REP008158B

Test Report

Product	**Collaboration Endpoint with Wifi and Bluetooth**
Name and address of the applicant	**Cisco Systems Norway AS** **Philip Pedersens vei 1** **1366 Lysaker, NORWAY**
Name and address of the manufacturer	**Cisco Systems, Inc.** **170 West Tasman Drive** **San Jose, CA 95134, USA**
Model	**TTC4-01**
Rating	**Mains (100-240V AC, 50-60Hz, 1.2-2.0A)**
Trademark	**CISCO**
Additional information	**Bluetooth LE, Bluetooth Classic, WiFi 6**
Tested according to	**FCC Part 15.247** Frequency Hopping Transmitters / Digital Transmission Systems **Industry Canada RSS-247, Issue 2** Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
Order number	**PRJ0019248**
Tested in period	**2022-08-29 to 2023-03-22**
Issue date	**2023-06-21**
Name and address of the testing laboratory	Nemko Scandinavia AS Instituttveien 6 2007 Kjeller, Norway www.nemko.com CAB Number: FCC: NO0001 ISED: NO470 ISED No: 2040D-1 **An accredited technical test executed under the Norwegian accreditation scheme**

Prepared by [Frode Sveinsen]	Approved by [G.Suhanthakumar]

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Template version: C

Revision history

Revision	Date	Comment	Sign
A	2023-05-24	First edition	FS
B	2023-06-21	Corrected Antenna Gain Statement on page 15	FS

GENERAL REMARKS

This report applies only to the sample(s) tested. It is the manufacturer's responsibility to ensure the additional production units of this product are manufactured with identical electrical and mechanical components. The manufacturer is solely responsible for any modifications to the product that could result in non-compliance with the relevant regulations.

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Opinions expressed within this report regarding general assessments and qualifications for PASS or FAIL to the standards limits and requirements, are not part of the current accreditation. Neither are opinions expressed regarding model variants covered by the testing of this report.

CALIBRATION

All instruments used in the tests given in this test report are calibrated and traceable to national or international standards. Between calibrations all test set-ups are controlled and verified on a regular basis by periodic checks to ensure, with 95% confidence, that the instruments remain within the calibrated levels.

MEASUREMENT UNCERTAINTY

Measurement uncertainties are calculated or considered for all instruments and instrument set-ups used during these tests. Uncertainty figures are found in a separate clause in this report.

CONTENTS

1 INFORMATION

1.1 Test Item

Name	**Cisco Room Bar Pro**
Model/version	**TTC4-01**
FCC ID	**LDK0401B2757**
ISED ID	**2461N-0401B2757**
Serial number	**Radiated Sample: FOC2650J4Y5** **50 Ohm Sample: TTCFOC2641N3SK (TTC6-15)**
Hardware identity and/or version	**DV1**
Software identity and/or version	**RoomOS 11.30.X**
Frequency Range	**2412 – 2462 MHz**
Number of Channels	**11**
Operating Modes	**802.11b/g/n/ax (only 20 MHz mode)**
Type of Modulation	**DSSS / OFDM / OFDMA**
Conducted Output Power	**DSS: 78 mW** **OFDM: 105 mW** **OFDMA: 33 mW**
Antenna Connector	**Internal U-FL**
Number of Antennas	**2**
Antenna Diversity	**YES**
Smart Antennas	**MIMO**
Power Supply	**Powered from Mains (120V 60Hz AC)**
Antennas	**Antenna 1: Ampenol Model OCF654-15-000-R** **Antenna 2: Ampenol Model OCF655-15-000-R**

Description of Test Item

The tested EUT is a Collaboration Endpoint with WiFi and Bluetooth.

The radio module is identical to the radio module in the already approved Cisco model TTC6-15 (FCC ID: LDK0615C2718, IC: 2461N-0615C2718), but this model has different antennas.

All 50 Ohm measurements were performed on Cisco TTC6-15.

The 2.4GHz WiFi part has been tested as a DTS system and fulfils all requirements for DTS systems.

1.2 Normal test conditions

Temperature:	**20 - 24 °C**
Relative humidity:	**20 - 50 %**
Normal test voltage:	**120 V 60 Hz**

The values are the limit registered during the test period.

1.3 Test Engineer(s)

Frode Sveinsen

1.4 Antenna Requirement

Does the EUT have detachable antenna(s)?	☐ **YES**	☒ **NO**
If detachable, is the antenna connector(s) non-standard?	☐ **YES**	☐ **NO**
The EUT have internal antennas.		

Requirement: FCC 15.203, 15.204

1.5 Power Levels

Ch.No.	Freq MHz	11b	11g	11n SISO	11n MIMO	11ax SISO		11ax MIMO	
						MCS0-MCS8	MCS9-MCS11	MCS0-MCS8	MCS9-MCS11
1	2412	15	14	13	10	9	9	8	8
2	2417	15	14	13	10	11	11	8	8
3	2422	18	17	16	13	14	12	11	9
4	2427	18	17	16	13	14	12	11	9
5	2432	18	17	16	13	14	12	11	9
6	2437	18	17	16	13	14	12	11	9
7	2442	18	17	16	13	14	12	11	9
8	2447	18	17	16	13	14	12	11	9
9	2452	16.5	16.5	16	13	14	12	11	9
10	2457	15	12	10	10	9.5	9.5	8	8
11	2462	15	12	10	10	9.5	9.5	8	8

Power levels above were used for all tests and shall also be programmed WiFi transmitter when put on the market.
Levels in red were modified from the default levels.

1.6 Comments

The measurements were done with the EUT powered by 120 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

MIMO measurements were performed with the EUT transmitting in MIMO mode on both antennas (P0 and P1). When measuring radiated the direction was locked and the maximum position was found.

Measurements in SISO mode was performed on P0 when measuring at the antenna connector, and on both antennas when measuring radiated.

2 TEST REPORT SUMMARY

2.1 General

All measurements are tracable to national standards.

The tests were conducted for demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.247 and ISED RSS-247 Issue 2 and RSS-GEN Issue 5.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were performed in a semi-anechoic chamber at measuring distances of 3m.

A description of the test facility is on file with the FCC and ISED.

☒ **New Submission**	☒ **Production Unit**
☐ **Class II Permissive Change**	☐ **Pre-production Unit**
DTS Equipment Code	☐ **Family Listing**

2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-247 Issue 2, RSS-GEN Issue 5 reference	ANSI C63.10-2013 Reference	Result
Supply Voltage Variations	15.31(e)	6.11 (RSS-GEN)	5.13	Complies
Antenna Requirement	15.203	6.8 (RSS-GEN)	5.8	Complies
Power Line Conducted Emission	15.107(a) 15.207(a)	7.2 / 8.8 (RSS-GEN)	6.2	Complies
Occupied Bandwidth (99% BW)	N/A	6.7 (RSS-GEN)	6.9.3	Complies
DTS Bandwidth	15.247(a)(2)	5.2 (1) (RSS-247)	11.8 Option 2	Complies
Peak Power Output	15.247(b)	5.4 (RSS-247)	11.9.1.1	Complies
Power Spectral Density	15.247(d)	5.2 (2) (RSS-247)	11.10.2 PKPSD (DTS)	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	5.5 (RSS-247)	6.7 11.11 (DTS)	Complies
Spurious Emissions (Radiated)	15.247(c) 15.109(a) 15.209(a)	5.5 (RSS-247) 7.3 (RSS-GEN) 8.9 (RSS-GEN)	6.3, 6.5, 6.6, 6.10 11.12, 11.13 (DTS)	Complies

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC Part 15.207

ISED RSS-GEN Issue 5, Clause 7.2 / 8.8

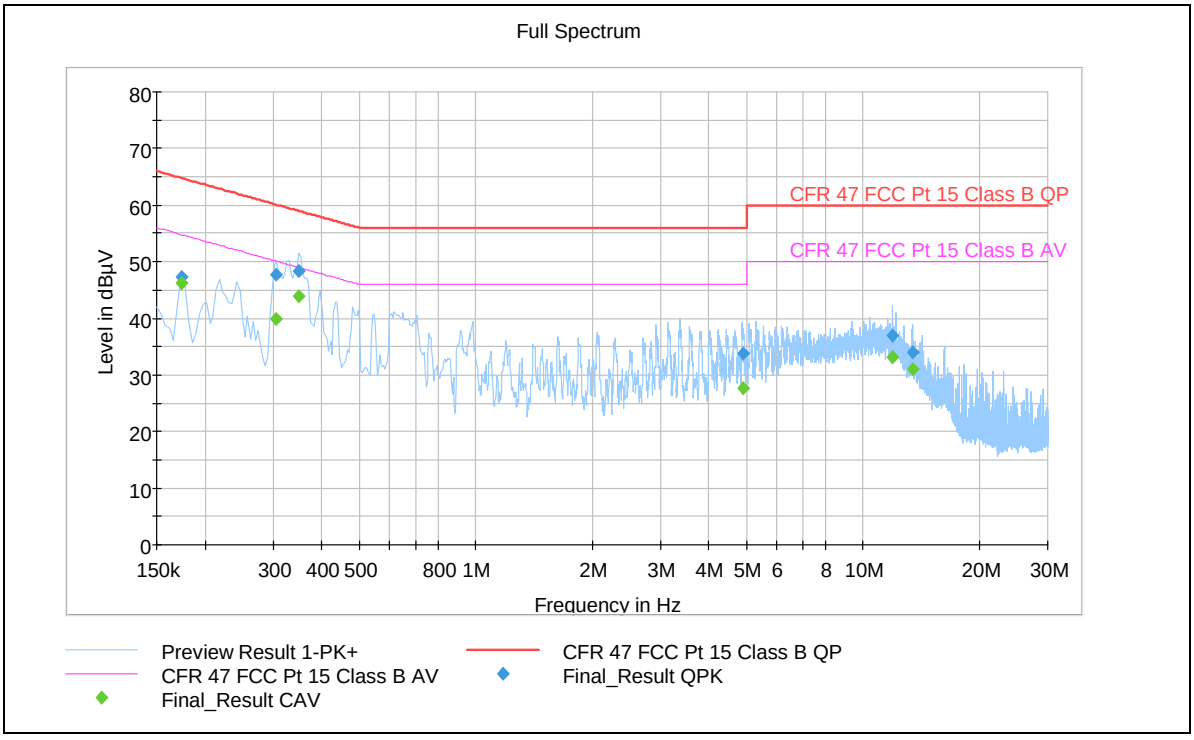
Measurement procedure: **ANSI C63.4-2014 using 50 µH/50 ohms LISN**

Test Results: **Complies**

Measurement Data: **120V 60Hz, See attached plots.**

Highest measured value (L1 and N):

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.174000	---	46.25	54.77	8.51	15000.0	9.000	L1	OFF	9.7
0.174000	47.25	---	64.77	17.52	15000.0	9.000	L1	OFF	9.7
0.306000	---	39.91	50.08	10.17	15000.0	9.000	N	OFF	9.7
0.306000	47.76	---	60.08	12.32	15000.0	9.000	N	OFF	9.7
0.350000	48.30	---	58.96	10.66	15000.0	9.000	L1	OFF	9.7
0.350000	---	43.88	48.96	5.08	15000.0	9.000	L1	OFF	9.7
4.894000	---	27.60	46.00	18.40	15000.0	9.000	L1	OFF	9.8
4.894000	33.72	---	56.00	22.28	15000.0	9.000	L1	OFF	9.8
11.954000	36.85	---	60.00	23.15	15000.0	9.000	L1	OFF	9.9
11.954000	---	33.09	50.00	16.91	15000.0	9.000	L1	OFF	9.9
13.482000	---	31.00	50.00	19.00	15000.0	9.000	N	OFF	9.7
13.482000	33.93	---	60.00	26.07	15000.0	9.000	N	OFF	9.7



3.2 Occupied Bandwidth (99% BW)

ISED Canada RSS-GEN Issue 5, Clause 6.7

Measurement procedure: ANSI C63.10-2013 Clause 6.9.2

Test Results: Complies

Measurement Data:

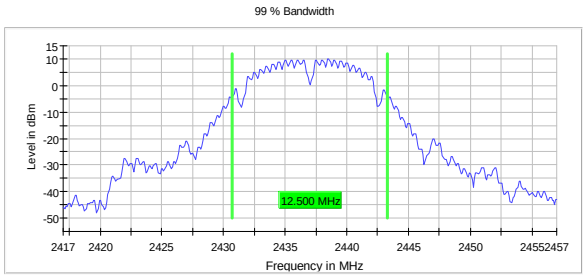
Carrier Frequency, Modulation, Data Rate	Occupied Bandwidth (99% BW)
2437 MHz, 802.11b 1Mb	12.5 MHz
2437 MHz, 802.11g 6Mb	16.9 MHz
2437 MHz, 802.11n MCS0 SISO	17.7 MHz
2437 MHz, 802.11n MCS8 MIMO	17.9 MHz
2437 MHz, 802.11ax MCS0 SISO	19.1 MHz
2437 MHz, 802.11ax MCS0 MIMO	19.1 MHz

Occupied Bandwidth is the same for all channels.

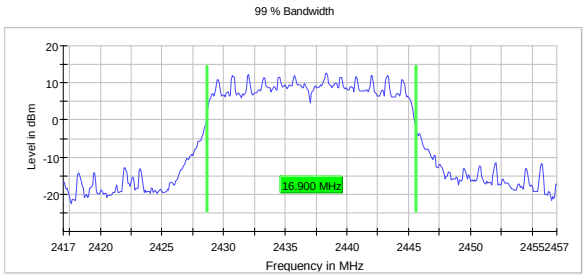
See attached plots.

Requirements:

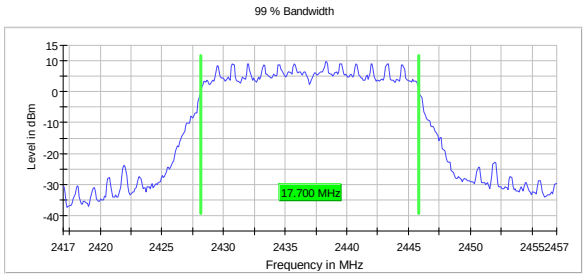
No requirements for Digital Transmission Systems.



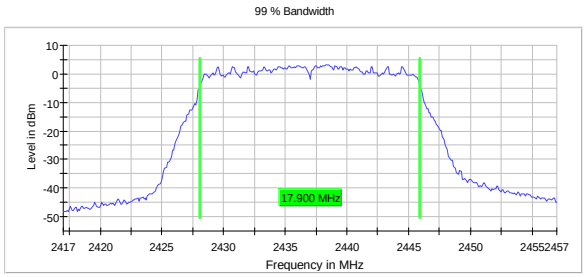
99% Occupied BW, 802.11b 1M



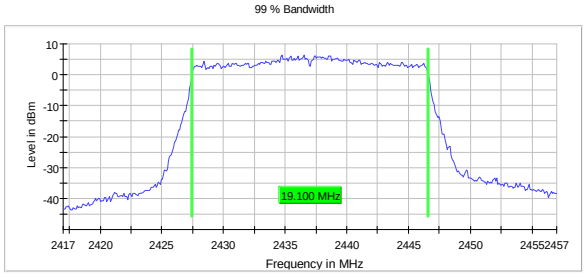
99% Occupied BW, 802.11g 6M



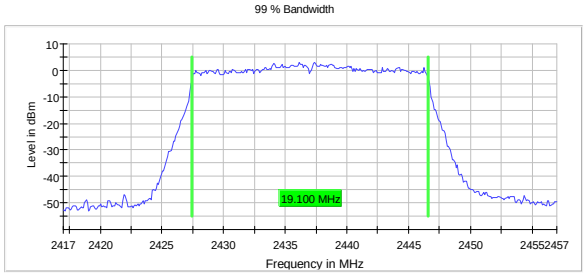
99% Occupied BW, 802.11n MCS0, SISO



99% Occupied BW, 802.11n MCS8, MIMO



99% Occupied BW, 802.11ax MCS0, SISO



99% Occupied BW, 802.11ax MCS0, MIMO

3.3 DTS Bandwidth

FCC Part 15.247 (a)(2)

ISED Canada RSS-247 Issue 2, Clause 5.2 (a)

Measurement procedure: **ANSI C63.10-2013 Clause 11.8**

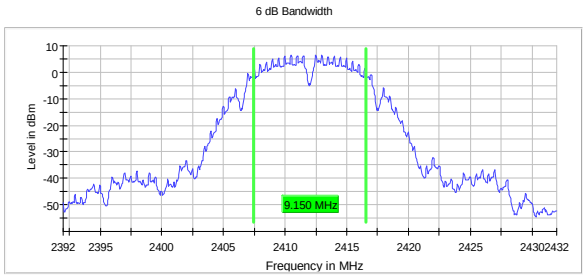
Test Results: **Complies**

Measurement Data:

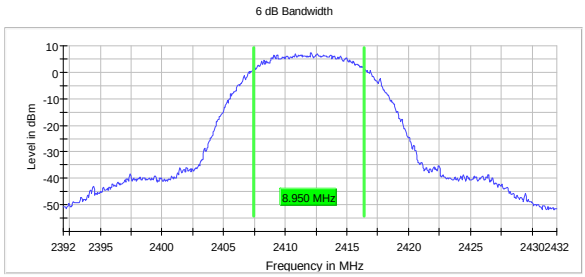
Modulation Scheme and bitrate	Measured DTS Bandwidth (MHz)		
	2412 MHz	2437 MHz	2462 MHz
802.11b 1M	9.2	9.2	9.2
802.11b 11M	9.0	9.4	8.7
802.11g 6M	15.3	15.3	15.3
802.11g 54M	16.6	16.6	16.6
802.11n MCS0 SISO	15.3	15.3	15.3
802.11n MCS7 SISO	17.9	17.9	17.8
802.11ax MCS0 SISO	19.1	19.1	19.1
802.11ax MCS8 SISO	19.3	19.3	19.3
802.11ax MCS11 SISO	19.2	19.3	19.2
802.11ax MCS0 MIMO	19.1	19.1	19.1

Power supply variation within 85 % to 115% of nominal value has no influence on measured value.

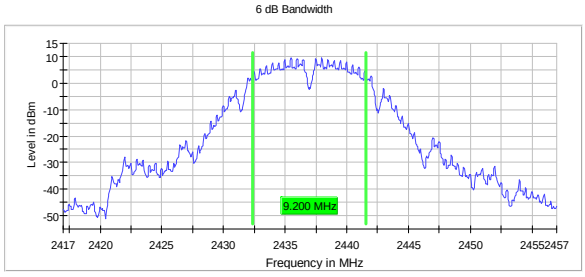
Frequency Band	Requirement for systems using Digital Modulation
902-928 MHz	The minimum 6 dB bandwidth shall be at least 500 kHz.
2400-2483.5 MHz	
5725-5850 MHz	



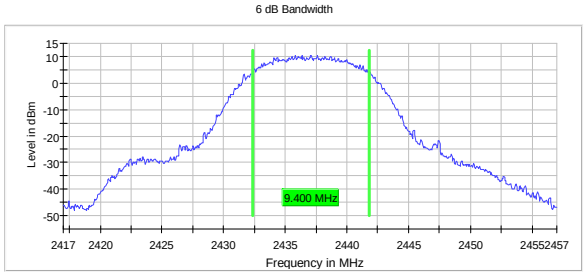
DTS BW, 2412 MHz, 802.11b 1M



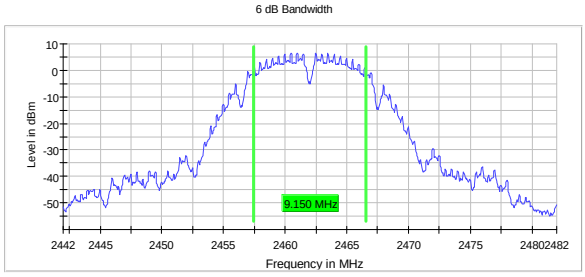
DTS BW, 2412 MHz, 802.11b 11M



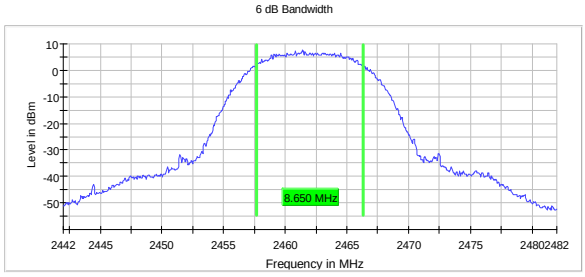
DTS BW, 2437 MHz, 802.11b 1M



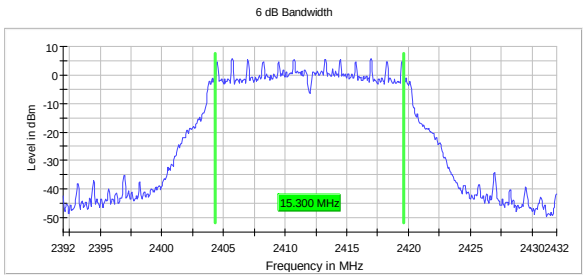
DTS BW, 2437 MHz, 802.11b 11M



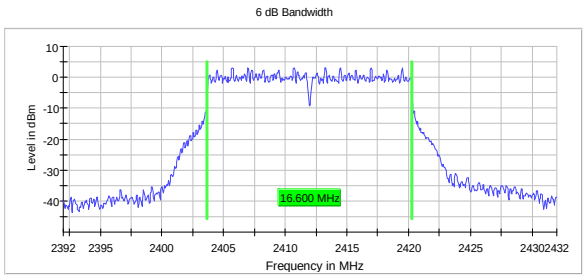
DTS BW, 2462 MHz, 802.11b 1M



DTS BW, 2462 MHz, 802.11b 11M



DTS BW, 2412 MHz, 802.11g 6M



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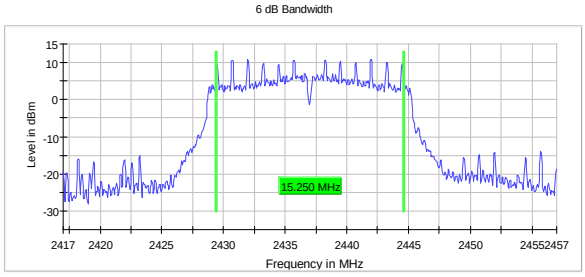

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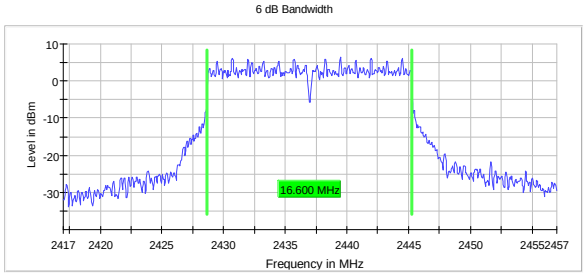

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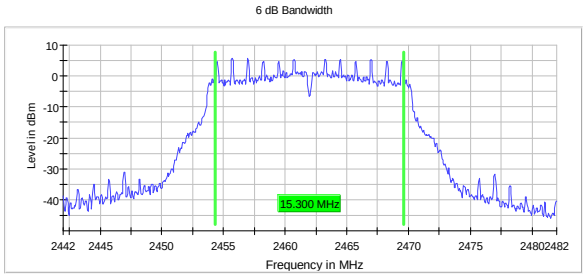
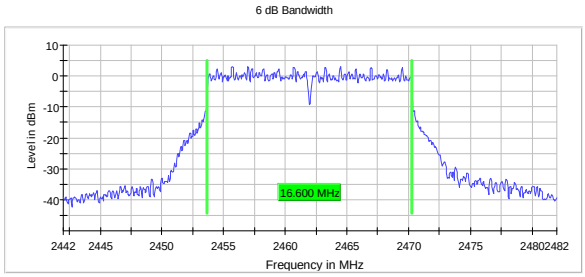
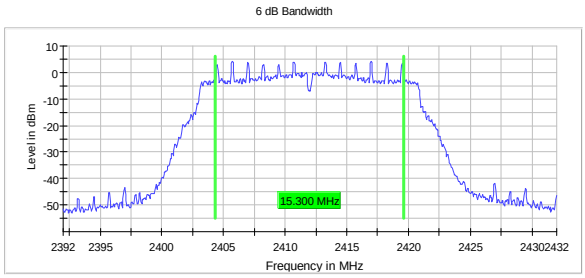


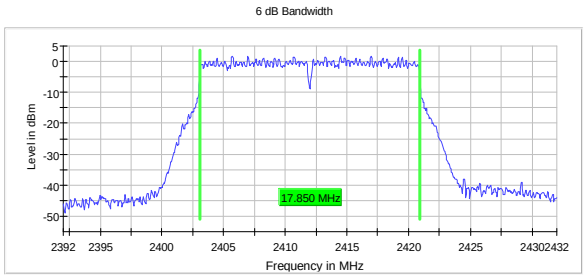
DTS BW, 2462 MHz, 802.11g 6M



DTS BW, 2462 MHz, 802.11g 54M



DTS BW, 2412 MHz, 802.11n MCS0, SISO



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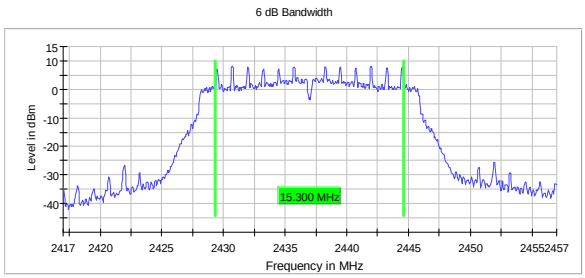
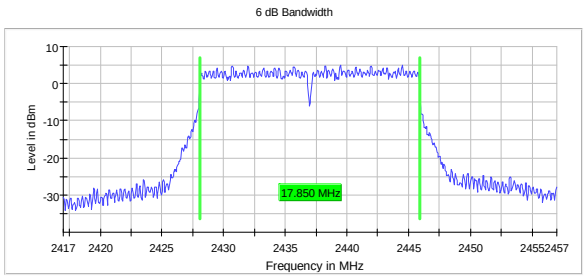


DTS BW, 2437 MHz, 802.11n MCS0, SISO



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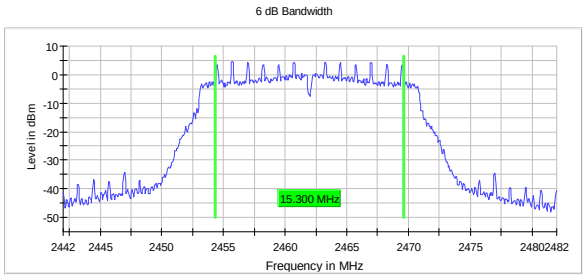
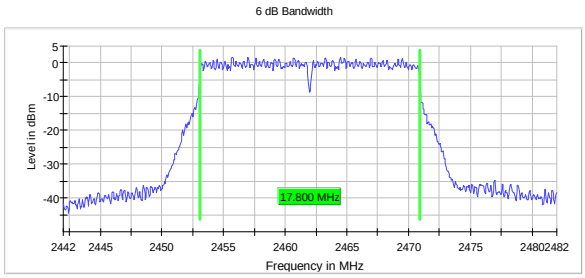


DTS BW, 2462 MHz, 802.11n MCS0, SISO



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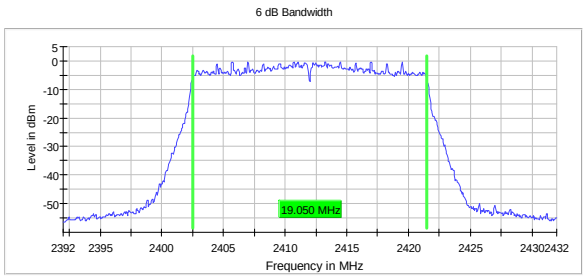
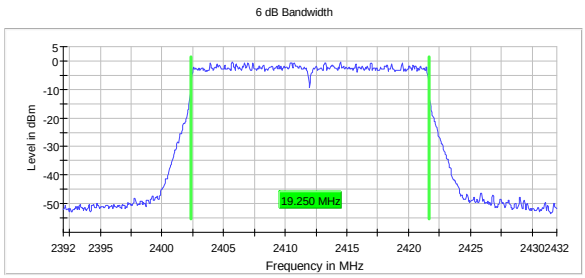


DTS BW, 2412 MHz, 802.11ax MCS0, SISO



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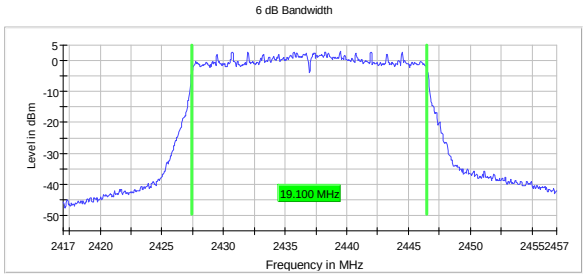
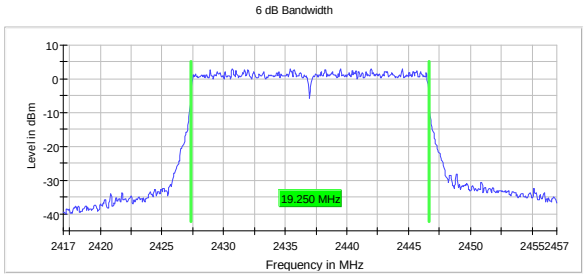
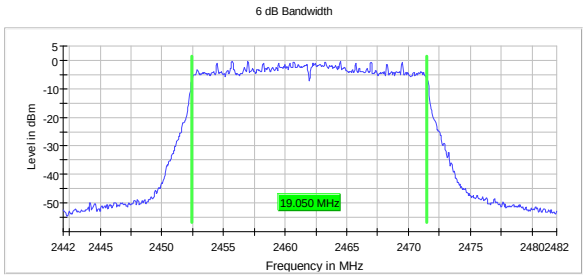


