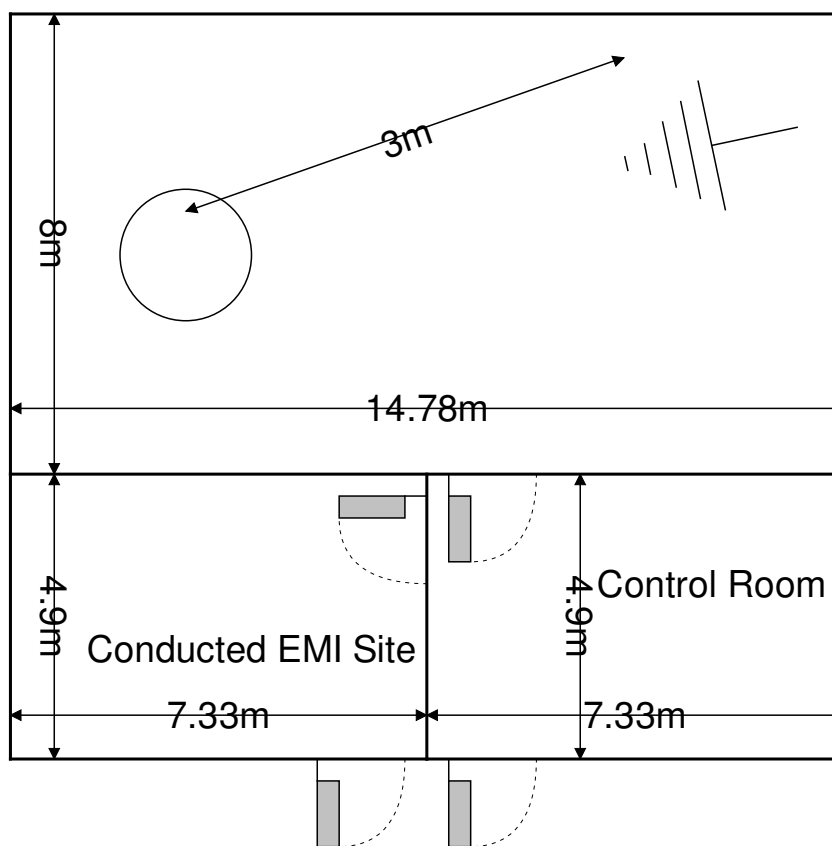


Figure 2.3.1-1: Semi-Anechoic Chamber Test Site

2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 m³. The power line conducted emission site includes two LISNs: a Solar Model 8028-50 50 Ω /50 μ 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:

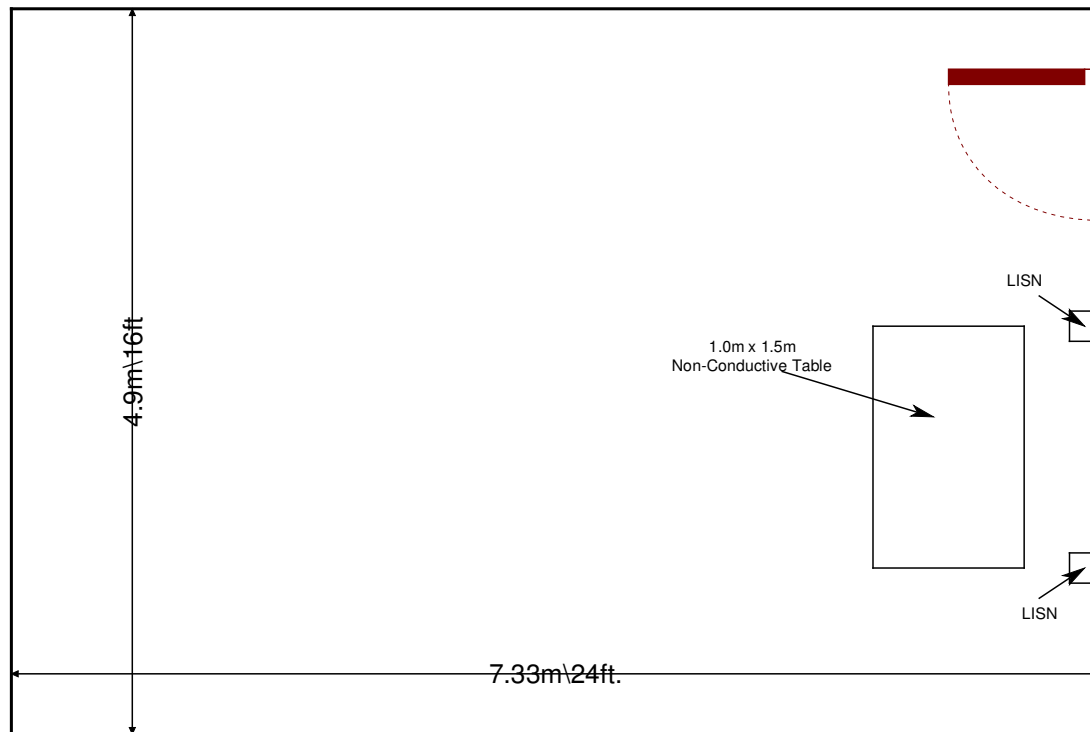


Figure 2.3.2-1: AC Mains Conducted EMI Site

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
- ❖ Industry 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.
- ❖ Industry 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 U-NII Test Procedures New Rules v01r01: Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E, January, 2016.
- ❖ FCC OET KDB Publication No. 905462 D06 802.11 Channel Plans New Rules v01: Operation in U-NII Bands – 802.11 Channel Plan, 15.407 (Part 15E), 1st R&O (FCC 06-96) June 2014
- ❖ FCC OET KDB Publication No. 644545 D03 Guidance for IEEE 802.11ac New Rules v01: Guidance for IEEE Standard 802.11acTM 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
22	Agilent	8449B	Amplifiers	3008A00526	5/18/2015	5/18/2016
283	Rohde & Schwarz	FSP40	Spectrum Analyzers	1000033	7/1/2015	7/1/2016
332	Rohde & Schwarz	TS-PR40	Amplifiers	100021	2/19/2014	2/19/2016
333	Rohde&Schwarz	3160-10	Antennas	45576	11/4/2010	NCR
479	Electro-Metrics	ALP-70	Antennas	158	12/2/2013	12/2/2015
479	Electro-Metrics	ALP-70	Antennas	158	12/3/2015	12/3/2017
523	Agilent	E7405	Spectrum Analyzers	MY45103293	12/26/2014	12/26/2016
653	Suhner	SF-102A	Cables	0944/2A	4/13/2015	4/13/2016
2003	EMCO	3108	Antennas	2148	2/18/2014	2/18/2016
2004	EMCO	3146	Antennas	1385	11/19/2015	11/19/2017
2006	EMCO	3115	Antennas	2573	4/14/2015	4/14/2017
2008	COM-Power	AH-826	Antennas	81009	NCR	NCR
2011	Hewlett-Packard	HP 8447D	Amplifiers	2443A03952	11/18/2015	11/18/2016
2022	EMCO	LISN3825/2R	LISN	1095	9/14/2015	9/14/2017
2045	ACS Boca	Conducted Cable Set	Cable Set	2045	11/11/2015	11/11/2016
2070	Mini Circuits	VHF-8400+	Filter	2070	11/17/2015	11/17/2016
2072	Mini Circuits	VHF-3100+	Filter	30737	11/17/2015	11/17/2016
2082	Teledyne Storm Products	90-010-048	Cables	2082	4/22/2015	4/22/2016
2086	Merrimac	FAN-6-10K	Attenuators	23148-83-1	11/16/2015	11/16/2016
2095	ETS Lindgren	TILE4! - Version 4.2.A	Software	85242	NCR	NCR
2111	Aeroflex Inmet	40AH2W-20	Attenuator	2111	7/22/2015	7/22/2016
2121	ACS Boca	Radiated Cable Set	Cable Set	2121	8/22/2015	8/22/2016
3004	Teseq	CFL 9206A	Attenuators	34720	10/7/2015	10/7/2016

Notes:

NCR = No Calibration Required

The calibration cycle information for asset 479 is provided to cover the entire test period.

5 SUPPORT EQUIPMENT

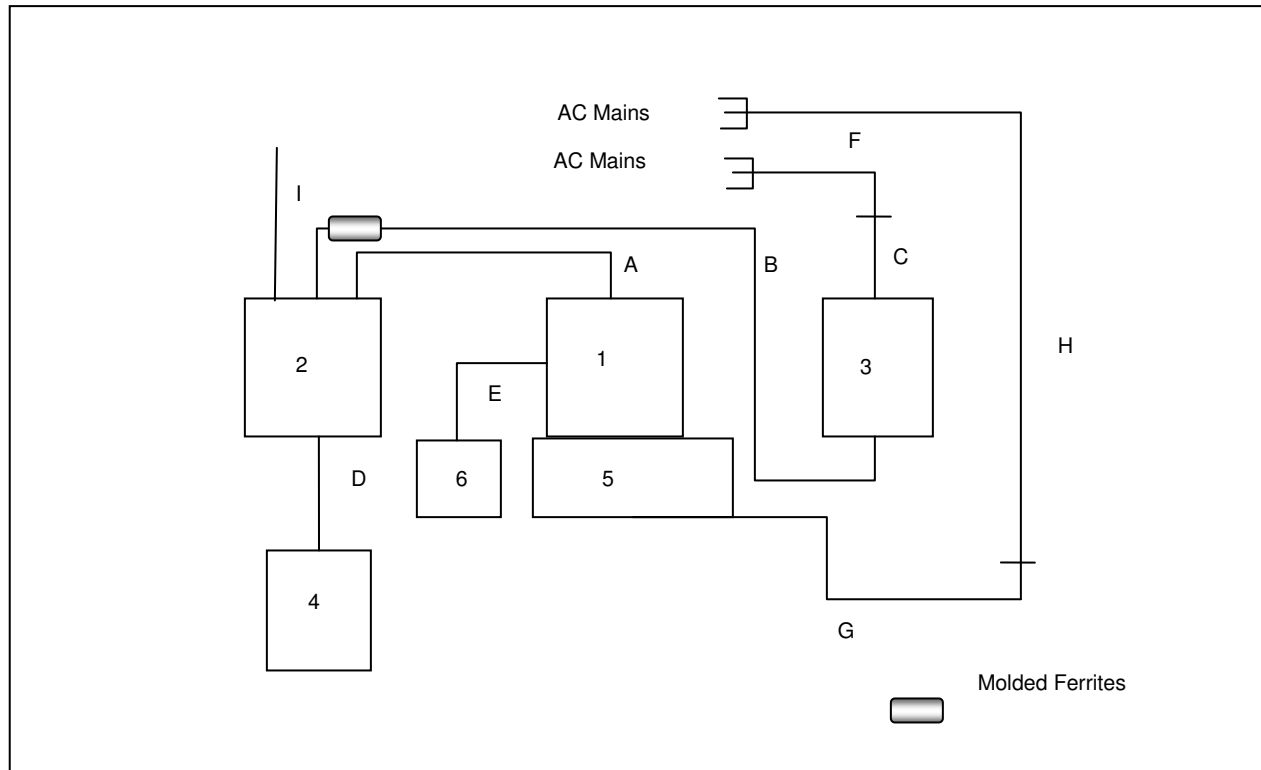
Table 5-1: EUT and Support Equipment

Item #	Type Device	Manufacturer	Model/Part #	Serial #
1	EUT	Motorola Solutions	Si 500 Fusion	ATPB104
2	Laptop	Dell	Latitude D531	CN-0XM006-48643-789-2125
3	Laptop AC Adapter	Dell	LA65NS2-01	CN-06TM1C- 72438-358- 218F- A01
4	Mouse	DELL	M-UAR DEL7	LZ9440C43W5
5	Multi-unit charger	Motorola	PMLN7093A 1512 MMI1 00018	N/A
6	Earpiece	Motorola Solutions	RLN4941A	N/A

Note: The Laptop AC adapter was used for testing purposes only.

Table 5-2: Cable Description

Cable #	Cable Type	Length	Shield	Termination
A	USB data cable	0.90 m	No	EUT to Laptop
B	Power cable	1.85 m	No	Laptop to AC Adapter
C	Power Cord	0.90 m	No	Laptop Adapter to AC Extension
D	Mouse USB cable	1.8 m	No	Laptop to Mouse
E	Coil Audio cable	0.55 m	No	EUT to Earpiece
F	Extension Power Cord	2.70 m	No	Adapter power cord to AC Mains
G	Power cable	1.10 m	No	Multi Charger to AC Extension
H	Power Cable	1.82 m	No	Extension cord to AC Mains
I	Serial Cable	1.84 m	No	Not Terminated

6 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM**Figure 6-1: Test Setup – Radiated and AC Power Line Conducted Emissions**

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 Si500 model HK2062A uses an internal surface mount BT/WLAN antenna which is soldered directly to the PCB. The antenna is not removable and the port is not accessible externally. The EUT meets the requirements of FCC Section 15.203.

7.2 Emission/Occupied Bandwidth - FCC: Section 15.407(a), 15.407(e); IC: 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 v01r01 “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 v01r01 “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

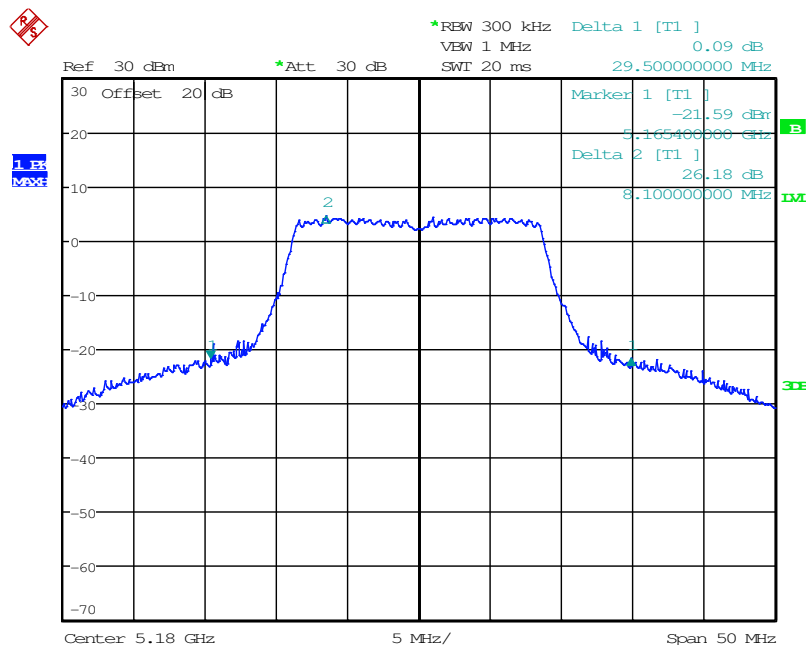
Results are shown below.

Band 5150 – 5250 MHz

802.11n 20 MHz

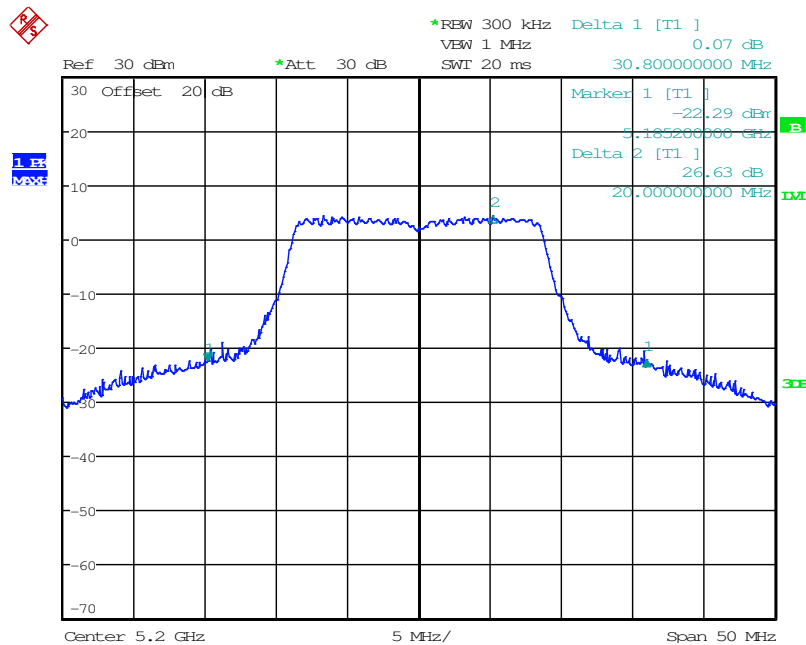
Table 7.2.2-1: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5180	29.5	18.5
5200	30.8	18.5
5240	29.7	18.3



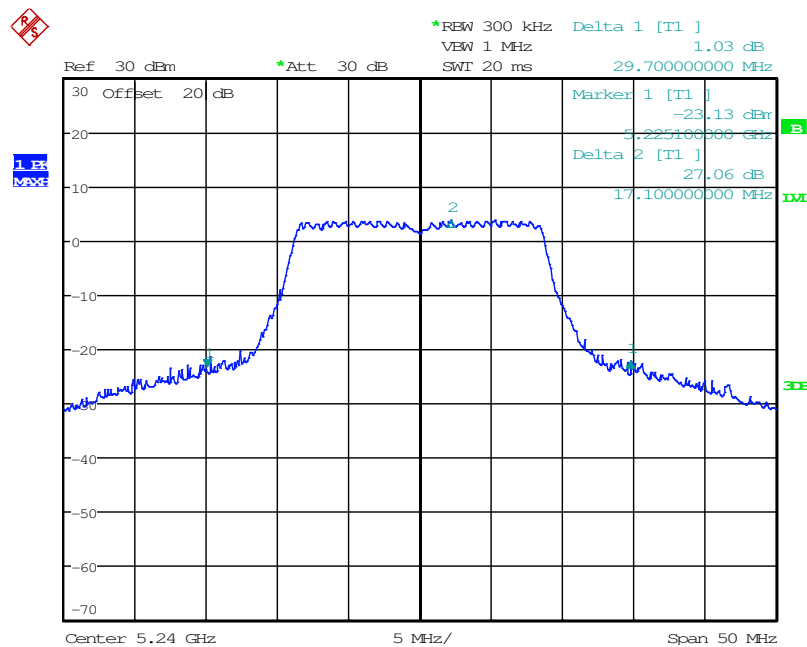
Date: 6.JAN.2016 14:07:55

Figure 7.2.2-1: EBW - Low Channel



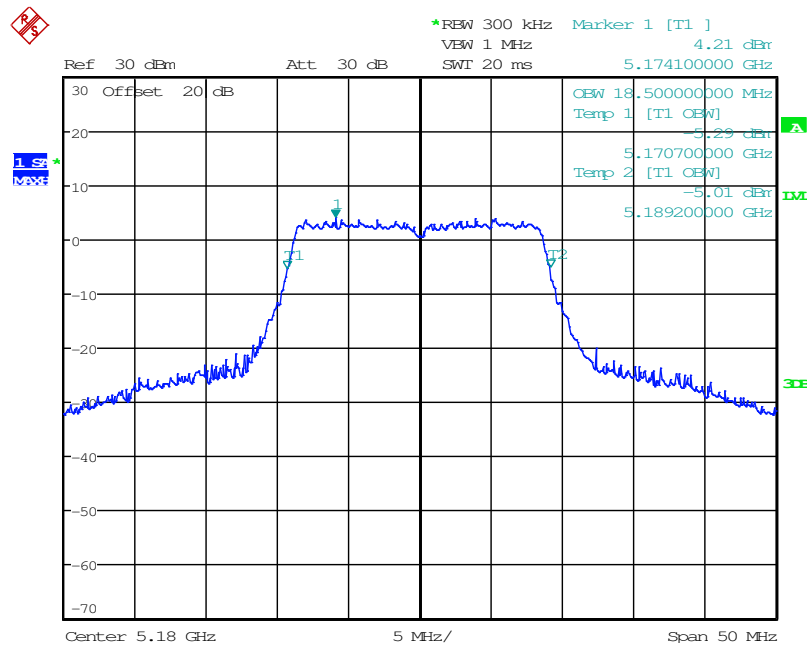
Date: 6.JAN.2016 14:18:46

Figure 7.2.2-2: EBW - Middle Channel



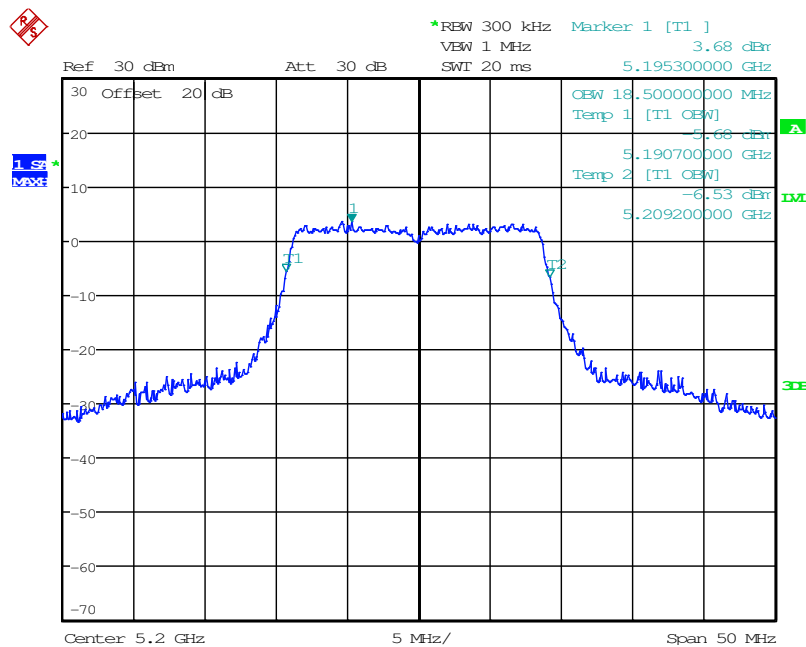
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Figure 7.2.2-3: EBW - High Channel



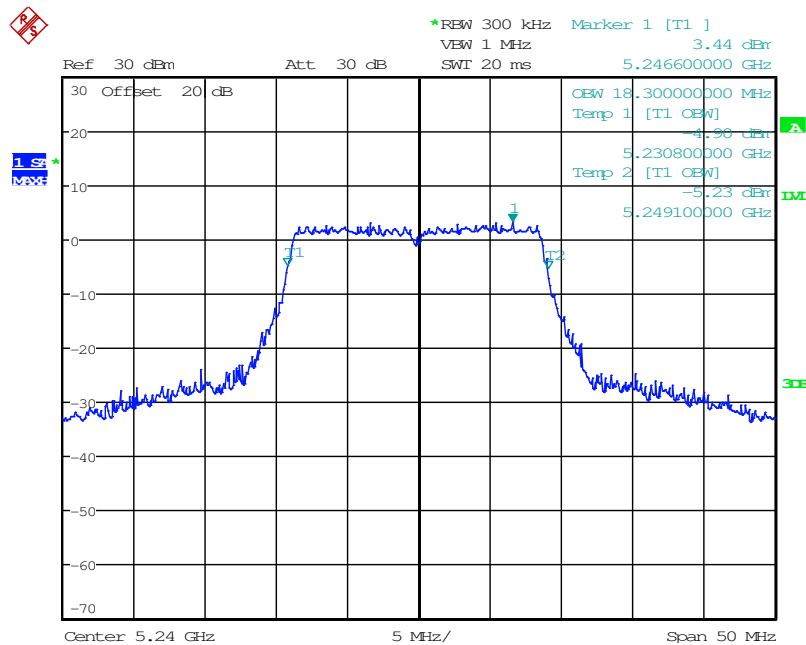
Date: 6.JAN.2016 12:56:42

Figure 7.2.2-4: 99% OBW - Low Channel



Date: 6.JAN.2016 14:22:59

Figure 7.2.2-5: 99% OBW - Middle Channel



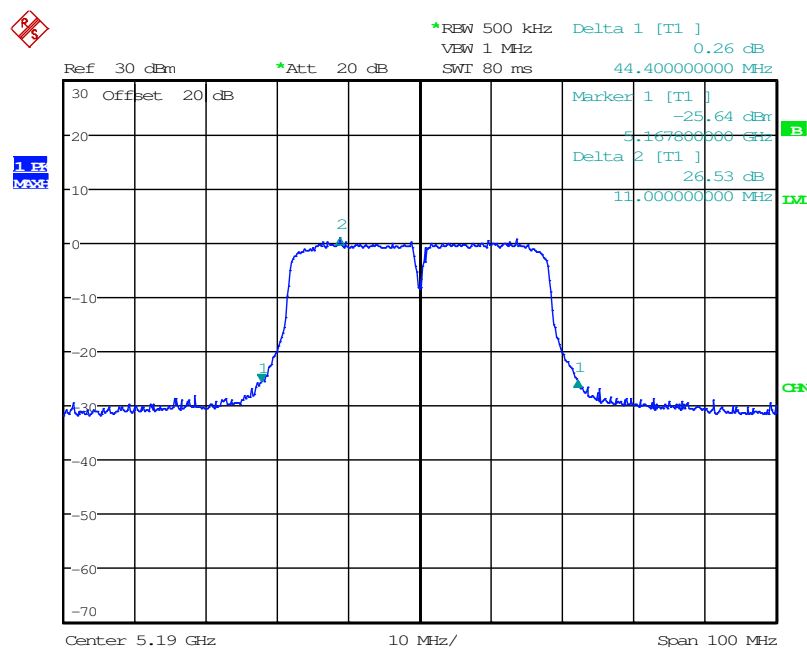
Date: 6.JAN.2016 14:26:35

Figure 7.2.2-6: 99% OBW - High Channel

802.11n 40 MHz

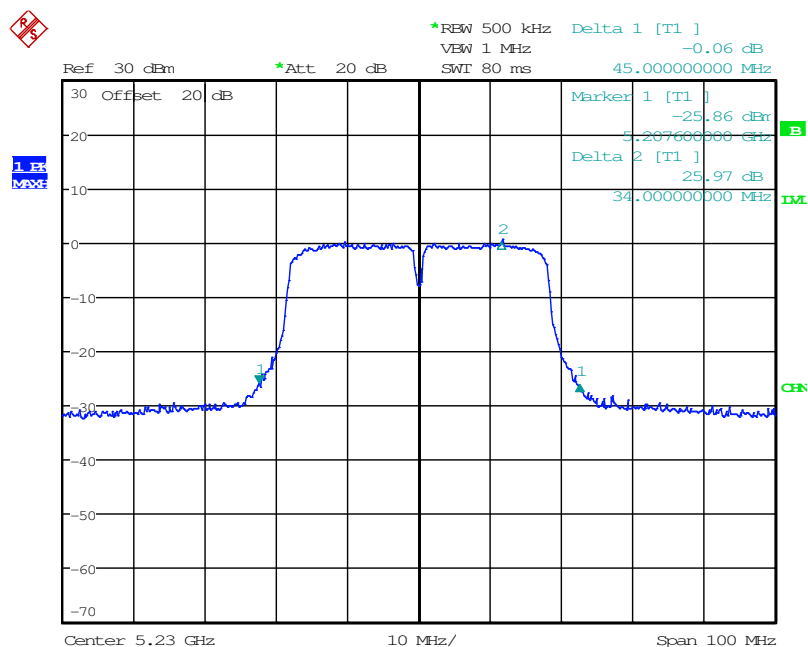
Table 7.2.2-2: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5190	44.4	37.2
5230	45.0	37.2



