

ISED CABid: ES1909

Test report No:

NIE: 66837RRF.001A2

Test report

USA FCC Part 15.407, 15.209

CANADA RSS-247, RSS-Gen

Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements.

Radiated emission limits; general requirements.

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

General Requirements and Information for the Certification of Radio Apparatus.

(*) Identification of item tested	Flexi Zone MulteFire Outdoor Pico BTS
(*) Trademark	Nokia
(*) Model and /or type reference	FW2RH-m
Other identification of the product	HW version: 474710A.X21 SW version: FLF18A_MF19_0001_200408_000035 FCC ID: 2AVO2FW2RH01 ID: 661AF-FW2RH01
(*) Features	MulteFire 1.0, GPS, GLONASS
Applicant	Nokia Innovations US LLC 600-700 Mountain Ave Murray Hill, NJ, 07974 USA
Test method requested, standard	USA FCC Part 15.407 (10-1-20) Edition: Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. USA FCC Part 15.209 (10-1-20) Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 Amendment 1 (March 2019). Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

	Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v02r01 dated 10/31/2013
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager  2021.10.27 19:42:24 +02'00'
Date of issue	2021-10-27
Report template No	FDT08_23 (*) "Data provided by the client"

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Competences and guarantees

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DEKRA Testing and Certification S.A.U. is an FCC-recognized accredited testing laboratory with the appropriate scope of accreditation that covers the performed test in this report.

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General conditions

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Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification internal document PODT000.

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested")
2. The Nokia Flexi Zone Pico BTS acts as an access point and provides wireless data service to connected client devices using MulteFire 1.0 protocol over UNII RF bands.

Usage of samples

Samples undergoing test have been selected by: the client.

Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
64023/006	Flexi Zone MulteFire Outdoor Pico BTS	FW2RH-m	EB184990224	2020-06-10
64023/003	Power Cable	---	--	2020-06-10
64023/018	Ethernet Cable UTP Cat6 0,5m	---	---	2020-06-10
64023/020	Test device	---	P2-4	2020-07-01
64023/026	Antenna	---	YE201100034	2020-07-01
64023/007	GPS Antenna	---	36100659005	2020-06-10

1. Sample S/01 has undergone the following test(s):

All radiated tests indicated in Appendixes A, B, C, D and E.

Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
64023/006	Flexi Zone MulteFire Outdoor Pico BTS	FW2RH-m	EB184990224	2020-06-10
64023/003	Power Cable	---	--	2020-06-10

1. Sample S/02 has undergone the following test(s):

All conducted tests indicated in Appendixes A, B, C, D and E.

Test sample description

Ports..... :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾
	Ant 1	0.55	☒	☒	☐
	Ant 2	0.55	☒	☒	☐
	RJ45-1	100	☒	☒	☐
	RJ45-2	100	☒	☒	☐
	GPS/GNSS	varies	☒	☒	☐
Supplementary information to the ports..... :	N/A				
Rated power supply	Voltage and Frequency		Reference poles		

		L1	L2	L3	N	PE
	☒ AC: 100/240 VAC. 50/60 Hz	☒	☐	☐	☒	☒
	☐ DC:					
Rated Power	27 dBm/Ant					
Clock frequencies.....	Not provided data					
Other parameters	N/A					
Software version	FLF18A_MF19_0001_200408_000035					
Hardware version	474710A.X21					
Dimensions in cm (W x H x D) :	Not provided data					
Mounting position	☒ Wall/Ceiling mounted equipment					
	☐ Floor standing equipment					
	☐ Hand-held equipment					
	☒ Other: Pole					
Modules/parts.....	Module/parts of test item		Type	Manufacturer		
	Flexi Zone MulteFire Outdoor Pico BTS		---	Nokia		
Accessories (not part of the test item).....	Description		Type	Manufacturer		
	FA2RE		Directional Ant	Nokia		
	FA2WH		GPS Ant	Nokia		
	FMWY		RF Cables	Nokia		
	FPWZ		AC cable	Nokia		
	FPW1		AC Cable	Nokia		
Documents as provided by the applicant.....	Description		File version	Issue date		

⁽³⁾ Only for Medical Equipment

Identification of the client

NOKIA INNOVATIONS US LLC
600-700 Mountain Ave
Murray Hill, NJ, 07974 USA

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2020-12-16
Date (finish)	2021-10-25

Document history

Report number	Date	Description
66837RRF.001	2021-07-28	First release
66837RRF.001A1	2021-08-13	Second release. First modification due to typos. This modification test report cancels and replaces the test report 66837RRF.001
66837RRF.001A1	2021-10-27	Third release. Second modification due to typos and to include the power setting for UNII-1 for Outdoor Behaviour.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Nicolás Salguero, José Manuel Jiménez, Verónica García, Pablo Redondo, Cristina Calle and Miguel Manuel López.

Used instrumentation:

Radiated Measurements:

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2. Shielded Room ETS LINDGREN S101	N.A.	N.A.
3. Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2020/04	2023/04
4. EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2020/12	2022/12
5. Preamplifier G>40dB 10MHz-6GHz, BONN ELEKTRONIK, BLNA 0160-01N	2021/03	2022/03
6. Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2020/07	2022/07
7. RF Preamplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2021/06	2022/06
8. Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
9. Horn Antenna 18-40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
10. EMI Test Receiver 20Hz-40GHz ROHDE AND SCHWARZ ESU40	2019/09	2021/09
11. RF Preamplifier, 30dB 500MHz-18GHz, NARDA AMF-3D-00501800-24-10P	2021/01	2022/01

Conducted Measurements

	Last Calibration	Due Calibration
1. Shielded Room ETS LINDGREN S101	N.A.	N.A.
2. Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40	2019/09	2021/09
3. DC Power Supply 40V/40A Rohde & Schwarz NGPE40	N.A.	N.A.
4. Digital Multimeter FLUKE 179	2020/10	2021/10
5. Open Switch Unit up to 40 GHz ROHDE AND SCHWARZ OSP-B157Wx	2019/10	2021/10
6. Open Switch Unit up to 7.5GHz ROHDE AND SCHWARZ OSP-B157W8 PLUS	2021/08	2023/08

Testing verdicts

Not applicable :	N/A
Pass :	P
Fail :	F
Not measured :	N/M

Summary

A. Common requirements for all bands

FCC PART 15 PARAGRAPH / RSS-247		
Requirement – Test case	Verdict	Remark
Duty Cycle	P	
Transmitter 99% Occupied Bandwidth	P	
Transmitter 26 dB Emission Bandwidth (EBW)	P	
<u>Supplementary information and remarks:</u> None.		

B. 5.15 GHz – 5.25 GHz Band

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.407 (a)(1)(iv)	Transmitter Maximum conducted Output Power	P	
RSS-247 6.2.1.1	Transmitter Maximum Equivalent Isotropically Radiated Power EIRP	P	
FCC 15.407 (a)(1)(iv)	Transmitter Maximum Power Spectral Density	P	
RSS-247 6.2.1.1	Transmitter EIRP Spectral Density	P	
FCC 15.407 (b)(1)(6) / RSS-247 6.2.1.2	Transmitter Out of Band Radiated Emissions	P	
FCC 15.407 (b)(1) / RSS-247 6.2.1.2	Transmitter Band Edge Radiated Emissions	P	
<u>Supplementary information and remarks:</u>			
None.			

C. 5.25 GHz – 5.35 GHz Band

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.407 (a) (2) / RSS-247 6.2.2.1 (a)	Transmitter Maximum conducted Output Power	P	
RSS-247 6.2.2.1 (b)	Transmitter Maximum Equivalent Isotropically Radiated Power EIRP	P	
FCC 15.407 (a) (2) / RSS-247 6.2.2.1 (a)	Transmitter Maximum Power Spectral Density	P	
FCC 15.407 (b) (2) / RSS-247 6.2.2.2	Transmitter Band Edge Radiated Emissions	P	
FCC 15.407 (b) (2) (6) / RSS-247 6.2.2.2	Transmitter Out of Band Radiated Emissions	P	
FCC 15.407 (h) (1) / RSS-247 6.2.2.1	Transmitter Power Control	P	
<u>Supplementary information and remarks:</u>			
(1) None.			

D. 5.47 GHz – 5.725 GHz Band

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.407 (a) (2) / RSS-247 6.2.3.1	Transmitter Maximum conducted Output Power	P	
RSS-247 6.2.3.1	Transmitter Maximum Equivalent Isotropically Radiated Power	P	
FCC 15.407 (a) (2) / RSS-247 6.2.3.1	Transmitter Maximum Power Spectral Density	P	
FCC 15.407 (b) (3) / RSS-247 6.2.3.2	Transmitter Band Edge Radiated Emissions	P	
FCC 15.407 (b) (3) (6) / RSS-247 6.2.3.2	Transmitter Out of Band Radiated Emissions	P	
FCC 15.407 (h) (1) / RSS-247 6.2.3.1	Transmitter Power Control	P	
<u>Supplementary information and remarks:</u>			
(1) None.			

E. 5.725 GHz – 5.85 GHz Band

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.407 (e) / RSS-247 Clause 6.2.4.1	6 dB Bandwidth.	P	
FCC 15.407 (a)(3) / RSS-247 6.2.4.1	Transmitter Maximum conducted Output Power	P	
FCC 15.407 (a)(3) / RSS-247 Clause 6.2.4.1	Transmitter Maximum Power Spectral Density	P	
FCC 15.407 (b) (4) / RSS-247 6.2.4.2	Transmitter Band Edge Radiated Emissions	P	
FCC 15.407 (b) (4) (6) / RSS-247 6.2.4.2	Transmitter Out of Band Radiated Emissions	P	
<u>Supplementary information and remarks:</u>			
None.			

Appendix A: Test Common requirements for all bands

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Section 15.35 Subclause (c) / RSS-Gen 6.10. Transmitter Duty Cycle	14
RSS-Gen 6.6 / RSS-247 6.2. Transmitter 99% Occupied Bandwidth	15
Section 15.407 Subclause 15.403(i) Transmitter 26 dB Emission Bandwidth (EBW)	42

Section 15.35 Subclause (c) / RSS-Gen 6.10. Transmitter Duty Cycle.

SPECIFICATION

When the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

RESULTS:

The results for all modes having a value > 98%.

RSS-Gen 6.6 / RSS-247 6.2. Transmitter 99% Occupied Bandwidth

The client supplied U.FL RF cables with the EUT in order to perform conducted measurements. The measured additional path loss was included in any path loss calculations.

Measurements were performed on all modes for testing.

Mode: QPSK - 20MHz

	Occ. BW (MHz)	Measurement uncertainty (KHz)
channel 36 (5180 MHz)	17.900	<±40.04
channel 40 (5200 MHz)	17.900	
channel 48 (5240 MHz)	17.900	
channel 52 (5260 MHz)	17.900	
channel 56 (5280 MHz)	17.900	
channel 64 (5320 MHz)	17.900	
channel 100 (5500 MHz)	17.900	
channel 116 (5580 MHz)	17.900	
channel 140 (5700 MHz)	17.900	
channel 149 (5745 MHz)	19.800	
channel 157 (5785 MHz)	18.800	
channel 165 (5825 MHz)	20.000	

Mode: 16QAM - 20MHz

	Occ. BW (MHz)	Measurement uncertainty (KHz)
channel 36 (5180 MHz)	17.900	<±40.04
channel 40 (5200 MHz)	17.900	
channel 48 (5240 MHz)	18.000	
channel 52 (5260 MHz)	18.000	
channel 56 (5280 MHz)	17.900	
channel 64 (5320 MHz)	18.000	
channel 100 (5500 MHz)	18.000	
channel 116 (5580 MHz)	17.900	
channel 140 (5700 MHz)	17.900	
channel 149 (5745 MHz)	18.300	
channel 157 (5785 MHz)	18.200	
channel 165 (5825 MHz)	18.600	

Mode: 64QAM - 20MHz

	Occ. BW (MHz)	Measurement uncertainty (KHz)
channel 36 (5180 MHz)	17.900	<±40.04
channel 40 (5200 MHz)	17.900	
channel 48 (5240 MHz)	17.900	
channel 52 (5260 MHz)	18.000	
channel 56 (5280 MHz)	17.900	
channel 64 (5320 MHz)	17.900	
channel 100 (5500 MHz)	18.000	
channel 116 (5580 MHz)	17.900	
channel 140 (5700 MHz)	17.900	
channel 149 (5745 MHz)	18.200	
channel 157 (5785 MHz)	19.900	
channel 165 (5825 MHz)	18.500	

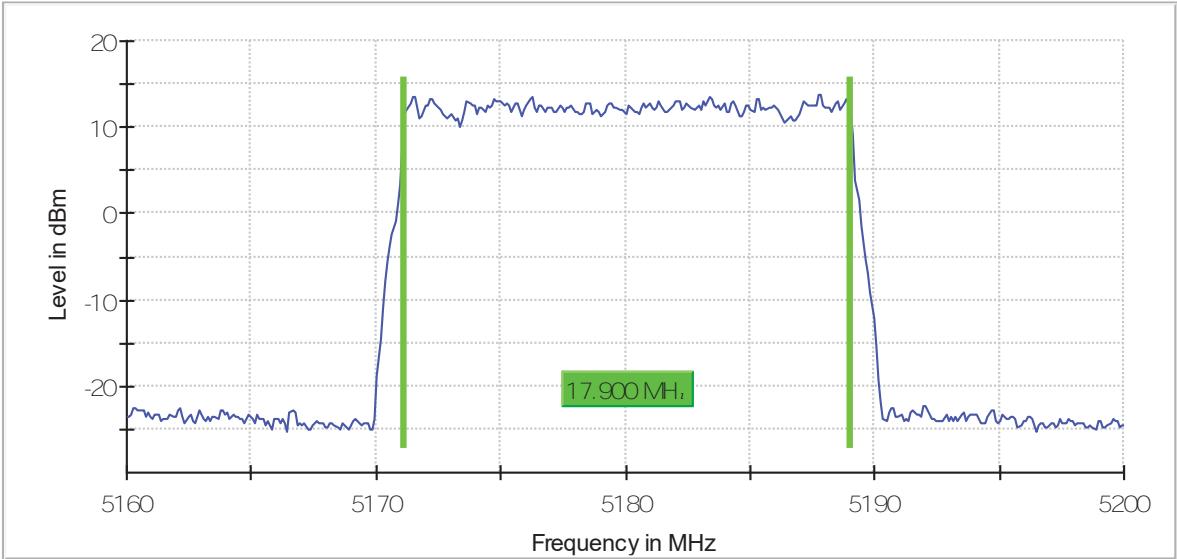
Mode: 256QAM - 20MHz

	Occ. BW (MHz)	Measurement uncertainty (KHz)
channel 36 (5180 MHz)	17.900	<±40.04
channel 40 (5200 MHz)	17.900	
channel 48 (5240 MHz)	17.900	
channel 52 (5260 MHz)	17.900	
channel 56 (5280 MHz)	17.900	
channel 64 (5320 MHz)	18.000	
channel 100 (5500 MHz)	17.900	
channel 116 (5580 MHz)	17.900	
channel 140 (5700 MHz)	17.900	
channel 149 (5745 MHz)	19.900	
channel 157 (5785 MHz)	18.300	
channel 165 (5825 MHz)	18.300	

Mode: QPSK - 20MHz

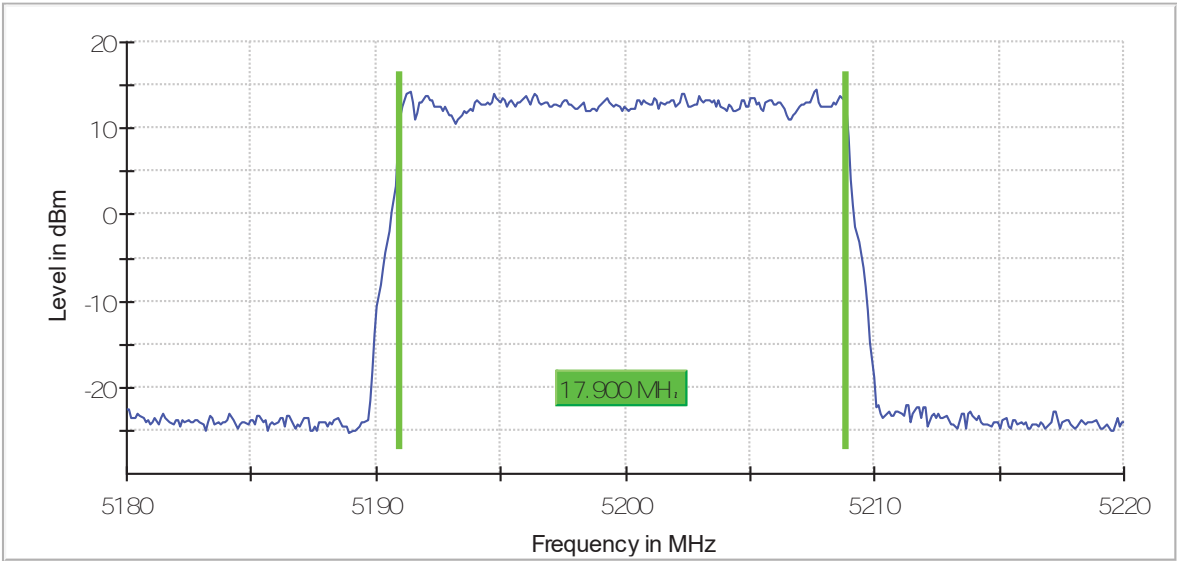
channel 36 (5180 MHz)

99 % Bandwidth



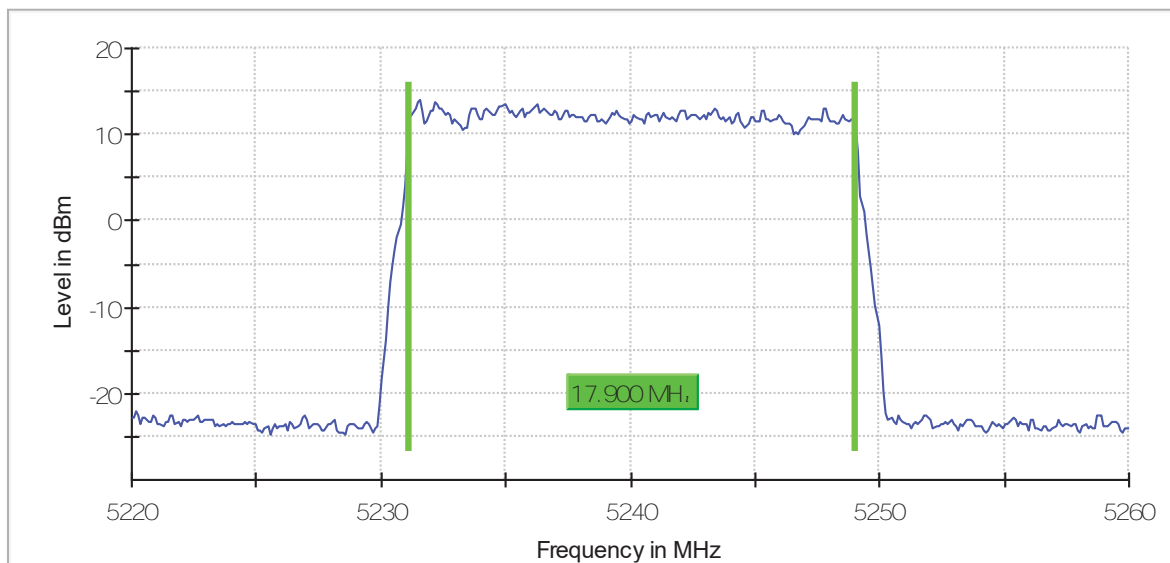
channel 40 (5200 MHz)

99 % Bandwidth



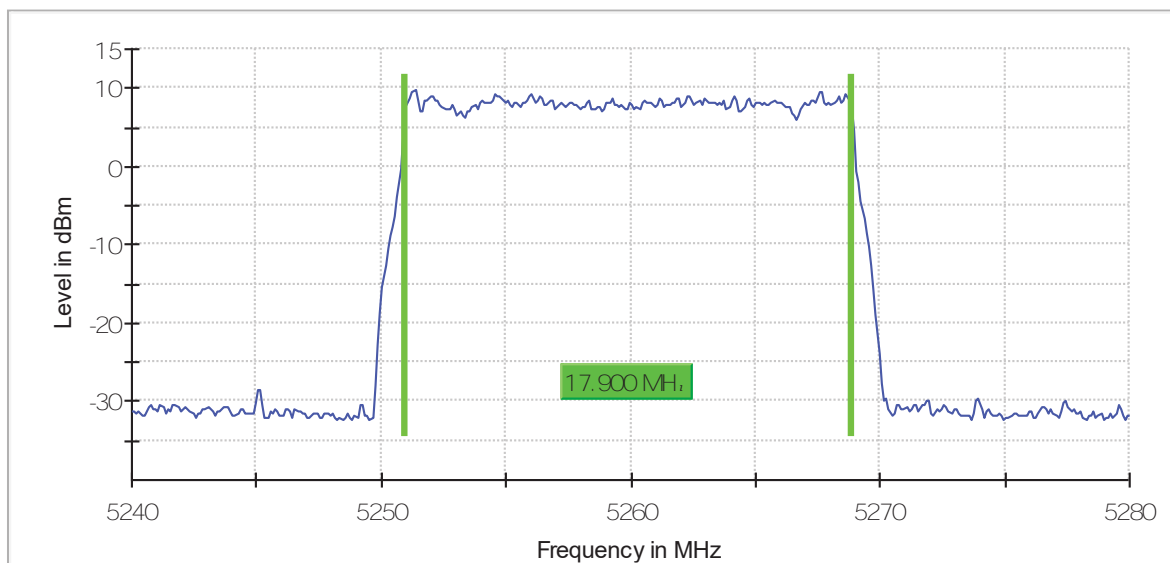
channel 48 (5240 MHz)

99 % Bandwidth



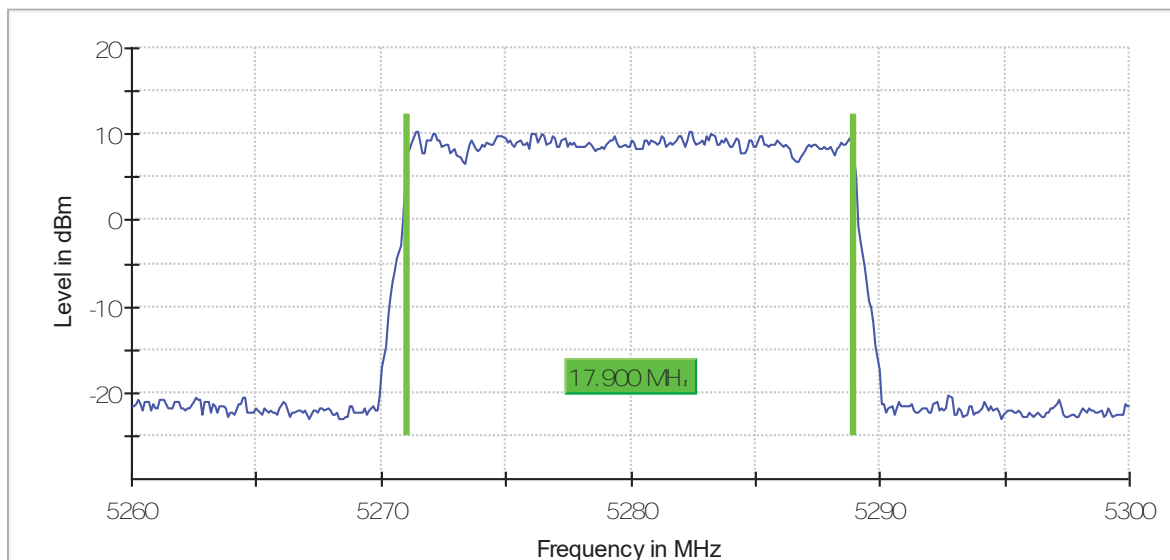
channel 52 (5260 MHz)

99 % Bandwidth



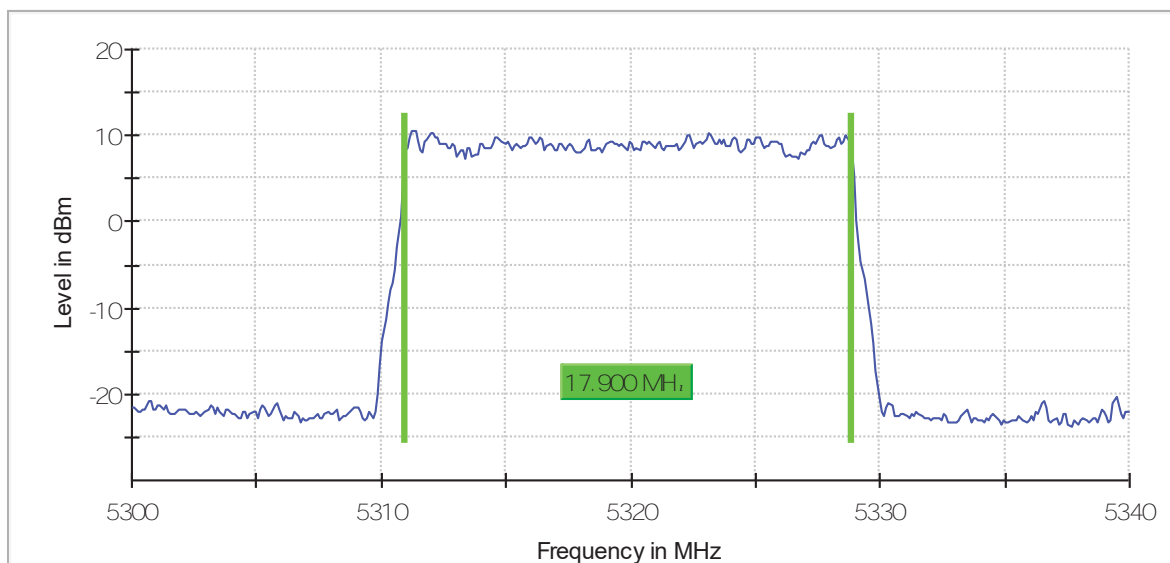
channel 56 (5280 MHz)

99 % Bandwidth

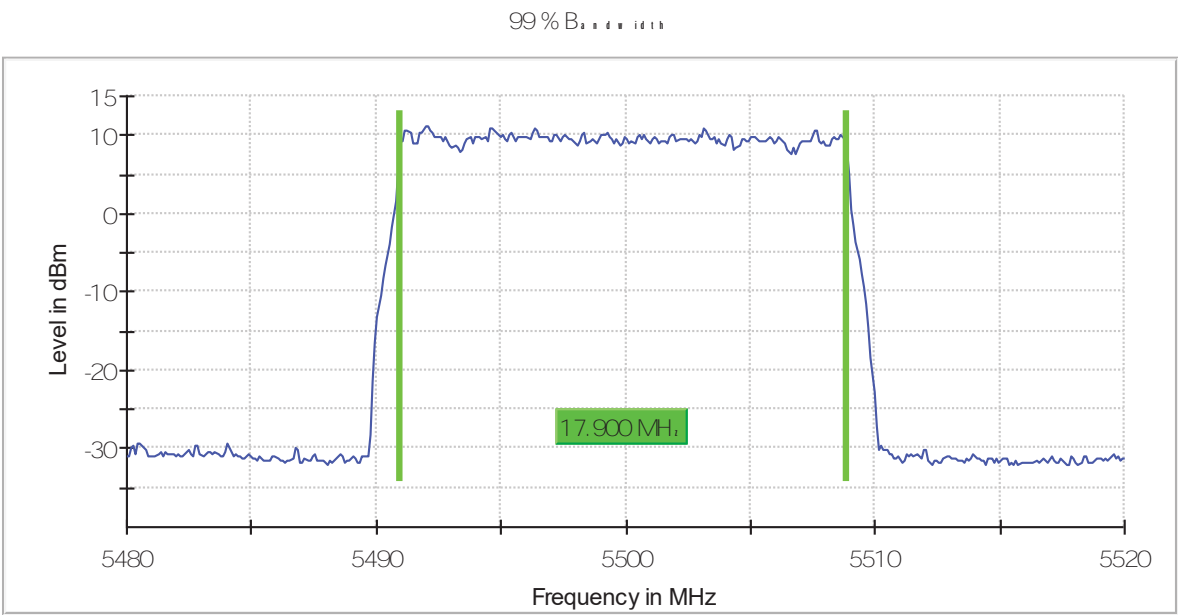


channel 64 (5320 MHz)

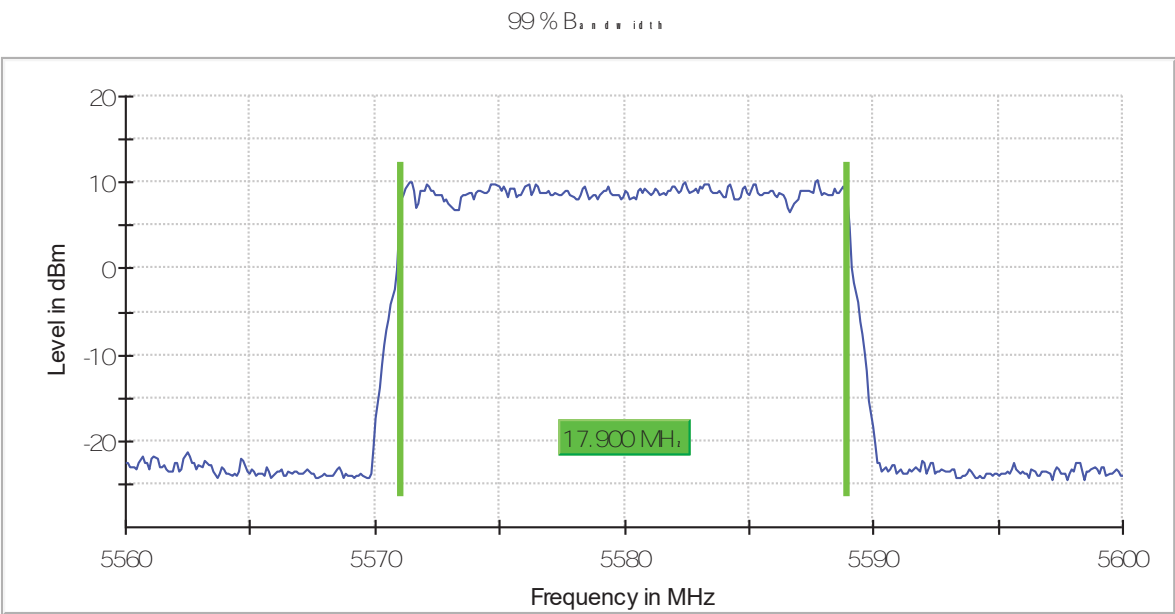
99 % Bandwidth



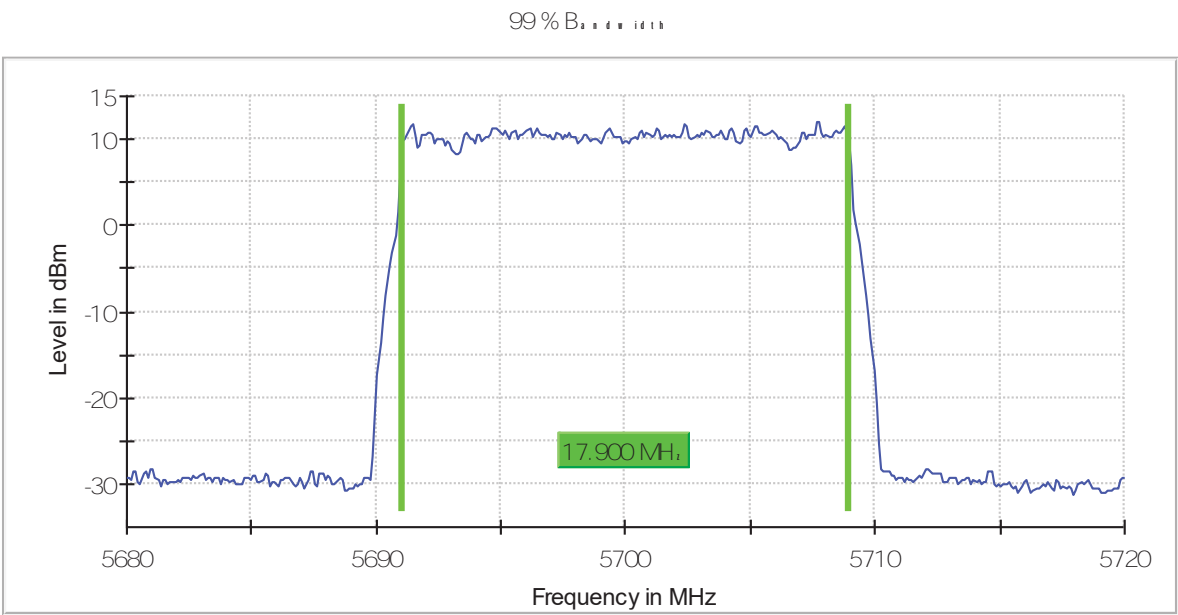
channel 100 (5500 MHz)



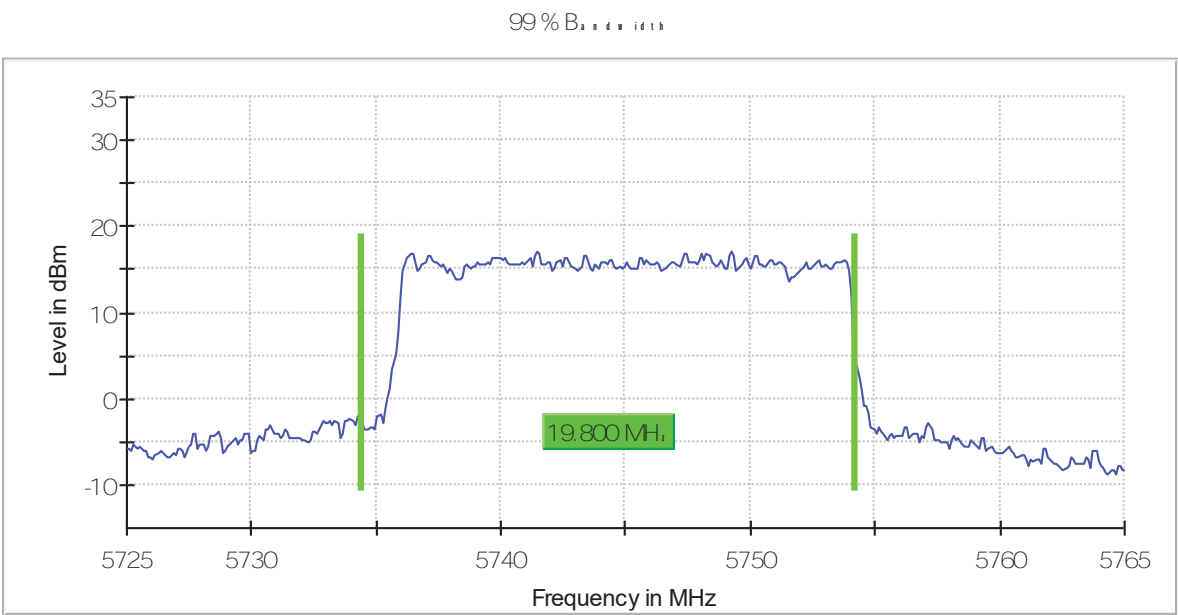
channel 116 (5580 MHz)



channel 140 (5700 MHz)

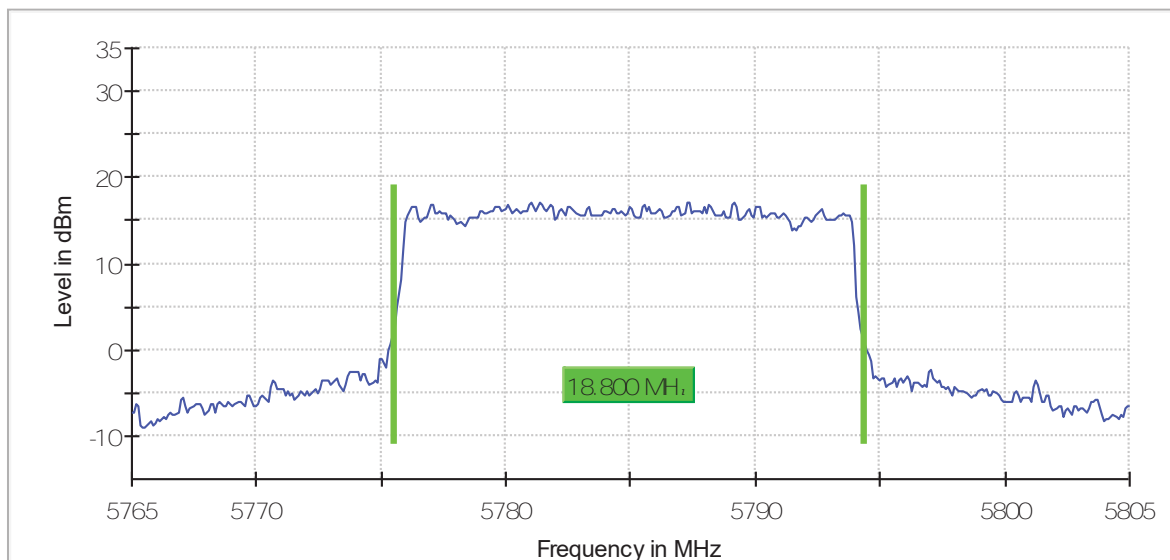


channel 149 (5745 MHz)



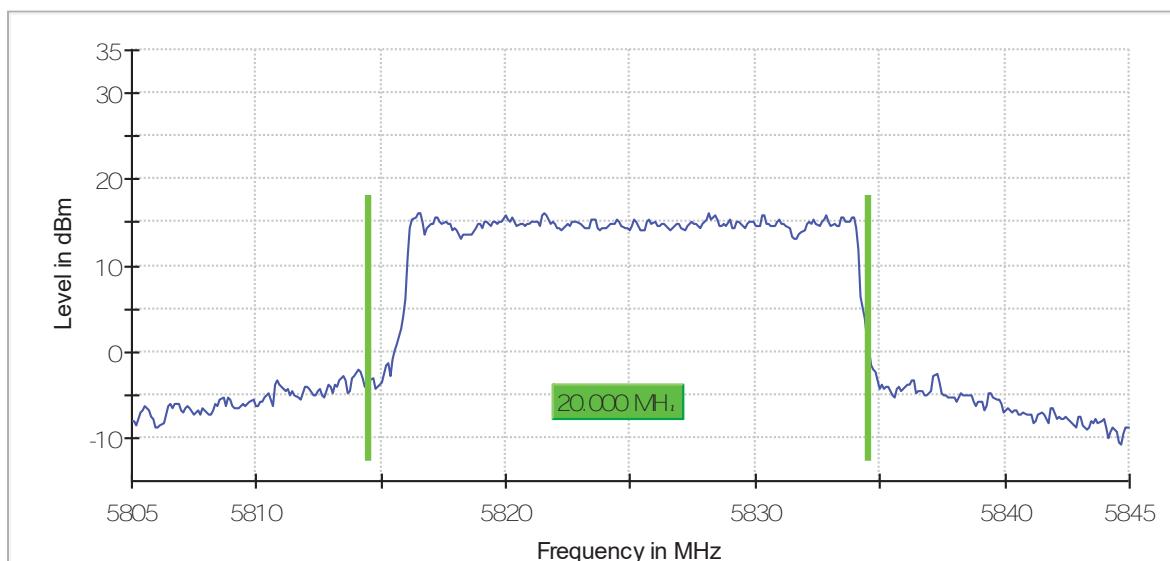
channel 157 (5785 MHz)

99 % Bandwidth



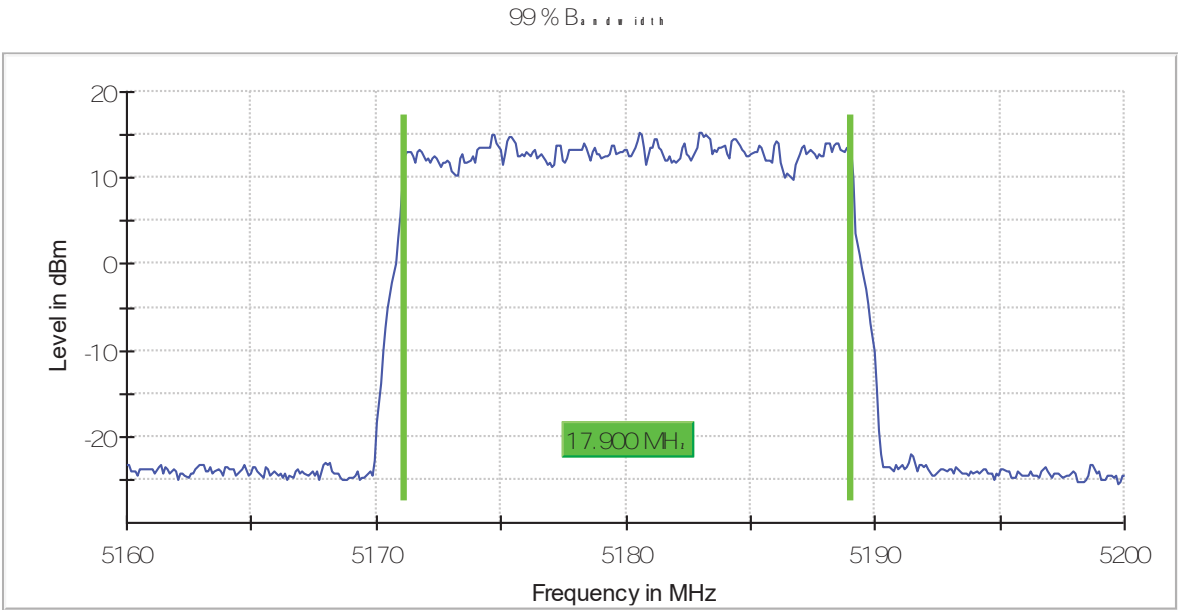
channel 165 (5825 MHz)

