RF REPORT

On Behalf of

FCC ID: 2ATYV-BLE-MODULE-A

Scangrip A/S FCC ID: 2ATYV-BLE-MODULE-A

BLE-MODULE-A

Model No.: 310.084

Prepared for	:	Scangrip A/S
Address	:	Rytterhaven 9, DK-5700 Svendborg, Denmark

Prepared By	:	Shenzhen Alpha Product Testing Co., Ltd
Address	:	Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103, Shenzhen, Guangdong, China

Report Number	:	A2303118-C01-R01
Date of Receipt	:	November 17, 2022
Date of Test	:	November 17, 2022 to March 28, 2023
Date of Report	:	March 28, 2023
Version Number	:	V0

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TEST REPORT DECLARATION

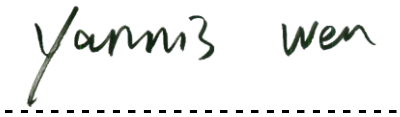
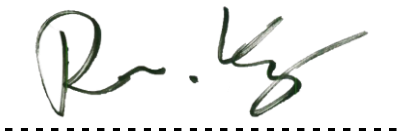
Applicant	:	Scangrip A/S
Address	:	Rytterhaven 9, DK-5700 Svendborg, Denmark
Manufacturer	:	Scangrip A/S
Address	:	Rytterhaven 9, DK-5700 Svendborg, Denmark
EUT Description	:	BLE-MODULE-A
(A)	Model No.	: 310.084
(B)	Trademark	: Scangrip A/S

Measurement Standard Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.247

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed full responsibility for the accuracy and completeness of test. Also, this report shows that the EUT is technically compliant with above listed standard(s) requirements.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature) ..... :	Yannis Wen Project Engineer	
Approved by (name + signature) ..... :	Reak Yang Project Manager	
Date of issue ..... :	March 28, 2023	

Revision History

Revision	Issue Date	Revisions	Revised By
V0	March 28, 2023	Initial released Issue	Yannis Wen

1 General Information

1.1 Description of Device (EUT)

Product Name	:	BLE-MODULE-A
Trademark	:	Scangrip A/S
Model Number	:	310.084
Operation Frequency	:	2402MHz to 2480MHz
Number of Channels	:	40
Modulation Type	:	GFSK
Data rate	:	1Mbps, 2Mbps
Power rating	:	4dBm
Antenna Type	:	PCB Antenna
Antenna Gain	:	1.95dBi

1.2 Test Lab information

Shenzhen Alpha Product Testing Co., Ltd Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103, Shenzhen, Guangdong, China
June 21, 2018 File on Federal Communication Commission Registration Number: 293961 Designation Number: CN1236 July 15, 2019 Certificated by IC Registration Number: CN0085

2 Summary of test

2.1 Test Standard description:

The tests were performed according to following standards:

47 CFR Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

KDB558074 D01 15.247 Meas Guidance v05r02: GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES

2.2 Summary of test

Item	Requirement	Method	Result
Antenna requirement	Part 15.203		Pass
Conducted Emission at AC power line	47 CFR 15.207(a)	ANSI C63.10-2013 section 6.2	Pass
Occupied Bandwidth	47 CFR 15.247(a)(2)	ANSI C63.10-2013, section 11.8	Pass
Maximum Conducted Output Power	47 CFR 15.247(b)(3)	ANSI C63.10-2013, section 11.9.1	Pass
Power Spectral Density	47 CFR 15.247(e)	ANSI C63.10-2013, section 11.10	Pass
Emissions in non-restricted frequency bands	47 CFR 15.247(d)	ANSI C63.10-2013 section 11.11	Pass
Band edge emissions (Radiated)	47 CFR 15.247(d)	ANSI C63.10-2013 section 6.6.4	Pass
Emissions in restricted frequency bands (below 1GHz)	47 CFR 15.247(d)	ANSI C63.10-2013 section 6.6.4	Pass
Emissions in restricted frequency bands (above 1GHz)	47 CFR 15.247(d)	ANSI C63.10-2013 section 6.6.4	Pass

2.3 Test Mode Description

Tested mode and channel		
Mode	**Channel**	**Frequency (MHz)**
GFSK(1Mbps)	Low : CH0	2402
	Middle: CH19	2440
	High: CH39	2480
GFSK(2Mbps)	Low : CH0	2402
	Middle: CH19	2440
	High: CH39	2480

Frequency list									
CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)	CH	Frequency (MHz)
CH0	2402	CH8	2418	CH16	2434	CH24	2450	CH32	2466
CH1	2404	CH9	2420	CH17	2436	CH25	2452	CH33	2468
CH2	2406	CH10	2422	CH18	2438	CH26	2454	CH34	2470
CH3	2408	CH11	2424	CH19	2440	CH27	2456	CH35	2472
CH4	2410	CH12	2426	CH20	2442	CH28	2458	CH36	2474
CH5	2412	CH13	2428	CH21	2444	CH29	2460	CH37	2476
CH6	2414	CH14	2430	CH22	2446	CH30	2462	CH38	2478
CH7	2416	CH15	2432	CH23	2448	CH31	2464	CH39	2480

Software Information			
Test Item	Software Name	Manufacturer	Version
RE	EZ-EMC	farad	Alpha-3A1
CE	EZ-EMC	farad	Alpha-3A1
RF-CE	MTS 8310	MWRFtest	2.0.0.0

Setting output power (Max)			
GFSK(1Mbps)	GFSK(2Mbps)	/	/
4dBm	4dBm	/	/

2.4 Test Equipment

Equipment	Manufacture	Model No.	Firmware version	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	CHENYU	9*6*6	/	N/A	2022.05.17	3Year
Spectrum analyzer	ROHDE&SCHWARZ	FSV40-N	2.3	102137	2022.08.22	1Year
Spectrum analyzer	Agilent	N9020A	A.14.16	MY499100060	2022.08.22	1Year
Receiver	ROHDE&SCHWARZ	ESR	2.28 SP1	1316.3003K03-102082-Wa	2022.08.22	1Year
Receiver	R&S	ESCI	4.42 SP1	101165	2022.08.22	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	/	VULB 9168#627	2021.08.30	2Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	/	2106	2021.08.30	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	/	00059	2021.08.30	2Year
RF Cable	Resenberger	Cable 1	/	RE1	2022.08.22	1Year
RF Cable	Resenberger	Cable 2	/	RE2	2022.08.22	1Year
RF Cable	Resenberger	Cable 3	/	CE1	2022.08.22	1Year
Pre-amplifier	HP	HP8347A	/	2834A00455	2022.08.22	1Year
Pre-amplifier	Agilent	8449B	/	3008A02664	2022.08.22	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	/	8126-466	2022.08.22	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	/	101043	2022.08.23	1 Year
Horn Antenna	SCHWARZBECK	BBHA9170	/	00946	2021.08.30	2 Year
Preamplifier	SKET	LNPA_1840-50	/	SK2018101801	2022.08.22	1 Year
Power Meter	Agilent	E9300A	/	MY41496628	2022.08.22	1 Year
Power Sensor	DARE	RPR3006W	/	15100041SNO91	2022.08.22	1 Year
Temp. & Humid. Chamber	Weihuang	WHTH-1000-40-880	/	100631	2022.08.22	1 Year
Switching Mode Power Supply	JUNKE	JK12010S	/	20140927-6	2022.08.22	1 Year
Adjustable attenuator	MWRFtest	N/A	/	N/A	N/A	N/A
10dB Attenuator	Mini-Circuits	DC-6G	/	N/A	N/A	N/A

Software Information			
Test Item	Software Name	Manufacturer	Version
RE	EZ-EMC	farad	Alpha-3A1
CE	EZ-EMC	farad	Alpha-3A1
RF-CE	MTS 8310	MWRFtest	2.0.0.0

2.5 Measurement Uncertainty

Item	Uncertainty
Uncertainty for Power point Conducted Emissions Test	1.63dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	3.5dB
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.74dB(Polarize: V)
	3.76dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	3.77dB(Polarize: V)
	3.80dB(Polarize: H)
Uncertainty for radio frequency	5.06×10^{-8}GHz
Uncertainty for conducted RF Power	0.40dB
Uncertainty for temperature	0.2℃
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

3 Evaluation Results (Evaluation)

3.1 Antenna requirement

Test Requirement:	An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

3.1.1 Conclusion:

The EUT antenna is PCB Antenna with max gain 1.95dBi. It comply with the standard requirement.

4 Radio Spectrum Matter Test Results (RF)

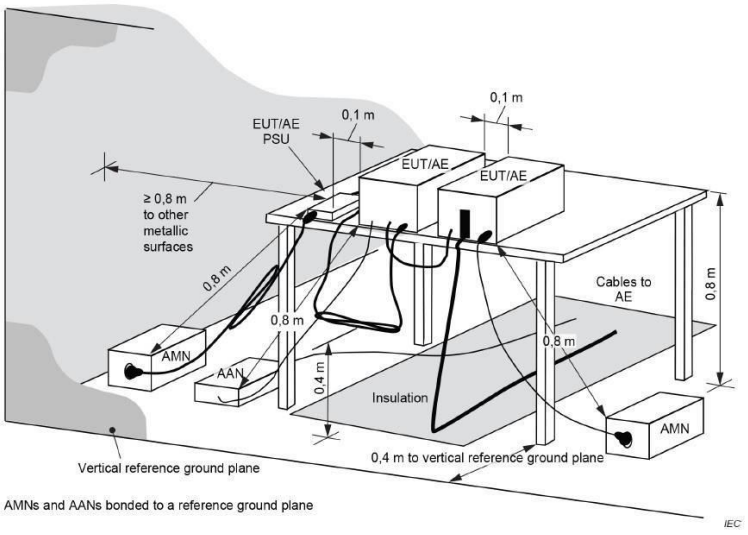
4.1 Conducted Emission at AC power line

Test Requirement:	Except as shown in paragraphs (b)and (c)of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN).
Test Limit:	Frequency of emission (MHz) / Conducted limit (dBμV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50 *Decreases with the logarithm of the frequency.
Test Method:	Refer to ANSI C63.10-2013 section 6.2, standard test method for ac power-line conducted emissions from unlicensed wireless devices

4.1.1 E.U.T. Operation:

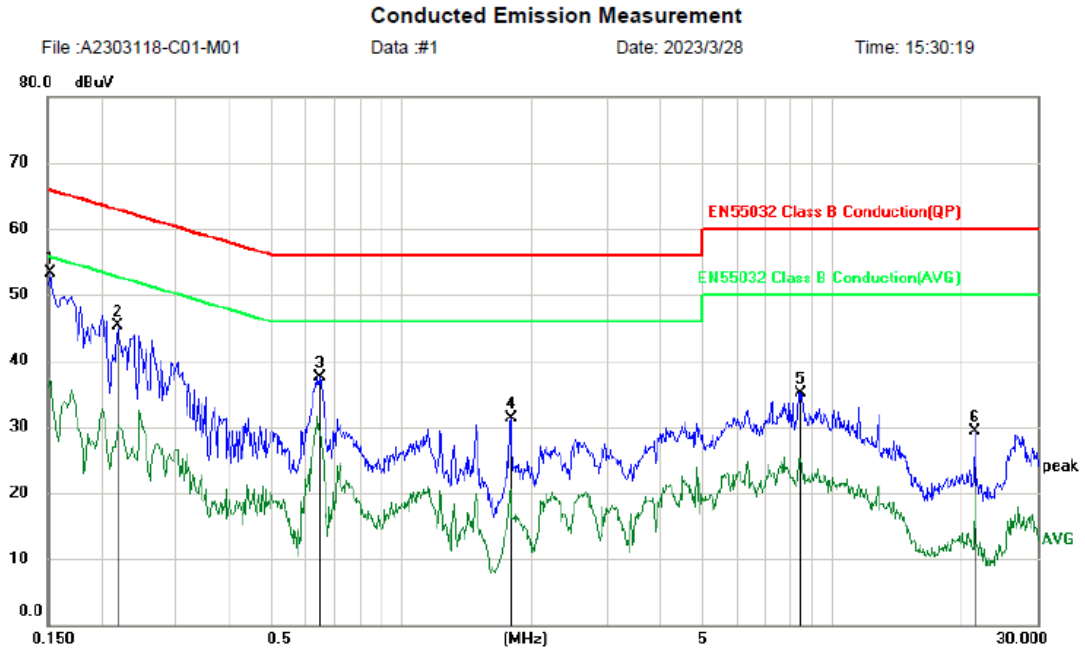
Operating Environment:					
Temperature:	23.8 °C	Humidity:	53.1 %	Atmospheric Pressure:	102 kPa
Pre test mode:	GFSK(1Mbps), GFSK(2Mbps)				
Final test mode:	GFSK(1Mbps)				

4.1.2 Test Setup Diagram:



4.1.3 Test Result:

GFSK（1Mbps） / Line: Line / CH: L

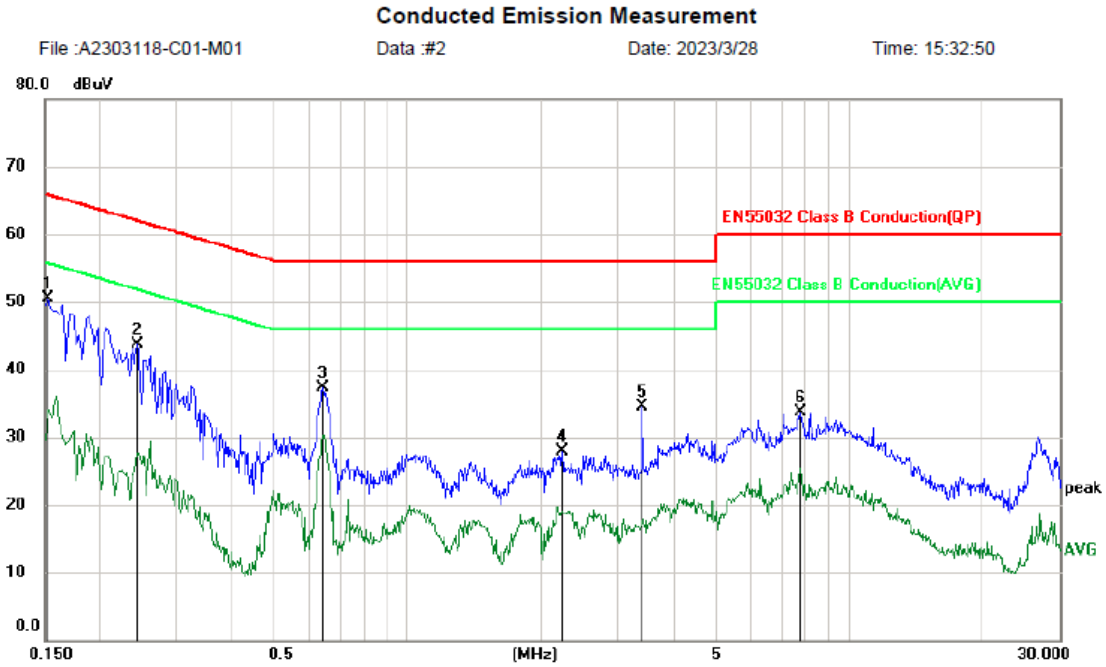


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1530	43.28	9.94	53.22	65.84	-12.62	peak	
2		0.2190	35.29	9.94	45.23	62.86	-17.63	peak	
3		0.6450	27.51	9.92	37.43	56.00	-18.57	peak	
4		1.7940	21.48	9.89	31.37	56.00	-24.63	peak	
5		8.4180	24.92	10.16	35.08	60.00	-24.92	peak	
6		21.4229	18.86	10.46	29.32	60.00	-30.68	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

GFSK（1Mbps） / Line: Neutral / CH: L



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1530	40.64	9.94	50.58	65.84	-15.26	peak	
2		0.2430	33.84	9.96	43.80	61.99	-18.19	peak	
3		0.6419	27.32	9.92	37.24	56.00	-18.76	peak	
4		2.2440	17.95	9.89	27.84	56.00	-28.16	peak	
5		3.4170	24.48	9.96	34.44	56.00	-21.56	peak	
6		7.7280	23.57	10.14	33.71	60.00	-26.29	peak	

*:Maximum data x:Over limit !:over margin 〈Reference Only

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

Note: All modes have been tested, and only worst data was listed in this report.

