

Radio Test Report

According to

**FCC part 15C,
RSS-247, RSS-Gen**

DUT Name: PAN9019A
Model No. : ENWF9511C1KF
Customer: Panasonic Industrial Devices Europe GmbH
Address: Zeppelinstr. 19, 21337 Lüneburg, Germany
Summary IN COMPLIANCE
Date of Reception: 27.11.2023
Date(s) of Test(s): 21.12.2023 – 15.01.2024

Tested by Test Engineer


Arto Kuosmanen

Approved by Technical Manager


Jukka Rauma

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Document Version History	Date of issue	Comments	Approved by
v0.1	8.3.2024	Initial version	
v1.0	27.3.2024	Approved version	Jukka Rauma

1. General Information

Test Engineer(s): Arto Kuosmanen, Pekka Pulkkinen

Location:

Test Firm Name	Eurofins Electric & Electronics Finland Oy (EEEF)
Test Site	Yrttipellontie, Peltola
Address of Test Site	Yrttipellontie 6, 90230 Oulu, Finland
FCC Designation number	FI0008
FCC site registration number	771880
ISED number	29576
CAB Identifier	T290

Customer: Panasonic Industrial Devices Europe GmbH
Zeppelinstr. 19, 21337 Lüneburg, Germany
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Climate Conditions: Temperature: 15 - 35 °C
Air pressure: 860 - 1060 hPa
Humidity: 30-60 rH%
These limits were not exceeded during testing.

2. Test Samples

General description:

The PAN9019 and PAN9019A are 2.4 GHz and 5 GHz ISM band Wi-Fi, Bluetooth, and 802.15.41 radio modules, which allow easy integration of Wi-Fi, Bluetooth, and 802.15.41 based technologies into various electronic devices.

Test sample (Conducted):

Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version
3938ER001	00000297	Panasonic	Wireless module	ENWF9511C1KF	03	01

Test sample (Radiated):

Sample number	Serial number	Manufacturer	DUT Type	Model	HW version	SW version
3938ER005	00000295	Panasonic	Wireless module + GW.51.5153	ENWF9511C1KF	03	01
3938ER004	00000327	Panasonic	Wireless module + 2JF1002P	ENWF9511C1KF	03	01
3938ER003	00000283	Panasonic	Wireless module + ANT162442 DT-2001A2	ENWF9511C1KF	03	01

Auxiliary equipment:

Sample number	Serial number	Manufacturer	DUT Type	Model	Description
3938ER006	na	Taoglas	Antenna	GW.51.5153	Tested with 3938ER005
3938ER005	#6	Embedded Artists	Host Board	EAK00393	MX8M Mini Developer's Kit V3 with GW.51.5153 antenna
3938ER004	#7	Embedded Artists	Host Board	EAK00393	MX8M Mini Developer's Kit V3 with 2JF1002P antenna
3938ER003	#8	Embedded Artists	Host Board	EAK00393	MX8M Mini Developer's Kit V3 with

Sample number	Serial number	Manufacturer	DUT Type	Model	Description
					ANT162442DT-2001A2 antenna
3938ER001	#5	Embedded Artists	Host Board	EAK00393	MX8M Mini Developer's Kit V3
3938ER007	na	Phihong Technology Co. Ltd.	Switching Power Supply	PSAA30R-120	
3938ER008	na	Phihong Technology Co. Ltd.	Switching Power Supply	PSAA30R-120	

Description	Information	
Additional model	ENWF9501C1KF, ENWF9511CMKF, ENWF9501CMKF, ENWF9511AMKF, ENWF9501AMKF	
Brand Names(s)	PAN9019, PAN9019A-M2E-EVD, PAN9019-M2E-EVD, PAN9019A-M2E-C-EVD, PAN9019-M2E-C-EVD	
PMN	PAN9019A	
HVIN	ENWF9511C1KF	
FVIN	n/a	
HMN	n/a	
FCC ID	T7V9019	
IC ID	216Q-9019	
Equipment type	Radio module	
Radio type	Transceiver	
- operating frequency range:	2400.0 MHz – 2483.5 MHz	
- Nominal Channel Bandwidth:	20 MHz, 40 MHz	
Radio technology / type of equipment	IEEE 802.11b/g/n/ax	
Modulation:	BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM, 1024-QAM	
Number of antennas	1	
Antenna 1	Type	Wi-Fi Terminal Mount Dipole Antenna
	Model	GW.51.5153
	Manufacturer	Taoglas
	Gain (dBi)	5.2 dBi
Antenna 2	Type	2.4/5.0/6.0 GHz WIFI 6E / WIFI 7 ISM Flexible ultra-thin PCB Adhesive Antenna
	Model	2JF1002P

	Manufacturer	2J Antennas
	Gain	4.2 dBi
Antenna 3	Type	TDK RF Ceramic Chip Antenna
	Model	ANT162442DT-2001A2
	Manufacturer	TDK
	Gain	2.1 dBi
Supply voltage	1.8/3.3VDC	
Type of Power source	AC/DC adapter	
Operating Temperature	TNom = 25°C	
Manufacturer	Panasonic Industrial Devices Europe GmbH Zeppelinstr. 19, 21337 Lüneburg, Germany	

3. Test mode output power

Test information	
Measurement method	ANSI C63.10 11.9, 14.3

Test procedure
1. EUT set to test mode 2. The peak power is measured with the wideband power sensor 3. The power is measured for the lowest data rate on all three channels 4. For the channel with the highest power the power is also measured for all data rates 5. The data rate with the highest output power is selected for test mode

Results

Results - DSSS			
Data rate [Mbps]	Power [dBm] Channel 2412 MHz	Power [dBm] Channel 2437 MHz	Power [dBm] Channel 2462 MHz
1	16,1	18,4	16,3
2	16,2	18,5	16,3
5	16	18,3	16,1
11	16,2	18,4	16,2

Results - OFDM			
Data rate [Mbps]	Power [dBm] Channel 2412 MHz	Power [dBm] Channel 2437 MHz	Power [dBm] Channel 2462 MHz
6	14,4	16,6	14,3
9	14,4	16,5	14,3
12	14,3	16,5	14,3
18	14,4	16,5	14,3
24	14,3	16,4	14,3
36	14,3	16,5	14,2
48	14,4	16,5	14,2
54	14,4	16,4	14,3

Results – HT20			
MCS	Power [dBm] Channel 2412 MHz	Power [dBm] Channel 2437 MHz	Power [dBm] Channel 2462 MHz
0	14,3	15,6	14,3
1	14,4	15,4	14,3
2	14,4	15,5	14,3
3	14,4	15,4	14,3
4	14,3	15,6	14,3
5	14,3	15,4	14,3
6	14,4	15,5	14,3

7	14,3	15,4	14,3
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Results – HT40			
MCS	Power [dBm] Channel 2422 MHz	Power [dBm] Channel 2437 MHz	Power [dBm] Channel 2452 MHz
0	13,2	14,4	13,3
1	13,3	14,3	13,2
2	13,3	14,4	13,2
3	13,3	14,4	13,3
4	13,2	14,2	13,3
5	13,3	14,3	13,2
6	13,3	14,3	13,2
7	13,3	14,2	13,1

Results – HE-SU 20			
MCS	Power [dBm] Channel 2412 MHz	Power [dBm] Channel 2437 MHz	Power [dBm] Channel 2462 MHz
0	14,6	15,8	14,6
1	14,6	15,7	14,6
2	14,6	15,8	14,5
3	14,6	15,6	14,5
4	14,6	15,8	14,5
5	14,6	15,7	14,5
6	14,5	15,7	14,5
7	14,5	15,6	14,5
8	12,4	13,6	12,5
9	12,4	13,5	12,4
10	9,3	10,5	9,4
11	9,4	10,6	9,4

Results – HE-SU 40			
MCS	Power [dBm] Channel 2422 MHz	Power [dBm] Channel 2437 MHz	Power [dBm] Channel 2452 MHz
0	13,6	14,7	13,5
1	13,5	14,6	13,5
2	13,5	14,7	13,6
3	13,6	14,7	13,7
4	13,5	14,6	13,6
5	13,5	14,7	13,6
6	12,8	14,7	13,6
7	13,6	14,5	13,5
8	9,5	10,7	9,6
9	9,6	10,7	9,5
10	9,4	10,6	9,5
11	9,4	10,6	9,4

Results – HE-TB 20 full RU			
MCS	Power [dBm] Channel 2412 MHz	Power [dBm] Channel 2437 MHz	Power [dBm] Channel 2462 MHz
0	9,4	9,6	9,5
1	9,3	9,5	9,4
2	9,4	9,5	9,4
3	9,4	9,4	9,4
4	9,3	9,4	9,3
5	9,4	9,5	9,4
6	9,4	9,6	9,5
7	9,2	9,3	9,4
8	9,4	9,4	9,4
9	9,4	9,4	9,4
10	9,4	9,3	9,3
11	9,3	9,3	9,3

Results – HE-TB 40 full RU			
MCS	Power [dBm] Channel 2422 MHz	Power [dBm] Channel 2437 MHz	Power [dBm] Channel 2452 MHz
0	9,6	9,7	9,6
1	9,5	9,5	9,5
2	9,5	9,5	9,5
3	9,4	9,4	9,4
4	9,4	9,4	9,4
5	9,5	9,5	9,4
6	9,6	9,5	9,6
7	9,3	9,3	9,3
8	9,4	9,4	9,4
9	9,4	9,4	9,4
10	9,3	9,5	9,4
11	9,4	9,3	9,3

4. Test mode duty cycle

Test information	
Measurement method	ANSI C63.10 11.6

Requirements	
Duty cycle	Duty cycle correction
≥ 98%	No correction required
< 98 %	Correction required ($10 \times \log_{10} (1/DC)$)

Test procedure
1. EUT set to test mode 2. Sweep time is set to long enough to capture at least 5 bursts 3. The maximum burst duration TON is measured 4. The minimum idle duration TOFF is measured 5. The duty cycle correction is calculated by $DC = -10 \times \log_{10} (T_{ON} / (T_{ON} + T_{OFF}))$

Results

Duty Cycle results		
Mode	Duty cycle	Correction Factor [dB]
BPSK	99.68%	0
OFDM	97.69%	0,1
HT20	97.65%	0,1
HT40	93.96%	0,3
HE-SU20	97.46%	0,1
HE-SU40	97.45%	0,1
HE-TB20	96.93%	0,1
HE-TB40	96.93%	0,1

5. Configuration and Operation Modes

Conducted tests:

Test modes	Description
IEEE 802.11b	Mode = Transmit Modulation = BPSK Spreading = DSSS Bandwidth = 20 MHz Duty cycle = 99.68% Power setting = Maximum Data rate = 2 Mbps (2412 MHz) Data rate = 2 Mbps (2437 MHz) Data rate = 2 Mbps (2462 MHz)
IEEE 802.11g	Mode = Transmit Modulation = OFDM Bandwidth = 20 MHz Duty cycle = 97.69% Power setting = Maximum Data rate = 6 Mbps (2412 MHz) Data rate = 6 Mbps (2437 MHz) Data rate = 6 Mbps (2462 MHz)
IEEE 802.11n, HT20	Mode = Transmit Modulation = OFDM Bandwidth = 20 MHz Duty cycle = 97.65% Power setting = Maximum Data rate = MCS 0 (2412 MHz) Data rate = MCS 0 (2437 MHz) Data rate = MCS 0 (2462 MHz)
IEEE 802.11n, HT40	Mode = Transmit Modulation = OFDM Bandwidth = 40 MHz Duty cycle = 93.96% Power setting = Maximum Data rate = MCS 0 (2412 MHz) Data rate = MCS 0 (2437 MHz) Data rate = MCS 0 (2462 MHz)
IEEE 802.11ax HE-SU, HT20	Mode = Transmit Modulation = OFDMA Bandwidth = 20 MHz Duty cycle = 97.46% Power setting = Maximum Data rate = MCS 0 (2412 MHz) Data rate = MCS 0 (2437 MHz) Data rate = MCS 0 (2462 MHz)
IEEE 802.1ax HE-SU, HT40	Mode = Transmit Modulation = OFDMA Bandwidth = 40 MHz

	Duty cycle = 97.45% Power setting = Maximum Data rate = MCS 0 (2412 MHz) Data rate = MCS 0 (2437 MHz) Data rate = MCS 0 (2462 MHz)
IEEE 802.11ax HE-TB full RU, HT20	Mode = Transmit Modulation = OFDMA Bandwidth = 20 MHz Duty cycle = 96.93% Power setting = Maximum Data rate = MCS 0 (2412 MHz) Data rate = MCS 0 (2437 MHz) Data rate = MCS 0 (2462 MHz)
IEEE 802.11 ax HE-TB full RU, HT40	Mode = Transmit Modulation = OFDMA Bandwidth = 40 MHz Duty cycle = 96.93% Power setting = Maximum Data rate = MCS 0 (2412 MHz) Data rate = MCS 0 (2437 MHz) Data rate = MCS 0 (2462 MHz)
Receive	Mode = receive 802.11g, middle channel 6
Comment: The above settings were found as worst case during pre-tests. Conducted peak / average output power was evaluated to determine the worst case settings.	

Test/configuration software

Manufacturer	Name	Version
Panasonic Industry	Web server application	

6. Test equipment

Conducted RF tests

R&S TS8997 Test System equipment list:

Equipment	Certification-No.	Calibration Date	Next calibration
SMW200A	1035089-D-K-15195-01-00-2022-03	26.06.2023	25.06.2026
SMB100A	1041326-D-K-15195-01-00-2022-03	26.06.2023	25.06.2026
OSP-B157WX+OSP220	300642762-D-K-15195-01-00-2022-03	26.06.2023	25.06.2024
OSP-B157W8plus+OSP150	300639878-D-K-15195-01-00-2022-03	26.06.2023	25.06.2024
ESW	1039208-D-K-15195-01-00-2022-03	05.07.2023	04.07.2024
CMW500	300693633-D-K-15195-01-00-2023-04	25.04.2023	24.04.2024

Radiated emission

New ID	Manufacturer	Equipment type	Description	Serial	Calibration information	Next calibration
G4C265	Rohde & Schwarz	ESW26	EMI test receiver	101324	29.6.2023	29.6.2024
G4C273	Frankonia	ALX-4000E	Broadband Antenna, 25MHz-4GHz with 6dB (50-A-MFN-06) att.	00816+1531	22.1.2024	22.1.2027
G4C292	Rohde & Schwarz	TS-LNA 1840	RF Preamplifier 18 to 40 GHz	100841	9.6.2022	9.6.2024
G4C469	Rohde & Schwarz	TS_PRE2	RF Preamplifier	101541	9.6.2022	9.6.2024
G4C294	Rohde & Schwarz	Antenna	Horn Antenna -> 40GHz	101067	4.11.2022	4.11.2025
G4C576	Rohde & Schwarz	HF907	Double-Ridged Waveguide Horn Antenna 800MHz-18GHz	100163	9.8.2022	9.8.2025

Test software

Description	Manufacturer	Name	Version
EMC Software	Rohde & Schwarz	EMC32	10.60.20
RF Software	Rohde & Schwarz	WMS32	11.60.00

7. Uncertainties

Description	Expanded Uncertainty (k=2)
RF Output Power	0,99
Peak Power	0,80
Power Spectral Density	0,99
Accumulated Transmit Time	0,01%
Minimum Frequency Occupation Time	0,01%
Hopping Frequency Separation	0,60%
Occupied Channel Bandwidth	2,08 %
Out-of-band emissions	0,89
Transmitter unwanted emissions in the spurious domain	1,76
AC conducted emission	2,24
Radiated emission ≤ 1 GHz	4,62
Radiated emission > 1 GHz	5,72

8. Sample emission level calculation

The following is a description of term and a sample calculation, as appears in the radiated emissions data table. The numbers used in the calculation are for example only. There is no direct correlation to the specific data taken for the product described in this document:

Reading:

This is the reading obtained on the spectrum analyzer in dBuV.

A.F.:

This is the antenna factor for the receiving antenna. It is a conversion factor, which converts electric fields strength to voltages, which can be measured directly on the spectrum analyzer. It is treated as a loss in dB. RF path losses, including RF cables and preamplifiers, have been included with the A.F to simplify the calculations. The antenna factor is used in calculations as follows:

$$\text{Reading on Analyzer (dBuV)} + \text{A.F. (dB/m)} = \text{Net field strength (dBuV/m)}$$

Net:

This is the net field strength measurement (as shown above).

Limit:

This is the FCC Class B radiated emission limit (in units of dBuV/m). The FCC limits are given in units of uV/m. The following formula is used to convert the units of uV/m to dbuV/m:

$$\text{Limit (dBuV/m)} = 20 * \log(\text{uV/m})$$

Margin :

This is the margin of compliance below the FCC limit. The units are given in dB. A negative margin indicates the emission was below the limit. A positive margin indicates that the emission exceeds the limit.

