N° 1-6736
Scope available
on www.cofrac.fr

TEST REPORT

EUT Description	**2x2 Wi-Fi and BT, M.2 1216 adapter card**
Brand Name	**Intel®**
Model Name	**BE211D2W / BE211D2W M**
Date of Test Start/End	**2025-06-10 / 2025-07-11**
Features	**2x2 Wi-Fi + Bluetooth®** **(see section 5)**

Applicant	**Intel Corporation SAS**
Address	**425 Rue de Goa – Le Cargo B6 – 06600 Antibes, FRANCE**
Contact Person	**Irina Vicente**
Telephone/Fax/ Email	**irina.vicente@intel.com**

Reference Standards	**ETSI EN 300 328 V2.2.2** **(see section 1)**

Test Report identification	**250522-02.TR03**
Revision Control	**Rev. 00** **This test report revision replaces any previous test report revision** **(see section 8)**

The test results relate only to the samples tested.
Reference to accreditation shall be used only by full reproduction of test report.

Issued by

Digitally signed by Khodor RIDA
Date: 2025.07.25 14:33:56 +02'00'

Khodor RIDA
(Test Engineer Lead)

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Zayd OUACHICHA
(Technical Manager)

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1. Standards, reference documents and applicable test methods

1. ETSI EN300 328 v2.2.2, Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum

2. General conditions, competences and guarantees

- ✓ Intel Corporation SAS Wireless RF Lab (Intel WRF Lab) is an ISO/IEC 17025:2017 testing laboratory accredited by the French Committee for Accreditation (Cofrac) with the certificate number 1-6736.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities

3. Environmental Conditions

✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

Temperature	Min: 21.21°C Max: 31.46°C Average: 26.34°C
Humidity	Min: 34.39% Max: 67.06% Average: 50.73%

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of receipt	Note
#01	250528-01.S01	Module	BE211D2W	289200F964C4	2025-05-28	Used for conducted Test
	240000-01.S03	Extender MotherBoard	PCB00887-008_A	2202207569	2024-12-12	
	210916-09.S03	Laptop	HP HSN-I45C	000176090Y	2021-12-10	
#02	250528-01.S07	Module	BE211D2W	289200F96596	2025-05-28	Used for Radiated Spurious Emissions tests
	200803-01.S01	Extender	ADEXELEC	139245	2020-08-31	
	170000-01.S57	Adapter	BNJ C0 V3	ASS00959-00-0C	2025-03-24	
	200611-03.S30	Test PC	Latitude 5401	6DJLK13	2020-08-19	
	230223-02.S48	Triband Antenna	-	006	2023-04-20	
	230526-09.S08	Triband Antenna	-	016	2023-07-06	
#03	250528-01.S07	Module	BE211D2W	289200F96596	2025-05-28	Used for Radiated Spurious Emissions tests
	200904-01.S14	Extender	ADEXELEC	12	2023-06-22	
	170000-01.S56	Adapter	BNJ C0 V3	E1578726888186A	2025-03-24	
	170000-01.S55	Test PC	LATITUDE 5530	0042500000000002AA521	2025-03-24	
	230526-09.S06	Triband Antenna	-	014	2023-07-06	
	230526-09.S05	Triband Antenna	-	013	2023-07-06	
#04	250528-01.S07	Module	BE211D2W	289200F96596	2025-05-28	Used Rx Radiated Spurious Emission tests
	170000-01.S57	Adapter	BNJ C0 V3	ASS00959-00-0C	2025-03-24	
	200615-05.S06	Test PC (Host)	Dell Latitude 7940	63QRMQ2	2020-06-12	

5. EUT Features

The herein information is provided by the customer.

Intel WRF Lab declines any responsibility for the accuracy of the stated customer provided information, especially if it has any impact on the correctness of test results presented in this report.

<table>
<tr><td>Brand Name</td><td>Intel®</td></tr>
<tr><td>Model Name</td><td>BE211D2W / BE211D2W M</td></tr>
<tr><td>Software Version</td><td>DRTU.08798.99.0.99</td></tr>
<tr><td>Driver Version</td><td>99.0.99.2</td></tr>
<tr><td>Supported Radios</td><td>802.11b/g/n/ax/be 2.4GHz
802.11a/n/ac/ax/be 5.2GHz
5.3GHz
5.6GHz
5.8GHz
802.11ax/be 6.0GHz</td></tr>
<tr><td>Antenna Information</td><td>
<table>
<tr><th>Transmitter</th><th>Chain A(1)</th><th>Chain B(2)</th></tr>
<tr><td>Manufacturer</td><td>Intel WRF Lab</td><td>Intel WRF Lab</td></tr>
<tr><td>Antenna type</td><td>PIFA</td><td>PIFA</td></tr>
<tr><td>Part number</td><td>WRF-Tri Band-Antenna</td><td>WRF-Tri Band-Antenna</td></tr>
<tr><td>Antenna peak gain (dBi)</td><td>+3.0</td><td>+3.0</td></tr>
</table>
</td></tr>
</table>

6. Remarks and comments

1. According to the applicant declaration the device BE211D2W / BE211D2W M operating in 802.11b/g/n/a/ac/ax/be mode is an adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. so it is considered as receiver category 1.
2. At customer request, all normal condition tests were carried out at tune up power (+0.5dB) Vs device setting.

7. Test Verdicts summary

The statement of conformity to applicable standards in the table below are based on the measured values, without taking into account the measurement uncertainties.

7.1. 802.11b/g/n/ax/be

Mode	ETSI clause	Test	Verdict
2.4GHz	4.3.2.2	RF output power	P
	4.3.2.3	Power Spectral Density	P
	4.3.2.4	Duty Cycle, Tx-sequence, TX gap	NA
	4.3.2.5	Medium Utilization (MU) factor.	NA
	4.3.2.6	Adaptivity (adaptive equipment using modulations other than FHSS)	P
	4.3.2.7	Occupied Channel Bandwidth	P
	4.3.2.8	Transmitter unwanted emissions in the out-of-band domain	P
	4.3.2.9	Transmitter unwanted emissions in the spurious domain	P
	4.3.2.10	Receiver spurious emissions	P
	4.3.2.11	Receiver Blocking	P

P: Pass
F: Fail
NM: Not Measured
NA: Not Applicable

8. Document Revision History

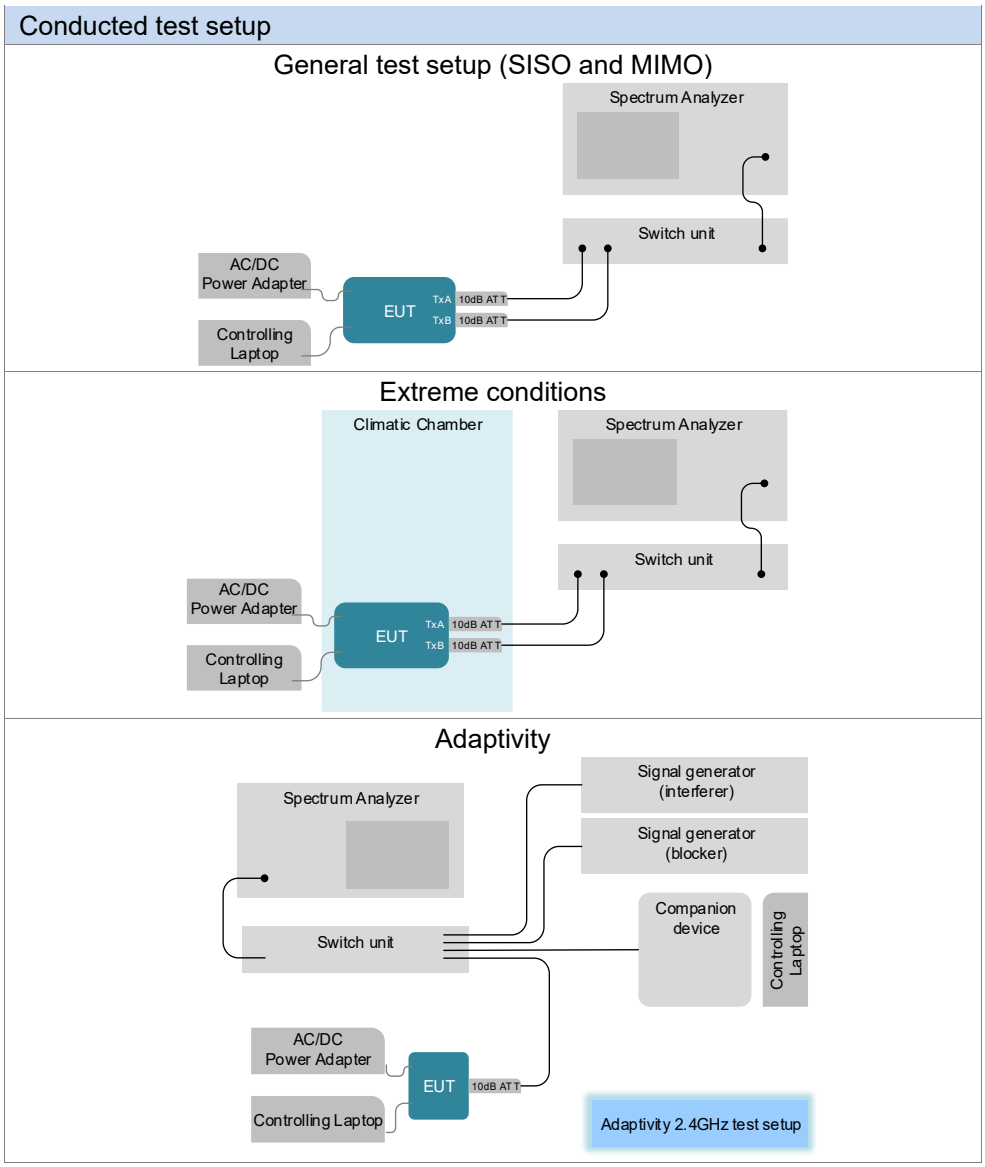
Revision #	Modified by	Revision Details
Rev. 00	K. RIDA T.Gamin	First Issue

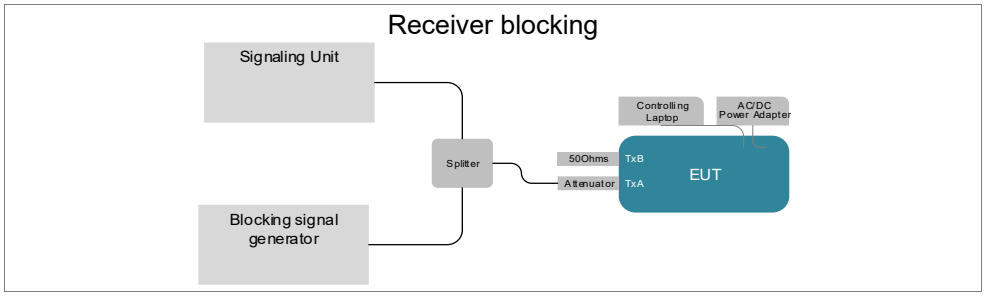
Annex A. Test & System Description

A.1 Measurement System

Measurements were performed using the following setups and made in accordance to the general provisions of ETSI EN 300 328 V2.2.2
Rohde & Schwarz TS8997 system with the switching unit OSP120, OSP B-157 and software EMC32 were employed.

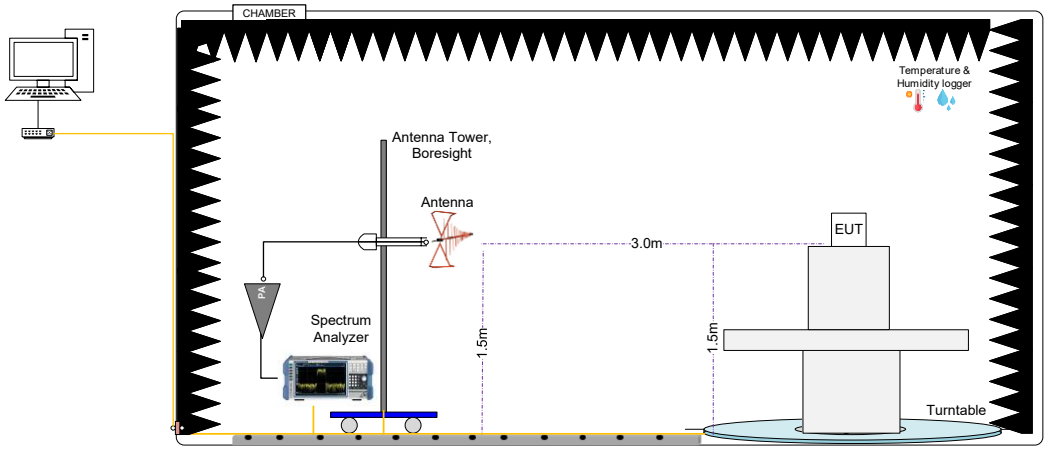
The DUT was installed in a test fixture and then connected to a laptop computer and AC/DC power adapter. The laptop computer was used to configure the EUT to continuously transmit at a specified output power using all different modes and modulation schemes, using the Intel proprietary tool DRTU.
Setups for conducted and radiated measurements are shown below.



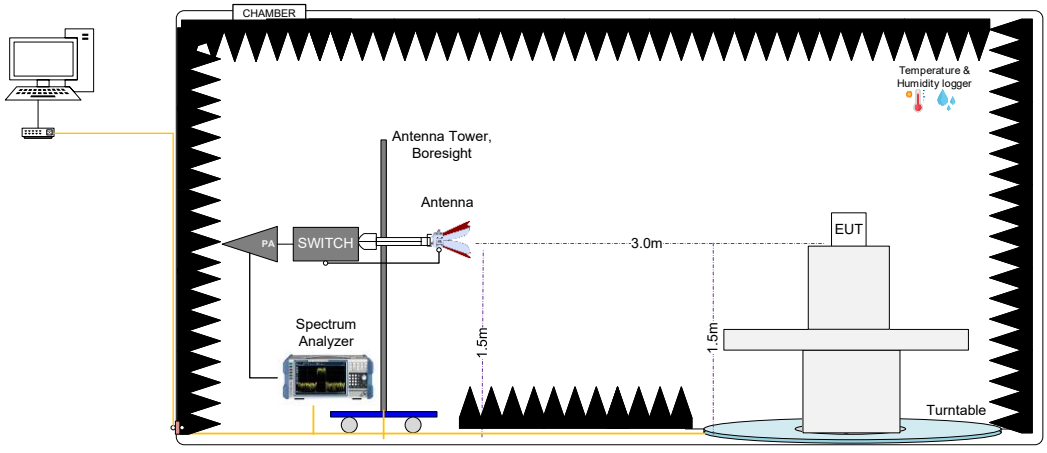


Radiated test setup

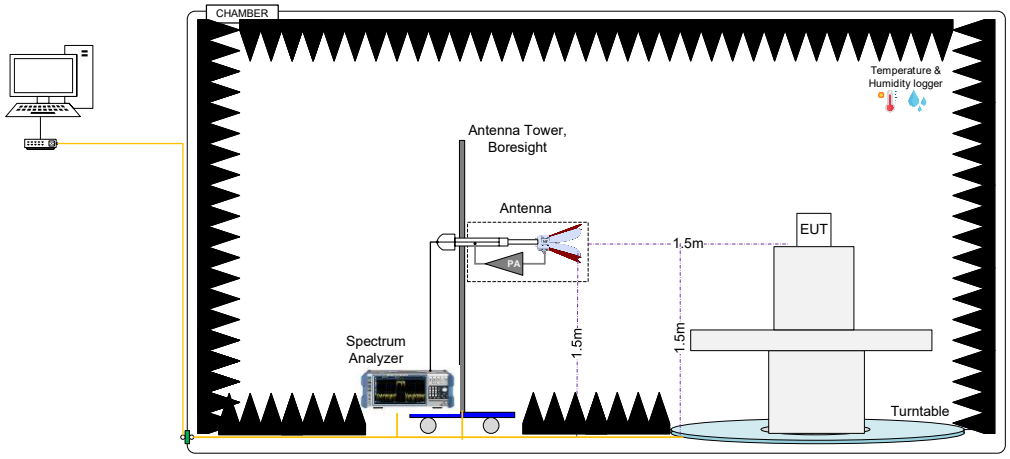
Radiated Setup 30 MHz - 1 GHz (Transmitter tests)



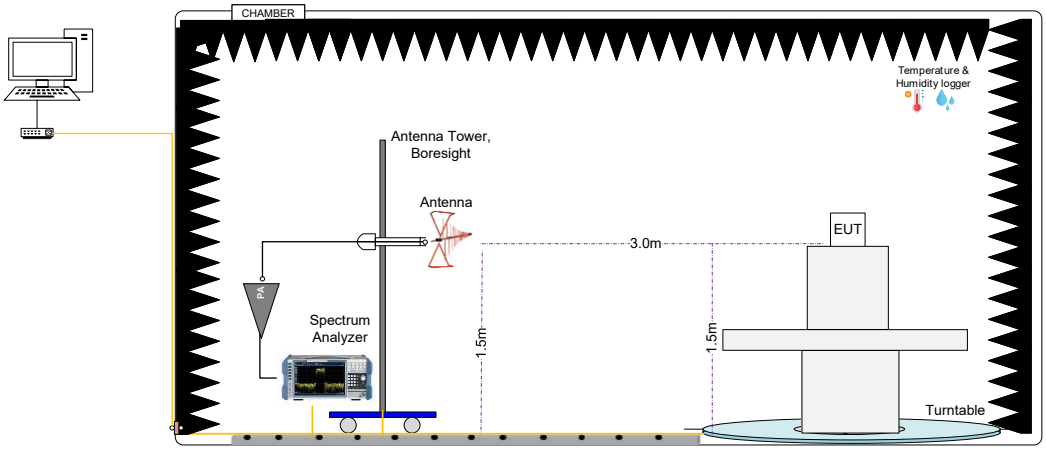
Radiated Setup 1 GHz – 11 GHz (Transmitter tests)



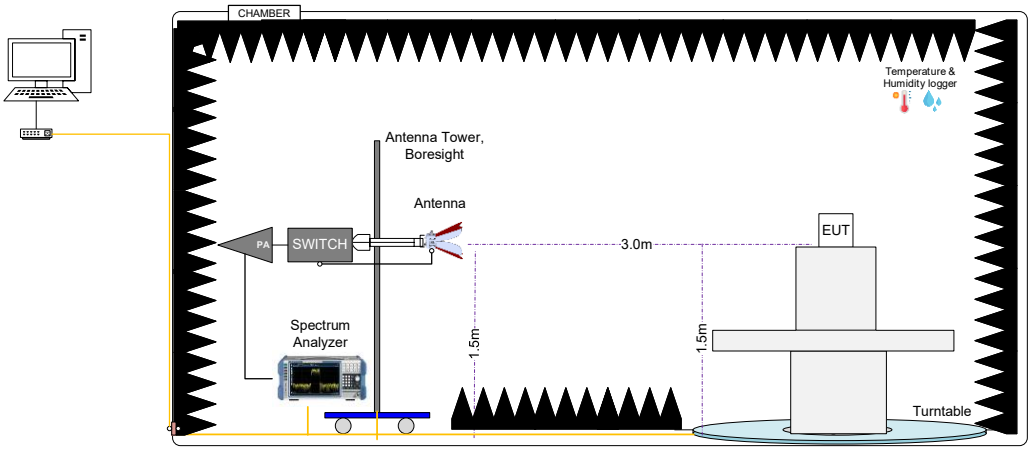
Radiated Setup 11 GHz – 12.75 GHz (Transmitter tests)



Radiated Setup 30 MHz – 1 GHz (Receiver tests)



Radiated Setup 1 GHz – 12.75 GHz (Receiver tests)



A.2 Test Equipment List

Conducted setup #01 (RF Tests)

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
017-015	Switch unit	OSP 120	101172	Rohde & Schwarz	2024-05-22	2026-05-22
481-000	Access point 802.11n	AIR-CAP3502E-A-K9	FTX1438S6P4	Cisco	N/A	N/A
017-003	DC Power supply	E3640A	MY40006885	Agilent	N/A	N/A
133-000	Oscilloscope	RTE1052	101135	Rohde & Schwarz	2024-03-04	2026-03-04
299-000	Multimeter	34401A	US360546853146A00597	HPAgilent	2024-03-14	2026-03-14
311-000	Climatic chamber	SLT34/40	56746020930010	Secasi	2023-12-20	2025-12-20
017-038	Spectrum analyzer	FSVA3013	102344	Rohde & Schwarz	2024-05-29	2026-05-29
017-000	Measurement Software	WMS32 V11.40	200226	Rohde & Schwarz	N/A	N/A
412-000	Measurement Software	DRTU Power Finder V2	N/A	WRF Lab	N/A	N/A
094-004	Temp & Humidity Logger	RMS-HCD-S	24050483	Rotronic	2024-09-02	2026-09-02
237-000	10dB directional coupler	MC2047-10	01-062	Fairview	2025-02-24	2026-02-24
017-005	RF Cable 0.5m	PE3CA1039	-	Pasternack	2025-02-24	2026-02-24
017-006	RF Cable 1.2m	PE3C0666	-	Pasternack	2025-02-24	2026-02-24
017-007	Cable SMA Male to ML51-P	HRMP-ML51LP	DTR178-100RS	Hirose	2025-02-24	2026-02-24
017-008	Cable SMA Male to ML51-P	HRMP-ML51LP	DTR178-100RS	Hirose	2025-02-24	2026-02-24
281-000	Thermometer	t3000FC	46320036	Fluke	2024-04-17	2026-04-17
053-000	Thermometer	t3000FC	46320032	Fluke	2023-12-13	2025-12-13
017-011	RF Cable 2m	0900670672000PJ	1936949	Radiall	2025-02-24	2026-02-24
017-012	RF Cable 2m	0900670672000PJ	1936947	Radiall	2025-02-24	2026-02-24
017-019	10dB attenuator	-	-	Pasternack	2025-02-24	2026-02-24
017-020	10dB attenuator	-	-	Pasternack	2025-02-24	2026-02-24
008-025	Power Sensor	NRP-Z57	101280	Rohde & Schwarz	2024-05-22	2026-05-22

N/A: Not Applicable

Conducted setup #02 (Adaptivity)

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
221-000	Switch unit	OSP 120	101396	Rohde & Schwarz	2023-09-15	2025-09-15
122-000	Climatic chamber	LHU-113	1012-00-5753	ESPEC	2024-09-30	2026-09-30
017-039	Spectrum analyzer	FSVA3013	102345	Rohde & Schwarz	2024-05-29	2026-05-29
017-031	Measurement Software	WMS32 V11.40	101512	Rohde & Schwarz	N/A	N/A
094-004	Temp & Humidity Logger	RMS-HCD-S	24050483	Rotronic	2024-09-02	2026-09-02
234-000	RF Cable 0.5m	PE3CA1039-50	-	Pasternack	2025-02-24	2026-02-24
017-007	Cable SMA Male to ML51-P	HRMP-ML51LP	DTR178-100RS	Hirose	2025-02-24	2026-02-24
017-008	Cable SMA Male to ML51-P	HRMP-ML51LP	DTR178-100RS	Hirose	2025-02-24	2026-02-24
017-032	RF Cable 2m	NA500-18-SS-2	N/A	HESA	2025-02-24	2026-02-24
017-033	RF Cable 2m	NA500-18-SS-2	N/A	HESA	2025-02-24	2026-02-24
017-034	6dB attenuator	BW-S6W2+	N/A	Mini-Circuits	2025-02-24	2026-02-24
017-035	6dB attenuator	BW-S6W2+	N/A	Mini-Circuits	2025-02-24	2026-02-24
053-000	Thermometer	t3000FC	46320032	Fluke	2023-12-13	2025-12-13
281-000	Thermometer	t3000FC	46320036	Fluke	2024-04-17	2026-04-17
481-000	Access point 802.11n	AIR-CAP3502E-A-K9	FTX1438S6P4	Cisco	N/A	N/A
017-006	RF Cable 1.2m	PE3C0666	-	Pasternack	2025-02-24	2026-02-24

N/A: Not Applicable

Receiver blocking Setup

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
125-000	Communication tester	CMW500	129337	Rohde & Schwarz	2025-05-28	2027-05-28
098-000	Signal generator	SMW200A	103732	Rohde & Schwarz	2023-07-26	2025-07-26
018-005	SMA-SMA 45cm RF Cable	FMC020285-18	-	Fairview Microwave	2025-02-21	2026-02-21
094-004	Temp & Humidity Logger	RMS-HCD-S	24050483	Rotronic	2024-09-02	2026-09-02
018-000	2 Way SMA Power Divider	PE2084	-	Pasternack	2025-02-21	2026-02-21
016-003	SMA-SMA 45cm RF Cable	FMC0202085-18	-	Fairview Microwave	2025-02-21	2026-02-21
018-006	SMA-SMA 45cm RF Cable	FMC0202085-18	-	Fairview Microwave	2025-02-21	2026-02-21

N/A: Not Applicable

Radiated Setup #1

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
006-000	Anechoic Chamber	FACT3	5720	ETS-Lindgren	2024-01-17	2026-01-17
006-001	Turn Table	ETS	-	ETS-Lindgren	N/A	N/A
094-002	Temp & Humidity Logger	RMS-HCD-S	24050486	Rotronic	2024-09-02	2026-09-02
006-011	Boresight antenna mast	BAM 4.0-P	P/278/2890.01	Maturo	N/A	N/A
006-002	Switch & Positioning systems	EMCenter	00159757	ETS-Lindgren	N/A	N/A
147-000	Spectrum analyzer	FSW43	101847	Rohde & Schwarz	2025-03-07	2027-03-07
006-008	Measurement SW, v11.3	EMC32	100623	Rohde & Schwarz	N/A	N/A
301-000	Amplifier 9kHz-1300MHz	8447F	3113A07440	HP	2025-02-11	2026-02-11
006-067	Low Pass Filter 1.6GHz	LPM17671	G002	Micro-Tronics	2025-02-11	2026-02-11
007-034	Broadband RF Power Amplifier 0.5-40.0GHz	DEPA0540-43	2024A02	Diamond Engineering	2025-02-11	2026-02-11
189-000	Double Horn Ridged antenna 10GHz-40GHz	3116C	227716	ETS-Lindgren	2024-05-29	2026-05-29
057-000	Double ridged horn antenna (1GHz to 18GHz)	ETS-Lindgren-3117	167062	ETS-Lindgren	2024-07-23	2026-07-23
006-061	Bi-Log Periodic antenna	CBL6143A	61382	Teseq	2024-11-13	2026-11-13
006-068	RF Switch DC-40GHz	LPM17671	G002	Mini-Circuits	2025-02-11	2026-02-11
261-000	RF Amplifier Used for 1 GHz-11GHz	ETS-Lindgren-3117-PA	00157993	ETS-Lindgren	2025-02-11	2026-02-11
009-007	Filter HPF 11GHz	Mini-Circuits-ZHSS-k11G+	84931831830	Mini-Circuits	2025-02-11	2026-02-11
006-051	RF Cable 1.0m	CBL-1.5M-SMSM+	202879	Mini-Circuits	2025-03-12	2026-03-12
006-066	Cable 7m – 25MHz to 40GHz	R286304174	20.46.370	Radiall	2025-02-10	2026-02-10
006-063	Cable 30cm – 1GHz to 40GHz	PE371-12	-	Pasternack	2025-02-10	2026-02-10
006-064	Cable 30cm – 1GHz to 40GHz	PE371-12	-	Pasternack	2025-02-10	2026-02-10
006-065	Cable 60cm – 25MHz to 1GHz	PE300-24	-	Pasternack	2025-02-10	2026-02-10