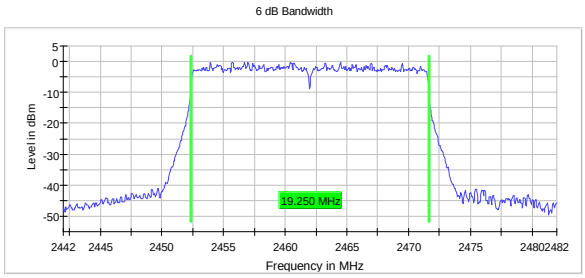
DTS BW, 2437 MHz, 802.11ax MCS0, SISO



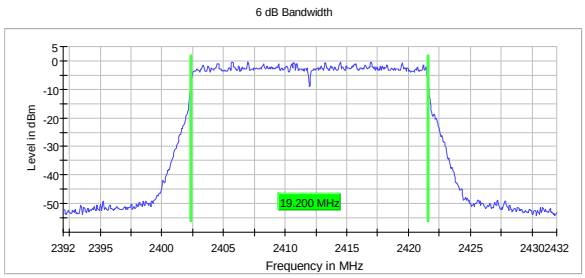
DTS BW, 2437 MHz, 802.11ax MCS8, SISO



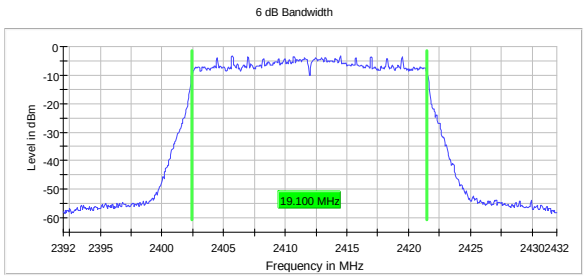
DTS BW, 2462 MHz, 802.11ax MCS0, SISO



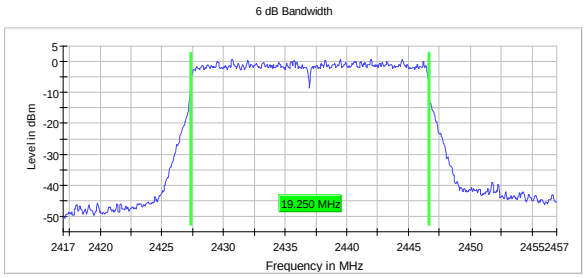
DTS BW, 2462 MHz, 802.11ax MCS8, SISO



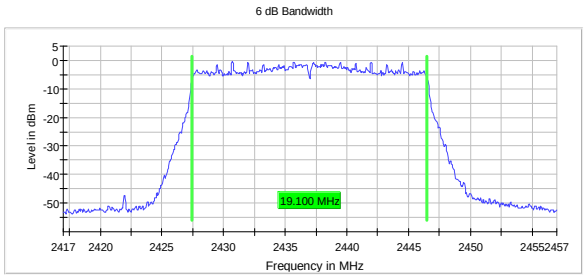
DTS BW, 2412 MHz, 802.11ax MCS11, SISO



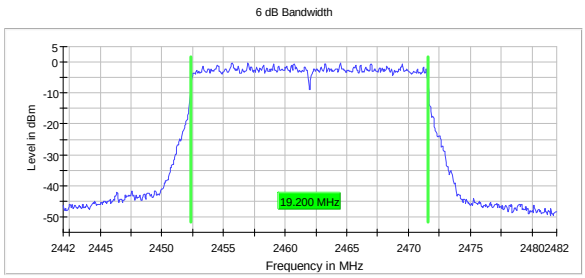
DTS BW, 2412 MHz, 802.11ax MCS0, MIMO



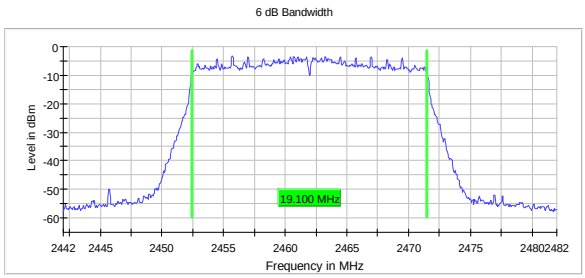
DTS BW, 2437 MHz, 802.11ax MCS11, SISO



DTS BW, 2437 MHz, 802.11ax MCS0, MIMO



DTS BW, 2462 MHz, 802.11ax MCS11, SISO



DTS BW, 2462 MHz, 802.11ax MCS0, MIMO

3.4 Output Power

FCC Part 15.247 (b)

ISED Canada RSS-247 Issue 2, Clause 5.4

Measurement procedure: ANSI C63.10-2013 Clause 11.9.1.2

Test Results: Complies

Measurement Data:

Modulation and bitrate	Average Conducted Power, dBm							
	2412 MHz	2422 MHz	2427 MHz	2437 MHz	2442 MHz	2447 MHz	2452 MHz	2462 MHz
802.11b 1M	15.4	18.6		18.3			18.3	15.5
802.11b 11M	15.5	18.9		18.8			18.9	15.7
802.11g 6M	14.3	16.9	19.3	19.7	19.9	20.2	17.7	14.7
802.11g 54M	15.2	16.9	18.0	18.2	18.3	17.1	16.2	15.2
802.11n MCS0, SISO	13.0	17.1		16.9			17.2	13.4
802.11n MCS7, SISO	13.6	16.0	17.0	16.8		16.6	15.9	13.7
802.11n MCS8, MIMO	12.0	15.0		14.6			14.6	11.7
802.11n MCS15, MIMO	12.3	15.6		15.2			15.2	12.3
802.11ax MCS0, SISO	11.3	14.6		14.5			14.7	11.1
802.11ax MCS8, SISO	11.7	15.2		15.2			15.1	11.9
802.11ax MCS11, SISO	11.8	12.9		12.9			12.7	11.8
802.11ax MCS0, MIMO	10.2	13.1		12.7			12.7	9.9
802.11ax MCS8, MIMO	10.8	13.7		13.5			13.4	10.5
802.11ax MCS11, MIMO	10.7	11.9		11.5			11.4	10.5

Modulation and bitrate	Average Conducted Power, mW							
	2412 MHz	2422 MHz	2427 MHz	2437 MHz	2442 MHz	2447 MHz	2452 MHz	2462 MHz
802.11b 1M	34.7	72.4		67.6			67.6	35.5
802.11b 11M	35.5	77.6		75.9			77.6	37.2
802.11g 6M	26.9	49.0	85.1	93.3	97.7	104.7	58.9	29.5
802.11g 54M	33.1	49.0	63.1	66.1	67.6	51.3	41.7	33.1
802.11n MCS0, SISO	20.0	51.3		49.0			52.5	21.9
802.11n MCS7, SISO	22.9	39.8	50.1	47.9		45.7	38.9	23.4
802.11n MCS8, MIMO	15.8	31.6		28.8			28.8	14.8
802.11n MCS15, MIMO	17.0	36.3		33.1			33.1	17.0
802.11ax MCS0, SISO	13.5	28.8		28.2			29.5	12.9
802.11ax MCS8, SISO	14.8	33.1		33.1			32.4	15.5
802.11ax MCS11, SISO	15.1	19.5		19.5			18.6	15.1
802.11ax MCS0, MIMO	10.5	20.4		18.6			18.6	9.8
802.11ax MCS8, MIMO	12.0	23.4		22.4			21.9	11.2
802.11ax MCS11, MIMO	11.7	15.5		14.1			13.8	11.2

Output Power reported is Average Power measured with a wideband power meter.

Output Power on P0 and P1 in SISO mode is identical. All SISO measurements in conducted mode were performed on P0.

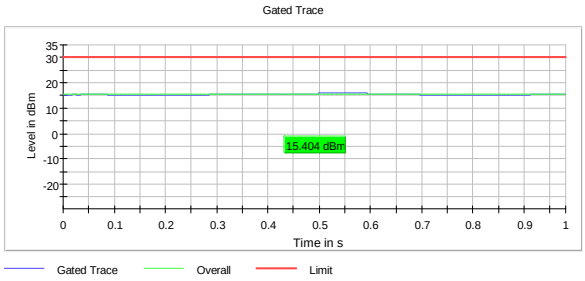
Output in MIMO mode is the sum power of P0+P1. The measurement was performed simultaneously with two power meters and the sum power was calculated. The R&S TS8997 Test System contains 8 identical power meters, however for this EUT only two of them were used.

Maximum Antenna Gain in MIMO mode is 9.6 dBi (6.7+2.9 dBi). Maximum Allowed Output Power is therefore reduced by 3.6 dB in MIMO mode, and by 0.7 dB in SISO mode.

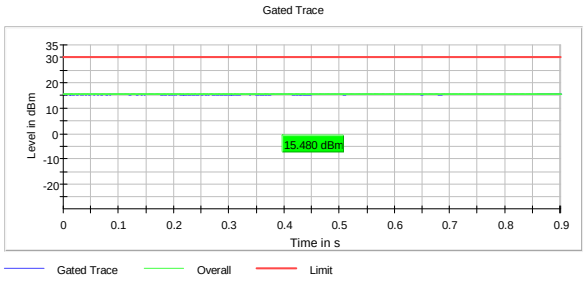
Maximum Allowed Output Power after correcting for Antenna Gain is therefore 26.4 dBm in MIMO mode and 29.3 dBm in SISO mode.

See attached plots.

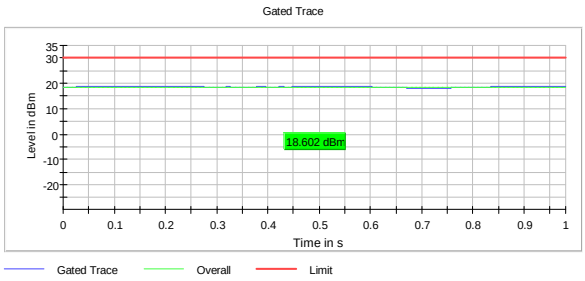
Requirements for Digital Modulation systems
For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the 1 Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.
Maximum allowed Antenna Gain
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced below the stated value above by the amount in dB that the directional gain of the antenna exceeds 6 dBi.



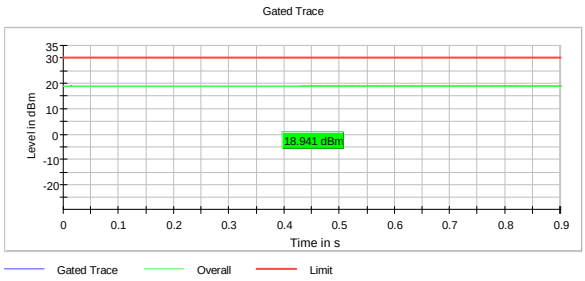
Output Power, 2412 MHz, 802.11b 1M



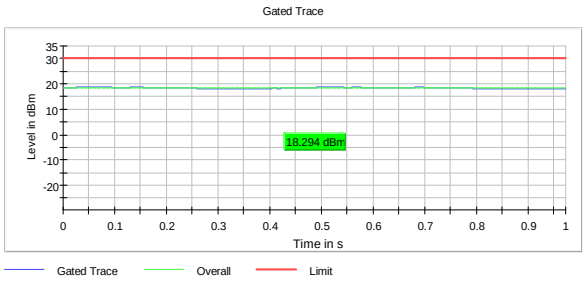
Output Power, 2412 MHz, 802.11b 11M



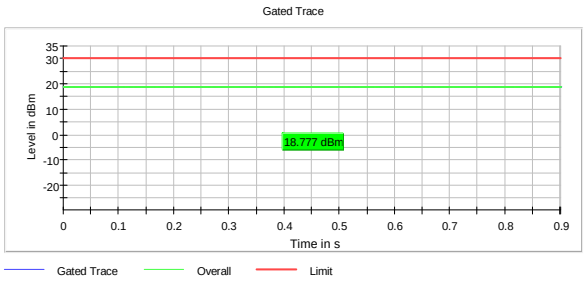
Output Power, 2422 MHz, 802.11b 1M



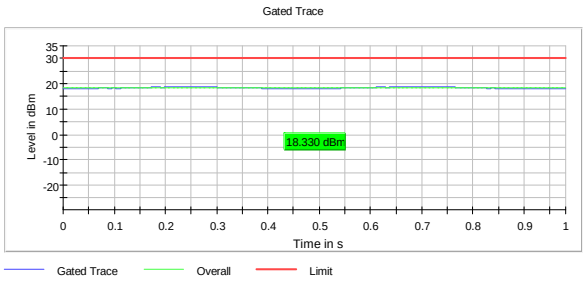
Output Power, 2422 MHz, 802.11b 11M



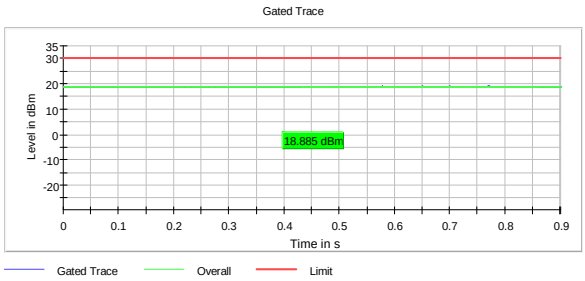
Output Power, 2437 MHz, 802.11b 1M



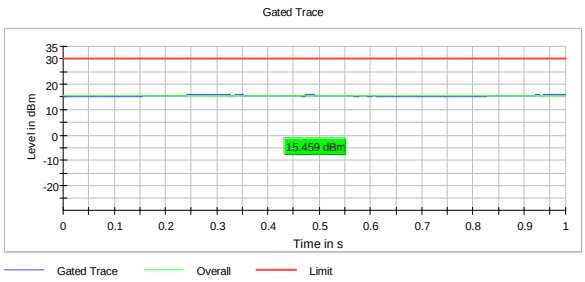
Output Power, 2437 MHz, 802.11b 11M



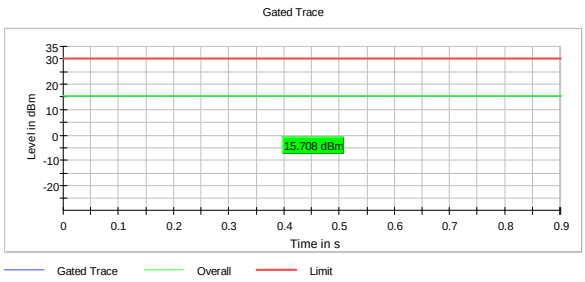
Output Power, 2452 MHz, 802.11b 1M



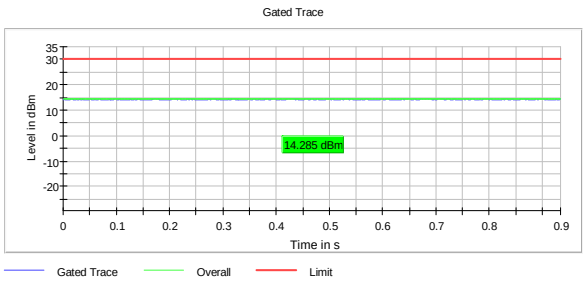
Output Power, 2452 MHz, 802.11b 11M



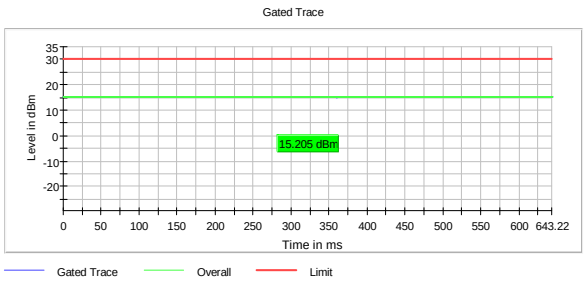
Output Power, 2462 MHz, 802.11b 1M



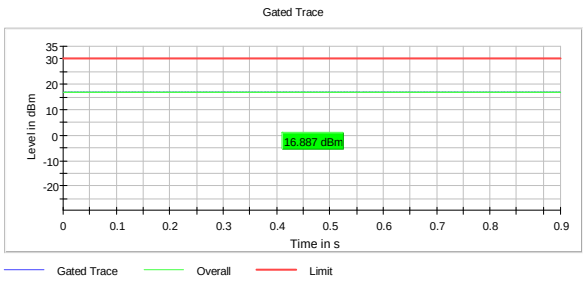
Output Power, 2462 MHz, 802.11b 11M



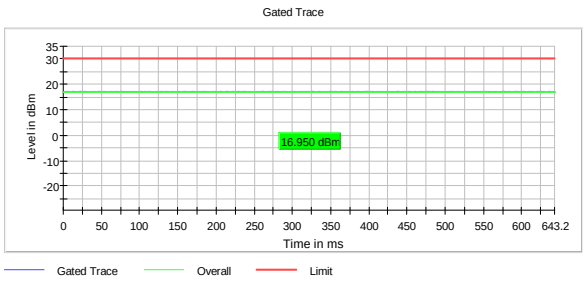
Output Power, 2412 MHz, 802.11g 6M



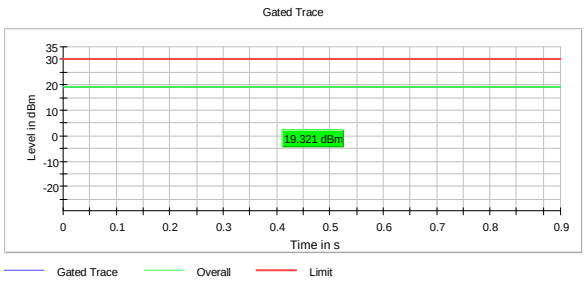
Output Power, 2412 MHz, 802.11g 54M



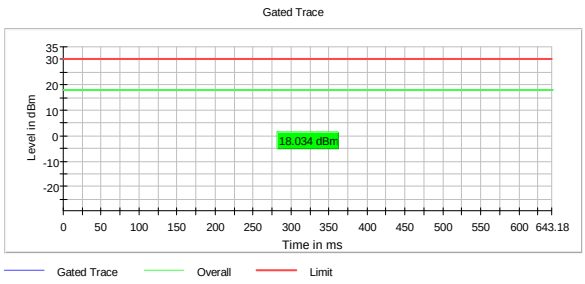
Output Power, 2422 MHz, 802.11g 6M



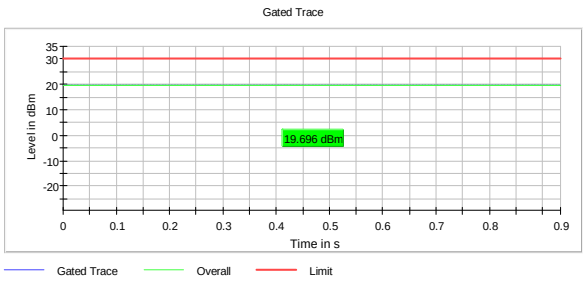
Output Power, 2422 MHz, 802.11g 54M



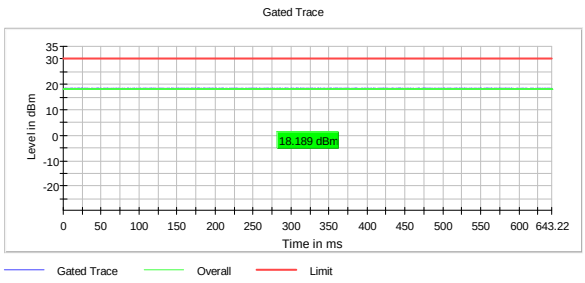
Output Power, 2427 MHz, 802.11g 6M



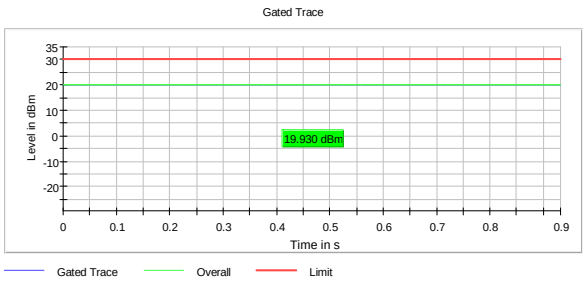
Output Power, 2427 MHz, 802.11g 54M



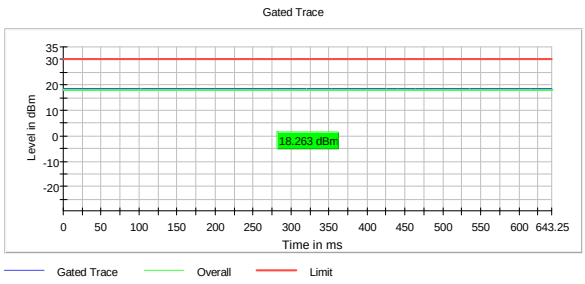
Output Power, 2437 MHz, 802.11g 6M



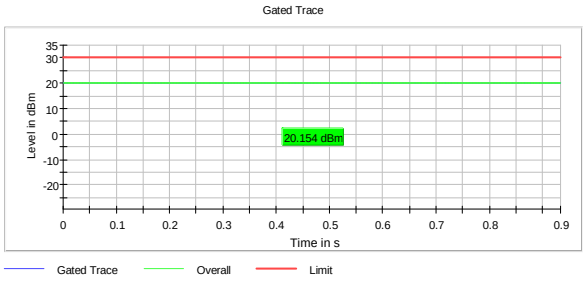
Output Power, 2437 MHz, 802.11g 54M



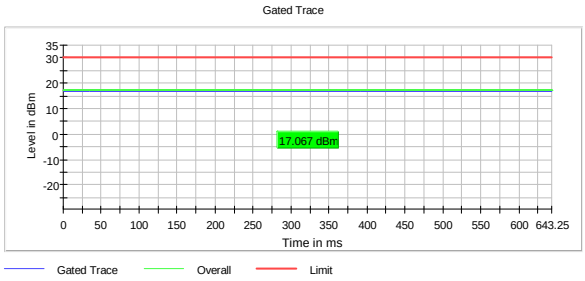
Output Power, 2442 MHz, 802.11g 6M



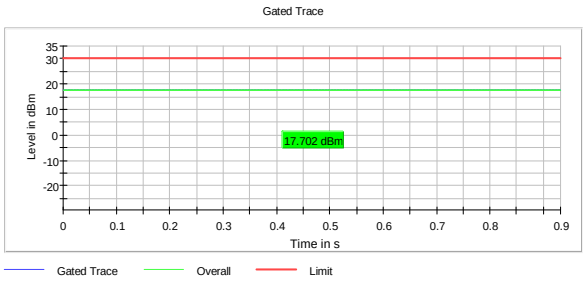
Output Power, 2442 MHz, 802.11g 54M



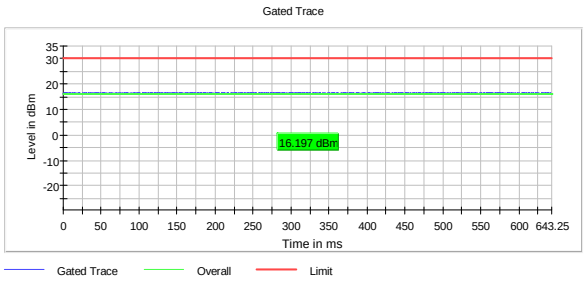
Output Power, 2447 MHz, 802.11g 6M



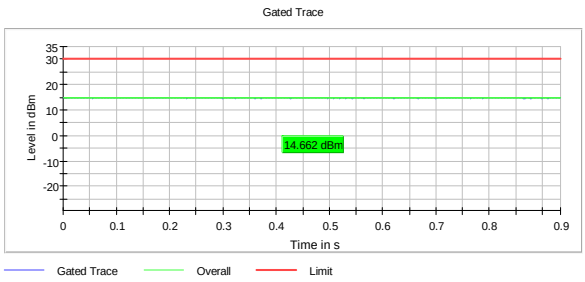
Output Power, 2447 MHz, 802.11g 54M



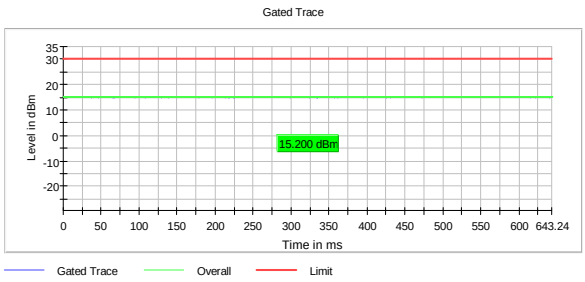
Output Power, 2452 MHz, 802.11g 6M



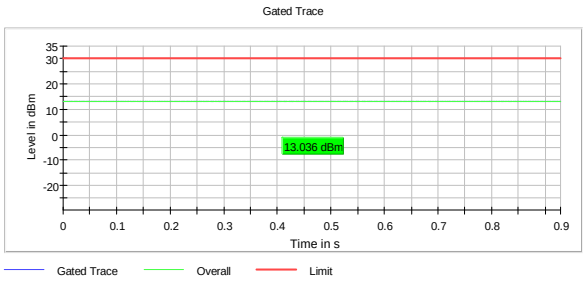
Output Power, 2452 MHz, 802.11g 54M



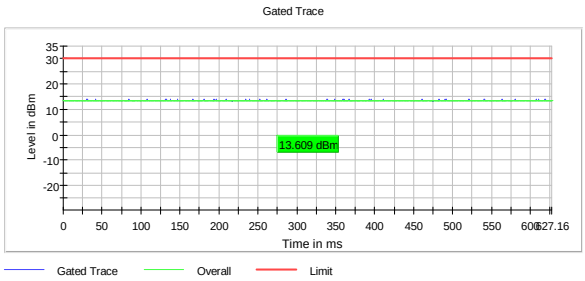
Output Power, 2462 MHz, 802.11g 6M



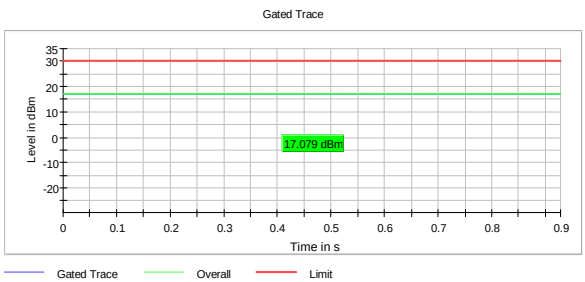
Output Power, 2462 MHz, 802.11g 54M



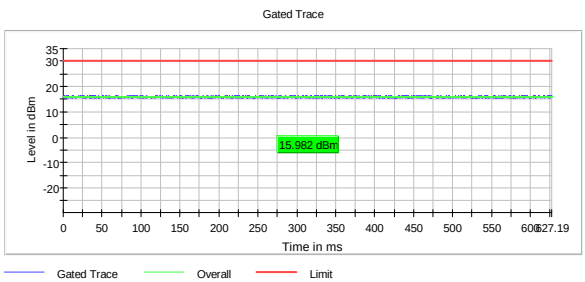
Output Power, 2412 MHz, 802.11n MCS0



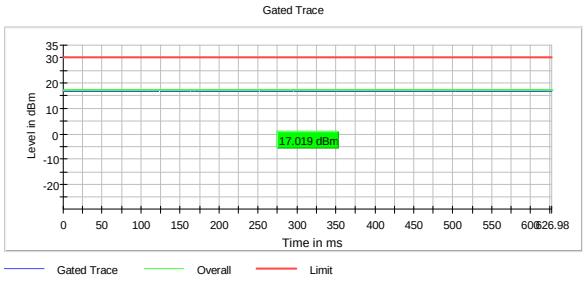
Output Power, 2412 MHz, 802.11n MCS7



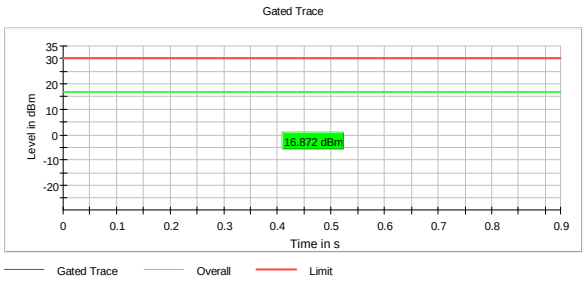
Output Power, 2422 MHz, 802.11n MCS0



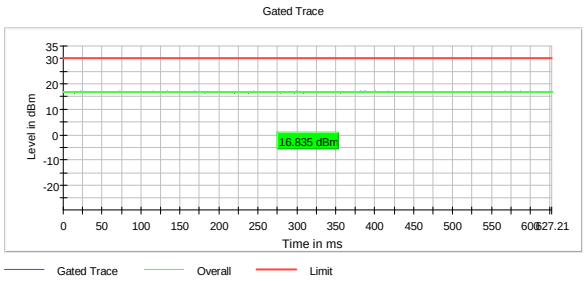
Output Power, 2422 MHz, 802.11n MCS7



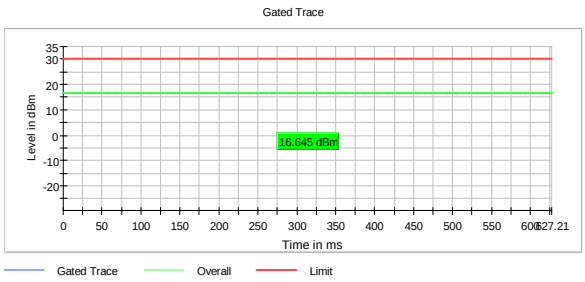
Output Power, 2427 MHz, 802.11n MCS7



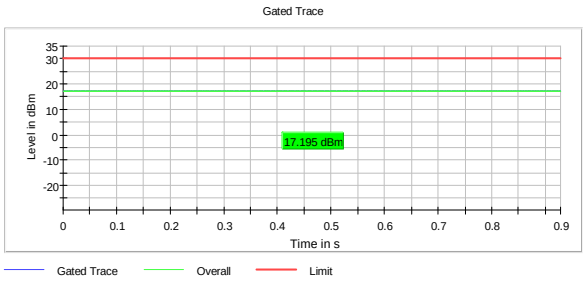
Output Power, 2437 MHz, 802.11n MCS0



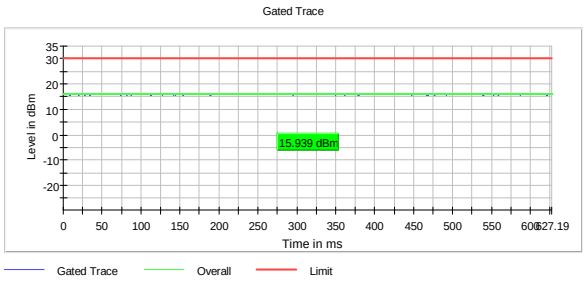
Output Power, 2437 MHz, 802.11n MCS7



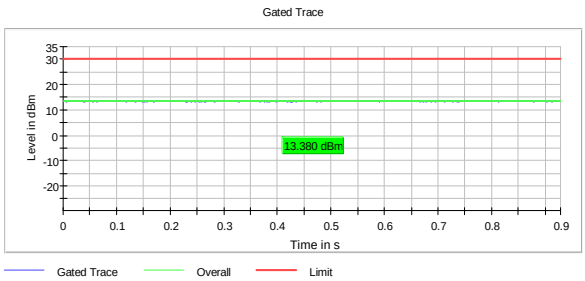
Output Power, 2447 MHz, 802.11n MCS7



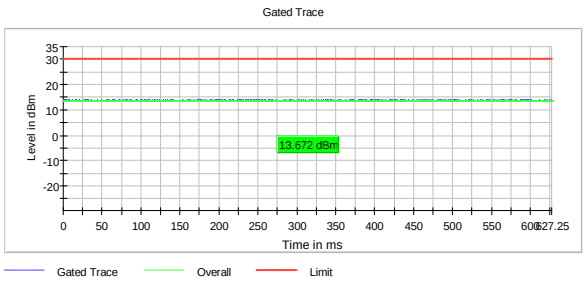
Output Power, 2452 MHz, 802.11n MCS0



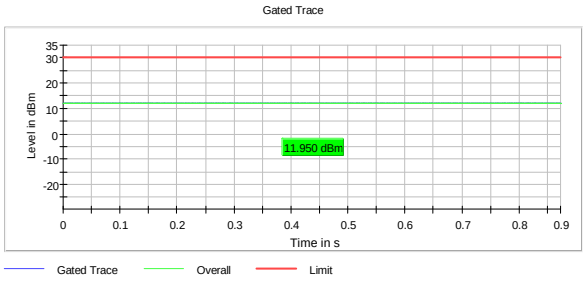
Output Power, 2452 MHz, 802.11n MCS7



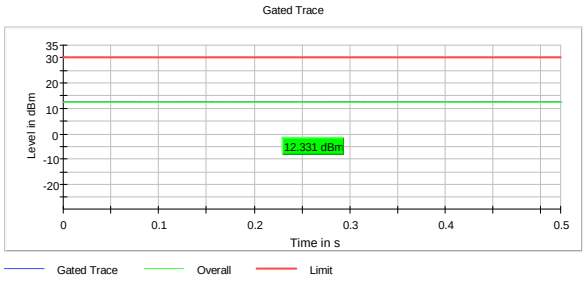
Output Power, 2462 MHz, 802.11n MCS0



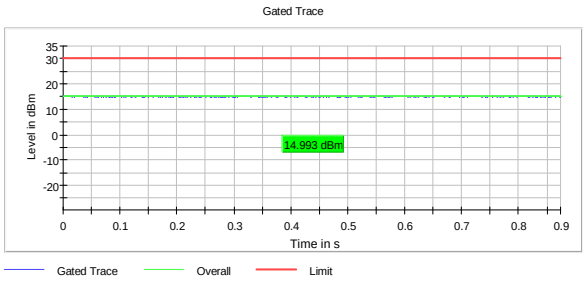
Output Power, 2462 MHz, 802.11n MCS7



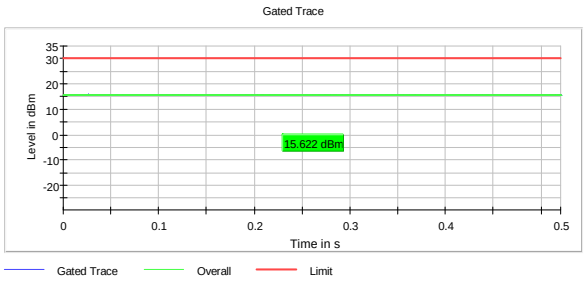
Output Power, 2412 MHz, 802.11n MCS8, MIMO