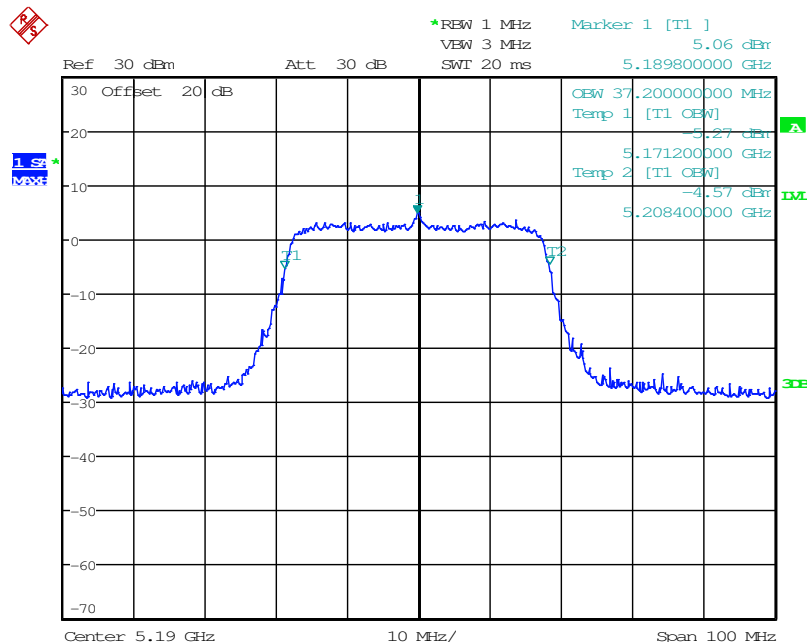
Date: 6.JAN.2016 17:10:32

Figure 7.2.2-7: EBW - Low Channel



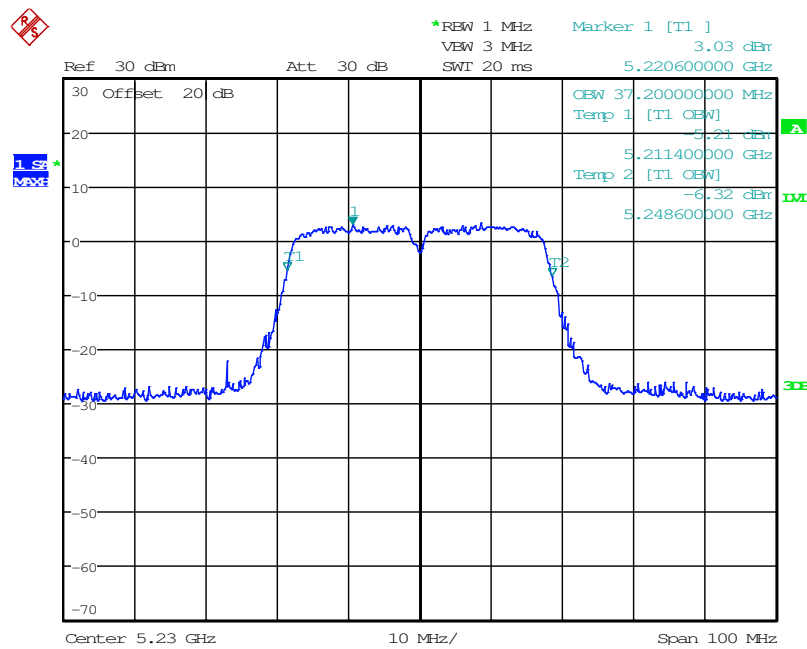
Date: 6.JAN.2016 17:15:09

Figure 7.2.2-8: EBW - High Channel



Date: 6.JAN.2016 16:36:43

Figure 7.2.2-9: 99% OBW - Low Channel



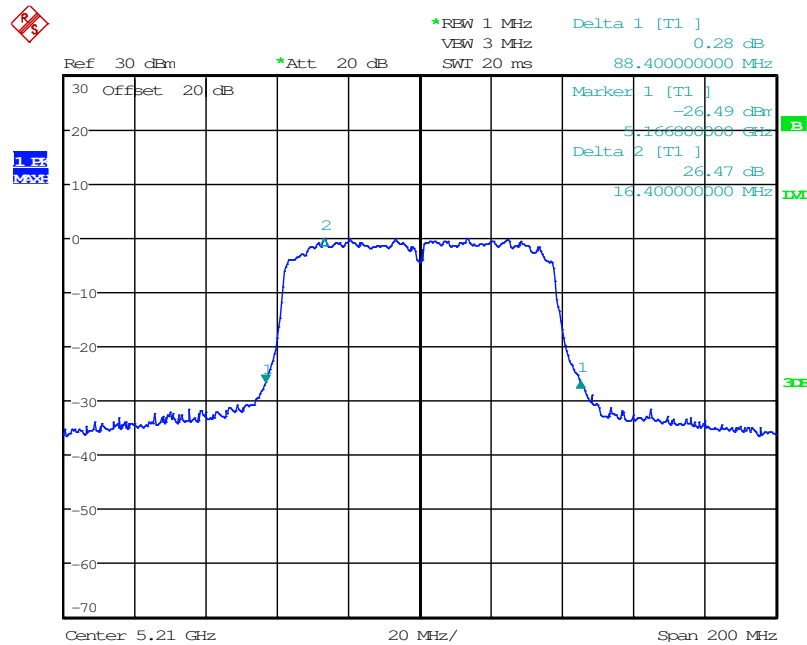
Date: 6.JAN.2016 17:18:06

Figure 7.2.2-10: 99% OBW - High Channel

802.11ac 80 MHz

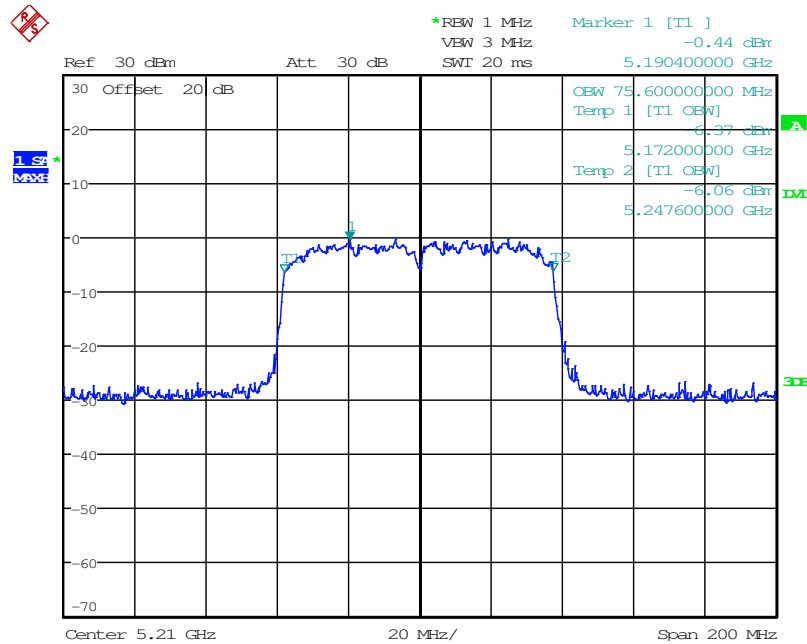
Table 7.2.2-3: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5210	88.4	75.6



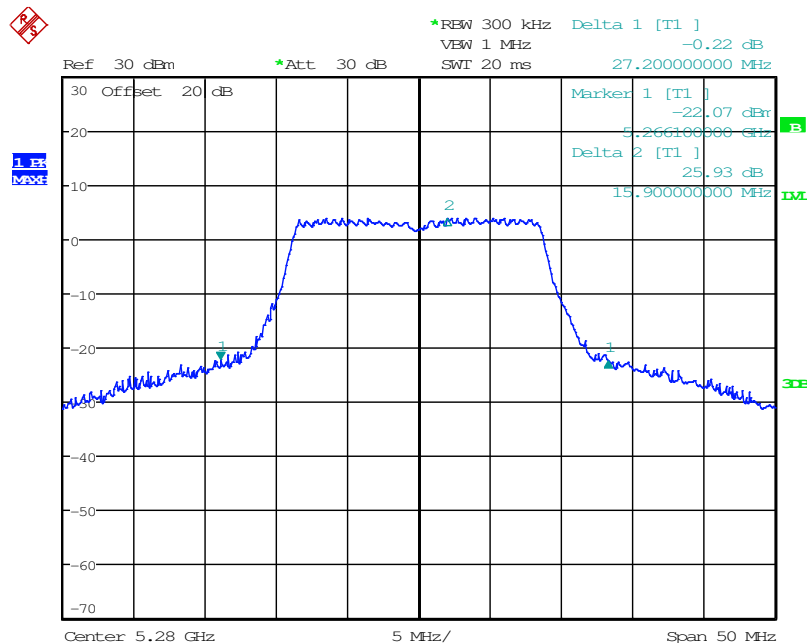
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Figure 7.2.2-11: EBW - Middle Channel



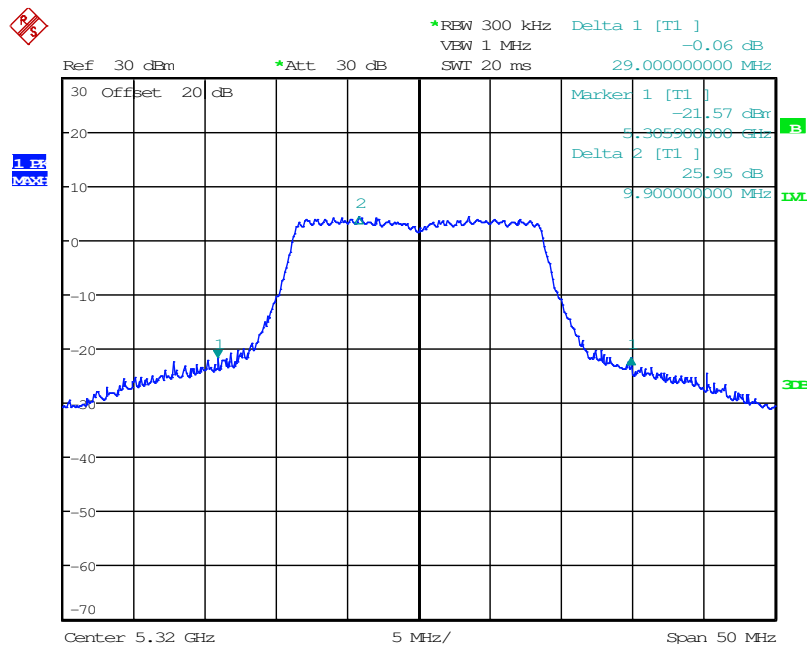
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Figure 7.2.2-12: 99% OBW - Middle Channel



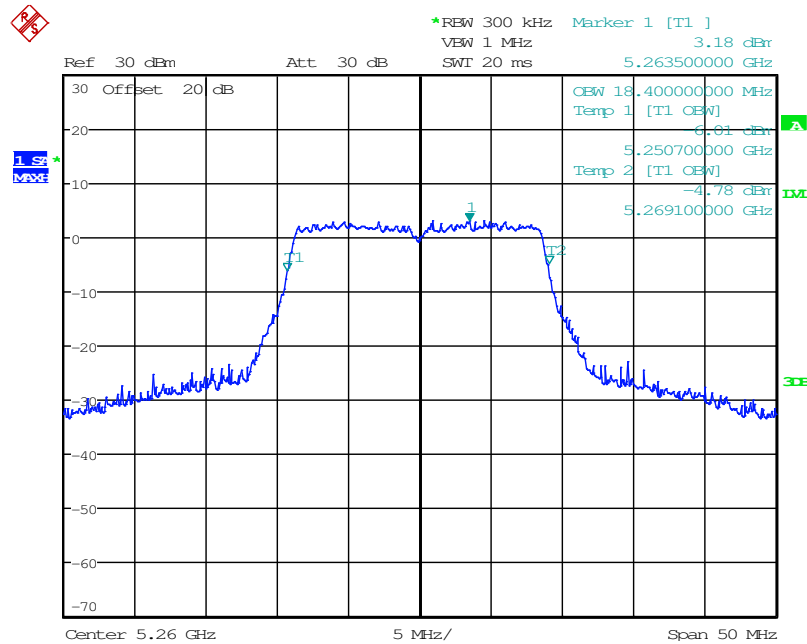
Date: 6.JAN.2016 14:49:07

Figure 7.2.2-14: EBW - Middle Channel



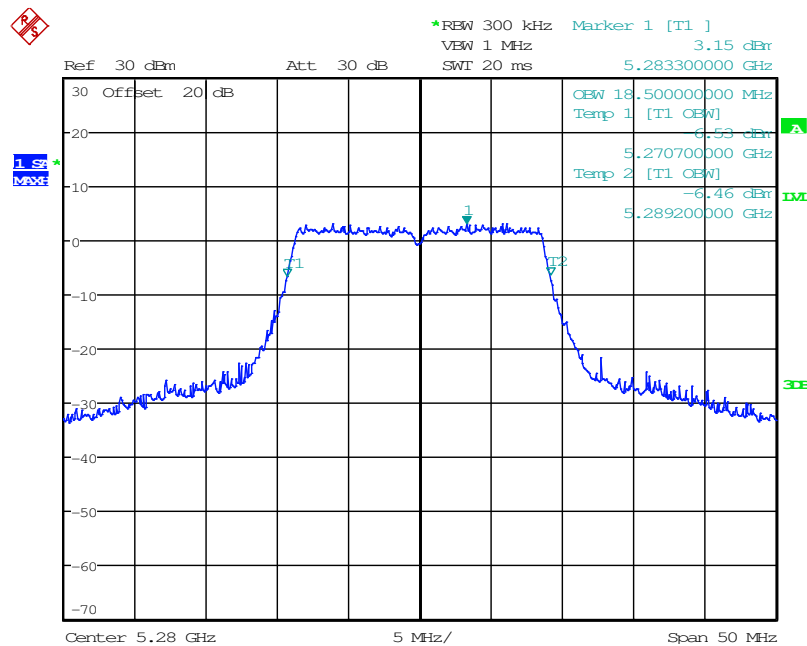
Date: 6.JAN.2016 14:54:09

Figure 7.2.2-15: EBW - High Channel



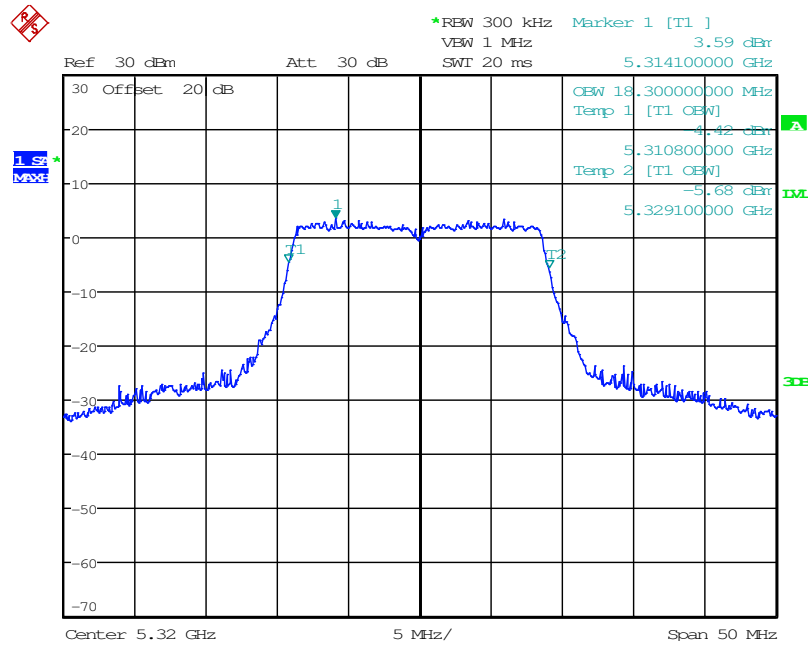
Date: 6.JAN.2016 14:40:55

Figure 7.2.2-16: 99% OBW - Low Channel



Date: 6.JAN.2016 14:45:19

Figure 7.2.2-17: 99% OBW - Middle Channel



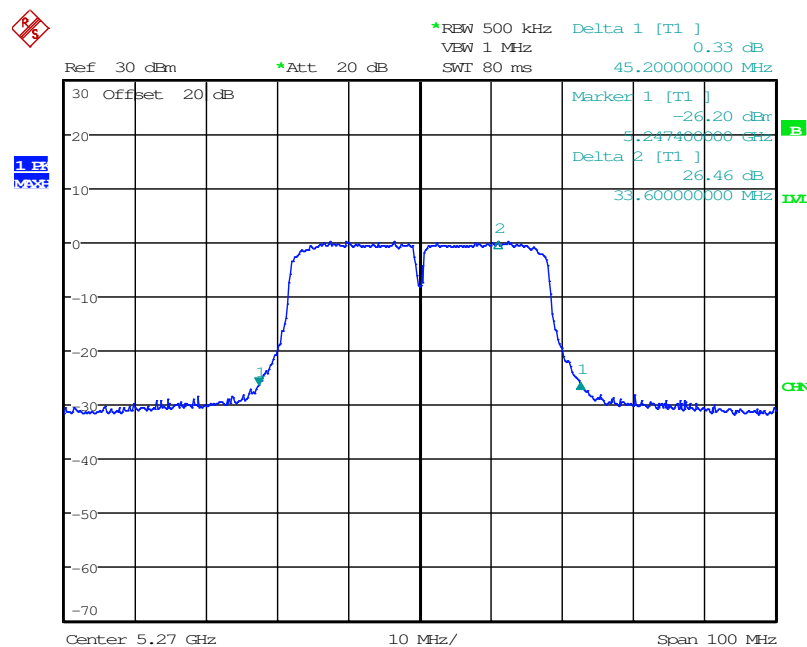
Date: 6.JAN.2016 14:56:38

Figure 7.2.2-18: 99% OBW - High Channel

802.11n 40 MHz

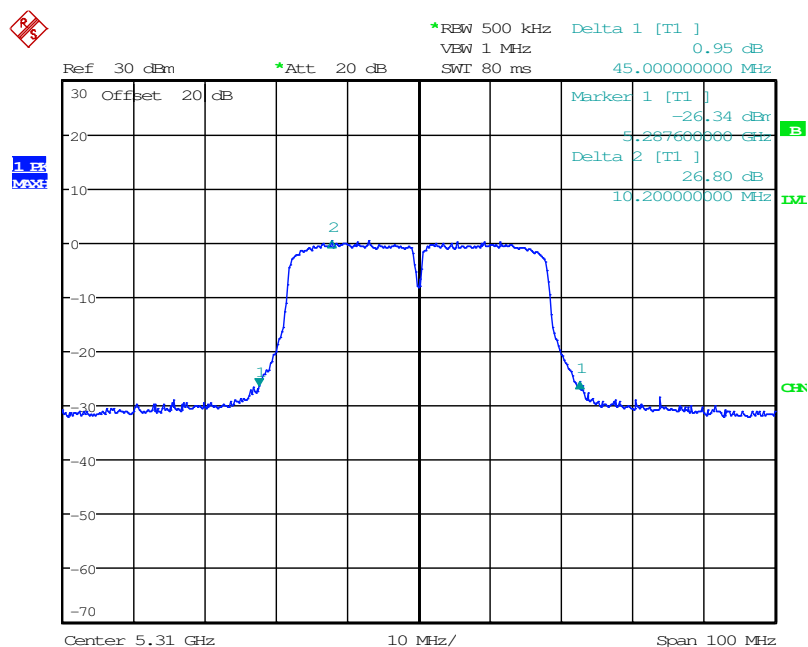
Table 7.2.2-5: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5270	45.2	37.0
5310	45.0	37.4



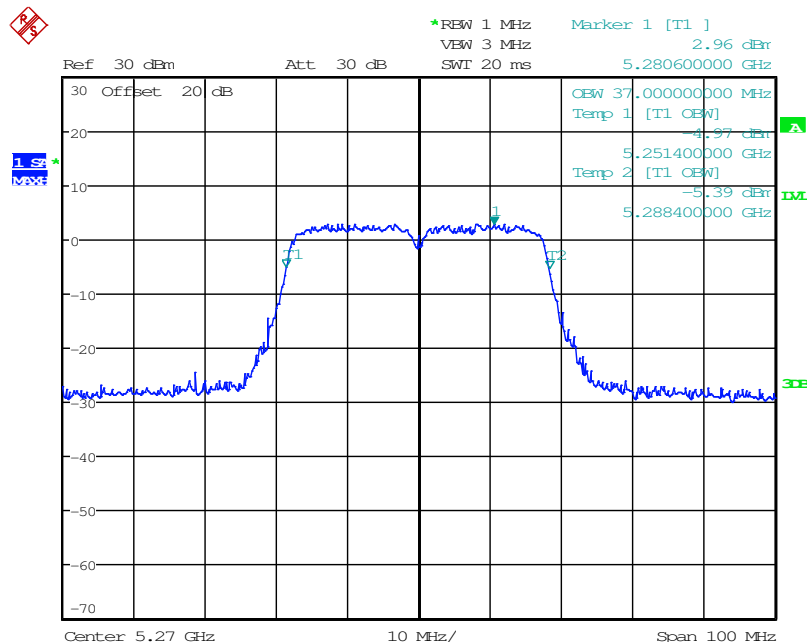
Date: 6.JAN.2016 17:30:38

Figure 7.2.2-19: EBW - Low Channel



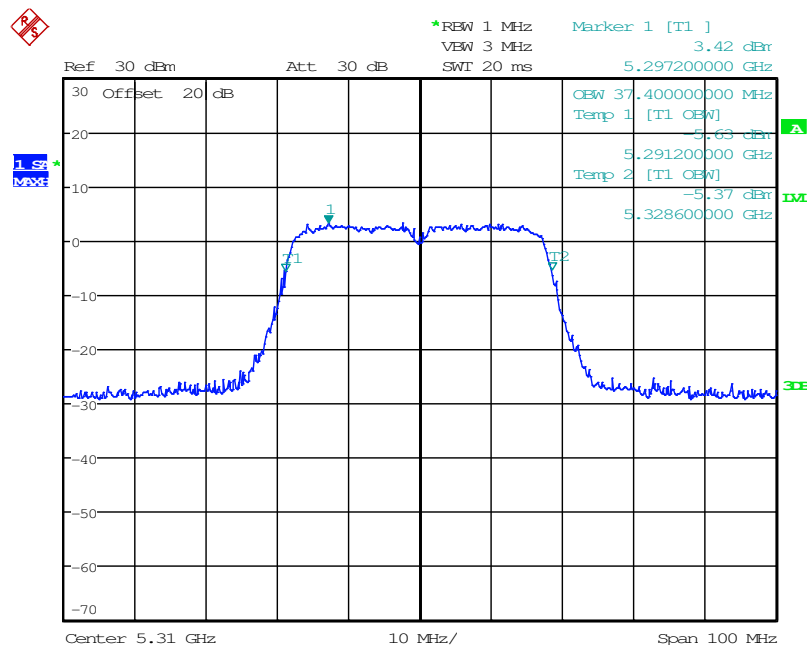
Date: 6.JAN.2016 17:36:16

Figure 7.2.2-20: EBW - High Channel



Date: 6.JAN.2016 17:21:20

Figure 7.2.2-21: 99% OBW - Low Channel



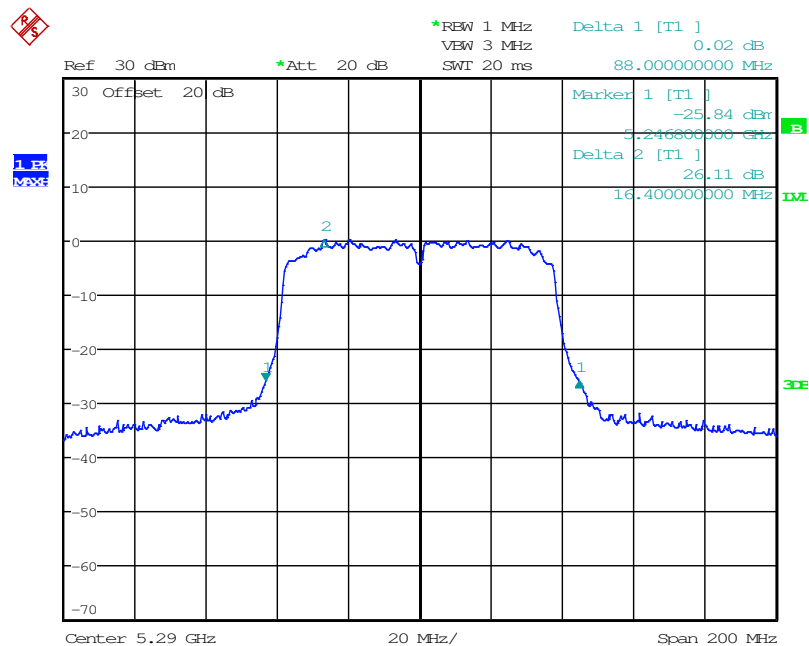
Date: 6.JAN.2016 17:41:05

Figure 7.2.2-22: 99% OBW - High Channel

802.11ac 80 MHz

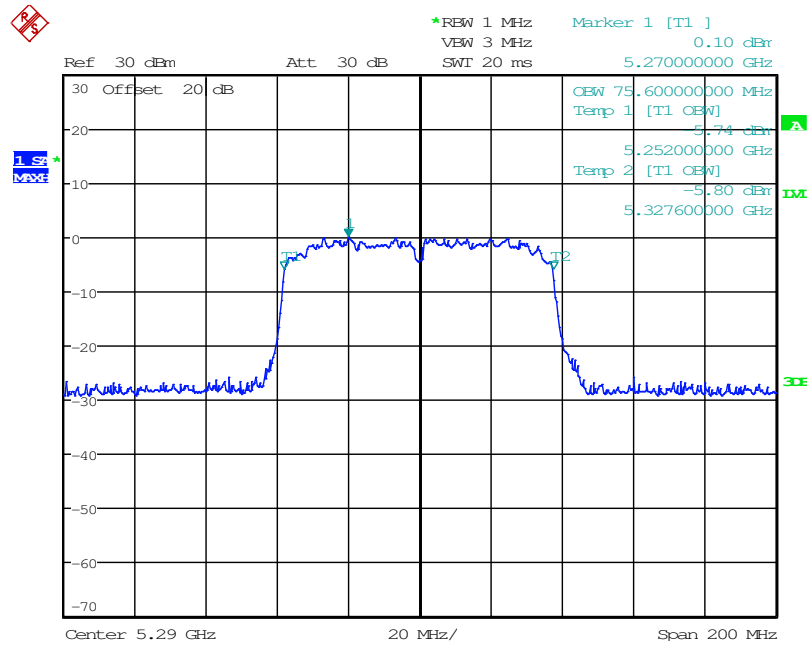
Table 7.2.2-6: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5290	88.0	75.6