Example only:

Reading + AF	= Net Reading :	Net reading – FCC limit	= Margin
+ 21.5 dBuV + 26 dB/m	= 47.5 dBuV/m :	47.5 dBuV/m – 57.0 dBuV/m	= -9.5 dB

9. Test conditions

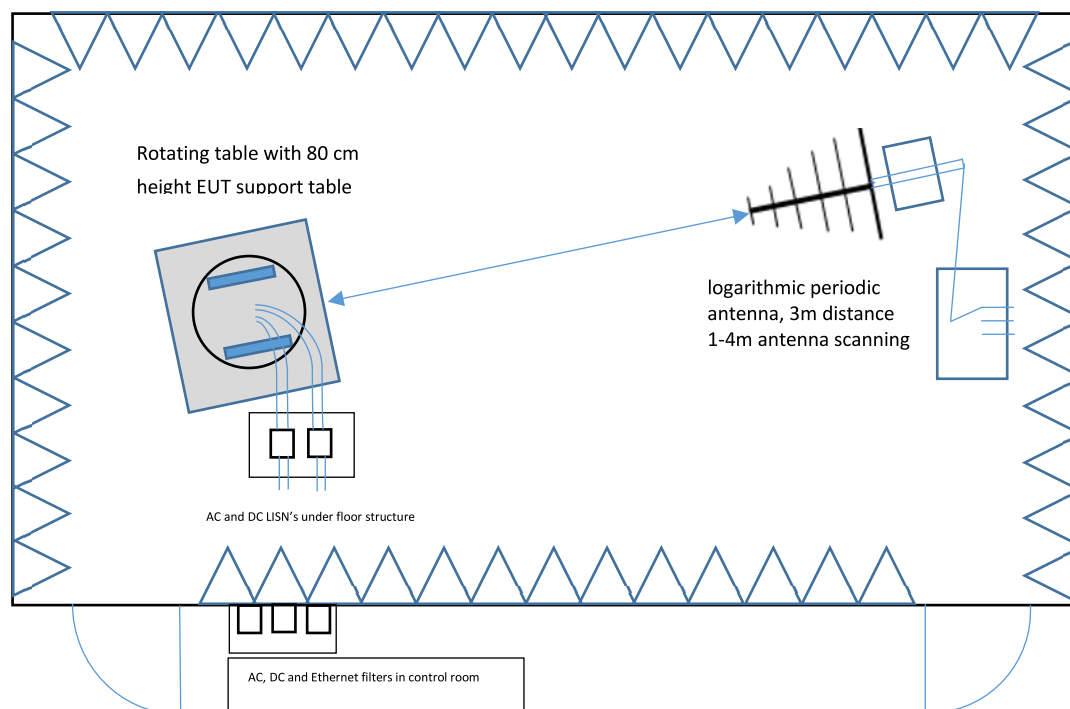
All radiated tests were performed in a semi-anechoic chamber, where the measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz, 1 GHz-18 GHz Double-ridged horn antenna and 18 GHz-40 GHz horn antenna) is located at a distance of 3 m.

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 (all antennas) was varied from 1 to 4 meters to find the maximum radiated emission.

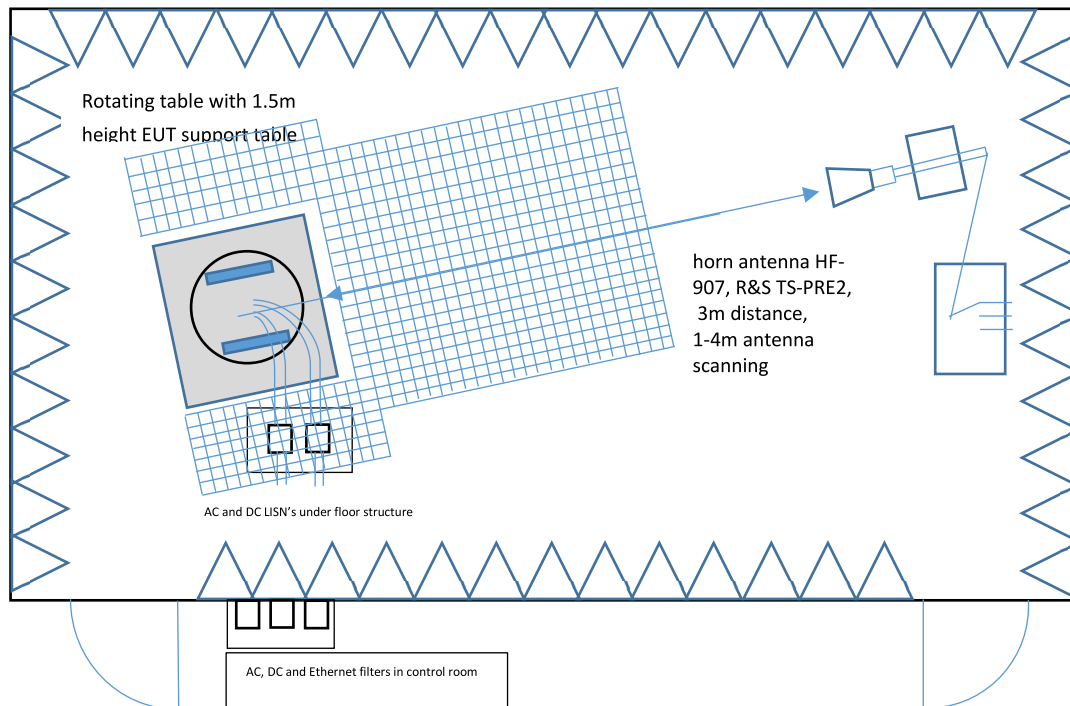
Measurements were made in both horizontal and vertical planes of polarization.

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.

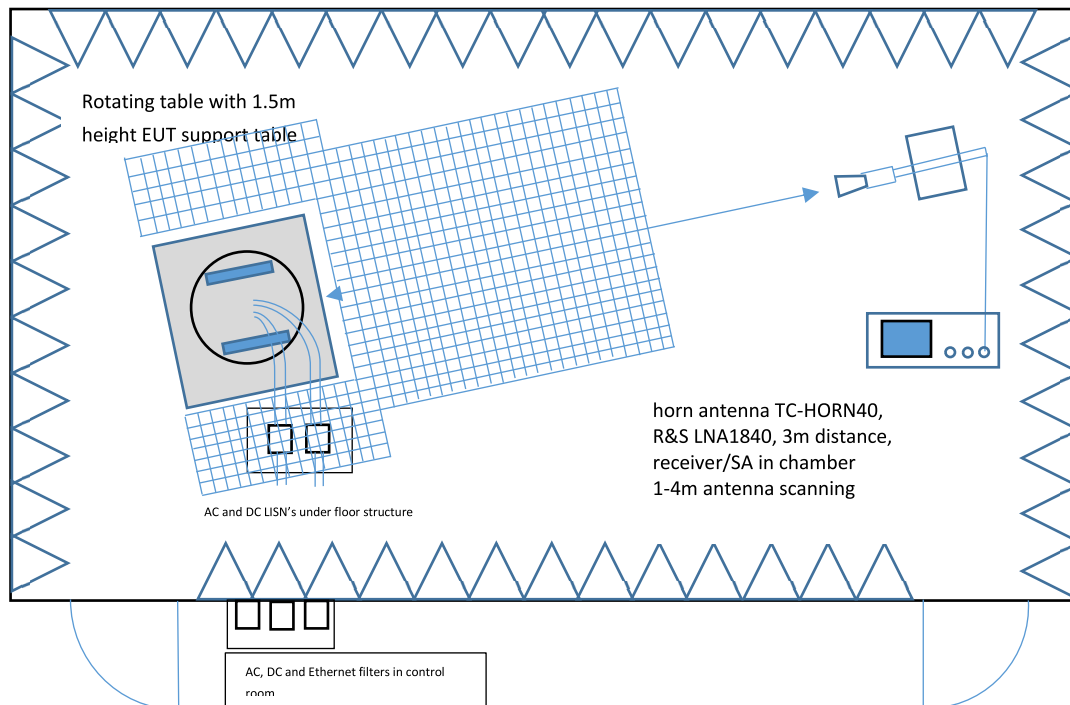
Radiated measurements setup from 30 MHz to 1 GHz:



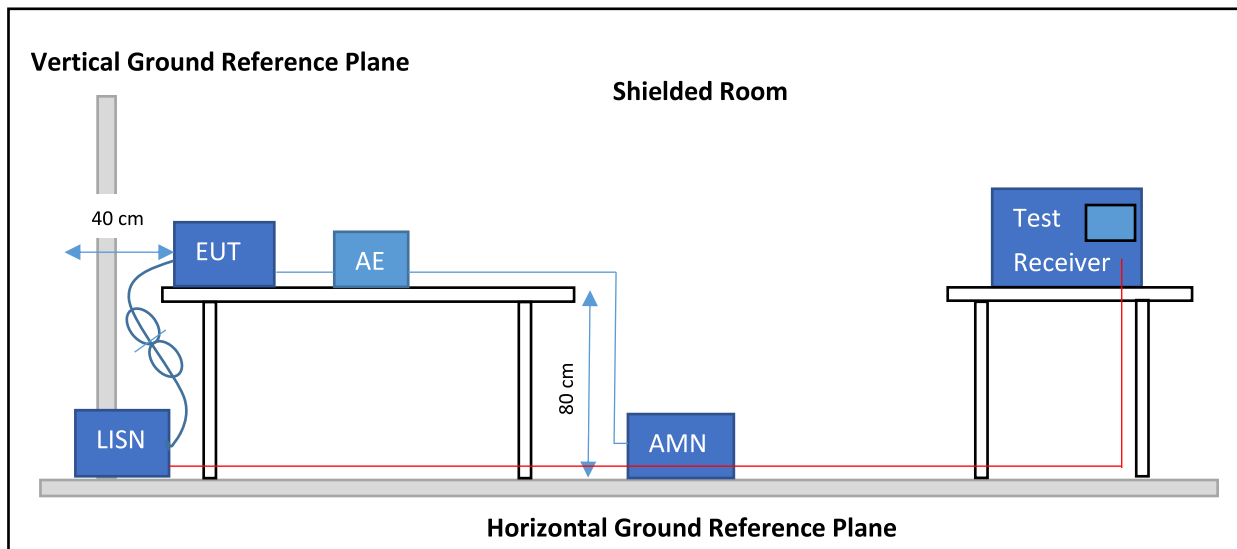
Radiated measurements setup from 1 GHz to 18 GHz:



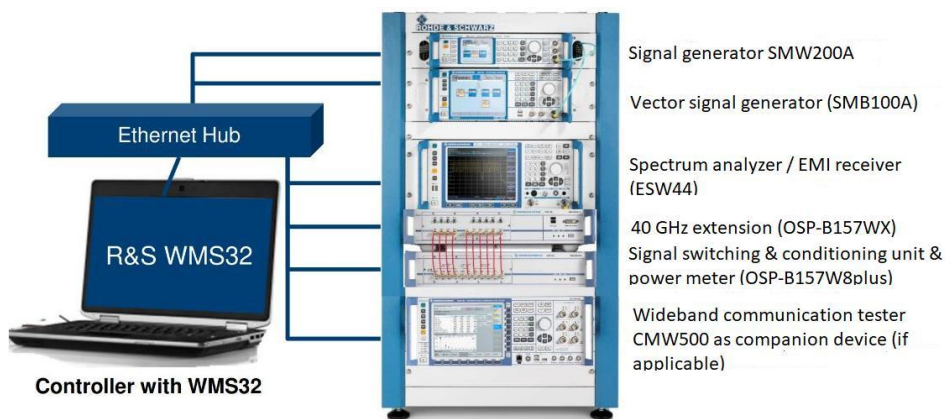
Radiated measurements setup from 18 GHz to 26 / 40 GHz:



Conducted emission setup



Conducted RF measurement system:



10. Summary

FCC/ISED Requirement (15.247 / RSS-247)		Reference method	Result	Remark
Occupied Bandwidth	ISED RSS-Gen, Issue 5 A2 (section 6.7)	ANSI C63.10-2013	PASS	
6 dB Bandwidth	FCC § 15.247(a)(2) / RSS-247, Issue 3 (section 5.2)	ANSI C63.10-2013	PASS	
Number of hopping sequences	FCC § 15.247(a)(1)(iii) / RSS-247, Issue 3 (section 5.1)	ANSI C63.10-2013	N/A	
Frequency hopping channel separation	FCC § 15.247(a)(1) / RSS-247, Issue 3 (section 5.1)	ANSI C63.10-2013	N/A	
Time of occupancy (Dwell time)	FCC § 15.247(a)(1)(iii) / RSS-247, Issue 3 (section 5.1)	ANSI C63.10-2013	N/A	
Maximum peak conducted power	FCC § 15.247(b) / RSS-247, Issue 3 (section 5.4 (d))	ANSI C63.10-2013	PASS	
Power spectral density	FCC § 15.247(e) / RSS-247, Issue 3 (section 5.2)	ANSI C63.10-2013	PASS	
AC power line conducted emissions	FCC § 15.207 / RSS-247, Issue 3 (section 3.1)	ANSI C63.10-2013	PASS	
Band edge compliance	FCC § 15.247(d) / RSS-247, Issue 3 (section 5.5)	ANSI C63.10-2013	PASS	
Conducted spurious emissions	FCC § 15.247(d) / RSS-247, Issue 3 (section 5.5)	ANSI C63.10-2013	PASS	
Emissions in restricted frequency bands	FCC § 15.247(d) / RSS-247, Issue 3 (section 6.2)	ANSI C63.10-2013	PASS	
Transmitter radiated spurious emissions	FCC § 15.247(d), FCC § 15.209 / RSS-Gen, Issue 5 A2 (section 6.13)	ANSI C63.10-2013	PASS	
Optional antenna spot check results	FCC § 15.247(d), FCC § 15.209 / ISED RSS-Gen Issue 5 A2 (section 6.13)	ANSI C63.10-2013	PASS	
Receiver radiated spurious emissions	ISED RSS-247, Issue 3 (section 3.1)	ANSI C63.4-2014	PASS	
Possible test case verdicts: PASS = Tested device meets the requirements FAIL = Tested device does not meet the requirements N/A = Test requirement not applicable for tested device N/T = Test requirement applicable for tested device, but not tested				
Applicable FCC KDB(s): KDB 558074 DO1: DTS measurement guidance v 0502 (Apr 2, 2019)				

11. Occupied bandwidth

Reference: ISED RSS-Gen, Issue 5 A2 (section 6.7)

Test method: ANSI C63.10 (6.9.3)

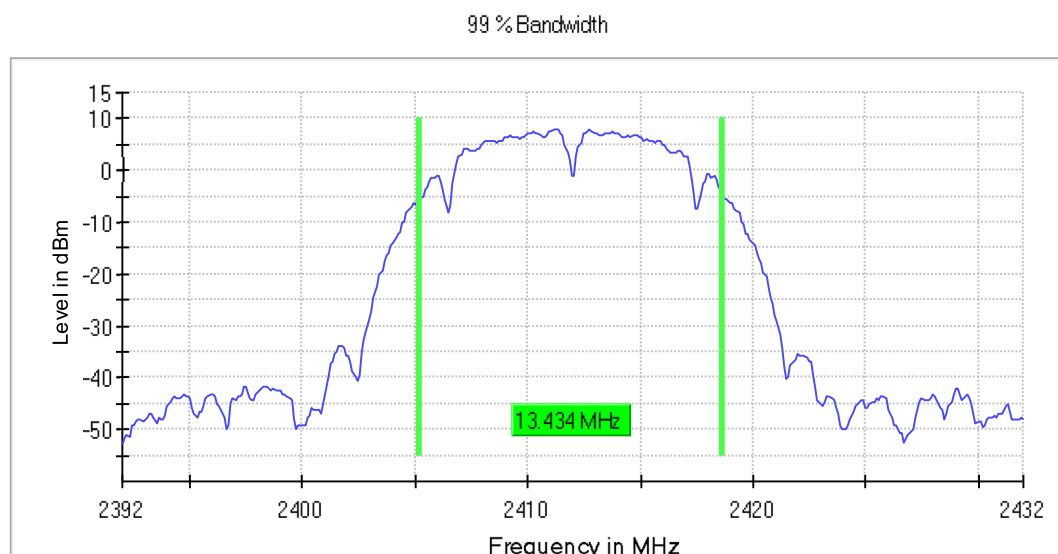
Limits
None (Informational only)

Procedure
1. EUT transmitter is activated in test mode under normal conditions 2. Spectrum analyzer is set to peak detection and maximum hold with a span twice the emission spectrum 3. The resolution bandwidth is set to the range of 1% to 5% of the occupied bandwidth 4. The occupied bandwidth is measured with the build-in analyzer function

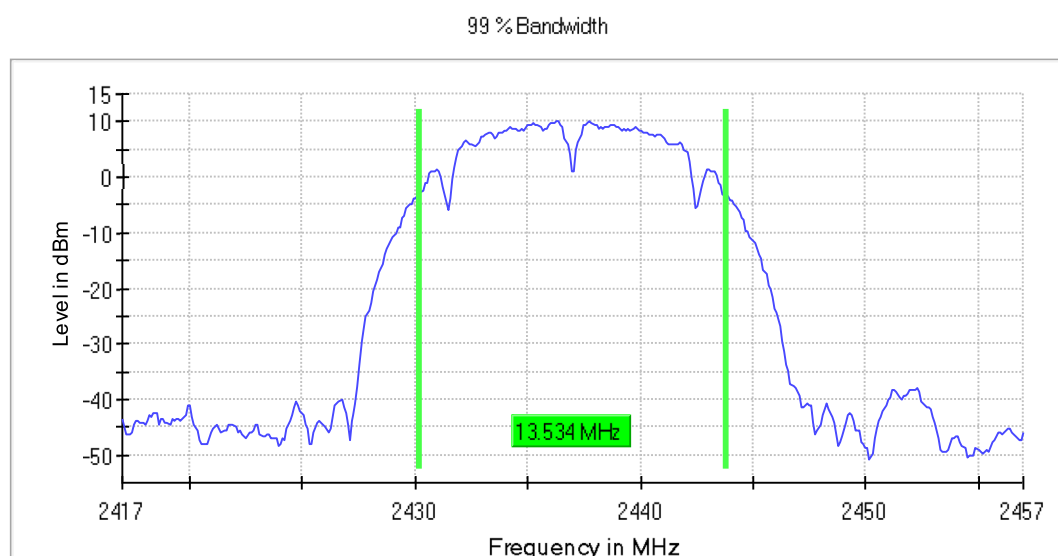
Summary:

Summary		
Mode / modulation	Frequency (MHz)	Bandwidth (MHz)
WLAN 802.11b, BW 20MHz, 2 Mbps	2412	13.433584
WLAN 802.11b, BW 20MHz, 2 Mbps	2437	13.533834
WLAN 802.11b, BW 20MHz, 2 Mbps	2462	13.533834
WLAN 802.11g, BW 20MHz, 6 Mbps	2412	16.541354
WLAN 802.11g, BW 20MHz, 6 Mbps	2437	16.641604
WLAN 802.11g, BW 20MHz, 6 Mbps	2462	16.541354
WLAN 802.11n, BW 20MHz, MCS0	2412	17.744360
WLAN 802.11n, BW 20MHz, MCS0	2437	17.744360
WLAN 802.11n, BW 20MHz, MCS0	2462	17.744360
WLAN 802.11ax HE-SU, BW 20MHz, MCS0	2412	18.847118
WLAN 802.11ax HE-SU, BW 20MHz, MCS0	2437	18.947368
WLAN 802.11ax HE-SU, BW 20MHz, MCS0	2462	18.847118
WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0	2412	18.847118
WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0	2437	18.847118
WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0	2462	19.248120
WLAN 802.11n, BW 40MHz, MCS5	2422	36.363636
WLAN 802.11n, BW 40MHz, MCS5	2437	36.363636
WLAN 802.11n, BW 40MHz, MCS5	2452	36.363636
WLAN 802.11ax HE-SU, BW 40MHz, MCS0	2422	37.868338
WLAN 802.11ax HE-SU, BW 40MHz, MCS0	2437	37.868338
WLAN 802.11ax HE-SU, BW 40MHz, MCS0	2452	37.868338
WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0	2422	37.868338
WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0	2437	37.868338
WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0	2452	37.868338

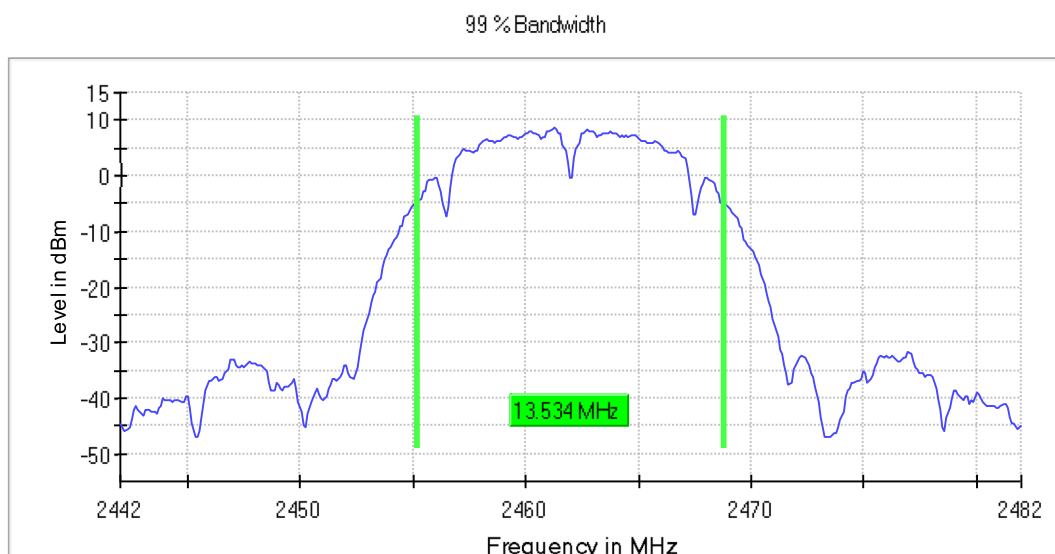
Occupied bandwidth, low channel WLAN 802.11b, BW 20MHz, 2 Mbps



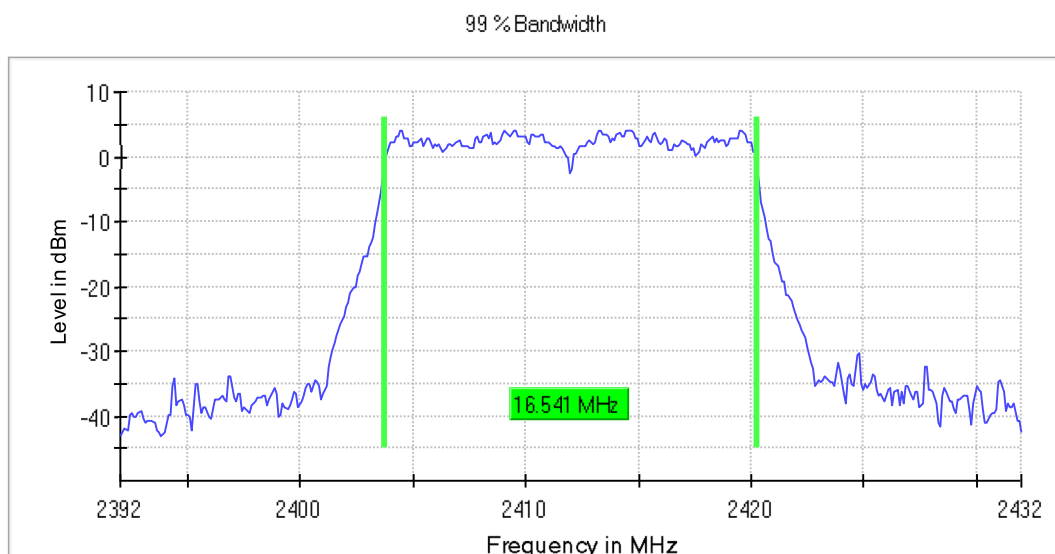
Occupied bandwidth, middle channel WLAN 802.11b, BW 20MHz, 2 Mbps



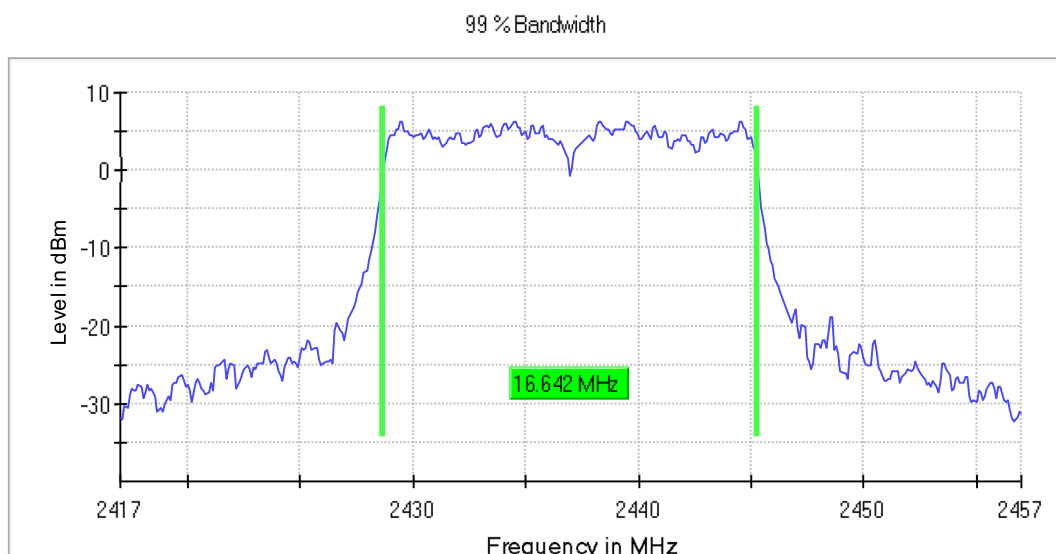
Occupied bandwidth, high channel WLAN 802.11b, BW 20MHz, 2 Mbps



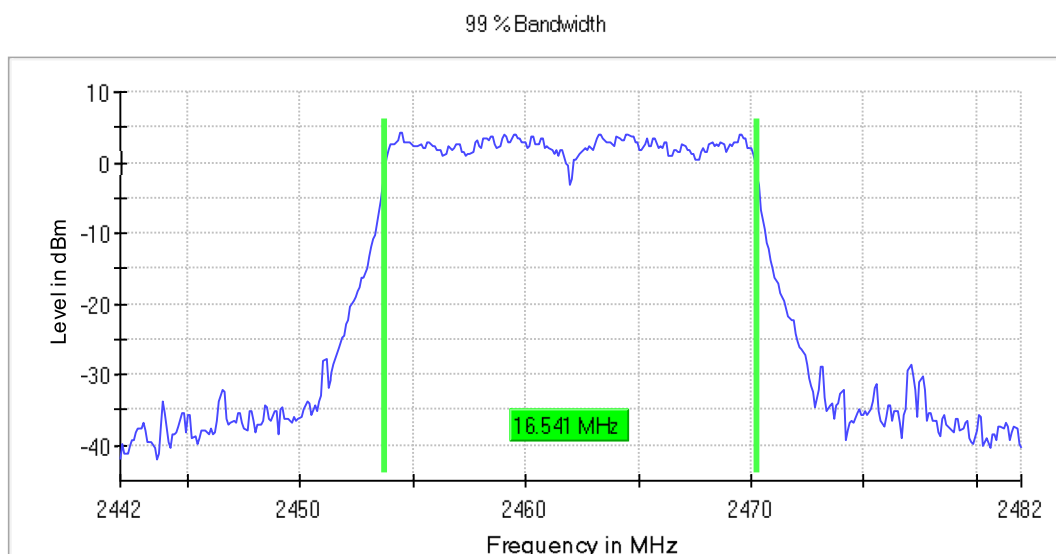
Occupied bandwidth, low channel WLAN 802.11g, BW 20MHz, 6 Mbps



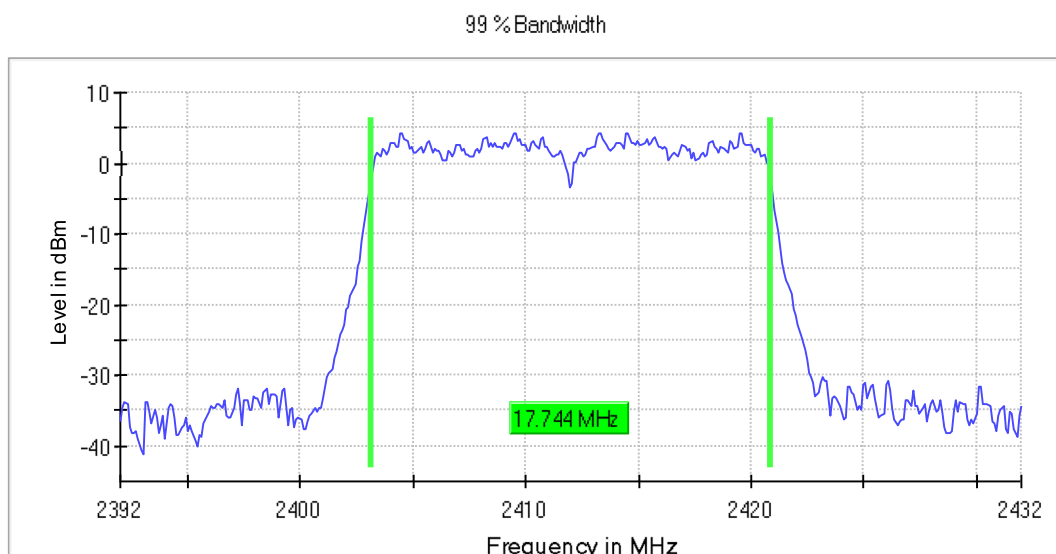
Occupied bandwidth, middle channel WLAN 802.11g, BW 20MHz, 6 Mbps



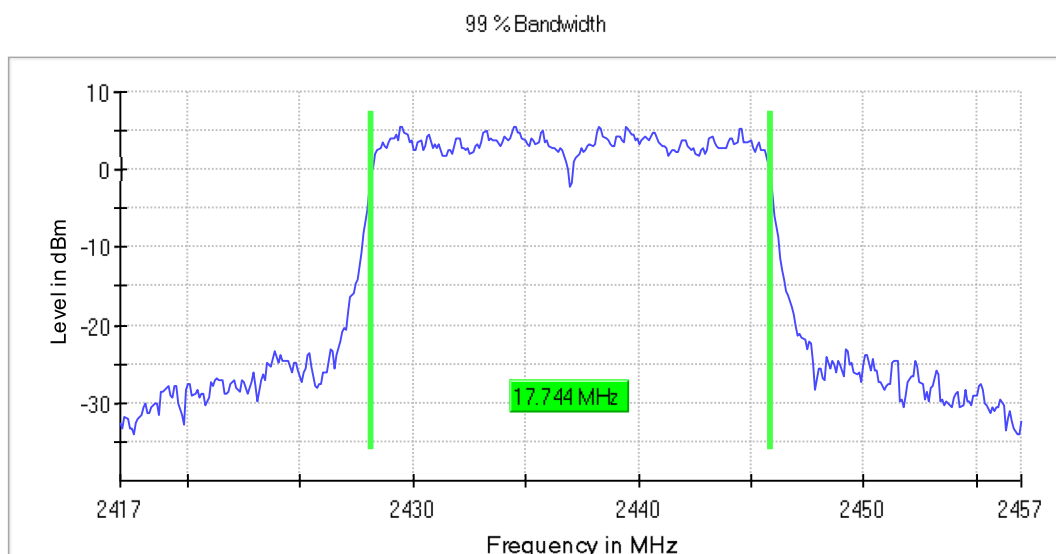
Occupied bandwidth, high channel WLAN 802.11g BW 20MHz, 6 Mbps



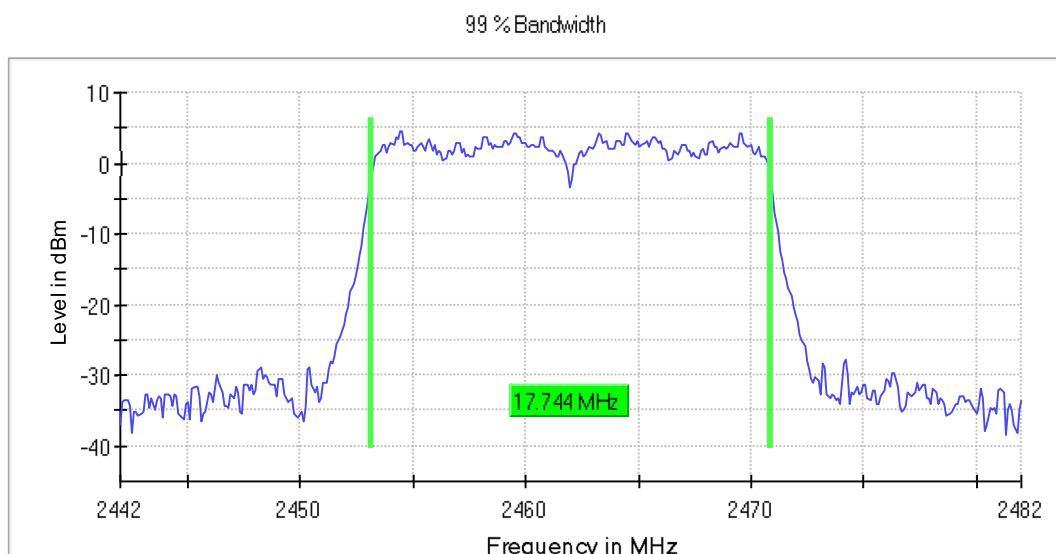
Occupied bandwidth, low channel WLAN 802.11n, BW 20MHz, MCS0



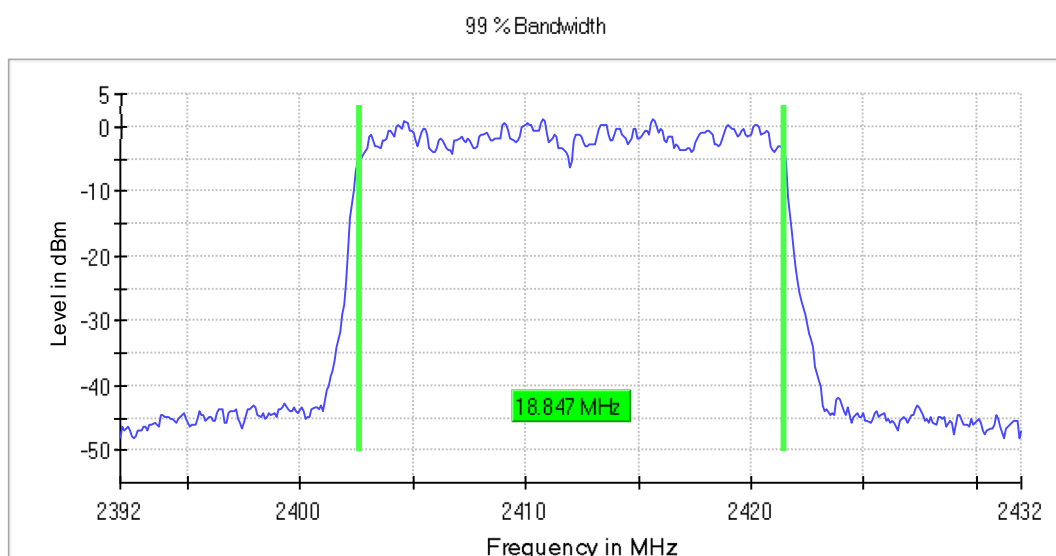
Occupied bandwidth, middle channel WLAN 802.11n, BW 20MHz, MCS0