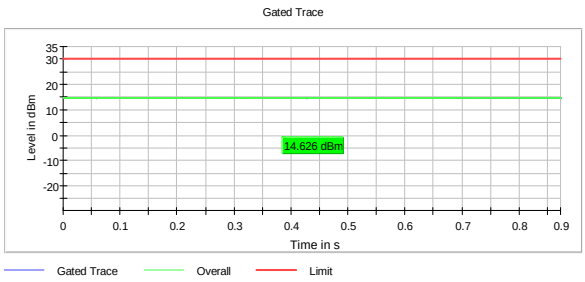
Output Power, 2412 MHz, 802.11n MCS15, MIMO



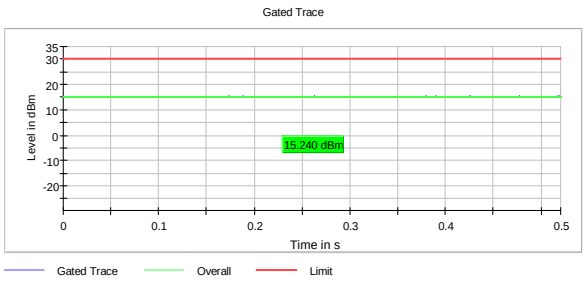
Output Power, 2422 MHz, 802.11n MCS8, MIMO



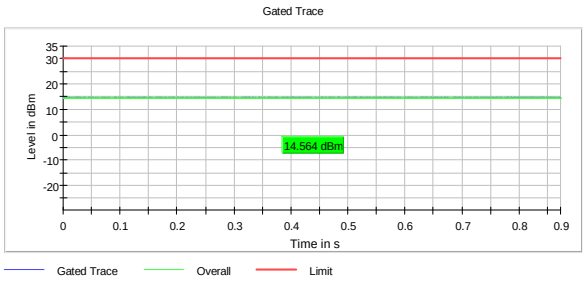
Output Power, 2422 MHz, 802.11n MCS15, MIMO



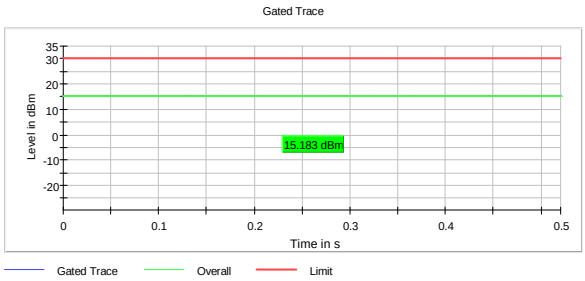
Output Power, 2437 MHz, 802.11n MCS8, MIMO



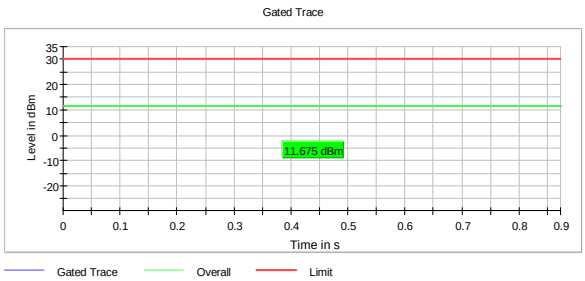
Output Power, 2437 MHz, 802.11n MCS15, MIMO



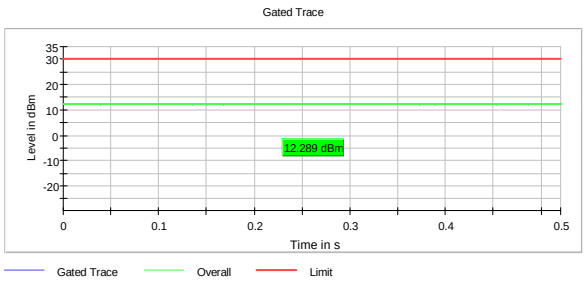
Output Power, 2452 MHz, 802.11n MCS8, MIMO



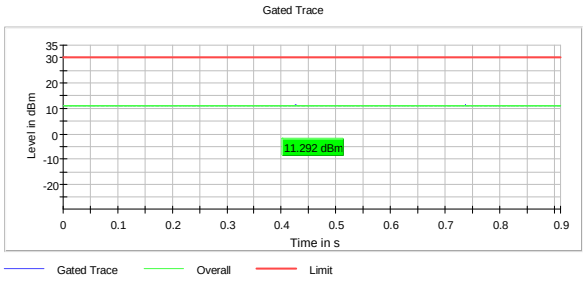
Output Power, 2452 MHz, 802.11n MCS15, MIMO



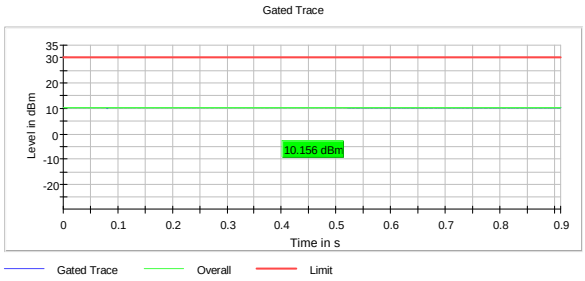
Output Power, 2462 MHz, 802.11n MCS8, MIMO



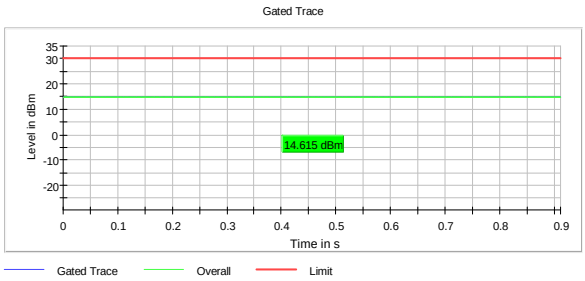
Output Power, 2462 MHz, 802.11n MCS15, MIMO



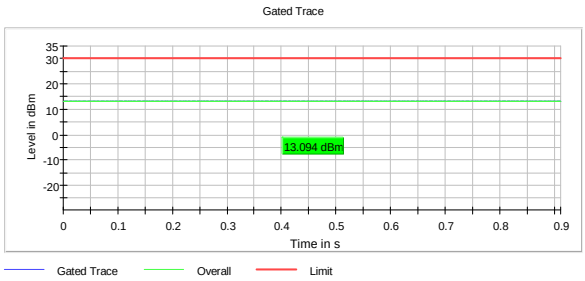
Output Power, 2412 MHz, 802.11ax MCS0



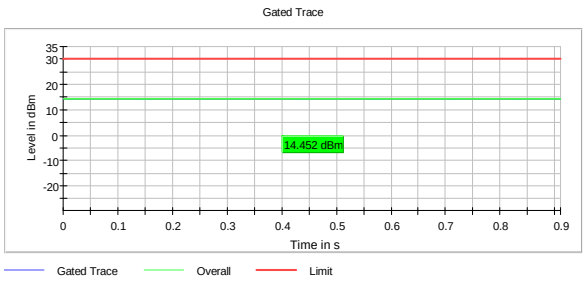
Output Power, 2412 MHz, 802.11ax MCS0, MIMO



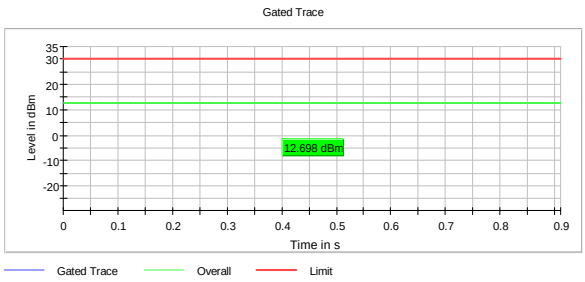
Output Power, 2422 MHz, 802.11ax MCS0



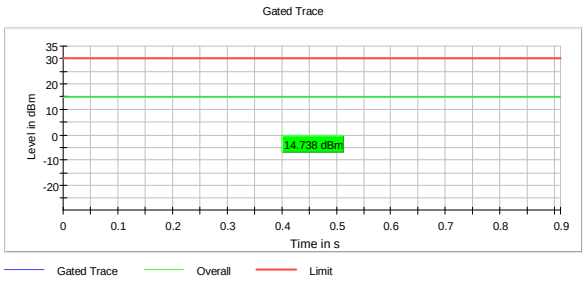
Output Power, 2422 MHz, 802.11ax MCS0, MIMO



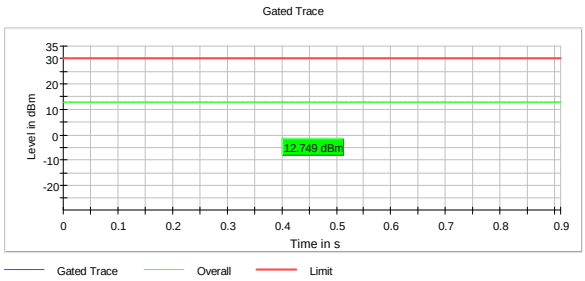
Output Power, 2437 MHz, 802.11ax MCS0



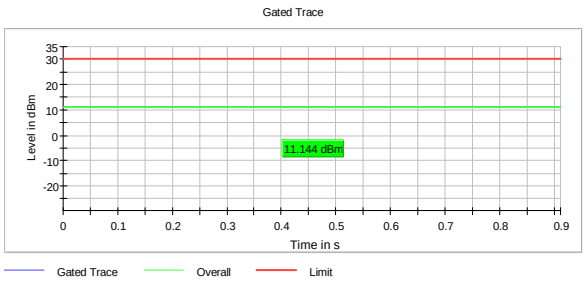
Output Power, 2437 MHz, 802.11ax MCS0, MIMO



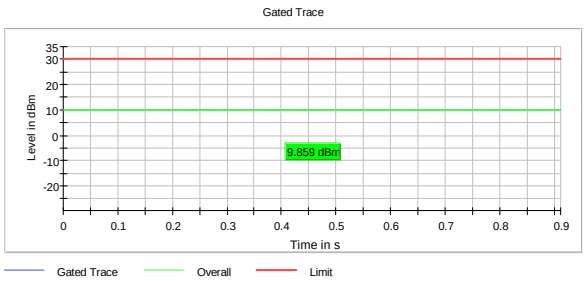
Output Power, 2452 MHz, 802.11ax MCS0



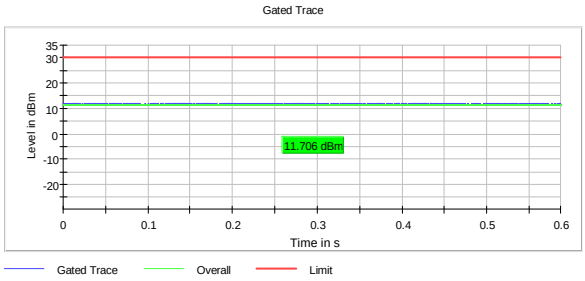
Output Power, 2452 MHz, 802.11ax MCS0, MIMO



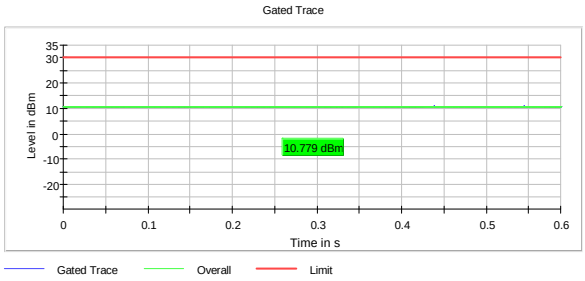
Output Power, 2462 MHz, 802.11ax MCS0



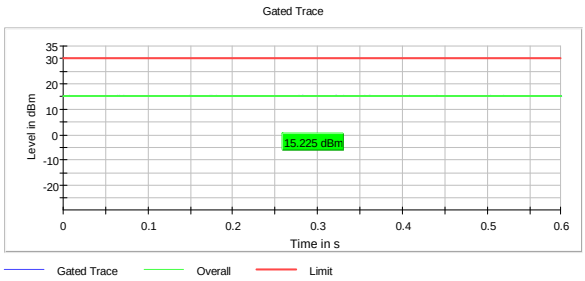
Output Power, 2462 MHz, 802.11ax MCS0, MIMO



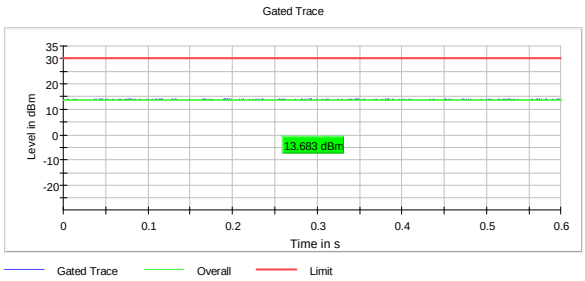
Output Power, 2412 MHz, 802.11ax MCS8



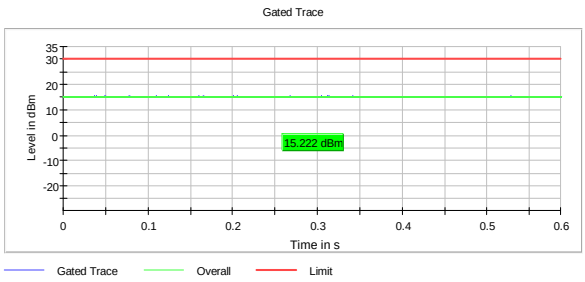
Output Power, 2412 MHz, 802.11ax MCS8, MIMO



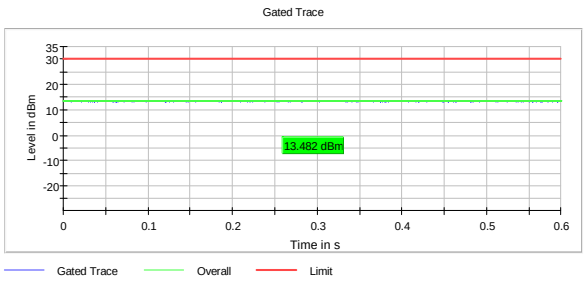
Output Power, 2422 MHz, 802.11ax MCS8



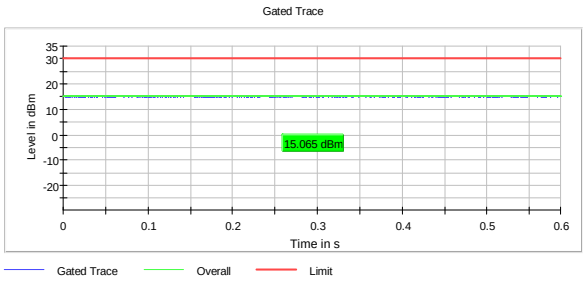
Output Power, 2422 MHz, 802.11ax MCS8, MIMO



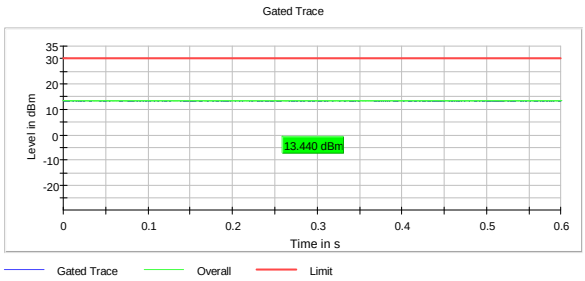
Output Power, 2437 MHz, 802.11ax MCS8



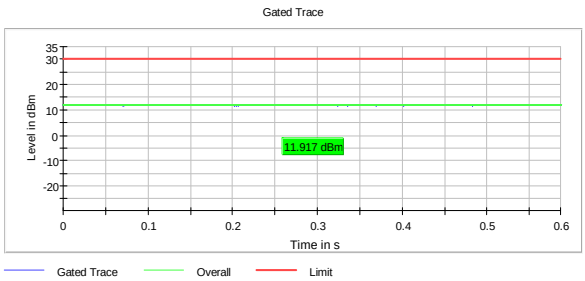
Output Power, 2437 MHz, 802.11ax MCS8, MIMO



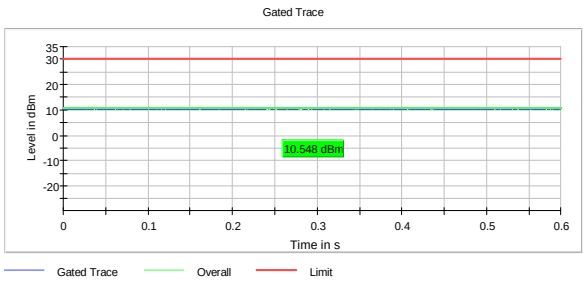
Output Power, 2452 MHz, 802.11ax MCS8



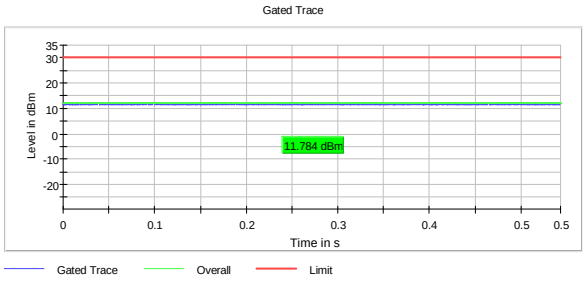
Output Power, 2452 MHz, 802.11ax MCS8, MIMO



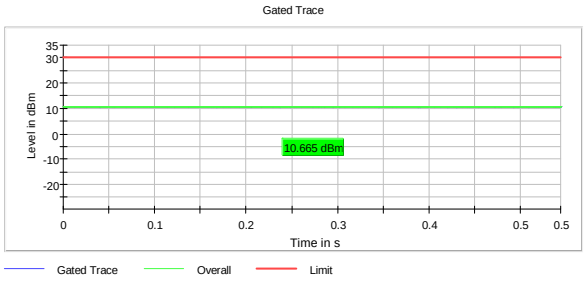
Output Power, 2462 MHz, 802.11ax MCS8



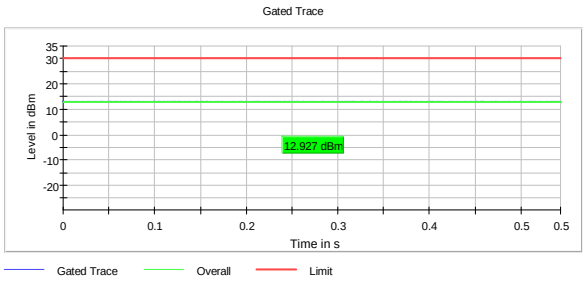
Output Power, 2462 MHz, 802.11ax MCS8, MIMO



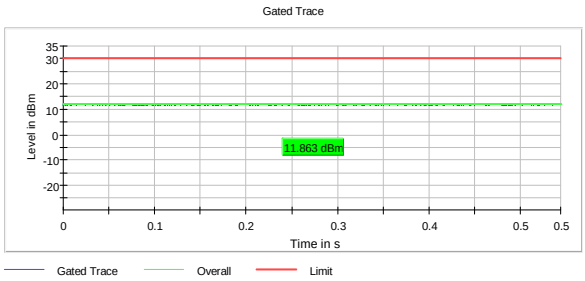
Output Power, 2412 MHz, 802.11ax MCS11



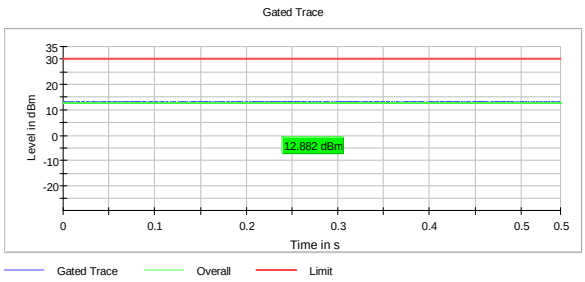
Output Power, 2412 MHz, 802.11ax MCS11, MIMO



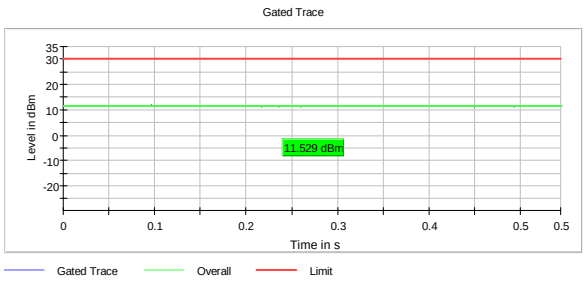
Output Power, 2422 MHz, 802.11ax MCS11



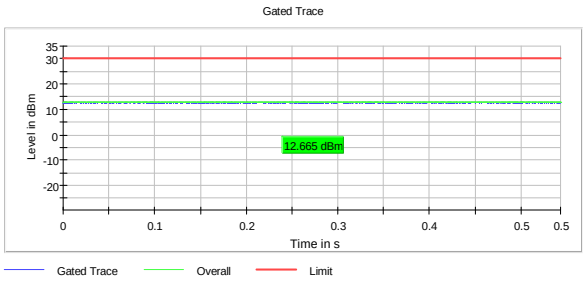
Output Power, 2422 MHz, 802.11ax MCS11, MIMO



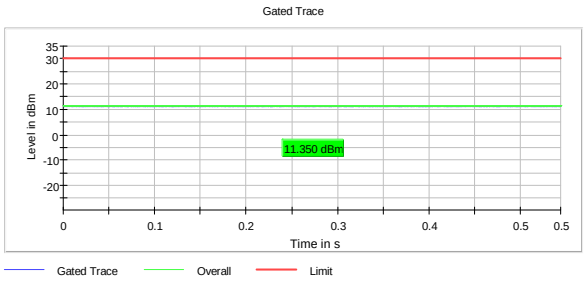
Output Power, 2437 MHz, 802.11ax MCS11



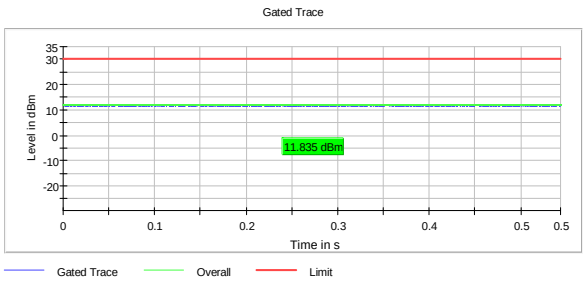
Output Power, 2437 MHz, 802.11ax MCS11, MIMO



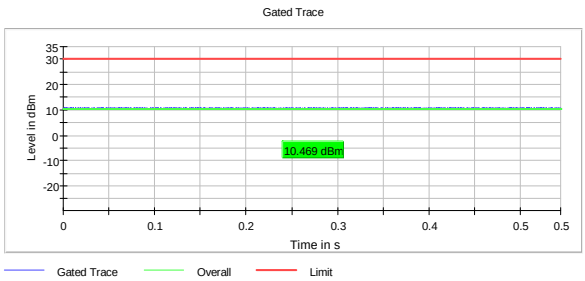
Output Power, 2452 MHz, 802.11ax MCS11



Output Power, 2452 MHz, 802.11ax MCS11, MIMO



Output Power, 2462 MHz, 802.11ax MCS11



Output Power, 2462 MHz, 802.11ax MCS11, MIMO

3.5 Conducted Emissions at Antenna Connector

FCC Part 15.247 (d)

ISED Canada RSS-247 Issue 2, Clause 5.5

Measurement procedure: ANSI C63.10-2013 Clause 11.11

Test Results: Complies

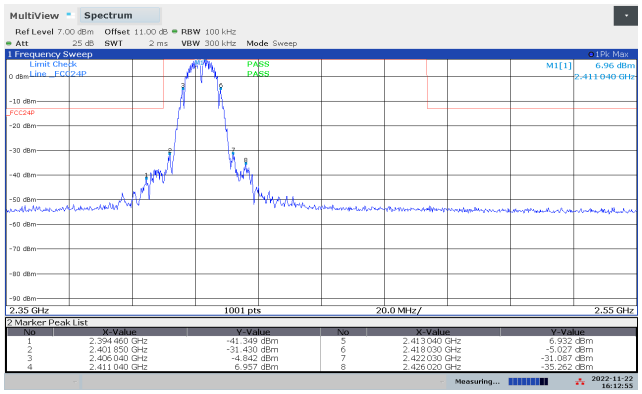
Measurement Data:

Carrier Frequency	Highest Value (dBc)	Margin (dB)	Verdict
2412 MHz	> 40	> 20	Pass
2437 MHz	> 40	> 20	Pass
2462 MHz	> 40	> 20	Pass

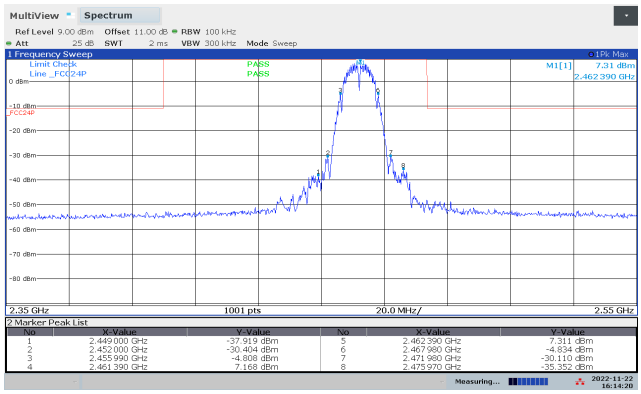
Measured with Peak Detector.

RF conducted power to 25 GHz: see attached plots.

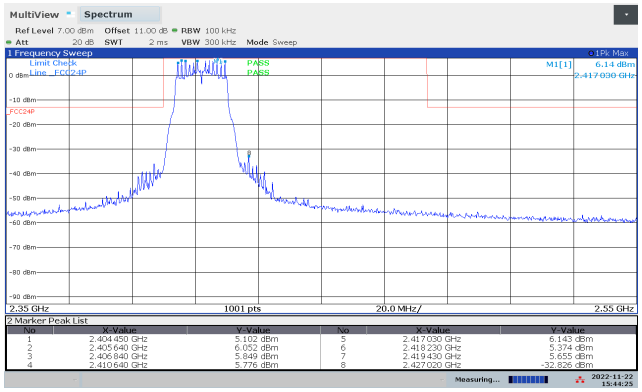
Requirements for all systems	
Peak measurement	**RMS averaging (alternative measurement)**
20 dB or more below carrier measured in 100 kHz bandwidth	30 dB or more below carrier measured in 100 kHz bandwidth
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.	