Date: 6.JAN.2016 19:35:16

Figure 7.2.2-23: EBW - Middle Channel



Date: 6.JAN.2016 19:32:06

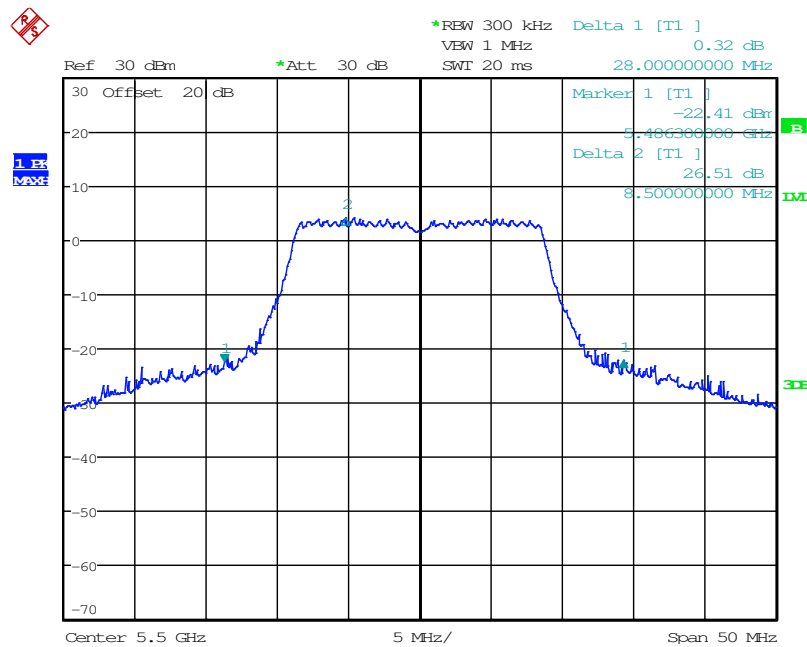
Figure 7.2.2-24: 99% OBW - Middle Channel

Band 5470 – 5725 MHz

802.11n 20 MHz

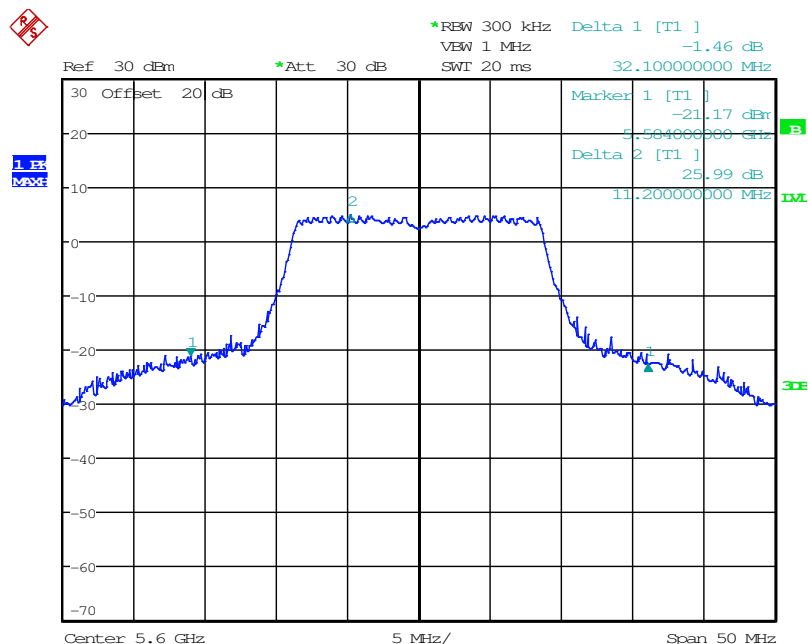
Table 7.2.2-7: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5500	28.0	18.4
5600	32.1	18.4
5720	34.1	18.5



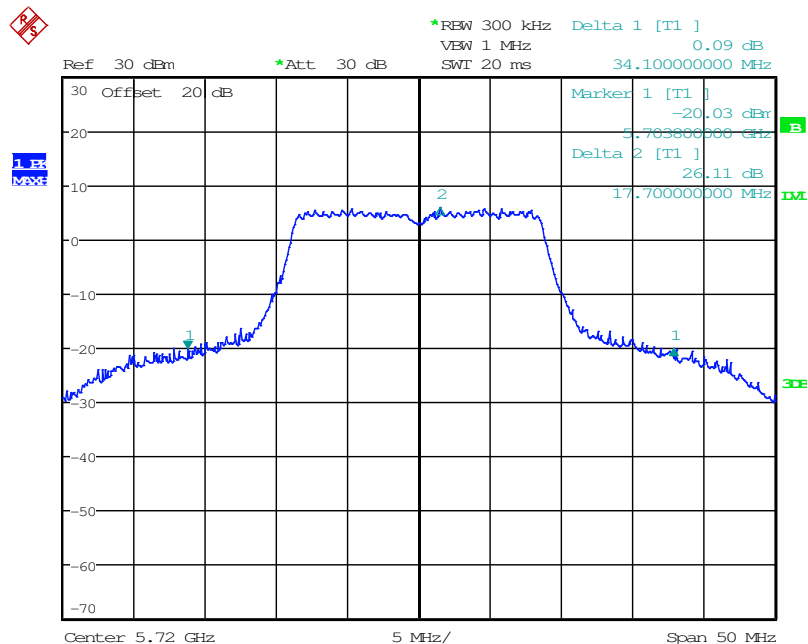
Date: 6.JAN.2016 15:04:17

Figure 7.2.2-25 EBW - Low Channel



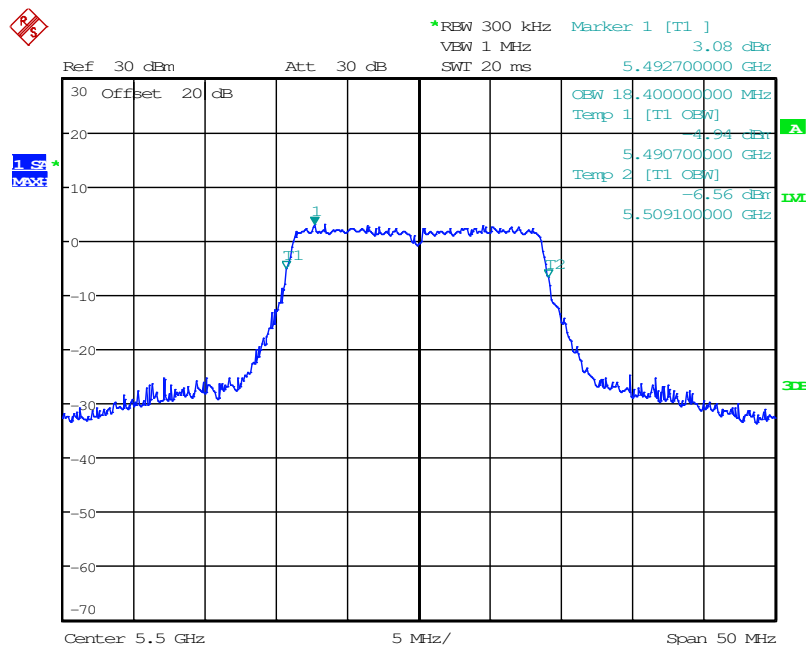
Date: 6.JAN.2016 15:09:54

Figure 7.2.2-26: EBW - Middle Channel



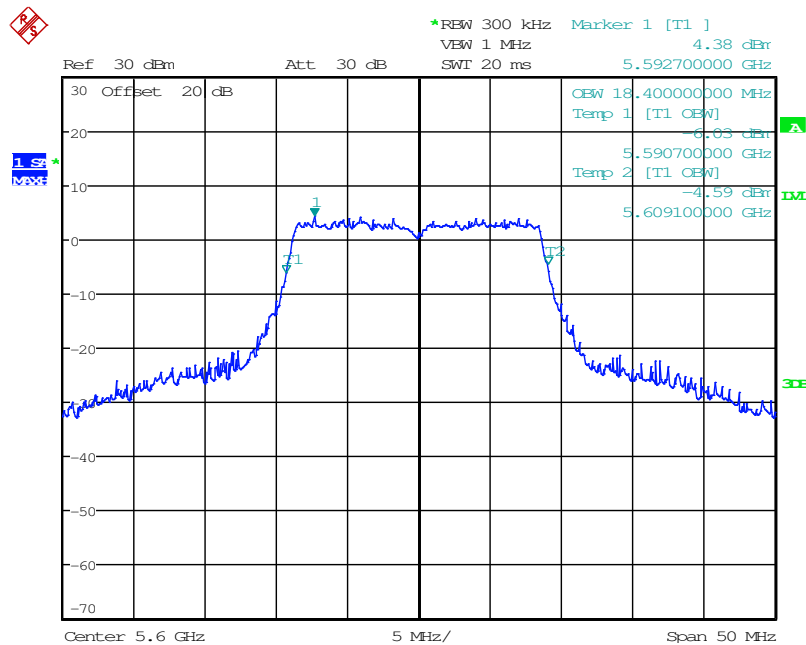
Date: 6.JAN.2016 15:38:04

Figure 7.2.2-27: EBW - High Channel



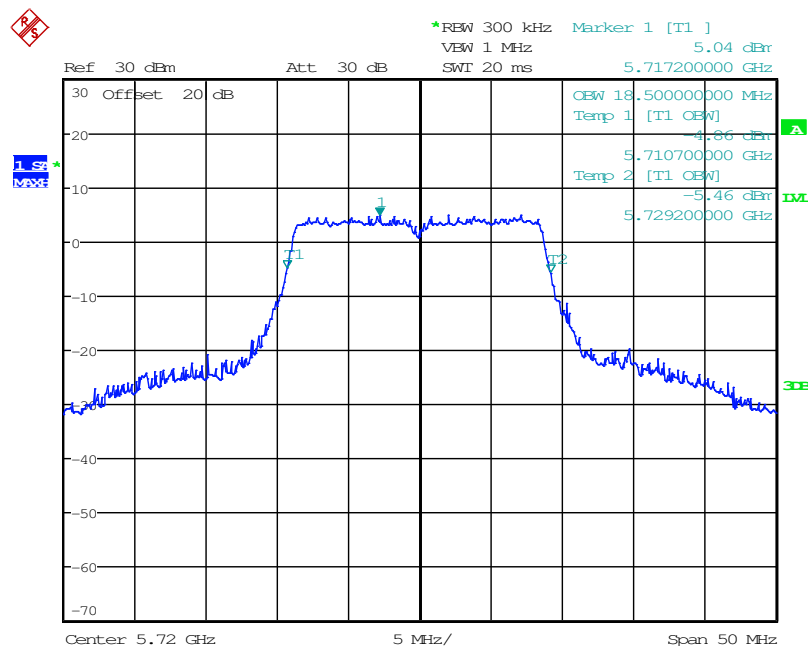
Date: 6.JAN.2016 15:00:05

Figure 7.2.2-28: 99% OBW - Low Channel



Date: 6.JAN.2016 15:12:58

Figure 7.2.2-29: 99% OBW - Middle Channel



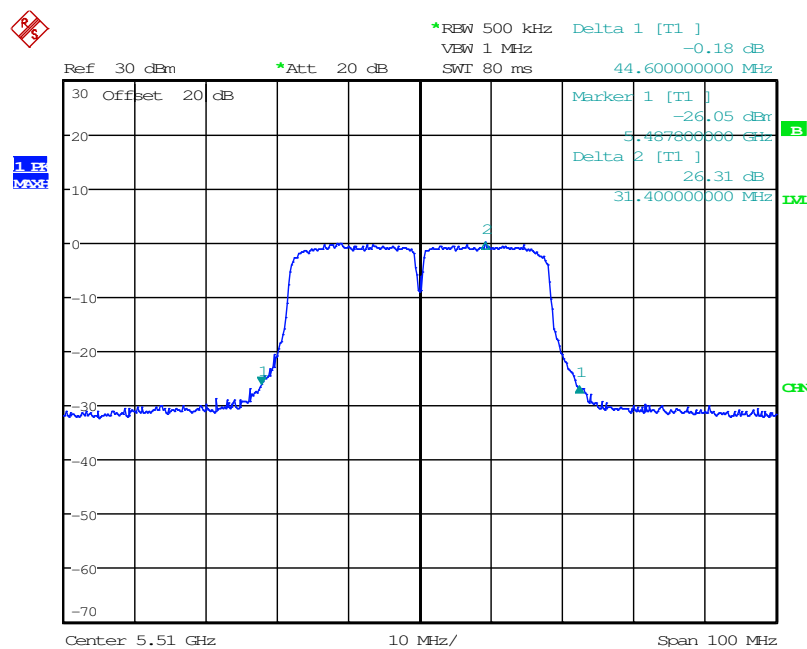
Date: 6.JAN.2016 15:17:28

Figure 7.2.2-30: 99% OBW - High Channel

802.11n 40 MHz

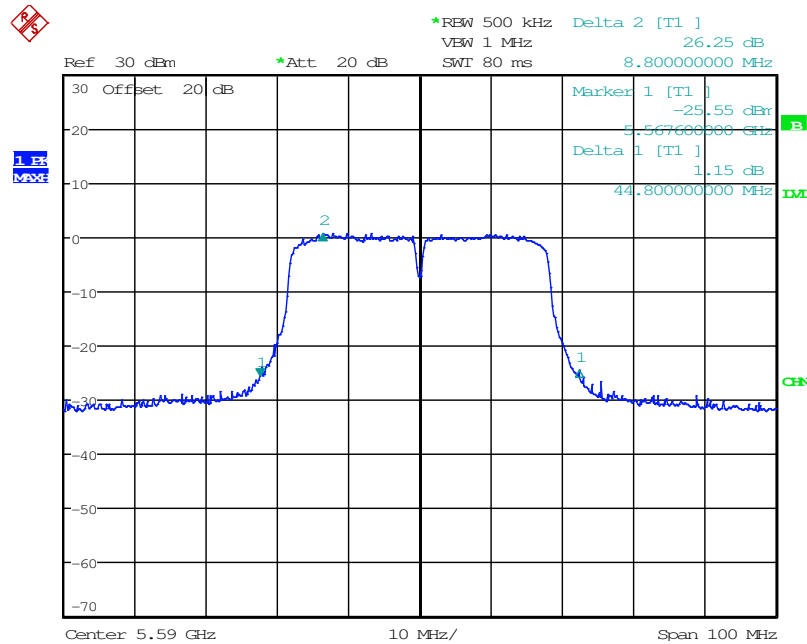
Table 7.2.2-8: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5510	44.6	37.2
5590	44.8	37.2
5710	44.4	37.0



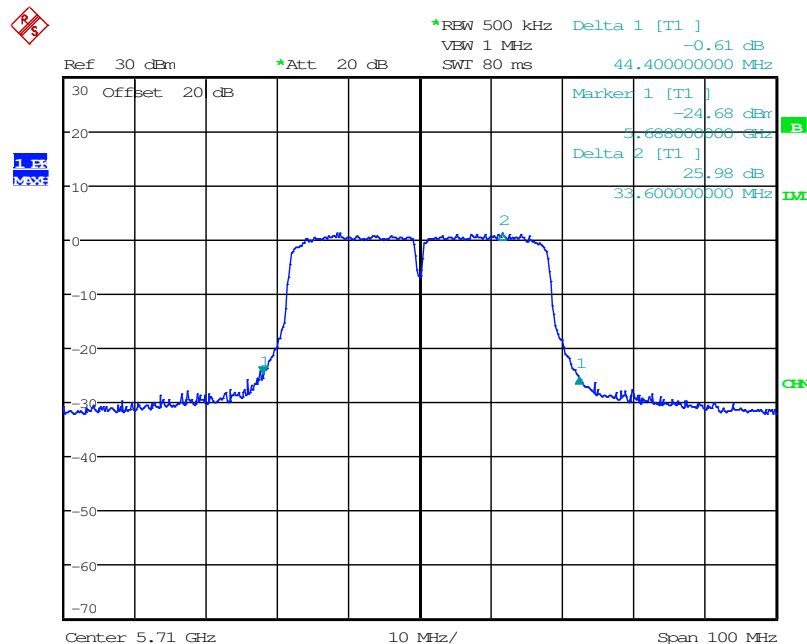
Date: 6.JAN.2016 17:50:36

Figure 7.2.2-31: EBW - Low Channel



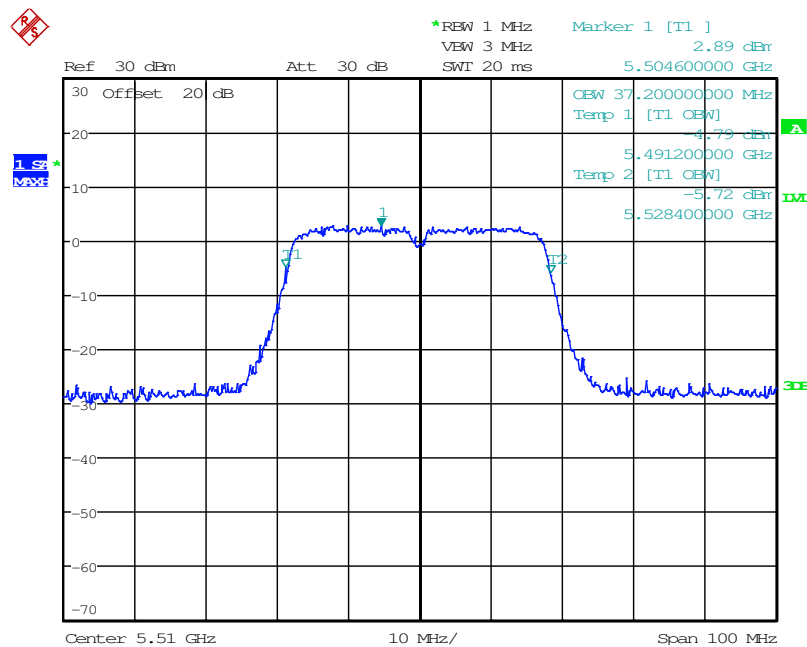
Date: 6.JAN.2016 17:53:52

Figure 7.2.2-32: EBW - Middle Channel



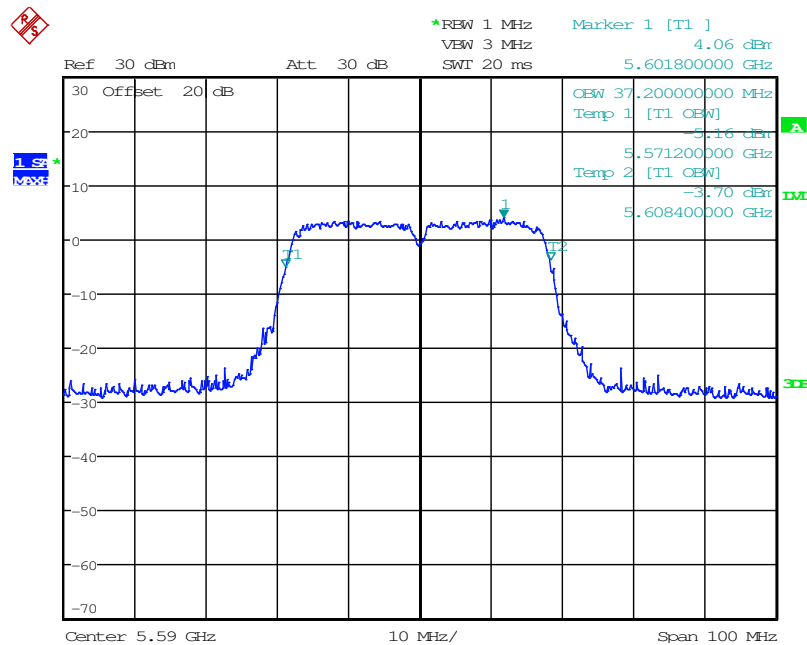
Date: 6.JAN.2016 18:01:31

Figure 7.2.2-33: EBW - High Channel



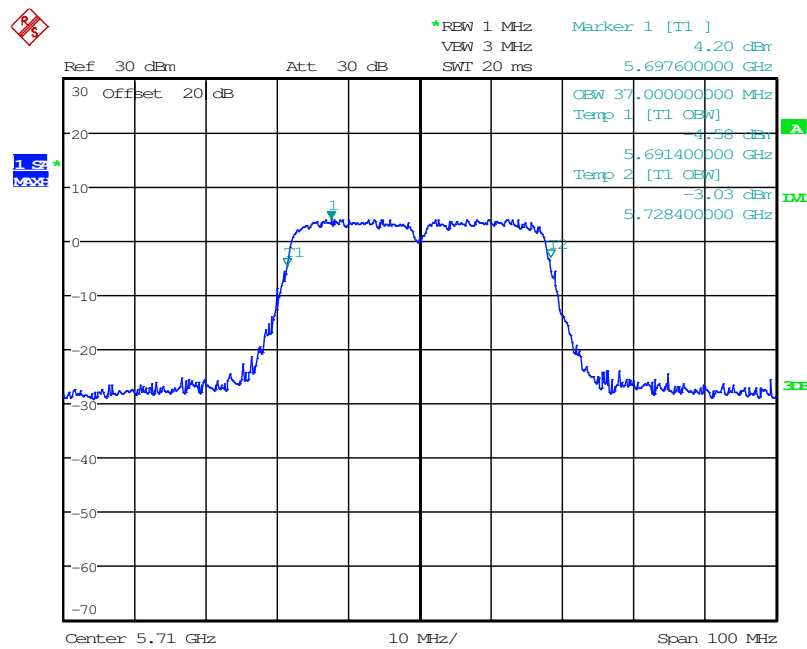
Date: 6.JAN.2016 17:46:28

Figure 7.2.2-34: 99% OBW - Low Channel



Date: 6.JAN.2016 17:56:41

Figure 7.2.2-35: 99% OBW - Middle Channel



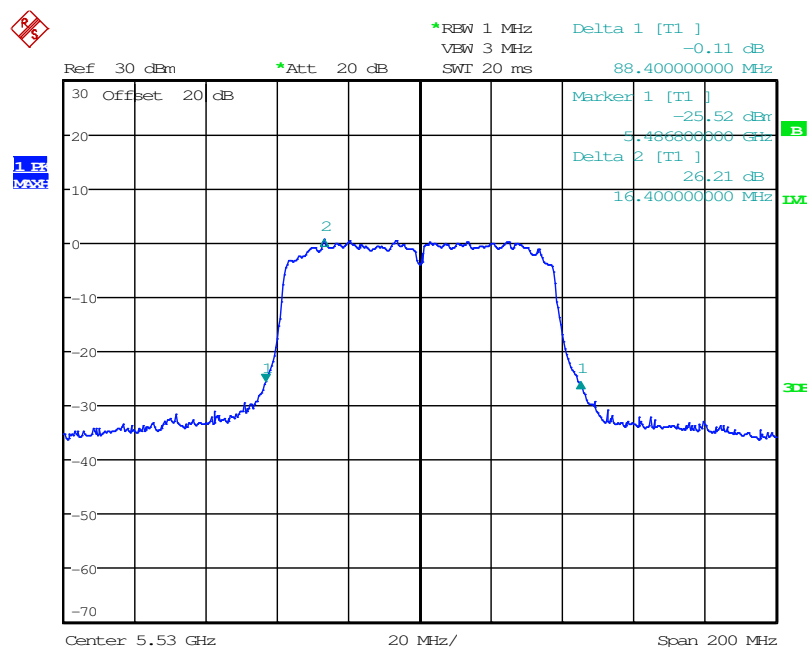
Date: 6.JAN.2016 18:05:58

Figure 7.2.2-36: 99% OBW - High Channel

802.11ac 80 MHz

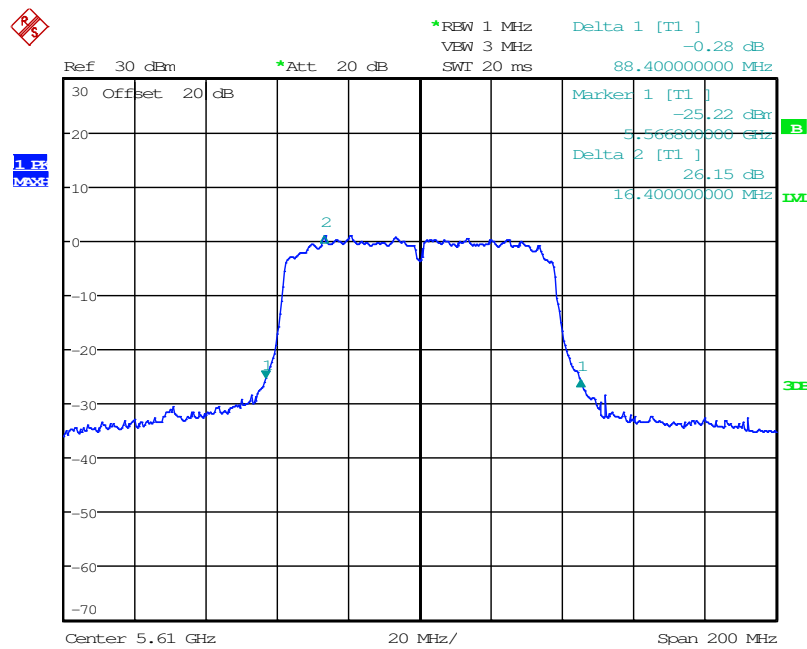
Table 7.2.2-9: EBW / 99% Bandwidth

Frequency [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5530	88.4	75.6
5610	88.4	75.6
5690	88.4	75.6