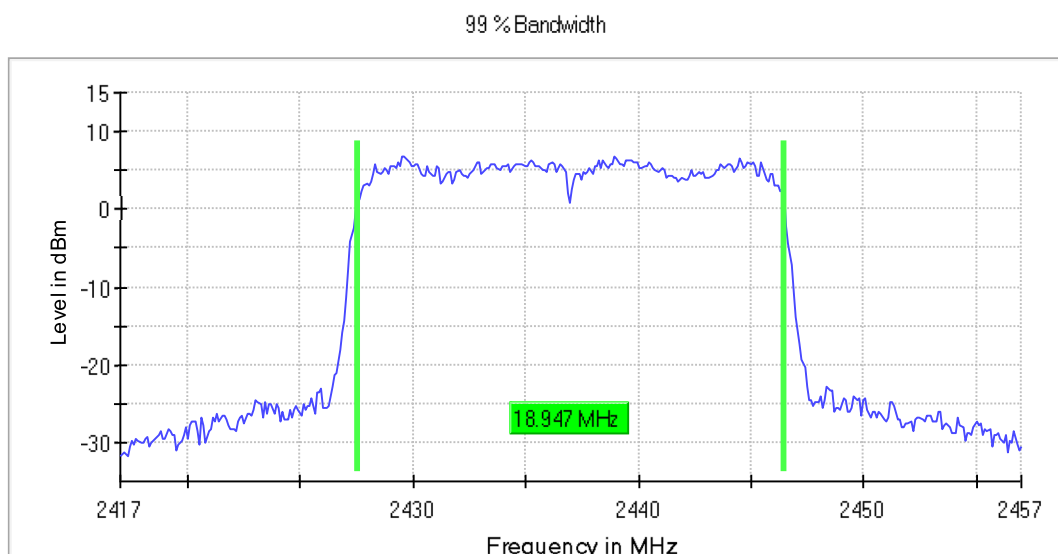
Occupied bandwidth, high channel WLAN 802.11n, BW 20MHz, MCS0



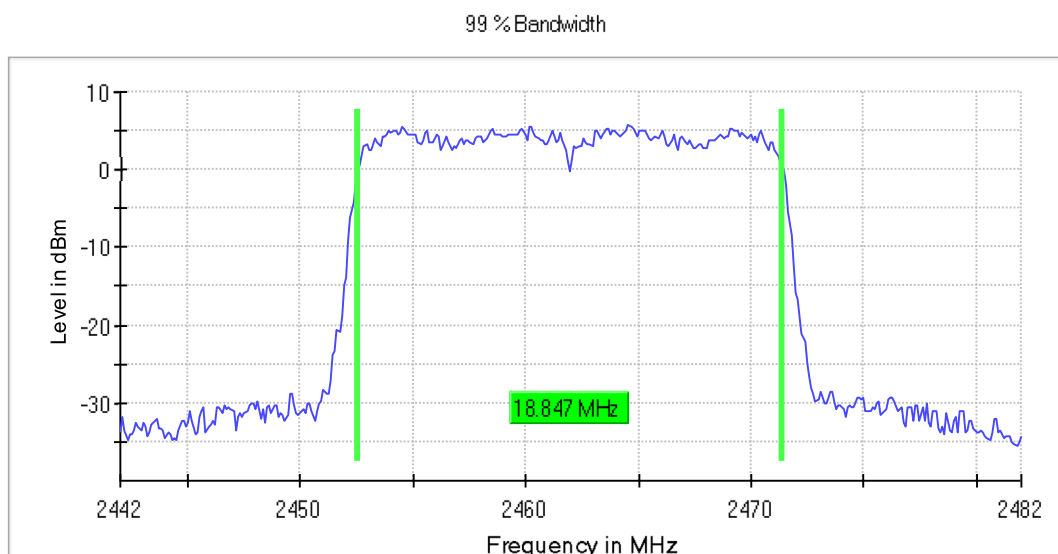
Occupied bandwidth, low channel WLAN 802.11ax HE-SU, BW 20MHz, MCS0



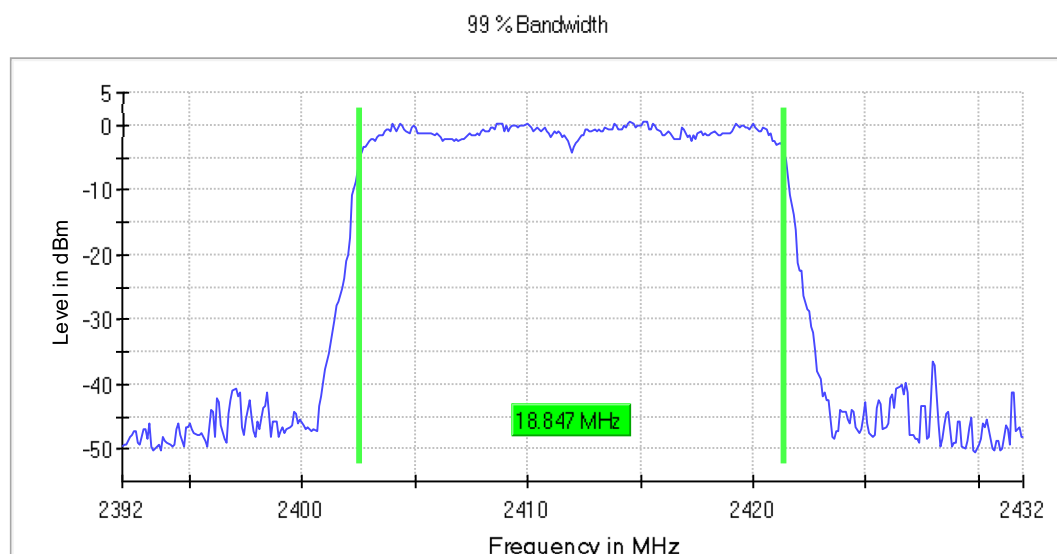
Occupied bandwidth, middle channel WLAN 802.11ax HE-SU, BW 20MHz, MCS0



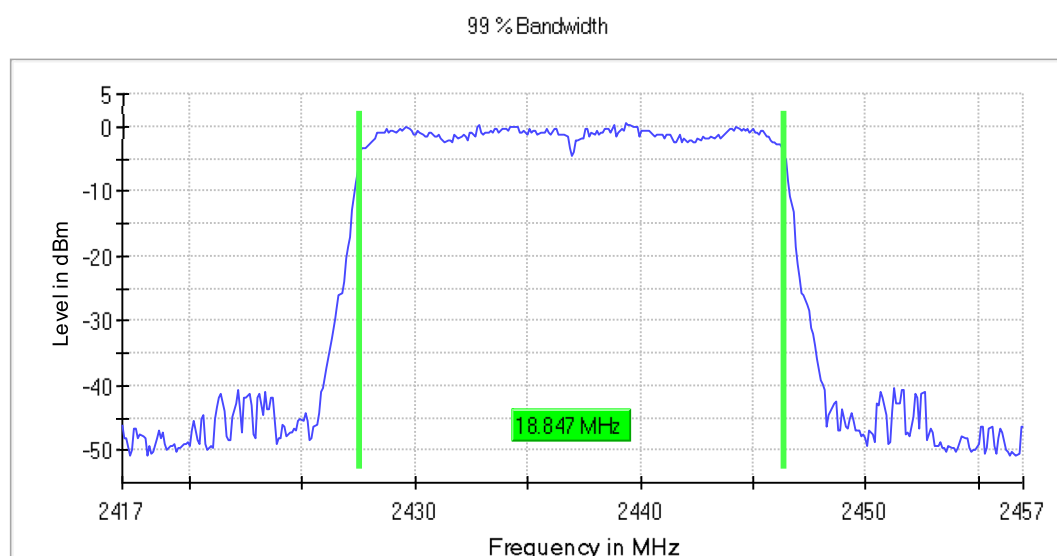
Occupied bandwidth, high channel WLAN 802.11ax HE-SU, BW 20MHz, MCS0



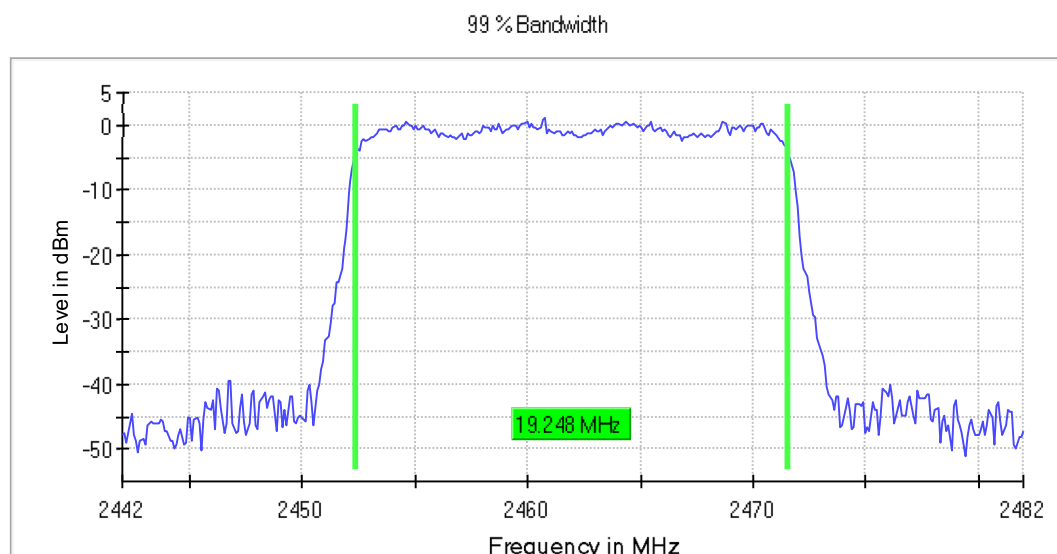
Occupied bandwidth, low channel WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0



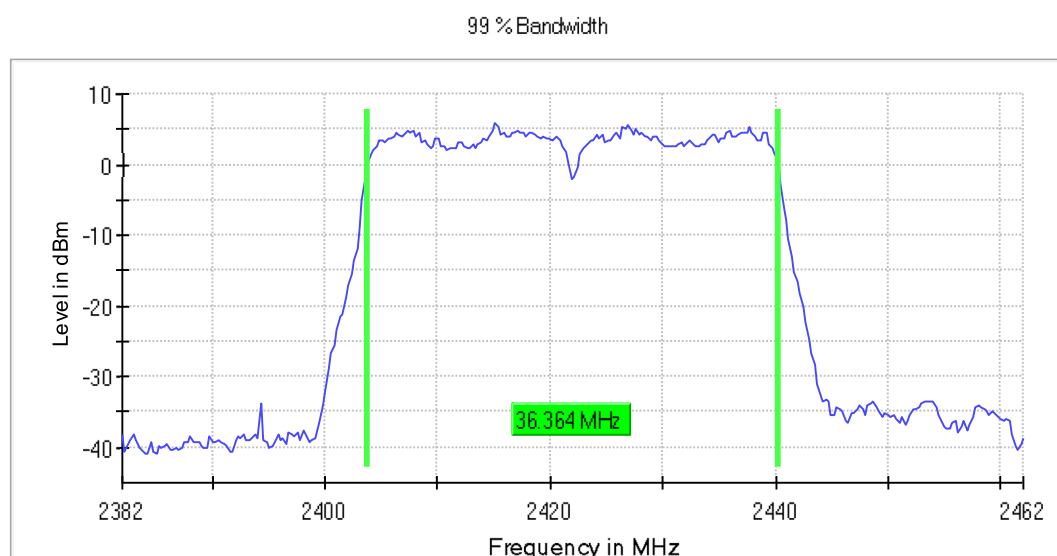
Occupied bandwidth, middle channel WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0



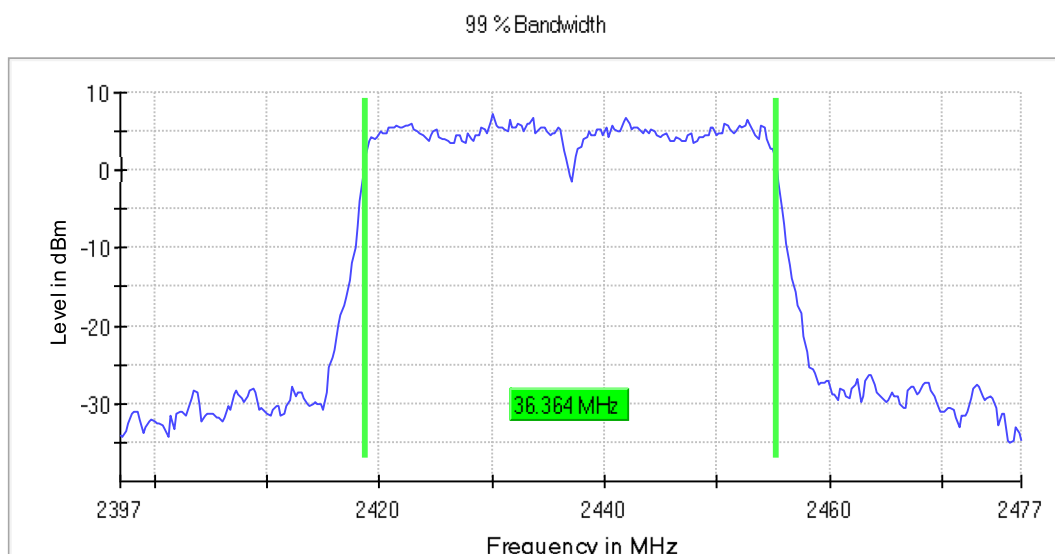
Occupied bandwidth, high channel WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0



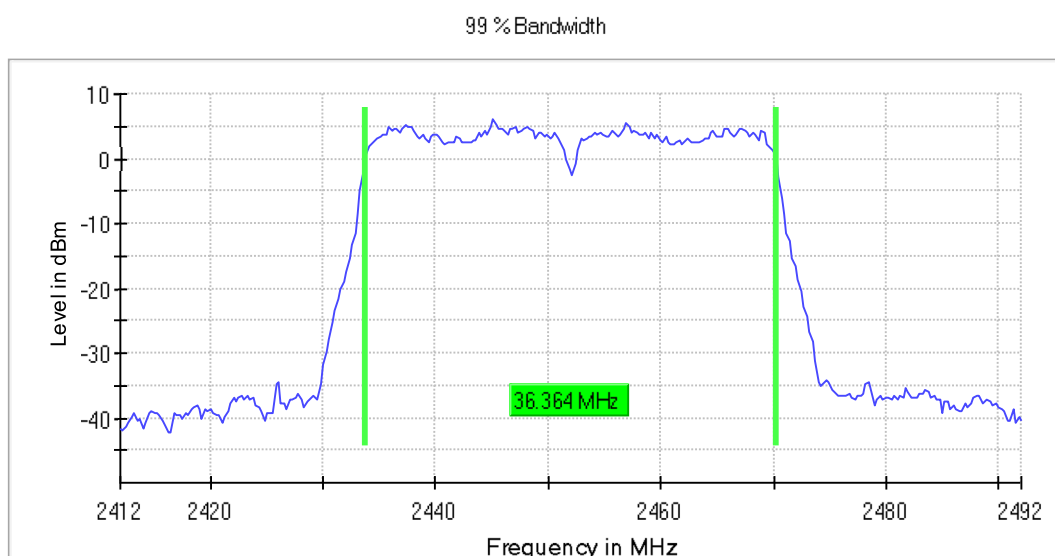
Occupied bandwidth, low channel WLAN 802.11n, BW 40MHz, MCS5



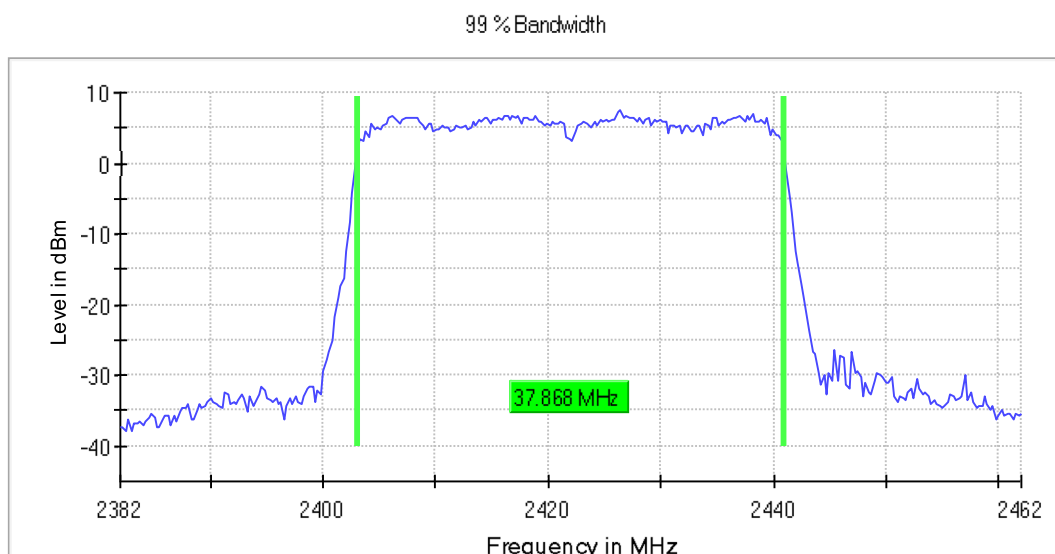
Occupied bandwidth, middle channel WLAN 802.11n, BW 40MHz, MCS5