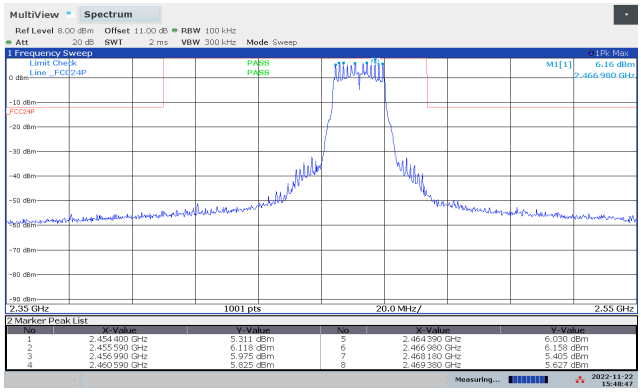
Conducted Emissions 2350-2550 MHz, 2412 MHz, 802.11b 1M



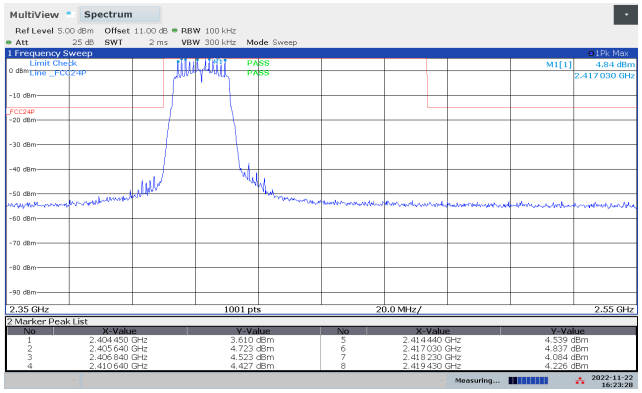
2462 MHz



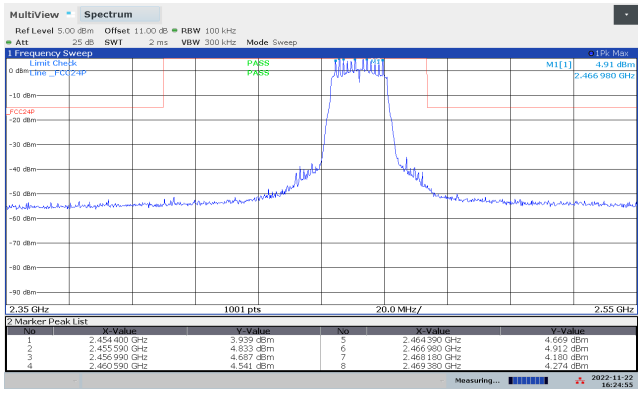
Conducted Emissions 2350-2550 MHz, 2412 MHz, 802.11g 6M



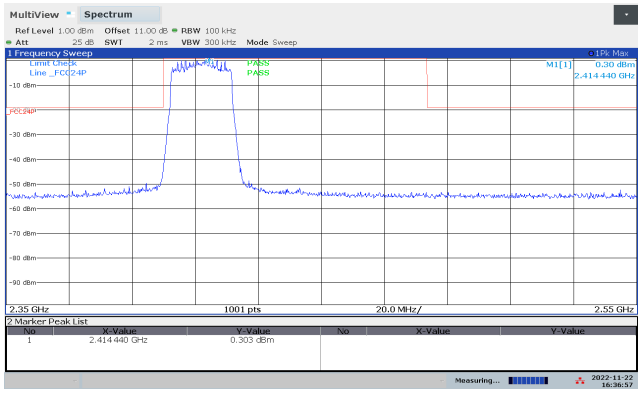
2462 MHz



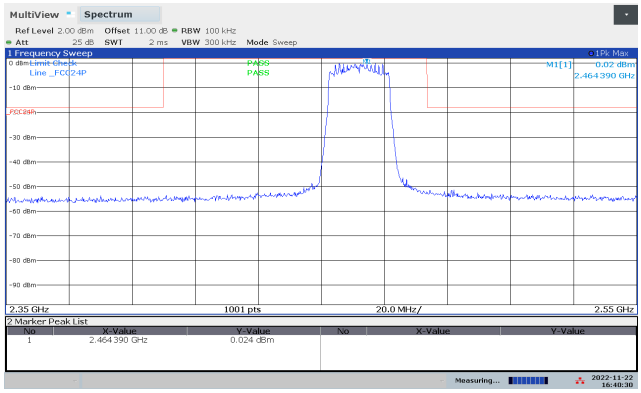
Conducted Emissions 2350-2550 MHz, 2412 MHz, 802.11n MCS0



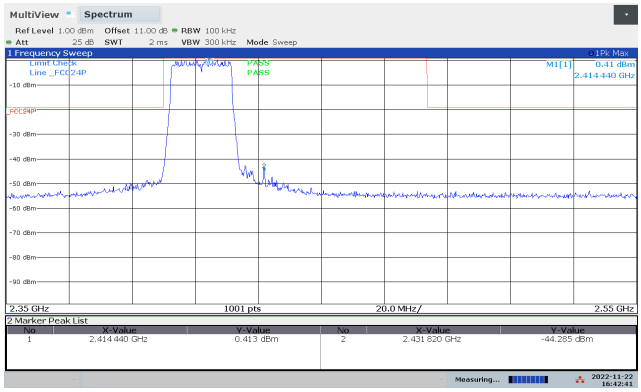
2462 MHz



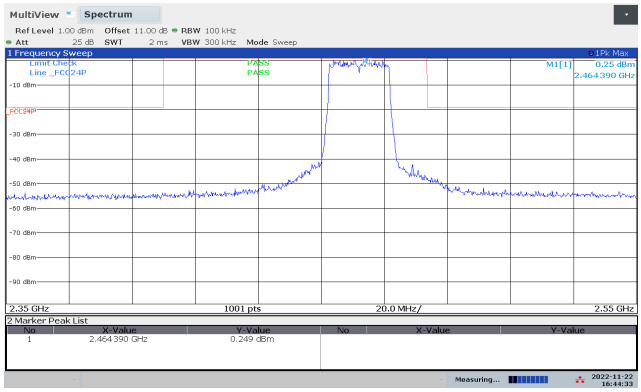
Conducted Emissions 2350-2550 MHz, 2412 MHz, 802.11ax MCS0



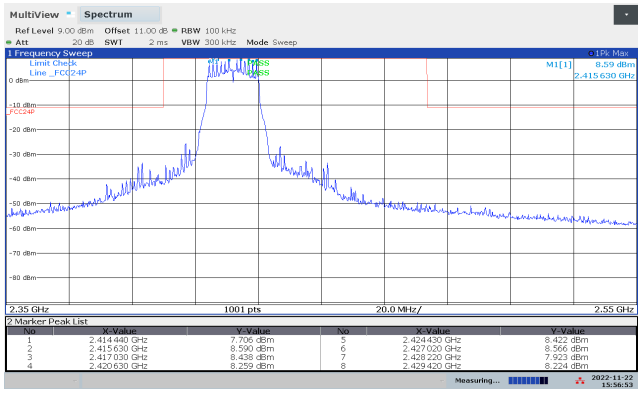
2462 MHz



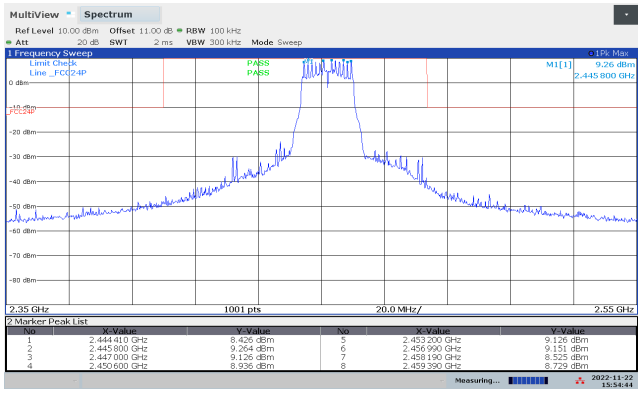
Conducted Emissions 2350-2550 MHz, 2412 MHz, 802.11ax MCS8



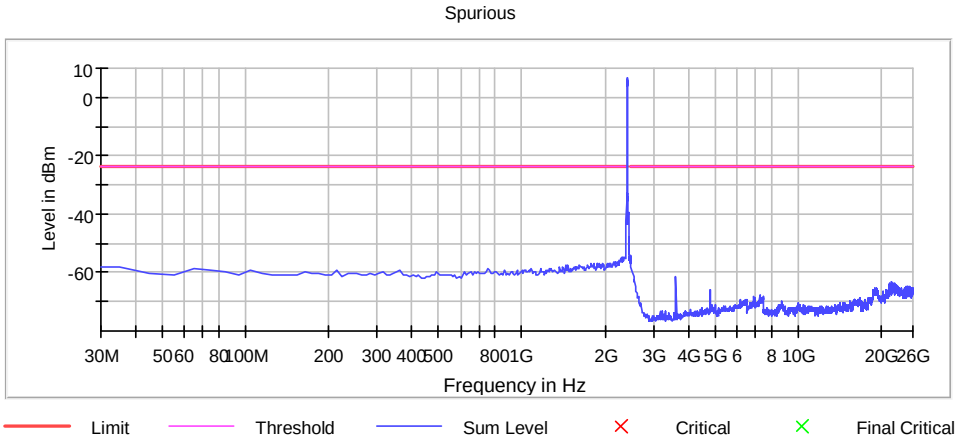
2462 MHz



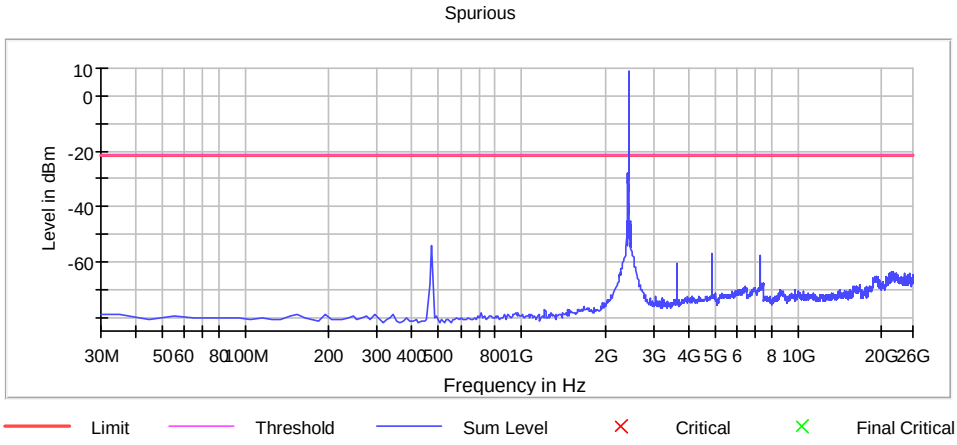
Conducted Emissions 2350-2550 MHz, 2422 MHz, 802.11g 6M



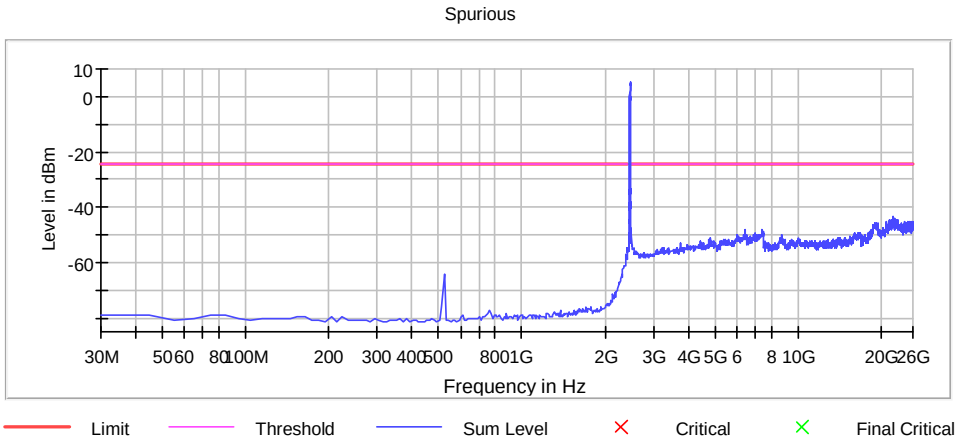
2452 MHz



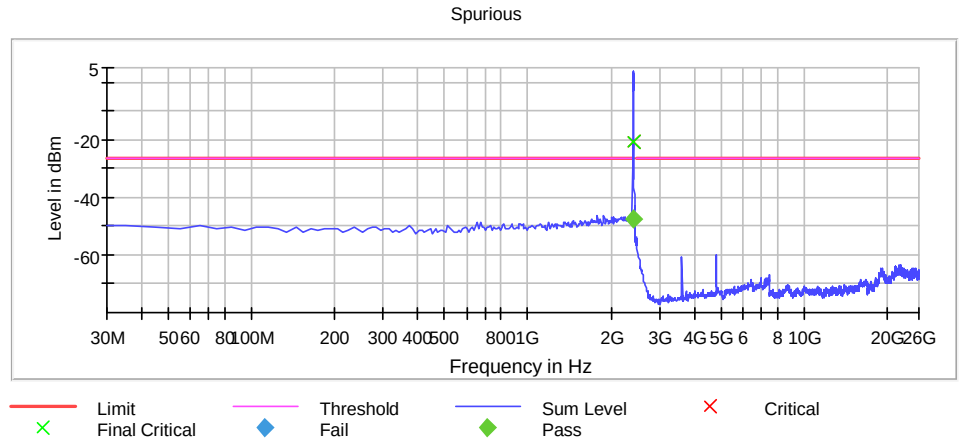
Conducted Emissions 30M-26G, 2412 MHz, 802.11b 1M



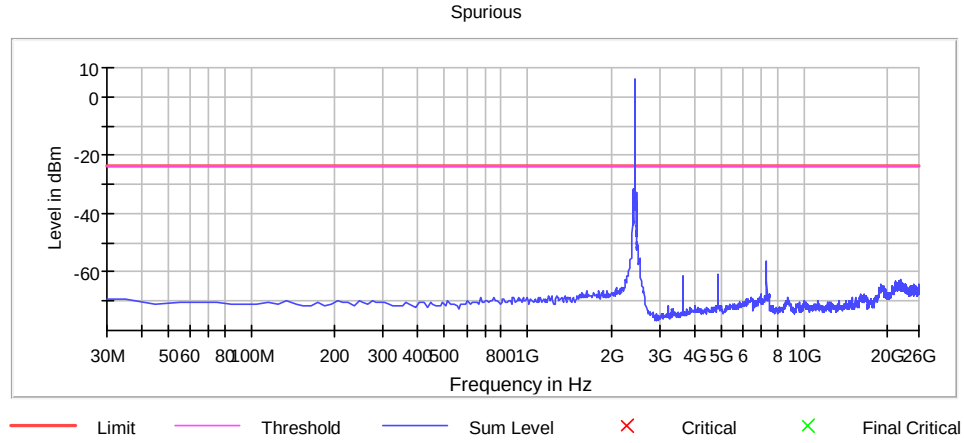
Conducted Emissions 30M-26G, 2437 MHz, 802.11b 1M



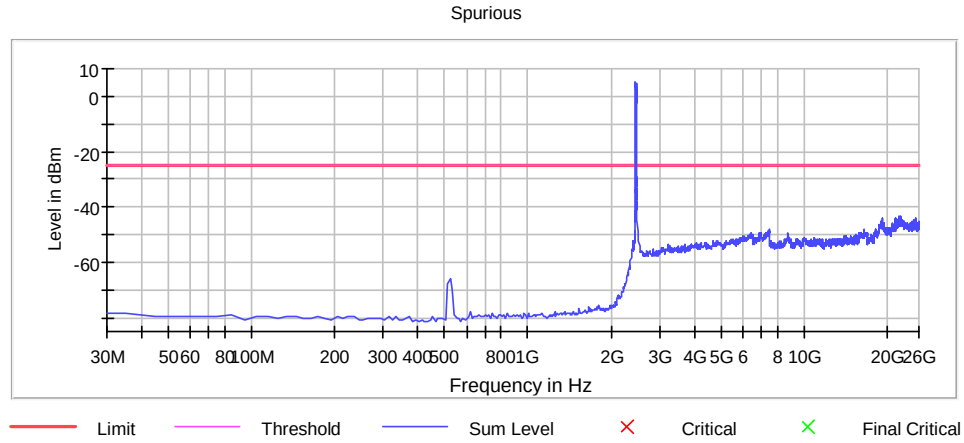
Conducted Emissions 30M-26G, 2462 MHz, 802.11b 1M



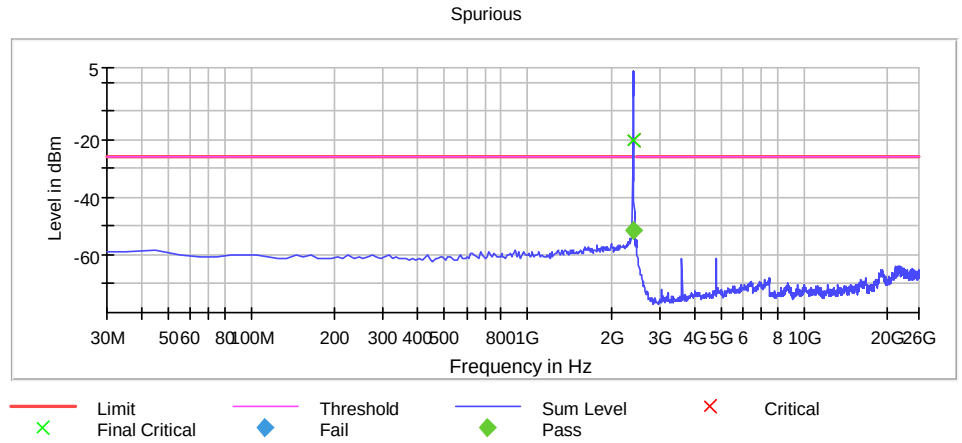
Conducted Emissions 30M-26G, 2412 MHz, 802.11g 6M



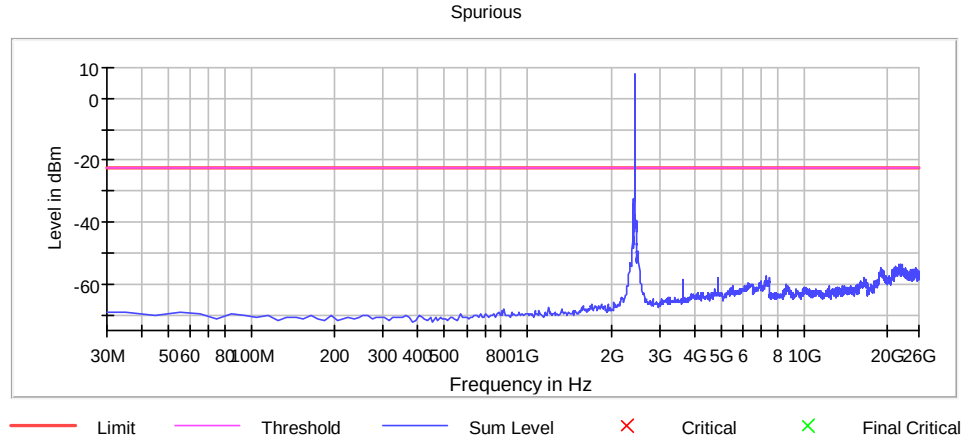
Conducted Emissions 30M-26G, 2437 MHz, 802.11g 6M



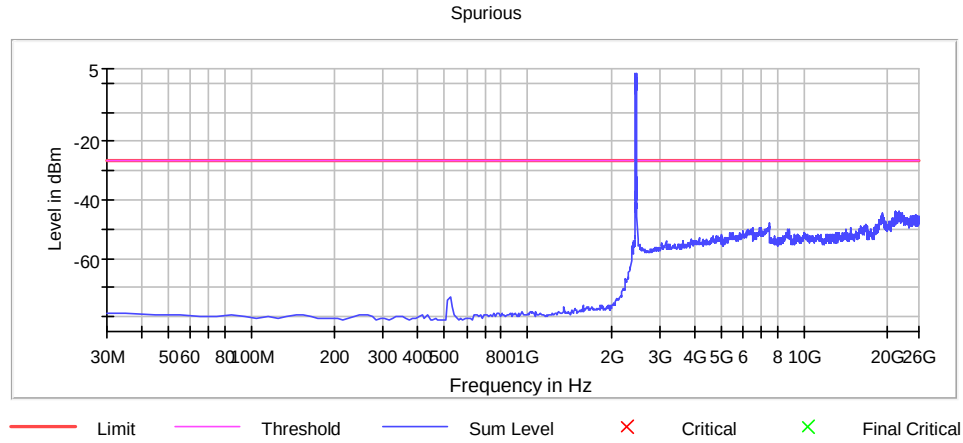
Conducted Emissions 30M-26G, 2462 MHz, 802.11g 6M



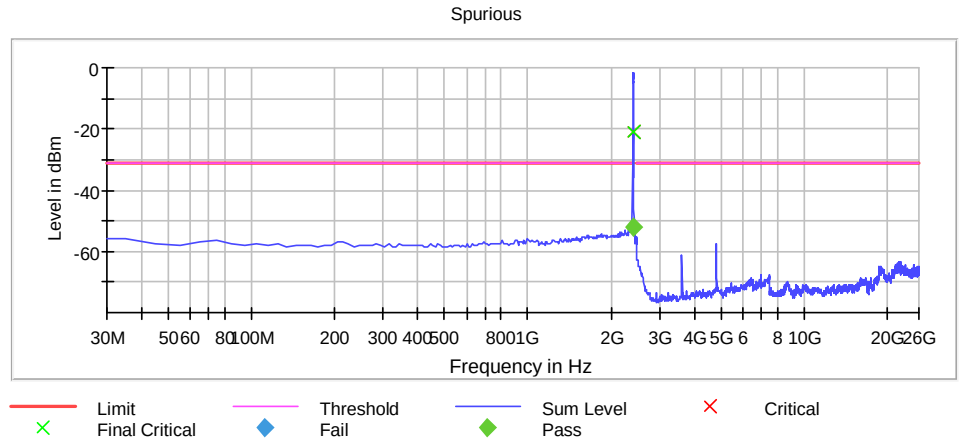
Conducted Emissions 30M-26G, 2412 MHz, 802.11n MCS0



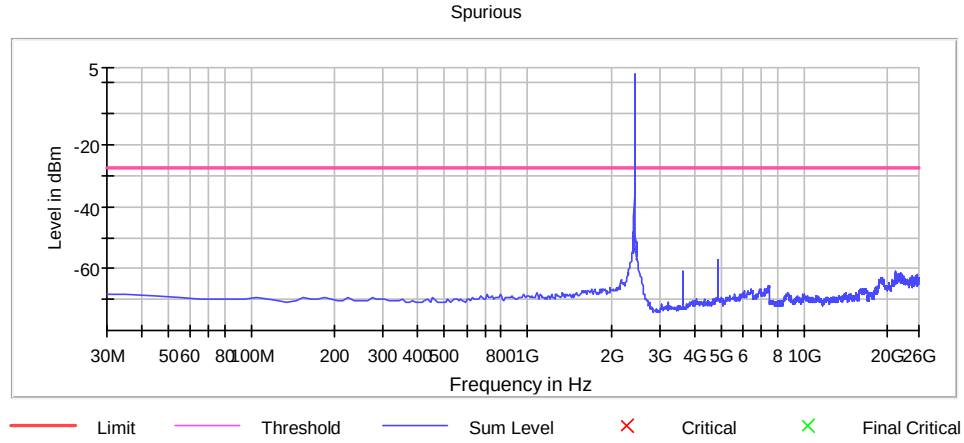
Conducted Emissions 30M-26G, 2437 MHz, 802.11n MCS0



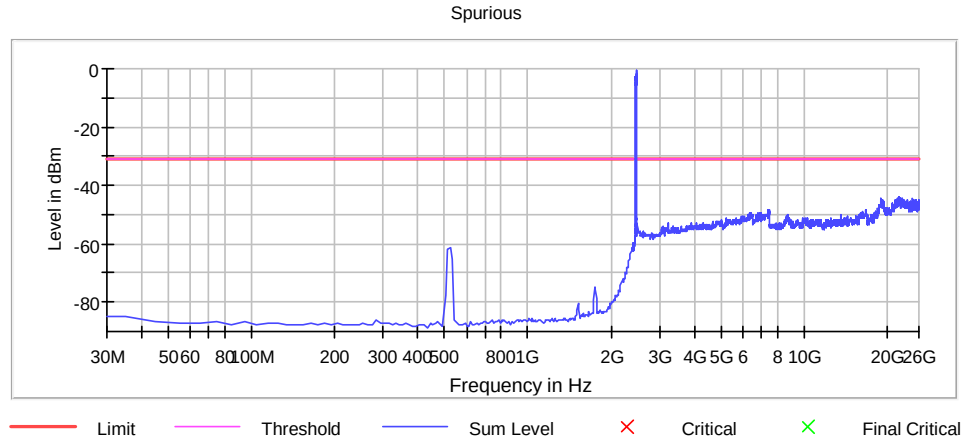
Conducted Emissions 30M-26G, 2462 MHz, 802.11n MCS0



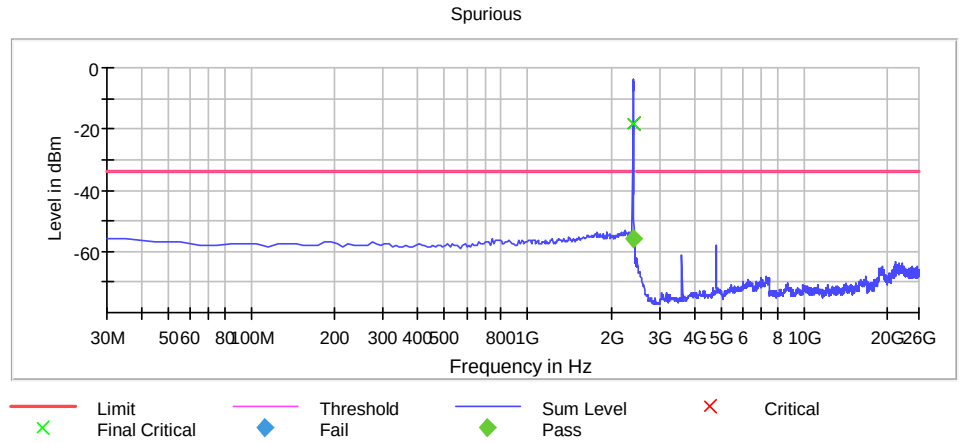
Conducted Emissions 30M-26G, 2412 MHz, 802.11n MCS8, MIMO



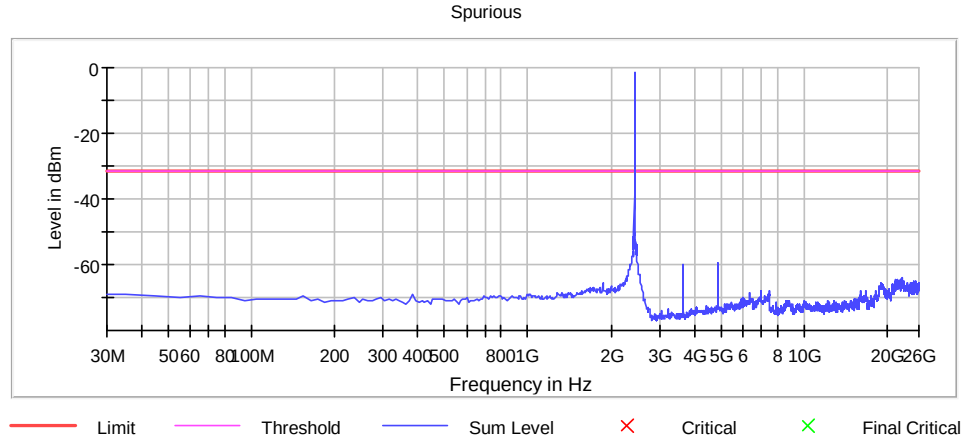
Conducted Emissions 30M-26G, 2437 MHz, 802.11n MCS8, MIMO



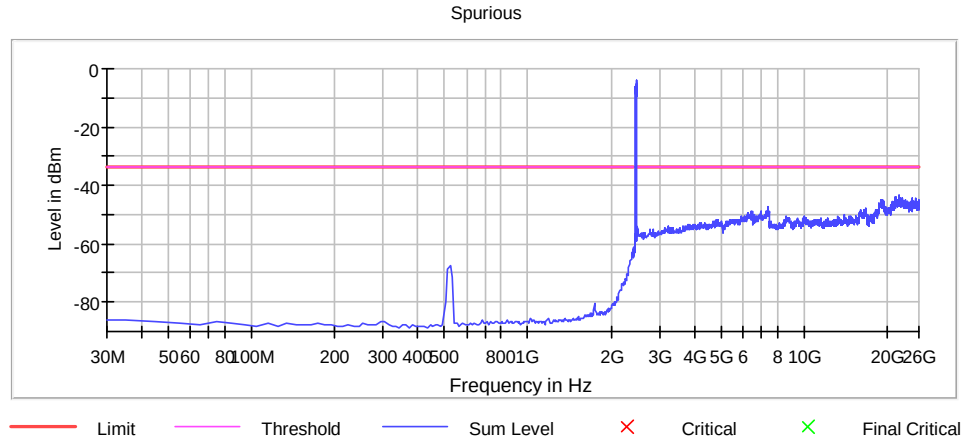
Conducted Emissions 30M-26G, 2462 MHz, 802.11n MCS8, MIMO



Conducted Emissions 30M-26G, 2412 MHz, 802.11ax MCS0, MIMO



Conducted Emissions 30M-26G, 2437 MHz, 802.11ax MCS0, MIMO



Conducted Emissions 30M-26G, 2462 MHz, 802.11ax MCS0, MIMO

3.6 Restricted Bands of operation

Restricted Bands of operation for FCC and ISED are defined in FCC Part 15.205 and ISED RSS-GEN, Issue 5 clause 8.10.

Generally, no fundamentals are allowed in the restricted bands and all emissions must comply with the limits in FCC 15.209 or RSS-GEN, Issue 5, clause 8.9.

FCC (MHz)	ISED (MHz)	FCC (GHz)	ISED (GHz)
0.090-0.110		**0.96-1.24** **1.3-1.427**	**0.96-1.427**
0.495-0.505		1.435-1.6265	
2.1735-2.1905		1.6455-1.6465	
	3.020-3.026	1.660-1.710	
4.125-4.128		1.7188-1.7222	
4.17725-4.17775		2.2-2.3	
4.20725-4.20775		2.31-2.39	
	5.677-5.683	2.4835-2.5	
6.215-6.218		**2.69-2.9**	**2.655-2.9**
6.26775-6.26825		3.26-3.267	
6.31175-6.31225		3.332-3.339	
8.291-8.294		3.3458-3.358	
8.362-8.366		**3.6-4.4**	**3.5-4.4**
8.37625-8.38675		4.5-5.15	
8.41425-8.41475		5.35-5.46	
12.29-12.293		7.25-7.75	
12.51975-12.52025		8.025-8.5	
12.57675-12.57725		9.0-9.2	
13.36-13.41		9.3-9.5	
16.42-16.423		10.6-12.7	
16.69475-16.69525		13.25-13.4	
16.80425-16.80475		14.47-14.5	
25.5-25.67		15.35-16.2	
37.5-38.25		17.7-21.4	
73-74.6		22.01-23.12	
74.8-75.2		23.6-24.0	
108-121.94 **123-138**	**108-138**	31.2-31.8	
149.9-150.05		36.43-36.5	
156.52475-156.52525		Above 38.6	
156.7-156.9			
162.0125-167.17			
167.72-173.2			
240-285			
322-335.4			
399.9-410			
608-614			

Frequencies in **Bold** text are specific for FCC or ISED, all other frequencies are common.

