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	**2025-07-16/ 2025-07-21**
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.TR01**
Revision Control	**Rev. 01** **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.

Reviewed by

Digitally signed by zayd
DN: cn=zayd, email=zayd.ouachicha@intel.com, c=US
Date: 2025.07.30 16:52:31 +02'00'

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: 24.95°C Max: 25.43°C Avg: 25.23°C
Humidity	Min: 39.02 % Max: 42.72 % Avg: 40.73 %

4. Test samples

Sample	Control #	Description	Model	Serial #	Date of receipt	Note
#01	250528-01.S01	Module	BE211D2W	289200F964C4	2025-05-28	Used for all RF Conducted tests
	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	004250000000002AA521	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 for 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.08927.99.0.99</td></tr>
<tr><td>Driver Version</td><td>23.162.25264.11807 (RFC RF Tests) / 23.160.25212.8026 (RFR RF Tests)</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 6.0 GHz
Bluetooth 2.4GHz</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 BLE mode is non adaptive equipment so it is considered as receiver category 2.

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. BT Low Energy

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)	NA
	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	T. GAMAIN K.RIDA	First Issue
Rev.01	Z.OUACHICHA	Digital signature issue

Annex A. Test & System Description

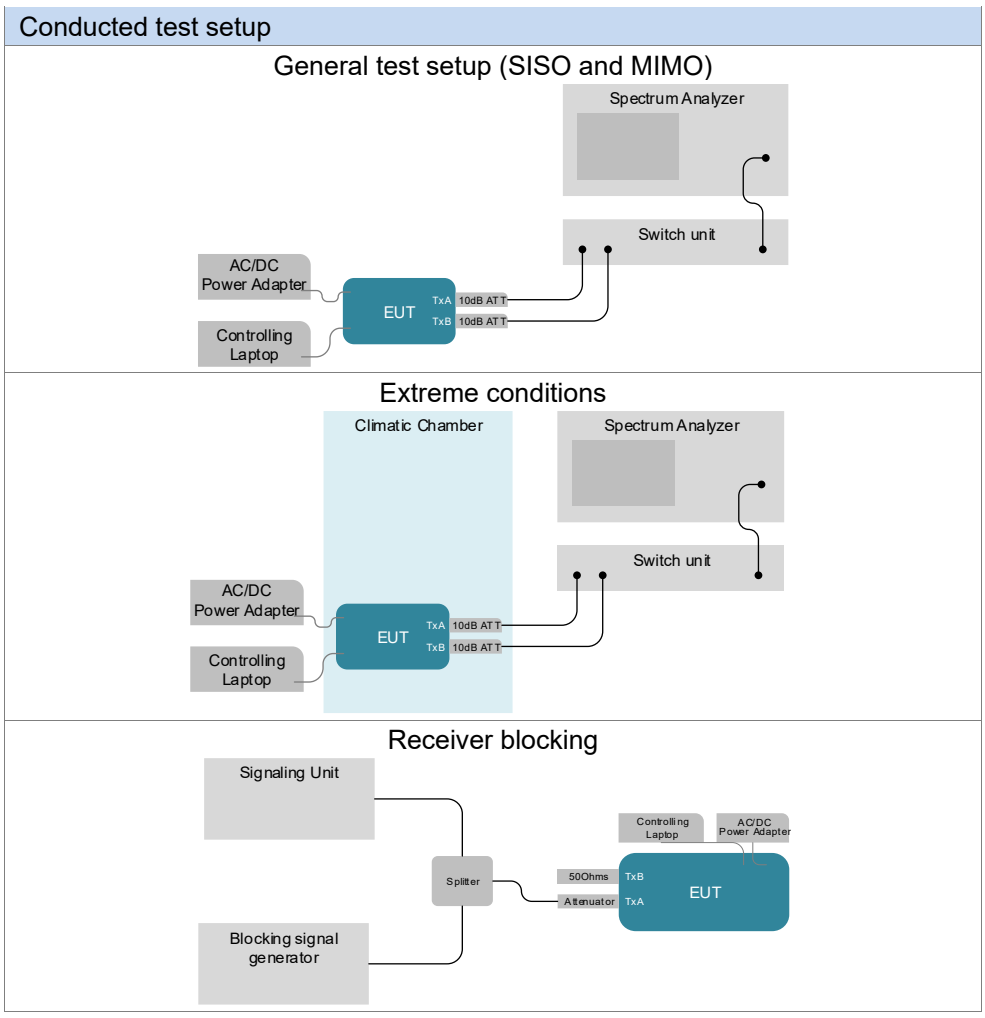
A.1 Measurement System

Bluetooth LE does not fulfill the FHSS requirements in clause §4.2.1. Instead, ETSI classifies Bluetooth LE as a system using DSSS modulation. Measurements were performed using the following setups and made in accordance to the general provisions of EN300 328 v2.2.2 agreeing to the requirements for DSSS modulation.

Rohde & Schwarz TS8997 system with the switching unit OSP120, OSP B-157 and software EMC32 were employed.

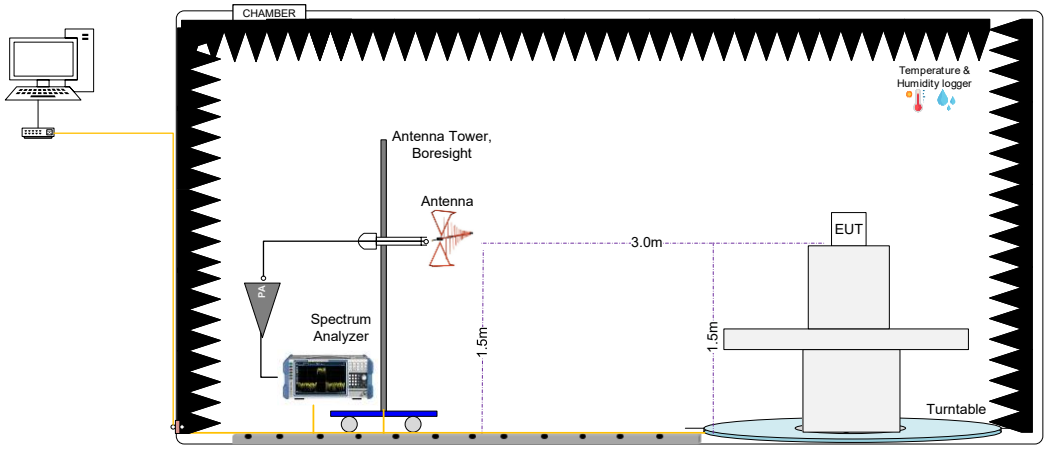
The DUT was installed in a test fixture and then connected to a laptop computer and AC/DC power adapter. The laptop computer was used to configure the EUT to continuously transmit at a specified output power using the Intel proprietary tool DRTU.

Setups for conducted and radiated measurements are shown below.

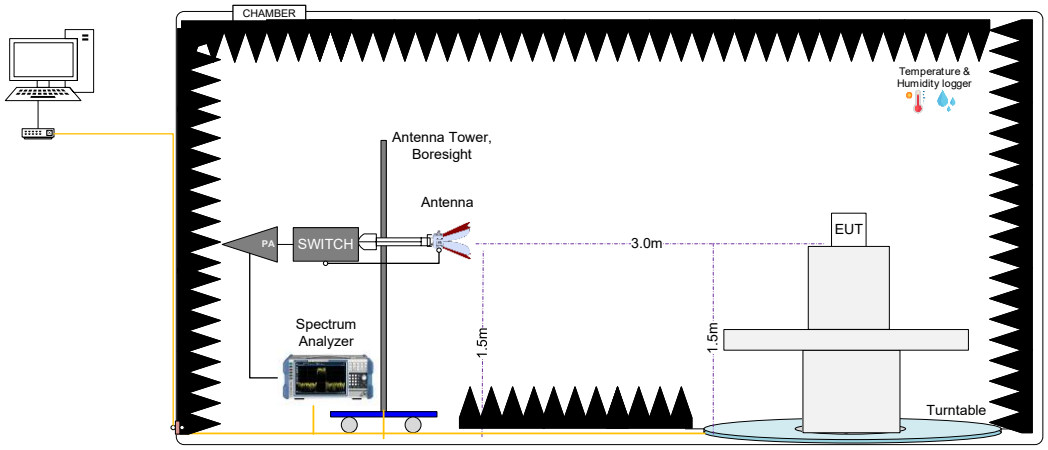


Radiated test setup

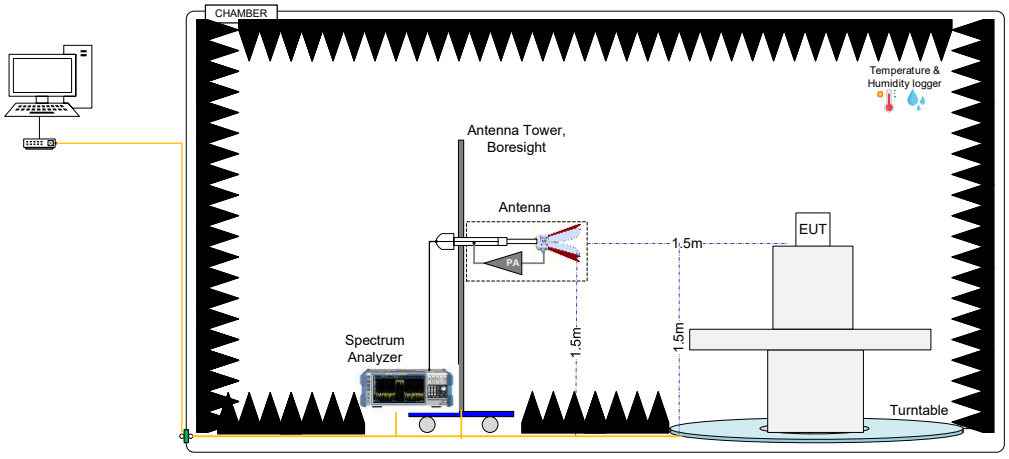
Radiated Setup 30 MHz - 1 GHz (Transmitter tests)



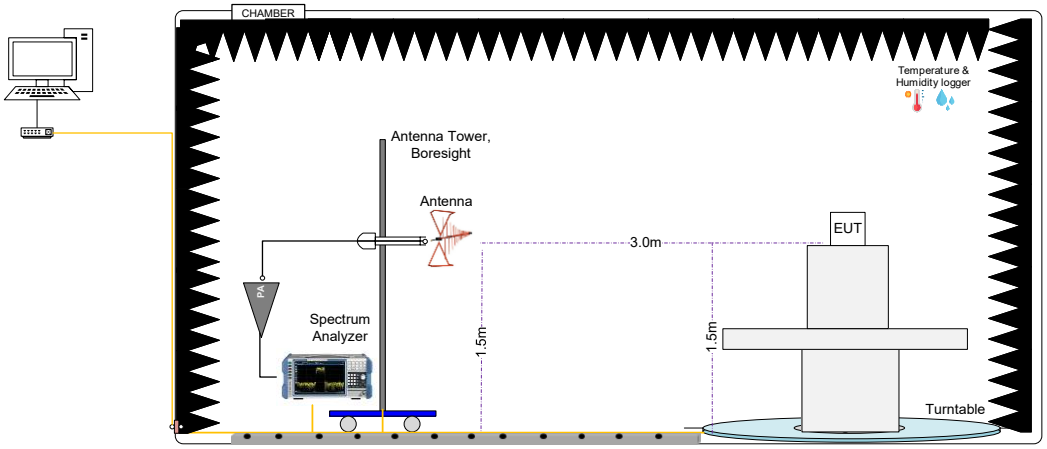
Radiated Setup 1 GHz – 11 GHz (Transmitter tests)



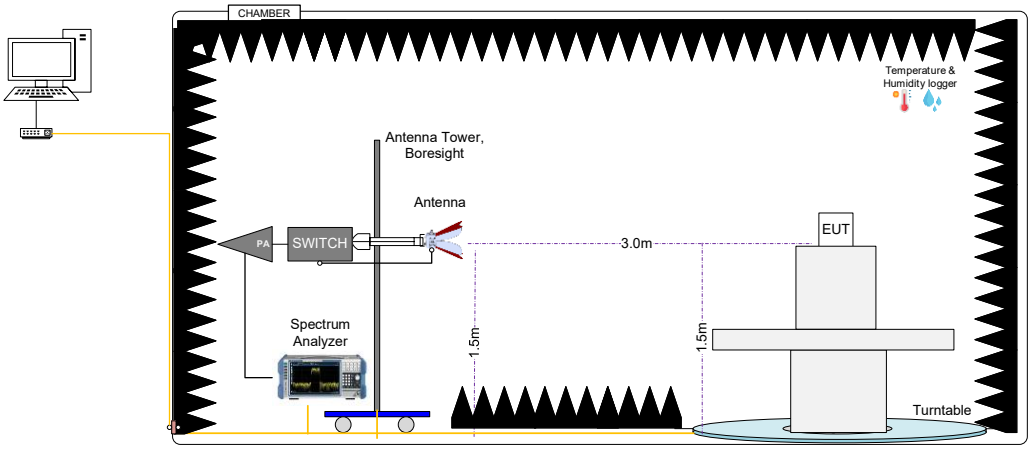
Radiated Setup 11 GHz – 12.75 GHz (Transmitter tests)



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

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

*Used from 12/06/2025 to 16/06/2025
**Used since 17/06/2025

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, duty cycle	T.GAMAIN
Power spectral density	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 %.	
5.1.2.2	The normal test voltage for the equipment shall be the nominal voltage for which the equipment was designed.	**"Information provided by the customer"**
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.	

B.2 RF output power

Test limits

ETSI clause	Limits
4.3.2.2.3	For non-adaptive non-FHSS equipment, where the manufacturer has declared an RF output power of less than 20 dBm e.i.r.p., the RF output power shall be equal to or less than that declared value. 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 in account and added by the software to the measurements. The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Results tables

RF Output Power						Normal Conditions Ambient Temparature +23°C		Extreme Conditions High Temparature +50°C		Extreme Conditions Low Temparature -10°C	
Mode	Rate	Duty cycle [%]	Channel	Freq [MHz]	Chain	Measured Conducted [dBm]	EIRP [dBm]	Measured Conducted [dBm]	EIRP [dBm]	Measured Conducted [dBm]	EIRP [dBm]
Bluetooth Low Energy	LE1M	60.40	0	2402	SISO A	6.90	9.90	6.50	9.50	6.50	9.50
					SISO B	6.90	9.90	6.70	9.70	6.60	9.60
		60.41			MIMO A	3.90	6.90	3.80	6.80	3.70	6.70
					MIMO B	3.80	6.80	3.90	6.90	3.80	6.80
		60.40	20	2442	SISO A	6.80	9.80	6.40	9.40	6.40	9.40
					SISO B	6.90	9.90	6.60	9.60	6.60	9.60
		60.41			MIMO A	3.80	6.80	3.80	6.80	3.60	6.60
					MIMO B	3.90	6.90	3.90	6.90	3.90	6.90
		60.39	39	2480	SISO A	6.90	9.90	6.50	9.50	6.50	9.50
					SISO B	6.90	9.90	6.50	9.50	6.50	9.50
		60.40			MIMO A	3.90	6.90	3.80	6.80	3.70	6.70
					MIMO B	3.90	6.90	3.80	6.80	3.90	6.90
	LE2M	56.97	0	2402	SISO A	6.90	9.90	6.50	9.50	6.40	9.40
					SISO B	6.90	9.90	6.70	9.70	6.50	9.50
		56.97			MIMO A	3.80	6.80	3.80	6.80	3.70	6.70
					MIMO B	3.90	6.90	3.90	6.90	3.70	6.70
		56.97	20	2442	SISO A	6.90	9.90	6.40	9.40	6.20	9.20
					SISO B	6.90	9.90	6.70	9.70	6.40	9.40
		56.96			MIMO A	3.90	6.90	3.80	6.80	3.60	6.60
					MIMO B	3.90	6.90	3.80	6.80	3.80	6.80
		56.97	39	2480	SISO A	6.90	9.90	6.50	9.50	6.30	9.30
					SISO B	6.90	9.90	6.50	9.50	6.40	9.40
		56.97			MIMO A	3.90	6.90	3.80	6.80	3.50	6.50
					MIMO B	3.90	6.90	3.70	6.70	3.70	6.70
Bluetooth High Data Throughput	HDT2	85.41	0	2402	SISO A	6.70	9.70	6.50	9.50	6.50	9.50
					SISO B	6.70	9.70	6.70	9.70	6.60	9.60
		85.41			MIMO A	3.90	6.90	3.70	6.70	3.70	6.70
					MIMO B	3.80	6.80	3.90	6.90	3.80	6.80
		85.41	20	2442	SISO A	6.80	9.80	6.40	9.40	6.30	9.30
					SISO B	6.80	9.80	6.70	9.70	6.60	9.60
		85.41			MIMO A	3.90	6.90	3.70	6.70	3.60	6.60
					MIMO B	4.00	7.00	3.90	6.90	3.80	6.80
		85.41	39	2480	SISO A	6.99	9.99	6.50	9.50	6.50	9.50
					SISO B	6.80	9.80	6.60	9.60	6.50	9.50
		85.41			MIMO A	3.90	6.90	3.70	6.70	3.60	6.60
					MIMO B	4.00	7.00	3.80	6.80	3.70	6.70

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 setup shown in section *Test & System Description* was used to measure the power spectral density (PSD) accordingly to the test method described in ETSI EN 300 328 v2.2.2 §5.4.3.2.1. 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 to measure all parameters.