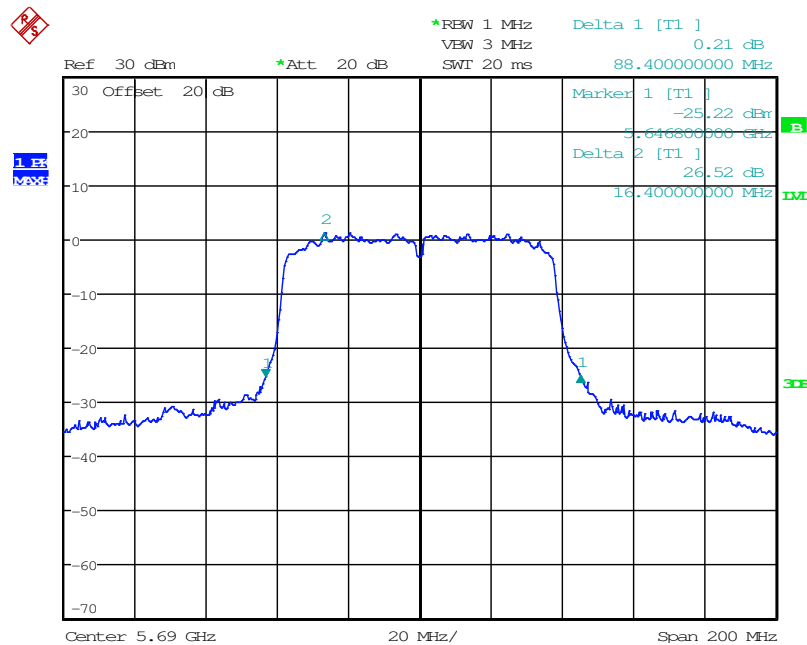
Date: 6.JAN.2016 19:39:39

Figure 7.2.2-37: EBW - Low Channel



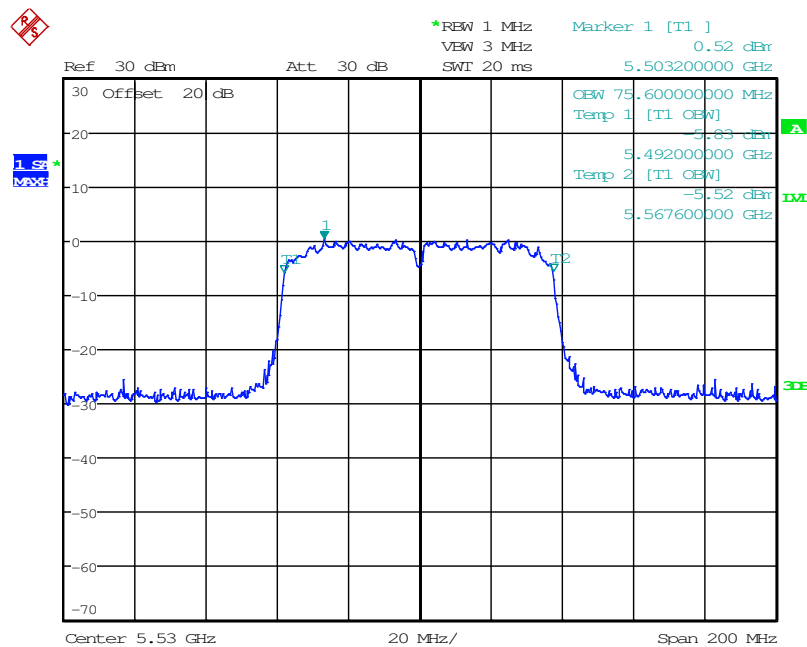
Date: 6.JAN.2016 20:01:13

Figure 7.2.2-38: EBW - Middle Channel



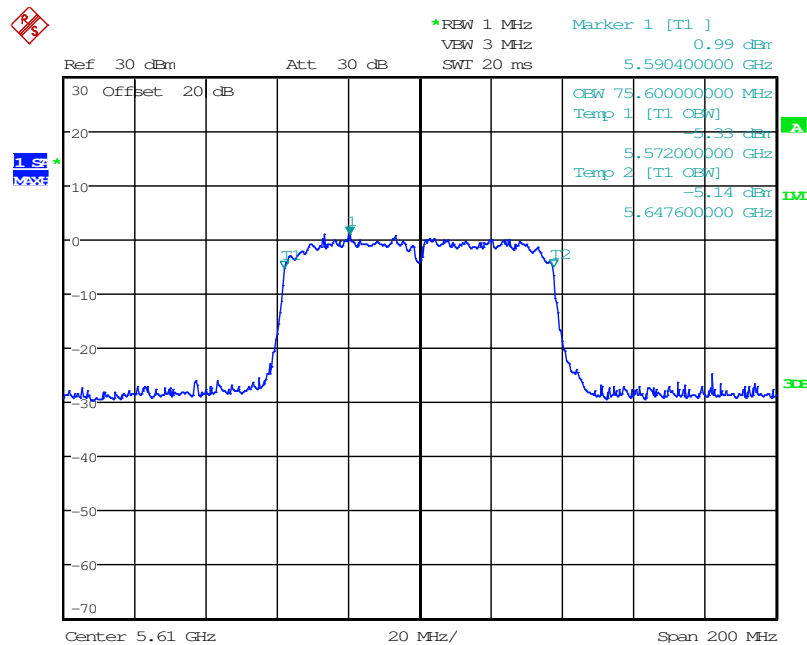
Date: 6.JAN.2016 20:15:36

Figure 7.2.2-39: EBW - High Channel



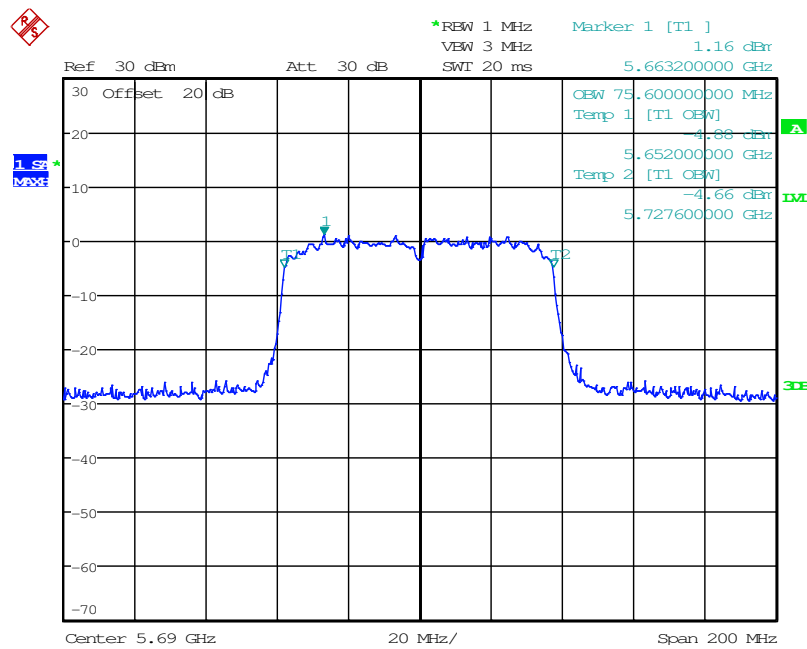
Date: 6.JAN.2016 19:43:47

Figure 7.2.2-40: 99% OBW - Low Channel



Date: 6.JAN.2016 19:54:27

Figure 7.2.2-41: 99% OBW - Middle Channel



Date: 6.JAN.2016 20:07:42

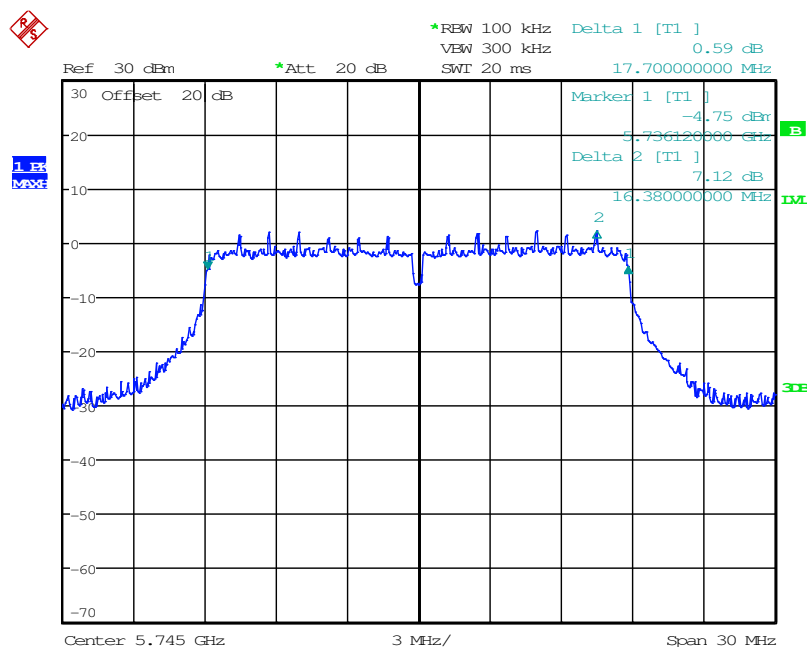
Figure 7.2.2-42: 99% OBW - High Channel

Band 5725 – 5850 MHz

802.11n 20 MHz

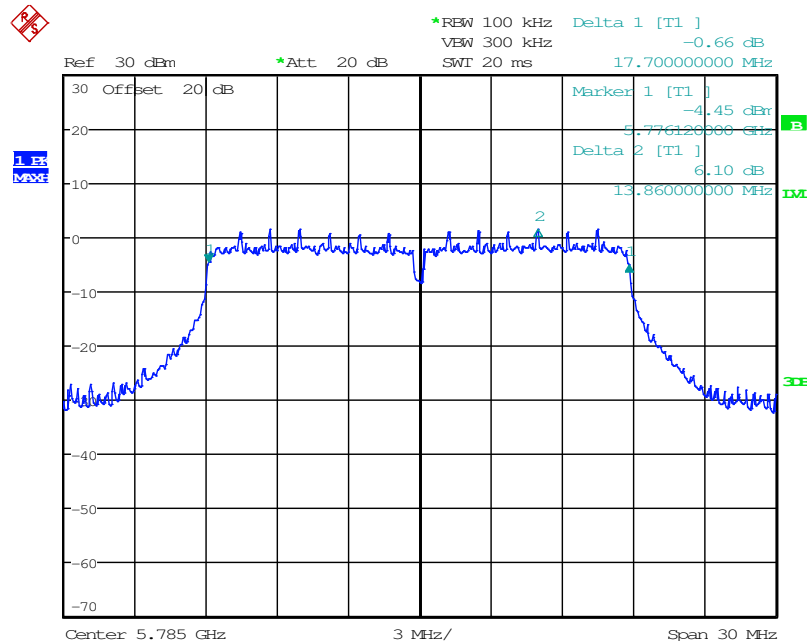
Table 7.2.2-10: 6dB / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5745	17.7	32.6	18.5
5785	17.7	30.3	18.4
5825	17.7	33.1	18.5



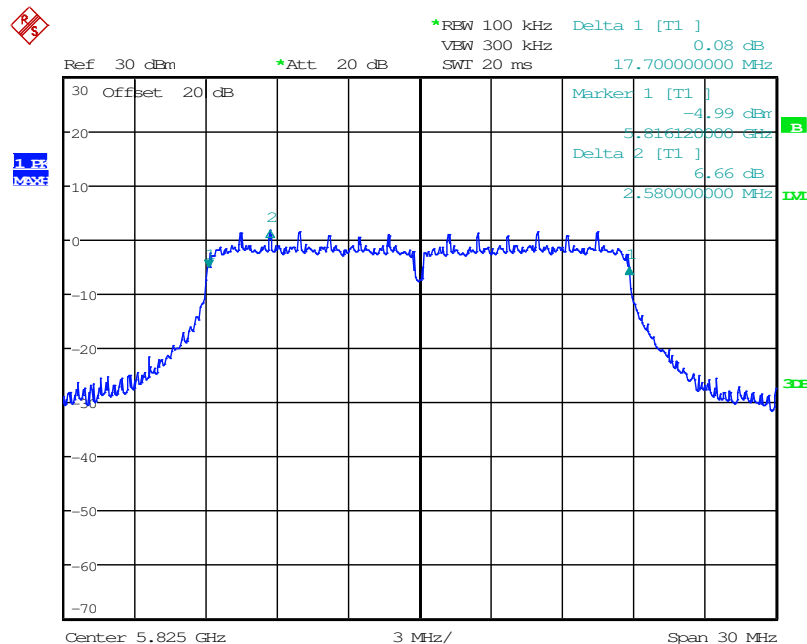
Date: 6.JAN.2016 21:24:50

Figure 7.2.2-43: 6dB BW - Low Channel



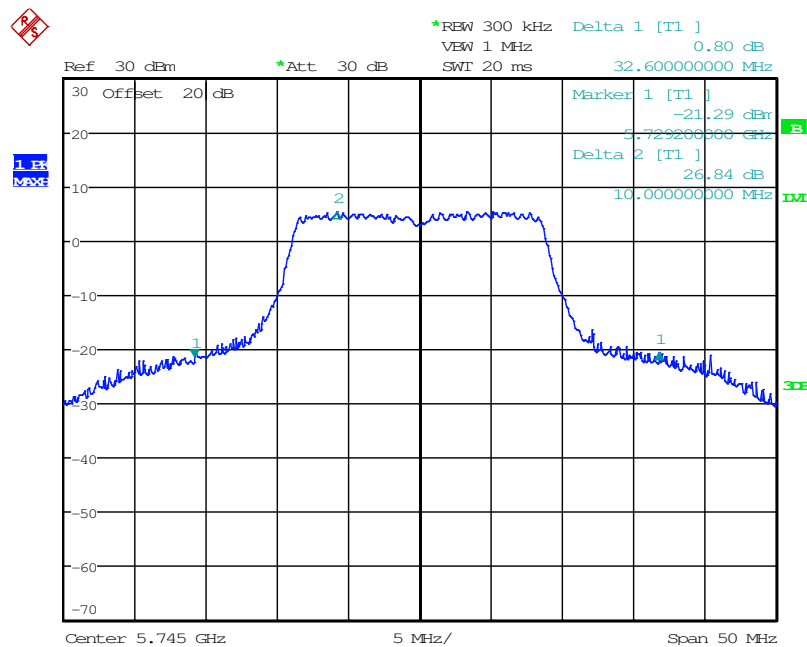
Date: 6.JAN.2016 21:28:24

Figure 7.2.2-44: 6dB BW - Middle Channel



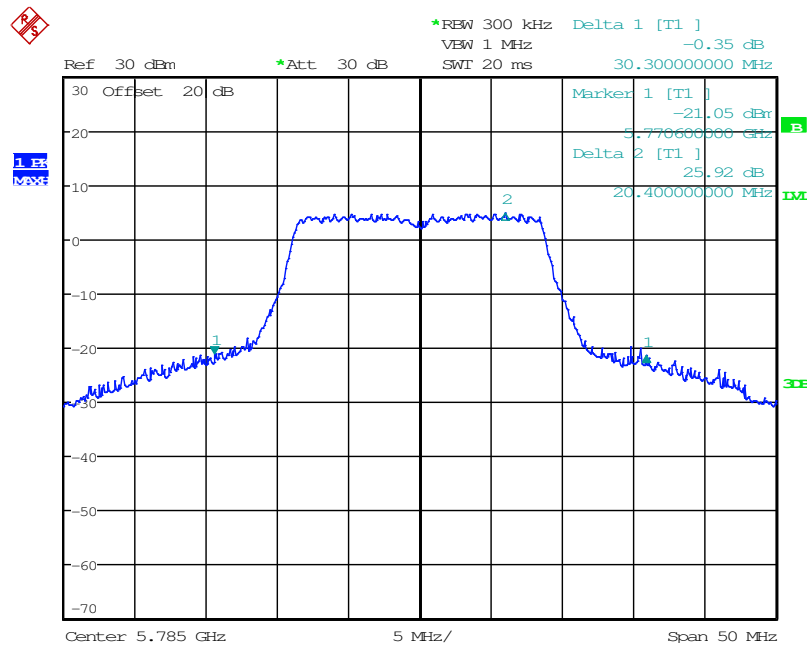
Date: 6.JAN.2016 21:42:19

Figure 7.2.2-45: 6dB BW - High Channel



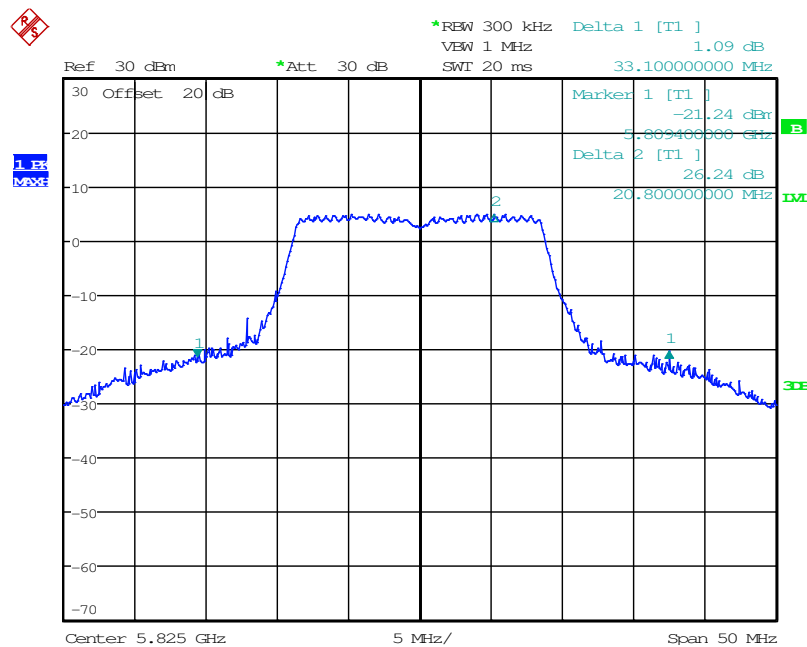
Date: 6.JAN.2016 15:44:35

Figure 7.2.2-46: 26dB BW - Low Channel



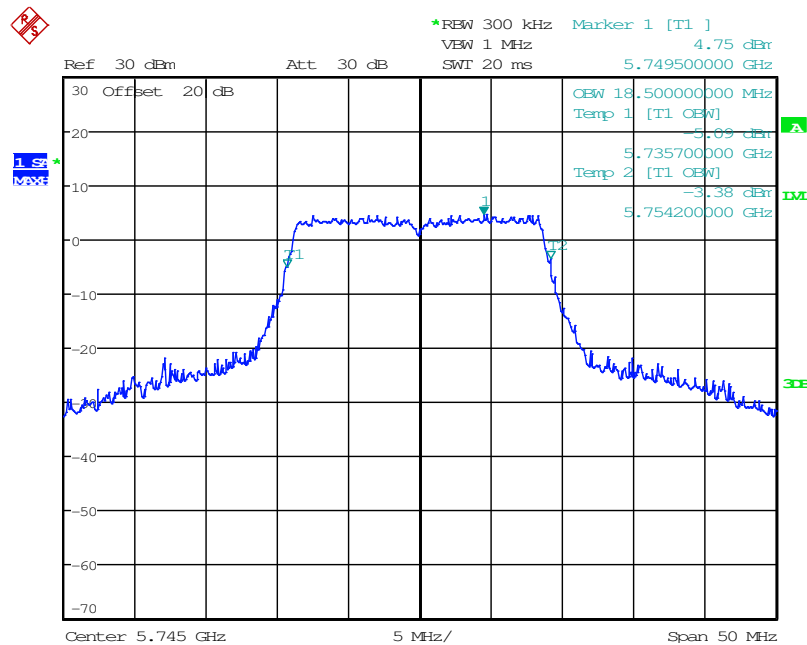
Date: 6.JAN.2016 15:57:45

Figure 7.2.2-47: 26dB BW - Middle Channel



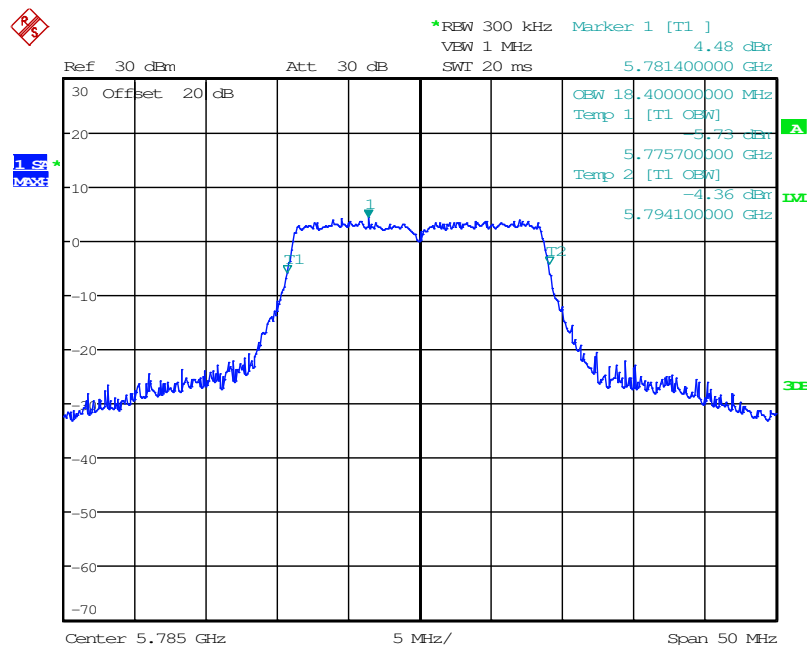
Date: 6.JAN.2016 16:05:19

Figure 7.2.2-48: 26dB BW - High Channel



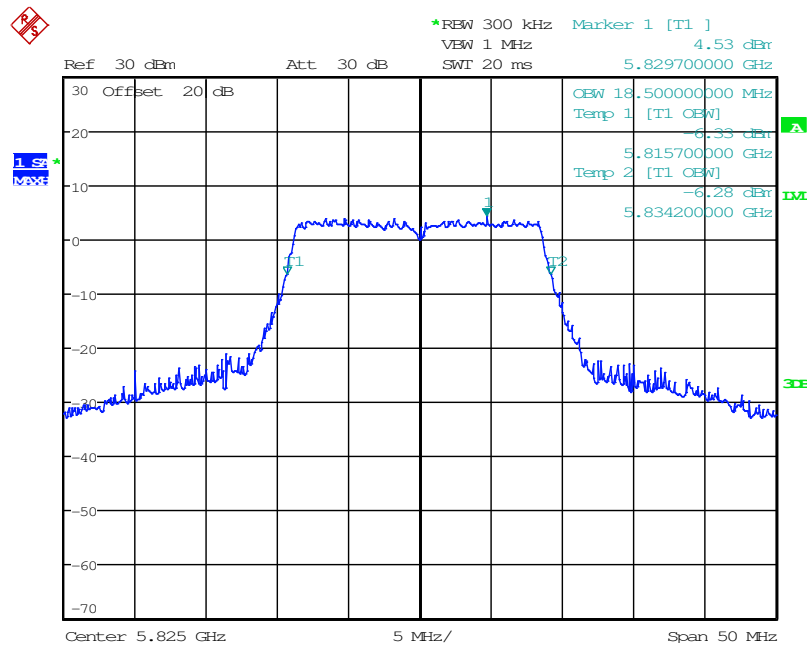
Date: 6.JAN.2016 15:49:27

Figure 7.2.2-49: 99% OBW - Low Channel



Date: 6.JAN.2016 15:53:45

Figure 7.2.2-50: 99% OBW - Middle Channel



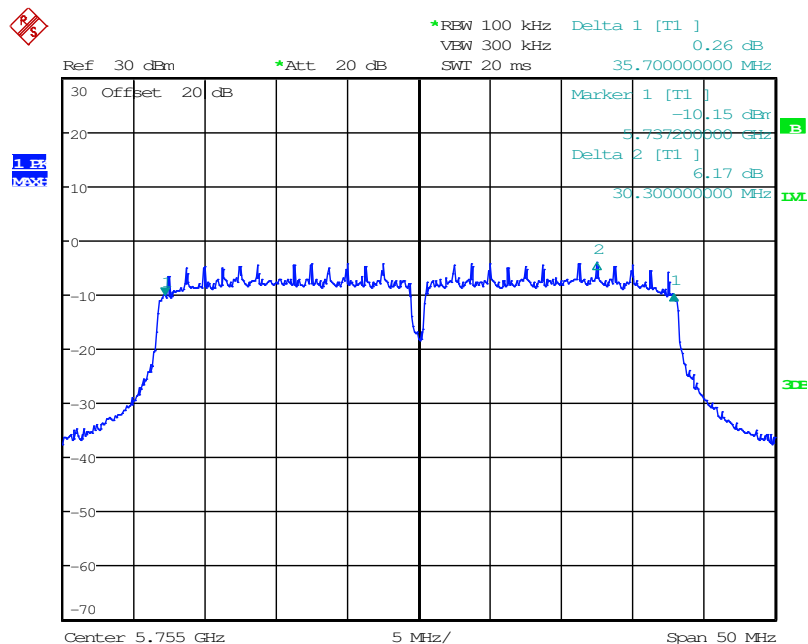
Date: 6.JAN.2016 16:08:53

Figure 7.2.2-51: 99% OBW - High Channel

802.11n 40 MHz

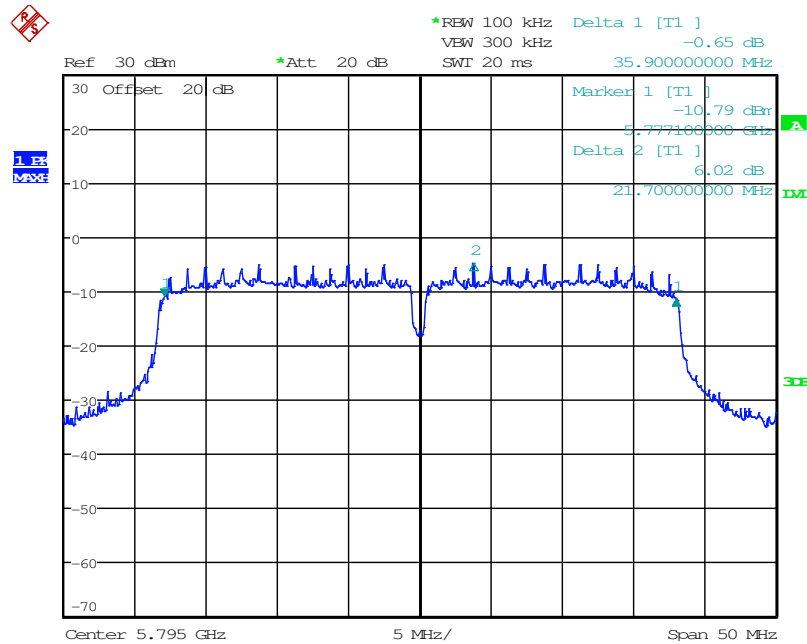
Table 7.2.2-11: 6dB / EBW / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5755	35.7	44.4	37.0
5795	35.9	44.6	37.4



