


Test Report No:  
 NIE: 68826RRF.001A1

# Test Report

## USA FCC Part 15.247, 15.209

(*) Identification of item tested	XGS-PON 10G ONT Home Gateway
(*) Trademark	Altice Labs
(*) Model and /or type reference	FiberGateway XSR150Dx
Other identification of the product	HW version: PCB 1497 SW version: 2.3 FCC ID: 2ACJF-FGW-XSR150DX
(*) Features	1 x XGS-PON, 1 x FXS, 4 x Ethernet Gigabit, 1 SFP Slot (Optical or Electrical), Dual Band Wi-Fi 6 4T4R and 1 x USB 3.1 Type C Gen1.
Applicant	Altice Labs S.A. Rua Eng. Ferreira Pinto Basto 3810-106 Aveiro Portugal
Test method requested, standard	USA FCC Part 15.247 (10-1-20 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-20 Edition): Radiated emission limits; general requirements. Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v02r01 dated 10/31/2013 ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López EMC Consumer & RF Lab. Manager 
Date of issue	2022-03-23 17:26:44 +01'00'
Report template No	FDT08_23 (*) "Data provided by the client"

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## Competences and guarantees

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## General conditions

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1. This report is only referred to the item that has undergone the test.
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## Uncertainty

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

## Data provided by the client

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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 sample of the FiberGateway is an Optical Terminal Equipment (ONT) unit for Passive Optical Networks (PON) termination in a FTTH (Fiber-To-The-Home) service delivery architecture. FiberGateway communicates with the OLT (Optical Line Terminal) for the PON side and with the customer's premises for the client side. This equipment supports triple-play services - high speed internet (HSI), voice (VoIP), video (IPTV) and Wi-Fi (Dual Band).

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of result.

## Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Reception
68826B/002	XGS-PON 10G ONT Home Gateway	FiberGateway XSR150Dx	PTIN205A5BCF	2021/07/22

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Reception
68826B/003	AC/DC Adapter	WA-36N12FU	--	2021/07/22

Sample S/01 has undergone the test(s): All radiated tests indicated in the Appendix A except Restricted Bands of all modes and 1-18 GHz range of 802.11b.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Reception
68826B/018	XGS-PON 10G ONT Home Gateway	FiberGateway XSR150Dx	PTIN205A5DDF	2021/07/22

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Reception
68826B/003	AC/DC Adapter	WA-36N12FU	--	2021/07/22

Sample S/01 has undergone the test(s): All Restricted Bands and 1-18 GHz range of 802.11b tests indicated in the Appendix A.

- Sample S/03 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Reception
68826B/019	XGS-PON 10G ONT Home Gateway	FiberGateway XSR150Dx	5054494E205A5DDF	2022/2/09

Auxiliary elements used with the Sample S/03:

Control Nº	Description	Model	Serial Nº	Reception
68826B/007	AC/DC Adapter	WA-36N12FU	--	2021/07/22
68826B/012	SMA to UFL cable	--	--	2021/10/01
68826B/013	SMA to UFL cable	--	--	2021/10/01
68826B/014	SMA to UFL cable	--	--	2021/10/01
68826B/015	SMA to UFL cable	--	--	2021/10/01

Sample S/03 has undergone the test(s): All conducted tests indicated in the Appendix A.

## Test sample description

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient <sup>(3)</sup>		
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Supplementary information to the ports..... :							
Rated power supply .....	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input type="checkbox"/>	DC:					
<input type="checkbox"/>	DC:						
Rated Power .....							
Clock frequencies..... :							
Other parameters .....							
Software version .....	Rev 2.3						
Hardware version .....	PCB 1497						
Dimensions in cm (W x H x D) .....							
Mounting position .....	<input type="checkbox"/>	Table top equipment					
	<input type="checkbox"/>	Wall/Ceiling mounted equipment					
	<input type="checkbox"/>	Floor standing equipment					
	<input type="checkbox"/>	Hand-held equipment					
	<input type="checkbox"/>	Other:					
Modules/parts..... :	Module/parts of test item		Type	Manufacturer			
Accessories (not part of the test item) .....	Description		Type	Manufacturer			
Documents as provided by the applicant .....	Description		File name	Issue date			

<sup>(3)</sup> Only applicable to medical equipments.

## Identification of the client

Altice Labs S.A.  
Rua Eng. Ferreira Pinto Basto 3810-106 Aveiro, Portugal

## Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-10-19
Date (finish)	2022-03-09

## Document history

Report number	Date	Description
68826RRF.001	2022-03-15	First release.
68826RRF.001A1	2022-03-23	Second release. Typographic error. This modification test report cancels and replaces the test report 68826RRF001s

## 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: Alfonso Gutiérrez, Francisco Javier Fernandez and Pablo Redondo.

Used instrumentation:

### Conducted Measurements:

	Last Calibration	Due Calibration
1. Spectrum Analyzer 9kHz-6GHz ROHDE AND SCHWARZ FSV40	2021-02-26	2023-02-26
2. Vector Signal Generator 100 KHz-7.5GHz ROHDE AND SCHWARZ SMW200A	2021-08-20	2023-08-20
3. Signal Generator 9 KHz-6 GHz, ROHDE AND SCHWARZ SMB100A	2021-11-03	2023-11-03
4. Open Switch and Control Platform ROHDE & SCHWARZ OSP-B157W8 PLUS	2021-08-20	2023-08-20
5. Software WMS32 ROHDE & SCHWARZ	N.A.	N.A.

### 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. EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2020/12	2022/12
4. Preamplifier G>40dB 10MHz-6GHz, BONN ELEKTRONIK, BLNA 0160-01N	2021/03	2022/03
5. Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2020/04	2023/04
6. Attenuator 3dB, 2W, DC-18GHz, TECHNIWAVE TWTS2G	2021/02	2022/02
7. Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2020/07	2022/07
8. RF Preamplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2021/06	2022/06
9. Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
10. Low Noise Amplifier G>30dB, 18 - 40 GHz BONN ELEKTRONIK BLMA 1840-3G	2019/11	2021/11
11. Horn Antenna 18-40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
12. DC Power Supply 30V/5A KEYSIGHT TECHNOLOGIES U8002A	N/A	N/A
13. Digital Multimeter FLUKE 175	2020/11	2021/11

## Testing verdicts

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

## Summary

### 802.11 bgn2040he2040 2x2.

FCC PART 15 PARAGRAPH			
Requirement – Test case		Verdict	Remark
FCC 15.247 (a)(2)	6 dB Bandwidth	P	
FCC 15.247 (b)	Maximum output power and antenna gain	P	
FCC 15.247 (d)	Band-edge emissions compliance (Transmitter)	P	
FCC 15.247 (e)	Power spectral density	P	
FCC 15.247 (d)	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u>			
None.			



## Appendix A: Test results. 802.11 bgn2040he2040

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## TEST CONDITIONS

(\*) Declared by the Client.

### POWER SUPPLY (\*):

Vnominal: 110 Vac  
Type of Power Supply: AC/DC Adapter.

### ANTENNAS – WLAN (\*):

Ant 0 – DB1: 1.5 dBi, Polarization: Vertical  
Ant 1 – DB2: 1.7 dBi, Polarization: Horizontal  
Ant 2 – DB3: 1.1 dBi, Polarization: Horizontal  
Ant 3 - DB4: 1.3 dBi, Polarization: Vertical

### Directional Antenna Gain Calculations for CDD MIMO:

- For 4Tx CDD MIMO modes, in accordance with KDB 662911 D01 v02r01 Section F)2)c)(ii), directional gain was calculated as (worst case):

$N_{SS} = 1$ ,  $N_{ANT} = 4$ ,  $G_{ANT0} = 1.5$  dBi,  $G_{ANT1} = 1.7$  dBi,  $G_{ANT2} = 1.1$  dBi,  $G_{ANT3} = 1.3$  dBi

Antennas horizontal polatization:

Directional Gain =  $G_{Ant}$  mayor ganancia + Array Gain = 1.7 dBi + 0 dB = 1.7 dBi

Antennas vertical polatization:

Directional Gain =  $G_{Ant}$  mayor ganancia + Array Gain = 1.5 dBi + 0 dB = 1.5 dBi

### TEST FREQUENCIES for 20 MHz modes (\*):

Low Channel (1): 2412 MHz  
Channel (2): 2417 MHz  
Channel (3): 2422 MHz  
Channel (4): 2427 MHz  
Channel (5): 2432 MHz  
Middle Channel (6): 2437 MHz  
Channel (7): 2442 MHz  
Channel (8): 2447 MHz  
Channel (9): 2452 MHz  
Channel (10): 2457 MHz  
High Channel (11): 2462 MHz

### TEST FREQUENCIES for 40 MHz modes (\*):

Low Channel (3): 2422 MHz  
Channel (4): 2427 MHz  
Channel (5): 2432 MHz  
Middle Channel (6): 2437 MHz  
Channel (7): 2442 MHz  
Channel (8): 2447 MHz  
High Channel (9): 2452 MHz

Transmit power setting:

Modes	Low Channel (1) 2412MHz	Channel (2) 2417MHz	Channel (3) 2422MHz	Channel (4) 2422MHz	Channel (5) 2427MHz	Middle Channel (6) 2437MHz
802.11 b (ANT0)	24 dBm	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm
802.11 b (ANT1)	24 dBm	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm
802.11 b (ANT2)	24 dBm	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm
802.11 b (ANT3)	24 dBm	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm
802.11 g (ANT0)	19.5 dBm	21.5 dBm	22.5 dBm	23.5 dBm	24.5 dBm	25.5 dBm
802.11 g (ANT1)	19.5 dBm	21.5 dBm	22.5 dBm	23.5 dBm	24.5 dBm	25.5 dBm
802.11 g (ANT2)	19.5 dBm	21.5 dBm	22.5 dBm	23.5 dBm	24.5 dBm	25.5 dBm
802.11 g (ANT3)	19.5 dBm	21.5 dBm	22.5 dBm	23.5 dBm	24.5 dBm	25.5 dBm
802.11 n20 (ANT0+ANT1+ANT2+ANT3)	20.5 dBm	22.5 dBm	23 dBm	24.5 dBm	25 dBm	25.5 dBm
802.11 HE20 (ANT0+ANT1+ANT2+ANT3)	20.5 dBm	21.5 dBm	22.5 dBm	23.5 dBm	24.5 dBm	24.5 dBm

Modes	Channel (7) 2442MHz	Channel (8) 2447MHz	Channel (9) 2452MHz	Channel (10) 2457MHz	High Channel (11) 2462MHz
802.11 b (ANT0)	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm	26 dBm
802.11 b (ANT1)	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm	26 dBm
802.11 b (ANT2)	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm	26 dBm
802.11 b (ANT3)	23.5 dBm	23.5 dBm	23.5 dBm	23.5 dBm	26 dBm
802.11 g (ANT0)	24.5 dBm	23.5 dBm	22.5 dBm	22.5 dBm	19.5 dBm
802.11 g (ANT1)	24.5 dBm	23.5 dBm	22.5 dBm	22.5 dBm	19.5 dBm
802.11 g (ANT2)	24.5 dBm	23.5 dBm	22.5 dBm	22.5 dBm	19.5 dBm
802.11 g (ANT3)	24.5 dBm	23.5 dBm	22.5 dBm	22.5 dBm	19.5 dBm
802.11 n20 (ANT0+ANT1+ANT2+ANT3)	24.5 dBm	24.5 dBm	23.5 dBm	22 dBm	18 dBm
802.11 HE20 (ANT0+ANT1+ANT2+ANT3)	24.5 dBm	23.5 dBm	22.5 dBm	21.5 dBm	18 dBm

Modes	Low Channel (3) 2422MHz	Channel (4) 2427MHz	Channel (5) 2427MHz	Middle Channel (6) 2437MHz	Channel (7) 2442MHz	Channel (8) 2447MHz	High Channel (9) 2452MHz
802.11 n40 (ANT0+ANT1+ANT2+ANT3)	18.5 dBm	19.5 dBm	19.5 dBm	20.5 dBm	19.5 dBm	18.5 dBm	14.5 dBm
802.11 HE40 (ANT0+ANT1+ANT2+ANT3)	19.5 dBm	19.5 dBm	20.5 dBm	21 dBm	19.5 dBm	17.5 dBm	18.5 dBm

The data rates of 1 Mbps for 802.11 b, 6.5 Mbps for 802.11 g, MCS0 for 802.11 n20,he20,n40 and he40 were selected based on preliminary testing that identified those rates corresponding to the worst cases for output power and band edge levels at restricted bands.

The sample was used to configure the EUT to continuously transmit at a specified output power in all channels with different modes and modulation schemes.

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.

#### CONDUCTED MEASUREMENTS:

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



#### RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz) and 1 GHz-18 GHz Double ridge horn antenna is situated at a distance of 3 m and a distance of 1 m for the frequency range 17 GHz-26 GHz (18 GHz-40 GHz horn antenna).

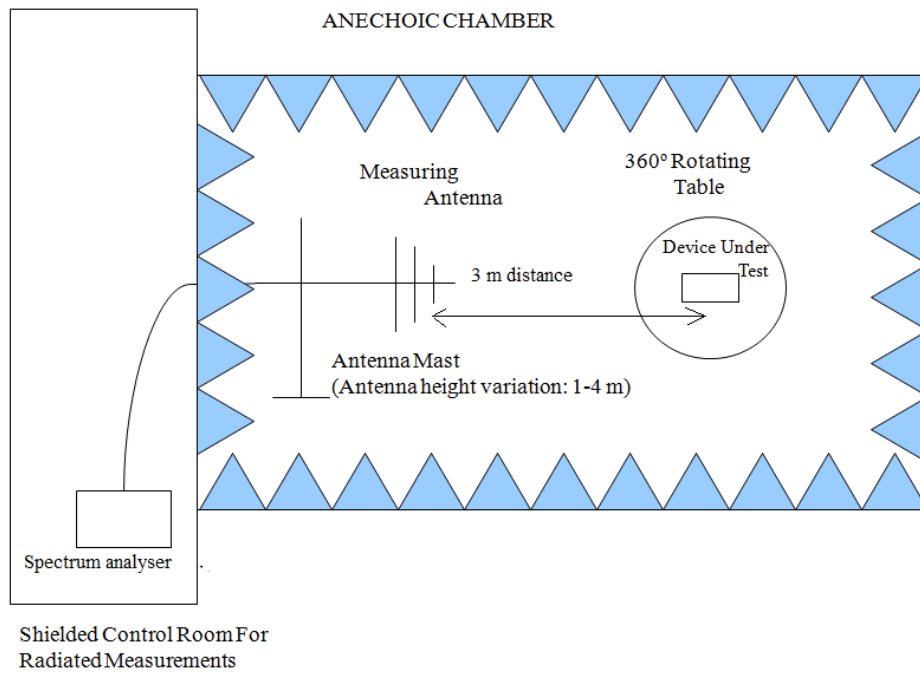
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

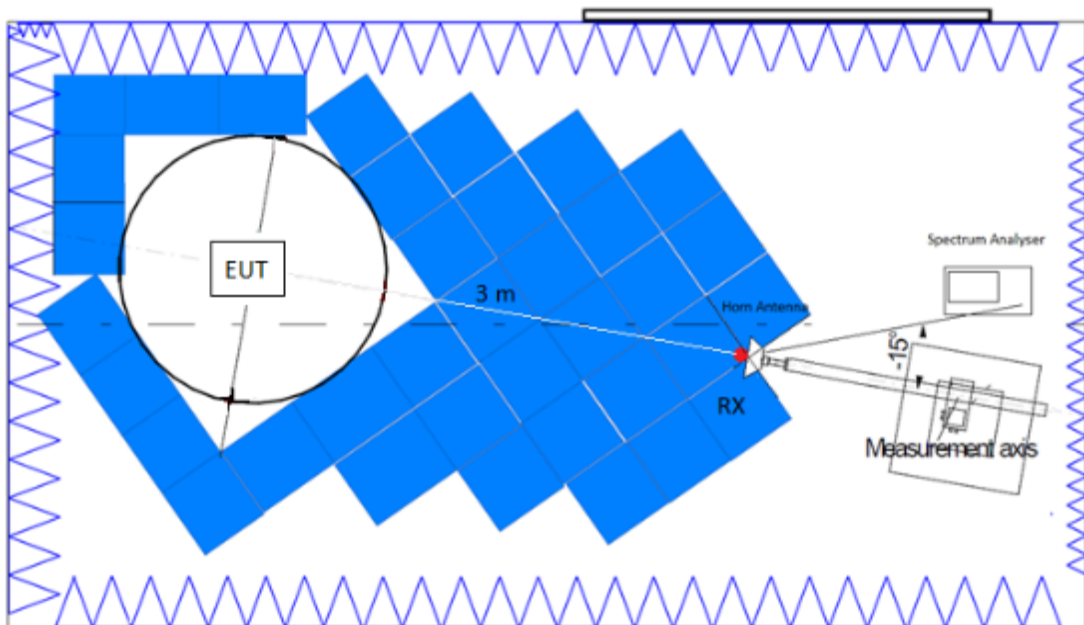
Measurements were made in both horizontal and vertical planes of polarization.

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

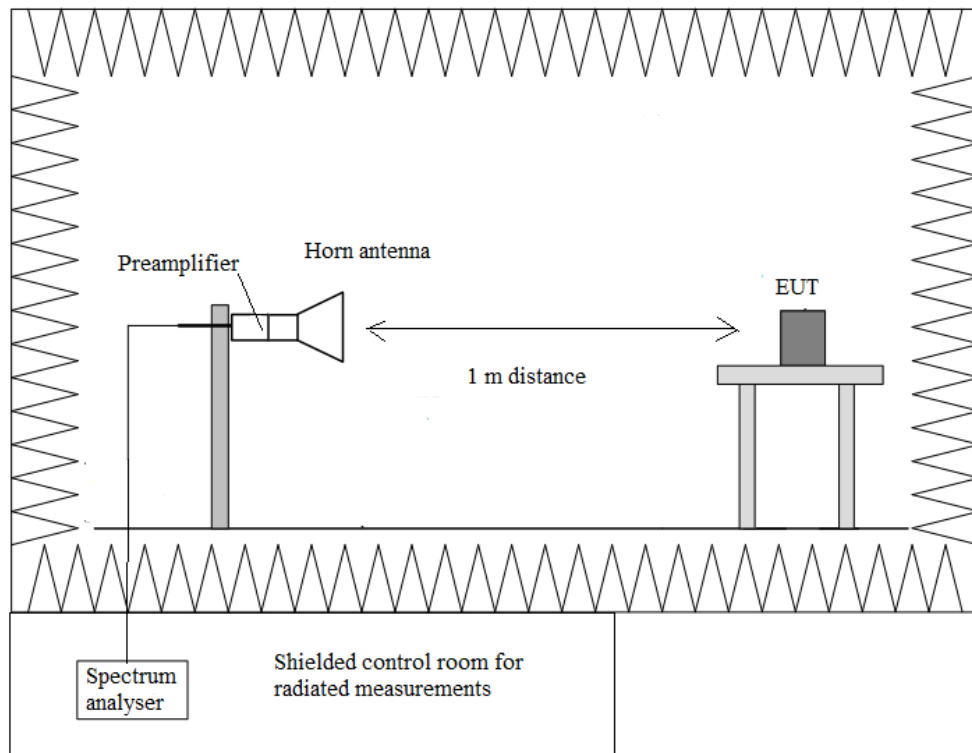
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup  $f > 17$  GHz:



## Occupied Bandwidth

### RESULTS:

The following modes and data rates were selected based on preliminary testing that identified those corresponding to the worst cases:

- 802.11 b: 1 Mbit/s.
- 802.11 g: 6 Mbit/s.
- 802.11 n HT20: MCS0.
- 802.11 n HT40: MCS0.
- 802.11 ax HE20: MCS0.
- 802.11 ax HE40: MCS0.

- Preliminary tests determined the SISO worst case: ANT1.
- MIMO: ANT0+ANT1+ANT2+ANT3.