Antenna gain is taken in account and added by the software to the measurements. The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Results tables

Mode	Rate	Channel	Freq [MHz]	Chain	EIRP PSD [dBm]
Bluetooth Low Energy	LE1M	0	2402	SISO A	9.88
				SISO B	9.80
				MIMO A	6.88
				MIMO B	6.79
		20	2442	SISO A	9.75
				SISO B	9.81
				MIMO A	6.78
				MIMO B	6.82
		39	2480	SISO A	9.81
				SISO B	9.81
				MIMO A	6.82
				MIMO B	6.85
	LE2M	0	2402	SISO A	8.77
				SISO B	8.72
				MIMO A	5.67
				MIMO B	5.71
		20	2442	SISO A	8.66
				SISO B	8.73
				MIMO A	5.82
				MIMO B	5.74
		39	2480	SISO A	8.71
				SISO B	8.76
				MIMO A	5.75
				MIMO B	5.78
Bluetooth High Data Throughput	HDT2	0	2402	SISO A	6.92
				SISO B	7.02
				MIMO A	4.13
				MIMO B	4.09
		20	2442	SISO A	7.05
				SISO B	7.03
				MIMO A	4.13
				MIMO B	4.20
		39	2480	SISO A	7.24
				SISO B	7.07
				MIMO A	4.16
				MIMO B	4.24

B.4 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

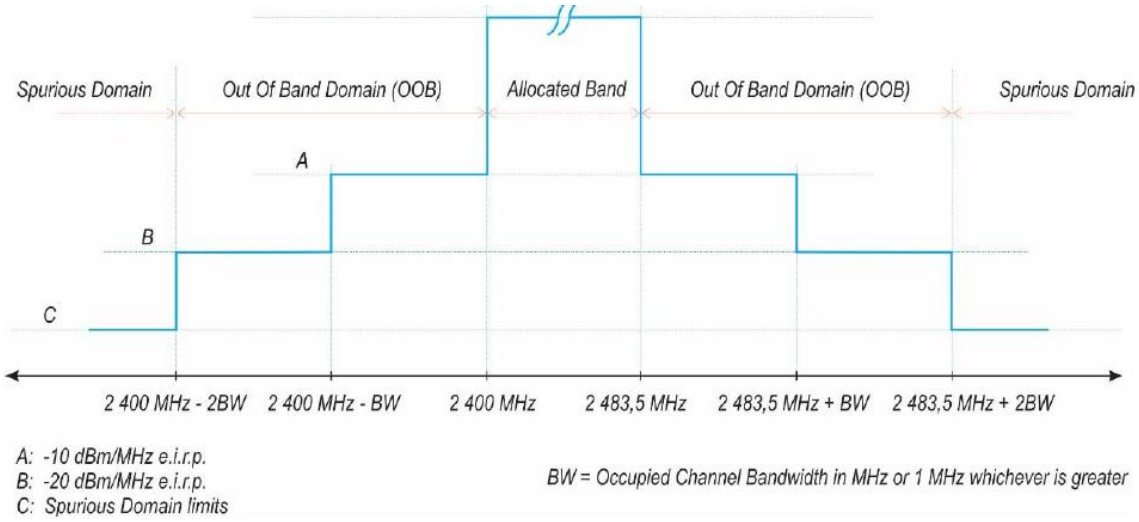
The conducted setup shown in section *Test & System Description* was used to measure the occupied bandwidth accordingly to the test method described in ETSI EN 300 328 v2.2.2 §5.4.7.2.1. The antenna terminal of the EUT is connected to the OSP120 through a 10 dB attenuator and a cable, the spectrum analyzer is connected to the receiver port on the OSP. System connection cable loss is compensated by the EMC32 software on measured parameters.

Results tables

Mode	Rate	Channel	Freq [MHz]	Nominal Bandwidth [MHz]	Chain	99% Bandwidth [MHz]	Lowest Frequency [MHz]	Highest Frequency [MHz]
Bluetooth Low Energy	LE1M	0	2402	1	SISO A	1.04	2401.48	2402.52
					SISO B	1.03	2401.50	2402.53
					MIMO A	1.04	2401.49	2402.53
					MIMO B	1.03	2401.50	2402.53
		39	2480	1	SISO A	1.04	2479.48	2480.52
					SISO B	1.03	2479.50	2480.54
					MIMO A	1.03	2479.50	2480.53
					MIMO B	1.04	2479.49	2480.53
	LE2M	0	2402	2	SISO A	2.10	2400.95	2403.05
					SISO B	2.10	2400.95	2403.05
					MIMO A	2.10	2400.95	2403.05
					MIMO B	2.10	2400.95	2403.05
		39	2480	2	SISO A	2.10	2478.95	2481.05
					SISO B	2.10	2478.95	2481.05
					MIMO A	2.10	2479.95	2481.05
					MIMO B	2.10	2478.95	2481.50
Bluetooth High Data Throughput	HDT2	0	2402	2.5	SISO A	2.50	2400.75	2483.25
					SISO B	2.50	2400.75	2403.25
					MIMO A	2.50	2400.75	2403.25
					MIMO B	2.50	2400.75	2403.25
		39	2480	2.5	SISO A	2.50	2478.75	2483.25
					SISO B	2.50	2478.75	2481.25
					MIMO A	2.50	2478.75	2481.25
					MIMO B	2.50	2478.75	2481.25

B.5 Transmitter unwanted emission in the out-of-band domain

Test limits 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 setup shown in section *Test & System Description* was 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.

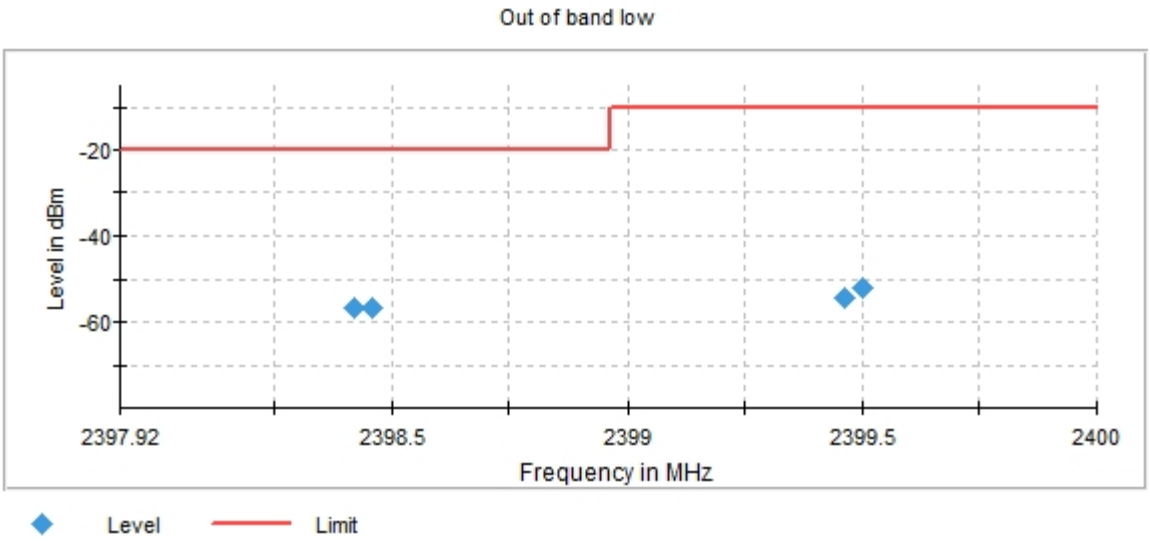
Antenna gain is taken into account and added by the software to the measurements.

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.

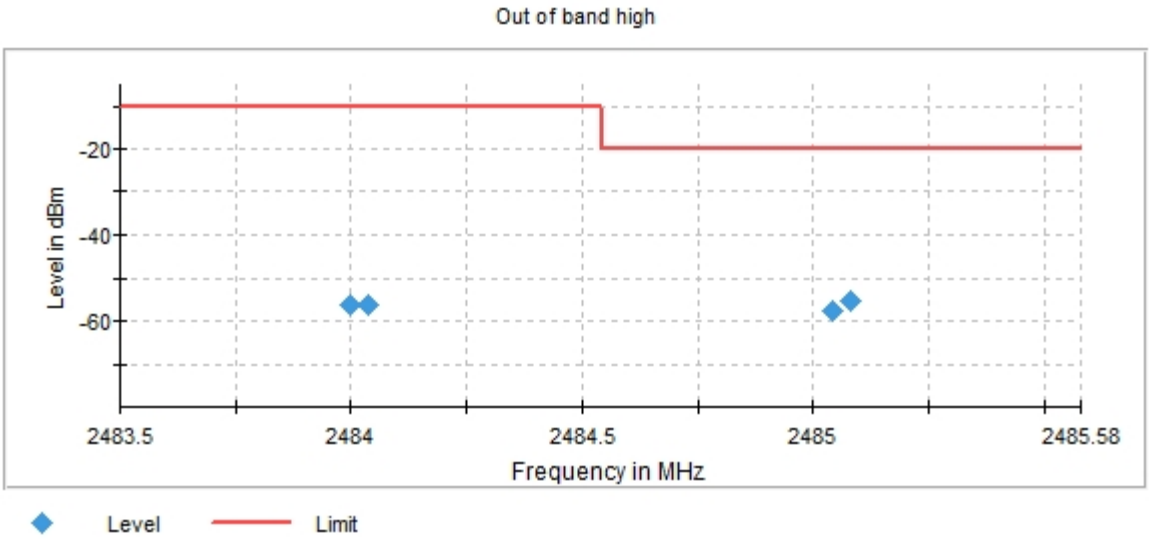
Results Screenshot

BLE – 1M - SISOA

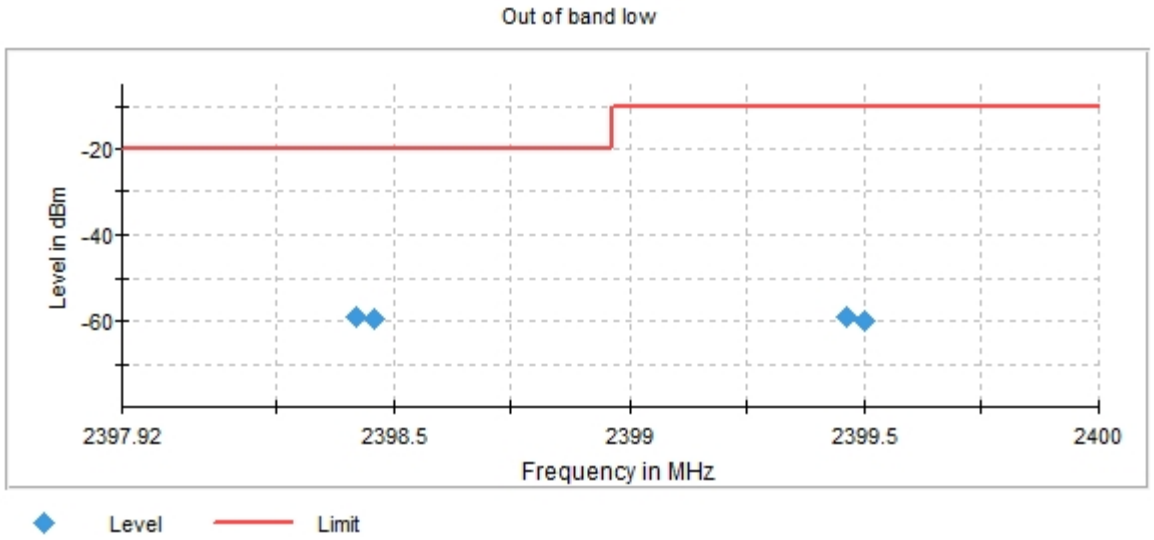
UNWANTED OOB Low Freq Section, 2402 MHz



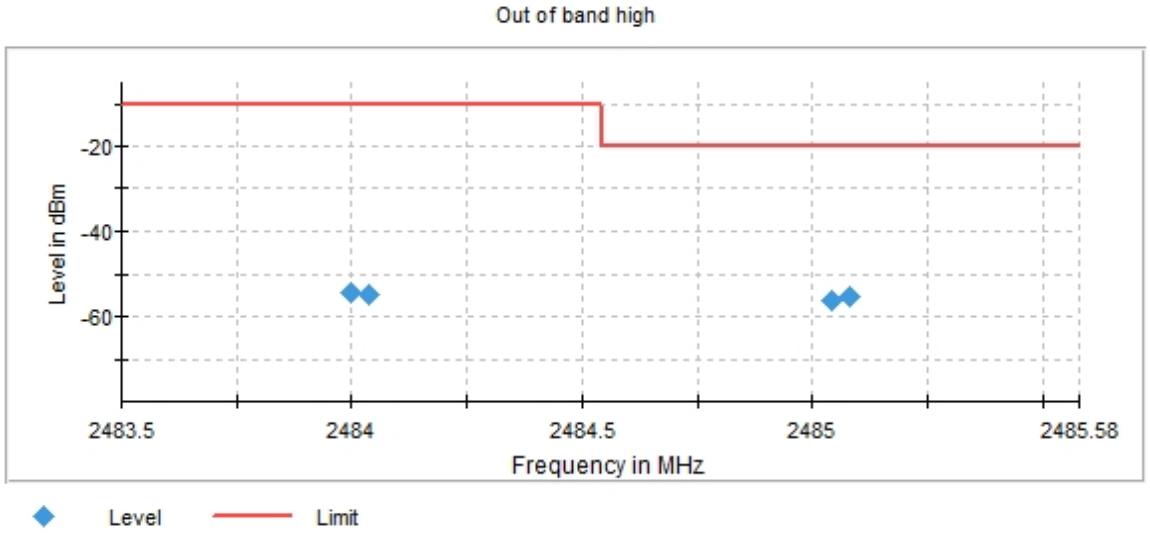
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