N/A: Not Applicable

Radiated Setup #2

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
007-000	Anechoic chamber	RFD-FA-100	5996	ETS Lindgren	2024-01-18	2026-01-18
138-000	Spectrum Analyzer	FSV40**	101556	Rohde & Schwarz	2024-02-27	2026-02-27
137-000	Spectrum Analyzer	FSW67*	103266	Rohde & Schwarz	2025-02-11	2027-02-11
007-007	Double Ridge Horn Antenna (1- 18GHz)	3117	00152266	ETS Lindgren	2024-03-26	2026-03-26
059-000	Double-ridged horn antenna + PA (1 GHz to 18 GHz)	3117-PA	201542	ETS-Lindgren	2023-09-26	2025-09-26
026-008	Low noise amplifier 1-18GHz	LA1018N3209	J10100000407	A-INFO	2025-02-19	2026-02-19
007-004	Switch & Positioner	EMCenter	00162359	ETS Lindgren	N/A	N/A
007-006	EMControl & EMSwitch	EMCenter	00151232	ETS Lindgren	N/A	N/A
007-036	SMA-SMA 6.5m Cable	140-8500-11-51-001	001	Atem	2025-03-12	2026-03-12
007-005	Measurement SW, v11.30.00	EMC32	100401	Rohde & Schwarz	N/A	N/A
007-001	Styrofoam Column, 151mm	-	-	-	N/A	N/A
007-002	Turntable	-	-	ETS Lindgren	N/A	N/A
007-003	Antenna Tower	2171B-3.0M	00150123	ETS Lindgren	N/A	N/A
007-015	N-SMA 1.5m Cable	-	-	Spirent	2025-02-19	2026-02-19
007-018	SMA-SMA 1.2m Cable	0500990991200KE	-	Radiall	2025-02-19	2026-02-19
007-022	N-SMA 1.5m Cable	0501050991500GX	19.23.493	Radiall	2025-02-10	2026-02-10
094-001	Temp & Humidity Logger	RMS-HCD-S	24050487	Rotronic	2024-09-02	2026-09-02

_ N/A: Not Applicable

Shared Radiated Equipment

ID#	Device	Type/Model	Serial #	Manufacturer	Cal. Date	Cal. Due Date
412-000	DRTU Power finder V2.1	-	-	Intel	NA	NA
139-000	Power Sensor	NRP-Z81	104383	Rohde & Schwarz	2025-05-20	2027-05-20
140-000	Power Sensor	NRP-Z81	104382	Rohde & Schwarz	2024-04-04	2026-04-04

A.3 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the table below with a coverage factor of k = 2 to indicate a 95% level of confidence:

Measurement type	Uncertainty	Unit
Occupied Channel Bandwidth	±6.18	%
RF Output Power, conducted	±0.99	dB
Power Spectral Density, conducted	±0.99	dB
Unwanted Emission, conducted	±1.53	dB
Radiated test < 1GHz	±4.03	dB
Radiated test 1GHz –12.75 GHz	±4.01	dB
Temperature	±0.23	ºC
Supply voltages	<±0.01	%
Time	±0.01	%

Annex B. Test Results

The herein test results were performed by:

Test case measurement	Test Personnel
RF output power	T.Gamain
Power spectral density	T.Gamain
Adaptivity (adaptive equipment using modulations other than FHSS)	T.Gamain
Occupied channel bandwidth	T.Gamain
Transmitter unwanted emission in the out-of-band domain	T.Gamain
Transmitter unwanted emissions in the spurious domain	K.RIDA
Receiver spurious emissions	K.RIDA
Receiver blocking	T.Gamain

B.1 Test conditions

ETSI clause	Conditions	ETSI EN 300 328 V2.2.2 Annex E
5.1.2.1	The normal temperature and humidity conditions for tests shall be any convenient combination of temperature and humidity within the following ranges: • Temperature: +15 °C to +35 °C; • Relative humidity: 20 % to 75 %.	**"Information provided by the customer"**
5.1.2.2	The normal test voltage for the equipment shall be the nominal voltage for which the equipment was designed.	
5.1.3	Some tests in the present document need to be repeated at extreme temperatures. Where that is the case, measurements shall be made over the extremes of the operating temperature range as declared by the manufacturer.	

For 802.11b mode the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually, but not simultaneously.

For 802.11n20, 802.11ax/be20 (20 MHz channel bandwidth), 802.11n40, 802.11ax/be40 (40MHz channel bandwidth), modes the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually, and also simultaneously.

The following data rates were selected based on preliminary testing that identified those rates as the worst cases for output power and spurious levels at the band edges:

Transmission	Mode	Bandwidth (MHz)	Worst Case Data Rate
SISO	802.11b	20	1Mbps
	802.11g	20	6Mbps
	802.11n	20	HT0
		40	HT0
	802.11ax/be	20	MCS0
		40	MCS0
MIMO	802.11n	20/40	HT8
	802.11ax/be	20/40	MCS0

B.2 RF output power

Test limits

ETSI clause	Limits
4.3.2.2.3	The RF output power for non-FHSS equipment shall be equal to or less than 20 dBm e.i.r.p. This limit shall apply for any combination of power level and intended antenna assembly.

Test conditions

ETSI clause	Conditions
5.4.2.1	The measurements for RF output power shall be performed at both normal environmental conditions and at the extremes of the operating temperature range. For equipment using wide band modulations other than FHSS, the measurement shall be performed at the lowest, the middle, and the highest channel on which the equipment can operate.

Test procedure

The conducted setups shown in section *Test & System Description* were used to measure the RF output power. The antenna terminal of the EUT is connected to the OSP120 through a 10dB attenuator and a cable. System connection cable loss is compensated by the EMC32 software

Antenna gain is taken into account and added by the software to the measurements. The E.I.R.P. power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

For MIMO modes accordingly to the test procedure described in ETSI EN 300 328 V2.2.2 §5.4.2.2.1.2, the measurement is done synchronously on all transmit ports, the power of the individual samples is sumed for all ports and then the reported power is the highest calculated RMS power for the active bursts.

Results tables

RF Output Power						Normal condition Ambient Temperature +23ºC		Extreme condition High Temperature +50ºC		Extreme condition Low Temperature -10ºC	
Mode	Meas Duty Cycle %	Rate	#Ch	Freq [MHz]	Chain	Measured Conducted [dBm]	EIRP [dBm]	Measured Conducted [dBm]	EIRP [dBm]	Measured Conducted [dBm]	EIRP [dBm]
802.11b	99.4	1Mbps	1	2412	A	16.1	19.1	16.1	19.1	16.1	19.4
					B	16.1	19.1	16.3	19.3	16.4	19.4
			7	2442	A	16.0	19.0	16.1	19.1	16.1	19.4
					B	15.9	18.9	16.1	19.1	16.3	19.3
			13	2472	A	16.0	19.0	16.2	19.2	16.2	19.4
					B	15.9	18.9	16.5	19.5	16.3	19.3
802.11g	97.8	6Mbps	1	2412	A	16.9	19.9	16.3	19.3	16.3	19.4
					B	16.9	19.9	16.1	19.1	16.5	19.5
			7	2442	A	16.9	19.9	16.3	19.3	16.3	19.4
					B	16.9	19.9	16.2	19.2	16.1	19.1
			13	2472	A	16.9	19.9	16.5	19.5	16.5	19.4
					B	16.9	19.9	16.3	19.3	16.6	19.6
802.11n20	98.8	HT0	1	2412	A	16.9	19.9	16.3	19.3	16.3	19.4
					B	16.9	19.9	16.3	19.3	17.5	19.4
			7	2442	A	16.9	19.9	16.3	19.3	16.3	19.4
					B	16.9	19.9	16.1	19.1	16.2	19.2
			13	2472	A	16.9	19.9	16.3	19.3	16.3	19.4
					B	16.9	19.9	16.5	19.5	16.6	19.6
	98.8	HT8	1	2412	A+B	16.9	19.9	16.8	19.8	16.8	19.4
			7	2442	A+B	16.9	19.9	16.8	19.8	16.8	19.4
			13	2472	A+B	16.9	19.9	16.9	19.9	16.9	19.4
802.11n40	98.8	HT0	3	2422	A	16.9	19.9	16.2	19.2	16.2	19.4
					B	16.9	19.9	16.5	19.5	16.5	19.5
			7	2442	A	16.9	19.9	16.5	19.5	16.5	19.4
					B	16.9	19.9	16.6	19.6	16.6	19.6
			11	2462	A	16.9	19.9	16.2	19.2	16.2	19.4
					B	16.9	19.9	16.6	19.6	16.3	19.3
	98.8	HT8	3	2422	A+B	16.9	19.9	16.9	19.9	16.9	19.4
			7	2442	A+B	16.9	19.9	16.9	19.9	16.9	19.4
			11	2462	A+B	16.9	19.9	16.9	19.9	16.9	19.4
802.11ax/be20	98.8	MCS0	1	2412	A	16.9	19.9	16.1	19.1	16.1	19.4
					B	16.9	19.9	16.1	19.1	16.5	19.5
			7	2442	A	16.9	19.9	16.1	19.1	16.1	19.4
					B	16.9	19.9	16.6	19.6	16.3	19.3
			13	2472	A	16.9	19.9	16.4	19.4	16.4	19.4
					B	16.9	19.9	16.6	19.6	16.3	19.3
	99.4	MCS0	1	2412	A+B	16.9	19.9	16.8	19.8	16.8	19.4
			7	2442	A+B	16.8	19.8	16.8	19.8	16.8	19.4
			13	2472	A+B	16.9	19.9	16.9	19.9	16.9	19.4
802.11ax/be40	98.8	MCS0	3	2422	A	16.9	19.9	16.1	19.1	16.1	19.4
					B	16.9	19.9	16.5	19.5	16.3	19.3
			7	2442	A	16.9	19.9	16.2	19.2	16.2	19.4
					B	16.9	19.9	16.5	19.5	16.5	19.5
			11	2462	A	16.9	19.9	16.1	19.1	16.1	19.4
					B	16.9	19.9	16.6	19.6	16.4	19.4
	99.4	MCS0	3	2422	A+B	16.9	19.9	16.9	19.9	16.9	19.4
			7	2442	A+B	16.9	19.9	16.9	19.9	16.9	19.4
			11	2462	A+B	16.9	19.9	16.9	19.9	16.9	19.4

B.3 Power Spectral Density

Test limits

ETSI clause	Limits
4.3.2.3.3	The maximum Power Spectral Density for non-FHSS equipment is 10 dBm per MHz.

Test conditions

ETSI clause	Conditions
5.4.3.1	These measurements shall only be performed at normal test conditions. The measurement shall be repeated for the equipment being configured to operate at the lowest, the middle, and the highest frequency of the stated frequency range. For the duration of the test, the equipment shall not change its operating frequency.

Test procedure

The conducted setups shown in section *Test & System Description* were used to measure the power spectral density (PSD). The antenna terminal of the EUT is connected to the OSP120 through a 10dB attenuator and a cable, the spectrum analyzer is connected to the receiver port on the OSP. System connection cable loss is compensated by the EMC32 software to measure all parameters.

Antenna gain is taken into account and added by the software to the measurements. The E.I.R.P. power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

For MIMO modes, accordingly to the test procedure described in ETSI EN 300 328 V2.2.2 §5.4.3.2.1, the measurement is done separately on each transmit ports and the power of the individual samples per frequency is sum for all ports. From all the recorded results, the highest value is the maximum Power Spectral Density.

Results tables

Mode	Meas. Duty Cycle %	Rate	Ch Number	Frequency [MHz]	Chain	PSD [dBm/MHz]
802.11b	99.4	1Mbps	1	2412	A	9.96
					B	9.95
			7	2442	A	9.92
					B	9.81
			13	2472	A	9.90
					B	9.86
802.11g	97.8	6Mbps	1	2412	A	8.24
					B	8.38
			7	2442	A	8.52
					B	8.54
			13	2472	A	8.18
					B	8.20
802.11n20	98.8	HT0	1	2412	A	8.03
					B	8.07
			7	2442	A	8.34
					B	8.23
			13	2472	A	7.90
					B	7.86
	98.8	HT8	1	2412	A+B	7.93
			7	2442	A+B	8.19
			13	2472	A+B	7.80
802.11n40	98.8	HT0	3	2422	A	5.03
					B	5.19
			7	2442	A	4.98
					B	5.18
			11	2462	A	4.86
					B	5.01
	98.8	HT8	3	2422	A+B	4.94
			7	2442	A+B	5.02
			11	2462	A+B	4.84
802.11ax/be20	98.8	MCS0	1	2412	A	7.45
					B	7.60
			7	2442	A	7.86
					B	7.86
			13	2472	A	7.45
					B	7.50
	99.4	MCS0	1	2412	A+B	7.50
			7	2442	A+B	7.81
			13	2472	A+B	7.33
802.11ax/be40	98.8	MCS0	3	2422	A	4.59
					B	4.60
			7	2442	A	4.65
					B	4.85
			11	2462	A	4.41
					B	4.54
	99.4	MCS0	3	2422	A+B	4.52
			7	2442	A+B	4.70
			11	2462	A+B	4.40

B.4 Adaptivity (adaptive equipment using modulations other than FHSS)

Test limits

ETSI clause	Limits
4.3.2.6.3.2.3	*Load Based Equipment* Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect as described in IEEE 802.11™-2012 [i.3], clause 9, clause 10, clause 16, clause 17, clause 19 and clause 20, or in IEEE 802.15.4™-2011 [i.4], clause 4, clause 5 and clause 8 providing the equipment complies with the conformance requirements referred to in clause 4.3.2.6.3.4. Load Based Equipment not using any of the mechanisms referenced above shall comply with the following minimum set of requirements: 1) Before a transmission or a burst of transmissions, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately. 2) If the equipment finds the channel occupied, it shall not transmit on this channel (see also the next paragraph). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 µs and at least 160 µs. If the extended CCA check has determined the channel to be no longer occupied, the equipment may resume transmissions on this channel. If the Extended CCA time has determined the channel still to be occupied, it shall perform new Extended CCA checks until the channel is no longer occupied. NOTE: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check as there are no transmissions during this period. The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4. 3) The total time that an equipment makes use of a RF channel is defined as the Channel Occupancy Time. This Channel Occupancy Time shall be less than 13 ms, after which the device shall perform a new CCA as described in step 1 above. 4) The equipment, upon correct reception of a packet which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). A consecutive sequence of transmissions by the equipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3 above. For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence. 5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the CCA threshold level may be relaxed to: TL = -70 dBm/MHz + 10 × log10 (100 mW / Pout) (Pout in mW e.i.r.p.) 6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in table 11.

4.3.2.6.4.2	**Table11: Unwanted Signal parameters** Wanted signal mean power from companion device: sufficient to maintain the link (see note 2) Unwanted signal frequency (MHz): 2 395 or 2 488,5 (see note 1) Unwanted signal power (dBm): -35 (see note 3) NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna. If implemented, Short Control Signalling Transmissions of adaptive non-FHSS equipment shall have a maximum TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms.

Test conditions

ETSI clause	Conditions
5.4.6.1	These measurements shall only be performed at normal test conditions.

Test procedure

The adaptivity setup shown in section *Test & System Description* was used to measure adaptivity. The EUT (client) is connected to an access point through a power splitter and an attenuator. Proprietary software was used on the EUT to configure a normal transmission with sufficient payload.

Interference and unwanted signals are emulated by using a modulated signal and a continuous wave (CW) respectively, generated by the vector signal generator (VSG) and the continuous wave generator.

The power levels for the signals at the input of the receiver are as follows:

- EUT = max power level
- Companion device= -30dBm/MHz
- Interference signal = ***TL + Antenna gain - Margin*** = -72dBm/MHz
- Unwanted signal (CW) = **cwPower + Antenna gain - Margin** = -37dBm
  TL = -70 dBm/MHz, limit of the ED Threshold Level assuming 0dBi antenna gain
  cwPower = -35dBm, assuming 0dBi antenna gain
  Antenna gain = Antenna gain declared by the applicant (3dBi)
  Margin = Additional margin requested by the applicant (5dB)

The frequency used for the interference signal is the same as the transmission frequency of the tested channel. The unwanted signal is fixed at 2488.5 MHz for the lowest channel tested and at 2395 MHz for the highest channel tested.

Results tables

802.11b Channel 1 – 2412 MHz, 1Mbps

Normal Operation

DutyCycle DUT (%)	Monitoring Length (ms)	COT Max (ms)	Limit Max (ms)	COT Min (ms)	Number of COTs	CCA Time Min (ms)	CCA Time Max (ms)	CCA Time Limit Min (ms)
84.194	10000.000	12.801	13.000	0.946	785	0.042	12.478	0.018

Reaction on Interferer and Blocker

DC* in max DC Evaluation Window (%)	Limit Max (%)	Result	Length of max DC Evaluation Window (ms)	Start of max DC Evaluation Window (ms)
0.610	10.000	PASS	50.000	60127.820

Stop of max DC Evaluation Window (ms)	Interferer On (ms)	Blocker On (ms)	Monitoring Offset (ms)	Monitoring Start (ms)	Monitoring Length (ms)
0.610	1000.000	62000.000	13.000	1013.000	121987.000

*Note: the DC is TxOn / (TxOn + TxOff) ratio of short control signaling transmissions.

802.11b Channel 11 – 2462 MHz, 1Mbps

Normal Operation

DutyCycle DUT (%)	Monitoring Length (ms)	COT Max (ms)	Limit Max (ms)	COT Min (ms)	Number of COTs	CCA Time Min (ms)	CCA Time Max (ms)	CCA Time Limit Min (ms)
83.078	10000.000	12.801	13.000	0.867	790	0.043	12.268	0.018

Reaction on Interferer and Blocker

DC in max DC Evaluation Window (%)	Limit Max (%)	Result	Length of max DC Evaluation Window (ms)	Start of max DC Evaluation Window (ms)
0.866	10.000	PASS	50.000	69393.908

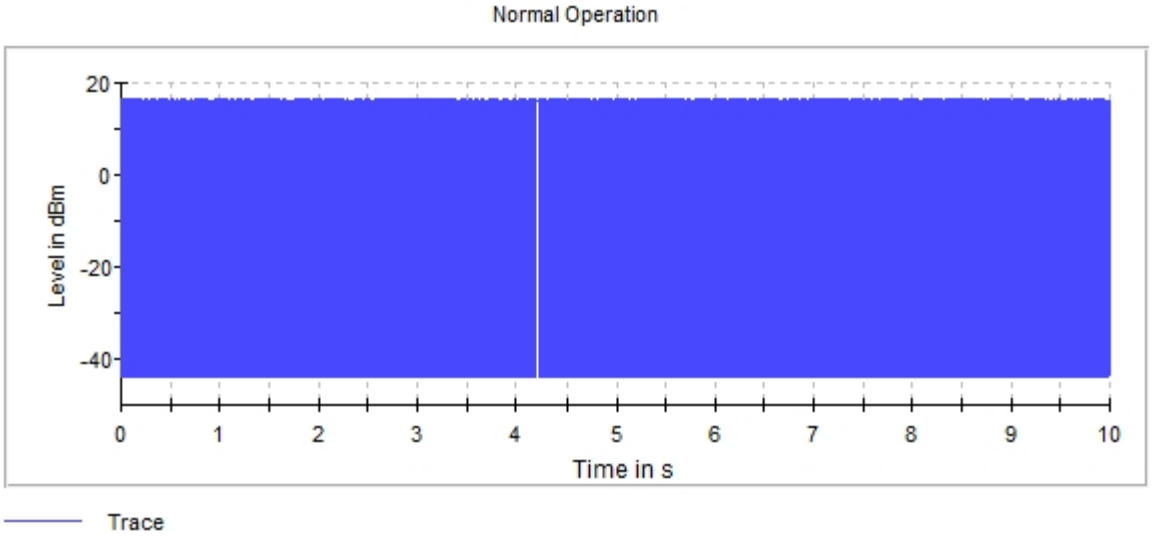
Stop of max DC Evaluation Window (ms)	Interferer On (ms)	Blocker On (ms)	Monitoring Offset (ms)	Monitoring Start (ms)	Monitoring Length (ms)
69443.908	1000.000	62000.000	13.000	1013.000	121987.000

*Note: the DC is TxOn / (TxOn + TxOff) ratio of short control signaling transmissions.

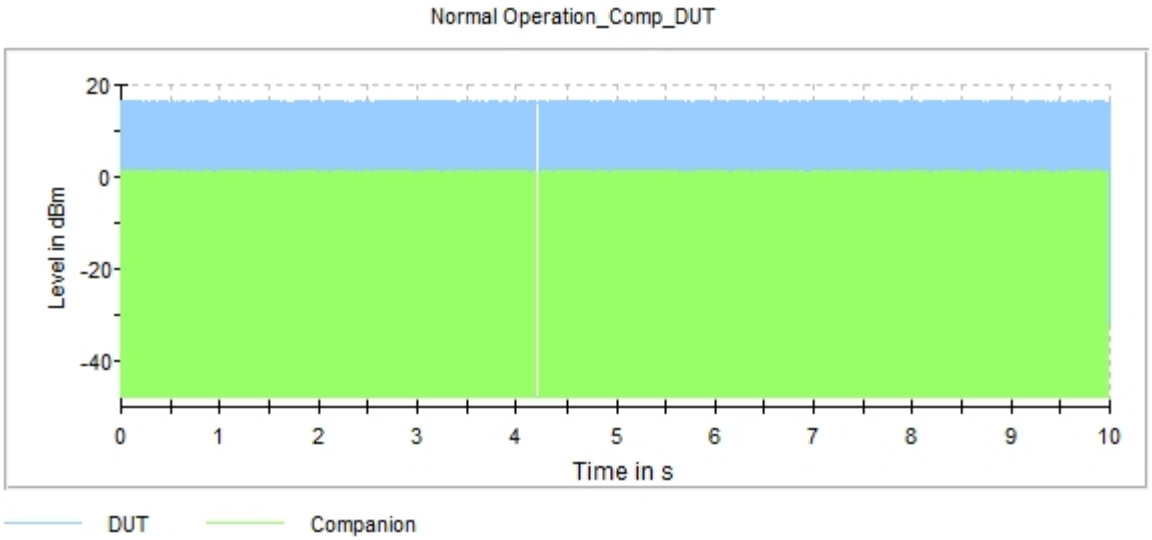
Results Screenshot

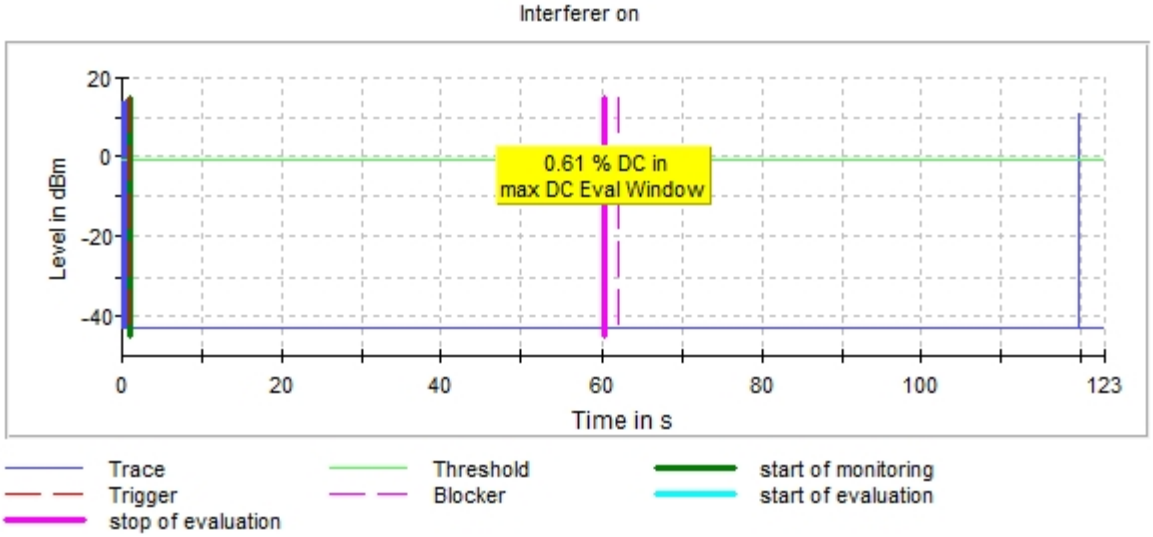
802.11b Channel 1 – 2412 MHz, 1Mbps

Normal Operation



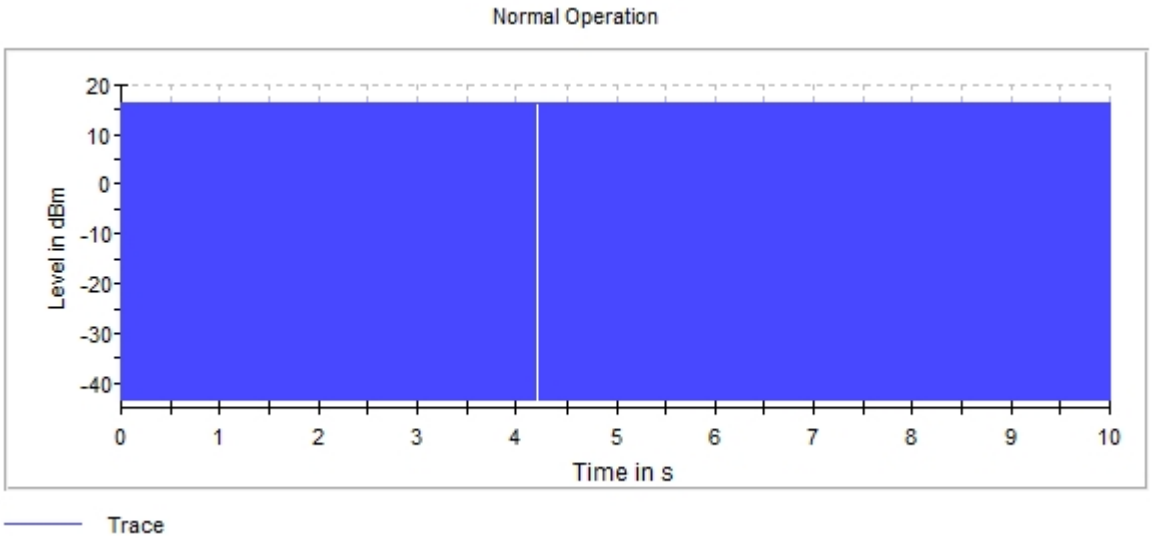
Reaction on Interferer and Blocker



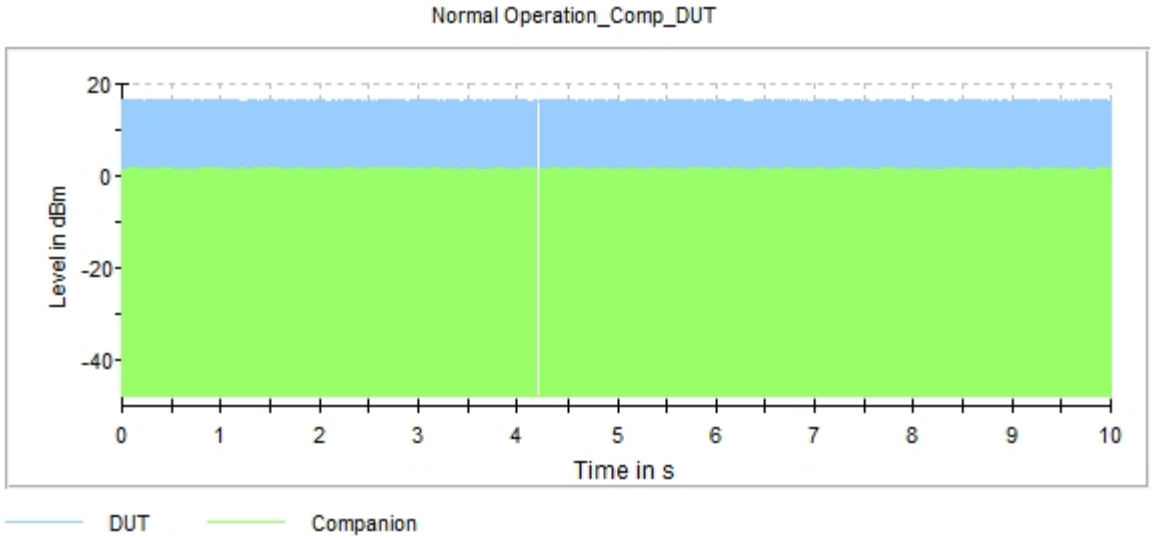


802.11b Channel 11 – 2462 MHz, 1Mbps

Normal Operation



Reaction on Interferer and Blocker



B.5 Occupied Channel Bandwidth

Tests limits

<table>
<tr><th>ETSI clause</th><th>Limits</th></tr>
<tr><td>4.3.2.7.3</td><td>The Occupied Channel Bandwidth shall fall completely within the band given in Table 1 (2.4 GHz to 2.4835 GHz).
Table 1: Service frequency bands
<table>
<tr><th></th><th>Service frequency bands</th></tr>
<tr><td>Transmit</td><td>2 400 MHz to 2 483,5 MHz</td></tr>
<tr><td>Receive</td><td>2 400 MHz to 2 483,5 MHz</td></tr>
</table>
In addition, for non-adaptive equipment using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.</td></tr>
</table>

Test conditions

ETSI clause	Conditions
5.4.7.1	These measurements shall only be performed at normal test conditions. In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains) measurements need only to be performed on one of the active transmit chains (antenna outputs). The measurement shall be performed only on the lowest and the highest frequency within the stated frequency range. If the equipment can operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz), then each channel bandwidth shall be tested separately.

Test procedure

The conducted setups shown in section *Test & System Description* were used to measure the occupied bandwidth accordingly to the test method described in ETSI EN 300 328 V2.2.2 §5.4.7.2.1. The antenna terminal of the EUT is connected to the OSP120 through a 10 dB attenuator and a cable, the spectrum analyzer is connected to the receiver port on the OSP. System connection cable loss is compensated by the EMC32 software on measured parameters.

For MIMO modes, occupied bandwidth measurements are performed on Chain A.

Results tables

Low channel

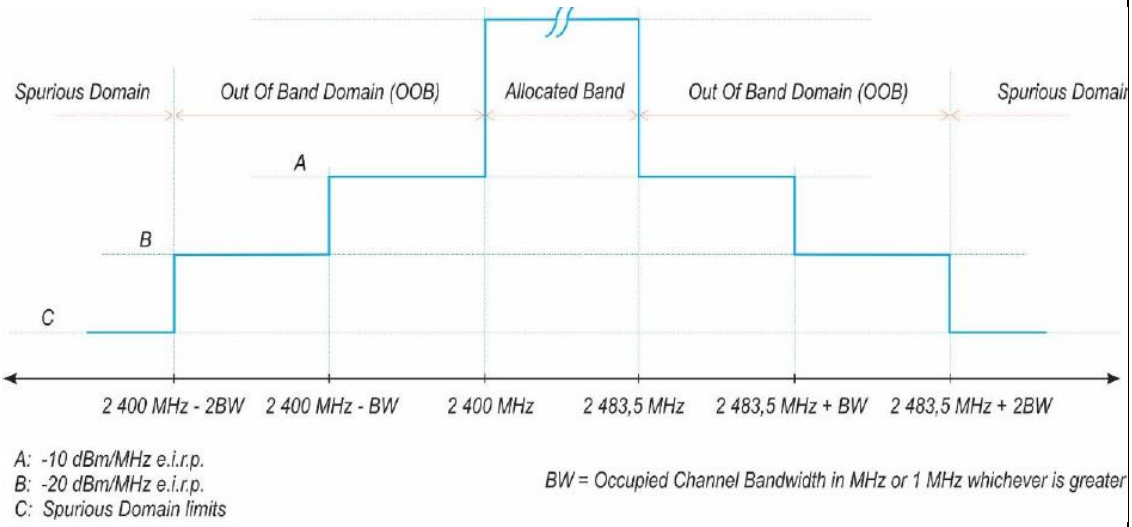
Mode	Rate	#Ch	Freq [MHz]	Chain	99% BW [MHz]
802.11b	1Mbps	1	2412	A	13.50
				B	13.50
802.11g	6Mbps			A	17.00
				B	17.00
802.11n20	HT0			A	18.00
				B	18.00
	HT8			A+B	18.00
802.11n40	HT0	3	2422	A	37.00
				B	37.00
	HT8			A+B	37.00
802.11ax/be20	MCS0	1	2412	A	19.25
				B	19.25
	MCS0			A+B	19.00
802.11ax/be40	MCS0	3	2422	A	38.00
				B	38.00
	MCS0			A+B	38.00

High channel

Mode	Rate	#Ch	Freq [MHz]	Chain	99% BW [MHz]
802.11b	1Mbps	13	2472	A	13.50
				B	13.50
802.11g	6Mbps			A	16.50
				B	16.50
802.11n20	HT0			A	18.00
				B	18.00
	HT8			A+B	18.00
802.11n40	HT0	11	2462	A	37.00
				B	18.00
	HT8			A+B	37.00
802.11ax/be20	MCS0	13	2472	A	19.00
				B	19.00
	MCS0			A+B	19.00
802.11ax/be40	MCS0	11	2462	A	38.00
				B	38.00
	MCS0			A+B	38.00

B.6 Transmitter unwanted emissions in the out-of-band domain

Test limits

ETSI clause	Limits
4.3.2.8.3	The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask below 

Test conditions

ETSI clause	Conditions
5.4.8.1	These measurements shall only be performed at normal test conditions. For non-FHSS equipment, the measurement shall be performed at the lowest and the highest channel on which the equipment can operate. These operating channels shall be recorded. The equipment shall be configured to operate under its worst case situation with respect to output power. If the equipment can operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz), then each channel bandwidth shall be tested separately.

Test procedure

The conducted setups shown in section *Test & System Description* were used to measure the unwanted emissions in the out of band domain accordingly to the test method described in ETSI EN 300 328 V2.2.2 §5.4.8.2.1. The antenna terminal of the EUT is connected to the OSP120 through a 10dB attenuator and a cable, the spectrum analyzer is connected to the receiver port on the OSP. System connection cable loss is compensated by the EMC32 software on measured parameters.

Antenna gain is taken into account and added by the software to the measurements.

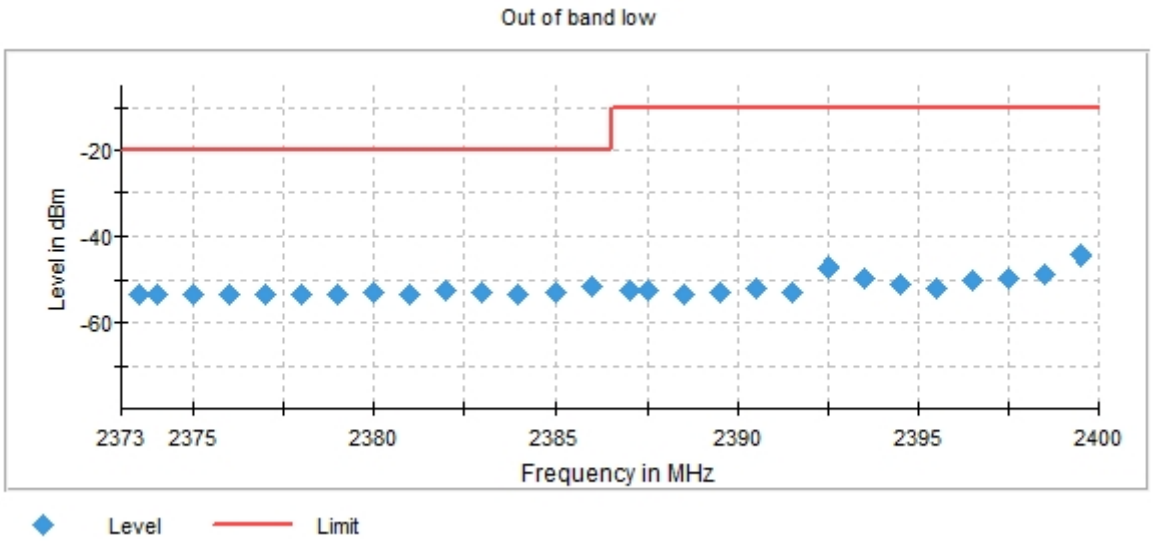
EMC32 provides the mask and the frequency limits based in the measured channel bandwidth. Maximum values for each limit level (-10dBm and -20dBm) are pointed using markers.

For MIMO modes the measurement is done separately on each transmit ports and the power of the individual 1MHz segments is sum for all ports.

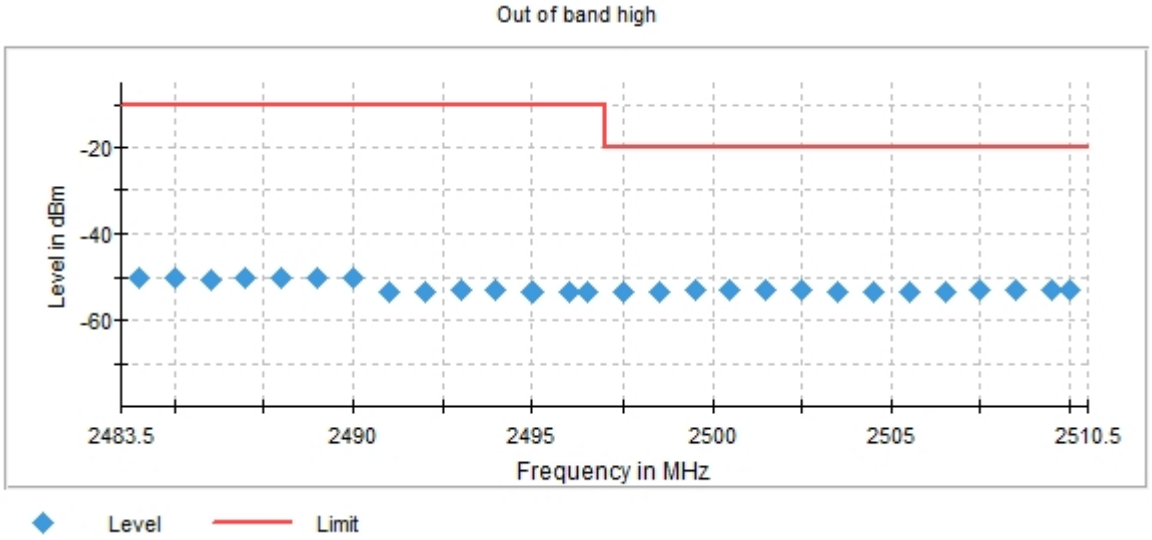
Results Screenshot

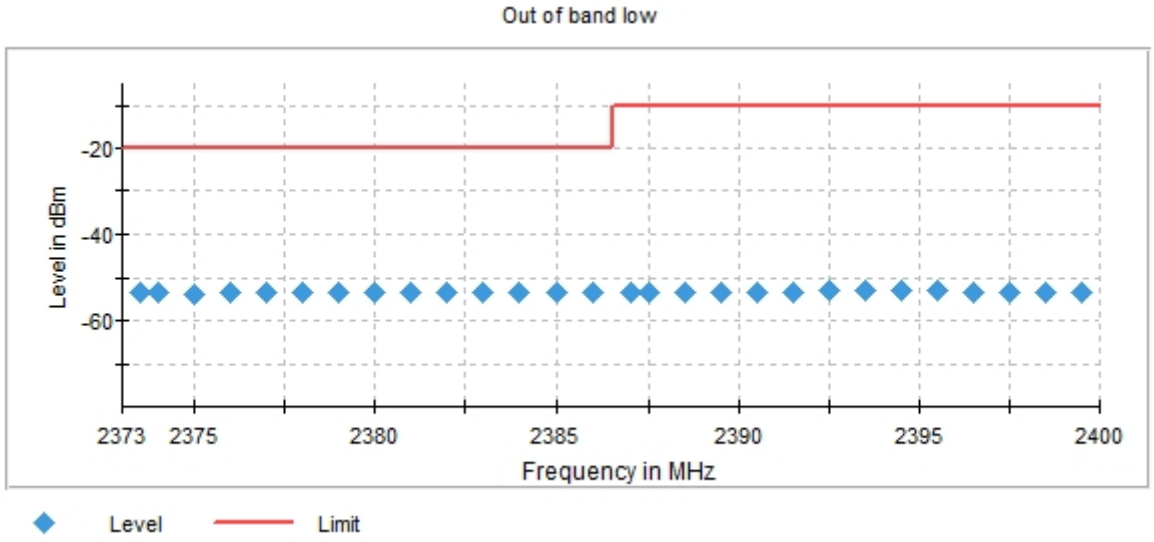
802.11b, 1Mbps – Chain A

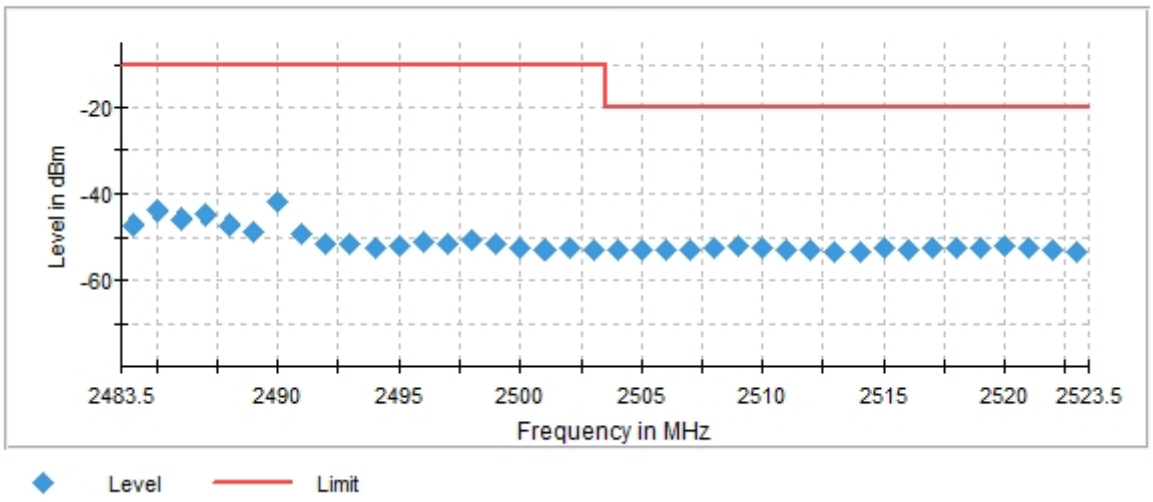
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section, Channel 1

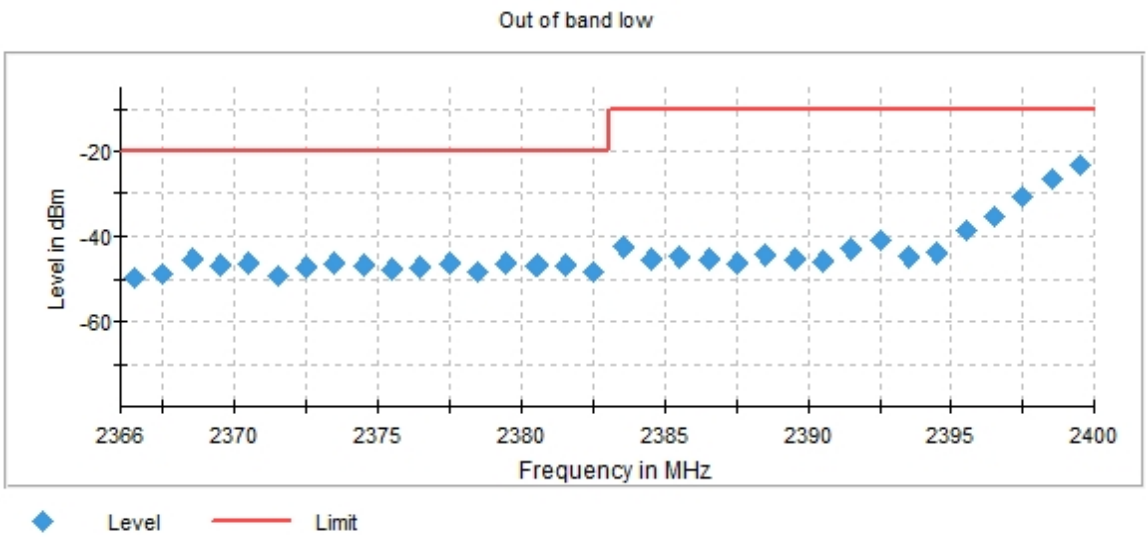


UNWANTED OOB Low Freq Section, Channel 13


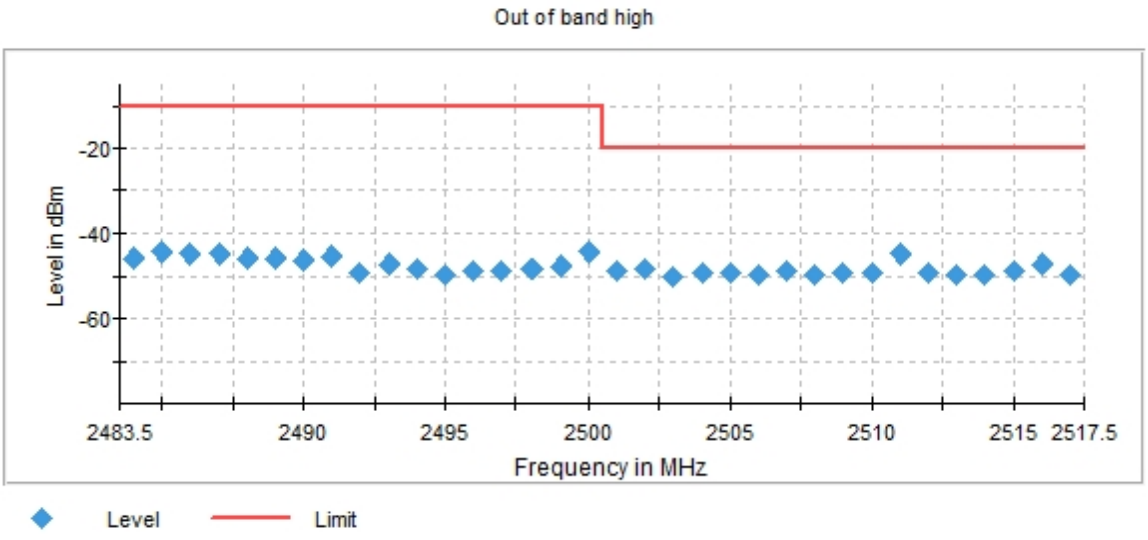
UNWANTED OOB High Freq Section, Channel 13


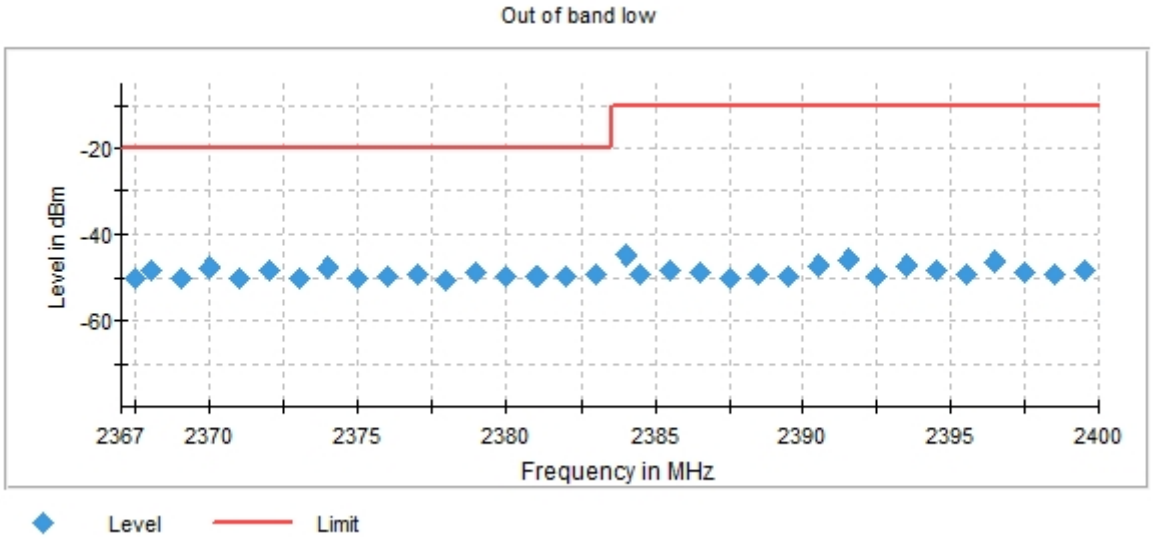
802.11g, 6 Mbps – Chain A

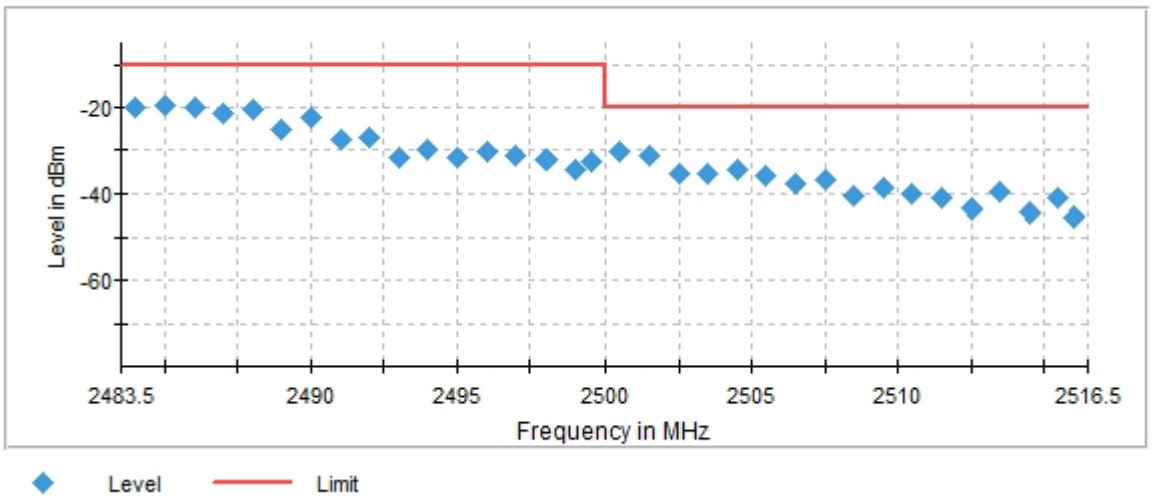
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section, Channel 1

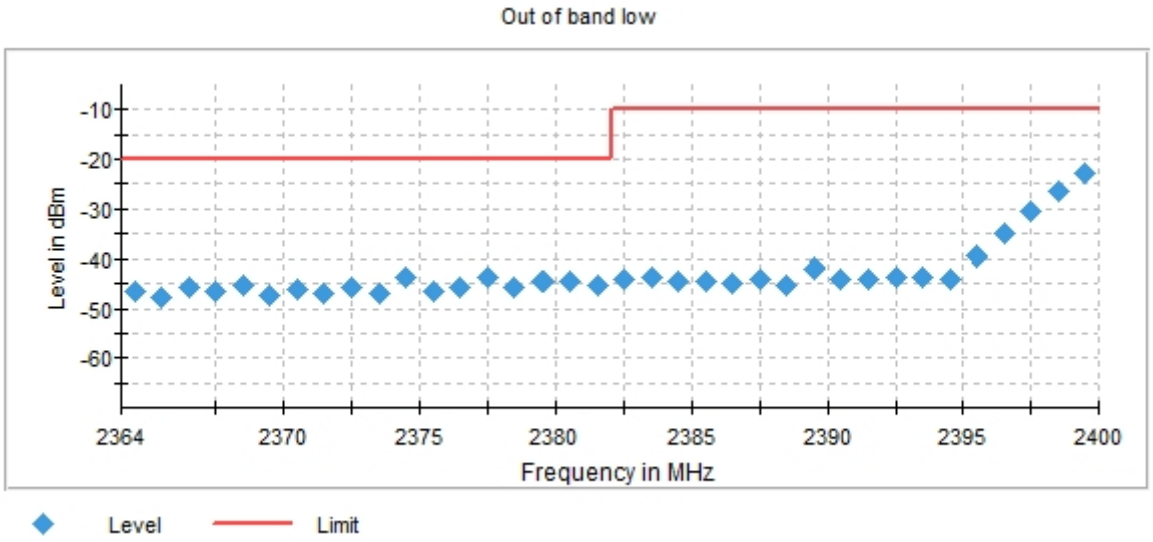


UNWANTED OOB Low Freq Section, Channel 13


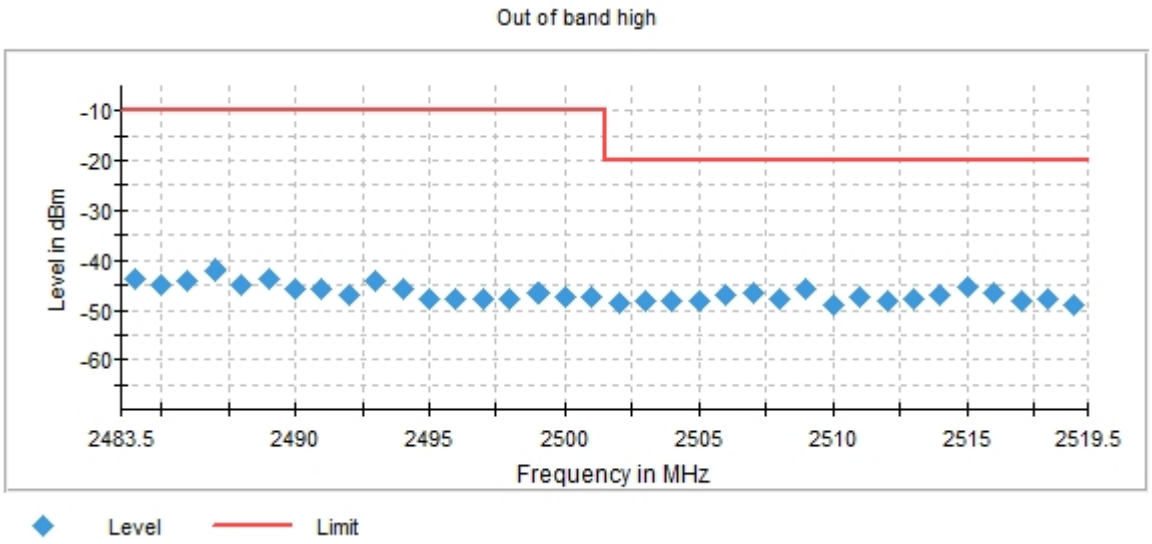
UNWANTED OOB High Freq Section, Channel 13


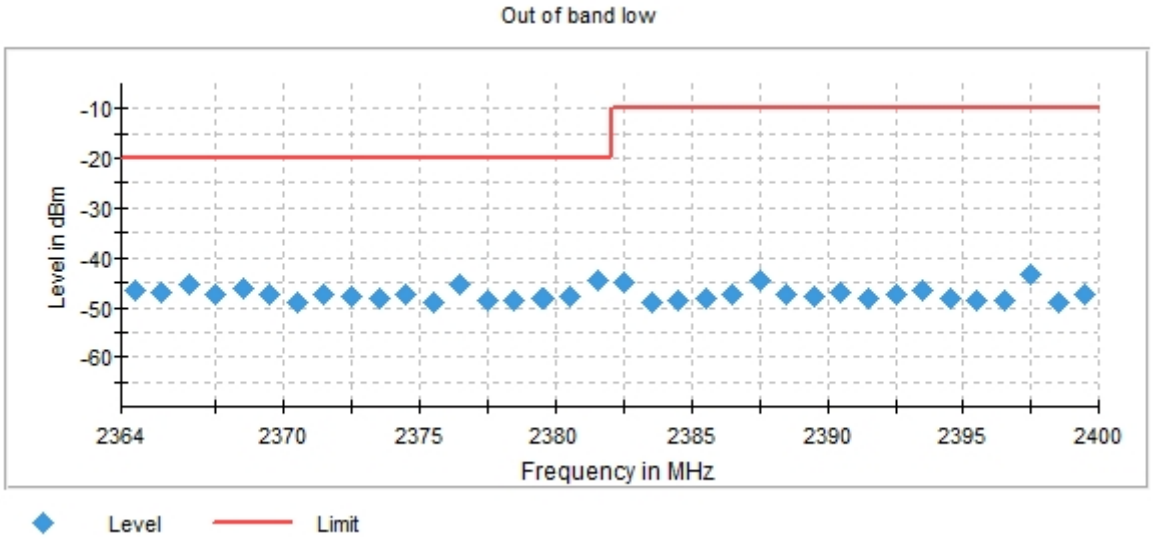
802.11n20, HT0 (SISO) – Chain A

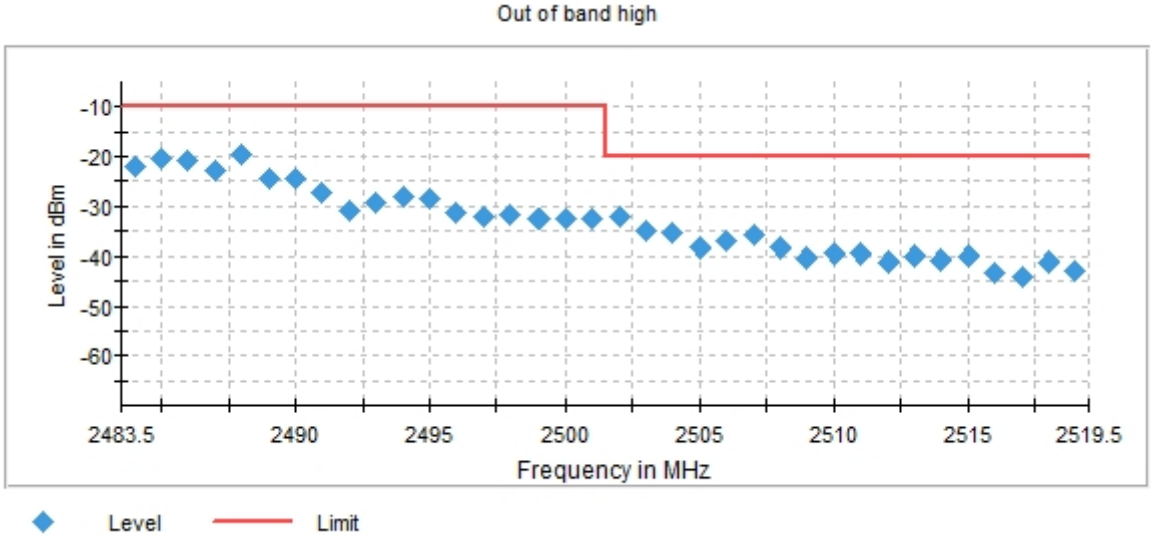
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section, Channel 1

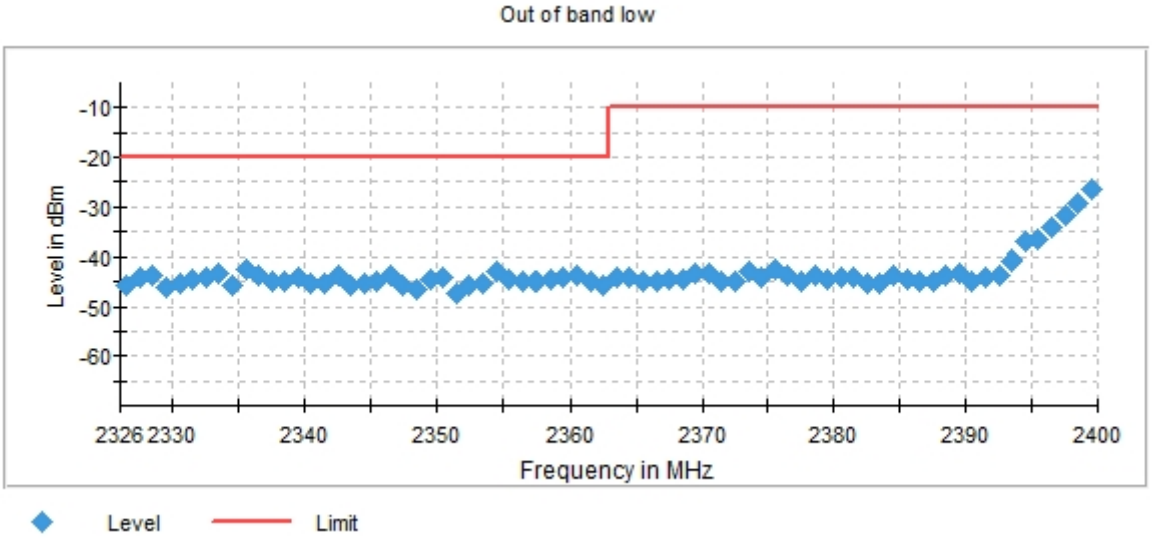


UNWANTED OOB Low Freq Section, Channel 13


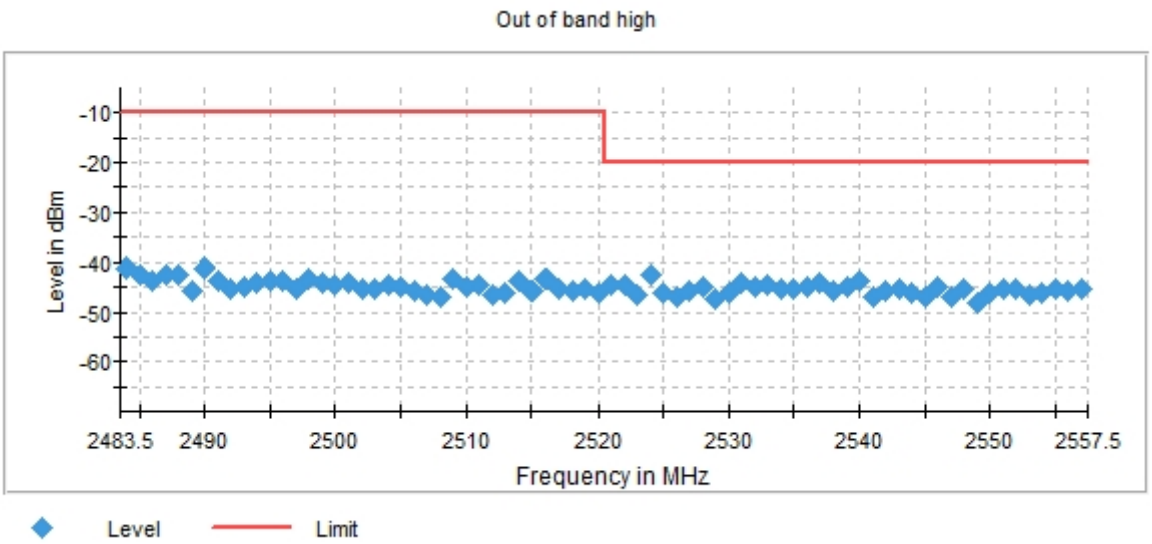
UNWANTED OOB High Freq Section, Channel 13


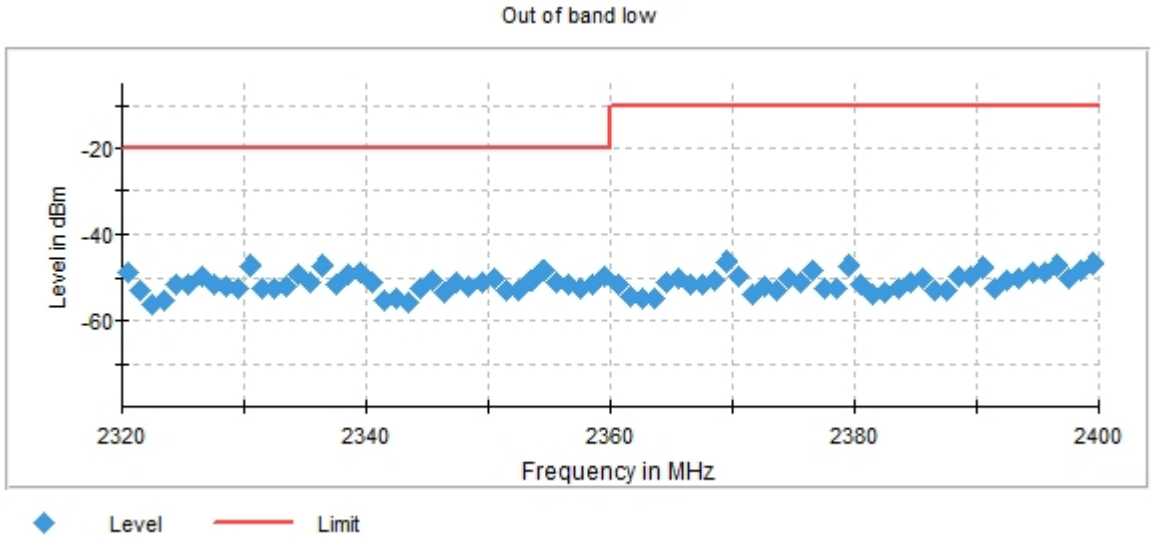
802.11n40, HT0 (SISO) – Chain A

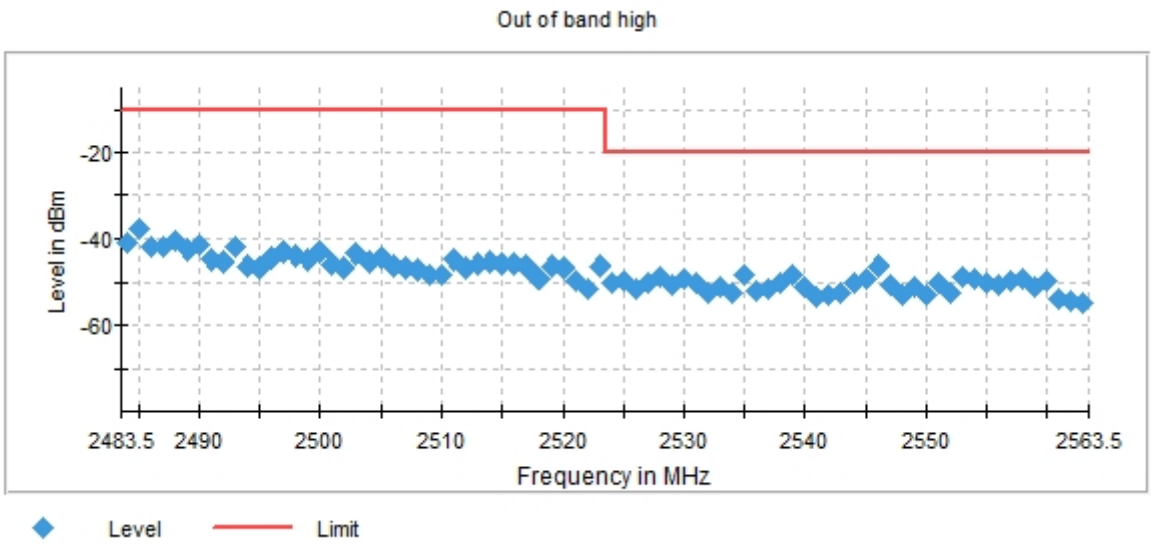
UNWANTED OOB Low Freq Section, Channel 3



UNWANTED OOB High Freq Section, Channel 3

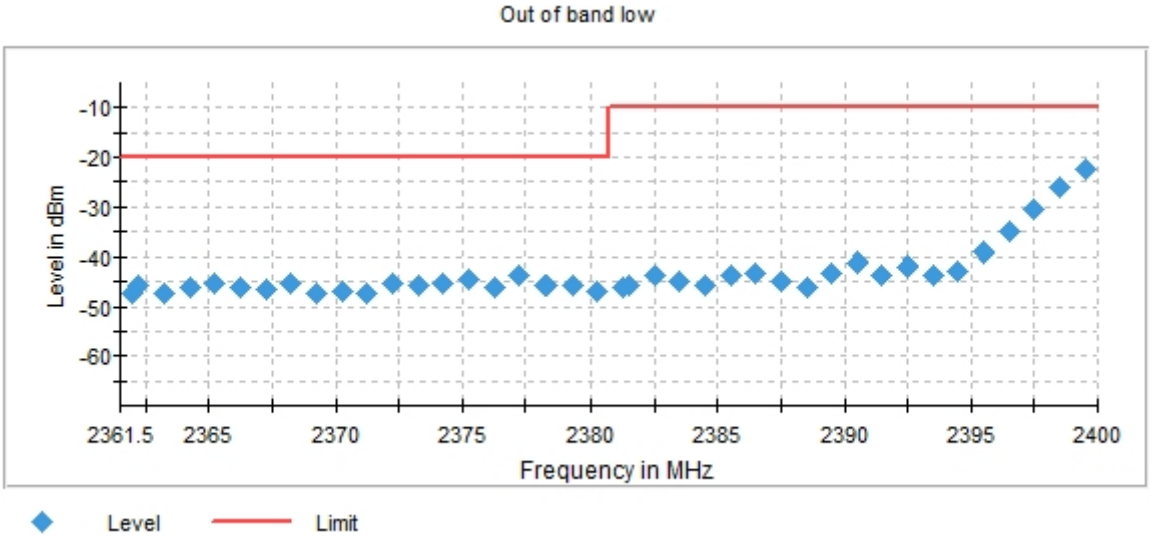


UNWANTED OOB Low Freq Section, Channel 11


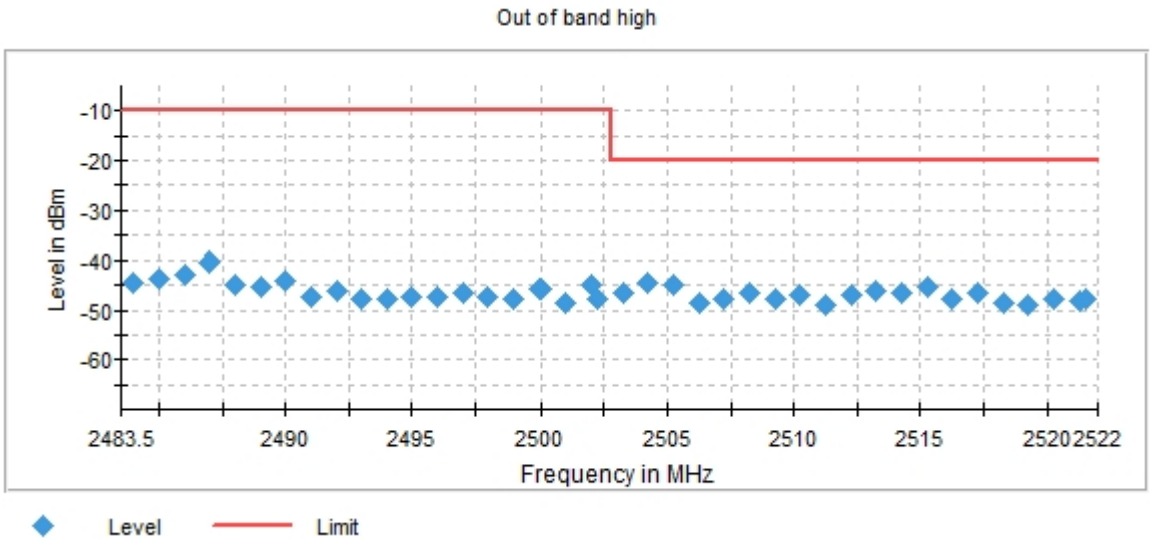
UNWANTED OOB High Freq Section, Channel 11


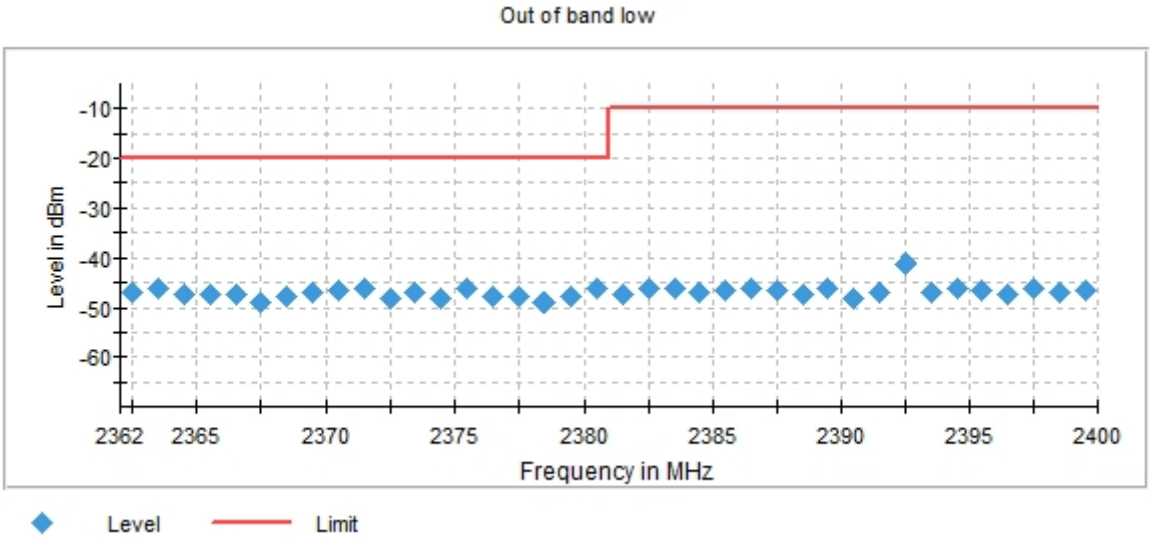
802.11ax20, HE0 (SISO) – Chain A

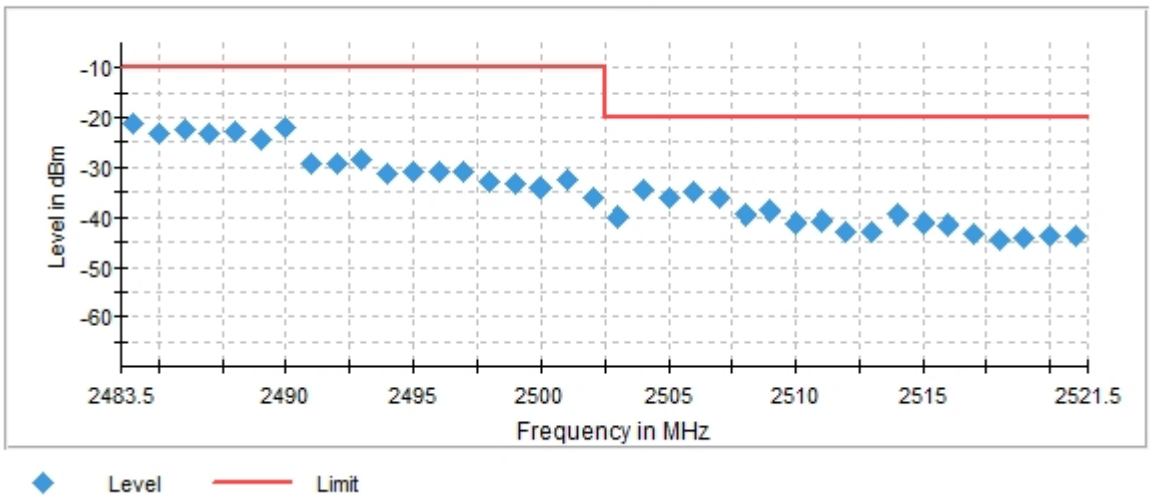
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section, Channel 1

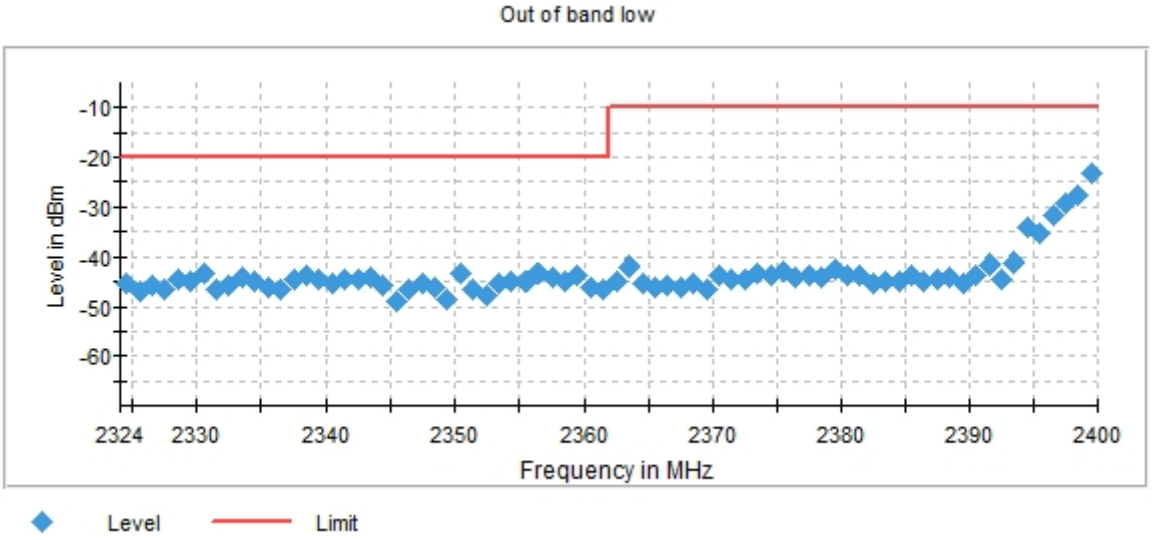


UNWANTED OOB Low Freq Section, Channel 13


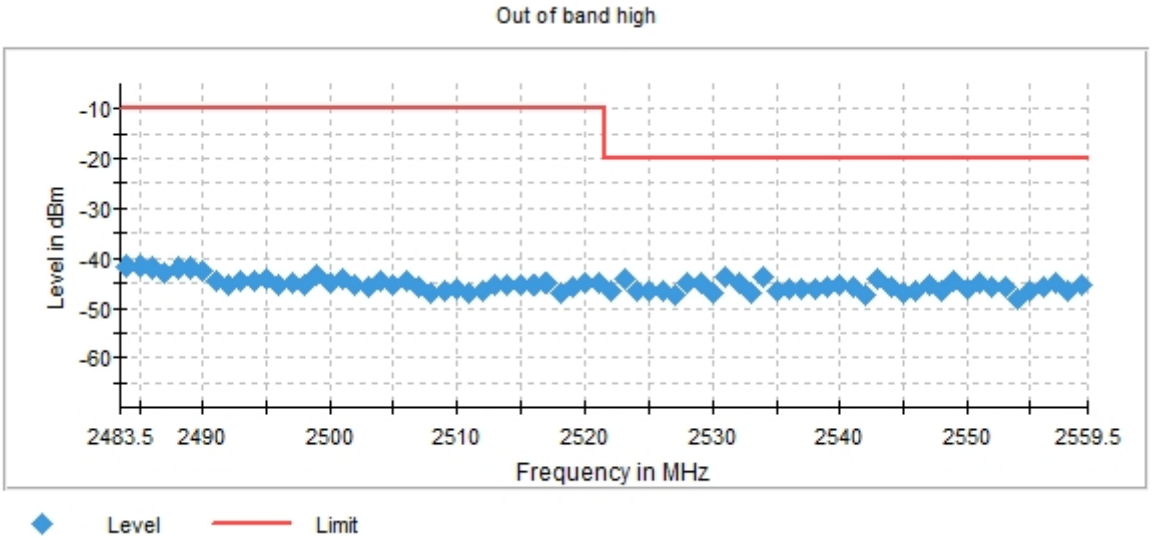
UNWANTED OOB High Freq Section, Channel 13


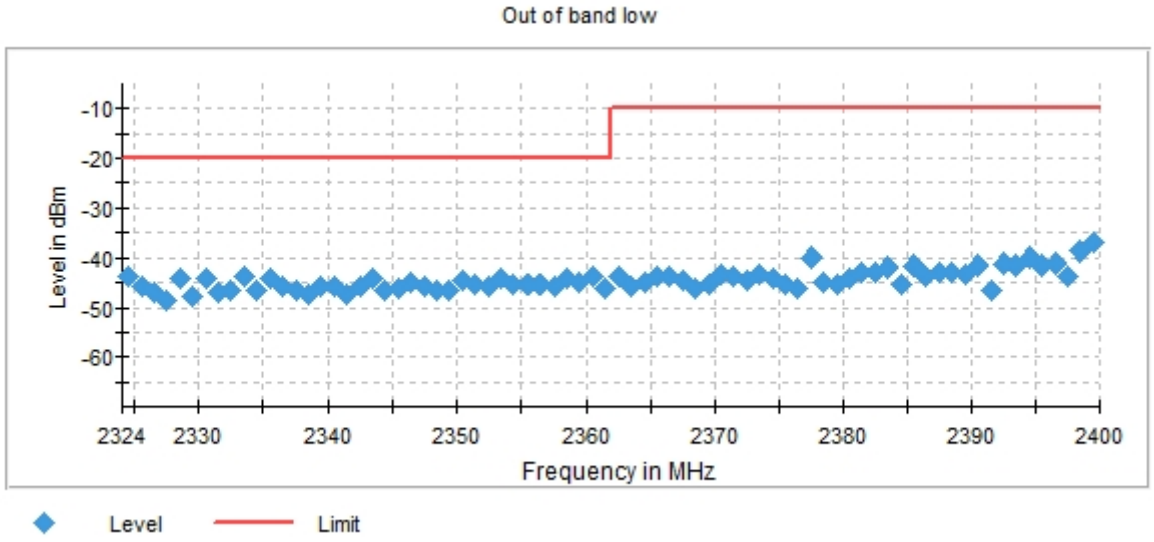
802.11ax40, HE0 (SISO) – Chain A

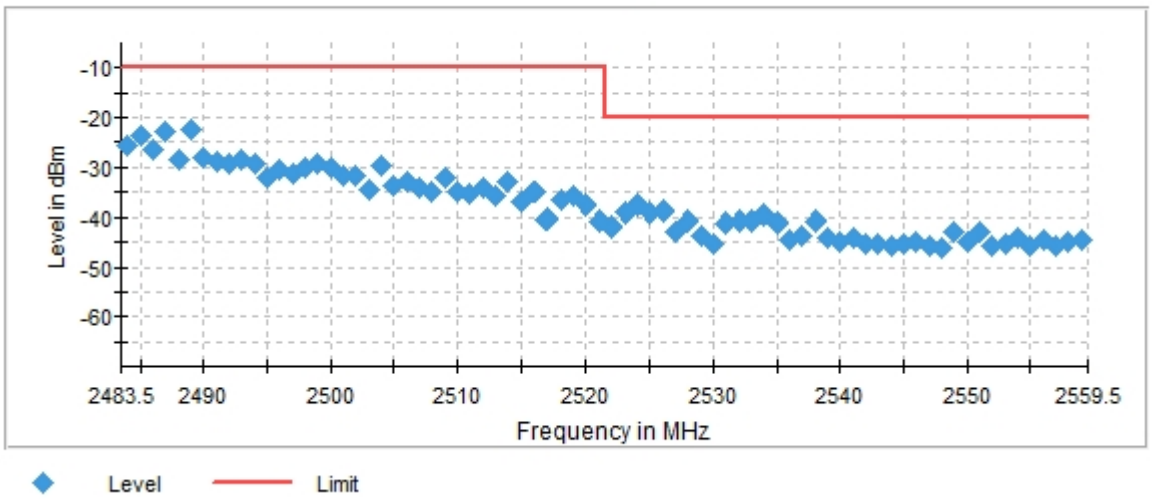
UNWANTED OOB Low Freq Section, Channel 3



UNWANTED OOB High Freq Section, Channel 3

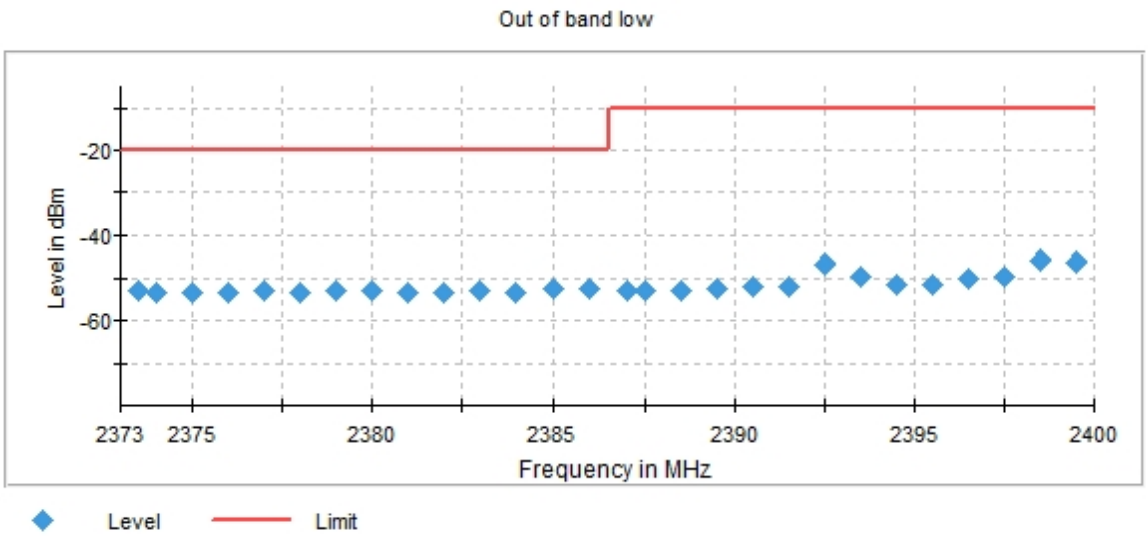


UNWANTED OOB Low Freq Section, Channel 11


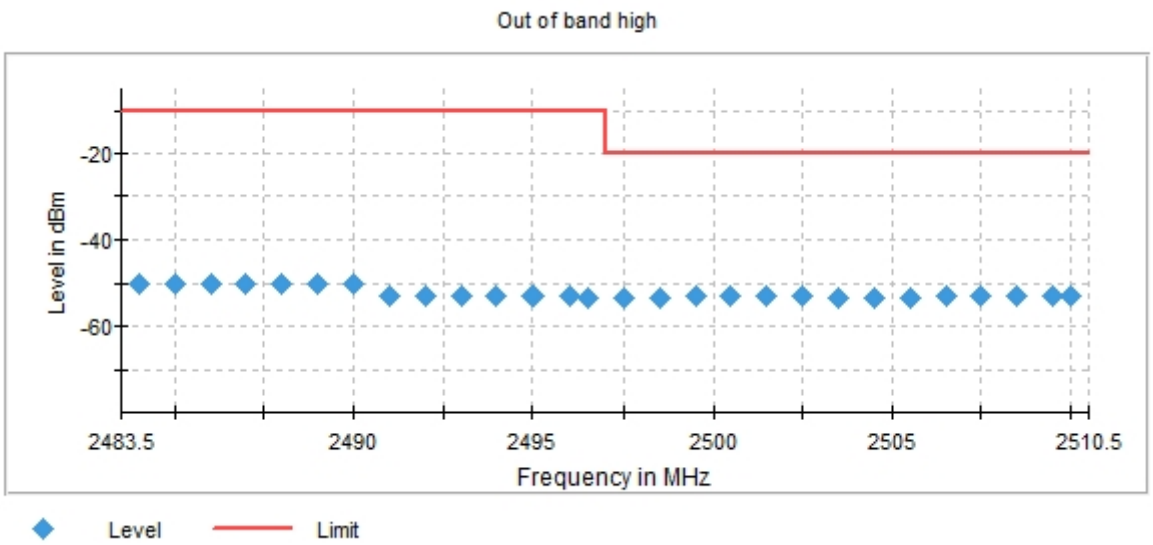
UNWANTED OOB High Freq Section, Channel 11


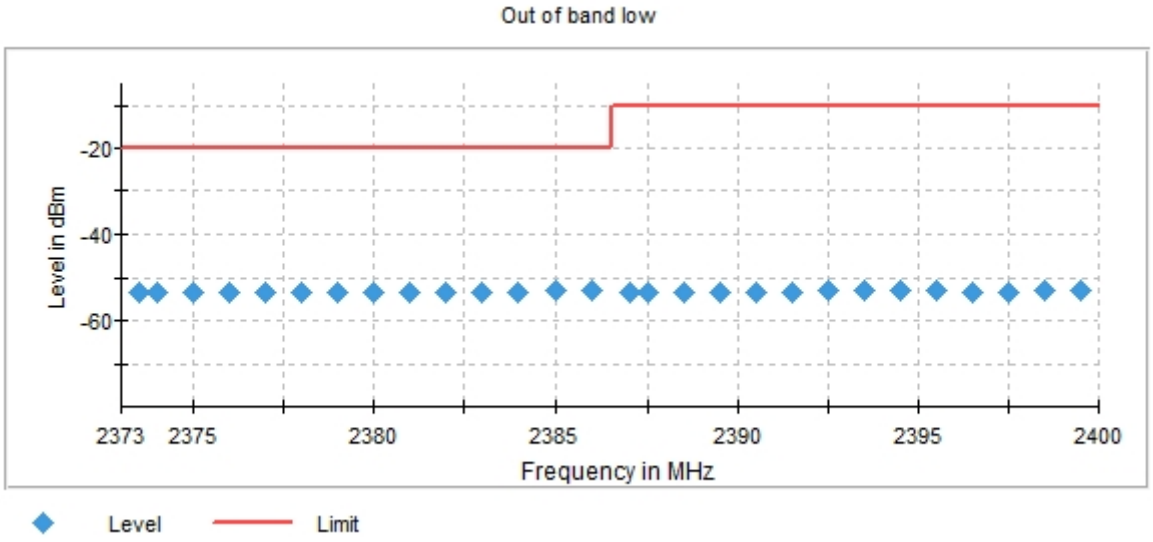
802.11b, 1Mbps – Chain B

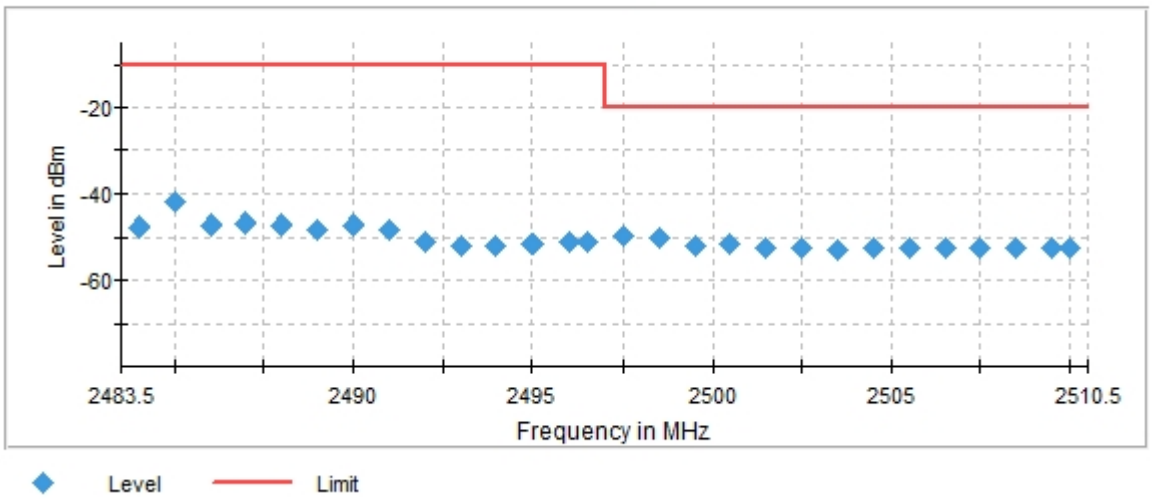
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section, Channel 1

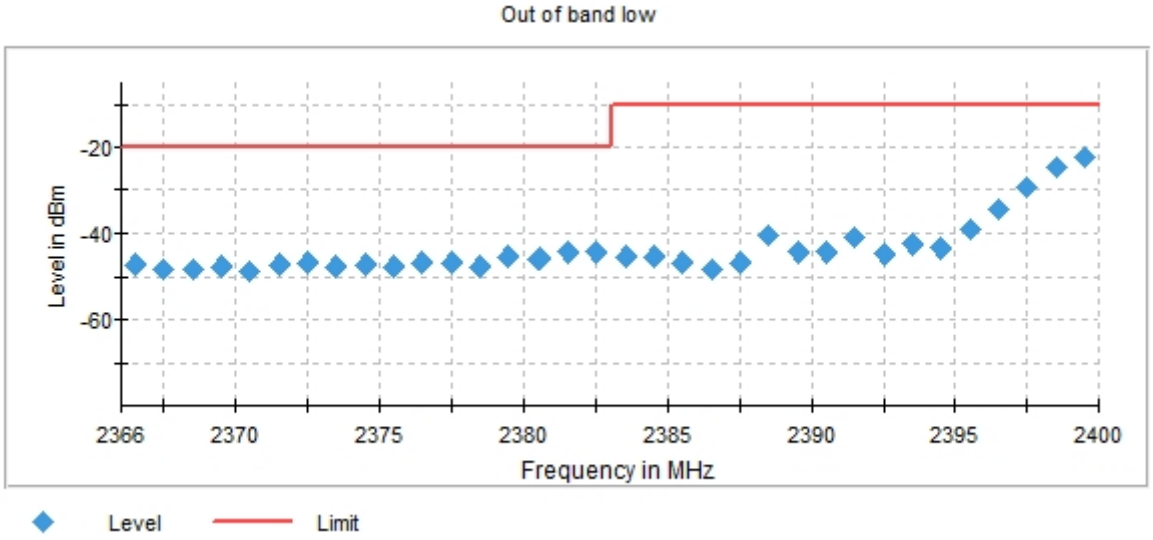


UNWANTED OOB Low Freq Section, Channel 13


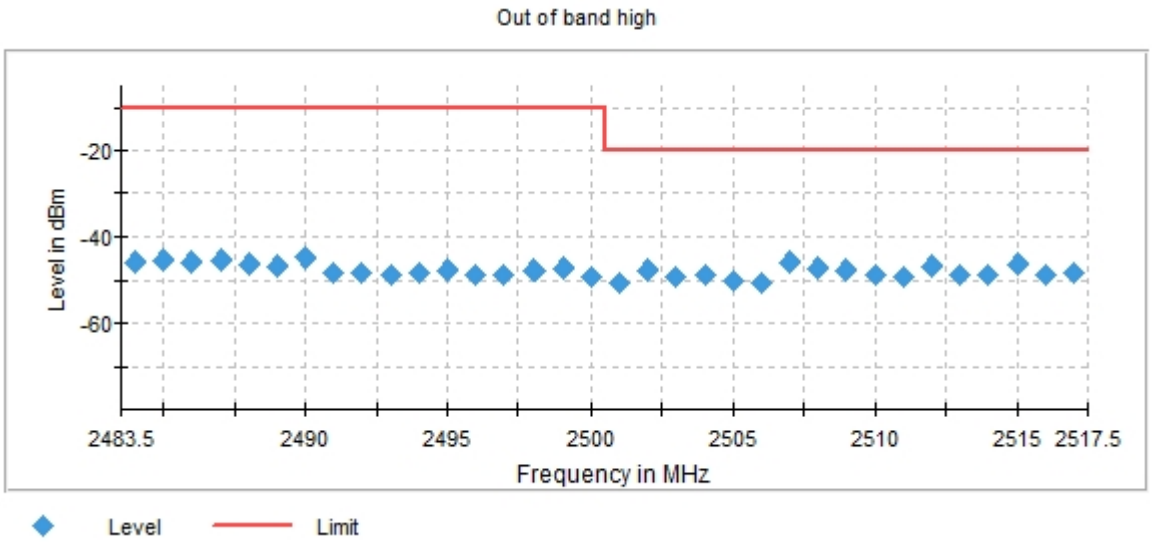
UNWANTED OOB High Freq Section, Channel13


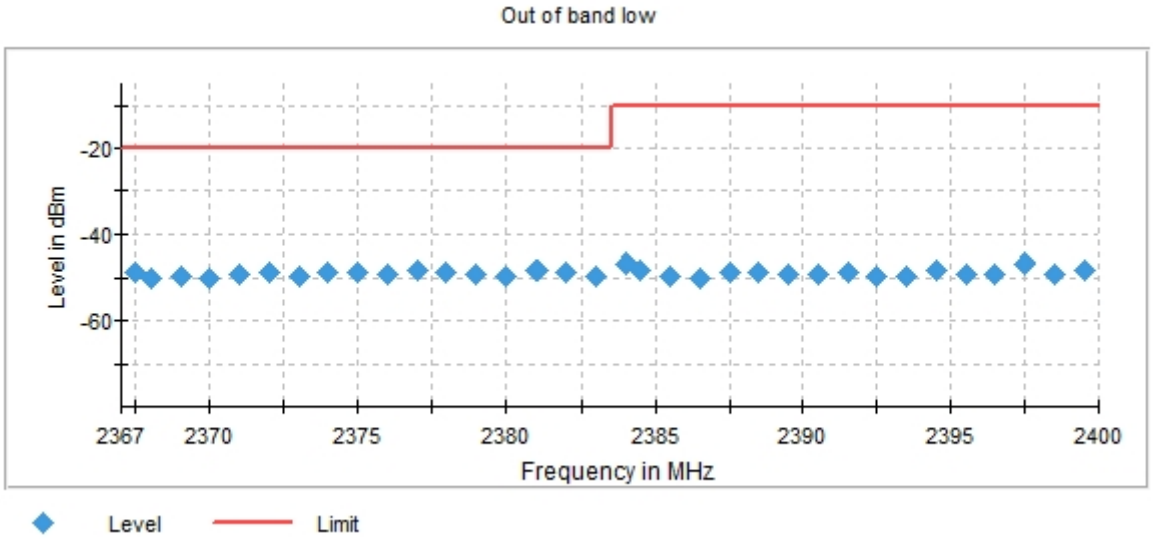
802.11g, 6 Mbps – Chain B

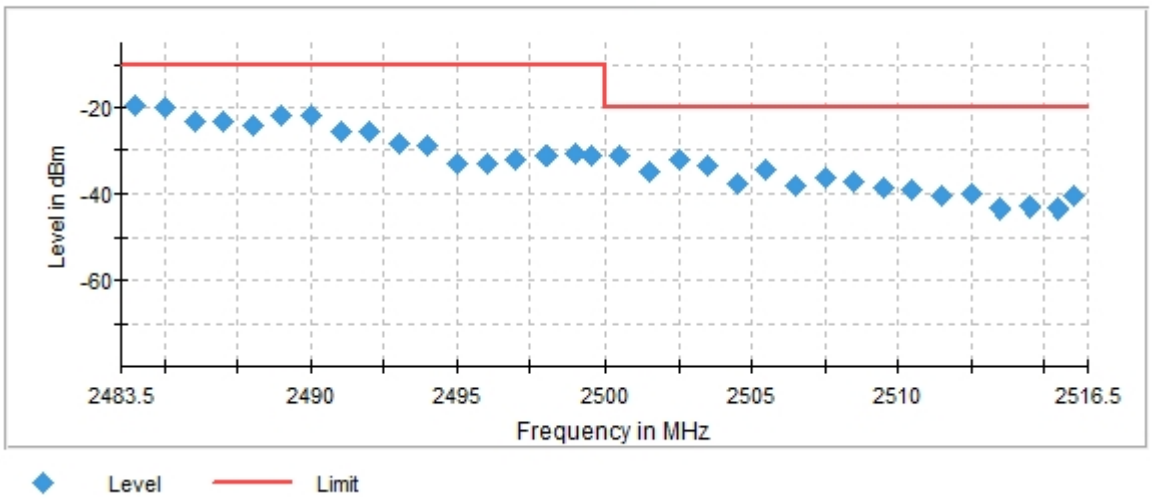
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section, Channel 1

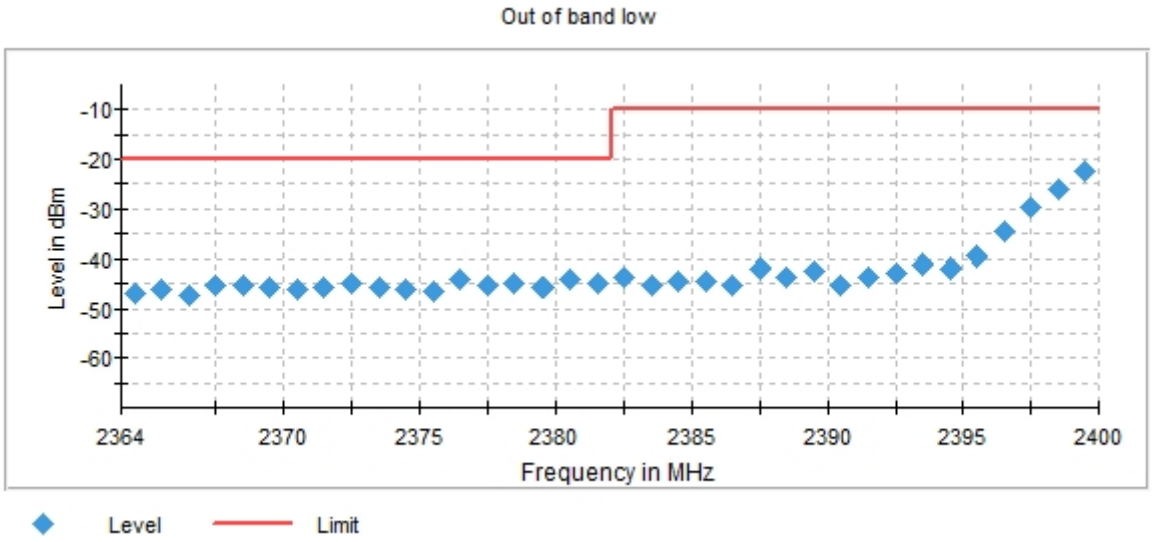


UNWANTED OOB Low Freq Section, Channel 13


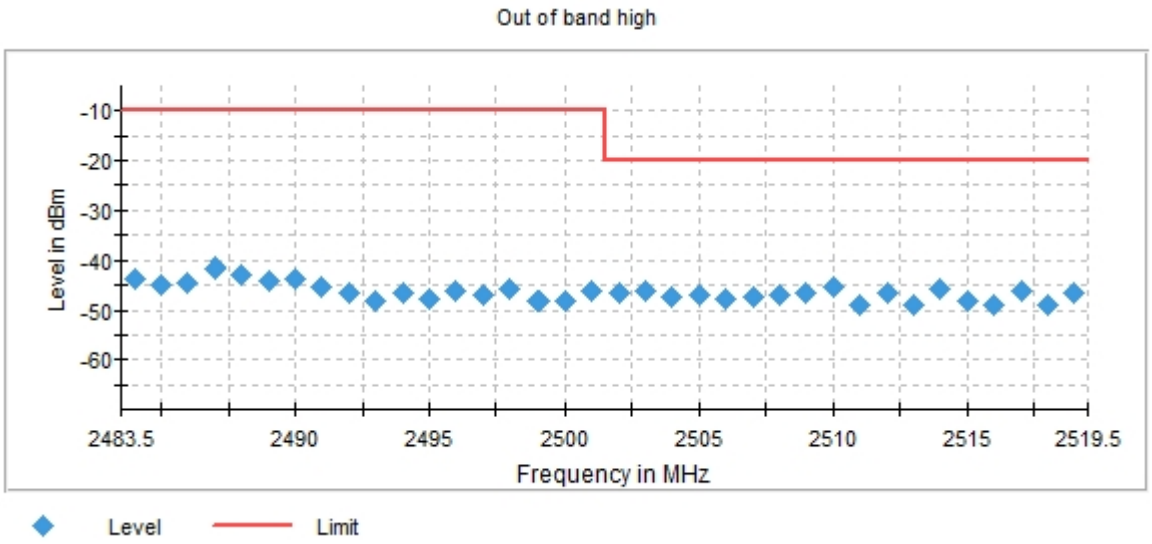
UNWANTED OOB High Freq Section, Channel 13


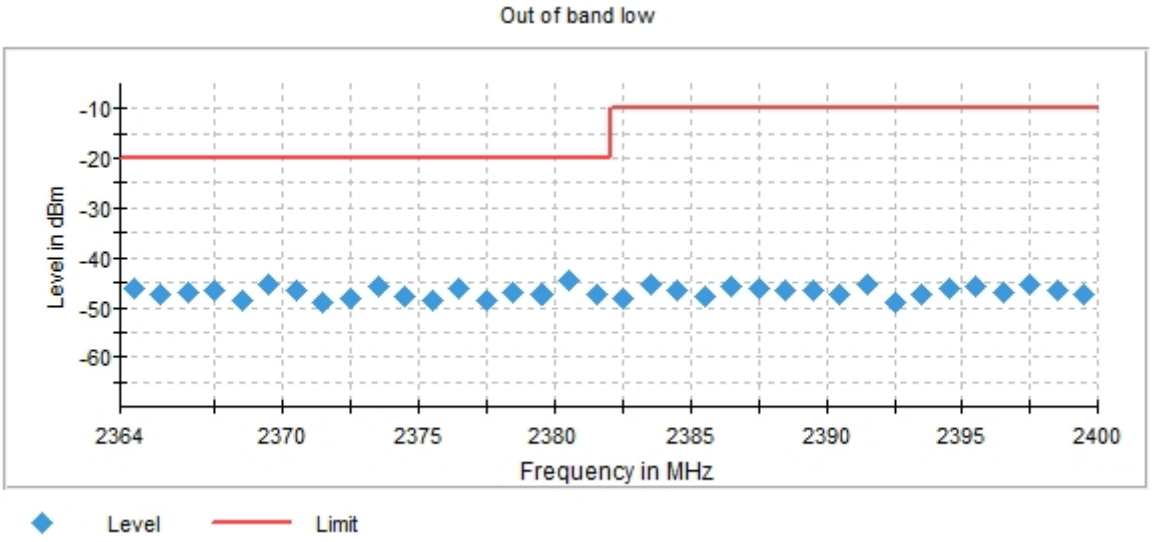
802.11n20, HT0 (SISO) – Chain B

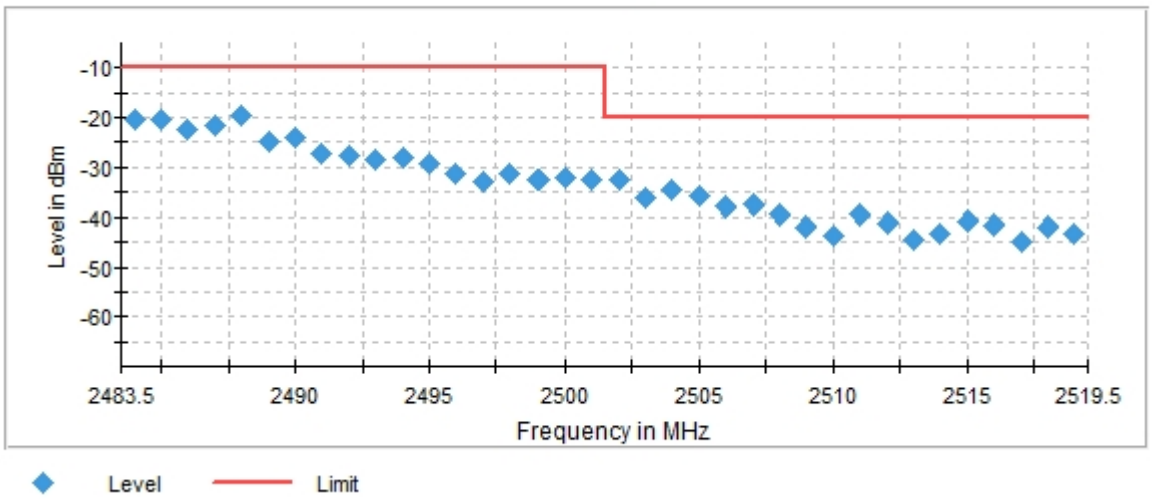
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section, Channel 1

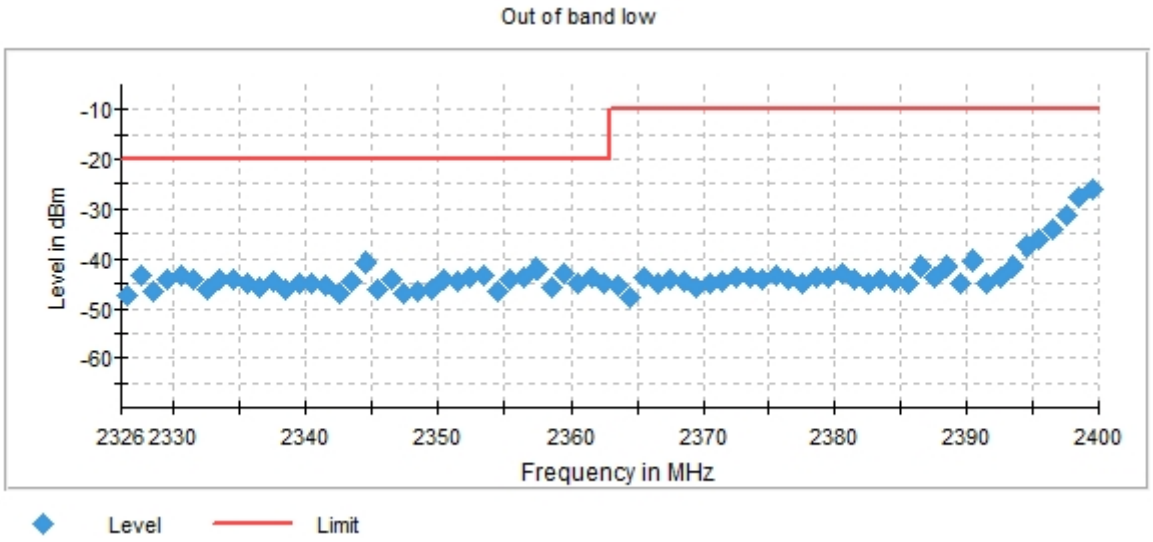


UNWANTED OOB Low Freq Section, Channel 13


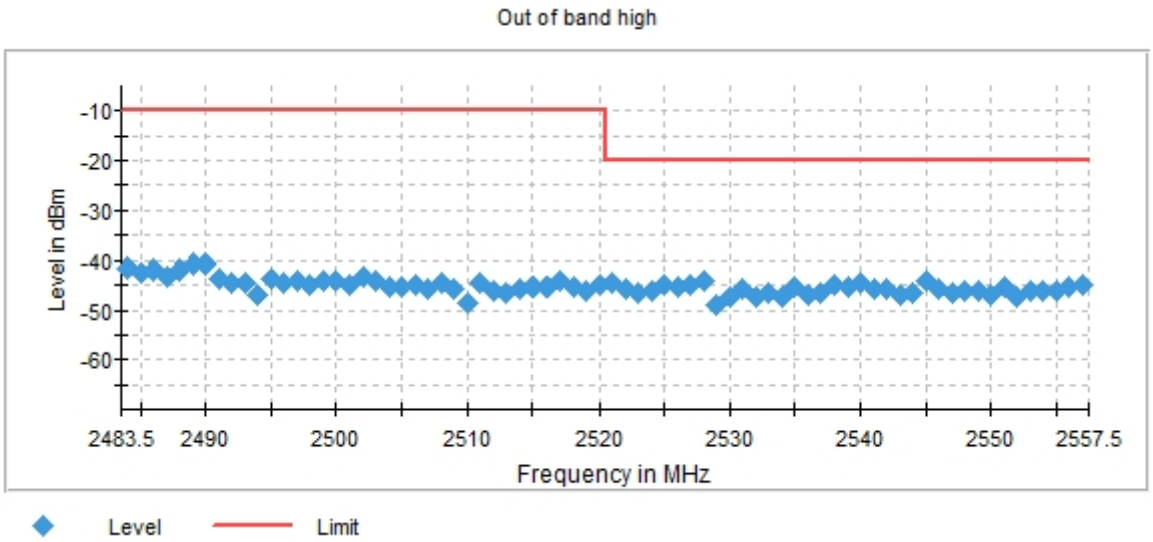
UNWANTED OOB High Freq Section , Channel 13


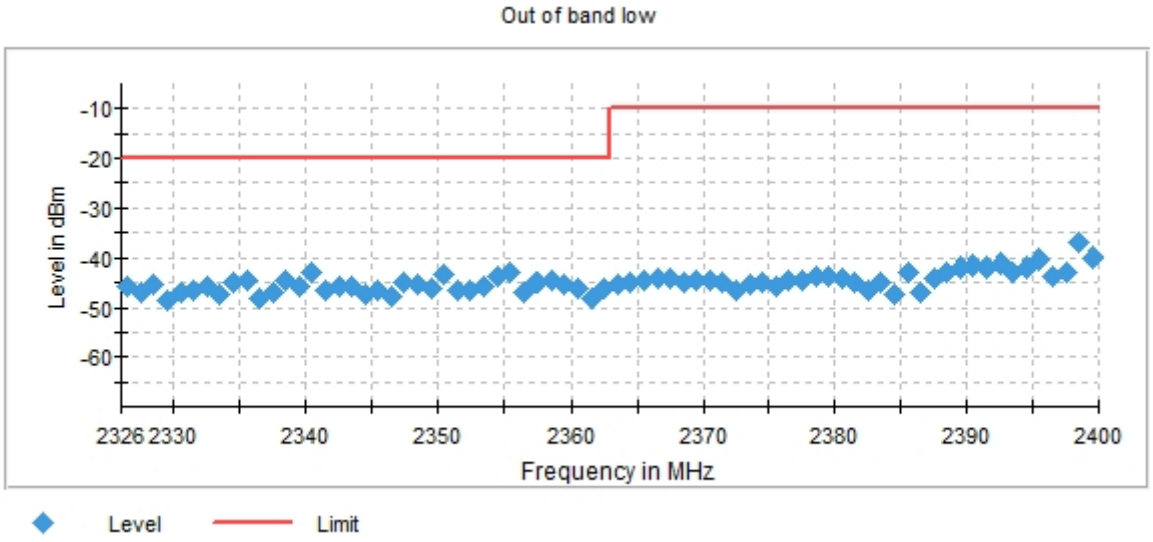
802.11n40, HT0 (SISO) – Chain B

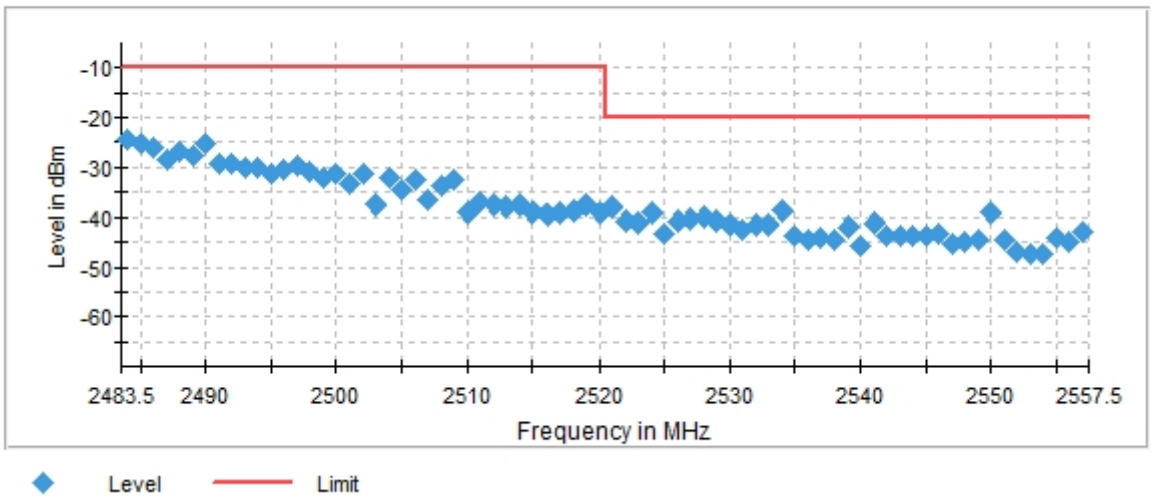
UNWANTED OOB Low Freq Section, Channel 3



UNWANTED OOB High Freq Section, Channel 3

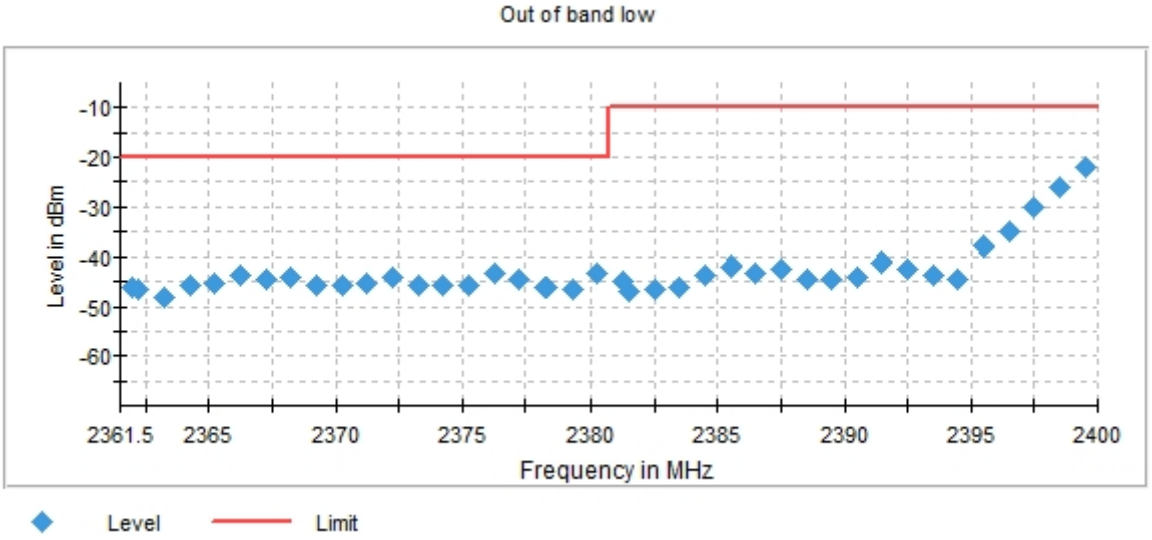


UNWANTED OOB Low Freq Section, Channel 11


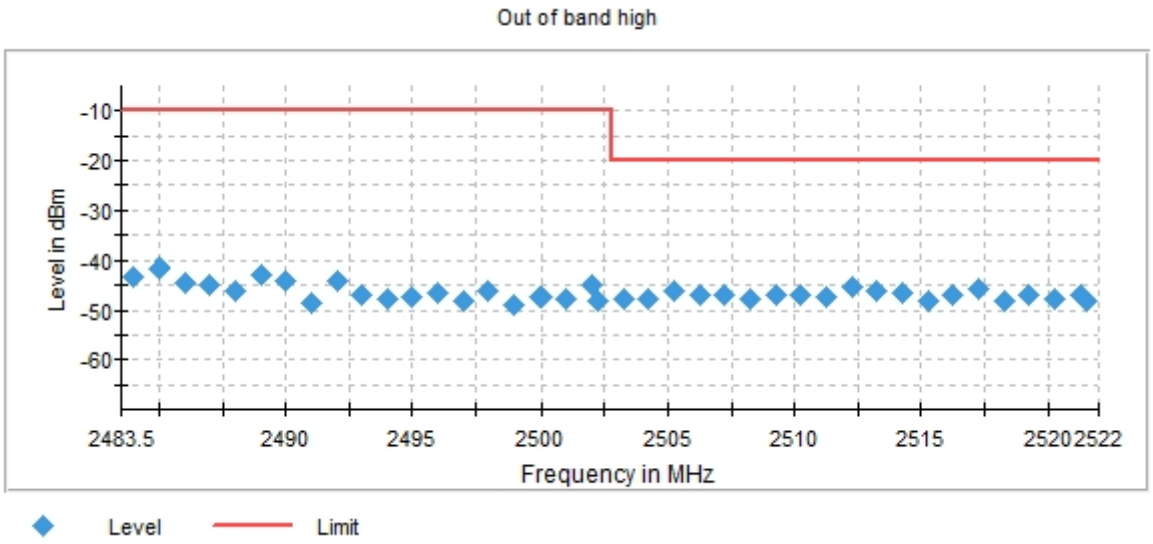
UNWANTED OOB High Freq Section, Channel 11


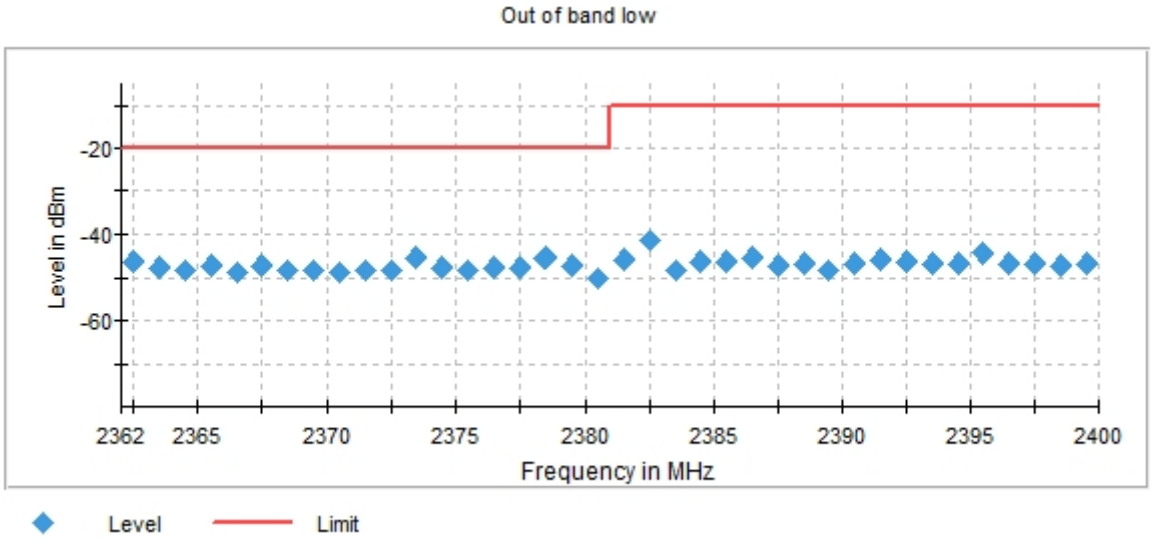
802.11ax20, HE0 (SISO) – Chain B

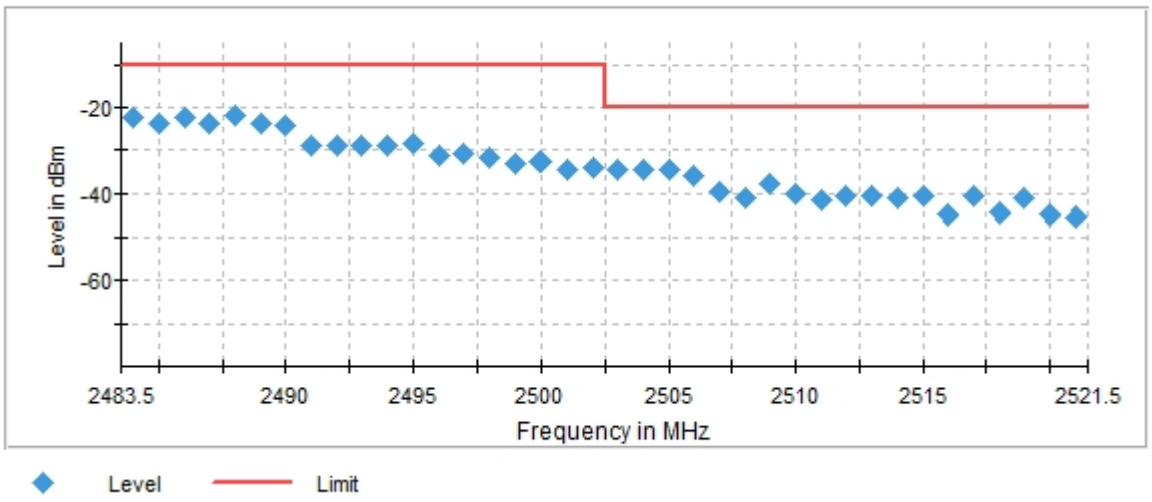
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section, Channel 1

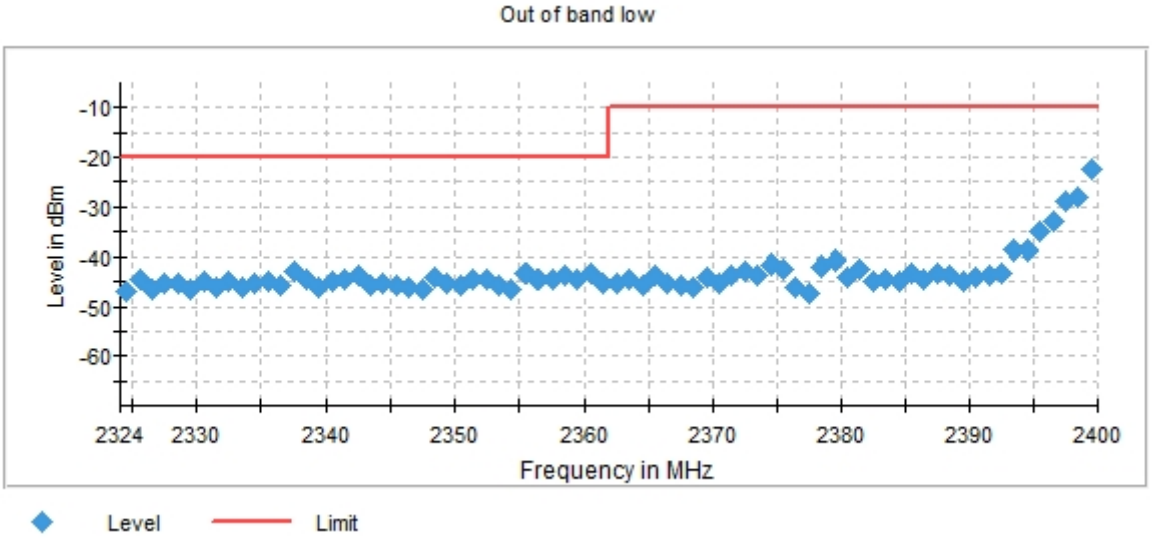


UNWANTED OOB Low Freq Section, Channel 13


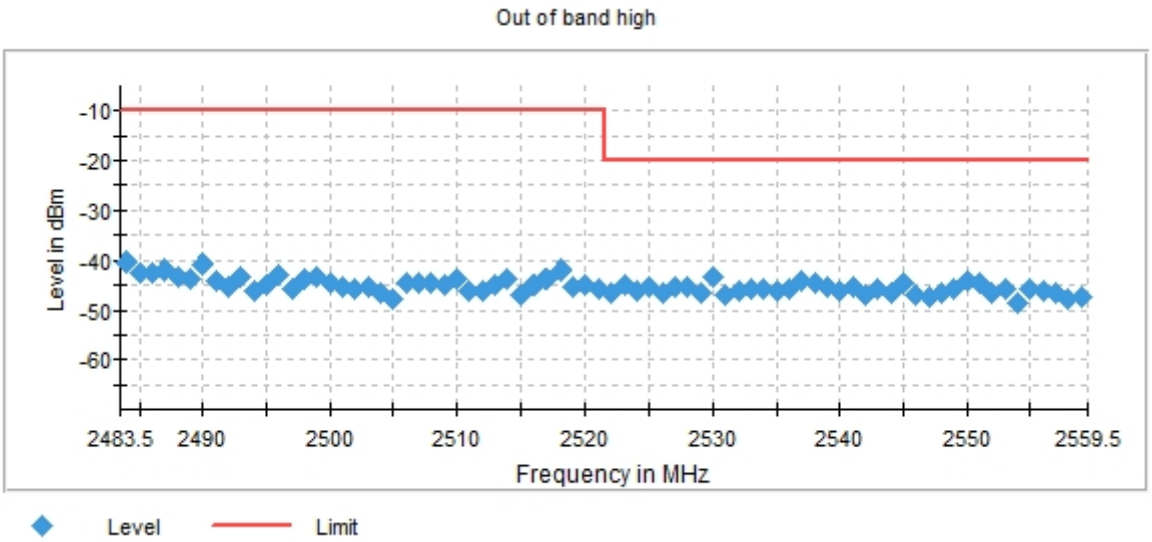
UNWANTED OOB High Freq Section , Channel 13


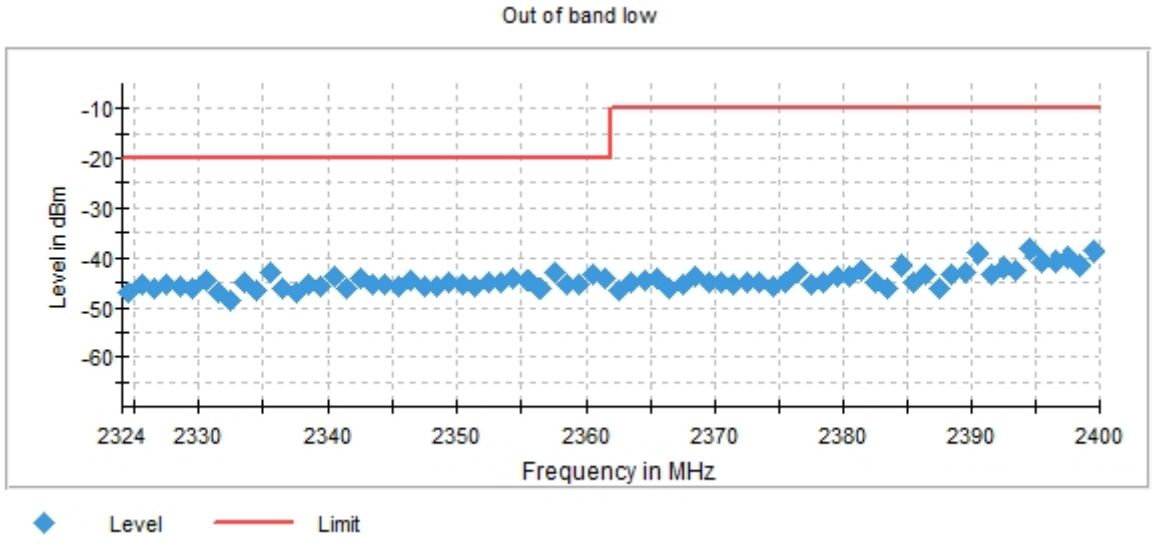
802.11ax40, HE0 (SISO) – Chain B

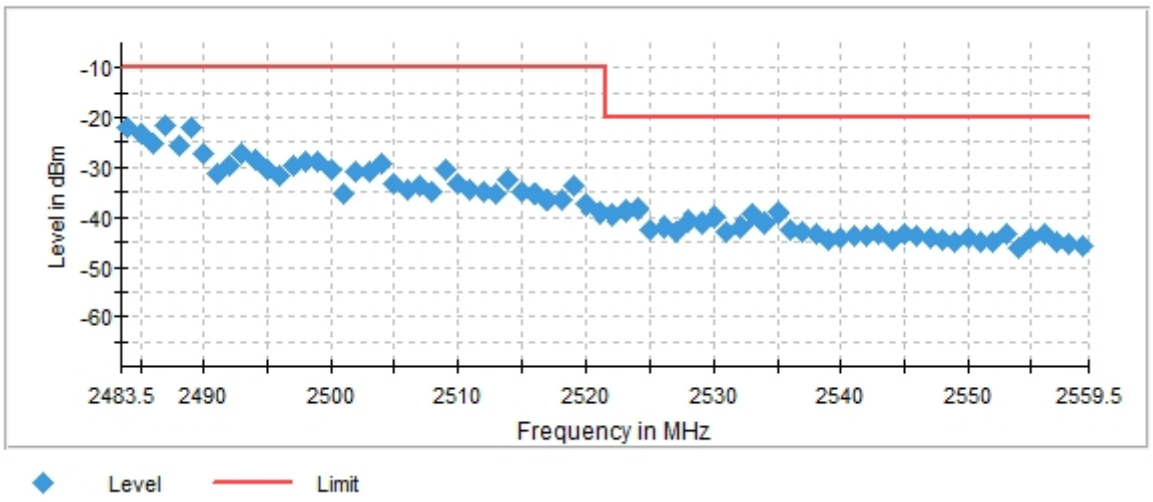
UNWANTED OOB Low Freq Section, Channel 3



UNWANTED OOB High Freq Section, Channel 3

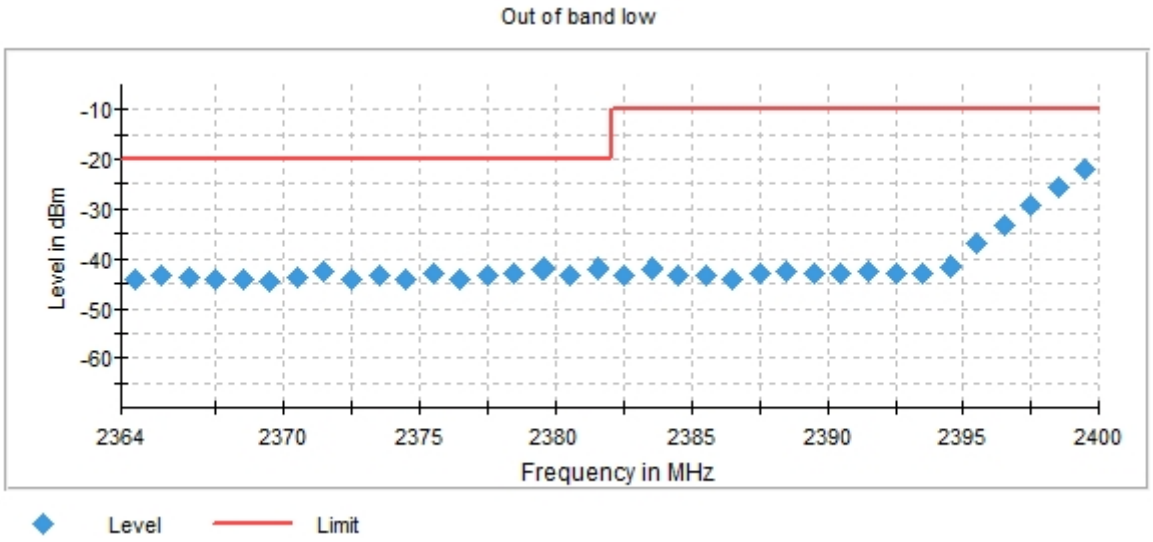


UNWANTED OOB Low Freq Section, Channel 11


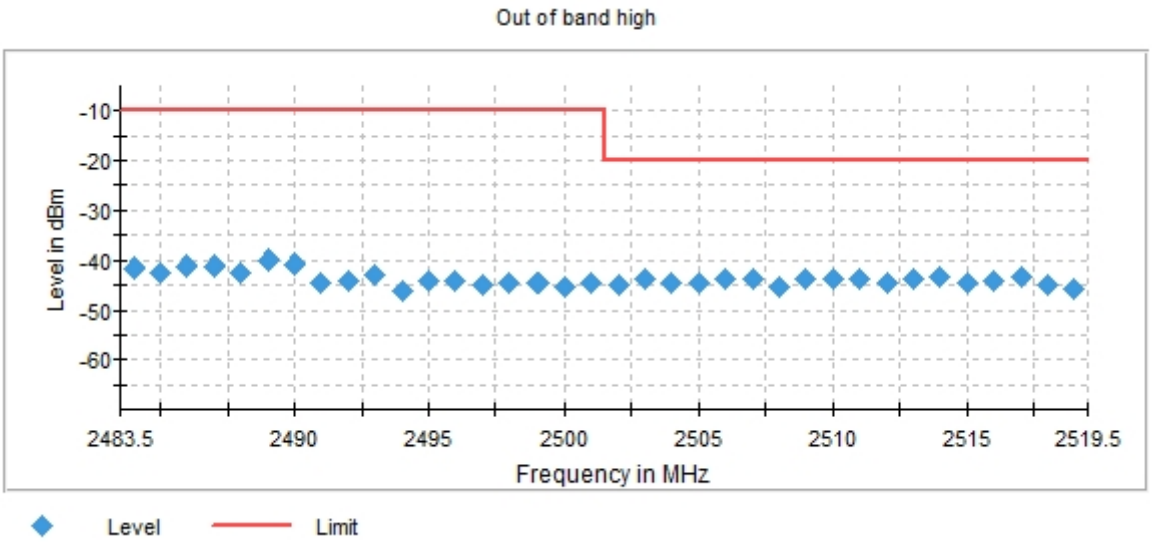
UNWANTED OOB High Freq Section, Channel 11


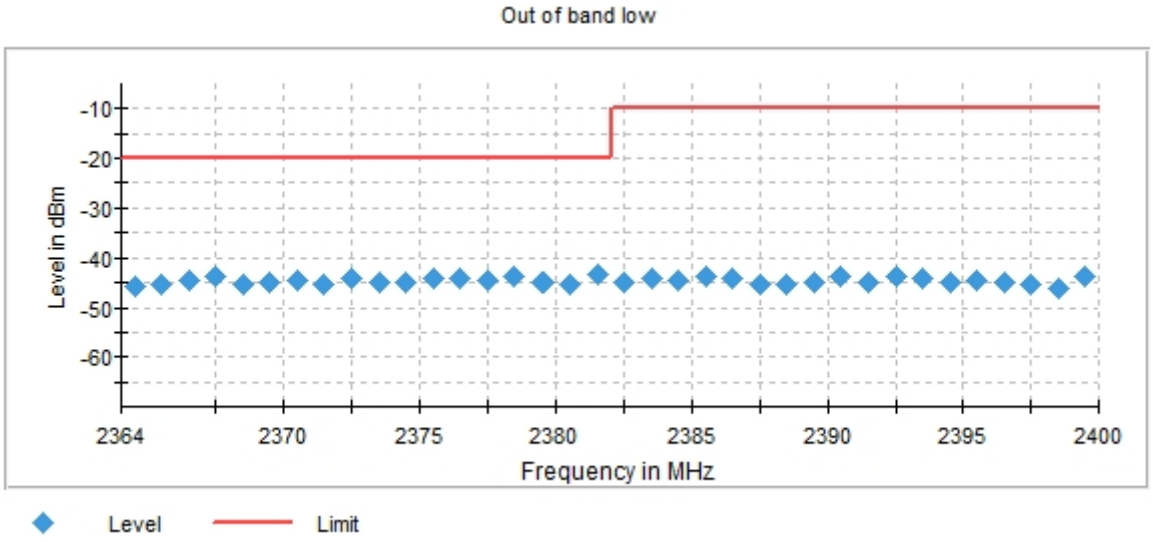
802.11n20, HT8 (MIMO)

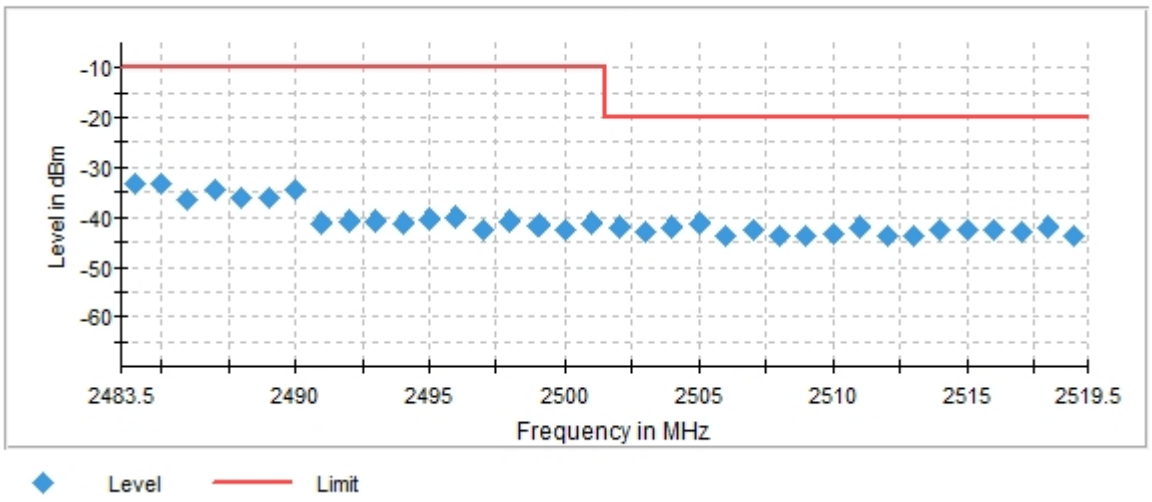
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section , Channel 1

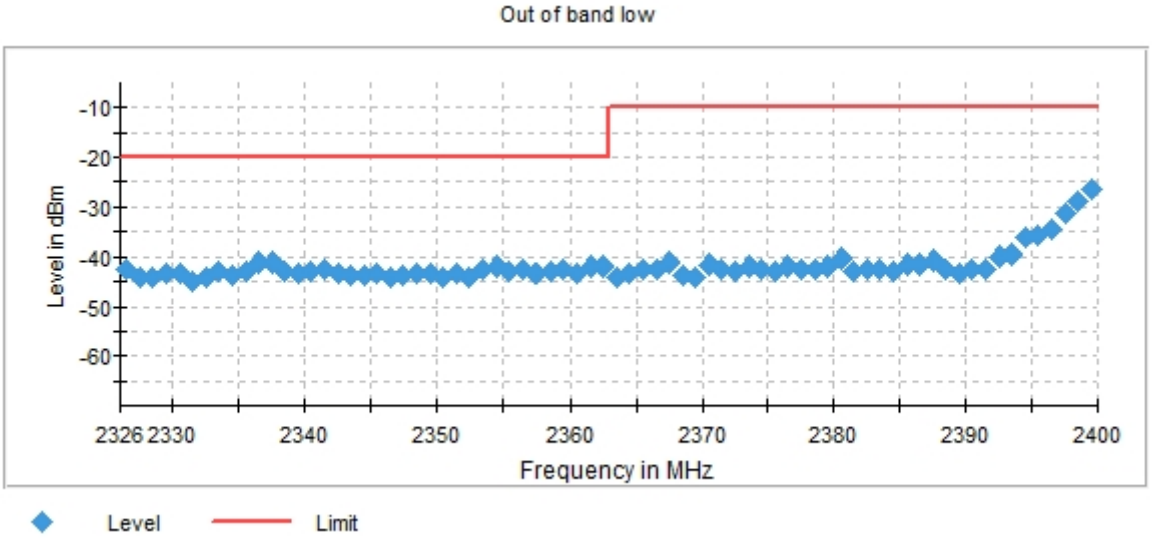


UNWANTED OOB Low Freq Section, Channel 13


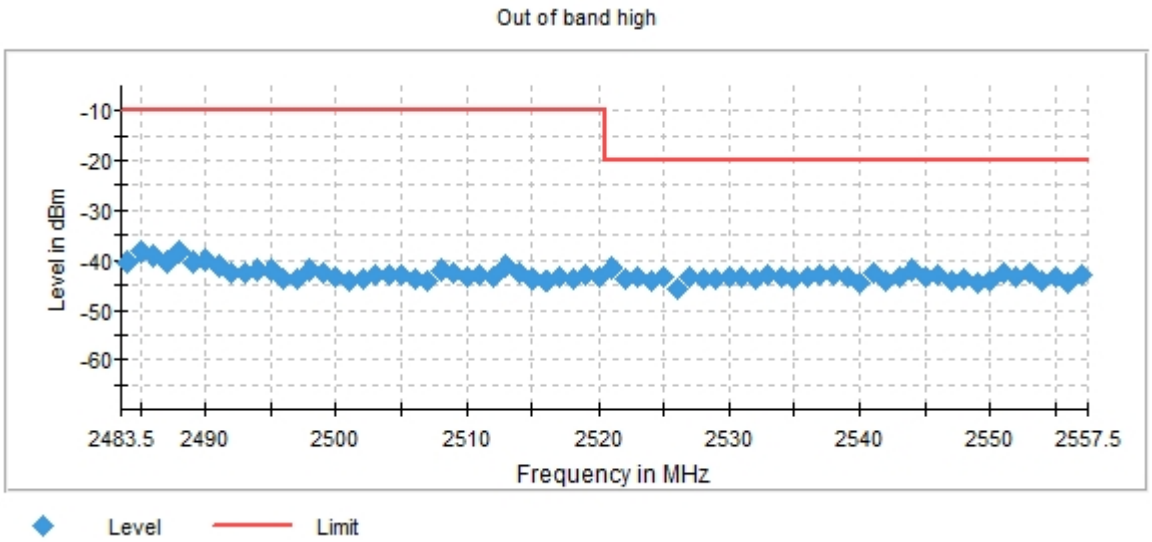
UNWANTED OOB High Freq Section, Channel 13


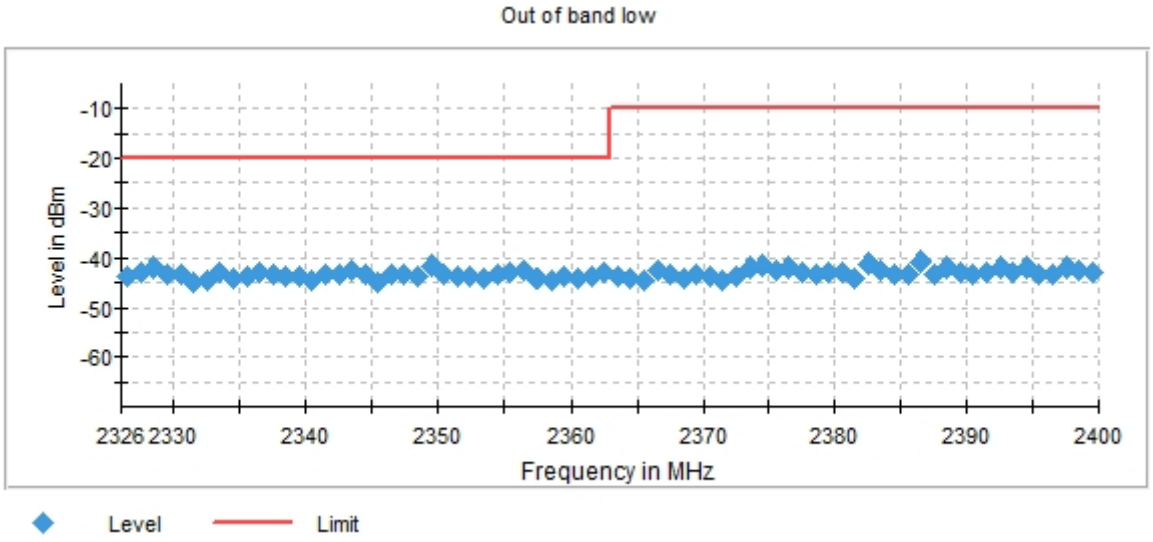
802.11n40, HT8 (MIMO)

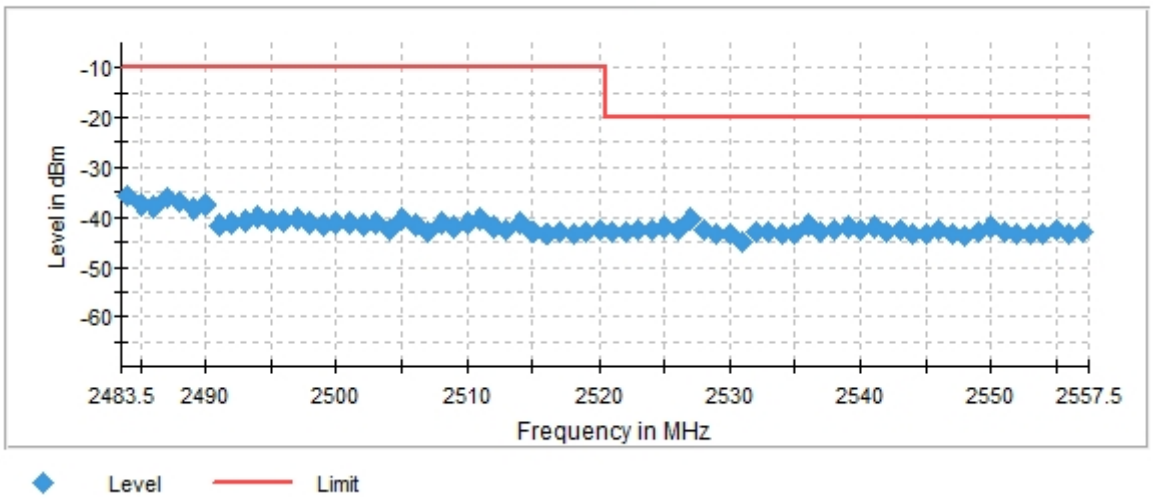
UNWANTED OOB Low Freq Section, Channel 3



UNWANTED OOB High Freq Section , Channel 3

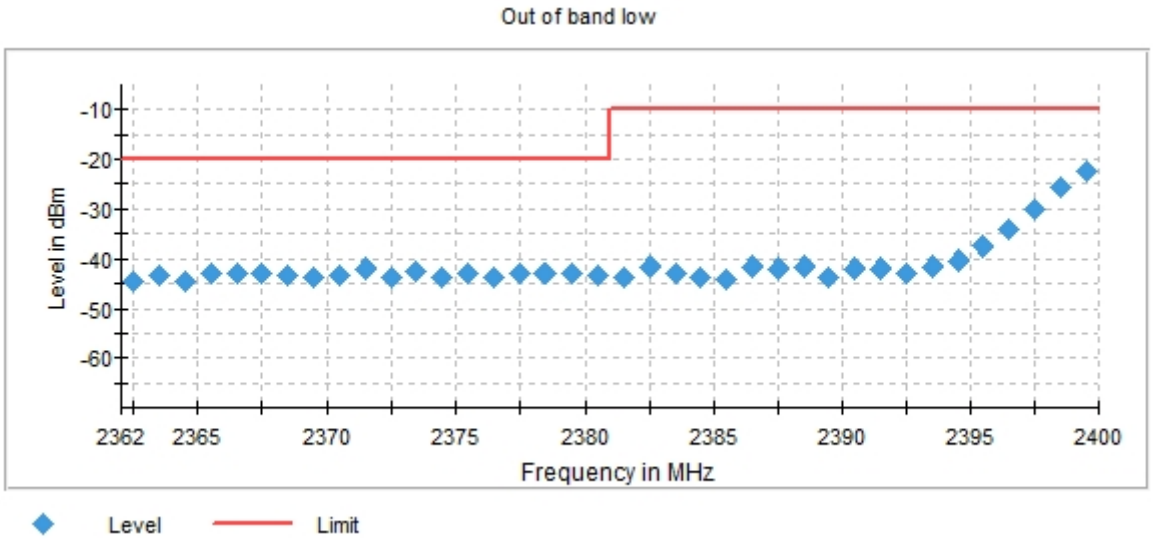


UNWANTED OOB Low Freq Section, Channel 11


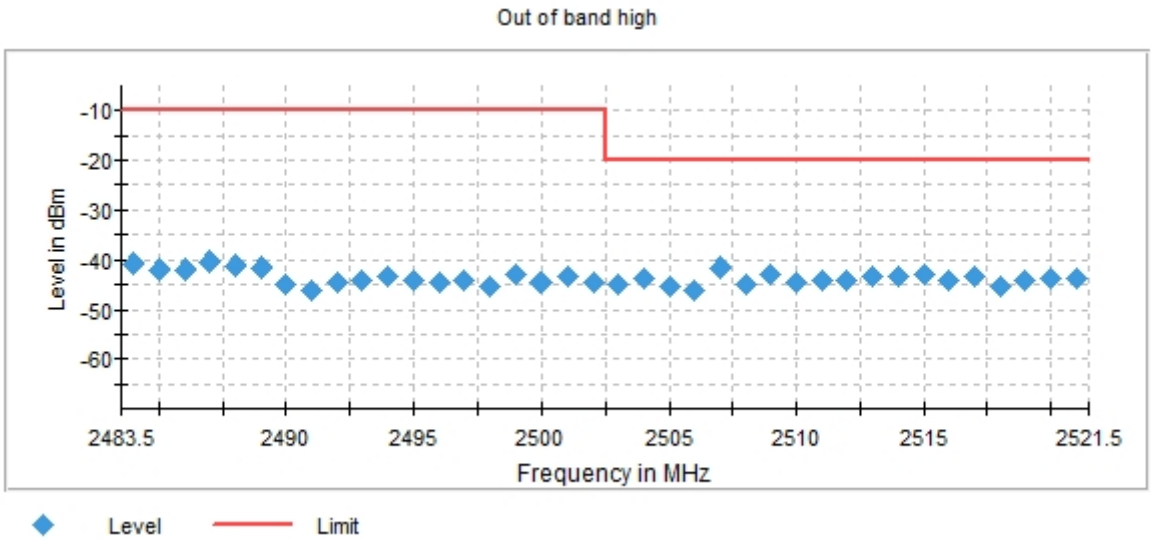
UNWANTED OOB High Freq Section, Channel 11


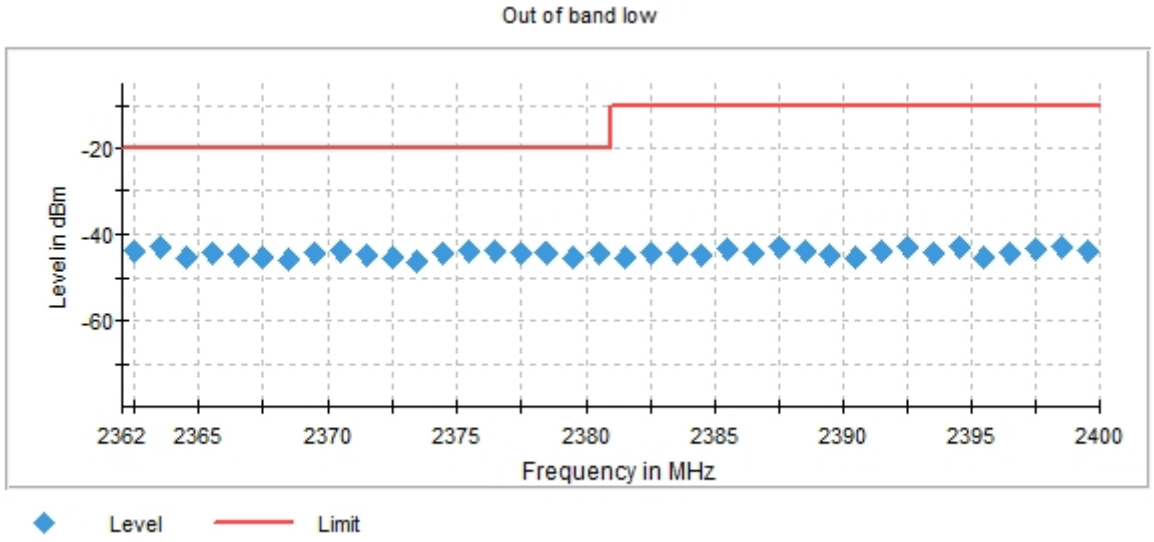
802.11ax20, HE0 (MIMO)

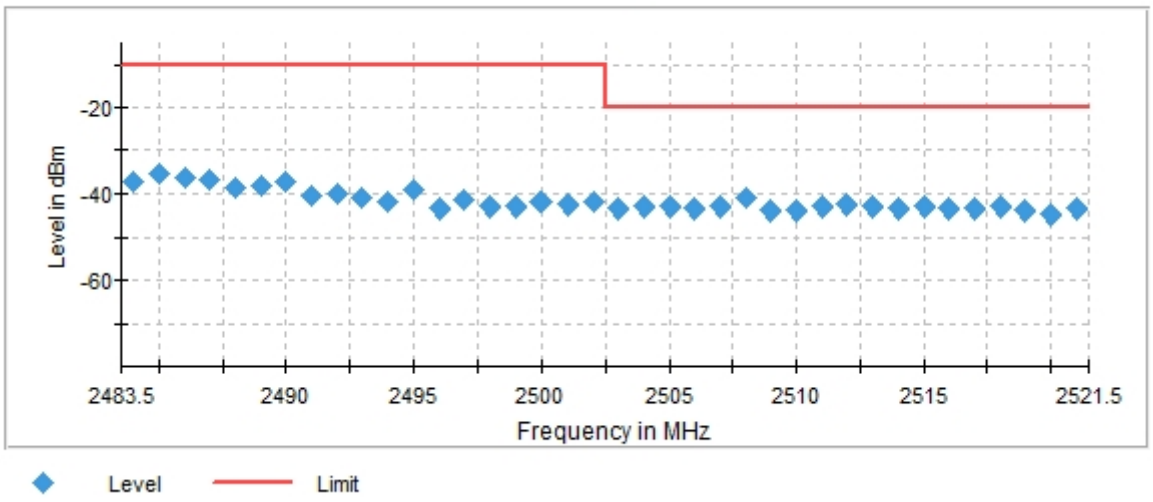
UNWANTED OOB Low Freq Section, Channel 1



UNWANTED OOB High Freq Section , Channel 1

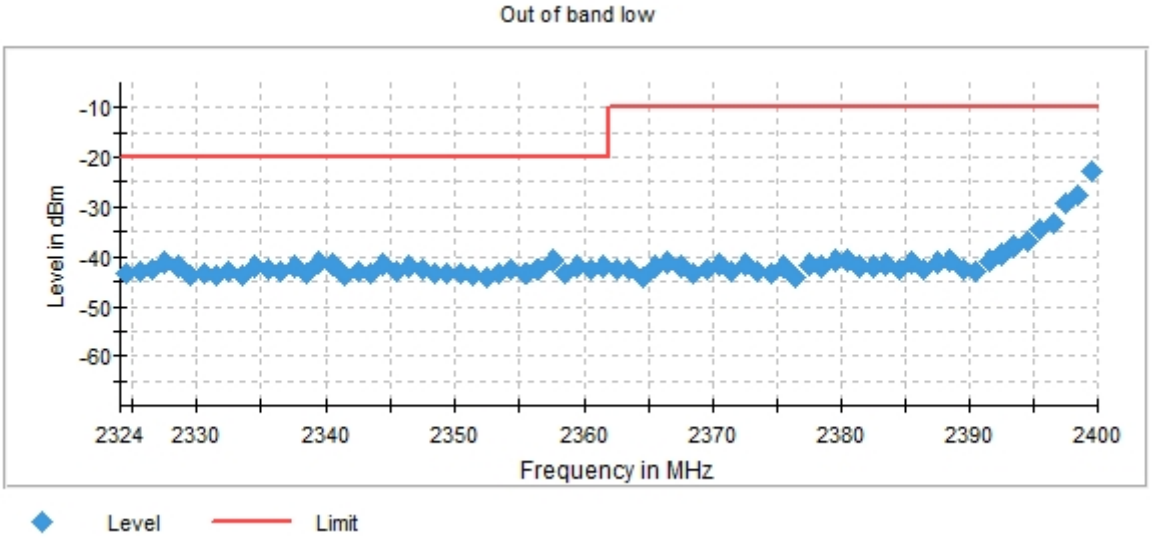


UNWANTED OOB Low Freq Section, Channel 13


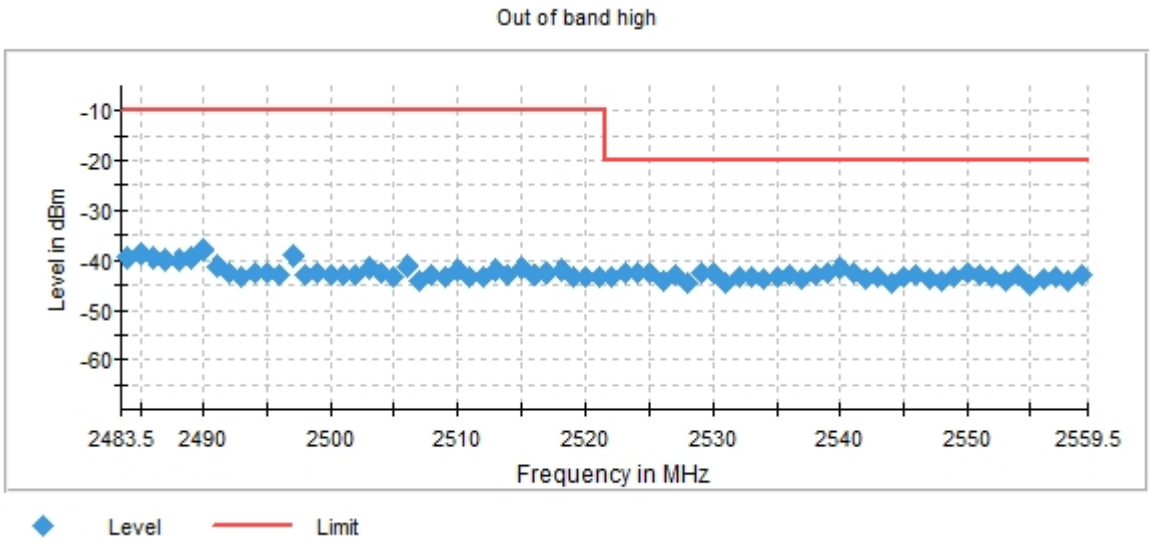
UNWANTED OOB High Freq Section, Channel 13


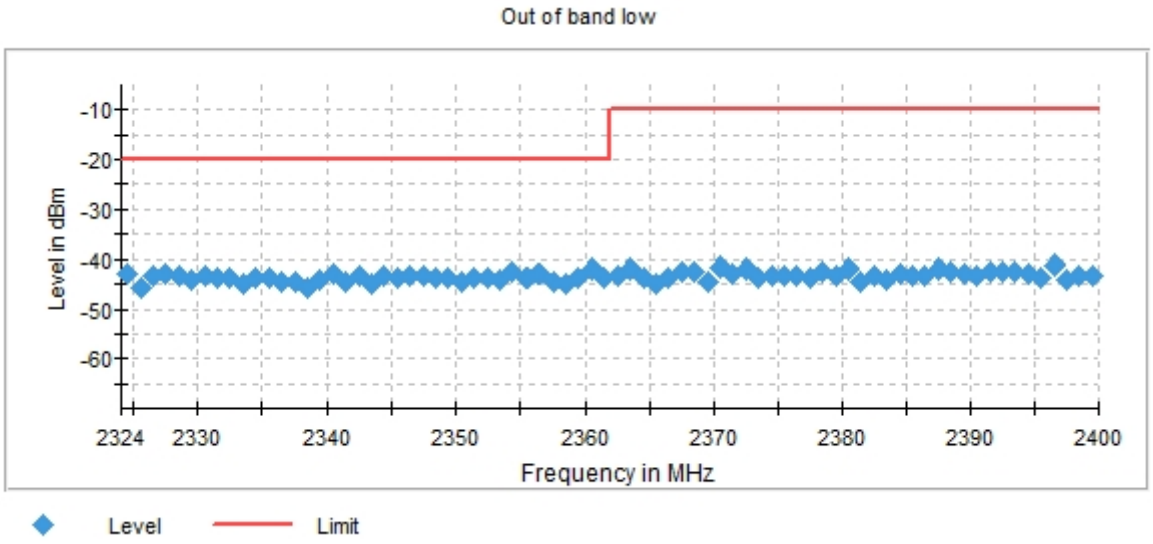
802.11ax40, HE0 (MIMO)

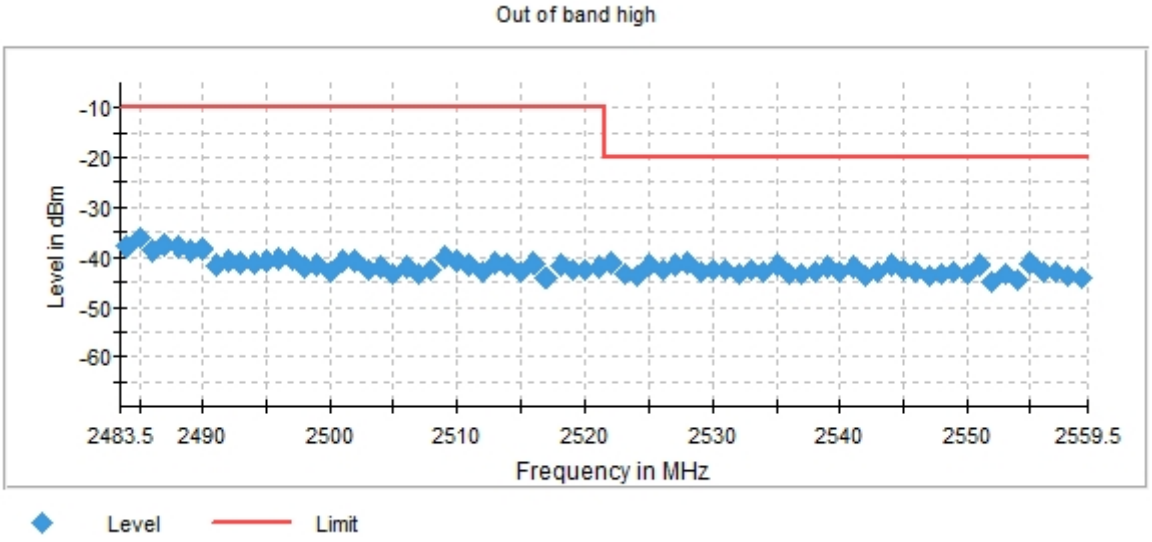
UNWANTED OOB Low Freq Section, Channel 3



UNWANTED OOB High Freq Section , Channel 3



UNWANTED OOB Low Freq Section, Channel 11


UNWANTED OOB High Freq Section, Channel 11


B.7 Transmitter unwanted emissions in the spurious domain

Test limits

<table>
<tr><th>ETSI clause</th><th>Limits</th></tr>
<tr><td>4.3.2.9.3</td><td>The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 12.
For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

Table12: Transmitter limits for spurious emissions
<table>
<tr><th>Frequency range</th><th>Maximum power</th><th>Bandwidth</th></tr>
<tr><td>30 MHz to 47 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>47 MHz to 74 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>74 MHz to 87.5 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>87.5 MHz to 118 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>118 MHz to 174 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>174 MHz to 230 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>230 MHz to 470 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>470 MHz to 694 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>694 MHz to 1 GHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>1 GHz to 12.75 GHz</td><td>-30 dBm</td><td>1 MHz</td></tr>
</table></td></tr>
</table>

Test conditions

ETSI clause	Conditions
5.4.9.1	These measurements shall only be performed at normal test conditions. For non-FHSS equipment, the measurement shall be performed at the lowest and the highest channel on which the equipment can operate. The equipment shall be configured to operate under its worst case situation with respect to output power. If the equipment can operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz), then the equipment shall be configured to operate under its worst case situation with respect to spurious emissions.

Test procedure

The radiated setups (transmitter) shown in section *Test & System Description* were used to measure the transmission spurious emissions accordingly with ETSI EN 300 328 V2.2.2§ 5.4.9.2.2. Depending of the frequency range and bands being tested, different antennas and filters were used; in consequence different setups are employed.

The final measurement is done by varying the antenna height from 1 to 4 meters, the EUT azimuth over 360º and for both Vertical and Horizontal polarizations.

According to ETSI EN 300 328, the device under test shall be configured to operate under its worst-case condition. In order to determine the worst case, a comprehensive evaluation was performed by varying all available bandwidths and operational modes. The results indicated that the narrowest bandwidth (20 MHz) represents the worst case, as it resulted in the lowest margins to the applicable spurious emission limits.
Radiated spurious emissions were measured on the lowest and highest channels.

For the 20 MHz bandwidth, only the operational modes identified as worst-case were retained and reported in this test report.

Test Results

30 MHz – 1 GHz, Tx spurious emissions

Tx Spurious Emissions – All modes

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
51.0	-63.7	Average	-51.9	11.8	V

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

Tx Spurious Emissions – 1 GHz to 12.75 GHz

Tx Spurious Emissions – 802.11n20 (SISO), Chain A – Channel 13

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
5661.5	-50.4	RMS	-30.0	20.4	H
10586.1	-40.5	RMS	-30.0	10.5	V

Tx Spurious Emissions – 802.11ax/be20 (SISO), Chain B – Channel 13

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
5666.8	-50.9	RMS	-30.0	20.9	V
10585.8	-40.5	RMS	-30.0	10.6	H

Tx Spurious Emissions – 802.11n20 (MIMO), Chain A+B – Channel 13

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
5660.5	-50.2	RMS	-30.0	20.2	V
10586.1	-40.6	RMS	-30.0	10.6	H

B.8 Receiver spurious emissions

Test limits

<table>
<tr><th>ETSI clause</th><th>Limits</th></tr>
<tr><td>4.3.2.10.3</td><td>The spurious emissions of the receiver shall not exceed the values given in table 13.

For emissions radiated by the cabinet or for emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Table 13: Spurious emission limits for recievers
<table>
<tr><th>Frequency range</th><th>Maximum power</th><th>Bandwidth</th></tr>
<tr><td>30 MHz to 1GHz</td><td>-57 dBm</td><td>100 kHz</td></tr>
<tr><td>1GHz to 12.75 GHz</td><td>-47 dBm</td><td>1 MHz</td></tr>
</table>
</td></tr>
</table>

Test conditions

ETSI clause	Conditions
5.3.10.1	These measurements shall only be performed at normal test conditions. Testing shall be performed when the equipment is in a receive-only mode. For non-FHSS equipment, the measurement shall be performed at the lowest and the highest channel on which the equipment can operate

Test procedure

The radiated setups (receiver) shown in section *Test & System Description* were used to measure receiver spurious emissions accordingly with ETSI EN 300 328 V2.2.2§ 5.4.10.2.2. Depending of the frequency range and bands being tested, different antennas and filters were used.

The final measurement is done by varying the antenna height from 1 to 4 meters, the EUT azimuth over 360º and for both Vertical and Horizontal polarizations.

The radiated spurious emissions were measured for all bandwidths on the low and high channels of each transmission mode. The worst-case configuration was reported

Test Results

30 MHz – 1 GHz, Rx spurious emissions

Rx Spurious Emissions – All modes

Frequency	Level	Detector	Limit (e.i.r.p)	Margin	Polar
MHz	dBm	---	dBm	dB	---
424.5	-66.8	RMS	-54.9	11.6	H

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

Rx Spurious Emissions – 1 GHz to 12.75 GHz

Rx Spurious Emissions – b/g/n20/ax/be20 (MIMO), Chain A+B – Channel 1

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
10753.3	-58.2	RMS	-47.0	11.2	V

B.9 Receiver Blocking

Test limits

<table>
<tr><th>ETSI clause</th><th>Limits</th></tr>
<tr><td>4.3.2.11.3

4.3.2.11.4</td><td>
The minimum performance criterion shall be a PER less than or equal to 10 %.

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in table below.

Receiver blocking parameters for Receiver Category 1 equipment
<table>
<tr><th>Wanted signal mean power from companion device (dBm) (see notes 1 and 4)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm) (see note 4)</th><th>Type of blocking signal</th></tr>
<tr><td>(-133 dBm + 10 × log₁₀(OCBW)) or -68 dBm whichever is less (see note 2)</td><td>2380
2504
2300
2584</td><td rowspan="2">-34</td><td rowspan="2">CW</td></tr>
<tr><td>(-139 dBm + 10 × log₁₀(OCBW)) or -74 dBm whichever is less (see note 3)</td><td>2300
2330
2360
2524
2584
2674</td></tr>
<tr><td colspan="4">
NOTE 1: OCBW is in Hz
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3 In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 20 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.
</td></tr>
</table>
</td></tr>
</table>

Test conditions

<table>
<tr><th>ETSI clause</th><th>Conditions</th></tr>
<tr><td>5.4.11.1</td><td>
These measurements shall only be performed at normal test conditions. For non-FHSS equipment, having more than one operating channel, the operating channels on which the testing has to be performed shall be selected as follows:
• For testing blocking frequencies less than 2400 MHz, the equipment shall operate on the lowest operating channel.
• For testing blocking frequencies greater than 2500 MHz, the equipment shall operate on the highest operating channel.
Equipment which can change their operating channel automatically (adaptive channel allocation), and where this function cannot be disabled, shall be tested as a FHSS equipment. If the equipment can be configured to operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz) and different data rates, then the combination of the smallest channel bandwidth and the lowest data rate for this channel bandwidth which still allows the equipment to operate as intended shall be used. This mode of operation shall be aligned with the performance criteria defined in clause 4.3.1.12.3 or clause 4.3.2.11.3 and shall be described in the test report..
</td></tr>
</table>

Test procedure

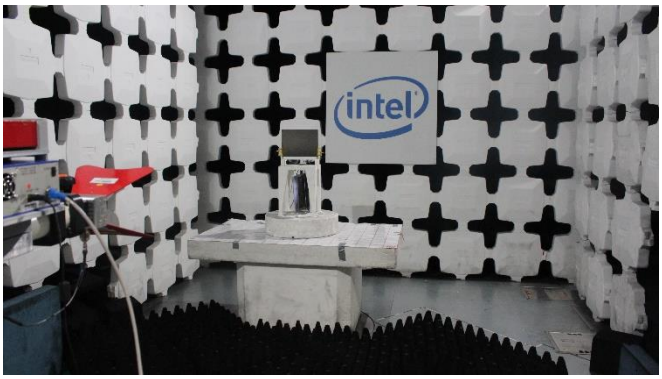
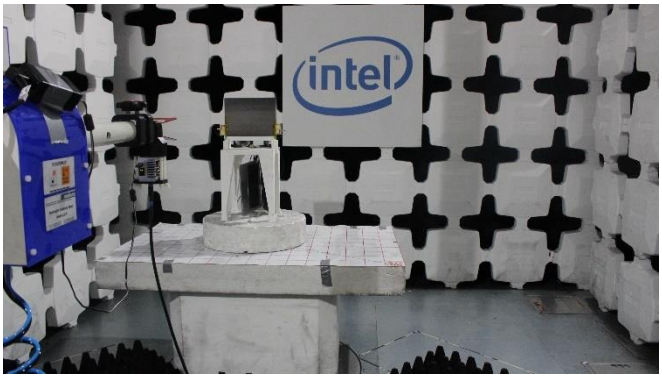
The receiver blocking setup (conducted) shown in section *Test & System Description* was used to measure receiver blocking signal. The signaling Unit is a CMW500.The packet error rate (PER) is measured with the CMW500. The blocking signal is emulated by the Signal generator SMB100A. Antenna gain and insertion loss are taken into account.

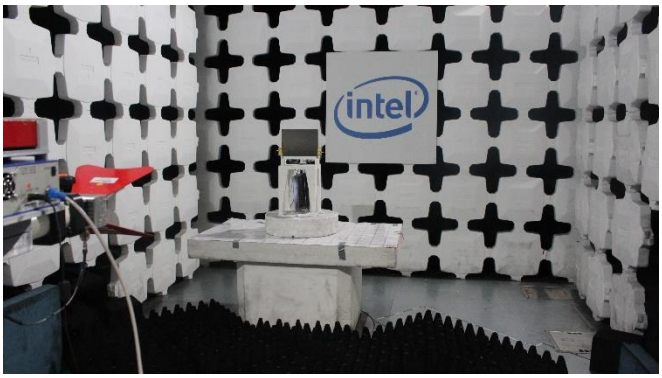
Test results

Configuration	99% Occupied bandwidth [MHz]	Wanted signal mean power from companion device (dBm)	PER [%] Without blocking signal	Blocking signal [MHz]	Blocking signal Power at DUT input [dBm]	PER [%] With Blocking signal	Verdict
		Without blocking signal		With blocking signal			
802.11b Chain A Channel 1 2412MHz 1Mbps	13.50	-70.00	0.00	2380	-36.00	0.00	PASS
		-76.00	0.10	2300	-36.00	0.00	PASS
				2330	-36.00	0.00	PASS
				2360	-36.00	0.22	PASS
802.11b Chain A Channel 13 2472MHz 1Mbps	13.50	-70.00	0.20	2504	-36.00	0.00	PASS
		-76.00	0.40	2524	-36.00	0.20	PASS
				2584	-36.00	0.10	PASS
				2674	-36.00	0.50	PASS

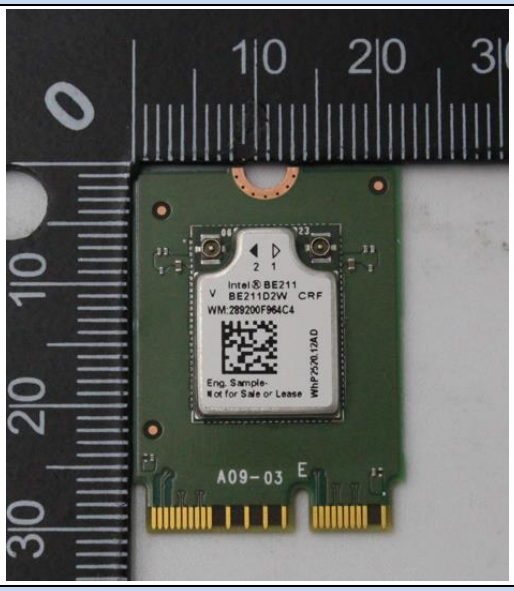
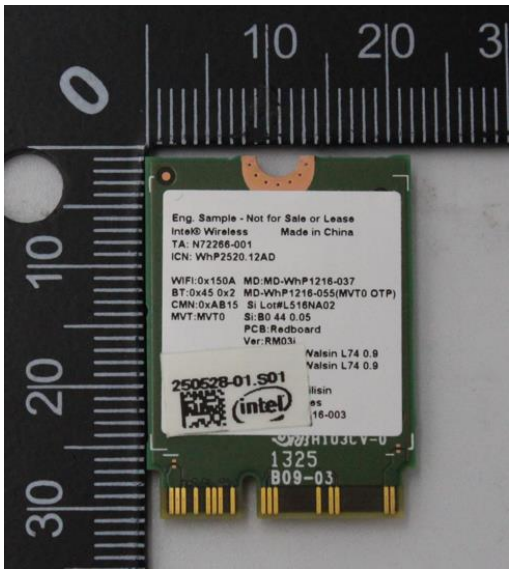
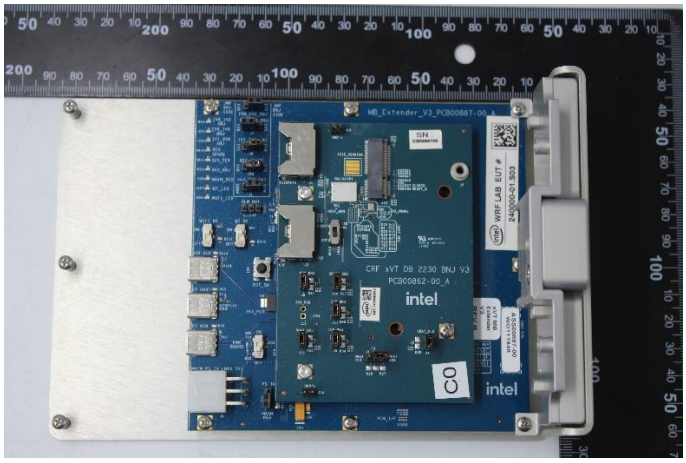
Annex C. Photographs

C.1 Test Setup

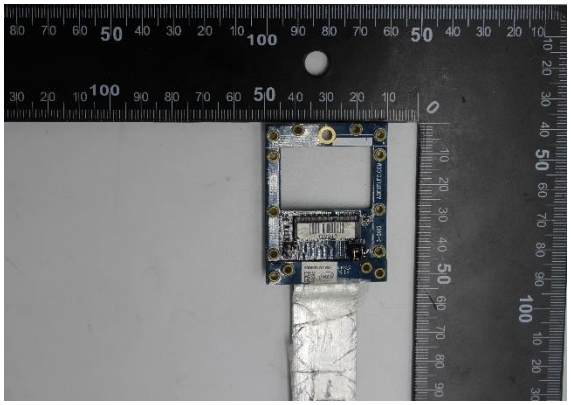
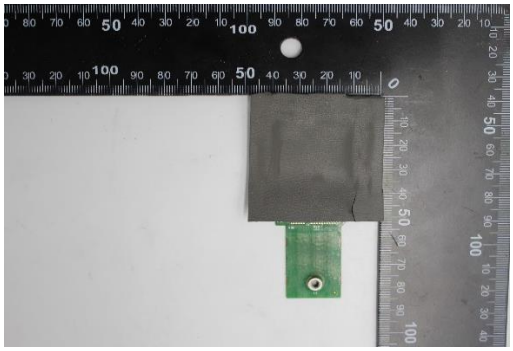
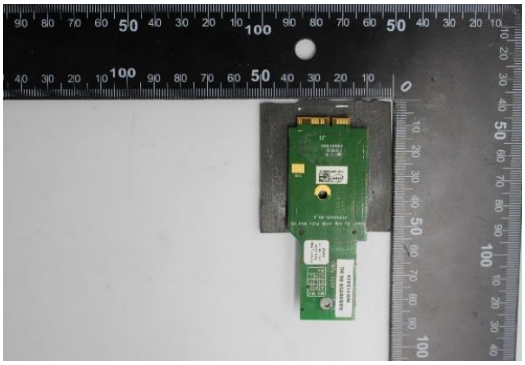
Radiated Setup 30 MHz – 1 GHz (Transmitter tests)	Radiated Setup 1 GHz – 11 GHz (Transmitter tests)
	
Radiated Setup 11 GHz – 12.75 GHz (Transmitter tests)	
	

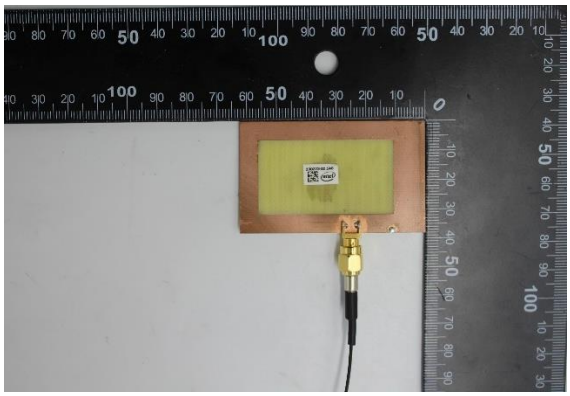
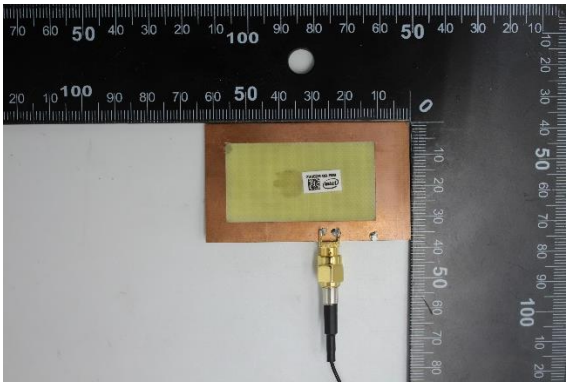
Radiated Setup 30 MHz – 1 GHz (Receiver tests)	Radiated Setup 1 GHz – 12.75 GHz (Receiver tests)
	

C.2 Test Sample

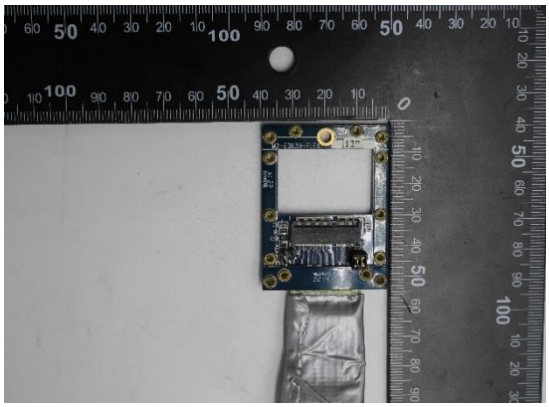
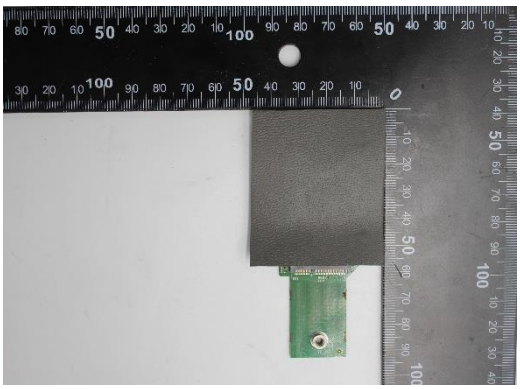
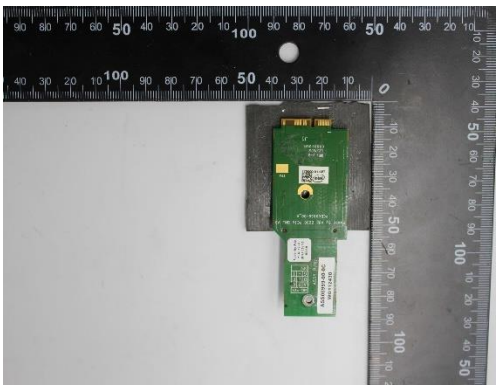
Sample #01	
Module Front	Module Back
	
Extender board	Laptop
	

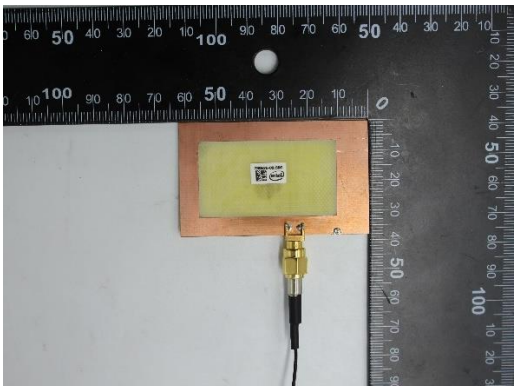
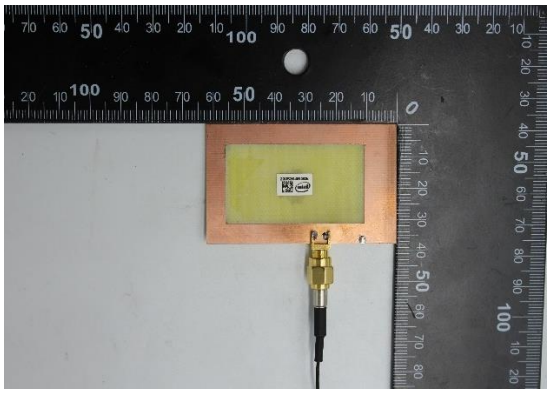
Sample #02

Module Front	Module Back
	
Extender board	**Laptop**
	
Adaptor Front	**Adaptor Back**
	

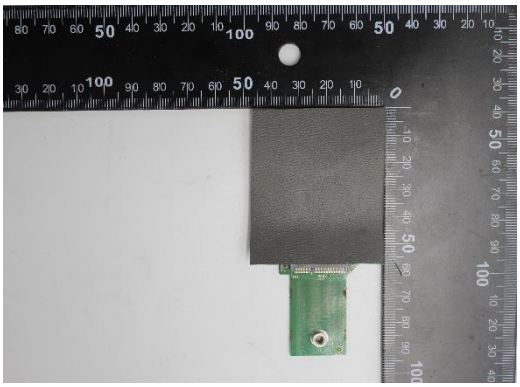
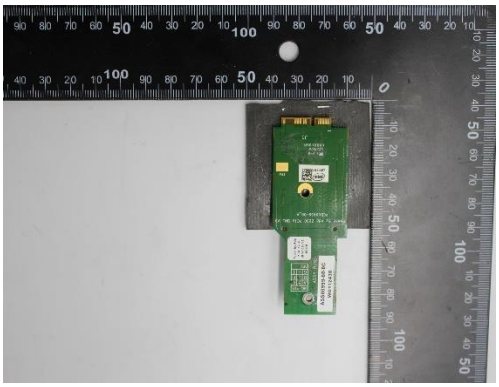
PIFA antenna (Main)	PIFA antenna (Aux)
	

Sample #03

Module Front	Module Back
	
Extender board	**Laptop**
	
Adaptor Front	**Adaptor Back**
	

PIFA antenna (Main)	PIFA antenna (Aux)
	

Sample #04

Module Front	Module Back
	
Adaptor Front	**Adaptor Back**
	
Laptop Rx (Host)	
	

End of the report

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