#### SISO worst case:

- **SISO 802.11 b:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
99% Bandwidth (MHz)	11.00	10.80	11.00
Measurement uncertainty (%)	<± 2		

- **SISO 802.11 g:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
99% Bandwidth (MHz)	16.80	17.10	16.80
Measurement uncertainty (%)	<± 1.40		

- **MIMO 802.11 n20:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
99% Bandwidth (MHz)	17.80	18.40	17.90
Measurement uncertainty (%)	<± 1.40		

- **MIMO 802.11 he20:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
99% Bandwidth (MHz)	19.00	19.20	19.10
Measurement uncertainty (%)	<± 1.40		



- **MIMO 802.11 n40:**

	Low Channel (3) 2422MHz	Middle Channel (6) 2437MHz	High Channel (9) 2452MHz
99% Bandwidth (MHz)	36.75	36.25	36.00
Measurement uncertainty (%)	<± 2		

- **MIMO 802.11 he40:**

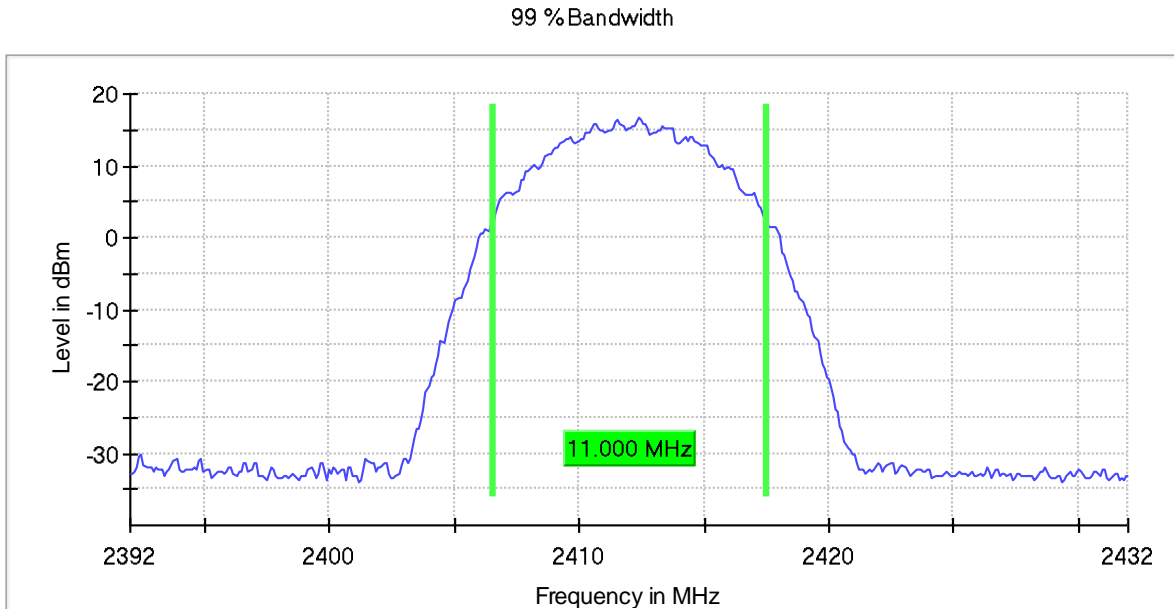
	Low Channel (3) 2422MHz	Middle Channel (6) 2437MHz	High Channel (9) 2452MHz
99% Bandwidth (MHz)	37.75	37.75	37.50
Measurement uncertainty (%)	<± 2		

Verdict: PASS

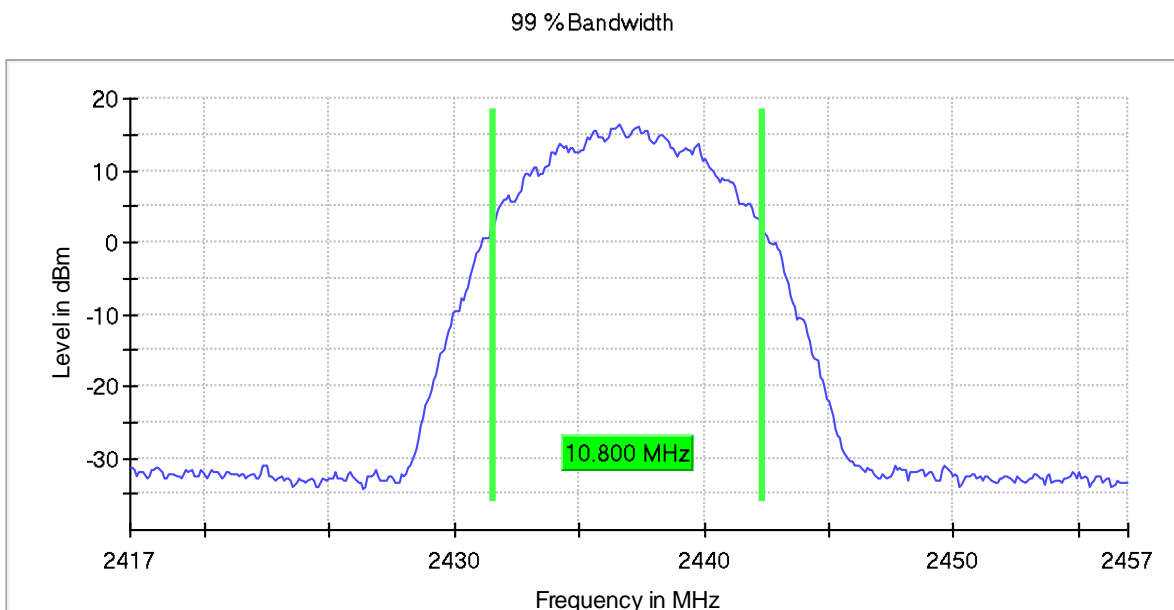
**SISO worst case:**

- **SISO 802.11 b – Occupied Bandwidth:**

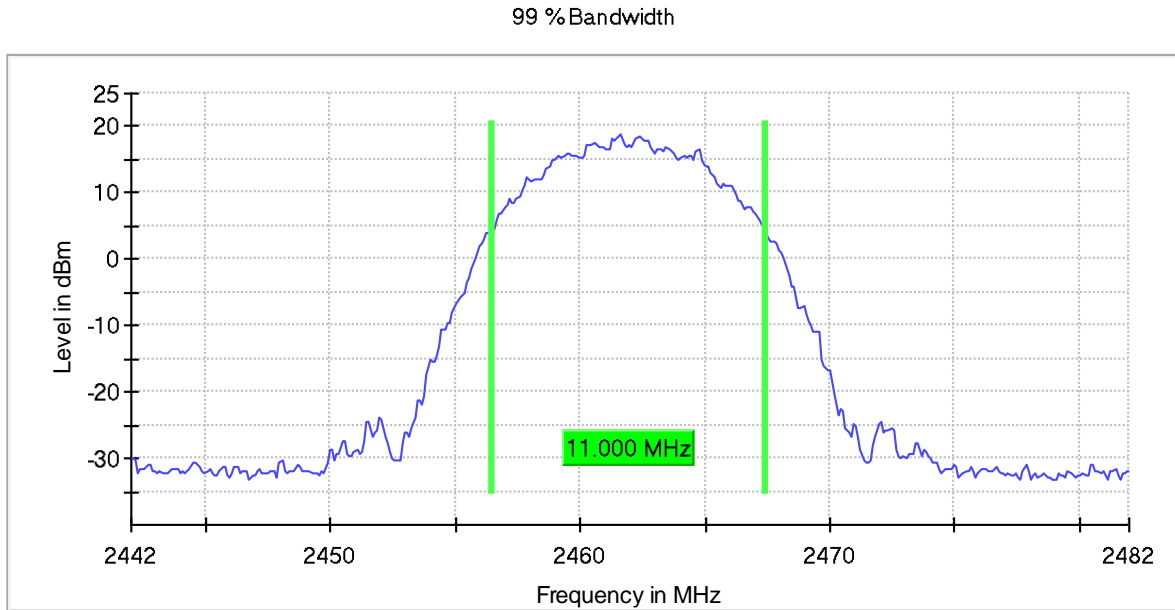
- Low Channel (1):



- Middle Channel (6):

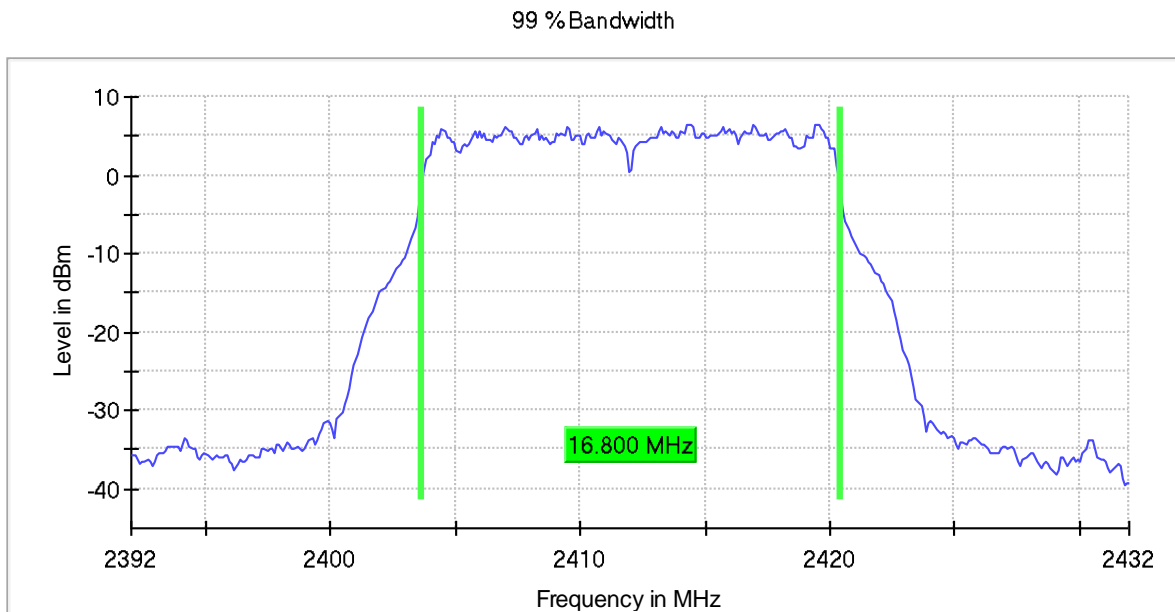


- High Channel (11):



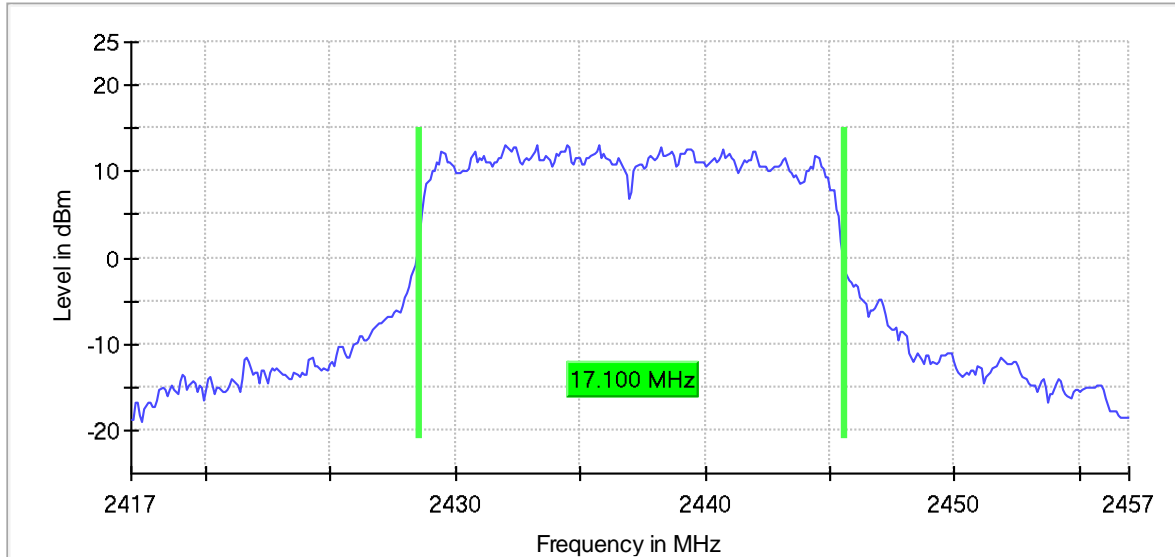
- **SISO 802.11 g – Occupied Bandwidth:**

- Low Channel (1):



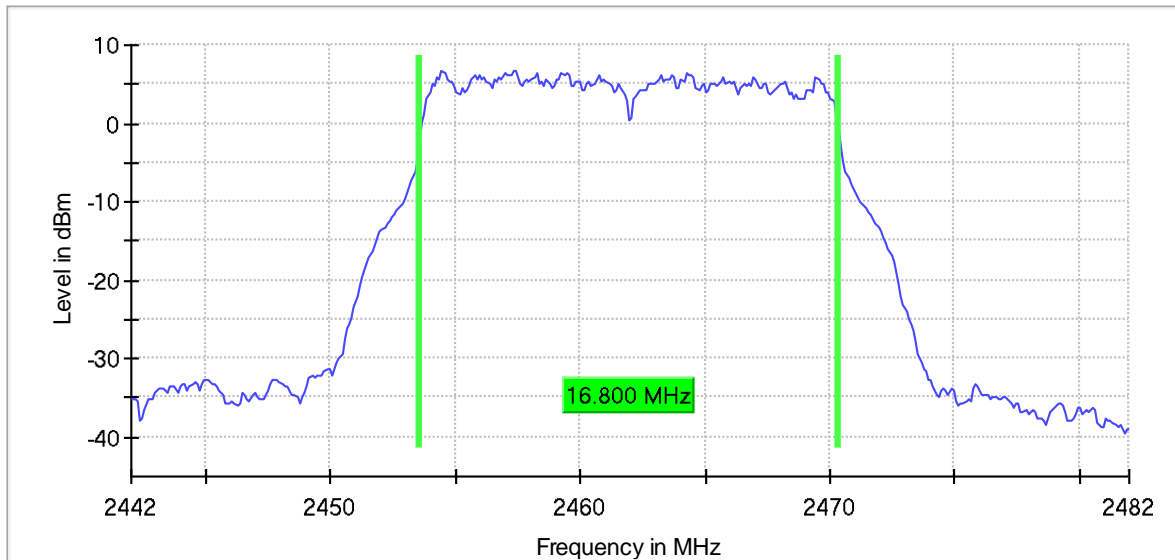
- Middle Channel (6):

99 % Bandwidth



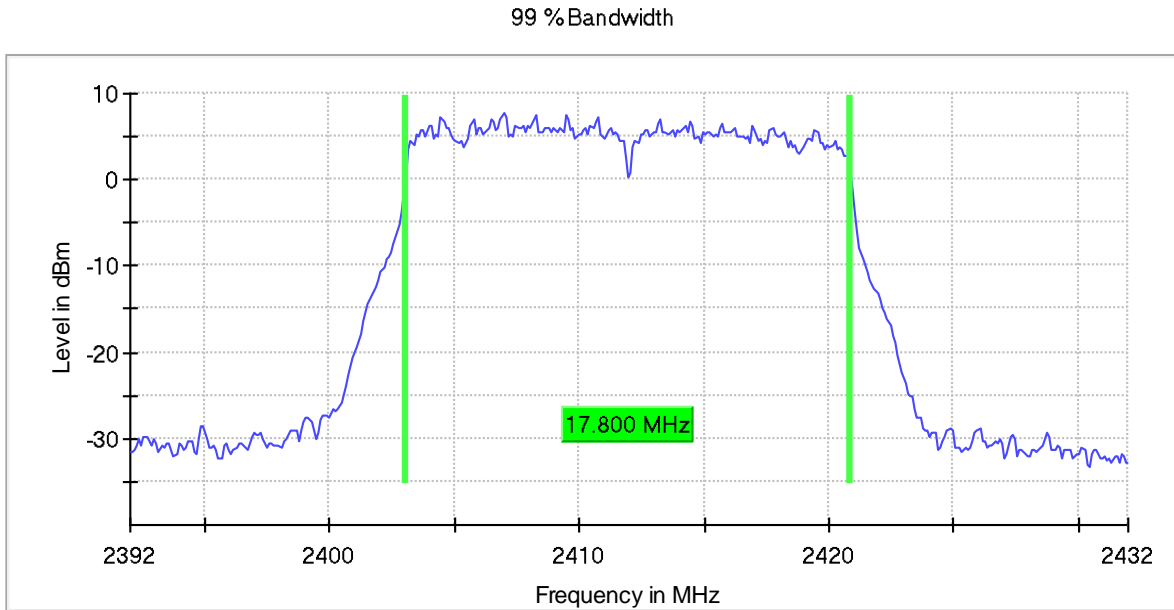
- High Channel (11):

99 % Bandwidth

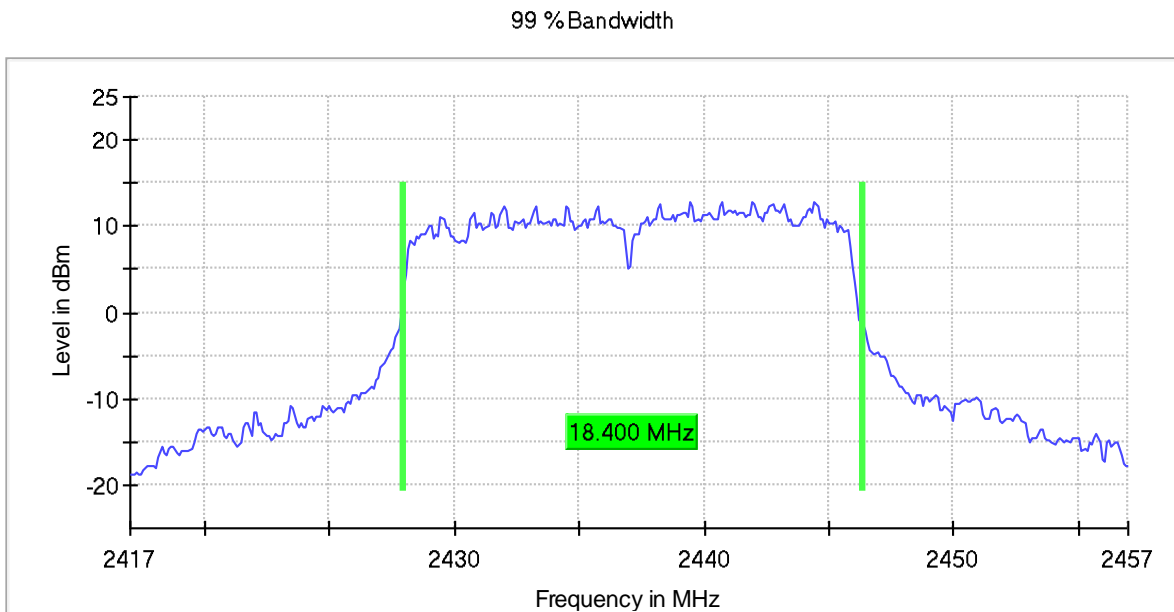


- **MIMO 802.11 n20 – Occupied Bandwidth:**

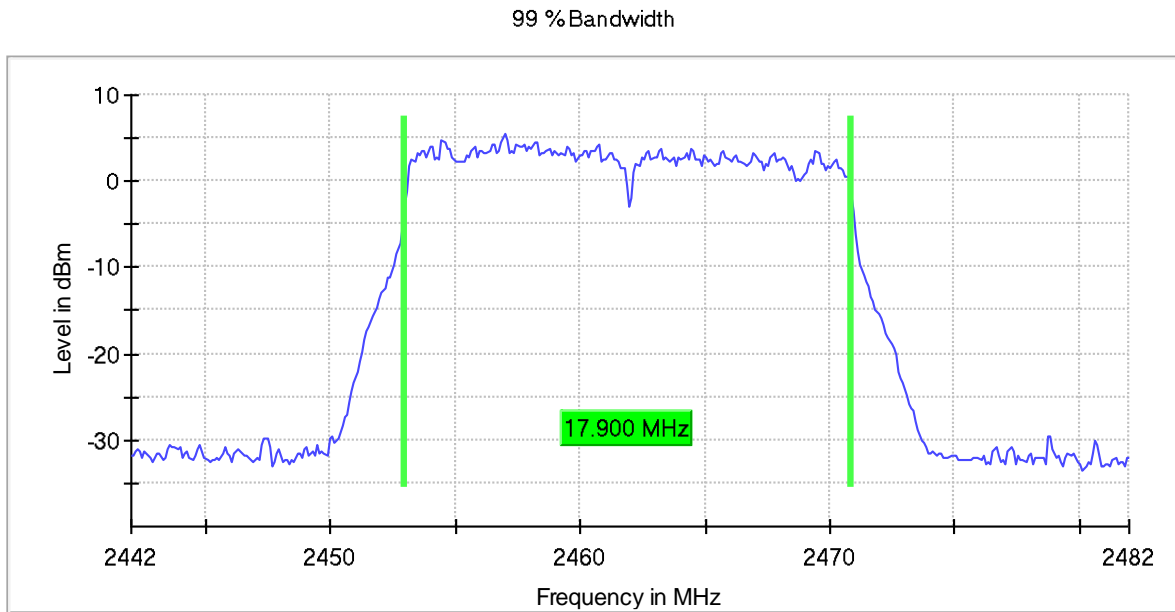
- Low Channel (1):



- Middle Channel (6):

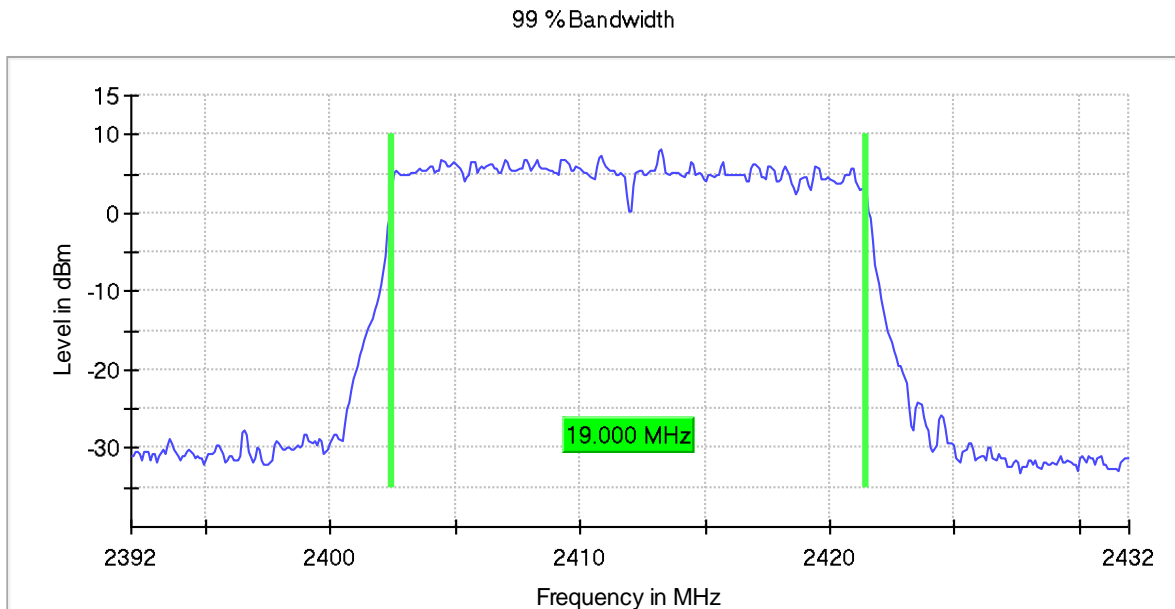


- High Channel (11):



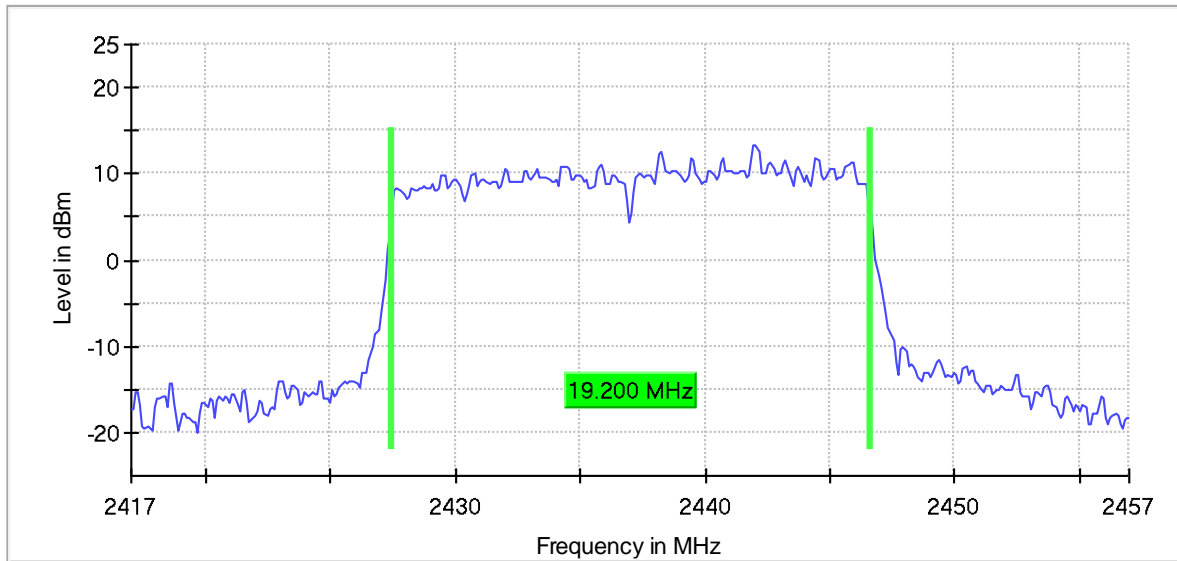
- **MIMO 802.11 he20 – Occupied Bandwidth:**