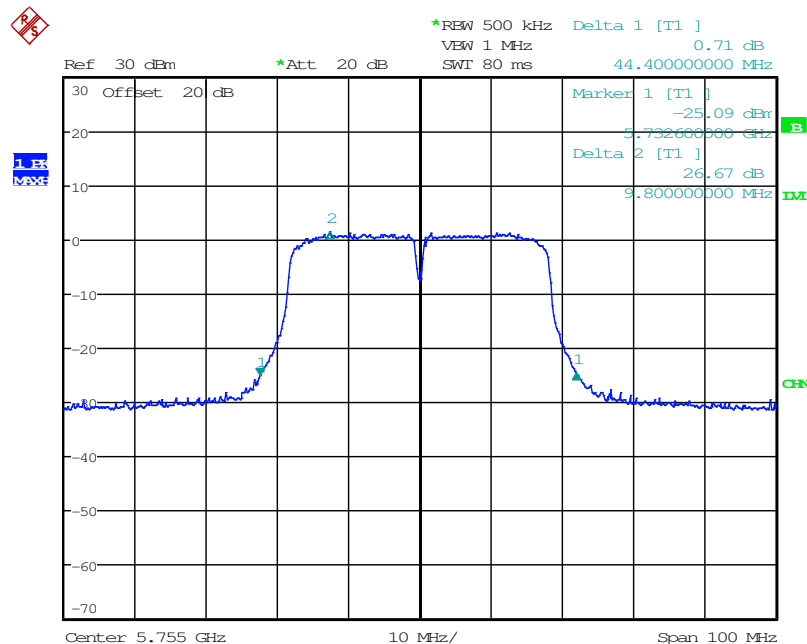
Date: 6.JAN.2016 20:59:22

Figure 7.2.2-52: 6dB BW - Low Channel



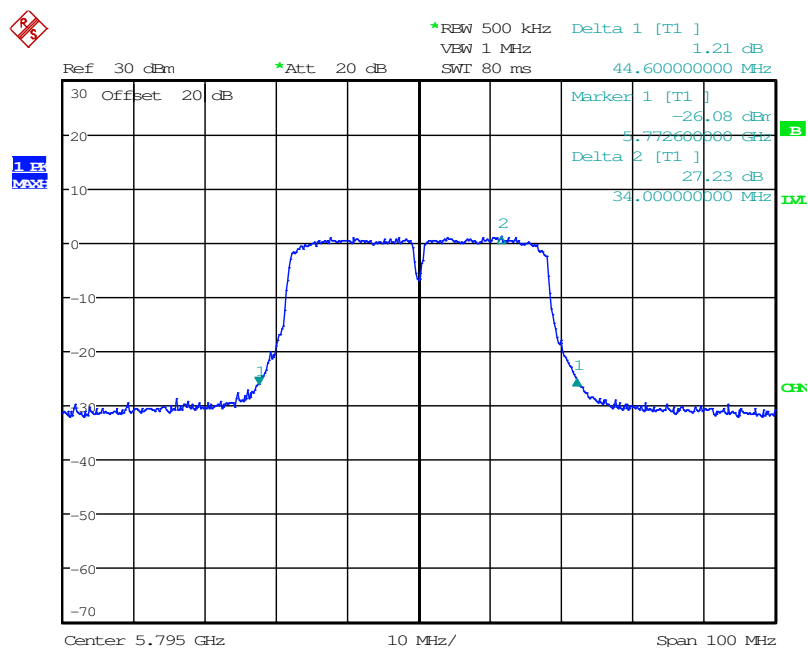
Date: 6.JAN.2016 19:15:12

Figure 7.2.2-53: 6dB BW - High Channel



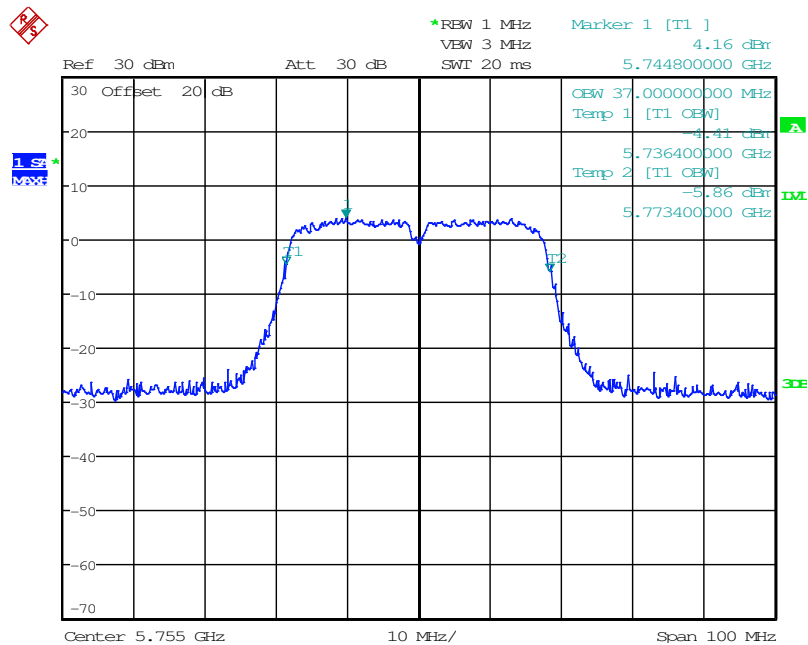
Date: 6.JAN.2016 18:26:16

Figure 7.2.2-54: 26dB BW - Low Channel



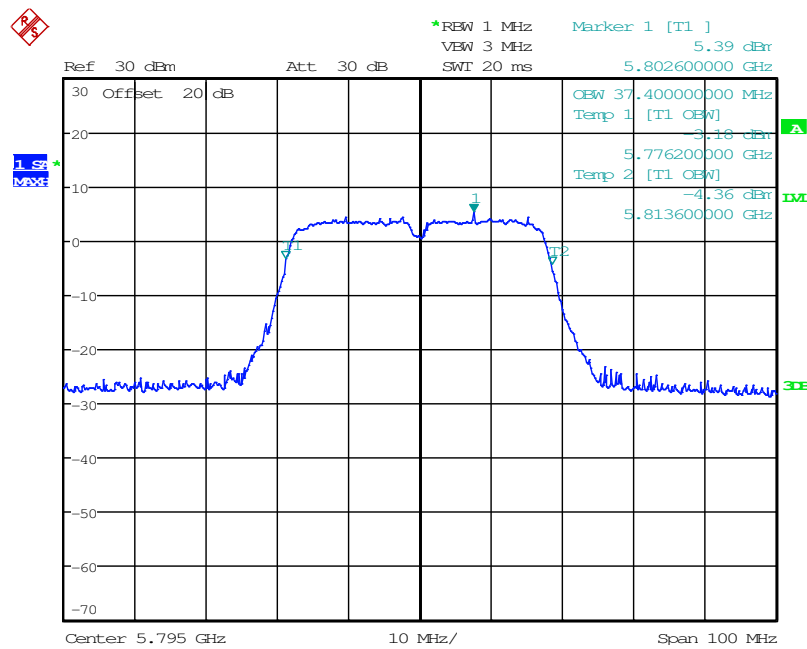
Date: 6.JAN.2016 18:54:48

Figure 7.2.2-55: 26dB BW - High Channel



Date: 6.JAN.2016 18:29:11

Figure 7.2.2-56: 99% OBW - Low Channel



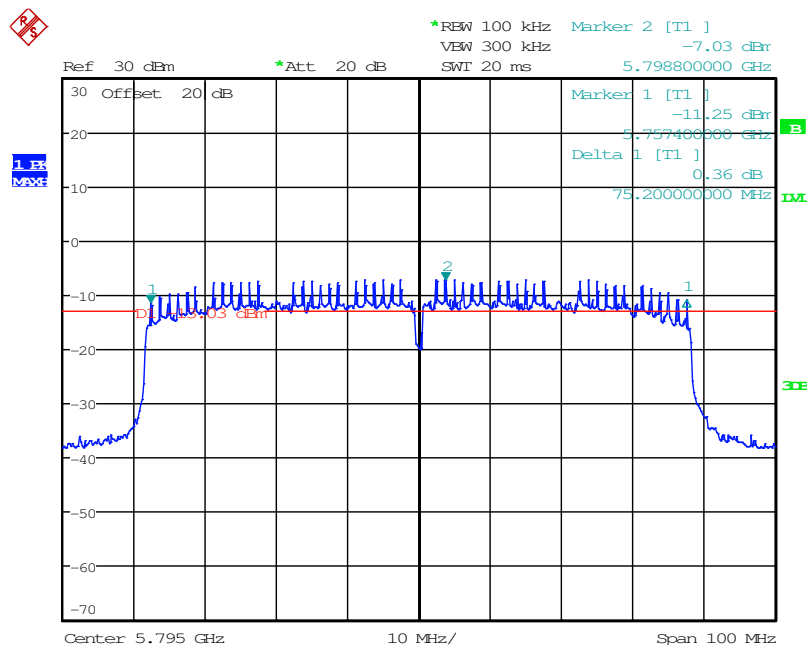
Date: 6.JAN.2016 18:48:38

Figure 7.2.2-57: 99% OBW - High Channel

802.11ac 80 MHz

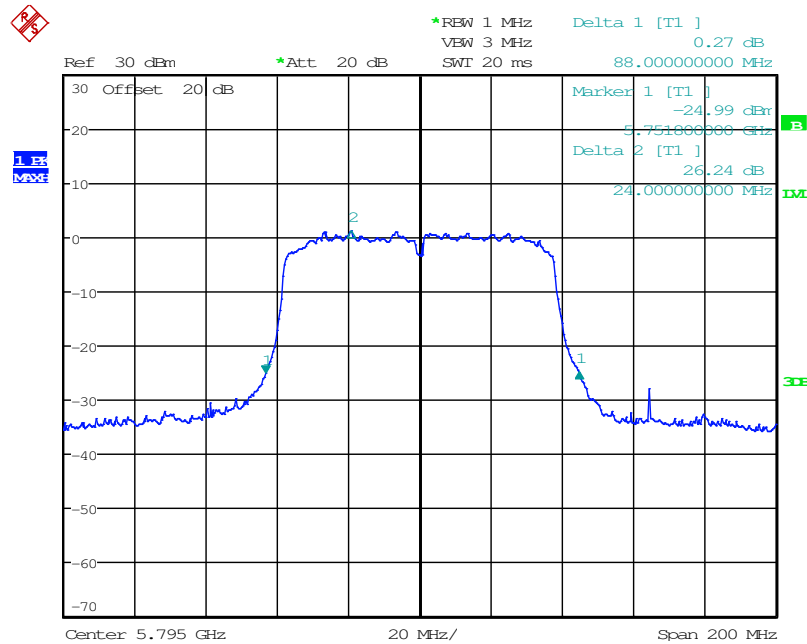
Table 7.2.2-11: 6dB / EBW / 99% Bandwidth

Frequency [MHz]	6dB Bandwidth [MHz]	26dB Bandwidth [MHz]	99% Bandwidth (MHz)
5795	75.2	88.0	75.6



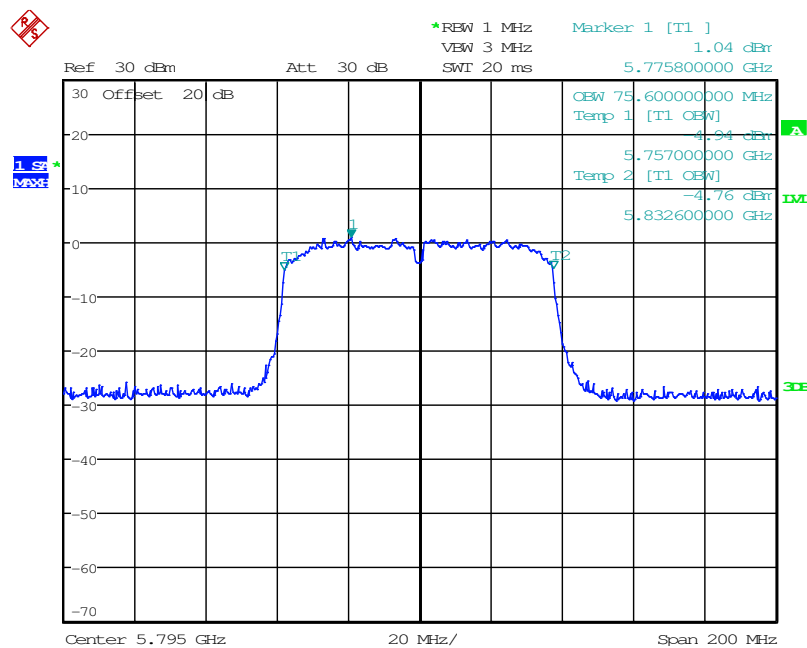
Date: 6.JAN.2016 20:45:18

Figure 7.2.2-58: 6dB BW - Middle Channel



Date: 6.JAN.2016 20:31:01

Figure 7.2.2-59: 26dB BW - Middle Channel



Date: 6.JAN.2016 20:23:28

Figure 7.2.2-60: 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 v01r01 "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E" Method SA-1. 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

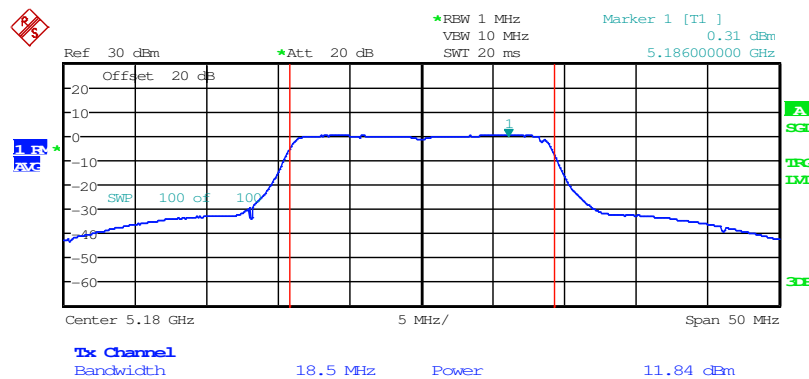
Results are shown below.

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

802.11n 20 MHz

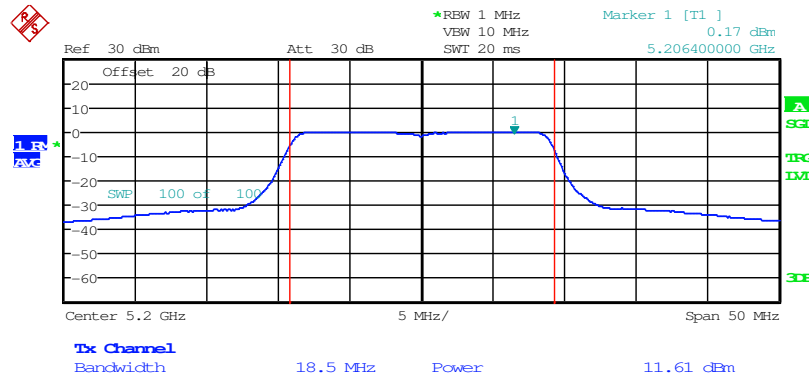
Table 7.3.2-1: RF Output Power

Frequency [MHz]	Level [dBm]
5180	11.84
5200	11.61
5240	11.22



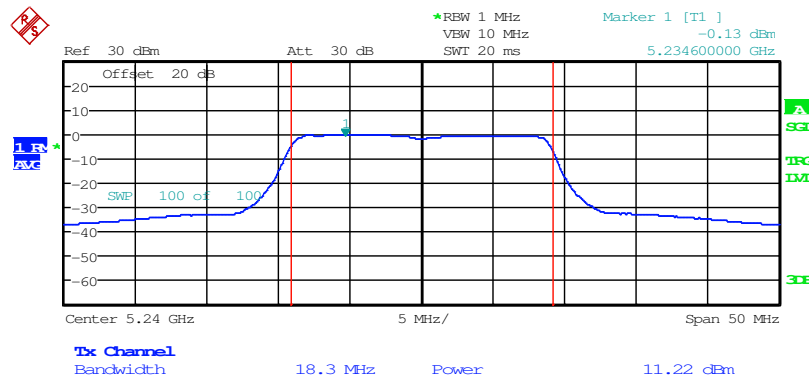
Date: 7.JAN.2016 22:31:57

Figure 7.3.2-1: RF Output Power - Low Channel



Date: 7.JAN.2016 15:43:50

Figure 7.3.2-2: RF Output Power - Middle Channel



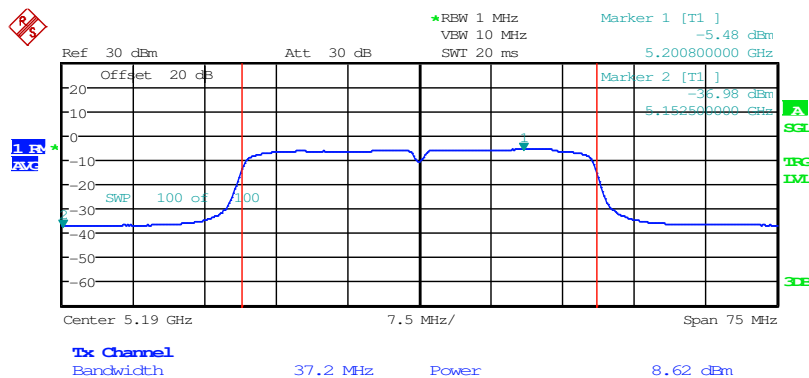
Date: 7.JAN.2016 15:49:37

Figure 7.3.2-3: RF Output Power - High Channel

802.11n 40 MHz

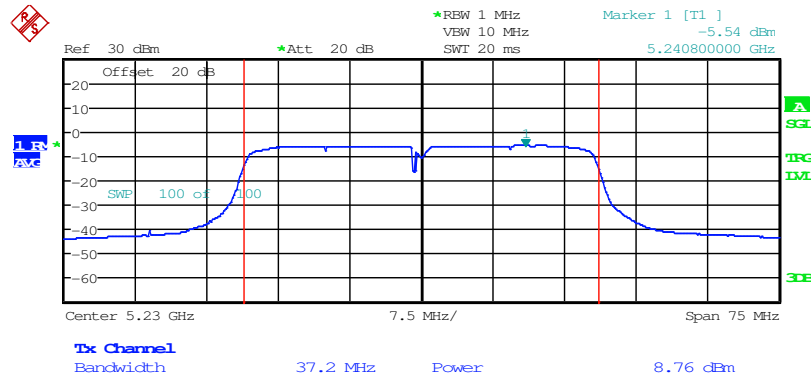
Table 7.3.2-2: RF Output Power

Frequency [MHz]	Level [dBm]
5190	8.62
5230	8.76



Date: 7.JAN.2016 19:47:19

Figure 7.3.2-4: RF Output Power - Low Channel



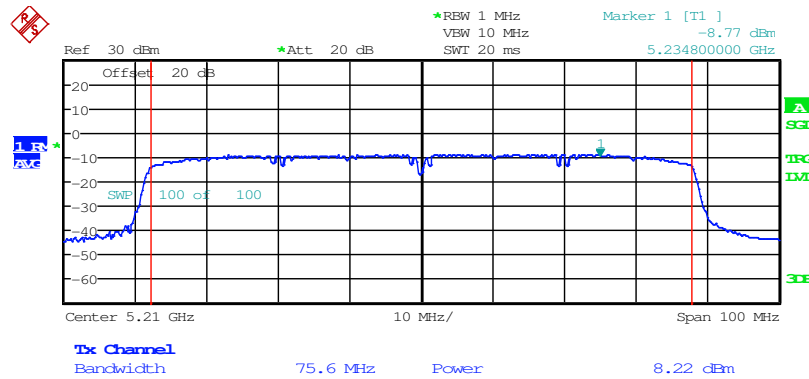
Date: 7.JAN.2016 22:10:47

Figure 7.3.2-5: RF Output Power - High Channel

802.11ac 80 MHz

Table 7.3.2-3: RF Output Power

Frequency [MHz]	Level [dBm]
5210	8.22



Date: 7.JAN.2016 21:46:09

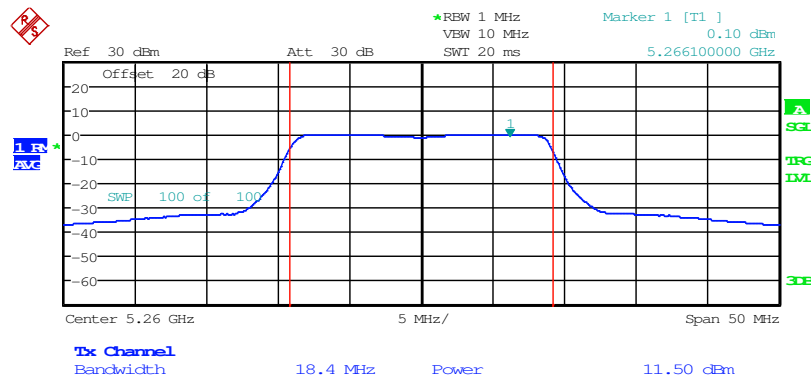
Figure 7.3.2-6: RF Output Power - Middle Channel