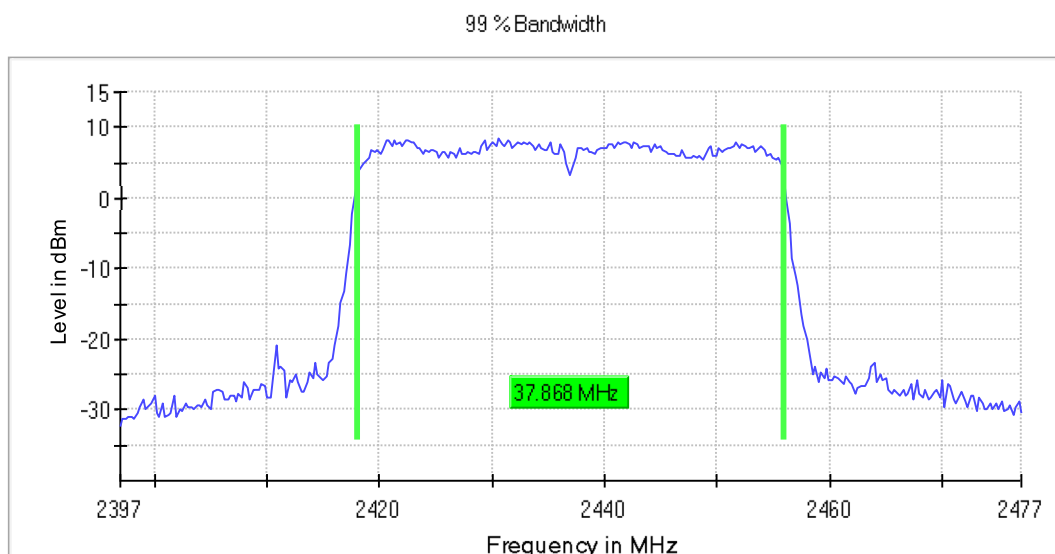
Occupied bandwidth, high channel WLAN 802.11n, BW 40MHz, MCS5



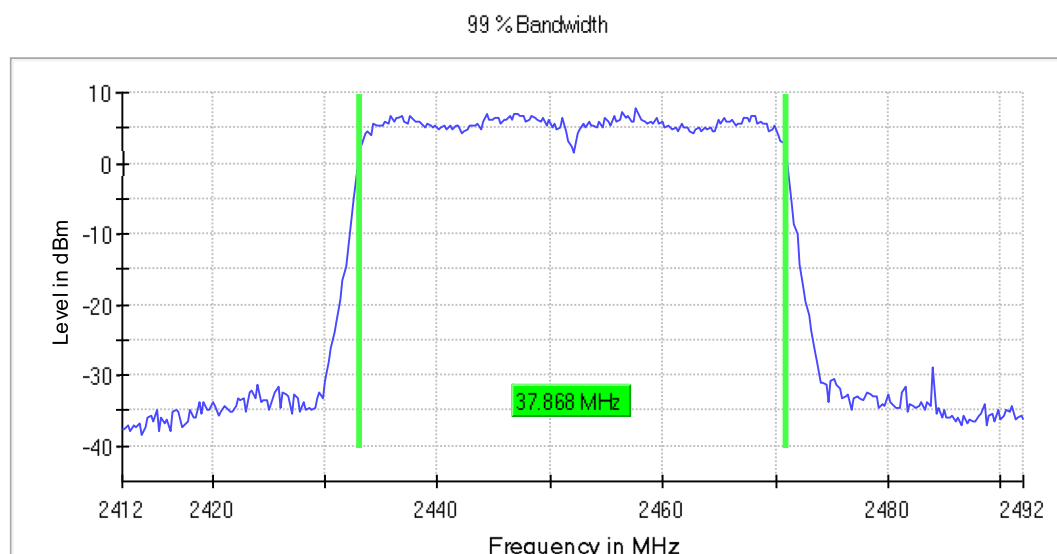
Occupied bandwidth, low channel WLAN 802.11ax HE-SU, BW 40MHz, MCS0



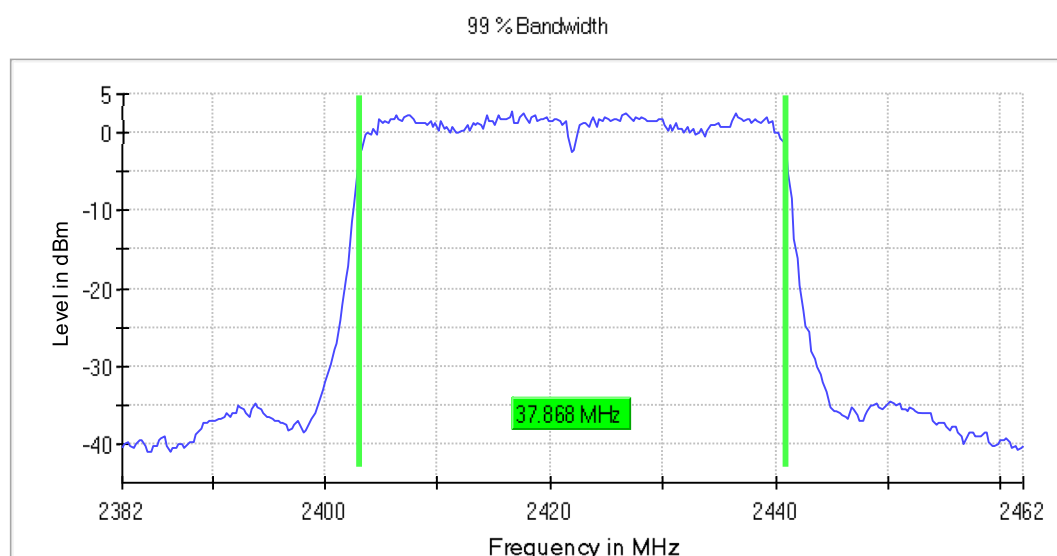
Occupied bandwidth, middle channel WLAN 802.11ax HE-SU, BW 40MHz, MCS0



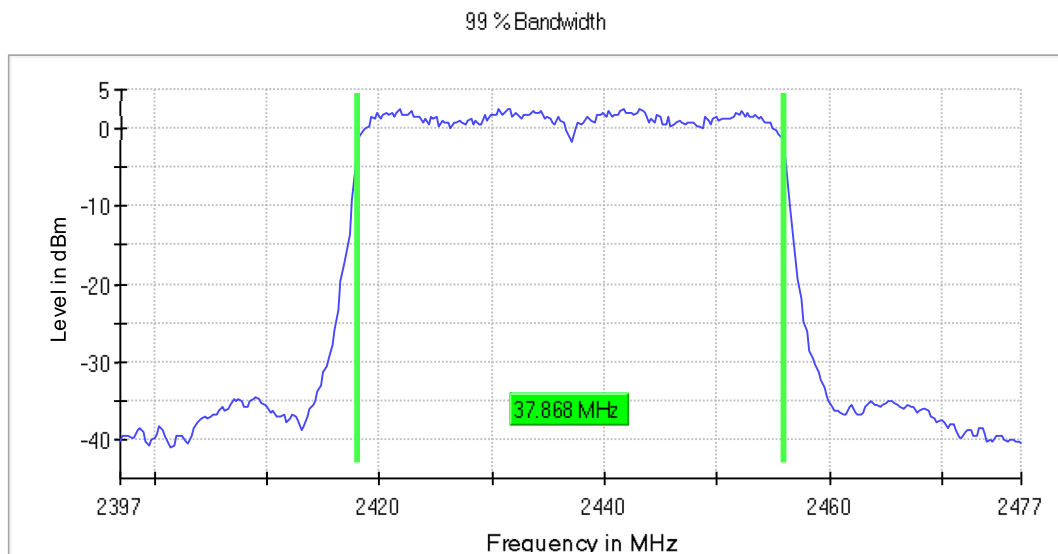
Occupied bandwidth, high channel WLAN 802.11ax HE-SU, BW 40MHz, MCS0



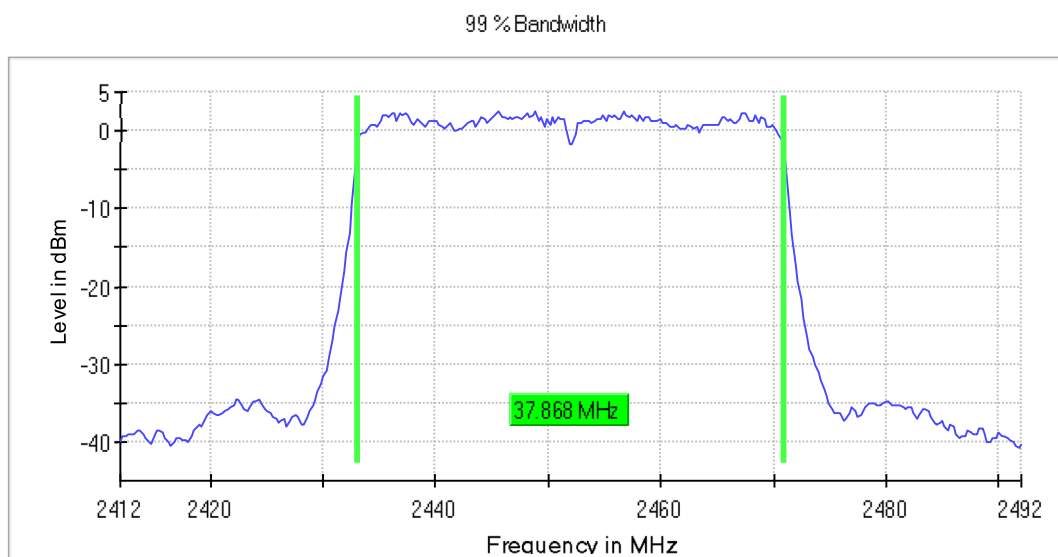
Occupied bandwidth, low channel WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0



Occupied bandwidth, middle channel WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0



Occupied bandwidth, high channel WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0



12. 6 dB bandwidth

Reference: FCC title 47 part 15 §15.247(a), ISED RSS-247, Issue 3 (section 5.2)

Test method: KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 (11.8.1)

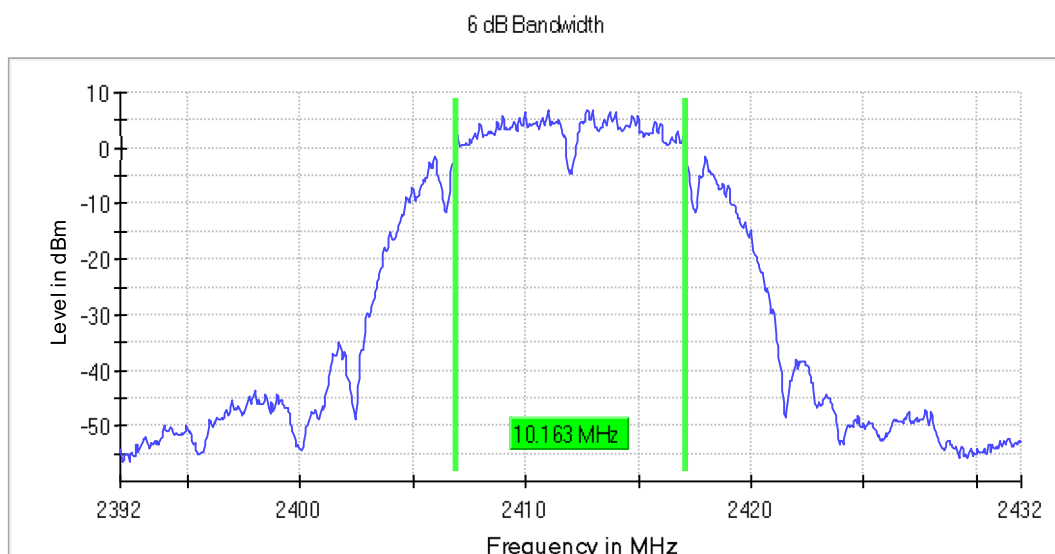
Limits
The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure
1. EUT set to test mode 2. Span set to at least twice the emission spectrum 3. Detector set to peak and max hold and BW is set to 100 kHz 4. Envelope peak value of emission spectrum is selected 5. Marker on envelope of spectrum is set to level of -6 dB to the left of the peak 6. Marker on envelope of spectrum is set to level of -6 dB to the right of the peak 7. 6 dB bandwidth is determined by marker frequency separation

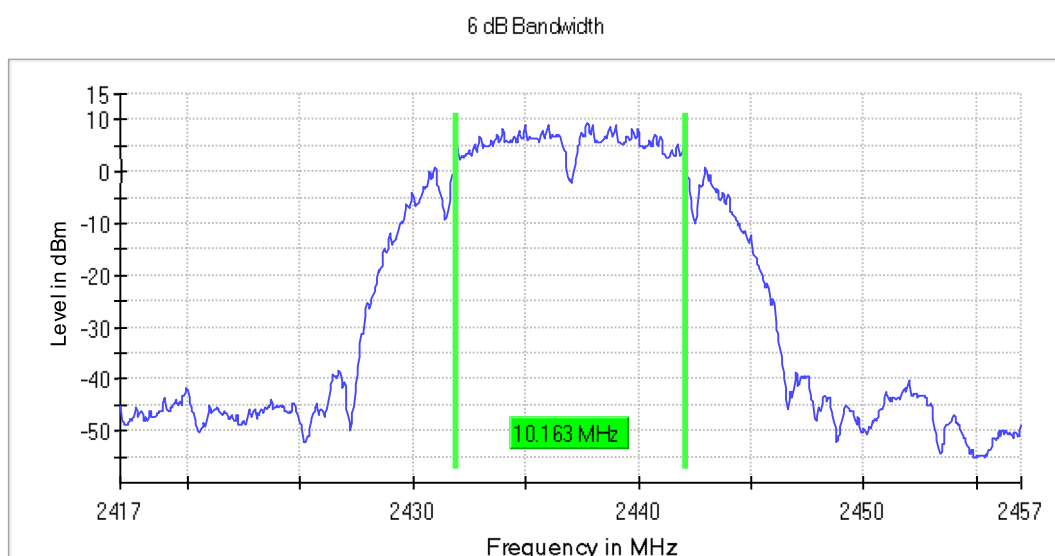
Mode / modulation	DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
WLAN 802.11b, BW 20MHz, 2 Mbps	2412.000000	10.162704	0.500000	---	2406.918648	2417.081352	6.9	PASS
WLAN 802.11b, BW 20MHz, 2 Mbps	2437.000000	10.162704	0.500000	---	2431.918648	2442.081352	9.3	PASS
WLAN 802.11b, BW 20MHz, 2 Mbps	2462.000000	10.162704	0.500000	---	2456.918648	2467.081352	7.3	PASS
WLAN 802.11g, BW 20MHz, 6 Mbps	2412.000000	16.420526	0.500000	---	2403.764706	2420.185232	3.2	PASS
WLAN 802.11g, BW 20MHz, 6 Mbps	2437.000000	16.420526	0.500000	---	2428.764706	2445.185232	5.5	PASS
WLAN 802.11g, BW 20MHz, 6 Mbps	2462.000000	16.420526	0.500000	---	2453.764706	2470.185232	3.2	PASS
WLAN 802.11n, BW 20MHz, MCS0	2412.000000	17.622027	0.500000	---	2403.163955	2420.785982	3.3	PASS
WLAN 802.11n, BW 20MHz, MCS0	2437.000000	17.421777	0.500000	---	2428.163955	2445.585732	4.7	PASS
WLAN 802.11n, BW 20MHz, MCS0	2462.000000	17.421777	0.500000	---	2453.163955	2470.585732	3.4	PASS
WLAN 802.11ax HE-SU, BW 20MHz, MCS0	2412.000000	18.673342	0.500000	---	2402.663329	2421.336671	3.4	PASS
WLAN 802.11ax HE-SU, BW 20MHz, MCS0	2437.000000	18.623279	0.500000	---	2427.663329	2446.286608	4.5	PASS
WLAN 802.11ax HE-SU, BW 20MHz, MCS0	2462.000000	18.623279	0.500000	---	2452.713392	2471.336671	3.5	PASS
WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0	2412.000000	18.823529	0.500000	---	2402.563204	2421.386733	-1.8	PASS

Mode / modulation	DUT Frequency (MHz)	Bandwidth (MHz)	Limit Min (MHz)	Limit Max (MHz)	Band Edge Left (MHz)	Band Edge Right (MHz)	Max Level (dBm)	Result
WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0	2437.000000	18.673342	0.500000	---	2427.663329	2446.336671	-1.5	PASS
WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0	2462.000000	18.723404	0.500000	---	2452.813517	2471.536921	-1.5	PASS
WLAN 802.11n, BW 40MHz, MCS5	2422.000000	36.522827	0.500000	---	2403.713571	2440.236398	-0.6	PASS
WLAN 802.11n, BW 40MHz, MCS5	2437.000000	36.472795	0.500000	---	2418.713571	2455.186366	0.4	PASS
WLAN 802.11n, BW 40MHz, MCS5	2452.000000	36.472795	0.500000	---	2433.713571	2470.186366	-0.7	PASS
WLAN 802.11ax HE-SU, BW 40MHz, MCS0	2422.000000	37.373358	0.500000	---	2403.313321	2440.686679	-0.6	PASS
WLAN 802.11ax HE-SU, BW 40MHz, MCS0	2437.000000	37.323327	0.500000	---	2418.313321	2455.636648	0.5	PASS
WLAN 802.11ax HE-SU, BW 40MHz, MCS0	2452.000000	37.223265	0.500000	---	2433.363352	2470.586617	-0.6	PASS
WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0	2422.000000	37.573483	0.500000	---	2403.163227	2440.736710	-4.7	PASS
WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0	2437.000000	37.823640	0.500000	---	2418.113196	2455.936836	-4.6	PASS

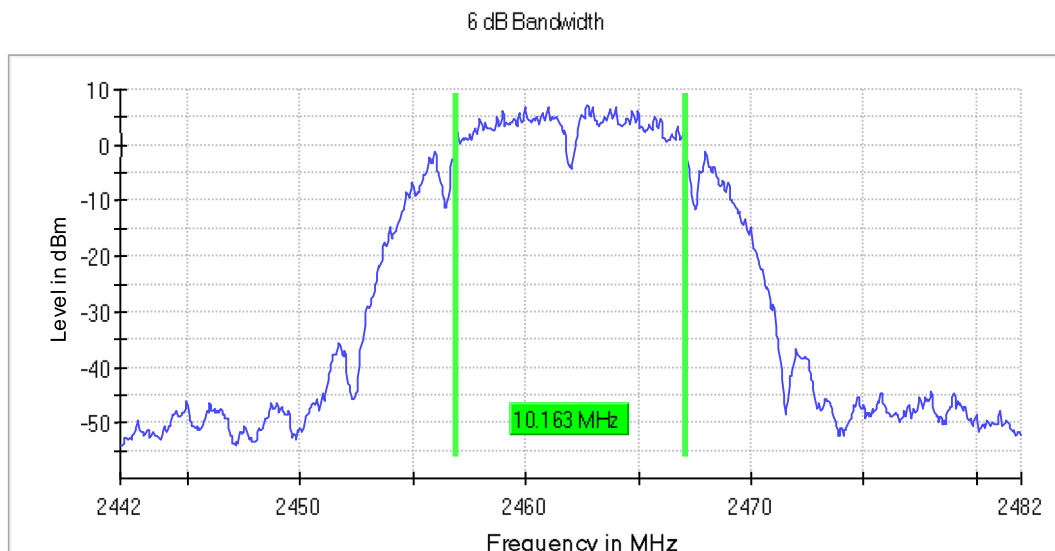
6dB bandwidth, low channel WLAN 802.11b, BW 20MHz, 2 Mbps



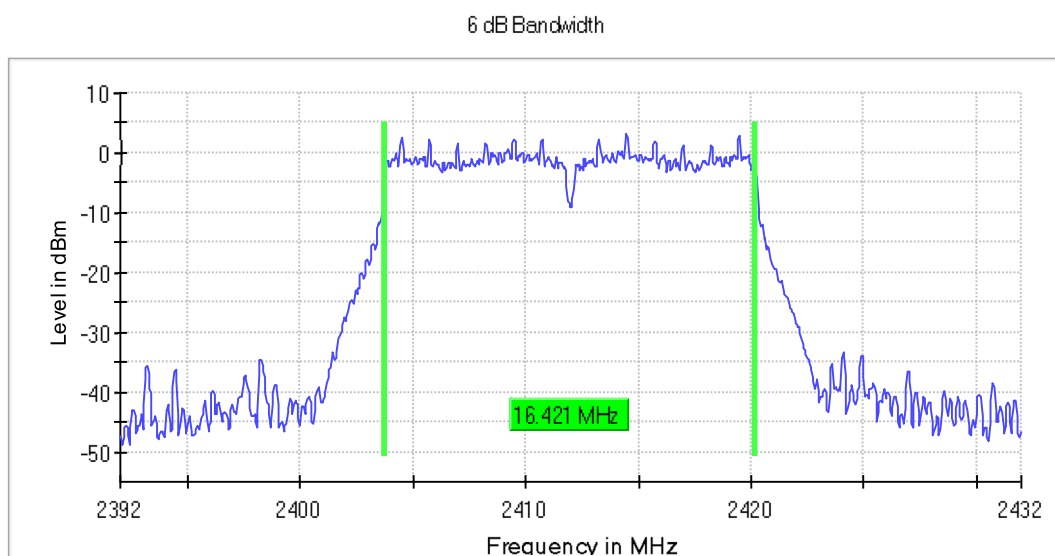
6dB bandwidth, middle channel WLAN 802.11b, BW 20MHz, 2 Mbps



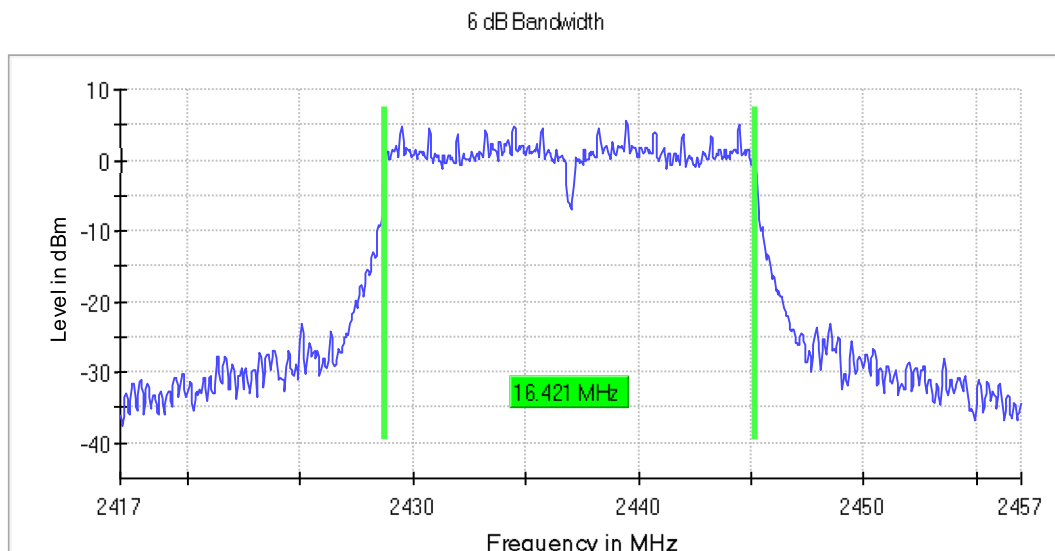
6dB bandwidth, high channel WLAN 802.11b, BW 20MHz, 2 Mbps



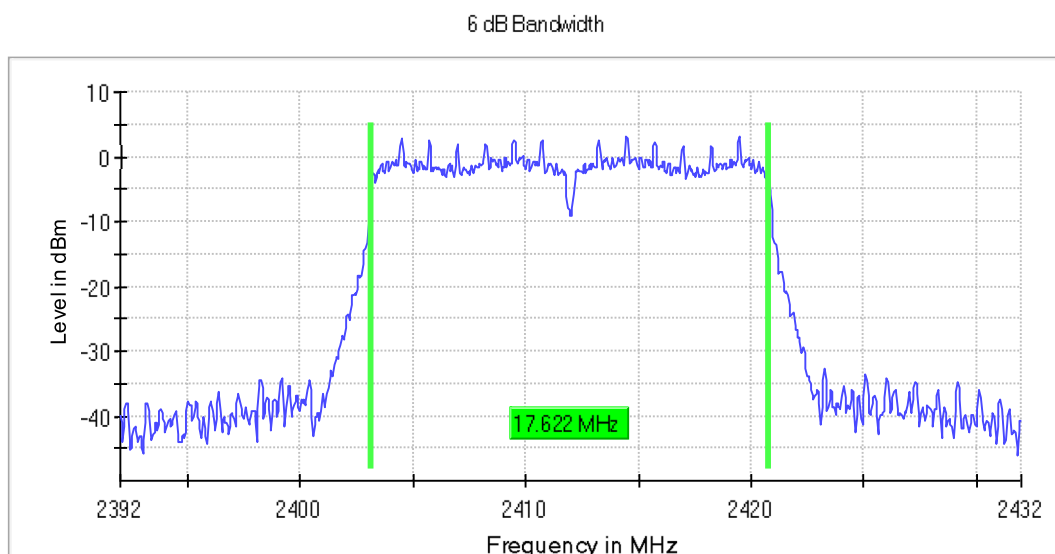
6dB bandwidth, low channel WLAN 802.11g, BW 20MHz, 6 Mbps



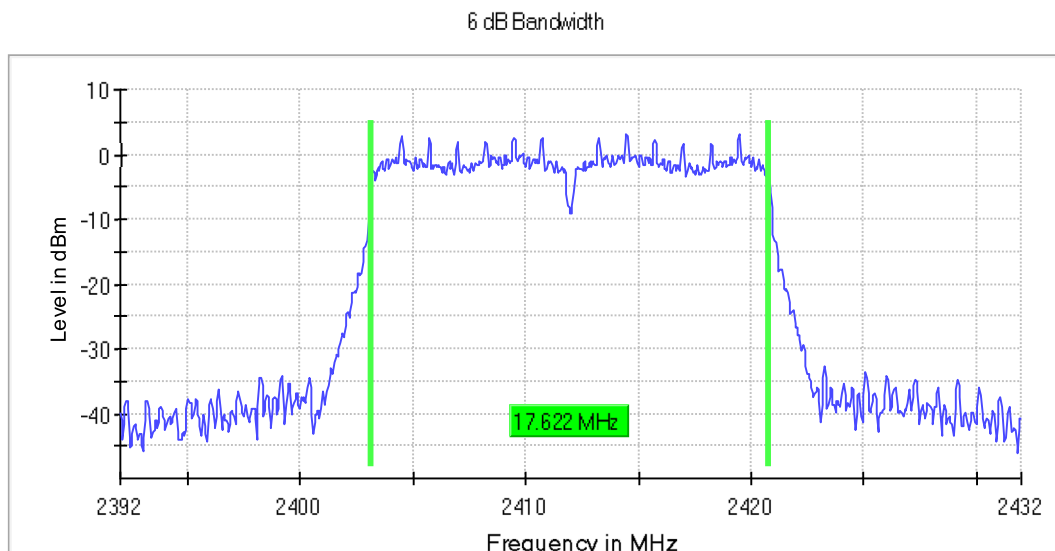
6dB bandwidth, middle channel WLAN 802.11g, BW 20MHz, 6 Mbps



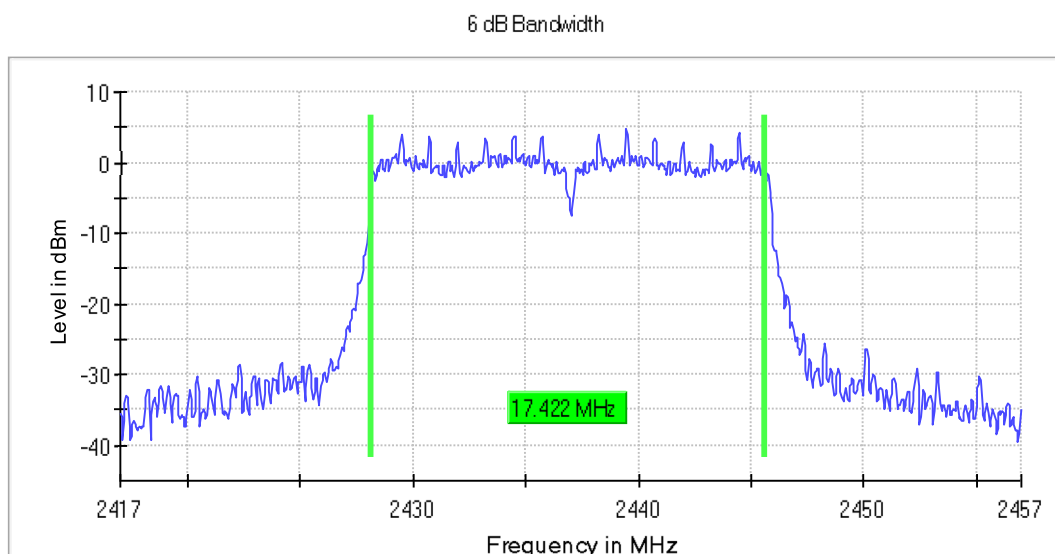
6dB bandwidth, high channel WLAN 802.11g, BW 20MHz, 6 Mbps



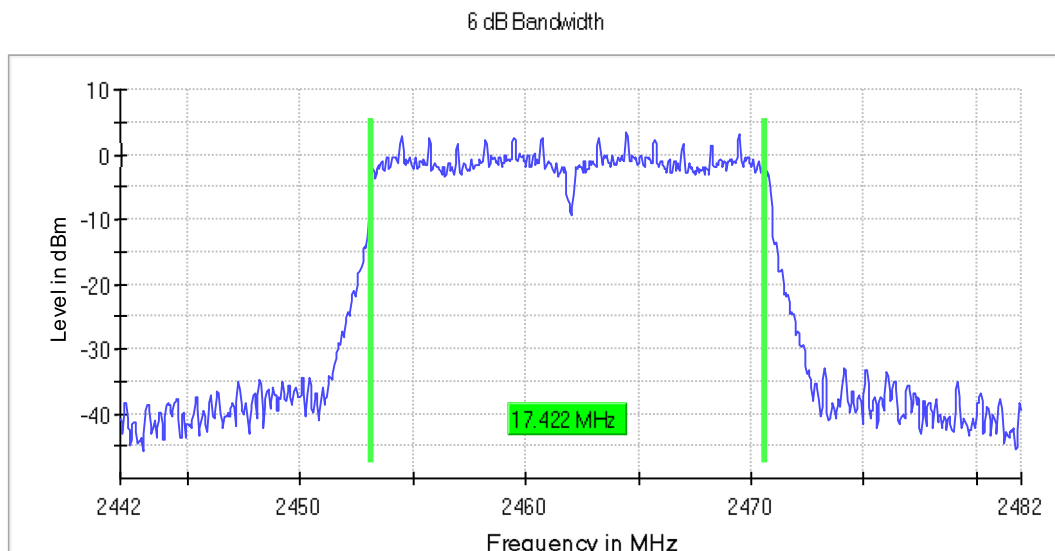
6dB bandwidth, low channel WLAN 802.11n, BW 20MHz, MCS0



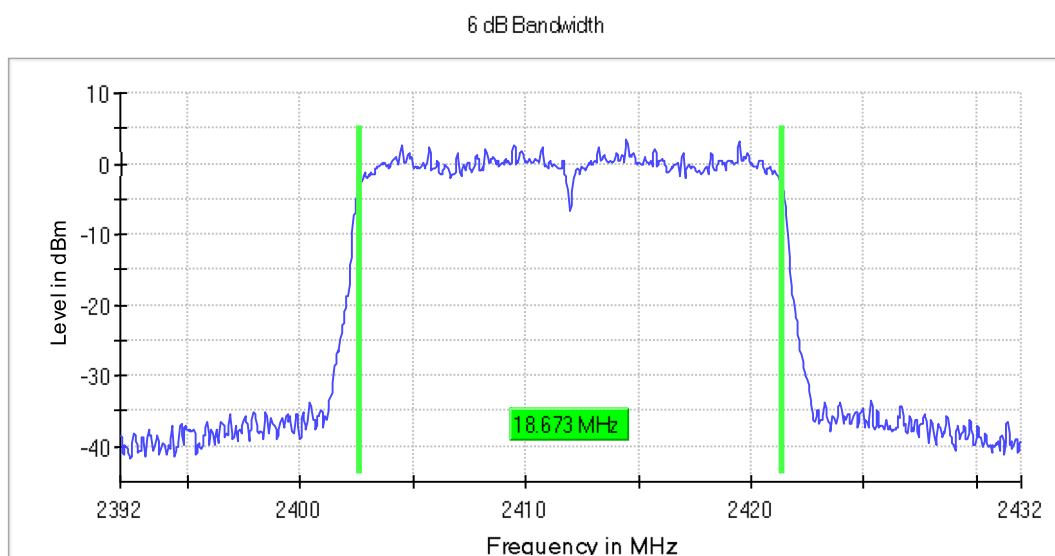
6dB bandwidth, middle channel WLAN 802.11n, BW 20MHz, MCS0



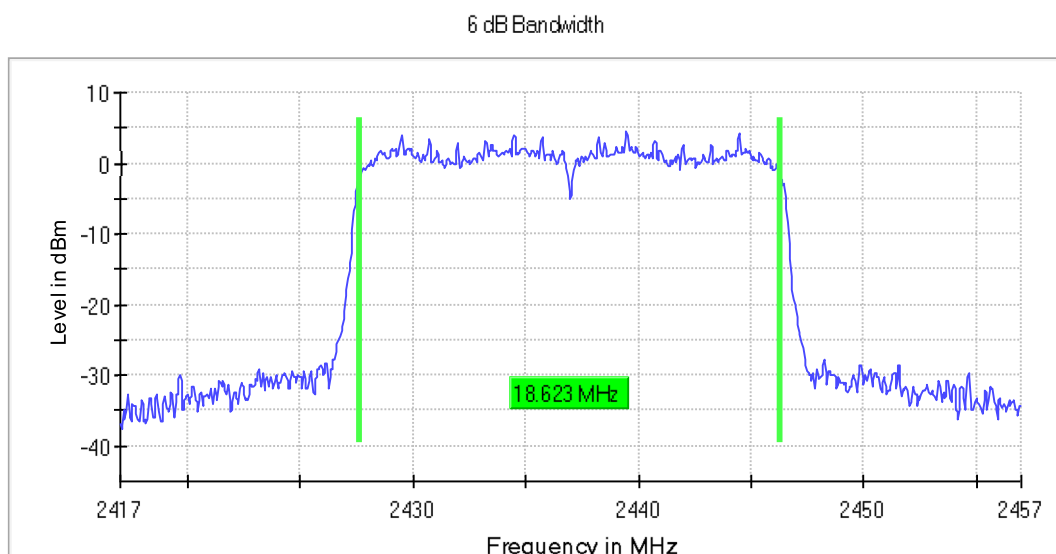
6dB bandwidth, high channel WLAN 802.11n, BW 20MHz, MCS0