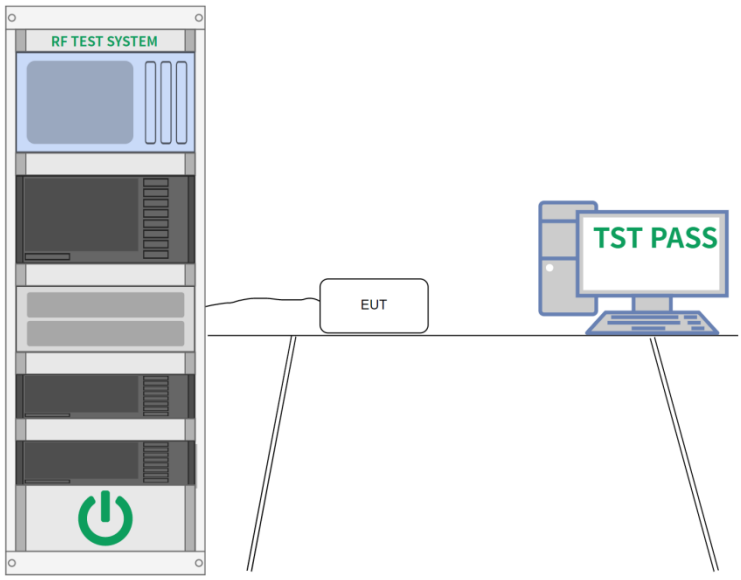
4.2 Occupied Bandwidth

Test Requirement:	Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Test Limit:	Section (a)(2), Systems using digital modulation techniques may operate in the 902-928 MHz, and 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Test Method:	DTS bandwidth
Procedure:	a) Set RBW = 100 kHz. b) Set the VBW >= [3 × RBW]. c) Detector = peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

4.2.1 E.U.T. Operation:

Operating Environment:					
Temperature:	23.8 °C	Humidity:	53.1 %	Atmospheric Pressure:	102 kPa
Pre test mode:	GFSK(1Mbps), GFSK(2Mbps)				
Final test mode:	GFSK(1Mbps), GFSK(2Mbps)				

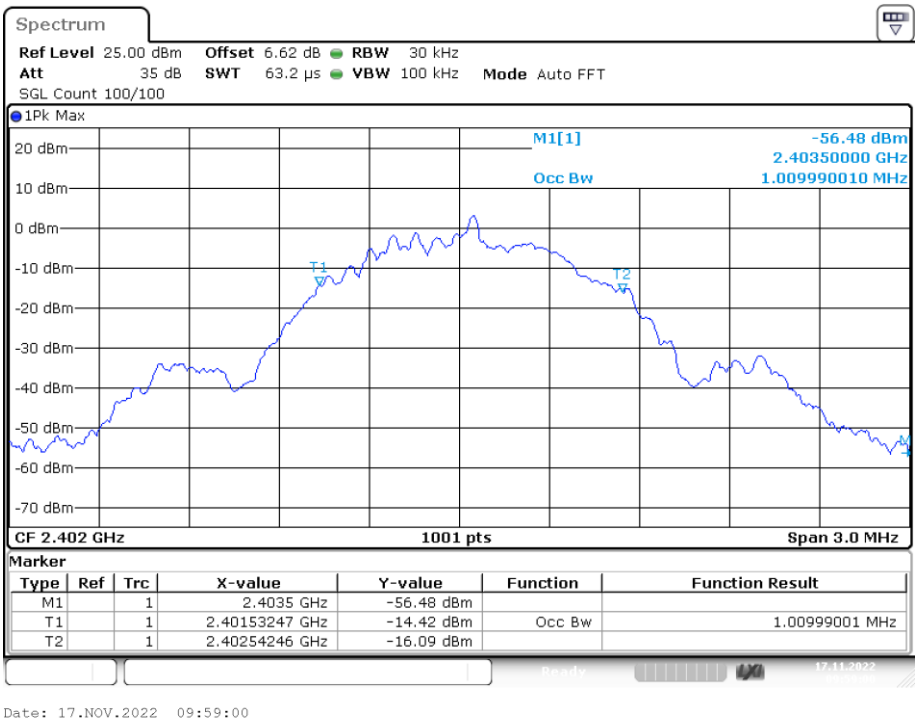
4.2.2 Test Setup Diagram:



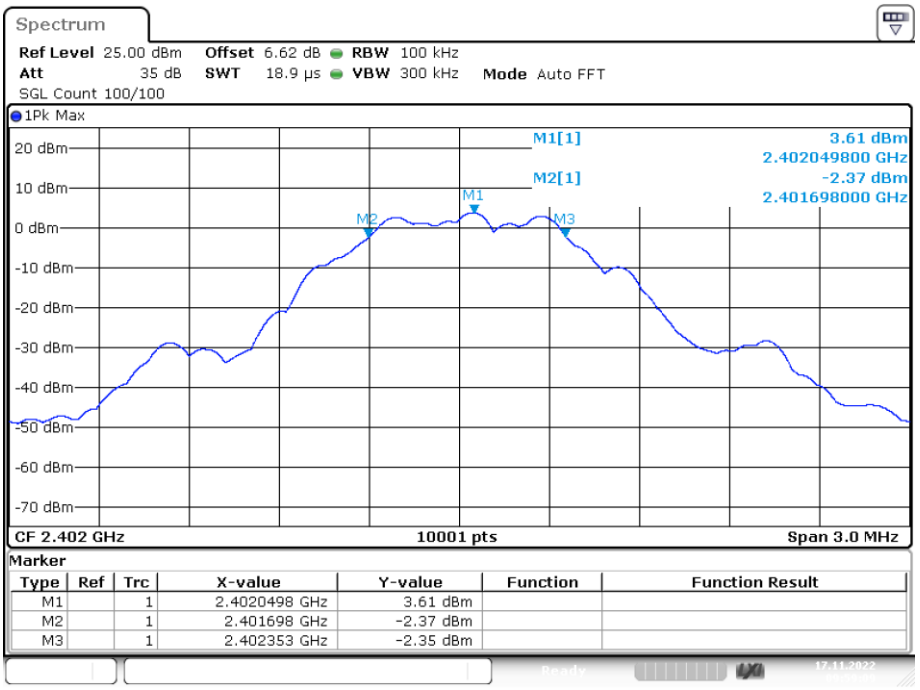
4.2.3 Test Result:

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	BLE 1M	2402	Ant 1	1.01	0.656	0.5	Pass
NVNT	BLE 1M	2440	Ant 1	1.007	0.645	0.5	Pass
NVNT	BLE 1M	2480	Ant 1	1.007	0.65	0.5	Pass

OBW NVNT BLE 1M 2402MHz Ant1



-6dB Bandwidth NVNT BLE 1M 2402MHz Ant1



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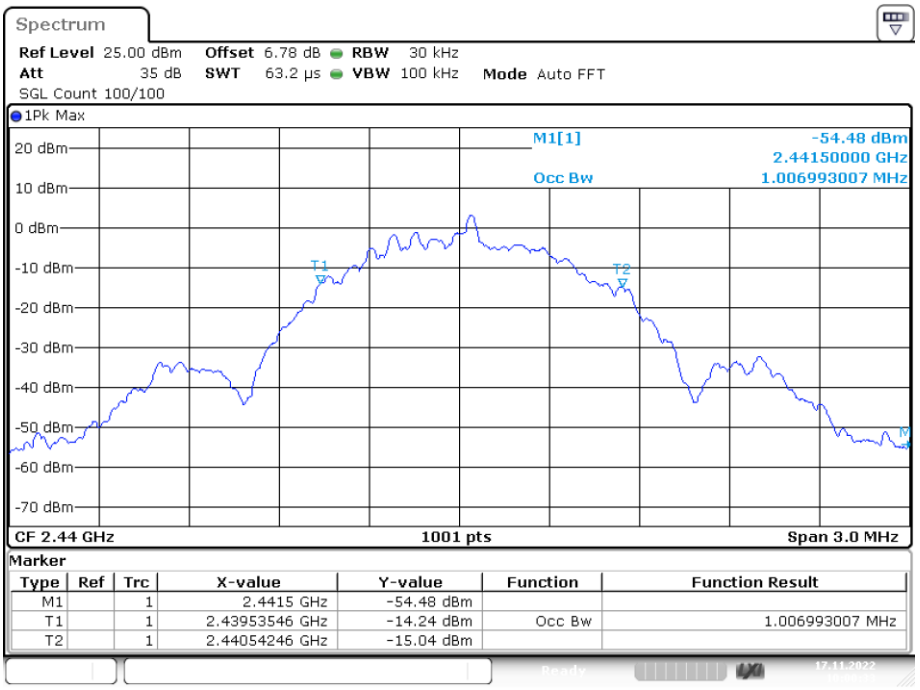
OBW NVNT BLE 1M 2440MHz Ant1



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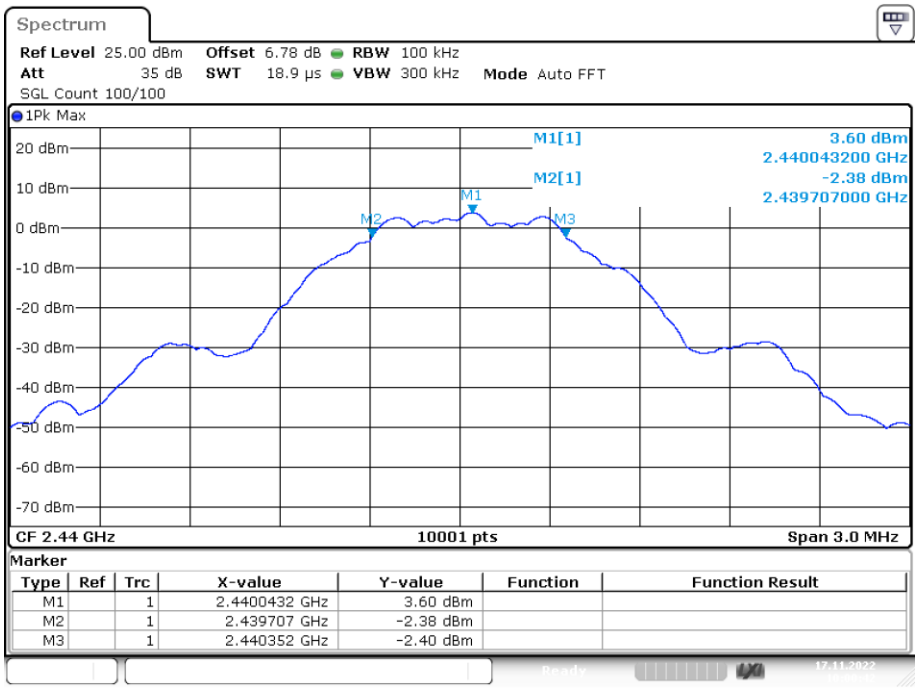

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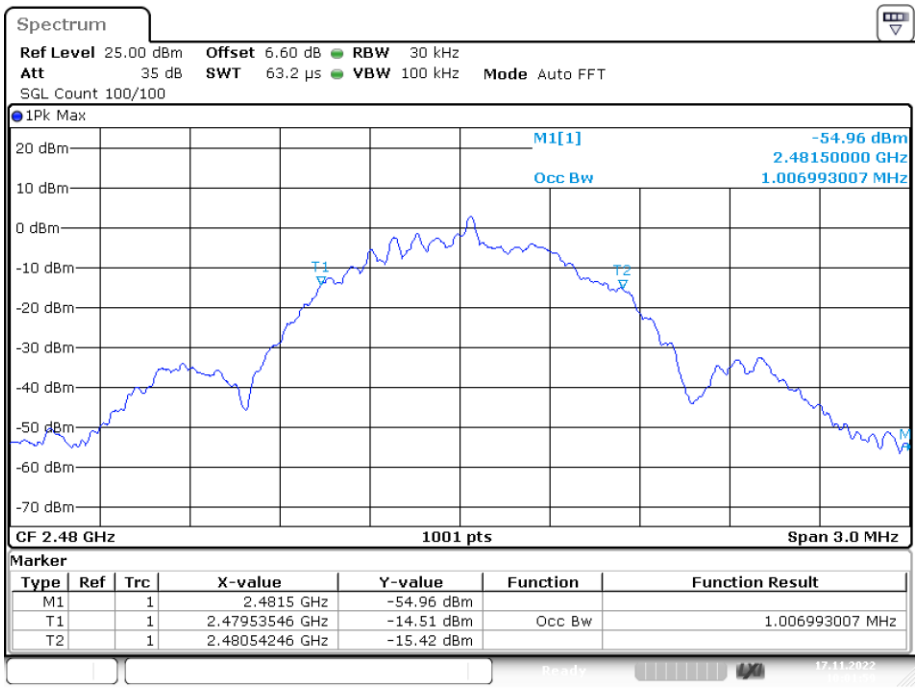
OBW NVNT BLE 1M 2480MHz Ant1



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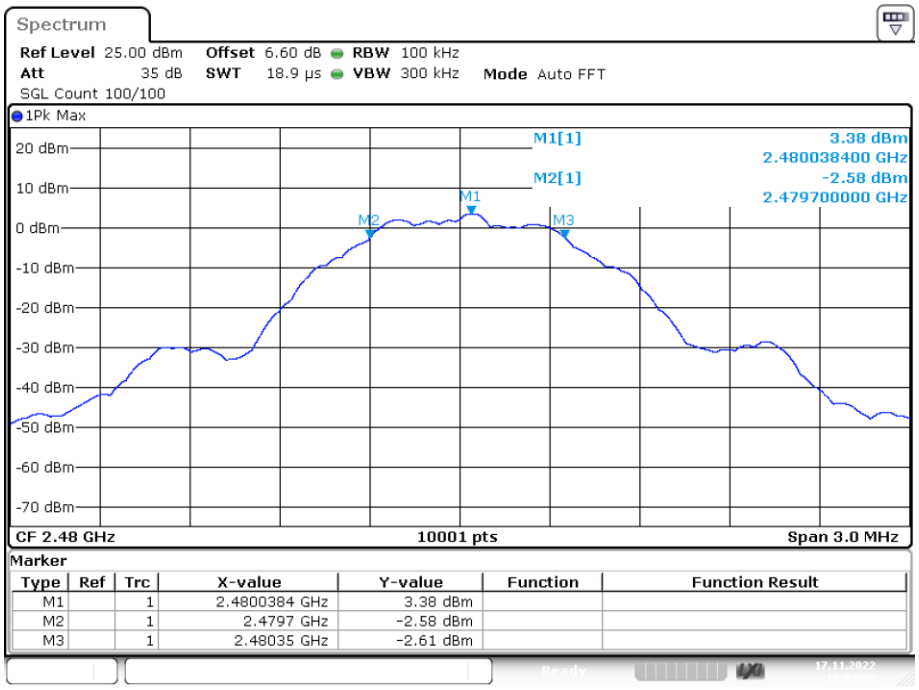
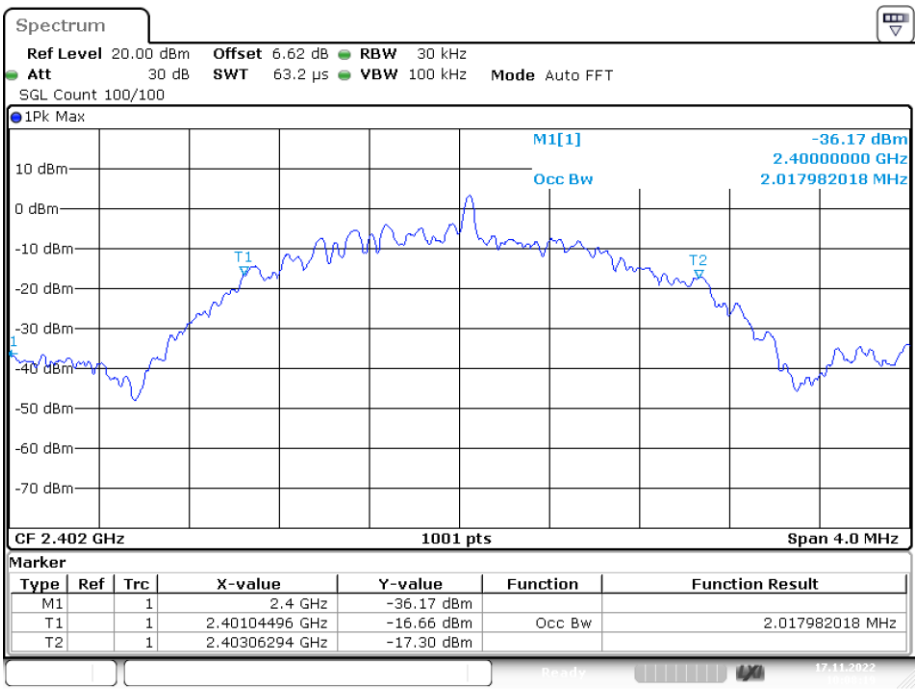
-6dB Bandwidth NVNT BLE 1M 2480MHz Ant1



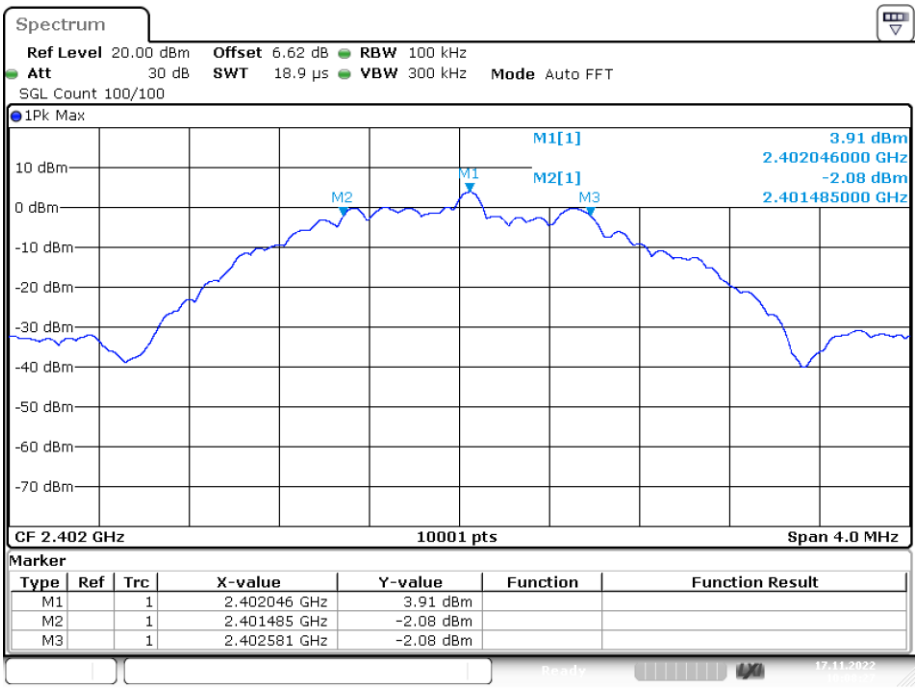
Date: 17.NOV.2022 10:02:08

Condition	Mode	Frequency (MHz)	Antenna	99% OBW (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
NVNT	BLE 2M	2402	Ant 1	2.018	1.096	0.5	Pass
NVNT	BLE 2M	2440	Ant 1	2.014	1.088	0.5	Pass
NVNT	BLE 2M	2480	Ant 1	2.018	0.96	0.5	Pass

