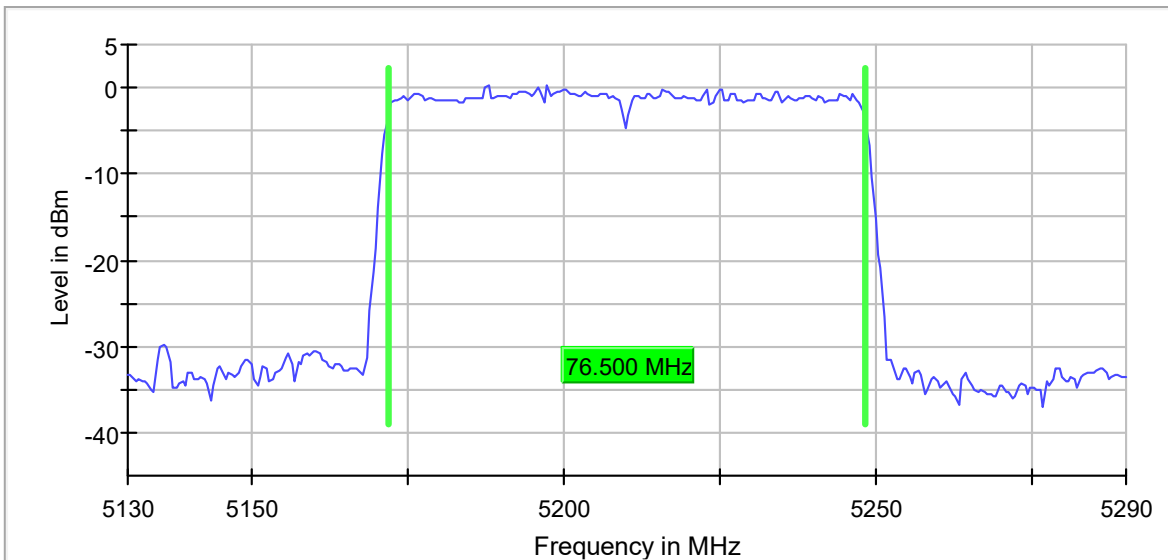


**Mode 802.11 ac80 (VHT80):**

**U-NII-1 (5150-5250 MHz)**

- Single Channel 42 (5210 MHz):

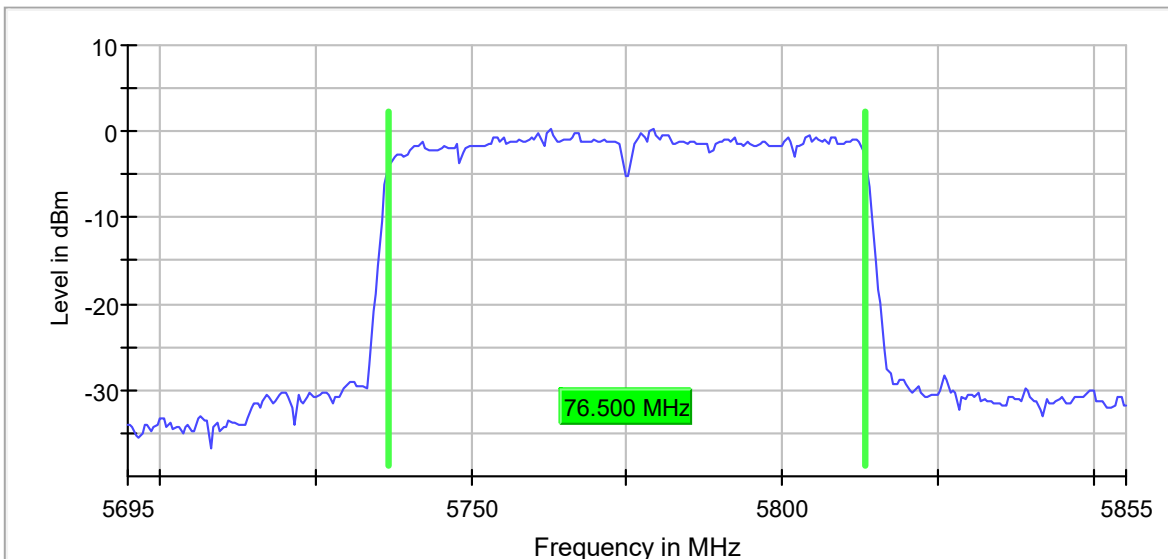
99 % Bandwidth



**U-NII-3 (5725-5850 MHz)**

- Single Channel 155 (5775 MHz):

99 % Bandwidth



## 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.

#### Mode 802.11 a20:

##### U-NII-1 (5150-5250 MHz)

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
-26 dBc bandwidth (MHz)	20.00	19.80	20.00
Measurement uncertainty (%)	<±1.17		

##### U-NII-3 (5725-5850 MHz)

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
-26 dBc bandwidth (MHz)	20.00	20.00	19.80
Measurement uncertainty (%)	<±1.17		

#### Mode 802.11 n20 (HT20):

##### U-NII-1 (5150-5250 MHz)

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
-26 dBc bandwidth (MHz)	20.40	20.10	20.40
Measurement uncertainty (%)	<±1.17		

##### U-NII-3 (5725-5850 MHz)

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
-26 dBc bandwidth (MHz)	20.20	20.80	20.50
Measurement uncertainty (%)	<±1.17		

**Mode 802.11 ac20 (VHT20):**

**U-NII-1 (5150-5250 MHz)**

Channels	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
-26 dBc bandwidth (MHz)	20.30	20.30	20.20
Measurement uncertainty (%)	<±1.17		

**U-NII-3 (5725-5850 MHz)**

Channels	Low Channel 149 (5745 MHz)	Middle Channel 157 (5785 MHz)	High Channel 165 (5825 MHz)
-26 dBc bandwidth (MHz)	20.30	20.40	20.50
Measurement uncertainty (%)	<±1.17		

**Mode 802.11 n40 (HT40):**

**U-NII-1 (5150-5250 MHz)**

Channels	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
-26 dBc bandwidth (MHz)	40.22	40.97
Measurement uncertainty (%)	<±1.15	

**U-NII-3 (5725-5850 MHz)**

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
-26 dBc bandwidth (MHz)	40.67	41.27
Measurement uncertainty (%)	<±1.15	

**Mode 802.11 ac40 (VHT40):**

**U-NII-1 (5150-5250 MHz)**

Channels	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
-26 dBc bandwidth (MHz)	40.37	40.37
Measurement uncertainty (%)	<±1.15	

**U-NII-3 (5725-5850 MHz)**

Channels	Low Channel 151 (5755 MHz)	High Channel 159 (5795 MHz)
-26 dBc bandwidth (MHz)	40.22	40.37
Measurement uncertainty (%)	<±1.15	

**Mode 802.11 ac80 (VHT80):**

**U-NII-1 (5150-5250 MHz)**

Channel	Single Channel 42 (5210 MHz)
-26 dBc bandwidth (MHz)	82.50
Measurement uncertainty (%)	<±1.20

**U-NII-3 (5725-5850 MHz)**

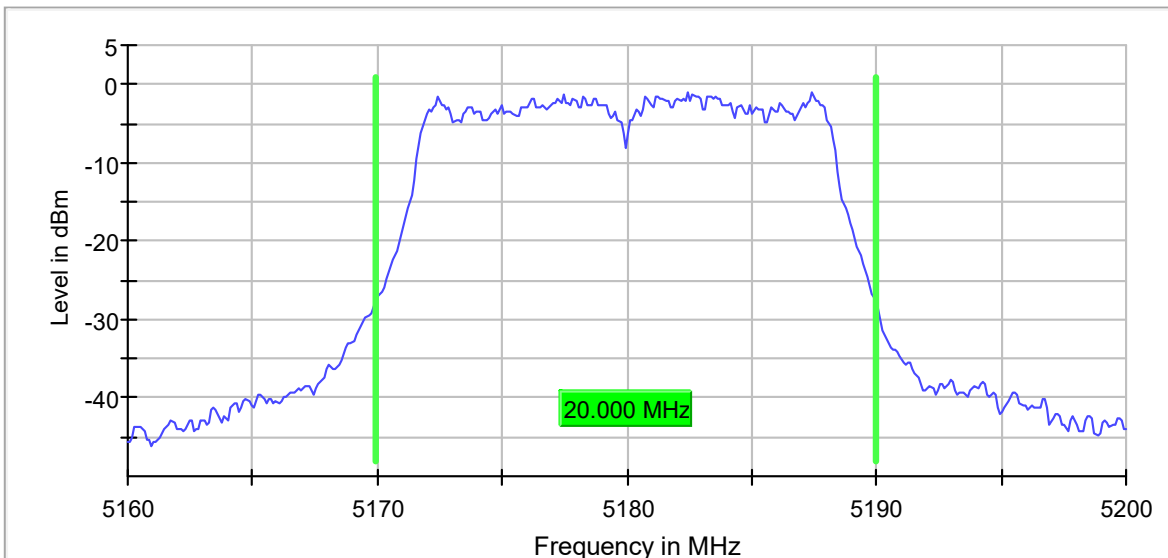
Channels	Single Channel 155 (5775 MHz)
-26 dBc bandwidth (MHz)	82.50
Measurement uncertainty (%)	<±1.20

**Mode 802.11 a20:**

**U-NII-1 (5150-5250 MHz)**

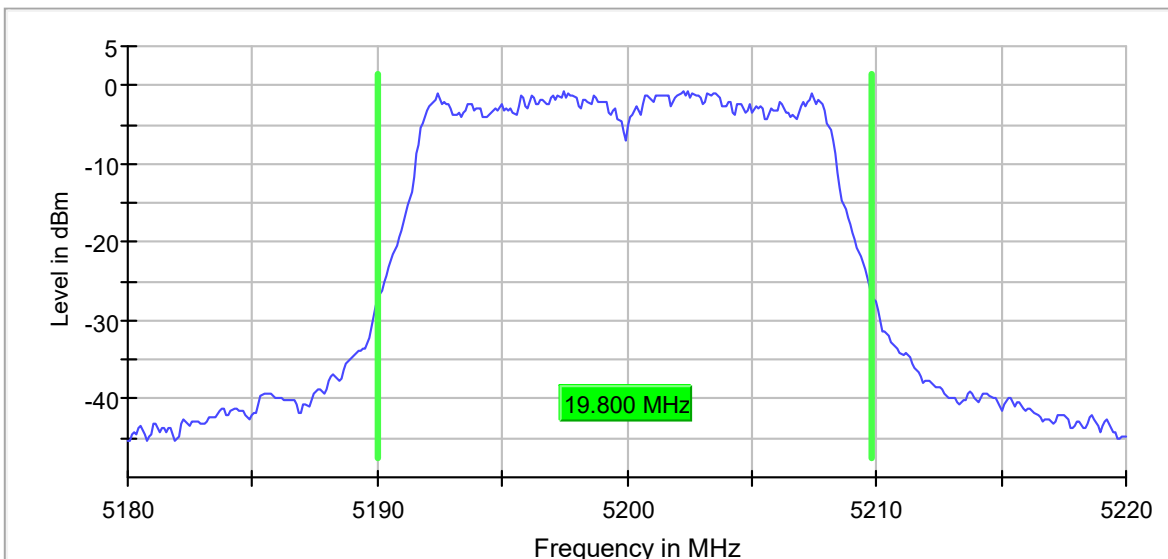
- Low Channel 36 (5180 MHz):