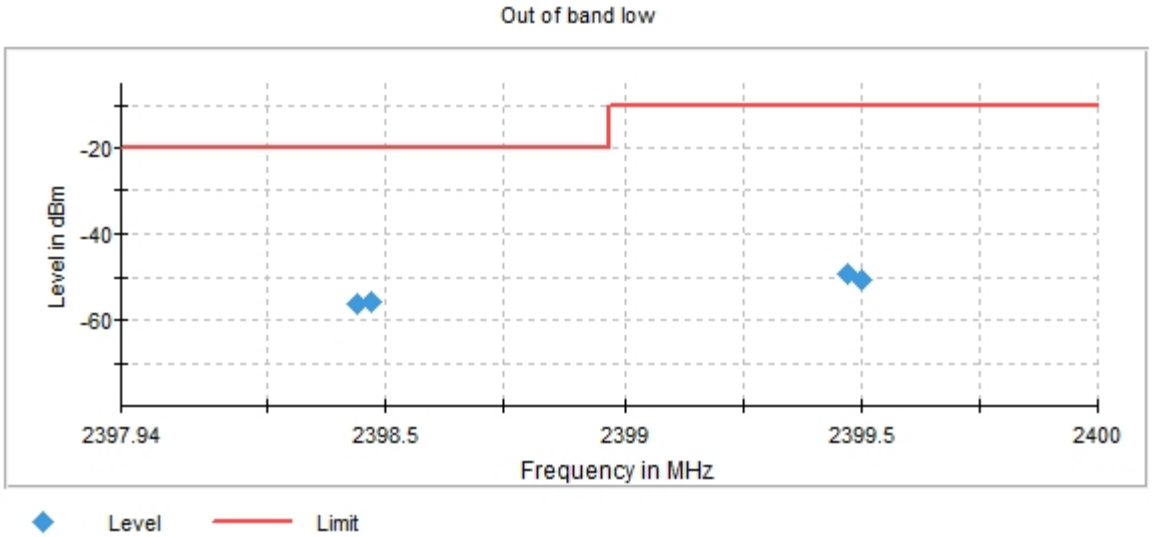


UNWANTED OOB High Freq Section, 2480 MHz

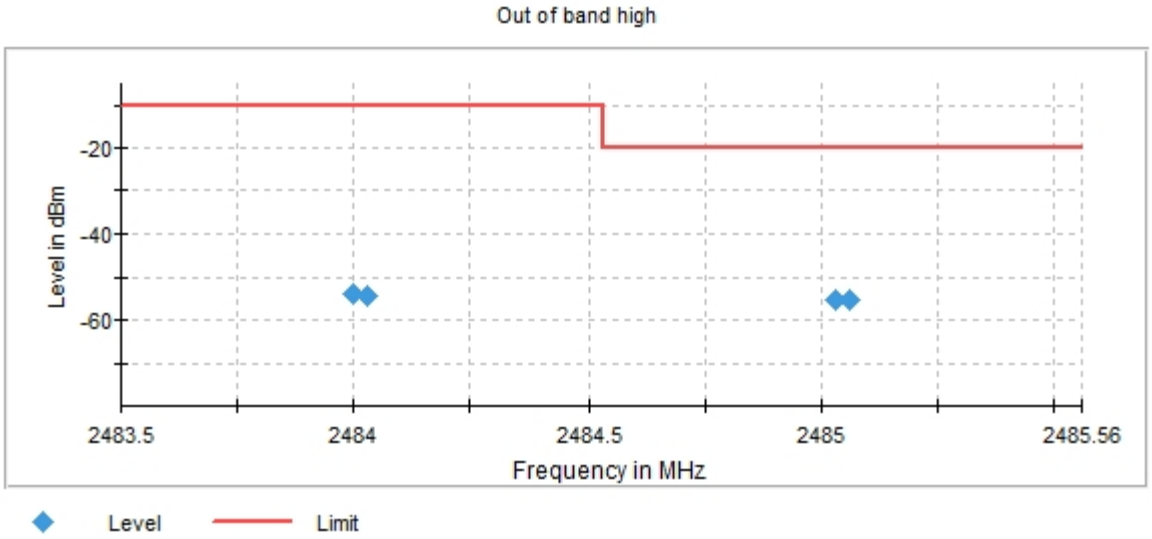


BLE – 1M - SISOB

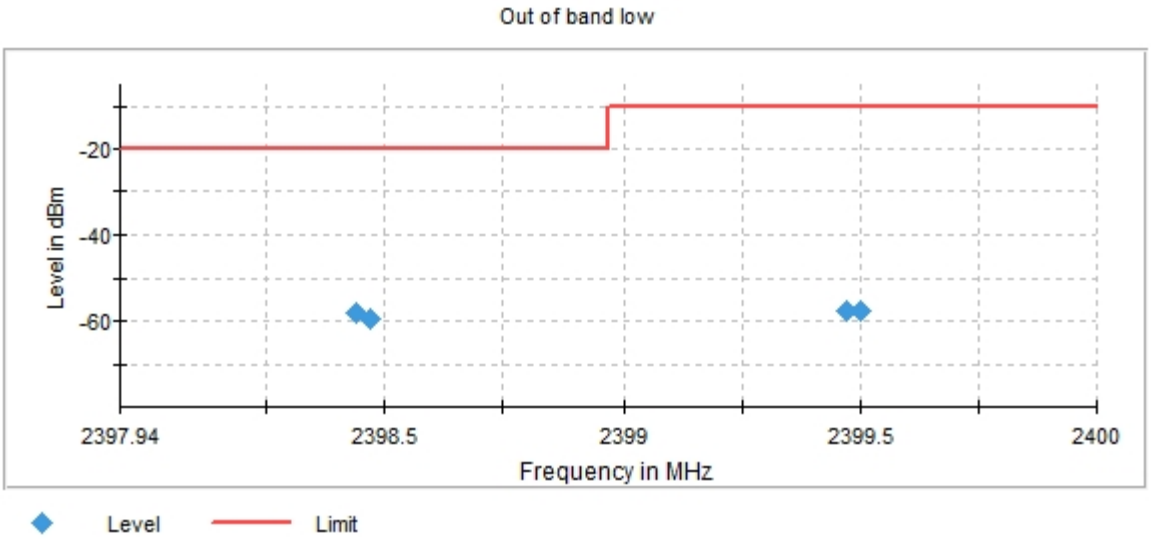
UNWANTED OOB Low Freq Section, 2402 MHz



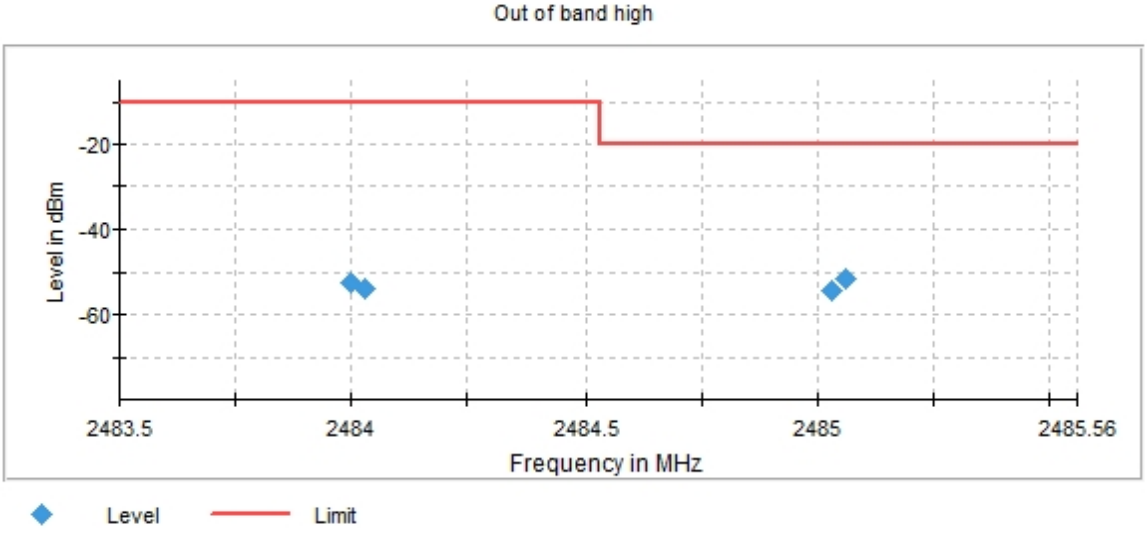
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

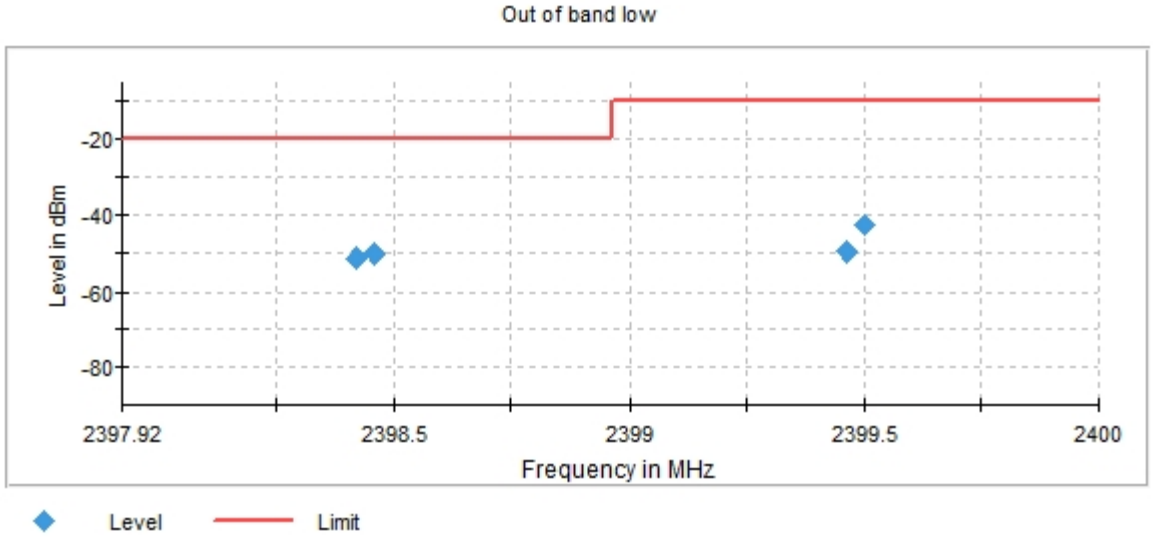


UNWANTED OOB High Freq Section, 2480 MHz

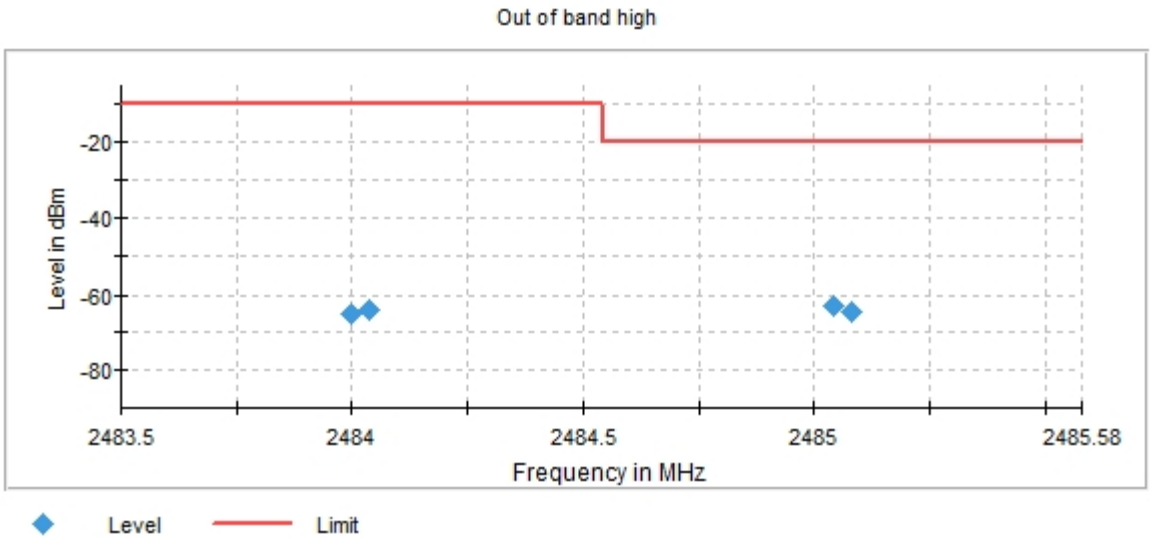


BLE – 1M - MIMOA

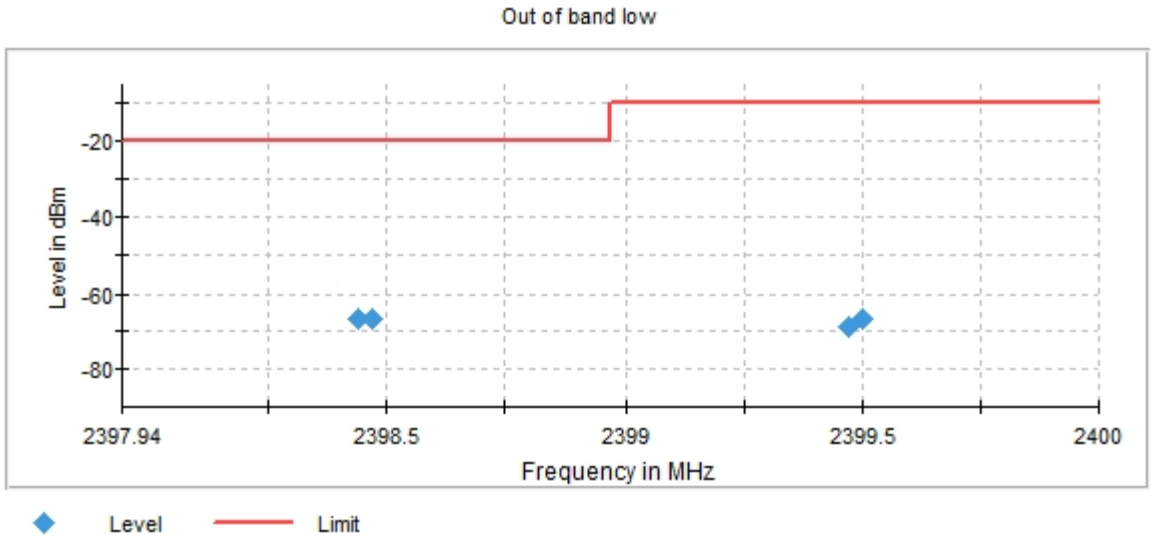
UNWANTED OOB Low Freq Section, 2402 MHz



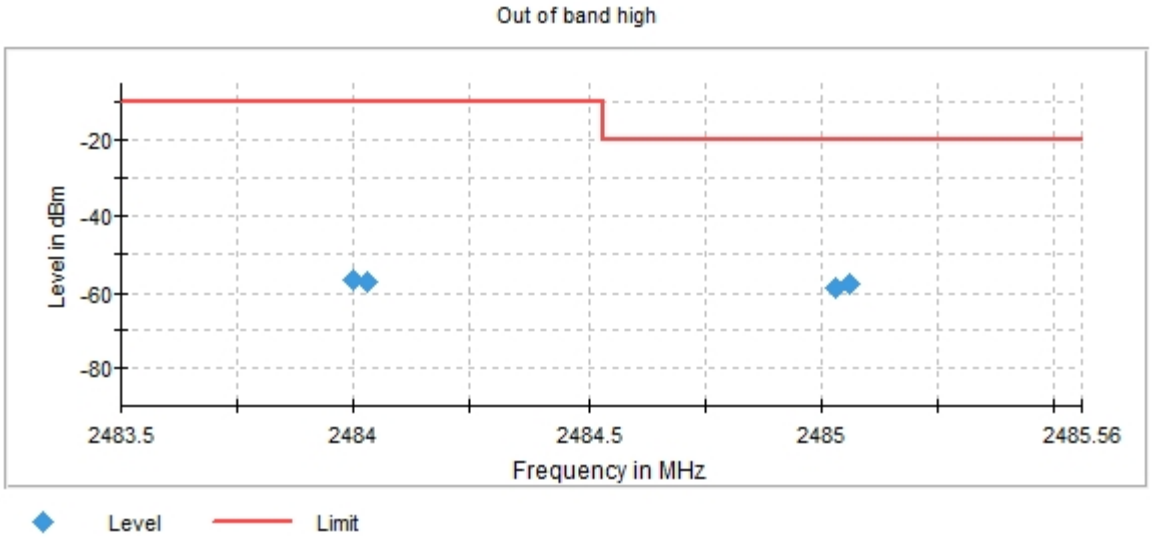
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