- Low Channel (1):



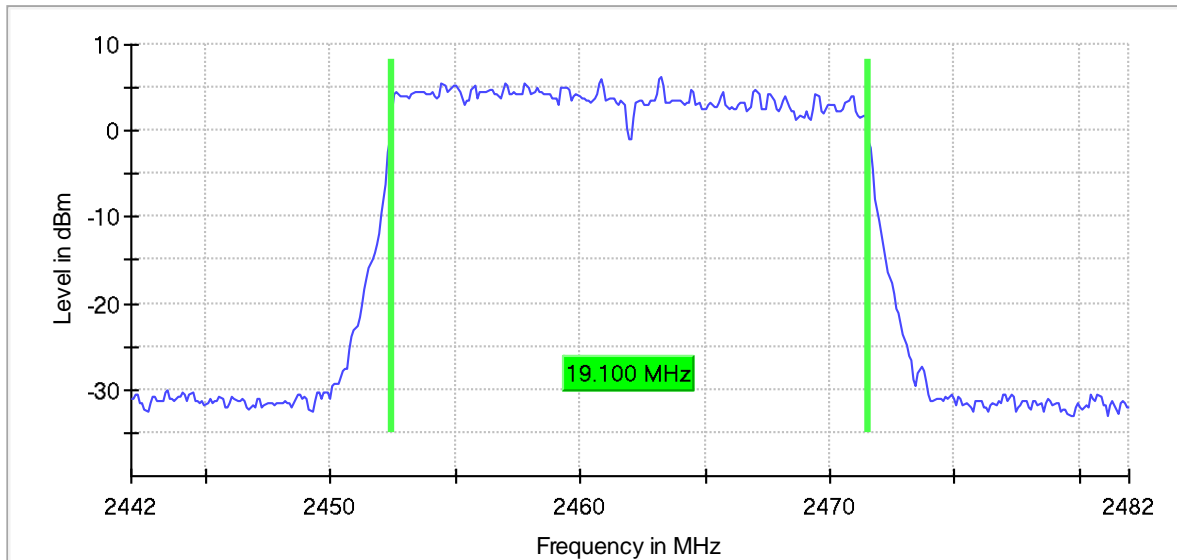
- Middle Channel (6):

99 % Bandwidth



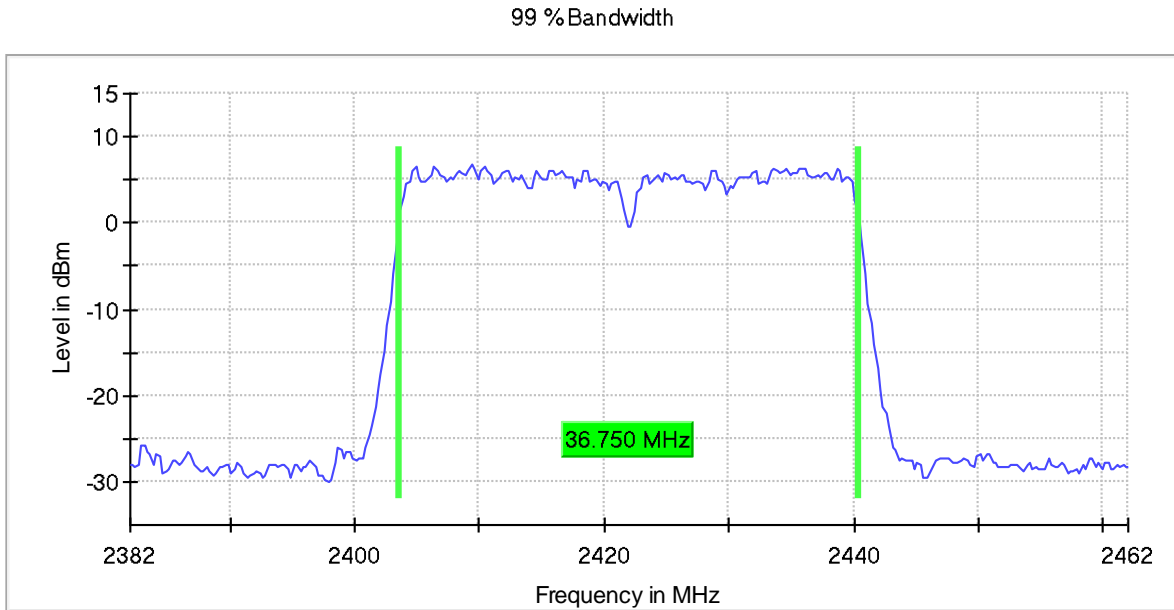
- High Channel (11):

99 % Bandwidth

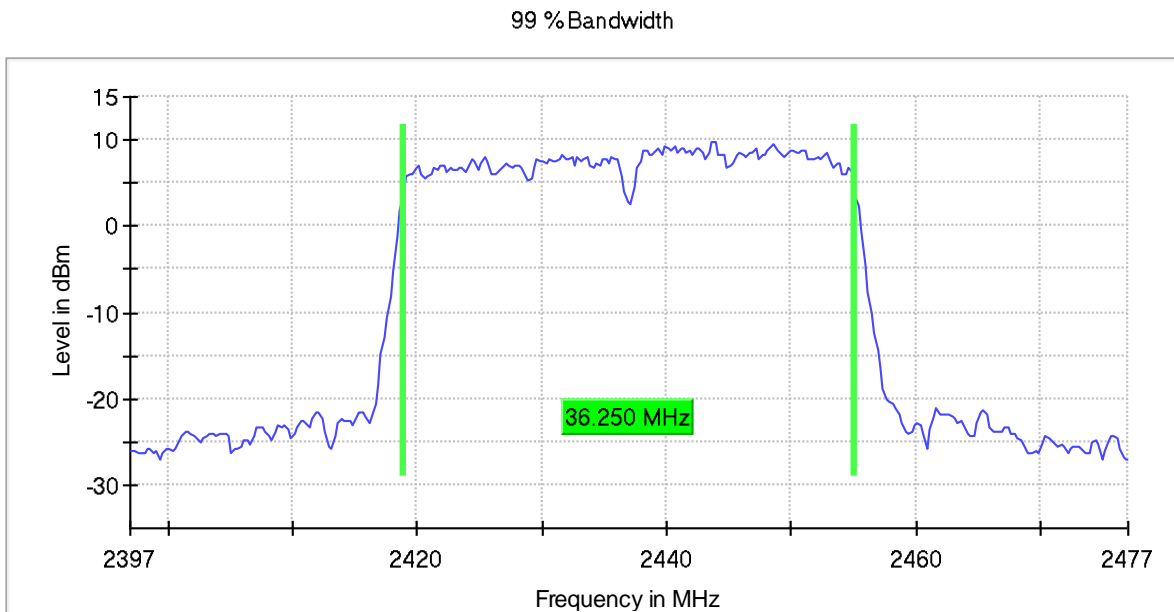


- **MIMO 802.11 n40 – Occupied Bandwidth:**

- Low Channel (3):

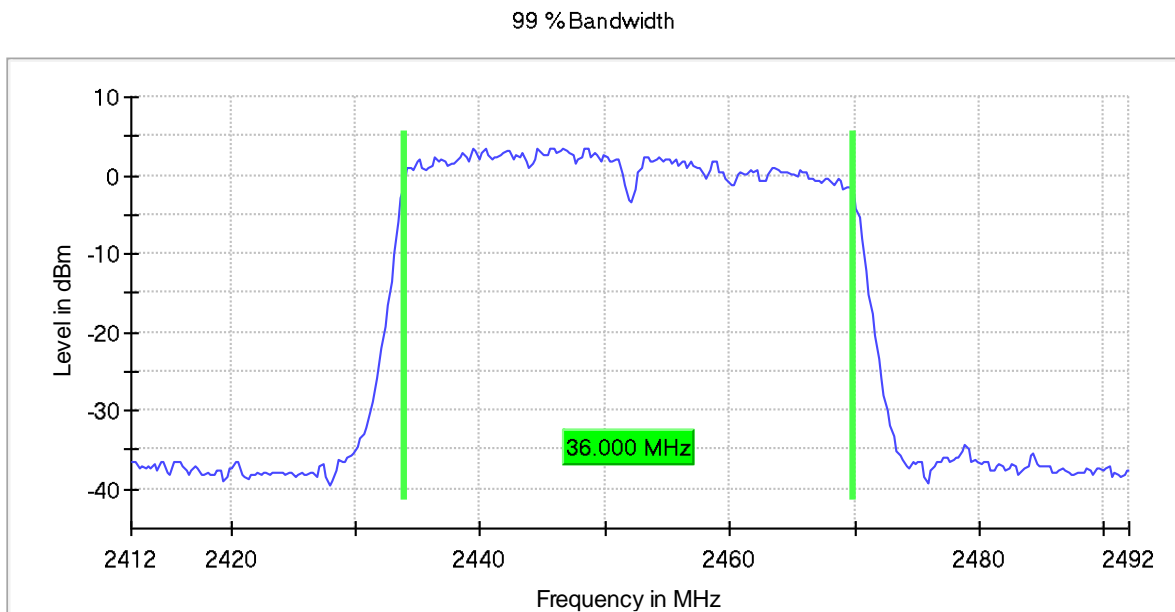


- Middle Channel (6):



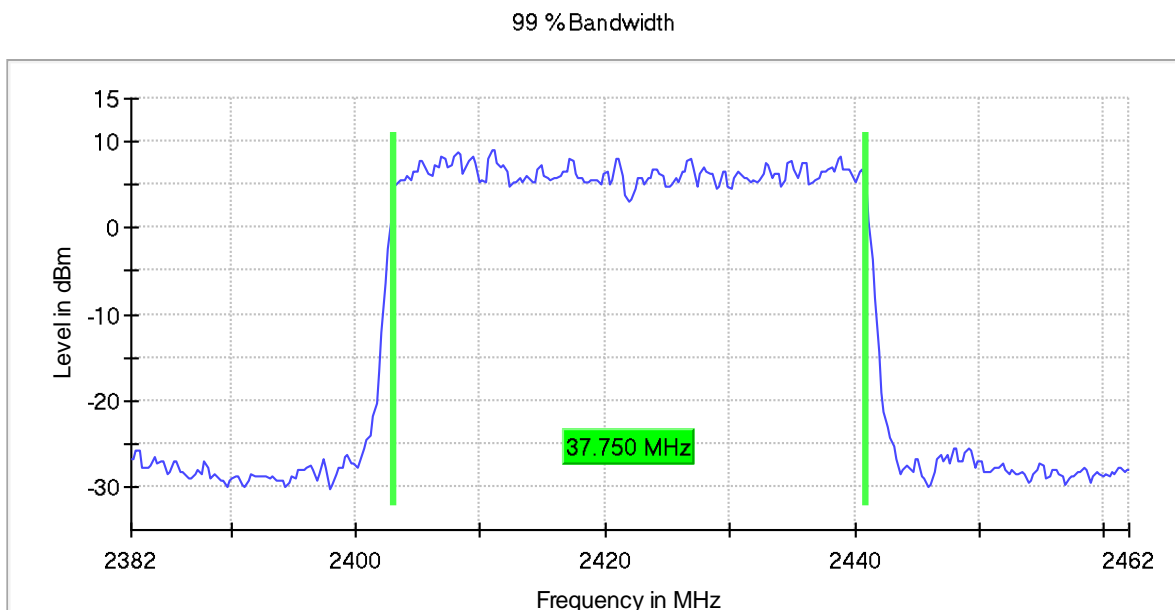


- High Channel (9):



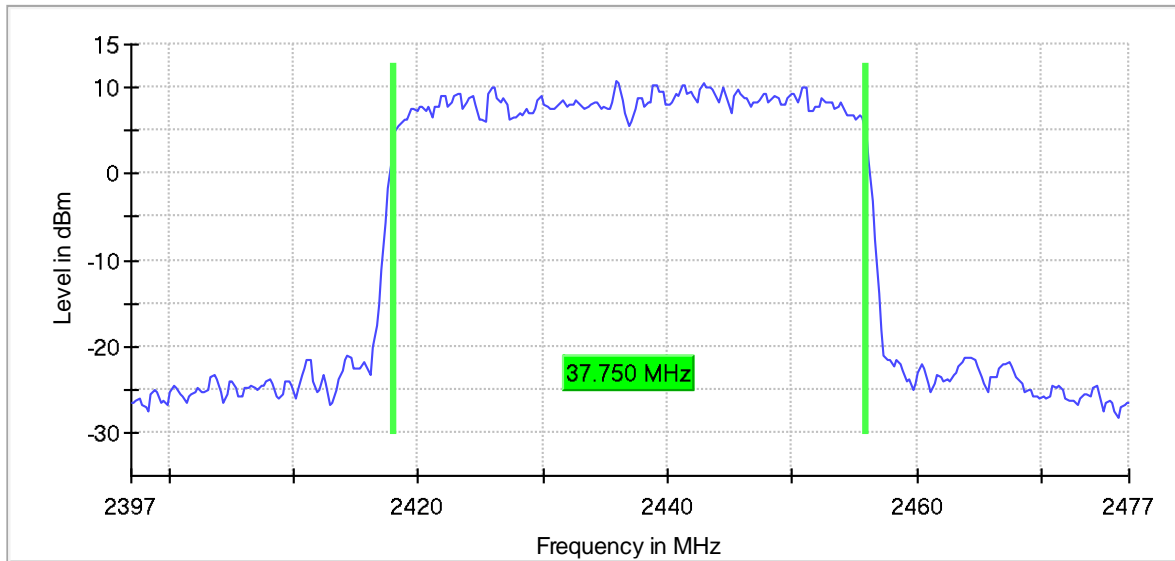
- **MIMO 802.11 he40 – Occupied Bandwidth:**

- Low Channel (3):



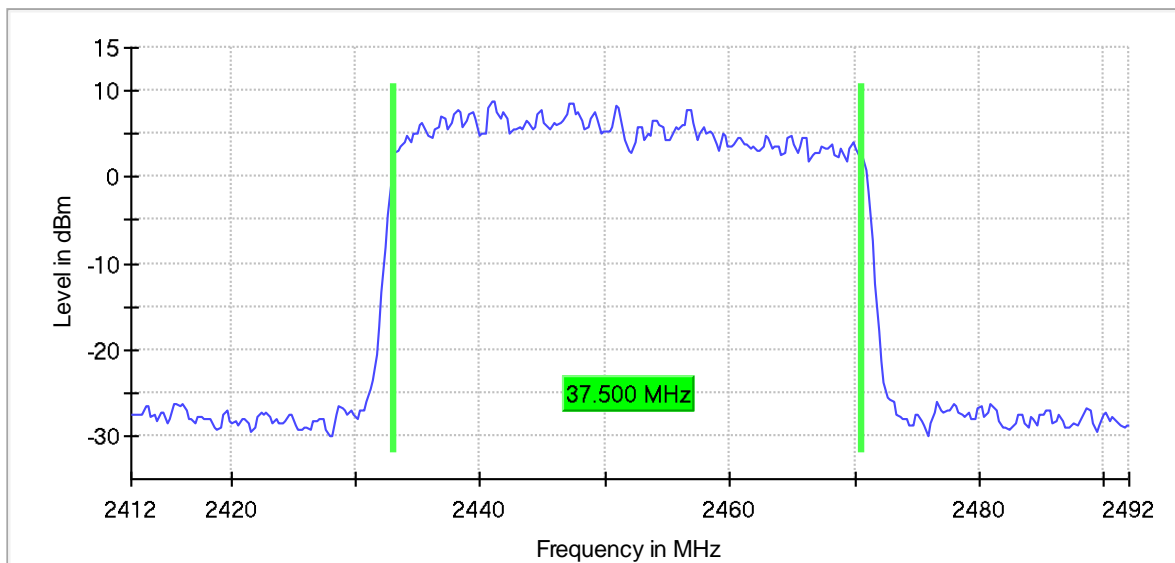
- Middle Channel (6):

99 % Bandwidth



- High Channel (9):

99 % Bandwidth



## FCC 15.247 (a) (2) 6 dB Bandwidth

### SPECIFICATION:

The minimum 6 dB bandwidth shall be at least 500 kHz.

### RESULTS:

The following modes and data rates were selected based on preliminary testing that identified those corresponding to the worst cases:

- 802.11 b: 6 Mbit/s.
- 802.11 g: 6 Mbit/s.
- 802.11 n HT20: MCS0.
- 802.11 n HT40: MCS0.
- 802.11 ax HE20: MCS0.
- 802.11 ax HE40: MCS0.

- Preliminary tests determined the SISO worst case: ANT1.
- MIMO: ANT0+ANT1+ANT2+ANT3.

#### **SISO worst case:**

- **SISO 802.11 b:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
6 dB Spectrum Bandwidth (MHz)	7.00	6.90	6.60
Measurement uncertainty (%)	<± 2		

- **SISO 802.11 g:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
6 dB Spectrum Bandwidth (MHz)	16.45	16.40	16.40
Measurement uncertainty (%)	<± 2		

- **MIMO 802.11 n20:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
6 dB Spectrum Bandwidth (MHz)	17.65	16.95	17.65
Measurement uncertainty (%)	<± 2		

- **MIMO 802.11 he20:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
6 dB Spectrum Bandwidth (MHz)	18.75	18.05	18.80
Measurement uncertainty (%)	<± 2.84		

- **MIMO 802.11 n40:**

	Low Channel (3) 2422MHz	Middle Channel (6) 2437MHz	High Channel (9) 2452MHz
6 dB Spectrum Bandwidth (MHz)	36.40	35.70	35.70
Measurement uncertainty (%)	<± 2.84		

- **MIMO 802.11 he40:**

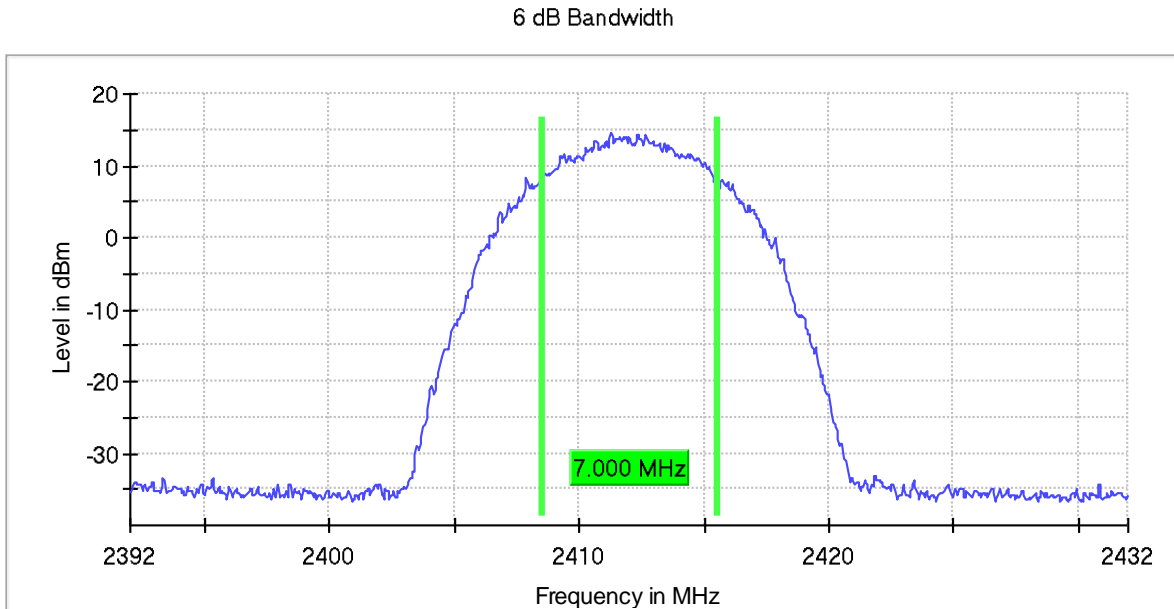
	Low Channel (3) 2422MHz	Middle Channel (6) 2437MHz	High Channel (9) 2452MHz
6 dB Spectrum Bandwidth (MHz)	37.20	35.30	35.25
Measurement uncertainty (%)	<± 2.84		

Verdict: PASS

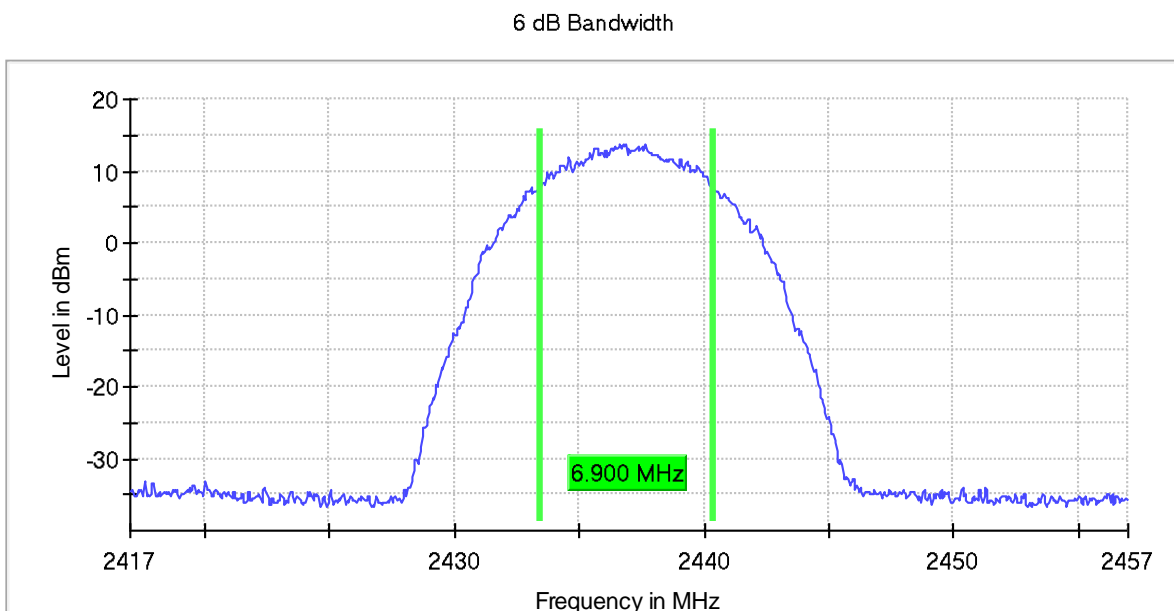
**SISO worst case:**

- **SISO 802.11 b – 6 dB Bandwidth:**

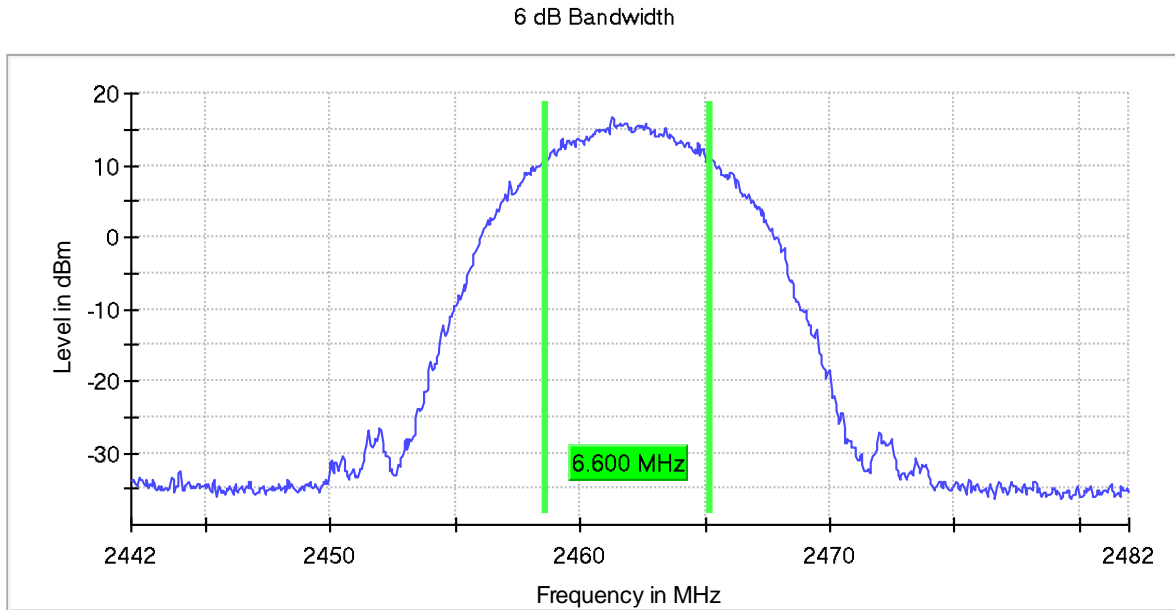
- Low Channel (1):