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

802.11n 20 MHz

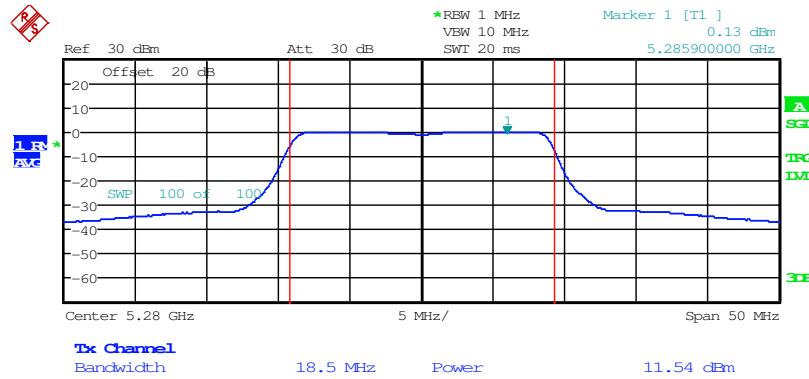
Table 7.3.2-4: RF Output Power

Frequency [MHz]	Level [dBm]
5260	11.50
5280	11.54
5320	11.76



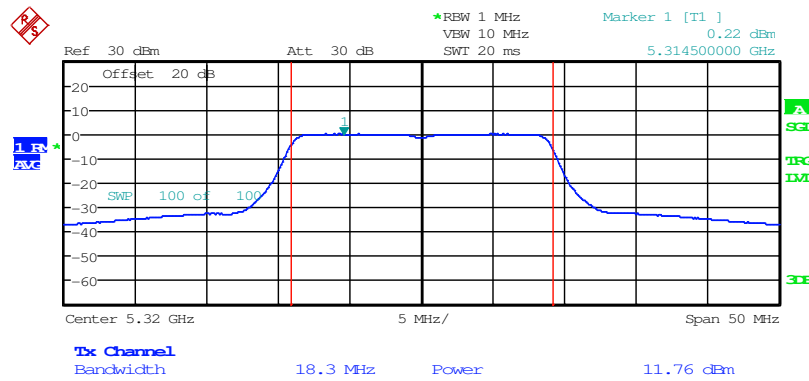
Date: 7.JAN.2016 15:58:18

Figure 7.3.2-7: RF Output Power - Low Channel



Date: 7.JAN.2016 16:00:39

Figure 7.3.2-8: RF Output Power - Middle Channel



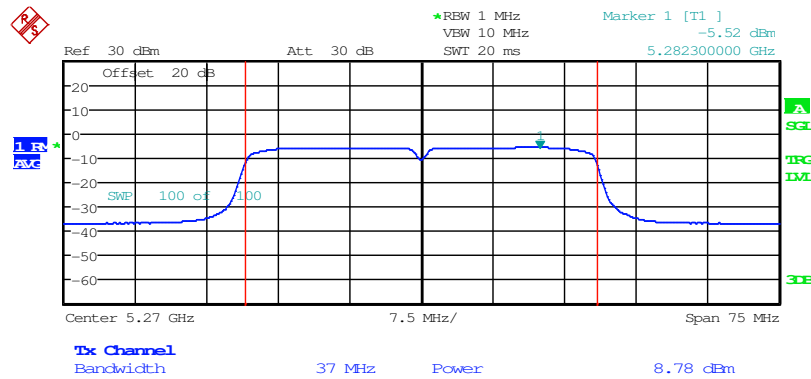
Date: 7.JAN.2016 16:03:05

Figure 7.3.2-9: RF Output Power - High Channel

802.11n 40 MHz

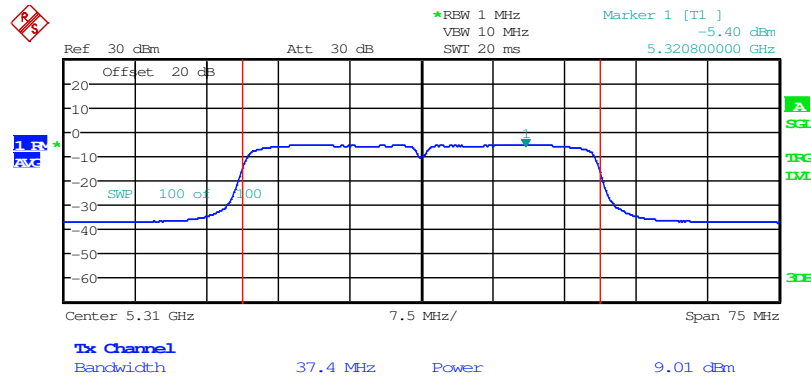
Table 7.3.2-5: RF Output Power

Frequency [MHz]	Level [dBm]
5270	8.78
5310	9.01



Date: 7.JAN.2016 19:59:32

Figure 7.3.2-10: RF Output Power - Low Channel



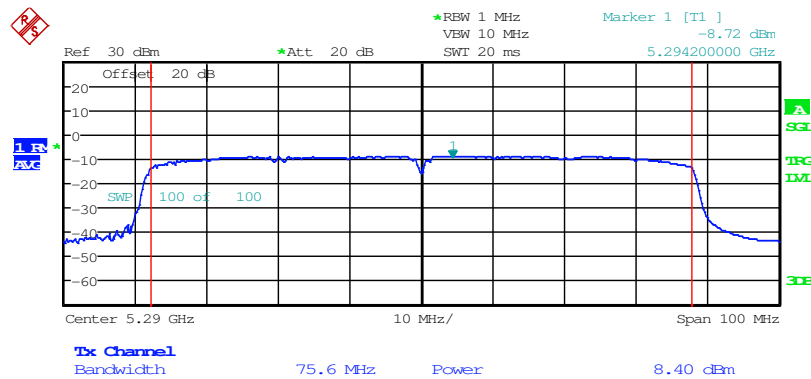
Date: 7.JAN.2016 20:01:42

Figure 7.3.2-11: RF Output Power - High Channel

802.11ac 80 MHz

Table 7.3.2-6: RF Output Power

Frequency [MHz]	Level [dBm]
5290	8.40



Date: 7.JAN.2016 21:43:41

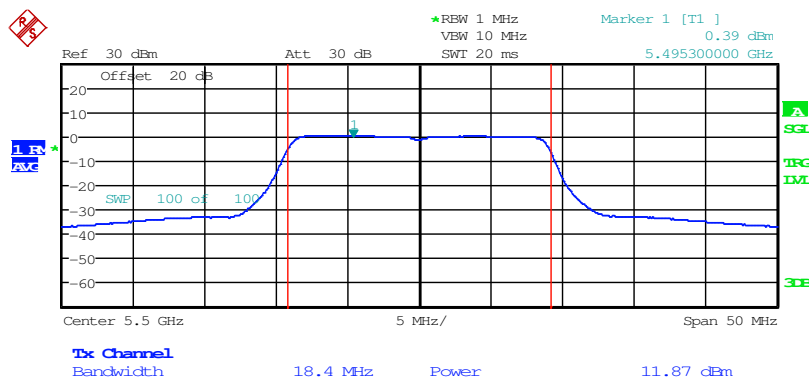
Figure 7.3.2-12: RF Output Power - Middle Channel

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

802.11n 20 MHz

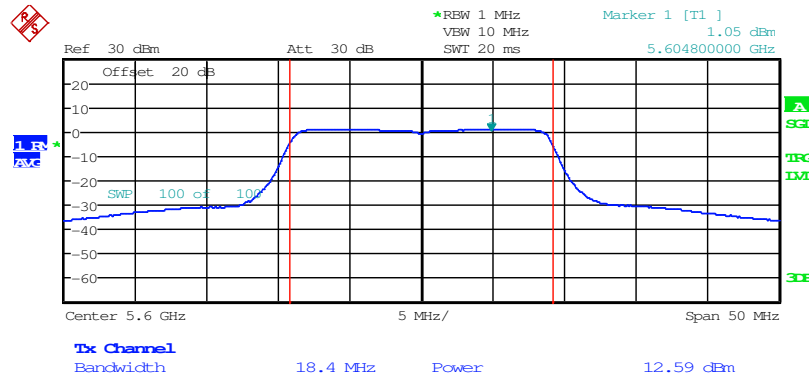
Table 7.3.2-7: RF Output Power

Frequency [MHz]	Level [dBm]
5500	11.87
5600	12.59
5720	11.84



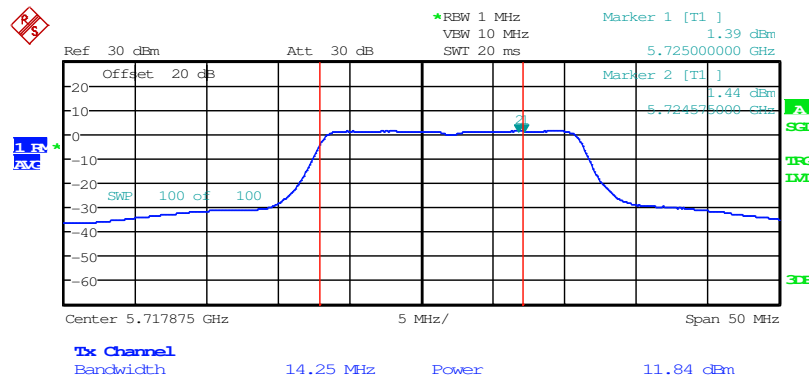
Date: 7.JAN.2016 16:05:03

Figure 7.3.2-13: RF Output Power - Low Channel



Date: 7.JAN.2016 16:06:27

Figure 7.3.2-14: RF Output Power - Middle Channel



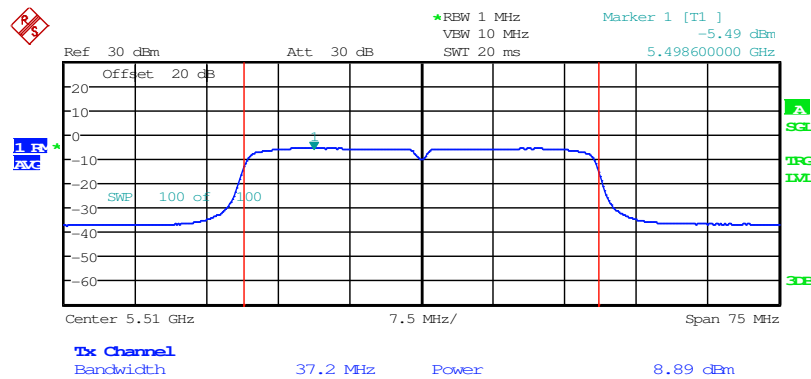
Date: 7.JAN.2016 18:48:45

Figure 7.3.2-15: RF Output Power - High Channel

802.11n 40 MHz

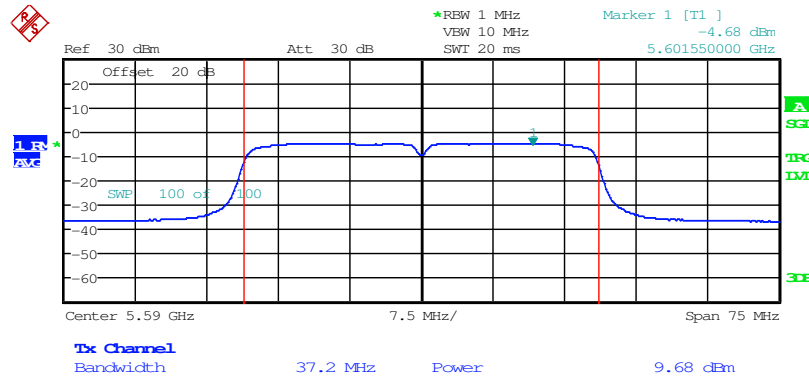
Table 7.3.2-8: RF Output Power

Frequency [MHz]	Level [dBm]
5510	8.89
5590	9.68
5710	9.72



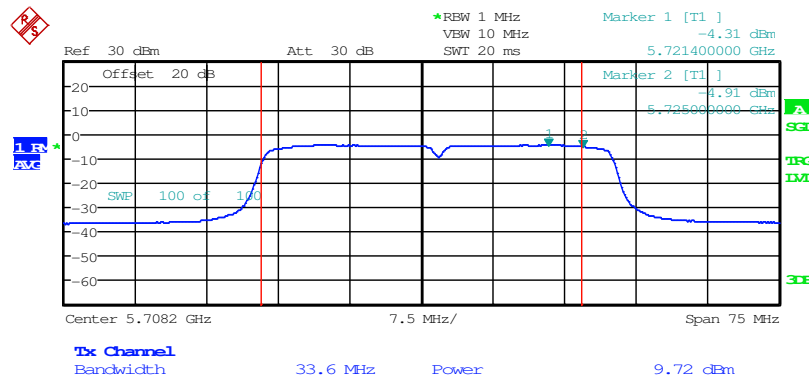
Date: 7.JAN.2016 20:15:29

Figure 7.3.2-16: RF Output Power - Low Channel



Date: 7.JAN.2016 20:22:37

Figure 7.3.2-17: RF Output Power - Middle Channel



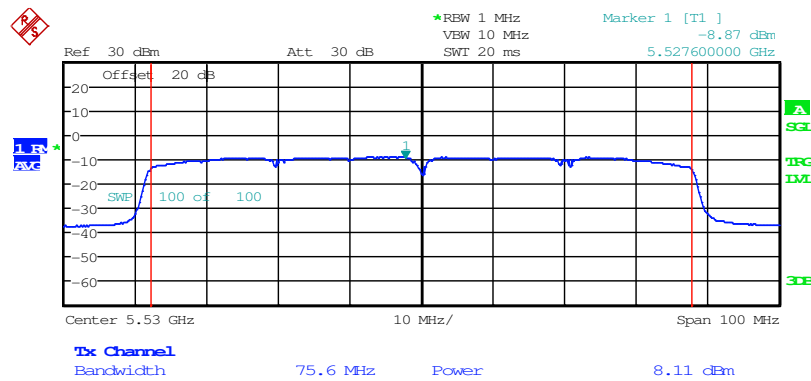
Date: 7.JAN.2016 20:32:39

Figure 7.3.2-18: RF Output Power - High Channel

802.11ac 80 MHz

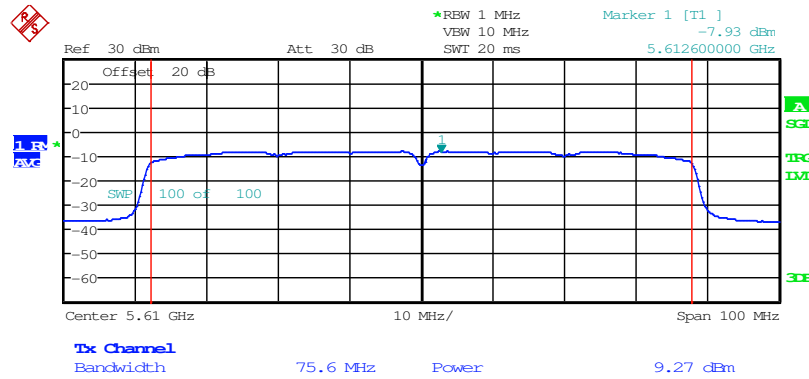
Table 7.3.2-9: RF Output Power

Frequency [MHz]	Level [dBm]
5530	8.11
5610	9.27
5690	9.22



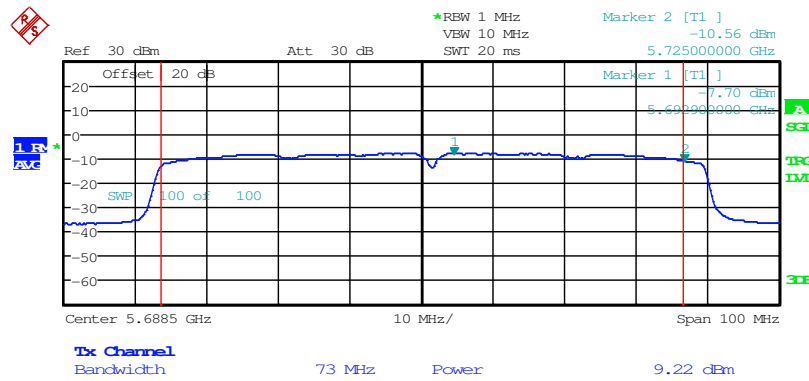
Date: 7.JAN.2016 21:25:07

Figure 7.3.2-19: RF Output Power - Low Channel



Date: 7.JAN.2016 21:22:19

Figure 7.3.2-20: RF Output Power - Middle Channel



Date: 7.JAN.2016 21:14:12

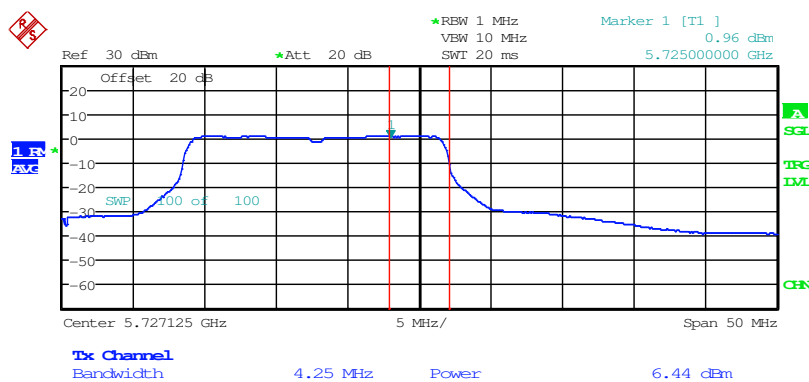
Figure 7.3.2-21: RF Output Power - High Channel

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

802.11n 20 MHz

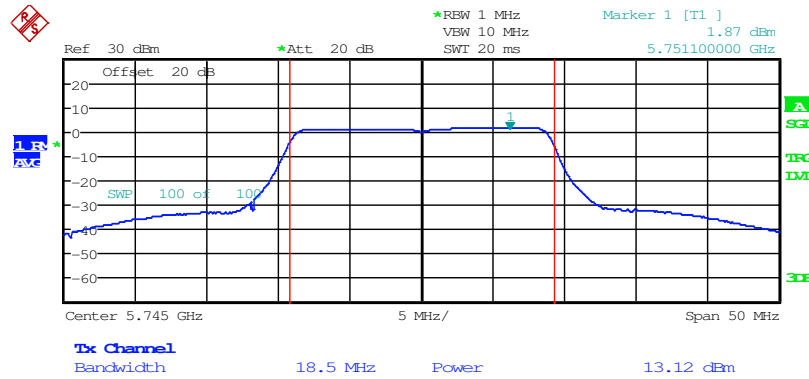
Table 7.3.2-10: RF Output Power

Frequency [MHz]	Level [dBm]
5720	6.44
5745	13.12
5785	12.55
5825	12.67



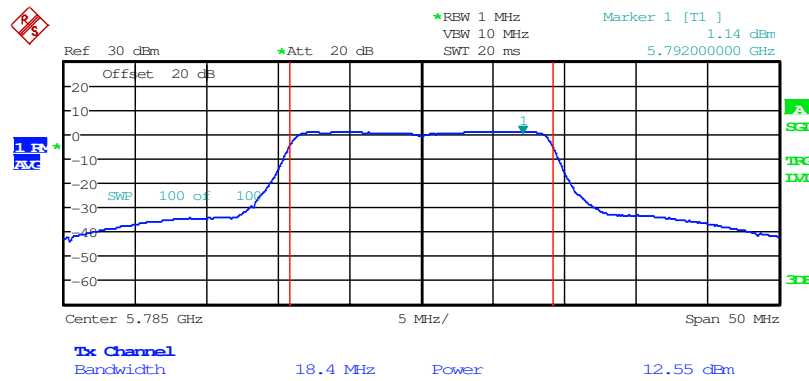
Date: 7.JAN.2016 22:41:32

Figure 7.3.2-22: RF Output Power – TX = 5720 MHz



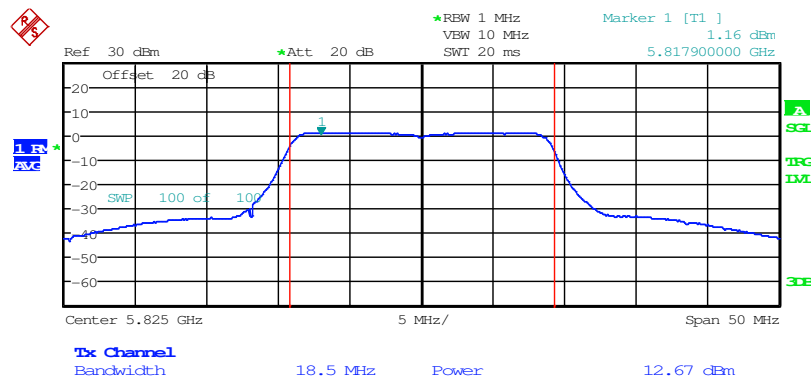
Date: 7.JAN.2016 22:27:45

Figure 7.3.2-23: RF Output Power - Low Channel



Date: 7.JAN.2016 22:20:55

Figure 7.3.2-24: RF Output Power - Middle Channel



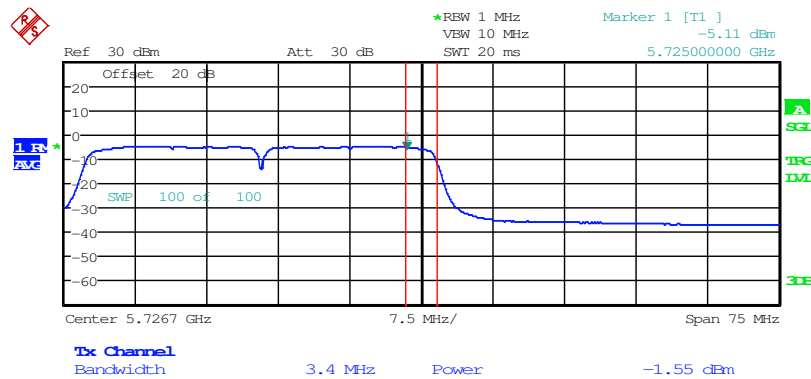
Date: 7.JAN.2016 22:16:37

Figure 7.3.2-25: RF Output Power - High Channel

802.11n 40 MHz

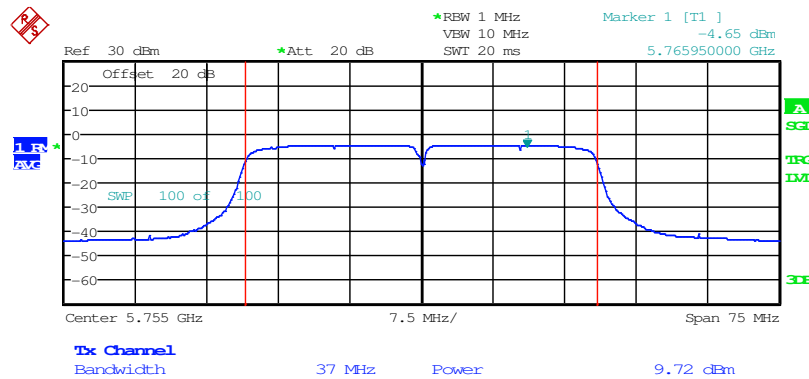
Table 7.3.2-11: RF Output Power

Frequency [MHz]	Level [dBm]
5710	-1.55
5755	9.72
5795	9.76



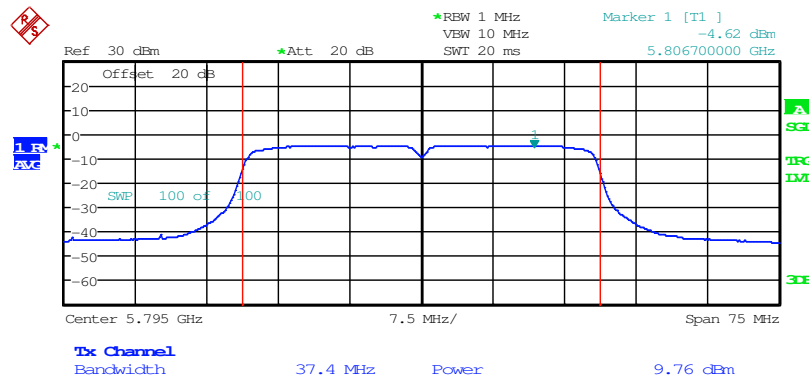
Date: 7.JAN.2016 20:35:51

Figure 7.3.2-26: RF Output Power – TX = 5710 MHz



Date: 7.JAN.2016 22:06:25

Figure 7.3.2-27: RF Output Power - Low Channel



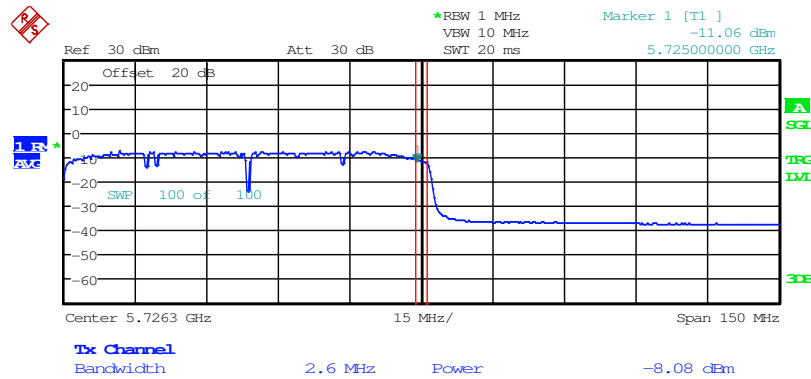
Date: 7.JAN.2016 22:01:09

Figure 7.3.2-28: RF Output Power - High Channel

802.11ac 80 MHz

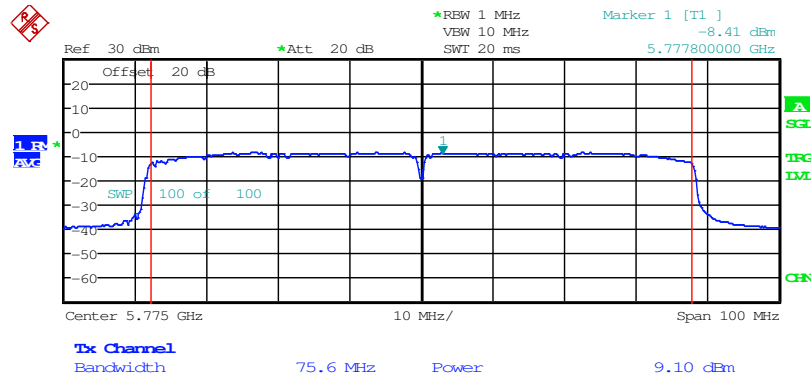
Table 7.3.2-12: RF Output Power

Frequency [MHz]	Level [dBm]
5690	-8.08
5775	9.10



Date: 7.JAN.2016 21:17:59

Figure 7.3.2-29: RF Output Power – TX = 5690 MHz



Date: 7.JAN.2016 21:56:21

Figure 7.3.2-30: 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 v01 "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) IC: RSS-247 6.2.1 Band 5.15 – 5.25 GHz