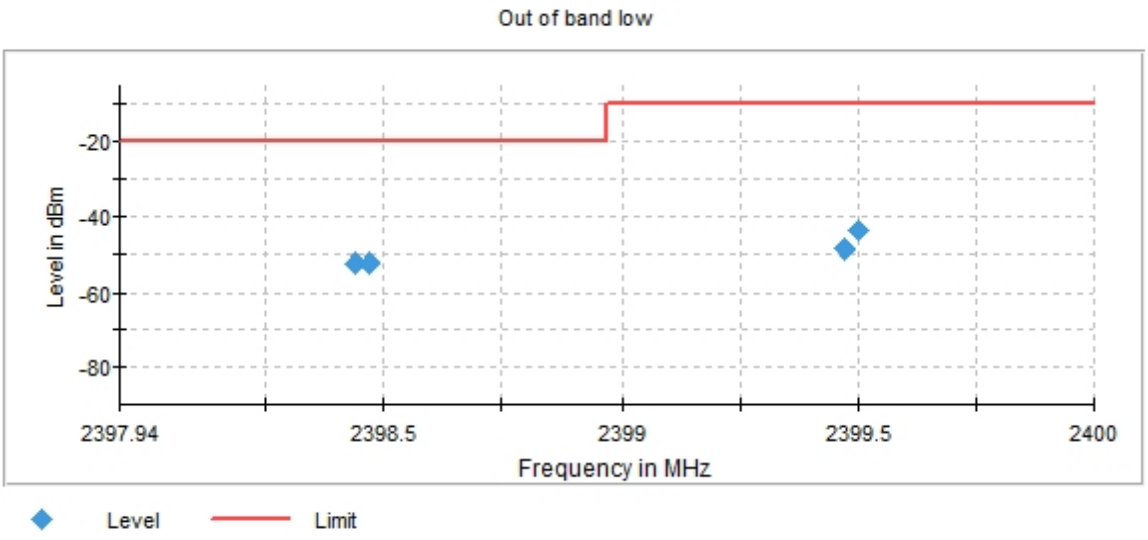


UNWANTED OOB High Freq Section, 2480 MHz

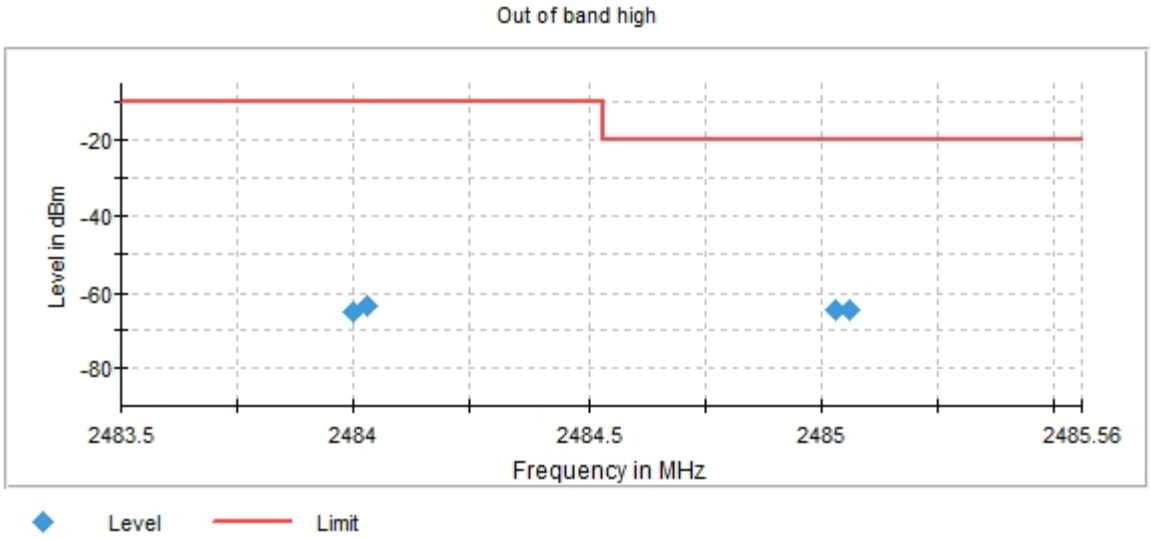


BLE – 1M - MIMOB

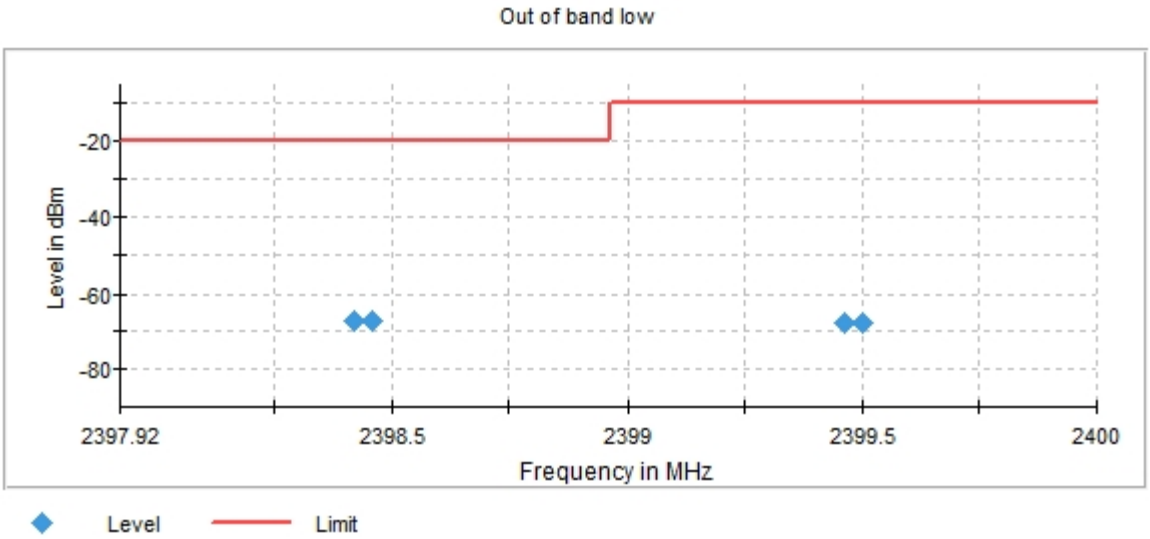
UNWANTED OOB Low Freq Section, 2402 MHz



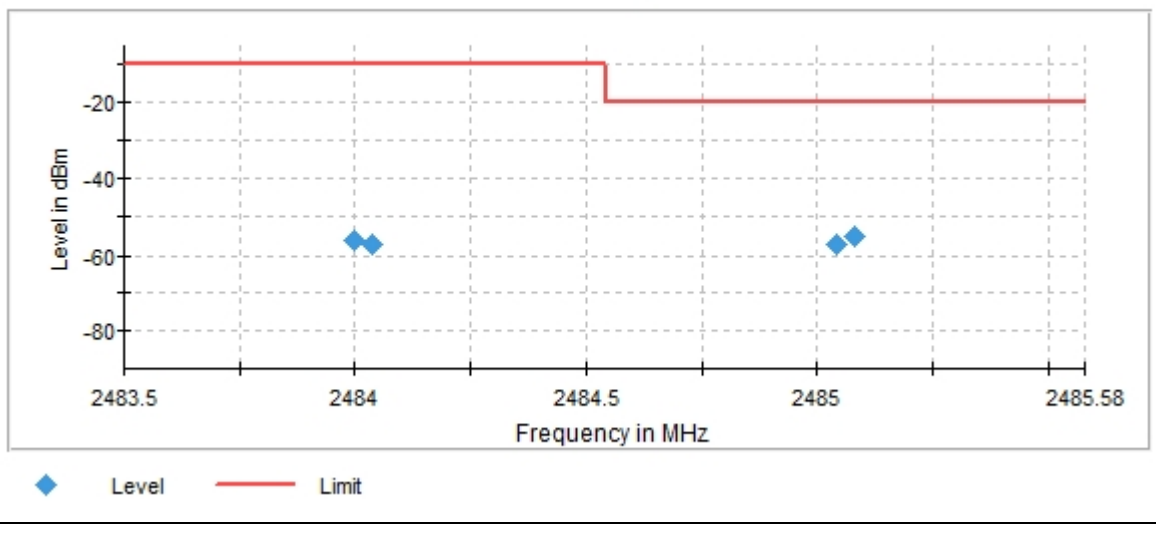
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

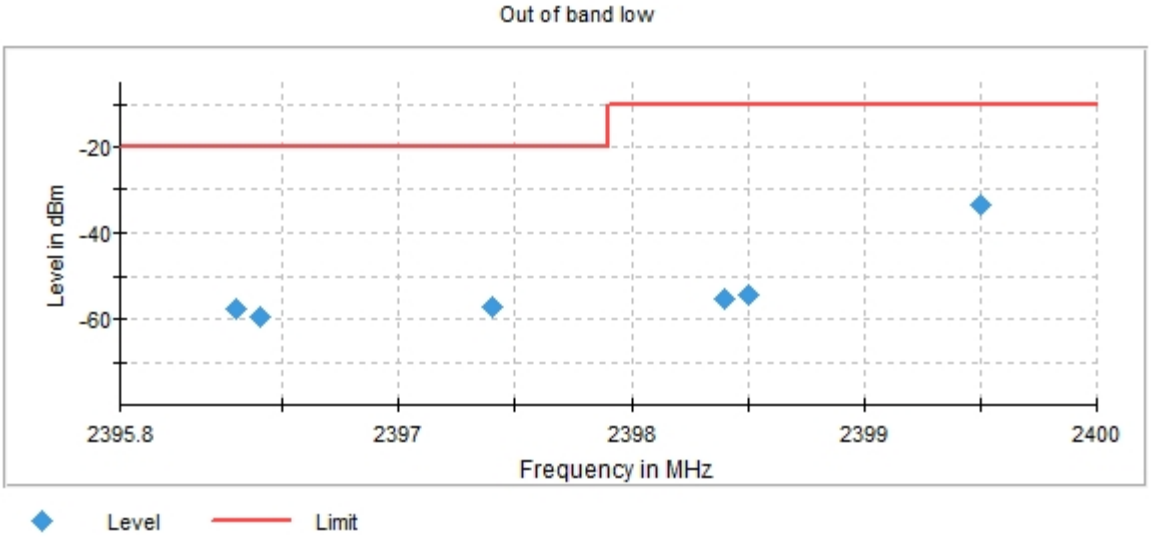


UNWANTED OOB High Freq Section, 2480 MHz

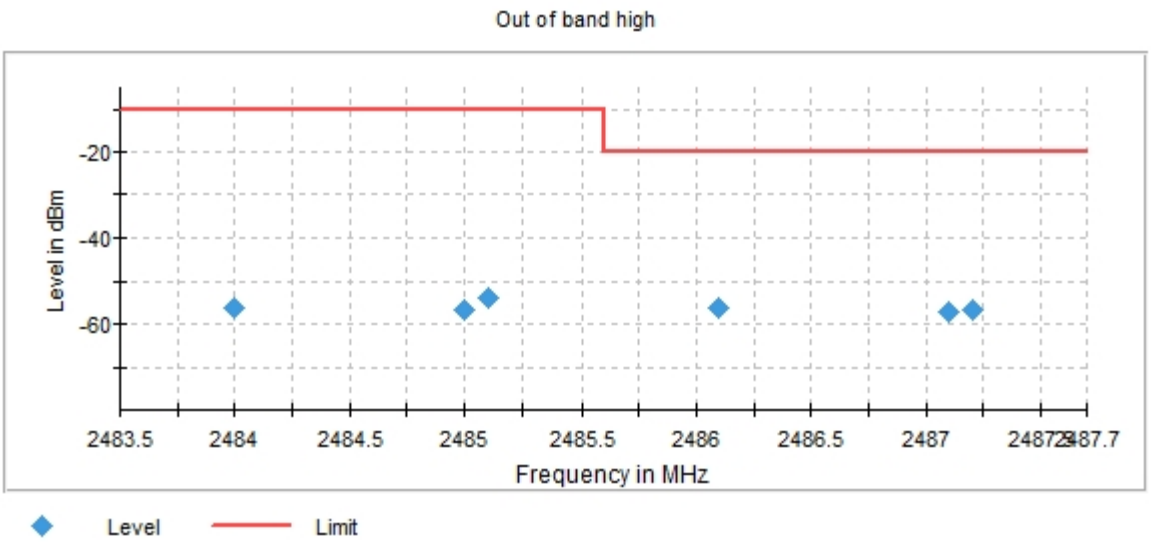


BLE – 2M - SISOA

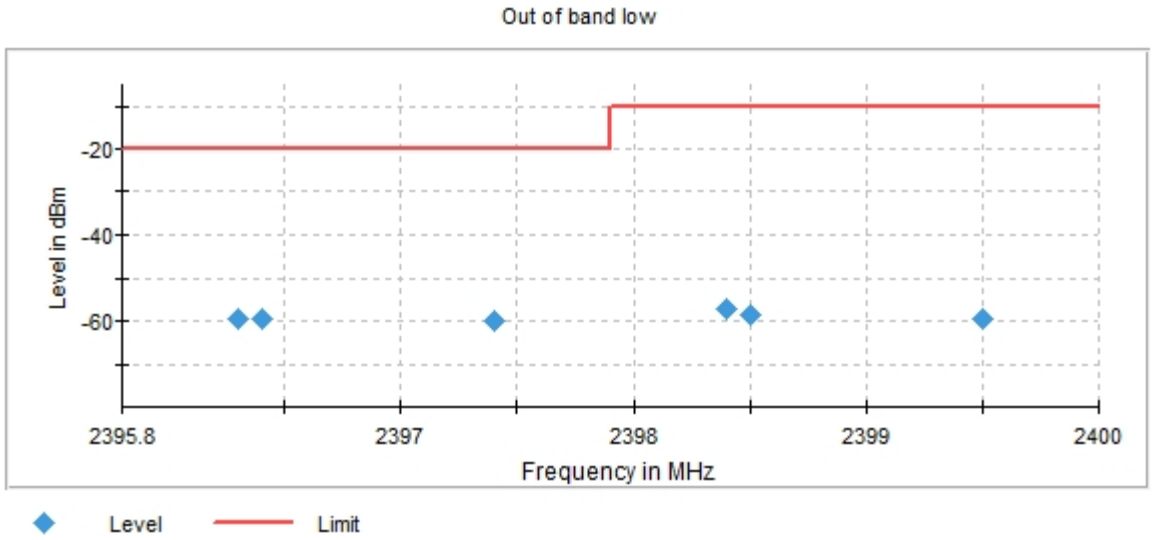
UNWANTED OOB Low Freq Section, 2402 MHz



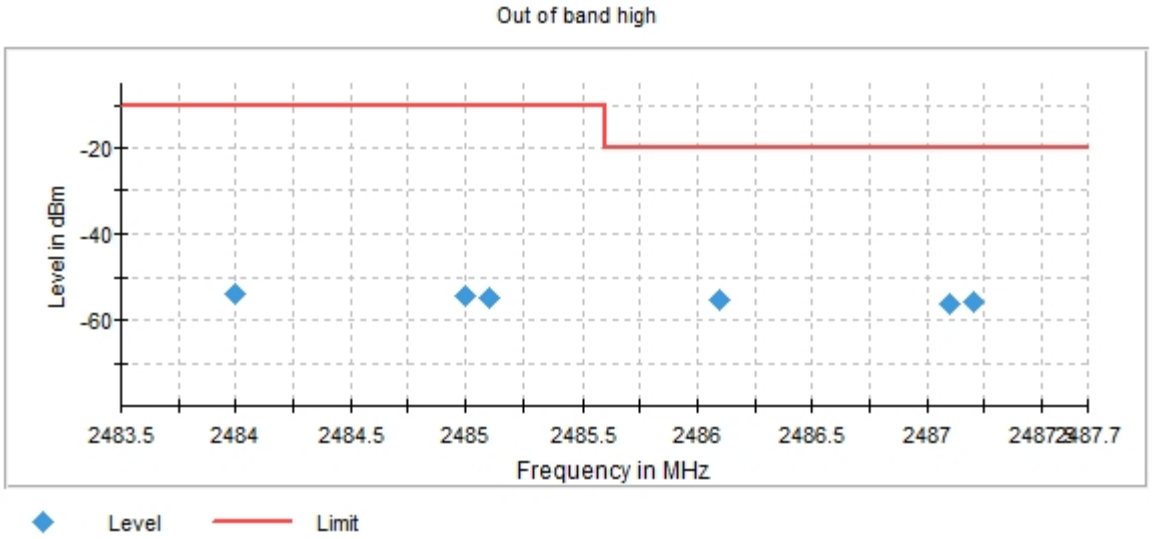
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