OBW NVNT BLE 2M 2402MHz Ant1



-6dB Bandwidth NVNT BLE 2M 2402MHz Ant1



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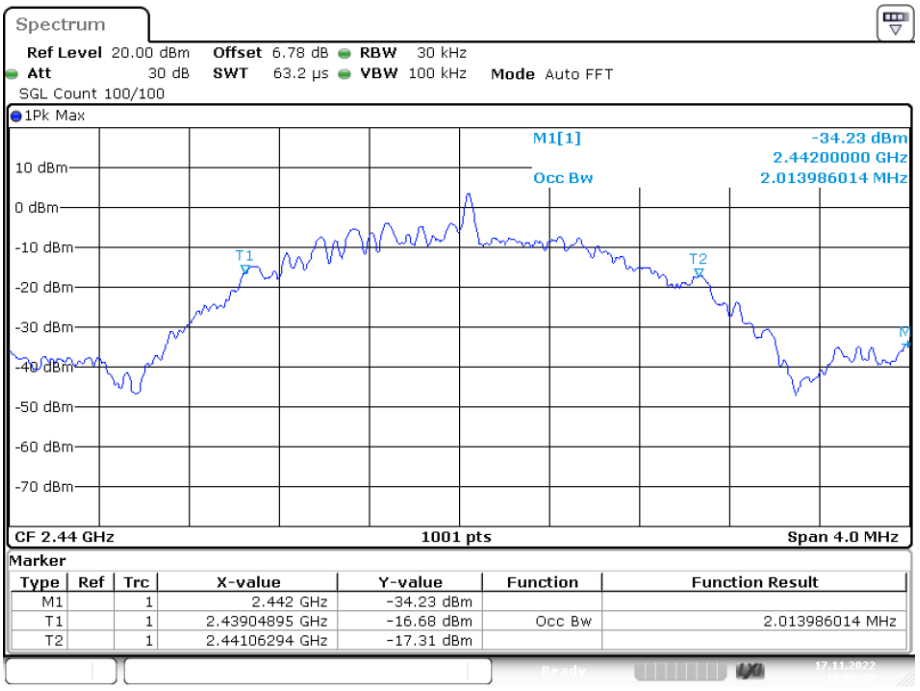
OBW NVNT BLE 2M 2440MHz Ant1



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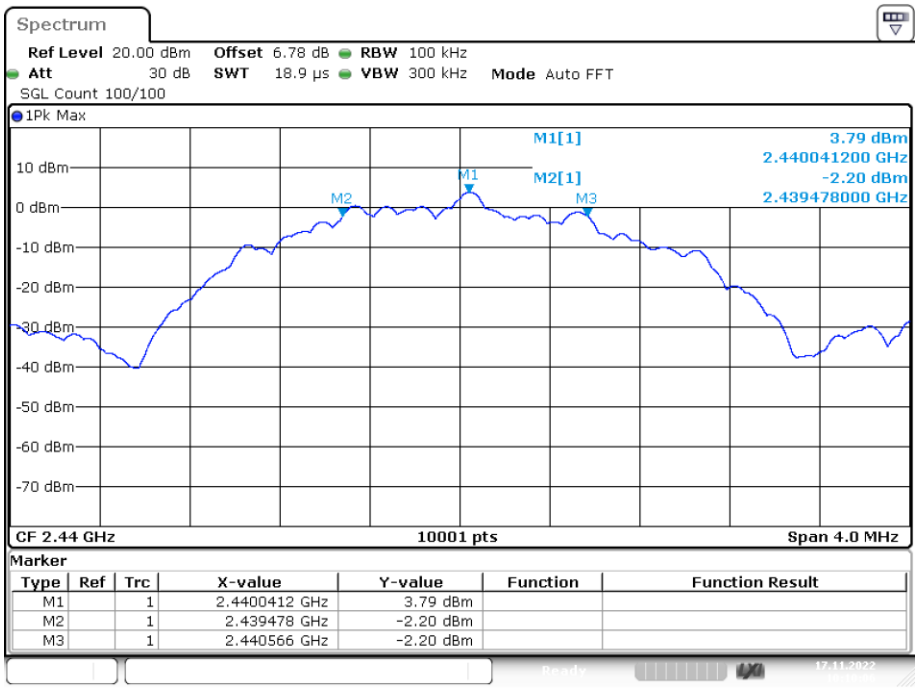
-6dB Bandwidth NVNT BLE 2M 2440MHz Ant1



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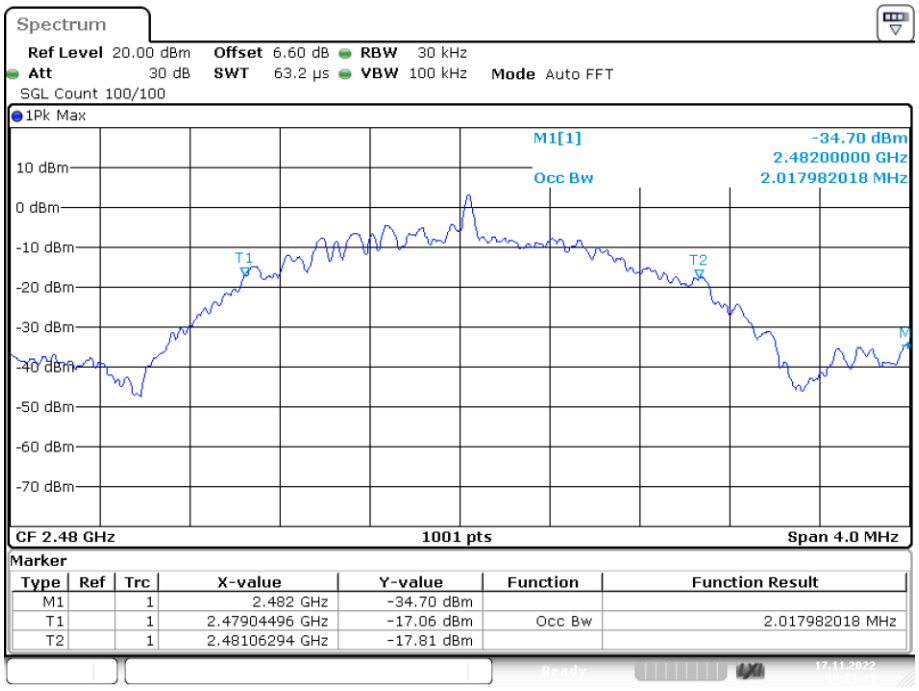
OBW NVNT BLE 2M 2480MHz Ant1



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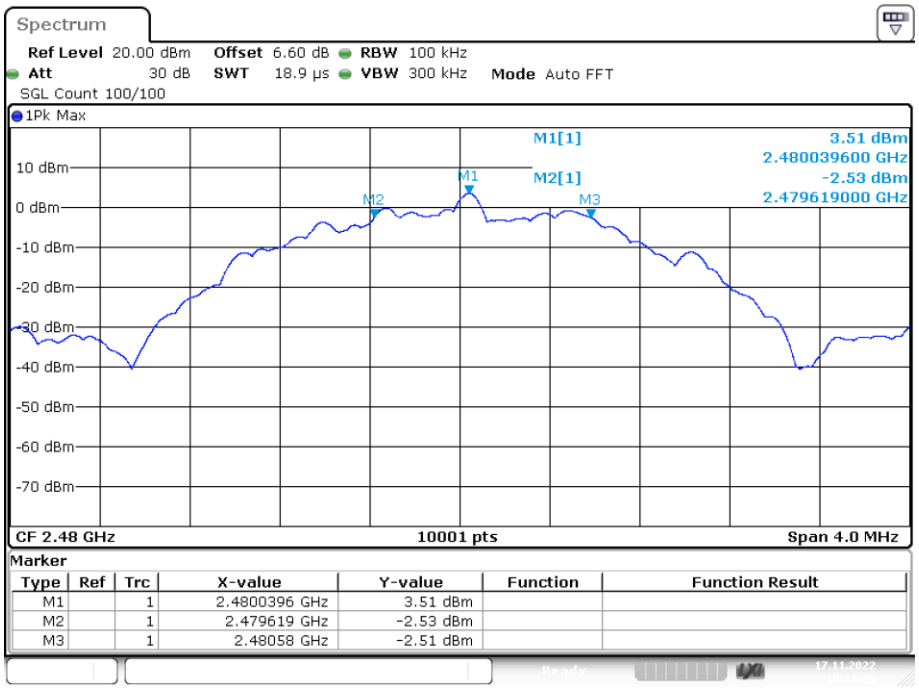
-6dB Bandwidth NVNT BLE 2M 2480MHz Ant1



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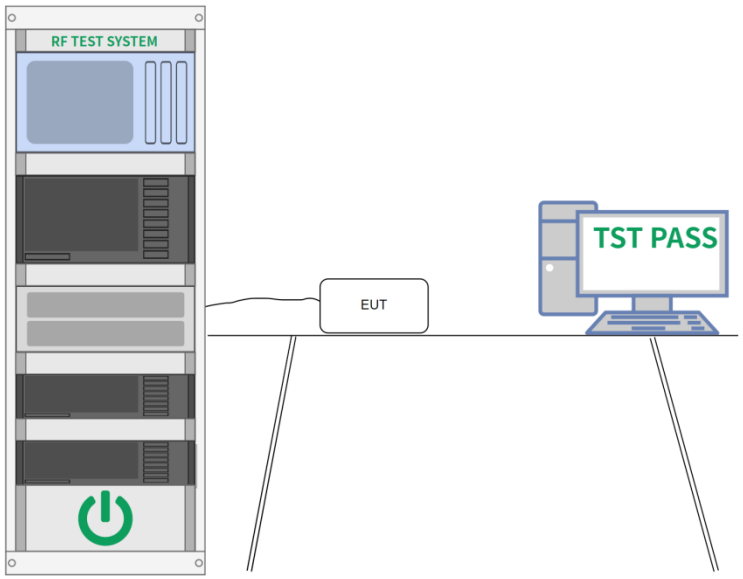
4.3 Maximum Conducted Output Power

Test Requirement:	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
Test Limit:	For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
Test Method:	Maximum peak conducted output power
Procedure:	ANSI C63.10-2013, section 11.9.1 Maximum peak conducted output power

4.3.1 E.U.T. Operation:

Operating Environment:					
Temperature:	23.8 °C	Humidity:	53.1 %	Atmospheric Pressure:	102 kPa
Pre test mode:	GFSK(1Mbps), GFSK(2Mbps)				
Final test mode:	GFSK(1Mbps), GFSK(2Mbps)				

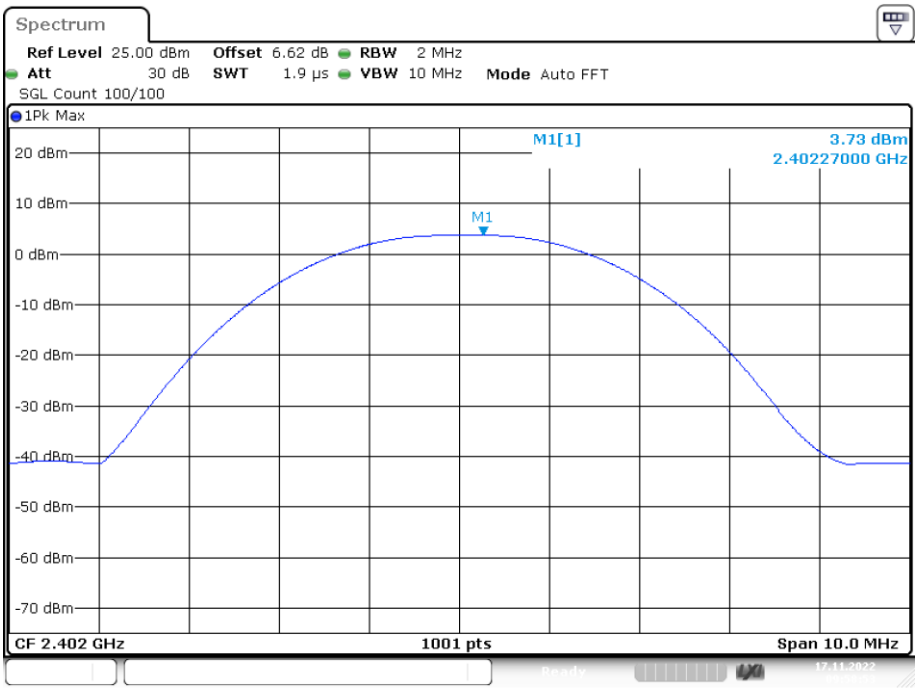
4.3.2 Test Setup Diagram:



4.3.3 Test Result:

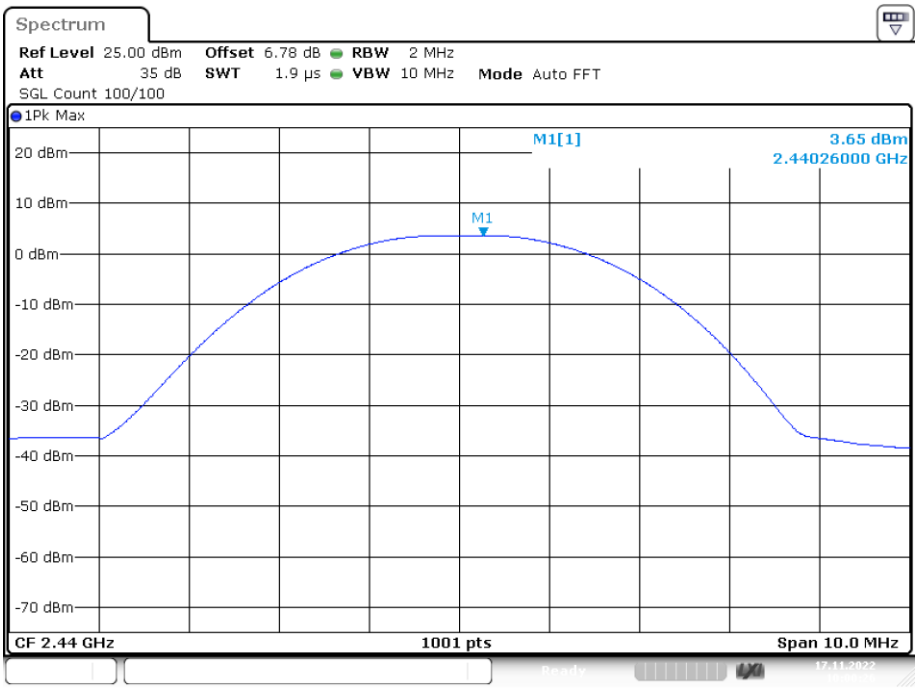
Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	BLE 1M	2402	Ant1	3.73	30	Pass
NVNT	BLE 1M	2440	Ant1	3.65	30	Pass
NVNT	BLE 1M	2480	Ant1	3.42	30	Pass