802.11n 20 MHz

Table 7.4.2-1: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5180	0.31	11	10.69
5200	0.17	11	10.83
5240	-0.13	11	11.13

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

802.11n 40 MHz

Table 7.4.2-2: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5190	-5.48	11	16.48
5230	-5.54	11	16.54

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

802.11ac 80 MHz

Table 7.4.2-3: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5210	-8.77	11	19.77

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

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

802.11n 20 MHz

Table 7.4.2-4: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5260	0.10	11	10.90
5280	0.13	11	10.87
5320	0.22	11	10.78

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

802.11n 40 MHz

Table 7.4.2-5: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5270	-5.52	11	16.52
5310	-5.40	11	16.40

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

802.11ac 80 MHz

Table 7.4.2-6: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5290	-8.72	11	19.72

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

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

802.11n 20 MHz

Table 7.4.2-7: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5500	0.39	11	10.61
5600	1.05	11	9.95
5720	1.39	11	9.61

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

802.11n 40 MHz

Table 7.4.2-8: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5510	-5.49	11	16.49
5590	-4.68	11	15.68
5710	-4.31	11	15.31

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

802.11ac 80 MHz

Table 7.4.2-9: Power Spectral Density

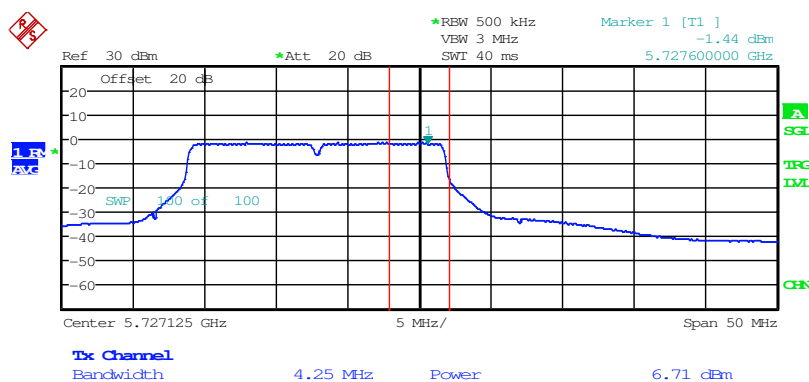
Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5530	-8.87	11	19.87
5610	-7.93	11	18.93
5690	-10.56	11	21.56

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

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

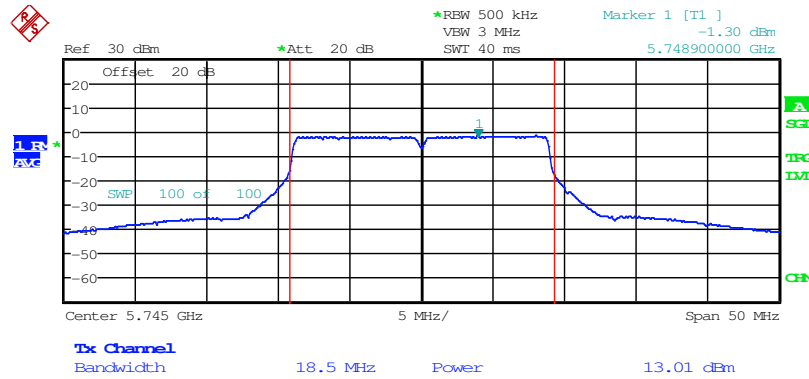
Table 7.4.2-10: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5720	-1.44	30	31.44
5745	-1.30	30	31.30
5785	-2.15	30	32.15
5825	-2.17	30	32.17



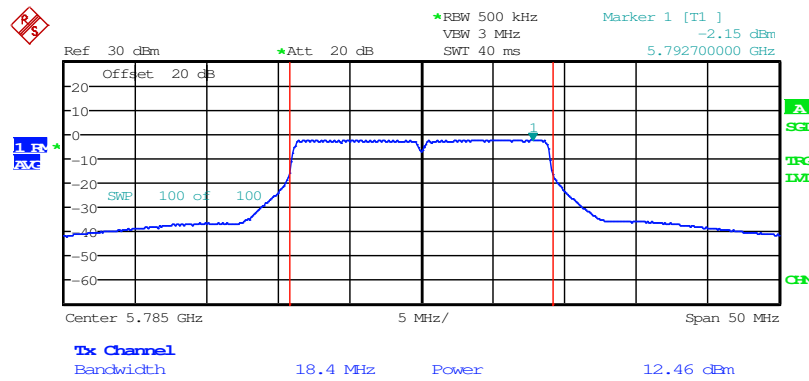
Date: 7.JAN.2016 22:42:37

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



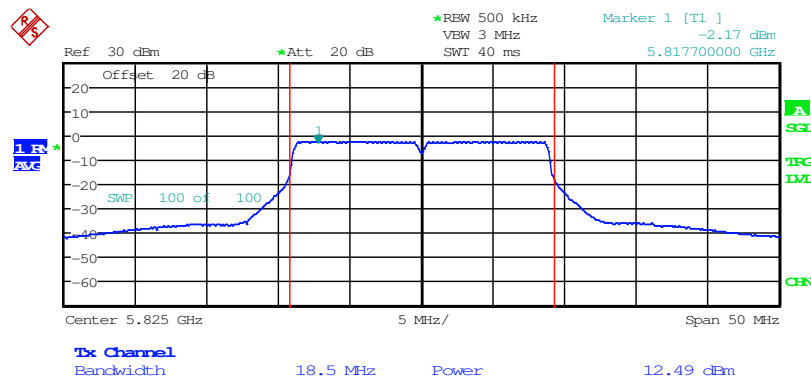
Date: 7.JAN.2016 22:28:55

Figure 7.4.2-2: Power Spectral Density - Low Channel



Date: 7.JAN.2016 22:19:57

Figure 7.4.2-3: Power Spectral Density - Middle Channel



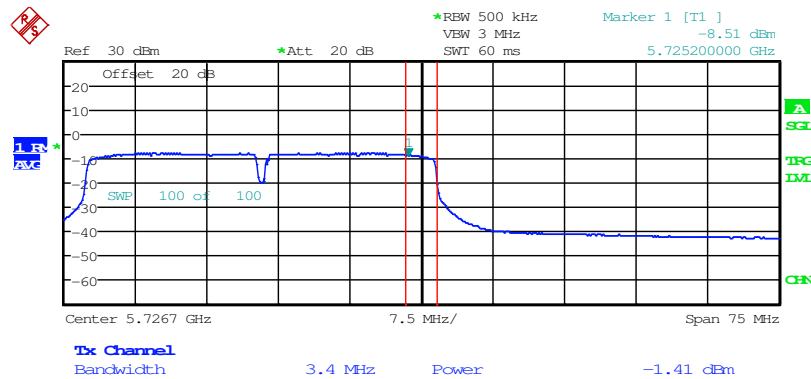
Date: 7.JAN.2016 22:17:49

Figure 7.4.2.4: Power Spectral Density – High Channel

802.11n 40 MHz

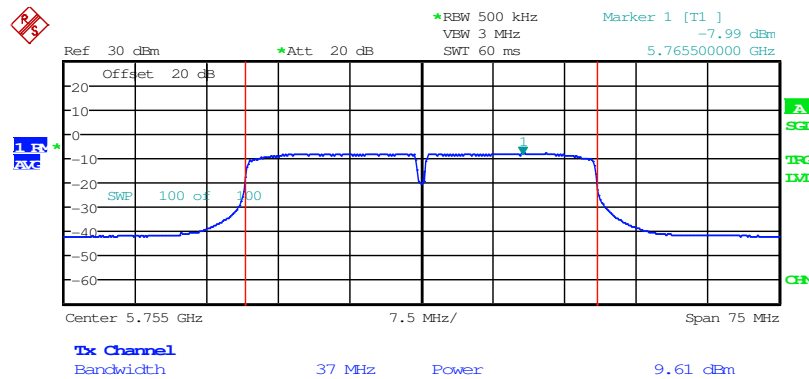
Table 7.5.2-11: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5710	-8.51	30	38.51
5755	-7.99	30	37.99
5795	-7.95	30	37.95



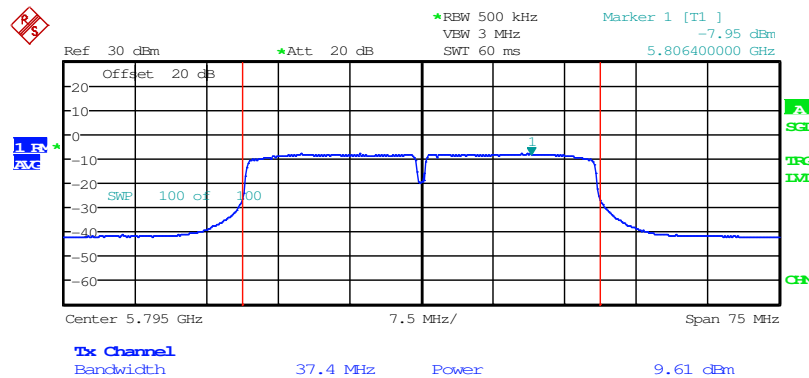
Date: 7.JAN.2016 22:45:20

Figure 7.4.2-5: Power Spectral Density – TX = 5710 MHz



Date: 7.JAN.2016 22:04:28

Figure 7.4.2-6: Power Spectral Density - Low Channel



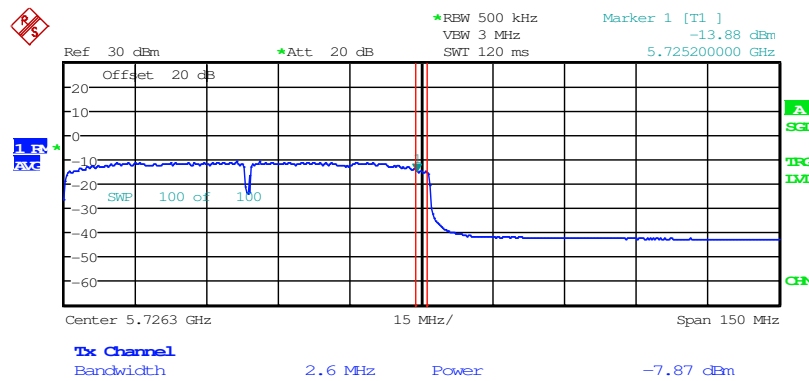
Date: 7.JAN.2016 22:02:35

Figure 7.5.2-7: Power Spectral Density – High Channel

802.11ac 80 MHz

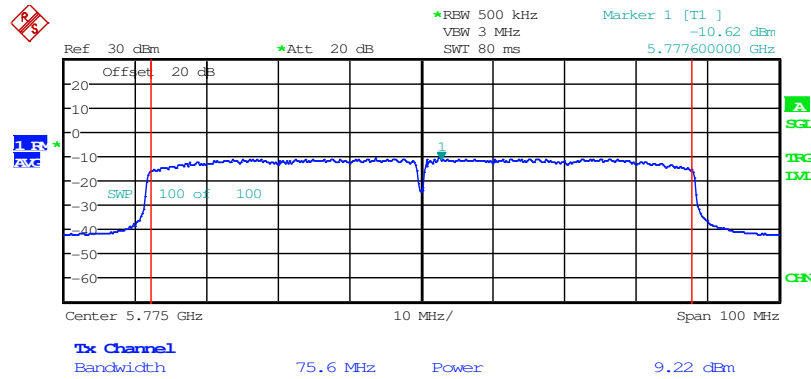
Table 7.5.2-12: Power Spectral Density

Frequency (MHz)	PSD (dBm)	Limit (dBm)	Margin (dB)
5690	-13.88	30	43.88
5775	-10.62	30	40.62



Date: 7.JAN.2016 22:50:56

Figure 7.4.2-8: Power Spectral Density – TX = 5690 MHz



Date: 7.JAN.2016 21:54:00

Figure 7.4.2-9: Power Spectral Density - Middle Channel

7.5 Band-Edge Compliance and Spurious Emissions-FCC 15.407(b) IC: RSS-247 6.2

7.5.1 Radiated Emissions below 1 GHz

7.5.1.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 9 kHz to 1 GHz.

For measurements below 30 MHz, the receive antenna height was set to 1m and the EUT was rotated through 360 degrees. The resolution bandwidth was set to 200 Hz below 150 kHz and to 9 kHz above 150 kHz.

For frequencies from 30 MHz to 1000 MHz, quasi-peak measurements were made using a resolution bandwidth RBW of 120 kHz and a video bandwidth VBW of 300 kHz. The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected.

7.5.1.2 Measurement Results

The highest radiated emissions with respect to the limits found in from 9 kHz to 1 GHz are reported in the tables below.

Table 7.5.1.2-1: Radiated Emissions Below 1 GHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
61.9844	49.57	46.57	H	-18.38	-----	28.19	-----	40.0	-----	11.8
71.9941	49.64	48.48	H	-18.98	-----	29.50	-----	40.0	-----	10.5
95.8684	47.34	44.62	H	-18.84	-----	25.78	-----	43.5	-----	17.7
119.991	50.91	49.54	H	-16.37	-----	33.17	-----	43.5	-----	10.3
167.992	46.33	44.43	H	-13.70	-----	30.73	-----	43.5	-----	12.8
215.989	45.36	42.78	H	-16.04	-----	26.74	-----	43.5	-----	16.8
35.043	49.83	44.78	V	-15.13	-----	29.65	-----	40.0	-----	10.3
41.9718	45.66	39.74	V	-16.00	-----	23.74	-----	40.0	-----	16.3
47.9368	51.40	44.11	V	-16.79	-----	27.32	-----	40.0	-----	12.7
134.416	46.80	43.69	V	-15.15	-----	28.54	-----	43.5	-----	15.0
168.002	42.99	40.02	V	-13.70	-----	26.32	-----	43.5	-----	17.2
472.499	45.53	43.46	V	-8.30	-----	35.16	-----	46.0	-----	10.8
994.313	26.54	22.20	V	0.27	-----	22.47	-----	54.0	-----	31.5

Note: The data reported corresponds to the worst case configuration which was achieved for the EUT operating at channel 42 in the 802.11ac (VHT80) mode.

7.5.2 Radiated Spurious Emissions above 1 GHz

7.5.2.1 Measurement Procedure

Radiated emissions tests were made over the frequency range of 1 GHz to 40 GHz. Each emission found to be in a restricted band as defined by section 15.205, including any emission at the operational band-edge, was compared to the radiated emission limits as defined in section 15.209. The other emissions were evaluated either per the general radiated emission limits of FCC Section 15.209 or the limits of FCC Section 15.407(b) / IC RSS-247 6.2. The EIRP limits of FCC Section 15.407(b) / IC RSS-247 6.2 were converted to field strength limits using a correction factor of 95.2 dB.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Peak measurements are made with RBW of 1 MHz and VBW of 3 MHz. Average measurements are performed in the linear scale using an RMS detector averaged over 100 sweeps.

7.5.2.2 Measurement Results

Radiated band-edge and spurious emissions found within or outside of the restricted frequency bands from 1 GHz to 40 GHz are reported in the tables below.

Band 5.15-5.25 GHz

Table 7.5.2.2-1: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 5180 MHz										
5150	56.68	40.18	H	9.56	66.24	49.74	74.0	54.0	7.8	4.3
5150	51.29	38.27	V	9.56	60.85	47.83	74.0	54.0	13.2	6.2
10360	45.96	-----	H	17.63	63.59	-----	77.7	-----	14.1	-----
10360	47.59	-----	V	17.63	65.22	-----	77.7	-----	12.5	-----
Middle Channel 5200 MHz										
10400	51.56	-----	H	17.75	69.31	-----	77.7	-----	8.4	-----
10400	50.62	-----	V	17.75	68.37	-----	77.7	-----	9.3	-----
High Channel 5240 MHz										
10480	49.13	-----	H	18.00	67.13	-----	77.7	-----	10.6	-----
10480	52.21	-----	V	18.00	70.21	-----	77.7	-----	7.5	-----

Notes:

- All emissions above 10.48 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-2: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 5190 MHz										
5150	60.40	43.07	H	9.56	69.96	52.63	74.0	54.0	4.0	1.4
5150	57.57	43.05	V	9.56	67.13	52.61	74.0	54.0	6.9	1.4
10380	49.67	-----	H	17.69	67.36	-----	77.7	-----	10.3	-----
10380	45.71	-----	V	17.69	63.40	-----	77.7	-----	14.3	-----
High Channel 5230 MHz										
10460	45.36	-----	H	17.94	63.30	-----	77.7	-----	14.4	-----
10460	46.53	-----	V	17.94	64.47	-----	77.7	-----	13.2	-----

Notes:

- All emissions above 10.46 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-3: Radiated Spurious Emissions Tabulated Data – 802.11ac 80 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Middle Channel 5210 MHz										
5150	51.60	39.40	H	9.56	61.16	48.96	74.0	54.0	12.8	5.0
5150	50.57	38.33	V	9.56	60.13	47.89	74.0	54.0	13.9	6.1
10420	42.32	-----	H	17.82	60.14	-----	77.7	-----	17.6	-----
10420	44.84	-----	V	17.82	62.66	-----	77.7	-----	15.0	-----

Notes:

- All emissions above 10.42 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Band 5.25-5.35 GHz

Table 7.5.2.2-4: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 5260 MHz										
10520	51.13	-----	H	18.12	69.25	-----	77.7	-----	8.4	-----
10520	52.70	-----	V	18.12	70.82	-----	77.7	-----	6.9	-----
Middle Channel 5280 MHz										
10560	53.62	-----	H	18.23	71.85	-----	77.7	-----	5.8	-----
10560	52.88	-----	V	18.23	71.11	-----	77.7	-----	6.6	-----
High Channel 5320 MHz										
5350	60.03	42.98	H	9.98	70.01	52.96	74.0	54.0	4.0	1.0
5350	55.56	40.78	V	9.98	65.54	50.76	74.0	54.0	8.5	3.2
10640	51.01	38.55	H	18.46	69.47	57.01	83.5	63.5	14.0	6.5
10640	48.90	36.55	V	18.46	67.36	55.01	83.5	63.5	16.1	8.5

Notes:

- All emissions above 10.64 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-5: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 5270 MHz										
10540	49.71	-----	H	18.18	67.89	-----	77.7	-----	9.8	-----
10540	47.82	-----	V	18.18	66.00	-----	77.7	-----	11.7	-----
High Channel 5310 MHz										
5350	53.81	41.05	H	9.98	63.79	51.03	74.0	54.0	10.2	3.0
5350	52.87	40.76	V	9.98	62.85	50.74	74.0	54.0	11.1	3.3
10620	43.17	31.20	H	18.40	61.57	49.60	83.5	63.5	21.9	13.9
10620	41.87	29.95	V	18.40	60.27	48.35	83.5	63.5	23.2	15.1

Notes:

- All emissions above 10.62 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-6: Radiated Spurious Emissions Tabulated Data – 802.11ac 80 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
	Middle Channel 5290 MHz									
5350	53.66	41.24	H	9.98	63.64	51.22	74.0	54.0	10.4	2.8
5350	52.96	40.83	V	9.98	62.94	50.81	74.0	54.0	11.1	3.2
10580	47.30	-----	H	18.29	65.59	-----	77.7	-----	12.1	-----
10580	43.26	-----	V	18.29	61.55	-----	77.7	-----	16.2	-----

Notes:

- All emissions above 10.58 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Band 5.47-5.725 GHz

Table 7.5.2.2-7: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 5500 MHz										
5448	51.13	39.54	H	10.19	61.32	49.73	74.0	54.0	12.7	4.3
5448	49.2	38.53	V	10.19	59.39	48.72	74.0	54.0	14.6	5.3
5460	51.64	38.39	H	10.22	61.86	48.61	74.0	54.0	12.1	5.4
5460	49.70	37.47	V	10.22	59.92	47.69	74.0	54.0	14.1	6.3
5470	55.47	-----	H	10.24	65.71	-----	68.2	-----	2.5	-----
5470	55.9	-----	V	10.24	66.14	-----	68.2	-----	2.1	-----
11000	49.04	37.42	H	19.47	68.51	56.89	83.5	63.5	15.0	6.6
11000	45.42	33.63	V	19.47	64.89	53.10	83.5	63.5	18.6	10.4
Middle Channel 5600 MHz										
11200	46.19	35.38	H	20.06	66.25	55.44	83.5	63.5	17.3	8.1
11200	45.79	35.03	V	20.06	65.85	55.09	83.5	63.5	17.7	8.4
High Channel 5720 MHz										
11440	46.95	36.28	H	20.76	67.71	57.04	83.5	63.5	15.8	6.5
11440	46.50	36.52	V	20.76	67.26	57.28	83.5	63.5	16.2	6.2

Notes:

- All emissions above 11.44 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-8: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 5510 MHz										
5460	48.45	36.50	H	10.22	58.67	46.72	74.0	54.0	15.3	7.3
5460	47.14	36.36	V	10.22	57.36	46.58	74.0	54.0	16.6	7.4
5470	53.75	-----	H	10.24	63.99	-----	68.2	-----	4.2	-----
5470	51.78	-----	V	10.24	62.02	-----	68.2	-----	6.2	-----
11020	41.01	28.99	H	19.52	60.53	48.51	83.5	63.5	23.0	15.0
11020	40.79	29.06	V	19.52	60.31	48.58	83.5	63.5	23.2	14.9
Middle Channel 5590 MHz										
11180	41.18	28.58	H	20.00	61.18	48.58	83.5	63.5	22.3	14.9
11180	42.05	29.46	V	20.00	62.05	49.46	83.5	63.5	21.5	14.0
High Channel 5710 MHz										
11420	45.12	33.36	H	20.70	65.82	54.06	83.5	63.5	17.7	9.4
11420	45.87	33.96	V	20.70	66.57	54.66	83.5	63.5	16.9	8.8

Notes:

- All emissions above 11.42 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-9: Radiated Spurious Emissions Tabulated Data – 802.11ac 80 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 5530 MHz										
5460	53.18	40.96	H	10.22	63.40	51.18	74.0	54.0	10.6	2.8
5460	52.95	40.52	V	10.22	63.17	50.74	74.0	54.0	10.8	3.3
5470	53.18	-----	H	10.24	63.42	-----	68.2	-----	4.8	-----
5470	53.23	-----	V	10.24	63.47	-----	68.2	-----	4.7	-----
11060	39.49	27.41	H	19.64	59.13	47.05	83.5	63.5	24.4	16.4
11060	39.46	27.77	V	19.64	59.10	47.41	83.5	63.5	24.4	16.1
Middle Channel 5610 MHz										
11220	43.00	31.72	H	20.11	63.11	51.83	83.5	63.5	20.4	11.7
11220	43.27	31.55	V	20.11	63.38	51.66	83.5	63.5	20.1	11.8
High Channel 5690 MHz										
11380	44.14	32.02	H	20.59	64.73	52.61	83.5	63.5	18.8	10.9
11380	42.49	30.02	V	20.59	63.08	50.61	83.5	63.5	20.4	12.9

Notes:

- All emissions above 11.38 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Band 5.725-5.85 GHz

Table 7.5.2.2-10: Radiated Spurious Emissions Tabulated Data – 802.11n 20 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 5745 MHz										
5715	63.69	42.88	H	4.91	68.60	47.79	74.0	54.0	5.4	6.2
5715	64.84	43.32	V	4.91	69.75	48.23	74.0	54.0	4.3	5.8
5725	69.71	-----	H	4.93	74.64	57.52	78.2	-----	3.6	-----
5725	72.65	-----	V	4.93	77.58	56.79	78.2	-----	0.6	-----
11490	46.87	35.92	H	20.91	67.78	56.83	83.5	63.5	15.7	6.7
11490	47.28	36.05	V	20.91	68.19	56.96	83.5	63.5	15.3	6.5
Middle Channel 5785 MHz										
11570	50.32	38.45	H	20.85	71.17	59.30	83.5	63.5	12.3	4.2
11570	48.76	36.83	V	20.85	69.61	57.68	83.5	63.5	13.9	5.8
High Channel 5825 MHz										
5850	58.32	-----	H	5.18	63.50	-----	78.2	-----	14.7	-----
5850	62.72	-----	V	5.18	67.90	-----	78.2	-----	10.3	-----
5860	55.53	42.19	H	5.20	60.73	47.39	74.0	54.0	13.3	6.6
5860	59.87	41.66	V	5.20	65.07	46.86	74.0	54.0	8.9	7.1
11650	49.08	37.94	H	20.75	69.83	58.69	83.5	63.5	13.7	4.8
11650	49.29	38.10	V	20.75	70.04	58.85	83.5	63.5	13.5	4.6

Notes:

- All emissions above 11.65 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.
- The emissions at 5715 MHz and 5860 MHz were compared to the intentional emissions limits per FCC 15.209 and RSS-Gen outside of the restricted bands.