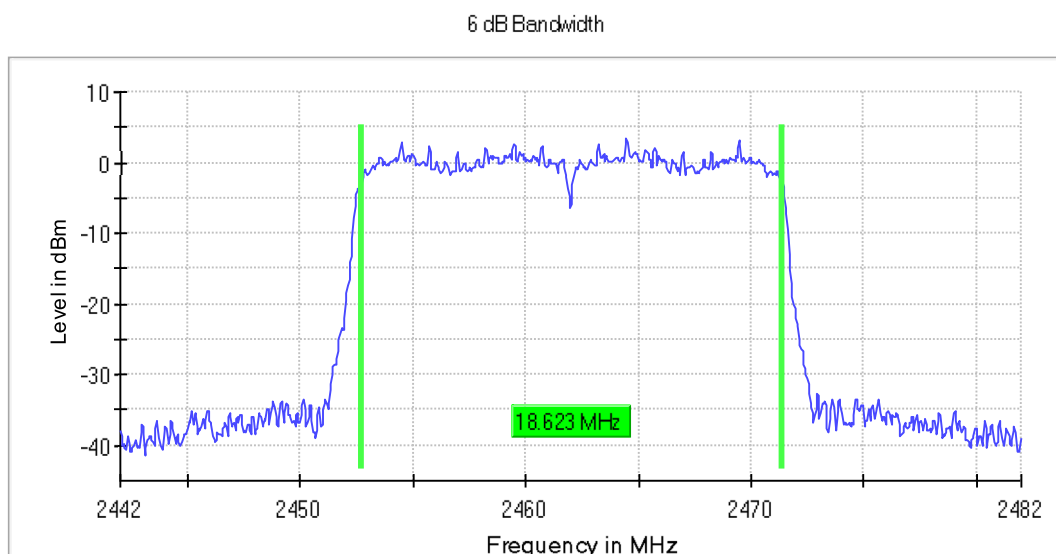
6dB bandwidth, low channel WLAN 802.11ax HESU, BW 20MHz, MCS0



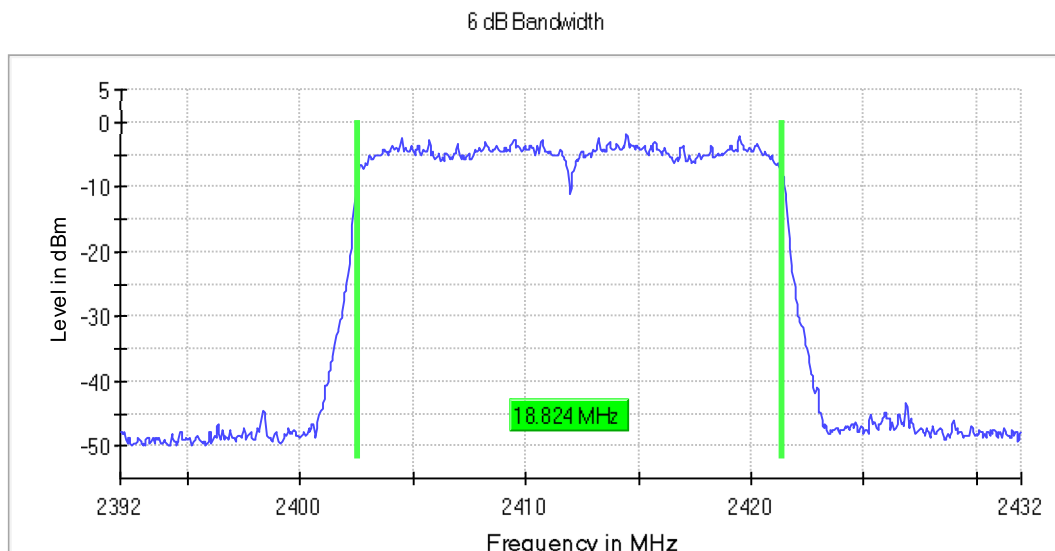
6dB bandwidth, middle channel WLAN 802.11ax HESU, BW 20MHz, MCS0



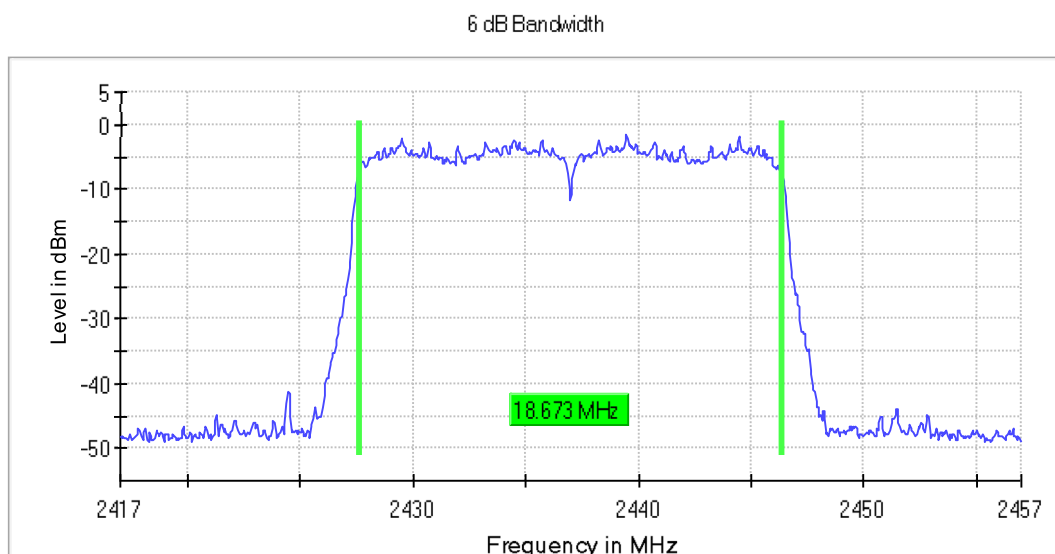
6dB bandwidth, high channel WLAN 802.11ax HESU, BW 20MHz, MCS0



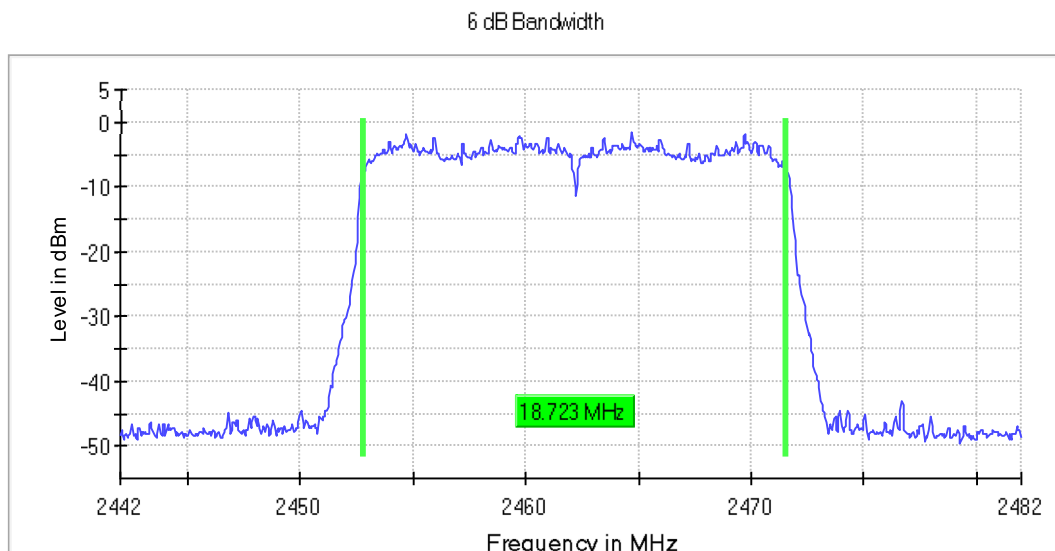
6dB bandwidth, low channel WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0



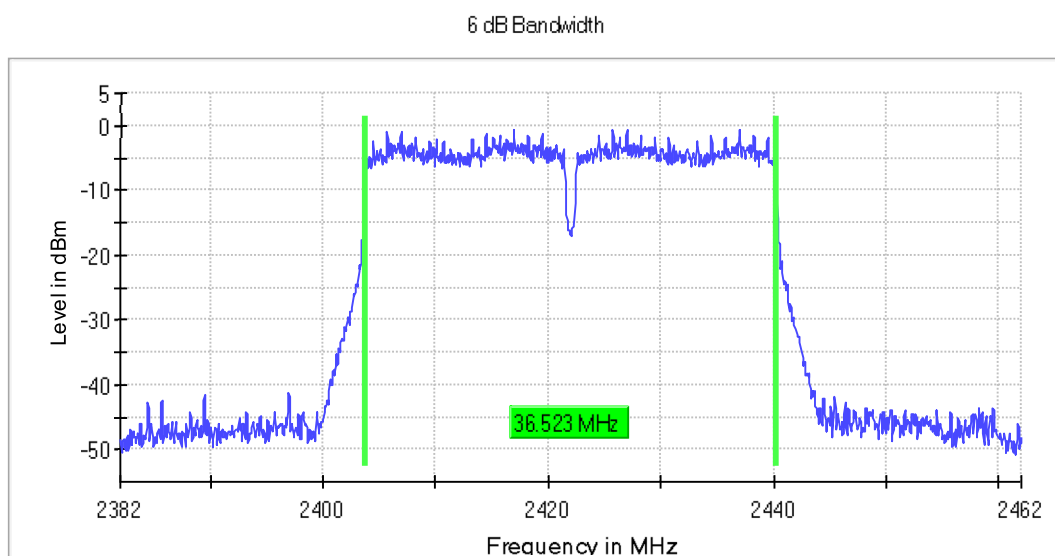
6dB bandwidth, middle channel WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0



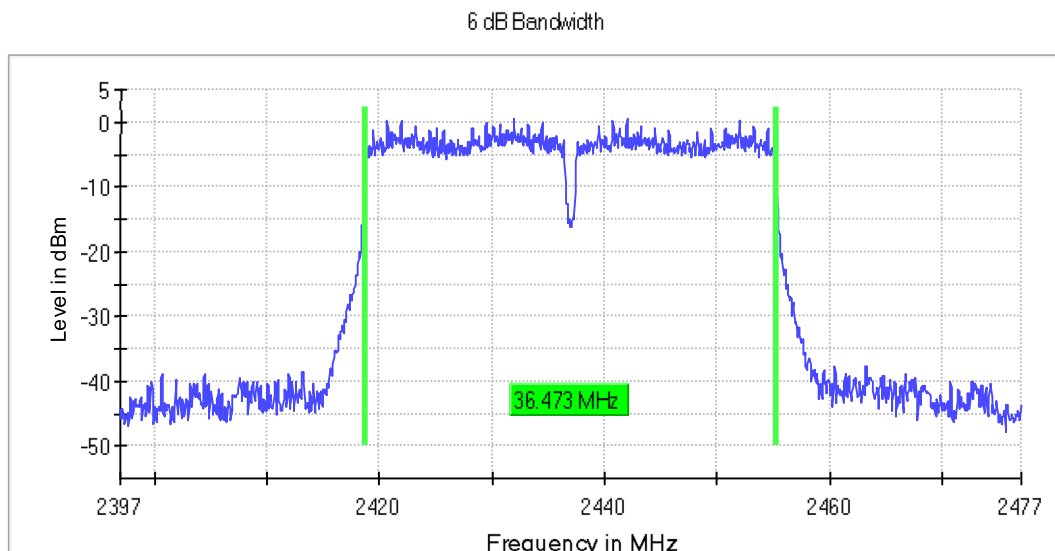
6dB bandwidth, high channel WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0



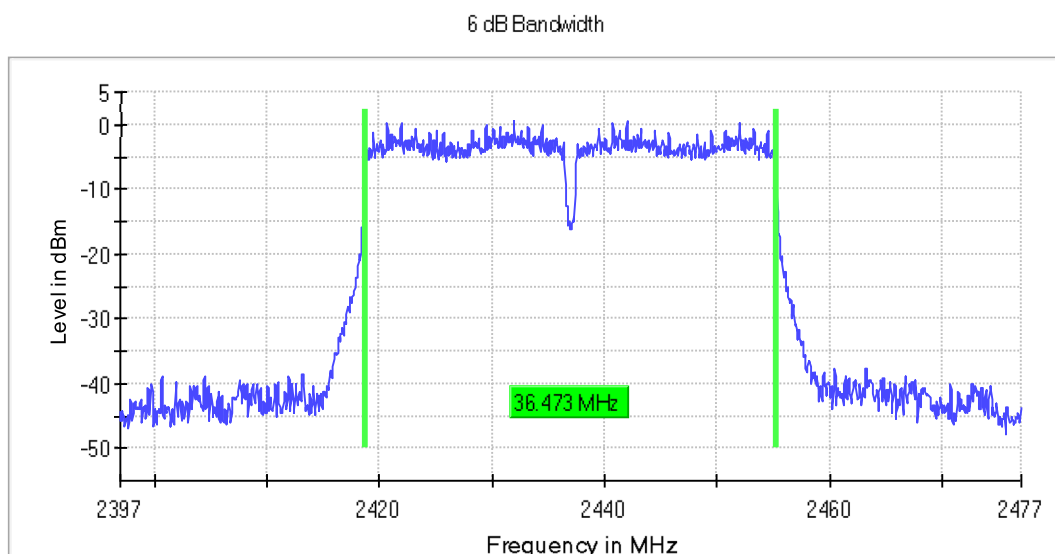
6dB bandwidth, low channel WLAN 802.11n , BW 40MHz, MCS0



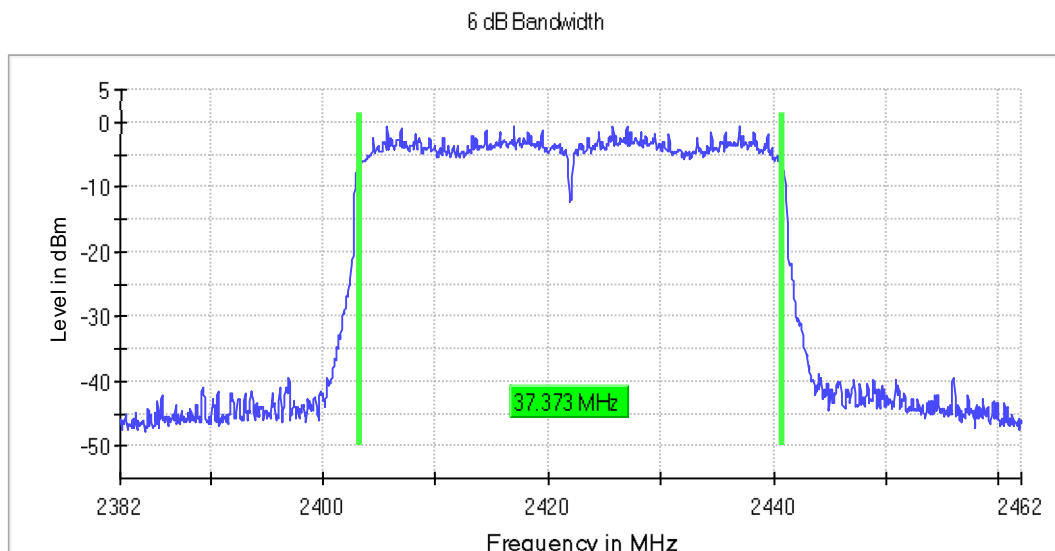
6dB bandwidth, middle channel WLAN 802.11n, BW 40MHz, MCS0



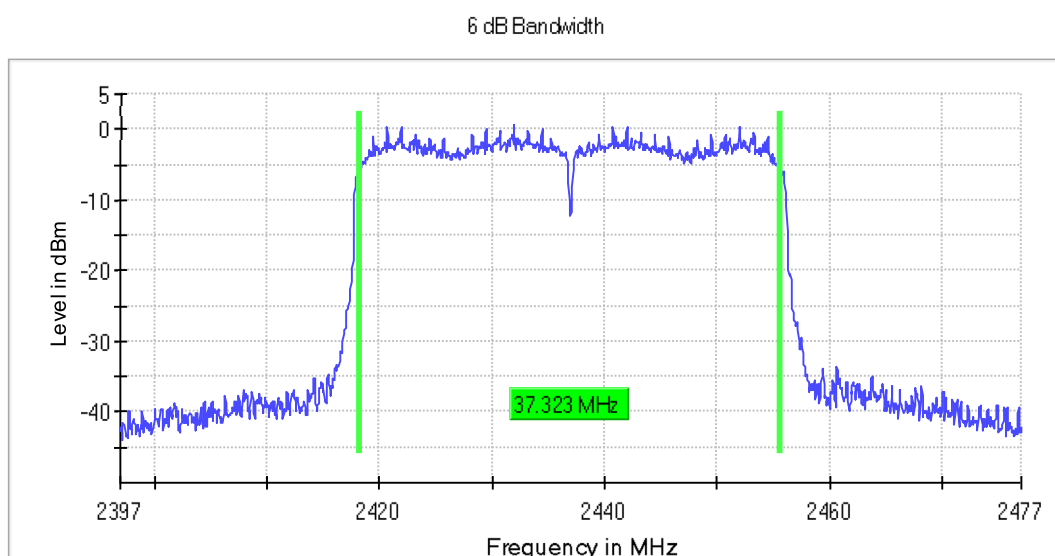
6dB bandwidth, high channel WLAN 802.11n, BW 40MHz, MCS0



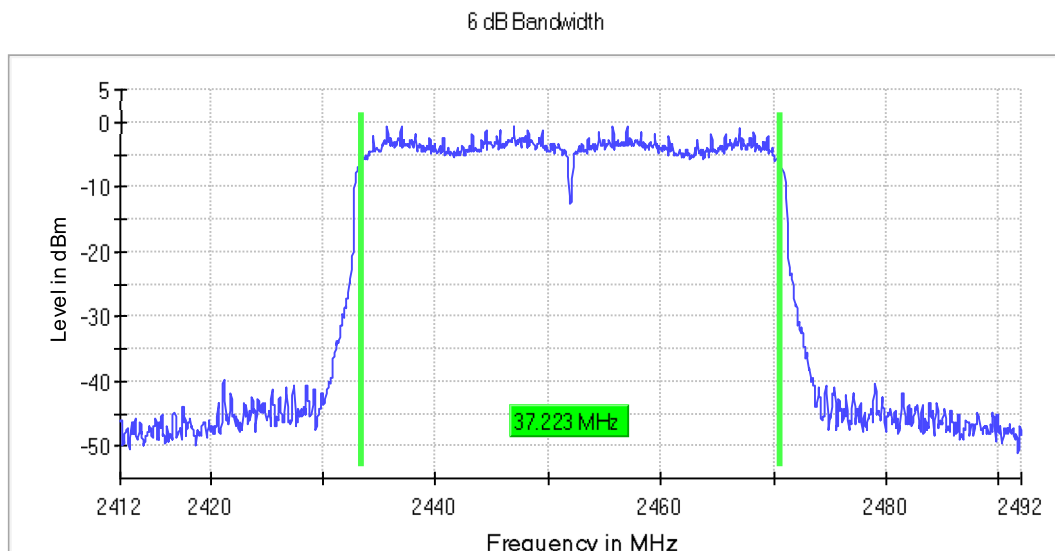
6dB bandwidth, low channel WLAN 802.11ax HE-SU, BW 40MHz, MCS0



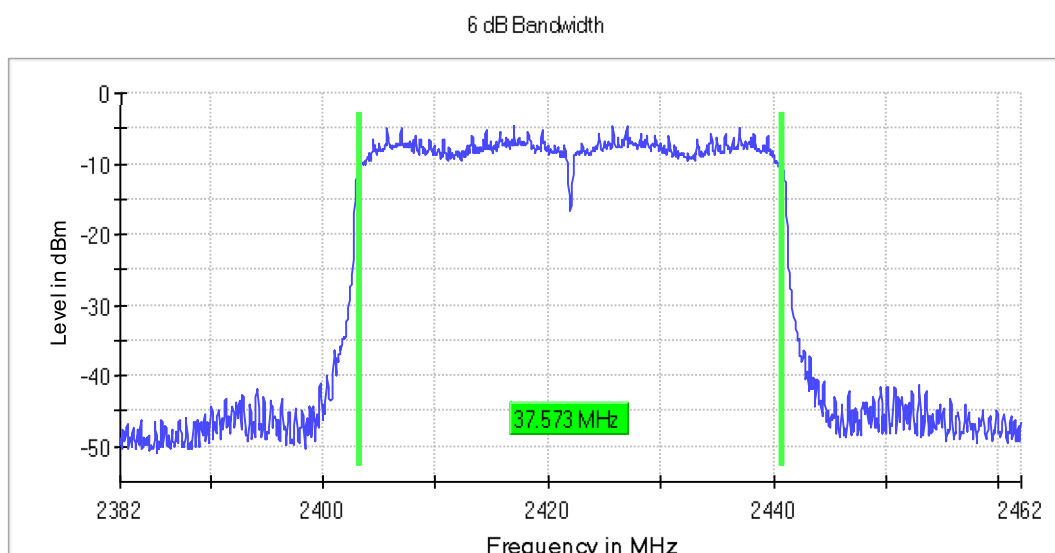
6dB bandwidth, middle channel WLAN 802.11ax HE-SU, BW 40MHz, MCS0



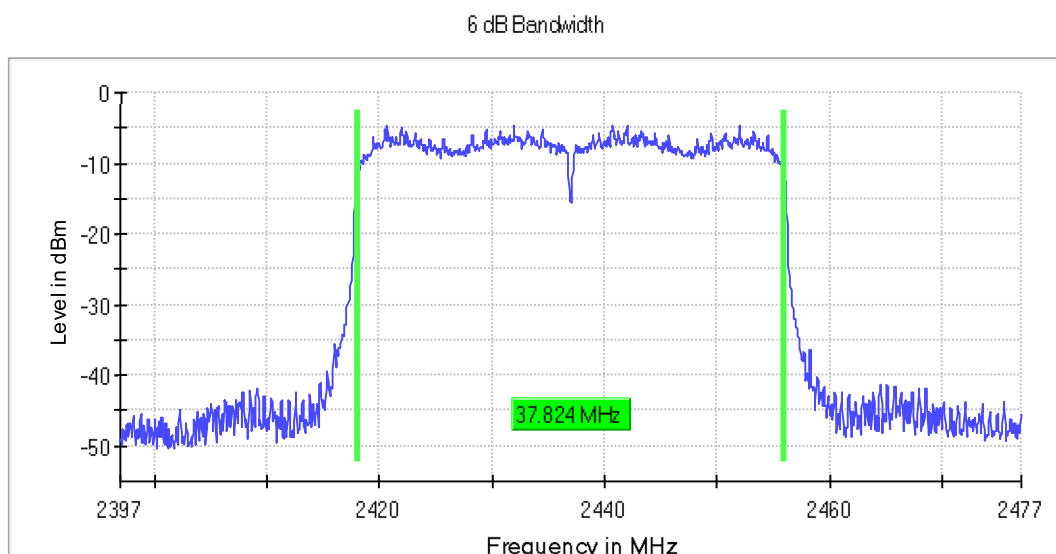
6dB bandwidth, high channel WLAN 802.11ax HE-SU, BW 40MHz, MCS0



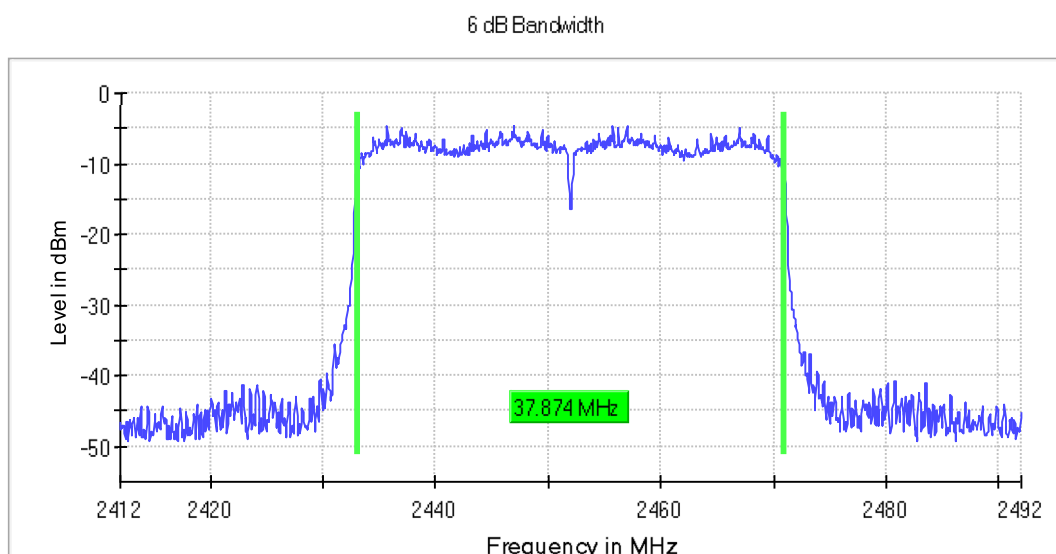
6dB bandwidth, low channel WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0



6dB bandwidth, middle channel WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0



6dB bandwidth, high channel WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0



13. Peak conducted output power

Reference: FCC part 15 §15.247(b), ISED RSS-247, Issue 3 (section 5.4)

Test method: KDB 558074 D01 DTS Meas Guidance v05r02 and ANSI C63.10-2013 (11.9.1.1)

Limits
For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm). The e.i.r.p. shall not exceed 4 W (36 dBm) (Canada).
The conducted output power limit specified above is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in the table, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Test procedure
1. EUT set to test mode (communication tested is used if needed)
2. Analyzer resolution bandwidth is set $\geq$ DTS bandwidth
3. Detector set to peak and max hold
4. Sweep time is set to auto
5. After trace has stabilized a marker is set to peak envelope

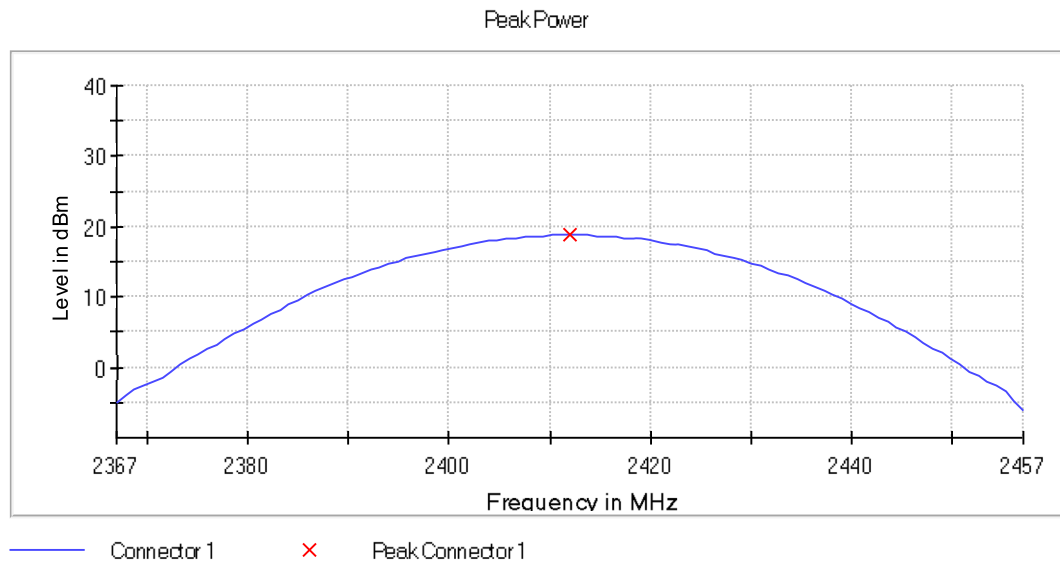
The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: 5.2 dBi

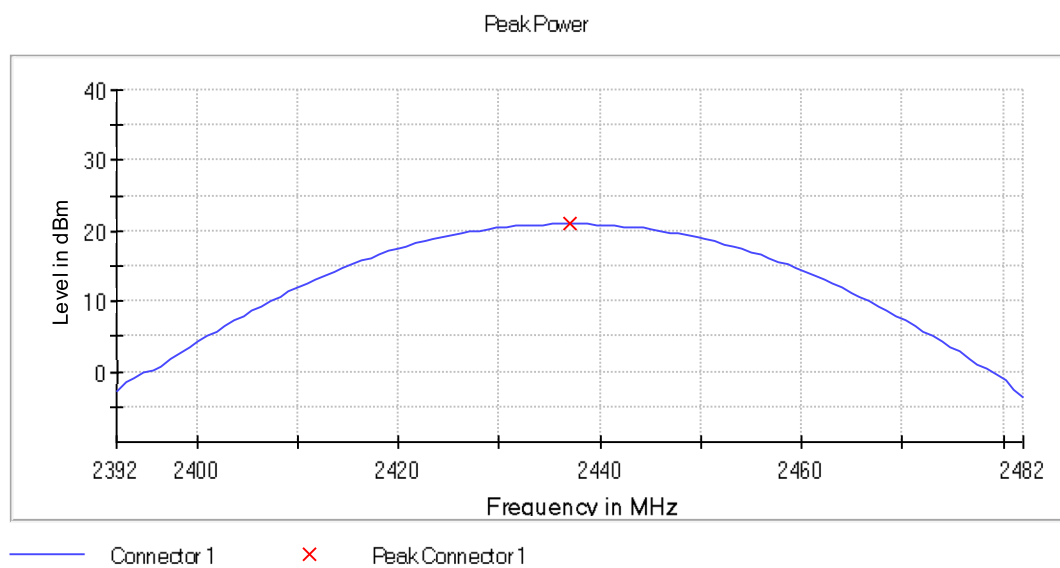
Mode / modulation	DUT Frequency (MHz)	Peak Power (dBm)	EIRP Power (dBm)	Result
WLAN 802.11b, BW 20MHz, 2 Mbps	2412.000000	18.8	24.0	PASS
WLAN 802.11b, BW 20MHz, 2 Mbps	2437.000000	21.0	26.2	PASS
WLAN 802.11b, BW 20MHz, 2 Mbps	2462.000000	19.4	24.6	PASS
WLAN 802.11g, BW 20MHz, 6 Mbps	2412.000000	23.6	28.8	PASS
WLAN 802.11g, BW 20MHz, 6 Mbps	2437.000000	23.7	28.9	PASS
WLAN 802.11g, BW 20MHz, 6 Mbps	2462.000000	23.5	28.7	PASS
WLAN 802.11n, BW 20MHz, MCS0	2412.000000	23.6	28.8	PASS
WLAN 802.11n, BW 20MHz, MCS0	2437.000000	23.7	29.9	PASS
WLAN 802.11n, BW 20MHz, MCS0	2462.000000	23.5	28.7	PASS
WLAN 802.11ax HE-SU, BW 20MHz, MCS0	2412.000000	22.3	27.5	PASS
WLAN 802.11ax HE-SU, BW 20MHz, MCS0	2437.000000	23.6	28.8	PASS
WLAN 802.11ax HE-SU, BW 20MHz, MCS0	2462.000000	23.5	28.7	PASS
WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0	2412.000000	20.7	25.9	PASS
WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0	2437.000000	20.1	25.3	PASS
WLAN 802.11ax HE-TB full RU, BW 20MHz, MCS0	2462.000000	20.5	25.7	PASS
WLAN 802.11n, BW 40MHz, MCS5	2422.000000	23.3	28.5	PASS
WLAN 802.11n, BW 40MHz, MCS5	2437.000000	23.7	28.9	PASS
WLAN 802.11n, BW 40MHz, MCS5	2452.000000	23.4	28.6	PASS
WLAN 802.11ax HE-SU, BW 40MHz, MCS0	2422.000000	23.6	28.8	PASS

Mode / modulation	DUT Frequency (MHz)	Peak Power (dBm)	EIRP Power (dBm)	Result
WLAN 802.11ax HE-SU, BW 40MHz, MCS0	2437.000000	23.7	28.9	PASS
WLAN 802.11ax HE-SU, BW 40MHz, MCS0	2452.000000	23.7	28.9	PASS
WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0	2422.000000	20.8	26.0	PASS
WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0	2437.000000	20.9	26.1	PASS
WLAN 802.11ax HE-TB full RU, BW 40MHz, MCS0	2452.000000	20.7	25.9	PASS

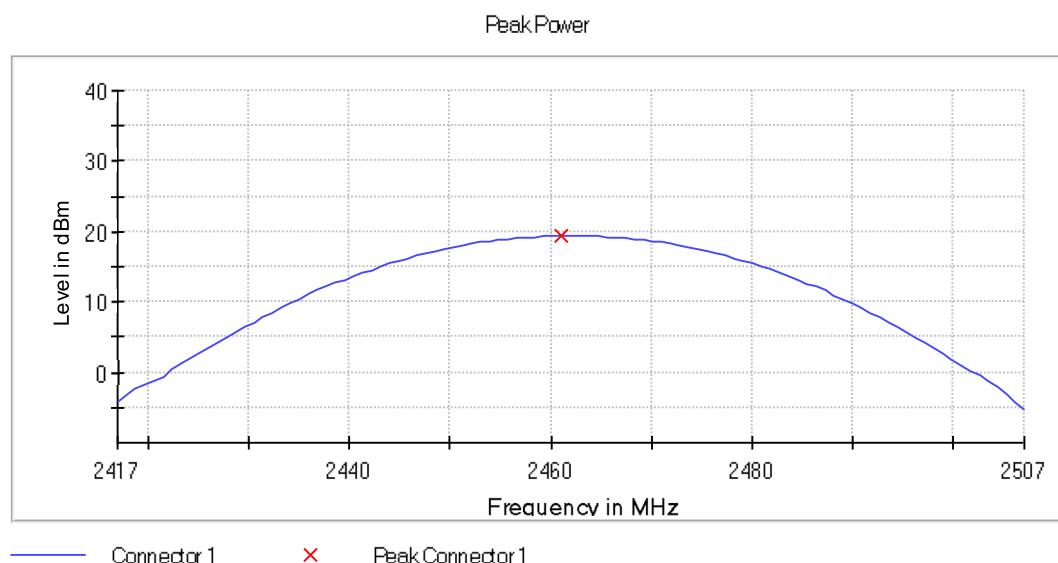
Peak power, low channel WLAN 802.11b, BW 20MHz, 2 Mbps



Peak power, middle channel WLAN 802.11b, BW 20MHz, 2 Mbps



Peak power, high channel WLAN 802.11b, BW 20MHz, 2 Mbps



Peak power, low channel WLAN 802.11g, BW 20MHz, 6 Mbps