Power NVNT BLE 1M 2402MHz Ant1



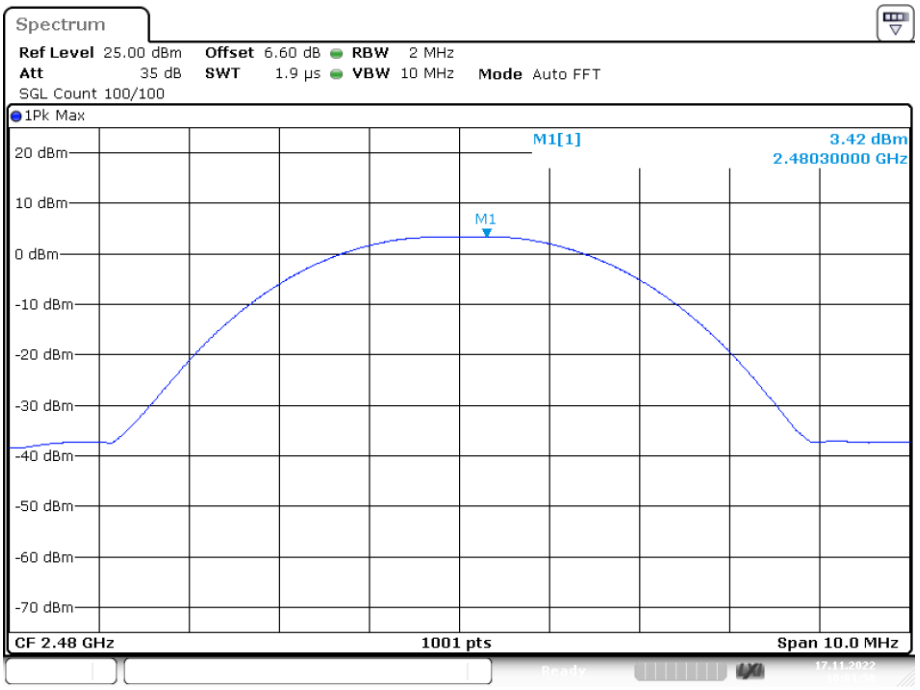
Date: 17.NOV.2022 09:58:53

Power NVNT BLE 1M 2440MHz Ant1



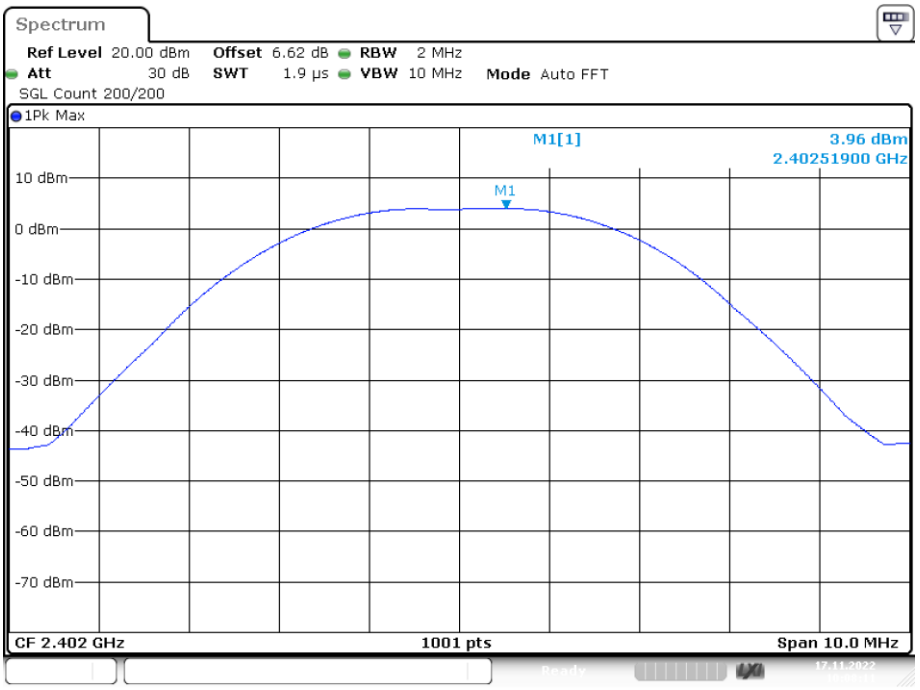
Date: 17.NOV.2022 10:00:26

Power NVNT BLE 1M 2480MHz Ant1

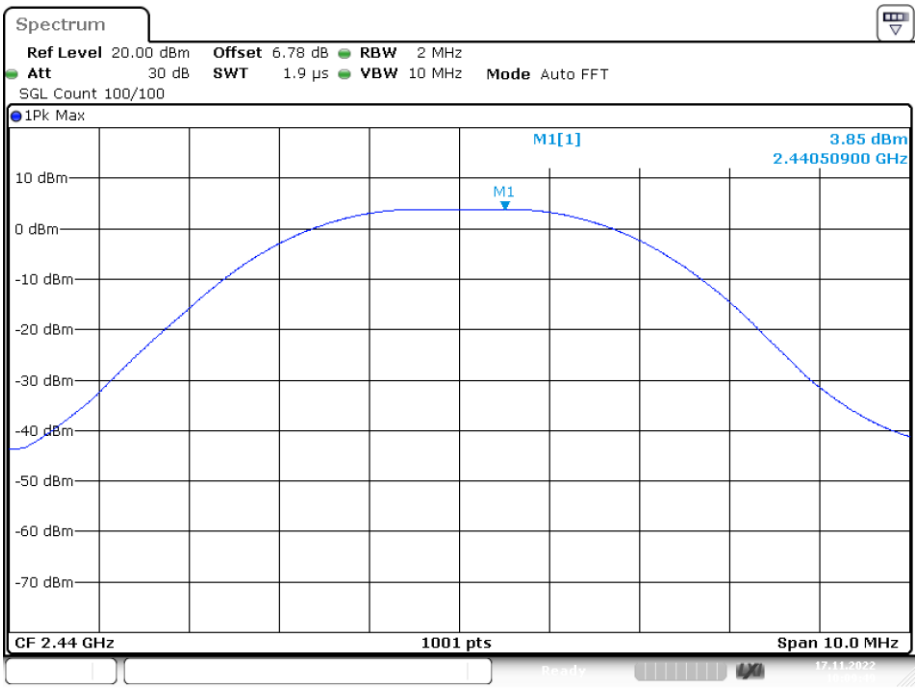


Condition	Mode	Frequency (MHz)	Antenna	Conducted Power (dBm)	Limit (dBm)	Verdict
NVNT	BLE 2M	2402	Ant1	3.96	30	Pass
NVNT	BLE 2M	2440	Ant1	3.85	30	Pass
NVNT	BLE 2M	2480	Ant1	3.56	30	Pass

Power NVNT BLE 2M 2402MHz Ant1

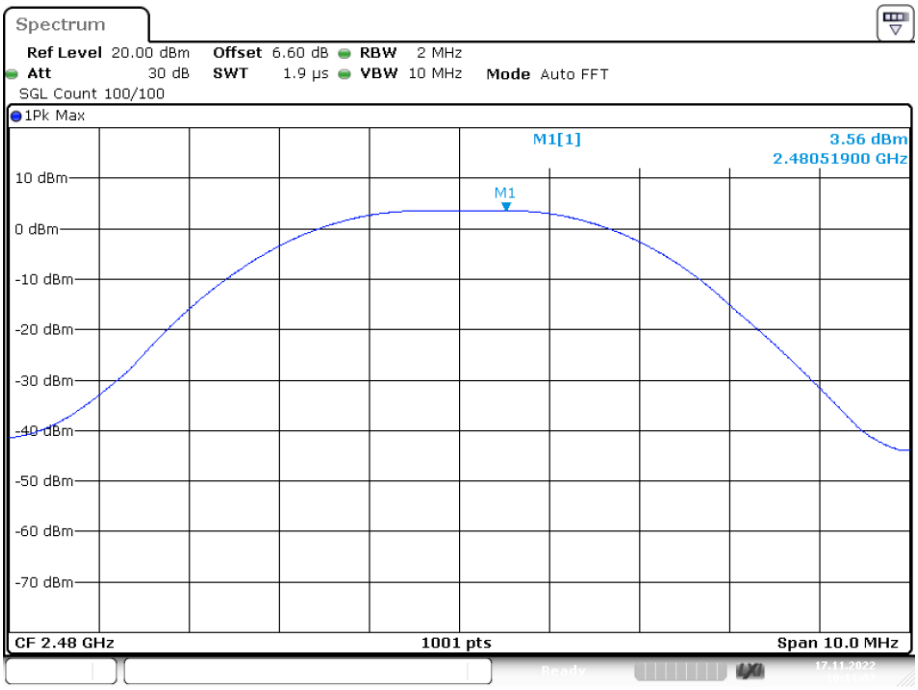


Power NVNT BLE 2M 2440MHz Ant1



Date: 17.NOV.2022 10:09:48

Power NVNT BLE 2M 2480MHz Ant1



Date: 17.NOV.2022 10:11:07

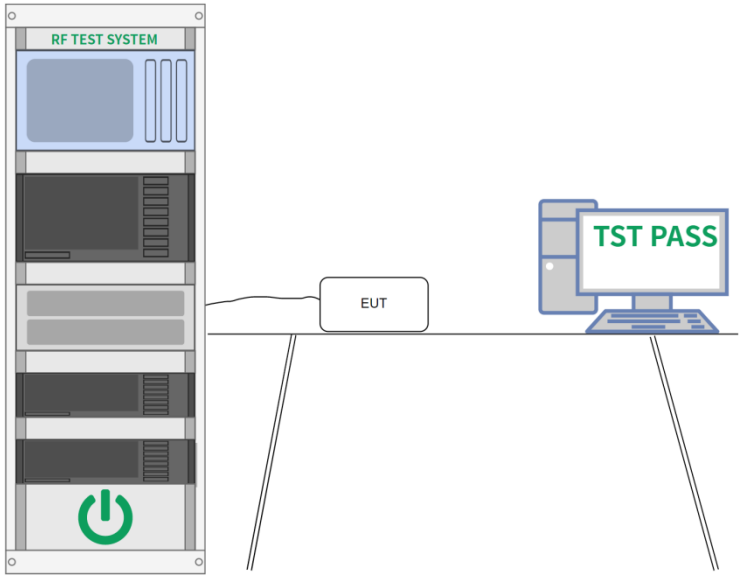
4.4 Power Spectral Density

Test Requirement:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
Test Limit:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.
Test Method:	Maximum power spectral density level in the fundamental emission
Procedure:	ANSI C63.10-2013, section 11.10 Maximum power spectral density level in the fundamental emission

4.4.1 E.U.T. Operation:

Operating Environment:					
Temperature:	23.8 °C	Humidity:	53.1 %	Atmospheric Pressure:	102 kPa
Pre test mode:	GFSK(1Mbps), GFSK(2Mbps)				
Final test mode:	GFSK(1Mbps), GFSK(2Mbps)				

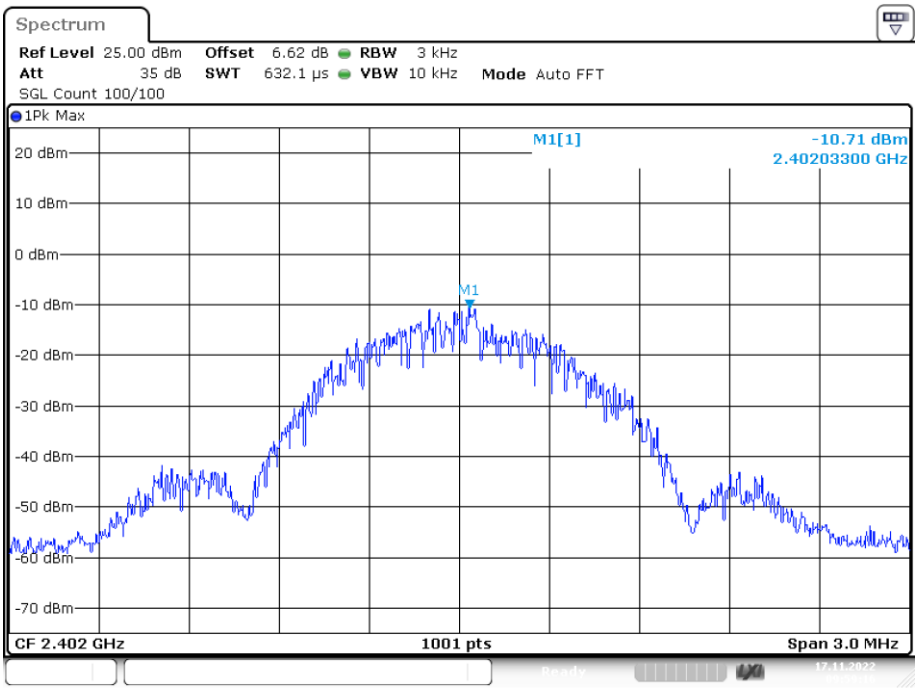
4.4.2 Test Setup Diagram:



4.4.3 Test Result:

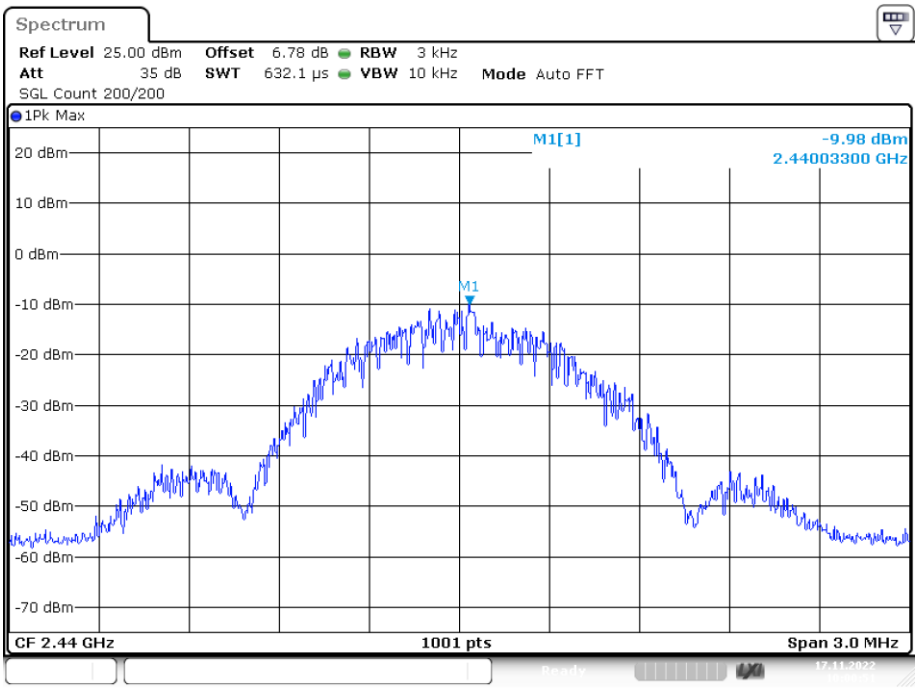
Condition	Mode	Frequency (MHz)	Antenna	Max PSD (dBm)	Limit (dBm)	Verdict
NVNT	BLE 1M	2402	Ant1	-10.71	8	Pass
NVNT	BLE 1M	2440	Ant1	-9.98	8	Pass
NVNT	BLE 1M	2480	Ant1	-9.86	8	Pass

PSD NVNT BLE 1M 2402MHz Ant1



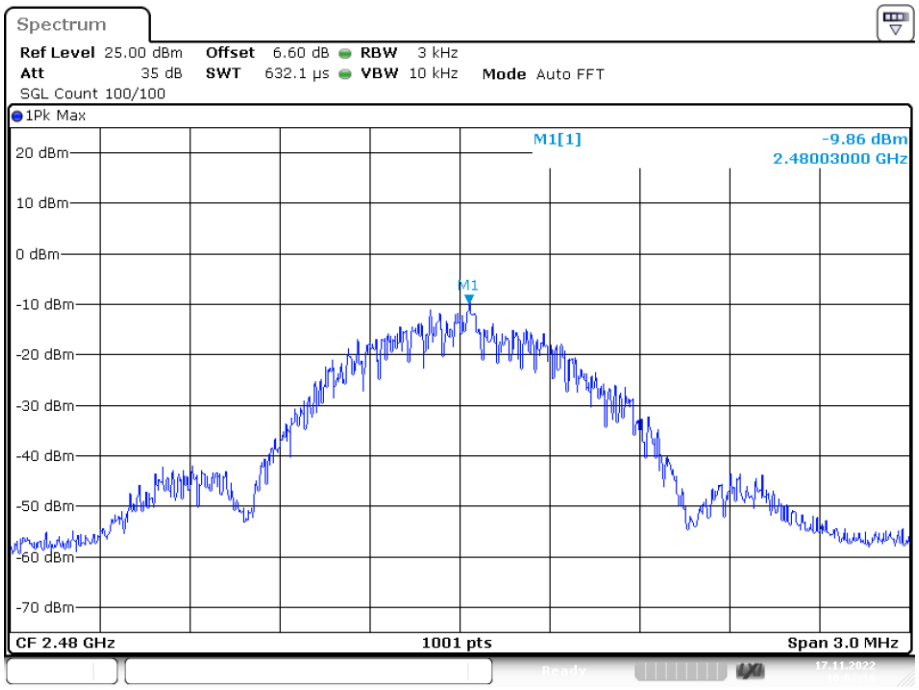
Date: 17.NOV.2022 09:59:15

PSD NVNT BLE 1M 2440MHz Ant1



Date: 17.NOV.2022 10:00:51

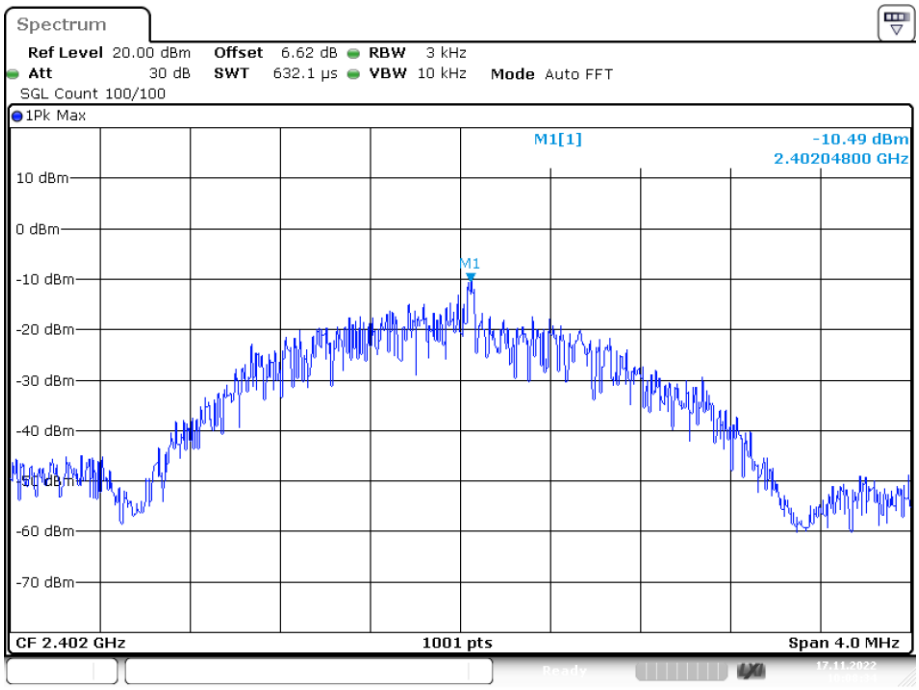
PSD NVNT BLE 1M 2480MHz Ant1



Date: 17.NOV.2022 10:02:16

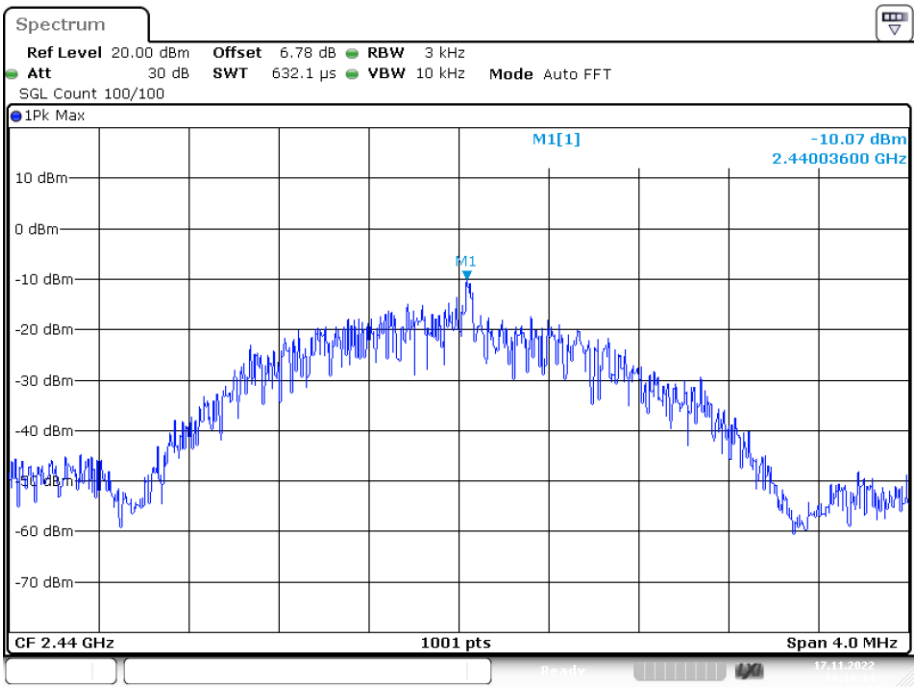
Condition	Mode	Frequency (MHz)	Antenna	Max PSD (dBm)	Limit (dBm)	Verdict
NVNT	BLE 2M	2402	Ant1	-10.49	8	Pass
NVNT	BLE 2M	2440	Ant1	-10.07	8	Pass
NVNT	BLE 2M	2480	Ant1	-10.02	8	Pass