Table 7.5.2.2-11: Radiated Spurious Emissions Tabulated Data – 802.11n 40 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Low Channel 5755 MHz										
5715	54.98	-----	H	10.59	65.57	-----	68.2	-----	2.6	-----
5715	56.14	-----	V	10.59	66.73	-----	68.2	-----	1.5	-----
5725	57.09	-----	H	10.60	67.69	-----	78.2	-----	10.5	-----
5725	58.61	-----	V	10.60	69.21	-----	78.2	-----	9.0	-----
11510	44.54	38.42	H	20.93	65.47	59.35	83.5	63.5	18.0	4.2
11510	44.55	37.70	V	20.93	65.48	58.63	83.5	63.5	18.0	4.9
High Channel 5230 MHz										
5850	47.28	-----	H	10.77	58.05	-----	78.2	-----	20.2	-----
5850	48.68	-----	V	10.77	59.45	-----	78.2	-----	18.8	-----
11590	43.71	31.20	H	20.83	64.54	52.03	83.5	63.5	19.0	11.5
11590	44.73	31.92	V	20.83	65.56	52.75	83.5	63.5	17.9	10.8

Notes:

- All emissions above 11.59 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

Table 7.5.2.2-12: Radiated Spurious Emissions Tabulated Data – 802.11ac 80 MHz

Frequency (MHz)	Level (dBuV)		Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m)		Limit (dBuV/m)		Margin (dB)	
	pk	Qpk/Avg			pk	Qpk/Avg	pk	Qpk/Avg	pk	Qpk/Avg
Middle Channel 5775 MHz										
5725	52.45	-----	H	10.60	63.05	-----	78.2	-----	15.1	-----
5725	52.91	-----	V	10.60	63.51	-----	78.2	-----	14.7	-----
5850	51.64	-----	H	10.77	62.41	-----	78.2	-----	15.8	-----
5850	51.21	-----	V	10.77	61.98	-----	78.2	-----	16.2	-----
5860	51.03	-----	H	10.78	61.81	-----	68.2	-----	6.4	-----
5860	50.75	-----	V	10.78	61.53	-----	68.2	-----	6.7	-----
11550	42.20	29.90	H	20.88	63.08	50.78	83.5	63.5	20.4	12.7
11550	42.71	29.99	V	20.88	63.59	50.87	83.5	63.5	19.9	12.6

Notes:

- All emissions above 11.55 GHz were attenuated below the limits and the noise floor of the measurement equipment.
- The emissions above 10 GHz were measured at a test distance of 1m. The limits are corrected accordingly using a distance factor of $20 \cdot \log(3/1) = 9.5$ dB.

7.5.3 Sample Calculation:

$$R_C = R_U + CF_T$$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation: Peak

Corrected Level: $56.68 + 9.56 = 66.24$ dB μ V/m

Margin: 74 dB μ V/m $- 66.24$ dB μ V/m = 7.8 dB

Example Calculation: Average

Corrected Level: $40.18 + 9.56 = 49.74$ dB μ V/m

Margin: 54 dB μ V/m $- 49.74$ dB μ V/m = 4.3 dB

Example Calculation: EIRP Limits to Field Strength Limits

$E(\text{dB}\mu\text{V/m}) = P(\text{dBm EIRP}) + 95.2$

$E(\text{dB}\mu\text{V/m}) = -17\text{dBm} + 95.2 = 78.2$ dB μ V/m

$E(\text{dB}\mu\text{V/m}) = -27\text{dBm} + 95.2 = 68.2$ dB μ V/m

7.6 Power Line Conducted Emissions – FCC: Section 15.207 IC: RSS-Gen 8.8

7.6.1 Measurement Procedure

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150 kHz to 30 MHz with the spectrum analyzer's resolution bandwidth set to 9 kHz and the video bandwidth set to 30 kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss

Margin = Applicable Limit - Corrected Reading

Preliminary evaluation was performed for all the modes of operation of the WLAN transceiver. The results reported correspond to the worst case. The EUT was in the 802.11 ac (VHT80) mode at channel 48.

7.6.2 Measurement Results

Results are shown below.

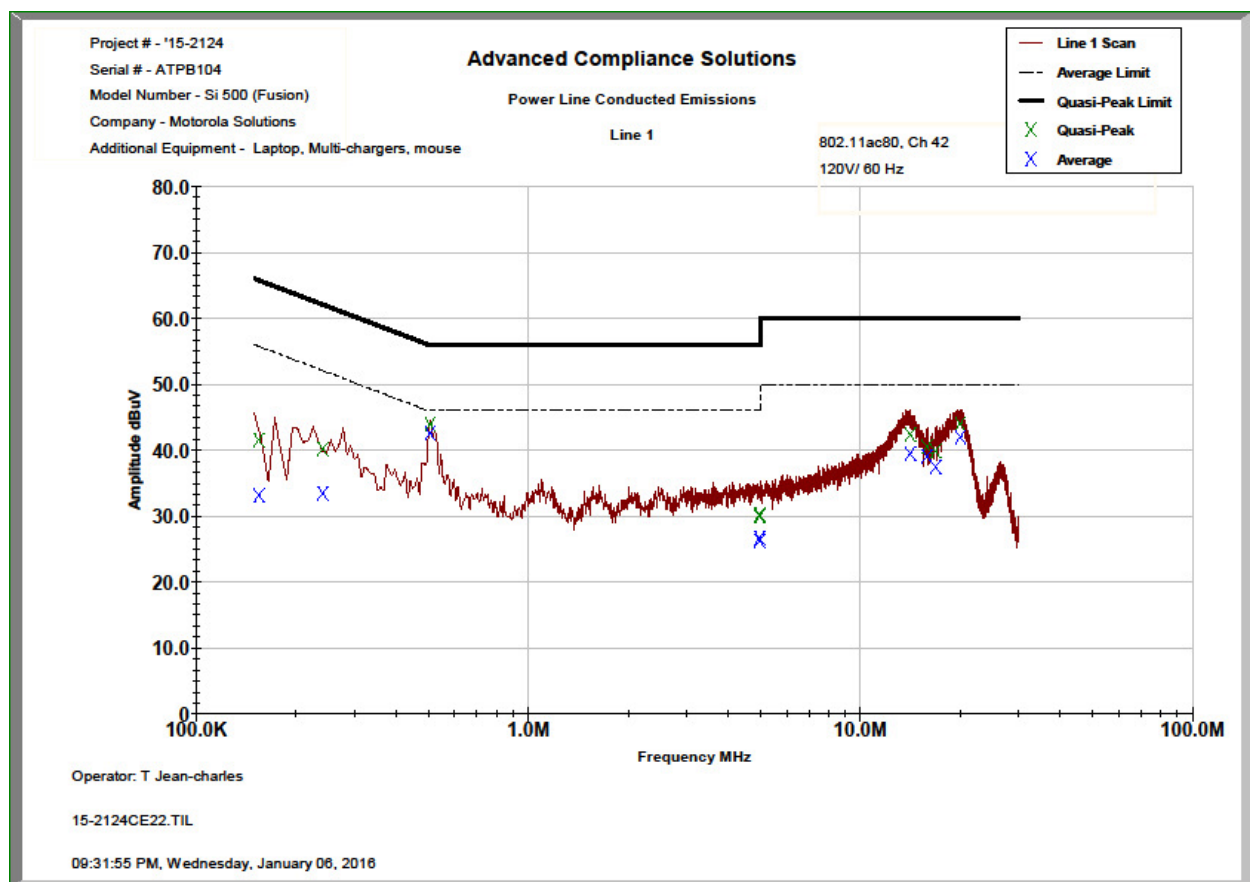


Figure 7.6.2-1: Conducted Emissions Results – Line 1

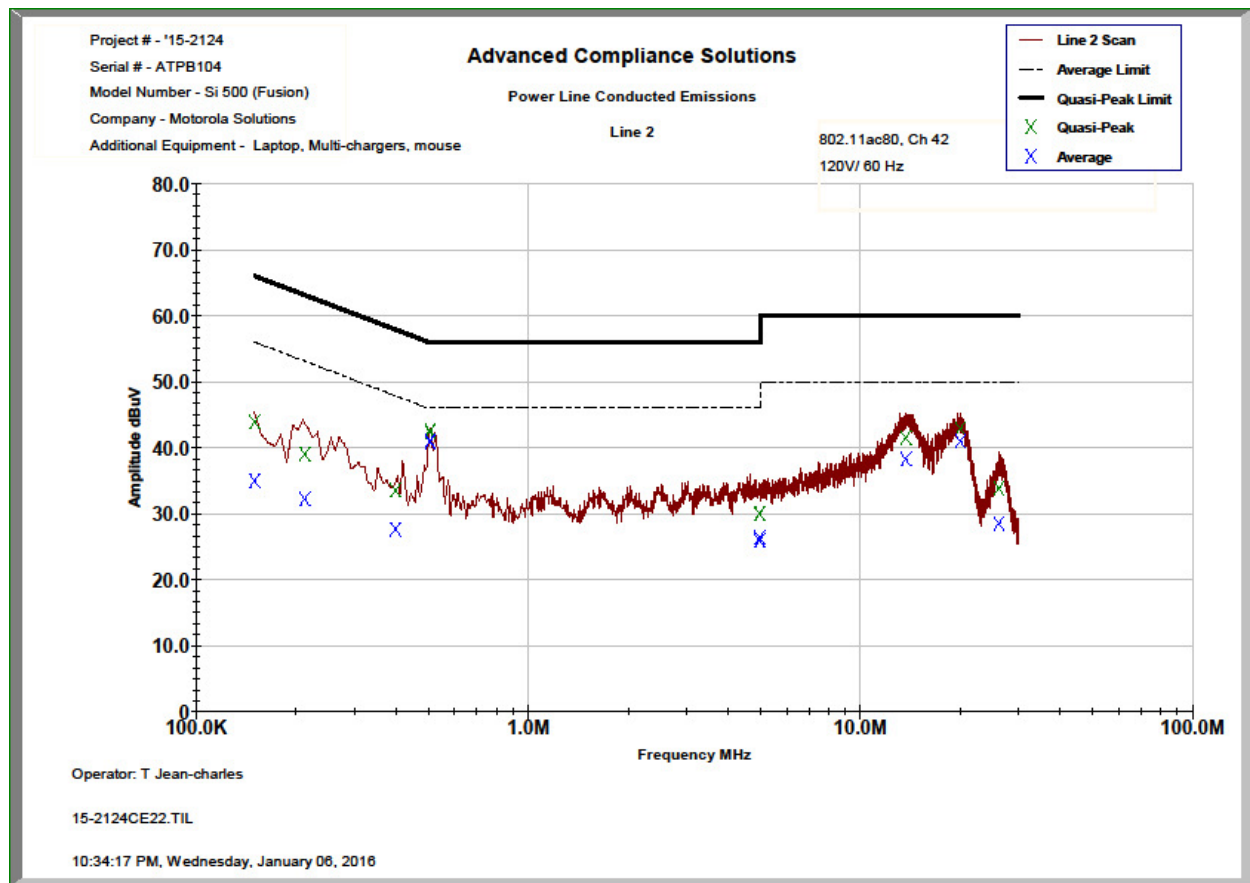


Figure 7.6.2-2: Conducted Emissions Results – Line 2

Table 7.6.2-1: Conducted EMI Results

☒ Line 1 ☒ Line 2 ☐ Line 3 ☐ Line 4 ☐ To Ground ☒ Floating ☐ Telecom Port _____ ☒ dBµV ☐ dBµA Plot Number: <u>15-2124CE22</u> Power Supply Description: <u>NA</u>									
Frequency (MHz)	Uncorrected Reading		Total Correction Factor (dB)	Corrected Level		Limit		Margin (dB)	
	Quasi- Peak	Average		Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
Line 1									
0.15462	31.337	22.947	10.22	41.56	33.17	65.75	55.75	24.2	22.6
0.240975	29.995	23.271	10.21	40.20	33.48	62.06	52.06	21.9	18.6
0.5065	33.754	32.348	10.20	43.96	42.55	56.00	46.00	12.0	3.4
0.5069	33.726	32.364	10.20	43.93	42.57	56.00	46.00	12.1	3.4
4.98	19.532	15.863	10.39	29.92	26.26	56.00	46.00	26.1	19.7
4.9801	19.796	16.28	10.39	30.19	26.67	56.00	46.00	25.8	19.3
14.1483	31.491	28.685	10.81	42.30	39.49	60.00	50.00	17.7	10.5
15.9153	29.565	28.201	10.91	40.47	39.11	60.00	50.00	19.5	10.9
16.8839	28.881	26.471	10.92	39.80	37.39	60.00	50.00	20.2	12.6
20.0378	32.995	31.04	10.99	43.99	42.03	60.00	50.00	16.0	8.0
Line 2									
0.150057	33.677	24.771	10.23	43.91	35.00	66.00	56.00	22.1	21.0
0.2125	28.834	22.008	10.22	39.05	32.22	63.11	53.11	24.1	20.9
0.39865	23.333	17.478	10.20	33.54	27.68	57.88	47.88	24.3	20.2
0.5057	32.217	30.667	10.21	42.42	40.87	56.00	46.00	13.6	5.1
0.5069	32.417	30.845	10.21	42.62	41.05	56.00	46.00	13.4	4.9
4.98	19.487	15.881	10.44	29.93	26.32	56.00	46.00	26.1	19.7
4.9801	19.582	15.416	10.44	30.02	25.86	56.00	46.00	26.0	20.1
13.7145	30.679	27.422	10.83	41.51	38.25	60.00	50.00	18.5	11.7
20.0387	31.874	29.931	11.02	42.90	40.95	60.00	50.00	17.1	9.0
26.1667	22.535	17.184	11.28	33.81	28.46	60.00	50.00	26.2	21.5

7.7 Frequency Stability – FCC Section 15.407(g), IC RSS-Gen 8.11**7.7.1 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 $+50^{\circ}\text{C}$ 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

7.7.2 Measurement Results

Frequency Stability

Frequency (MHz): 5240

Deviation Limit (PPM): 20

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	5239.983125	-3.220	100%	4.30
-20 C	5239.996000	-0.763	100%	4.30
-10 C	5239.996250	-0.716	100%	4.30
0 C	5239.987625	-2.362	100%	4.30
10 C	5239.981875	-3.459	100%	4.30
20 C	5239.971250	-5.487	100%	4.30
30 C	5239.958750	-7.872	100%	4.30
40 C	5239.956000	-8.397	100%	4.30
50 C	5239.960000	-7.634	100%	4.30
20 C	5239.966500	-6.393	Endpoint	3.00

Frequency Stability vs. Temperature

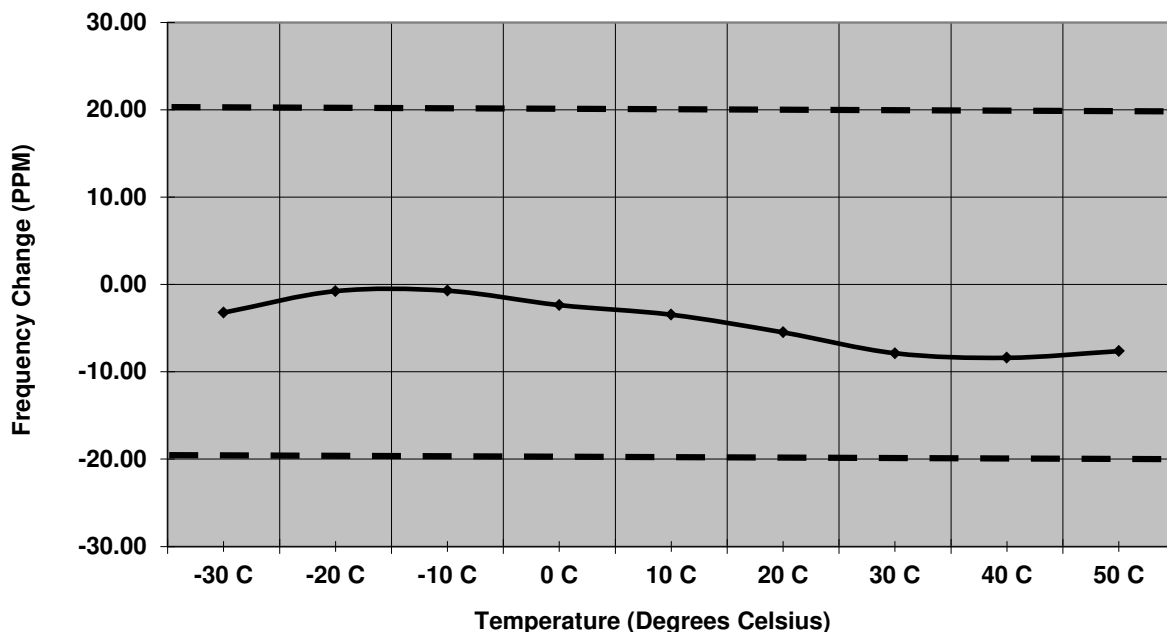


Figure 7.7.2.1-1: Frequency Stability 5.15 GHz – 5.25 GHz

Frequency Stability

Frequency (MHz): 5320

Deviation Limit (PPM): 20

Temperature C	Frequency MHz	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	5319.998613	-0.261	100%	4.30
-20 C	5319.996375	-0.681	100%	4.30
-10 C	5319.996750	-0.611	100%	4.30
0 C	5319.987000	-2.444	100%	4.30
10 C	5319.981500	-3.477	100%	4.30
20 C	5319.970000	-5.639	100%	4.30
30 C	5319.956750	-8.130	100%	4.30
40 C	5319.955000	-8.459	100%	4.30
50 C	5319.958250	-7.848	100%	4.30
20 C	5319.965750	-6.438	Endpoint	3.00

Frequency Stability vs. Temperature

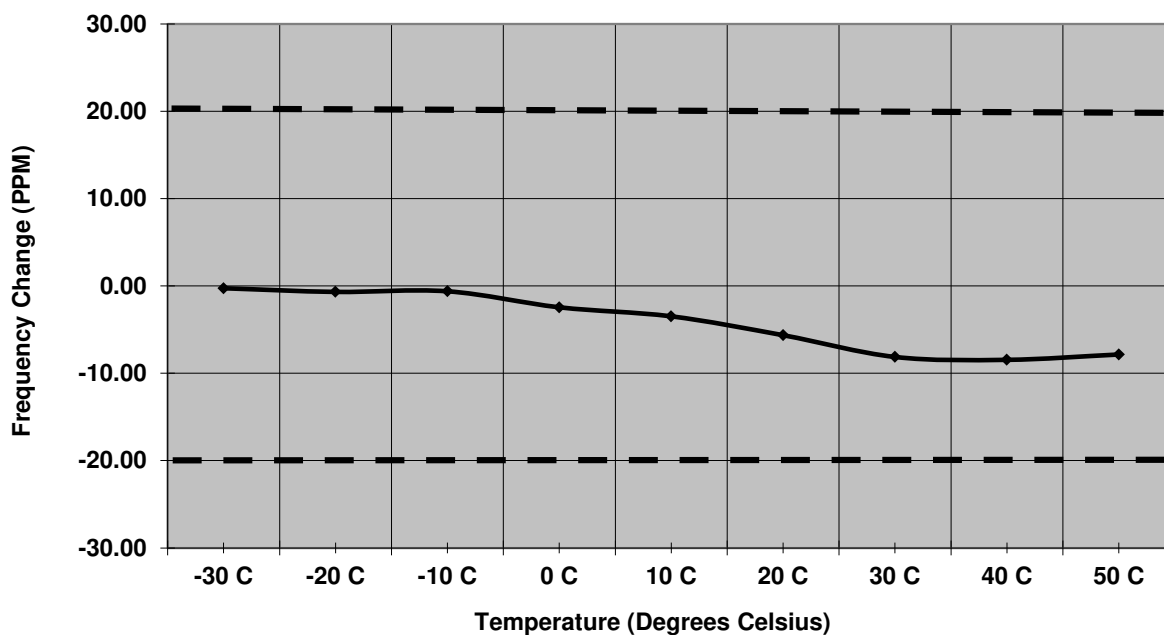


Figure 7.7.2.1-2: Frequency Stability 5.25 GHz – 5.35 GHz

Frequency Stability

Frequency (MHz): 5500

Deviation Limit (PPM): 20

Temperature C	Frequency MHz	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	5499.983500	-3.000	100%	4.30
-20 C	5499.997125	-0.523	100%	4.30
-10 C	5499.996750	-0.591	100%	4.30
0 C	5499.986125	-2.523	100%	4.30
10 C	5499.980375	-3.568	100%	4.30
20 C	5499.969000	-5.636	100%	4.30
30 C	5499.957000	-7.818	100%	4.30
40 C	5499.954250	-8.318	100%	4.30
50 C	5499.960750	-7.136	100%	4.30
20 C	5499.964750	-6.409	Endpoint	3.00

Frequency Stability vs. Temperature

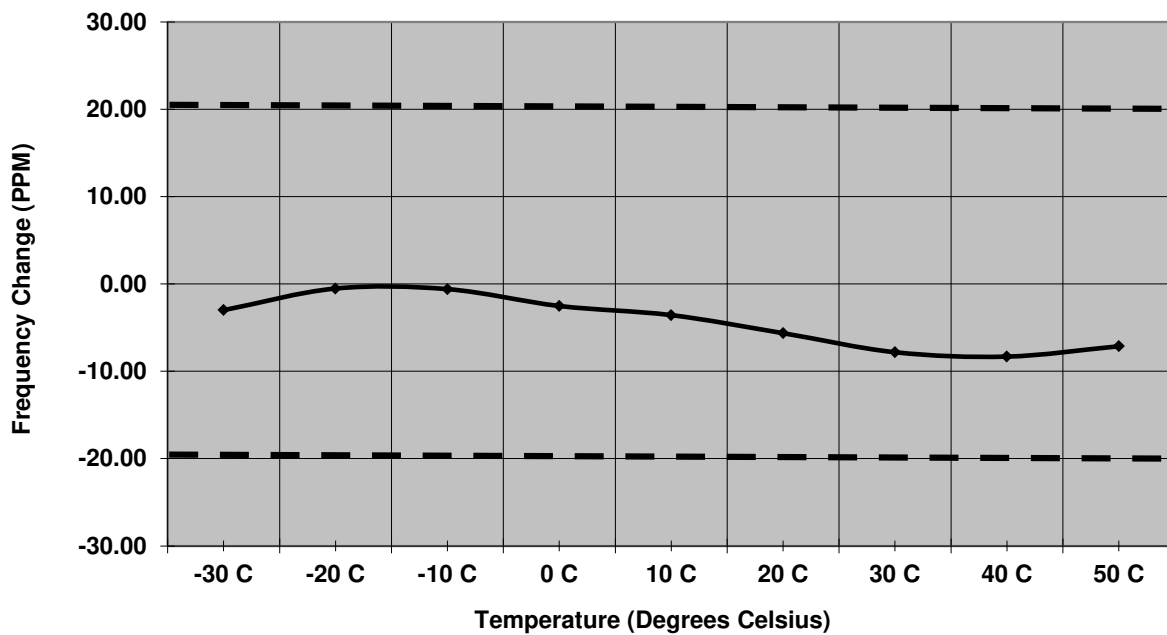


Figure 7.7.2.1-3: Frequency Stability 5.47 GHz – 5.725 GHz

Frequency Stability

Frequency (MHz): 5825

Deviation Limit (PPM): 20

Temperature C	Frequency MHz	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	5824.985500	-2.489	100%	4.30
-20 C	5824.996500	-0.601	100%	4.30
-10 C	5824.994625	-0.923	100%	4.30
0 C	5824.990250	-1.674	100%	4.30
10 C	5824.979125	-3.584	100%	4.30
20 C	5824.959500	-6.953	100%	4.30
30 C	5824.953000	-8.069	100%	4.30
40 C	5824.952250	-8.197	100%	4.30
50 C	5824.959250	-6.996	100%	4.30
20 C	5824.965750	-5.880	Endpoint	3.00

Frequency Stability vs. Temperature

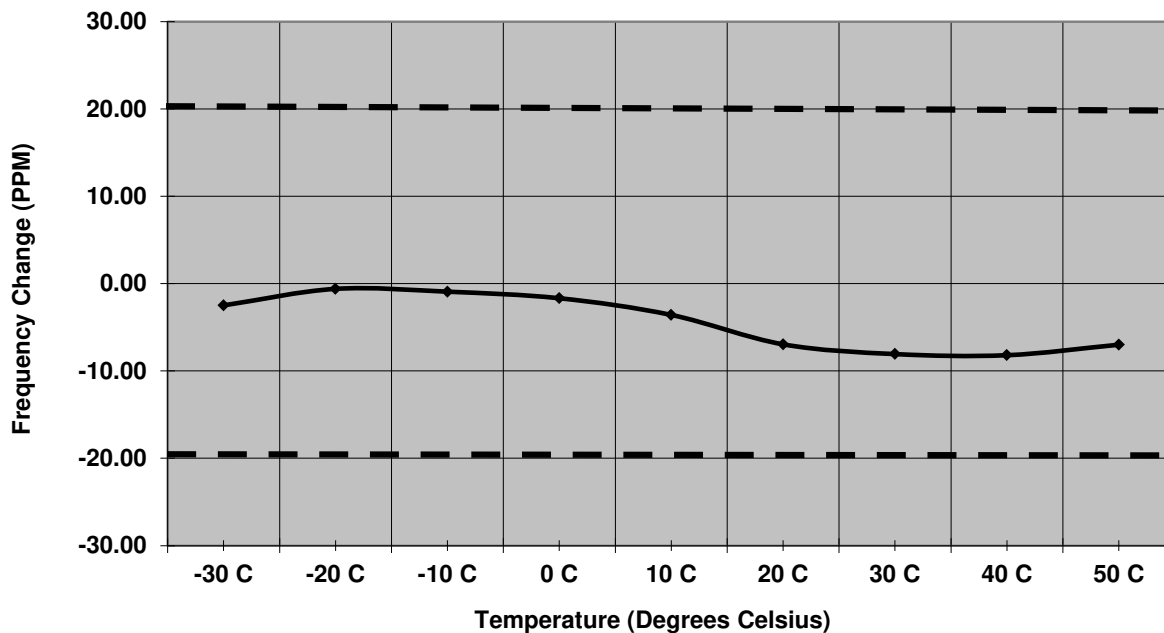


Figure 7.7.2.1-4: Frequency Stability 5.725 GHz – 5.85 GHz

8 CONCLUSION

In the opinion of ACS, Inc., the model HK2062A meets the requirements of FCC Part 15 subpart E and Industry Canada's Radio Standards Specification RSS-247 for the test procedures documented in the test report.

END REPORT