26 dB Bandwidth



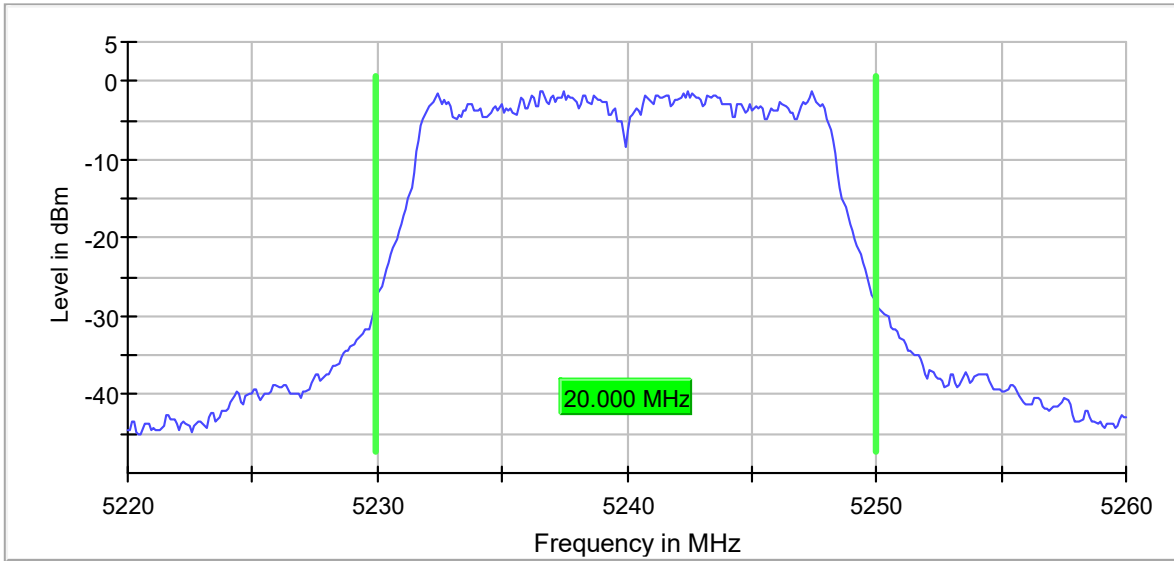
- Middle Channel 40 (5200 MHz):

26 dB Bandwidth



- High Channel 48 (5240 MHz):

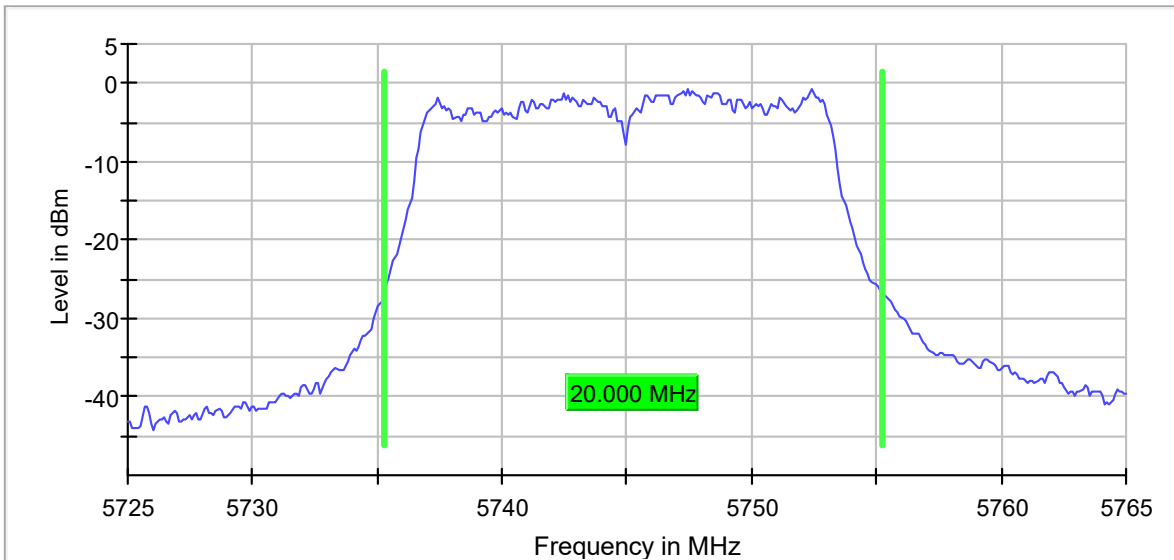
26 dB Bandwidth



**U-NII-3 (5725-5850 MHz)**

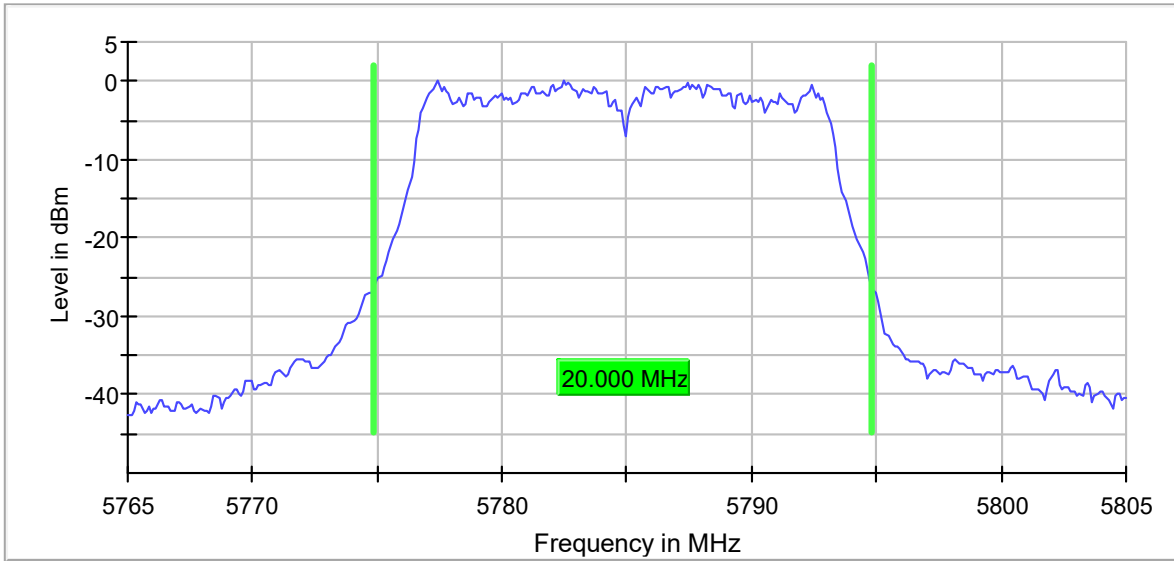
- Low Channel 149 (5745 MHz):

26 dB Bandwidth



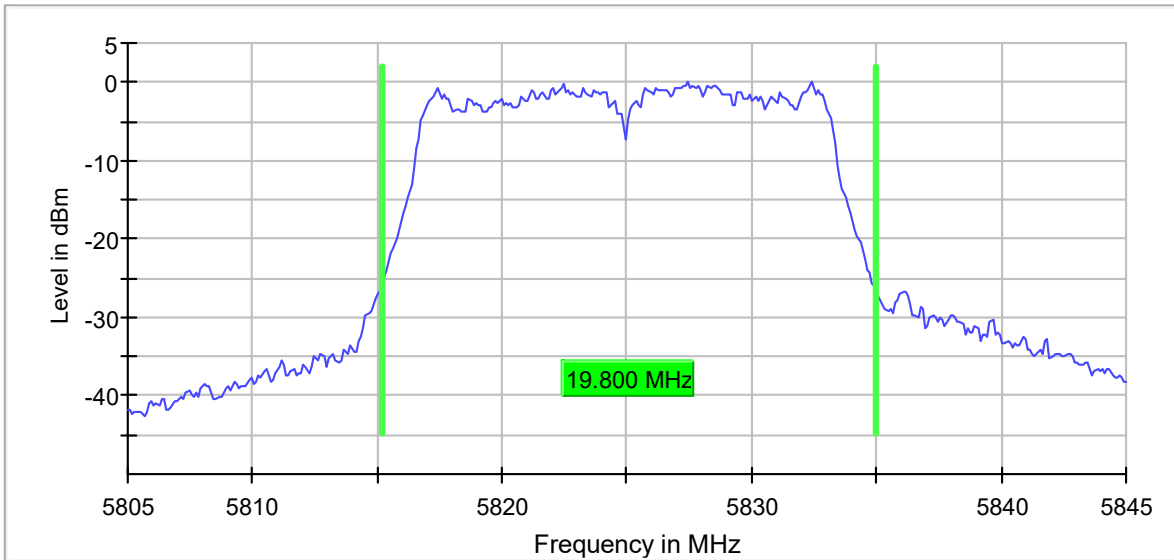
- Middle Channel 157 (5785 MHz):

26 dB Bandwidth



- High Channel 165 (5825 MHz):

26 dB Bandwidth

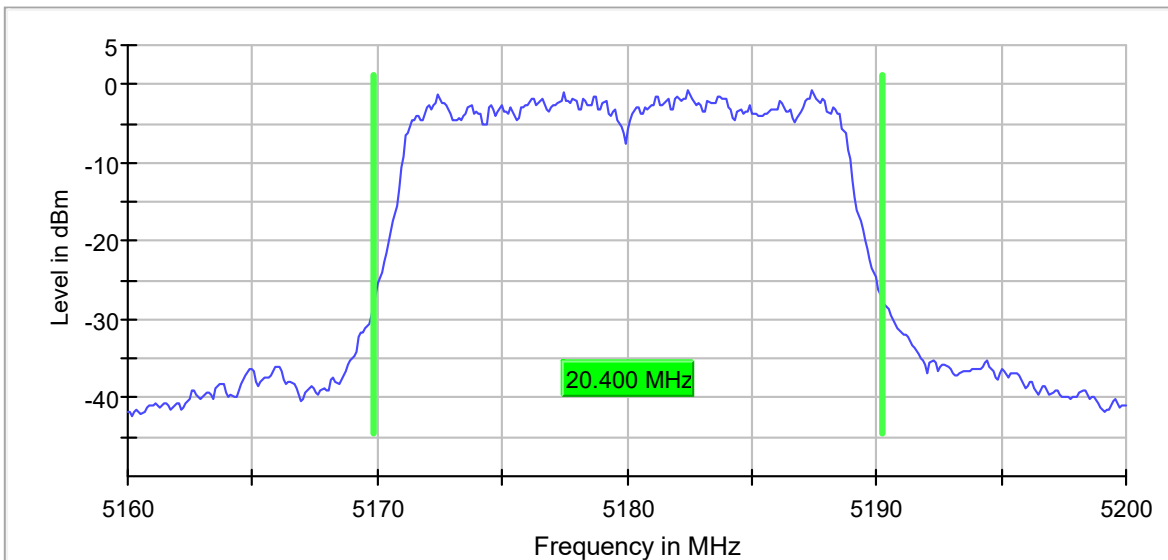


**Mode 802.11 n20 (HT20):**

**U-NII-1 (5150-5250 MHz)**

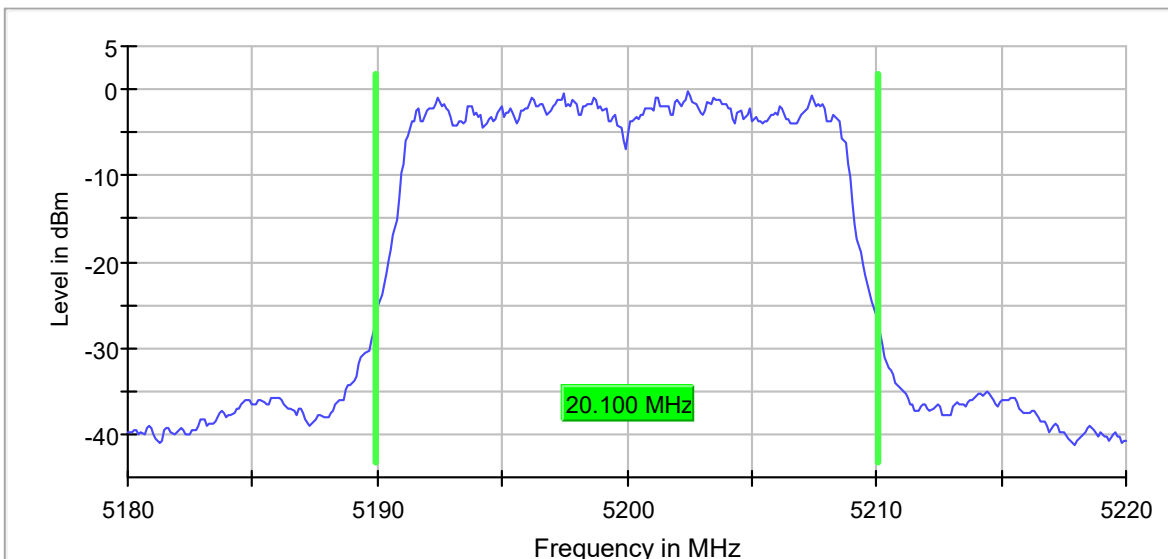
- Low Channel 36 (5180 MHz):

26 dB Bandwidth



- Middle Channel 40 (5200 MHz):

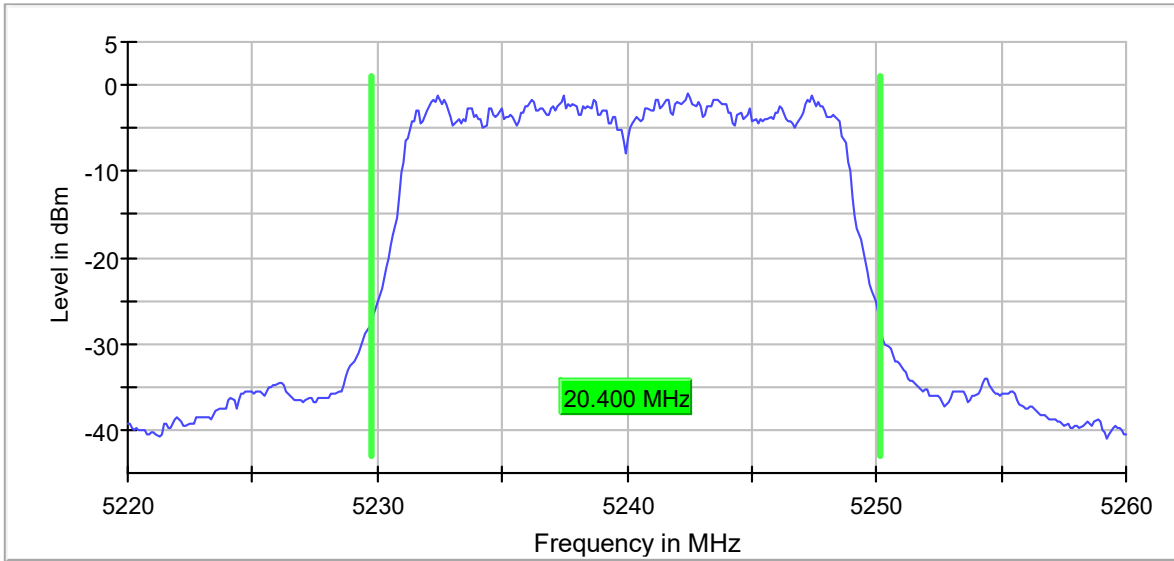
26 dB Bandwidth





- High Channel 48 (5240 MHz):

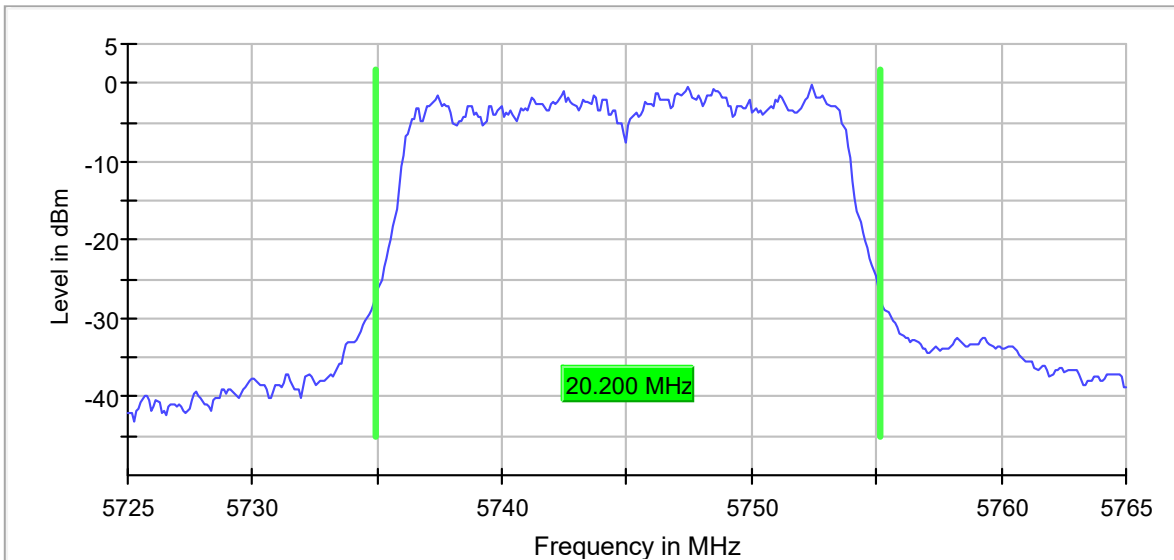
26 dB Bandwidth



**U-NII-3 (5725-5850 MHz)**

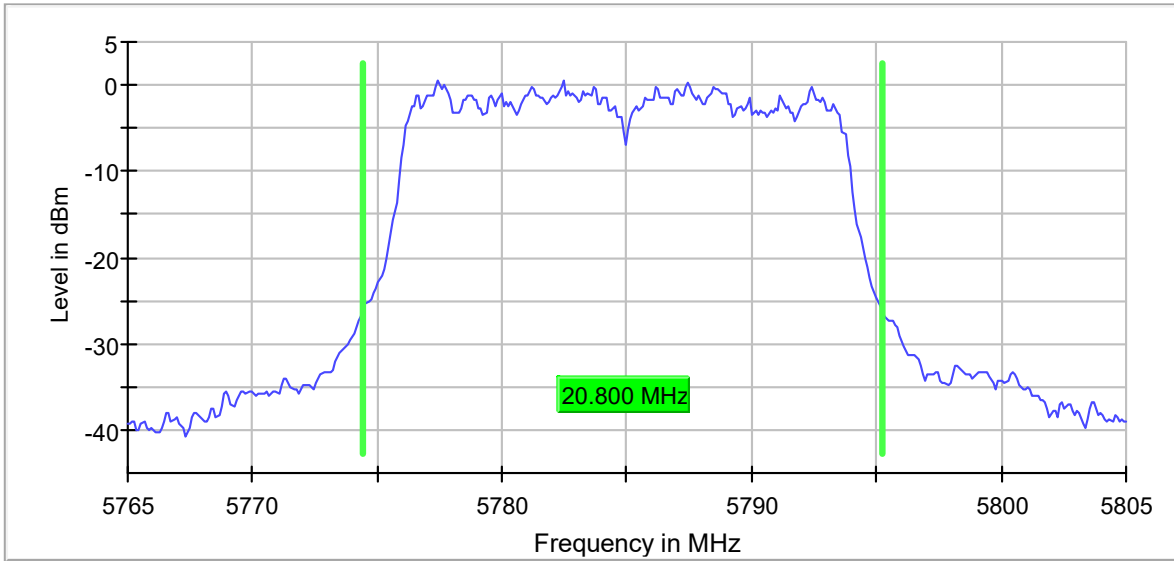
- Low Channel 149 (5745 MHz):

26 dB Bandwidth



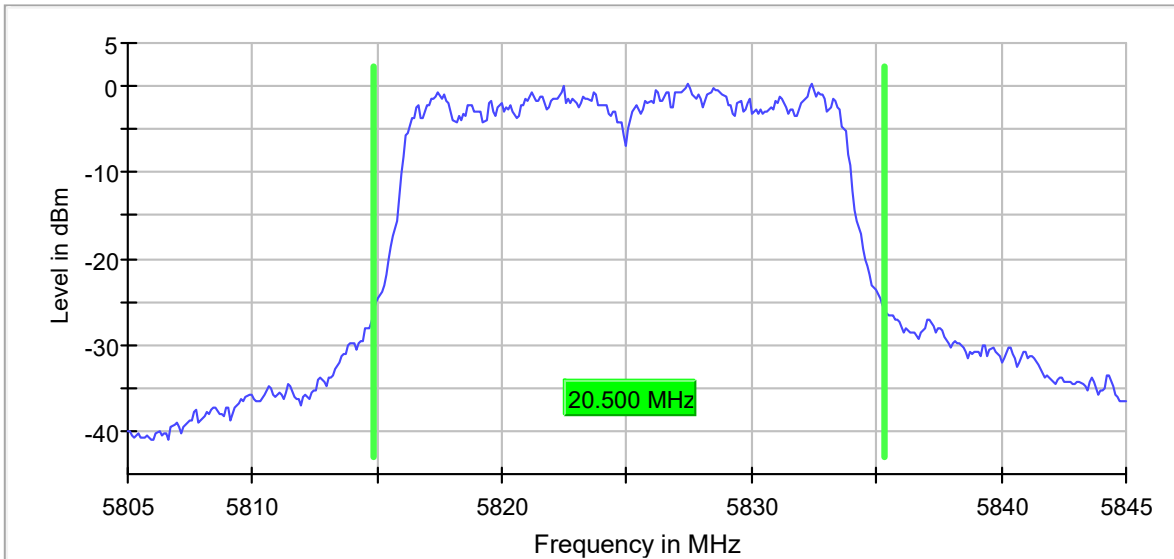
- Middle Channel 157 (5785 MHz):

26 dB Bandwidth



- High Channel 165 (5825 MHz):

26 dB Bandwidth

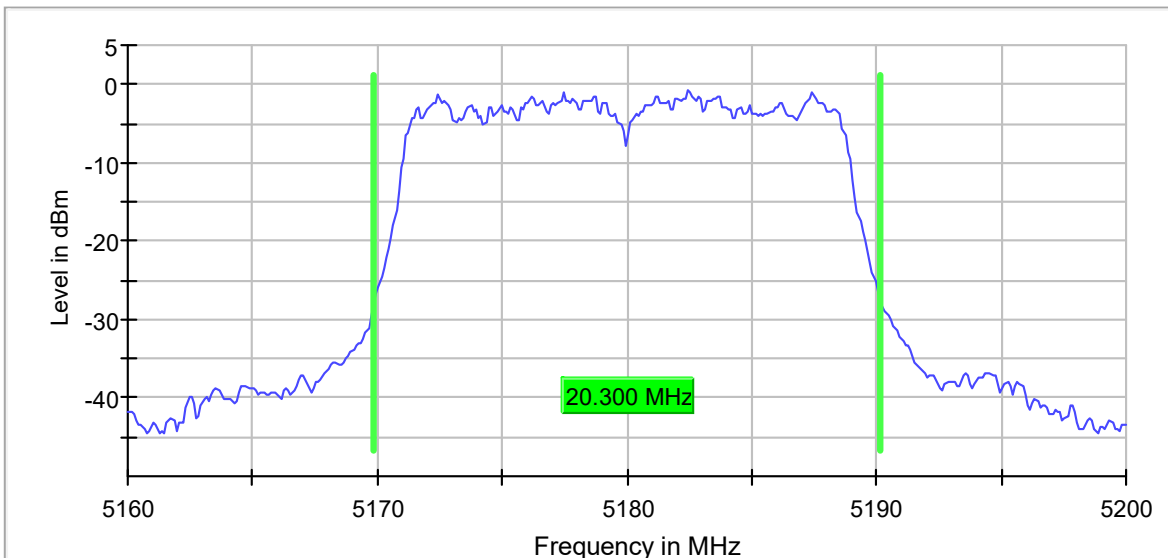


**Mode 802.11 ac20 (VHT20):**

**U-NII-1 (5150-5250 MHz)**

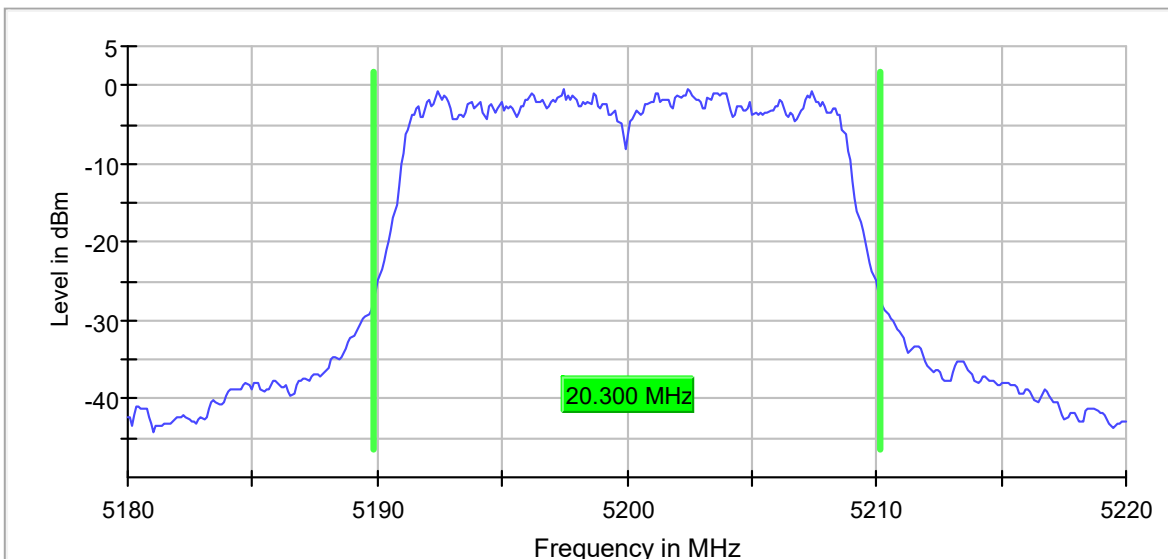
- Low Channel 36 (5180 MHz):

26 dB Bandwidth



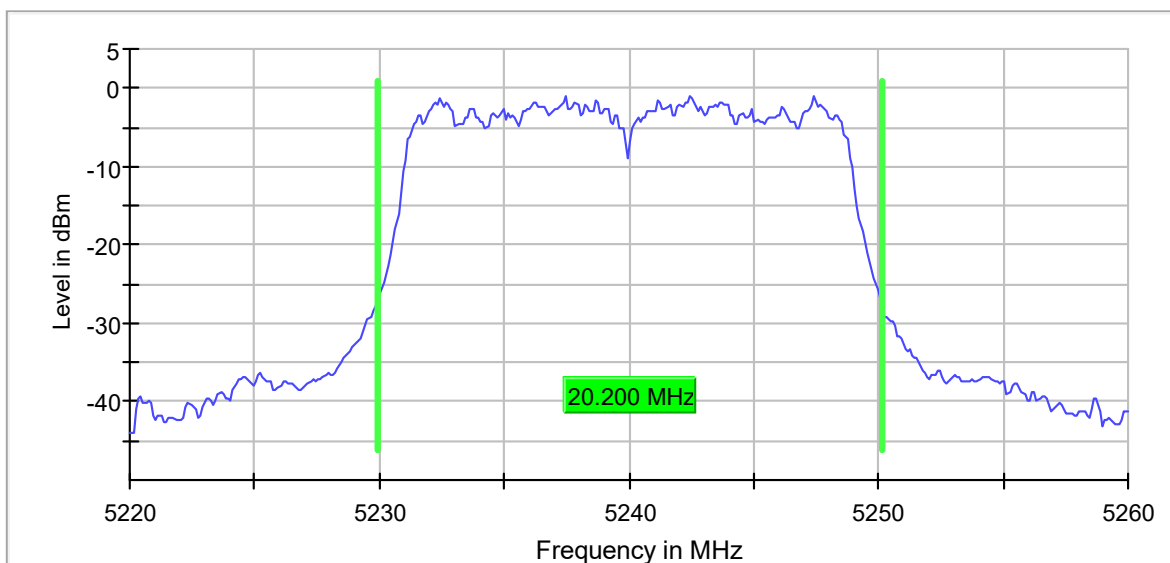
- Middle Channel 40 (5200 MHz):

26 dB Bandwidth



- High Channel 48 (5240 MHz):

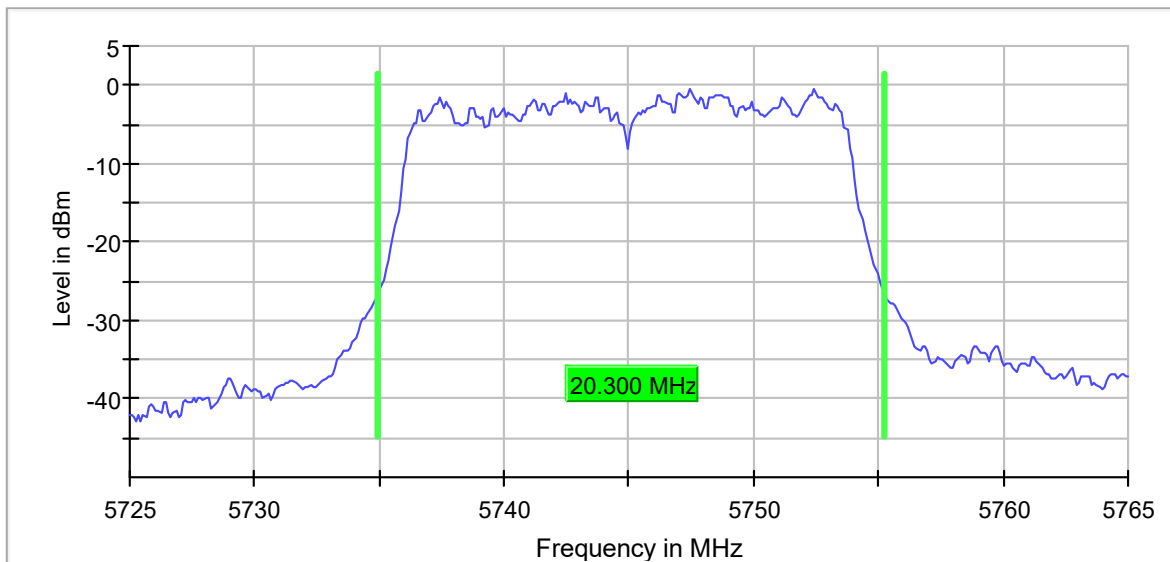
26 dB Bandwidth



**U-NII-3 (5725-5850 MHz)**

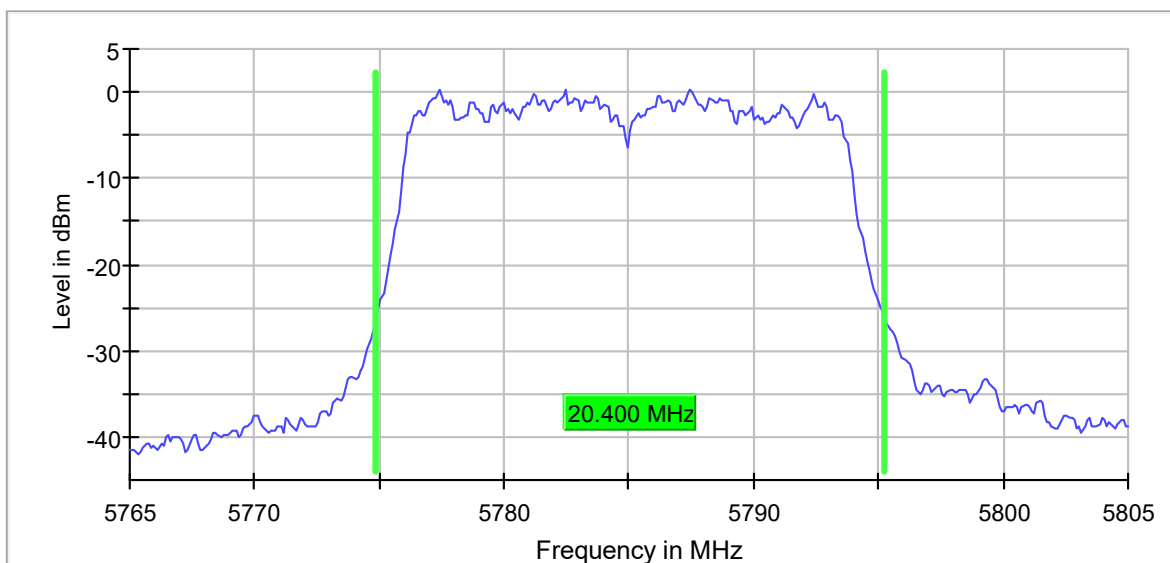
- Low Channel 149 (5745 MHz):

26 dB Bandwidth



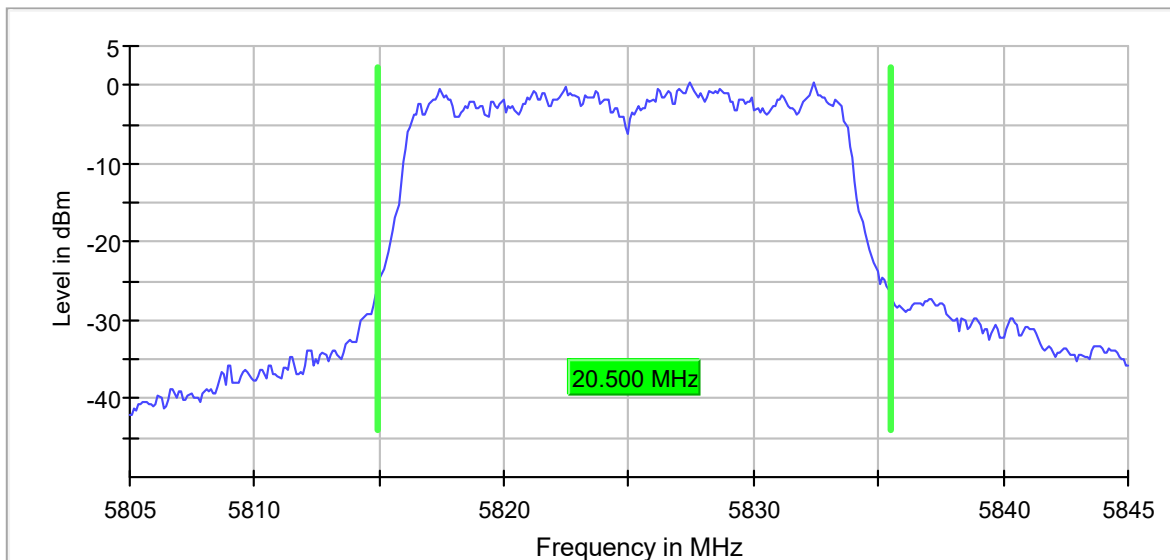
- Middle Channel 157 (5785 MHz):

26 dB Bandwidth



- High Channel 165 (5825 MHz):

26 dB Bandwidth

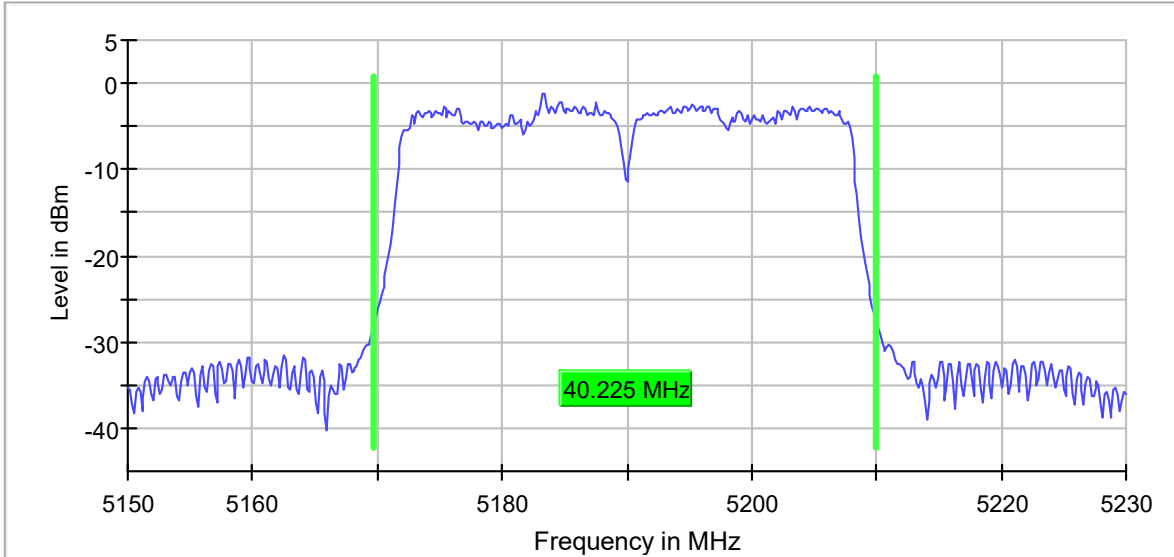


**Mode 802.11 n40 (HT40):**

**U-NII-1 (5150-5250 MHz)**

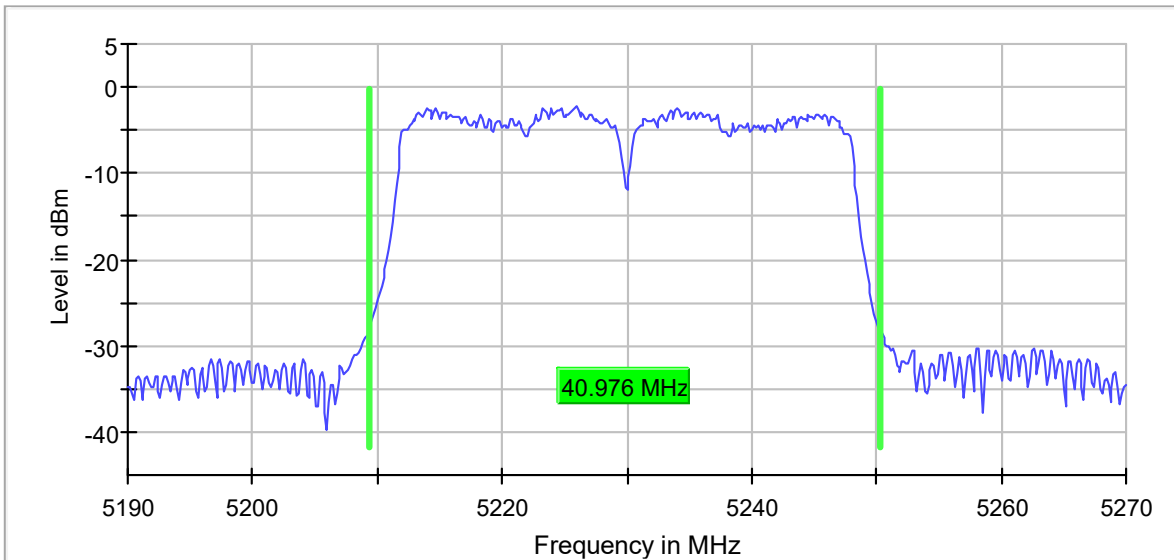
- Low Channel 38 (5190 MHz):

26 dB Bandwidth



- High Channel 46 (5230 MHz):

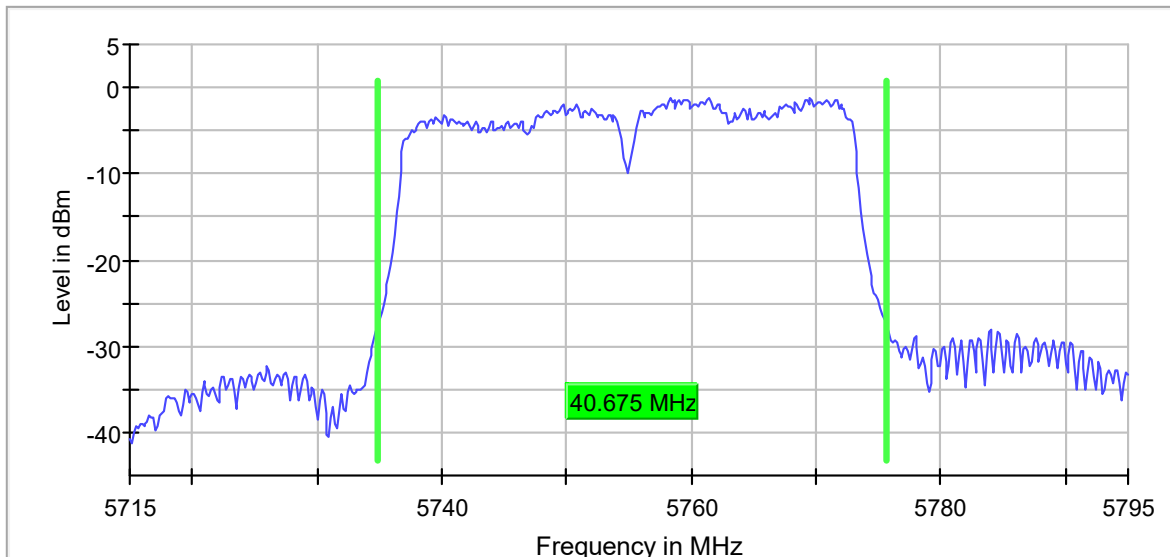
26 dB Bandwidth



**U-NII-3 (5725-5850 MHz)**

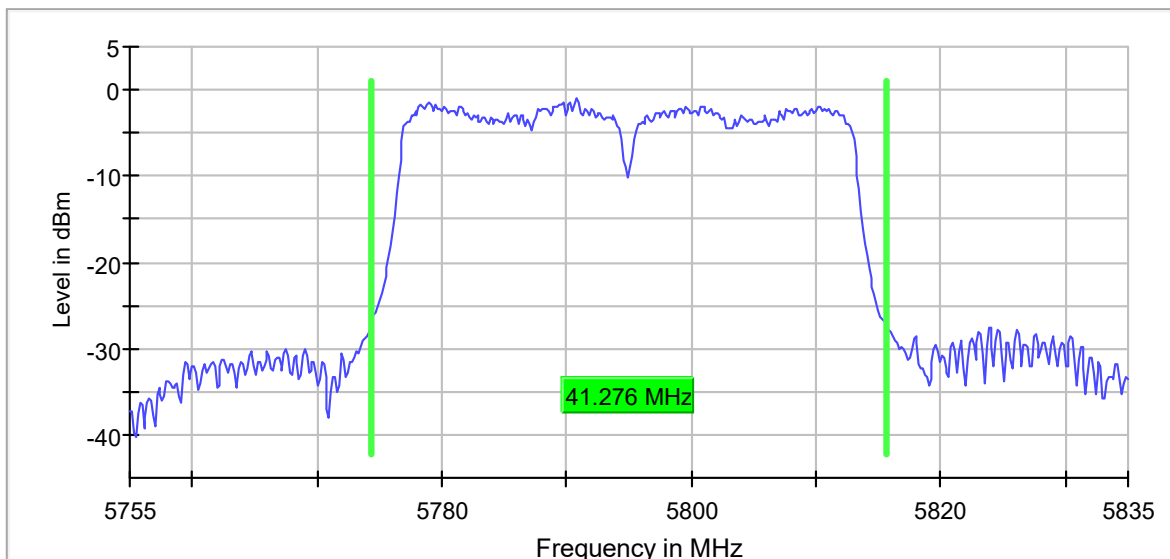
- Low Channel 151 (5755 MHz):

26 dB Bandwidth



- High Channel 159 (5795 MHz):

26 dB Bandwidth

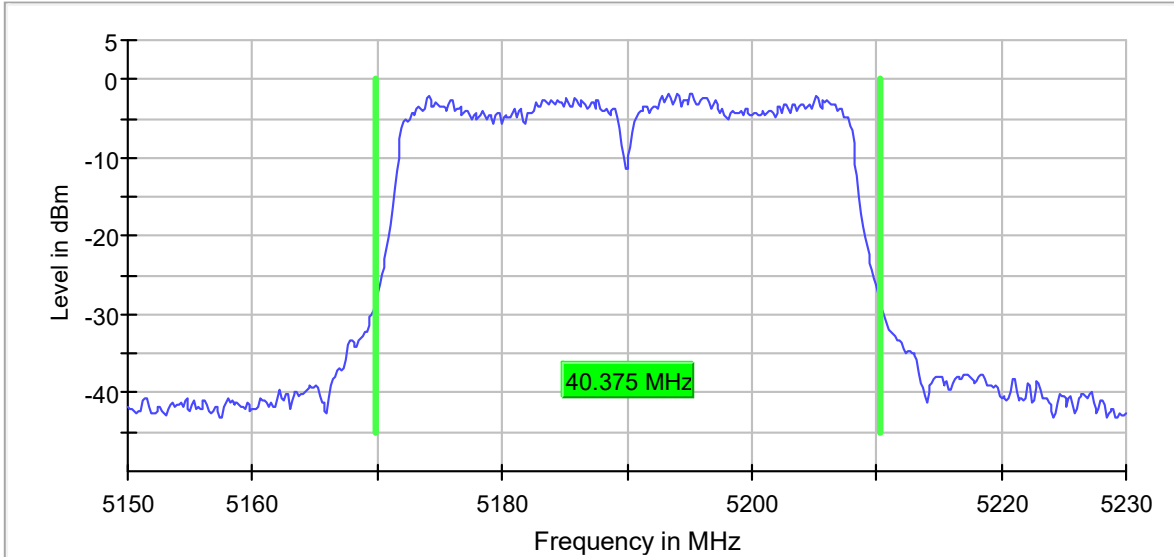


**Mode 802.11 ac40 (VHT40):**

**U-NII-1 (5150-5250 MHz)**

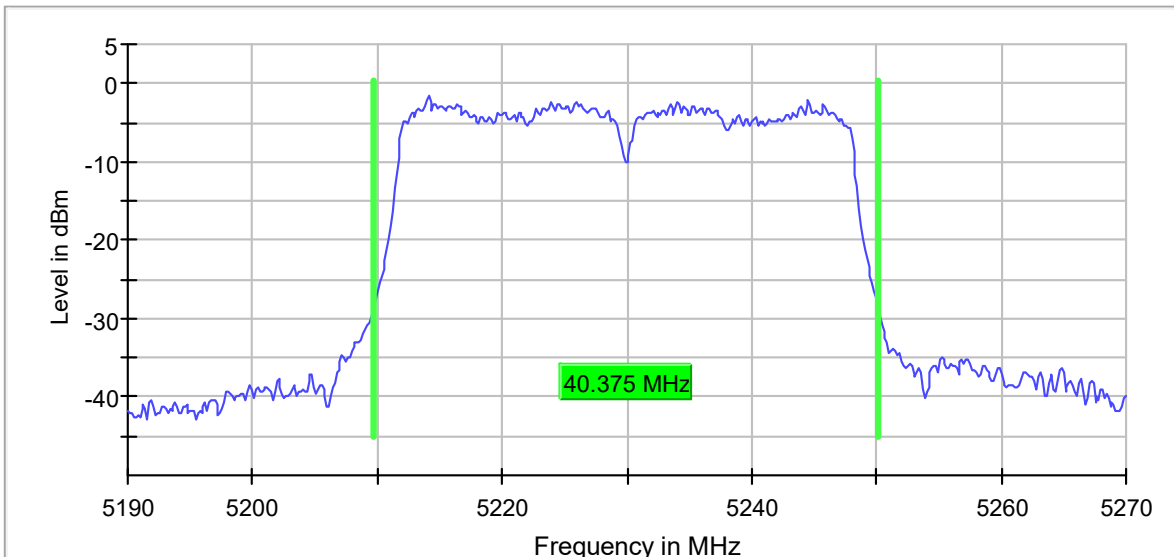
- Low Channel 38 (5190 MHz):

26 dB Bandwidth



- High Channel 46 (5230 MHz):

26 dB Bandwidth

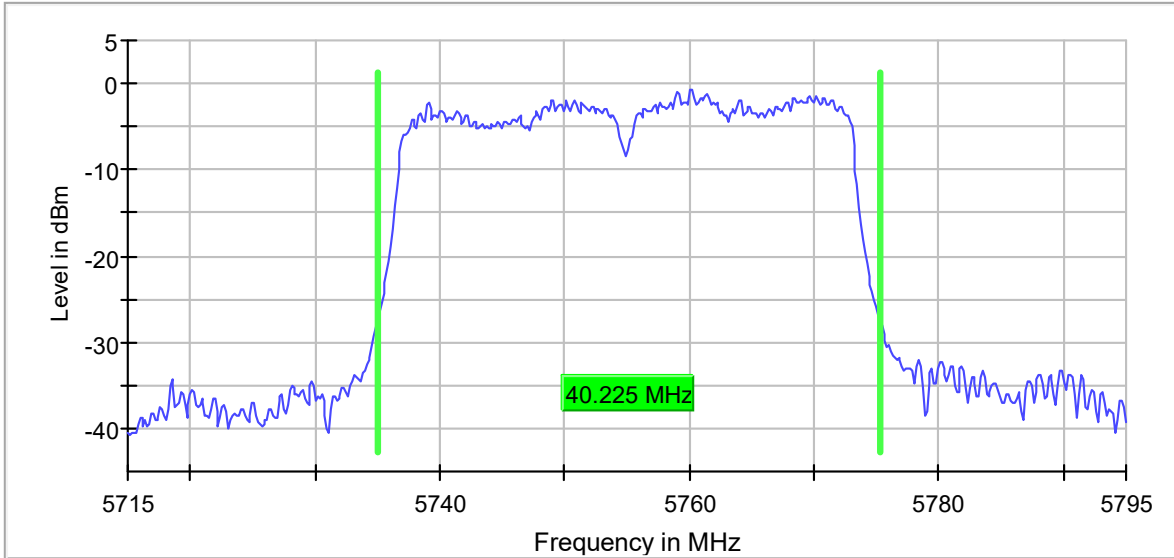




**U-NII-3 (5725-5850 MHz)**

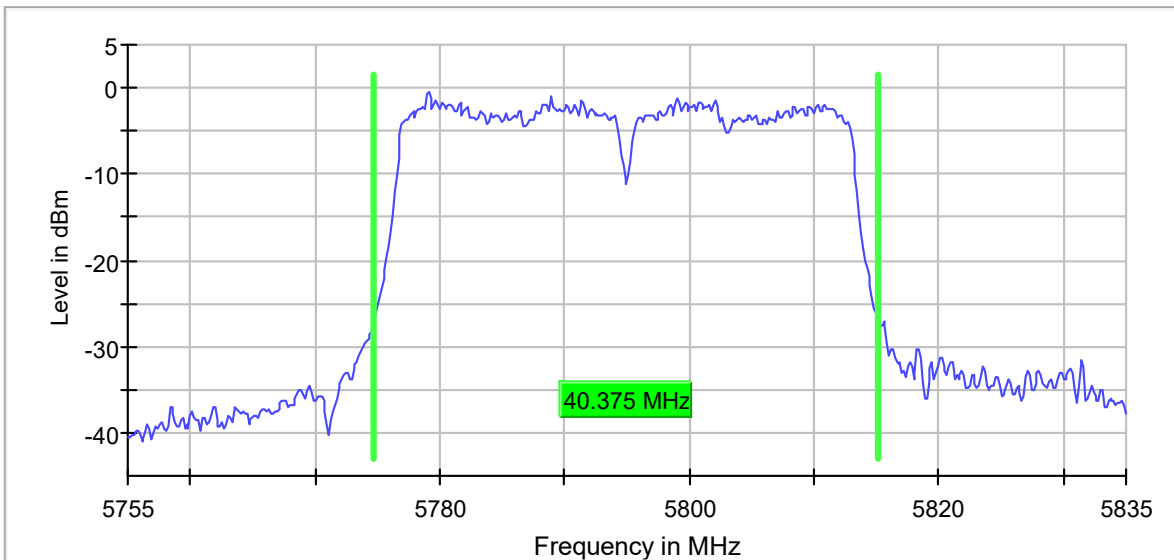
- Low Channel 151 (5755 MHz):

26 dB Bandwidth



- High Channel 159 (5795 MHz):

26 dB Bandwidth

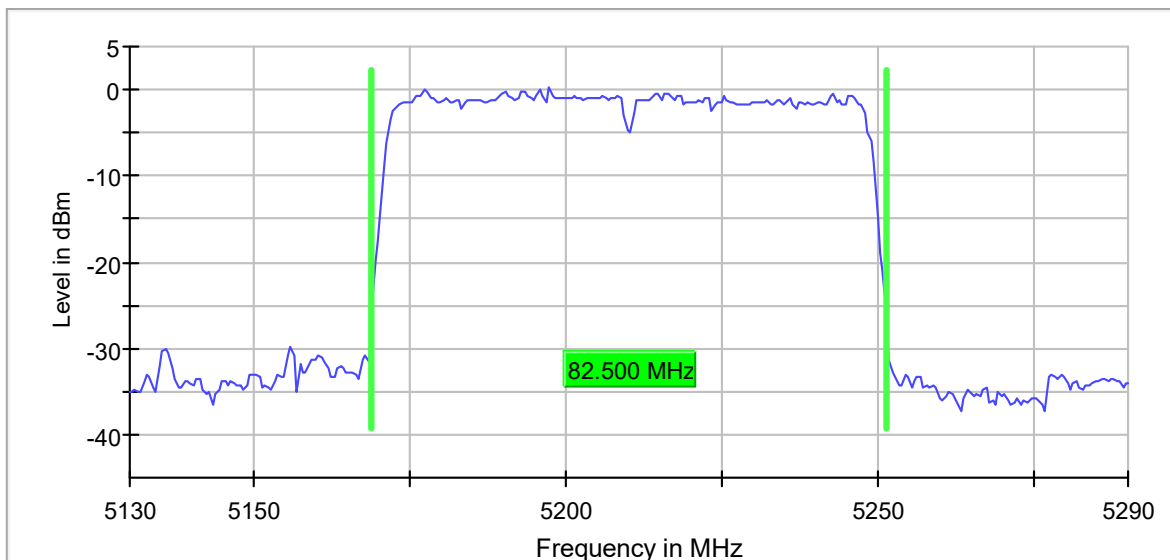


**Mode 802.11 ac80 (VHT80):**

**U-NII-1 (5150-5250 MHz)**

- Single Channel 42 (5210 MHz):

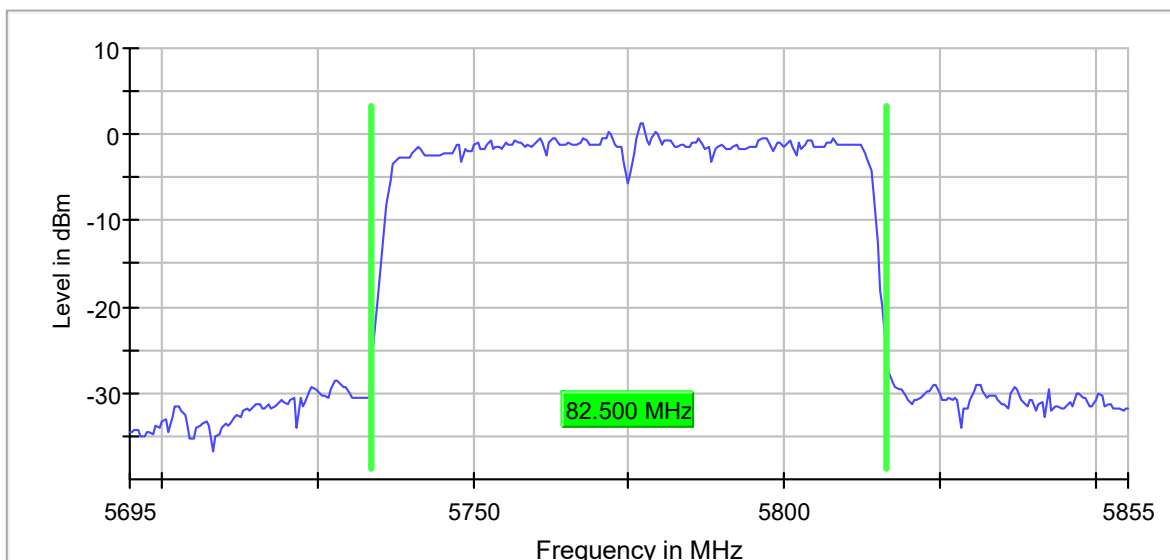
26 dB Bandwidth



**U-NII-3 (5725-5850 MHz)**

- Single Channel 155 (5775 MHz):

26 dB Bandwidth



## **Appendix B: Tests results for the U-NII-1 Band 5.15 – 5.25 GHz**

## INDEX

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## TEST CONDITIONS

(\*) Declared by the Client.

### POWER SUPPLY (\*):

V nominal: 12 Vdc.  
 Type of Power Supply: DC External (Car Battery).

### ANTENNA (\*):

Type of Antenna: External.  
 Maximum Declared Antenna Gain: +0.9 dBi

### TEST FREQUENCIES (\*):

Technology Tested:	WLAN (IEEE 802.11 a,n,ac) / U-NII-1	
Modes:	802.11a20: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps	
	802.11n HT20: MCS0 to MCS7	
	802.11n HT40: MCS0 to MCS7	
	802.11ac VHT20: MCS0 to MCS9	
	802.11ac VHT40: MCS0 to MCS9	
	802.11ac VHT80: MCS0 to MCS9	
Setting of cores / ports:	One port.	
Beamforming:	No.	
Frequency Range:	5150 MHz to 5250 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Low: 36	5180
	Middle: 40	5200
	High: 48	5240
Channel Spacing:	40 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Low: 38	5190
	High: 46	5230
Channel Spacing:	80 MHz	
Transmit Channels	Middle: 42	5210

POWER SETTING (\*):

**UNII-1 FCC:**

Channel	Frequency	11a	11n	11ac
36	5180 MHz	16	16	16
40	5200 MHz	16	16	16
44	5220 MHz	16	16	16
48	5240 MHz	16	16	16
38	5190 MHz		16	16
46	5230 MHz		16	16
42	5210 MHz			16

**UNII-1 Canada:**

Channel	Frequency	11a	11n	11ac
36	5180 MHz	12	12	12
40	5200 MHz	12	12	12
44	5220 MHz	12	12	12
48	5240 MHz	12	12	12
38	5190 MHz		12	12
46	5230 MHz		12	12
42	5210 MHz			12

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 on the lowest and highest channels at the rated power for the channel under test.

For all modes, the EUT was configured in test mode using a software application. The application was used to enable a continuous transmission and to select the test channels as required. The client supplied instructions to configure the EUT. The customer supplied a document containing the setup instructions.

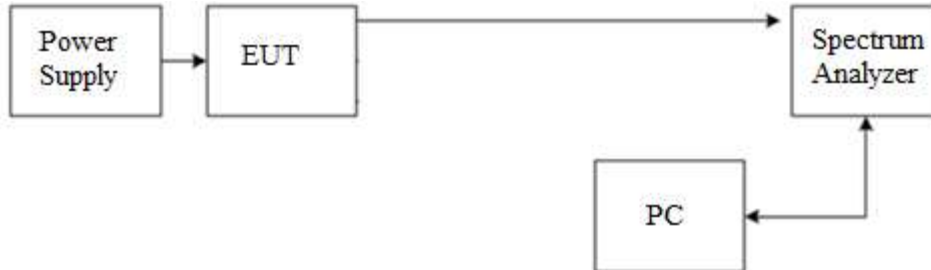
The worst cases for testing were identified for output power and spurious levels at the band edges which were selected based on preliminary testing that correspond to next data rates:

- 802.11 a20: 6 Mbps
- 802.11 n HT20: MCS0
- 802.11 n HT40: MCS0
- 802.11 ac VHT20: MCS0
- 802.11 ac VHT40: MCS0
- 802.11 ac VHT80: MCS0

### CONDUCTED MEASUREMENTS:

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

For all modes:



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

### 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 1m for the frequency range 17 GHz-40 GHz (18 GHz-40 GHz horn antenna).

For radiated emissions in the range 17 GHz-40 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.

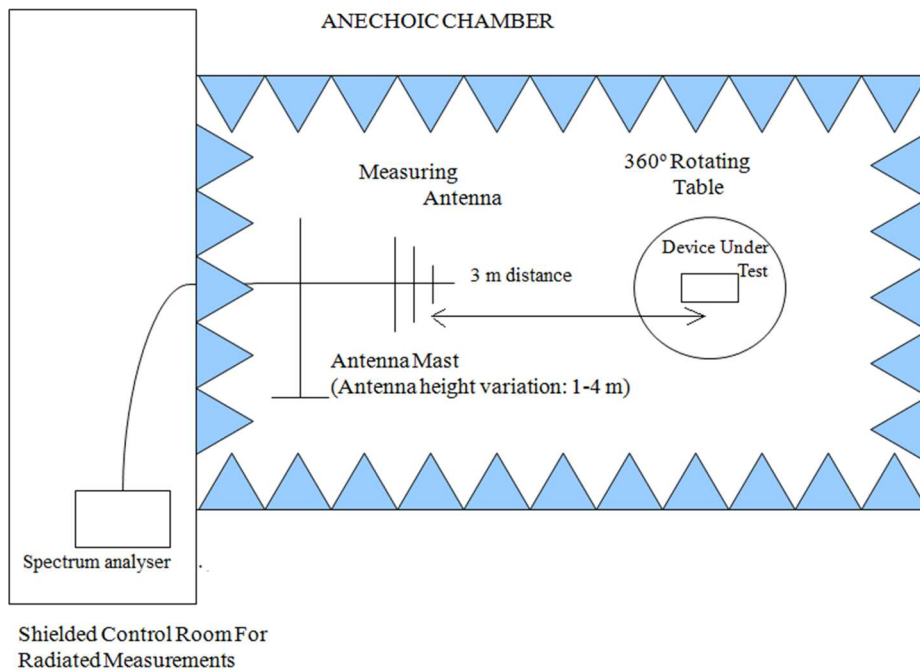
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

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

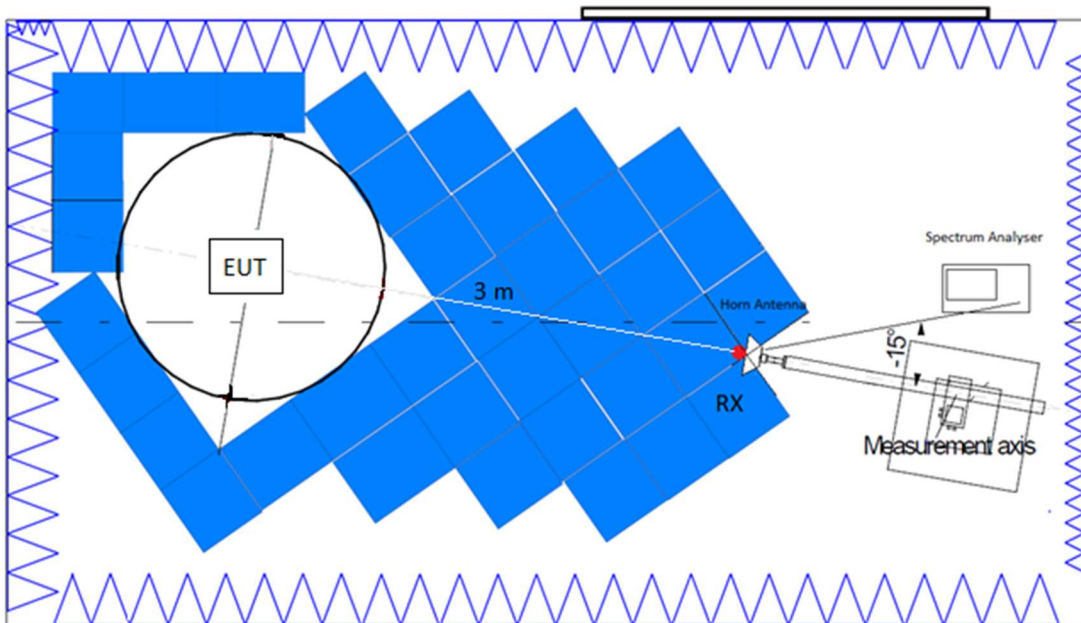
The final measured value, for the given emission, in the tables below incorporates the calibrated antenna factor and cable loss.

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

Radiated measurements setup from 30 MHz to 1 GHz:

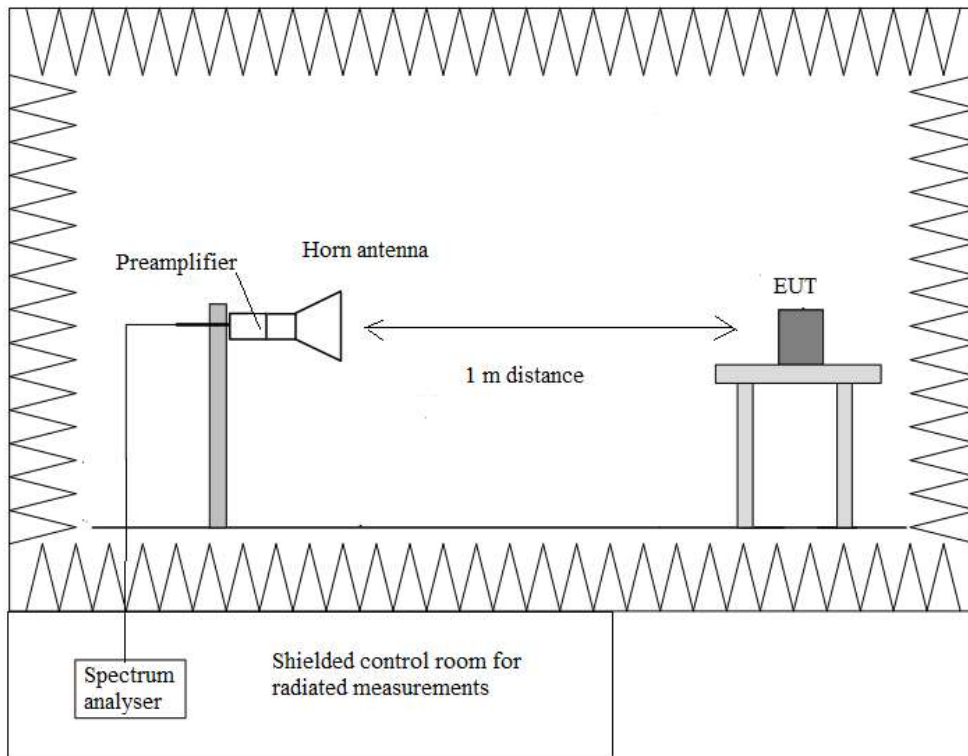


Radiated measurements setup from 1 GHz to 17 GHz:





Radiated measurements setup  $f > 17$  GHz:



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

### SPECIFICATION:

FCC 15.407: For client devices in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW (24 dBm) provided the maximum antenna gain does not exceed 6 dBi. 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: For OEM devices installed in vehicles, the maximum e.i.r.p. shall not exceed 30 mW or  $1.76 + 10 \log_{10} B$ , dBm, whichever is less. Devices shall implement transmitter power control (TPC) in order to have the capability to operate at least 3 dB below the maximum permitted e.i.r.p. of 30 mW.

### 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.

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

For all modes of operation, the antenna gain is less than 6 dBi.

Maximum Declared Antenna Gain: +0.9 dBi

### FCC power setting

#### **Mode 802.11 a20:**

	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
Max. Conducted Power (dBm)	10.62	11.06	10.39
Max. EIRP power (dBm)	11.52	11.96	11.29
Measurement uncertainty (dB)	<±0.48		

#### **Mode 802.11 n20 (HT20):**

	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
Max. Conducted Power (dBm)	10.56	11.00	10.38
Max. EIRP power (dBm)	11.46	11.90	11.28
Measurement uncertainty (dB)	<±0.48		

**Mode 802.11 ac20 (VHT20):**

	Low Channel 36 (5180 MHz)	Middle Channel 40 (5200 MHz)	High Channel 48 (5240 MHz)
Max. Conducted Power (dBm)	10.58	11.01	10.39
Max. EIRP power (dBm)	11.48	11.91	11.29
Measurement uncertainty (dB)	<±0.48		

**Mode 802.11 n40 (HT40):**

	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
Max. Conducted Power (dBm)	10.75	10.47
Duty Cycle Correction Factor (dB)	0.10	
Max. Conducted Power Corrected (dBm)	10.85	10.57
Max. EIRP Power Corrected (dBm)	11.75	11.47
Measurement uncertainty (dB)	<±0.48	

**Mode 802.11 ac40 (VHT40):**

	Low Channel 38 (5190 MHz)	High Channel 46 (5230 MHz)
Max. Conducted Power (dBm)	10.76	10.46
Duty Cycle Correction Factor (dB)	0.10	
Max. Conducted Power Corrected (dBm)	10.86	10.56
Max. EIRP Power Corrected (dBm)	11.76	11.46
Measurement uncertainty (dB)	<±0.48	

**Mode 802.11 ac80 (VHT80):**

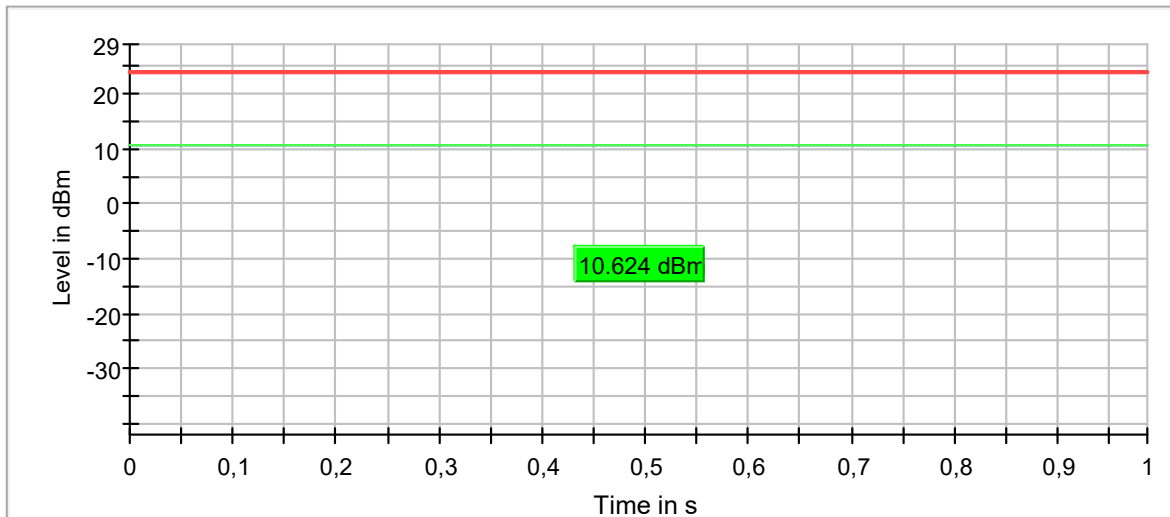
	Single Channel 42 (5210 MHz)
Max. Conducted Power (dBm)	10.75
Duty Cycle Correction Factor (dB)	0.21
Max. Conducted Power Corrected (dBm)	10.96
Max. EIRP Power Corrected (dBm)	11.86
Measurement uncertainty (dB)	<±0.48

Verdict: PASS

**Mode 802.11 a20:**

- Low Channel:

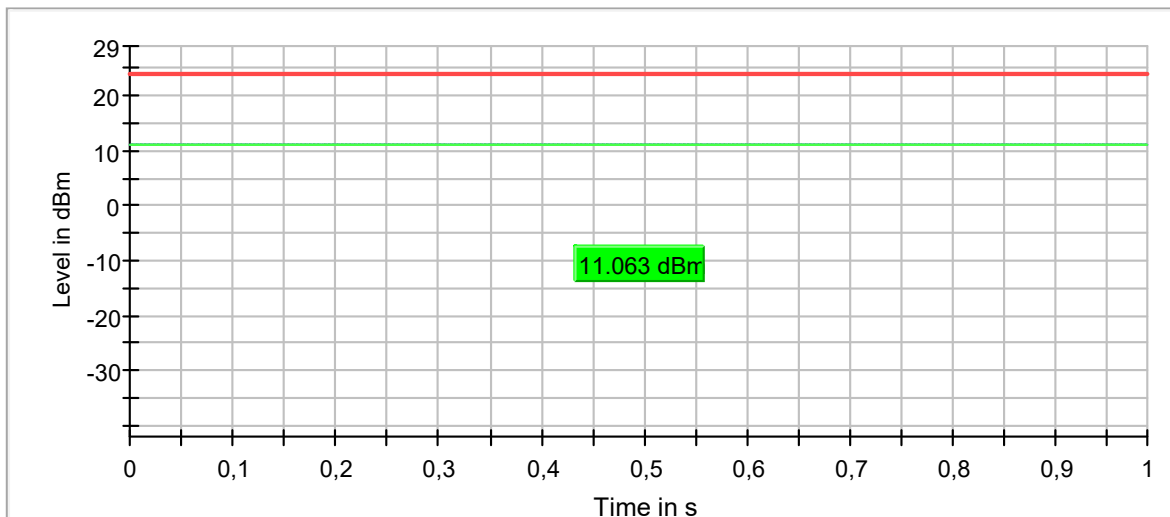
Gated Trace



— Gated Trace — Overall — Limit

- Middle Channel:

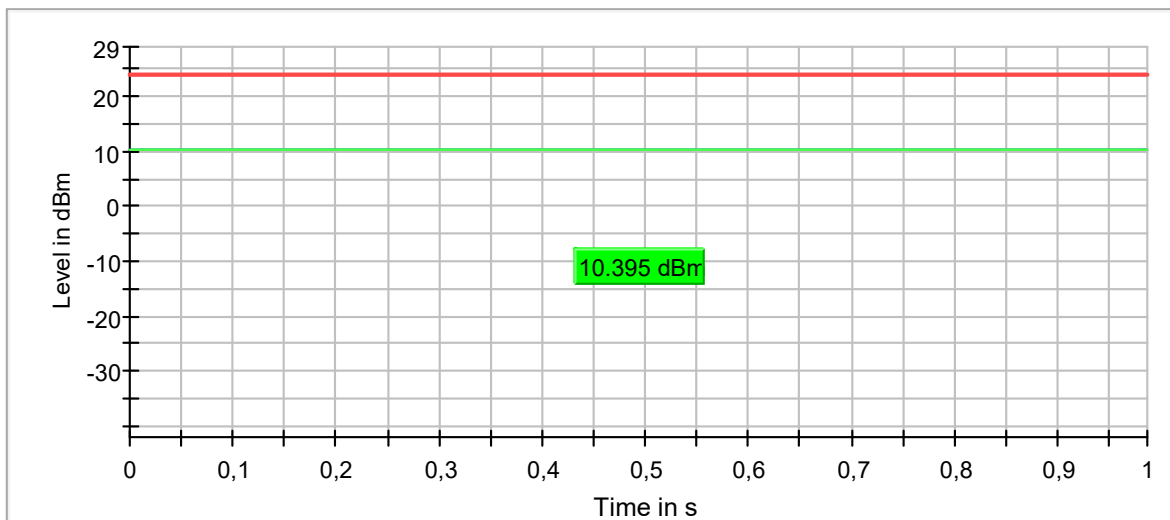
Gated Trace



— Gated Trace — Overall — Limit

- High Channel:

Gated Trace

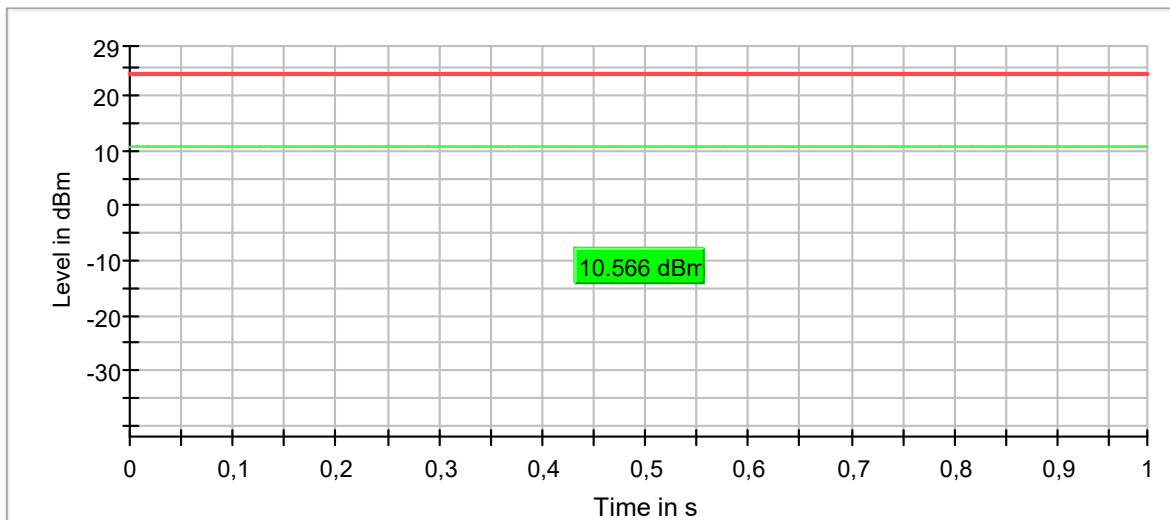


— Gated Trace — Overall — Limit

**Mode 802.11 n20 (HT20):**

- Low Channel:

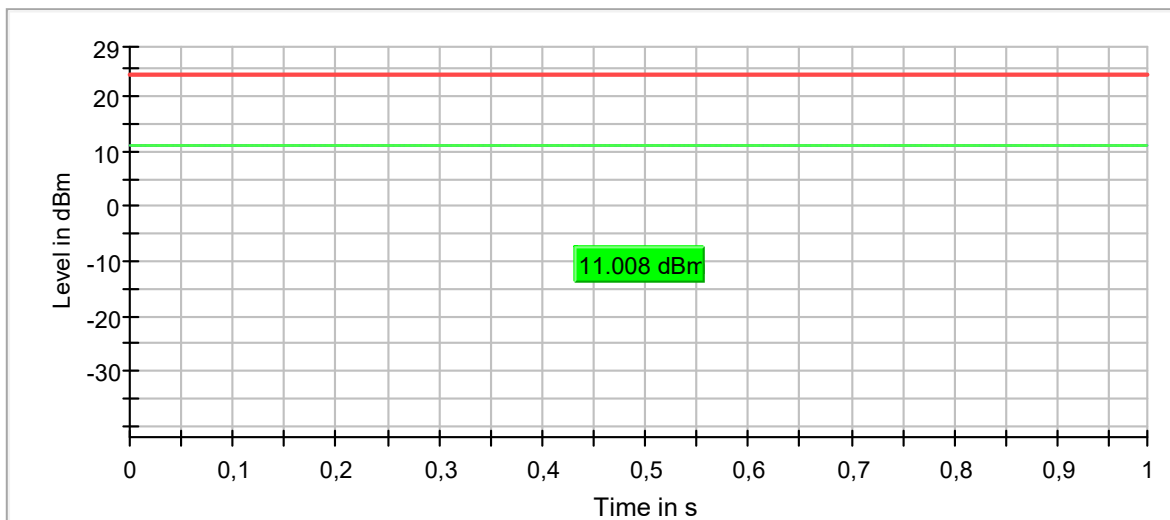
Gated Trace



— Gated Trace — Overall — Limit

- Middle Channel:

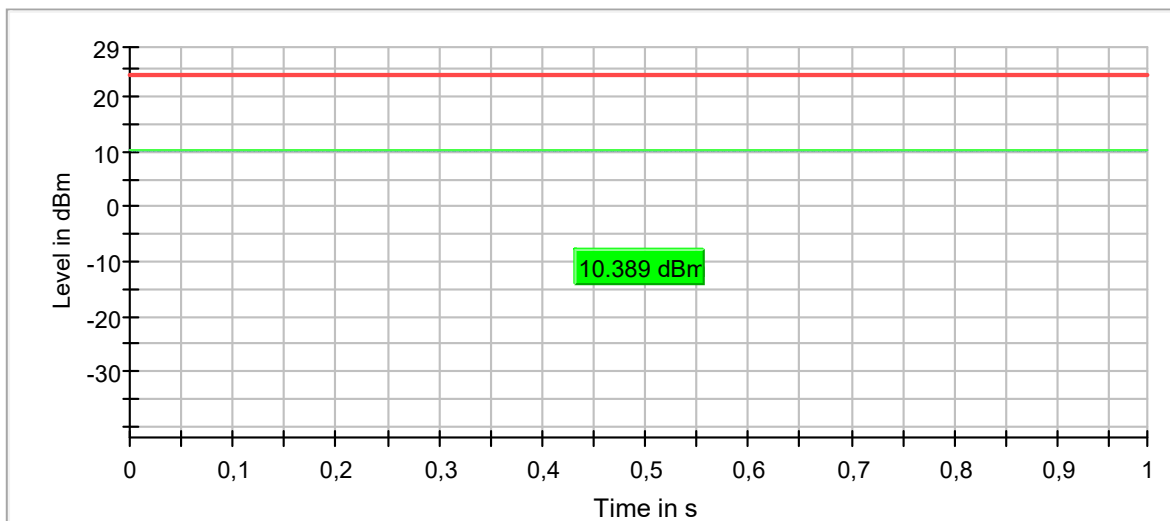
Gated Trace



— Gated Trace — Overall — Limit

- High Channel:

Gated Trace



— Gated Trace — Overall — Limit