3.7 Radiated Emissions, Band Edge

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3 / 8.9

Measurement procedure: **ANSI C63.10-2013 Clause 11.12**

Test Results: Complies

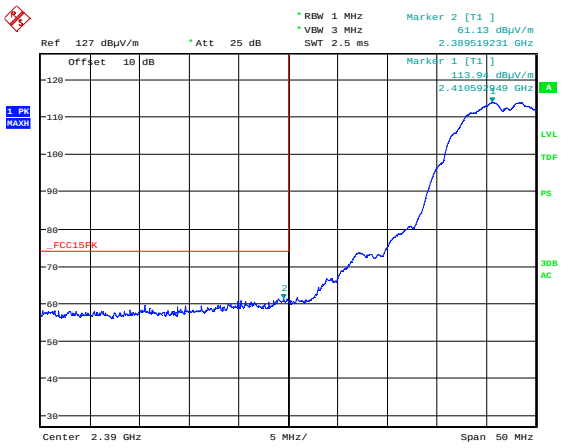
Measurement Data:

Peak Detector					
Modulation and Bitrate	Measured field strength (dBµV/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
802.11b, 1 Mbps	63.6	60.7	74	10.4	13.3
802.11g, 6 Mbps	71.7	69.6	74	2.3	4.4
802.11n, MCS0	65.4	70.4	74	8.6	3.6
802.11n, MCS8, MIMO	64.3	62.4	74	9.7	11.6
802.11ax, MCS0	71.7	67.1	74	2.3	6.9
802.11ax, MCS0, MIMO	62.9	58.9	74	11.1	15.1

Average Detector					
Modulation and Bitrate	Measured field strength (dBµV/m)		Limit	Margin	
	2390 MHz	2483.5 MHz	dB	dB	
802.11b, 1 Mbps	51.5	52.6	54	2.5	1.4
802.11g, 6 Mbps	52.2	53.6	54	1.8	0.4
802.11n, MCS0	52.7	52.3	54	1.3	1.7
802.11n, MCS8, MIMO	49.1	49.4	54	4.9	4.6
802.11ax, MCS0	51.4	52.9	54	2.6	1.1
802.11ax, MCS0, MIMO	49.2	46.0	54	4.8	8.0

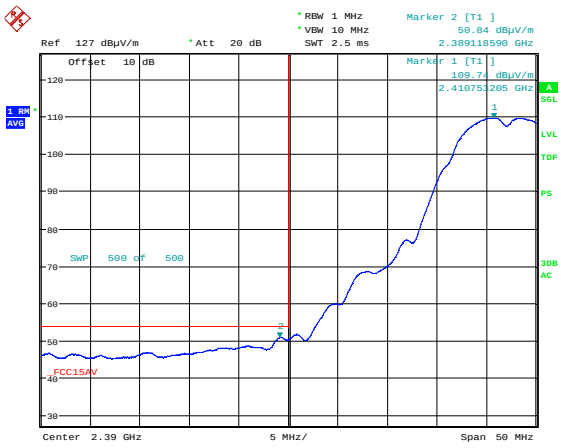
Average values were measured using trace averaging as described in ANSI C63.10-2013 clause 11.12.2.5.1 (Duty Cycle ≈100%).

See attached plots.