PSD NVNT BLE 2M 2402MHz Ant1



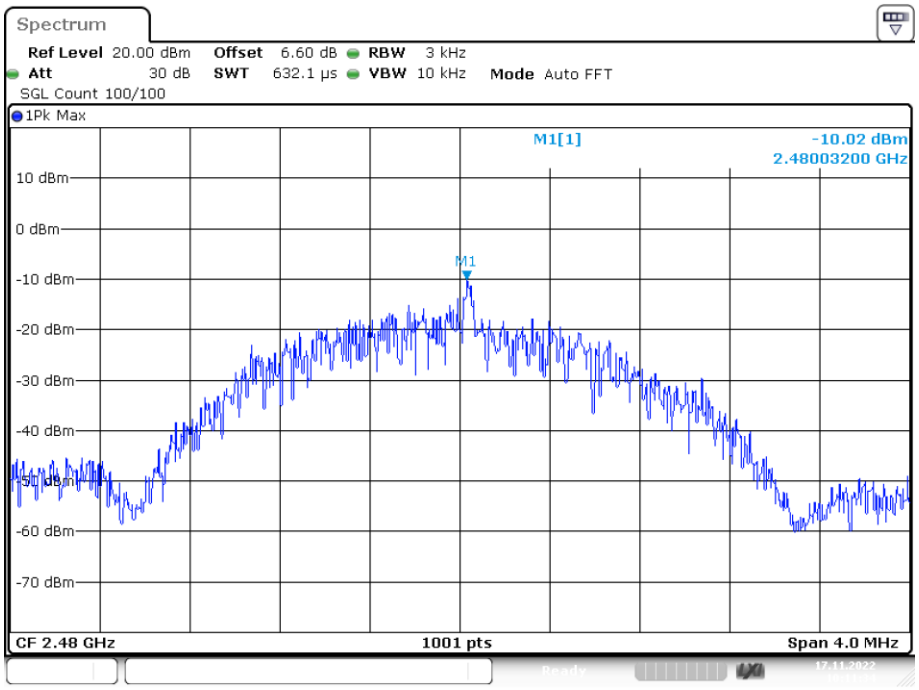
Date: 17.NOV.2022 10:08:34

PSD NVNT BLE 2M 2440MHz Ant1



Date: 17.NOV.2022 10:10:14

PSD NVNT BLE 2M 2480MHz Ant1



Date: 17.NOV.2022 10:11:35

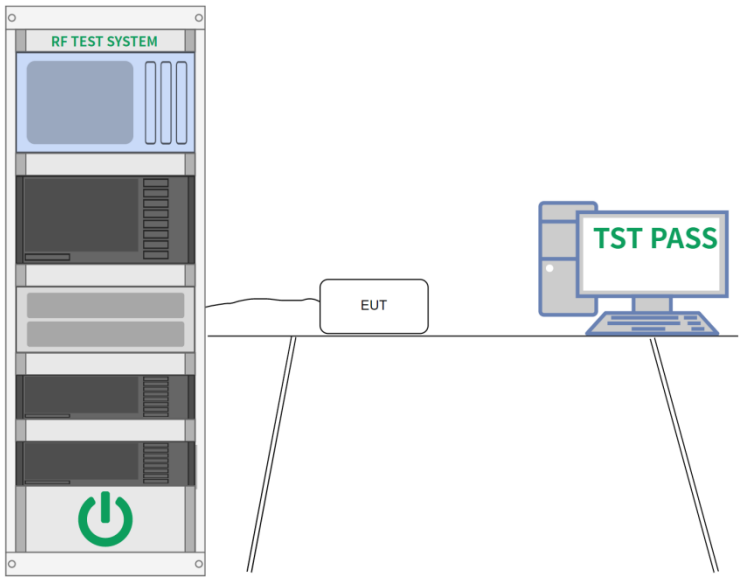
4.5 Emissions in non-restricted frequency bands

Test Requirement:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Test Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required.
Test Method:	Emissions in nonrestricted frequency bands
Procedure:	ANSI C63.10-2013 Section 11.11.1, Section 11.11.2, Section 11.11.3

4.5.1 E.U.T. Operation:

Operating Environment:					
Temperature:	23.8 °C	Humidity:	53.1 %	Atmospheric Pressure:	102 kPa
Pre test mode:	GFSK(1Mbps), GFSK(2Mbps)				
Final test mode:	GFSK(1Mbps), GFSK(2Mbps)				

4.5.2 Test Setup Diagram:

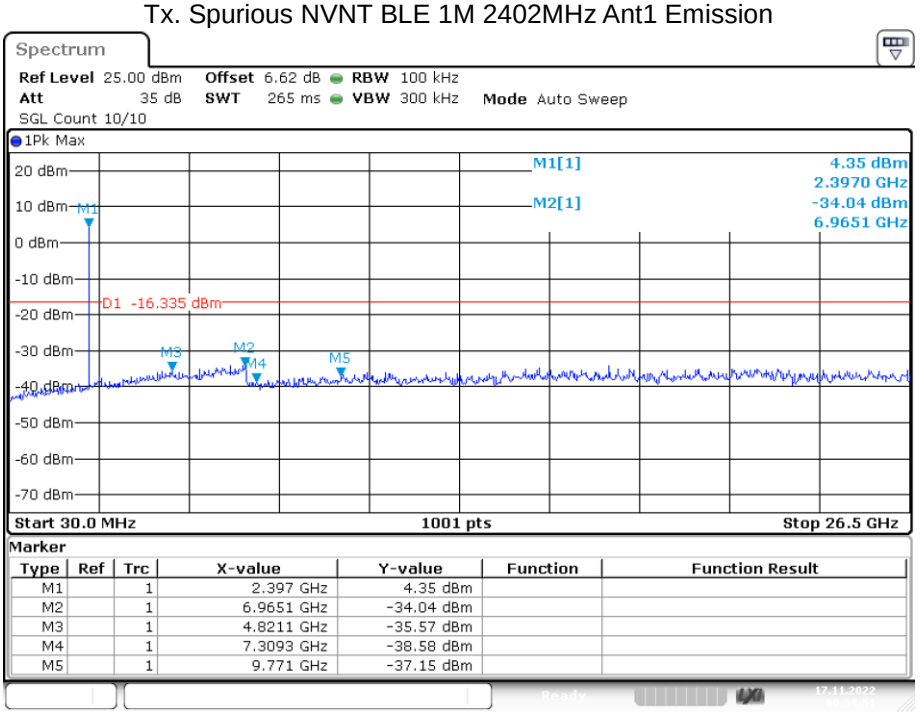


4.5.3 Test Result:

Conducted RF Spurious Emission

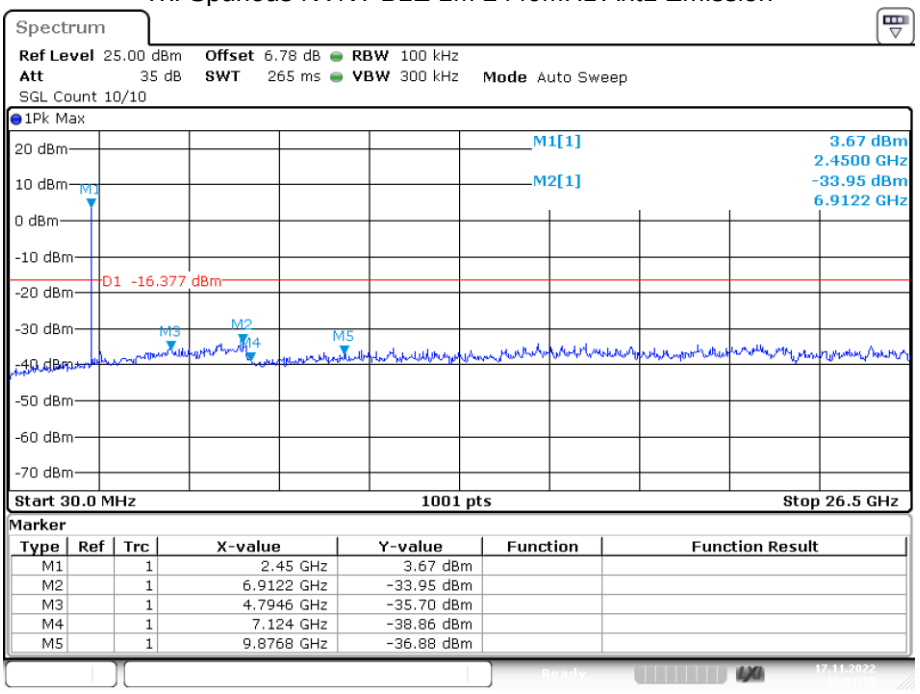
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 1M	2402	Ant1	-37.69	-20	Pass
NVNT	BLE 1M	2440	Ant1	-37.56	-20	Pass
NVNT	BLE 1M	2480	Ant1	-37.47	-20	Pass

Tx. Spurious NVNT BLE 1M 2402MHz Ant1 Emission



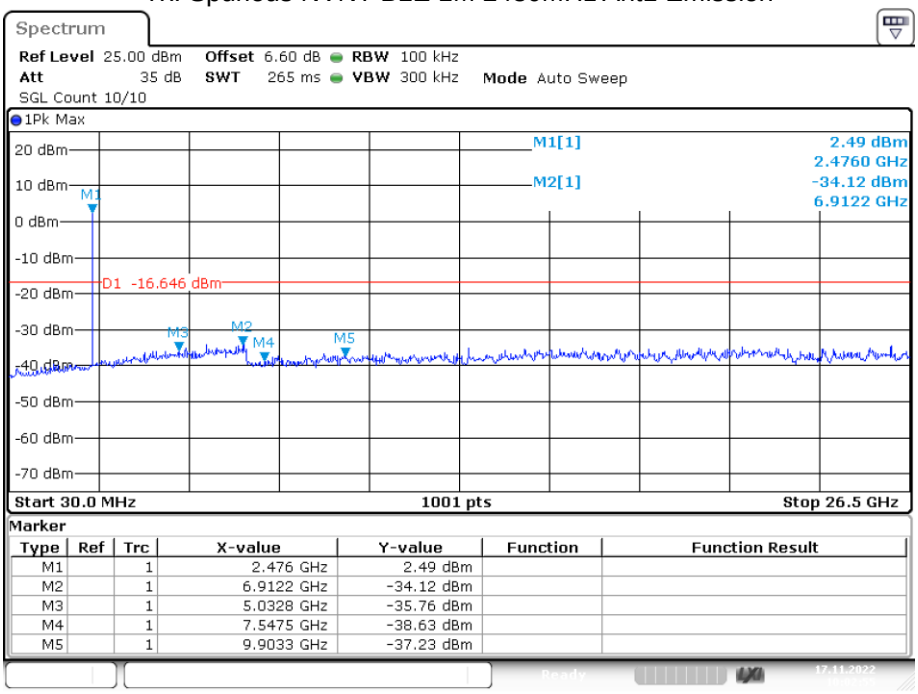
Date: 17.NOV.2022 09:59:51

Tx. Spurious NVNT BLE 1M 2440MHz Ant1 Emission



Date: 17.NOV.2022 10:01:15

Tx. Spurious NVNT BLE 1M 2480MHz Ant1 Emission



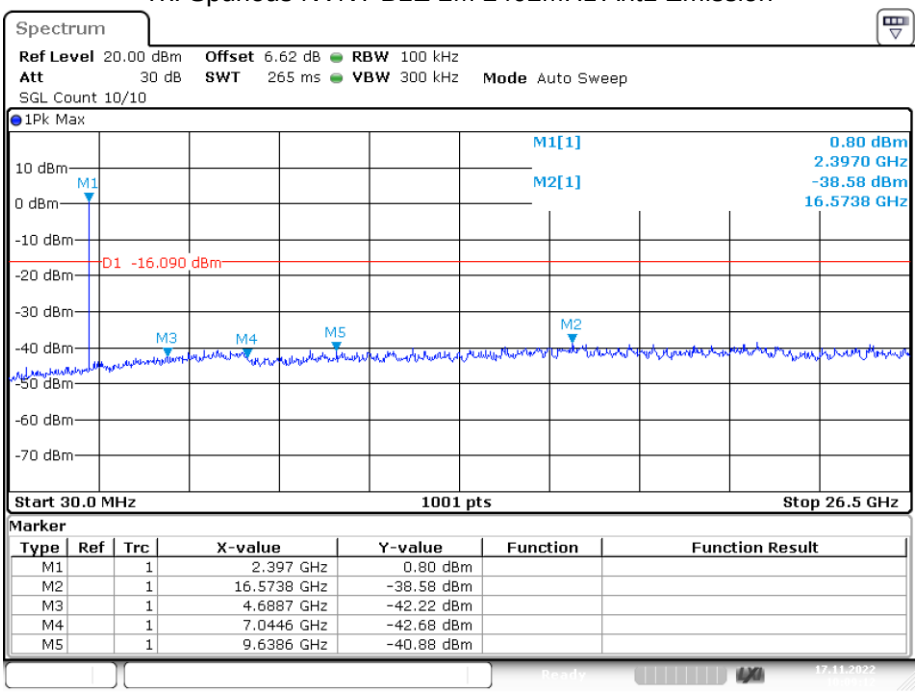
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.476 GHz	2.49 dBm		
M2		1	6.9122 GHz	-34.12 dBm		
M3		1	5.0328 GHz	-35.76 dBm		
M4		1	7.5475 GHz	-38.63 dBm		
M5		1	9.9033 GHz	-37.23 dBm		

Date: 17.NOV.2022 10:02:54

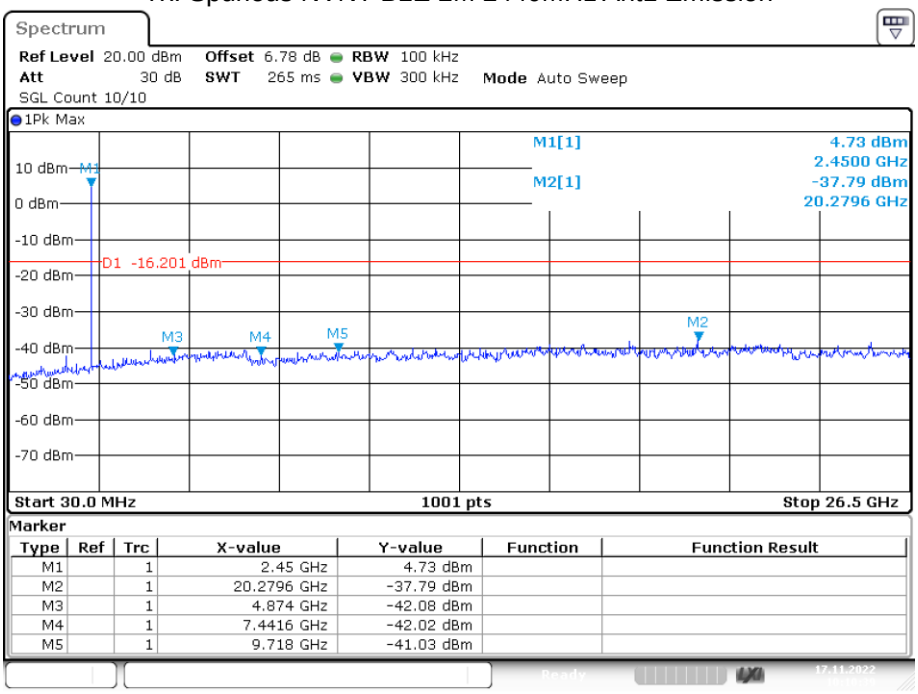
Condition	Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
NVNT	BLE 2M	2402	Ant1	-42.49	-20	Pass
NVNT	BLE 2M	2440	Ant1	-41.58	-20	Pass
NVNT	BLE 2M	2480	Ant1	-41.69	-20	Pass

Tx. Spurious NVNT BLE 2M 2402MHz Ant1 Emission



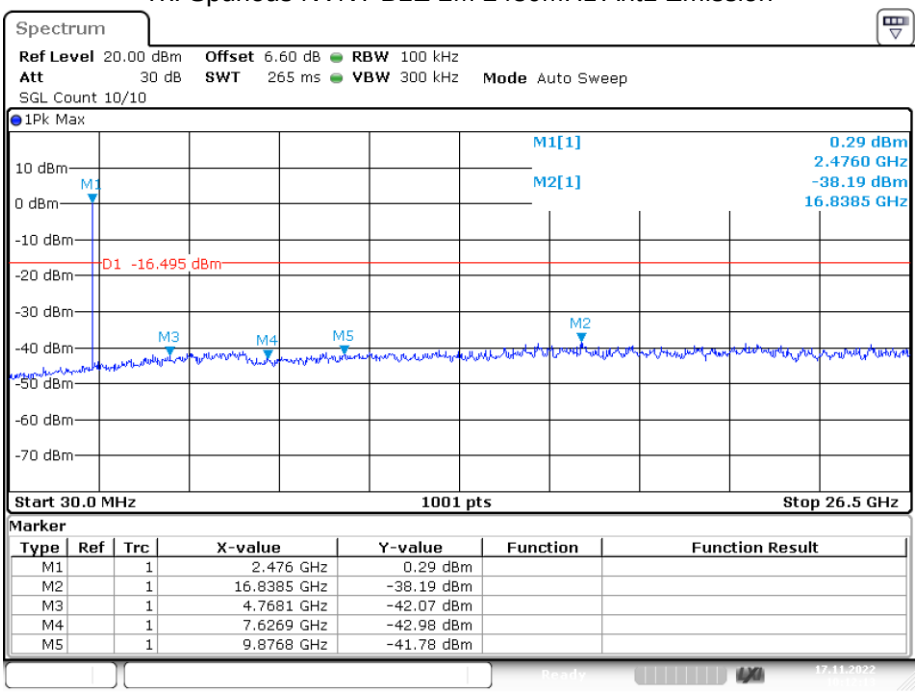
Date: 17.NOV.2022 10:09:11

Tx. Spurious NVNT BLE 2M 2440MHz Ant1 Emission



Date: 17.NOV.2022 10:10:39

Tx. Spurious NVNT BLE 2M 2480MHz Ant1 Emission



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.476 GHz	0.29 dBm		
M2		1	16.8385 GHz	-38.19 dBm		
M3		1	4.7681 GHz	-42.07 dBm		
M4		1	7.6269 GHz	-42.98 dBm		
M5		1	9.8768 GHz	-41.78 dBm		

Date: 17.NOV.2022 10:12:13

4.6 Band edge emissions

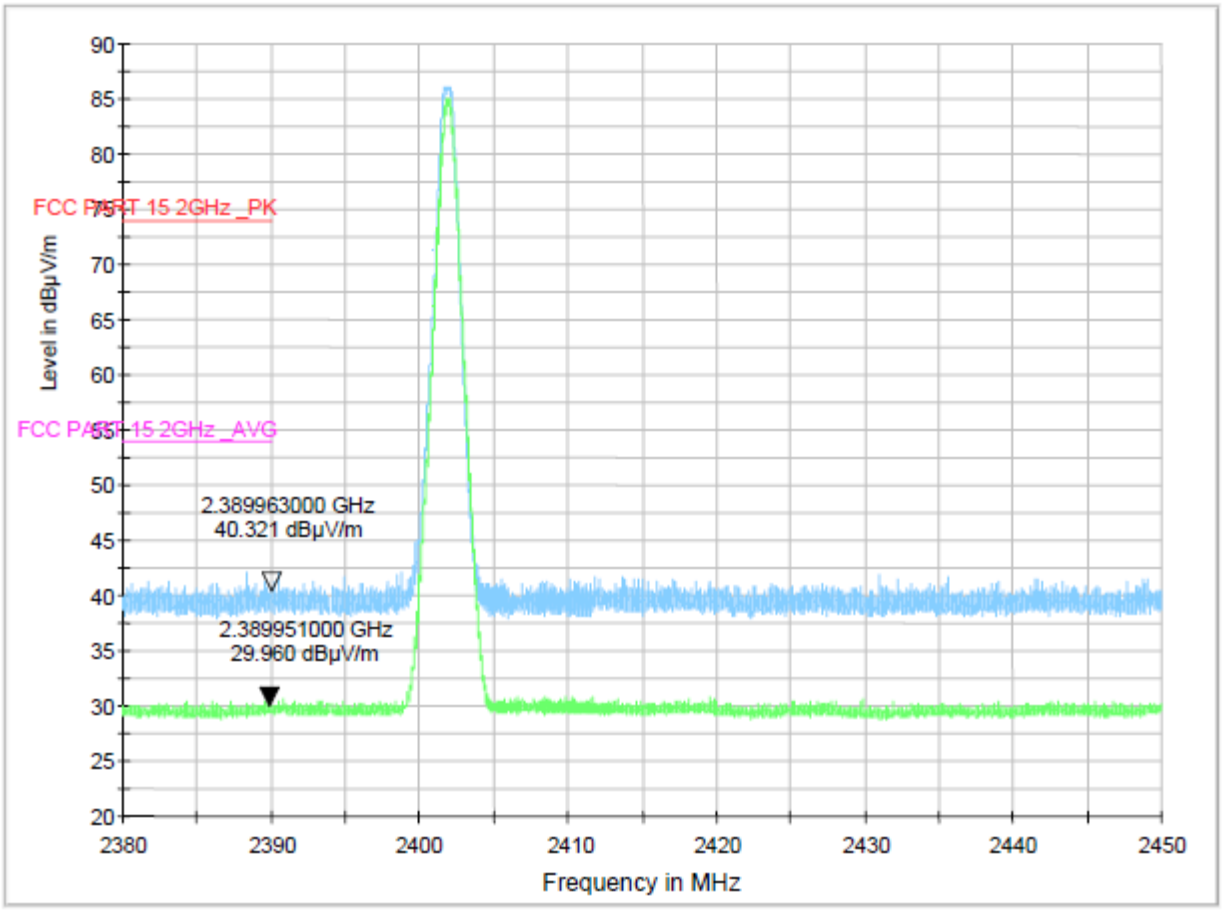
<table>
<tr><td>Test Requirement:</td><td colspan="3">In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`</td></tr>
<tr><td>Test Limit:</td><td colspan="3"><table>
<tr><td>Frequency (MHz)</td><td>Field strength (microvolts/meter)</td><td>Measurement distance (meters)</td></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100 **</td><td>3</td></tr>
<tr><td>88-216</td><td>150 **</td><td>3</td></tr>
<tr><td>216-960</td><td>200 **</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.</td></tr>
<tr><td>Test Method:</td><td colspan="3">Radiated emissions tests</td></tr>
<tr><td>Procedure:</td><td colspan="3">ANSI C63.10-2013 section 6.6.4</td></tr>
</table>

4.6.1 E.U.T. Operation:

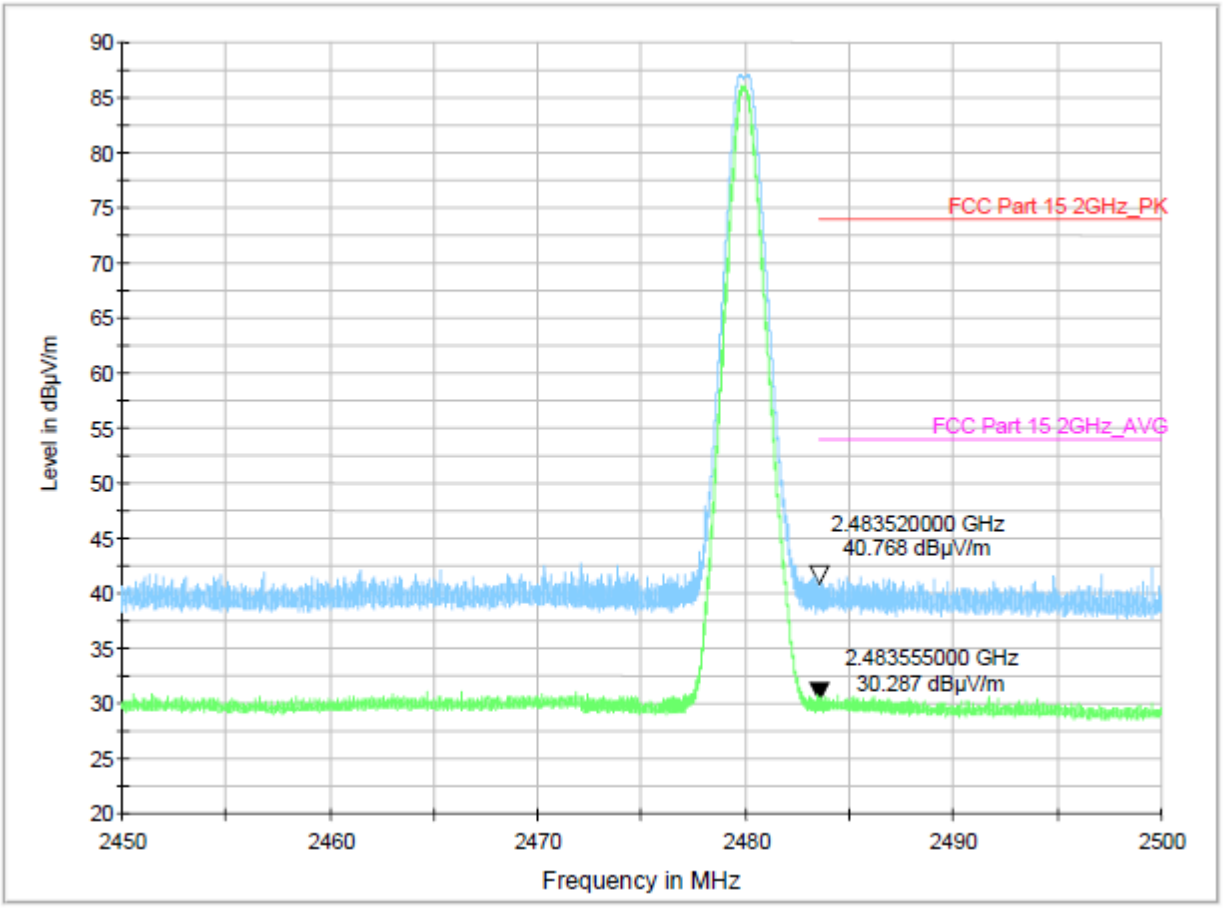
<table>
<tr><td colspan="6">Operating Environment:</td></tr>
<tr><td>Temperature:</td><td>23.8 °C</td><td>Humidity:</td><td>53.1 %</td><td>Atmospheric Pressure:</td><td>102 kPa</td></tr>
<tr><td>Pre test mode:</td><td colspan="5">GFSK(1Mbps), GFSK(2Mbps)</td></tr>
<tr><td>Final test mode:</td><td colspan="5">GFSK(1Mbps), GFSK(2Mbps)</td></tr>
</table>

4.6.2 Test Result:

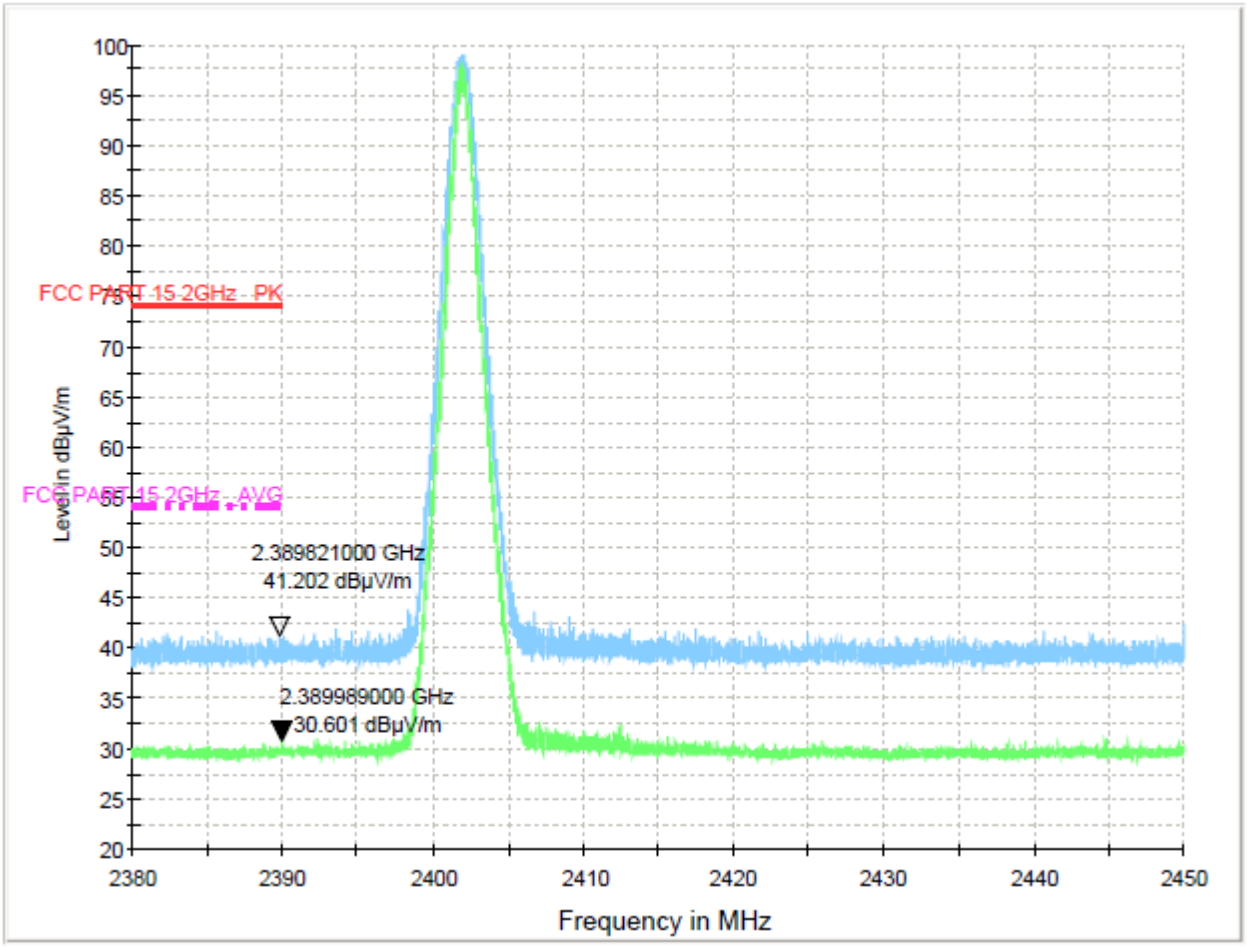
Radiated Method:
GFSK(1Mbps)/ CH: L



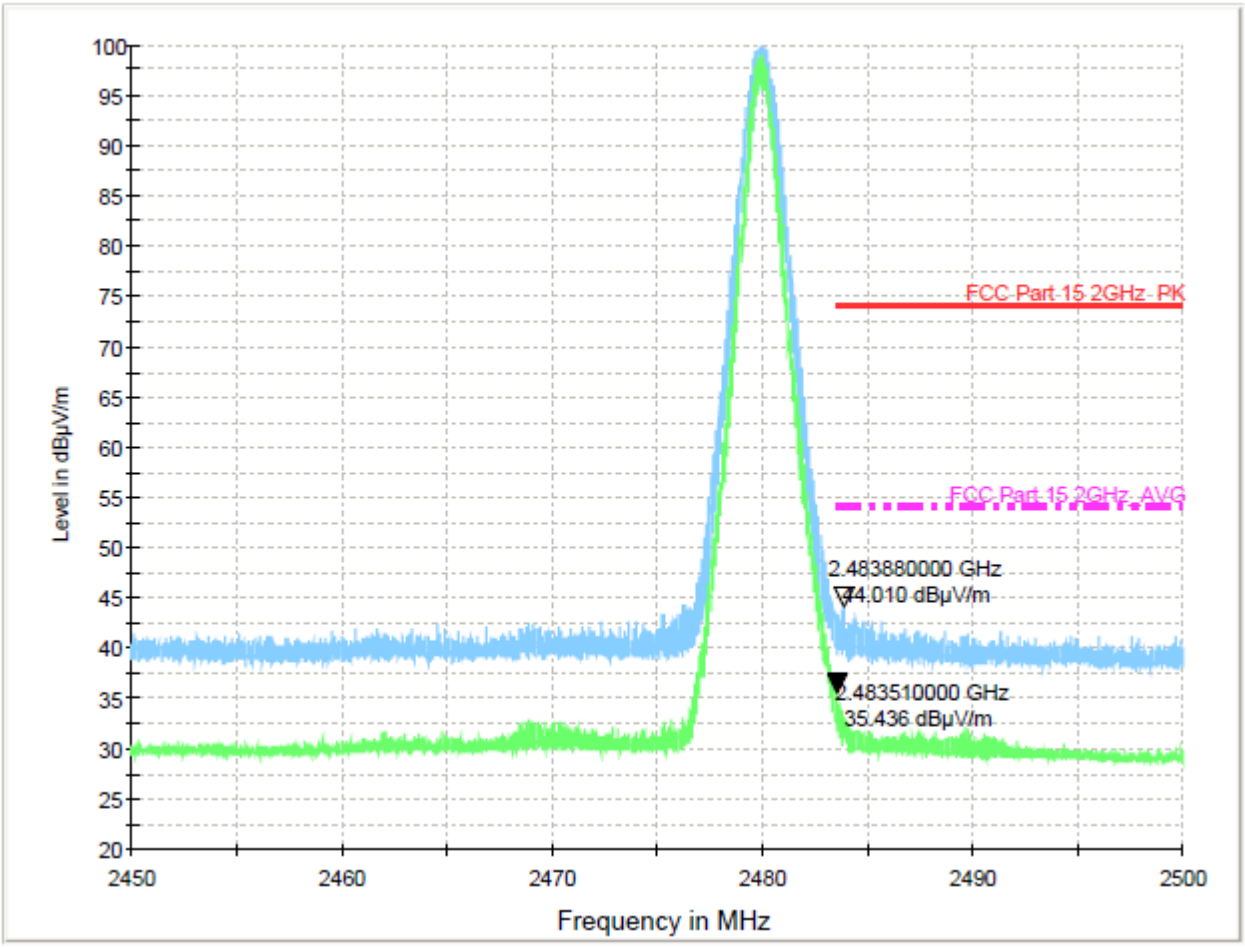
GFSK(1Mbps) /CH: H



GFSK(2Mbps) / CH: L

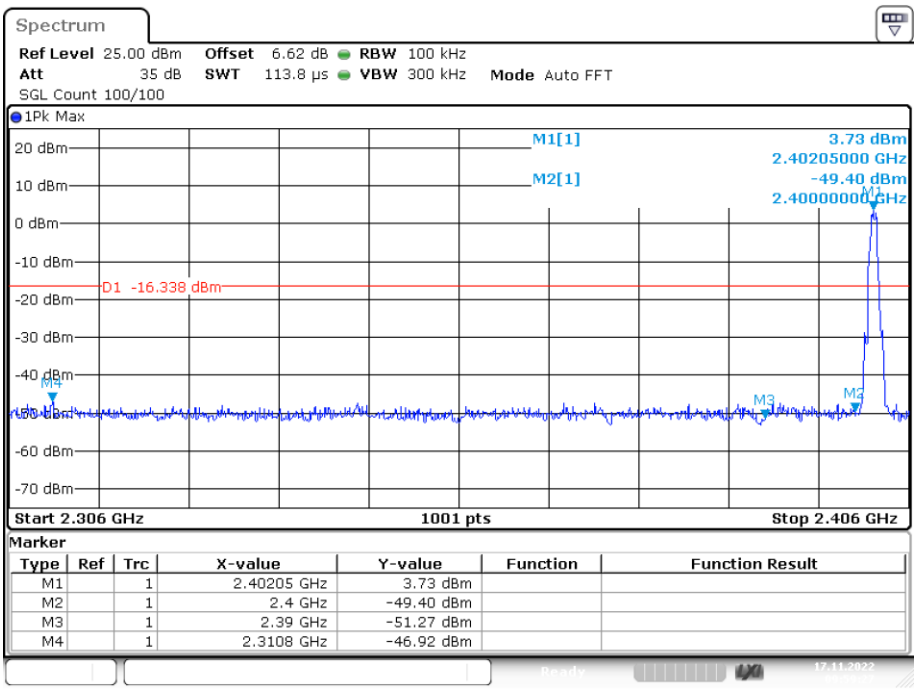


GFSK(2Mbps) / CH: H



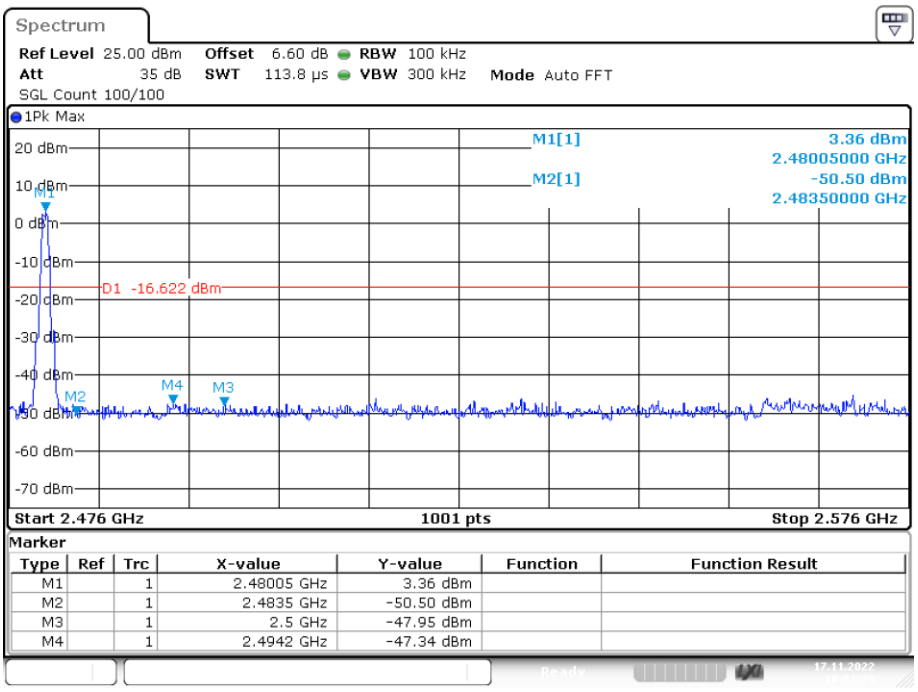
Conducted Method:

GFSK(1Mbps) / CH: L



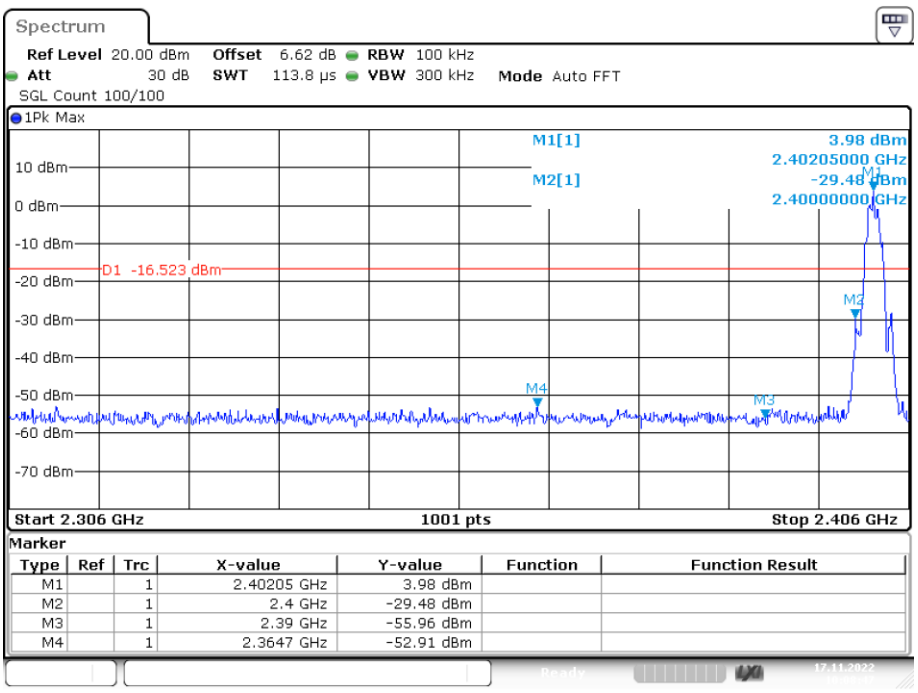
Date: 17.NOV.2022 09:59:27

GFSK(1Mbps) /CH: H



Date: 17.NOV.2022 10:02:29

GFSK(2Mbps) / CH: L

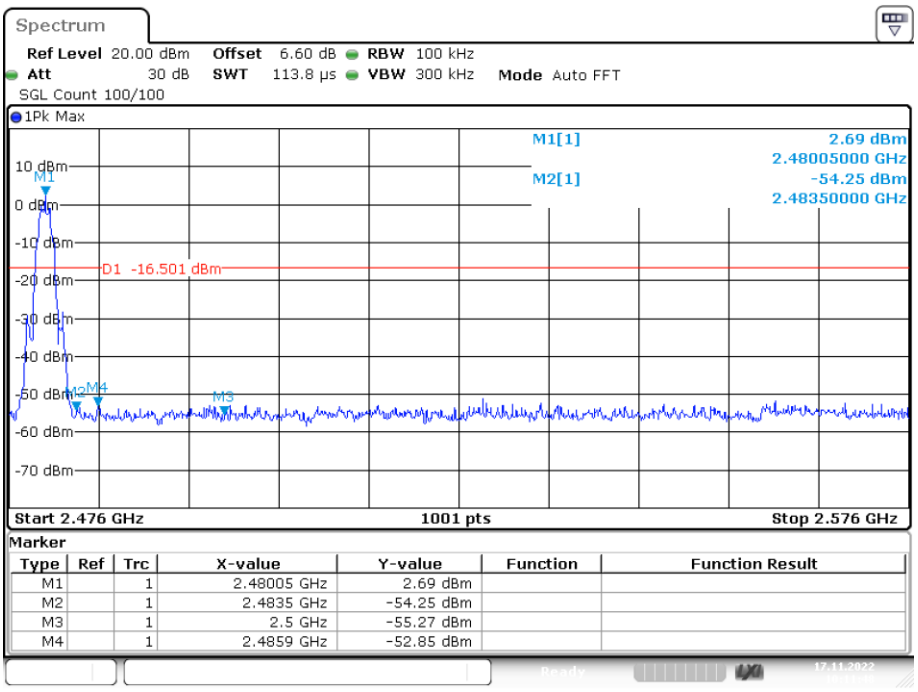


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40205 GHz	3.98 dBm		
M2		1	2.4 GHz	-29.48 dBm		
M3		1	2.39 GHz	-55.96 dBm		
M4		1	2.3647 GHz	-52.91 dBm		

Date: 17.NOV.2022 10:08:47

GFSK(2Mbps) / CH: H



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48005 GHz	2.69 dBm		
M2		1	2.4835 GHz	-54.25 dBm		
M3		1	2.5 GHz	-55.27 dBm		
M4		1	2.4859 GHz	-52.85 dBm		

Date: 17.NOV.2022 10:11:48

4.7 Emissions in restricted frequency bands (below 1GHz)

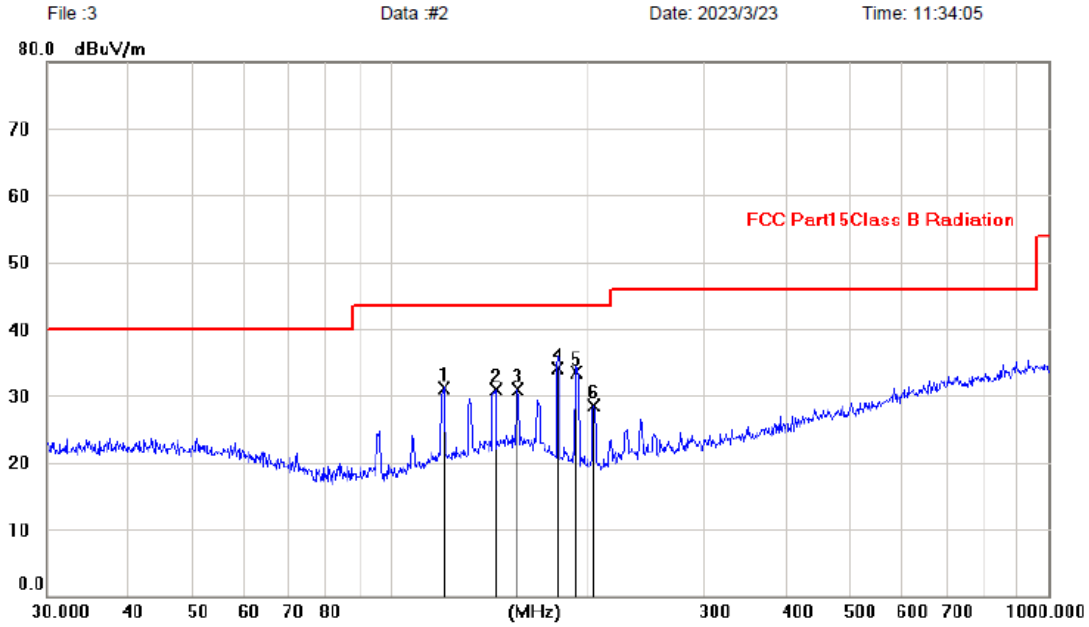
<table>
<tr><td>Test Requirement:</td><td>In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`</td></tr>
<tr><td>Test Limit:</td><td>
<table>
<tr><td>Frequency (MHz)</td><td>Field strength (microvolts/meter)</td><td>Measurement distance (meters)</td></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100 **</td><td>3</td></tr>
<tr><td>88-216</td><td>150 **</td><td>3</td></tr>
<tr><td>216-960</td><td>200 **</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.
</td></tr>
<tr><td>Test Method:</td><td>Radiated emissions tests</td></tr>
<tr><td>Procedure:</td><td>ANSI C63.10-2013 section 6.6.4</td></tr>
</table>

4.7.1 E.U.T. Operation:

<table>
<tr><td colspan="6">Operating Environment:</td></tr>
<tr><td>Temperature:</td><td>23.8 °C</td><td>Humidity:</td><td>53.1 %</td><td>Atmospheric Pressure:</td><td>102 kPa</td></tr>
<tr><td>Pre test mode:</td><td colspan="5">GFSK(1Mbps), GFSK(2Mbps)</td></tr>
<tr><td>Final test mode:</td><td colspan="5">GFSK(1Mbps)</td></tr>
</table>

4.7.2 Test Result:

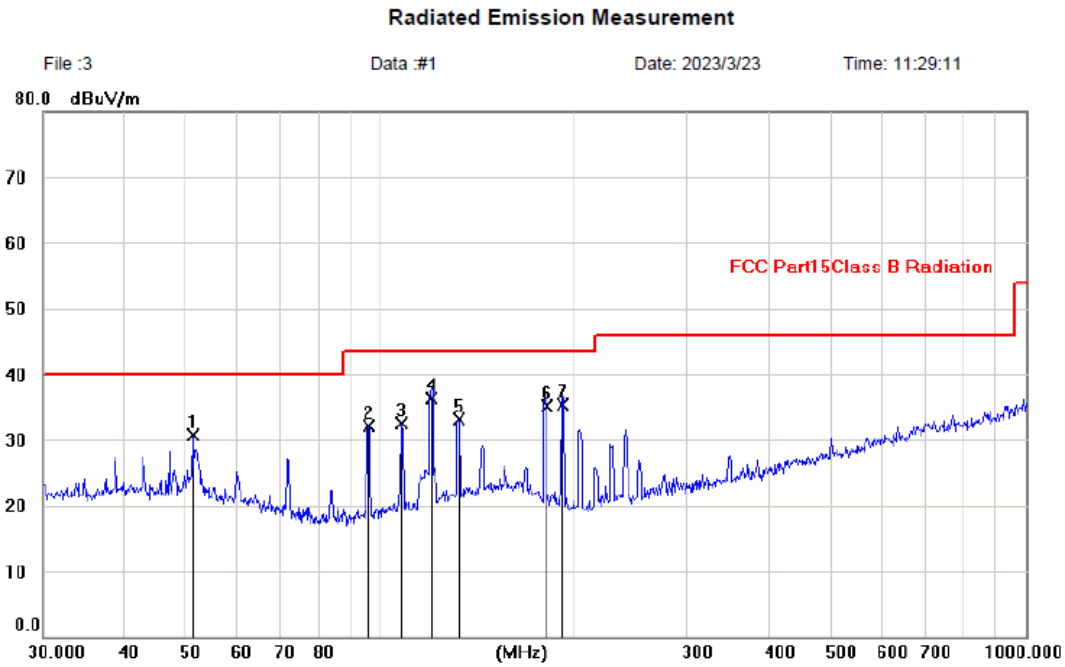
GFSK(1Mbps) / Polarization: Horizontal /CH: L



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		120.5159	18.13	13.07	31.20	43.50	-12.30	peak			
2		144.4023	16.33	14.64	30.97	43.50	-12.53	peak			
3		155.9283	15.89	15.05	30.94	43.50	-12.56	peak			
4	*	179.9113	21.45	12.69	34.14	43.50	-9.36	QP			
5		191.7674	22.13	11.37	33.50	43.50	-10.00	QP			
6		203.8085	17.57	10.96	28.53	43.50	-14.97	peak			

Note:1. *:Maximum data; x:Over limit; !:over margin.
2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

GFSK(1Mbps) / Polarization: Vertical /CH: L



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		51.2166	16.85	13.88	30.73	40.00	-9.27	peak			
2		96.0537	21.47	10.54	32.01	43.50	-11.49	peak			
3		107.7365	20.88	11.61	32.49	43.50	-11.01	peak			
4	*	120.2485	23.24	13.05	36.29	43.50	-7.21	QP			
5		132.3907	19.39	13.76	33.15	43.50	-10.35	peak			
6		180.6488	22.46	12.60	35.06	43.50	-8.44	QP			
7		192.0365	23.86	11.35	35.21	43.50	-8.29	QP			

Note:1. *:Maximum data; x:Over limit; !:over margin.
2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

4.8 Emissions in restricted frequency bands (above 1GHz)

<table>
<tr><td>Test Requirement:</td><td>In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`</td></tr>
<tr><td>Test Limit:</td><td>
<table>
<tr><td>Frequency (MHz)</td><td>Field strength (microvolts/meter)</td><td>Measurement distance (meters)</td></tr>
<tr><td>0.009-0.490</td><td>2400/F(kHz)</td><td>300</td></tr>
<tr><td>0.490-1.705</td><td>24000/F(kHz)</td><td>30</td></tr>
<tr><td>1.705-30.0</td><td>30</td><td>30</td></tr>
<tr><td>30-88</td><td>100 **</td><td>3</td></tr>
<tr><td>88-216</td><td>150 **</td><td>3</td></tr>
<tr><td>216-960</td><td>200 **</td><td>3</td></tr>
<tr><td>Above 960</td><td>500</td><td>3</td></tr>
</table>
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.
</td></tr>
<tr><td>Test Method:</td><td>Radiated emissions tests</td></tr>
<tr><td>Procedure:</td><td>ANSI C63.10-2013 section 6.6.4</td></tr>
</table>

4.8.1 E.U.T. Operation:

<table>
<tr><td colspan="6">Operating Environment:</td></tr>
<tr><td>Temperature:</td><td>23.8 °C</td><td>Humidity:</td><td>53.1 %</td><td>Atmospheric Pressure:</td><td>102 kPa</td></tr>
<tr><td colspan="2">Pre test mode:</td><td colspan="4">GFSK(1Mbps), GFSK(2Mbps)</td></tr>
<tr><td colspan="2">Final test mode:</td><td colspan="4">GFSK(1Mbps), GFSK(2Mbps)</td></tr>
</table>

4.8.2 Test Result:

From 1G-25GHz: GFSK(1Mbps)

Test Mode: TX Low									
Freq (MHz)	Read Level (dBuV/m)	Polar (H/V)	Antenna Factor (dB/m)	Cable loss(dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804	43.55	V	33.95	10.18	34.26	53.42	74	-20.58	PK
4804	38.92	V	33.95	10.18	34.26	48.79	54	-5.21	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	43.16	H	33.95	10.18	34.26	53.03	74	-20.97	PK
4804	35.40	H	33.95	10.18	34.26	45.27	54	-8.73	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: TX Mid									
4880	44.34	V	33.93	10.2	34.29	54.18	74	-19.82	PK
4880	34.73	V	33.93	10.2	34.29	44.57	54	-9.43	AV
7320	/	/	/	/	/	/	/	/	/
9760	/	/	/	/	/	/	/	/	/
4880	44.03	H	33.93	10.2	34.29	53.87	74	-20.13	PK
4880	35.22	H	33.93	10.2	34.29	45.06	54	-8.94	AV
7320	/	/	/	/	/	/	/	/	/
9760	/	/	/	/	/	/	/	/	/
Test Mode: TX High									
4960	46.79	V	33.98	10.22	34.25	56.74	74	-17.26	PK
4960	35.30	V	33.98	10.22	34.25	45.25	54	-8.75	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	44.32	H	33.98	10.22	34.25	54.27	74	-19.73	PK
4960	31.44	H	33.98	10.22	34.25	41.39	54	-12.61	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/

Note:
1, Result = Read level + Antenna factor + cable loss-Amp factor
2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.

From 1G-25GHz: GFSK(2Mbps)

Test Mode: TX Low									
Freq (MHz)	Read Level (dBuV/m)	Polar (H/V)	Antenna Factor (dB/m)	Cable loss(dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804	41.27	V	33.95	10.18	34.26	51.14	74	-22.86	PK
4804	38.33	V	33.95	10.18	34.26	48.20	54	-5.80	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	45.56	H	33.95	10.18	34.26	55.43	74	-18.57	PK
4804	37.23	H	33.95	10.18	34.26	47.10	54	-6.90	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: TX Mid									
4880	41.74	V	33.93	10.2	34.29	51.58	74	-22.42	PK
4880	33.32	V	33.93	10.2	34.29	43.16	54	-10.84	AV
7320	/	/	/	/	/	/	/	/	/
9760	/	/	/	/	/	/	/	/	/
4880	43.27	H	33.93	10.2	34.29	53.11	74	-20.89	PK
4880	33.65	H	33.93	10.2	34.29	43.49	54	-10.51	AV
7320	/	/	/	/	/	/	/	/	/
9760	/	/	/	/	/	/	/	/	/
Test Mode: TX High									
4960	46.70	V	33.98	10.22	34.25	56.65	74	-17.35	PK
4960	36.09	V	33.98	10.22	34.25	46.04	54	-7.96	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	42.01	H	33.98	10.22	34.25	51.96	74	-22.04	PK
4960	33.83	H	33.98	10.22	34.25	43.78	54	-10.22	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/

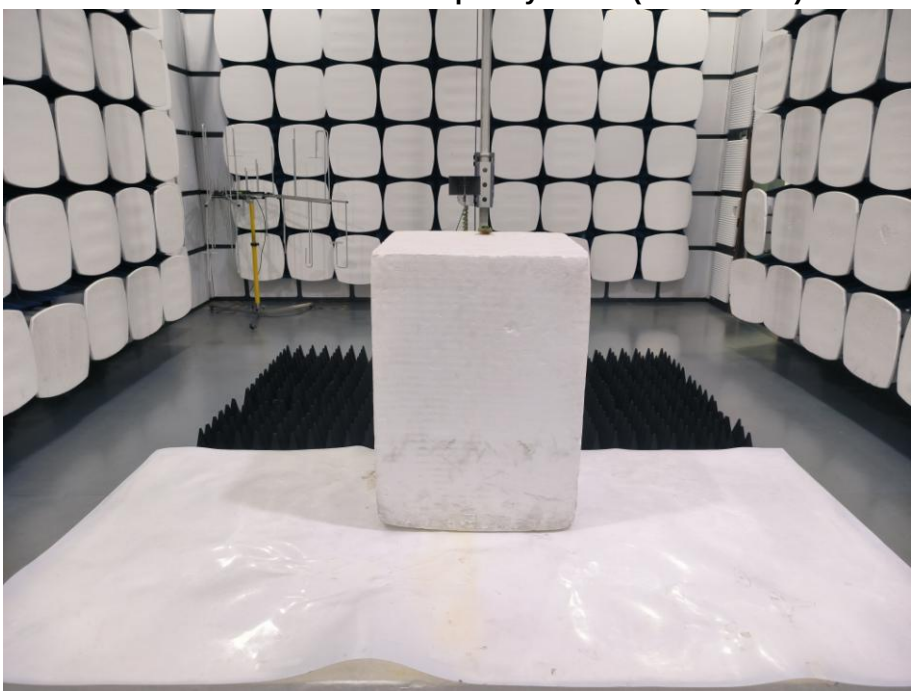
Note:
1, Result = Read level + Antenna factor + cable loss-Amp factor
2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.

5 Test Setup Photos

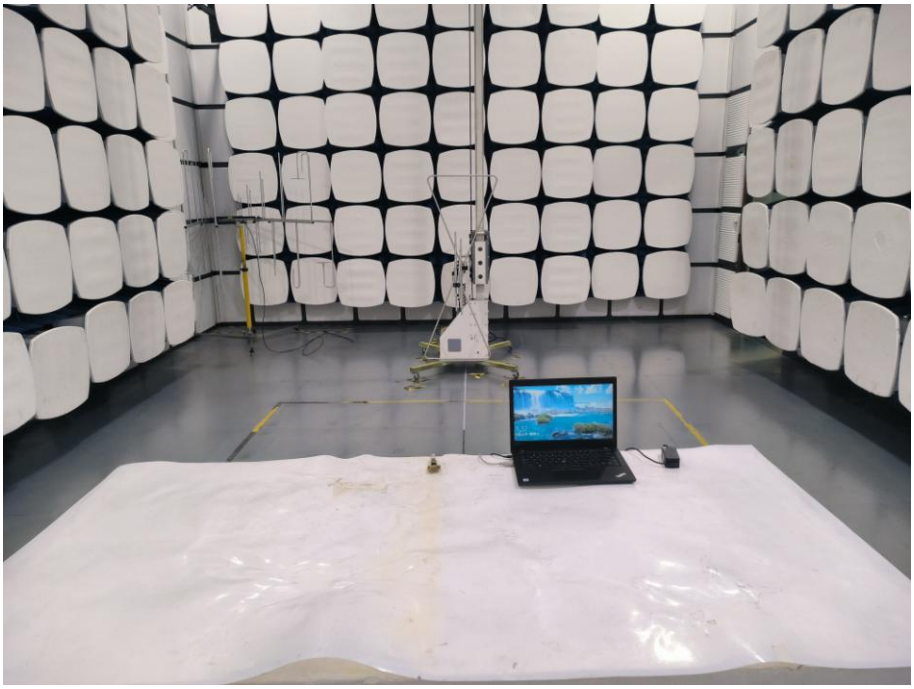
Conducted Emission at AC power line

Band edge emissions

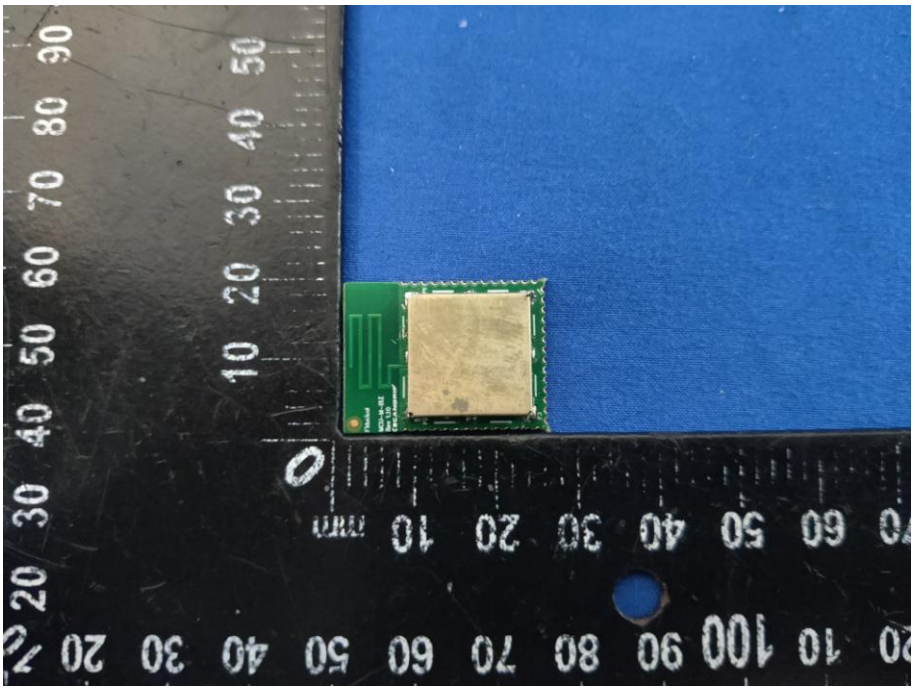
Emissions in restricted frequency bands (above 1GHz)

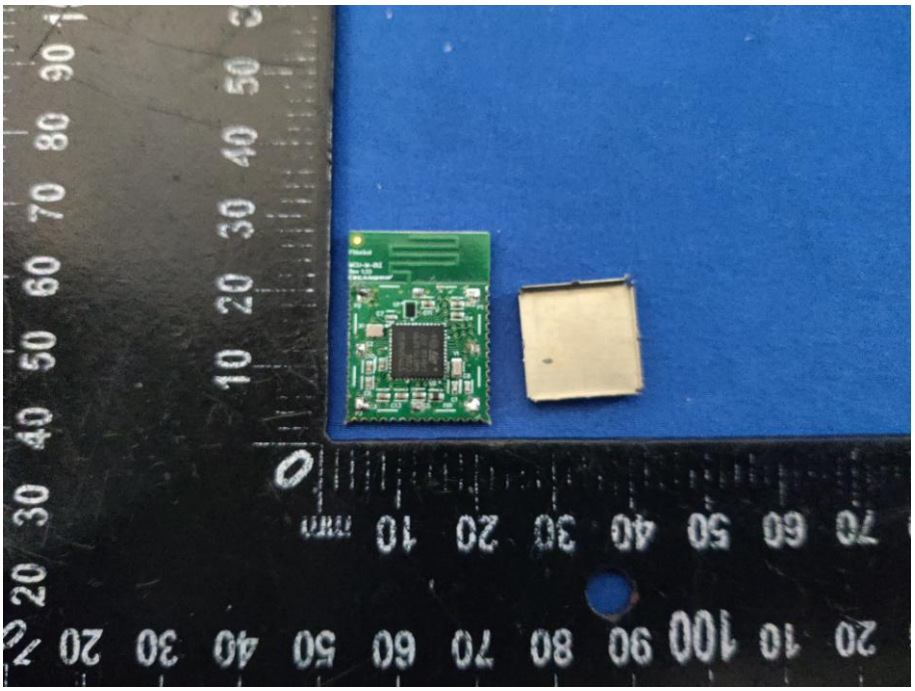


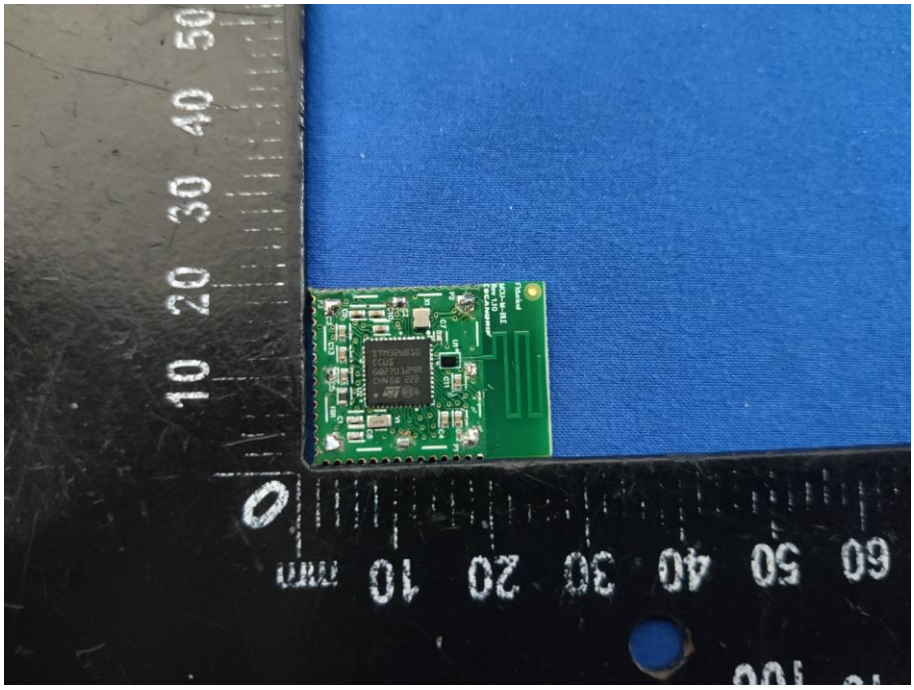
Emissions in restricted frequency bands (below 1GHz)

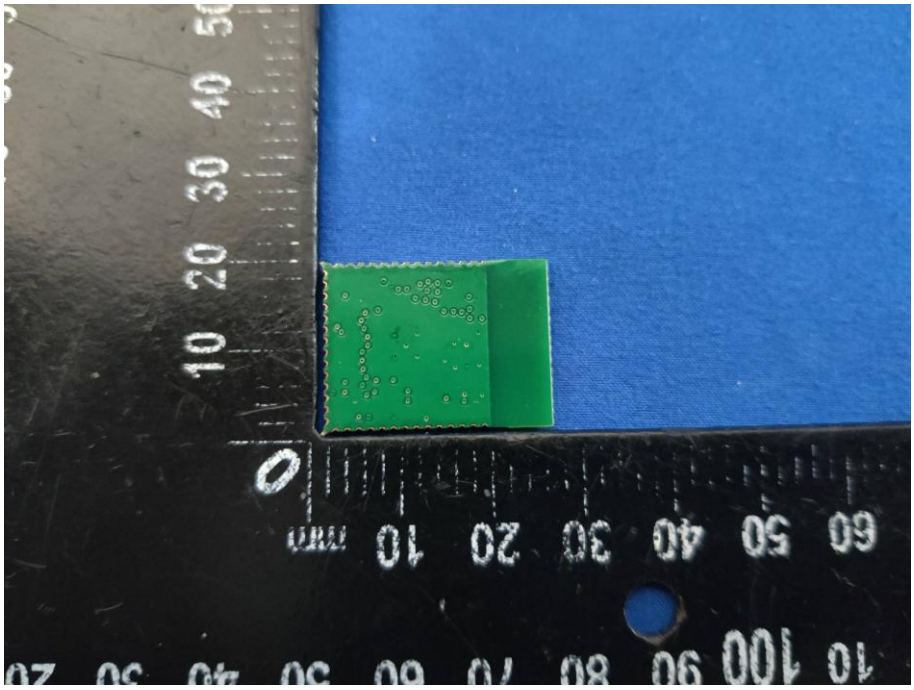


6 EUT Constructional Details (EUT Photos)









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