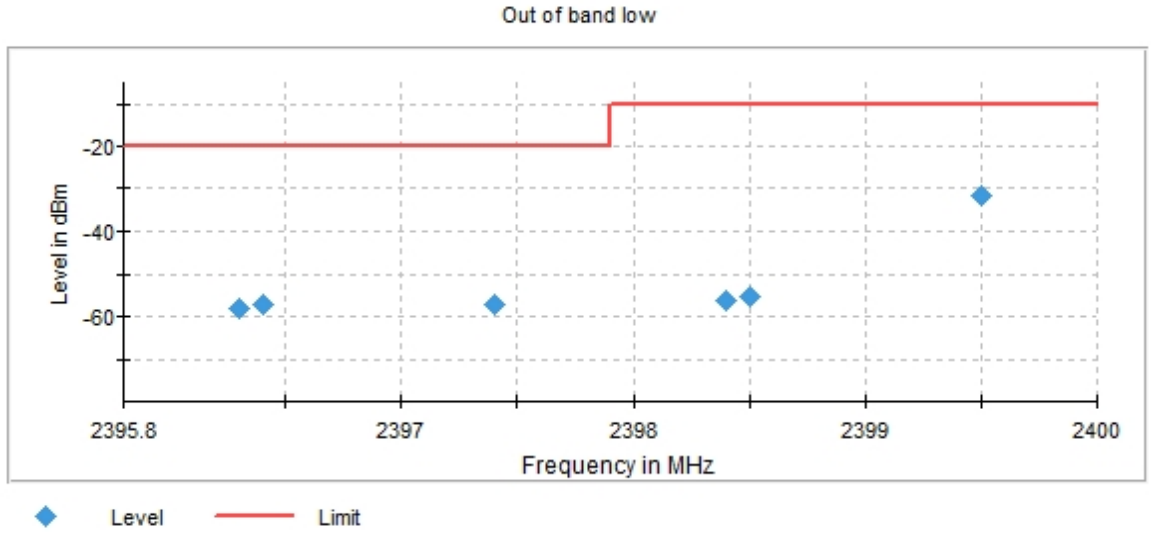


UNWANTED OOB High Freq Section, 2480 MHz

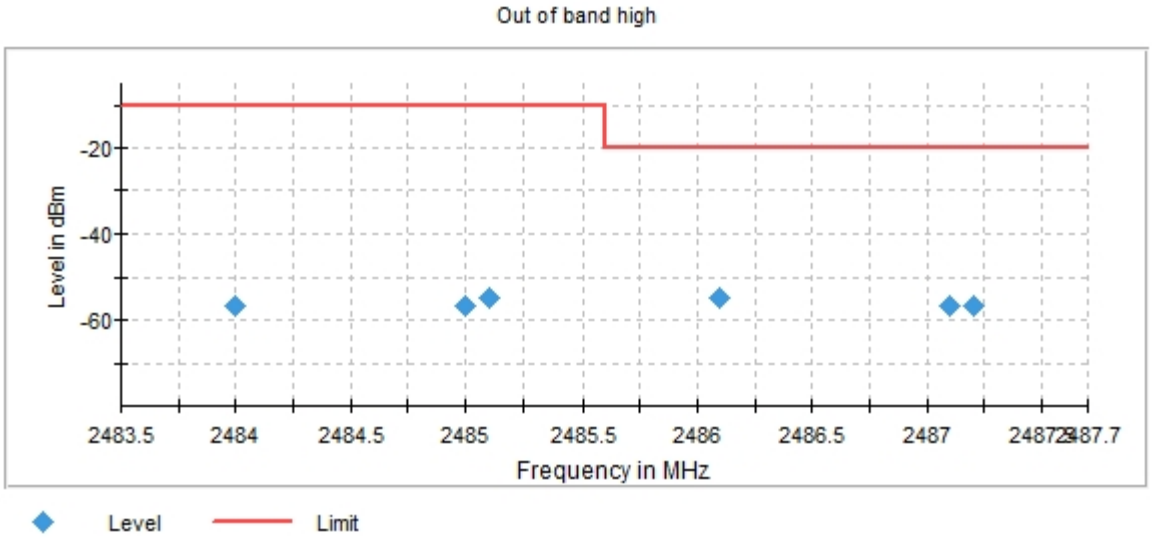


BLE – 2M - SISOB

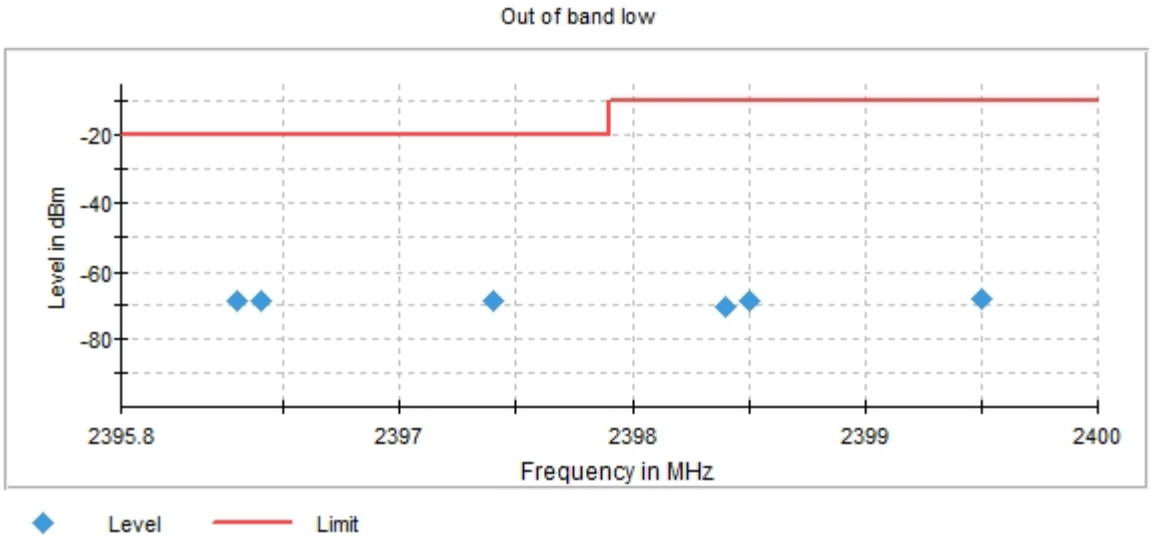
UNWANTED OOB Low Freq Section, 2402 MHz



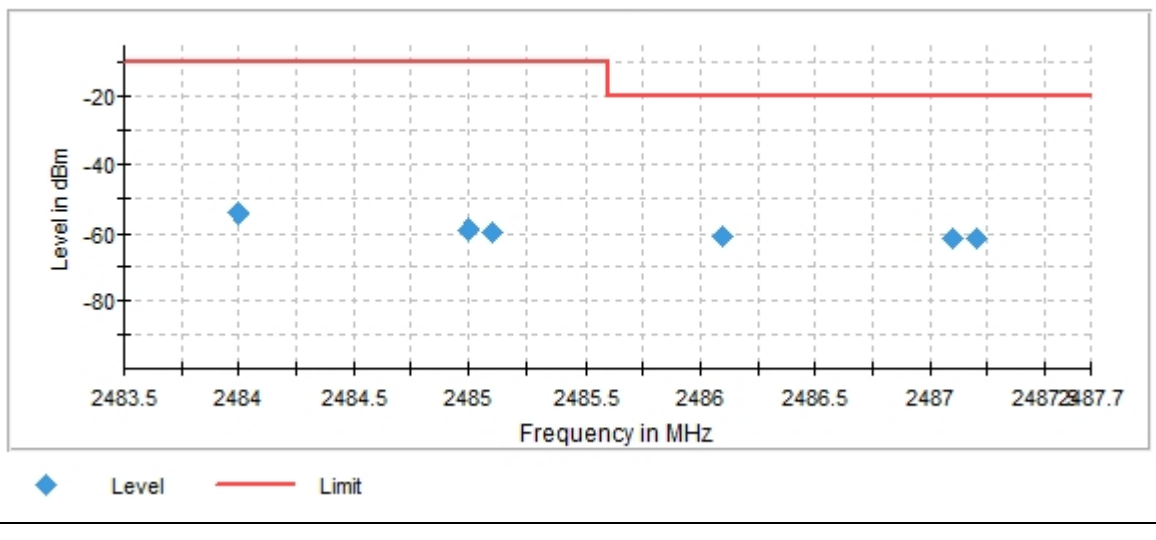
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

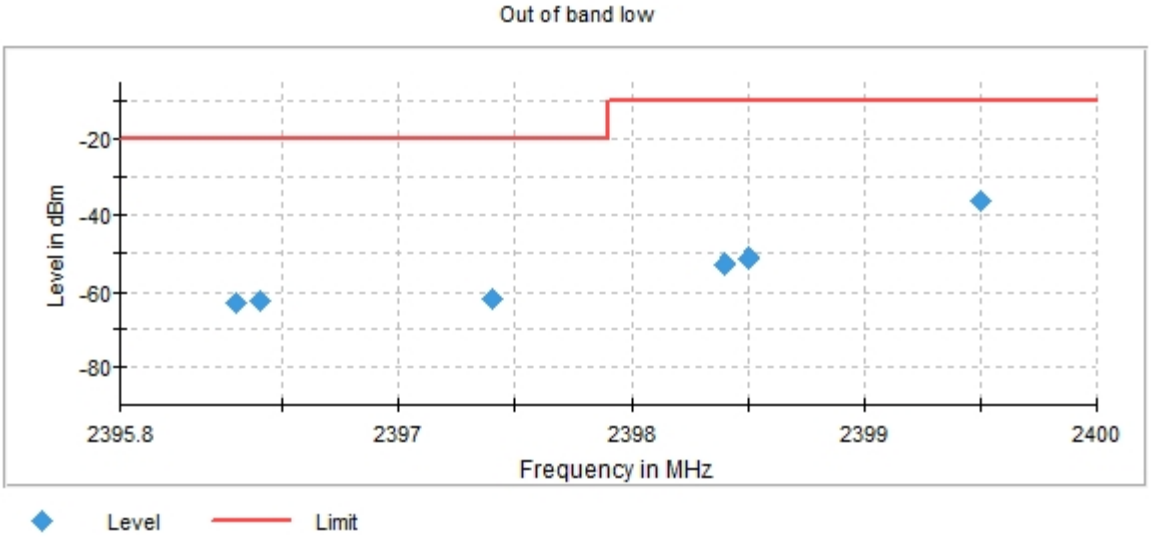


UNWANTED OOB High Freq Section, 2480 MHz

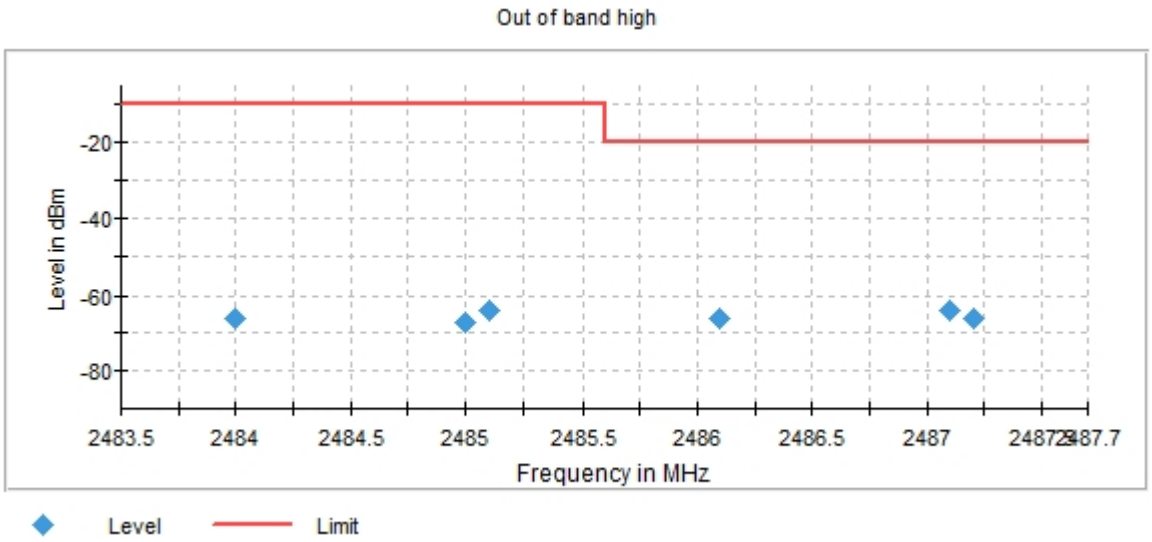


BLE – 2M - MIMOA

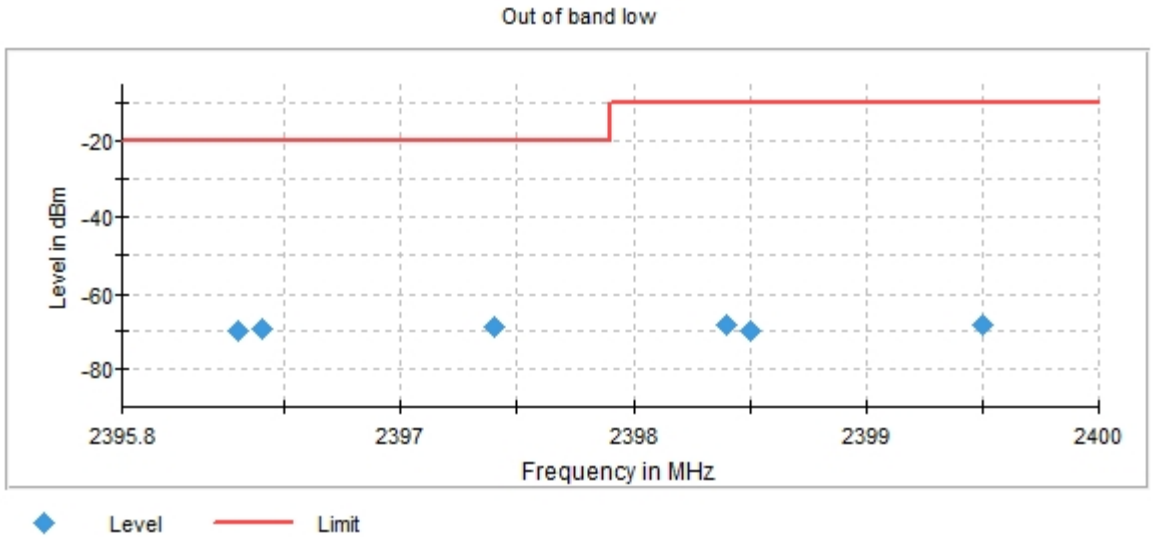
UNWANTED OOB Low Freq Section, 2402 MHz



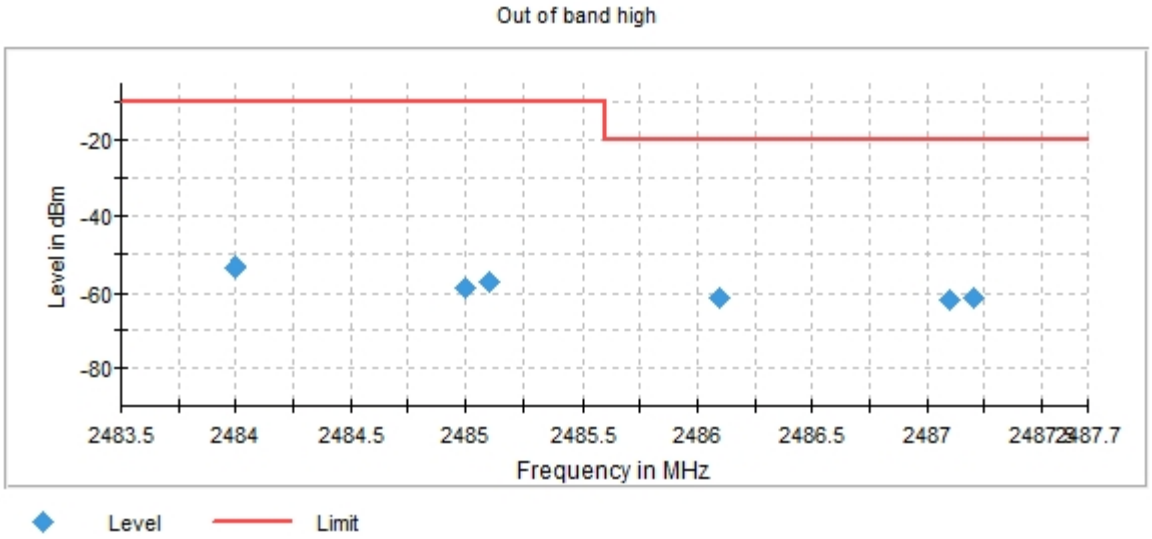
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