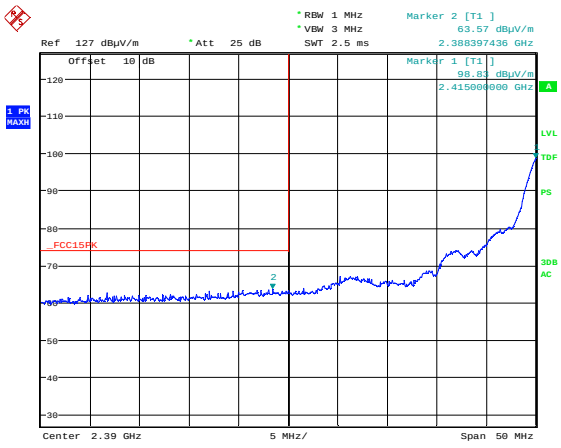
Date: 6.FEB.2023 10:09:47

Lower Band Edge, 2412 MHz, 802.11b 1M, Peak



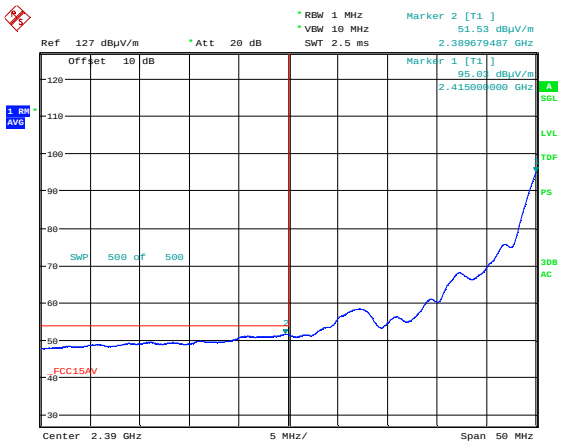
Date: 6.FEB.2023 10:10:40

Average



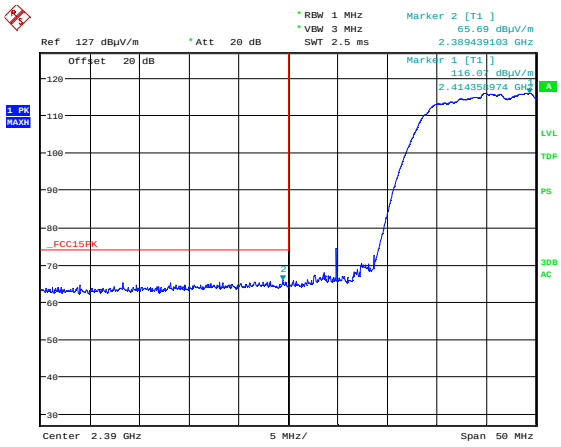
Date: 6.FEB.2023 11:49:00

Lower Band Edge, 2422 MHz, 802.11b 1M, Peak



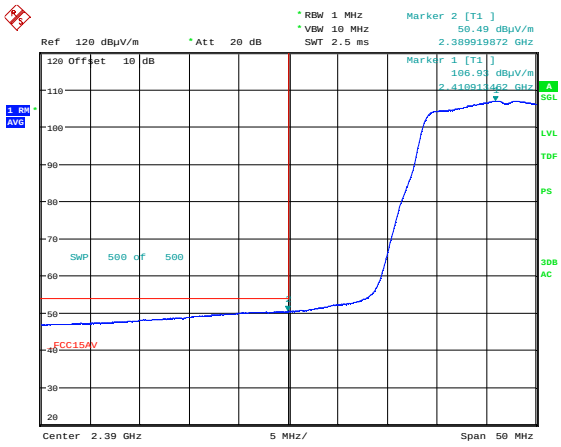
Date: 6.FEB.2023 11:49:30

Average



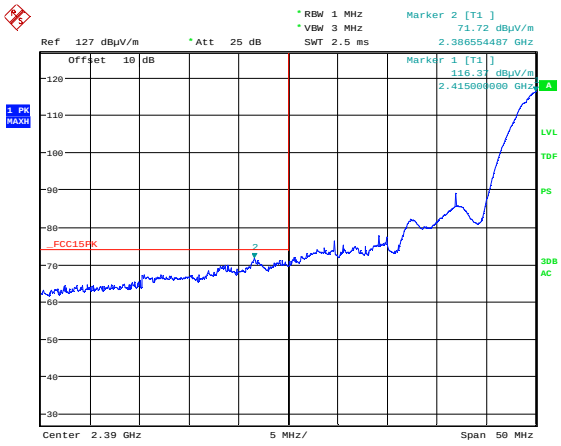
Date: 6.FEB.2023 10:20:42

Lower Band Edge, 2412 MHz, 802.11g 6M, Peak



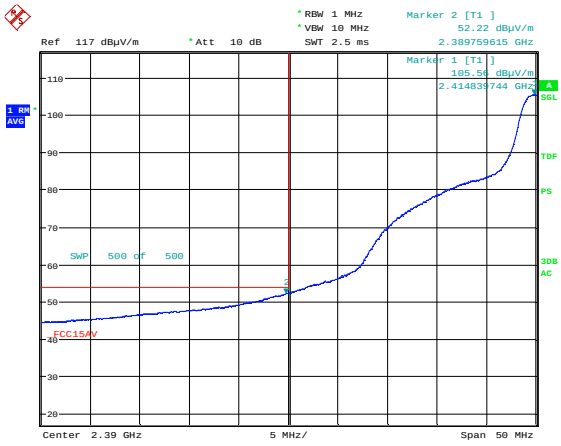
Date: 6.FEB.2023 11:15:04

Average



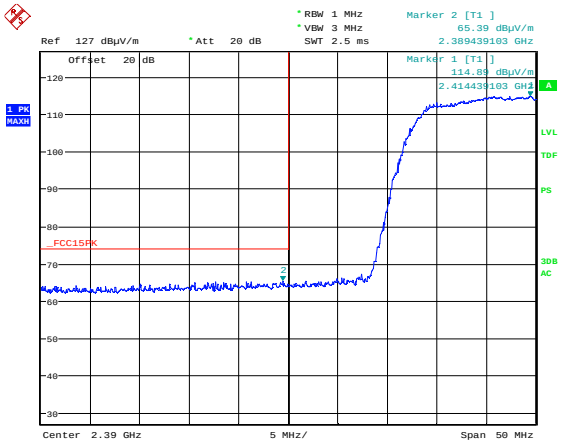
Date: 6.FEB.2023 11:52:52

Lower Band Edge, 2422 MHz, 802.11g 6M, Peak



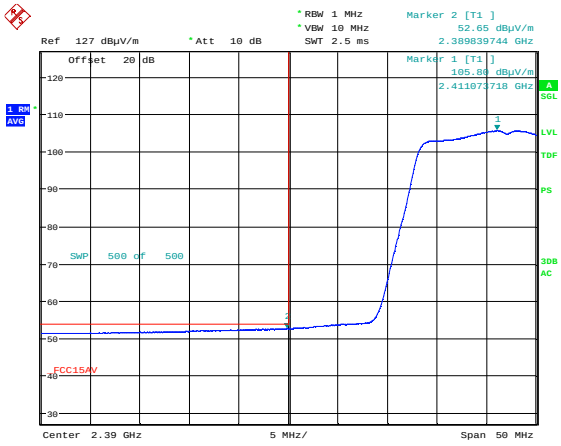
Date: 6.FEB.2023 11:58:04

Average



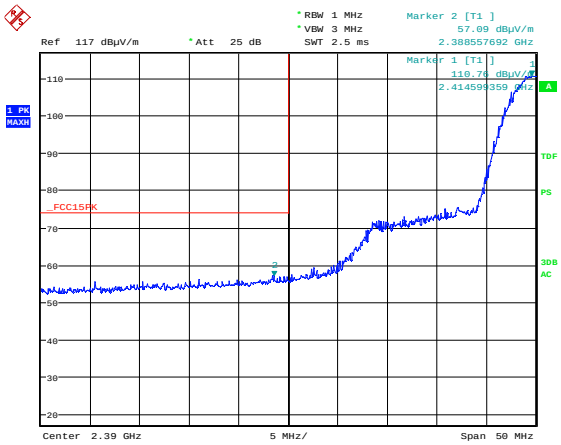
Date: 6.FEB.2023 10:42:14

Lower Band Edge, 2412 MHz, 802.11n MCS0, Peak



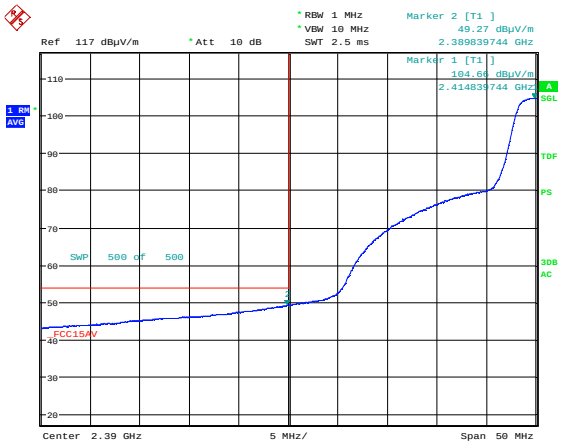
Date: 6.FEB.2023 10:42:45

Average



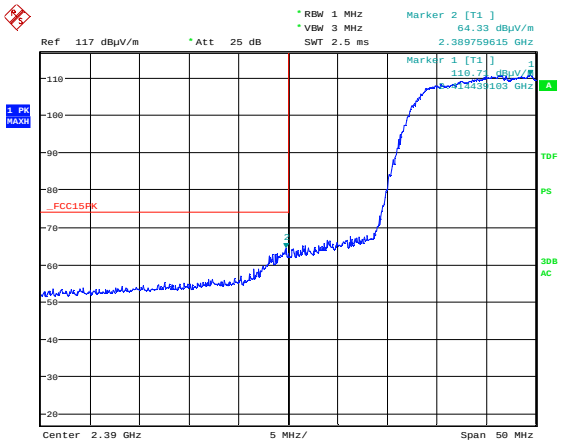
Date: 6.FEB.2023 13:52:01

Lower Band Edge, 2422 MHz, 802.11n MCS0, Peak



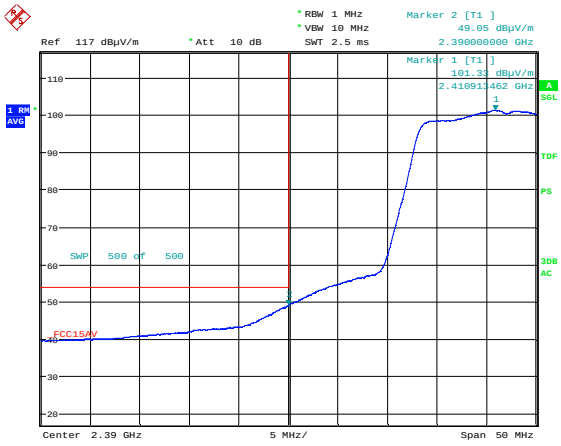
Date: 6.FEB.2023 12:01:15

Average



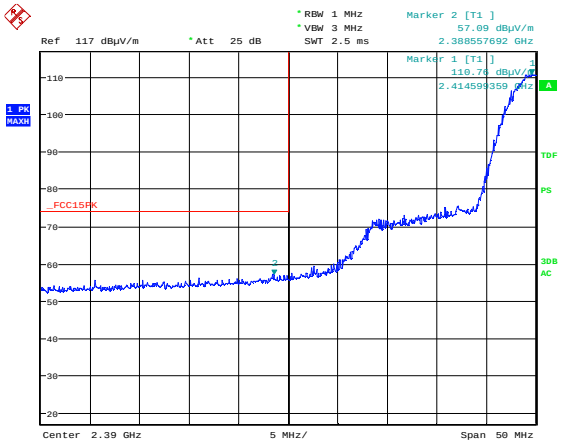
Date: 6.FEB.2023 13:49:09

Lower Band Edge, 2412 MHz, 802.11n MCS8, MIMO, Peak



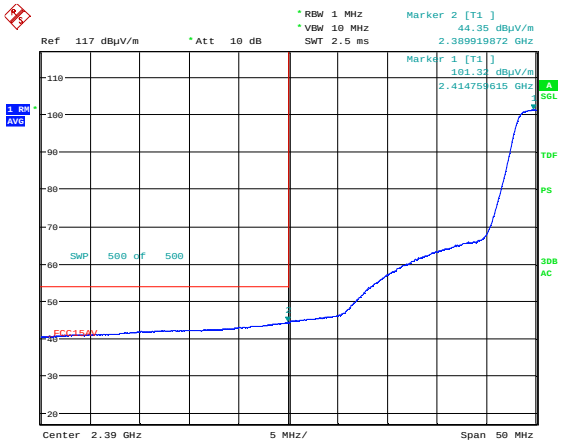
Date: 6.FEB.2023 13:48:22

Average



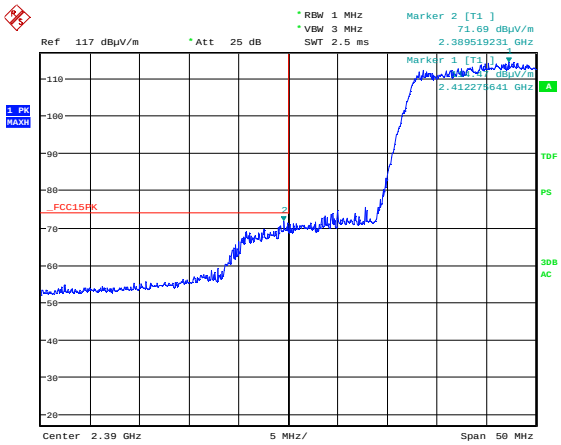
Date: 6.FEB.2023 13:52:01

Lower Band Edge, 2422 MHz, 802.11n MCS8, MIMO, Peak



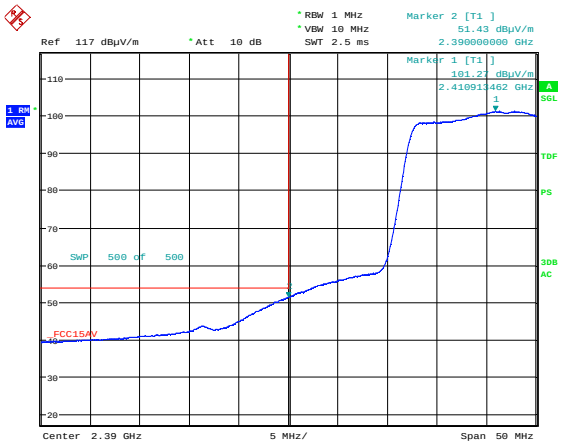
Date: 6.FEB.2023 13:51:13

Average



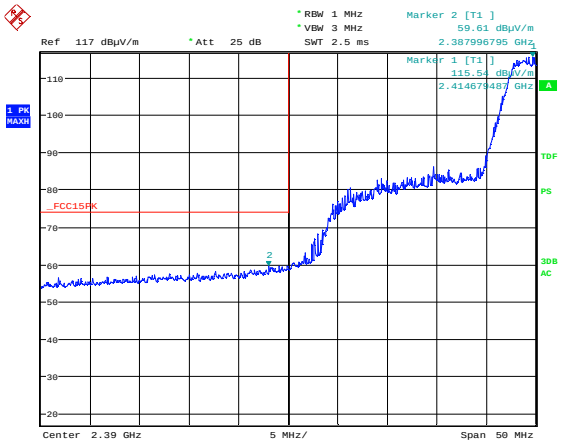
Date: 6.FEB.2023 12:18:19

Lower Band Edge, 2412 MHz, 802.11ax MCS0, Peak



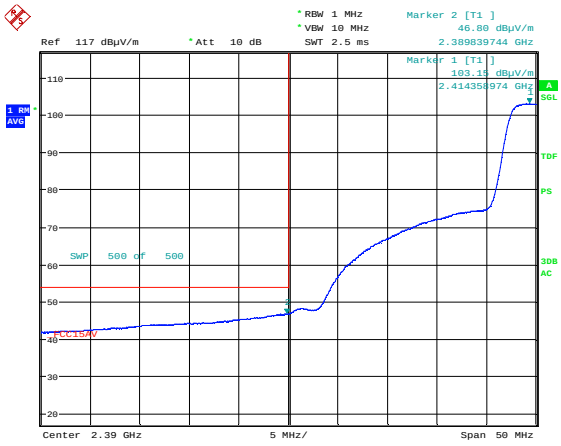
Date: 6.FEB.2023 12:22:36

Average PL9



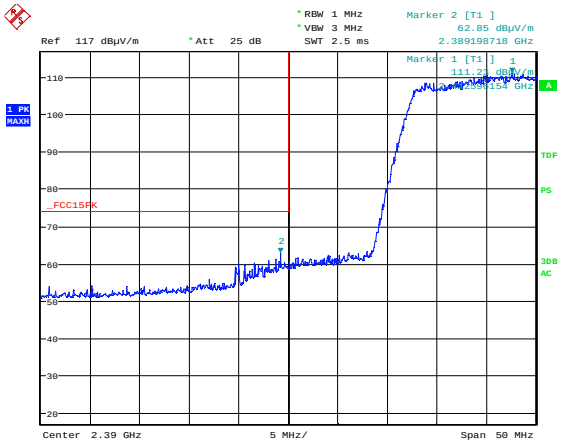
Date: 6.FEB.2023 12:13:00

Lower Band Edge, 2422 MHz, 802.11ax MCS0, Peak



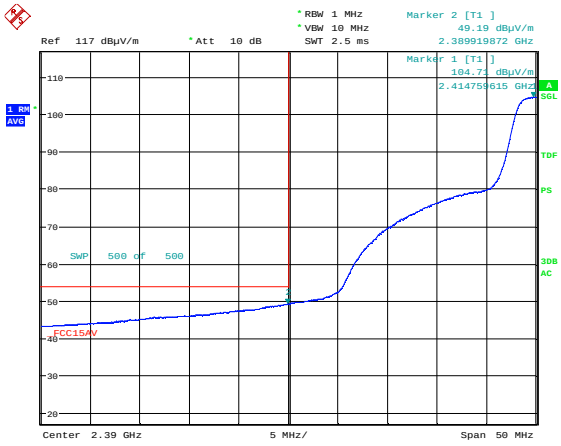
Date: 6.FEB.2023 12:13:29

Average



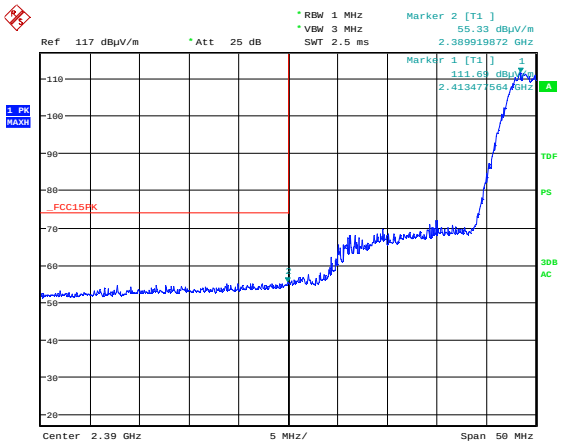
Date: 6.FEB.2023 13:55:54

Lower Band Edge, 2412 MHz, 802.11ax MCS0, MIMO, Peak



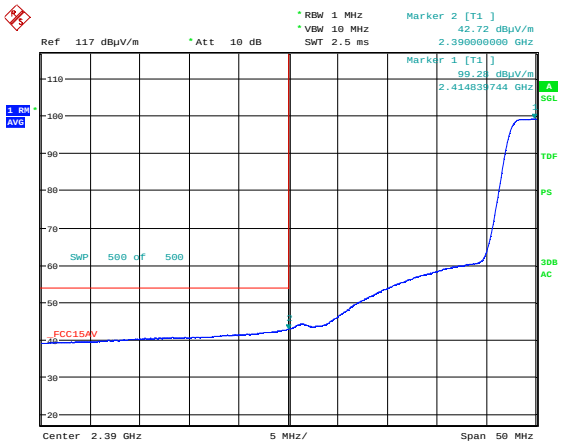
Date: 6.FEB.2023 12:05:23

Average



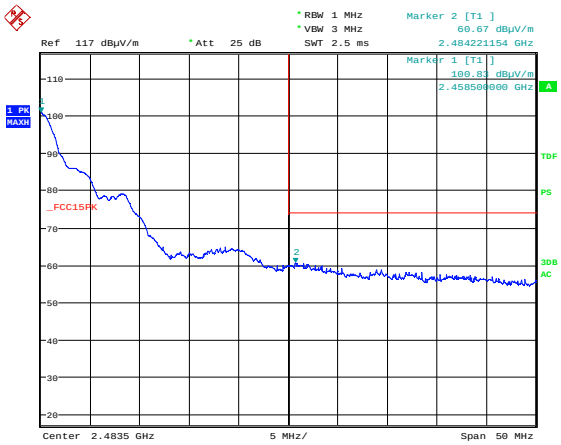
Date: 6.FEB.2023 13:54:01

Lower Band Edge, 2422 MHz, 802.11ax MCS0, MIMO, Peak



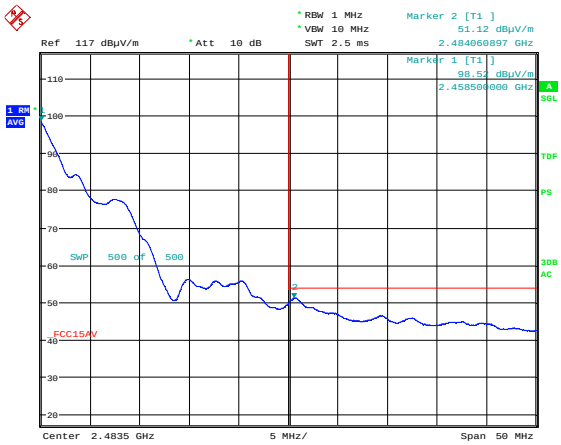
Date: 6.FEB.2023 13:53:14

Average



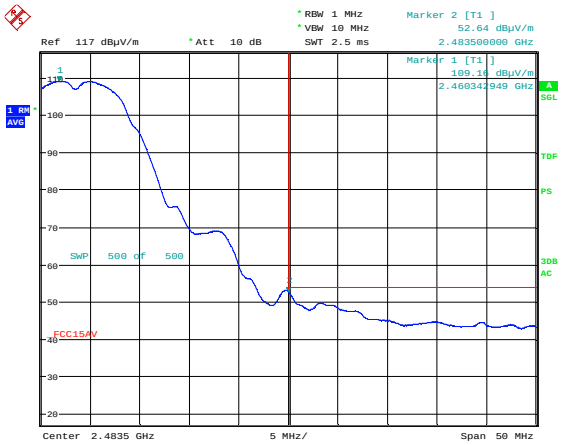
Date: 6.FEB.2023 13:06:43

Upper Band Edge, 2452 MHz, 802.11b 1M, Peak



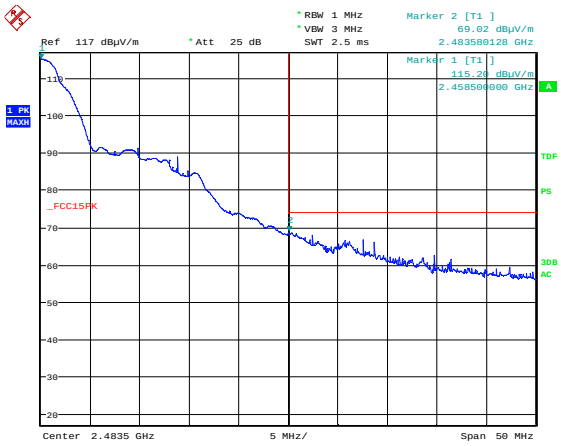
Date: 6.FEB.2023 13:05:58

Average PL16.5



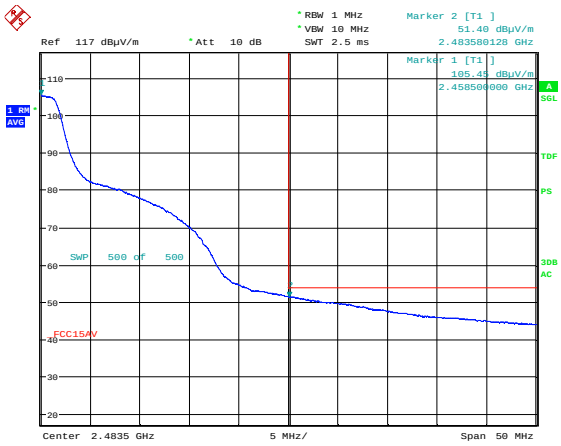
Date: 6.FEB.2023 12:39:50

Upper Band Edge, 2462 MHz, 802.11b 1M, Peak



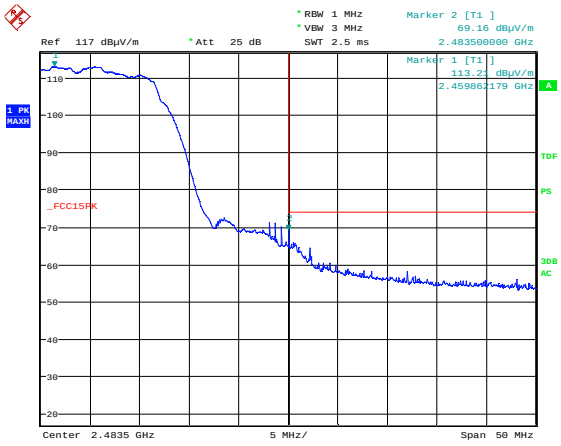
Date: 6.FEB.2023 13:04:19

Upper Band Edge, 2452 MHz, 802.11g 6M, Peak



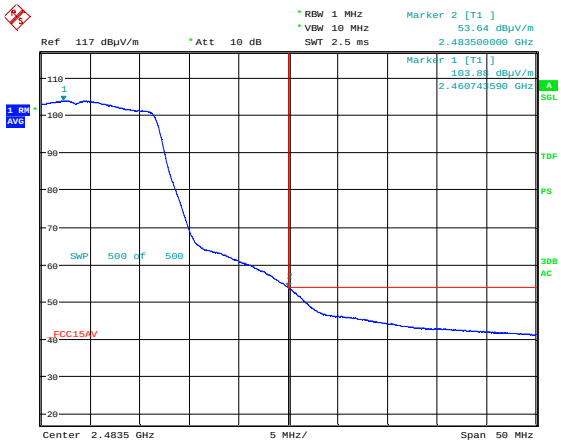
Date: 6.FEB.2023 13:03:18

Average PL16.5



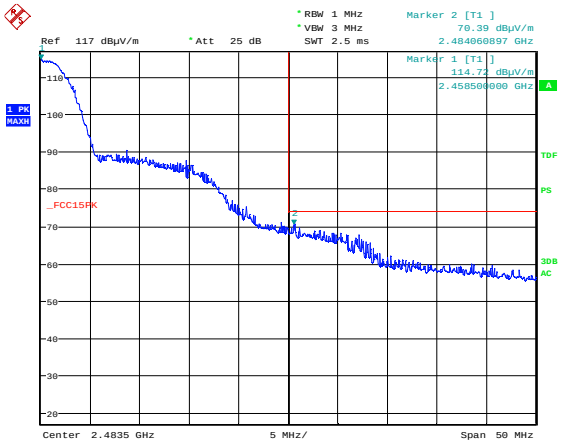
Date: 6.FEB.2023 12:43:26

Upper Band Edge, 2462 MHz, 802.11g 6M, Peak



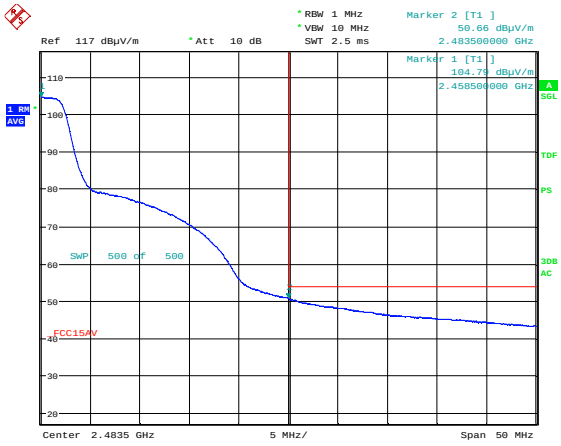
Date: 6.FEB.2023 12:42:34

Average PL12



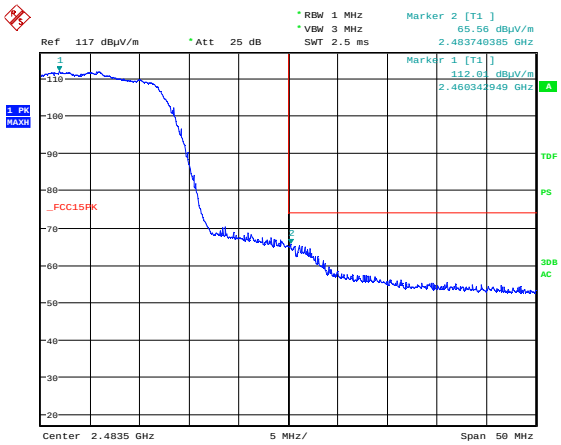
Date: 6.FEB.2023 13:00:28

Upper Band Edge, 2452 MHz, 802.11n MCS0, Peak



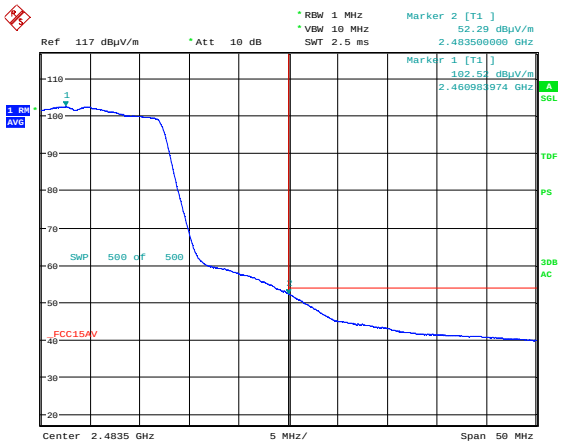
Date: 6.FEB.2023 12:59:41

Average



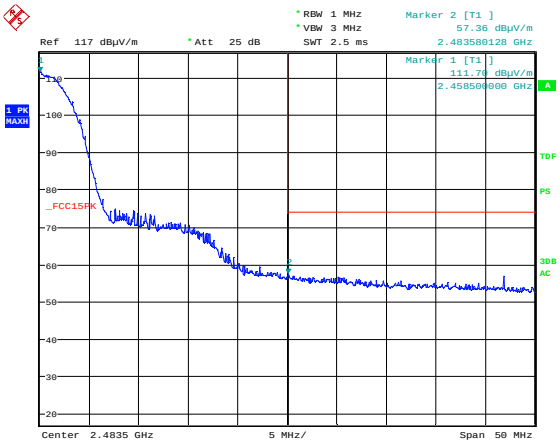
Date: 6.FEB.2023 12:50:57

Upper Band Edge, 2462 MHz, 802.11n MCS0, Peak



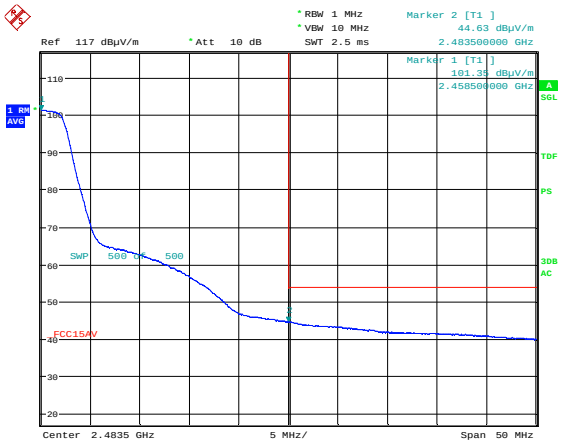
Date: 6.FEB.2023 12:48:17

Average PL10



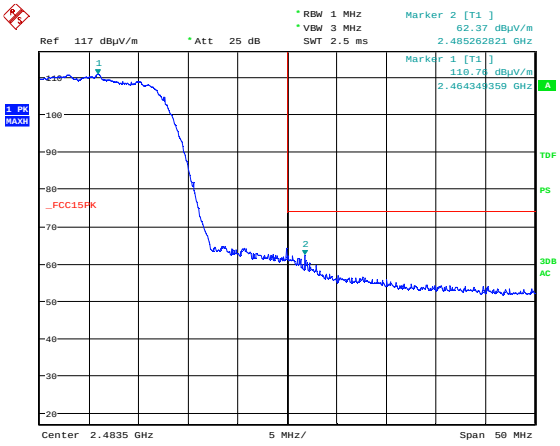
Date: 6.FEB.2023 13:42:23

Upper Band Edge, 2452 MHz, 802.11n MCS8, MIMO, Peak



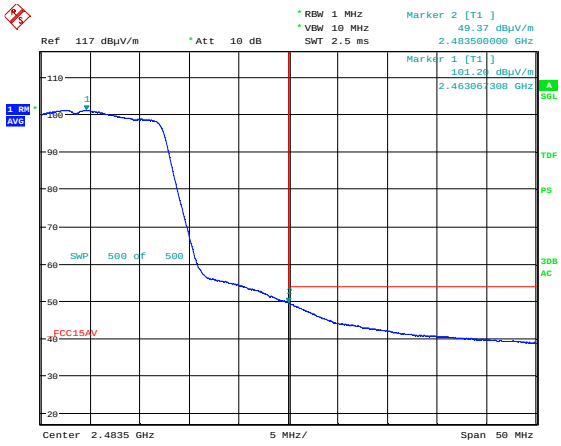
Date: 6.FEB.2023 13:41:36

Average



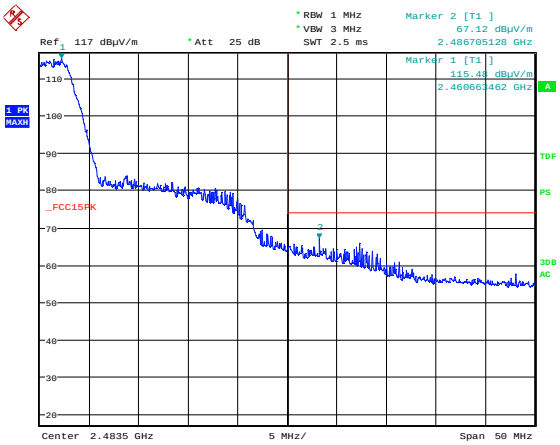
Date: 6.FEB.2023 13:45:23

Upper Band Edge, 2462 MHz, 802.11n MCS8, MIMO, Peak



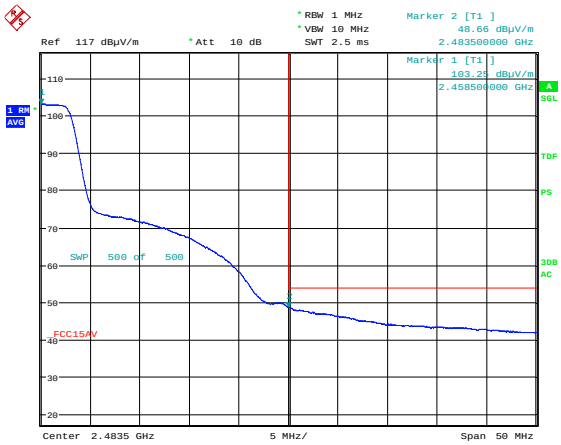
Date: 6.FEB.2023 13:44:35

Average



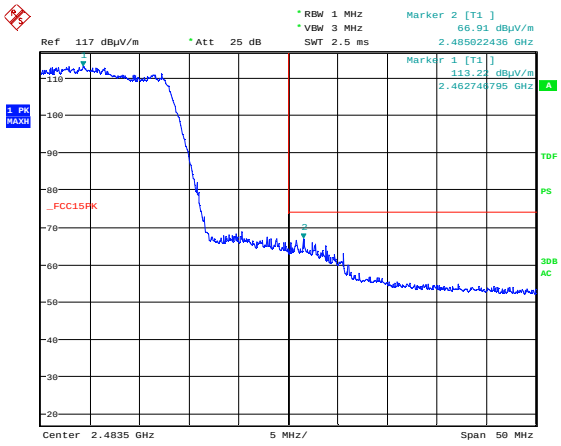
Date: 6.FEB.2023 12:57:55

Upper Band Edge, 2452 MHz, 802.11ax MCS0, Ant0, Peak



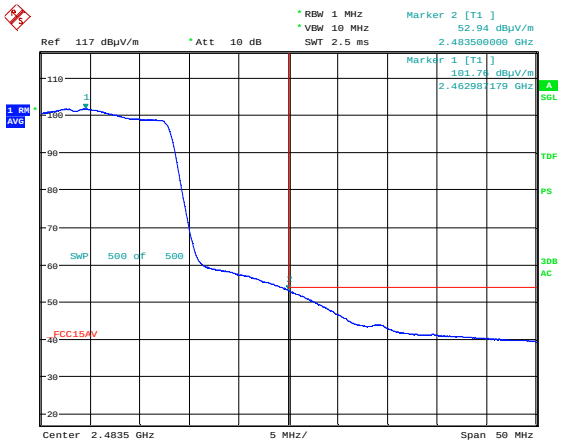
Date: 6.FEB.2023 12:57:07

Average



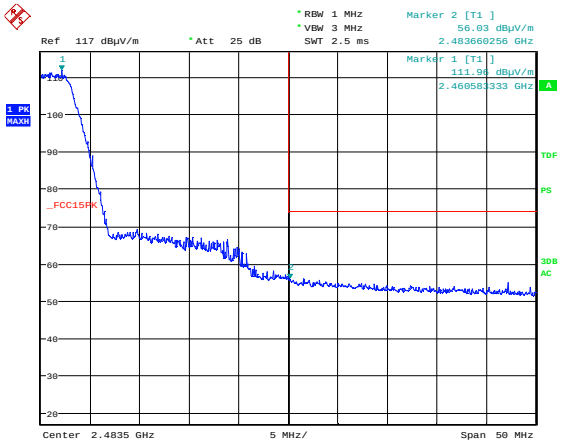
Date: 6.FEB.2023 12:55:04

Upper Band Edge, 2462 MHz, 802.11ax MCS0, Ant0, Peak



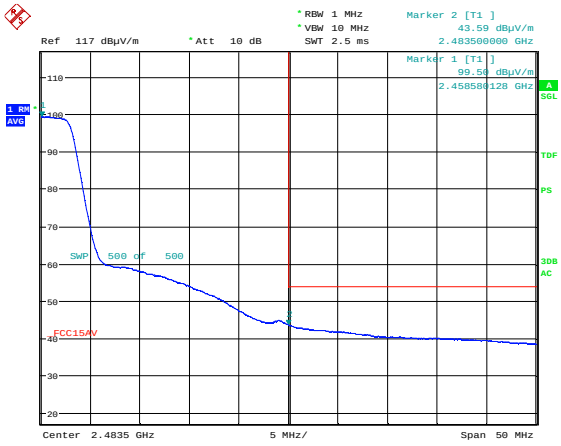
Date: 6.FEB.2023 12:54:18

Average PL9.5



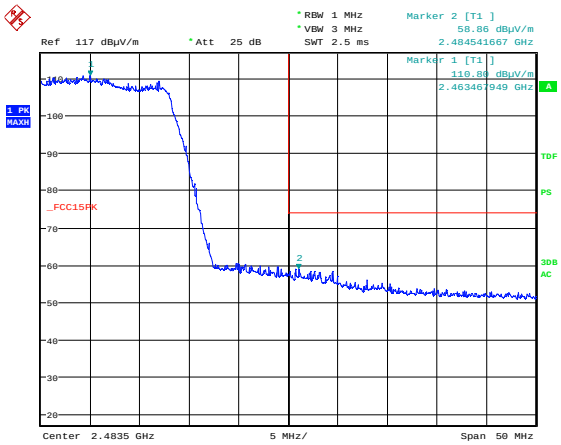
Date: 6.FEB.2023 13:39:09

Upper Band Edge, 2452 MHz, 802.11ax MCS0, MIMO, Peak



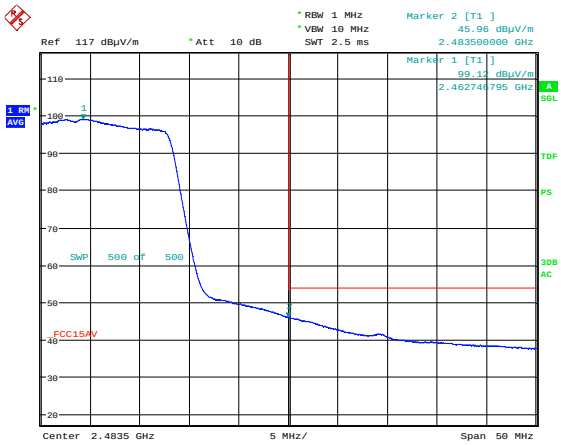
Date: 6.FEB.2023 13:38:23

Average



Date: 6.FEB.2023 13:36:18

Upper Band Edge, 2462 MHz, 802.11ax MCS0, MIMO, Peak



Date: 6.FEB.2023 13:35:30

Average

3.8 Radiated Emissions, 30 – 1000 MHz.

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: ANSI C63.10-2013 Clause 11.12

Test Results: Complies

Measurement Data:

Detector: Quasi-Peak (Pre-Scan with Peak Detector)

Measuring distance 3m

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
32.448922	28.52	40.00	11.48	15000.0	120.000	104.0	V	32.0	-15.5
98.303552	37.60	43.50	5.90	15000.0	120.000	351.0	H	19.0	-14.3
107.520442	37.67	43.50	5.83	15000.0	120.000	265.0	H	0.0	-14.6
138.239652	40.29	43.50	3.21	15000.0	120.000	218.0	H	351.0	-17.5
147.455768*	46.06	43.50	-2.56	15000.0	120.000	276.0	H	5.0	-17.4
176.776408	36.98	43.50	6.52	15000.0	120.000	132.0	H	162.0	-16.1
221.183634	40.32	46.00	5.68	15000.0	120.000	127.0	H	331.0	-13.5
614.397694	40.69	46.00	5.31	15000.0	120.000	257.0	H	315.0	-3.2
712.702020	40.82	46.00	5.18	15000.0	120.000	109.0	H	243.0	-2.4

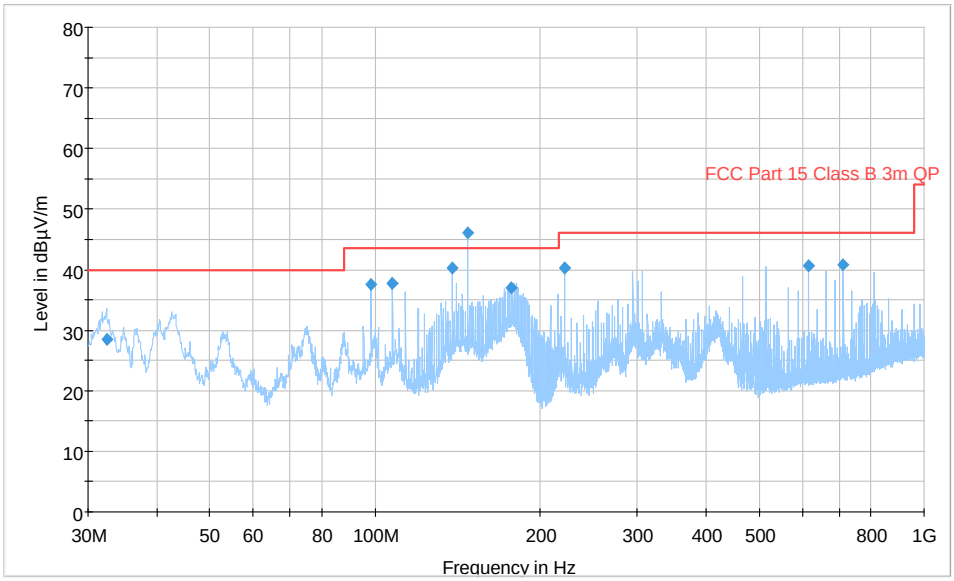
*This is a Class A device. The spurious at 147.46 MHz is not from the RF part.

See attached plots.

Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, Clause 8.9 @ frequencies defined in clause 8.10	
Frequency	Radiated emission limit @3 meters	
30 – 88 MHz	100 µV/m	40.0 dBµV/m
88 – 216 MHz	150 µV/m	43.5 dBµV/m
216 – 960 MHz	200 µV/m	46.0 dBµV/m
960 – 1000 MHz	500 µV/m	54.0 dBµV/m
	Limits above are with Quasi Peak Detector	

Full Spectrum



Radiated Emissions 30 - 1000 MHz, 2437MHz, 802.11g 6M

3.9 Radiated Emissions, 1 – 26 GHz

FCC Part 15.209 (a)

ISED Canada RSS-GEN Issue 5, Clause 7.3/8.9

Measurement procedure: **ANSI C63.10-2013 Clause 11.12**

Test Results: Complies

Measurement Data:

Measuring distance: 3m (1 – 18 GHz)

A pre-scan was performed above 18 GHz and no spurious emissions were detected.

RBW=1 MHz

Carrier freq. (MHz)	Measured Freq. (MHz)	Mode	Measured Emissions (dBµV/m)		Limit (dBµV/m)		Margin (dB)	
			Peak	Average	Pk	Av	Pk	Av
Any	Any	All other	< 54	<44	74	54	> 20	> 10

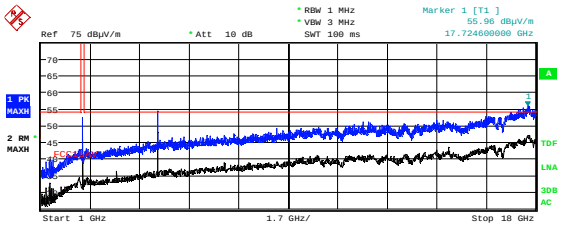
A Band Reject Filter was used for measurements from 1 GHz to 18 GHz

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer “Transducer factor”.

See plots.

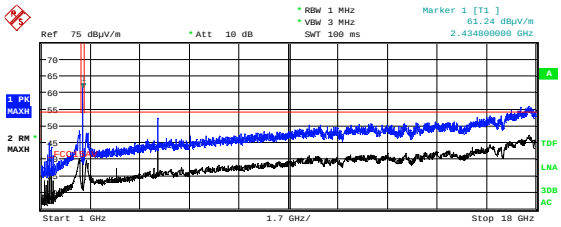
Requirements/Limit

FCC	Part 15.209 @ frequencies defined in §15.205	
ISED	RSS-GEN Issue 5, clause 8.9 @ frequencies defined in clause 8.10	
	Radiated emission limit @3 meters	
Frequency	Average Detector	Peak Detector
1 – 26 GHz	54.0 dBµV/m	74.0 dBµV/m



#	Frequency	Level
1	2.438200 GHz	52.34 dBµV
2	5.012000 GHz	54.13 dBµV
3	17.724600 GHz	55.96 dBµV

Date: 8.FEB.2023 13:06:51

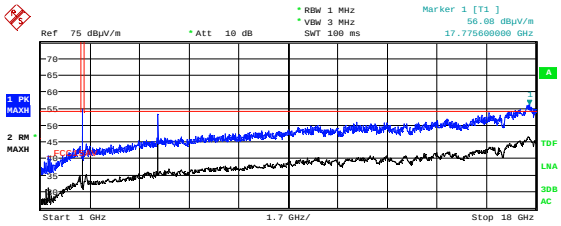


#	Frequency	Level
1	1.275400 GHz	44.52 dBµV
2	1.326400 GHz	42.40 dBµV
3	1.374000 GHz	43.53 dBµV
4	2.329400 GHz	48.44 dBµV
5	2.434800 GHz	61.24 dBµV
6	2.611600 GHz	47.72 dBµV
7	5.012000 GHz	52.02 dBµV
8	17.755200 GHz	55.52 dBµV

Date: 8.FEB.2023 13:04:50

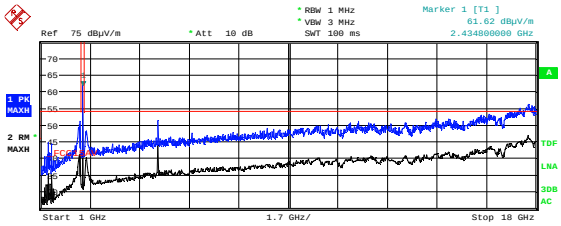
Emissions 1 - 18 GHz, 2437 MHz, 802.11b 1M, Ant0 HP

VP



#	Frequency	Level
1	2.434800 GHz	54.41 dBµV
2	5.012000 GHz	53.02 dBµV
3	17.775600 GHz	56.08 dBµV

Date: 8.FEB.2023 12:28:55

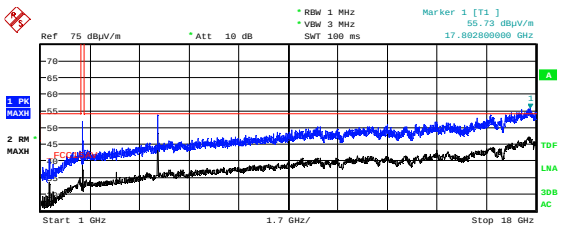


#	Frequency	Level
1	1.272000 GHz	44.58 dBµV
2	1.374000 GHz	44.15 dBµV
3	2.339600 GHz	50.91 dBµV
4	2.434800 GHz	61.62 dBµV
5	2.564000 GHz	48.18 dBµV
6	5.012000 GHz	51.25 dBµV
7	17.734800 GHz	56.02 dBµV

Date: 8.FEB.2023 12:26:36

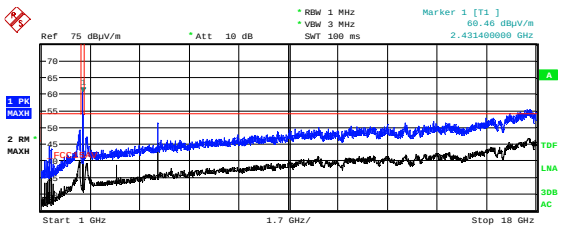
Emissions 1 - 18 GHz, 2437 MHz, 802.11g 6M, Ant0 HP

VP



#	Frequency	Level
1	2.434800 GHz	51.57 dBµV
2	5.012000 GHz	53.50 dBµV
3	17.802800 GHz	55.73 dBµV

Date: 8.FEB.2023 13:12:41

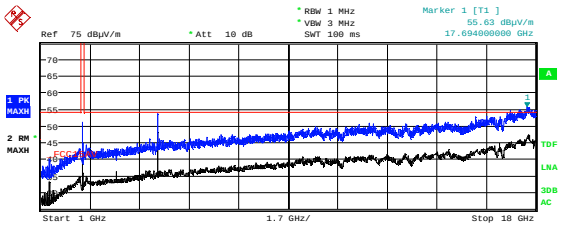


#	Frequency	Level
1	1.275400 GHz	44.22 dBµV
2	1.326400 GHz	43.00 dBµV
3	1.374000 GHz	43.38 dBµV
4	2.339600 GHz	49.08 dBµV
5	2.431400 GHz	60.46 dBµV
6	2.570800 GHz	47.03 dBµV
7	5.012000 GHz	51.26 dBµV
8	17.677000 GHz	55.25 dBµV

Date: 8.FEB.2023 13:10:44

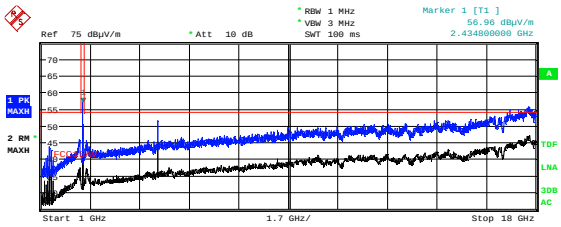
Emissions 1 - 18 GHz, 2437 MHz, 802.11n MCS0, Ant0, HP

VP



#	Frequency	Level
1	2.434800 GHz	50.90 dBµV
2	5.012000 GHz	53.51 dBµV
3	17.694000 GHz	55.63 dBµV

Date: 8.FEB.2023 13:20:01

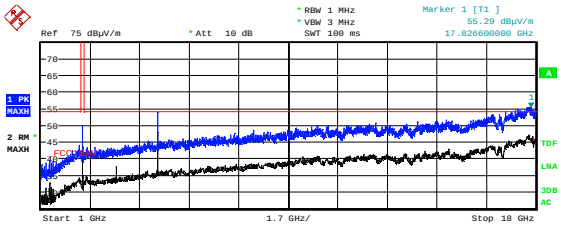


#	Frequency	Level
1	1.275400 GHz	43.59 dBµV
2	1.326400 GHz	43.25 dBµV
3	1.374000 GHz	42.59 dBµV
4	2.326000 GHz	45.82 dBµV
5	2.434800 GHz	56.96 dBµV
6	5.012000 GHz	51.50 dBµV
7	17.745000 GHz	55.52 dBµV

Date: 8.FEB.2023 13:18:04

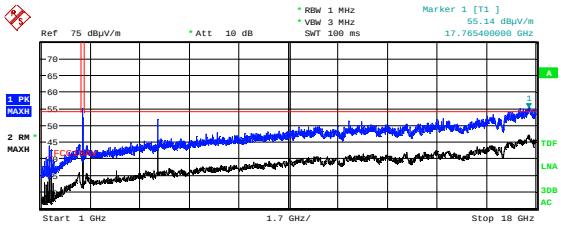
Emissions 1 - 18 GHz, 2437 MHz, 802.11n MCS0, MIMO, HP

VP



#	Frequency	Level
1	2.434800 GHz	49.85 dBµV
2	5.012000 GHz	53.76 dBµV
3	17.826600 GHz	55.29 dBµV

Date: 8.FEB.2023 13:36:25

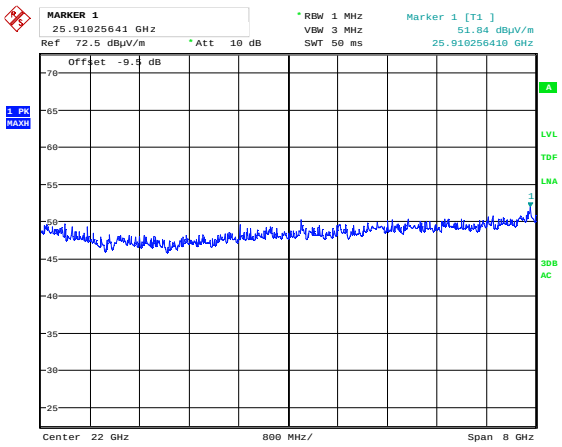


#	Frequency	Level
1	1.275400 GHz	43.73 dBµV
2	1.326400 GHz	42.26 dBµV
3	1.374000 GHz	42.45 dBµV
4	2.434800 GHz	54.92 dBµV
5	5.012000 GHz	51.72 dBµV
6	17.765400 GHz	55.14 dBµV

Date: 8.FEB.2023 13:34:23

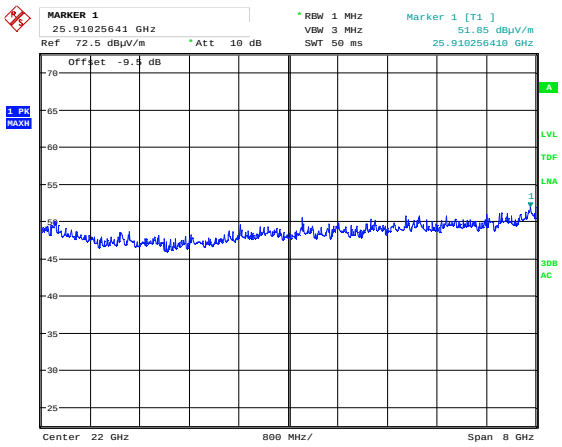
Emissions 1 - 18 GHz, 2437 MHz, 802.11ax MCS0, MIMO, HP