- Middle Channel (6):

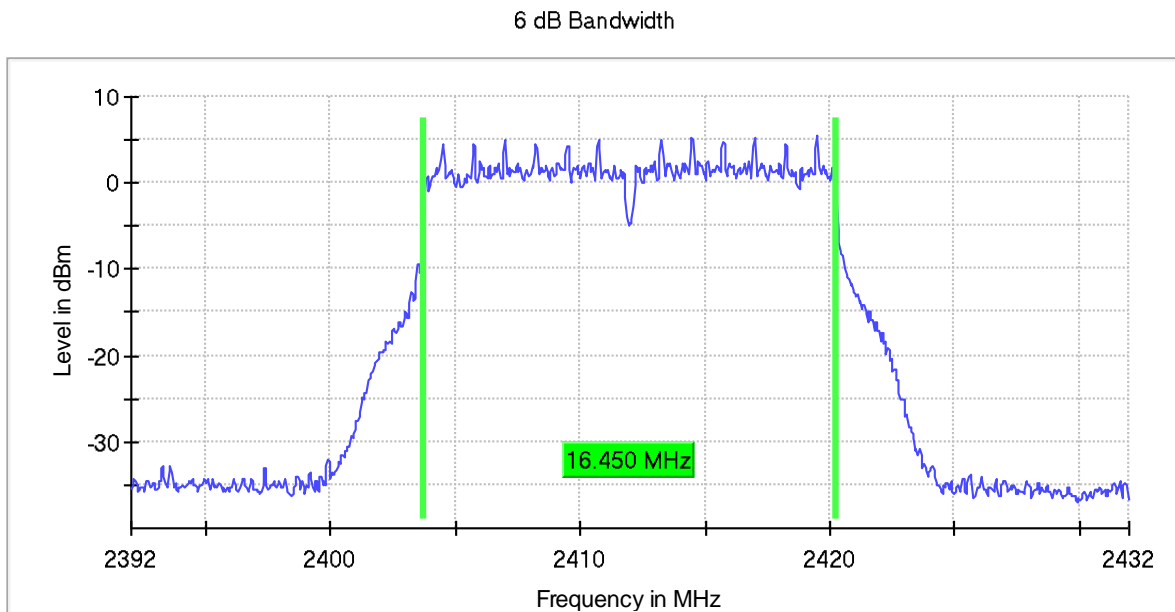


- High Channel (11):



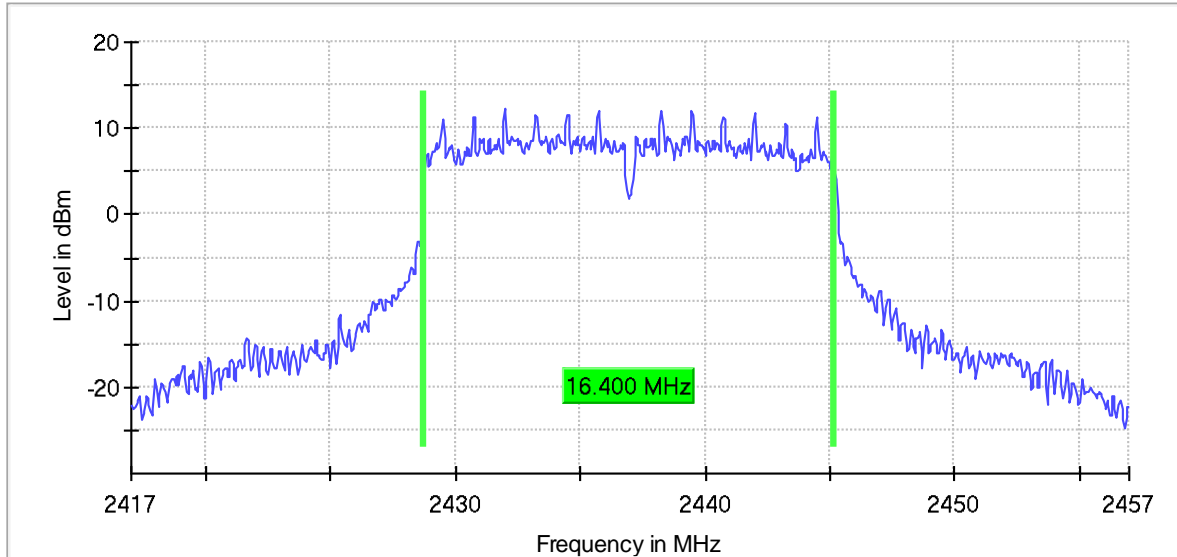
- SISO 802.11 g – 6 dB Bandwidth:

- Low Channel (1):



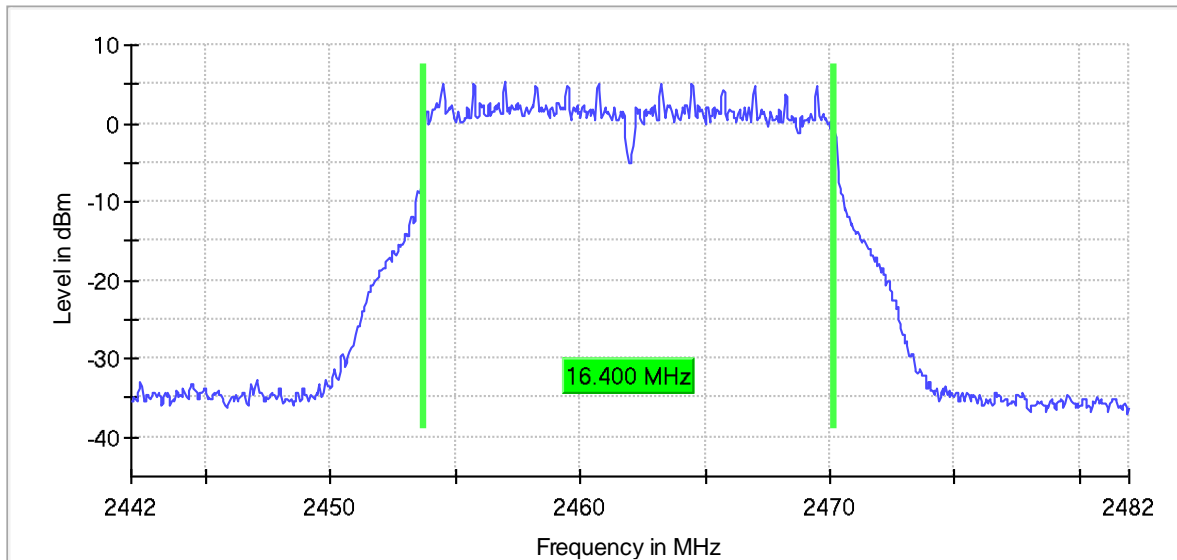
- Middle Channel (6):

6 dB Bandwidth



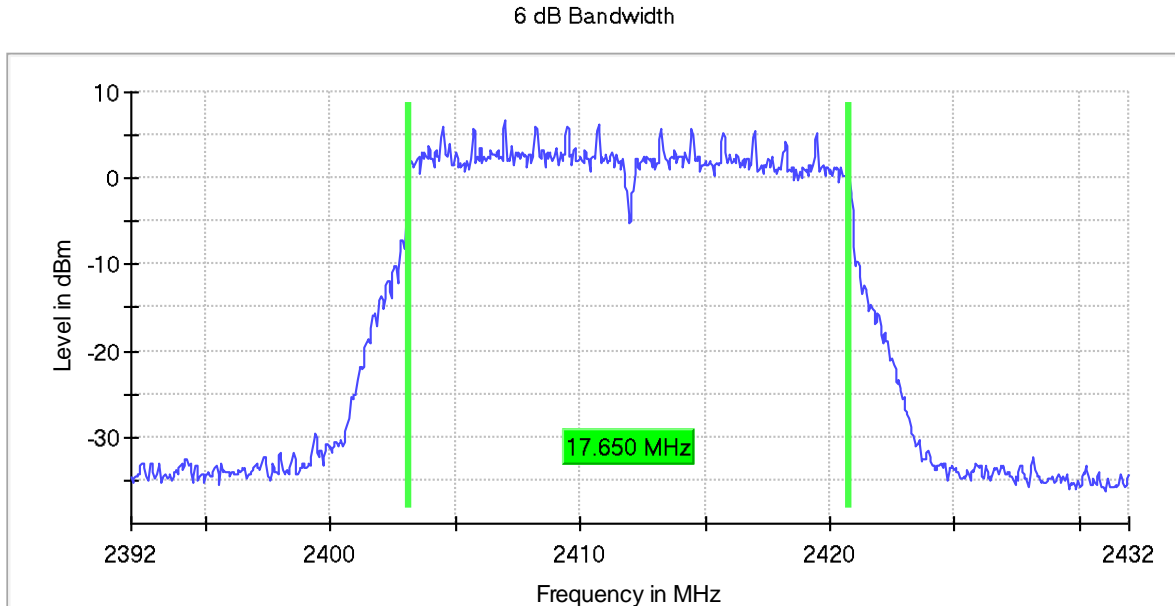
- High Channel (11):

6 dB Bandwidth

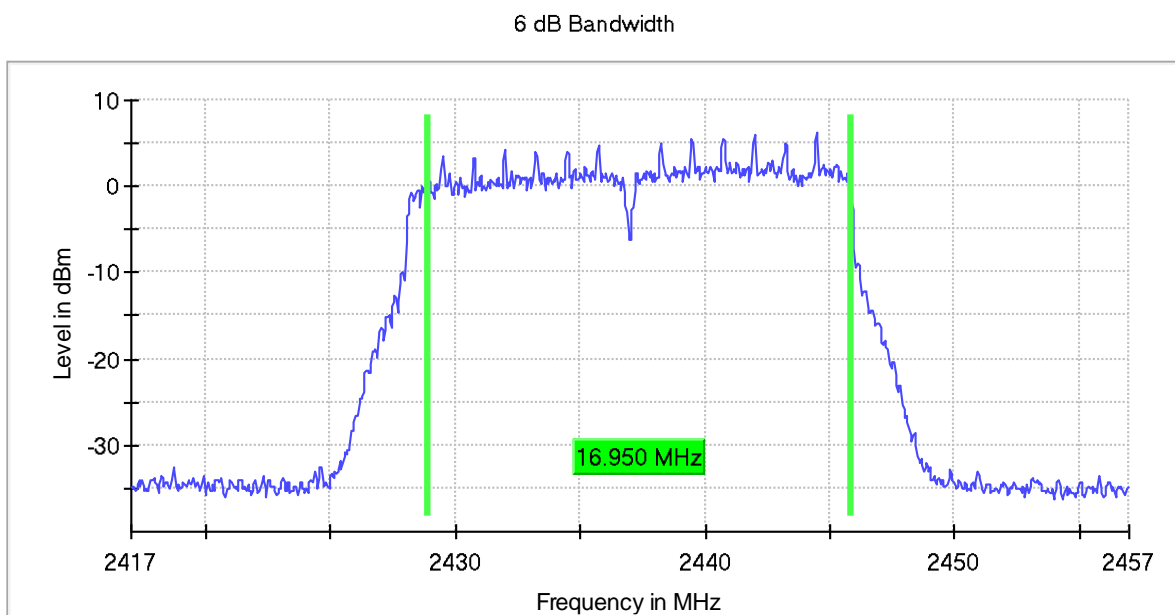


- **MIMO 802.11 n20 – 6 dB Bandwidth:**

- Low Channel (1):



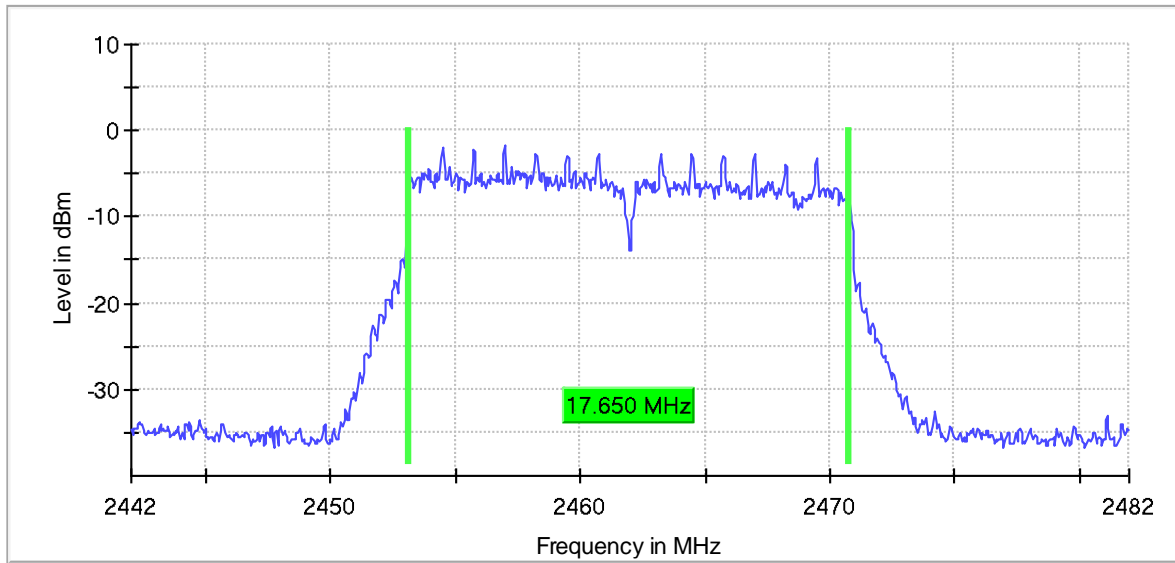
- Middle Channel (6):





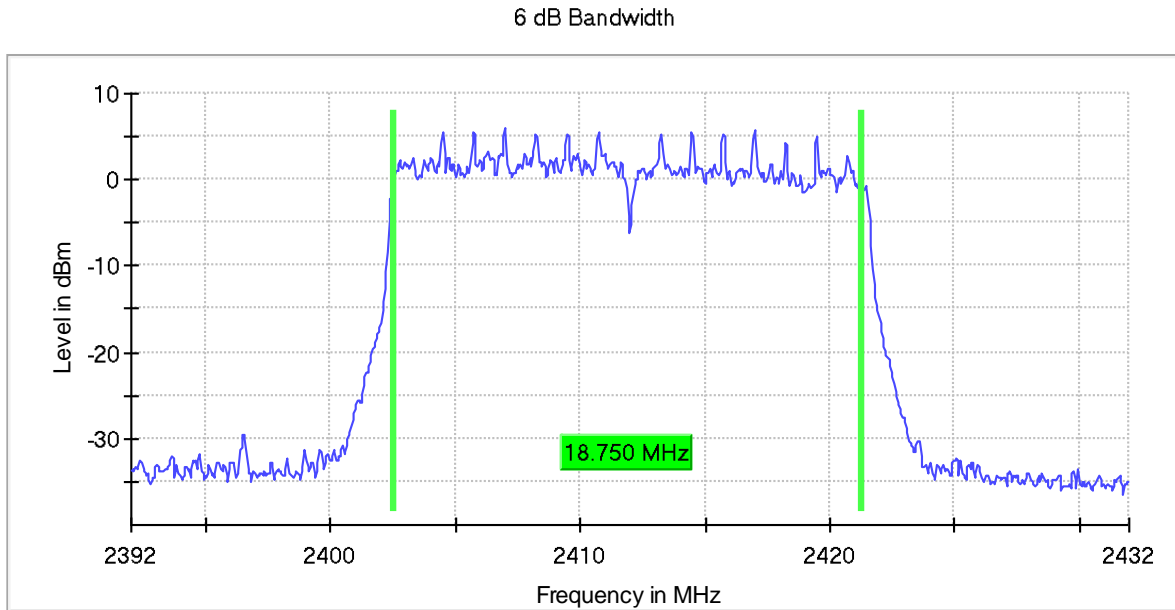
- High Channel (11):

6 dB Bandwidth

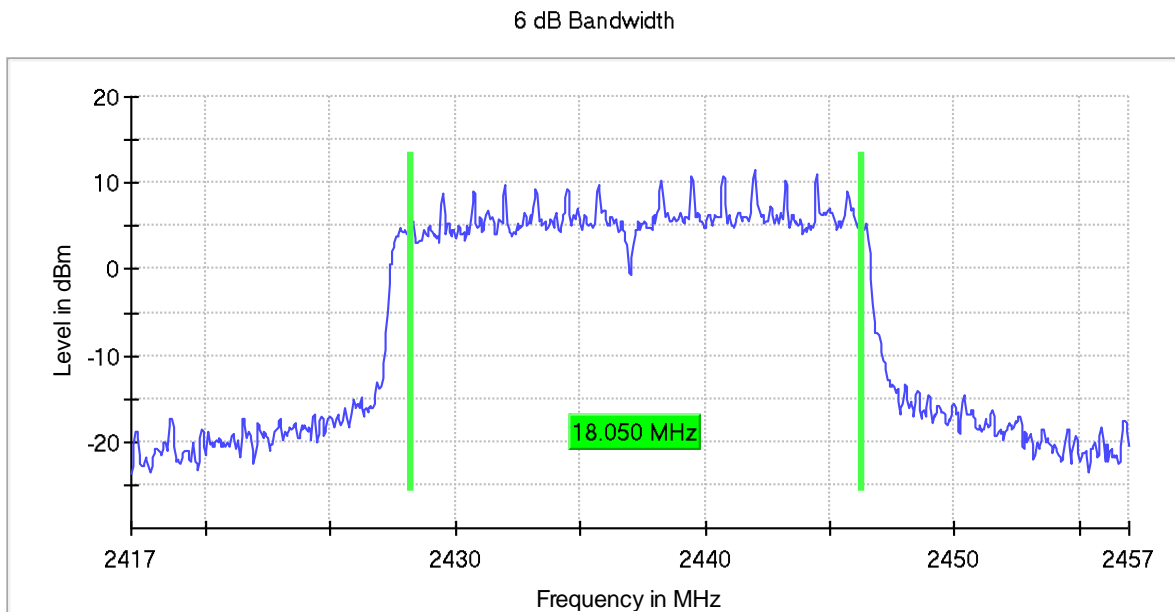


- **MIMO 802.11 he20 – 6 dB Bandwidth:**

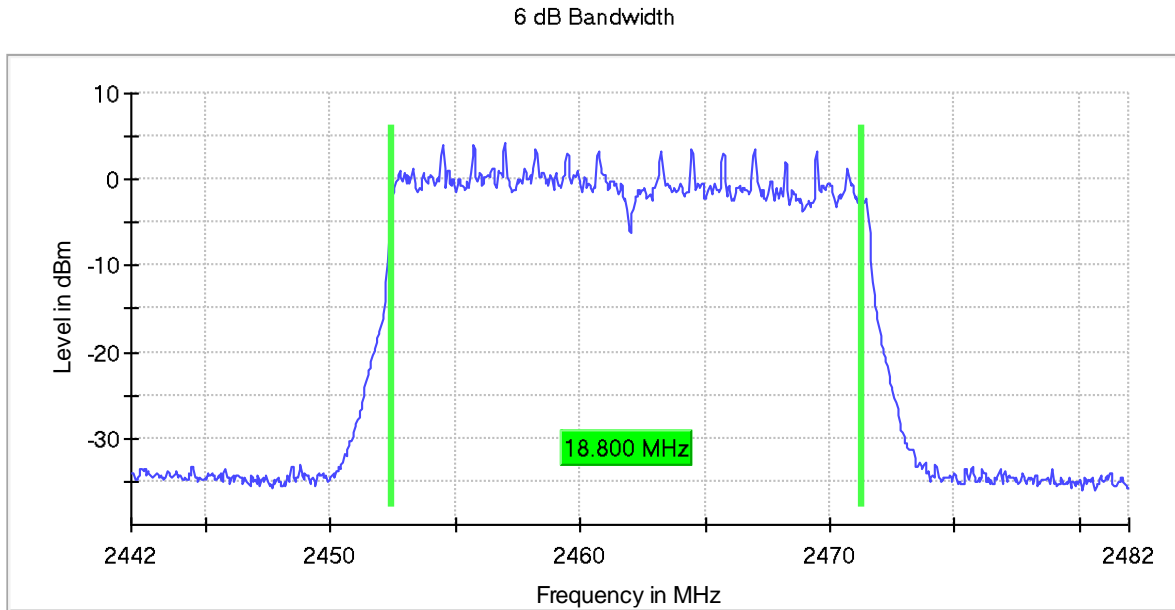
- Low Channel (1):



- Middle Channel (6):