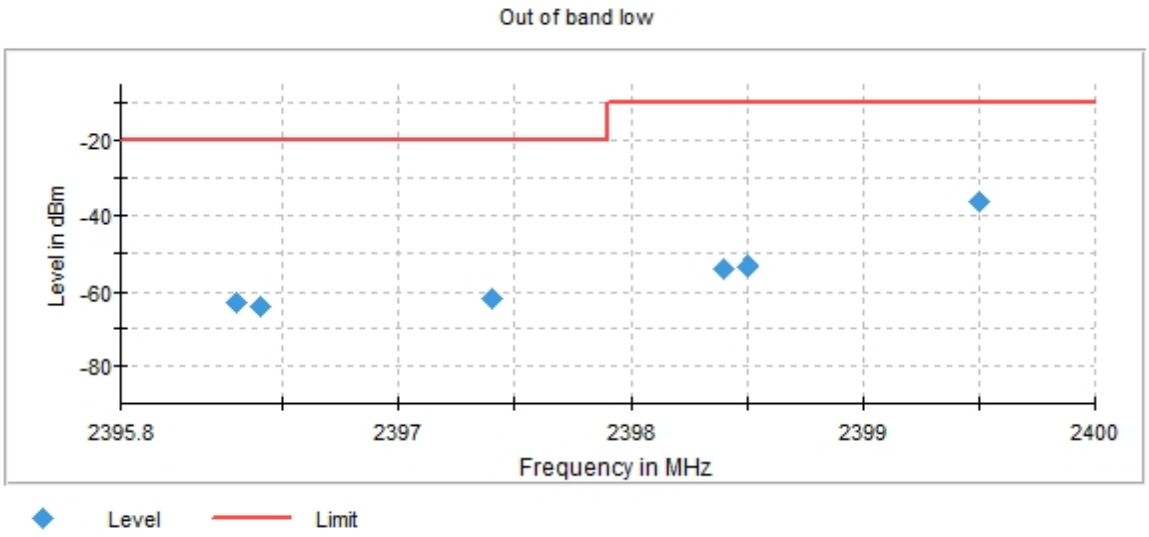


UNWANTED OOB High Freq Section, 2480 MHz

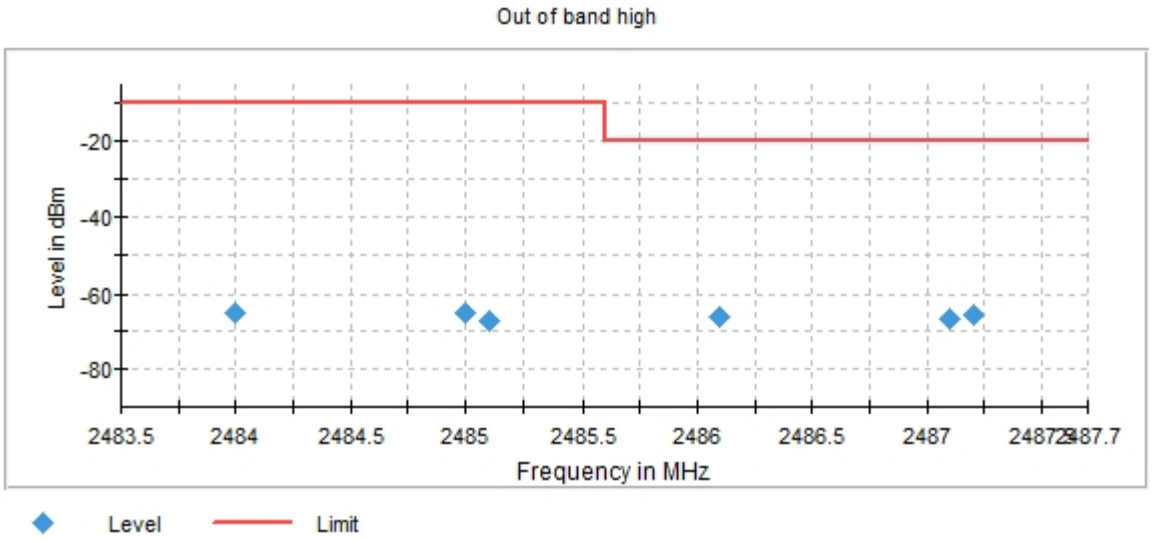


BLE – 2M - MIMOB

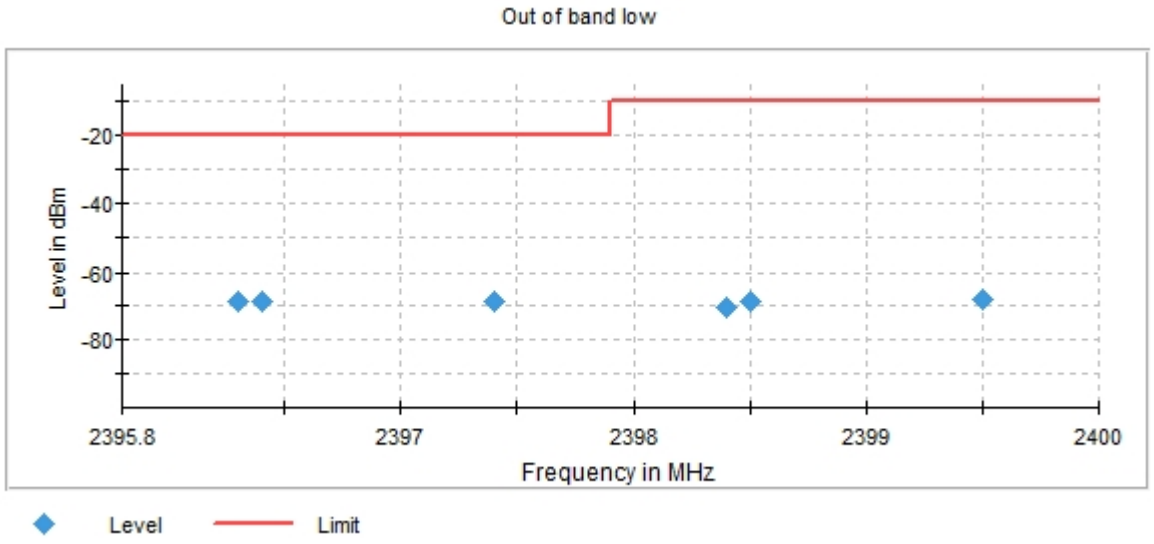
UNWANTED OOB Low Freq Section, 2402 MHz



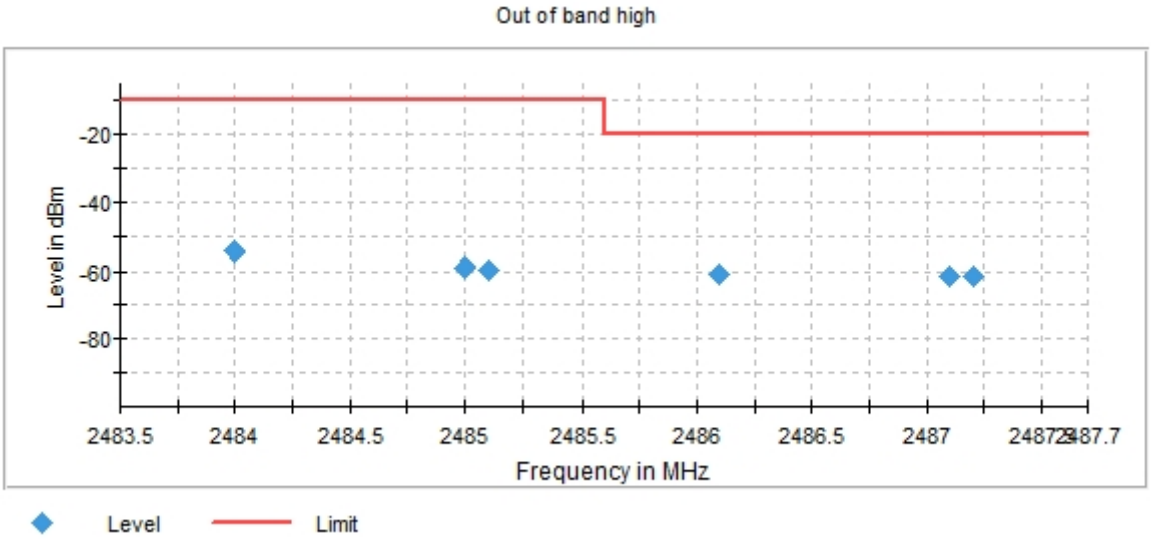
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

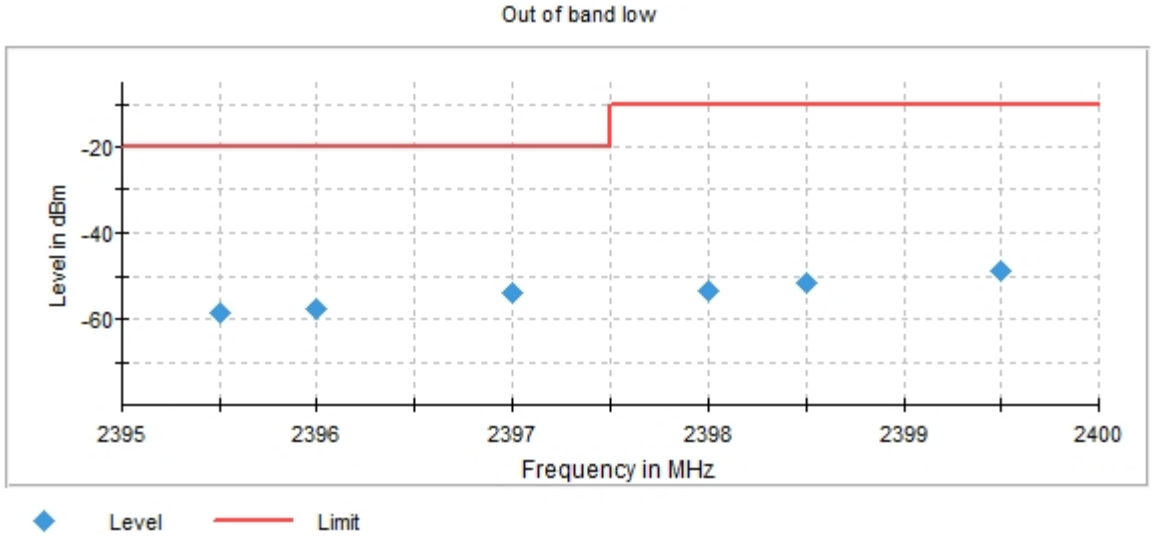


UNWANTED OOB High Freq Section, 2480 MHz

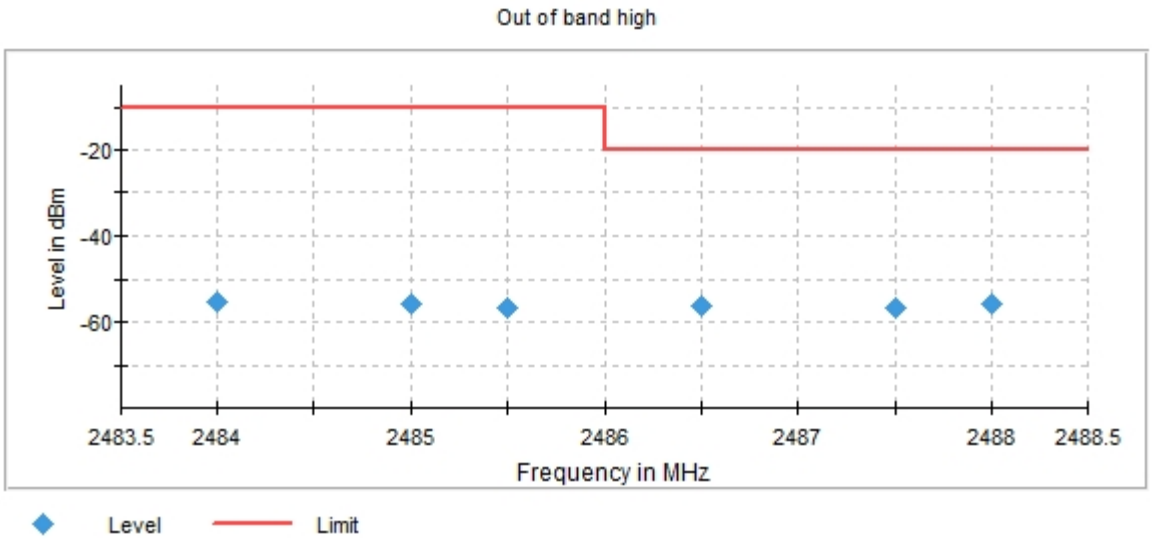


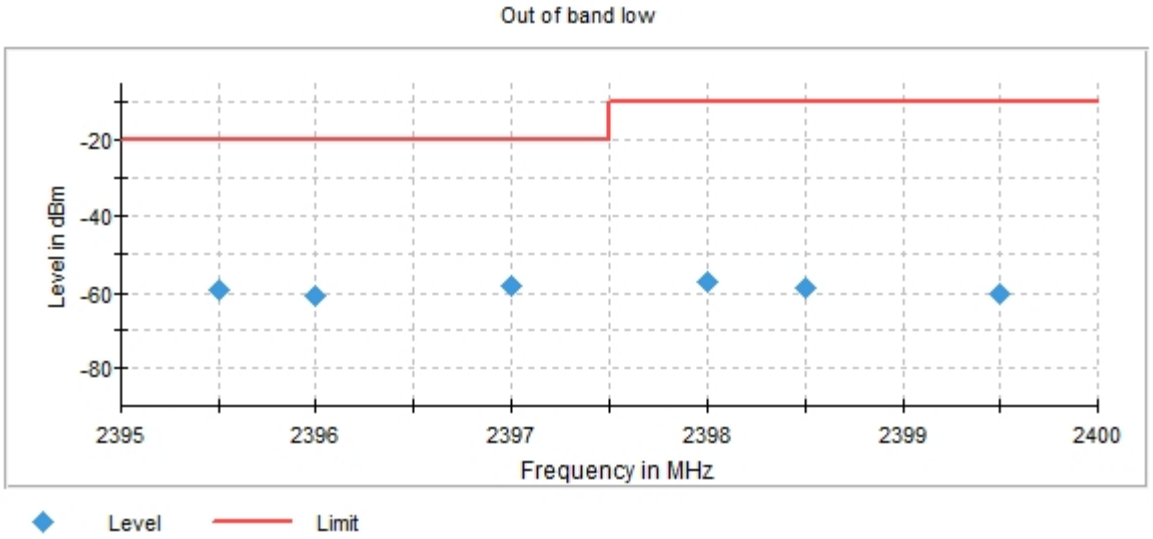
BLE – HDT2 - SISOA

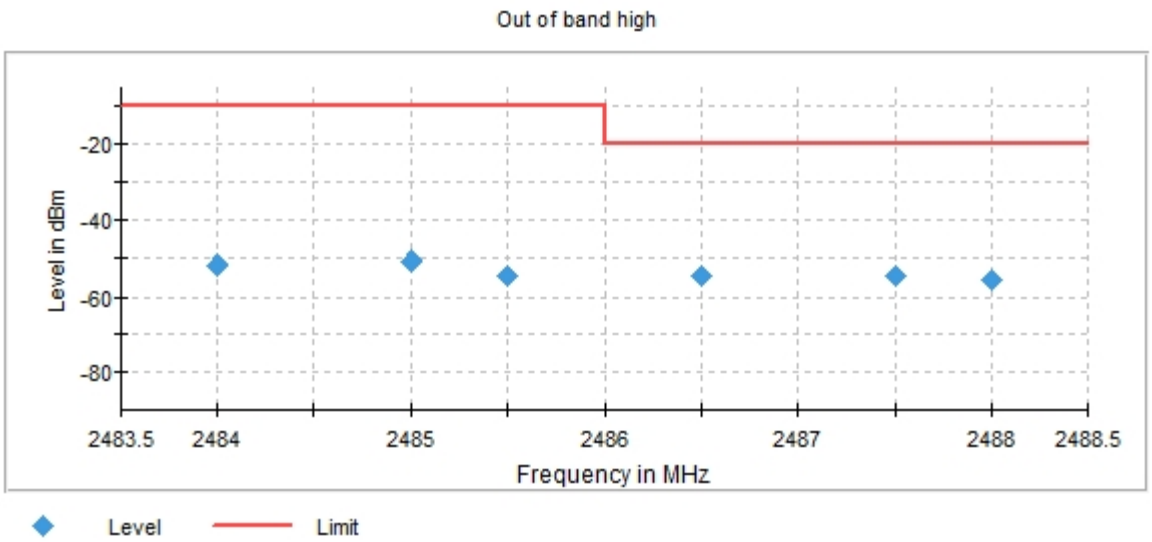
UNWANTED OOB Low Freq Section, 2402 MHz



UNWANTED OOB High Freq Section, 2402 MHz

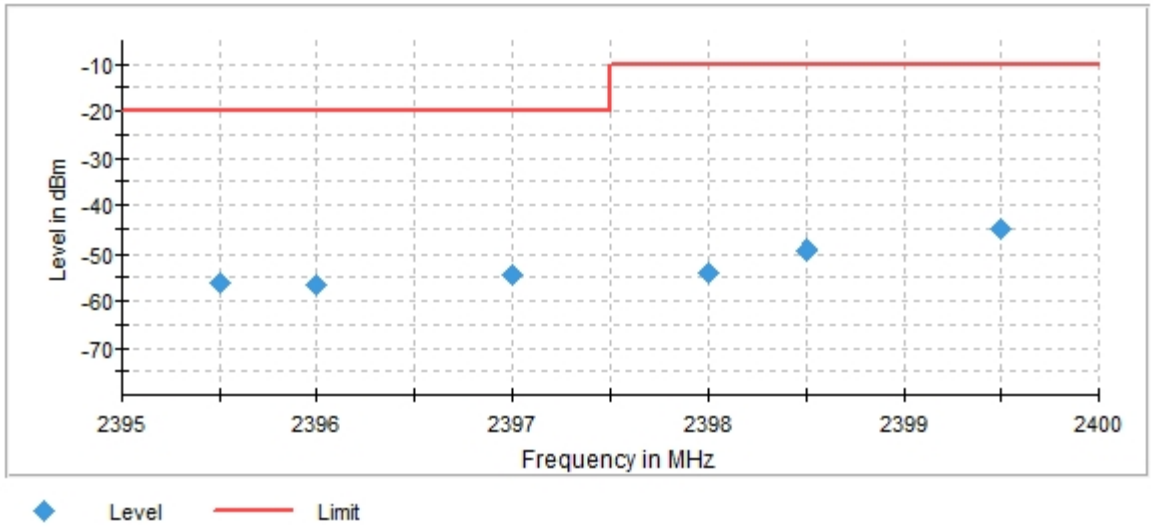


UNWANTED OOB Low Freq Section, 2480 MHz


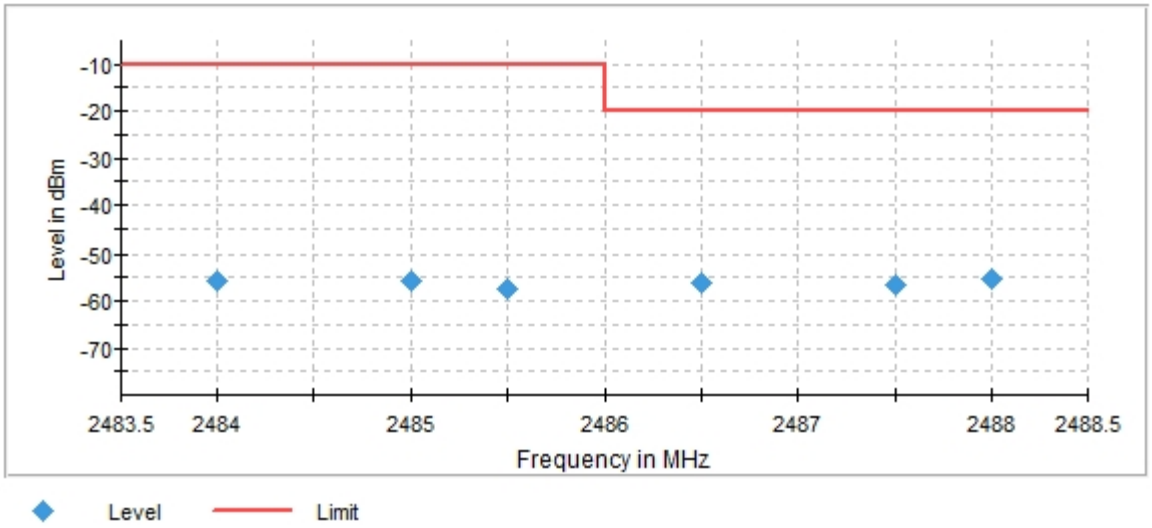
UNWANTED OOB High Freq Section, 2480 MHz


BLE – HDT2 - SISOB

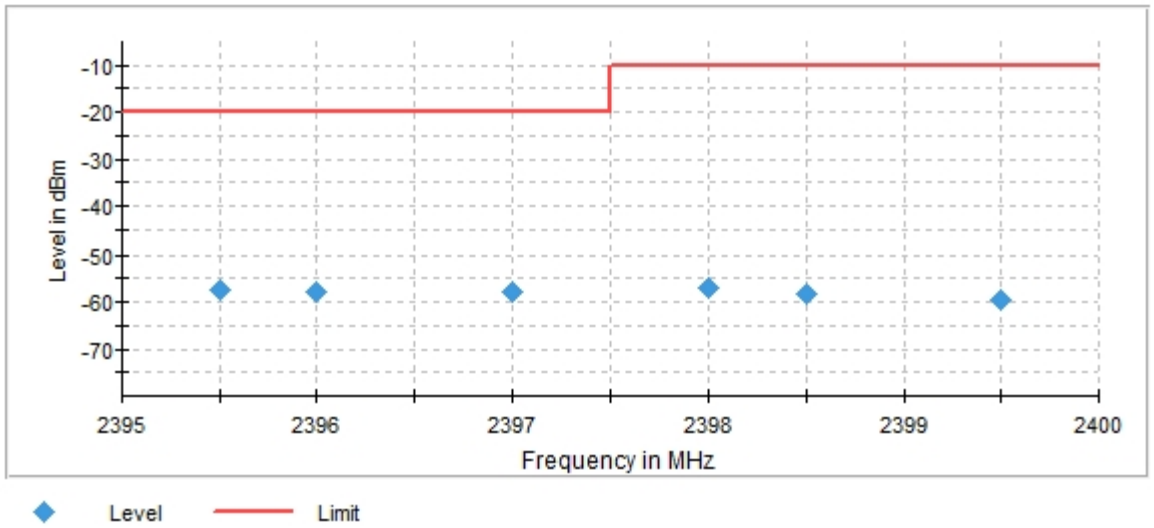
UNWANTED OOB Low Freq Section, 2402 MHz



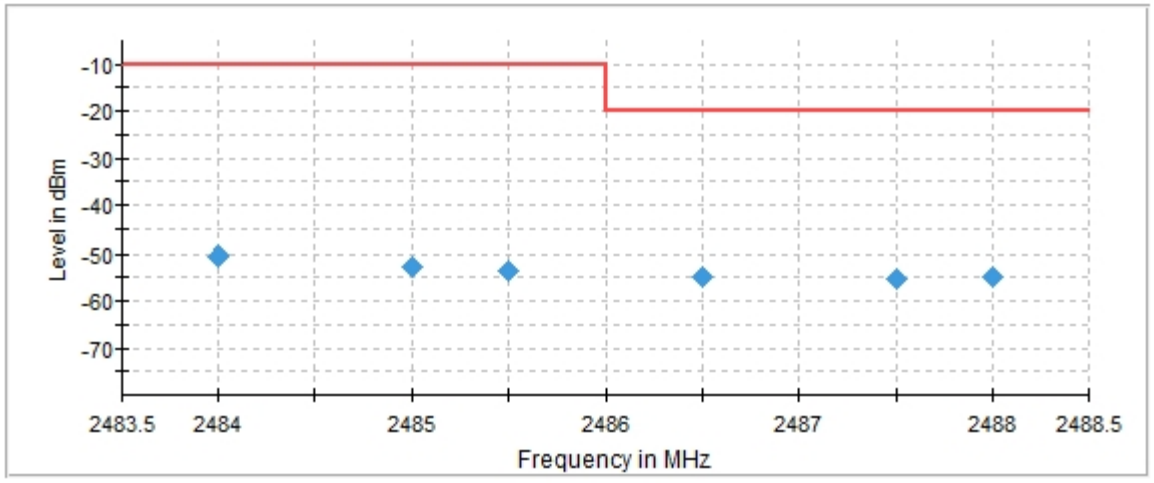
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

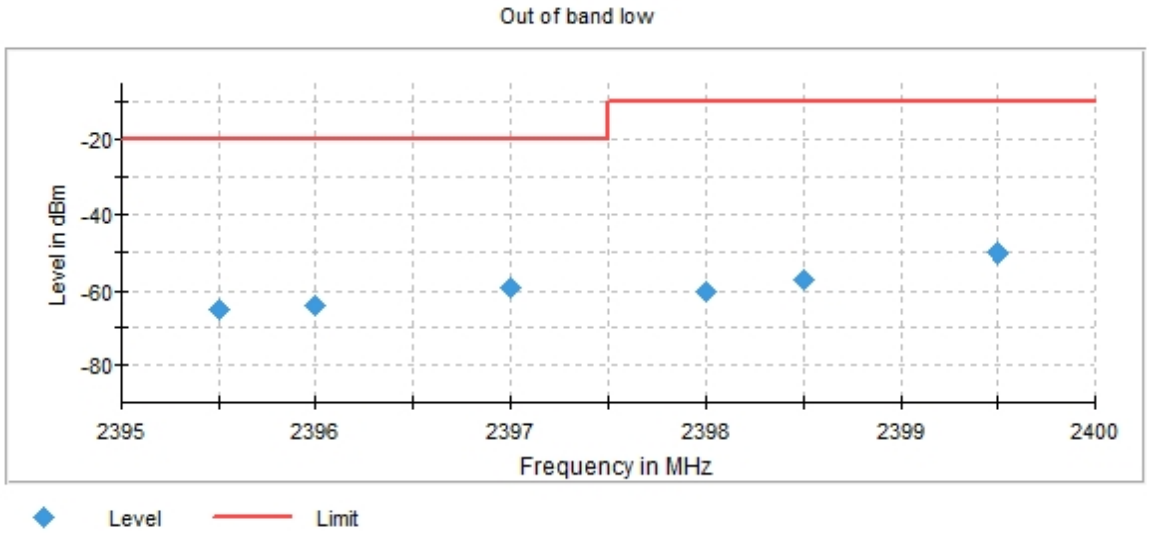


UNWANTED OOB High Freq Section, 2480 MHz

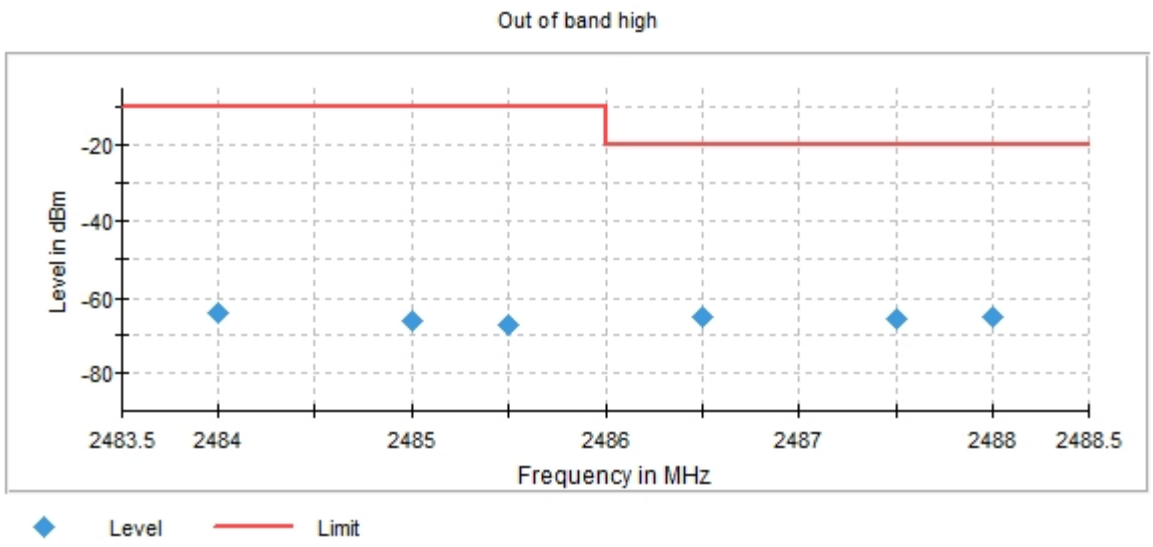


BLE – HDT2 - MIMOA

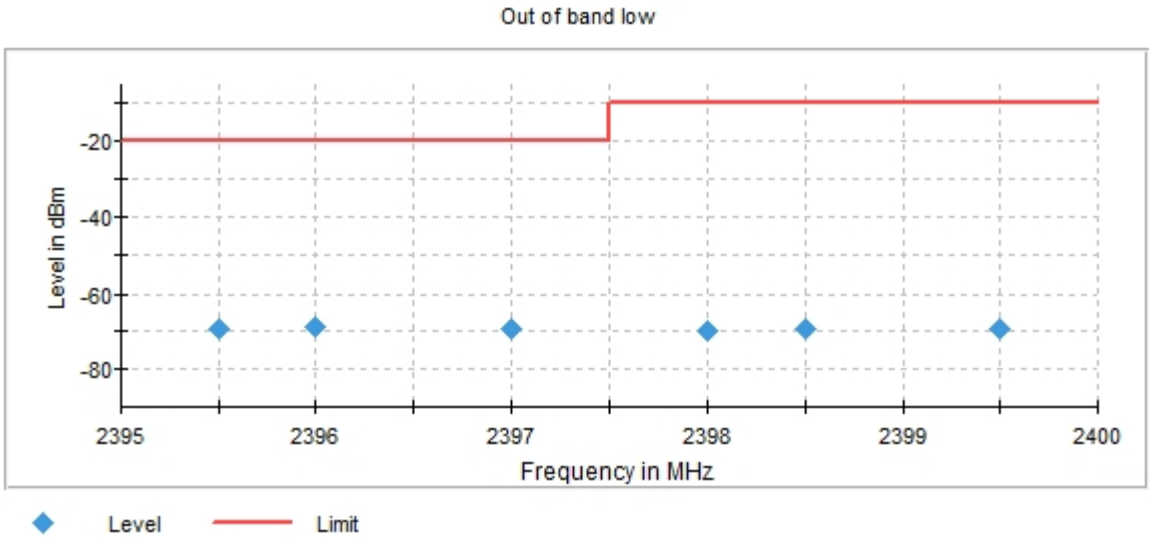
UNWANTED OOB Low Freq Section, 2402 MHz



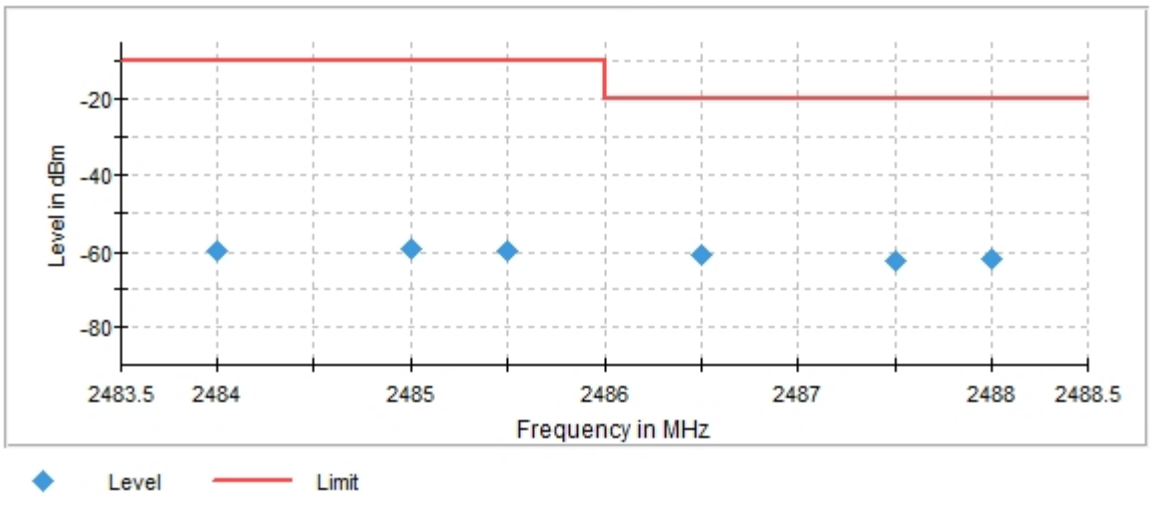
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz

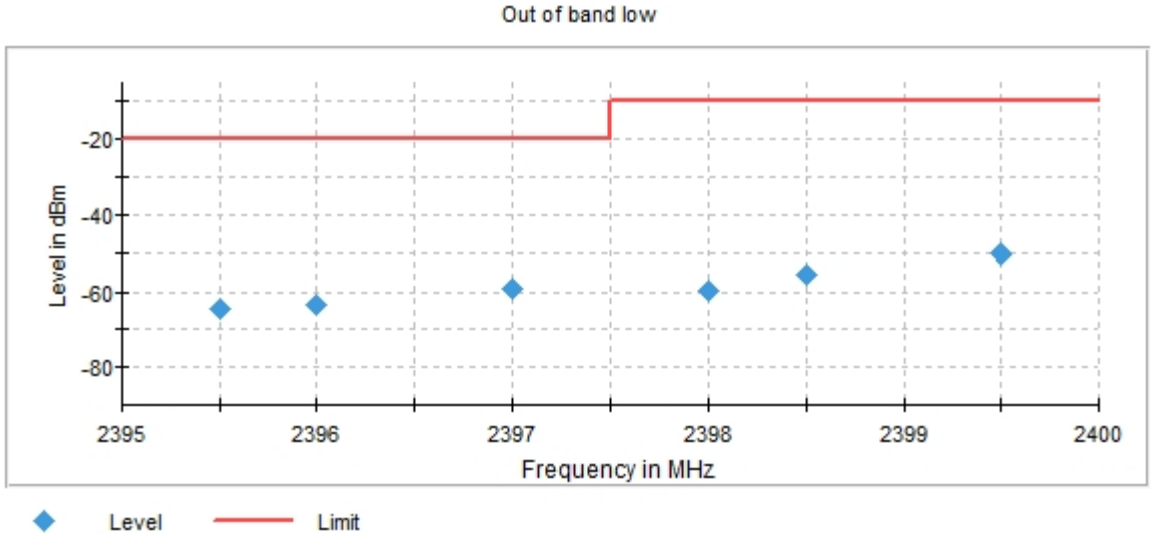


UNWANTED OOB High Freq Section, 2480 MHz

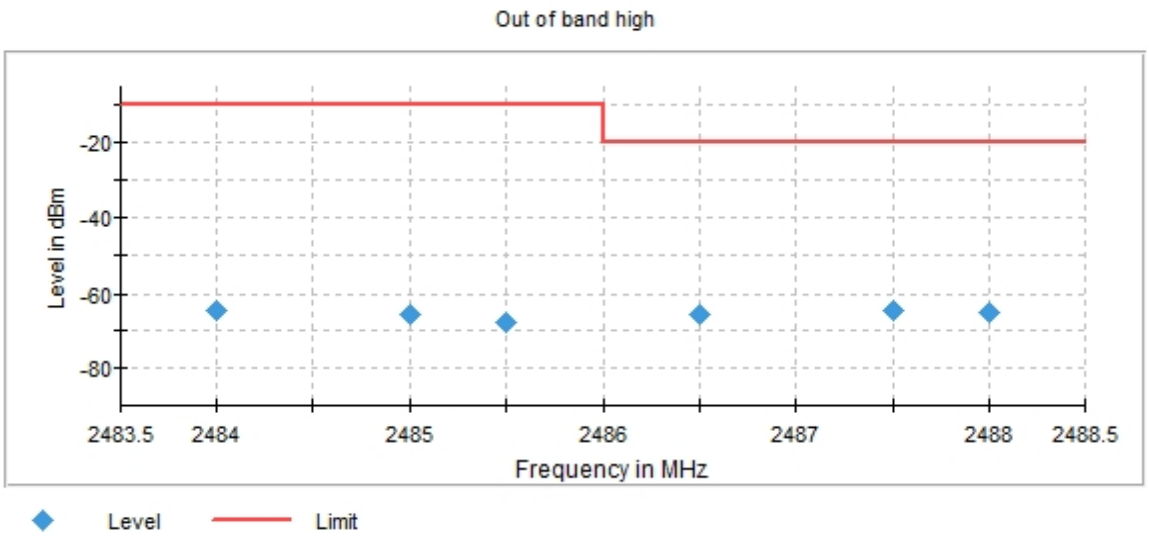


BLE – HDT2 - MIMOB

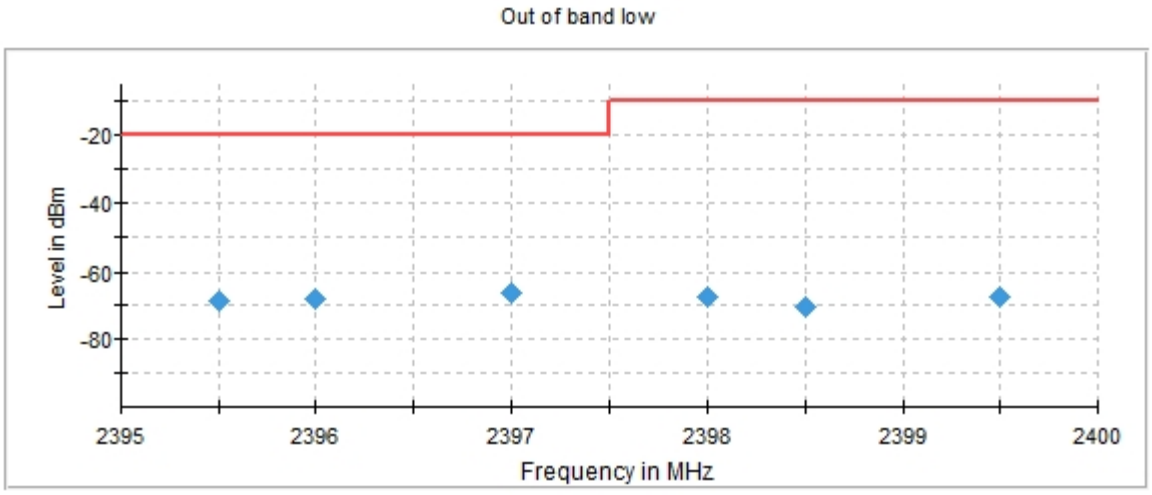
UNWANTED OOB Low Freq Section, 2402 MHz



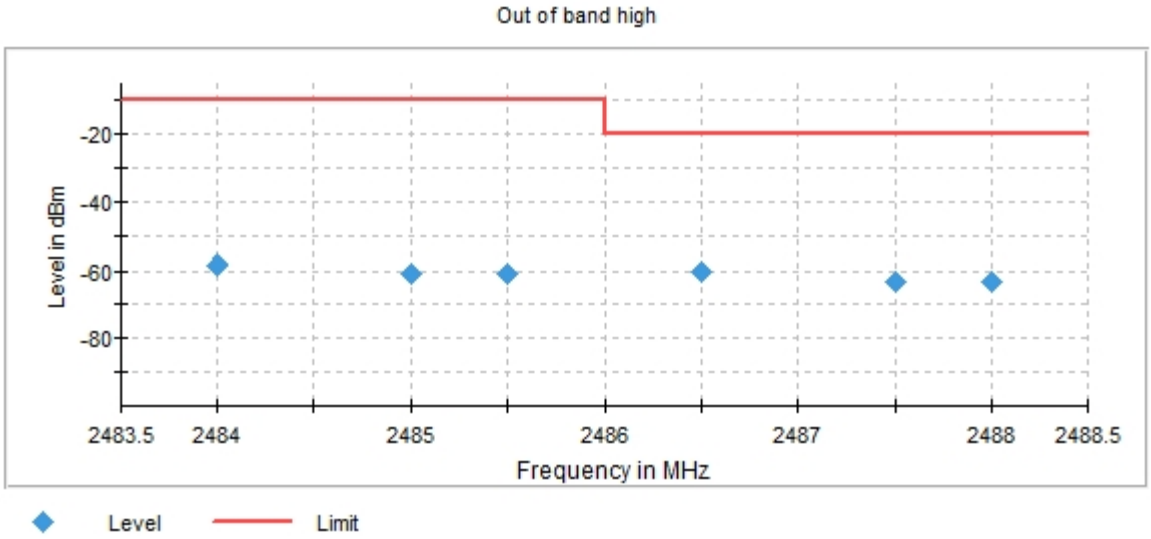
UNWANTED OOB High Freq Section, 2402 MHz



UNWANTED OOB Low Freq Section, 2480 MHz



UNWANTED OOB High Freq Section, 2480 MHz



B.6 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 below.

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

<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.

The radiated spurious emission was measured on the worst case configuration on the low and high channel for each transmission mode.

The identified worst-case among all tested cases were retained and reported in this test report.

Test Results

30MHz - 1GHz, Tx Spurious Emissions

Tx Spurious Emissions - All modes

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
101.8	-79.2	Average	-51.9	27.3	V

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

Tx Spurious Emissions – 1GHz to 12.75GHz

Tx Spurious Emissions – Bluetooth BLE , 2480 MHz

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
6353.1	-54.6	RMS	-30.0	24.6	H

B.7 Receiver spurious emissions

Test limits

ETSI clause	Limits
4.3.2.10.3	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** Frequency range / Maximum power / Bandwidth 30 MHz to 1GHz / -57 dBm / 100 kHz 1GHz to 12.75 GHz / -47 dBm / 1 MHz

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 emission was measured on the worst case configuration on the low and high channel for each transmission mode.

The identified worst-case among all tested cases were retained and reported in this test report.

Test Results

Rx Spurious Emissions – 30 MHz to 12.75GHz

Rx Spurious Emissions – Bluetooth BLE , 2402 MHz

Frequency	Level	Detector	Limit	Margin	Polar
MHz	dBm	---	dBm	dB	---
424.6	-74.4	RMS	-54.9	19.5	H
10750.0	-57.7	RMS	-47.0	10.7	H

B.8 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>For equipment that supports a PER or FER test to be performed, the minimum performance criterion shall be a PER or FER 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 2 equipment
<table>
<tr><th>Wanted signal mean power from companion device (dBm) (see notes 1 and 3)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm) (see note 3)</th><th>Type of blocking signal</th></tr>
<tr><td>(-139 dBm + 10 × log10(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)</td><td>2380
2504
2300
2584</td><td>-34</td><td>CW</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: 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 shown in section *Test & System Description* was used to measure receiver blocking signal. The signaling Unit is a CMW500.

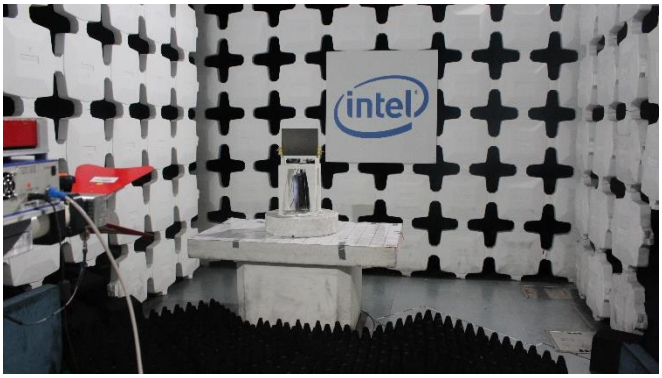
The packet error rate (PER) is measured with the CMW500. The blocking signal is emulated by the Signal generator SMW200A. Antenna gain and insertion loss are taken into account.

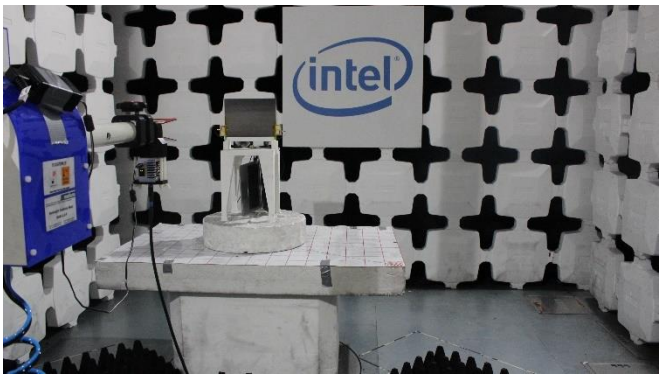
Test results

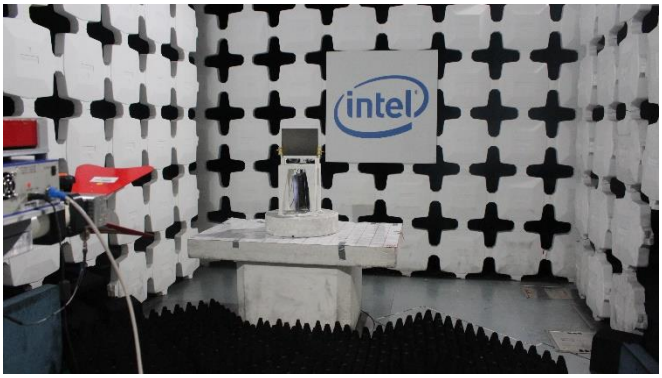
Configuration	99% Occupied bandwidth [MHz]	Wanted signal mean power from companion device (dBm)	PER [%] Without blocking signal	Blocking signal [MHz]	Blocking signal Power at DUT input [dBm]	PER [%] With Blocking signal	Verdict
		Without blocking signal		With blocking signal			
BLE Chain B 2402MHz	1.04	-70.87	2.58	2300	-36.00	2.39	PASS
			2.58	2380	-36.00	2.45	PASS
BLE Chain B 2480MHz	1.04	-70.8	1.16	2504	-36.00	1.60	PASS
			1.16	2584	-36.00	1.22	PASS

Annex C. Photographs

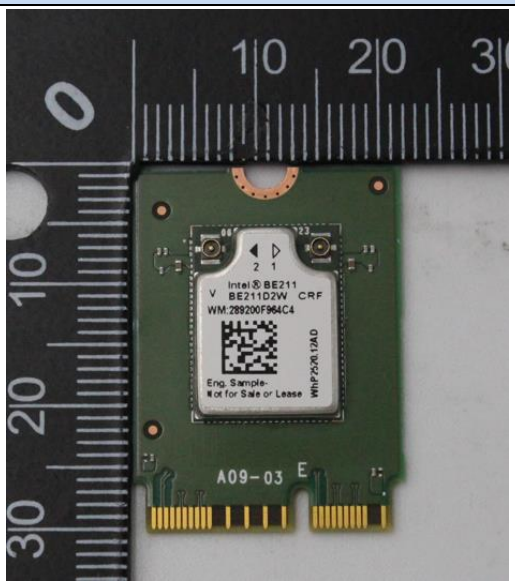
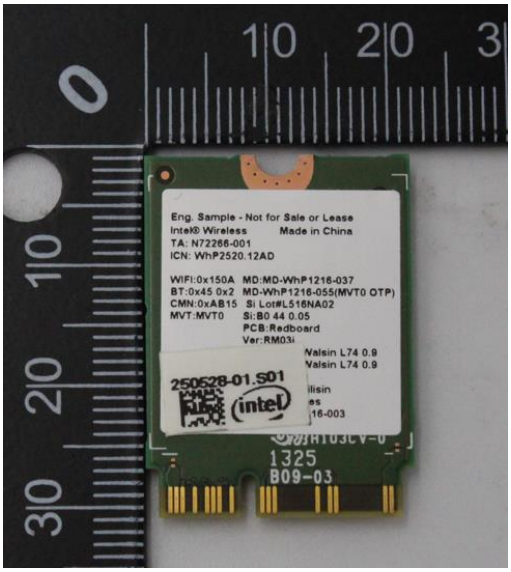
C.1 Test Setup

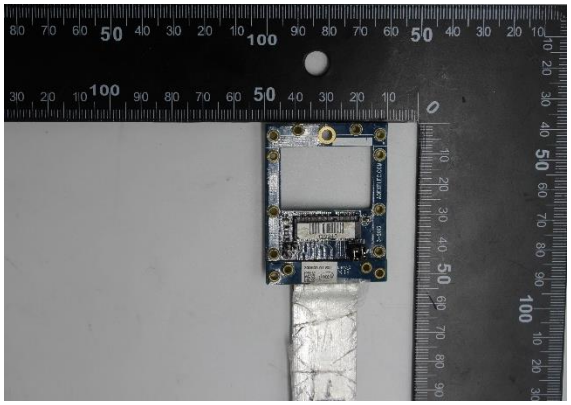
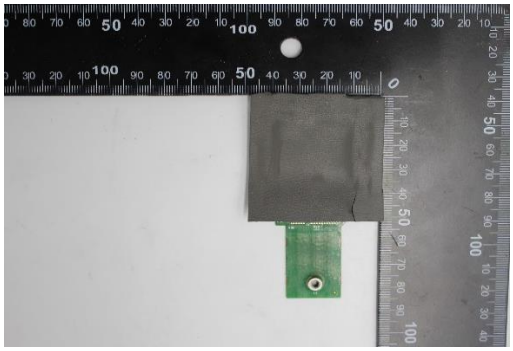
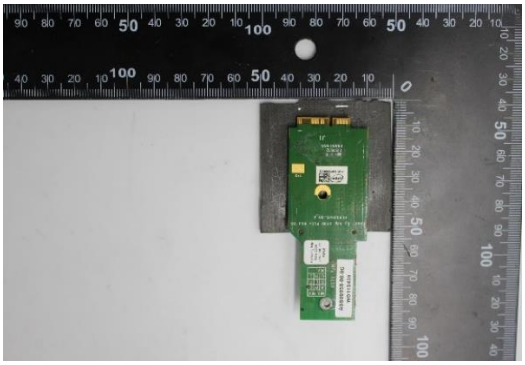
Radiated Setup 30 MHz – 1 GHz (Transmitter tests)	Radiated Setup 1 GHz – 11 GHz (Transmitter tests)
	

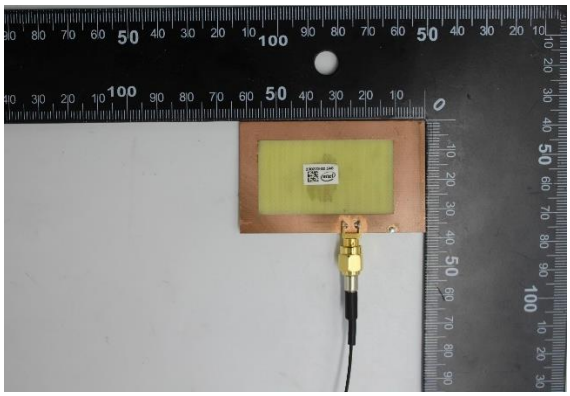
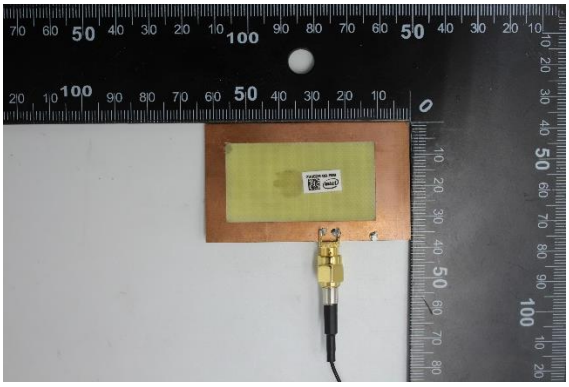
Radiated Setup 11 GHz – 12.75 GHz (Transmitter tests)


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

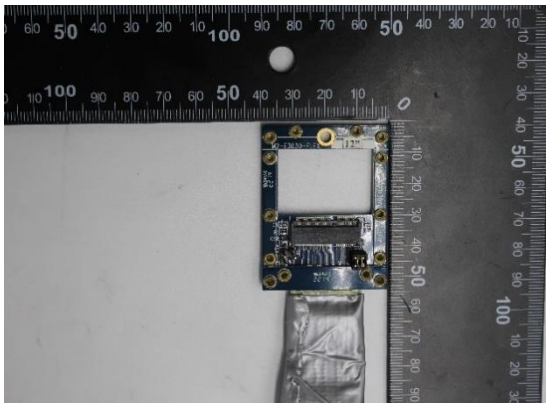
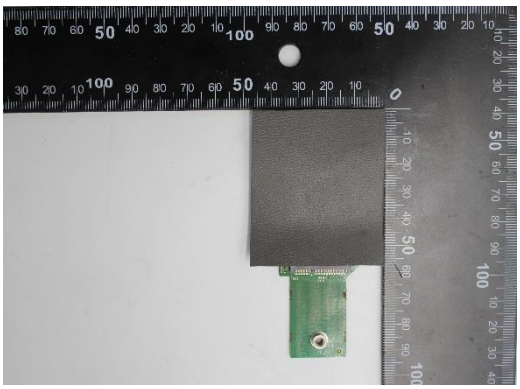
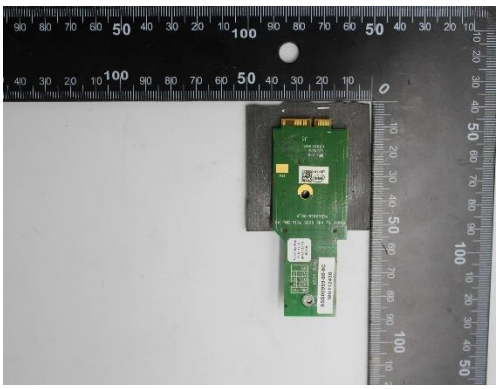
C.2 Test Sample

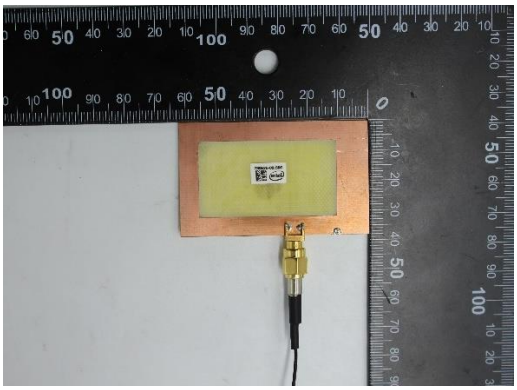
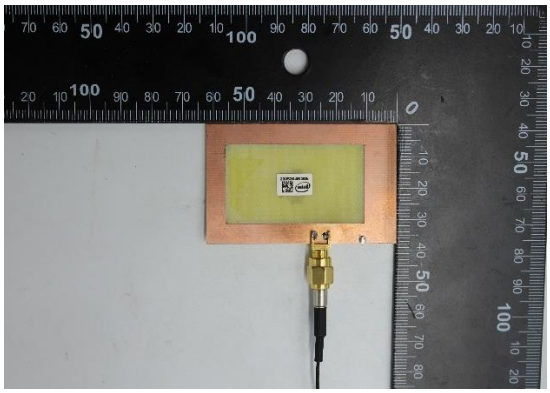
Sample #01	
Module Front	Module Back
	
Extender board	Laptop
	

Sample #02	
Module Front	Module Back
	
Extender board	Laptop
	
Adaptor Front	Adaptor Back
	

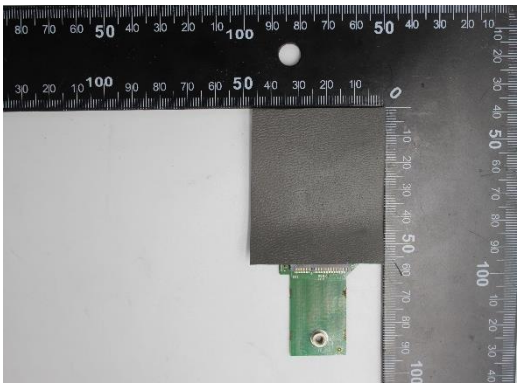
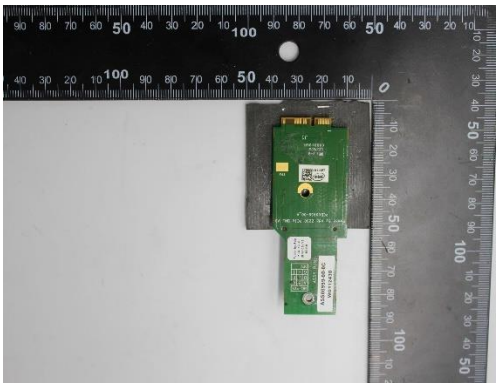
PIFA antenna (Main)	PIFA antenna (Aux)
	

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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