VP



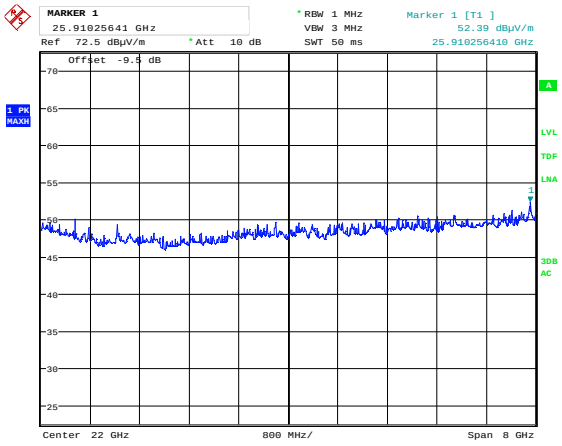
Date: 22.MAR.2023 15:32:32

Emissions 18 - 26 GHz, 2437 MHz, 802.11b 1M, Ant0 HP @1m



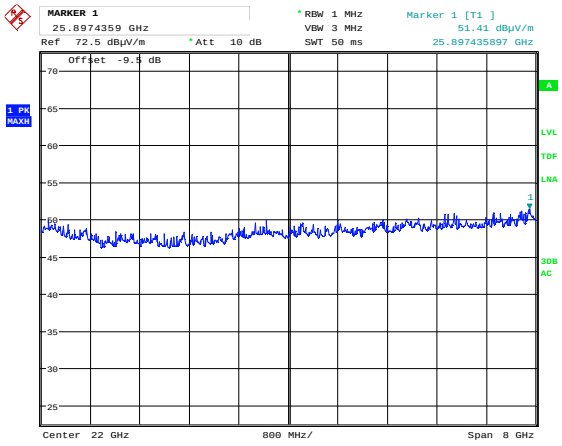
Date: 22.MAR.2023 15:30:10

VP



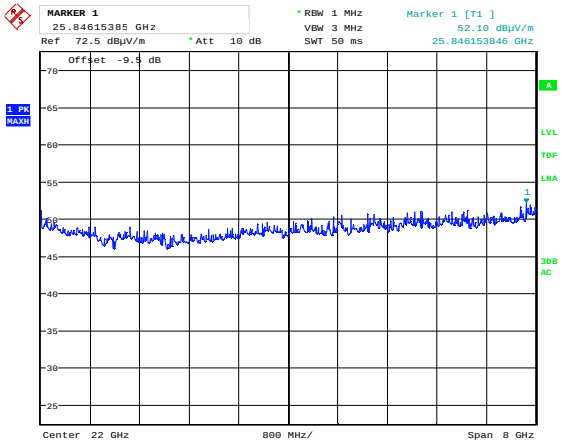
Date: 22.MAR.2023 15:35:16

Emissions 18 - 26 GHz, 2437 MHz, 802.11b 1M, Ant1 HP @1m



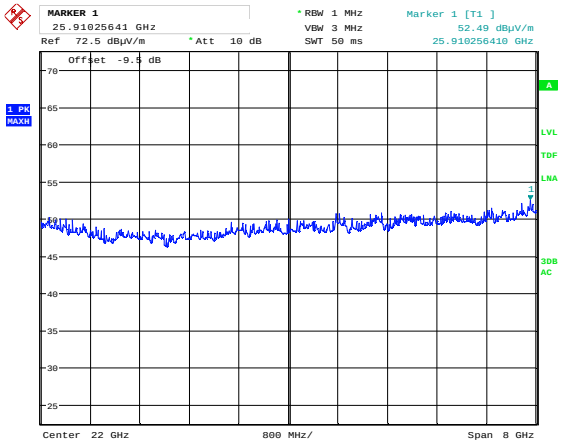
Date: 22.MAR.2023 15:37:37

VP



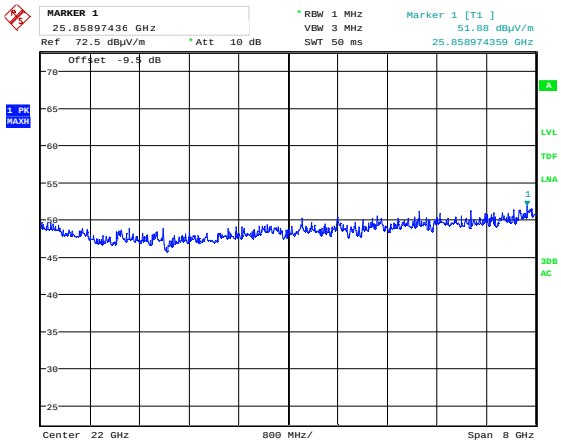
Date: 22.MAR.2023 14:55:47

Emissions 18 - 26 GHz, 2437 MHz, 802.11g 6M, Ant0 HP @1m



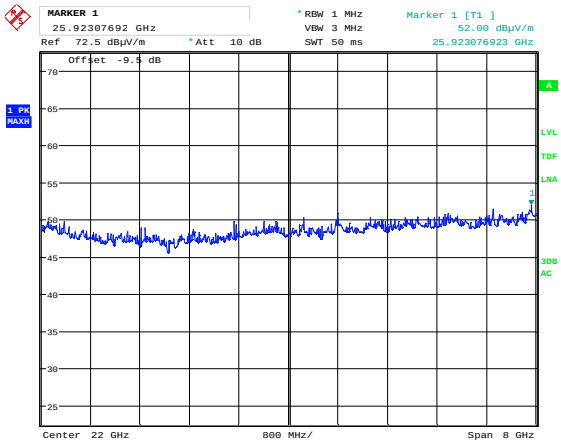
Date: 22.MAR.2023 14:53:42

VP



Date: 22.MAR.2023 14:58:45

Emissions 18 - 26 GHz, 2437 MHz, 802.11g 6M, Ant1 HP @1m



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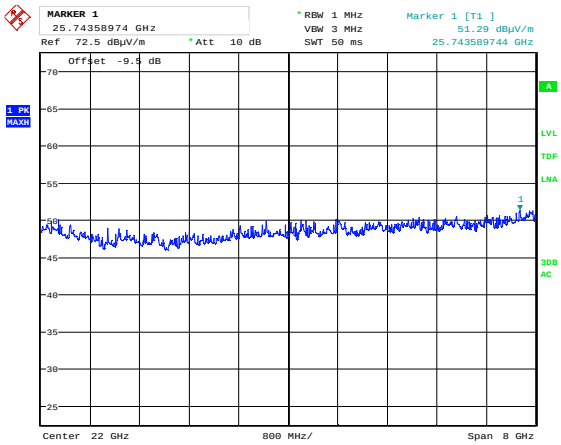
VP



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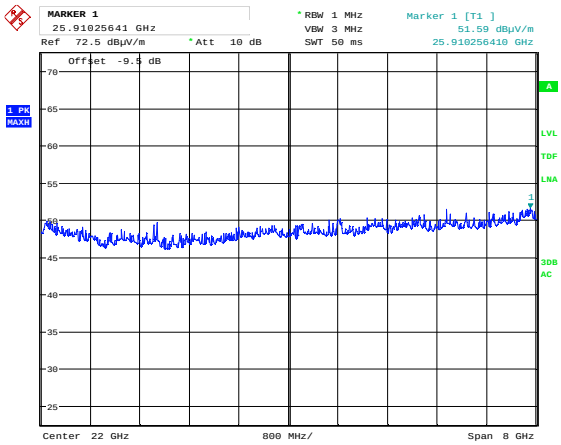
Emissions 18 - 26 GHz, 2437 MHz, 802.11n MCS8 MIMO, HP @1m



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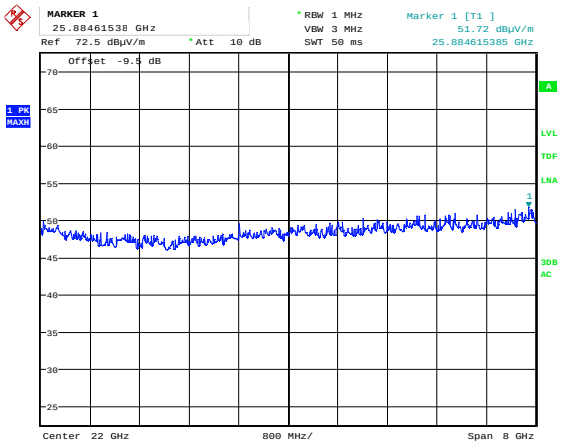

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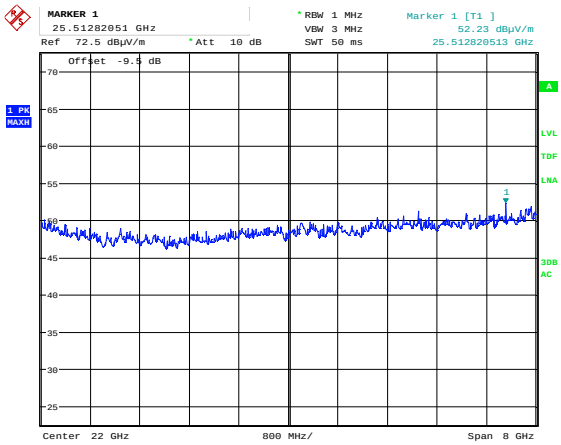
Emissions 18 - 26 GHz, 2437 MHz, 802.11ax MCS0 MIMO, HP @1m



Date: 22.MAR.2023 15:23:37

VP

3.10 Power Spectral Density (PSD)

FCC part 15.247(d)

ISED Canada RSS-247 Issue 2, Clause 5.2 (2)

Measurement procedure: ANSI C63.10-2013 Clause 11.10

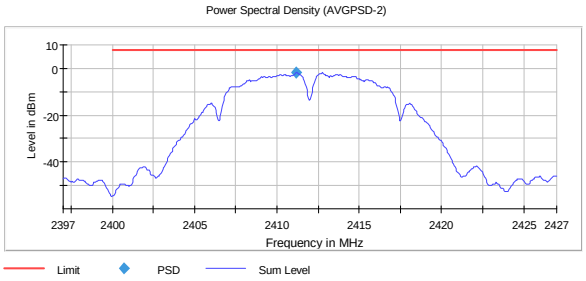
Test Results: Complies

Measurement Data:

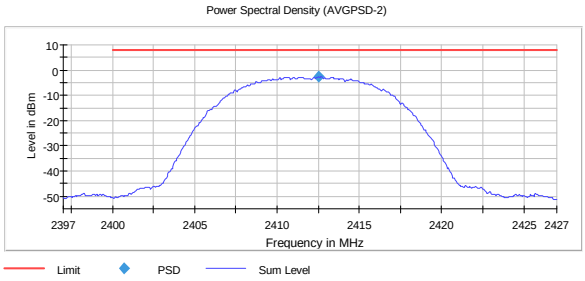
The measurement procedure SA-2 described in ANSI C63.10-2013 was used.

Modulation Type	Measured Average Power Spectral Density (dBm/3kHz)				
	2412 MHz	2422 MHz	2437 MHz	2452 MHz	2462 MHz
802.11b	-1.9	1.1	0.8	0.7	-2.0
802.11g	-3.8	-1.8	1.1	-1.7	-4.2
802.11n SISO	-5.8	-2.3	-1.7	-2.0	-5.7
802.11n MIMO	-6.4	-3.0	-3.4	-3.4	-6.6
802.11ax SISO	-7.3	-3.8	-4.6	-4.8	-7.4
802.11ax MIMO	-8.3	-6.0	-6.5	-6.4	-8.7

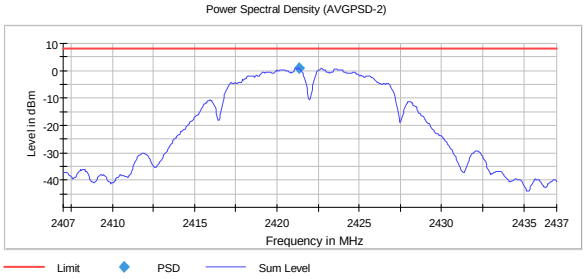
Requirement for systems using Digital Modulation
The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.