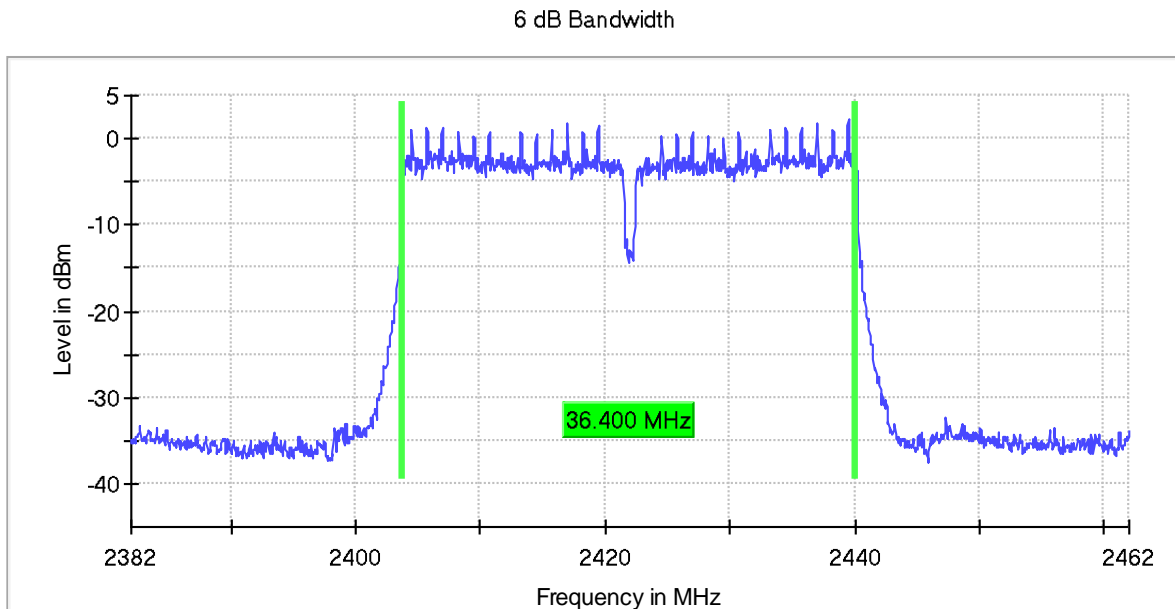


- High Channel (11):



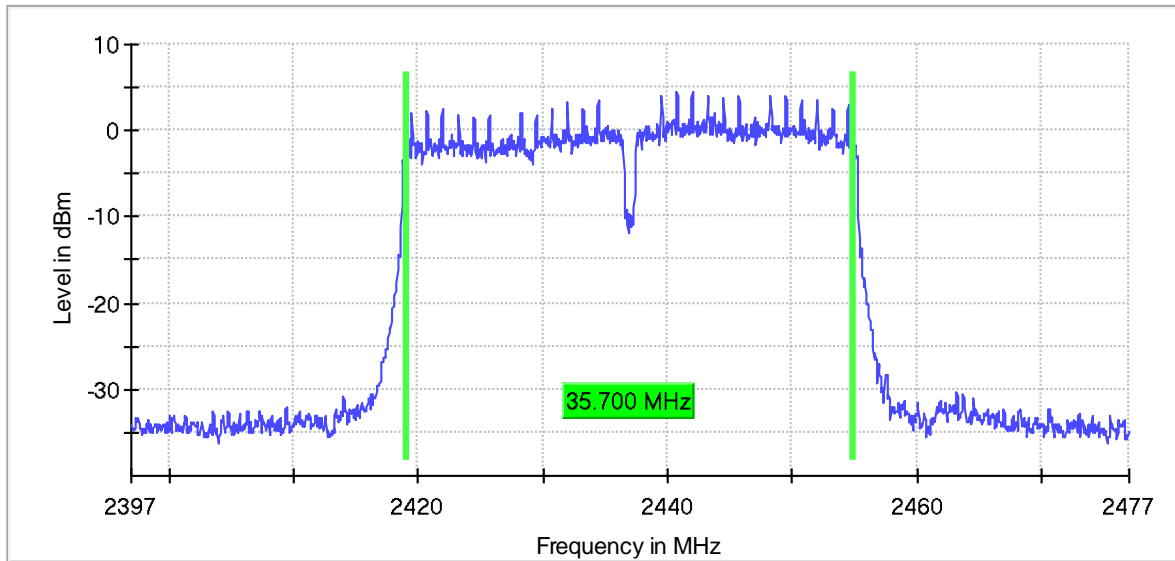
- **MIMO 802.11 n40 – 6 dB Bandwidth:**

- Low Channel (3):



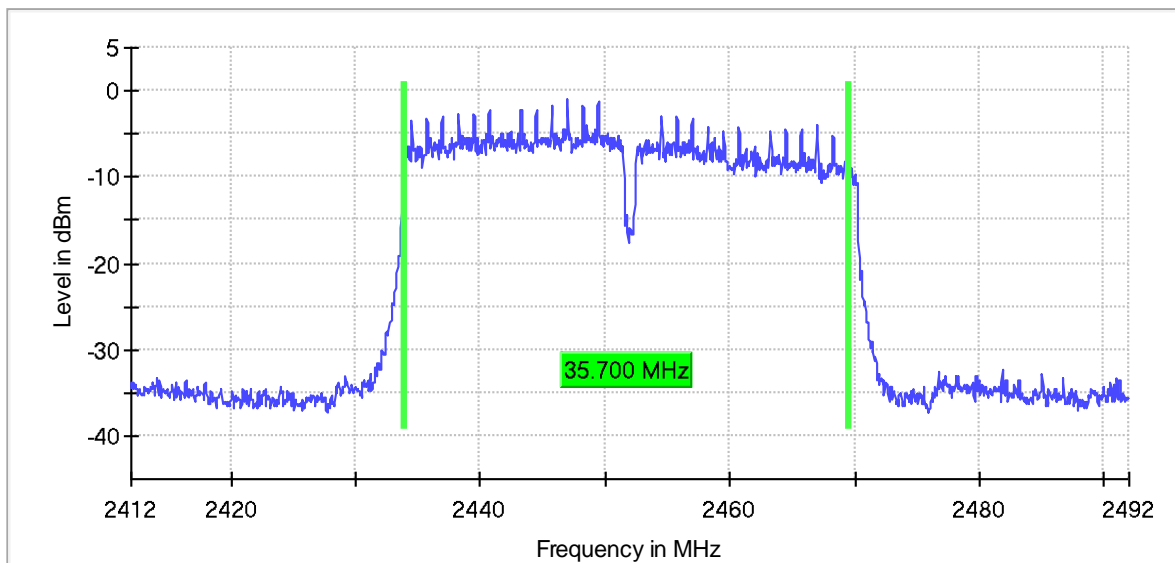
- Middle Channel (6):

6 dB Bandwidth



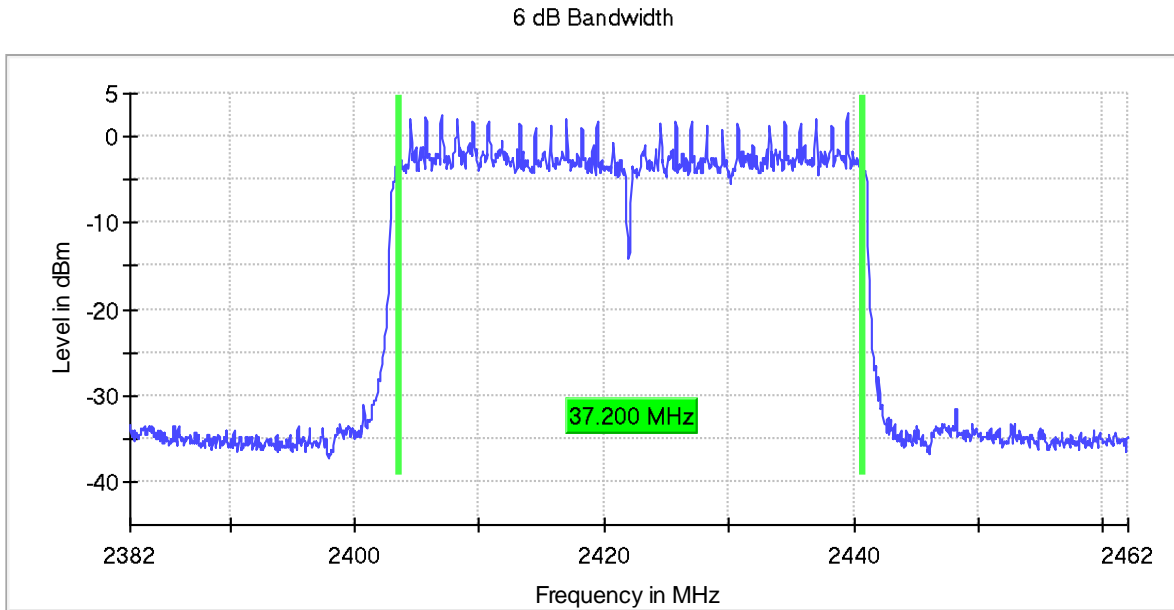
- High Channel (9):

6 dB Bandwidth

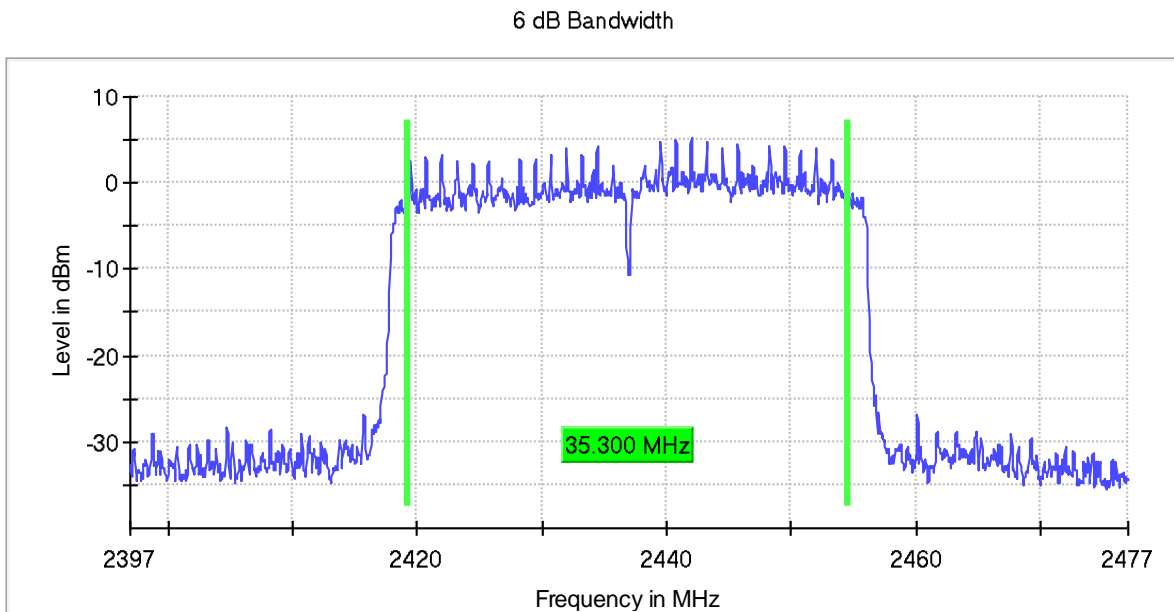


- **SISO 802.11 he40 – 6 dB Bandwidth:**

- Low Channel (3):

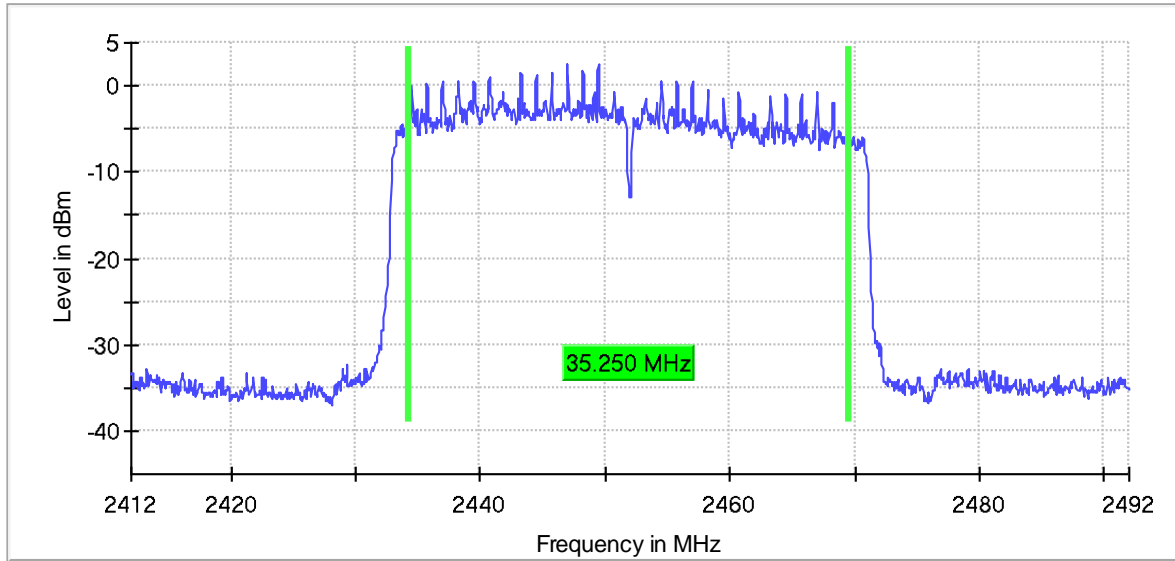


- Middle Channel (6):



- High Channel (9):

6 dB Bandwidth



## FCC 15.247 (b) Maximum output power and antenna gain

### SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

### RESULTS:

The maximum conducted output power was measured using the method according to FCC title 47 part 15 §15.247(b), KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 11.9.2.3.2.

The testing was performed in according with Method AVGPM-G.

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).

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

- Preliminary tests determined the SISO worst case: WLAN1.
- MIMO: WLAN0 & WLAN1 & WLAN2 & WLAN3.

#### Maximum Declared Antenna Gain:

- SISO Antenna – ANT1: +1.7 dBi
- MIMO Antennas – ANT0 & ANT1 & ANT2 & ANT3: +1.7 dBi
  - Ant 0: 1.5 dBi, Polarization: Vertical
  - Ant 1: 1.7 dBi, Polarization: Horizontal
  - Ant 2: 1.1 dBi, Polarization: Horizontal
  - Ant 3: 1.3 dBi, Polarization: Vertical

**SISO worst case:**

- **SISO 802.11 b:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
Maximum Average Conducted Power (dBm)	23.21	22.63	25.14
Measurement uncertainty (dB)	<±0.80		

- **SISO 802.11 g:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
Maximum Average Conducted Power (dBm)	18.87	24.99	18.89
Measurement uncertainty (dB)	<±0.80		

- **MIMO 802.11 n20:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
Maximum Average Conducted Power (dBm)	24.96	29.88	22.90
Measurement uncertainty (dB)	<±0.80		

- **MIMO 802.11 he20:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
Maximum Average Conducted Power (dBm)	24.78	29.27	23.39
Measurement uncertainty (dB)	<±0.80		



- **MIMO 802.11 n40:**

	Low Channel (3) 2422MHz	Middle Channel (6) 2437MHz	High Channel (9) 2452MHz
Maximum Average Conducted Power (dBm)	23.31	25.33	19.49
Measurement uncertainty (dB)	<±0.80		

- **MIMO 802.11 he40:**

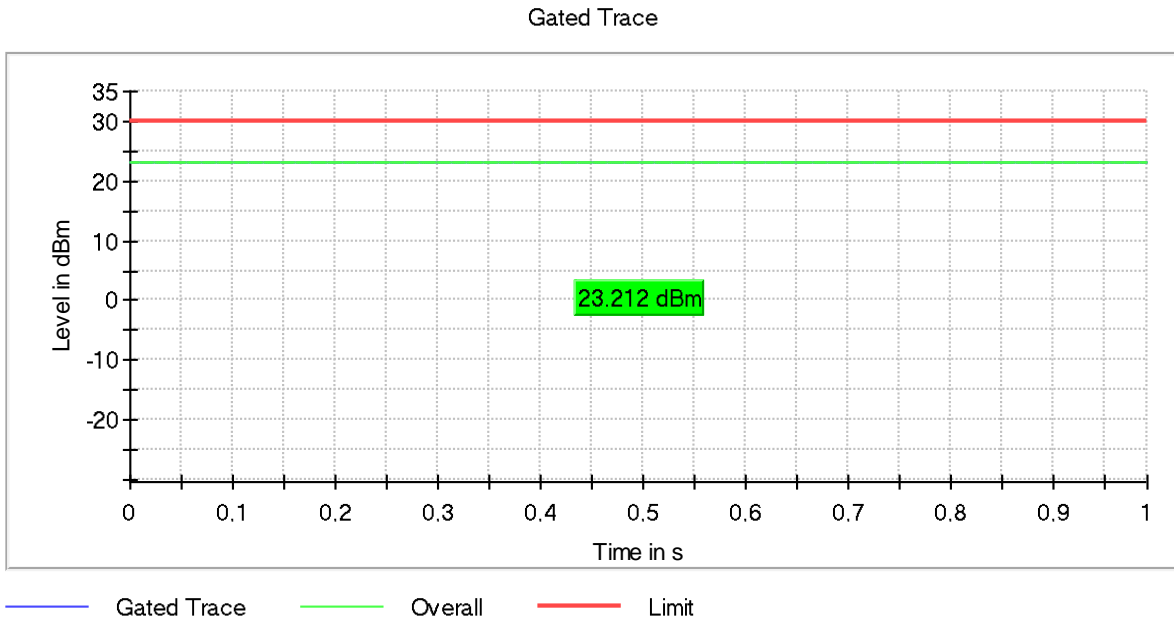
	Low Channel (3) 2422MHz	Middle Channel (6) 2437MHz	High Channel (9) 2452MHz
Maximum Average Conducted Power (dBm)	24.05	26.11	23.11
Measurement uncertainty (dB)	<±0.80		

Verdict: PASS

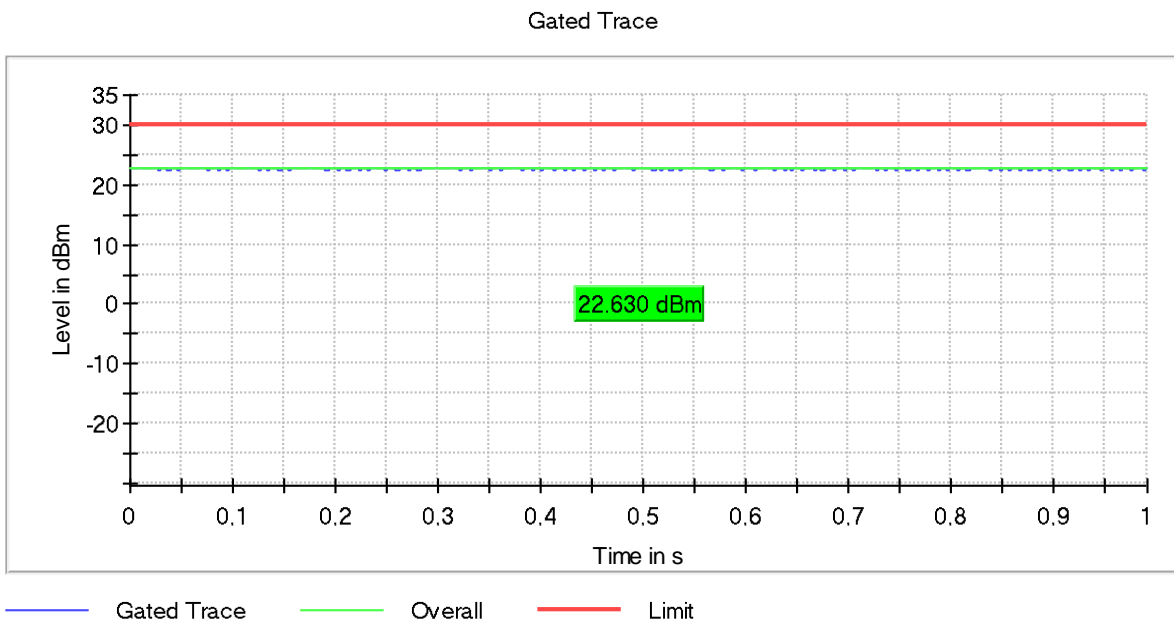
**SISO worst case:**

- **SISO 802.11 b – RF Output Power:**

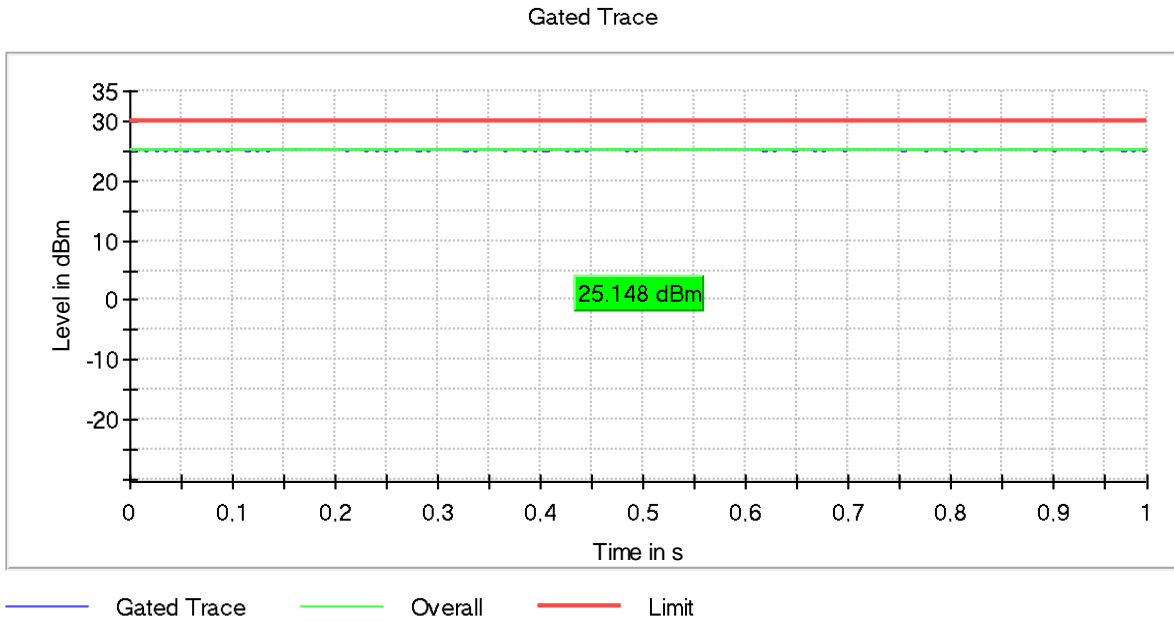
- Low Channel (1):



- Middle Channel (6):

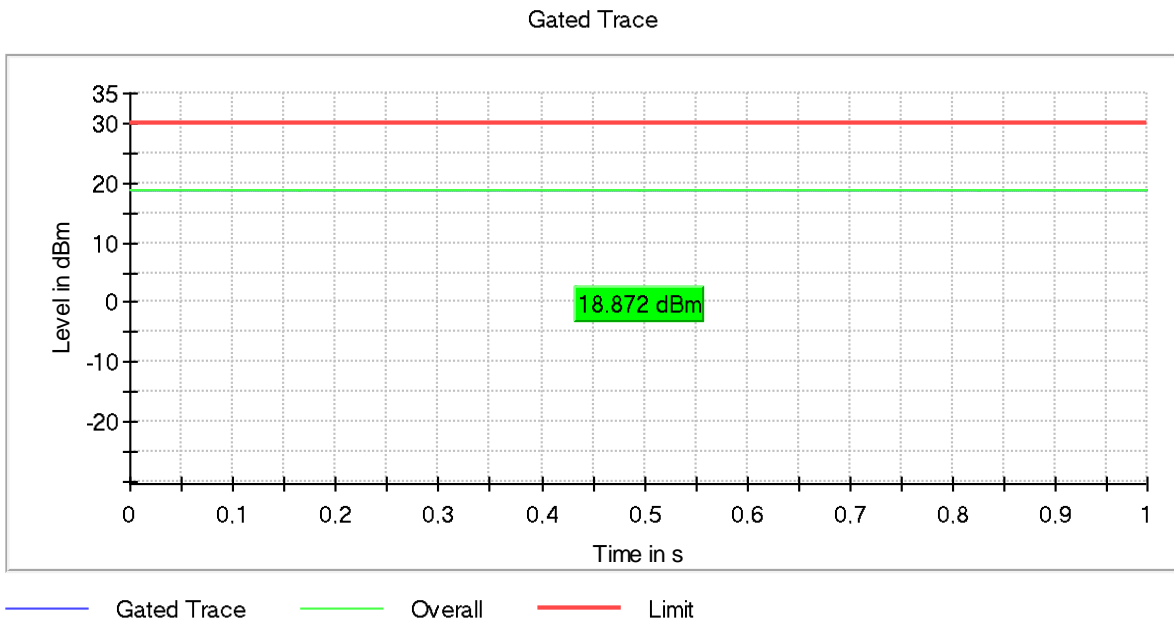


- High Channel (11):

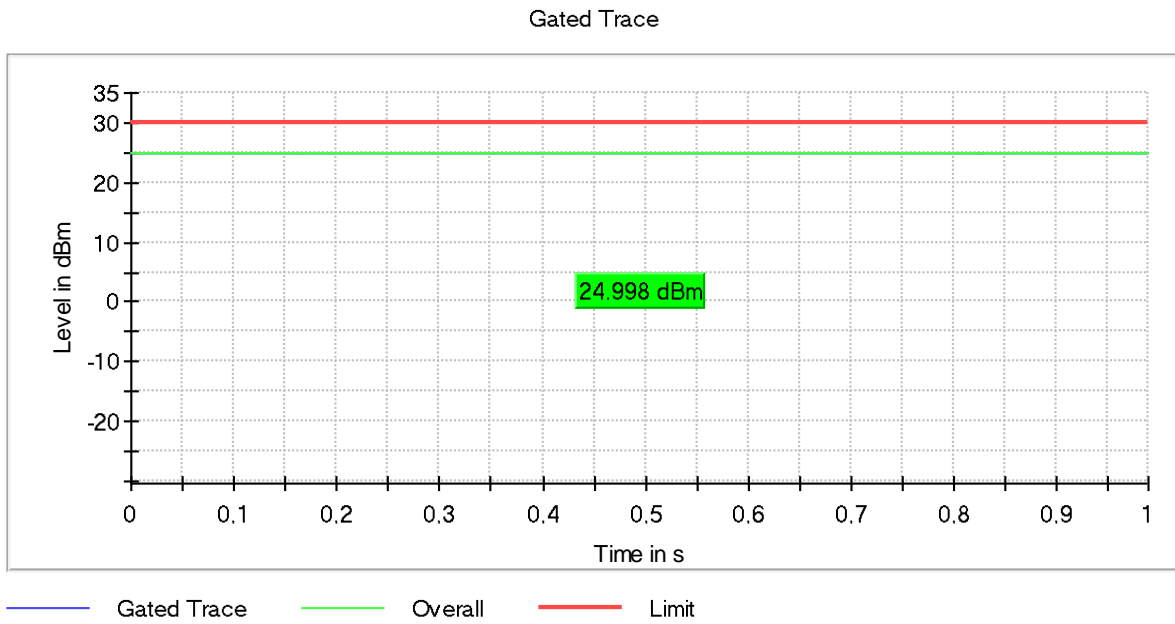


- **SISO 802.11 g – RF Output Power:**

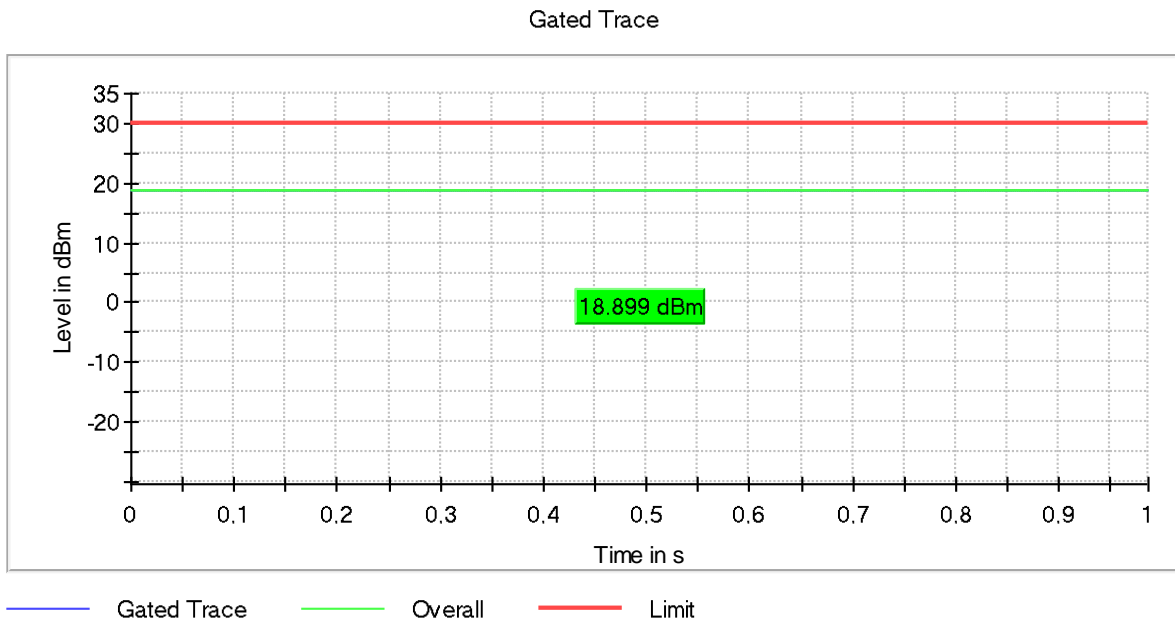
- Low Channel (1):



- Middle Channel (6):

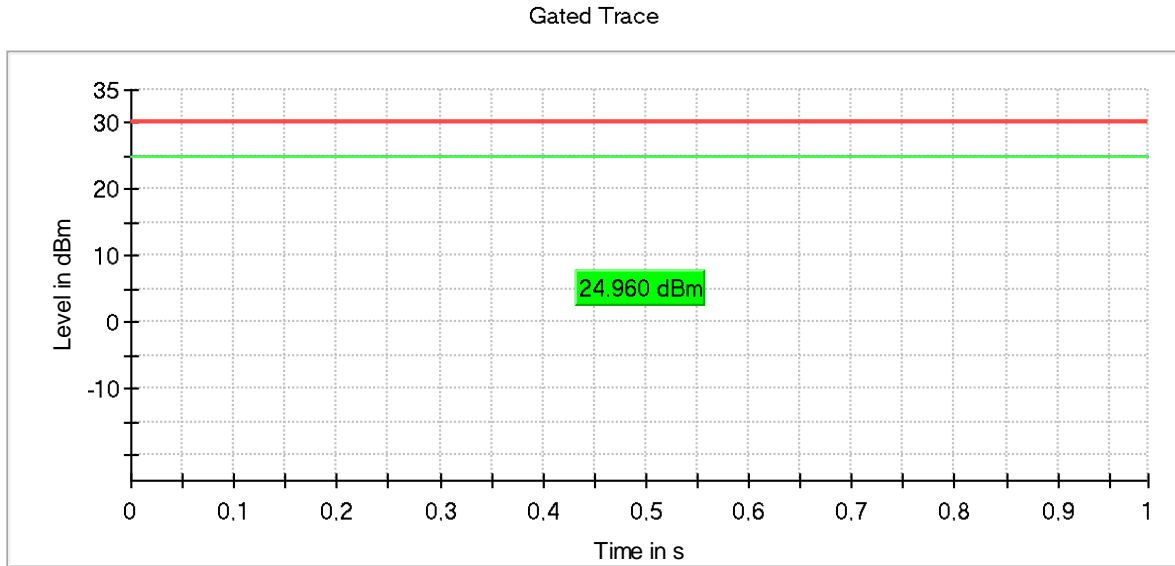


- High Channel (11):



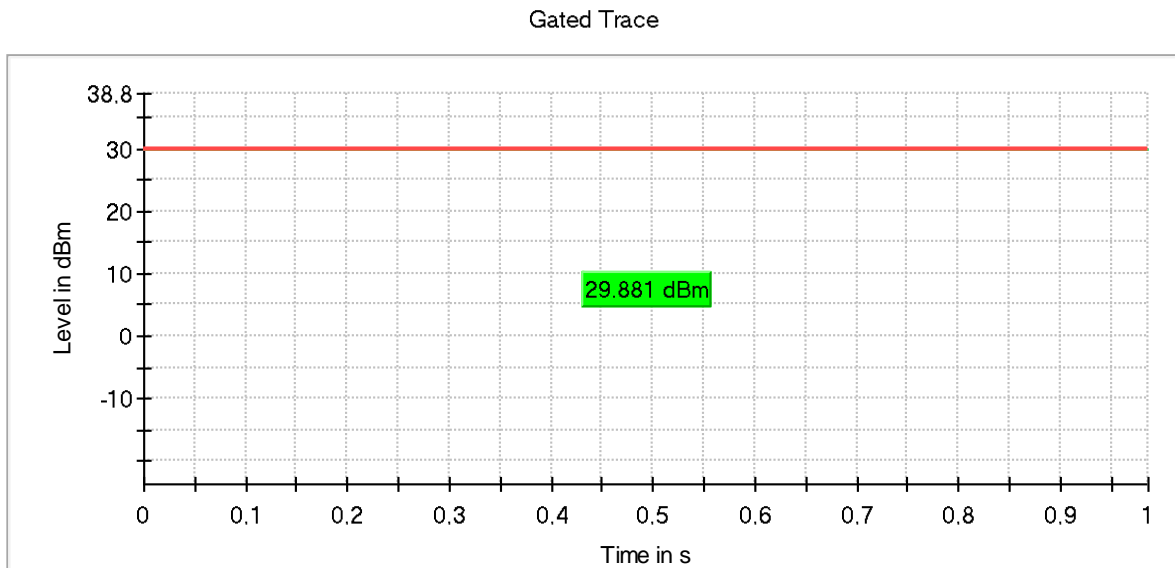
- **MIMO 802.11 n20 – RF Output Power:**

- Low Channel (1):



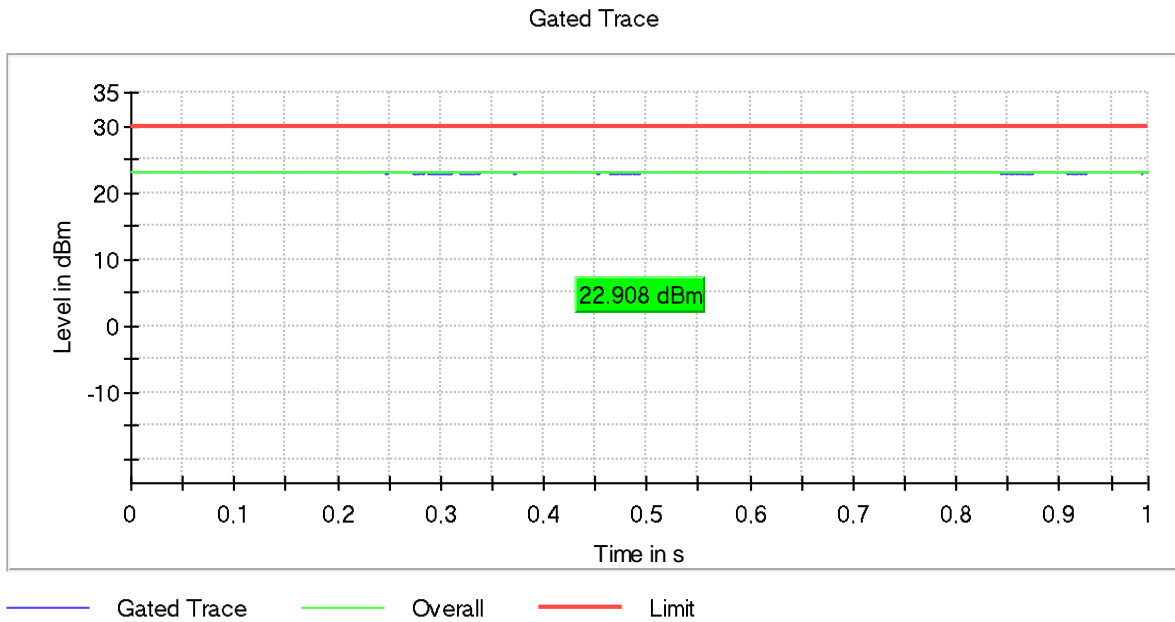
— Gated Trace    — Overall    — Limit

- Middle Channel (6):



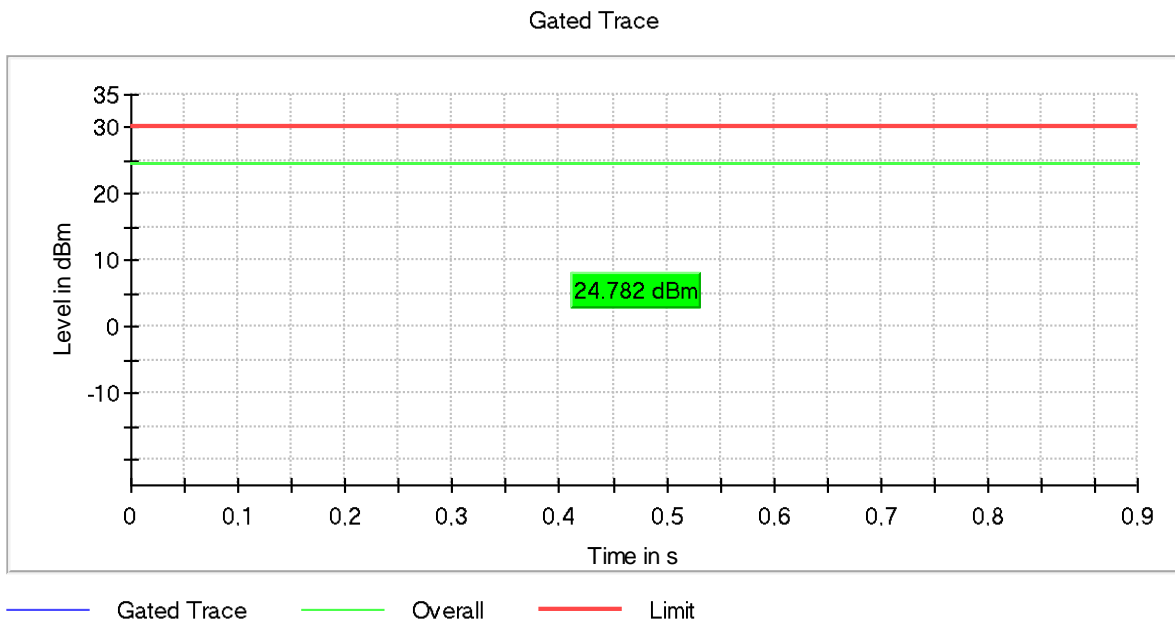
— Gated Trace    — Overall    — Limit

- High Channel (11):



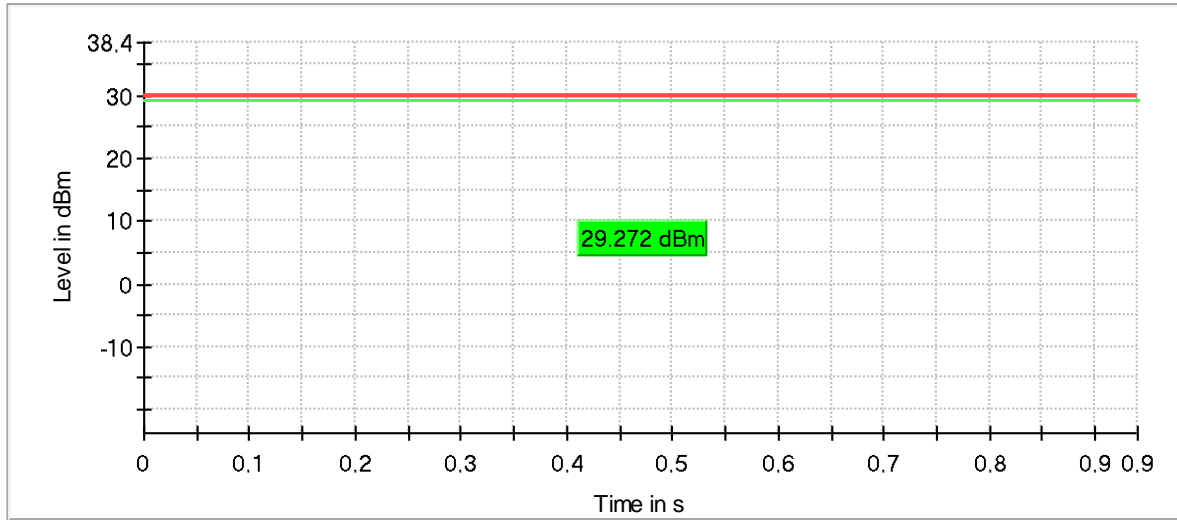
- **MIMO 802.11 he20 – RF Output Power:**

- Low Channel (1):



- Middle Channel (6):

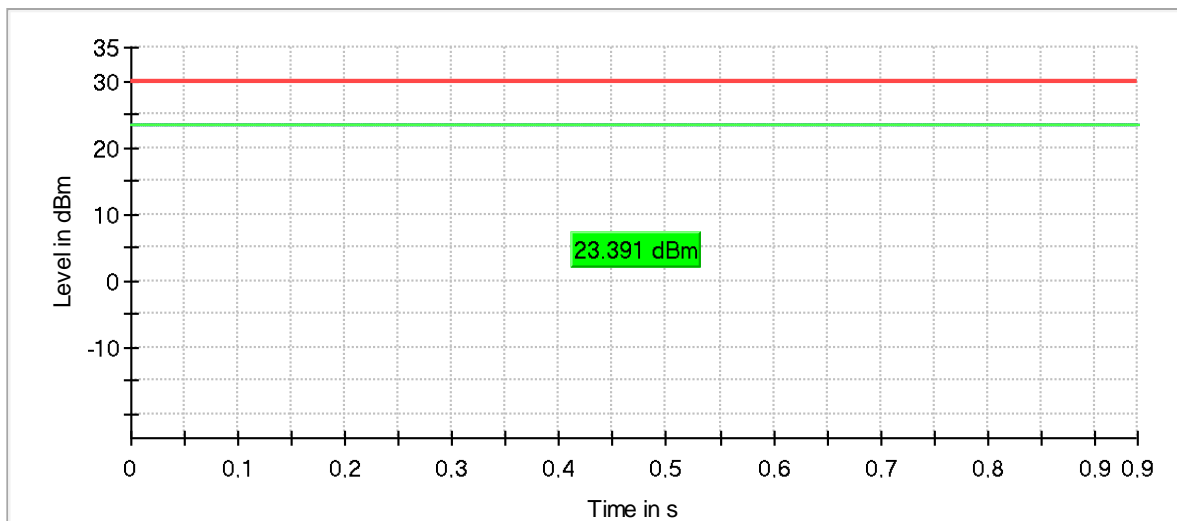
Gated Trace



— Gated Trace    — Overall    — Limit

- High Channel (11):

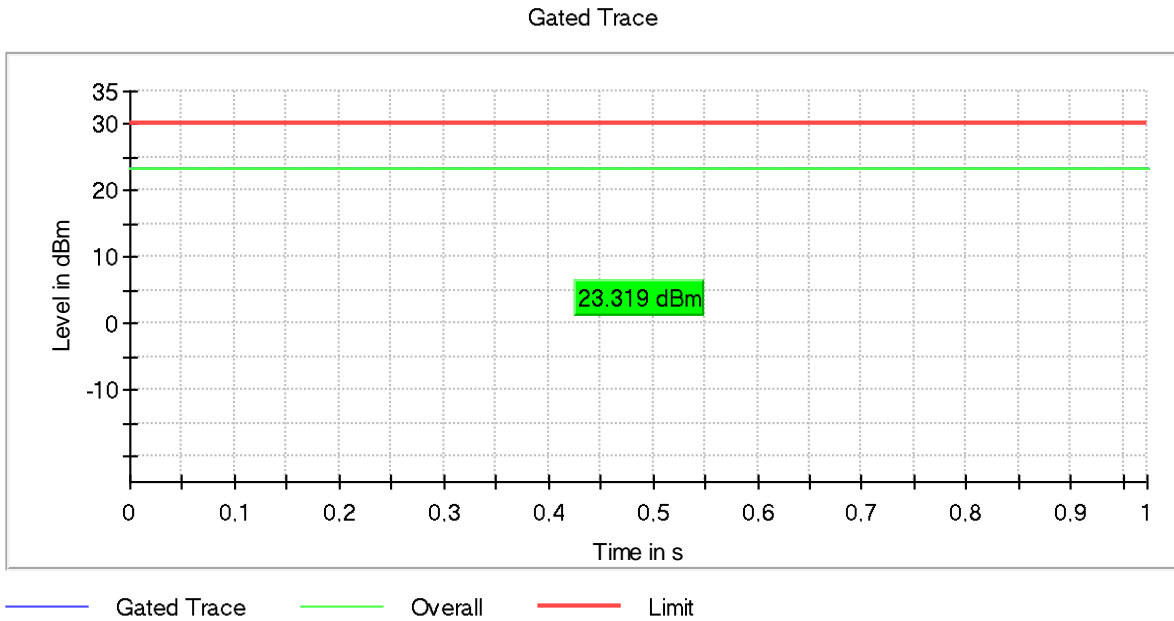
Gated Trace



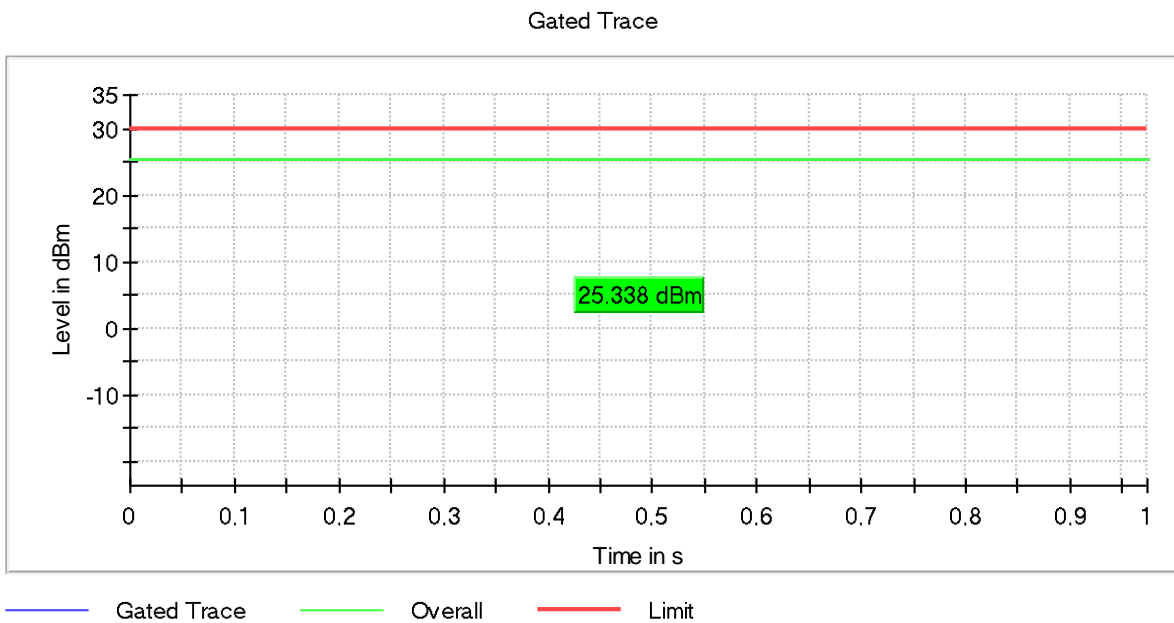
— Gated Trace    — Overall    — Limit

- **MIMO 802.11 n40 – RF Output Power:**

- Low Channel (3):

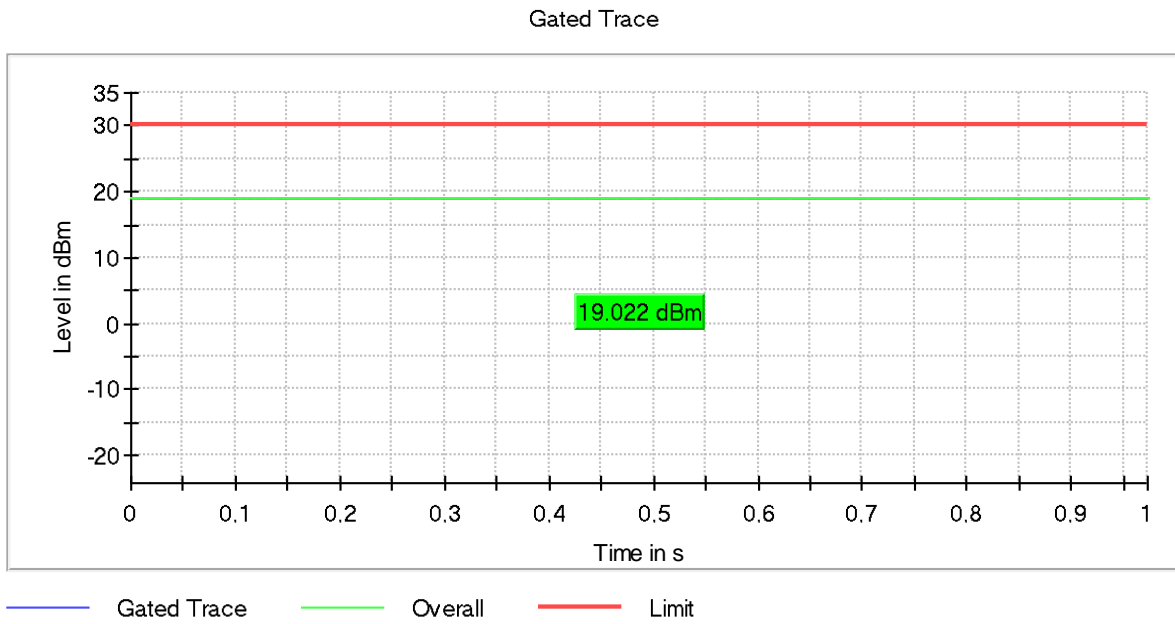


- Middle Channel (6):



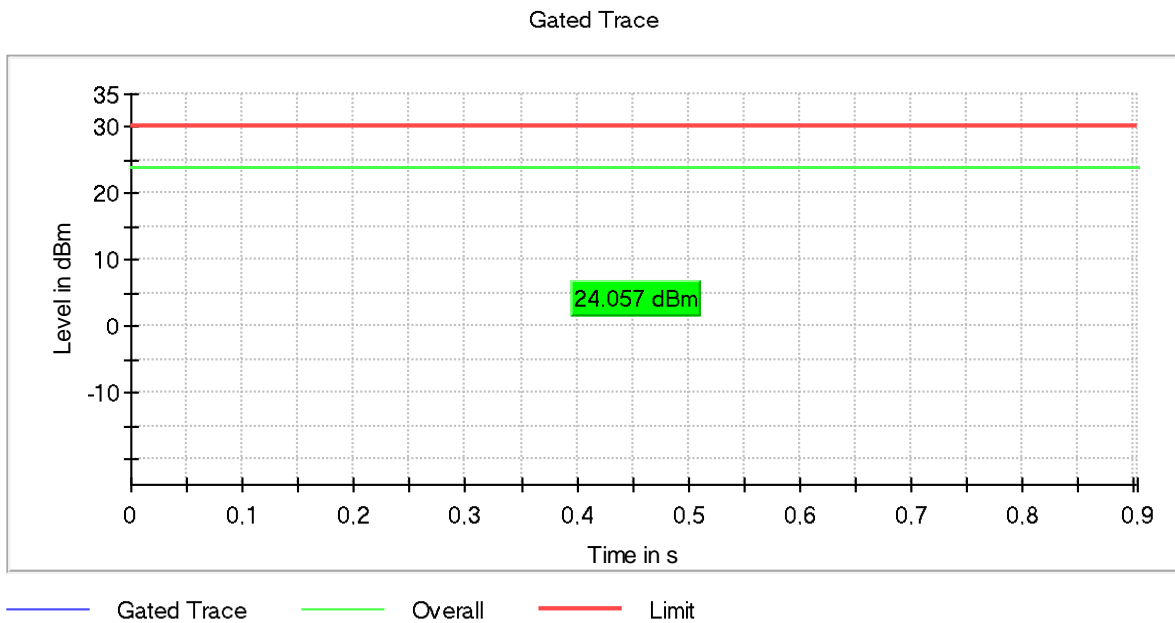


- High Channel (9):



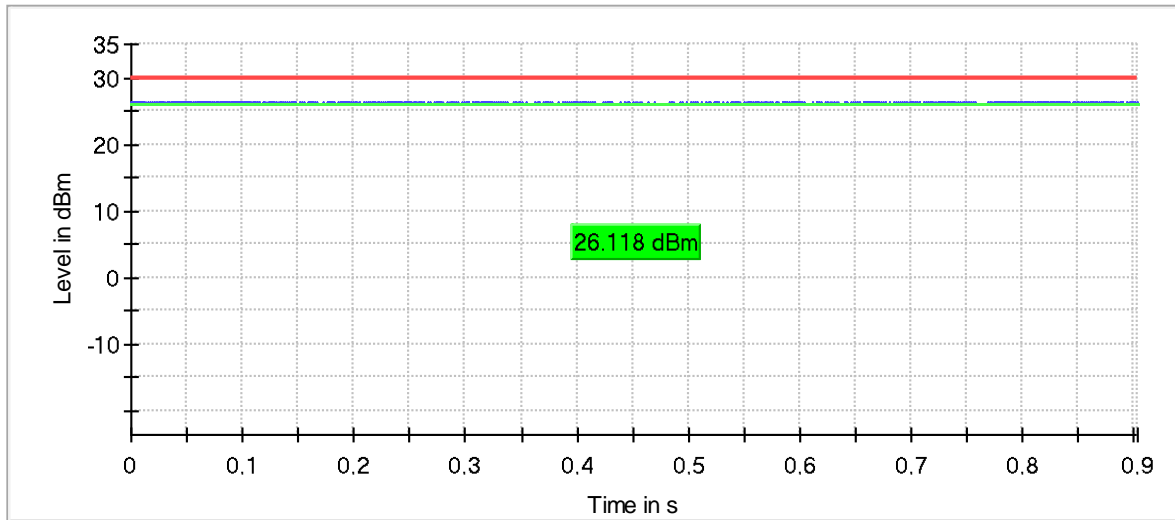
- **MIMO 802.11 he40 – RF Output Power:**

- Low Channel (3):



- Middle Channel (6):

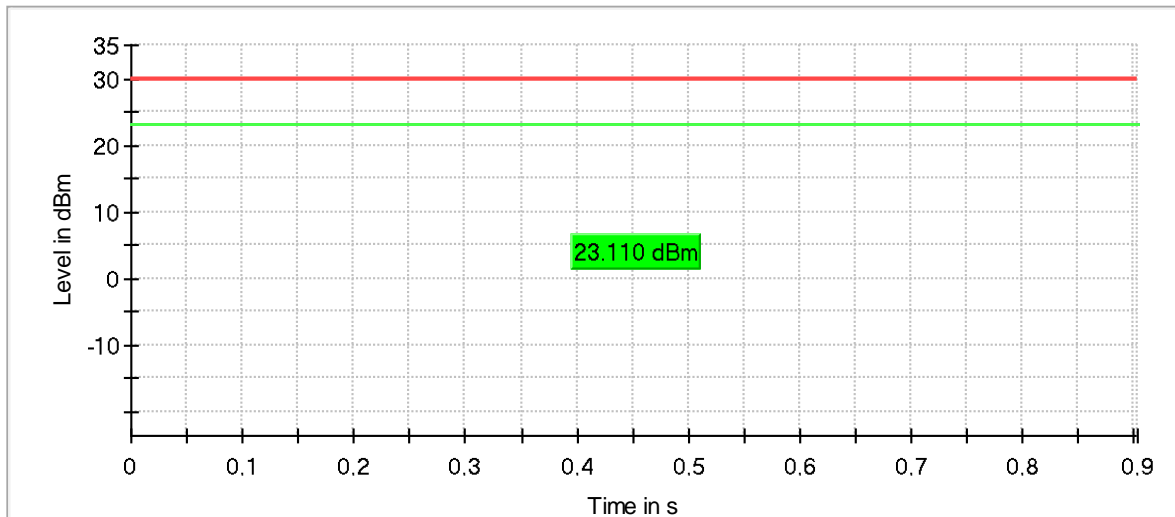
Gated Trace



— Gated Trace    — Overall    — Limit

- High Channel (9):

Gated Trace



— Gated Trace    — Overall    — Limit

## FCC 15.247 (d) Band-edge emissions compliance (Transmitter)

### SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

### RESULTS:

Radiated measurements were used to show compliance with the limits in the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

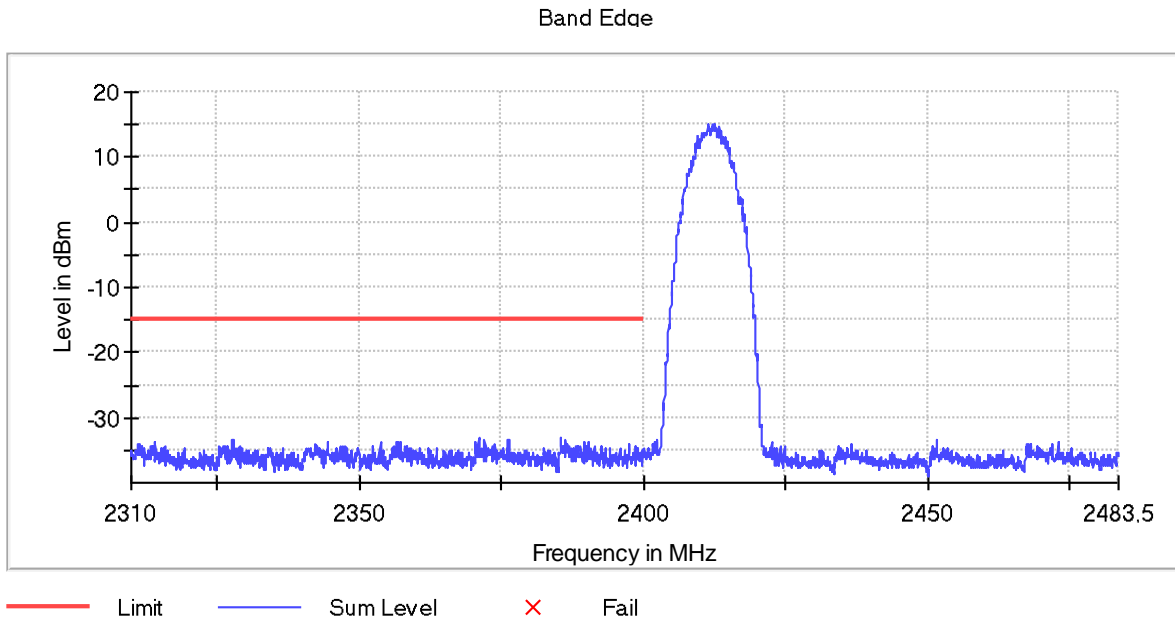
Measurement uncertainty (dB)	<± 1.53
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- Preliminary tests determined the SISO worst case: ANT1.
- Preliminary tests determined the MIMO worst case: ANT0 & ANT1 & ANT2 & ANT3.

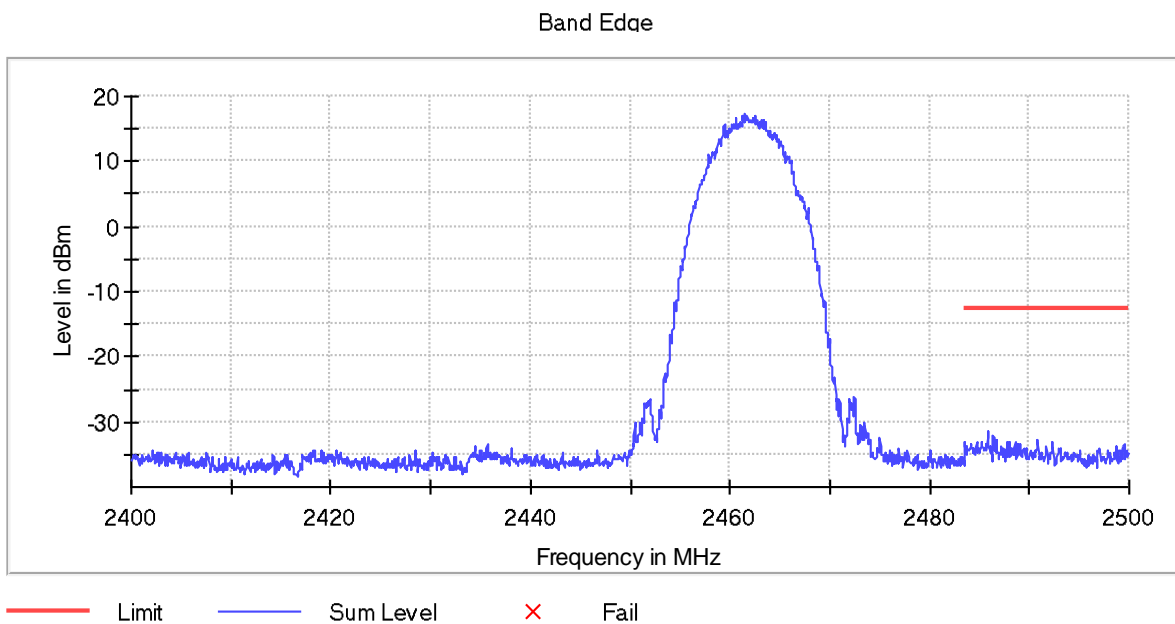
**SISO worst case:**

- **SISO 802.11 b – Band-edge emissions compliance:**

- Low Channel:



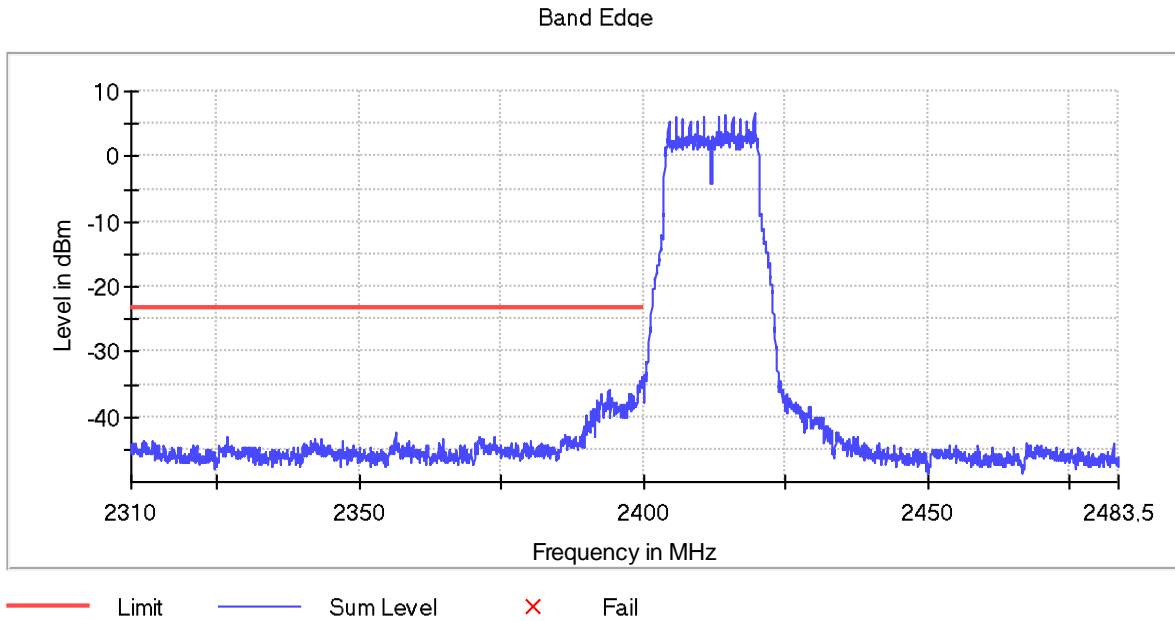
- High Channel:



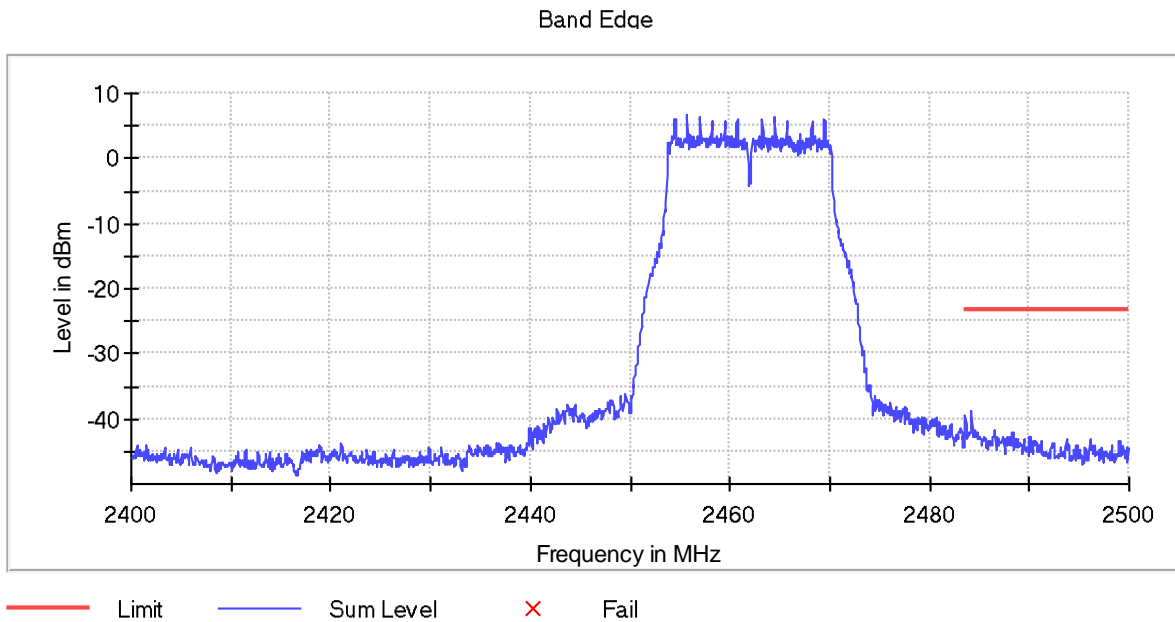
Verdict: PASS

- **SISO 802.11 g – Band-edge emissions compliance:**

- Low Channel:



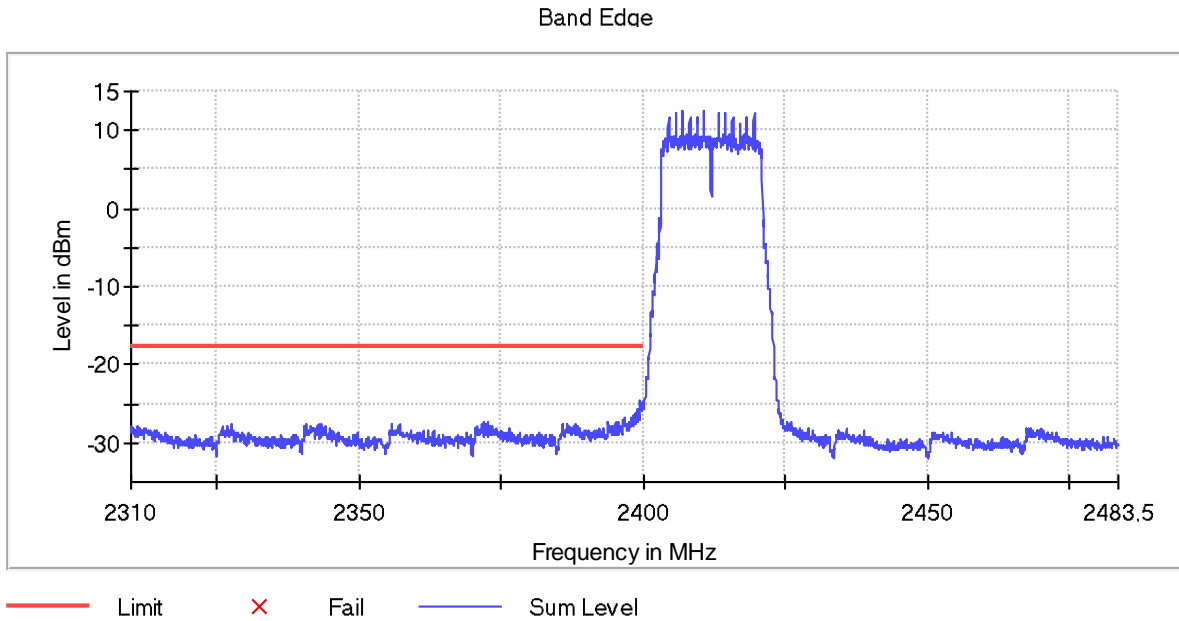
- High Channel:



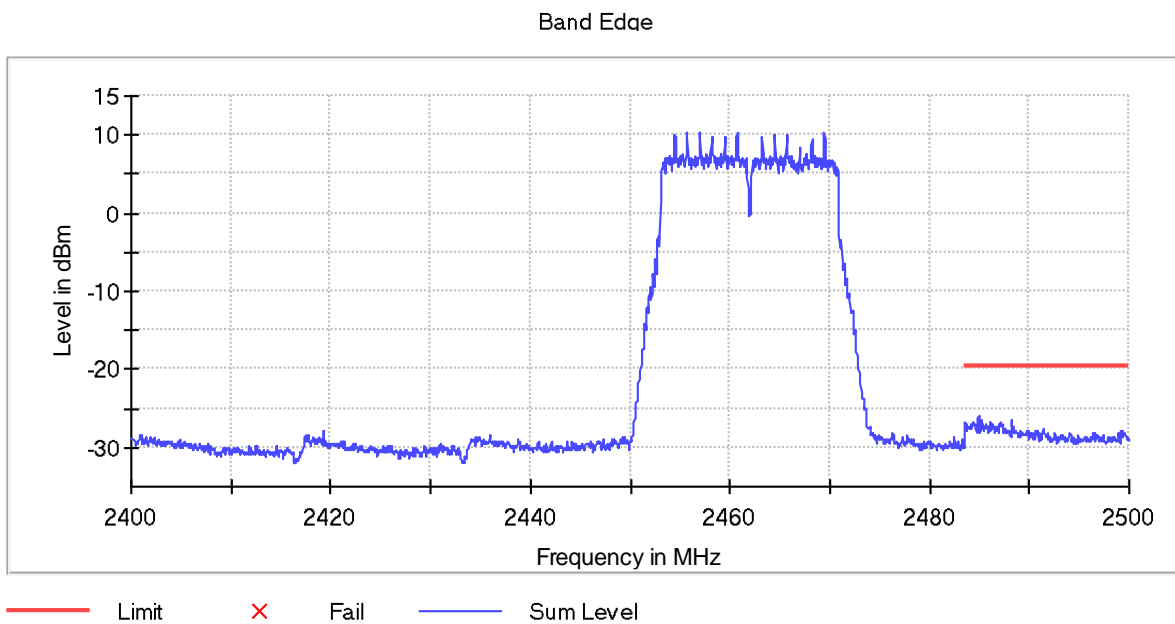
Verdict: PASS

- **MIMO 802.11 n20 – Band-edge emissions compliance:**

- Low Channel:



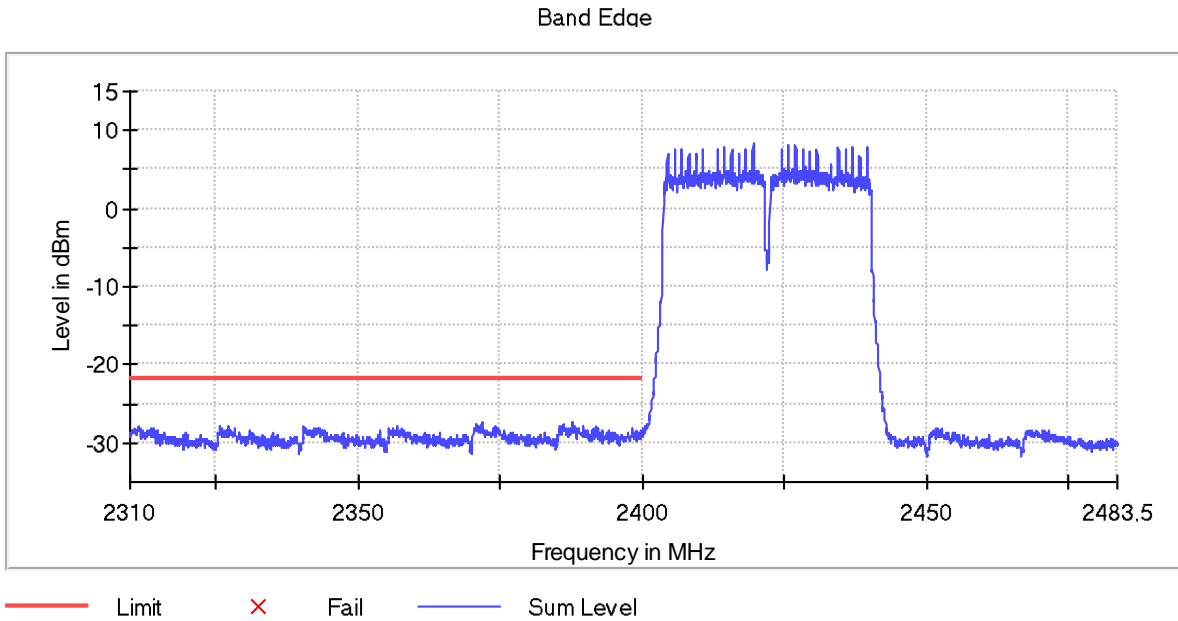
- High Channel:



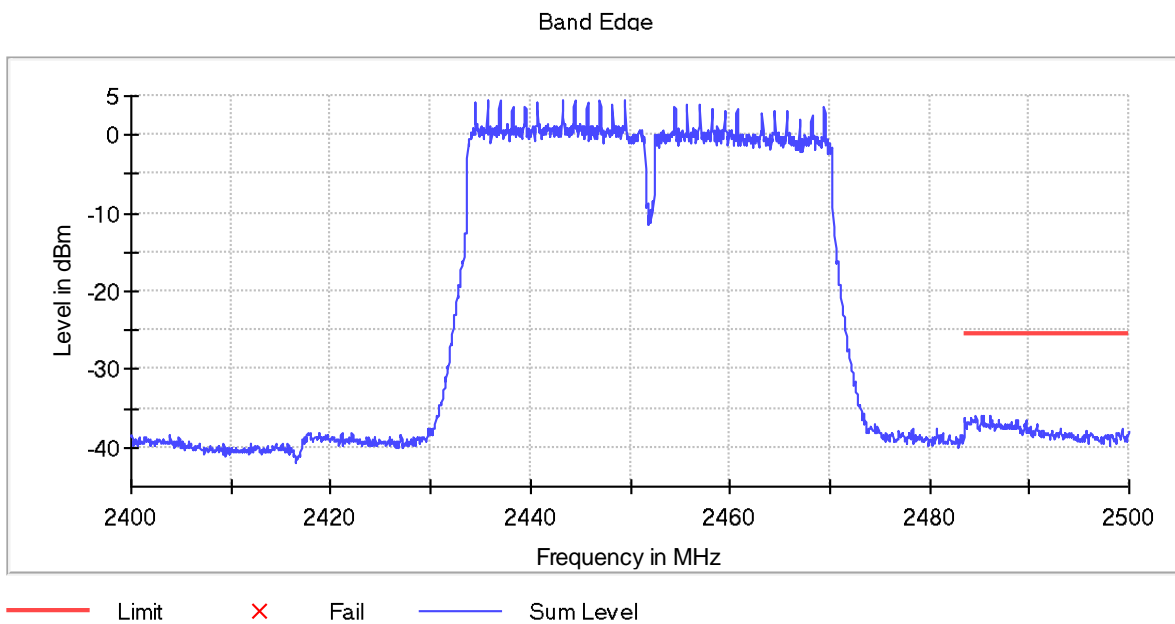
Verdict: PASS

- **MIMO 802.11 n40 – Band-edge emissions compliance:**

- Low Channel:



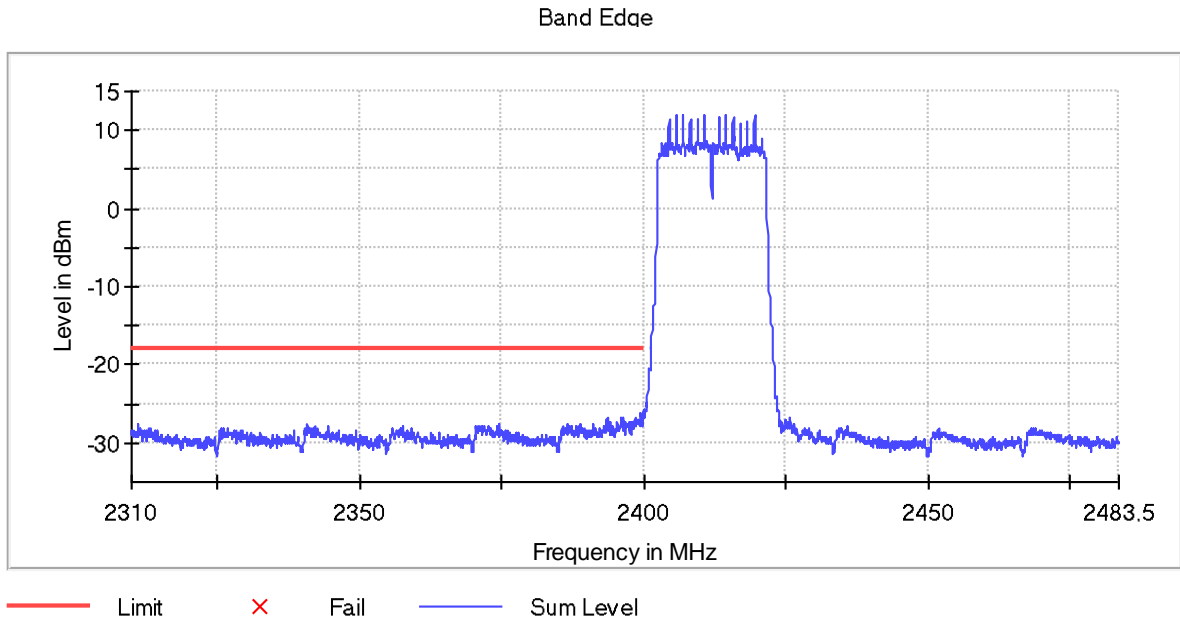
- High Channel:



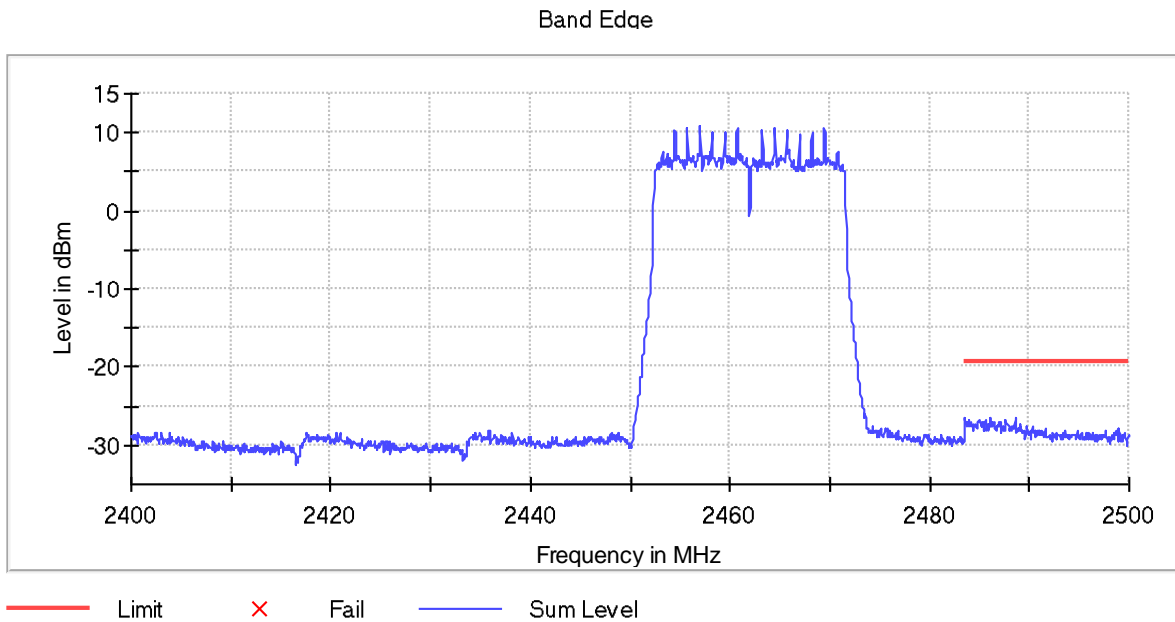
Verdict: PASS

- **MIMO 802.11 he20 – Band-edge emissions compliance:**

- Low Channel:



- High Channel:

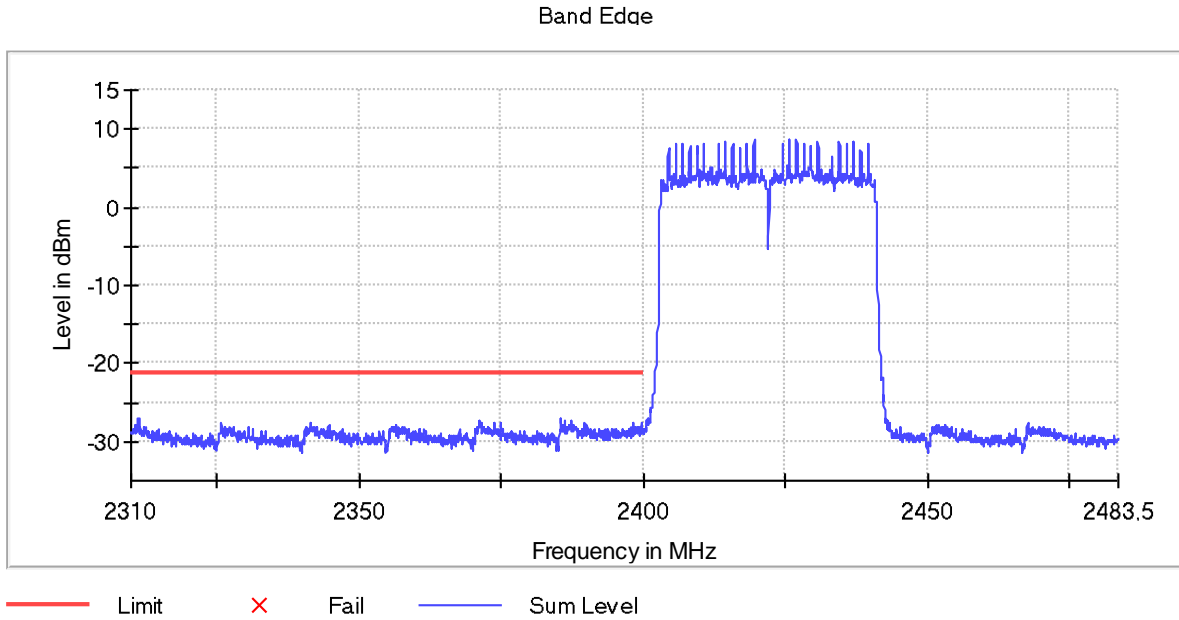


Verdict: PASS

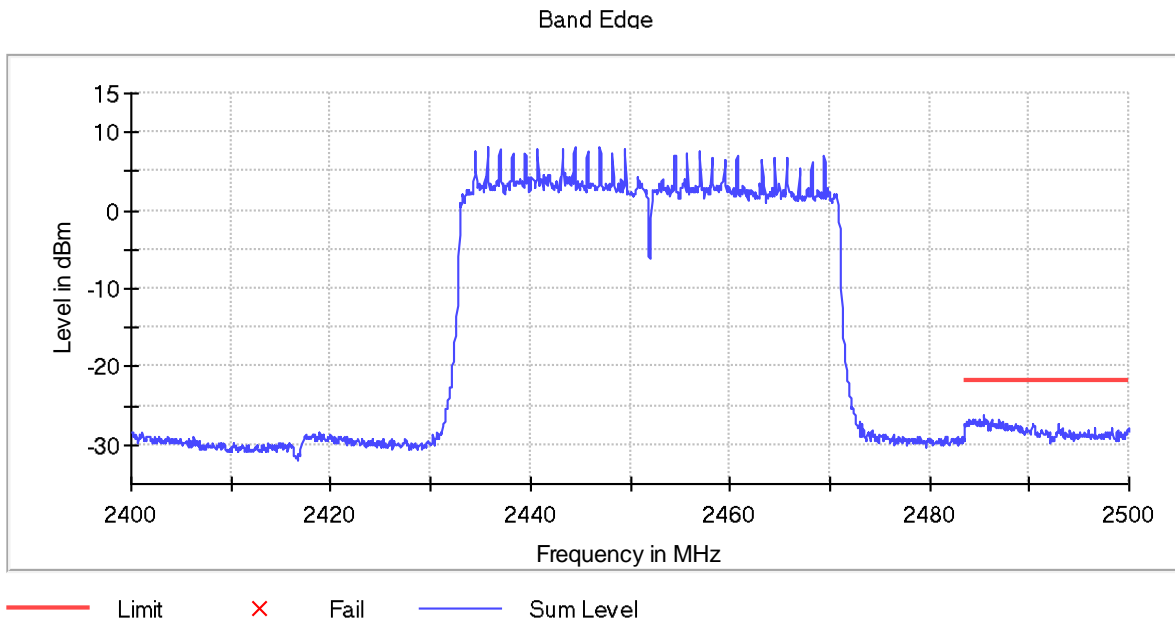


- **MIMO 802.11 he40 – Band-edge emissions compliance:**

- Low Channel:



- High Channel:



Verdict: PASS

## FCC 15.247 (e) Power spectral density

### SPECIFICATION:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### RESULTS:

The power spectral density was measured using the method according to FCC title 47 part 15 §15.247(a),(e), KDB 558074 D01 DTS Meas Guidance v05r02 F and ANSI C63.10-2013.

The testing was performed in according with Method AVGPS-1.

- Preliminary tests determined the SISO worst case: ANT1.
- MIMO: ANT0 & ANT1 & ANT2 & ANT3.

The PSD was measured on all ports and then using the measure and sum spectral maxima across the outputs technique, stated in FCC KDB 662911 D01 Section E)2)b).

#### **SISO worst case:**

- **SISO 802.11 b – Power Spectral Density:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
Average Power Spectral Density (dBm)	4.51	4.19	6.51
Measurement uncertainty (dB)	<± 0.99		

- **SISO 802.11 g – Power Spectral Density:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
Average Power Spectral Density (dBm)	-3.29	3.00	-3.18
Measurement uncertainty (dB)	<± 0.99		

- **MIMO 802.11 n20 – Power Spectral Density:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
Average Power Spectral Density (dBm)	2.43	7.26	0.50
Measurement uncertainty (dB)	<± 0.99		

- **MIMO 802.11 he20 – Power Spectral Density:**

	Low Channel (1) 2412MHz	Middle Channel (6) 2437MHz	High Channel (11) 2462MHz
Average Power Spectral Density (dBm)	1.77	6.16	0.33
Measurement uncertainty (dB)	<± 0.99		

- **MIMO 802.11 n40 – Power Spectral Density:**

	Low Channel (3) 2422MHz	Middle Channel (6) 2437MHz	High Channel (9) 2452MHz
Average Power Spectral Density (dBm)	-1.94	0.41	-5.30
Measurement uncertainty (dB)	<± 0.99		

- **MIMO 802.11 he40 – Power Spectral Density:**

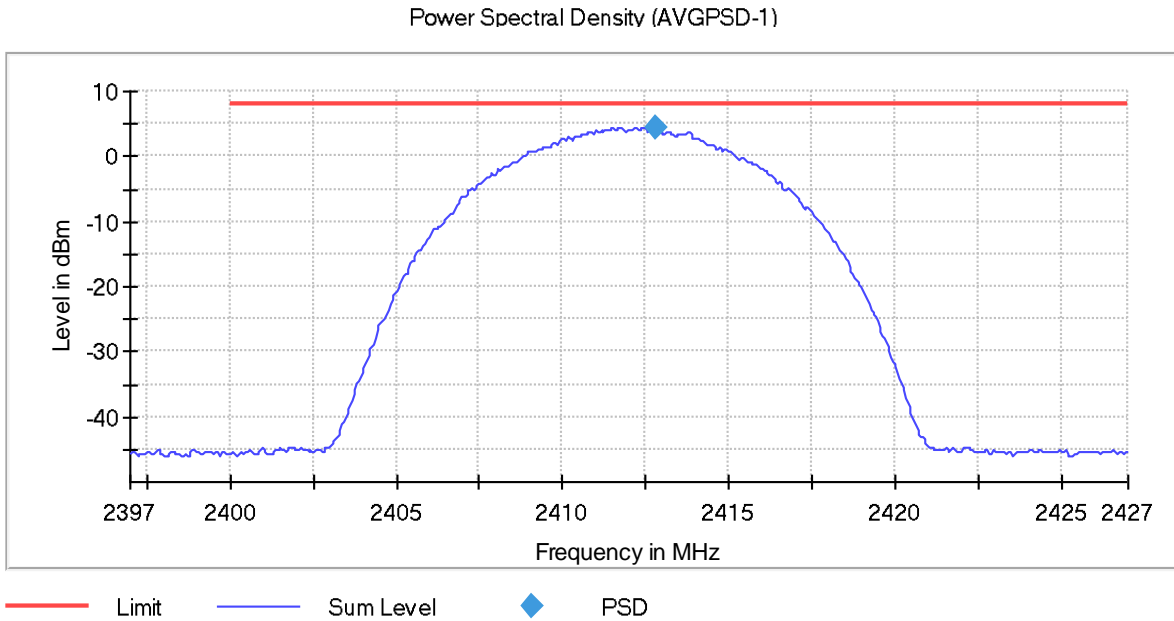
	Low Channel (3) 2422MHz	Middle Channel (6) 2437MHz	High Channel (9) 2452MHz
Average Power Spectral Density (dBm)	-1.40	0.83	-2.07
Measurement uncertainty (dB)	<± 0.99		

Verdict: PASS

**SISO worst case:**

- **SISO 802.11 b – Power Spectral Density:**

- Low Channel (1):



- Middle Channel (6):