99 % Bandwidth

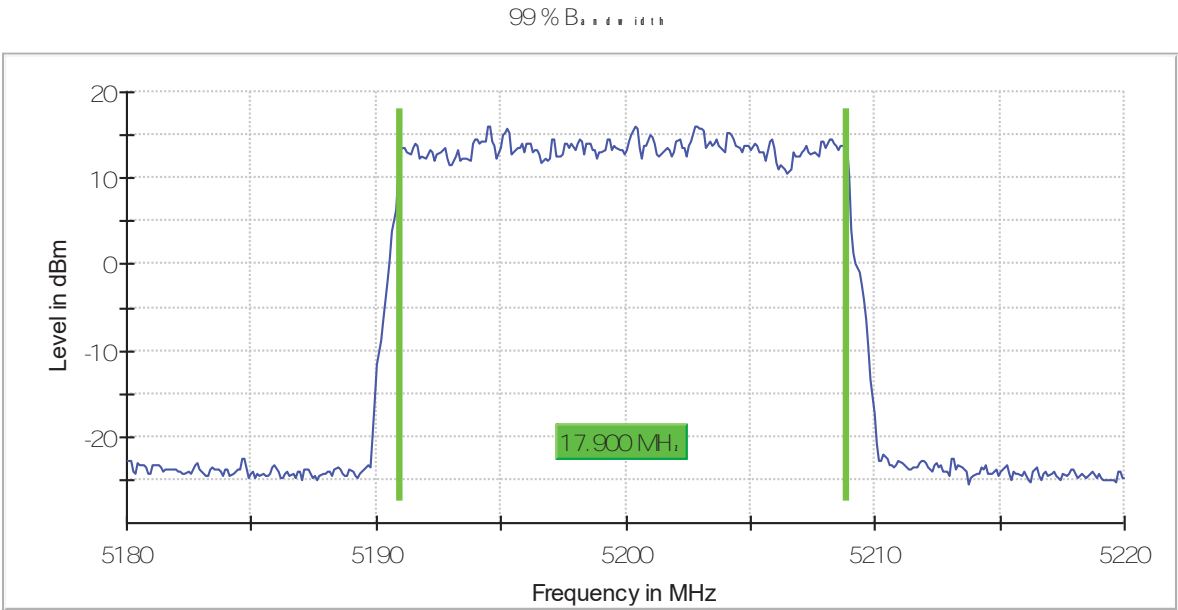


Mode: 16QAM- 20MHz

channel 36 (5180 MHz)

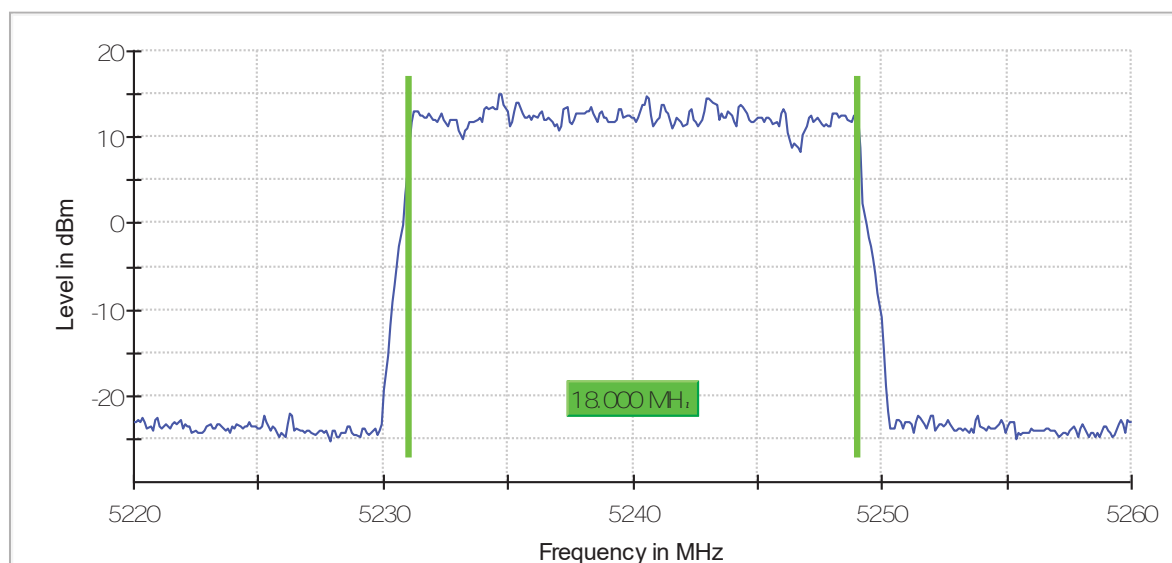


channel 40 (5200 MHz)



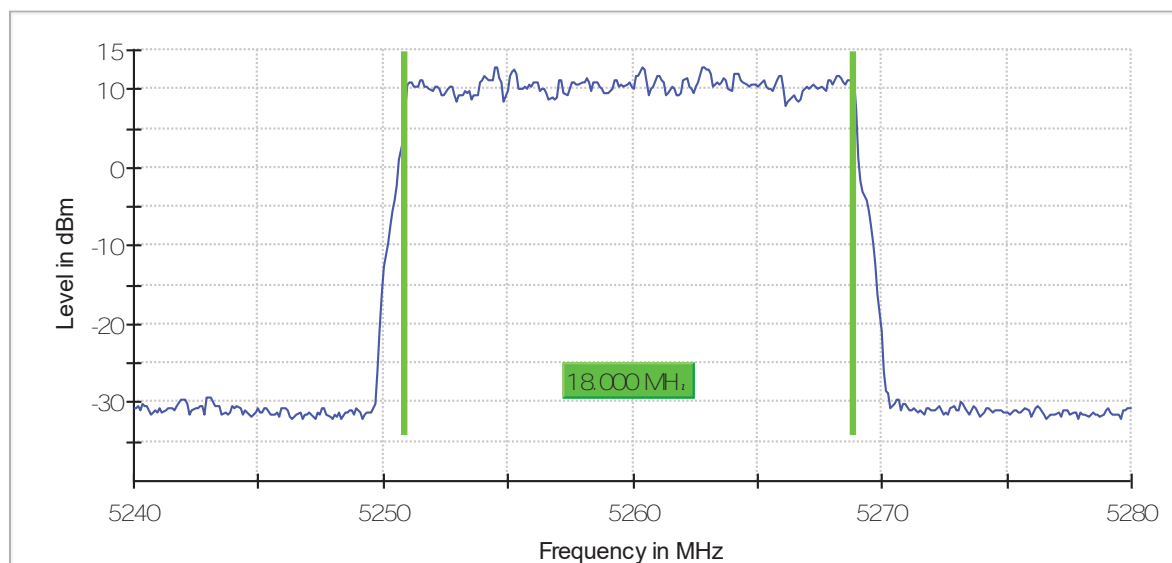
channel 48 (5240 MHz)

99 % Bandwidth



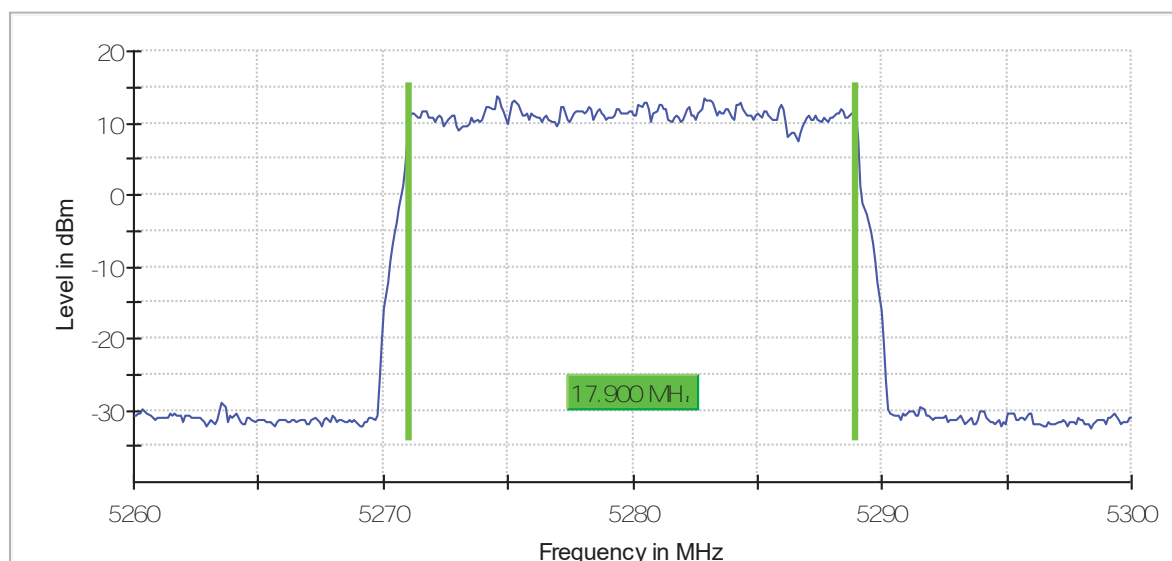
channel 52 (5260 MHz)

99 % Bandwidth



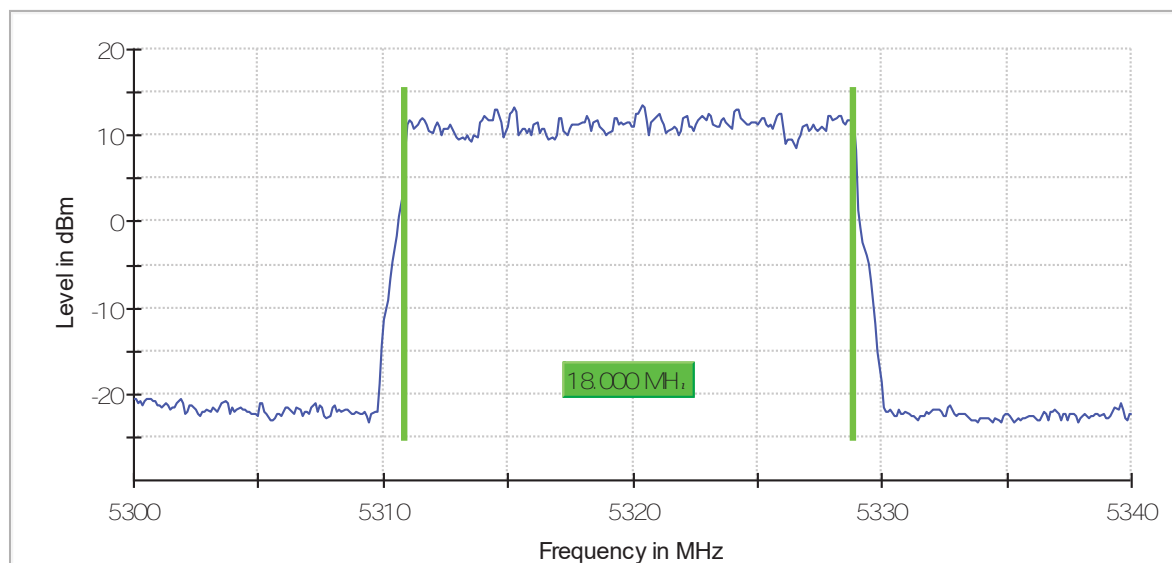
channel 56 (5280 MHz)

99 % Bandwidth

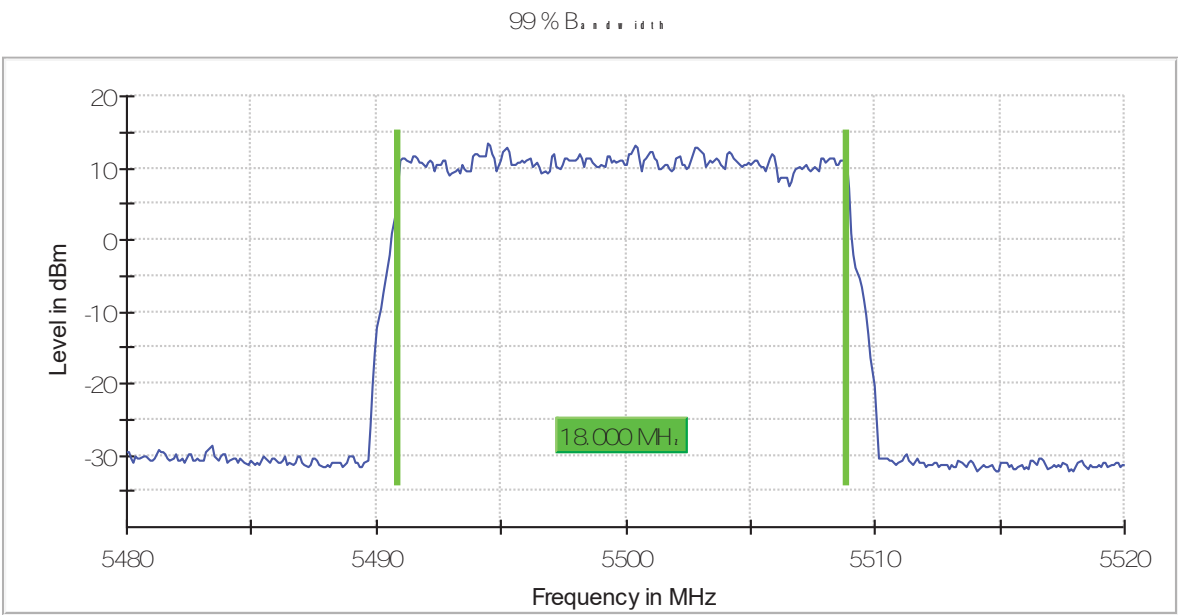


channel 64 (5320 MHz)

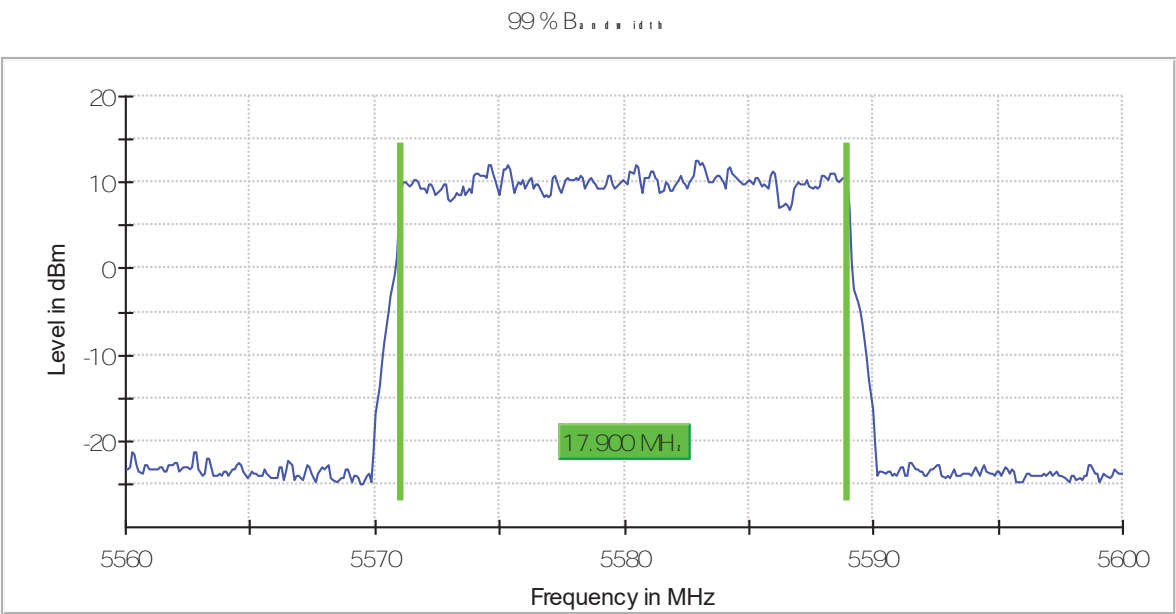
99 % Bandwidth



channel 100 (5500 MHz)

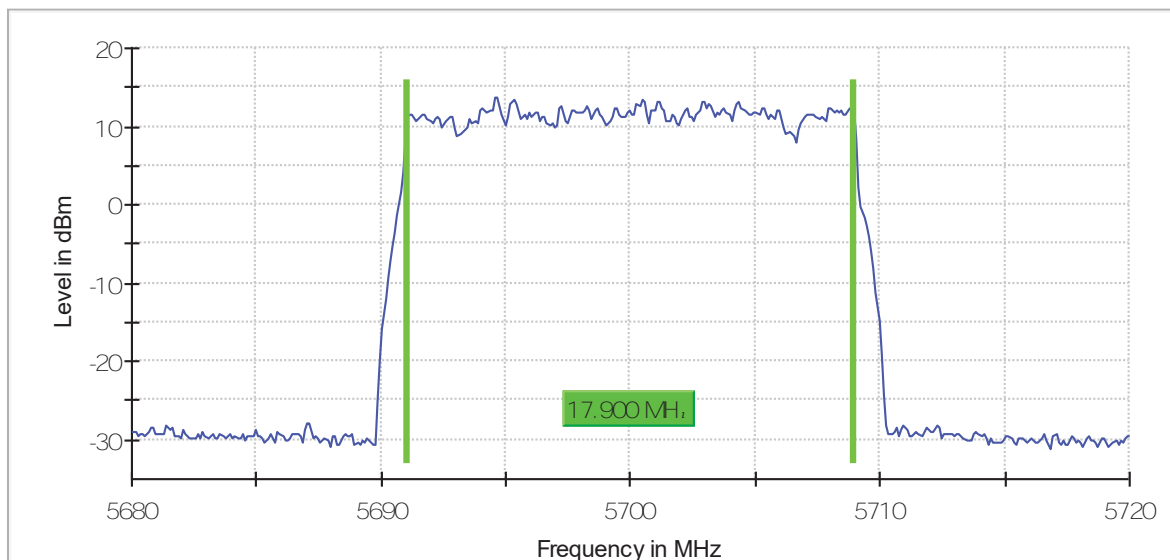


channel 116 (5580 MHz)



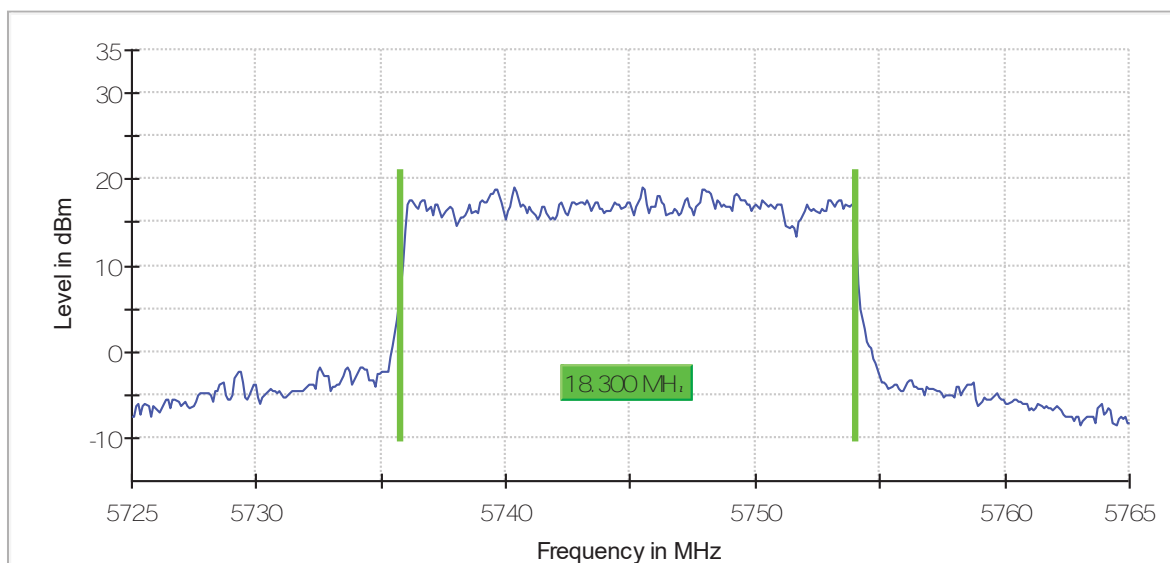
channel 140 (5700 MHz)

99 % Bandwidth

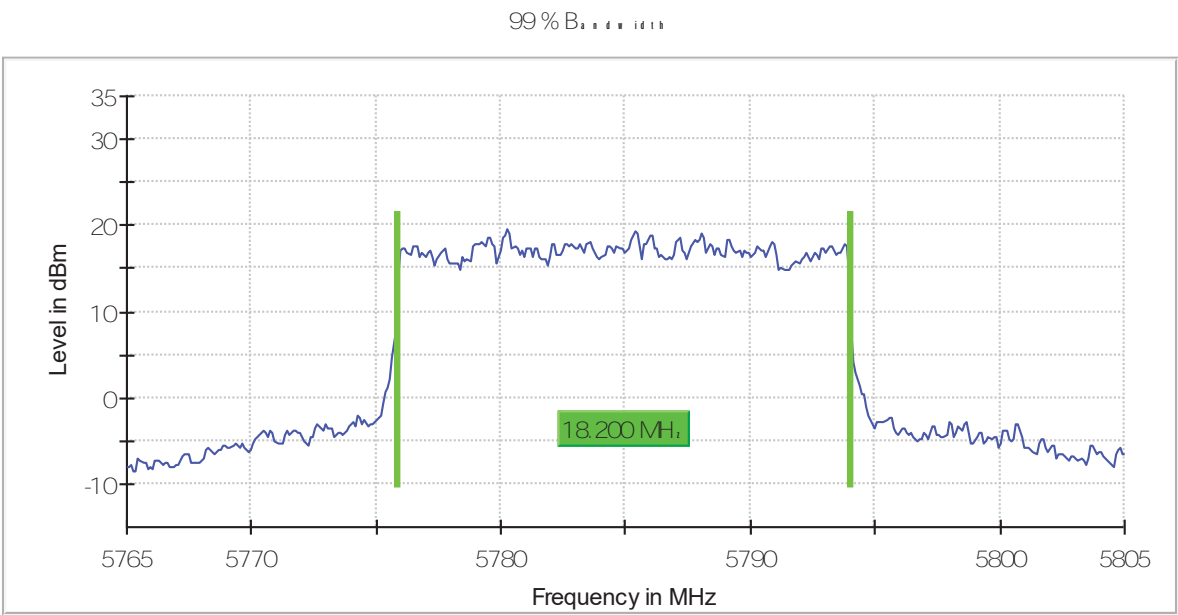


channel 149 (5745 MHz)

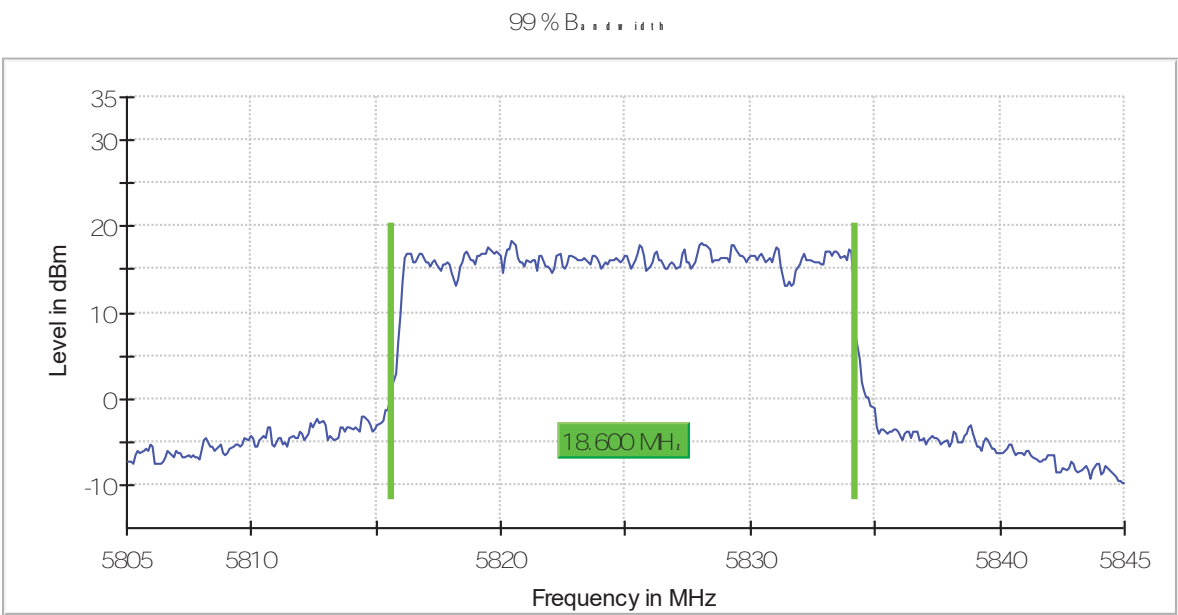
99 % Bandwidth



channel 157 (5785 MHz)

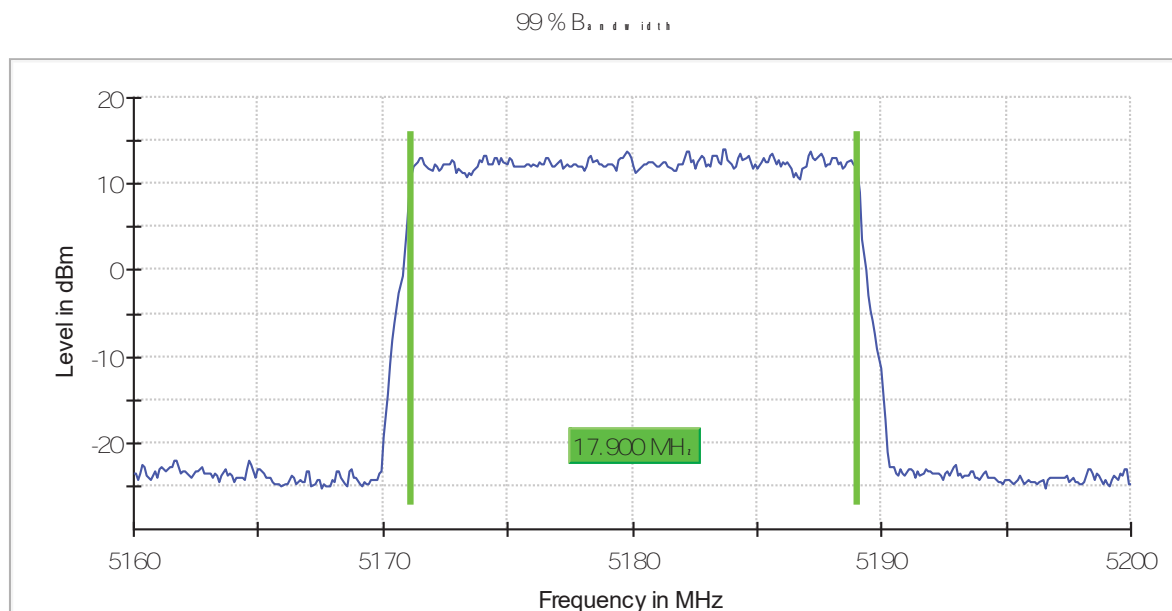


channel 165 (5825 MHz)

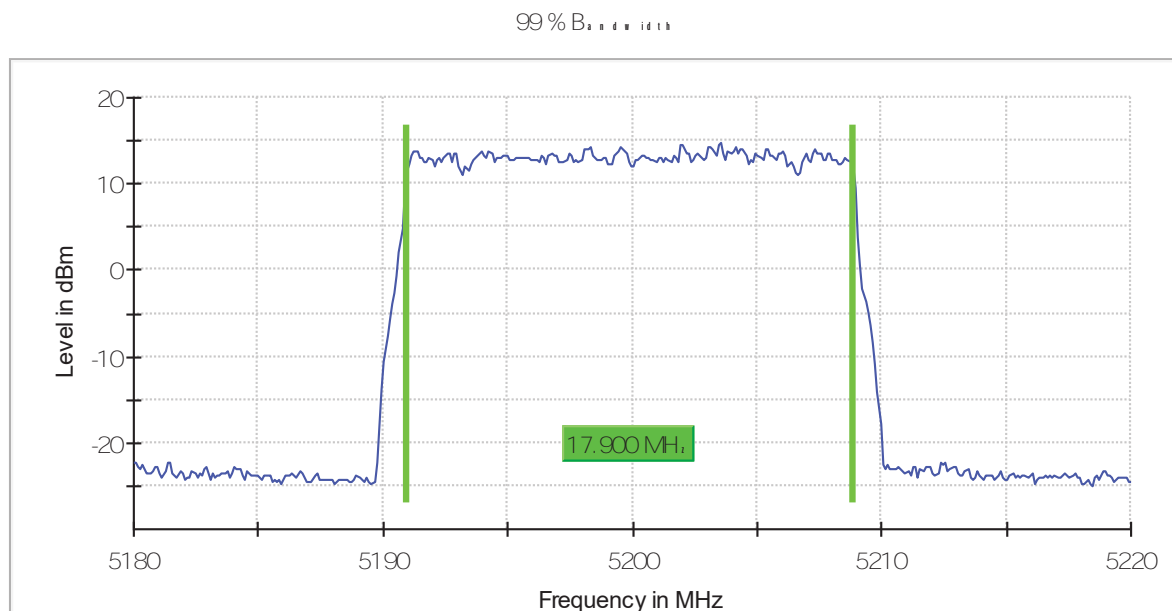


Mode: 64QAM - 20MHz

channel 36 (5180 MHz)

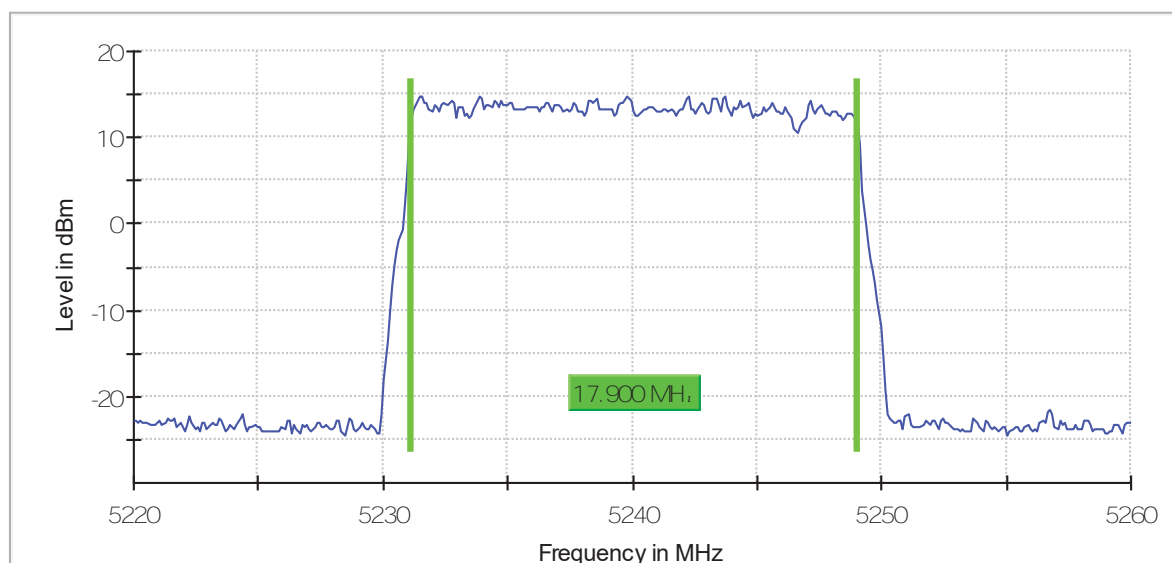


channel 40 (5200 MHz)



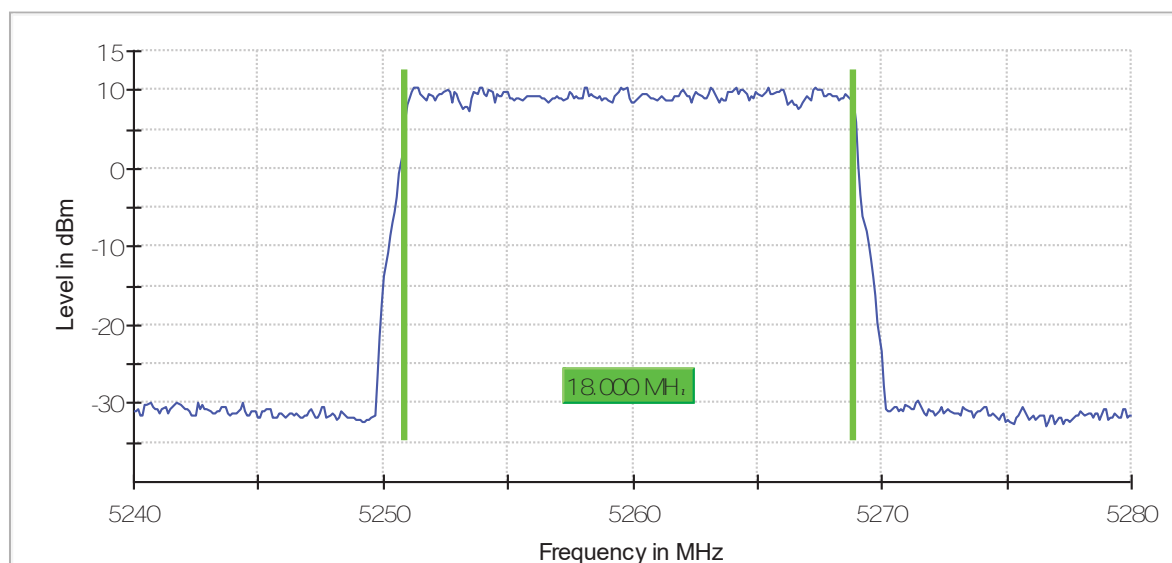
channel 48 (5240 MHz)

99 % Bandwidth

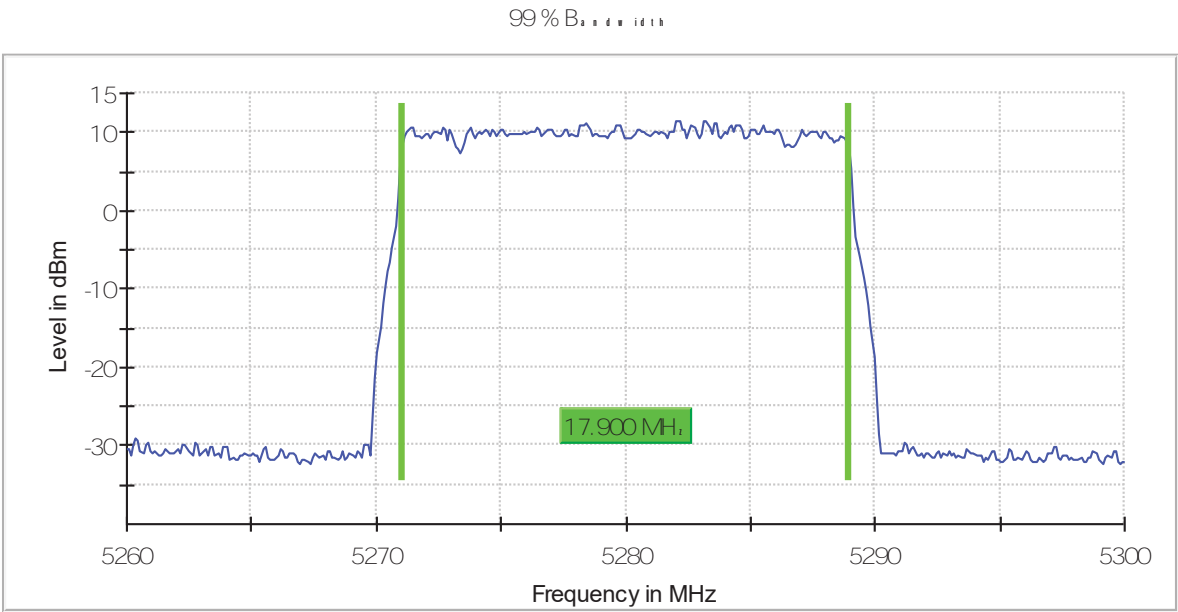


channel 52 (5260 MHz)

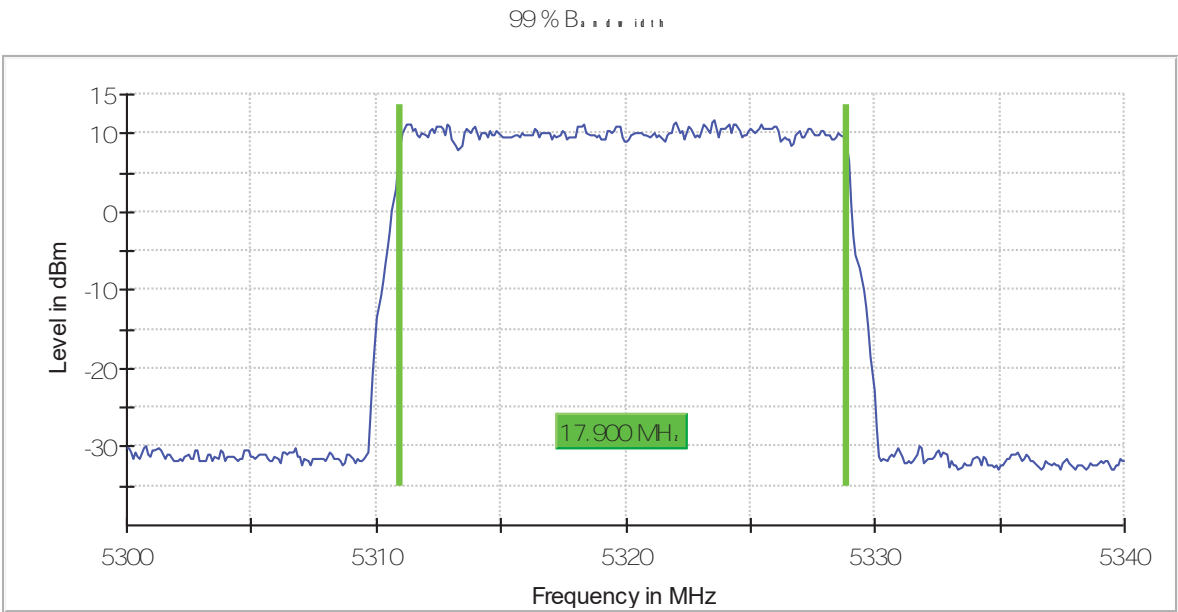
99 % Bandwidth



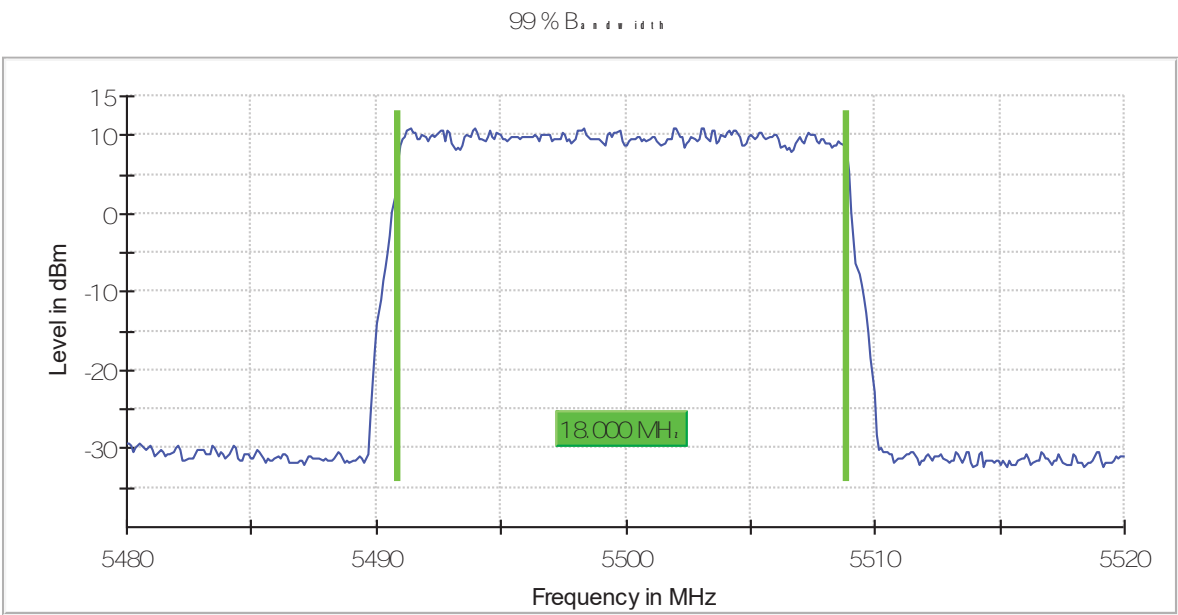
channel 56 (5280 MHz)



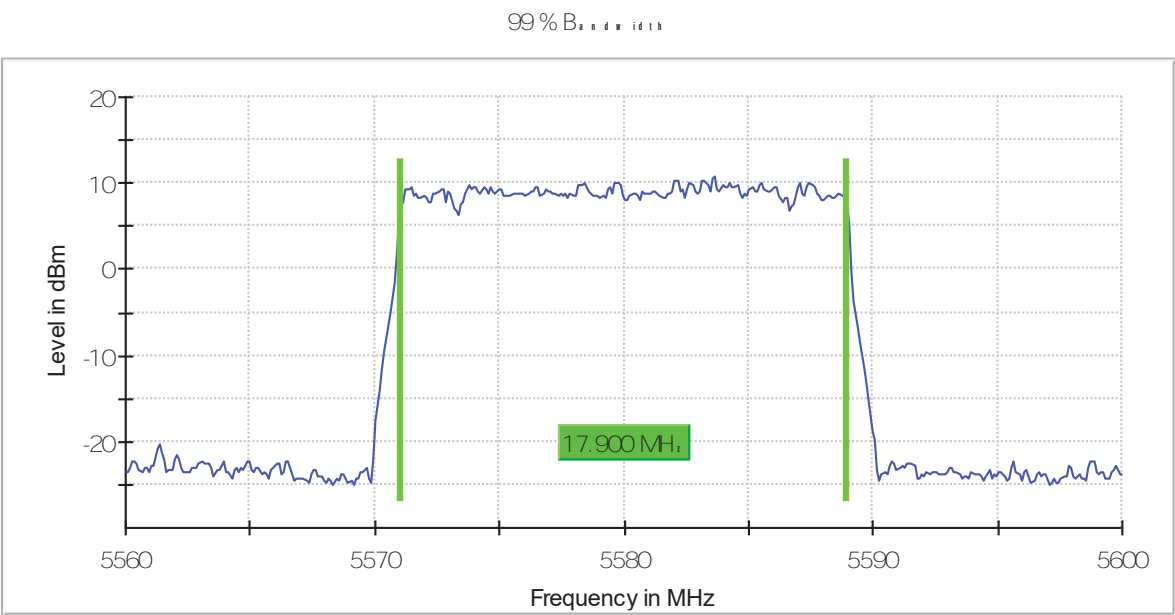
channel 64 (5320 MHz)



channel 100 (5500 MHz)

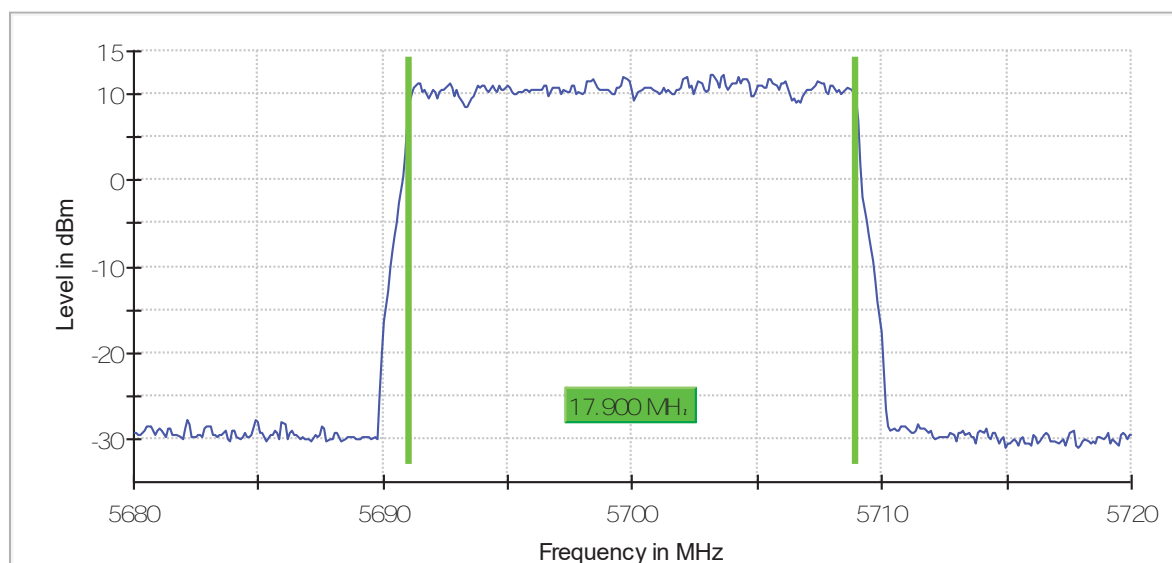


channel 116 (5580 MHz)



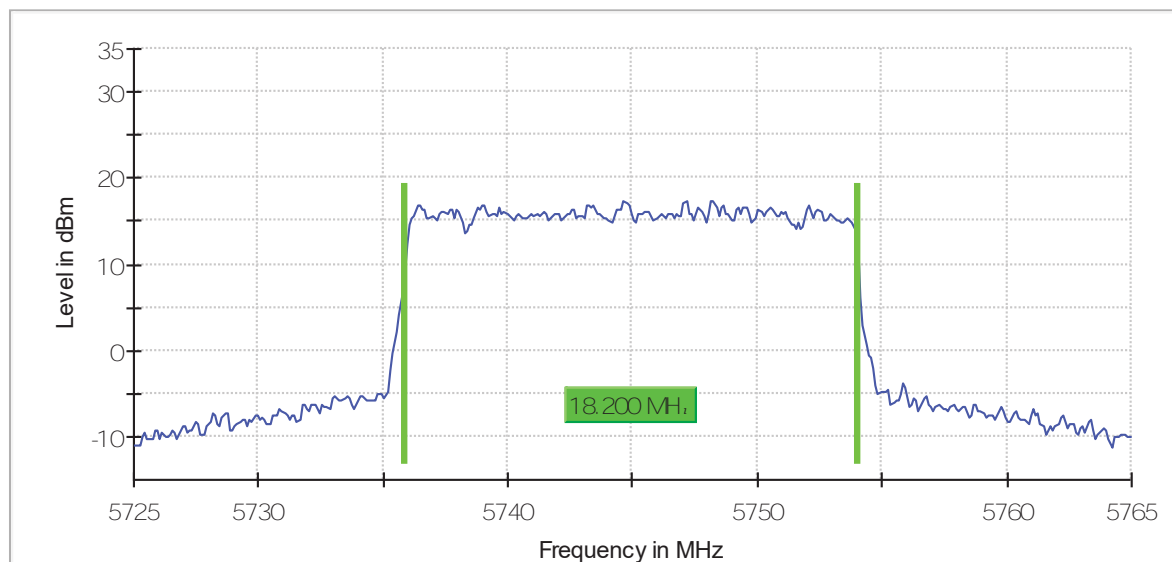
channel 140 (5700 MHz)

99 % Bandwidth



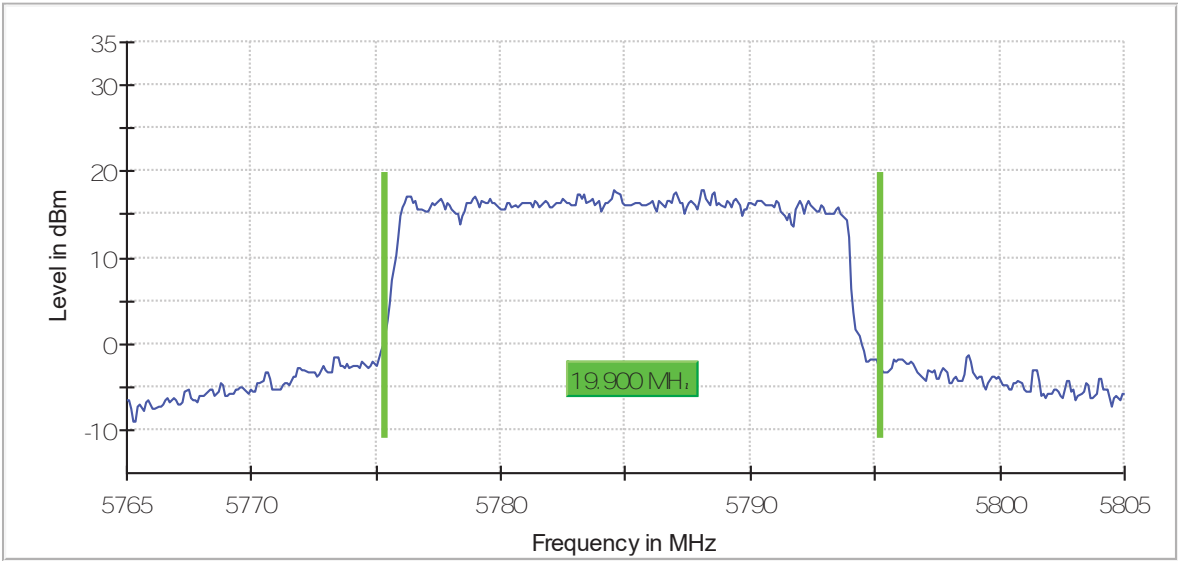
channel 149 (5745 MHz)

99 % Bandwidth



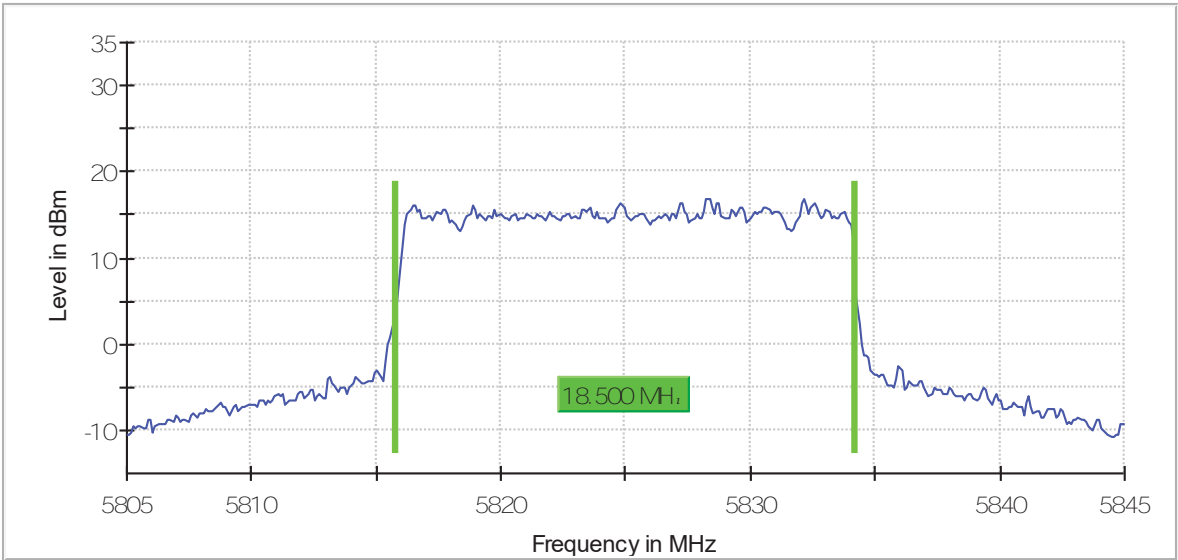
channel 157 (5785 MHz)

99 % Bandwidth



channel 165 (5825 MHz)

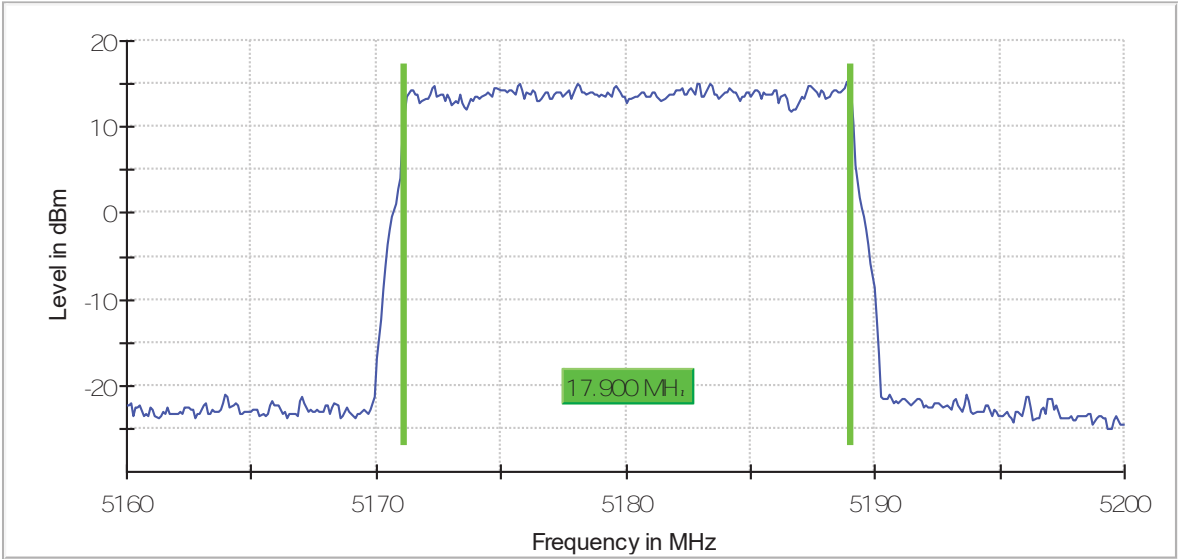
99 % Bandwidth



Mode: 256QAM - 20MHz

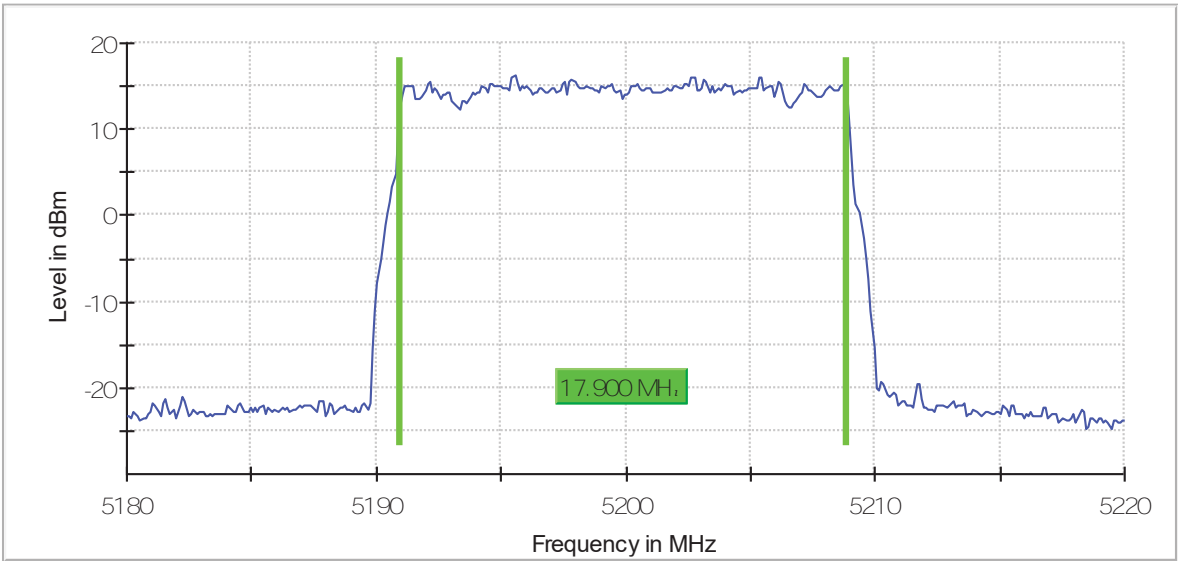
channel 36 (5180 MHz)

99 % B a n d w i d t h

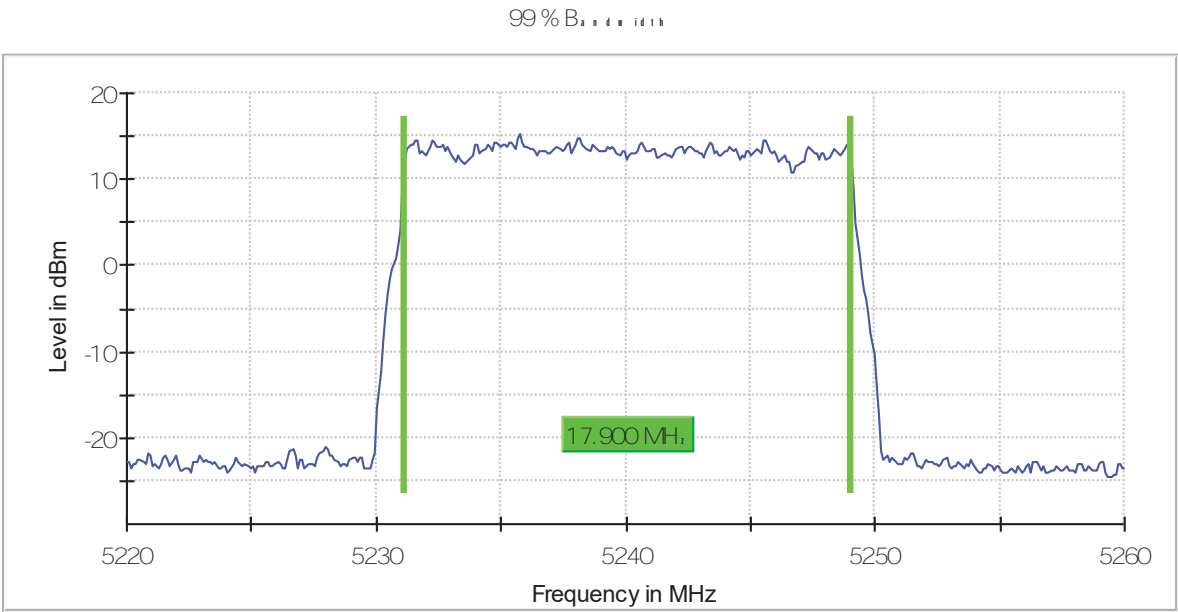


channel 40 (5200 MHz)

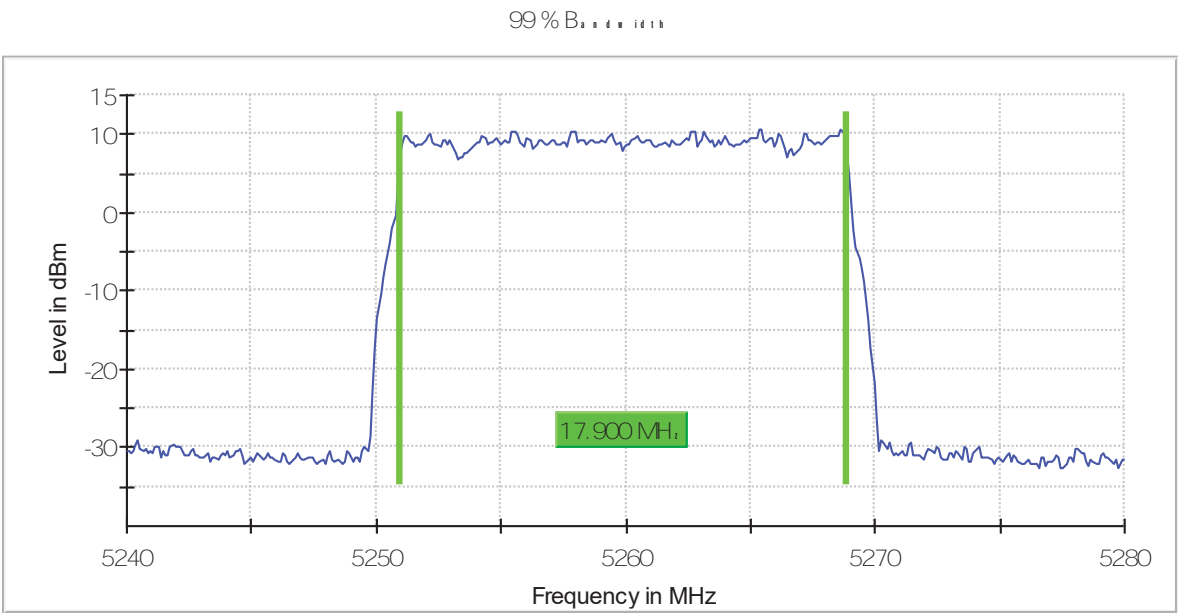
99 % B a n d w i d t h



channel 48 (5240 MHz)

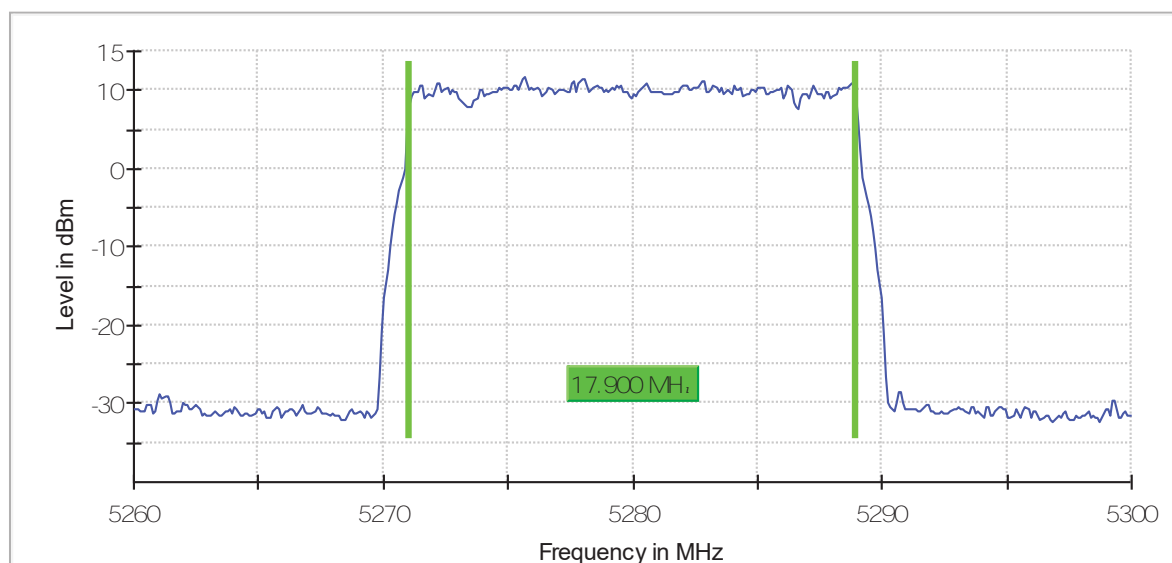


channel 52 (5260 MHz)



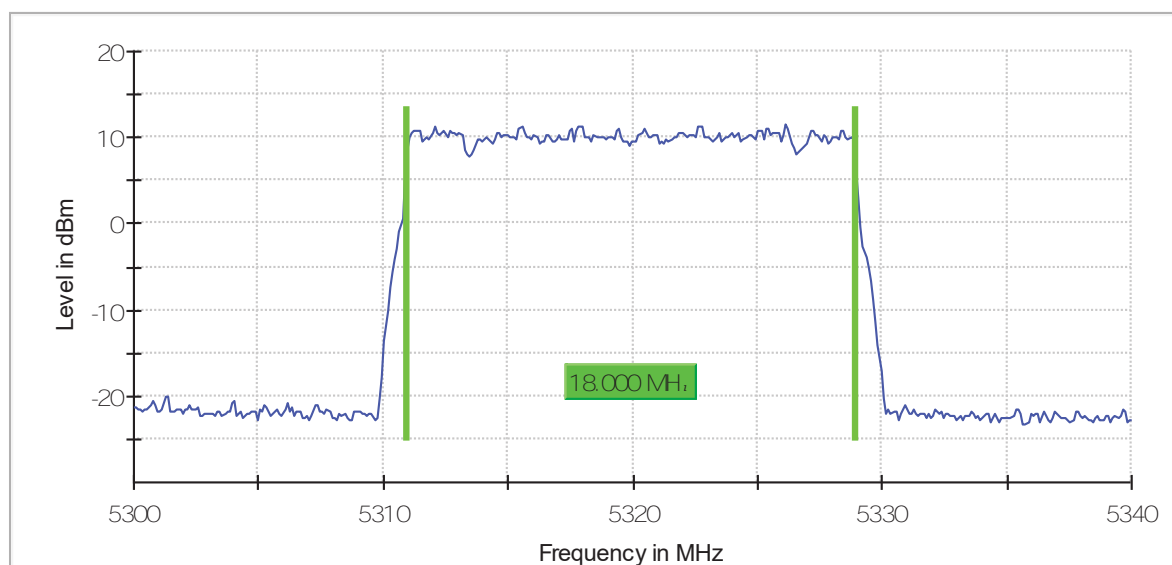
channel 56 (5280 MHz)

99 % Bandwidth



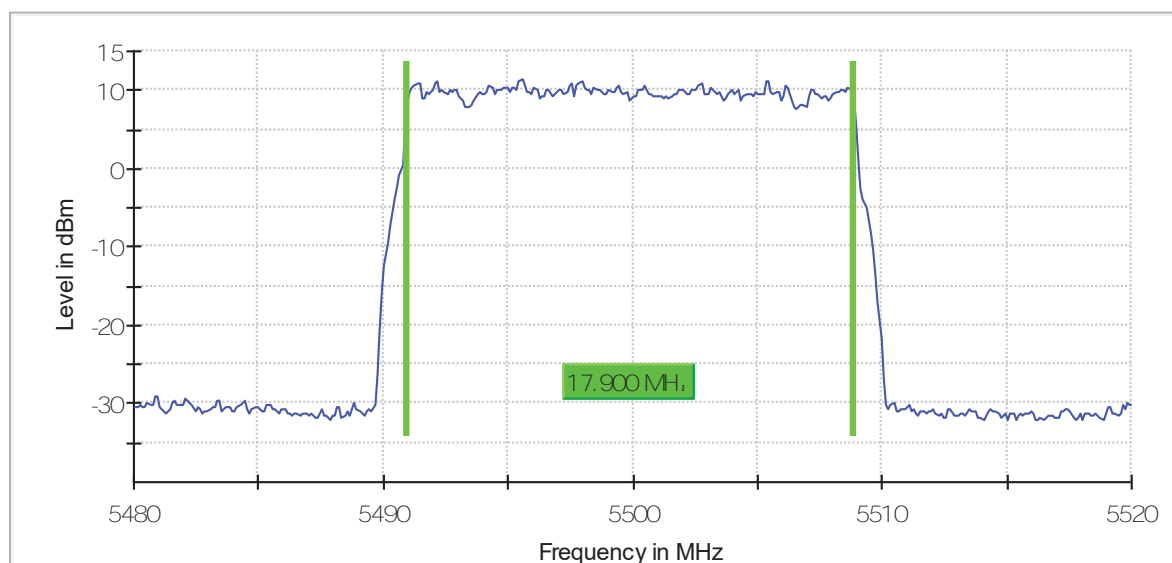
channel 64 (5320 MHz)

99 % Bandwidth



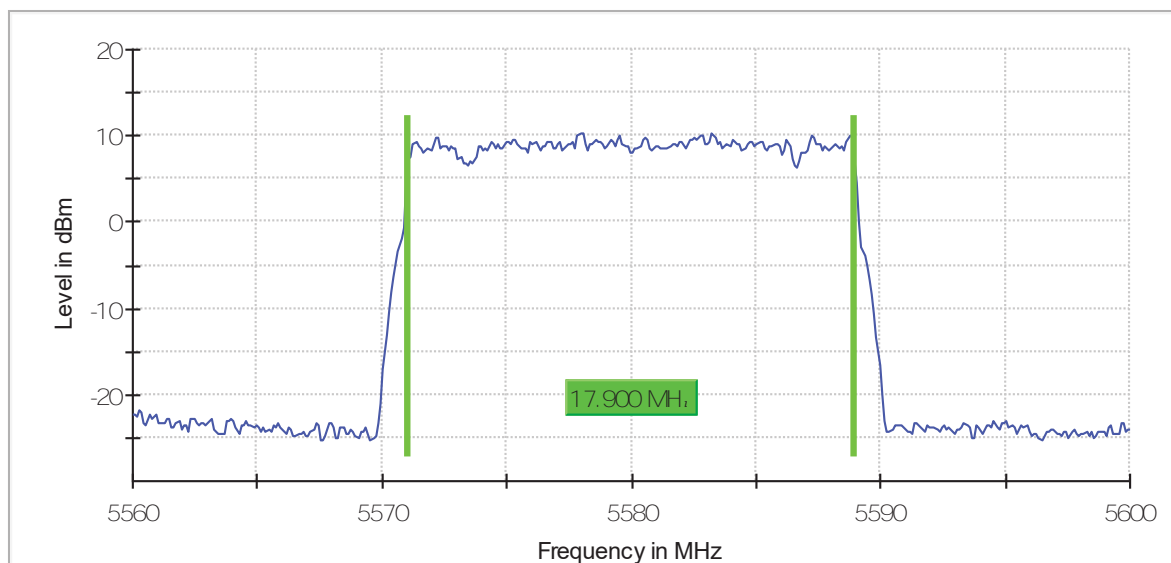
channel 100 (5500 MHz)

99 % Bandwidth



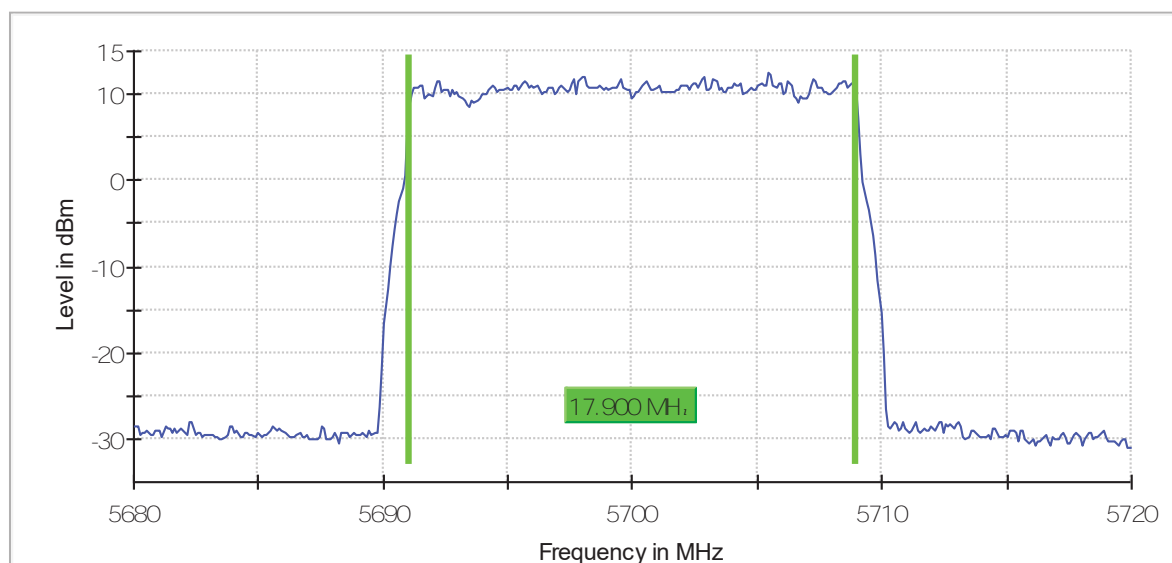
channel 116 (5580 MHz)

99 % Bandwidth



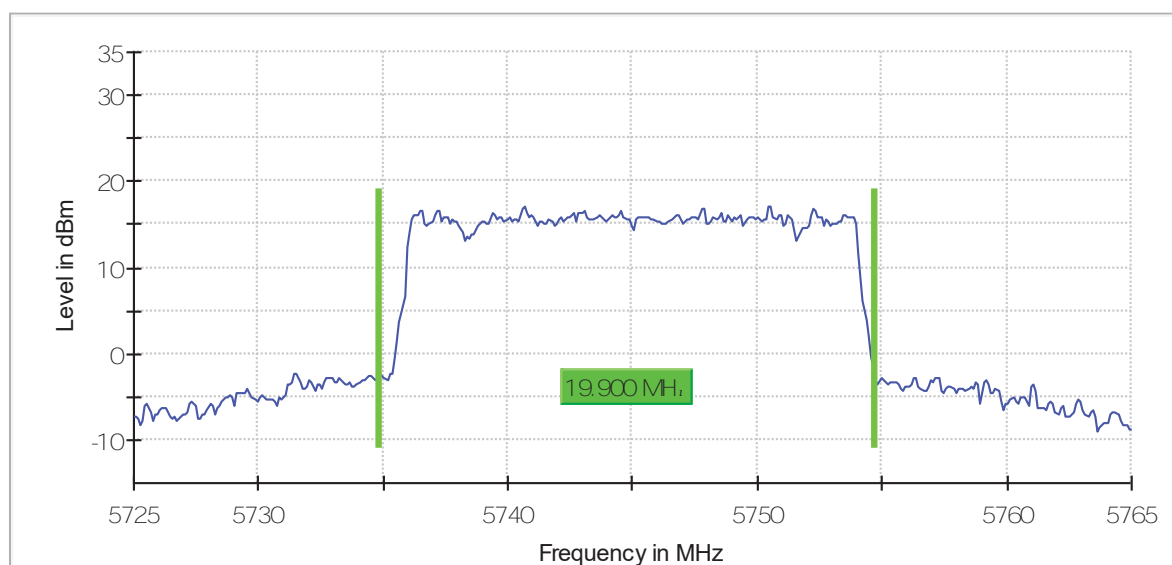
channel 140 (5700 MHz)

99 % Bandwidth



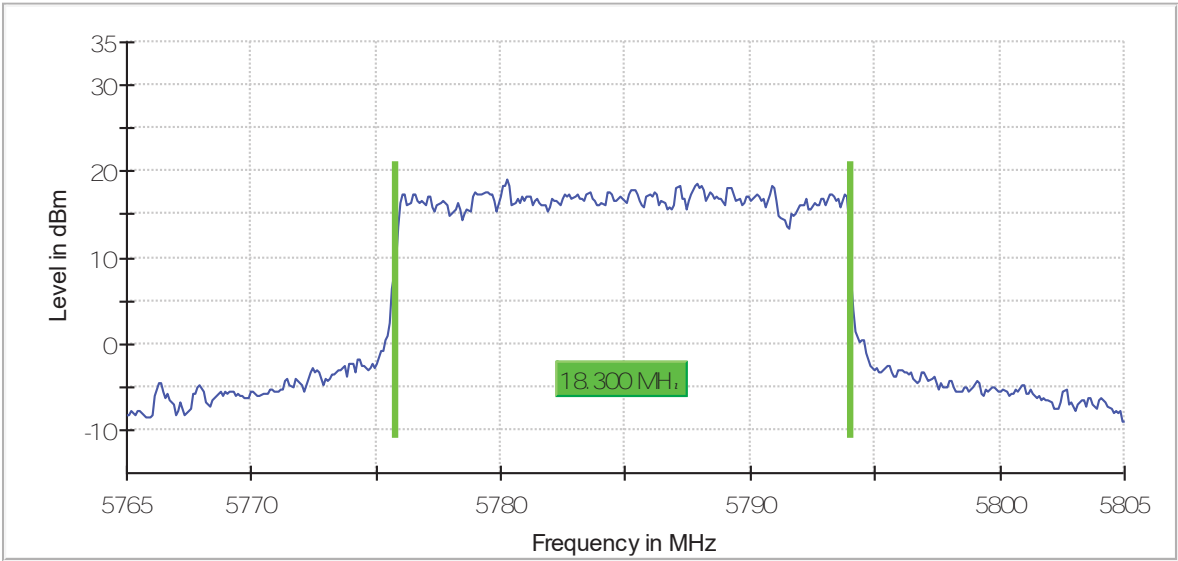
channel 149 (5745 MHz)

99 % Bandwidth



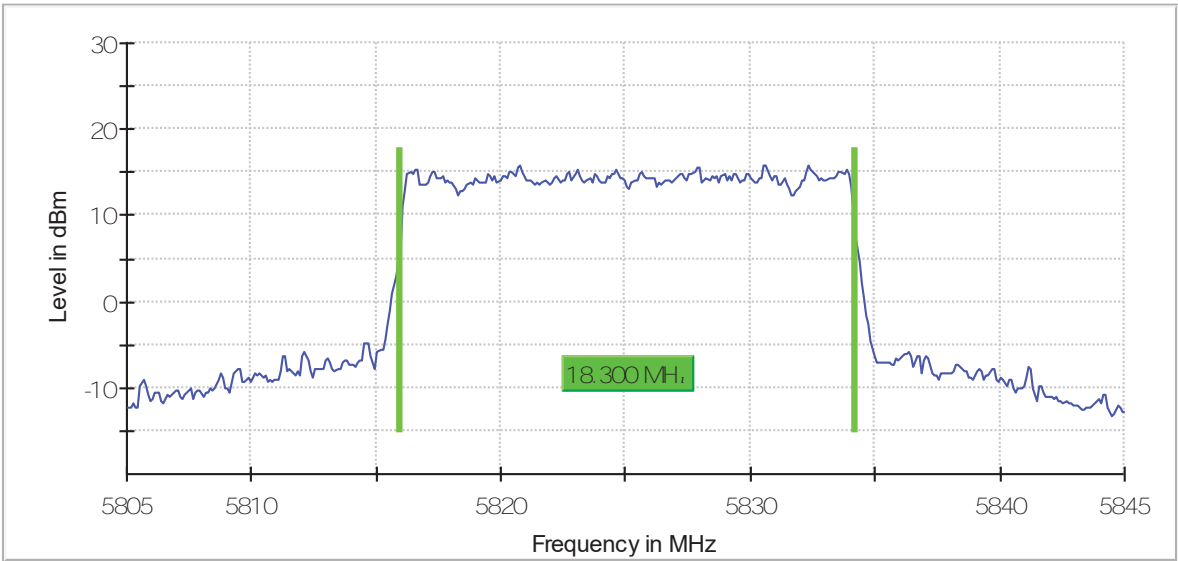
channel 157 (5785 MHz)

99 % Bandwidth



channel 165 (5825 MHz)

99 % Bandwidth



Section 15.407 Subclause 15.403(i) Transmitter 26 dB Emission Bandwidth (EBW)

RESULTS:

The 26 dB emission Bandwidth was measured using the method according to point C) 1) of 789033 D02 General UNII Test Procedures New Rules v02r01.

Measurements were performed on all modes for testing.

Mode: QPSK – 20MHz

	26dB Emission Bandwidth (MHz)	Measurement uncertainty (KHz)
channel 36 (5180 MHz)	19.900	<±40.04
channel 40 (5200 MHz)	19.900	
channel 48 (5240 MHz)	19.800	
channel 52 (5260 MHz)	19.900	
channel 56 (5280 MHz)	19.900	
channel 64 (5320 MHz)	19.900	
channel 100 (5500 MHz)	19.900	
channel 116 (5580 MHz)	19.900	
channel 140 (5700 MHz)	19.900	

Mode: 16QAM – 20MHz

	26dB Emission Bandwidth (MHz)	Measurement uncertainty (KHz)
channel 36 (5180 MHz)	19.900	<±40.04
channel 40 (5200 MHz)	19.800	
channel 48 (5240 MHz)	19.800	
channel 52 (5260 MHz)	19.900	
channel 56 (5280 MHz)	19.800	
channel 64 (5320 MHz)	19.900	
channel 100 (5500 MHz)	18.900	
channel 116 (5580 MHz)	19.800	
channel 140 (5700 MHz)	19.900	

Mode: 64QAM – 20MHz

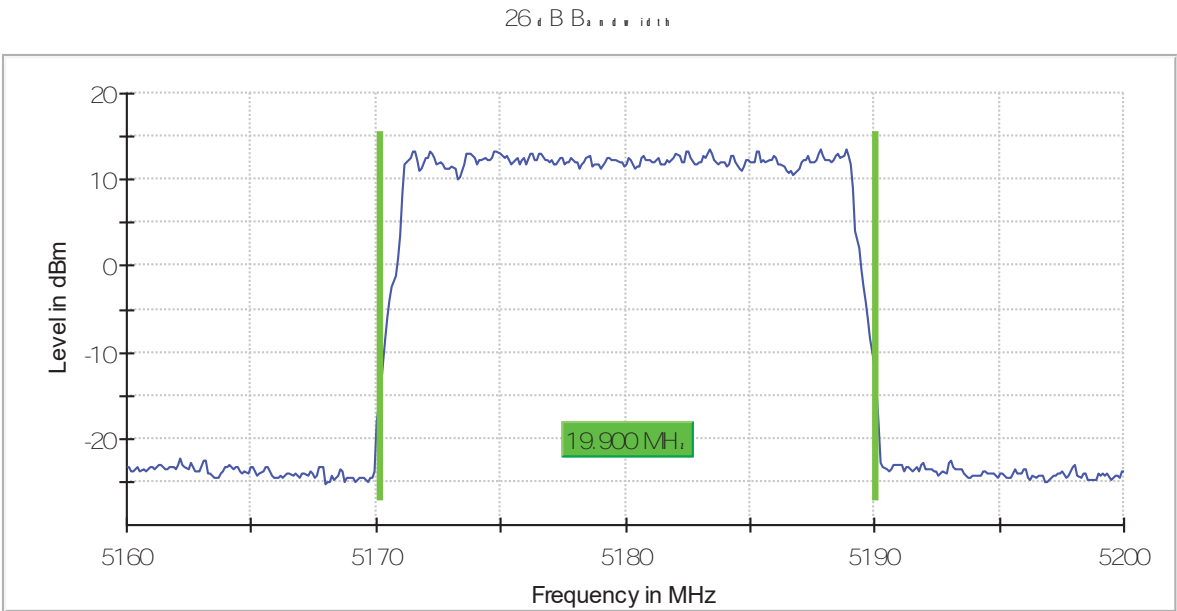
	26dB Emission Bandwidth (MHz)	Measurement uncertainty (KHz)
channel 36 (5180 MHz)	19.900	<±40.04
channel 40 (5200 MHz)	19.900	
channel 48 (5240 MHz)	19.800	
channel 52 (5260 MHz)	19.900	
channel 56 (5280 MHz)	19.800	
channel 64 (5320 MHz)	19.800	
channel 100 (5500 MHz)	19.800	
channel 116 (5580 MHz)	19.800	
channel 140 (5700 MHz)	19.900	

Mode: 256QAM – 20MHz

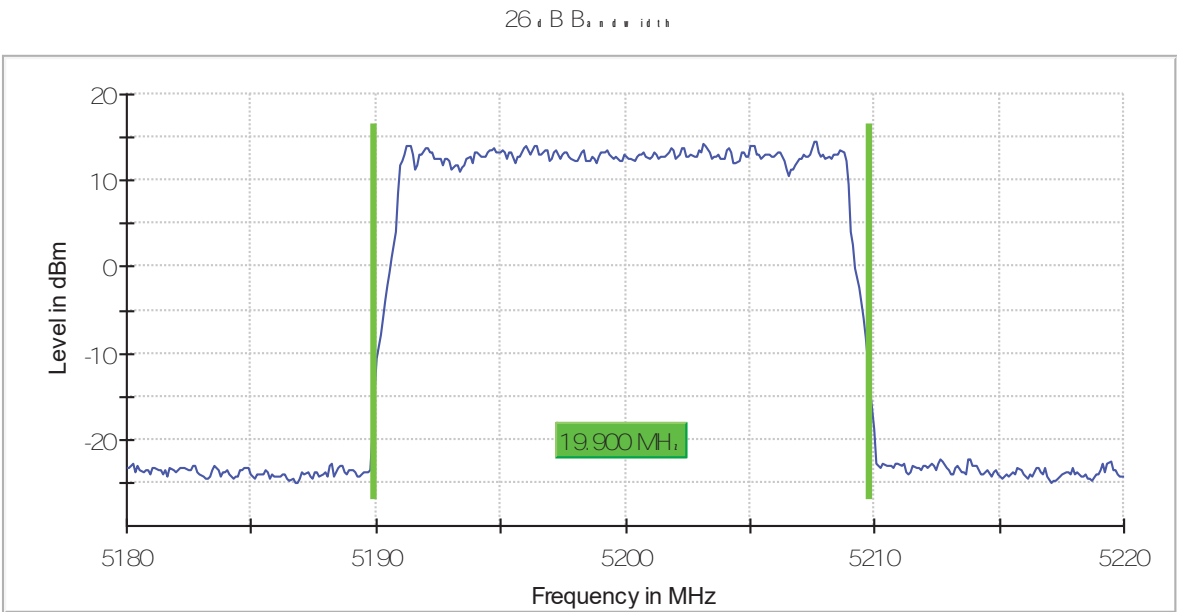
	26dB Emission Bandwidth (MHz)	Measurement uncertainty (KHz)
channel 36 (5180 MHz)	19.900	<±40.04
channel 40 (5200 MHz)	19.900	
channel 48 (5240 MHz)	19.900	
channel 52 (5260 MHz)	19.900	
channel 56 (5280 MHz)	19.900	
channel 64 (5320 MHz)	19.900	
channel 100 (5500 MHz)	19.900	
channel 116 (5580 MHz)	19.900	
channel 140 (5700 MHz)	19.900	

Mode: QPSK – 20MHz

channel 36 (5180 MHz)

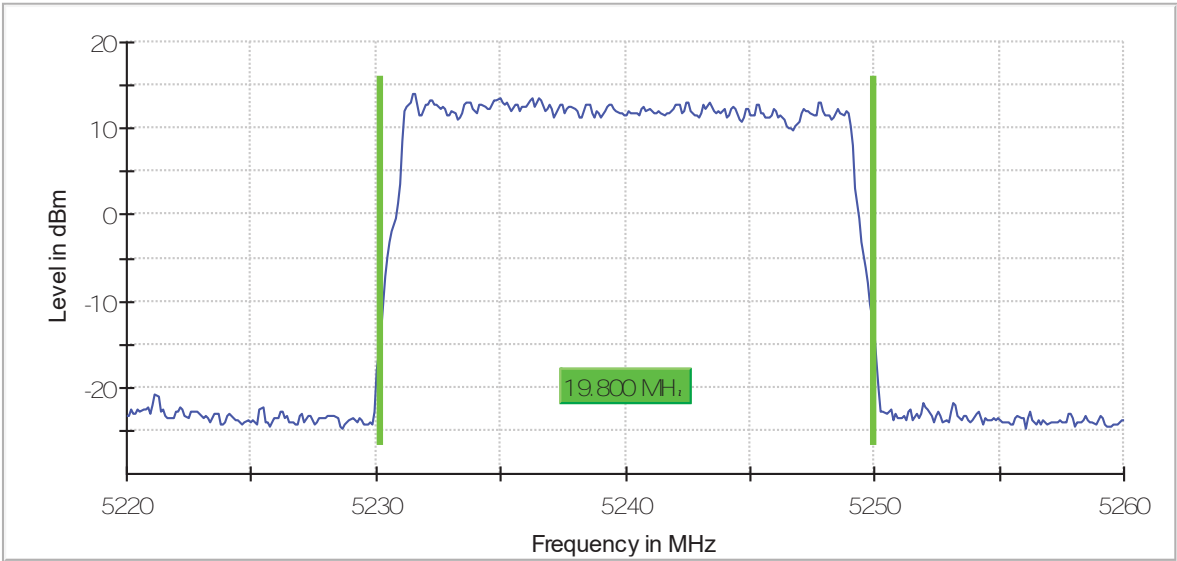


channel 40 (5200 MHz)



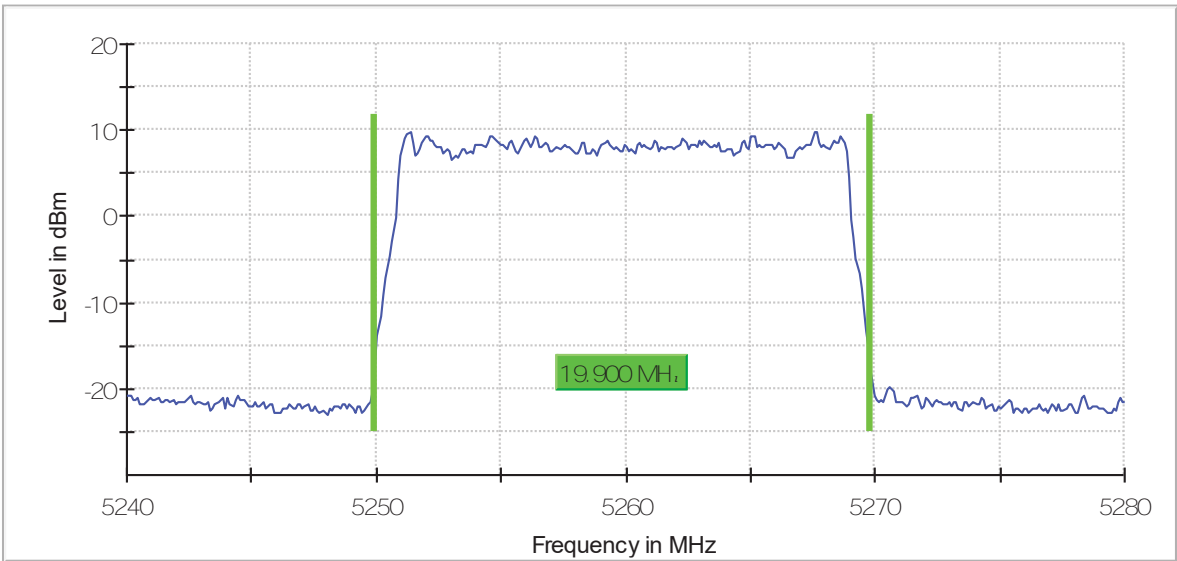
channel 48 (5240 MHz)

26 dB Bandwidth



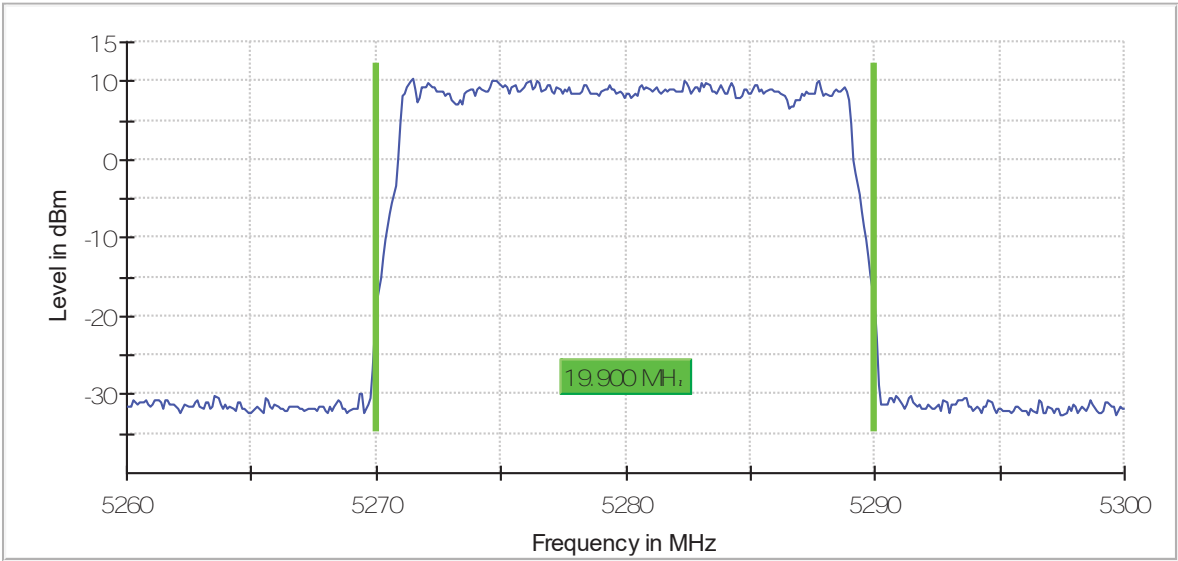
channel 52 (5260 MHz)

26 dB Bandwidth



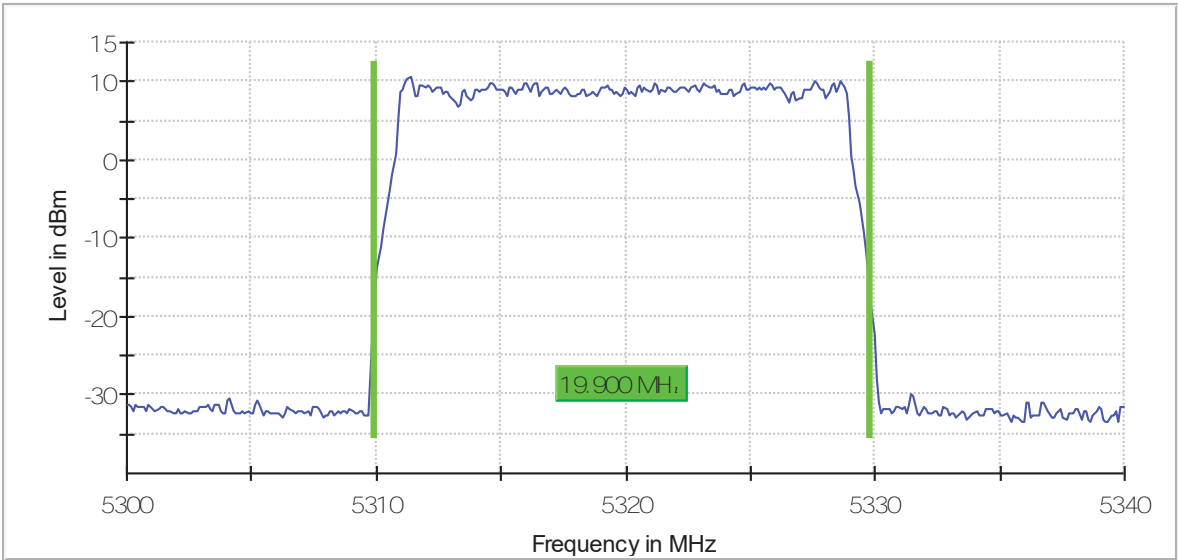
channel 56 (5280 MHz)

26 dB Bandwidth



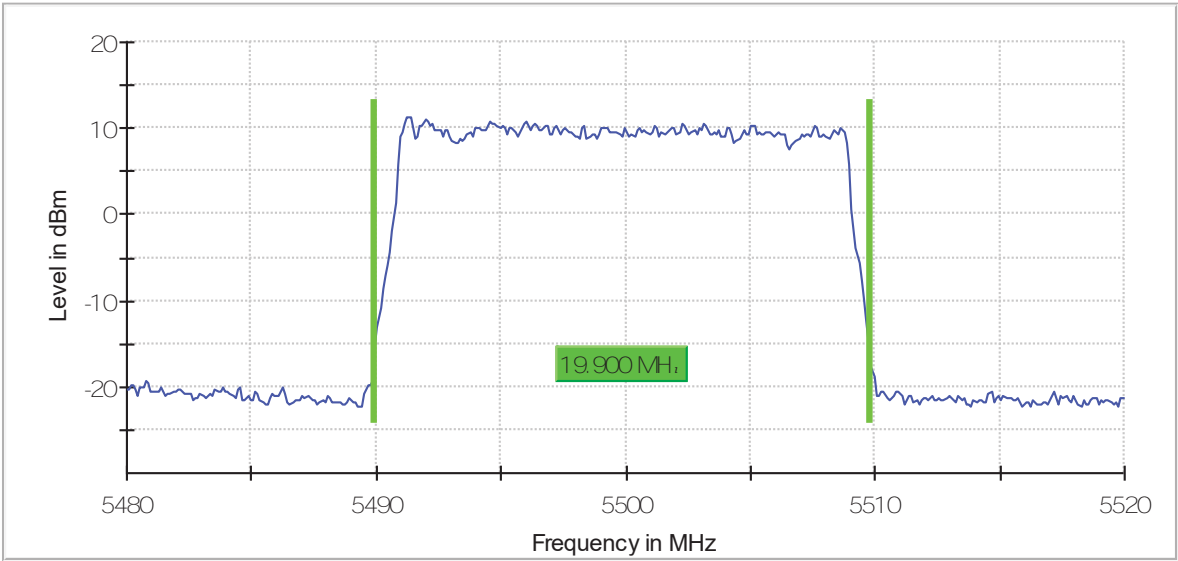
channel 64 (5320 MHz)

26 dB Bandwidth



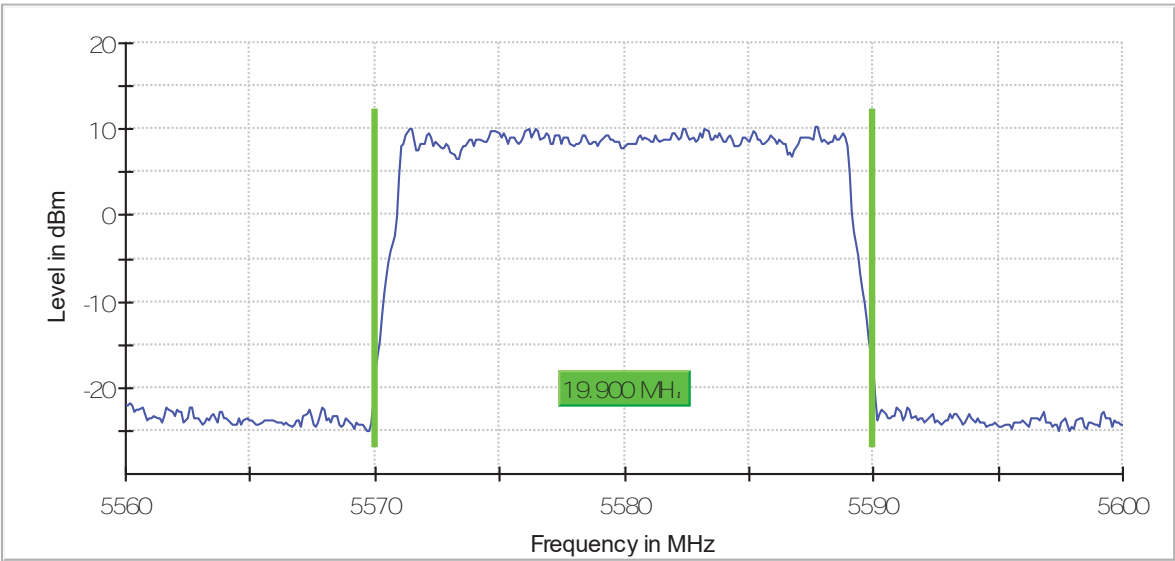
channel 100 (5500 MHz)

26 dB Bandwidth



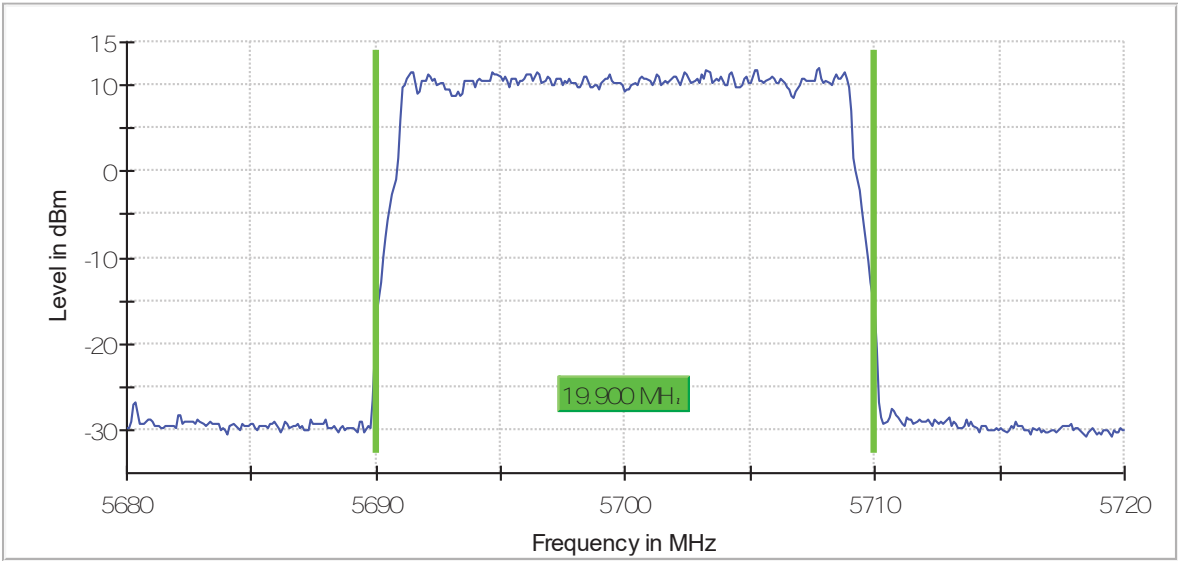
channel 116 (5580 MHz)

26 dB Bandwidth



channel 140 (5700 MHz)

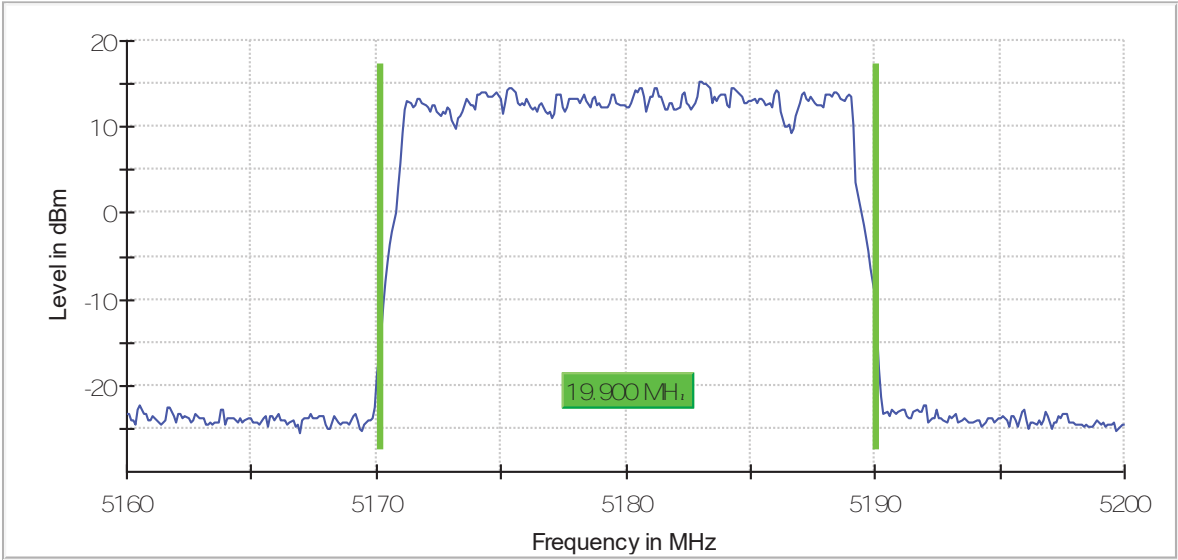
26 dB Bandwidth



Mode: 16QAM – 20MHz

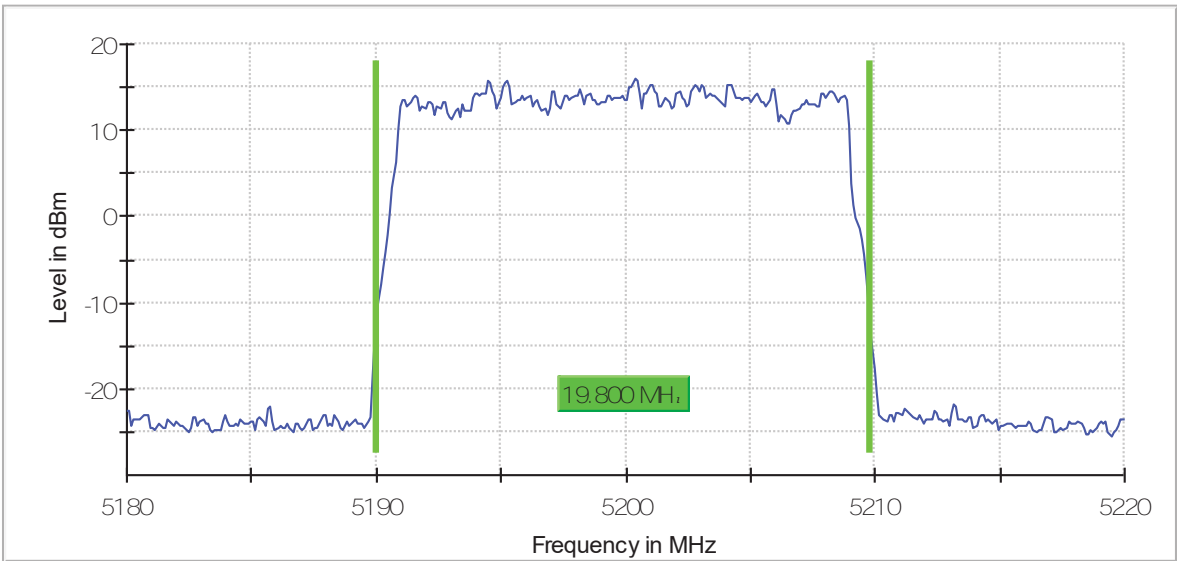
channel 36 (5180 MHz)

26 dB Bandwidth



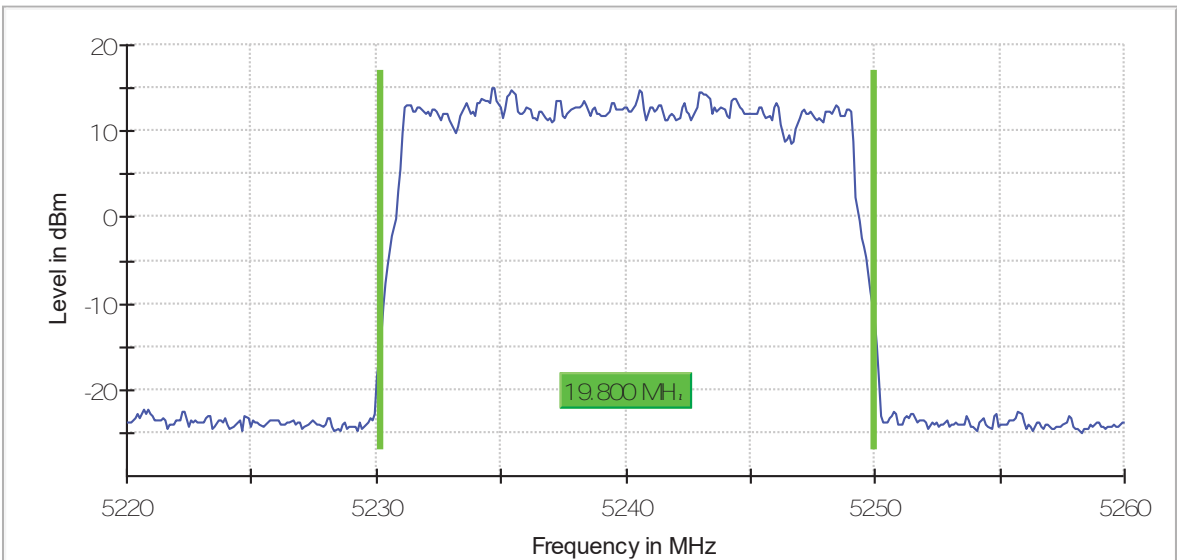
channel 40 (5200 MHz)

26 dB Bandwidth



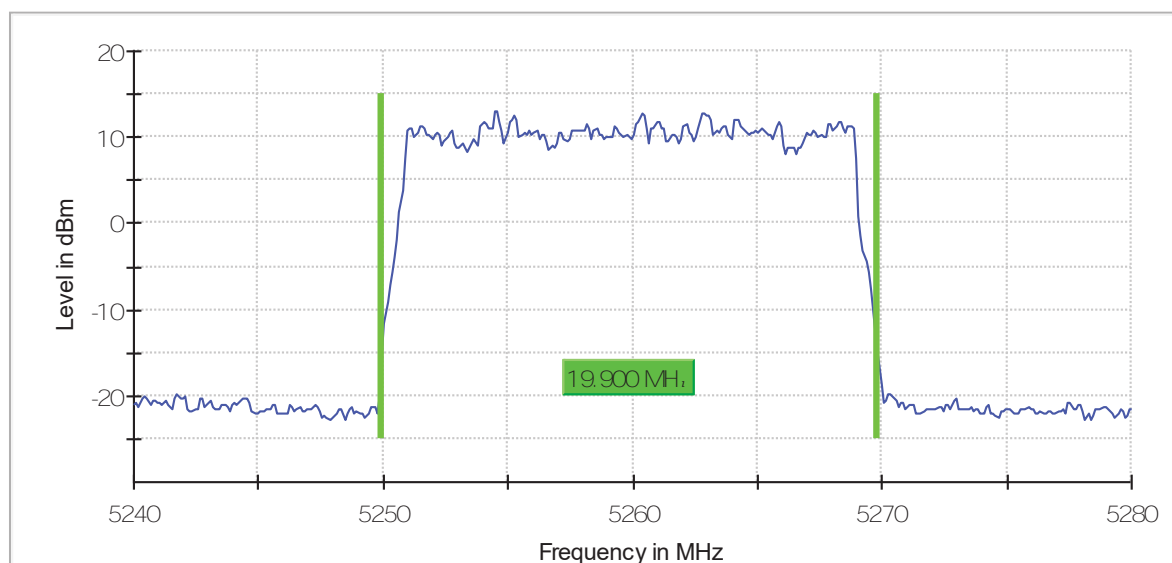
channel 48 (5240 MHz)

26 dB Bandwidth



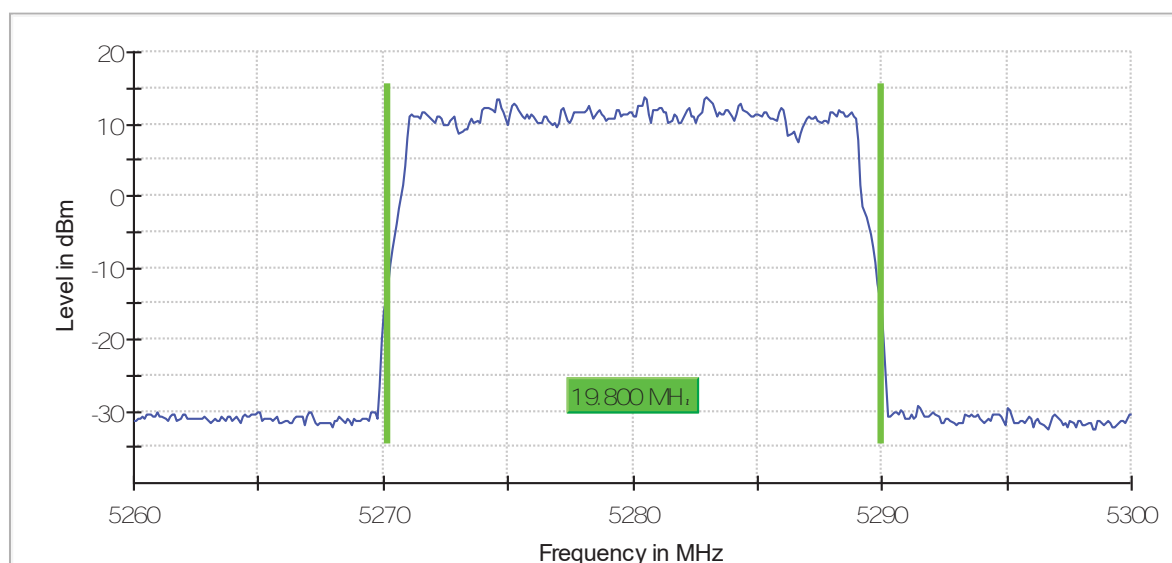
channel 52 (5260 MHz)

26 dB Bandwidth



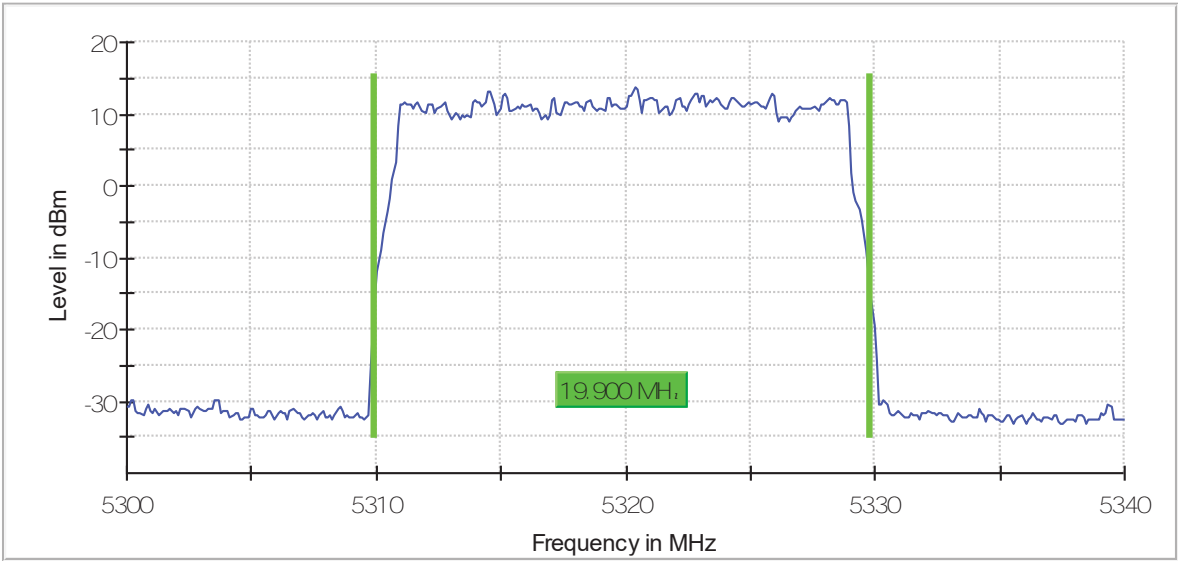
channel 56 (5280 MHz)

26 dB Bandwidth



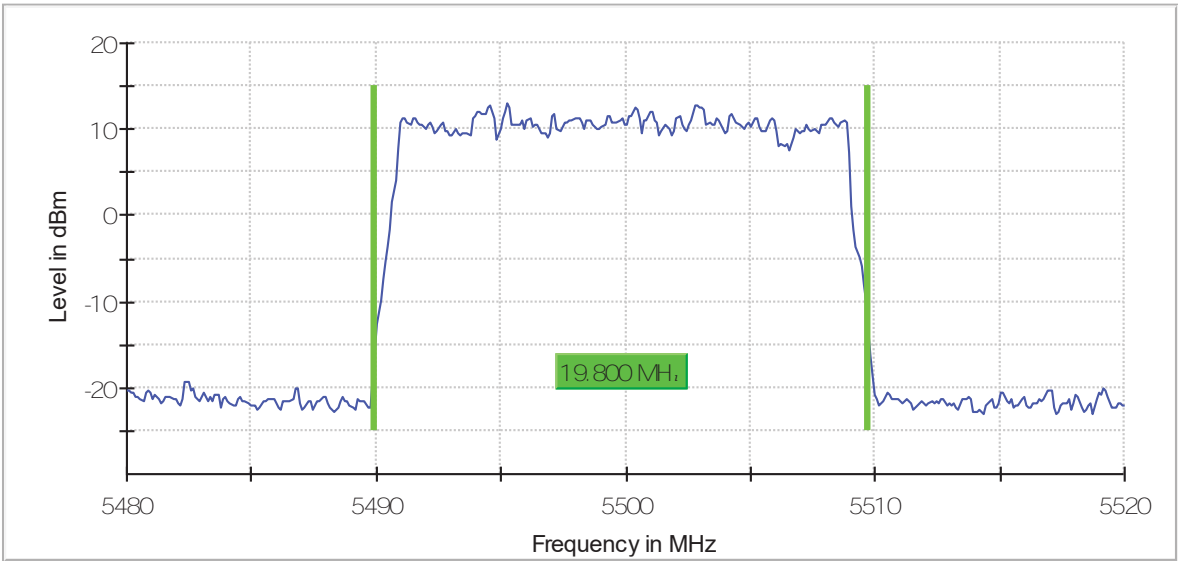
channel 64 (5320 MHz)

26 dB Bandwidth



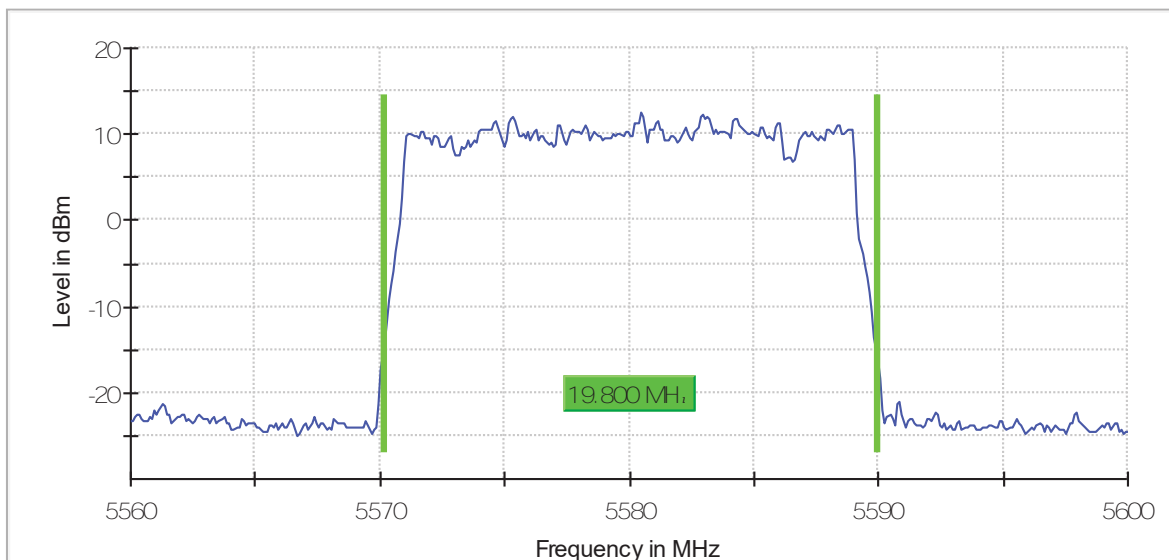
channel 100 (5500 MHz)

26 dB Bandwidth



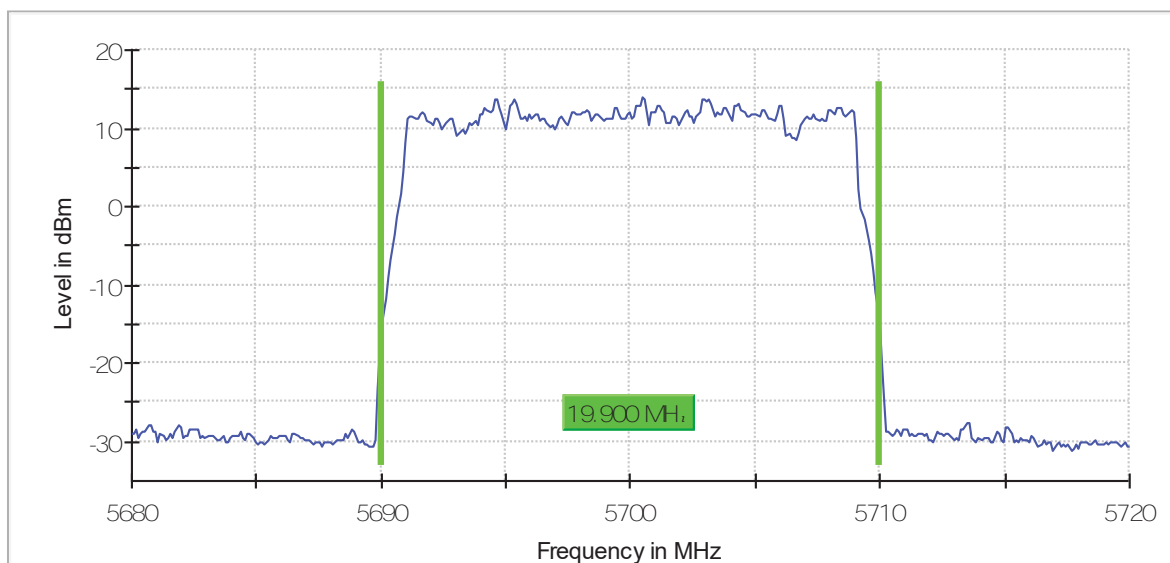
channel 116 (5580 MHz)

26 dB Bandwidth



channel 140 (5700 MHz)

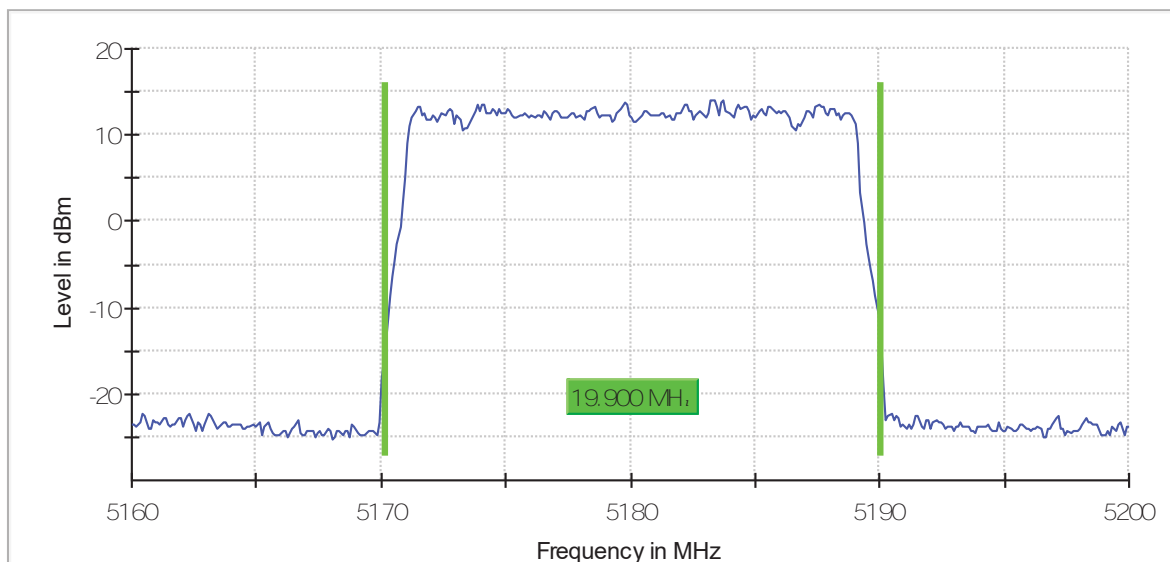
26 dB Bandwidth



Mode: 64QAM – 20MHz

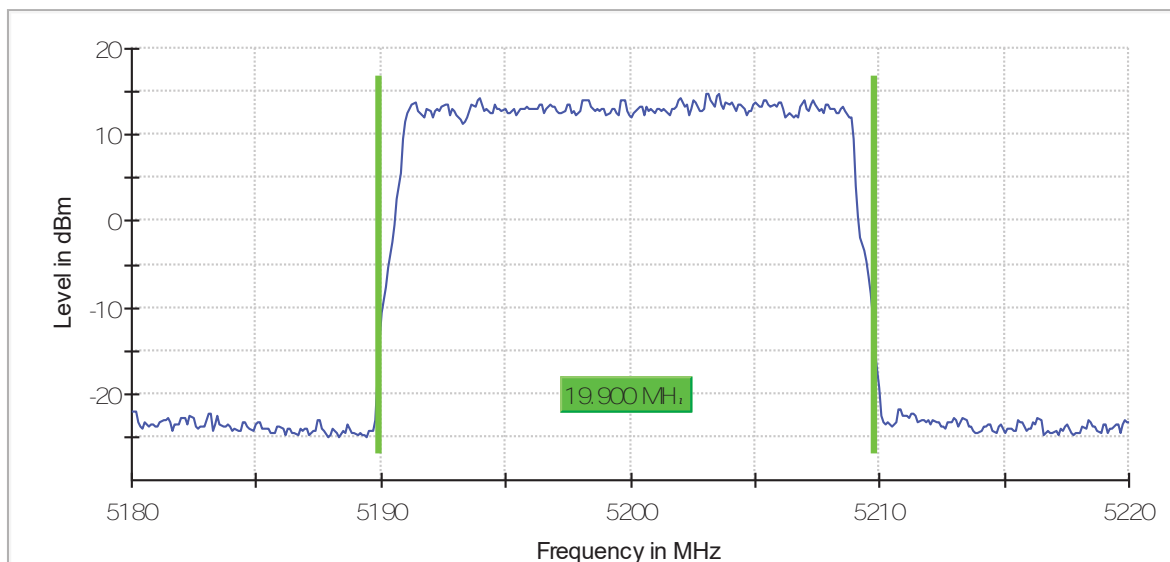
channel 36 (5180 MHz)

26 dB Bandwidth



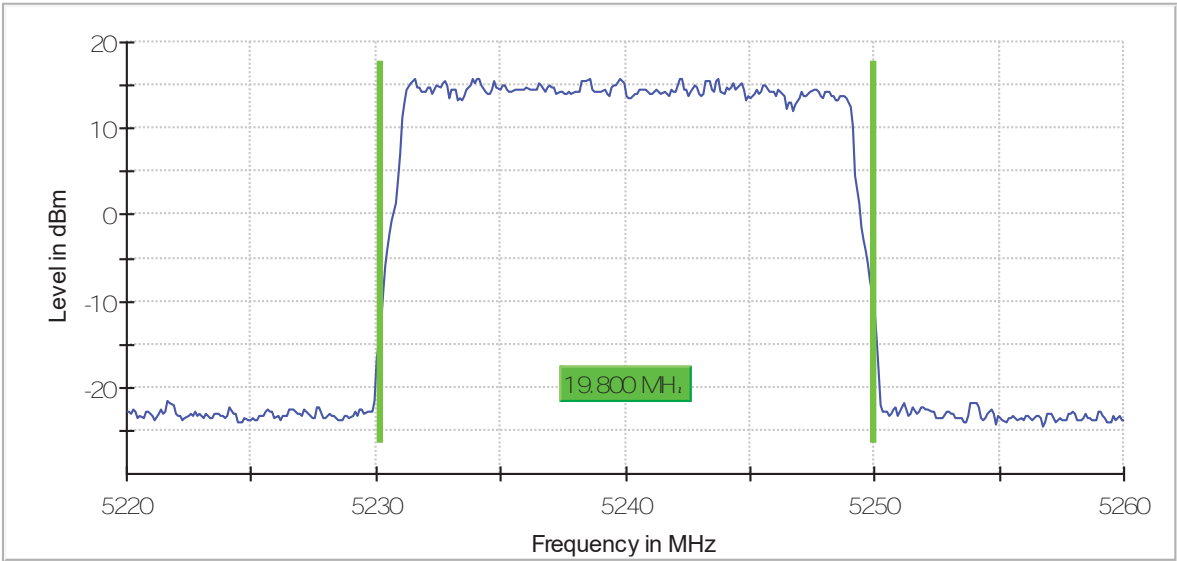
channel 40 (5200 MHz)

26 dB Bandwidth



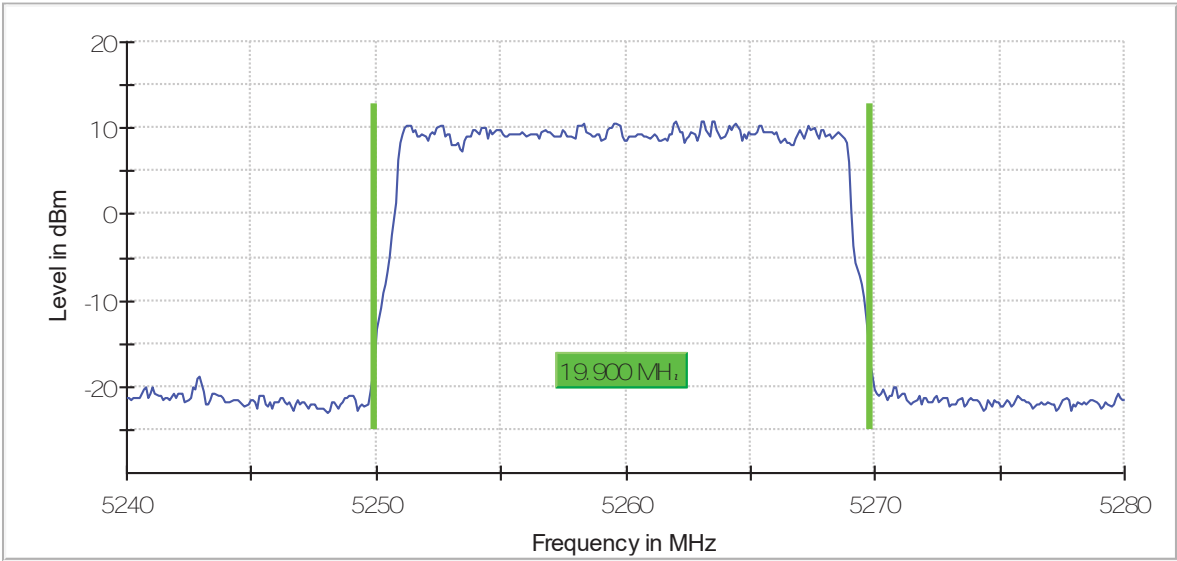
channel 48 (5240 MHz)

26 dB Bandwidth



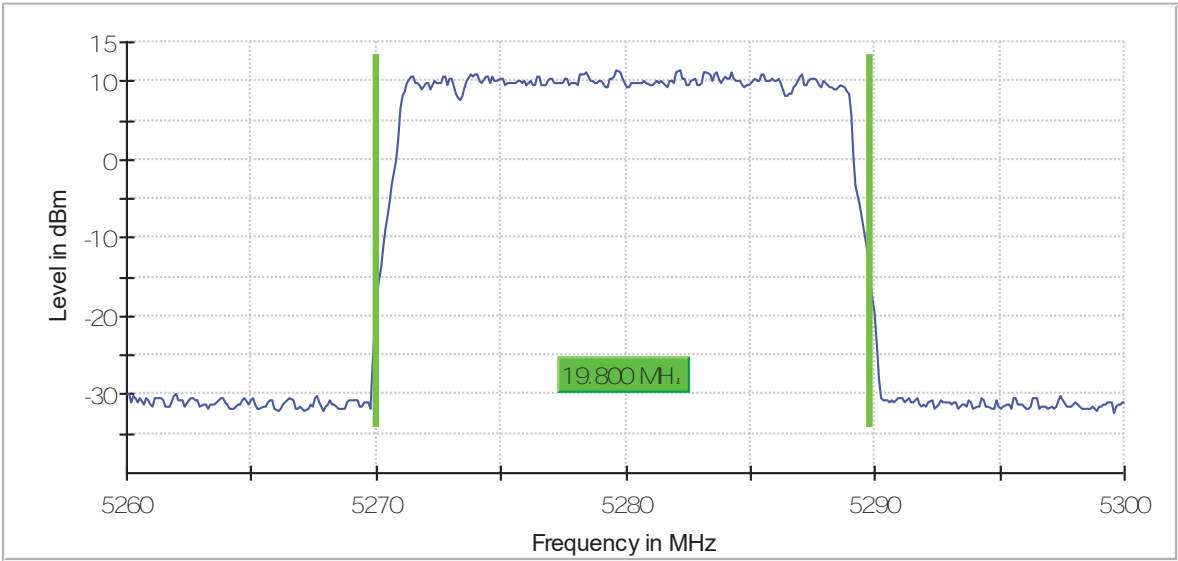
channel 52 (5260 MHz)

26 dB Bandwidth



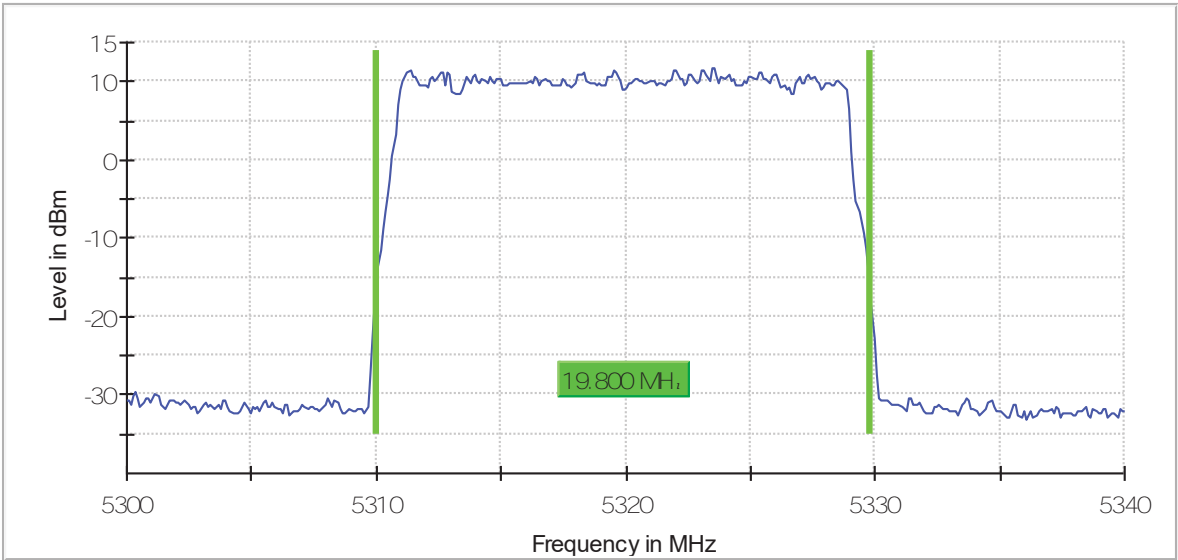
channel 56 (5280 MHz)

26 dB Bandwidth



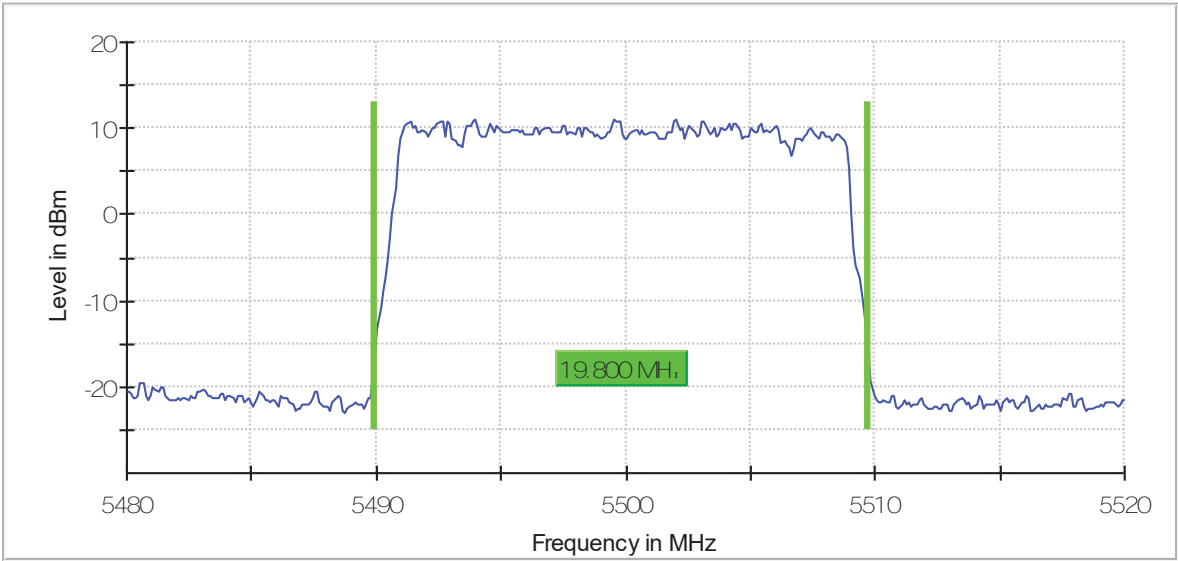
channel 64 (5320 MHz)

26 dB Bandwidth



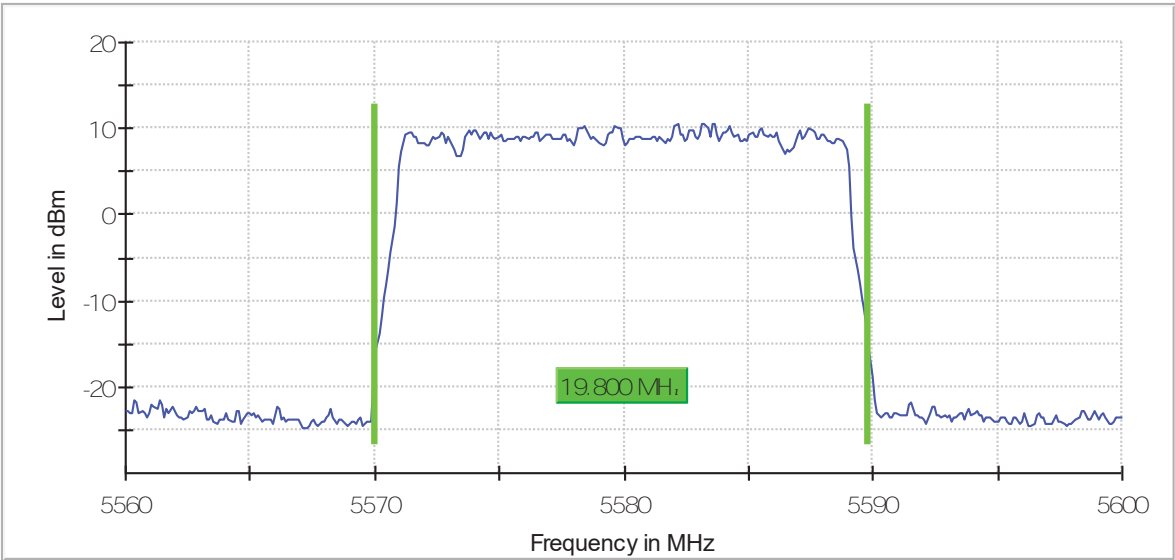
channel 100 (5500 MHz)

26 dB Bandwidth



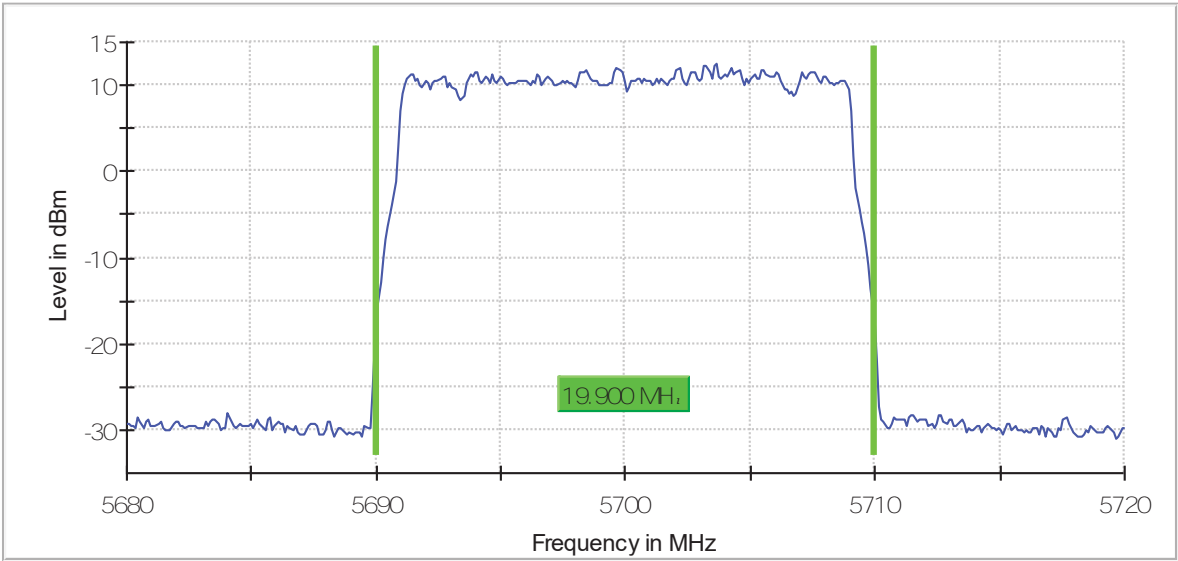
channel 116 (5580 MHz)

26 dB Bandwidth



channel 140 (5700 MHz)

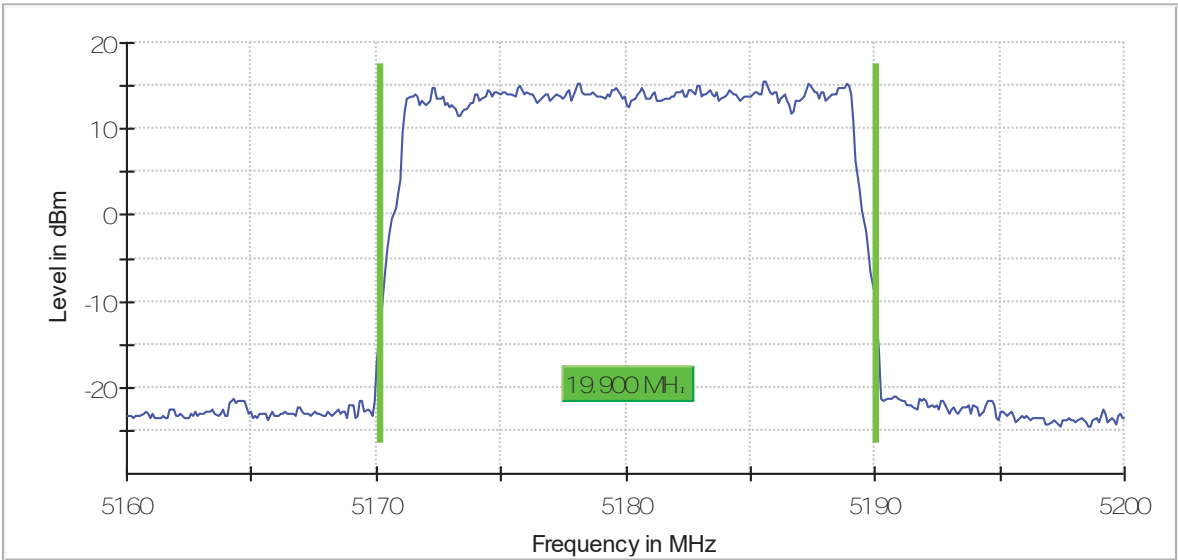
26 dB Bandwidth



Mode: 256QAM – 20MHz

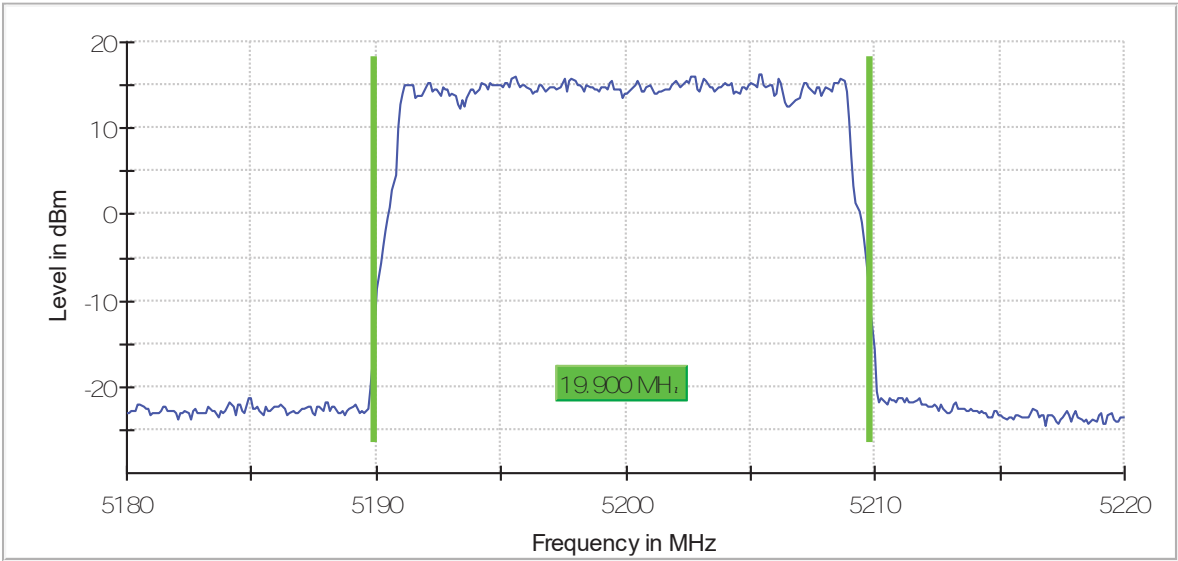
channel 36 (5180 MHz)

26 dB Bandwidth



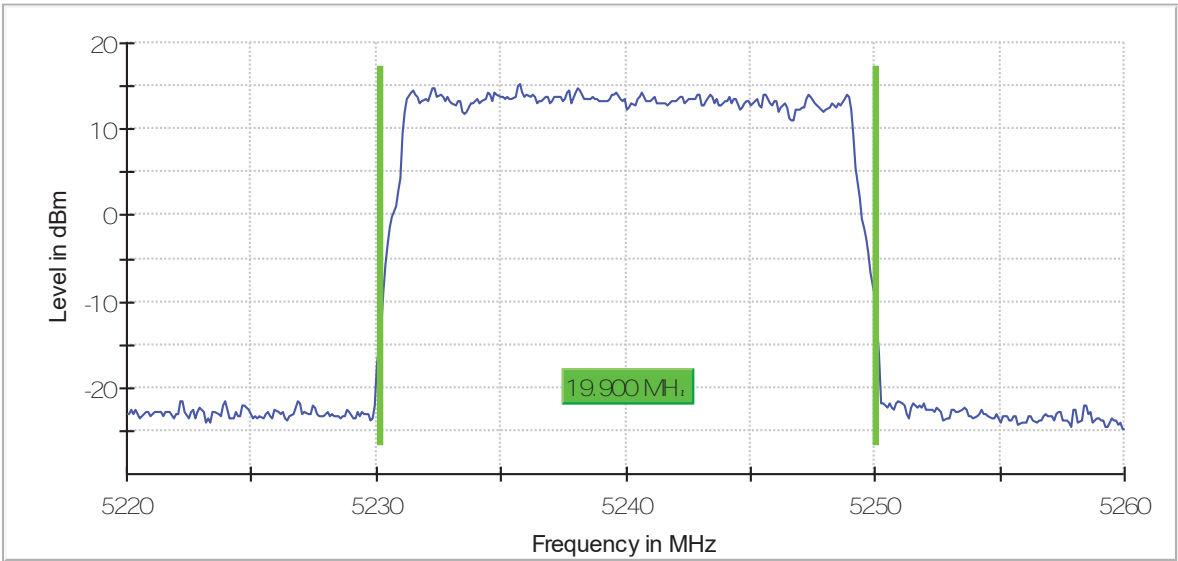
channel 40 (5200 MHz)

26 dB Bandwidth



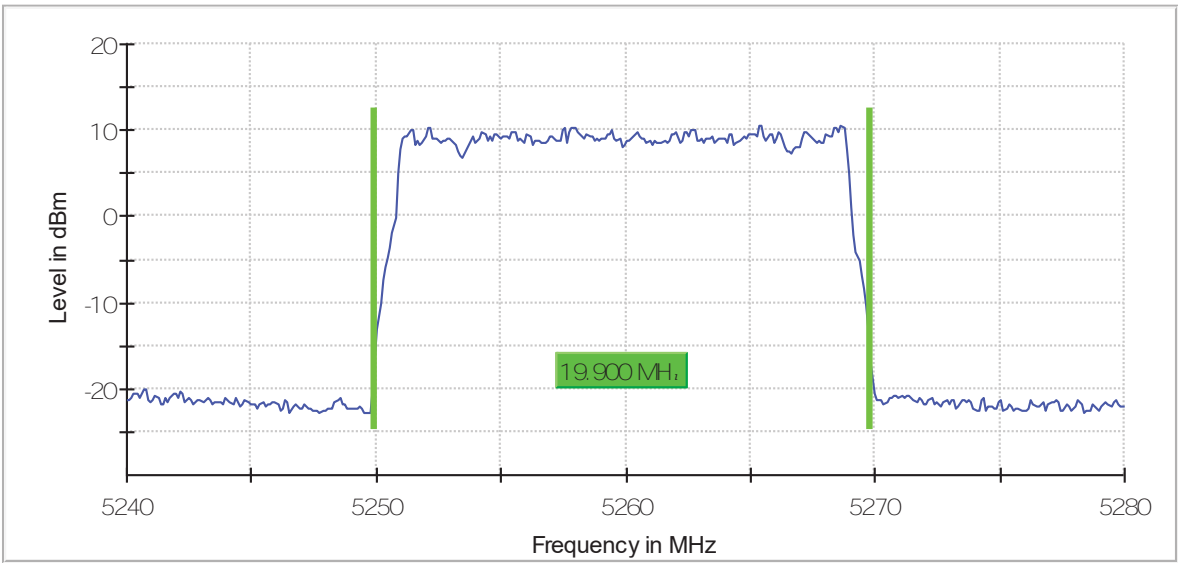
channel 48 (5240 MHz)

26 dB Bandwidth



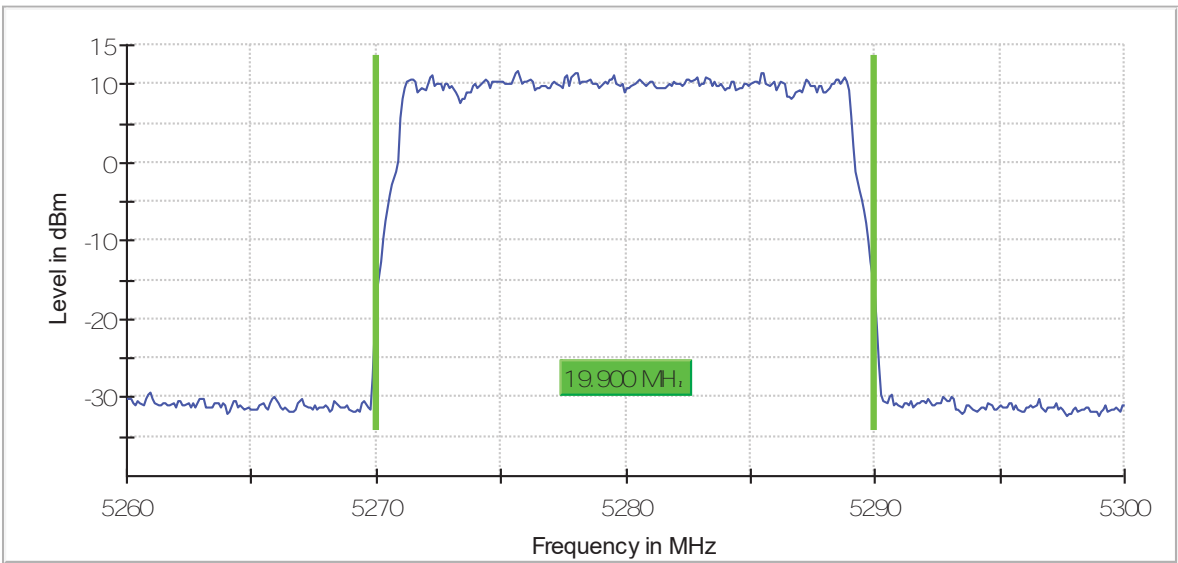
channel 52 (5260 MHz)

26 dB Bandwidth



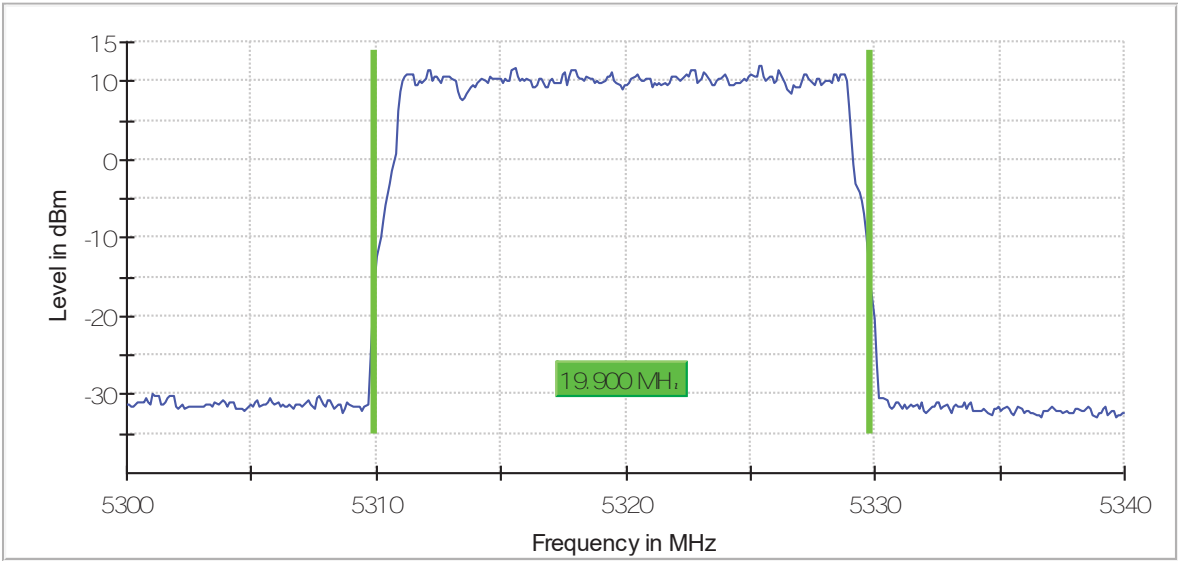
channel 56 (5280 MHz)

26 dB Bandwidth



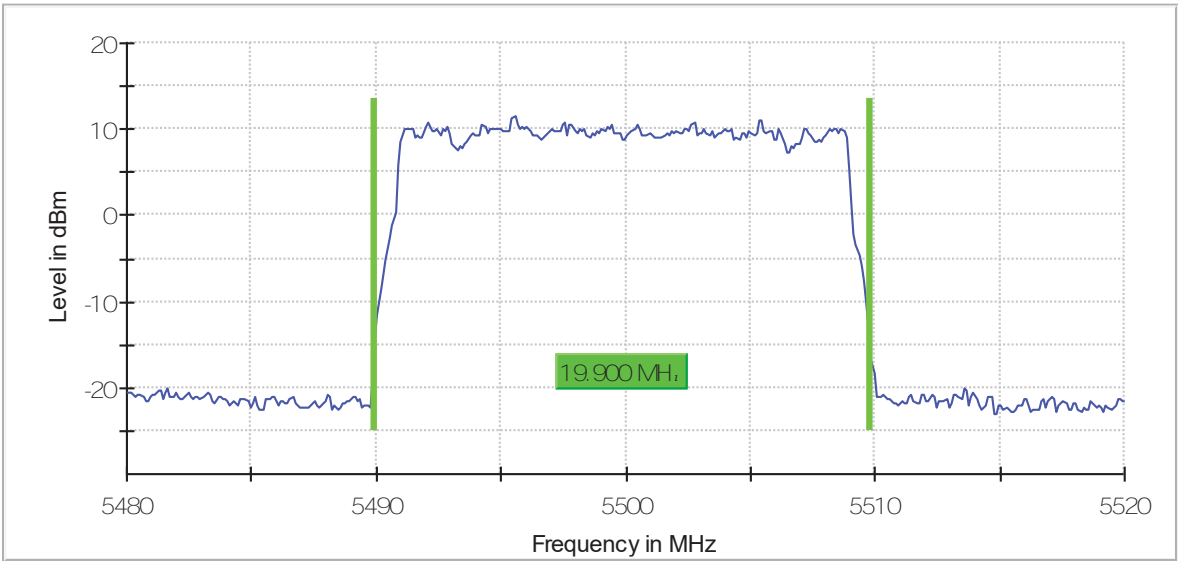
channel 64 (5320 MHz)

26 dB Bandwidth



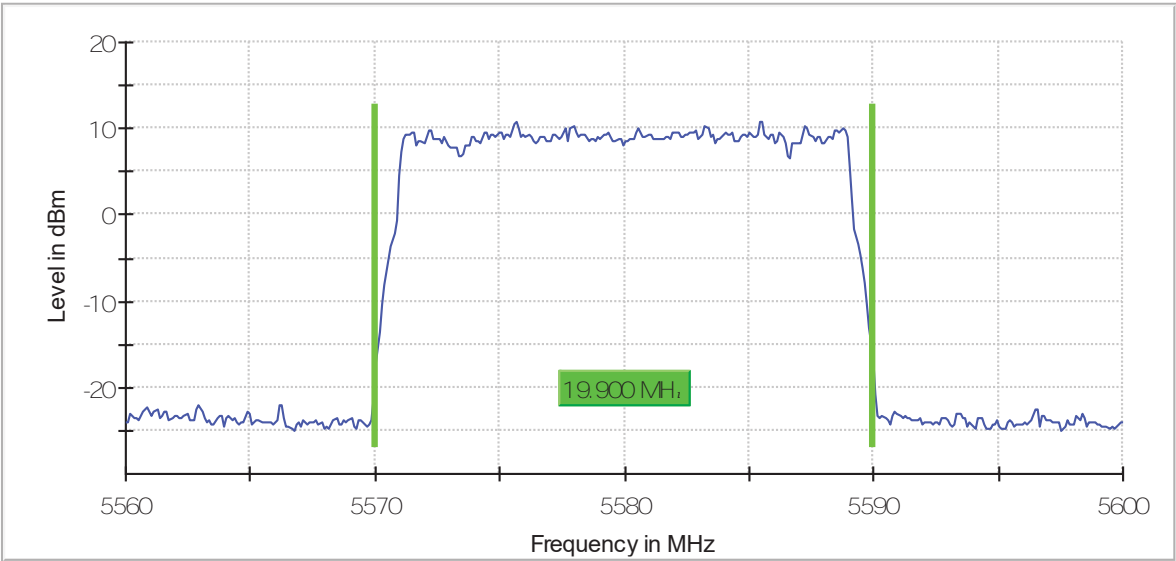
channel 100 (5500 MHz)

26 dB Bandwidth



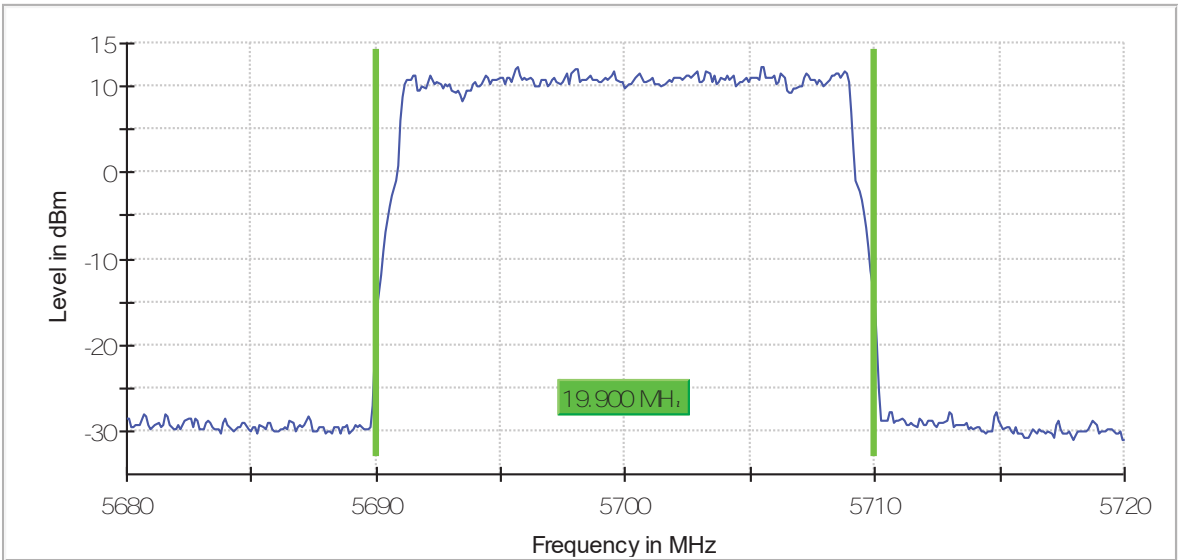
channel 116 (5580 MHz)

26 dB Bandwidth



channel 140 (5700 MHz)

26 dB Bandwidth



Appendix B: Test result for 5.15GHz – 5.25GHz.

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TEST CONDITIONS

Power supply (V):

Vnominal = 120 Vac

Type of power supply = AC voltage main supply.

Type of antenna = External antenna.

Declared Gain for antenna MIMO (maximum): $G_{\text{ANTENNA1+2}} = 6 \text{ dBi}$ (*)

(*) According to KDB 662911 D01 antennas are cross-polarized with fixed orientations that the user cannot change.

Declared Antenna Gain above 30° from horizontal (UNII-1 Band) = -6dBi

Technology Tested:	MulleFire 1.0	
Modes:	QPSK, 16QAM, 64QAM and 256QAM	
Beamforming:	No	
Frequency Range:	5150 MHz to 5250 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Lowest: 36	5180
	Middle: 40	5200
	Highest: 48	5240

The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power in all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode for the channel under test.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes. FCC and Canada power setting used during the test were different to be in compliance with both limits.

Channel	Channel Frequency (MHz)	FCC Power Value	CANADA power value
Lowest: 36	5180	23	12
Middle: 40	5200	22	12
Highest: 48	5240	24	12

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The AC supply voltage is applied using an external power supply.

RADIATED MEASUREMENTS

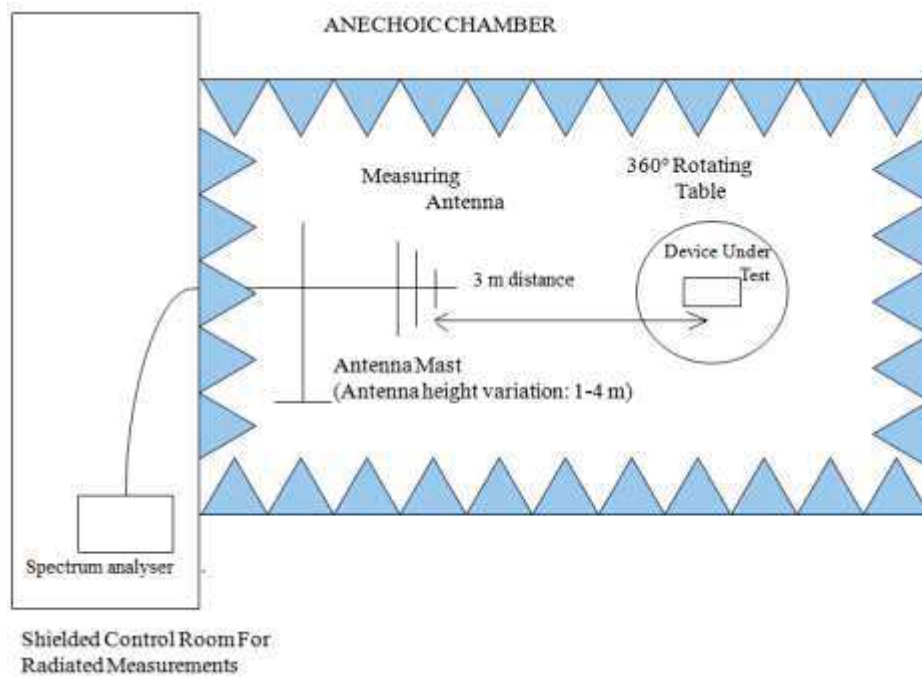
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the center of the chamber turntable to perform the measurements below 1GHz and The EUT was placed at a height of 1.5 meters above the test chamber floor in the center of the chamber turntable to perform the measurements above 1GHz. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

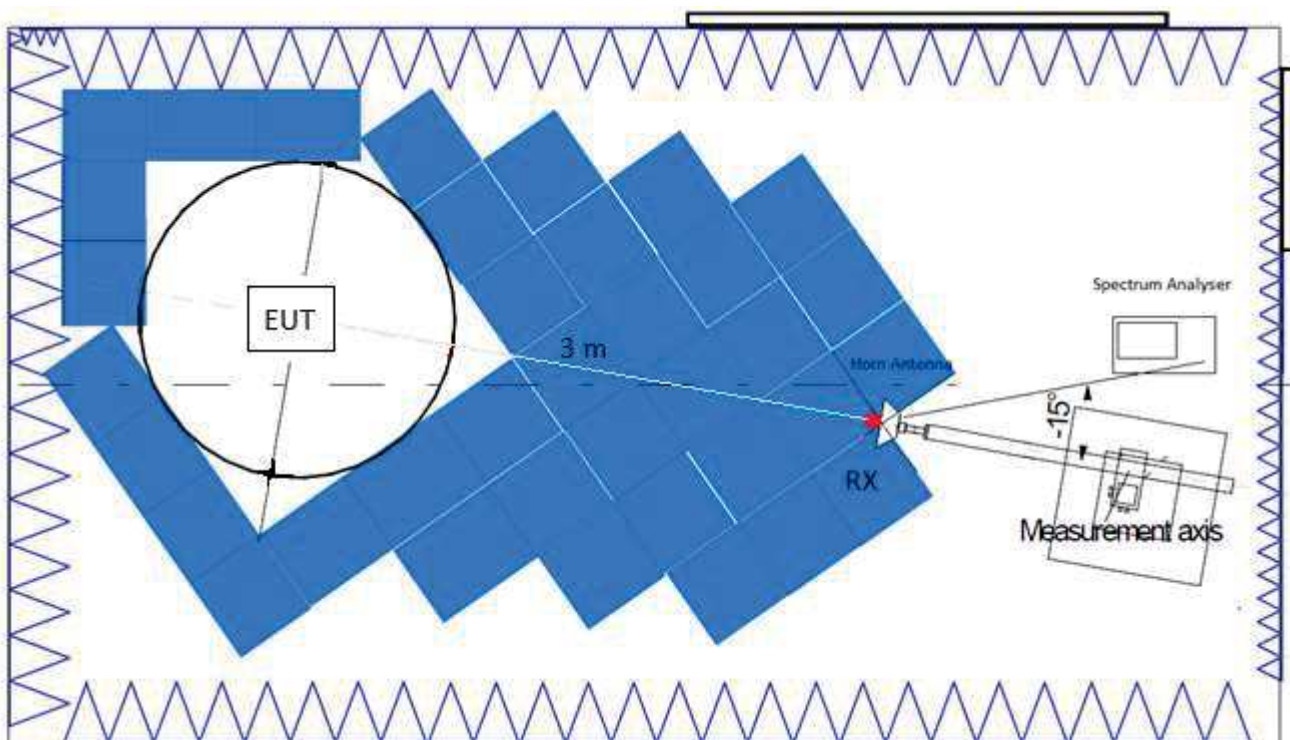
The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.

A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1MHz/3MHz for frequencies above 1 GHz.

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



FCC Section 15.407 Subclause (a)(1)(iv). Transmitter Maximum Conducted Output Power / RSS-247 Clause 6.2.1.1. Transmitter Maximum Equivalent Isotropically Radiated Power

SPECIFICATION

FCC 15.407:

For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247: The maximum e.i.r.p. shall not exceed 200 mW (23 dBm) or $10 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

RESULTS:

The maximum conducted output power was measured using the channel power integration method according to point E) 3) b) (Method PM-G) of 789033 D02 General UNII Test Procedures New Rules v02r01.

In the measure-and-sum approach for MIMO mode, the conducted emission level (*e.g.*, transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units (mW—not dBm).

The e.i.r.p. levels are calculated by adding the corresponding antenna gain (dBi).

FCC Power setting:

Mode: QPSK - 20MHz

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
Max. conducted power (dBm)	26.63	25.69	26.70
Conducted Power Limit (dBm)	30		
Margin (dB)	3.37	4.31	3.30
E.I.R.P (dBm)(*)	20.63	19.69	20.70
E.I.R.P Limit (dBm)	21(*)		
Measurement uncertainty (dB)	<±1.20		

(*): above 30° from horizontal

Mode: 16QAM - 20MHz

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
Max. conducted power (dBm)	26.66	25.73	26.97
Conducted Power Limit (dBm)	30		
Margin (dB)	3.34	4.27	3.03
E.I.R.P (*) (dBm)	20.66	19.73	20.97
E.I.R.P Limit (dBm)	21(*)		
Measurement uncertainty (dB)	<±1.20		

(*): above 30° from horizontal

Mode: 64QAM - 20MHz

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
Max. conducted power (dBm)	26.65	25.66	26.74
Conducted Power Limit (dBm)	30		
Margin (dB)	3.35	4.34	3.26
E.I.R.P (*) (dBm)	20.65	19.66	20.74
E.I.R.P Limit (dBm)	21(*)		
Measurement uncertainty (dB)	<±1.20		

(*): above 30° from horizontal

Mode: 256QAM - 20MHz

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
Max. conducted power (dBm)	26.57	25.71	26.71
Conducted Power Limit (dBm)	30		
Margin (dB)	3.43	4.29	3.29
E.I.R.P (*) (dBm)	20.57	19.71	20.71
E.I.R.P Limit (dBm)	21(*)		
Measurement uncertainty (dB)	<±1.20		

(*): above 30° from horizontal

Canada power setting

Mode: QPSK - 20MHz

Antenna gain: 6 dBi

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
Max. conducted power (dBm)	15.27	15.92	14.65
Maximum EIRP power (dBm)	21.27	21.92	20.65
EIRP power Limit (dBm)	22.528		
Margin (dB)	1.26	0.61	1.88
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM - 20MHz

Antenna gain: 6 dBi

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
Max. conducted power (dBm)	15.00	16.00	15.83
Maximum EIRP power (dBm)	21.00	22.00	21.83
EIRP power Limit (dBm)	22.528		
Margin (dB)	2.52	0.52	0.69
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM - 20MHz

Antenna gain: 6 dBi

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
Max. conducted power (dBm)	15.32	16.64	15.58
Maximum EIRP power (dBm)	21.32	21.64	21.58
EIRP power Limit (dBm)	22.528		
Margin (dB)	1.21	0.89	0.95
Measurement uncertainty (dB)	<±1.20		

Mode: 256QAM - 20MHz

Antenna gain: 6 dBi

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
Max. conducted power (dBm)	15.12	15.29	15.38
Maximum EIRP power (dBm)	21.12	21.29	21.38
EIRP power Limit (dBm)	22.528		
Margin (dB)	1.41	1.24	1.15
Measurement uncertainty (dB)	<±1.20		

FCC Section 15.407 Subclause (a) (1) (iv). Transmitter Maximum Power Spectral Density / RSS-247 Clause 6.2.1.1. Transmitter EIRP Spectral Density

FCC 15.407: The maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247: The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

RESULTS

The maximum power spectral density (PSD) was measured using the method according to point F) referencing E.2.b) (Method SA-1) of Guidance 789033 D02 General UNII Test Procedures New Rules v02r01.

The PSD test uses the same setup than the transmitter maximum conducted output power test. The result of the Peak PSD was measured by setting a marker on the peak of the signal and the results are in the tables below.

FCC power setting

Mode: QPSK - 20MHz

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
PSD (dBm/MHz)	15.24	14.10	15.53
PSD Limit (dBm/MHz)	17		
Margin (dB)	1.76	2.90	1.47
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM - 20MHz

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
PSD (dBm/MHz)	15.47	14.58	15.97
PSD Limit (dBm/MHz)	17		
Margin (dB)	1.53	2.42	1.03
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM - 20MHz

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
PSD (dBm/MHz)	15.21	14.26	15.66
PSD Limit (dBm/MHz)	17		
Margin (dB)	1.79	2.74	1.34
Measurement uncertainty (dB)	<±1.20		

Mode: 256QAM - 20MHz

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
PSD (dBm/MHz)	15.16	14.15	15.65
PSD Limit (dBm/MHz)	17		
Margin (dB)	1.84	2.84	1.35
Measurement uncertainty (dB)	<±1.20		

Canada power setting

Mode: QPSK - 20MHz

Declared antenna gain: 6 dBi

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
PSD (dBm/MHz)	3.84	3.71	3.20
e.i.r.p PSD (dBm/MHz)	9.84	9.71	9.20
e.i.r.p PSD Limit (dBm/MHz)	10		
Margin (dB)	0.84	0.71	0.20
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM - 20MHz

Declared antenna gain: 6 dBi

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
PSD (dBm/MHz)	3.79	3.97	3.59
e.i.r.p PSD (dBm/MHz)	9.79	9.97	9.59
e.i.r.p PSD Limit (dBm/MHz)	10		
Margin (dB)	0.21	0.03	0.41
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM - 20MHz

Declared antenna gain: 6 dBi

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
PSD (dBm/MHz)	3.75	3.65	3.32
e.i.r.p PSD (dBm/MHz)	9.75	9.65	9.32
e.i.r.p PSD Limit (dBm/MHz)	10		
Margin (dB)	0.25	0.35	0.68
Measurement uncertainty (dB)	<±1.20		

Mode: 256QAM - 20MHz

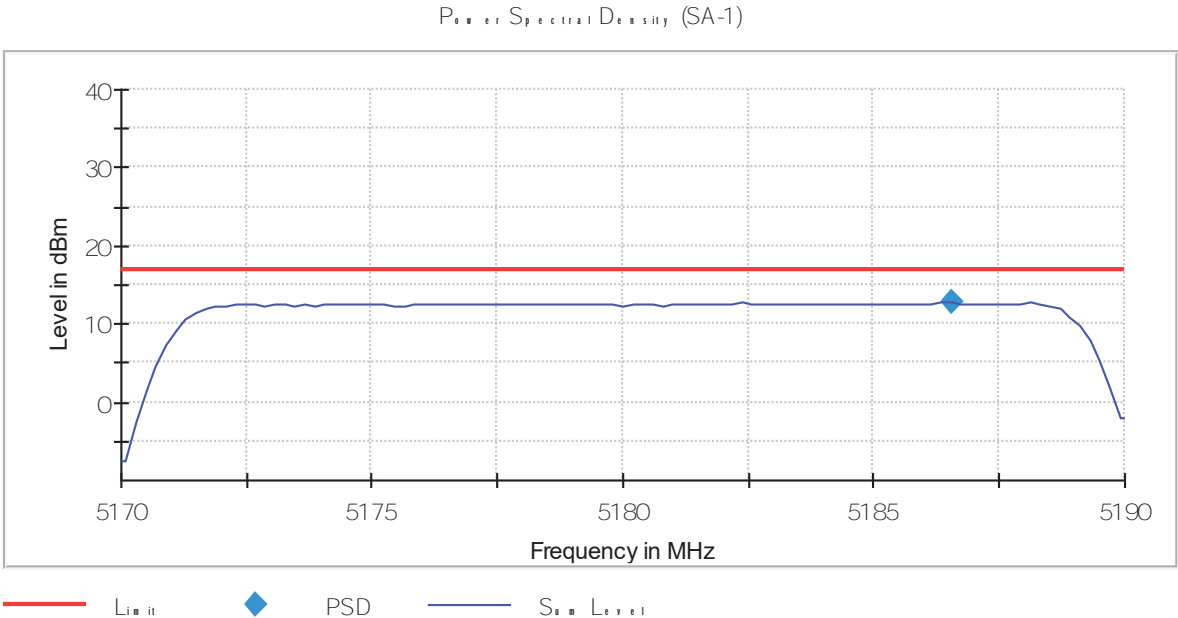
Declared antenna gain: 6 dBi

	channel 36 5180 MHz	channel 40 5200 MHz	channel 48 5240 MHz
PSD (dBm/MHz)	3.73	3.63	3.24
e.i.r.p PSD (dBm/MHz)	9.73	9.63	9.24
e.i.r.p PSD Limit (dBm/MHz)	10		
Margin (dB)	0.27	0.37	0.76
Measurement uncertainty (dB)	<±1.20		

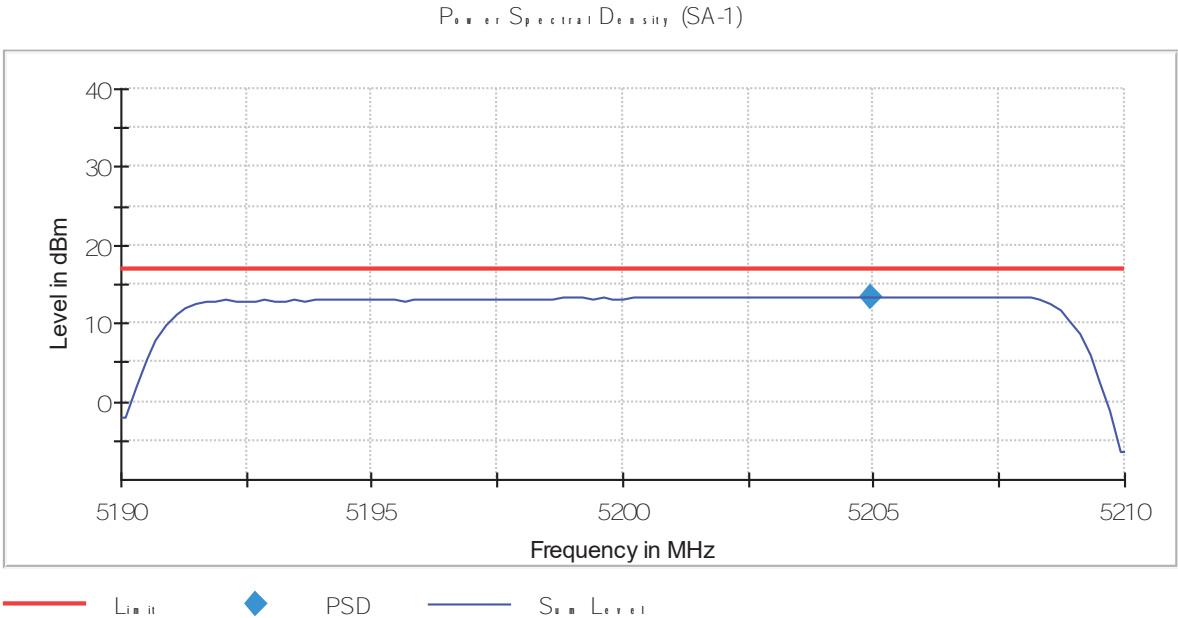
FCC Power Setting:

QPSK- 20MHz:

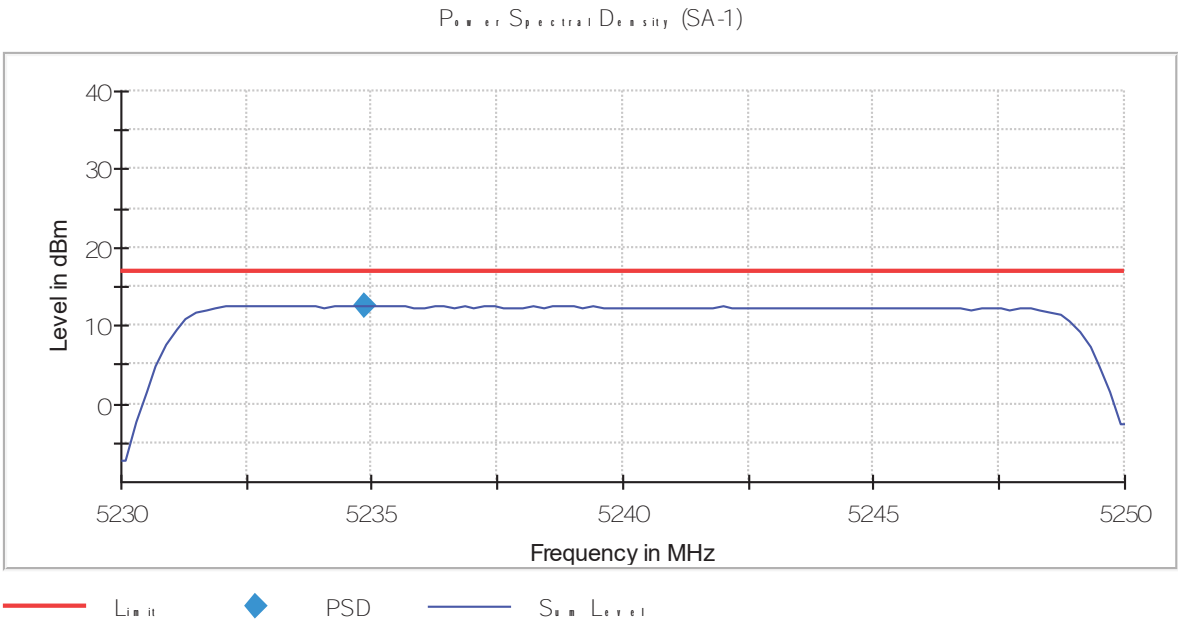
- Low Channel 36:



- Middle Channel 40:

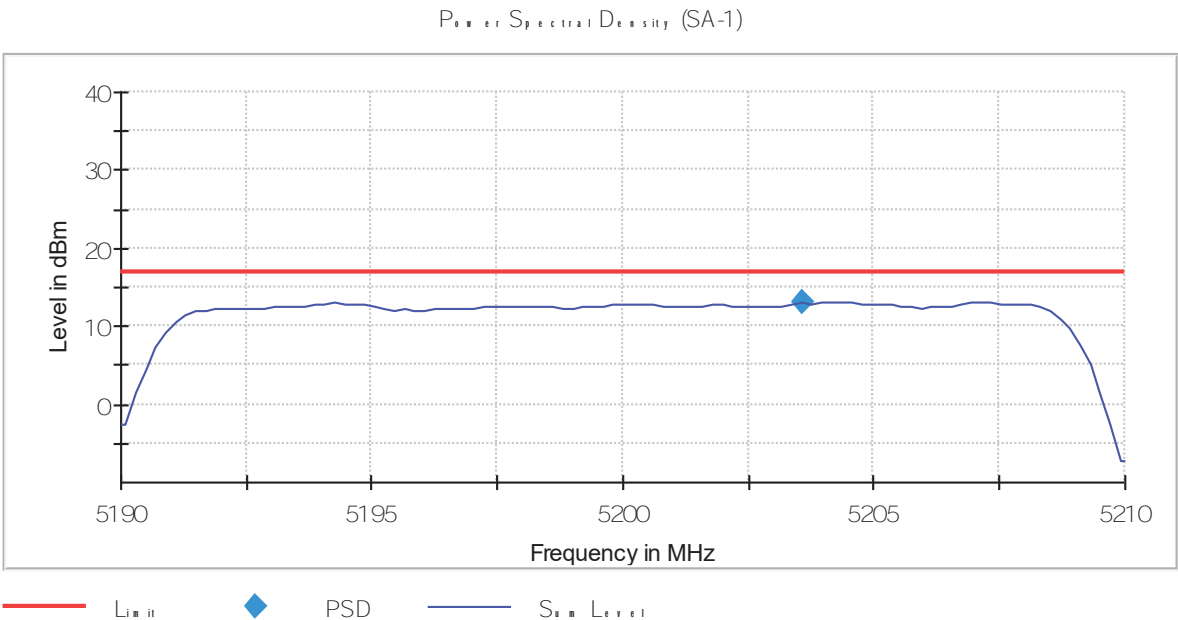


- High Channel 48:

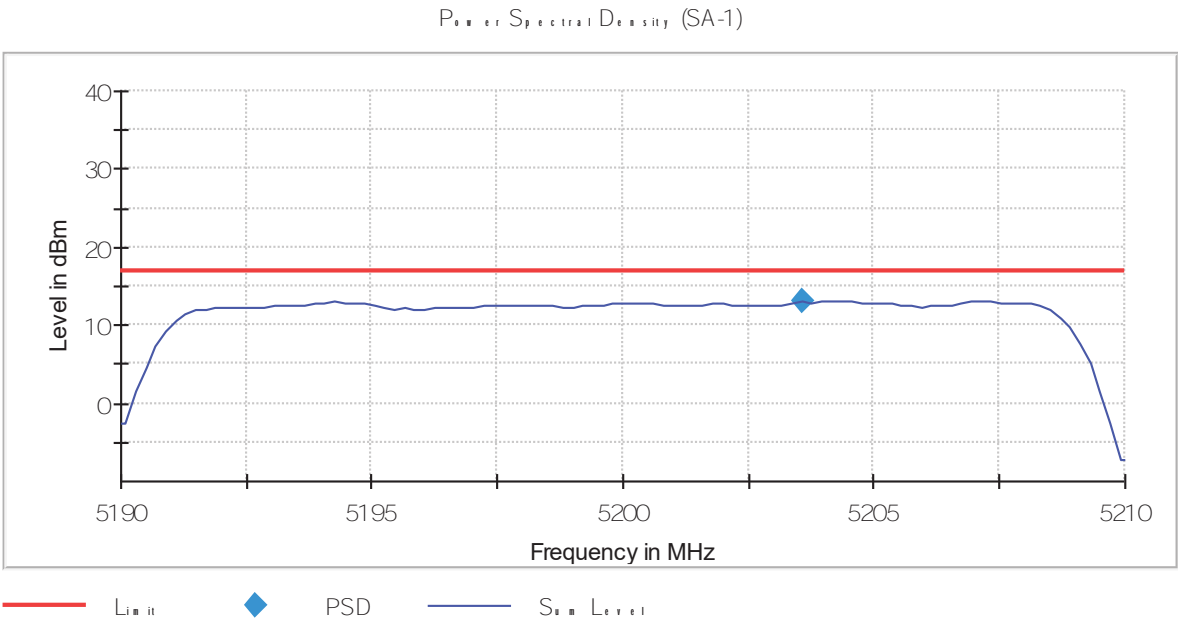


16QAM- 20MHz:

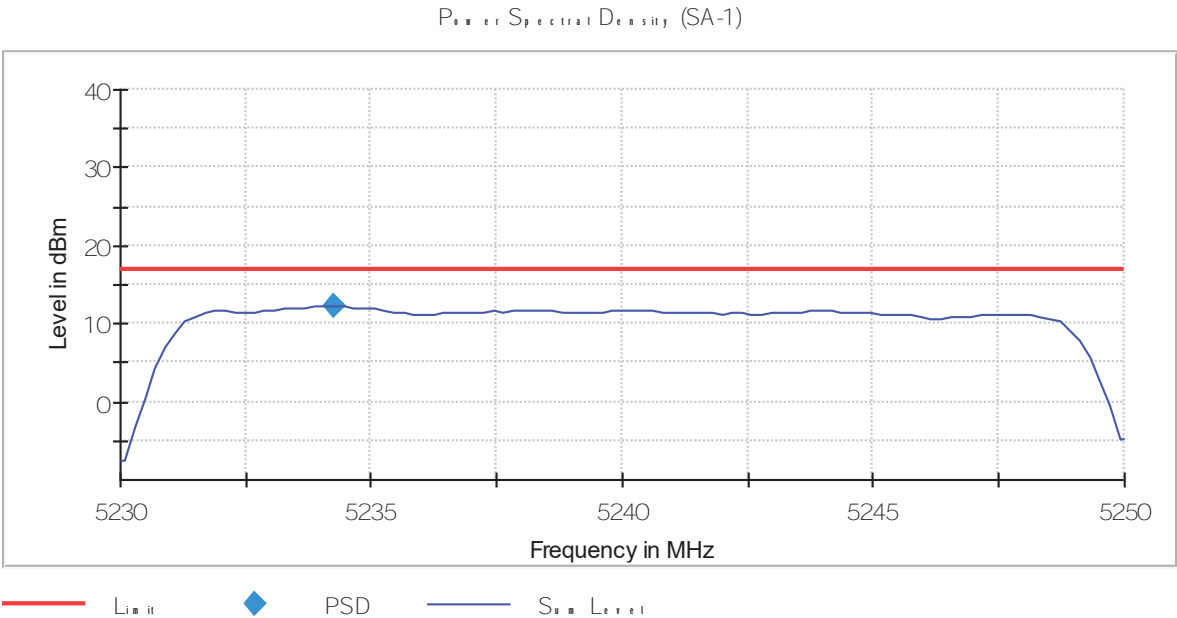
- Low Channel 36:



- Middle Channel 40:

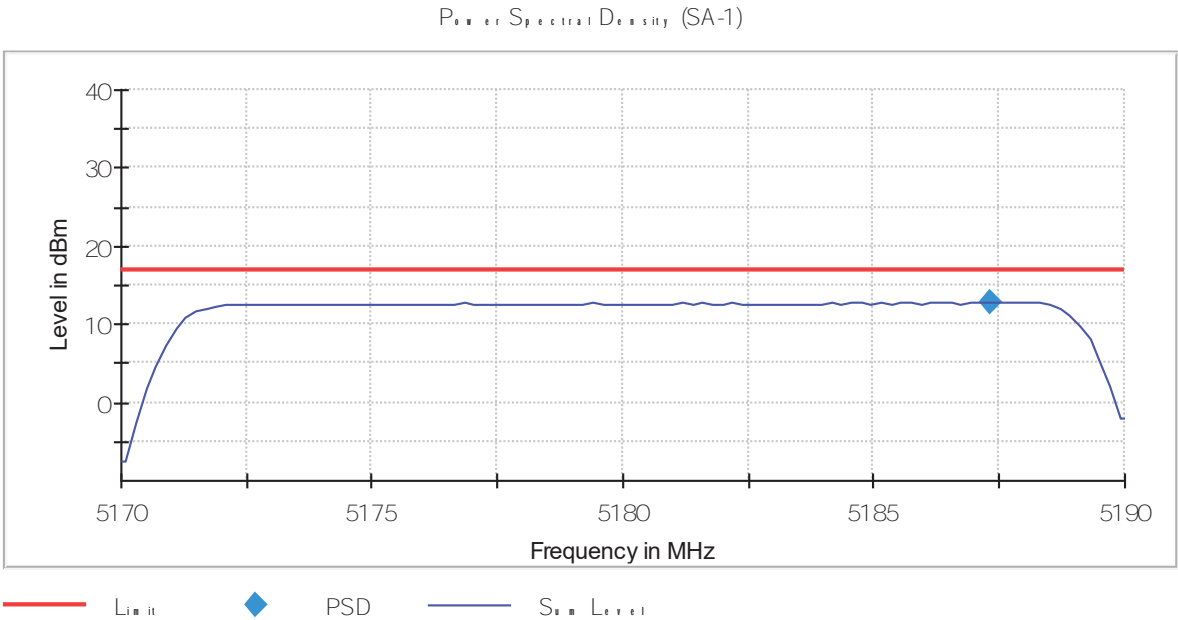


- High Channel 48:

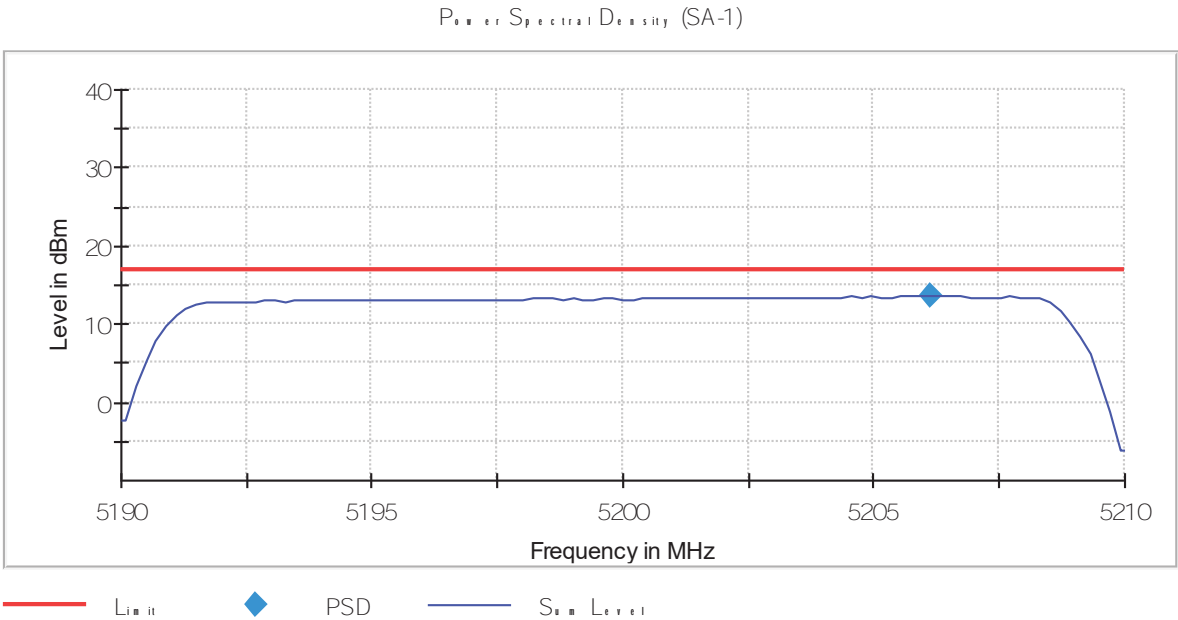


64QAM- 20MHz:

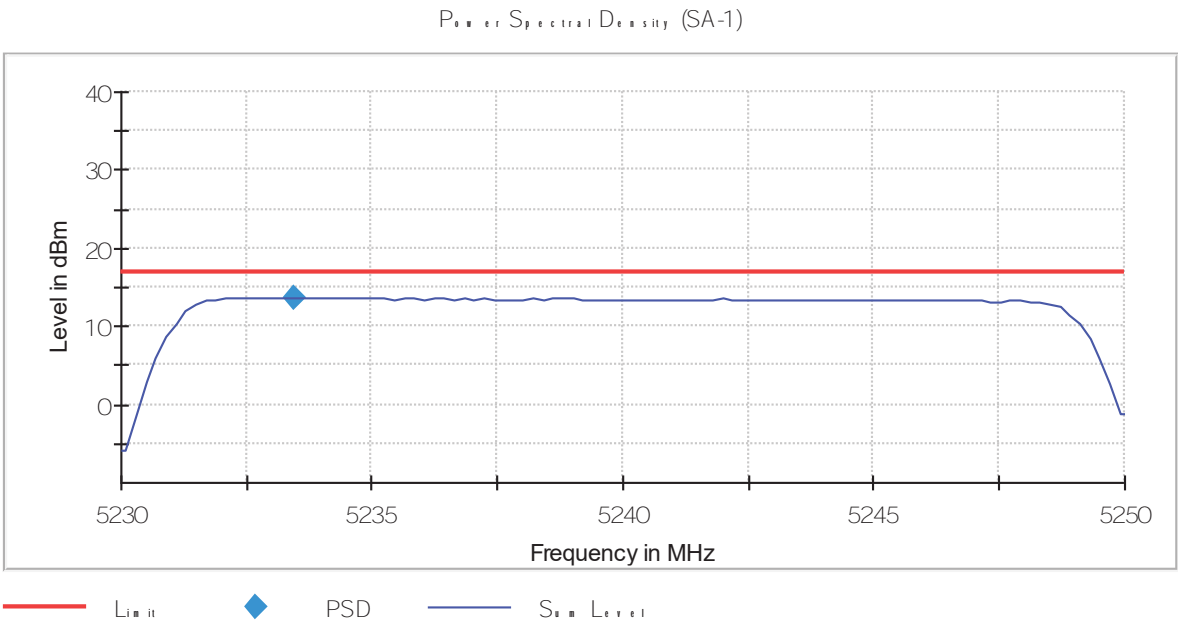
- Low Channel 36:



- Middle Channel 40:

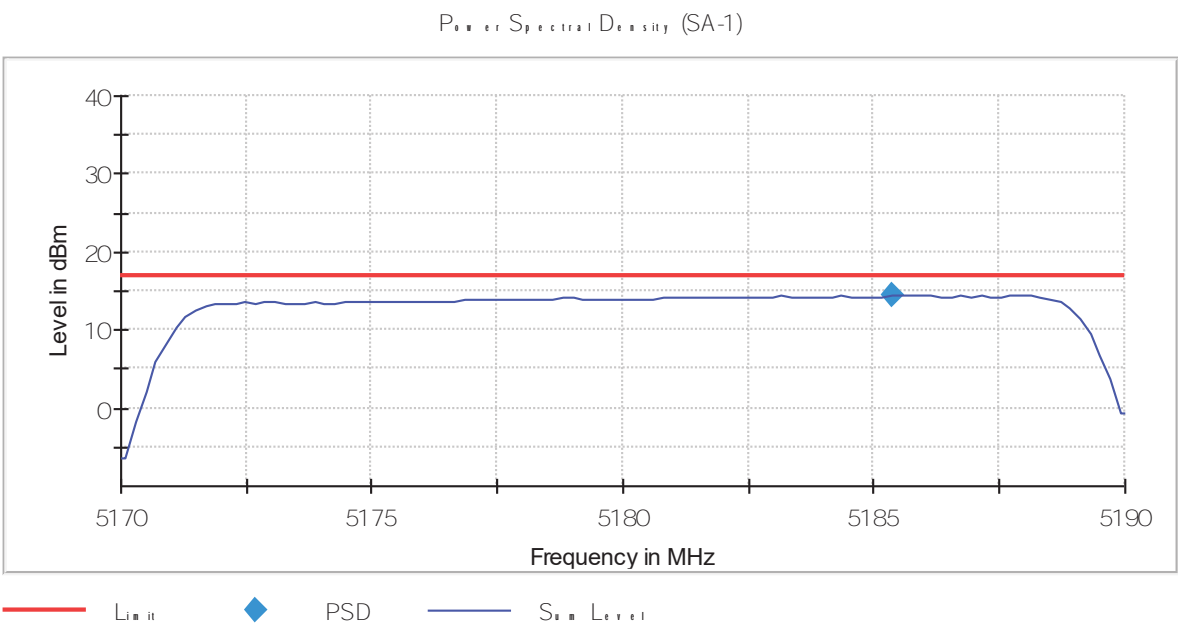


- High Channel 48:

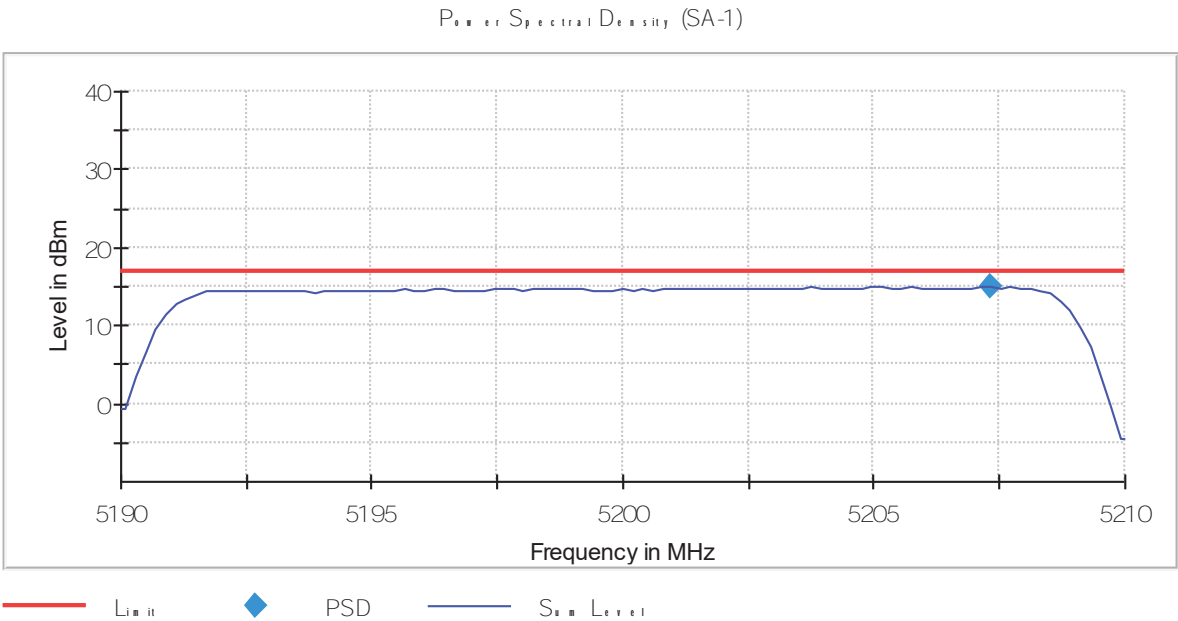


256QAM- 20MHz:

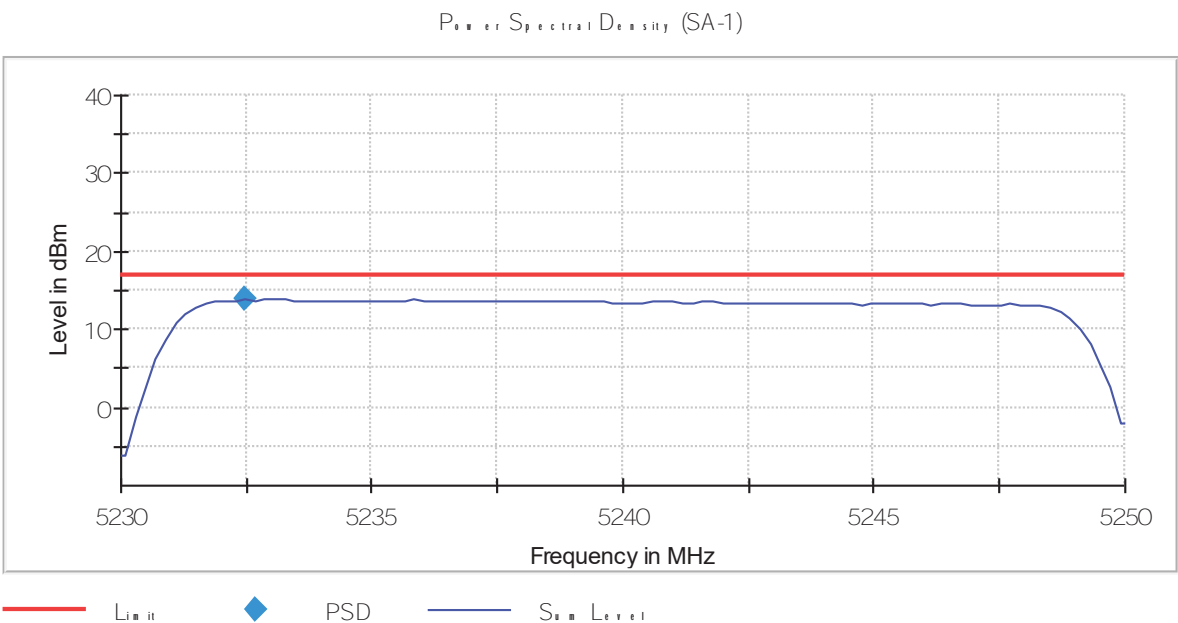
- Low Channel 36:



- Middle Channel 40:



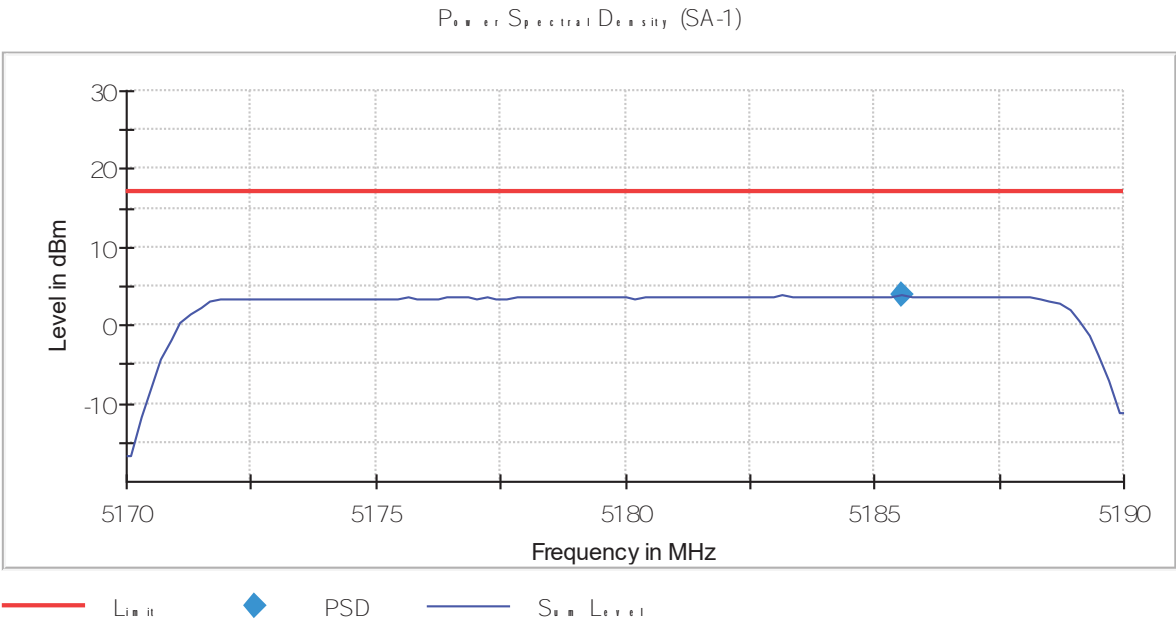
- High Channel 48:



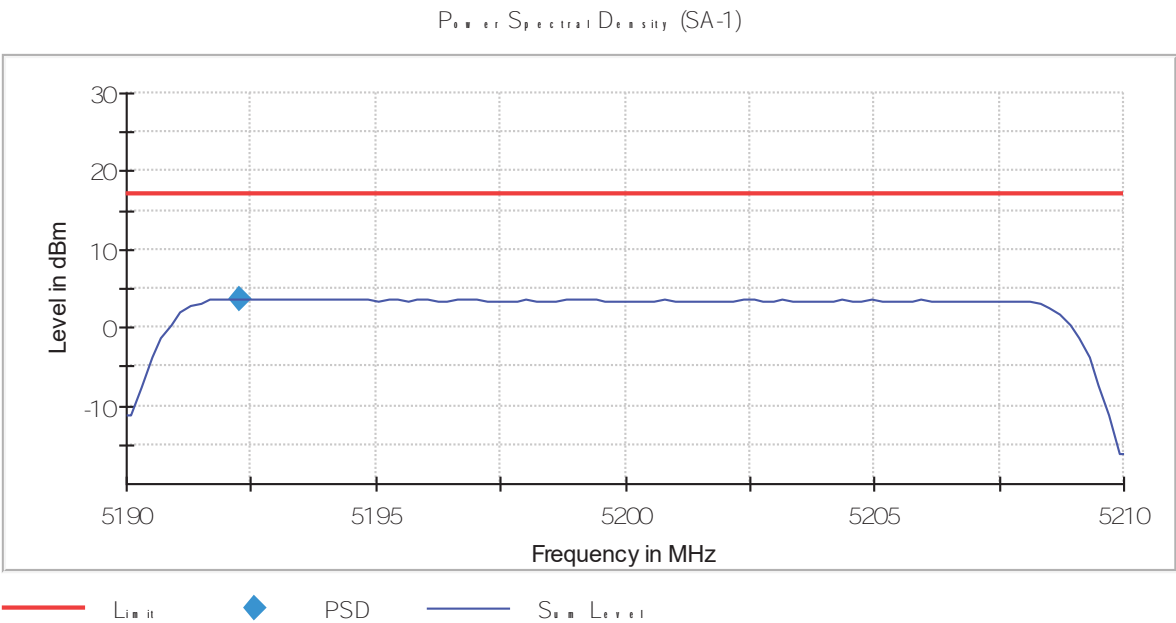
Canada Power Setting:

QPSK- 20MHz:

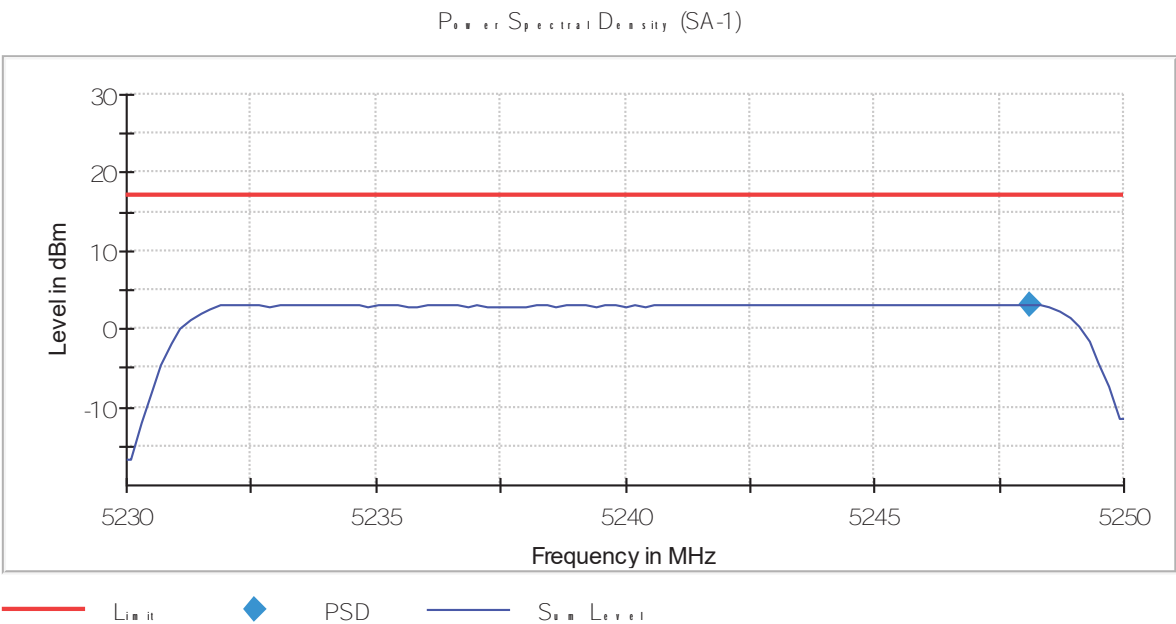
- Low Channel 36:



- Middle Channel 40:

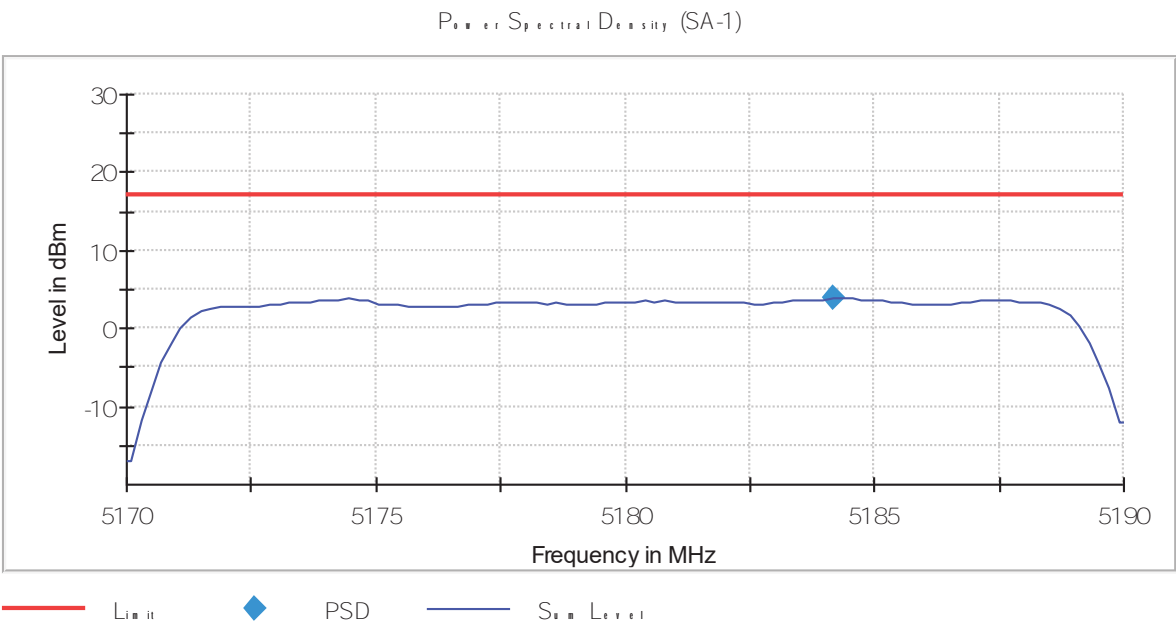


- High Channel 48:

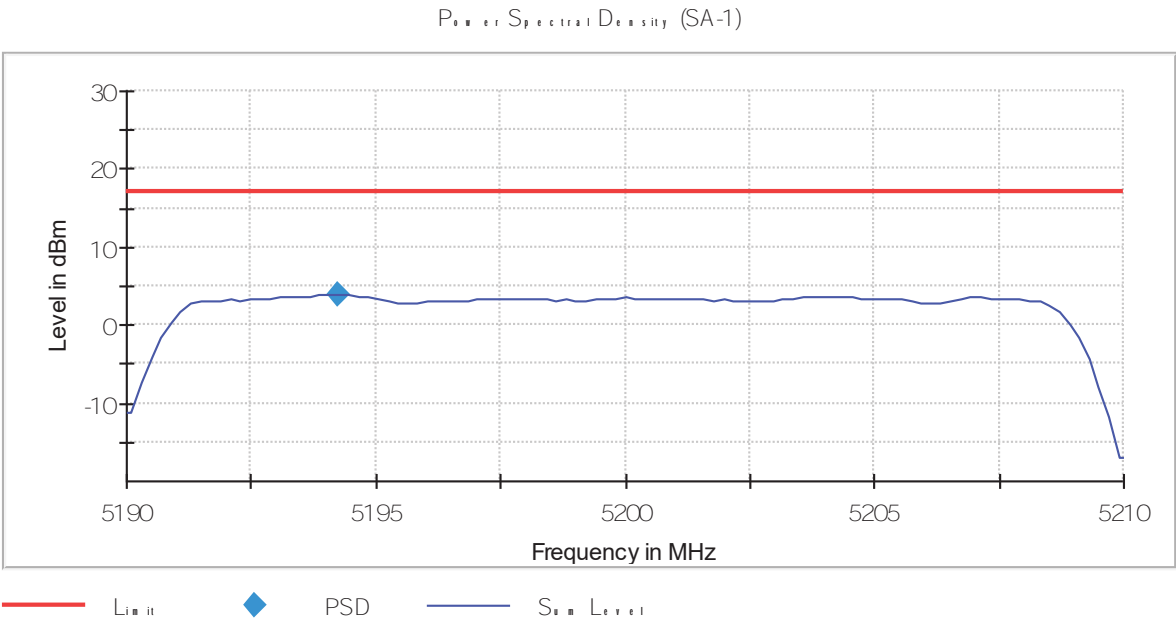


16QAM- 20MHz:

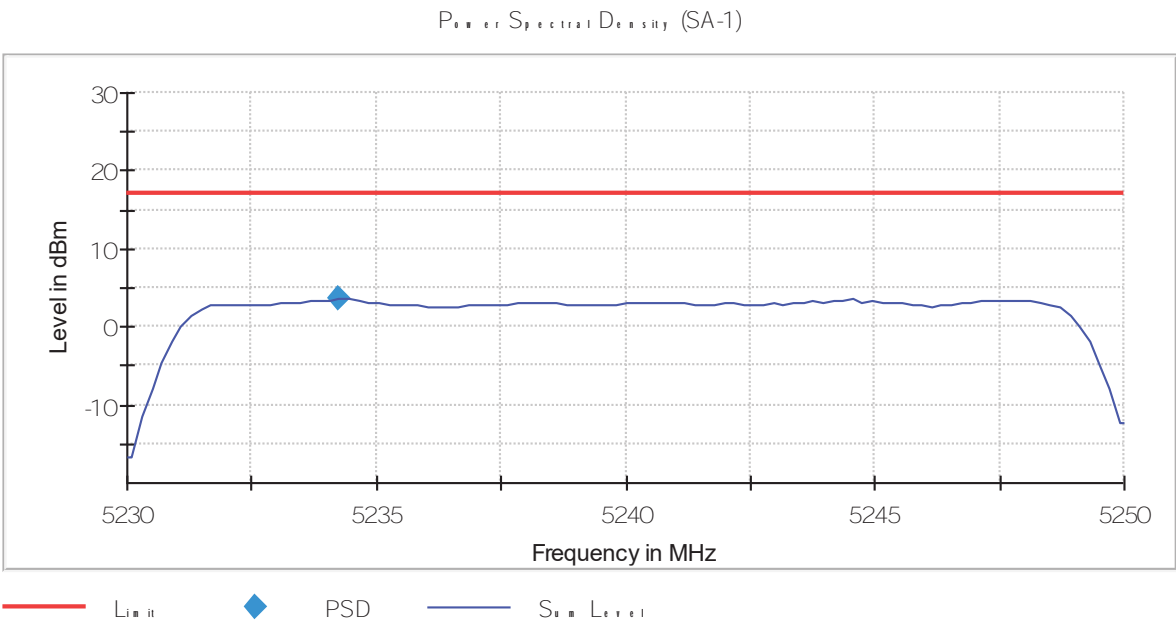
- Low Channel 36:



- Middle Channel 40:

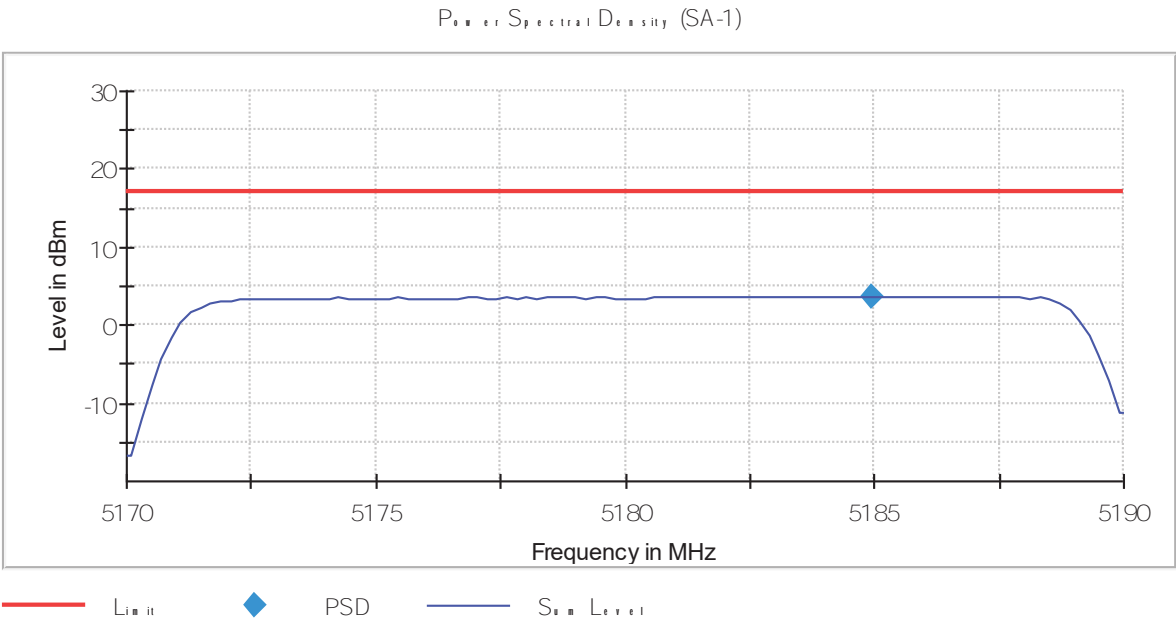


- High Channel 48:

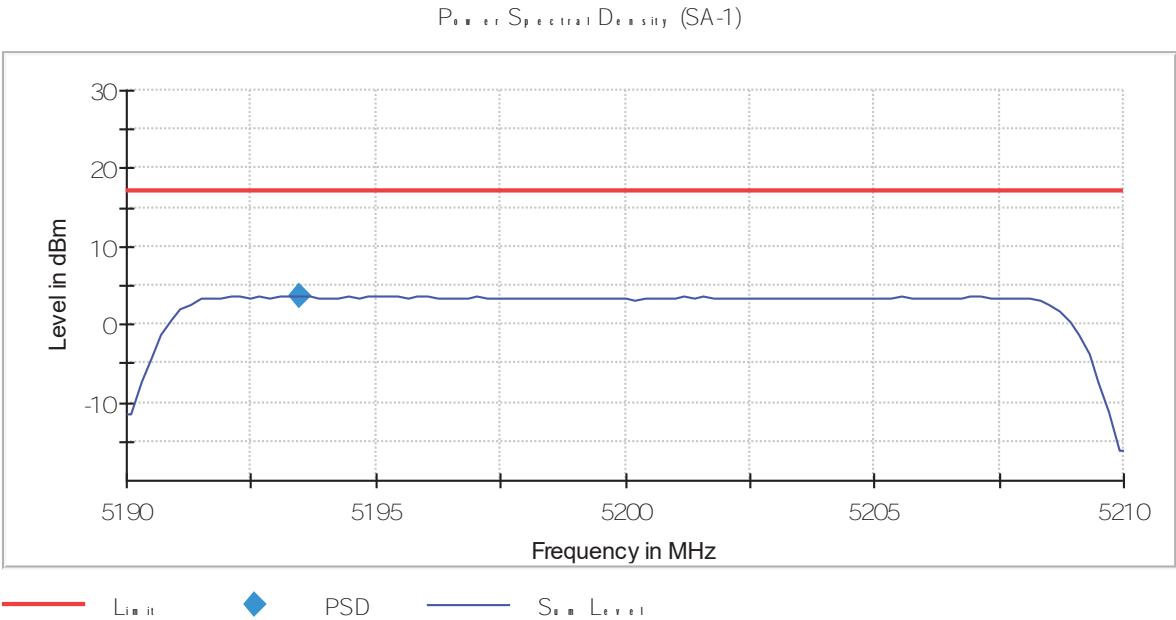


64QAM- 20MHz:

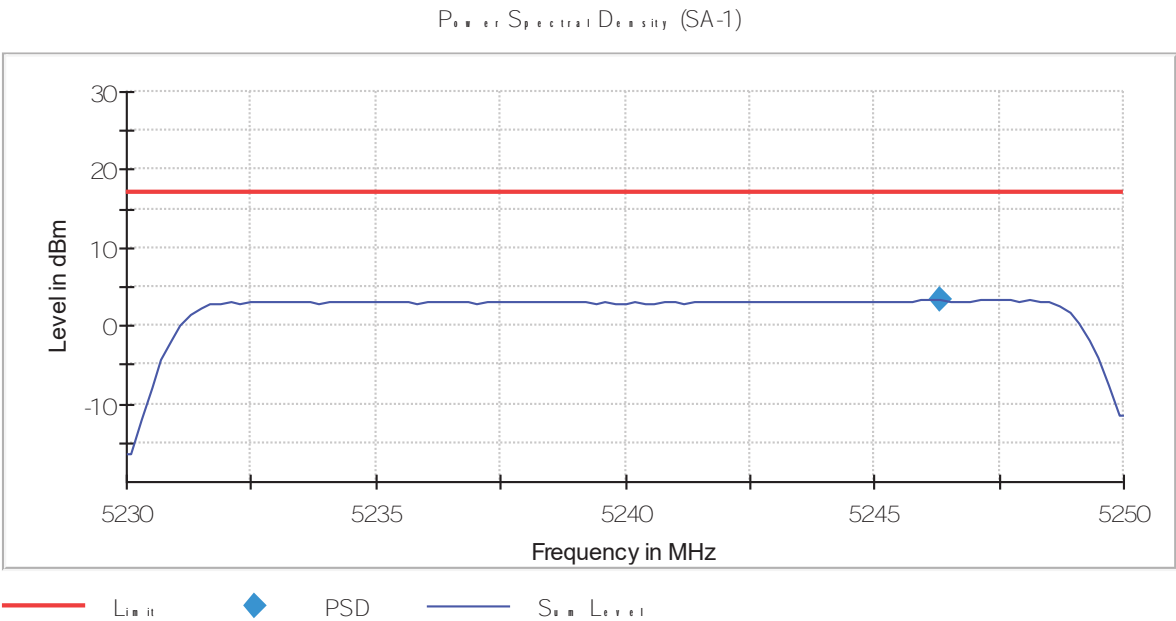
- Low Channel 36:



- Middle Channel 40:

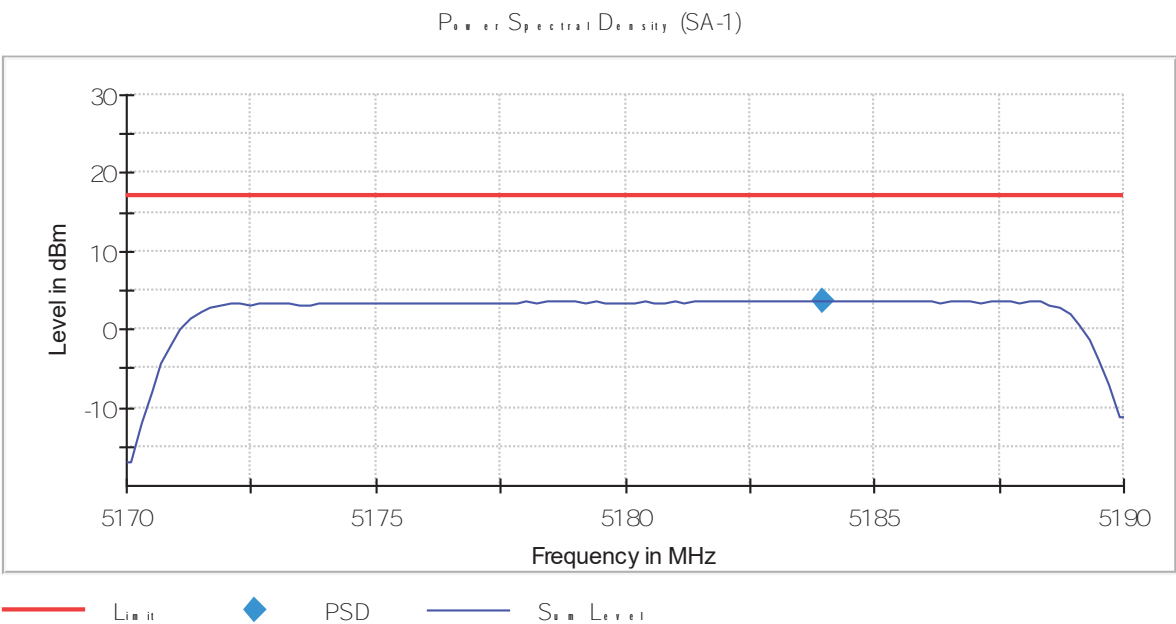


- High Channel 48:

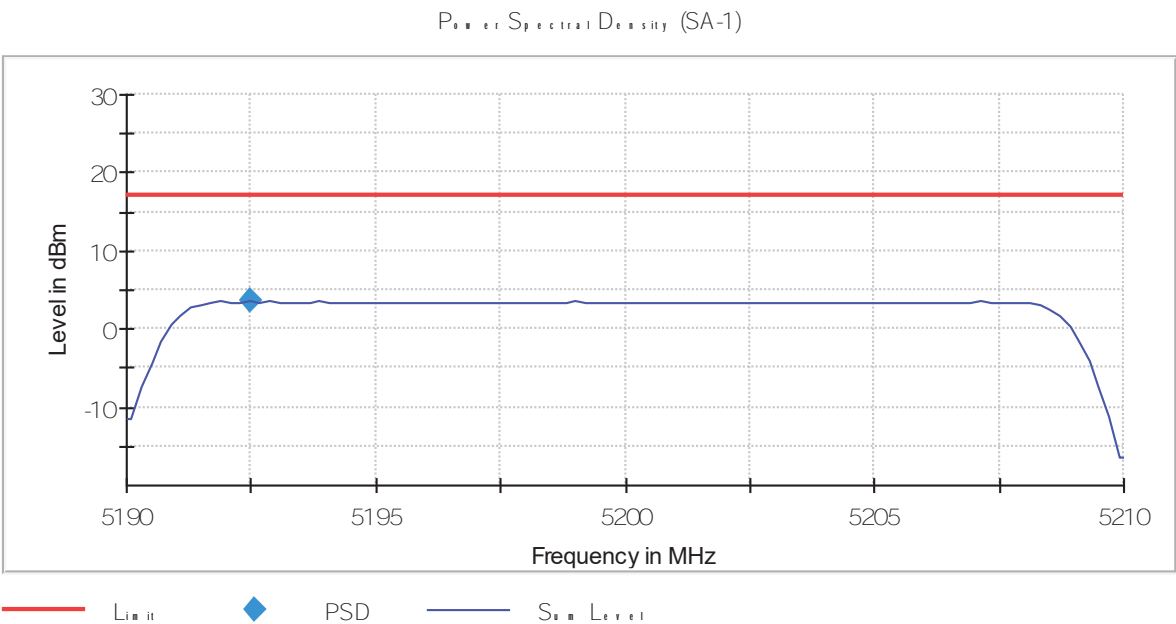


256QAM- 20MHz:

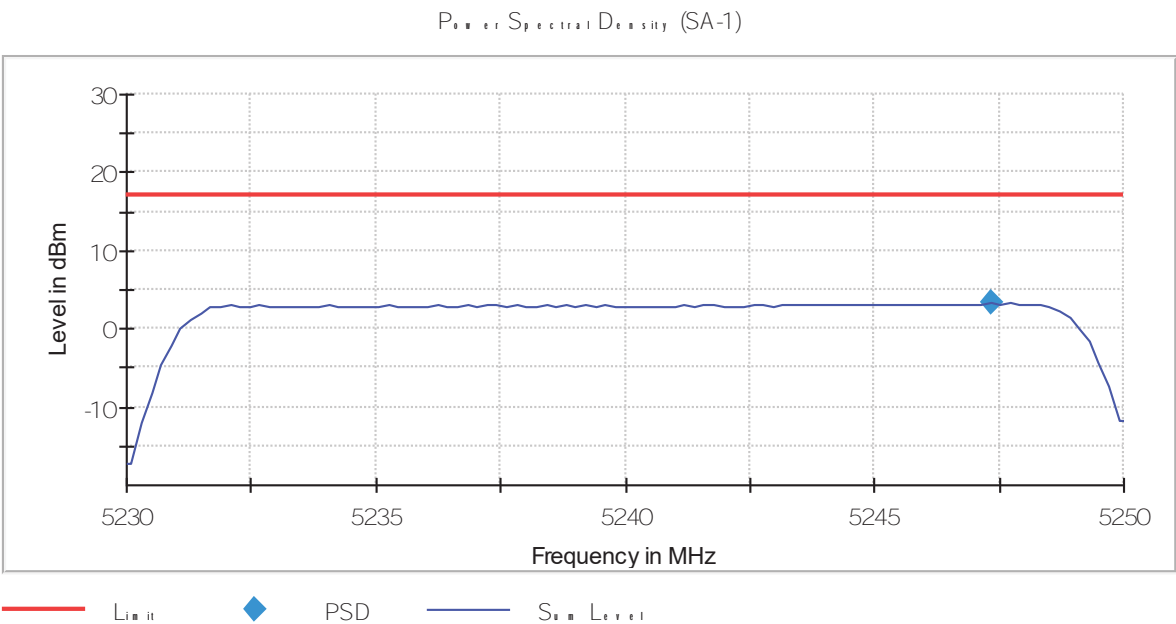
- Low Channel 36:



- Middle Channel 40:



- High Channel 48:



FCC Section 15.407(b)(1)(6) /RSS-247 6.2.1.2. Transmitter Out of Band Radiated Emissions

SPECIFICATION

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.23 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-40 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Test performed on the following worst case of modulation QPSK

Frequency range 30 MHz-1000 MHz.

Note: The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

Spurious levels operating (radiated) closest to limit.

Spurious frequency (MHz)	Polarization	Detector	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Measurement Uncertainty (dB)
38.9240	Vertical	Quasi-Peak	16.50	40	23.50	± 4.99
411.2100	Vertical	Quasi-Peak	25.30	46	20.70	± 4.99
770.8860	Vertical	Quasi-Peak	30.06	46	15.95	± 4.99

Frequency range 1 GHz-40 GHz

The results in the next tables show the maximum measured levels in the 1-40 GHz frequency range.

Mode QPSK:

Channel 36

- No radiated spurious signals were detected at less than 20 dB respect to the limit.

Channel 40

- No radiated spurious signals were detected at less than 20 dB respect to the limit.

Channel 48

- No radiated spurious signals were detected at less than 20 dB respect to the limit.

Measurement Uncertainty (dB): 1GHz to 17GHz <± 4.98

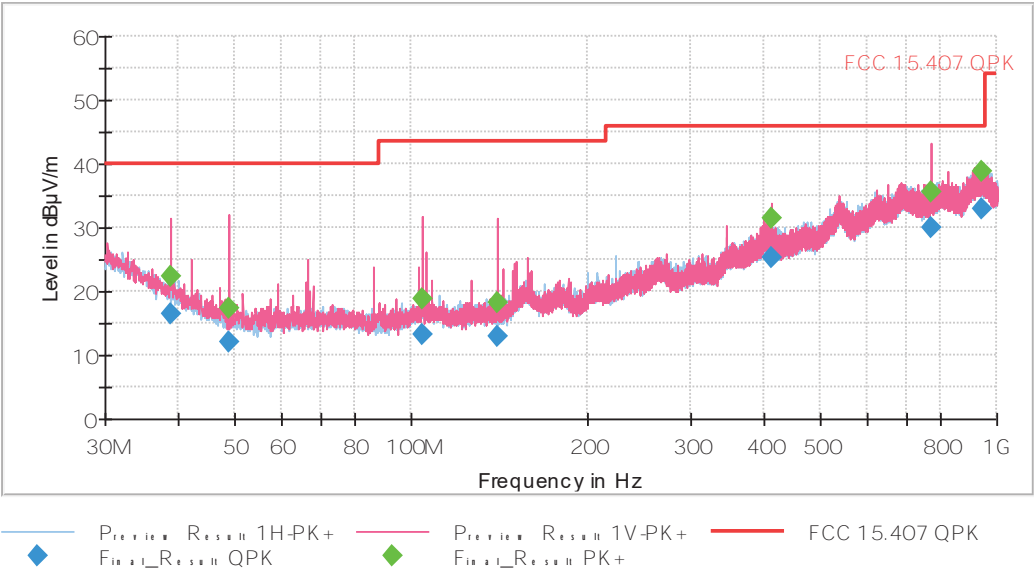
17GHz to 26.5GHz <± 5.08

26.5GHz to 40GHz <± 5.33

Verdict: PASS

FREQUENCY RANGE 30 MHz-1000 MHz.

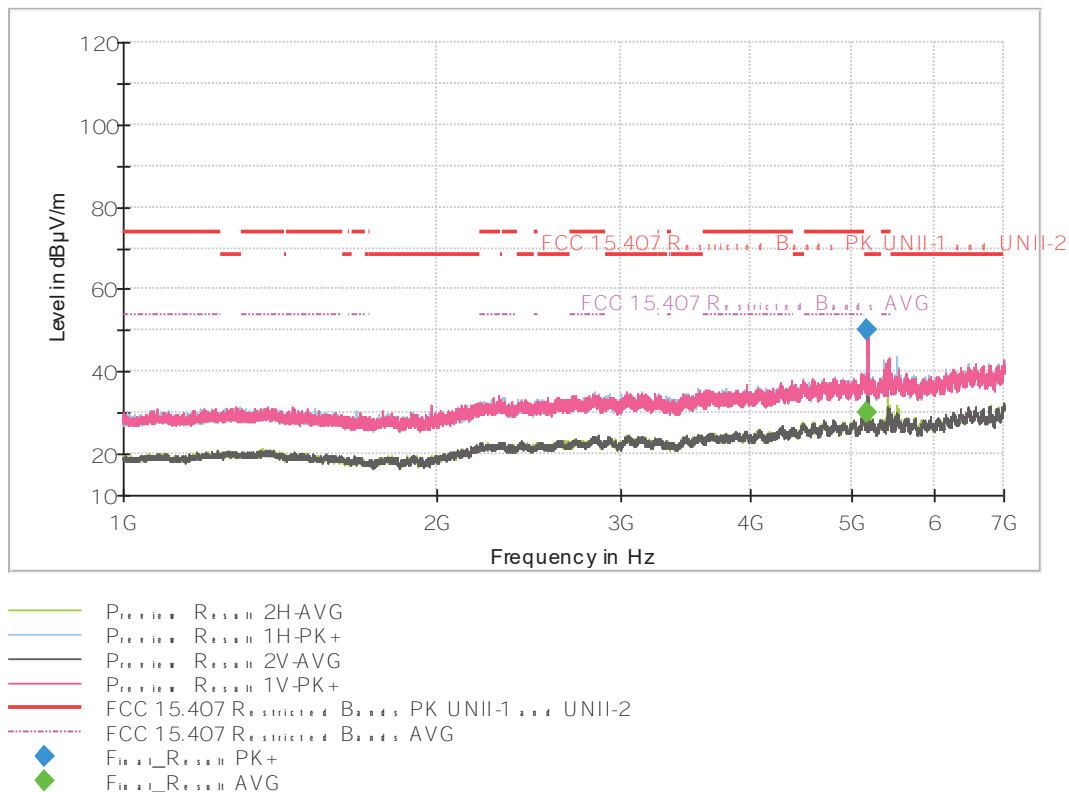
This plot is valid for all channels.



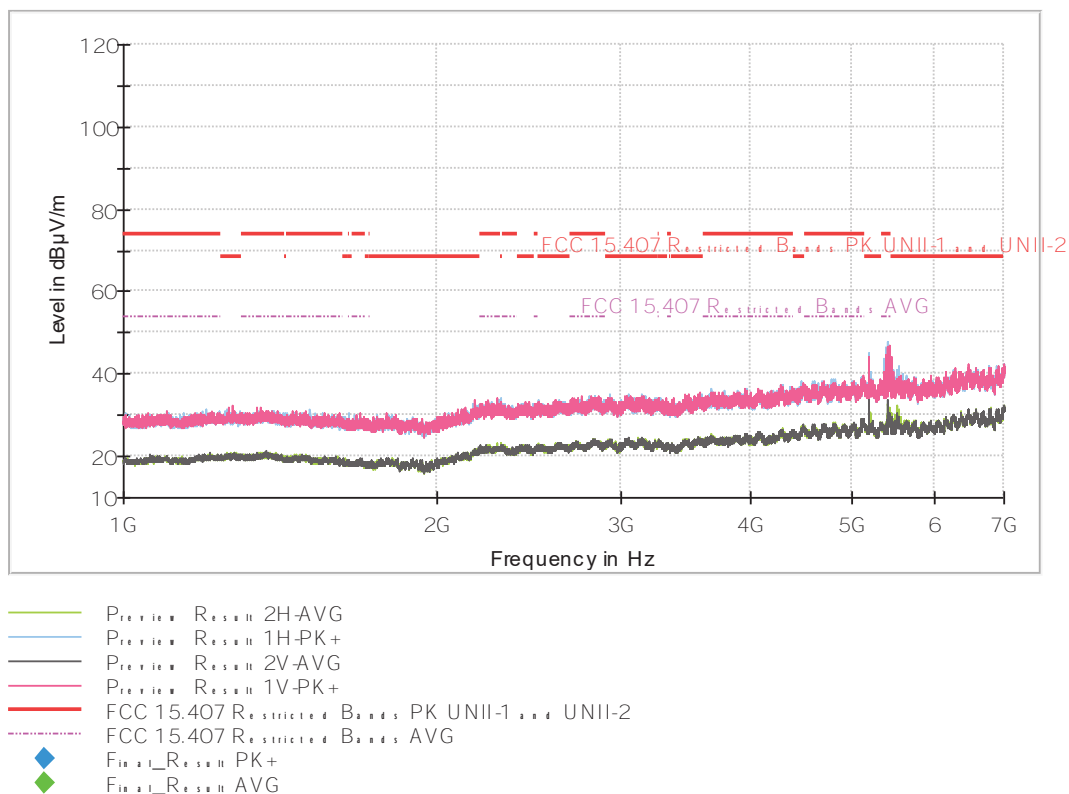
FREQUENCY RANGE 1 GHz to 7 GHz.

Mode QPSK:

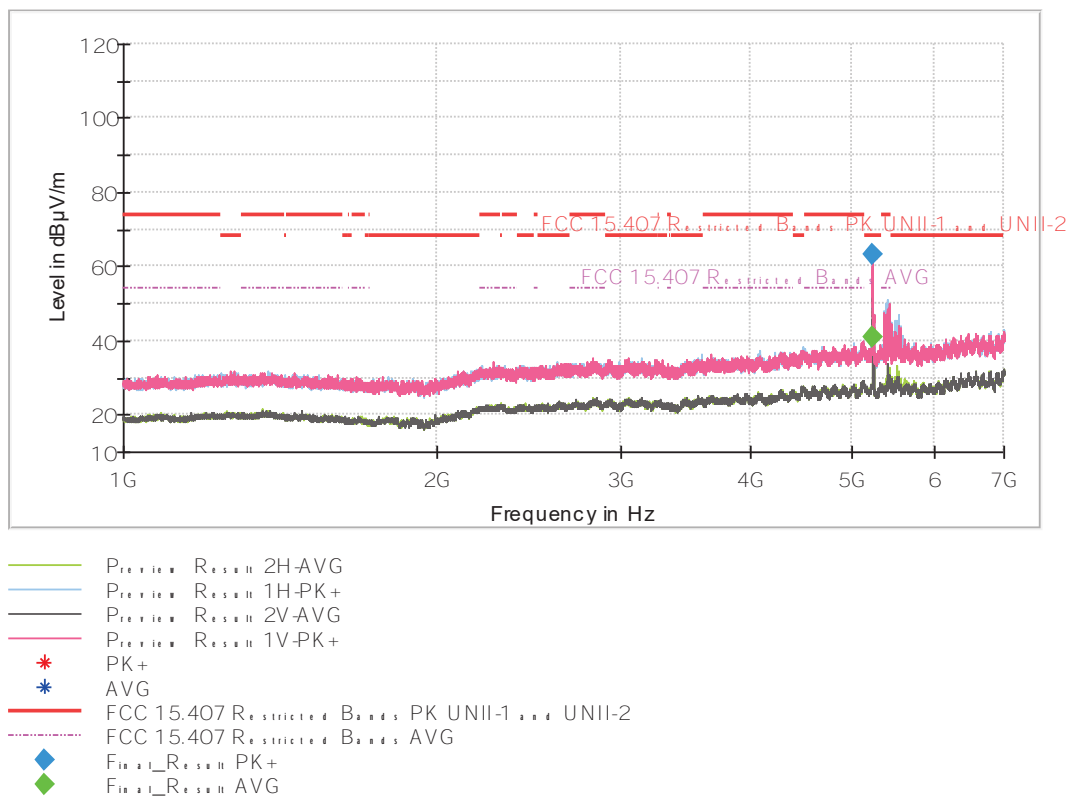
Channel 36



Channel 40



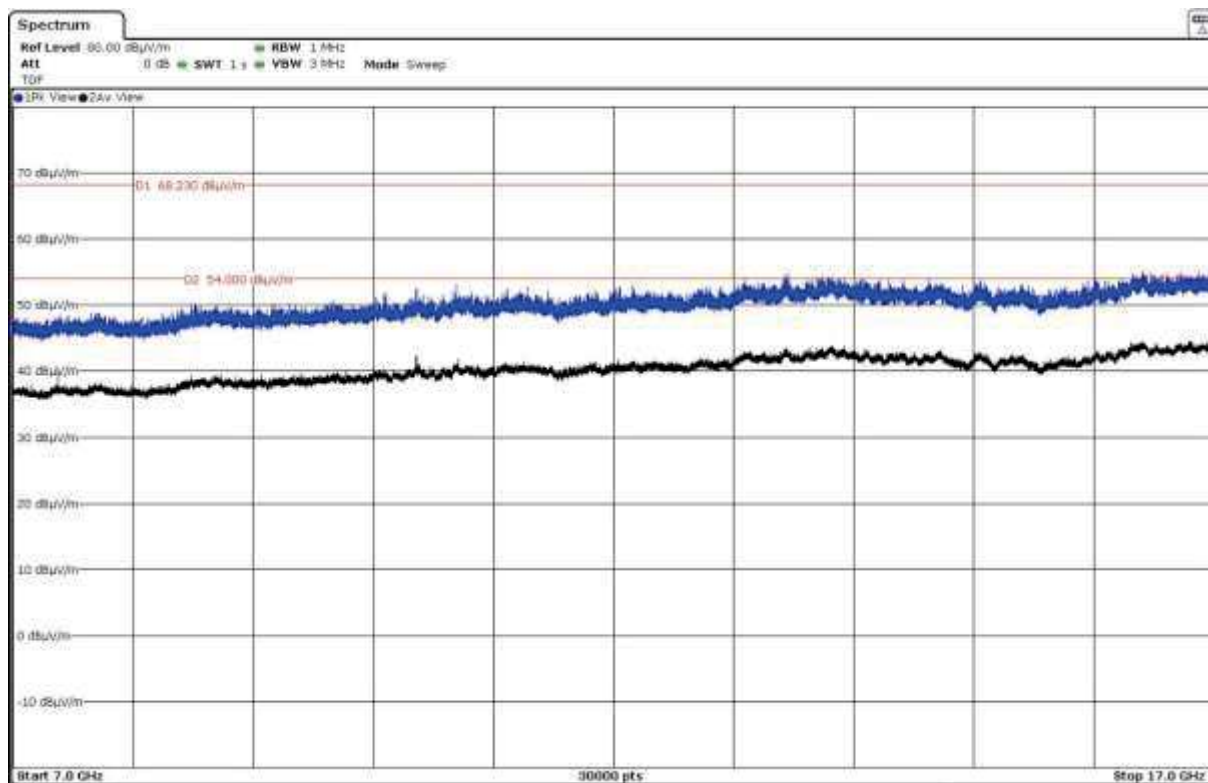
Channel 48



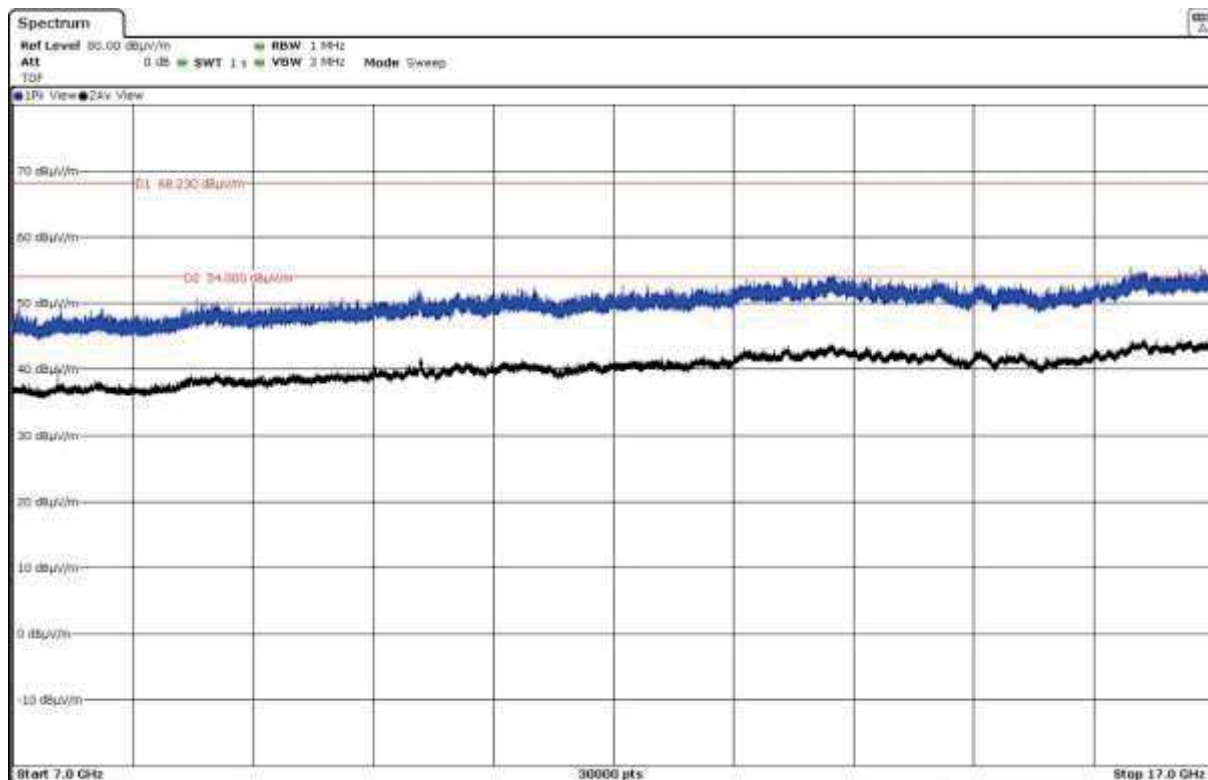
FREQUENCY RANGE 7 GHz to 17 GHz.

Mode QPSK:

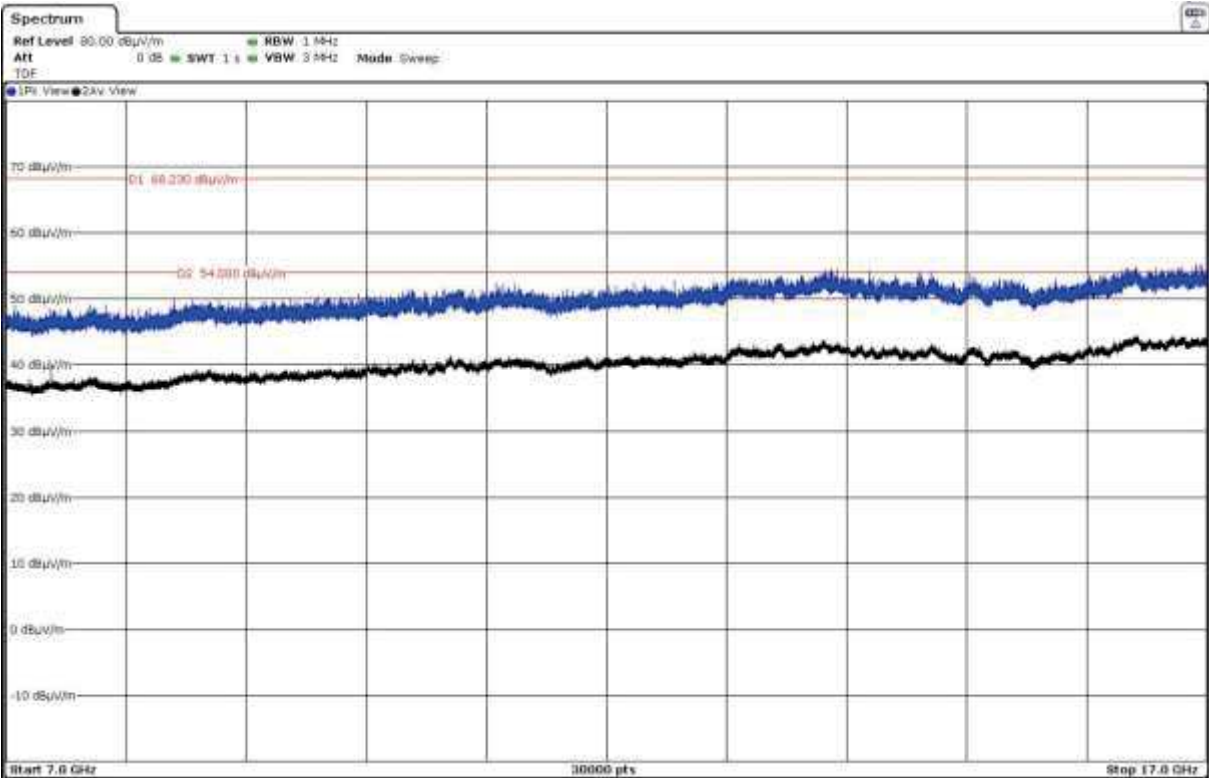
Channel 36:



Channel 40:



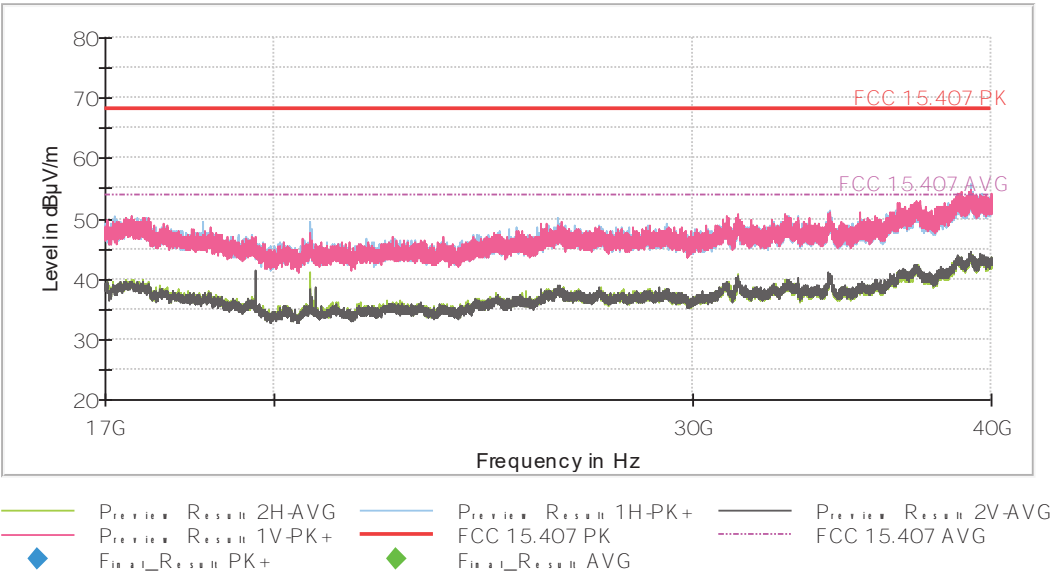
Channel 48:



FREQUENCY RANGE 17 GHz to 40 GHz.

Mode QPSK:

This plot is valid for all channels.



FCC Section 15.407 Subclause (b) (1) / RSS-247 6.2.1.2. Transmitter Band Edge Radiated Emissions.

SPECIFICATION

For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (68.20 dBμV/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS 247: Any unwanted emissions that fall into the band 5250-5350 MHz shall be attenuated below the channel power by at least 26 dB, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth (i.e. 99% bandwidth), above 5250 MHz.

RESULTS:

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

All emissions outside of the 5.15-5.35GHz band shall not exceed an EIRP of -27dBm/MHz. There are restricted bands of operation below band edge at 4.5-5.15 GHz also above the upper band edge at 5.35-5.46GHz therefore the provision of FCC Part 15.205 apply.

Field strength measurements using peak and average detector were performed in the restricted bands below 5.15GHz and above 5.35 GHz.

Test performed on the following worst cases modes in all relevant tests channels:

Results for Mode: QPSK - 20 MHz

Results: Peak / Channel 36

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5147.3670	Horizontal	60.04	74	13.96	<± 4.65	PASS

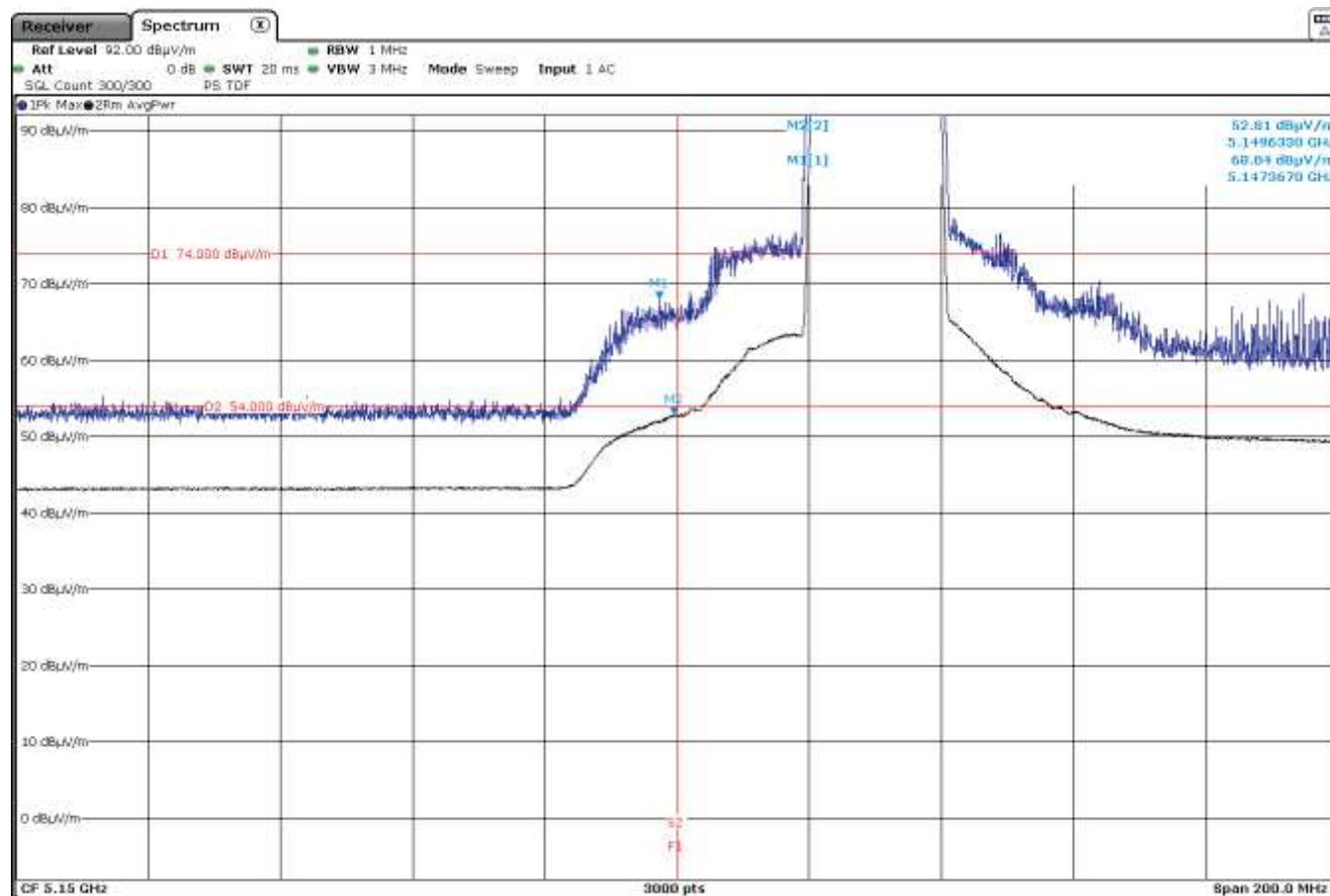
Results: Average / Channel 36

Frequency (MHz)	Antenna Polarity	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5149.6330	Horizontal	52.81	54	1.19	<± 4.65	PASS

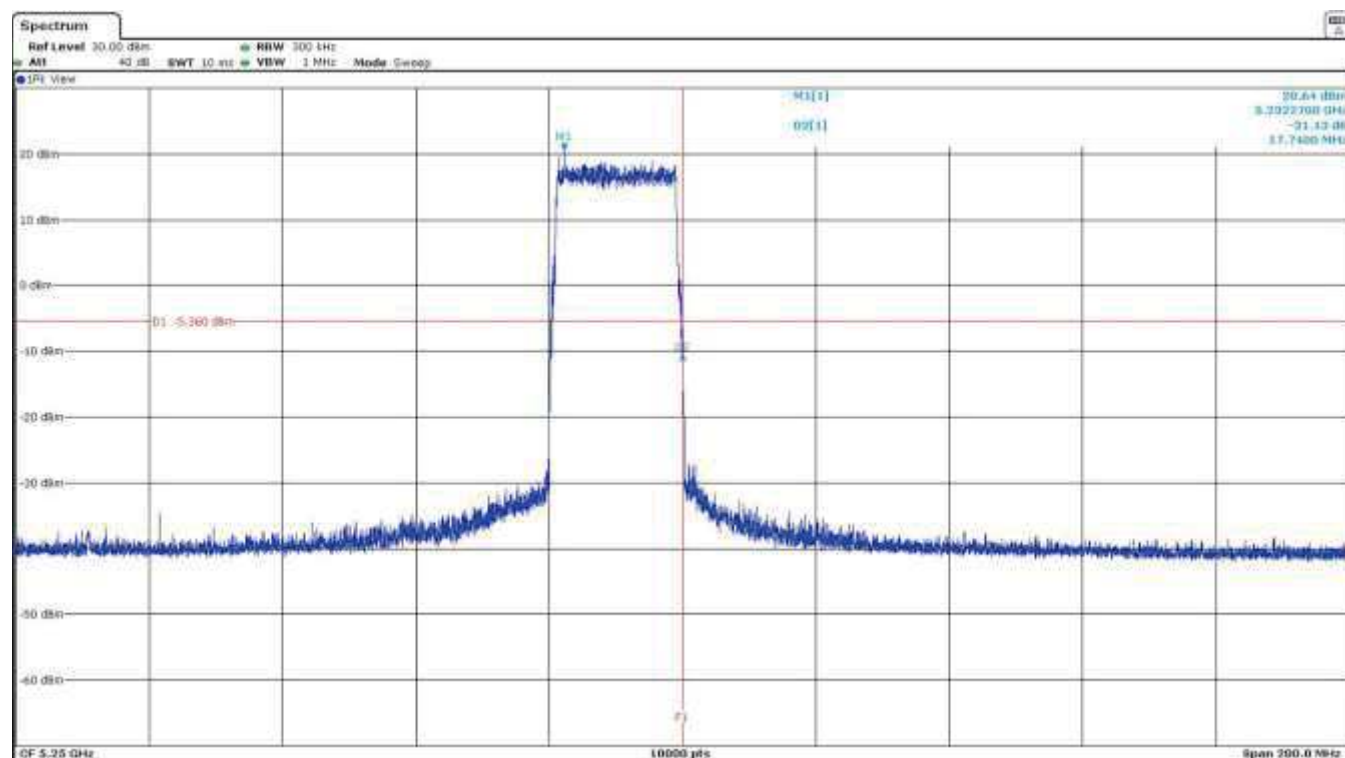
Results: Peak / Channel 48 RSS Band Edge

Frequency (MHz)	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5250.01	-31.13	-26dBc	5.13	<± 4.65	PASS

4500 MHz to 5150 MHz Lower Band Edge Channel 36



5250 MHz to 5350 MHz RSS Band Edge Channel 48



Results: 16QAM - 20 MHz

Results: Peak / Channel 36

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5145.3000	Horizontal	70.04	74	3.96	<± 4.65	PASS

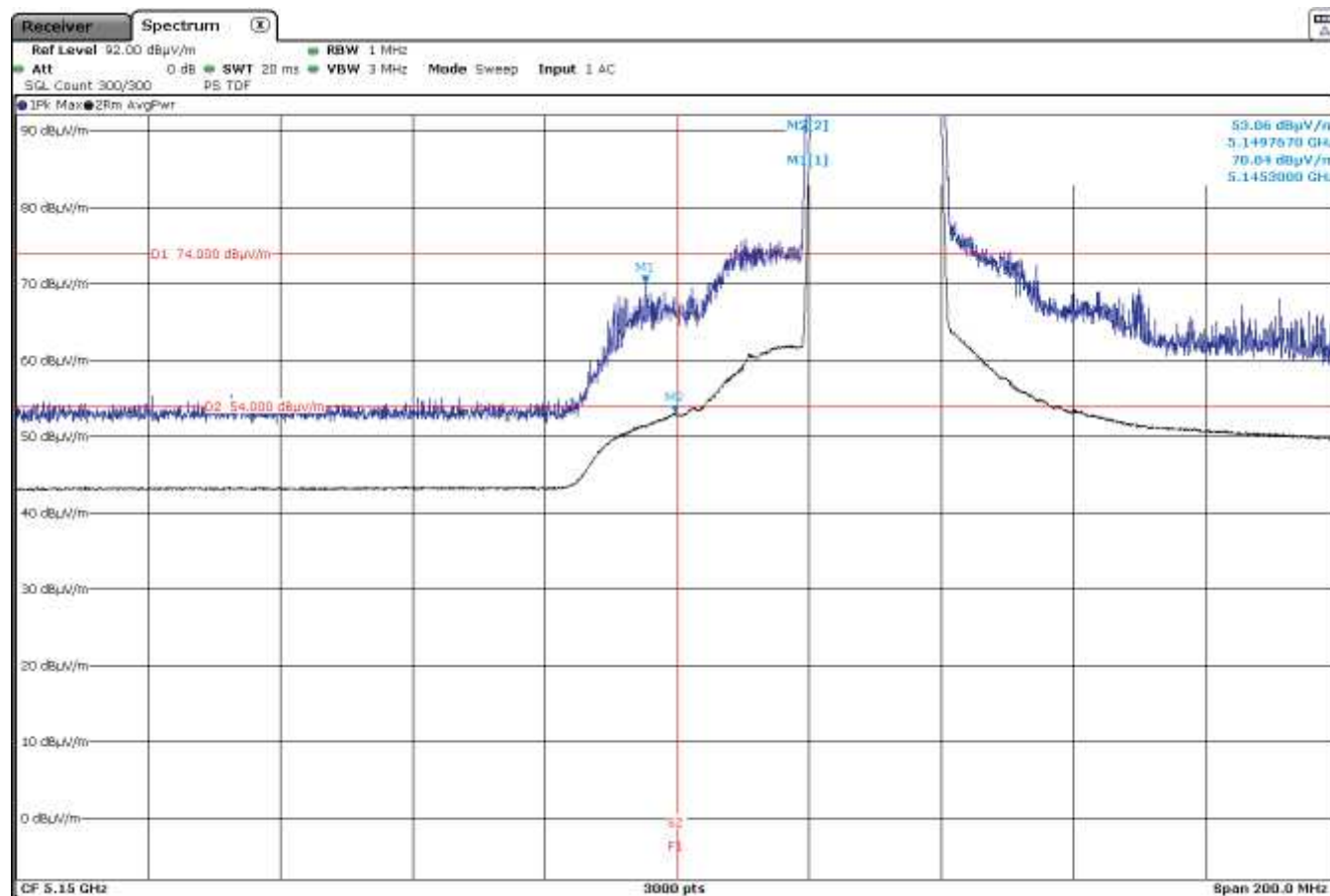
Results: Average / Channel 36

Frequency (MHz)	Antenna Polarity	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5149.7670	Horizontal	53.06	54	0.94	<± 4.65	PASS

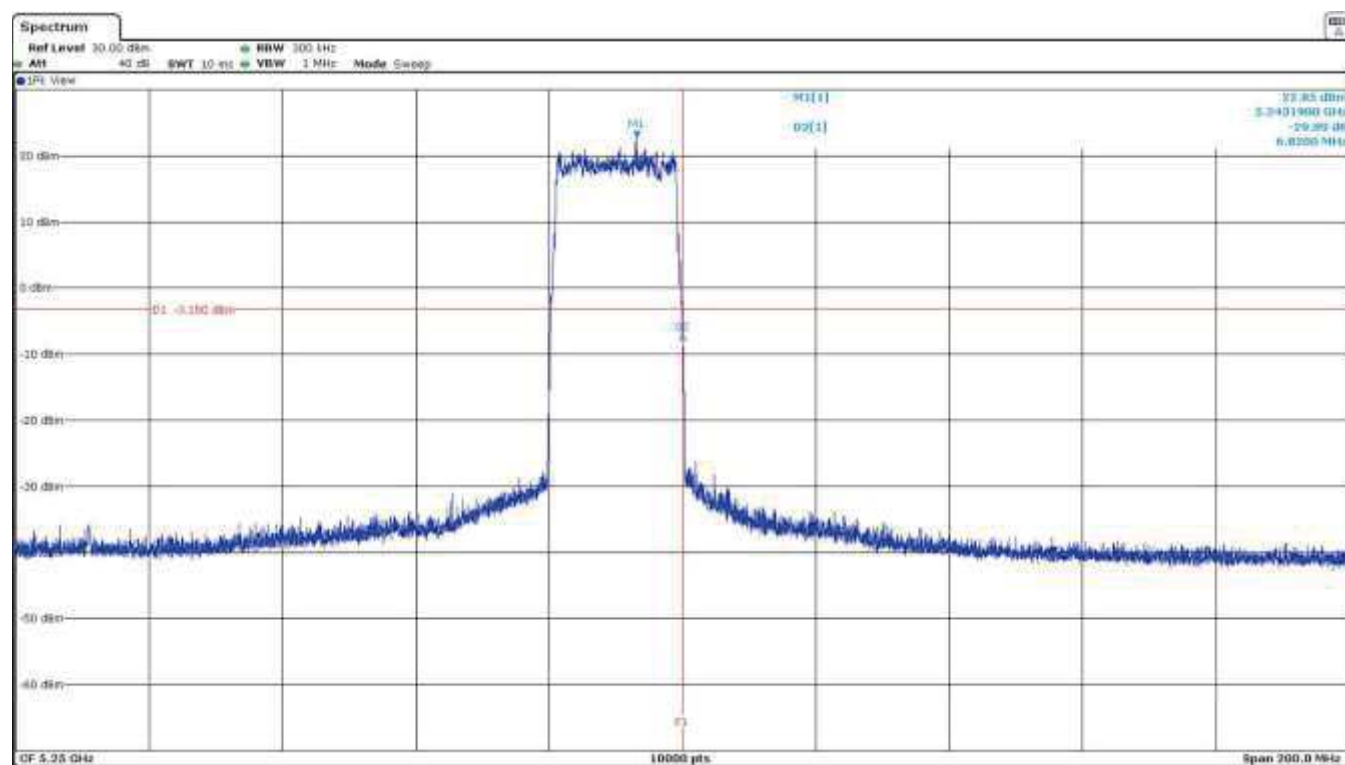
Results: Peak / Channel 48 RSS Band Edge

Frequency (MHz)	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5250.01	-29.89	-26dBc	3.89	<± 4.65	PASS

4500 MHz to 5150 MHz Lower Band Edge Channel 36



5250 MHz to 5350 MHz RSS Band Edge Channel 48



Results: 64QAM - 20 MHz

Results: Peak / Channel 36

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5141.7000	Horizontal	68.00	74	6.0	<± 4.65	PASS

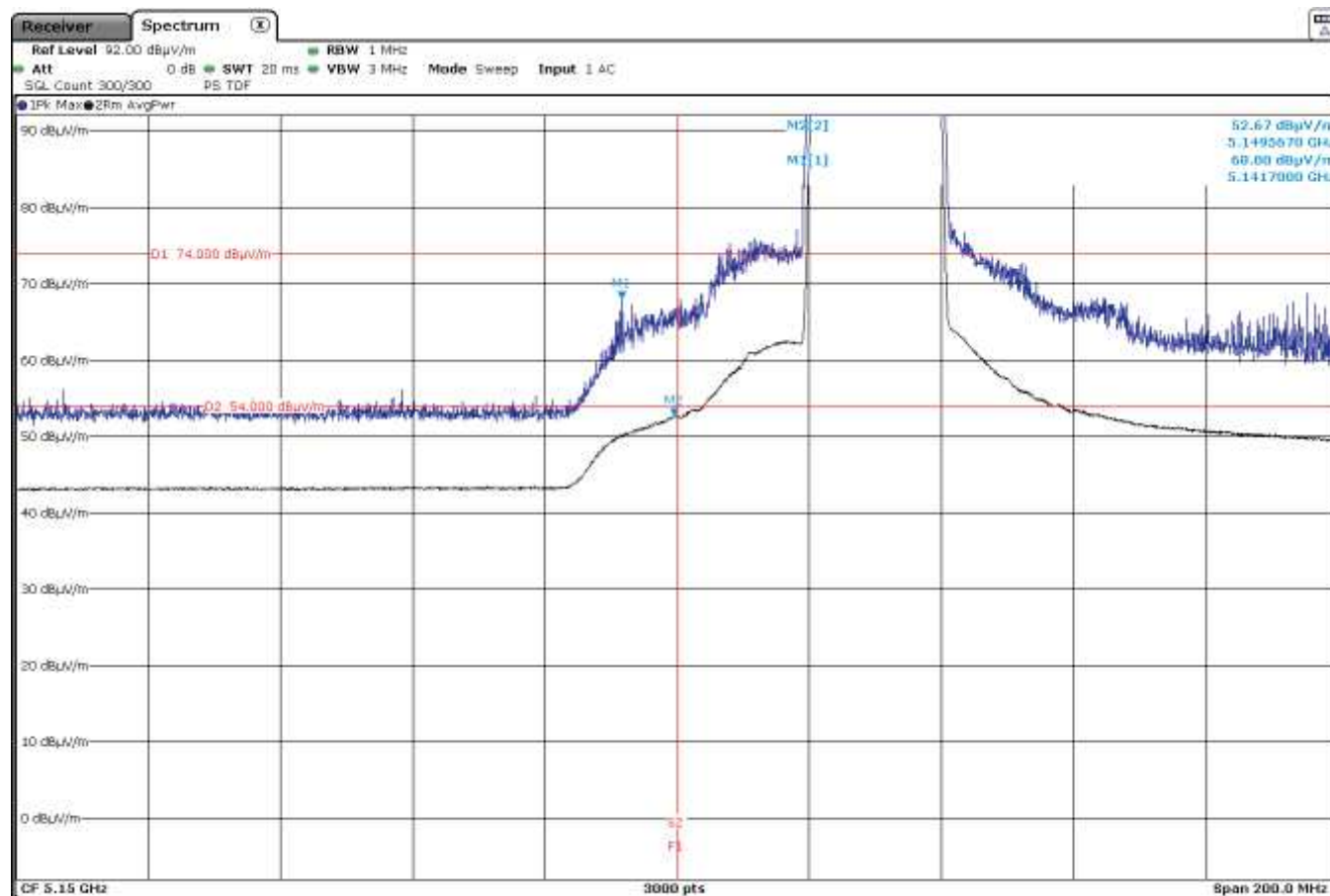
Results: Average / Channel 36

Frequency (MHz)	Antenna Polarity	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5149.5670	Horizontal	52.67	54	1.33	<± 4.65	PASS

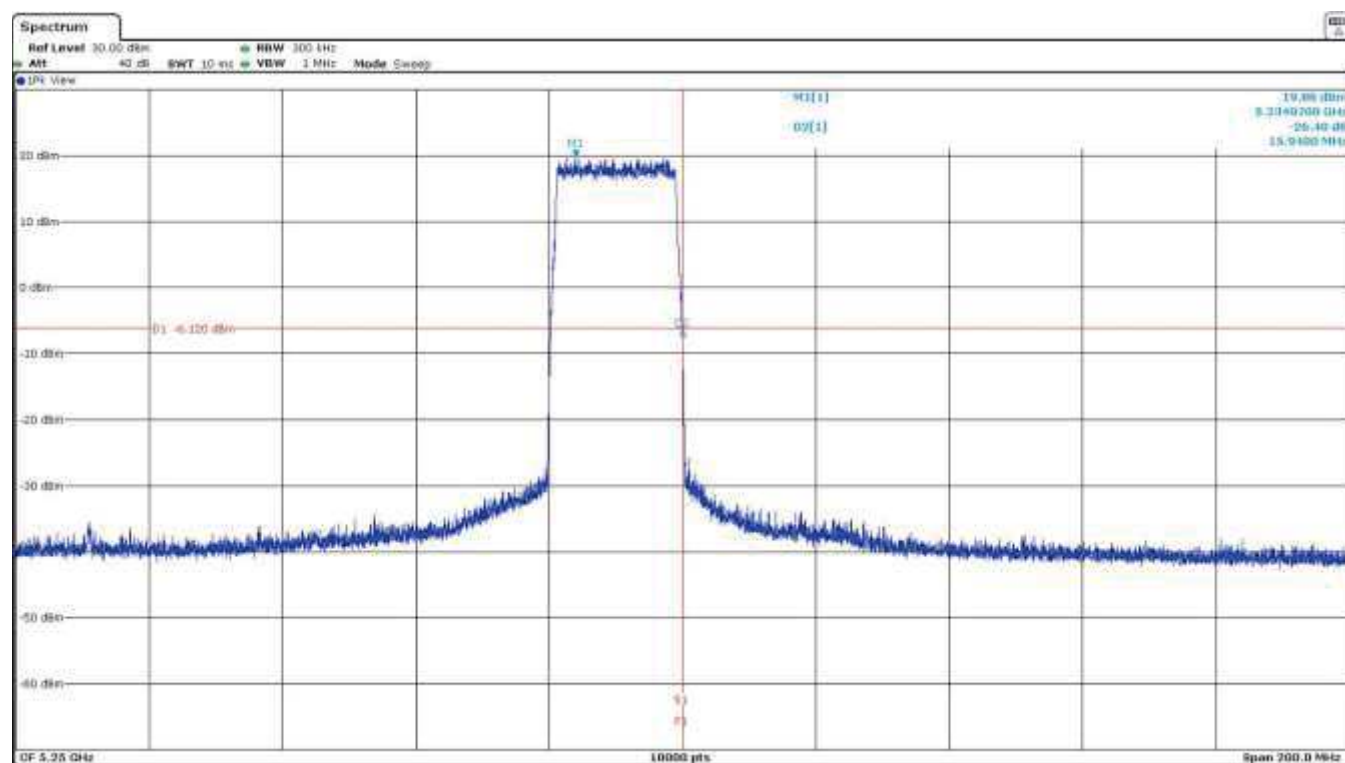
Results: Peak / Channel 48 RSS Band Edge

Frequency (MHz)	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5250.01	-26.40	-26dBc	0.4	<± 4.65	PASS

4500 MHz to 5150 MHz Lower Band Edge Channel 36



5250 MHz to 5350 MHz RSS Band Edge Channel 48



Results: 256QAM - 20 MHz

Results: Peak / Channel 36

Frequency (MHz)	Antenna Polarity	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5149.5670	Horizontal	68.61	74	5.39	<± 4.65	PASS

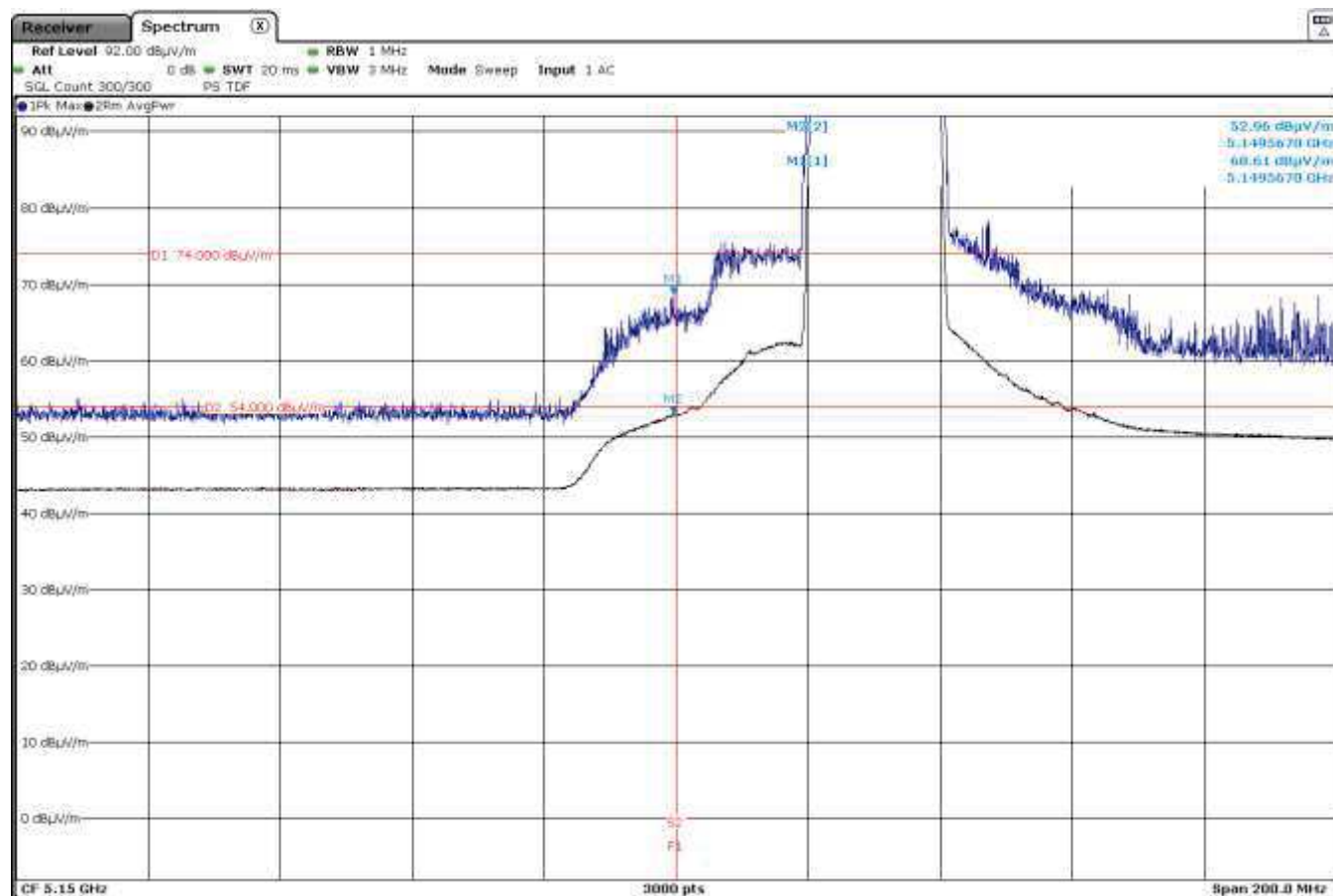
Results: Average / Channel 36

Frequency (MHz)	Antenna Polarity	Average Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5149.5670	Horizontal	52.96	54	1.04	<± 4.65	PASS

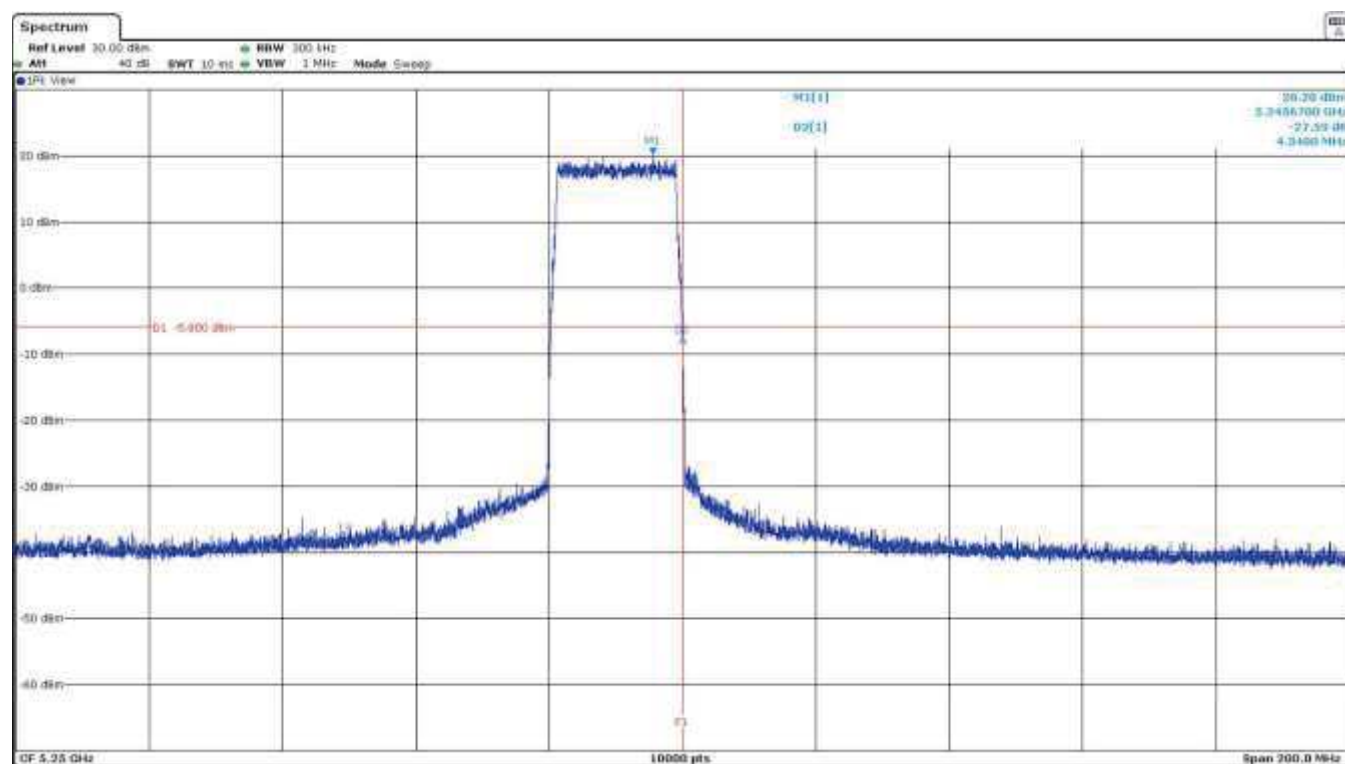
Results: Peak / Channel 48 RSS Band Edge

Frequency (MHz)	Peak Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement uncertainty (dB)	Verdict
5250.01	-27.59	-26dBc	1.59	<± 4.65	PASS

4500 MHz to 5150 MHz Lower Band Edge Channel 36



5250 MHz to 5350 MHz RSS Band Edge Channel 48



Appendix C: Test result for 5.25GHz – 5.35GHz.

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TEST CONDITIONS

Power supply (V):

Vnominal = 120 Vac

Type of power supply = AC voltage main supply.

Type of antenna = External antenna.

Declared Gain for antenna MIMO (maximum): $G_{\text{ANTENNA1+2}} = 6 \text{ dBi}$ (*)

(*) According to KDB 662911 D01 antennas are cross-polarized with fixed orientations that the user cannot change.

Technology Tested:	MulleFire 1.0	
Modes:	QPSK, 16QAM, 64QAM and 256QAM	
Beamforming:	No	
Frequency Range:	5250 MHz to 5350 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Lowest: 52	5260
	Middle: 56	5280
	Highest: 64	5320

The test set-up was made in accordance to the general provisions of FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power in all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode for the channel under test.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes. FCC and Canada power setting used during the test were different to be in compliance with both limits.

Channel	Channel Frequency (MHz)	FCC Power Value	CANADA power value
Lowest: 52	5260	20	19
Middle: 56	5280	20	19
Highest: 64	5320	20	19

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



The AC supply voltage is applied using an external power supply.

RADIATED MEASUREMENTS

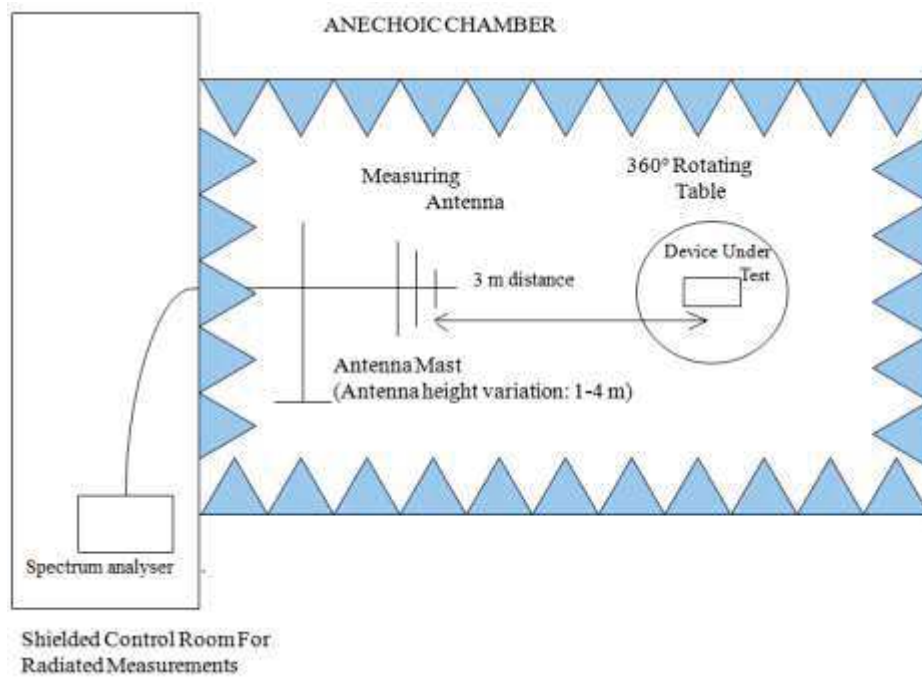
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m. The EUT was placed at a height of 80 cm above the reference ground plane in the center of the chamber turntable to perform the measurements below 1GHz and The EUT was placed at a height of 1.5 meters above the test chamber floor in the center of the chamber turntable to perform the measurements above 1GHz. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

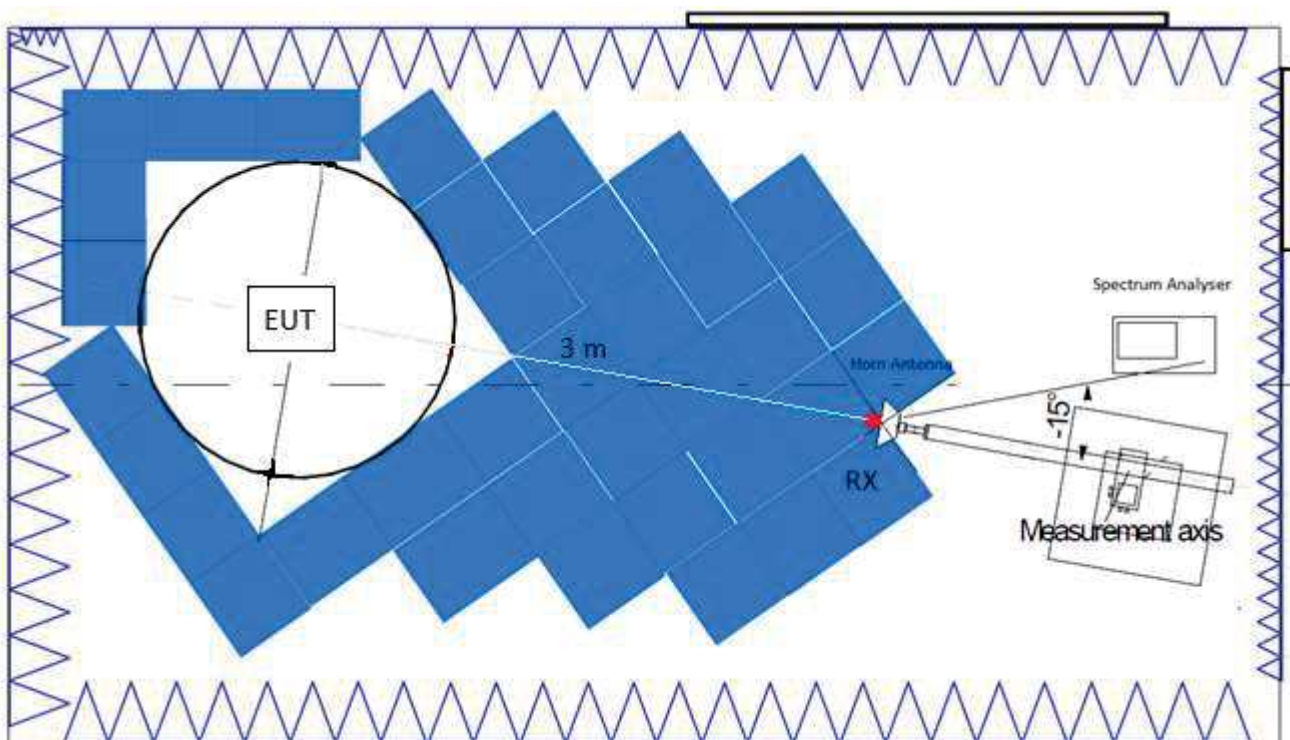
The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.

A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1MHz/3MHz for frequencies above 1 GHz.

Radiated measurements setup $f < 1$ GHz



Radiated measurements setup $f > 1$ GHz



FCC Section 15.407 Subclause (a)(2). Transmitter Maximum Conducted Output Power / RSS-247 Clause 6.2.2.1(a). Transmitter Maximum Equivalent Isotropically Radiated Power

SPECIFICATION

FCC 15.407: For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-247: The maximum conducted output power shall not exceed 250 mW (24 dBm) or $11 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

The maximum e.i.r.p. shall not exceed 1.0 W (30 dBm) or $17 + 10 \log_{10} B$, dBm, whichever is less. B is the 99% emission bandwidth in megahertz.

RESULTS:

The maximum conducted output power was measured using the channel power integration method according to point E) 2) b) (Method SA-1) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is $>98\%$ and the channel power integration method according to point E) 2) d) (Method SA-2) of 789033 D02 General UNII Test Procedures New Rules v02r01 when the duty cycle is $<98\%$.

For data rates where the EUT was transmitting at $<98\%$ duty cycle, the duty calculated in Appendix A was added to the measured power in order to calculate the total average power during the actual transmission time.

In the measure-and-sum approach for MIMO mode, the conducted emission level (*e.g.*, transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units (mW—not dBm).

The e.i.r.p. levels are calculated by adding the corresponding antenna gain (dBi).

FCC power setting

Mode: QPSK – 20MHz

Declared antenna gain: 6 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	23.009	23.557	23.611
Conducted Power Limit (dBm)	24		
Margin (dB)	0.991	0.443	0.389
Maximum EIRP power (dBm)	29.001	29.557	29.611
EIRP power Limit (dBm)	30		
Margin (dB)	0.991	0.443	0.389
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 6 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	22.397	23.419	23.670
Conducted Power Limit (dBm)	24		
Margin (dB)	1.603	0.581	0.330
Maximum EIRP power (dBm)	28.397	29.419	29.670
EIRP power Limit (dBm)	30		
Margin (dB)	1.603	0.581	0.330
Measurement uncertainty (dB)	<±1.20		

Mode: 64QAM – 20MHz

Declared antenna gain: 6 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	23.056	23.475	23.575
Conducted Power Limit (dBm)	24		
Margin (dB)	0.844	0.525	0.425
Maximum EIRP power (dBm)	29.056	29.475	29.575
EIRP power Limit (dBm)	30		
Margin (dB)	0.844	0.525	0.425
Measurement uncertainty (dB)	<±1.20		

Mode: 256QAM – 20MHz

Declared antenna gain: 6 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	22.960	23.511	23.068
Conducted Power Limit (dBm)	24		
Margin (dB)	1.040	0.489	0.952
Maximum EIRP power (dBm)	28.960	29.511	29.068
EIRP power Limit (dBm)	30		
Margin (dB)	1.040	0.489	0.952
Measurement uncertainty (dB)	<±1.20		

Canada power setting

Mode: QPSK – 20MHz

Declared antenna gain: 6 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	22.28	21.94	21.87
Conducted Power Limit (dBm)	23.52		
Margin (dB)	1.24	1.58	1.65
Maximum EIRP power (dBm)	28.28	27.94	27.87
EIRP power Limit (dBm)	29.52		
Margin (dB)	1.24	1.58	1.65
Measurement uncertainty (dB)	<±1.20		

Mode: 16QAM – 20MHz

Declared antenna gain: 6 dBi

	channel 52 5260 MHz	Channel56 5280 MHz	channel 64 5320 MHz
Max. conducted power (dBm)	21.36	20.92	20.88
Conducted Power Limit (dBm)	23.52		
Margin (dB)	2.16	2.60	2.64
Maximum EIRP power (dBm)	27.36	26.92	26.88
EIRP power Limit (dBm)	29.52		
Margin (dB)	2.16	2.60	2.64
Measurement uncertainty (dB)	<±1.20		