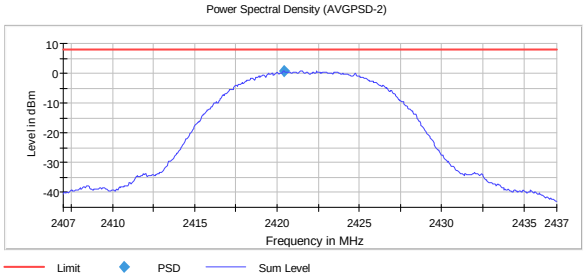
PSD, 2412 MHz, 802.11b 1M -1.9



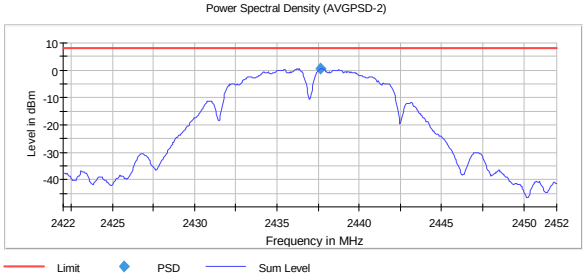
PSD, 2412 MHz, 802.11b 11M -2.5



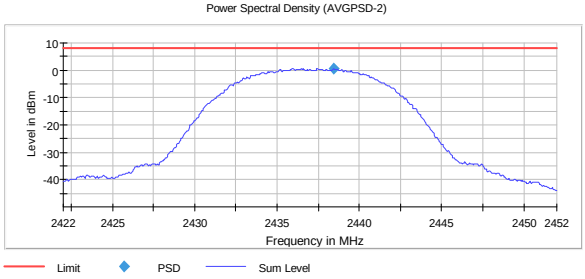
PSD, 2422 MHz, 802.11b 1M 1.1



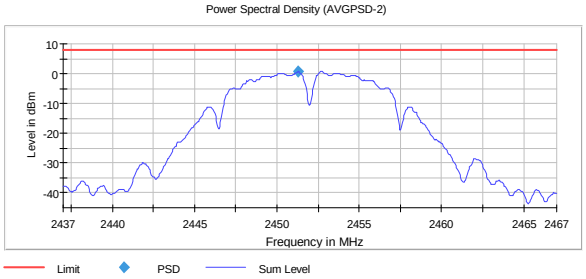
PSD, 2422 MHz, 802.11b 11M 0.9



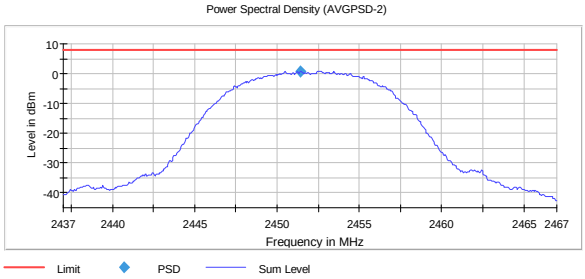
PSD, 2437 MHz, 802.11b 1M 0.6



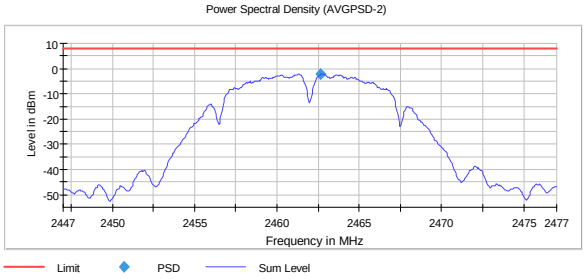
PSD, 2437 MHz, 802.11b 11M 0.8



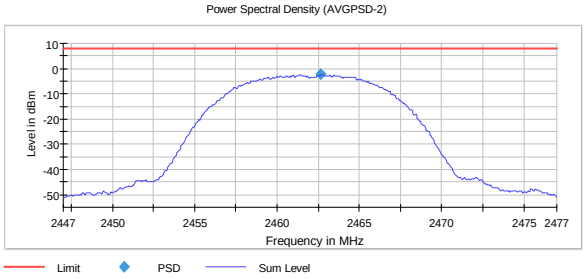
PSD, 2452 MHz, 802.11b 1M 0.7



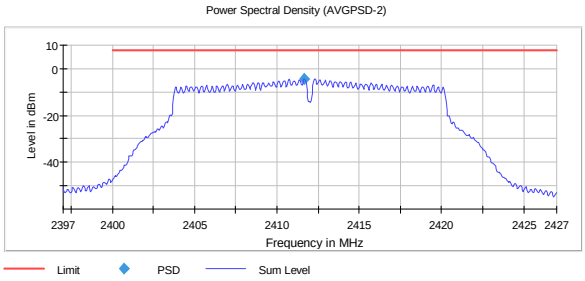
PSD, 2452 MHz, 802.11b 11M 0.7



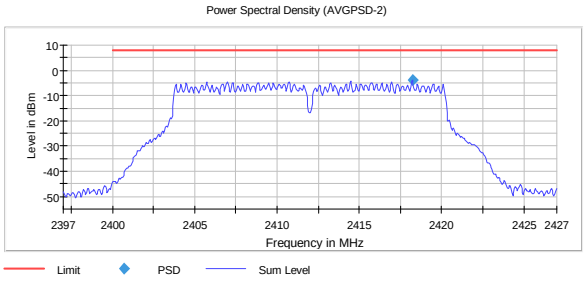
PSD, 2462 MHz, 802.11b 1M -2.0



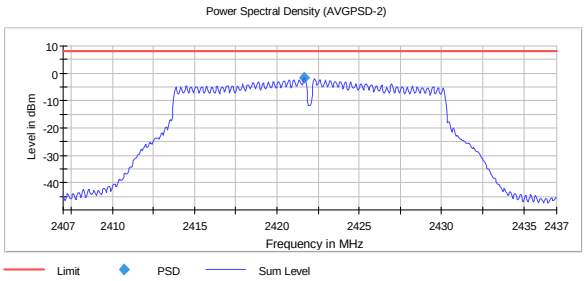
PSD, 2462 MHz, 802.11b 11M -2.4



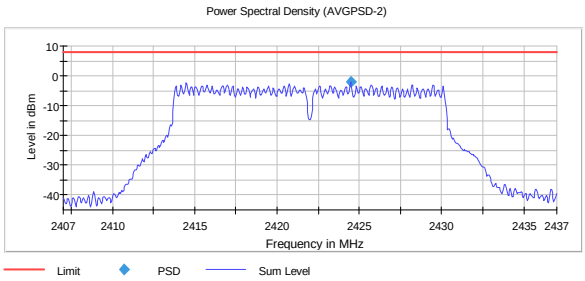
PSD, 2412 MHz, 802.11g 6M -4.5



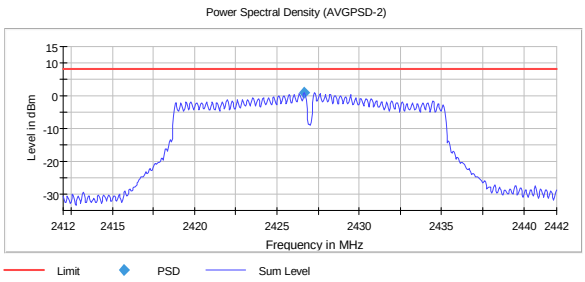
PSD, 2412 MHz, 802.11g 54M -3.8



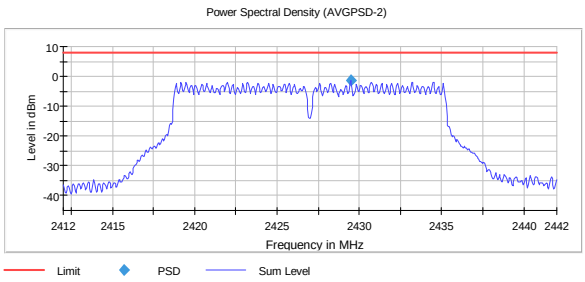
PSD, 2422 MHz, 802.11g 6M -1.8



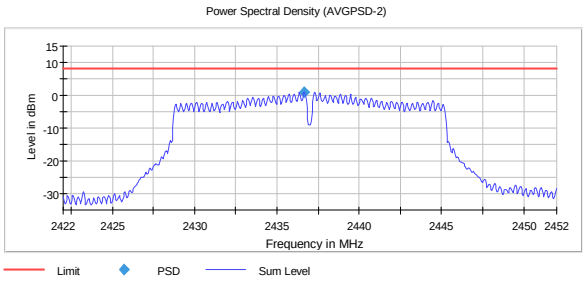
PSD, 2422 MHz, 802.11g 54M -2.2



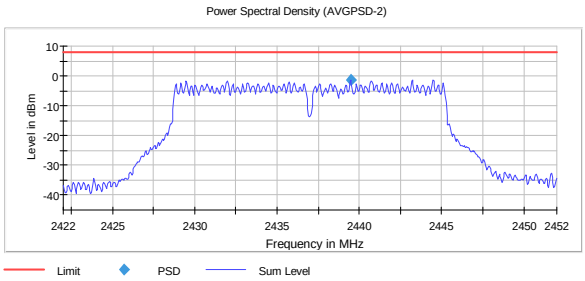
PSD, 2427 MHz, 802.11g 6M 1.0



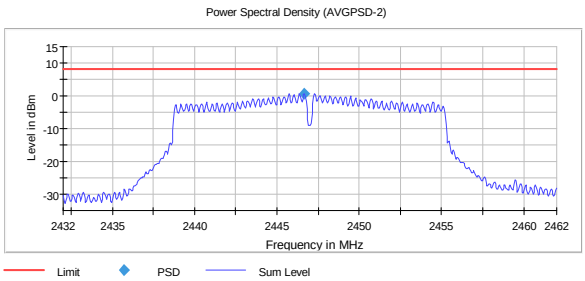
PSD, 2427 MHz, 802.11g 54M -1.2



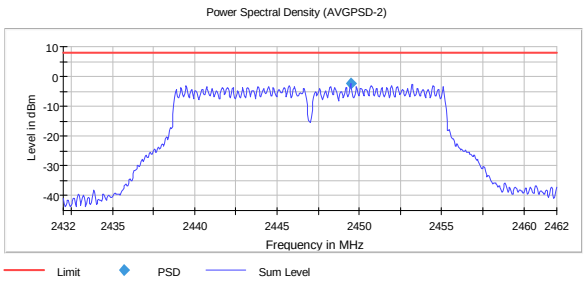
PSD, 2437 MHz, 802.11g 6M 1.1



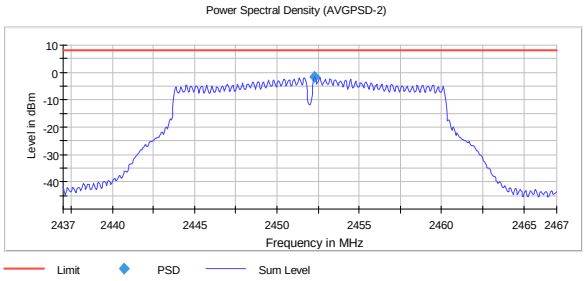
PSD, 2437 MHz, 802.11g 54M -1.3



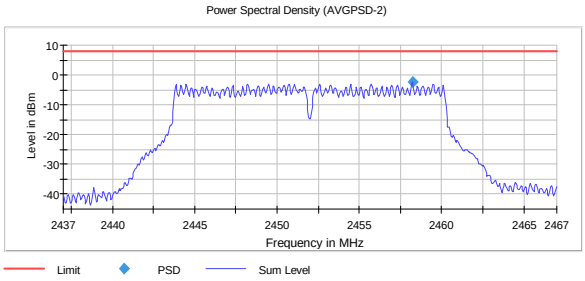
PSD, 2447 MHz, 802.11g 6M 0.8



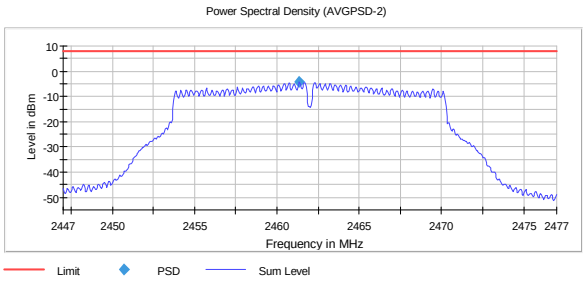
PSD, 2447 MHz, 802.11g 54M -2.4



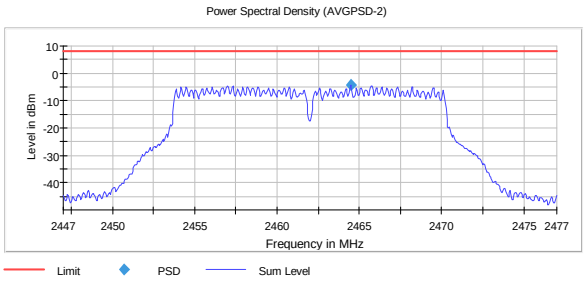
PSD, 2452 MHz, 802.11g 6M -1.7



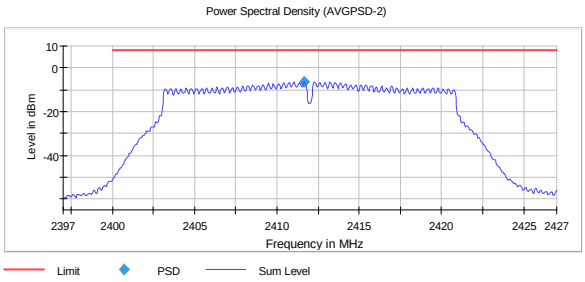
PSD, 2452 MHz, 802.11g 54M -2.3



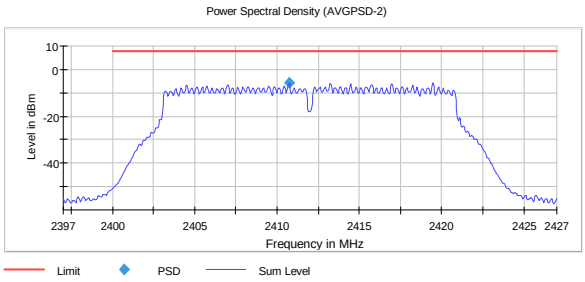
PSD, 2462 MHz, 802.11g 6M -4.2



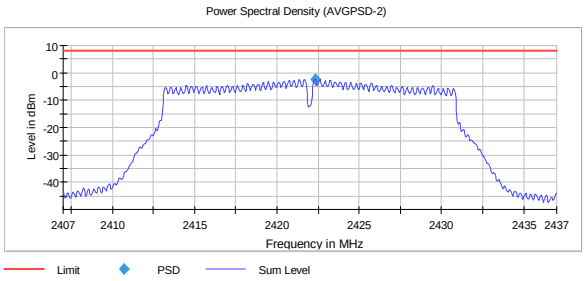
PSD, 2462 MHz, 802.11g 54M -4.4



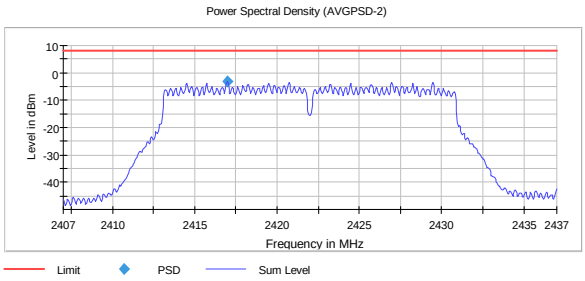
PSD, 2412 MHz, 802.11n MCS0 SISO -6.2



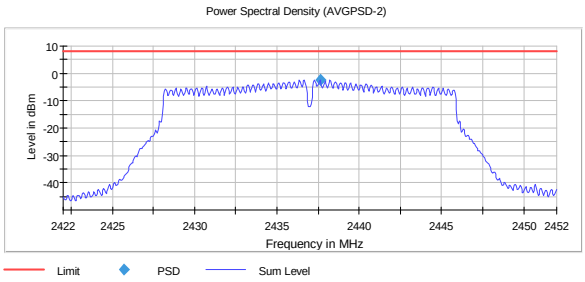
PSD, 2412 MHz, 802.11n MCS7 SISO -5.8



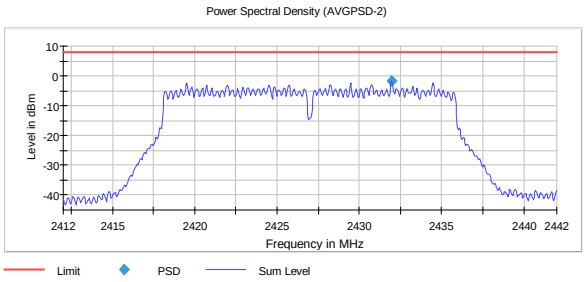
PSD, 2422 MHz, 802.11n MCS0 SISO -2.3



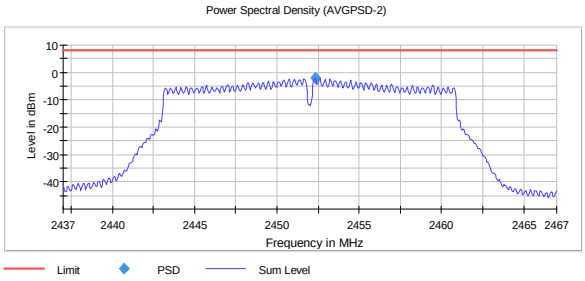
PSD, 2422 MHz, 802.11n MCS7 SISO -3.1



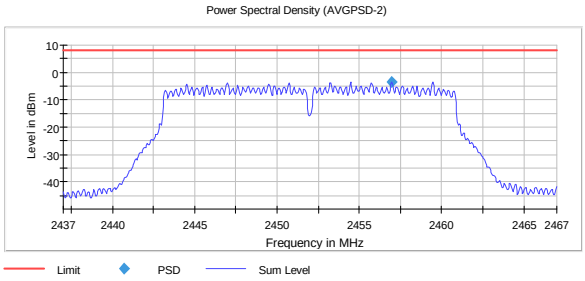
PSD, 2437 MHz, 802.11n MCS0 SISO -2.2



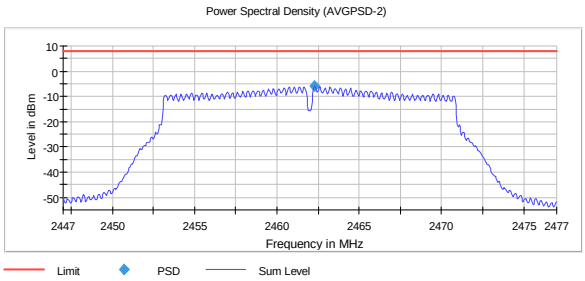
PSD, 2437 MHz, 802.11n MCS7 SISO -1.7



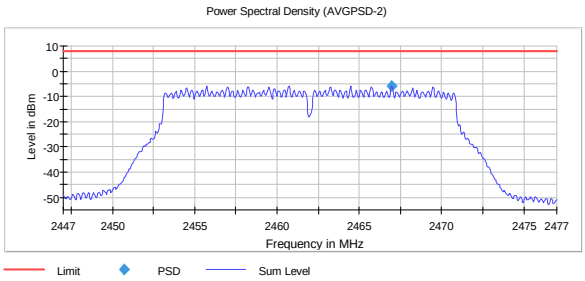
PSD, 2452 MHz, 802.11n MCS0 SISO -2.0



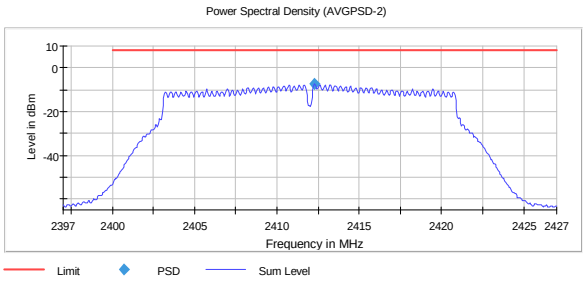
PSD, 2452 MHz, 802.11n MCS7 SISO -3.4



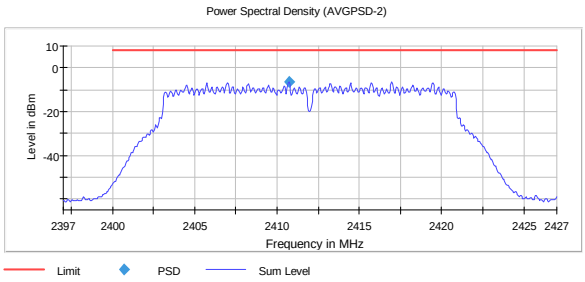
PSD, 2462 MHz, 802.11n MCS0 SISO -6.0



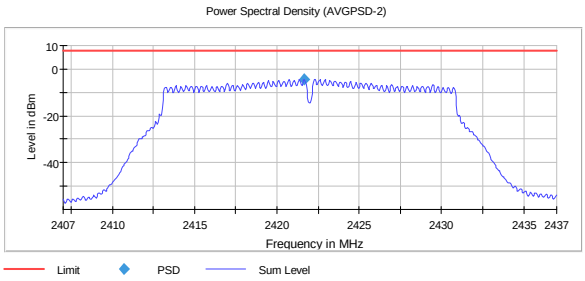
PSD, 2462 MHz, 802.11n MCS7 SISO -5.7



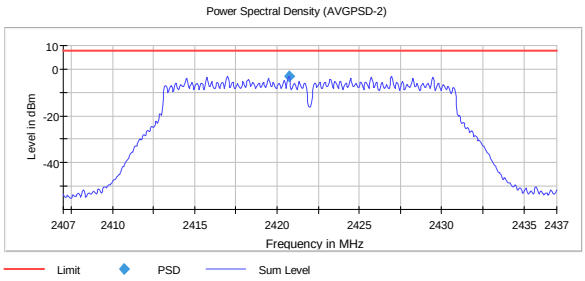
PSD, 2412 MHz, 802.11n MCS8 MIMO -7.4



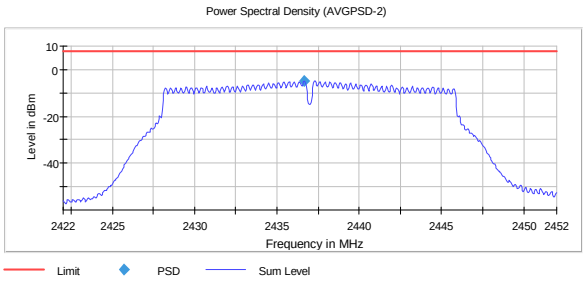
PSD, 2412 MHz, 802.11n MCS15 MIMO -6.4



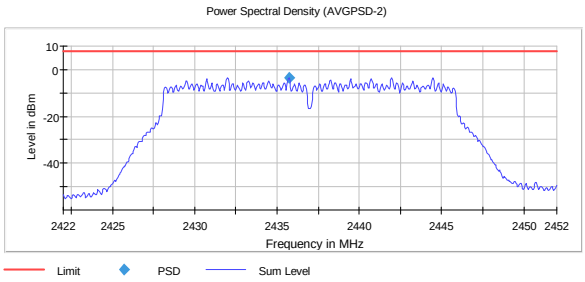
PSD, 2422 MHz, 802.11n MCS8 MIMO -4.4



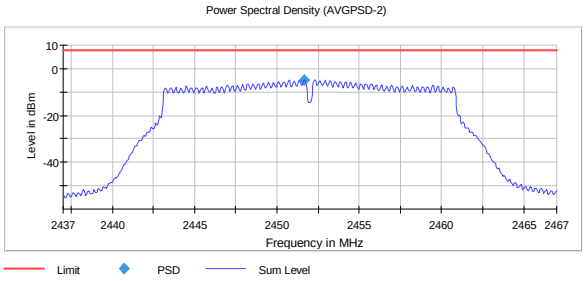
PSD, 2422 MHz, 802.11n MCS15 MIMO -3.0



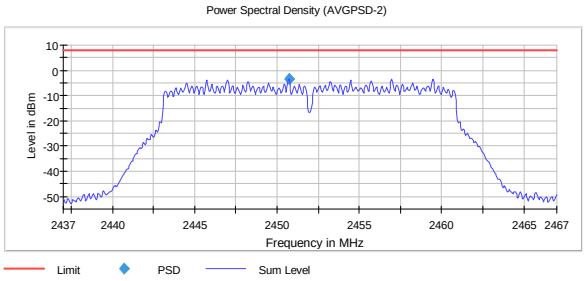
PSD, 2437 MHz, 802.11n MCS8 MIMO -4.8



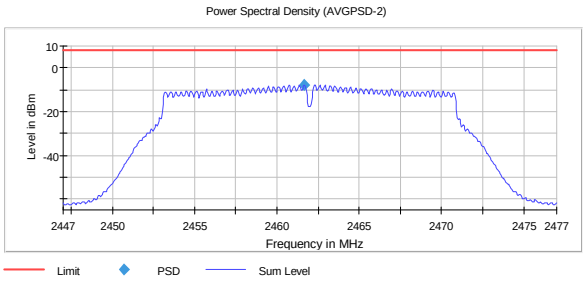
PSD, 2437 MHz, 802.11n MCS15 MIMO -3.4



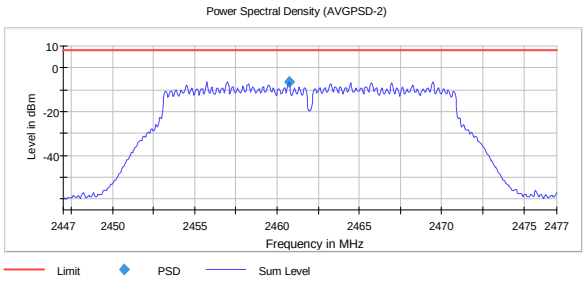
PSD, 2452 MHz, 802.11n MCS8 MIMO -4.8



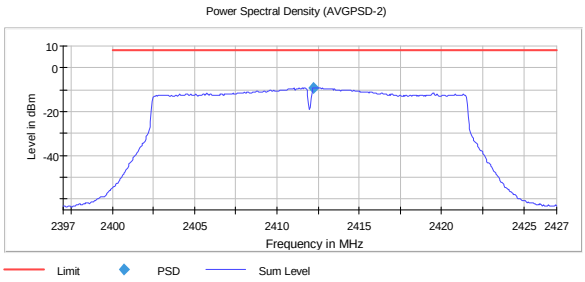
PSD, 2452 MHz, 802.11n MCS15 MIMO -3.4



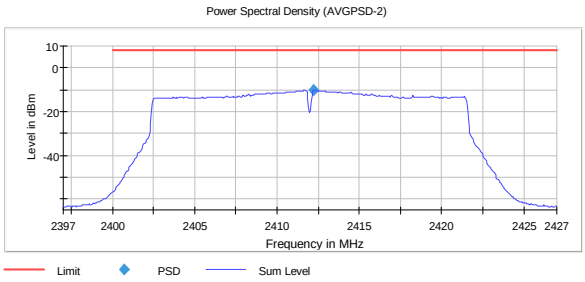
PSD, 2462 MHz, 802.11n MCS8 MIMO -7.8



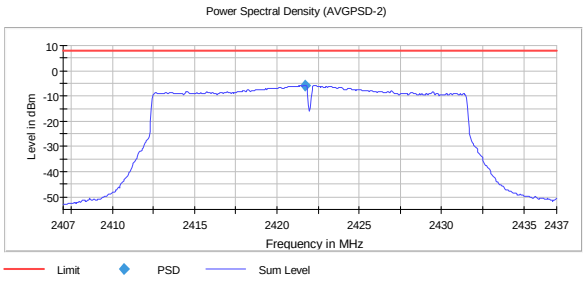
PSD, 2462 MHz, 802.11n MCS15 MIMO -6.6



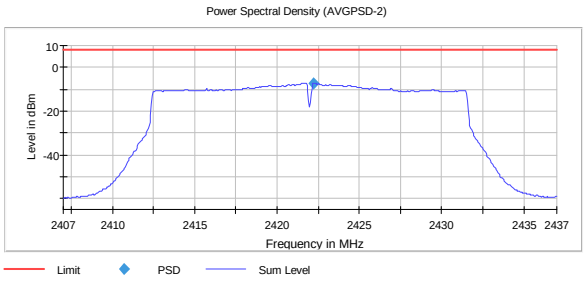
PSD, 2412 MHz, 802.11ax MCS0 SISO -9.0



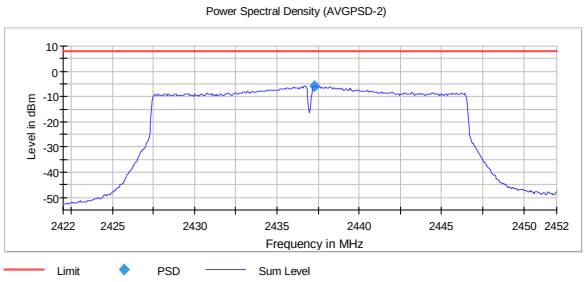
PSD, 2412 MHz, 802.11ax MCS0 MIMO -10.0



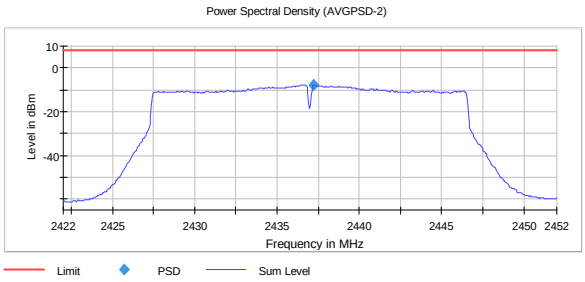
PSD, 2422 MHz, 802.11ax MCS0 SISO -5.7



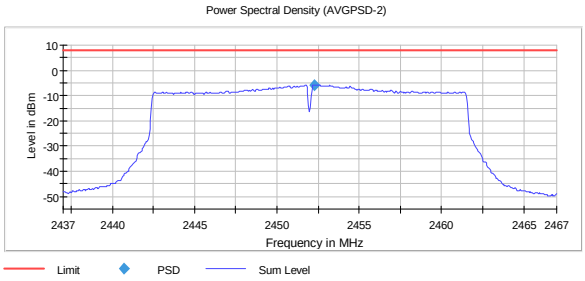
PSD, 2422 MHz, 802.11ax MCS0 MIMO -7.3



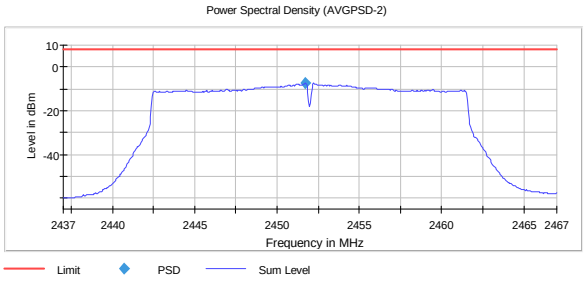
PSD, 2437 MHz, 802.11ax MCS0 SISO -5.8



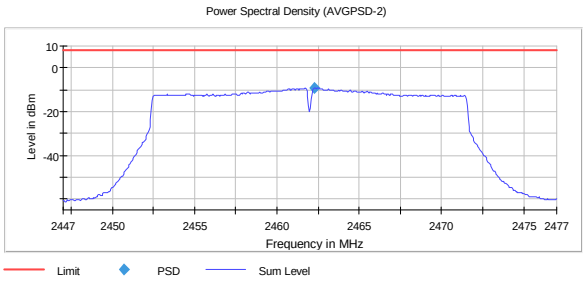
PSD, 2437 MHz, 802.11ax MCS0 MIMO -7.6



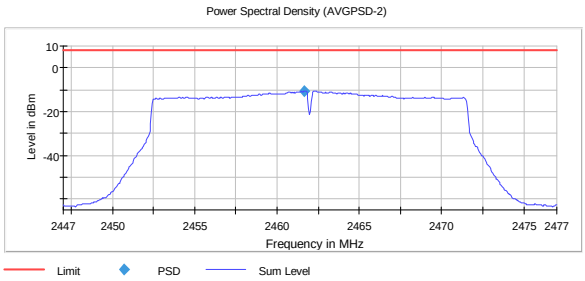
PSD, 2452 MHz, 802.11ax MCS0 SISO -5.7



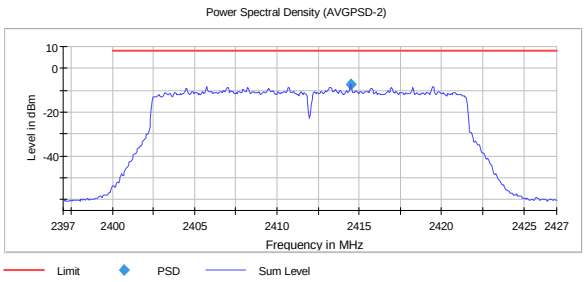
PSD, 2452 MHz, 802.11ax MCS0 MIMO -7.4



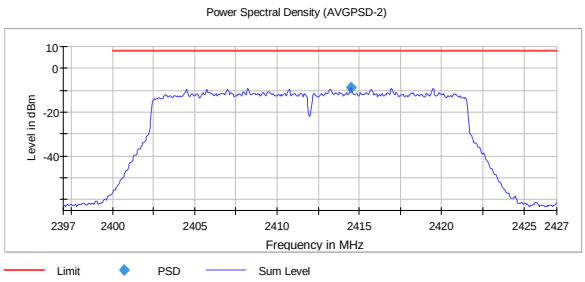
PSD, 2462 MHz, 802.11ax MCS0 SISO -9.3



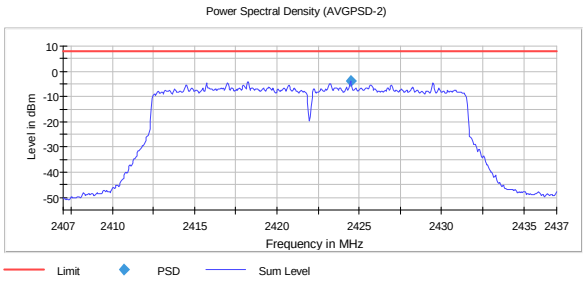
PSD, 2462 MHz, 802.11ax MCS0 MIMO -10.6



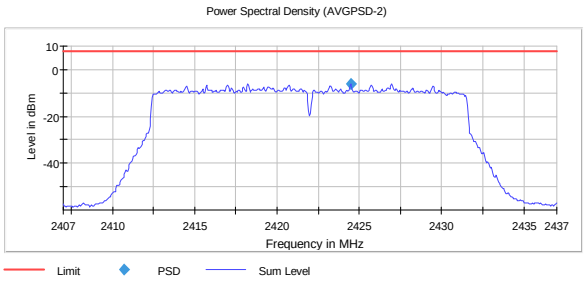
PSD, 2412 MHz, 802.11ax MCS8 SISO -7.3



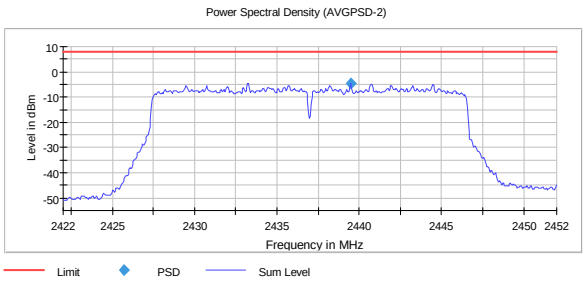
PSD, 2412 MHz, 802.11ax MCS8 MIMO -8.9



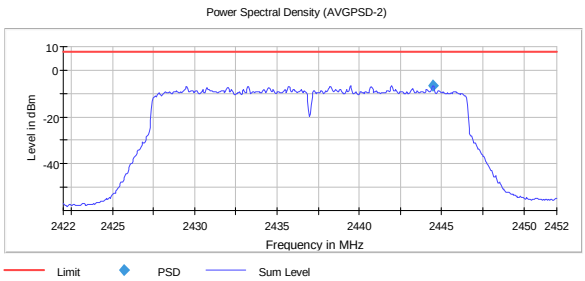
PSD, 2422 MHz, 802.11ax MCS8 SISO -3.8



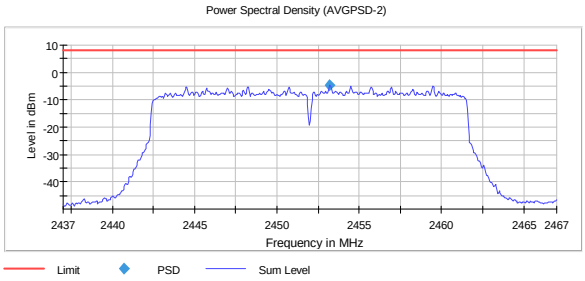
PSD, 2422 MHz, 802.11ax MCS8 MIMO -6.0



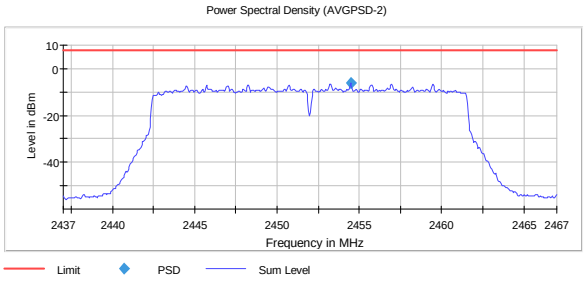
PSD, 2437 MHz, 802.11ax MCS8 SISO -4.6



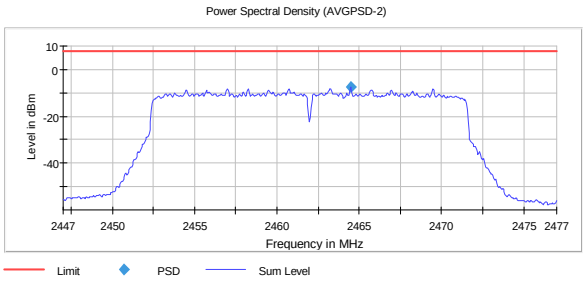
PSD, 2437 MHz, 802.11ax MCS8 MIMO -6.5



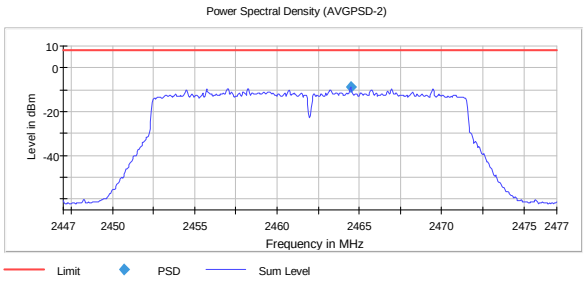
PSD, 2452 MHz, 802.11ax MCS8 SISO -4.8



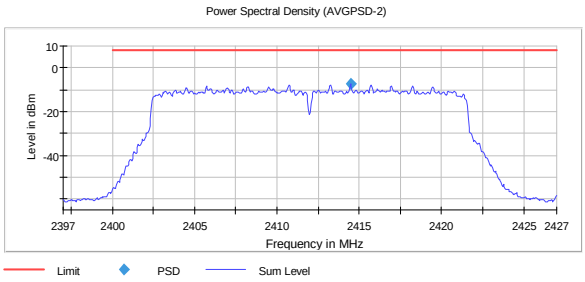
PSD, 2452 MHz, 802.11ax MCS8 MIMO -6.4



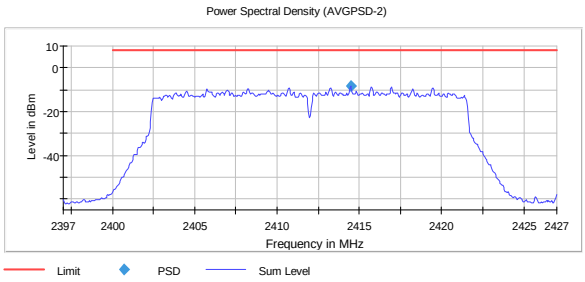
PSD, 2462 MHz, 802.11ax MCS8 SISO -7.4



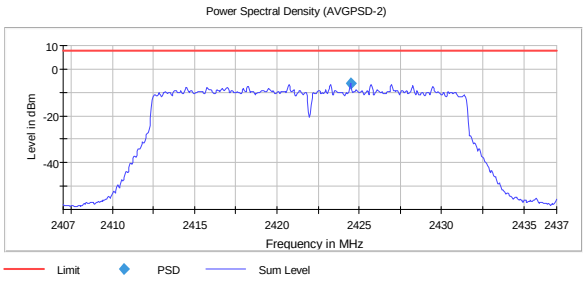
PSD, 2462 MHz, 802.11ax MCS8 MIMO -8.7



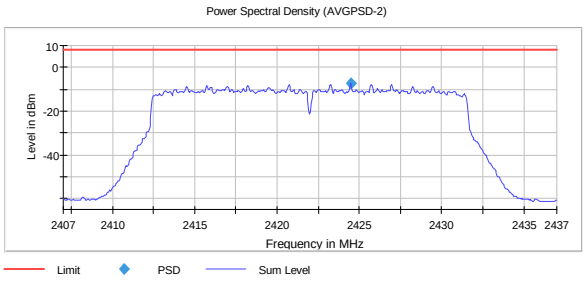
PSD, 2412 MHz, 802.11ax MCS11 SISO -7.4



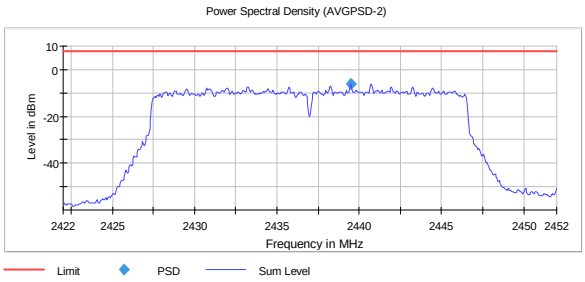
PSD, 2412 MHz, 802.11ax MCS11 MIMO -8.3



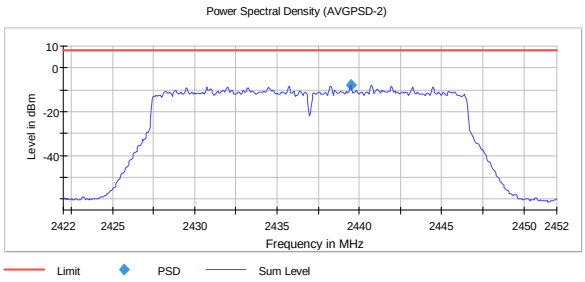
PSD, 2422 MHz, 802.11ax MCS11 SISO -6.3



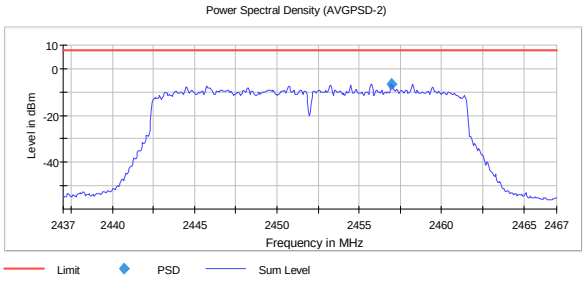
PSD, 2422 MHz, 802.11ax MCS11 MIMO -7.3



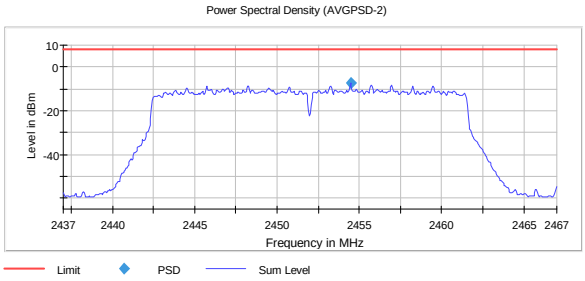
PSD, 2437 MHz, 802.11ax MCS11 SISO -6.1



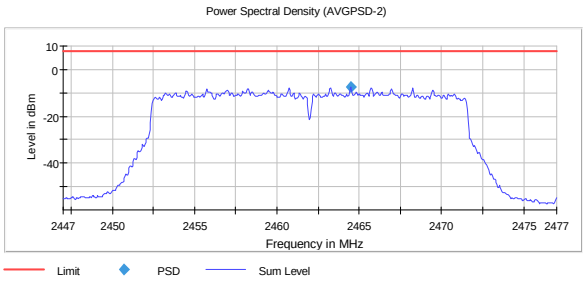
PSD, 2437 MHz, 802.11ax MCS11 MIMO -7.7



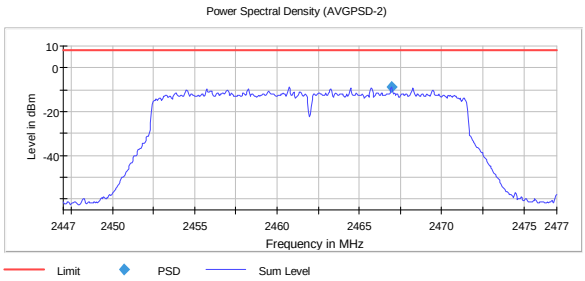
PSD, 2452 MHz, 802.11ax MCS11 SISO -6.6



PSD, 2452 MHz, 802.11ax MCS11 MIMO -7.5



PSD, 2462 MHz, 802.11ax MCS11 SISO -7.5



PSD, 2462 MHz, 802.11ax MCS11 MIMO -9.0

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		**Uncertainty**
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	**< 3.6 GHz**	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	**< 1 GHz**	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	**Frequency**	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

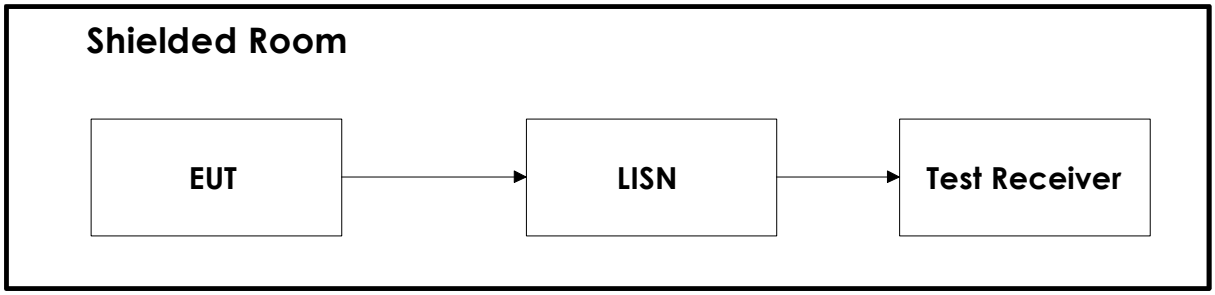
No.	Model number	Description	Manufacturer	Ref. no.	Cal. date	Cal. Due
1	FSW43	Spectrum Analyzer	Rohde & Schwarz	LR 1690	2022-01 2023-01	2023-01 2024-01
2	ESU40	Measuring Receiver	Rohde & Schwarz	LR 1639	2022-01 2023-01	2023-01 2024-01
3	6810.17B	Attenuator	Suhner	LR 1669	2022-05	2023-05
4	NO324415	Band Reject Filter (2.4 GHz)	Microwave Circuits	LR 1760	COU	
5	VULB 9163	BiLog Antenna	Schwarzbech	LR 1616	2021-05	2024-05
6	310	Pre-amplifier	Sonoma Inst.	LR 1686	2022-08	2023-08
7	3117-PA	Horn Antenna +PreAmp	EMCO	LR 1717	2022-08	2023-08
8	L01G18G1	LowPass Filter (1 GHz)	Microwave Circuits	LR 1768	COU	
9	3115	Horn Antenna	EMCO	LR 1226	2022-11	2027-11
10	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2022-08	2023-08
11	638	Antenna Horn	Narda	LR 1480	N/A	
12	6812B	AC Power Source	Agilent	LR 1515	2022-11	2024-11
13	Model 87V	Multimeter	Fluke	LR 1600	2022-03	2024-03
14	ENV216	Two Line V-Network	Rohde & Schwarz	LR 1665	2021-12	2023-12
15	ESCI3	Measuring Receiver	Rohde & Schwarz	N-4259	2021-10	2023-10
16	ST18/SMA/N/36	RF Cable	Suhner	LR 1627	COU	
17	OSP-B157W8	Peak Power Meters	Rohde & Schwarz	LR 1793	2022-02	2024-02
18	OSP-B157WX	Switch Unit	Rohde & Schwarz	LR 1806	2022-08	2023-08
19	FSVA3044	Spectrum Analyzer	Rohde & Schwarz	LR 1808	2022-08	2023-08

The software listed below has been used for one or more tests.

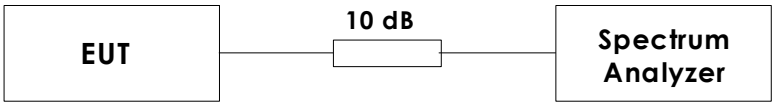
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	EMC32	10.50.40	EMC test software
2	Nemko AS	RSPlot	1.0.8.0	Screen capture from R&S Spectrum Analyzers
3	Rohde & Schwarz	WMS	10.40.00	Radio Test Software

6 BLOCK DIAGRAM

6.1 Power Line Conducted Emission

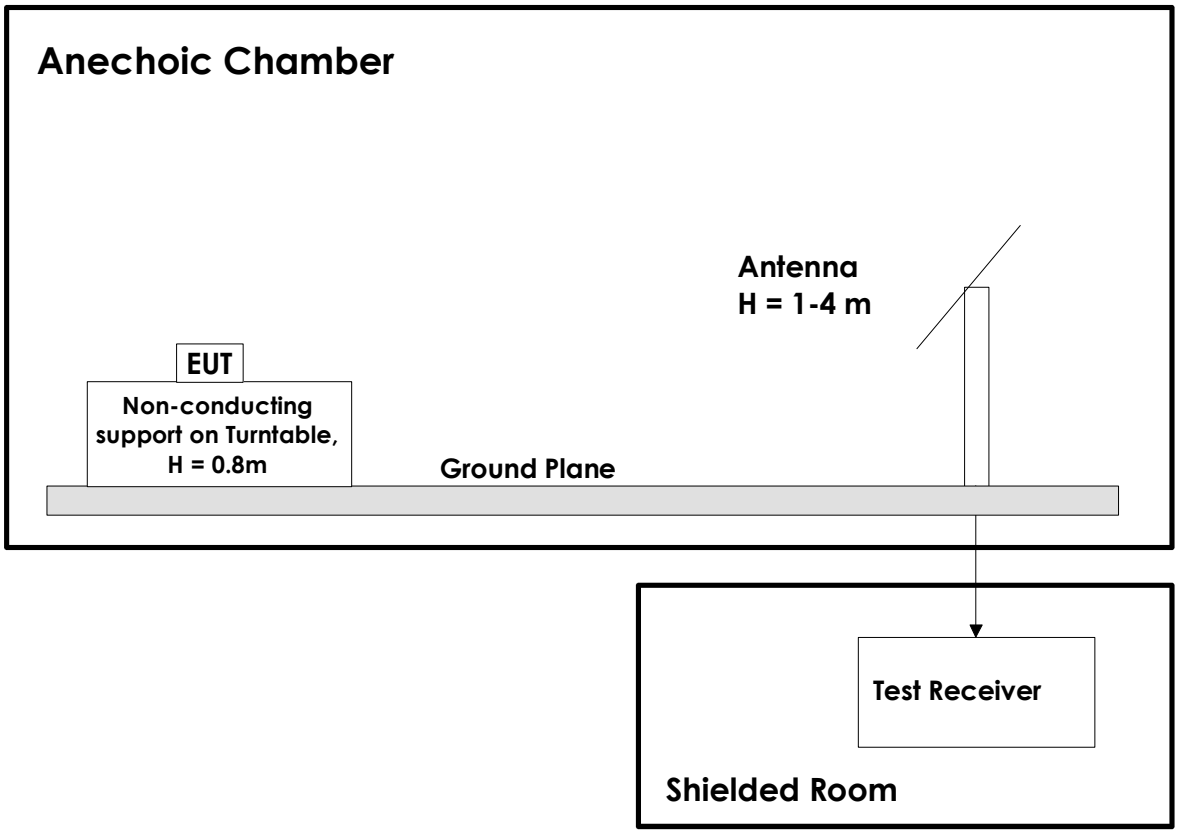


6.2 Conducted Tests



This test set-up is used for all Conducted tests.
For the Frequency Stability test the EUT was placed in a climatic chamber.

6.3 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics.